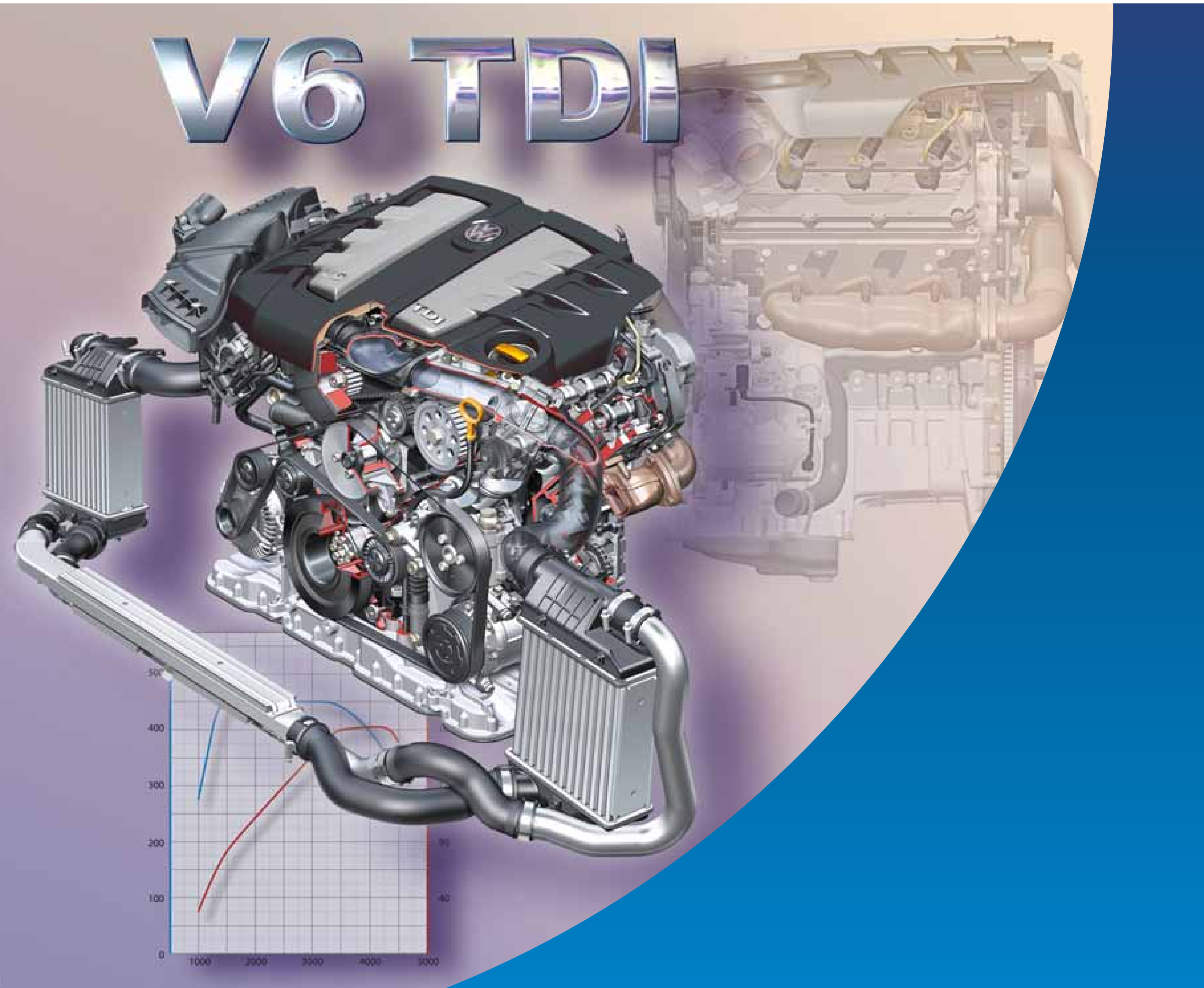
Service Training

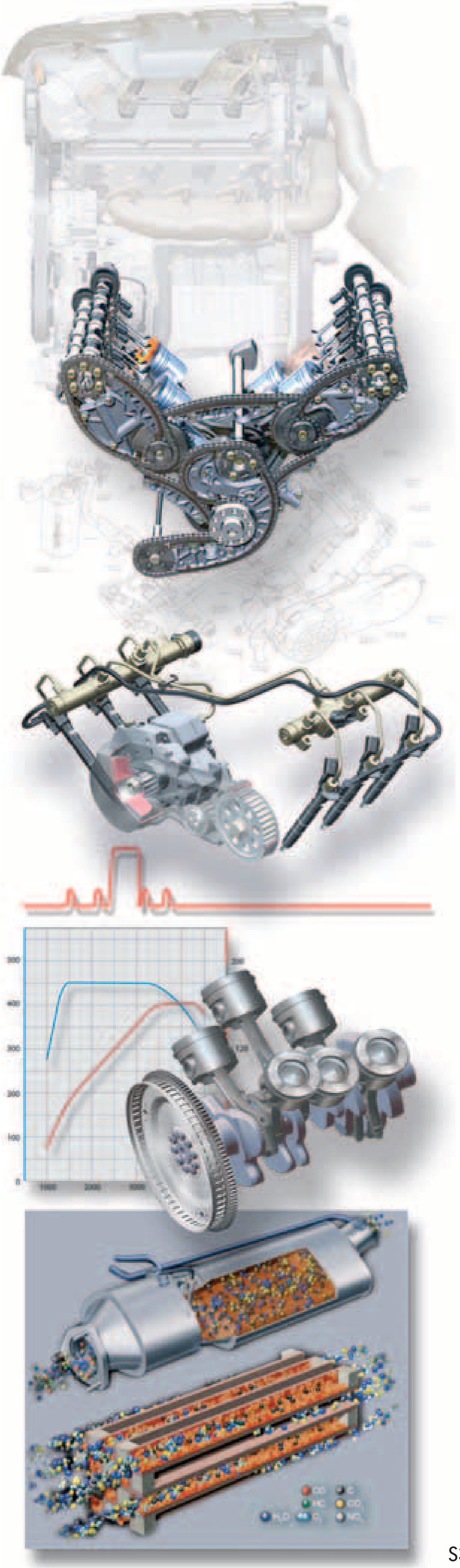
Self-study programme 350

The 3.0l V6 TDI engine

Design and function



V6 TDI



S350_001

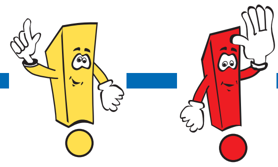
The range of engines fitted in the Phaeton and Touareg is being extended by a high-tech turbodiesel engine.

The 3.0l V6 TDI engine has been developed by Audi and is equipped with a piezo-controlled common rail fuel injection system.

This unifies power and smoothness in a compact engine.

The engine is combined with a diesel particulate filter and meets the EU 4 exhaust emission standard.

NEW



Attention
Note

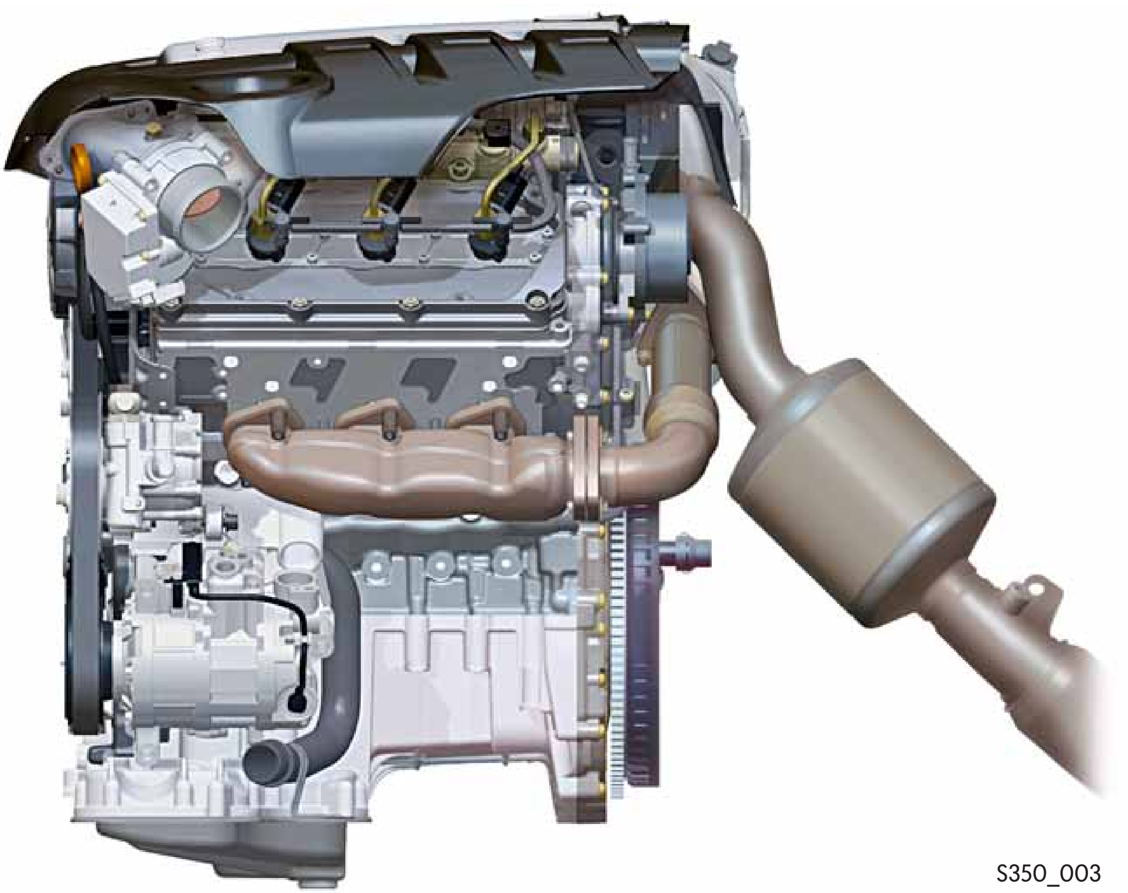
The self-study programme portrays the design and function of new developments!
The contents will not be updated.

For current testing, adjustment and repair instructions, please refer to the customer service literature intended for this purpose.

At a glance

The 3.0l V6 TDI engine

The 3.0l V6 TDI engine is a new diesel engine developed from the Audi V engine family.
This engine family's special characteristic is its extremely short and compact design, which is achieved by means of a chain drive. The engine additionally combines high output and ample torque with smooth running characteristics and low exhaust emissions. A piezo-controlled common rail fuel injection system ensures high injection pressure and a flexible injection process. The engine is installed in the Volkswagen Phaeton and Touareg.



S350_003

(View of the Phaeton engine)

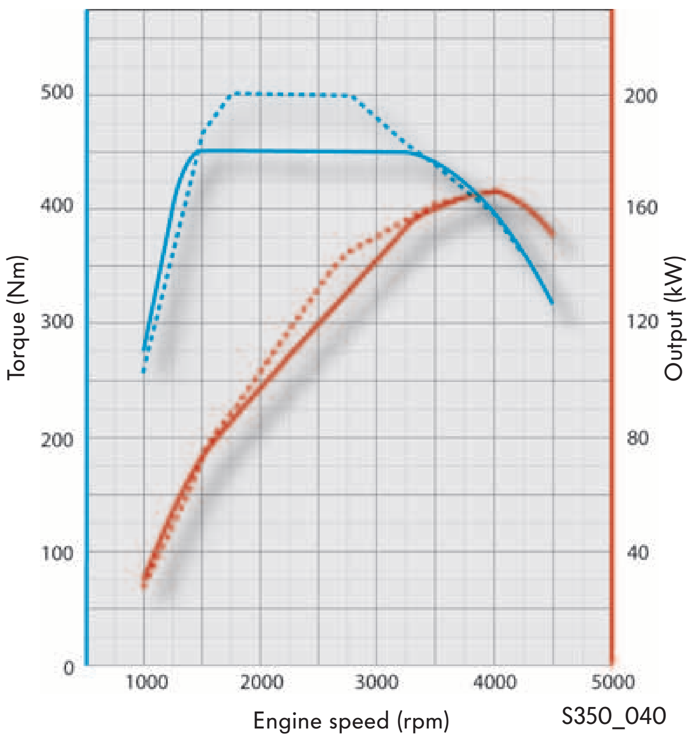
Technical engine features:

- High-strength, compacted graphite iron cylinder block
- 4-valve technology
- Intake manifolds with swirl flaps
- Chain drive for valve control system, balancer shaft and oil pump
- Common rail fuel injection system
- Piezo-controlled injectors (piezo injectors)
- Diesel particulate filter

Technical data

Engine code	BMK (Phaeton)	BKS (Touareg)
Design type	6-cylinder V engine (90° V angle)	
Displacement	2967 cm^3	
Bore	83 mm	
Stroke	91.4 mm	
Compression ratio	17 : 1	
Valves per cylinder	4	
Firing sequence	1 - 4 - 3 - 6 - 2 - 5	
Max. output	165 kW at 4000 rpm	
Max. torque	450 Nm at 1400 to 3250 rpm	500 Nm at 1750 to 2750 rpm
Engine management system	Bosch EDC 16 C common rail fuel injection system	
Fuel	Diesel, at least 51 CN	
Exhaust gas cleaning	Oxidising catalytic converter, exhaust gas recirculation, diesel particulate filter	
Exhaust emission standard	EU 4	

Torque and output graph



S350_040

In the Phaeton, the 3.0l V6 TDI engine achieves its maximum torque of 450 Nm as of an engine speed of 1600 rpm; this is available over a wide speed range, up to 3250 rpm.
In the Touareg, the engine offers maximum torque of 500 Nm in the engine speed range from 1750 to 2750 rpm.
Its maximum output of 165 kW is achieved at 4000 rpm in both vehicles.

Engine mechanical system

Cylinder block

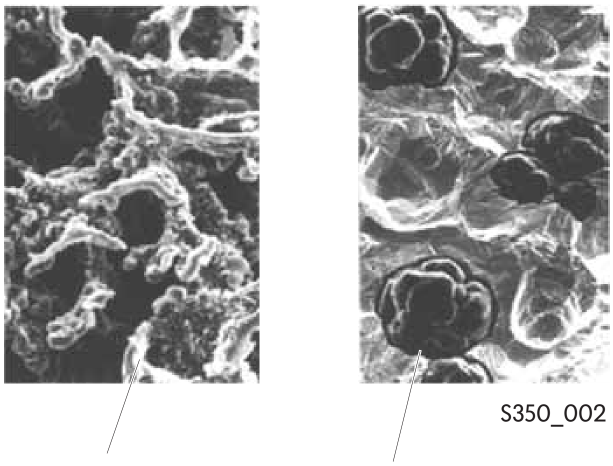
The cylinder block has a 90° V angle and is manufactured from compacted graphite iron (CGI-450).
The cylinder liners are finished using the new UV photon honing process. This reduces friction and improves running-in behaviour.

S350_006

Compacted graphite iron

Cast iron with vermicular graphite is commonly named as such due to its worm-like graphite structure (worm-shaped = vermicular, Latin).
In professional circles, this material is called compacted graphite iron (CGI).

Compacted graphite iron is a high-strength material which enables a thin-walled, cast iron construction. This results in a weight saving of 5 – 10 % in comparison with a grey cast iron design.



S350_002

Cast iron with vermicular graphite

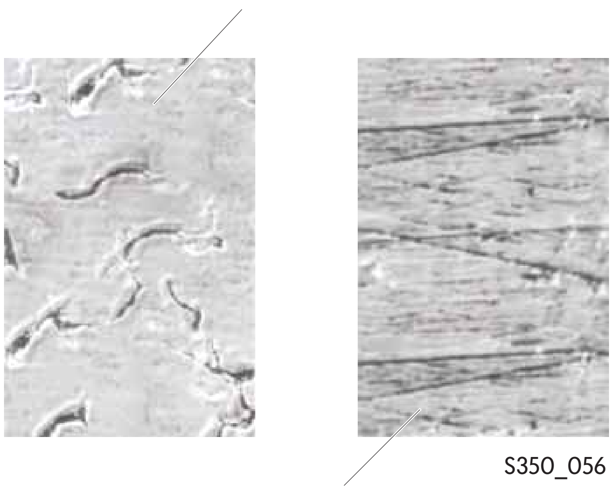
Cast iron with nodular graphite

UV photon honing

The cylinder contact surface is honed in the conventional manner and is then processed using UV photon honing.

During this process, a laser beam melts the surface of the cylinder contact surface, and nitrogen penetrates it. This smoothes and hardens the cylinder surface.

With UV photon honing



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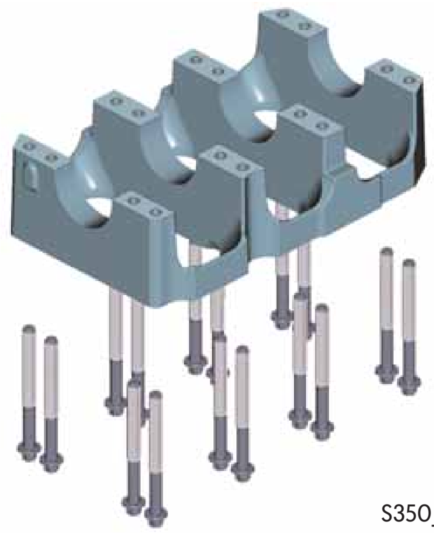
Without UV photon honing

Bearing frame

A grey cast iron bearing frame is bolted into the crankcase. This contains the support for the crankshaft and additionally stiffens the cylinder block.

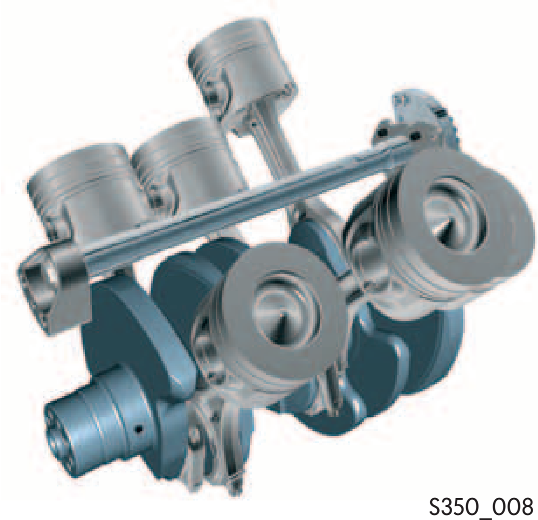


S350_007

Crankshaft and balancer shaft

The crankshaft, which is forged from tempered steel, is supported at four points in the bearing frame. Due to the 90° V angle, the crank pins are offset by 30°. This is necessary to achieve an even firing interval.

To ensure low-vibration engine operation, a balancer shaft is located in the V of the cylinder block to compensate the moments of inertia which occur. The balancer shaft is driven by the crankshaft via a chain. This rotates at engine speed counter to the direction in which the engine is running.



S350_008

Pistons

The aluminium pistons are designed without valve pockets.
The swirl is influenced by the ports in the cylinder head and the position of the swirl flaps in the intake module, and ensures optimum mixture formation.

To cool the piston ring zone, the pistons are equipped with an annular cooling duct, into which oil is sprayed via piston spray nozzles.

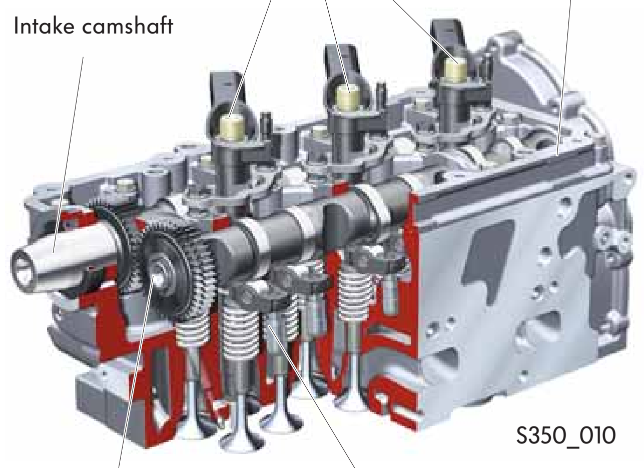
S350_009

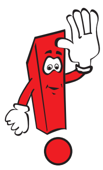
Engine mechanical system

Cylinder head

The 3.0l V6 TDI engine has two cylinder heads manufactured from aluminium alloy. Two intake and two exhaust valves per cylinder are arranged according to the principle of cross-flow.

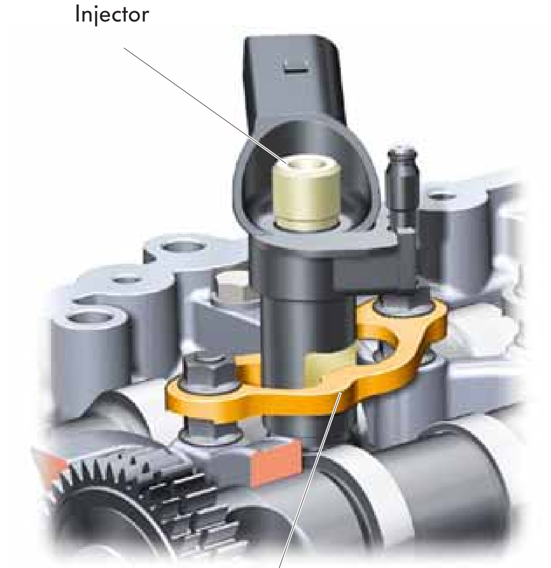
Each cylinder head is fitted with one camshaft for the intake valves and one camshaft for the exhaust valves. The intake and exhaust camshafts are linked via spur gear toothing with integrated backlash compansation. The bearing frame for the camshafts is bolted to the cylinder head.
The valves are actuated via low-friction roller rocker fingers with hydraulic valve clearance compensation elements.





For the structure and function of the hydraulic valve clearance compensation elements, refer to self-study programme No. 183 "The 2.5l V6 TDI 4V engine".

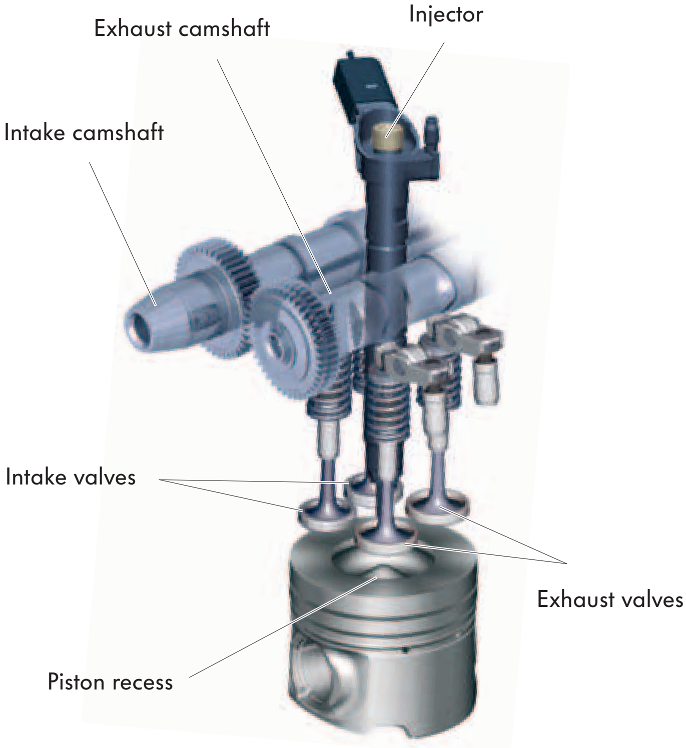
The injectors are secured in the cylinder head with the aid of clamping pieces. They can be removed via small covers in the cylinder head cover.



4-valve technology

Two intake and two exhaust valves per cylinder are arranged vertically in the cylinder head.

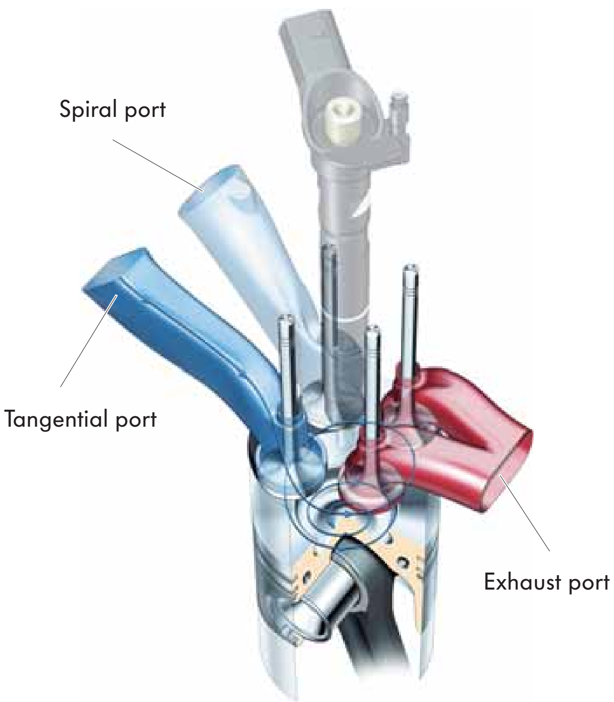
The vertically positioned, centrally located injection valve is positioned directly over the central piston recess. This design leads to good mixture formation, resulting in low fuel consumption and low exhaust emissions.



S350_044

The shape, size and layout of the intake and exhaust ports ensure good volumetric efficiency and a favourable gas cycle in the combustion chamber.

The intake ports are designed as spiral and tangential ports.
Thanks to the tangential port, the inflowing air generates the desired, high degree of in-cylinder flow. Particularly at high speeds, the spiral port leads to good combustion chamber filling.

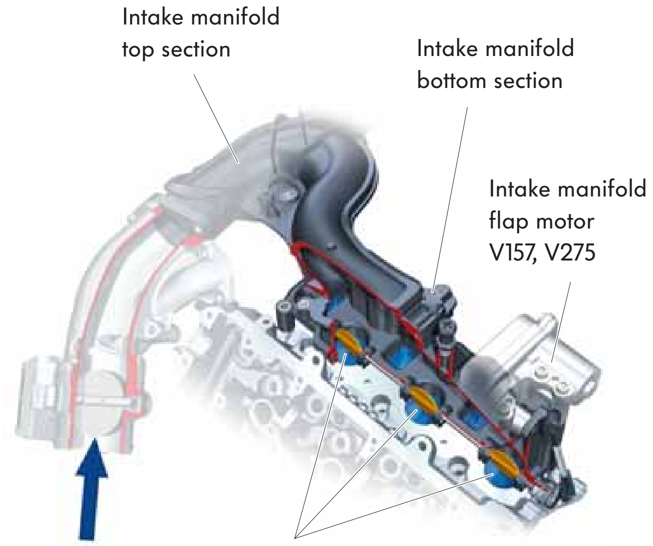


S350_015

Air intake system

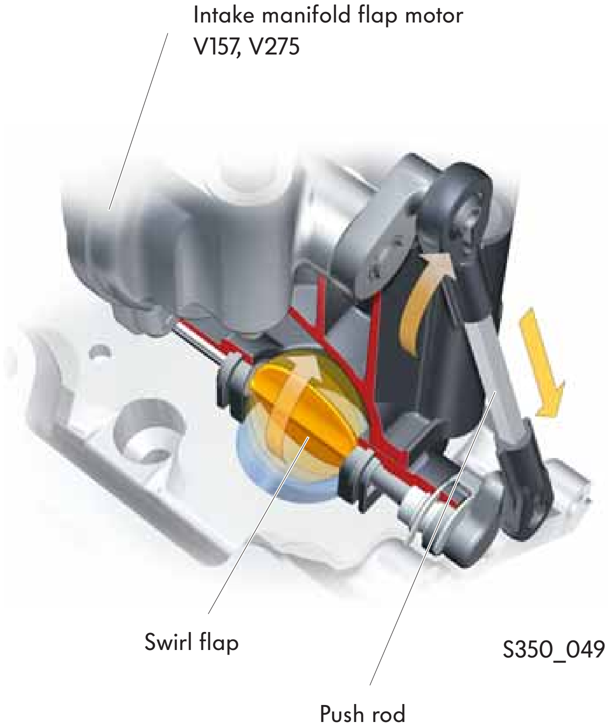
Intake manifolds with swirl flaps

The intake manifolds of both cylinder banks are fitted with continuously variable swirl flaps. Due to the position of the swirl flaps, the intaken air's swirl is adjusted depending on the engine speed and load.



S350_016

The swirl flaps are moved by the intake manifold flap motor via a push rod. To do this, the positioning motor is actuated by the engine control unit. An integrated sensor serves to feed back the current position of the swirl flaps.



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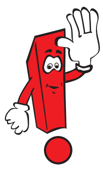


The intake manifold flap motors must only be renewed completely together with the intake manifold lower section. Please observe the notes in the workshop manual!

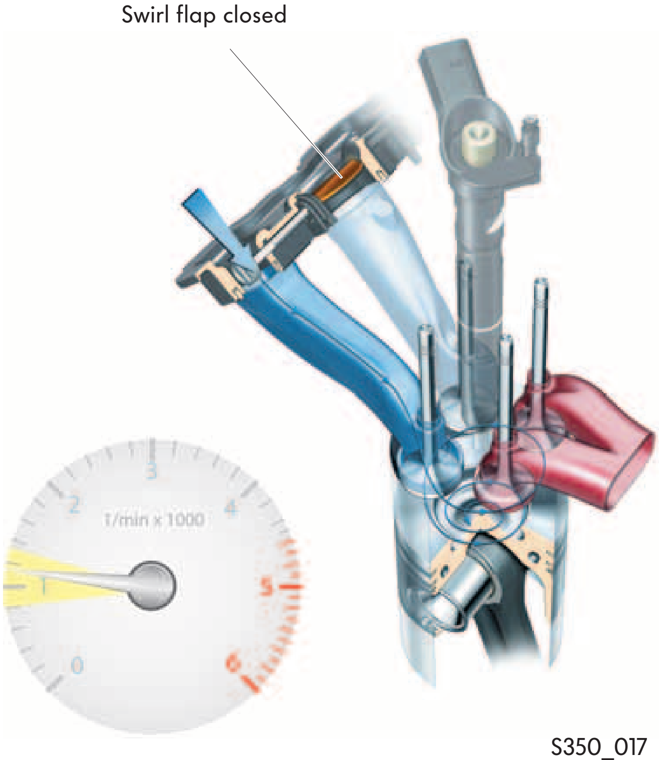
Function of the swirl flaps

Low engine speeds

The swirl flaps are closed when the engine is idling and at low engine speeds. This causes a high level of swirling, which leads to good mixture formation.

The swirl flaps are open when the engine is started, in limp-home mode and at full throttle.

Swirl flap closed



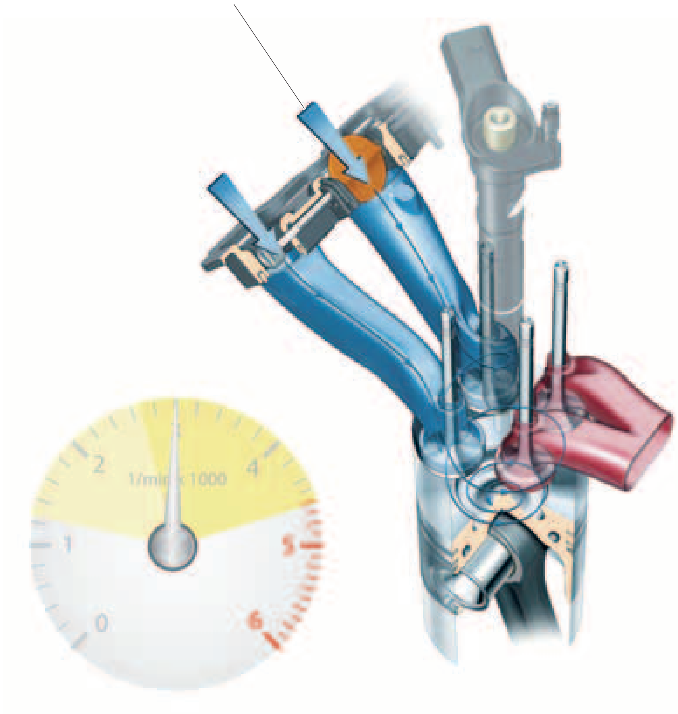
S350_017

High engine speeds

As of an engine speed of approx. 1250 rpm, the swirl flaps are open continuously. Good combustion chamber filling is achieved thanks to the increased air throughput.

As of an engine speed of approx. 2750 rpm, the swirl flaps are opened completely.

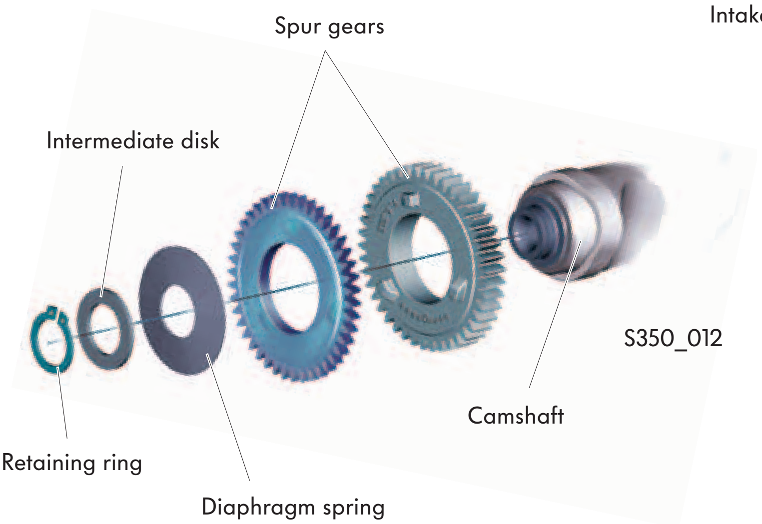
Swirl flap open



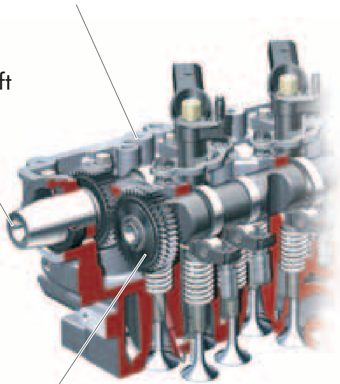
S350_018

Backlash compensation

The intake and exhaust camshafts are linked via spur gear toothing with integrated backlash compansation.
In this case, the exhaust camshaft's spur gear is driven by the intake camshaft's spur gear. Backlash compensation ensures that the camshafts are driven with little noise.



S350_012

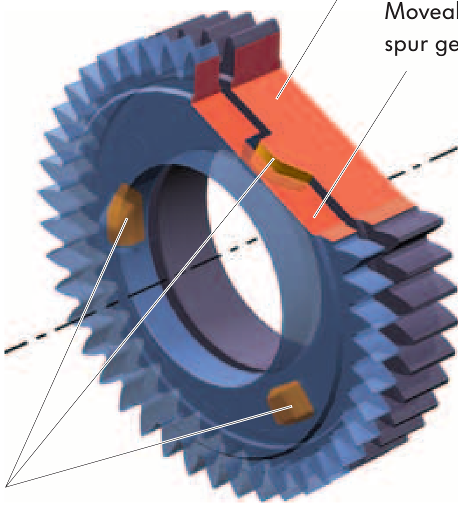


S350_011

Structure

The exhaust camshaft spur gear is split into two parts in the left-hand cylinder head. (The intake camshaft spur gear is split into two parts in the right-hand cylinder head.)

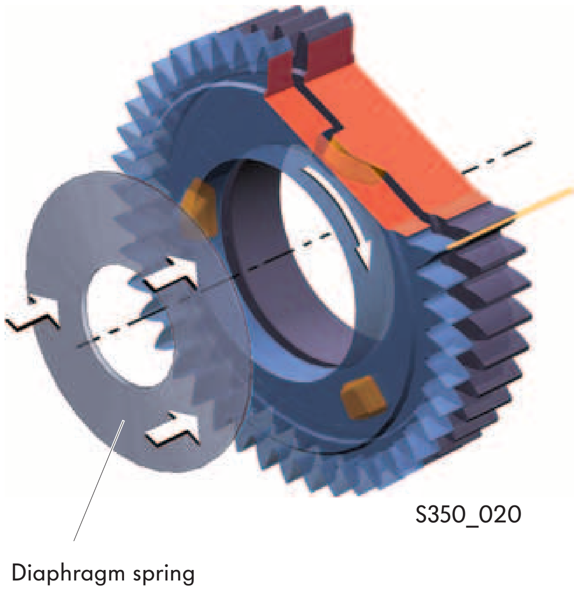
The broader part of the spur gear (fixed spur gear) is positively connected to the camshaft.
Three lugs are located on the front face.
The narrower part of the spur gear (moveable spur gear) can be moved radially and axially. Recesses for the three lugs are located on its rear side.



S350_019

How it works:

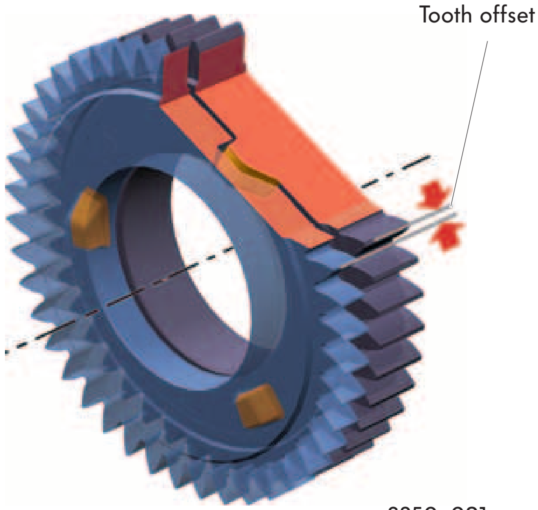
Both spur gear parts are pushed axially together via the force exerted by a diaphragm spring. Whilst this occurs, they are simultaneously caused to rotate via the lugs.



S350_020

This rotational movement offsets the teeth of both spur gear parts and therefore leads to backlash compensation between the intake and exhaust camshafts' gear wheels.

Backlash compensation

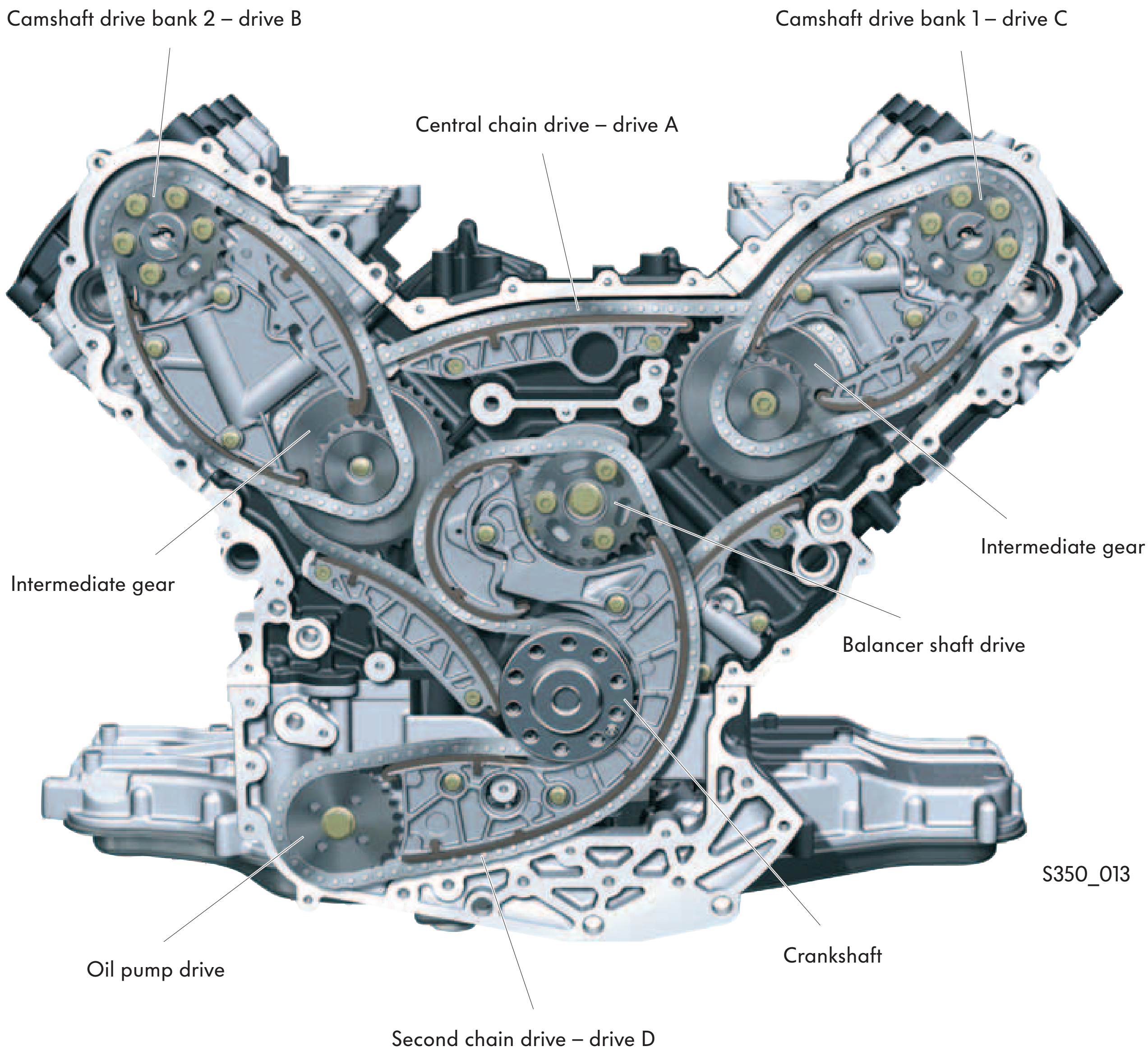


S350_021

Chain drive

The camshafts, the balancer shaft and the oil pump are driven by the crankshaft via a chain drive.
This is located on the engine's gearbox side.

The chain drive makes the engine's compact design possible.



The chain drive is comprised of:

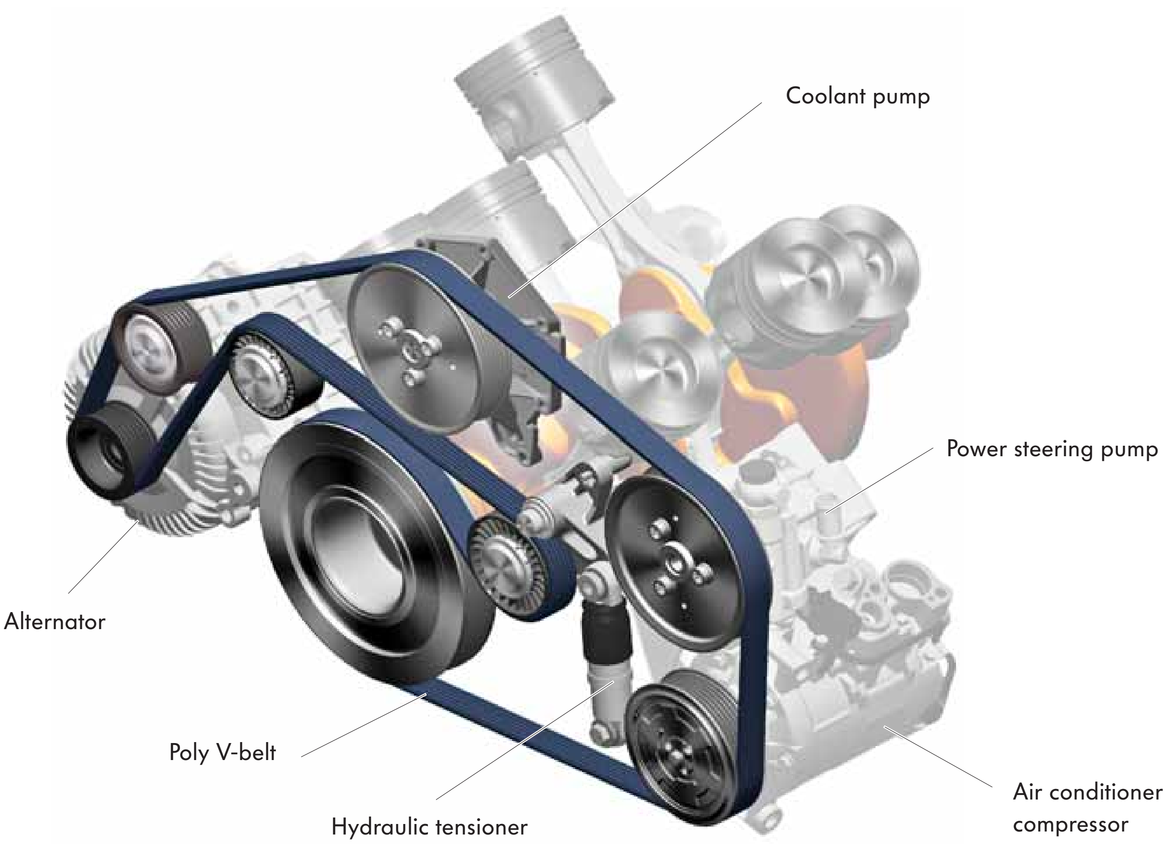
- A central chain from the crankshaft to the intermediate gears (drive A),
- A chain from each of the intermediate gears to the intake camshafts (drives B and C),
- A chain from the crankshaft to the oil pump drive and to the balancershaft.

The camshaft chain sprockets have the same diameter as the crankshaft sprocket.
The necessary camshaft: crankshaft ratio of 2 : 1 is achieved by means of the intermediate gears.

The chains are tensioned by sprung, hydraulic chain tensioners; this system is maintenance-free.

Ancillary component drive

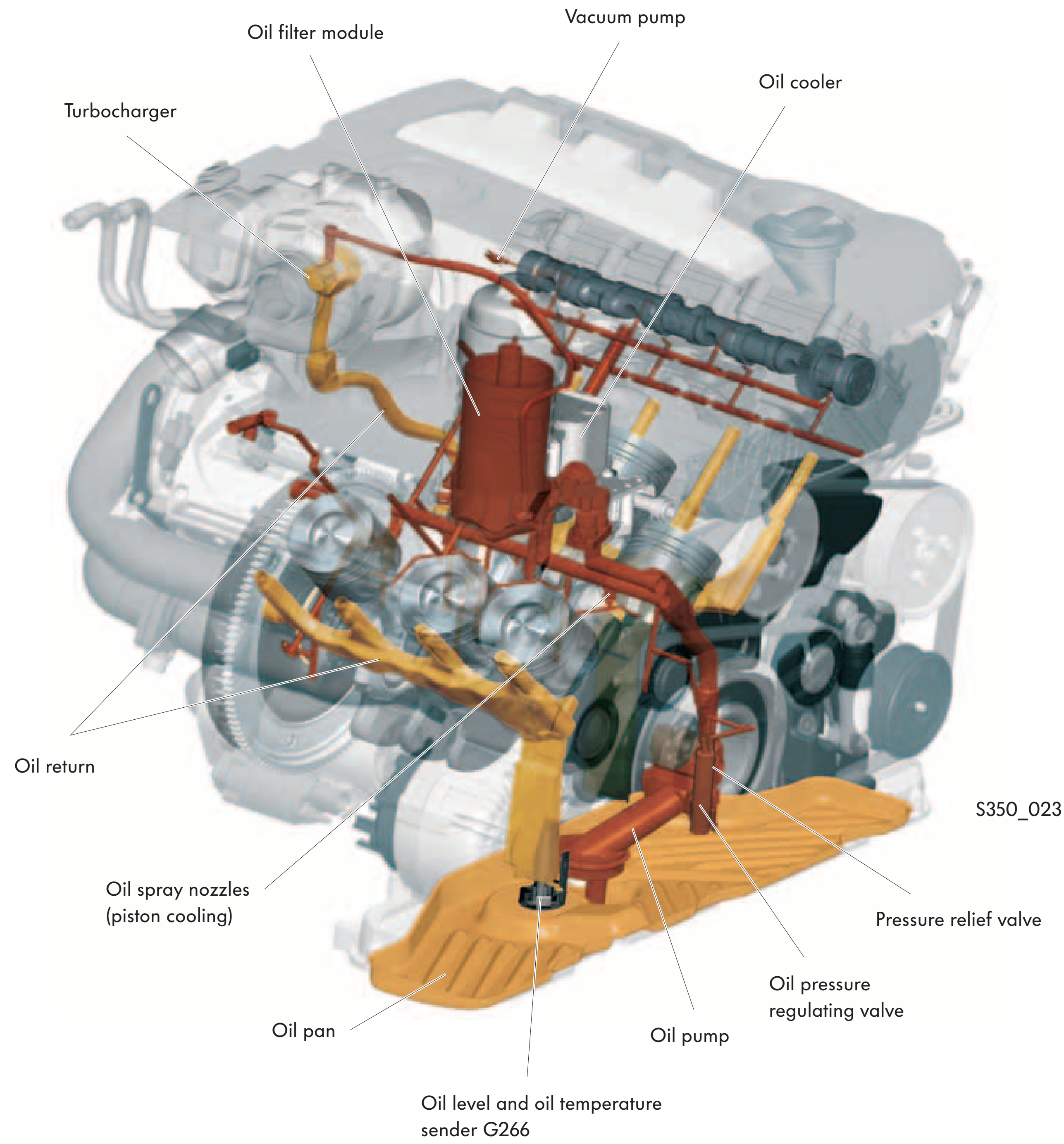
The coolant pump, the power steering pump, the air conditioner compressor and the alternator are driven by the crankshaft via a poly V-belt.



S350_022

Lubrication system

Overview of the system



Oil without pressure

Oil under pressure

Oil filter module

The oil filter module contains an oil non-return valve and the short-circuit valve. The oil non-return valve prevents oil from flowing back into the oil pan from the oil filter housing when the engine is switched off. The short-circuit valve is a bypass valve, which opens when the oil filter or oil cooler is blocked and thereby ensures that the engine is supplied with oil.
It opens at 2.5 bar.

Oil pressure regulating valve

The oil pressure regulating valve is integrated into the oil pump and regulates the engine's oil pressure.

Oil spray nozzles

Oil is sprayed into the pistons' cooling ducts via the oil spray nozzles. This cools the pistons.

Pressure relief valve

This is a safety valve in the oil pump. It protects the lubrication system from excessive pressure on cold-starting.
It opens at 11 bar.

Engine mechanical system

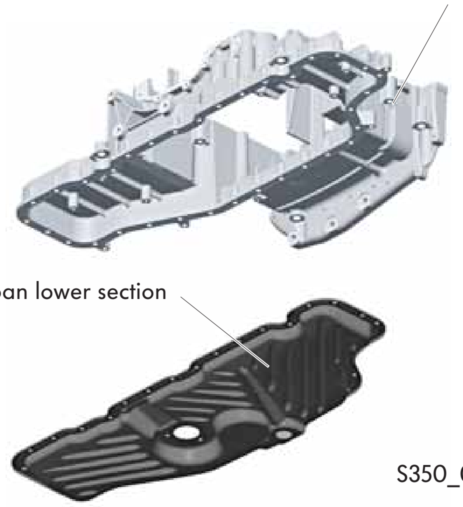
Oil pan

The oil pan is comprised of two components; a cast aluminium upper oil pan section and a sheet steel lower oil pan section.

The design of the oil pan differs in the Phaeton and the Touareg. This is the result of installation space conditions and off-road capability requirements. The oil pump's oil intake system has accordingly been adapted to the different design forms.

Phaeton oil pan

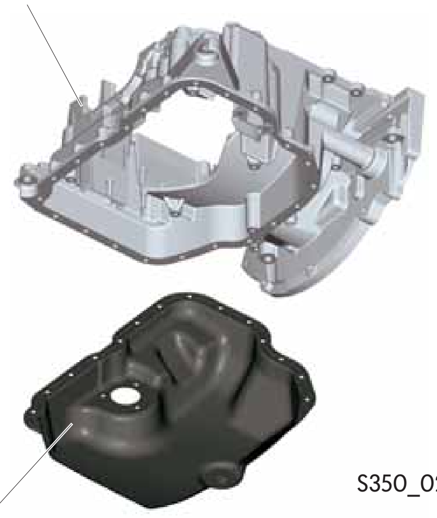
Due to the limited installation space, the oil pan fitted in the Phaeton flattens and broadens at the bottom.



S350_014

Touareg oil pan

The design of the oil pan fitted in the Touareg is 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.

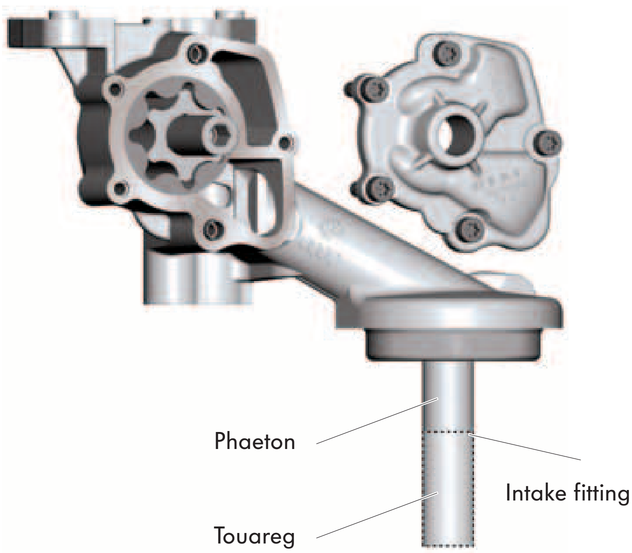


S350_026

Oil pump

The oil pump is a crescent pump. It operates according to the duocentric principle and is driven by chain drive D via a stub shaft.

The length of the intake fitting has been adapted to the different oil pan designs.

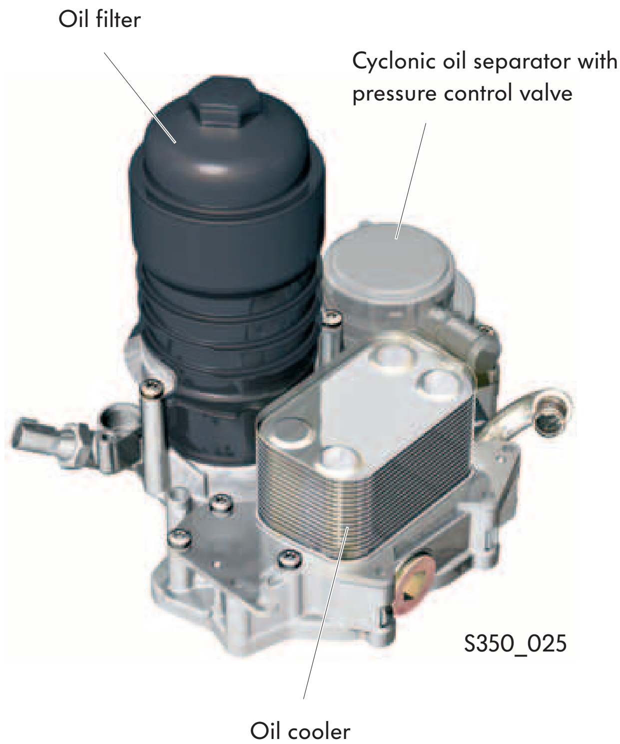


S350_024

Oil filter module

The oil filter module is located in the V of the engine. The oil filter, the oil cooler and the cyclonic oil separator with pressure control valve for the crankcase breather system are integrated into the oil filter module.

The oil cooler is connected to the engine's coolant circuit.

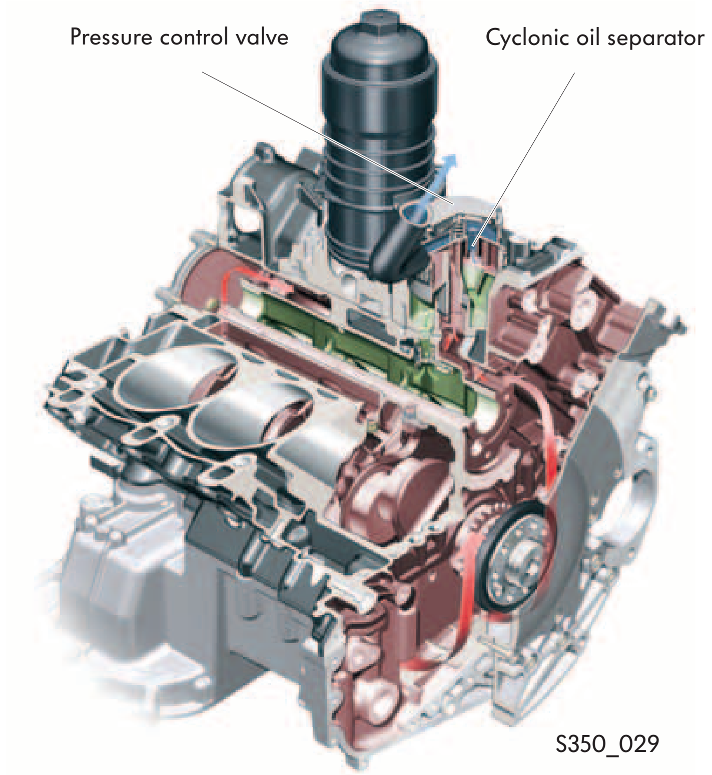


S350_025

Engine mechanical system

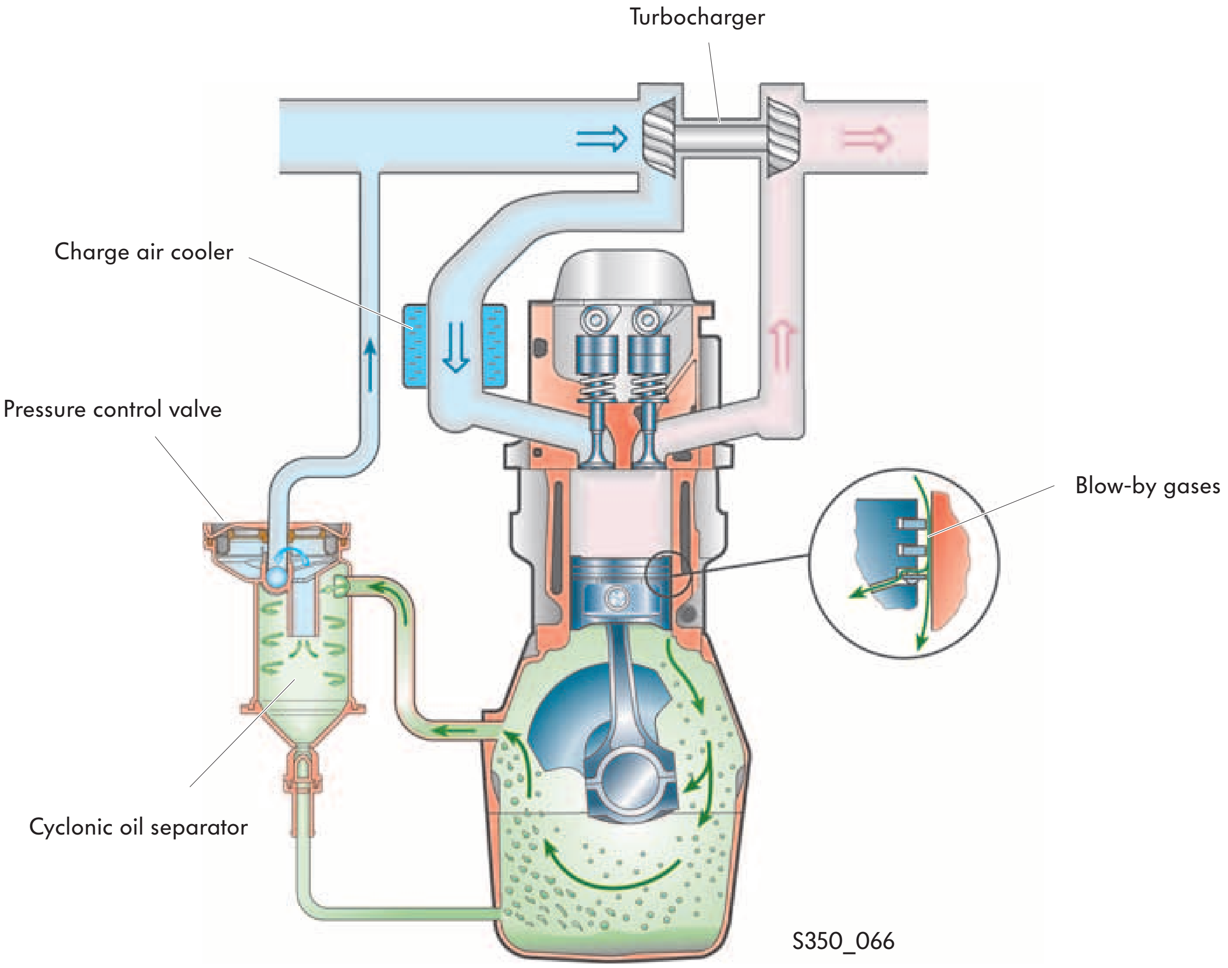
Crankcase breather system

In combustion engines, pressure differences between the combustion chamber and crankcase lead to air flows between the piston rings and cylinder contact surface; these are called blow-by gases.
To prevent environmental pollution, these gases, which contain oil, are fed back to the intake area via the crankcase breather system.
A cyclonic oil separator separates the oil contained in the gases from the air. This oil is returned to the oil pan via a port in the crankcase.



S350_029

Functional principle

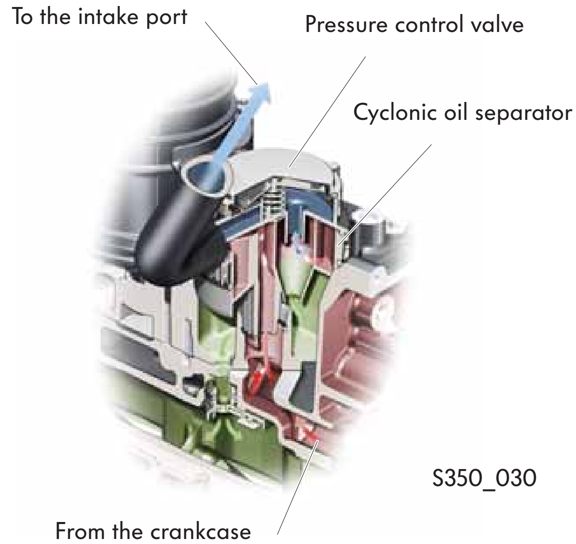


S350_066

Function of the cyclonic oil separator

The blow-by gases are fed to the cyclonic oil separator via a port inside the engine.

The cyclonic oil separator causes the air to rotate. Due to the centrifugal force which occurs, the oil spray is spun onto the wall of the separator.
Oil droplets form there, and these flow off into the oil pan via a port in the crankcase. The air, from which the oil spray has been removed, is fed back into the intake port via the pressure control valve.



S350_030

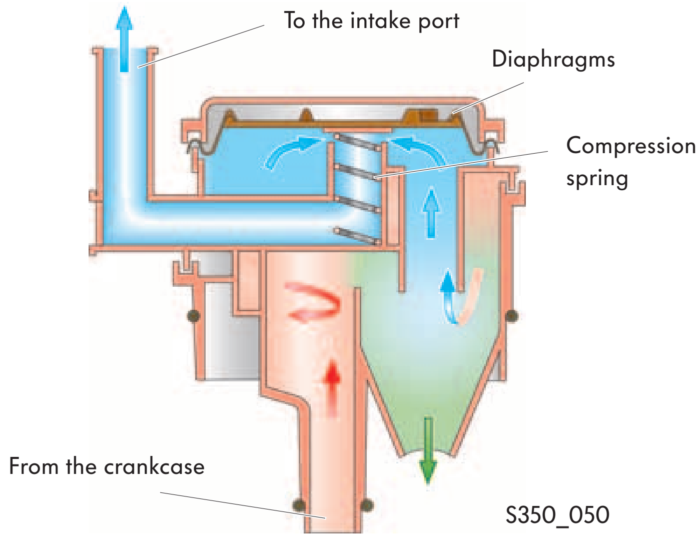
Function of the pressure control valve

The pressure control valve is located in the cover of the cyclonic oil separator. It is comprised of a membrane and a pressure spring, and regulates the pressure for venting the crankcase.

When the blow-by gases are introduced, the pressure control valve limits the vacuum in the crankcase, as engine gaskets may become damaged if there is an excessive vacuum.

If the vacuum in the intake port is high, the pressure control valve closes. In the case of a low vacuum in the intake port, it opens by means of the pressure spring's force.

Pressure control valve open



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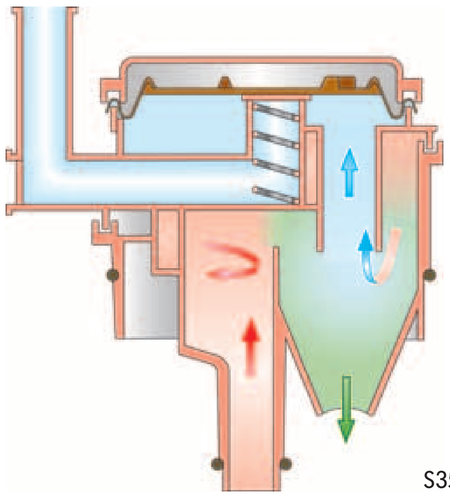
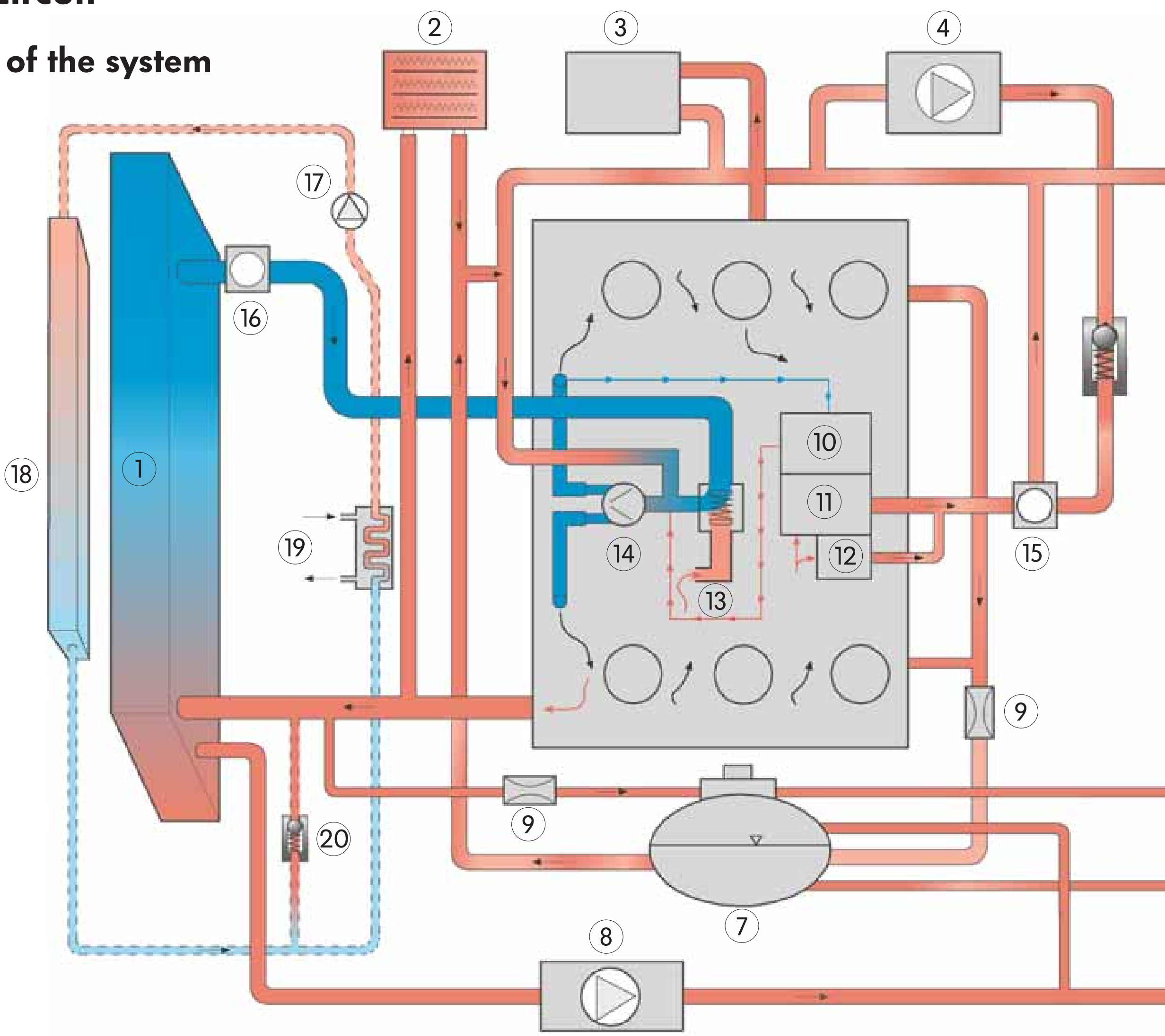
Pressure control valve closed



S350_034

Coolant circuit

Overview of the system



Engine coolant circuit

Hot

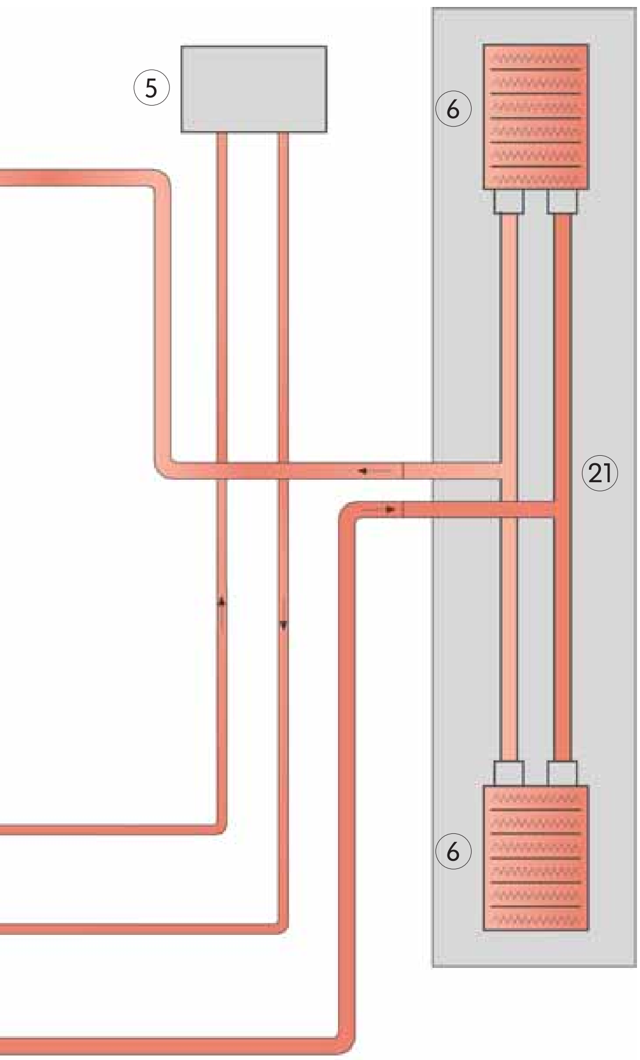
Cold

Coolant circuit for fuel cooling (Touareg only)

Hot

Cold

1	Cooler for engine coolant circuit
2	Gearbox oil cooler
3	Alternator
4	Continued coolant circulation pump V51 (with towing attachment only)
5	Air reservoir
6	Heat exchanger
7	Expansion tank
8	Additional heater
9	Choke
10	Oil cooler
11	Cooler for exhaust gas recirculation
12	Exhaust gas recirculation flap
13	Thermostat (opens as of a coolant temperature of 87 °C)



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Coolant circuit for fuel cooling (Touareg only)

In the Touareg, the 3.0l V6 TDI engine is equipped with a separate coolant circuit for the fuel cooler. This is necessary because the temperature of the coolant is too high, when the engine is at operating temperature, to cool the returning fuel.

Water pump V36 (Touareg only)

The water pump V36 is an electric circulation pump. It is initialised as required by the engine control unit, and ensures that the coolant is circulated in the coolant circuit in order to cool the fuel.

Continued coolant circulation pump V51 (vehicles with towing attachment only)

The continued coolant circulation pump V51 is an electrically driven pump. It is initialised according to a performance map by the engine control unit, and therefore ensures that the coolant is circulated for cooling purposes when the engine is "off".

14 Coolant pump
15 Coolant temperature sender G62
16 Radiator outlet coolant temperature sender G83
17 Water pump V36
18 Cooler for fuel cooling
19 Fuel cooler
20 Non-return valve
21 Heating

Engine mechanical system

Common rail fuel injection system

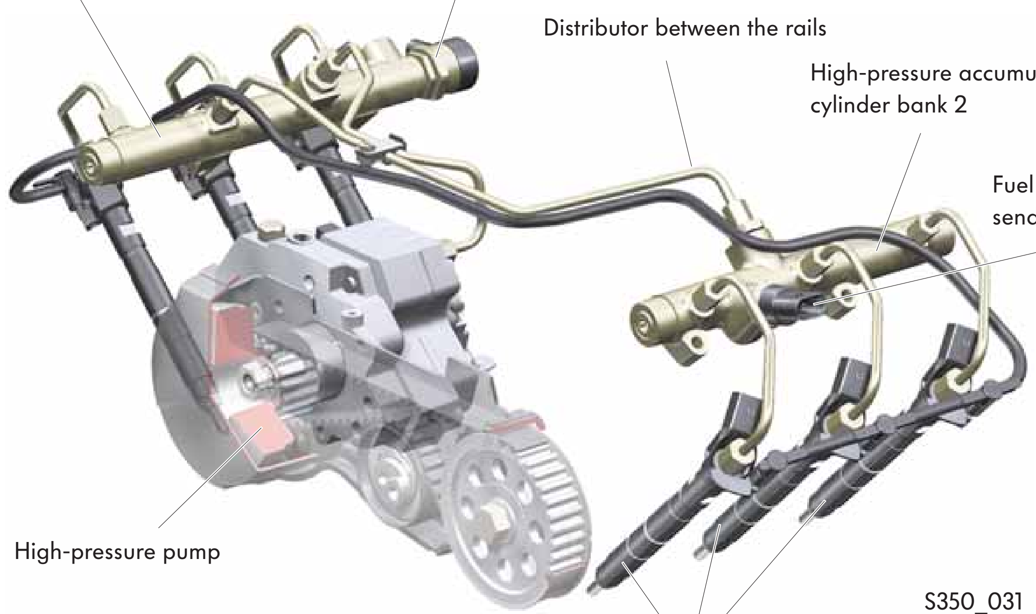
The common rail fuel injection system is a high-pressure accumulator fuel injection system for diesel engines.

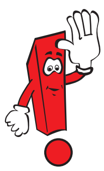
The term "common rail" means that all of one cylinder bank's injectors have a common, high-pressure fuel accumulator.

In this system, pressure generation and fuel injection are separate. The high pressure required for injection is generated by a separate high-pressure pump. This fuel pressure is stored in a high-pressure accumulator (rail) and is made available to the injectors via short injector pipes.

The main features of this fuel injection system are:

- The injection pressure can be selected almost infinitely within the performance map.
- The availability of high injection pressure enables optimal mixture formation.
- A flexible pilot, primary and secondary injection process is achieved.





A detailed description of the common rail fuel injection system can be found in self-study programme No. 351 "The common rail fuel injection system".

Injectors (piezo injectors)

The 3.0l V6 TDI engine is fitted with piezo-controlled injectors. In comparison with solenoid valve-controlled injectors, piezo technology has approximately 75 % less moved mass at the injector needle.
This weight reduction offers the following advantages:

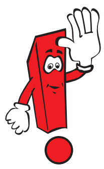
- Very short switching times
- Several injections per working cycle are possible
- Precisely apportionable injection quantities

The injection process, with a total of up to five partial injections per working cycle, has up to two pilot injections in the lower engine speed range and two secondary injections. This enables low emissions and smooth combustion.

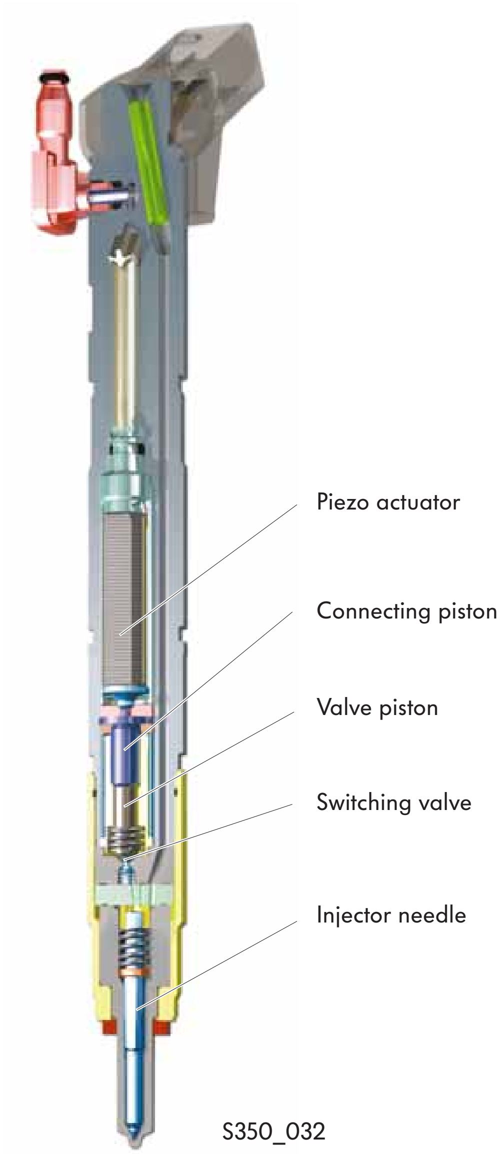
Piezo effect

(Piezo [Greek] = pressure)

The piezo-electric effect was discovered by Pierre Curie in 1880.
If a crystalline lattice (turmaline, quartz) comprised of ions is deformed under pressure, electrical voltage is generated.
The piezo-electric effect can also be reversed by applying an electric voltage. In this case, the crystal expands. This effect is used to control the injectors.



Caution! The piezo-controlled injectors are actuated with a voltage of 110 – 148 V. Observe the safety instructions in the workshop manual!



S350_032

Engine mechanical system

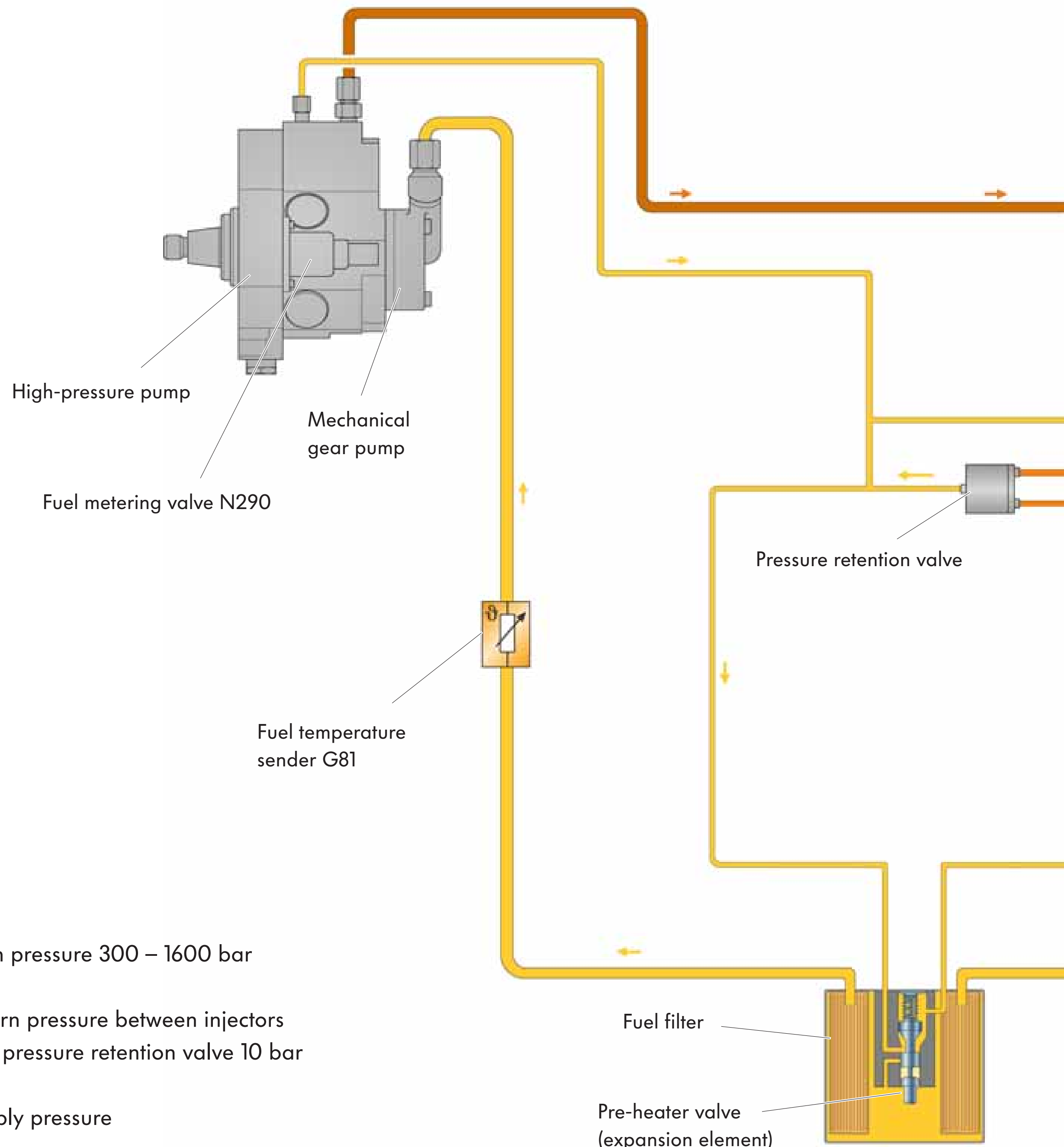
Fuel system

Overview of the system

The fuel system is sub-divided into three pressure ranges:

- Supply and return pressure
- Return pressure between the injectors and pressure retention valve
- High pressure

In the fuel supply system, the fuel is delivered to the high-pressure pump from the fuel tank via the fuel filter by the pressurisation pump and the mechanical gear pump. The high fuel pressure required for injection is generated in the high-pressure pump and is fed into the high-pressure accumulator (rail).



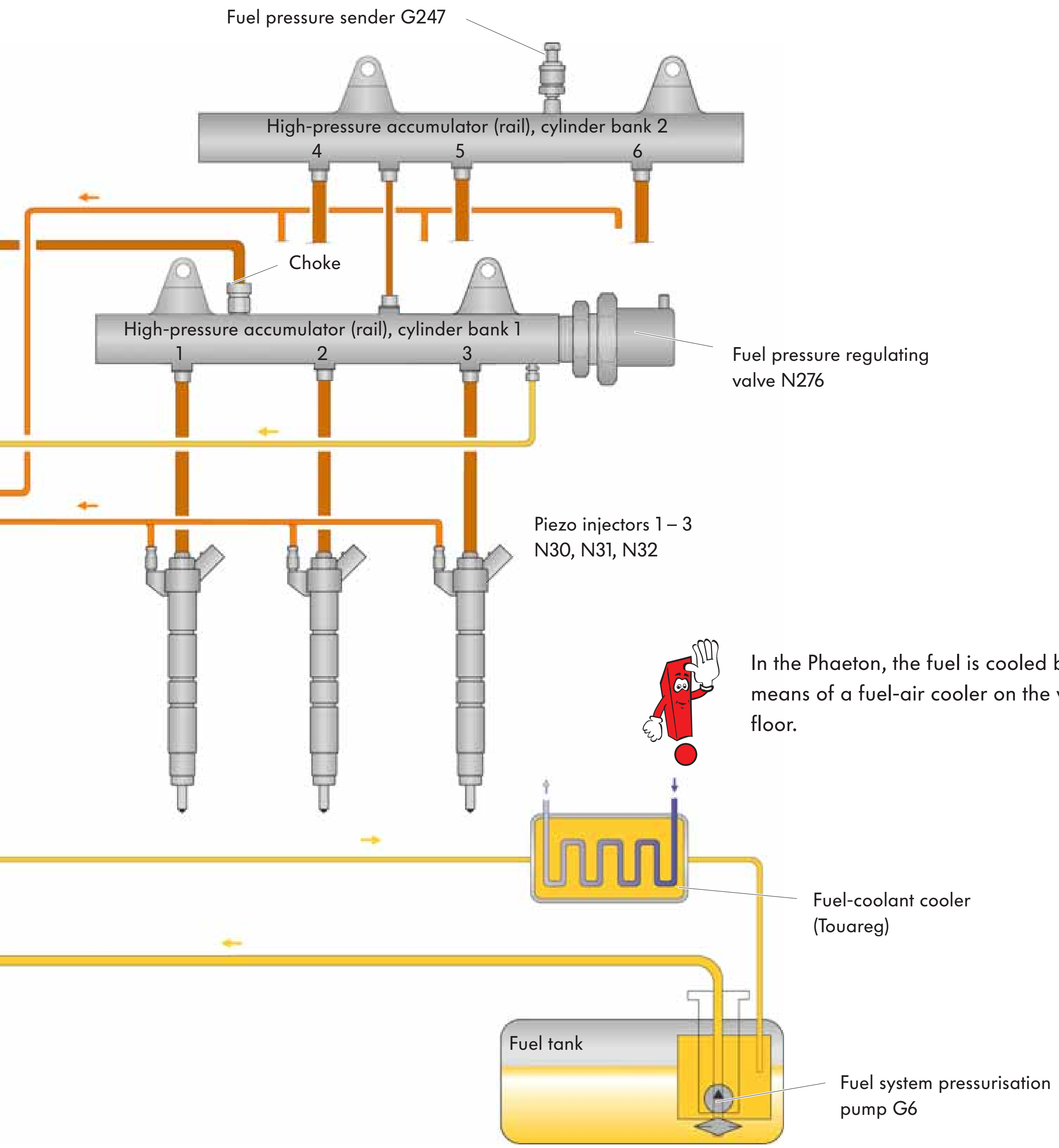
High pressure 300 – 1600 bar

Return pressure between injectors and pressure retention valve 10 bar

Supply pressure
Return pressure

From the high-pressure accumulator, the fuel is forwarded to the injectors, which inject it into the combustion chambers.

The pressure retention valve maintains the injectors' return pressure of 10 bar. This pressure is required for the piezo injectors' function.



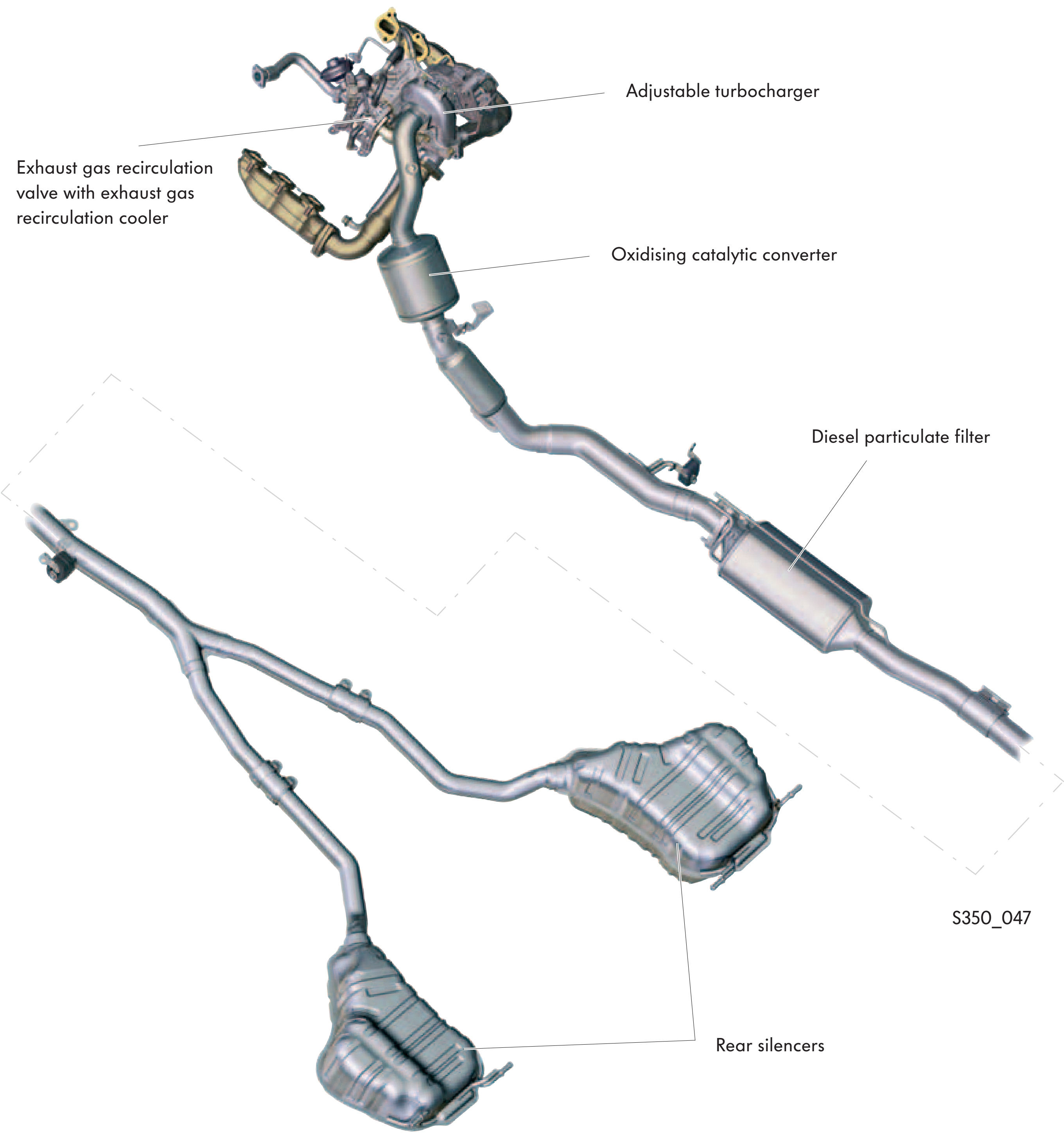
In the Phaeton, the fuel is cooled by means of a fuel-air cooler on the vehicle floor.

S350_033

Exhaust system

The 3.0l V6 TDI engine's exhaust system is comprised of an electrically adjustable turbocharger, an oxidising catalytic converter located beneath the bonnet, a diesel particulate filter, two rear silencers and an exhaust gas recirculation system with switchable exhaust gas recirculation cooler.

The Figure shows the exhaust system fitted in the Phaeton.



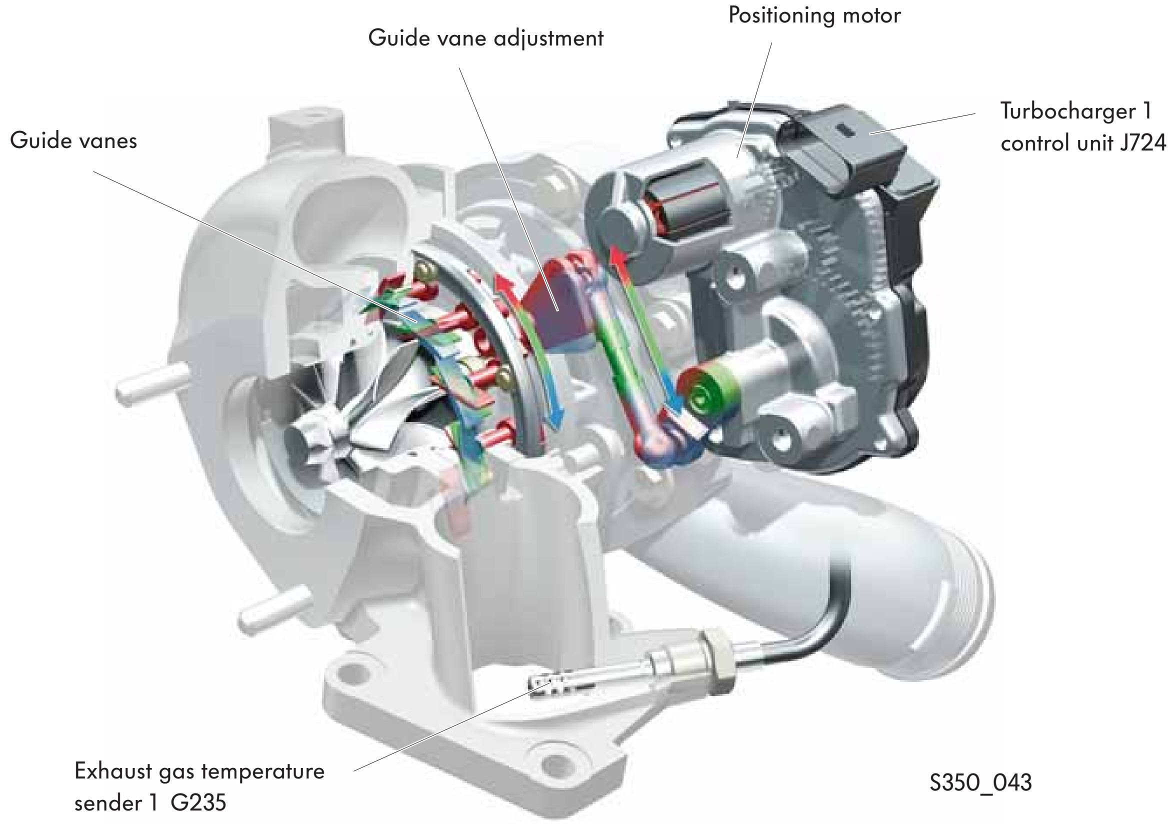
S350_047

Turbocharger

In the 3.0l V6 TDI engine, the charge pressure is generated by an adjustable turbocharger.
This is equipped with adjustable guide vanes, which enable the flow of exhaust gas onto the turbine impeller to be influenced. The advantage of this is that optimal charge pressure and therefore good combustion are achieved throughout the entire engine speed range. In the lower engine speed range, the adjustable guide vanes offer high torque and good starting behaviour; in the upper engine speed range, they enable low fuel consumption and low emission values.

The guide vanes are adjusted via an electric positioning motor. Electric initialisation makes fast turbocharger response behaviour and precise regulation possible.

An exhaust gas temperature sender is located upstream of the turbocharger. The engine control unit uses the exhaust gas temperature sender's signal to protect the turbocharger from impermissibly high exhaust gas temperatures. In the event of excessive exhaust gas temperatures, e.g. during full-throttle operation, the engine output is reduced.



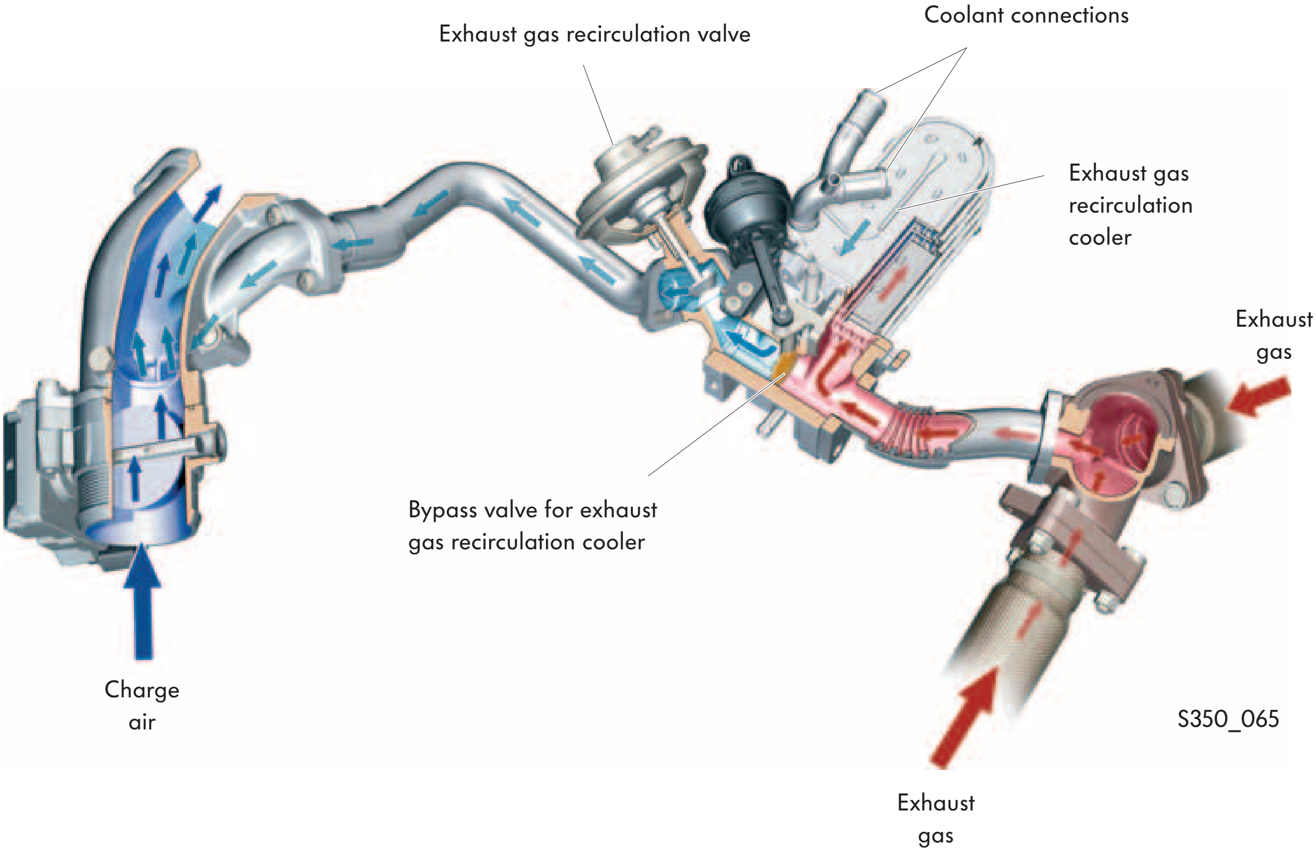
S350_043

The principle of the adjustable turbocharger is explained in self-study programme No. 190 "Adjustable turbocharger".

Exhaust gas recirculation

Thanks to exhaust gas recirculation, part of the exhaust gases are returned to the combustion process. The reduction in the fuel-air mixture's oxygen concentration which is achieved in this process slows combustion down. This leads to a reduction in the peak combustion temperature and therefore reduces nitrogen oxide emissions.

The quantity of exhaust gas which is recirculated is controlled by the exhaust gas recirculation valve according to a performance map in the engine control unit.
An exhaust gas recirculation cooler ensures that the combustion temperature is additionally lowered by cooling the recirculated exhaust gases, and that an increased quantity of exhaust gases can be recirculated.

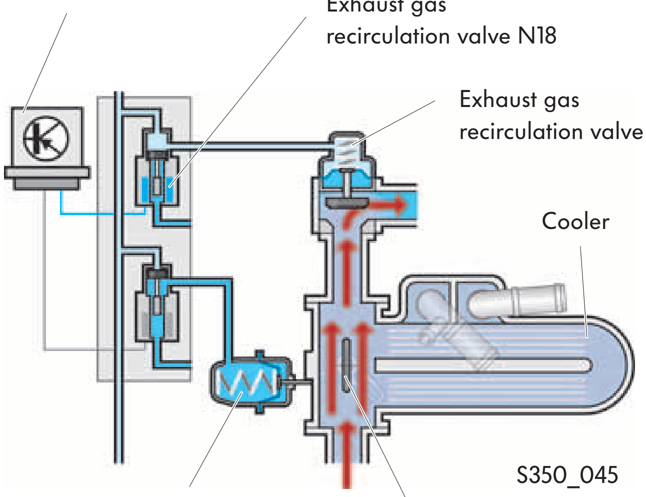


S350_065

Exhaust gas cooling switched off

Up to a coolant temperature of 60 °C, the bypass valve remains open and the exhaust gas is conducted past the cooler.

As a result of this, the engine and catalytic converter reach their relevant operating temperature within a short time.

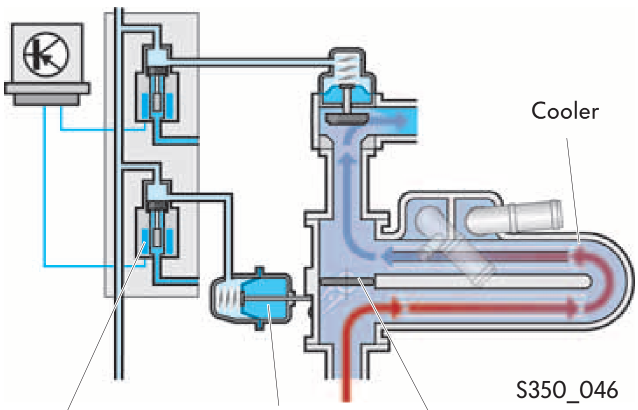


S350_045

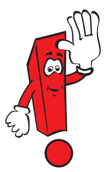
Exhaust gas cooling switched on

As of a coolant temperature of 60 °C, the bypass valve is closed by the change-over valve.

The recirculated exhaust gas is thereby conducted to the exhaust gas recirculation valve via the cooler.



S350_046



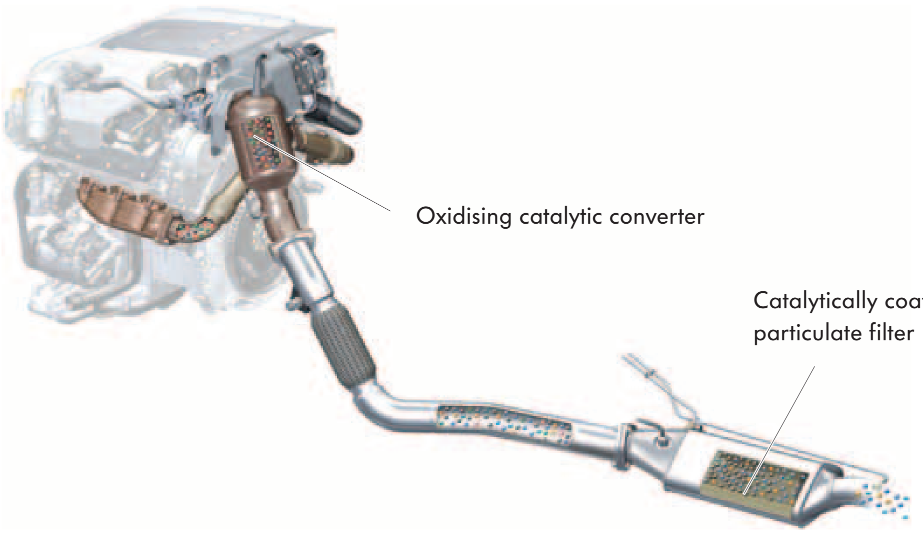
In the following cases, the bypass valve is also switched when the engine is at operating temperature:

The bypass valve is opened during idling to maintain the oxidising catalytic converter's operating temperature.
During deceleration, the bypass valve is switched back and forth once to guarantee unimpeded valve movement.

Engine mechanical system

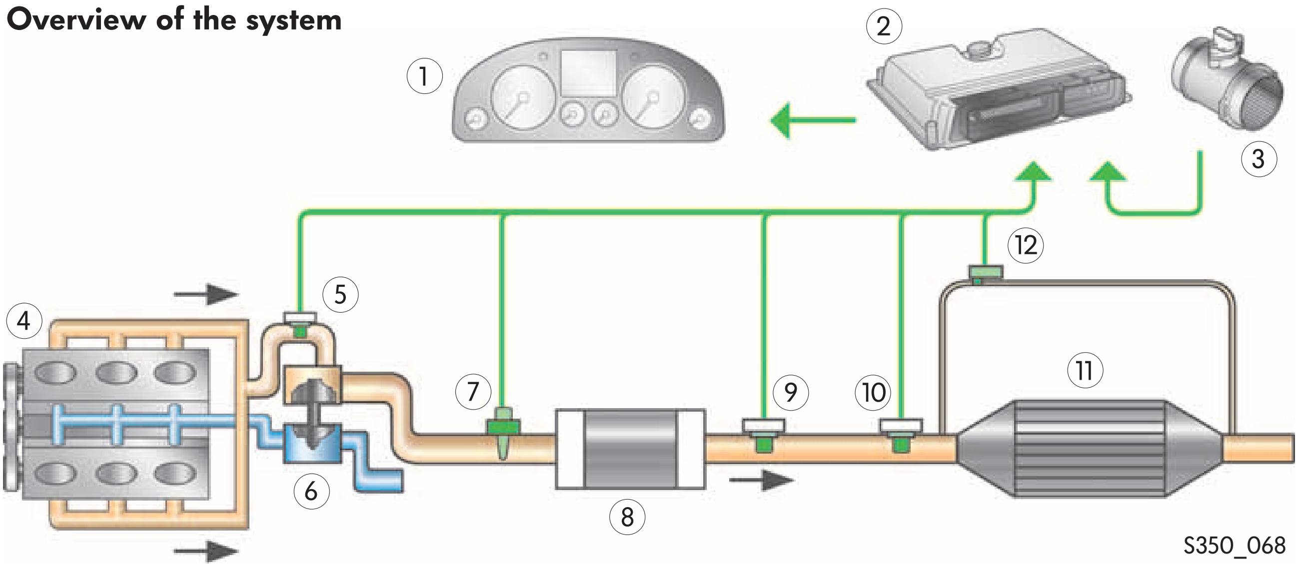
Diesel particulate filter

In the 3.0l V6 TDI engine, carbon particulate emissions are additionally reduced by means of a diesel particulate filter in addition to measures implemented inside the engine. This diesel particulate filter is located in the exhaust system downstream of the oxidising catalytic converter which is positioned under the bonnet.



S350_035

Overview of the system



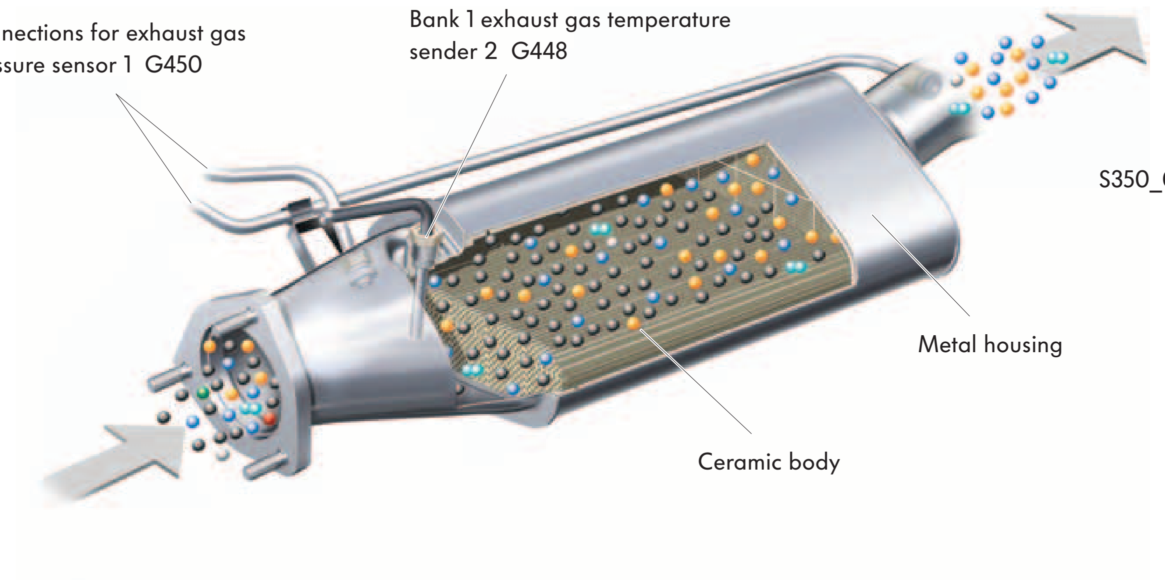
S350_068

1. Control unit with display in dash panel insert J285
2. Diesel direct injection system control unit J248
3. Air mass meter G70
4. Diesel engine
5. Exhaust gas temperature sender 1 G235
6. Turbocharger
7. Lambda probe G39
8. Oxidising catalytic converter
9. Catalytic converter temperature sensor 1 G20 (Phaeton only)
10. Bank 1 exhaust gas temperature sender 2 G448
11. Particulate filter
12. Exhaust gas pressure sensor 1 G450

Structure

The diesel particulate filter is comprised of a honeycombshaped ceramic body manufactured from silicon carbide, which is contained in a metal housing. The ceramic body is sub-divided into a multitude of small channels, which are sealed on alternating sides. This results in intake and exhaust channels which are separated by filter walls.

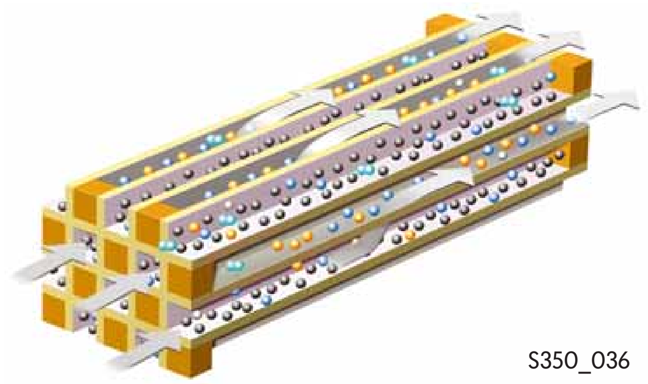
The silicon carbide filter walls are porous and are coated with a substrate comprised of aluminium oxide and cerium oxide. The precious metal platinum, which serves as the catalyst, is vapour-deposited onto this substrate.
The cerium oxide coating in the particulate filter lowers the carbon's ignition temperature and accelerates the thermal reaction with oxygen.



S350_062

Function

The exhaust gas, which contains carbon, flows through the intake channels' filter walls. Unlike the gaseous components of the exhaust gas, the carbon particles are retained in the intake channels.



S350_036

Regeneration

To prevent the particulate filter from becoming blocked with carbon particles, thereby impeding its function, it must be regularly regenerated. During the regeneration process, the carbon particles which have collected in the particulate filter are burned (oxidised).
During regeneration of the catalytically coated particulate filter, a distinction is made between passive and active regeneration. This process is imperceptible to the driver.

Passive regeneration

During passive regeneration, the carbon particles are continuously combusted without engine management system intervention. This is primarily carried out at high engine loads, e.g. motorway driving, at exhaust gas temperatures of 350 – 500 °C.

In this case, the carbon particles are converted to carbon dioxide via a reaction with nitrogen dioxide.

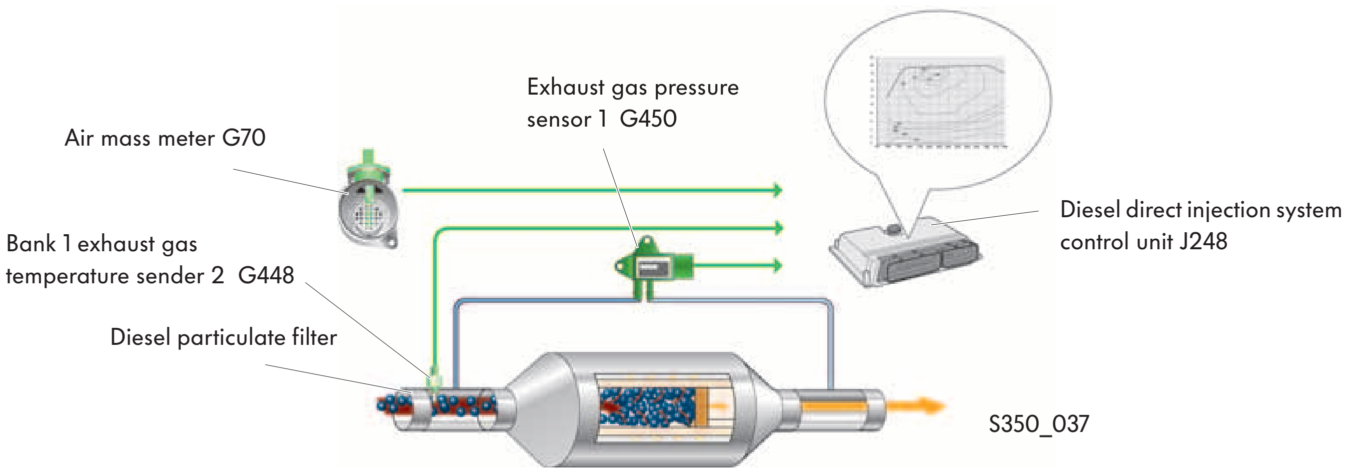
Active regeneration

In urban traffic, i.e. low engine load, the exhaust gas temperatures are too low for passive regeneration. As no further carbon particles can be degraded, the carbon accumulates in the filter.

As soon as a specific level of carbon has been reached in the filter, active regeneration is introduced by the engine management system. This process takes approximately 10 – 15 minutes. The carbon particles are combusted together with oxygen at an exhaust gas temperature of 600 – 650 °C to form carbon dioxide.

Active regeneration function

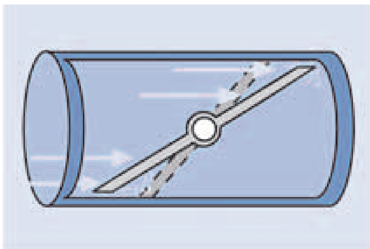
The particulate filter's carbon level is calculated by two pre-programmed level models in the engine control unit. One carbon level model is determined from the user's driving style and the exhaust gas temperature sensor and lambda probe signals. The other carbon level model is the diesel particulate filter's flow resistance, which is calculated from the signals output by exhaust gas pressure sensor 1, bank 1 exhaust gas temperature sender 2 and the air mass meter.



S350_037

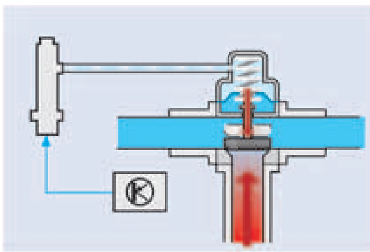
As soon as the carbon level limit value has been reached in the particulate filter, active regeneration is introduced by the engine management system. The following measures lead to a specific, temporary increase in exhaust gas temperature to approximately 600 – 650 °C. In this temperature range, the carbon collected in the particulate filter oxidises to form carbon dioxide.

- The intake air supply is regulated via the electric throttle valve.



S350_041

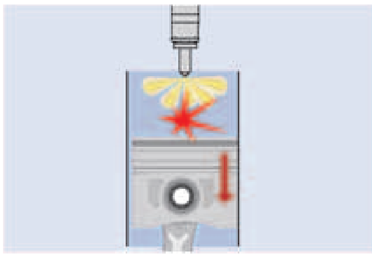
- Exhaust gas recirculation is switched off to increase the combustion temperature and the oxygen content in the combustion chamber.



S350_038

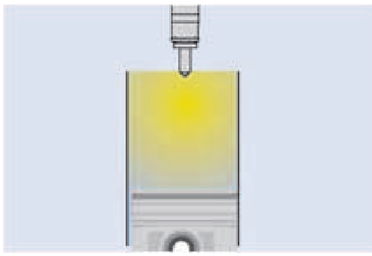
Engine mechanical system

- Shortly after "retarded" main injection, the first secondary injection is introduced to increase the combustion temperature.



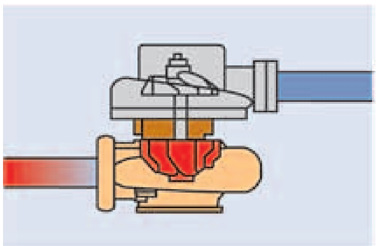
S350_039

- Further secondary injection is introduced long after main injection. This fuel does not combust in the cylinder, but evaporates in the combustion chamber. The uncombusted hydrocarbons contained in this fuel vapour are oxidised in the oxidising catalytic converter. The heat which is generated during this process increases the exhaust gas temperature upstream of the particulate filter to approximately 620 °C.
The engine control unit uses the signals transmitted by the bank 1 exhaust gas temperature sender 2 (Touareg) or catalytic converter temperature sensor 1 (Phaeton) to calculate the injection quantity for retarded secondary injection.



S350_069

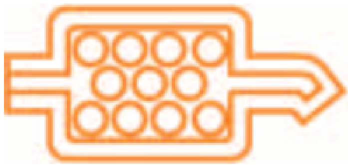
- The charge pressure is adapted to prevent the driver from noticing a perceptible change in torque during the regeneration process.



S350_042

Diesel particulate filter warning lamp K231

In the event of extreme, short-distance operation, regeneration of the diesel particulate filter may be impeded, because the exhaust gas temperature fails to achieve the required temperature value. As regeneration is unable to take place, filter damage or blockage due to carbon overloading is possible. To avoid cases such as these, the diesel particulate filter warning lamp in the dash panel insert lights up if the carbon level has reached a certain limit value.



S350_070

Via this signal, the driver is requested to drive at increased speed for a short period of time.
The warning lamp must go out following this measure. If the diesel particulate filter warning lamp does not go out despite this measure, the glow period warning lamp lights up. The text "Engine malfunction - workshop" appears in the dash panel insert display. The driver is thereby requested to seek the next workshop.

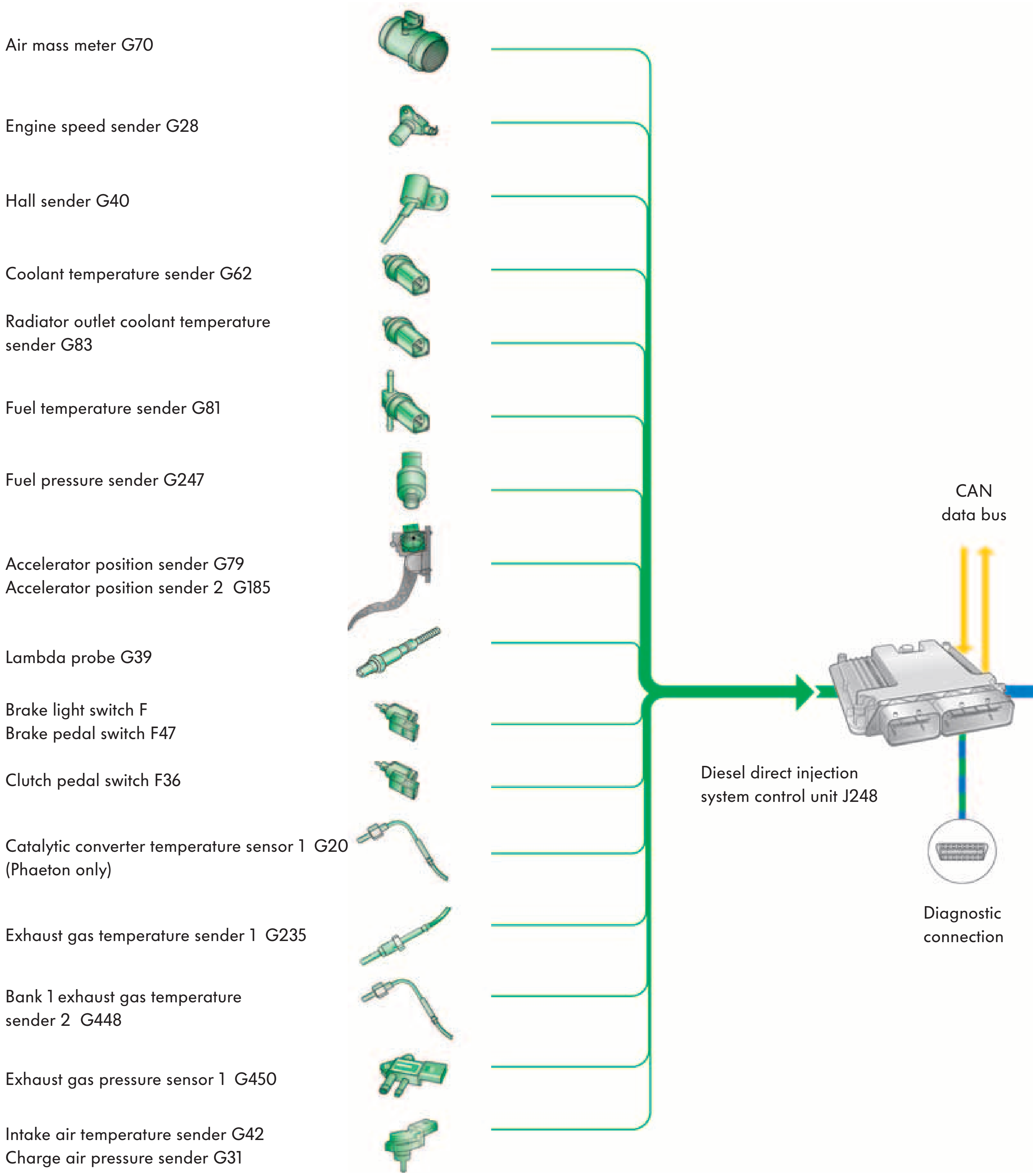
For detailed information on driving behaviour when the diesel particulate filter warning lamp lights up, please refer to the owner's manual.

A detailed description of the diesel particulate filter system can be found in self-study programme No. 336 "The catalytically coated diesel particulate filter".

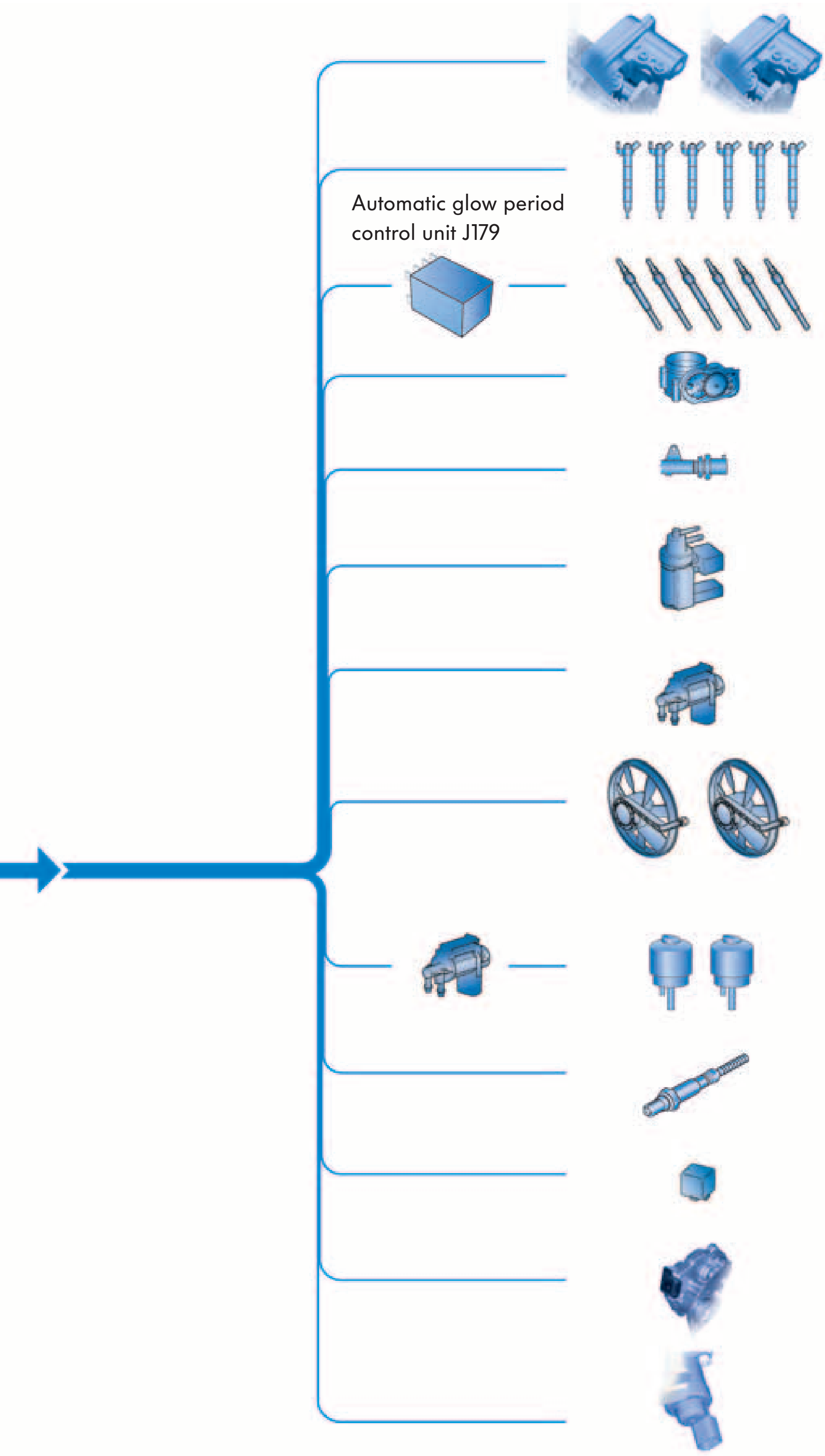
Engine management system

Overview of the system

Sensors



Actuators



Intake manifold flap motor V157
Intake manifold flap 2 motor V275

Injectors for cylinders 1 – 6
N30, N31, N32, N33, N83 and N84

Glow plugs 1 – 6
Q10, Q11, Q12, Q13, Q14 and Q15

Throttle valve module J338

Fuel pressure regulating valve N276

Exhaust gas recirculation valve N18

Exhaust gas recirculation cooler change-over valve N345

Radiator fan control unit J293
Radiator fan control unit 2 J671
Radiator fan V7
Radiator fan 2 V177

Left electrohydraulic engine mounting solenoid valve N144 (Phaeton only)

Lambda probe heater Z19

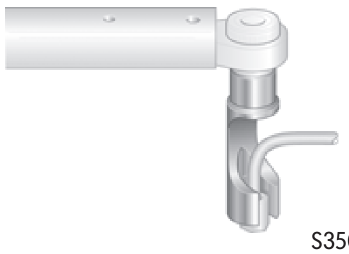
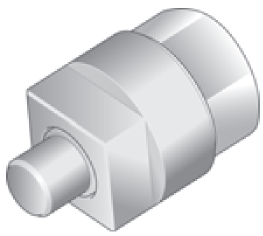
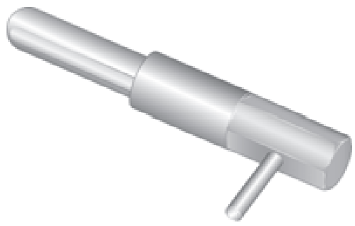
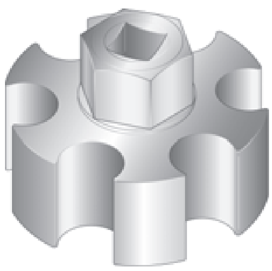
Fuel pump relay J17 for
fuel pumps G6 and G23

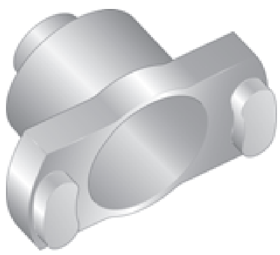
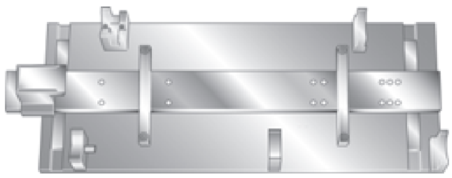
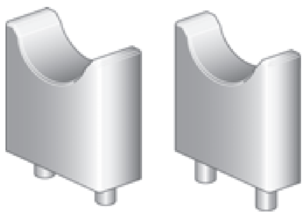
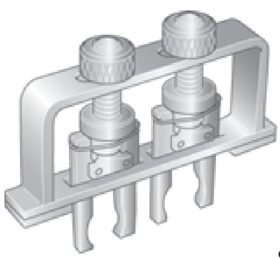
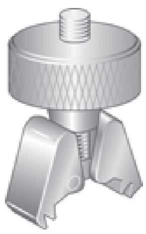
Turbocharger 1 control unit J724

Fuel metering valve N290

S350_048

Special tools

Designation	Tool	Use
T40049 Adapter	 S350_059	For turning the crankshaft over.
T40055 Socket	 S350_051	For loosening and tightening the union nut connection on high-pressure pipes in the common rail fuel injection system.
T40058 Adapter	 S350_058	For turning the crankshaft over.
T40060 Adjustment pin	 S350_060	For securing the camshafts when adjusting valve timing.
T40061 Adapter	 S350_061	For correcting the position of the camshafts when adjusting the valve timing.

Designation	Tool	Use
T40062 Adapter	 S350_057	For tensioning the chain sprocket when adjusting valve timing.
T40094 Camshaft insert tool	 S350_052	For installing the camshafts.
T40094/1 and T40094/2 Support	 S350_055	For installing the camshafts.
T40095 Bracket	 S350_054	For installing the camshafts.
T40096 Tensioner	 S350_053	For installing the camshafts.

Test your knowledge

Which are the correct answers?

One, several or all answers may be correct.

1. What is the task of camshaft spur gear backlash compensation?

☐ a) Backlash compensation ensures that the camshafts are driven with little noise.
☐ b) Backlash compensation ensures that the intake camshaft is adjusted at high engine speeds.
☐ c) Backlash compensation ensures rigid engine speed compensation between the gears on the intake and exhaust camshaft.

2. What do the swirl flaps in the intake manifold do?

☐ a) The swirl flaps interrupt the supply of air in the intake port. Due to this, less air is intaken and compressed, as a result of which engine coasting is gentle.
☐ b) Due to the position of the swirl flaps, air movement in the intake swirl port is adapted to the engine speed.
☐ c) In certain engine operating states, the swirl flaps generate a difference between the intake manifold pressure and exhaust gas pressure. This guarantees effective exhaust gas recirculation.

3. In the timing chain drive, how is the necessary camshaft : crankshaft ratio of 2 : 1 achieved?

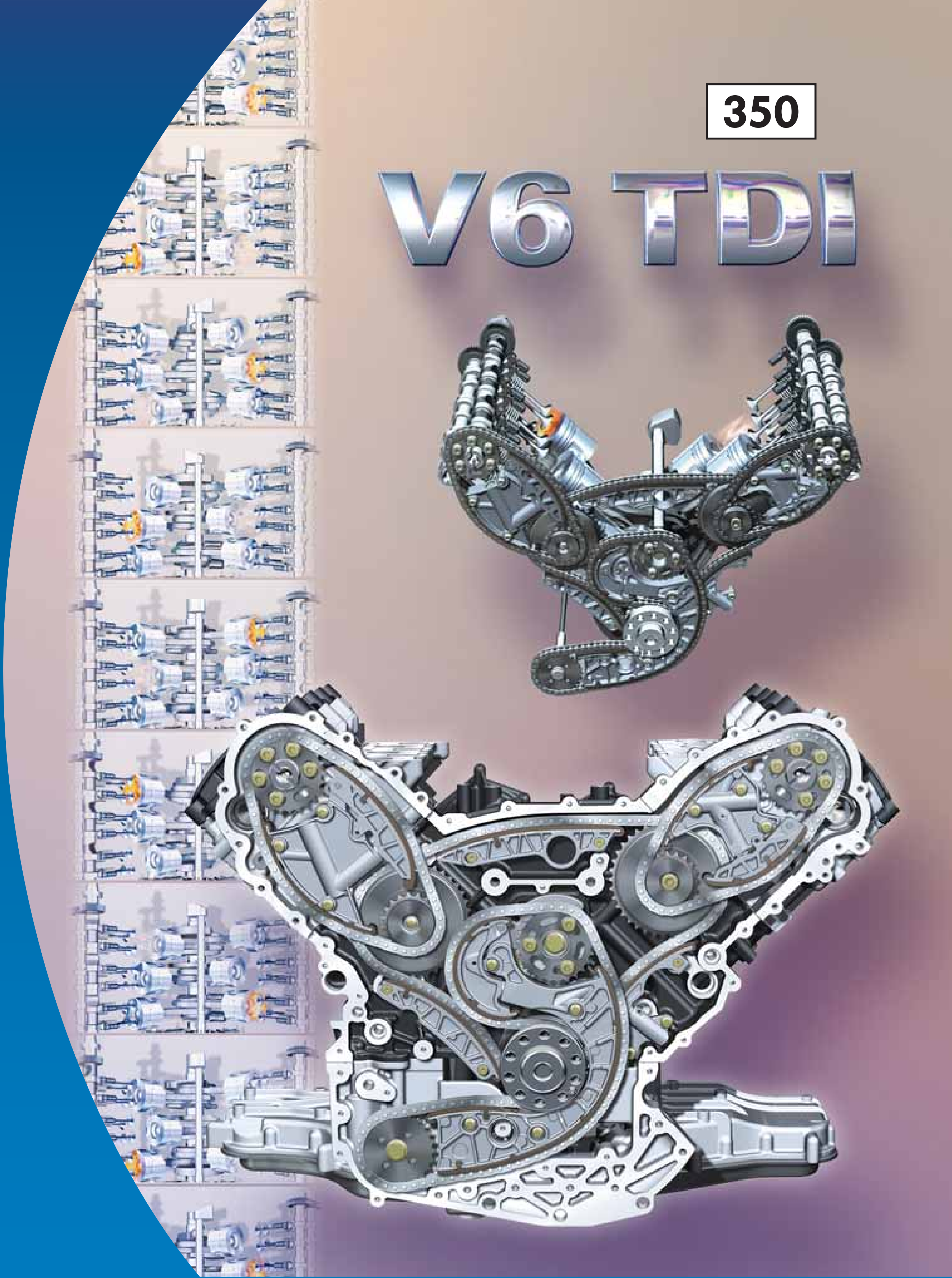
☐ a) Via hydraulic chain tensioners.
☐ b) Via intermediate gears.
☐ c) Via the length of the timing chains.

4. Which statement regarding the diesel particulate filter system fitted in the 3.0l V6 TDI engine in the Phaeton and Touareg is correct?

☐ a) An oxidising catalytic converter and a catalytically coated diesel particulate filter are combined in one component and located beneath the bonnet.
☐ b) A catalytically coated diesel particulate filter is located in the exhaust system below the vehicle floor.
☐ c) The 3.0l V6 TDI engine has a diesel particulate filter system which is supported by an additive.

Solutions:

1. a; 2. b; 3. b; 4. b



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