



Self-study programme 890495AG

The 3.0 l V6 TDI Engine (Generation 2)

Design and function



The material in this Self Study Program (SSP) may contain technical information or reference vehicle systems and configurations which are not available in the Canadian market.

Please ensure you reference ElsaPro for the most current technical information and repair procedures.

The first generation of the 3.0 I V6 TDI engine entered series production at Volkswagen in 2005 (it was first used by Audi in 2003).

The 3.0 I V6 engine developed by Audi has been used in various VW Group models with great success. Over 1.6 million V6 TDI engines have now been built.

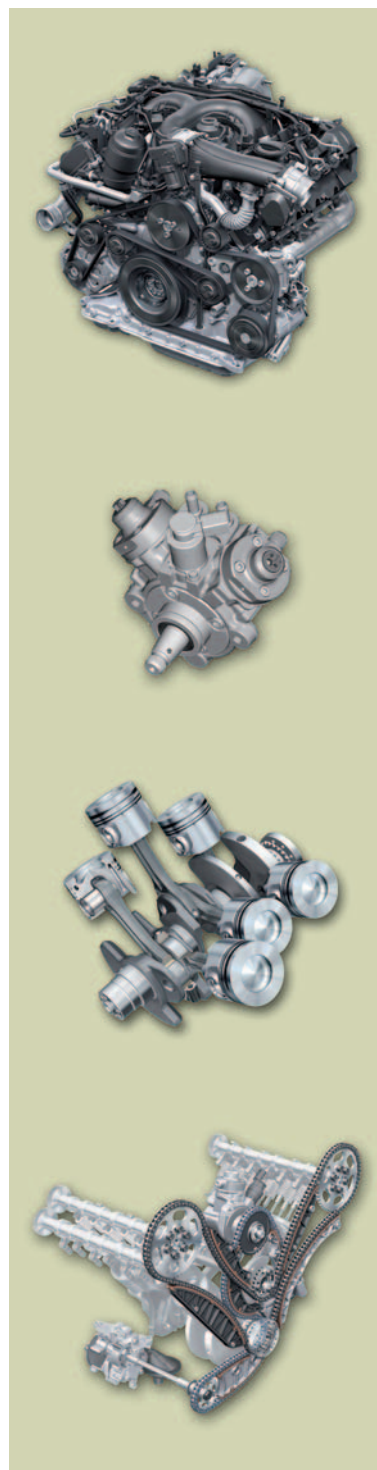
Now in 2011, Volkswagen is introducing the second generation of this engine.

This newly developed engine successfully combines low consumption figures, low emissions and a high level of power development with reduced engine weight. The focus was on minimising friction and achieving a lightweight design.

The new V6 TDI generation comes in two output versions — a 180 kW version and a 150 kW version.

An optimised piezo common rail injection system with up to 2,000 bar fuel rail pressure is used.

The V6 TDI engine is already designed for future developments in terms of output, emissions and fuel consumption.



S495_002

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

Current testing, setting and repair instructions can be found in the provided service literature.



**Important
note**

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Introduction



The 3.0 l V6 150 kW TDI Engine (Generation 2) with Bosch common rail injection system

Technical features

- Bosch common rail injection system with piezo injectors (2,000 bar injection pressure)
- Oxidising catalytic converter/diesel particulate filter
- Turbocharger from Honeywell Turbo Technologies (HTT) GT 2256
- Innovative Thermal Management (ITM)
- Chain drive, new chain layout
- Demand-controlled in-tank fuel pump

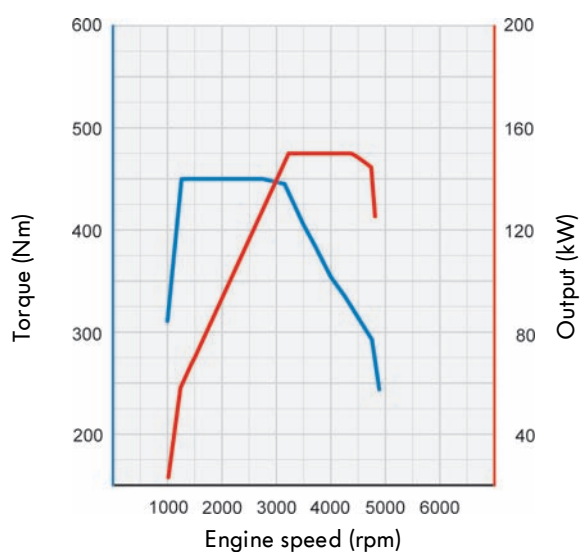


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Technical data

Engine code	CJMA
Type	V6 engine with 90° V angle
Displacement	2,967 cm ³
Bore	83 mm
Stroke	91.4 mm
Valves per cylinder	4
Compression ratio	16.8 : 1
Max. output	150 kW at 3,200 to 4,400 rpm
Max. torque	450 Nm at 1,250 at 2,750 rpm
Engine management	Bosch CRS 3.3 common rail injection system
Fuel	Diesel, according to DIN EN590
Exhaust emissions standard	EU5

Torque and output diagram



S495_005

The 3.0 l V6 180 kW TDI Engine (Generation 2) with Bosch common rail injection system



Technical features

- Bosch common rail injection system with piezo injectors (2,000 bar injection pressure)
- Oxidising catalytic converter/diesel particulate filter
- Turbocharger from Honeywell Turbo Technologies (HTT) GT 2260
- Innovative Thermal Management (ITM)
- Chain drive, new chain layout
- Demand-controlled in-tank fuel pump

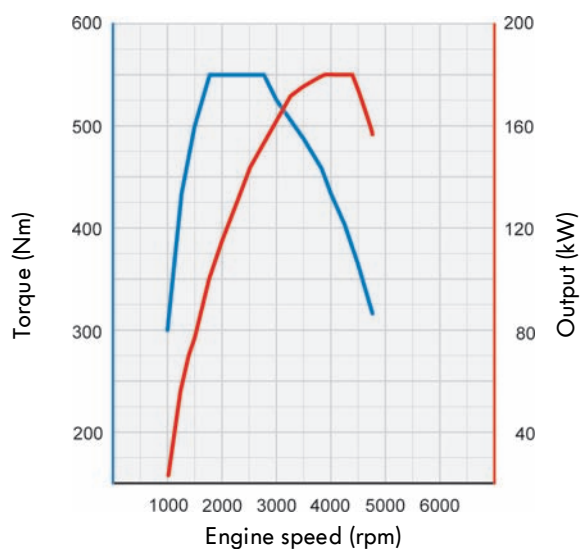


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Technical data

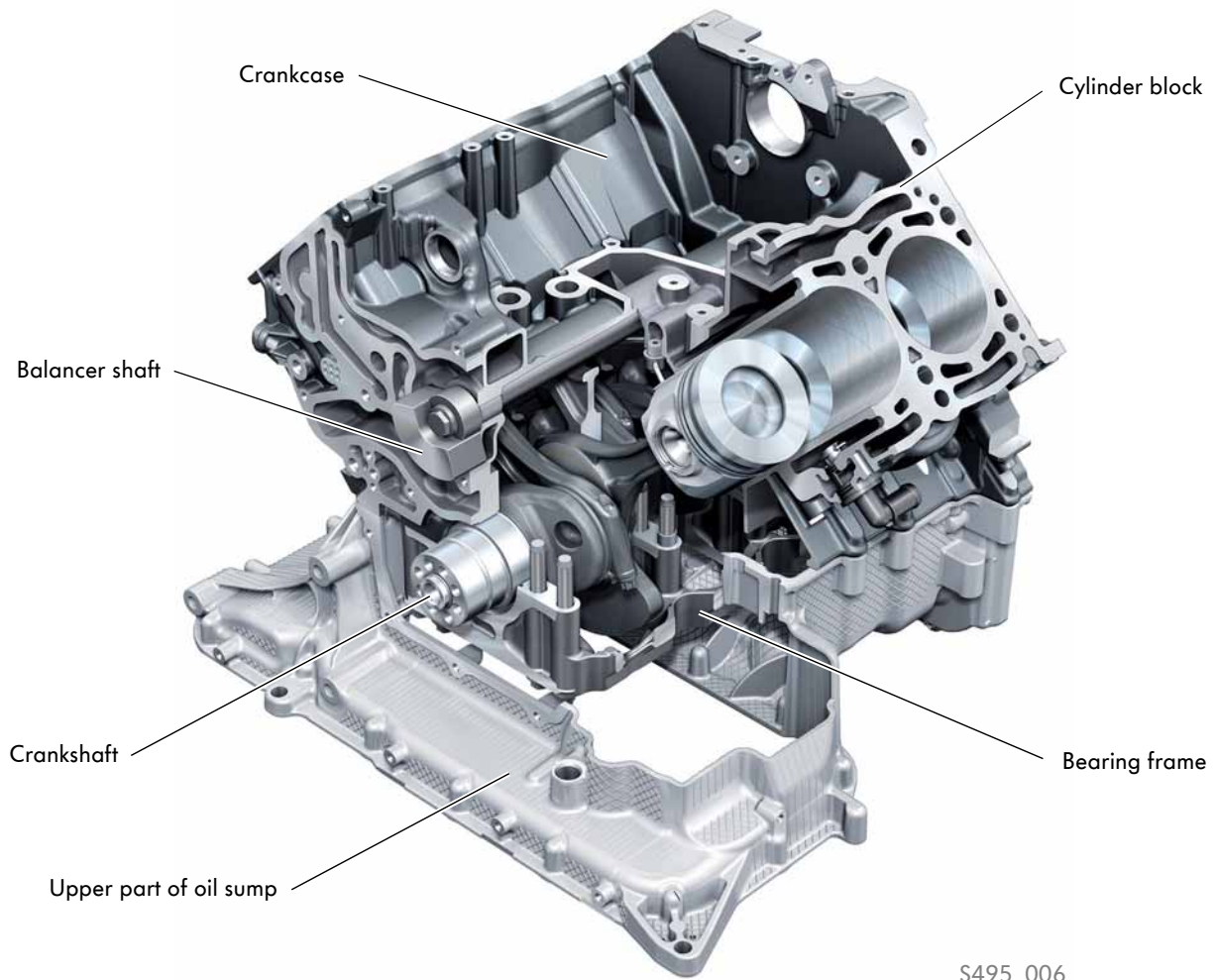
Engine code	CRCA
Type	V6 engine with 90° V angle
Displacement	2,967 cm ³
Bore	83 mm
Stroke	91.4 mm
Valves per cylinder	4
Compression ratio	16.8 : 1
Max. output	180 kW at 3,800 to 4,400 rpm
Max. torque	550 Nm at 1,750 to 2,750 rpm
Engine management	Bosch CRS 3.3 common rail injection system
Fuel	Diesel, according to DIN EN590
Exhaust emissions standard	EU5

Torque and performance diagram



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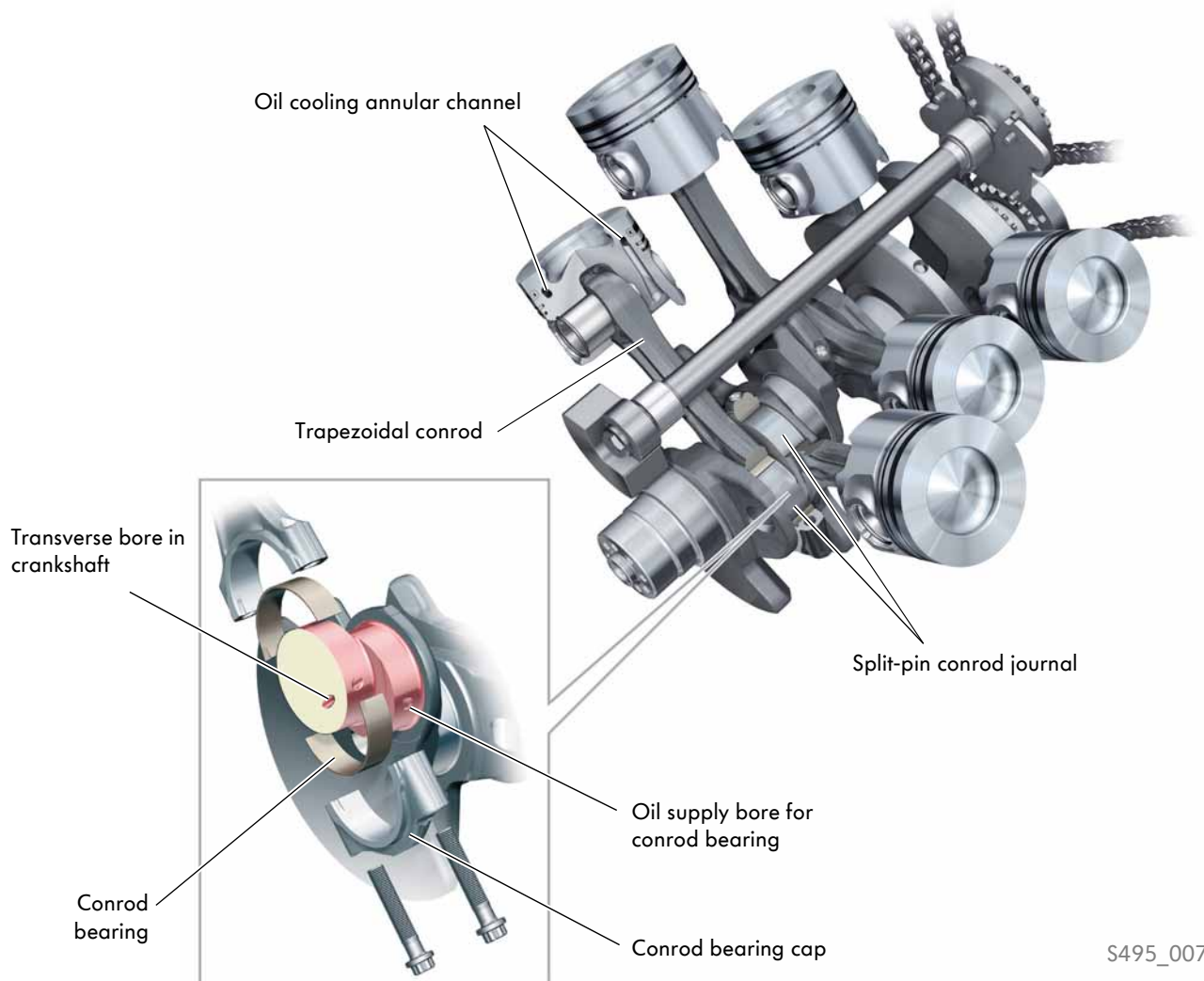
Crankshaft drive



The basic design of the crankcase has been kept for the new generation of engines. High strength and high load-bearing capacity are crucial here.

The proven bearing frame design has been retained for the crankshaft bearings for reasons of strength. By reducing the wall thicknesses throughout and by means of optimisation, it has been possible to reduce the weight of the crankcase by 8 kg compared with the previous generation and thus follow the principles of lightweight design.

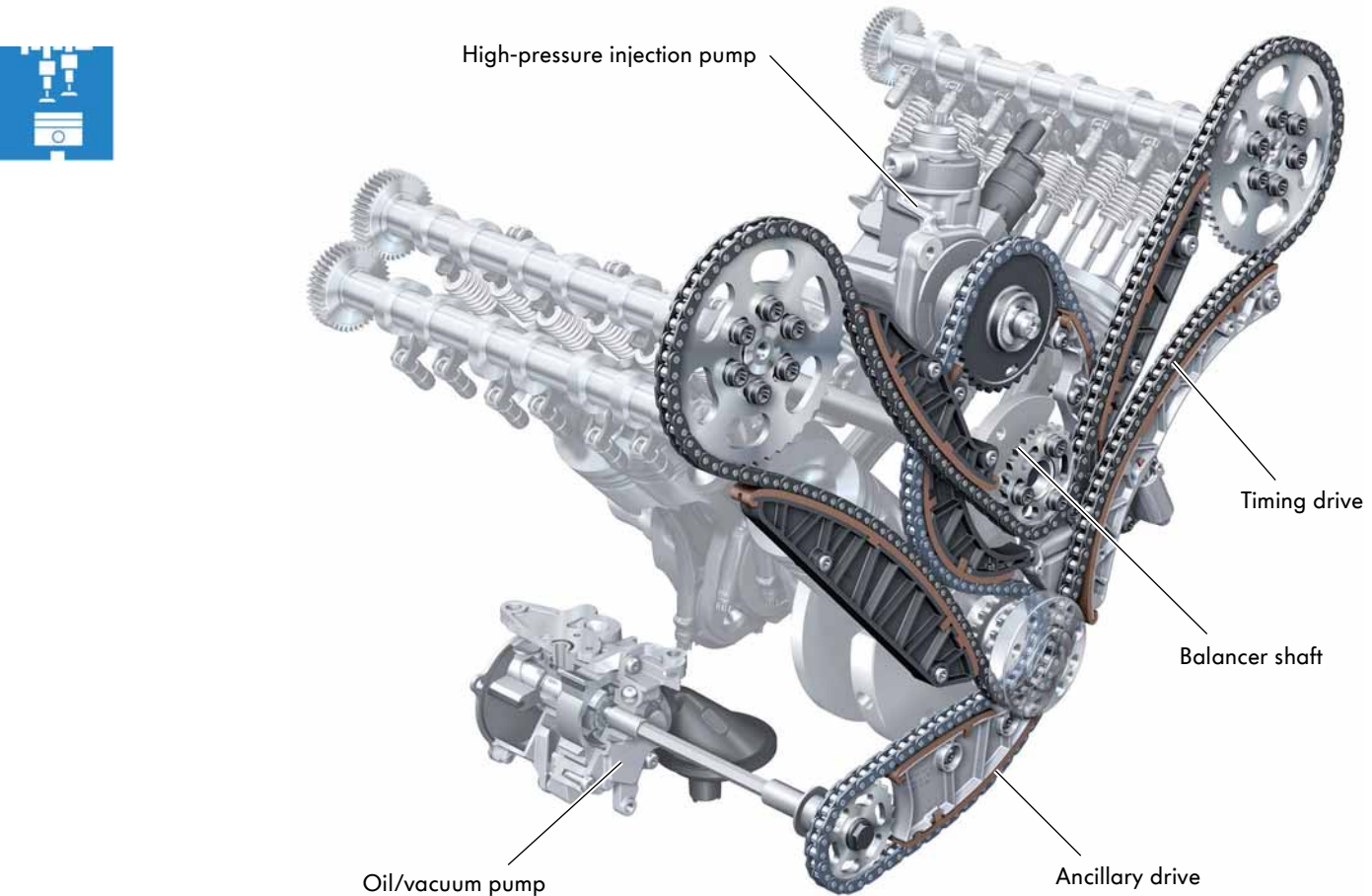
The deck-plate honing method has been used for the cylinder bores. This creates an optimum cylinder shape. The near perfect shape allows lower piston ring tension, which results in lower blow-by rates and lower mechanical friction.



The forged crankshaft uses a split-pin design in the 90° V engine to achieve equal firing intervals and improve the quiet running of the engine. Both the main bearing and the conrod bearing journals are induction hardened to ensure sufficient strength.

The forged conrods are split diagonally and industrially cracked. Due to the high thermal loading, the aluminium pistons use a salt-core cooling gallery and splash oil cooling for optimum cooling of the piston crown and piston ring set.

Chain drive



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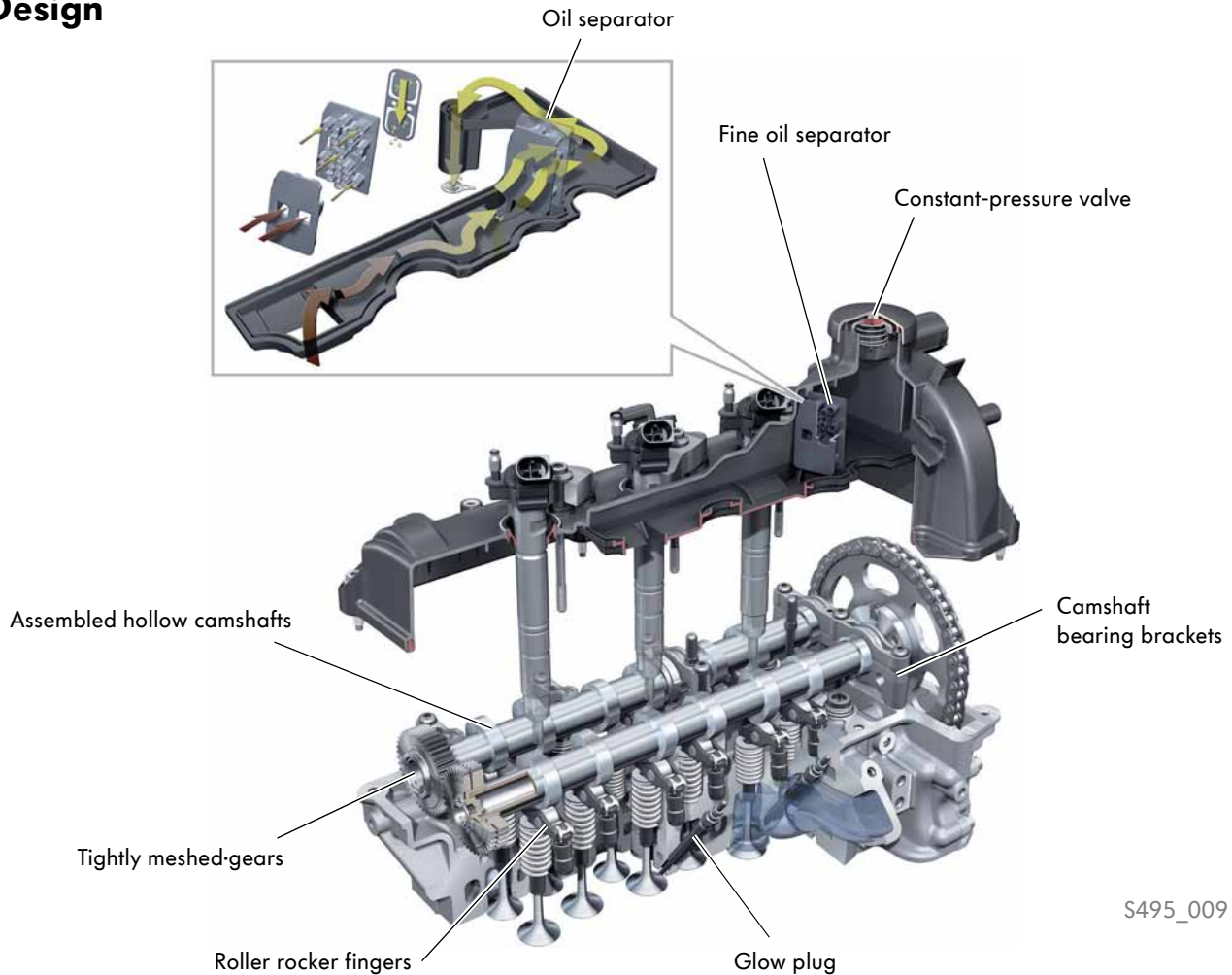
The dual-chain drive on the gearbox end has been further improved for the V6 engine.

In the timing drive, a relatively long roller chain with 206 links is used to drive the two inlet camshafts and the balancer shaft. The chains have a wear-resistant coating. This reduces the amount the chains stretch over long periods of usage. The ancillary drive chain is also a roller chain. It drives the high-pressure injection pump and the oil and vacuum pumps, which are combined in one case.

The new chain layout has allowed the number of chains and chain tensioners to be reduced from four to two. The omission of two idler gears and the new drive system for the high-pressure pump without additional toothed belt drive also contribute to simplifying assembly and reducing friction and weight.

Cylinder head

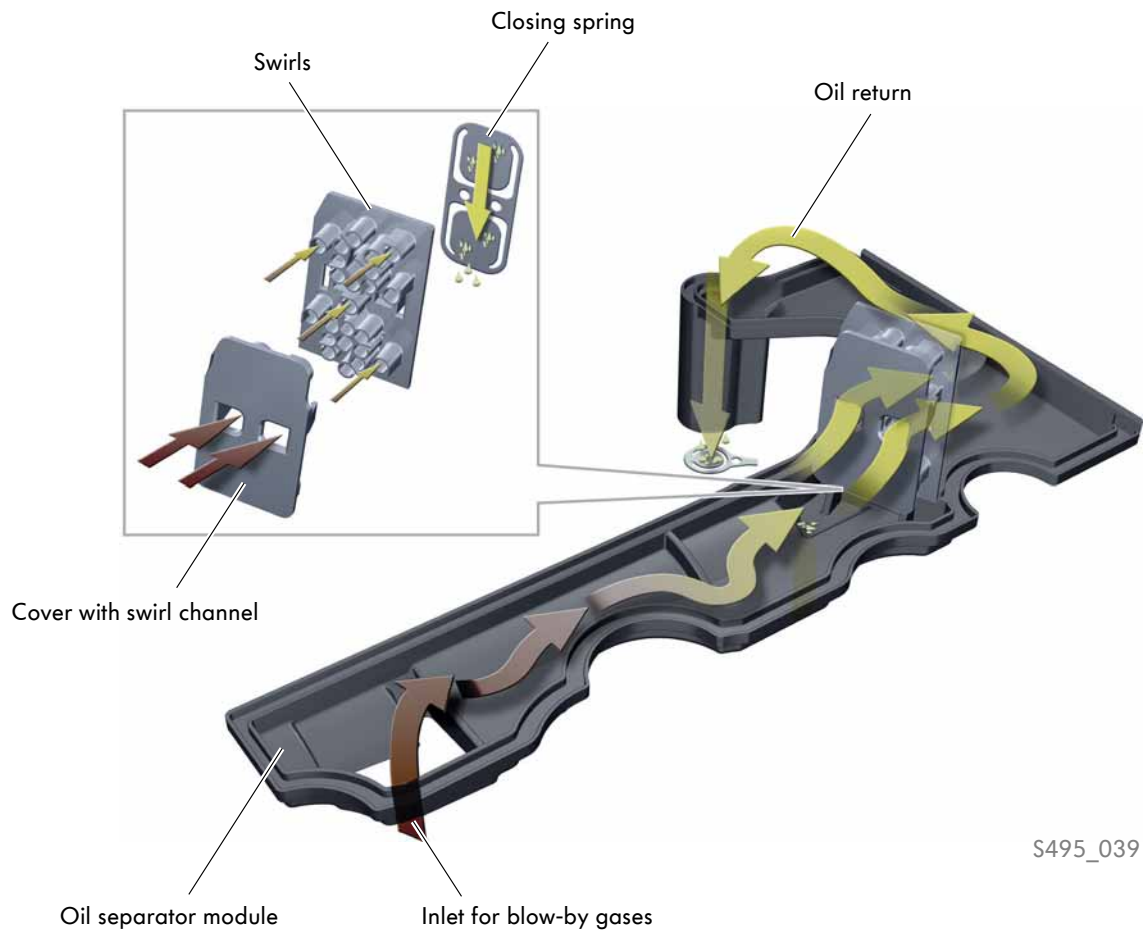
Design



The proven four-valve combustion method has been taken from the previous engine with one tangential and one filling port on the inlet side and two combined exhaust ports. The inlet ports have been improved in terms of swirl and gas flow. The cooling concept of the cylinder head has been revised to keep the temperatures in the vicinity of the combustion chamber at an acceptable level. The exhaust ports have been positioned further apart and made smaller to increase the size of the coolant chamber. Furthermore, the coolant chamber has been designed so that a specific flow of coolant at high rates and optimum cooling is possible in the areas close to the combustion chambers. The coolant enters on the exhaust side via three separate ports for each cylinder.

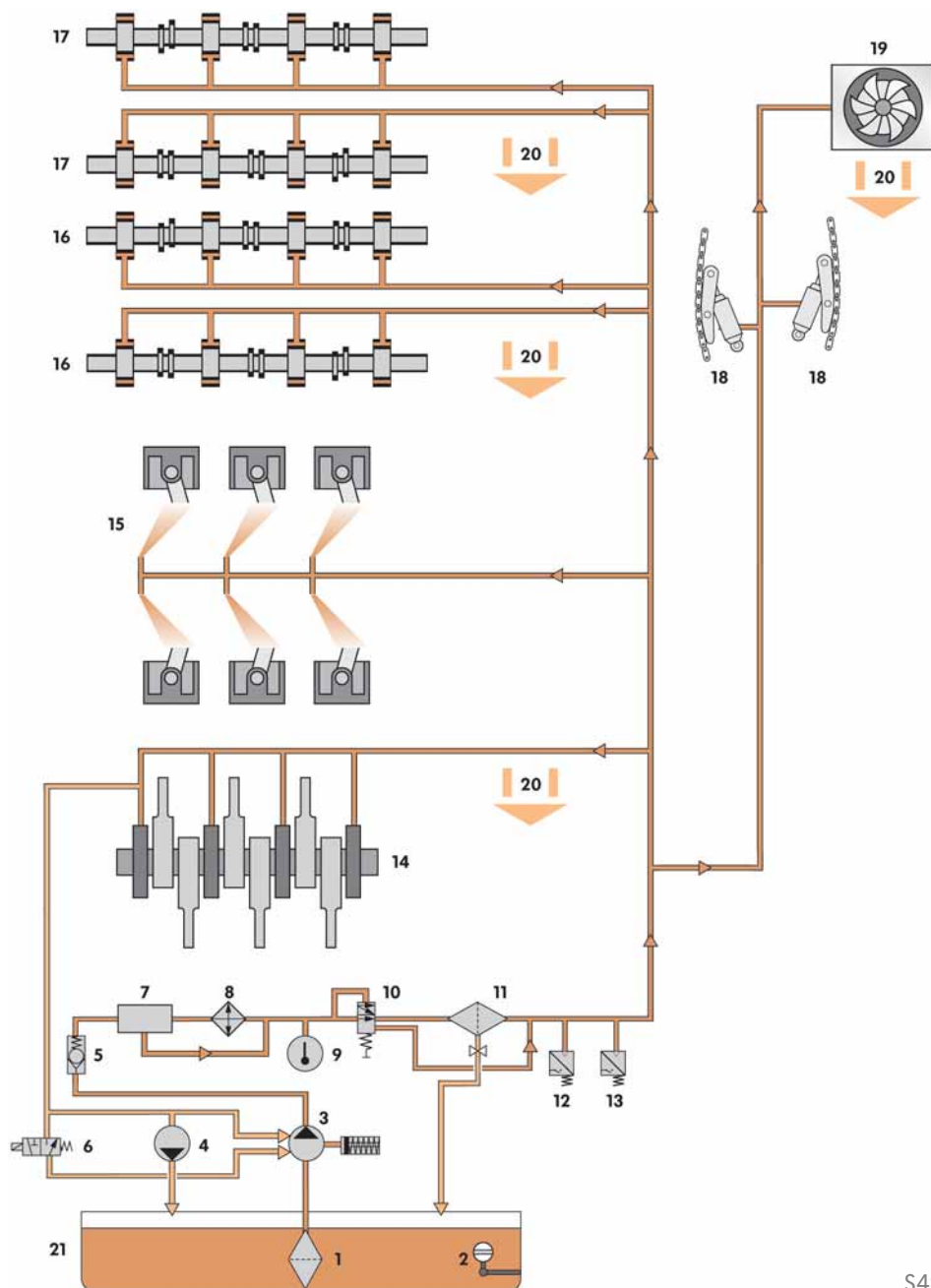
The main flow is guided between the exhaust valves and is then distributed among the remaining bridge areas between valves.

The assembled hollow camshafts are fitted with split double bearing brackets (instead of ladder frame). This assembly sequence allows for a camshaft design without special clearances for fitting the cylinder head bolts. For acoustic reasons, the exhaust camshafts are driven via tightly meshed gears. The bearing diameter of the camshafts has been reduced from 32 mm to 24 mm to reduce friction.



The engine breather system has been moved from the inner V to the cylinder heads. Coarse and fine oil separators are integrated into both cylinder head covers. The crankcase breathers run via the pressure regulating valve to the suction side of the turbocharger.

Oil system



S495_010

- | | |
|--|---|
| 1. Pickup screen | 12. Oil pressure switch for reduced oil pressure F378 |
| 2. Oil level and oil temperature sender G266 | 13. Oil pressure switch F22 |
| 3. Oil pump | 14. Crankshaft |
| 4. Vacuum pump | 15. Spray jets for piston cooling |
| 5. Non-return valve | 16. Camshafts for cylinder bank 1 |
| 6. Valve for oil pressure control N428 | 17. Camshafts for cylinder bank 2 |
| 7. Thermostat | 18. Chain tensioner |
| 8. Engine oil cooler | 19. Turbocharger |
| 9. Oil temperature sender G8 | 20. Oil return |
| 10. Filter bypass valve | 21. Sump |
| 11. Oil filter | |

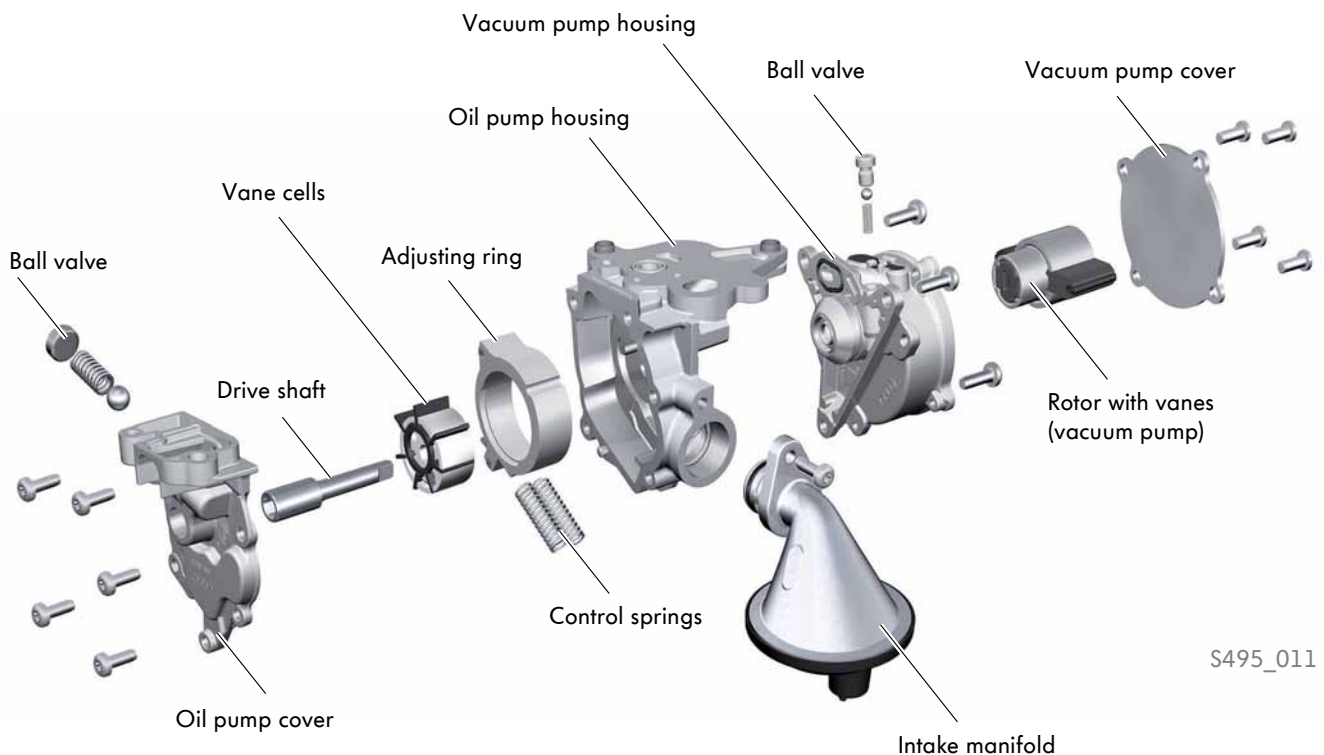
Volumetric flow-controlled oil pump with vacuum pump

The oil pump with two pressure stages from the 4.2 l V8 TDI engine is also used on the new 3.0 l V6 TDI engine.

The volumetric flow-controlled vane pump can change its supply characteristics by means of an eccentrically mounted adjusting ring. The oil pump switches between the pressure stages depending on the engine load, engine speed and the oil temperature.

The configuration as a pump combination is new. The oil pump and the vacuum pump are combined in one housing. The two pumps are driven by the chain drive system on the gearbox side via a stub shaft. The vacuum pump produces the vacuum by means of a rotor with adjustable vanes.

Design



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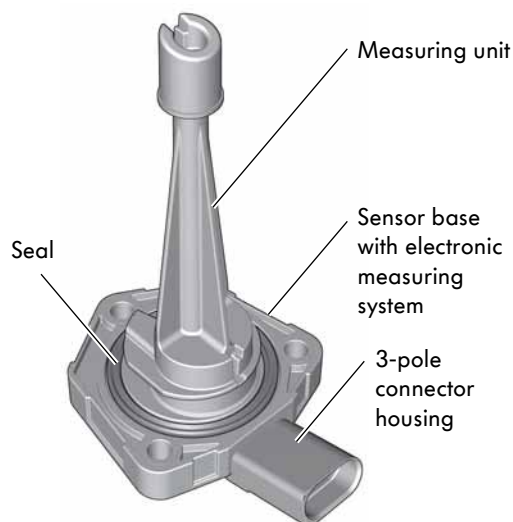


You will find further information on the volumetric flow-controlled oil pump in self-study programme no. 467 "The 4.2 l V8 TDI engine with common rail fuel injection system".

Oil level sensor

An electronic oil level sensor is used in Volkswagen vehicles featuring the 3.0 I V6 TDI (for example, the Touareg). A conventional oil dipstick is not used. The oil level sensor works with ultrasound. The emitted ultrasonic pulses are reflected by the boundary layer of oil and air.

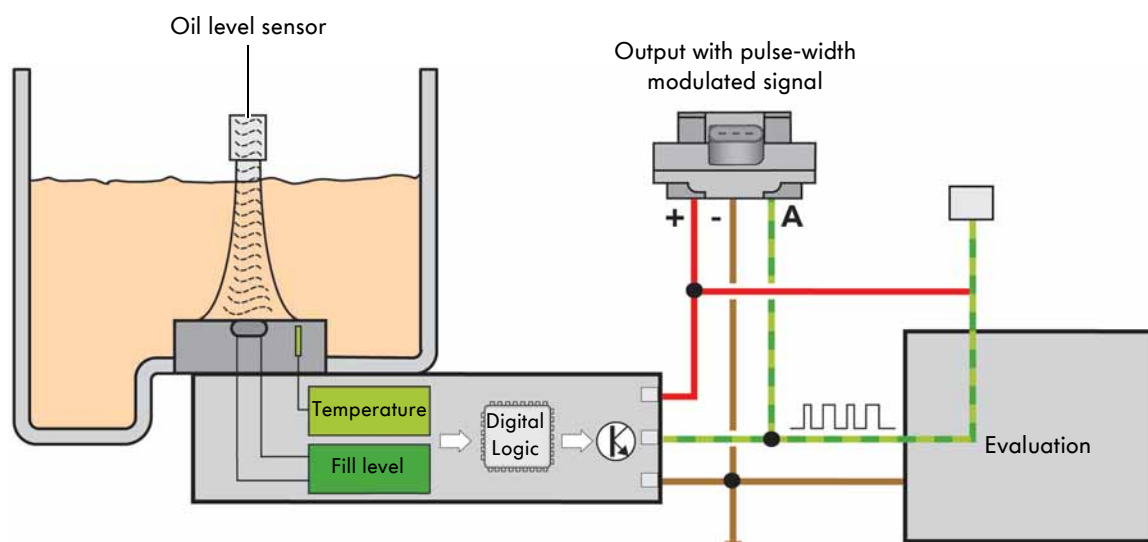
Oil level sensor



S495_012

Operating principle

The oil level is calculated from the time difference between the transmission and the return of the pulse. A PWM (Pulse Width Modulated) signal is transmitted.



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The design and function of the oil level sensor is described in self-study programme no. 467 "The 4.2 I V8 TDI engine with common rail fuel injection system".

Air intake

The intake air reaches the throttle valve from the front end via a plastic air duct. A short plastic air pipe is connected to the throttle valve. The recirculated exhaust gases are fed into the intake connecting pipe via a thermally decoupled sheet metal structure in a way that aids the air flow.

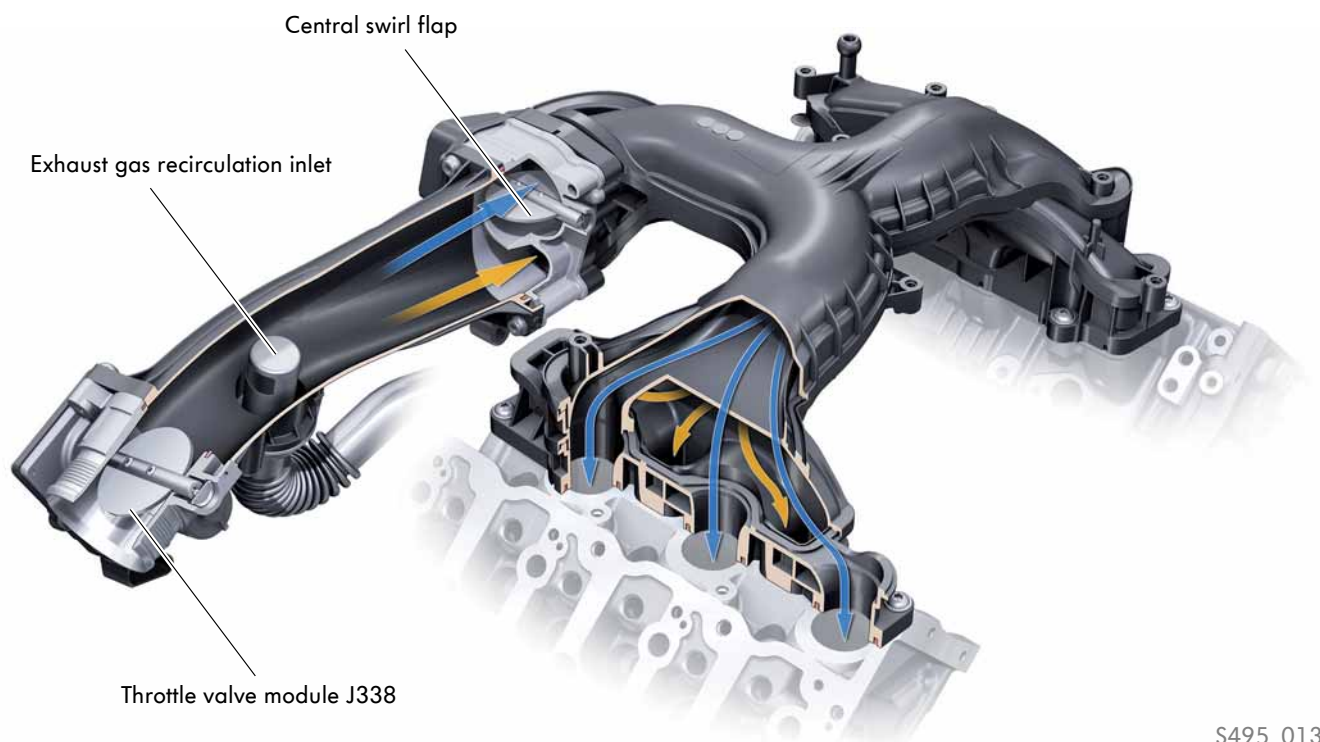
When the exhaust gases are fed in, deposits on the inside plastic wall can be avoided in all operating modes thanks to the geometric shape. At the same time, it ensures a good mixture.

Only one central swirl flap is used for swirl regulation in this new generation of engines compared with the previous six individual flaps in the previous generation.

The intake manifold has two air paths from the swirl flap to the two cylinder banks. The upper part leads the flow of air to the swirl ports and the lower part goes to the filling ports.

The intake manifold geometry has been further improved with regard to pressure loss and even distribution of the air flows to the individual cylinders. The reduction in pressure losses improves performance and consumption.

The plastic intake manifold consists of three shells and is friction welded.



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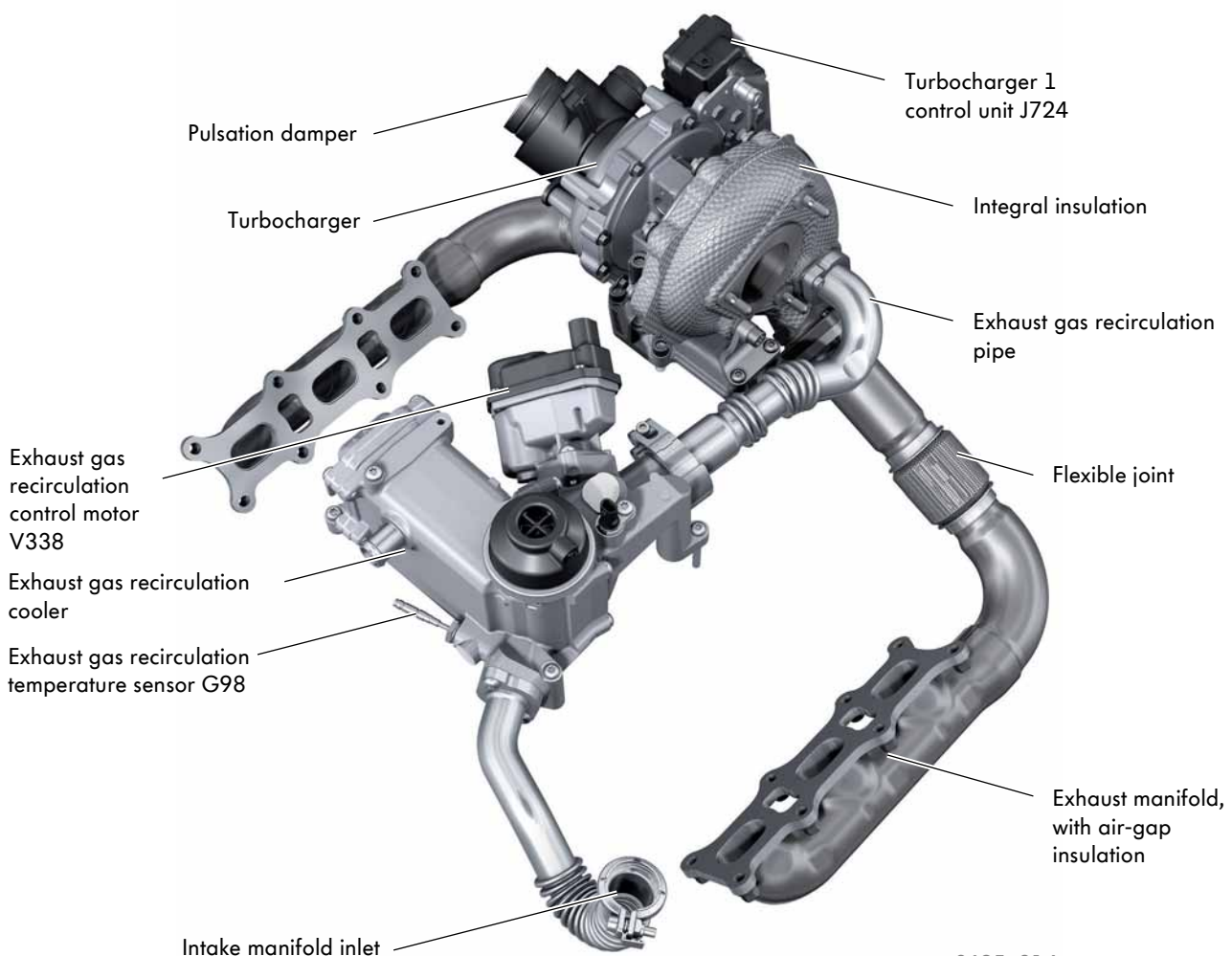
Exhaust gas recirculation (EGR)

The exhaust gas recirculation system plays a decisive role in meeting the emissions standards. The components of the exhaust gas recirculation system, i.e. exhaust gas recirculation valve, exhaust gas recirculation cooler and bypass valve, are combined in the EGR module.

The EGR system collects the exhaust gases at the turbocharger housing. It has been optimised to reduce pressure losses related to the high recirculation rates. The cooling performance of the EGR system has been optimised so that, despite the omission of the separate low-temperature coolant circuit, the same EGR cooling performance is achieved as for the previous engine.

The exhaust gas recirculation cooler has been incorporated into the cylinder head circuit. It is no longer supplied with cold coolant from the main radiator. This causes the temperature of the coolant supplied to the EGR cooler system to rise. The cooling performance of the exhaust gas recirculation cooler has, however, been increased by approx. 1 kW. As a result, it was possible to slightly increase the cooling performance of the whole system.

The advantage of the new EGR cooling system is its greatly reduced complexity. This includes the incorporation of the EGR coolant circuit into the cylinder head circuit of the new dual-circuit cooling system. Furthermore a considerable reduction in weight has also been achieved.



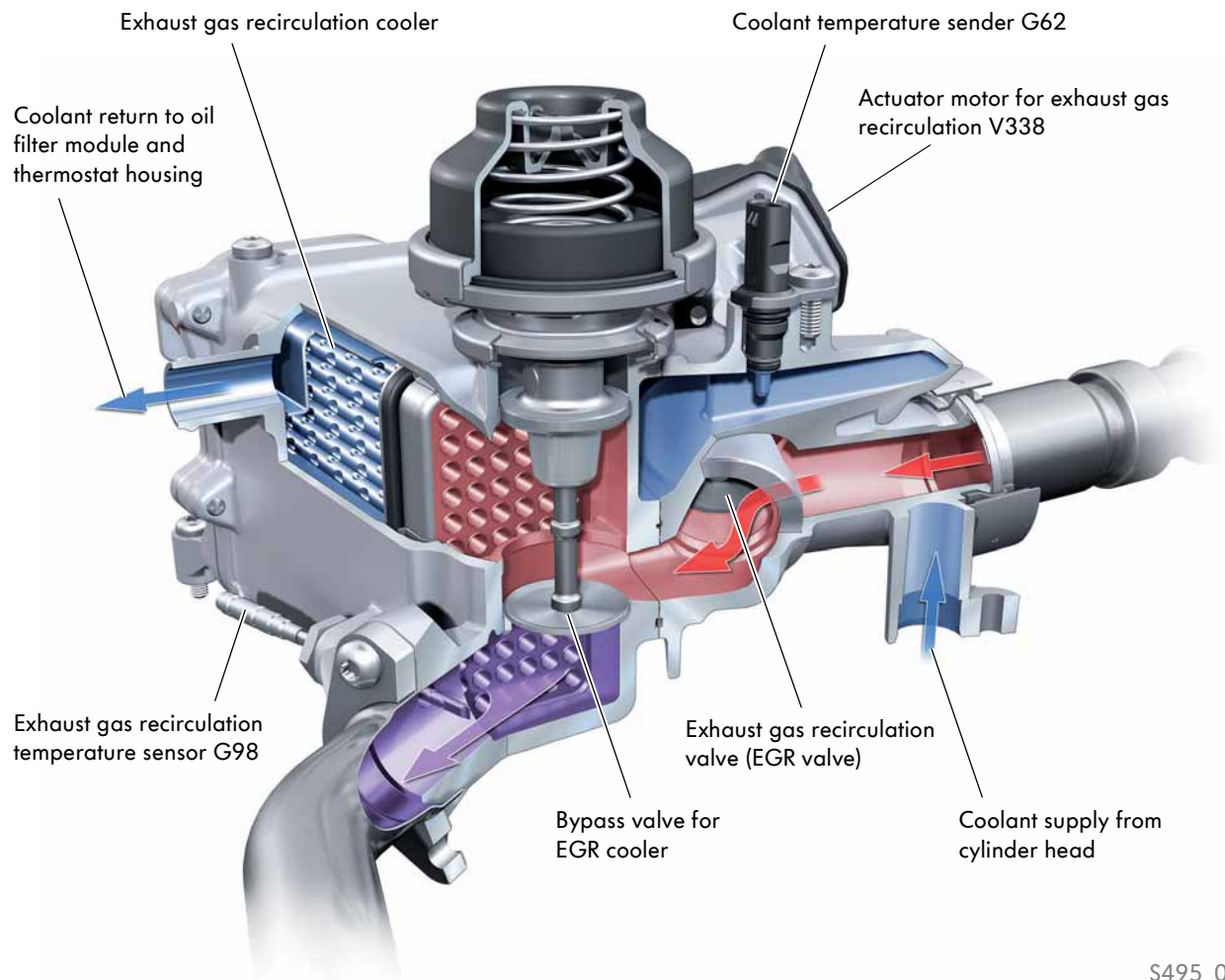
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Cooler for exhaust gas recirculation

The newly developed electrically operated exhaust gas recirculation valve is located on the “hot side” of the engine. To reduce pressure loss, the seat diameter of the valve has been enlarged from 27 mm to 30 mm for the new generation.

The high-performance exhaust gas recirculation cooler is made from stainless steel in a pipe design and is integrated into the aluminium housing of the EGR module. A pneumatic lift valve is fitted instead of a flap to bypass the cooler if necessary.

Compared with a flap that inevitably always has a gap, a lift valve guarantees a tight seal during cooling operation. This is an advantage in achieving maximum cooling performance. An EGR temperature sensor (G98) is built into the exhaust gas outlet of the EGR module. The exhaust gas temperature downstream of the cooler is regulated to a minimum value with this temperature sensor. In this way, the aim of cooling the recirculated exhaust gas as much as possible to minimise NO_x emissions and, at the same time, to prevent the formation of condensation can be achieved.

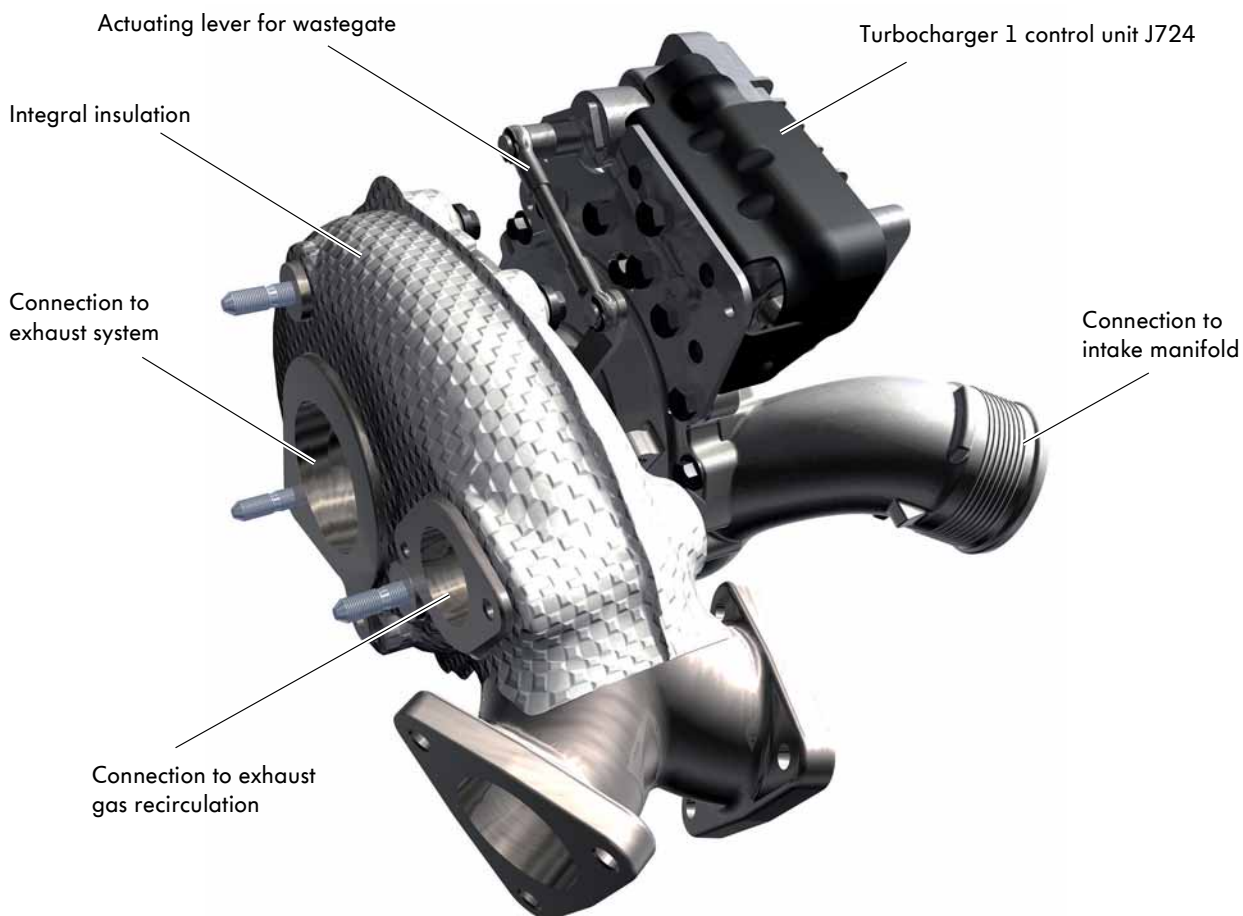


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Turbocharger

The turbocharger has been adapted for the increased performance requirements of the new 3.0 l V6 engine generation. Each performance version of the engine uses a different turbocharger from Honeywell Turbo Technologies (HTT). The turbocharger GT 2256 is fitted on the 150 kW version and the turbocharger GT 2260 is fitted on the 180 kW version.

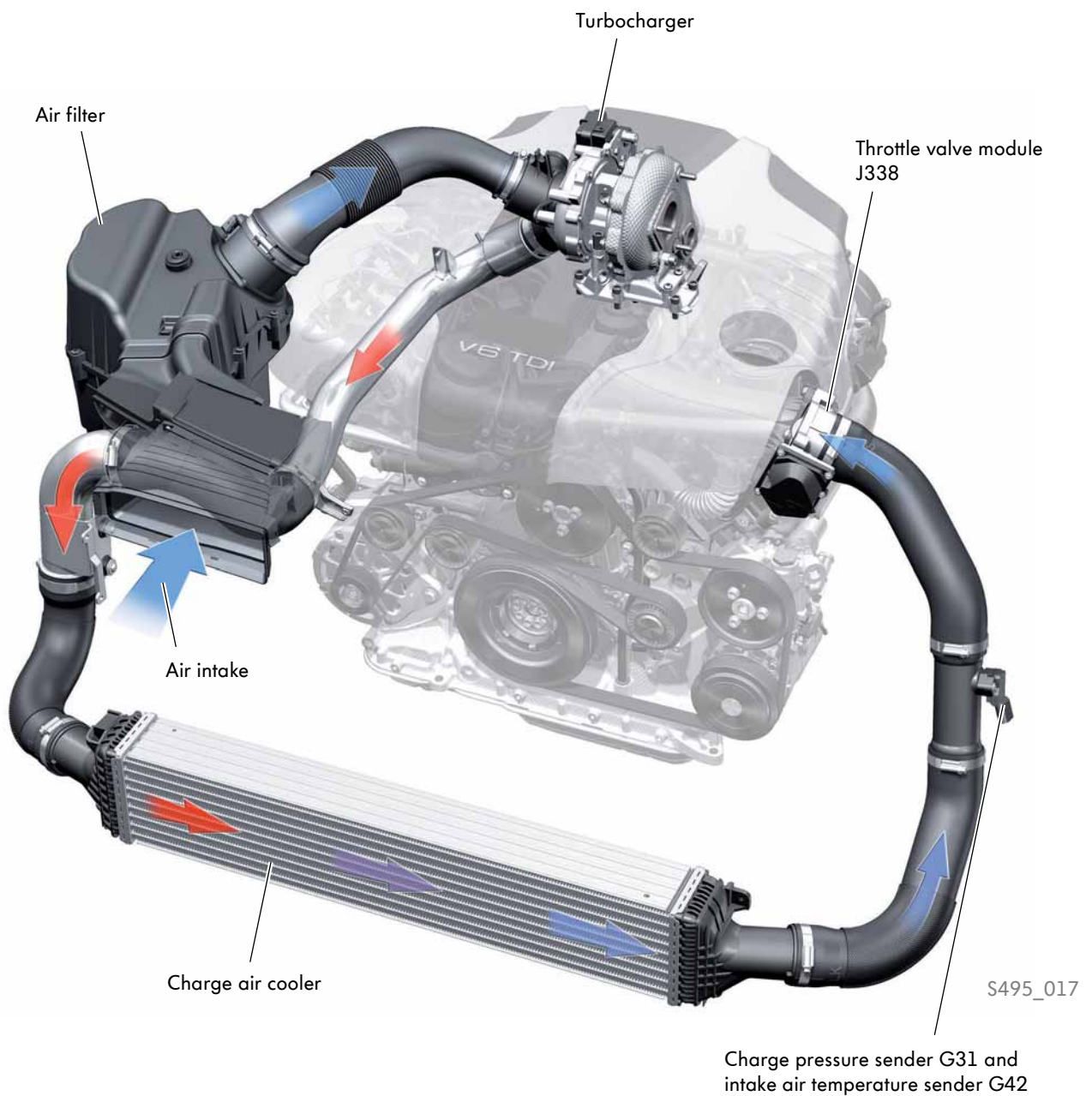
The turbocharger has been optimised in many areas. Both the compressor wheel and turbine have been improved again and the bearings for the rotating parts have been further developed to reduce friction. This allows fast response and an even torque development.



S495_016

Charge air cooling

The whole charge air system has been revised from the air filter to the turbocharger. On the pressure side, it has been possible to further optimise the air duct system with the charge air cooler by using low-turbulence hose connections. In this way, the response of the engine and the emissions and consumption figures could be improved.



Cooling system

Cylinder head coolant circuit

The permanently flowing cylinder head coolant circuit mainly consists of the coolant chambers in the cylinder heads, the exhaust gas recirculation cooler, the oil cooler, the heating and gearbox oil heat exchanger and the main radiator. The cylinder head coolant circuit is regulated by a heatable thermostat with a wax thermostatic element (see page 22 and 23).

The thermostat is not energised during the warm-up phase of the engine and opens at approx. 90 °C. As a result, no heat is transferred to the main radiator until this temperature is reached. The hot coolant is supplied to warm up the gearbox and, if necessary, for the heating and ventilation system.

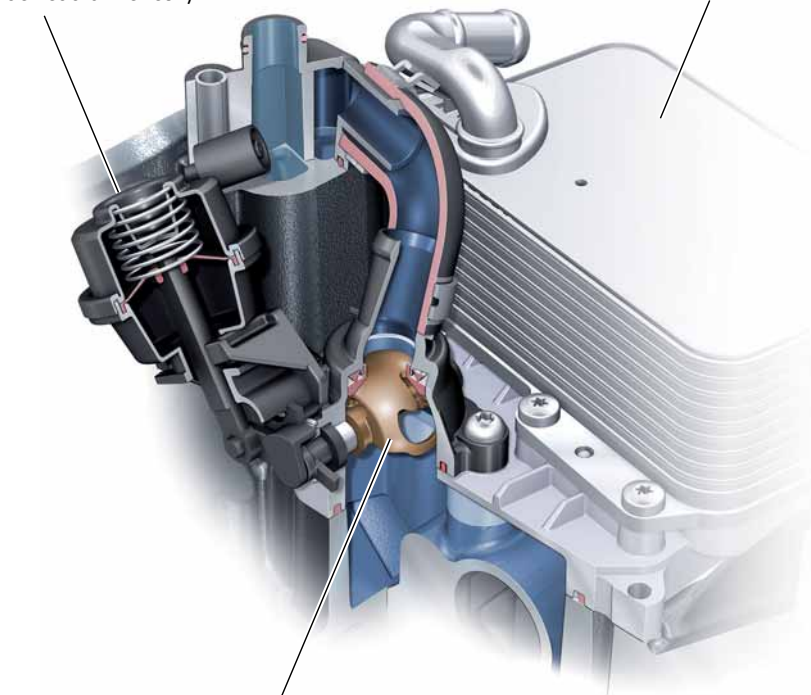
Energising the wax thermostatic element allows the temperature of the cylinder head circuit to be reduced within the physical limits of the main radiator. The conditions for this are:

- Cylinder head component protection
- Maximum EGR cooling requirement
- Gearbox cooling requirement



Pneumatic regulating valve
(operation of the cylinder head and
cylinder block coolant circuit)

Engine oil cooler



Cylinder block coolant circuit closed

— Cylinder head coolant circuit

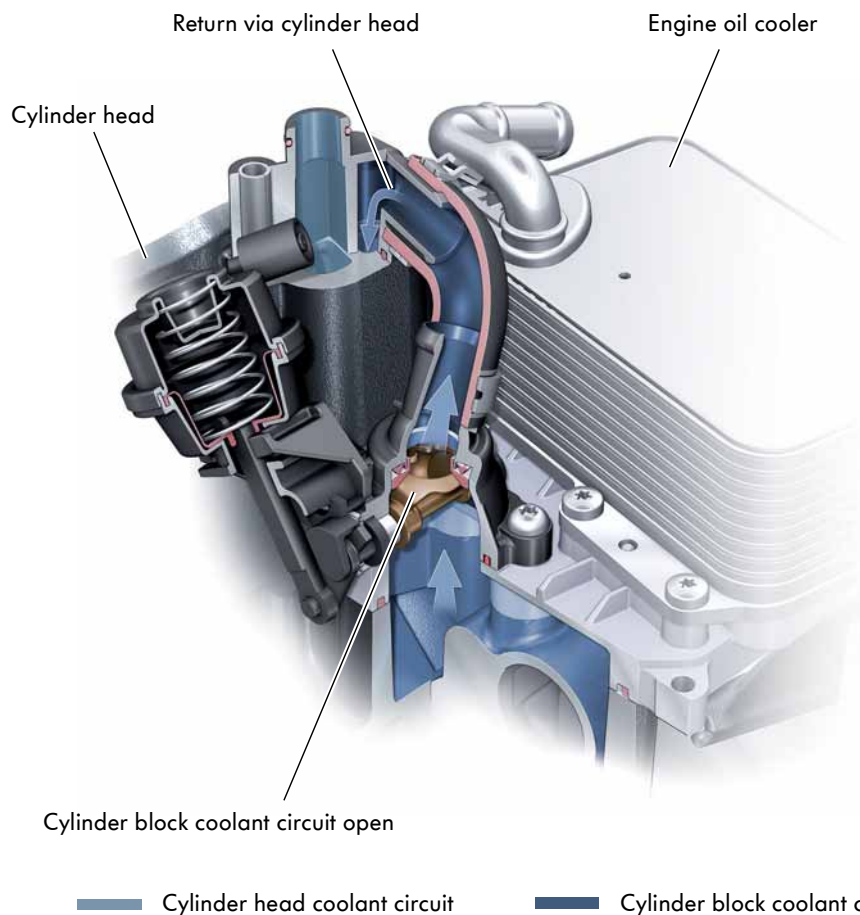
— Cylinder block coolant circuit

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Cylinder block coolant circuit

The coolant for the cylinder block coolant circuit reaches the exhaust side of the cylinder banks via non-return valves in the cylinder block. The non-return valves prevent a return flow of coolant between the cylinder banks and unwanted heat transfer from the cylinder block. This ensures a controlled flow in the circuit. The cylinder block coolant circuit is closed via a vacuum-controlled ball valve. The coolant is stationary, the warm-up phase of the engine is shortened and friction is reduced.

The temperature level of the cylinder block coolant circuit is regulated at approx. 105 °C with the aid of the ball valve. As a result, the crankshaft group works at the best possible friction temperature level. One major focus during the development was achieving the “stationary coolant” in the cylinder block coolant circuit. The ball valve is activated by the coolant valve for cylinder head N489 using pulse-width modulation (PWM). To help the system warm up quickly, an engine oil cooler bypass is also fitted in the oil system.

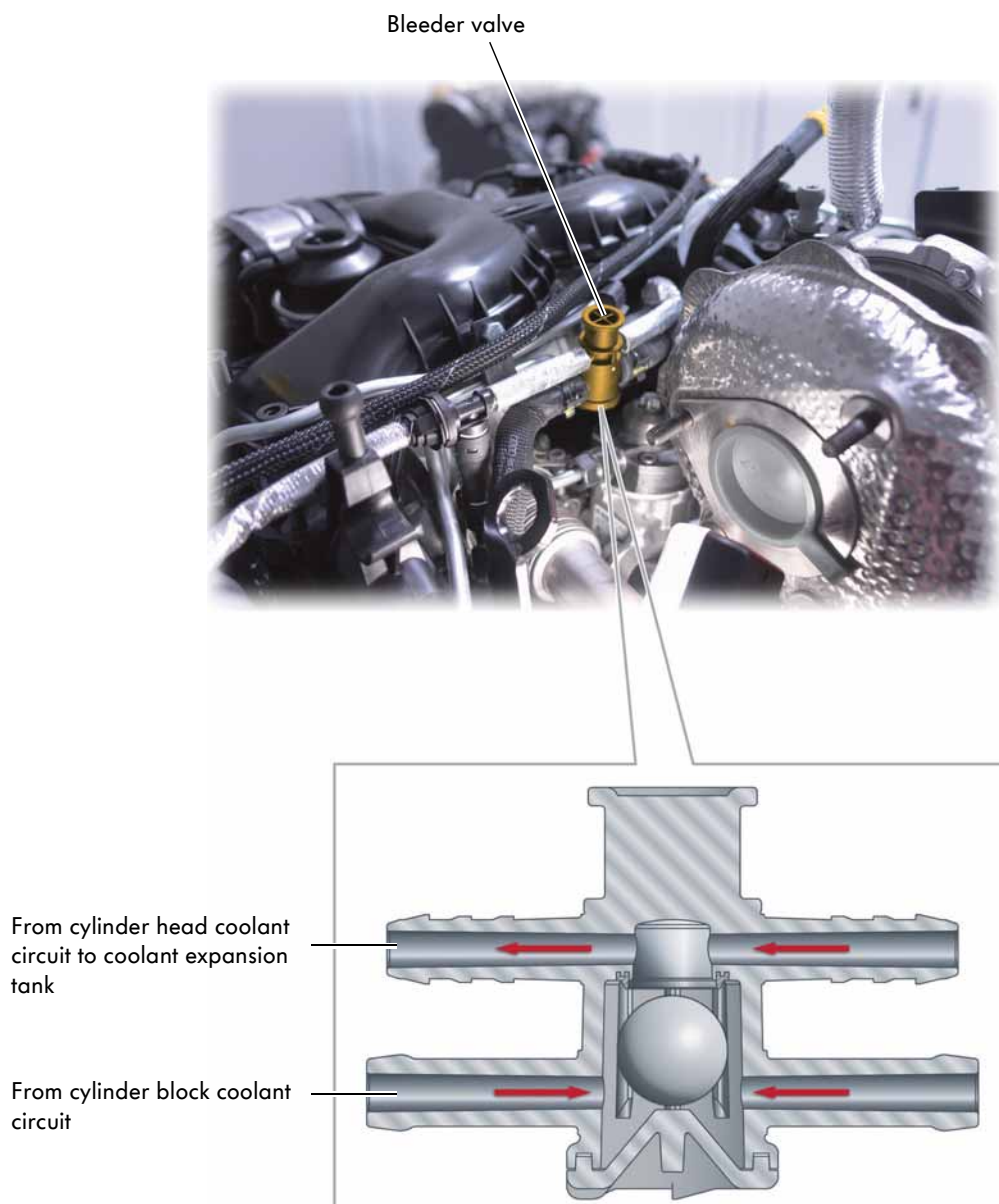


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Bleeding the system

The cylinder block coolant circuit has its own bleeder valve. The cylinder banks are connected via the cylinder head gasket to collectors in the cylinder heads. This allows air bubbles in the cylinder block circuit to escape at the highest point of the system even when the coolant is stationary.

The bleeder lines run from the collectors to a bleeder valve. The bleeder valve connects the permanent bleeder system of the cylinder head coolant circuit to the bleeder system of the cylinder block circuit. The valve seals the two sub-circuits from each other with the aid of a floating ball.



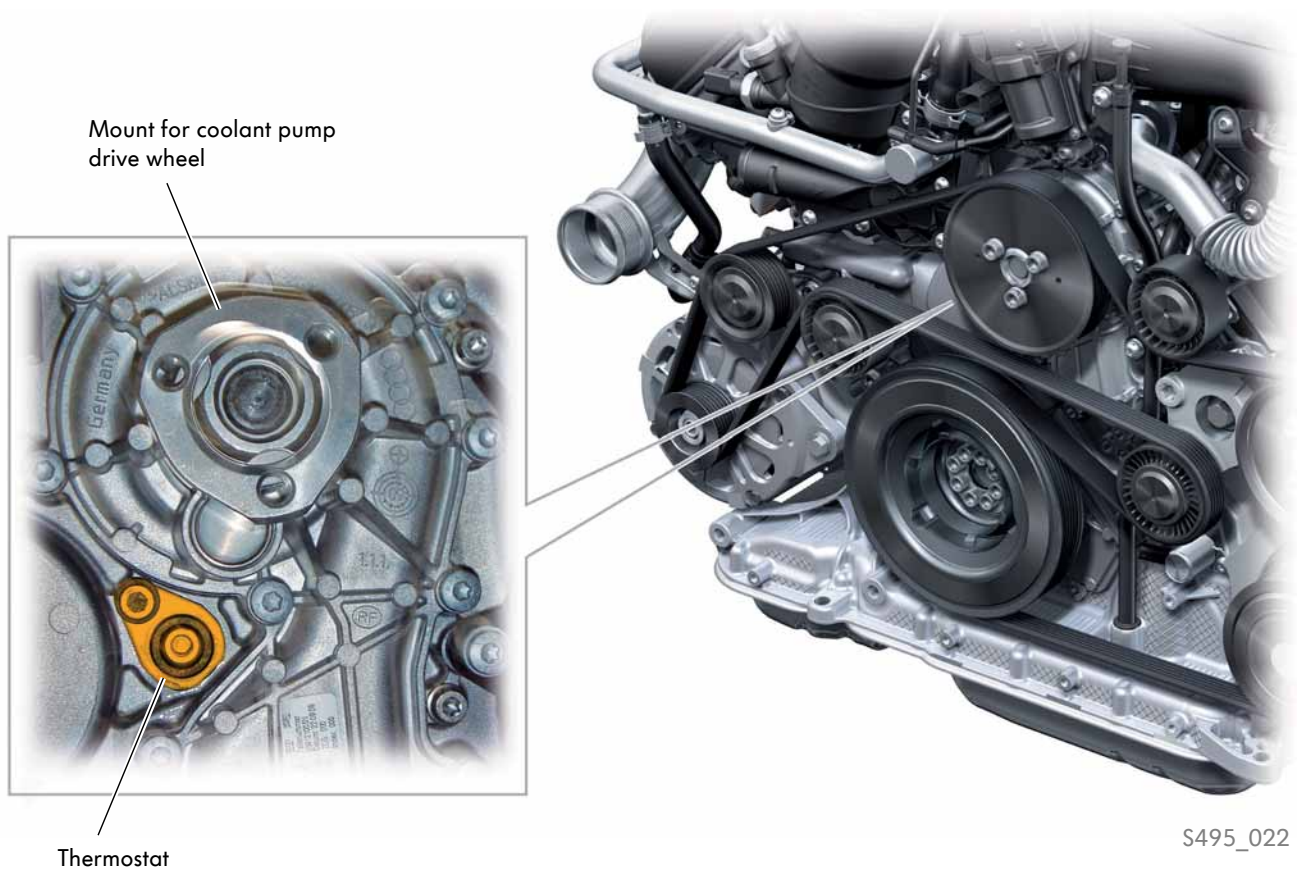
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Engine oil cooler with thermostat-controlled bypass channel

The engine oil cooler is equipped with a thermostat-controlled oil cooler bypass.



Design

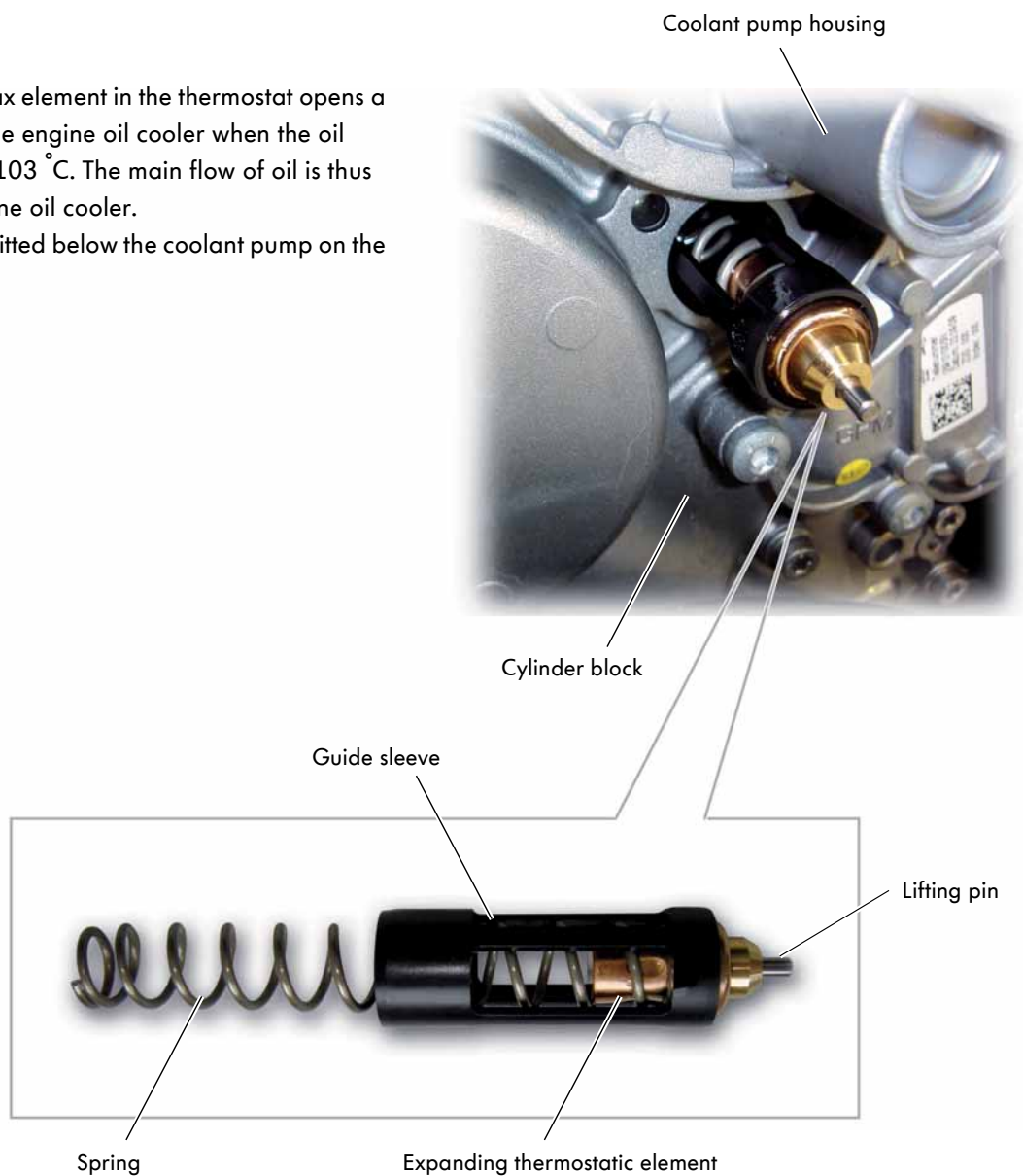




Function

The expanding wax element in the thermostat opens a bypass valve at the engine oil cooler when the oil temperature is $< 103^{\circ}\text{C}$. The main flow of oil is thus sent past the engine oil cooler.

The thermostat is fitted below the coolant pump on the cylinder block.



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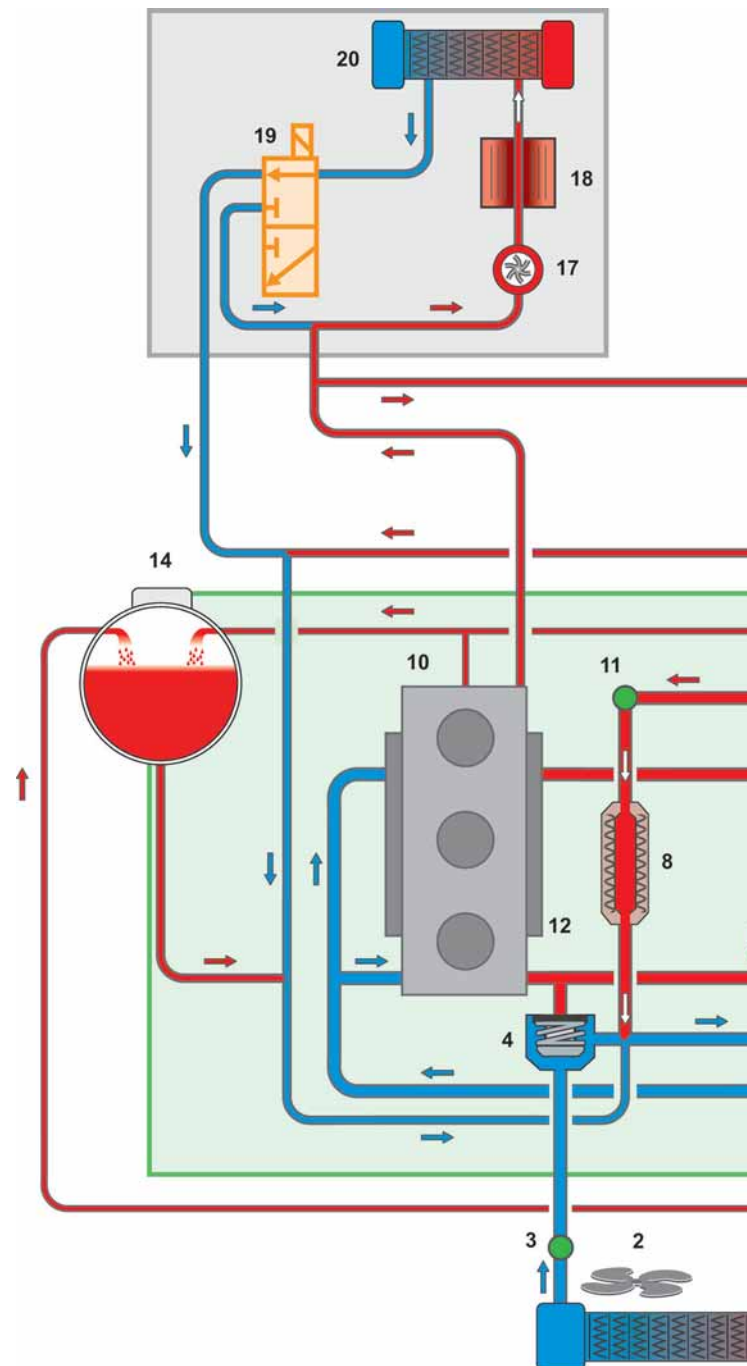
Innovative thermal management system for 3.0 l V6 TDI engine (generation 2)

During the development of the 3.0 l V6 TDI engine (generation 2), particular attention was paid to thermal behaviour. The aim of the thermal management system is to reduce the warm-up time of the engine and increase the temperature in the partial load range so that the engine runs at a good friction level.

The cooling system uses a split-cooling concept in which the cylinder block and cylinder head each have their own coolant circuits. This allows the ideal temperatures to be set for the cylinder block and cylinder head even when the engine has reached operating temperature.

The coolant pump, which is located at the front of the engine inner V, continuously delivers coolant to the crankcase on the exhaust side of the engine. The flow of coolant is split there between the cylinder heads and the crankcase. Once coolant has flowed through the two sub-circuits, the flow of coolant reaches the suction side of the coolant pump.

Thanks to the split cooling concept, the innovative thermal management system used in the new 3.0 l V6 TDI engine allows an independent supply of coolant to the interior and gearbox oil heaters regardless of whether the coolant in the cylinder block is stationary. We have managed to reduce the emissions and consumption figures considerably since each sub-circuit is operated at the temperature that ensures minimum friction.

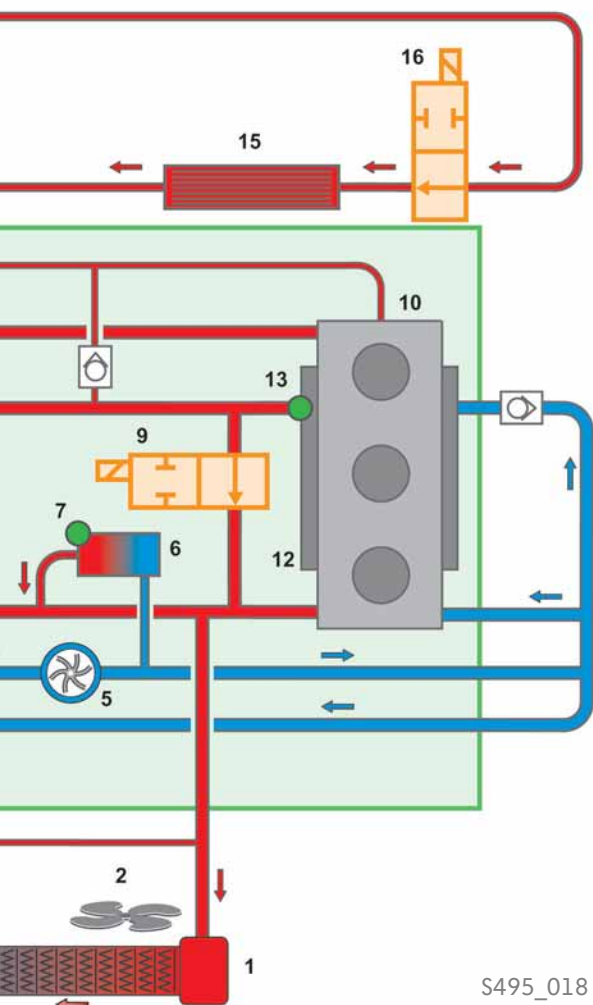




Always follow the instructions in the workshop manual when filling the cooling system.

Key:

- 1 Radiator
- 2 Radiator fan
- 3 Radiator outlet coolant temperature sender G83
- 4 Thermostat for map controlled engine cooling F265
- 5 Coolant pump
- 6 Engine oil cooler
- 7 Oil level and oil temperature sender G266
- 8 Cooler for exhaust gas recirculation
- 9 Coolant shut-off valve
- 10 Cylinder head
- 11 Coolant temperature sender G62
- 12 Cylinder block
- 13 Temperature sender for engine temperature regulation G694
- 14 Coolant expansion tank
- 15 ATF cooler
- 16 Coolant valve for gearbox N488
- 17 Coolant circulation pump V50
- 18 Auxiliary heater
- 19 3/2-way valve
- 20 Heat exchanger for heater



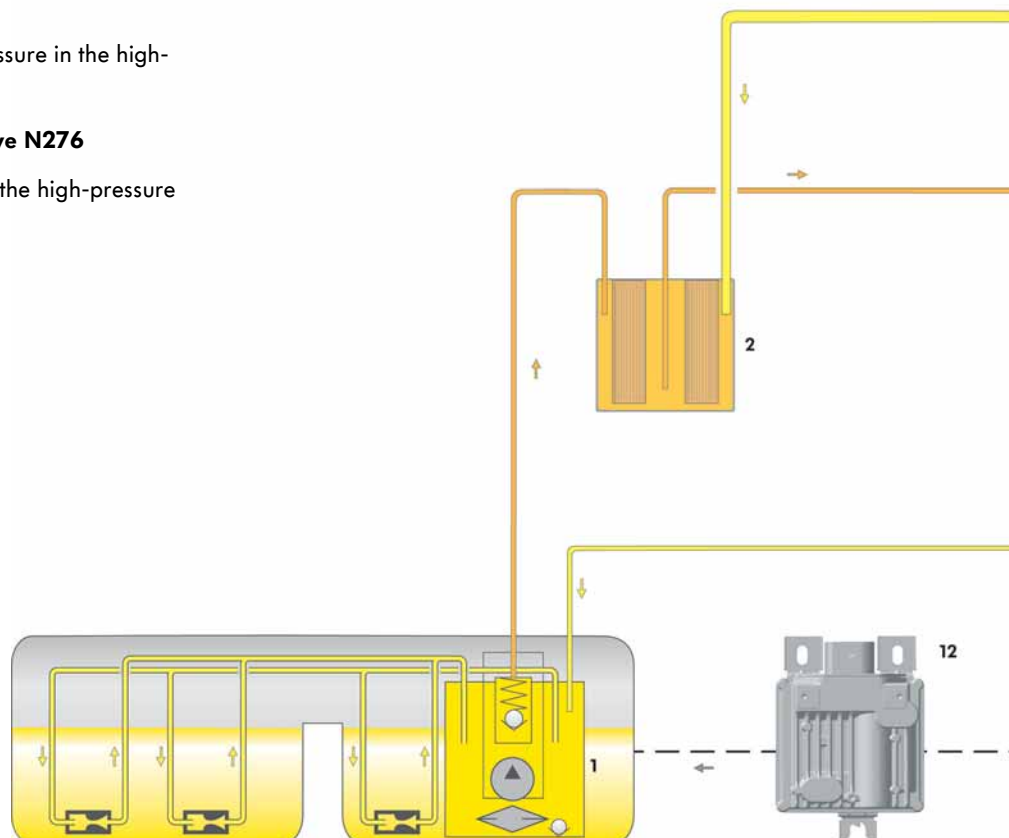
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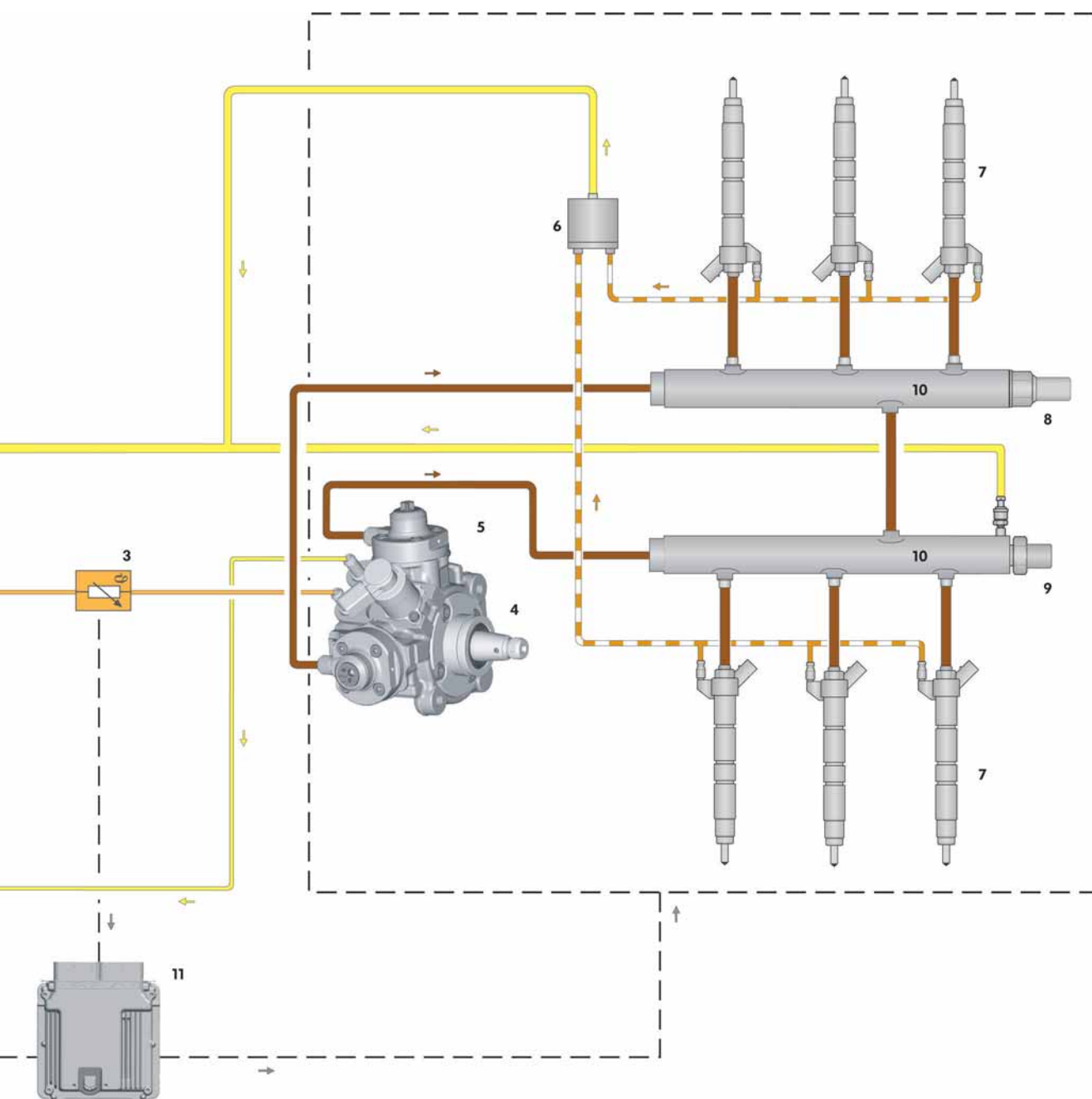
Fuel system

Schematic overview



- | | |
|---|---|
| 1 Fuel delivery unit
Constantly delivers fuel to the presupply. | 10 High-pressure accumulator (rail)
Stores the fuel required for injection into all cylinders at high pressure. |
| 2 Pressure-resistant fuel filter | 11 Engine control unit J623 |
| 3 Fuel temperature sender G81
Measures the current fuel temperature. | 12 Fuel pump control unit J538 |
| 4 Dual-piston high-pressure pump
Generates the high fuel pressure required for injection. | |
| 5 Fuel metering valve N290
Regulates the quantity of fuel to be pressurised as required. | |
| 6 Pressure retention valve/restrictor
A pressure of 3.5 – 10 bar is present in the return from the injectors. | |
| 7 Injectors for cylinders 1 - 6 N30 - N33, N83, N84 | |
| 8 Fuel pressure sender G247
Measures the current fuel pressure in the high-pressure range. | |
| 9 Fuel pressure regulating valve N276
Regulates the fuel pressure in the high-pressure range. | |





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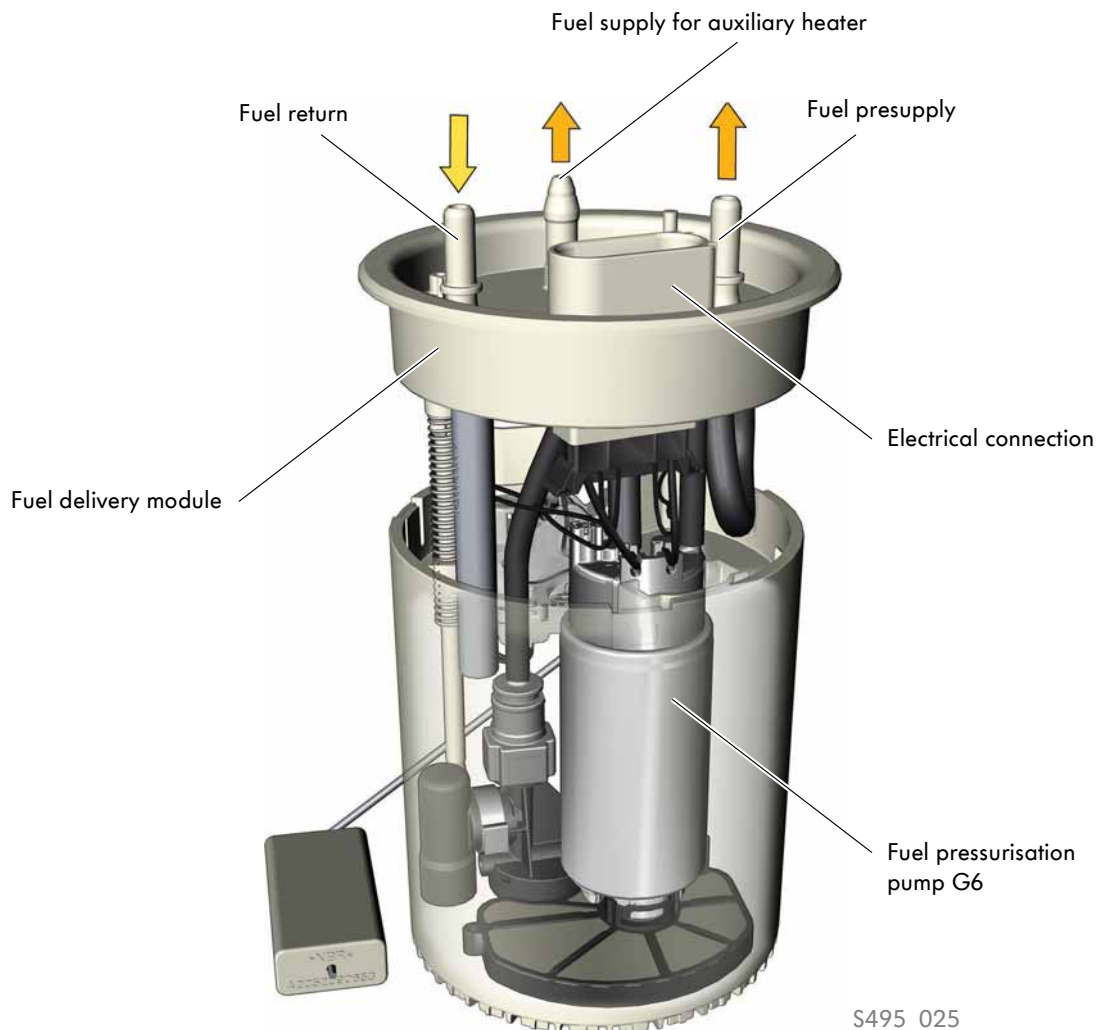
Fuel delivery unit

The fuel delivery unit GX1 basically consists of two sections:

- The fuel level sender that uses 3-conductor technology and detects the fuel level in the fuel tank.
- The fuel system pressurisation pump G6 that uses an EC motor. The EC motor is a brushless, permanently activated synchronous motor.

Thanks to its brushless design, the motor is wear-free except for the bearings. The fuel system pressurisation pump G6 is activated by the fuel pump control unit J538. A PWM signal is used for activation by the engine control unit J623. Error feedback messages are sent via the same wires.

This guarantees a demand-regulated supply of fuel.

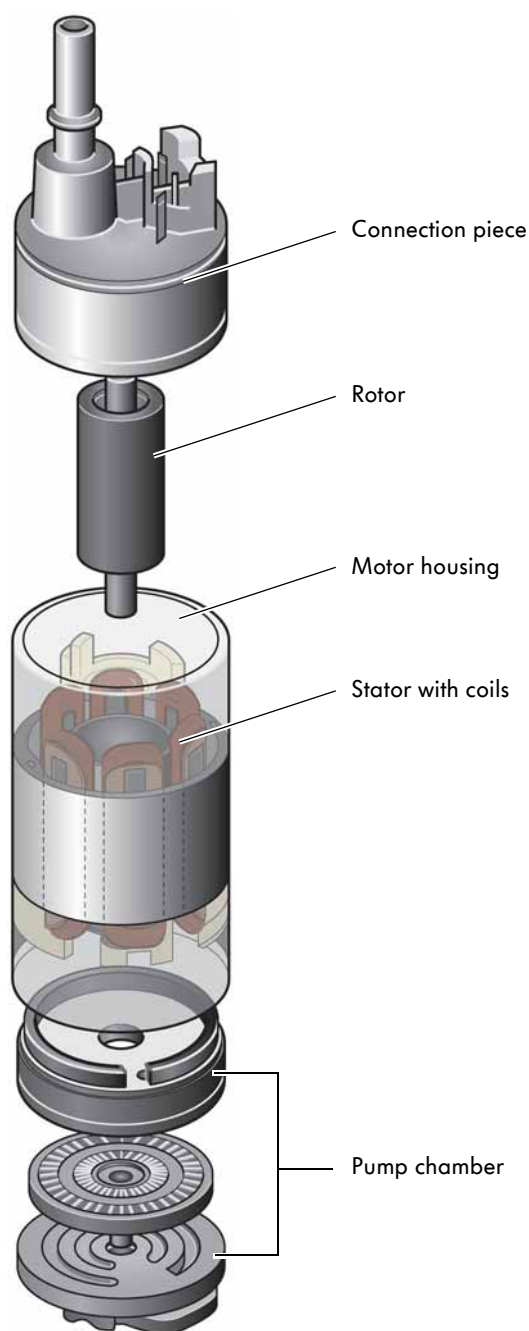


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Fuel pressurisation pump G6

The fuel system pressurisation pump G6 uses an EC motor (EC = electronically commutated). The motor is made up of a rotor, stator, pump chamber and housing with connection piece. The rotor is a permanent magnet and the stator is an electromagnet. The brushless motor in the fuel pump contains two pairs of permanent magnets and three pairs of electromagnets.

The change in the current direction (commutation), which is necessary for rotation, is controlled by an external electronic control unit (fuel pump control unit J538). There is therefore no contact between the moving parts of the motor and operation is virtually wear-free.



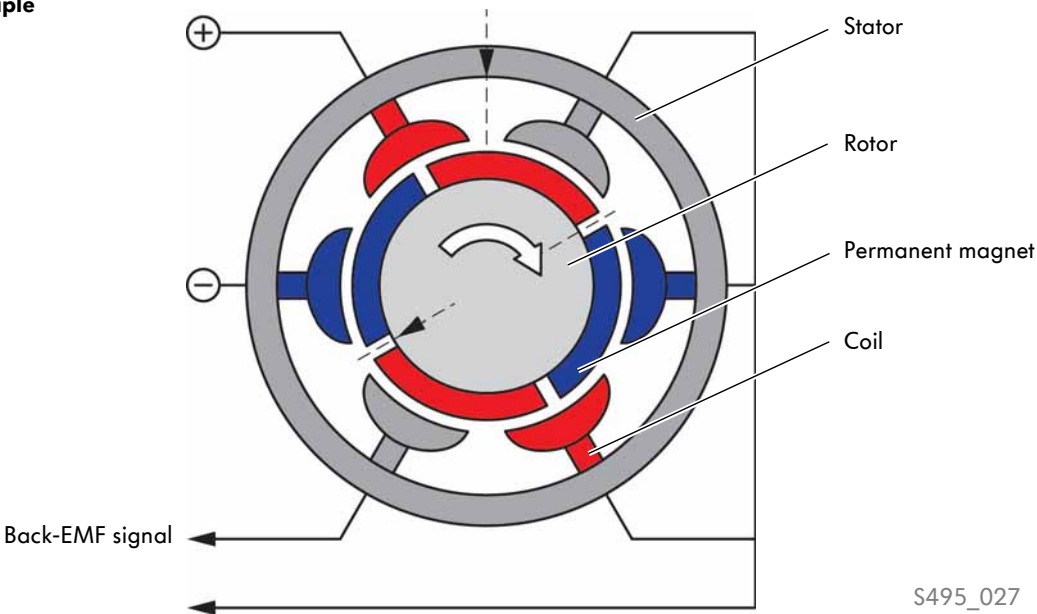
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Function of fuel pump

The fuel pump control unit J538 switches between the individual phases. The switching must be timed precisely in order to create a rotating magnetic field in the stator coil.

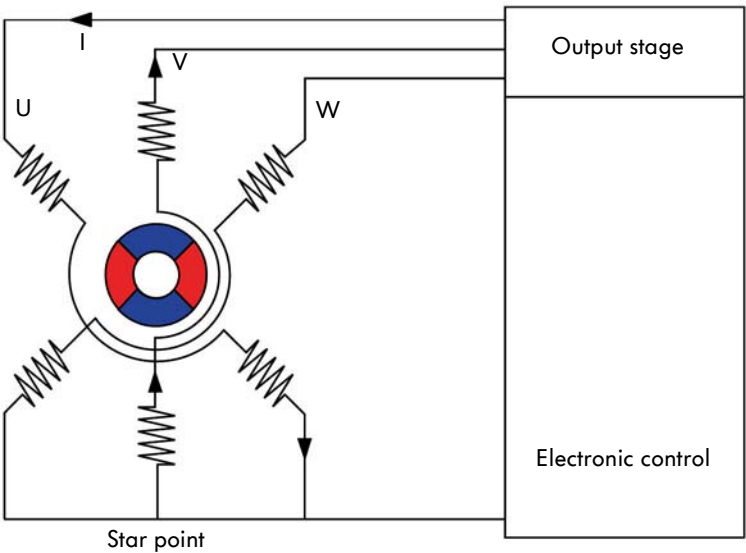
The permanent magnet pairs force the rotor to re-align itself and thus follow the magnetic field. This causes rotation. The fuel pump produces mechanical rotation in twelve individual steps. The control unit recognises the position of the rotor from the de-energised coil pair. The Back-EMF Signal (ElectroMotive Force feedback signal) is used for this.

Functional principle



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Circuit of coil windings



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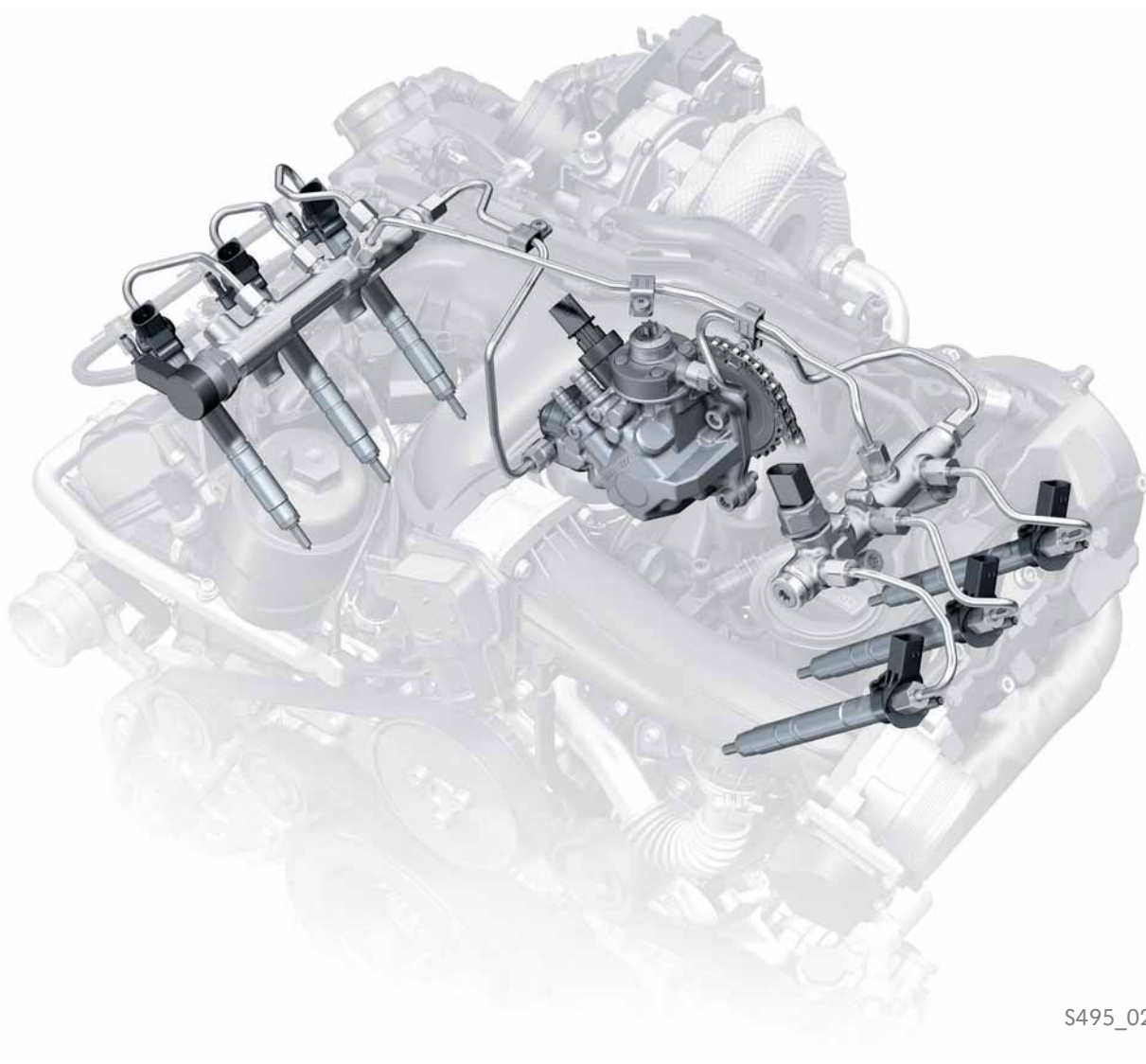
Common rail fuel injection system

The 3.0 l V6 TDI engine (generation 2) features a Bosch common rail injection system that uses piezo injectors. The maximum injection pressure is 2,000 bar. Each different engine version has its own injector nozzle configuration.

The piezo injectors are connected to the forged fuel rails via very short injector pipes. The rail pressure is generated by a dual-piston high-pressure pump, the CP 4.2.

The high-pressure pump is located in the inner V on the gearbox side. The pump is driven directly by the crankshaft via the ancillary drive chain.

A ratio of 1 : 0.75 to the crankshaft has been chosen to ensure fuel delivery is in sync with the injectors. The pump is fitted on the engine timed to the injection phases to reduce the chain forces.



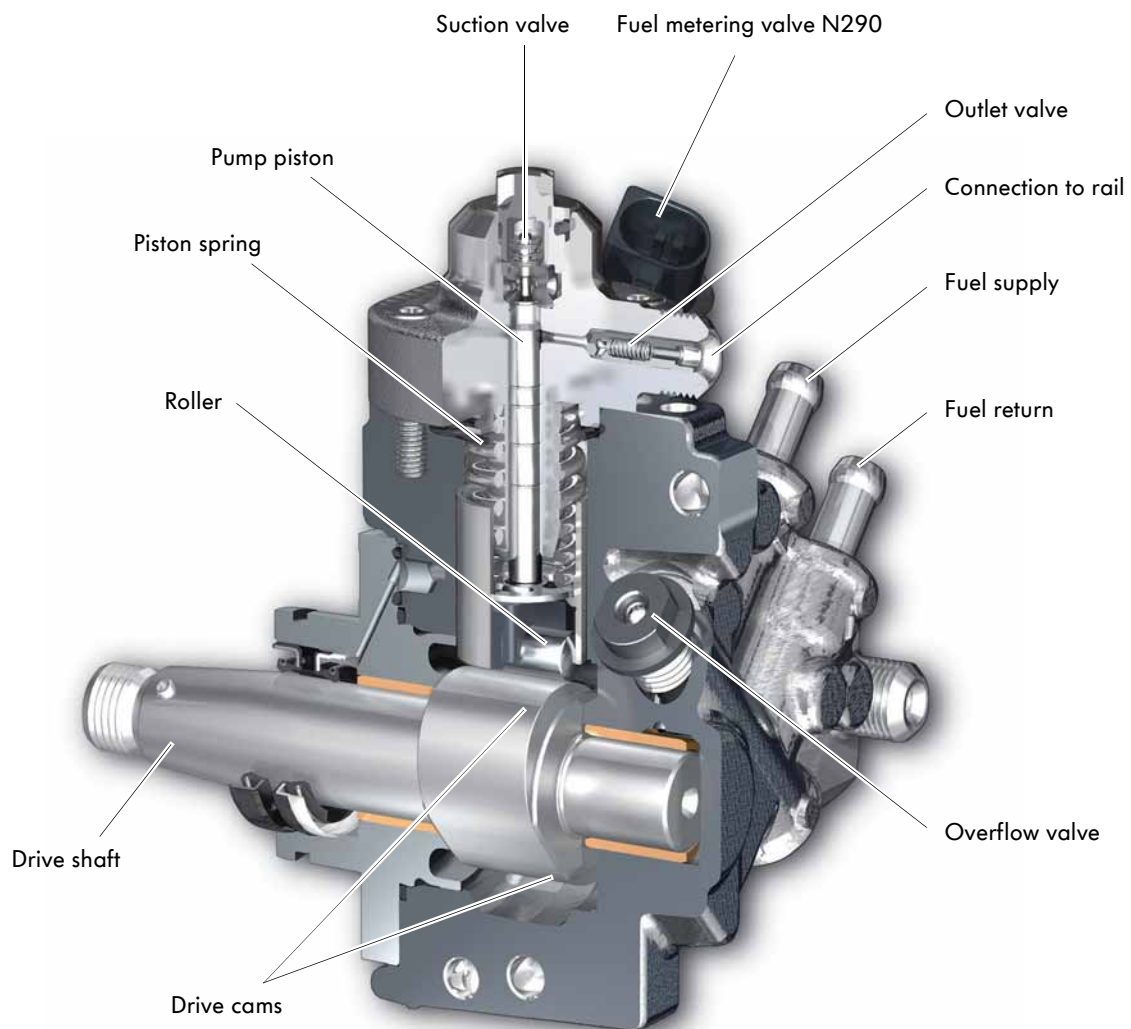
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Design of the high-pressure pump CP 4.2

The high-pressure pump works with two pistons and is driven via the ancillary drive chain. It generates a maximum injection pressure of 2,000 bar.



S495_032



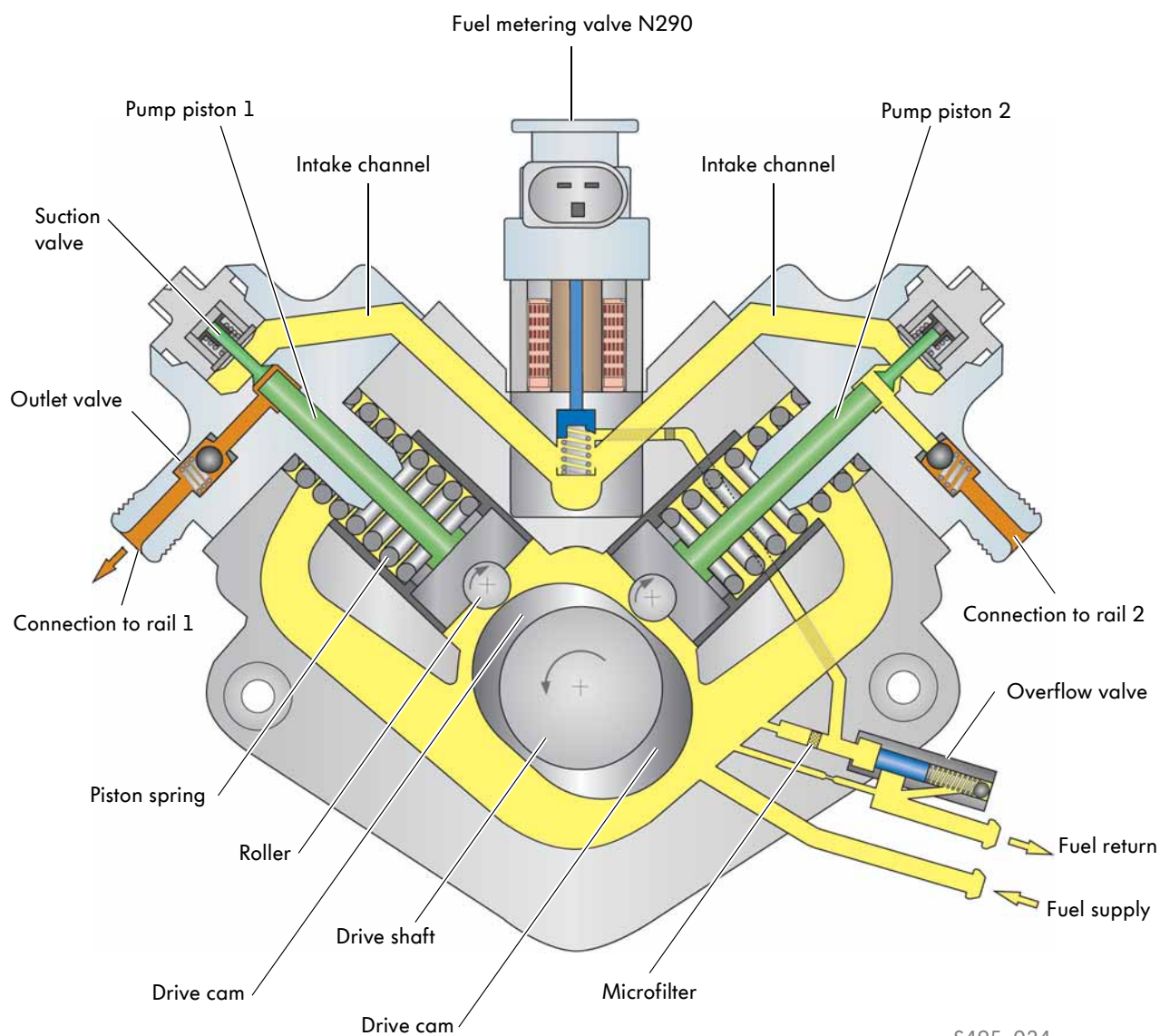
S495_033



The illustration shows a cross-section of the dual-piston high-pressure pump through only one pump piston.

How the high-pressure pump works

Suction and delivery strokes are performed one after the other by the pistons, which are offset by 90° . The delivery stroke pushes fuel alternately into the left and right rails. The fuel metering valve distributes fuel evenly between the intake channels for the two pump pistons.



High-pressure fuel system

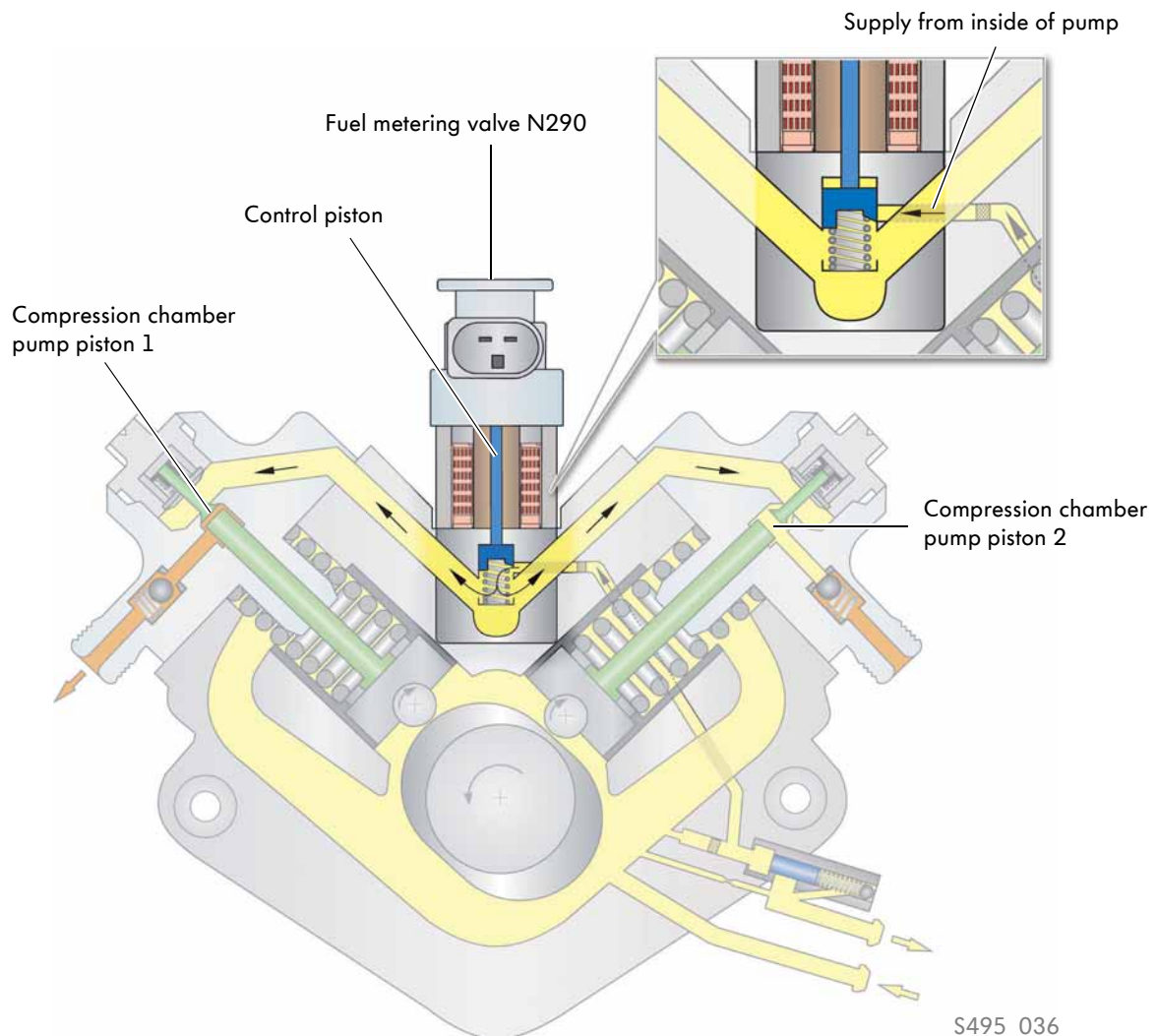
Fuel metering valve N290

The fuel metering valve is part of the high-pressure pump and regulates the fuel quantity required to generate high pressure. This has the advantage that the high-pressure pump only has to generate the pressure required for the current operating situation. In this way, the power consumption of the high-pressure pump is reduced and unnecessary heating up of the fuel is avoided.

How it works

When no current is supplied, the fuel metering valve is open. The valve is actuated by the engine control unit with a pulse-width-modulated signal (PWM) in order to reduce the supply quantity to the compression chamber.

The fuel metering valve is pulsed closed by the PWM signal. Depending on the pulse duty factor, the position of the control piston and thus the fuel supply quantity in the compression chamber of the respective pump piston 1 or 2 are changed.



Overflow valve

The fuel pressure in the low-pressure area of the high-pressure pump is regulated by the overflow valve.

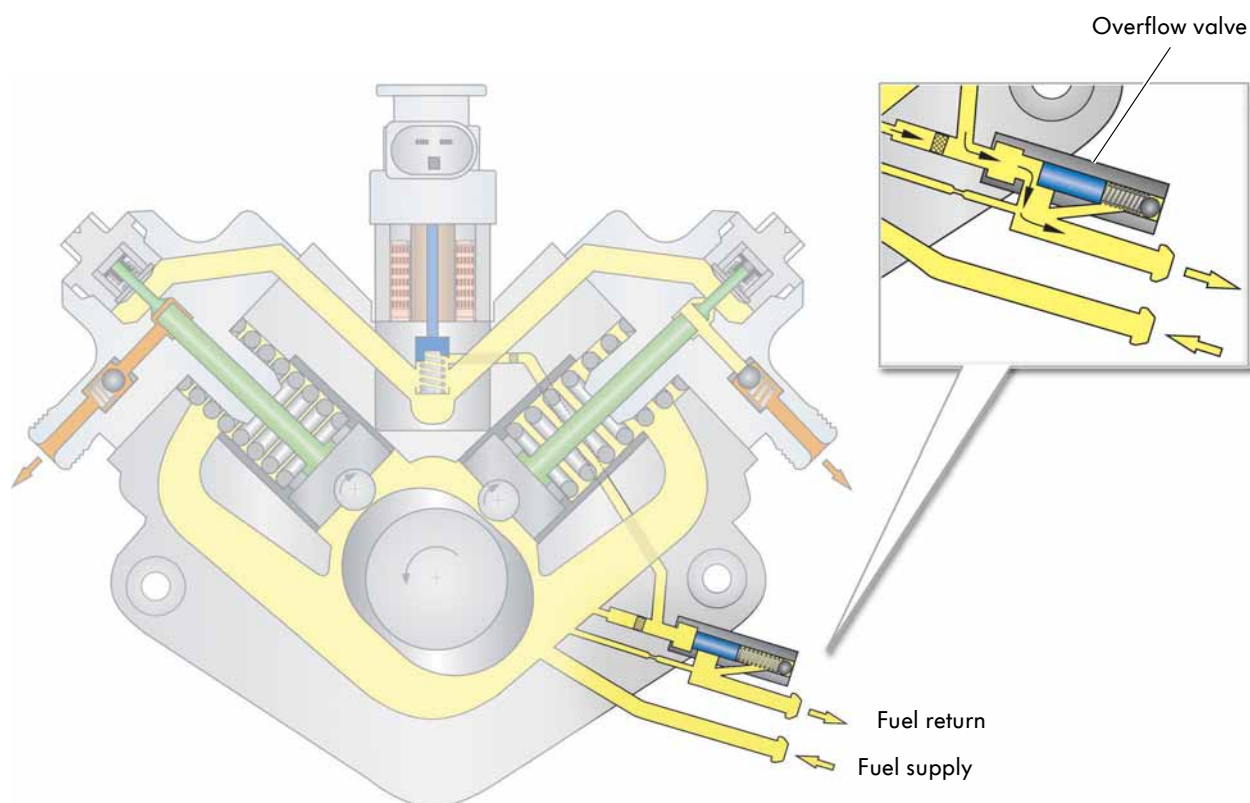


How it works

The fuel system pressurisation pump G6 delivers fuel from the fuel tank to the high-pressure pump at a pressure of approx. 5 bar. This safeguards the supply of fuel to the high-pressure pump in all operating conditions.

The overflow valve regulates the fuel pressure in the high-pressure pump to approx. 4.3 bar.

The fuel delivered by the fuel system pressurisation pump G6 works against the piston and the piston spring of the overflow valve. When the fuel pressure rises above 4.3 bar, the overflow valve opens and opens up the path for return of the fuel. The excess fuel flows via the fuel return line into the fuel tank.

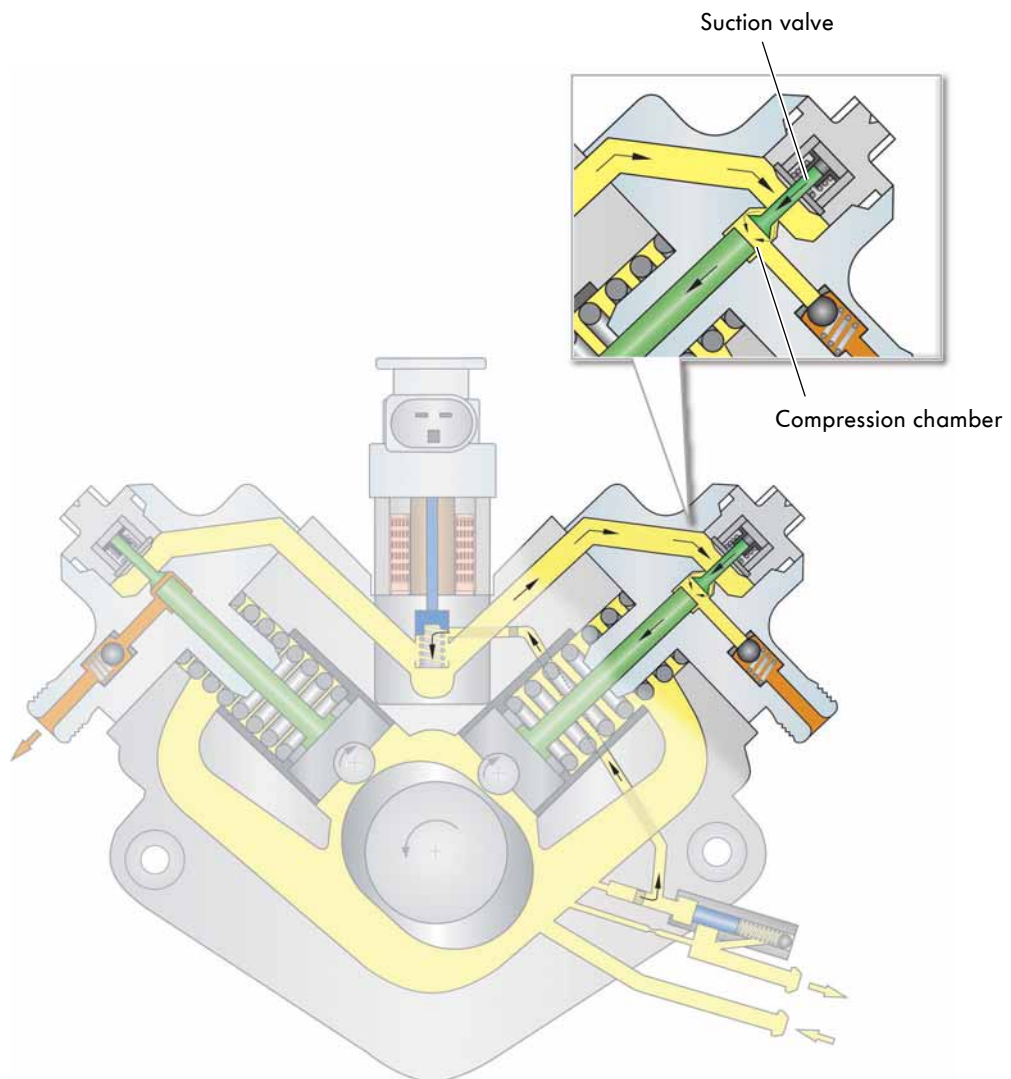


S495_041

High-pressure generation

Suction stroke

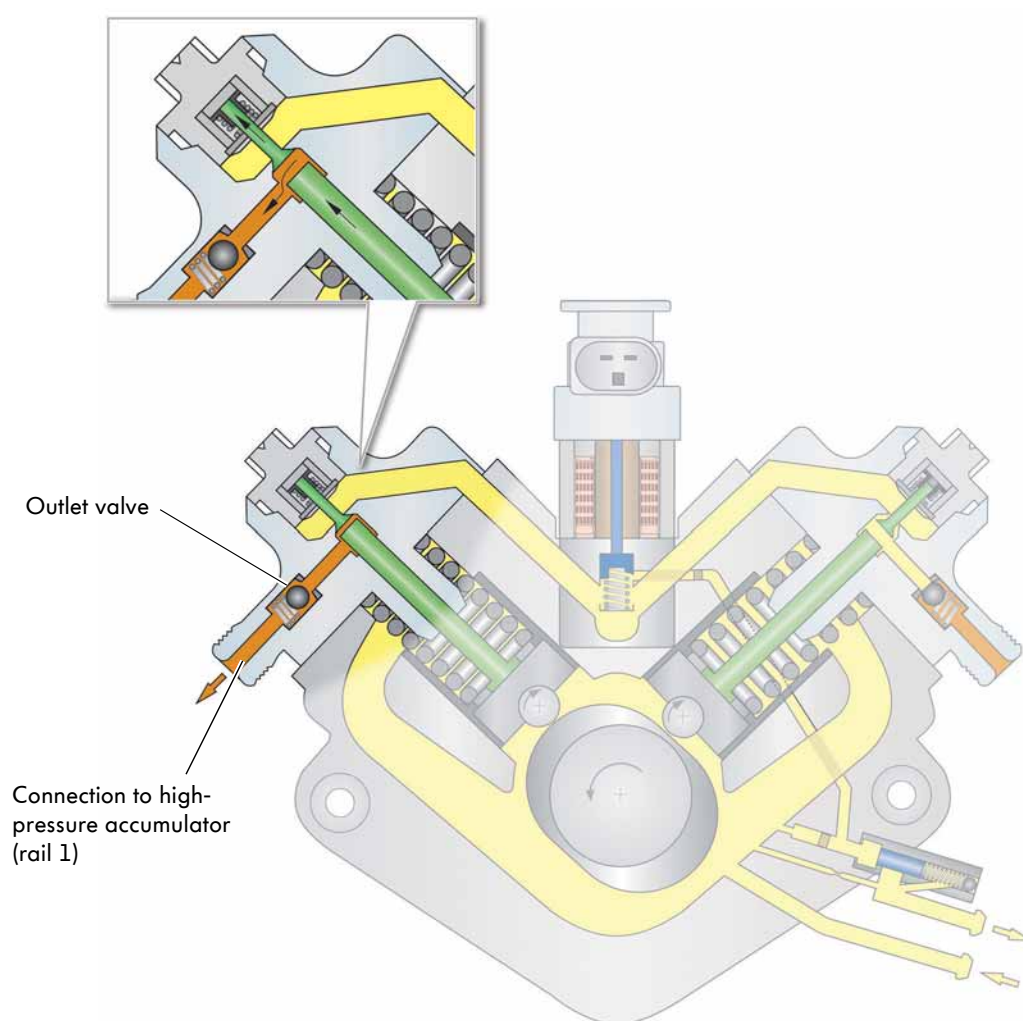
The downwards motion of the pump piston increases the volume of the compression chamber. As a result, the pressure of the fuel in the high-pressure pump and the pressure in the compression chamber differ. The suction valve opens and fuel flows into the compression chamber.



S495_037

Delivery stroke

Once one of the pump pistons starts to move upwards, the pressure in the corresponding compression chamber rises and the suction valve closes. As soon as the fuel pressure in the compression chamber rises above the pressure in the high-pressure area, the outlet valve (non-return valve) opens and fuel is delivered to the high-pressure accumulator (rail).



System overview

Sensors

Air mass meter G70

Engine speed sender G28

Hall sender G40

Coolant temperature sender G62

Radiator outlet coolant temperature sender G83

Fuel temperature sender G81

Temperature sender for engine temperature regulation G694

Oil level and oil temperature sender G266

Fuel pressure sender G247

Accelerator position sender G79
Accelerator position sender 2 G185

Exhaust gas recirculation potentiometer G212

Brake light switch F

Charge pressure sender G31 and intake air temperature sender G42

Lambda probe G39

Oil temperature sender 2 G664

Oil pressure switch F22

Oil pressure switch for reduced oil pressure F378

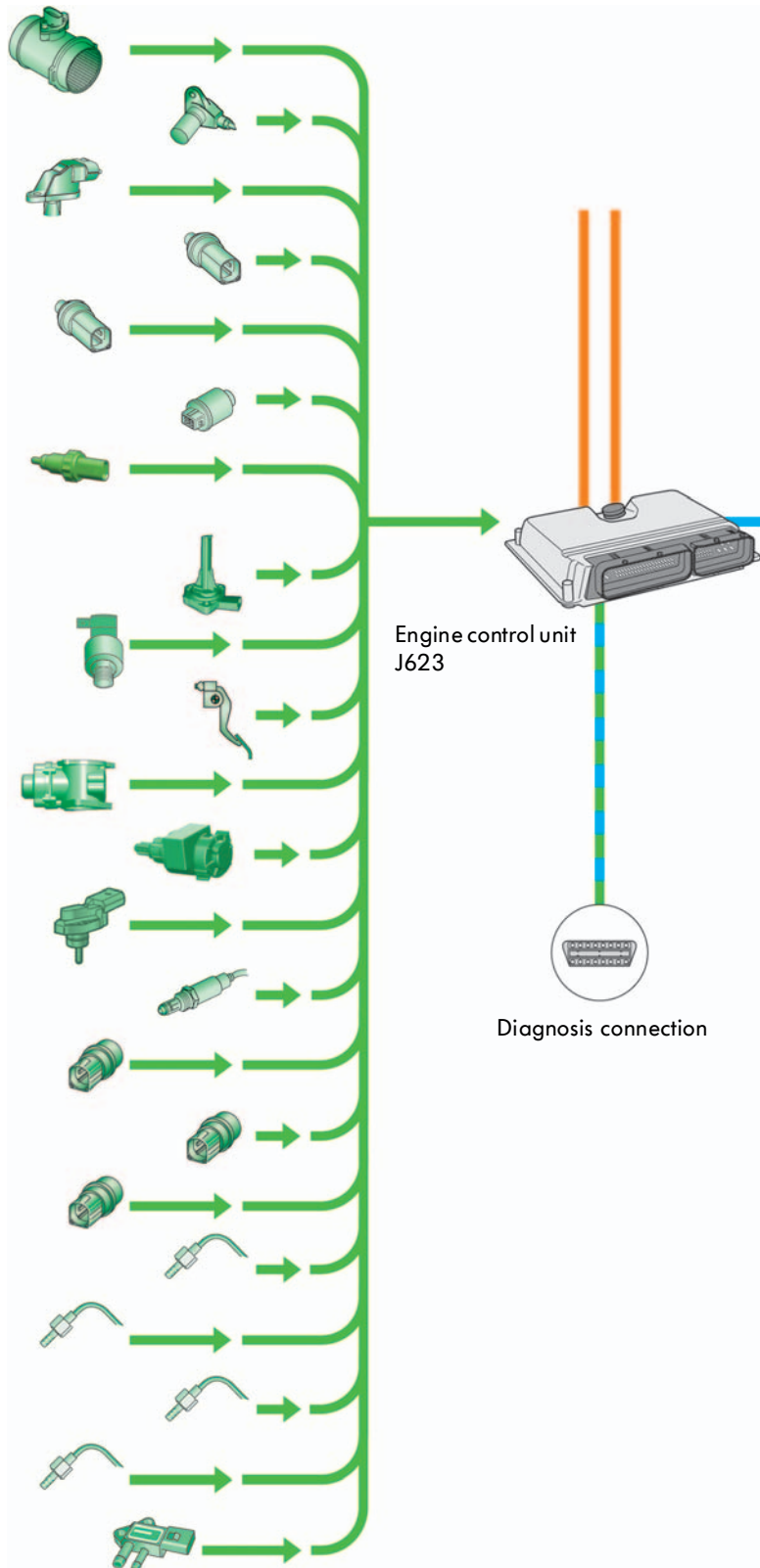
Exhaust gas temperature sender 3 (after catalytic converter) G495

Exhaust gas recirculation temperature sensor G98

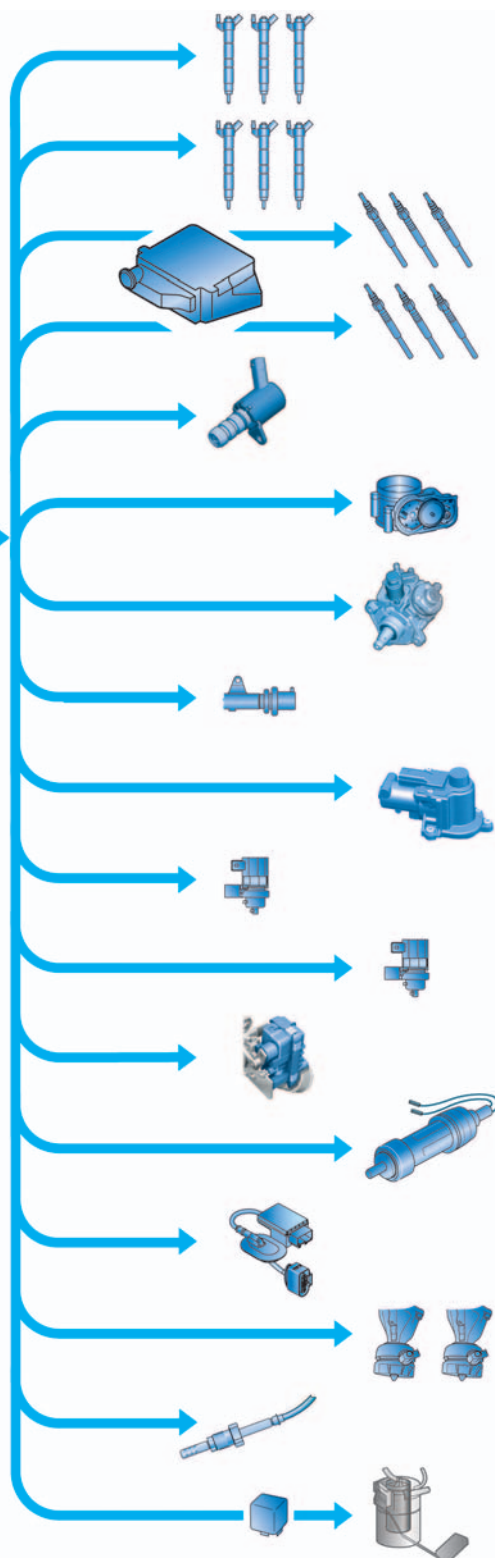
Exhaust gas temperature sender 1 G235

Exhaust gas temperature sender 4 (after particle filter) G648

Pressure differential sender G505



Actuators



Injectors, cylinders 1 - 3
N30, N31, N32

Injectors, cylinders 4 - 6
N33, N83, N84

Automatic glow period control unit J179
Glow plugs 1 - 3
Q10, Q11, Q12

Glow plugs 4 - 6
Q13, Q14, Q15

Valve for oil pressure control N428

Throttle valve module J338

Fuel metering valve N290

Fuel pressure regulating valve N276

Actuator motor for exhaust gas recirculation V338

Exhaust gas recirculation cooler changeover valve N345

Coolant valve for cylinder head N489

Turbocharger 1 control unit J724

Map-controlled engine cooling system thermostat F265

Fuel pump control unit J538

(Left, right) electrohydraulic engine mounting solenoid
valves N144, N145

Lambda probe heater Z19

Fuel pump relay J17
Fuel system pressurisation pump G6

S495_046



Exhaust gas treatment

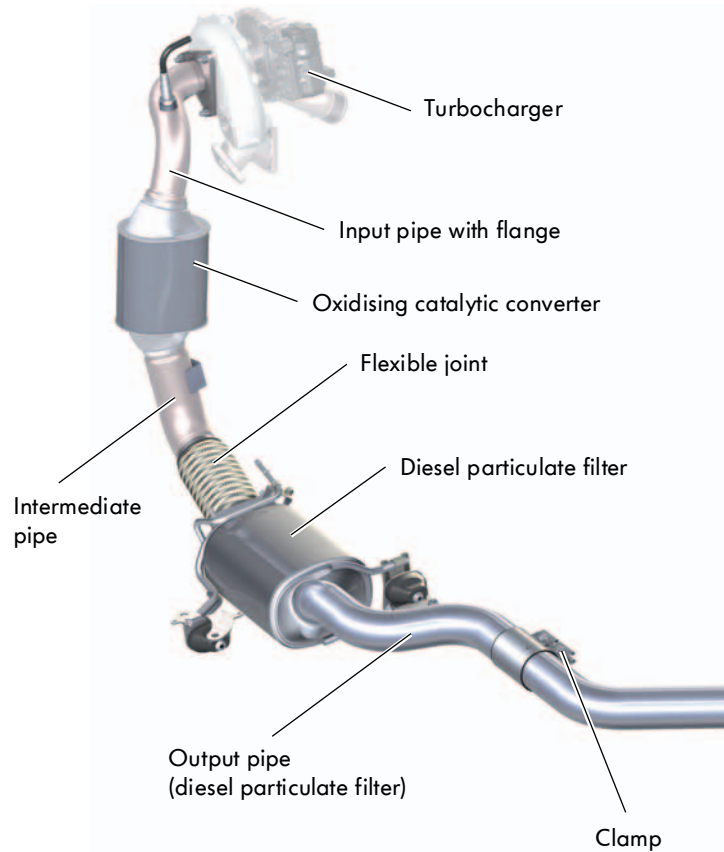
Design of exhaust system

The exhaust system for the new 3.0 l V6 TDI engine features an improved oxidising catalytic converter and a coated diesel particulate filter.

The oxidising catalytic converter and the diesel particulate filter are positioned separately one after the other in the exhaust system due to design features.

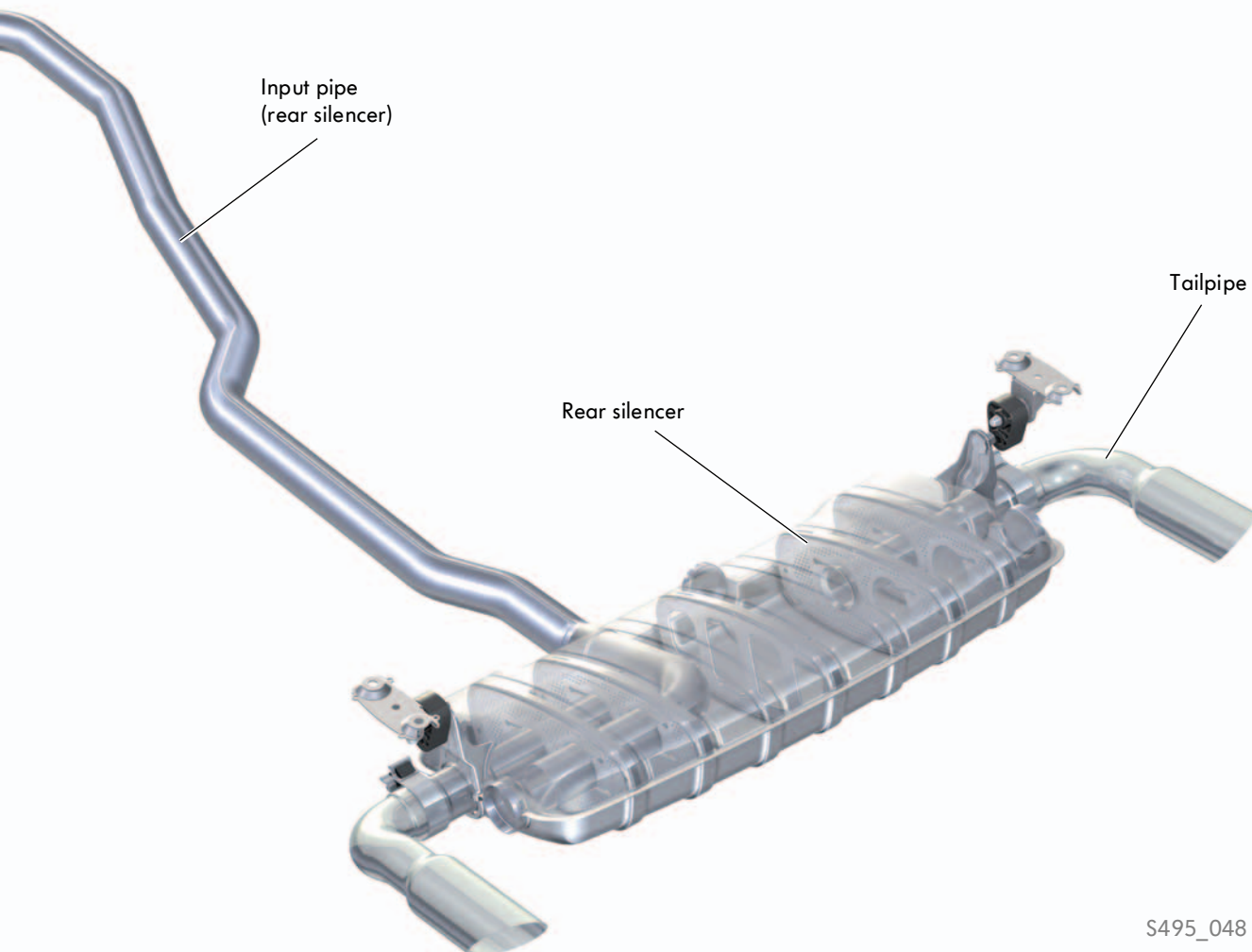
The oxidising catalytic converter is flanged onto the turbocharger close to the engine via a short input pipe. An intermediate pipe, the flexible joint and the diesel particulate filter then follow the oxidising catalytic converter.

The connection to the rear silencer is formed by the output pipe on the diesel particulate filter and the inlet pipe for the rear silencer. The rear silencer has two tailpipes.



In order to cover the widest possible frequency range for noise absorption, the exhaust system uses a combination of reflection silencer and absorption silencer.

Reflection silencers mainly dampen the low frequencies by means of the noise reflection principle. Absorption silencers primarily absorb the high frequencies. The noise energy is converted into heat in this case.



S495_048

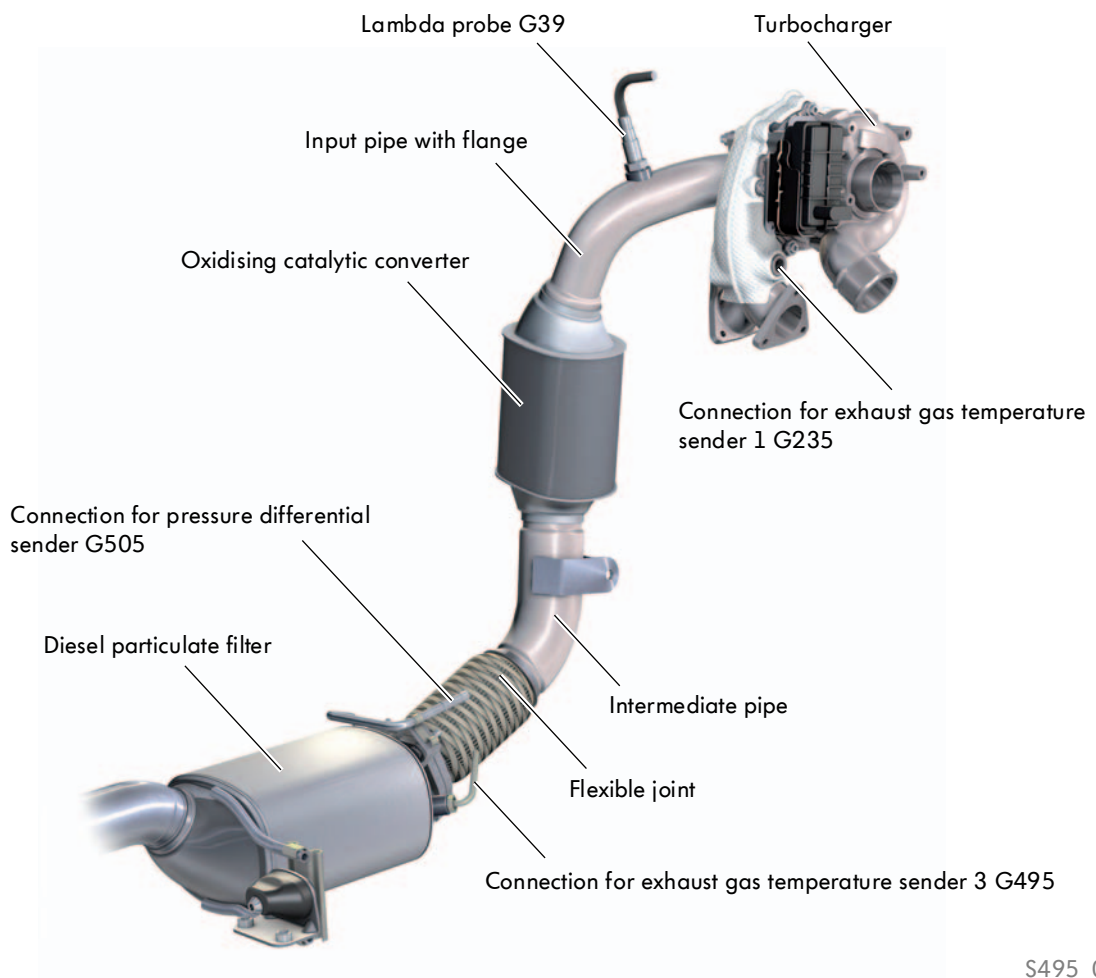
Oxidising catalytic converter and diesel particulate filter

The oxidising catalytic converter has a volume of 1.67 l. The volume of the diesel particulate filter is 4.08 l. Thanks to its aluminium titanate coating, the diesel particulate filter has considerably longer regeneration intervals.

For the first time, a triple post-injection is being used in the 3.0l V6 TDI engine during particulate filter regeneration to increase the exhaust gas temperature in low-load operation.

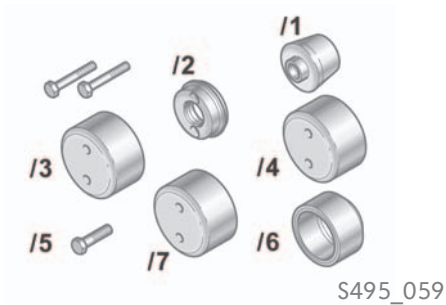
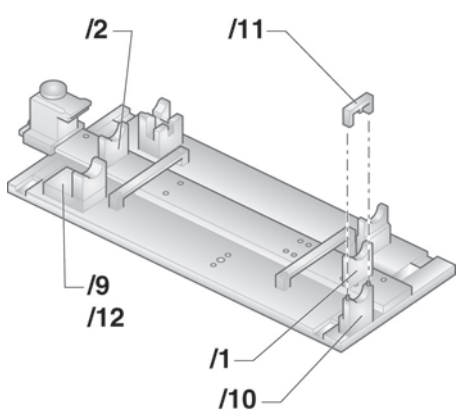
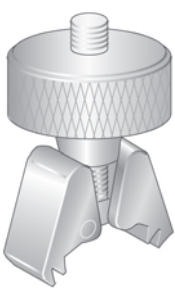
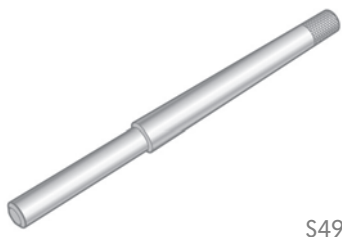
A safe and quick burn-off of particulates is thus guaranteed in all driving conditions, particularly in slow-moving traffic.

The thermal energy required for this is generated by two combusting post-injections that come in quick succession. The third late post-injection uses very small injection quantities. The triple post-injection also ensures diesel particulate filter regeneration when the exhaust gases are colder. At the same time, oil dilution is minimised and the life of the oxidising catalytic converter is extended.



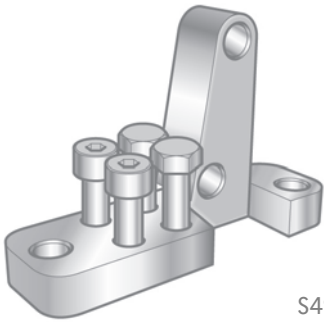
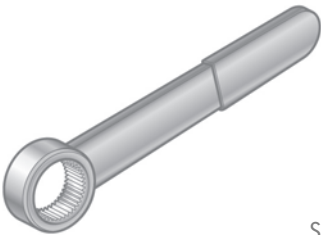
S495_049

Special tools

Designation	Tool	Application
T40048	 S495_059	Assembly tool for crankshaft seal
T40094 T40094/1 T40094/2 T40094/9 T40094/10 T40094/11 T40094/12	 S495_051	Camshaft removal and fitting tool
T40096	 S495_053	Camshaft fitting tool
T40245	 S495_057	Locking pin for chain sprocket





Designation	Tool	Application
T40246	 S495_058	Bracket for securing chain tensioner
T40248	 S495_060	Counterhold tool for high-pressure pump
VAS 5161	 S495_056	Removal and installation device for valve cotters

Which answers are correct?

One or several of the given answers may be correct.

1. How is the high-pressure pump driven?

- ☐ a) The high-pressure pump is driven by the crankshaft via spur gearing.
- ☐ b) The high-pressure pump is driven by the inlet camshaft of cylinder bank 2 via a toothed belt.
- ☐ c) The high-pressure pump is driven via the ancillary drive chain.

2. How is the swirl of the intake air regulated?

- ☐ a) By swirls flaps for each cylinder.
- ☐ b) Only by specially shaped swirl channels.
- ☐ c) By a central swirl flap.

3. Which statement about the EGR cooling system is correct?

- ☐ a) The EGR coolant circuit is a separate coolant circuit.
- ☐ b) The EGR coolant circuit is integrated into the cylinder head coolant circuit.
- ☐ c) The EGR coolant circuit is part of the cylinder block coolant circuit.

4. Which statement about the thermal management system for the 3.0 I V6 TDI (generation 2) is true?

- ☐ a) The coolant circuit uses the split cooling concept.
- ☐ b) The cylinder head and cylinder block coolant circuits are separate.
- ☐ c) The cylinder head and cylinder block have a common, non-separable coolant circuit – the coolant pump can be switched off (stationary coolant).



Test Yourself

5. At what temperature does the thermostat for the oil cooler bypass open?

- ☐ a) Oil temperature $< 70^{\circ}\text{C}$
- ☐ b) Oil temperature $> 120^{\circ}\text{C}$
- ☐ c) Oil temperature $< 103^{\circ}\text{C}$

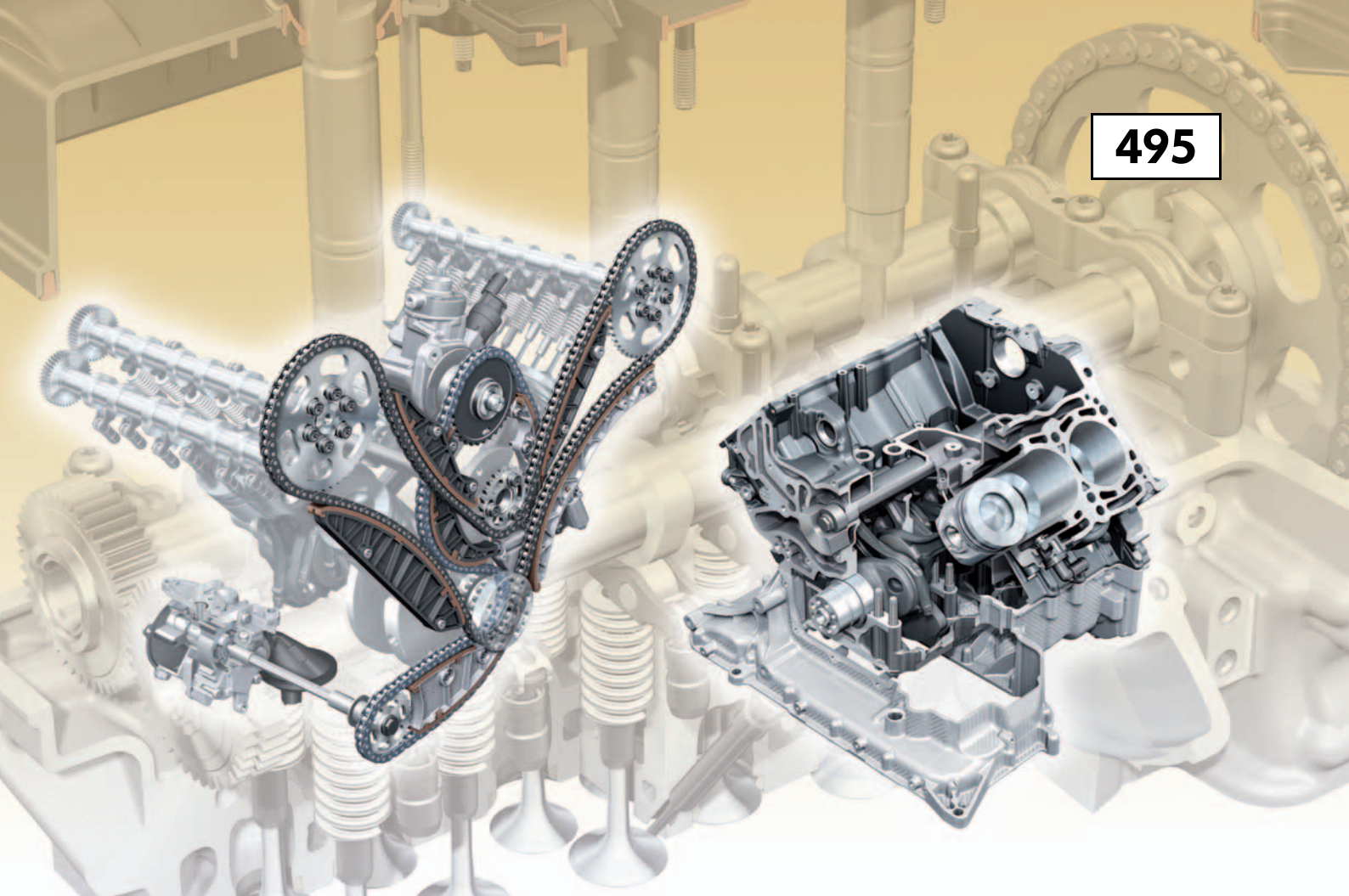
6. How high are the injection pressures for the two engine output versions?

- ☐ a) 1,800 and 2,000 bar
- ☐ b) 1,600 and 2,200 bar
- ☐ c) 2,000 and 2,200 bar



Answers:

- 1.) c)
- 2.) c)
- 3.) b)
- 4.) b)
- 5.) c)
- 6.) a)



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