Service Training

Self Study Program 820133

The 3.0L V6 TDI Engine (Generation 2)

Design and Function

Volkswagen Group of America, Inc.
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Contents

This Self-Study Program provides information regarding the design and function of new models.
This Self-Study Program is not a Repair Manual.

This information will not be updated.
For maintenance and repair procedures, always refer to the latest electronic service information.

Note

Important!

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Introduction

The first generation of the 3.0L V6 TDI engine entered series production at Volkswagen in 2005.

Over 1.6 million V6 TDI engines have now been built. Now, Volkswagen is introducing the second generation of this engine.

This newly developed engine combines low consumption, low emissions and a high level of power with reduced weight. The development focus was to minimize friction and weight reduction.

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

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Introduction

The 3.0L 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)
- Oxidizing 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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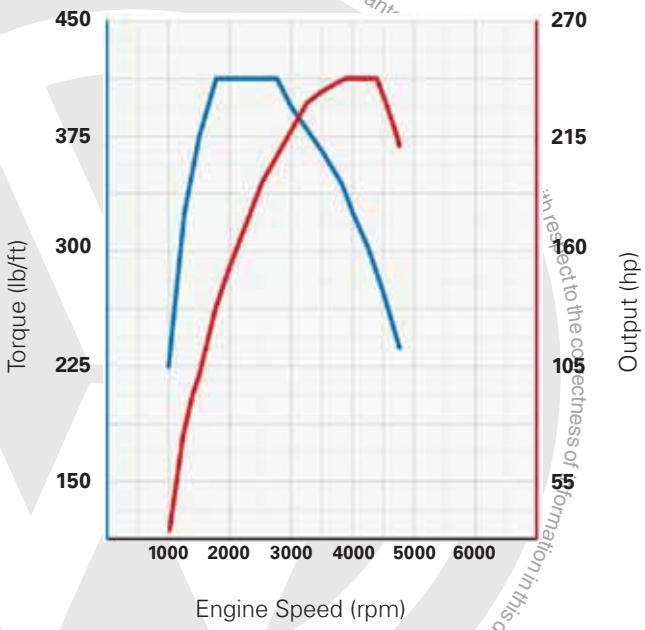
Technical Data

Engine Code	CRCA
Type	V6 Engine with 90° V angle
Displacement	181 in³ (2,967 cm3)
Bore	3.3 in (83 mm)
Stroke	3.6 in (91.4 mm)
Valves per Cylinder	4
Compression Ratio	16.8 : 1
Max. Output	241 hp (180 kW) at 3,800 to 4,400 rpm
Max. Torque	406 lb/ft (550 Nm) at 1,750 at 2,750 rpm
Engine Management	Bosch CRS 3.3 common rail injection system
Fuel	Ultra-low sulfur diesel
Exhaust Emissions Standard	EU5

Torque and Output Diagram



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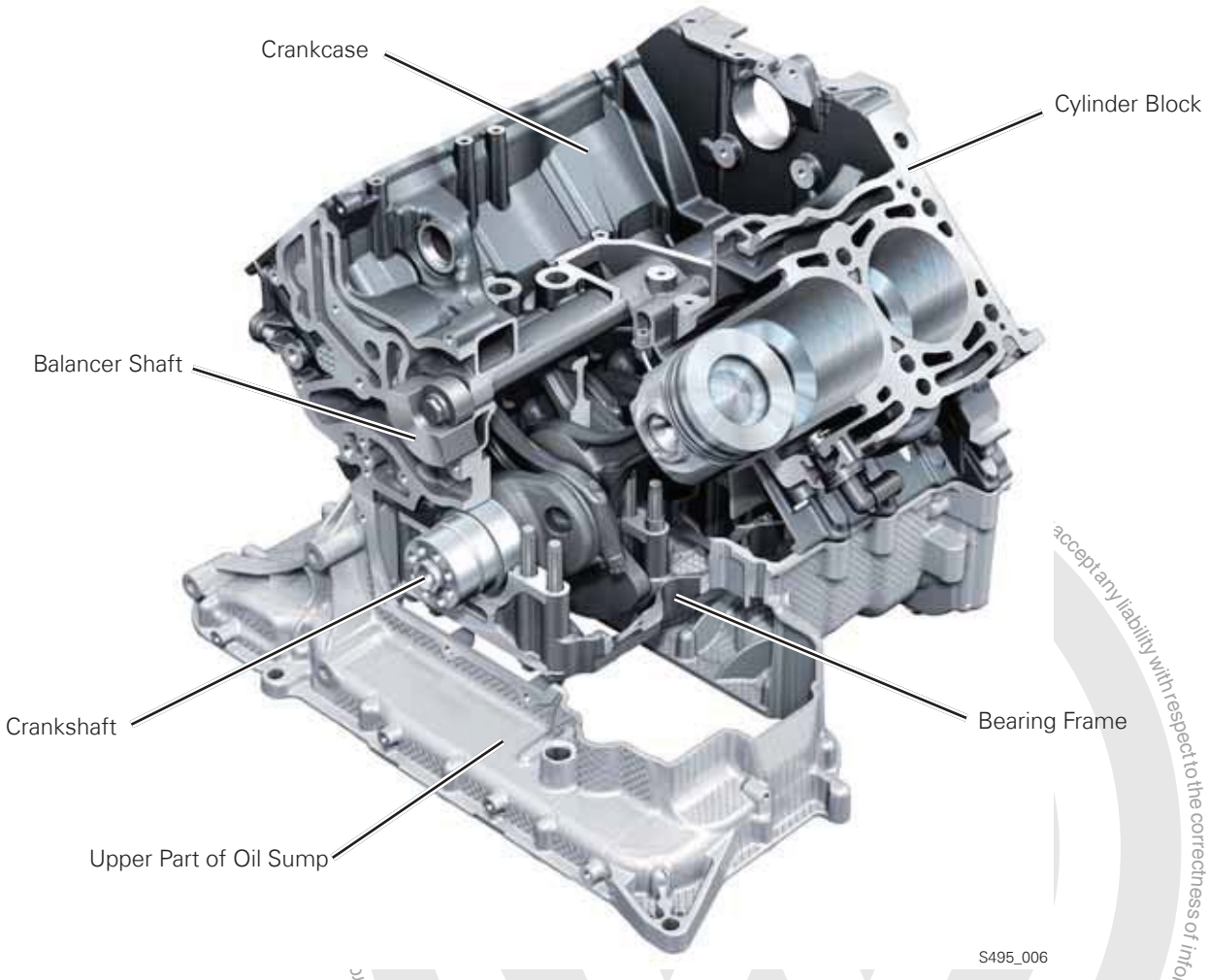
Crankshaft Drive

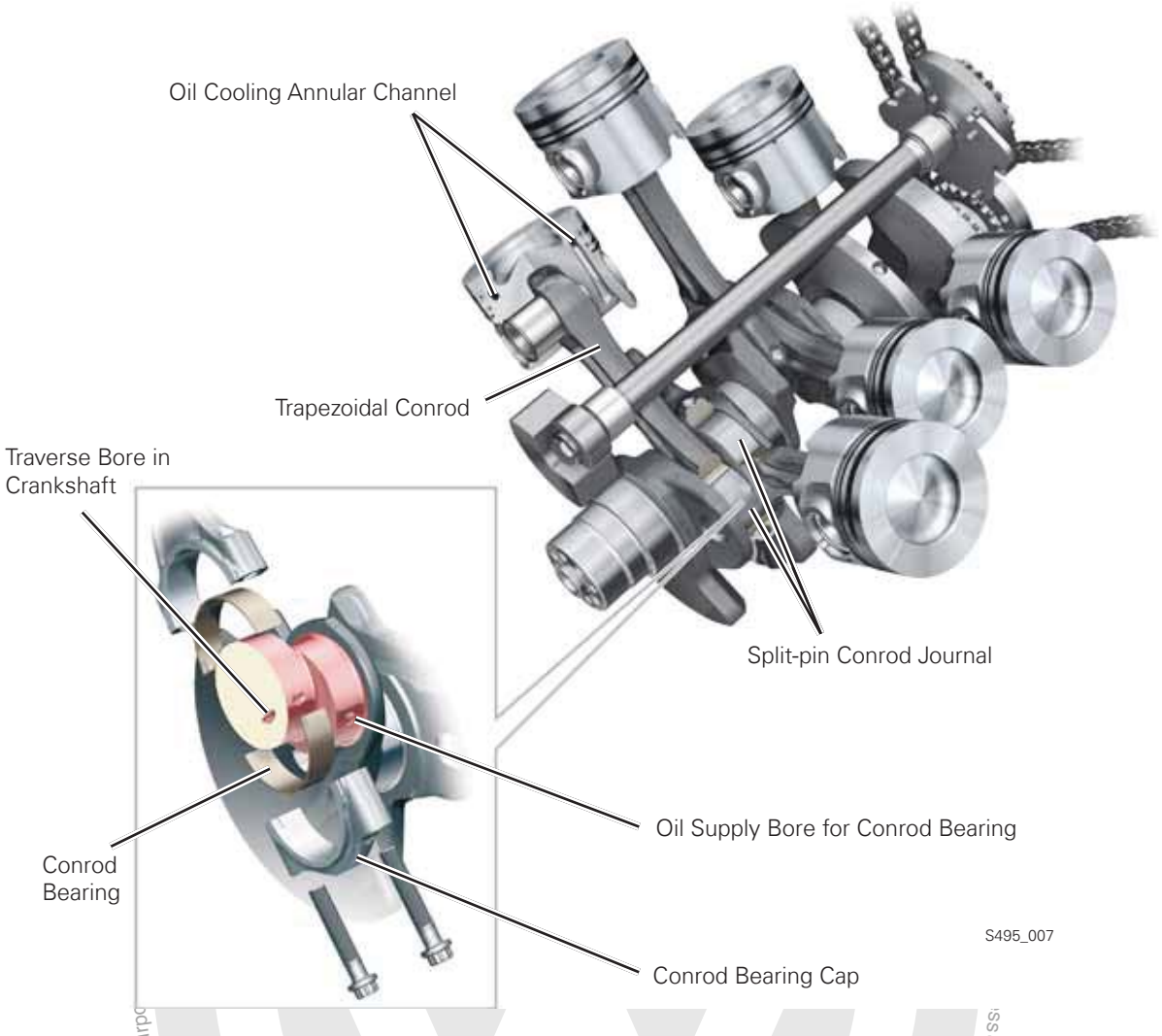


The basic design of the crankcase is the same as the previous engine, with high strength and high load-bearing capabilities.

The bearing frame design is also the same for strength reasons. The weight of the crankcase has been reduced by approximately 8kg (17 lb) by reducing the wall thicknesses throughout the crankcase.

The deck-plate honing method has been used for the cylinder bores. This creates an optimum cylinder shape, allowing for lower piston ring tension. This reduces blow-by rates and decreases mechanical friction

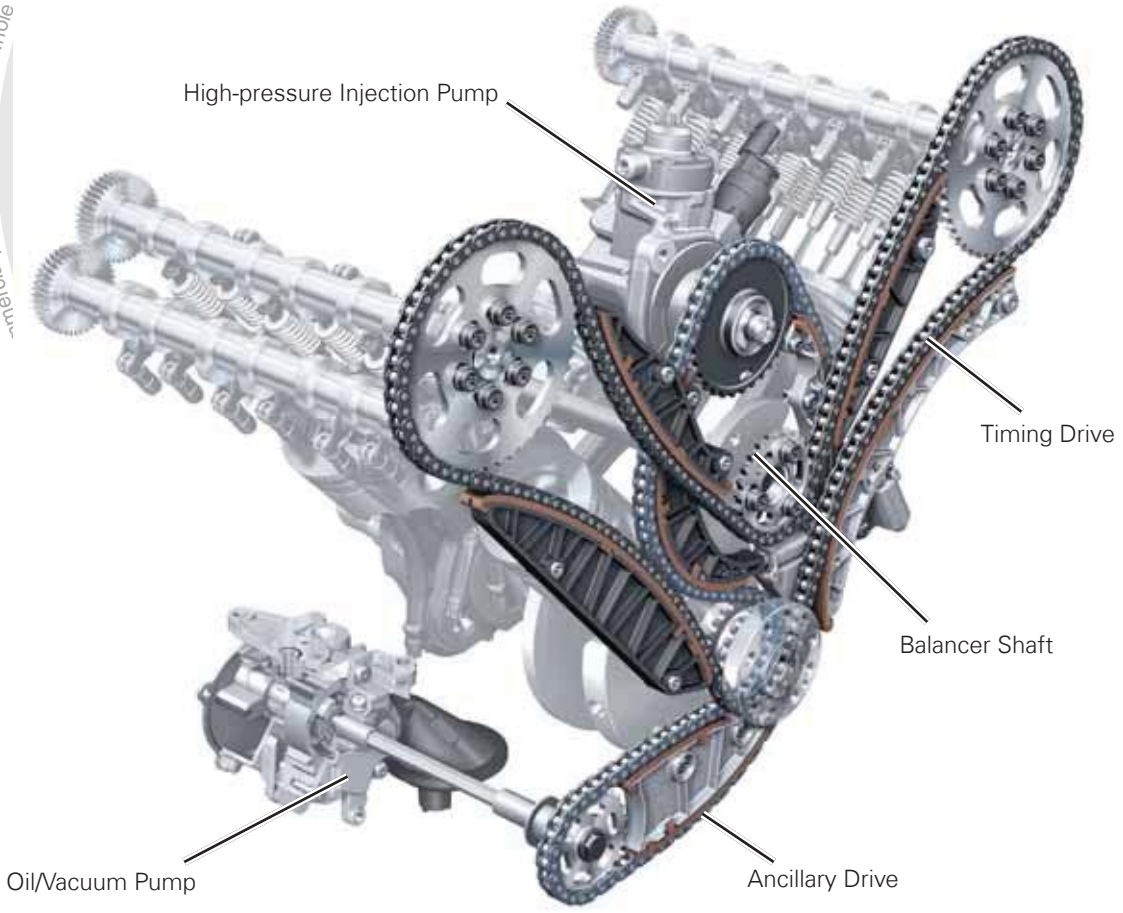
Engine Mechanics



The forged crankshaft uses a split-pin design in the 90° V engine for equal firing intervals and to reduce engine noise. Both the main bearing and the conrod bearing journals are induction hardened for strength.

The forged conrods are split diagonally and industrially cracked. The aluminium pistons use a salt-core cooling gallery and splash oil cooling for optimum cooling of the piston crown and piston rings.

Chain Drive



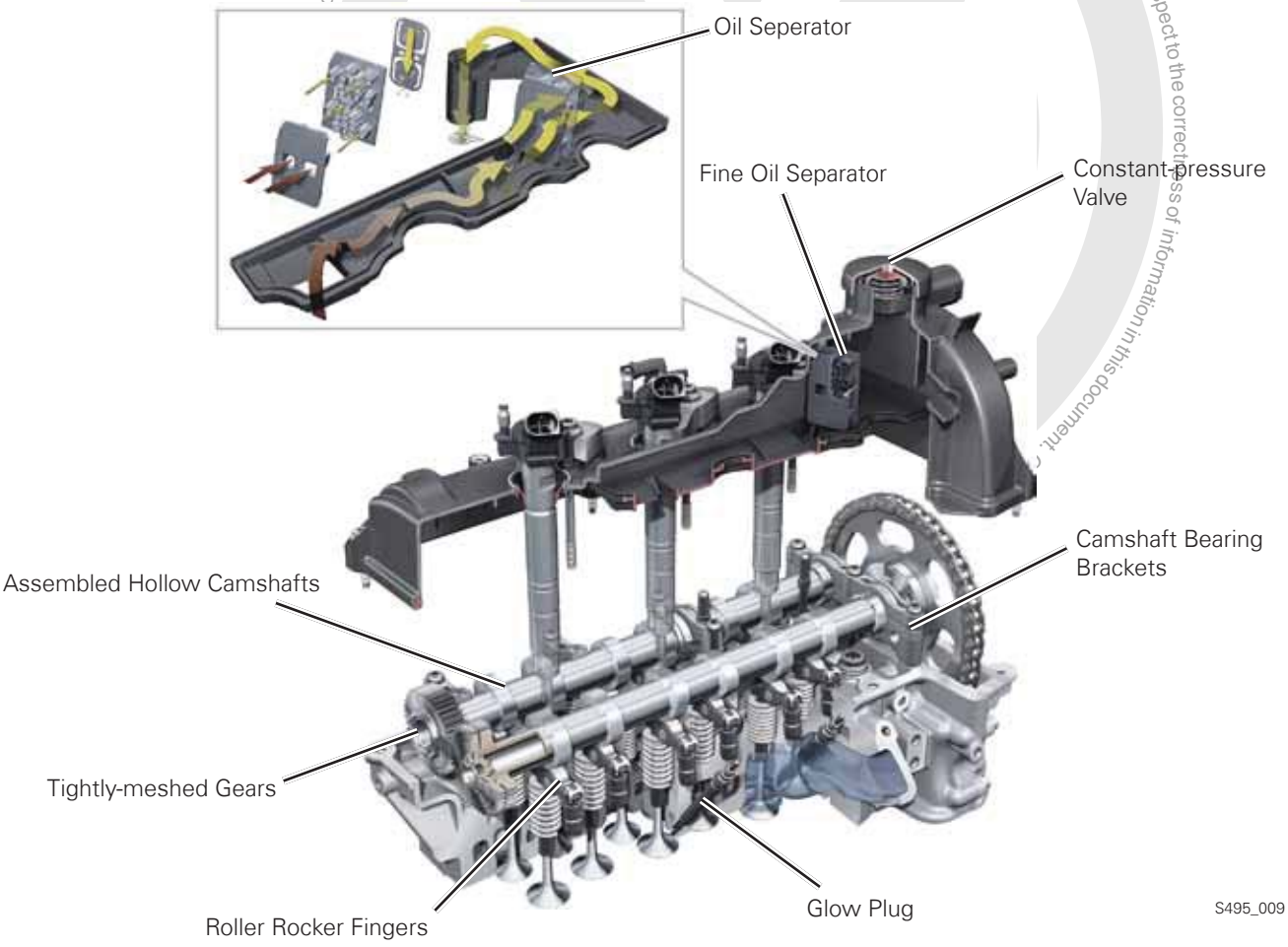
A relatively long roller chain with 206 links is used to drive the two inlet camshafts and the balance shaft. The chains have a wear-resistant coating. This reduces chain stretch over time.

The ancillary drive chain is also a roller chain. It drives the high-pressure injection pump, the oil pump and the vacuum pumps (combined in one housing).

The new chain layout has two chains and two chain tensioners instead of four of each. Also, two idler gears have been removed.

The new drive system for the high-pressure pump removes a toothed belt, simplifying assembly and reducing friction and weight.

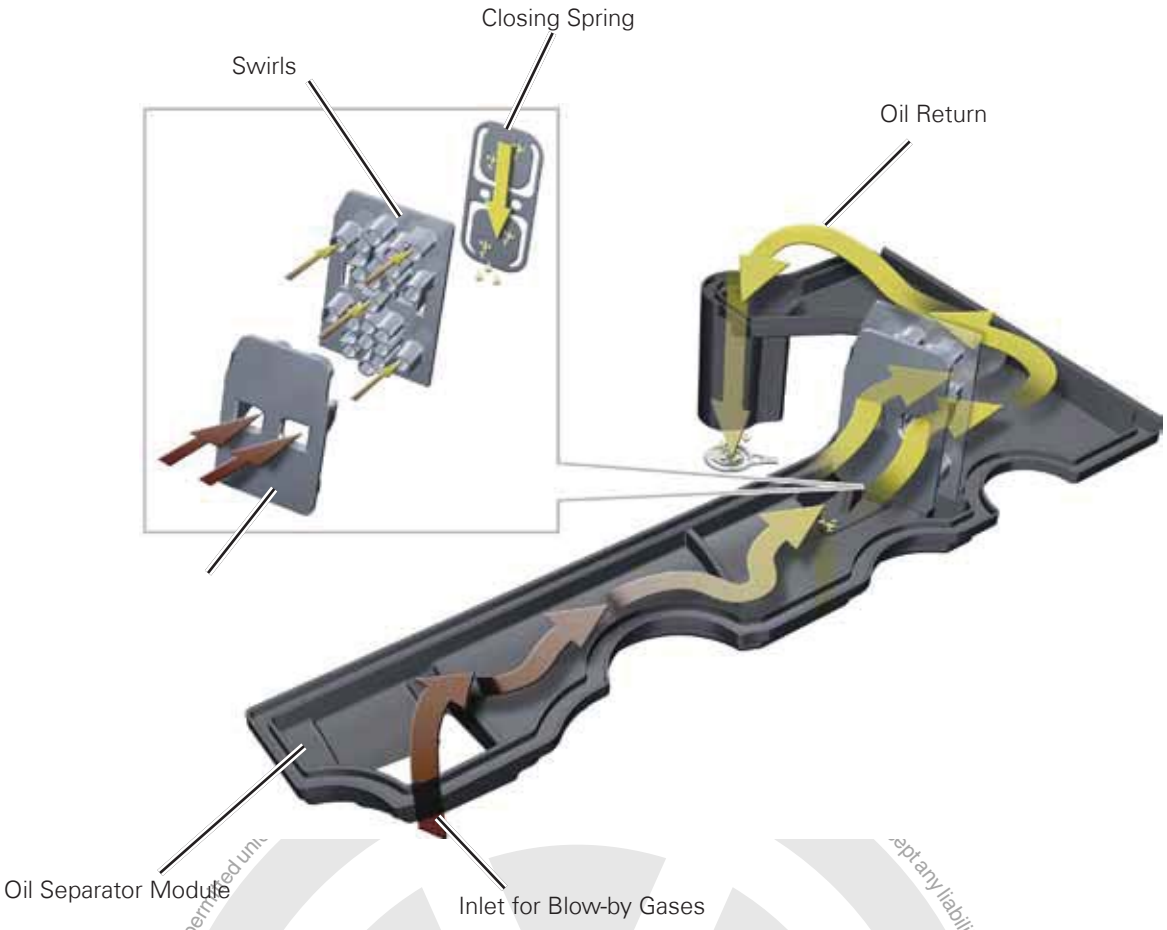
Cylinder Head



The four-valve combustion design is carryover 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 changed to keep the combustion chamber temperatures at an acceptable level. The exhaust ports are positioned further apart and made smaller to increase the size of the coolant chamber. Also, the coolant chamber has been designed for consistent volume and flow speed in areas close to the combustion chambers. The coolant enters on the exhaust side using three separate ports for each cylinder.

The main flow is guided between the exhaust valves and is then branches into the areas between valves. The hollow camshafts have with split double bearing brackets (instead of ladder frame). This eliminates the need for special clearances when installing cylinder head bolts.

To reduce noise, the exhaust camshafts are driven by tightly meshed gears. The bearing diameter of the camshafts has been reduced from 32 to 24 mm (1.26 to 0.9 in) to reduce friction.



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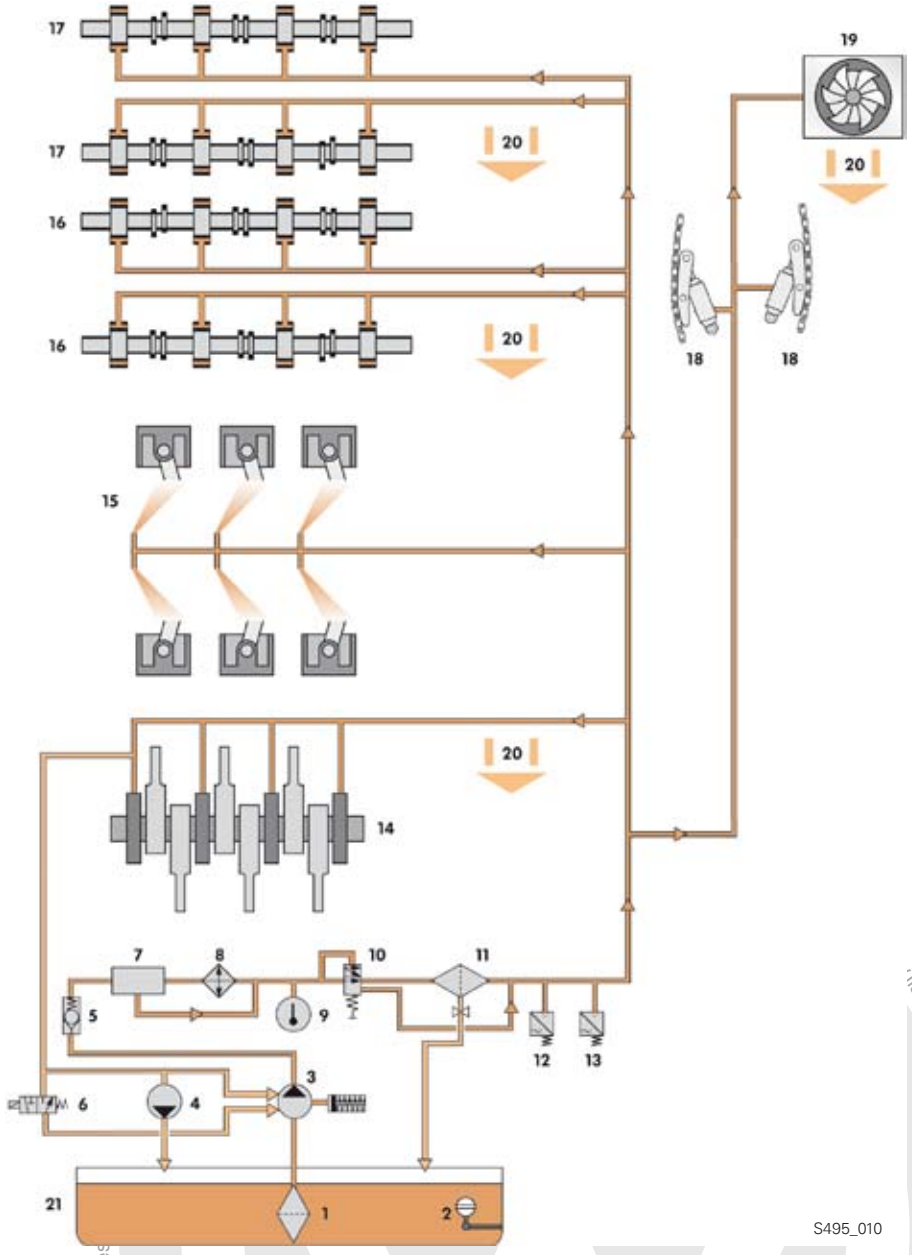
The engine breather system has been moved from the inner V to the cylinder heads. Coarse and fine oil separators are integrated into both cylinder head covers. The crankcase breathers run via the pressure regulating valve to the suction side of the turbocharger.

Oil System



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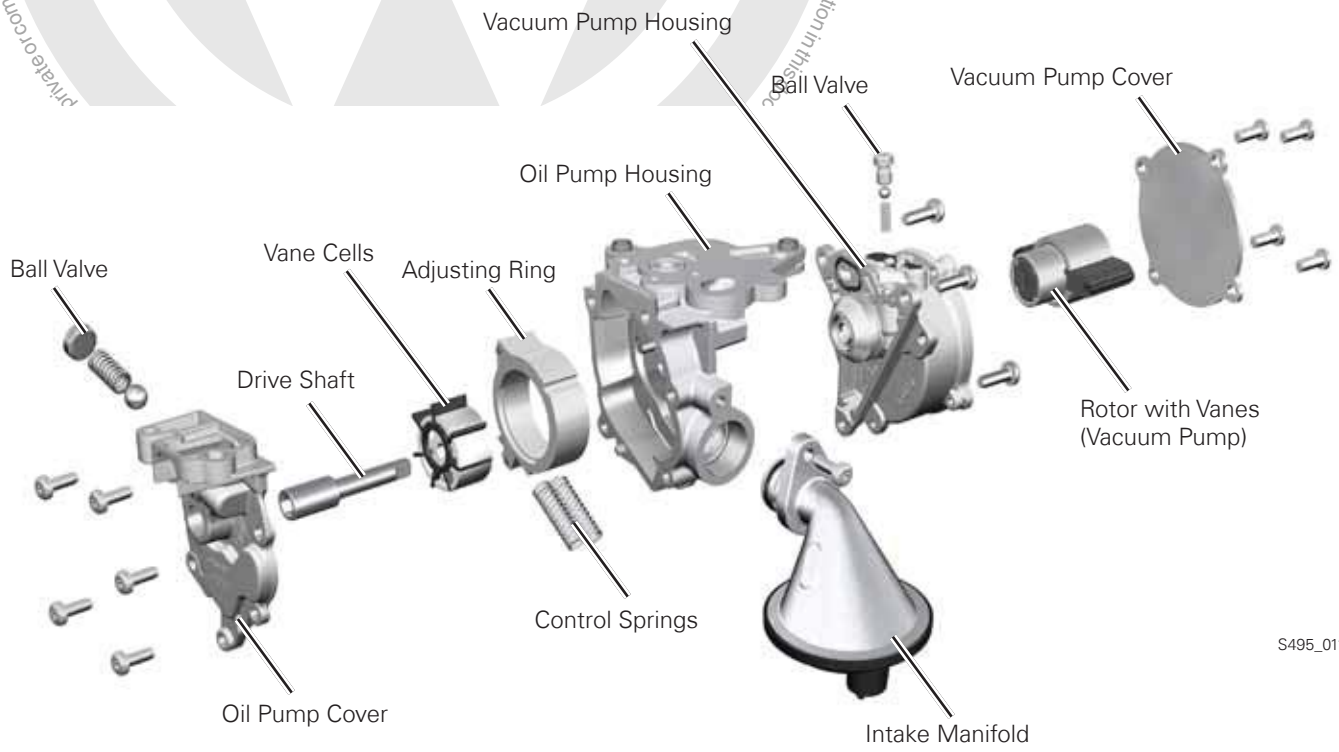
1. Pickup Screen
2. Oil Level Thermal Sensor G266
3. Oil Pump
4. Vacuum Pump
5. Non-return Valve
6. Oil PRessure Regulation Valve N428
7. Thermostat
8. Engine Oil Cooler
9. Oil Temperature Sensor G8
10. Filter Bypass Valve
11. Oil Filter
12. Reduced Oil Pressure Switch F378
13. Oil Pressure Switch F22
14. Crankshaft
15. Spray Jets for Piston Cooling
16. Camshafts for Cylinder Bank 1
17. Camshafts for Cylinder Bank 2
18. Chain Tensioner
19. Turbocharger
20. Oil return
21. Sump

Volumetric Flow-controlled Oil Pump with Vacuum Pump

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

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

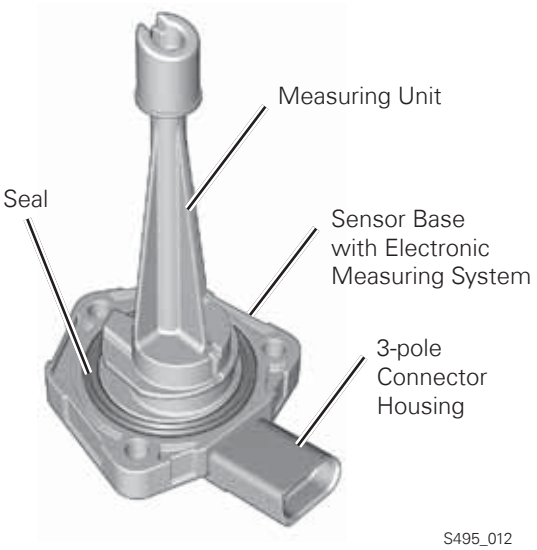
The oil pump and the vacuum pump are combined in one housing. The two pumps are driven by the chain drive system on the gearbox side through a stub shaft. The vacuum pump produces the vacuum by means of a rotor with adjustable vanes.



Oil Level Sensor

An electronic oil level sensor is used in 3.0L V6 TDI engines. There is not a conventional oil dipstick. The oil level sensor works with ultrasound. The ultrasonic pulses are reflected by the boundary layer of oil and air.

Oil Level Sensor



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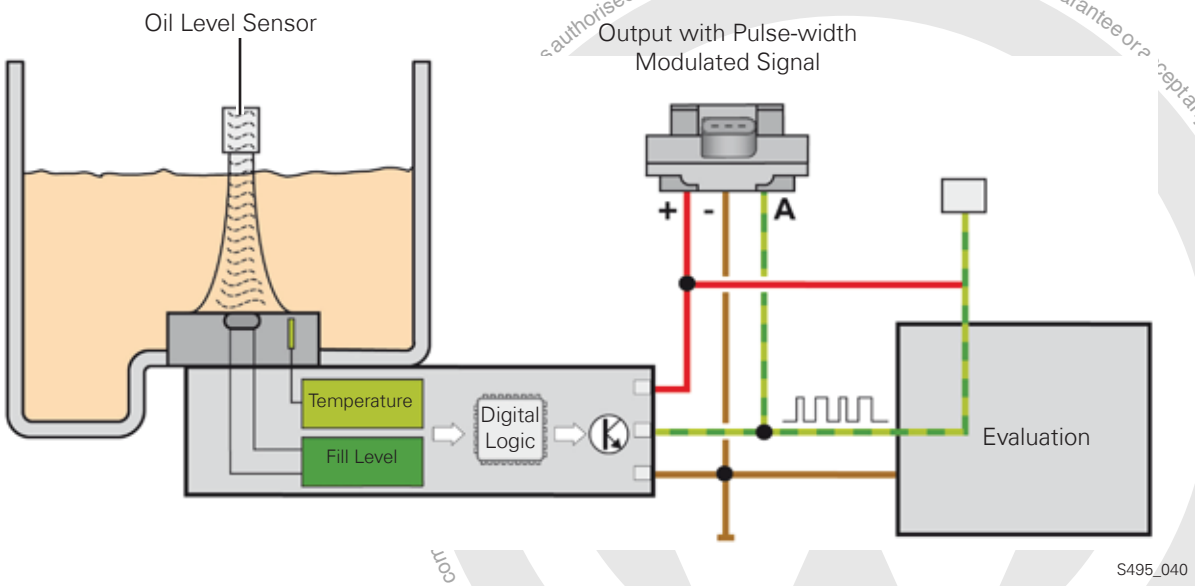
Operating Principle

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



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Air Intake

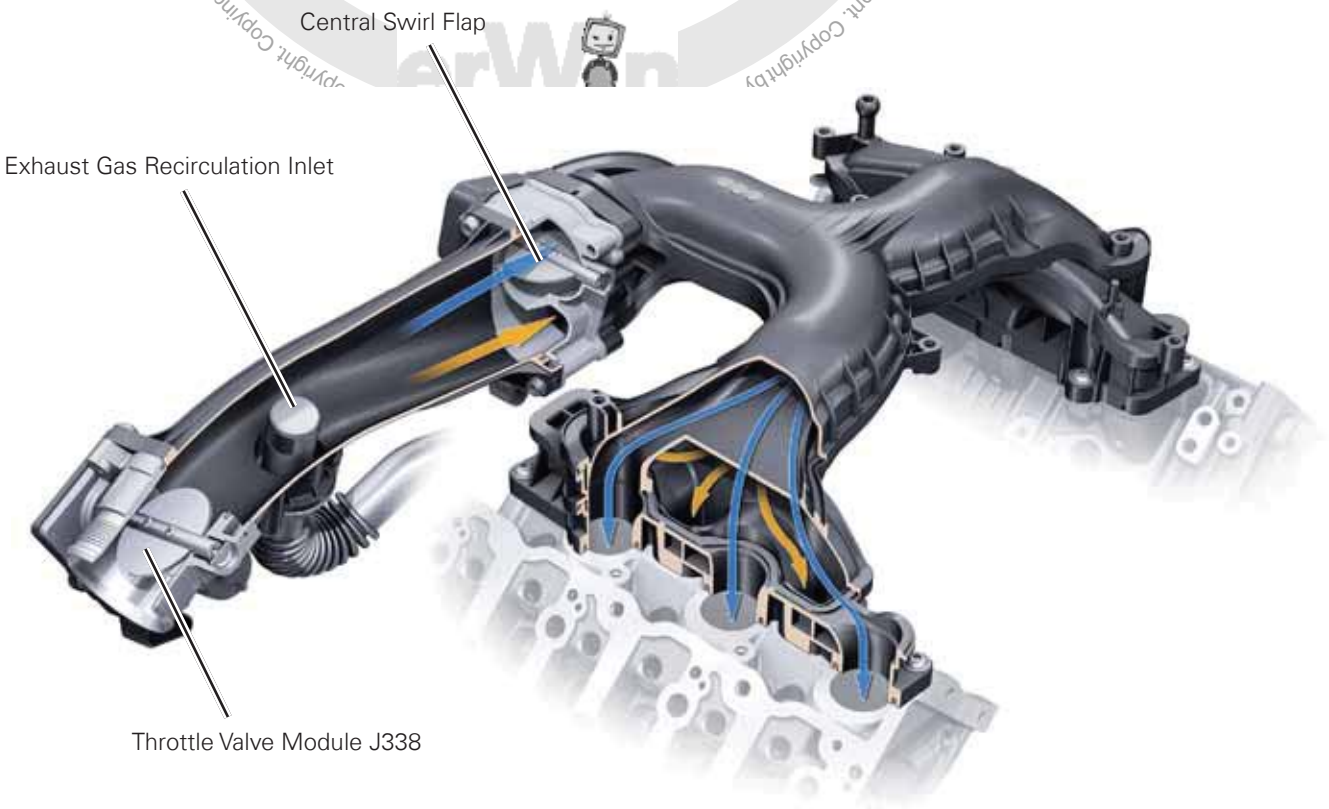
The intake air reaches the throttle valve through a plastic air duct. Recirculated exhaust gases are fed into the intake connecting pipe in a way that assists the air flow.

When the exhaust gases are fed in, deposits on the inside plastic wall are avoided due to the geometric shape.

In previous engines, six flaps were used for swirl regulation. This engine only uses one flap because 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 improved to control pressure loss and to evenly distribute air flow 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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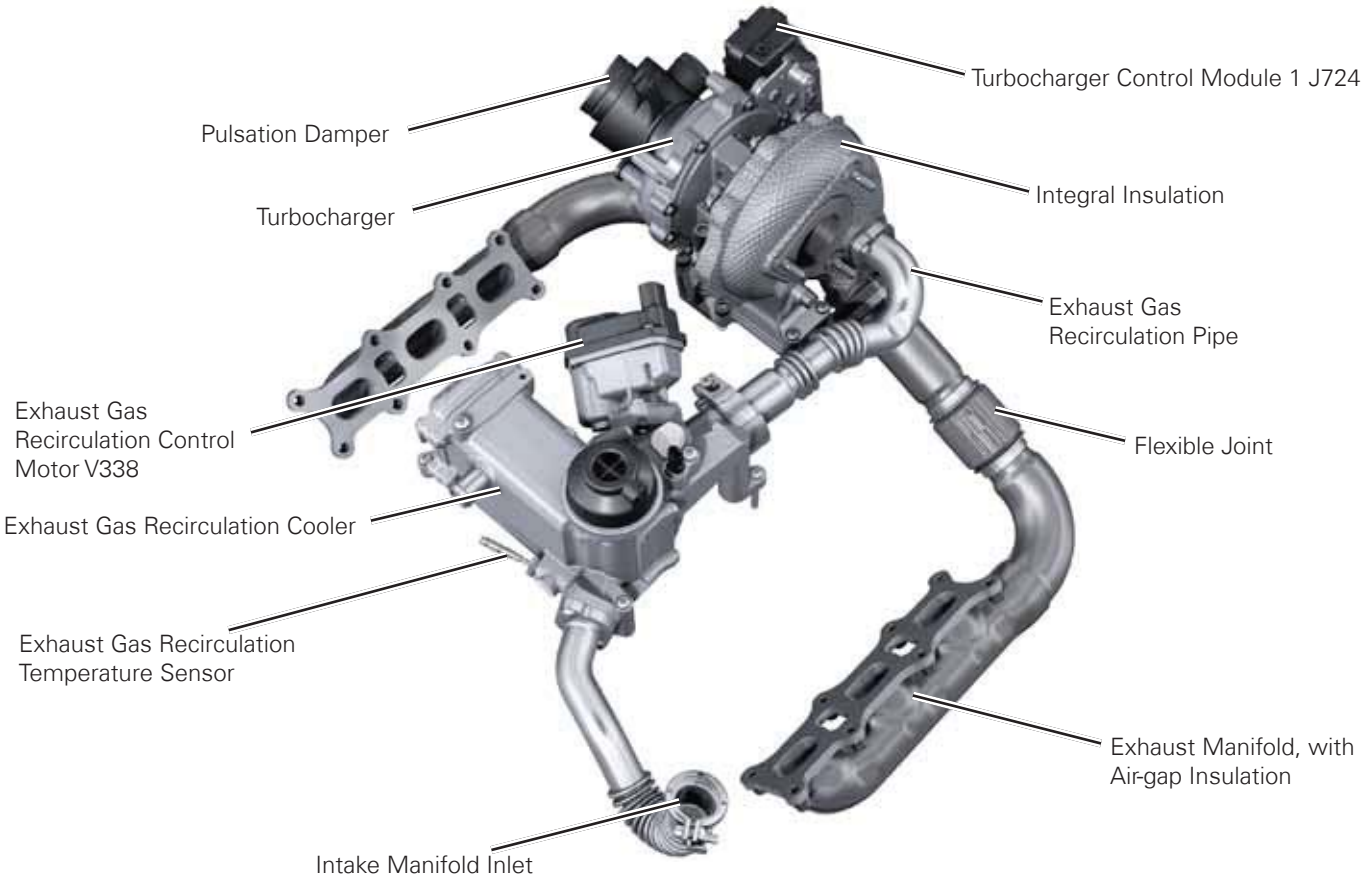
Exhaust Gas Recirculation (EGR)

The exhaust gas recirculation system plays a decisive role in meeting the emissions standards. The components of the exhaust gas recirculation system such as the 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 optimized to reduce pressure losses related to high recirculation rates. Despite the omission of the separate low-temperature coolant circuit, this engine has the same EGR cooling performance as the previous engine.

The exhaust gas recirculation cooler is now incorporated into the cylinder head circuit and 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. It is also much lighter.

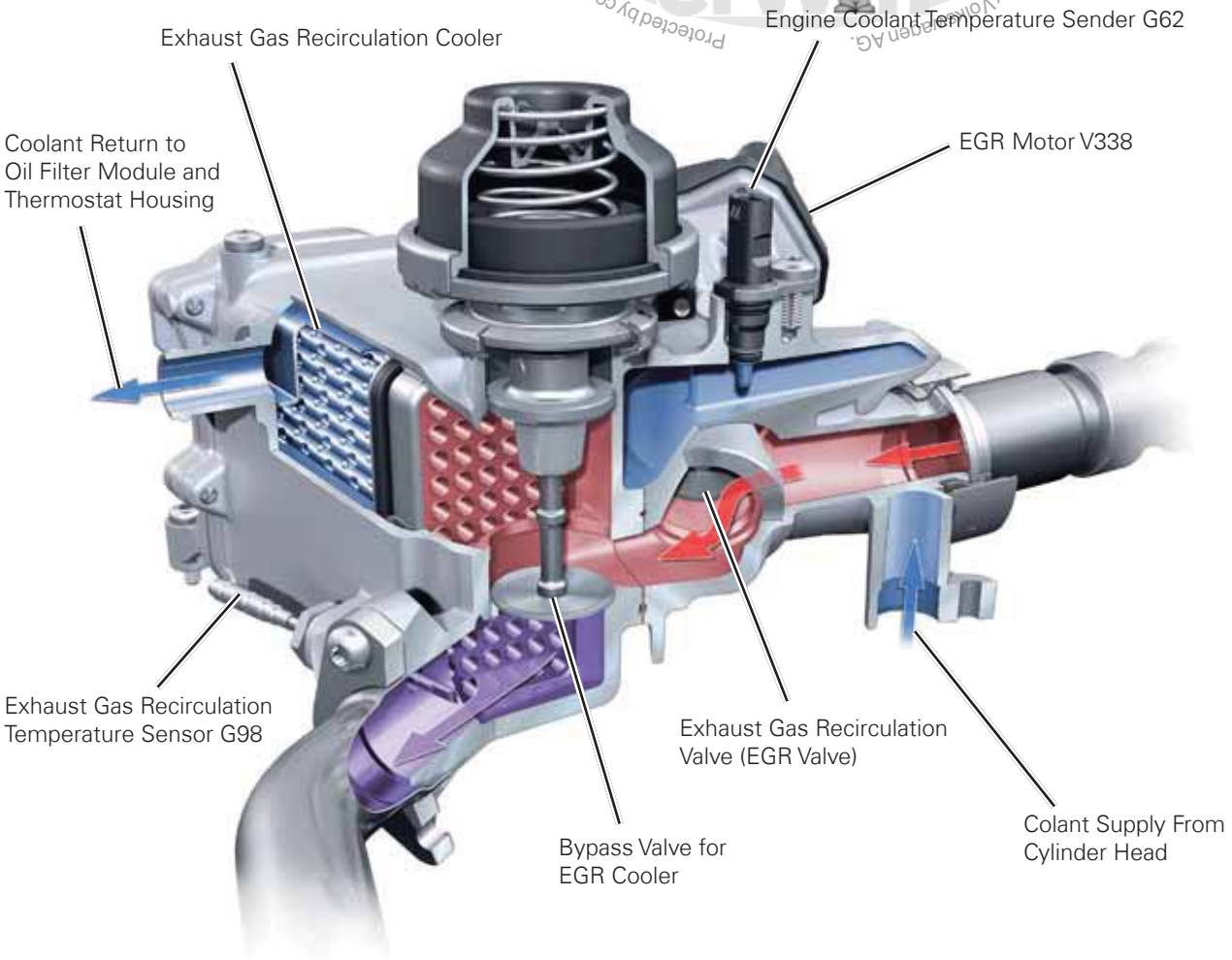


Cooler for Exhaust Gas Recirculation

The 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 to 30 mm.

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

Compared with a flap that inevitably always has a gap, a lift valve guarantees a tight seal during cooling operation. This enables 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. This allows maximum EGR cooling to minimise NOx emissions and to prevent the formation of condensation.



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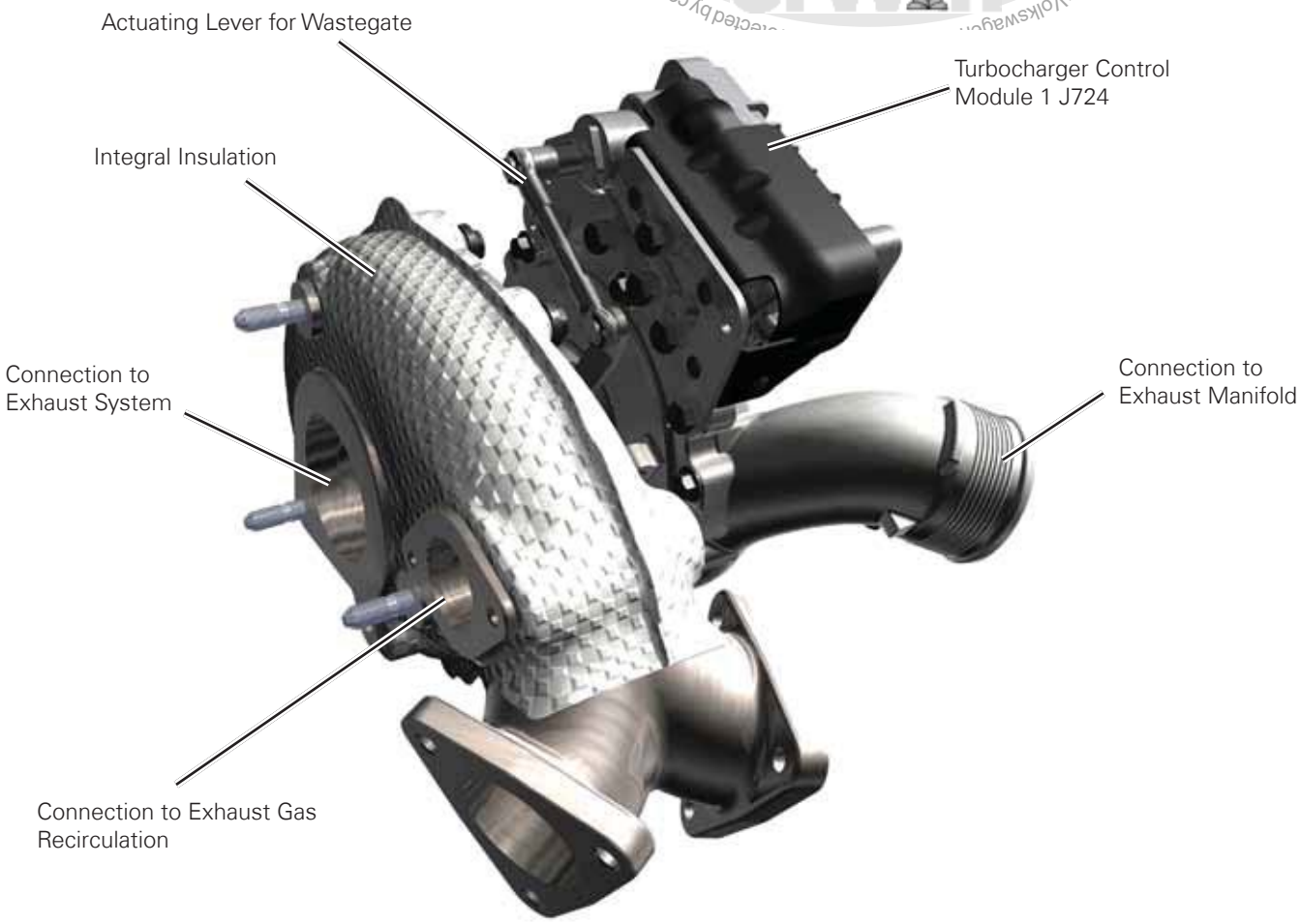
Turbocharger

The turbocharger has is a Honeywell GT 2260 turbocharger with increased performance. The turbocharger has been optimized in many areas. Both the compressor wheel and turbine have been modified and the rotating parts have been altered reduce friction. This allows fast response and an even torque delivery.



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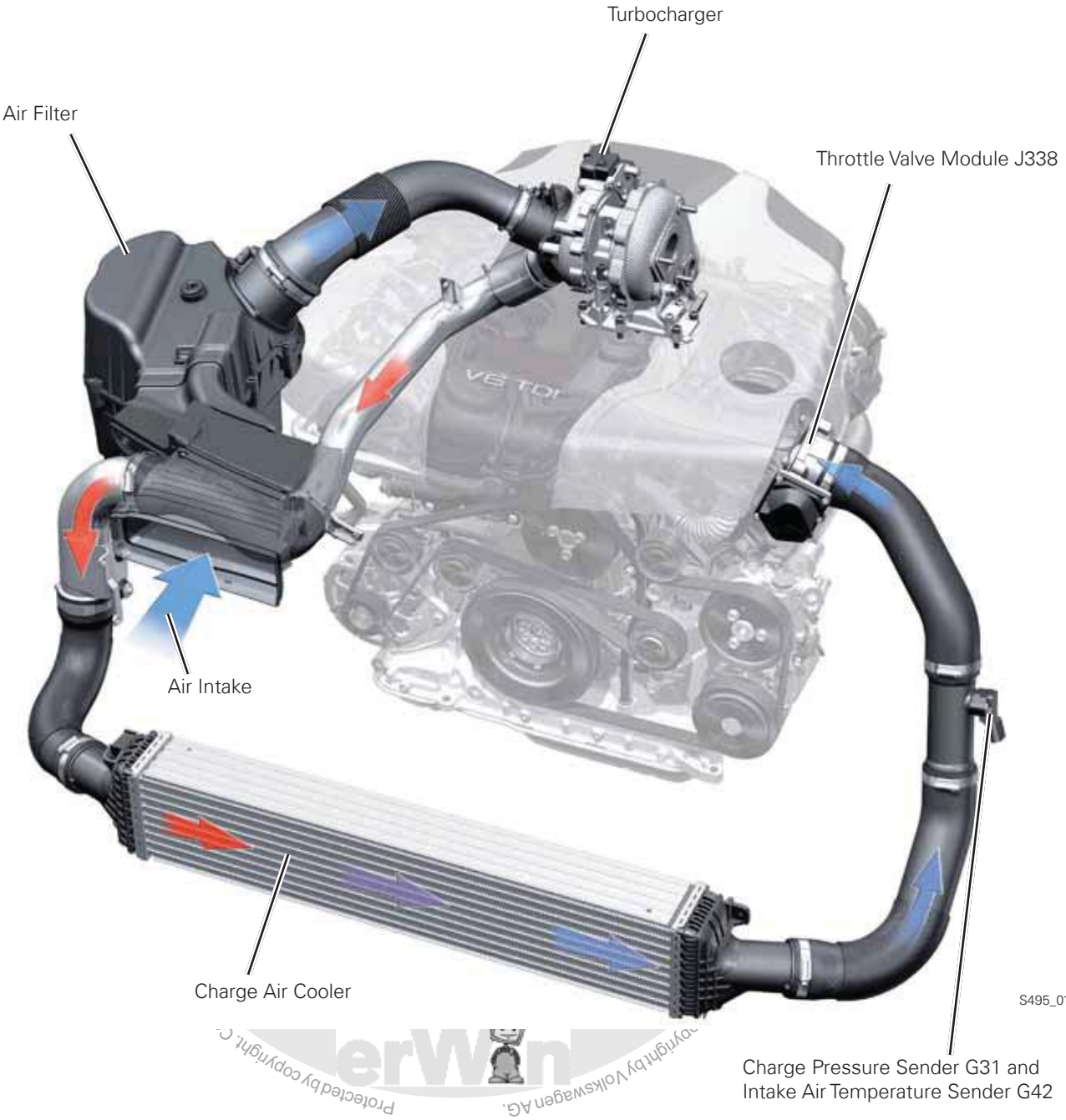
Charge Air Cooling

The charge air system has been revised from the air filter to the turbocharger. On the pressure side, low-turbulence hose connections are used to improve airflow, reducing consumption while improving engine response time.



Cooling System

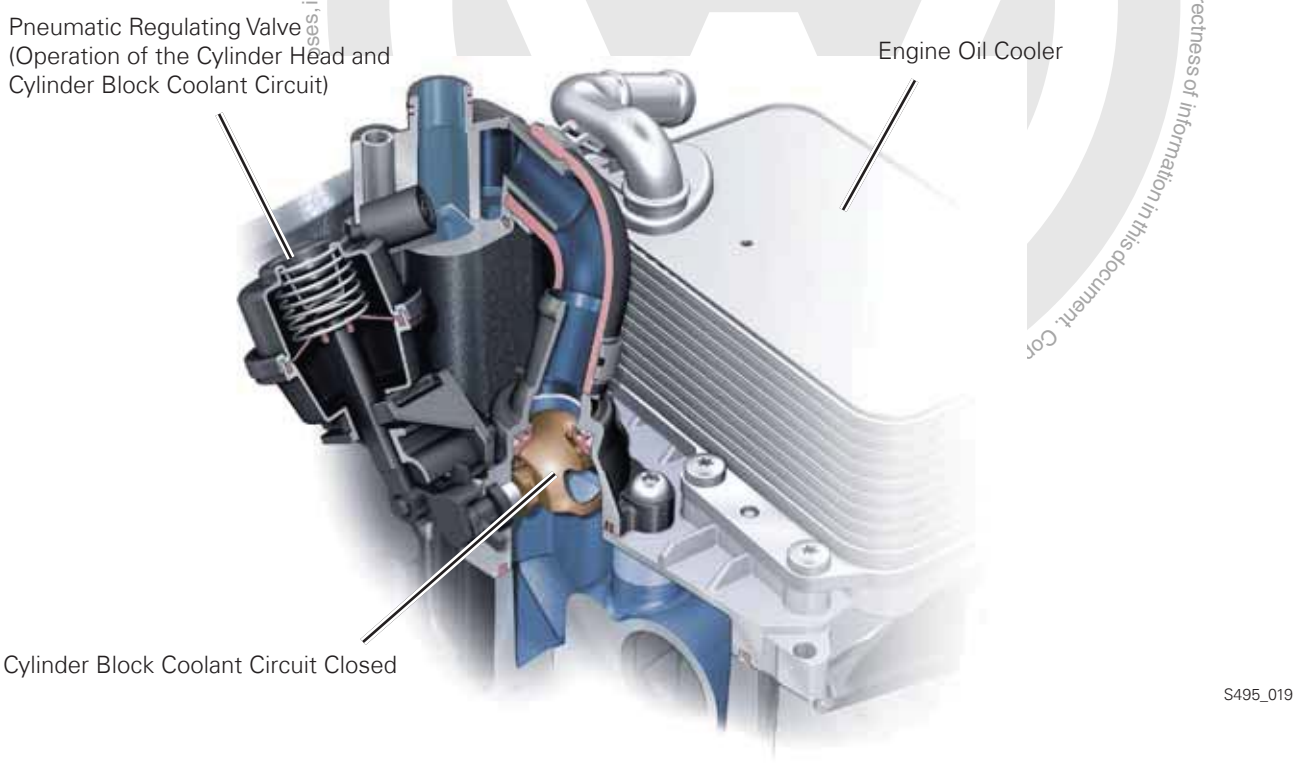
Cylinder Head Coolant Circuit

The cylinder head coolant circuit is made up of coolant chambers in the cylinder heads, the exhaust gas recirculation cooler, the oil cooler, the heating and transmission oil heat exchanger and the main radiator. The cylinder head coolant circuit is regulated by a wax thermostatic element.

The thermostat is not energized during the warm-up phase of the engine and opens at approx. 90° C (194° F). No heat is transferred to the main radiator until this temperature is reached. The coolant is only used to warm the transmission and the HVAC system (if necessary).

Energizing the wax thermostatic element allows coolant to be exchanged between the radiator and the cylinder head for:

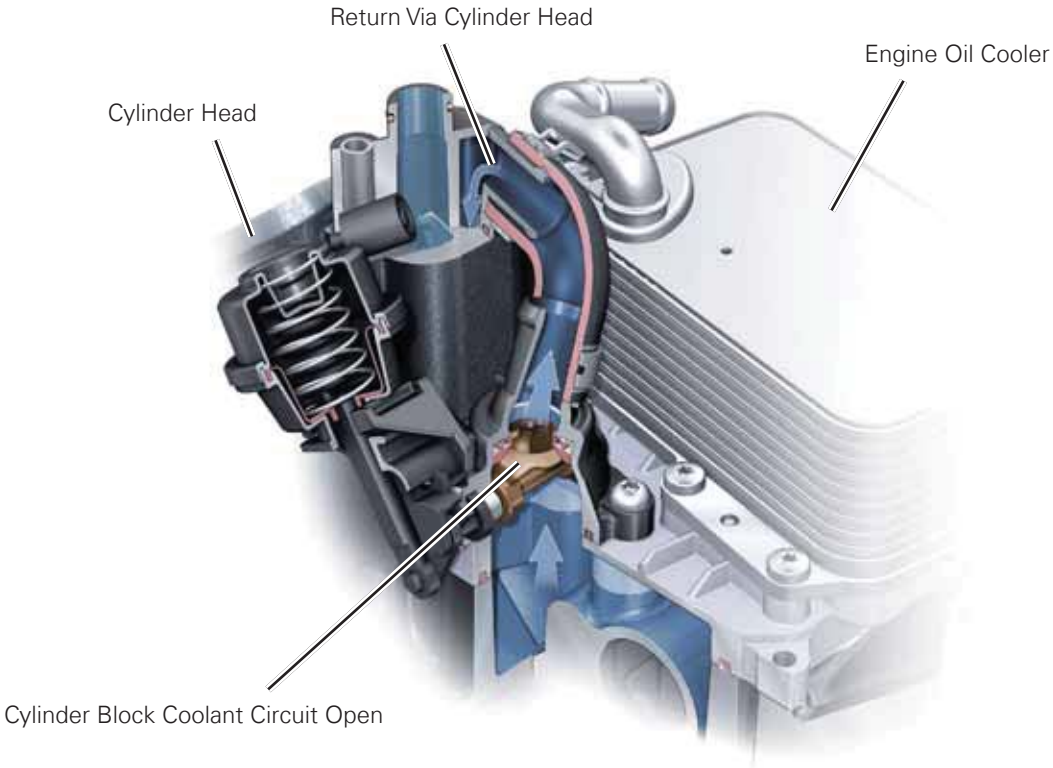
- Cylinder Head Component Protection
- Maximum EGR Cooling Requirement
- Transmission Cooling Requirement



Cylinder Block Coolant Circuit

The coolant for the cylinder block coolant circuit reaches the exhaust side of the cylinder banks through non-return valves in the cylinder block. The non-return valves prevent return flow of coolant between the cylinder banks and unwanted heat transfer from the cylinder block, controlling the flow in the circuit. The cylinder block coolant circuit is closed by a vacuum-controlled ball valve. This allows the coolant to be heated quicker, shortening the warm-up phase of the engine and reducing friction.

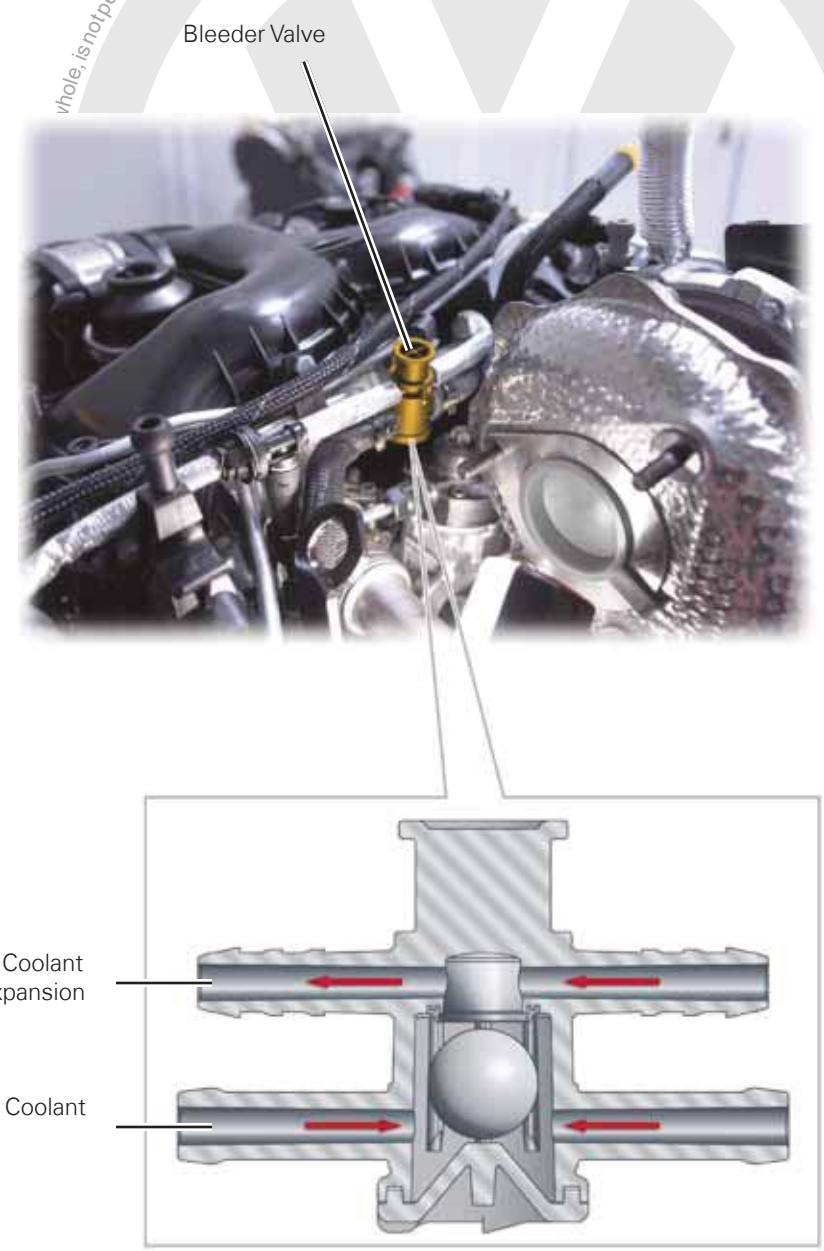
The temperature level of the cylinder block coolant circuit is regulated at approx. 105° C (221° F). This allows the rotating assemblies to work at the best possible friction temperature level. The ball valve is activated by the Cylinder Head Coolant Valve N489 using pulse-width modulation (PWM). To help the system warm up quickly, an engine oil cooler bypass is also located in the oil system.



Bleeding the System

The cylinder block coolant circuit has its own bleeder valve. 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 coolant circuits to a bleeder valve. The bleeder valve connects 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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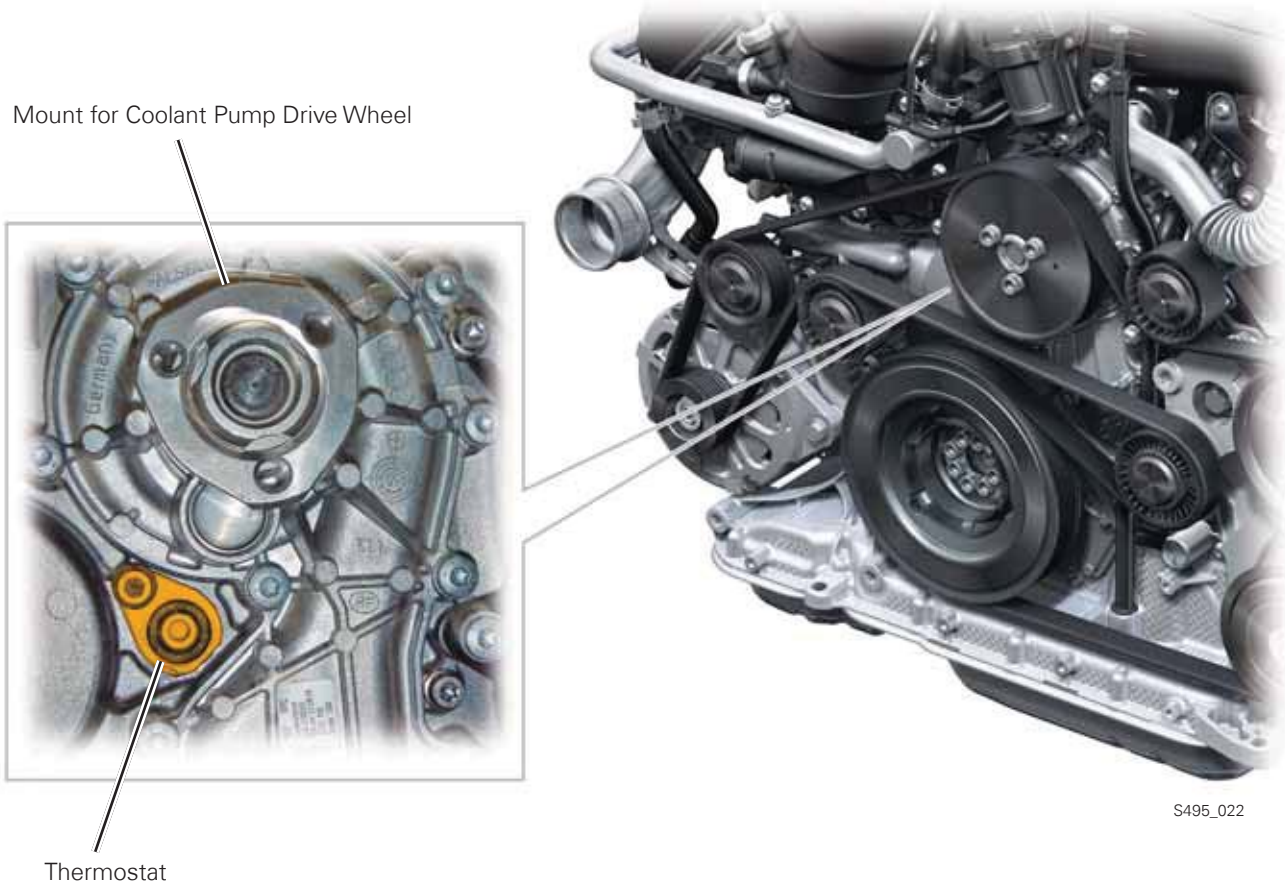
Engine Oil Cooler with Thermostat-controlled Bypass Channel

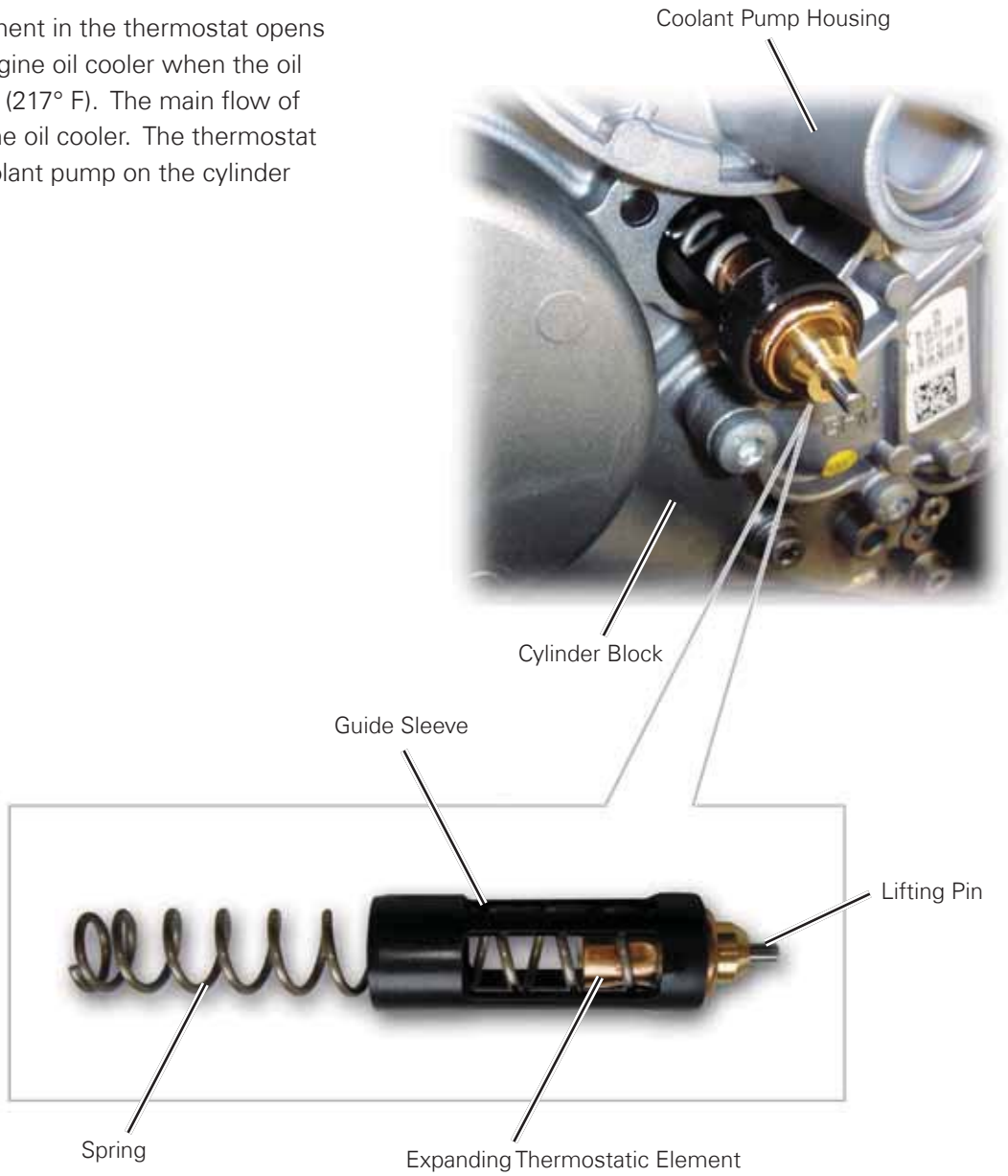
The engine oil cooler is equipped with a thermostat-controlled oil cooler bypass.

Design



Function

The expanding wax element in the thermostat opens a bypass valve at the engine oil cooler when the oil temperature is < 103° C (217° F). The main flow of oil is sent past the engine oil cooler. The thermostat is located below the coolant pump on the cylinder block.



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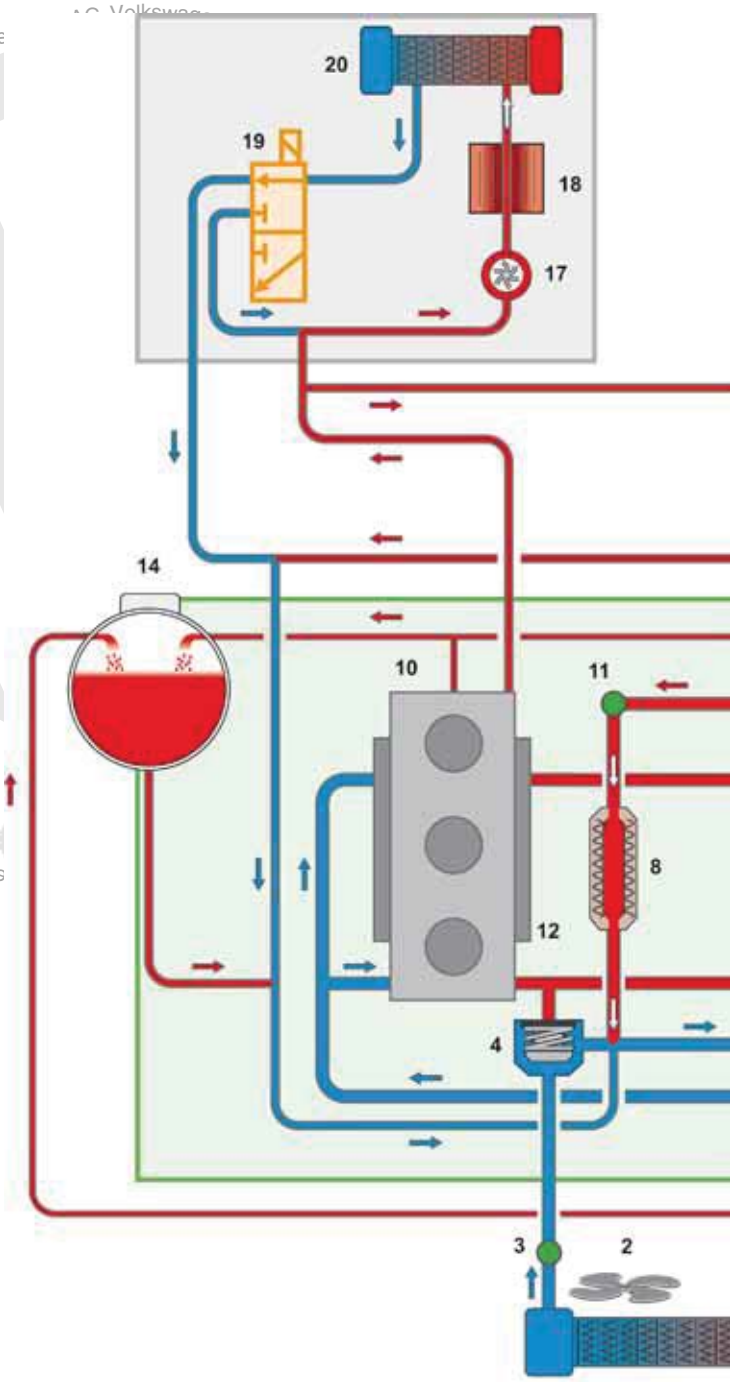
Innovative Thermal Management System for 3.0L V6 TDI Engine (Generation 2)

The purpose of the thermal management system is to reduce the warm-up time of the engine and control temperatures so that the engine runs at a good friction level.

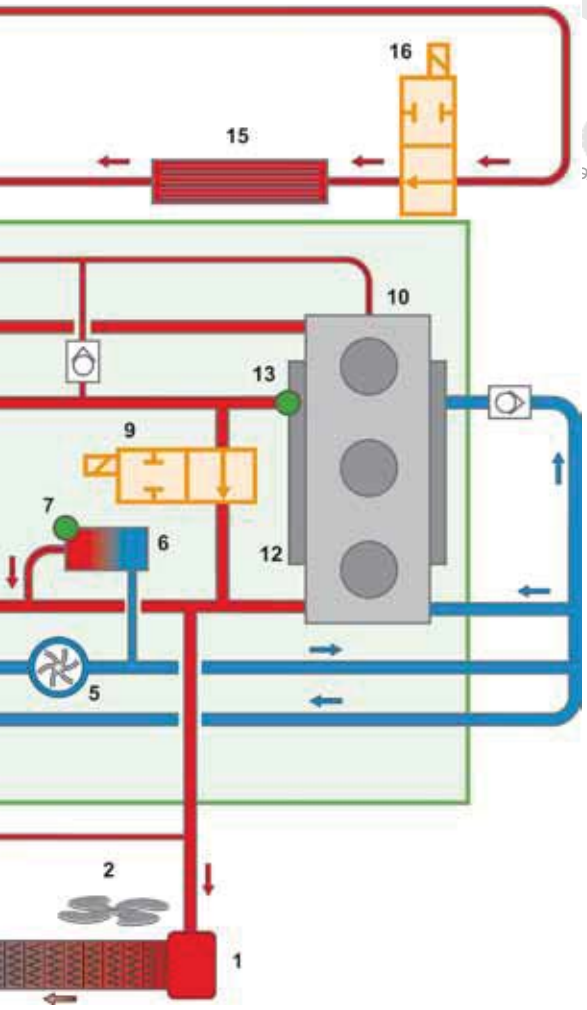
The cooling system uses a split-cooling concept in which the cylinder block and cylinder head each have their own coolant circuits. This allows the individual temperatures to be set for the cylinder block and cylinder head even when the engine has reached operating temperature.

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 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.

This split-cooling design also allows independent supply of coolant to the interior and transmission oil heaters regardless of whether the coolant in the cylinder block is stationary.



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



Key:

1. Radiator
2. Radiator Fan
3. Engine Coolant Temperature Sensor on Radiator Outlet G83
4. Map Controlled Engine Cooling Thermostat F265
5. Coolant Pump
6. Engine Oil Cooler
7. Oil Level Thermal Sensor G266
8. Cooler for Exhaust Gas Recirculation
9. Coolant Shut-off Valve
10. Cylinder Head
11. Engine Coolant Temperature Sender G62
12. Cylinder Block
13. Engine Temperature Control Sensor G694
14. Coolant Expansion Tank
15. ATF Cooler
16. Transmission Coolant Valve N488
17. Coolant Recirculation Pump V50
18. Auxiliary Heater (not for NAR)
19. 3/2-way Valve
20. Heat Exchanger for Heater

Fuel System

Schematic Overview

1. **Fuel Delivery Unit**
   Constantly delivers fuel to the presupply.

2. **Pressure-resistant Fuel Filter**

3. **Fuel Temperature Sensor G81**
   Measures the current fuel temperature.

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

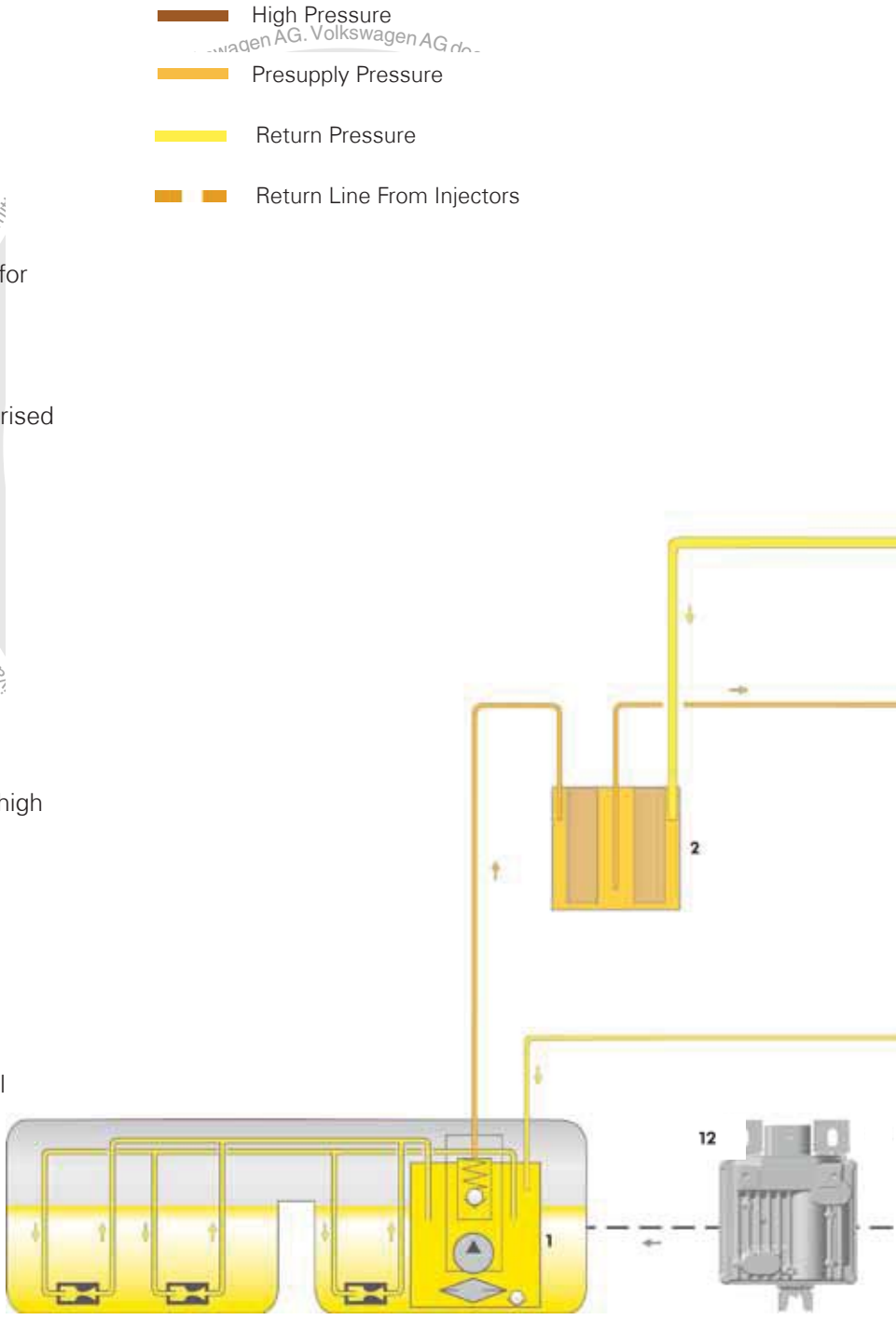
8. **Fuel Pressure Sensor G247**
   Measures the current fuel pressure in the high pressure range.

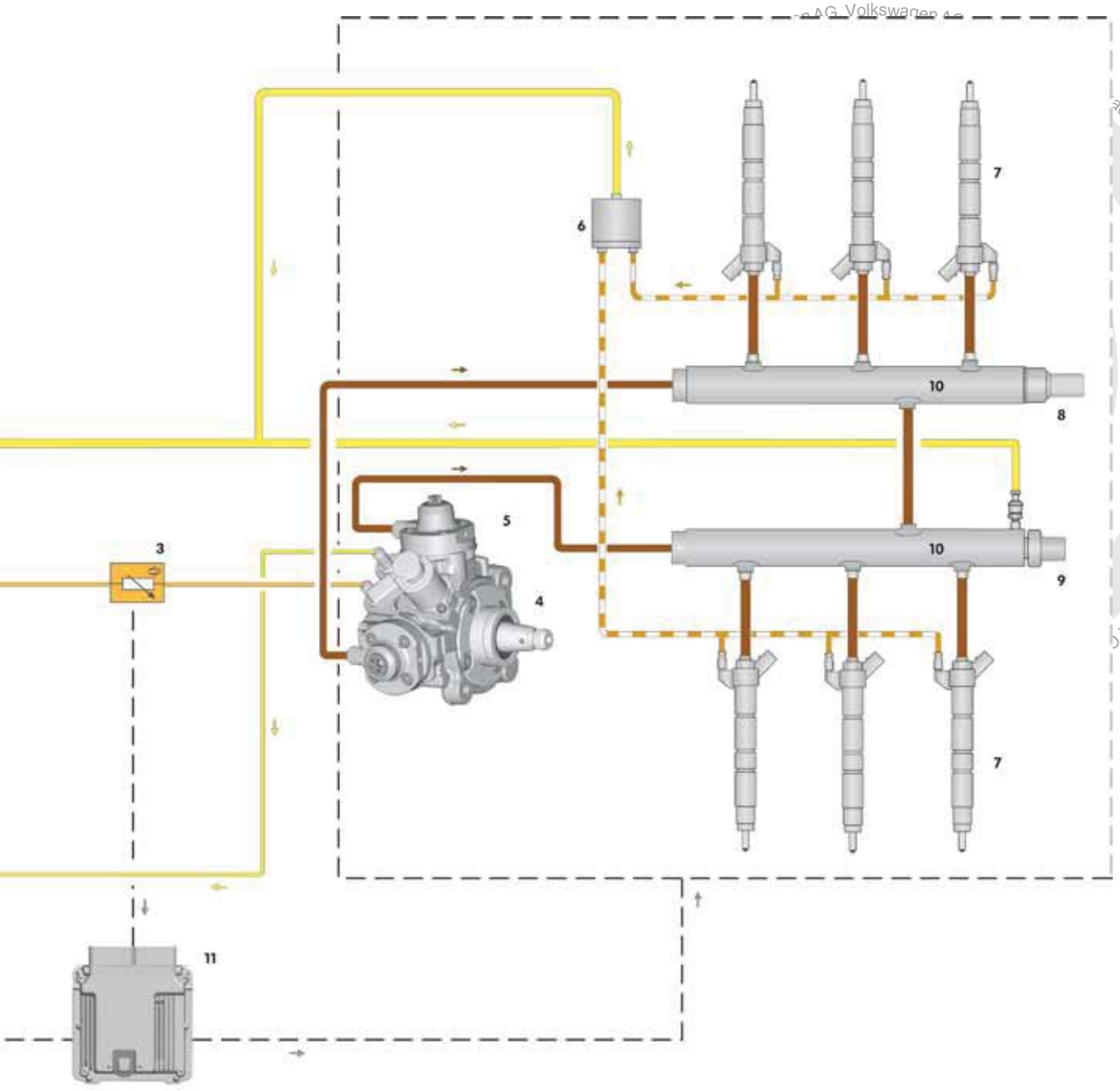
9. **Fuel Pressure Regulator Valve N276**
   Regulates the fuel pressure in the high-pressure range.

10. **High-pressure Accumulator (Rail)**
    Stores the fuel required for injection into all cylinders at high pressure.

11. **Engine Control Module J623**

12. **Fuel Pump Control Module J538**





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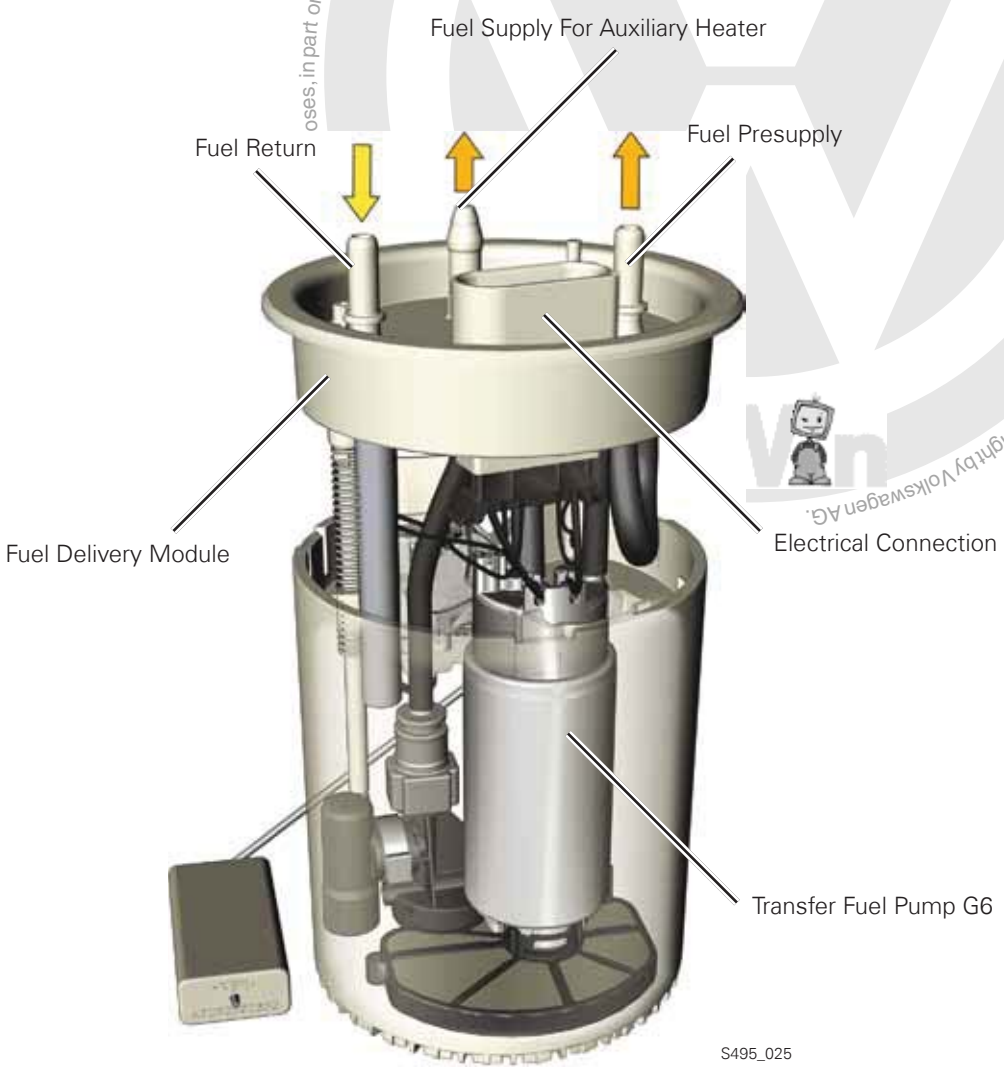
Fuel Delivery Unit GX1

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 pressurization 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 Transfer Fuel Pump G6 is activated by the Fuel Pump Control Module J538. A PWM signal is used for activation by the Engine Control Module J623. Error feedback messages are sent via the same wires.

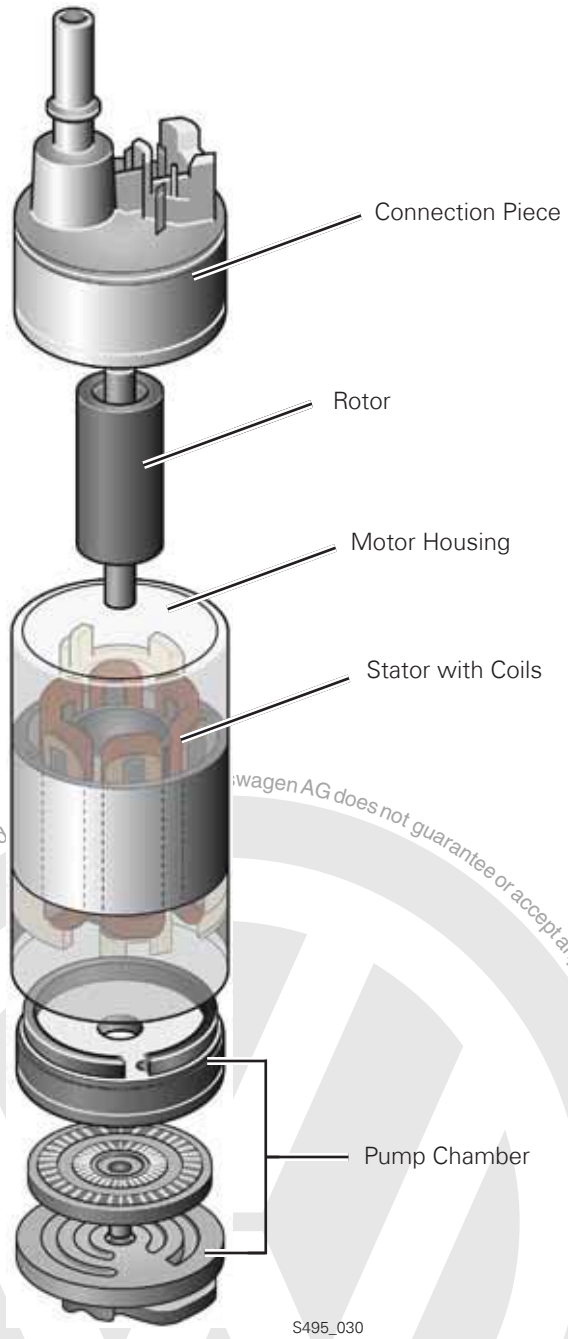
This provides a demand-regulated supply of fuel.



Transfer Fuel Pump G6

The Transfer Fuel Pump G6 uses an EC motor (EC = electronically commutated). The motor is made up of a rotor, stator, pump chamber and housing. 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 Module J538). This design assures no contact between the moving parts of the motor and operation is virtually wear- free.

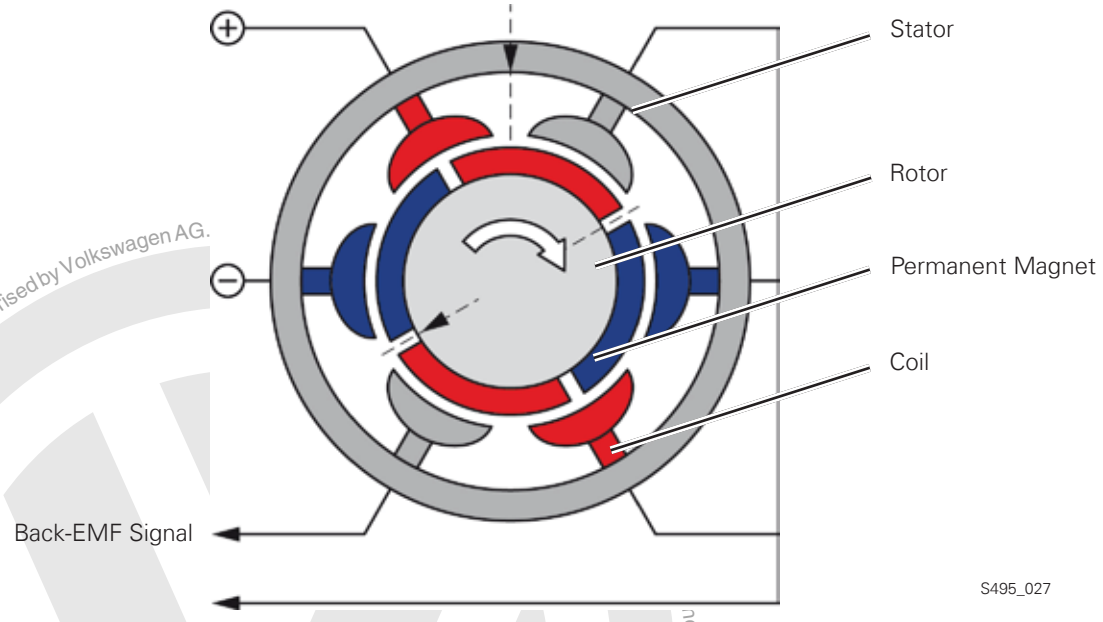


Function of Fuel Pump

The Fuel Pump Control Module J538 switches between phases. The phase 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 realign itself and follow the magnetic field. This causes rotation. The fuel pump produces mechanical rotation in twelve individual steps. The control module recognizes the position of the rotor from the de-energized coil pair. The Back-EMF Signal (ElectroMotive Force feedback signal) is used for this.

Functional Principle



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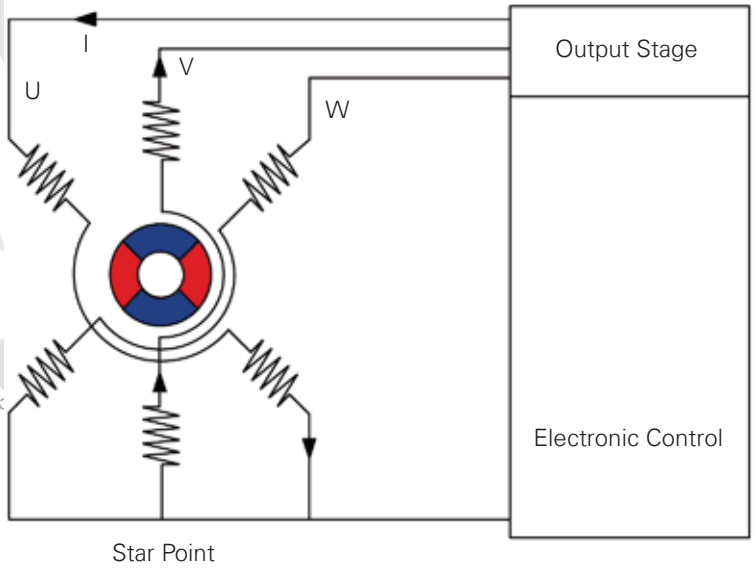
Circuit of Coil Windings



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Common Rail Fuel Injection System

The 3.0L V6 TDI engine (generation 2) features a Bosch common rail injection system that uses piezo injectors. The maximum injection pressure is 2,000 bar (29,000 psi). Each engine variation has its own injector nozzle configuration.

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

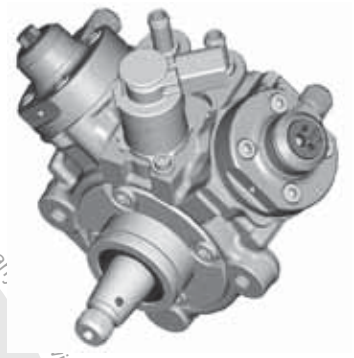
The high-pressure pump is located in the inner V on the transmission side. The pump is driven directly by the crankshaft by the ancillary drive chain.

A ratio of 1:0.75 to the crankshaft has been chosen to synchronize fuel delivery with the injectors and to reduce the chain forces.

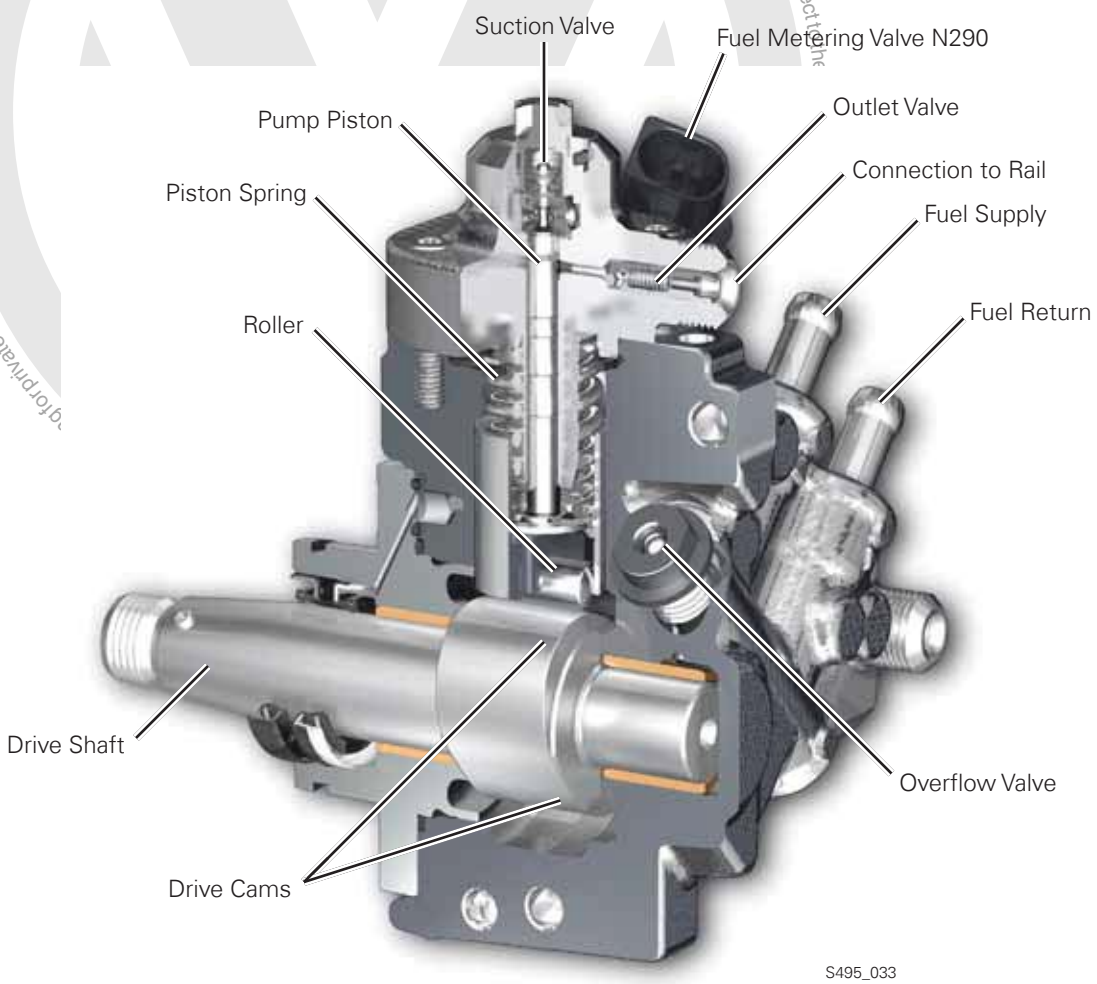
S495_028

Design of the High-pressure Pump CP 4.2.

The high-pressure pump works with two pistons and is driven by the ancillary drive chain. It generates a maximum injection pressure of 2,000 bar (29,000 psi).



S495_032

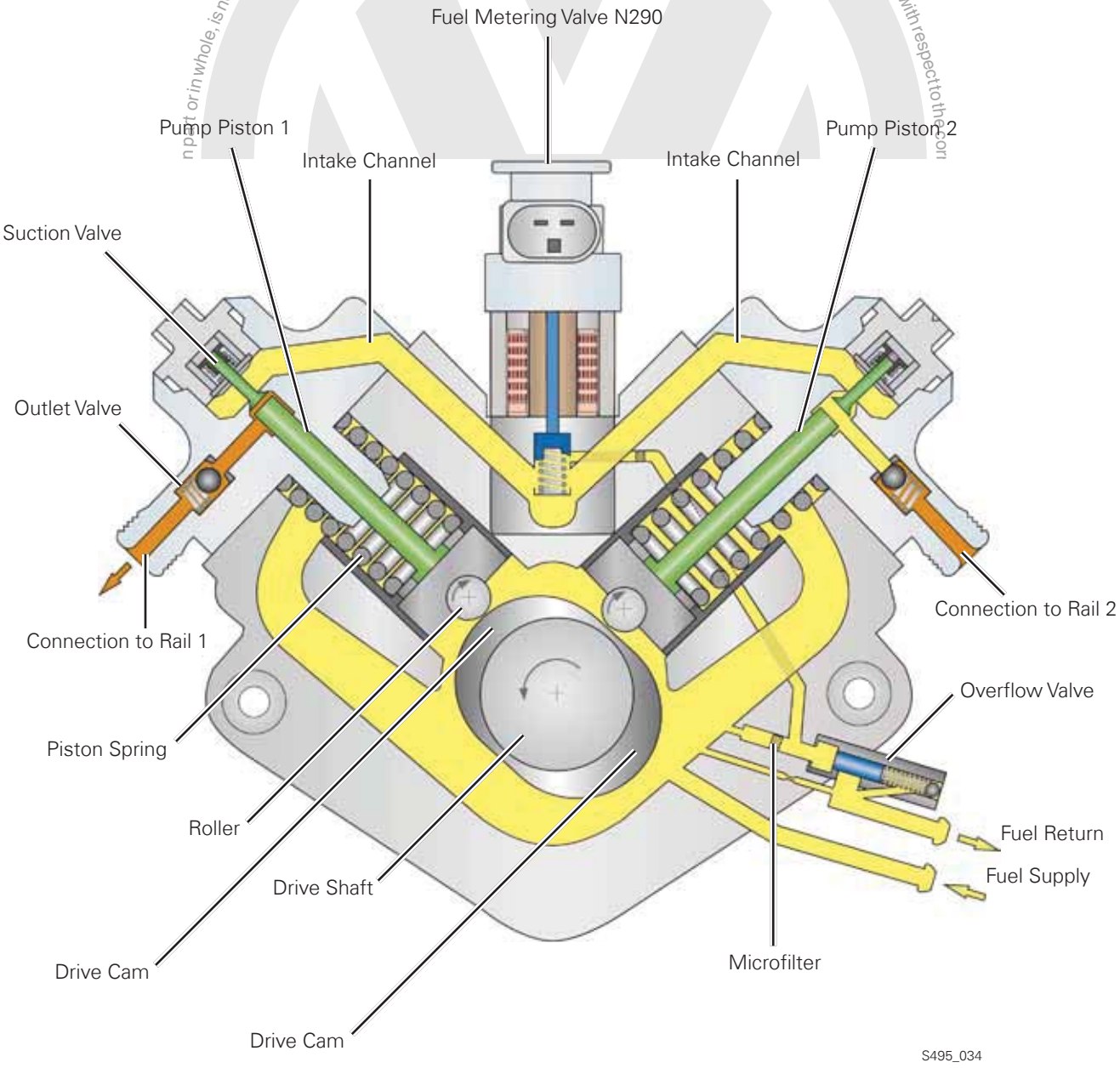


S495_033

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

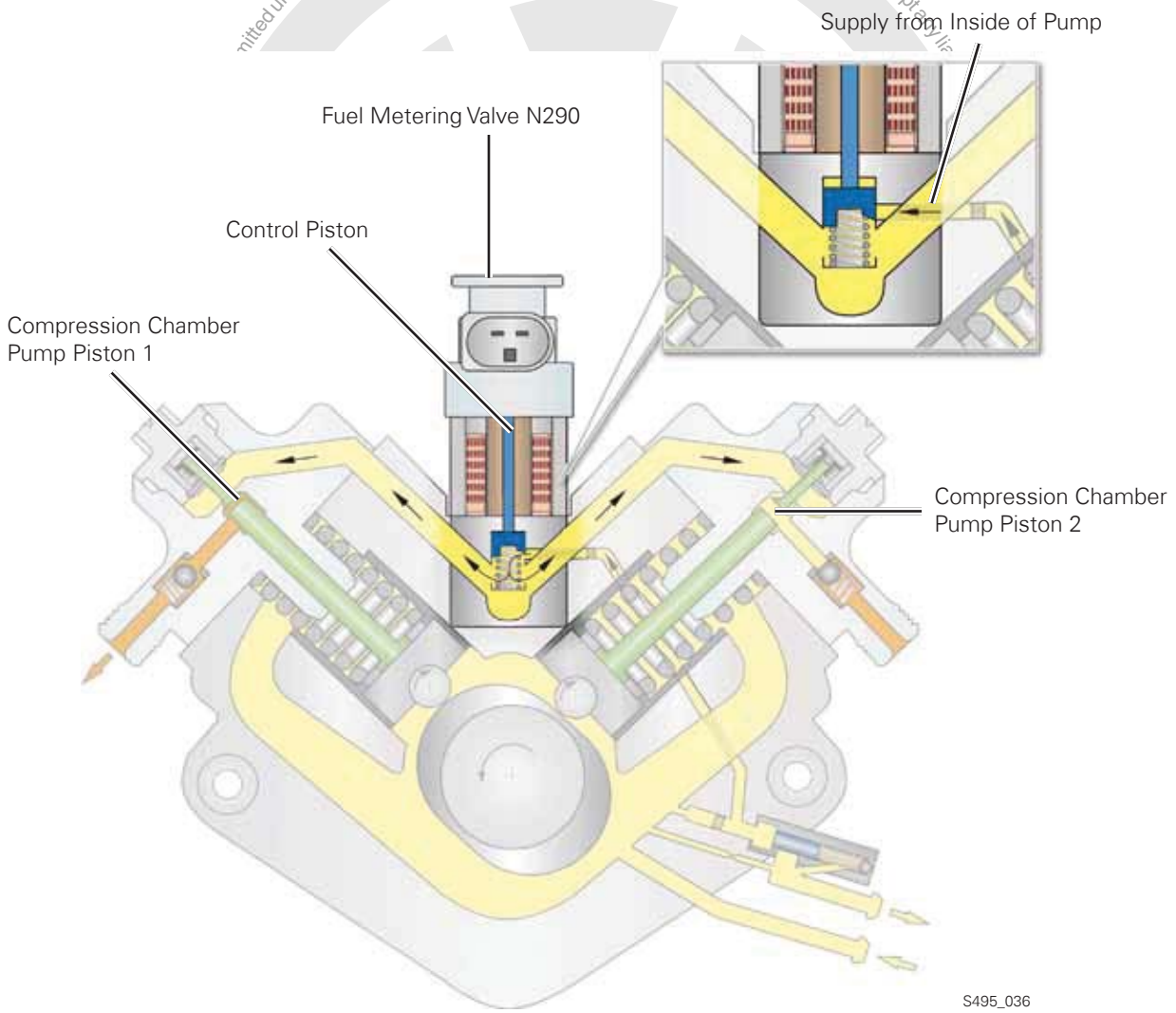
Fuel Metering Valve N290

The fuel metering valve is part of the high-pressure pump and regulates the fuel quantity required to generate high pressure. The high-pressure pump only has to generate the pressure necessary for the current operating situation. This reduces power consumption and unnecessary fuel heating.

How it Works

When no current is supplied, the fuel metering valve is open. The valve is actuated by the ECM with a Pulse-Width-Modulated signal (PWM) signal to reduce the supply quantity to the compression chamber.

The fuel metering valve is pulsed closed by the PWM signal. Depending on the PWM frequency, the position of the control piston moves. This controls the fuel supply quantity in the compression chamber of the respective pump piston 1 or 2.



Overflow Valve

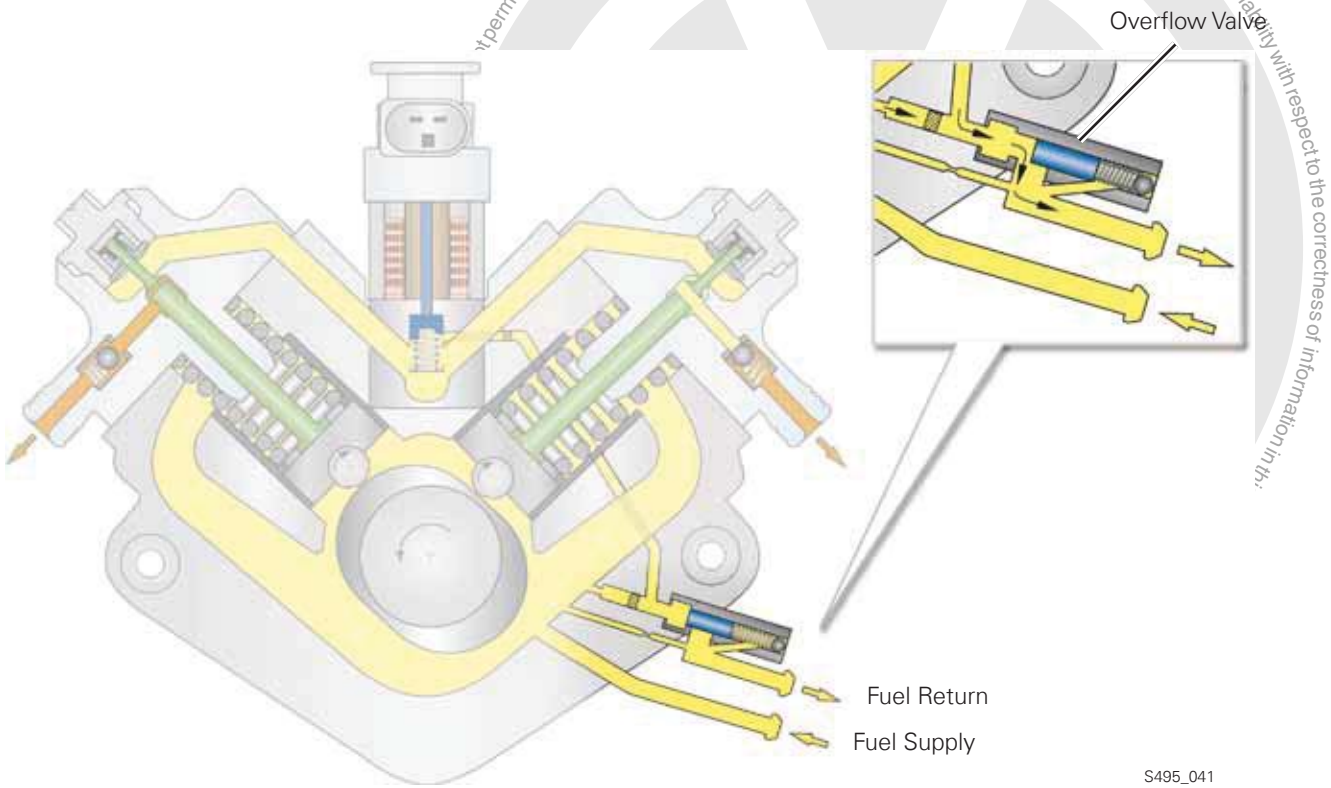
The fuel pressure in the low-pressure area of the high-pressure pump is regulated by the overflow valve.

How it Works

The Transfer Fuel Pump G6 delivers fuel from the fuel tank to the high-pressure pump at a pressure of approx. 5 bar (72.5 psi).

The overflow valve regulates the fuel pressure in the high-pressure pump to approx. 4.3 bar (62 psi).

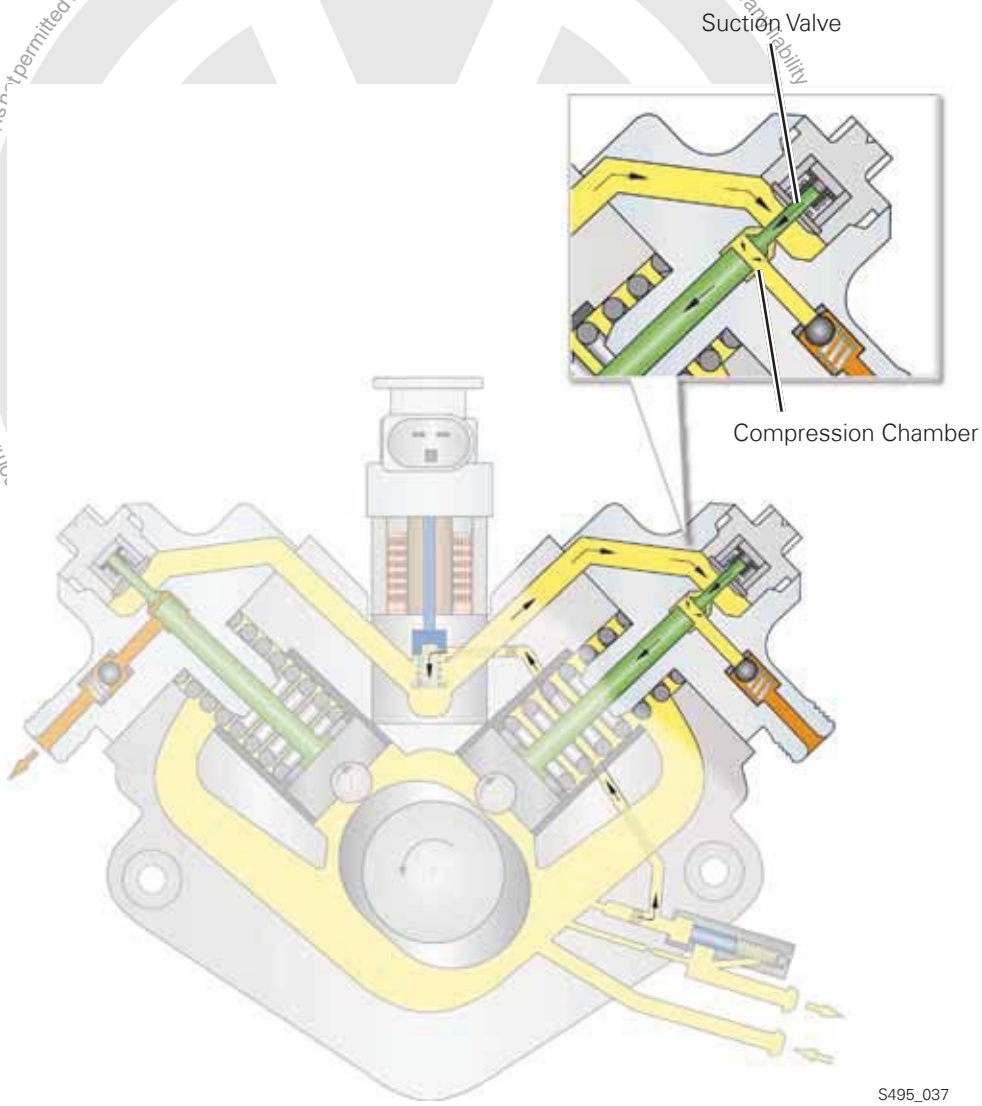
The fuel delivered by the Transfer Fuel Pump G6 works against the piston and the piston spring of the overflow valve. When the fuel pressure rises above 4.3 bar, the overflow valve opens and opens up the path for return of the fuel. The excess fuel flows to the fuel tank through the fuel return line.



High-pressure Generation

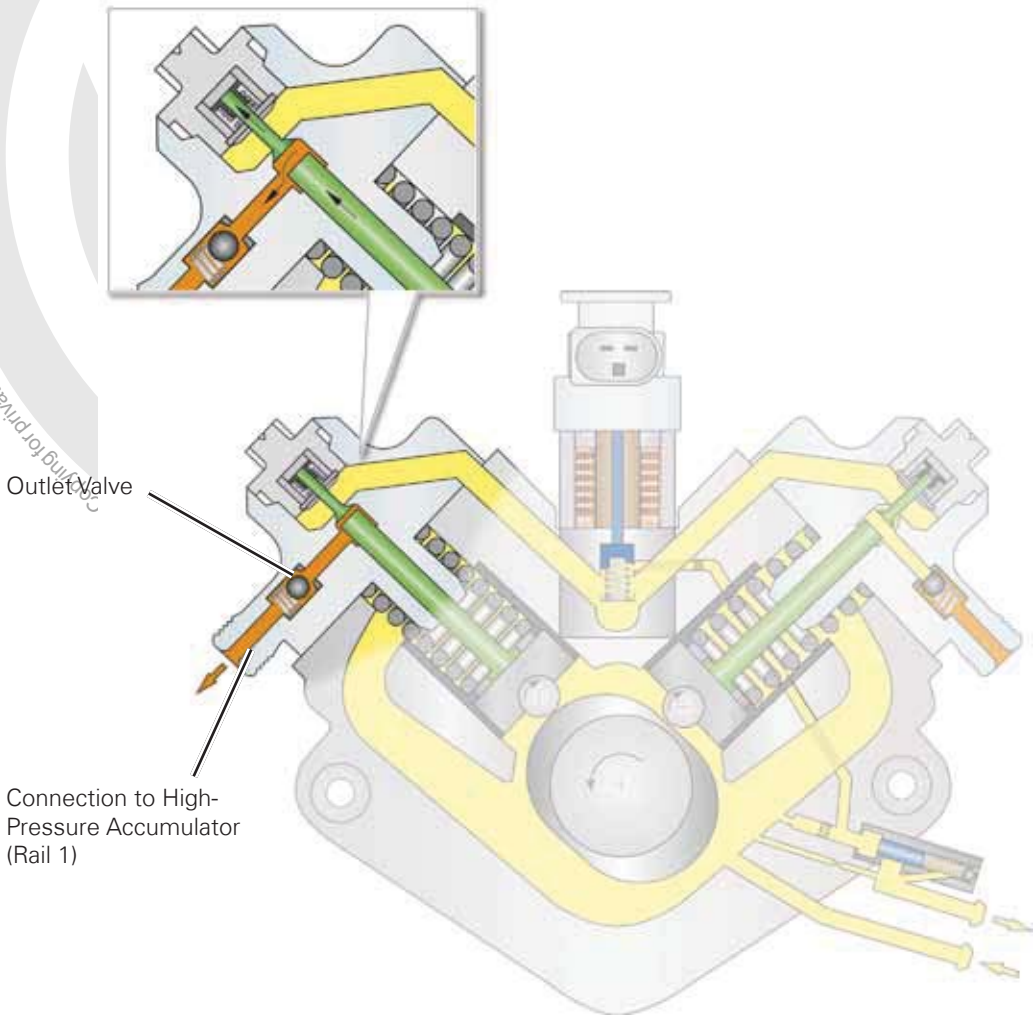
Suction Stroke

The downward 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.



Delivery Stroke

Once one of the pump pistons starts to move upward, 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

Mass Airflow Sensor G70

Engine Speed Sensor G28

Camshaft Position Sensor G40

Engine Coolant Temperature Sensor G62

Engine Coolant Temperature Sensor on Radiator Outlet G83

Fuel Temperature Sensor G81

Engine Temperature Control Sensor G694

Oil Level Thermal Sensor G266

Fuel Pressure Sensor G247

Accelerator Pedal Position Sensor G79
Accelerator Pedal Position Sensor 2 G185

Exhaust Gas Recirculation Potentiometer G212

Brake Light Switch F

Charge Air Pressure Sensor G31 and Intake Air Temperature Sensor G42

Heated Oxygen Sensor G39

Oil Temperature Sensor 2 G664

Oil Pressure Switch F22

Reduced Oil Pressure Switch F378

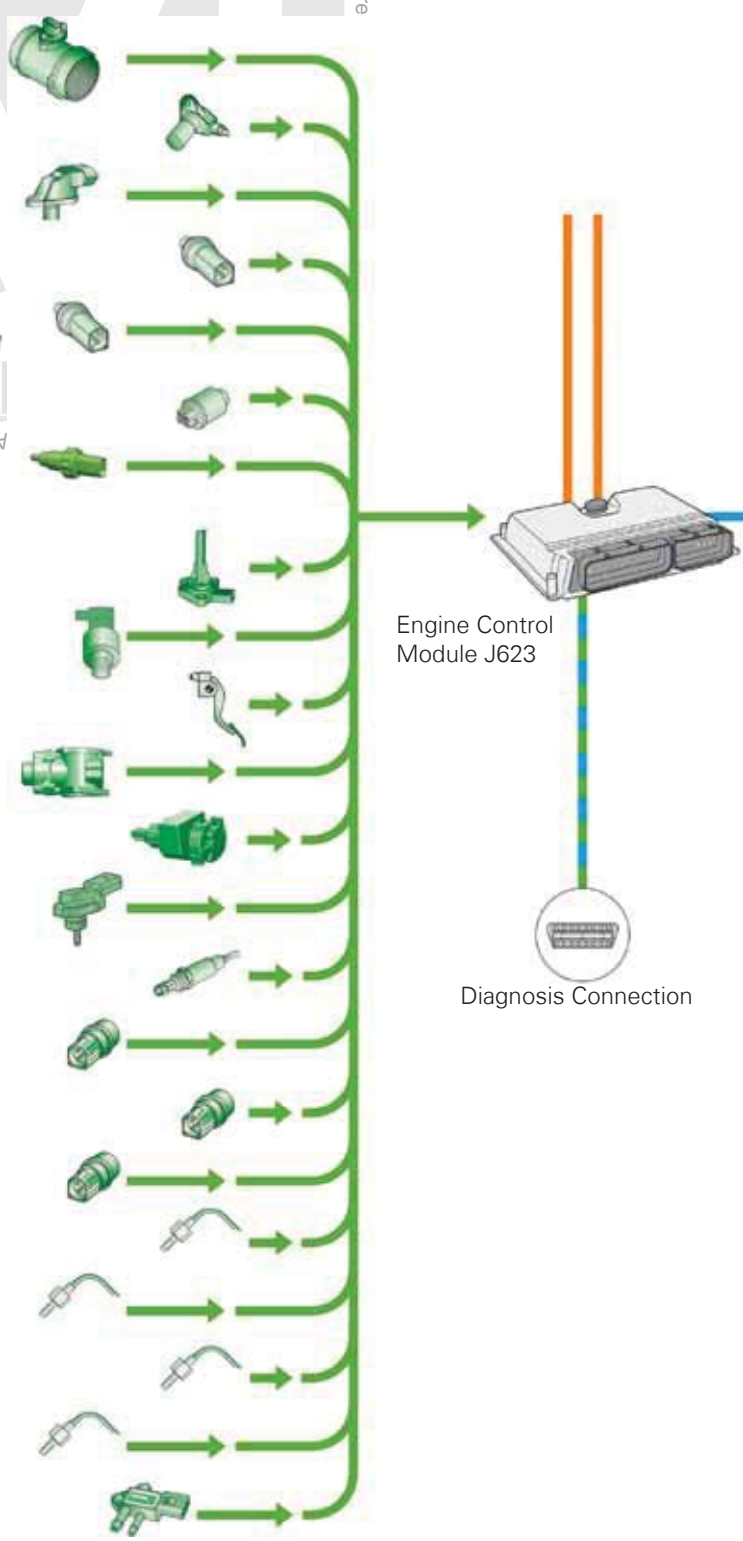
Exhaust Gas Temperature Sensor 3 (after Catalytic Converter) G495

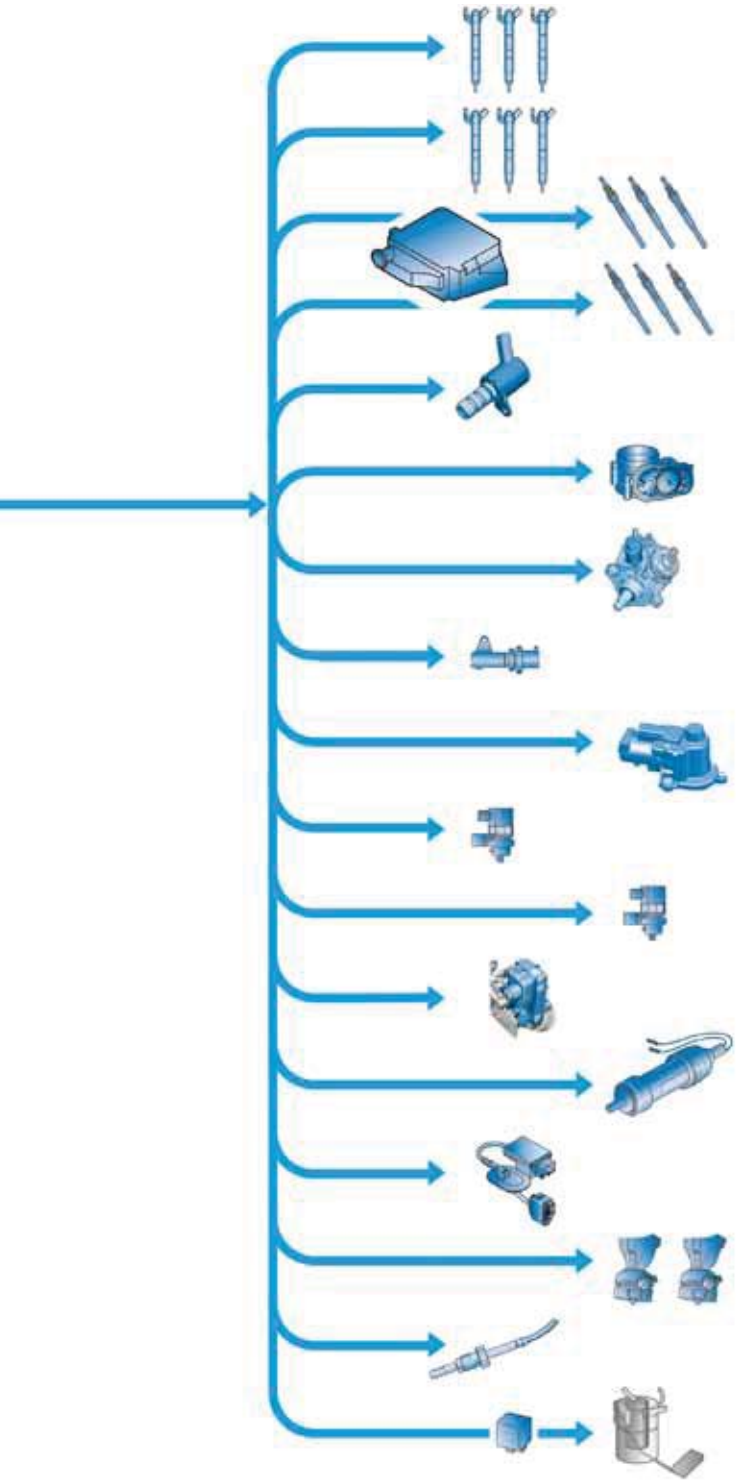
Exhaust Gas Recirculation Temperature Sensor G98

Exhaust Gas Temperature Sensor 1 G235

Exhaust Gas Temperature Sensor 4 (after Particle Filter) G648

Pressure Differential Sensor G505





S495_046

Actuators

Injectors, Cylinders 1 - 3
N30, N31, N32

Injectors, Cylinders 4 - 6
N33, N83, N84

Automatic Glow Time Control Module J179
Glow plugs 1 - 3
Q10, Q11, Q12

Glow plugs 4 - 6
Q13, Q14, Q15

Oil Pressure Regulation Valve N428

Throttle Valve Control Module J338

Fuel Metering Valve N290

Fuel Pressure Regulator Valve N276

Exhaust Gas Recirculation Motor V338

Exhaust Gas Recirculation Cooler Changeover Valve N345

Cylinder Head Coolant Valve N489

Turbocharger Control Module 1 J724

Map-controlled Engine Cooling Thermostat F265

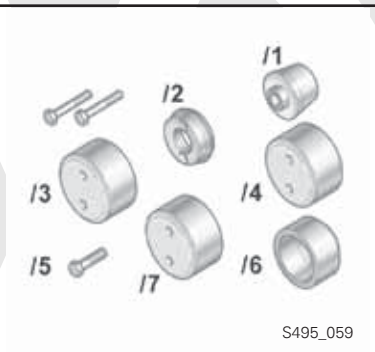
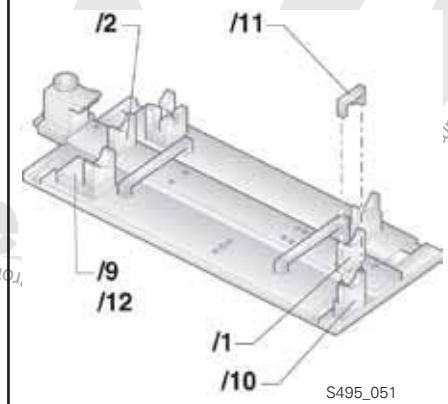
Fuel Pump Control Module J538

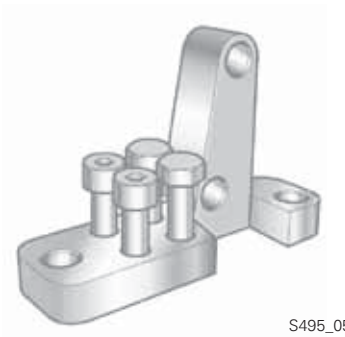
(Left, right) Electrohydraulic Engine Mount Solenoid Valves
N144, N145

Oxygen Sensor Heater Z19

Fuel Pump Relay J17
Transfer Fuel Pump G6

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

Important Links

https://www.datarunners.net/vw_crc/default.asp?pageid=home

www.vwwebsource.com

www.vwhub.com

Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this Self-Study Program.

The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at:

www.vwwebsource.com

For Assistance, please call:

Volkswagen Academy

Certification Program Headquarters

1-877-791-4838

(8:00 a.m. to 8:00 p.m. EST)

Or, E-mail:

concierge@volkswagenacademy.com

Volkswagen Group of America
2200 Ferdinand Porsche Drive
Herndon, VA 20171
March 2013

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.

- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

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Version 1.0

Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

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Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

back OK