Self Study Programme 624
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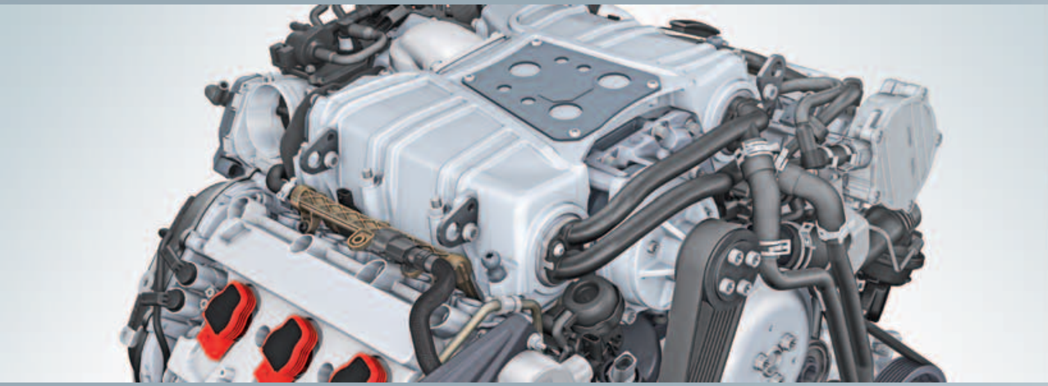
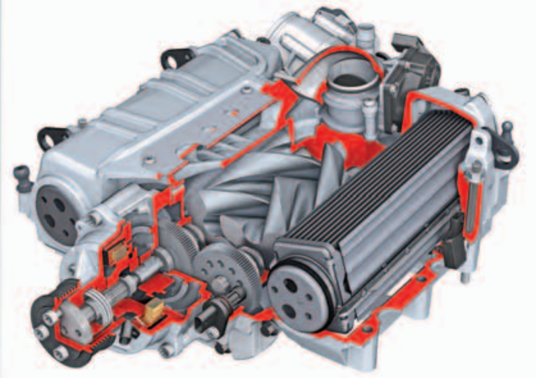




Fourth-generation Audi 3.0l V6 TFSI engine EA837 (evo)

Audi
Service Training

Audi V6 petrol engines

2004 marked the launch of the first V6 engine with petrol direct injection, the 3.2l FSI. This was followed in 2006 by the first representative with the Audi valvelift system and regulated oil pump. 2008 marked the rollout of the 3.0 l TFSI, the first Audi V6 engine with direct injection and supercharging. It was used in a number of model series beginning with the Audi S4.

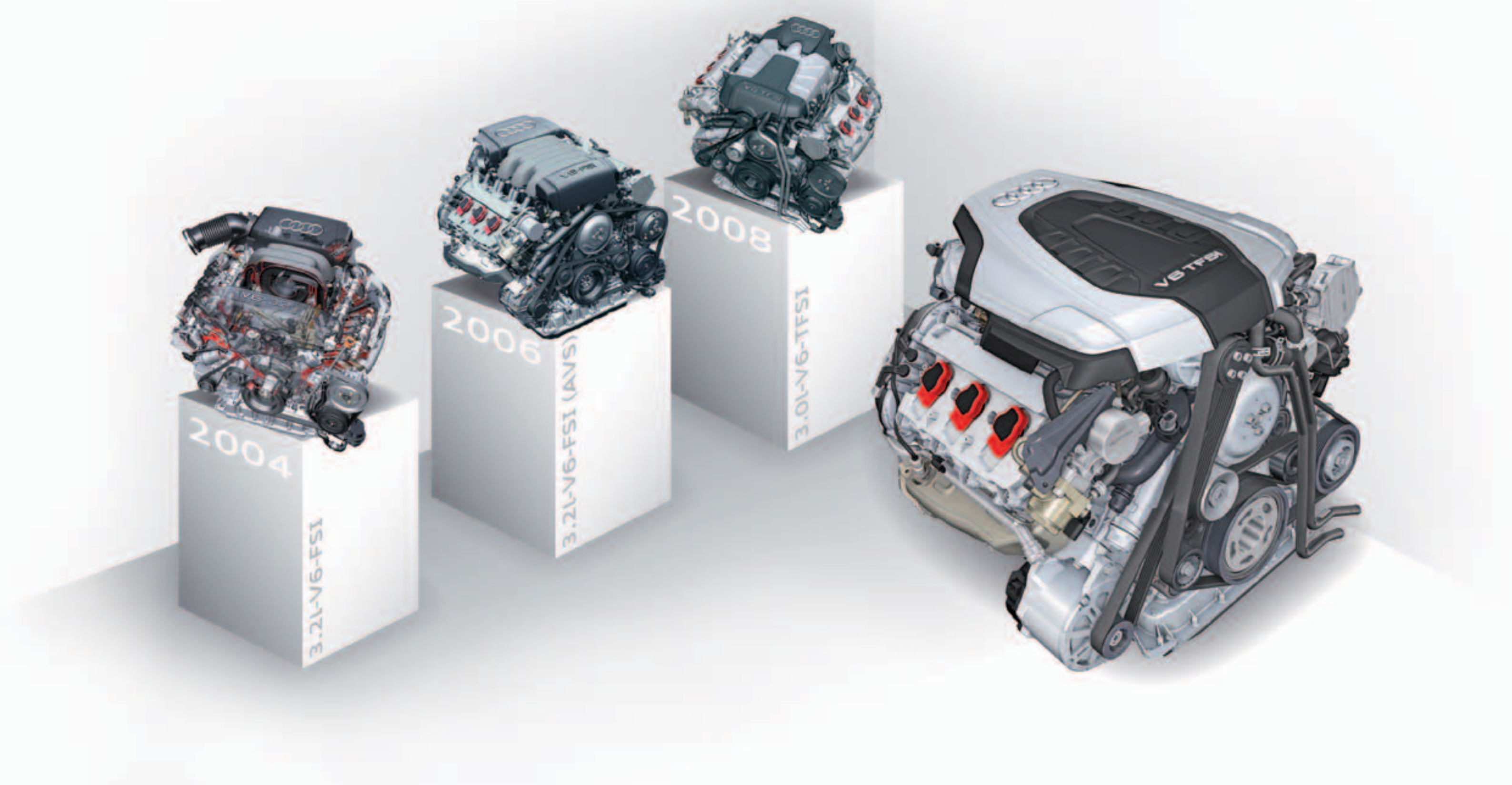
The engine was once again radically reworked as the fourth-generation 3.0l V6 TFSI EA837 (evo). Power and torque are unchanged, as are the dynamic power delivery.
As with the previous engine, the new engine takes approximately 0.3 seconds to reach full intake manifold pressure. This short time span makes for convincing and near-instant throttle response. Activating the supercharger does not involve any loss of throttle response either.

In comparison with the third-generation 3.0l V6 TFSI engine, the CO_2 emissions of the Audi A8 were reduced from 205 to 183 g/km (10 %). Fuel consumption was reduced from 8.8 to 7.8 litres per 100 km.

The third-generation 3.0l V6 TFSI engine was revised with the aim of significantly improving fuel economy while retaining all the desirable characteristics of the previous engine. This was achieved by making the modifications listed below.

- Friction in the base engine was reduced by 9 % by utilising
  - an improved chain drive
  - an optimised piston ring assembly with reduced preload force, better volumetric efficiency and lower oil consumption
  - enhanced camshaft bearings (finishing process)
- A "supercharging on demand" solution for the mechanical charging system, achieved by introducing a magnetic clutch
- A highly flexible fuel injection strategy allowing for a combination of high pressure injection and low pressure injection
- A radically improved combustion process
- Detailed enhancement of all components and systems relevant to fuel efficiency

This SSP contains a QR code which you can use to access additional interactive content (see "Information on QR codes" on page 47).



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Learning objectives of this self study programme:

This self study programme describes the design and function of the fourth-generation 3.0l V6 TFSI engine (evo). Once you have completed this self study programme you will be able to answer the following questions:

- Which modifications were made compared with the third-generation 3.0l V6 TFSI engine?
- How does the supercharger shut-off function work?
- How is the fuel injection system designed?
- What are the differences in the oil supply and cooling system?

Contents

Introduction

Engine mechanicals

Oil supply

Air intake and turbocharger systems

Cooling system

Fuel system

Engine management system

Service

Appendix

The self study programme teaches a basic understanding of the design and mode of operation of new models, new automotive components or new technologies.
It is not a repair manual! Figures are given for explanatory purposes only and refer to the data valid at the time of preparation of the SSP.
This content is not updated.
For further information on maintenance and repair work, always refer to the current technical literature.
In the glossary at the end of this self study programme you will find an explanation of all terms written in *italics* and indicated by an arrow ↗.

Note

Reference

Introduction

Brief technical description

The description of the fourth-generation 3.0l V6 TFSI engine EA837 (evo) in this self study programme refers first and foremost to the Audi A8 (Type 4H). The engine is used for the first time in this vehicle:

The main new features at a glance:

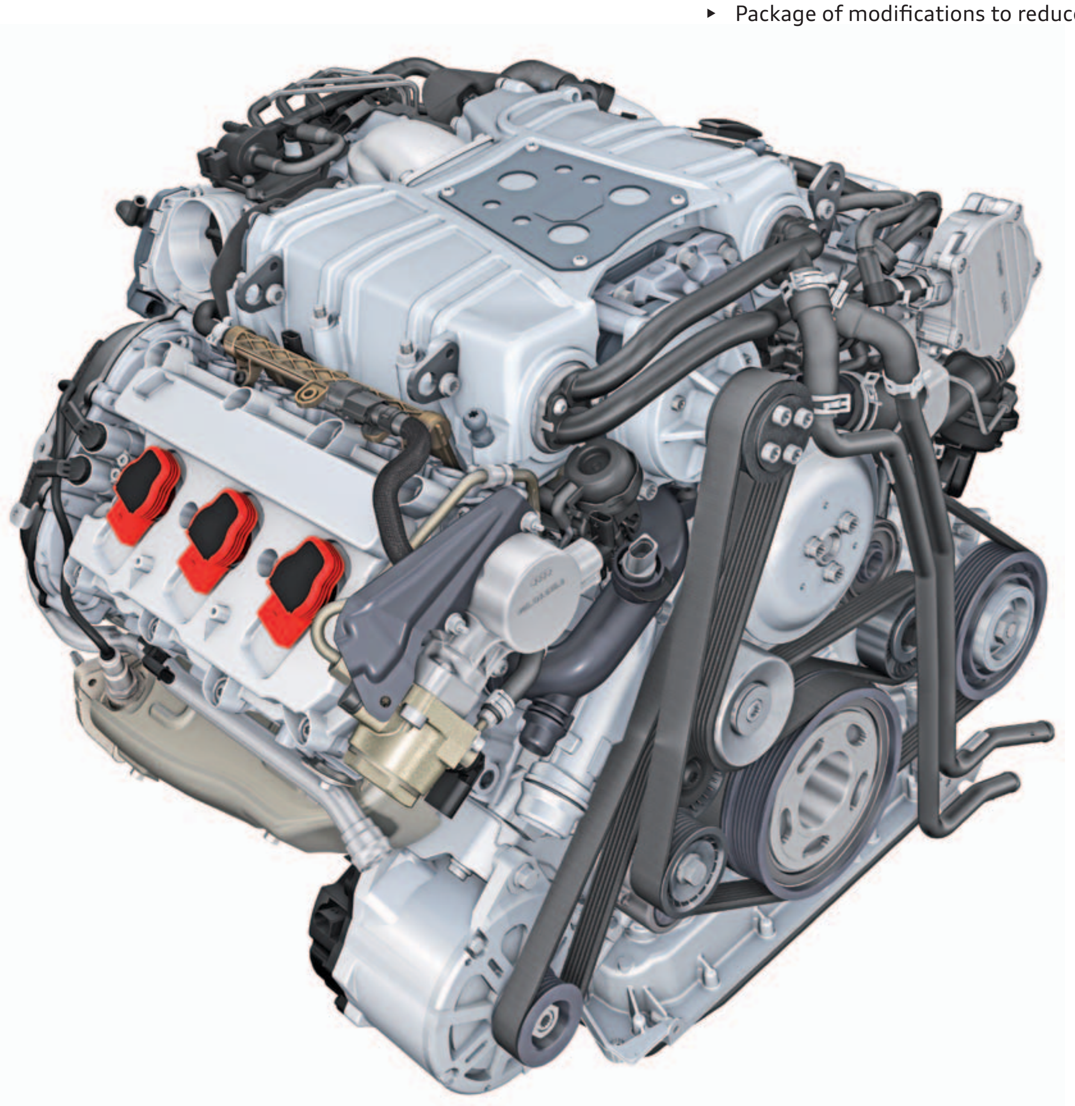
- 6-cylinder V-engine with mechanical supercharging by means of a belt-driven supercharger (Roots blower)
- Combined direct and multipoint injection
- Continuous camshaft adjustment on intake and exhaust side

Key modifications compared to the third-generation 3.0l V6 TFSI engine:

- Cast-iron cylinder liners
- Deactivable supercharger (Roots blower)
- Multipoint injection added
- Exhaust-side camshaft adjustment added
- Compliance with exhaust emission standard EU 6 W
- Repositioning of the motor oil cooler (switchable) to the back of the engine
- Chain drive with different chain routing
- Positive crankcase ventilation on one cylinder bank only
- A continuous design hood

The following adaptions were made:

- Piston shape
- Oil pan and rear engine cover (sealing flange)
- Crankshaft with hollow-bored crank pin
- Coolant pump with modified pump gear ("potted")
- *Terophon* ↗ coated timing chain covers
- Package of modifications to reduce friction and weight



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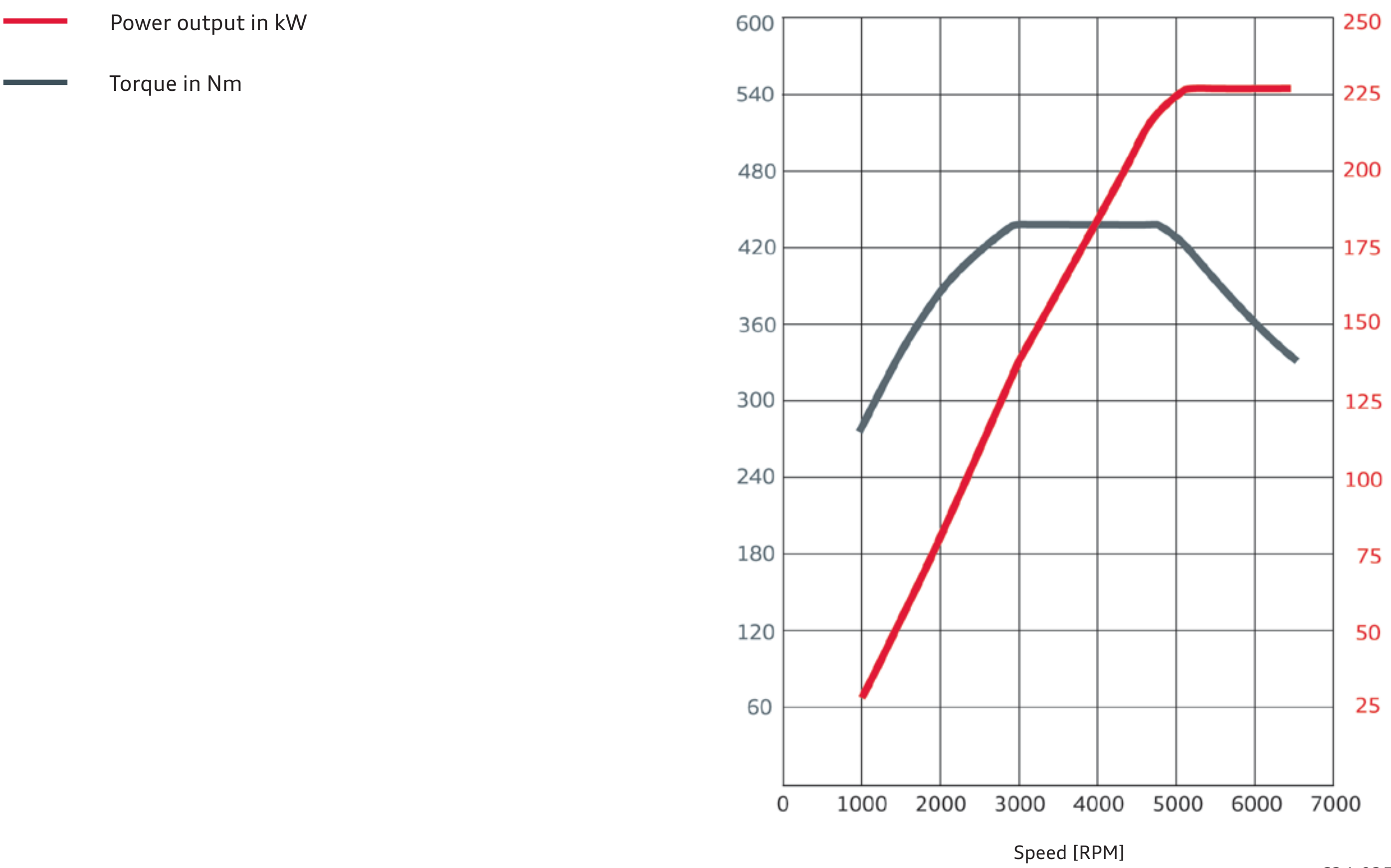
Reference
The design and function of the basic engine are described in Self Study Programmes 411 "Audi 2.8l and 3.2l FSI engine with Audi valvelift system" and 437 "Audi 3.0l V6 TFSI engine with Roots blower".

Specifications

Torque-power curve



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Features	Specifications
Engine code	CREA
Type	V6-cylinder engine
Displacement in cm^3	2995
Stroke in mm	89
Bore in mm	84.5
Number of valves per cylinder	4
Firing order	1–4–3–6–2–5
Compression ratio	10.8 : 1
Power output in kW at rpm	228 at 5200 - 6500
Torque in Nm at rpm	440 at 2900 - 4750
Fuel type	Premium unleaded (95 RON)[1)]
Turbocharging	Deactivable supercharger (Roots blower)
Maximum charge pressure in bar (absolute)	1.8
Engine management system	Simos
Knock control	2 sensors
Lambda control	2 sensors upstream of catalytic converter and 2 sensors downstream of catalytic converter
Mixture formation	Combined (dual) direct (FSI) and multipoint (MPI) injection
Emission standard	EU 6
CO_2 emissions in g/km	183 g/km

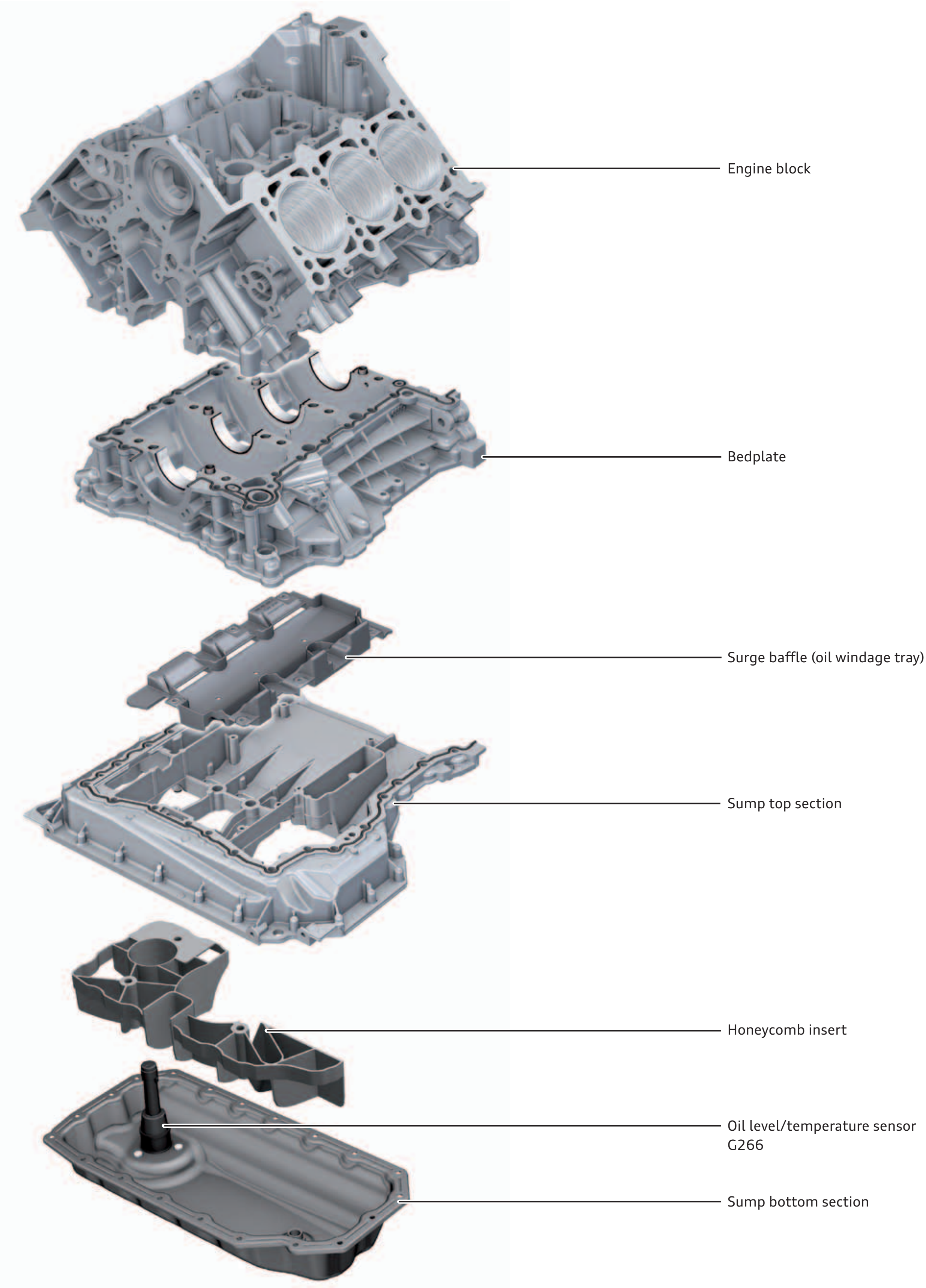
[1)] Unleaded regular 91 RON petrol can also be used, with slight loss of power.

Engine mechanicals

Engine block and oil pan

Basically, both of these components are new designs. They were necessary, mostly due to the need to create installation space for the electro-mechanical steering system. Also in the course of making these modifications, parts of the oil supply system - the motor oil cooler in particular, but also the cooling system - were relocated within the engine.

The honeycomb insert in the oil pan allows oil to be reliably drawn by the oil pump under high transverse acceleration.



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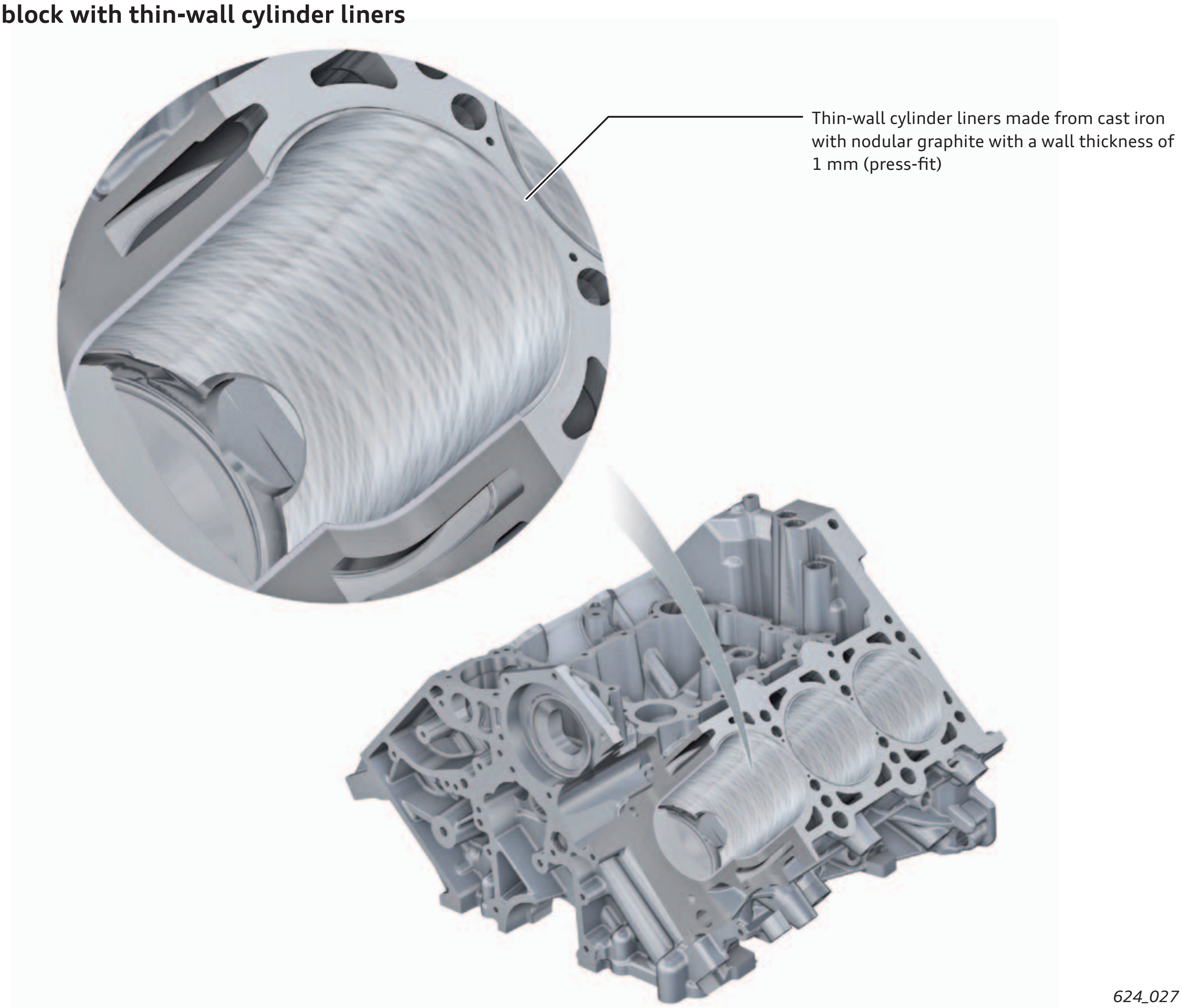
Components and modifications at a glance

Component	Features and tasks
Engine block	▸ Closed-deck construction ▸ Thin-wall cylinder liners made from cast iron with nodular graphite with a wall thickness of 1 mm ▸ Material: aluminium-silicon alloy
Bedplate	▸ Accommodates the oil pump ▸ Material: aluminium-silicon alloy
Surge baffle	▸ Bolted into the oil pan top section ▸ Prevents frothing of the oil due to the crankshaft ▸ Material: polyamide (PA) polymer
Sump top section	▸ Geometrically adapted to facilitate the use of electro-mechanical steering ▸ Increases engine block rigidity ▸ Houses the surge baffle ▸ Bonded with liquid sealant ▸ Material: aluminium-silicon alloy
Honeycomb insert	▸ Ensures that oil pump can draw oil during sporty driving ▸ Bolted together with the oil pan top section ▸ Material: polyamide (PA) polymer
Sump bottom section	▸ Extended measurement range of oil level/temperature sender G266 to ensure compatibility with fuels containing ethanol (E25 – E85) ▸ Uniform material thickness to optimise weight and reduce component warpage (leak tightness) ▸ Sealed with liquid sealing compound ▸ Material: sheet steel

Engine block with thin-wall cylinder liners



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Sealing flange with oil filter and motor oil cooler

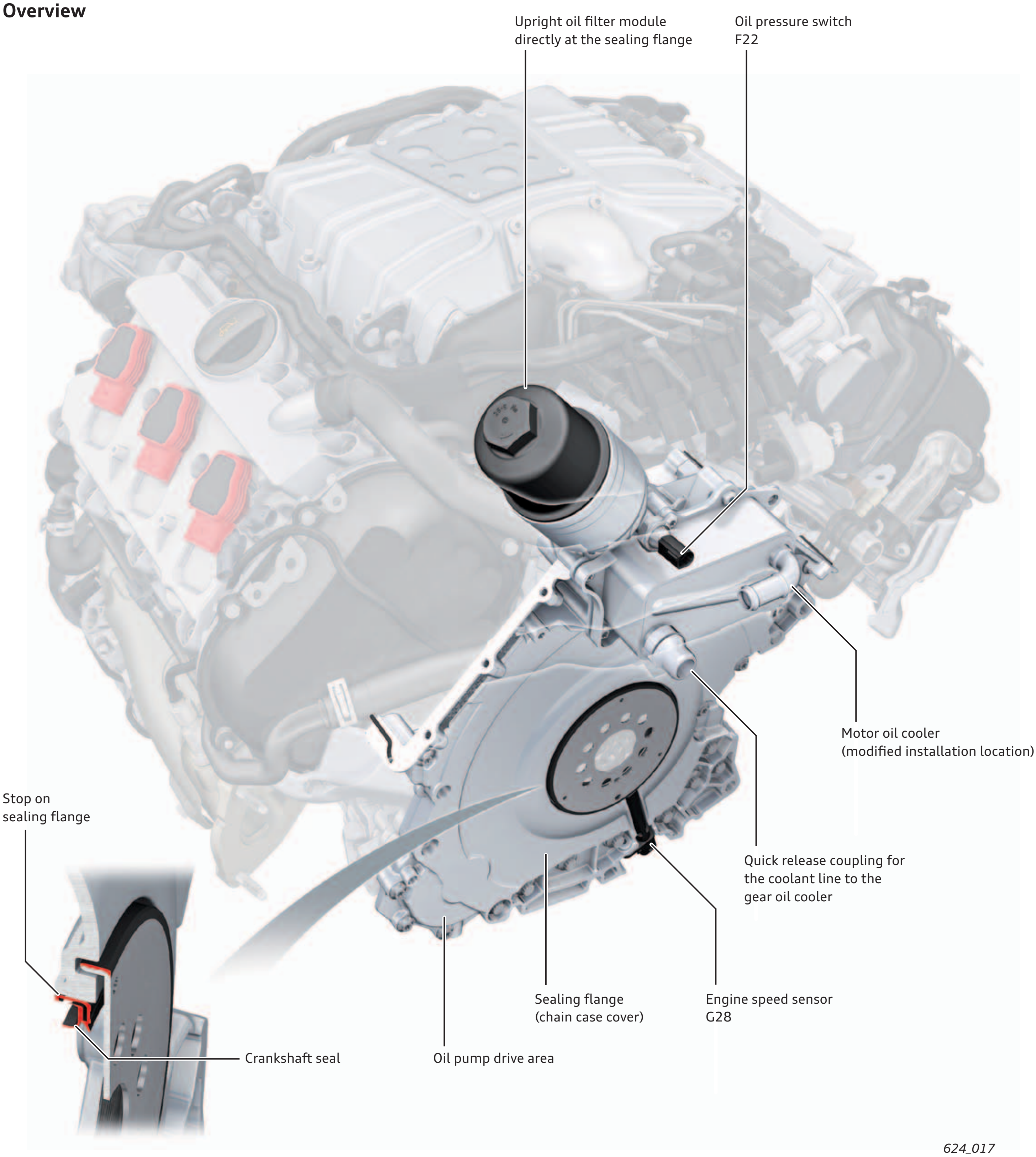
The die cast aluminium (Alusil) sealing flange (chaincase cover) on the back of the engine was also modified to create space for the installation of an electro-mechanical steering system in the engine bay. Given that the oil pump drive gear is smaller, it was also possible to reduce the size of the installation space at the sealing flange.

The sealing flange is mounted to the engine block and to the bed plate on the gearbox side. It therefore seals off the chain case and covers the section of the timing drive towards the gearbox.

The upright oil filter module is now a direct component part of the sealing flange. The installation location of the motor oil cooler was shifted from the oil pan top section to the sealing flange in direct proximity to the oil filter.
On the motor oil cooler itself there is a quick release coupling for the coolant line running to the gear oil cooler.

The pressure inside the crankcase is slightly higher than in the third-generation engine, and could potentially suck the crankcase oil seal inwards. To prevent this from occurring, there is a stop on the sealing flange.

Overview



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Crankshaft drive

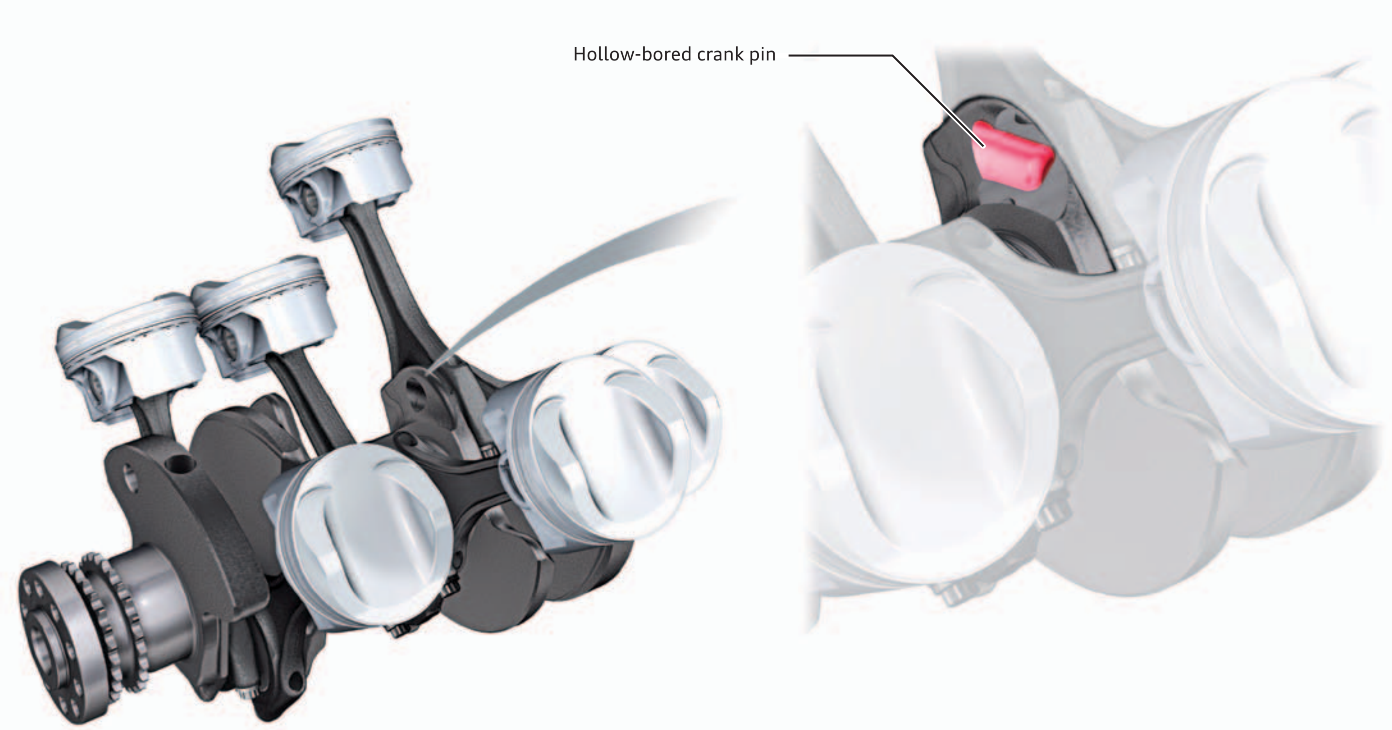
The crankshaft is manufactured from a forged blank. The aim of the development work was to achieve a significant reduction in weight.
This was achieved by reducing the size of the crank webs and by boring the crank pin. Altogether, these modifications have reduced the weight of the crankshaft by 1670 grammes.

Connecting rod

Use is made of *cracked conrods* ↗ with a conrod bush made from bronze.

Bearing specifications

Feature	Specifications
Bearing shells	Three-material bearing Steel back with a bronze function layer and an electro-plated bismuth layer Main bearing: Two-material bearing (coated)
Diameter of main bearing	65 mm
Diameter of conrod bearing	56 mm



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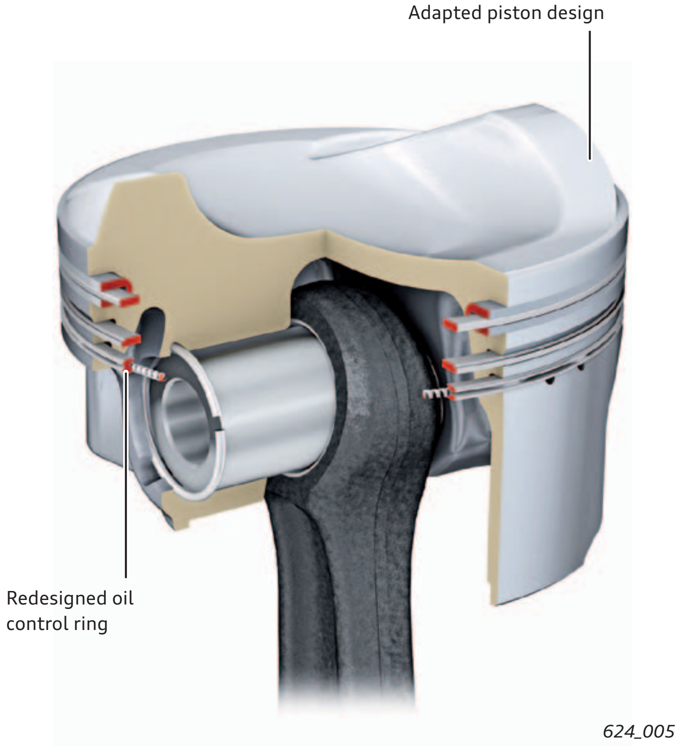
Piston

The new piston is part of the redesigned combustion chamber. The development objectives here were to reduce weight as well as to reduce fuel consumption and exhaust emissions, and above all particulate emissions.

The following modifications were made:

- Reduction of piston weight through new piston ring design
  - Reduction of the oscillating masses
- Reduction of squish gaps (clearance between the piston crown and piston lug and the cylinder head)
  - Compression ratio increased to 10.8 : 1 (gen. 3 engine: 10.3 : 1)
  - Improvement in fuel efficiency
- Reduction of tangential forces acting on the piston rings
  - Reduction in friction
  - Reduction of CO_2 emissions
- New oil control ring design
  - Reduction in oil consumption
- Graphite coating
  - Required for cast iron cylinder races
  - Reduction in friction
  - Improved limp-home performance



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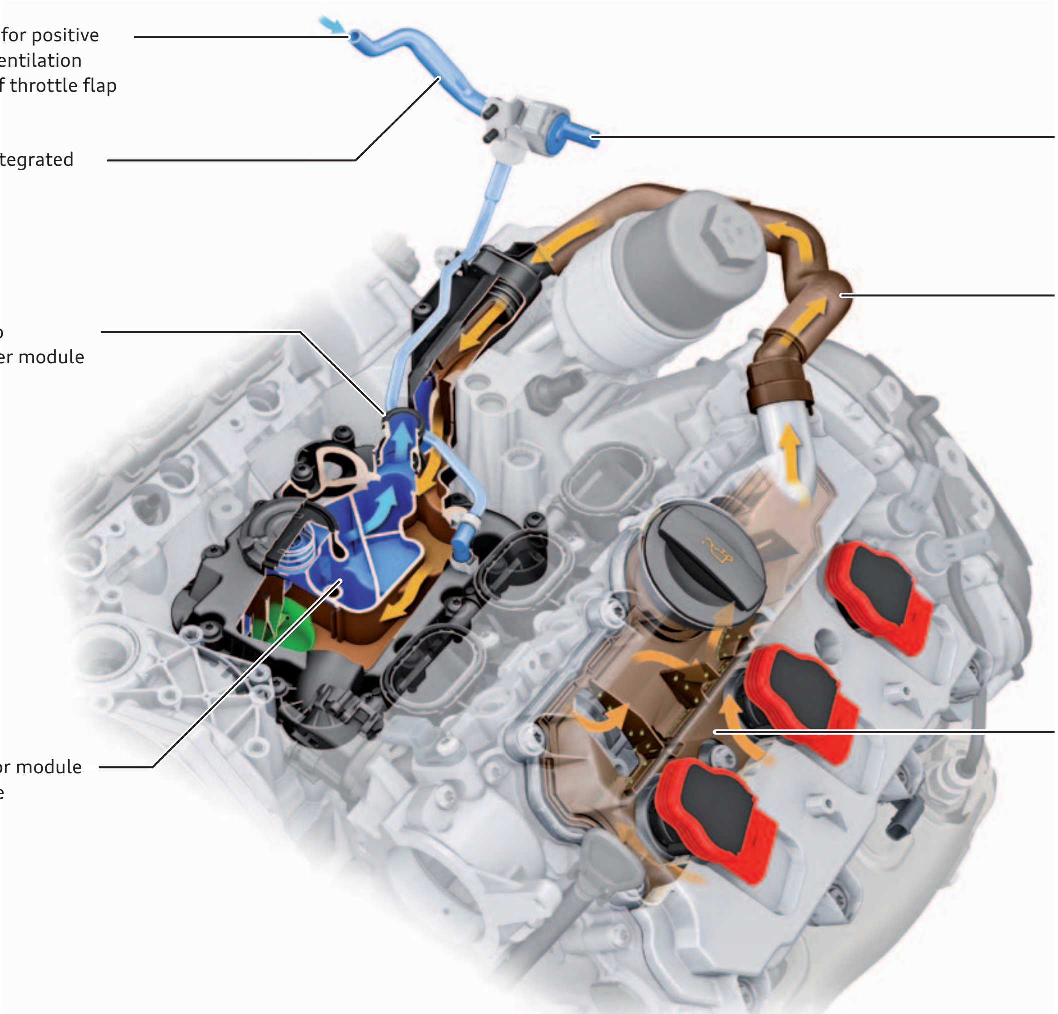
↗ Refer to "Glossary" on page 46.

Positive crankcase ventilation

The positive crankcase ventilation system has once again been radically revised with the emphasis on optimising separation behaviour. The system is vented through only one cylinder bank.

Coarse separation takes place in a labyrinth of the cylinder head cover. The vent pipe between the coarse separator and the oil separator module is insulated.

Carbon contained in the blow-by gas therefore cannot condense on the components. The fine oil separator with integrated pressure control valve in the inner vee has largely been adopted from the third-generation 3.0l V6 TFSI engine. The system is rated for a partial pressure of 150 mbar.
Other functions of the positive crankcase ventilation system are described in SSP 411 "Audi 2.8l and 3.2l FSI engine with Audi valvelift system".



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Note
The vent pipe has a fixed, i.e. non-detachable, connection to the cylinder head cover in order to meet the requirements of the CARB (California Air Resource Board). The vent pipe is identical in all country-spec versions (reduction in the number of variants).

Positive crankcase ventilation (PCV)

To purge the crankcase, air is extracted from the clean air line (downstream of the air filter). The clean air then flows into the crankcase through a line connection on the fine oil separator. During the development of the system the following objectives were pursued:

- Reduction in noise emission
- Improved engine idling performance

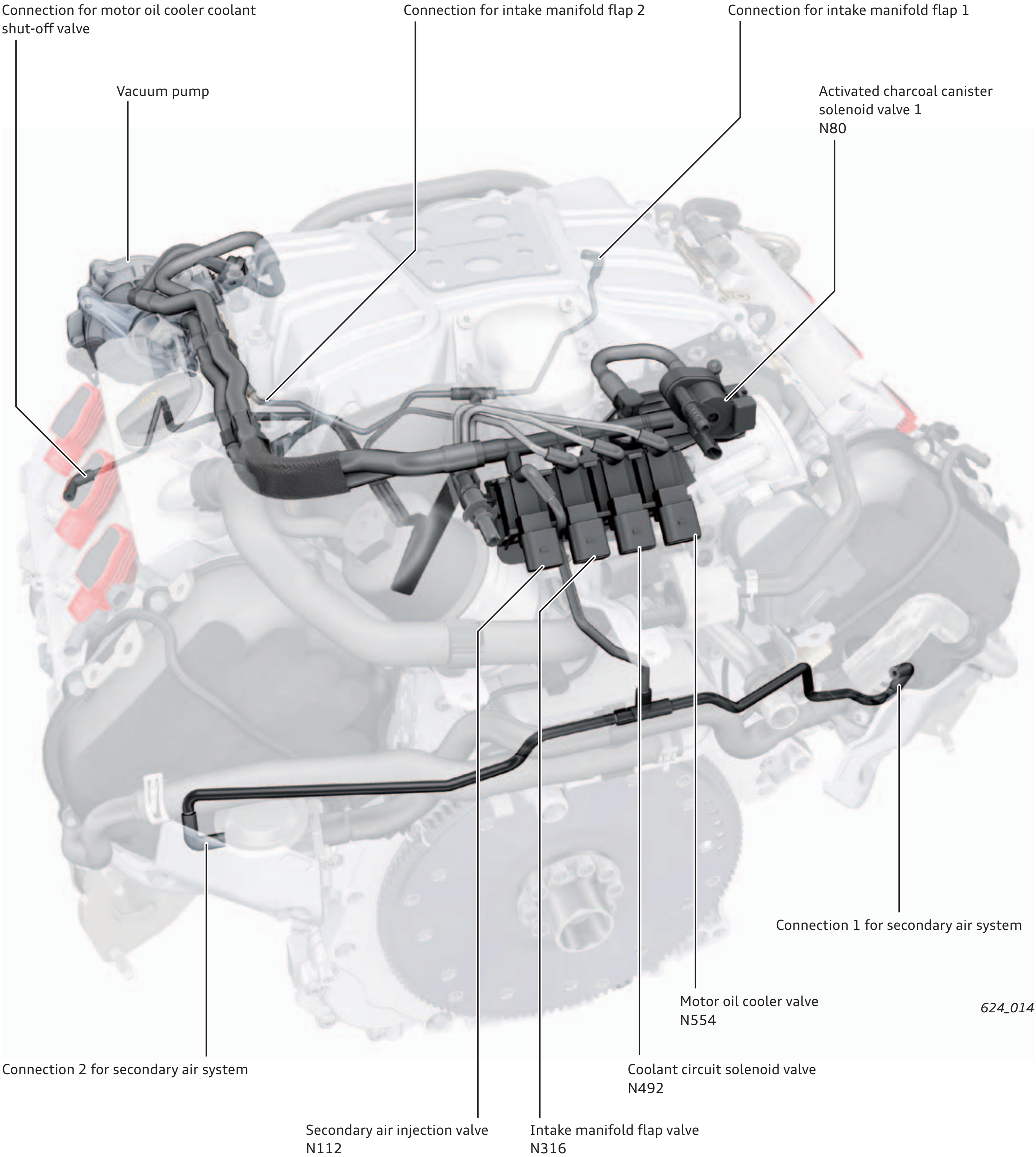
To reduce noise, a plastic coil was integrated into the pipe system. A high hydrocarbon concentration in the crankcase could impair the engine's idling performance. Idling performance is improved by the crankcase ventilation shut-off valve N548. This valve closes the vent line when the engine is idling if the oxygen sensor detects an excessively high hydrocarbon concentration from the positive crankcase ventilation system. The crankcase ventilation shut-off valve N548 is activated by a *PWM signal* ↗ from the engine control unit. It is fully open when de-energised ("fail-safe position").

↗ Refer to "Glossary" on page 46.

Vacuum supply system

To ensure a safe supply of vacuum, the vacuum pump is located on the front of the engine. It is driven directly by the intake camshaft of the left cylinder bank. The solenoid valves for activating the vacuum consumers are located on the back of the engine.

The following systems are vacuum-activated:
- Secondary air system (2 combi valves)
- Intake manifold flaps
- Cooling system
  - Switchable motor oil cooler
  - Switchable coolant pump



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Note
The vacuum lines and electrical connectors must alway be correctly assigned and should not under any circumstances be interchanged.

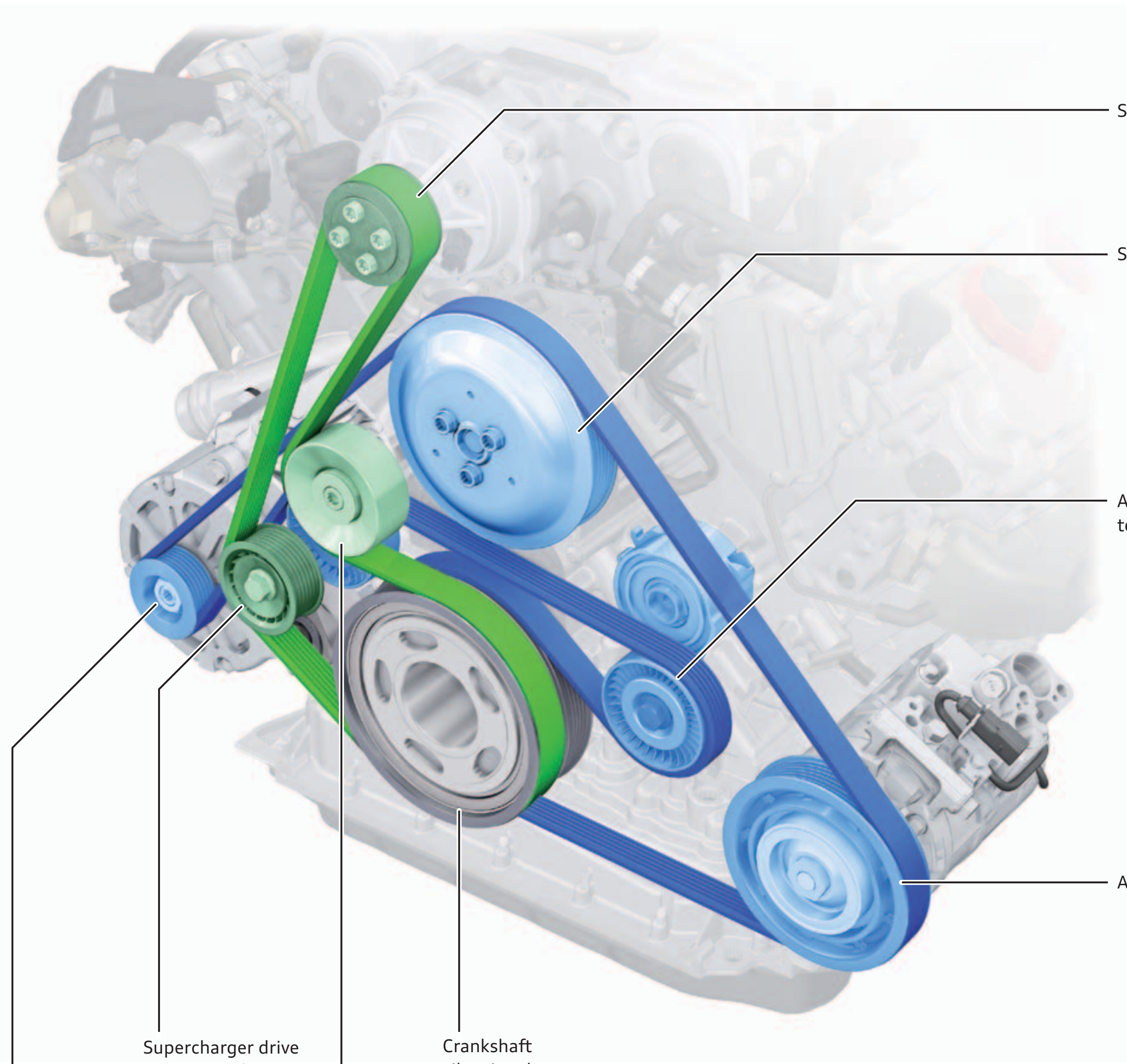
Belt drive

The engine has two separate belt drives for driving the ancillary units. The ancillary unit drive drives the alternator, the switchable coolant pump and the A/C compressor. The supercharger is driven by a separate belt drive.

Key:

Ancillary unit drive

Supercharger drive



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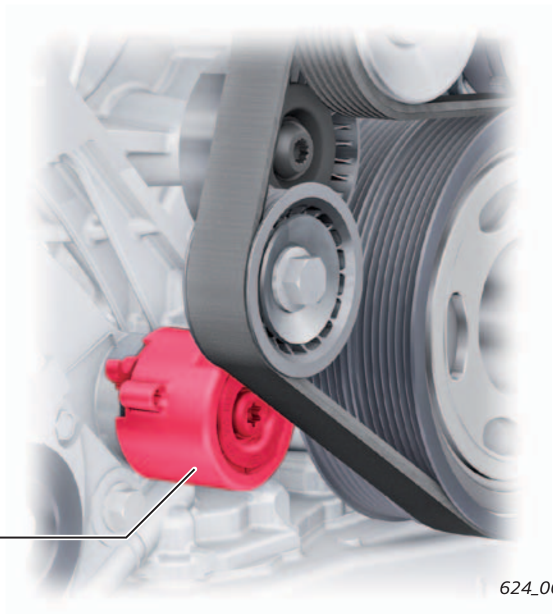
Supercharger drive

As with the third-generation 3.0l V6 TFSI engine, a second belt drive is used for driving the supercharger. However, due to the switchability of the supercharger, a higher tensile force (tensioning force) must be applied to the belt tensioner.
The supercharger poly V-belt has a set change interval (refer to table of maintenance operations on page 45). Always refer to the current maintenance tables.

Features:

- Tensile force 290 N (previously: 219 N)
- Belt drive ratio i = 2.5



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Chain drive

In design terms, the chain drive derives from the previous V6 petrol engines. The development objectives for the chain drive were to reduce friction, weight and cost.

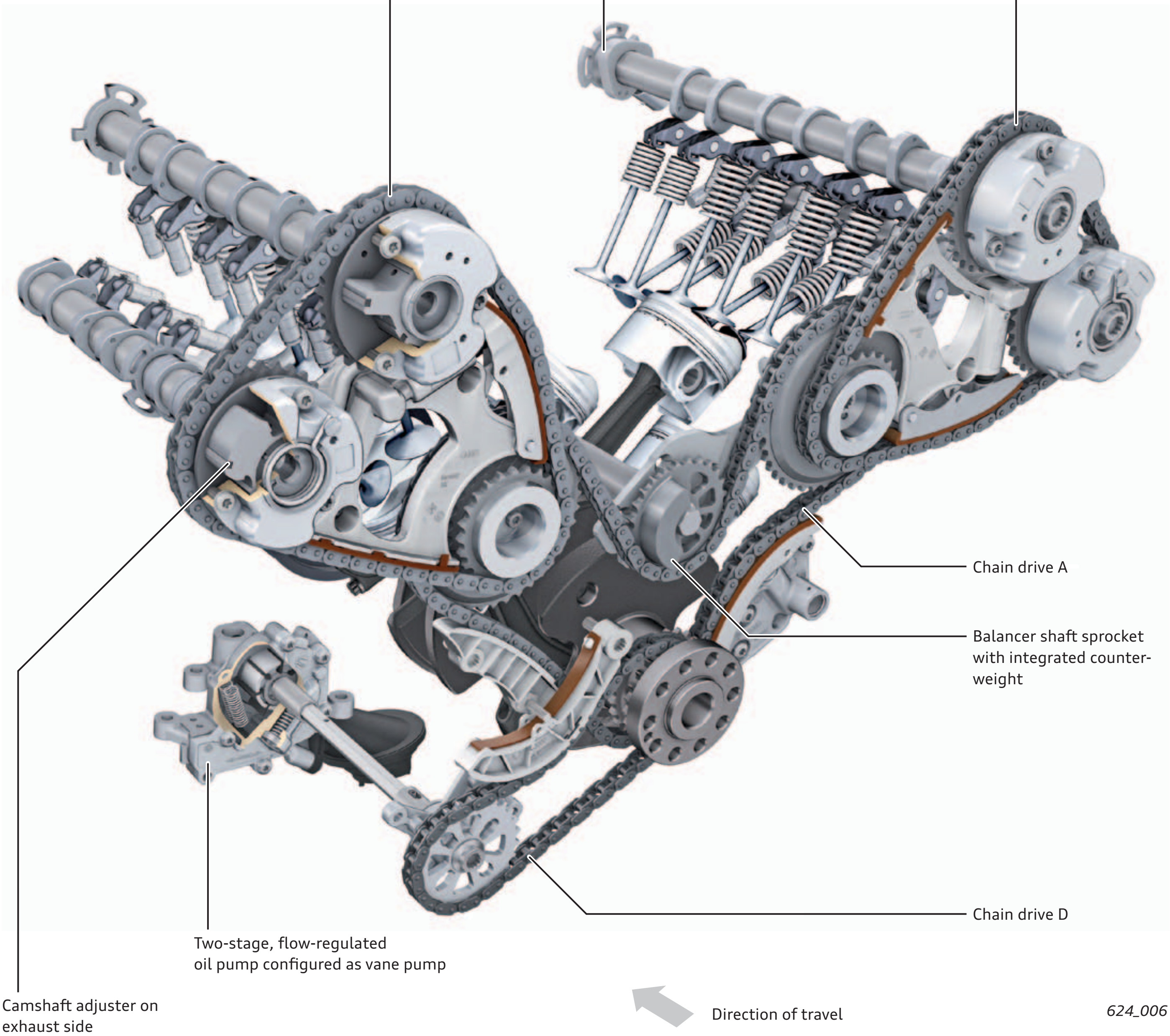
Compared to the third-generation 3.0l V6 TFSI engine, the chain routings of chain drive A (also drives the balancer shaft) and chain drive D (drives the oil pump only) were modified. As a result, both chains have a fewer links, which in turn saves weight.

The chain tensioners of chain drives A, B and C are hydraulic-assisted mechanical chain tensioners – as used in the third-generation 3.0l V6 TFSI engine.

The chain tensioner housings of pinions B and C are weight-optimised. The short guide rails are integrated into the cylinder head cover. The chain tensioner of chain drive D is a non-hydraulic-assisted mechanical chain tensioner. Chain tensioning is provided by a leaf spring assembly. The engine also has a balancer shaft, which is located in the inner vee. However, a sintered sprocket with integrated counterweight is now used. The shaft itself is "kneaded" and has no oil ring groove in either bearing.

In addition to the intake camshafts, the exhaust camshafts now also have a camshaft adjuster.

Overview



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Note
Due to the design modifications to the chain drive, it was also necessary to modify the assembly operations. Please refer to the workshop manual.

Camshaft adjuster

The task of the camshaft adjuster is to optimise power output and torque across the entire rev band by phase shifting the intake and exhaust camshaft timings. The camshafts are adjusted by hydraulically actuated adjusters on the sprockets.

The camshaft adjusters are locked in an unpressurised state. This eliminates knocking noise when starting the engine. Spring-loaded locking pins are used to lock the camshaft adjusters. They connect the stator to the rotor.

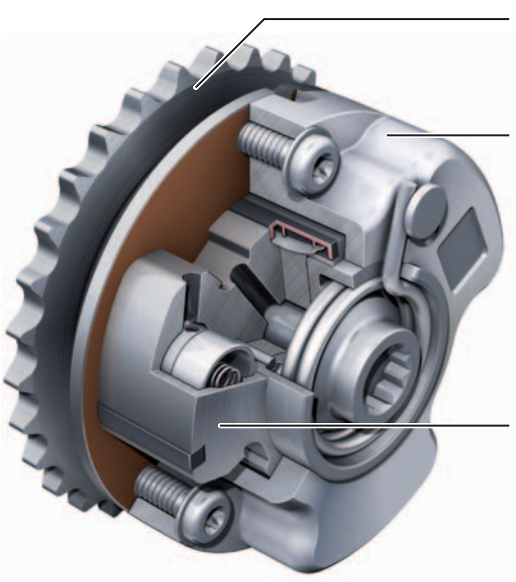
All camshaft adjustment valves are de-energised for this purpose. When the solenoid is de-energised, the intake camshafts are retarded and the exhaust camshafts are advanced.

The exhaust camshafts are adjusted to advance (basic position) by means of a spring The camshaft adjusters have trioval sprockets.

Design of camshaft adjuster

Technical features

- Design carry-over from third-generation 3.0l V6 TFSI engine (reduced leakage, lightweight design)
- 50° intake crank angle adjustment range (3rd generation: 42°)
- 42° exhaust crank angle adjustment range (positioner is new)
- Trioval sprockets
- Camshaft adjustment valves with rugged mesh inserts to prevent vibration breakage (carry-over from 4.0l V8 TFSI engine)



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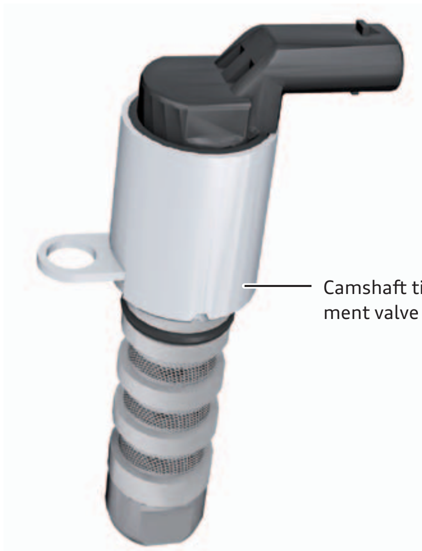

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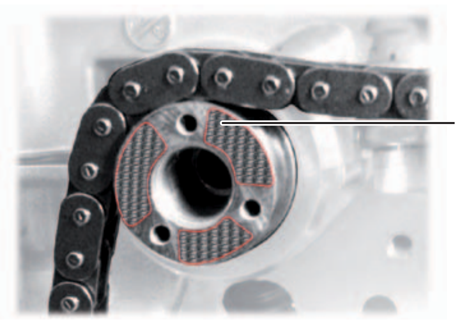
Laser-structured surfaces

To improve torque transfer through coupling, the surface on the face of the camshafts is laser-structured. A corresponding structure is formed by the 1st coupling with the aluminium camshaft adjuster. It is important to use new screws after disconnecting the coupling (refer to workshop manual).



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624_038

Reference
The basic design and function of the camshaft adjuster are described in Self Study Programme 267 "The Audi 6.0l W12 engine in the Audi A8 - Part 1".

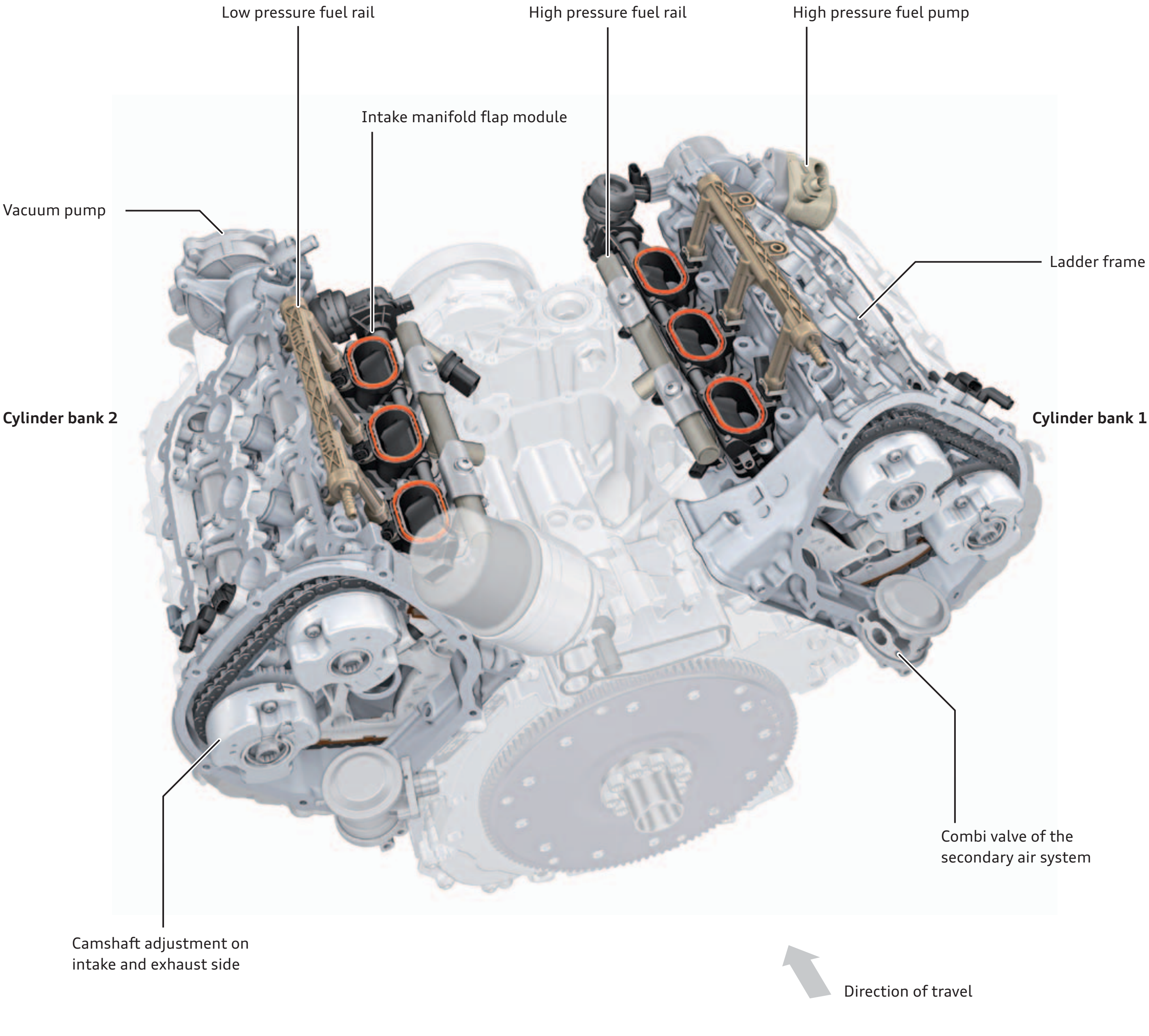
Cylinder head

The cylinder heads have seen a number of improvements. The key modifications are as follows:

- Adaptation to the new combustion chamber geometry
- Modified supercharger mounting
- Integration of the dual fuel injection system
  - Installation of additional low pressure injectors
  - Rerouting of the fuel lines
- Adapted cooling circuit (X bore)
- Additional adjuster on the exhaust camshafts
- More wear-resistant valve gear
- New intake valve seat ring (suitable for fuel containing ethanol, E25)
- Wear-resistant exhaust valve guide
- Ladder frame with mounting for camshaft adjustment valves 1+ 2
- New combi valves (secondary air system) with modified mounting

The weight of the cylinder heads was reduced by optimising the heavy components, e.g. the end piece of camshaft adjuster connection.
The friction of the camshafts, specifically at the start of the engine's service life, was reduced by *finishing* ↗ the camshaft bearings.

The valve seat rings must not be reworked. The valves can be replaced and ground.



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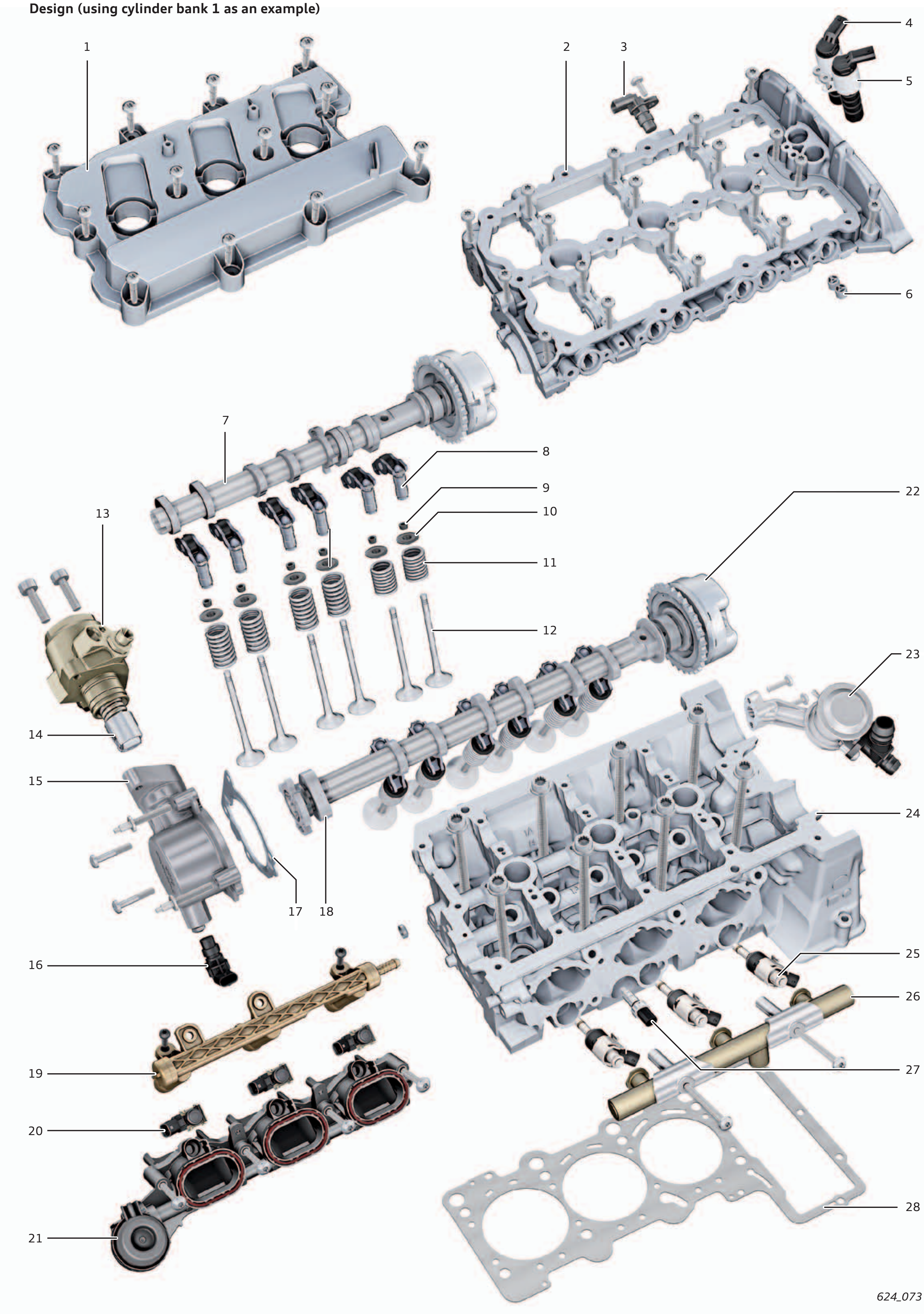
↗ Refer to "Glossary" on page 46.

Design (using cylinder bank 1 as an example)



Legend of figure on page 16:

1 Cylinder head cover

2 Camshaft bearing frame (ladder frame)

3 Hall-effect sensor G40

4 Camshaft timing adjustment valve 1 N205

5 Exhaust camshaft timing adjustment valve 1 N318

6 Retention valves

7 Exhaust camshaft with camshaft adjuster

8 Roller-lever cam follower with support

9 Valve collets

10 Valve spring retainer

11 Valve spring

12 Exhaust valve

13 High pressure fuel pump

14 Roller tappet

15 High pressure fuel pump drive housing

16 Hall-effect sensor 2 G163

17 Gasket

18 Drive cam for high pressure fuel pump

19 Low pressure fuel rail

20 Injector 2, cylinders 1 – 3 (low pressure) N532 – N534

21 Intake manifold flap module

22 Intake camshaft with camshaft adjuster

23 Combi valve of secondary air system

24 Cylinder head

25 Injectors, cylinders 1 – 3 (high pressure) N30 – N32

26 High pressure fuel rail

27 Temperature sensor for engine temperature regulation G694

28 Cylinder head gasket

Timing chain covers

The timing chain covers are bolted to the cylinder heads and sealed with liquid sealant.
They are made from sheet aluminium with a wall thickness of 0.8 mm, which brings a weight saving of about 400 g. The shape of the covers was adapted to the new layout of the secondary air system. Both covers are identical.

The covers are externally coated with a temperature-resistant soundproofing material called *Terophon* ↗ in order to reduce chain meshing noise. The spray-applied Terophon coating is approx. 3 mm thick.

624_040

↗ Refer to "Glossary" on page 46.

Oil supply

Introduction

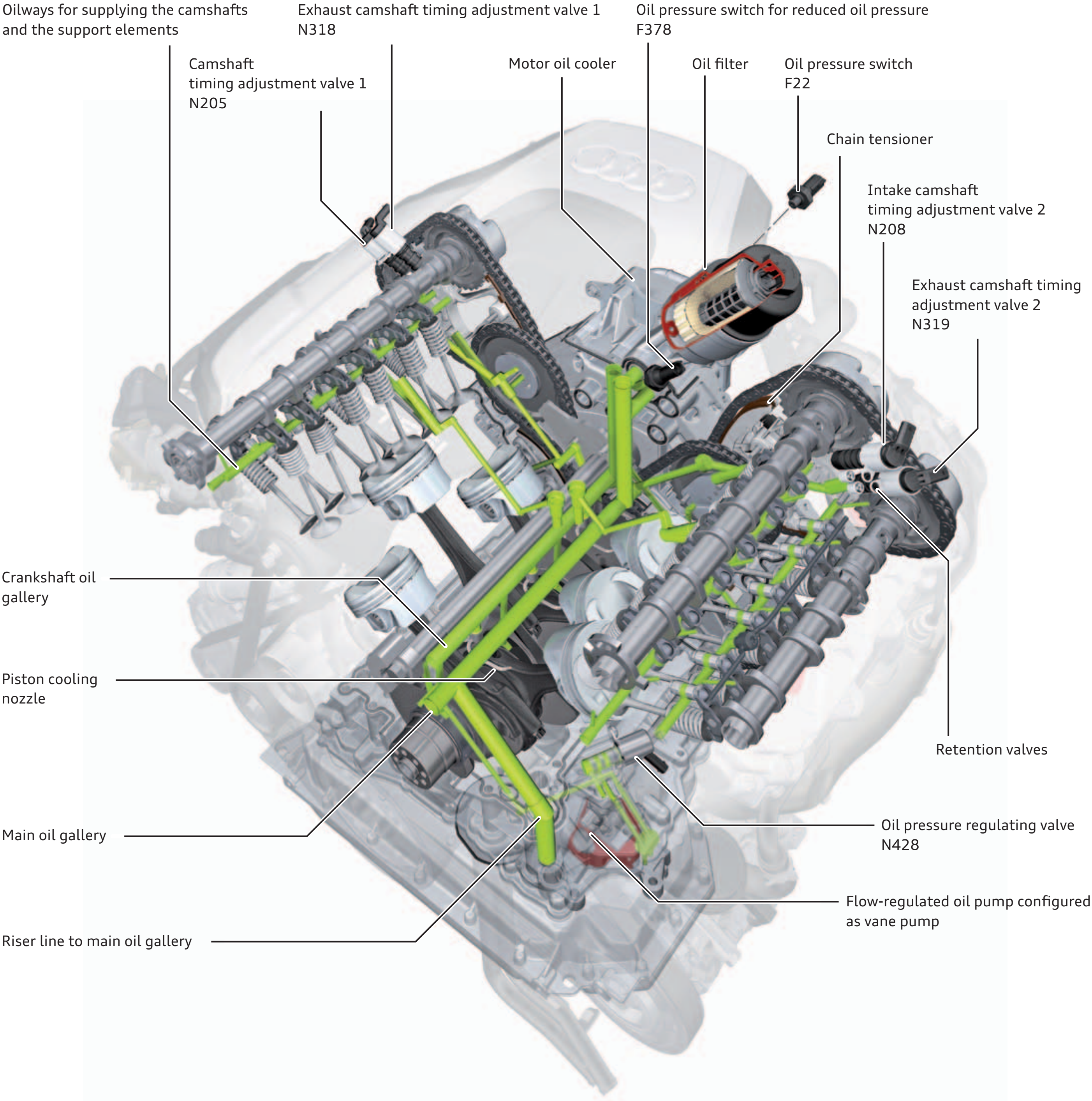
The oil supply system was adapted to the new configuration, including such modifications as a smaller oil pan.

The oil cooler was relocated to the back of the engine at the sealing flange (chain case cover) and is attached here by bolts. The upright oil filter module combines with the sealing flange to form a complete unit.

The cylinder heads were adapted for oil circulation. The additional exhaust camshaft adjusters are supplied with oil pressure.

Piston cooling nozzles are integrated in the engine block. They have an opening pressure of about 2.5 bar and a closing pressure of about 2 bar, and are controlled by spring-loaded ball valves.

Overview of the oil circuit



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Oil pump

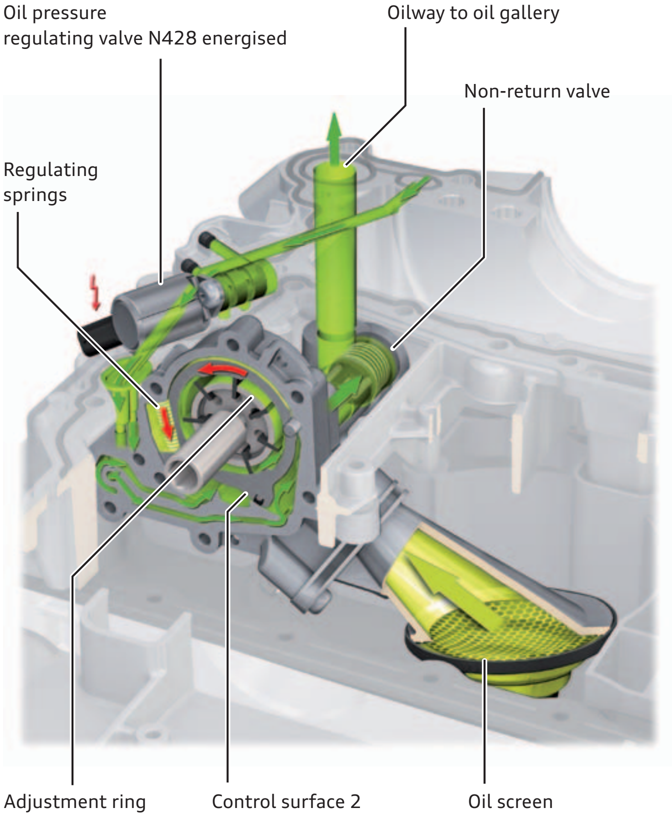
A 2-stage vane pump with a regulating valve serves as the oil pump.

Low pressure setting

The oil pressure regulating valve N428 is activated by the engine control unit, opening the duct to control surface 2. The oil pressure produced by the pump now acts upon both control surfaces and rotates the adjustment ring still further.
The inner volume of the pump decreases, in turn reducing the oil flow rate. The oil pressure drops. The pump requires less drive power, thereby saving fuel.

The oil pressure in the low flow setting is approx. 1.5 bar.

If electrical activation of the oil pressure regulating valve N428 fails, the oil pump operates continuously in the high pressure setting.



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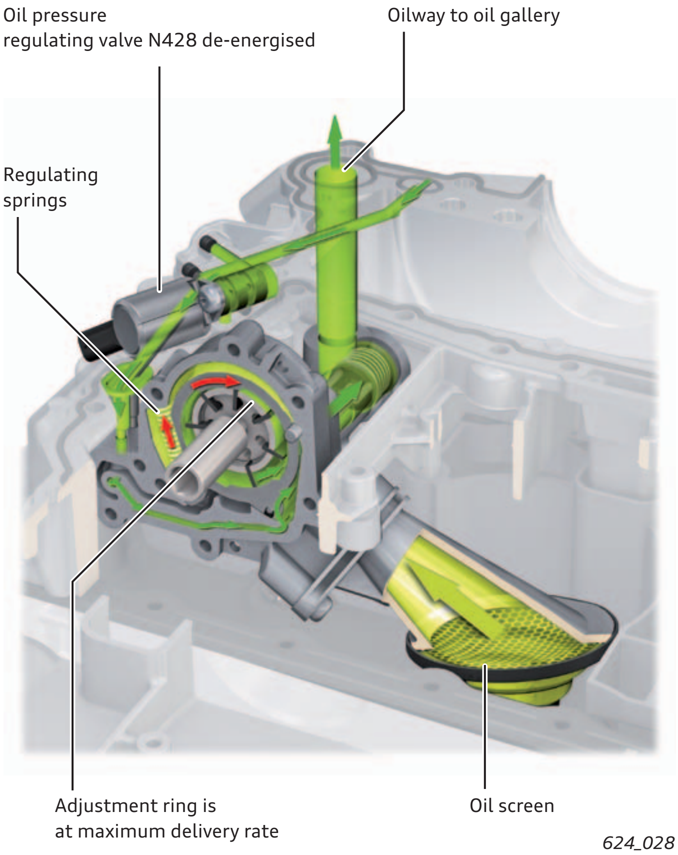
High pressure setting

The system switches to the high pressure setting at an engine speed of 4600 RPM by actuating the oil pressure regulating valve N428.
As a result of this the oil flow to control surface 2 of the adjustment ring is interrupted. The regulating springs now push back the adjustment ring, thereby increasing the pump's inner volume. The delivery rate of the pump increases, and the oil pressure is adjusted to the high pressure setting. The oil pushed back from control surface 2 is diverted into the oil pan via N428. When the engine speed drops below 4300 RPM, the system reverts to the lower pressure setting with a five-second delay.

The oil pressure in the high flow setting is approx. 3.3 bar.

To protect the system against excessively high oil pressure, e.g. low-viscosity oil with a very low temperature, an overpressure valve is integrated into the pump. This valve opens at approx. 11 bar (relative).



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Reference
The flow-regulated oil pump is described in Self Study Programme 607 "Audi 4.0l V8 TFSI engine with bi-turbo charging".

Oil pump drive gear

As in previous engines, the oil pump is bolted inside the upper oil pan. The oil pump is driven via the oil pump drive shaft, which in turn is driven by chain drive D from the crankshaft.

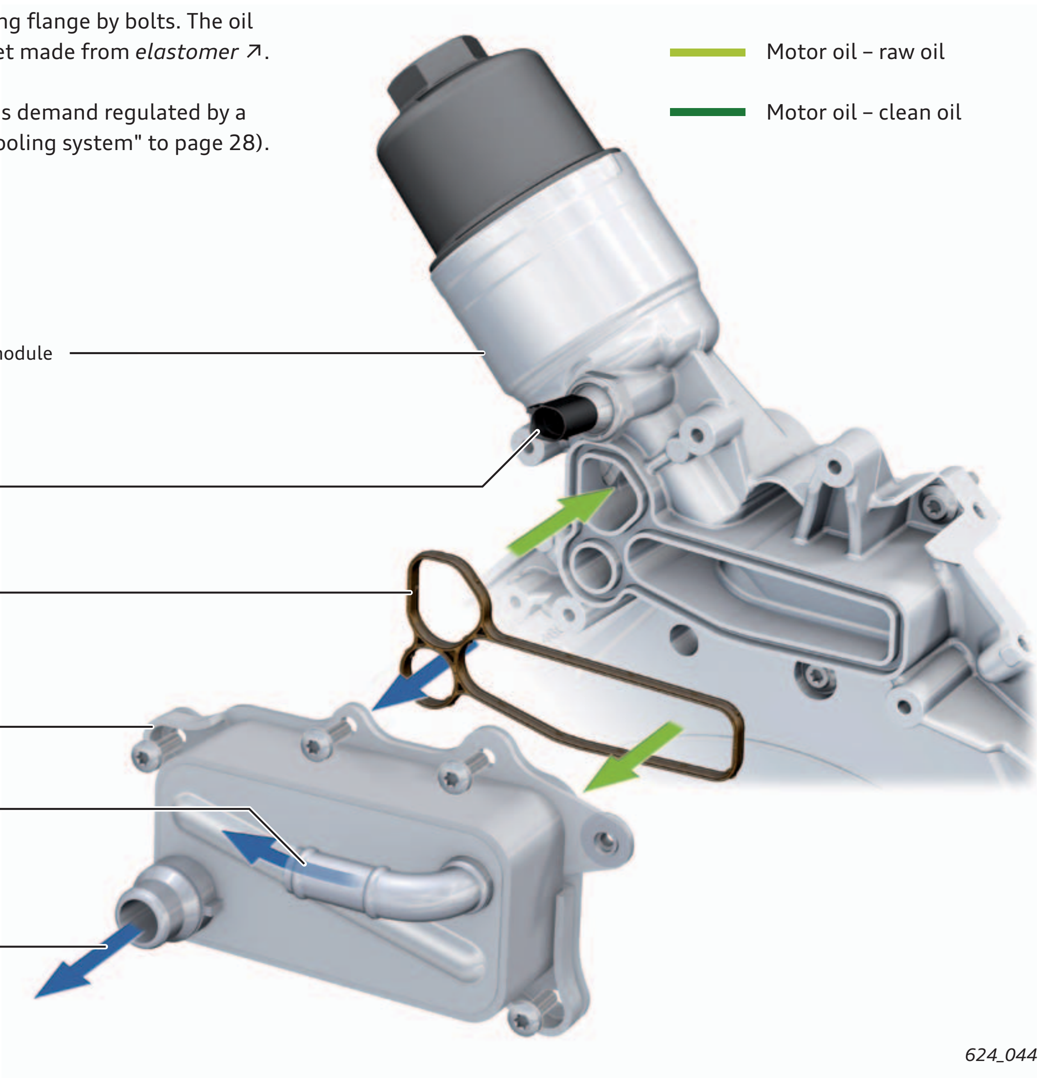
The gear ratio is i = 1.08. To remove the oil pump without having to dismantle the chain drive, the oil pump drive shaft can be displaced axially against the force of compression spring.

624_043

Switchable oil cooler

The positioning of the oil cooler has been changed compared to the third-generation engine. It is now located on the sealing flange (chain case cover) in close proximity to the oil filter module.
The oil cooler is secured to the sealing flange by bolts. The oil ducts are sealed by a moulded gasket made from *elastomer* ↗.

Coolant flow through the oil cooler is demand regulated by a vacuum activated actuator (refer "Cooling system" to page 28).



624_044

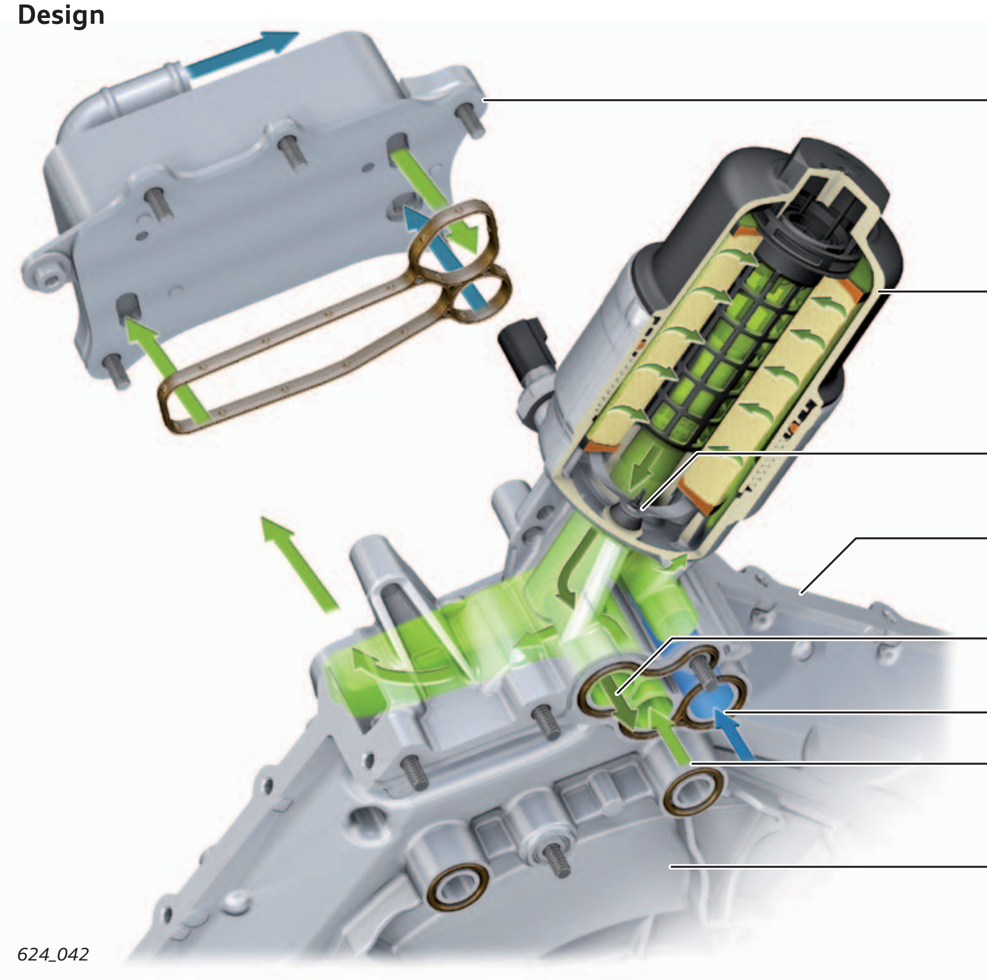
↗ Refer to "Glossary" on page 46.

Oil filter module

The oil filter module is a part of the sealing flange (chain case cover) on the back of the engine. This makes it readily accessible for service personnel, allowing for easy replacement of the filter cartridge.

The oil from the oil pump flows through the oil cooler and is subsequently cleaned in the oil filter, before being directed to the engine lubrication points.

Design

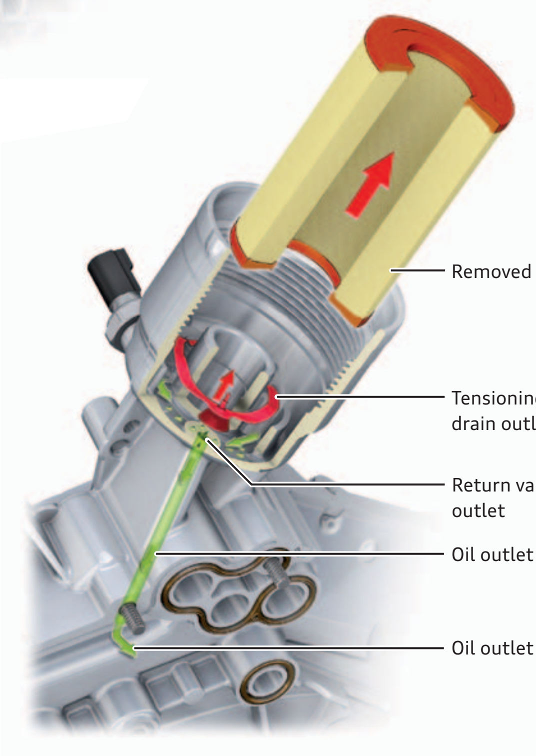


624_042

Oil filter replacement

It is important to avoid spilling oil onto the engine when replacing the oil filter. To prevent spillage, the oil in the oil filter housing must be able to drain into the oil pan when the oil filter is replaced.
After the oil filter housing has been loosened several turns, a return valve opens to allow the oil to flow out of the oil filter housing and into the oil pan. The return valve is held shut by a spring-loaded tensioning clamp. The clamp is tensioned over the oil filter cartridge when the oil filter housing is securely bolted together with the oil filter module.

When replacing an oil filter, i.e. before fitting a new filter cartridge, care must be taken to ensure that the tensioning clamp is correctly seated. Oil pressure cannot build up unless the return valve is properly sealed by the tensioning clamp.



624_041

Note
When carrying out an oil change pay attention to the instructions for removing and installing the oil filter cartridge in the workshop manual, particularly the instructions for handling the tensioning clamp.

Air intake and turbocharger systems

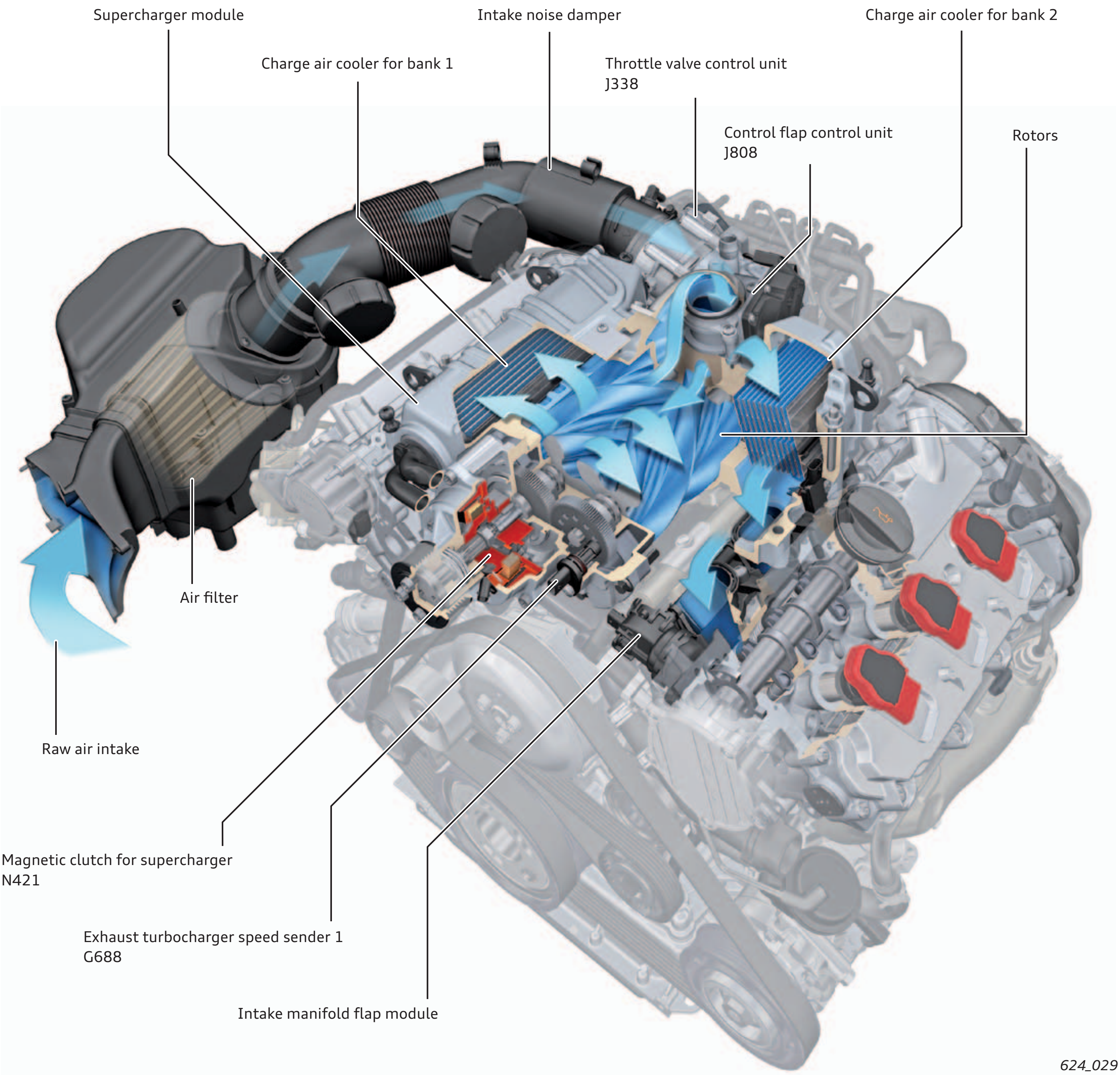
Overview

Many details of the air supply and charging system were revised. Here, the designers saw another possibility for improving the engine's fuel economy. Previously, the supercharger (Roots blower) was permanently driven. In the third-generation 3.0l TFSI engine, charge pressure was controlled by the throttle flap and by the control flap only.

There is now a magnetic clutch in the supercharger head unit. It allows power flow to the supercharger to be interrupted when no boost is required.

A number of modifications were needed in order to implement the supercharger shut-off function. These are described on the following pages.

Overall system



624_029

Supercharger module (Roots blower)

In addition to the magnetic clutch for shutting off the supercharger, further changes were made to the supercharger module:

- Modified charger pressure sender 2 G447 / intake manifold pressure sender G71, now digital sensors with *SENT data protocol* ↗, as with the third-generation EA888 engine
- Additional attachment points for the continuous design hood (supercharger is concealed in engine bay)
- Enlarged and angled charge air cooler (higher overall efficiency)
- Enlarged transport lugs
- Improved flap bearings (throttle flap, air recirculation flap)

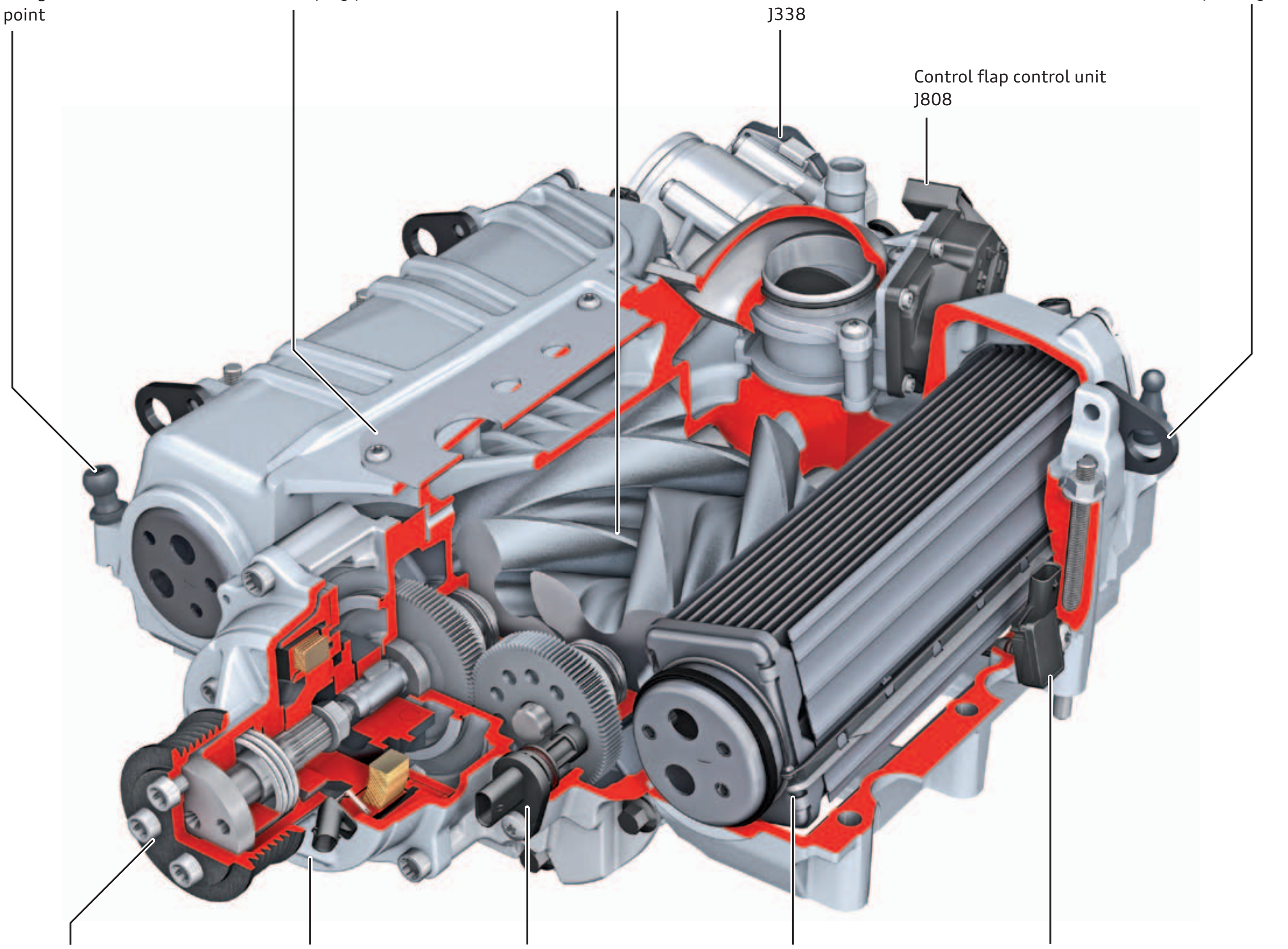
The activability of the supercharger puts more stress on the belt drive. For this reason, a rugged belt tensioner is used (refer to "Belt drive" on page 12).

Service operations

In comparison with the third-generation engine, additional components can be replaced when carrying out repair work on the supercharger module. The following assembly operations are possible:

- Removing and installing the magnetic clutch
- Removing and installing the supercharger belt pulley
- Removing and installing the rotor unit
- Replacing the drive shaft oil seal
- Replacing the needle bearings

Design



624_001

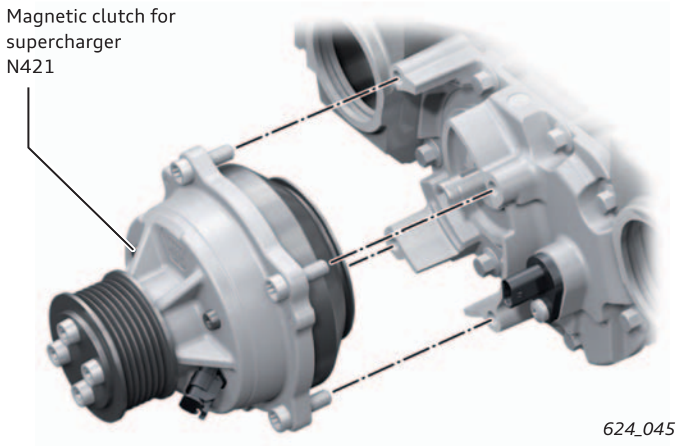
↗ Refer to "Glossary" on page 46.

Reference

For more information about Roots blowers, charge pressure control and charge air cooling in the 3.0l V6 TFSI engine, please refer to Self-Study Programme 437 "Audi 3.0l V6 TFSI engine with Roots blower".

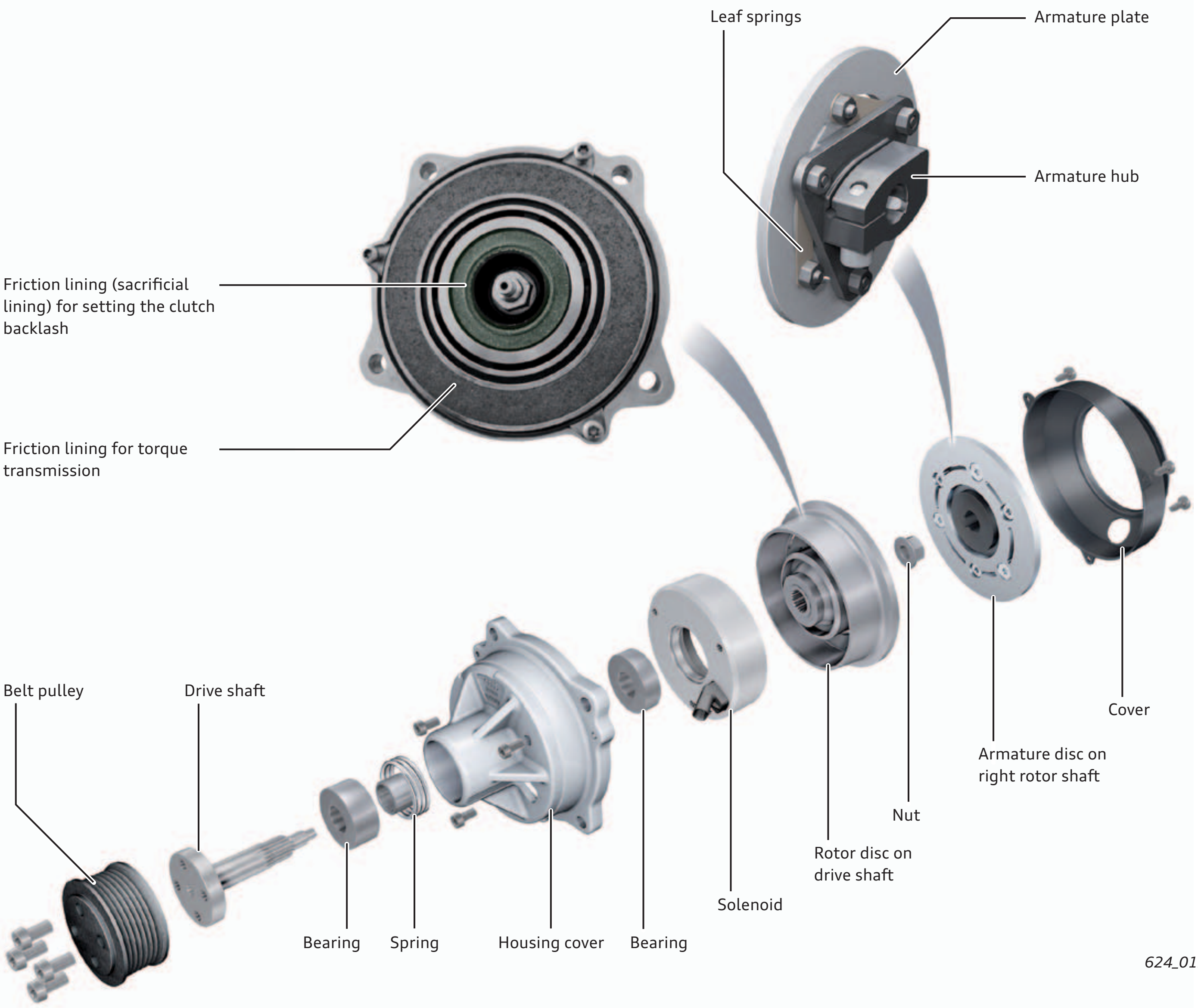
Magnetic clutch for supercharger N421

The magnetic clutch for supercharger N421 is, as a separate module, bolted onto the supercharger in front of the right rotor shaft. It is responsible for activating and deactivating the supercharger.



624_045

Design



624_012

Note
The magnetic clutch can be replaced separately during repair work. Follow the instructions given in the workshop manual.

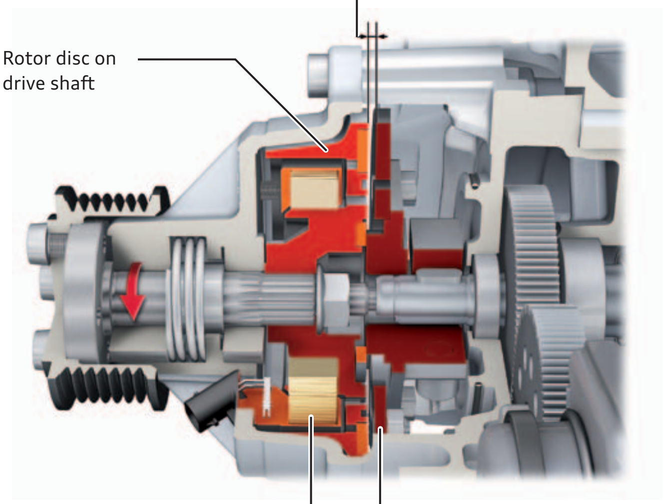
Function

Magnetic clutch open – supercharger deactivated

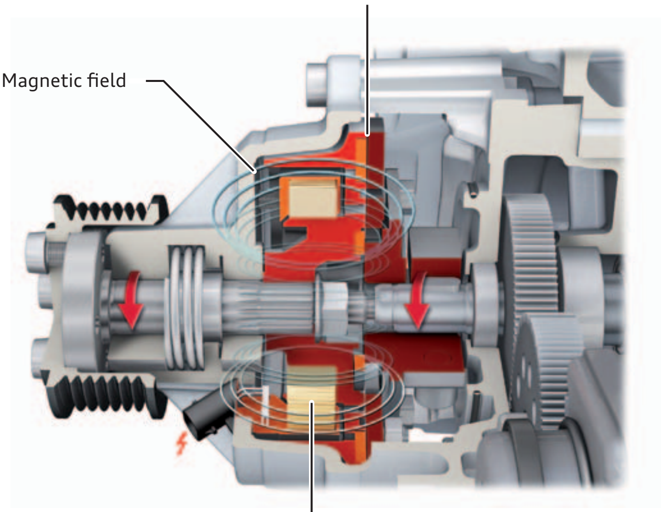
The magnetic clutch is not activated at low and medium RPM, as well as at low engine load. It is therefore open and, thus, the supercharger is deactivated. There is a clearance between the rotor disc and the armature disc. Power flow to the rotors is interrupted. In addition, the control flap is closed. The entire engine air throughput flows through the rotors, with the result that they rotate at low RPM.

Magnetic clutch closed – supercharger activated

The magnetic clutch is activated by the engine control unit by means of a *PWM signal* ↗ (current regulation). The magnetic force draws the armature disc onto the friction lining of the rotor disc against the force of the leaf springs. Traction is established and the supercharger rotors are driven.



624_020



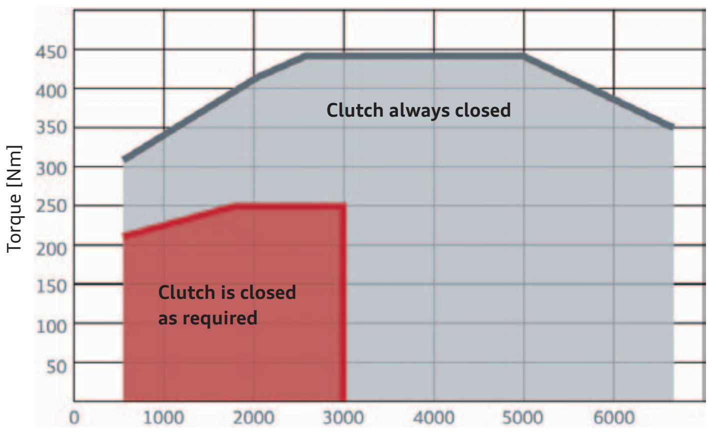
624_021

Audi QR-Code

Scan the QR code to find out more about how the magnetic clutch works.

Supercharger activation/deactivation

The adjacent diagram shows the map for supercharger activation/ deactivation.
Maximum deactivation of the supercharger within the mapped engine speed/torque range is ensured by implementing an elaborate activation/deactivation strategy. The supercharger is disengaged at partial engine load, resulting in better fuel economy.
The key parameters are engine speed and driver torque demand.
The calculation is also affected by other factors, too.



624_019

↗ Refer to "Glossary" on page 46.

Shift comfort

One of the major challenges during the development of the magnetic clutch was assuring comfortable shifting. It should not be possible to feel or hear the engagement/disengagement of the supercharger when it is activated and deactivated.

To achieve this, the clutch is, firstly, engaged or disengaged as smoothly as possible by applying a controlled current and, secondly, the airflow is directed over the rotors by selective activation of the throttle valve and air circulation flap in such a way that they remain in motion. This results in smoother activation of the supercharger.

Current regulation

Torque is taken off the crankshaft whenever the supercharger is activated. This torque take-off can briefly produce up to 70 Nm of dynamic torque and would manifest itself to the driver as noticeable judder when the supercharger engages or disengages.

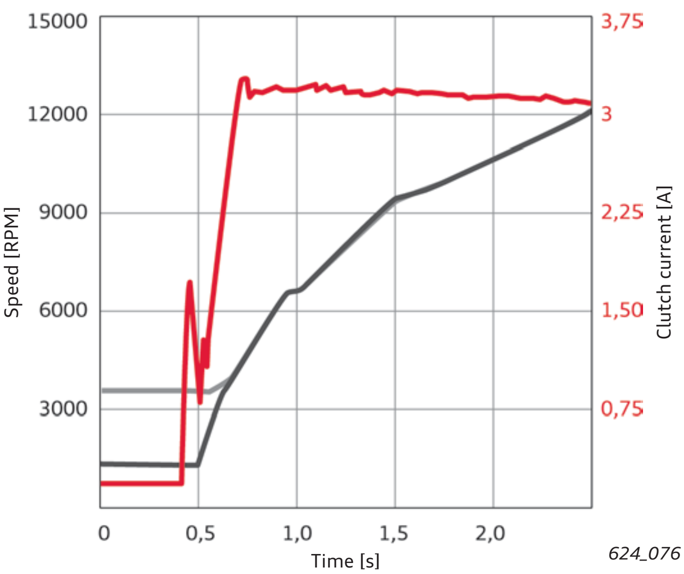
To ensure optimal ride comfort at all operating points, the engagement and disengagement of the clutch are *PWM* ↗-controlled. This allows clutch engagement/disengagement times to be adapted. The engagement/disengagement time is varied within the 100 – 1500 ms range depending on driver input. A shorter engagement/disengagement time is, therefore, required under dynamic acceleration.

Function

When the armature moves to within the magnetic field, a current drop occurs due to self-induction in the coil (see red line in diagram). This is detected by the current sensor in the engine control unit. The current control cycle begins when contact between the armature and rotor is detected. The current is controlled in dependence on nominal and actual supercharger RPM. The speed of the rotors is utilised as an input signal for this purpose and transmitted to the synchronous gear stage of the supercharger (exhaust turbocharger speed sender 1 G688) via a Hall-effect sensor.

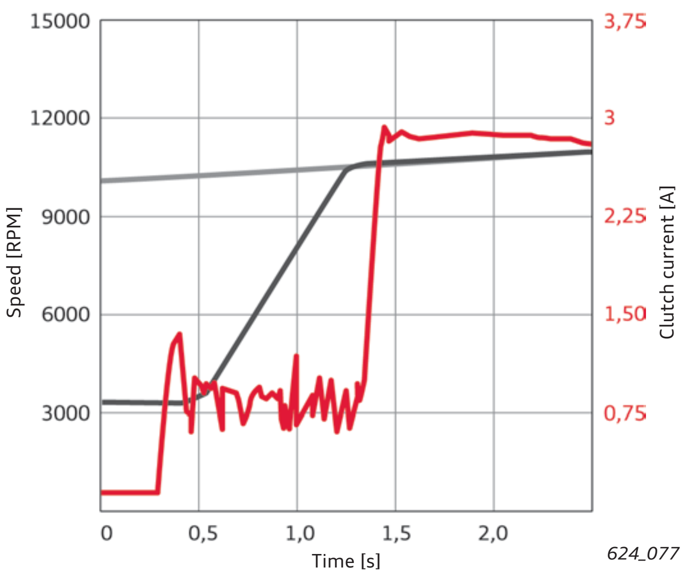
A comfortable increase in engine torque is achieved during and after engagement/disengagement of the magnetic clutch through controlled activation of the throttle valve and the bypass valve and through an adapted increase in supercharger RPM based on vehicle operating mode (comfort = slow increase in speed, dynamic = rapid increase in speed).

Short shift (during kick-down)



624_076

Long shift (if max RPM is exceeded)



624_077

Key:

- Clutch input RPM
- Supercharger RPM
- Clutch current

Exhaust turbocharger speed sender 1 G688

The supercharger speed sensor is a Hall-effect sensor. It is based technically on the engine speed sensor G28 of the third-generation EA3888 engine. The integrated sensor electronics were adapted due to the higher speed of the supercharger.

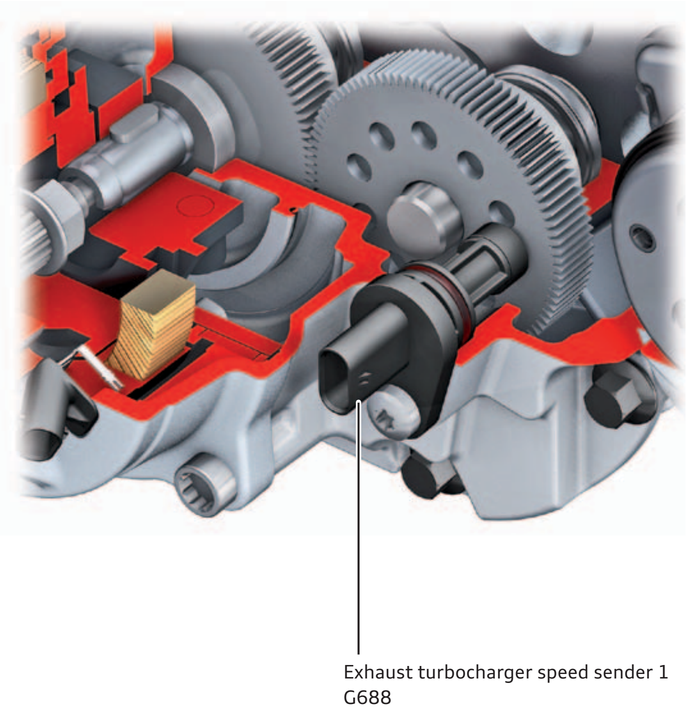
Signal utilisation

The engine control unit utilises the signal from the sensor to determine the speed of the supercharger when the magnetic clutch engages. This signal is used for calculating the engagement/disengagement times of the clutch and for monitoring the functioning of the clutch.

Diagnostics

In addition to the usual options for diagnosis of the sensor for open circuit or short circuit as well as the signal, the following fault states of the clutch can be identified:

- Plausibility of supercharger speed in comparison with crankshaft speed (ratio: i = 2.5) in the event of a MIL and EPC fault
- In the event of MIL signal loss



624_046

Failure of the sensor

In the event of sensor failure, controlled activation of the clutch is not possible, i.e. the clutch is activated and deactivated directly and harshly. In the event of a fault, engagement of the clutch may be noticeable.

Clutch protection

Frequent engagement/disengagement of the clutch results in heat buildup due to friction. Excessively high temperatures can destroy the component parts of the clutch. However, there is no sensor for monitoring clutch temperature.

To protect the clutch, a model-based "stress factor" is calculated from the speed differential and the acceleration time in the engine control unit.

This gives an indication of the temperature of components. If the stress factor exceeds a pre-defined threshold, the clutch will not be allowed to disengage for a set amount of time. The engaged components rotate and are not connected to the housing. This enables the clutch to dissipate the heat which has built up.

↗ Refer to "Glossary" on page 46.

Cooling system

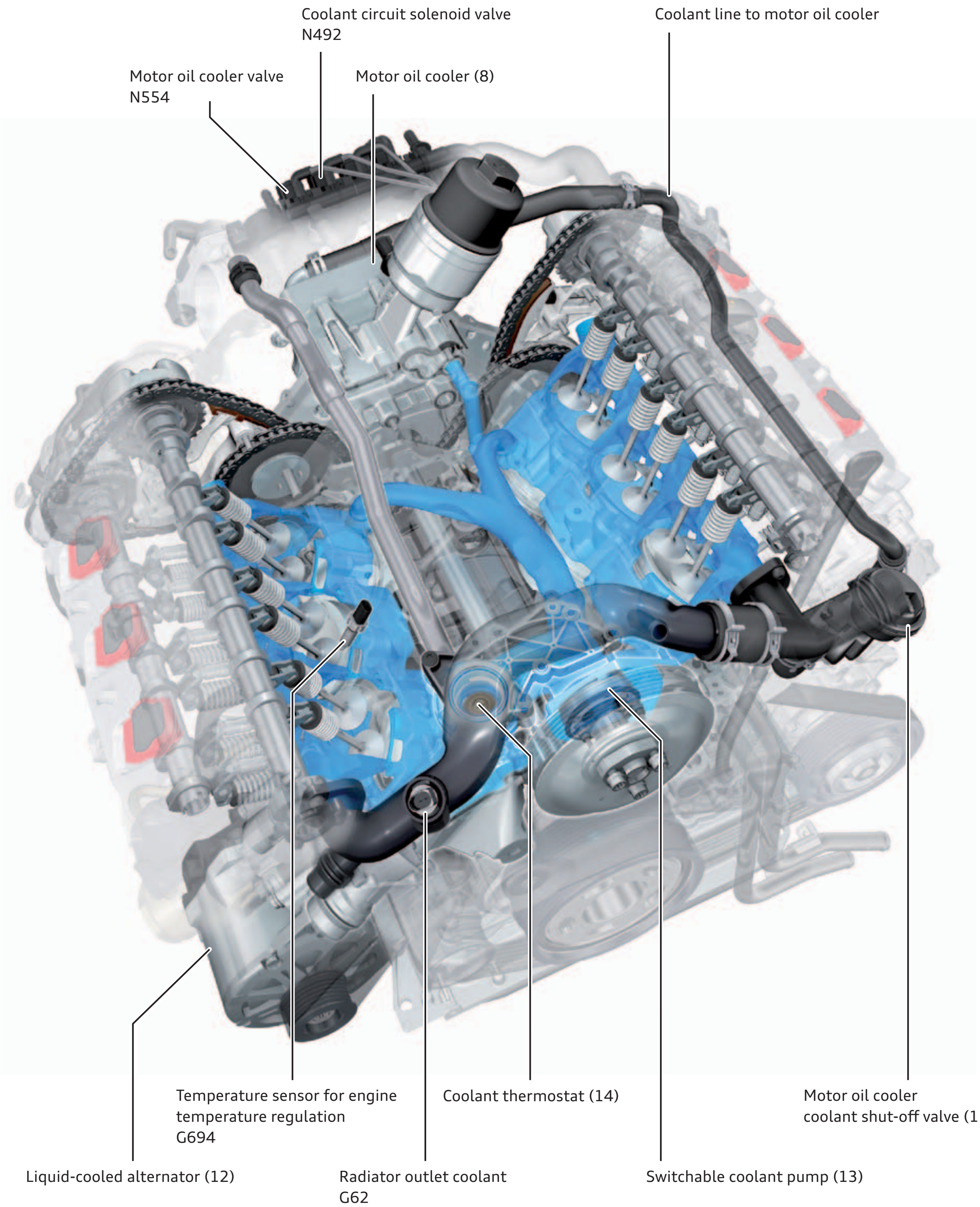
Introduction

The coolant circuit is a slightly modified version of the coolant circuit in the third-generation 3.0l V6 TFSI engine. This engine also had an a switchable coolant pump, which provides for non-circulating coolant as part of the Innovative Thermal Management system.

Given that the oil cooler is on the back of the engine and its coolant flow can be shut off, additional lines and a shut-off valve were installed. The coolant shut-off valve is vacuum-actuated by the motor oil cooler valve N554.

Overview

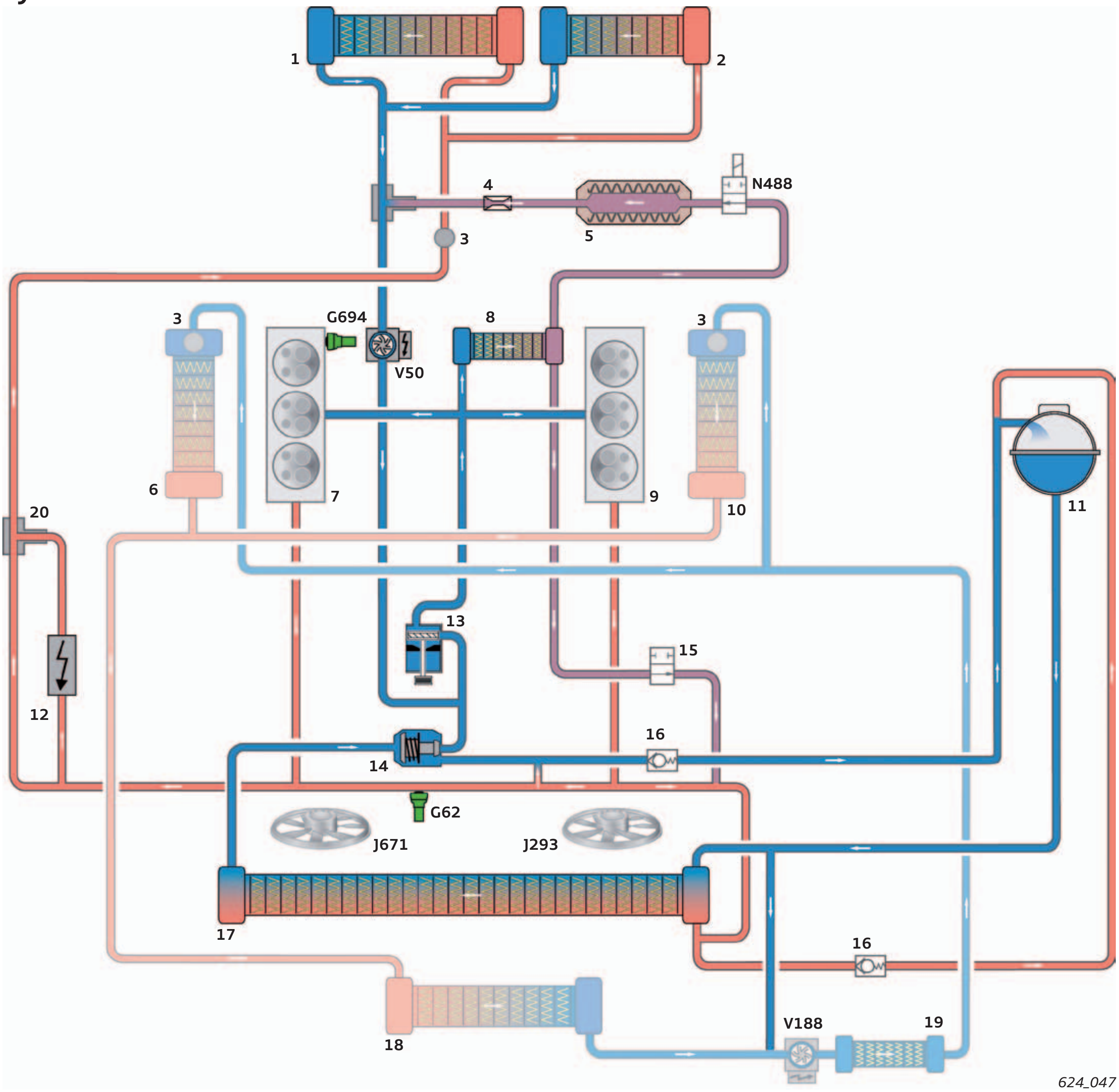
The coolant jacket in the engine block is shown blue in the figure below.



624_011

The numbers in brackets indicate the position of the component in the system overview on page 29.

System overview



624_047

Key:

1 Front heater heat exchanger
2 Rear heater heat exchanger
3 Vent screw
4 Flow restrictor
5 ATF cooler
6 Right charge air cooler
7 Cylinder head, bank 1
8 Motor oil cooler
9 Cylinder head, bank 2
10 Left charge air cooler
11 Coolant expansion tank
12 Liquid-cooled alternator
13 Switchable coolant pump
14 Coolant thermostat
15 Coolant shut-off valve
16 Non-return valve
17 Radiator
18 Front cooler for charge air cooling circuit
19 Left cooler for charge air cooling circuit
20 Suction jet pump

G62 Coolant temperature sensor
G694 Temperature sensor for engine temperature regulation
J293 Radiator fan control unit
J671 Radiator fan control unit 2
N488 Gearbox coolant valve
V50 Coolant circulation pump
V188 Charge air cooling pump

Cooled coolant
Cooled coolant (charge air cooling)

Hot coolant
Hot coolant (charge air cooling)

Switchable coolant pump

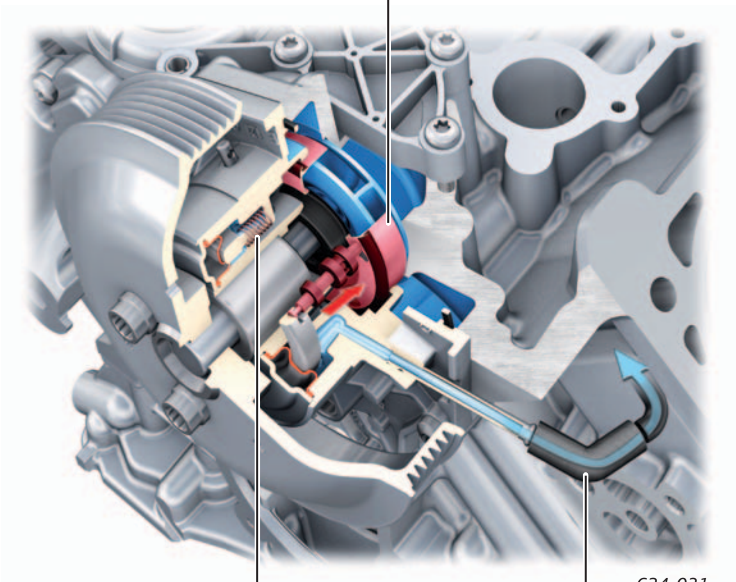
The internal friction in an internal combustion engine is lowest at operating temperature. To reach this temperature as quickly as possible after engine startup, the thermal management system provides for "non-circulating coolant" during the warm-up phase. This is implemented technically by using a switchable coolant pump, which is driven permanently by a poly V-belt.

Unlike the third-generation 3.0l V6 TFSI engine, the pump has a "potted" impeller. When this pump is activated, the coolant stops circulating through the engine.

No coolant flow

This is achieved by pushing a diaphragm over the pump impeller. The diaphragm is displaced by means of a vacuum acting against the force of a spring. The springs pull the diaphragm away from the impeller with the result that coolant flow is maintained even in the event of a system malfunction.

The condition for this operating state is a coolant temperature of less than 30 °C.



624_031

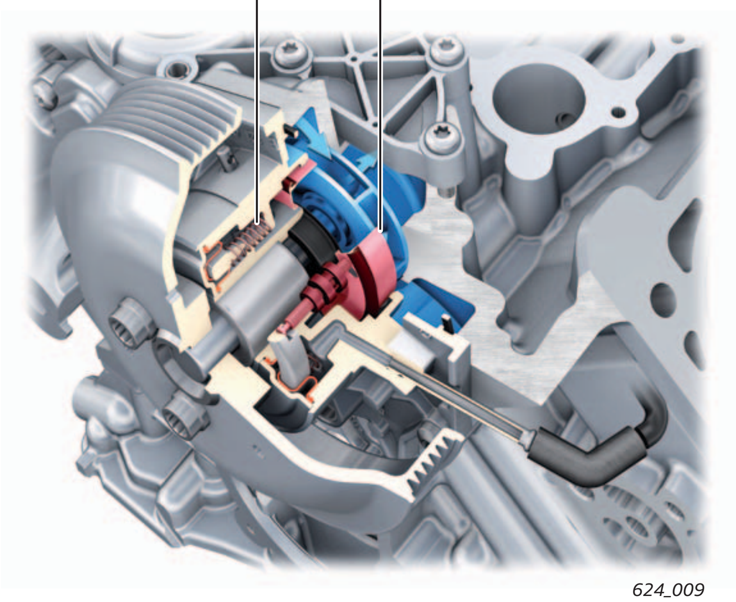
Coolant is pumped

The vacuum supply is shut off to activate the coolant flow. The diaphragm is retracted by spring pressure.

Special restarting characteristics:

- Switches on and off for a duration of 1 second
- This cycle is repeated several times in succession
- The interval between cycles is approx. 7 seconds

Thus the hot coolant from the engine mixes slowly with the cold coolant. When heating is required, the pump is switched on immediately.



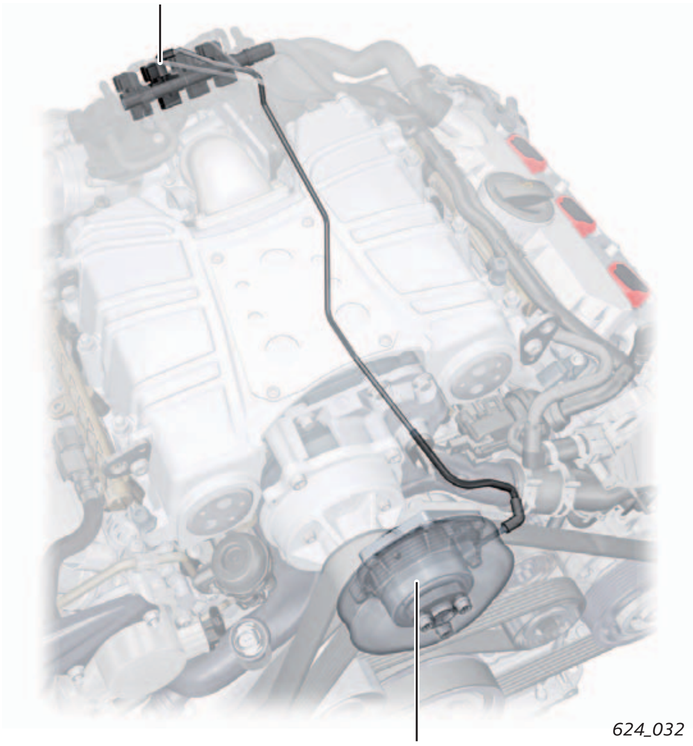
624_009

Vacuum activation

The vacuum for the coolant pump is switched by the coolant circulation solenoid valve N492. This valve is activated by the engine control unit (on the basis of a map) by means of a *PWM signal* ↗. The diaphragm is not pushed variably over the coolant pump impeller; it is only switched on or off.

If the valve is de-energised or fails, coolant flow cannot be controlled since the diaphragm is kept retracted by the spring pressure (maximum coolant flow).

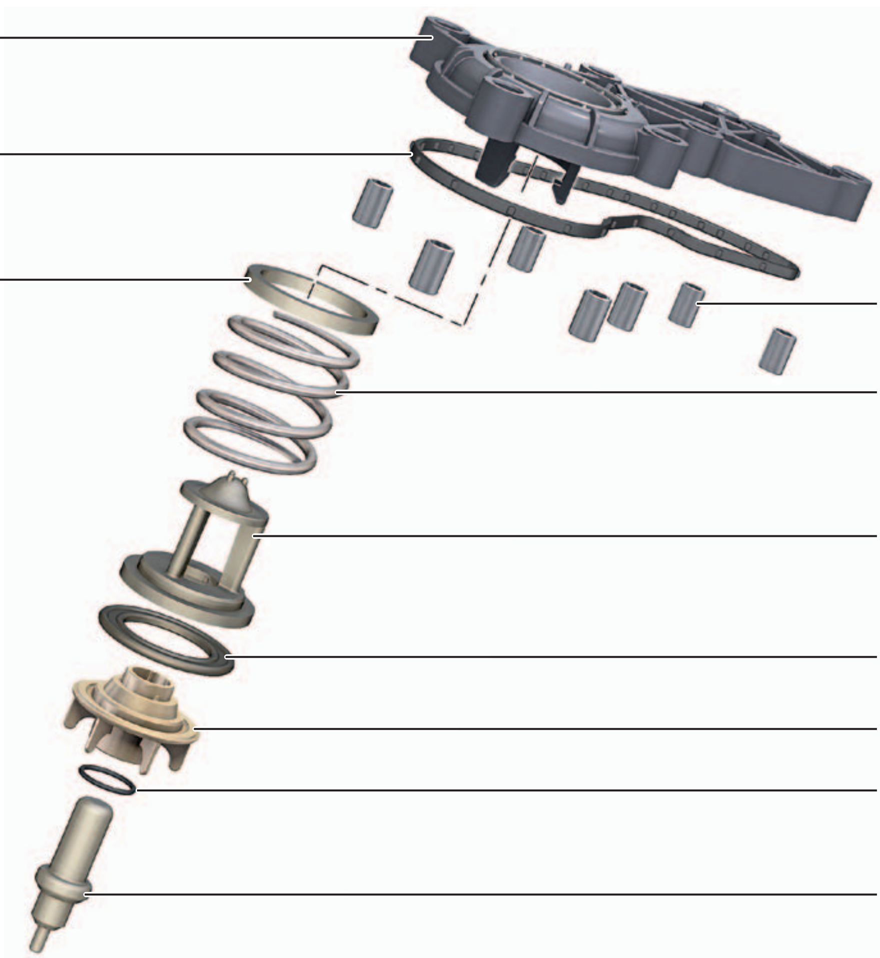
- **Failure when de-energised:** the engine reaches its operating temperature more slowly.
- **Failure when energised:** the coolant temperature rises to an unacceptably high level since the coolant pump is unable to feed in fresh coolant. The coolant temperature warning lamp and the exhaust warning lamp K83 are switched on.



624_032

Thermostat

The thermostat controls the engine coolant intake temperature by alternately opening the large and small cooling circuits.

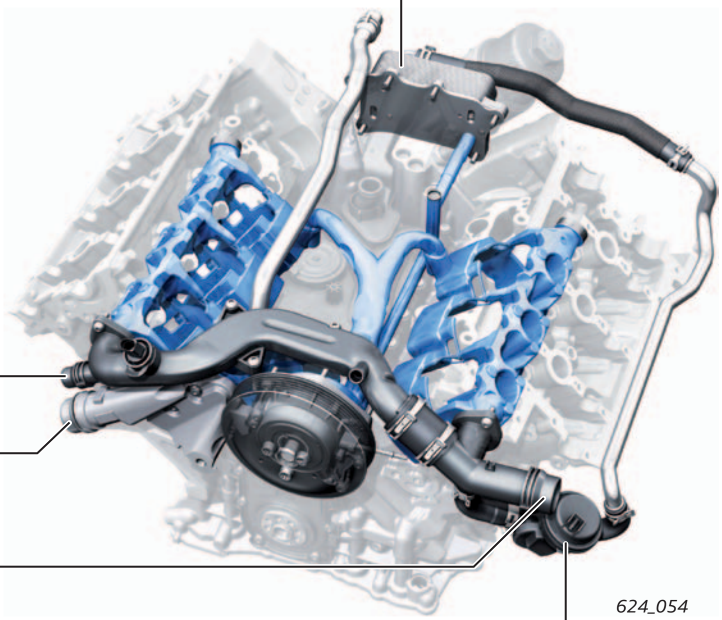


624_068

↗ Refer to "Glossary" on page 46.

Motor oil cooler coolant shut-off valve

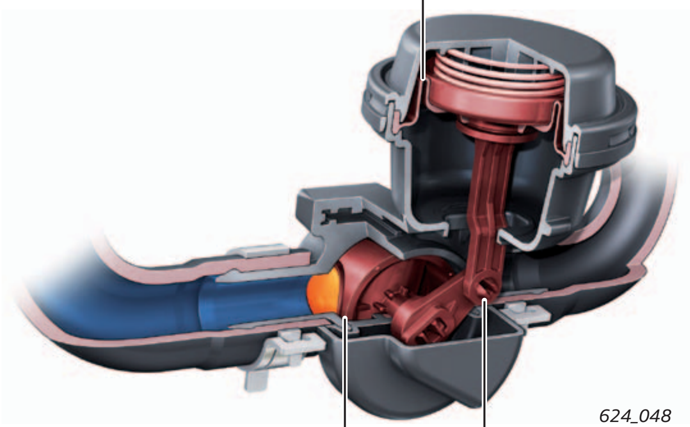
Coolant can flow through the motor oil cooler when required. The supply of coolant to the oil cooler is controlled by the coolant shut-off valve. Opening and closing of the valve are controlled by spring force and vacuum.
The vacuum is controlled by a solenoid valve, the motor oil cooler valve N554 (refer to Fig. 624_014 on page 11).



624_054

No coolant flow

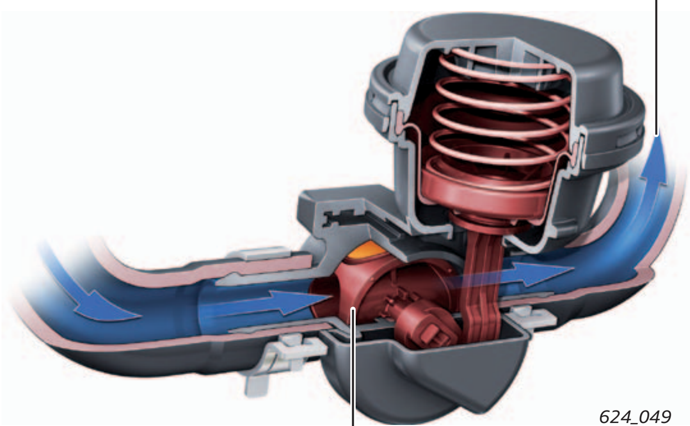
Coolant flow is interrupted in that the motor oil cooler valve N554 is activated by the engine control unit. This allows vacuum to be applied to the coolant shut-off valve diaphragm. The diaphragm with linkage is pulled upwards against the force of the spring. The mechanism in the linkage closes the rotary valve. Coolant flow to the motor oil cooler is now interrupted.



624_048

Coolant flow to the motor oil cooler

The vacuum supply is shut off in order to activate the coolant flow. The motor oil cooler valve N554 is no longer activated. The shut-off valve opens to allow coolant to flow to the oil cooler.



624_049

Electrical coolant pumps and coolant valve

Coolant circulation pump V50

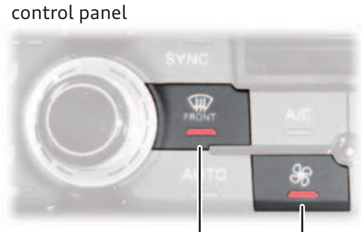
The pump serves as a circulation pump for the heater heat exchanger and is mounted to the gearbox. It assist the engine's own coolant pump in order to ensure a steady flow of sufficient coolant through the air conditioner heat exchanger(s). It is activated (PWM) and diagnosed by the Climatronic control unit J255. It is possible to adapt pump output to requirements by PWM activation. When the pump is running, the heated coolant from the cylinder heads flows through the heater heat exchanger via pump V50 and the mechanical coolant pump and then returns to the engine. For this purpose, oversizing of the mechanical coolant pump is cancelled. The pump is activated:

- when the ignition is turned on, depending on the coolant temperature and the setting of the air conditioning system (e.g. heating demand)
- when the "Defrost" function is selected
- when the "Residual heat" function is selected
- to start the engine (in this case, V50 serves as the run-on pump when the engine is shut down).

The pump is activated on the basis of a characteristic map stored in the engine control unit.

Pump activation and the duration of pump operation are dependent on the previous driving condition and the thermal state of the engine. The pump is activated in such a way that the direction of flow of the coolant is reversed. This reverses the flow through the main radiator. Pump V50 is not installed in vehicles with an auxiliary heater. In this case, the built-in circulation pump V55 performs these tasks.

624_053



624_082

Charge air cooling pump V188

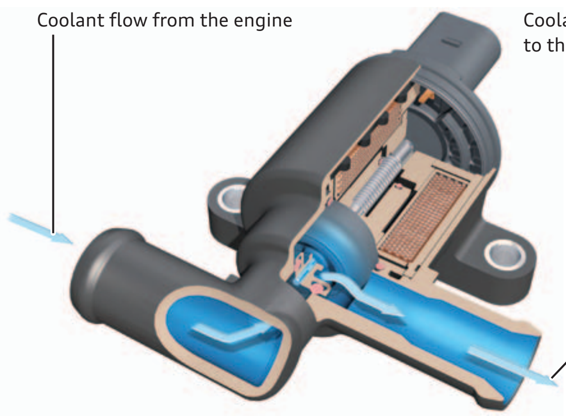
Unlike the third-generation 3.0l V6 TFSI engine, the pump is sourced from a different supplier (Saleri). Consequently, different pin assignments apply. In addition, speed is no longer reduced step by step at low temperatures rather continuously. The charge air cooling pump V188 is activated by a PWM signal from the engine control unit. The delivery rate of the pump can, therefore, be adapted to the thermodynamic conditions in the cooling circuit. If voltage is applied to the charge air cooling pump V188, the system performs a self-test and then waits for the PWM signal from the engine control unit J623 for the charge air cooling pump V188. As soon as the pump receives the signal from the engine control unit, the system enters controlled mode.

The charge air cooling pump V188 is diagnosed together with the engine control unit. The necessary event memory entries are stored in the engine control unit.

624_052

Gearbox coolant valve N488

The gearbox coolant valve N488 controls the flow of warm coolant from the engine to the gear oil cooler. The solenoid valve is demand activated by the engine control unit. It is held open by mechanical spring force when not activated and closes when the engine is started.

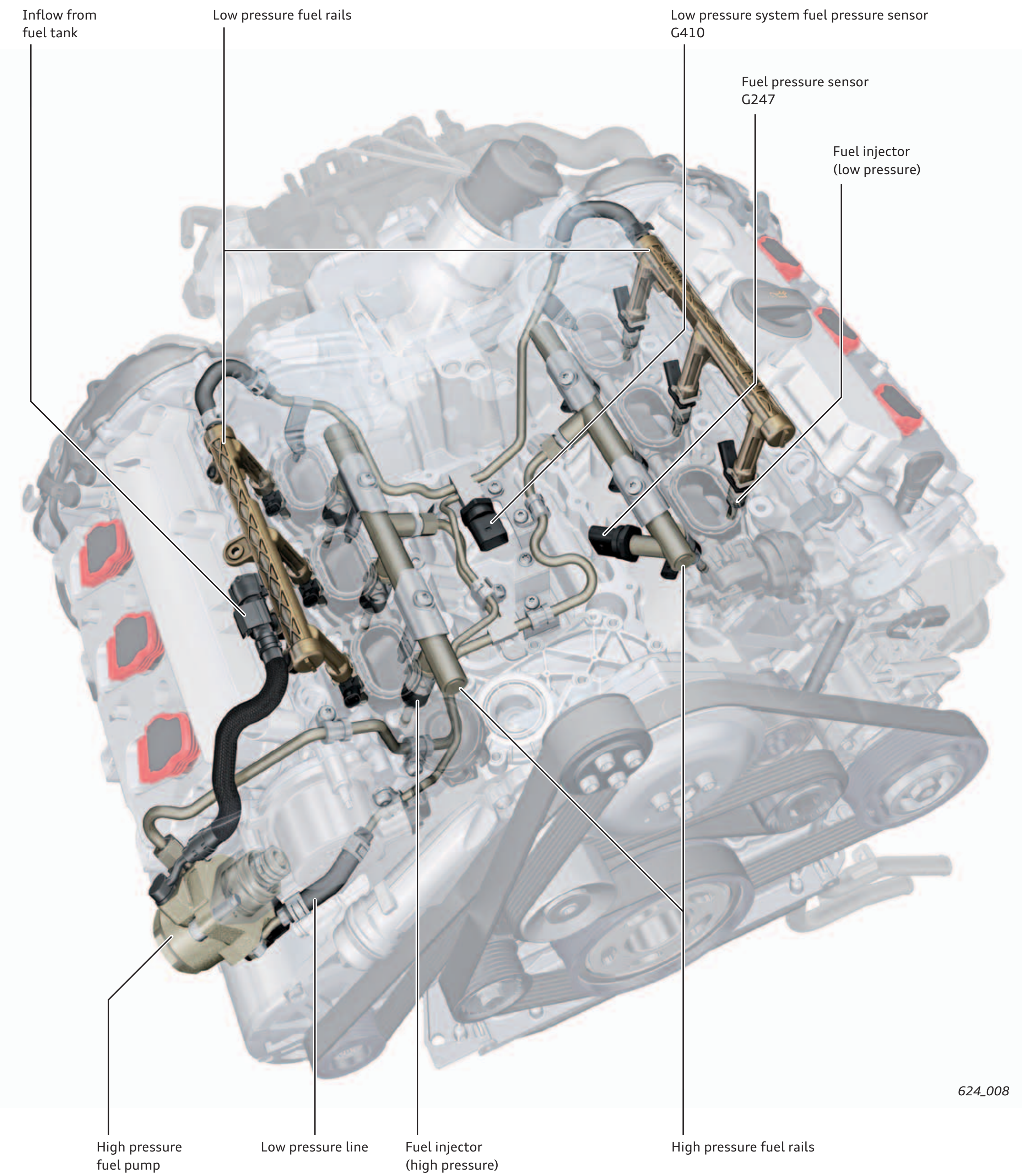


624_051

Reference
For more information on electrical coolant pumps and on the coolant valve, please refer to Self Study Programme 606, "Audi 1.8 and 2.0l TFSI EA888 series engines (3rd generation)".

Fuel system

Dual fuel injection system on engine



624_008

Requirements

With effect from september 2014 the EU 6 W exhaust emission limits will apply in Europe. The important thing for petrol engines in particular is to reduce particulate emissions. To achieve this goal, above all the fuel system was systematically improved compared with the third-generation 3.0l V6 TFSI engine.
Particulate emissions were substantially reduced through selective use of the *MPI injection system* ↗.

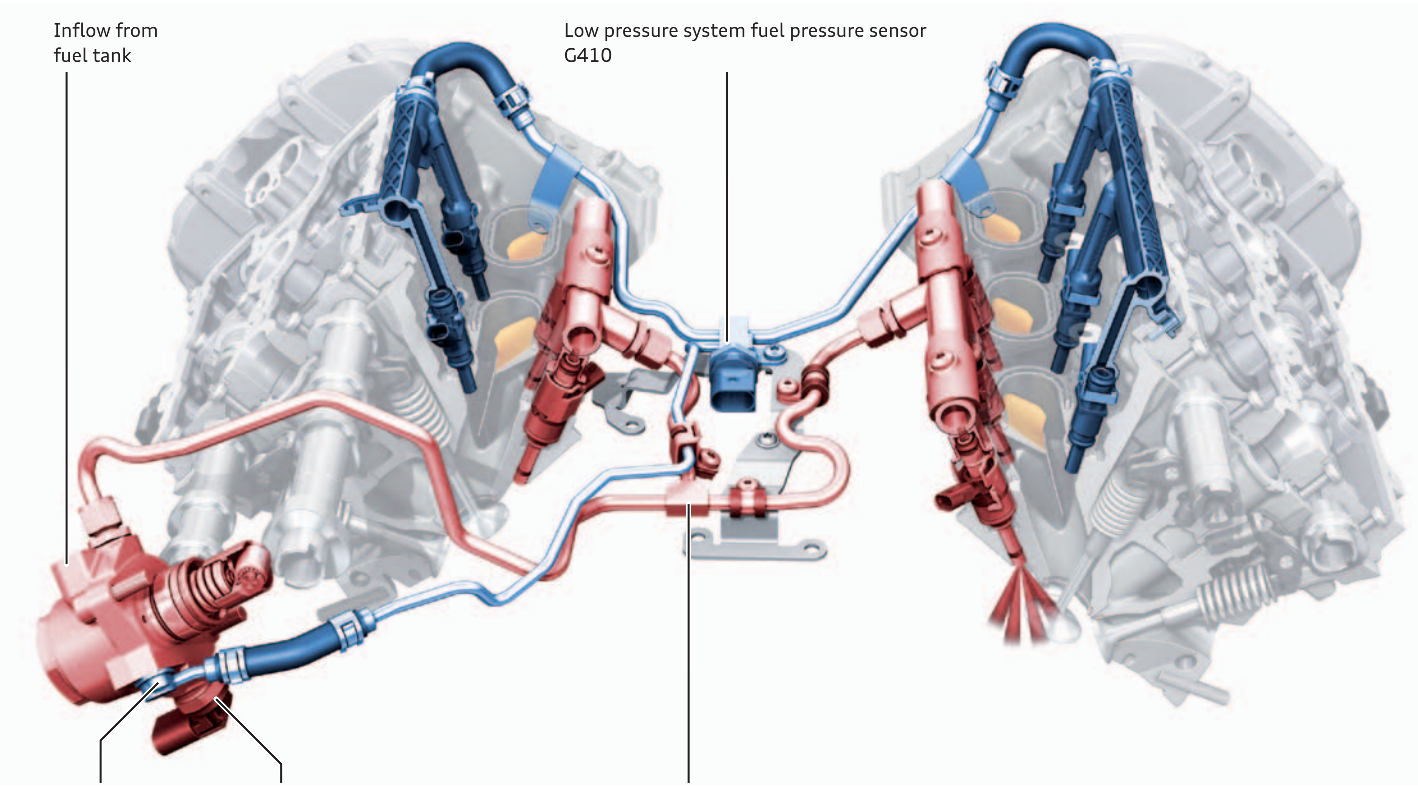
By using a dual fuel system, it was not necessary to introduce a particulate filter. Another significant modification is the increase in injection pressure from 150 to 200 bar within the *FSI injection system* ↗. For this purpose, all components had to be adapted to the higher injection pressure.

MPI injection system

The fuel rails are arranged on the left and right of the supercharger module. They are made from polymer. Two lines leading to the MPI injectors branch off from the rails. These injectors project into the intake manifold flange behind the intake manifold flaps.
Fuel is supplied to the rails from a flushing connection on the high pressure fuel pump. This ensures that fuel flows through the pump in MPI mode thereby cooling the pump.

FSI injection system

The Hitachi high pressure fuel pump is driven by a three-lobed cam on the intake camshaft, cylinder bank 1 (refer to page 13). It produces a system pressure ranging from 100 to 200 bar depending on RPM and requirements (map).
The fuel rails were redesigned and adapted to suit the higher pressure conditions. In addition, the connection between the rail and intake system has been improved in order to reduce noise. For this purpose, the rails are bolted directly onto the cylinder head by means of 2 cast joints.
The high pressure injectors were also redesigned. They were adapted for flow behaviour and interaction with the MPI system.



624_050

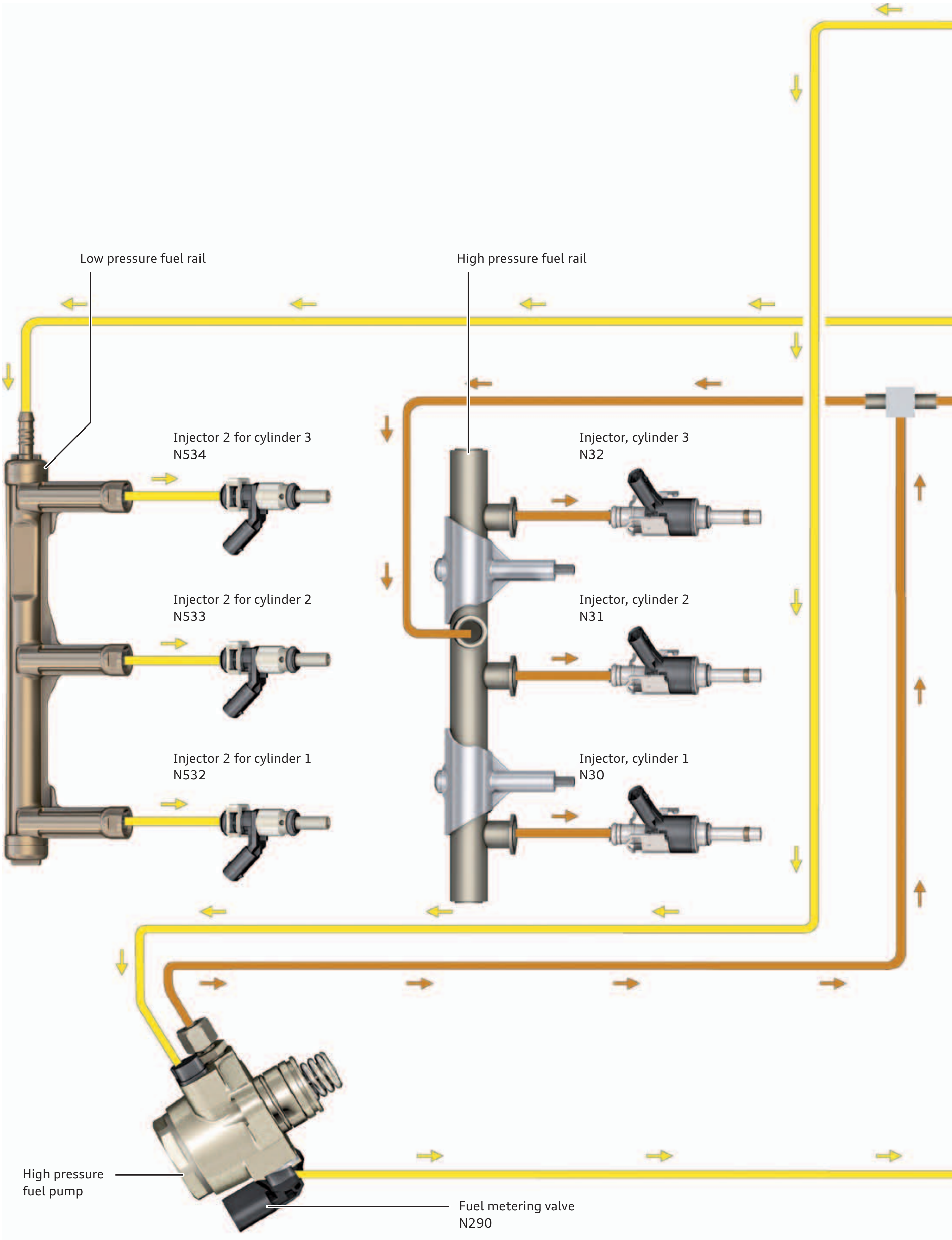
Key:

FSI injection system

MPI injection system

↗ Refer to "Glossary" on page 46.

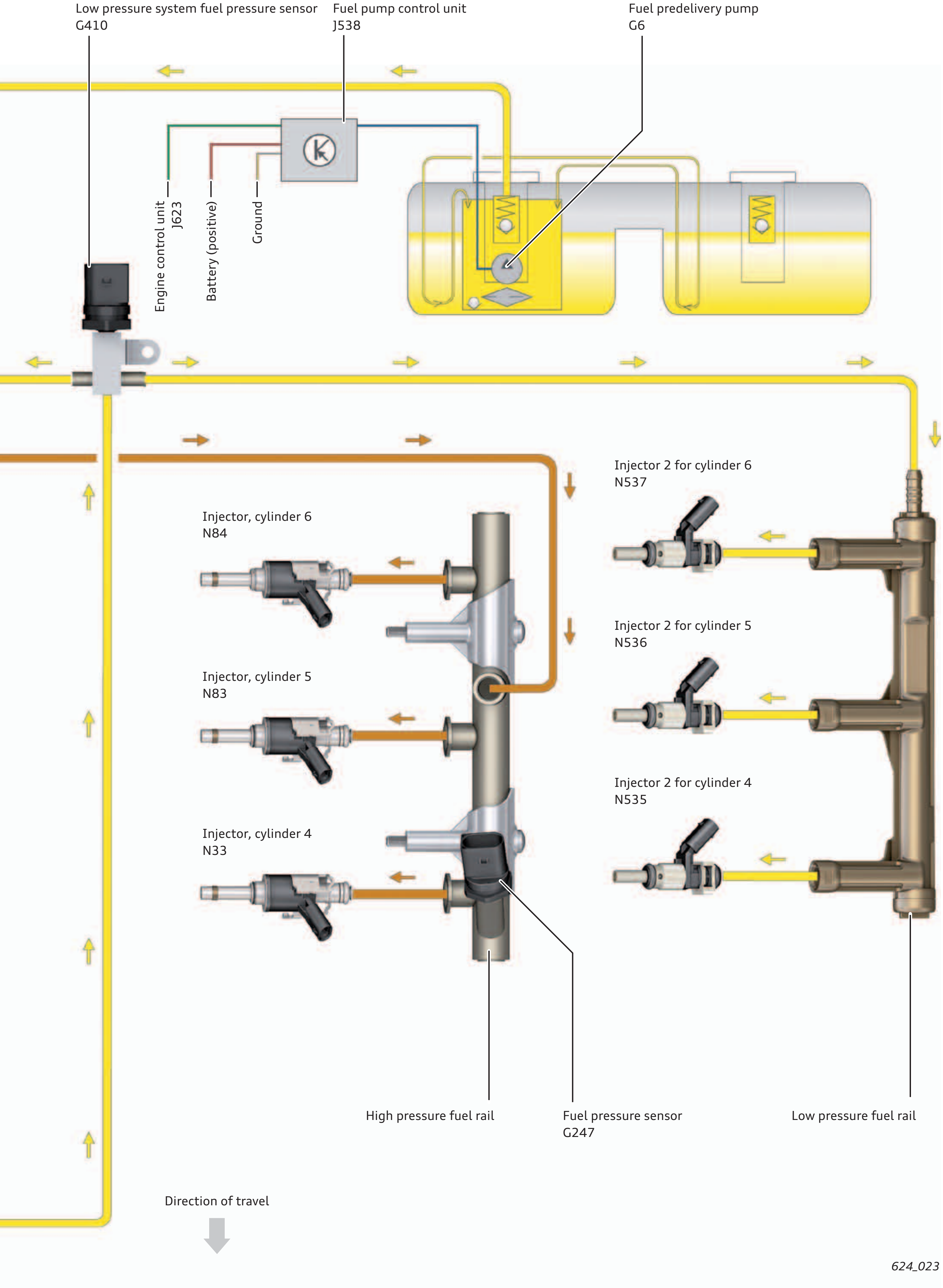
System overview



Key:

Fuel pressure 4 – 5 bar

Fuel pressure 100 – 200 bar


Low pressure system fuel pressure sensor
G410
Fuel pump control unit
J538
Fuel predelivery pump
G6
Engine control unit
J623
Battery (positive)
Ground
Injector 2 for cylinder 6
N537
Injector, cylinder 6
N84
Injector 2 for cylinder 5
N536
Injector, cylinder 5
N83
Injector 2 for cylinder 4
N535
Injector, cylinder 4
N33
High pressure fuel rail
Fuel pressure sensor
G247
Low pressure fuel rail
Direction of travel
624_023

Combined injection

The MPI system integrated in addition to the direct injection system offers several advantages:

- The on the whole more homogeneous mixture formation process reduces particulate emissions by a factor of ten.
- The throttle flap can be opened further in the lower partial load range, resulting in better fuel economy.
- The low manifold wall fuel condensation during injection reduces the ingress of fuel into the motor oil.
- Due to the fact that the MPI fuel pressure is available earlier and that pressure does not first have to be built up by the high pressure pump, fuel can be injected earlier thus allowing shorter cold-starting times to be achieved.
- Given that MPI injection is used at idle and the MPI injectors are quieter than the FSI injectors, the acoustics are better.

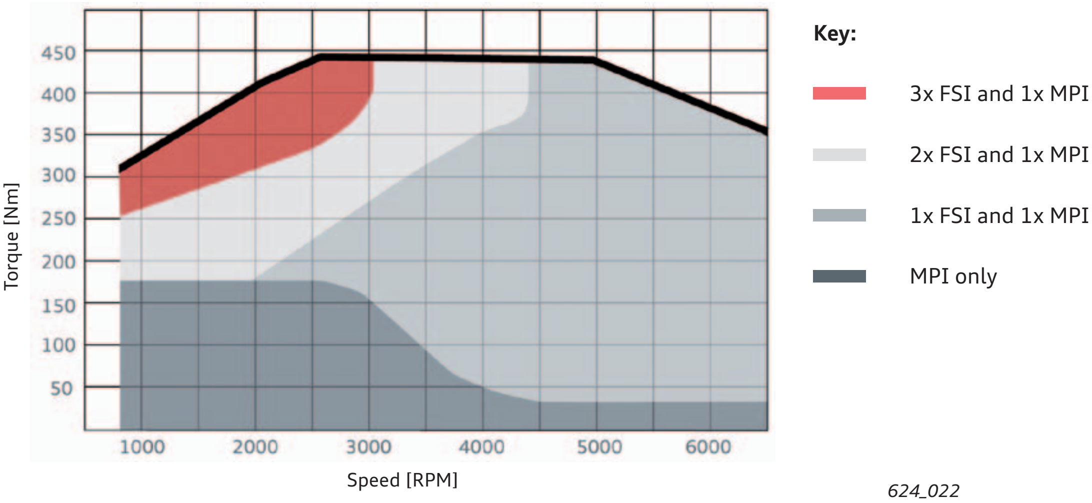
All ranges of the operating map (refer to Fig. 624_022) can be individually optimised.

- To achieve better fuel economy at low RPM and high engine load, multi-pulse fuel stratified injection (FSI) is employed in combination with multi-point injection (MPI).
- In order to reduce particulate emissions, the engine runs in MPI mode up to medium load.
- Approaching full throttle, the multi-point injection component is reduced resulting in more even basic homogenisation of the air/fuel mixture and lower O_2 emissions. Due to the lower O_2 emissions in the exhaust gas there is less of an increase in the catalytic converter temperature. This makes it possible to reduce full throttle enrichment for the protection of the catalytic converter and improve fuel economy still further.

Operating map for fuel injection modes

A highly flexible fuel injection strategy is employed allowing a combination of high pressure fuel injection and low pressure fuel injection.

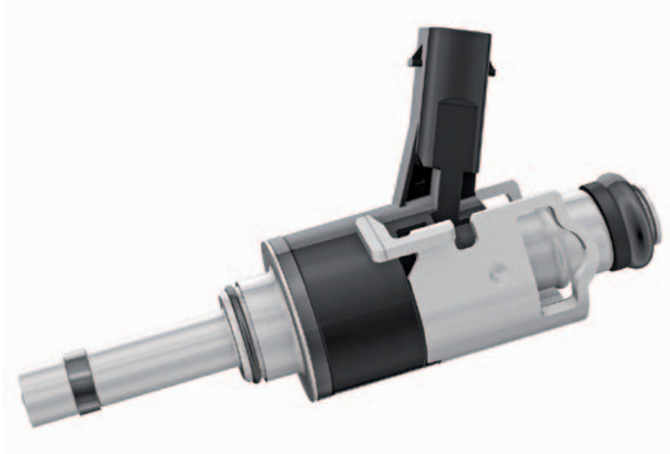
The distribution of individual quantities in the various fuel injection modes is fully variable. The transitions between the fuel injection modes are configured in the engine control unit in such a way that no sudden changes in the air/fuel ratio occur.



624_022

High pressure injectors

The Continental solenoid injector is a new development. Special emphasis was placed on meeting the stringent future exhaust emission standards.



624_078

Technical features:

- Suitable for fuel injection pressures of up to 200 bar
- Fast opening and closing
- Very precise metering, particularly in the low volume range
- Option for multi-injection
- Reduced *dead volume* ↗
- 65 V activation voltage

Combustion process

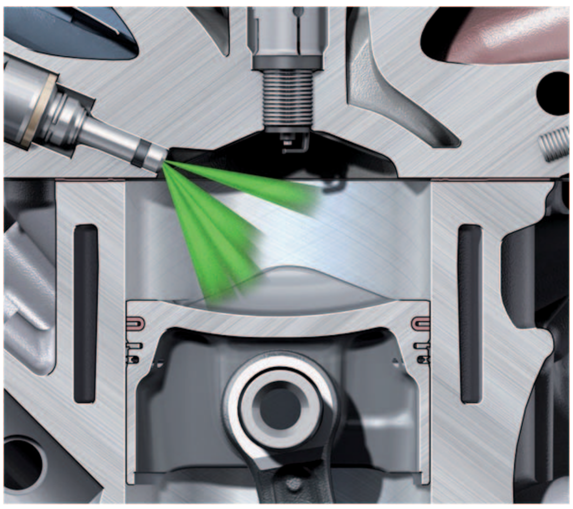
Compared with the third-generation 3.0l V6 TFSI engine, the following modifications were made:

- Increase in compression ratio to 10.8 from 10.3
- Intensification of charge motion inside the combustion chamber through modified piston shape
- Optimisation of injector spray pattern
- The centre of gravity of the fuel spray jet is angled further towards the spark plugs
- The injectors are positioned further to the rear in order to increase the clearance to the opposing cylinder lining

Aims achieved:

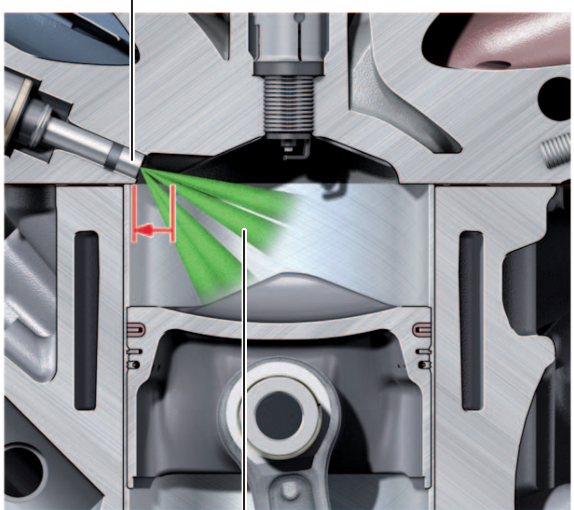
- Improved mixture formation
- Reduced echaust emissions
- Improved combustion efficiency
- Reduced full throttle enrichment
- Better fuel economy

3.0l V6 TFSI, 3rd generation



624_079

3.0l V6 TFSI, 4th generation (evo)



624_080

↗ Refer to "Glossary" on page 46.

Engine management system

System overview (2014 model Audi A8)

Sensors

Exhaust turbocharger speed sender 1 G688

Charge pressure senders 1+2 G31, G447

Brake servo pressure sensor G294

Intake manifold pressure sender G71
Intake air temperature sensor G42

Engine speed sensor G28

Throttle valve control unit J338
Throttle actuator position sensors 1+2 for vehicles with electronic accelerator G187, G188

Control valve control unit J808
Control valve potentiometer G584

Hall-effect senders 1 – 4
G40, G163, G300, G301

Accelerator pedal position sensor G79
Accelerator pedal position sensor 2 G185

Brake light switch F

Oil level/temperature sender G266

Fuel pressure sender G247
Low-pressure fuel pressure sender G410

Knock sensors 1+2 G61, G66

Fuel gauge sender G
Fuel gauge senders 2+3 G169, G237

Oil pressure switch F22

Temperature sender for engine temperature regulation G694

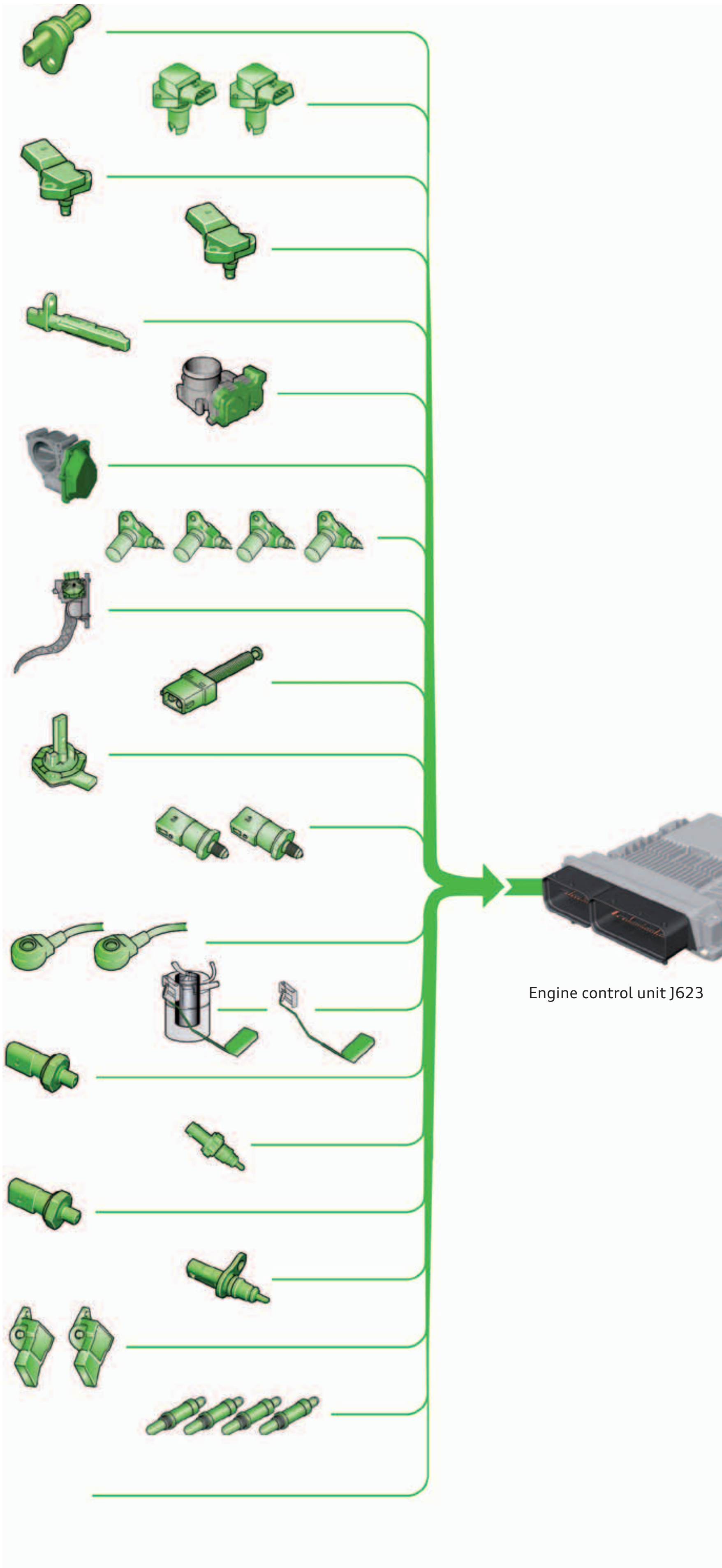
Oil pressure switch for reduced oil pressure F378

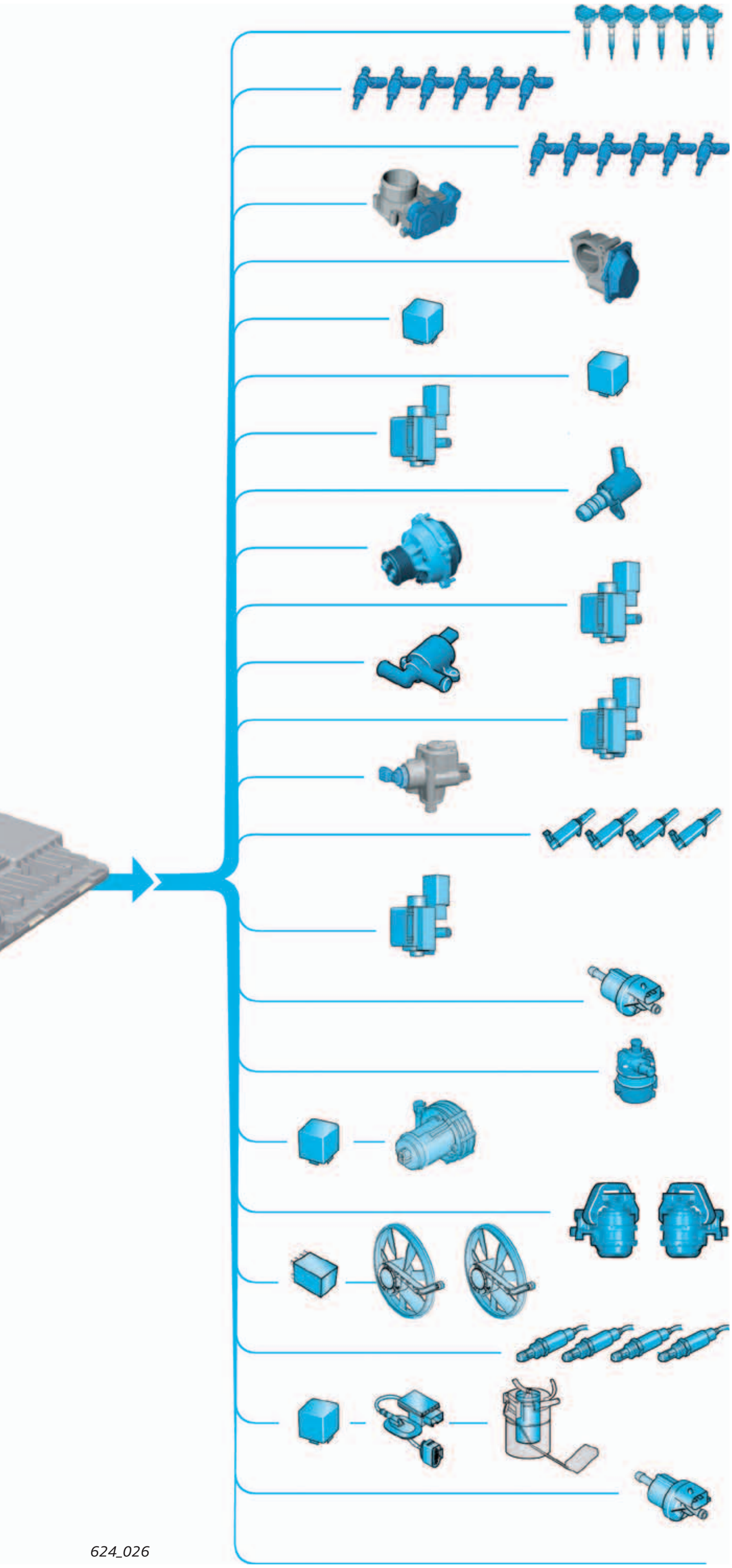
Coolant temperature sensor G62

Intake manifold flap potentiometers 1+2 G336, G512

Oxygen sensors 1+2 G39, G108
Oxygen sensors 1+2 after catalytic converter G130, G131

Auxiliary signals:
- Convenience system central control unit
- Cruise control system
- Auxiliary heater control unit
- Starter relays 1+2
- Entry and start authorisation control unit





624_026

Actuators

Ignition coils with output stages 1 – 6
N70, N127, N291, N292, N323, N324

Injector for cylinders 1 – 6
N30 – 33, N83, N84

Injectors 2, cylinders 1 - 6
N532 – N537

Throttle valve control unit J338
Throttle valve positioner for electronic power control G186

Regulating flap control unit J808
Control flap adjustment servomotor V380

Engine component power supply relay J757

Main relay J271

Coolant circuit solenoid valve N492

Oil pressure regulating valve N428

Magnetic clutch for supercharger N421

Secondary air injection valve N112

Gearbox cooling valve N509

Motor oil cooler valve N554

Fuel metering valve N290

Camshaft timing adjustment valves 1+2 N205, N208
Exhaust camshaft timing adjustment valves 1+2 N318, N319

Intake manifold flap valve N316

Crankcase ventilation shut-off valve N548

Charge air cooling pump V188

Secondary air pump relay J299
Secondary air pump motor V101

Left electrohydraulic engine mounting solenoid valve N144
Right electrohydraulic engine mounting solenoid valve N145

Radiator fan control unit J293
Radiator fans 1+2 V7, V177

Heater for oxygen sensors 1+2 Z19, Z28
Heater for oxygen sensors 1+2 after catalytic converter Z29, Z30

Fuel pump relay J17
Fuel pump control unit J538
Fuel predelivery pump G6

Activated charcoal canister solenoid valve 1 N80

Auxiliary signals:
engine speed to automatic gearbox control unit J217
(for vehicles with automatic gearbox 01J only)

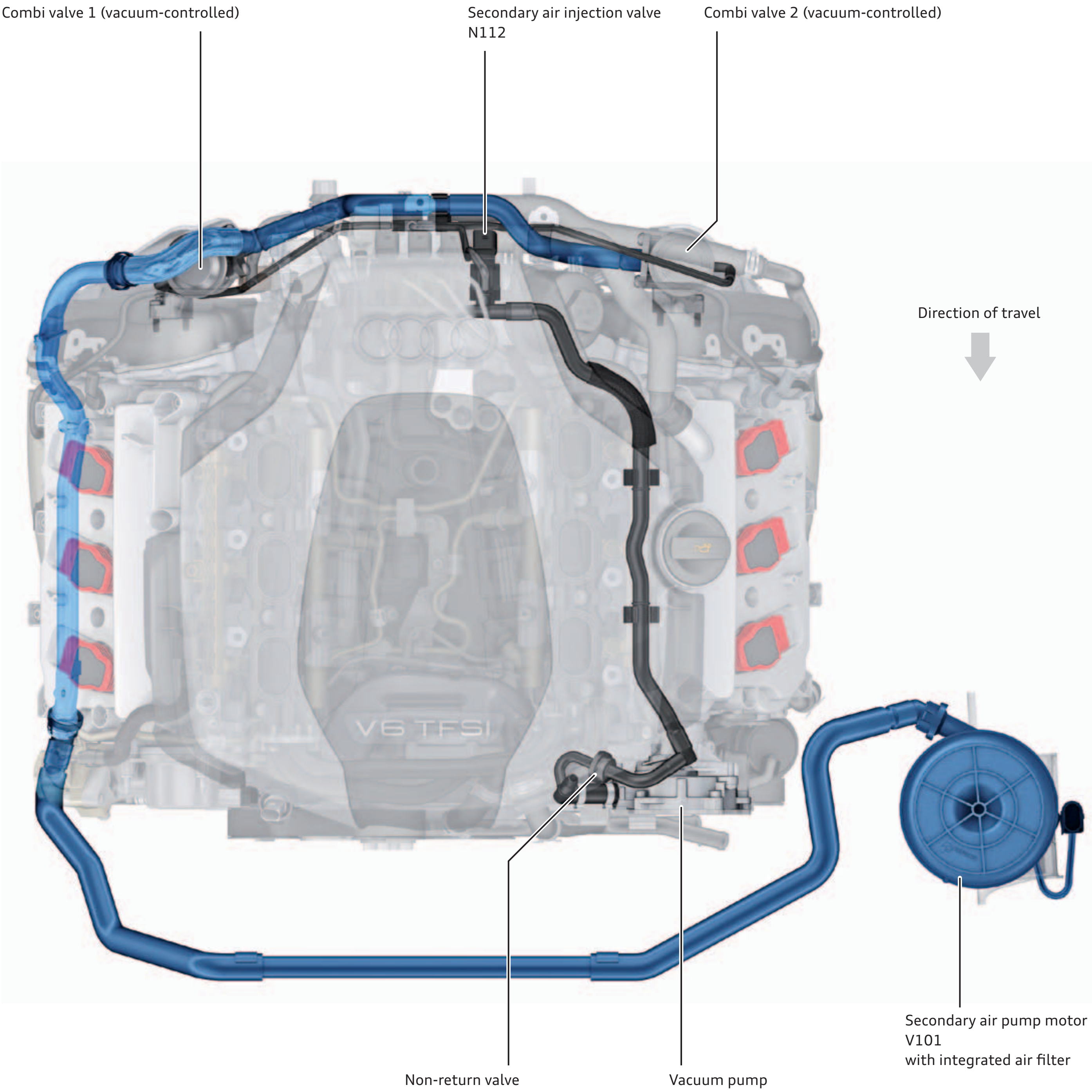
Secondary air system

Compared with the third-generation 3.0l V6 TFSI engine, a number of modifications were made to the secondary air system:
Instead of the previous 2, now only 1 electric changeover valve (secondary air injection valve N112) is used to activate the combi valves. The intake of secondary air intake differs depending on vehicle model. In all vehicles with the fourth-generation 3.0l V6 TFSI engine except the Audi A8 from model year 2014 onwards, secondary air is drawn from the air filter box.

In the Audi A8 from model year 2014 and later, secondary air is drawn through an air filter mounted on the secondary air pump motor V101.

As a further result of the modifications to the third-generation 3.0l V6 TFSI engine, it was possible to reduce air throughput within the activated secondary air system. The engine therefore burns less fuel during the warm-up phase.

Overview

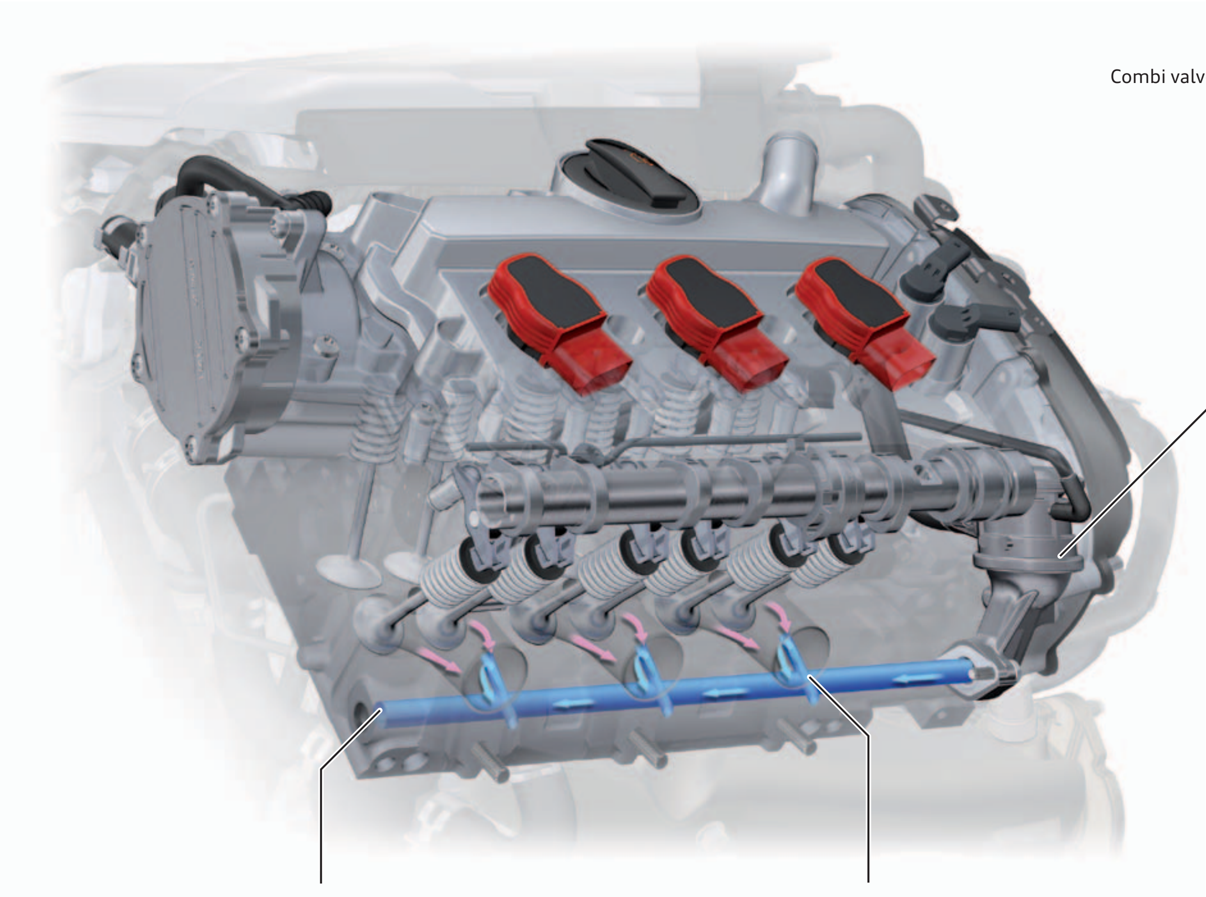


624_018

Secondary air ducts

Compared with the third-generation 3.0l V6 TFSI engine, the secondary air ducts were modified:

This significantly reduces susceptibility to clogging.



624_030

Diagnostics

Vehicles for the US and Canadian markets

The previous pressure-based diagnostic routine, described in Self Study Programme 437 "Audi 3.0l V6 TFSI engine with Roots blower", is no longer performed as it has a detrimental effect on exhaust emissions because of its functional principle.
The new diagnostic routine is lambda-based. The advantage over the pressure-based diagnostic routine is better emission behaviour. The diagnostic routine is active while the secondary air pump is running in order to reduce exhaust emissions.
The lambda value is measured by the oxygen sensors in the exhaust manifold during secondary air injection, and the secondary air mass is calculated from the lambda value and the engine air mass.
On completion of secondary air injection, the pump runs on for several seconds while the combi valves are closing.

This allows the leak tightness of the combi valves to be checked. If the lambda value exceeds a lean threshold value, an event is registered indicating that a valve is leaky.
On completion of the valve leak test, the lambda value is re-measured and the result of the secondary air measurement corrected. In this way static deviations can be corrected, giving a more accurate result.
However, no measurement result or event memory entry is displayed until diagnosis of the oxygen sensors upstream of catalytic converter has been completed. This routine is performed at the same time as the catalytic converter is diagnosed. To obtain a result after a cold start, therefore, the vehicle must be warmed up.

Vehicles for the EU and RoW markets

No diagnosis is performed because the corresponding limit values are achieved even if the secondary air system fails.

Service

Tools

Puller T40301

624_061

Removing clutch module from supercharger module

Centring device T40302

624_062

Centring clutch module

Power supply unit clutch module VAS 6909

624_063

Pre-wiring for clutch module installation

Support T40304

624_064

Mounting supercharger module on gearbox support T40206 for assembly work and leak testing

Thrust piece T40303

624_065

Fitting bearing to supercharger module

Inner extractor set VAS 501 001

624_081

Removing needle bearing from supercharger module

Maintenance operations

Information on required maintenance operations	Interval or value
Quantity of motor oil inc. filter (change quantity)	6.8 l
Motor oil standard	VW 50400
Motor oil extraction permitted	yes
Electronic oil gauge tester (specifications for adjustment ring / specifications for min. oil to max. oil)	Upper scale value: 141 Lower scale value: 0 – 11
Service interval	According to service interval display, between 15,000 km / 1 year and 30,000 km / 2 years depending on driving style and conditions of use.
Air filter change interval	60,000 km
Fuel filter change interval	Lifetime
Spark plug change interval	90,000 km / 6 years
Pollen filter change interval	30,000 km / 2 years
Gear oil change interval	Lifetime
Poly V-belt change interval (supercharger)	90,000 km
Timing drive / chain	Lifetime
Timing drive tensioning system	Lifetime

Note
The specifications in the current service literature generally apply.
When changing the oil, it is important to observe the applicable oil standard.

Appendix

Glossary

This glossary explains to you all terms written in italics and indicated by an arrow ↗ in this self study programme.

↗ Blow-by gases

When the engine is running blow-by gases flow from the combustion chamber and past the piston into the crankcase. This is due to the high pressure inside the combustion chamber and the absolutely normal leakage that occurs around the piston rings. Blow-by gases are extracted from the crankcase by the positive crankcase ventilation system and re-admitted into the combustion chamber.

↗ Cracked conrod

624_072

This term derives from the method by which the conrod is manufactured. The conrod shaft and conrod head cap are separated from another by controlled cracking. The advantage of this process is that it provides an exact fit and a high degree of joining accuracy whereby only these two parts fit together perfectly.

↗ Dead volume

The term dead volume refers to the volume of the fuel injection system on the high pressure side. Dead volume increases during each injection cycle and decreases again at the end of the cycle. This results in a loss of compression and slows down the fuel injection cycle.
The fuel is compressed by a dynamic pressure wave in the "filamentary" volume of the fuel injection line. The greater the dead volume, the lower the hydraulic efficiency of the fuel injection system. The aim during development of the fuel injection system was, therefore, to keep dead volume as low as possible.

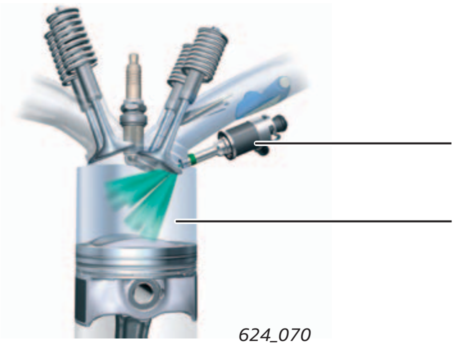
↗ Elastomer

An elastomer is a dimensionally stable polymer with elastic properties. Polymers of this type can change shape under tensile and compressive load, subsequently returning to their original shape. Elastomers are used, for example, in oil seals.

↗ Finishing

Finishing is a process which involves ultrafine machining of surfaces, where cylindrical workpieces are manufactured with a higher-precision surface finish and roundness attributes.

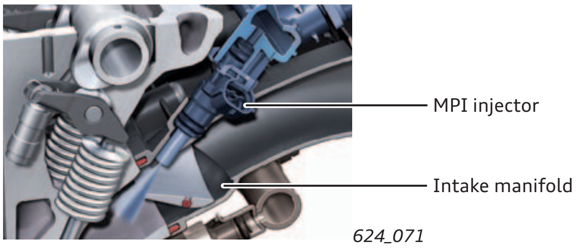
↗ FSI



624_070

FSI is the abbreviation for Fuel Stratified Injection, a technology used by Audi for direct fuel inejction into the combustion chamber in petrol engines. Fuel is injected at pressures of up to 200 bar.

↗ MPI



624_071

MPI is the abbreviation for Multi Point Injection, an injection system for petrol engines where the fuel is injected into the intake manifold upstream of the injectors. In some engines, it is used in combination with the FSI direct injection system.

↗ PWM signal

The abbreviation PWM stands for pulse width modulated signal. This is a digital signal where one variable (e.g. electrical current) alternates between two values. The intervals between these alternations vary depending on activation. This allows digital signals to be transmitted.

↗ SENT

The SENT (Single Edge Nibble Transmission) data protocol can, in conjunction with accompanying sensors, be used for digital data transfer as a replacement for analog interfaces.

↗ Terophon

Terophon is an injectable, solvent-free, reactive rubber-based coating compound used for the reduction of structure-borne noise. The material is elastic and has good sound-deadening properties. The coating is applied by spraying. It is subsequently hardened in a paint curing oven.

Self study programmes

For more information about the technology of the Audi V6 engines, please refer to the following self study programmes.

SSP 267 The 6.0 l W12 engine in the Audi A8 - Part 1

- Design and function of the camshaft adjuster

Order number: 140.2810.86.20

SSP 411 Audi 2.8l and 3.2l FSI engines with Audi valvelift system

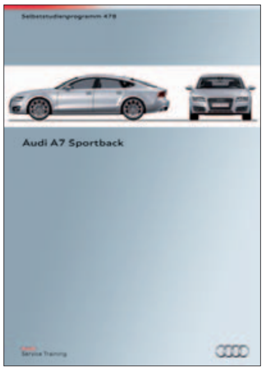
- Basic information on engine design

Order number: A07.5S00.42.20

SSP 437 Audi 3.0l V6 TFSI engine with Roots blower

- Engine mechanicals
- Basic information on supercharger module

Order number: A08.5S00.53.20



SSP 478 Audi A7 Sportback

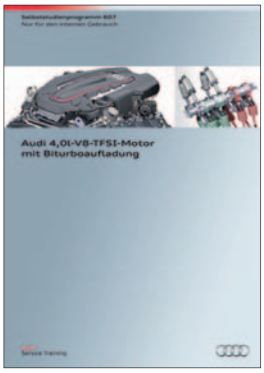
- Innovative Thermal Management (ITM)

Order number: A10.5S00.71.20

SSP 606 Audi 1.8l and 2.0l series EA888 TFSI engines (3rd Generation)

- Dual fuel injection system
- Electrical coolant pumps

Order number: A12.5S00.90.20



SSP 607 Audi 4.0l V8 TFSI engine with bi-turbo charging

- Design and function of the oil pump

Order number: A12.5S00.91.20

Information on QR codes

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