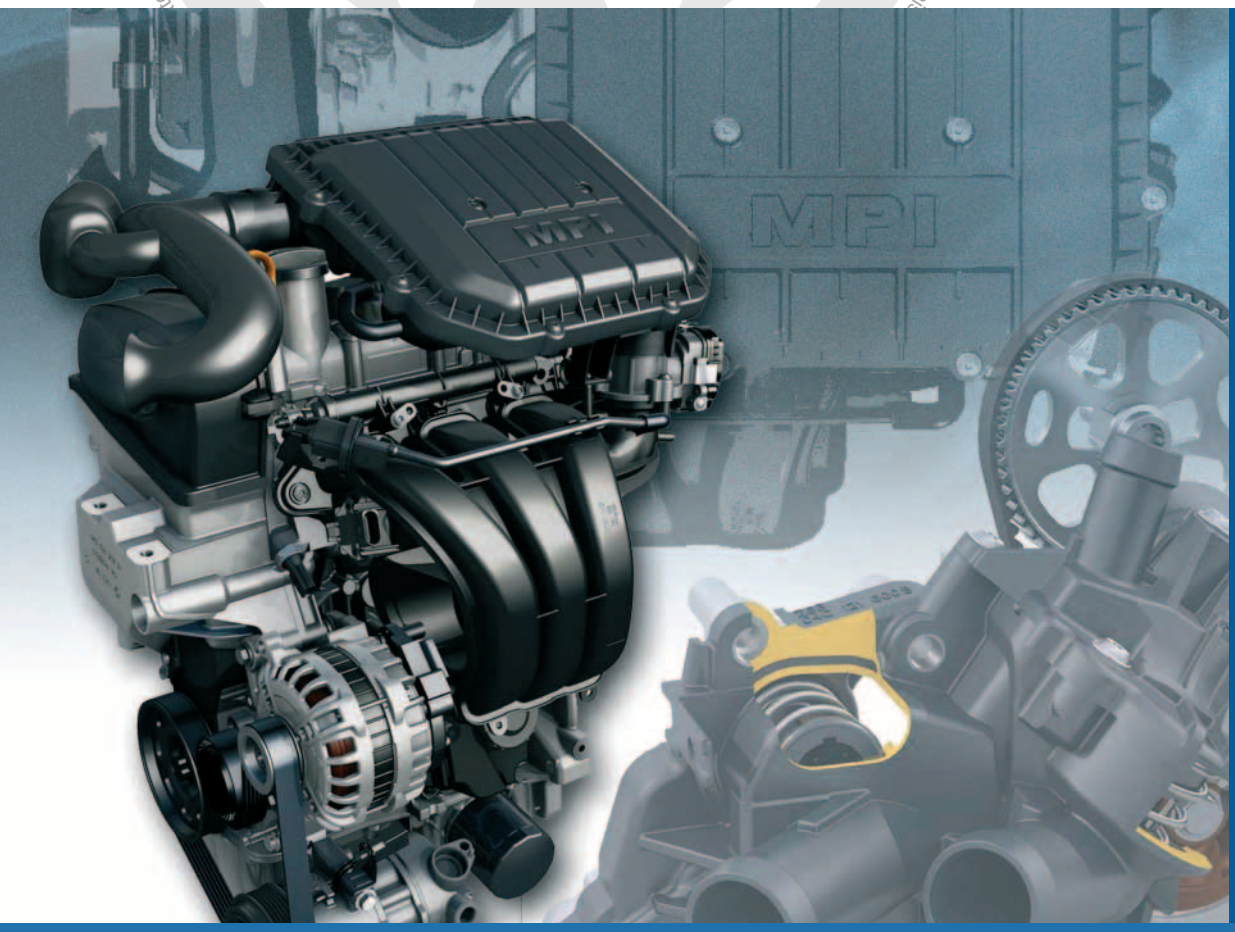
Service Training

Self-study programme 508

The 1.0 l 44/55 kW MPI Engine

Design and function

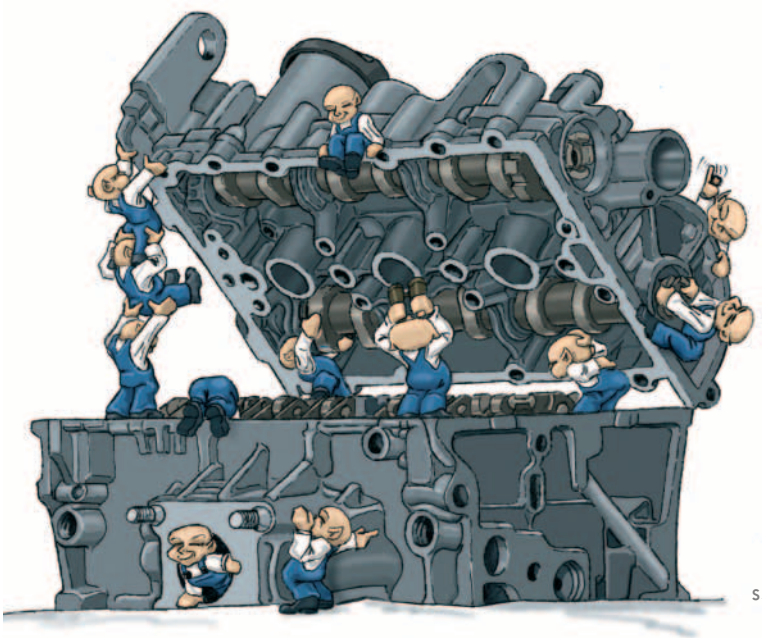


The 1.0 l 44/55 kW MPI engine, featuring the same intake manifold injection as in the up!, is the first example of a completely newly developed generation of engines which are now being installed in diverse models across the Volkswagen Group. For the market launch of the up! there are two power versions, one with 44 kW and one with 55 kW. At a later point in time there will also be an up! EcoFuel with 50 kW.

When an engine is newly developed, or improved, there are always a multitude of specifications which must be met. Along with fuel consumption and therefore the CO_2 emissions, weight, costs and compliance with existing and future exhaust emission standards, attention must also be paid to the most compact design possible.
The new series of engines have allowed all these targets to be achieved.

As the new generation of engines presently stands, there are the following capacity and power versions available:

- 1.0l 44kW to 55kW with intake manifold injection
- 1.2l 63kW to 77kW with direct injection
- 1.4l 66kW to 110kW with intake manifold injection or direct injection
- 1.6l- 77kW to 88kW with intake manifold injection



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On the following pages, we will be introducing you to the design and function of the new 1.0 l 44/55 kW MPI engine with intake manifold injection.

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

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

Important note

Contents

The 1.0 l 44/55 kW MPI Engine

The 1.0 l 44/55 kW MPI engine is a completely new design, and is the first in a new generation of engines. The engine mechanics are the same for both power variants. The differences in power are achieved by the software.

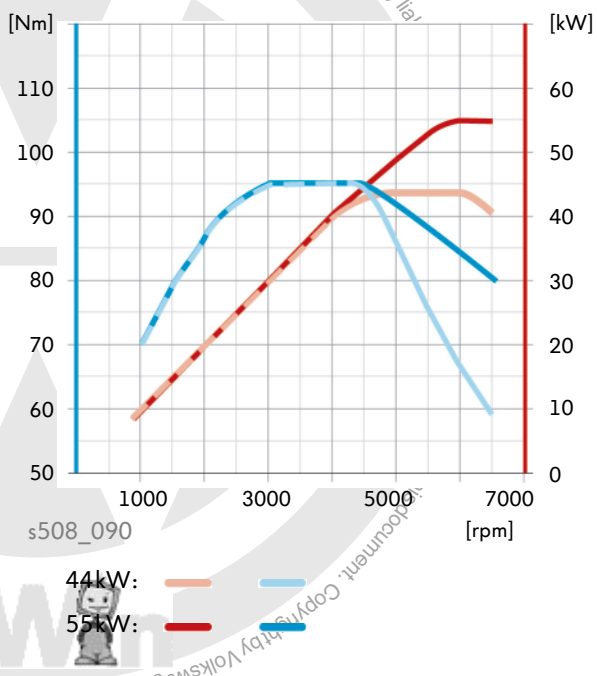
Technical features

- Camshafts driven by a toothed belt
- Camshaft housing features a modular design
- Cylinder head with integrated exhaust manifold
- Coolant pump integrated into the thermostat housing
- Coolant pump driven by a toothed belt from the exhaust camshaft
- Inlet camshaft adjustment

Technical data

Engine code	CHYA	CHYB
Design	3-cylinder inline engine	
Displacement	999 cm^3	
Bore	74.5 mm	
Stroke	76.4 mm	
Valves per cylinder	4	
Compression ratio	10.5:1	
Max. output	44 kW at 5500 rpm	55 kW at 6200 rpm
Max. torque	95 Nm at 3000-4300 rpm	
Engine Management	Bosch Motronic ME 17.5.20	
Fuel	Super unleaded RON 95 (normal unleaded RON 91 with a slight reduction in performance)	
Exhaust gas treatment	Three-way catalytic converter with one step-type lambda probe upstream and one downstream of the catalytic converter	
Emissions standard	EU5	

Torque and performance diagram

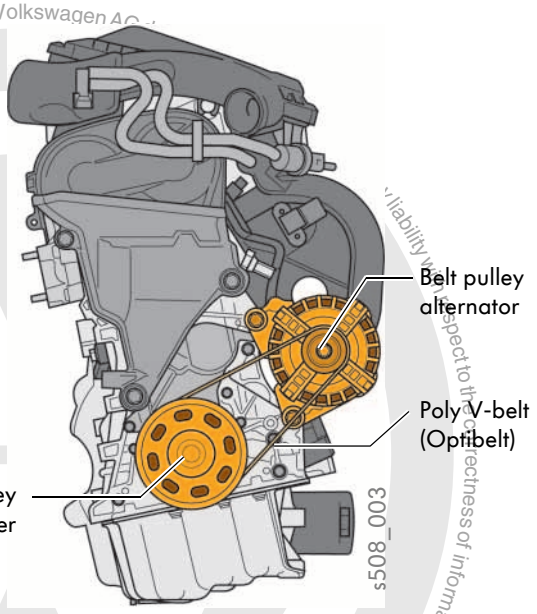


Poly V-belt drive

There are two basic types of poly V-belt drive, one with and one without an air conditioner compressor.
Both are driven by a six-rib poly V-belt. The belt pulley on the crankshaft is equipped with a vibration damper to ensure the engine runs quietly.

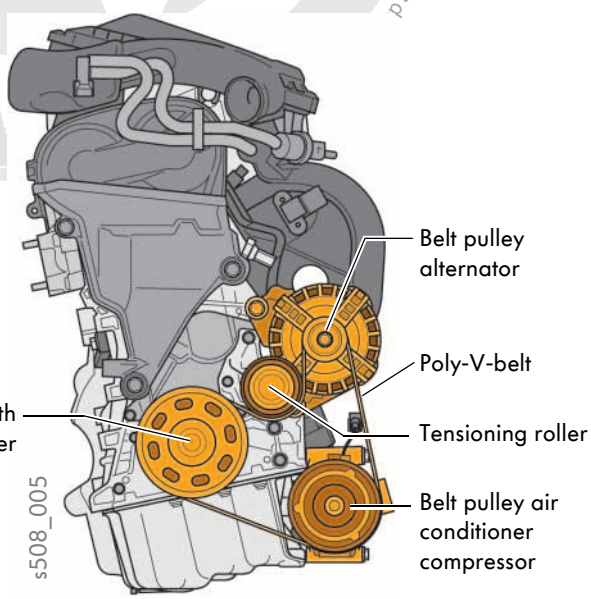
Poly V-belt drive without A/C compressor:

Without the air conditioner compressor, only the alternator is driven.
The poly V-belt (Optibelt) is flexible and elastic.
The combination of this, and low mechanical stresses, means a tensioning roller is not required.



Poly V-belt drive with A/C compressor:

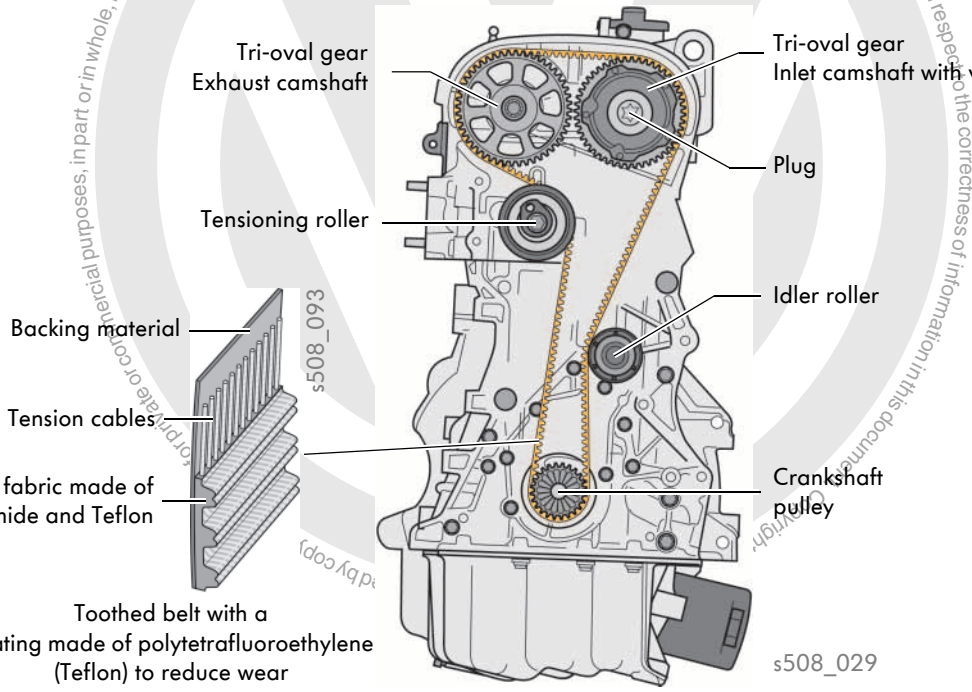
If an air conditioner compressor has been installed, then a standard poly V-belt is used.
This version tensions the poly V-belt using a fixed tensioning roller.



An automatic tensioning roller and an alternator with a coasting function are installed in all vehicles which feature BlueMotion technology, regardless of whether an air conditioner compressor has been installed.
They reduce friction and fuel consumption.

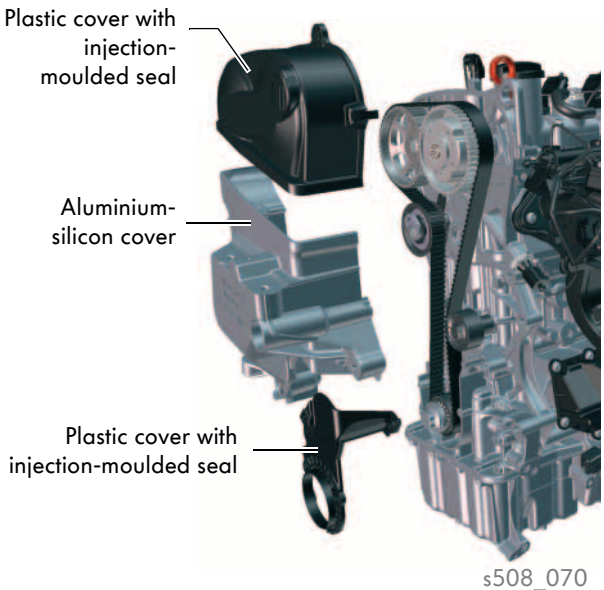
Toothed belt drive

The camshafts are driven by a maintenance-free toothed belt. It is tensioned using an automatic tensioning roller, which uses contact shoulders at the same time to ensure the toothed belt is guided correctly.
A idler roller on the tensioning side and tri-oval camshaft gears ensure the toothed belt runs smoothly.



Toothed belt cover

The toothed belt is protected against the ingress of dust and dirt by a three-part toothed belt cover. This extends the service life of the toothed belt.



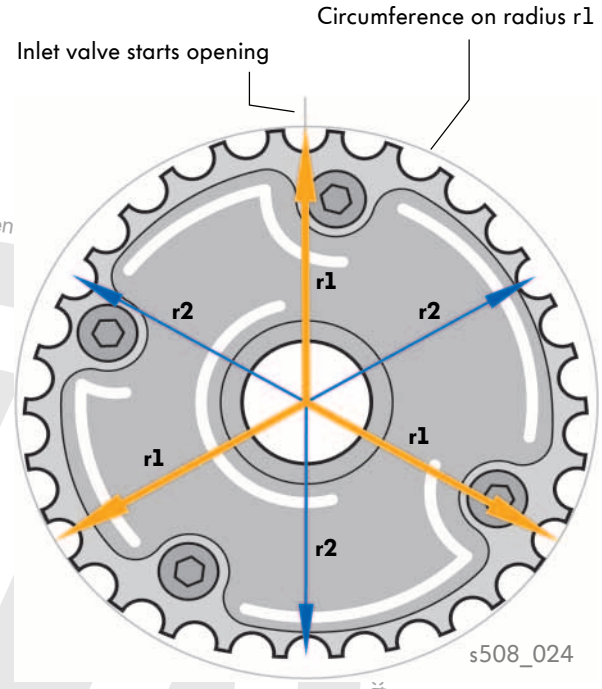
Toothed belt drive with tri-oval camshaft gears

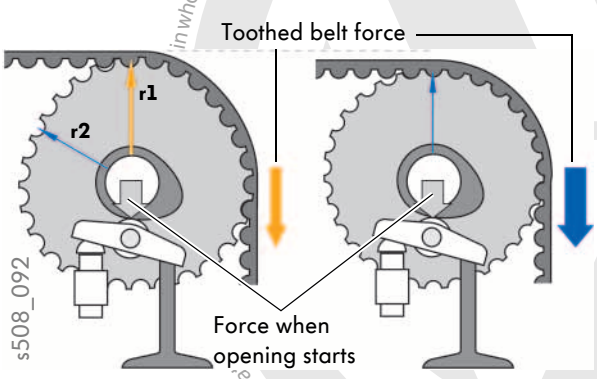
A certain amount of force is required to open the valves of a cylinder. This force also acts on the toothed belt drive every time the valve is opened, and at higher speeds will cause it to vibrate.

To minimise the strong vibrations which are typical for 3-cylinder engines in particular, special camshaft gears have been employed.
It has been designed with a larger radius, at intervals of 120° (tri-oval).

How it works

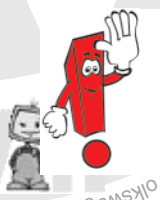
The larger radius (r1) enlarges the moment arm acting on the valves when they start to open. This allows the force of the toothed belt to be reduced, but still allows an equally high moment to be transmitted as a standard gear does.
The lower force of the toothed belt minimises annoying vibrations.





Radius

r1 - large	r2 - small
53.75 mm	51.55 mm



You will require the assembly tool VAS 10476 to position the tri-oval camshaft gear.

Advantages

- The lower toothed belt forces allow the tension force of the tensioning roller to be reduced. This results in lower friction and mechanical stress on the entire toothed belt drive.
- The reduced level of vibrations allows the toothed belt drive to run even more quietly.

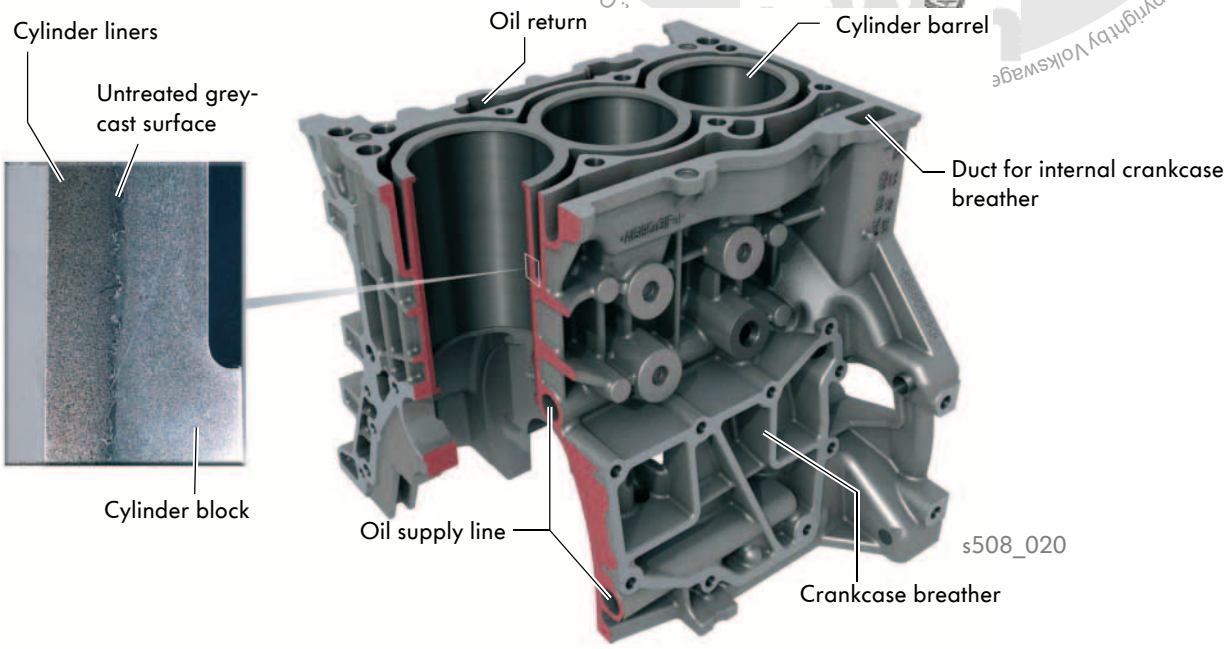
Cylinder block

The cylinder block consists of cast aluminium and has been designed as an open-deck version. Open deck means that it has no webs between the outer wall of the cylinder block and the cylinder tubes.

This has the advantage of:

- No air bubbles being able to form in this area, which would lead to ventilation and cooling problems
- Cylinder deformation is kept low when the cylinder head is bolted to the cylinder block.
  The piston rings can easily compensate for this low level of cylinder deformation, and the consumption of oil is reduced.

The oil pressure supply lines, the oil return pipes and the crankcase breather have been cast into the cylinder block. This reduces the number of additional components as well as the amount of machining required.

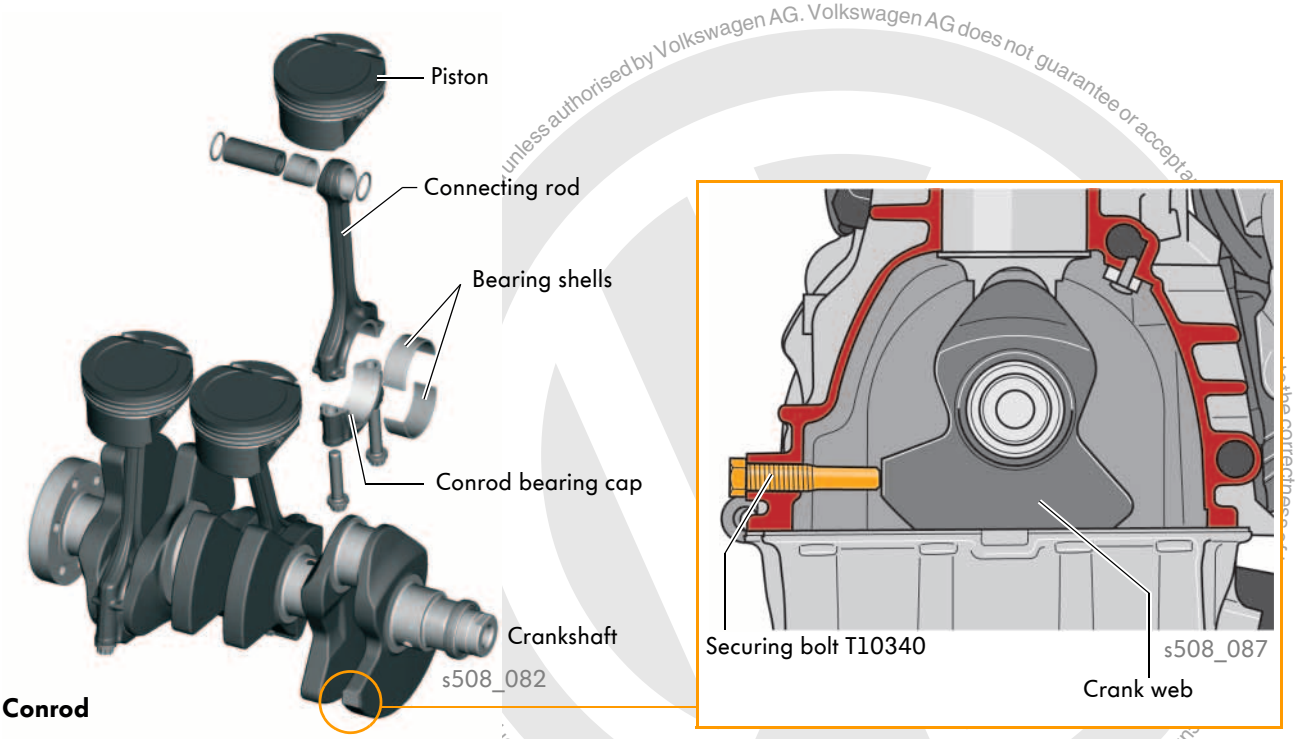


Grey cast iron cylinder liners

The grey cast iron cylinder liners are individually cast into the cylinder block. Their outer surface is very rough, which increases the surface area and improves the transfer of heat to the cylinder block.
Furthermore, this ensures the fit between the cylinder block and the cylinder liner is a very good positive one.

Crankshaft drive

The crankshaft drive was designed for low, moving masses and low friction. The weight of the conrods and the pistons has been so well designed that the balancer shaft, otherwise standard in three-cylinder engines, could be eliminated. Together with the small main bearings and conrod bearings, which have a diameter of 42 mm, the weight of the engine, and the drive gear friction, could be reduced even further. The cast crankshaft with four bearings features six counterweights which reduce the inner forces of the crankshaft and therefore the load on the main bearings.



Conrod

The connecting rods are fracture-split.
Fracturing involves machining the conrods as complete parts, and only when this is finished are they split into a connecting rod and conrod bearing cap.

The advantages are:

- A non-interchangeable fracture surface is produced, and only the two components made from the one blank will fit together.
- Its manufacture is inexpensive
- There is a good frictional lock between the components

Note that when adjusting the valve timing, the crank web should only just be touching the securing bolt.
The crankshaft is not fixed and can be rotated against the direction of engine rotation.

Cylinder head

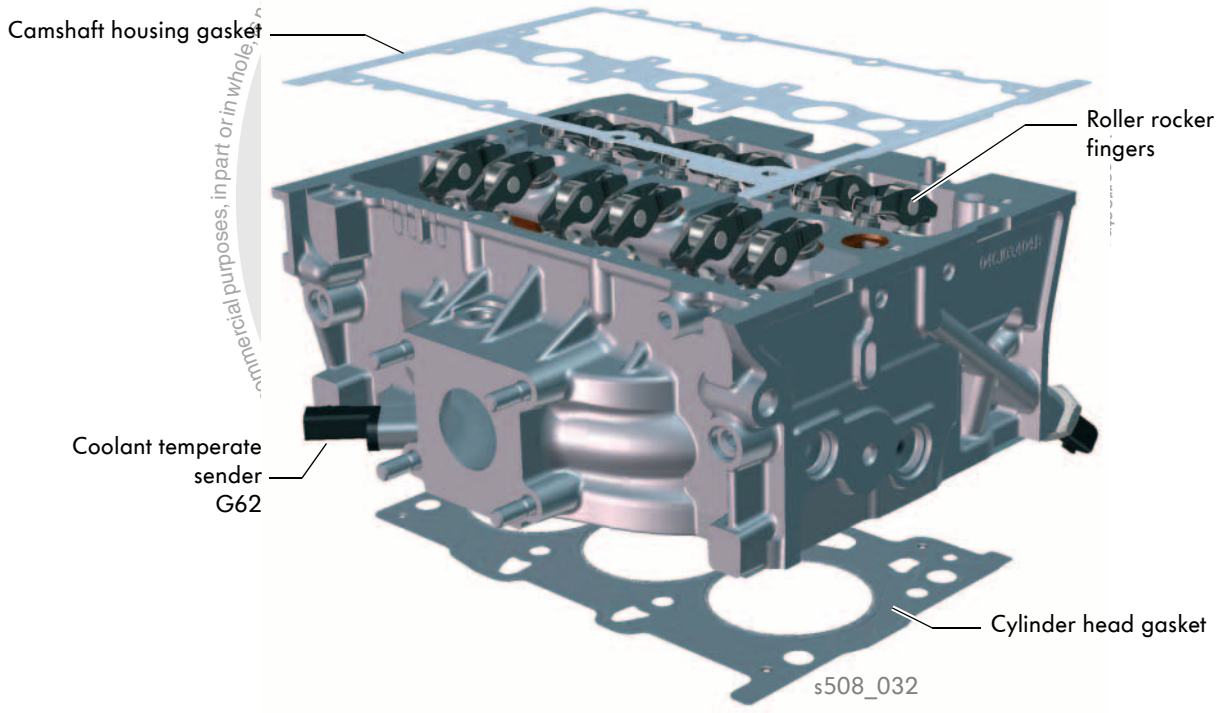
The 4-valve cylinder head is made of an aluminium alloy.

Camshaft housing gasket

The gasket is a metal bead gasket.
It is designed with a cover plate and a special oil-resistant and hydrocarbon-resistant coating.

Cylinder head gasket

The cylinder head gasket is a single-layer metal gasket. Due to the low combustion pressures and low cylinder block distortion, a single-layer gasket is adequate.



Coolant temperature sensor G62

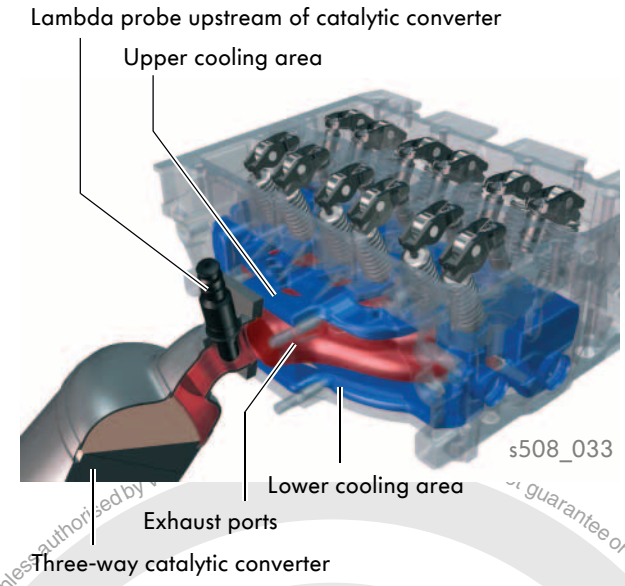
The coolant temperature sender has been screwed into the integrated exhaust manifold, and measures the temperature of the coolant. This is where the highest temperatures are found.

Integrated exhaust manifold

The three exhaust ports within the cylinder head have been combined into one central flange in the integrated exhaust manifold. The catalytic converter is bolted directly onto this flange.

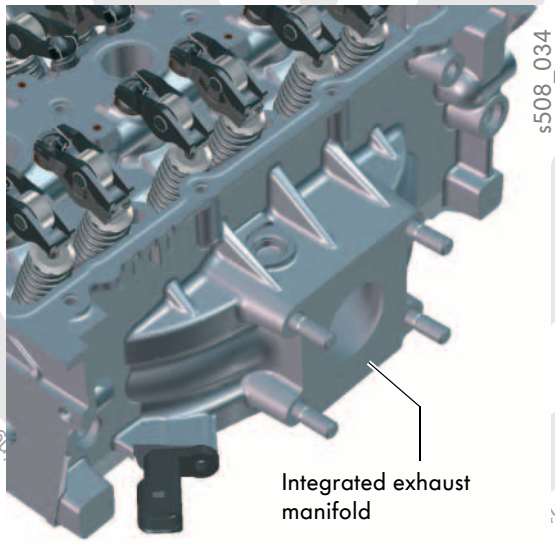
Design

The cross-flow cylinder head allows the coolant to flow from the inlet side to the exhaust side via the combustion chambers. On the exhaust side, it is divided into two areas,
one above and one below the exhaust manifold. It flows through several ports, absorbing the heat.
It flows from the cylinder head into the thermostat housing, mixing with the remaining coolant.



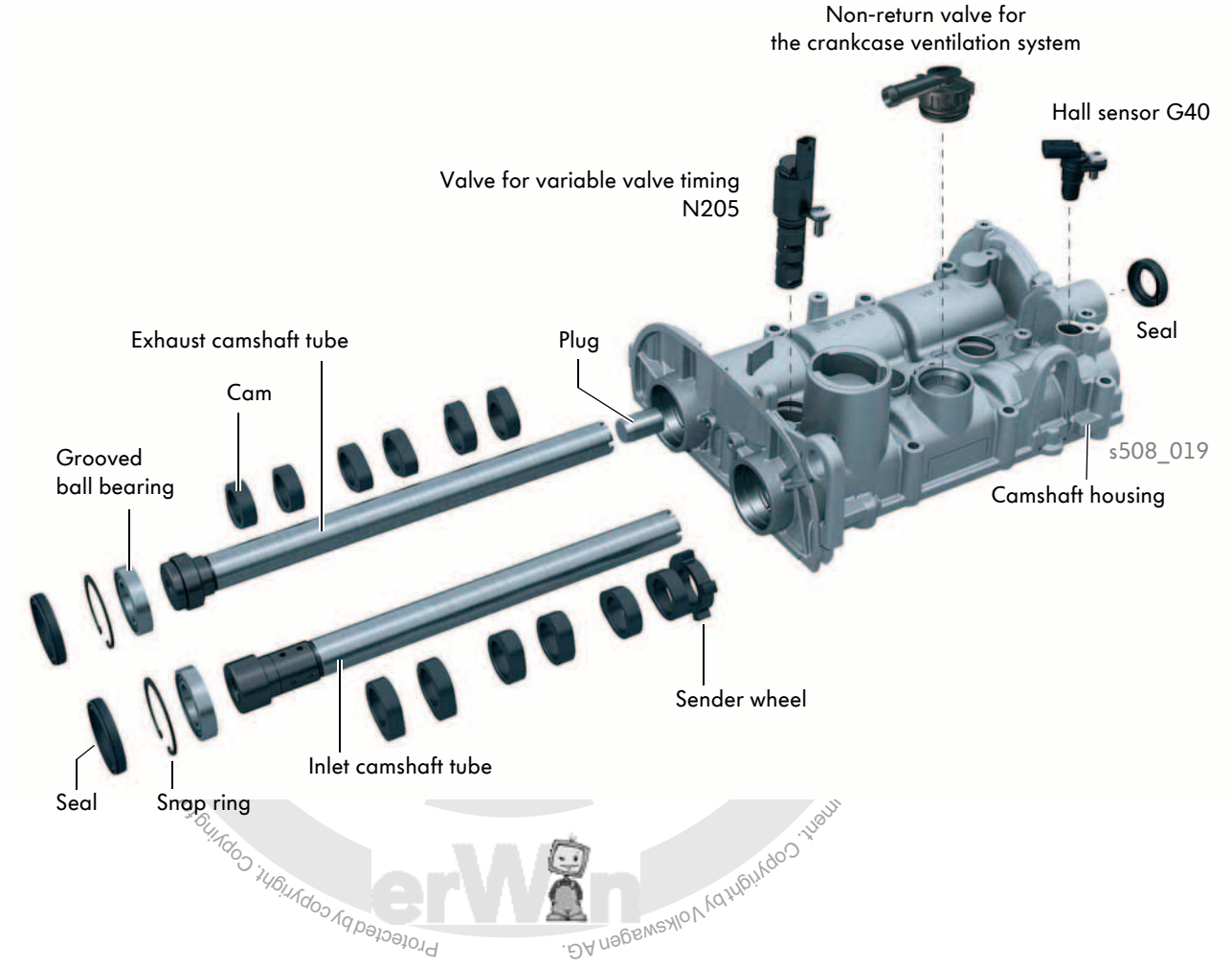
This design has several benefits:

- The coolant is warmed up more quickly by the exhaust gas while the engine is warming up. The engine reaches its operating temperature faster. This reduces fuel consumption, and the vehicle interior can be heated more quickly.
- Due to the smaller area of the exhaust gas-side wall surface extending to the catalytic converter, the exhaust gas does not emit as much heat during the warm-up phase, and the catalytic converter is more quickly heated up to its operating temperature by the coolant, despite its cooling effect.
- When the system is operating under full load, the coolant temperature is further reduced, thereby increasing the engine operating temperature range at which lambda = 1. Fuel consumption and exhaust emissions are thus optimised.



Camshaft housing

The camshaft housing is made of cast aluminium and, together with the two camshafts, forms an integral module. This means that the four-bearing camshafts can no longer be removed.
To reduce friction, the first bearing of that particular camshaft, which is subjected to the highest load from the toothed belt drive, is a grooved ball bearing.
Furthermore, the camshaft housing is used to accommodate the valve for the variable valve timing N205, the Hall sender G40 and the non-return valve for the crankcase ventilation system.



The grooved ball bearings are secured by a snap ring, however they cannot be replaced.

Modular camshaft housing design

The modular design involves assembling the camshafts directly in the camshaft housing.

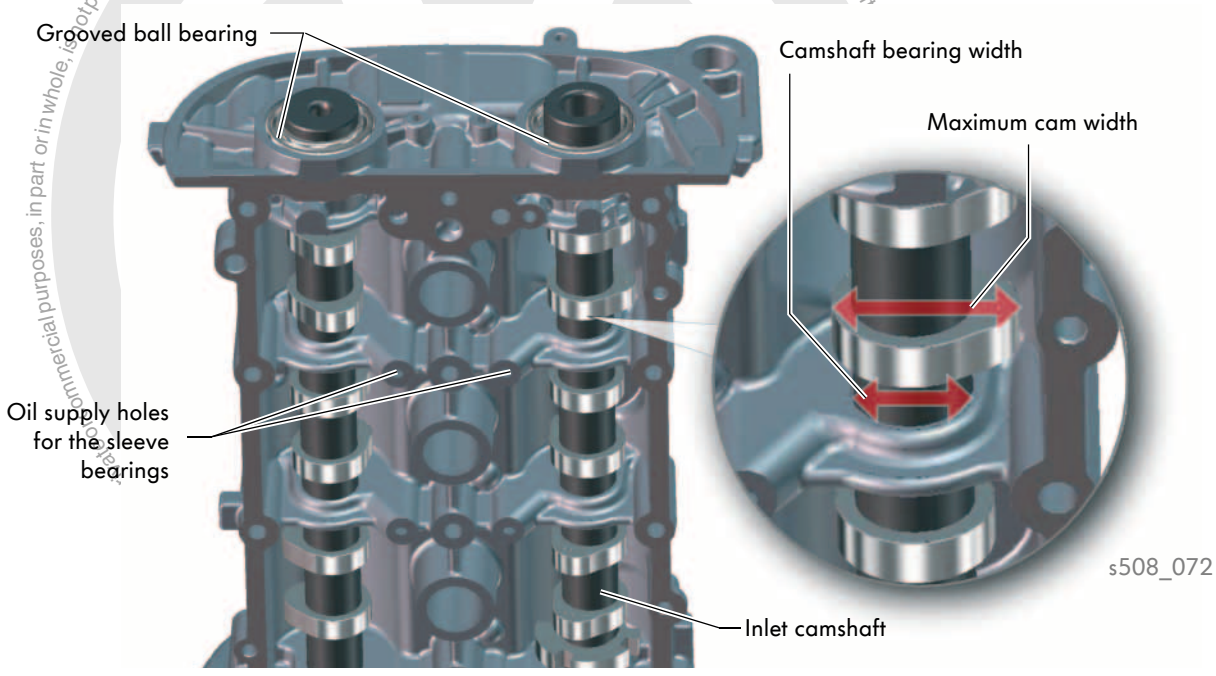
Assembly

During assembly, the cams were initially warmed, before being positioned in the housing. At the same time, the camshaft tube is cooled intensively and inserted into the camshaft housing through the cams.
Once the components reach ambient temperature, an inseparable join is created.
As the cams no longer have to fit through the bearing points, it is possible to design very small bearings.

Advantages of smaller bearing points:

- lower friction in the bearings and
- higher rigidity.

In the event of a repair, the camshaft housing is replaced together with the camshafts.



Oil supply to the bearing points

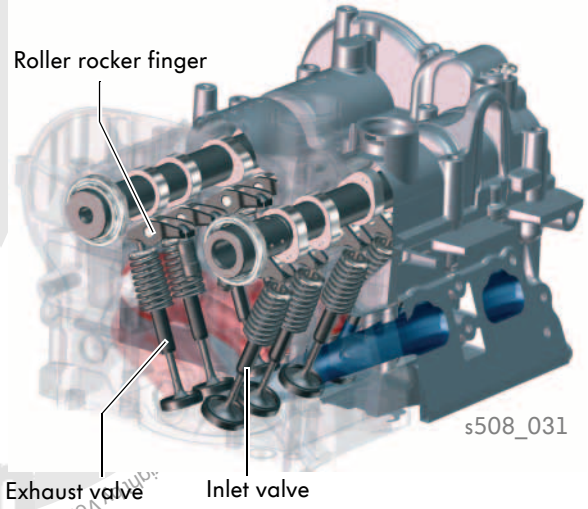
The sleeve bearings are supplied with oil from oil supply holes.

Valve gear

The inlet valves are installed at an angle of 21°, and the exhaust valves at an angle of 22.4°, arranged overhead in the combustion chamber. The valves are actuated by roller rocker fingers.

Other features

- The valve stems have a diameter of 5 mm.
- The valve seat angle is 90° on the inlet side and 120° on the exhaust side, which increases their resistance to wear when alternative fuels are used (e.g. for natural gas).

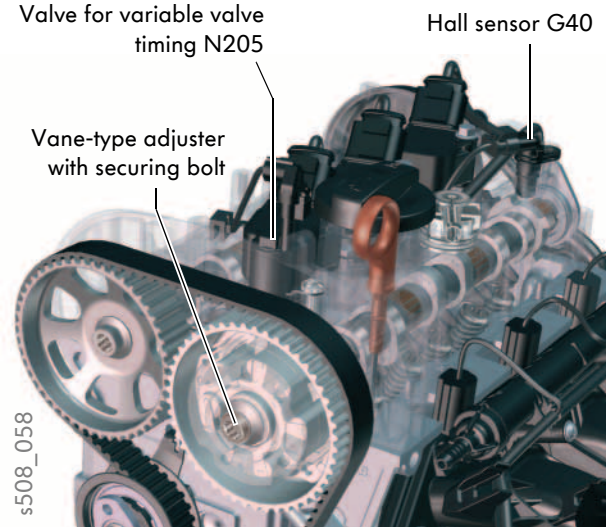


Variable valve timing

A continuously variable inlet camshaft adjustment for a crankshaft angle of up to 42° has been utilised.
A vane-type adjuster on the inlet camshaft carries out the adjustment according to the engine load and speed.
The vane-type adjuster is adjusted by the valve for variable valve timing, which is integrated directly into the oil circuit.
The adjustment angle is measured using the Hall sender G40.

The variable valve timing results in:

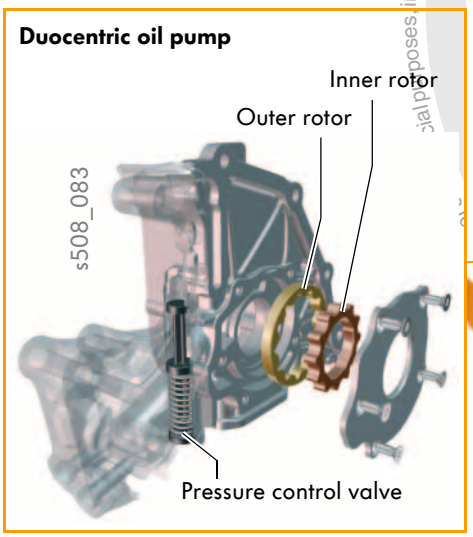
- Very good inner exhaust gas recirculation, which lowers the combustion temperature along with the nitrogen oxide emissions
- An improved the torque band.

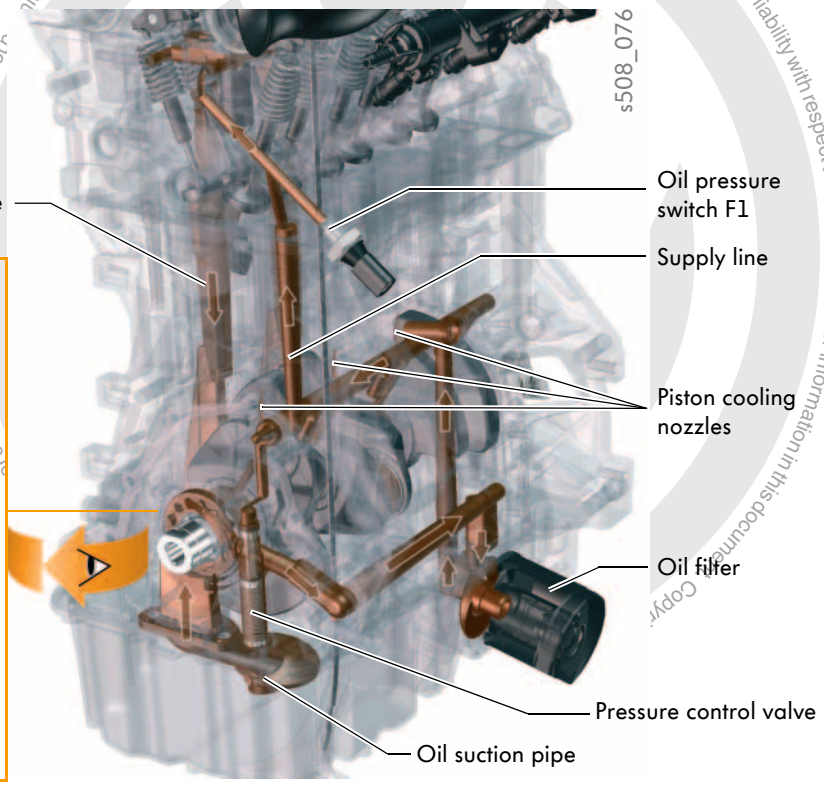


The securing bolt is situated behind a plug and has a right-hand thread.

Oil supply

The oil supply for the bearing points, the piston cooling nozzles, the variable valve timing and the valve gear is supplied using a duocentric oil pump. It has been installed on the poly V-belt side as a crankshaft oil pump to save space. This means the inner rotor is found directly on the front pivot area of the crankshaft and is driven by it directly.
The advantages of this design are the low friction, low weight and low drive noises.





Pressure control valve

The pressure control valve is integrated into the oil pump housing and regulates the oil pressure to approx. 3.5 bar. This prevents the oil pressure from increasing too rapidly, for example when the engine is started, which damages the gaskets.

Oil pressure switch F1

The oil pressure switch is screwed into the cylinder head. If the oil pressure is less than 0.5 bar, the switch will open and the oil pressure warning lamp K3 lights up.

Oil filter

The oil filter is installed on the oil sump.
A diaphragm valve in the oil filter prevents the oil from escaping from the oil filter when the engine is not running.

Piston cooling nozzles

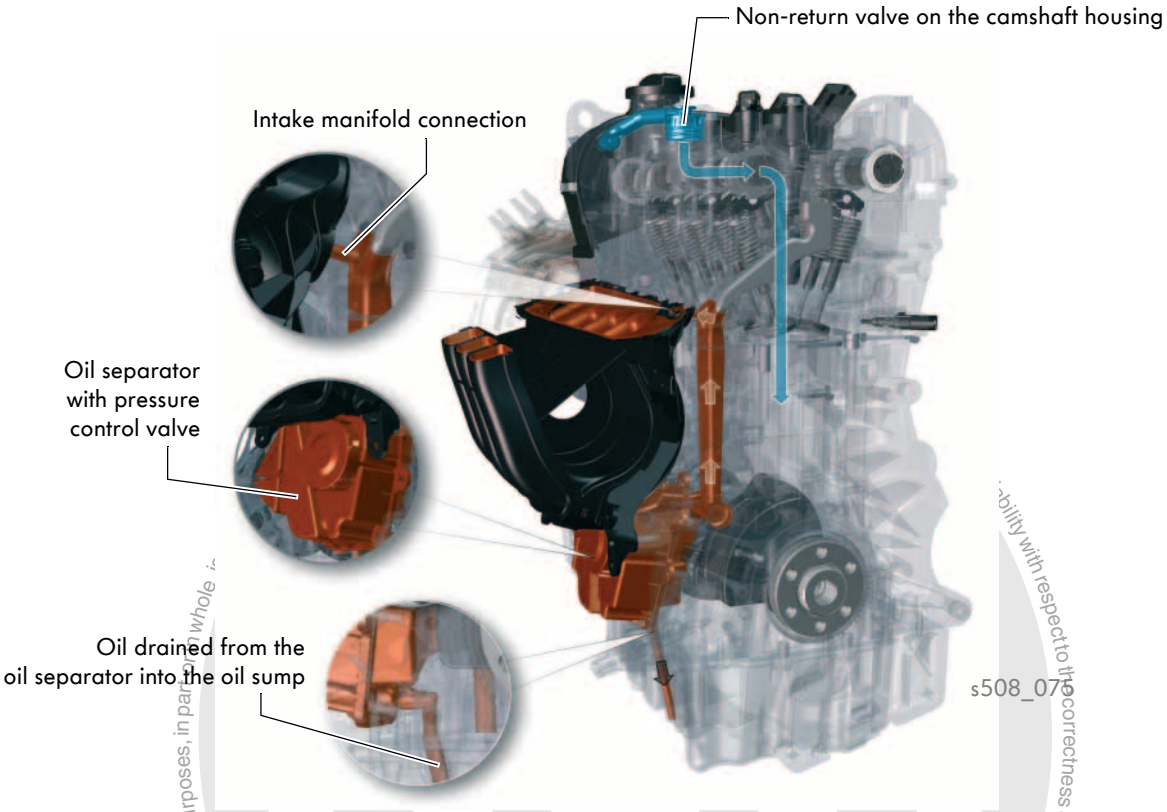
The piston cooling nozzles are used to squirt oil onto the underside of the pistons, thereby cooling them.

Crankcase breather and ventilation system

The crankcase breather and ventilation system must ensure that:

- The formation of condensation in the oil remains low on short trips and therefore prevents the crankcase breather from freezing,
- Oil vapour and uncombusted hydrocarbons are prevented from being emitted into the environment under all operating conditions.

To achieve this, a pressure-controlled system featuring forced ventilation is used.



Crankcase ventilation system

The crankcase ventilation system allows the crankcase to be flushed, therefore reducing the formation of condensation in the oil. It is ventilated with fresh air using a hose leading from the air filter to the non-return valve, which is installed in the camshaft housing.
The non-return valve prevents oil or unfiltered blow-by gases from entering into the air filter.

Crankcase breather

The crankcase is ventilated internally, meaning gases containing oil flow through ducts in the cylinder block to the intake manifold and are distributed evenly among the cylinders there.
The oil vapours are cleaned in the oil separator. This is made of plastic and is screwed to the cylinder block.

Coarse oil and oil mist separation

The gases flow from the crankcase into the oil separator. In the coarse oil separator, the large drops of oil are first separated from the gases by baffle plates and swirl ports. The finer oil mist is then separated in swirl ports in the oil mist separator.

Diaphragm valves

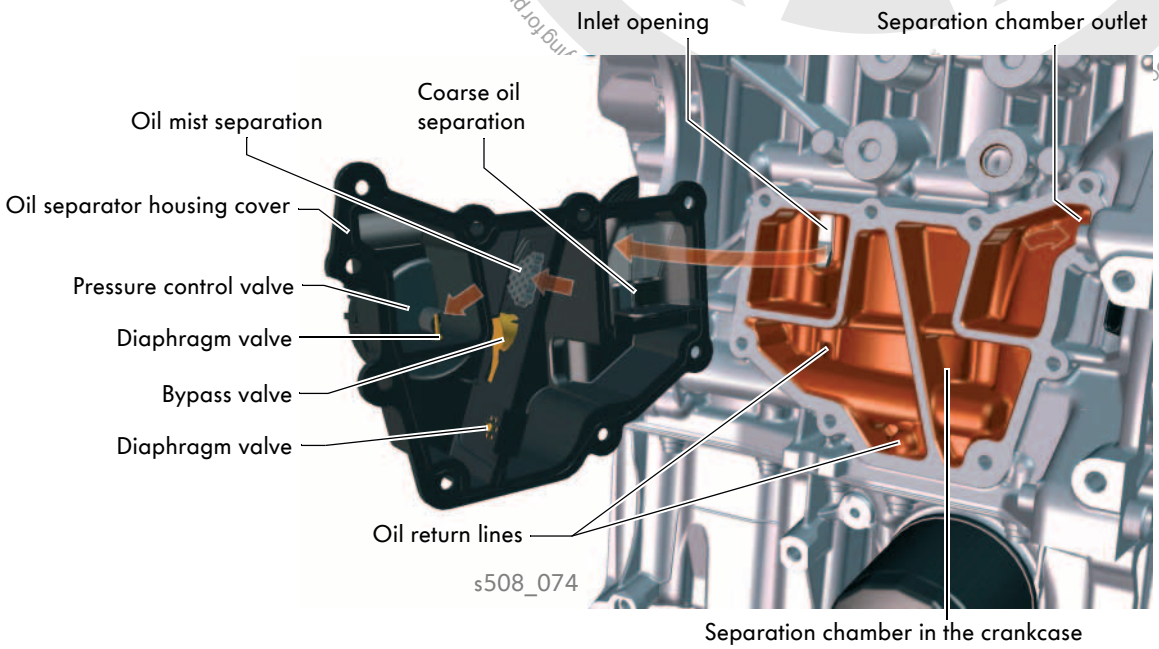
Pulsations in the intake manifold produce waves of pressure which flow back from the intake manifold to the oil separator. To dampen this pressure, one valve opens first, before the second one opens. This is an effective method of reducing pressure.

Pressure control valve

The pressure control valve ensures the vacuum in the crankcase remains constant. This ensures that, on the one hand, fresh air is continually drawn in, and on the other hand, that the pressure cannot increase so far that the gaskets could be damaged.

Bypass valve

If the pressure in the crankcase does increase so much that the gases can no longer be discharged through the swirl ports, the bypass valve opens.

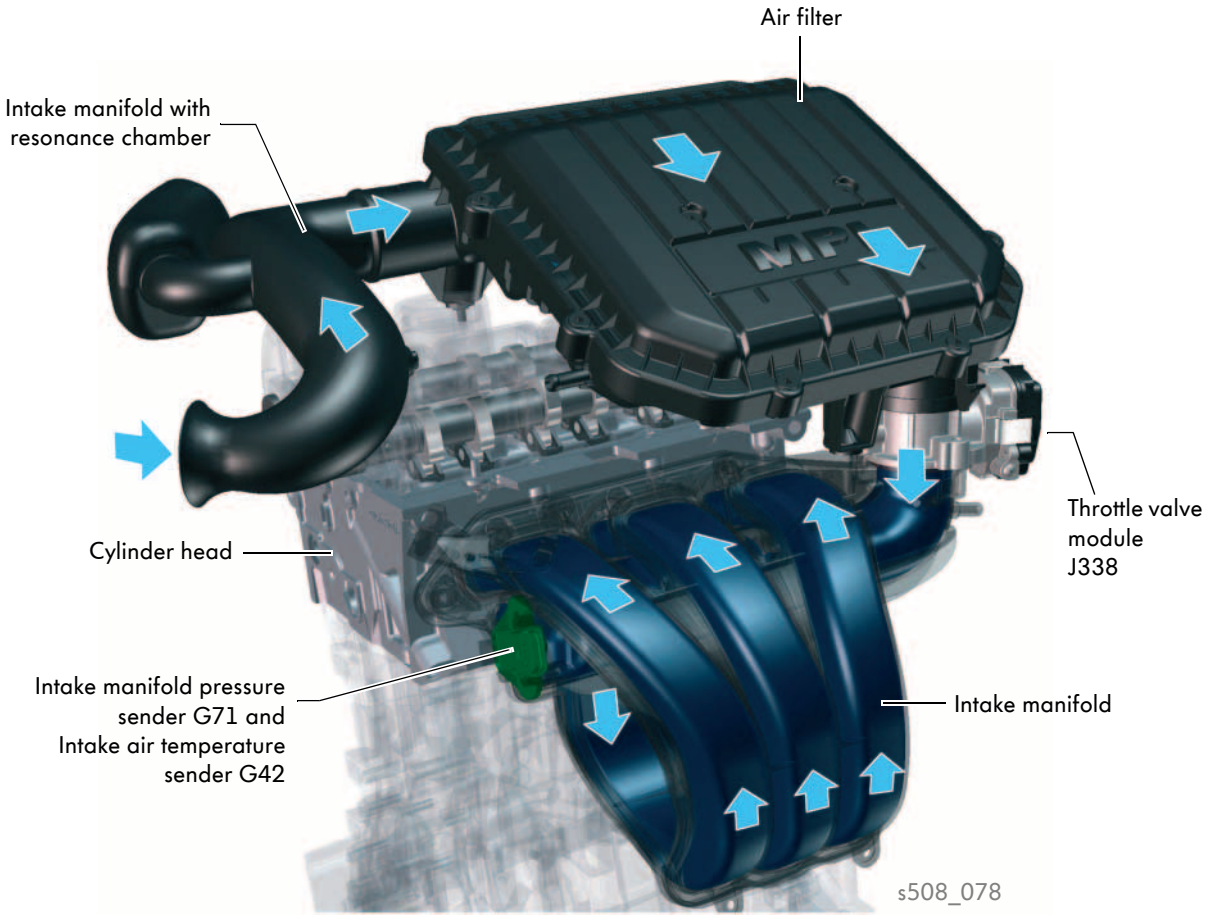


Intake system

The intake system comprises the intake manifold with a resonance chamber, the air filter, the throttle valve module, the intake manifold, and the inlet ports in the cylinder head.

The plastic inlet pipe, heat welded from four parts, has been designed as a “screw-shaped intake manifold”. This design makes it possible to fit a pipe of 550 mm, required for a good torque band, into the installation space available.

The inlet ports provide good air flow control with low engine speeds.

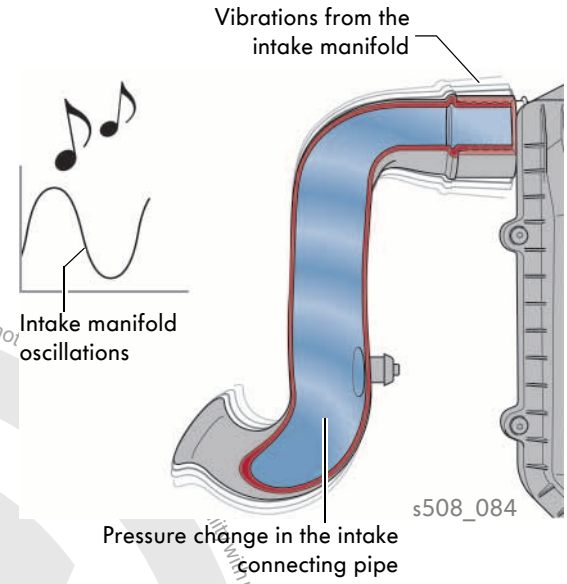


Intake manifold with resonance chamber

During the intake process, vibrations are produced in the intake system which will cause different types of noises according to their frequency. However, to keep these noises as inaudible as possible, there is a resonance chamber in the intake manifold which helps reduce the volume of the noises.

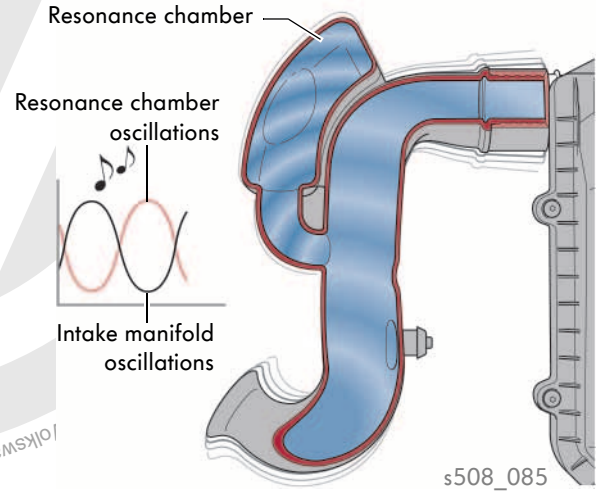
Intake manifold without resonance chamber

When there is an intake manifold without a resonance chamber, the intake of fresh air produces vibrations which can result in annoying noises.



Intake manifold with resonance chamber

When there is an intake manifold with a resonance chamber, the same vibrations are produced during intake. However, the air that has been drawn in now causes the air in the resonance chamber to vibrate. Its vibrations have a similar frequency to the vibrations of the intake manifold, which induce the intake noises. By overlaying both frequencies, annoying noises are reduced.

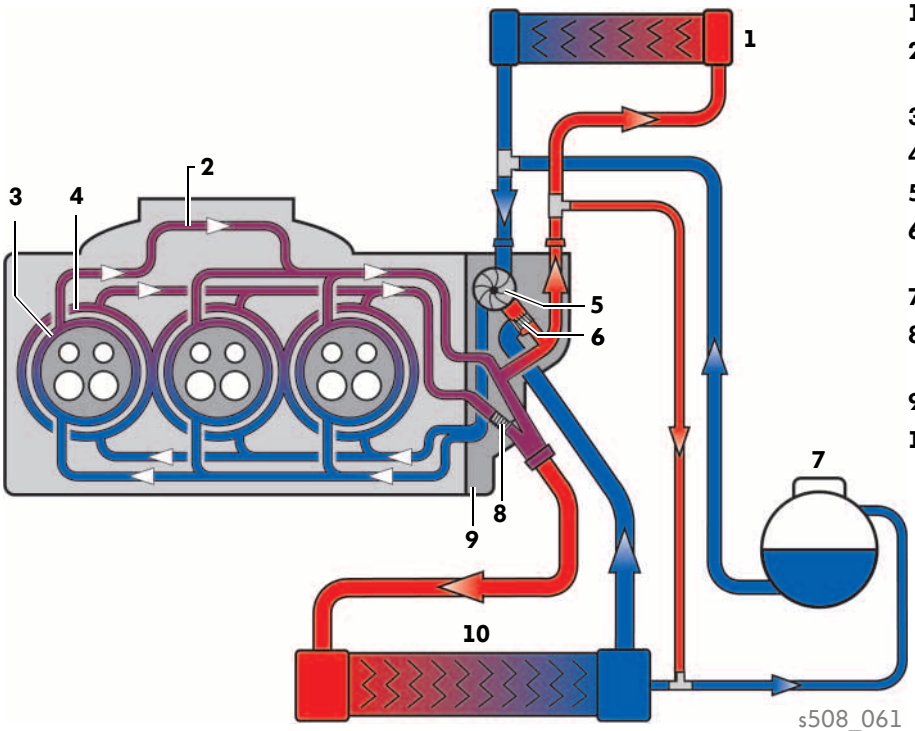


Cooling system

The cooling system was completely redesigned from scratch, and was adapted to the installation space available in the up!
The coolant pumps and their drive are now on the gearbox side, and the coolant expansion tank has been relocated to the front end.

Special features of the cooling system:

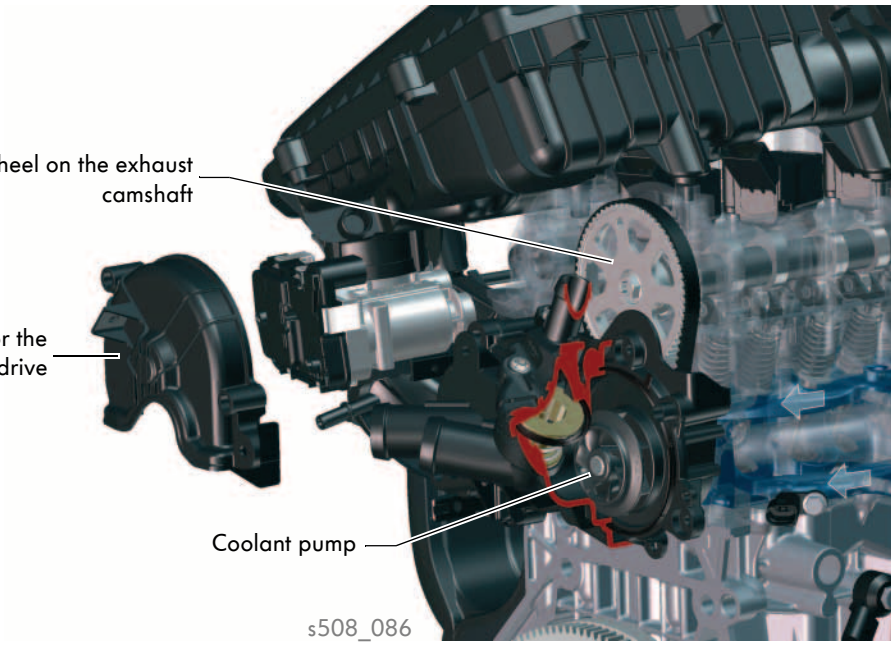
- Dual-circuit cooling system for different coolant temperatures in the cylinder head and cylinder block
- Cross-flow cooling in the cylinder head (from the inlet side to the outlet side) for a more uniform temperature distribution
- Thermostat housing with integrated coolant pump
- Coolant pump driven by the exhaust camshaft using a toothed belt
- Coolant expansion tank installed at the front end
- Cooling for the integrated exhaust manifold



1 Heat exchanger for heater
2 Exhaust manifold cooling system
3 Cylinder head cooling system
4 Cylinder block cooling system
5 Coolant pump
6 Thermostat 1 for cylinder head (87°C)
7 Coolant expansion tank
8 Thermostat 2 for cylinder block (103°C)
9 Coolant controller housing
10 Radiator

Thermostat housing with integrated coolant pump

The thermostat housing is installed on the cylinder head on the gearbox side. The coolant pump has been integrated into the thermostat housing to produce the most compact module possible.
The coolant pump is driven by the exhaust camshaft via a maintenance-free toothed belt.



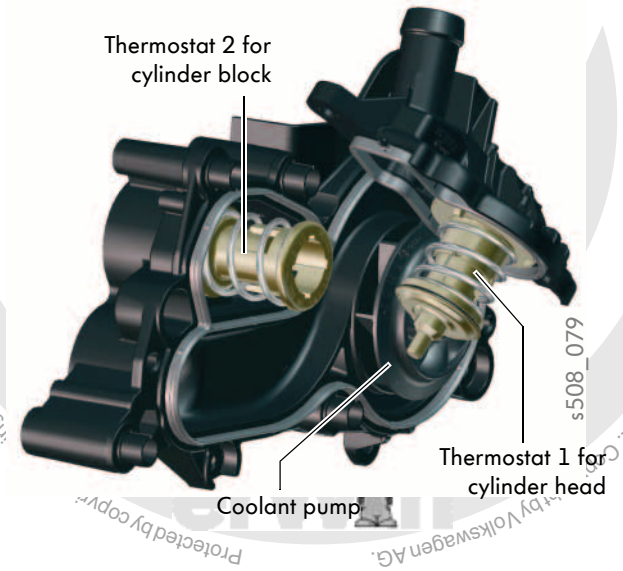
Before removing the drive wheel, and when tensioning the toothed belt, you must pay attention to the notes in ELSA.
Only a correctly tensioned toothed belt will ensure the coolant pump functions long-term without fail.

Thermostats in the thermostat housing

The two thermostats for the dual-circuit cooling system are installed in the thermostat housing.

Thermostat 1 for cylinder head
It opens at a temperature of 87°C or above, and opens the path from the radiator to the coolant pump.

Thermostat 2 for cylinder block
It opens at a temperature of 103°C or above, and opens the path for the warm coolant from the cylinder block to the radiator.
The entire coolant circuit is open.



Fuel system

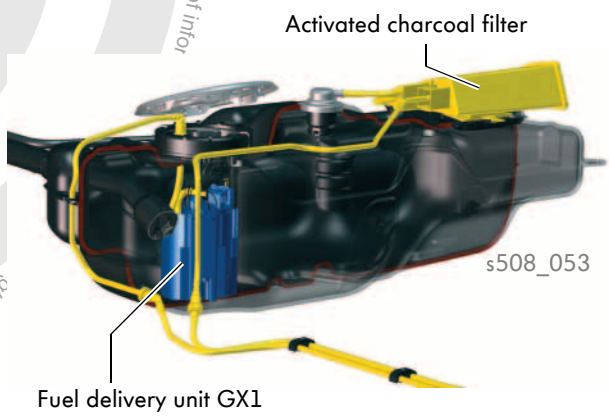
A non-return fuel system is used in the up! This means there is no fuel return line from the fuel rail to the fuel tank.

The fuel is pumped from the fuel delivery unit to the fuel rail and the injectors at a pressure of approximately 3 bar.

Fuel system near the fuel tank

It consists of the following components:

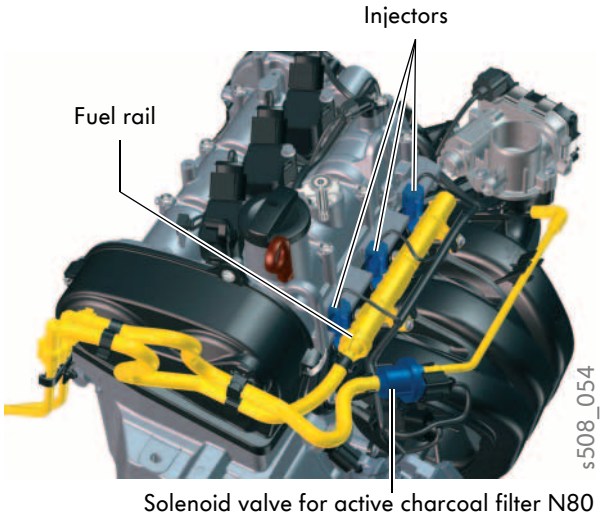
- The fuel tank, which is made of plastic, and has a capacity of 35 litres.
- The fuel delivery unit with its integrated fuel filter and fuel pressure regulator (approx. 3 bar).
- The activated charcoal filter, which can be removed after lowering the fuel tank.



Fuel system near the engine

It consists of the following components:

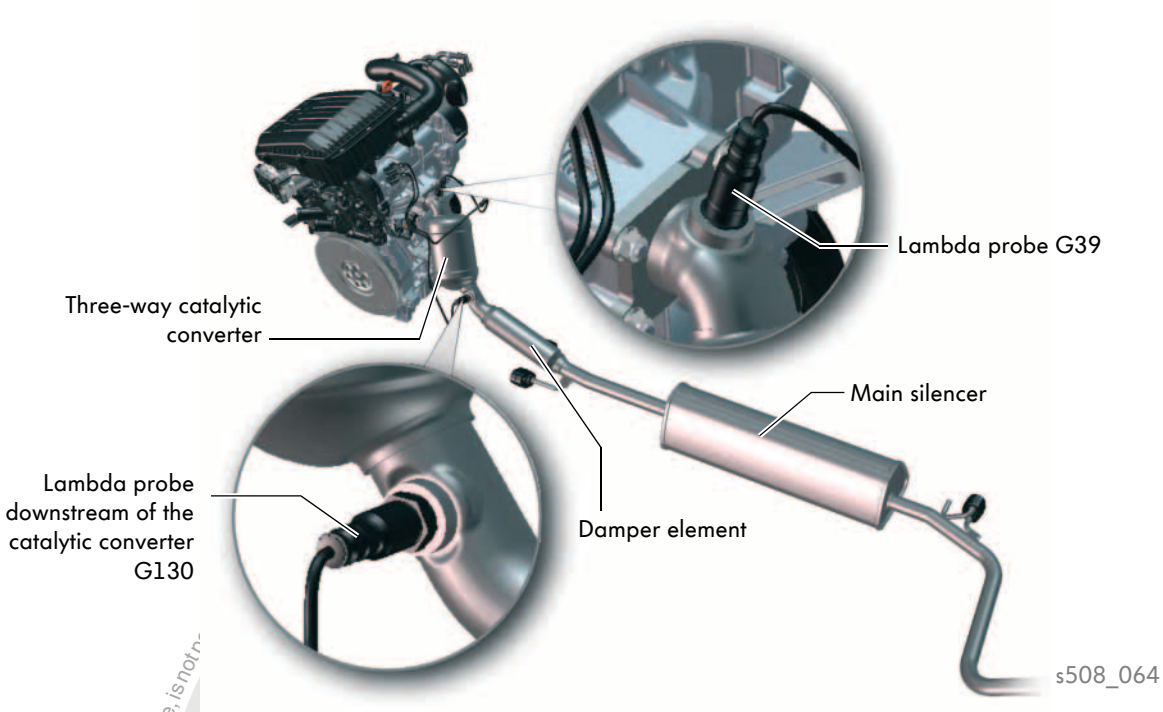
- The 4-hole injectors, which are inserted into the intake manifold and are therefore nowhere near the “hot” cylinder head. This stops steam bubbles from forming in the valves, making fuel pressure of around 3 bar sufficient. This reduces the energy needed by the electric fuel pump.
- The fuel rail is made of plastic, which is screwed onto the intake manifold together with the injectors. The bleeder valve is not required.
- The solenoid valve for the activated charcoal filter N80, which is clamped onto the intake manifold.



You can find further information on the non-return fuel system in the self-study programme no. 260
“The 1.2 l 3-cylinder Petrol Engine”.

Exhaust system

The exhaust system comprises an exhaust manifold integrated into the cylinder head, a discrete-level lambda probe upstream of the catalytic converter, a close-coupled three-way catalytic converter, a discrete-level lambda probe downstream of the catalytic converter, a damper element and a main silencer.

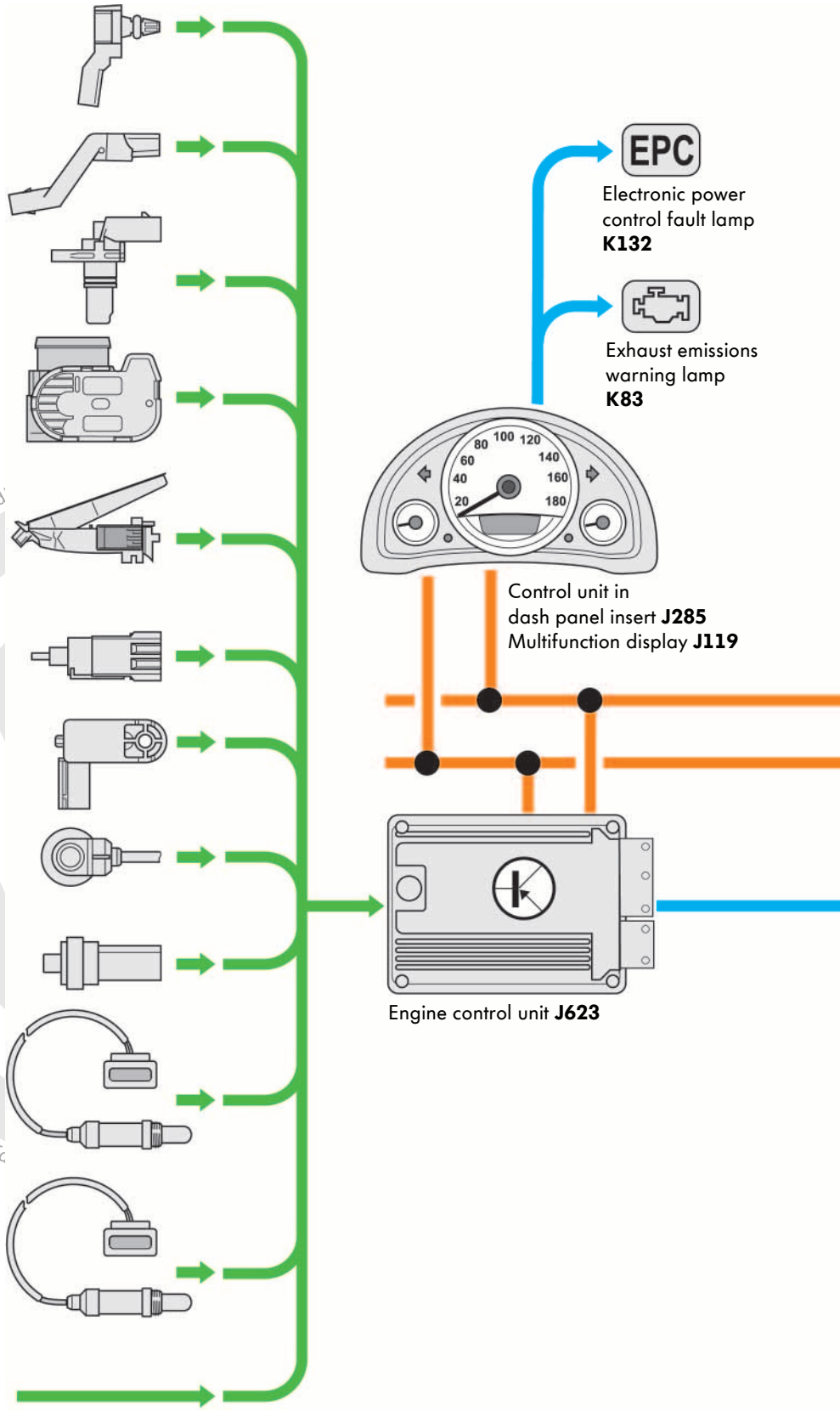


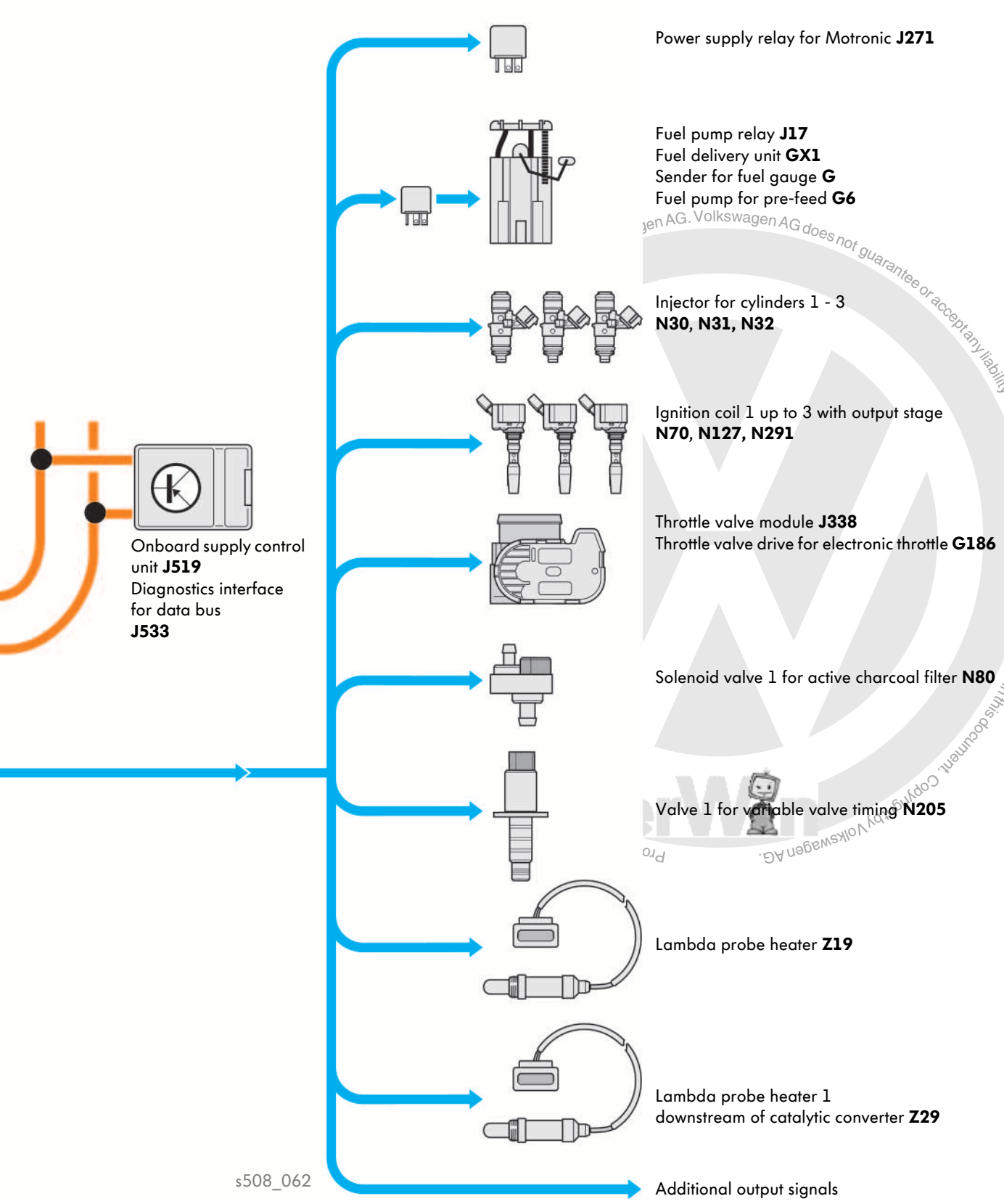
Mixture regulation and catalytic converter monitoring

The two discrete-level lambda probes regulate the mixture and monitor the catalytic converter.
Enhancements to the software in the engine control unit make it possible to eliminate the usual wideband lambda probes used upstream of the catalytic converter, allowing them to be replaced with a simple and less expensive discrete-level lambda probe.
The rear discrete-level lambda probe monitors the function of the catalytic converter.

System overview

Bosch Motronic ME 17.05.20, Basic equipment

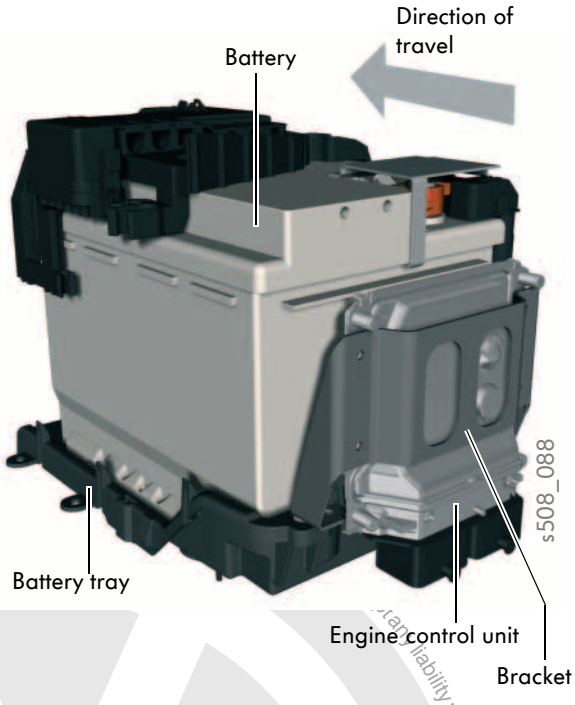




Engine control unit

The engine control unit is installed between the plenum chamber partition panel and the vehicle battery.
It is attached to the battery tray, together with a bracket, by shear bolts.
It features two connectors, each with 56 pins.

The engine management system used is Bosch Motronic ME 17.5.20.
Along with the engine management system's actual functions, it is also responsible for activating the air conditioner compressor and the radiator fan.

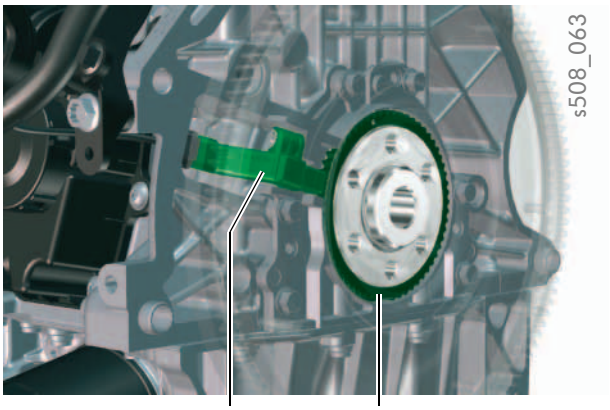


You will require the 6606/1 isolator box with the test cable VAS 6606/13 to test the wires and components.

Sensors

Engine speed sender G28

The engine speed sender is integrated into the sealing flange on the gearbox side, with the flange being, in turn, bolted to the cylinder block. It scans a 60-2 sender wheel in the crankshaft sealing flange. Using these signals, the engine control unit calculates the engine speed and the position of the crankshaft in relation to the camshaft using the Hall sender G40.



Signal utilisation

The calculated injection time, the injection duration and the ignition timing are determined using this signal. It is also used for the variable valve timing.

Effects of signal failure

If the engine speed sender should fail, the signal from the Hall sender G40 will be used instead. At the same time, the maximum engine speed will be limited to a fixed value and an entry is made in the fault memory.

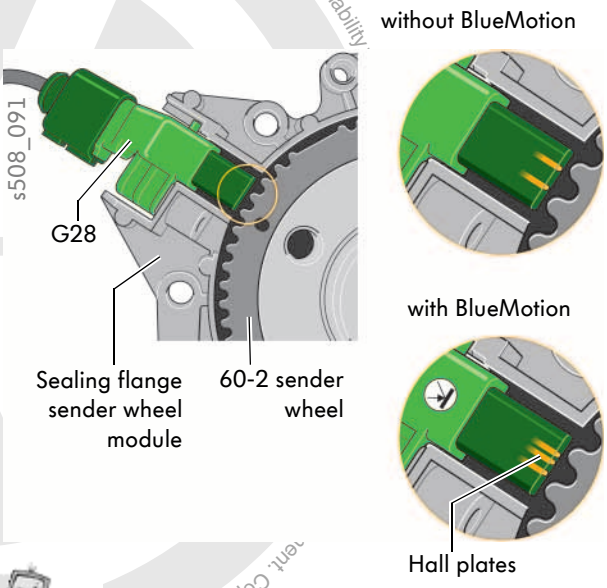
Two different versions

Two different speed senders are used in the up!:

- In the up! with BlueMotion and start-stop function, a speed sender with direction of rotation detection is used
- In the up! without BlueMotion, a speed sender without direction of rotation detection is used

They cannot be distinguished from the outside at a glance. Only the retaining tabs used to affix them are different.

The main difference can be found in the number of hall plates in the sender. The standard sender features two hall plates, while the sender with direction of rotation detection features three.



Engine Management

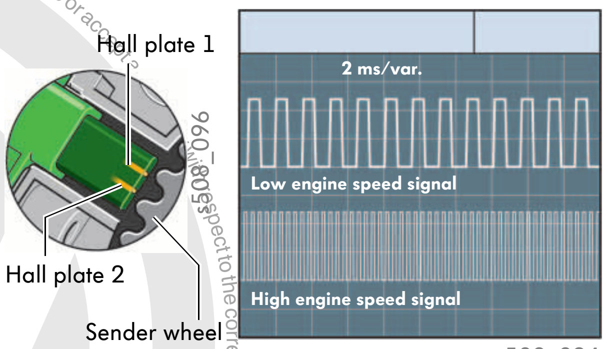
Why is there an engine speed sender with direction of rotation detection?

In vehicles with a start-stop function, the engine is switched off as often as possible to save fuel. To ensure it starts up again as quickly as possible, the engine control unit must know the exact position of the crankshaft. However, when switched off, the engine does not come to a standstill immediately, but rather keeps turning for a few revolutions. If, before stopping, a piston is just short of the TDC in the compression phase, it is pushed back by the compression pressure. At this moment, the engine rotates to the left. A standard engine speed sender cannot detect this.

How it works:

Engine speed sensor without direction of rotation detection

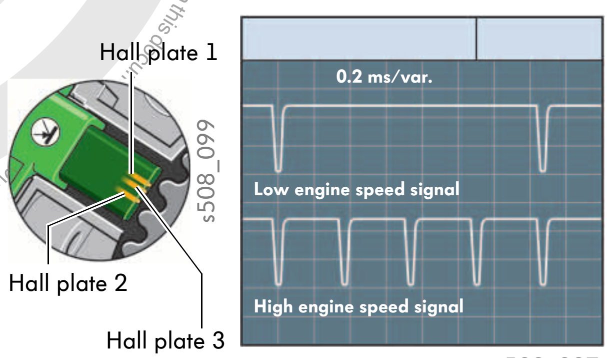
At the same moment as the two hall plates, the sender detects a rising and a falling gear flank on the sender wheel. Whether the engine is turning to the right or left is something it does not detect.
The same signals are sent to the engine control unit, which then assumes that the engine was turning to the right until it came to a standstill. The position it stores can therefore be wrong.



s508_094

Engine speed sensor with direction of rotation detection

Three hall plates are installed for a sender with direction of rotation detection. However, the third plate is in an offset position between the two outer plates. It is decisive for detecting the direction of rotation.
While the engine is running, the function is similar to a sender without direction of rotation detection. In this case, the rise and fall of the flank on the sender wheel is detected at the same time. It is only the type of signal which is different.



s508_097

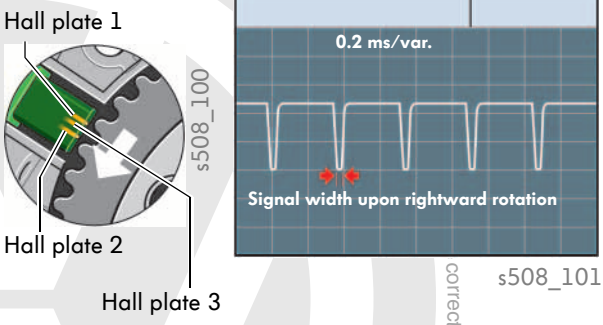
Different times must be specified on the digital storage oscilloscope (DSO) to ensure the signals from both engine speed senders are displayed correctly.

Direction of rotation detector

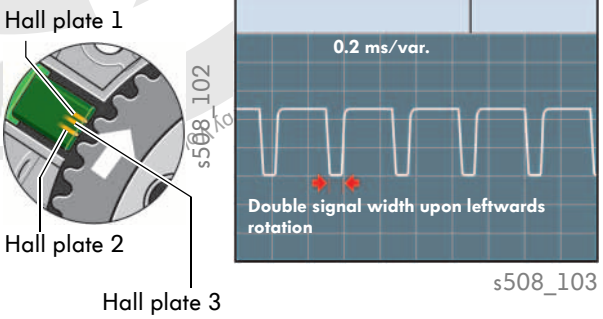
In order to detect whether the engine is turning to the right or to the left, the timing of the signal sequence from the three hall plates is decisive for detecting a rising flank.

When the engine is turning to the right, the sender wheel turns to the left.

- Engine is turning to the left
  When turning to the right, the rising flank is detected by hall plate 1 first. After a short moment, hall plate 3 detects the rising flank and finally hall plate 2. Because the time interval between hall plate 1 and hall plate 3 is shorter than between hall plate 3 and hall plate 2, the fact that the engine is turning to the right is detected.
  The sender electronics process the signal and send it to the engine control unit with a certain low width.



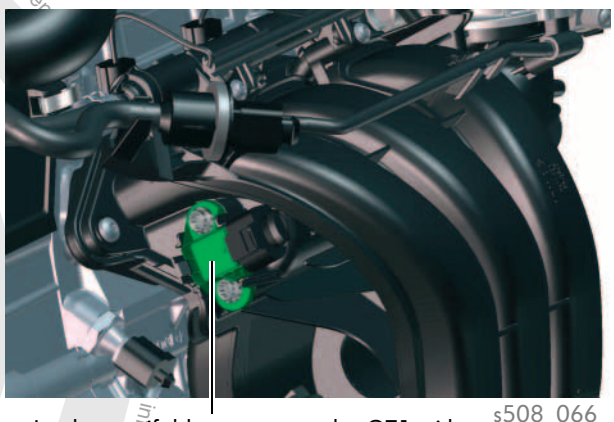
- Engine is turning to the left
  When turning to the left, the rising flank is detected by hall plate 2 first. After a short moment, hall plate 3 detects the rising flank and finally hall plate 1. Because the timing of the signal sequence is now the opposite, the fact that the engine is turning to the left is detected.
  The sender electronics process the signal and send it to the engine control unit with double the low width.



On diesel engines, an engine speed sender without direction of rotation detection is installed. Because diesel engines require a crank angle of at least 180° when starting to build up the necessary compression, an engine speed sender with direction of rotation detection would not provide any benefits.
All petrol engines with start-stop function have an engine speed sender installed with direction of rotation detection. This makes a start possible at a crank angle of just 60°.

Intake manifold pressure sender G71 and intake air temperature sender G42

The intake manifold pressure sender and intake air temperature sender are screwed into the intake manifold on the toothed belt side.
It measures the pressure and the temperature in the intake manifold.



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Intake manifold pressure sender G71 with intake air temperature sender G42

Signal utilisation

The engine control unit calculates the air mass drawn in using the signals and the engine speed.

Effects of signal failure

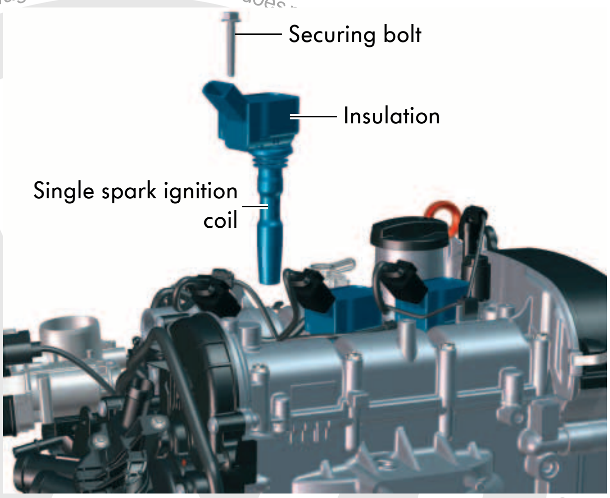
If the intake air temperature sender fails, a fixed substitute value of 20°C is assumed.
If the intake manifold pressure sender fails, a substitute value is calculated from the throttle valve position and the engine speed.
In both cases, the fault is recorded in the fault memory.

Actuators

Single-spark ignition coils N70, N127 and N291

The single-spark ignition coils have been inserted in the middle of the cylinder head, and are only fastened to the camshaft housing by one bolt.

The insulation has been enlarged on the ignition coils and the ignition voltage increased. This extends the service life and produces cleaner combustion.



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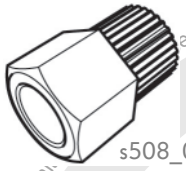
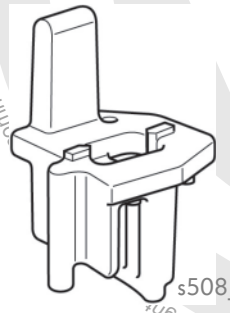
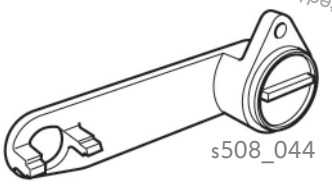
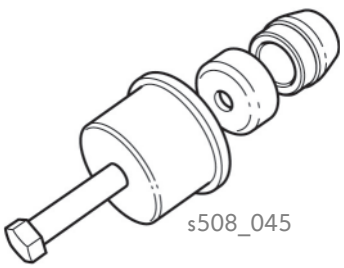
Task

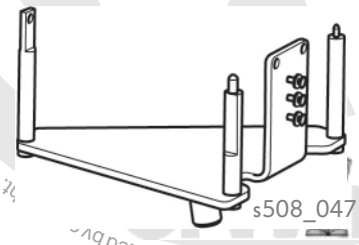
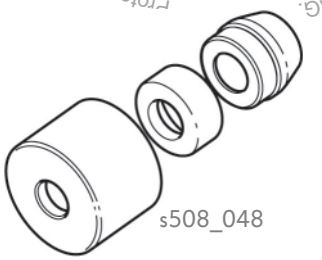
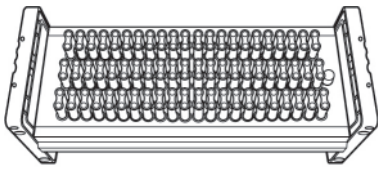
The ignition coils have the task of igniting the fuel-air mixture at the right time.
The ignition timing is controlled individually for each cylinder.

Effects of failure

If an ignition coil fails, then the corresponding injector will no longer be activated, resulting in an entry being made in the fault memory.

Special tools

Name	Tool	Application
T10474 Adapter	 s508_041	For removing and installing the poly V-belt with freewheel on the alternator for vehicles with BlueMotion technology.
T10475 Counterhold tool	 s508_042	Counterhold tool on the vibration damper/crankshaft for undoing and tightening the securing bolt.
T10476 Assembly tool	 s508_043	Assembly aid for positioning the tri-oval camshaft gears precisely.
T10477 Camshaft fixing device	 s508_044	Fixing the camshaft when checking and adjusting the valve timing.
T10478 Assembly tool	 s508_045	For replacing the oil seal for the camshaft (pulley side)

Name	Tool	Application
T10479 Assembly tool	 s508_046	For replacing the oil seal for the camshaft (gear side).
T10483 Engine bracket	 s508_047	Removing and installing the engine in conjunction with engine and gearbox support V.A.G 1383 A.
T10485 Assembly tool	 s508_048	For replacing the oil seal for the crankshaft (pulley side).
VAS 6606/1 Isolator box	 s508_105	Use for the wire and component test together with test cable VAS 6606/13.

Test Your Knowledge

Which answers are correct?

One or several of the given answers may be correct.

1. Which statement about the camshaft housing is true?

❒ a) The camshafts can be replaced individually.

❒ b) The grooved ball bearings in the camshaft housing are secured by a snap ring, and can be replaced individually.

❒ c) The camshaft housing and camshafts are installed together in an integral module design. The camshafts cannot be removed.

2. What advantages does the integrated exhaust manifold offer?

❒ a) The coolant is warmed up more quickly by the exhaust gas while the engine is warming up.

❒ b) Due to the smaller area of the exhaust gas-side wall surface extending to the catalytic converter, the exhaust gas does not emit as much heat during the warm-up phase, and the catalytic converter is heated up to its operating temperature more quickly by the coolant, despite its cooling effect.

❒ c) When the system is operating under full load, the coolant temperature is further reduced, thereby increasing the engine operating temperature range at which lambda = 1. Fuel consumption and exhaust emissions are thus optimised.

3. Which statements about the cooling system are true?

❒ a) A dual-circuit cooling system is used.

❒ b) The coolant pump is integrated into the thermostat housing.

❒ c) The coolant pump can be deactivated.

4. What must be taken into account when installing the coolant pump for the 1.0 l 44/55 kW MPI engine in the up!?

❒ a) During installation, the coolant pump must be pretensioned to ensure that the toothed belt is correctly tensioned.

❒ b) Before installation, the thread of the screws must be dipped into a new locking and sealing agent.

❒ c) Some of the securing bolts have a left-handed thread.

5. On which engines is a G28 engine speed sensor fitted with direction of rotation recognition?

❒ a) The engine speed sender with direction of rotation detection is used in all engines without a start-stop function.

❒ b) The engine speed sender with direction of rotation detection has gradually been employed in all engines.

❒ c) The sensor with direction of rotation recognition is fitted in all vehicles with petrol engines and start/stop system.

Answers:
1. c); 2. a), b), c); 3. a), b); 4. a); 5. c)

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