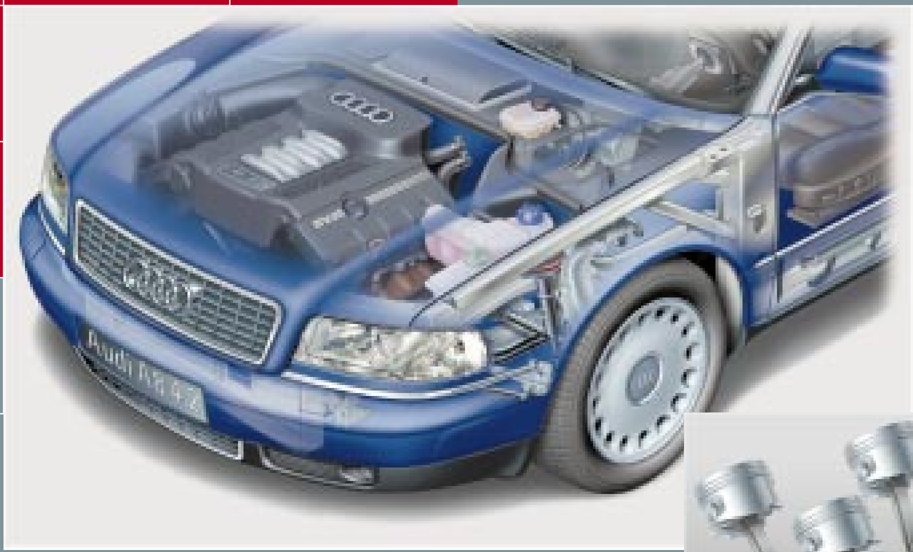
217

Service.



The V8-5V Engine

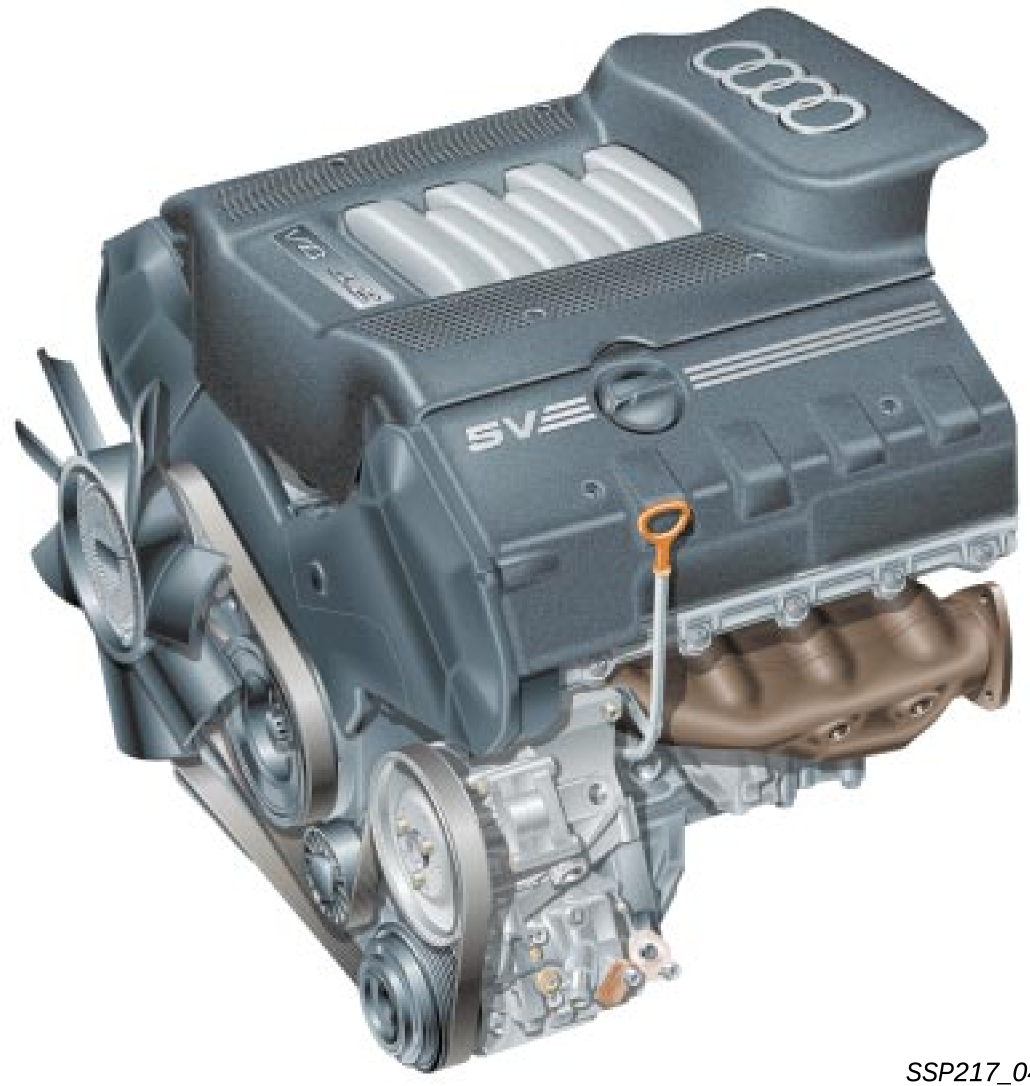
Construction Features and Functions

Self-Study Programme 217

For internal use only

AUDI has been producing advanced 8-cylinder engines since 1988. Their capacity has increased from 3.6 l to 4.2 l.

The V8 engine in combination with Aluminium Space Frame technology was the technical basis for Audi's breakthrough into the luxury class.



SSP217_048

Steps to enhance the value of the Audi A8 have included the redesign of the V8 engine.

The new V8-5V engines are now also available for the Audi A6 model range.

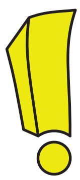
Content

The self-study programme provides you with information concerning the engine's construction features and functions.

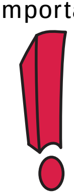
The self-study programme is not a repair manual!

When carrying out maintenance and repair work, it is essential to use the latest technical literature.

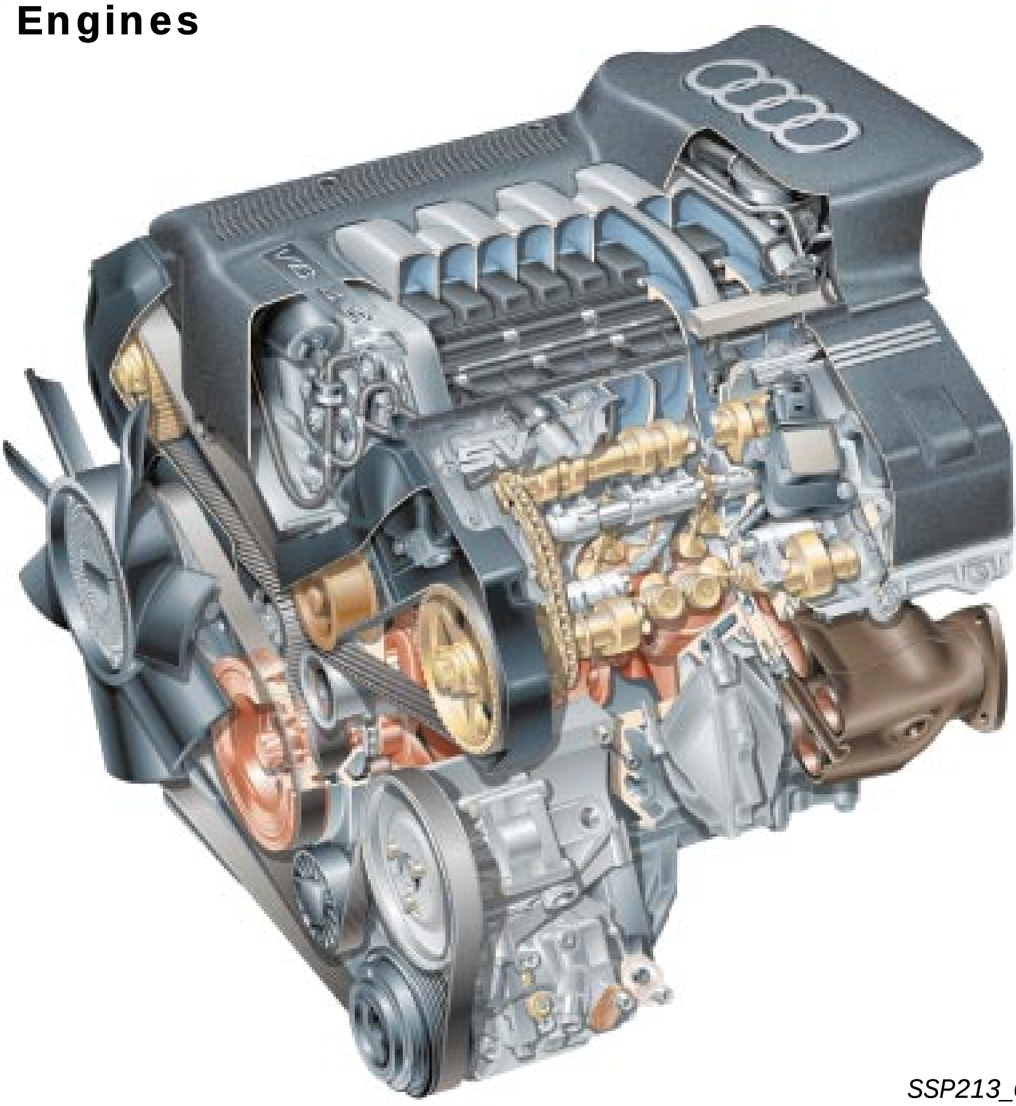
New!



Caution! Important!



V8-5V Engines



SSP213_073

Major modifications were made to the V8 engines during the course of further development.
Emphasis was placed on the following development objectives:

- compliance with future exhaust-emission regulations
- reduction of fuel consumption
- increase in torque and power
- improvement of comfort and convenience
- reduction of engine weight
- increased use of shared components for the AUDI engine series.

The following new features and modifications have been incorporated in the V8 4-valve engine.

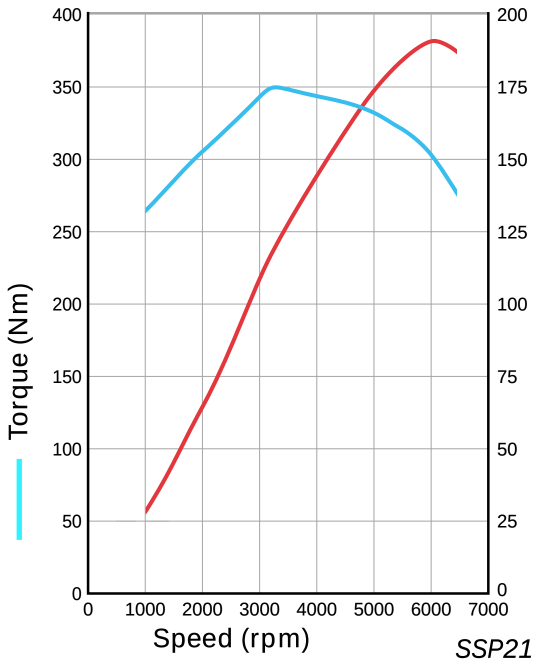
New features
- Five-valve cylinder head with roller rocker
- Camshaft adjustment
- 3-stage variable intake manifold
- Engine management system, Bosch ME 7.1
- Electro-hydraulic engine mounting

Modifications
- to crankcase and crankgear
- to oil circuit
- to cooling circuit

Technical data

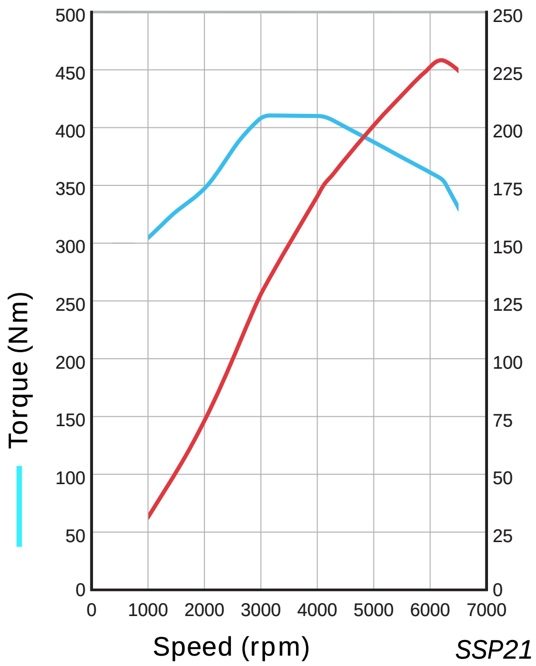
	3.7 l	4.2 l
Engine code	AQG	AQF (A8) ARS (A6)
Design	V8 engine with 90° V angle	
Capacity	3697 cm^3	4172 cm^3
Power output	191 kW 260 hp at 6000 rpm	228/220 kW 310/300 hp at 6000 rpm
Specif. output	51.6 kW/l 70.3 hp/l	54.6 kW/l 74.3 hp/l
Torque	350 Nm at 3200 rpm	410 Nm at 3000 rpm
Specif. torque	94.7 Nm/l	98.3 Nm/l
Bore	84.5 mm	84.5 mm
Stroke	82.4 mm	93.0 mm
Compression ratio	11:1	11:1
Weight	198 kg	200 kg
Engine management	Motronic ME 7.1	
Fuel	98/95 RON	
Firing sequence	1 - 5 - 4 - 8 - 6 - 3 - 7 - 2	
Exhaust-emission standard	EU 3	

3.7 l V8-5V engine



SSP217_004

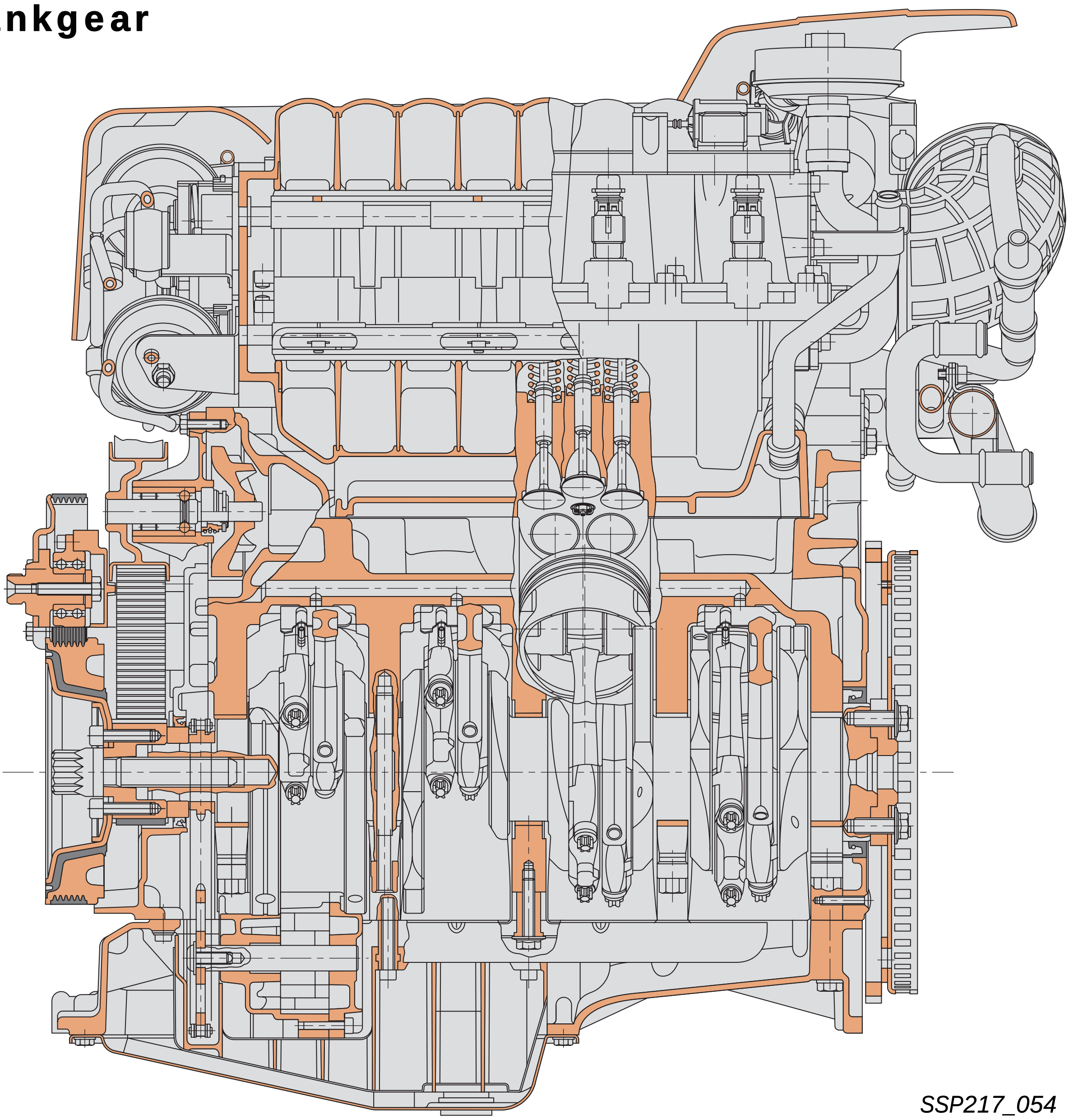
4.2 l V8-5V engine



SSP217_005

The specified power data is only possible if 98 RON fuel is used.
A reduction in power output must be expected if 95 RON fuel is used.

Crankgear



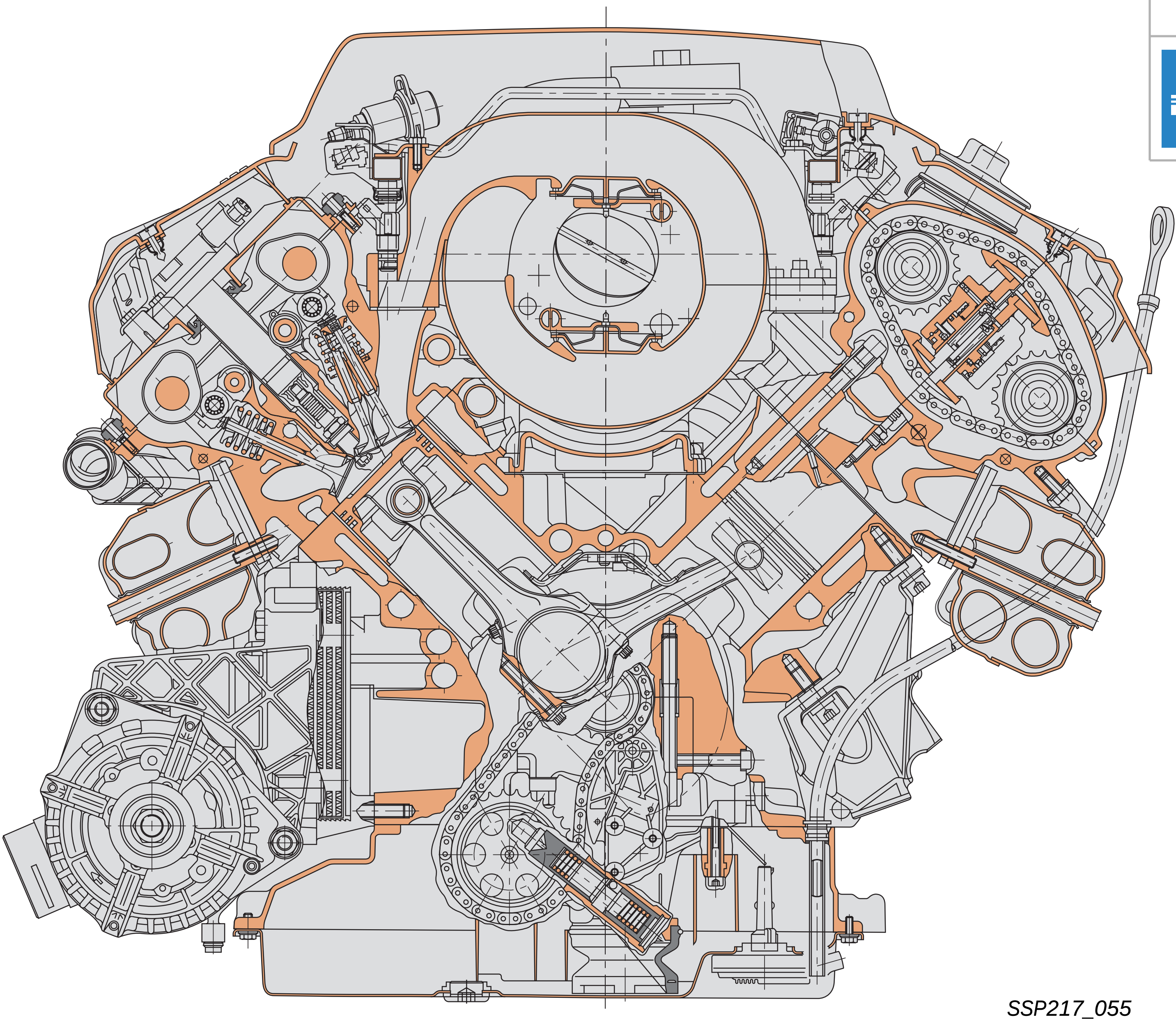
SSP217_054

The crankcase has been adapted to the modifications made to the oil supply system and cooling circuit.

Cracked-steel conrods have been used for the 3.7 l engine since 1995 and are now also being used for the 4.2 l engine.

The conrods are shared components used in both the 2.4 l and 2.8 l engine.

SSP217_006



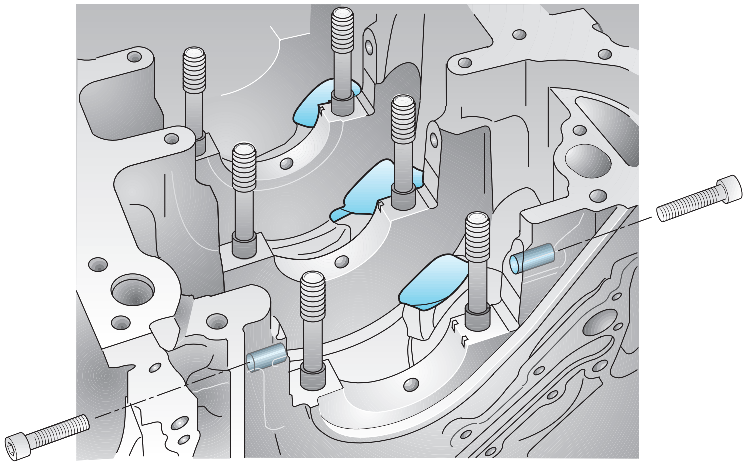
SSP217_055

Owing to the design of the valve recesses, the pistons are specifically intended for use in the appropriate cylinder bank only.

SSP217_002

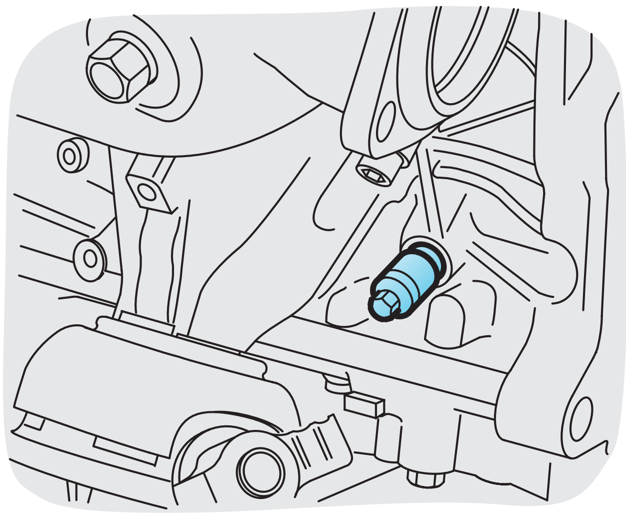
Wide, milled ventilation recesses above the thrust bearings reduce pumping losses.

Bolts are also inserted at the side of the two front crankshaft bearing caps to improve running smoothness
(see SSP 198, page 6).



SSP217_007

The locking mandrel (V.A.G 3242) used for the V6 engines is also used for locking the crankshaft. It is applied to the crank web of the 4th cylinder and is used for basic engine adjustment and also as a counterhold for loosening and tightening the central bolt of the crankshaft.

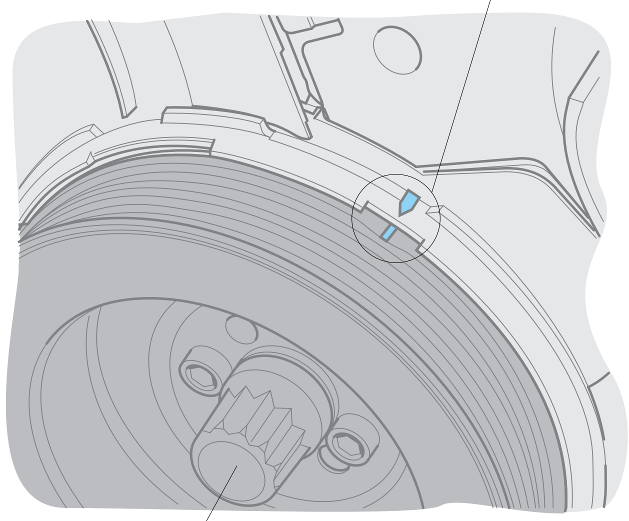


SSP217_009

The 5th cylinder must be set to ignition TDC.

The central bolt does not have to be unscrewed for the vibration damper to be removed.

The marking indicates the ignition TDC of the 5th cylinder.



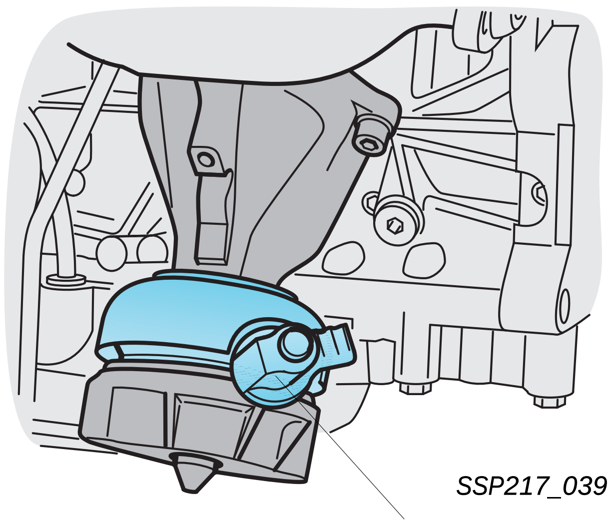
SSP217_050

Engine mounting

To enhance driving comfort, hydraulic engine mounts with electrical activation are used for the 8-cylinder engines.

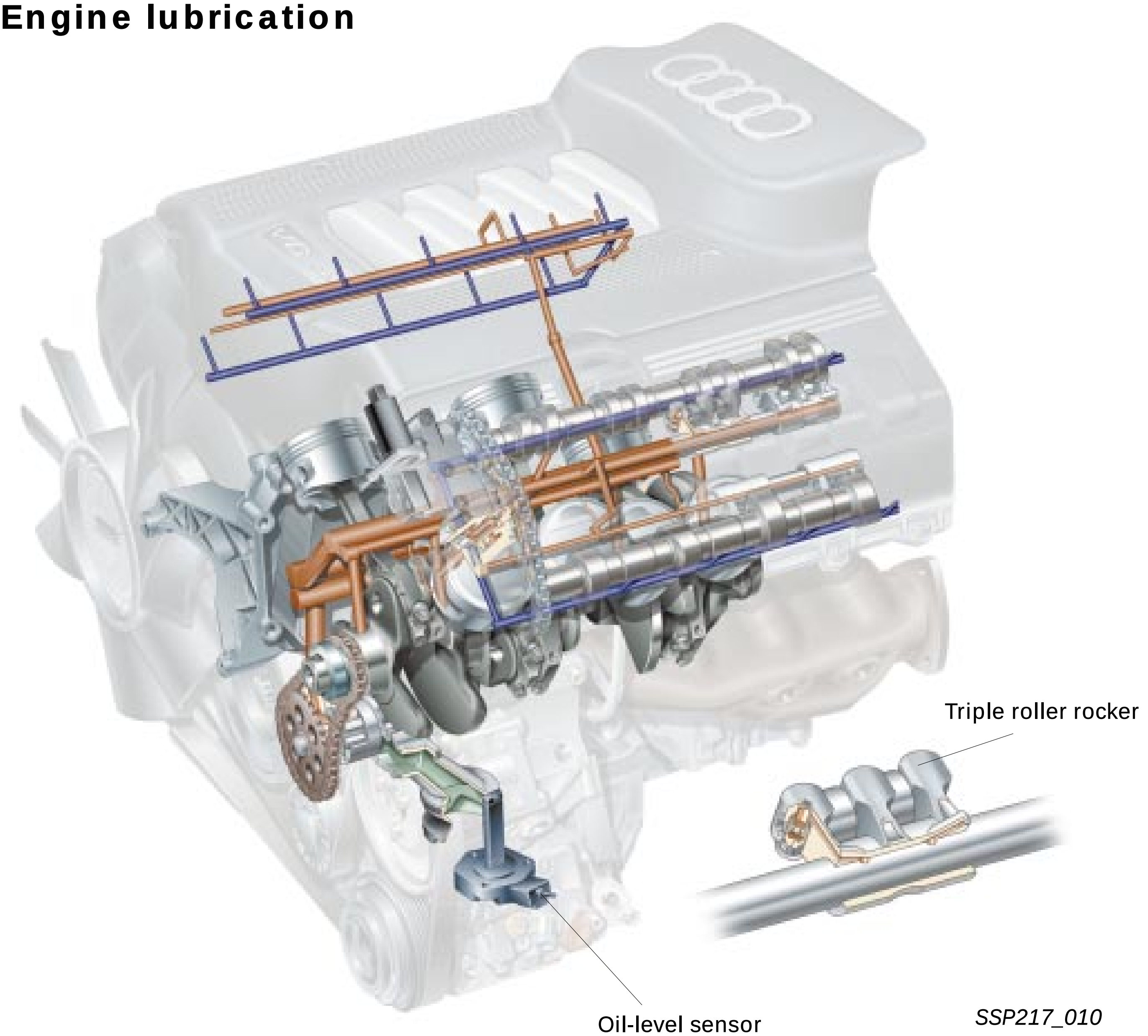
They function in the way as described in SSP 183/16.

The mounts are activated by the engine control unit according to engine speed and vehicle speed.



SSP217_039

Engine lubrication



SSP217_010

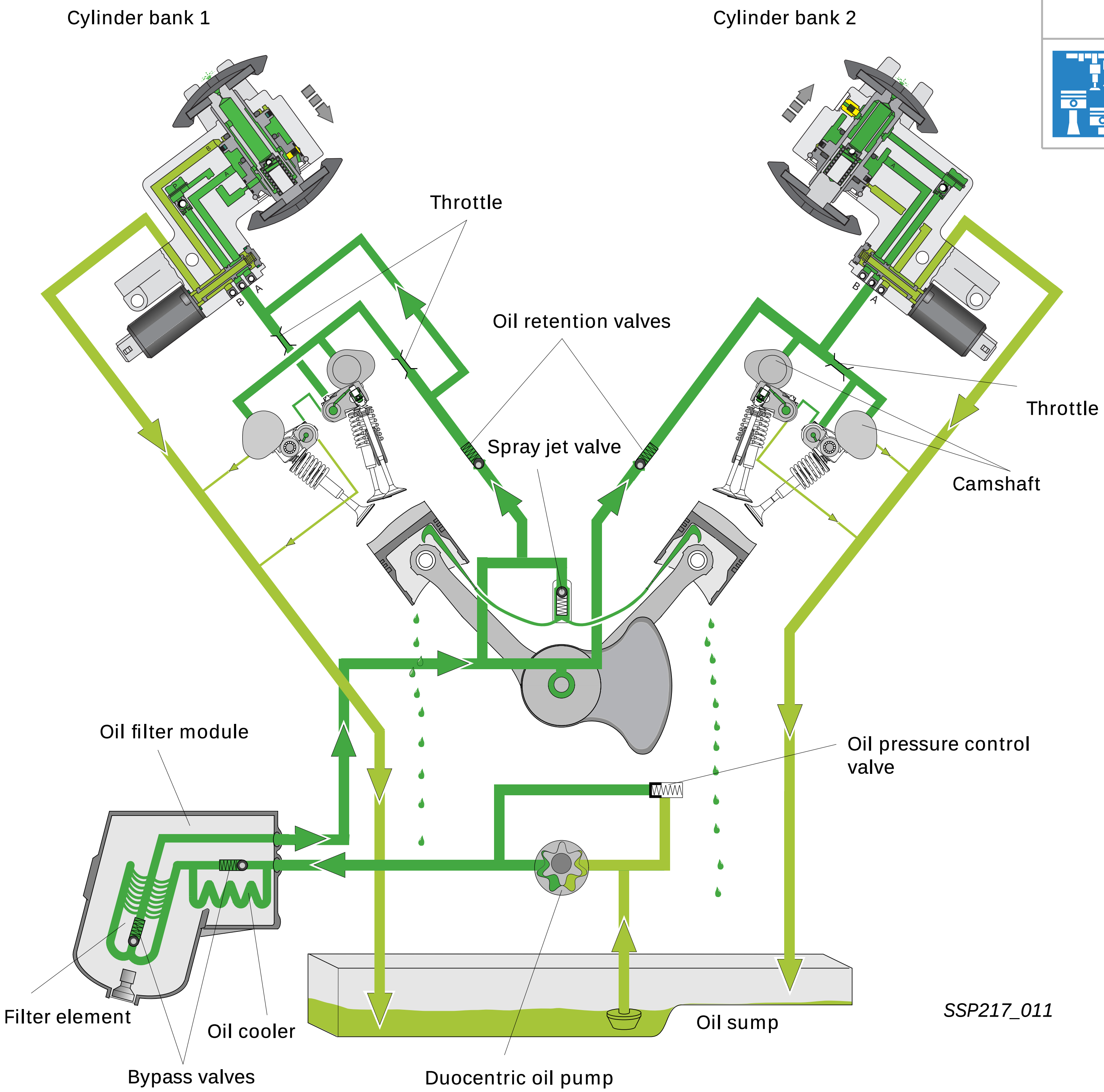
A duocentric oil pump driven by the crankshaft via a chain replaces the previously used external gear oil pump.

The duocentric oil pump extends deep into the oil sump. The low suction height means that the oil pressure can build up quickly, especially with cold-starts.

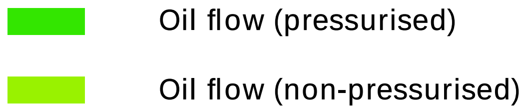
The oil-pressure control valve is located in the oil pump housing. The “diverted“ oil is led off to the intake side of the oil pump. This helps optimise the level of efficiency.

In the intake spindle shafts, there are 5 oil bores per triple roller rocker. Three oil bores each supply one hydraulic tappet. Two oil bores supply the oil-spray bores integrated in the roller rocker to lubricate the rollers. The oil-spray bores are only opened when the roller rockers are actuated. This results in a reduction of the amount of oil required in the cylinder head.

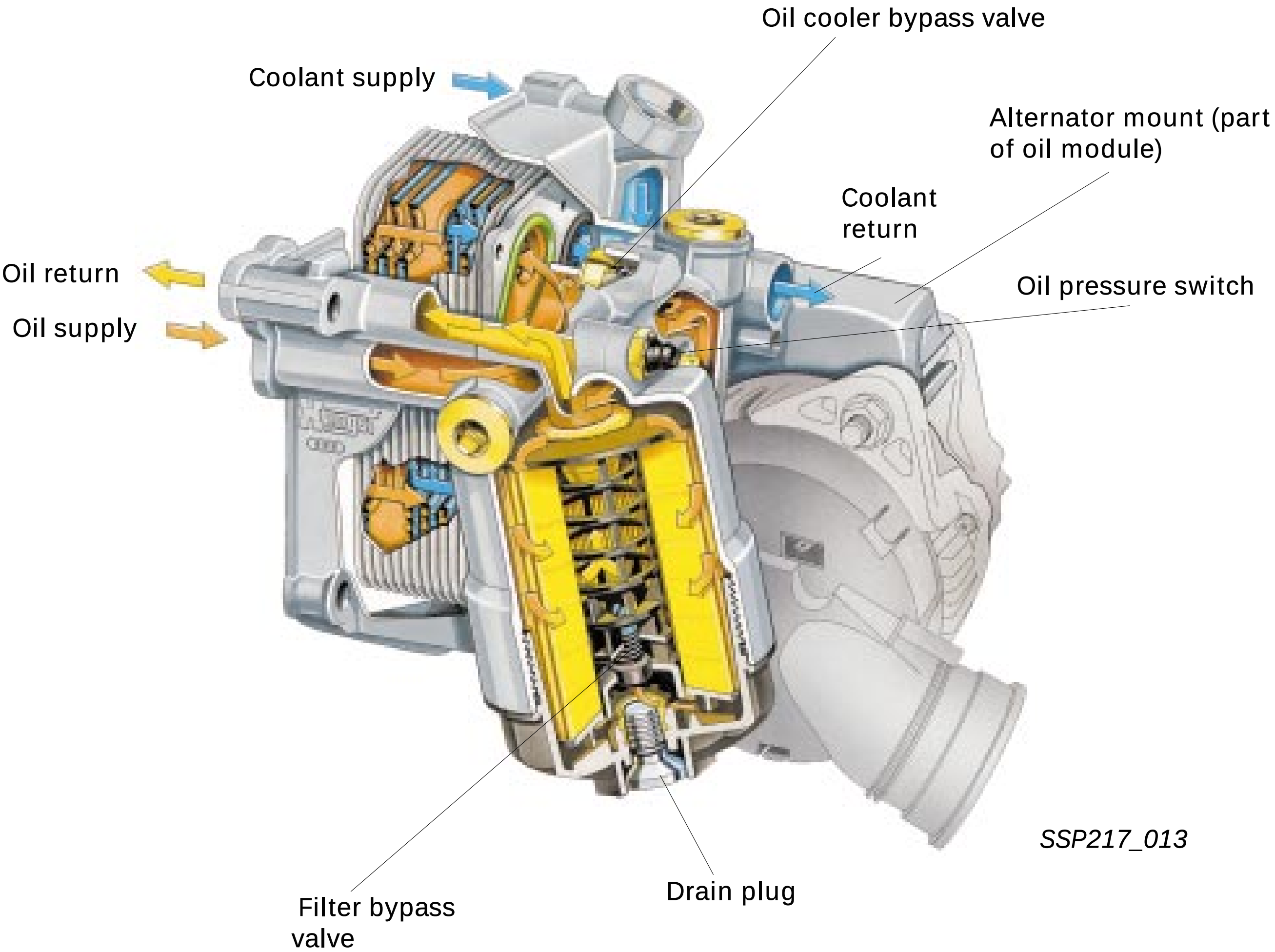
The roller rockers are described on pages 20 and 21.



Slight modifications have been made to the oil circuit in the cylinder heads.
The oil circuit for cylinder bank 2 shown in the illustration is the oil circuit that has been used since the introduction of the new model.
Cylinder bank 1 shows the modified oil circuit.



Oil filter module (A8)

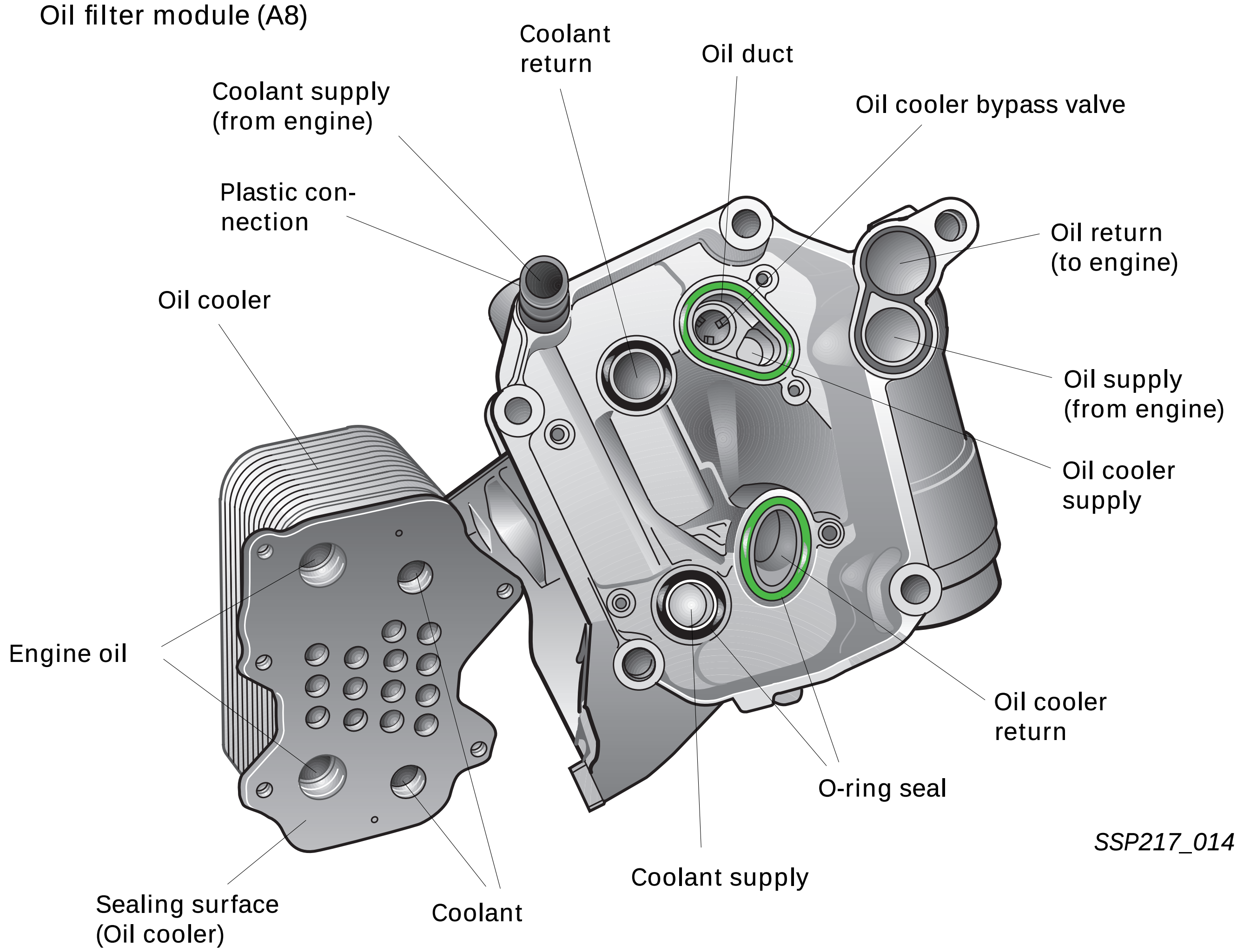


SSP217_013

The oil filter module contains the oil filter and oil cooler. It is also used to hold the alternator.

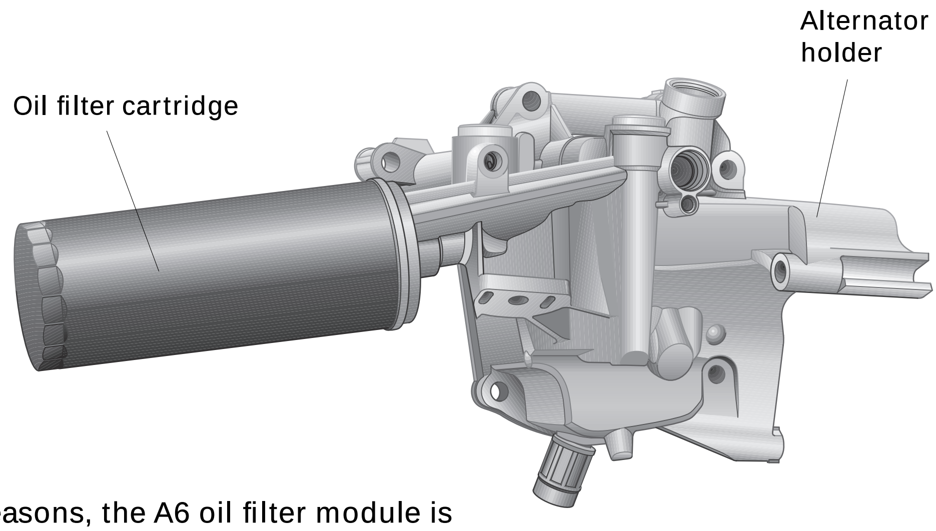
As was previously the case, the oil cooler is designed as a coolant-to-oil heat exchanger. The “housing-less“ oil cooler is bolted to the oil filter module using an O-ring seal to form a single unit.

Oil filter module (A8)



SSP217_014

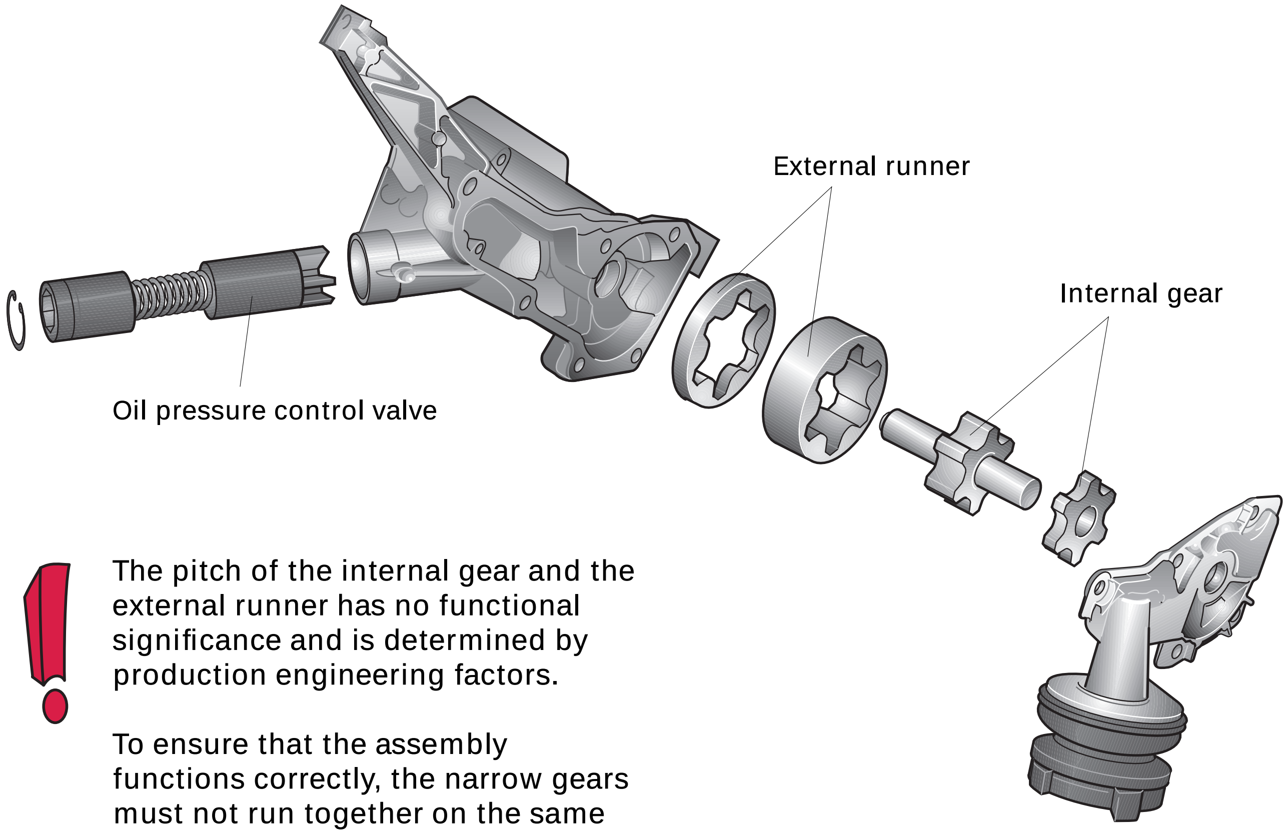
Oil filter module (A6)



SSP217_003

For space reasons, the A6 oil filter module is fitted with an oil filter cartridge.

Duocentric oil pump



The pitch of the internal gear and the external runner has no functional significance and is determined by production engineering factors.

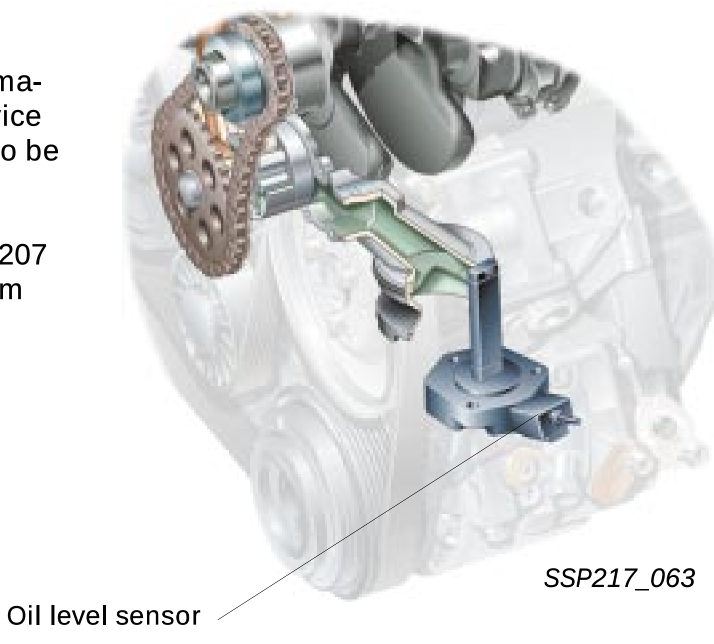
To ensure that the assembly functions correctly, the narrow gears must not run together on the same plane.

SSP217_012

Oil level sensor

The oil level sensor functions as an information sender which allows the flexible service interval to be calculated and the oil level to be displayed in the dash panel insert.

Further information can be found in SSP 207 (from page 84 onwards) and SSP 213 (from page 55 onwards).

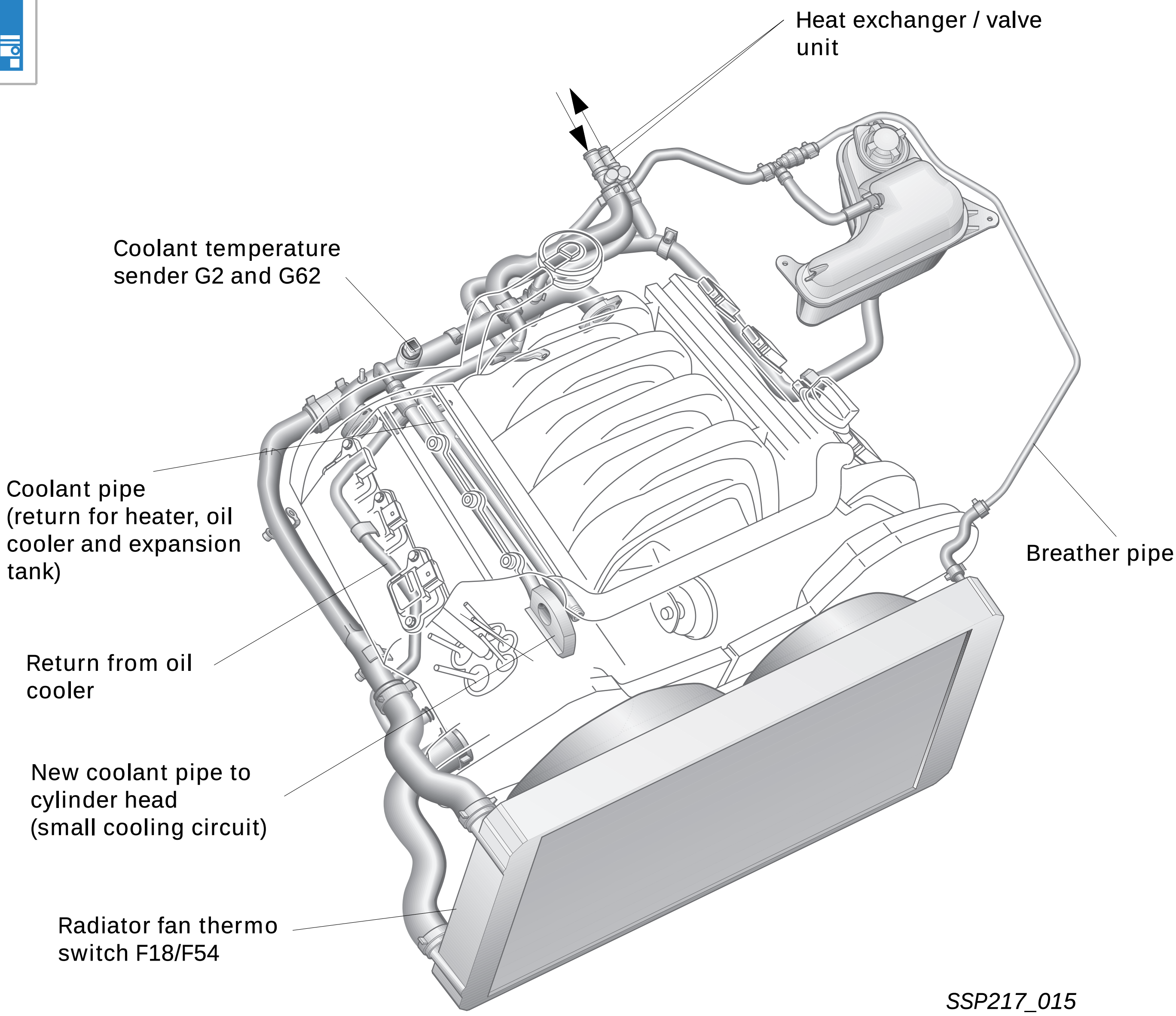


SSP217_063

Notes

Cooling circuit

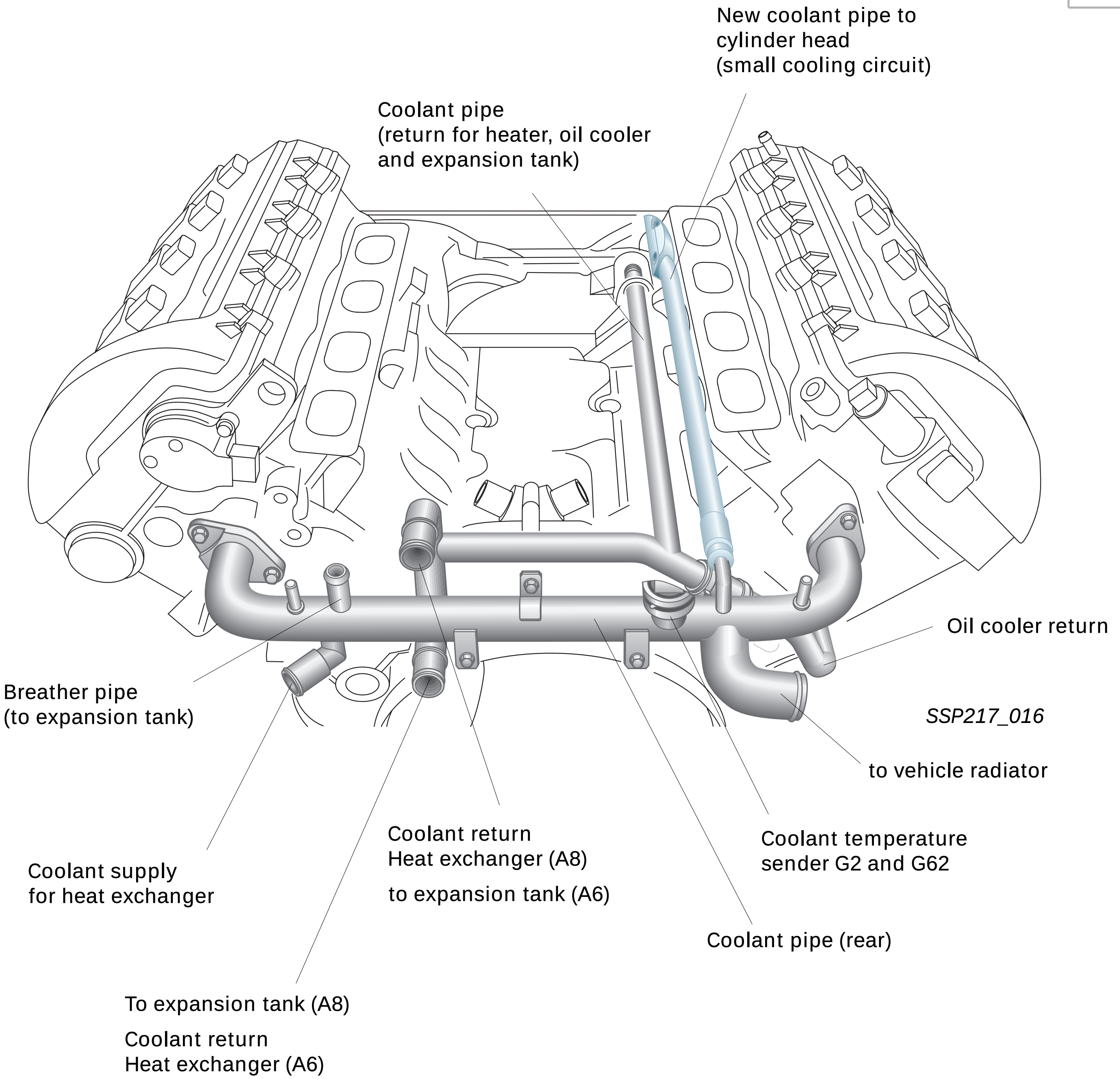
(Example: A8)



SSP217_015

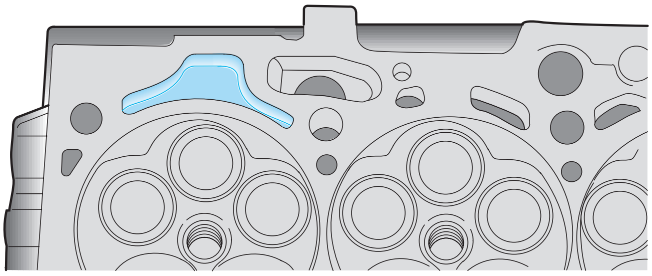
The flow direction of the coolant has been changed in the new V8 5-valve engines.
As with the V6 engines, the coolant leaving the cylinder heads merges in the rear coolant pipe from where it is then led off to the cooler.

The new coolant pipe alters the coolant flow in the „small“ cooling circuit.



Previous design:

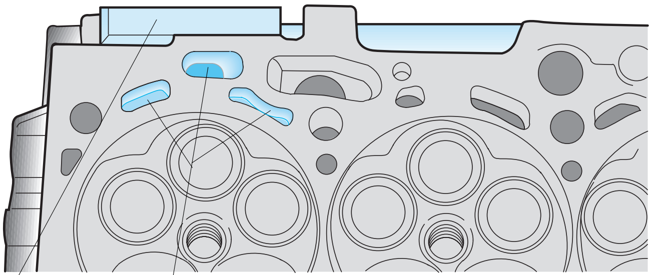
The coolant thermostat is connected to the “small coolant circuit“ via two holes in the cylinder crankcase (see Fig. 217_017).
The holes are directly connected to the cylinder-head water jacket (1st cylinder) and the water jacket of the cylinder crankcase. The heated coolant flows from the 1st cylinder to the coolant thermostat.



SSP217_018

New design - modified components:

– Cylinder head in bank 1 modified
– Additional coolant pipe
– Rear coolant pipe modified



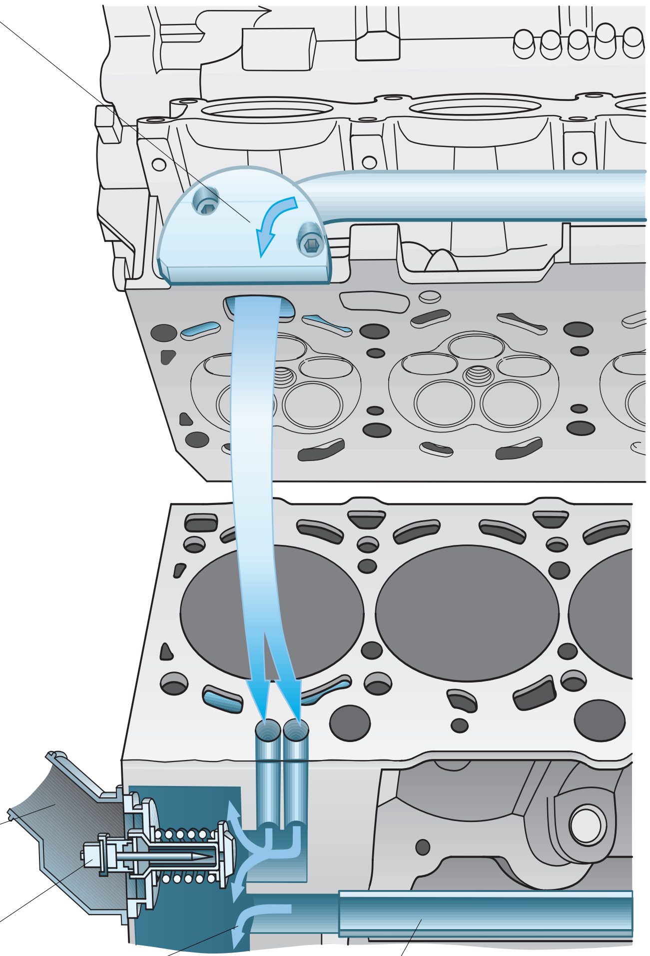
SSP217_019

The connection in the cylinder head to the water jacket (cylinder crankcase) has been split (see Fig. 217_019).

The coolant from the rear coolant pipe is forked by the new coolant pipe (mixture from all cylinders) and then passes through the cylinder head to the two holes which lead off to the coolant thermostat.

This ensures uniform temperature control.

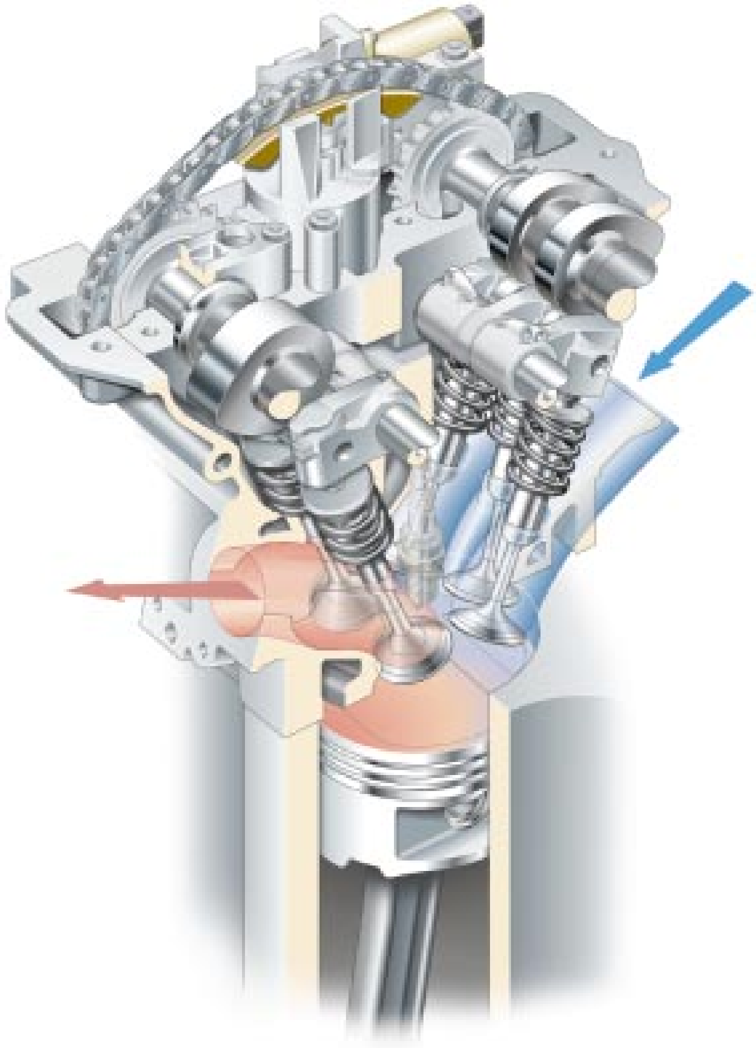
The function of the cylinder head is to connect the coolant pipe to the two holes leading off to the coolant thermostat.



SSP217_017

Cylinder head

Five-valve technology



SSP217_020

Five-valve technology is now also being used in the V8 engines.

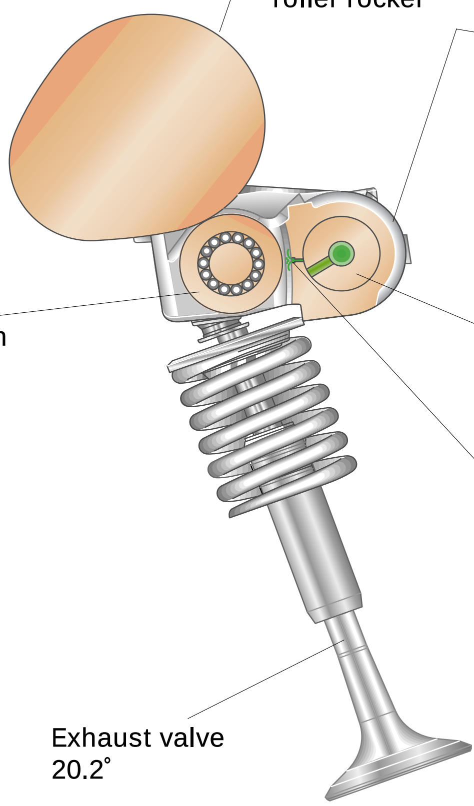
Roller rockers are being used for the first time in the enhanced five-valve cylinder head. This considerably reduces frictional losses in the valvegear which, in turn, significantly improves efficiency.

The rockers are made of die-cast aluminium in order to keep inertia forces as low as possible. As a result, the valvegear is able to function reliably at engine speeds of up to 7200 rpm.

The use of roller rockers has not only meant a considerable reduction in frictional losses in the valvegear, but has also halved the oil delivery rate in the cylinder heads. This also has a positive effect on the degree of efficiency.

Roller rocker

Exhaust valve



SSP217_022

SSP217_023

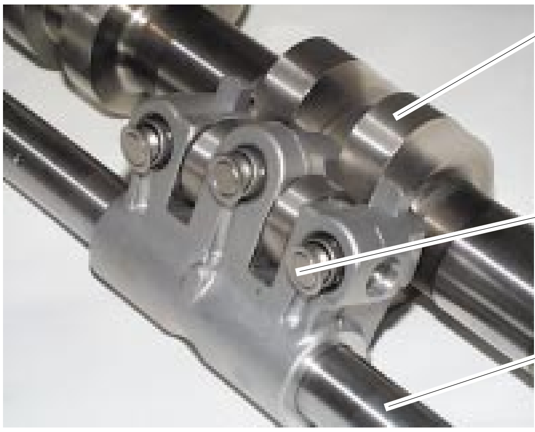
Every valve has a hydraulic valve lifter which is integrated in the rocker. The rockers are supported by a spindle shaft which is also used to supply oil to the bearings and the hydraulic valve lifters.

The two exhaust valves are actuated by a twin roller rocker.

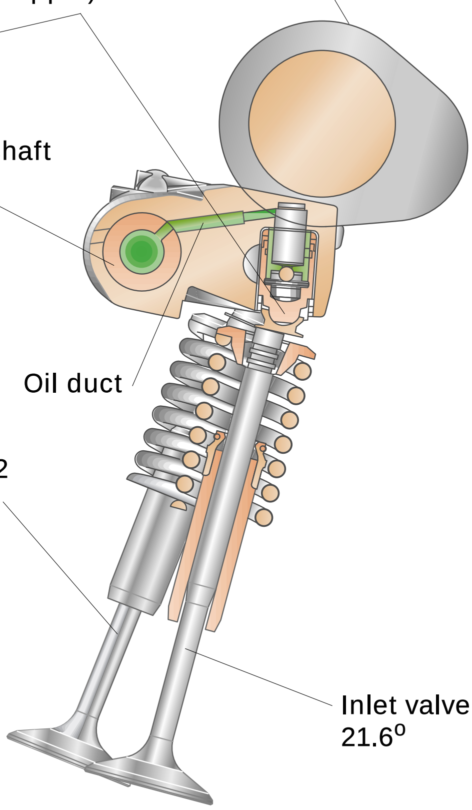
The single cam actuates the rocker by means of a roller located between the rocker arms.

The individual hydraulic valve lifters can be replaced without the rockers needing to be removed.

Inlet valve



Triple roller rocker *SSP217_025*

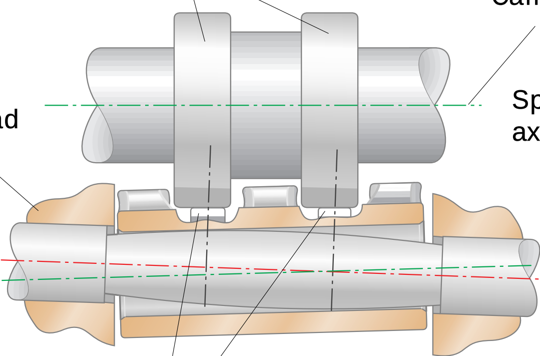


SSP217_024

The three inlet valves are actuated via a triple roller rocker.
A double cam actuates the rocker by means of two rollers between the rocker arms.

Tolerance compensation for inlet triple RR (roller rocker)

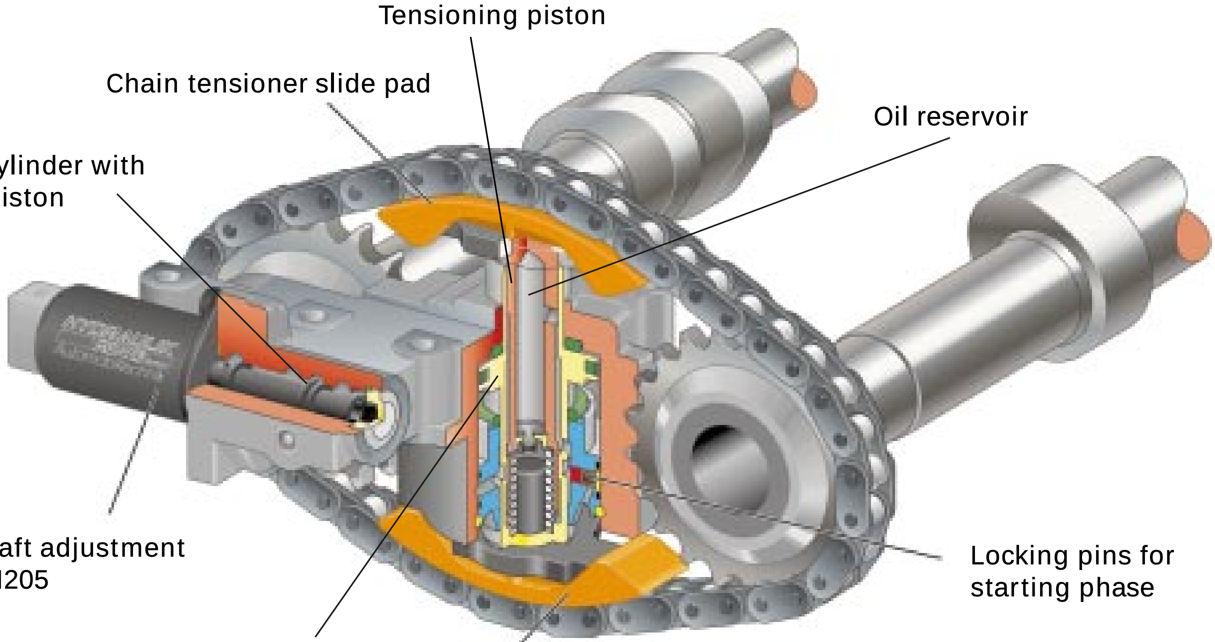
To ensure uniform compression between the two cams and rollers of the roller rockers, the spindle shaft of the inlet roller rocker is convex in shape in order to compensate alignment and component tolerances. This prevents the roller rockers from “tilting“.



SSP217_021

For the sake of clarity, the tolerance of the spindle shaft relative to the camshaft has been greatly exaggerated in the illustration.

Camshaft adjuster (cylinder bank 1)



SSP217_026

The camshaft adjustment system, a feature incorporated in Audi's current range of engines, is also used in the new generation of V8-5V engines.

When the engine is switched off, no oil pressure is applied to the chain tensioner and camshaft adjuster.

Owing to the Ferraria effect in the chain drive when the engine is started, vibrations which generate noise occur until sufficient oil pressure has built up.

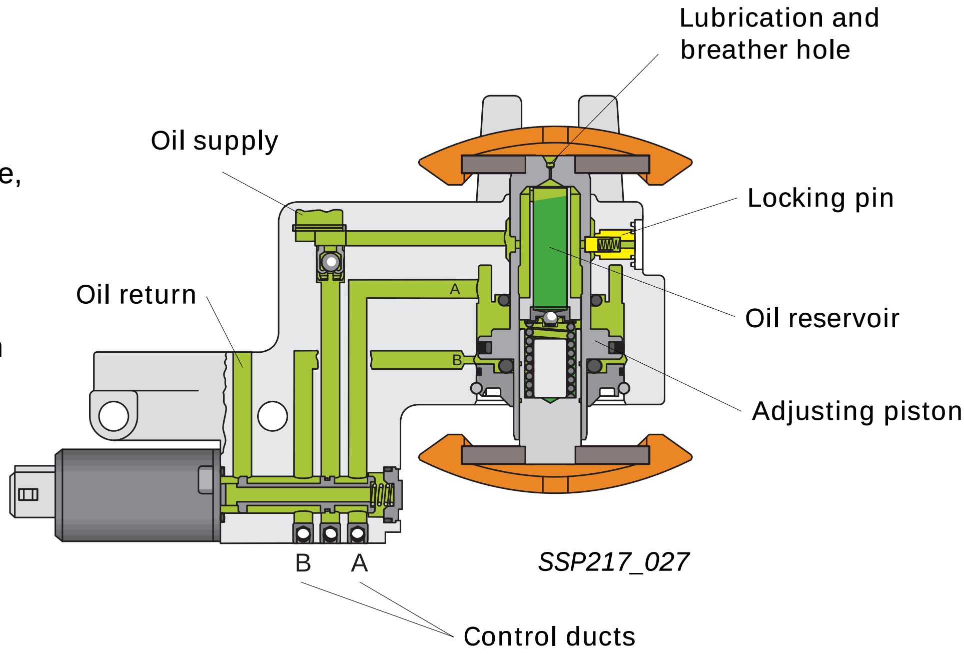
In the case of the new V8 engines, an interlock function and an oil reservoir were added to the proven system during the course of further development.

These new features prevent vibrations in the chain drive which has a positive effect on acoustic behaviour during the start phase.

The principle of camshaft adjustment is described in SSP 182.

Engine off:

If there is no oil pressure, a spring-loaded locking pin is pushed into the detent slot of the adjusting piston. The adjusting piston is then locked.



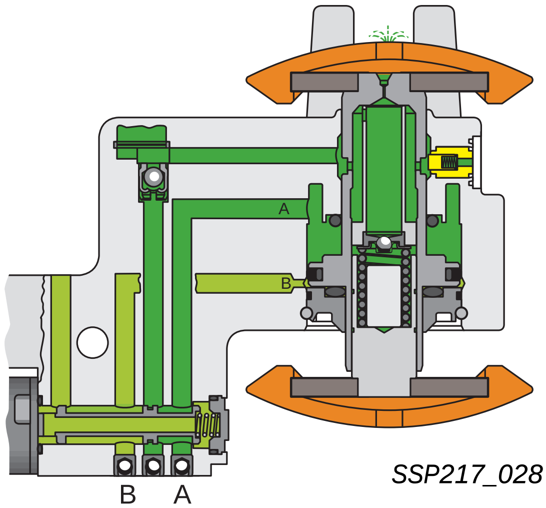
SSP217_027

Engine start:

The adjusting piston is locked until sufficient oil pressure has built up. This prevents vibrations in the chain drive and, therefore, noise generation.

The camshaft adjuster is locked in the “Retard position“.

Retard setting
(Basic and power setting)

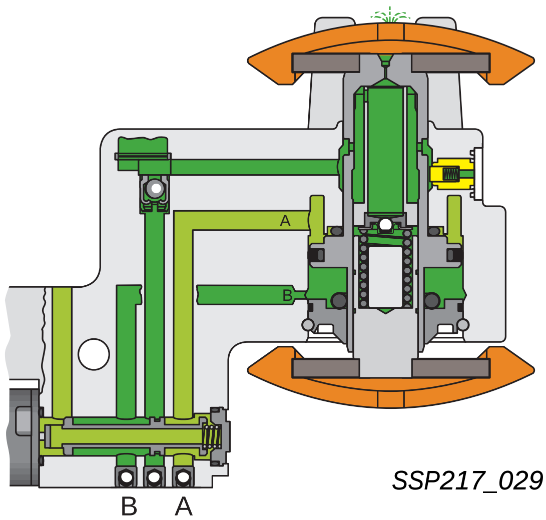


SSP217_028

Engine running:

Once a defined oil pressure has been reached, it acts on the surface of the locking pin, i.e. against the resistance of the spring.
The locking pin releases the adjusting piston so that the engine control unit can adjust the timing in the “Advance“ direction.

Advance setting
(Torque setting)



SSP217_029

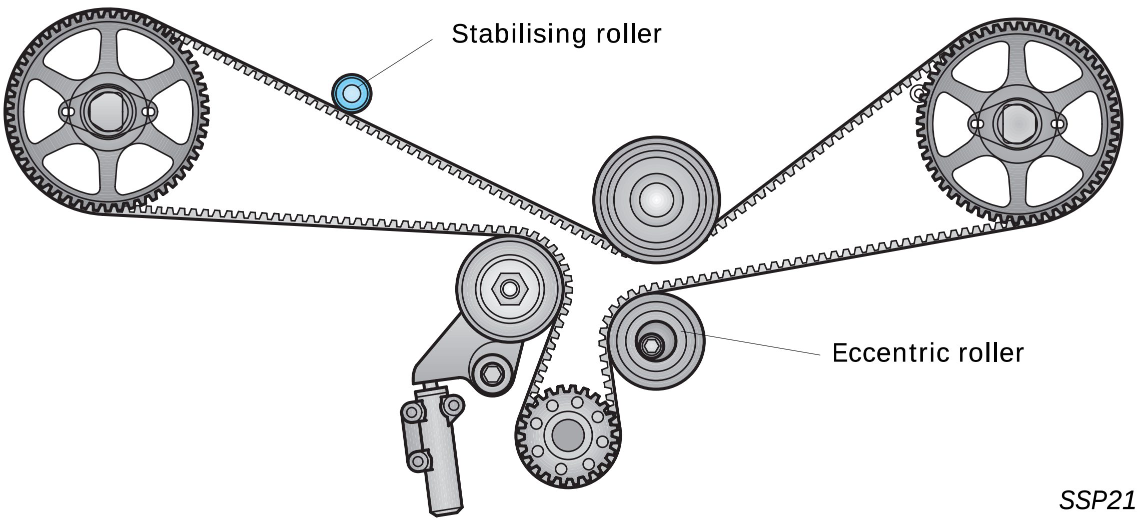
Oil reservoir

The oil reservoir ensures that the pressure chamber of the tensioner piston is filled during the non-pressurised phase of the starting cycle.
This also has a positive effect on acoustic behaviour when the engine is started.

A hole in the top of the oil reservoir allows air to escape and supplies the chain with oil.

Toothed-belt drive

The toothed-belt drive is identical to that of the V6-5V engine. The V8-5V engine is also fitted with a stabilising roller.
The components are largely identical to those of the V6-5V engine.



SSP217_038

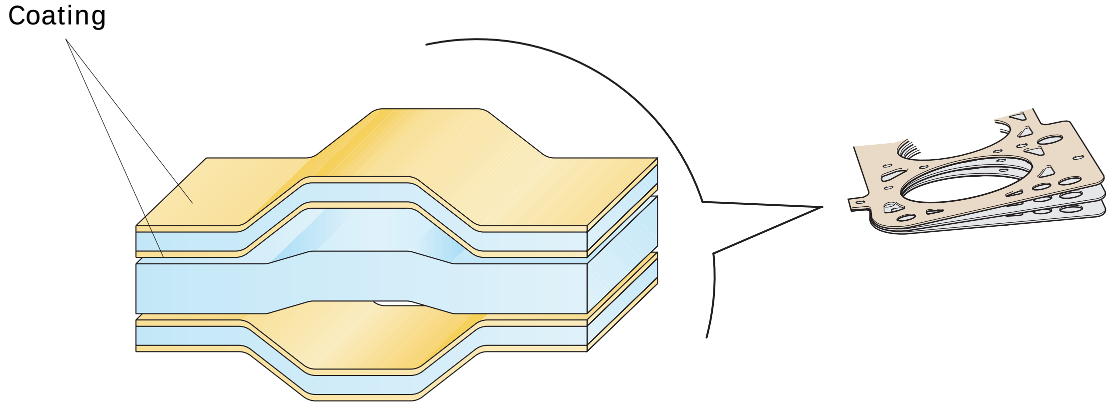
Cylinder-head seal

The new V8-5V engines have a multi-layer metallic cylinder-head seal already used in the 4 and 6-cylinder engines. This seal replaces the soft seal used in previous models.

It consists of 3 individual metallic layers. The two outermost layers are treated with a special coating.

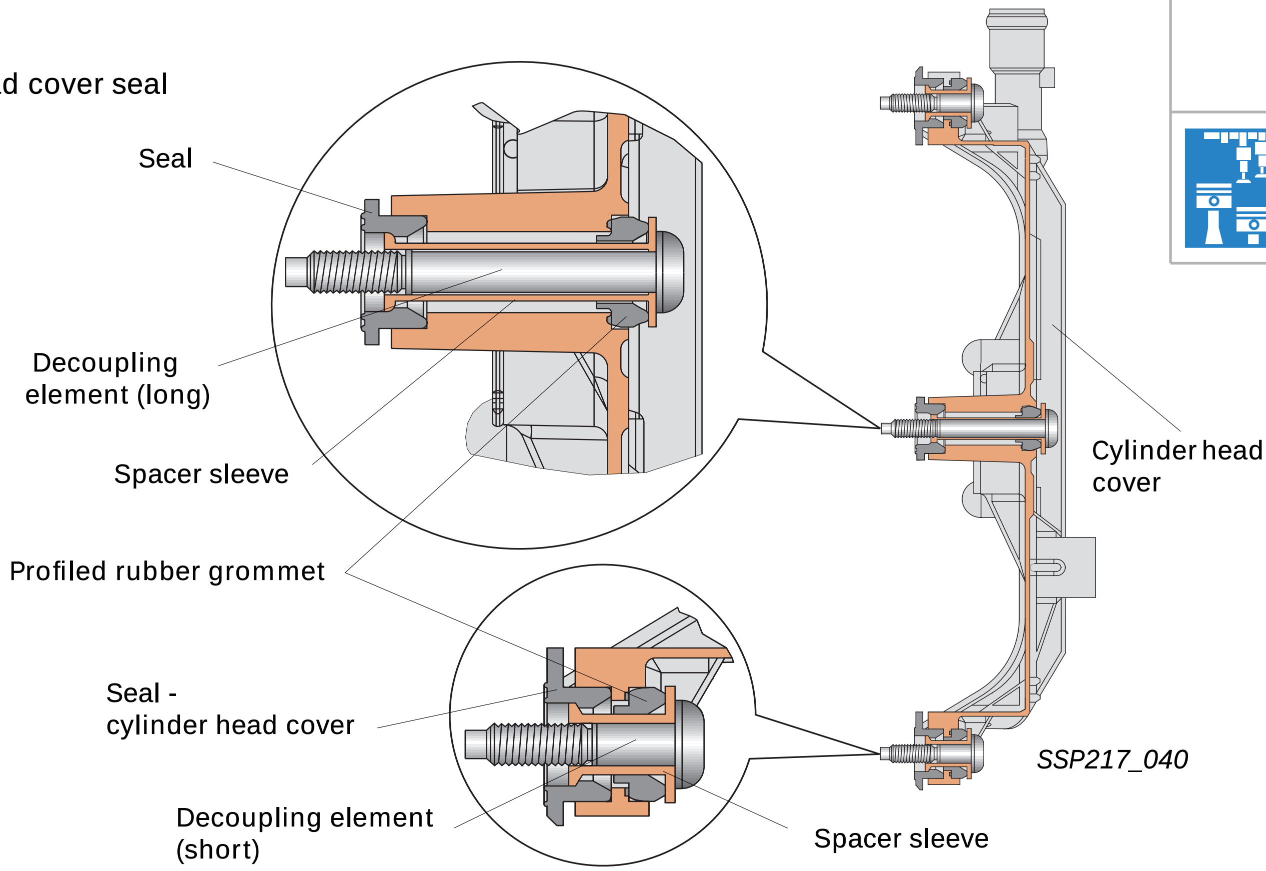
Advantages:

– Very good settling behaviour
– Improved durability



SSP217_056

Cylinder-head cover seal



SSP217_040

The thin-wall cylinder head covers are made of a die-cast magnesium alloy. A seal concept, which decouples the cylinder head cover from the cylinder head, improves the acoustics of the engine.

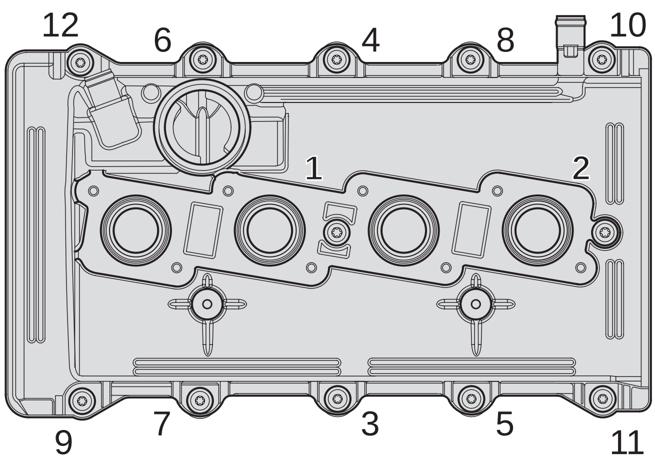
The bolted connections of the cylinder head cover have decoupling elements.

A seal, which is similar to a radial shaft oil seal, is used for the spark-plug shaft.

The above-mentioned measures means that the cylinder head cover is not directly coupled with the cylinder head. It is, therefore, “insulated“ against vibrations generated by the engine.

The securing bolts must be tightened uniformly in the specified order to prevent distortion of the cylinder head cover and to ensure that the seal is completely air-tight.

Always refer to the information given in the repair manual.



SSP217_043