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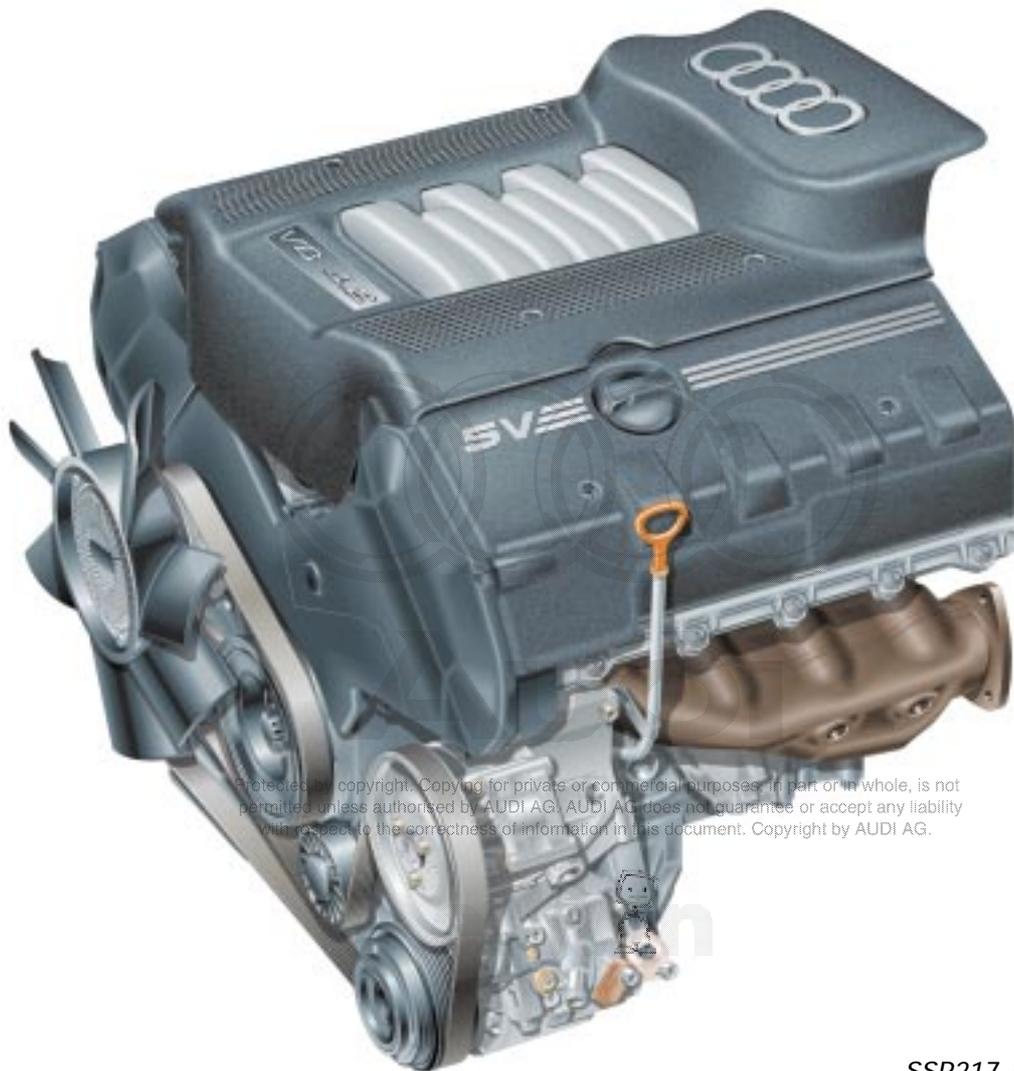
## The V8-5V Engine

### Construction Features and Functions

### Self-Study Programme 217

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.



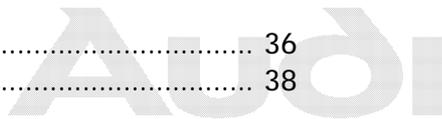
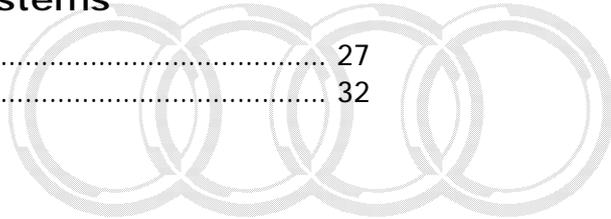
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SSP217\_048

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.

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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!



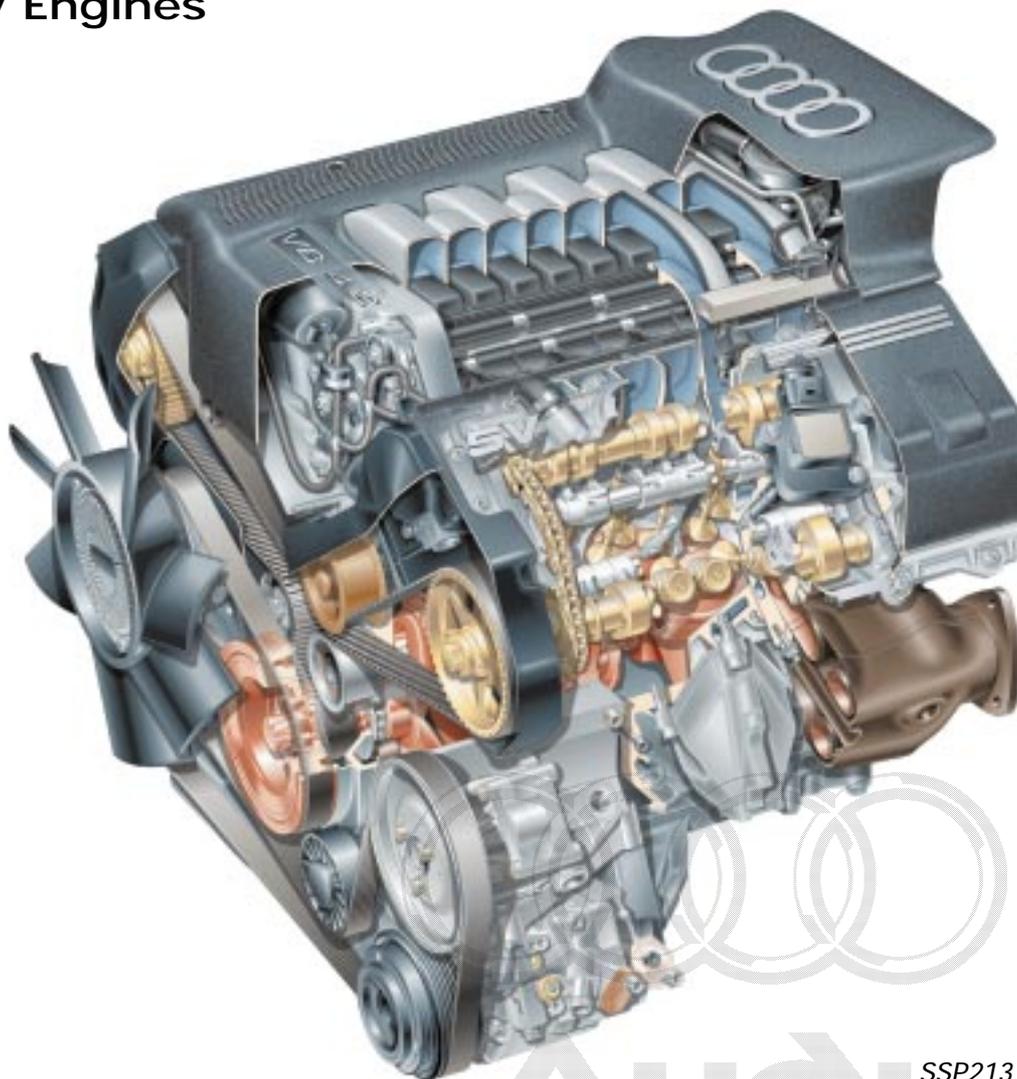
Caution!  
Important!



# Introduction



## 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

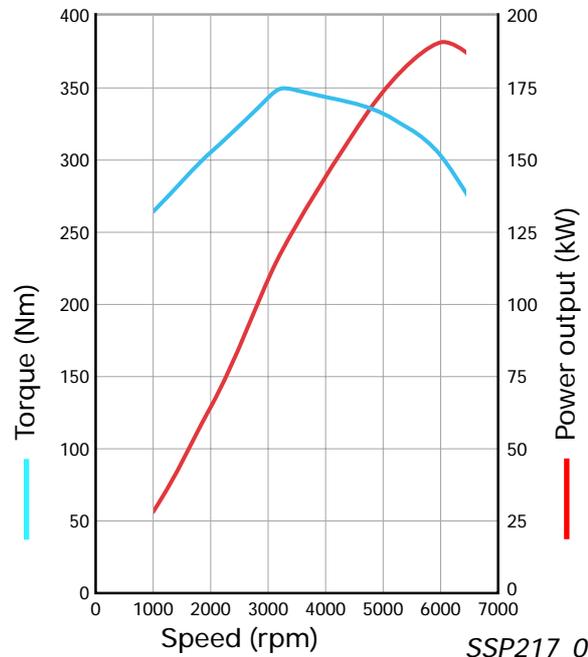
### Modifications

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

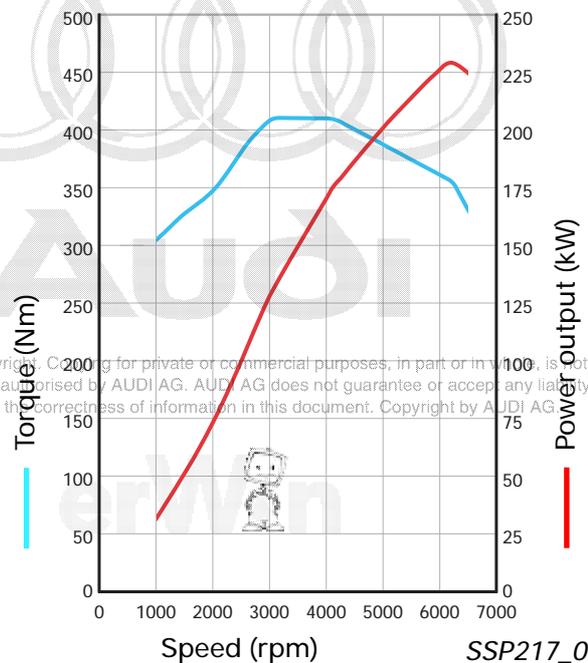
## Technical data

	3.7 l	4.2 l
Engine code	AQG	AQF (A8) ARS (A6)
Design	V8 engine with 90° V angle	
Capacity	3697 cm <sup>3</sup>	4172 cm <sup>3</sup>
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

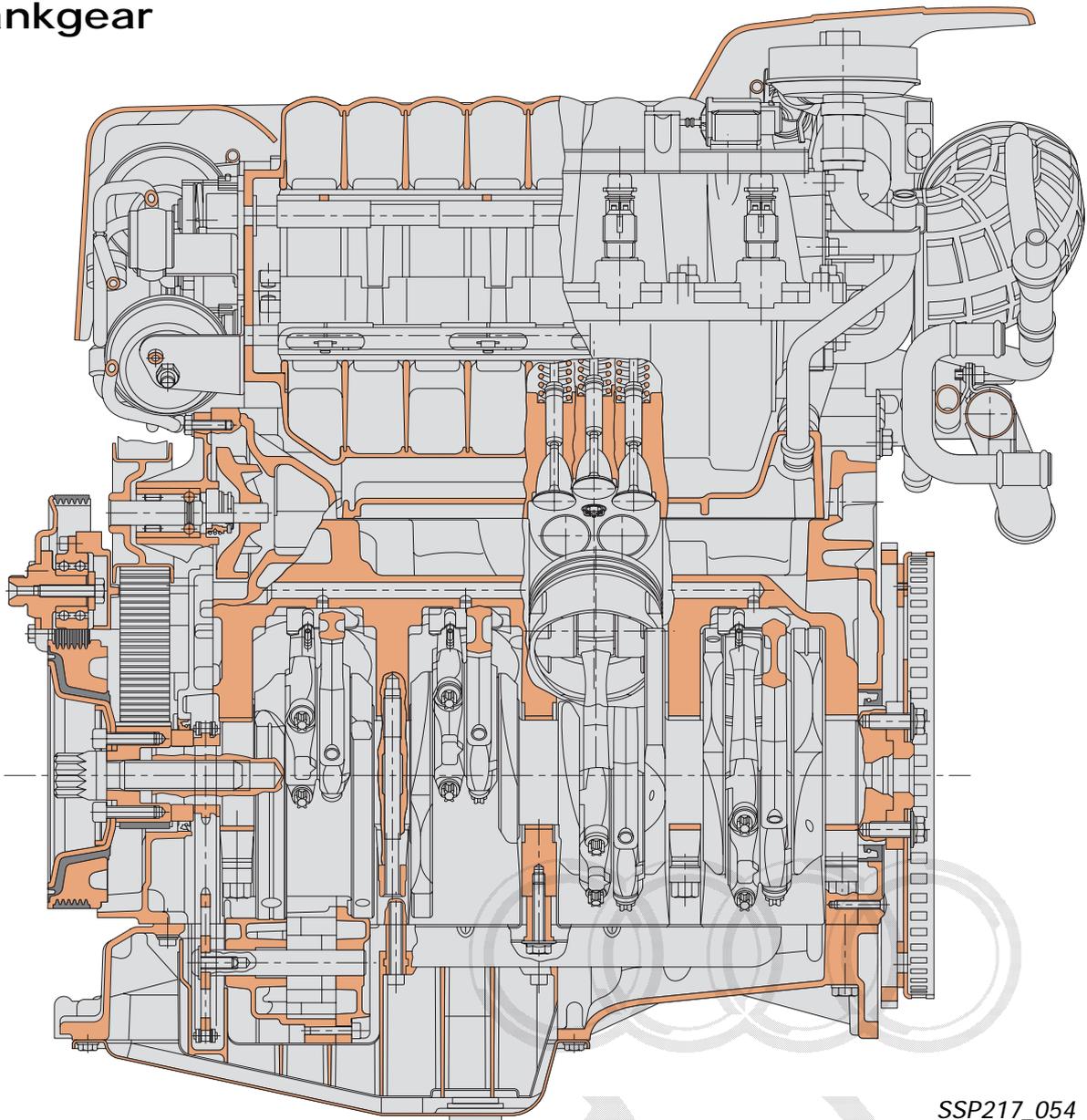


4.2 l V8-5V engine



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.

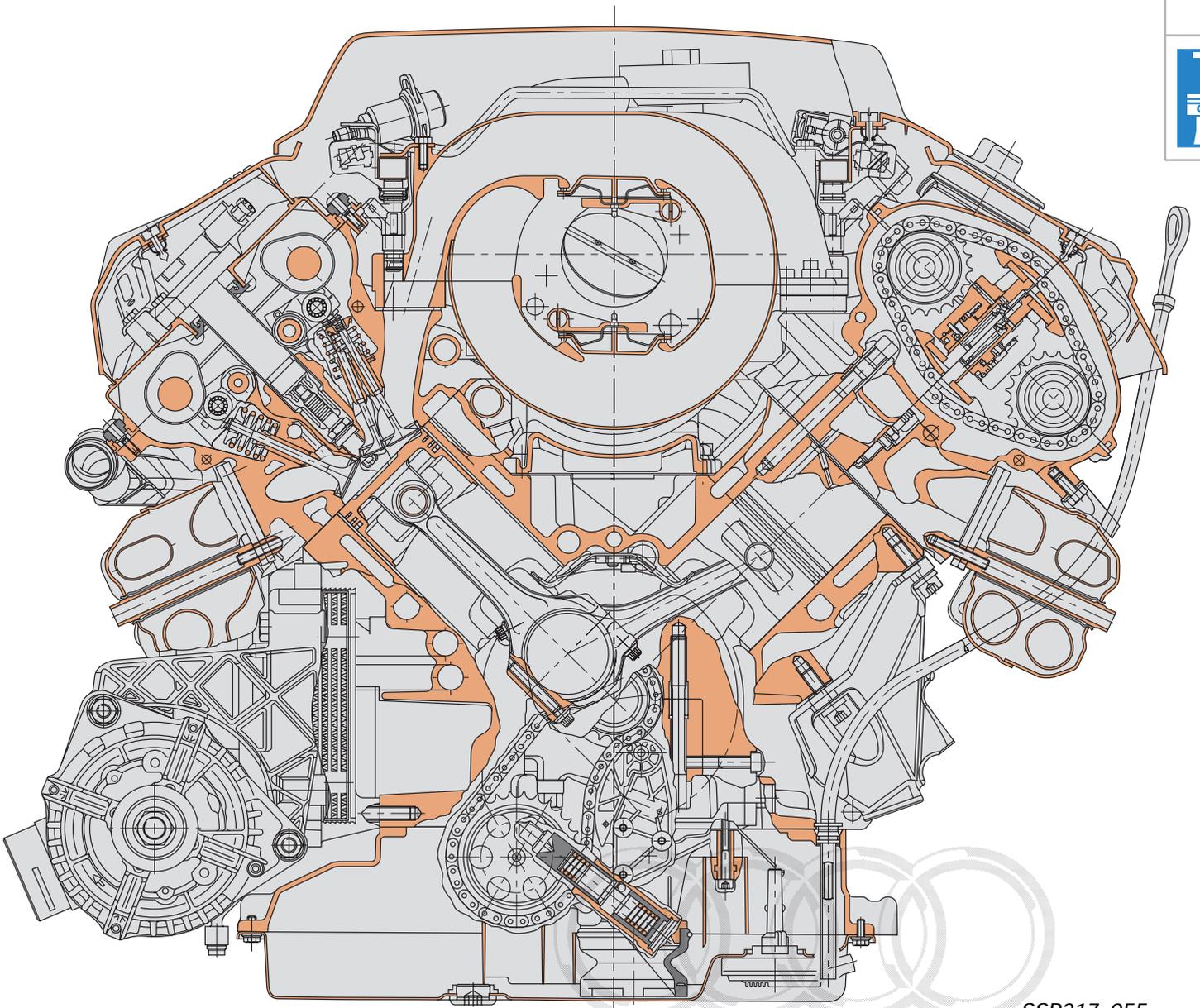
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Cracked-steel conrods have been used for the 3.7 l engine since 1995 and are now also being used for the 4.2 l engine.

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.

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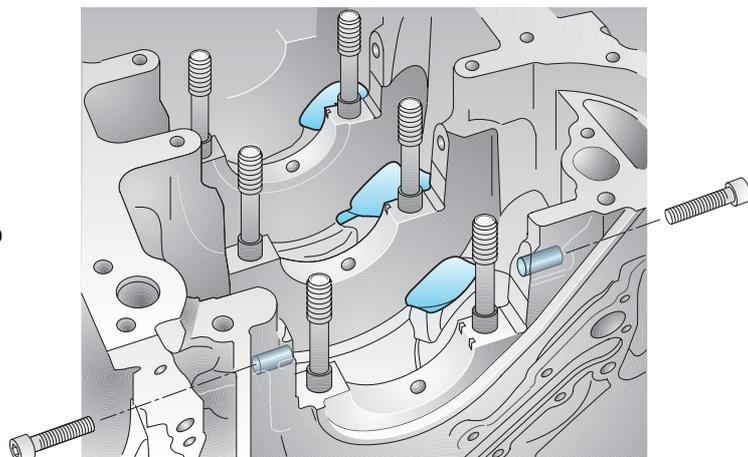
SSP217\_002

# Engine - Mechanics



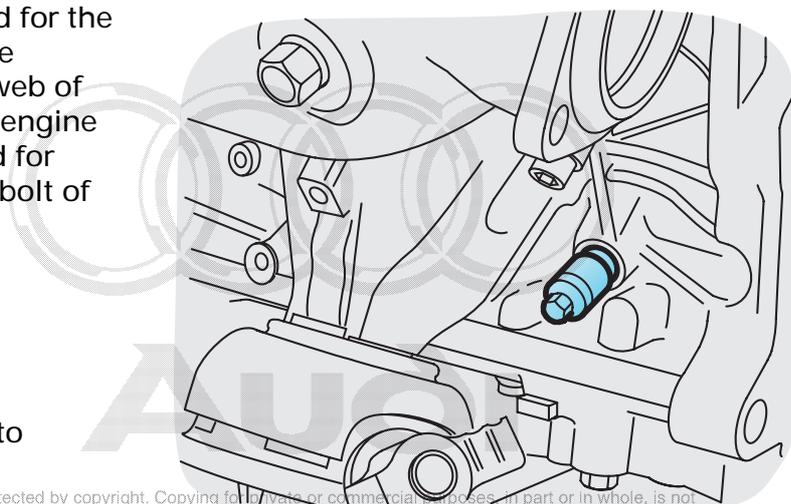
Wide, milled ventilation recesses above the thrust bearings reduce pumping losses.

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.



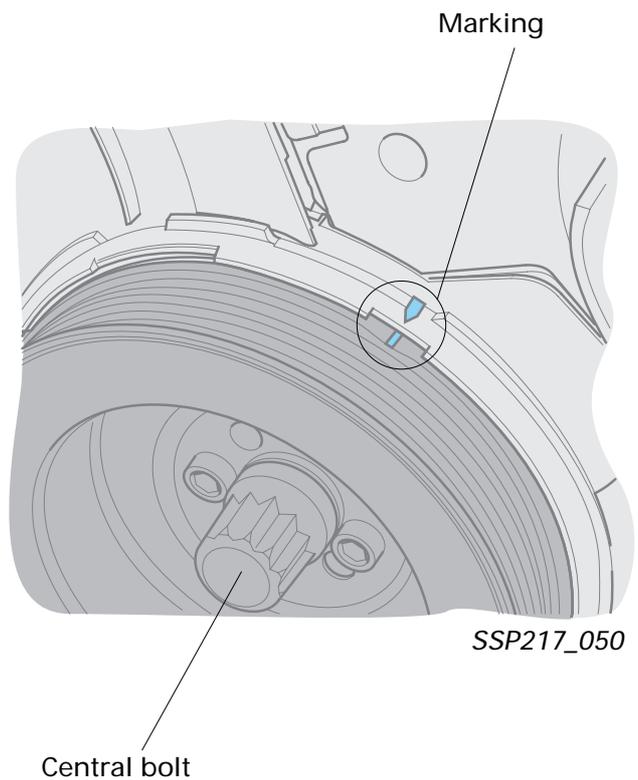
The 5th cylinder must be set to ignition TDC.

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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.

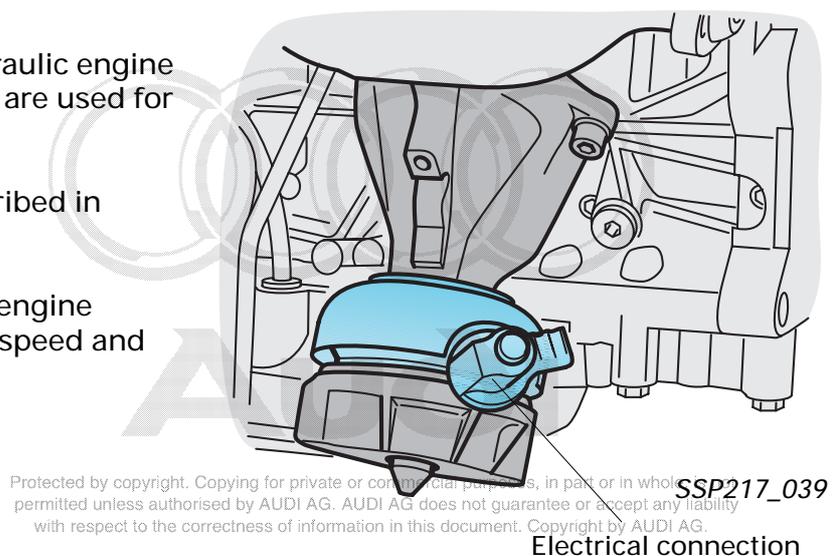


## Engine mounting

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

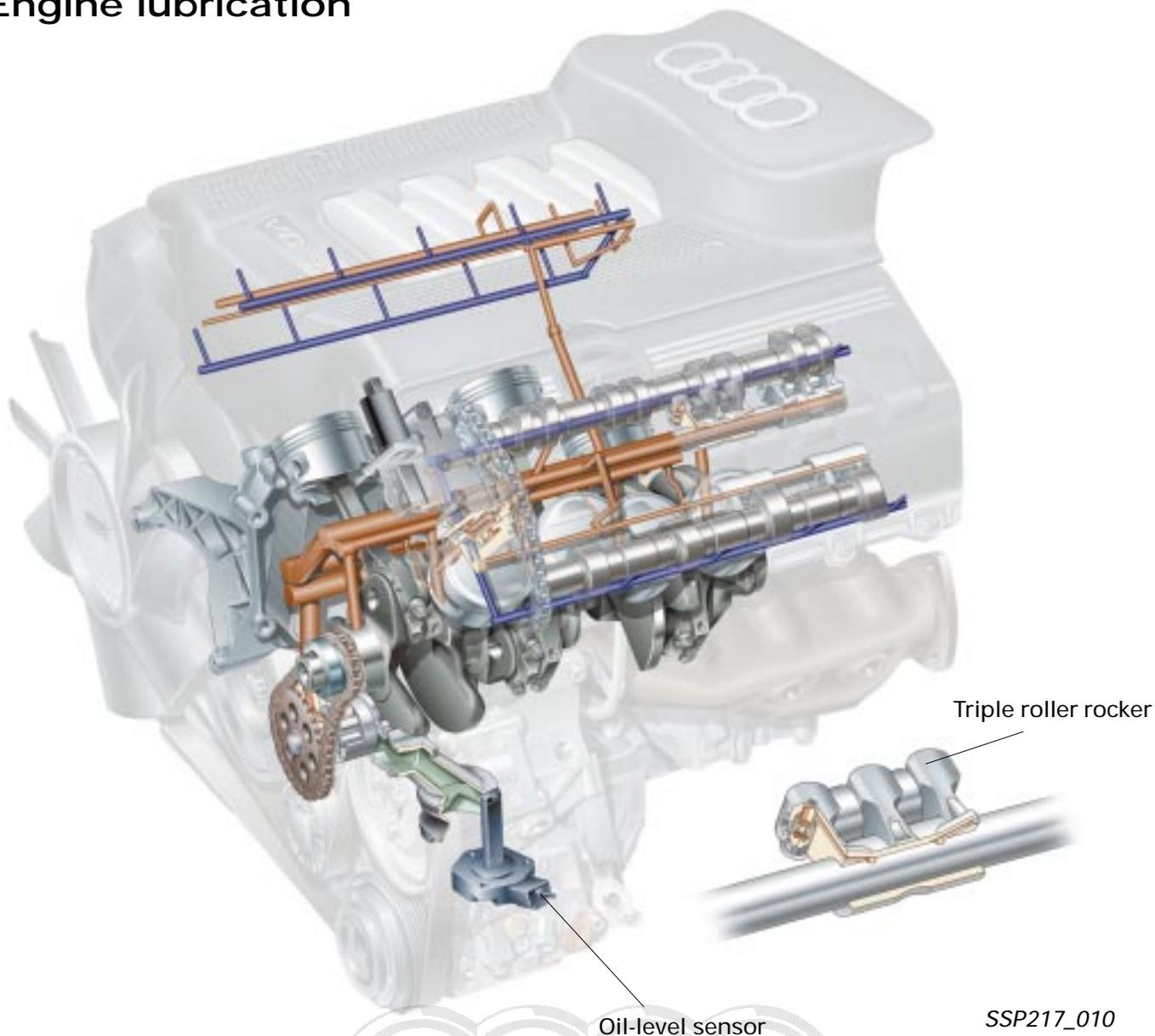
They function in the way as described in SSP 183/16.

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



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## Engine lubrication



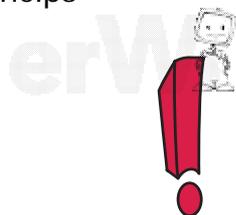
A duocentric oil pump driven by the crankshaft via a chain replaces the previously used external gear oil pump.

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.

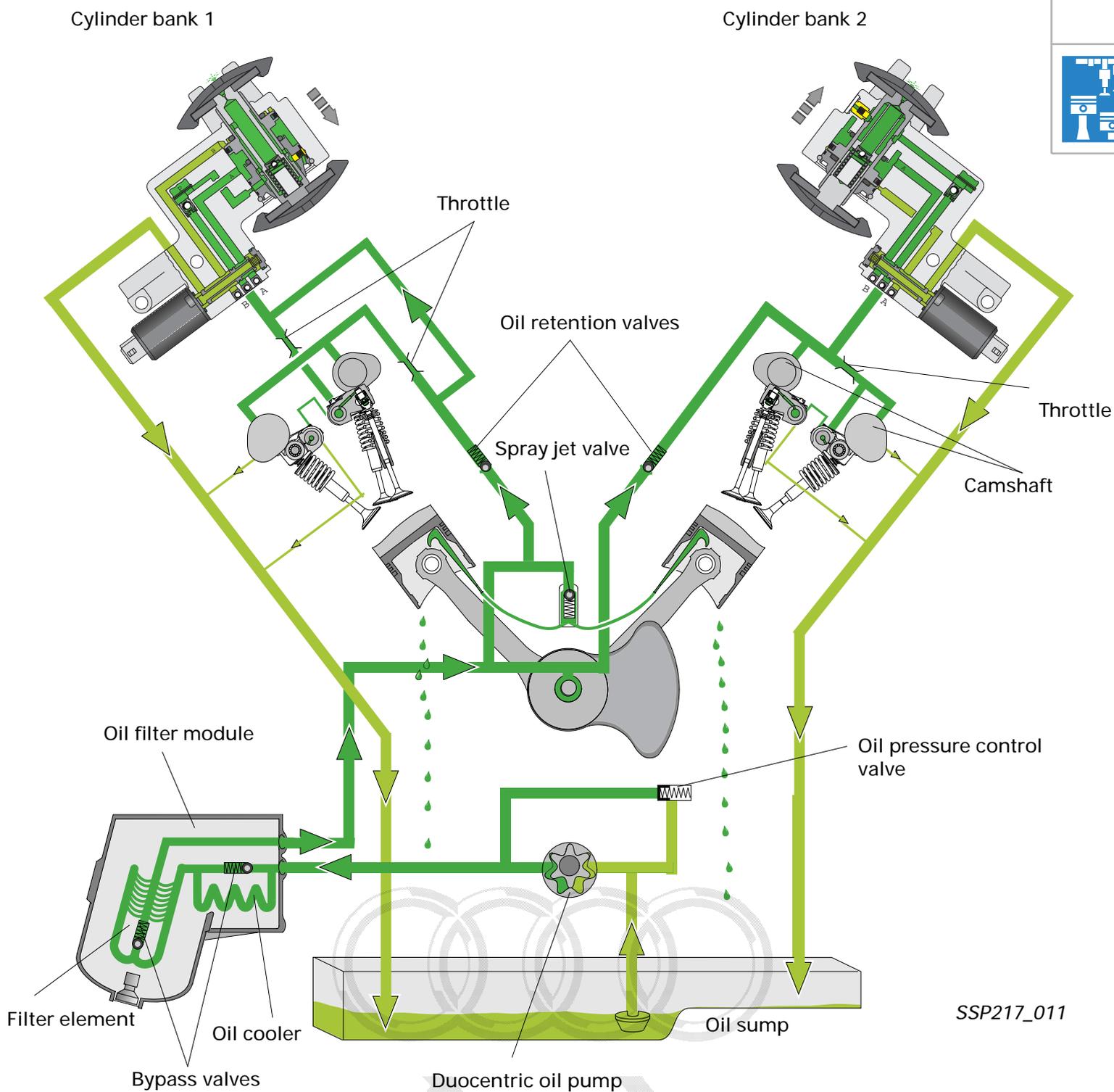
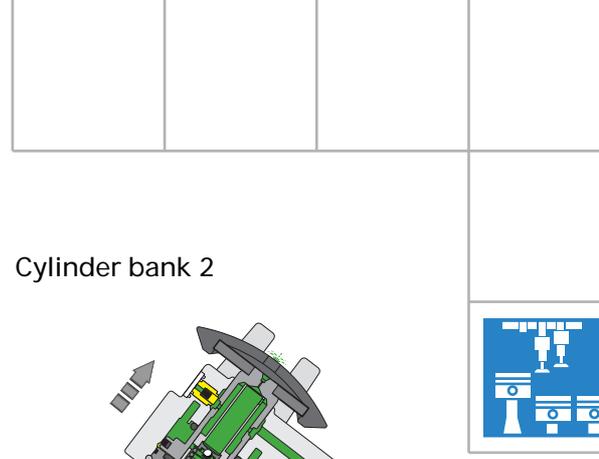
The oil-pressure control valve is located in the oil pump housing. The "diverted" oil is led off to the intake side of the oil pump. This helps optimise the level of efficiency.

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.

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The roller rockers are described on pages 20 and 21.



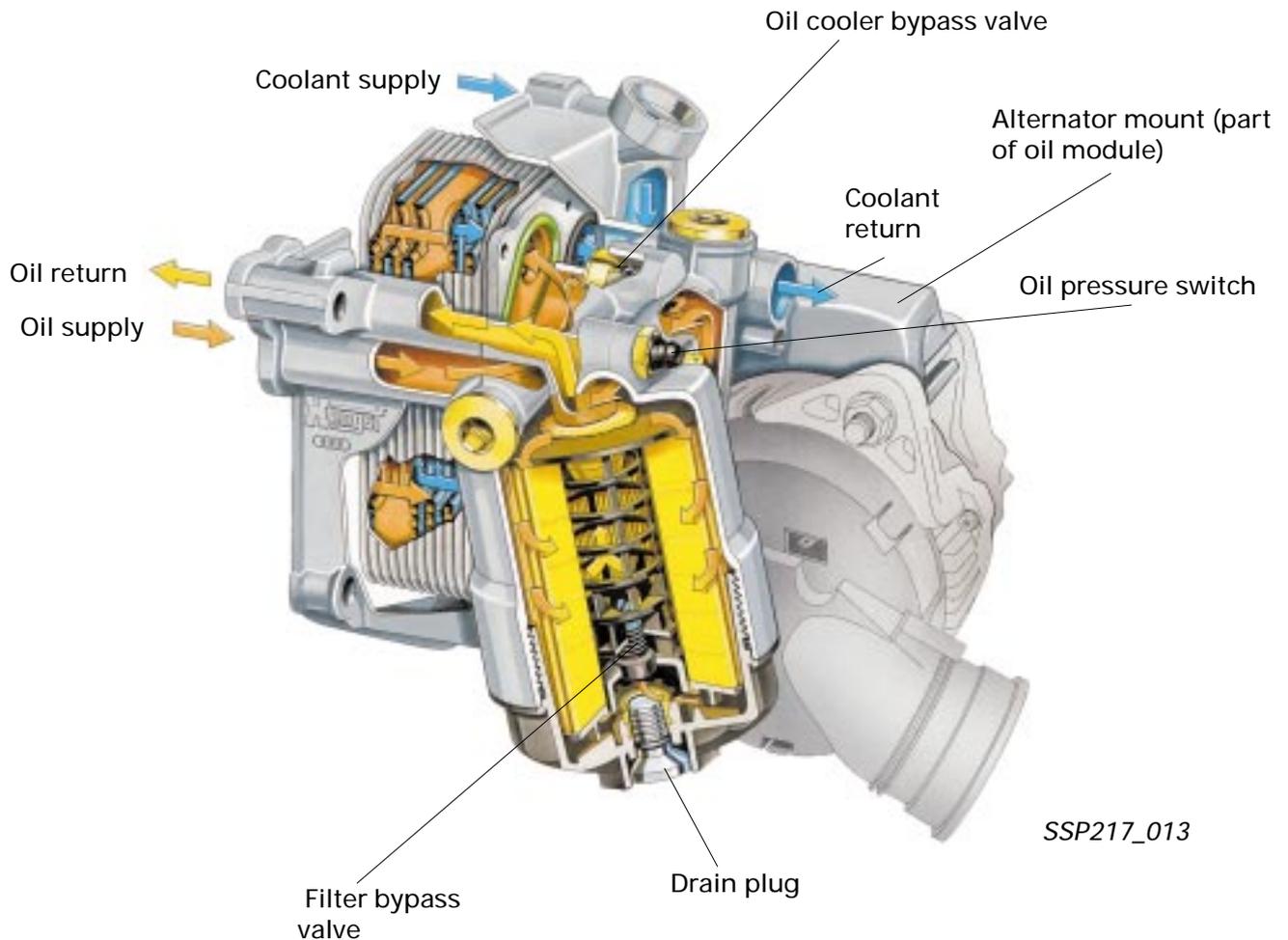
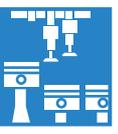
SSP217\_011

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 flow (pressurised)  
Oil flow (non-pressurised)

# Engine - Mechanics

## Oil filter module (A8)



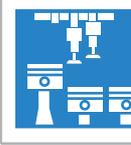
The oil filter module contains the oil filter and oil cooler. It is also used to hold the alternator.

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.

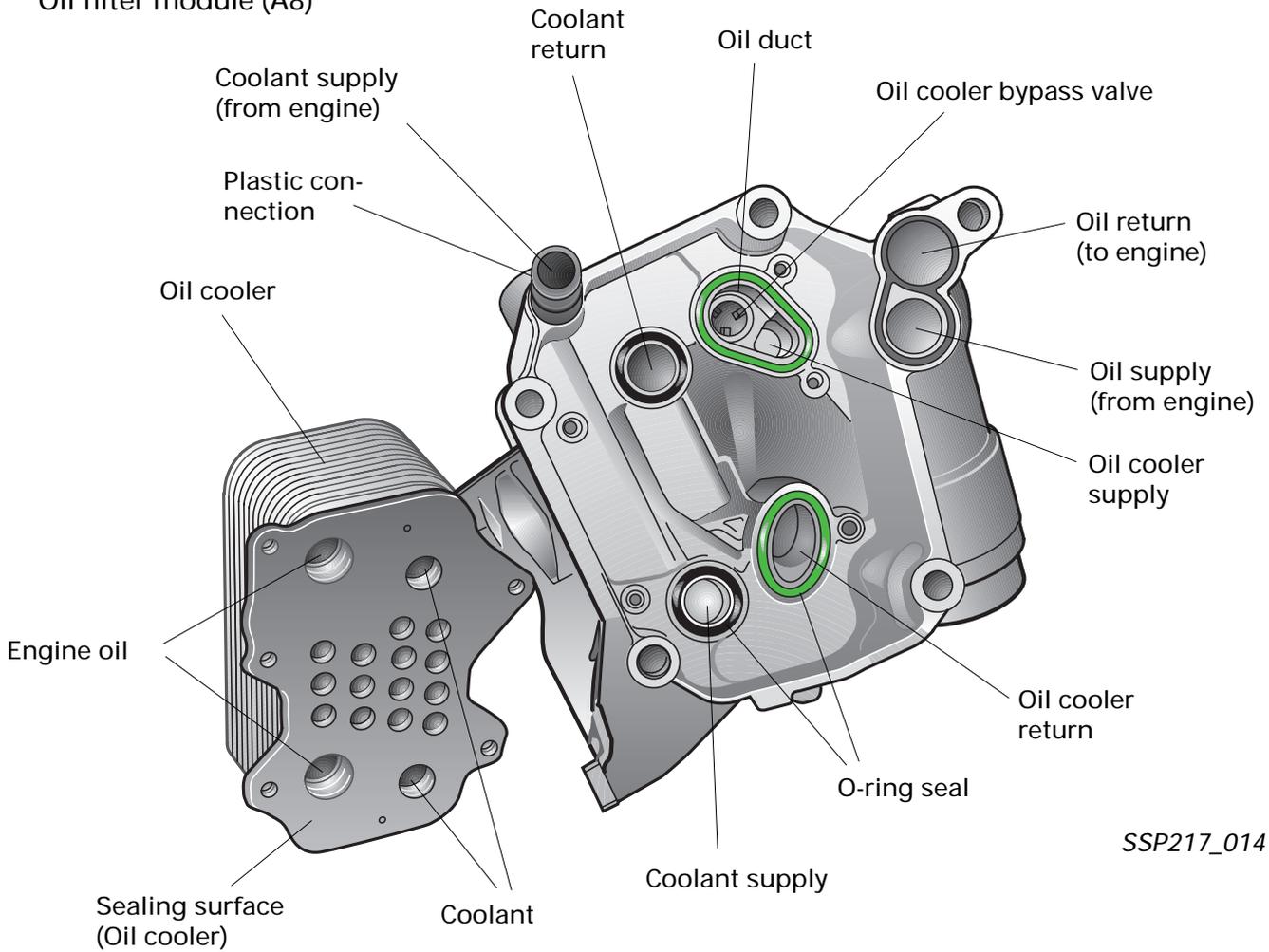
# Audi

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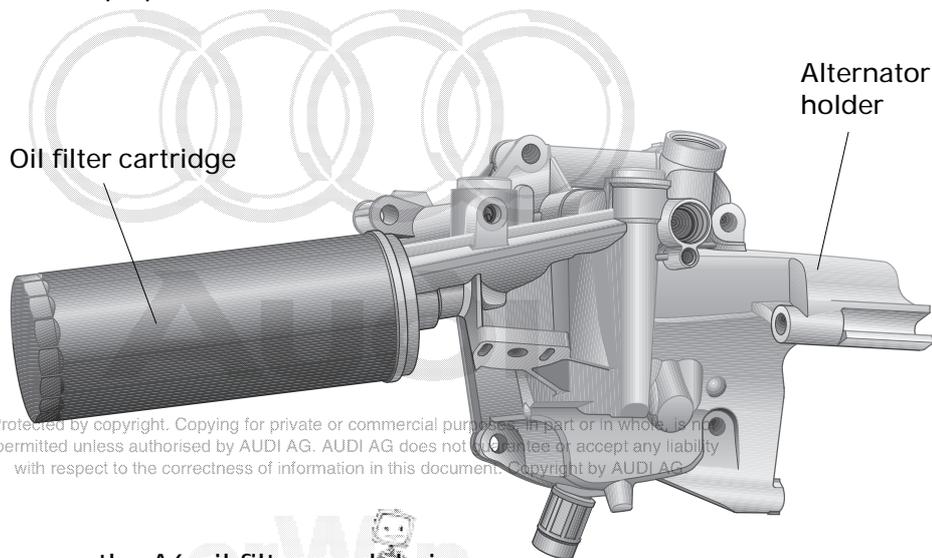


### Oil filter module (A8)



SSP217\_014

### Oil filter module (A6)



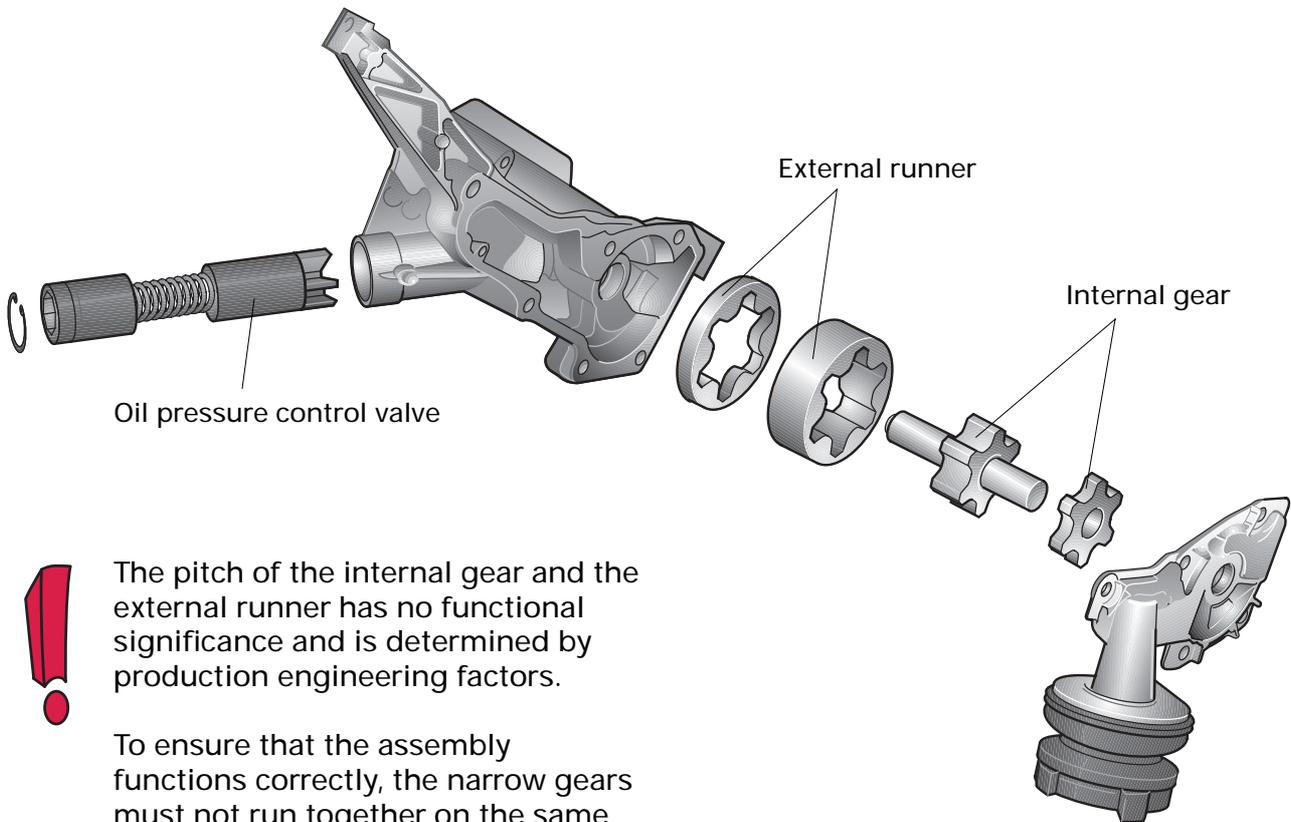
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For space reasons, the A6 oil filter module is fitted with an oil filter cartridge.

SSP217\_003

# Engine - Mechanics

## 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.

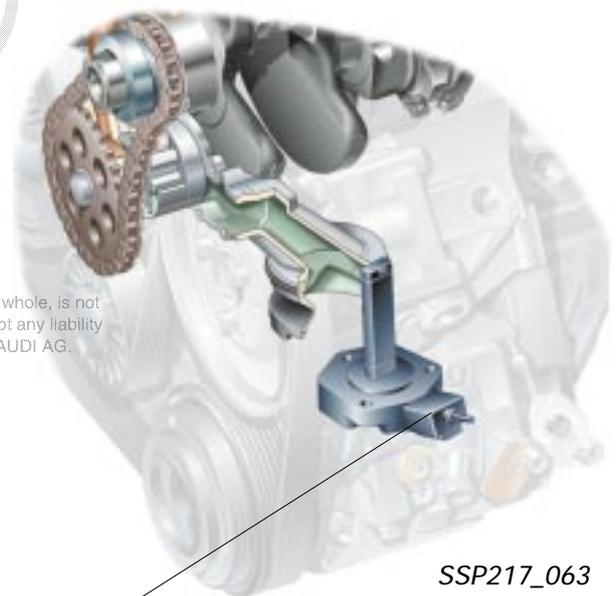
SSP217\_012

## 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.

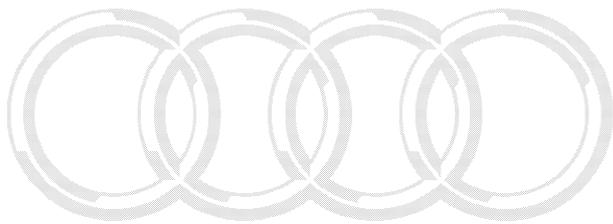
Further information can be found in SSP 207 (from page 84 onwards) and SSP 213 (from page 55 onwards).

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Oil level sensor

SSP217\_063



**Audi**

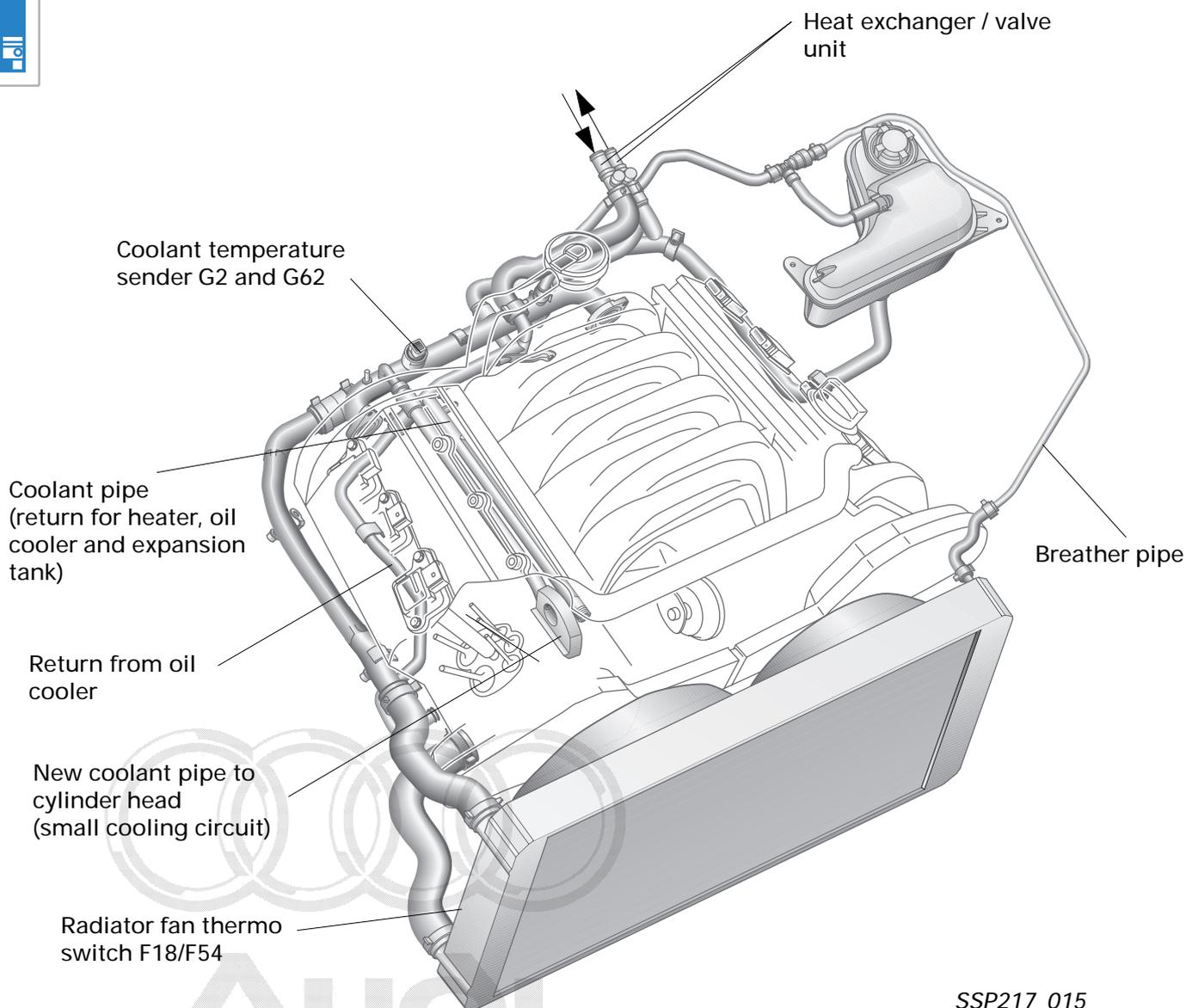
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# Engine - Mechanics

## Cooling circuit

(Example: A8)

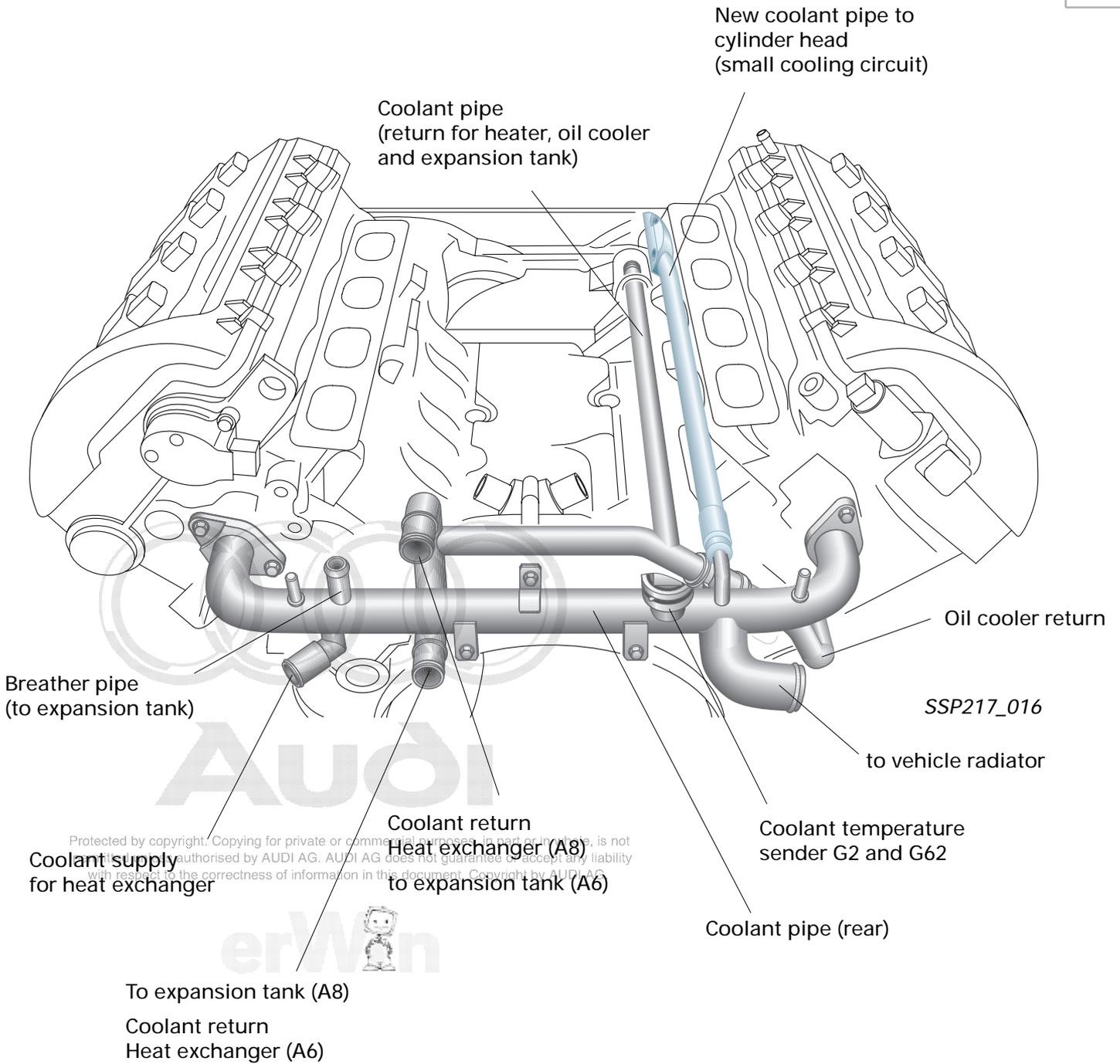
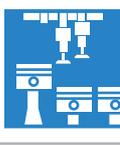


SSP217\_015

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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.



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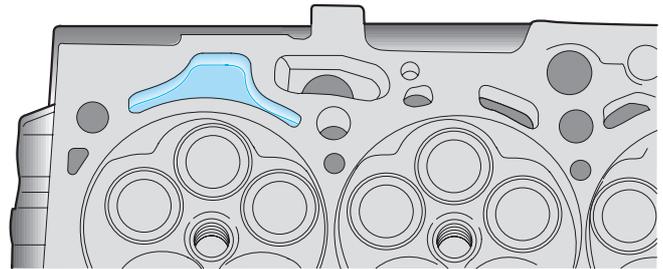
# Engine - Mechanics



Previous design:

The coolant thermostat is connected to the "small coolant circuit" via two holes in the cylinder crankcase (see Fig. 217\_017).

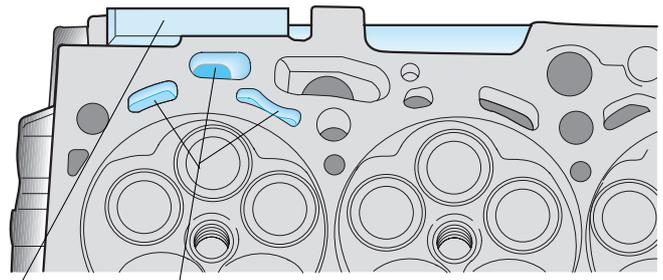
The holes are directly connected to the cylinder-head water jacket (1st cylinder) and the water jacket of the cylinder crankcase. The heated coolant flows from the 1st cylinder to the coolant thermostat.



SSP217\_018

New design - modified components:

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



SSP217\_019

New design

New coolant pipe

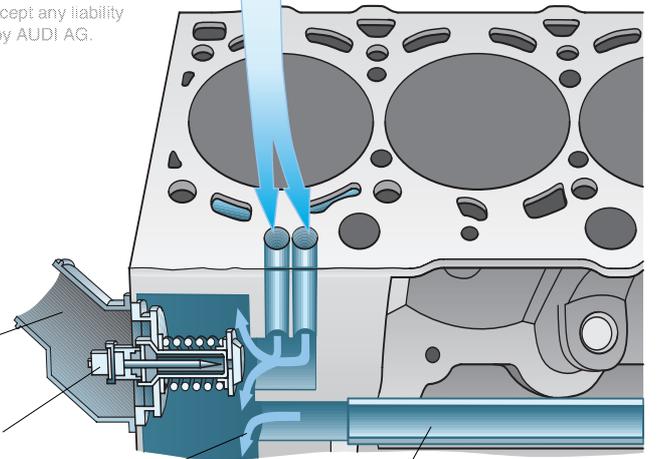
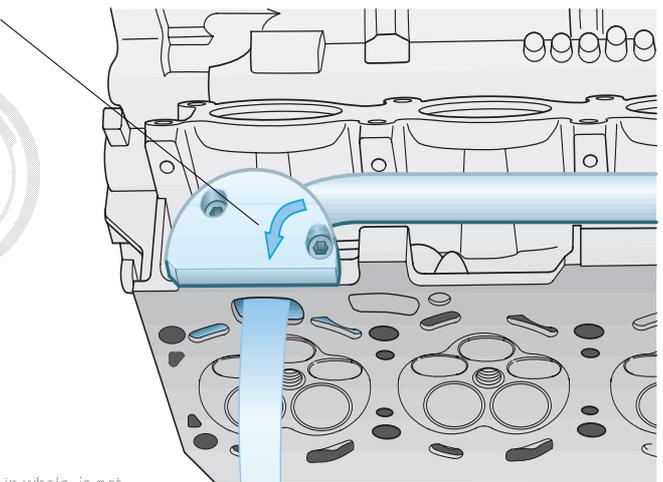
The connection in the cylinder head to the water jacket (cylinder crankcase) has been split (see Fig. 217\_019).

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.

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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.



From radiator

Coolant thermostat

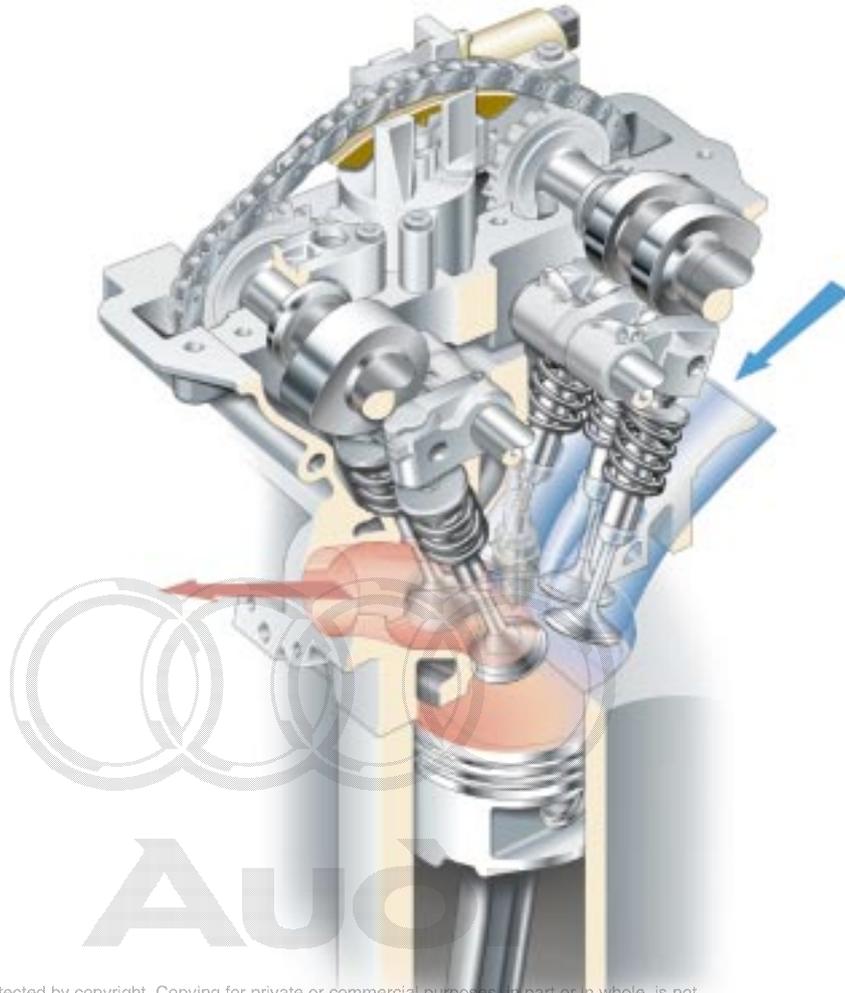
To coolant pump

Coolant pipe (return for heater, oil cooler and expansion tank)

SSP217\_017

# Cylinder head

Five-valve technology



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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 valvetrain which, in turn, significantly improves efficiency.

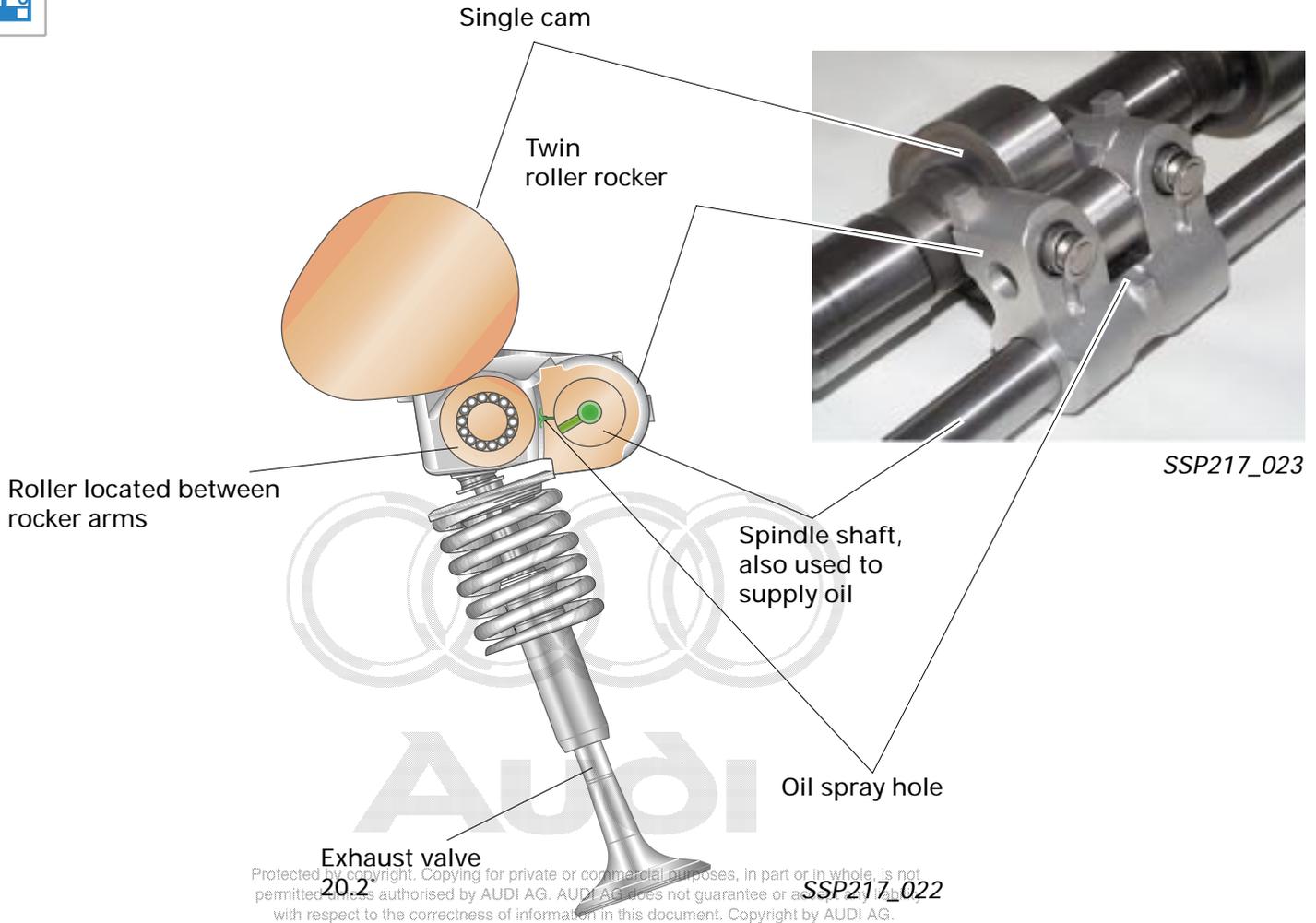
The rockers are made of die-cast aluminium in order to keep inertia forces as low as possible. As a result, the valvetrain is able to function reliably at engine speeds of up to 7200 rpm.

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

# Engine - Mechanics

Roller rocker

Exhaust valve



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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.

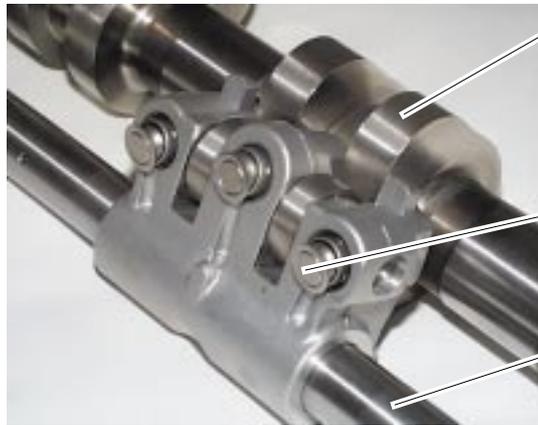
The single cam actuates the rocker by means of a roller located between the rocker arms.



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

Inlet valve

Double cam



Triple roller rocker

SSP217\_025

Hydraulic valve lifter with slide pad (hydraulic valve tappet)

Spindle shaft

Oil duct

Inlet valve 2  
14.9°

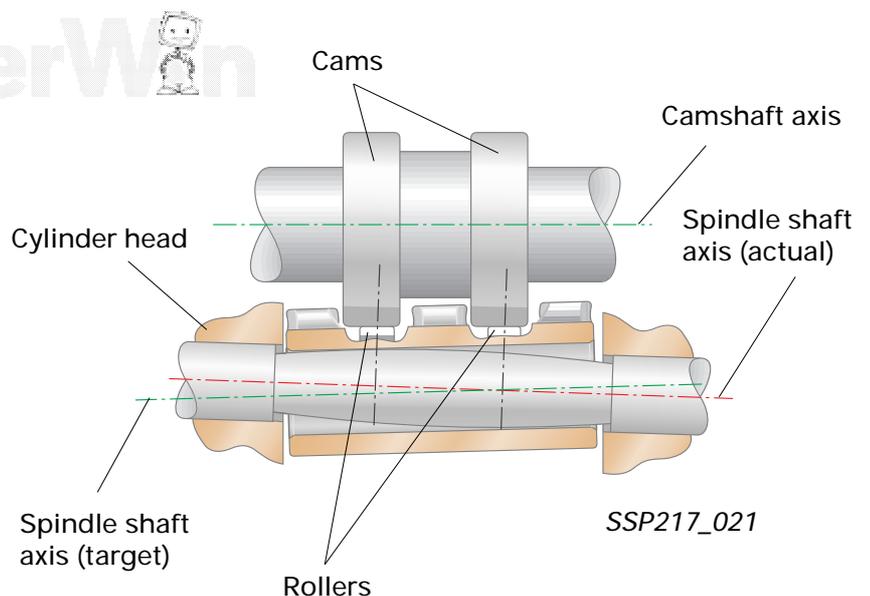
Inlet valve 1 and 3  
21.6°

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SSP217\_024

### 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

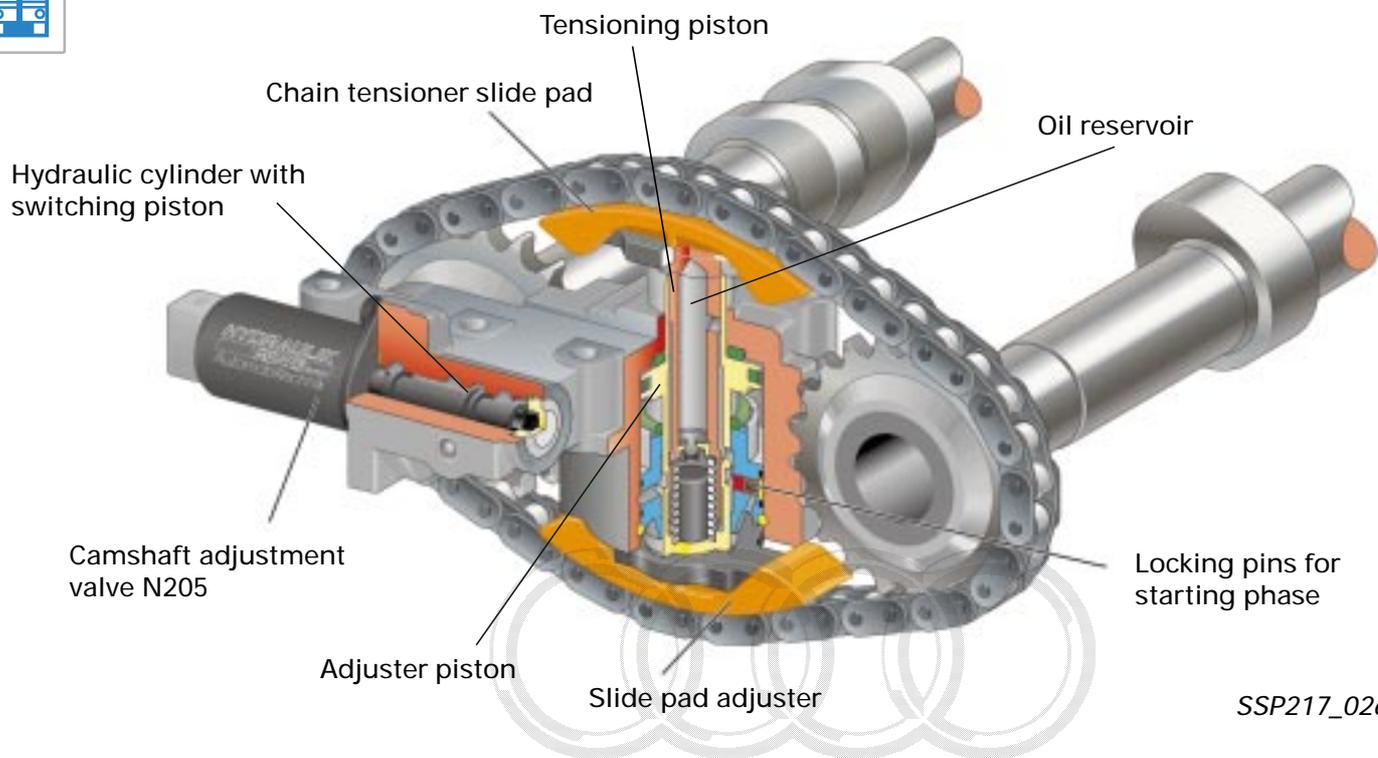


For the sake of clarity, the tolerance of the spindle shaft relative to the camshaft has been greatly exaggerated in the illustration.



# Engine - Mechanics

## 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.

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.

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

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

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

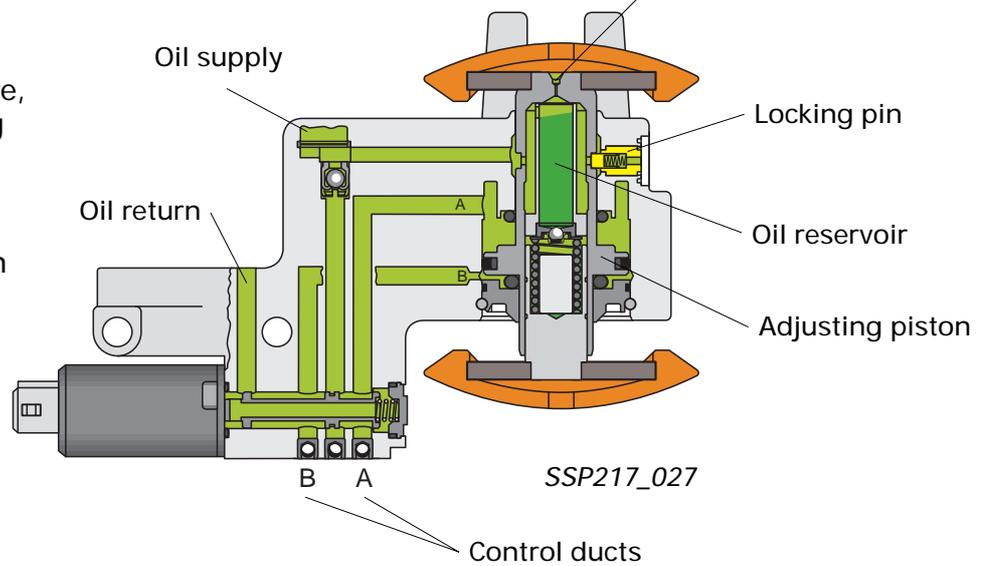


The principle of camshaft adjustment is described in SSP 182.

Lubrication and breather hole

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.



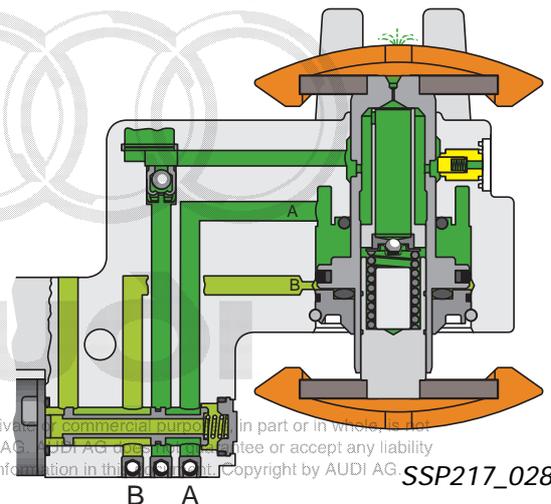
Engine start:

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

Retard setting  
(Basic and power setting)



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



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.

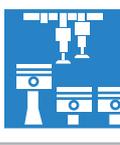
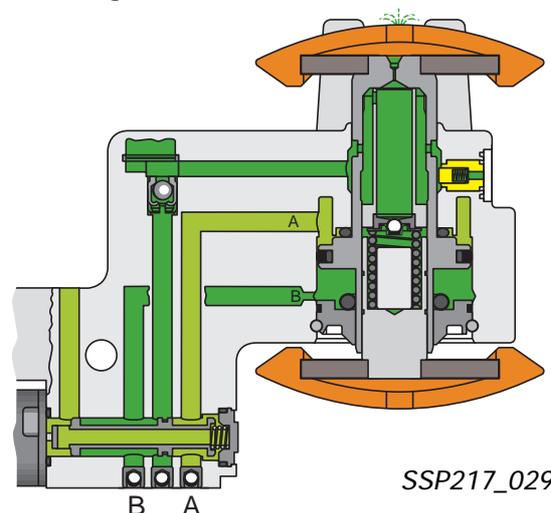
Advance setting  
(Torque setting)

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.

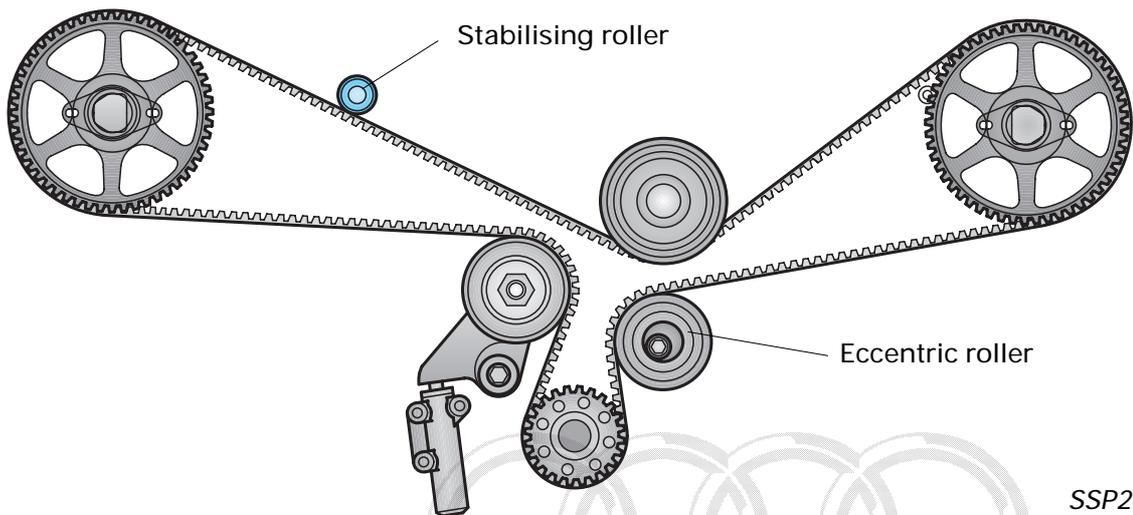


# Engine - Mechanics

## 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

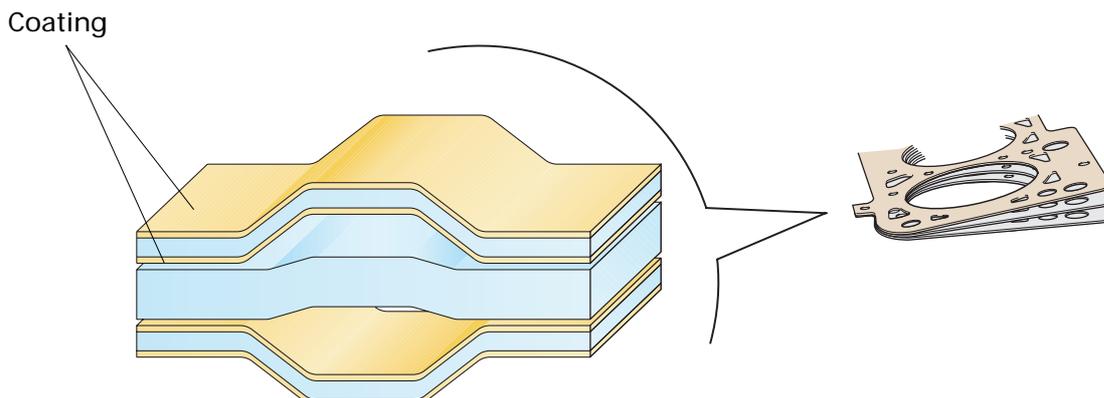
The new V8-5V engines have a multi-layer metallic cylinder-head seal already used in the 4 and 6-cylinder engines. This seal replaces the soft seal used in previous models.

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

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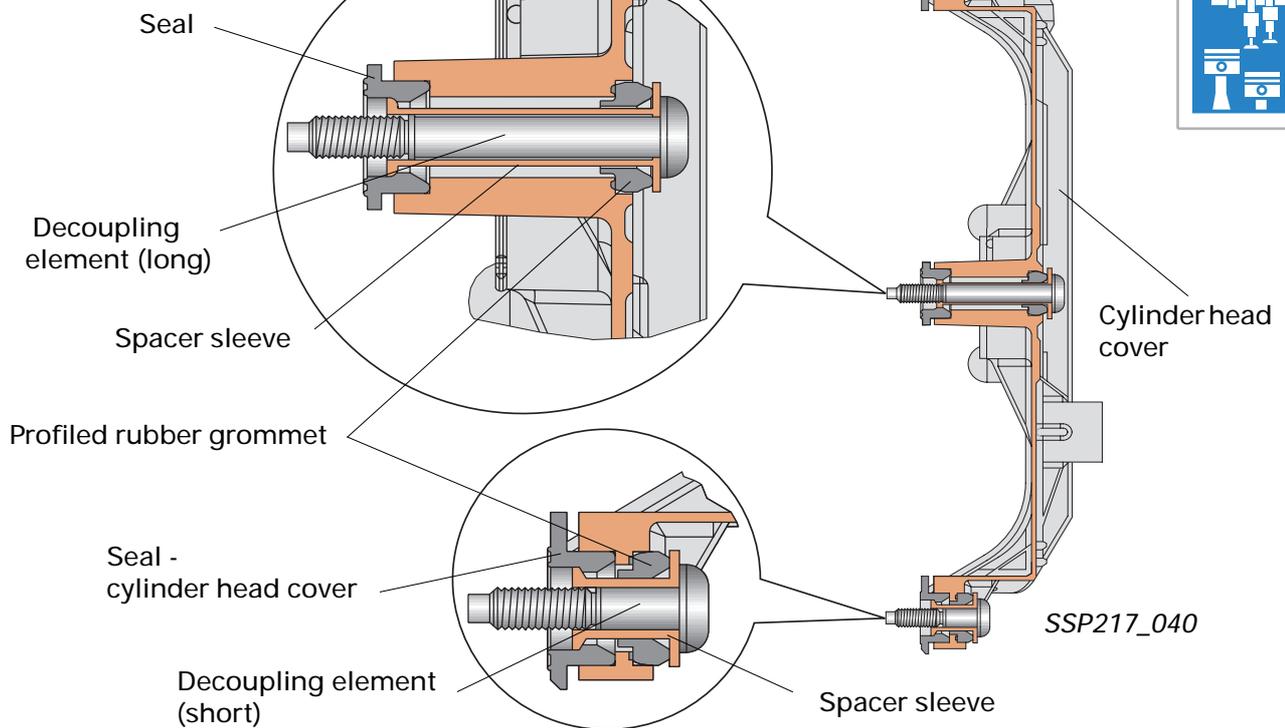
### Advantages:

- Very good settling behaviour
- Improved durability



SSP217\_056

## Cylinder-head cover seal



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 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.

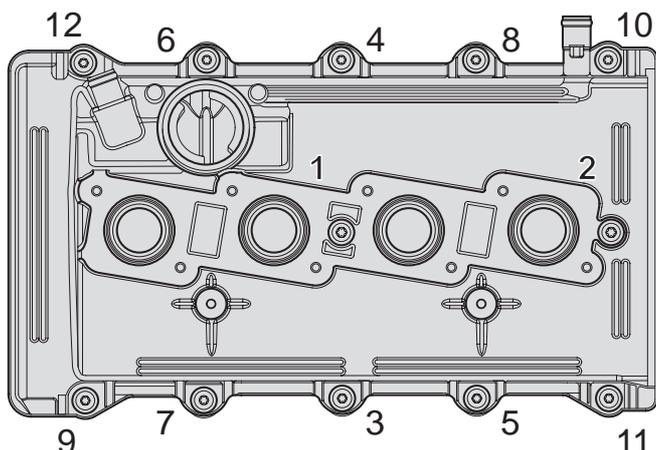
The bolted connections of the cylinder head cover have decoupling elements.

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



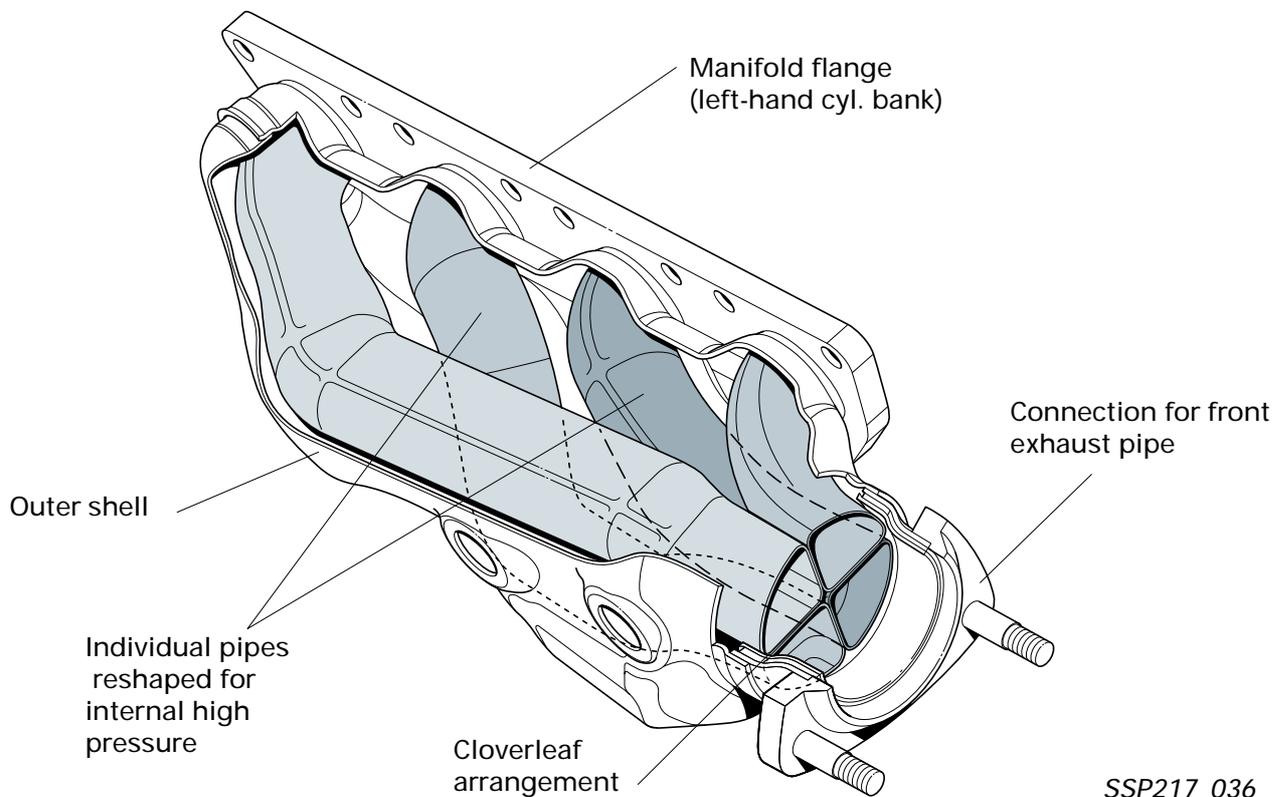
The securing bolts must be tightened uniformly in the specified order to prevent distortion of the cylinder head cover and to ensure that the seal is completely air-tight.

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SSP217\_043

## Exhaust manifold



The pipe sections and assembly of the air-gap-insulated exhaust manifold have been modified.

The exhaust pipes of the individual cylinders are assembled in a cloverleaf configuration for each cylinder bank (4 in 1 arrangement).

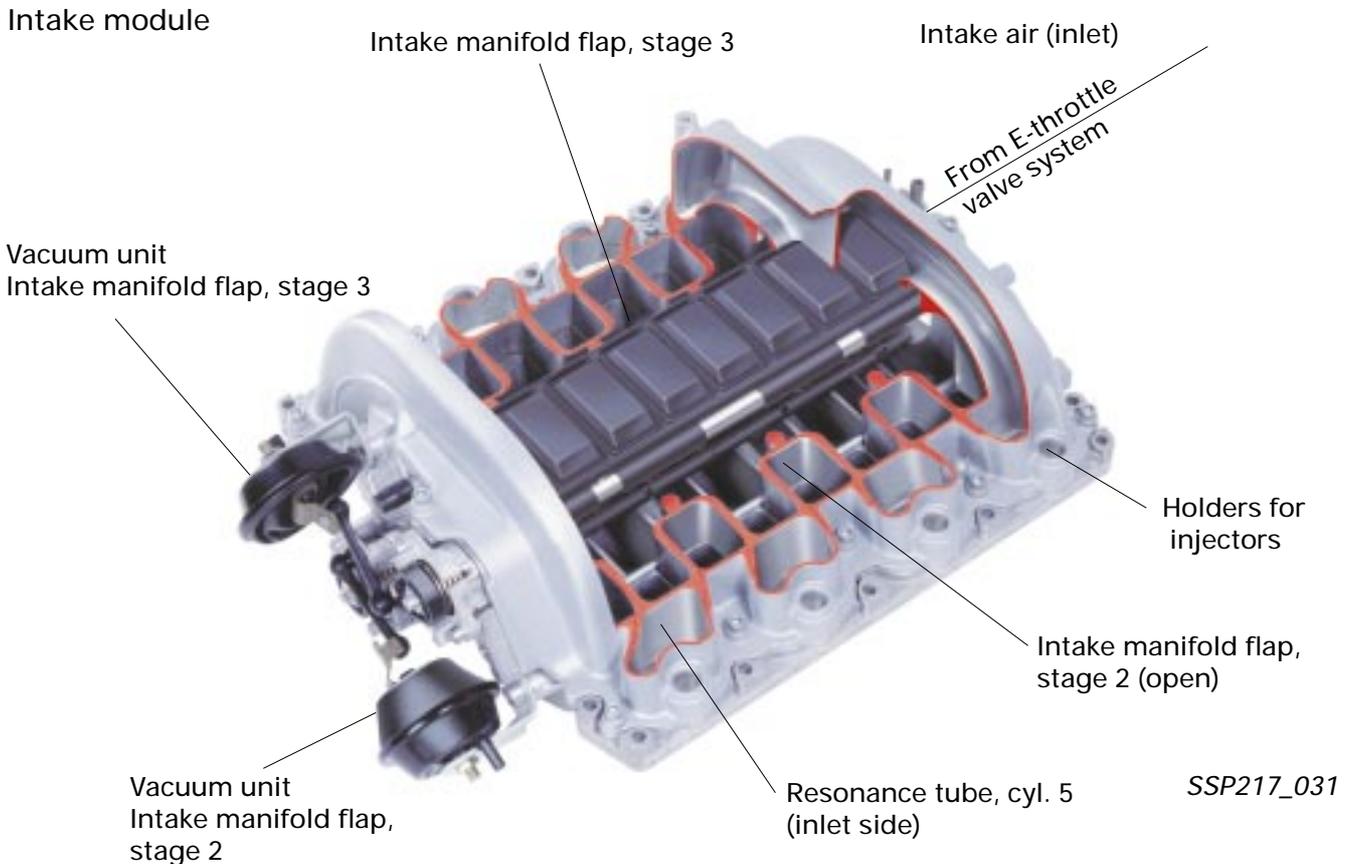
This protects the individual cylinders effectively against annoying exhaust vibrations which, in turn, has a positive effect on engine-torque characteristics.

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# Engine - Motronic Subsystems

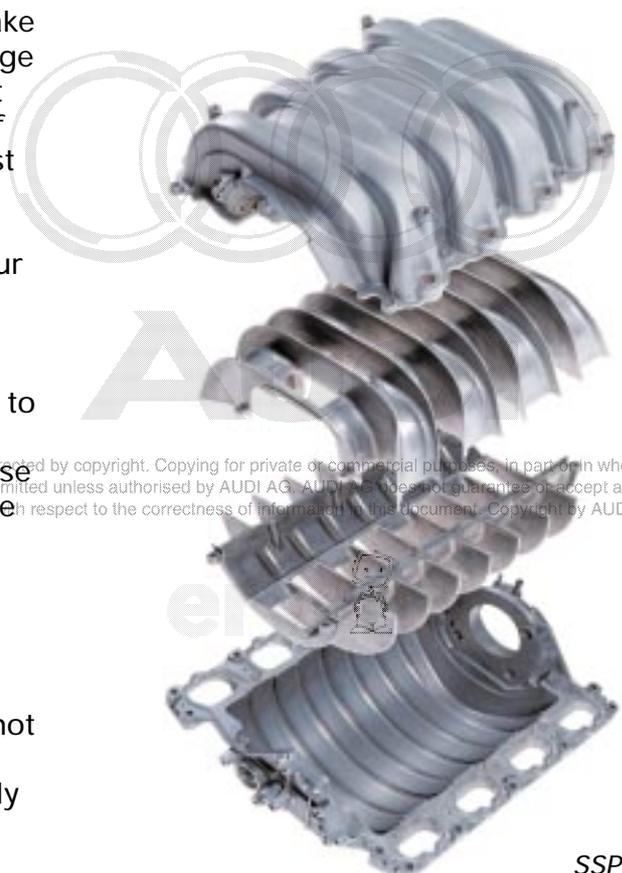
## Variable intake manifold



Increasing torque by means of variable intake manifolds is a tradition at Audi. A three-stage variable intake manifold made of a die-cast magnesium alloy, a further development of previous concepts, is to be used for the first time.

The variable intake manifold consists of four principal housing components which are bonded and bolted together.

The concept uses two intake manifold flaps to produce three different intake manifold lengths ("resonance tube lengths"). To utilise the pulsations to optimum effect, the intake manifold flaps close the resonance tube openings by means of a circumferential, moulded-on sealing lip.



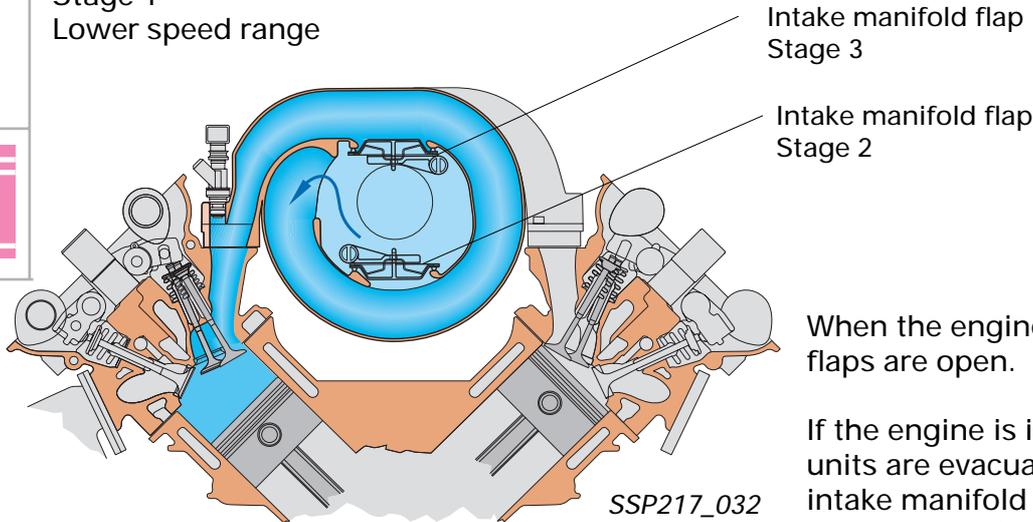
The variable intake manifold must not be dismantled. If necessary, the entire assembly must be completely replaced.

SSP217\_030



# Engine - Motronic Subsystems

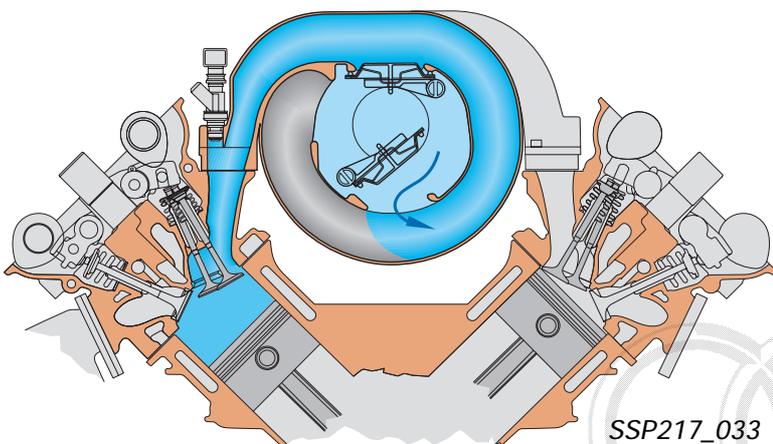
Stage 1  
Lower speed range



When the engine is switched off, both flaps are open.

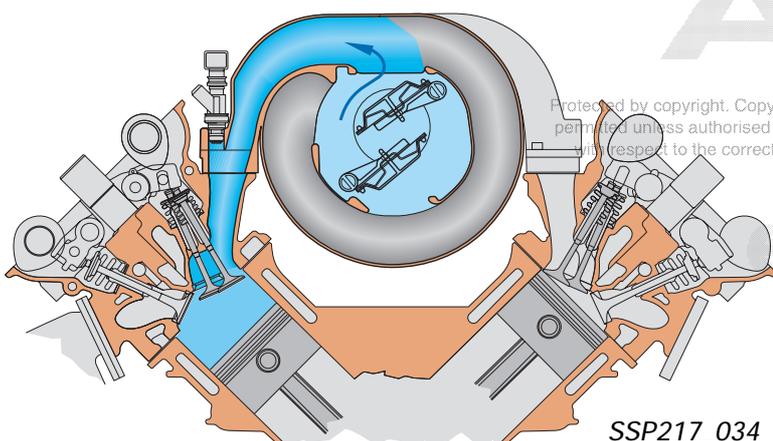
If the engine is idling, the two vacuum units are evacuated by the appropriate intake manifold changeover solenoid valves. The intake manifold flaps are, therefore, closed between the idling speed and the switching speed.

Stage 2  
Middle speed range



In the middle speed range, the intake manifold changeover solenoid valve N156 allows atmospheric pressure into the vacuum unit of the stage 3 intake manifold flap. The stage 2 intake manifold flap is opened and the intake path is shortened.

Stage 3  
Upper speed range

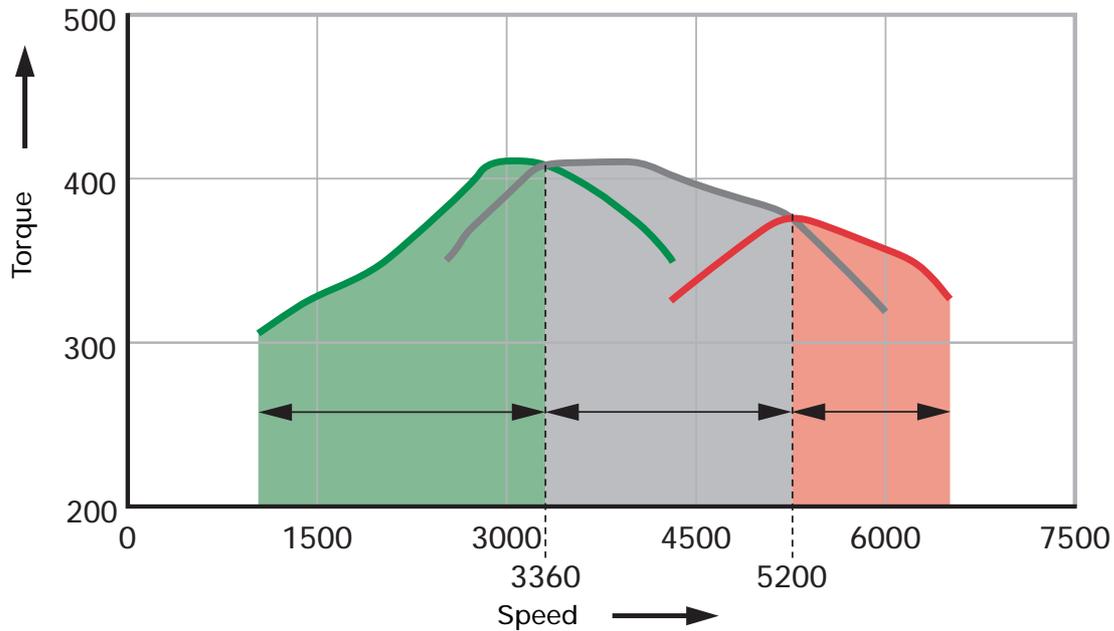


In the upper speed range, the stage 3 intake manifold flap is also opened. The intake air takes the shortest path to the combustion chamber.

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## Effect of variable intake manifold on torque



SSP217\_035

- Lower full throttle (stage 1)
- Middle full throttle (stage 2)
- Upper full throttle (stage 3)

Since the maximum torque across the speed range depends primarily on the length and cross section of the intake manifold, the new three-stage variable intake manifold comes closest to producing the optimum characteristic torque curve across the speed range.

The illustration explains the correlation between the length/cross section of the intake manifold and engine speed and shows the characteristic torque curve produced by the 3 stages.

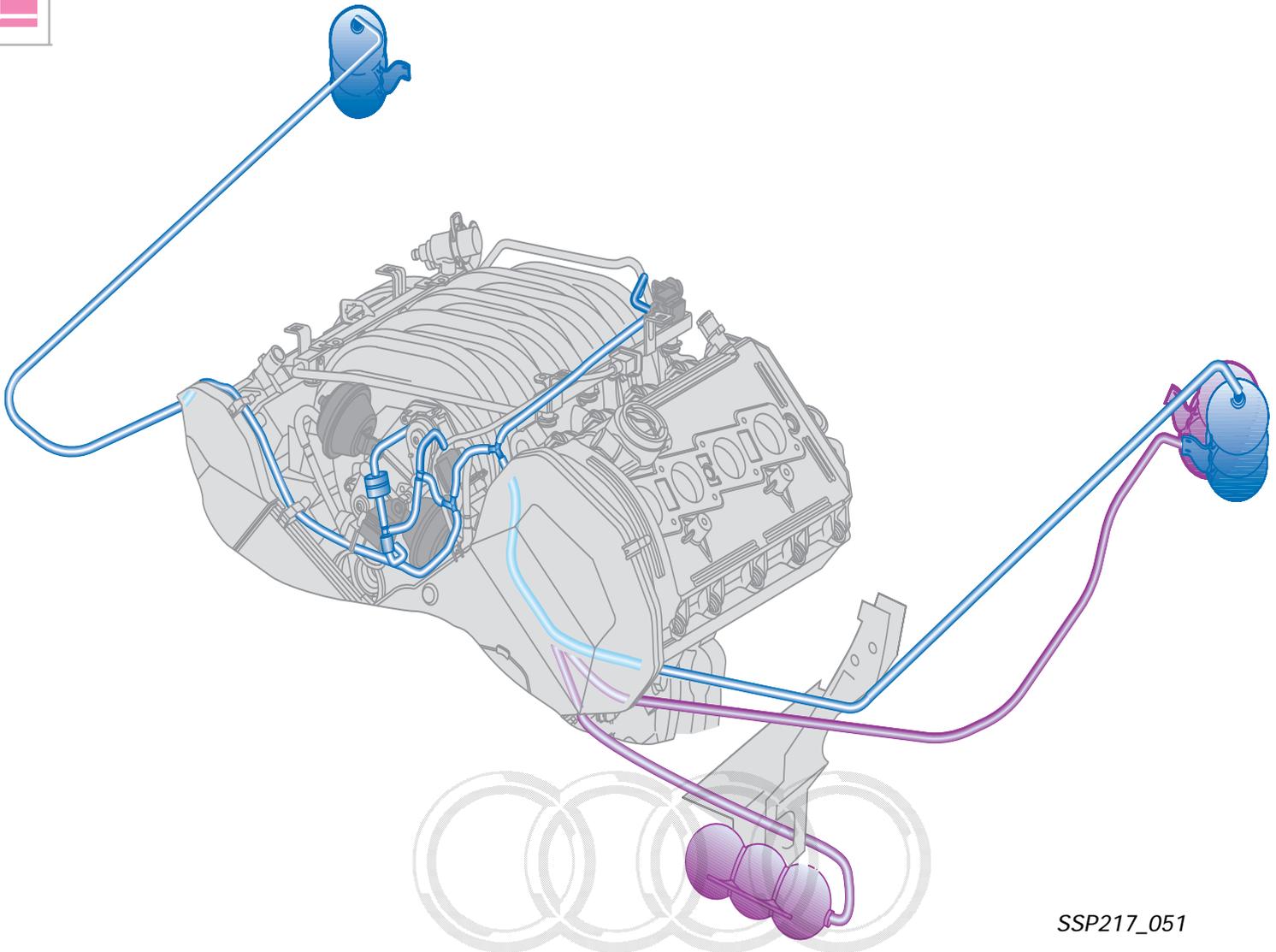
Depending on the engine speed, appropriate "resonance tube lengths" are available for the lower, middle and upper speed range.

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# Engine - Motronic Subsystems

The vacuum required to control the variable intake manifold and the secondary air system is provided by two vacuum reservoirs. If a vacuum exists in the intake manifold, the reservoirs are evacuated via a non-return valve.



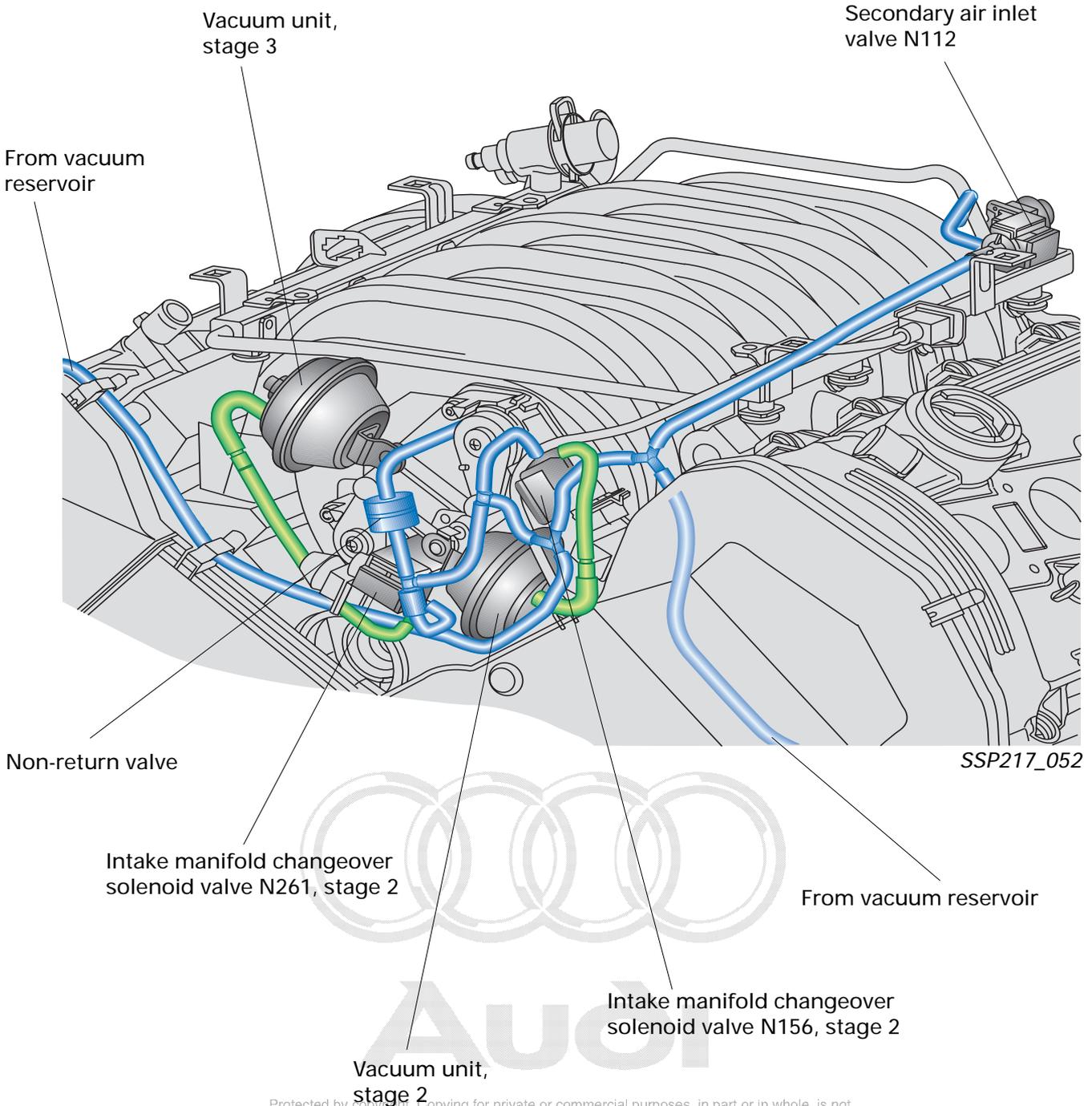
SSP217\_051

 Fitting location of vacuum reservoir,  
Audi A8

 Fitting location of vacuum reservoir,  
Audi A6

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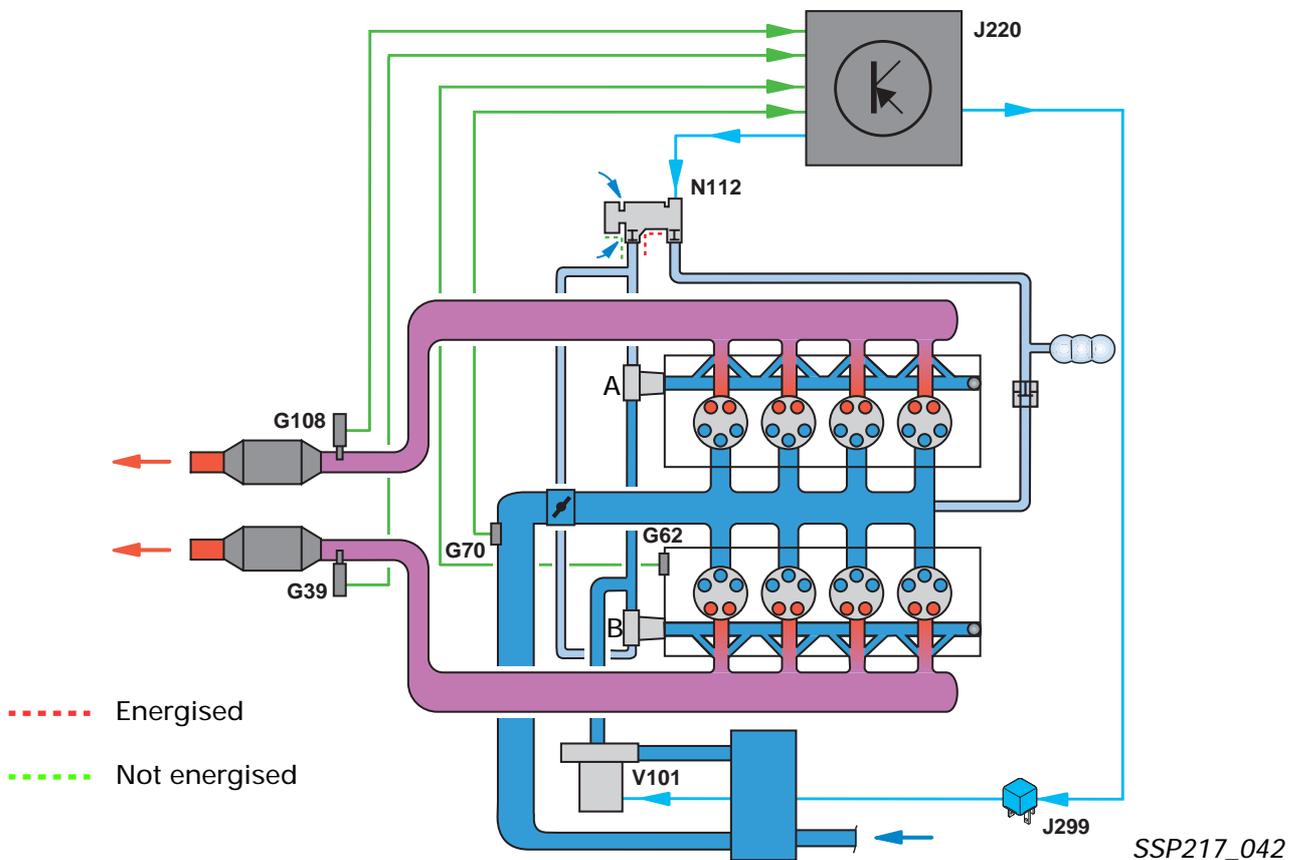


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# Engine - Motronic Subsystems

## Secondary air system



Owing to the high mixture enrichment during the cold-start and warm-up phase, an increased proportion of unburnt hydrocarbons exists in the exhaust gas during this time.

The catalytic converter cannot process this high proportion of hydrocarbons because:

1. the required operating temperature of the catalytic converter has not yet been reached and
2. a lambda 1 mixture must exist to allow complete conversion.

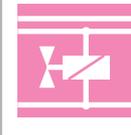
Air injection downstream of the outlet valves causes oxygen enrichment of the exhaust gases. As a result, the hydrocarbons and the carbon monoxide undergo post-oxidation (afterburning). The thermal energy released during this process also heats up the catalytic converter so that it reaches its operating temperature more quickly.

The secondary air system consists of

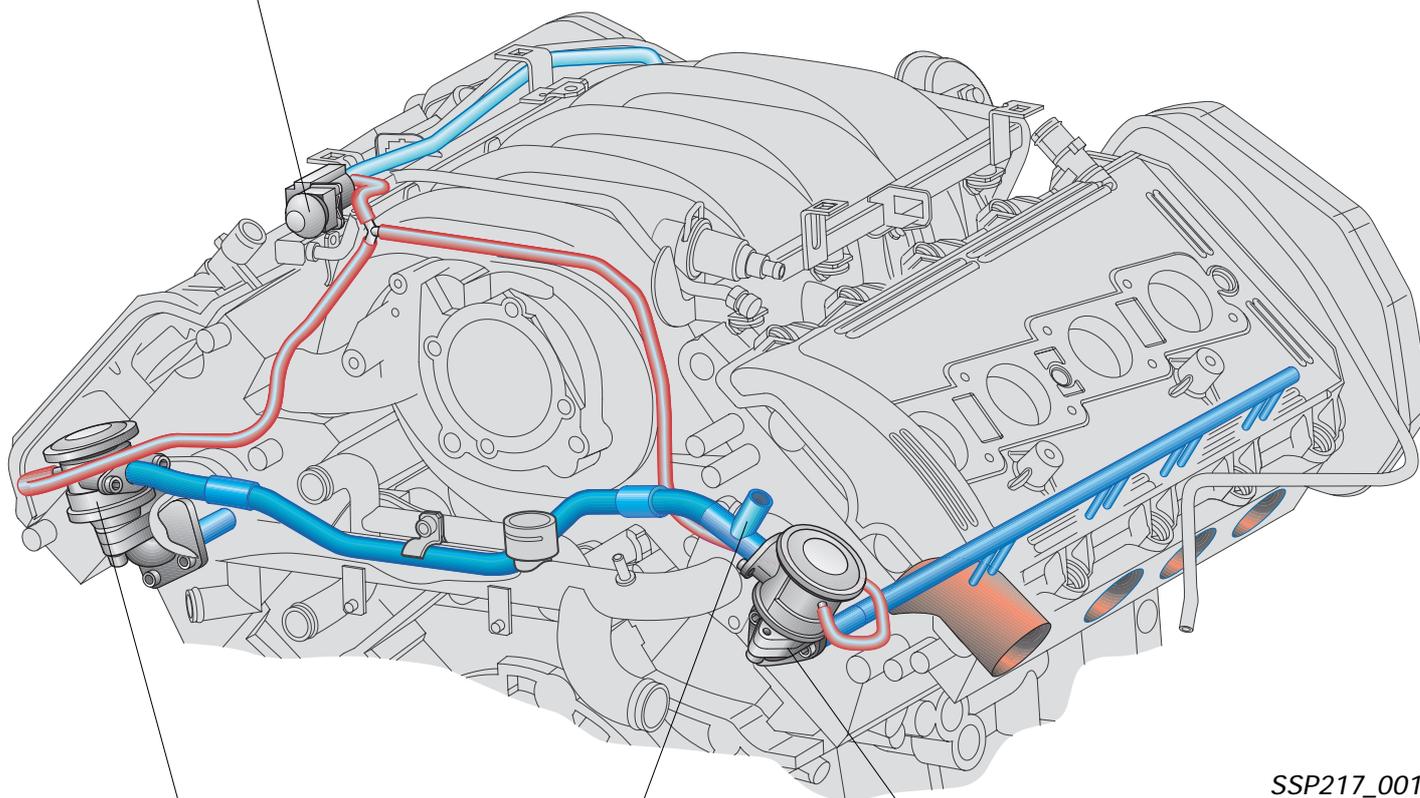
- the secondary air pump V101
- two combination valves A + B
- the secondary air inlet valve N112

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Secondary air inlet valve N112



SSP217\_001

Combination valve  
Cylinder bank 2

Connection for fresh air from  
secondary air pump V101

Combination valve  
Cylinder bank 1



Vacuum from engine



Control line (vacuum or atmospheric pressure from secondary air inlet valve N112)

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Fresh air from secondary air pump  
V101

# Engine - Motronic Subsystems

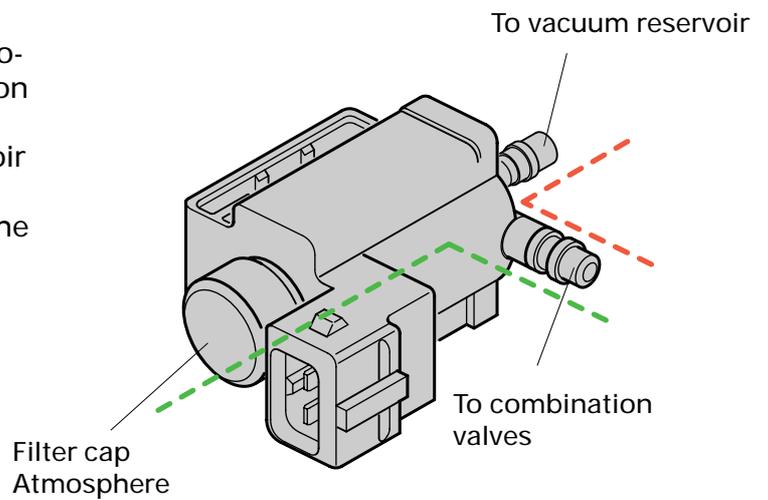
## Secondary air inlet valve N112

The secondary air inlet valve is an electro-pneumatic valve. It is activated by the Motronic control unit and controls the combination valve.

It releases the vacuum stored in the reservoir to open the combination valve.

Atmospheric pressure is released to close the combination valve.

- ..... Energised
- ..... Not energised

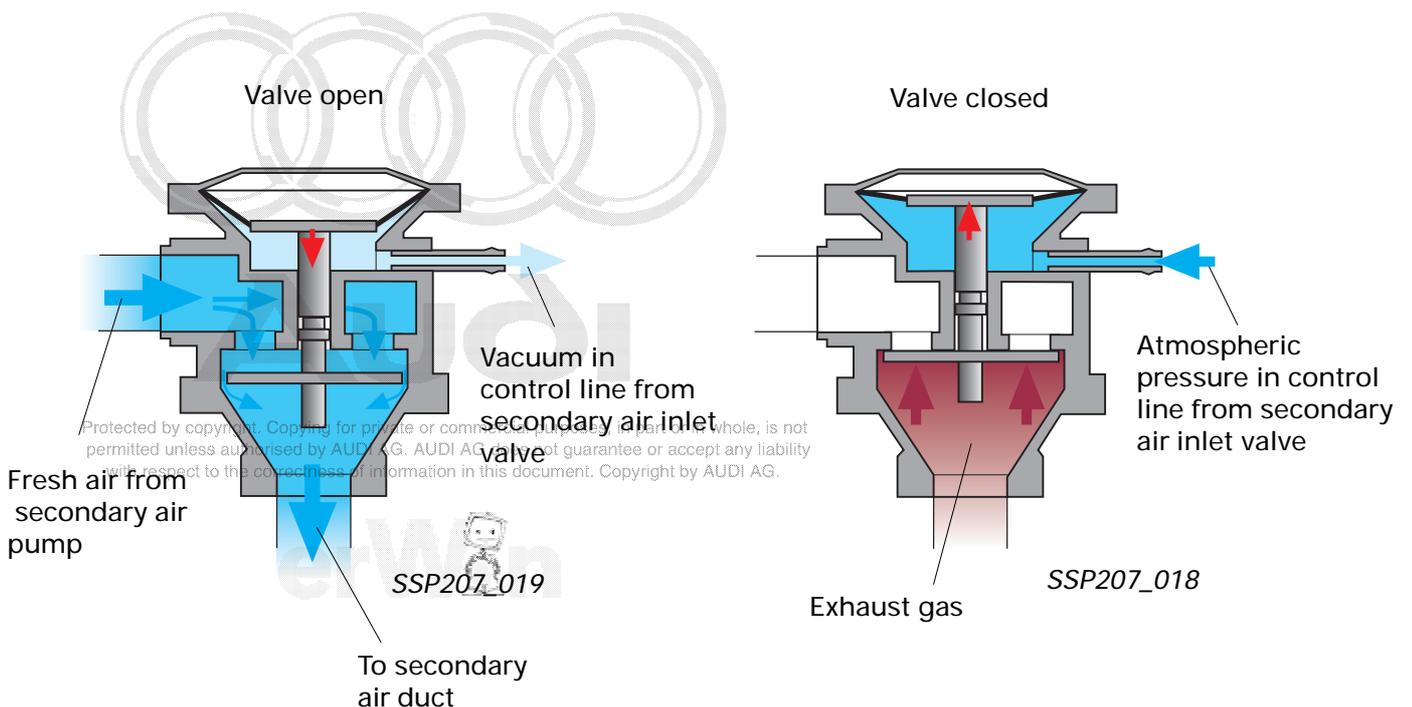


## Combination valve

SSP207\_016

The combination valve is bolted to the secondary air duct of the cylinder head. The vacuum from the secondary air inlet valve causes the air channel between the secondary air pump and the secondary duct of the cylinder head to open.

At the same time, the valve prevents hot exhaust gases from entering and then damaging the secondary air pump.



## Secondary air pump V101

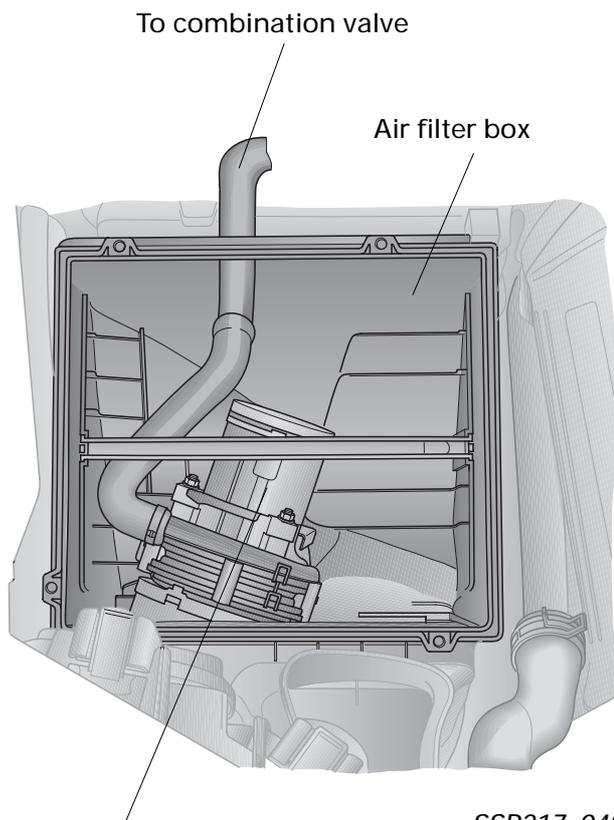
The secondary air pump relay J299 activated by the Motronic control unit connects the power supply for the secondary air pump motor V101. The fresh air mixed with the exhaust gas is drawn from the air filter housing by the secondary air pump and released by the combination valve.

The secondary air pump in the Audi A8 has its own air filter. The pump is integrated in the air filter housing where it draws in unfiltered air.

The secondary air system is active at coolant temperatures between 0 and 55 °C.

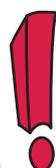
The secondary air pump relay J299 and the secondary air inlet valve N112 are activated simultaneously.

The system is switched off after a defined air mass has been drawn in by the motor (information from the air mass meter). At idling speed, this occurs after approx. 60 - 90 seconds.

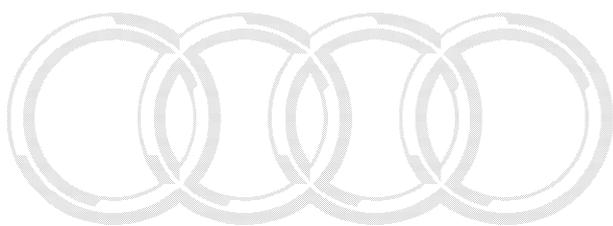


Secondary air pump, Audi A8

SSP217\_049



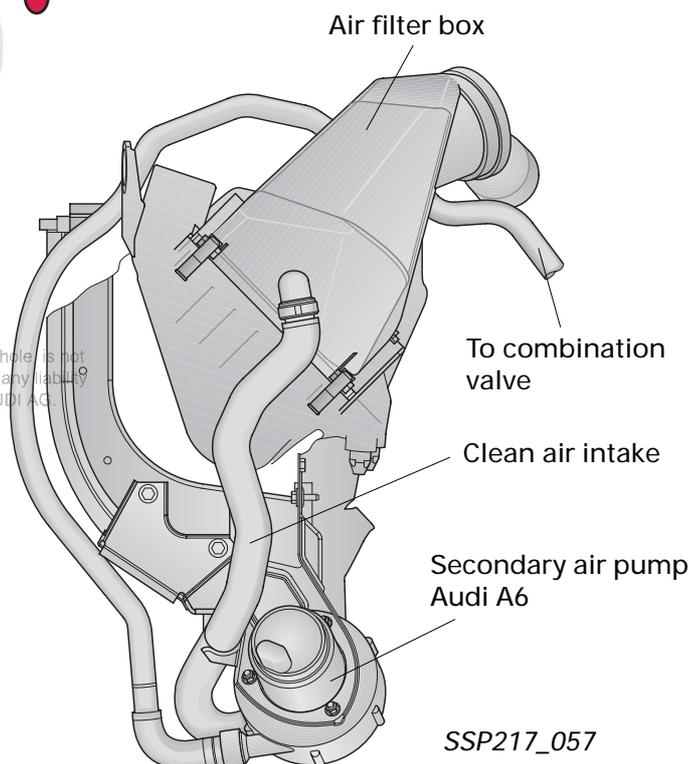
The secondary air system is described in SSP 207.



Audi

The secondary air pump in the Audi A6 does not have its own air filter. It is mounted to the longitudinal member and draws the filtered air from the air filter box.

erWin



SSP217\_057

# Engine Management

## System overview

Motronic ME 7.1

### Sensors

Hot-film air mass meter G70

Engine speed sender G28

Hall sender G40 (bank 2) and  
Hall sender 2 G163 (bank 1)

Lambda probe G39 (bank 1) and  
lambda probe G108 (bank 2)

Throttle valve control unit J338 with  
throttle valve drive G186 (electric  
throttle operation)  
Angle sender -1- for throttle valve drive G187  
Angle sender -2- for throttle valve drive G188

Coolant temperature sender G2 and G62

Knock sensor 1 G61 (bank 1) and  
knock sensor 2 G66 (bank 2)

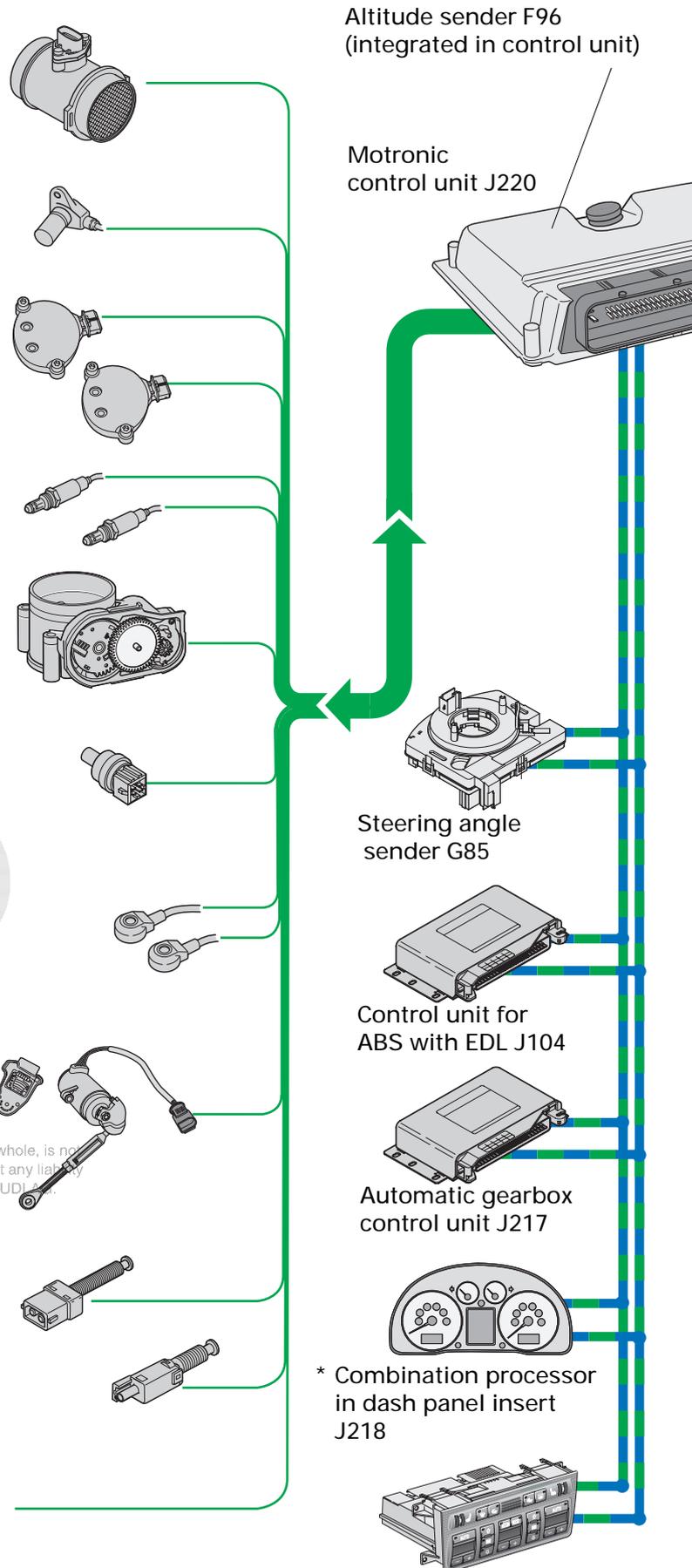
Pedal sender/accelerator pedal module with  
accelerator pedal position sender (1) G79  
and  
accelerator pedal position sender (2) G185

Brake light switch F and  
brake pedal switch F47

Clutch pedal switch F3  
(with manual gearbox only)

### Additional signals

- Air conditioner requirement signal
- Air conditioner compressor,  
bidirectional
- Crash signal
- CCS switch



Altitude sender F96  
(integrated in control unit)

Motronic  
control unit J220

Steering angle  
sender G85

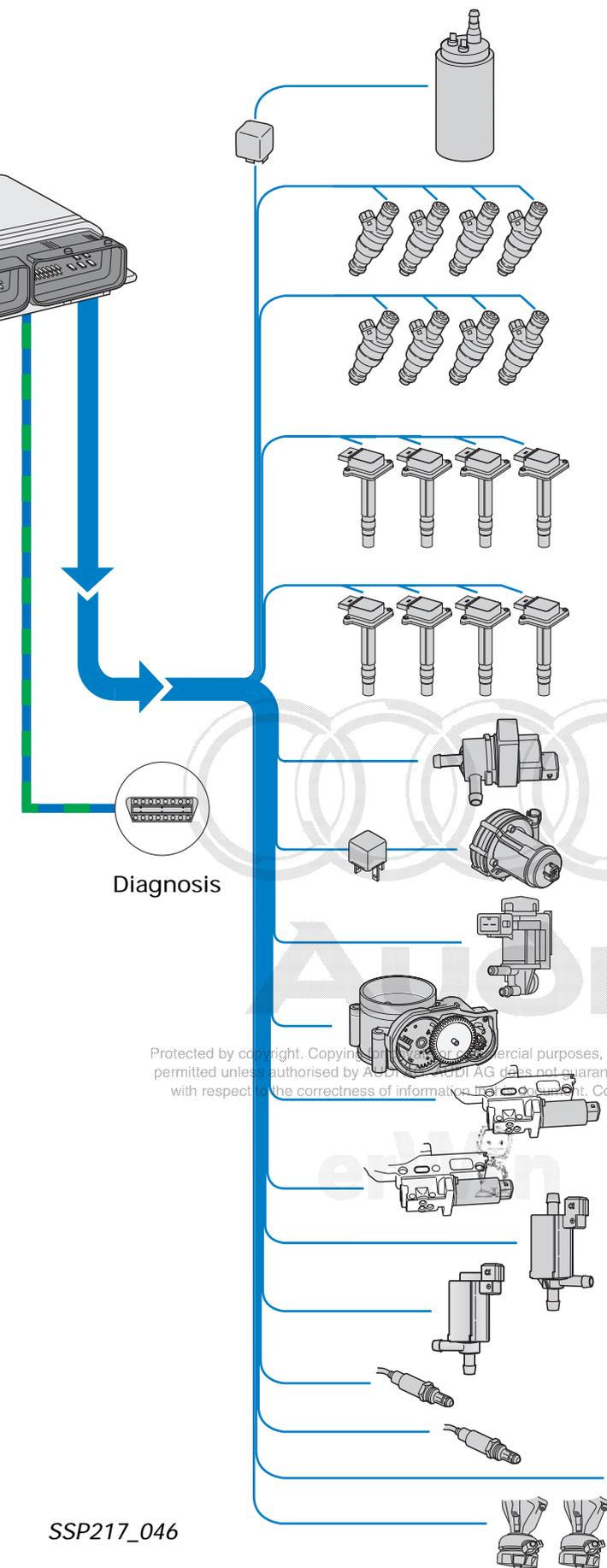
Control unit for  
ABS with EDL J104

Automatic gearbox  
control unit J217

\* Combination processor  
in dash panel insert  
J218

\* Air conditioner/Climatronic  
operating and display unit  
E87

\* No CAN businterface  
with Audi A6



## Active components

Fuel pump relay J17 and  
fuel pump G6

Injectors N30, N31, N32, N33  
(bank 1)

Injectors N83, N84, N85, N86  
(bank 2)

Ignition coil N (1st cyl.), N128 (2nd cyl.),  
N158 (3rd cyl.), N163 (4th cyl.)

Ignition coil N164 (5th cyl.), N189 (6th cyl.),  
N190 (7th cyl.), N191 (8th cyl.)

Activated charcoal filter system solenoid valve N80

Secondary air pump relay J299 and  
secondary air pump motor V101

Secondary air inlet valve N112

Throttle valve control unit J338  
with throttle valve drive G188

Camshaft adjustment valve  
N205 (bank 1) and N208 (bank 2)

Intake manifold changeover  
valve N156  
Intake manifold changeover  
valve 2 N261

Lambda probe heating Z19 (bank 1) and  
lambda probe heating Z28 (bank 2)

Additional signals  
– Air conditioner compressor (out)  
Engine mount 1 and 2

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# Engine Management

## Function diagram

4.2/3.7 l in A8 GP

Colour coding

 = Input signal

 = Positive

 = Bidirectional

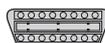
 = Output signal

 = Earth

Components

A	Battery	N144	Solenoid valve (left) for electro/hydraulic engine mounting
E45	Cruise control system switch	N145	Solenoid valve (right) for electro/hydraulic engine mounting
D	Ignition/starter switch	N156	Intake manifold changeover valve
F	Brake light switch	N158	Ignition coil 3
F36*	Clutch pedal switch (with manual gearbox only)	N163	Ignition coil 4
F47	Brake pedal switch for cruise control system	N164	Ignition coil 5
G2	Coolant temperature sender	N189	Ignition coil 6
G3	Coolant temperature gauge	N190	Ignition coil 7
G6	Fuel pump	N191	Ignition coil 8
G28	Engine speed sender	N205	Camshaft adjustment valve 1
G39	Lambda probe	N208	Camshaft adjustment valve 2
G40	Hall sender	N261	Intake manifold changeover valve 2
G61	Knock sensor 1	P	Spark plug connector
G62	Coolant temperature sender	Q	Spark plugs
G66	Knock sensor 2	S	Fuse
G70	Air mass meter	ST	Fuse holder
G79	Accelerator position sender	V101	Secondary air pump motor
G108	Lambda probe 2	Z19	Lambda probe heating
G163	Hall sender 2	Z28	Lambda probe heating 2
G185	Accelerator position sender 2	S204	Fitting location in Audi A6: plenum chamber next to battery
G186	Throttle valve drive (electric throttle operation)		Fitting location in Audi A8: top right in luggage compartment
G187	Angle sender 1 for throttle valve drive		
G188	Angle sender 2 for throttle valve drive		
J17	Fuel pump relay		
J220	Motronic control unit		
J299	Secondary air pump relay		
M9	Brake light bulb (left)		
M10	Brake light bulb (right)		
N	Ignition coil (cylinder 1)		
N30	Injector (cylinder 1)		
N31	Injector (cylinder 2)		
N32	Injector (cylinder 3)		
N33	Injector (cylinder 4)		
N80	Activated charcoal filter system solenoid valve		
N83	Injector (cylinder 5)		
N84	Injector (cylinder 6)		
N85	Injector (cylinder 7)		
N86	Injector (cylinder 8)		
N112	Secondary air inlet valve		
N128	Ignition coil 2		

### Additional signals and connections



K diagnosis connection

①

Crash signal (in) from airbag control unit

②

Air conditioner requirement signal (in)

③

Air conditioner compressor signal (in-out)

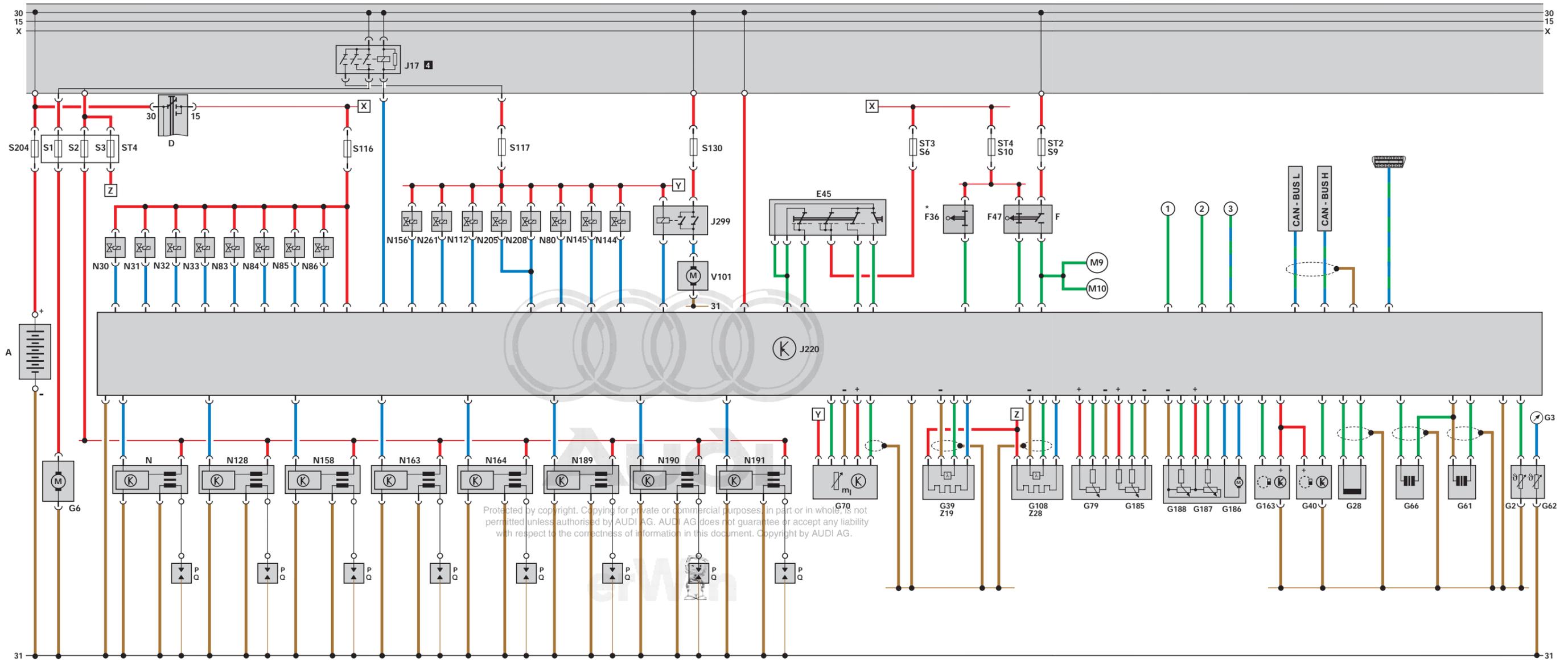
CAN-BUS L } Connection to data bus  
CAN-BUS H }

X }

Y }

Z }

} Connections in function diagram



# Engine Management

## Quick-start functions

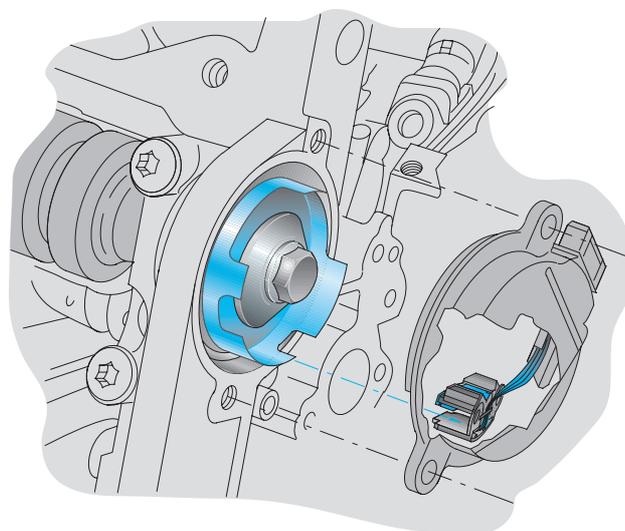
Camshaft position sensor G40 and G163

As with the V6-5V engines, the new V8-5V engines also have two sensors for determining the position of the camshaft (G40 and G163).

The sender system with "quick-start rotor ring" already used in the 4-cylinder 5-valve engines is implemented.

The quick-start rotor ring has two wide and two narrow stops (two small and two large windows).

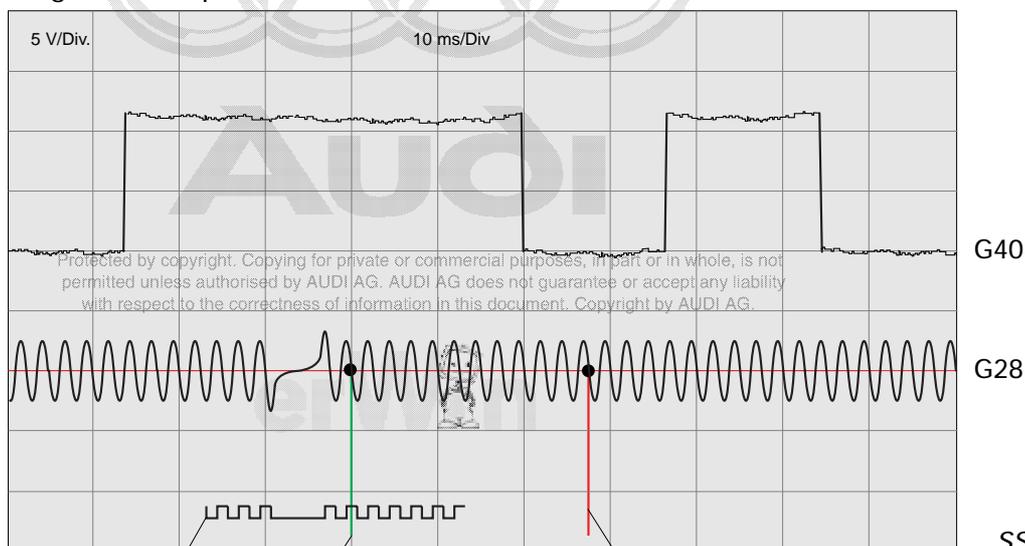
If a stop is in the Hall sensor, the level at the signal output sensor is high.



SSP217\_053

Signal trace for engine speed sender G28 and Hall sender G40 using oscilloscope function of VAS 5051

Automatic mode



SSP217\_062

Sender wheel

\* Software reference mark  
66° before TDC of 1st cylinder

TDC of 1st cylinder

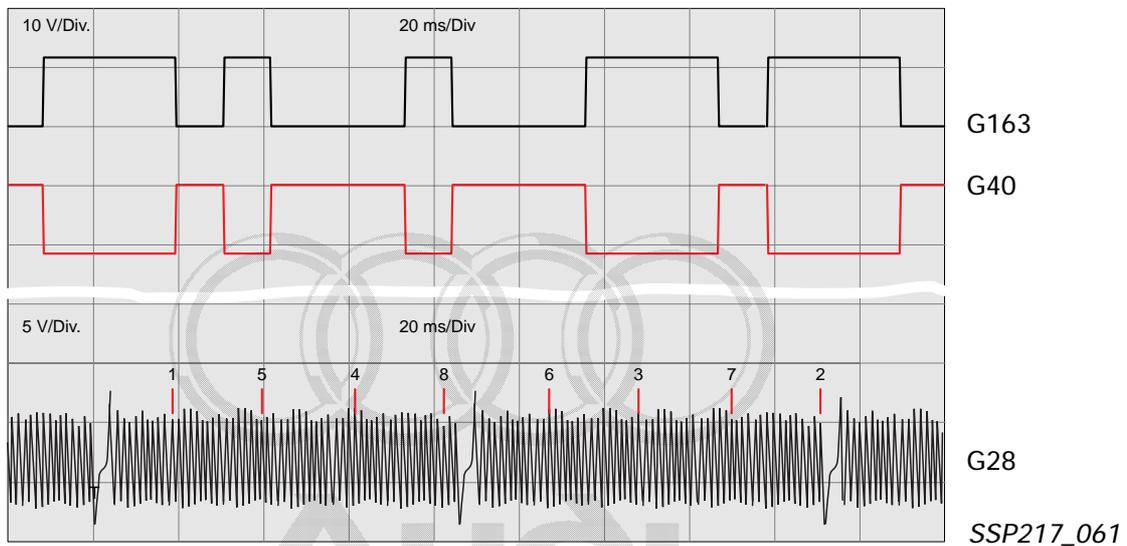
By using different stop widths, it is possible to use the signal from G40 together with the engine speed sender G28 to determine the camshaft position relative to the crankshaft more quickly.

When the engine is started, the engine control unit can thus determine the ignition TDC of the next cylinder more quickly so that the engine starts more quickly (synchronisation with the 1st cylinder is no longer necessary). This is referred to as quick-start synchronisation or the quick-start function.

\* The software reference mark is the point from which the control unit commences its calculations to determine the ignition point. It is about one tooth after the hardware reference mark, which is approximately 66° - 67° cr./shaft before ignition TDC of the 1st cylinder.

Signal trace of engine speed sender G28, and Hall sender G40 and G163

Automatic mode



The camshaft position sensor G163 is used to monitor camshaft adjustment and to generate a substitute signal if the G40 fails.

The camshaft position sensor G40 is mounted to cylinder bank 2. The camshaft position sensor G163 is mounted to cylinder bank 1.

### Engine run-down sensor

The ME 7.1 engine management system has an engine run-down sensor. This device supports the quick-start function so that fuel injection can occur before quick-start synchronisation.

The engine control unit remains active for a defined time after the ignition has been switched off and, with the aid of the G28, "monitors" the engine as it slows to a standstill.

The position of the engine mechanics (position of the next cylinder at ignition TDC) is stored and is available the next time the engine is started. The ME 7.1 can immediately begin injection and has a fuel mixture ready, which has a positive effect on starting behaviour.

# Engine Management

The ME 7.1 engine management system has to a large extent been described in SSP 198. The new functions and features of the system used in the V8-5V engine are dealt with below.



## Electronic throttle function

Apart from the following features, the electronic throttle functions are identical to those described in SSP 198.

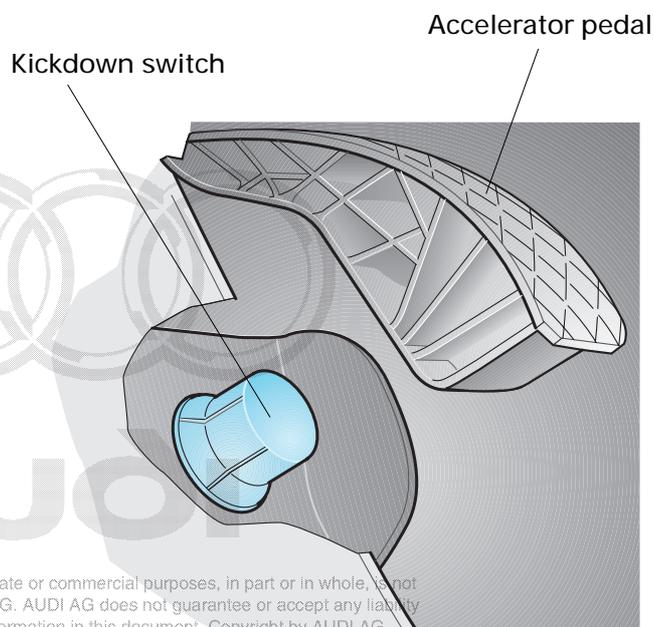
The pedal sender is used in the Audi A8 and the accelerator pedal module in the Audi A6 to determine the requirements of the driver.

### Pedal sender (Audi A8)

A separate switch is used to provide kickdown information.

It is located in the footwell and doubles as the accelerator pedal stop.

The full-throttle and kickdown positions must be calibrated accordingly.



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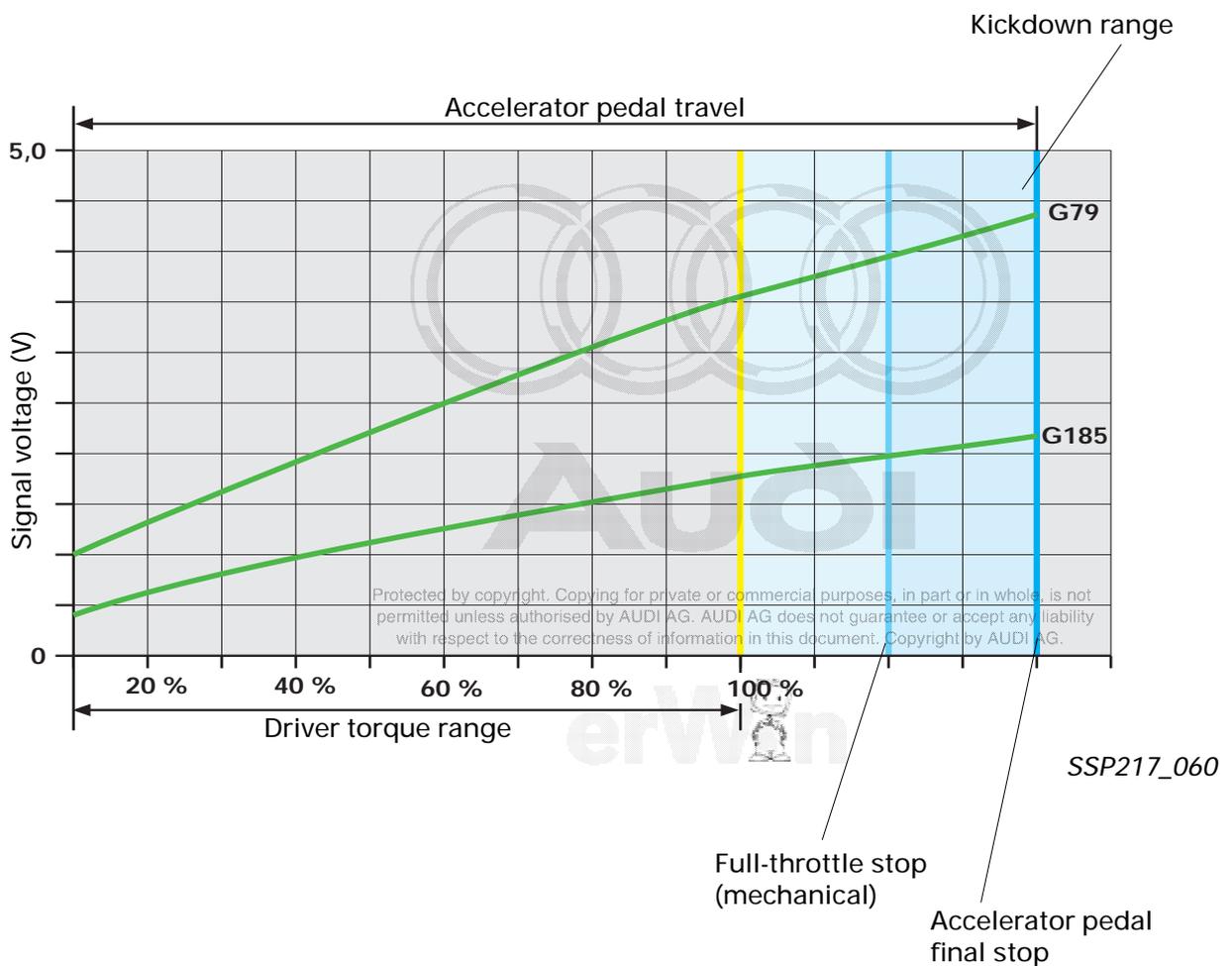
SSP217\_041



## Accelerator pedal module (Audi A6)

No separate switch is used to provide kick-down information. In the case of automatic-gearbox vehicles, the accelerator pedal stop is replaced by a pressure element. The pressure element generates a "mechanical pressure point" which gives the driver the "kickdown feeling".

If the driver activates the kickdown, the full-throttle voltage of the accelerator pedal senders is exceeded. If a voltage defined in the engine control unit is reached, this is interpreted as a kickdown and the information is sent to the automatic gearbox via the CAN bus. The kickdown switching point can only be tested using diagnostic testers.

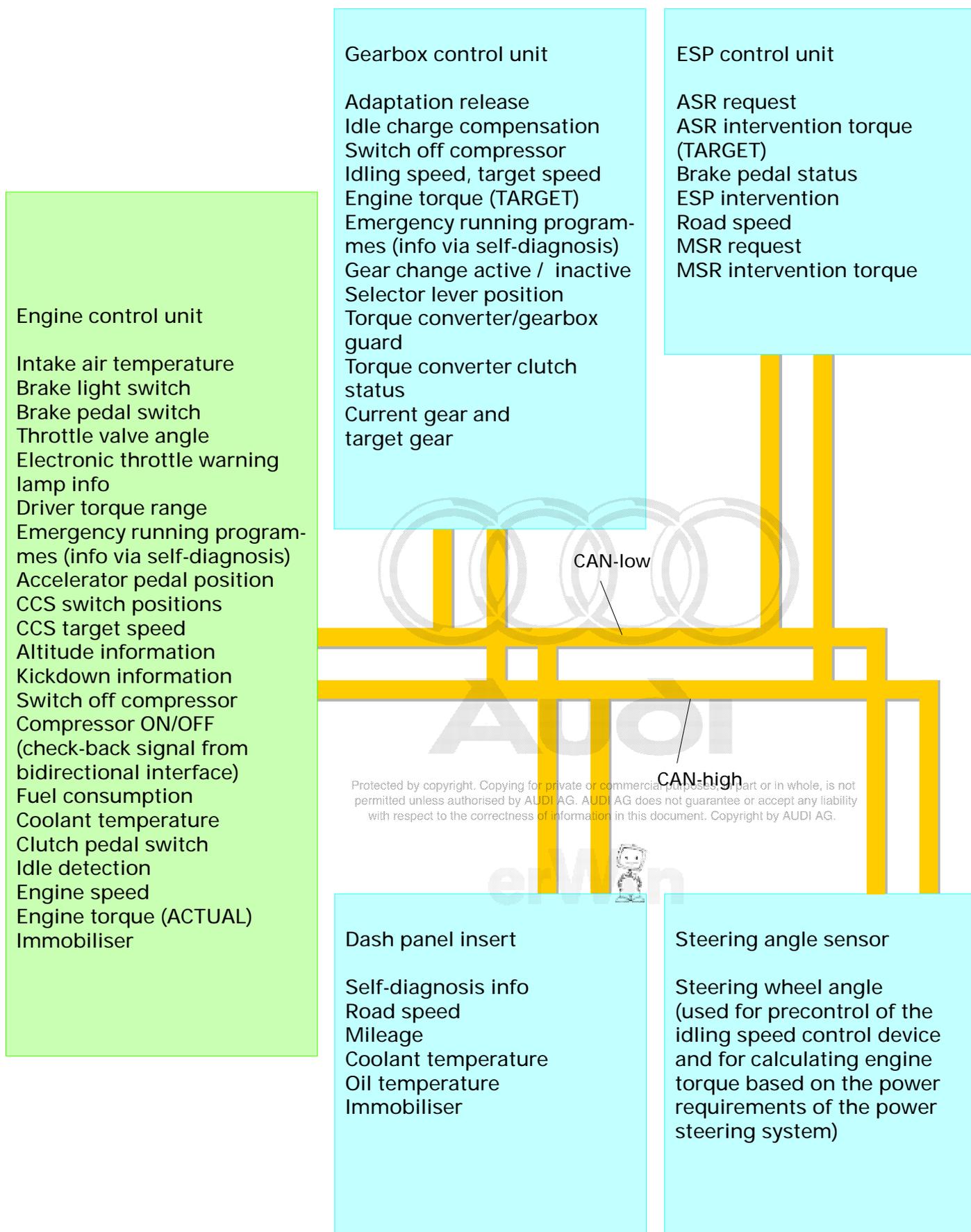


If the accelerator pedal module or the engine control unit is changed, the switching point of the kickdown switch must be reprogrammed using the diagnostic tester – see the repair manual.



# Engine Management

## CAN bus interfaces



In the Audi A8, data between the engine control unit and the other control units is, with the exception of a few interfaces, exchanged via the CAN system.

The system overview shows the information which is provided by the engine control unit via the CAN bus, and received and used by the connected control units.

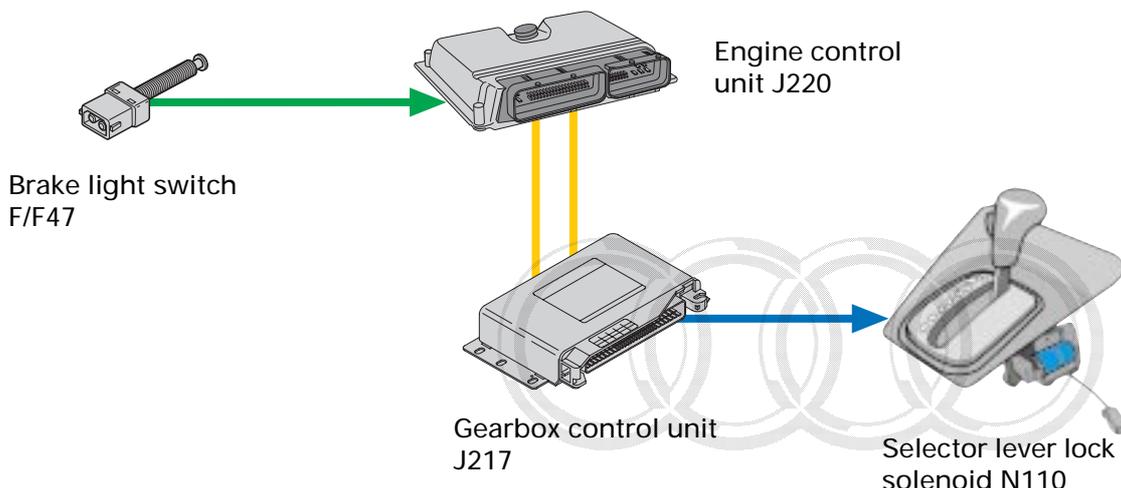
The following two examples simplify the complexity of the CAN bus network.



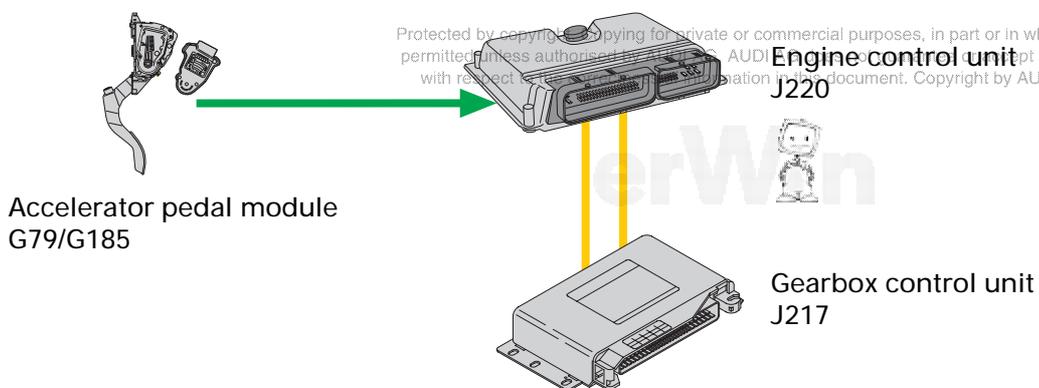
Detailed information concerning the CAN data bus can be found in SSP 186.



Selector lever lock:



Kickdown (for example, Audi A6):



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 Information which is sent by the engine control unit.

 Information which is received and evaluated by the engine control unit.

# Engine Management

## Additional signals/ interfaces

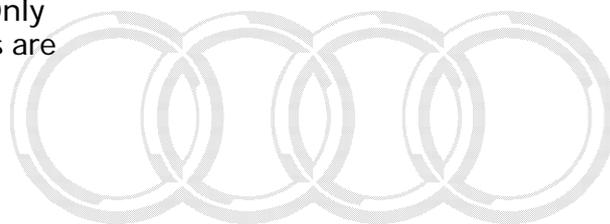
In the Audi A8, the following interfaces also exist for data exchange via CAN bus:

- Pin 67 Crash signal
- Pin 43 K-line/diagnostic connection
- Pin 41 Compressor ON/OFF
- Pin 40 Air conditioner requirement signal

In the A6, there will be no CAN data exchange with the dash panel insert when production of the model begins. For this reason, the A6 has the following interfaces in addition to those of the A8:

- Pin 43 Immobiliser/self-diagnosis
- Pin 19 Coolant temperature signal
- Pin 81 Fuel consumption signal
- Pin 54 Road speed signal
- Pin 37 Engine speed signal
- Pin 48 Warning lamp for electronic throttle

Most of the interfaces and additional signals of the ME 7.1 are described in SSP 198. Only the new interfaces and additional signals are dealt with below.



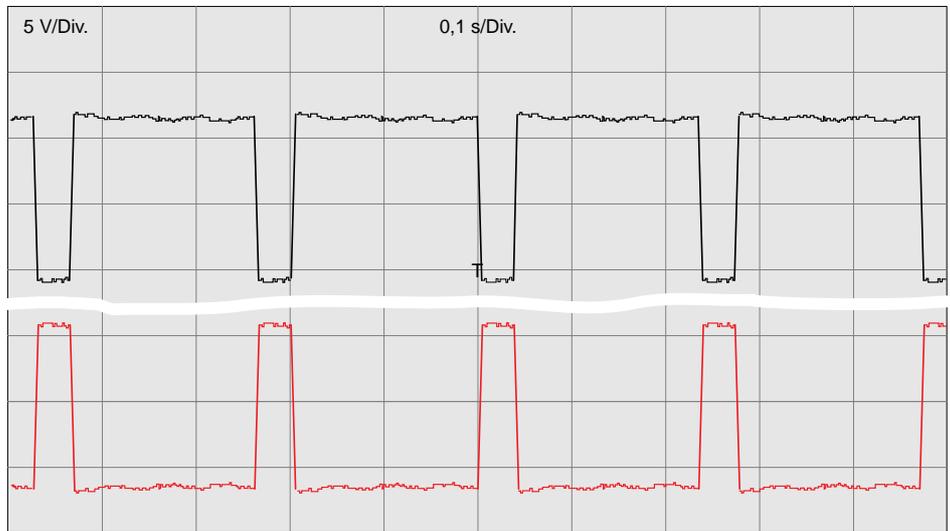
Audi

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erWin 

## Crash signal

Signal traces for crash signal using oscilloscope  
function of VAS 5051

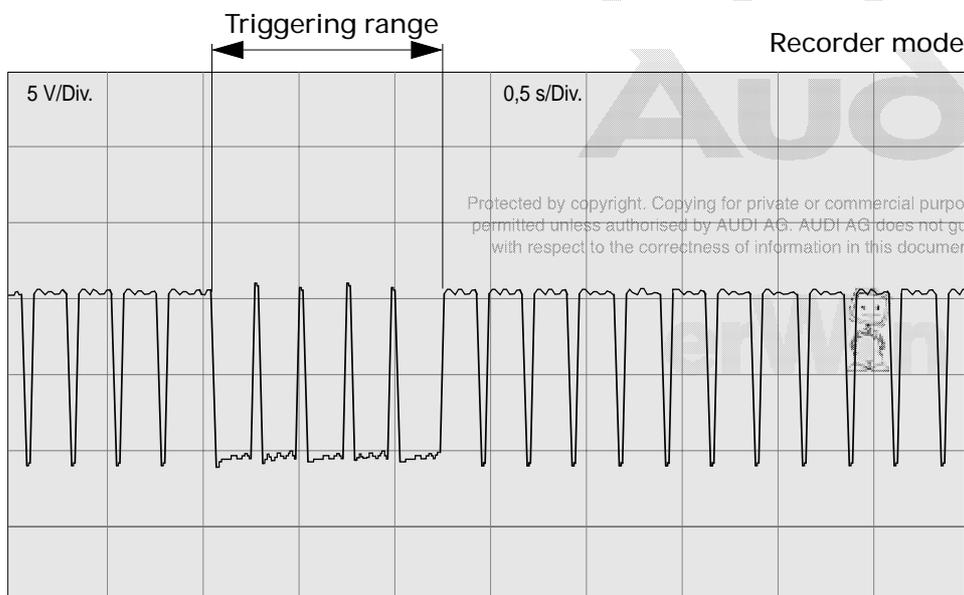
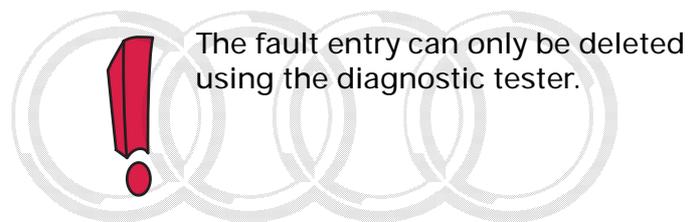


In the event of a crash where the belt tensioners/airbags are triggered, the engine control unit deactivates actuation of the fuel pump relay. This prevents excessive quantities of fuel escaping if the fuel system is damaged.

In the event of a crash, the signal ratio is inverted for a defined period of time. During this period, the signal ratio is inverted relative to the standard signal so that the supply of fuel is shut off until the engine is restarted.

The crash signal is a square-wave signal with a specific signal ratio (high level to low level). The signal is transmitted continuously by the airbag control unit.

In addition, the "crash shut-off" fault is stored.



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# Engine Management

## Self-diagnosis

The crash signal is checked with respect to the plausibility of the crash signal and voltage.

## Effect of fault

If the "crash shut-off" fault is stored in the engine control unit and is not erased, the fuel pump is not primed with fuel when the ignition is switched on (no precompression is generated in the fuel system). This may result in delayed starting of the engine.



The fuel shut-off system will not be incorporated in the Audi A6 and A8 until model year 2000.



Further information concerning the fuel shut-off system can be found under Vehicle Safety in SSP 207 and SSP 213.



## The air conditioner requirement interface

In the case of a high air conditioner output requirement, the idling speed of the engine is increased to increase the output of cool air from the air conditioner compressor.

In some cases, air conditioning requirements may be such that the "air conditioner requirement" interface is also switched to "high" at the air conditioner operating and display unit whereupon the engine control unit is informed of the increased output requirement.

This can be tested using the "Read measured value block" function of the diagnosis tester (see repair manual).

**It is important to note that the function for increasing the idling speed is not available for all engine variants, even if the signal is sent to the engine control unit.**

## Self-diagnosis

The air conditioner requirement interface is not monitored by the self-diagnosis system.

## Effect of fault

The idling speed is not increased which results in a reduction in the output of cool air when the engine is idling.

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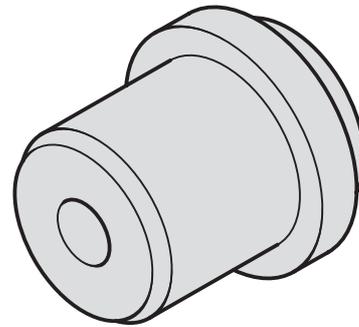


A number of new special tools are required by the Service department for repairing the V8-5V engine.

Thrust pad

for crankshaft oil seal

Order No.T40007

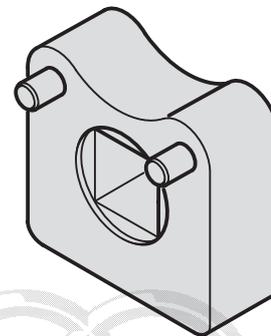


SSP213\_007



Tensioning roller spanner

Order No.T40009



SSP213\_008

Camshaft retainer

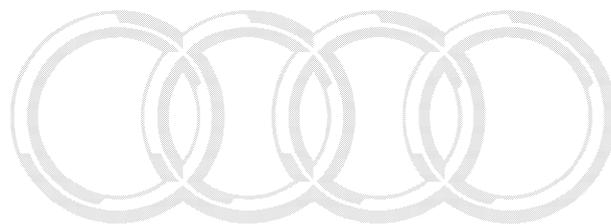
Order No.T40005



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SSP213\_009





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Dear Reader,

This self-study programme has allowed you to familiarise yourself with the new technical features of the V8-5V engine.

Our aim is to make the content of the self-study programme material as interesting as possible.

This is why we want to give you the opportunity to tell us your opinions and suggestions for future self-study programmes.

The following questionnaire is intended to assist you in doing this.

Send your comments and suggestions to the fax number 0049/841 89 36 36 7.

We thank you for your support.

The Technical Training Service Team



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