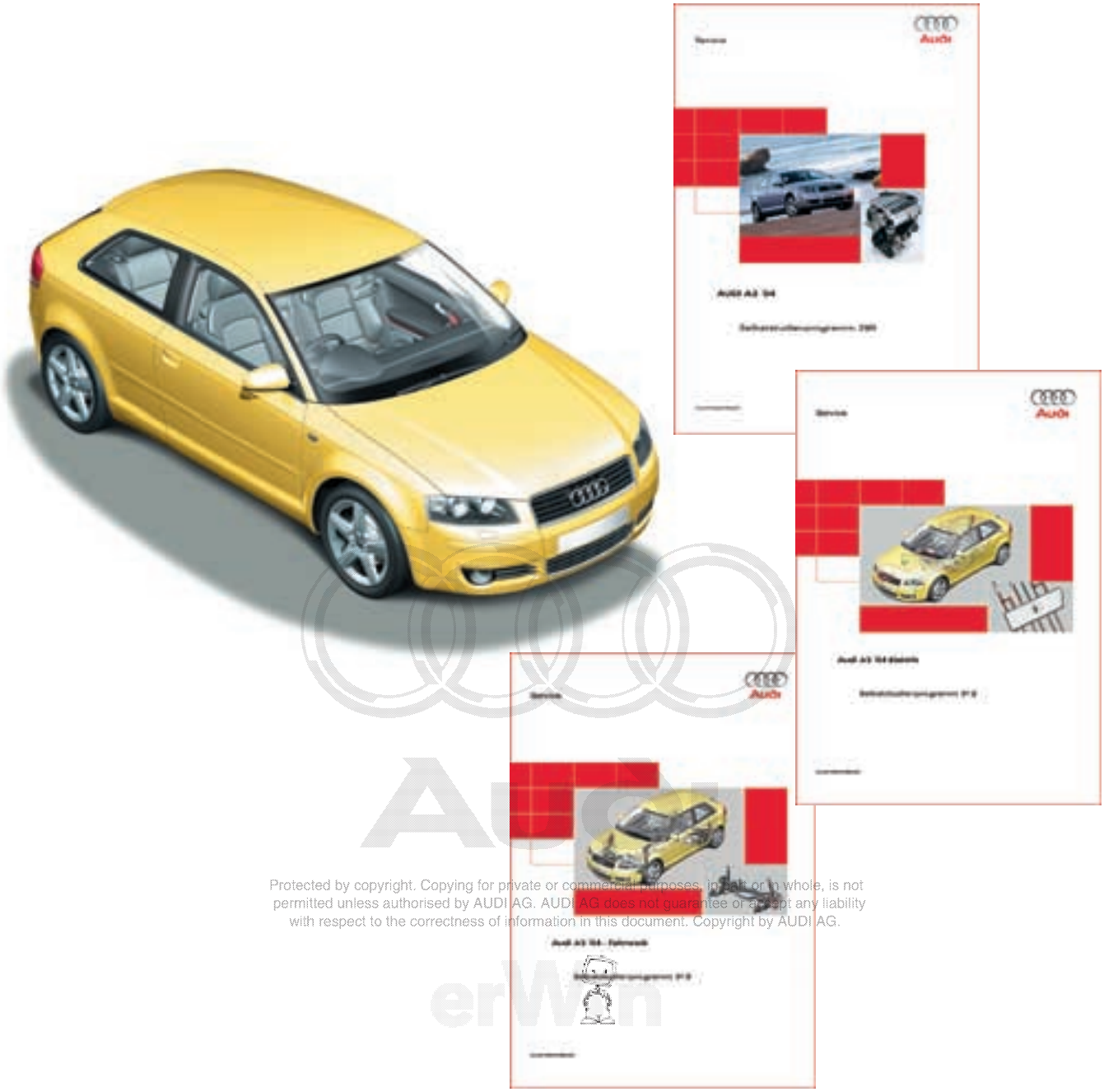
Service.

AUDI A3 ´04

Self Study Programme 290

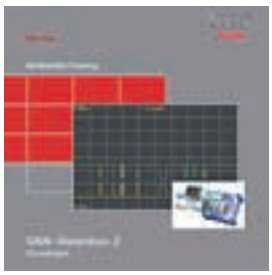
For internal use only

This SSP is intended to give a general outline of the design and operation of the Audi A3 ‘04. Further relevant information can be found in the various Self Study Programmes and other media such as the CAN data bus CDs.



Vorsprung durch Technik

Media containing further material on the Audi A3 ‘04 include the CAN data bus CDs Parts 1 and 2.



This Self Study Programme deals exclusively with the special features of the Audi A3 ‘04.

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The Self Study Programme contains information on design features and functions.

The Self Study Programme is not intended as a Workshop Manual. Values given are only intended to help explain the subject matter and relate to the software version applicable at the time of SSP compilation.

Use should always be made of the latest technical publications when performing maintenance and repair work.

Attention

New

Introduction

The new Audi A3 ‘04

The new top sports model in the compact class is raring to go and is to take the place of its predecessor of the same name.
In combination with the highly dynamic running gear, powerful petrol and diesel engines up to 177 kW, quattro drive and the new automatic-shift sporty gearbox DSG make sure the image of driving fun created by the sporty body design does not remain an empty promise.
The use of exclusive equipment and materials again guarantees that the high standards typical of the large Audi models come into play in the compact class as well.

Gateway as
separate control unit

V6 engine

Direct-shift
gearbox

Body shell
modifications

Individual climate
control

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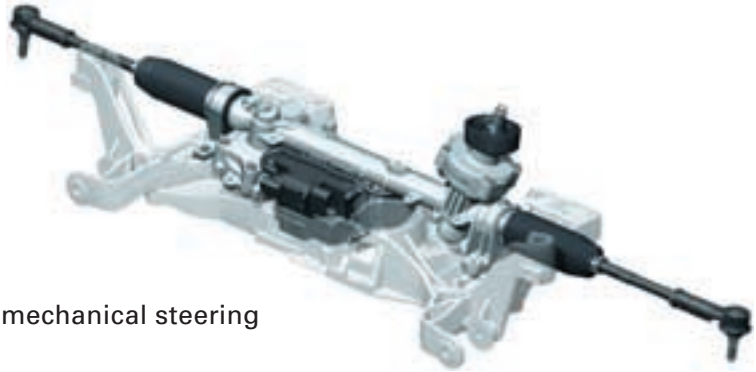
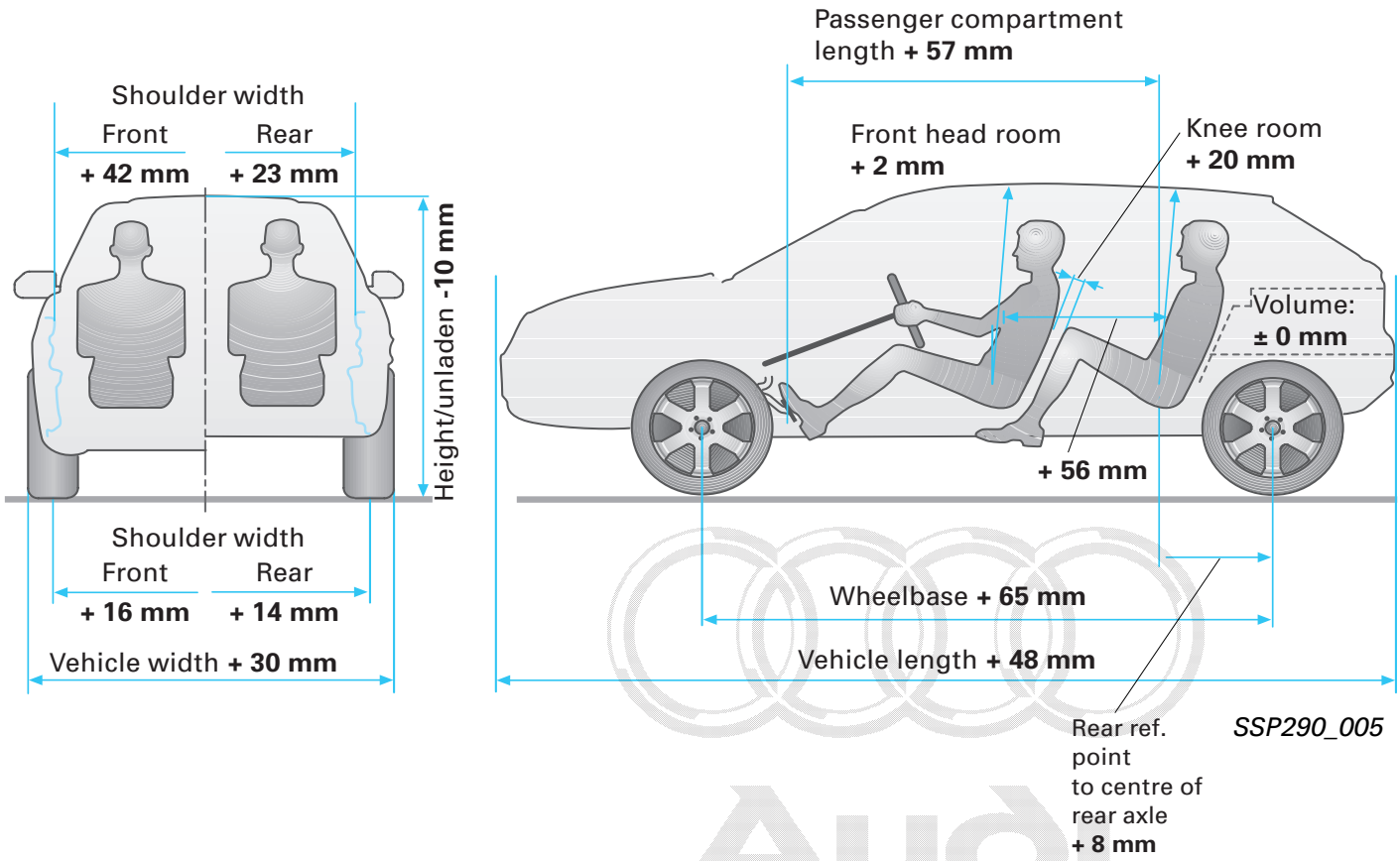


Electromechanical steering

Introduction

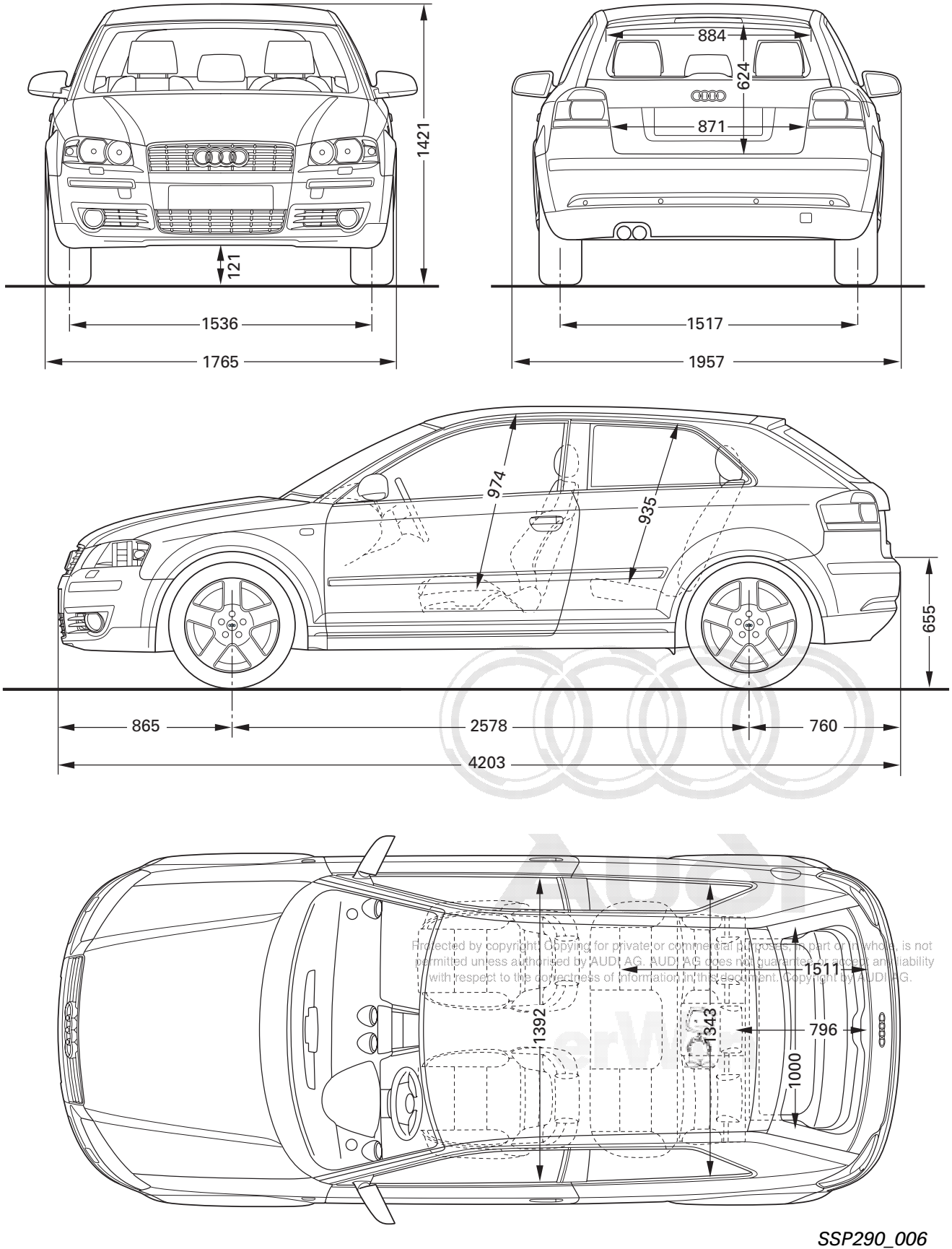
Brief outline

Principal Audi A3 '04 dimensions.
The diagrams below illustrate the changes in relation to the predecessor model.



Length	4203 mm	Front track	1536 mm
Width	1765 mm	Rear track	1517 mm
Height	1421 mm	Gross weight	1835 kg
Wheelbase	2578 mm	Kerb weight	1275 kg
Turning circle	10,70 m	Luggage compartment volume	350 litres
Tank capacity	55 litres	Drag coefficient	0.31 c_d

The vehicle dimensions indicated are measured in mm at kerb weight.



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Body shell

Lightweight body

Bearing in mind the requirements in terms of
- Passive safety
- Torsional rigidity
- Vibration damping
- Acoustics

vehicle development work focused on lightweight construction methods.

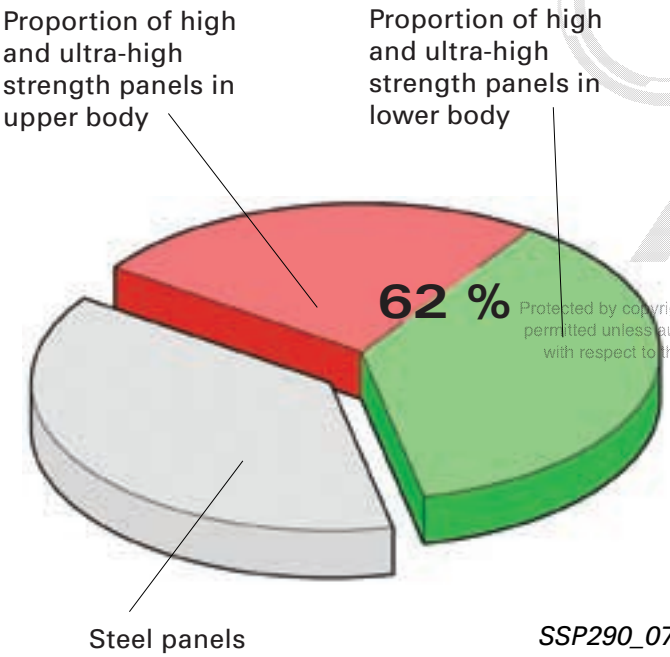
Upper body

The strength of the upper body is achieved by employing modern fastening methods.
A great deal more use has been made of laser and bonded seams than in the predecessor model. The weight component of high and ultra-high strength panels in the upper body has been increased to almost 50 %.

SSP290_072

Lower body

Whilst maintaining the same strength, material weight reductions of around 25 % were obtained for certain components through the use of tailored blanks and high/ ultra-high strength panels.
The weight component of high-strength steel panels in the underbody is 56 % and that of ultra-high strength panels 15 %.



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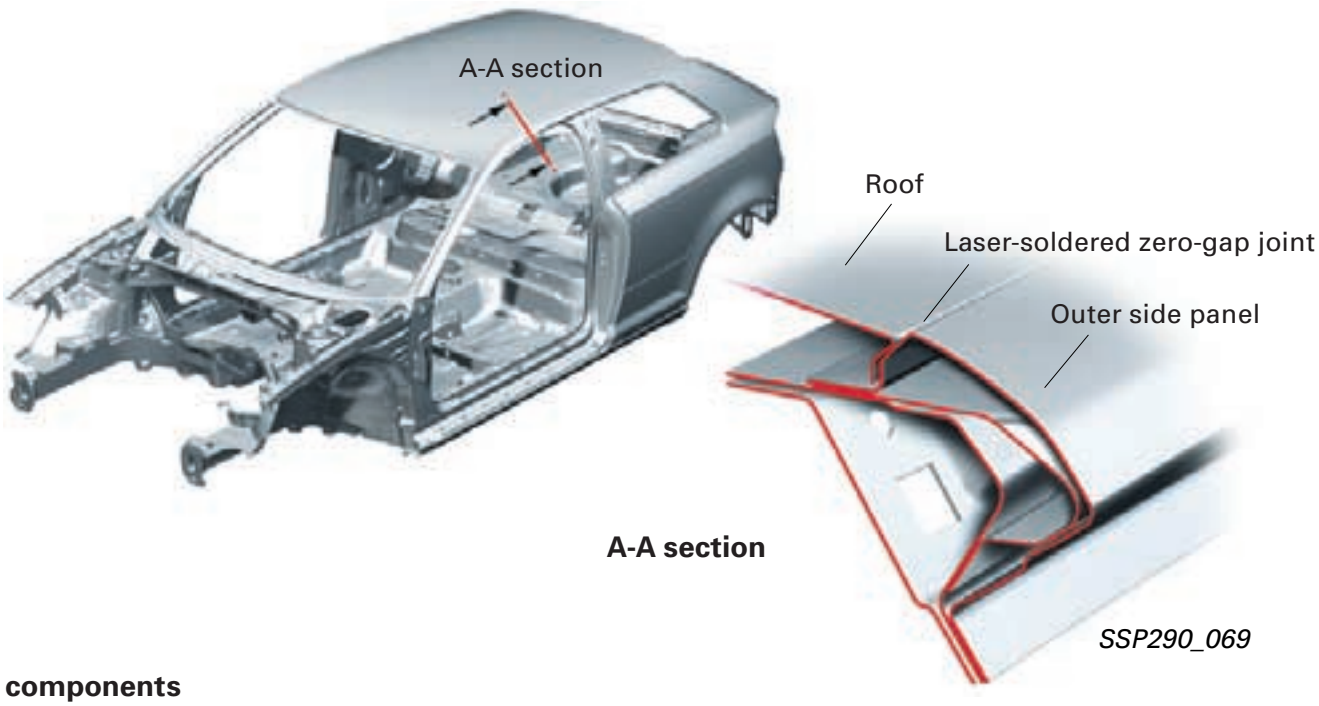
"Tailored blanks" are panels manufactured to size with different material thicknesses.

Roof zero-gap joint

The roof and side wall frames are seamlessly joined by way of laser soldering.

The overall length of the laser soldered joint is 3 metres.



A-A section

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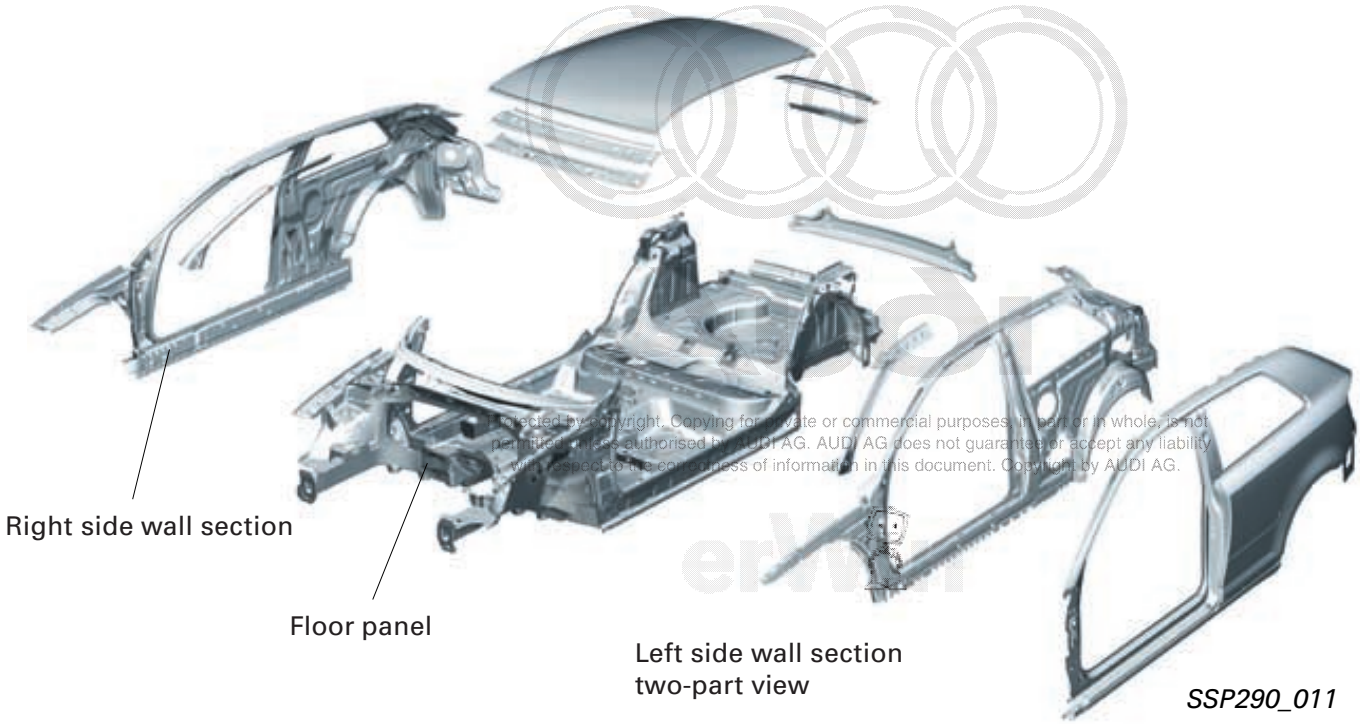
Body components

This robust upper body structure helps to increase the overall bending strength and torsional rigidity in the trimmed body by 20 %.

Major factors in this were optimised joints and a modified joining sequence.



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Front bumper

The bumper of the Audi A3 ‘04 is painted entirely in the same colour as the vehicle.

It comprises the following components:
- Bumper cover
- Cover for towing eye
- Side end plate
- Radiator grille
- Centre grille
- Side air inlet grilles and
- Bumper bracket

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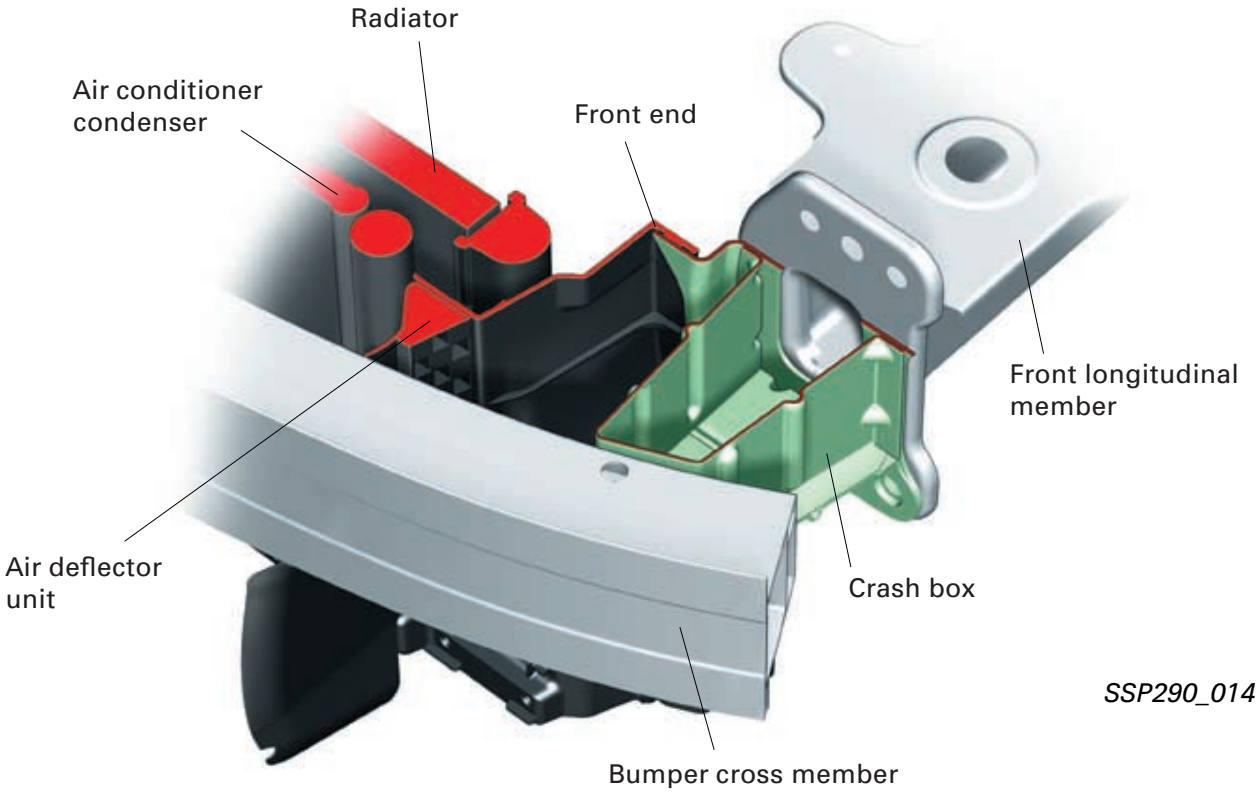
The bumper bracket takes the form of an aluminium cross member.

Connection to the longitudinal members is provided by the so-called steel crash boxes.



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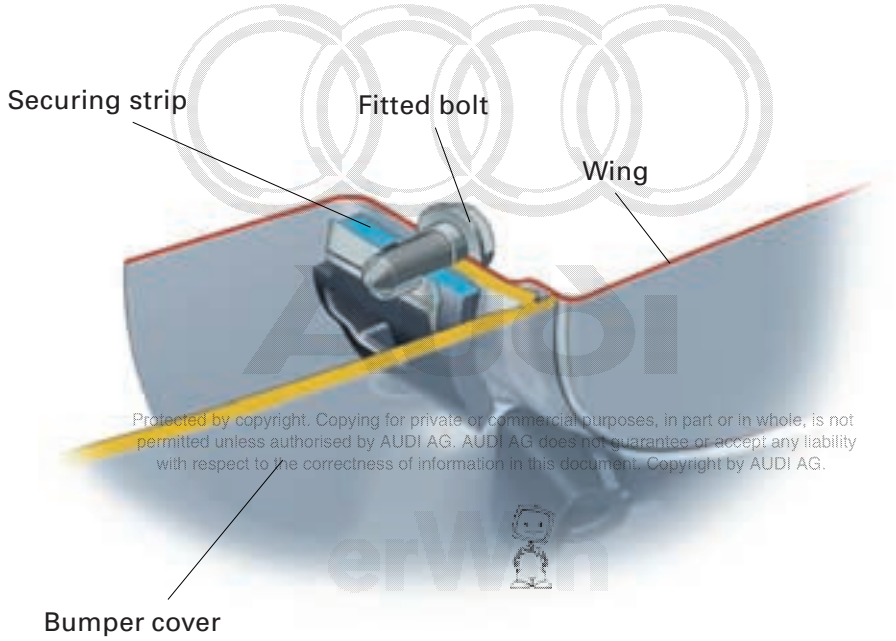
The zero-gap joint between bumper and wing is guaranteed by a zero-gap joint bolt.

This connects the wing to the bumper cover.



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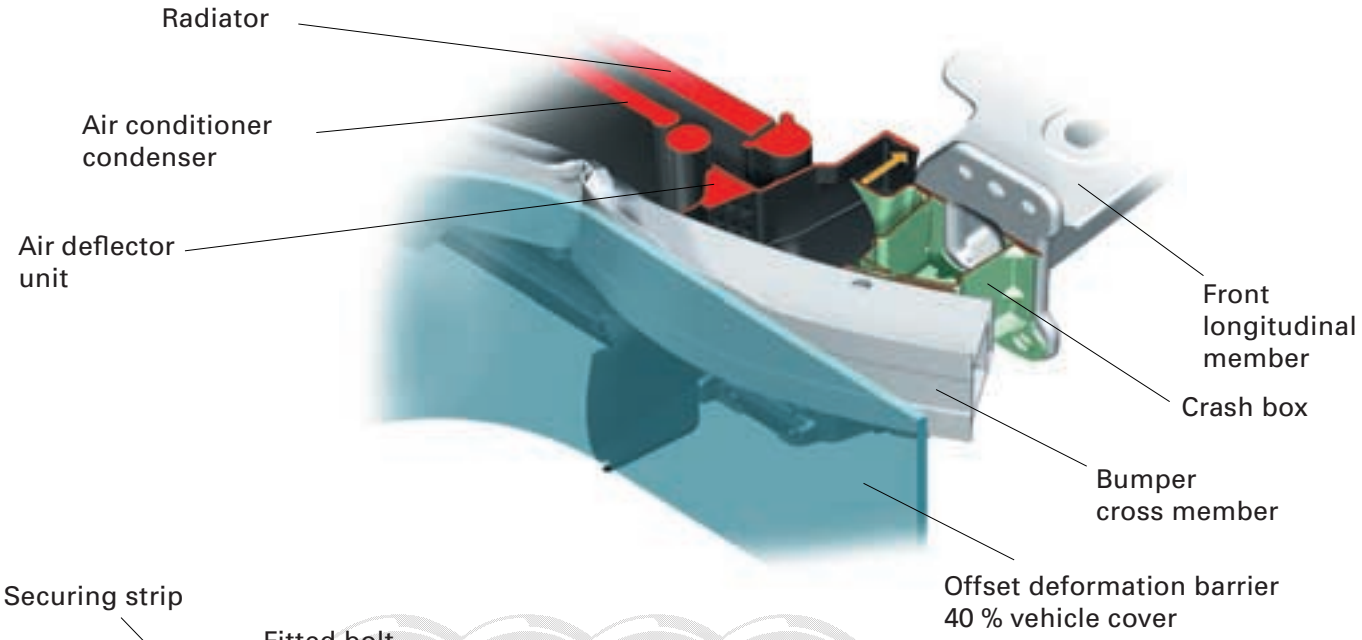
Body

With a view to achieving optimum crash safety, the development work for the entire bumper system was coordinated from the outset with that for the front end and its add-on components (air-conditioner condenser and radiator.

Success was thus achieved in considerably reducing damage to these components, particularly in the 15 km/h model damage and 64 km/h Euro NCAP* tests.

In the model damage test, the bumper bracket strikes the front end carrier and breaks it out of its bolted connections to the body.
This produces a larger crumple zone for the bumper bracket and avoids damage to the air conditioner condenser and radiator.

The transverse forces acting on the longitudinal member in the model damage and Euro NCAP* tests are reduced and robust deformation properties result.



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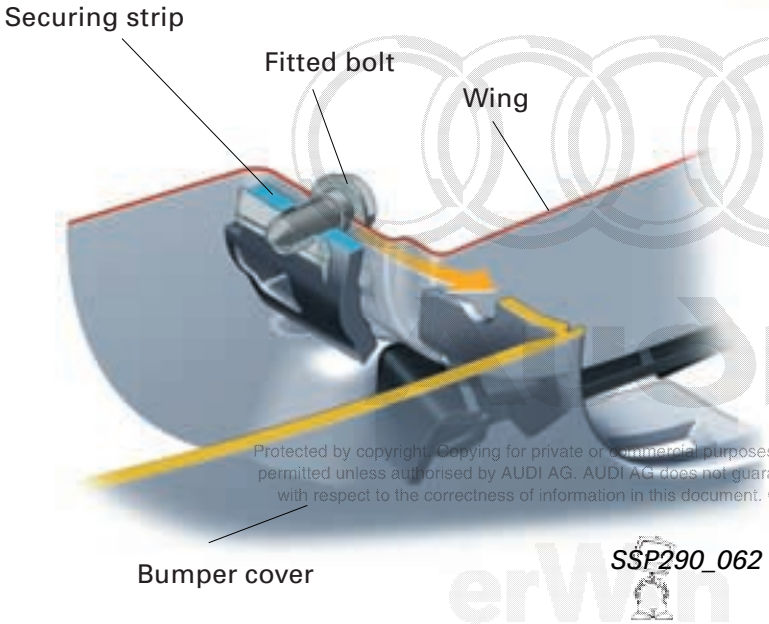

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To avoid wing damage in the model damage test, the bumper cover detaches itself from the wing and breaks away to the side.

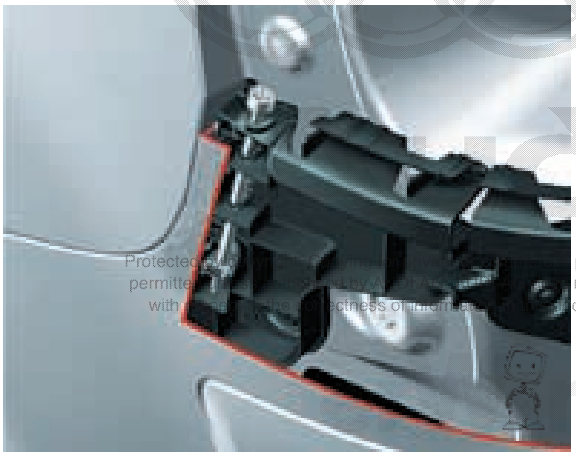
* New Car Assessment Programme
Association of government agencies, institutes and organisations at a European level, e.g. TÜV, ADAC, insurers, aimed at providing consumers with transparent vehicle safety standards.

Rear bumper

The bumper bracket and support bracket are produced as aluminium extruded sections.

The bumper comprises the following components
- Bumper cover
- Spoiler
- Cover for towing eye and
- End plate

SSP290_068



The zero-gap joint between bumper and side panel takes the form of a clipped rather than a bolted joint.

The clipped joint is fastened by a bolt which is accessible after removing the rear light.

SSP290_074

Passenger protection

Safety systems

The safety system in the new Audi A3 '04 has been revised and adapted accordingly to meet with current and future demands in terms of occupant safety.

The system essentially consists of familiar components such as: airbag control unit, driver's and front passenger's airbag, front side airbags, front belt tensioners, sideguards (head airbags) and side impact recognition sensors.

New features are the external front airbag crash sensors (so-called upfront sensors for detection of head-on collisions) and battery deactivation in the event of a crash on vehicle models with the battery fitted in the luggage compartment.

Vehicles can optionally be equipped with a key switch for front passenger's airbag deactivation and the corresponding warning lamp.

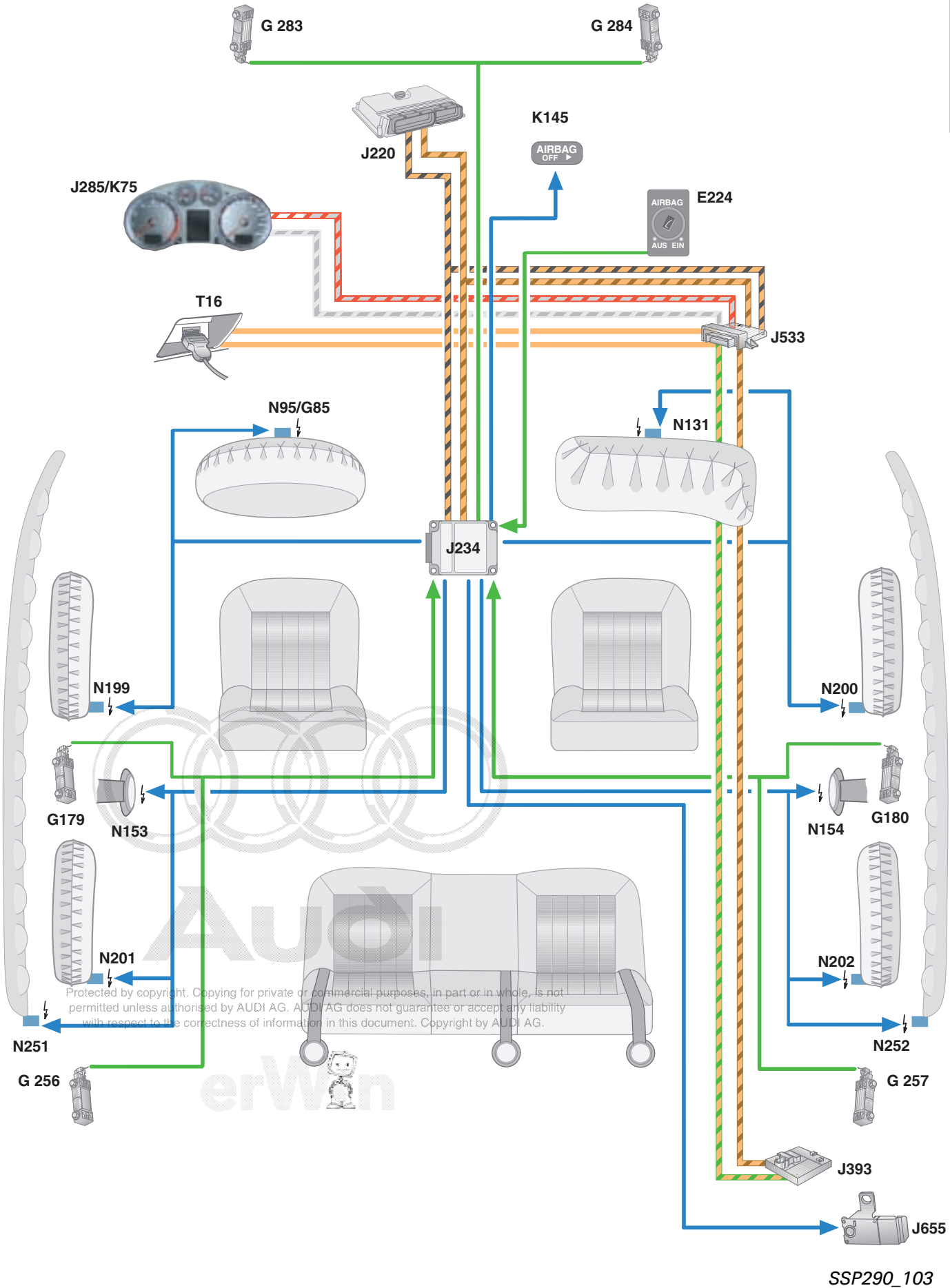
The Audi A3 '04 safety system is rounded off by the active head restraints in the front seats.

For the first time use is made in the Audi A3 '04 of airbag modules which are not subject to any replacement intervals.

Always heed the corresponding safety regulations outlined in the Workshop Manuals before working on the airbag system.

Key:

E224	Airbag disabling key switch, front passenger side
G179	Side airbag crash sensor, driver side (B-pillar)
G180	Side airbag crash sensor, front passenger side (B-pillar)
G256	Rear side airbag crash sensor, driver side
G257	Rear side airbag crash sensor, front passenger side
G283	Front airbag crash sensor, driver side
G284	Front airbag crash sensor, front passenger side
J220	Engine control unit
J234	Airbag control unit
J285	Control unit with display in dash panel insert
J393	Convenience system central control unit
J533	Data bus diagnostic interface (gateway)
J655	Battery cut-off relay
K75	Airbag warning lamp
K145	Airbag disabled warning lamp, front passenger side
N95	Airbag igniter, driver side
N131	Airbag igniter 1, front passenger side
N153	Belt tensioner igniter 1, driver side
N154	Belt tensioner igniter 2, front passenger side
N199	Side airbag igniter, driver side
N200	Side airbag igniter, front passengerside
N251	Curtain airbag igniter, driver side
N252	Curtain airbag igniter, front passenger side
T16	Connector, 16-pin diagnostic connection

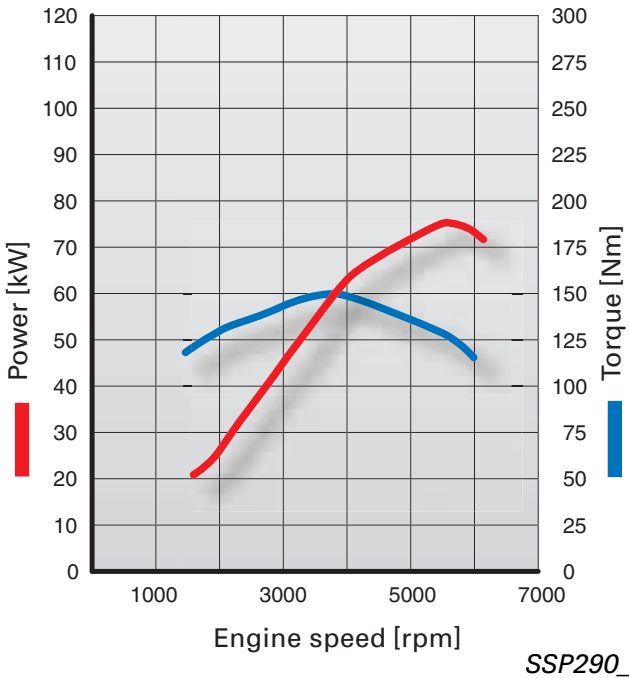


SSP290_103

Engines – Audi A3 '04

Technical data of 1.6 l 2V engine

Code letters:	BGU
Capacity:	1595 cm^3
Stroke:	77.4 mm
Bore:	81.0 mm
Compression ratio:	10.3 : 1
Valves:	two per cylinder
Power:	75 kW/102 hp at 5600 rpm
Torque:	148 Nm at 3800 rpm
Firing order:	1-3-4-2
Capacity Engine oil incl. filter:	4.6 l
Engine management:	MPI
Consumption:	Urban 9.6 - 9.8 l/100 km Non-urban 5.5 - 5.7 l/100 km Average 7.0 - 7.2 l/100 km
Acceleration:	0 - 100 km/h in 11.9 s
Emission standard:	EU 4
Fuel:	Premium Unleaded 95 RON



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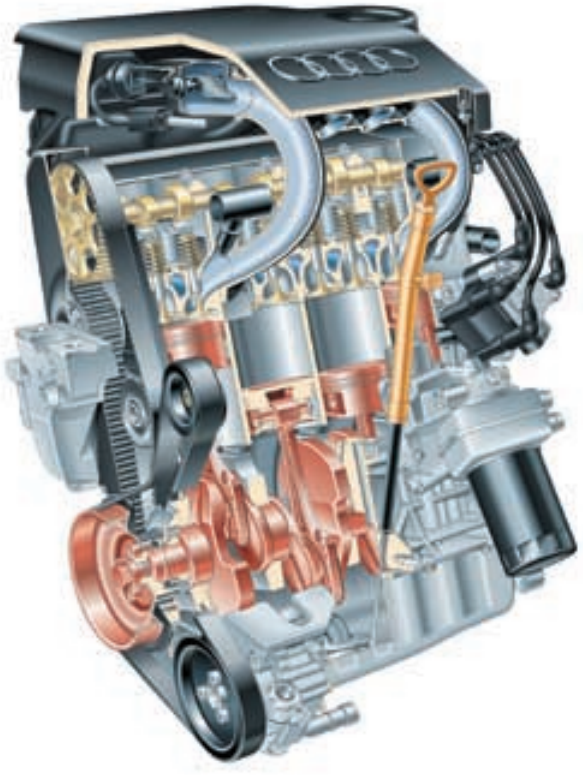
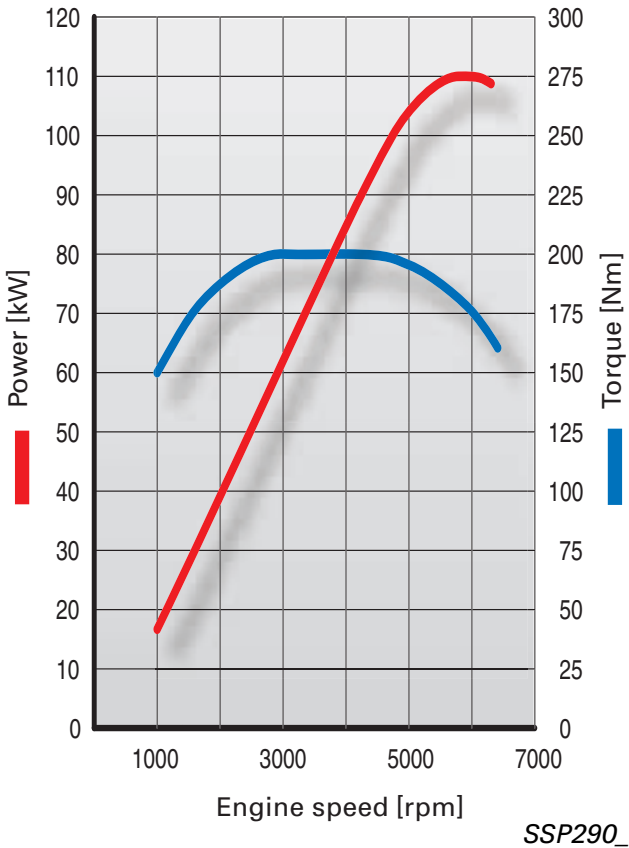


SSP290_009

Technical data of 2.0 l FSI engine

Code letters:	AXW
Capacity:	1984 cm^3
Stroke:	92.8 mm
Bore:	82.5 mm
Compression ratio:	11.5 : 1
Valves:	four per cylinder
Power:	110 kW/150 hp at 6000 rpm
Torque:	200 Nm at 3500 rpm
Camshaft adjustment range:	42° crank angle
Firing order:	1-3-4-2
Capacity Engine oil incl. filter:	4.6 l
Engine management:	MED 9.5.10
Consumption:	Urban 9.6 - 10.1 l/100 km Non-urban 5.3 - 5.8 l/100 km Average 6.9 - 7.4 l/100 km
Acceleration:	0 - 100 km/h in 9.1 s
Emission standard:	EU 4
Fuel:	Premium Plus Unleaded 98 RON



SSP290_004

SSP290_029

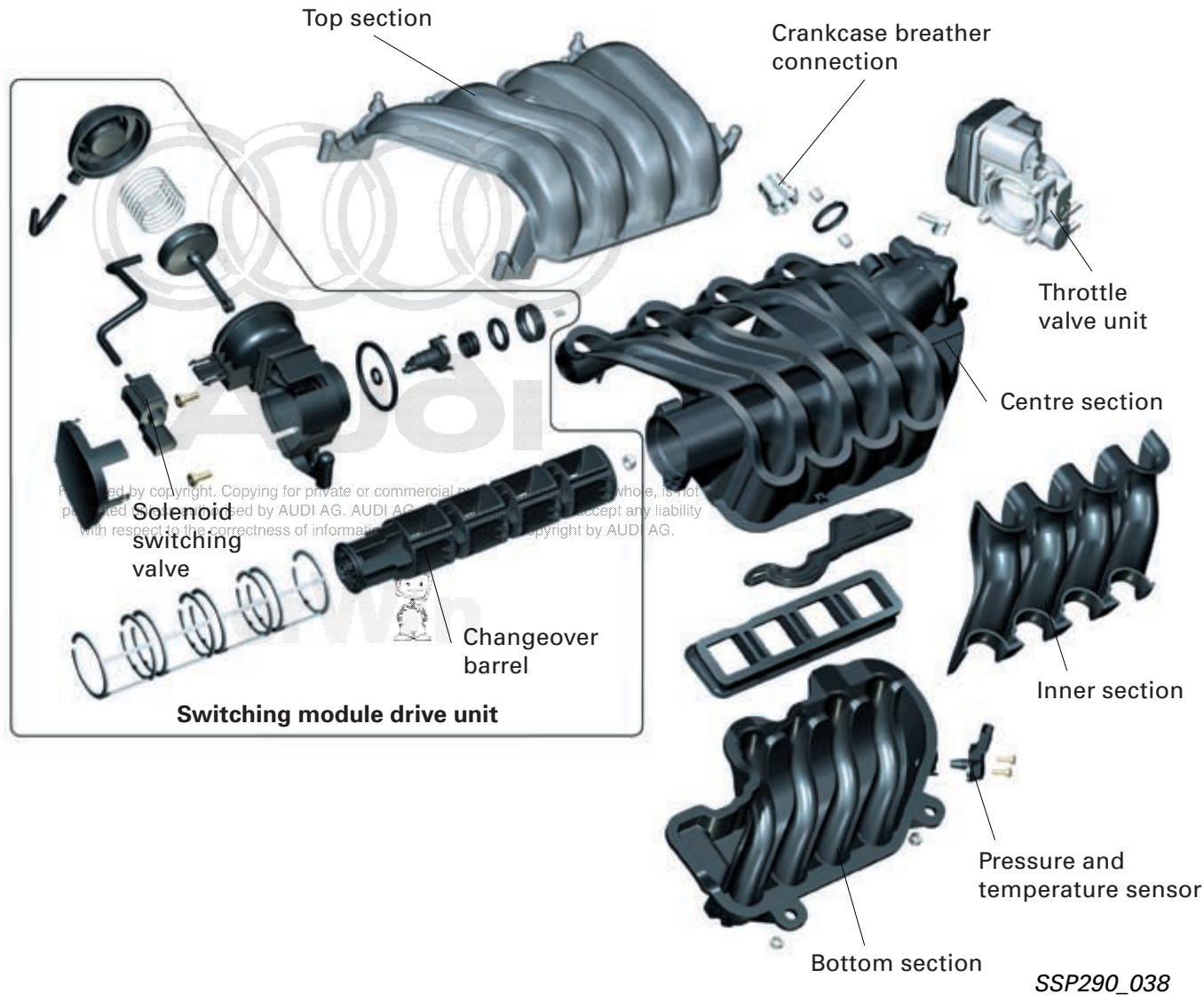
Design and operation are described in Self Study Programme 279.

FSI engine

Use is made of the longitudinally mounted 2.0 l 4V FSI engine familiar from the A4. The modifications are described in the following.

For transverse installation, a new intake manifold was developed with changeover barrel as switching element. For space reasons the torque pipes had to be installed in crossover arrangement to maintain the optimum intake manifold length. Enlarging the diameter of the changeover barrel to 60 mm (A4 50 mm) permitted an increase in the air throughput of the short power pipes.

For further details refer to Self Study Programme 279.

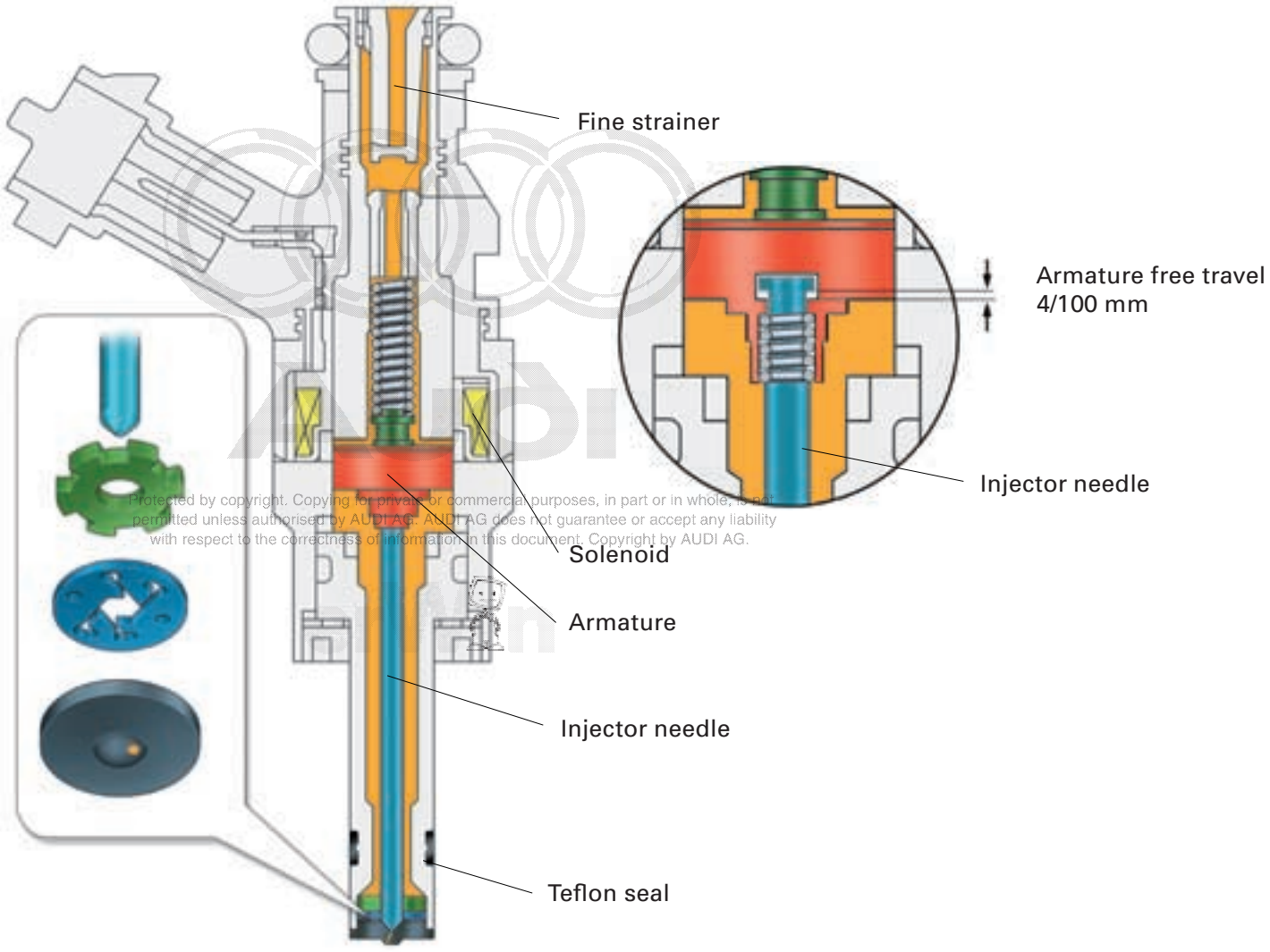


Engine management without air-mass meter

The management system for the 2.0 l FSI engine has been switched from MED7.1.1 to MED9.5.10. The use of a 32-bit processor and a new PCB layout provides scope for the future introduction of functions currently still under development.
The control unit design has become more compact thanks to new output stages (less heat generation).

The injector actuation voltage has been reduced from 90 V to 65 V. This was made possible by so-called armature free travel.

Armature free travel was achieved by decoupling the injector needle from the armature.
Energisation of the solenoid first causes the armature to be energised (breakaway torque) and the injector needle is raised after a delay by way of a driver.



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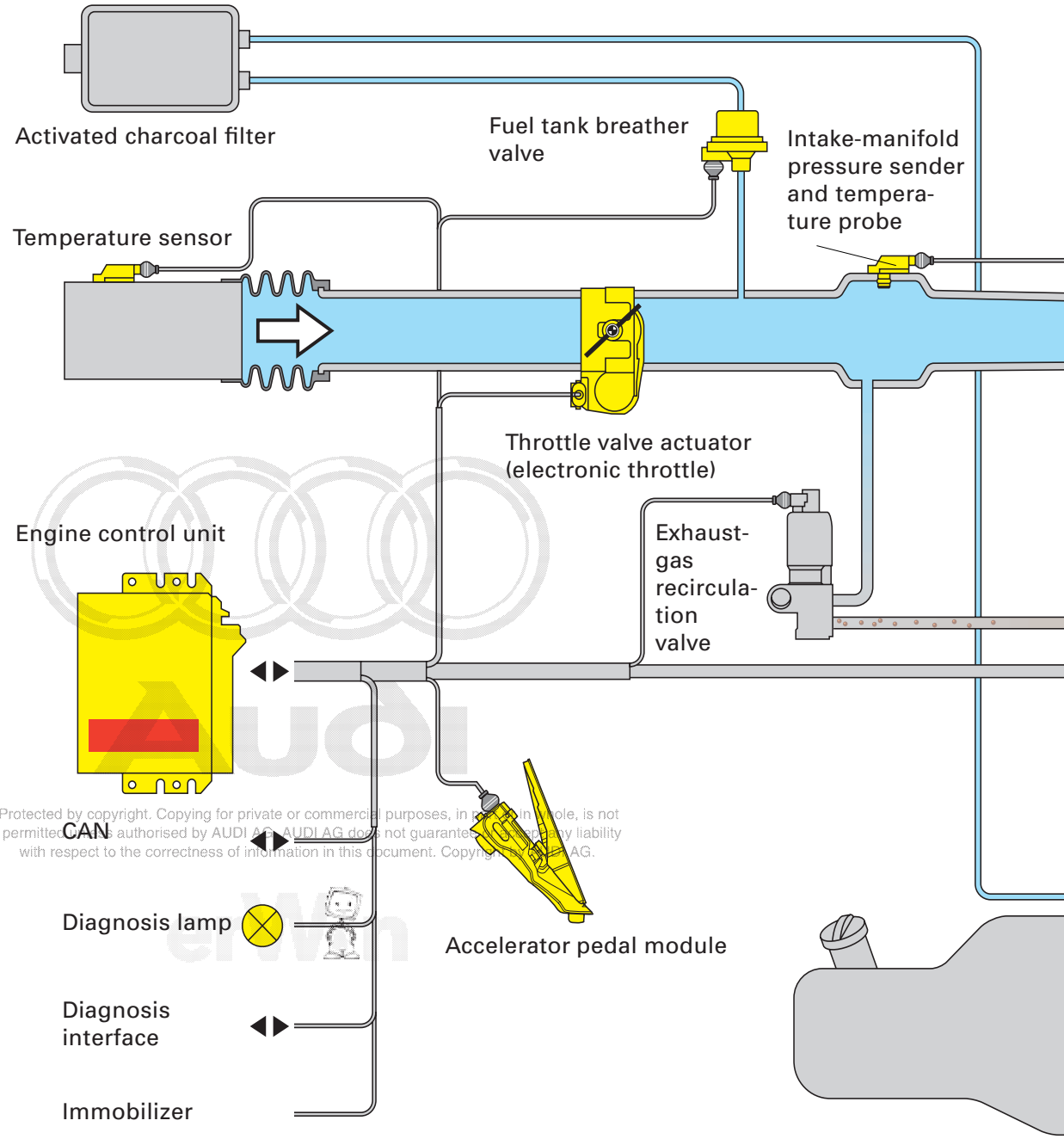
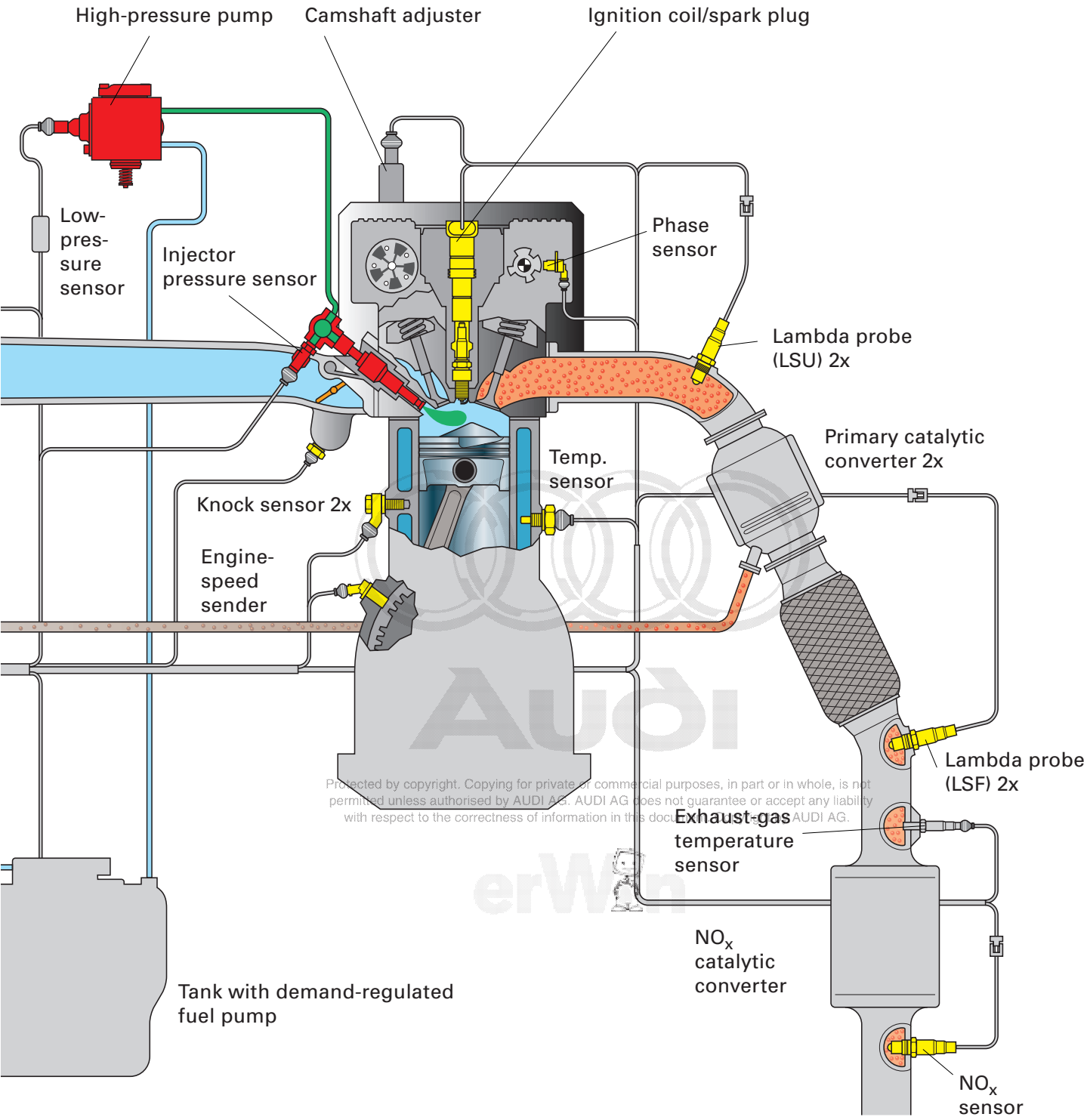
The Teflon seal always has to be replaced after removing the injector.

FSI block diagram



Load detection is based on the following sensor signals:

- Atmospheric pressure supplied by altitude sender in engine control unit
- Intake-air temperature supplied by sensor fitted upstream of throttle valve
- Throttle valve position



SSP290_043

- Pressure and temperature in intake manifold via twin sensor at intake manifold
- Position of EGR valve flap
- Position of in-cylinder flow flaps
- Position of inlet camshaft

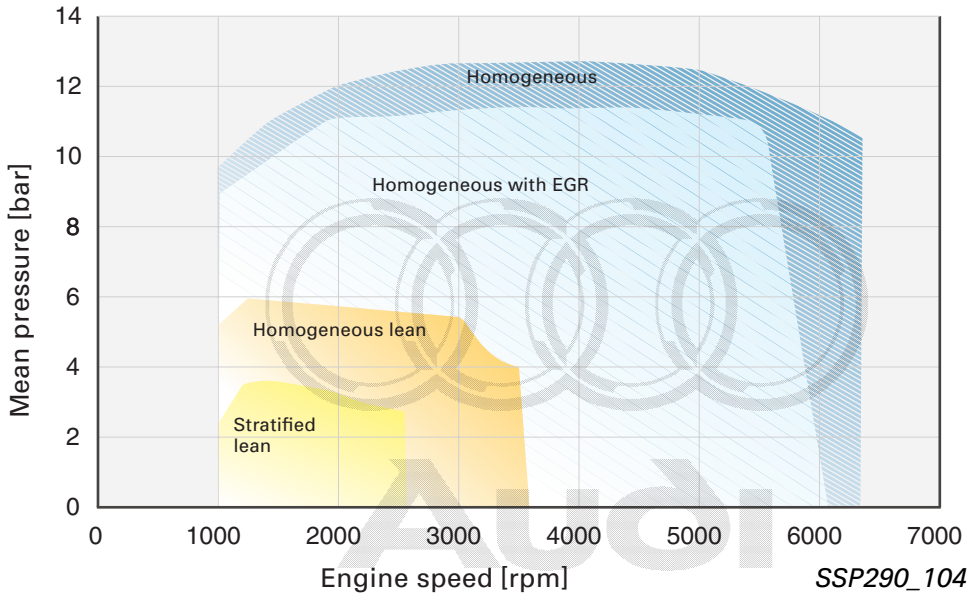
Modes of operation

An air-controlled combustion process permits homogeneous and stratified charge operation.

The engine electronics always set the optimum operating status to suit the load condition and accelerator pedal position.

There are 4 main modes of operation:

- Stratified lean with exhaust-gas recirculation
- Homogeneous lean with no EGR
- Homogeneous with Lambda = 1 and EGR
- Homogeneous with Lambda = 1 without EGR



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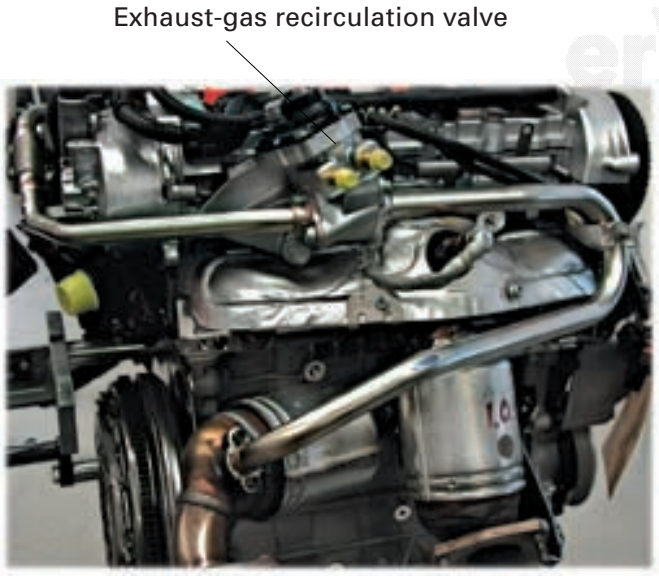
Exhaust-gas recirculation



SSP290_091

The exhaust-gas recirculation valve takes the form of a butterfly valve as in the A4.

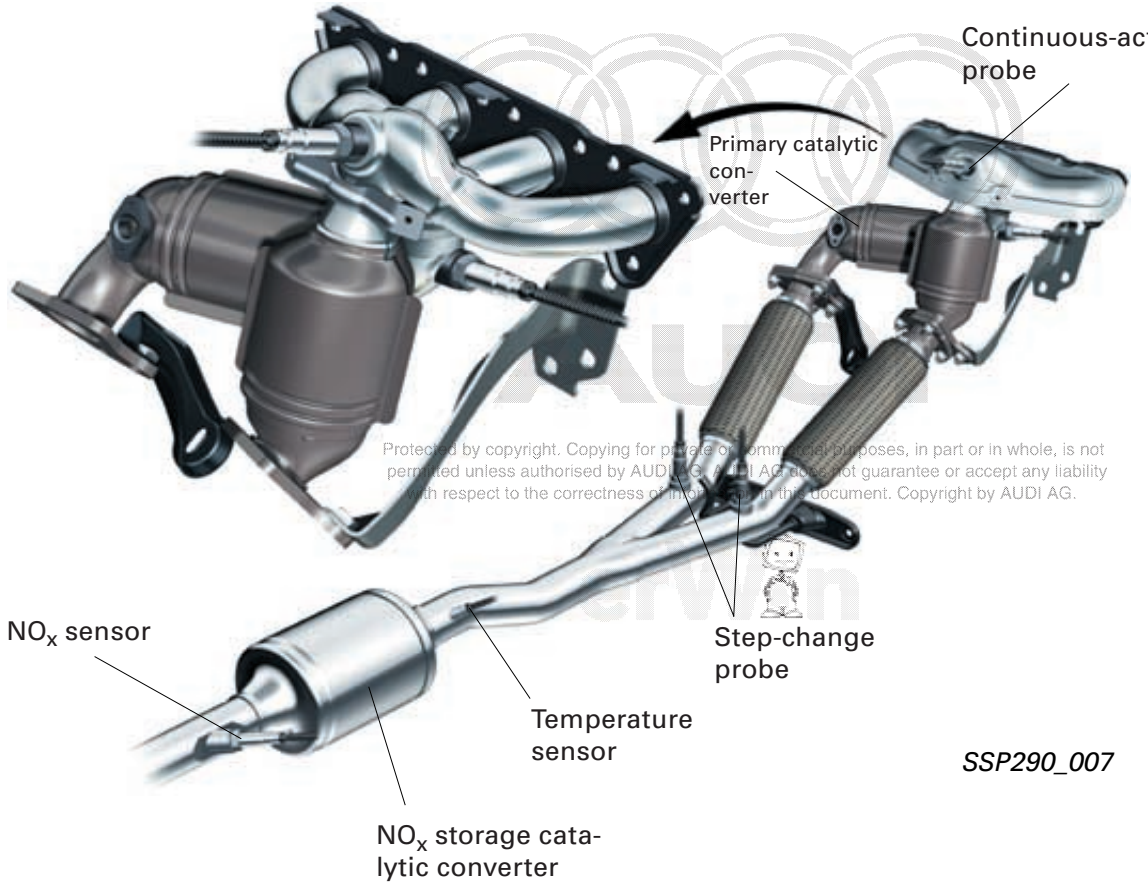
On account of its special installation position, the EGR valve fitted is water-cooled.

Exhaust system

To increase the torque in the lower engine speed range, the front section of the exhaust system is of the dual-flow type.
This necessitates the use of two primary catalytic converters in the exhaust manifold.

These are permanently connected to the exhaust manifold. Two wide-band probes monitor the mixture composition. Two step-change probes monitor catalytic converter action.

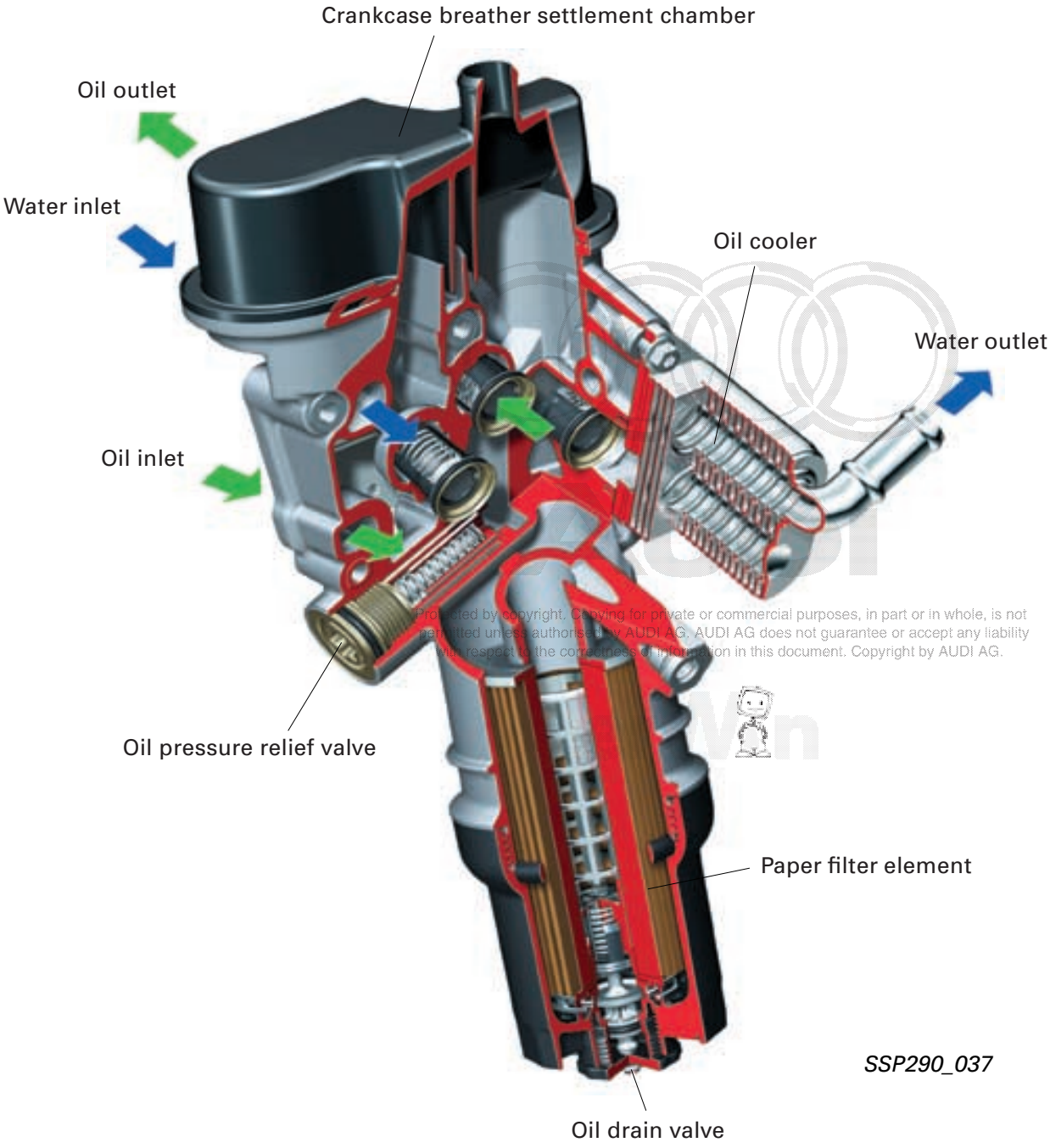
In lean mode, the storage catalytic converter provides buffer storage for the nitrogen oxides (NO_x), with the NO_x sensor monitoring the degree of saturation and triggering regeneration of the storage catalytic converter.



Oil filter module

The new oil filter module in the Audi A3 '04 was developed as a highly integrated plastic assembly containing the following units for example:

- Oil pressure relief valve
- Replaceable paper element as oil filter
- Integrated water-cooled oil cooler
- Settlement chamber for crankcase breather coarse oil separation



Filter replacement

Before replacing the paper filter element, the oil filter is to be drained using the **oil drain adapter T 40057**.

This requires the following operations:

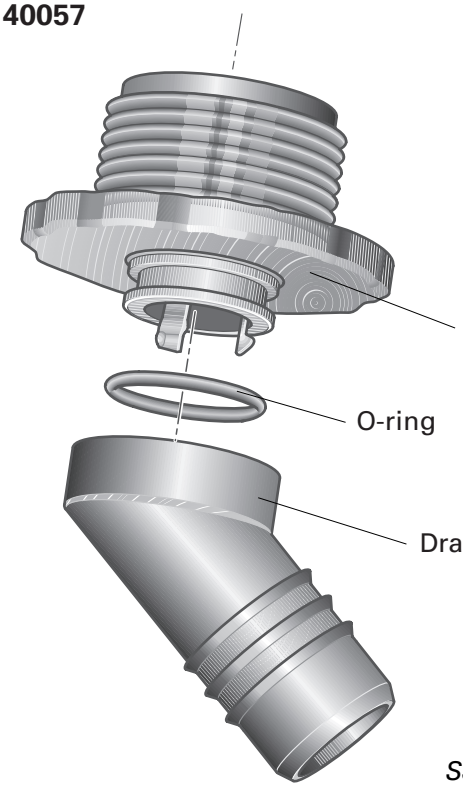
1. Unscrew plastic cover at oil filter.

SSP290_089

Plastic cover
at oil filter

2. Screw home **oil drain adapter T 40057** with drain hose in bottom part of oil filter housing and drain off oil (approx. 0.5 l). Screwing in the adapter opens a drain valve in the oil filter housing.

Oil drain adapter T 40057



SSP290_083

Note:
Pay attention to Maintenance booklet.

Fuel supply control

As with all petrol engines, as soon as the driver's door of the Audi A3 '04 is opened the fuel pump is actuated by the onboard power supply control unit and builds up the fuel pressure in the system.
In contrast to the A4, use is made of a demand-regulated fuel system. The electric fuel pump only supplies the high-pressure fuel pump with the amount of fuel it requires at a given load and engine speed.
The lower power input reduces fuel consumption.

The fuel pump control unit J538 is fitted in the cover for the fuel gauge sender. It regulates the low-pressure delivery between 0.6 l/h and 55 l/h at a constant 4 bar. On warm starting, the pressure is increased from 4 bar to 5 bar to prevent the formation of vapour bubbles and to permit injection of the quantity required for cold starting.

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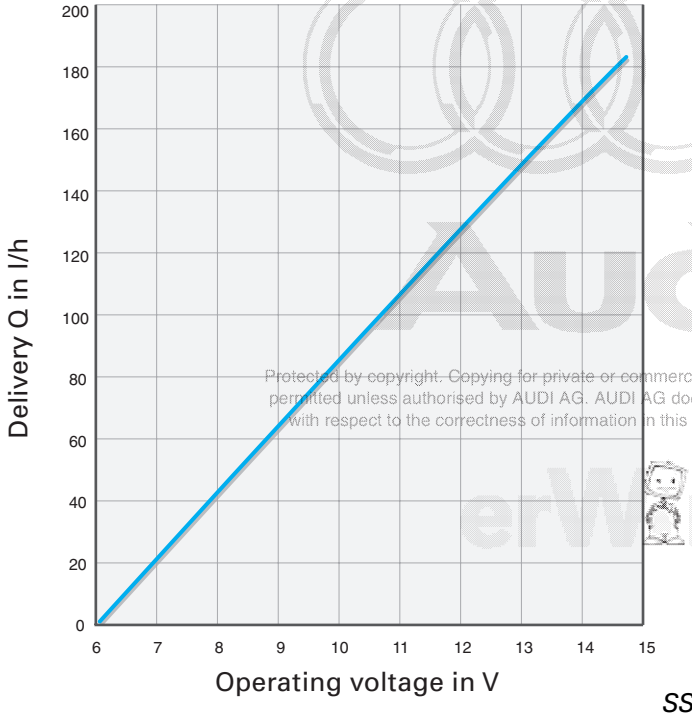

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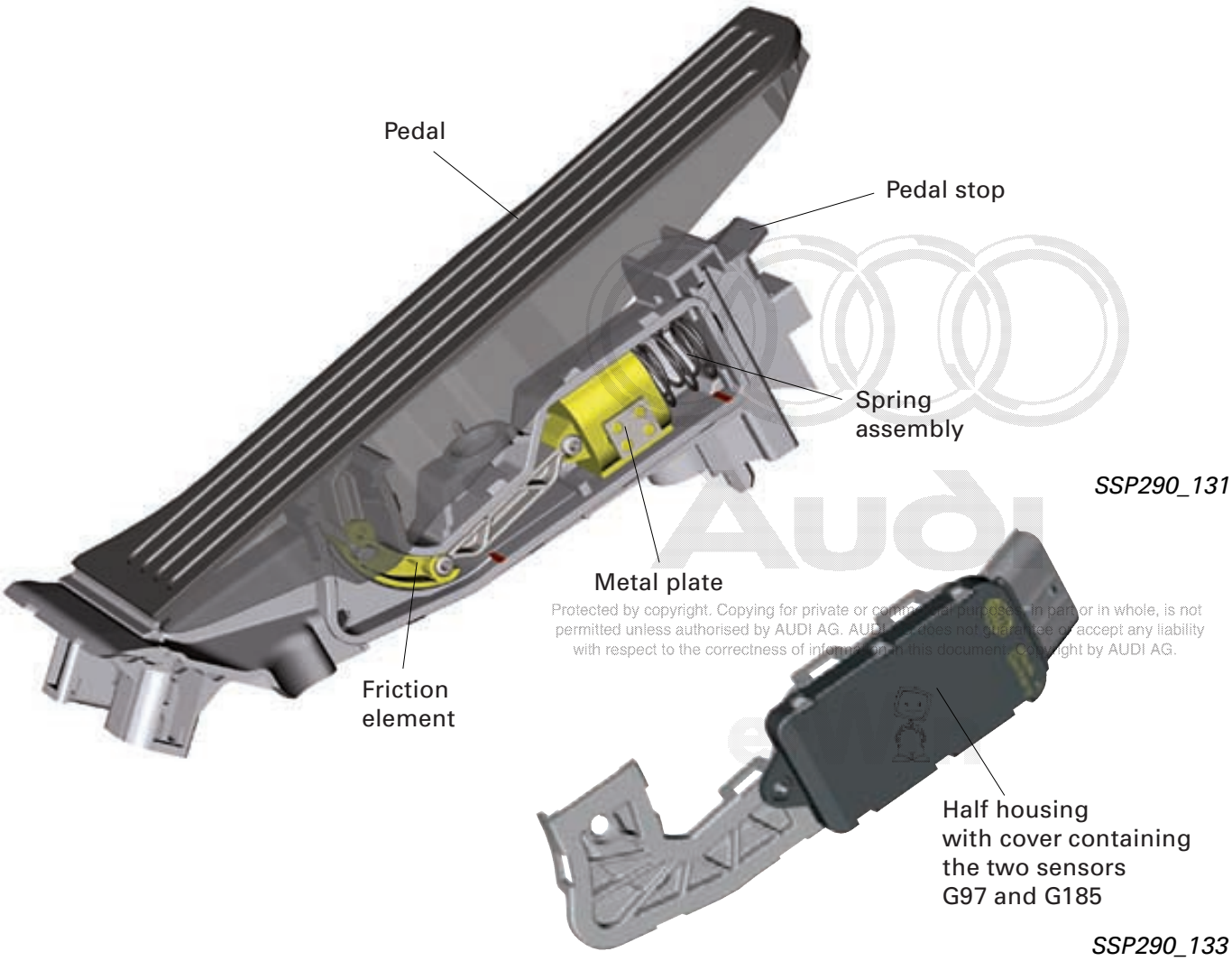
Accelerator pedal module

The accelerator pedal module in the Audi A3 '04 is arranged vertically. Accelerator pedal, kinematic mechanism, pedal position sender, kickdown element and now also as a new feature the pedal stop, have been combined into one unit.

In addition to improved ergonomics, the new accelerator pedal module has the advantage that no basic setting is required for kickdown. As the pedal stop is an integral part of the module, there are no tolerances between pedal and body-end stop. The module always supplies the same sender values in whatever vehicle it is fitted.

A new feature is the pedal position sender in the form of a linear travel sender. The two accelerator pedal position senders G79 and G185 are of the non-contacting type and employ the induction principle.
The kinematic mechanism of the accelerator pedal module converts the angular movement of the accelerator pedal into linear motion. Together with the friction element, the spring assembly provides a normal pedal feel.



SSP290_131

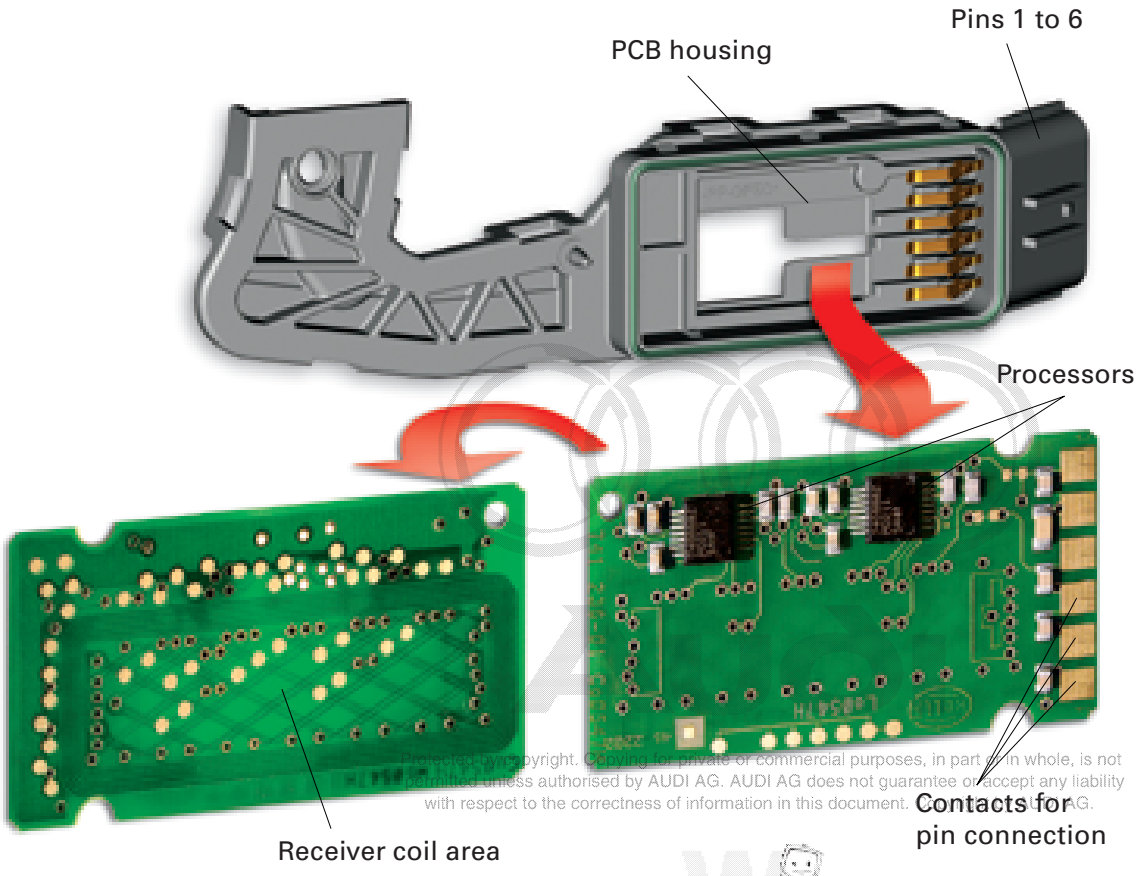
SSP290_133

Design and operation

As previously, the pedal position sender has two independent sensors (G79/G189). One excitation coil and three receiver coils as well as control and evaluation electronics are provided for each sender on a multi-layer PCB. The geometry of the receiver coils takes the form of a diamond shape and the coils are arranged so as to have a mutual phase offset. The excitation coils are located above the receiver coils.

A metal plate is attached to the kinematic mechanism of the accelerator pedal module such that it moves along in a straight line close to the PCB on pressing the accelerator pedal.

For greater clarity, design and operation are explained on the basis of one sender only.



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Function

An alternating current flows through the excitation coil. This generates an electromagnetic alternating field, the induction of which permeates the metal plate.

In turn, the current induced in the metal plate produces a second electromagnetic alternating field around the metal plate.

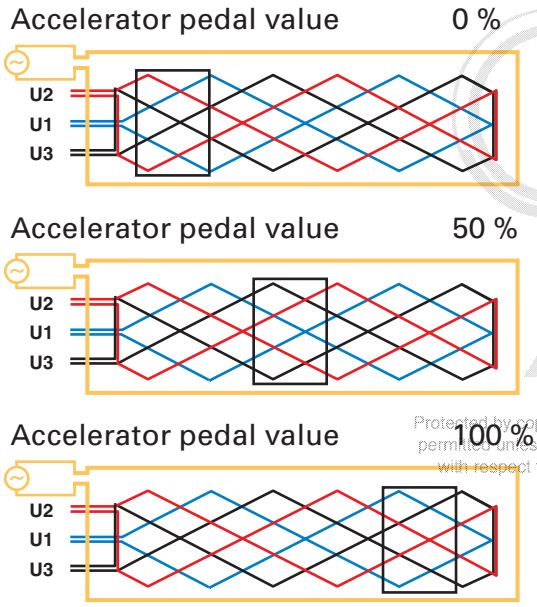
The alternating fields of both the excitation coil and the metal plate act on the receiver coils and induce a corresponding AC voltage in them.

Whereas the induction of the metal plate is not position-specific, the induction of the receiver coils is governed by their position in relation to the metal plate and thus also by the position of the plate itself.

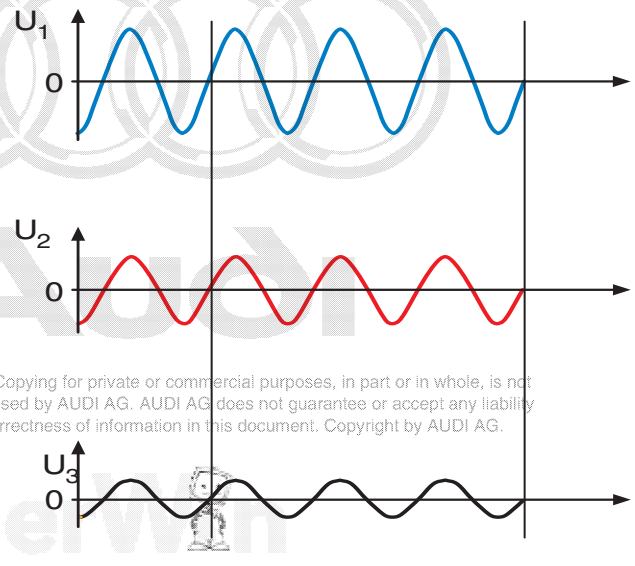
As the extent to which the metal plate covers the respective receiver coils is a function of position, their induced voltage amplitudes differ according to position.

The evaluation electronics rectify the AC voltages of the receiver coils, amplify the voltages and form the ratio between the output voltages of the three receiver coils (ratio measurement). Following voltage evaluation, the result is converted into a corresponding linear voltage signal and made available at the sender output.

Example of defined position.



SSP290_120



SSP290_128

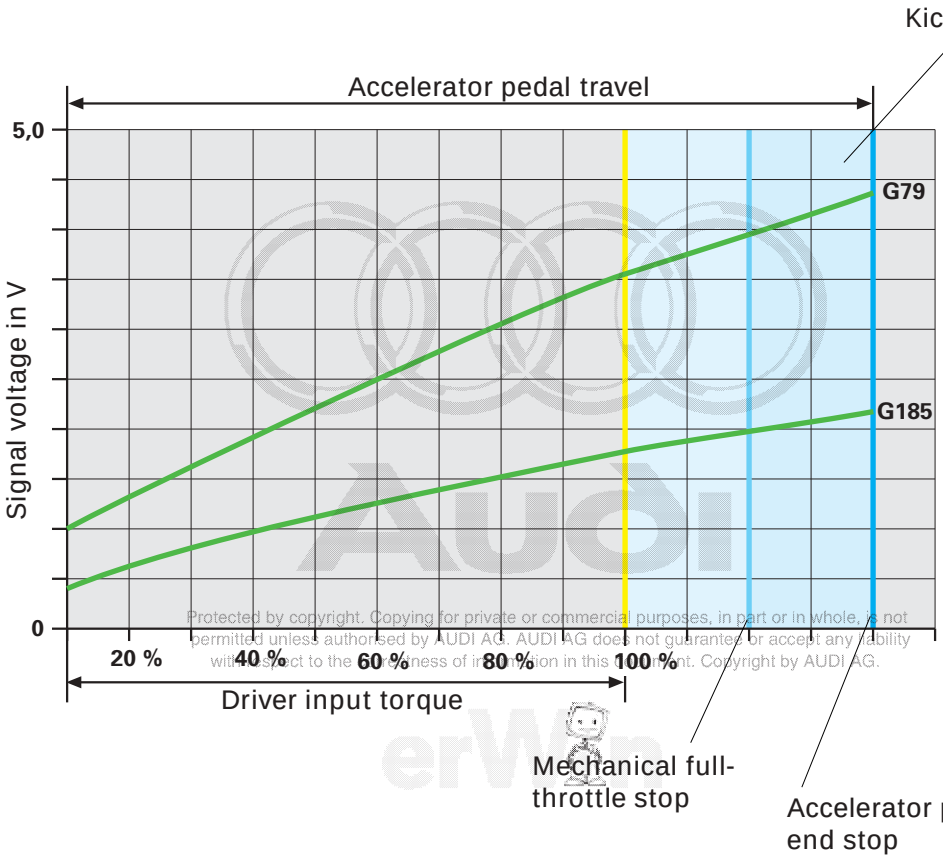
In addition to non-contacting and thus wear-free operation, the advantage of this sender is its ratio measurement method.
Ratio formation makes the travel-proportional output signal largely insensitive to component tolerances and electromagnetic interference.
As no magnetic materials are required, there are hardly any deviations caused by decreasing magnetism.

The output signals of the two senders are generated such that they are identical to the previous sliding contact senders (refer to graph).
Modifications to the engine control units are therefore not necessary.

Pin assignment at pedal position sender:

Pin 1	Power supply 5 V for G185
Pin 2	Power supply 5 V for G79
Pin 3	Earth for G79
Pin 4	Voltage signal from G79 (refer to graph)
Pin 5	Earth for G185
Pin 6	Voltage signal from G185 (refer to graph)

The accelerator pedal module is the same for both diesel and petrol engines. There are however differences for manual and automatic gearboxes.



SSP290_135

Notes

Engine

3.2 l V6 engine

The idea of using a VR engine (common term until 1987) was conceived in mid-1977.
This concept then led to the design of a 2.0 l, 2-valve engine and finally to the development in 1988 of the 2.8 l, 2-valve engine, which entered series production with the code letters AAA.
Further information on VR engines can be found in the following SSPs:

174: Modifications to VR6 engine
195: The 2.3 l V5 engine
212: Variable intake manifolds for VR engines
246: Camshaft timing control

The design and operation of this engine are outlined in Self Study Programme 127.

The engine is fitted in the new Audi A3 '04 and the Audi TT, as this is the only design with which it is possible to achieve a capacity of 3.2 l with front transverse installation in this vehicle class.

The engine technology has of course been constantly modernised.
Comfort, power and the stringent emission standards were accordingly adapted to the requirements of the new Audi A3 '04.

The technical modifications applying to this engine are described on the following pages.

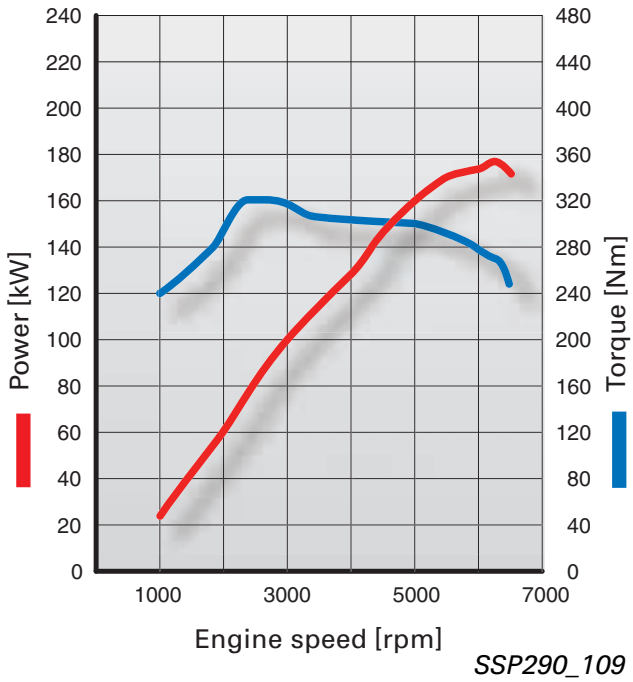
SSP290_108

Design of basic engine

- V-shaped grey cast iron cylinder block and crankcase with a cylinder angle of 15°
- Four-valve cylinder head with roller-type rocker fingers - driven via a simple roller chain
- Variable inlet and exhaust camshaft timing
- Plastic variable intake manifold
- Pencil-type ignition coil for each cylinder

Technical data of VR6 3.2 l 4V engine

Code letters:	BDB
Capacity:	3189 cm^3
Stroke:	95.9 mm
Bore:	84.0 mm
Compression ratio:	11.3 : 1
Valves:	four per cylinder
Engine management:	ME7.1.1
Power:	177 kW/241 hp at 6250 rpm
Torque:	320 Nm at 2500 - 3000 rpm
Firing order:	1-5-3-6-2-4
Camshaft adjustment range:	Inlet 52° crank angle Exhaust 42° crank angle
Emission standard:	EU 4
Fuel:	Premium Plus Unleaded 98/95 RON

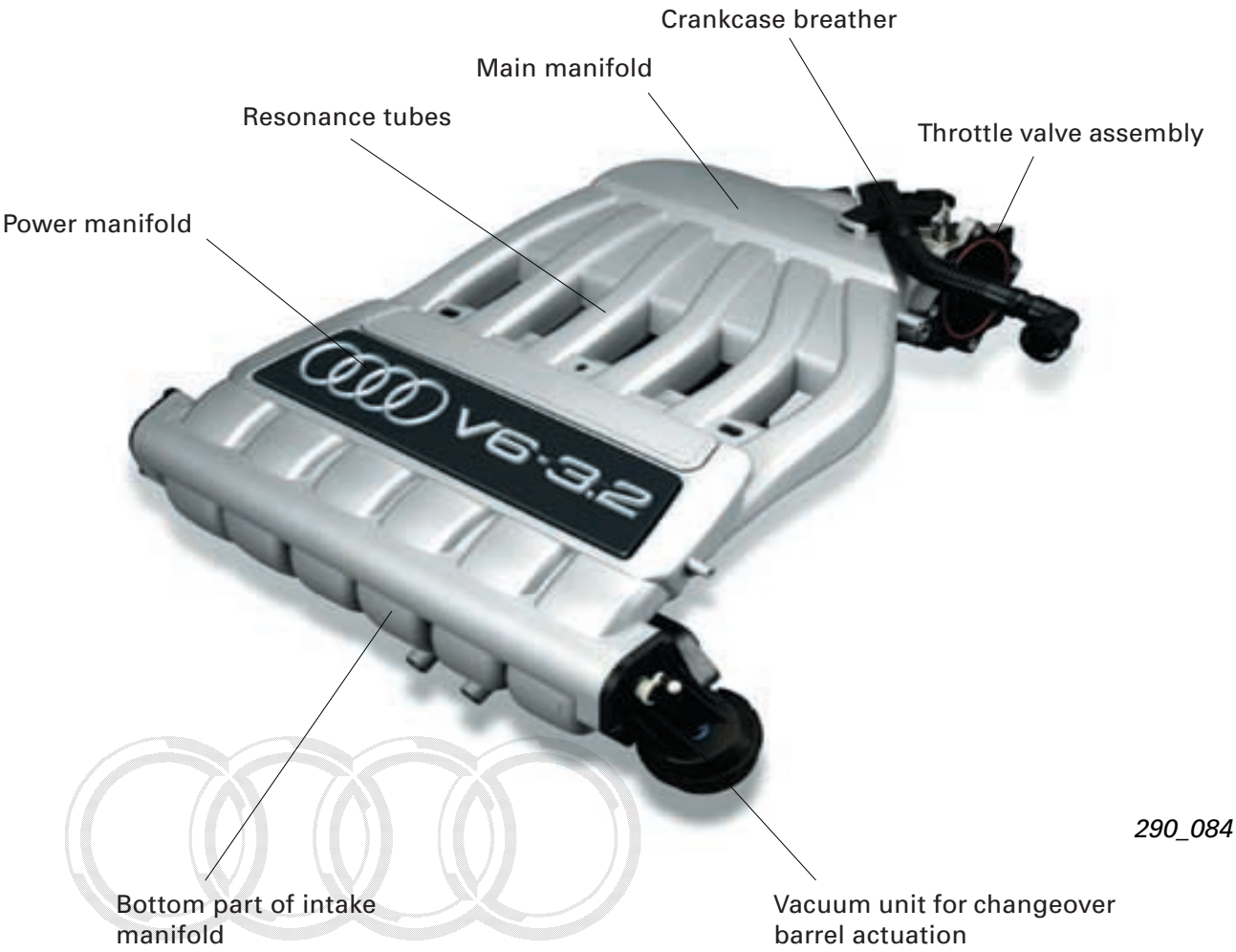


SSP290_109

Variable intake manifold

The design principle of the overhead variable intake manifold arrangement with separate main and power manifold was adopted from the 2.8 l engine and adapted to the new situation.

Good cross-sectional utilisation of the individual intake manifolds was achieved by further reducing flow and pressure losses. This resulted in higher characteristic specific power values.



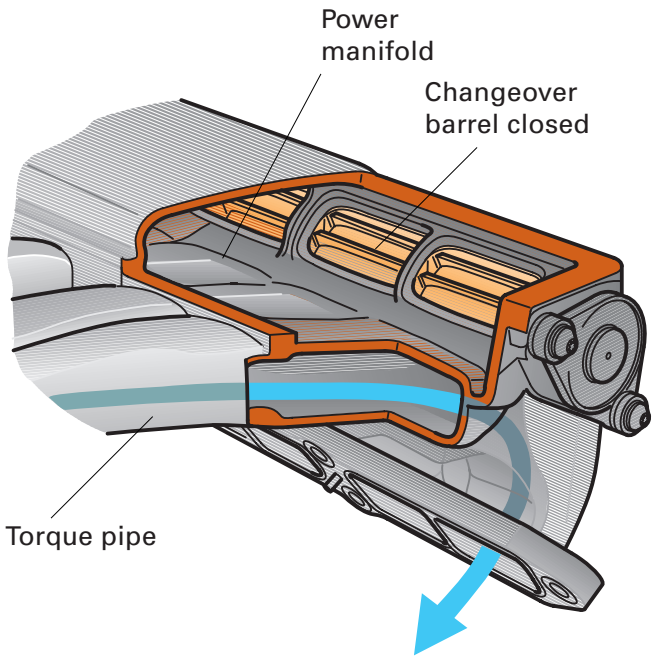
290_084

Operation

The changeover barrel is turned through 90° by a vacuum unit. The variable intake manifold changeover valve N156 provides actuation.
With the engine stopped and at idle, the changeover barrel is set to power position (short intake path).

It is held in this position by spring force. The variable intake manifold changeover valve N156 is then not energised by the engine control unit J220.

Torque position

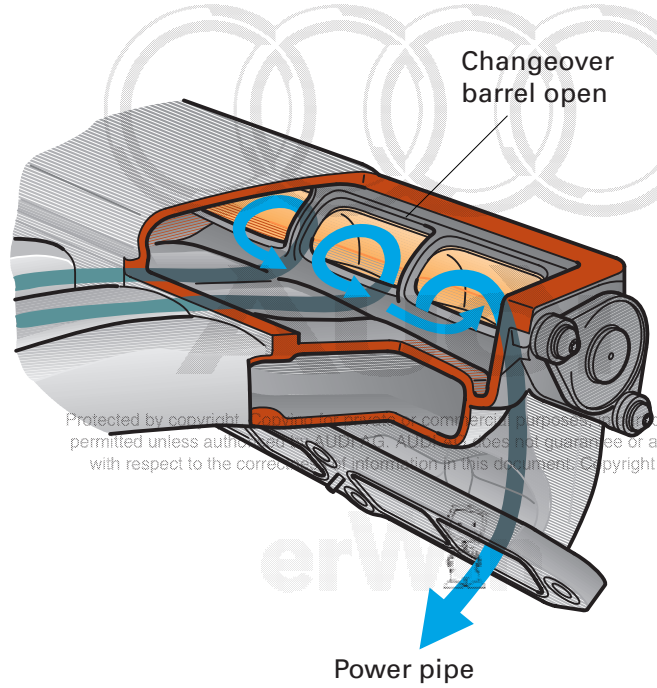


SSP290_085

As of an engine speed of 1100 rpm, the changeover barrel is turned through 90°, thus sealing off the power pipes.

The cylinder currently in the induction phase draws in air through the long torque pipes directly from the main manifold.

Power position



SSP290_086

As of an engine speed of 4100 rpm, the variable intake manifold changeover valve is no longer energised and atmospheric pressure is applied to the vacuum unit.

The changeover barrel is then turned back through 90° to its initial position by means of spring force.

The cylinder draws in air via its short intake manifold. This cylinder obtains its air from the power manifold.

The power manifold is supplied with air by way of the torque pipes of the other cylinders which are not currently in the induction phase.

Camshaft timing control

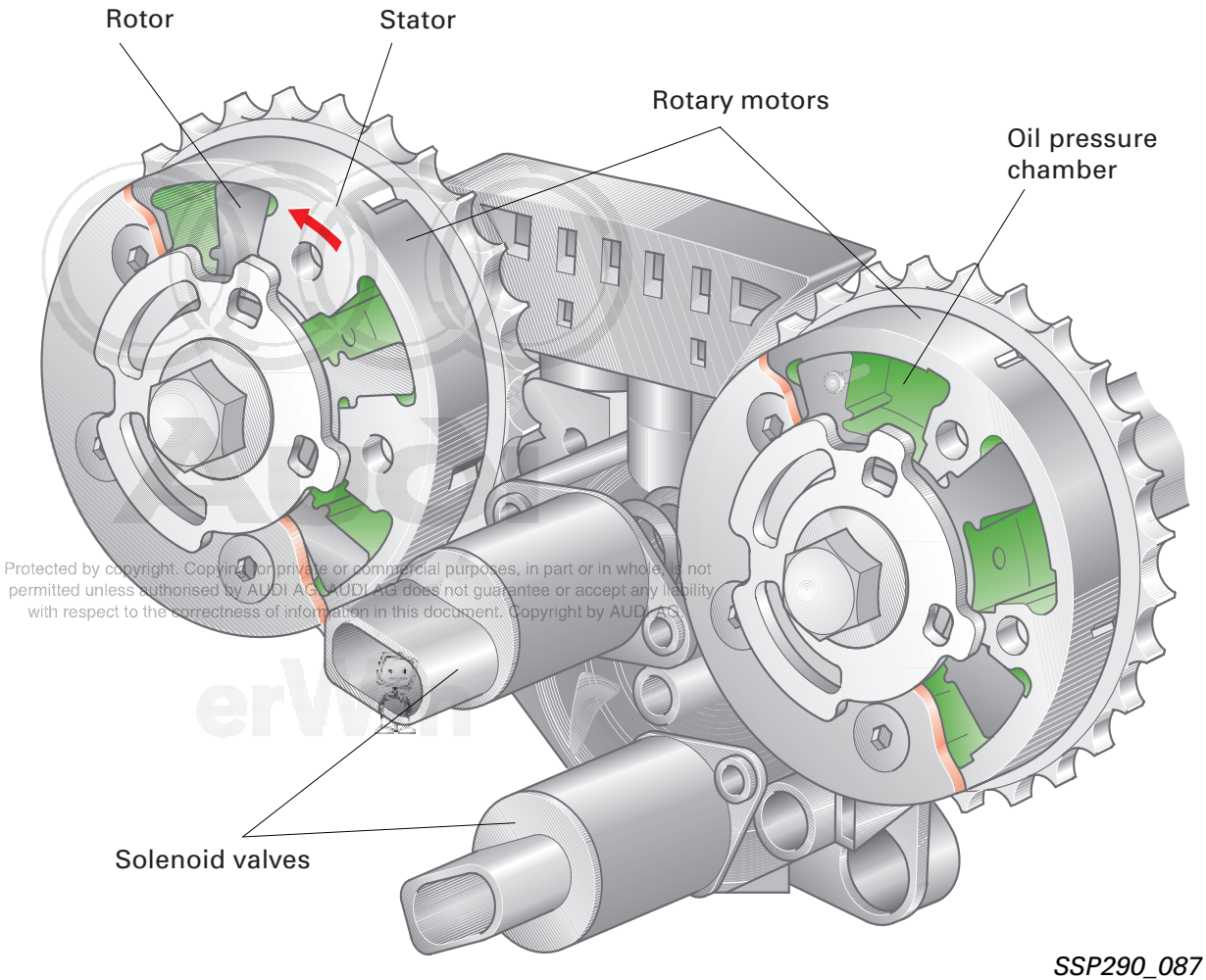
The principle of twin camshaft timing control has been extended on the 3.2 l engine to include scope for continuous exhaust camshaft adjustment.

The inlet and exhaust camshaft adjustment angles are 52° and 42° crank angle respectively.

The extended exhaust camshaft adjustment range produces a greater overlap angle than with previous applications.

This has the following advantages in terms of internal exhaust gas recirculation:

- More economical consumption thanks to a reduction in charge cycle work
- Extended part throttle range with internal exhaust gas recirculation
- Smoother operation
- Less sensitivity to mixture fluctuations
- Implementation of exhaust gas recirculation even with cold engine



SSP290_087

Inlet camshaft

The inlet camshaft adjustment angle is a continuous 52° crank angle.

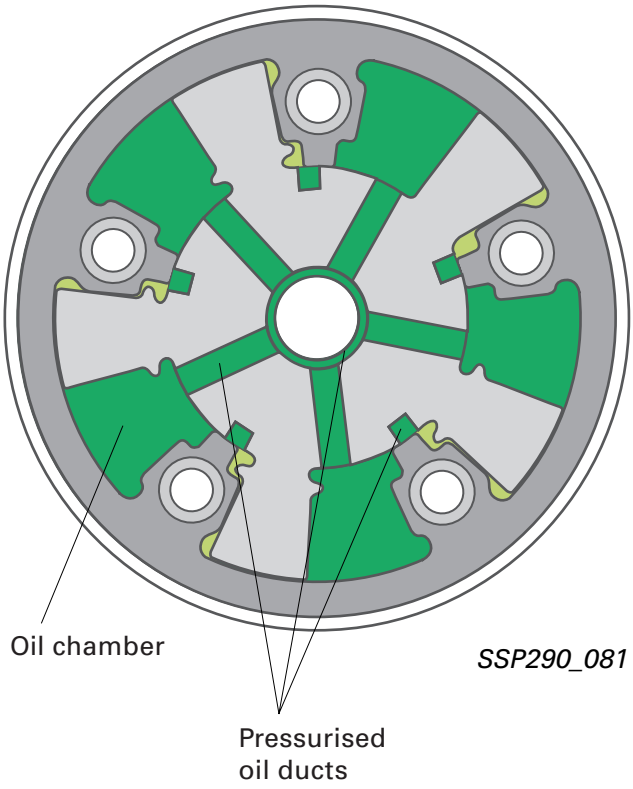
The design basic position of the inlet camshaft is set to opening retard. The rotor is set to "retard" stop.

Advance and retard are implemented as a function of the maps stored in the control unit.

The position of the camshaft is sensed by the Hall sender G40.

The following measured quantities are also required by the engine control unit for camshaft timing control:

- Air mass signal from air-mass meter G70
- Engine speed from engine speed sender G28
- Coolant temperature from coolant temperature sender G62



SSP290_081

Exhaust camshaft

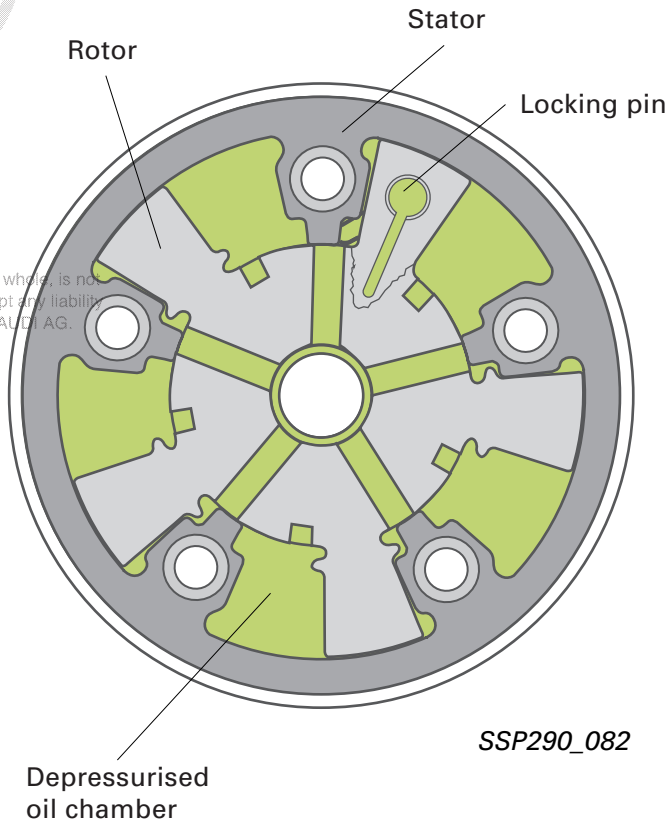
The exhaust camshaft adjustment angle is a continuous 42° crank angle.

With the exhaust camshaft, it was not possible on account of the broad adjustment range to ensure reliable starting in the retard position under all operating conditions, particularly at low temperatures.

For this reason, the exhaust camshaft adjuster is mechanically locked in the "advance" position by means of a locking pin.

The camshaft also remains in this basic position at idle.

There is thus little valve overlap, resulting in both reliable starting and smooth idling.



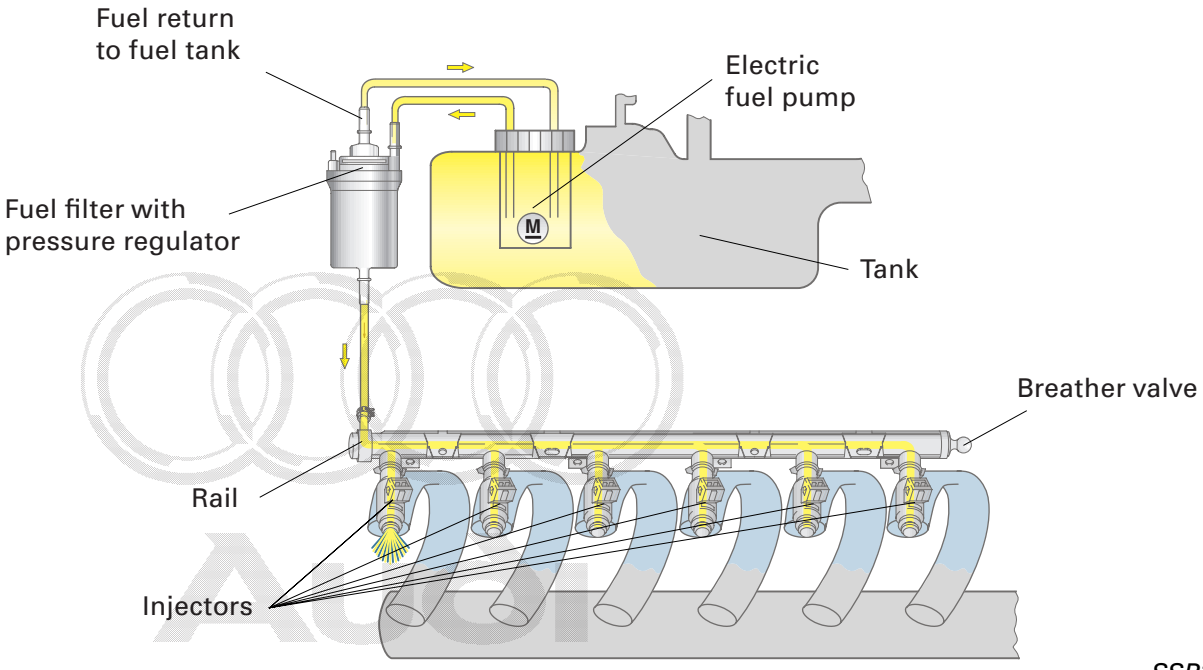
SSP290_082

Non-return fuel system

With this fuel system there is no return pipe from the rail to the tank and thus also no pressure regulator at the rail.
The pressure regulator is inserted in the fuel filter, which is attached in readily accessible position to the right side of the fuel tank.

The fuel in the tank does not become as hot with this system, as there is no return flow of hot fuel from the engine.
Evaporation emissions are reduced.

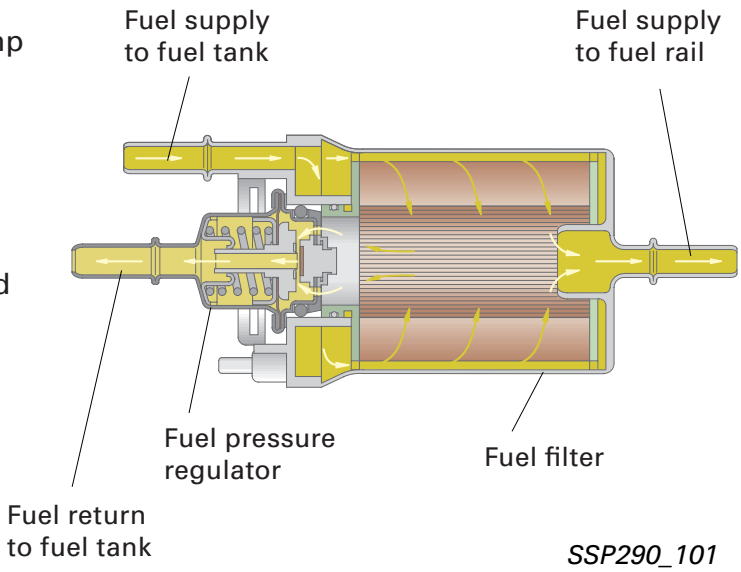
The system is always to be bled at the rail on completion of work on fuel system.



SSP290_100

Fuel pressure regulator

The fuel is conveyed by the electric fuel pump to the fuel filter, from where it flows to the rail.
The fuel pressure regulator and fuel filter form one unit. The regulator maintains the fuel pressure at a constant 4 bar.
This is achieved by a spring-loaded diaphragm valve. The cut-off fuel is returned directly to the fuel tank.



SSP290_101

Engine management

Due to the introduction of variable exhaust valve control and the associated internal exhaust gas recirculation, the residual exhaust gas content of the cylinder has to be calculated, leading to an increase in computation work in the processor.

Use is made for engine management of the Bosch Motronic ME7.1.1.
The processor speed was increased from 32 to 40 MHz.

The increased computer capacity also helps to improve calculation of the intake manifold pressure and enhance mixture formation.

The radiator fans are controlled by way of a discrete wire from the engine control unit, which contains the information required to set the desired coolant temperature.

Engine management, gearbox control, ABS, ESP, air conditioner, immobilizer and dash panel insert are interlinked via the drive system CAN bus.

SSP290_116

Exhaust system

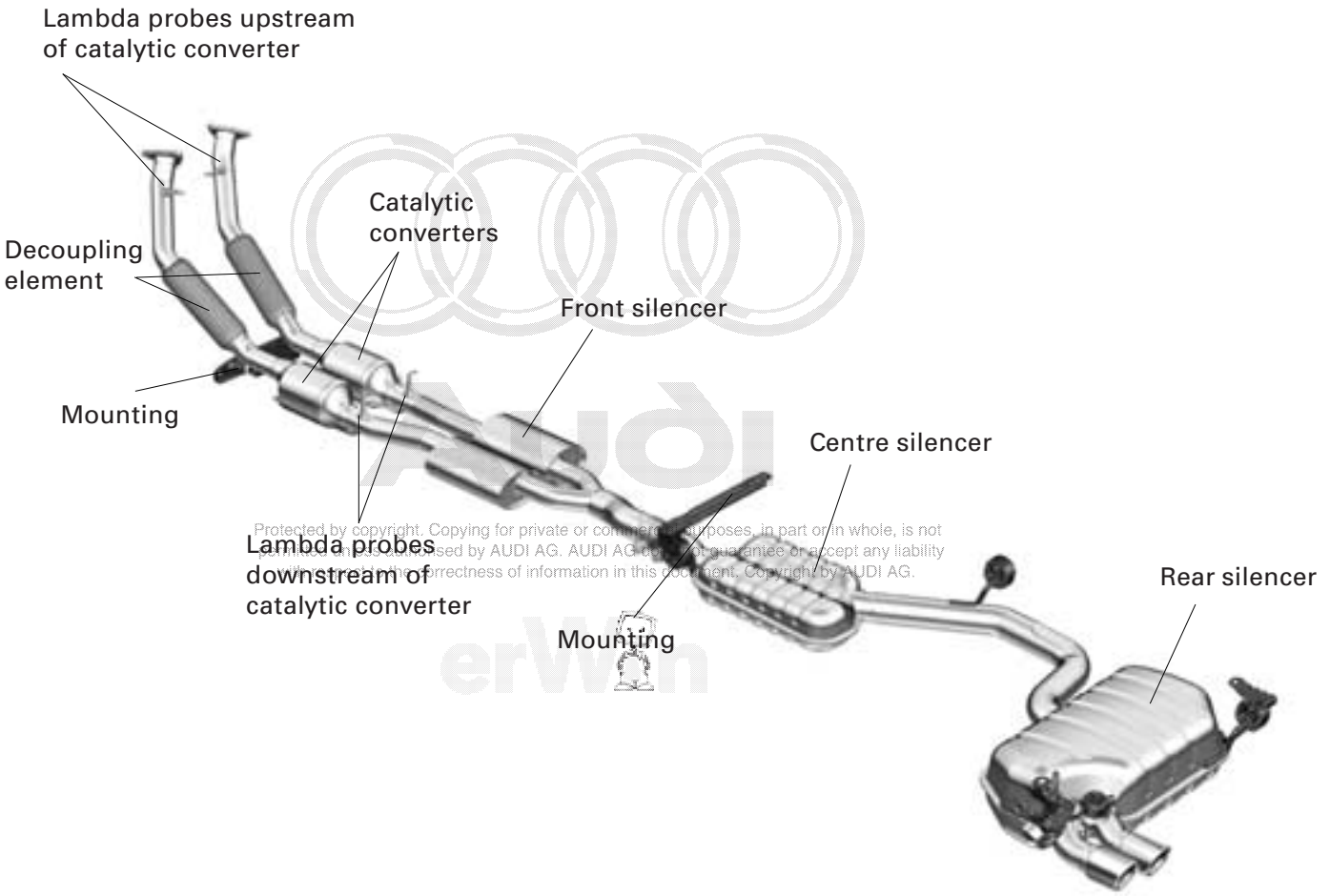
The exhaust system is of dual-flow design as far as downstream of the front silencers. This ensures a very high torque level in the low engine speed range.

The exhaust system is equipped with one catalytic converter and two Lambda probes per exhaust pipe.

The probe upstream of the catalytic converter is a Bosch LSU 4.9 wide-band Lambda probe with regulated heating (G39, G130). There is thus a very early Lambda control response.

The probe downstream of the catalytic converter takes the form of the conventional Lambda step-change probe (G108, G131), which is only used to monitor the catalytic converter.

Secondary air injection helps to ensure the early response of the two catalytic converters.



SSP290_098

Switchable exhaust flap

The exhaust flap is switched by the engine control unit J220 by means of a vacuum unit. Intake manifold pressure is applied to this by the solenoid valve N321, causing it to close. If the flap is to be opened, the solenoid valve N321 switches and atmospheric pressure is applied to the vacuum unit.

The force of the spring in the vacuum unit opens the flap.

Flap positions

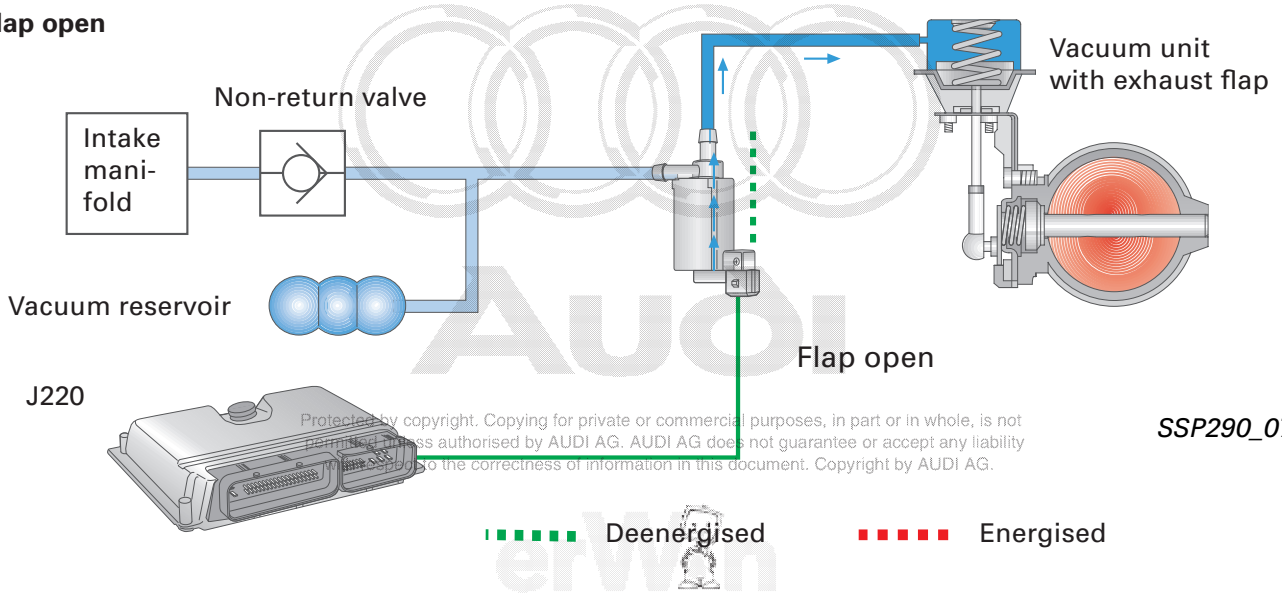
Open: (deenergised)
In all gears and at idle
Engine speed n > 2000 rpm
Engine load > 40 % - 100 %

Closed: (energised)
In all gears
Engine speed n < 2000 rpm
Engine load < 40 %

Hysteresis:
Flap opens on exceeding engine speed of 2000 rpm or 40 % engine load.

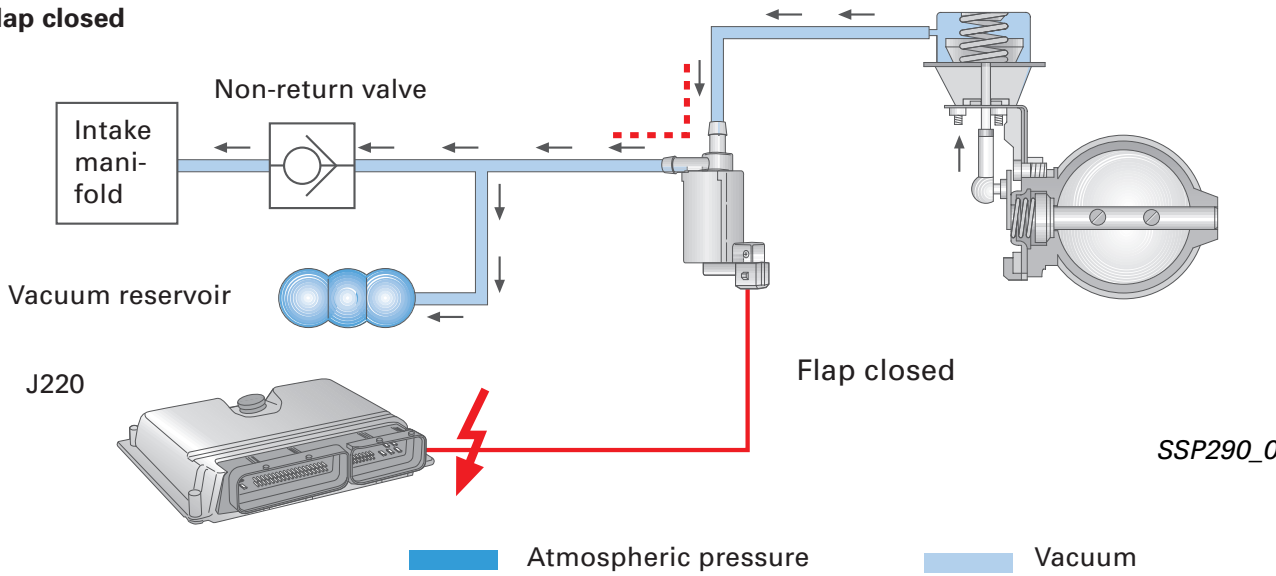
Flap closes on dropping below engine speed of 1800 rpm or 30 % engine load.

Flap open



SSP290_079

Flap closed

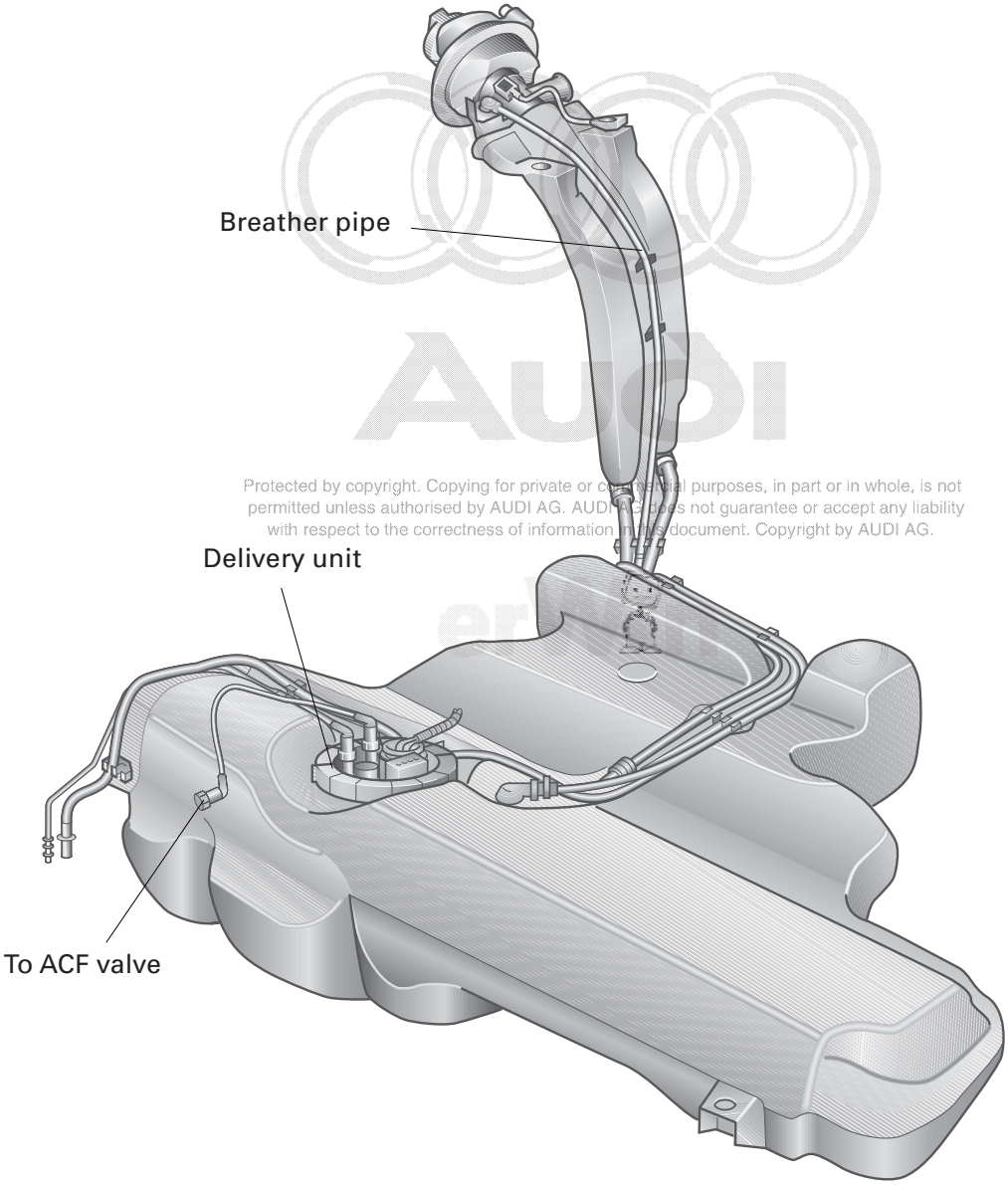


SSP290_080

Fuel tank

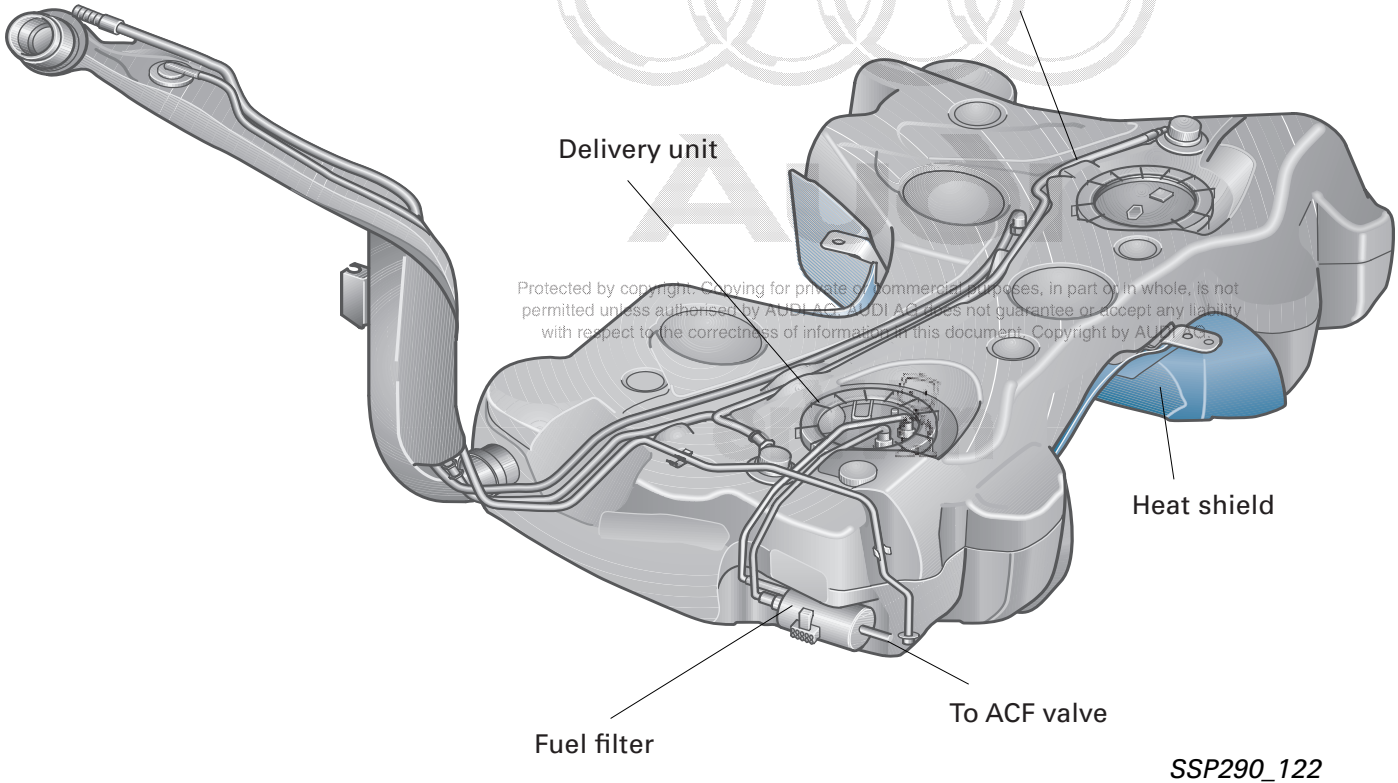
Use is made in the new Audi A3 '04 of a blow-moulded fuel tank with a capacity of 55 litres for the FWD version and 60 litres for the "quattro" version.
The fuel tank is located in crash-safe position between the rear wheels outside the passenger compartment and the rear-end impact zone.

Thanks to this design the vehicle will be able to comply with future US rear-end crash legislation. A heat shield provides thermal insulation with respect to the exhaust system.



SSP290_121

A two-chamber tank is required for the quattro®drive.
A suction jet pump and an additional level sender are integrated into the second tank chamber.



SSP290_122

System layout

Actuators/sensors

Hot-film air-mass meter G70

Engine speed sender G28

Hall sender G40 and
Hall sender 2 G163

Lambda probe upstream of catalytic converter G39
Lambda probe II upstream of catalytic converter G108

Lambda probe after catalytic converter G130

Lambda probe II after catalytic converter G131

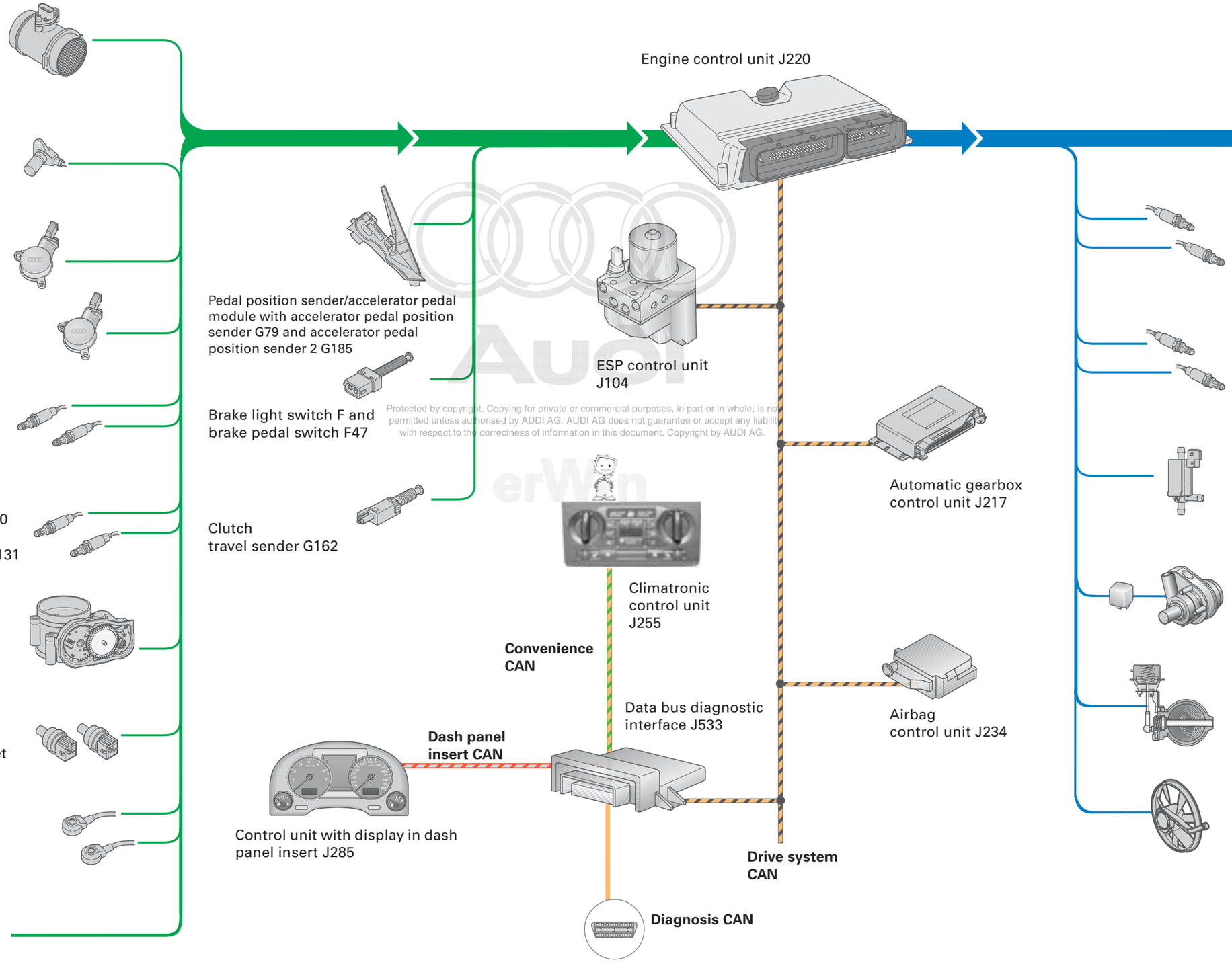
Throttle valve control unit J338 with
throttle valve drive G186
(electric power control)
Throttle valve drive angle sender 1 G187
Throttle valve drive angle sender 2 G188

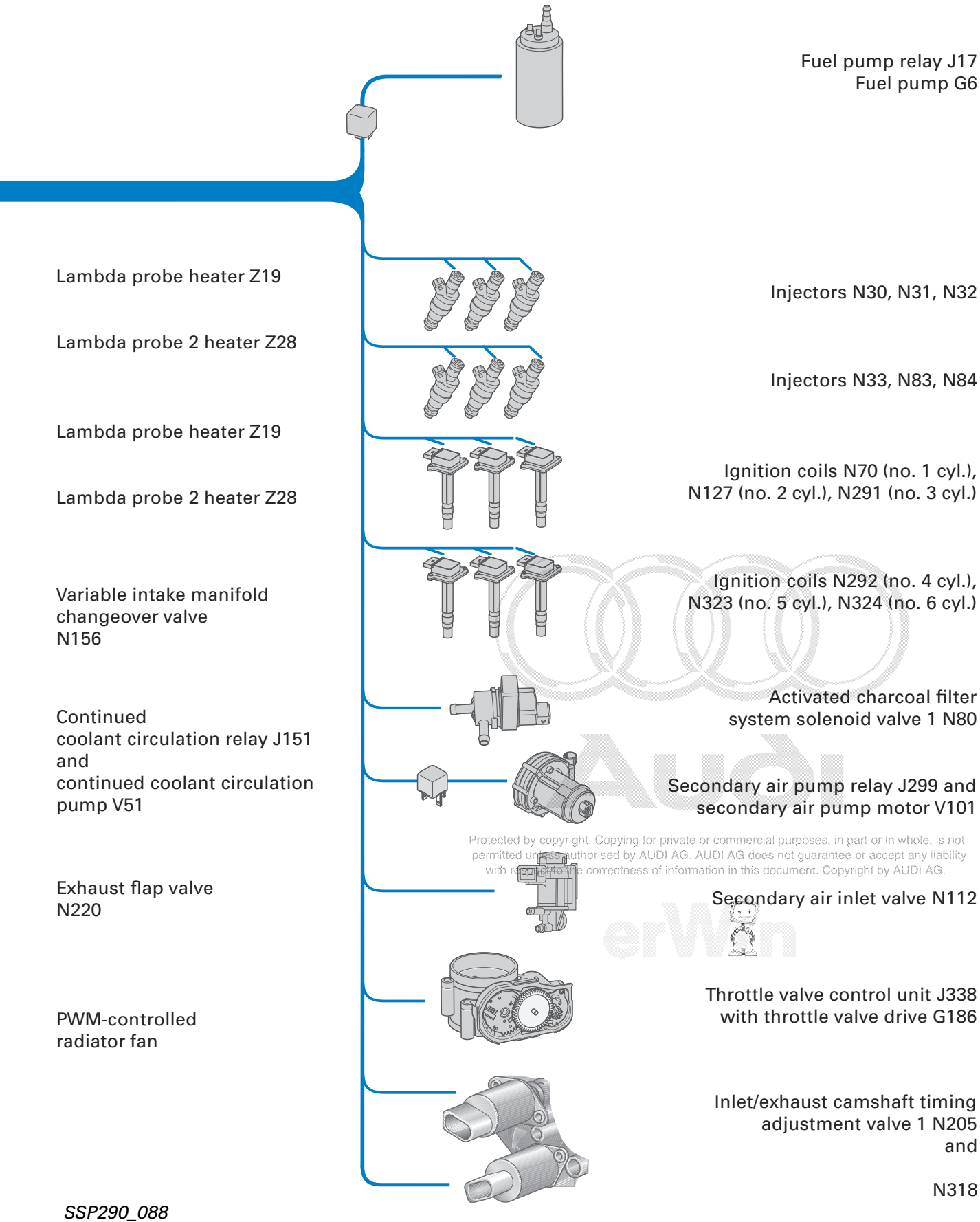
Coolant temperature sender G2
Coolant temperature sender - radiator outlet G83

Knock sensor 1 G61 and
knock sensor 2 G66

Additional signals:

Cruise control system switch ON/OFF





Fuel pump relay J17
Fuel pump G6

Lambda probe heater Z19

Lambda probe 2 heater Z28

Injectors N30, N31, N32

Injectors N33, N83, N84

Lambda probe heater Z19

Lambda probe 2 heater Z28

Ignition coils N70 (no. 1 cyl.), N127 (no. 2 cyl.), N291 (no. 3 cyl.)

Ignition coils N292 (no. 4 cyl.), N323 (no. 5 cyl.), N324 (no. 6 cyl.)

Variable intake manifold changeover valve N156

Activated charcoal filter system solenoid valve 1 N80

Continued coolant circulation relay J151 and continued coolant circulation pump V51

Secondary air pump relay J299 and secondary air pump motor V101

Exhaust flap valve N220

Secondary air inlet valve N112

PWM-controlled radiator fan

Throttle valve control unit J338 with throttle valve drive G186

Inlet/exhaust camshaft timing adjustment valve 1 N205 and

N318

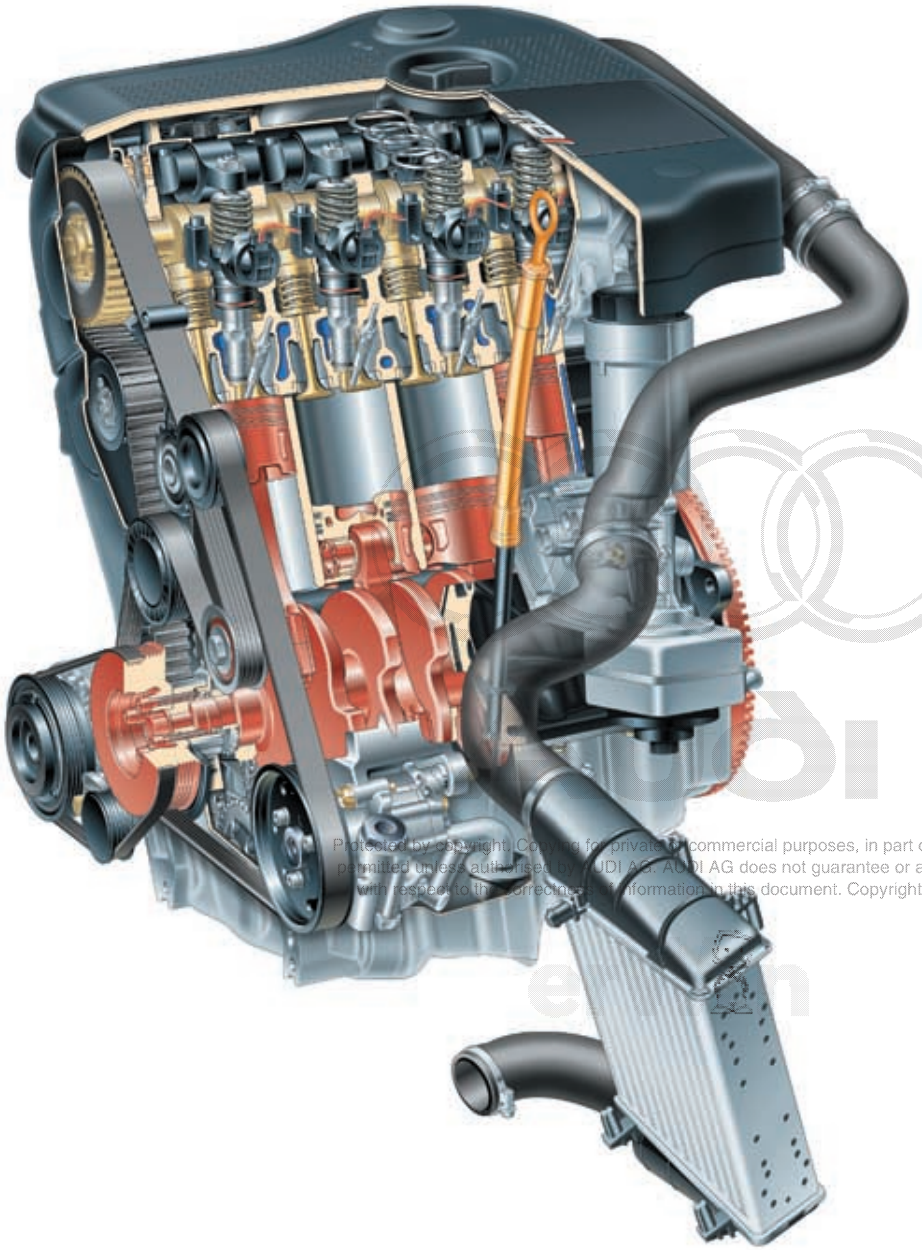
SSP290_088

Engine

1.9 l 4-cylinder TDI unit injector system engine

The engine is a modified version of the original 1.9 l/77 kW engine with new features for the following areas:

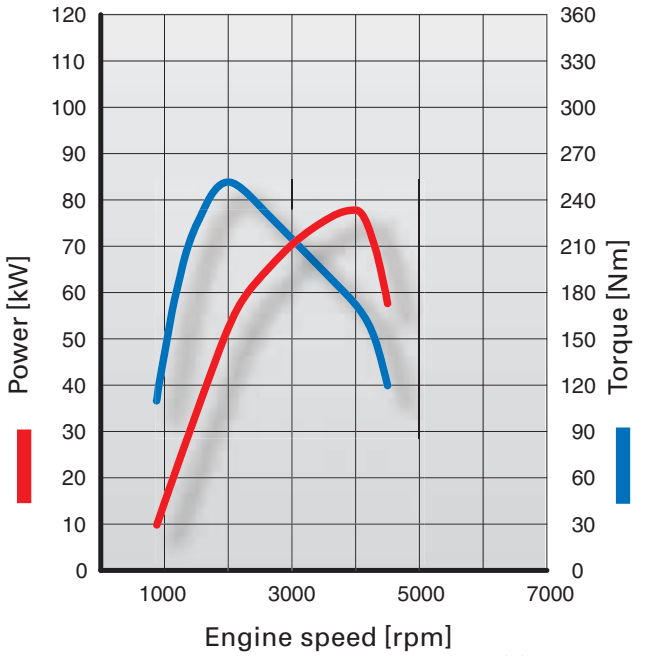
- Unit injector system - optimised in part throttle range with higher injection pressure
- Exhaust gas recirculation electrically actuated and with separate cooler
- Modified combustion chamber
- Use of thin-walled oxidation catalytic converter



SSP290_008

Technical data

Code letters:	BKC
Capacity:	1896 cm^3
Stroke:	95.5 mm
Bore:	79.5 mm
Compression ratio:	19.0 : 1
Design:	In-line four-cylinder diesel engine with VTG turbocharger
Power:	77 kW/105 hp at 4000 rpm
Torque:	250 Nm at 1900 rpm
Firing order:	1-3-4-2
Capacity Engine oil incl. filter:	4.5 l
Engine management:	Bosch EDC 16
Emission standard:	EU 4
Fuel:	Diesel, min. 51 CN



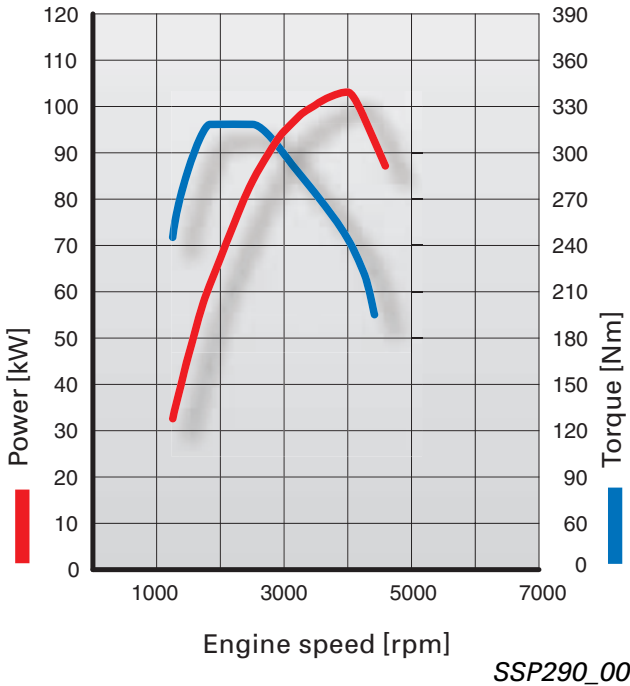
SSP290_019

Engine

2.0 l 4V TDI unit injector system engine

Technical data

Code letters:	BKD
Capacity:	1968 cm^3
Stroke:	95.5 mm
Bore:	81.0 mm
Compression ratio:	18.0 : 1
Design:	4-cylinder 4-valve 4-stroke turbodiesel in-line engine
Power:	103 kW/140 hp at 4000 rpm
Torque:	320 Nm at 1750 - 2500 rpm
Firing order:	1-3-4-2
Turbocharger system:	Garret GT 1749V with variable turbine geometry
Injection system:	Bosch EDC 16
Capacity Engine oil incl. filter:	3.8 l
Consumption:	Urban 7.2 - 7.3 l/100 km Non-urban 4.5 - 4.6 l/100 km Average 5.5 - 5.6 l/100 km
Acceleration:	0 - 100 km/h in 9.5 s
Emission standard:	EU 4
Fuel:	Diesel, min. 51 CN



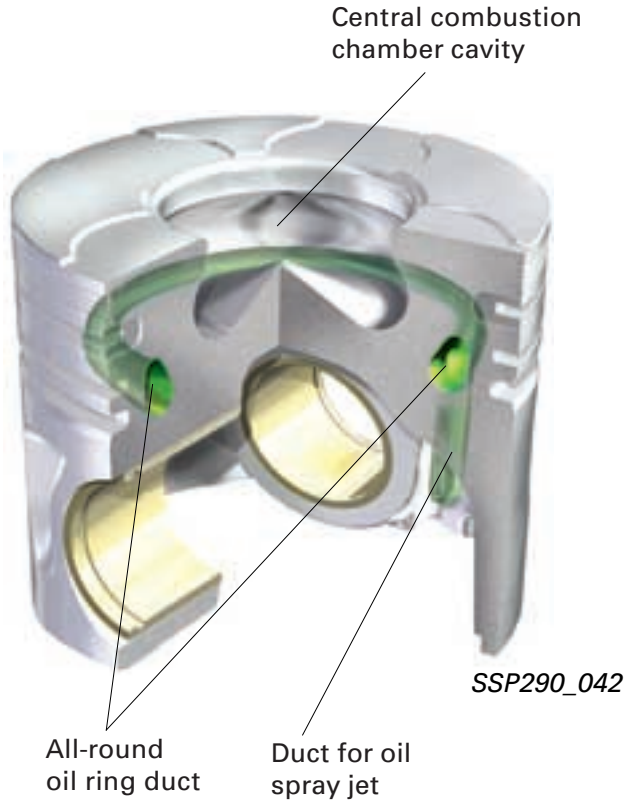
SSP290_003

SSP290_001

Modifications to unit injector system engine

Piston

Enlarging the cylinder bore made it possible to increase the capacity from 1.9 l to 2.0 l. The piston with central combustion chamber cavity and emission-optimised geometry was designed with reduced valve cut-out depth to lessen the pollutant volume in the combustion chamber. An oil ring duct in the piston provides cooling of the piston crown.

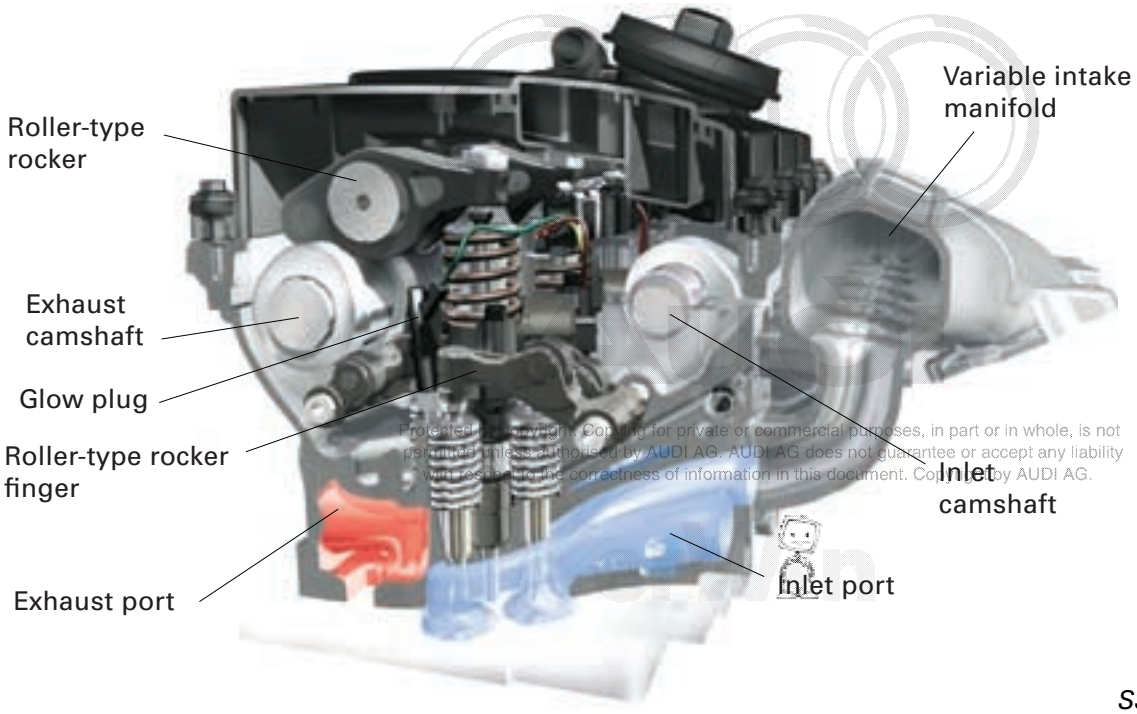


SSP290_042

Cylinder head

The cylinder head design has been changed from a two to a four-valve system with two overhead camshafts. The glow plugs are located in the area through which oil passes.

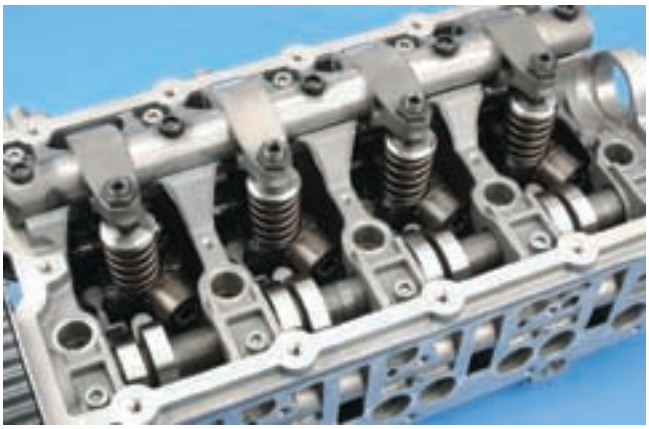
The valves are actuated via roller-type rocker fingers with hydraulic valve lifters. The unit injector system is driven by the exhaust camshaft via roller-type rockers.



SSP290_002

Support frame

To provide the necessary cylinder head rigidity, the conventional camshaft cover was replaced with a support frame (ladder frame). This is bolted by means of the two inner rows of bolts directly into the heads of the cylinder head bolts. The frame accommodates the rocker shaft for the pump elements, the wiring connections for the glow plugs and the solenoid valves of the unit injector system.

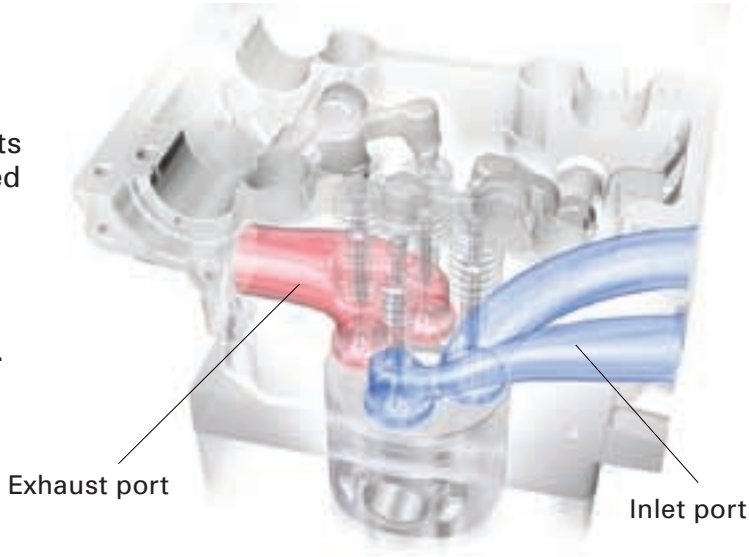


SSP290_092

Cross-flow cylinder head

The valves are arranged around the central unit injector system in angled star configuration with two tangential inlet ports and one exhaust port in the form of a forked pipe.

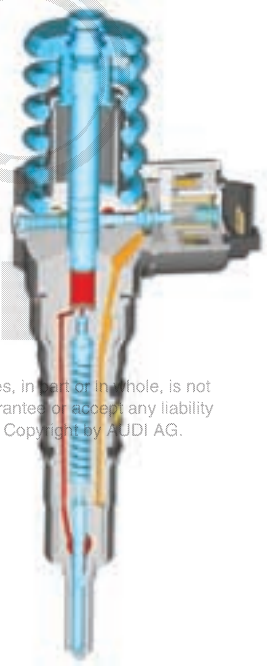
This creates optimum conditions for giving the intake air the appropriate swirl and ensuring the best possible cylinder charge.



SSP290_021

Unit injector system

The injector is of prime importance in complying with the stringent EU 4 limit values. The centrally located 6-hole injector with tapered, flow-optimised orifices was improved to achieve a 10 % increase in part throttle injection pressure.
To obtain the central installation position, use was made of a 114° conical seat instead of a flat cylinder head rest with packing plate.



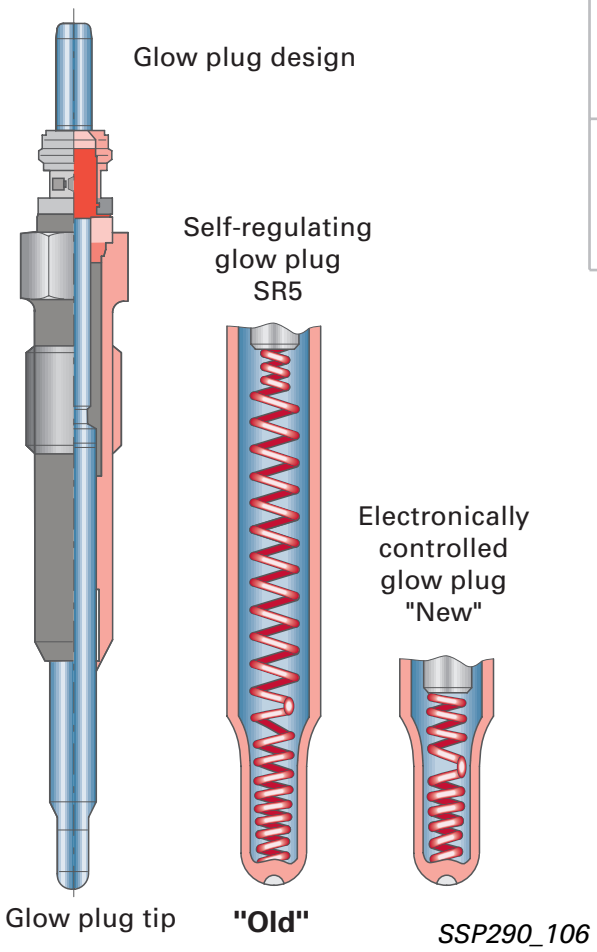
SSP290_096

Diesel rapid start system

Use is made of a combined system of steel glow plugs and control unit to improve diesel engine starting (key start = starting without preheating).

This newly developed glow plug requires a warm-up time of max. 2 seconds, as opposed to the usual 5 second period.

Power semi-conductors which replace the conventional electromagnetic relay are used in the control unit to actuate the glow plugs. Separate actuation, monitoring and diagnosis are thus possible for each glow plug.
To achieve the very short warm-up time (to 1000 °C in 2 seconds), the filament was designed as a sensor and heater filament and shortened to concentrate the glow effect in the front area of the plug.

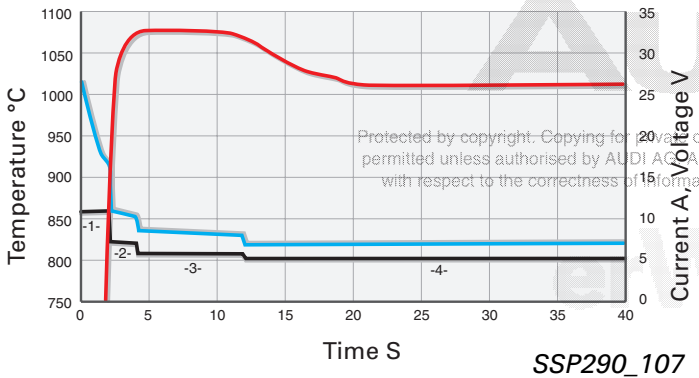


SSP290_106

Approx. 11 V are briefly applied on a pulse-width modulated basis to the glow elements designed for 5 V, thus causing the required temperature of 1000 °C to be attained in 2 seconds.
The voltage is then gradually reduced in the subsequent actuation intervals to a level much lower than that of the available electrical system voltage.

A repeat starting recognition function prevents overheating of the glow elements in the event of several preheating operations in quick succession.
On account of the reduced power input of the glow elements, more energy is available to the starter.

Individual actuation of the glow elements with power semi-conductors permits comprehensive diagnosis and protection functions.



SSP290_107

Voltage profile:
Phase 1: Rapid warm-up
Phase 2: 7.4 V for 2 seconds
Phase 3: 6 V for 8 seconds
Phase 4: 5.3 V

Temperature profile
Current profile
Voltage profile

Gearbox

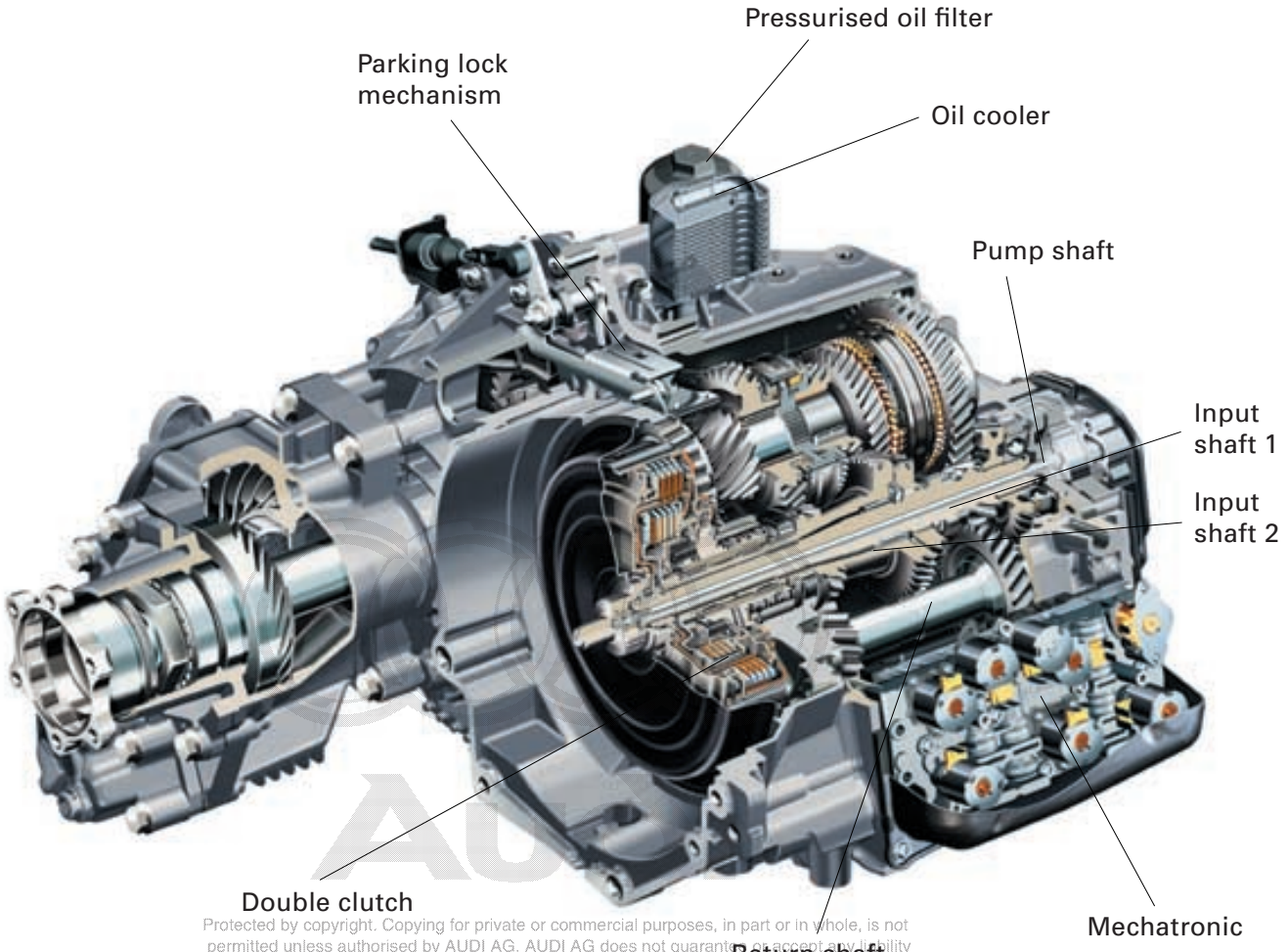
Direct-shift gearbox 02E

The direct-shift gearbox (DSG) is basically a parallel gearbox made up of two fully functional manual gearbox units with a joint differential.

The engine torque is distributed to the gearbox units via two clutches.

One unit selects the even gears and the other the odd gears.
Each gear is assigned a conventional manual gearbox synchromesh and shift unit as used by VW and AUDI in manual gearboxes.

Refer to Self Study Programme 297 for design and operation.



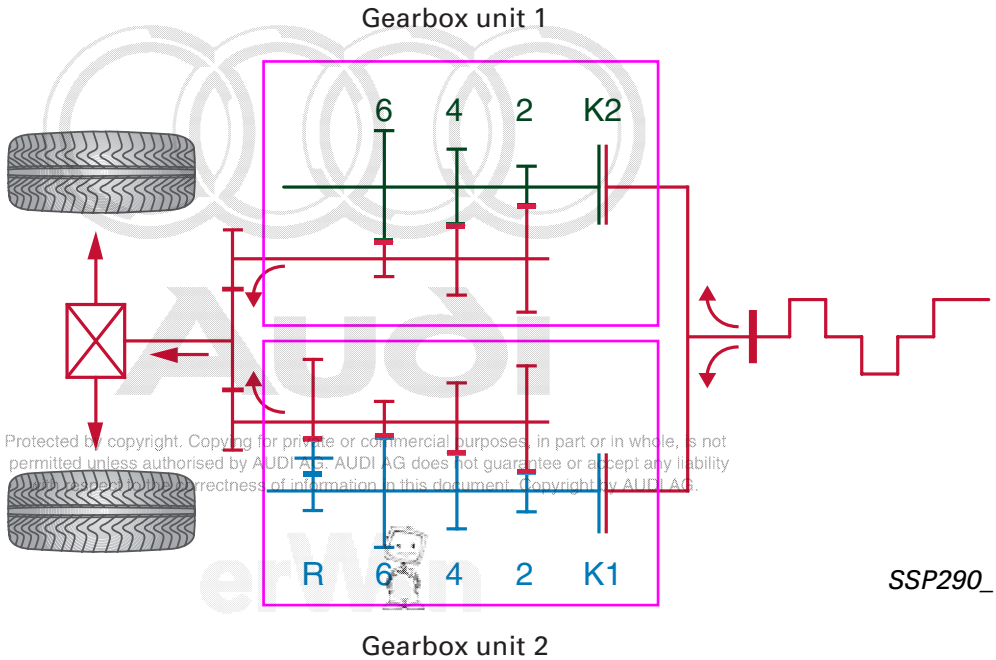
SSP290_110

Technical data

Direct-shift gearbox	
Designation:	02E
Max. torque transmission:	325 Nm
Operating modes:	Automatic and Tiptronic
Gear oil capacity (total):	6.4 litres ATF
Specification:	G 052 182
Total weight: including oil:	approx. 80 kg

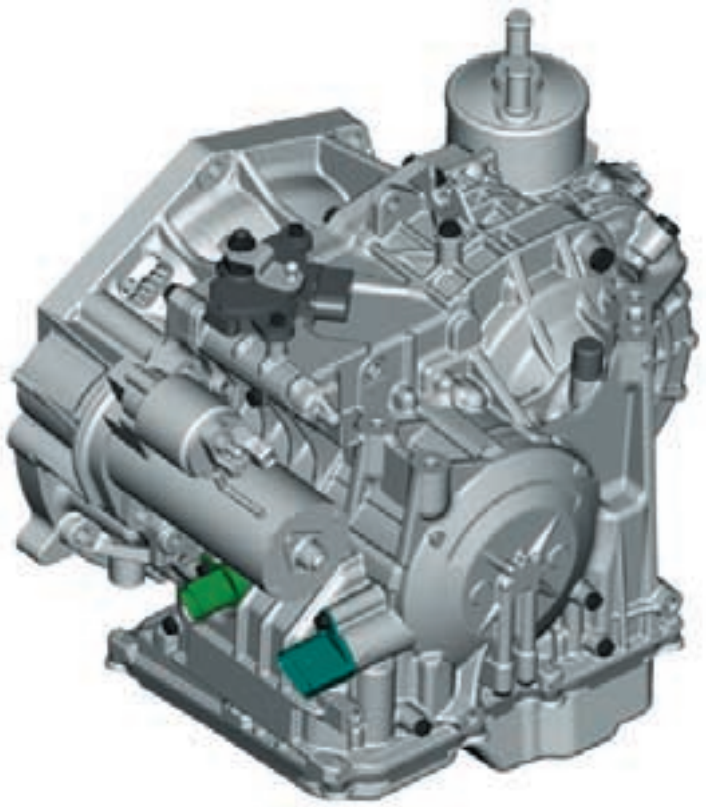
These shift units operate independently. This satisfies the requirement for free gear selection - including even to even and odd to odd gearshift. Gearshift takes place directly, rapidly and with no loss of tractive power.

By means of the differential the torque is conveyed to the wheels and, in the case of four-wheel drive vehicles, additionally to the rear axle (via propshaft) by way of the bevel box.



Gearbox

Automatic gearbox 09G (6-speed)



SSP290_034

Technical data

Designation: 09G

Manufacturer:	AISIN AW CO, LTD Japan
Designation:	TF-60SN
Type:	6-speed planetary gearbox (multi-step automatic gearbox) with electrohydraulic control and hydrodynamic torque converter with slip-controlled torque converter lock-up clutch Front-wheel drive/transverse installation
Control:	Hydraulic control unit in oil pan with external electronic control unit Dynamic shift program DSP with separate sports program in "Position S" and Tiptronic shift program for manual gear change (optional with Tiptronic steering wheel)

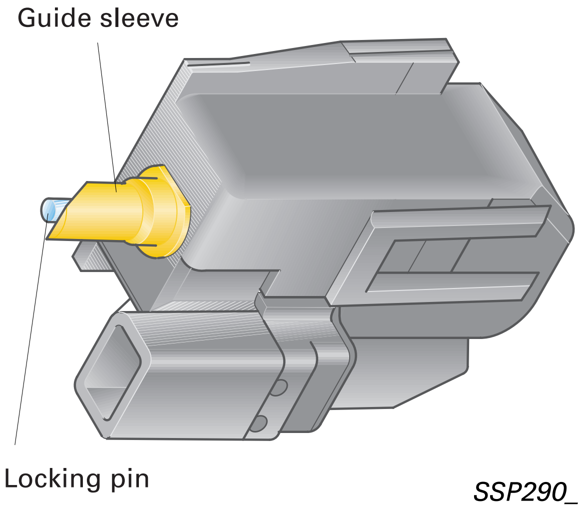
Torque/ power:	Up to above 300 Nm depending on version
Planetary gearbox ratios (for code letters GSY 1.6 l and GJZ 2.0 l FSI)	1st gear 4.148 2nd gear 2.370 3rd gear 1.556 4th gear 1.155 5th gear 0.859 6th gear 0.686 Reverse 3.394
ATF specification:	G 052 025 A2 (1 litre) Esso JWS 3309
Capacity:	7.0 litres (fresh fill) lifetime fill
Weight:	approx. 82.5 kg
Overall length:	approx. 350 mm

Design and operation of the automatic gearbox 09E are described in SSP 291.

Ignition key withdrawal lock

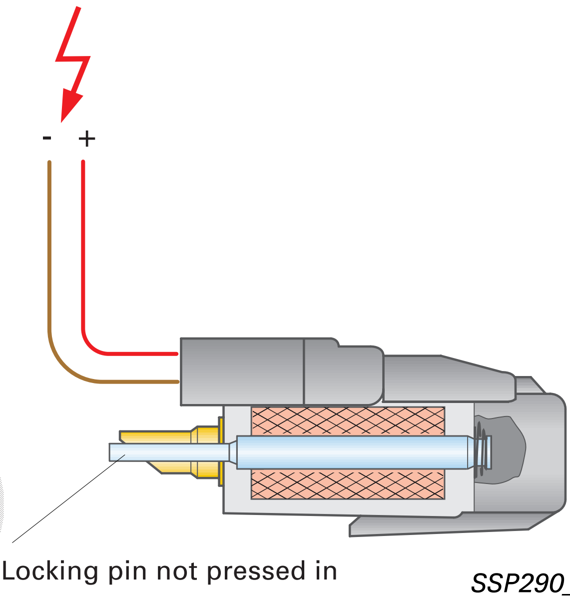
Operation

With ignition on and selector lever set to position other than P, the ignition key withdrawal lock solenoid N376 is energised. Overcoming spring force, the locking pin of N376 is pressed into the steering lock.



SSP290_113

As long as N376 is energised (locking pin not pressed in), the ignition switch cannot be turned to withdrawal position.
The ignition key cannot be removed. After switching off ignition, J527 energises N376 for as long as selector lever is not set to position "P".

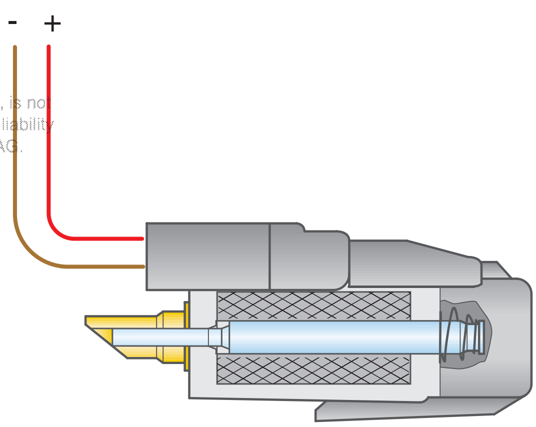


SSP290_115

Solenoid is deenergised.

Ignition key is no longer locked and can be removed.

Leaving the stationary vehicle for a lengthy period with selector lever set to a position other than P will lead to long-term battery discharge.



SSP290_114

Running Gear

As opposed to the predecessor model with torsion beam rear axle, the running gear in the Audi A3 '04 features a new four-link rear axle with individual suspension.
It consists of a broad longitudinal member and a total of three transverse links.

This design permits more agile performance as well as improving handling at high levels of lateral acceleration.

The basic running gear is equipped with 16-inch wheels whereas 17-inch wheels are fitted for the sports running gear.

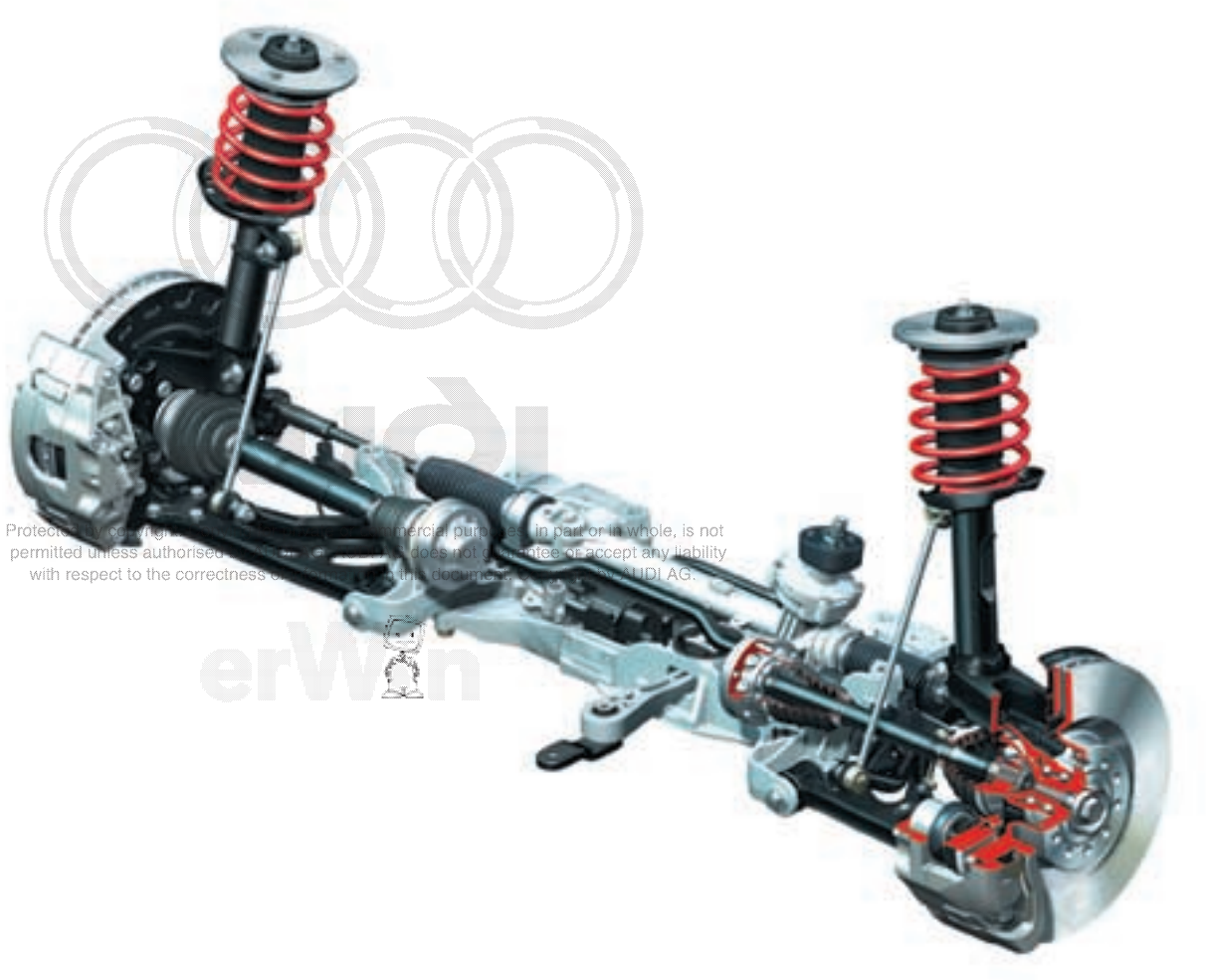
SSP290_050

Front axle

The 3-part aluminium subframe is designed to accommodate transverse link, anti-roll bar and steering box.
Use is made of linear coil springs with progressive polyurethane auxiliary springs as suspension elements.
The Audi A3 '04 features a bolted third-generation wheel bearing unit (flange bearing with wheel hub as single structural unit).

Two drive shafts of equal length are fitted to prevent drive system interference. This necessitated the use of an intermediate shaft (only on vehicles with high drive torque and front-wheel drive as with 2.0 l TDI).

Information on design and operation can be found in SSP 313 (Audi A3 '04 - Running Gear).



SSP290_016

Steering

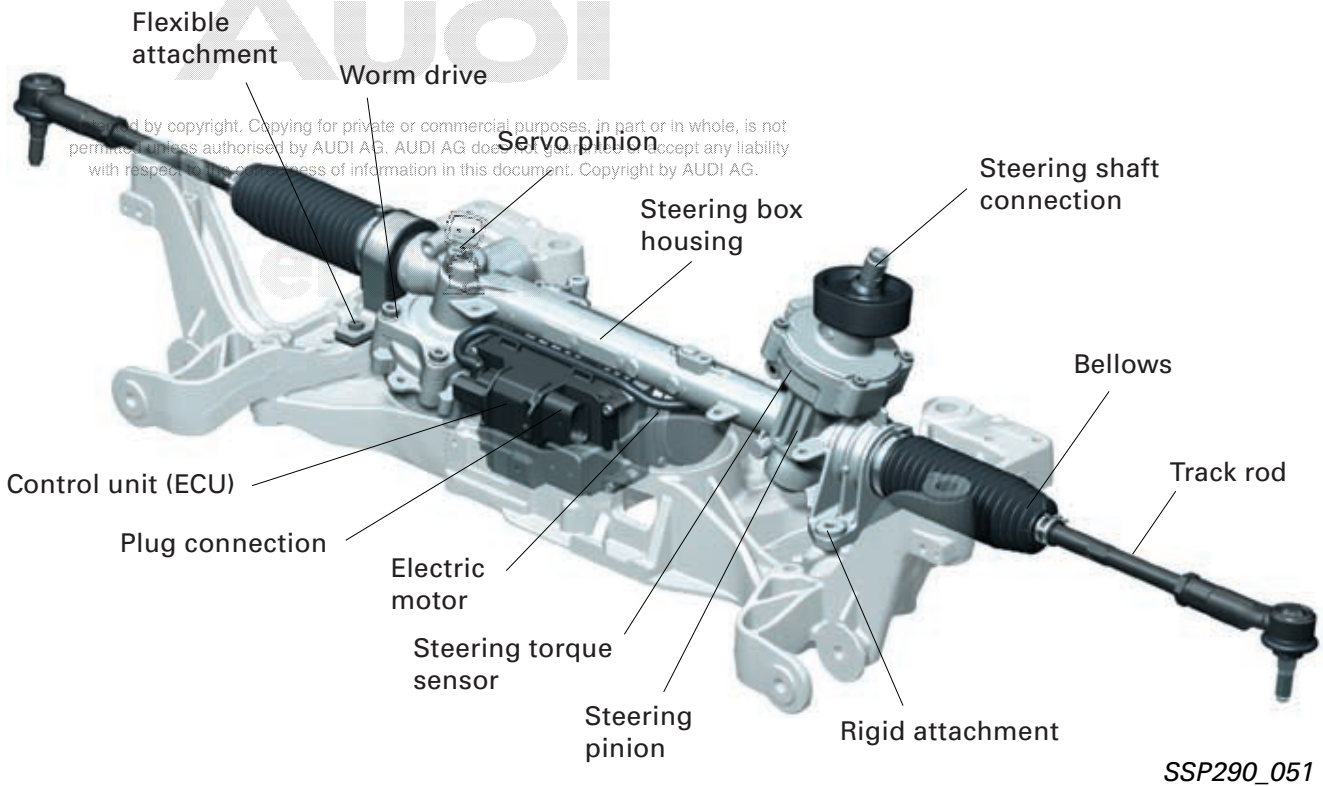
Electromechanical steering

Use is made for the first time in the Audi A3 '04 of an electromechanical steering system with "double pinion" to replace hydraulic power assistance.

Advantages:

- Reduced fuel consumption thanks to requirement-specific power input
- Simple implementation of speed-dependent power assistance and damping and thus an optimum steering feel in all situations
- Reduced sensitivity to road surface irregularities
- Only two hardware versions are now required (LHD/RHD), as adaption is possible by way of software modifications
- Active re-positioning of wheels to straight ahead setting
- Minimal noise generation in passenger compartment
- High rack force levels

Power assistance is provided by a separate gear unit which acts on the rack and is driven by an electric motor.
A torque sensor located at the torsion bar of the steering wheel determines the torque at the steering pinion.
The electric control unit establishes the assistance torque required as a function of torque, vehicle speed, steering angle and steering rate.



SSP290_051

Rear axle

Rear axle (front-wheel drive)

The subframe is made of welded steel and rigidly bolted to the body.
The body rests by way of the steel spring on the axle at the deep-drawn steel spring link.

The upper transverse link forms the connection between subframe and wheel bearing housing at the upper level. Its T-shaped cross section is primarily designed to absorb lateral forces.

Use is made of a cylindrical high-strength steel spring with linear characteristics.

The spring is supported by rubber mounts at the body and spring link.

The twin-tube gas-filled dampers are mounted well to the outside at the wheel bearing housings.

This achieves an optimum 1:1 ratio between wheel travel and damper travel as well as a generous luggage compartment through-loading width.

SSP290_017

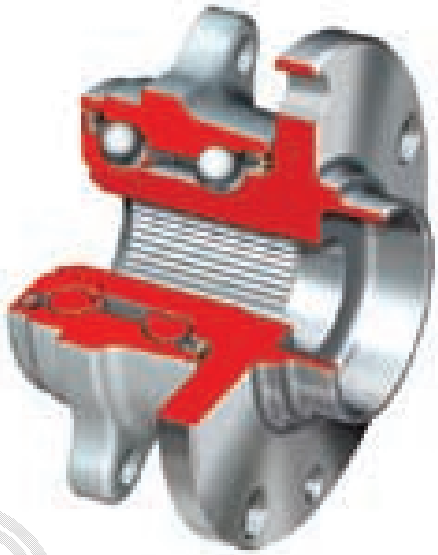
Rear axle

Rear axle for quattro® drive

The rear-axle subframe is a welded aluminium structure and at the same time supports the rear final drive.

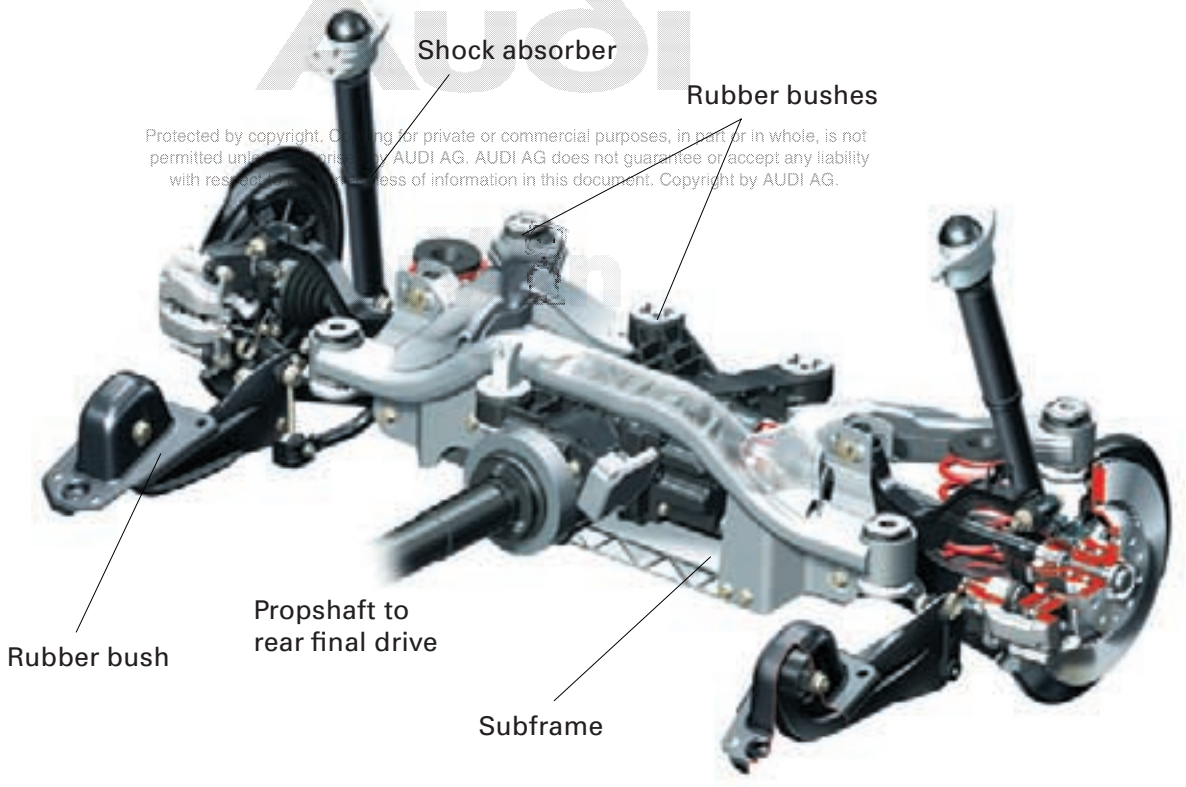
It is bolted to the body by way of amply dimensioned rubber bushes.
This method of attachment guarantees good acoustic isolation of the components.

Use is made of the same 3rd-generation wheel bearing as at the front axle.



3rd-generation wheel bearing

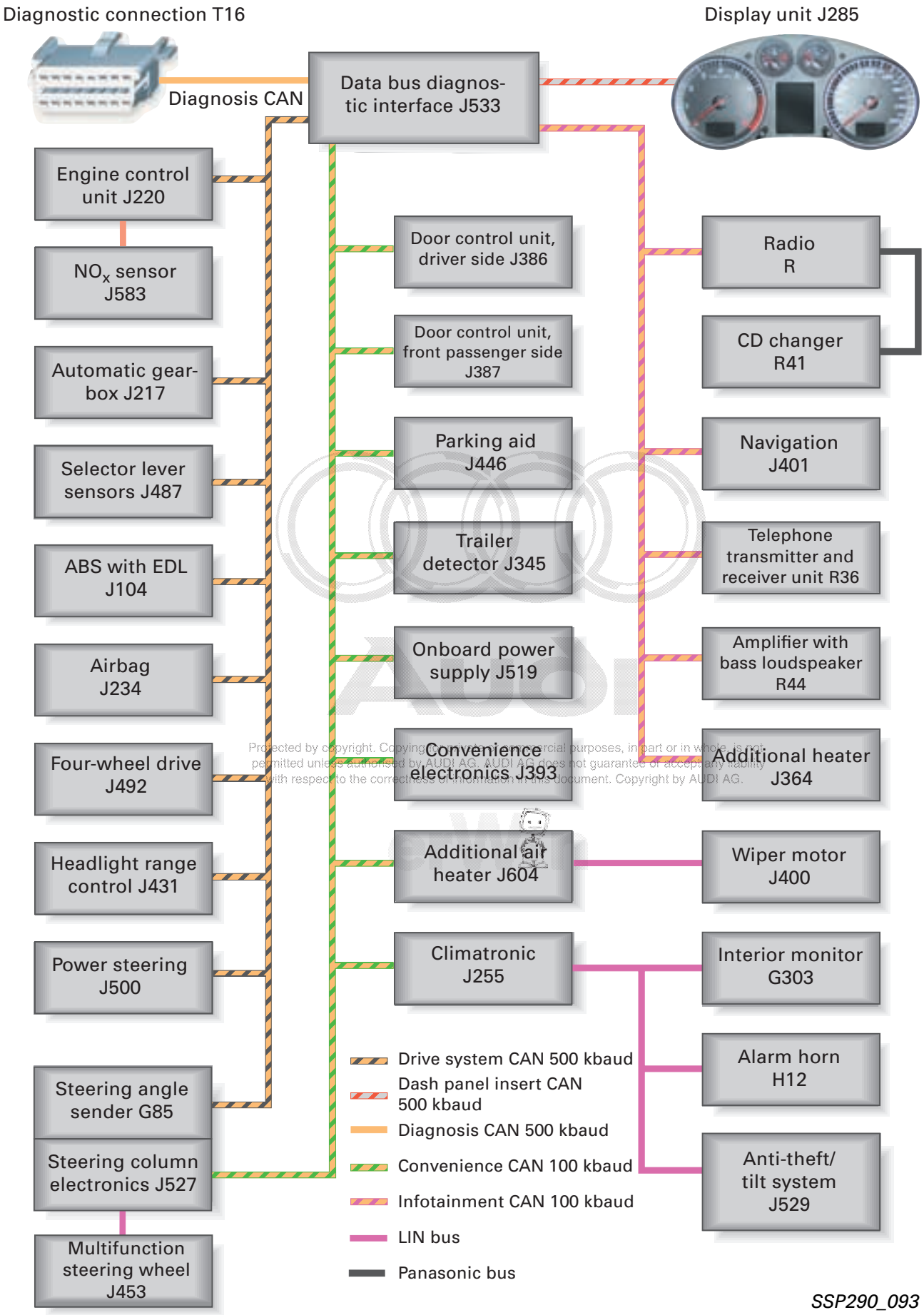
SSP290_032



SSP290_077

Notes

Bus topology



SSP290_093

Convenience electronics

Selective convenience CAN sleep mode

As with the A8 ‘03, wake-up takes place simultaneously for convenience CAN, dash panel insert CAN and infotainment CAN (A8 ‘03:. MOST). On the Audi A3 ‘04, the convenience CAN can be switched to sleep mode independently of the other two CAN buses to save energy.

As a result, the dash panel insert J285 and the components linked to the infotainment CAN may continue to transmit data (e.g. brightness value, readings on centre display, navigation data) with the convenience CAN in sleep mode.

SSP290_134

Information on design and operation can be found in Self Study Programme 312.

Load management

The wide range of electrical equipment may cause the battery/alternator voltage to drop below a permissible level and thus jeopardise proper functioning of vital systems such as ABS or electromechanical steering.

The onboard power supply control unit is able to boost the electrical system voltage to the necessary extent by increasing idling speed and deactivating heavy-duty loads. The alternator is however designed to restrict load management intervention to exceptional circumstances.

Steering column switch module

The design of the steering column switch module has been modified for use in the new Audi A3 ‘04.

It includes the following components:

- Mechanical ignition switch with immobilizer reading coil D2
- Steering column electronics J527 for signal conversion and processing of signals from drive system and convenience CAN
- Equipment-specific control elements
- Coil connector with steering angle sender G85
- Electrical ignition key withdrawal lock (on vehicles with automatic gearbox)
- LIN function for connection to steering wheel electronics module J453 and operating unit E221 in multifunction steering wheel

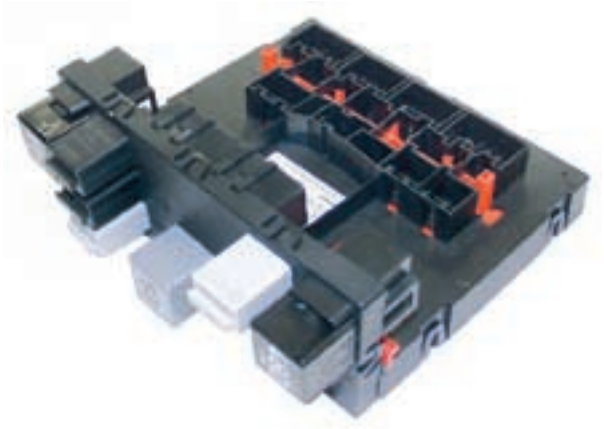
The task of the steering column electronics is to transmit information from operating elements such as turn signal indicators or wipers to the bus in the form of a CAN message and to read any incoming information.

SSP290_097

Onboard power supply control unit

The onboard power supply control unit is responsible for the following

- Exterior lighting
- Terminals 15, 75x and 50
- Terminal 58s
- Electric fuel pump relay J17
- Windscreen wipers
- Heated rear window
- Horn
- Interior lighting
- Footwell lights (optional)
- Load management (no battery energy manager fitted)



SSP290_112

Tester online link

The main modification to the diagnostic process is the VAS 5051 online link. Adaption of components forming part of the immobilizer system and radio code call-up are now only possible if the tester is directly linked to the manufacturer's FAZIT data base.

PINs will therefore no longer be issued.

SSP290_102

Further information on the VAS 5051 online link can be found in SSP 294.

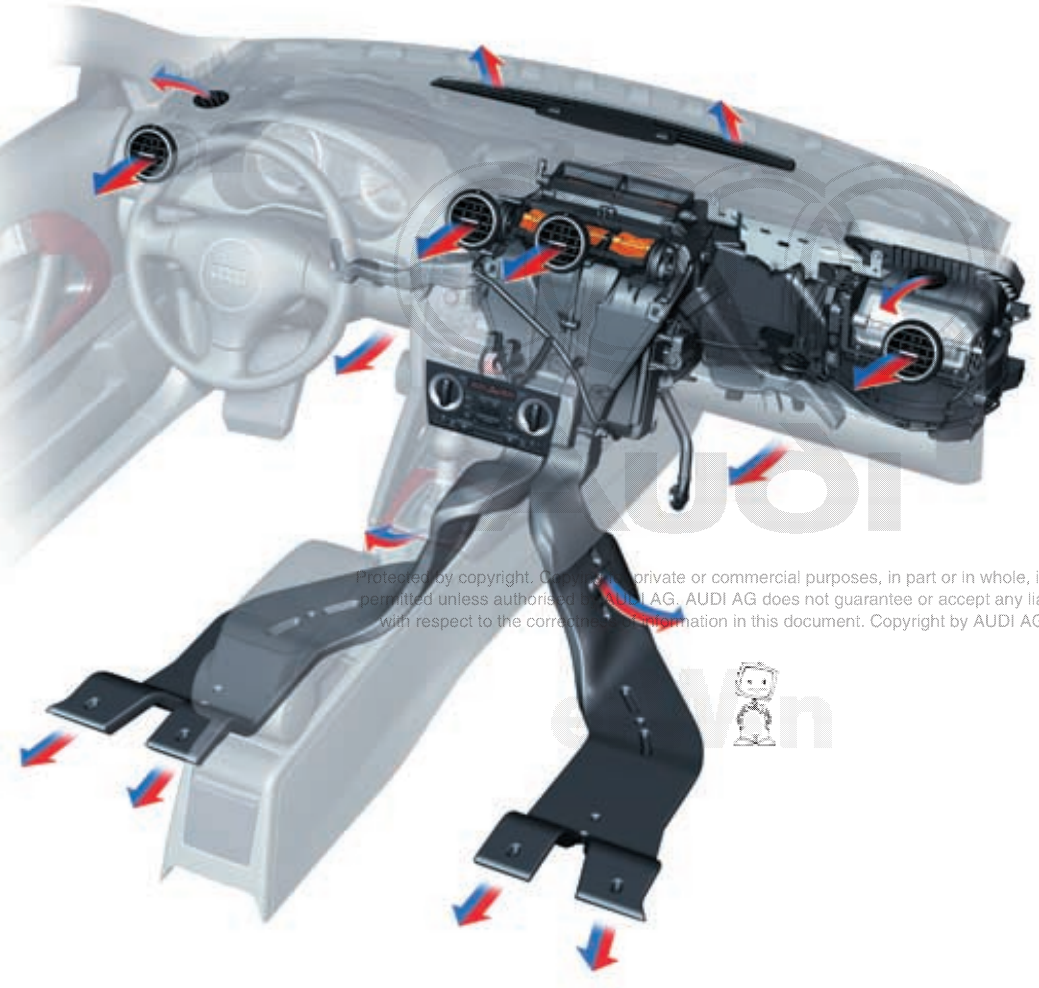
Design and operation

The heater/air conditioner in the new Audi A3 '04 is an advanced system with a new equipment concept.
It is characterised by optimised individual components and higher output levels.
The electric additional heater J604 is fitted as standard for diesel vehicles with no additional auxiliary heater.
The Climatronic control unit J255 is available in versions with/without seat heating and for use with various different radios (slot size 1 or 2 as per DIN). The same applies to use of the heater control unit J65.

Electrical load management

In the event of an electrical system power "bottleneck" whilst driving, the first step is to increase idling speed.
If this is not sufficient, the following heating/air conditioning loads can be minimised in line with requirements by means of the onboard power supply control unit J519:

- Electric additional heater J604 in four stages
- Heated rear window Z1
- Seat heating via convenience CAN
- Air conditioner on account of consumption-intensive electric fan operation

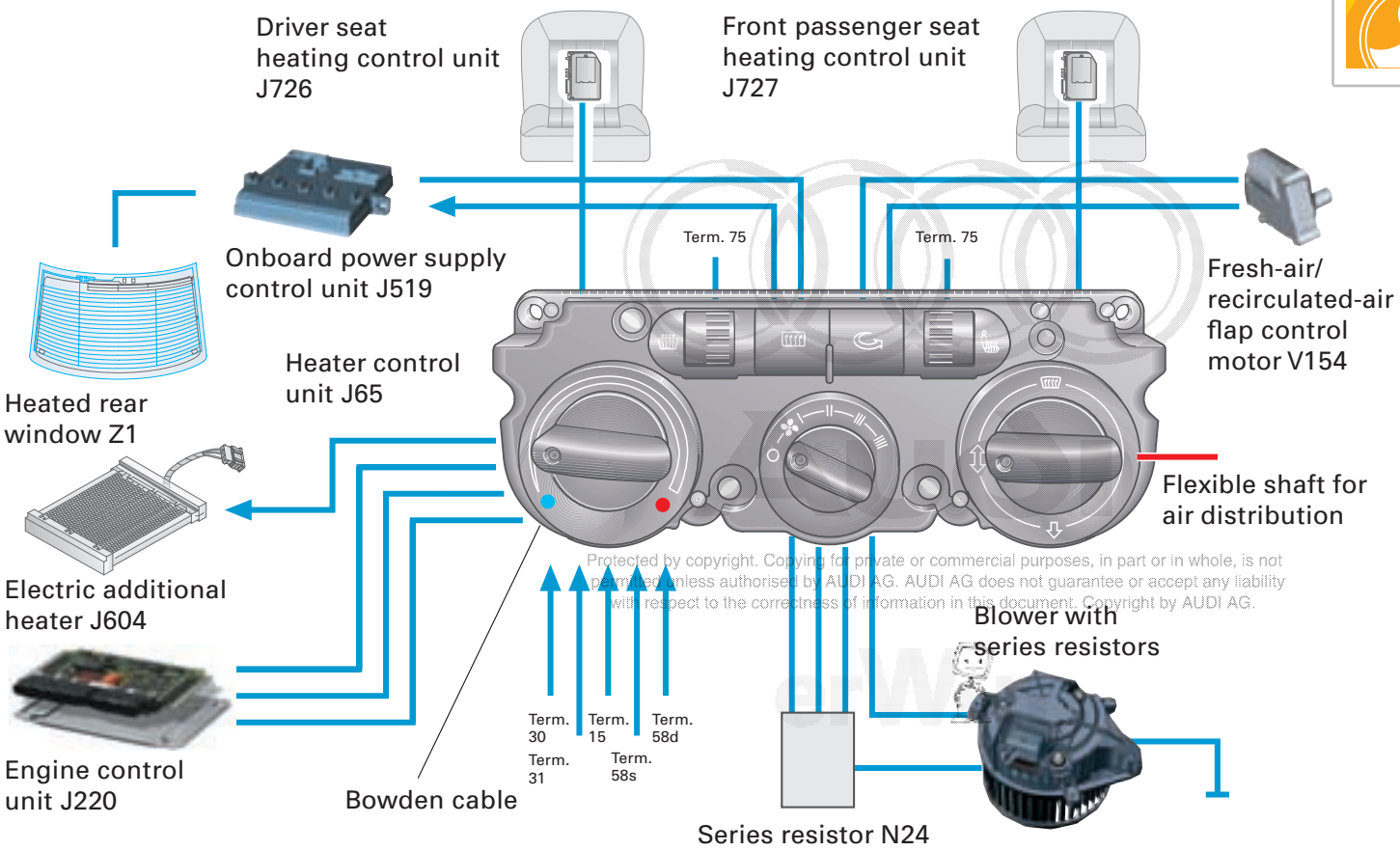


SSP290_030

Heater control panel

The heater control unit J65 is of analog type. It is equipped with rotary controls, a flexible shaft for regulating air distribution and a Bowden cable for controlling the temperature flaps.
The air-recirculation flap control motor is actuated electrically. It is only supplied with current until the flap reaches its stop position and actuates a limit switch.
Air recirculation is deactivated in defroster mode to stop the windows misting up.

Seat heating may also be fitted in conjunction with the heater. The driver and front passenger seat heating control units J726/ J727 are then installed at the seats. Only the seat heating potentiometers are integrated into the heater control unit J65.
Activation of the heated rear window Z1 is signalled by the heater control unit J65 to the onboard power supply control unit J519, which actuates the LED in the button of the heater control unit J65 following successful activation of the heated rear window.
If the heated rear window is defective the LED does not light.



SSP290_027

Heating/Air Conditioner

Automatic air conditioner

The automatic air conditioner in the new Audi A3 '04 is based on a concept containing modified components.
This includes separate driver's and passenger's side temperature regulation with separate sunlight sensors. With this air conditioner, the heated rear window Z1 is controlled by means of the Climatronic control unit J255 and the onboard power supply control unit J519 via the convenience CAN.

The enhanced filter concept includes an activated charcoal filter unit in the pollen filter (accessible from front passenger's footwell).
The quality of the air in the passenger compartment is thus far better even in recirculated-air mode. Cigarette smoke or evaporator odours can be filtered out.

The Climatronic control unit J255 is available in the versions with and without seat heating as well as 1DIN or 2DIN radio slot height.

SSP290_026

Air quality sensor

The air quality sensor G238 is now also available as additional equipment for the Audi A3 '04 and is located in the plenum chamber at the front right.

SSP290_031

The air conditioner is operated by a swash plate compressor with 6 reciprocating pistons and regulating valve N280.
Use is now also made for control purposes in the new Audi A3 '04 of an evaporator outflow temperature sender G263.
When the wipers are in operation, the evaporator outflow temperature is reduced to lessen humidity.

In the new Audi A3 '04, the compressor is not controlled by the fan control unit, but rather by the air conditioner via the Climatronic control unit J255. The radiator fan request is passed via the CAN to the engine control unit, which uses a pulse-width modulated signal to directly actuate either the fan control unit or the fan depending on engine power.

The motor of the fresh-air blower V2 is of the brush type and is also controlled via a pulse-width modulated signal.

For further details of air conditioner components, refer to SSP 240 (Audi A2 - Technical Features) or SSP 254 (Audi A4 '01 - Technical Features).

Pollen filter for Audi A3 '04, model 2004

SSP290_117

The adjacent illustration indicates the position and fitting location of the pollen filter in the front passenger's footwell.

Design bending points

SSP290_118

Pollen filter with design bending points to facilitate replacement in the rather inaccessible footwell area.

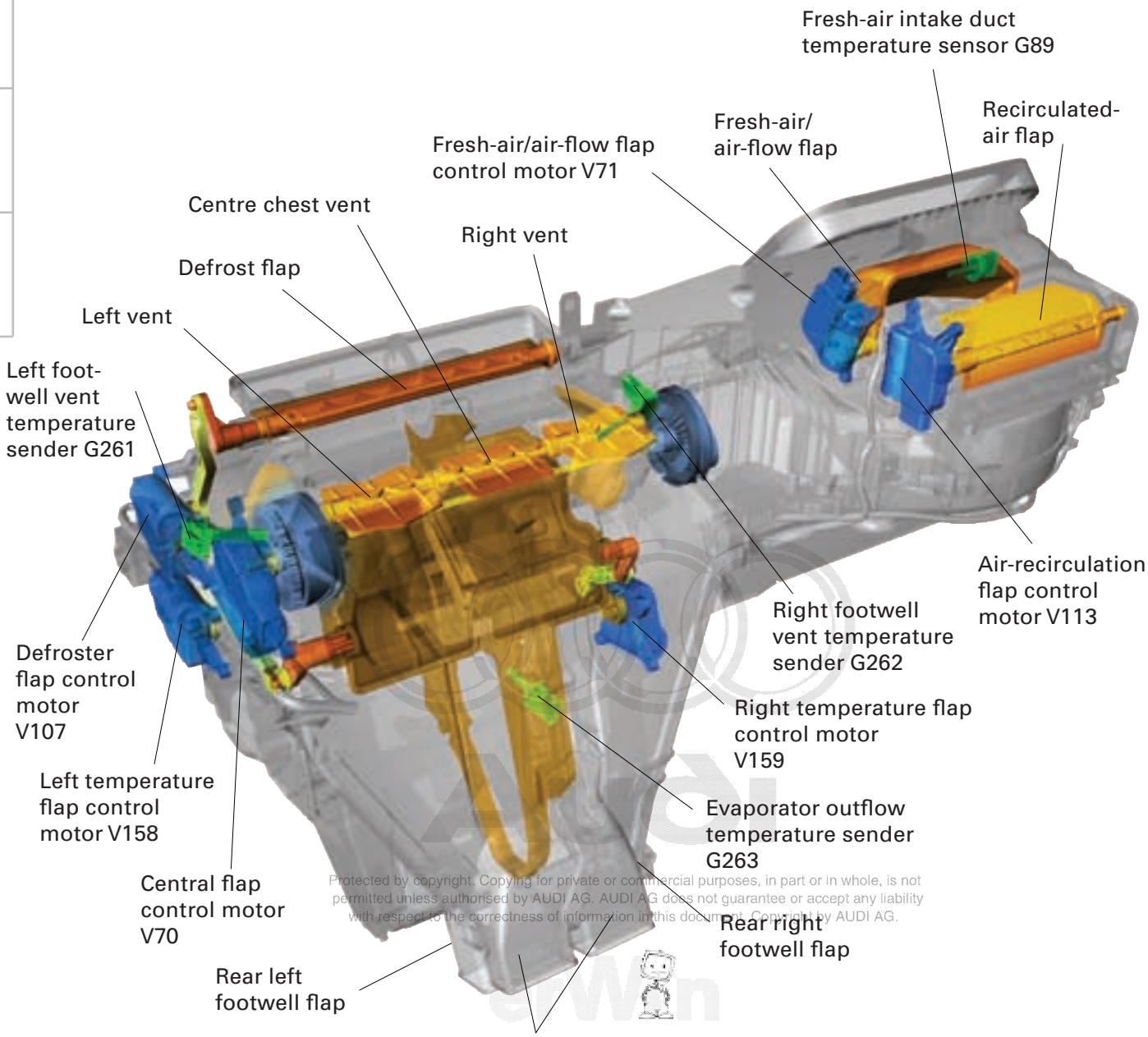
Mode of operation

The controls for the heated rear window, seat heating and air recirculation are integrated into the Climatronic control unit J255.
The heated rear window is controlled by means of the Climatronic control unit J255 and the onboard power supply control unit J519 via the convenience CAN.

The basic setting of the control motors used is determined in the course of the "Basic setting" function for the Climatronic control unit J255 by moving from stop to stop.

The encoding is also learnt at the same time. This takes place simultaneously for all control motors in the "basic setting" function.

After activating the air conditioner, the control unit with display in dash panel insert J285 determines the necessary air throughput automatically in line with the ambient temperature.



SSP290_028

Auxiliary heater deactivation conditions

Under the following conditions, the auxiliary heater cannot be started up:

- Fuel gauge on zero (only applicable before starting auxiliary heater)
- Fault detected for both ambient temperature sensors
- Fault memory entry preventing starting
- Triggering of crash signal

Compressor

Depending on vehicle equipment, the compressor is now actuated by the air conditioner instead of the fan control unit.
With certain equipment versions, outflow temperature sensors are fitted in the evaporator to control the compressor valves.
When the windscreen wipers are in operation, the control unit reduces the evaporator temperature to achieve better dehumidification.
Compressor operation is reduced to a minimum after pressing the ECON button, without this affecting energisation of the PTC element.
With the recirculated-air button pressed and an ambient temperature of -1 °C, compressor operation is reduced to minimum power.
The radiator fan request is passed via the CAN bus from the engine control unit.

Auxiliary heater

With terminal 15 off, auxiliary heater or auxiliary ventilation mode can be activated depending on ambient temperature by pressing the blower "+" button for at least 2 seconds. Blower delivery has been reduced to a maximum of 4 output stages.
Auxiliary heater/auxiliary ventilation is active for a maximum of 62 minutes.

If a crash signal has been triggered by the airbag control unit, the additional heater may be disabled for safety reasons.
It is then only ready for operation again after deactivating the lock function with the VAS 5051 tester (adaption channel 42).

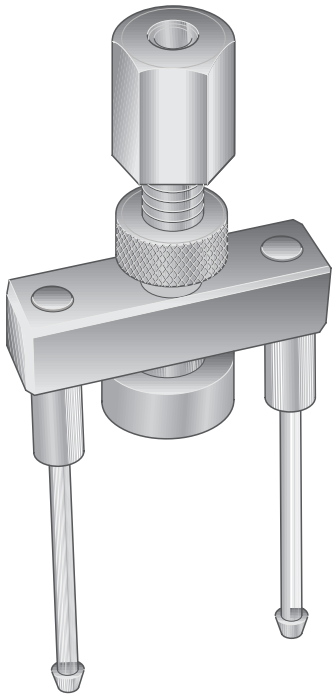
Electric additional air heater

Given a heating request from the vehicle occupants, an ambient temperature of less than 7 °C and an engine speed of at least 500 rpm, the additional heater is switched in.
This electric additional air heater with a rated power of 1000 W is located in the air flow downstream of the heating system heat exchanger and is fitted as standard on vehicles with diesel engine.

If a vehicle is fitted both with a diesel engine and an auxiliary heater as optional extra, the electric additional air heater function is assumed by the auxiliary heater J364.
An electric additional air heater is then not fitted.

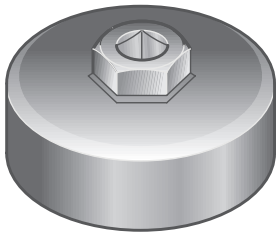
Special tools

Extractor for unit injector element T10163



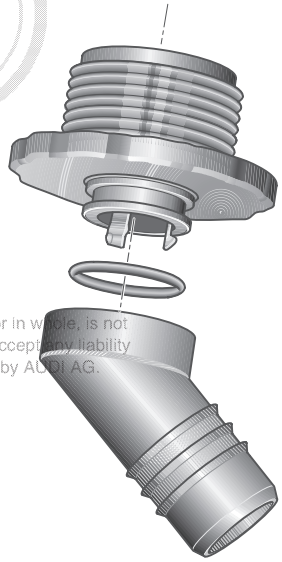
SSP290_124

Oil filter wrench 3417



SSP290_125

Oil drain adapter T40057



SSP290_083

Notes

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