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Audi A4 1995 ➤

6-Cylinder engine (5-valve turbo), Mechanics									
Engine ID	AGB	AZB							

Edition 12.1997

List of Workshop Manual Repair GroupsList of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi A4 1995 ➢

6-Cylinder engine (5-valve turbo), Mechanics

Repair Group

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10 - Removing and installing engine
13 - Crankshaft group
15 - Cylinder head, Valve gear
17 - Lubrication
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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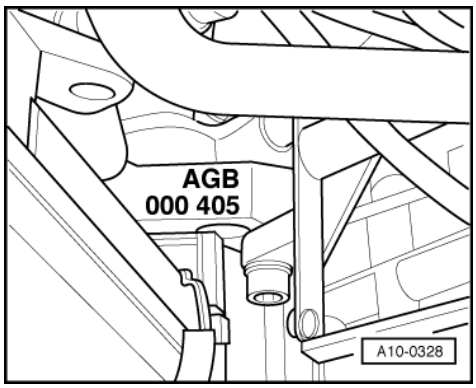
00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



-> The engine number (engine code and serial number) is on the machined surface on the cylinder block, at the front of the right cylinder bank.

The engine code is also indicated on the vehicle data sticker.

1.3 - Engine data

Engine code		AGB	AZB
Manufactured		09.97 ä	10.00ä
Capacity	cm3	2671	2671
Power	kW at rpm	195/5800	195/5800
Torque	Nm at rpm	400/1850	400/1850
Bore	ø mm	81	81
Stroke	mm	86.4	86.4
Compression		9.5	9.5
RON	min.	RON 981)	RON 981)
Firing order		1-4-3-6-2-5	1-4-3-6-2-5
Injection system		Motronic	Motronic
Self-diagnosis		yes	yes
Lambda control		yes	yes
Secondary air system		no	no
Camshaft timing control		yes	yes

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1) If necessary in exceptional cases, fuel with not less than 95 RON can also be used, but this will cause a loss of power.

Engine code	AGB	AZB
Catalytic converter	yes	yes
Exhaust gas recirculation	no	no
Charging	yes	yes
Emission standard	EU2 + D3	EU3

Engine code	AGB	AZB
Valve timing		
At 1 mm valve lift and 0 mm valve clearance, camshaft timing control not activated		
Inlet opens after TDC	10°	10°
Inlet closes after BDC	20°	20°
Exhaust opens before BDC	38°	38°
Exhaust closes before TDC	8°	8°

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10 - Removing and installing engine

1 - Removing and installing engine

1.1 - Removing and installing engine

Notes:

- All cable ties which are released or cut open when removing the engine must be replaced in the same position when installing the engine.
- The engine is removed from the front without the gearbox.
- Catch drained-off coolant in a clean container for re-use or disposal.
- Renew all gaskets and seals.
- Do not open the air conditioner refrigerant circuit.

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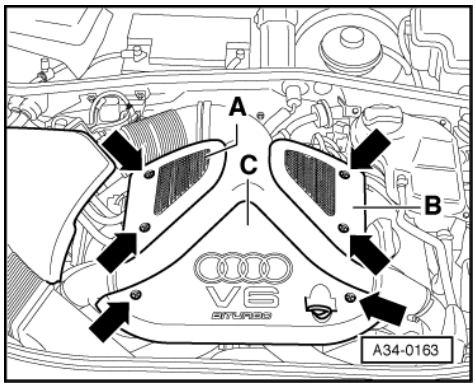
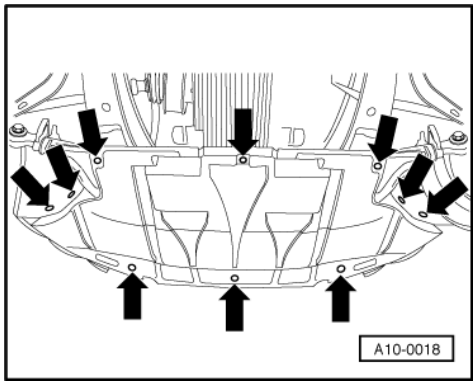


- Obtain radio code on vehicles with coded radio.
- With ignition switched off, disconnect battery earth strap.
- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.
- Remove cover above air cleaner.
- Remove plenum chamber cover.

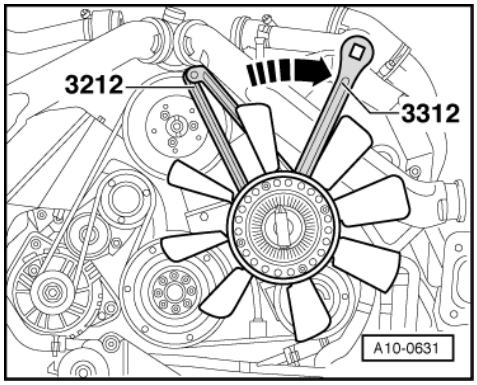


- -> Remove noise insulation -arrows-.
- Remove retaining bracket for noise insulation on subframe.
- Drain off coolant => Page 181
- Remove front bumper:

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Remove lock carrier

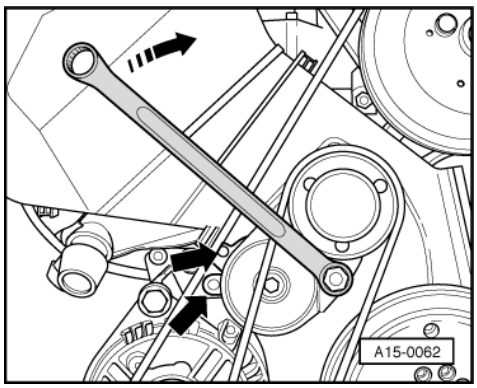
=> General body repairs; Repair group 50; Removing and installing lock carrier Removing and installing lock carrier



- -> Remove viscous fan (counter-hold with pin wrench 3212).

Note:

Viscous fan has left-hand thread: turn in direction indicated.

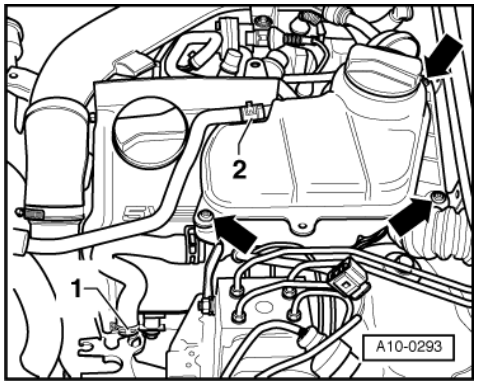


- Mark direction of rotation of ribbed belt.
- -> To slacken ribbed belt, turn to the right using a 17 mm ring spanner until the two holes are aligned with each other -arrow- and hold in position with mandrel 3204.

Note:

Mark direction of rotation of ribbed belt. The belt can break if it runs in the opposite direction when refitted.

- Take off ribbed belt.



- -> Disconnect water hoses -1- and -2-.
- Remove coolant reservoir (arrows).
- Unplug connector for coolant level monitor.

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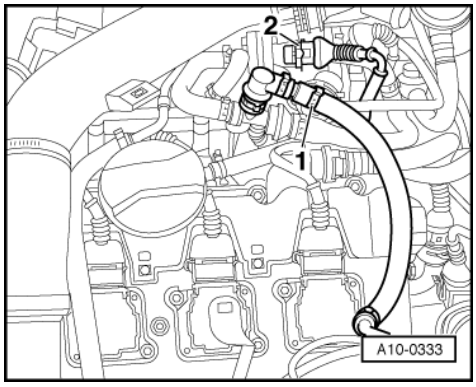
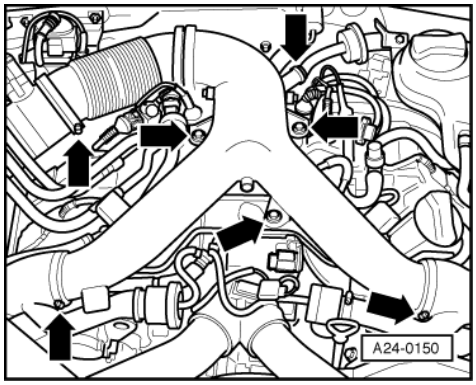
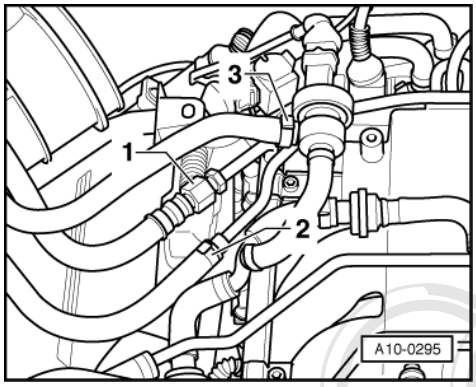
- Remove cover panel from cylinder head cover (cylinder bank 4-6).



- -> Pull off hose -1- going to vacuum reservoir.



- -> Remove air duct -arrows-.



Warning
Fuel system is under pressure. Before opening the system, place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off ACF valve -3-.

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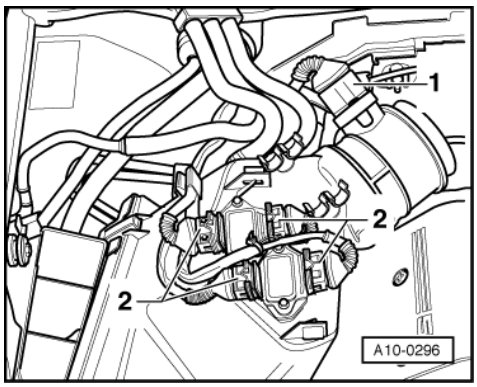

- -> Unplug connector -1- from air mass meter.
- Unplug connectors -2- from ignition output stages, and move wiring clear.
- Remove air cleaner.

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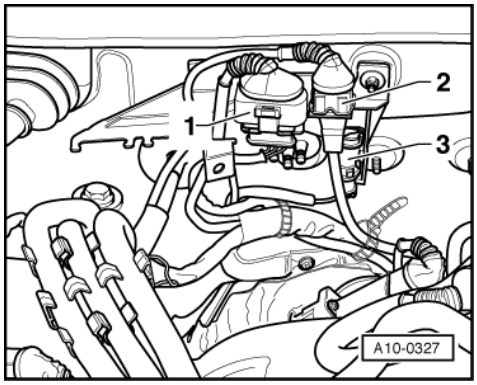
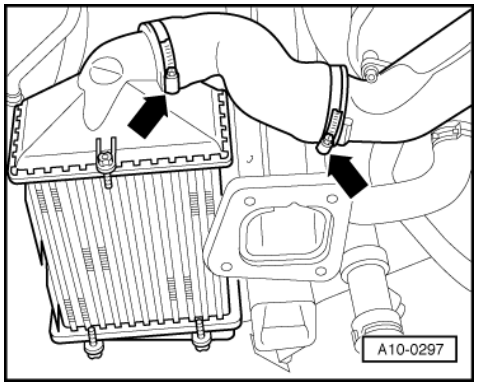
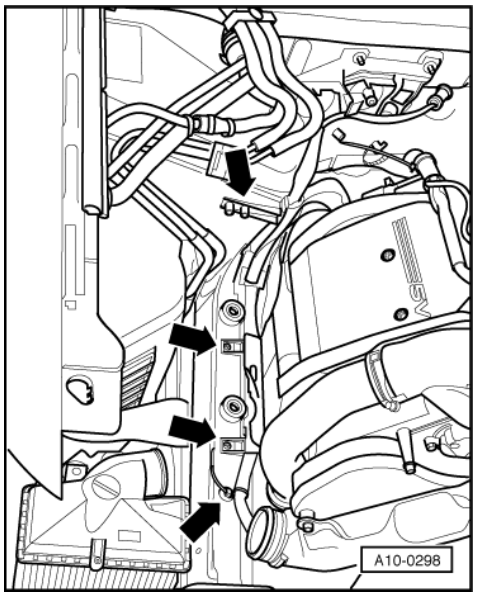


- -> Unplug connector -1- for lambda probe at bulkhead.
- Unplug connector -2- for knock sensor.
- Unplug connector -3-.
- Move wiring harness clear.



- -> Remove pressure hoses -arrows- between charge air coolers and pressure pipes (right and left).



- Unscrew and disconnect cable from positive battery terminal.
- Disconnect positive terminal from battery.
- -> Move wiring harness clear together with cable duct for starter -arrows-.

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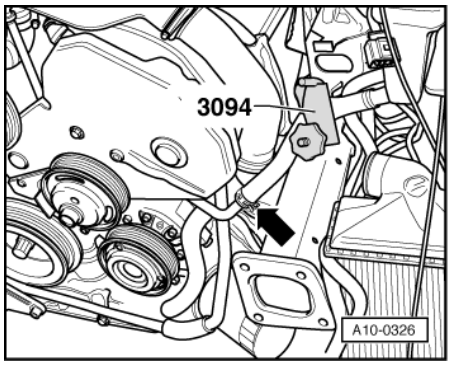
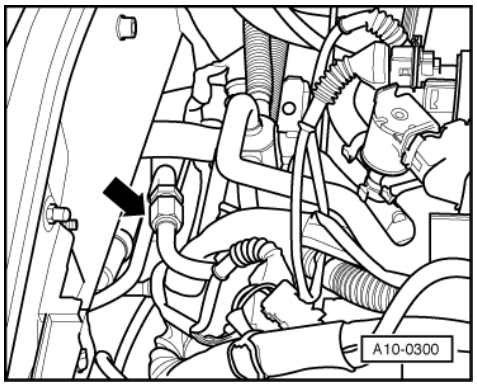
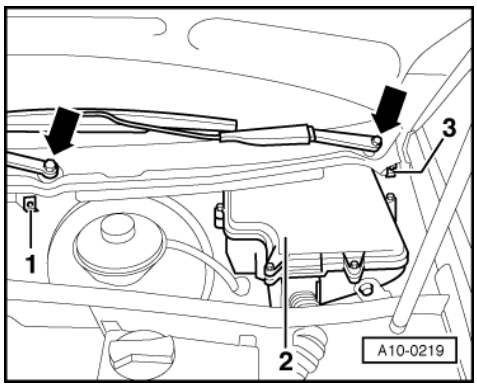


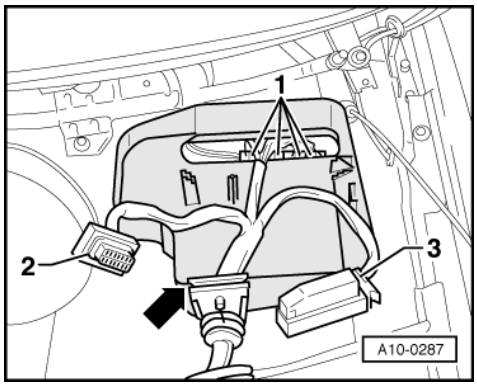
- -> Fit clamp (special tool 3094) on hose from power steering reservoir to power steering pump.
- Disconnect power steering hose -arrow-.



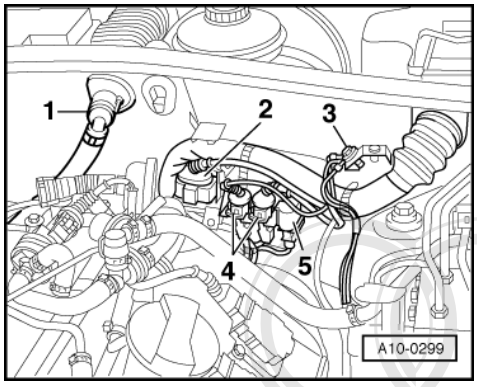
- -> Disconnect hydraulic pipe -arrow-.
- Unplug connector from speedometer sender.
- Unplug connector from reverse gear switch.



- -> Take off wiper arms -arrows-.
- Pull clips -1- off water deflector.
- Pull clips -3- off water deflector (left and right).
- Take off water deflector.
- Unbolt cover -2- from electronics box.
- Open electronics box in plenum chamber.



- Unclip retainer for engine control unit.
- -> Detach engine control unit, release catches on connectors -2- and -3- and unplug connectors.
- Unplug connectors -1-.



- -> Pull off brake servo hose -1- at bulkhead.
- Unscrew and detach earth connection -3-.
- Unplug connectors -2- and -5- at bulkhead, and pull lower parts of connectors out of their brackets.
- Pull connectors -4- out of bracket and move wiring clear.
- Remove bracket for plug connectors.
- Pull both heater hoses off engine. To do this, disengage retainers on connector flange.

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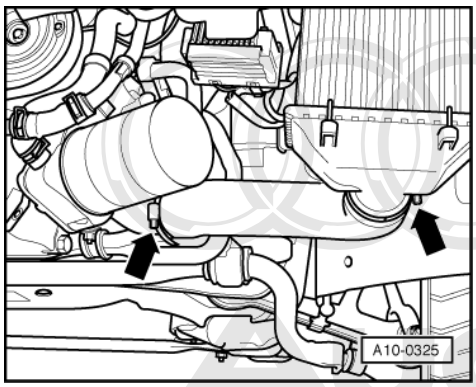

- -> Remove pressure hoses -arrows- between turbocharger and charge air cooler (left and right sides).

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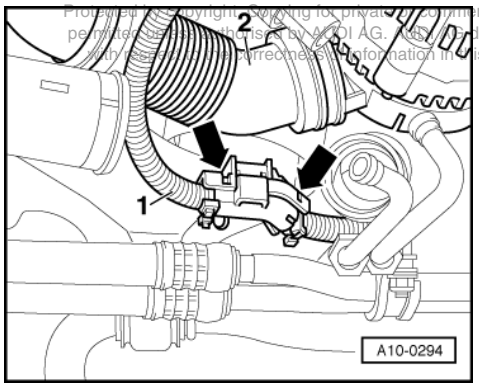
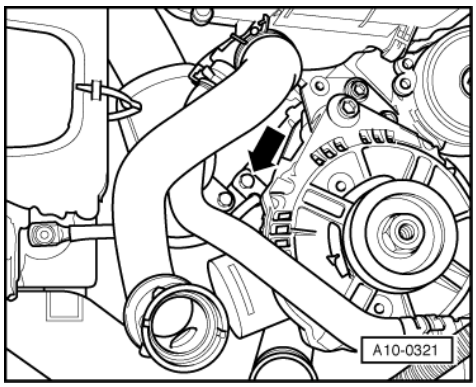
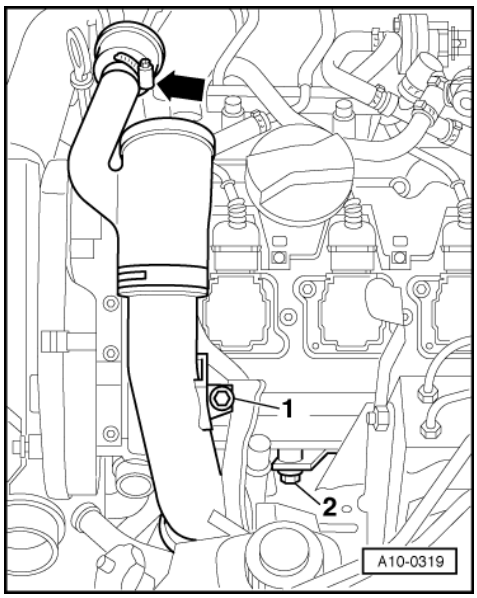


- -> Move starter cable -1- clear. To do this, cut open cable tie and unclip retainer -arrows-.
- Remove alternator cooling hose -2-.



- -> Unbolt earth cable -arrow- from engine support.



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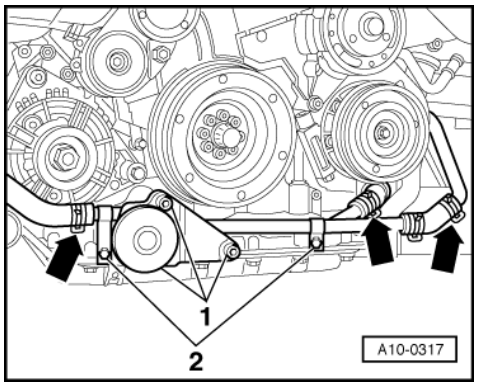
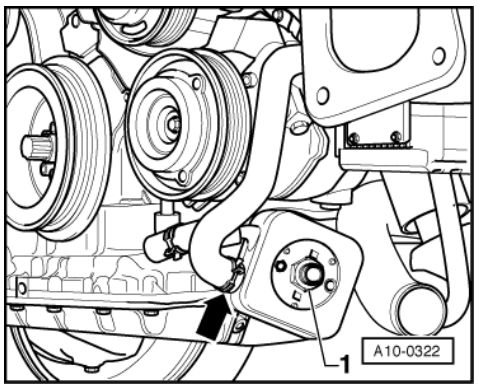
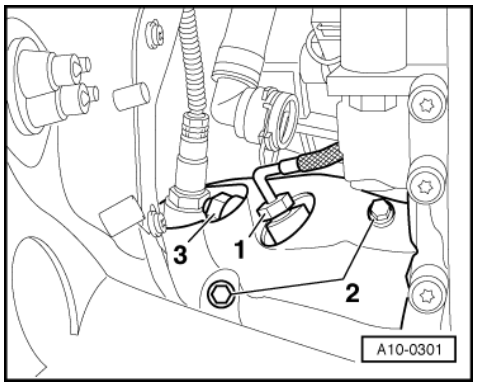
- -> Release hose clamp -arrow-.
- Remove intake pipe -1-.
- Remove water pipe -2-.



- -> Remove torque reaction support -1-.
- Release hose clamps -arrows-.
- Remove water pipe -2-.



- Place drip tray V.A.G 1306 under engine.
- Remove oil filter.
- -> Release hose clamps -arrows-.
- Remove oil cooler -1-.



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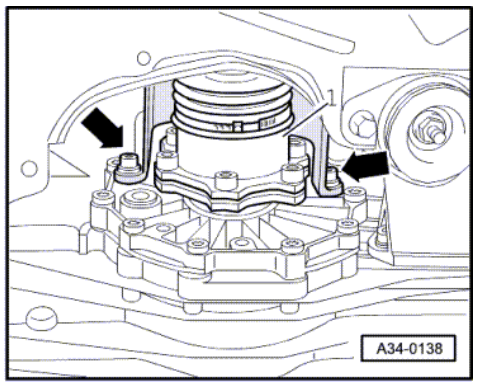
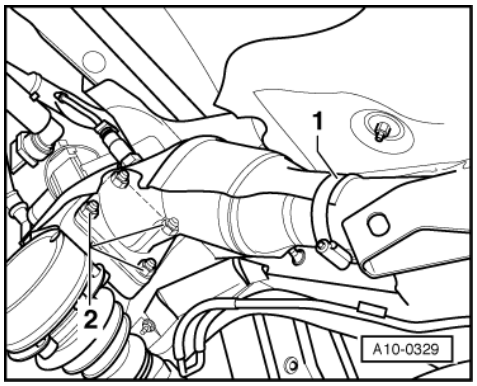
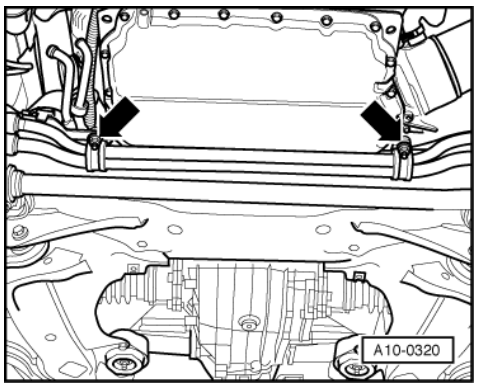
- -> Unscrew exhaust gas temperature sensor -1- from right-hand turbocharger using special tool 3035.
- Detach heat shield -2- from left and right turbochargers.
- Unscrew upper bolts -3- from front exhaust pipes at left and right turbochargers.



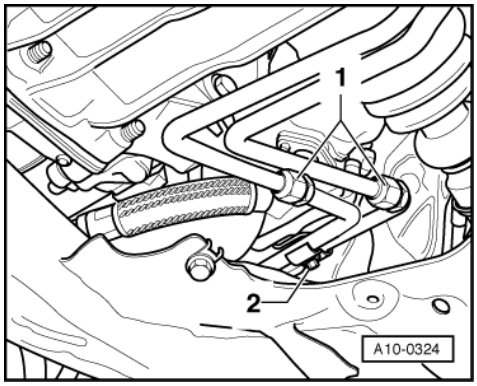
- -> Detach guard plates -arrows- above left and right drive shafts from gearbox.



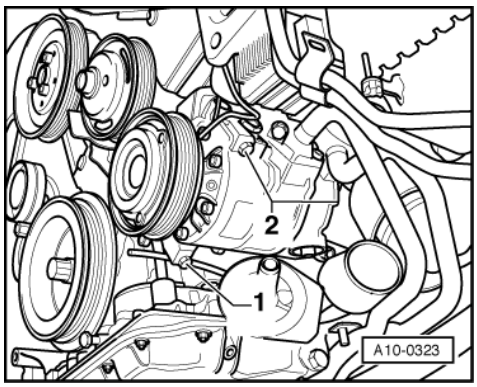
- -> Release hose clamps -1- from left and right turbocharger guard plates.
- Unbolt left and right exhaust pipes -2- from turbochargers.



- -> Detach air conditioner pipes from sump -arrows-.



- -> Disconnect gearbox oil pipes -1-.
- Detach oil pipe at turbocharger -2-.



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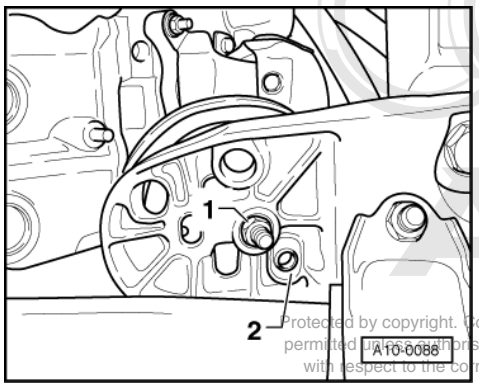
Important
The air conditioner refrigerant circuit must not be opened.

- -> Remove air conditioner compressor -1...3-.
- Move compressor clear to the side and attach it to the body with wire, leaving the pipes connected.

Notes:

- Note position of guide bushes when installing.
- When installing, insert bolt -1- into compressor first.



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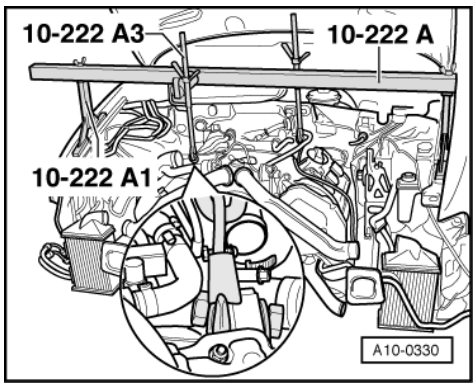
- To prevent damage to the condenser and refrigerant pipes/hoses. ensure that the pipes and hoses are not stretched, kinked or bent.

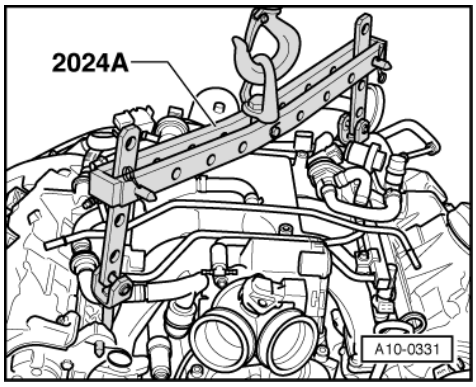
- -> Mark positions of securing points -1- and locating sleeves -2- under engine mountings on right and left sides.
- Unscrew nuts -1- at engine mountings on left and right sides.

Note:

When installing, ensure that locating sleeves -2- engage in position.



- Set up support bar 10-222A with 10-222A1 on bolted flanges of wing panels.
- -> Using support bar 10-222A with 10-222A1 and extension 10-222A3, lift engine upwards.
- Unscrew engine/gearbox bolts from underneath.
- Remove support bar.
- Unscrew engine/gearbox bolts from above.



- -> Attach lifting tackle 2024 A at rear right and front left, and secure attachment points.

Note:

To balance the centre of gravity of the engine, secure the hook attachments in the positions shown in the illustration.

The hook attachments and locating pins on the lifting tackle must be secured with locking pins.

- Remove front left wheel.
- Support gearbox with trolley jack.
- Bring workshop crane into position and hook up lifting tackle.

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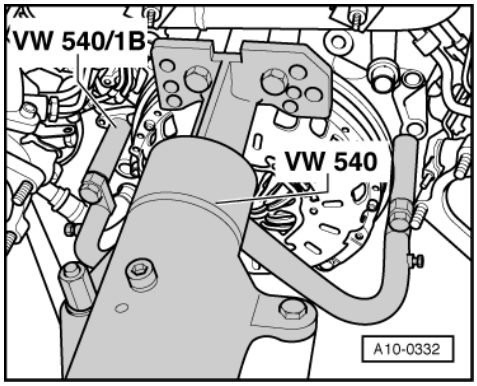
Note:

Check that all hoses, pipes and electrical wires between engine and gearbox have been disconnected.

- Carefully pull out engine towards the front until there is sufficient clearance.
- Guide engine forwards out of engine compartment.
- Remove spacer plate between engine and gearbox.

1.2 - Attaching engine to repair stand



-> When working on the engine, attach it to the repair stand using engine bracket VW 540 with attachments VW 540/1B.

1.3 - Installing

Installation is carried out in the reverse order; when doing this note the following points:

Note:

When performing repairs, renew seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.

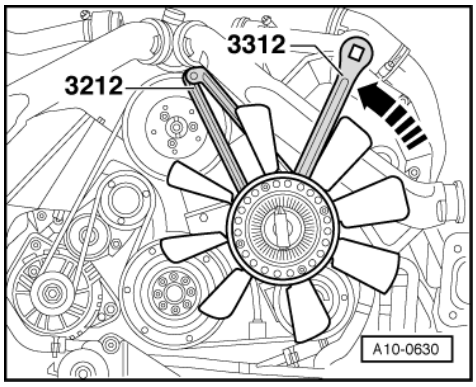
- Install clutch

=> 6-Speed manual gearbox 01E; Repair group 30; Servicing clutch Servicing clutch

- Check that dowel sleeves for centralising engine/gearbox are in the cylinder block; install if necessary.
- Lightly grease splines on gearbox input shaft with G 000 100. Do not grease guide sleeve for release bearing.
- Check that clutch plate is properly centred (where applicable).

- On vehicles with manual gearbox, a needle bearing must be fitted in the dual-mass flywheel. Install needle bearing if necessary=>Page 54 .

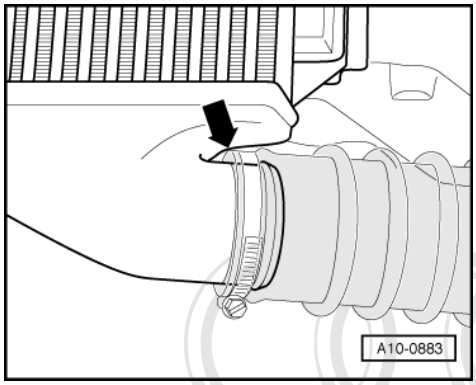
- Install spacer plate between engine and gearbox.
- Install ribbed belt =>Page 35 .



- -> Counterhold viscous fan pulley using pin wrench 3212 and secure viscous fan using open-end spanner 3312 and torque wrench 1331 (left-hand thread).

Note:

Viscous fan has left-hand thread: turn in direction indicated.



- -> Hoses on the charge air coolers and the air intake pipes should be put on as far as they will go -arrow-. Do not lubricate or grease.

Notes:

- The screw-type clips should be tightened directly behind the lip on the charge air cooler and the lip on the air intake pipe.
- The screw fasteners of the screw-type clips should be located at the 'X' mark on the hose.

Tightening torque: 3.5 Nm

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- Check gearbox oil level

=> 6-Speed manual gearbox 01E; Repair group 34, Checking gearbox oil level in gearbox

- Fill cooling system=> Page 181 .

Notes

- Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.

- Drained coolant must not be used again if it contains dirt.

- Ensure that engine mountings are free of stress when installing: shake engine to align it before tightening engine mountings.
- Install lock carrier with attachments:

=> General body repairs; Repair group 50; Removing and installing lock carrier Removing and installing lock carrier

- Align exhaust system so it is free of stress.

- Connect vacuum lines=>Page 18 .
- Always use special tool 3122 B to remove and install spark plugs.
- Electrical connections and routing of wiring:

=> "Current flow diagrams, Electrical fault-finding and Fitting locations"

- After connecting battery, enter anti-theft code for radio

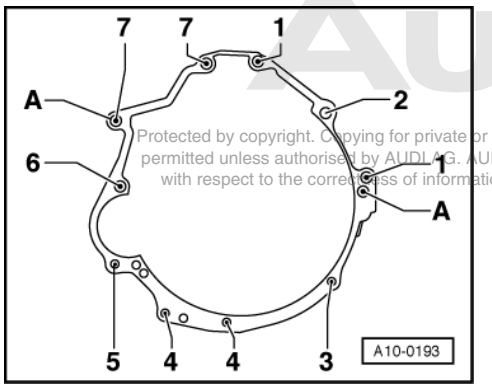
=> Radio operating instructions

- Run front side windows all the way to their top positions using electric switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Check engine oil level before starting engine.

1.4 - Tightening torques

Notes:

- The tightening torques listed below apply only to lightly greased, oiled, phosphated, or black-finished nuts and bolts.
- Additional lubricant such as engine or gear oil may be used, but do not use graphite lubricant.
- Do not use degreased parts.
- Tolerance for tightening torques is ±15%.



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-> Engine/gearbox mountings (6-cylinder engine)

Item No.	Bolt	Quantity	Nm
1	M 12 x 90	2	65
2	M 12 x 100	1	65
3	M 10 x 60	1	45
4	M 10 x 60	2	45
5	M 10 x 150	1	65

Item No.	Bolt	Quantity	Nm
6	M12 x 130	1	65
7	M12 x 80	2	65

-A- Dowel sleeves for centering

Component		Tightening torque
Bolts and nuts	M6	10 Nm
	M8	20 Nm
	M10	45 Nm
	M12	60 Nm
Except for the following:		
Front exhaust pipe to turbocharger		30 Nm
Heat shield to turbocharger		10 Nm
Exhaust pipe clamp		40 Nm
Engine support to engine mounting	M10	45 Nm
A/C compressor to bracket		25 Nm
Torque reaction support		45 Nm
Heat shields above drive shafts to gearbox		25 Nm
Torque wrench V.A.G 1331 and open-end spanner 3312		37 Nm
Torque wrench without open-end spanner 3312		70 Nm
Screw-type clips for air intake system		3.5 Nm

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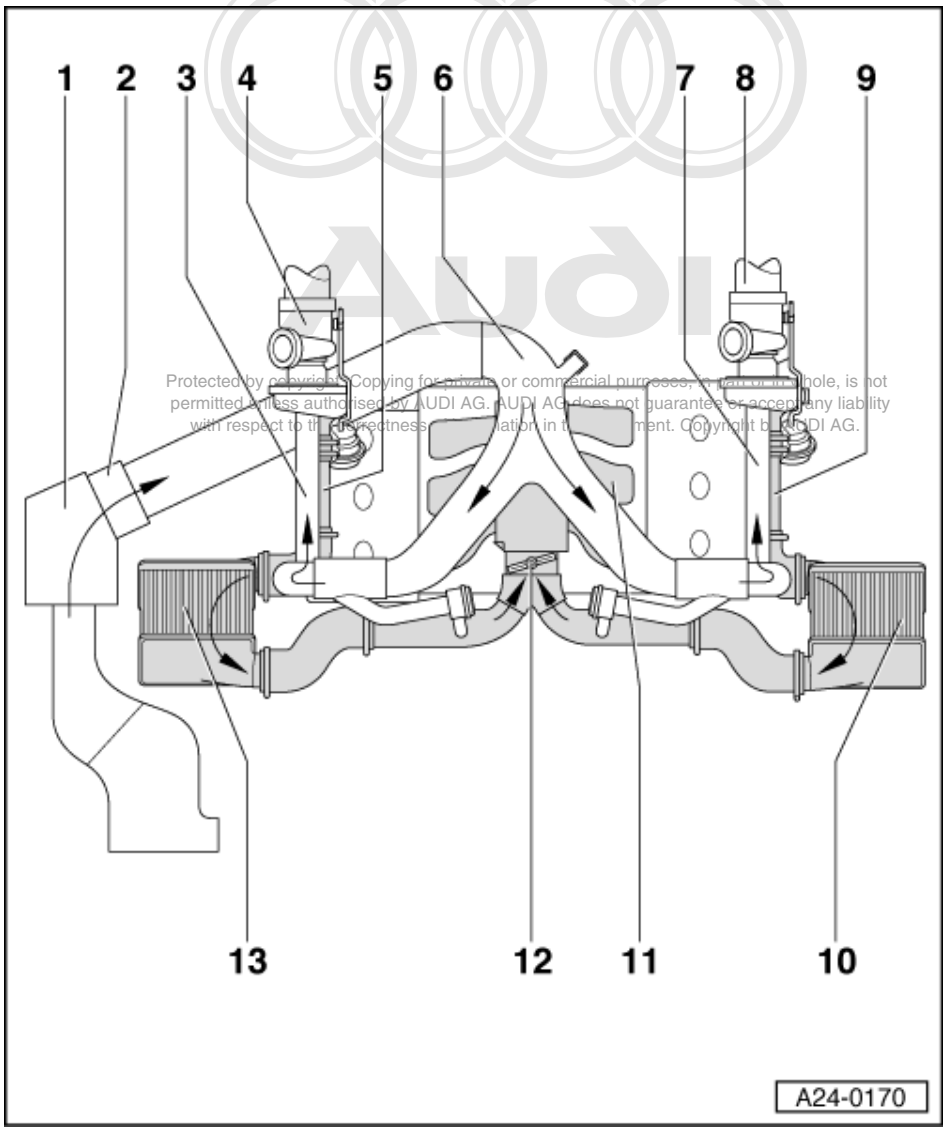
2 - Vacuum system layout

2.1 - Vacuum system layout



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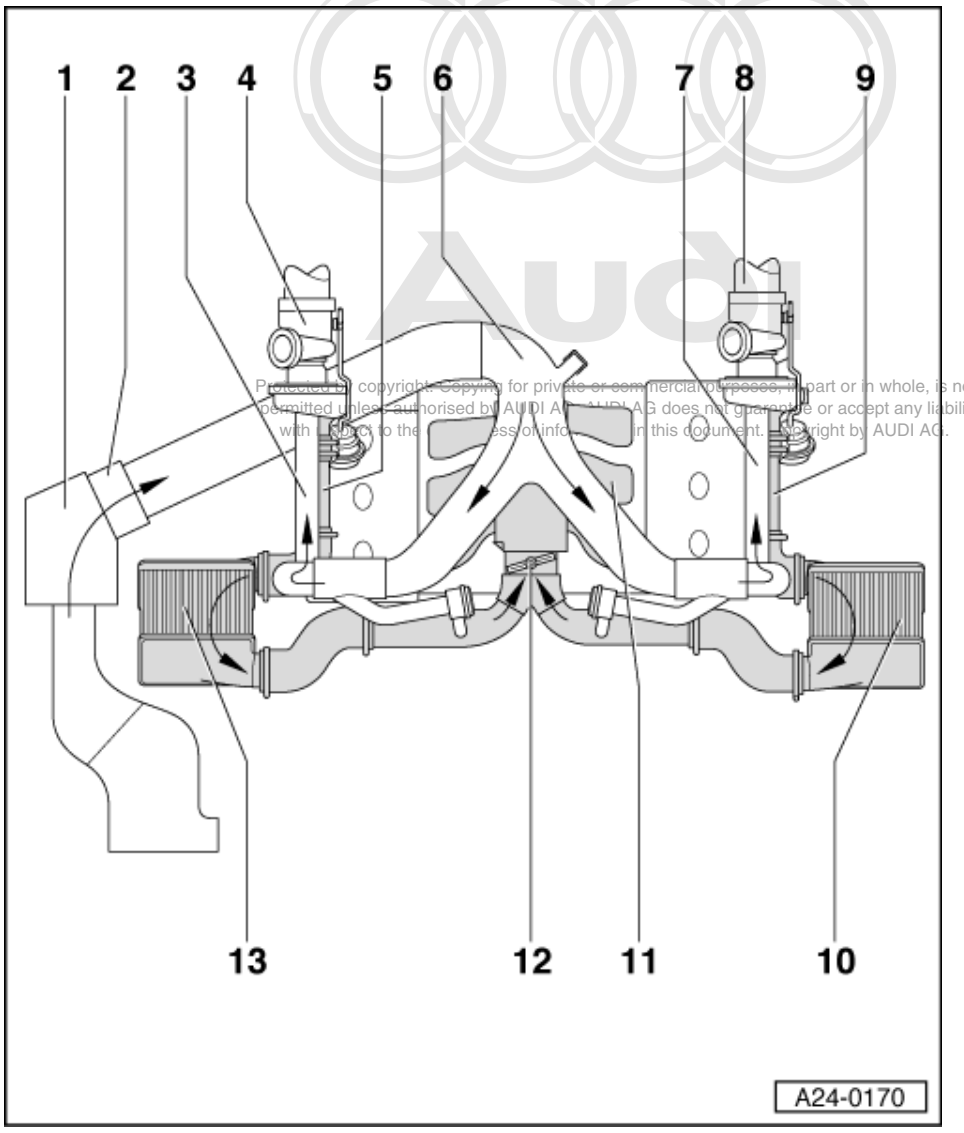
2.2 - Air flow diagram (general)

1 Air filter
2 Air mass meter (G70)
3 Intake side of turbocharger, Bank 1
4 Turbocharger, Bank 1
5 Pressure side of turbocharger, Bank 1
6 Air duct



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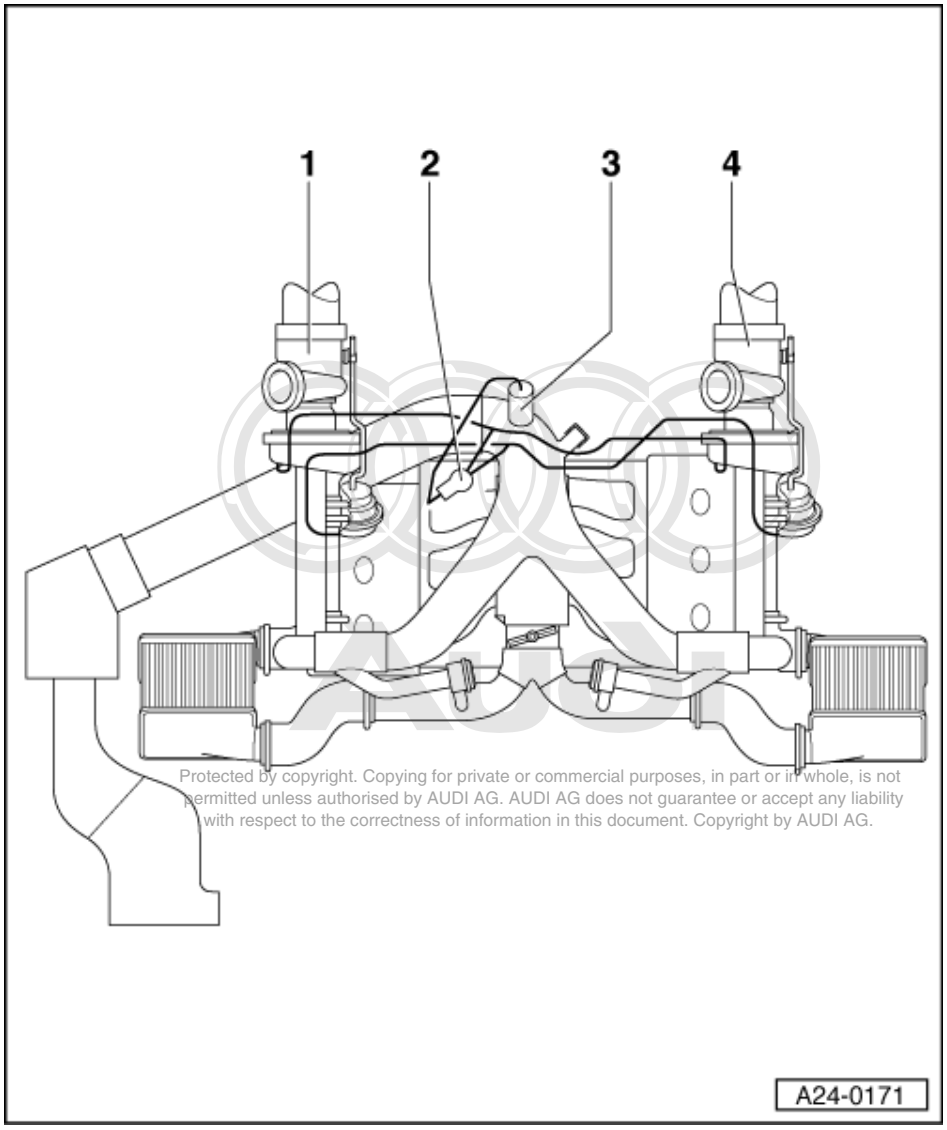
7 Intake side of turbocharger, Bank 2
8 Turbocharger, Bank 2
9 Pressure side of turbocharger, Bank 2
10 Charge air cooler, Bank 2
11 Intake manifold
12 Throttle valve control part (J338)
13 Charge air cooler, Bank 1

2.3 - Charge pressure control system



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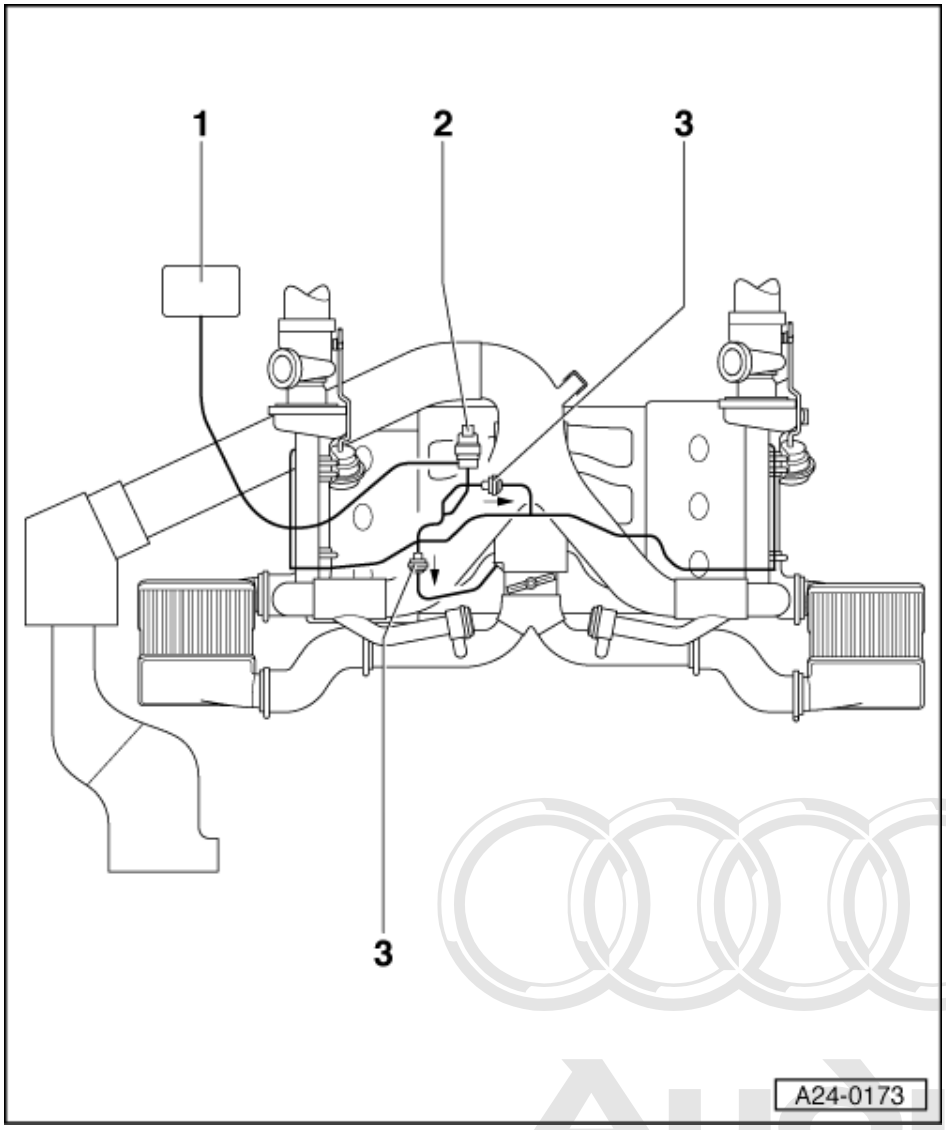
1 Turbocharger, Bank 1
2 Charge pressure control solenoid valve (N75)
3 Distributor piece
4 Turbocharger, Bank 2

2.4 - Fuel tank breather system (ACF system)



1 Activated charcoal filter
2 Solenoid valve 1 for activated charcoal filter (N80)
3 Non-return valves (arrows indicate direction of flow)

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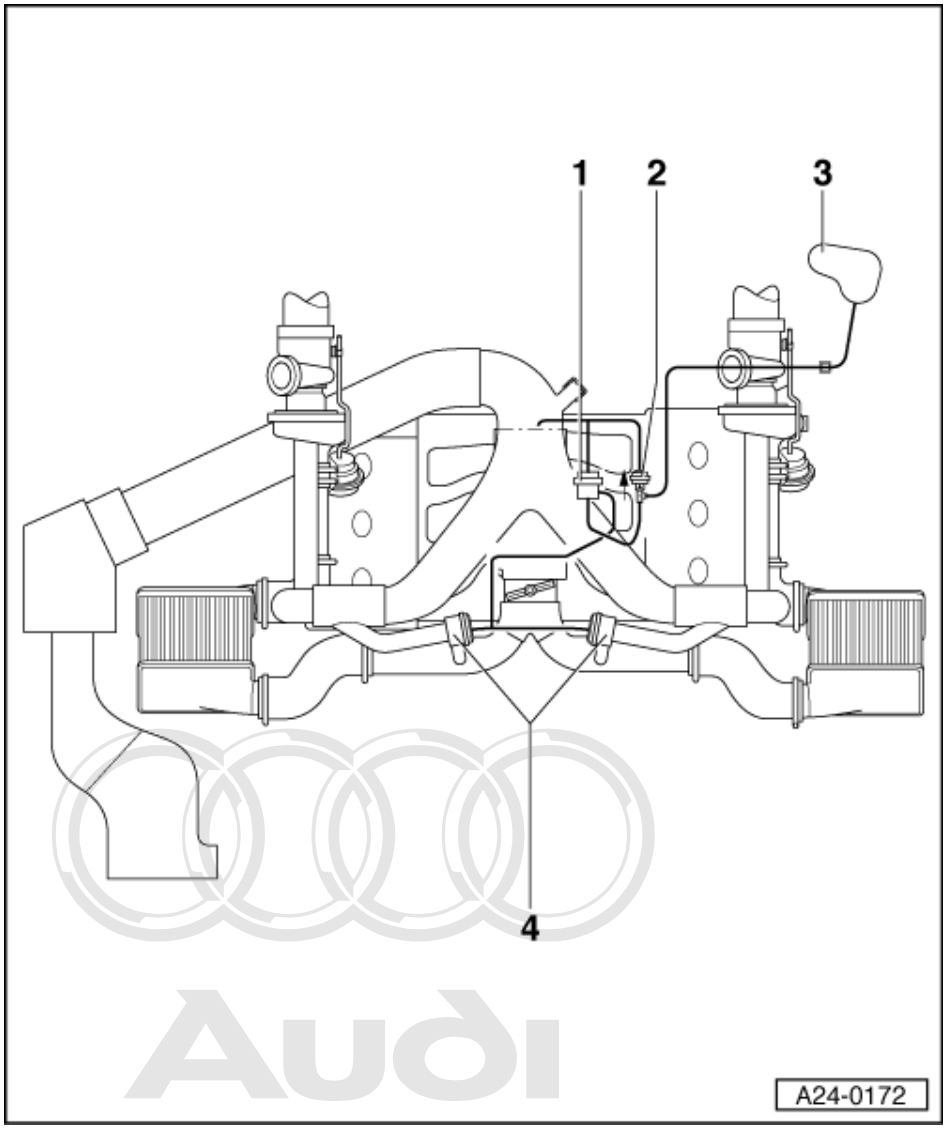
2.5 - Air diversion system (air "recirculation" on overrun)



1 Air recirculation valve for turbocharger (N249)
2 Non-return valve (arrow indicates direction of flow)
3 Vacuum reservoir
4 Mechanical air recirculation valves

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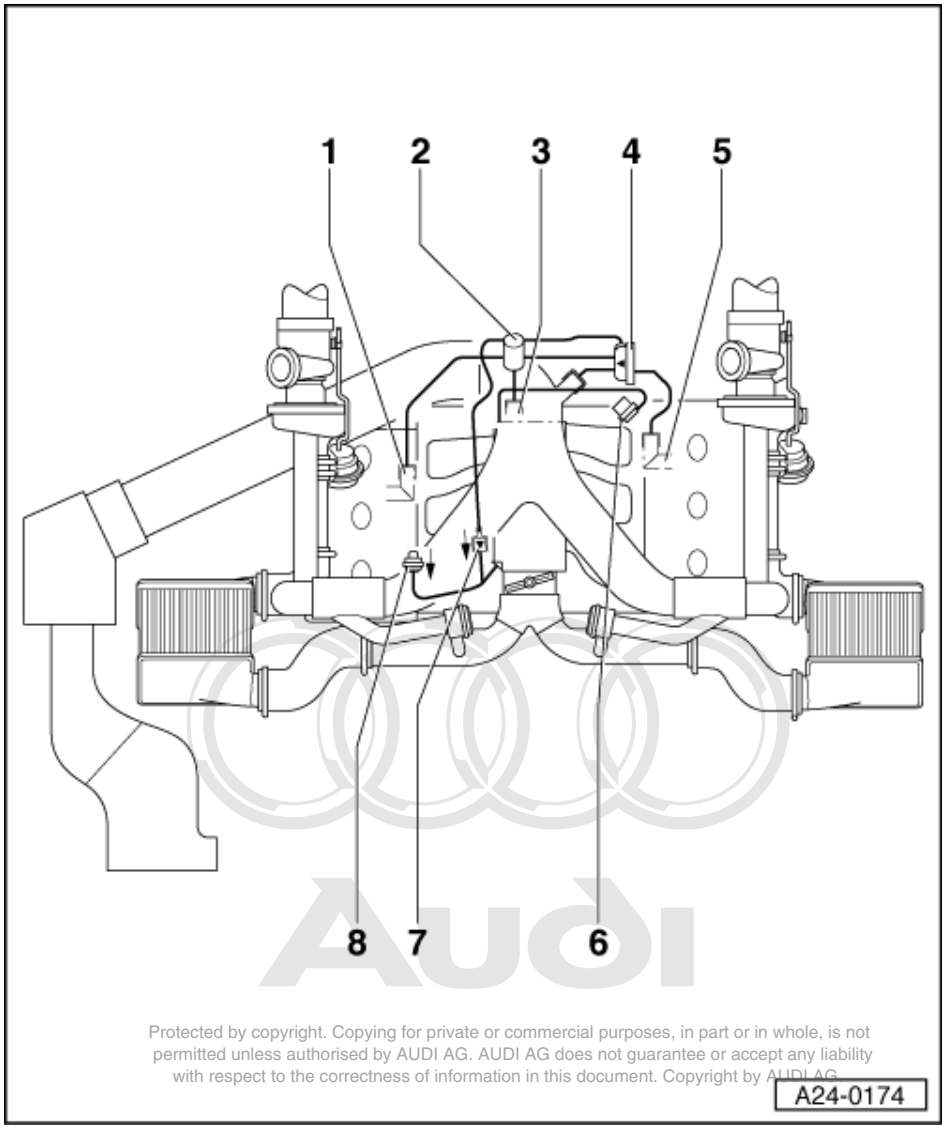
2.6 - Crankcase breather system



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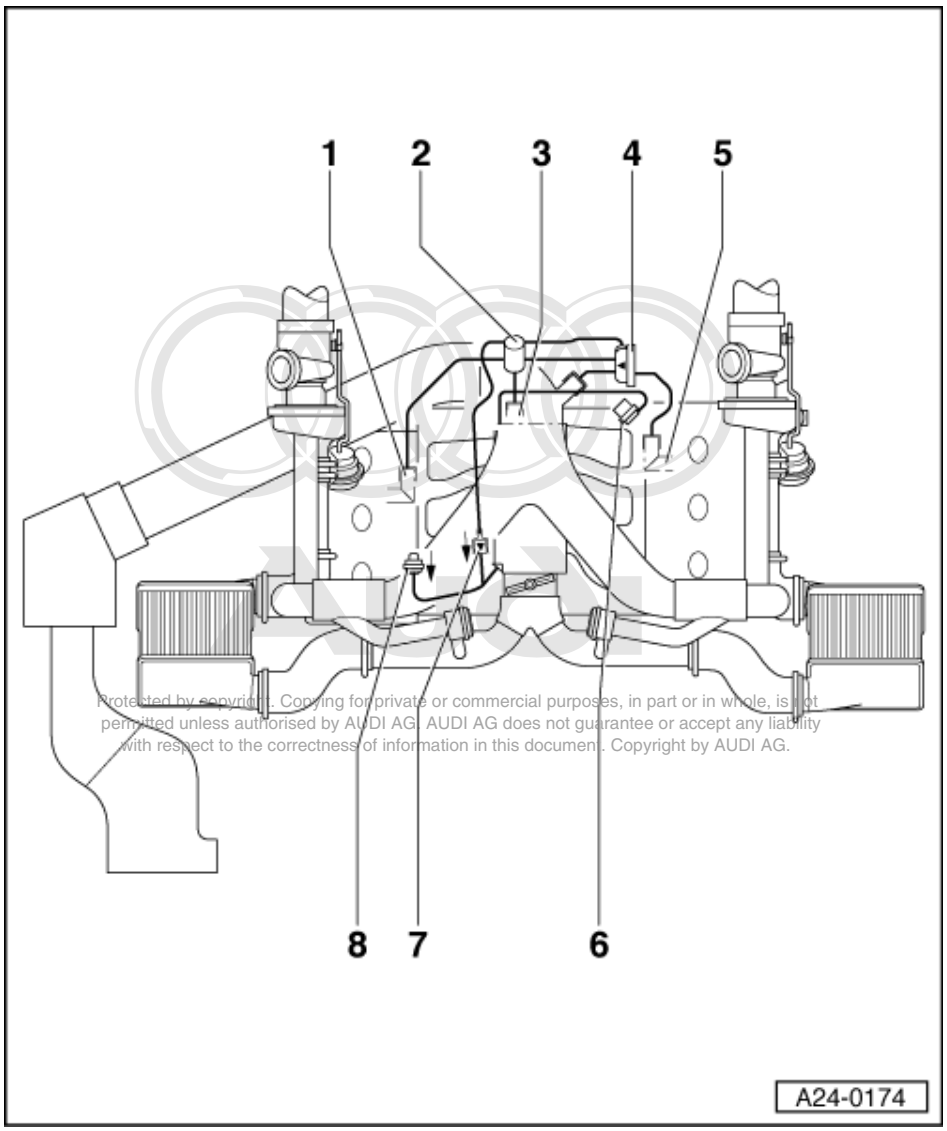
1 Connection on valve cover for cylinder bank 1
2 Distributor piece
3 Connection on crankcase
4 Pressure-limiting valve
5 Connection on valve cover for cylinder bank 2



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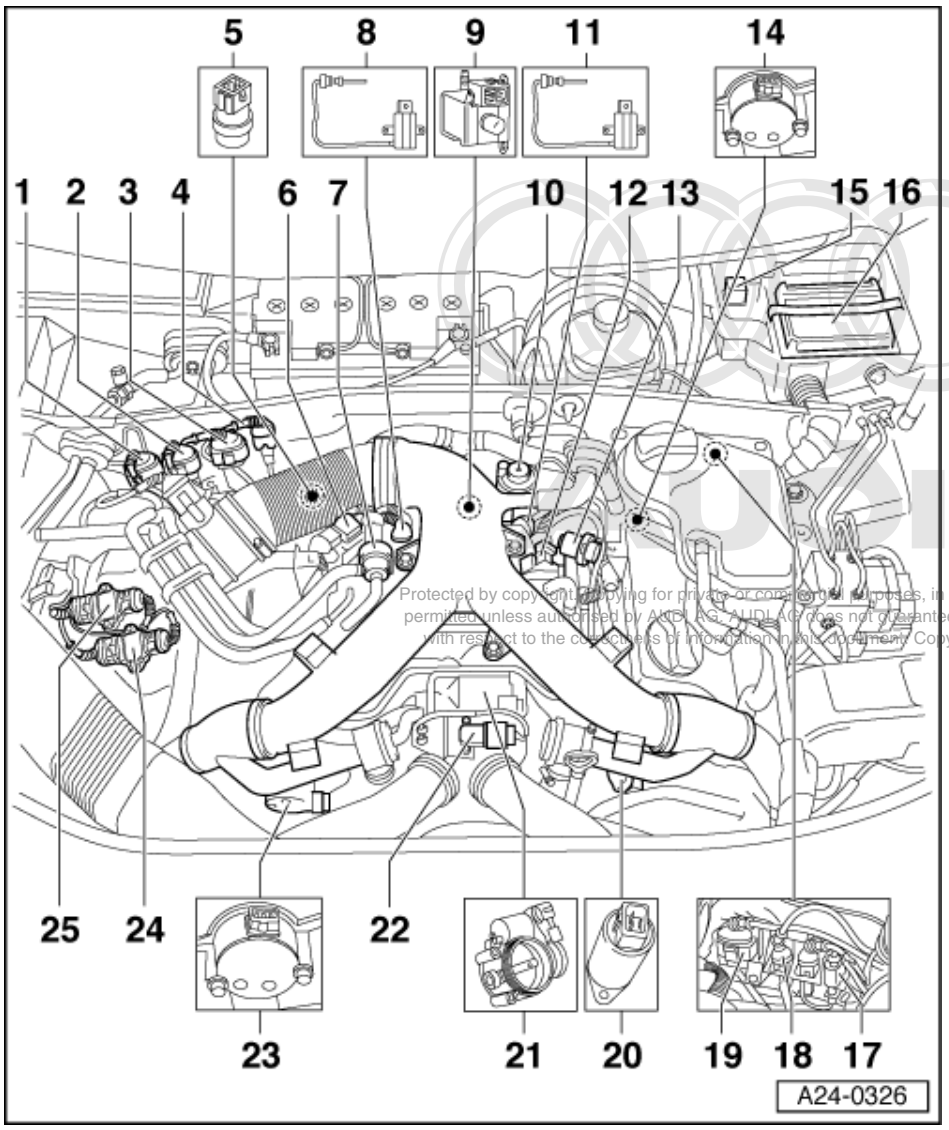
6 Fuel pressure regulator
7 Non-return valve (arrow indicates direction of flow)
8 Non-return valve (arrow indicates direction of flow)- see also fuel tank breather system => Page 21

3 - Fitting locations overview

3.1 - Fitting locations overview



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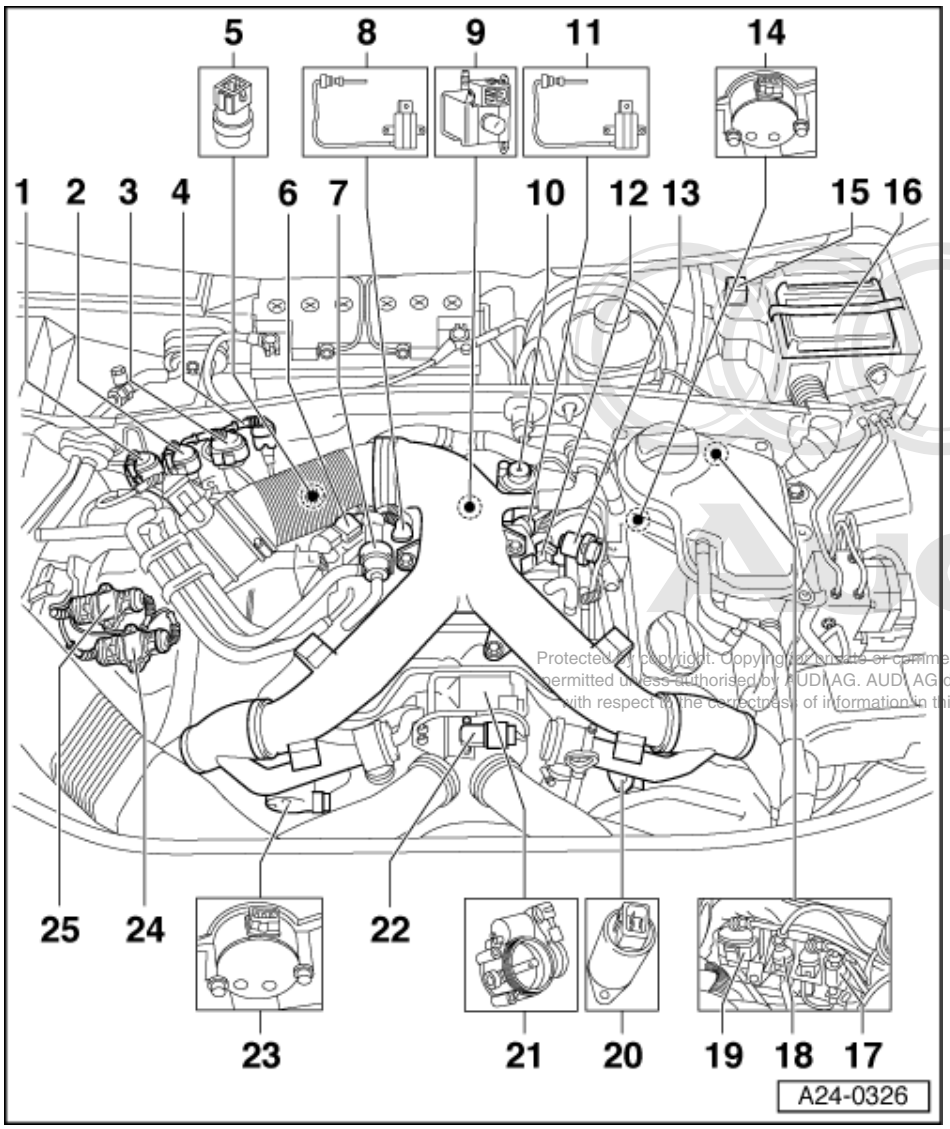
1 Connector for Bank 1 Lambda probe 2 -G130 and Lambda probe heater -Z29
- 4-pin/green

2 Connector for Bank 2 Lambda probe 2 -G131 and Lambda probe heater -Z30
- 4-pin/brown

3 Connector for Bank 1 Lambda probe 1 -G39 and Lambda probe heater -Z19
- 4-pin/black



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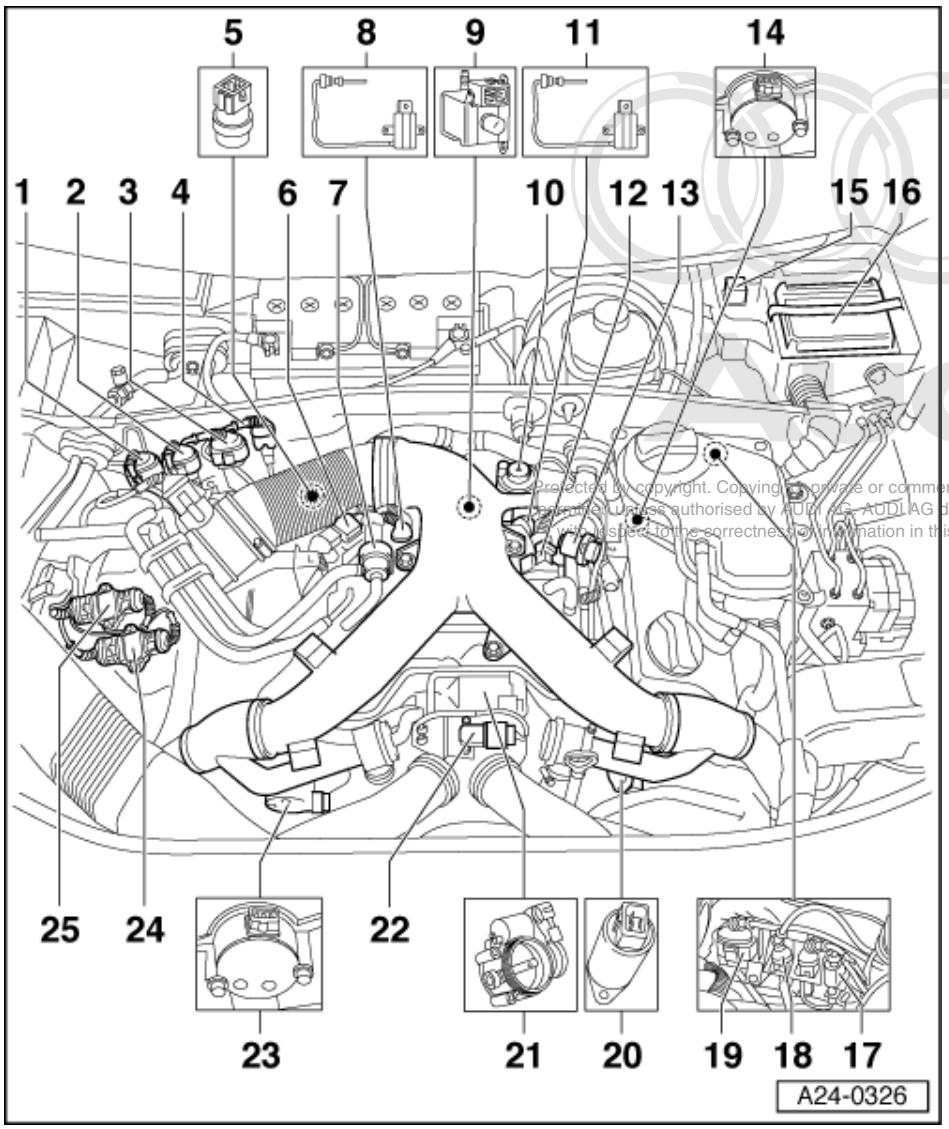
4 3 pin connector
- For knock sensor 1 (G61)

5 Coolant temperature sender (G62)
- On coolant pipe behind cylinder head, Bank 1

6 Charge pressure control solenoid valve (N75)

7 Activated charcoal filter solenoid valve 1 (N80)



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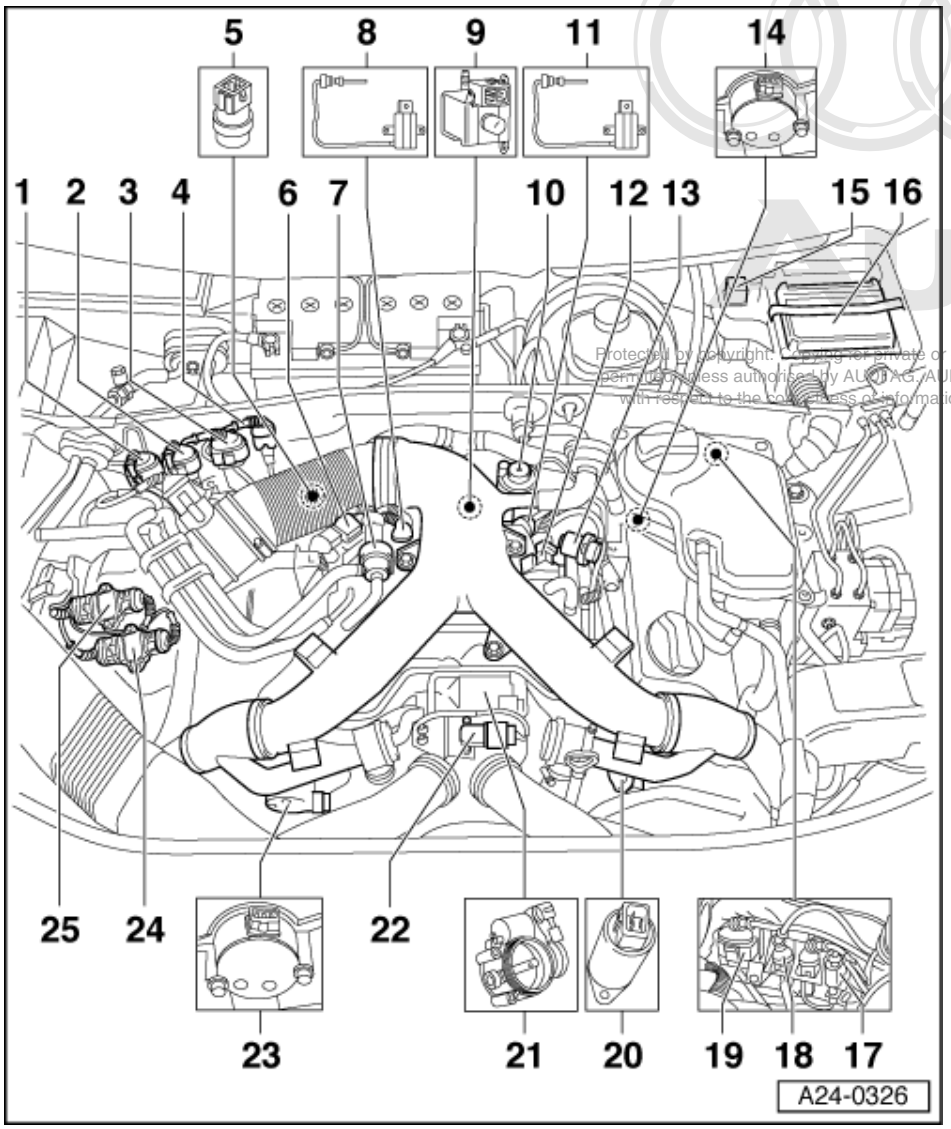
8 Exhaust gas temperature sender 1 (G235)

- At rear of intake manifold on the left-hand side (looking from the front of the engine compartment). On vehicles meeting emission standard EU-III, the exhaust gas temperature sender 2 (G236) is located at this position as well, see Page 34 .

9 Secondary air inlet valve -N112

- Not fitted on this engine version



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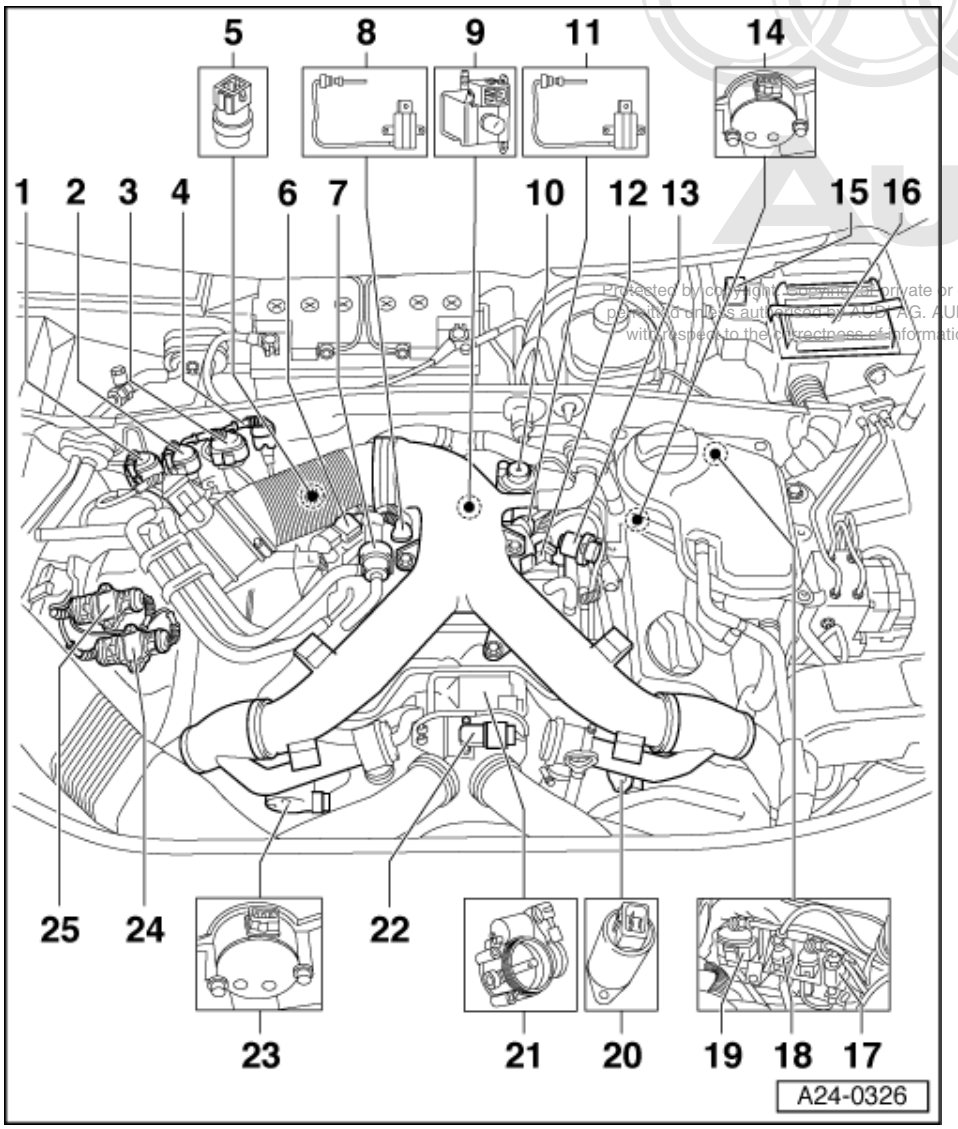
10 Secondary air pump motor -V101

- Not fitted on this engine version

11 Exhaust gas temperature sender 2 (G236)

- On vehicles meeting emission standard EU III, this sender is fitted together with exhaust gas temperature sender -1- (G235) at position -8-. In that case both senders are fitted one behind the other, see Page 34 .



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12 Air recirculation valve for turbocharger (N249)

13 Fuel pressure regulator

14 Hall sender (G163)

- Cylinder bank 2

15 Relay for secondary air pump (J299)

- Not fitted on this engine version

16 Engine control unit (J220)

17 3 pin connector

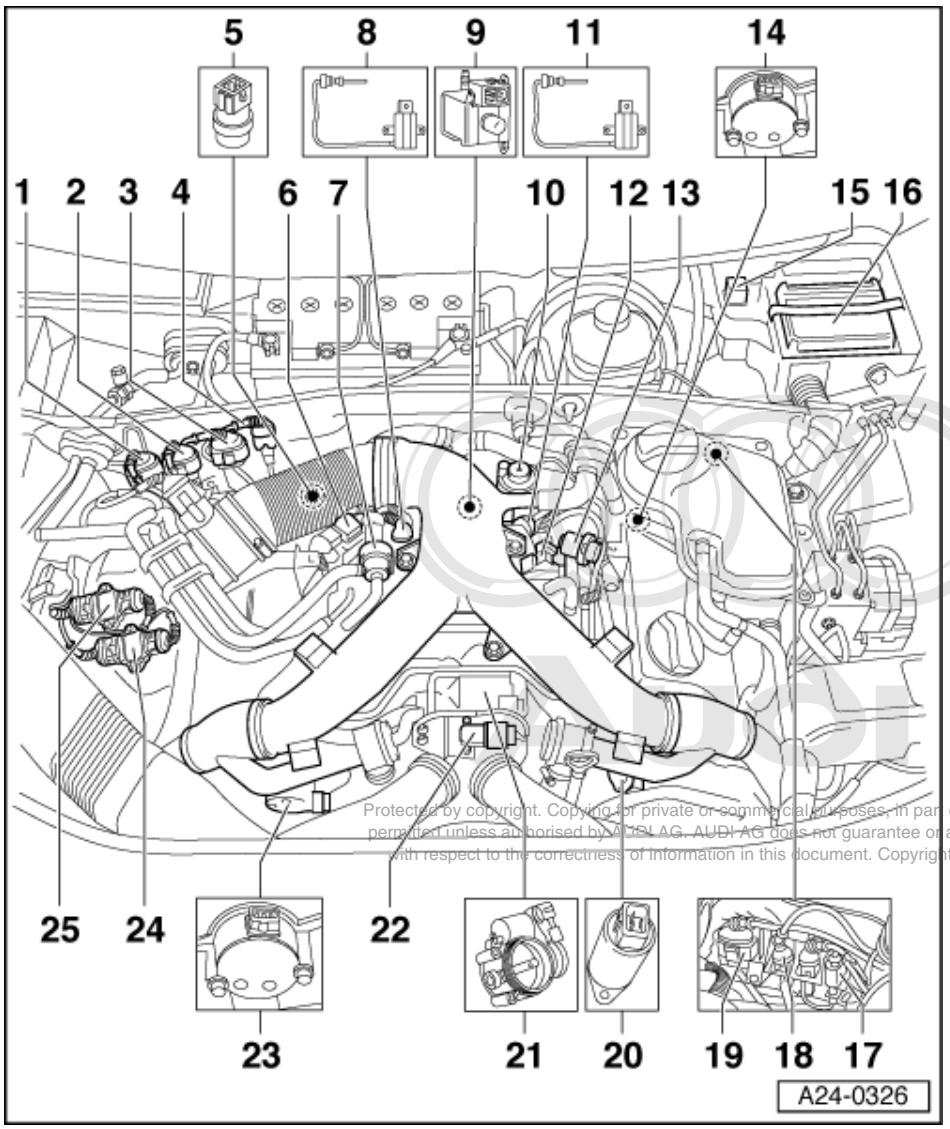
- For engine speed sender (G28)
- Grey

18 3 pin connector

- For knock sensor 2 (G66)

19 Connector for Bank 2 Lambda probe 1 -G108 and Lambda probe heater -Z28

- 4-pin/black



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20 Camshaft adjustment valve 2 (N208)

21 Throttle valve control part (J338)

- With throttle valve drive (G186), angle sender for throttle valve drive (G187) and angle sender 2 for throttle valve drive (G188)

22 Charge pressure sender (G31)

- In rubber connecting piece in front of throttle valve control part

23 Hall sender (G40)

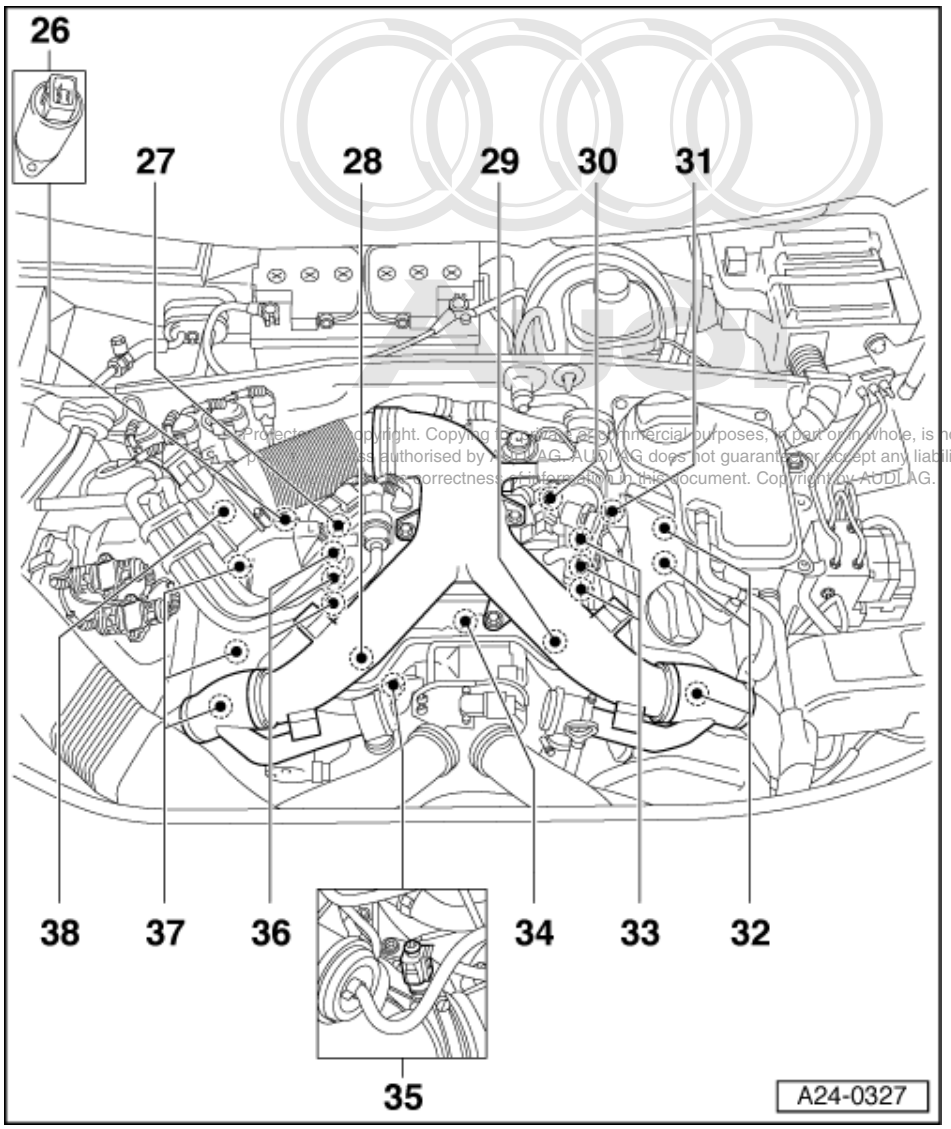
- Cylinder bank 1

24 Output stage 2 (N192)

- For ignition coils on cylinder bank 2

25 Output stage (N122)

- For ignition coils on cylinder bank 1



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26 Camshaft adjustment valve 1 (N205)

27 Bank 1 Lambda probe 1 -G39 with lambda probe heater -Z19

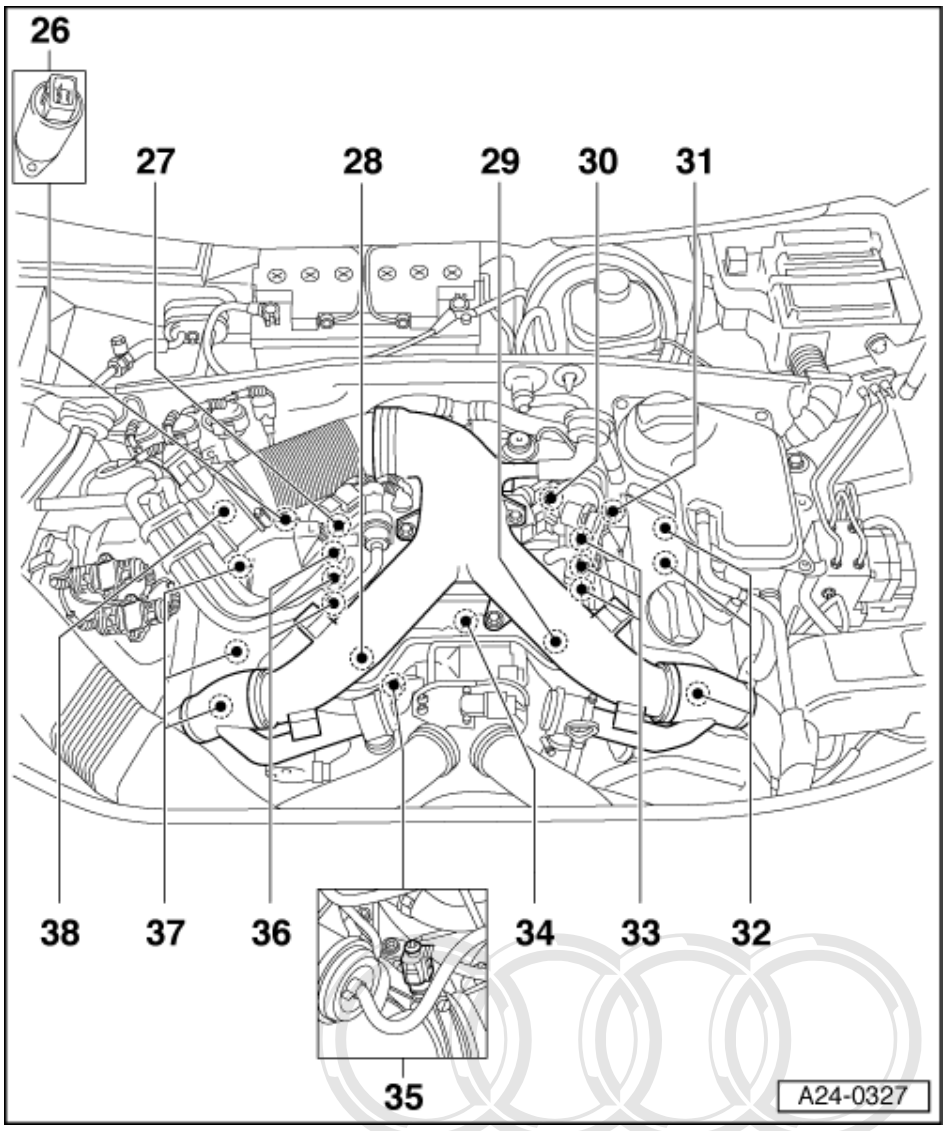
28 Knock sensor 1 (G61)

29 Knock sensor 2 (G66)

30 Engine speed sender (G28)

- In gearbox housing above sender disc

31 Bank 2 Lambda probe 1 -G108 with lambda probe heater -Z28



32 Ignition coils for cylinder bank 2

- Cylinder 4 (-N163)
- Cylinder 5 (-N164)
- Cylinder 6 (-N189)

33 Injectors

- Cylinder bank 2
  Cylinder 4 (N33)
  Cylinder 5 (N83)
  Cylinder 6 (N84)

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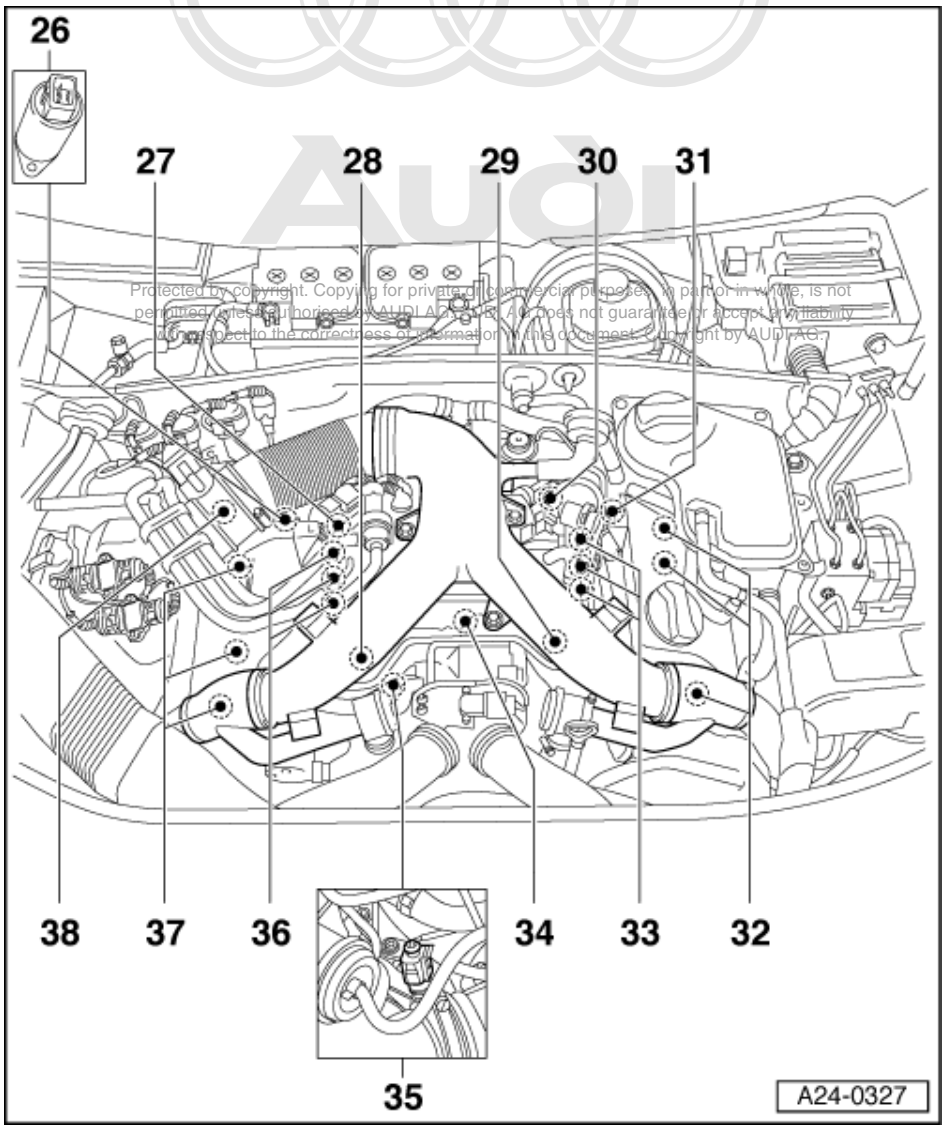
34 Intake air temperature sender (G42)

- Under the intake manifold at the front, near the throttle valve control part

35 2-pin connector

- For intake air temperature sender (This connector is used as the connection point for tests.)



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36 Injectors

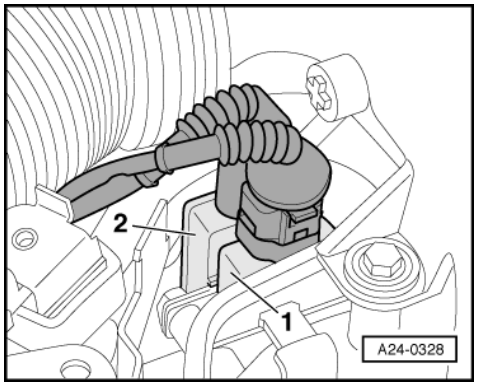
- Cylinder bank 1
  Cylinder 1 (N30)
  Cylinder 2 (N31)
  Cylinder 3 (N32)

37 Ignition coils for cylinder bank 1

- Cylinder 1 (-N)
- Cylinder 2 (-N128)
- Cylinder 3 (-N158)

38 Air mass meter (G70)

Fitting location of exhaust gas temperature senders



-> Fig.1 Fitting location of exhaust gas temperature senders on vehicles meeting emission standard EU-III.

-1- = Sender 1 for exhaust gas temperature -G235

-2- = Sender 2 for exhaust gas temperature -G236

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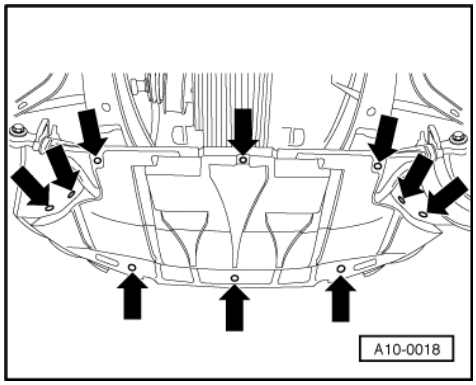
13 - Crankshaft group

1 - Removing and installing ribbed belt

1.1 - Removing and installing ribbed belt



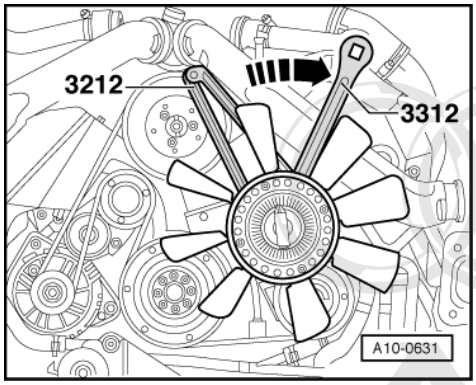
Removing:

- -> Remove noise insulation -arrows-.
- Remove bumper

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Move lock carrier to service position

=> General body repairs; Repair Group 50; Removing and installing lock carrier; Service position of lock carrier



- -> Remove viscous fan (counter-hold with pin wrench 3212).

Note:

Viscous fan has left-hand thread, turn in direction indicated.

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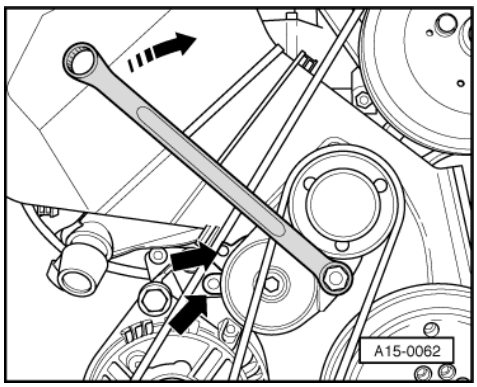
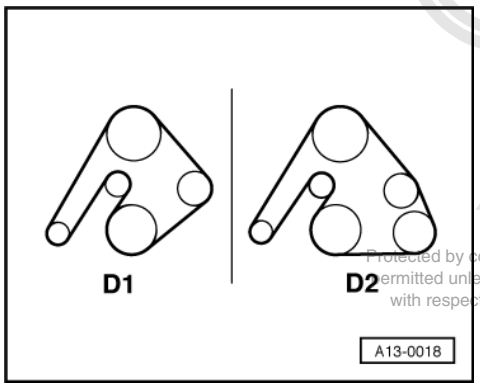


- Mark direction of rotation of ribbed belt.
- -> To slacken ribbed belt, turn to the right using a 17 mm ring spanner until the two holes are aligned with each other -arrow- and hold in position with mandrel 3204.

Note:

Mark the direction of rotation of the ribbed belt with chalk or felt pen before removing. A used belt can break if it rotates in the opposite direction when refitted.

- Take off ribbed belt.



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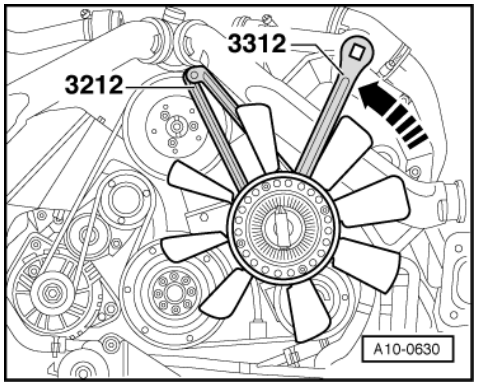
Installing:

- -> Fit ribbed belt onto crankshaft pulley and idler wheel first, and push belt onto tensioning roller last.

Routing of ribbed belt

- D1 - vehicles without air conditioner
- D2 - vehicles with air conditioner

- Take out mandrel 3204.



- -> Counterhold viscous fan pulley using pin wrench 3212 and secure viscous fan using open-end spanner 3312 and torque wrench 1331 (left-hand thread).

Note:

Viscous fan has left-hand thread: turn in direction indicated.

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50; Body front, Lock carrier in service position

- Install bumper

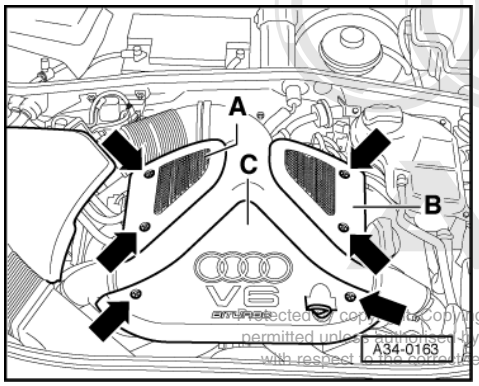
=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

- Install noise insulation.

Component	Tightening torque
Torque wrench V.A.G 1331 and open-end spanner 3312	37 Nm
Torque wrench without open-end spanner 3312	70 Nm

1.2 - Removing and installing toothed belt

Removing:



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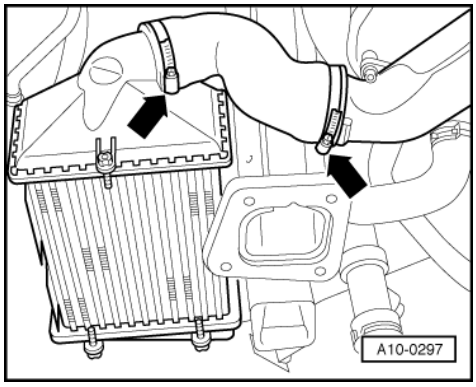
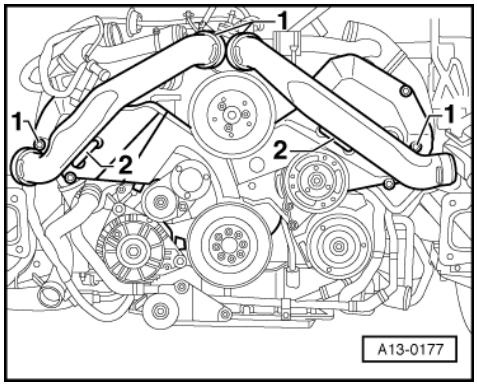
- Remove ribbed belt => Page 35 .
- -> Unscrew bolts -arrows- and remove engine cover panel -C-.



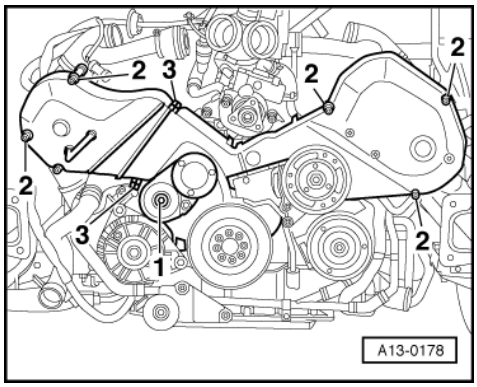
- -> Remove pressure hoses -arrows- between charge air coolers and pressure pipes (left and right sides).



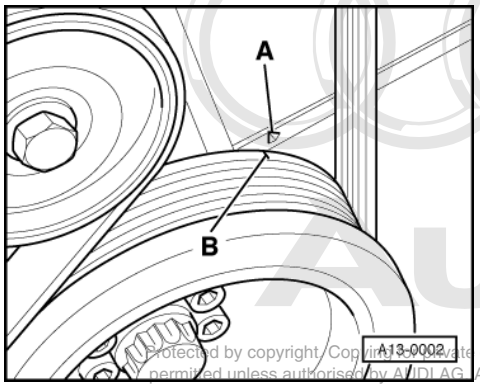
- -> Remove pressure pipes -1-.

Note:

Watch position of retaining strips -2-.



- -> Remove tensioner -1- for ribbed belt.
- Remove left and right toothed belt guards -2-.
- Remove centre toothed belt guard -3-.



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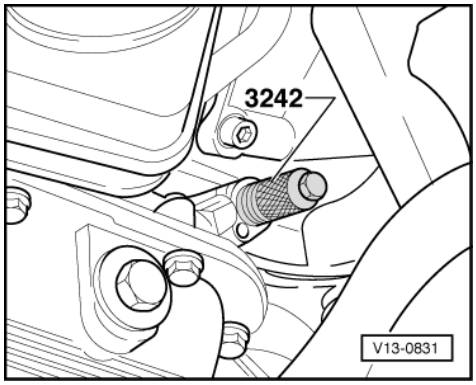
- -> Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: the larger holes in the securing plates on the camshaft sprockets must align opposite one another on the inside. If this is not the case, turn crankshaft one revolution further.

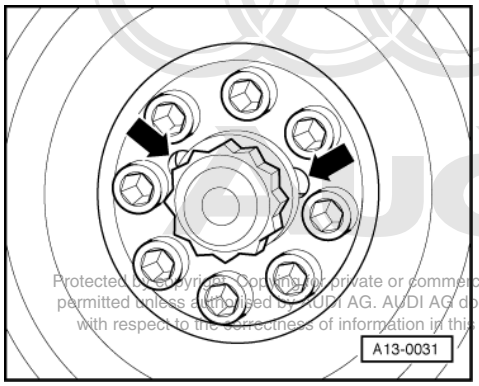
- Remove sealing plug from cylinder block, left.



- The TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.

Caution:
Injury risk - do not turn engine while feeling for TDC drilling.

- -> Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.



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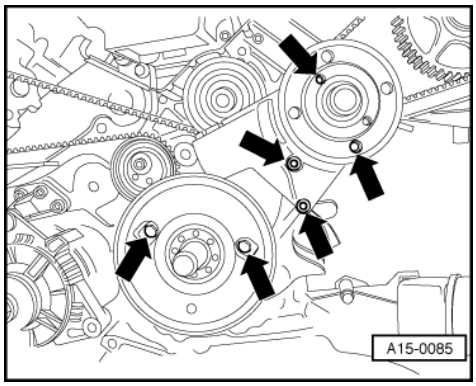
- -> Remove vibration damper on crankshaft.

Note:

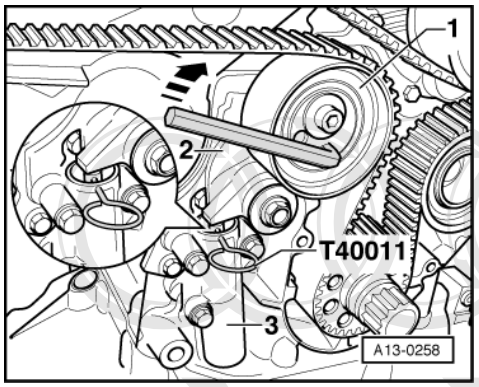
The central bolt does not have to be loosened to remove the vibration damper.



- -> Remove idler wheel for ribbed belt -arrows-.
- Remove toothed belt guard behind vibration damper -arrows-.

Notes:

- Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when refitted.



- The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.

- -> Using an 8 mm hexagon key, turn toothed belt tensioning roller -1- clockwise in direction of arrow until tensioning lever -2- compresses tensioning element -3- far enough to insert a special tool T40011 in the drilling and in the plunger.
- Insert special tool T40011 and release toothed belt tensioning roller.
- Take off toothed belt.

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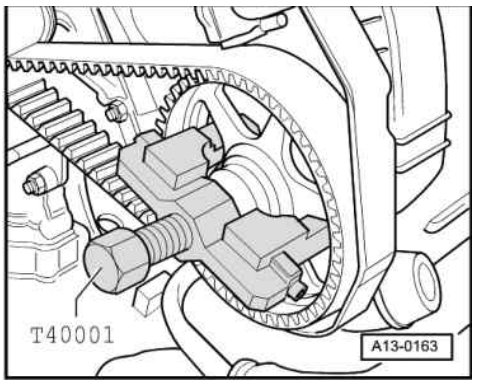
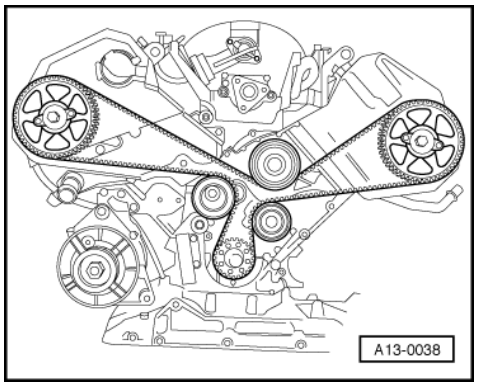
Installing



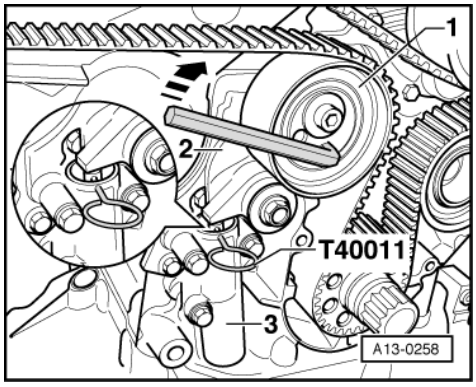
- Insert camshaft clamp 3391 in the securing plates of the two camshafts.
- Slacken both camshaft bolts and unscrew approx. 5 turns.
- Take out camshaft clamp 3391.
- -> Pull off both camshaft sprockets with special tool T40001.
- Refit both camshaft sprockets with securing plates and tighten hand-tight again.



Note:

The camshaft sprockets should be just tight enough on the camshaft tapers so that they can still be turned but do not move axially.

- -> Fit toothed belt on all sprockets as illustrated.
- Fit camshaft clamp 3391.



- -> Using an 8 mm hexagon key, turn toothed belt tensioning roller -1- clockwise in direction of arrow until special tool T40011 can be removed.

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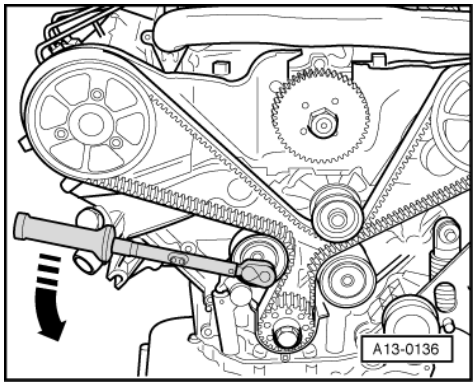
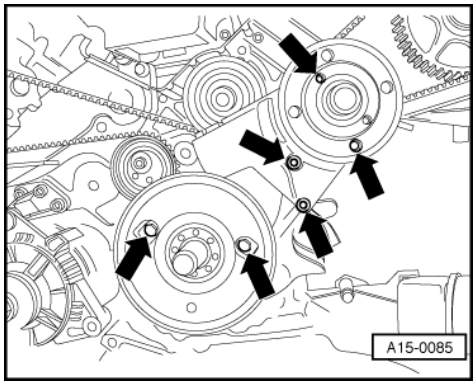
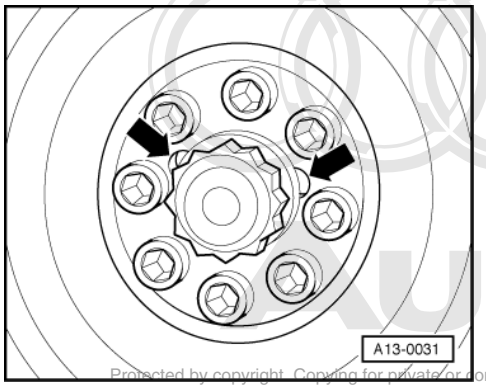


- -> Pre-tension the toothed belt by a turning in direction of arrow with a torque of 15 Nm using a torque wrench.
- Tighten bolts on camshaft sprockets.



- -> Install idler wheel for ribbed belt -arrows-.
- Install toothed belt guard behind vibration damper -arrows-.



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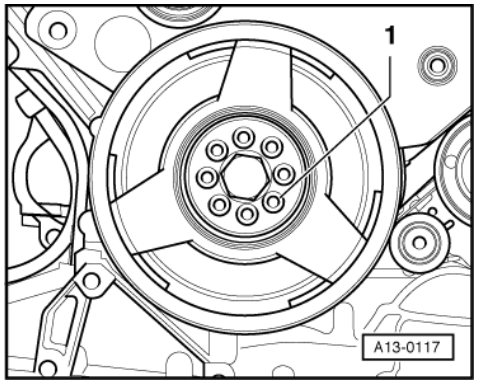
- -> Install vibration damper. Note positions of locating lugs -arrows- on belt sprocket.
- Install toothed belt guard.
- Install ribbed belt => Page 36 .

Tightening torques	
Toothed belt sprocket to camshaft	55 Nm
Idler wheel	45 Nm
Toothed belt tensioning roller	20 Nm
Pulley to crankshaft	20 Nm
Toothed belt tensioning element	10 Nm
Central bolt 1) to crankshaft	200 Nm + 180°2)

1) The central bolt must always be renewed.

2) Turning in two stages of 90°is also permissible.

1.3 - Removing and installing vibration damper

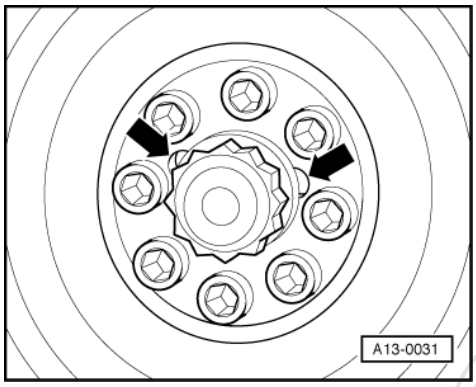


- Remove ribbed belt => Page 35 .

Note:

The central bolt does not have to be loosened to remove the vibration damper.

- -> Remove vibration damper.



- -> When installing, ensure that the notches -arrows- in the vibration damper are aligned with the locating lugs on the toothed belt sprocket.
  - Tightening torque: 25 Nm

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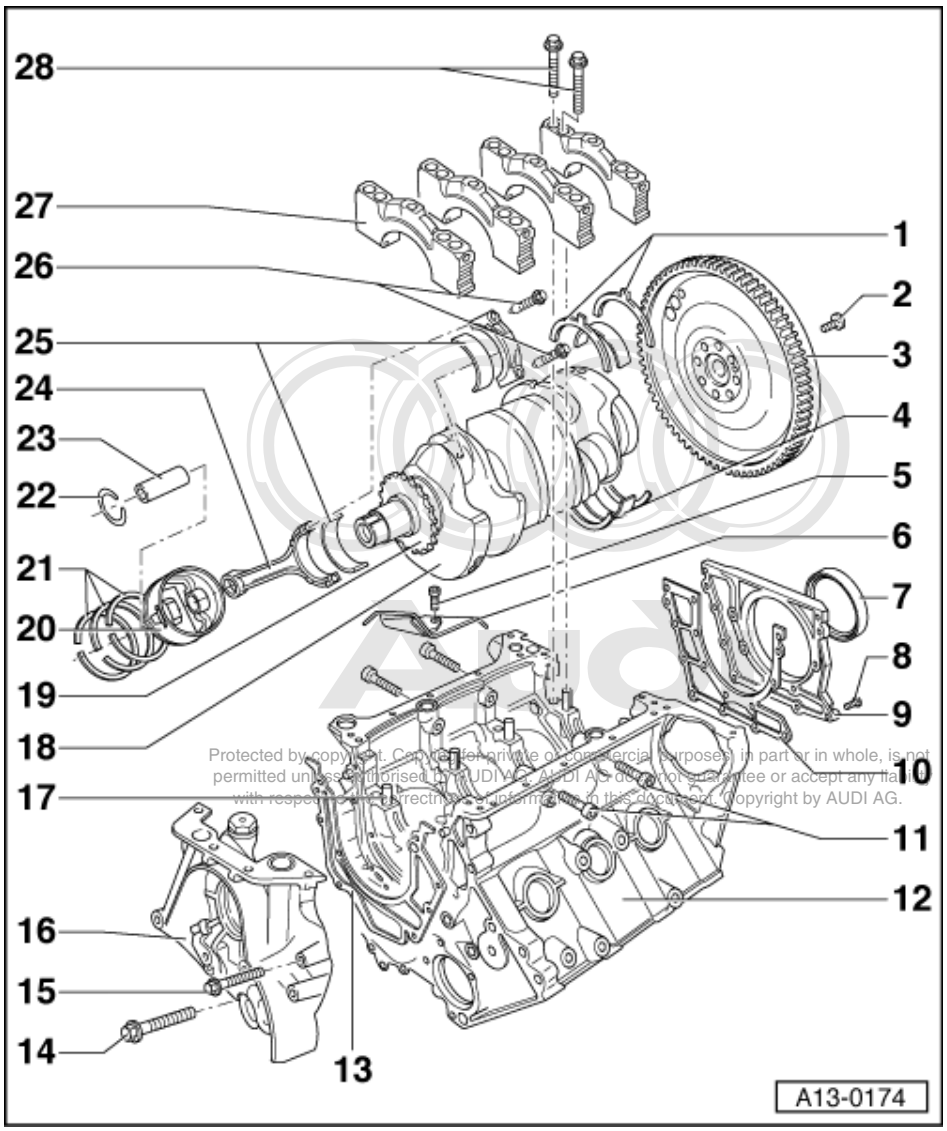
2 - Dismantling and assembling cylinder block, crankshaft and flywheel

2.1 - Dismantling and assembling cylinder block, crankshaft and flywheel



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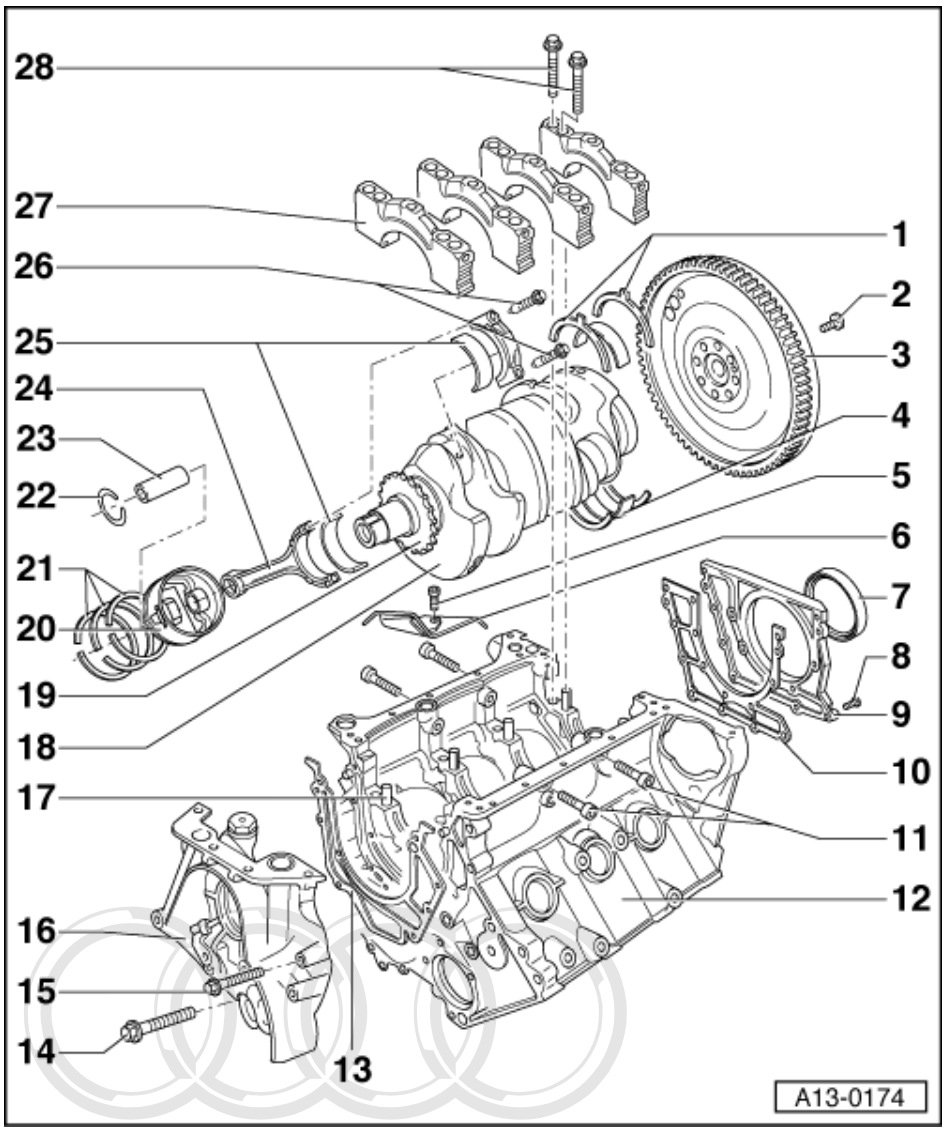
Note:

- Renew all gaskets and seals.

1 Thrust washers
- Measuring axial clearance of crankshaft =>Page 50
- Thrust washer only fitted on 4th crankshaft bearing

2 Special bolt (double hexagon)
- Renew
- Dual-mass flywheel:
  60 Nm + 180° (1/2 turn)



3 Dual-mass flywheel

- Removing and installing => Page 53
- Removing and installing needle bearing => Page 54

4 Crankshaft bearing

- Checking axial and radial clearance => Page 50

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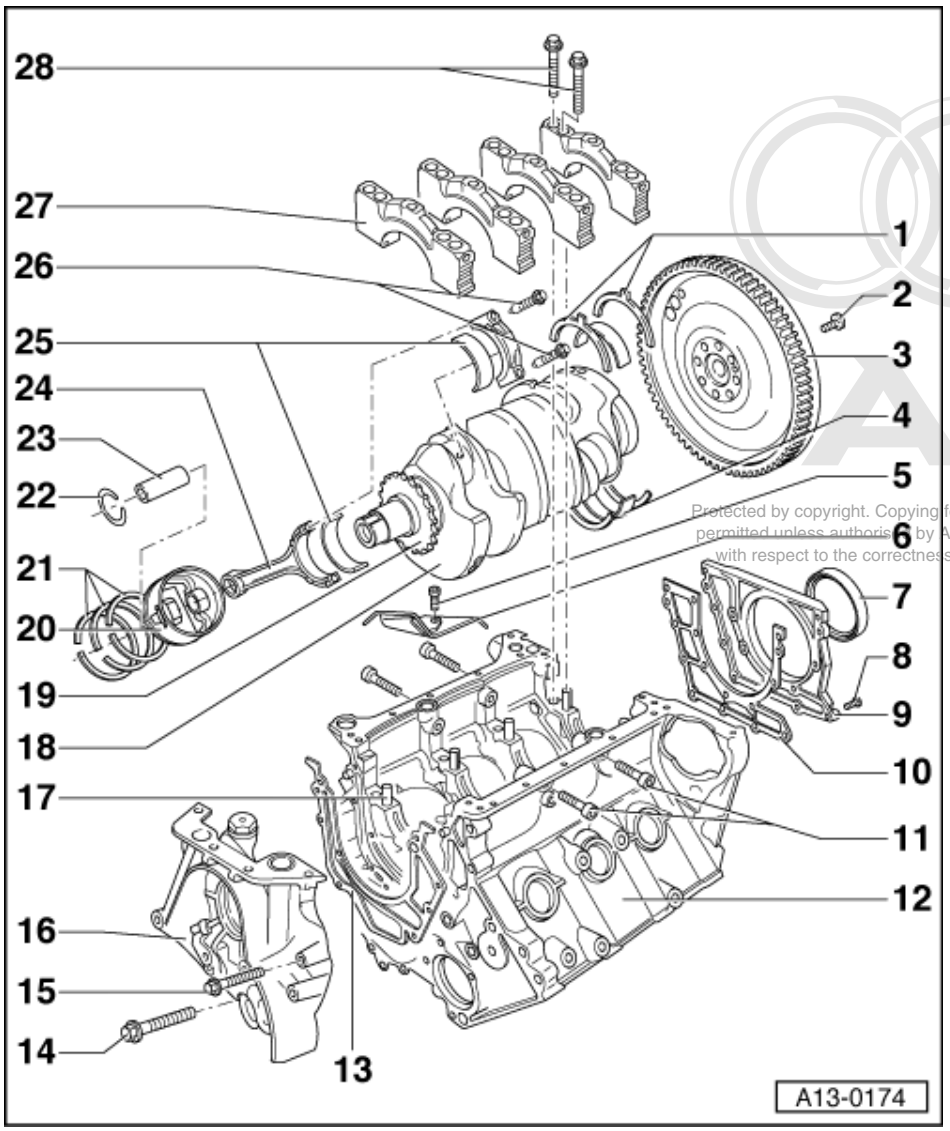
5 Bolt, tightening torque 10 Nm

6 Oil spray jet

- For piston cooling

7 Oil seal for rear sealing flange

- Renewing => Page 51



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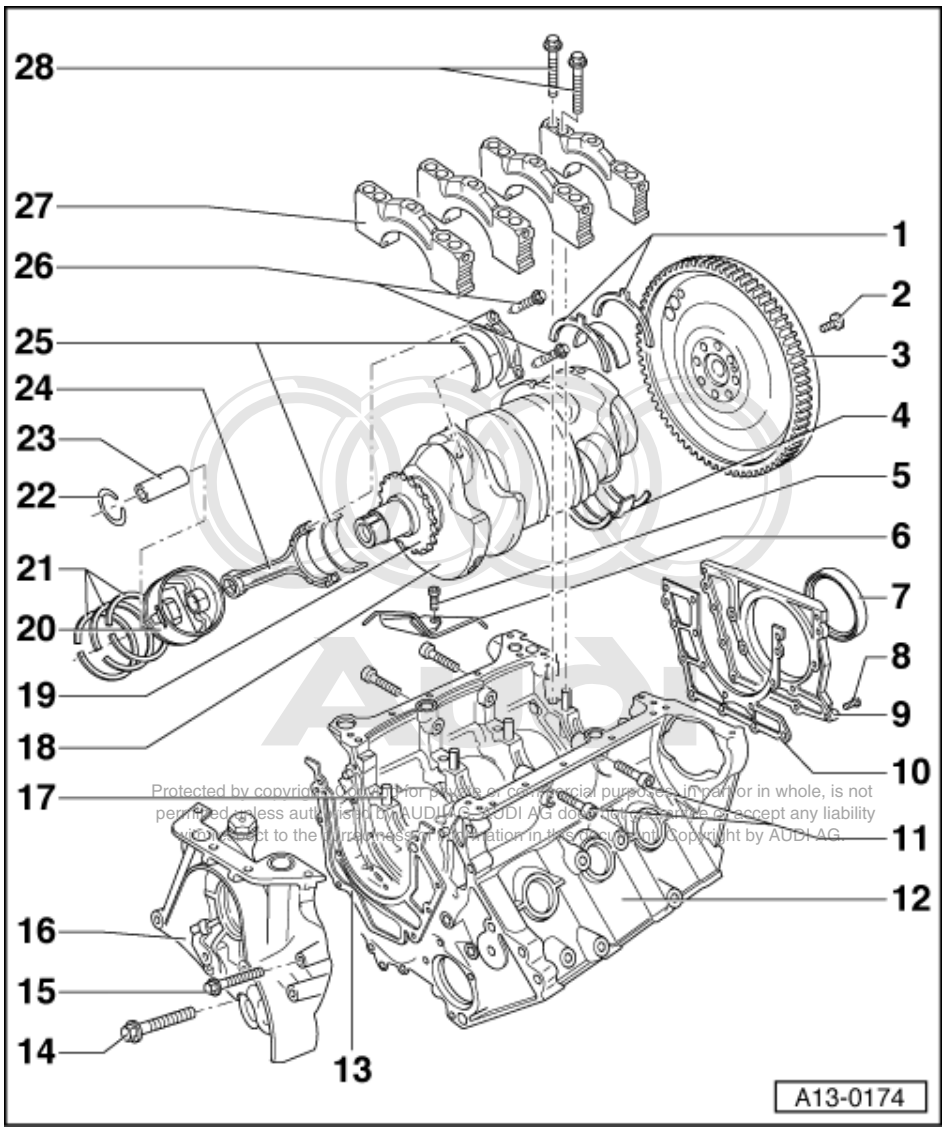
8 Bolt, tightening torque 10 Nm
9 Rear sealing flange
10 Gasket
11 Bolt, tightening torque 25 Nm
- Screw in bolts on left and right sides finger-tight before tightening bolts on main bearing caps.

12 Cylinder block
13 Gasket



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14 Collar bolt, tightening torque 30 Nm

- Apply Loctite when installing

15 Bolt, tightening torque 10 Nm

16 Front sealing flange

17 Crankshaft

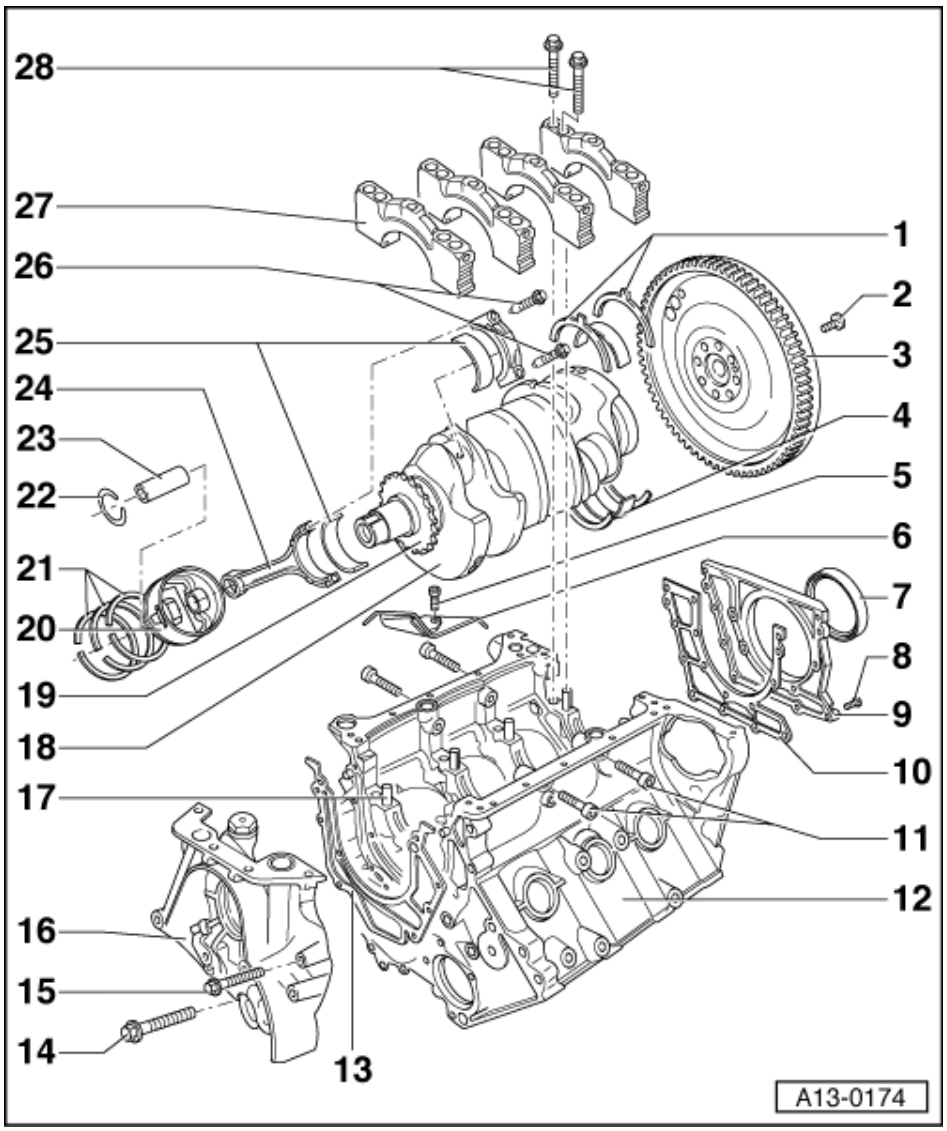
- Checking =>Page 50

18 Chain sprocket for oil pump

- Removing and installing => Page 159 .

19 Pistons

- Checking =>Page 54



20 Piston rings

- Checking =>Page 54

21 Circlip for piston pin

22 Piston pin

23 Conrod

- Mark cylinder number and installation position of matching conrods and bearing caps before removing
- Installation position: wider, slightly convex machined surfaces on the same side

24 Conrod bearing

- Do not interchange used bearing shells.
- Conrods, conrod bearings =>Page 56

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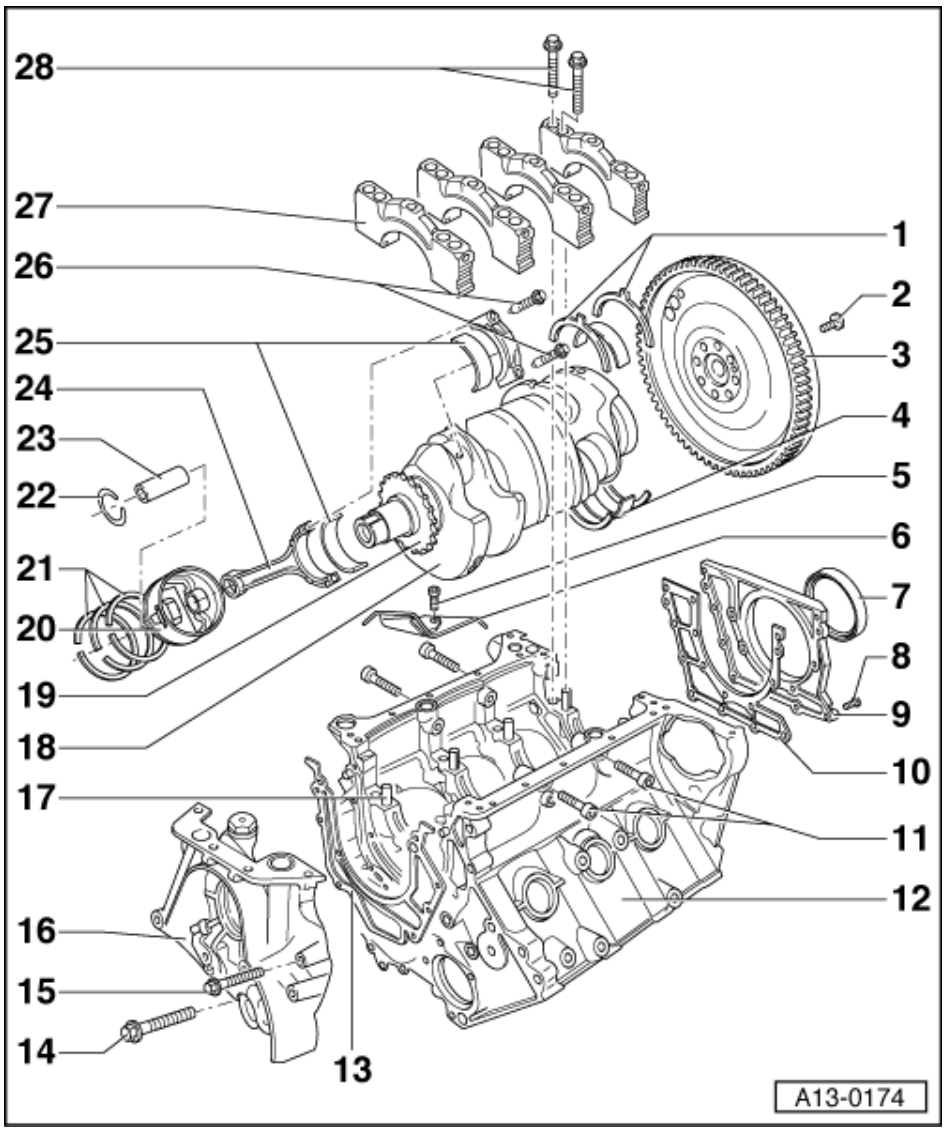

25 Conrod bearing bolts

- Renew
- Tightening torque: 30 Nm + 90° (1/4 turn)
- When measuring radial clearance, tighten to 20 Nm but do not turn further.

26 Main bearing cap

- Marking -1- on oil pump side
- Renew bolts for main bearing caps
- Watch position of dowel sleeves
- Checking bearing clearance
  =>Page 50

27 Bolts for main bearing caps

- Renew
- Tightening torque
  => Page 50
- Tightening sequence
  => Page 50

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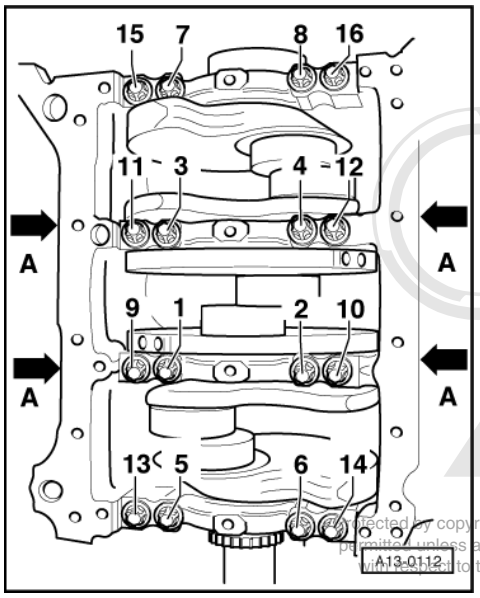
2.2 - Installing crankshaft bearing caps

- Bearing -1- is at the toothed belt end; bearing -4- is at the flywheel end.



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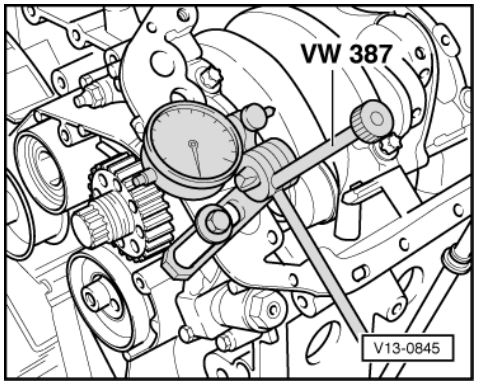
-> Tightening sequence:

- Stage 1
  Tighten all bolts in the sequence shown (1 - 16) to 30 Nm.
- Stage 2
  Tighten all bolts in the sequence shown (1 - 16) to 60 Nm.
- Stage 3
  Using a fixed wrench, turn all bolts in the sequence shown (1 - 16) 90° further.
- Tighten bolts -A- to 25 Nm.

2.3 - Measuring axial and radial clearance of crankshaft



Axial clearance

Note:

Do not interchange used bearings.

- -> Attach dial gauge with universal dial gauge bracket VW 387 to oil pump and bring it into contact with crank web.
- Press crankshaft against dial gauge by hand and set gauge to -0-.

- Press crankshaft away from dial gauge.
- Note reading:

Clearance when new	Wear limit
0.090 ... 0.251 mm	0.28 mm

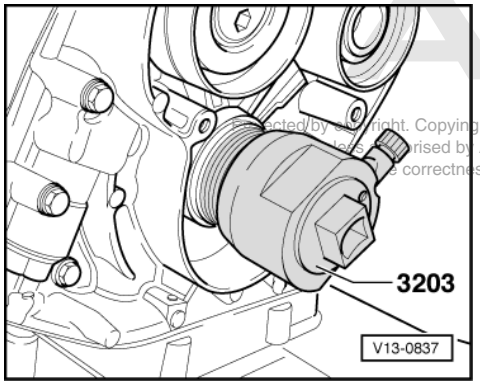
Radial clearance

Measure radial clearance with Plastigage.

- Note indicated clearance:

Clearance when new	Wear limit
0.018 ... 0.045 mm	0.10 mm

2.4 - Renewing crankshaft oil seals



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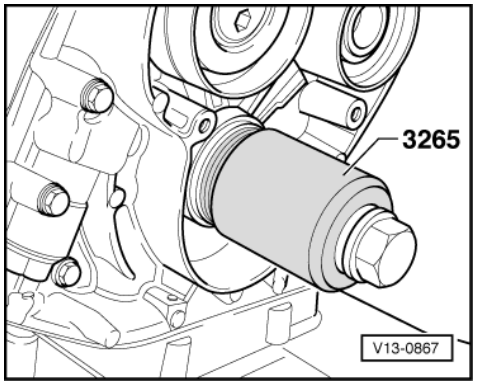
A - Toothed belt end

- Remove toothed belt => Page 37 .
- Remove toothed belt sprocket from crankshaft
- -> Pull out oil seal with oil seal extractor 3203.
- Clean contact surface and sealing surface.
- Do not lubricate sealing lip or outer circumference of seal before pressing in.



- Push on seal using fitting sleeve 3202/1.
- -> Press in seal until flush using fitting sleeve 3265 and central bolt.

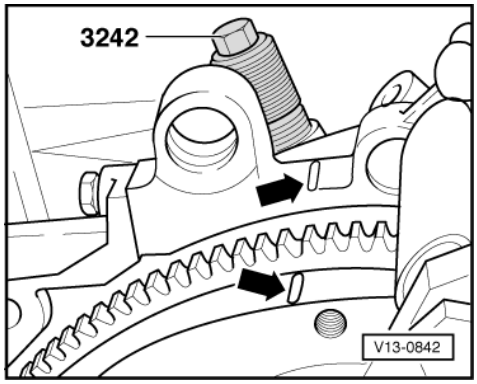
B - Flywheel end

Notes:

Renew oil seal together with sealing flange.

- Drain off coolant=>Page 181 .
- Remove gearbox

=> 6-Speed manual gearbox 01E, four-wheel drive; Repair group 34; Removing and installing gearbox Removing and installing gearbox



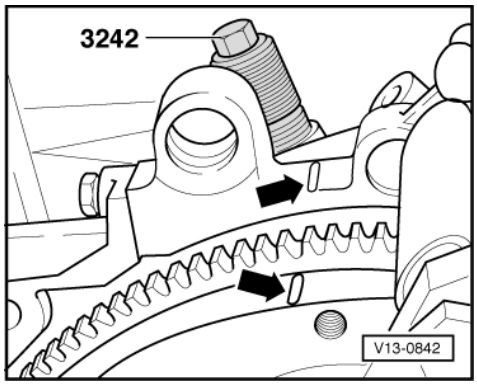
- Remove clutch.
- -> With crankshaft at TDC, screw in clamping bolt 3242.
- Mark position of flywheel relative to engine -arrows-.
- Remove dual-mass flywheel.
- Remove sealing flange.

Installing

- Install sealing flange.
- Install dual-mass flywheel.

Note:

Always renew securing bolts for dual-mass flywheel.



- -> With crankshaft at TDC, unscrew clamping bolt 3242.
- Install clutch

=> 6-Speed manual gearbox 01E, four-wheel drive; Repair group 30; Servicing clutch Servicing clutch

- Install gearbox

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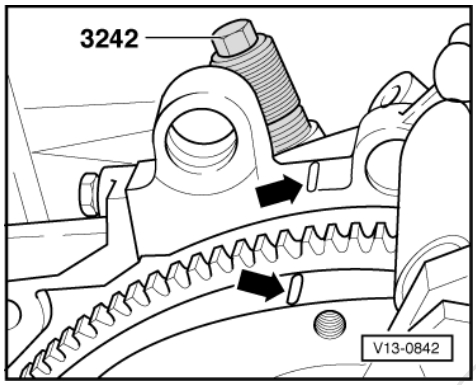
=> 6-Speed manual gearbox 01E, four-wheel drive; Repair group 34; Removing and installing gearbox Removing and installing gearbox

Tightening torques	
Dual-mass flywheel to crankshaft	60 Nm + 180°
Clutch to dual-mass flywheel	20 Nm

2.5 - Removing and installing dual-mass flywheel; installation dimensions

Removing:



- Remove gearbox

=> 6-Speed manual gearbox 01E, four-wheel drive; Repair group 34; Removing and installing gearbox Removing and installing gearbox

- Remove clutch
- -> With crankshaft at TDC, screw in clamping bolt 3242.
- Mark position of flywheel relative to engine -arrows-.
- Unscrew bolts (bolts must be renewed).

Note:

The needle bearing is located in the flywheel and must be pressed in if a new flywheel is installed => Page 54 .

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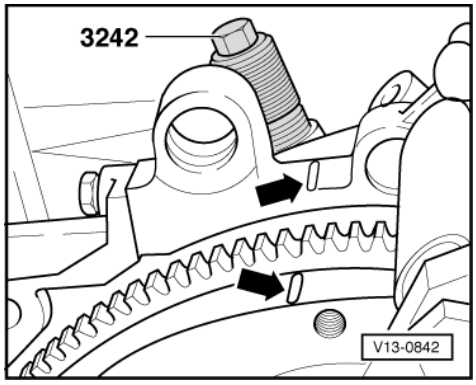
Installing

- Install dual-mass flywheel.

Note:

Always renew flywheel securing bolts.



- -> With crankshaft at TDC, unscrew clamping bolt 3242.

- Install clutch

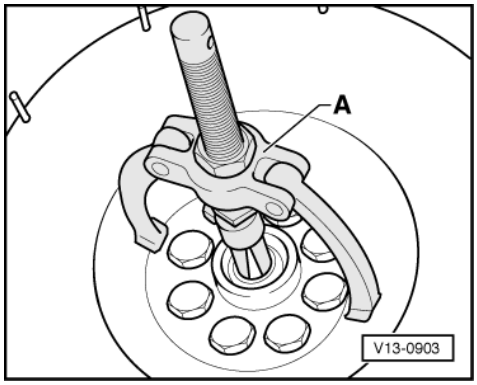
=> 6-Speed manual gearbox 01E, four-wheel drive; Repair group 30; Servicing clutch Servicing clutch

- Install gearbox

=> 6-Speed manual gearbox 01E, four-wheel drive; Repair group 34; Removing and installing gearbox Removing and installing gearbox

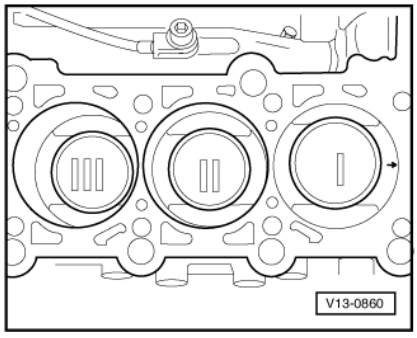
Tightening torques	
Dual-mass flywheel to crankshaft	60 Nm + 180°
Clutch to dual-mass flywheel	20 Nm

2.6 - Removing and installing needle bearing in dual-mass flywheel



- -> Pull out with puller, such as KUKKO 21/2 and KUKKO 22-1.
- Drive in with drift 3264.

2.7 - Pistons and piston rings



Pistons

-> Position: arrow on piston crown must always face in direction of travel.

- Mark cylinder number on piston crown with waterproof felt pen.

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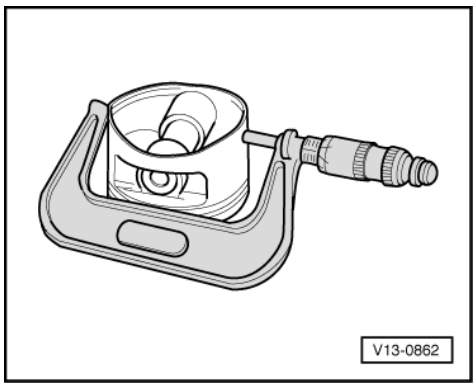
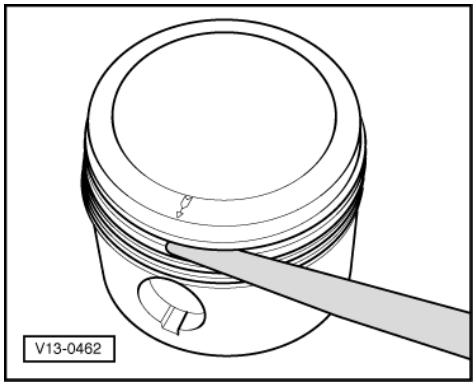
Note:

Do not use a centre-punch or similar, as pistons have a special coating.



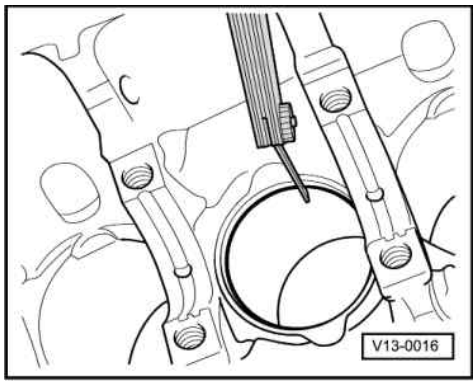
Checking piston diameter

- -> Measure pistons approx. 10 mm from bottom of skirt, at 90° to piston pin axis.
  - Difference between actual and nominal diameter:
    not more than 0.04 mm.



-> Ring-to-groove clearance

Clearance when new	Wear limit
0.02 ... 0.08 mm	0.10 mm



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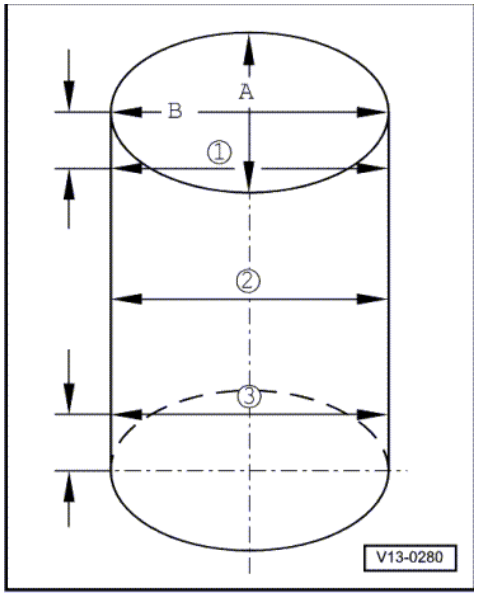
-> Checking piston ring gap

- Push ring in squarely to a position approx. 15 mm from bottom end of cylinder.

Piston ring	Gap when new	Wear limit
1	0.35 ... 0.50 mm	1.0 mm
2	0.50 ... 0.70 mm	1.4 mm

Piston ring	Gap when new	Wear limit
3	0.25 ... 0.50 mm	0.8 mm

2.8 - Checking cylinder bores



- -> Measure bores at three points in both directions: across the engine -A- and in line with crankshaft -B-.
- Use internal dial gauge 50 ... 100 mm.
  - Difference between actual and nominal diameter: not more than 0.08 mm.

Piston and cylinder dimensions

Honing dimension	Piston dia.	Cyl. bore dia.
Basic dimension	80.95mm	81.01mm

Note:

Replacement pistons are only available with basic dimension.

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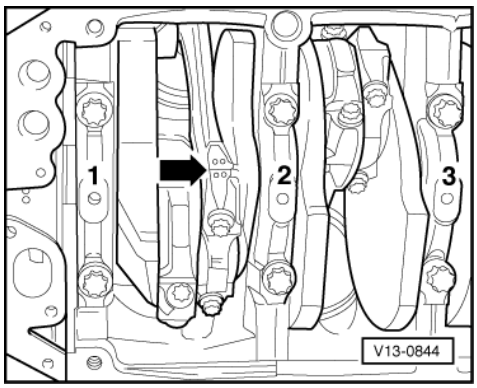
2.9 - Conrods, conrod bearings



Notes:

- Only renew complete sets of conrods
- Do not interchange conrod bearings.

- -> Before removing, mark positions of conrod bearing caps with a felt pen or similar.

Checking radial clearance

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.
- Fit conrod bearing cap and tighten to 20 Nm. Do not rotate crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with calibrated scale.

Clearance when new	Wear limit
0.015 ... 0.062 mm	0.12 mm

- Fit new conrod bearing bolts.

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15 - Cylinder head, Valve gear

1 - Servicing valve gear

1.1 - Servicing valve gear

Notes:

- Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.
- After installing new tappets the engine must not be started for about 30 minutes (otherwise valves will strike pistons). Turn crankshaft two complete revolutions before starting.
- Carefully apply a small amount of sealant at the four end points of the sealing surfaces on the cylinder head, using a small screwdriver=>Fig. 1 .

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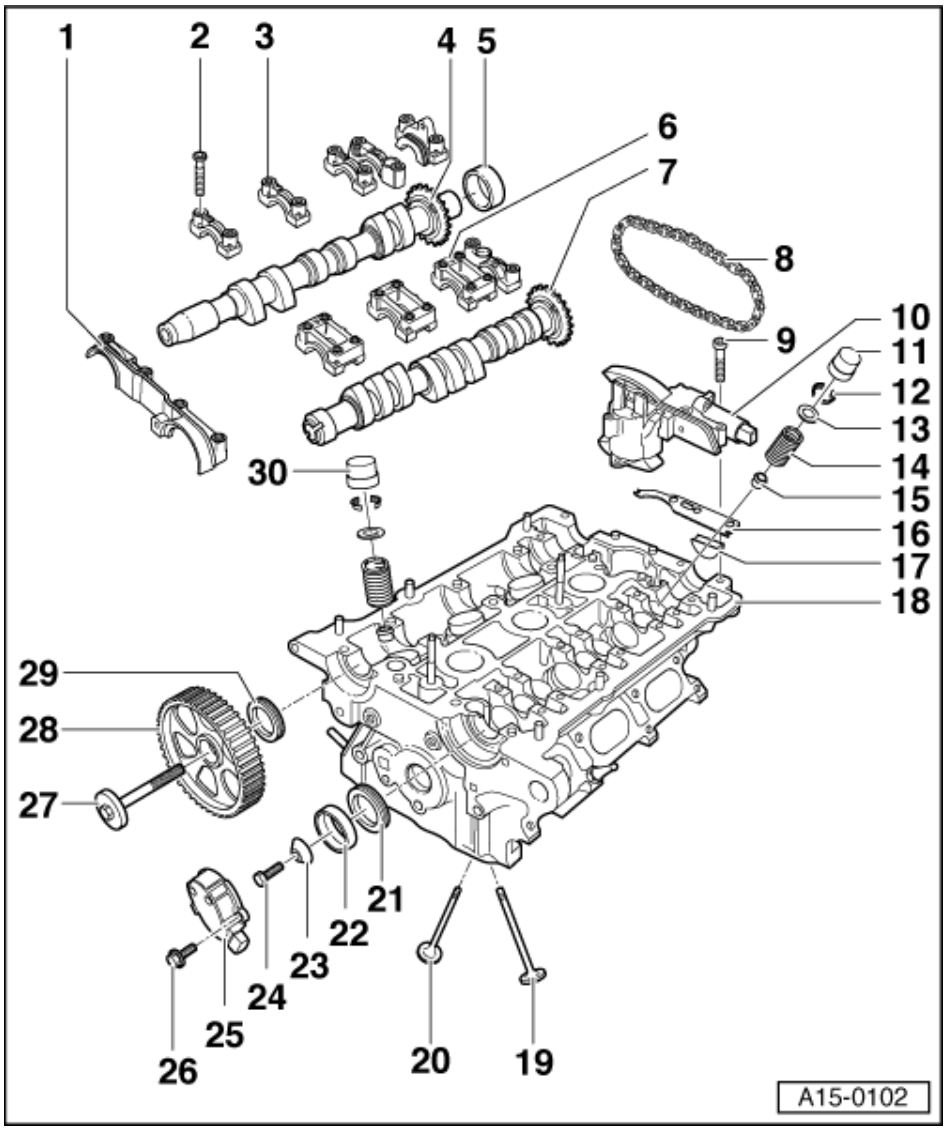
Sealant

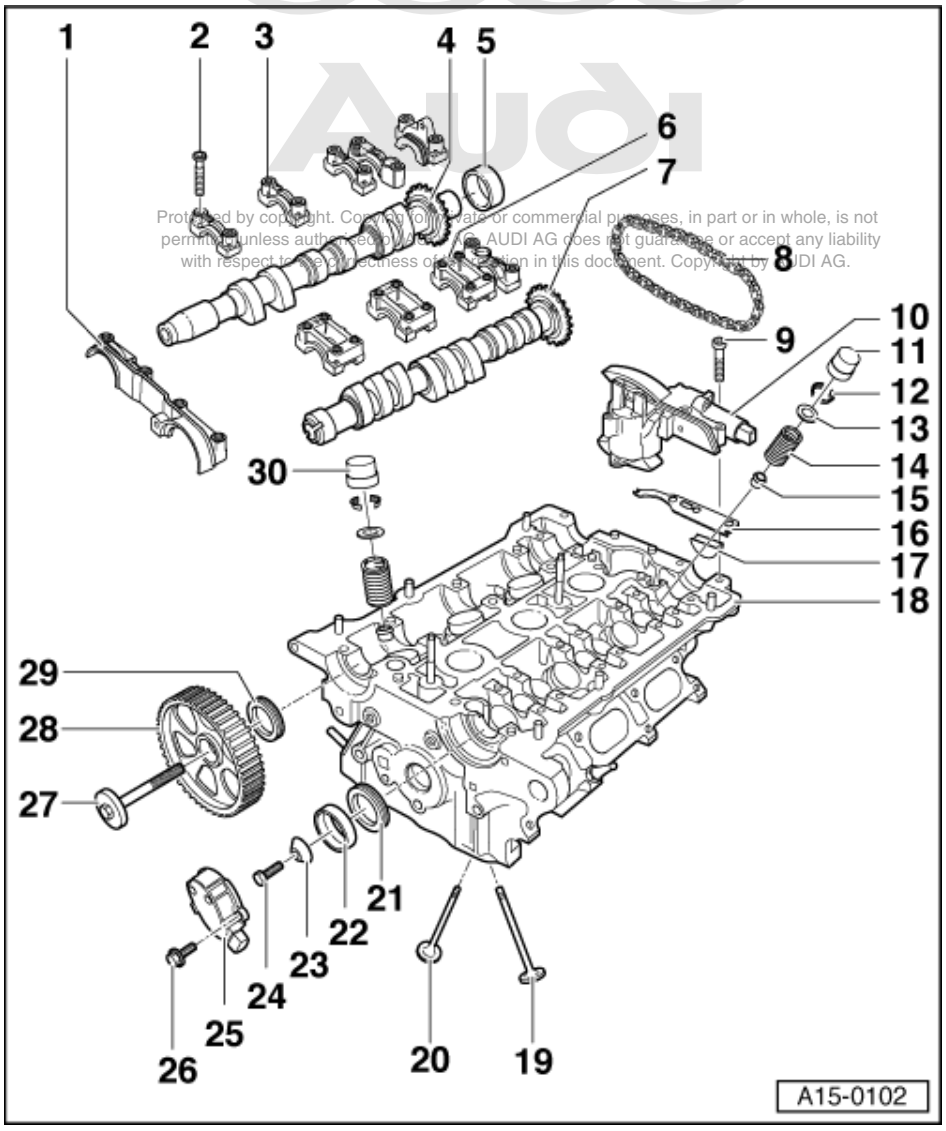
=> Parts Catalogue



1 Double bearing cap
- Lightly coat with sealant before installing=>from Page 68

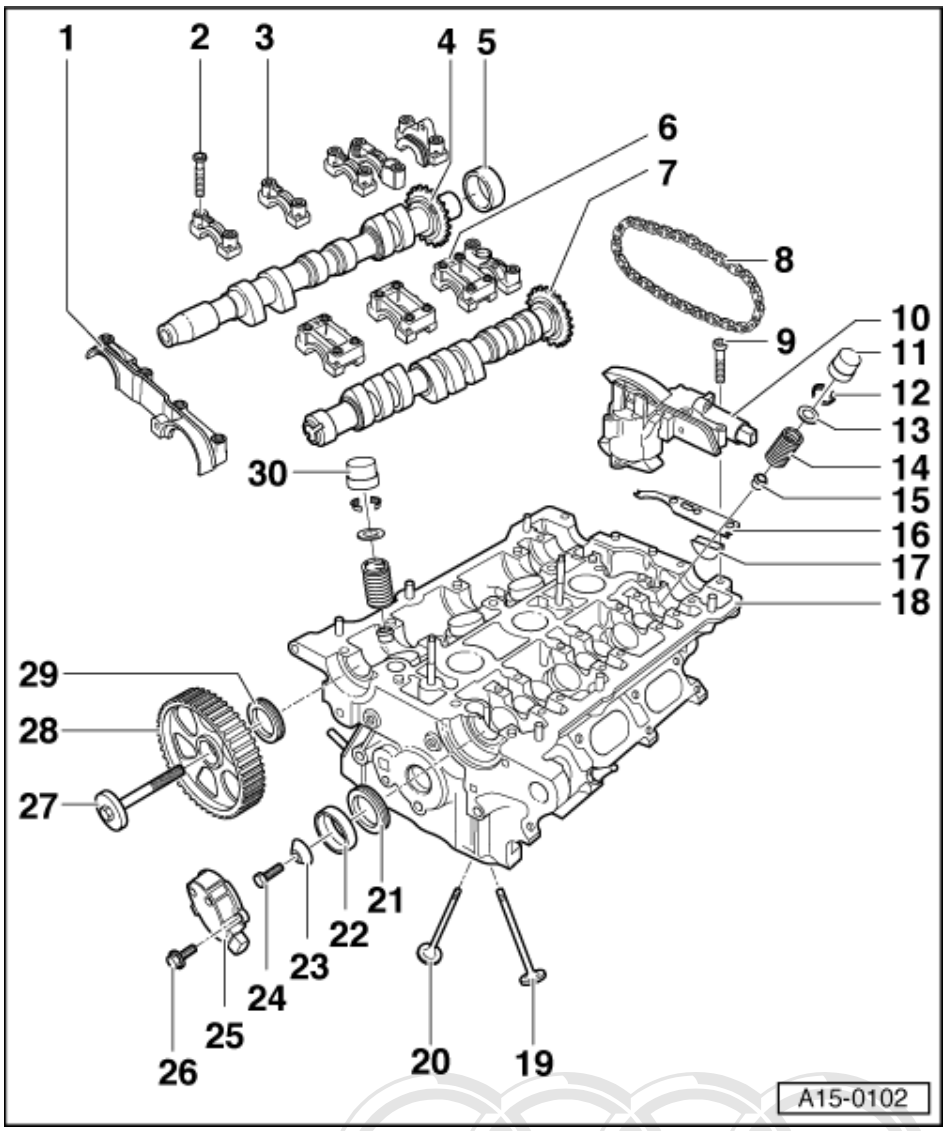
2 Exhaust camshaft bearing cap
- With connection for oil feed pipe
- Watch position of dowel sleeve
- Note installation position and numbering =>Page 106
- Lightly coat last bearing cap (after the chain) with sealant before installing

3 10 Nm



4 Exhaust camshaft
- Checking axial clearance =>Page 113
- Removing and installing =>Page 106
- Check radial clearance with Plastigage (tappets removed)
  Wear limit: 0.1 mm
  Run-out: 0.01 mm (maximum)

5 Cap
- Renew



6 Inlet camshaft bearing cap

- With connection for oil feed pipe
- Note installation position and numbering => Page 106

7 Inlet camshaft

- Checking axial clearance =>Page 113
- Removing and installing =>Page 106
- Check radial clearance with Plastigage (tappets removed)
  Wear limit: 0.1 mm
  Run-out: 0.01 mm (maximum)

8 Drive chain

- Installing => Page 106

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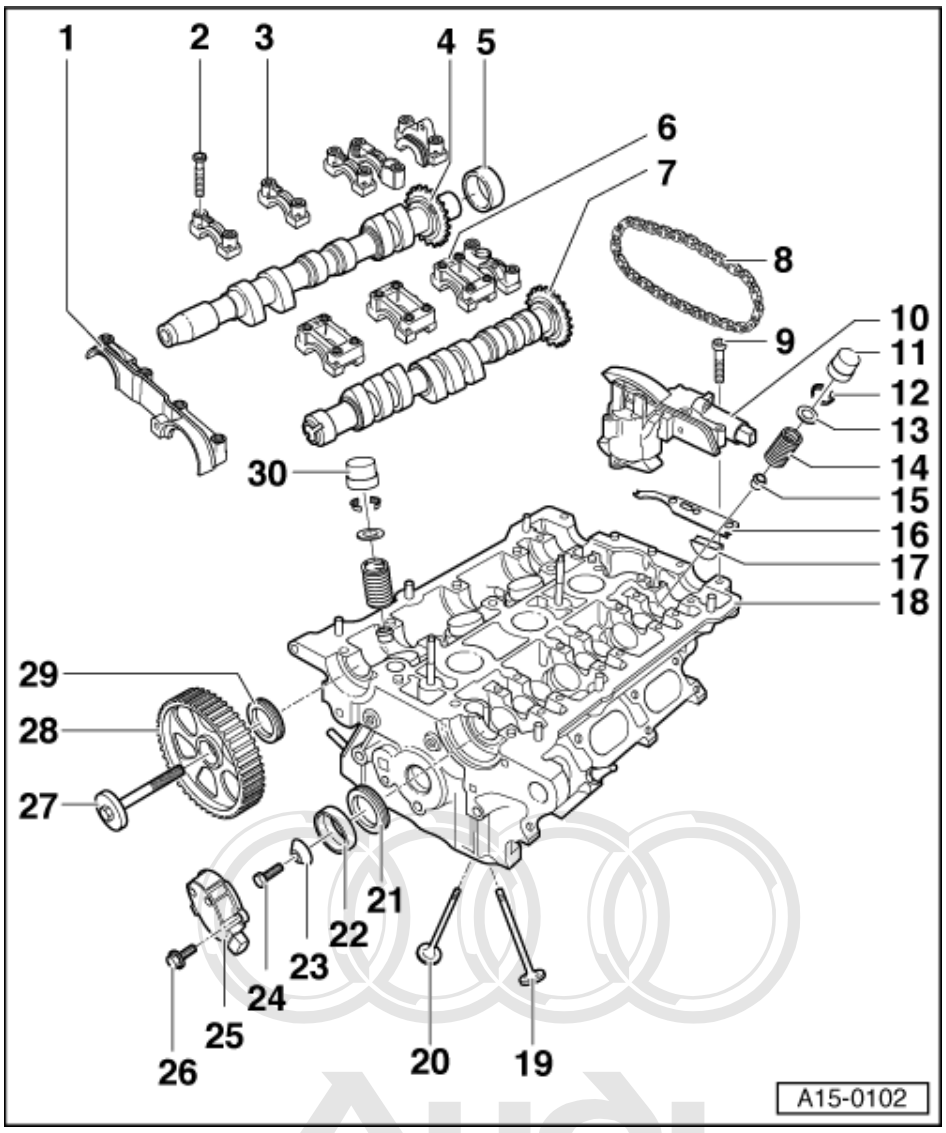

9 10 Nm

10 Mechanical camshaft adjuster

- With camshaft adjustment valve -N205
- Secure with special tool 3366 before removing => Page 106

11 Hydraulic bucket tappet

- Notes => Page 114
- Removing and installing with cylinder head installed => Page 106

12 Valve cotters

13 Valve spring plate

14 Valve spring

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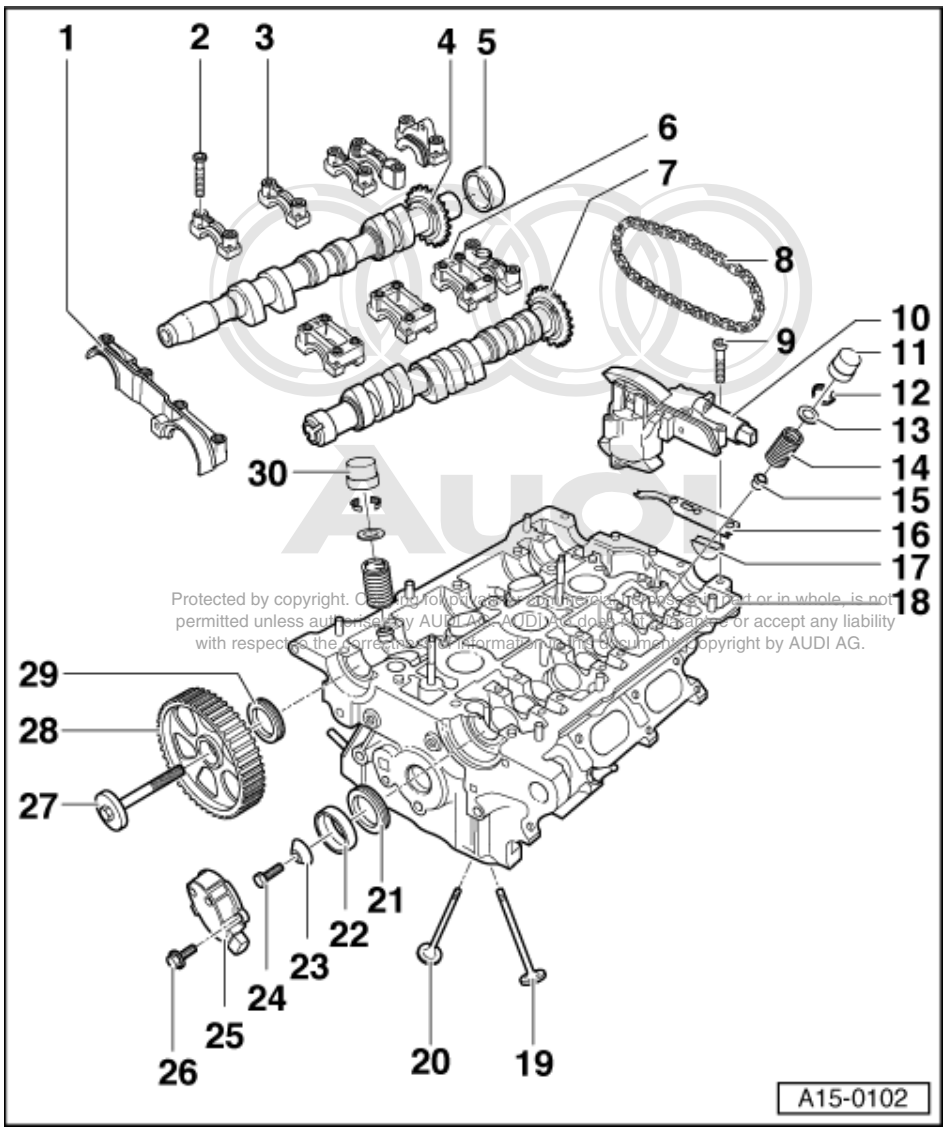

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15 Valve stem seal

- Renewing with cylinder head installed => Page 115

16 Rubber/metal gasket

- Renew

17 Seal

- Renew

18 Cylinder head

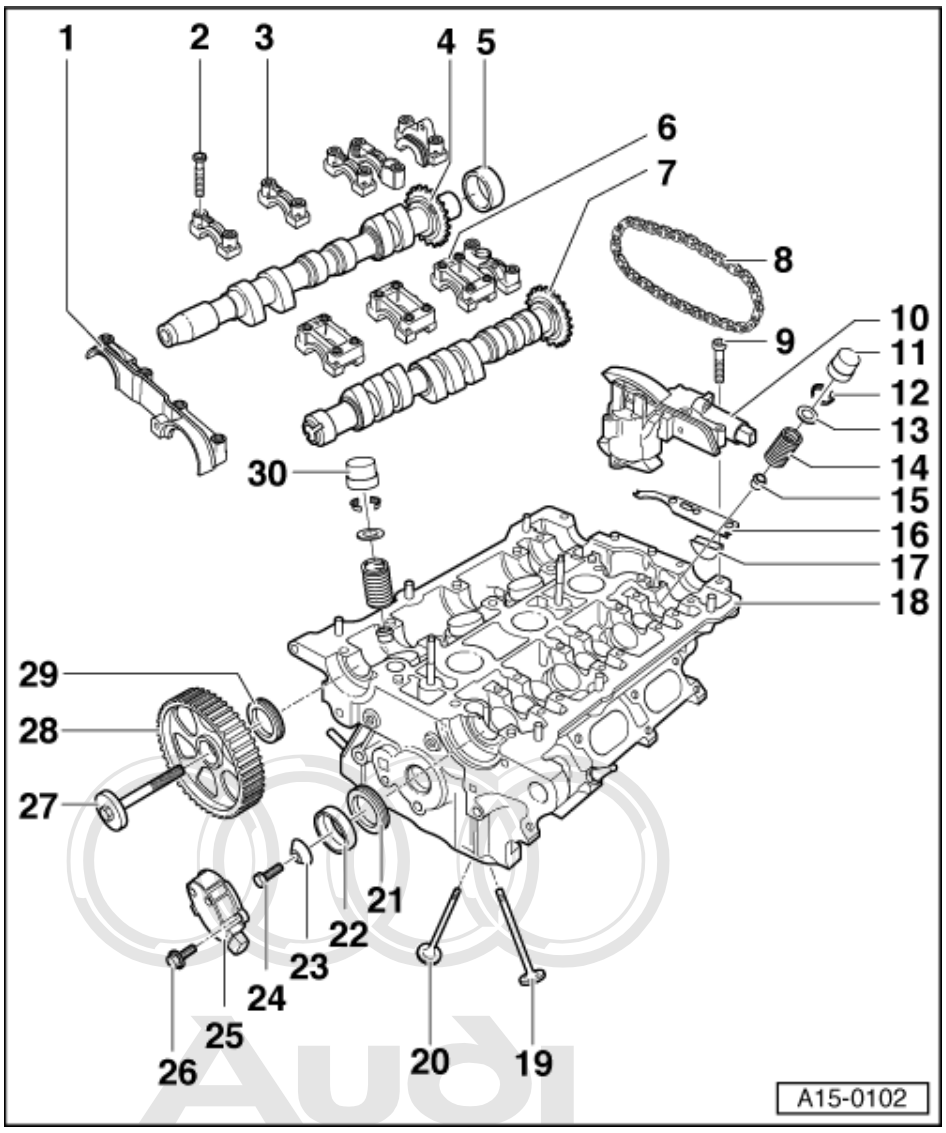
- Checking for distortion => Page 95
- Reworking => Page 95

19 Exhaust valve

20 Inlet valve

21 Oil seal (Hall sender end)

- Renew => Page 64



22 Rotor for Hall sender

- Note position (notch on camshaft)

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23 Washer

- Conical

24 25 Nm

25 Hall sender

26 10 Nm

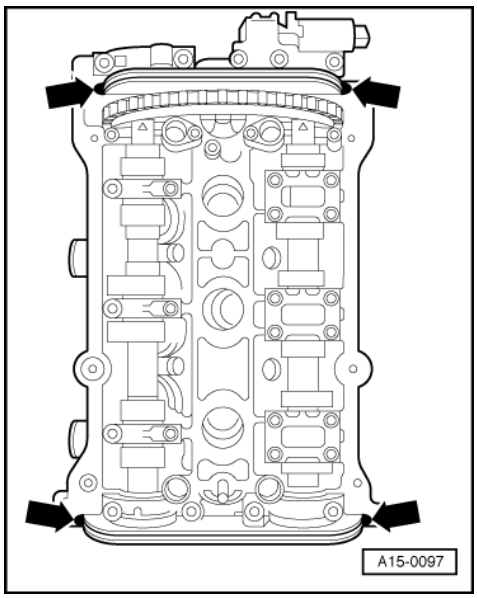
27 55 Nm

- Renew

28 Camshaft sprocket

29 Oil seal (toothed belt end)

- Renewing => Page 64



-> Fig.1 Sealing end points of joints between bearing caps and cylinder head

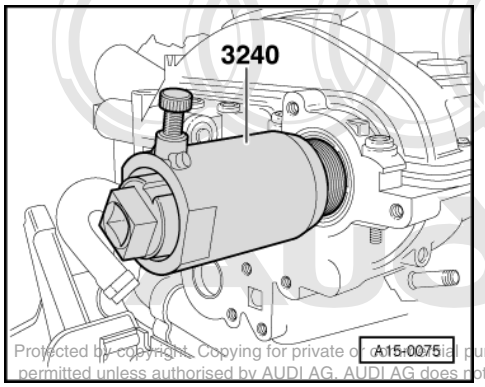
Carefully apply a small quantity of sealant at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

Sealant

=> Parts Catalogue

1.2 - Renewing oil seals in cylinder heads

Oil seal for camshaft drive (left and right cylinder heads)



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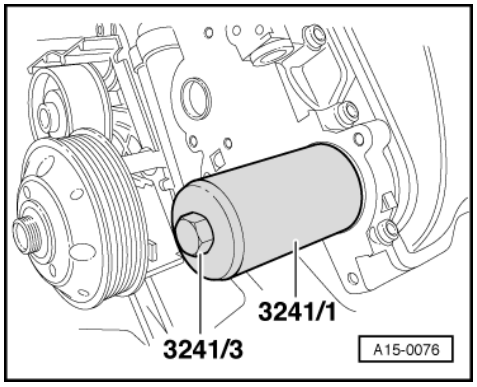
Note:

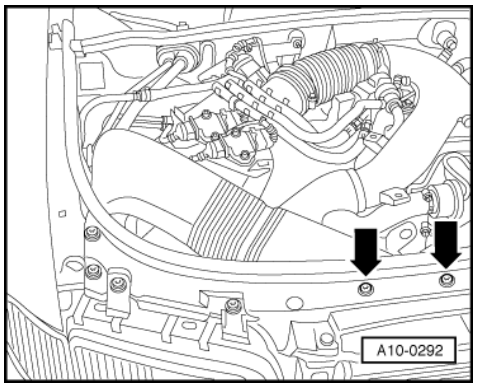
If the oil seal on one side is leaking it is advisable to renew the seals on both sides.

- Remove ribbed belt => Page 35 .
- Remove toothed belt => Page 37 .
- Remove rear toothed belt guard.
- -> Pull out oil seal with oil seal extractor 3240.

- Clean contact surface and sealing surface.



- Do not apply oil to sealing lip or outer circumference of seal.
- Fit guide sleeve 3241/2 (from tool set 3241) onto camshaft.
- -> Press seal flush into cylinder head using press sleeve 3241/1 and bolt 3241/3.



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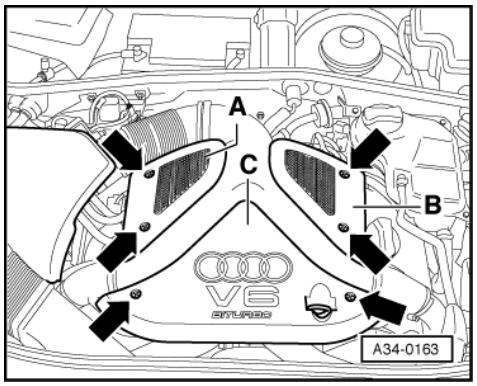
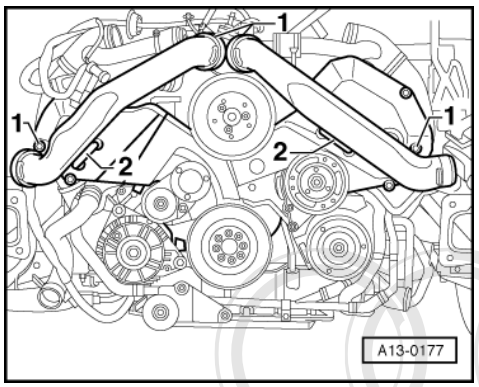
Oil seal at Hall sender (right cylinder head)

- -> Remove intake hose going to air cleaner (arrows).



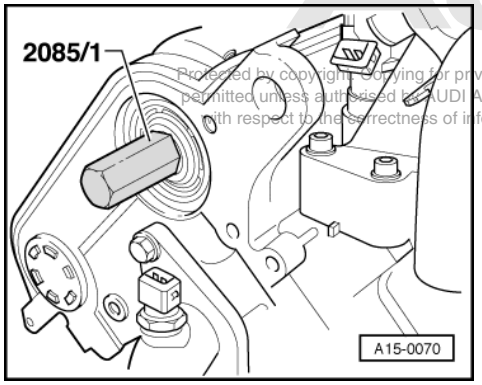
- -> Unscrew bolts -arrows- and remove engine cover panel -C-.



- -> Remove pressure pipe -1- (right side).

Note:

Watch position of retaining strip -2-.



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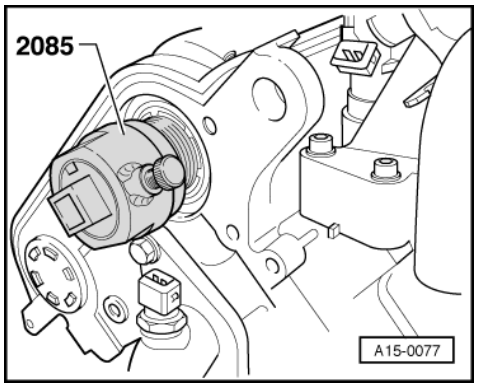
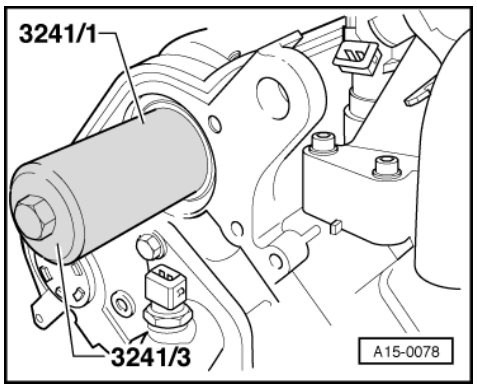
- Unbolt Hall sender housing (10 Nm).
- Unscrew bolt securing Hall sender rotor (20 Nm) and carefully lever off rotor with a screwdriver.
- -> Screw in bolt from oil seal extractor 2085/1.



- -> Pull out seal with oil seal extractor 2085 and bolt 2085/1.
- Clean contact surface and sealing surface.
- Do not apply oil to sealing lip or outer circumference of seal before installing.
- Fit guide sleeve (from tool set 3241) onto camshaft.



- -> Press in seal until flush using press sleeve 3241/1 and bolt 3241/3.

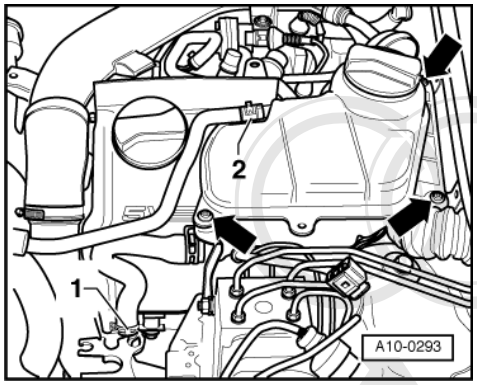
Installing

Install in reverse sequence.

Note:

When installing Hall sender rotor, ensure that locating lug engages in slot in camshaft.

Removing oil seal at Hall sender (left cylinder head)



- -> Detach coolant reservoir -arrows- and move it clear to the side.

Note:

Leave coolant hoses connected.

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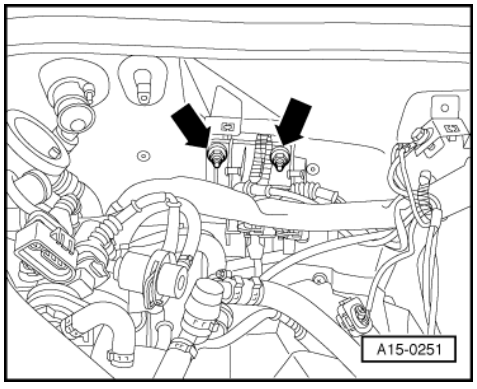
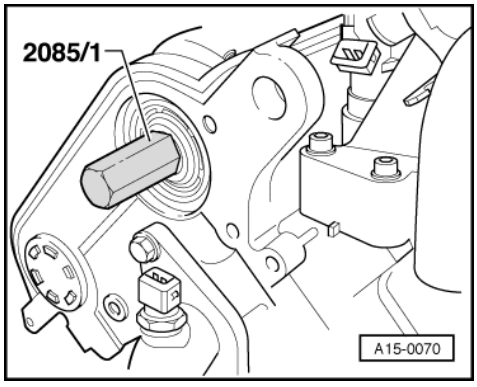
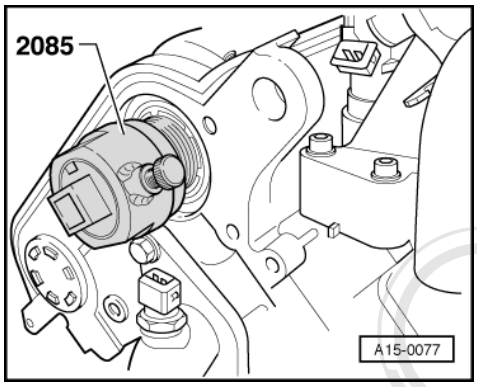
- Unplug connector from coolant level monitor.



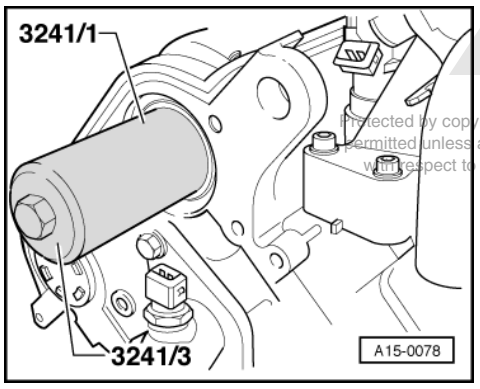
- Move wiring harness clear at bulkhead.
- -> Unbolt bracket -arrows- for plug connectors on bulkhead and move clear to the side.



- Unbolt Hall sender housing (10 Nm).
- Unscrew bolt securing Hall sender rotor (20 Nm) and carefully lever off rotor using a screwdriver.
- -> Screw in bolt 2085/1 from oil seal extractor 2085.



- -> Pull out seal with oil seal extractor 2085 and bolt 2085/1.
- Clean contact surface and sealing surface.
- Do not apply oil to sealing lip or outer circumference of seal before installing.
- Fit guide sleeve (from tool set 3241) onto camshaft.



- -> Press in seal until flush using press sleeve 3241/1 and bolt 3241/3.

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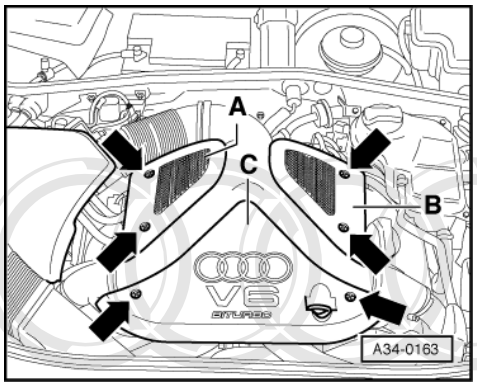
Installing

Install in reverse sequence.

Note:

When installing Hall sender rotor, ensure that locating lug engages in slot in camshaft.

Rear oil seal and sealing flange (left cylinder head)



Note:

Rear sealing flange and oil seal on left-hand cylinder head must be renewed together as follows:

- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.

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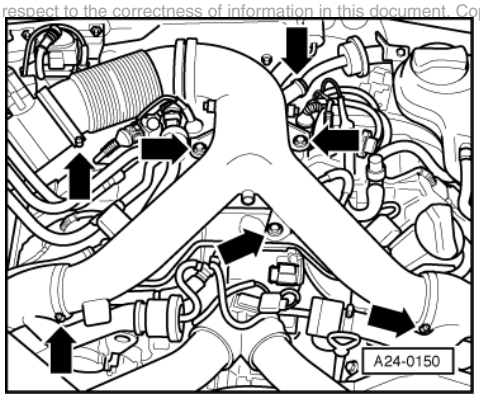
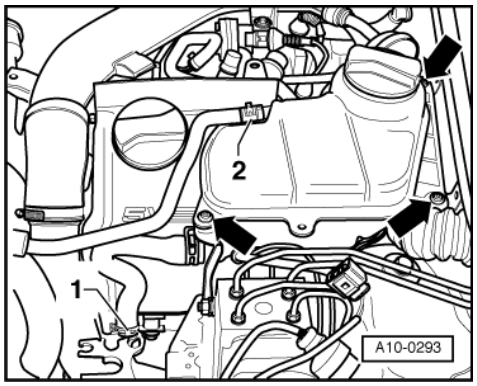


- -> Remove air duct -arrows-.

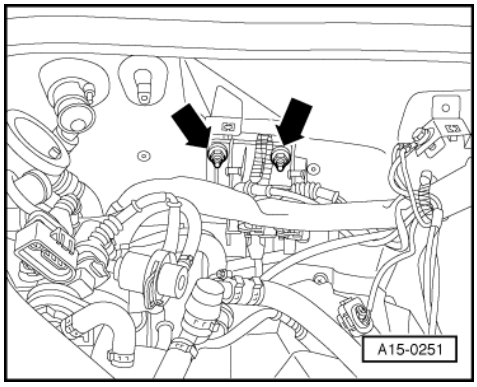


- -> Remove coolant reservoir -arrows- and move it clear to the side.

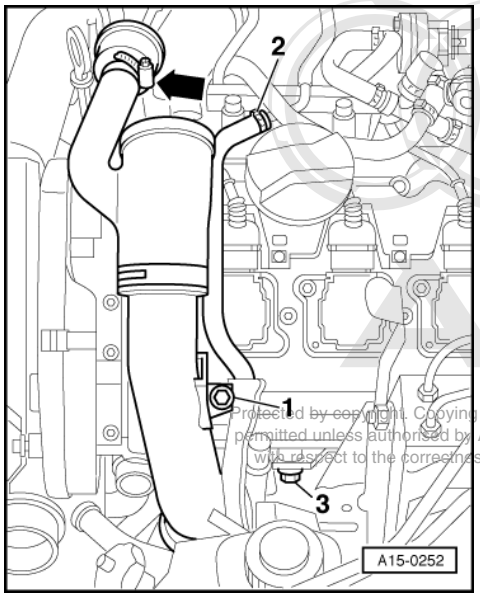
Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.



- Move wiring harness clear at bulkhead.
- -> Unbolt bracket -arrows- for plug connectors on bulkhead and move clear to the side.
- Unbolt Hall sender housing (10 Nm).
- Unscrew bolt securing Hall sender rotor (20 Nm) and carefully lever off rotor using a screwdriver.



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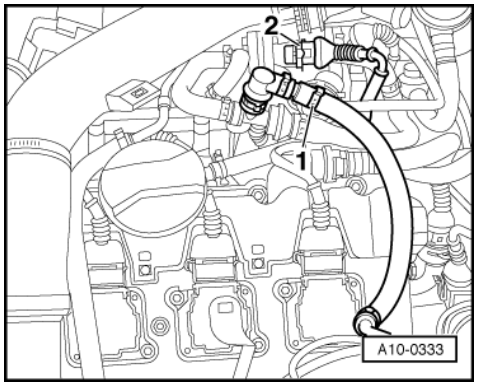
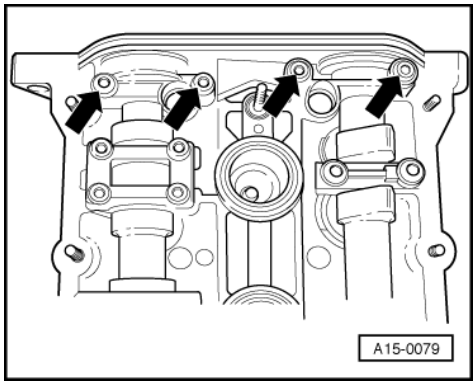
- Remove cover panel from cylinder head cover (cylinder bank 4-6).
- -> Release hose clamp -arrow-.
- Remove upper section of intake pipe -1-.
- Disconnect hose -2-.

Note:

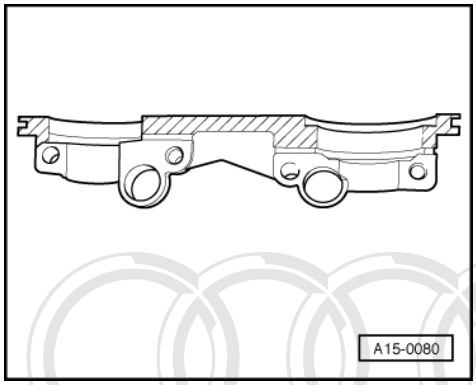
Insert plug in lower section of intake pipe.



- -> Pull off hose -1-.
- Unscrew bolt securing toothed belt guard from cylinder head cover.
- Pull plug connectors off ignition coils.
- Pull crankcase breather off cylinder head cover.
- Remove cylinder head cover.

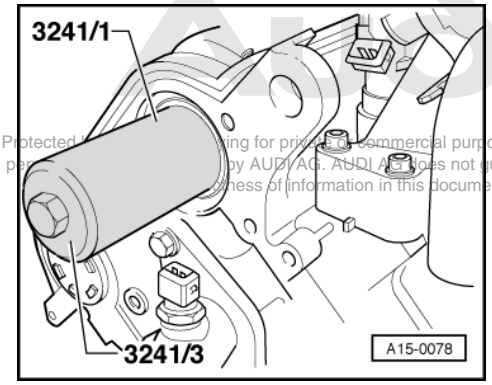


- -> Remove double bearing cap -arrows-.
- Take out oil seal and sealing flange.
- Clean contact surfaces and sealing surfaces of double bearing cap.



- -> Apply a thin coating of sealant to shaded areas on double bearing cap (see illustration), fit bearing cap and tighten bolts to 10 Nm.

=> Parts Catalogue



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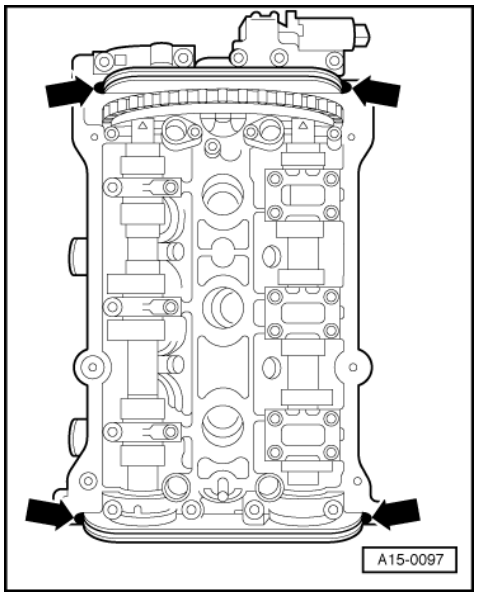
- Fit guide sleeve (from tool set 3241) onto camshaft.
- -> Press in oil seal until flush using press sleeve 3241/1 and bolt 3241/3.
- Carefully knock in sealing flange against stop using 3202 and a plastic hammer.



Installing

Install in reverse sequence; note the following points:

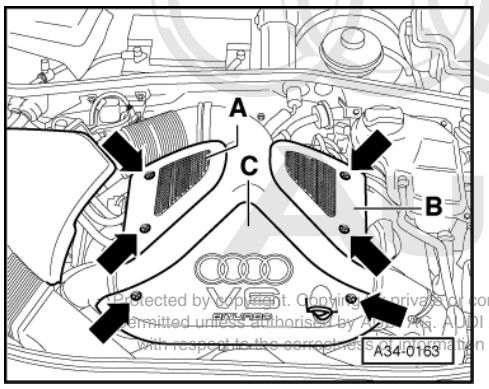
- -> Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

- Sealant

=> Parts Catalogue

1.3 - Removing and installing cylinder head covers

Removing and installing left cylinder head cover



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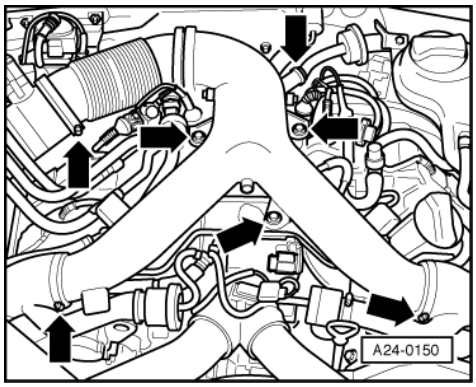
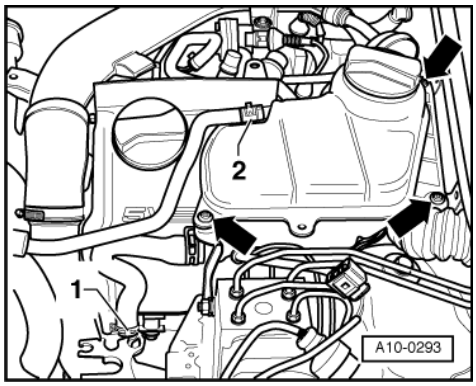
Removing

- -> -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.

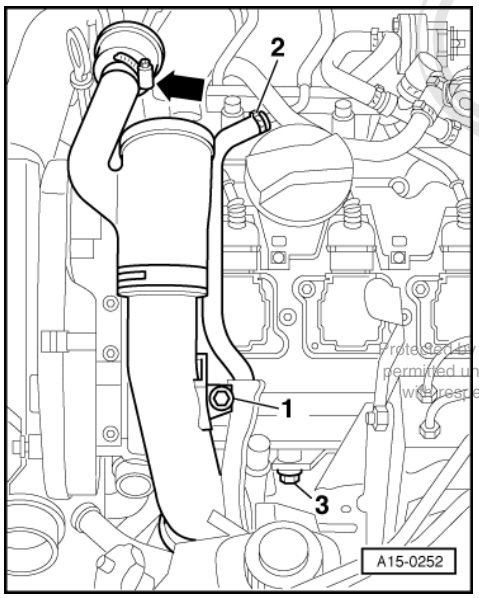


- -> Remove coolant reservoir -arrows- and move it clear to the side.

Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.



- Remove cover panel from cylinder head cover (cylinder bank 4-6).
- -> Release hose clamp -arrow-.
- Remove upper section of intake pipe -1-.
- Disconnect hose -2-.

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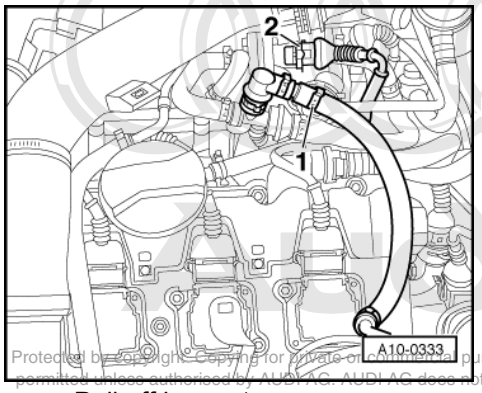
- Detach water pipe -3-.

Note:

Insert plug in lower section of intake pipe.



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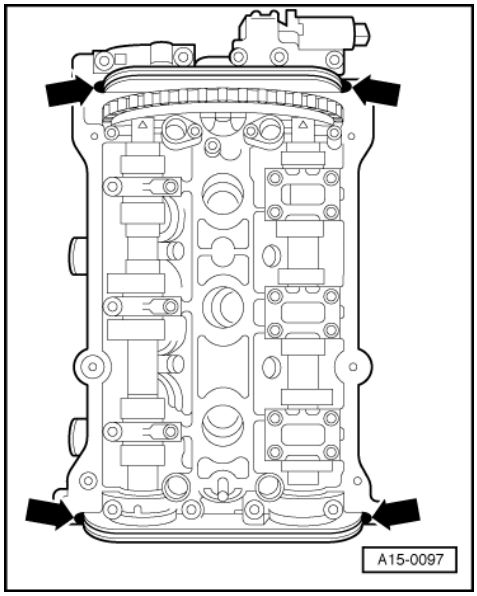
- -> Pull off hose -1-
- Pull plug connectors off ignition coils.
- Pull crankcase breather off cylinder head cover.
- Remove ignition coils.
- Remove cylinder head cover.

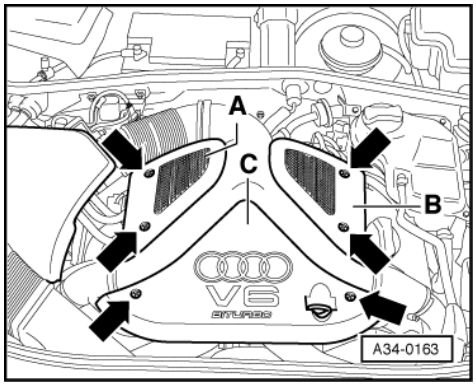


Installing

Install in reverse sequence; note the following points:

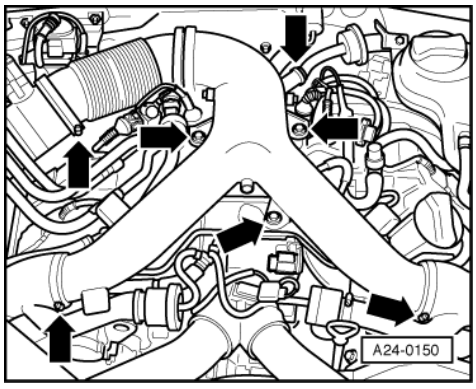
- -> Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant D 454 300 A2 at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

Removing and installing right cylinder head cover

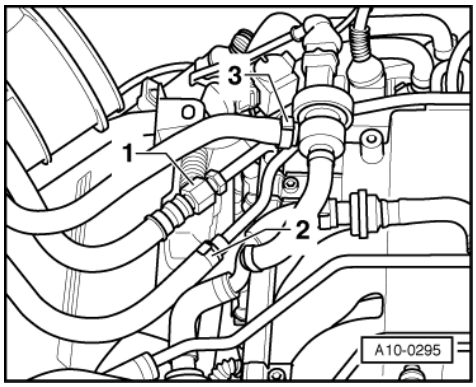


Removing

- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.
- Remove cover above air cleaner.



- -> Remove air duct -arrows-.



Warning
Fuel system is under pressure. Before opening the system, place a cloth around the connection. Then release pressure by carefully loosening the connection.

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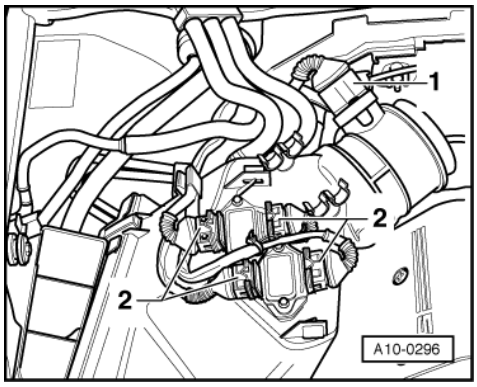
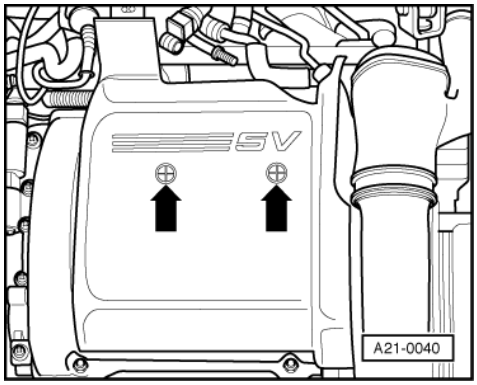
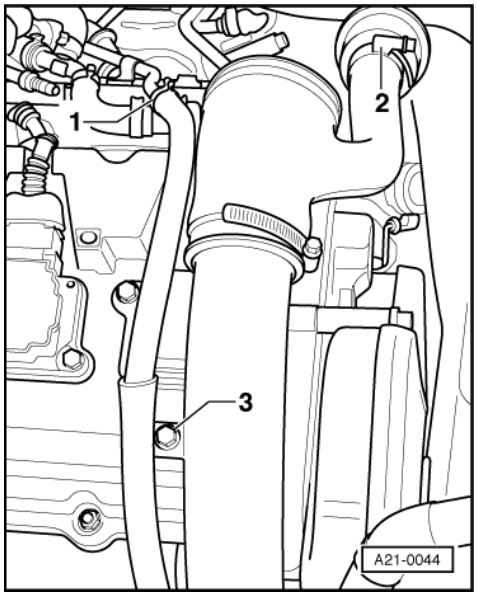
- -> Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off ACF valve -3-.



- -> Unplug connector -1- from air mass meter.
- Unplug connectors -2- from ignition output stages, and move wiring clear.
- Remove air cleaner.



- -> Remover cover panel from right-hand cylinder head cover -arrows-.



- -> Disconnect hose -1-.
- Disconnect hose -2-.
- Detach upper section of intake pipe -3-.

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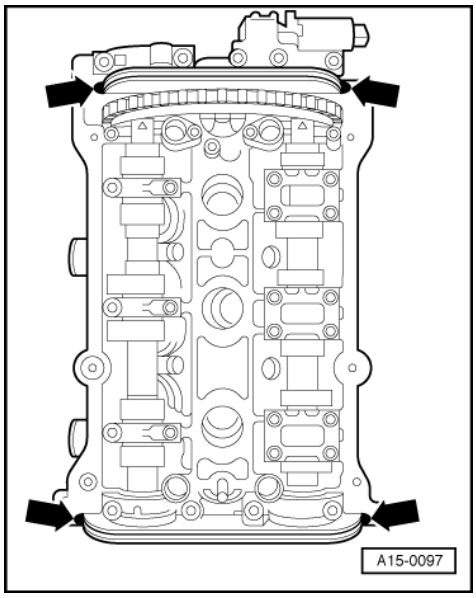
Note:

Insert plug in lower section of intake pipe.

- Unscrew bolt securing toothed belt guard from cylinder head cover.
- Unplug connectors from ignition coils.
- Pull crankcase breather off cylinder head cover.
- Remove ignition coils.
- Remove cylinder head cover.



Installing

Install in reverse sequence; note the following points.

- -> Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

◆ Sealant

=> Parts Catalogue

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1.4 - Removing and installing cylinder head

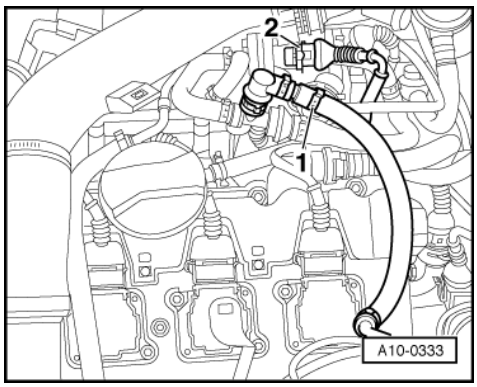
Removing and installing left cylinder head

Notes:

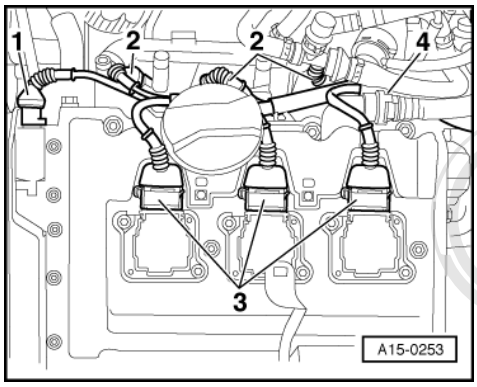
- ◆ All hose connections are secured with clips.
- ◆ Charge air system must be free of leaks.
- ◆ Renew all seals and gaskets

Removing

- Remove engine => Page 3 .



- -> Unplug connector from air recirculation valve -2-.



- -> Unplug connector for camshaft timing control -1- (cylinder bank 4..6).
- Unplug connectors from injectors -2- (cylinder bank 4..6).
- Unplug connectors from ignition coils -3- and move wiring harness clear (cylinder bank 4..6).
- Pull crankcase breather -4- off cylinder head cover (cylinder bank 4..6).
- Remove ignition coils.

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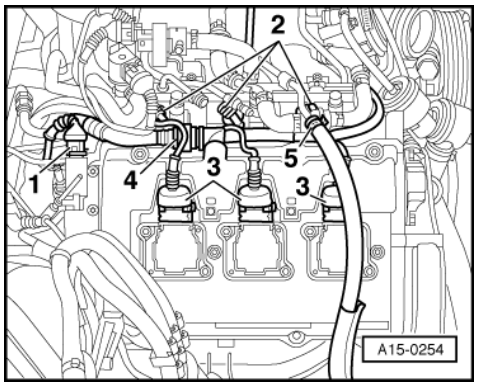
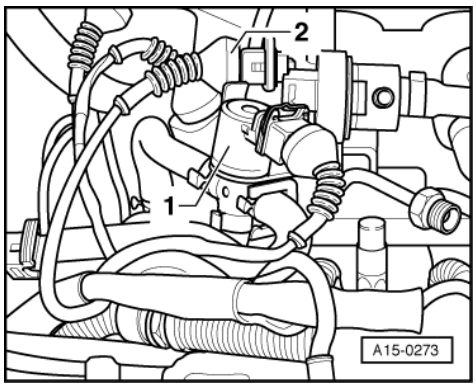
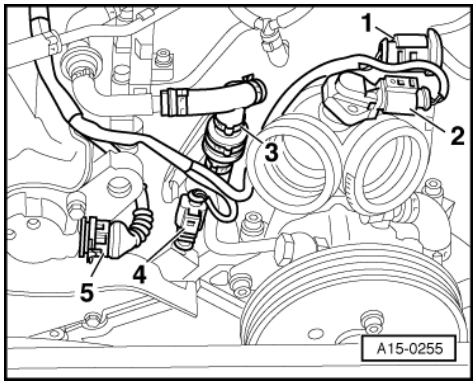


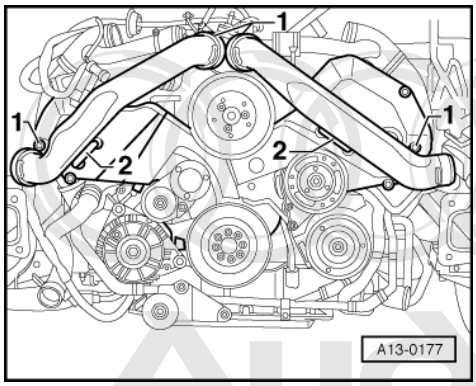
- -> Unplug connectors from injectors -2- (cylinder bank 1..3).
- Pull off hose -5- going to turbocharger intake side.



- -> Unclip solenoid valve for charge pressure control -1-.
- Pull connector off ACF valve -2-.



- -> Pull connector off throttle unit -1-.
- Pull connector off charge air sensor -2-.
- Pull off crankcase breather -3-.
- Pull connector off intake air temperature sender -4-.



- -> Remove pressure pipes -1-.

Note:

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Watch position of retaining strips -2-.

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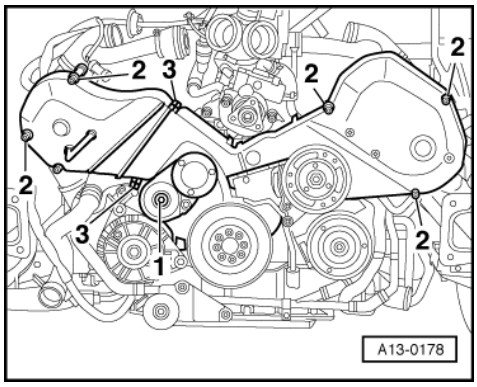
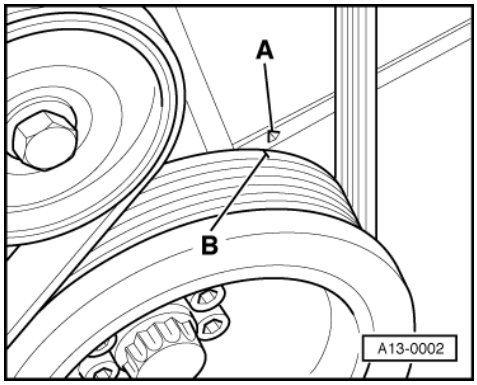


- -> Remove tensioner -1- for ribbed belt.
- Remove toothed belt guards -2- (left and right).
- Remove toothed belt guard -3- (centre).

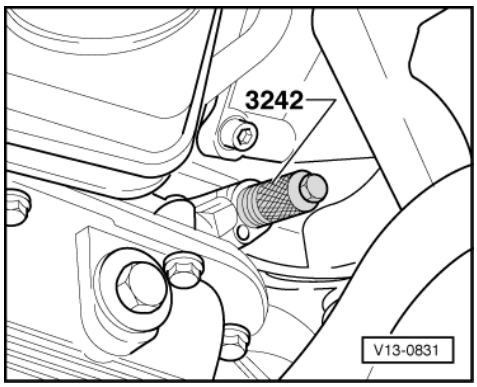


- -> Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

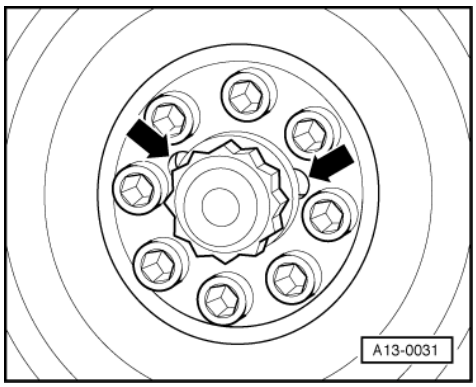
Note:

Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: the larger holes in the securing plates on the camshaft sprockets must align opposite one another on the inside. If this is not the case, turn crankshaft one revolution further.



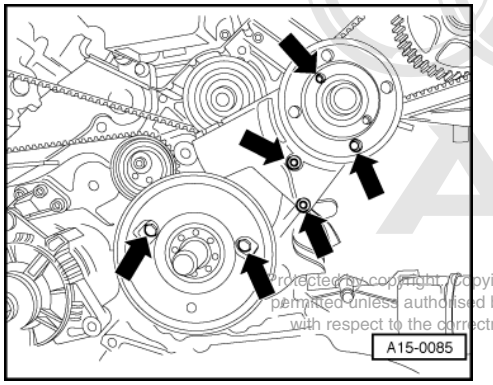
- Remove sealing plug from cylinder block, left.
- The TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.
- -> Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.



- -> Remove vibration damper on crankshaft.

Note:

The central bolt does not have to be loosened to remove the vibration damper.



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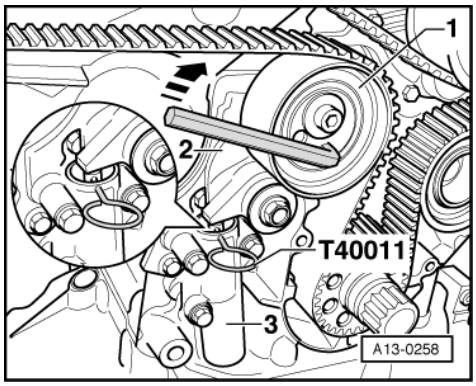
- -> Remove idler wheel for ribbed belt -arrows-.
- Remove toothed belt guard behind vibration damper -arrows-.

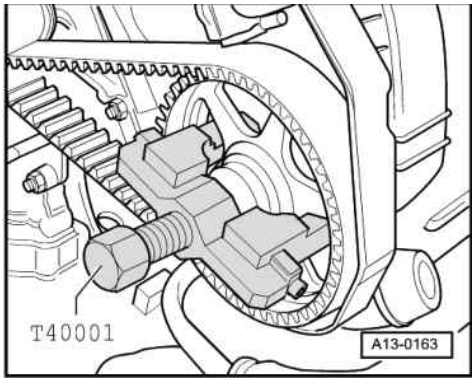
Notes:



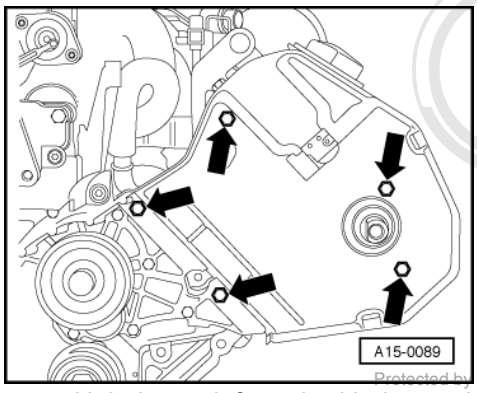
- Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when refitted.
- The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.

- -> Using an 8 mm hexagon key, turn toothed belt tensioning roller -1- clockwise in direction of arrow until tensioning lever -2- compresses tensioning element -3- far enough to insert special tool T40011 in the drilling and in the plunger.

- Insert special tool T40011 and release toothed belt tensioning roller.



- Insert camshaft clamp 3391 in the securing plates of the two camshafts.
- Loosen both camshaft bolts and unscrew approx. 5 turns.
- Take out camshaft clamp 3391.
- -> Pull off both camshaft sprockets with special tool T40001.



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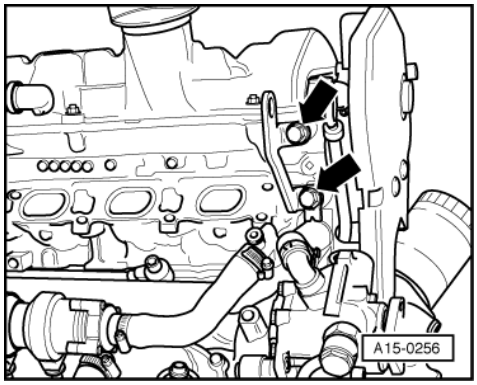
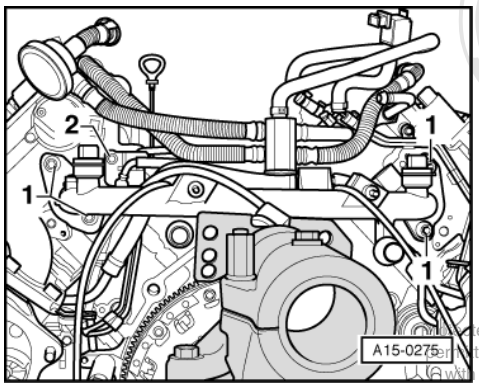
- -> Unbolt rear left toothed belt guard -arrows-.
- Detach intake manifold using special tool 3249.



- -> Unbolt cylinder head lifting bracket with coolant pipe -arrows- from cylinder head.



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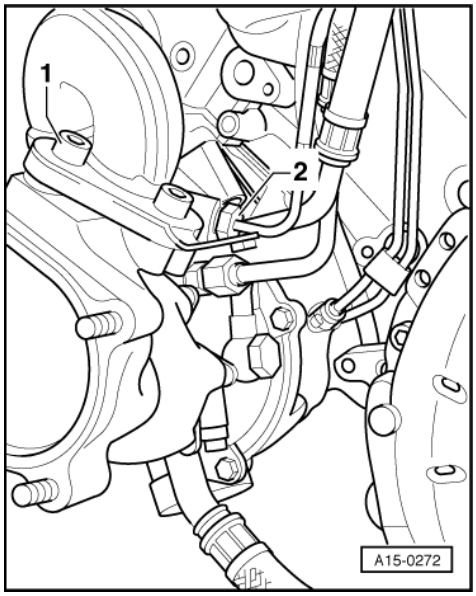
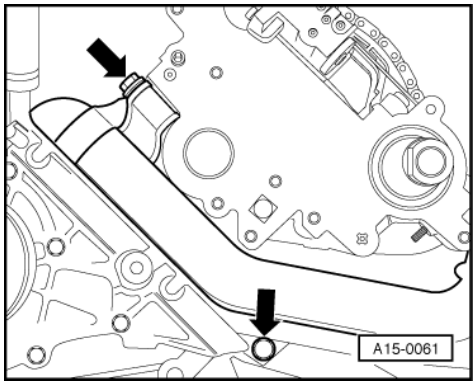
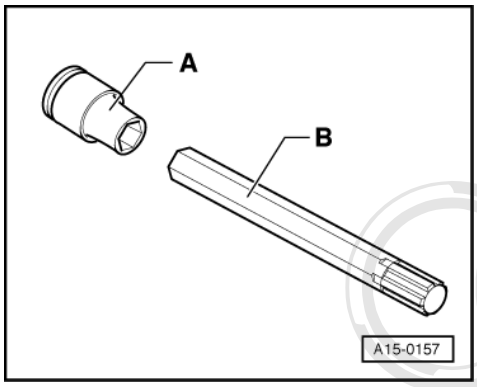
- -> Unbolt water pipe -1- and pull it towards the rear.
- Unbolt bracket -2- from cylinder head.



- Unscrew heat sensor -2-.
- -> Unbolt turbocharger -1- from exhaust manifold (3 bolts).



- -> Unbolt coolant pipe at front of cylinder head -arrows-.
- Unbolt cylinder head cover.
- Loosen and unscrew cylinder head bolts in opposite sequence to tightening sequence using special tool 3452 (Polidrive).
- Carefully lift off cylinder head.



Note:

-> Use special tool 3452 together with a normal commercial 10 mm socket when removing and installing.

Installing

Notes:

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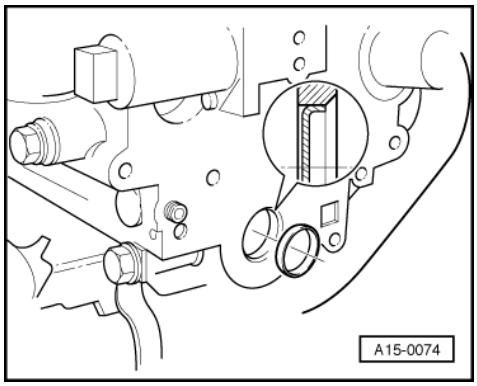
- Do not allow any oil or coolant to remain in the blind holes for the cylinder head bolts in the cylinder block.
- Fit new cylinder head bolts.
- Connecting vacuum hoses =>Page 10-23.

When installing a new cylinder head:

- Screw in centring pin for intake manifold.

The cylinder head supplied as a replacement part can be used on both sides (left or right). But a sealing cap (core plug) must be fitted in the front end of the cylinder head in each case.

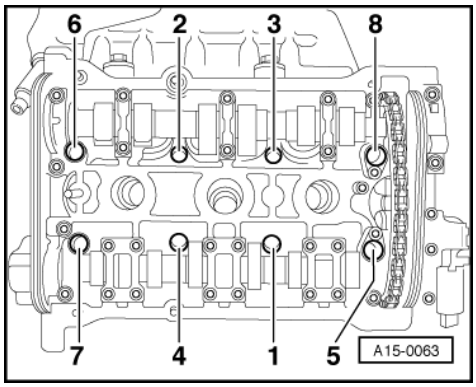


- Coat outside circumference of sealing cap (core plug) with sealant.

=> Parts Catalogue

- -> Using drift VW 295, knock in sealing cap (core plug) until the outside rim is flush with the end of the chamfer in the cylinder head.

- Before fitting cylinder head in position, turn crankshaft and camshafts to TDC of No. 3 cylinder.
- Fit cylinder head gasket on dowel sleeves. The marking "oben" (top) or the part number must face towards the cylinder head.
- Fit cylinder head, insert cylinder head bolts and tighten finger-tight.



- -> Tighten cylinder head bolts in two stages in the sequence shown, as follows:

- Stage 1 = 60 Nm.
- Stage 2 = turn a further 1/2 turn (180°) with a rigid wrench (turning 2 x 90°is also permissible).

It is not necessary to torque down cylinder head bolts again after repairs have been completed.

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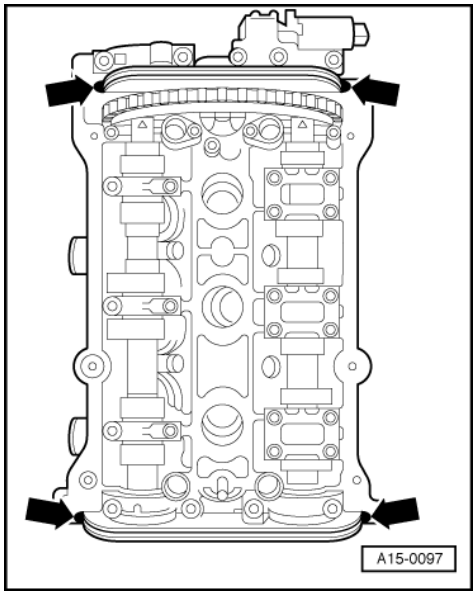


- -> Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

- Sealant

=> Parts Catalogue

Tightening torques

Component		Nm
Bolts	M6	10
Bolts	M8	20
Camshaft bearing caps and camshaft adjuster		10
Exhaust manifold to cylinder head		25
Front exhaust pipe to exhaust manifold		25
Lambda probe		50

Spark plugs	25
Toothed belt sprocket to camshaft	55
Intake manifold to cylinder head	10
Cylinder head cover	10

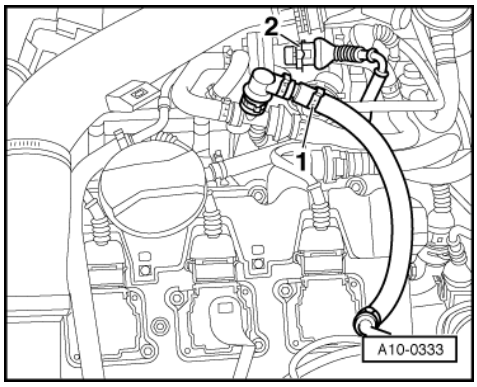
Removing and installing right cylinder head

Notes:

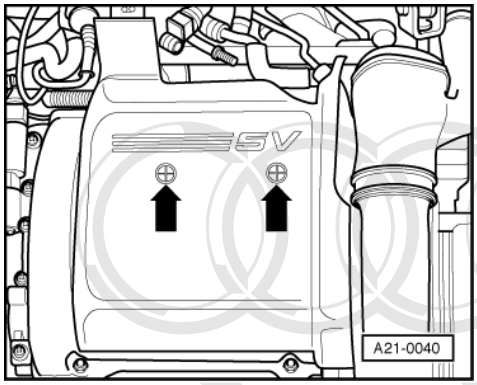
- All hose connections are secured with clips.
- Charge air system must be free of leaks.
- Renew all seals and gaskets

Removing

- Remove engine => Page 3 .



- -> Unplug connector from air recirculation valve -2-.



- -> Remove cover panel from right-hand cylinder head cover -arrows-.

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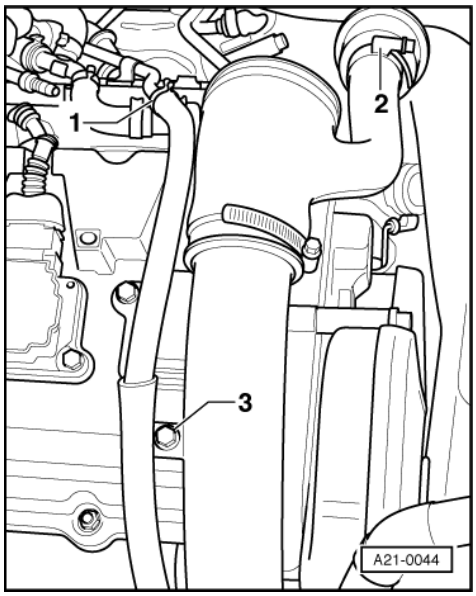
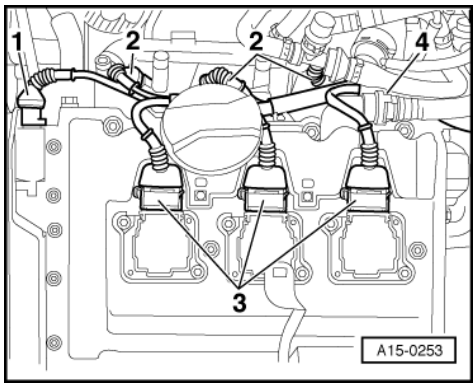


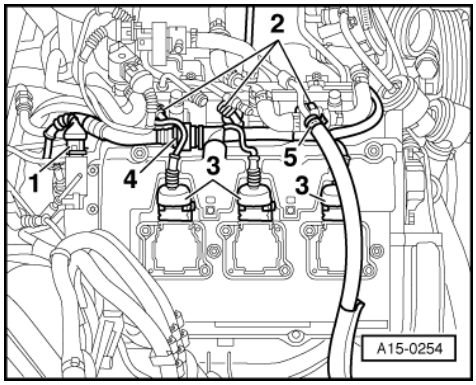
- -> Disconnect hose -1-.
- Disconnect hose -2-.
- Unbolt upper section of intake pipe -3-.

Note:

Insert plug in lower section of intake pipe.



- -> Unplug connectors from injectors -2- (cylinder bank 4..6).



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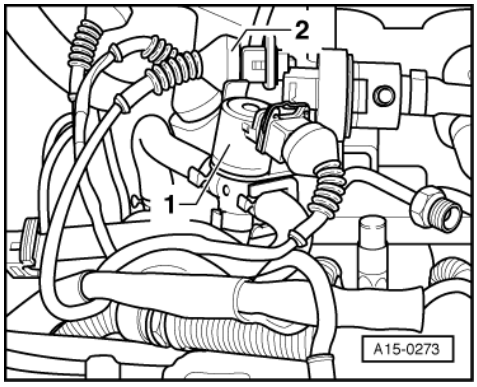
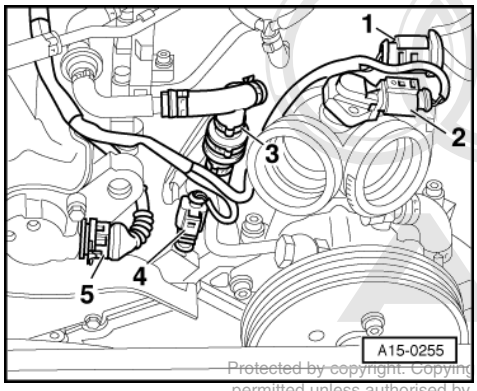
- -> Unplug connector for camshaft timing control -1- (cylinder bank 1..3).
- Unplug connectors from injectors -2- (cylinder bank 1..3).
- Unplug connectors from ignition coils -3- and move wiring harness clear (cylinder bank 1..3).
- Pull crankcase breather -4- off cylinder head cover (cylinder bank 1..3).
- Pull off hose -5- going to turbocharger intake side.

- Remove ignition coils.



- -> Unclip solenoid valve for charge pressure control -1-.
- Pull connector off ACF valve -2-.



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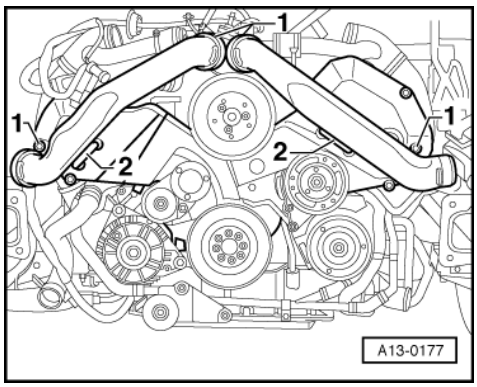
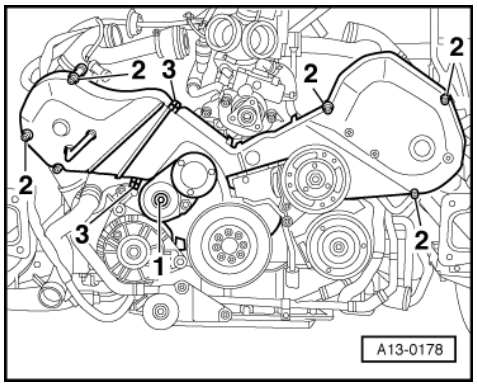
- -> Pull connector off throttle unit -1-.
- Pull connector off charge air sensor -2-.
- Pull off crankcase breather -3-.
- Pull connector off intake air temperature sensor -4-.
- Pull connector -5- off Hall sender.



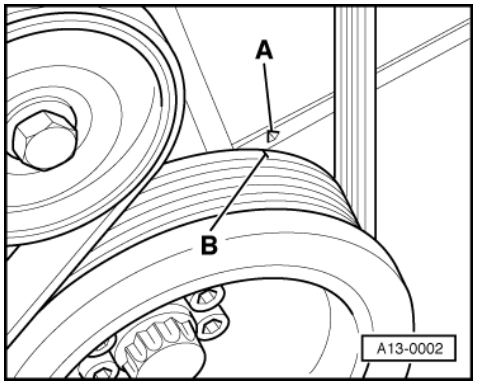
- -> Remove pressure pipes -1-.

Note:

Watch position of retaining strips -2-.



- -> Remove tensioner -1- for ribbed belt.
- Remove toothed belt guards -2- (left and right).
- Remove toothed belt guard -3- (centre).



- -> Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

Turn over the engine at the central bolt on the crankshaft.

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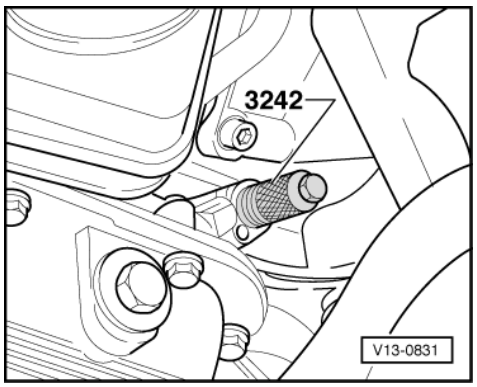
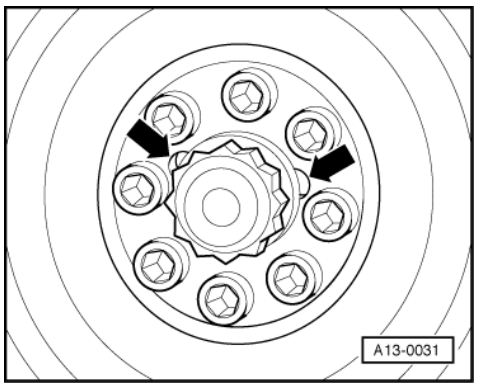
- Check position of camshafts: the larger holes in the securing plates on the camshaft sprockets must align opposite one another on the inside. If this is not the case, turn crankshaft one revolution further.



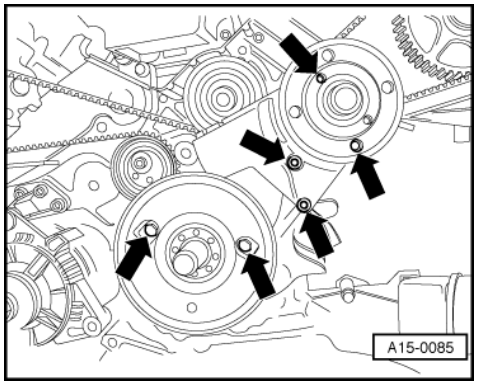
- Remove sealing plug from cylinder block, left.
- The TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.
- -> Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.



- -> Remove vibration damper on crankshaft.

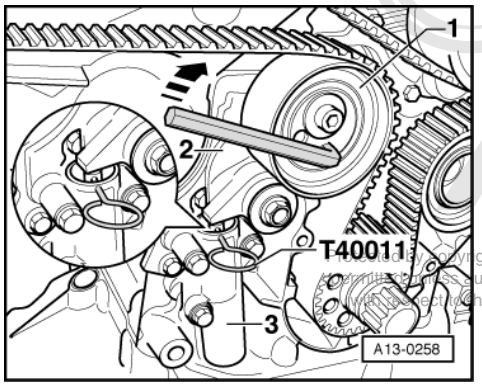
Note:

The central bolt does not have to be loosened to remove the vibration damper.



- -> Remove idler wheel for ribbed belt -arrows-.
- Remove toothed belt guard behind vibration damper -arrows-.

Notes:



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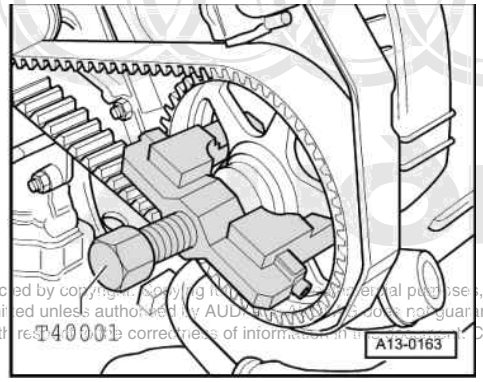
- Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when refitted.
- The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.

- -> Using an 8 mm hexagon key, turn toothed belt tensioning roller -1- clockwise in direction of arrow until tensioning lever -2- compresses tensioning element -3- far enough to insert special tool T40011 in the drilling and in the plunger.

- Insert special tool T40011 and release toothed belt tensioning roller.



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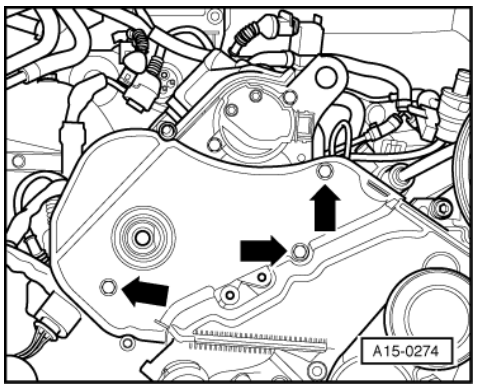
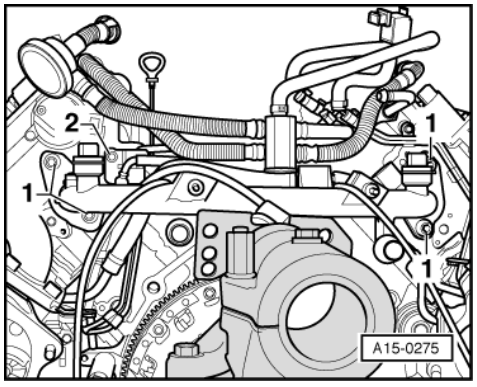
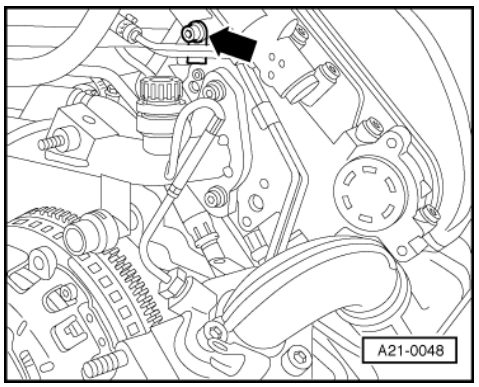
- Insert camshaft clamp 3391 in the securing plates of the two camshafts.
- Loosen both camshaft bolts and unscrew approx. 5 turns.
- Take out camshaft clamp 3391.
- -> Pull off both camshaft sprockets with special tool T40001.



- -> Unbolt rear right toothed belt guard -arrows-.
- Detach intake manifold using special tool 3249.



- -> Unbolt water pipe -1- and pull it towards the rear.
- Unbolt bracket -2- from cylinder head.



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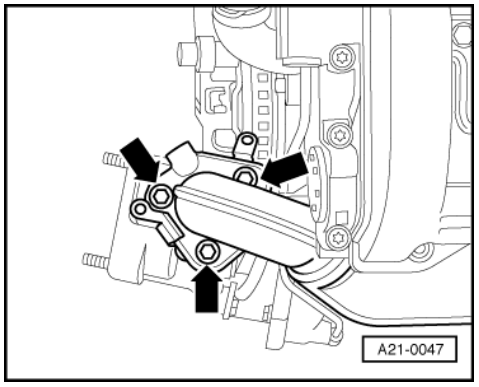
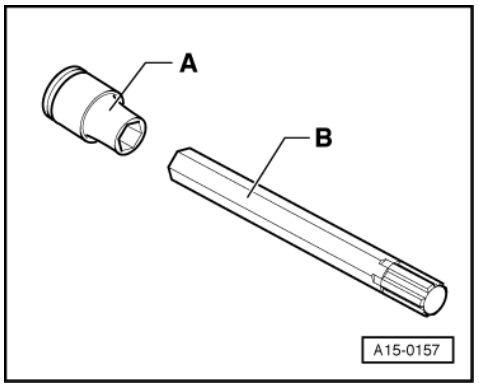
- -> Unbolt line -arrow- from cylinder head.



- -> Remove turbocharger -arrows-.

- Unbolt cylinder head cover.
- Loosen and unscrew cylinder head bolts in opposite sequence to tightening sequence using special tool 3452 (Polidrive).
- Carefully lift off cylinder head.



Note:

-> Use special tool 3452 together with a normal commercial 10 mm socket when removing and installing.

Installing

Notes:

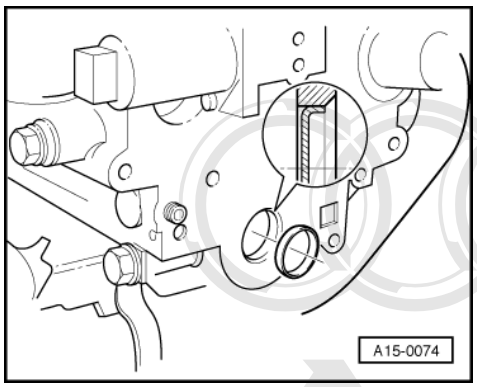
- Do not allow any oil or coolant to remain in the blind holes for the cylinder head bolts in the cylinder block.
- Fit new cylinder head bolts.

- Connecting vacuum hoses =>Page 10-23.

When installing a new cylinder head:

- Screw in centring pin for intake manifold.

The cylinder head supplied as a replacement part can be used on both sides (left or right). But a sealing cap (core plug) must be fitted in the front end of the cylinder head in each case.



- Coat outside circumference of sealing cap (core plug) with sealant.

=> Parts Catalogue

- -> Using drift VW 295, knock in sealing cap (core plug) until the outside rim is flush with the end of the chamfer in the cylinder head.

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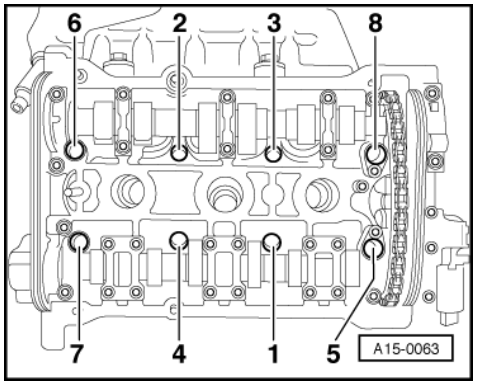
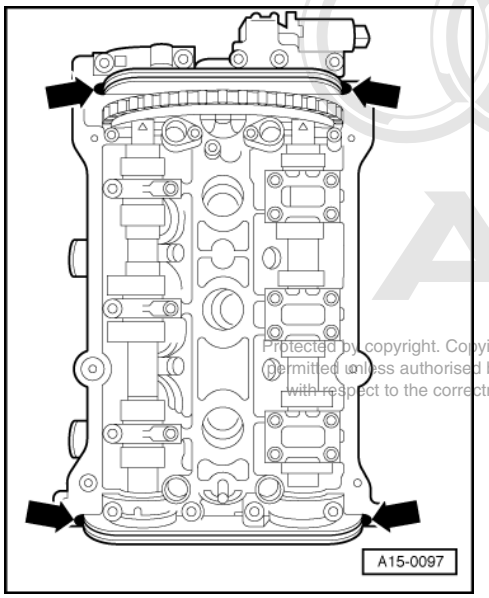
- Before fitting cylinder head in position, turn crankshaft and camshafts to TDC of No. 3 cylinder.
- Fit cylinder head gasket on dowel sleeves. The marking "oben" (top) or the part number must face towards the cylinder head.
- Fit cylinder head, insert cylinder head bolts and tighten finger-tight.



- -> Tighten cylinder head bolts in two stages in the sequence shown, as follows:

- Stage 1 = 60 Nm.
- Stage 2 = turn a further 1/2 turn (180°) with a rigid wrench (turning 2 x 90°is also permissible).

It is not necessary to torque down cylinder head bolts again after repairs have been completed.



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- -> Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

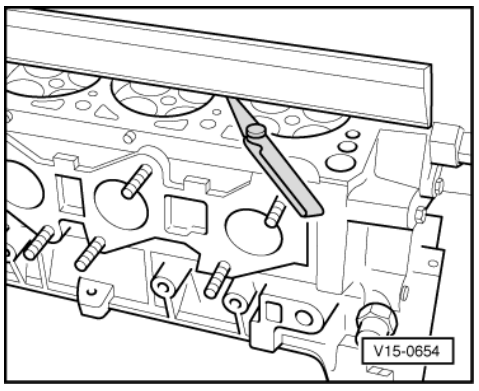
◆ Sealant

=> Parts Catalogue

Tightening torques

Component		Nm
Bolts	M6	10
Bolts	M8	20
Camshaft bearing caps and camshaft adjuster		10
Exhaust manifold to cylinder head		25
Front exhaust pipe to exhaust manifold		25
Lambda probe		50
Spark plugs		25
Toothed belt sprocket to camshaft		55
Intake manifold to cylinder head		10
Cylinder head cover		10

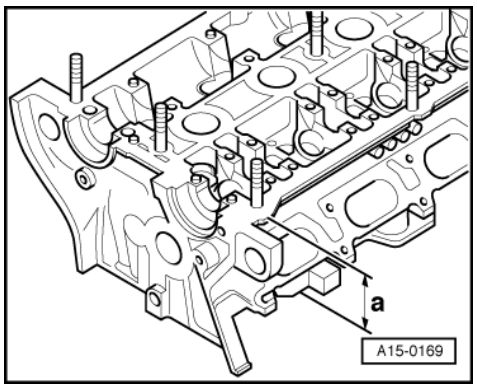
1.5 - Checking cylinder head for distortion



- -> Measure at several points with straight-edge.

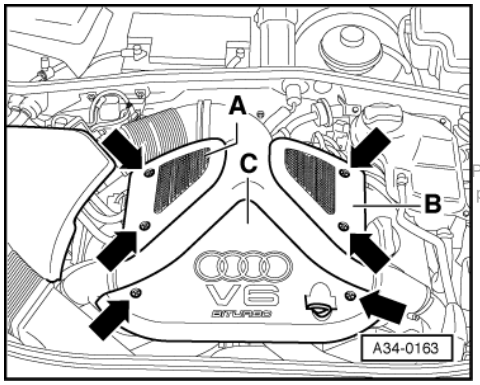
◆ Maximum permissible distortion: 0.1 mm.

1.6 - Reworking cylinder head



- -> Reworking the cylinder head (skimming) is only permissible down to a minimum dimension of a =139.25 mm.

1.7 - Checking compressions



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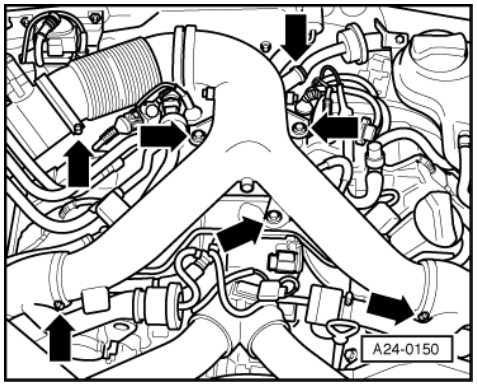
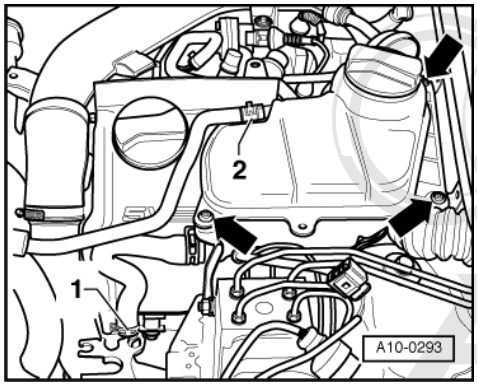
Test requirements:

- Engine oil temperature at least 30°C.
- Battery fully charged.

- -> -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.



- -> Remove coolant reservoir -arrows- and move it clear to the side.

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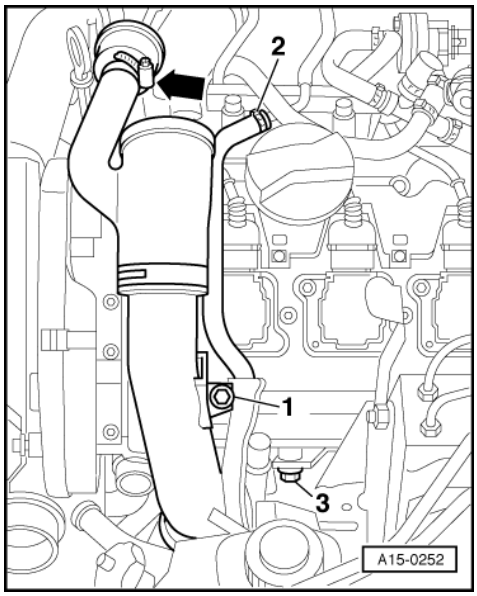
Note:

Leave coolant hoses connected.

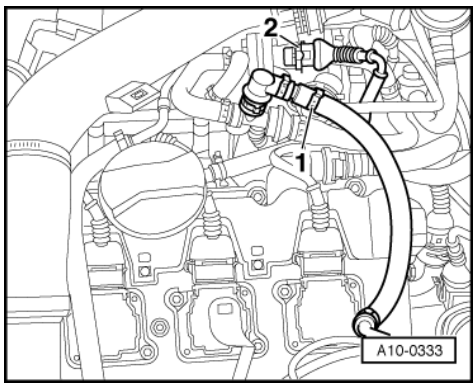
- Unplug connector from coolant level monitor.



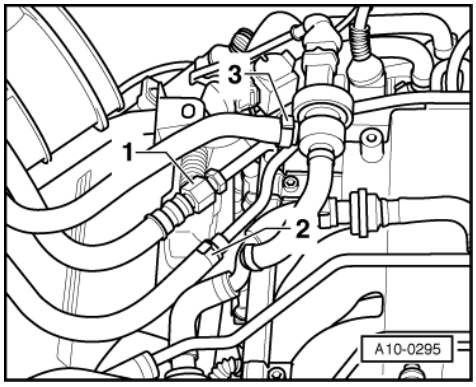
- Remove cover panel from cylinder head cover (cylinder bank 4-6).
- -> Release hose clamp -arrow-.
- Remove upper section of intake pipe -1-.
- Disconnect hose -2-.
- Detach water pipe -3-.

Note:

Insert plug in lower section of intake pipe.



- -> Pull off hose -1-.



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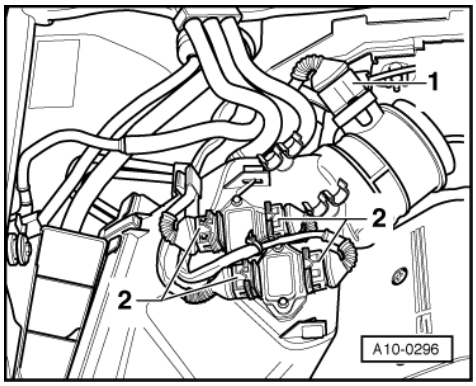
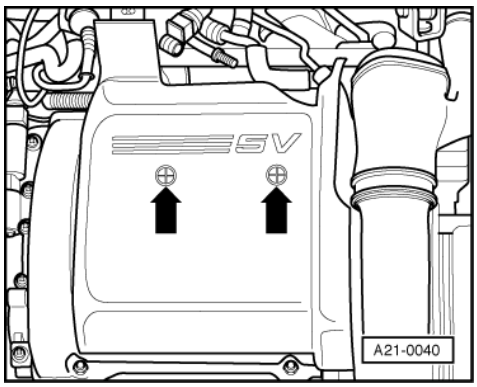
Warning
Fuel system is under pressure. Before opening the system, place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off ACF valve -3-.

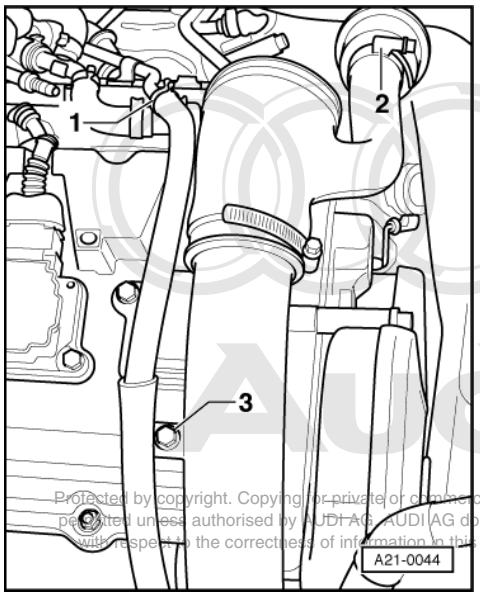


- -> Unplug connector -1- from air mass meter.
- Unplug connectors -2- from ignition output stages, and move wiring clear.

- Remove air cleaner.



- -> Remover cover panel from right-hand cylinder head cover -arrows-.



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- -> Disconnect hose -1-.
- Disconnect hose -2-.
- Detach upper section of intake pipe -3-.

Note:

Insert plug in lower section of intake pipe.

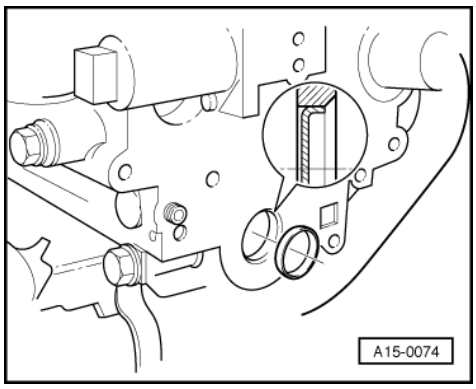
- Pull crankcase breathers off cylinder head covers.
- Pull plug connectors off ignition coils.
- Remove ignition coils.
- Unplug connectors from all 6 injectors.
- Unplug 5-pin connector from output stage of ignition coils.
- Throttle fully open.
- Use compression tester V.A.G 1381 or V.A.G 1763.
- Operate starter until pressure reading on tester no longer rises.

Compression pressure values

New	Wear limit	Max. permissible difference between cylinders
9 ... 13 bar	7 bar	3 bar

1.8 - Fitting sealing cap (core plug) in cylinder head

The cylinder head supplied as a replacement part can be used on both sides (left or right). But a sealing cap (core plug) must be fitted in the front end of the cylinder head in each case.

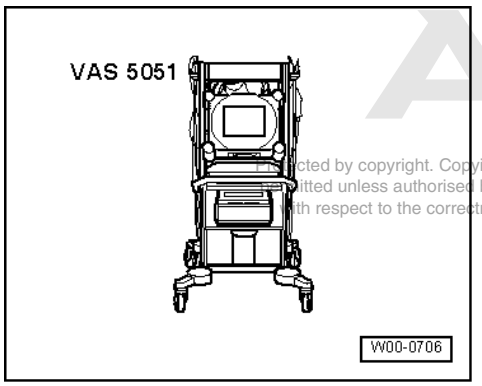


- Coat outside circumference of sealing cap (core plug) with sealant.

=> Parts Catalogue

- -> Using drift VW 295, knock in sealing cap (core plug) until the outside rim is flush with the end of the chamfer in the cylinder head.

1.9 - Checking function of camshaft timing control



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Special tools and workshop equipment required

- VAS 5051 with VAS 5051/1

  or

- V.A.G 1551 and V.A.G 1551/3 A

Test requirement:

- Coolant temperature at least 80 °C

Warning
- **Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.**
- **If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.**

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01".
  When doing this the engine must be idling.

=> Motronic injection and ignition system; Repair group 01; Self-diagnosis of Motronic system; Connecting vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and selecting functions Self-diagnosis of Motronic system Connecting vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and selecting functions

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "04" to select "Basic setting" and confirm with Q key.

-> Indicated on display:

```
Introduction of basic setting     Q
Enter display group number XXX
```

- Enter "094" for Display Group 094 and confirm entry with Q key.

-> Indicated on display:

```
System in basic setting     94
     1     2     3     4
```

- Function of camshaft timing control is tested.
- Increase speed to above 2000 rpm.

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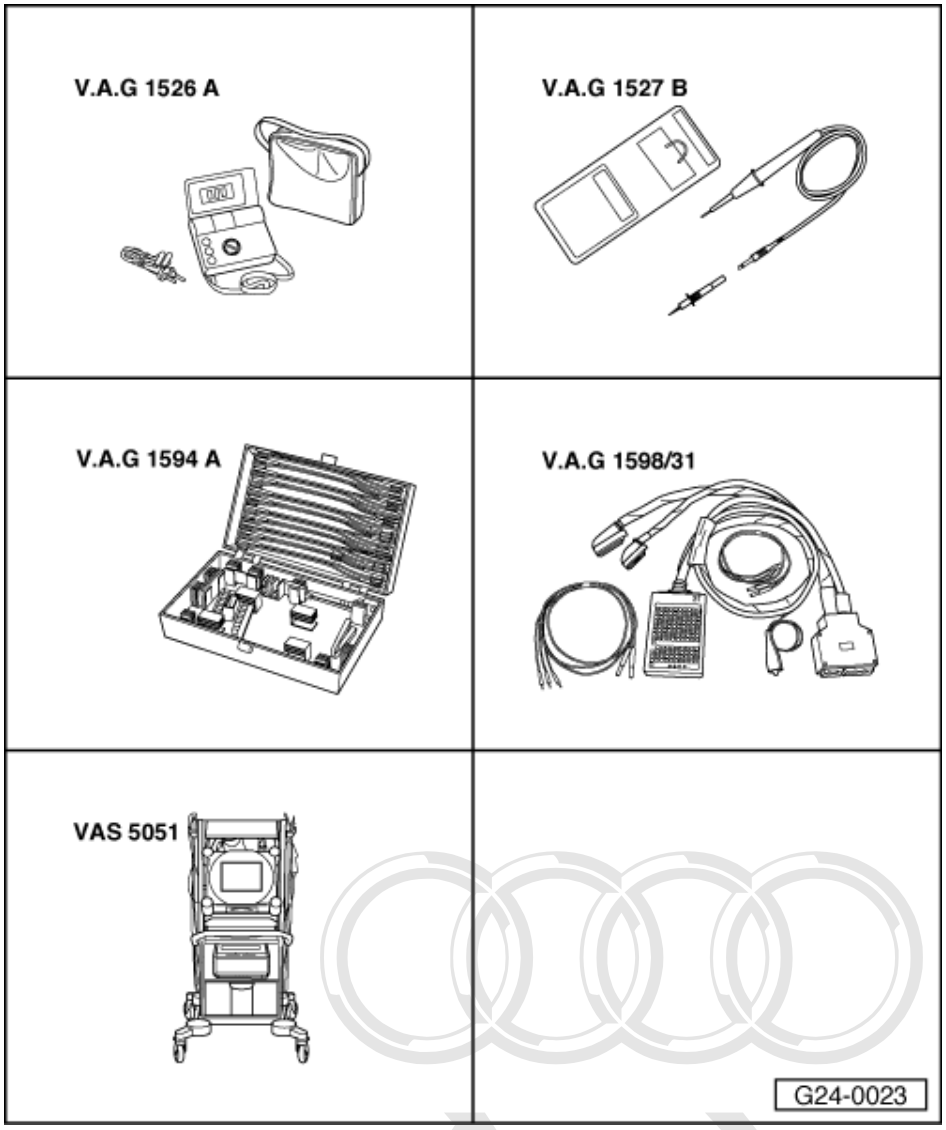
	Display zones			
	1	2	3	4
Display group 94: Function of camshaft timing control				
Display	xxxx rpm	Text	Text	Text
Indicates	Engine speed	Camshaft timing control	Test result Bank 1	Test result Bank 2
Specification	>2000	CS-ctrlON	Test ON Syst. OK	Test ON Syst. OK
Note				

If "system n. OK" is indicated in display zone 3 and/or 4:

- Test solenoid valves for camshaft timing control.

1.10 - Testing solenoid valves for camshaft timing control



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31
- VAS 5051

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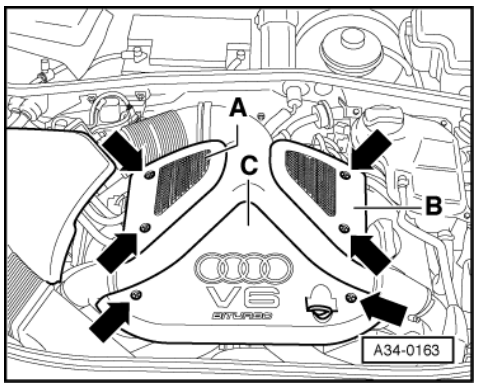
or

- V.A.G 1551 with V.A.G 1551/3 A

- Start final control diagnosis and select solenoid valves for camshaft adjustment.

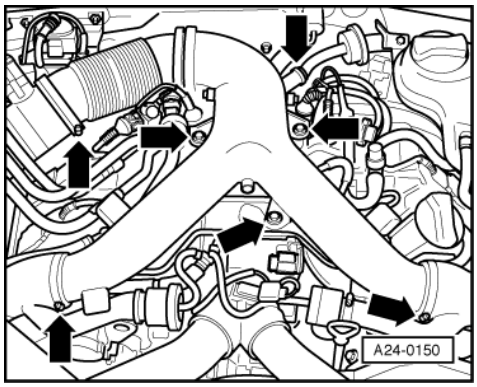
=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis



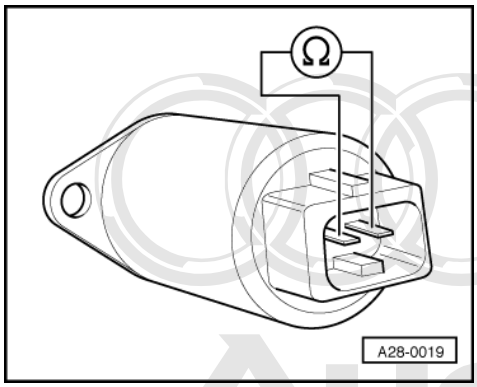
If one of the valves is not activated (does not click) during final control diagnosis:

Testing internal resistance

- Switch off ignition.
- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.



- Unplug electrical connector on relevant solenoid valve.
- -> Connect multimeter to valve (resistance measurement range)
  - Specification: 10 ... 18ω

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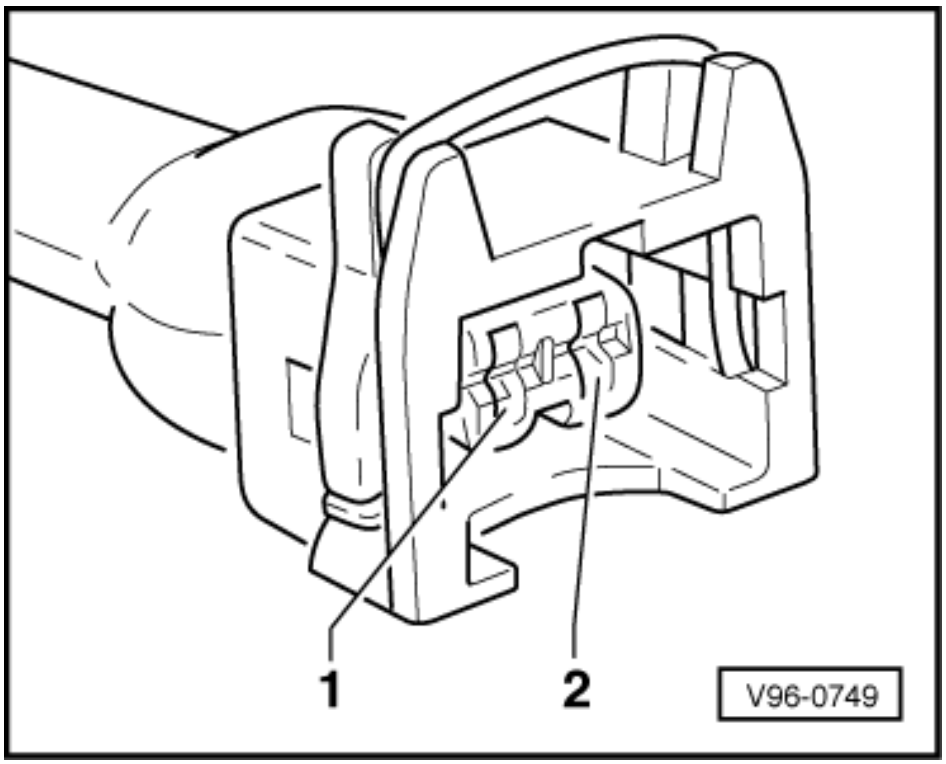
If the specification is not obtained:

- Fit a new valve.

Checking voltage supply



- Unplug connector on relevant valve.
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine earth

- Operate starter briefly.
  - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):

• Check fuse for solenoid valves for camshaft timing control.

=> Current flow diagrams, Electrical fault-finding and Fitting locations

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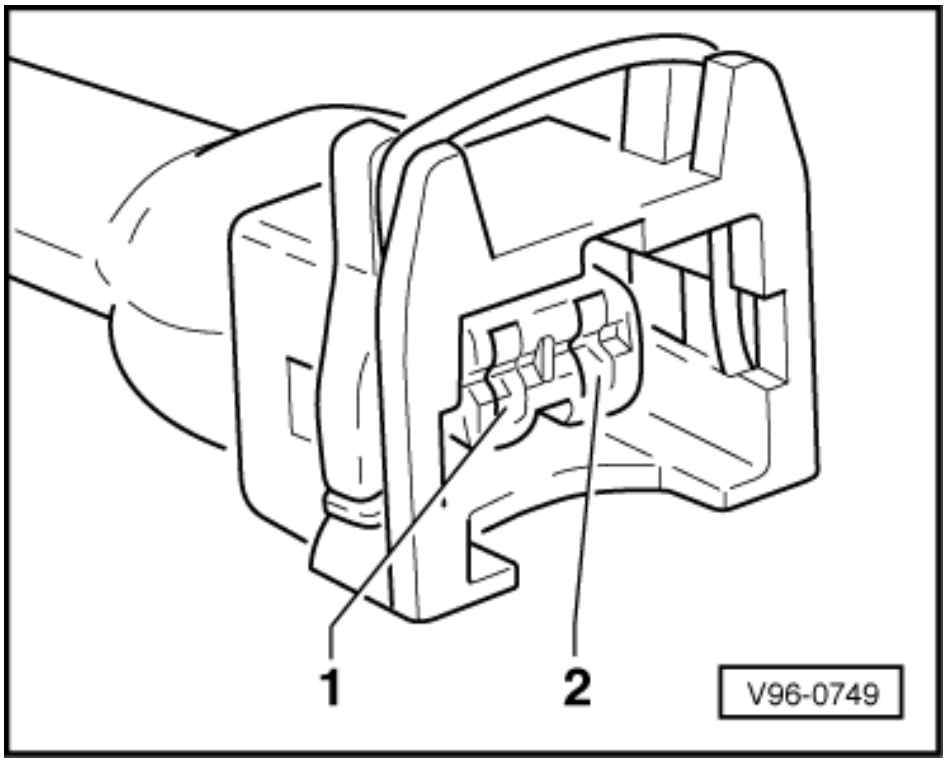

- -> Test for open circuit in wiring from fuel pump relay to connector contact 1 via fuse -S234 (socket 34 in fuse box):

=> Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify any open circuits.

If no fault is found:

- Test fuel pump relay.

=> Motronic ignition and injection system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation. Servicing Motronic injection system Testing fuel pump relay and activation.

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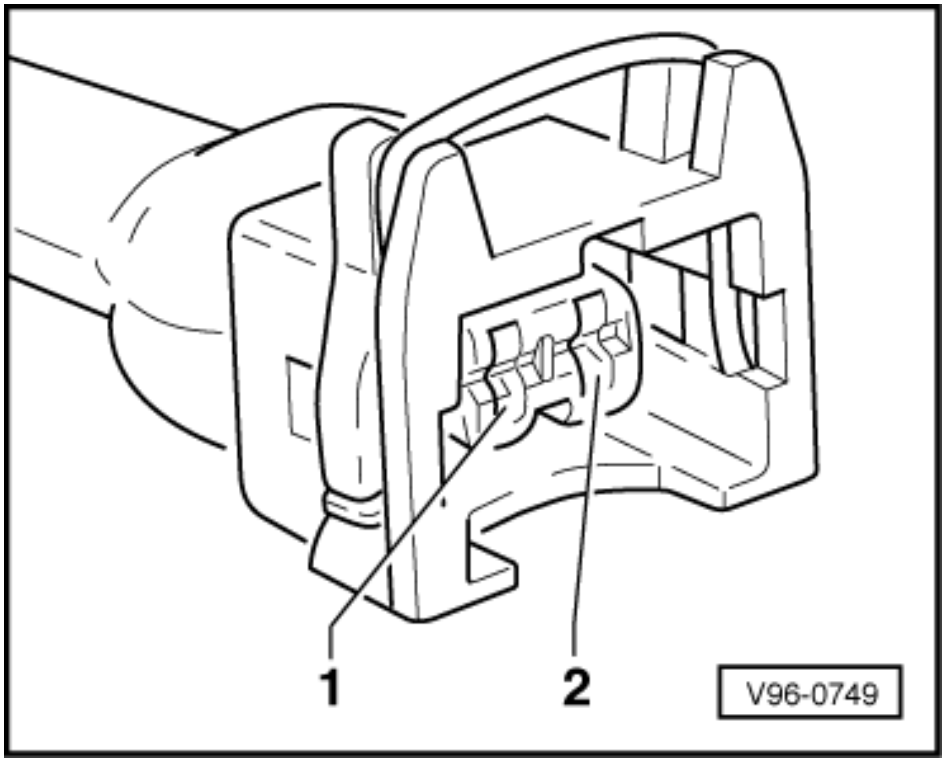
Testing activation



- -> Connect voltage tester V.A.G 1527 B between contacts 1 (positive) and 2 using test cables from V.A.G 1594 A.
- Start final control diagnosis and activate solenoid valves for camshaft timing control.

=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis

- The LED should flash.

If the LED lamp does not flash or if it lights up continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit.Do notconnect to the engine control unit itself.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation

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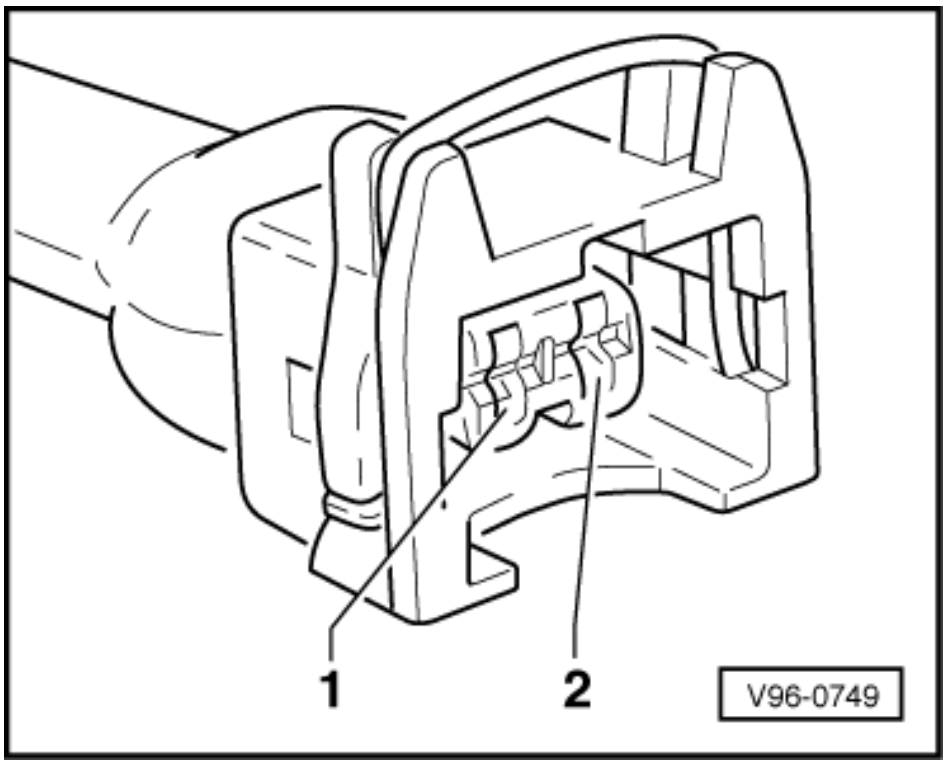

- -> Test for open circuit and short to positive or earth in the following wiring connections:

Inlet camshaft timing adjustment valve -1- -N205 and inlet camshaft timing adjustment valve -2- -N208

Connector Contact	Test box V.A.G 1598/31 Socket
2	=> Current flow diagrams, Electrical fault-finding and Fitting locations

- Eliminate open circuit or short circuit to earth if necessary.

If the wiring is OK:

- Fit a new engine control unit

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection and ignition system; Renewing engine control unit Servicing Motronic injection and ignition system Renewing engine control unit

If no fault is found:

- Install a new mechanical camshaft adjuster.

1.11 - Removing and installing camshafts and camshaft adjusters

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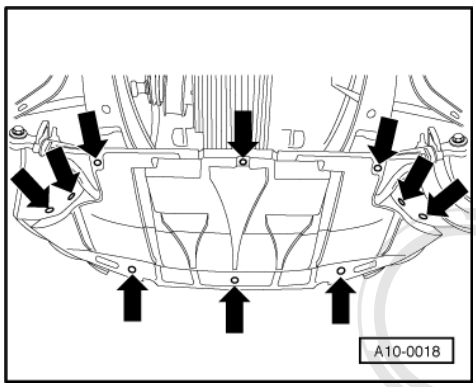
Removing

- Cylinder head installed



- -> Remove noise insulation panel -arrows-.
- Remove front bumper

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Move lock carrier to service position

=> General body repairs; Repair Group 50; Removing and installing lock carrier; Service position of lock carrier

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- Remove ribbed belt => Page 35 .
- Remove toothed belt => Page 37 .

Left cylinder head:

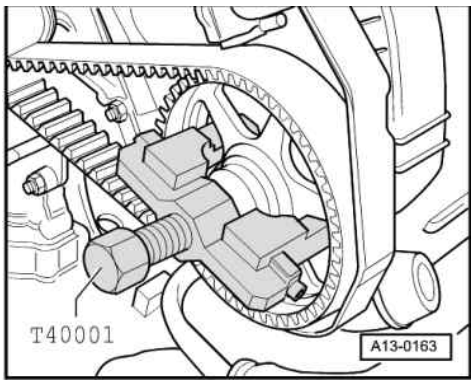
- Remove left-hand cylinder head cover=>Page 72

Right cylinder head

- Remove right-hand cylinder head cover=>Page 75

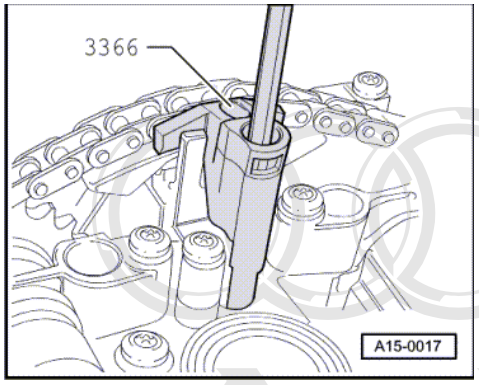
All:

- Unbolt Hall sender housing (10 Nm).
- Remove bolt securing Hall sender rotor (20 Nm) and carefully lever off rotor using a screwdriver.
- Insert camshaft clamp 3391 in the securing plates of the two camshafts.
- Loosen both camshaft bolts and unscrew approx. 5 turns.
- Take out camshaft clamp 3391.



- -> Pull off both camshaft sprockets with special tool T40001.
- Using a screwdriver, carefully lever oil feed pipes for camshaft bearings out of camshaft bearings.

Make sure that the retaining catches do not break off when levering out the oil pipes.



- -> Secure camshaft adjuster using retainer for chain tensioner 3366.

Note:

Do not overtighten retainer for chain tensioner, otherwise camshaft adjuster can be damaged.

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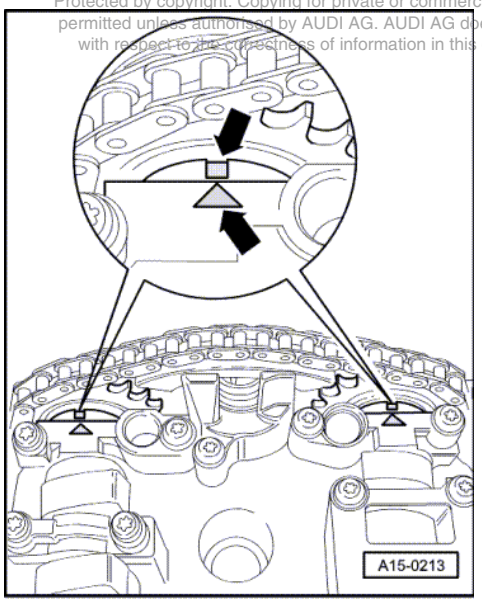
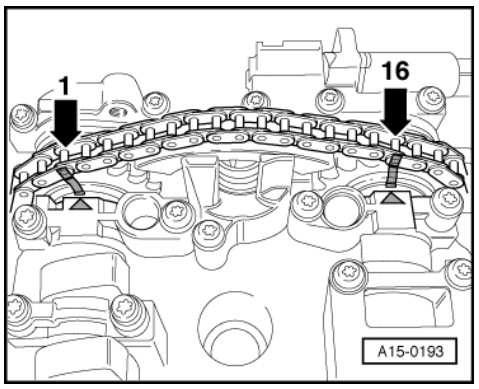


- -> Check TDC position of camshafts once again.

Note:

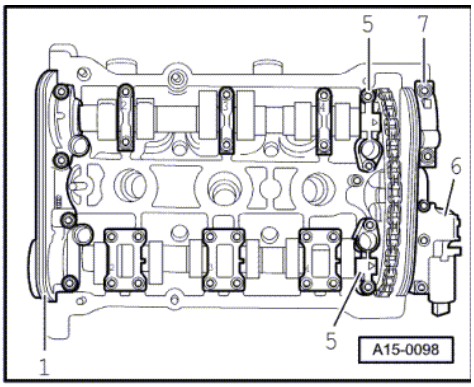
The two markings on the camshafts must be in line with the two arrows on the bearing caps.

- Clean drive chain and camshaft chain sprockets in the vicinity of the arrows on the bearing caps and mark the position of the chain on the sprockets with paint opposite the two arrows.



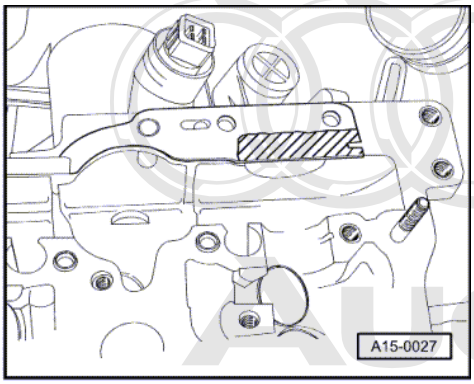
Notes:

- -> The distance between the two arrows (and thus between the paint markings) is 16 rollers on the chain.
- The notch on the exhaust camshaft is offset slightly towards the inside in relation to chain roller -1-.
- Do not mark the chain with a centre punch or by making a notch or similar.



- -> Unscrew bolts securing camshaft adjuster -6-.
- Remove bearing caps 1, 3, 5 and 7 from inlet and exhaust camshafts and place them in the correct order on a clean surface.
- Slacken off bearing caps 2 and 4 alternately and in diagonal sequence, and remove from both camshafts.
- Take out both camshafts together with the camshaft adjuster.

Installing



- -> Renew rubber/metal gasket for camshaft adjuster and apply a thin coat of sealant "D 454 300 A2" to the shaded area.

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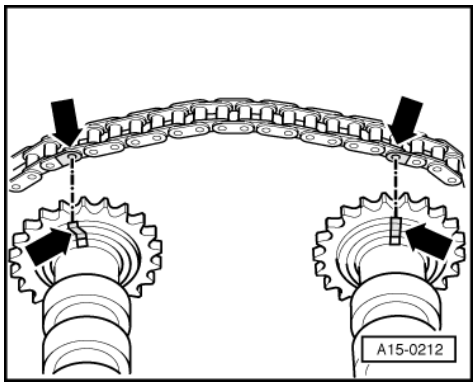
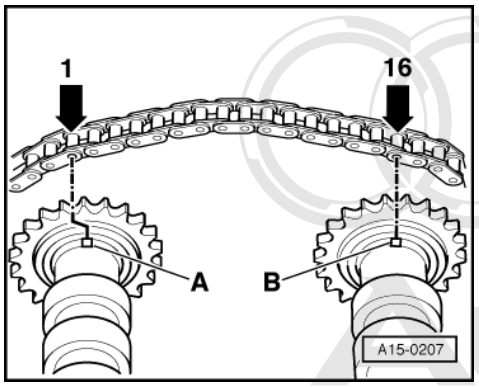


- Fit drive chain on camshaft sprockets as follows:
  - -> When the old chain is being used again, fit the chain so that the paint parkings are in line.



- -> When a new chain is being installed, the distance between the notches -A- and -B- on the camshafts must be 16 rollers on the chain. The illustration shows the exact positions of the 1st and 16th rollers on the sprockets.
- Notch -A- is offset slightly towards the inside in relation to chain roller -1-.

Insert the camshaft adjuster inside the chain (second mechanic required).
Locate camshafts with chain and camshaft adjuster in cylinder head.
Oil camshaft bearing surfaces.

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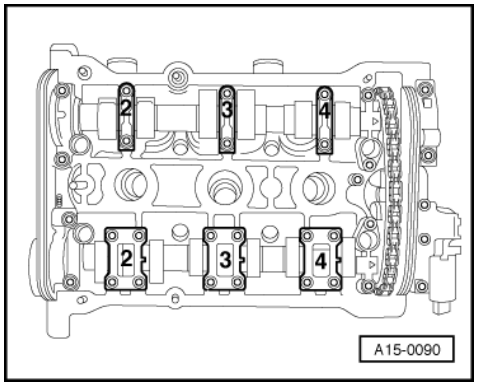
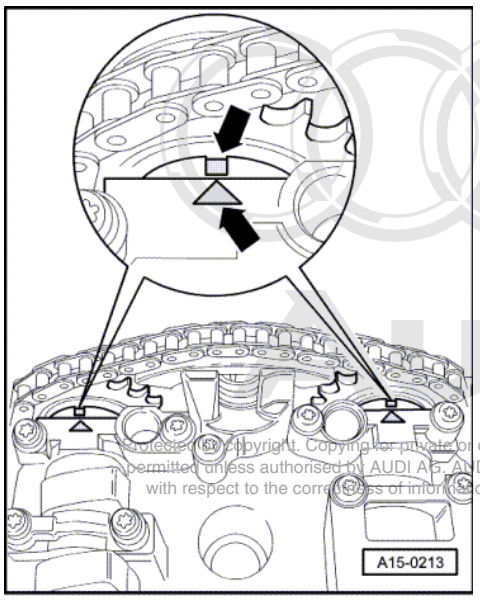
Notes:

- The dowel sleeves for the bearing caps and camshaft adjuster must be in the cylinder head.
- Install the bearing caps so that the markings on the bearing caps can be read from the inlet side of the cylinder head.



- Tighten bolts securing chain tensioner (watch position of dowel sleeves).
- -> Tighten bearing caps 2 and 4 of inlet and exhaust camshafts alternately and in diagonal sequence (watch position of dowel sleeves).
- Fit the two bearing caps next to the chain sprockets on the inlet and exhaust camshafts.



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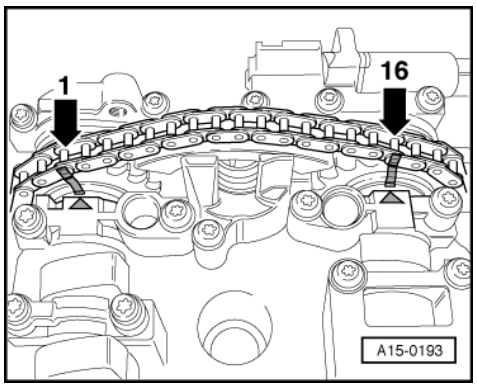
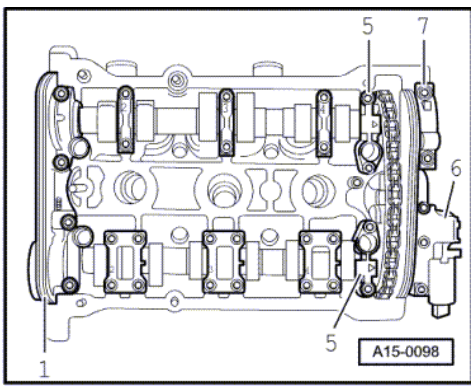
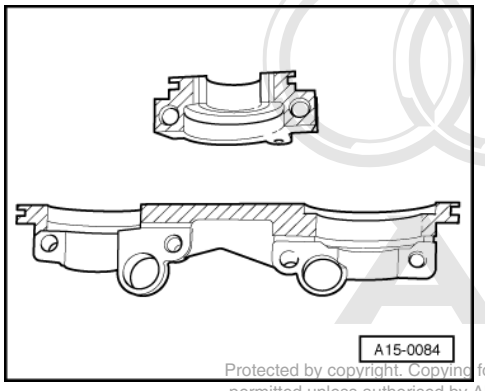
- Check correct setting of camshafts:
  - -> The two markings on the camshafts must be in line with the two arrows on the bearing caps -arrows-.



  - -> The distance between the two arrows on the bearing caps (or between the paint markings) is 16 rollers on the chain.
  - The notch on the exhaust camshaft is offset slightly towards the inside in relation to chain roller -1-.



- -> Prepare shaded areas on double bearing cap -1- and bearing cap -7- .....



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- -> ... by applying a thin coat of sealant and install bearing caps (watch position of dowel sleeves).

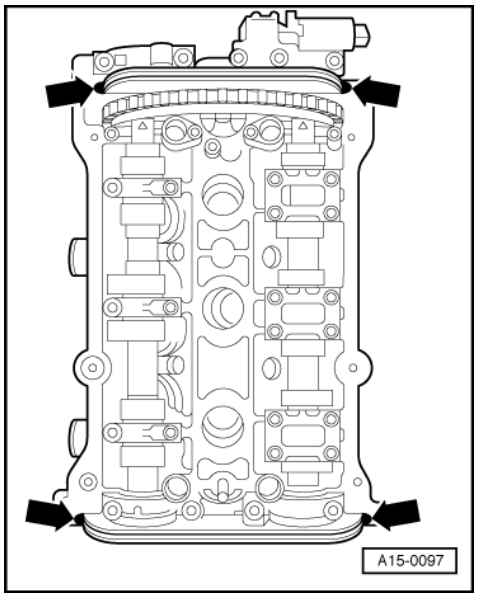
• Sealant

=> Parts catalogue

- Install remaining bearing caps (watch position of dowel sleeves).
- Fit new oil feed pipes for camshaft bearings.
- Fit new oil seals for inlet and exhaust camshafts; installing => Page 64 .
- Remove retainer for chain tensioner 3366.

Notes:

- When new tappets have been installed the engine must not be started for about 30 minutes. The hydraulic compensation elements must settle (otherwise valves will strike pistons). Then turn crankshaft two full revolutions before starting.
- After working on the valve gear, turn over the engine carefully at least two revolutions by hand to ensure that none of the valves make contact when the starter is operated.



- -> Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

- Sealant

=> Parts Catalogue

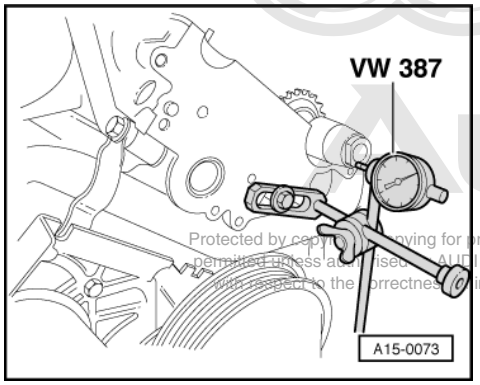
- Install cylinder head covers => Page 72 .
- Install toothed belt => Page 37 .
- Install ribbed belt => Page 35 .

Tightening torques

Component		Nm
Bolts	M6	10
	M8	20
Except for the following:		
Bearing caps to cylinder head		10
Camshaft adjuster to cylinder head		10
Hall sender rotor to camshaft		25
Hall sender housing to cylinder head		10
Camshaft sprocket to camshaft		55
Cylinder head cover		10

1.12 - Checking camshaft axial clearance

- Remove camshafts => Page 106 .



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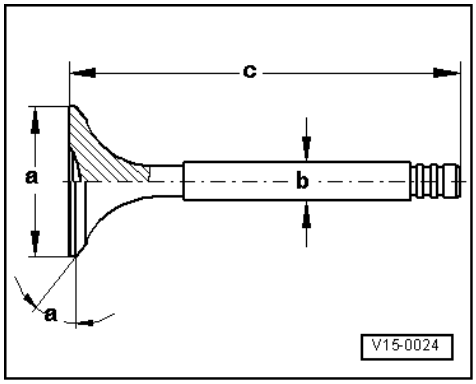
- Remove tappets.
- Fit camshafts in cylinder head without drive chain and secure by tightening bearing caps 2 and 4.
- -> Attach dial gauge to cylinder head with universal dial gauge bracket VW 387.
- Press camshaft against dial gauge by hand.
- Set dial gauge to -0-.
- Press camshaft away from dial gauge.
- Note reading on gauge:

New	Wear limit
0.05 ... 0.15 mm	0.20 mm

1.13 - Valve dimensions



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Note:

Valves must not be reworked. Only grinding-in (lapping) is permitted.

Dimension	Inlet valve	Exhaust valve
a = ømm	26.8 ... 27.0	29.8 ... 30.0
b = ømm	5.96 ... 5.97	5.94 ... 5.95
c = mm	104.84 ... 105.34	103.64 ... 104.14
α = <°	45	45

Worn sodium-cooled exhaust valves must be treated as follows before disposal:
Saw the valves into two sections with a metal saw at a point between the centre of the valve stem and the valve head. The valves must not come into contact with water when this is done. Then throw the valves into a bucket of water (not more than ten at a time) and step back, because a sudden chemical reaction occurs when the sodium filling burns. After this treatment the valves can be disposed of in the normal way.

1.14 - Checking hydraulic bucket tappets

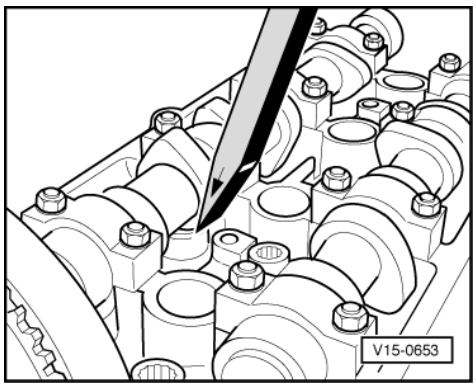
Notes:

- Renew defective tappets complete (tappets cannot be adjusted or repaired).
- When new tappets have been installed the engine must not be started for about 30 minutes (otherwise valves will strike pistons).
- Irregular valve noises when starting engine are normal.

- Start engine and run until coolant temperature reaches approx. 80°C.
- Increase engine speed to about 2500 rpm for approx. 2 minutes: if necessary, perform road test.

If the hydraulic tappets are still noisy, locate defective tappets as follows:

- Remove cylinder head cover.
- Rotate crankshaft clockwise by turning securing bolt for toothed belt sprocket until the cams of the tappets to be checked are pointing upwards.



- Measure clearance between cam and tappet.
- -> Push tappet down with a wooden or plastic wedge. If a 0.20 mm feeler gauge can then be inserted between camshaft and tappet, renew tappet if necessary: removing and installing camshafts and camshaft adjuster=> Page 106

Note:

If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be renewed => Page 131 .

1.15 - Renewing valve stem seals

- Cylinder head installed

- Remove ribbed belt => Page 35 .
- Remove toothed belt => Page 37 .
- Remove camshafts => Page 106 .
- Remove tappets and put them down with the contact surface downwards. Ensure that tappets are not interchanged.
- Remove spark plugs.
- Set piston of relevant cylinder to bottom dead centre.

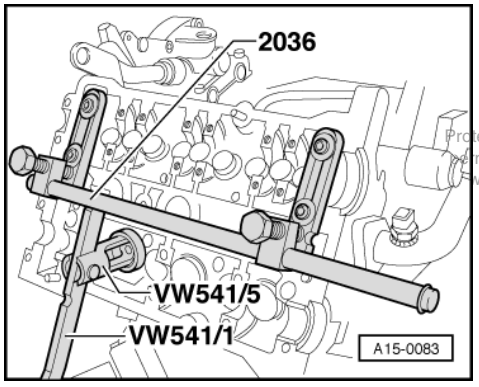
Note:

Tight cotters can be released by tapping lightly on the valve lever with a hammer.

Exhaust side

Note:

Before attaching the valve assembly appliance, remove the two studs in the centre of the cylinder head and the three upper studs (inlet side) for securing the cylinder head cover.



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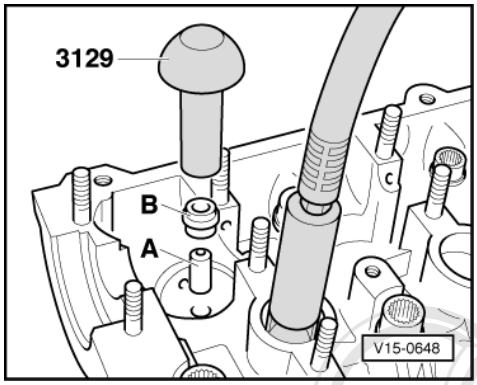
- Screw pressure hose VW 653/3 with sealing ring finger-tight into the spark plug thread of the relevant cylinder, and maintain a constant pressure of at least 6 bar.
- -> Attach valve assembly appliance 2036 as illustrated: use M6 x 40 bolts with large washers.
- Remove valve spring using valve lever VW 541/1 and thrust piece VW 541/5.

- Take out valve spring and valve spring plate.
- Pull off valve stem seal with 3047 A.



- -> To prevent damage to the new valve stem seals, place plastic sleeve -A- on the valve stem.
- Lightly oil sealing lip.
- Insert valve stem seal -B- (without oiling outside of seal) into fitting tool 3129 and carefully push it down onto the valve guide.
- When fitting new valves, lightly oil valve stems before installing.

Inlet side

Note:

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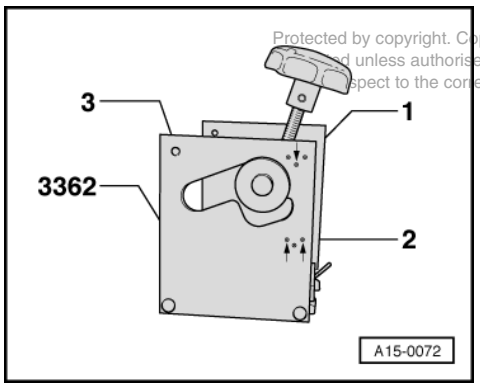
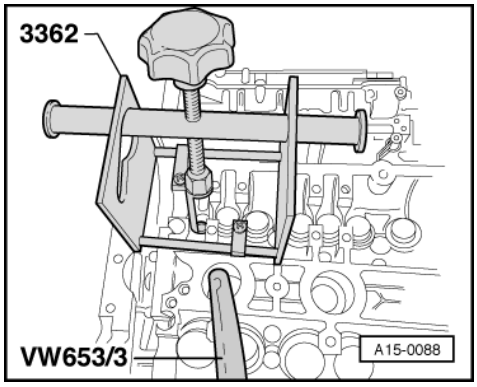


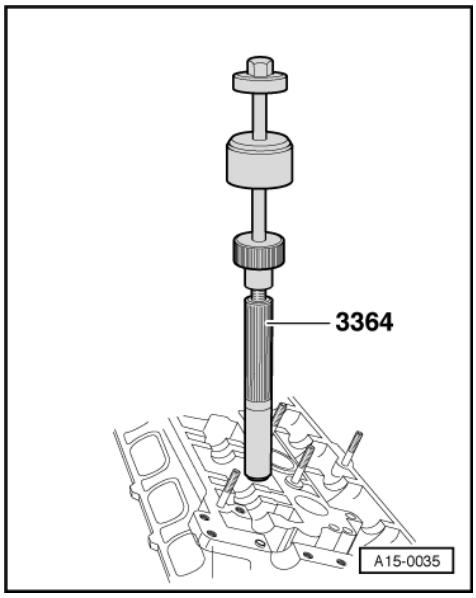
The inlet valves are installed in the cylinder head at different angles.

-> Valve spring compressor 3362 can be set accordingly to two different positions:

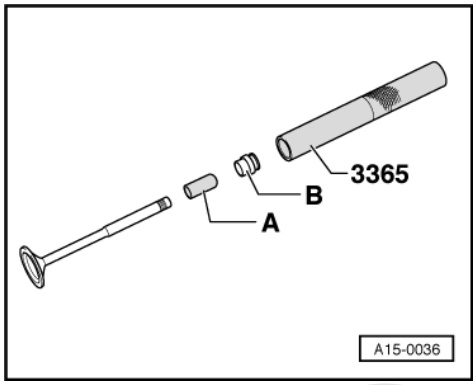
1 - Upper position for centre valve
2 - Lower position for the two outer valves
3 - Threads on each side to take M6 x 25 bolts for securing spring compressor to cylinder head



- -> Mount spring compressor 3362 on cylinder head with the two bolts supplied, as in illustration.
- Screw pressure hose VW 653/3 with sealing ring finger-tight into the spark plug thread of the relevant cylinder, and maintain a constant pressure of at least 6 bar.
- Set position of spring compressor for the relevant valve, and remove valve spring using threaded spindle.



- -> Pull off valve stem seal using 3364.



- -> To prevent damage to the new valve stem seals, place plastic sleeve -A- on the valve stem.
- Lightly lubricate sealing lip with oil.
- Insert valve stem seal -B- (without oiling outside of seal) into fitting tool 3365 and carefully push it down onto the valve guide.
- When fitting new valves, lightly oil valve stems before installing.

Reworking valves

Valves must not be reworked. Only grinding-in (lapping) is permitted.

Important
Note precautions required when disposing of sodium-cooled exhaust valves => Page 114 .

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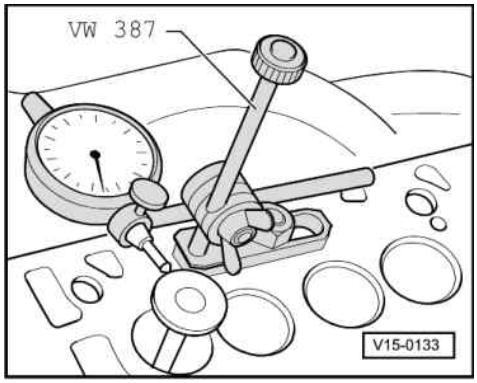
1.16 - Checking valve guides

When repairing engines or cylinder heads with leaking valves, it is not sufficient to reface the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high-mileage engines.



- -> Insert valve into valve guide so that end of valve stem is flush with end of guide. The valve stems have different diameters, so only use an inlet valve in an inlet guide and an exhaust valve in an exhaust guide.
- Measure the amount of rock.

Wear limit

Inlet valve guide	Exhaust valve guide
0.8 mm	0.8 mm

If the wear limit is exceeded, renew cylinder head.

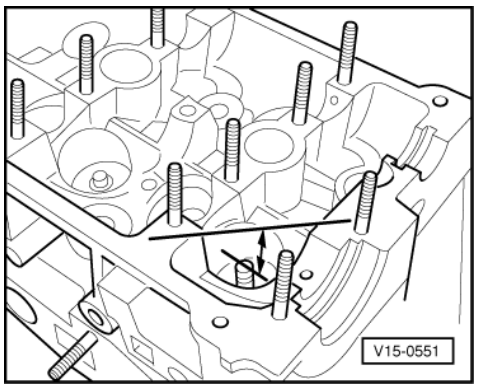
1.17 - Reworking (refacing) valve seats

Notes:

- The valve seats should only be reworked just enough to produce a good seating pattern.
- Calculate the maximum permissible reworking dimension before reworking.
- If the reworking dimension is exceeded, the function of the hydraulic tappets can no longer be guaranteed and the cylinder head should be renewed.

Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.



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Note:

If the valve is to be renewed as part of a repair, use a new valve for the calculation.

- -> Measure distance between end of valve stem and top surface of cylinder head (illustration shows a 4-valve head).
- Calculate maximum permissible reworking dimension from measured distance and minimum dimension.

Minimum dimensions		
Outer inlet valve	Centre inlet valve	Exhaust valve
32.2 mm	33.2 mm	33.0 mm

Measured distance minus minimum dimension
= maximum permissible reworking dimension.

Example	
Outer inlet valve	
Measured distance	33.0 mm
Minimum dimension	- 32.2 mm
Maximum permissible reworking dimension	= 0.8 mm

Note:

If the measured distance is less than the minimum dimension, repeat the measurement with new valves, or renew cylinder head.

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17 - Lubrication

1 - Removing and installing parts of lubrication system

1.1 - Removing and installing parts of lubrication system

Notes:

- If large quantities of metal particles or other deposits (caused, for example, by partial seizure of the crankshaft or conrod bearings) are found in the engine oil when performing repairs, clean the oil passages thoroughly and renew the oil cooler in order to prevent further damage from occurring later.
- The oil level must not be above the max. mark - otherwise this can cause damage to the catalytic converter. Markings => Page 162
- Always replace O-rings, gaskets and oil seals when performing repairs.

Checking oil pressure =>Page 161

Oil system capacity:

=> Emissions test binder

Viscosity grades and oil specifications:

=> Maintenance manual

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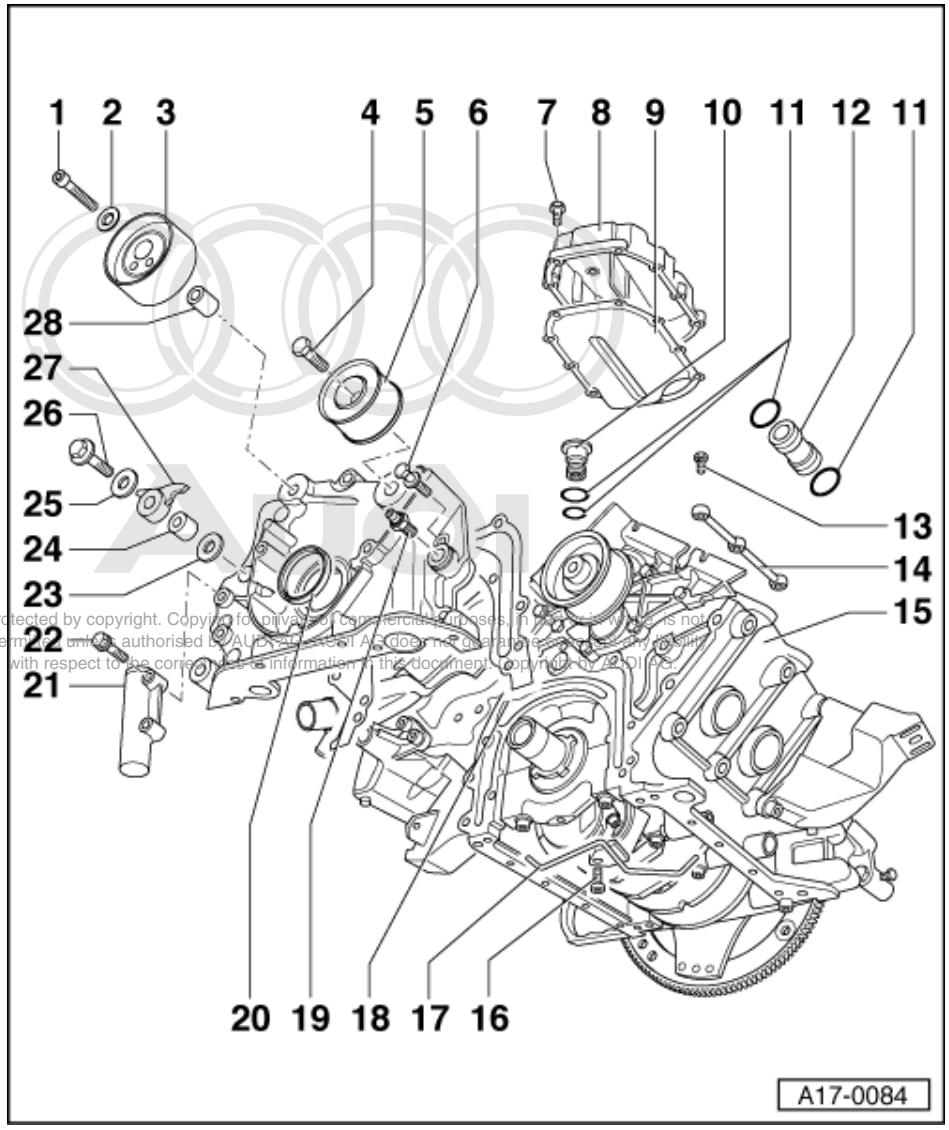
1.2 - Crankcase breather and oil spray jets



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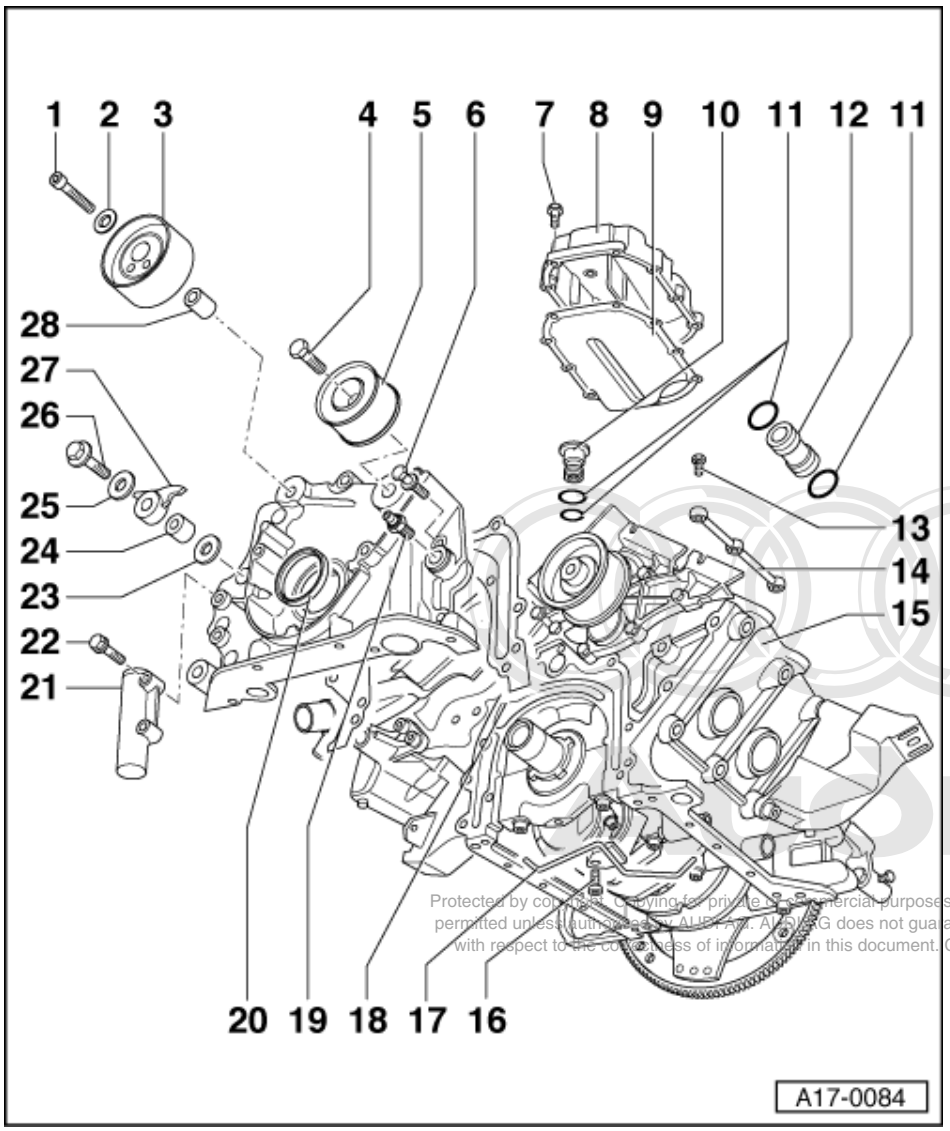
Removing and installing oil pump, sump, oil filter and oil cooler=>Page 127

1 **Bolt, tightening torque: 20 Nm**
2 **Washer**
3 **Tensioning roller**
4 **Bolt, tightening torque: 45 Nm**
5 **Idler wheel**
- For toothed belt



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6 Bolt

- M6 Tightening torque: 10 Nm
- M8 Tightening torque: 20 Nm

7 Bolt, tightening torque 10 Nm

8 Breather housing

9 Gasket/breather plate

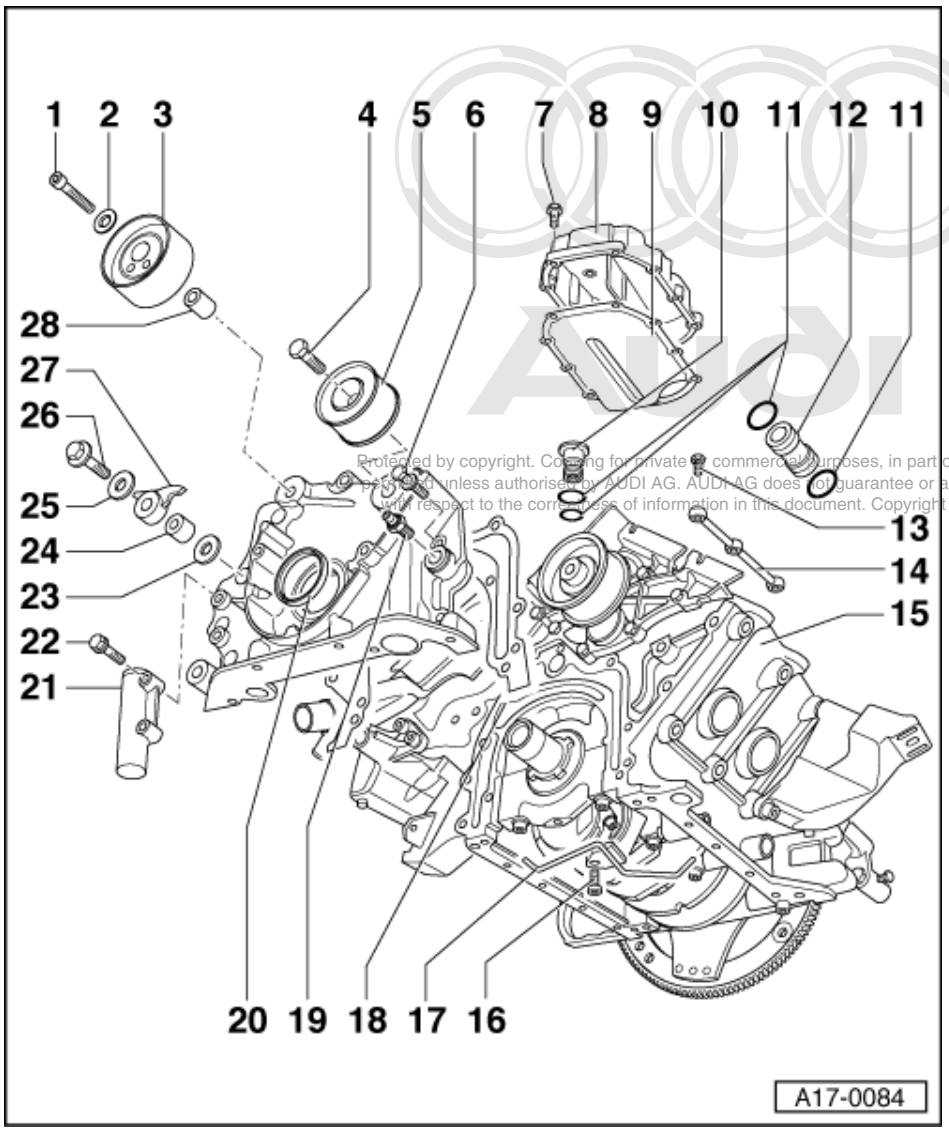
- Renew

10 Oil check valve

- Tightening torque: 25 Nm

11 Seal

12 Connector



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13 Banjo bolt

- Tightening torque: 15 Nm

14 Oil distribution pipe

- For oil spray jets for piston cooling

15 Cylinder block

16 Bolt, tightening torque 10 Nm

- Apply locking fluid when installing

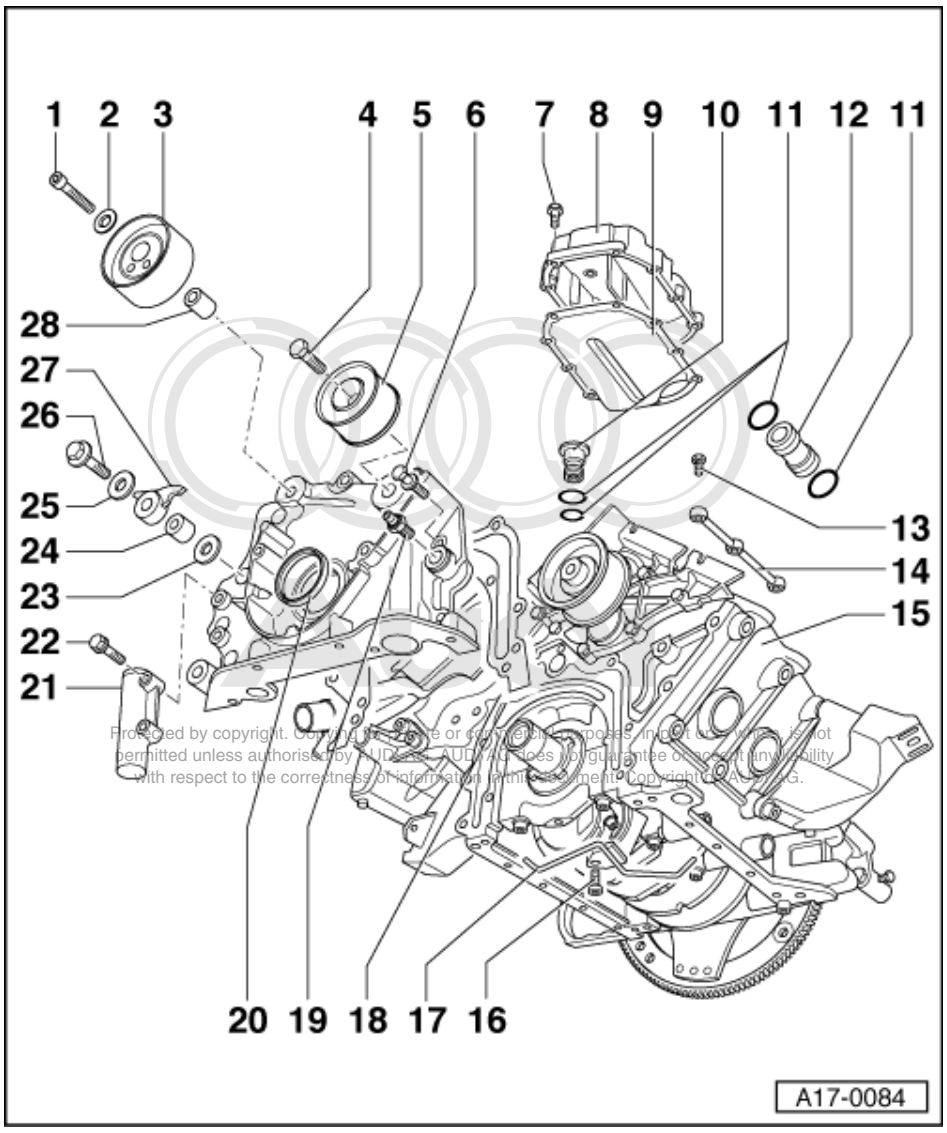
=> Parts Catalogue

17 Oil spray jet

- For piston cooling

18 Gasket

- Metal gasket
- Renew



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19 Oil temperature sender (-G8), tightening torque 10 Nm

- For oil temperature gauge
- White
- If seal is leaking, cut open with pliers and replace.

20 Oil seal

- Renewing => Page 64

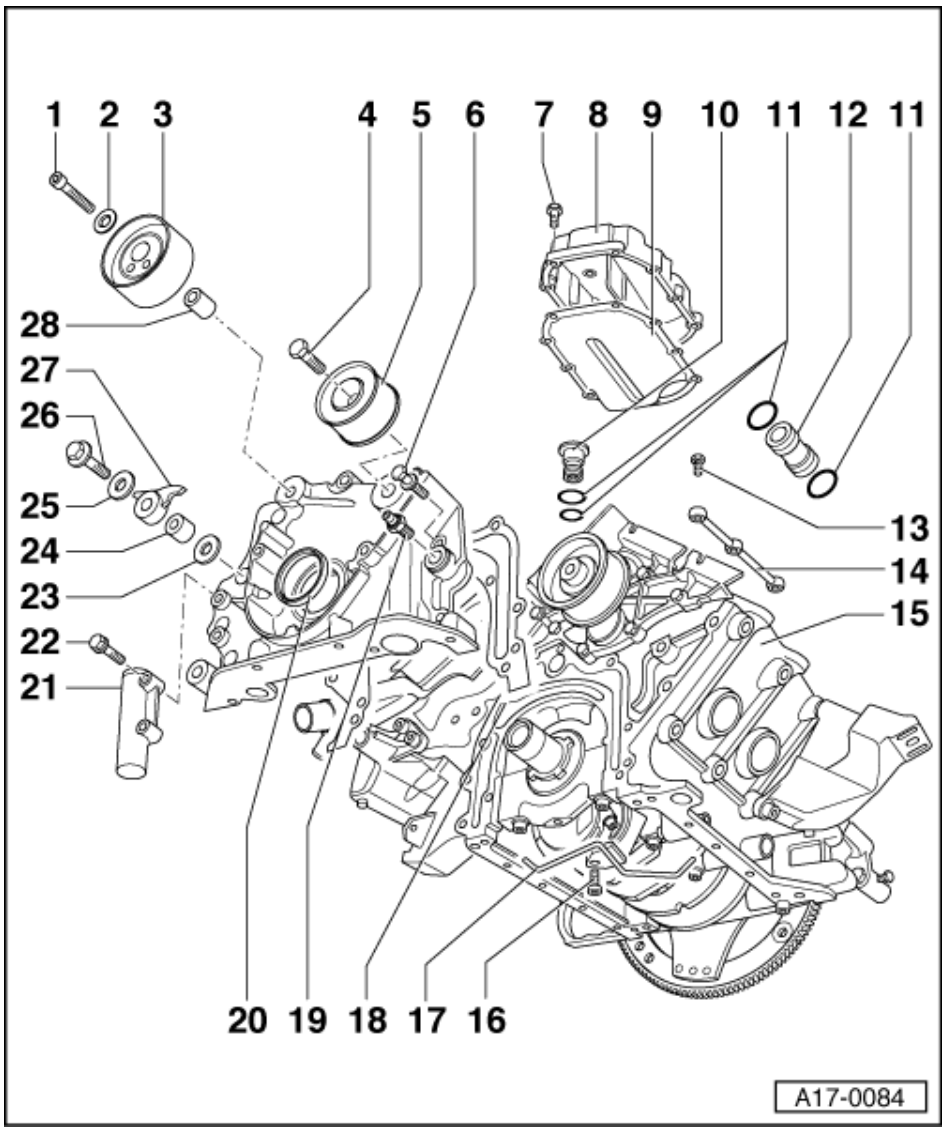
21 Tensioner

- Secure in position before removing
  => Fig. 1

22 Bolt, tightening torque: 10 Nm

- Apply locking fluid when installing

=> Parts Catalogue



23 Washer

24 Bearing bush

- For tensioning lever

25 Washer

26 Bolt, tightening torque: 25 Nm

27 Tensioning lever

28 Bearing bush

- For tensioning roller

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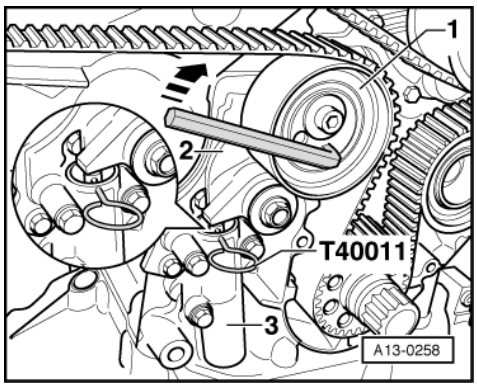

Fig.1 Using an 8 mm hexagon key, turn toothed belt tensioning roller -1- clockwise in direction of arrow until tensioning lever -2- compresses tensioner -3- far enough to enable special tool T40011 to be inserted in the drilling and in the plunger.

Notes:

- The toothed belt tensioner is oil-damped and can only be compressed slowly by applying gradual pressure.

- Insert special tool T40011 and release toothed belt tensioning roller.

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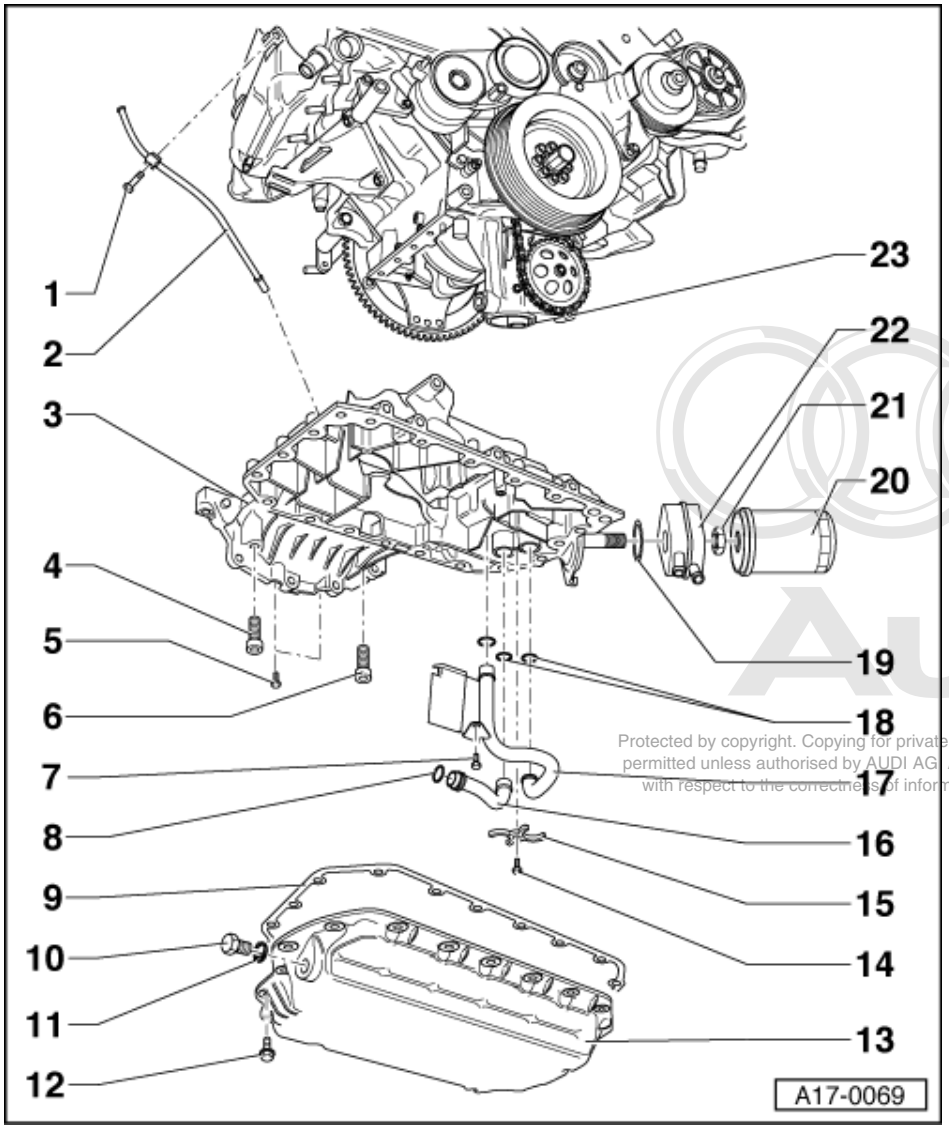
1.3 - Oil pump, sump, oil filter and oil cooler



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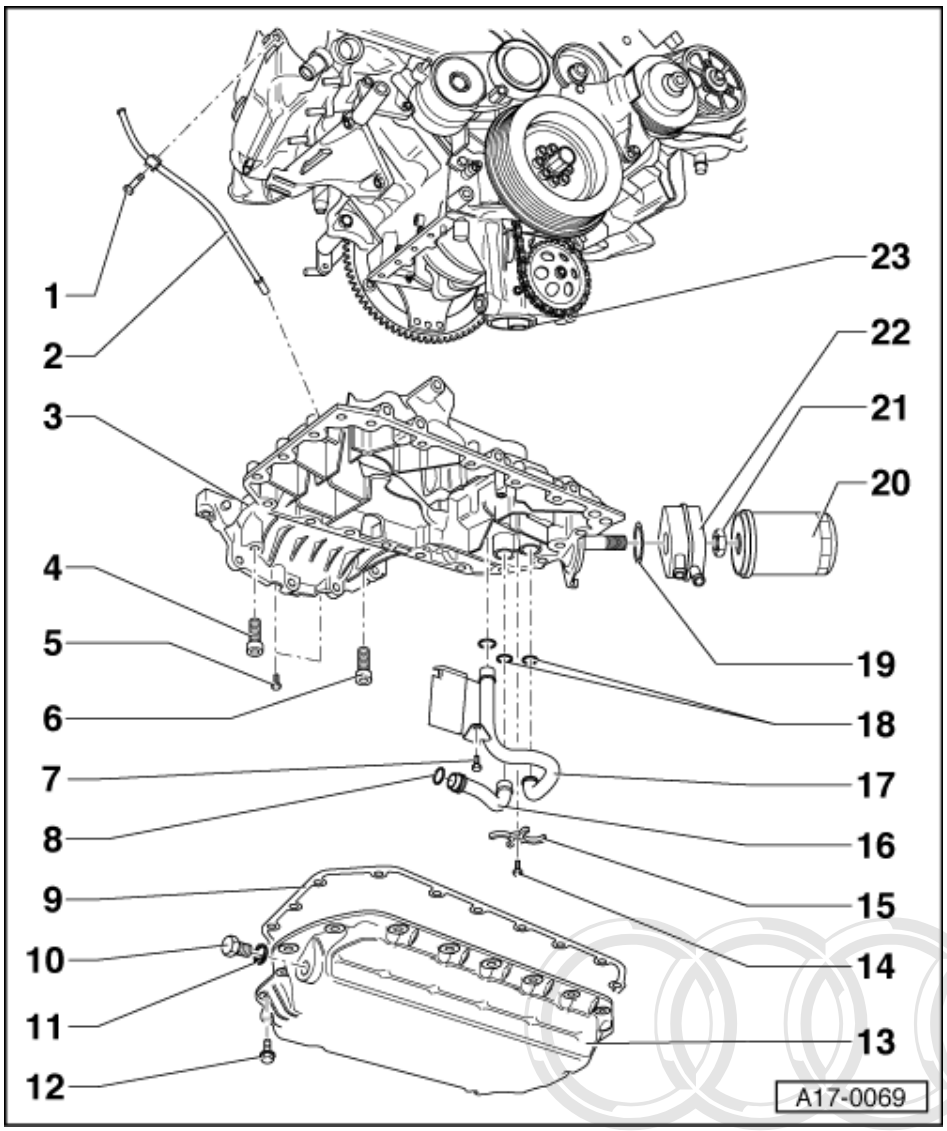
1 **Bolt for dipstick guide tube**
- Tightening torque: 25 Nm

2 **Dipstick guide tube**
- Replace O-ring

3 **Sump - upper section**
- Removing and installing=>Page 143

4 **Hexagon socket head bolt M8**
- Tightening torque: 20 Nm

5 **Hexagon bolt M6**
- Tightening torque: 15 Nm



6 Hexagon socket head bolt M8

- Tightening torque: 20 Nm
- The coolant drain screw is next to this bolt

7 Hexagon bolt M6

- Tightening torque: 10 Nm

8 O-ring

- Renew

9 Gasket for lower section of sump

- Sealing surfaces should be clean and dry

10 Oil drain plug

- Tightening torque: 30 Nm

11 Seal for oil drain plug

- Renew

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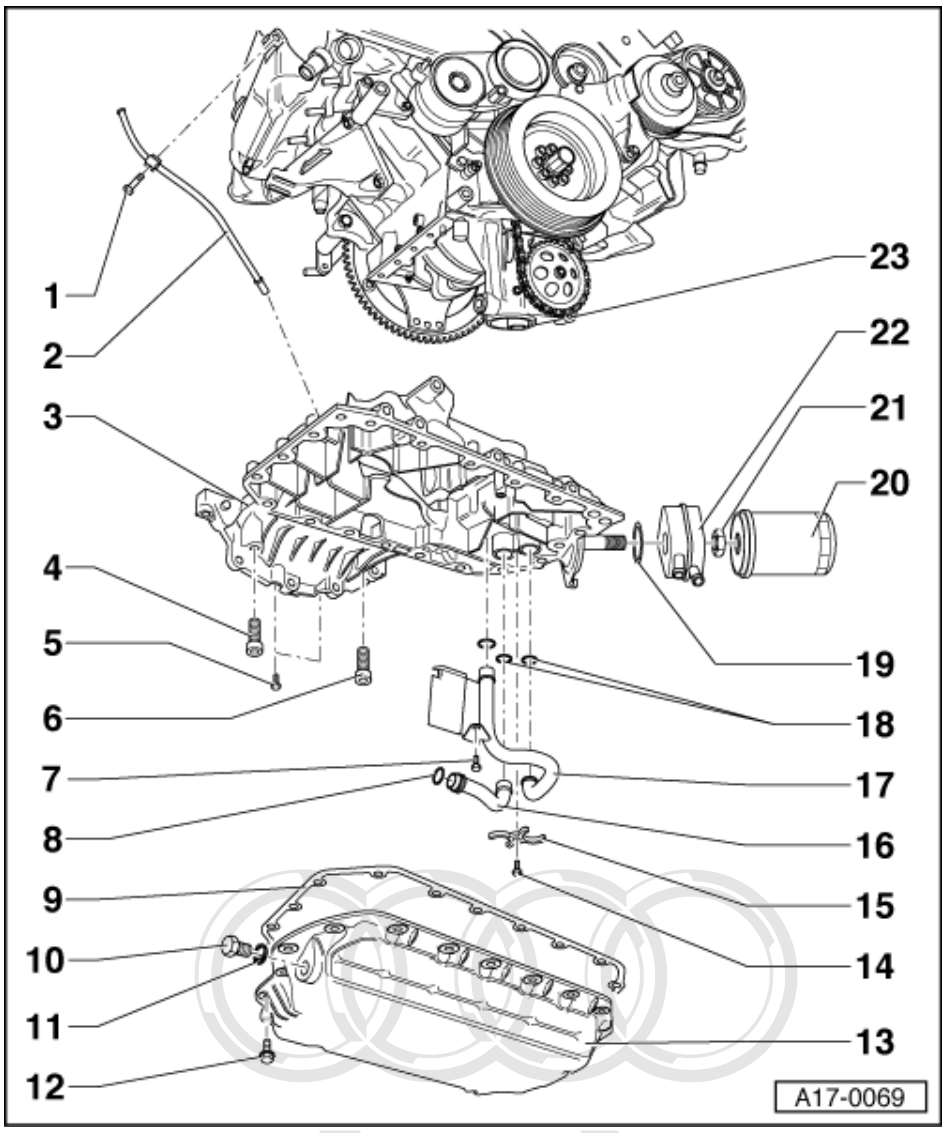

12 Hexagon bolt M6

- Tightening torque: 10 Nm

13 Sump - lower section

14 Hexagon bolt M6

- Tightening torque: 10 Nm

15 Retainer for oil pipes

16 Oil supply pipe

- From pump to oil filter

17 Oil supply pipe

- From oil filter to engine oil system

18 O-ring

- Renew

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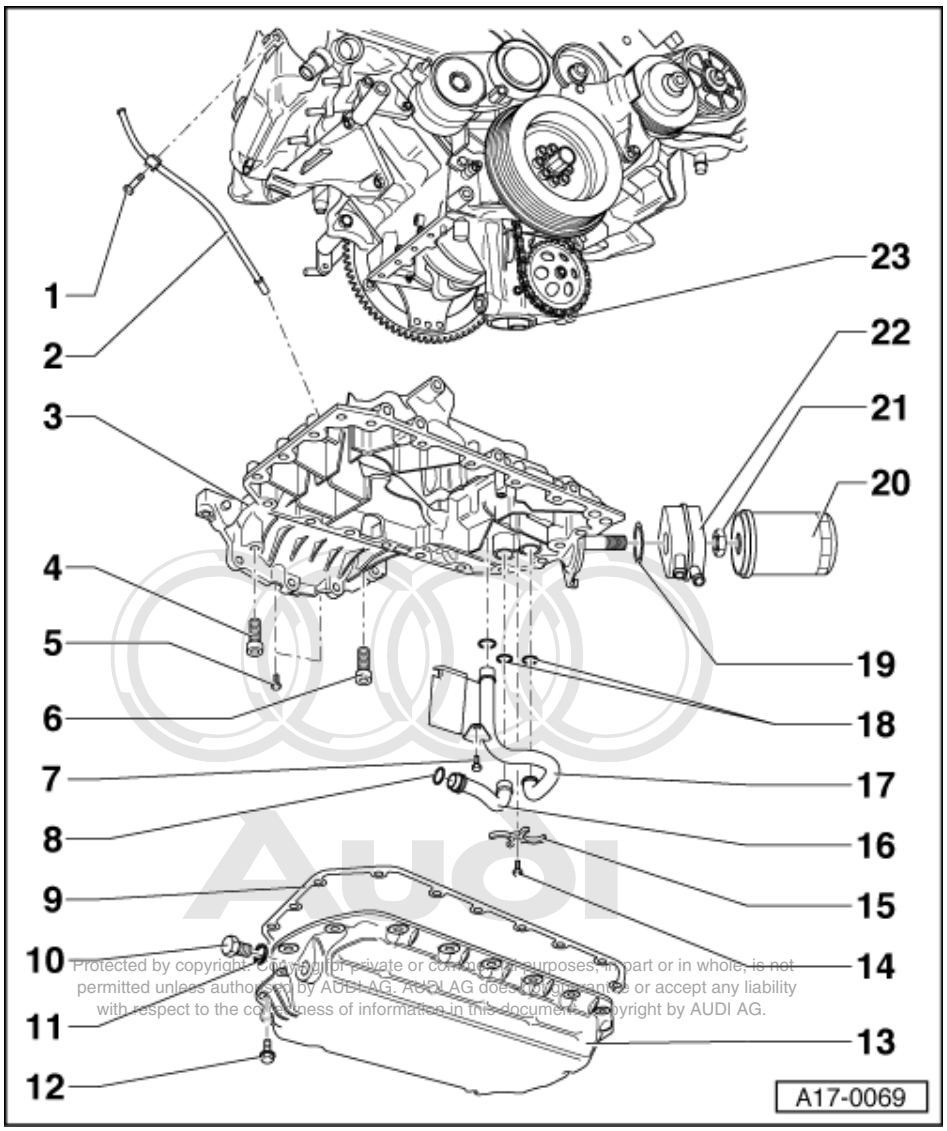

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19 O-ring

- Renew

20 Oil filter

21 Hexagon nut

- Tightening torque: 30 Nm
- Threaded pipe for oil cooler and oil filter is screwed into upper section of sump with 20 Nm tightening torque.

22 Oil cooler

- Ensure O-ring is fitted correctly when installing

23 Oil pump

- Driven off crankshaft via chain
- Tightening torque of chain sprocket to oil pump: 25 Nm
- Tightening torque of oil pump to engine block: 25 Nm

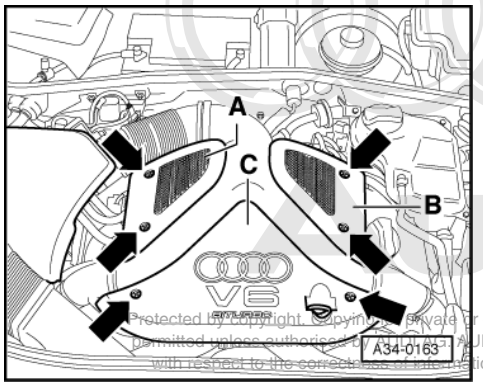
1.4 - Renewing oil check valves

Notes:

If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be renewed.

- All cable ties which are released or cut open when removing the engine must be replaced in the same position when installing the engine.
- Catch drained-off coolant in a clean container for re-use or disposal.
- Renew all gaskets and seals.

Removing



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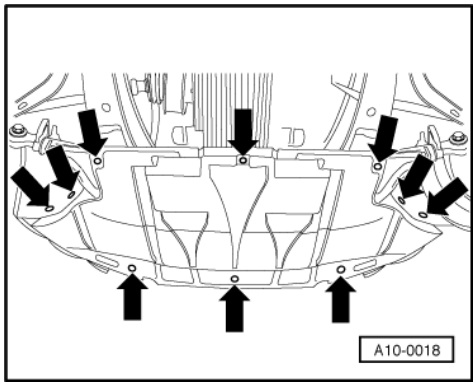
- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.
- Remove cover above air cleaner.

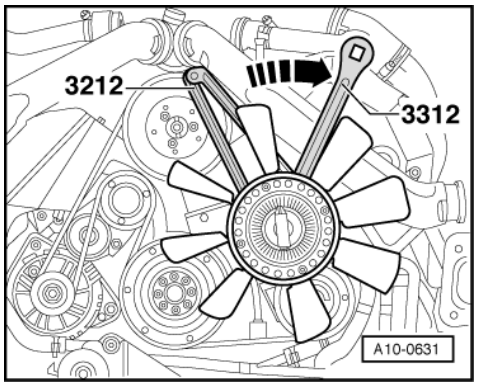


- -> Remove noise insulation -arrows-.
- Drain off coolant => Page 181
- Remove bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

- Move lock carrier to service position

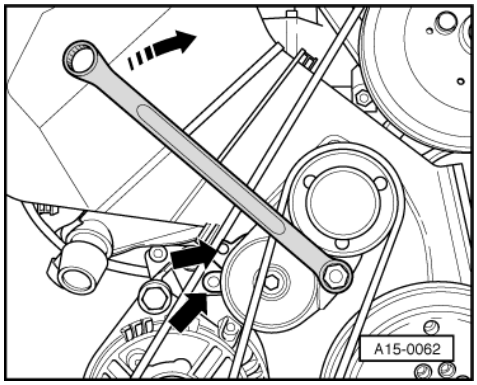
=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position



- -> Remove viscous fan (counter-hold with pin wrench 3212).

Note:

Viscous fan has left-hand thread.

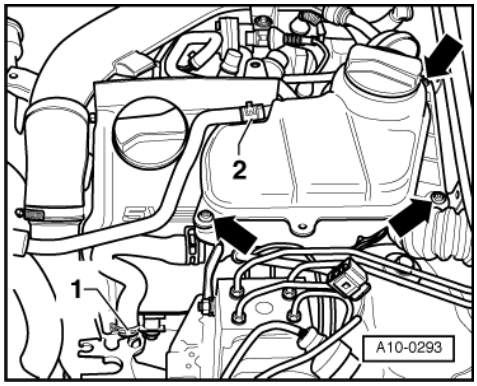


- Mark direction of rotation of ribbed belt.
- -> To slacken ribbed belt, turn to the right using a 17 mm ring spanner until the two holes are aligned with each other -arrow- and hold in position with mandrel 3204.

Note:

Mark direction of rotation of ribbed belt. The belt can break if it runs in the opposite direction when refitted.

- Take off ribbed belt.



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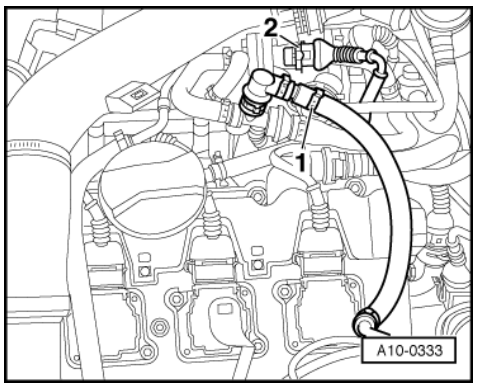
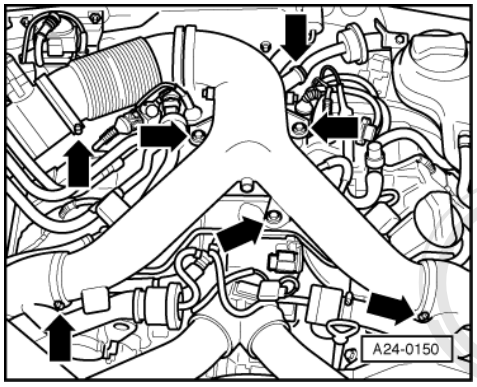
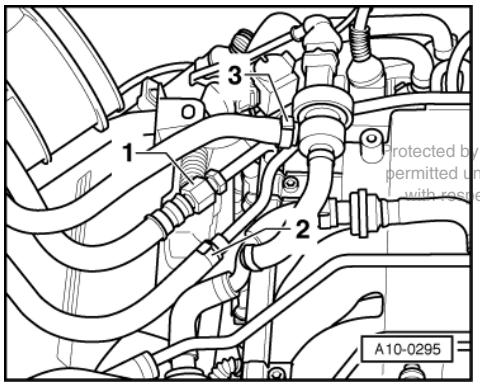
- -> Disconnect water hoses -1- and -2-.
- Remove coolant reservoir (arrows).
- Unplug connector for coolant level monitor.
- Remove cover panel from cylinder head cover (cylinder bank 4-6).



- -> Pull off hose -1- going to vacuum reservoir.



- -> Remove air duct -arrows-.



Warning
Fuel system is under pressure. Before opening the system, place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off ACF valve -3-.

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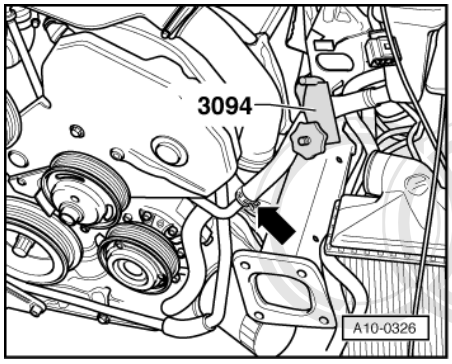

- -> Fit clamp (special tool 3094) on hose from power steering reservoir to power steering pump.
- Disconnect power steering hose -arrow-.

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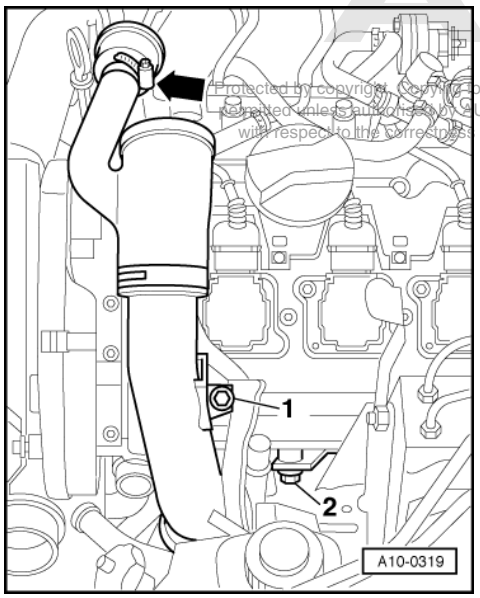
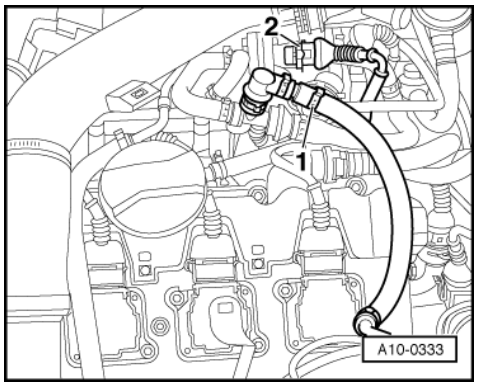


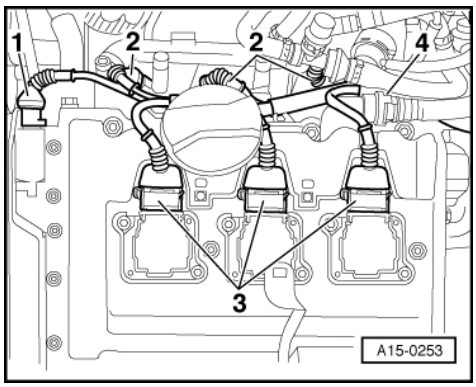
- -> Release hose clamp -arrow-.
- Remove intake pipe -1-.

Notes:

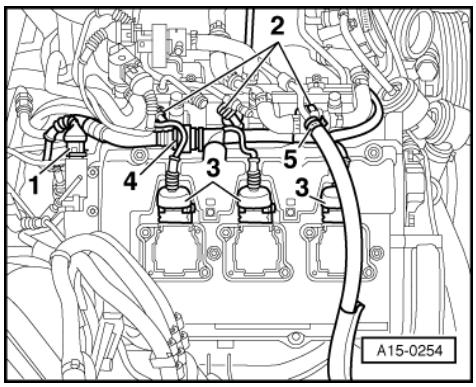
- All hose connections are secured with clips.
- Charge air system must be free of leaks.
- Renew all seals and gaskets



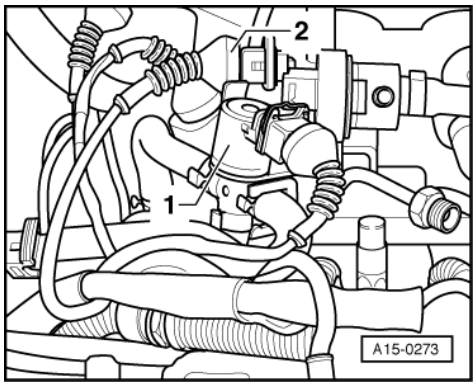
- -> Unplug connector from air recirculation valve -2-.



- -> Unplug connector for camshaft timing control -1- (cylinder bank 4..6).
- Unplug connectors from injectors -2- (cylinder bank 4..6).
- Pull crankcase breather -4- off cylinder head cover (cylinder bank 4..6).



- -> Unplug connectors from injectors -2- (cylinder bank 1..3).
- Pull off hose -5- going to turbocharger intake side.



- -> Unclip solenoid valve for charge pressure control -1-.
- Pull connector off ACF valve -2-.

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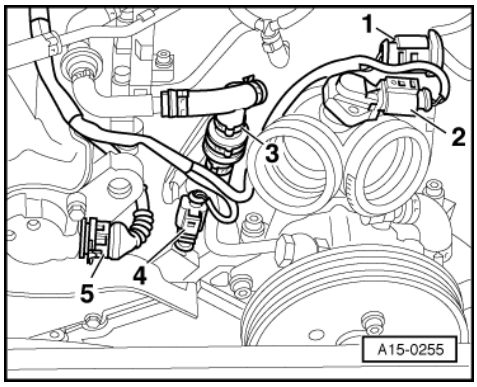
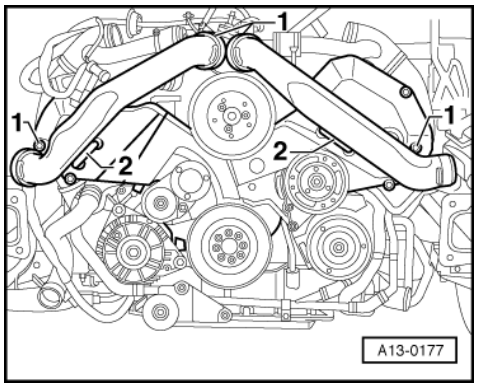


- -> Pull connector off throttle unit -1-.
- Pull connector off charge air sensor -2-.
- Pull off crankcase breather -3-.
- Pull connector off intake air temperature sender -4-.



- -> Remove pressure pipes -1-.

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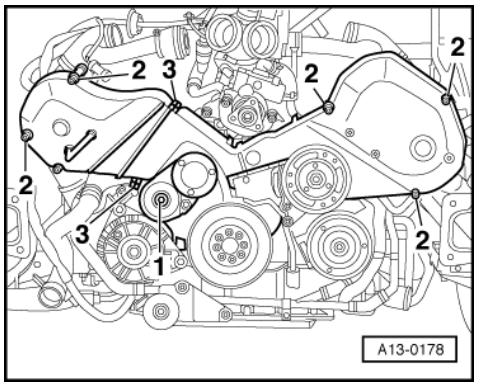
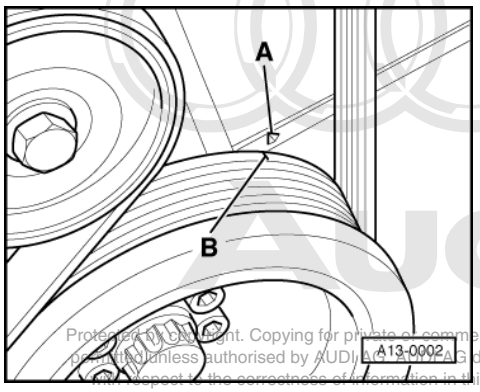
Note:

Watch position of retaining strips -2-.



- -> Remove tensioner -1- for ribbed belt.
- Remove toothed belt guards -2- (left and right).
- Remove toothed belt guard -3- (centre).



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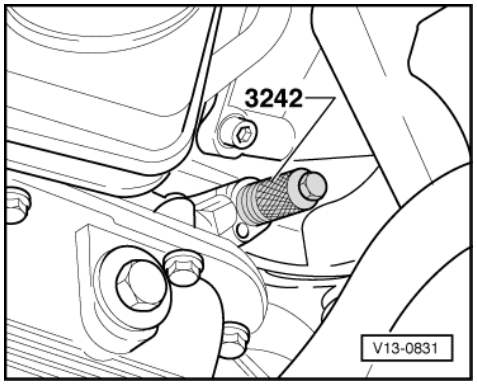
- -> Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

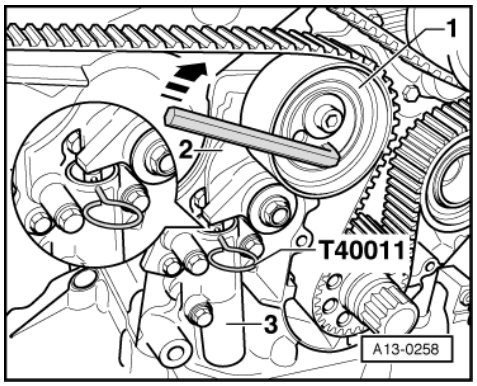
Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: the larger holes in the securing plates on the camshaft sprockets must align opposite one another on the inside. If this is not the case, turn crankshaft one revolution further.



- Remove sealing plug from cylinder block, left.
- The TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.
- -> Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.

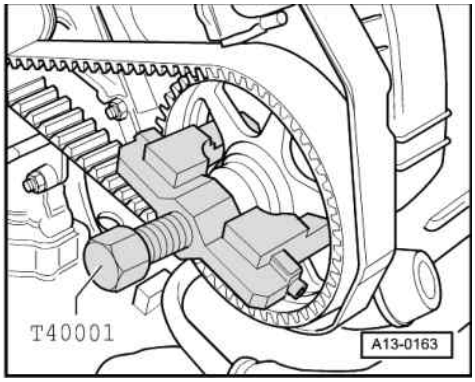
Notes:



- Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when refitted.
- The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.

- -> Using an 8 mm hexagon key, turn toothed belt tensioning roller -1- clockwise in direction of arrow until tensioning lever -2- compresses tensioner -3- far enough to enable special tool T40011 to be inserted in the drilling and in the plunger.

- Insert special tool T40011 and release toothed belt tensioning roller.



- Insert camshaft clamp 3391 in the securing plates of the two camshafts.
- Loosen both camshaft bolts and unscrew approx. 5 turns.
- Take out camshaft clamp 3391.
- -> Pull off both camshaft sprockets with special tool T40001.

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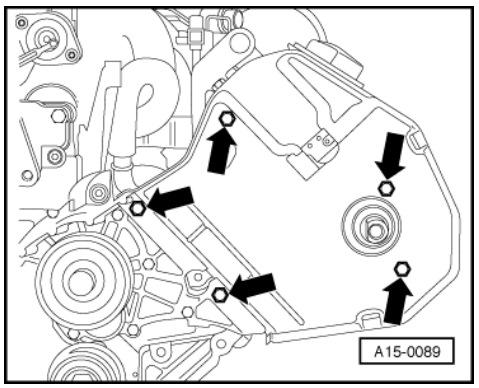
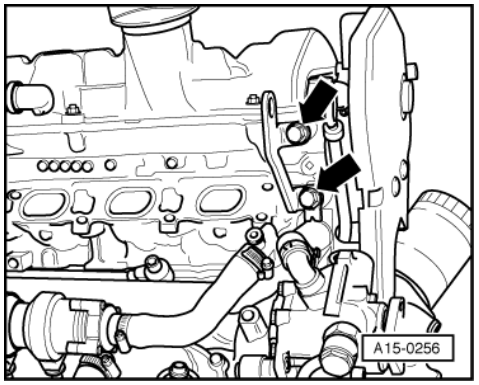
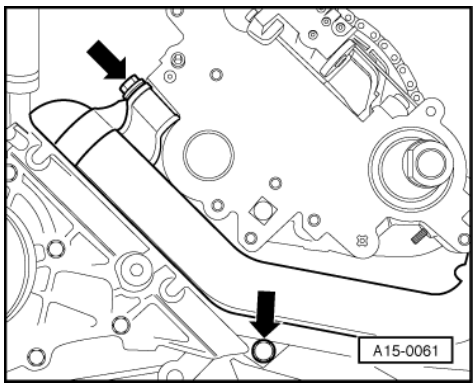


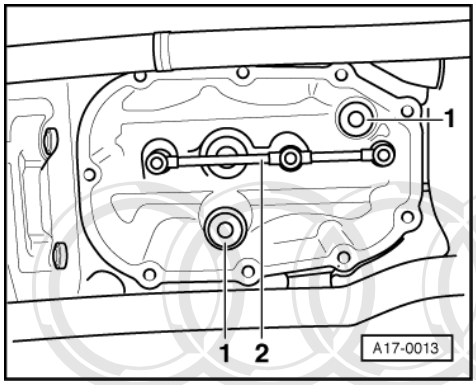
- -> Unbolt rear left toothed belt guard -arrows-.
- Detach intake manifold using special tool 3249.



- -> Unbolt cylinder head lifting bracket with coolant pipe -arrows- from cylinder head.



- -> Unbolt coolant pipe at front of cylinder head -arrows- and remove.
- Remove water pipe and auxiliary water pump.



- Remove cover on oil check valves.
- -> Renew oil check valves -1- (25 Nm).

Note:

The oil distribution pipe -2- for the spray jets for piston cooling is also located in the opening.

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Installing:

- Install in the opposite order to removing. When installing, note the following points:

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50; Front body; Lock carrier service position

- Install bumper

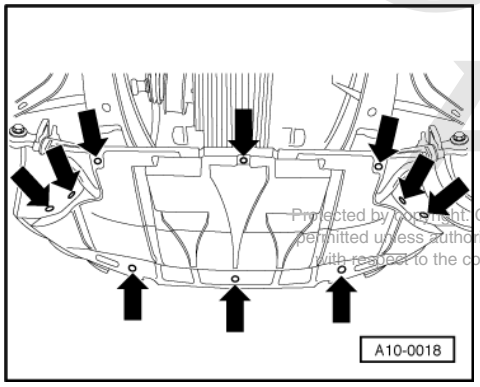
=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

- Filling up coolant =>Page 181 .

Component		Nm
Bolts	M6	10
Bolts	M8	20
Toothed belt sprocket to camshaft		55
Intake manifold to cylinder head		10
Oil check valves		25

Component	Nm
Cover for oil check valves	10

1.5 - Removing and installing lower section of sump



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Special tools, testers and auxiliary items

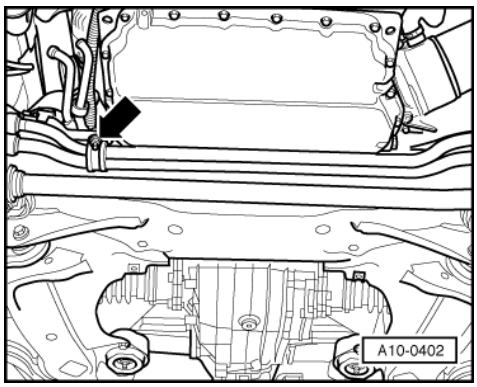
- Drip tray V.A.G 1306

- -> Remove noise insulation panel -arrows-.
- Remove bumper

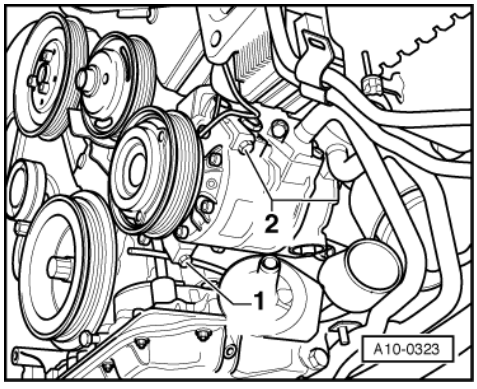
=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper- Assembly overview Front bumper Removing and installing front bumper- Assembly overview

- Move lock carrier to service position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position



- Remove ribbed belt => Page 35 .
- -> Unbolt air conditioner pipes from sump -arrow-.

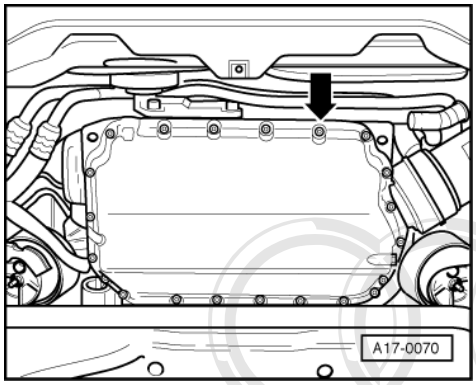


Warning
Do not open air conditioner refrigerant circuit.

- -> Detach air conditioner compressor -1...2-.

Notes:

- Watch position of guide bushes when installing.
- When installing, insert bolt -1- in the compressor first.
- To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.



- Drain off engine oil.

Note:

Use a separate container to collect the engine oil.

- -> Remove lower section of sump.

Installing:

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- Install in the opposite order to removing. When installing, note the following points:

Note:

Do not use any adhesive or sealant.

- Clean the sealing surfaces; ensure that they are free of oil and grease.
- Fit new gasket on lower section of sump and install on upper section of sump with two diagonally opposite bolts.
- Tighten all securing bolts hand-tight.
- Tighten bolts to 10 Nm with torque wrench, working from the centre outwards.
- Fit new seal on oil drain plug and tighten to 30 Nm.

- Fill up engine oil.

Oil system capacity:

=> Maintenance manual

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position

- Install bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

1.6 - Checking chain tensioner for oil pump

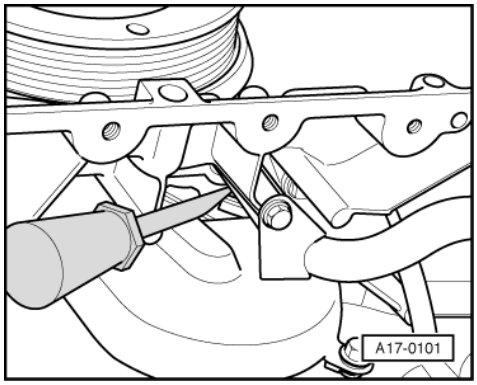
The chain tensioner incorporates a leaf spring. To check the spring tension, the lower section of the sump must be removed.

- Remove bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

- Move lock carrier to service position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position



- Remove ribbed belt => Page 35 .
- Remove lower section of sump =>Page 140
- -> Insert a screwdriver between chain and chain tensioner and press screwdriver against chain tensioner.

If no spring tension can be felt and the chain is not being tensioned, this means the chain tensioner is defective and must be renewed.

To renew oil pump chain tensioner, remove front sealing flange => Page 156 .

Installing:

- Install in the opposite order to removing. When installing, note the following points:

- Fill up engine oil.

Oil system capacity:

=> Maintenance manual

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position

- Install bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

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1.7 - Removing and installing upper section of sump

Special tools, testers and equipment required

- Engine support bracket 10-222A with adapter 10-222A/3
- Drip tray V.A.G 1306
- Electric drill with plastic brush attachment
- Torque wrench 10 Nm/ 45 Nm

Obtain radio code on vehicles with coded radio.
With ignition switched off, disconnect battery earth strap.
Pull out dipstick.

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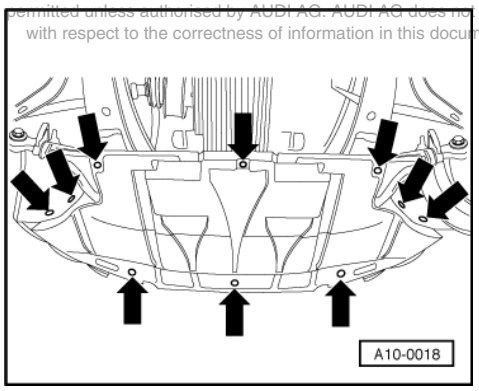


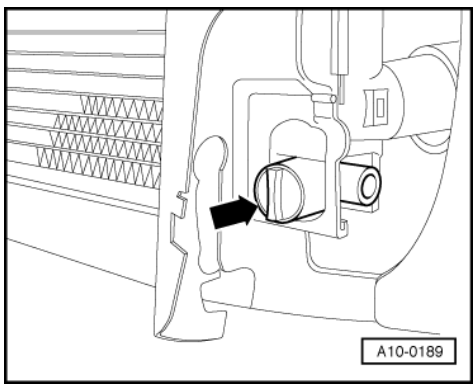
- Unbolt dipstick guide tube at front of cylinder head (right side), and pull out of sump from the top.
- -> Remove noise insulation panel -arrows-.
- Remove bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

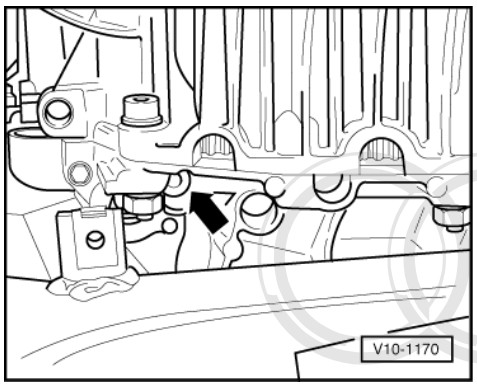
- Move lock carrier to service position

=> General body repairs, Exterior; Repair Group 50; Front body; Lock carrier service position

Warning
Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and unscrew it carefully.



- Unscrew cap on coolant expansion tank.
- Place drip tray V.A.G 1306 below engine.
- -> Turn drain screw -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.



- -> Also open coolant drain screw -arrow- at rear right of sump.
- Draining off and filling up coolant =>Page 181 .
- Drain off engine oil.

Use a separate container to collect the engine oil.

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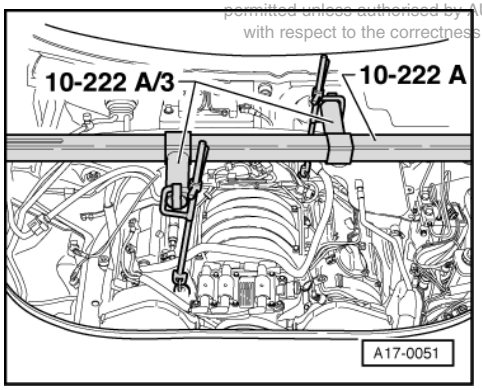
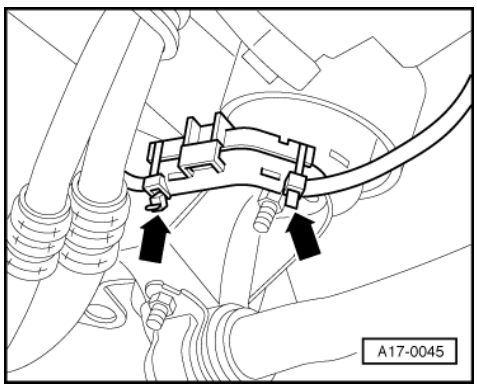
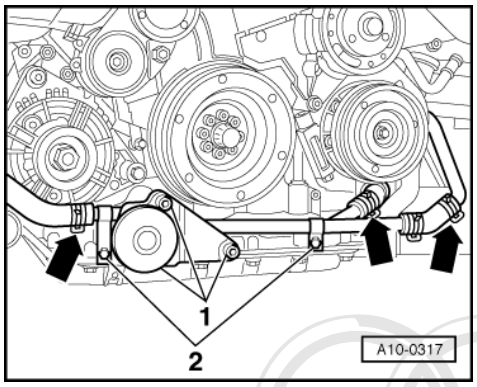


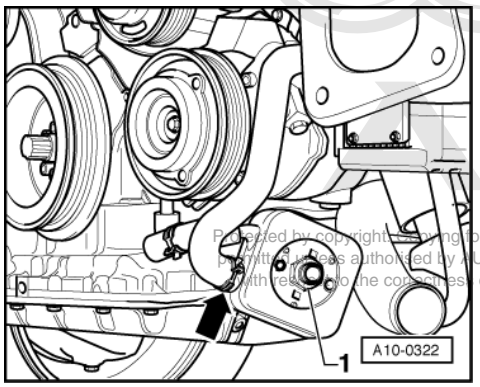
- -> Set up support bracket 10-222A with adapter 10-222A/3 on bolted flanges for wing panels.
- Attach support bracket to front and rear lifting eyes on engine.
- Raise engine as far as possible with spindles of support bracket.



- -> Cut open cable ties -arrows-, open retainer for starter cable and take out cable.
- Unbolt torque reaction support at front of sump.
- Unbolt coolant pipe from sump.
- Unplug connector from oil pressure switch on left of sump.



- -> Remove torque reaction support -1-.
- Release hose clamps -arrows-.
- Remove water pipe -2-.



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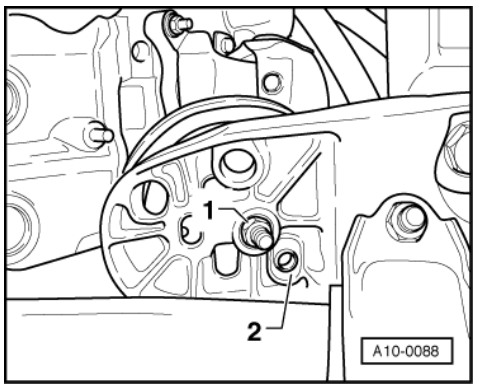
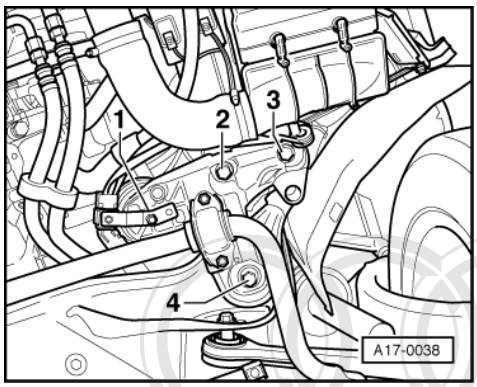
- Place drip tray V.A.G 1306 under engine.
- Remove oil filter.
- -> Release hose clamps -arrows-.
- Remove oil cooler -1-.

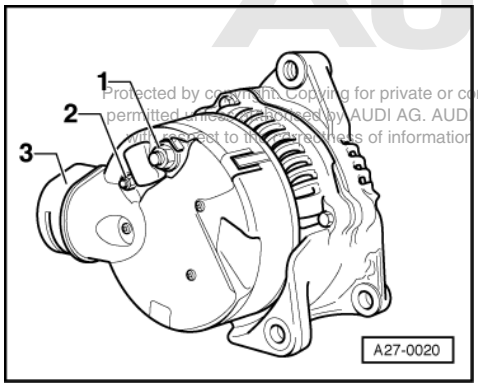


- -> Unscrew bottom nuts on engine mountings -1- (left and right sides).
- Mark positions of securing points -1- and locating sleeves -2- under engine mountings on left and right sides.



- -> First remove front subframe bolts -2- and -3- (left and right). Then unscrew bolts -4-.
- Move anti-roll bar downwards.

- Remove charge air cooler -2- on right side (release hose connection at top and 3 rubber mountings).



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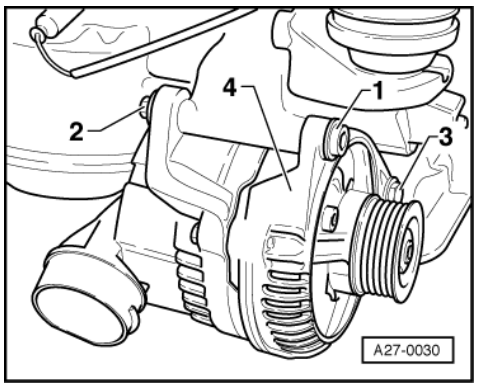
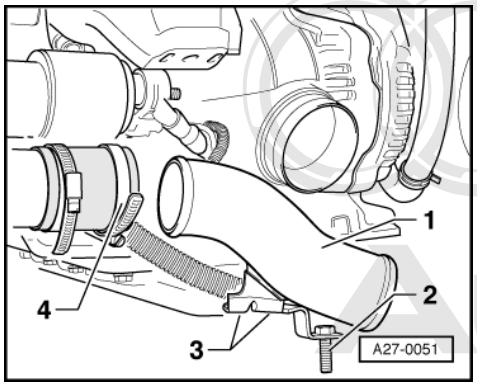
- -> Remove air duct from connector elbow on alternator -3-.
- Disconnect wire from terminal 30/B+ -1-.
  Tightening torque: 16 Nm
- Disconnect wire from terminal D+ -2-.
  Tightening torque: 4 Nm



- -> Remove hexagon socket head bolt -1-
  -lock nut -2-
  Tightening torque: 45 Nm
- Slacken bolt -3-.
  Tightening torque: 22 Nm
- Take out alternator -4- from below.



1 - -> Remove air pipe -1-.
2 - Mounting for oil and air conditioner pipes
3 - Mounting on cylinder block
4 - Release hose clamp

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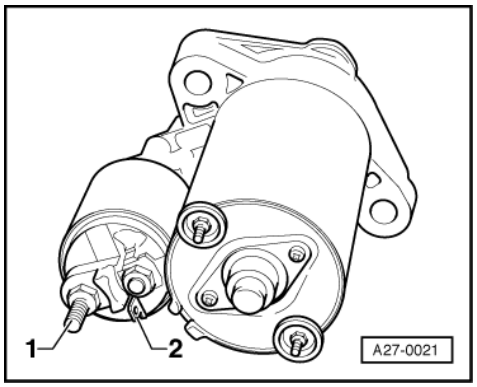
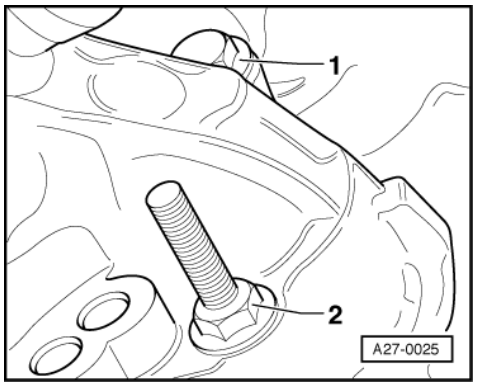
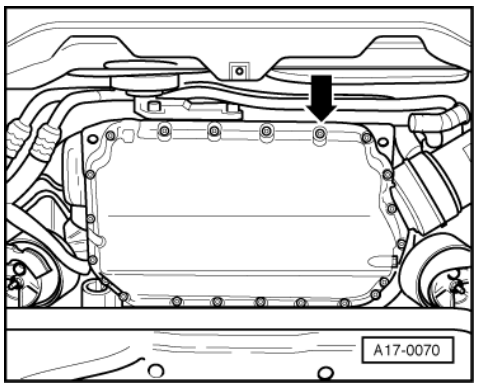


- -> Disconnect wire from terminal 30/B+ -1-.
  Tightening torque: 16 Nm
- Unplug connector for terminal 50 -2-.

- Remove right wheel



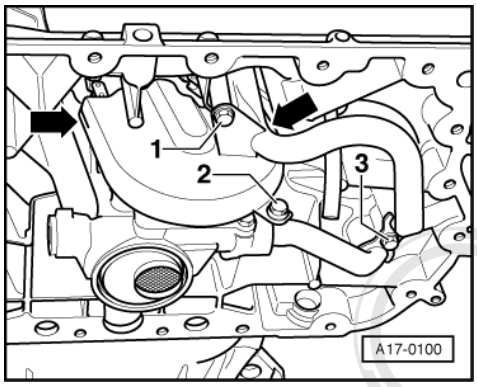
- -> Unscrew top bolt -1- from right wheel housing.
  Tightening torque: 65 Nm
- Unscrew lower bolt (accessible from engine side).
  Tightening torque: 65 Nm
- Remove starter from the front of vehicle.



Note:

To avoid having to check and adjust wheel alignment, only loosen the front subframe mountings and lower the subframe at the front.

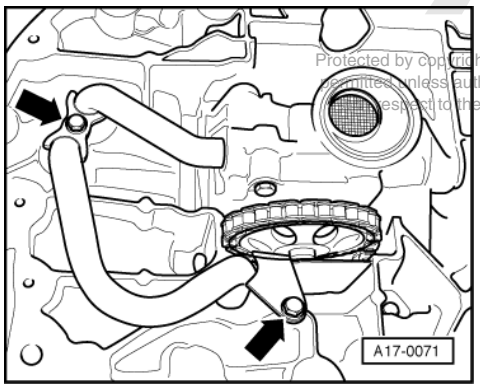
- -> Remove lower section of sump.
- Detach return pipes for turbocharger from upper section of sump.



- -> Unbolt cover plate -2- for oil pump sprocket.

Notes:

- When loosening bolt -2- securing cover plate, counter-hold at welded nut.
- When installing, make sure that the plate engages in position -arrows-.



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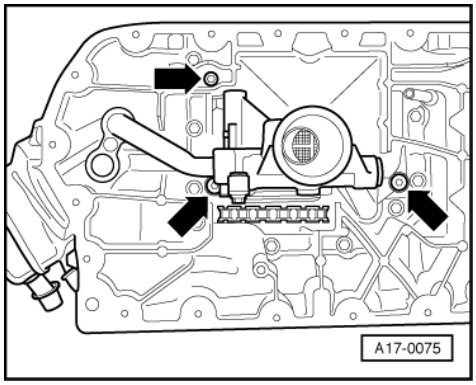
- -> Unbolt the two oil supply pipes, and pull the longer of the two pipes downwards to detach from upper section of sump.

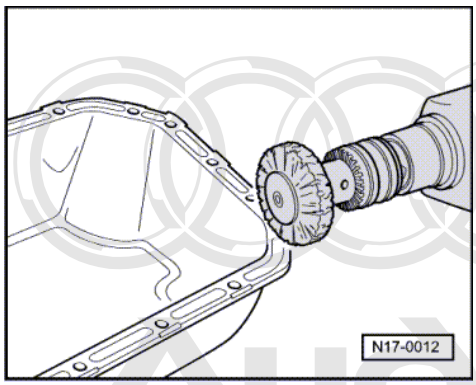


- -> Unbolt oil pump from engine so that the shorter oil supply pipe can be detached (do not remove oil pump).
- Unscrew bolts securing upper section of sump to gearbox.
- Unbolt upper section of sump from engine.

Note:

Two M6 bolts and two M8 bolts are located vertically at rear of sump upper section (in front of joint between engine and gearbox).

Installing:



Install in the opposite order to removing. When installing, note the following points:

- Clean the sealing surfaces; ensure that they are free of oil and grease.

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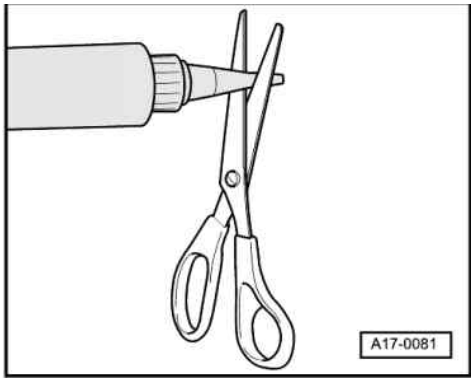
Warning
Wear protective goggles.

- -> Remove any residues of sealant on sump and engine block using plastic brush attachment, or similar.

Note:



The sump must be installed within 5 minutes after applying silicone sealant.

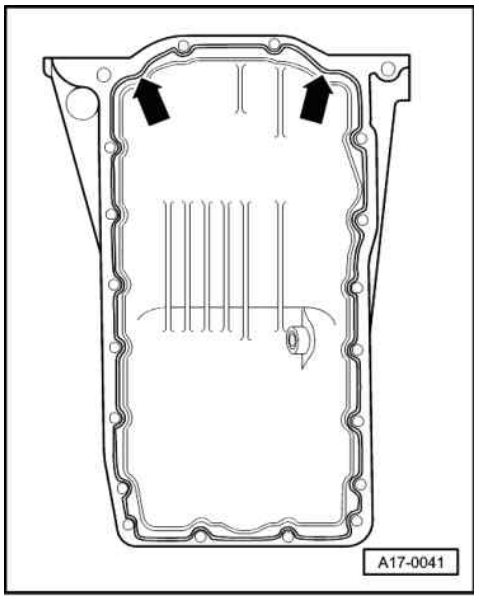
Sealant

=> Parts Catalogue

- -> Cut off nozzle of tube at front marking (diameter of nozzle approx. 3 mm).
  - Thickness of sealant bead: 2 ... 3 mm

Note:

The bead of sealant must not be thicker than 3 mm, as otherwise excess sealant may enter the sump and block the strainer in the oil intake pipe.



- -> Make sure sealing surface is clean and then apply silicone sealant on sealing surface of sump, as shown in illustration. (Illustration shows position of sealant on cylinder block.)

Note:

Be particularly careful when applying the sealant around the rear sealing flange -arrows in illustration-.

- Locate sump in position immediately, and tighten all bolts securing sump to cylinder block to 5 Nm initially.
- Tighten bolts securing sump to gearbox to 45 Nm.
- Tighten bolts securing sump to cylinder block in diagonal sequence in 2 stages; tighten to 10 Nm when tightening second time.
- Tighten M10 bolts securing sump to cylinder block to 45 Nm.

- Clean both sealing surfaces for lower section of sump; ensure that they are free of oil and grease.
- Fit new gasket on lower section of sump and install on upper section of sump with two diagonally opposite bolts.
- Tighten all securing bolts hand-tight.
- Tighten bolts to 10 Nm with torque wrench, working from the centre outwards.
- Fit new seal on oil drain plug and tighten to 30 Nm.

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Notes:

- When installing the upper section of the sump with the engine removed from the vehicle, ensure that the sump is positioned flush with the cylinder block at the flywheel end.
- The sealant must be left to dry for about 30 minutes after installing the sump before engine oil can be put in.

- Fill up coolant =>Page 181 .

- Fill up engine oil.

Oil system capacity:

=> Maintenance manual

- Install subframe

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 40; Removing and installing subframe Removing and installing subframe

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position

- Install bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

- Install noise insulation.

Tightening torques

Component		Nm
Upper section of sump to cylinder block	M6	10
	M8	20
Lower section of sump to upper section of sump		10
Sump to gearbox	M8	25
	M10	45
Coolant pipe to sump		10
Oil drain plug in lower section of sump		30
Dipstick guide tube to cylinder head		25
Oil pump to cylinder block		25
Oil pump supply pipes to upper section of sump		10
Front sealing flange	M6	10
Collar bolt	M8	30
Bracket for coolant pipes to sump		10
Coolant drain screw on engine		20

Component	Nm
Stop for torque reaction support to bracket on engine	25
Engine mounting to subframe	25
Torque reaction support to front of sump	25
Engine mounting to engine support	25
Chain sprocket to oil pump	25

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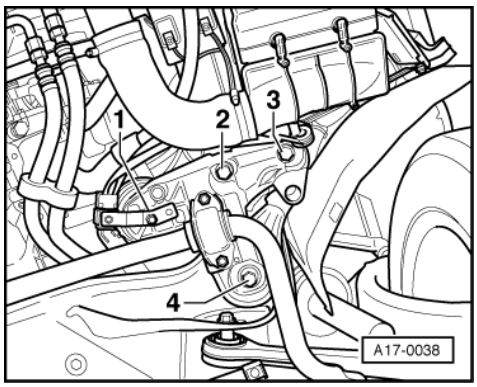
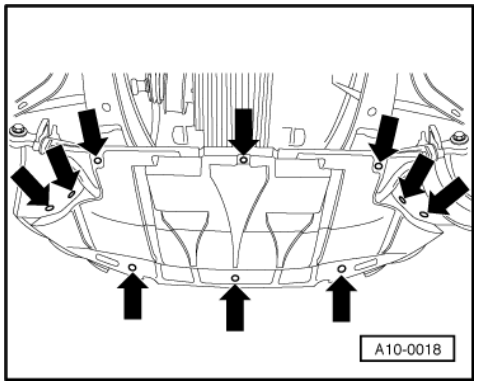


-> Other tightening torques

Nut for engine mounting -1-	25
Bolts -2- and -3-	60
Combi bolt -4- **	110 + 90°

** Combi bolt -4- must be replaced after removing.

1.8 - Removing and installing oil pump

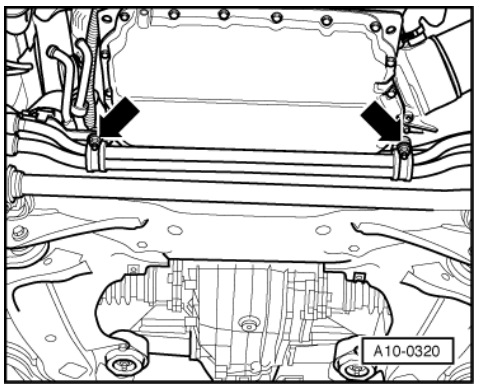


- -> Remove noise insulation panel -arrows-.
- Remove bumper

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Move lock carrier to service position

=> General body repairs; Repair group 50; Removing and installing lock carrier; Lock carrier service position



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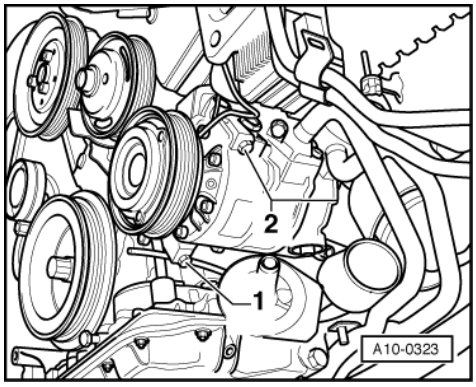
- -> Unbolt air conditioner pipes from sump -arrows-.



Warning
Do not open air conditioner refrigerant circuit.

- -> Detach air conditioner compressor -1...3-.

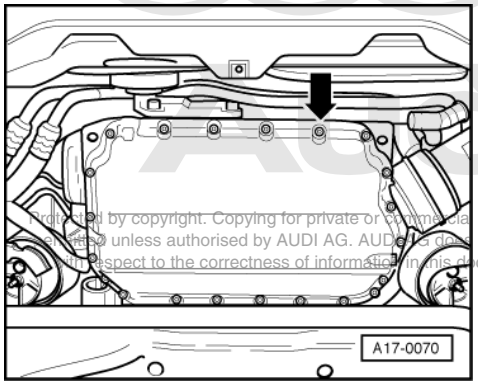
Notes:

- Watch position of guide bushes when installing.
- When installing, insert bolt -1- in the compressor first.
- To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- Drain off engine oil.

Note:

Use a separate container to collect the engine oil.



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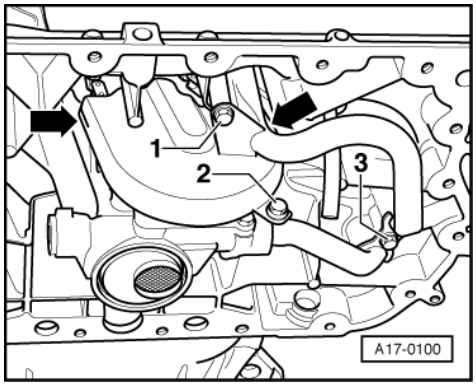
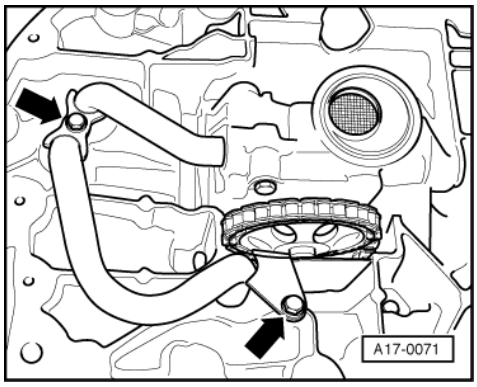
- -> Remove lower section of sump.



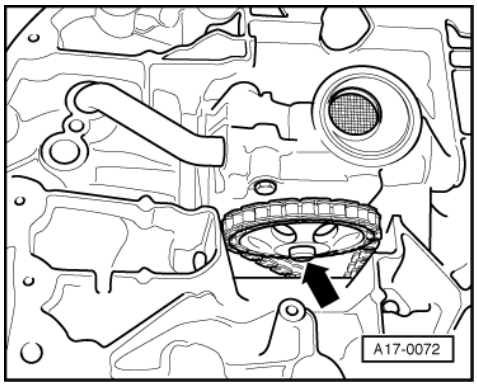
- Unbolt cover plate for oil pump sprocket (-2-).

Notes:

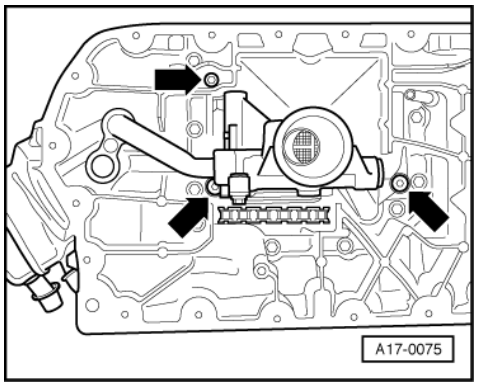
- When loosening bolt -2- securing cover plate, counter-hold at welded nut.
- When installing, make sure that the plate engages in position -arrows-.



- -> Unbolt brackets for oil supply pipes -arrows- and pull the front (longer) oil supply pipe away downwards.



- -> Unscrew bolt securing chain sprocket to oil pump using Torx T45, and pull sprocket off oil pump.



- -> Remove oil pump together with shorter oil supply pipe.

Installing:

Install in the opposite order to removing. When installing, note the following points:

- Before bolting on oil pump, fit short oil supply pipe into pump and upper section of sump with new O-rings.

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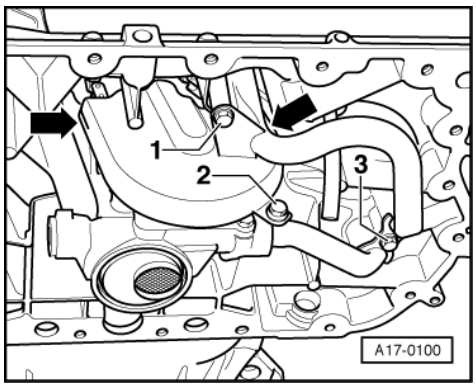

- -> Bolt on cover plate -2- for oil pump sprocket.

Notes:

- When installing, make sure that the plate engages in position -arrows-.
- When tightening bolt -2- securing cover plate, counter-hold at welded nut.

- Clean both sealing surfaces for lower section of sump; ensure that they are free of oil and grease.

Note:

Do not use any adhesive or sealant.

- Fit new gasket on lower section of sump and install on upper section of sump with two diagonally opposite bolts.
- Tighten all securing bolts hand-tight.
- Tighten bolts to 10 Nm with torque wrench, working from the centre outwards.
- Fit new seal on oil drain plug and tighten to 30 Nm.
- Fill up engine oil.

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Oil system capacity:

=> Maintenance manual

- Install subframe

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 40; Removing and installing subframe Removing and installing subframe

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50;

=> Front body; Lock carrier service position

- Install bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

Tightening torques

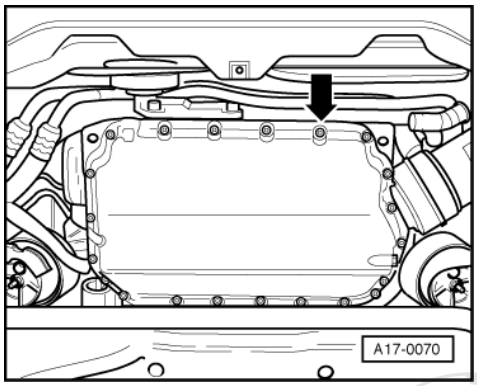
Component	Nm
Chain sprocket to oil pump	25
Lower section of sump to upper section of sump	10
Oil drain plug in lower section of sump	30
Oil pump to cylinder block	25
A/C compressor to bracket	25
Oil pump supply pipes to upper section of sump	10

Component	Nm
Bracket for A/C pipes to sump	10

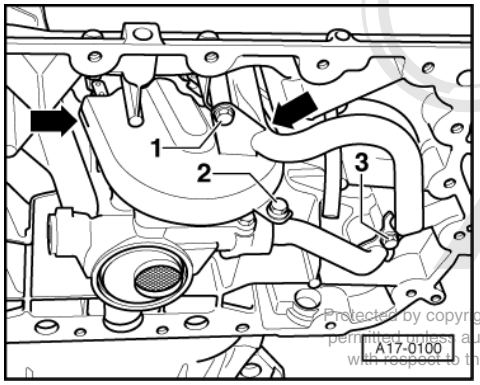
1.9 - Removing and installing front sealing flange and oil pump drive chain

Removing

- Remove ribbed belt => Page 35 .
- Remove toothed belt => Page 37 .
- Drain off engine oil.
- Use a separate container to collect the engine oil.



- -> Remove lower section of sump.



- Unbolt cover plate for oil pump sprocket (-2-).

Notes:

- When loosening bolt -2- securing cover plate, counter-hold at welded nut.
- When installing, make sure that the plate engages in position -arrows-.

- -> Unbolt both oil supply pipes -1- and -3- from upper section of sump and pull the longer of the two pipes away downwards.

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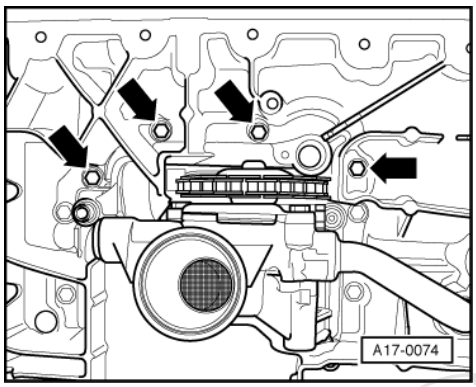
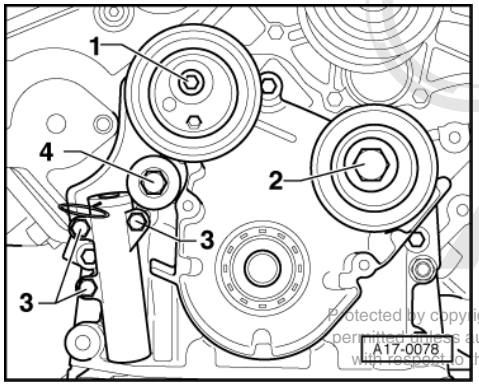


- -> Unscrew 4 bolts from upper section of sump.



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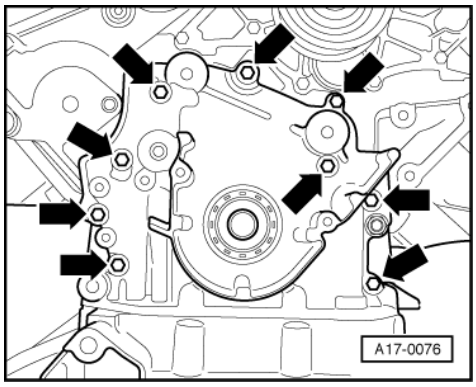
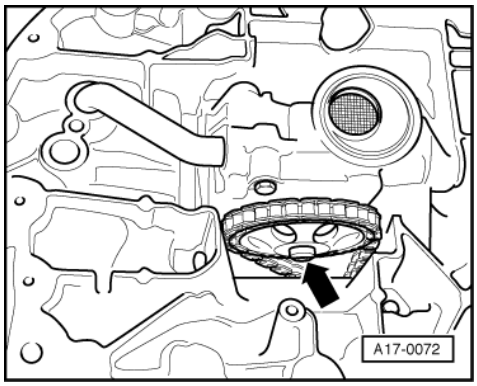
- -> Remove the following components before unbolting the front sealing flange:
- 1- Tensioning roller for toothed belt: 20 Nm
- 2- Idler wheel: 45 Nm
- 3- Toothed belt tensioner: 10 Nm
- 4- Lever for toothed belt tensioner: 20 Nm

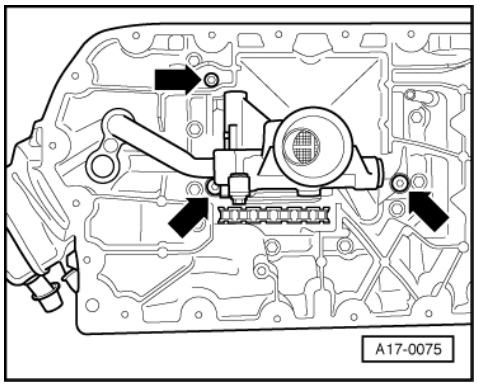


- -> Unbolt front sealing flange and take off gasket for front sealing flange
  M6 bolts: 10 Nm
  M8 collar bolt: 30 Nm

Replacing oil pump drive chain



- -> Unscrew bolt securing chain sprocket to oil pump using Torx T45, and pull sprocket off oil pump.



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- -> Remove oil pump together with shorter oil supply pipe.
- Take out oil pump sprocket and remove drive chain from crankshaft.

Removing and installing chain sprocket on crankshaft=>Page 159 .

Installing:

Install in the opposite order to removing. When installing, note the following points:

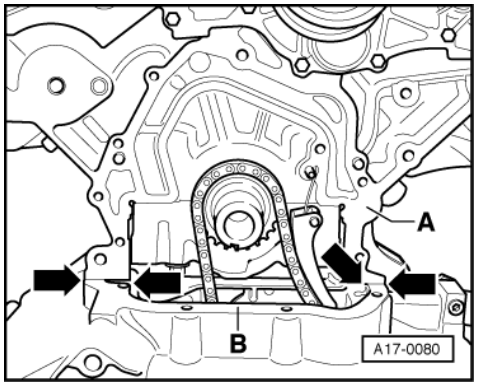
- Remove any residues of sealant on front of sump or engine block, if necessary.
- Clean the sealing surfaces; ensure that they are free of oil and grease.

Note:

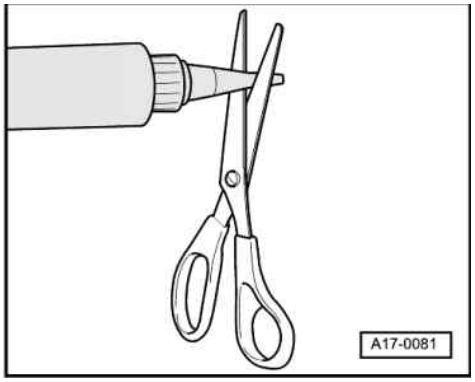
The front sealing flange must be installed within 5 minutes of applying silicone sealant.

Sealant

=> Parts Catalogue

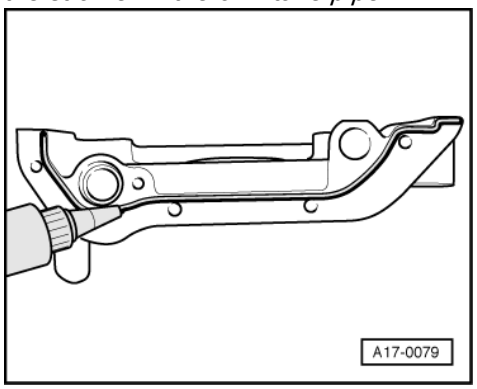


- -> Do not apply any sealant on sealing surface -A- of the cylinder block.
- After fitting gasket on sealing surface -A-, apply a small quantity of sealant to the joints between the two arrows -left and right-.



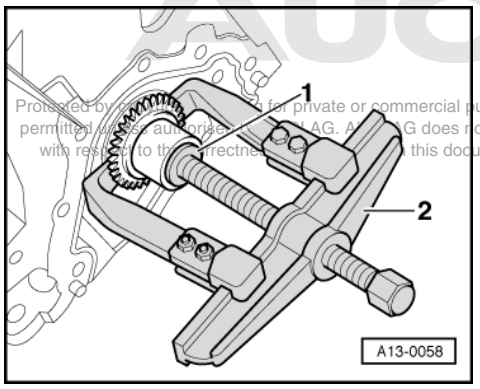
- -> Cut off nozzle of tube at front marking (diameter of nozzle approx. 3 mm).
  - Thickness of sealant bead: 2 ... 3 mm

Note:
The bead of sealant must not be thicker than 3 mm, as otherwise excess sealant may enter the sump and block the strainer in the oil intake pipe.



- -> Make sure sealing surface is clean and then apply silicone sealant on sealing surfaceof front sealing flange, as shown in illustration. (The illustration shows where the bead of sealant is applied.)
- Use fitting sleeve 3202/1 to install sealing flange. Locate sealing flange in position immediately and tighten all 4 bolts in sump hand-tight initially.
- Tighten bolts securing sealing flange
  Tightening torque:
  Front sealing flange: M6 10 Nm, M8 20 Nm
  4 bolts in sump: 10 Nm

1.10 - Removing and installing chain sprocket for oil pump on crankshaft



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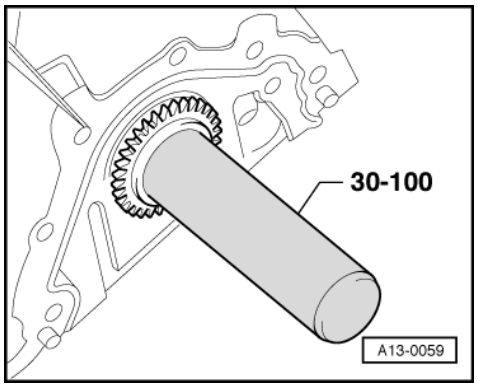
Removing

Removing and installing front sealing flange and oil pump drive chain => Page 156 .

- -> Pull chain sprocket off crankshaft using a normal commercial-type puller -2-: use a suitable washer -1- to protect end of crankshaft.

Installing



- Heat chain sprocket in oven for about 15 minutes at 220°C.

Notes:

- Wear protective gloves.
- Installation position: it should be possible to read the lettering on the chain sprocket.

- -> Using pliers, fit chain sprocket on end of crankshaft and push against stop on crankshaft with drift sleeve 30-100. If necessary knock on carefully using a plastic hammer.

1.11 - Replacing crankshaft oil seal - pulley end

Removing

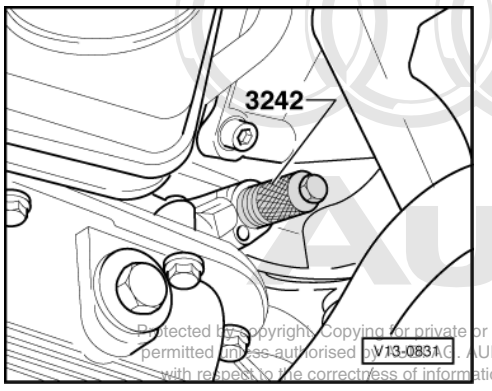
- Remove front bumper:

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Move lock carrier to service position

=> General body repairs; Repair group 50; Removing and installing lock carrier; Lock carrier service position

- Remove ribbed belt => Page 35 .
- Remove toothed belt => Page 37 .



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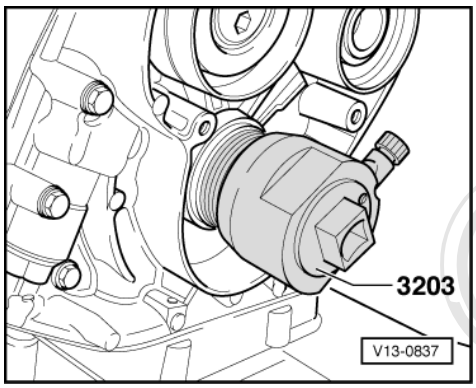
- Remove sealing plug from hole in cylinder block (left side).
- Position crankshaft to TDC of No. 3 cylinder. The crankshaft TDC drilling should be visible (or it should be possible to feel the drilling) in the sealing plug hole.
- -> Screw clamping bolt 3242 into hole so that the crankshaft is secured against turning.



- Then remove crankshaft toothed belt sprocket.
- Unscrew inner part of the oil seal extractor 3203 two turns (approx. 3 mm) out of the outer part and lock with knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and, exerting firm pressure, screw it in as far as possible into oil seal.
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.

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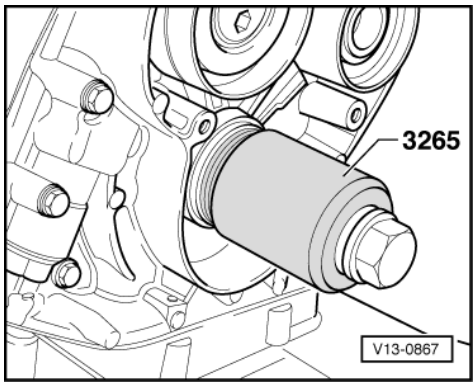
Installing



- Place guide sleeve 3202/1 onto crankshaft journal.
- Slide dry seal over guide sleeve.
- -> Press oil seal in flush with fitting sleeve 3265.

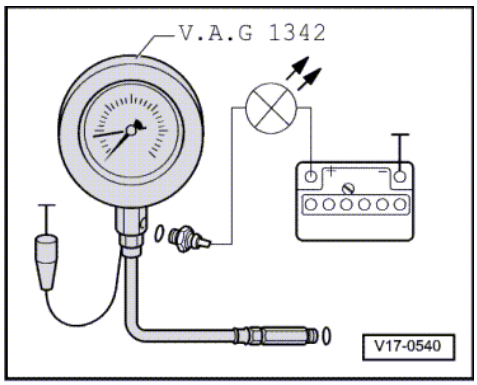
Then proceed as for removing, performing steps in reverse order.

1.12 - Checking oil pressure and oil pressure switch

Note:

Servicing and checking function of oil pressure warning lamp and buzzer:

=> Current flow diagrams, Electrical fault-finding and Fitting locations



Test procedure

- -> Remove oil pressure switch (F1) and screw oil pressure switch into tester.
- Screw tester into sump in place of oil pressure switch.
- Connect brown wire of tester to earth (-).
- Using test leads from V.A.G 1594, connect diode test lamp V.A.G 1527 between positive battery terminal (+) and oil pressure switch.
- Start engine and gradually increase engine speed
  The LED should light up at
  1.2...1.6 bar,
  otherwise renew oil pressure switch.
- Increase engine speed further.
  At 2000 rpm and an oil temperature of 80°C the oil pressure should be at least 2.0 bar.

1.13 - Engine oil

A high-quality multigrade oil is put in at the factory: this can be used all year round, except in extremely cold climates.

Viscosity grades and oil specifications

Viscosity grades and oil specifications:

=> Maintenance manual

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Oil capacities:

=> Emissions test binder

1.14 - Checking oil level

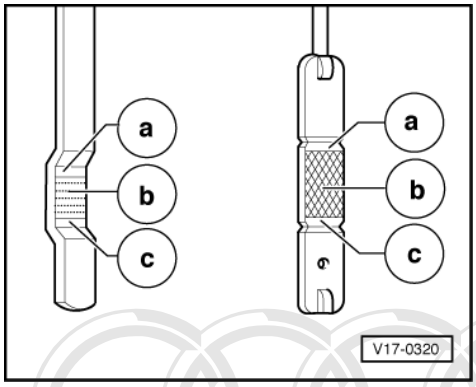
Test conditions

- Oil level should always be checked with the engine warm (oil temperature above 60°C).
- The vehicle must be standing on level ground when checking the oil level. Wait for a few minutes after switching off the engine to allow the oil to flow back into the sump.

Test sequence

- Pull out the dipstick, wipe off with a clean cloth and insert it again as far as it will go.

- Pull out the dipstick again and read off the oil level.



-> Markings on oil dipstick:

a - Do not top up oil.
b - Oil can be topped up. The oil level may rise as far as area -a- after topping up.
c - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping up.

Note:

The oil level must not be above marking -a- on the dipstick.

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19 - Cooling system

1 - Removing and installing parts of cooling system

1.1 - Removing and installing parts of cooling system

Warning
Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and unscrew it carefully.

Notes:

- When the engine is hot the cooling system is under pressure. Carefully open filler cap on expansion tank to release pressure before starting repair work.
- Hoses are secured with spring-type clips. When repairing only use spring-type clips.
- V.A.G 1921 pliers are recommended when installing spring-type clips.
- The O-rings fitted at the quick-release connections must be renewed if damaged or leaking.
- When installing coolant hoses, ensure that they are free of stress and do not come into contact with other components (observe markings on coolant connection and hose).

Perform leak test on cooling system with cooling system tester V.A.G 1274 and adapter V.A.G 1274/8.

1.2 - Parts of cooling system (on body)

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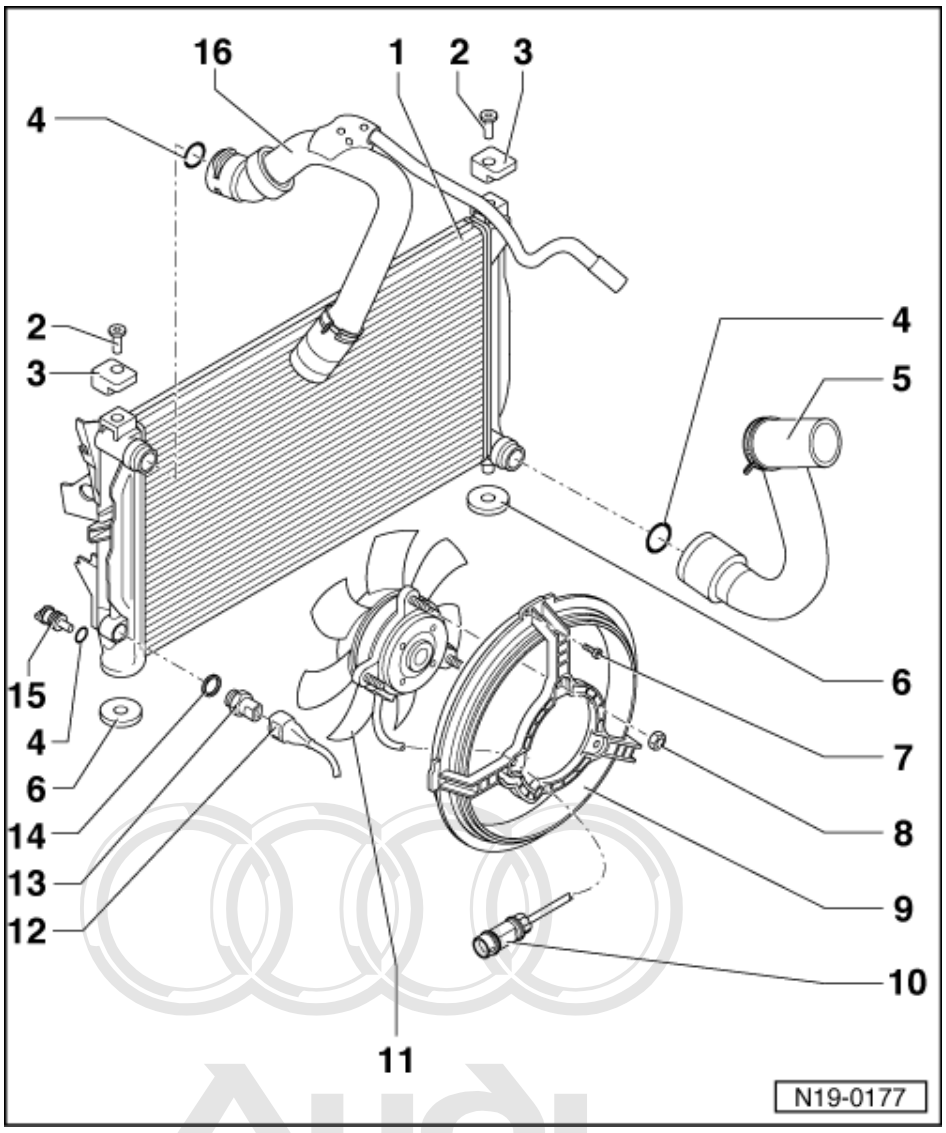
Notes:

- Parts of cooling system on engine =>Page 170 .
- Diagram of coolant hose connections => Page 179 .
- Draining and filling with coolant=> Page 181 .
- Coolant mixture ratios => Page 181 , draining and filling cooling system.



1 Radiator
- Removing and installing
  => Page 184
- After replacing, renew coolant in complete system

2 Securing clip

3 Securing rubber

4 O-ring
- Renew if damaged

5 Bottom coolant hose
- Secured to radiator with retaining clip
- Check for secure seating
- Diagram of coolant hose connections => Page 179

6 Rubber washer

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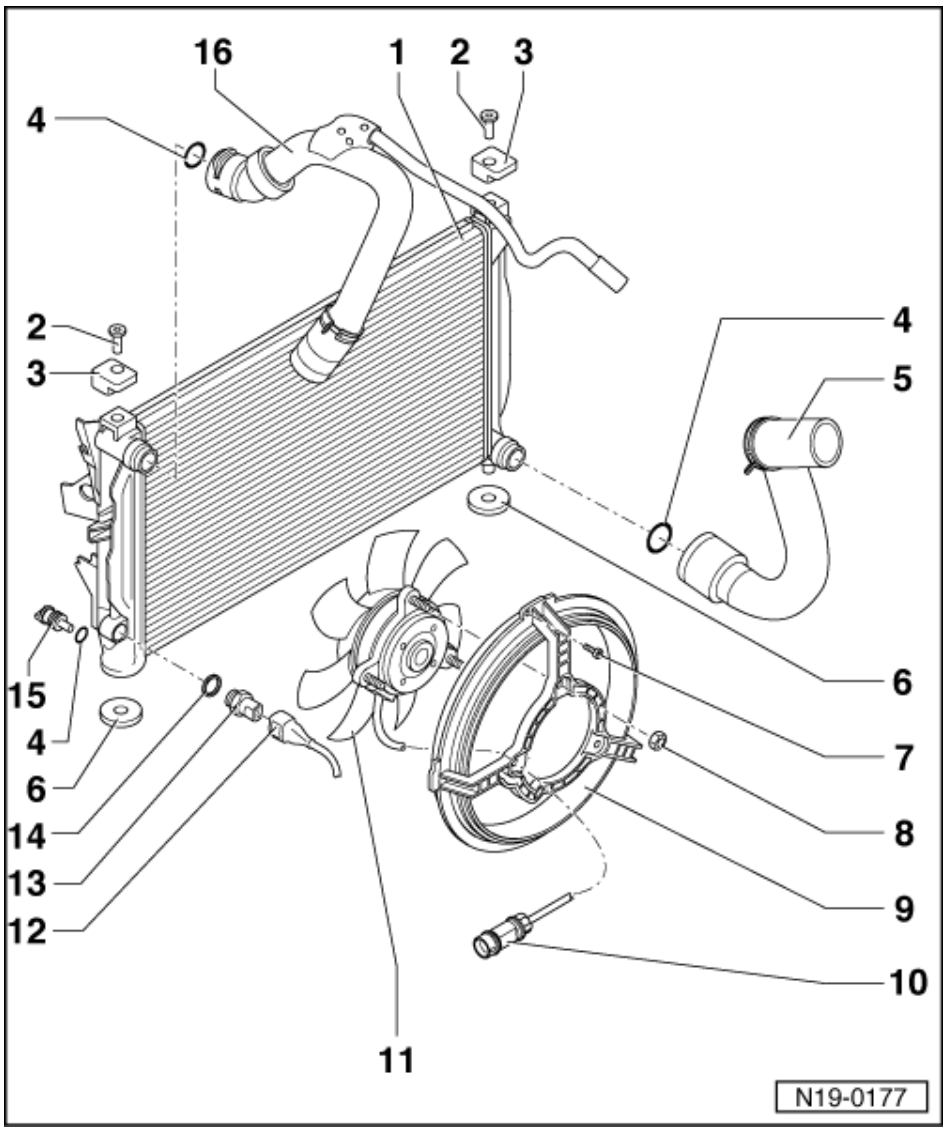

7 Retaining bolt

8 Nut

- Tightening torque: 10 Nm

9 Fan ring

- Clipped into air ducting and secured with retaining bolt -Item 7 -

10 2-pin connector

11 Radiator fan (-V7)

- Checking => Page 195

12 Connector

- Black, 3-pin
- For radiator fan thermoswitch

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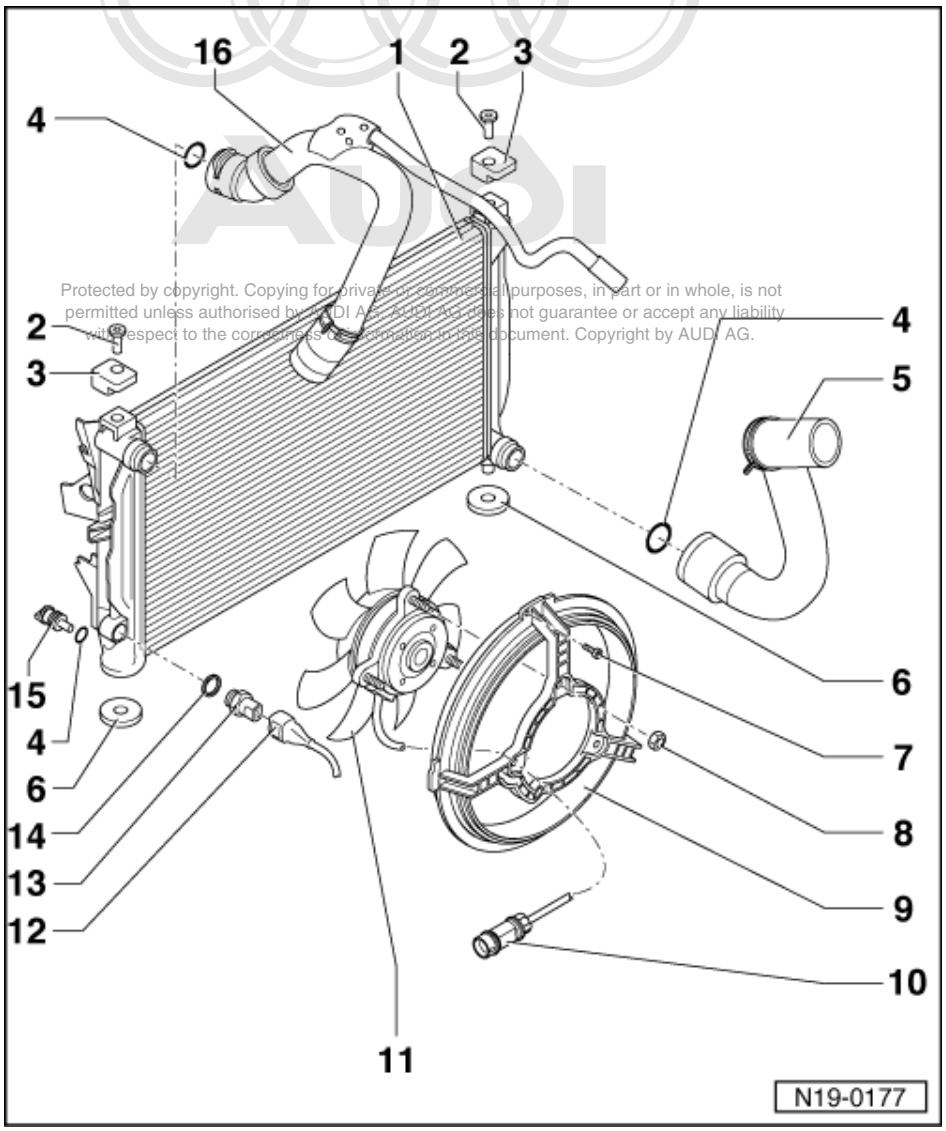


13 Radiator fan thermoswitch (-F18), 35 Nm

- For electric fan
- Switching temperatures:
  Stage 1
  on: 92...97 °C
  off: 84...91 °C
  Stage 2
  on: 99...105 °C
  off: 91...98 °C

14 Seal

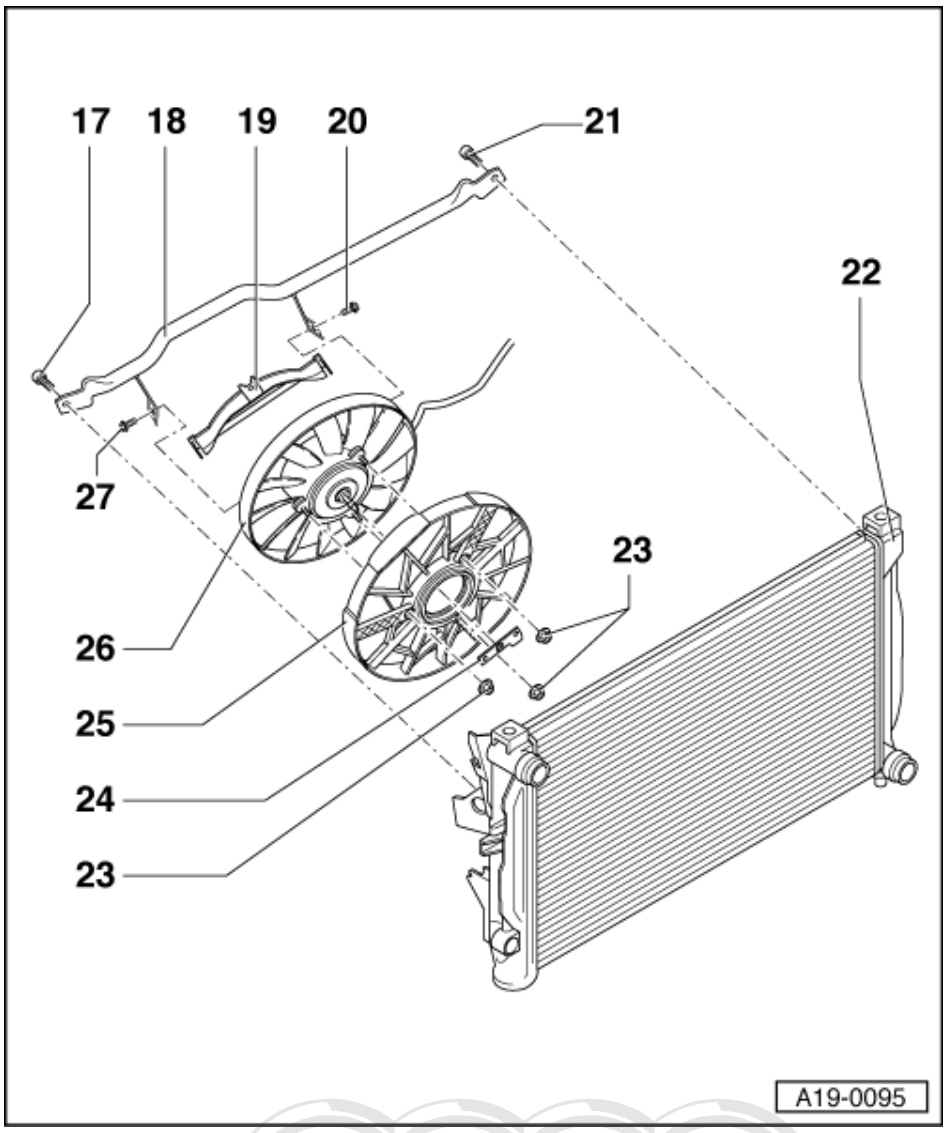
- Renew

15 Drain screw

- Tightening torque: 10 Nm

16 Top coolant hose

- Secured to radiator with retaining clip
- Check for secure seating
- Diagram of coolant hose connections => Page 179



17 Bolt

- Tightening torque: 5 Nm

18 Mounting rod

19 Guard plate

20 Bolt

- Tightening torque: 5 Nm

21 Bolt

- Tightening torque: 5 Nm

22 Radiator

- Removing and installing
  => Page 184
- After replacing, renew coolant in complete system

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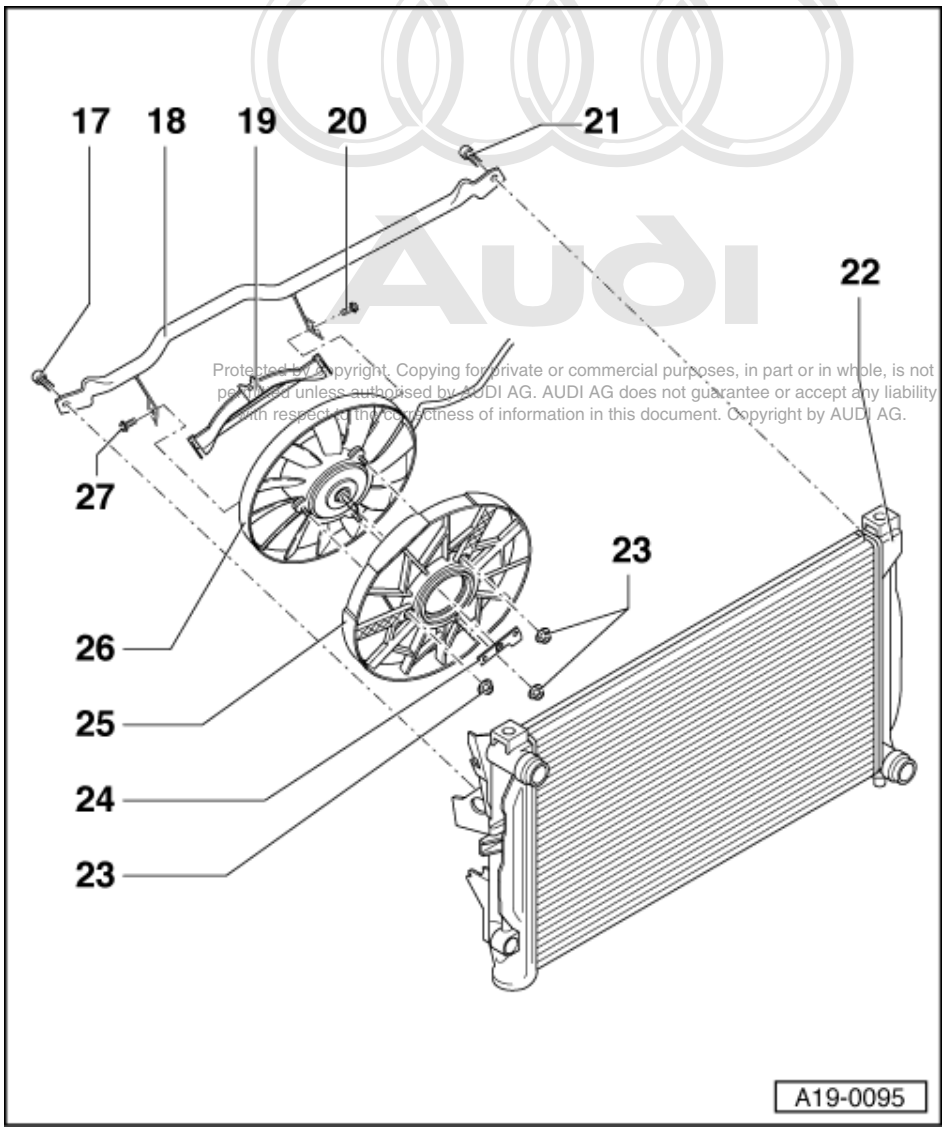

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23 Nut

- Tightening torque: 5 Nm

24 Bracket

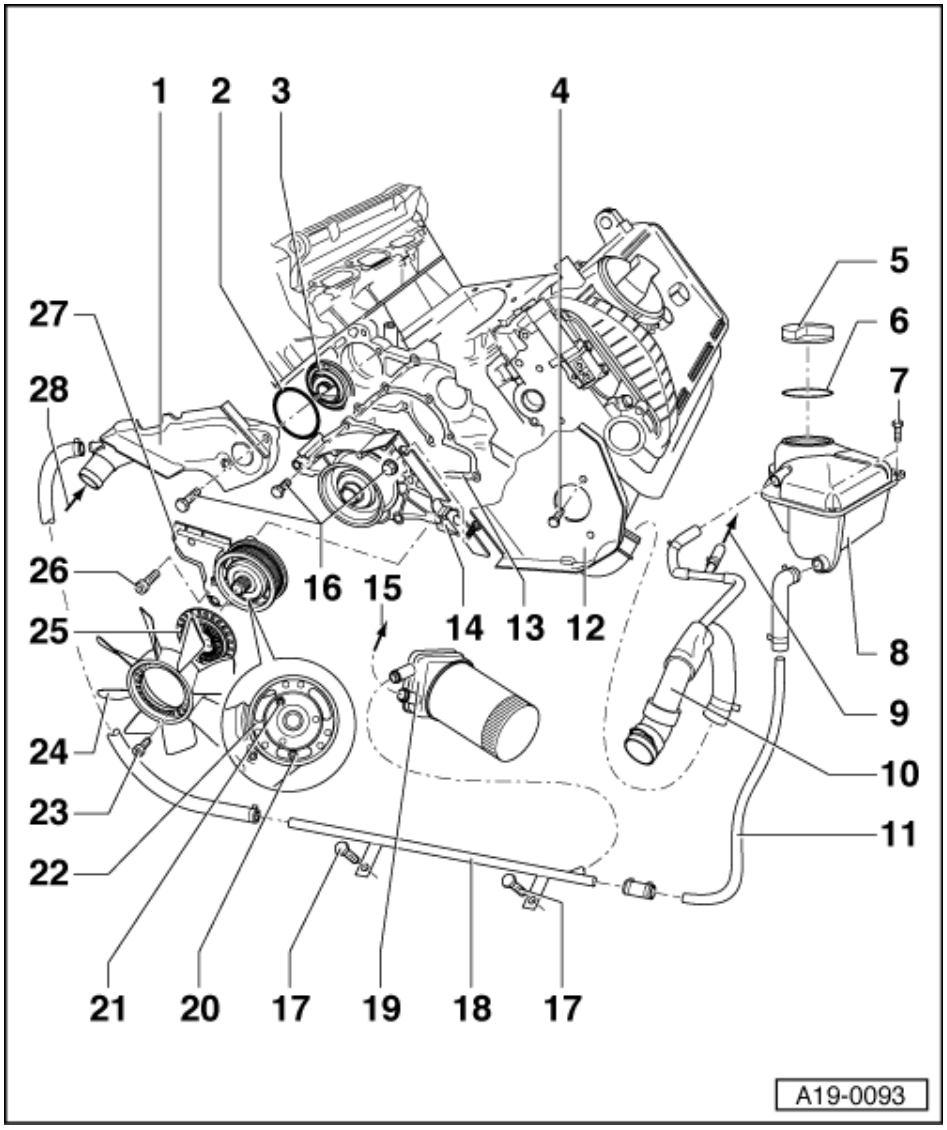
25 Fan ring

26 Pressurising fan

27 Bolt

- Tightening torque: 5 Nm

1.3 - Parts of cooling system (on engine, front)



1 **Connection**
- For thermostat

2 **O-ring**
- Renew

3 **Thermostat**
- Removing and installing
  => Page 187
- Note installation position
  => Page 187 , Removing and installing thermostat
- Checking: heat the thermostat in water
- Starts to open at about 86 °C
- Opening travel: at least 7 mm

4 **Bolt**
- Tightening torque: 10 Nm

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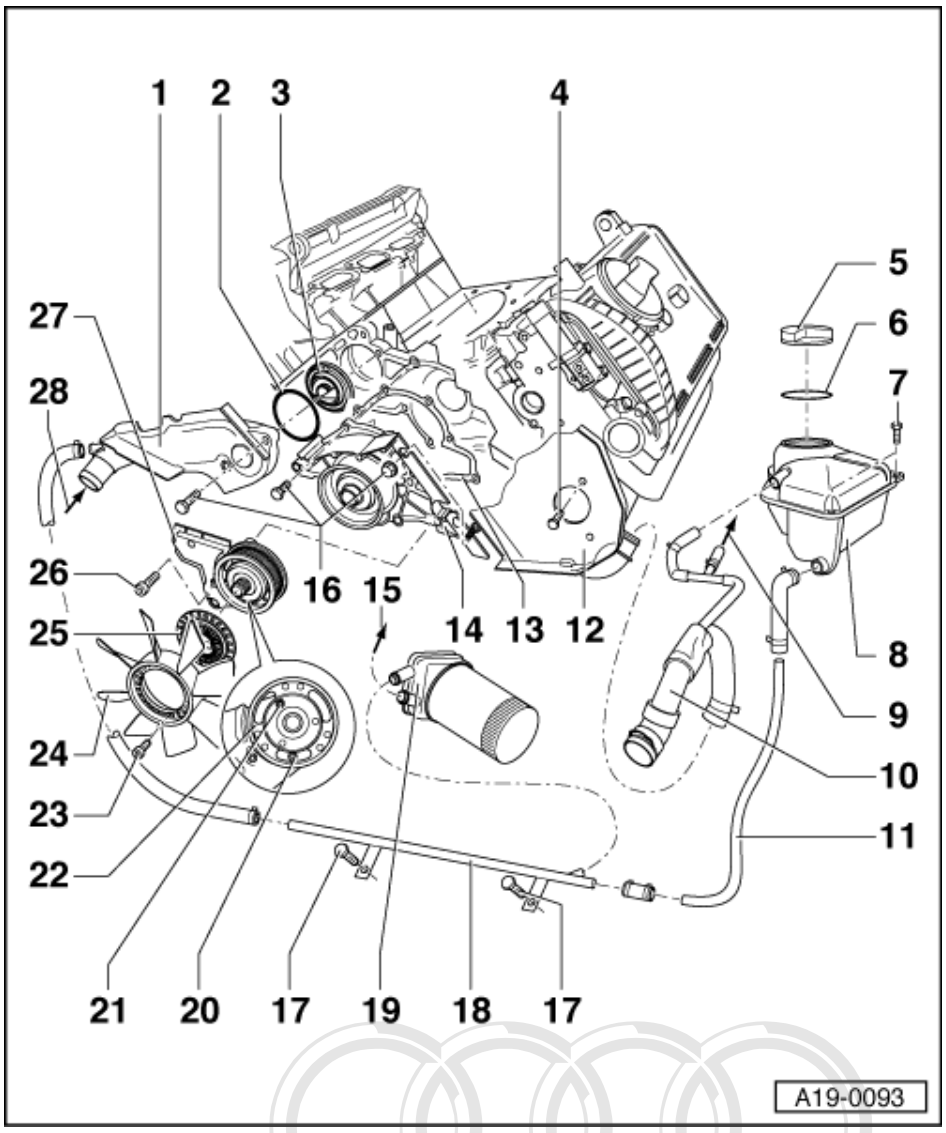

5 Filler cap

- Test with cooling system tester V.A.G 1274 and adapter V.A.G 1274/9
- Test pressure 1.4...1.6 bar

6 O-ring

- Renew if damaged

7 Bolt

- Tightening torque: 10 Nm

8 Expansion tank

- Carry out leak test of cooling system with cooling system tester V.A.G 1274 and adapter V.A.G1274/8

9 To rear water pipe

- Diagram of coolant hose connections => Page 179

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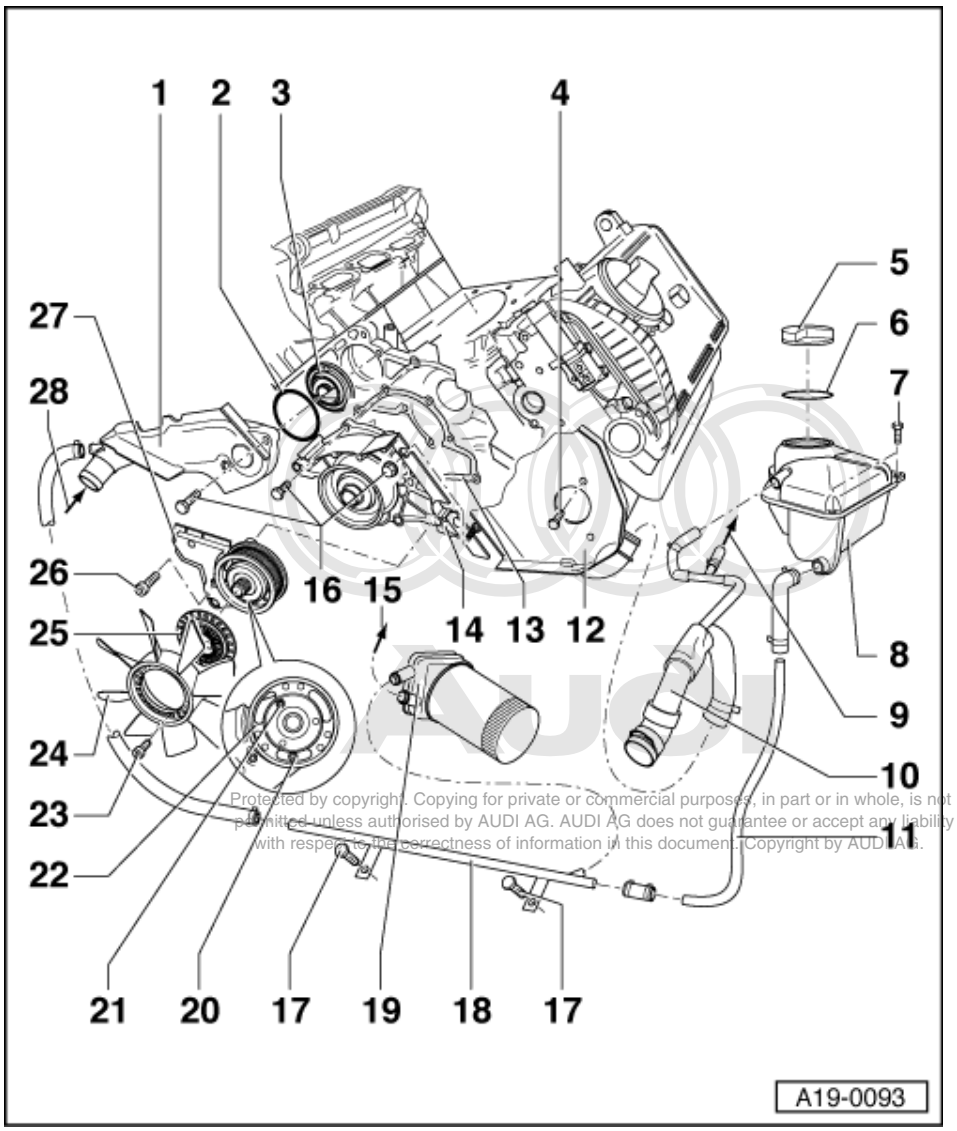

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10 Top coolant hose

- Secured to radiator with retaining clip
- Check for secure seating
- Diagram of coolant hose connections => Page 179

11 Coolant pipe

- Diagram of coolant hose connections => Page 179

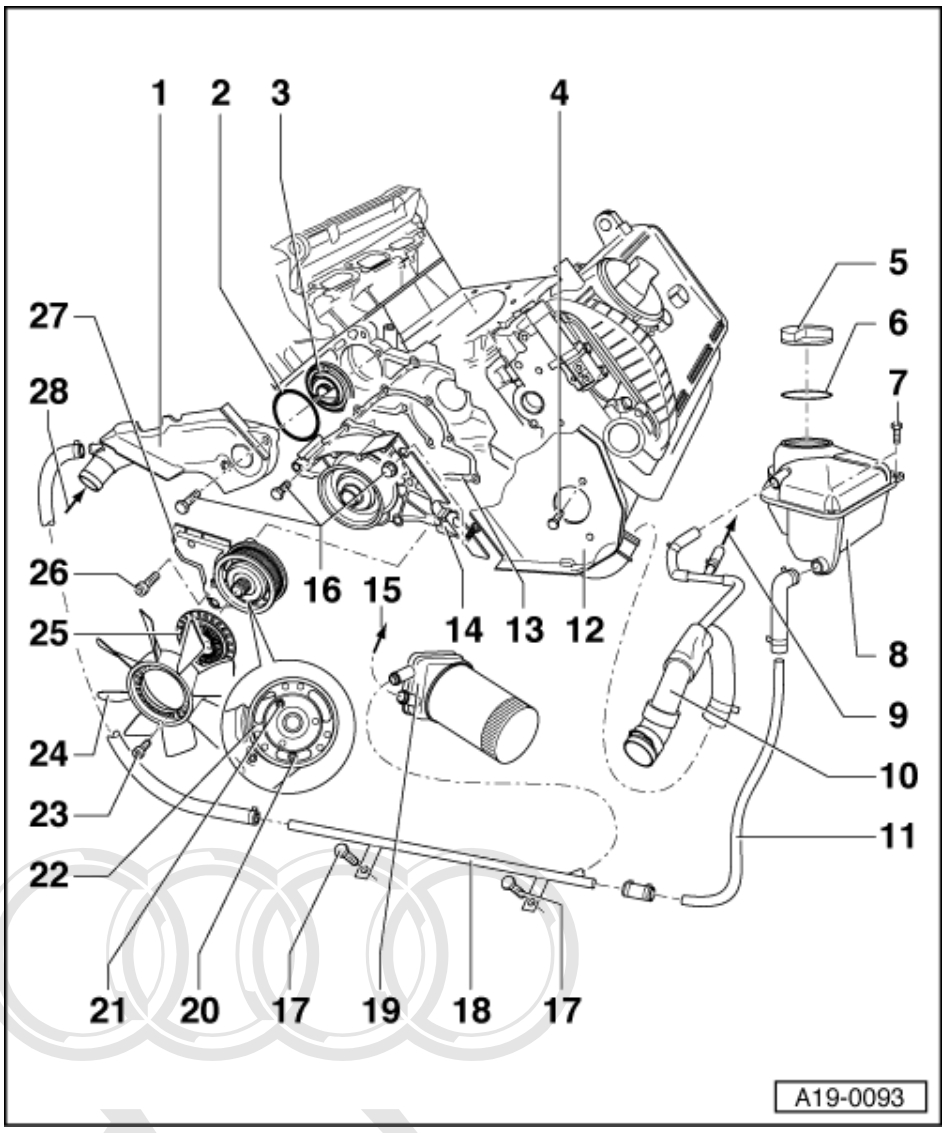
12 Rear toothed belt guard

13 Gasket

- Renew

14 Coolant pump

- Check that pump runs freely
- If damaged or leaking renew complete
- Removing and installing
  => Page 186



15 To front coolant pipe

- Diagram of coolant hose connections => Page 179

16 Bolt

- Tightening torque: 10 Nm

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17 Bolt

- Tightening torque: 25 Nm

18 Lower coolant pipe

- Diagram of coolant hose connections => Page 179

19 Oil cooler

20 Bolt

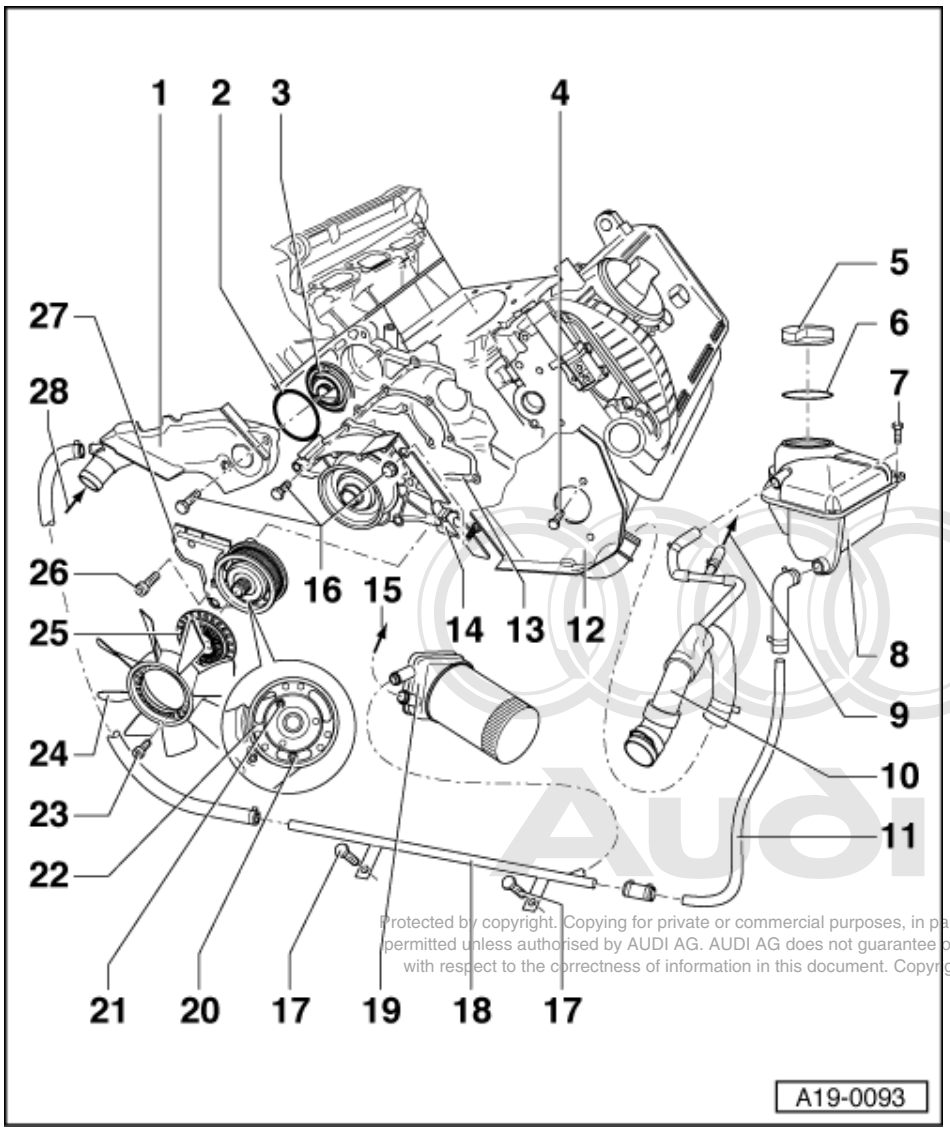
- Tightening torque: 25 Nm

21 Bolt

- Tightening torque: 10 Nm

22 Belt pulley

- For viscous fan



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23 Bolt

- Tightening torque: 10 Nm

24 Fan wheel for viscous fan

25 Viscous fan coupling

- Note left-hand thread
- Tightening torque only applicable when using open-end spanner 3312
- Tighten to 37 Nm
- Removing and installing
  => Page 194

26 Bolt

- Tightening torque: 25 Nm

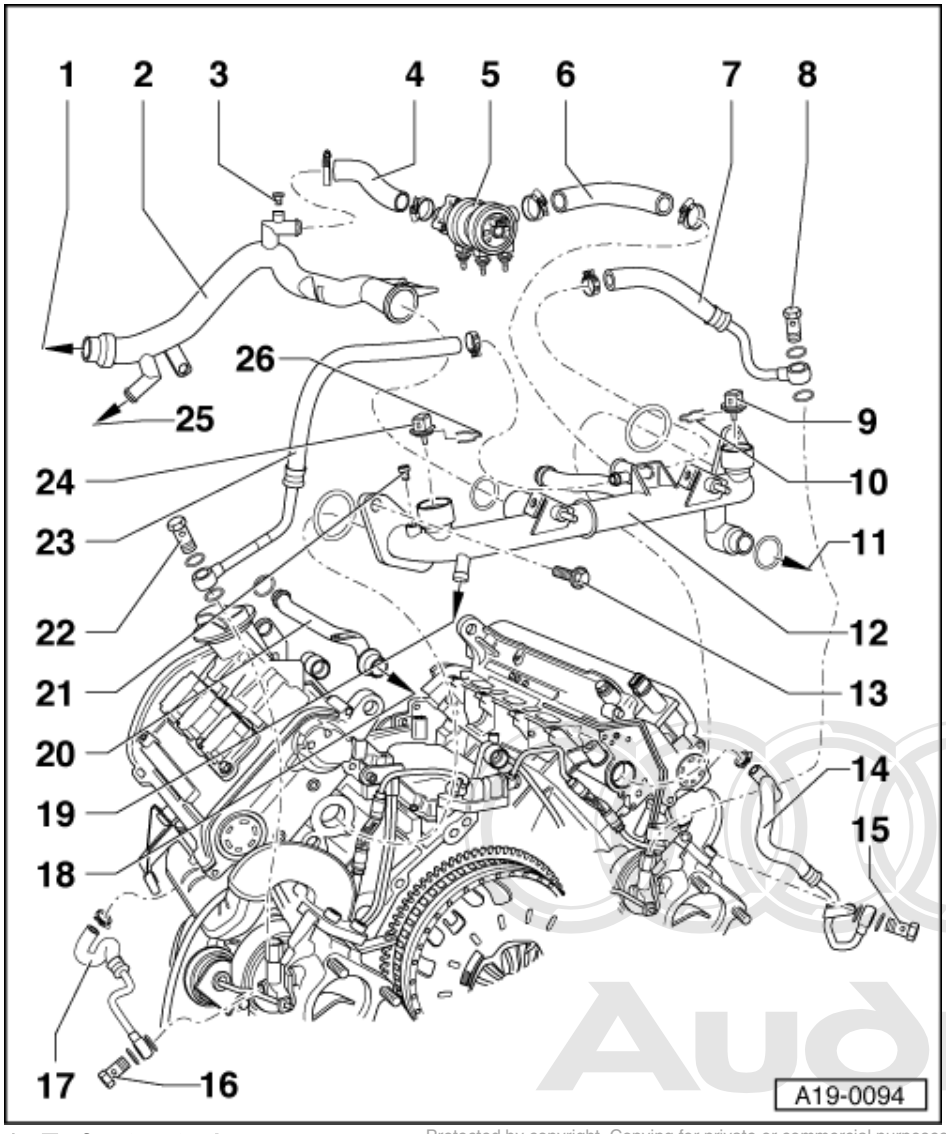
27 Bracket

- For viscous fan

28 From bottom of radiator

- Diagram of coolant hose connections => Page 179

1.4 - Parts of cooling system (on engine, rear)



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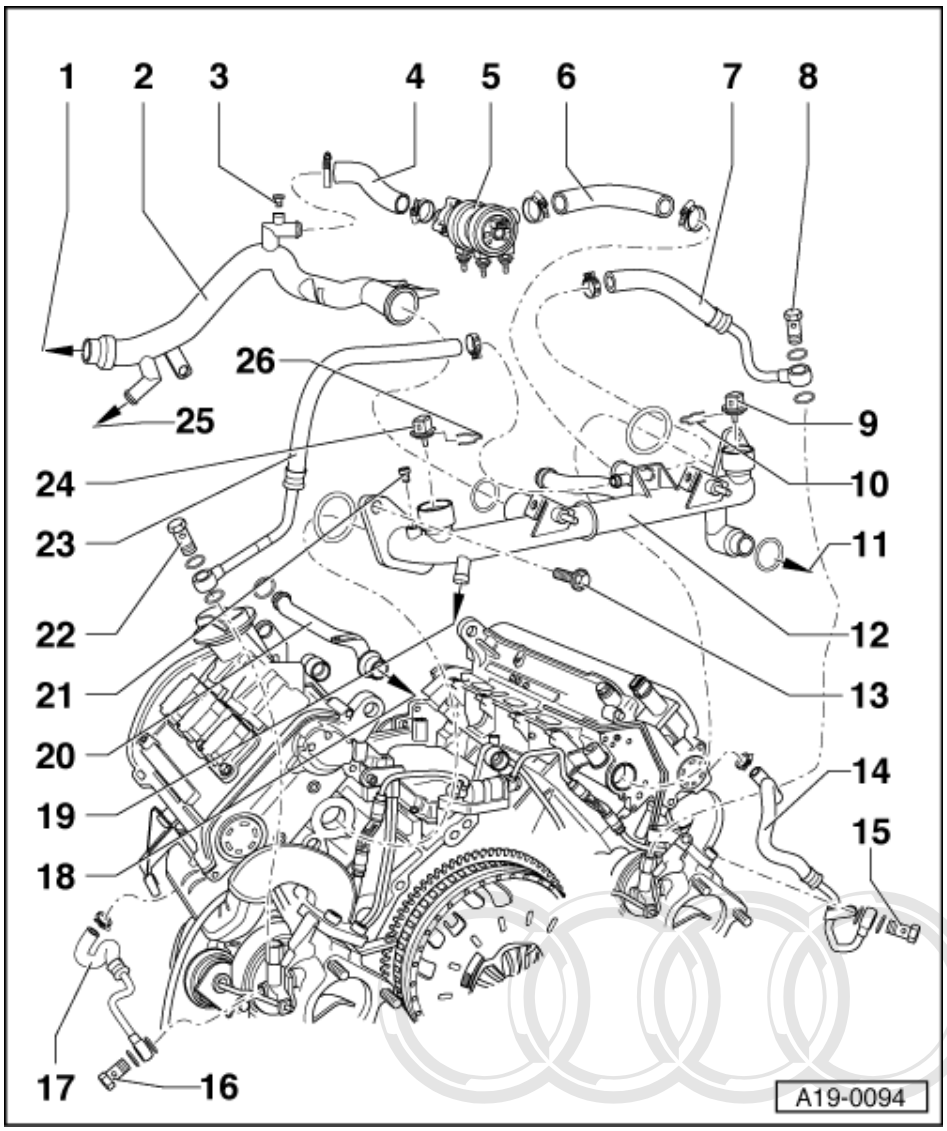
1 **To front water hose**
2 **Front coolant pipe**
- Diagram of coolant hose connections => Page 179

3 **Bleeder screw**
- Tightening torque: 20 Nm

4 **Coolant hose**
- From auxiliary water pump to front coolant pipe

5 **Auxiliary water pump**
6 **Coolant hose**
- From rear coolant pipe to auxiliary water pump



7 Right coolant pipe

- From turbocharger to rear coolant pipe

8 Banjo bolt

- Tightening torque: 35 Nm

9 Coolant temperature sender (-G62)

- For engine control unit
- If necessary, release pressure in cooling system before removing
- Checking:

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=> Repair group 01; Self-diagnosis; Interrogating and erasing fault memory Self-diagnosis Interrogating and erasing fault memory

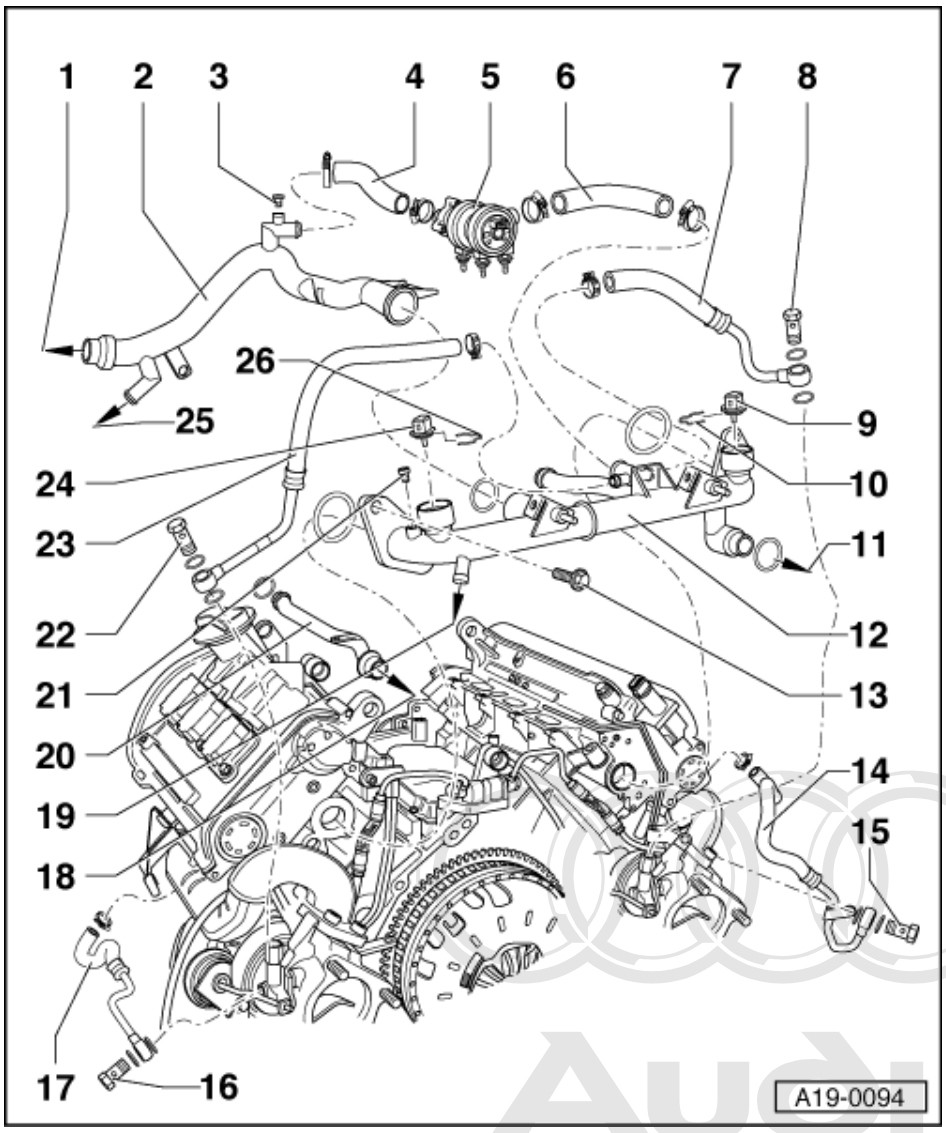
10 Retaining clip

- Check for proper seating

11 To heat exchanger

12 Rear coolant pipe

- Diagram of coolant hose connections => Page 179



13 Bolt

- Tightening torque: 10 Nm

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14 Right coolant pipe

- From engine block to turbocharger

15 Banjo bolt

- Tightening torque: 35 Nm

16 Banjo bolt

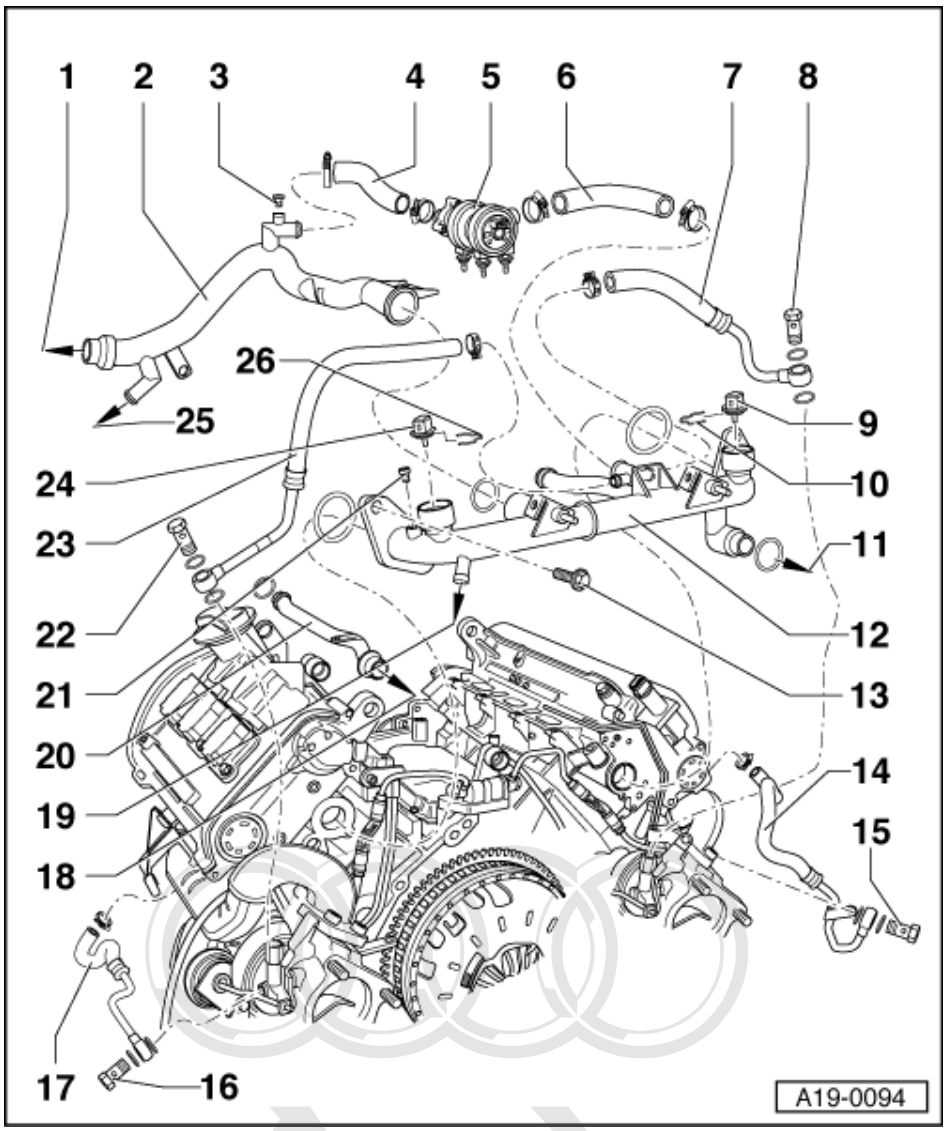
- Tightening torque: 35 Nm

17 Left coolant pipe

- From engine block to turbocharger

18 From heat exchanger

19 To front coolant hose



20 Coolant pipe

- Diagram of coolant hose connections => Page 179

21 Bleeder screw

- Tightening torque: 20 Nm

22 Banjo bolt

- Tightening torque: 35 Nm

23 Left coolant pipe

- From turbocharger to rear coolant pipe

24 Sender for auxiliary water pump

- 2-pin
- If necessary, release pressure in cooling system before removing

25 To oil cooler

26 Retaining clip

- Check for proper seating

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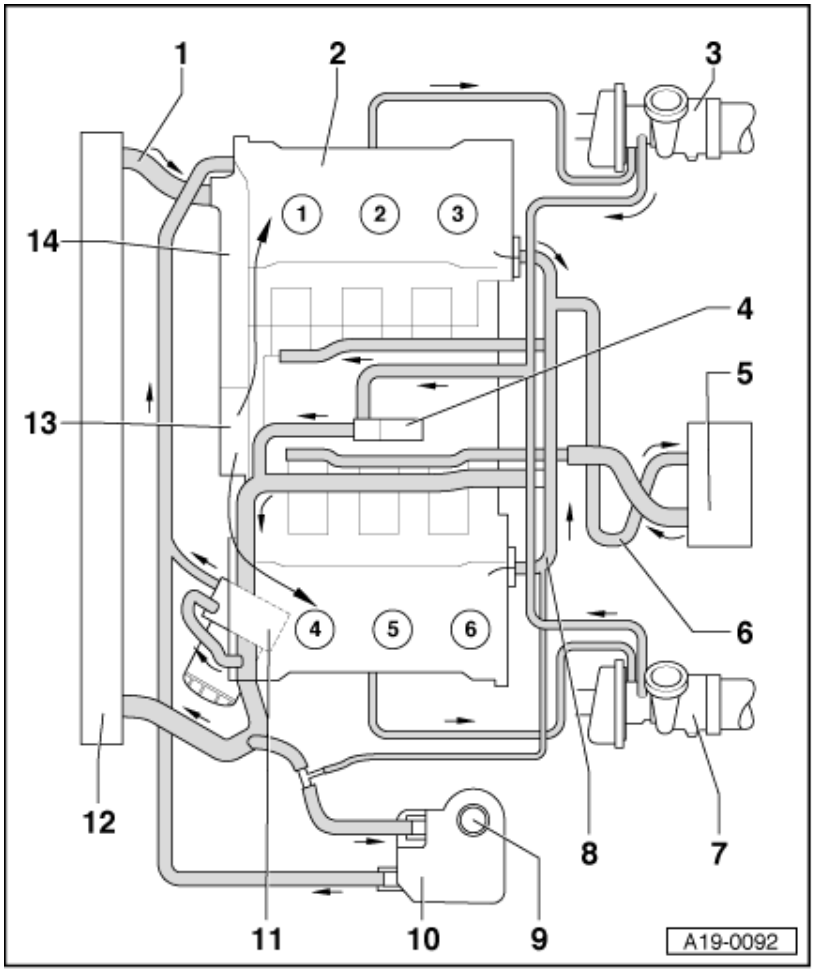
1.5 - Diagram of coolant hose connections



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1 **Bottom coolant hose**
- From radiator to engine

2 **Cylinder head/ cylinder block**

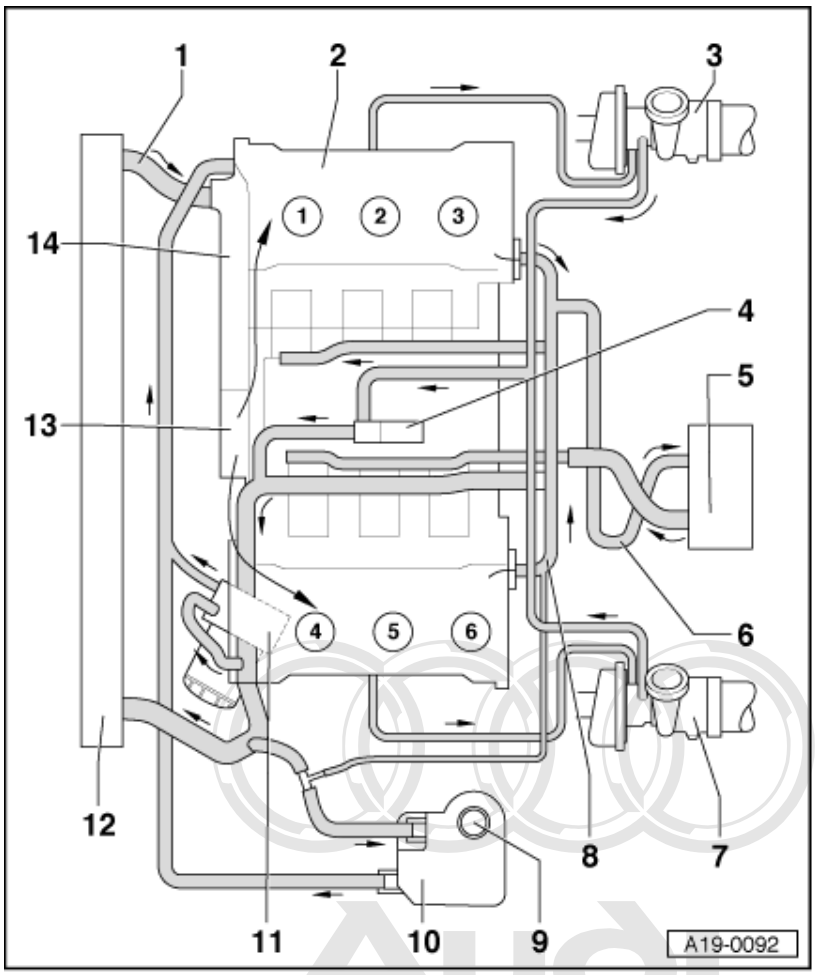
3 **Right turbocharger**

4 **Auxiliary water pump**
- For continued coolant circulation

5 **Heat exchanger for heater system**

6 **Coolant hose**
- To heat exchanger

7 Left turbocharger



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8 Rear coolant pipe
9 Cap for expansion tank
10 Expansion tank
11 Oil cooler
12 Radiator
- Removing and installing
  => Page 184
- After replacing, renew coolant in complete system

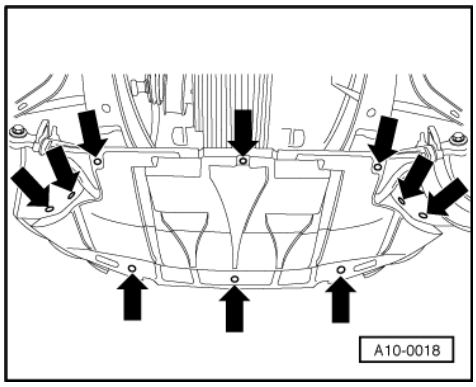
13 Coolant pump

14 Connection

- For thermostat

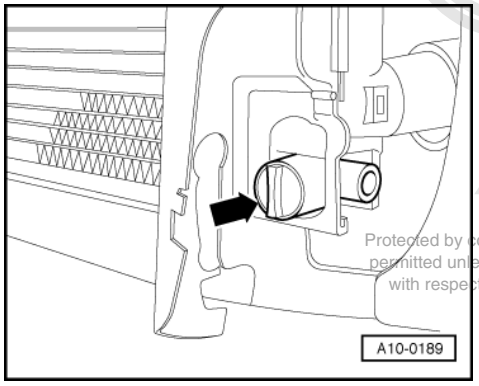
1.6 - Draining and filling cooling system

Draining



Warning
Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and unscrew it carefully.

- Unscrew filler cap on coolant expansion tank.
- -> Remove noise insulation panel.
- Place drip tray V.A.G 1306 under the engine.



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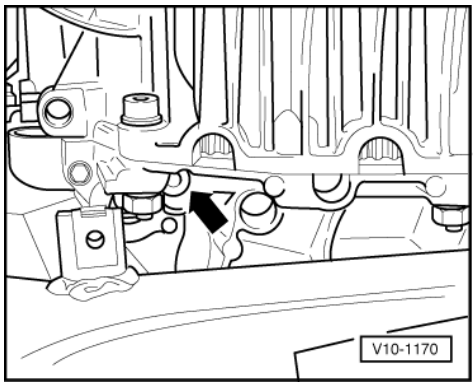
- -> If bumper has been removed from vehicle, open drain tap -arrow- on bottom of radiator (left side) by turning anti-clockwise. Fit drain hose on connection if necessary.
- If bumper has not been removed from vehicle, pull out retaining clip on bottom hose going from radiator to engine (right side), and pull hose off radiator.



- -> Drain coolant from engine at drain screw -arrow-.

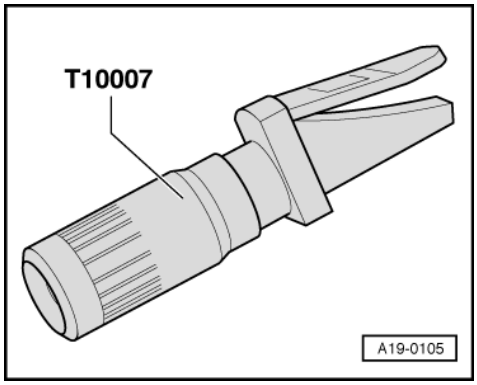
Note:
Observe disposal regulations for coolant.

Filling

Notes:

- Use only coolant additive G 12 - meeting specification VW 774 D.
  Identification: coloured red.
- G 12 must not be mixed with any other additives.
- If the fluid in the expansion tank is brown, this is an indication that G 12 has been mixed with another type of coolant. In this case the coolant must be changed.

- G 12 and coolant additives complying with specification "VW 774 D" prevent frost and corrosion damage, scaling and also raise the boiling point of the coolant. For this reason the system must be filled all year round with the correct additive for frost and corrosion protection.
- Particularly in countries with tropical climates, the higher boiling point of the coolant improves engine reliability when working under heavy load.
- The system must be protected against frost to about -25 °C (in arctic climates to about -35 °C).



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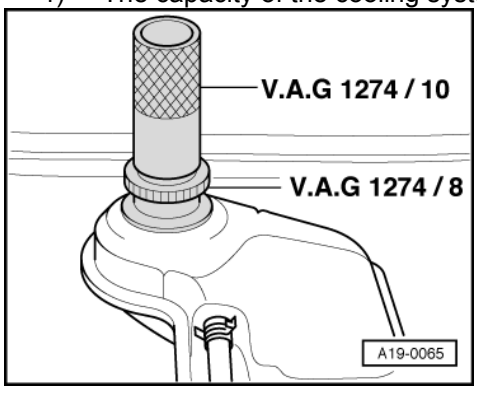
- -> Use special tool T10007 to test coolant concentration and antifreeze protection.

- The coolant concentration should not be reduced by adding plain water, even in warmer seasons and in warmer countries. The concentration must be at least 40 %.
- If extra antifreeze protection is required in cold climates, the concentration of G 12 can be increased, but only up to a maximum of 60 % (frost protection to about -40 °C); if this concentration is exceeded, the antifreeze protection will be reduced again and cooling effectiveness will also be impaired.
- Do not reuse the old coolant if the radiator, heat exchanger, cylinder head or cylinder head gasket have been replaced.

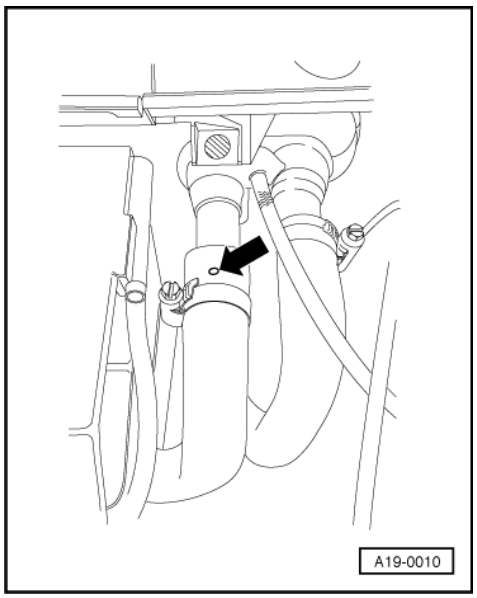
Recommended mixture ratios:

Frost protection to	Antifreeze concentration	G 121)	Water1)
-25 °C -35 °C	40 % 50 %	2.5 ltr. 3.0 ltr.	3.5 ltr. 3.0 ltr.

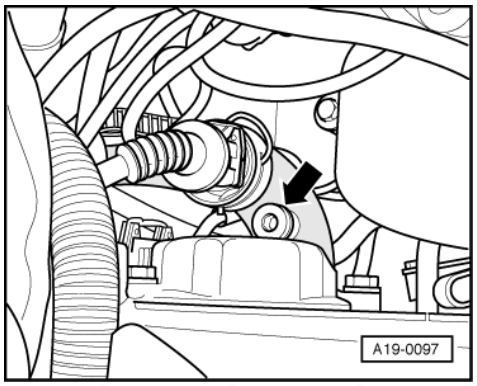
1) The capacity of the cooling system can vary depending on the equipment fitted to the vehicle.



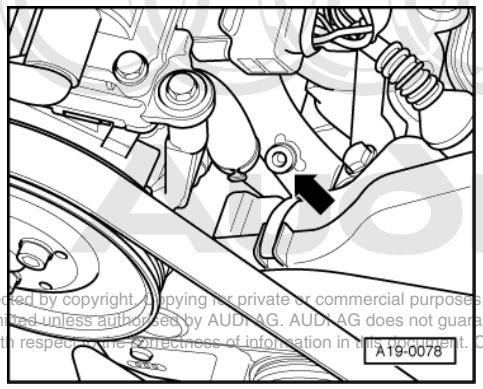
- Renew O-ring on coolant drain screw and screw drain screw back into engine
  Tightening torque: 20 Nm.
- Install bottom coolant hose and secure.
- Close coolant drain tap on radiator.
- -> Screw adapter V.A.G 1274/8 onto expansion tank and insert extension V.A.G 1274/10 into the adapter.



- -> Loosen coolant hose on heat exchanger and pull back hose far enough so that the bleeder hole in the hose -arrow- is no longer covered by the connection.
- Fill up coolant until it comes out at bleeder hole in coolant hose.
- Push coolant hose onto connection and tighten.



- -> Loosen bleeder screw on rear coolant pipe -arrow- below expansion tank.
- Fill up coolant until it comes out at bleeder screw.
- Screw in bleeder screw (20 Nm).



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- -> Loosen bleeder screw on front coolant pipe -arrow- between power steering pump and left cylinder head.
- Fill up coolant until it comes out at bleeder screw.
- Screw in bleeder screw (20 Nm).
- Fill coolant up to max. mark.
- Close filler cap on expansion tank.
- Switch off air conditioning system throughout the complete bleeding process.

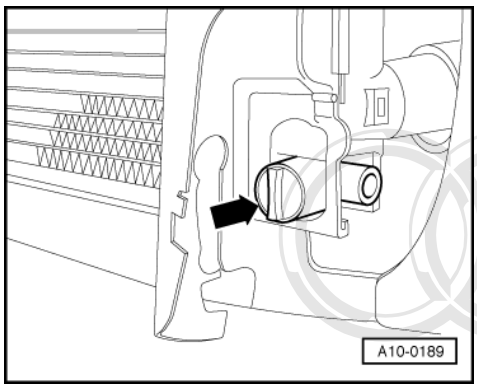
- Start engine and let it idle for about 10 minutes.
- Maintain an engine speed of about 2000 rpm for about 5 minutes.
- Then allow engine to run at idling speed until bottom hose on radiator becomes hot.
- Check coolant level and top up if necessary. When the engine is at normal operating temperature the coolant level must be on the max. mark, and between the min. and max. marks when the engine is cold.

Note:

When the engine is hot the cooling system is under pressure. Carefully open filler cap on expansion tank to release pressure before starting repair work.

Warning
Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and unscrew it carefully.

1.7 - Removing and installing radiator



Removing

- Remove front bumper

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

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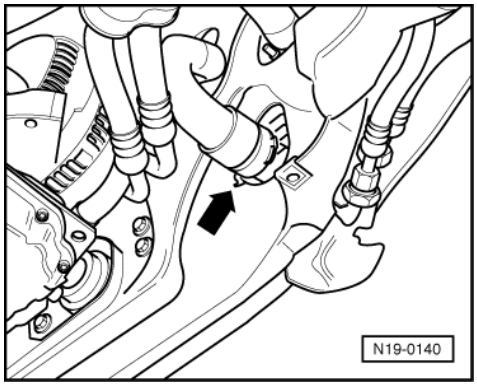
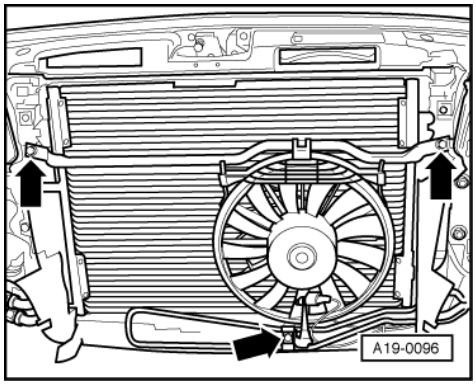
- -> Drain coolant => Page 181 .



- -> Disengage retaining clips on connecting flanges -arrow- and pull coolant hoses off radiator.
- Unplug connector from thermoswitch on radiator (bottom left).



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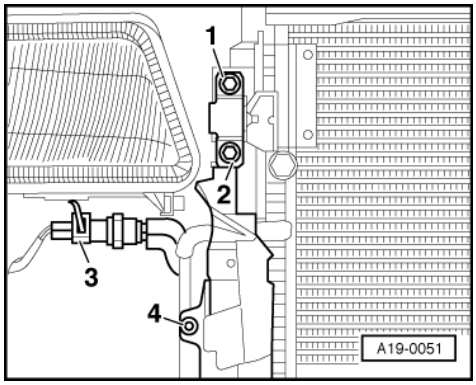
- -> Unbolt pressurising fan and detach cooling pipes for power steering hydraulic fluid -arrows-.

Vehicles with air conditioner

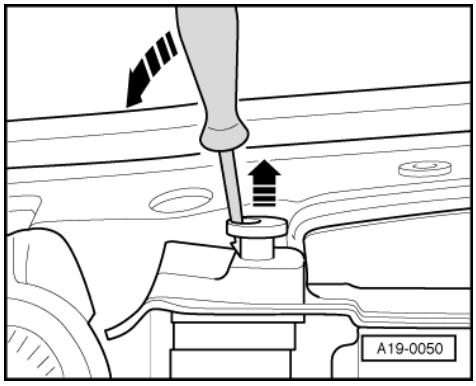
Warning Do not open the air conditioner refrigerant circuit.

Note:

To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.



- -> Detach air cowls from radiator -4- (left and right).
- Remove securing bolts -1- and -2- for condenser.
- Unplug connector -3- from air conditioner pressure switch -F129.
- Lift condenser up out of its bracket, turn it towards the side and secure to right-hand front wheel with wire.



- -> Release two retaining pins for radiator and pull out upwards -arrows-.

- Pivot radiator towards the front and lift out.

Installing

Install in the opposite order to removing. When installing, note the following points:

- Fill up with coolant=> Page 181 .

Tightening torques

Component	Nm
Condenser to radiator	10
Cooling pipes to radiator	10
Pressurising fan to radiator	10

1.8 - Removing and installing coolant pump

Notes:

- Always renew seals and gaskets.
- Cover toothed belt with a cloth to protect it from coolant before removing coolant pump.

Removing

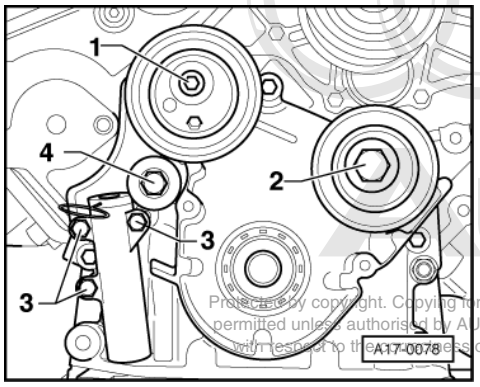
- Remove front bumper:

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Move lock carrier to service position

=> General body repairs; Repair group 50; Removing and installing lock carrier; Lock carrier service position

- Remove ribbed belt => Page 35 .
- Remove toothed belt => Page 37 .
- Drain coolant => Page 181 .



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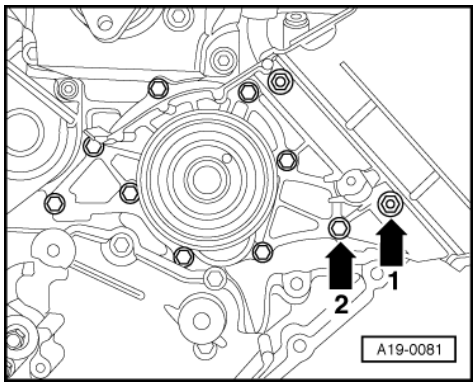
- -> Remove the following components before unbolting the coolant pump:
- 1- Tensioning roller for toothed belt: 20 Nm
- 2- Idler wheel: 45 Nm

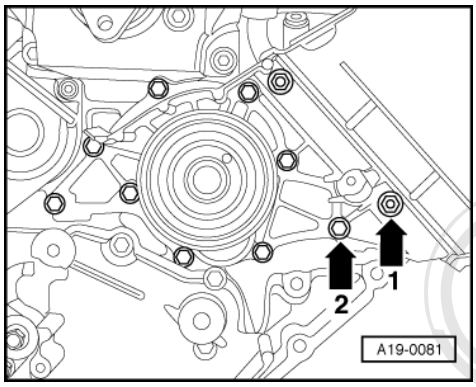


- -> Unbolt coolant pump from toothed belt guard -1- (2 nuts). Unscrew securing bolts -2- (9 bolts) for coolant pump and remove coolant pump.

Installing

Install in the opposite order to removing. When installing, note the following points:

- Remove residues of sealant on sealing surfaces of coolant pump and cylinder block.
- Clean the sealing surfaces; ensure that they are free of oil and grease.



- Fit new gasket on coolant pump flange.
- -> Insert coolant pump into cylinder block and tighten all 9 securing bolts -2-.
- Secure rear toothed belt guard at coolant pump housing -1- .

Tightening torque: 10 Nm.

- Install toothed belt => Page 37 .
- Install ribbed belt => Page 35 .
- Install toothed belt guard.
- Fill cooling system => Page 181 .

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1.9 - Removing and installing thermostat

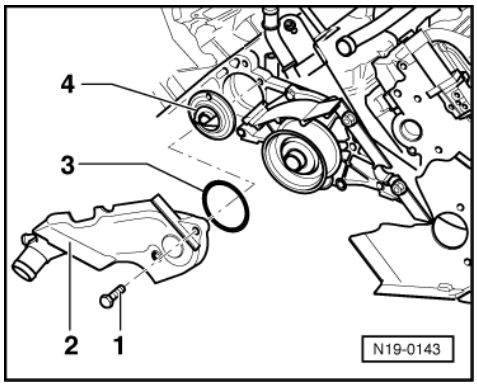
Notes:

- Always renew seals and gaskets.
- Cover toothed bolt with a cloth to protect it from coolant before removing thermostat.

Removing

- Drain coolant => Page 181 .
- Remove front bumper:

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

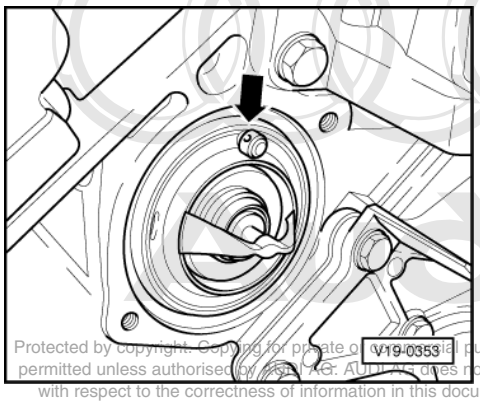


- Move lock carrier to service position

=> General body repairs; Repair group 50; Removing and installing front lock carrier; Lock carrier service position

- Remove ribbed belt => Page 35 .
- Remove toothed belt => Page 37 .
- -> Unscrew securing bolts -1- of connection for thermostat and remove connection -2-.
- Take out thermostat -4-.

Installing



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Install in the opposite order to removing. When installing, note the following points:

- Lubricate new O-ring -3- with coolant.
- Fit thermostat -4- into engine block.
- -> Make sure that thermostat bleeder valve -arrow- is on top.

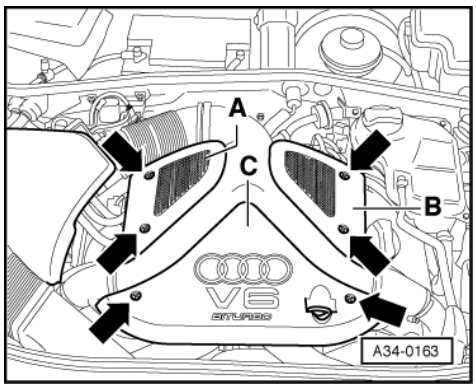
- Install connection for thermostat and tighten bolts.
  Tightening torque: 10 Nm
- Install toothed belt => Page 37 .
- Install ribbed belt => Page 35 .
- Fill cooling system => Page 181 .

1.10 - Removing and installing auxiliary water pump

Notes:

- All hose connections are secured with clips.
- Charge air system must be free of leaks.

- Renew all seals and gaskets



Removing

- -> -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.
- Remove front bumper:

=> General body repairs; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Move lock carrier to service position

=> General body repairs; Repair group 50; Removing and installing lock carrier; Lock carrier service position

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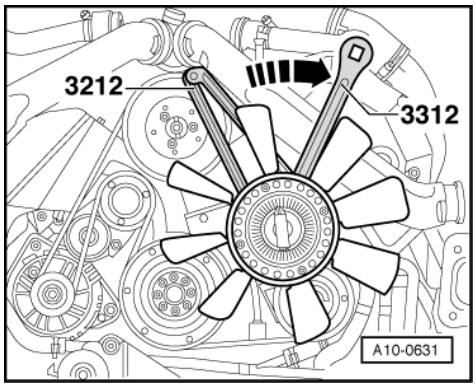
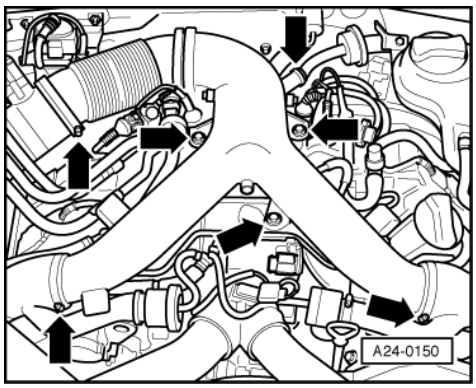


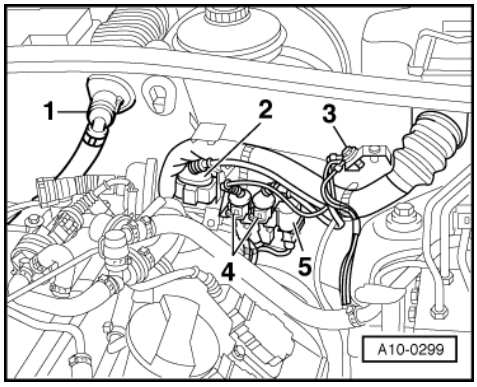
- -> Remove viscous fan (counter-hold with pin wrench 3212).

Note:

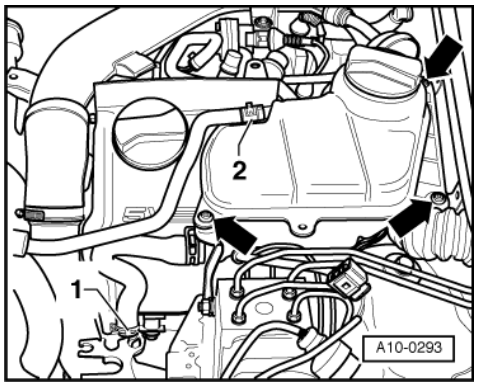
Viscous fan has left-hand thread: turn in direction indicated.



- -> Remove air duct -arrows-.



- -> Pull off brake servo hose -1- at bulkhead.
- Disconnect earth wire from exhaust temperature sender (left side).
- Unscrew exhaust temperature senders from intake manifold (left and right sides) => Fitting locations overview, Page 25 .

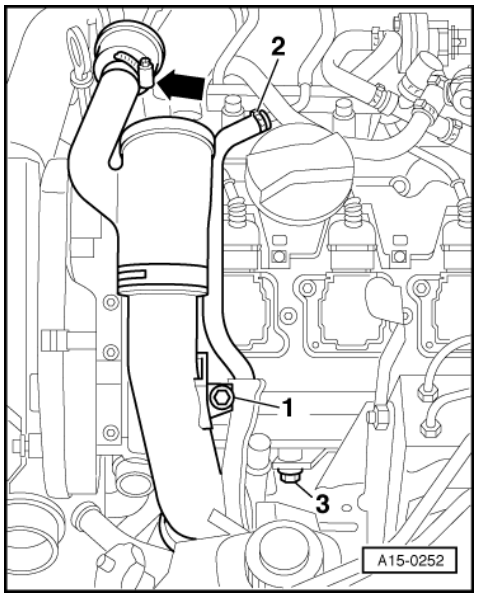


- -> Remove coolant reservoir -arrows- and move it clear to the side.

Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.



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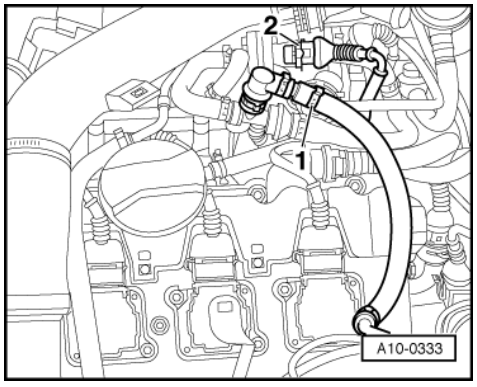
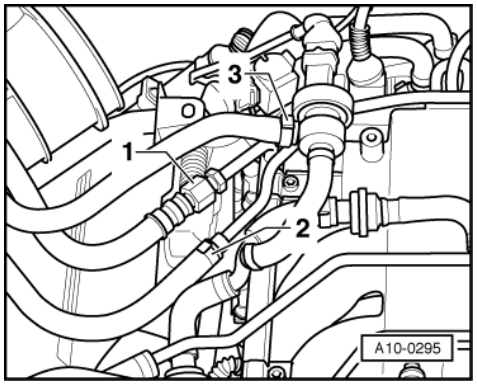
- Remove cover panel from cylinder head cover (cylinder bank 4-6).
- -> Disconnect hose -2-.



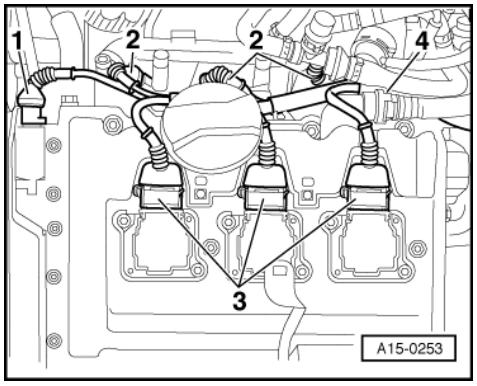
- -> Pull off hose -1- for vacuum reservoir.
- Unplug connector from air recirculation valve -2-.

- Remove cover above air cleaner.

Warning
Fuel system is under pressure. Before opening the system, place a cloth around the connection. Then release pressure by carefully loosening the connection.



- -> Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off ACF valve -3-.
- Remove cover panel from cylinder head cover (cylinder bank 1-3).



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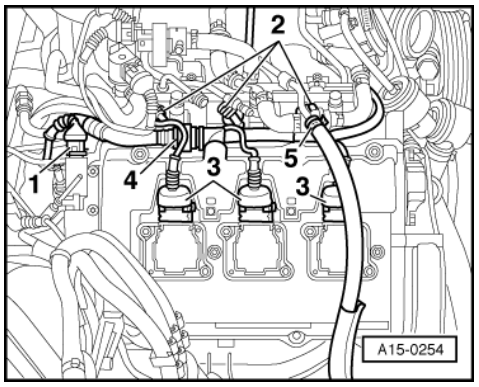
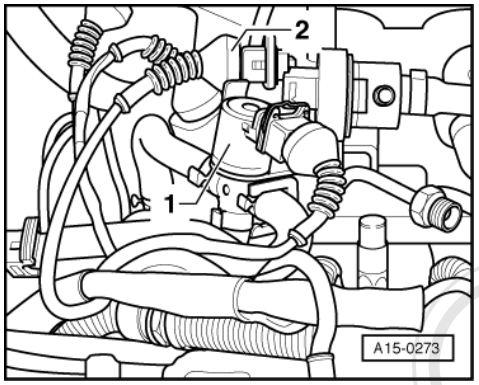
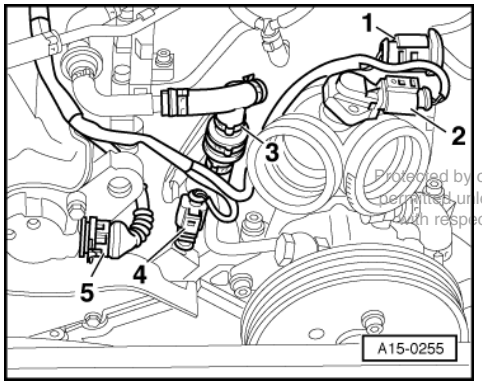
- -> Pull connectors off injectors -2- on cylinder bank 4 - 6.



- -> Unplug connectors from injectors -2- (cylinder bank 1..3).
- Pull off hose -5- going to turbocharger intake side.



- -> Unclip solenoid valve for charge pressure control -1-.
- Pull connector off ACF valve -2-.



- -> Pull connector off throttle unit -1-.
- Pull connector off charge air sensor -2-.
- Pull off crankcase breather -3-.
- Pull connector off intake air temperature sensor -4-.

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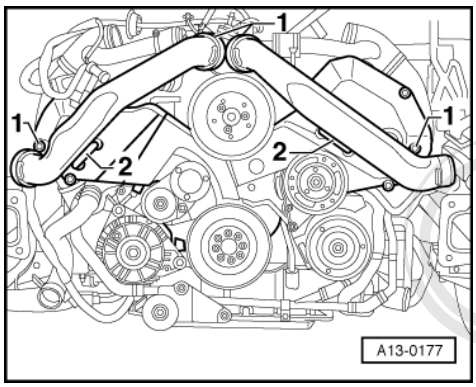

- -> Remove pressure pipes -1-.

Note:

Watch position of retaining strips -2-.

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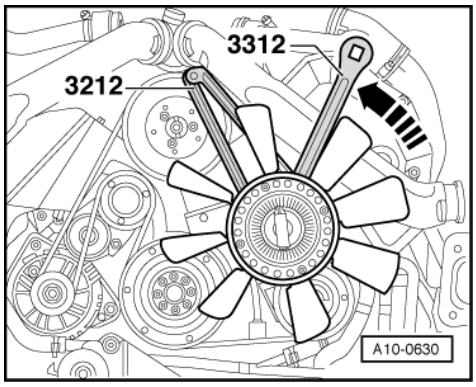
- Unbolt intake manifold using special tool 3249.
- Pull off connector for auxiliary water pump.
- Fit clamps 3094 on water hoses for auxiliary water pump.
- Remove auxiliary water pump.

Installing

Install in the opposite order to removing. When installing, note the following points:



- -> Counterhold viscous fan pulley using pin wrench 3212 and secure viscous fan using open-end spanner 3312 and torque wrench 1331 (left-hand thread).

Note:

Viscous fan has left-hand thread: turn in direction indicated.

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position

- Install bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

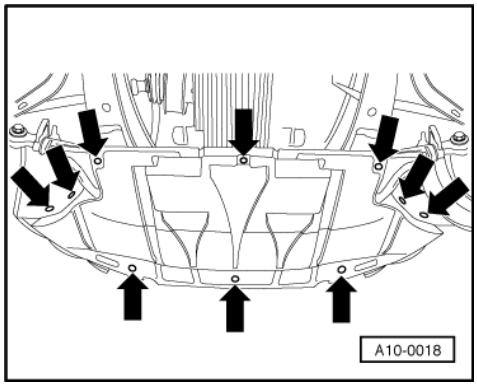
Tightening torques

Component		Nm
Bolts	M6	10
Bolts	M8	20

Component	Nm
Intake manifold to cylinder head	10
Torque wrench V.A.G 1331 and open-end spanner 3312	37 Nm
Torque wrench without open-end spanner 3312	70 Nm

1.11 - Removing and installing viscous fan

Removing

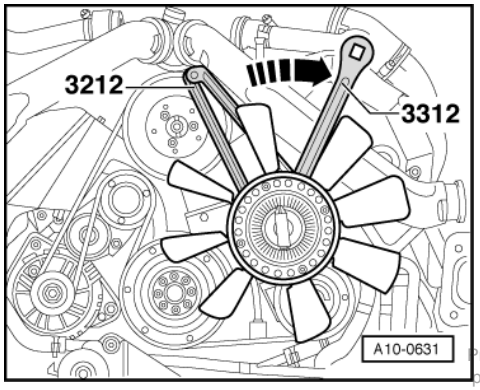


- -> Remove noise insulation -arrows-.
- Remove bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

- Move lock carrier to service position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position



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- -> Hold viscous fan pulley with 2-hole pin wrench 3212 and unscrew viscous fan using open-end spanner 3312 (left-hand thread).

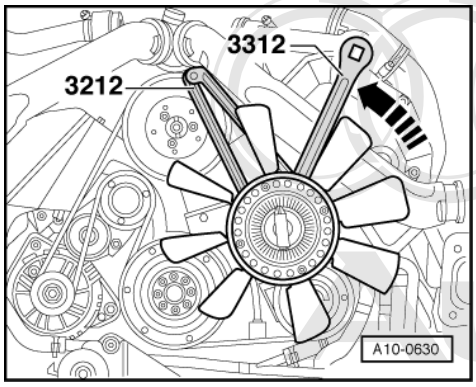
Note:

Viscous fan has left-hand thread: turn in direction indicated.

- Carefully remove viscous fan from above.

Installing

Install in the opposite order to removing. When installing, note the following points:



- -> Counterhold viscous fan pulley using pin wrench 3212 and secure viscous fan using open-end spanner 3312 and torque wrench 1331 (left-hand thread).

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Note:

Viscous fan has left-hand thread: turn in direction indicated.

- Install lock carrier in normal position

=> General body repairs, Exterior; Repair Group 50; Body front; Lock carrier service position

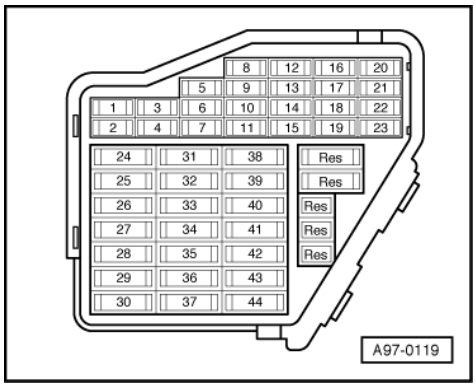
- Install bumper

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper - Assembly overview Front bumper Removing and installing front bumper - Assembly overview

- Install noise insulation.

Tightening torque for viscous fan	
Torque wrench V.A.G 1331 and open-end spanner 3312	37 Nm
Torque wrench without open-end spanner 3312	70 Nm

1.12 - Checking radiator fan

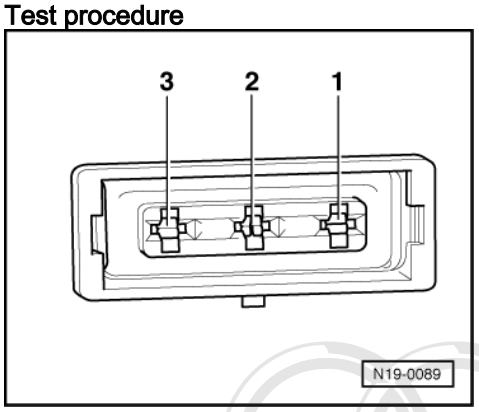


Test requirements

- -> Fuse No. 34 OK.

- Radiator fan thermoswitch (-F18) OK.

Test procedure



- Unplug 3-pin connector from radiator fan thermoswitch (-F18) on radiator (bottom left).
- Switch on ignition.
- -> Bridge contact -1- and contact -2- of connector with auxiliary cables from V.A.G 1594.
  Radiator fan (-V7) should run at 1st speed (stage 1).

- Bridge contact -1- and contact -3- of connector with auxiliary cables from V.A.G 1594.
  Radiator fan (-V7) should run at 2nd speed (stage 2).

If 1st or 2nd fan speeds do not work:
- Trace and repair open circuit in wiring using Current flow diagram:

=> Current-flow diagrams, Electrical fault-finding and Fitting locations
If no open circuit can be found:
- Renew radiator fan (-V7).

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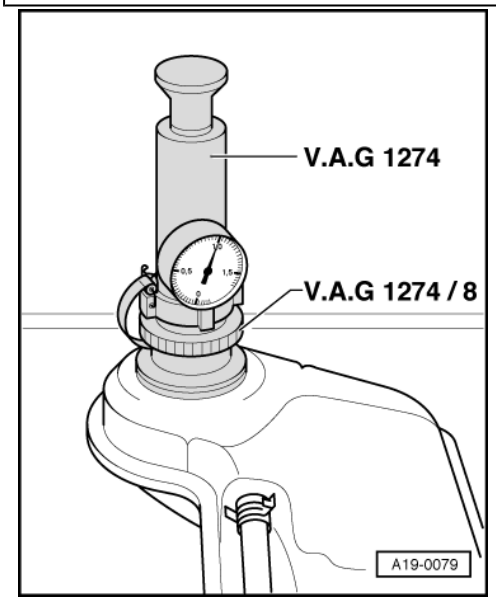
1.13 - Checking cooling system for leaks

Test requirements:
- Engine at normal operating temperature.

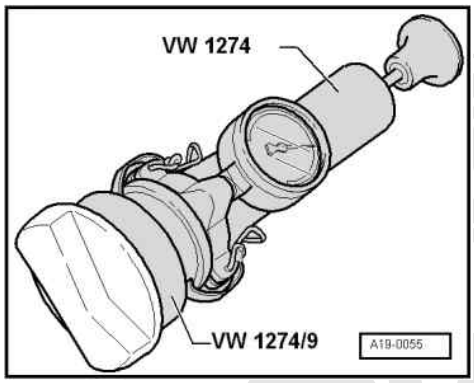
Warning
Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and unscrew it carefully.



- Unscrew filler cap on expansion tank.
- -> Fit tester V.A.G 1274 and adapter V.A.G 1274/8 on expansion tank.
- Build up a pressure of approx 1.0 bar with hand pump on tester.
- If this pressure is not maintained, trace and repair leaks.

Checking pressure relief valve in filler cap

- Screw filler cap onto tester with adapter V.A.G 1274/9.



- -> Fit hand pump and build up pressure.
- Pressure relief valve should open at 1.4 ... 1.6 bar.

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21 - Charging

1 - Charge air system with turbocharger

1.1 - Charge air system with turbocharger

1.2 - Removing and installing turbocharger

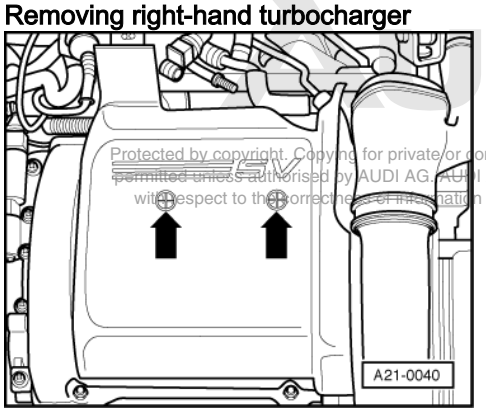
Observe rules for cleanliness => Page 202 .

Notes:

- Always renew both turbochargers together.
- All hose connections are secured with clips.
- Charge air system must be free of leaks.
- Renew self-locking nuts.
- Renew all seals and gaskets

- Remove engine => Page 3 .

Removing right-hand turbocharger



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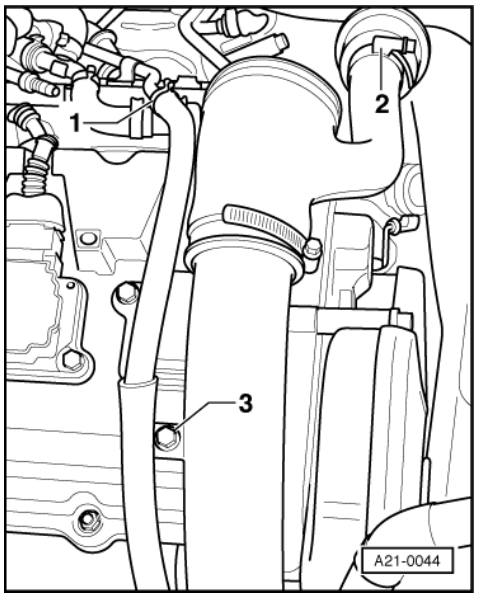
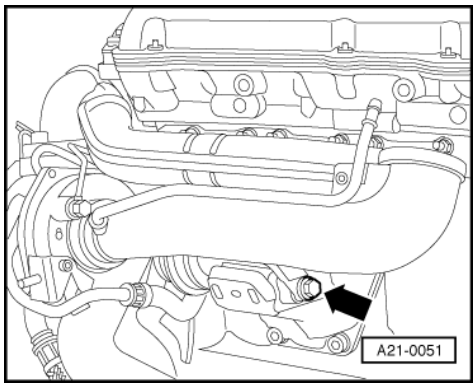
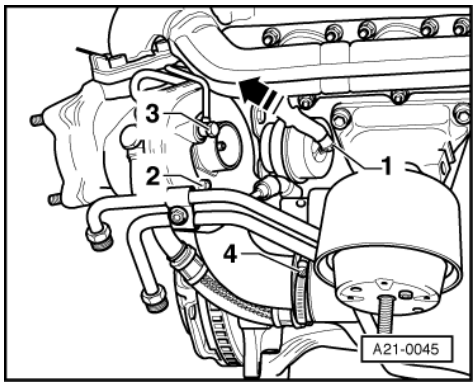
- -> Remove cover panel from right-hand cylinder head cover -arrows-.



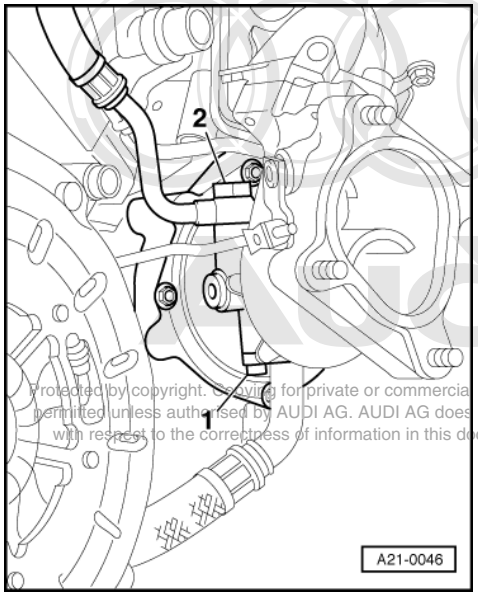
- -> Disconnect hose -1-.
- Disconnect hose -2-.
- Unbolt upper section of intake pipe -3-.



- -> Remove lower section of intake pipe -arrow-.



- -> Push back heat insulation hose in direction of arrow.
- Disconnect vacuum hose -1-.
- Unbolt bracket -2- with gearbox oil pipes.
- Disconnect pipe -3-.
- Disconnect pressure hose -4- from turbocharger.



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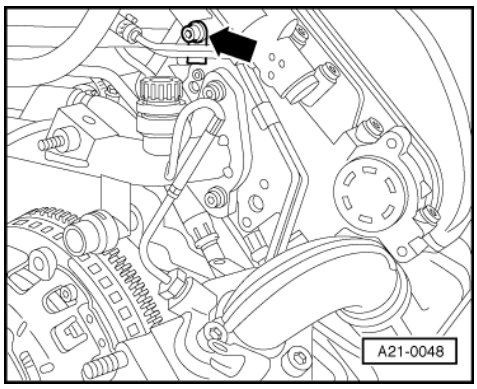
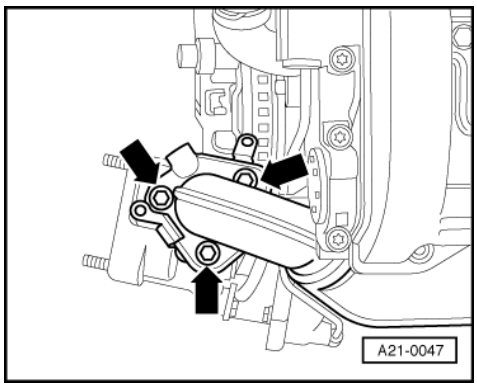
- -> Disconnect oil return pipe -1-.

- Disconnect water pipe -2-.



- -> Unbolt line -arrow- from cylinder head.



- -> Remove turbocharger -arrows-.

Installing:

- Install in reverse sequence.

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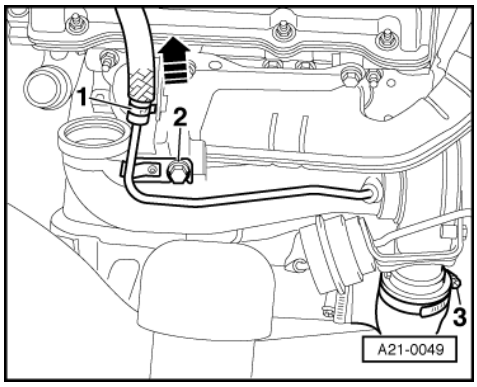
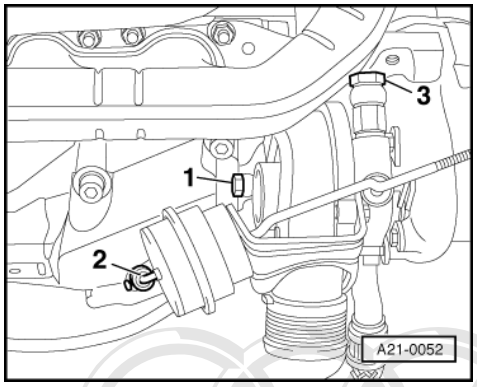
Notes:

- When installing turbocharger, ensure that O-ring for oil return is not damaged.

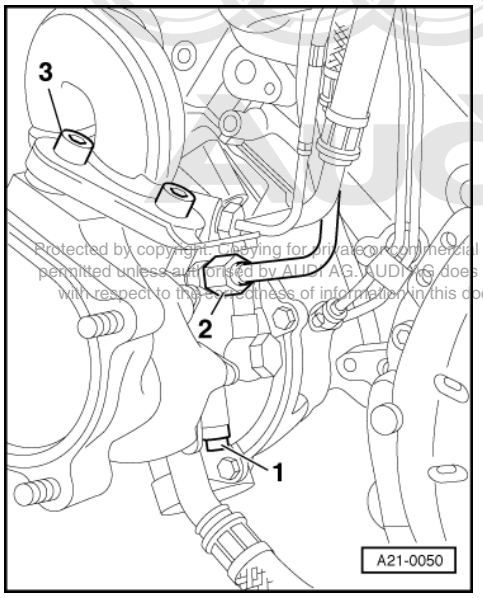


Removing left-hand turbocharger

- -> Push back heat insulation hose in direction of arrow.
- Disconnect vacuum hose -1-.
- Remove lower section of pressure pipe -2-.
- Disconnect pressure hose -3- from turbocharger.



- -> Disconnect vacuum pipe -1-.
- Disconnect vacuum hose -2-.
- Disconnect pipe -3- going to right-hand turbocharger.



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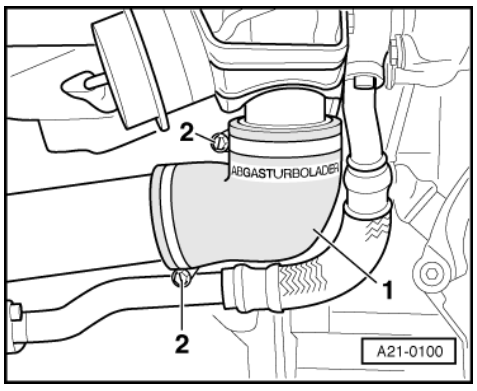
- -> Disconnect oil return pipe -1-.
- Disconnect water pipe -2-.
- Remove turbocharger -3- (3 bolts).

Installing:

- Install in reverse sequence.

Note:

When installing turbocharger, ensure that O-ring for oil return connection is not damaged.



- The lettering "ABGASTURBOLADER" (turbocharger) should be readable as illustrated. Install turbocharger hose -1- properly if necessary.
- The screw-type clips -2- should be fitted as illustrated and the screw fasteners should be located at the 'X'-mark on the hose.

Tightening torque

Bolted mountings	Tightening torque
Turbocharger to manifold	60 Nm
Intake pipe to cylinder head	10 Nm
Heat shield to turbocharger	10 Nm
Exhaust manifold to exhaust pipe	25 Nm
Injector pipes	30 Nm
Intake pipe to engine support	10 Nm
Oil pipe to turbocharger	15 Nm
Oil pipe to intake manifold	20 Nm

1.3 - Rules for cleanliness

When working on the exhaust gas turbocharger, pay careful attention to the following "5 rules":

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover or seal opened components if the repair cannot be carried out immediately.
- Only install clean components:
  Only unpack replacement parts immediately prior to installation.
  Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open:
  Do not work with compressed air if this can be avoided.
  Do not move vehicle unless absolutely necessary.

1.4 - Checking turbocharger and charge pressure regulating valve

Safety notes

Note the following points if test equipment has to be used during a road test:

Warning
- **Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.**
- **If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.**

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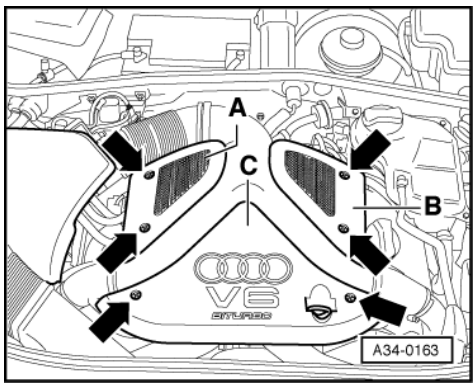
Special tools, testers and auxiliary items

- Turbocharger tester V.A.G 1397 A
- Fault reader V.A.G 1551 or V.A.G 1552 with cable V.A.G 1551/3

Requirements for test:

- Fault memory has been interrogated



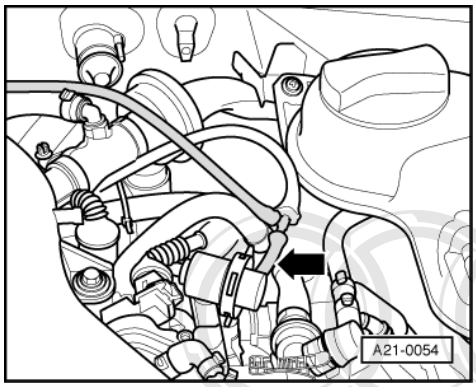
=> Motronic injection and ignition system (6-cylinder turbo); Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

- Final control diagnosis has been performed

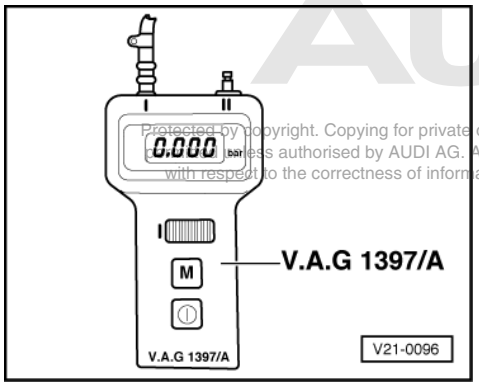
=> Motronic injection and ignition system (6-cylinder turbo); Repair group 01; Final control diagnosis Final control diagnosis

- All vacuum connections airtight

- -> Loosen bolts -arrows- and remove engine cover panel -B-.



- -> Connect T-piece with measuring hose of turbocharger tester V.A.G 1397 A to fuel pressure regulator -arrow-.
- Route measuring hose under rear edge of bonnet and into passenger compartment via right-hand window.



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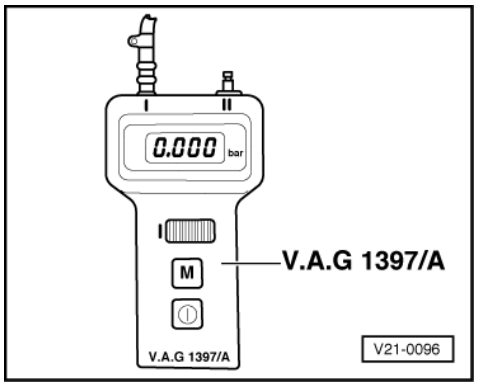
- -> Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.

Notes:

- Hose connections must be completely airtight, otherwise measurements will not be correct.
- Ensure that measuring hose is not pinched at bonnet or side window.

- Pressing memory key M on turbocharger tester will store the last measured value until memory key M is pressed again or tester is switched off.
- The decimal point in the display flashes to indicate that the value is being stored.
- If the battery voltage of the turbocharger tester drops below the minimum level, an arrow will appear at the top left of the display.
- Before performing the test, drive the vehicle at a brisk speed for at least 3 km (without stopping at traffic lights etc.).
- A second mechanic is required to note the readings on the tester when the vehicle is moving.
- Observe safety notes => Page 202 .



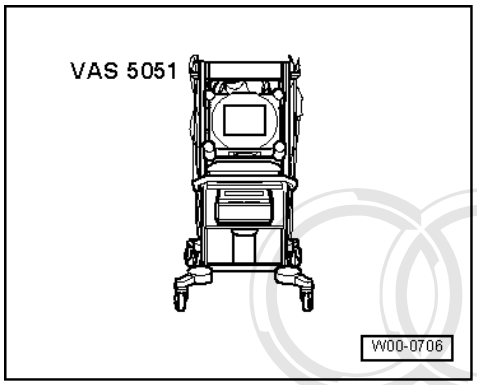
- Accelerate the vehicle from 2000 rpm at full throttle in fourth gear, and watch the rev counter.
- -> Press memory key -M- on turbocharger tester at 3000 rpm.
  - Specification: 1.650 ... 1.750 bar

Note:

If no charge pressure is obtained and a throbbing noise can be heard in the engine compartment, the causes can be as follows:

- Air recirculation valve defective.
- Vacuum line to air recirculation valve leaking or has become disconnected.

1.5 - Testing charge pressure control



Special tools and workshop equipment required

- VAS 5051 with VAS 5051/1

  or

- V.A.G 1551 and V.A.G 1551/3 A

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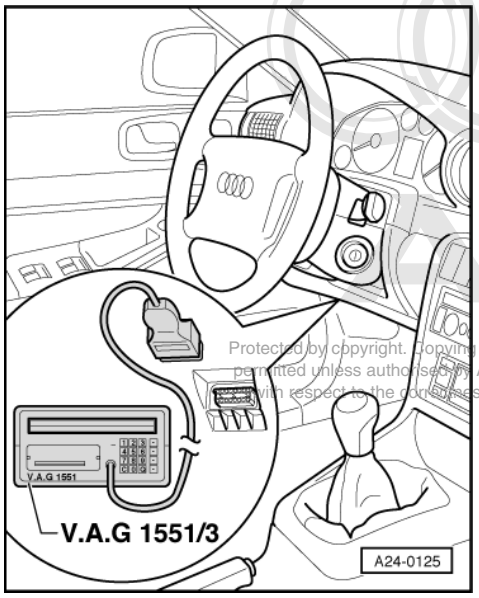
Test requirement:

- Coolant temperature at least 80 °C

Warning
- **Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.**
- **If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.**



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Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01"
  When doing this the engine must be idling.

=> Motronic injection and ignition system; Repair group 01; Self-diagnosis of Motronic system; Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions Self-diagnosis of Motronic system Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     Q
Enter display group number XXX
```

- Enter "115" to select Display Group 115 and confirm entry with Q key.

-> Indicated on display:
(1...4=Display zones)

```
Read measured value block 115
     1     2     3     4
```

- Test charge pressure control.

- Perform road test with engine running at
  - Full throttle

  for some period.

- Perform measurement at full throttle.

	Display zones			
	1	2	3	4
Display group 115: Charge pressure control				
Display	xxxx rpm	%	mbar	mbar
Indicates	Engine speed	Actual load	Specified pressure	Actual pressure
Specification			980	960...1000
Note				

Specified pressure and actual pressure should not deviate by more than max±20 mbar.

- Proceed to measured value block 117.
- Check function of accelerator pedal in display zone 2 by depressing accelerator pedal to full throttle for a short period of time.

	Display zones			
	1	2	3	4
Display group 117: Charge pressure control				
Display	xxxx rpm	**%**	%	mbar
Indicates	Engine speed	**Accelerator pedal position**	Throttle valve angle	Specified charge pressure
Specification		**0...100**		
Note				

If the specification 100% is not obtained at full throttle:

- Check accelerator pedal.
- Proceed to measured value block 116.

- Check adjusting factors in display zones 2 to 4.

	Display zones			
	1	2	3	4
Display group 116: Charge pressure control				
Display	xxxx rpm	**%**	%	mbar
Indicates	Engine speed	**Adjusting factor Fuel**	**Adjusting factor Coolant temperature**	**Adjusting factor Intake air temperature**
Specification				
Note				

If the display in display zone 2 indicates an adjusting factor of <0 %, the octane rating of the fuel might not be correct.

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- Fill up tank with correct fuel.

If the display in display zone 3 indicates an adjusting factor of <0 %, the coolant temperature is too high (the overheating warning lamp in the combi-instrument lights up) or the engine control unit is receiving an incorrect temperature signal from the combi-instrument.

- Check coolant temperature gauge.

=> Electric system; Repair group 90

If the display in display zone 4 indicates an adjusting factor of <0 %, the air being drawn in is too hot, or the intake air temperature sender is defective.

=> Motronic injection and ignition system; Repair group 24

- Proceed to measured value block 114.

	Display zones			
	1	2	3	4
Display group 114: Charge pressure control				
Display	%	%	%	
Indicates	Specified load, not adjusted	Specified load, adjusted	Actual load	On-off ratio Pulsed CPC valve
Specification	136. 0	134.3	137.5	55.2
Note				

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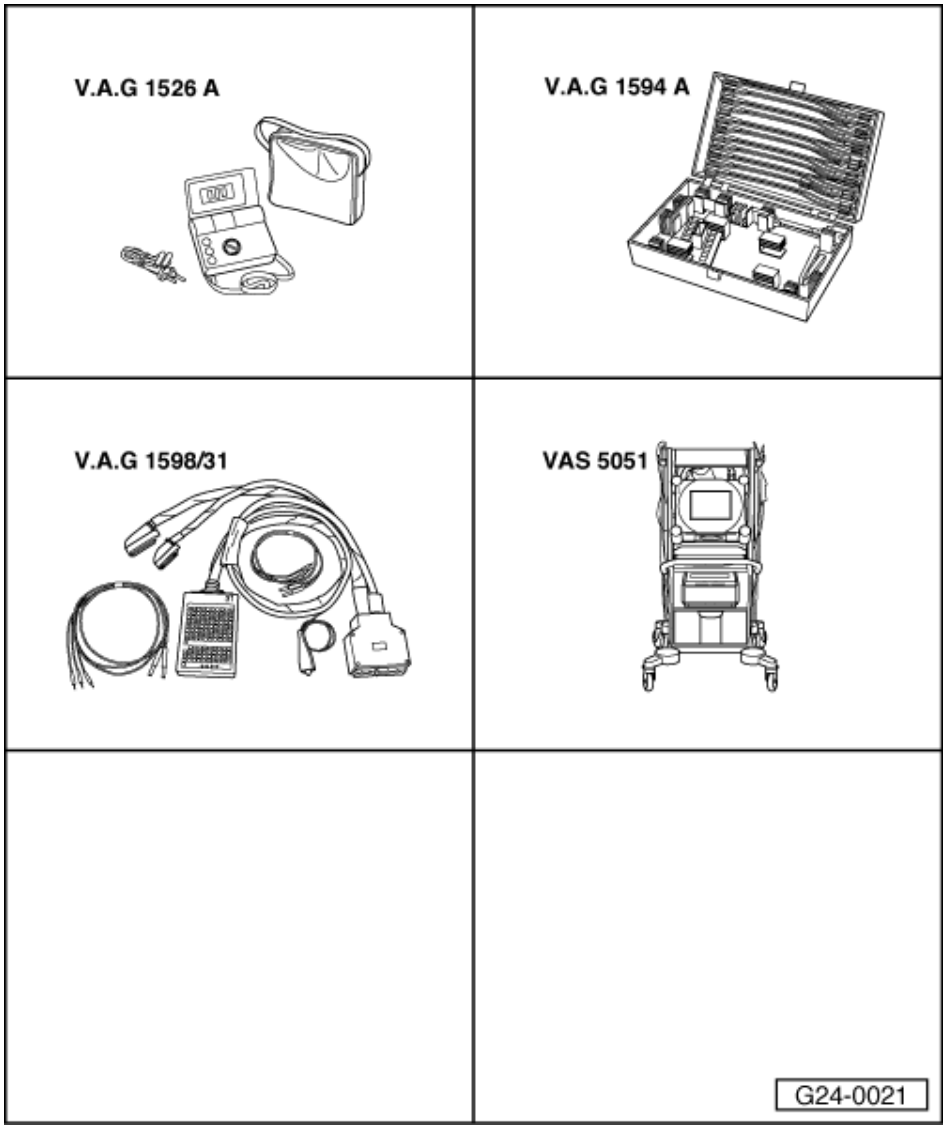
The load values in display zones 1 to 3 may differ up to±5 %.

If the specifications in the measured value blocks are not obtained:

Test charge air pressure sender -G31.

1.6 - Testing air recirculation valve for turbocharger -N249



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31
- VAS 5051 with VAS 5051/1

  or

- V.A.G 1551 with V.A.G 1551/3 A

Note:

The air recirculation valve for turbocharger -N249 and its wiring are monitored by the engine control unit.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01"
  When doing this the engine must be idling.

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=> Motronic injection and ignition system; Repair group 01; Self-diagnosis of Motronic; Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions Self-

diagnosis of Motronic Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions

- Interrogate fault memory of engine control unit.

=> Motronic injection and ignition system; Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

If the display shows a fault relating to air recirculation valve for turbocharger -N249:

- Disconnect hoses from air recirculation valve; the electrical connector remains connected.
- Connect auxiliary hose to valve at one of the connections.

- Start final control diagnosis and select air recirculation valve for turbocharger -N249.

=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis

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-> Indicated on display:

```
Final control diagnosis
Air recirc. valve for turbocharger -N249
```

The valve should click ...

... and open and close (can be checked by blowing into auxiliary hose).

If the valve does not click:

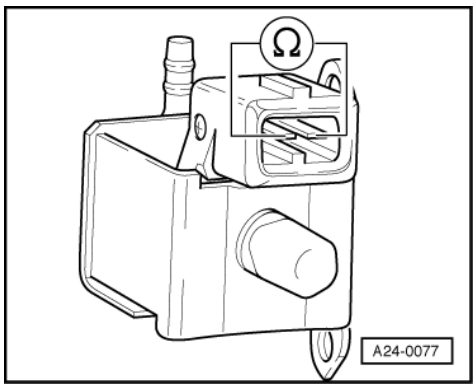
- Test internal resistance of valve.

If the valve does not open and close properly:

- Renew air recirculation valve for turbocharger -N249.

Testing internal resistance

- Unplug electrical connector from valve.



- -> Connect multimeter to valve (resistance measurement range)
  - Specification: 27 ... 30ω

If the specification is not obtained:

- Renew air recirculation valve for turbocharger -N249.

If the specification is obtained:

- Check voltage supply.

Checking voltage supply

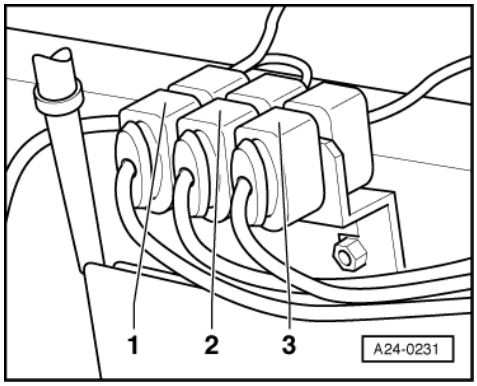
Note:

The air recirculation valve receives its voltage supply via the fuel pump relay.

Test requirement:

- Fuse for air recirculation valve OK.

- Disconnect electrical connector from valve.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine earth

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- Operate starter briefly.
  - The LED should light up.

If the LED does not light up:

- Test for open circuit in wiring connection between fuel pump relay and contact 1 on connector via fuse

=> Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify any open circuits.

If the wiring is OK:

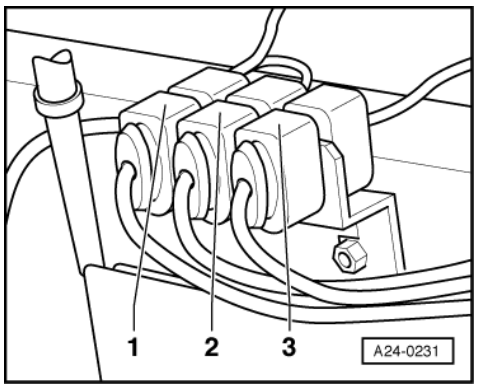
- Test fuel pump relay.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Checking fuel pump relay and activation. Servicing Motronic injection system Checking fuel pump relay and activation.

If the LED lights up:

- Check activation.

Checking activation



- -> Connect voltage tester V.A.G 1527 B to contact 1 (positive) and contact 2 of the connector.
- Start final control diagnosis and select air recirculation valve for turbocharger -N249.

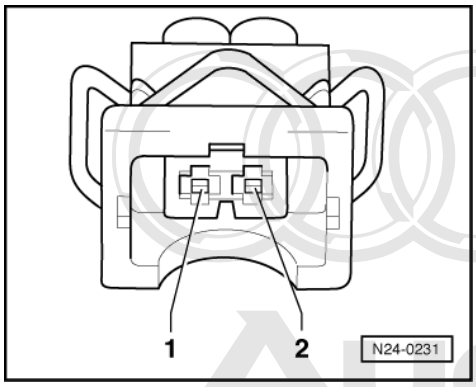
=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis

- The LED should flash.

If the LED lamp does not flash or if it lights up continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit.Do notconnect to the engine control unit itself.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Checking fuel pump relay and activation. Servicing Motronic injection system Checking fuel pump relay and activation.



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector	Test box V.A.G 1598/31
Contact	Socket
2	9

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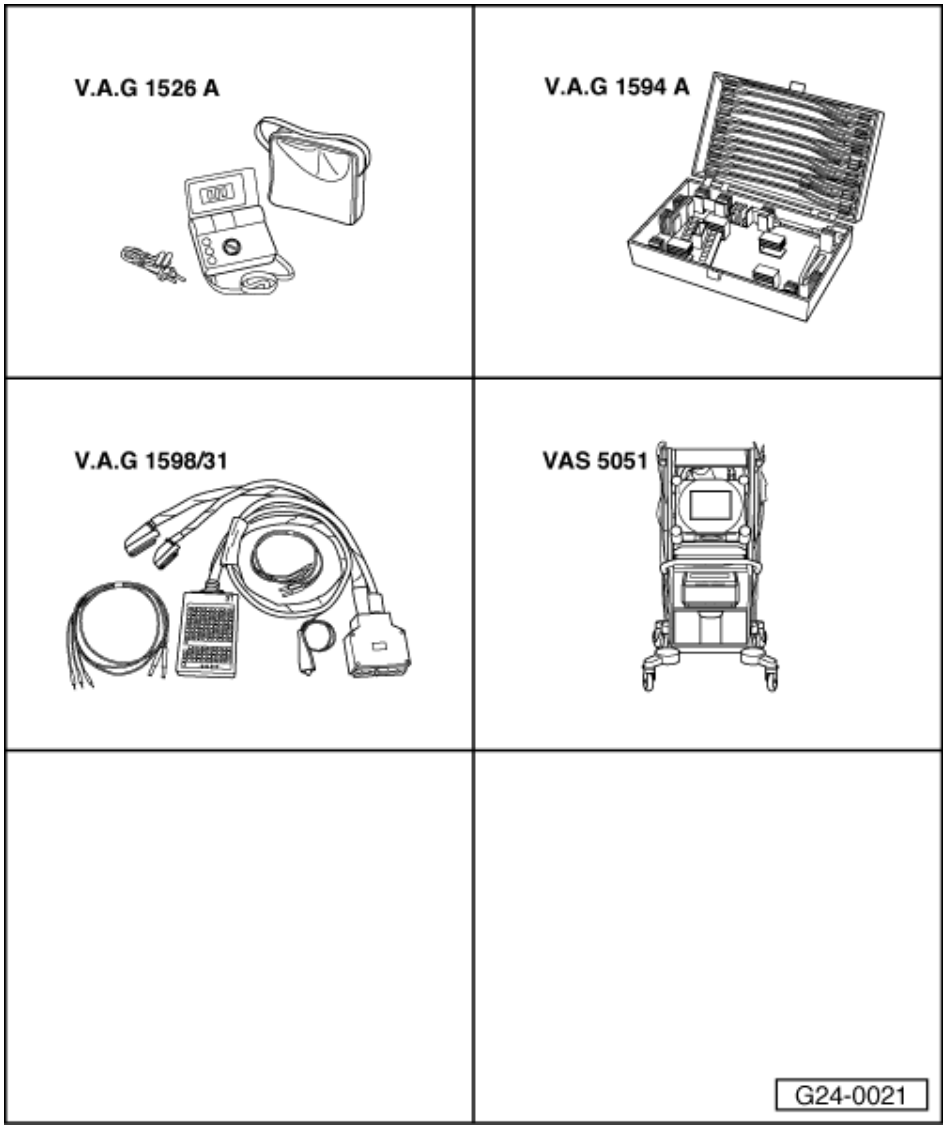
- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Fit a new engine control unit.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Renewing engine control unit Servicing Motronic injection system Renewing engine control unit

1.7 - Testing charge pressure sender -G31



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598/31
- VAS 5051 with VAS 5051/1

  or

- V.A.G 1551 with V.A.G 1551/3 A

Note:

Charge pressure sender -G31 and its wiring are monitored by the engine control unit.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01".
  When doing this the engine must be idling.

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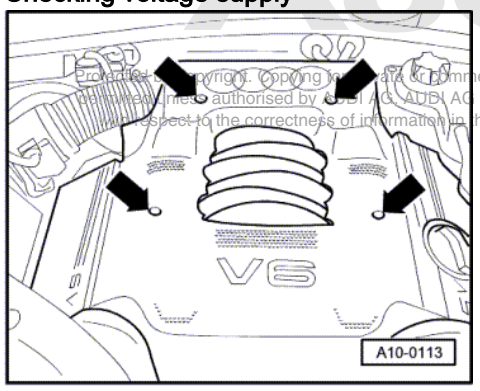
=> Motronic injection and ignition system; Repair group 01; Self-diagnosis of Motronic system; Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions

Self-diagnosis of Motronic system Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions
- Interrogate fault memory of engine control unit.

=> Motronic injection and ignition system; Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory
If the display shows a fault relating to charge pressure sender -G31:

Checking voltage supply



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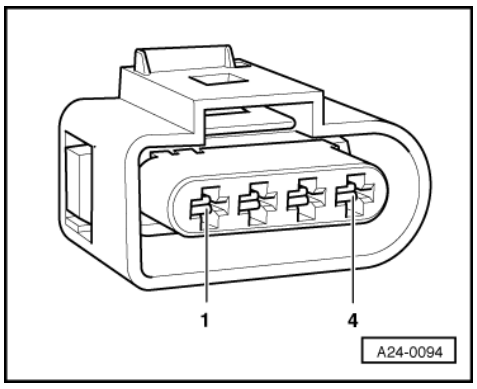
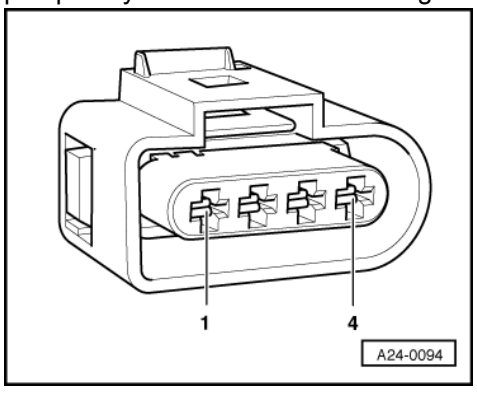
- Switch off ignition.
- -> Lift off engine cover panel -arrows-.
- Unplug connector on charge air pressure sender.



- -> Connect multimeter (voltage measurement range) between contacts 1 and 3 on connector.
- Switch on ignition.
  - Specification: approx. 5 V

If the specification is not attained:
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Connect the engine control unit as well.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Checking fuel pump relay and activation. Servicing Motronic injection system Checking fuel pump relay and activation.



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1	108
3	98

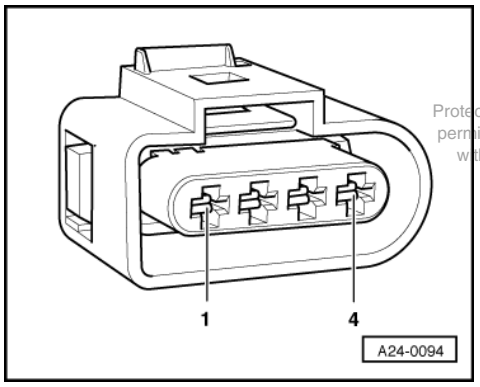
- Rectify any open/short circuit as necessary.

If the specification is obtained:

Testing signal wire

- Unplug connector on charge pressure sender.
- Connect multimeter (voltage measurement range) between sockets 101 and 108 on test box.
- Start engine and run at idling speed.
  - Specification: approx 1.90 V
- Increase engine speed by operating throttle quickly.
  - Specification: approx. 2.00 ... 3.00 V

If the specifications are not obtained:



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- -> Test for open circuit and short to positive or earth in the following wiring connections:

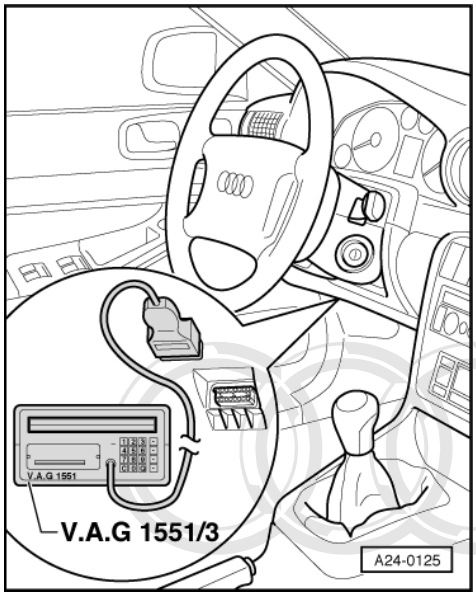
Connector Contact	Test box V.A.G 1598/31 Socket
4	101

- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Renew charge pressure sender -G31.

1.8 - Testing charge pressure control function via load signal



Notes:

- A second operator is required to note readings with the vehicle moving.
- Observe safety precautions => Page 202 .
- The vehicle tester system V.A.G 1552 can also be used instead of fault reader V.A.G 1551.

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- Unclip cover for diagnostic connection.
- -> Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.

-> Indicated in display

```
V.A.G - SELF DIAGNOSIS     HELP
1 - Rapid data transfer 1)
2 - Flash code output 1)
```

1) appears alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

- Press key 1 for "Rapid data transfer".
- Start engine.

-> Indicated on display:

```
Rapid data transfer     HELP
Enter address word XX
```

```
Rapid data transfer     Q
01 - Engine electronics
```

-> Press keys 0 and 1 for address word "Engine electronics" and confirm entry by pressing the Q key.

-> The display on fault reader V.A.G 1551 will show the control unit identification.

```
06A906018..     1.8l     R4/5T MOTR HS
0...     " Coding 04000     WSC 12345
```

- Press ⇒key.

-> Indicated on display:

```
Rapid data transfer     HELP
Select function XXX
```

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display

```
Read measured value block     HELP
Enter display group number XXX
```

- Enter display group number 025 and confirm entry with Q key.

-> The measured value block shows 4 display zones: => Page 216 for explanation of readings in display zones 1 ... 4.

```
Read measured value block     25
1     2     3     4
```

Explanation of readings in display zones

-> Indicated in display

```
Read measured value block     25
1     2     3     4
```

Display zone	Reading
1	Disregard reading
2	Specified engine load (after correction)
3	Actual engine load
4	Duty cycle (activation of solenoid valve for charge pressure control -N75)

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- Watch readings in display zones 2 and 3 while vehicle is accelerated at a constant rate.
  - Specification:
    Difference between readings 2 and 3 must not be more than 0.3 ms.

Note:

If faults in the charge pressure control function are detected by the self-diagnosis of the control unit, the duty cycle (display zone 4) will be set to a constant 5 %.

Faults in charge pressure control function

Fault	Display on V.A.G 1397 A	Display on V.A.G 1551	Possible causes of fault
Charge pressure too low	▪ Reading below 1.370 bar ▪ (vehicles with manual gearbox) ▪ Reading below 1.300 bar ▪ (vehicles with automatic gearbox)	▪ Actual engine load (display zone 3) less than specified engine load (display zone 2) ▪ Duty cycle (display zone 4) tends towards 99%	- Solenoid valve for charge pressure control -N75 defective - Wiring to solenoid valve for charge pressure control defective - Charge pressure regulating valve in turbocharger jammed in open position - Leaks between turbocharger and intake manifold - Turbocharger defective

Fault	Display on V.A.G 1397 A	Display on V.A.G 1551	Possible causes of fault
Charge pressure too high 1)	▪ Reading above 1.470 bar ▪ (vehicles with manual gearbox) ▪ Reading above 1.400 bar ▪ (vehicles with automatic gearbox)	▪ Actual engine load (display zone 3) higher than specified engine load (display zone 2) ▪ Duty cycle (display zone 4) tends towards 0%	- Pressure unit for charge pressure regulating valve defective - Hoses to pressure unit for charge pressure regulating valve (via -N75) leaking - Charge pressure regulating valve in turbocharger jammed in closed position

1) If the charge pressure is too high the fuel supply will be interrupted in order to protect the engine. This results in misfiring at high engine speeds.

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26 - Exhaust system

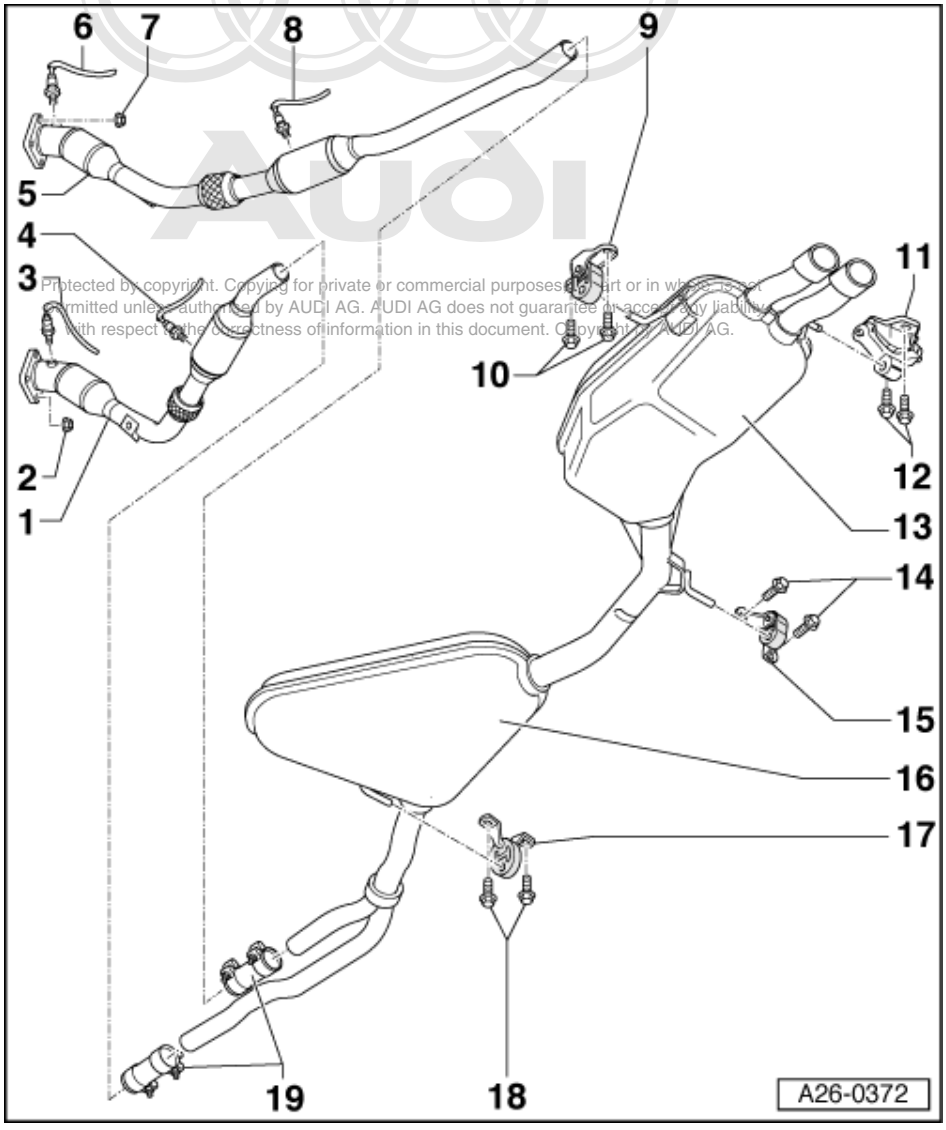
1 - Removing and installing parts of exhaust system

1.1 - Removing and installing parts of exhaust system

Notes:

- Removing and installing exhaust manifold =>Page 226
- After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen double and single clamps and align silencer and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.
- Stress-free alignment of exhaust system
  => Page 224
- Renew self-locking nuts.

1.2 - Silencers with mountings



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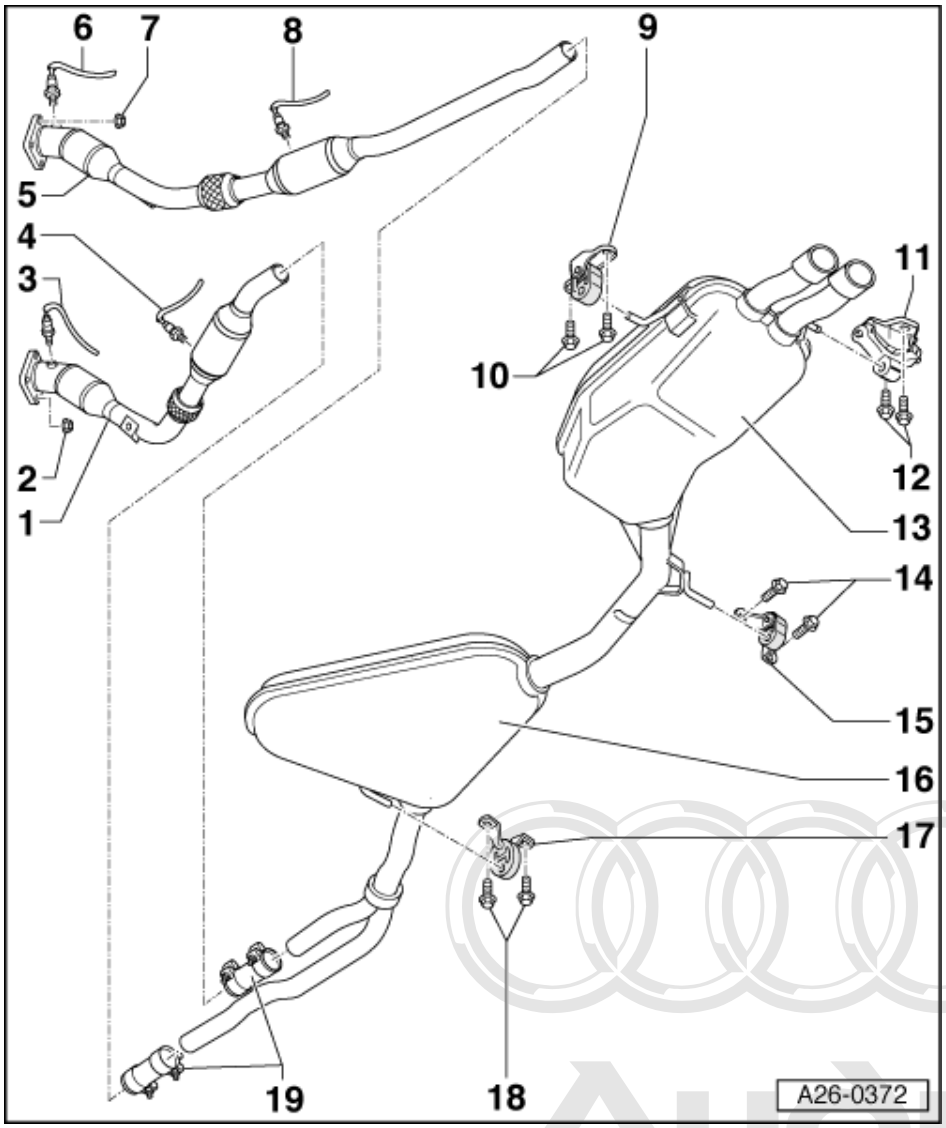
1 Exhaust pipe with catalytic converter (left-side)
2 30 Nm
3 Lambda probe (left-side)
4 Lambda probe (left-side)
- After catalytic converter
- Only engine code AZB

5 Exhaust pipe with catalytic converter (right-side)
6 Lambda probe (right-side)
7 30 Nm
8 Lambda probe (right-side)
- After catalytic converter
- Only engine code AZB

9 Mounting
- With retaining ring



10 25 Nm
11 Mounting
- With retaining ring

12 25 Nm
13 Rear silencer
- Cutting=> 223

14 25 Nm

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15 Mounting
- With retaining ring

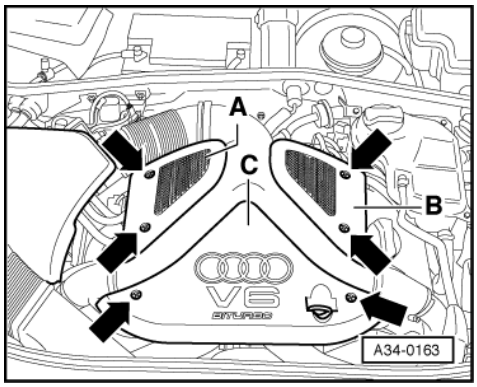
16 Centre silencer
- Cutting=> 223

17 Mounting
- With retaining ring

18 25 Nm

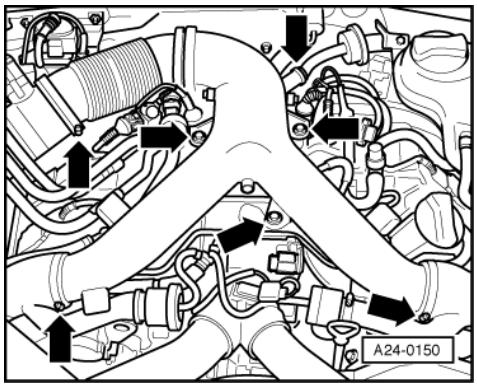
19 Double clamp

1.3 - Removing and installing catalytic converter



Removing

- -> Unscrew bolts -arrows- and take off engine cover panels -A ... C-.



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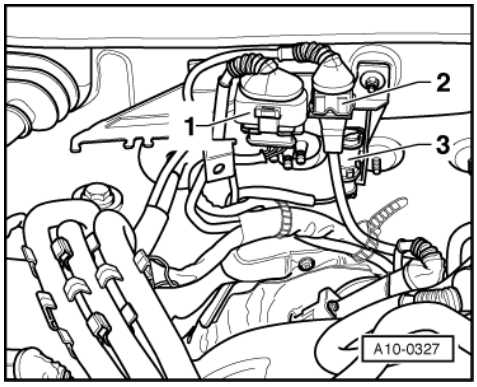
- -> Remove air duct -arrows-.



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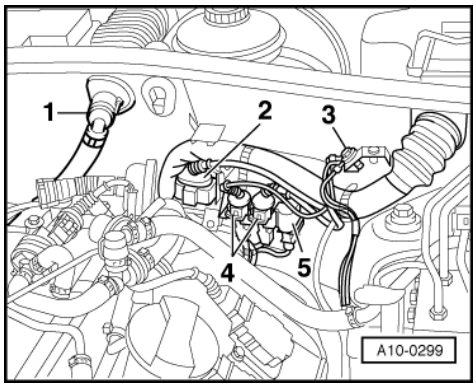
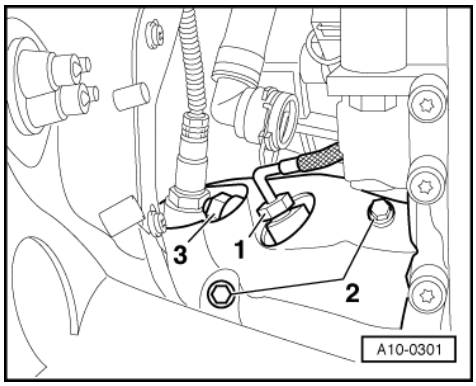
Right-hand catalytic converter:

- -> Unplug connector -1- for lambda probe at bulkhead.

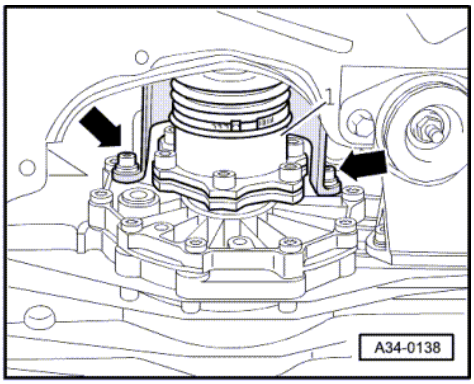


Left-hand catalytic converter:

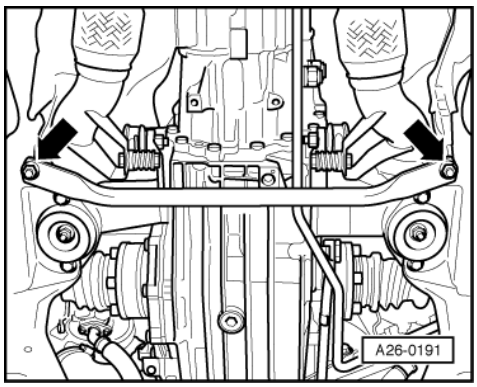
- -> Unplug connector -2- for lambda probe at bulkhead.



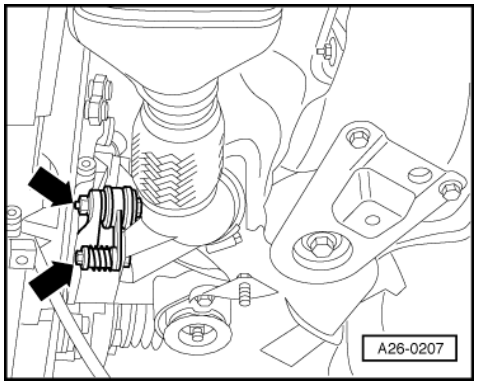
- Unbolt heat shield -2- on turbocharger.
- Remove upper bolt -3- securing front exhaust pipe to turbocharger.



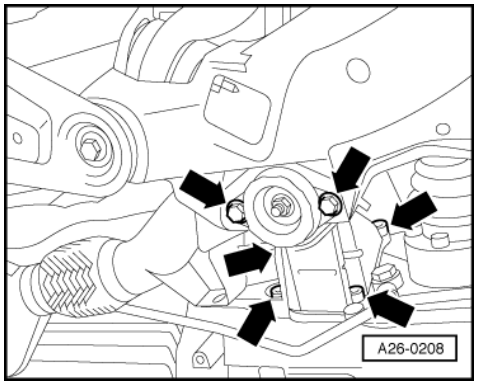
- -> Unbolt guard plate -arrows- above drive shaft from gearbox.
- Unbolt drive shaft -1- at gearbox, move clear and tie up.



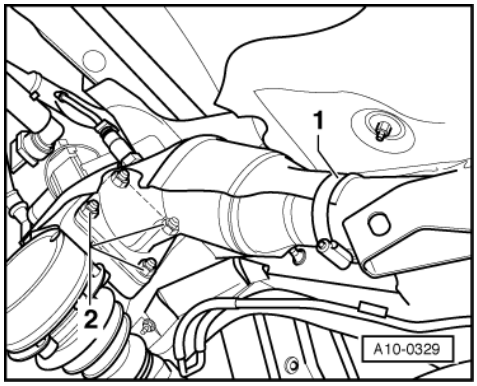
- -> Remove cross strut -arrows-.



- -> Remove bracket -arrows-.



- -> Remove gearbox support -arrows-.
- Loosen exhaust system clamp and push clamp towards silencer.



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- -> Loosen hose clamp -1- on turbocharger heat shield.
- Unbolt exhaust pipe -2- from turbocharger.

Note:
Avoid excessive bending of the flexible pipe connection (decoupling element) on the front exhaust pipe. The angle between the catalytic converter and the front exhaust pipe must not exceed 10 °, otherwise the flexible connection will be damaged.

Installing

- Install in the reverse order.

Notes:

- When installing, the lambda probe wire must be secured in exactly the same position as before in order to avoid contact between the wire and the exhaust pipe.
- The screw thread on the lambda probe is coated with high-temperature paste. This paste must not be allowed to penetrate the openings on the probe.

- High-temperature paste

=> Parts Catalogue

- The double clamp must be renewed after unscrewing the bolted connection.

- Adjust preload at centre silencer/catalytic converter=>Page 224 .

Tightening torques

Bolted mountings	Tightening torques
Exhaust pipe with catalytic converter to turbocharger	30 Nm
Heat shield to turbocharger	10 Nm
Exhaust system clamp	40 Nm
Heat shields above drive shafts to gearbox	25 Nm
Drive shaft to gearbox	70 Nm
Strut to underbody	20 Nm

1.4 - Removing and installing centre silencer and rear silencer

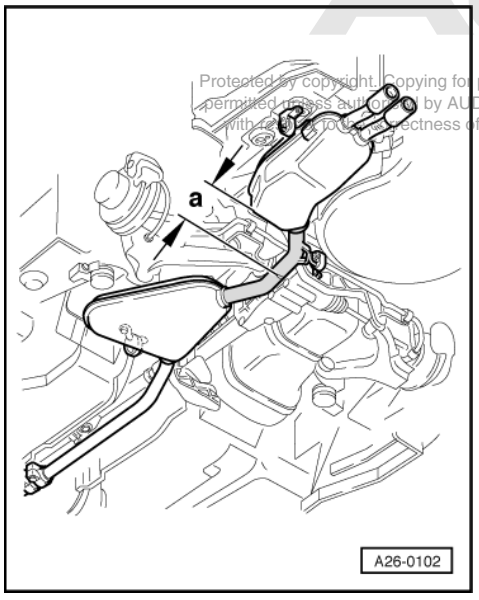

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Fig.1 -> Separating point between centre silencer and rear silencer

Note:

- There is a separating point between the centre silencer and rear silencer for replacement purposes.
- A double clamp is used for connecting the centre silencer to the rear silencer.

- Cut through the connecting pipe between the centre silencer and rear silencer at the point marked with a groove.
- Distance - a - approx. 160 - 170 mm.
- Aligning exhaust system=> Page 224 .

1.5 - Aligning exhaust system

Align the exhaust system as follows to avoid stresses in the system and prevent the transmission of noise into the body:

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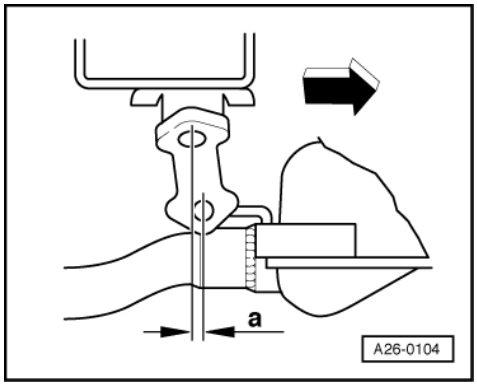
Notes:

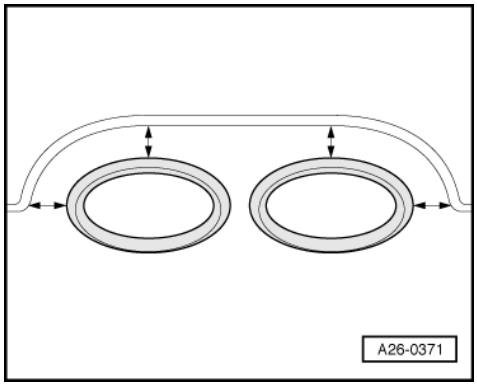
- Before assembling the exhaust system, the front exhaust pipes and the catalytic converters must be aligned accurately and secured.
- Loosen all bolted connections on the exhaust system (except exhaust manifold and flange mountings, catalytic converter/intermediate pipe).
- The exhaust system must be aligned when it is cold.
- Keep to the sequence described below.
- The dimensions in the illustrations are approximate guidelines.

- **Vehicles without clamp between centre silencer and rear silencer**



- Slacken bolted connections on front clamps between catalytic converters and centre silencer.
- -> Push exhaust system towards front of vehicle -arrow- so that rear right mounting on rear silencer is preloaded by a = 9 ... 11 mm.
- Tighten bolts on front clamps between catalytic converters and centre silencer evenly to 40 Nm; installation position => Page 226 .

Aligning tailpipes



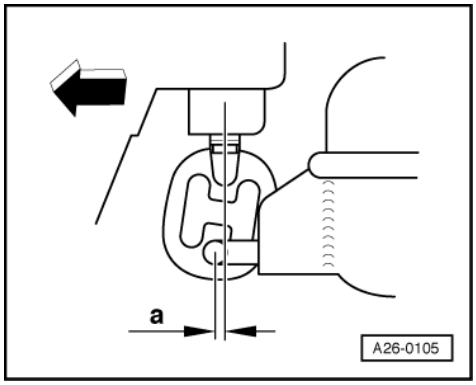
- -> Align tailpipes so that the distances -arrows- are equal.

- **Vehicles with clamp between centre silencer and rear silencer**

Note:

It is only necessary to additionally align the centre silencer on vehicles with clamp fitted between centre silencer and rear silencer.

- Slacken bolted connections on front clamps between catalytic converters and centre silencer.



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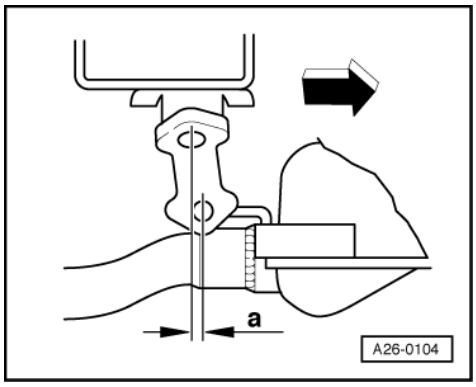
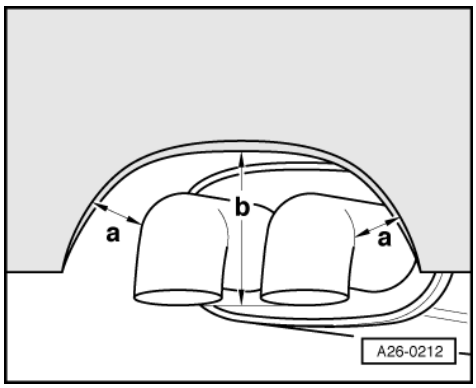
- -> Push exhaust system towards front of vehicle -arrow- so that rear left mounting on centre silencer is preloaded by a = 7 ... 9 mm.
- Tighten bolts on front clamps between catalytic converters and centre silencer evenly to 40 Nm; installation position => Page 226 .



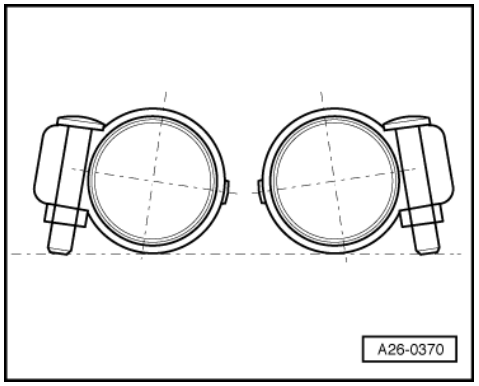
- -> Push rear silencer towards front of vehicle -arrow- so that rear right mounting on rear silencer is preloaded by a = 9 ... 11 mm.
- Tighten bolted connections on rear clamp between centre silencer and rear silencer evenly to 40 Nm; installation position => Page 226 .

Aligning tailpipes



- -> Align tailpipes so that the distances -arrows- are equal.

Installation position of clamp at front



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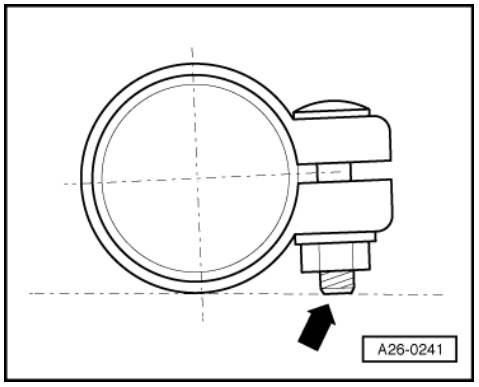
- -> The ends of the bolts must not project below the bottom of the clamp.

Installation position of clamp at rear



- -> The ends of the bolts must not project below the bottom of the clamp.

1.6 - Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug the tailpipe (e. g. with rags or stoppers) and leave plugged until the check is complete.
- Listen for noise at the connection points (cylinder head/manifold, manifold/turbocharger, turbocharger/catalytic converter, etc.) to locate any leaks.
- Rectify any leaks that are found.

1.7 - Removing and installing exhaust manifold

Removing

- Remove engine => Page 3 .
- Remove turbocharger => Page 198
- Unbolt exhaust manifold.

Installing

Notes:

- Renew self-locking nuts.

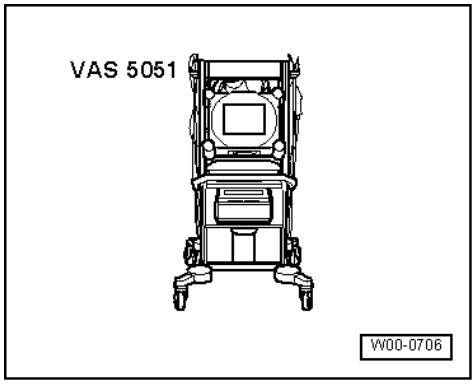
- Renew gaskets.

- Install in reverse sequence.

Tightening torques

Bolted mountings	Tightening torques
Exhaust pipe between exhaust manifold and turbocharger	25 Nm
Exhaust pipe with catalytic converter to turbocharger	25 Nm
Exhaust manifold to cylinder head	25 Nm
Exhaust pipe to gearbox	25 Nm
Catalytic converter to centre silencer	25 Nm
Heat shield to turbocharger	10 Nm

1.8 - Testing function of exhaust gas temperature senders



Special tools and workshop equipment required

- VAS 5051 with VAS 5051/1

  or

- V.A.G 1551 and V.A.G 1551/3 A

Test requirement:

- Coolant temperature at least 80 °C

Warning
- **Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.**
- **If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.**

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01".

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When doing this the engine must be idling.

=> Motronic injection and ignition system; Repair group 01; Self-diagnosis of Motronic; Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions. Self-diagnosis of Motronic Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions.

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     Q
Enter display group number XXX
```

- Enter "112" to select Display Group 112 and confirm entry with Q key.

-> Indicated on display:
(1...4=Display zones)

```
Read measured value block 112
     1     2     3     4
```

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- Check exhaust gas temperature.

- Perform a road test during which
  - Full throttle at engine speeds between 5000...6500 rpm

  is attained.

Note:

The exhaust gas temperature should increase to above 980°C to initiate the control process. Values below 945°C are indicated as 945°C.

	Display zones			
	1	2	3	4
Display group 112: Exhaust gas temperature				
Display	°C	%	°C	%
Indicates	Exhaust gas temperature Bank 1	Enrichment factor sensor Bank 1	Exhaust gas temperature Bank 2	Enrichment factor sensor Bank 2
Specification	980 1)	max. 40 2)	980	max. 40 2)
Note	Control process is only initiated at exhaust gas temperatures above 980 °C	A fault will be registered in the memory if the enrichment factor exceeds 30 %	Control process is only initiated at exhaust gas temperatures above 980 °C	A fault will be registered in the memory if the enrichment factor exceeds 30 %

1) Values up to 1025°C can be indicated for a short period of time during the starting-up process.

2) Values of 25% can be indicated for a short period of time during the starting-up process.

If values above 20% are indicated continuously, then possible causes could be:

- Fuel pressure too low.
- Air mass meter signal too low.

- Proceed to measured value block 220.

-> Indicated on display:

(1...4=Display zones)

```
Read measured value block 220
     1     2     3     4
```

- Check exhaust gas temperature control.

	Display zones			
	1	2	3	4
Display group 220: Exhaust gas temperature control				
Display	xxxx rpm	%	%	Text
Indicates	Engine speed	Load	On-off ratio sensor Bank 1	Operating status Bank 1
Specification	> 5000	> 100	42 ± 10	Control ON
Note	Increase engine speed and load until control switches to "ON"			

- Repeat test procedure for Bank 2=>Measured value block 221

	Display zones			
	1	2	3	4
Display group 221: Exhaust gas temperature control				
Display	xxxx rpm	%	%	Text
Indicates	Engine speed	Load	On-off ratio sensor Bank 2	Operating status Bank 2
Specification	> 5000	> 100	42 ± 10	Control ON
Note	Increase engine speed and load until control switches to "ON"			

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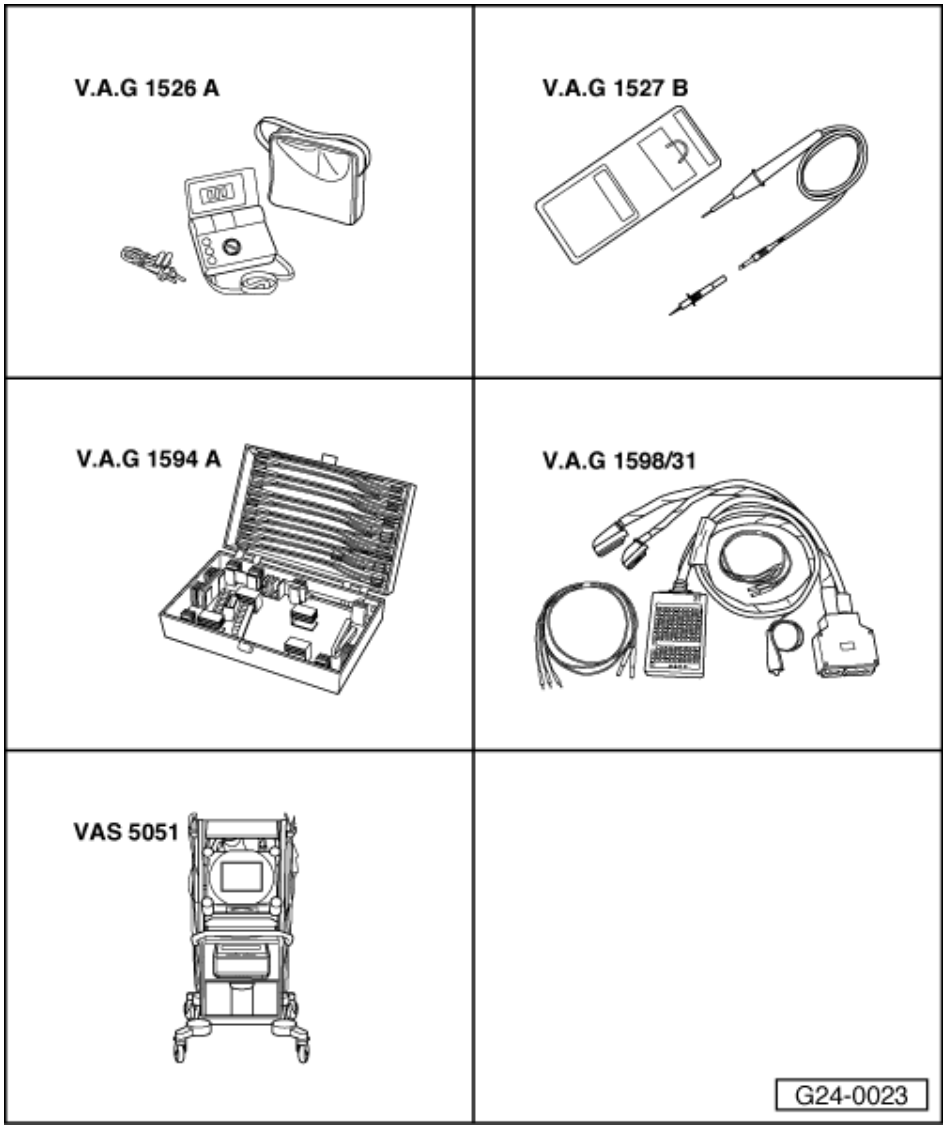
If the specifications are not obtained and a fault is stored in the fault memory:

- Check exhaust gas temperature sender.

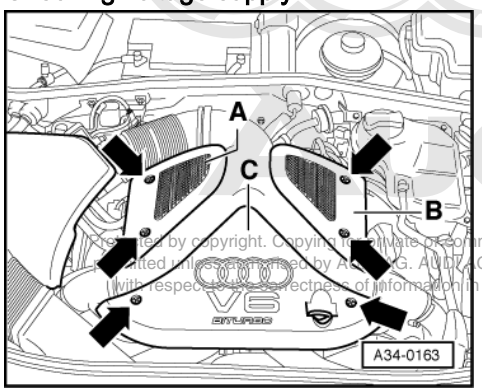
1.9 - Checking exhaust gas temperature senders



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31

Checking voltage supply



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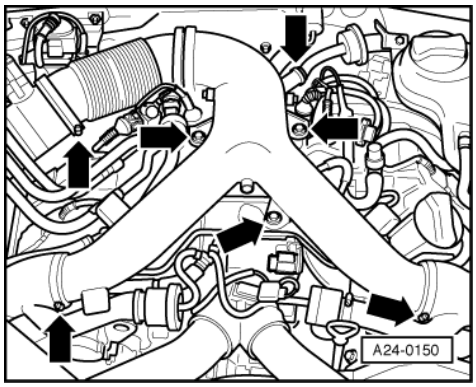
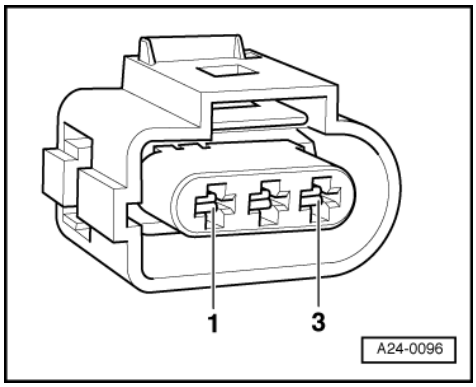
Left-hand exhaust gas temperature sender

- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.
- Switch off ignition.
- Unplug the connector from the relevant exhaust gas temperature sender.

All models:



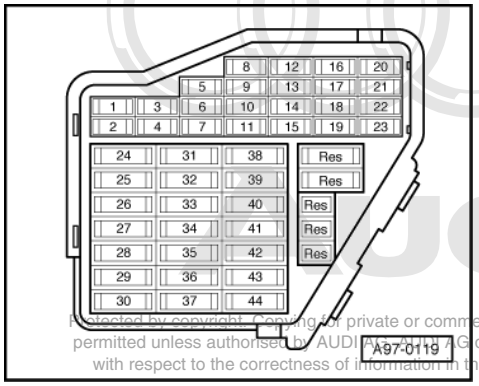
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
3	Engine earth

- Operate starter briefly.
  - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):



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- -> Test fuse No. S234 (in fuse box, socket 34)
- Test for open circuit in wiring from exhaust gas temperature sender to fuel pump relay via fuse -S234 (socket 34 in fuse box):

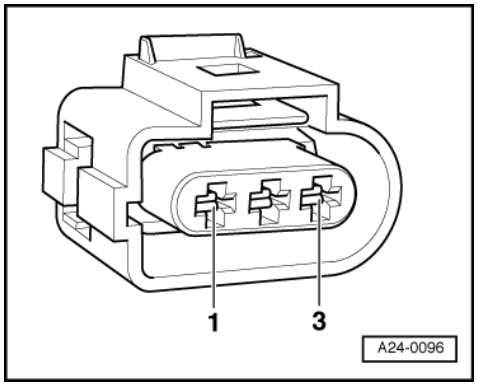
=> Current flow diagrams, Electrical fault finding and Fitting locations

- Test fuel pump relay .

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit.Do notconnect to the engine control unit itself.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
1 (bank 1)	61
1 (bank 2)	20
2	50

If the wiring is OK:

- Renew exhaust gas temperature sender.

If the same fault occurs after renewing the exhaust gas temperature sender:

- Fit a new engine control unit.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Renewing engine control unit Servicing Motronic injection system Renewing engine control unit

1.10 - Removing and installing left-hand exhaust gas temperature sender

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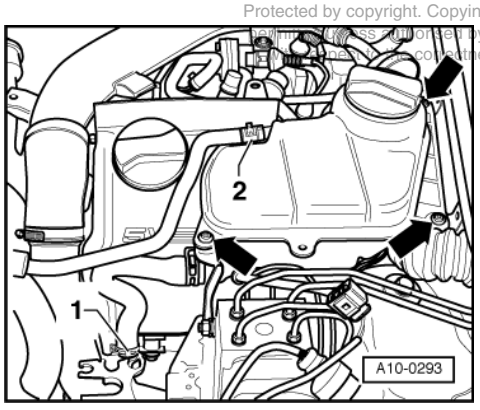
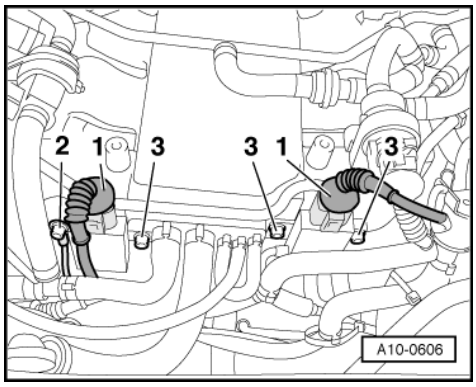


- -> Remove coolant reservoir -arrows- and move it clear to the side.

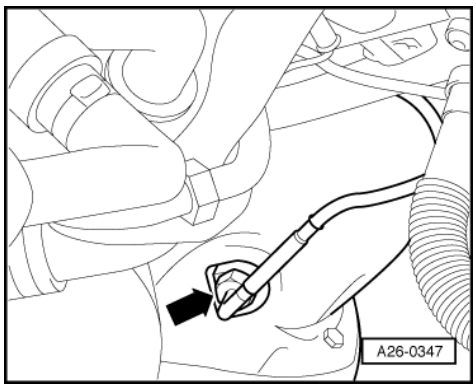
Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.



- -> Unplug connector -1- from left-hand exhaust gas temperature sender control unit.
- Unbolt control unit from intake manifold -2 and 3- and move wiring clear.



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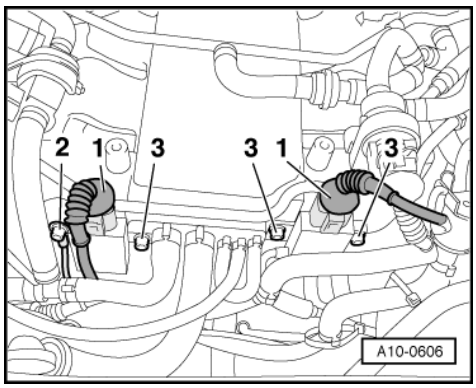
- -> Remove exhaust gas temperature sender -arrow- from exhaust manifold using special tool 3035.

Installing



Install in reverse sequence.

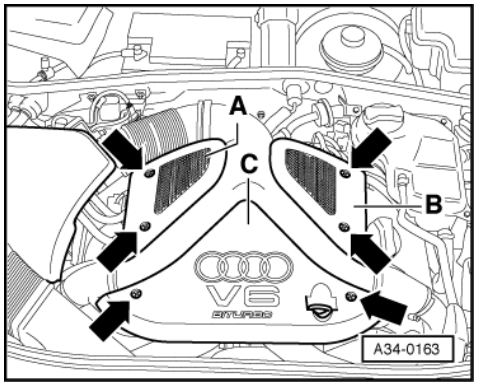
Note:

Note earth wire -2-.

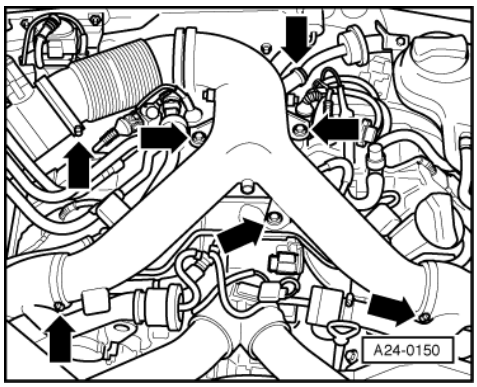
Tightening torques

Component	Nm
Exhaust gas temperature sender	27
Exhaust gas temperature control unit to intake manifold	10

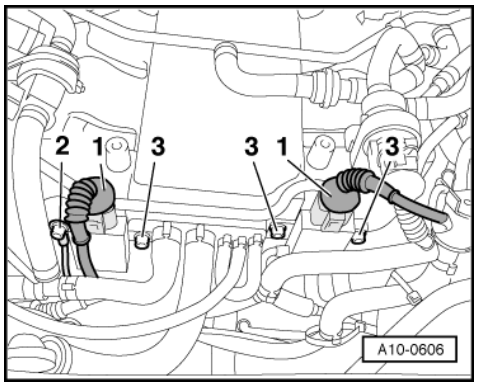
1.11 - Removing and installing right-hand exhaust gas temperature sender



- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.



- -> Unplug connector -1- from right-hand exhaust gas temperature sender control unit.

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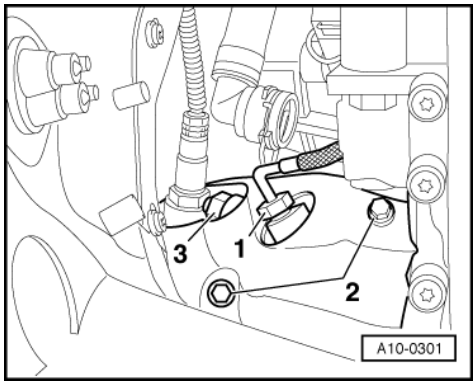
- Remove control unit from intake manifold -3- and move wiring clear.



- -> Unscrew exhaust gas temperature sensor -1- from right-hand turbocharger using special tool 3035.

Installing

Install in reverse sequence.

Tightening torques

Component	Nm
Exhaust gas temperature sender	27
Exhaust gas temperature control unit to intake manifold	10

Audi
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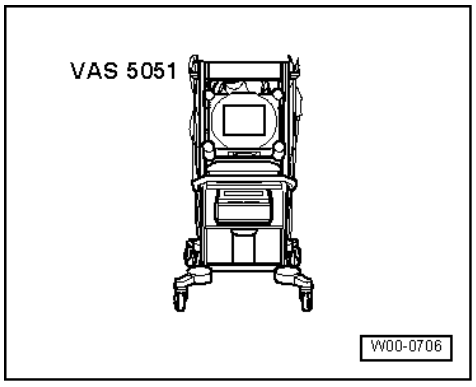
2 - Exhaust gas temperature control

2.1 - Exhaust gas temperature control

2.2 - Testing function of exhaust gas temperature senders (display groups 200/201 and 202) - vehicles with engine code AGB only



Special tools and workshop equipment required

- VAS 5051 with VAS 5051/1

  or

- V.A.G 1551 and V.A.G 1551/3 A

Test requirement:

- Coolant temperature at least 80 °C

Warning
- **Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.**
- **If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.**

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Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01".
  When doing this the engine must be idling.

=> Motronic injection and ignition system; Repair group 01; Self-diagnosis of Motronic; Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions. Self-diagnosis of Motronic Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions.

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block     Q
Enter display group number XXX
```

- Enter "202" to select Display Group 202 and confirm entry with Q key.

-> Indicated on display:
(1...4=Display zones)

```
Read measured value block 202
     1     2     3     4
```

- Test the exhaust gas temperature control

- Perform a road test during which
  - Full throttle at engine speeds between 5000...6500 rpm

  is attained.

	Display zones			
	1	2	3	4
Display group 202: Exhaust gas temperature				
Display	xxxx rpm	%	%	%
Indicates	Engine speed	Load	Enrichment factor sensor Bank 1	Enrichment factor sensor Bank 2
Specification	>5000	> 100	0....30 1)	0....30 1)

	Display zones			
Note		Display min: 15 Display max: 175	A fault will be registered in the memory if the enrichment factor exceeds 30 %	A fault will be registered in the memory if the enrichment factor exceeds 30 %

1) The control unit recognizes a fault if the difference between bank 1 and bank 2 is more than 8.5 % for a period of 5 sec. and enriches both banks by 30%.

If values above 20% are displayed continuously, then possible causes could be:

- Fuel pressure too low.
- Air mass meter signal too low.

- Proceed to measured value block 220.

-> Indicated on display:
(1...4=Display zones)

```
Read measured value block 200
     1     2     3     4
```

- Test exhaust gas temperature control.

Note:

The exhaust gas temperature should increase to 980°C (display 42 %) to initiate the control process. Values below945°Care displayed as 5%.

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	Display zones			
	1	2	3	4
Display group 200: Exhaust gas temperature control				
Display	xxxx rpm	%	%	Text
Indicates	Engine speed	Load	On-off ratio sensor Bank 1	Operating status Bank 1
Specification	> 5000	> 100	42 ± 10	Control ON
Note	Increase engine speed and load until control switches to "ON"		Display min: 5 Display max: 95	

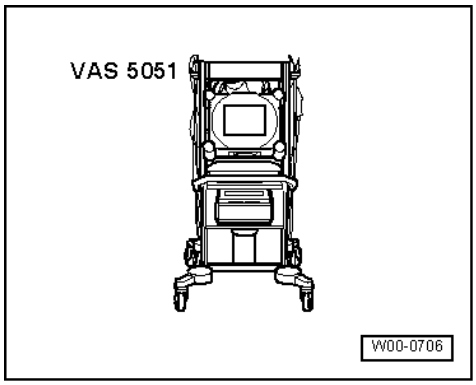
- Repeat test procedure for Bank 2=>Measured value block 201.

	Display zones			
	1	2	3	4
Display group 201: Exhaust gas temperature control				
Display	xxxx rpm	%	%	Text
Indicates	Engine speed	Load	On-off ratio sensor Bank 2	Operating status Bank 2
Specification	> 5000	> 100	42 ± 10	Control ON
Note	Increase engine speed and load until control switches to "ON"		Display min: 5 Display max: 95	

If the specifications are not obtained and a fault is stored in the fault memory:

- Check exhaust gas temperature sender.

2.3 - Testing function of exhaust gas temperature senders (display groups 112 and 220/221) - vehicles with engine code AZB only



Special tools and workshop equipment required

- VAS 5051 with VAS 5051/1

  or

- V.A.G 1551 and V.A.G 1551/3 A

Test requirement:

- Coolant temperature at least 80 °C

Warning
- **Test equipment must always be secured on the rear seat and operated from the rear seat by a second person.**
- **If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.**

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01". When doing this the engine must be idling.

=> Motronic injection and ignition system; Repair group 01; Self-diagnosis of Motronic; Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions. Self-diagnosis of Motronic Connecting vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and selecting functions.

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

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-> Indicated on display:

```
Read measured value block     Q
Enter display group number XXX
```

- Enter "112" to select Display Group 112 and confirm entry with Q key.

-> Indicated on display:

(1...4=Display zones)

```
Read measured value block 112
     1     2     3     4
```

- Check exhaust gas temperature.

- Perform a road test during which
  - Full throttle at engine speeds between 5000...6500 rpm

  is attained.

Note:

The exhaust gas temperature should increase to above 980°C to initiate the control process. Values below 945°C are indicated as 945°C.

	Display zones			
	1	2	3	4
Display group 112: Exhaust gas temperature				
Display	°C	%	°C	%
Indicates	Exhaust gas temperature Bank 1	Enrichment factor sensor Bank 1	Exhaust gas temperature Bank 2	Enrichment factor sensor Bank 2
Specification	980 1)	40 ± 5 2)	980	40 ±5
Note	Control process is only initiated at exhaust gas temperatures above 980 °C	A fault will be registered in the memory if the enrichment factor exceeds 30 %	Control process is only initiated at exhaust gas temperatures above 980 °C	A fault will be registered in the memory if the enrichment factor exceeds 30 %

1) Values up to 1025°C can be indicated for a short period of time during the starting-up process.

2) Values of 25% can be indicated for a short period of time during the starting-up process.

If values above 20% are indicated continuously, then possible causes could be:

- Fuel pressure too low.
- Air mass meter signal too low.

- Proceed to measured value block 220.

-> Indicated on display:
(1...4=Display zones)

```
Read measured value block 220
     1     2     3     4
```

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- Test exhaust gas temperature control.

	Display zones			
	1	2	3	4
Display group 220: Exhaust gas temperature control				
Display	xxxx rpm	%	%	Text
Indicates	Engine speed	Load	On-off ratio sensor Bank 1	Operating status Bank 1
Specification	> 5000	> 100	42 ± 10	Control ON
Note	Increase engine speed and load until control switches to "ON"			

- Repeat test procedure for Bank 2=>Measured value block 221.

	Display zones			
	1	2	3	4
Display group 221: Exhaust gas temperature control				
Display	xxxx rpm	%	%	Text
Indicates	Engine speed	Load	On-off ratio sensor Bank 2	Operating status Bank 2
Specification	> 5000	> 100	42 ± 10	Control ON
Note	Increase engine speed and load until control switches to "ON"			

If the specifications are not obtained and a fault is stored in the fault memory:

- Test exhaust gas temperature sender.

2.4 - Testing exhaust gas temperature senders

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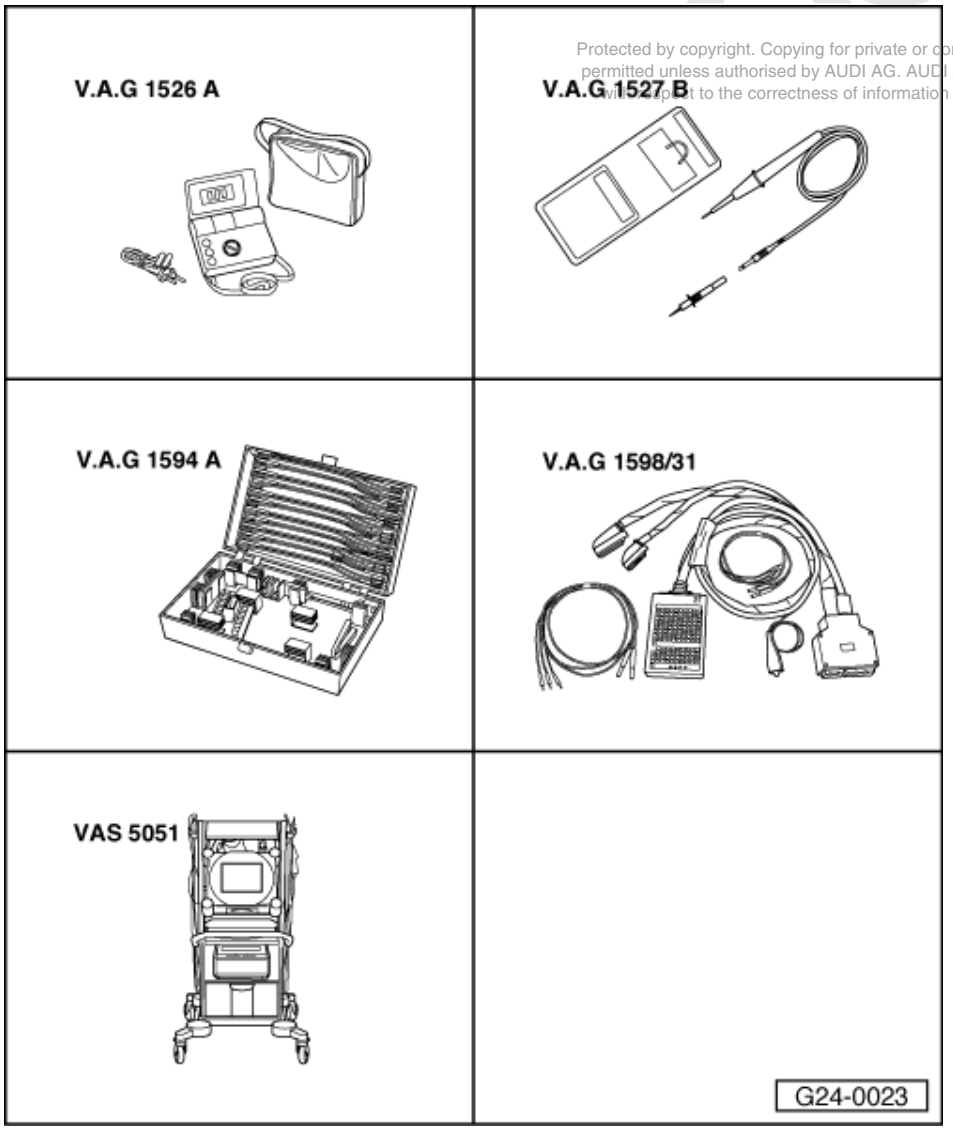
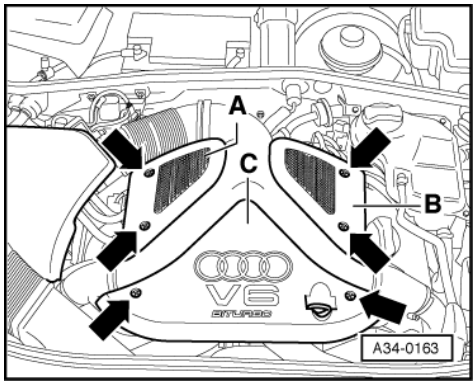


Special tools and workshop equipment required

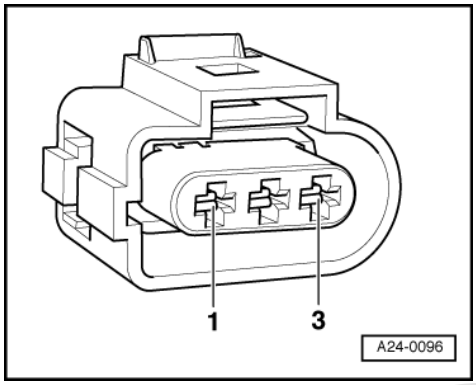
- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31

Checking voltage supply

- Switch off ignition.



- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.
- Unplug the connector from the relevant exhaust gas temperature sender.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
3	Engine earth

- Operate starter briefly.
  - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):

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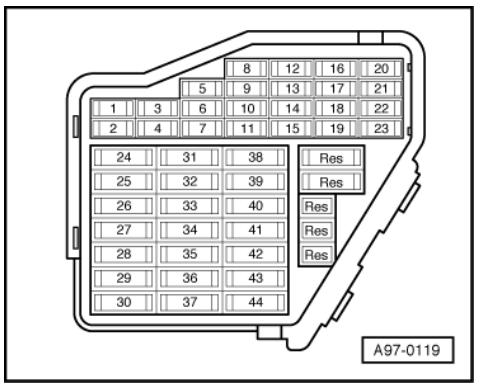


- -> Test fuse No. S234 (in fuse box, socket 34)
- Test for open circuit in wiring from exhaust gas temperature sender to fuel pump relay via fuse -S234 (socket 34 in fuse box):

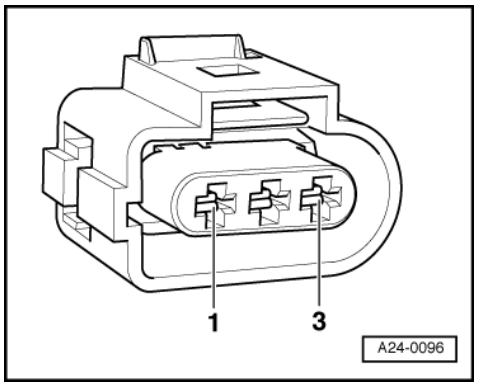
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Test fuel pump relay .

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit.Do notconnect to the engine control unit itself.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation



- -> Test for open circuit and short to positive or earth in the following wiring connections:

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Connector Contact	Test box V.A.G 1598/31 Socket
1 (Bank 1)	61
1 (Bank 2)	20
2	50

If the wiring is OK:

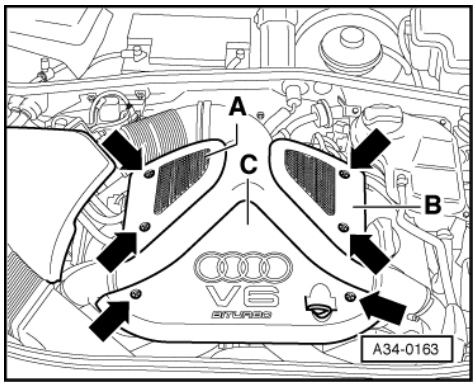
- Renew exhaust gas temperature sender.

If the same fault occurs after renewing the exhaust gas temperature sender:

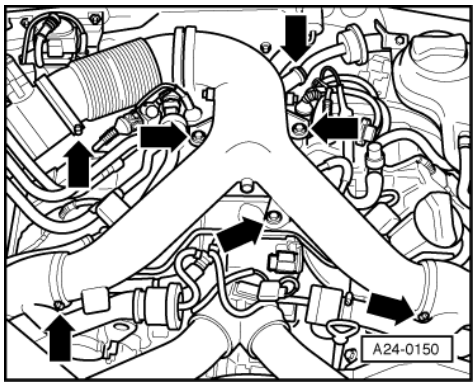
- Fit a new engine control unit .

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Renewing engine control unit Servicing Motronic injection system Renewing engine control unit

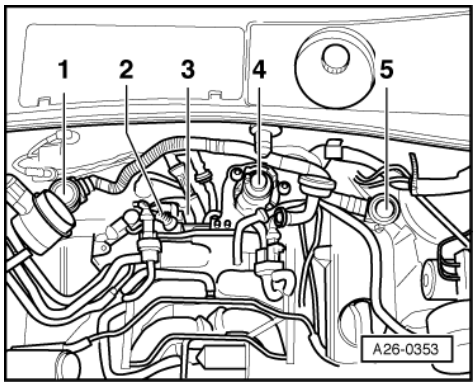
2.5 - Removing and installing exhaust gas temperature senders



- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.



Vehicles with secondary air system

- -> Unplug both connectors -2- from exhaust gas temperature sender control units.
- Unbolt control unit from intake manifold and move wiring clear.

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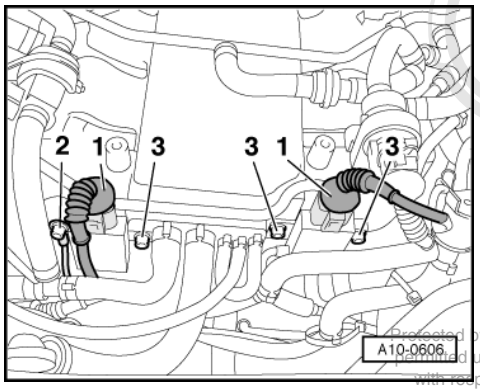

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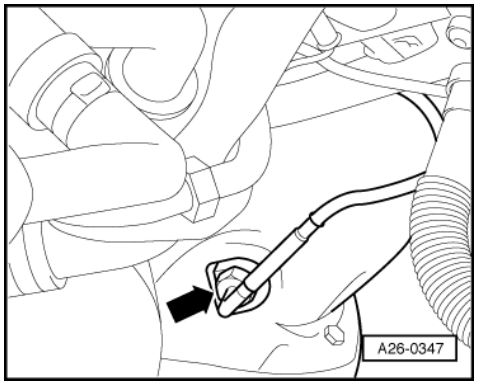
Vehicles without secondary air system

- -> On vehicles without secondary air system the control units for the left-hand and right-hand exhaust gas temperature senders are located on the intake manifold at the rear.



- Remove the exhaust gas temperature sender from the exhaust manifold.

Installing

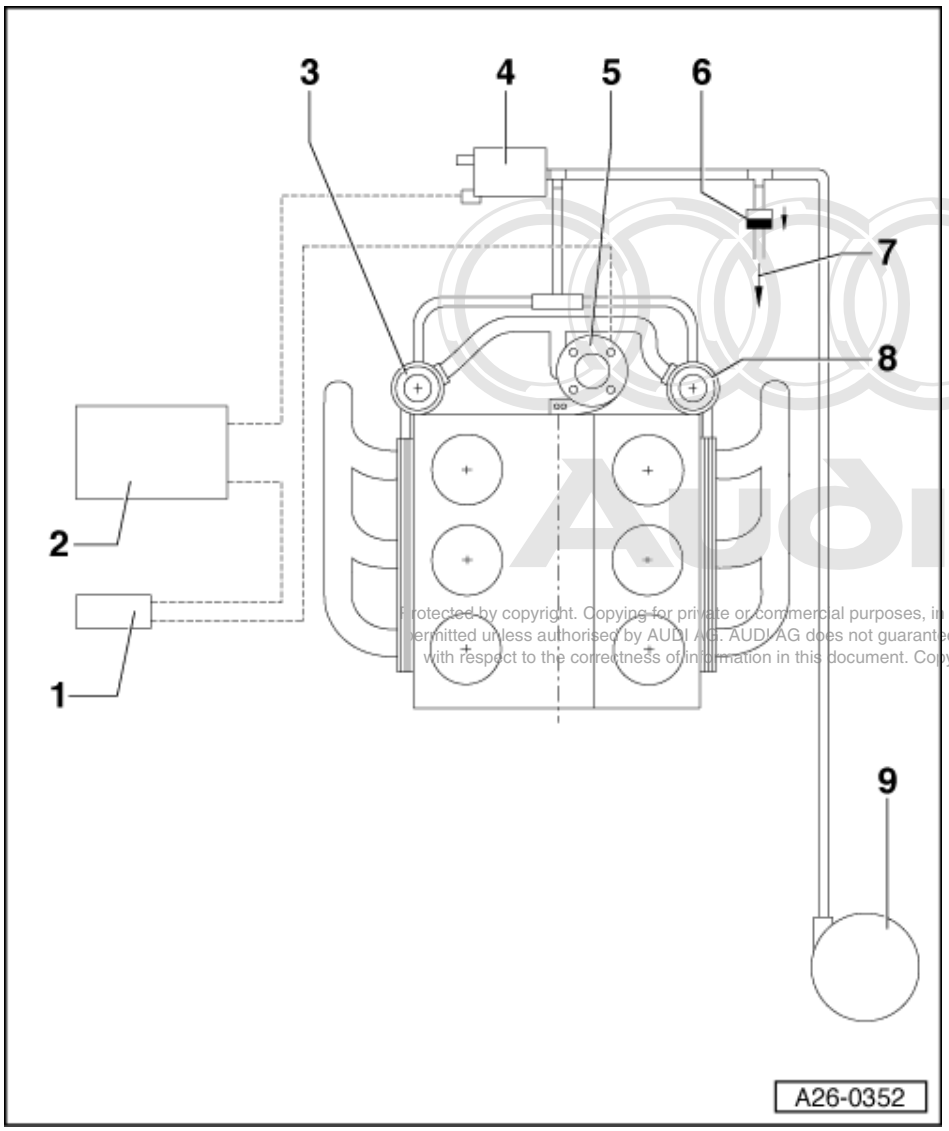
- Install in reverse sequence.

Tightening torques

Bolted mountings		Tightening torques
Bolts and nuts	M6	10 Nm
	M8	20 Nm
	M10	45 Nm
	M12	60 Nm
Except for the following:		
Exhaust gas temperature sender		27 Nm

3 - Secondary air system

3.1 - Secondary air system



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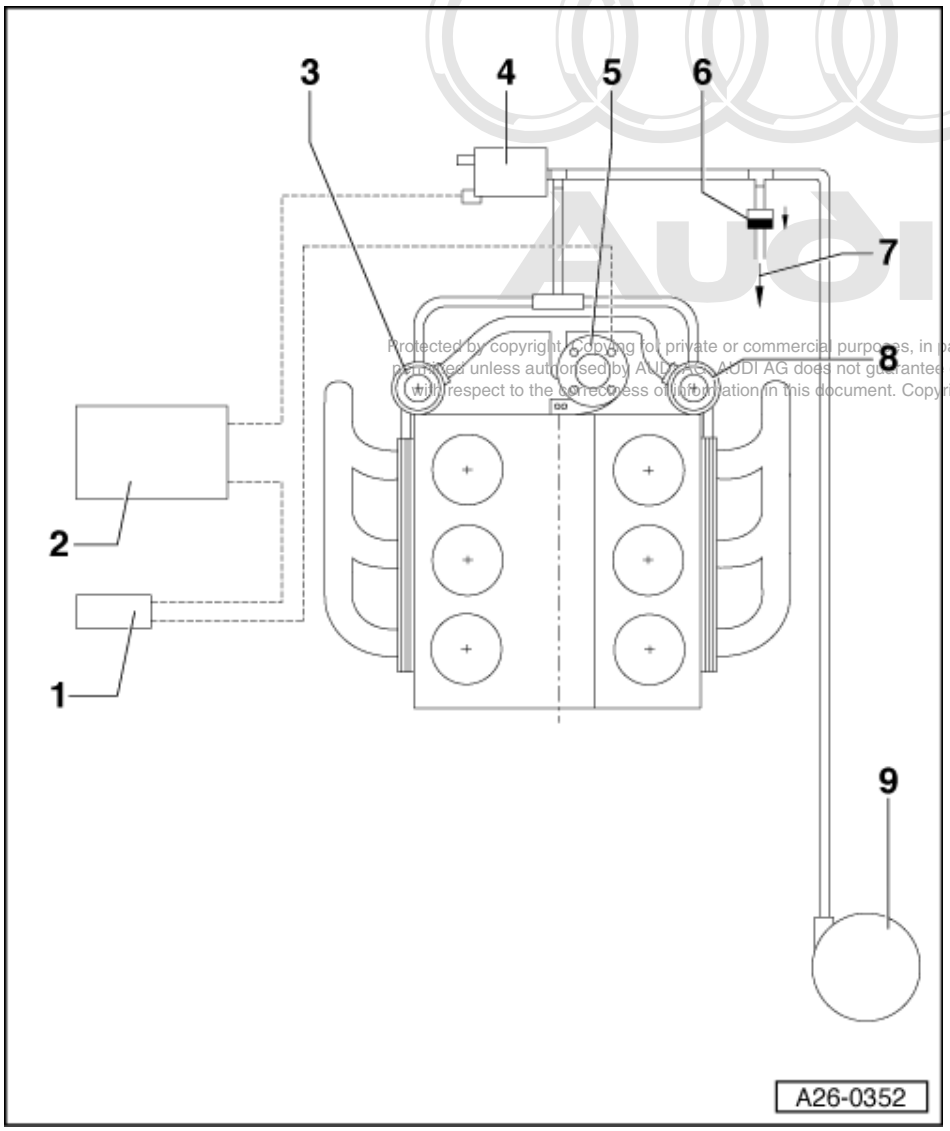
The secondary air system is designed to enable the catalytic converter to heat up and reach its operating temperature more quickly after a cold start.

Principle of operation

Due to the extra mixture enrichment during the cold-start phase, an increased amount of unburnt hydrocarbons is carried in the exhaust gas. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and in this way reduces toxic emissions. The heat generated by oxidisation accelerates the "light off" of the catalytic converter and significantly improves exhaust gas quality during warm-up.



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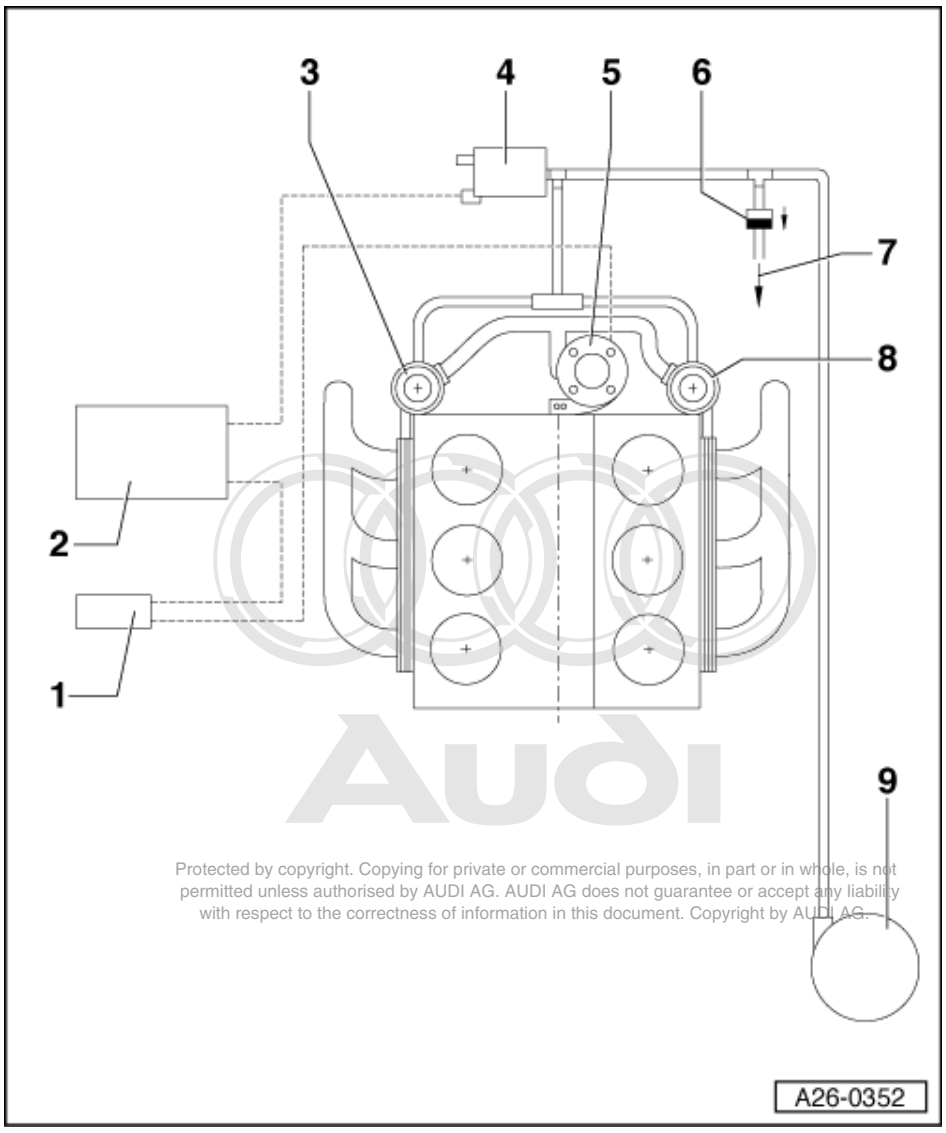
Function

- After a cold start, engine control unit -2-activates secondary air pump -5- via secondary air pump relay -1-, and air is fed to combination valves for secondary air system -3- and -8-.
- At the same time, the system activates secondary air inlet valve -4-, which supplies vacuum to combination valves -3- and -8-. The relevant combination valve opens a passage for the secondary air system to supply air to the exhaust ports in the cylinder head.

1 Secondary air pump relay -J299

- Removing and installing=>Page 250 .
- Checking=>Page 257



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2 Engine control unit -J220

3 Combination valve for secondary air system

4 Secondary air inlet valve -N112
- Location => Fig 1

5 Secondary air pump motor -V101
- Location => Fig. 2

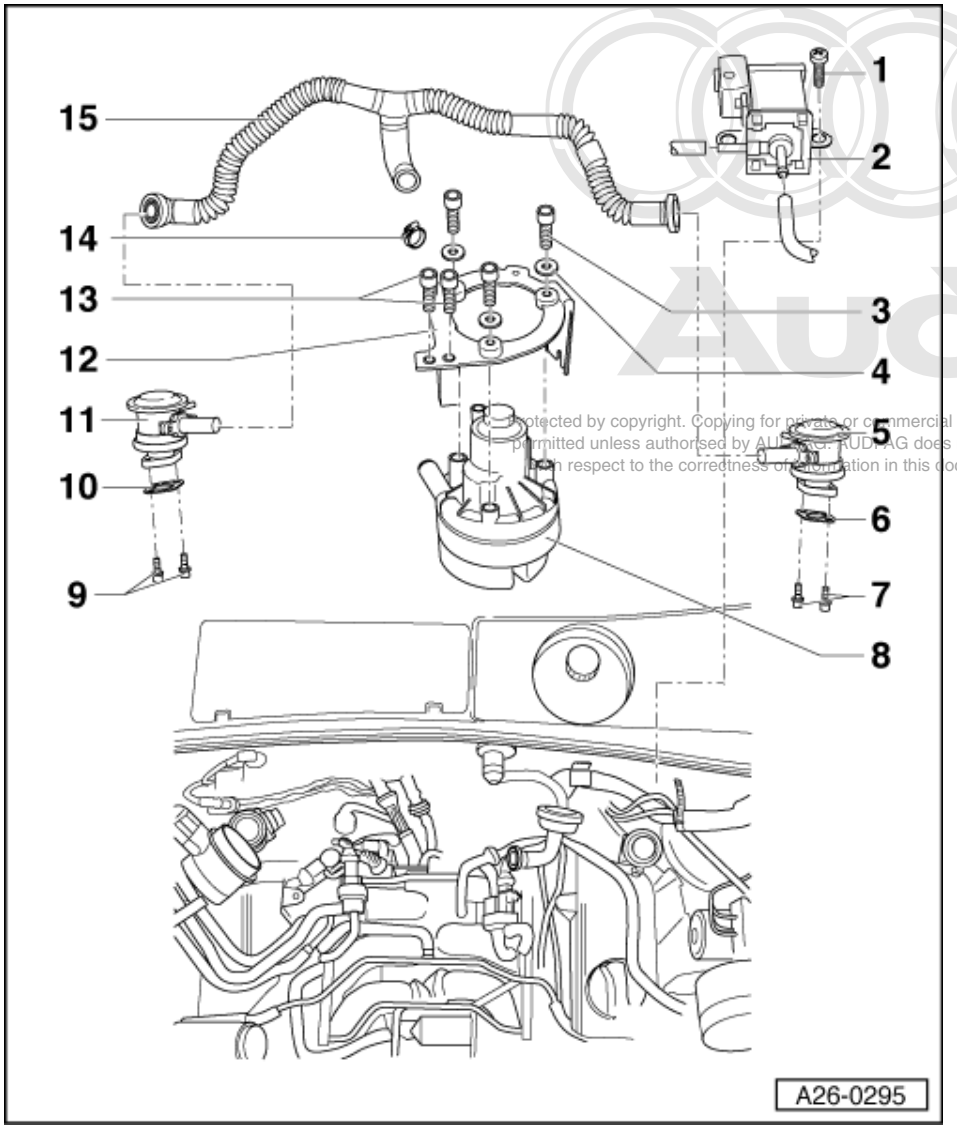
6 Non-return valve
- Installation position (light side/ dark side) as shown in illustration. Arrow indicates direction of flow

7 To intake manifold

8 Combination valve for secondary air system

9 Vacuum reservoir
- Fitting location: in front left wheel housing behind wheel housing liner

3.2 - Removing and installing parts of secondary air system



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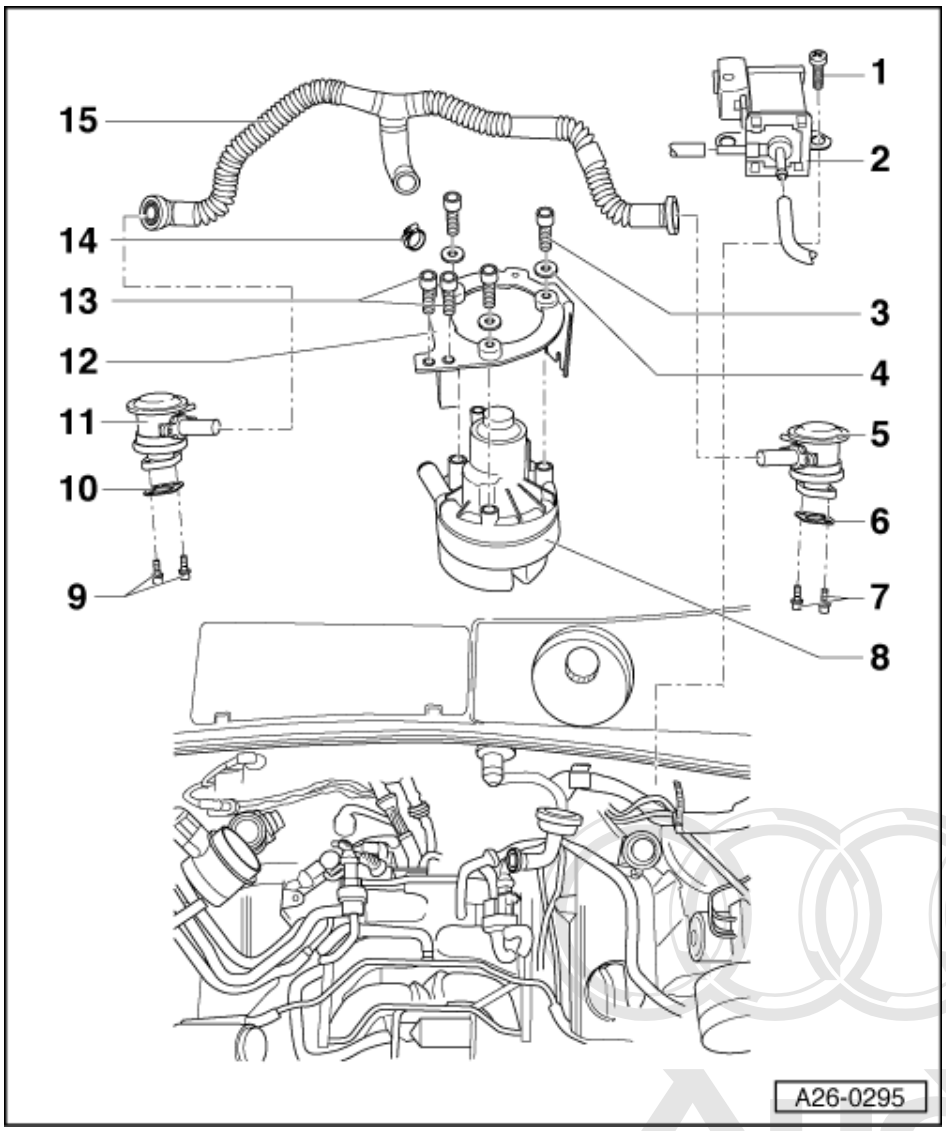
The components for the secondary air system are located below the air duct between intake manifold and plenum chamber.

1 6 Nm
2 Secondary air inlet valve N112
3 10Nm
4 Large flat washer
- For all three bonded rubber mountings on the secondary air pump bracket

5 Combination valve, left
6 Gasket



7 10 Nm
8 Secondary air pump with air cleaner fitted
9 10 Nm
10 Gasket
11 Combination valve, right
12 Secondary air pump bracket
- Fitted to rear of intake manifold

13 10 Nm
14 Screw-type clip
15 Connecting pipe
- Between secondary air pump and combination valves

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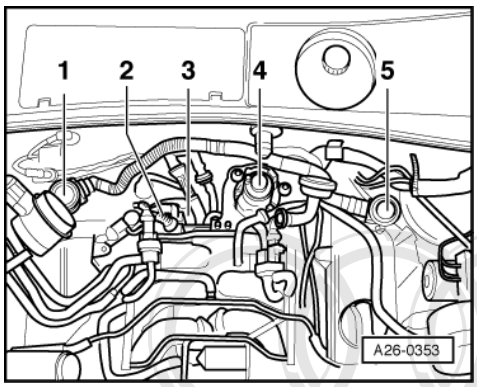

-> Fig.1 Location of secondary air inlet valve

-N112

- Secured to bracket below control units together with connector for exhaust gas temperature at rear right of intake manifold next to secondary air pump motor -item 3-.

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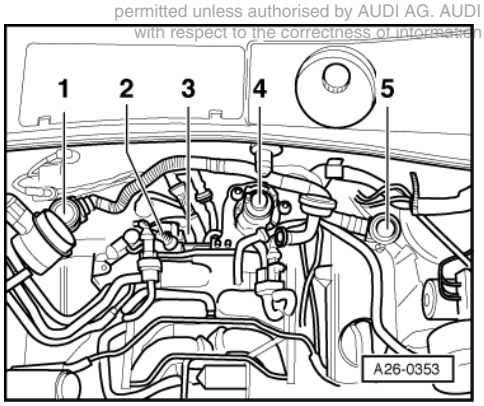
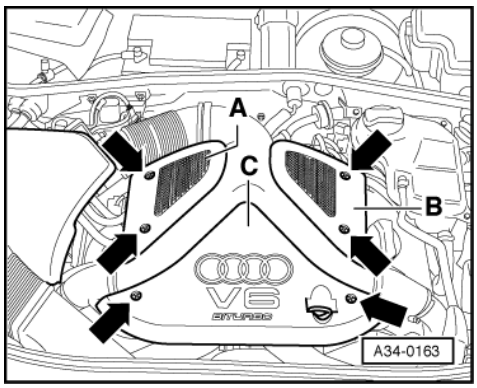


-> Fig.2 Location of secondary air pump motor

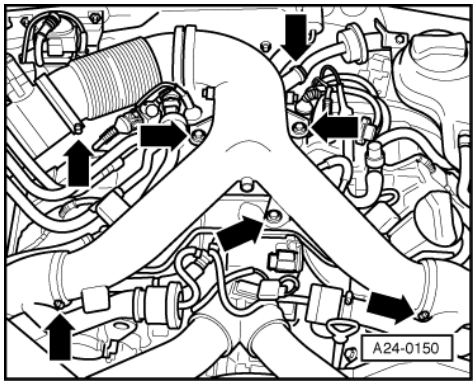
-V101

- At rear left of intake manifold -item 4-.

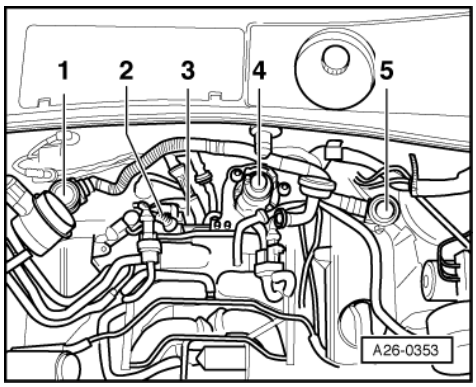
3.3 - Removing and installing secondary air inlet valve -N112



- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.



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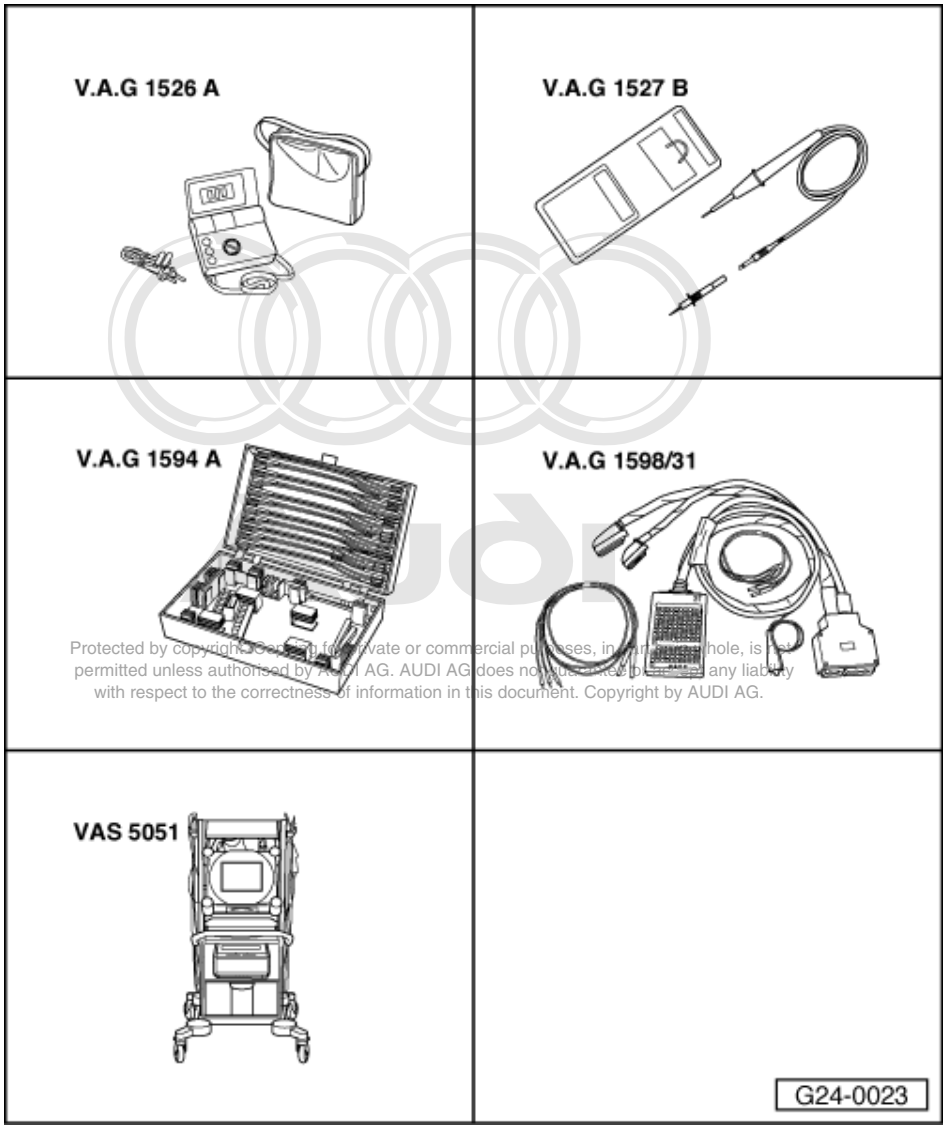
- -> Unplug both connectors -2- from exhaust gas temperature sender control units.
- Unbolt control units from intake manifold and move wiring clear.
- The secondary air inlet valve -N112 is fitted to a bracket below the exhaust gas temperature sender control units.
- Unplug the connector from the valve and push the bracket with vacuum pipes connected off the studs on the intake manifold.
- Disconnect vacuum pipes from secondary air inlet valve and unscrew valve from bracket.

3.4 - Testing secondary air inlet valve -N112



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Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Fitting location=>Fitting locations overview

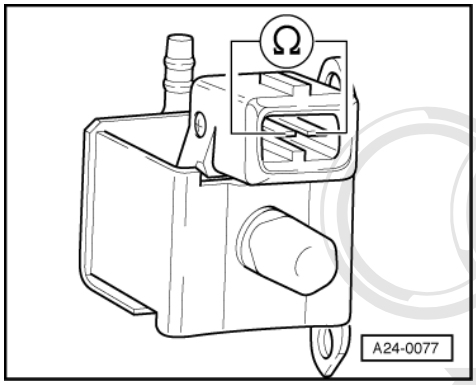
=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Fitting locations overview Servicing Motronic injection system Fitting locations overview

Test requirement:

- Final control diagnosis has been performed

Testing internal resistance

- Unplug connector from secondary air inlet valve -N112.



- -> Connect multimeter to valve (resistance measurement range)
  - Specification: 25 ... 35 ω
- If the reading does not match the specification, renew secondary air inlet valve -N112.

Checking voltage supply

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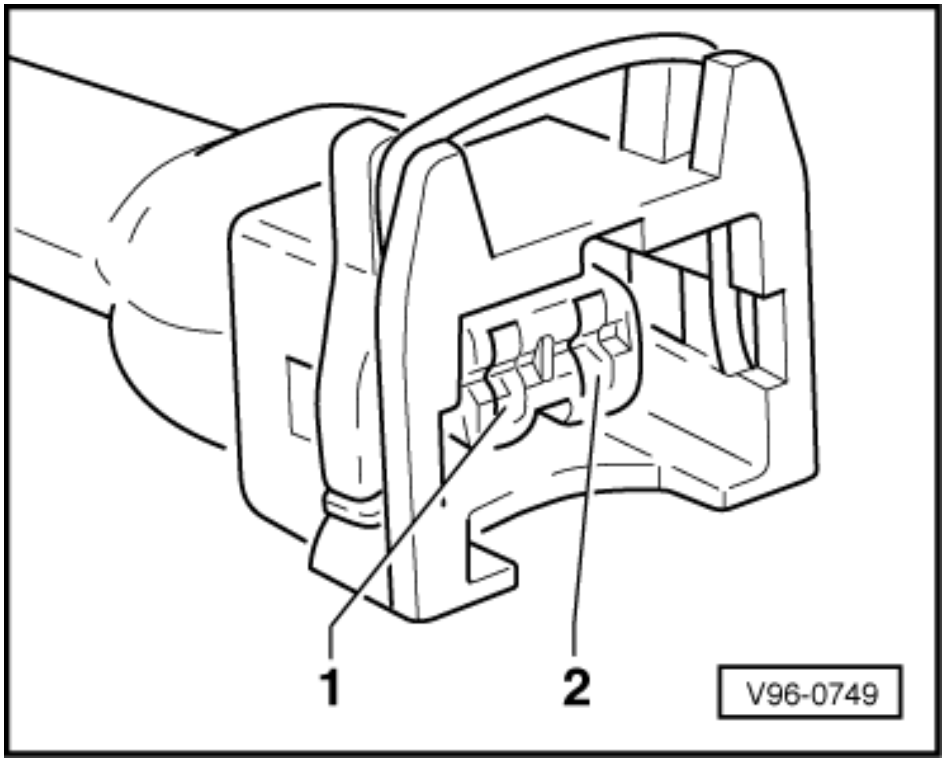
- Unplug connector from secondary air inlet valve -N112.



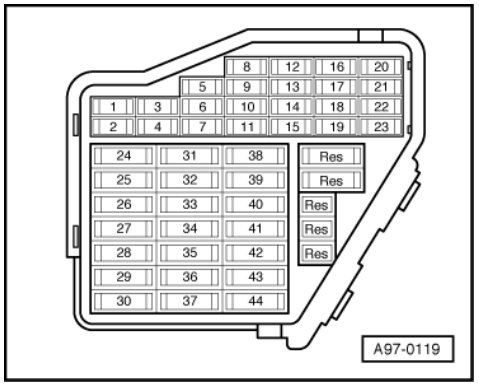
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure against
1	Engine earth

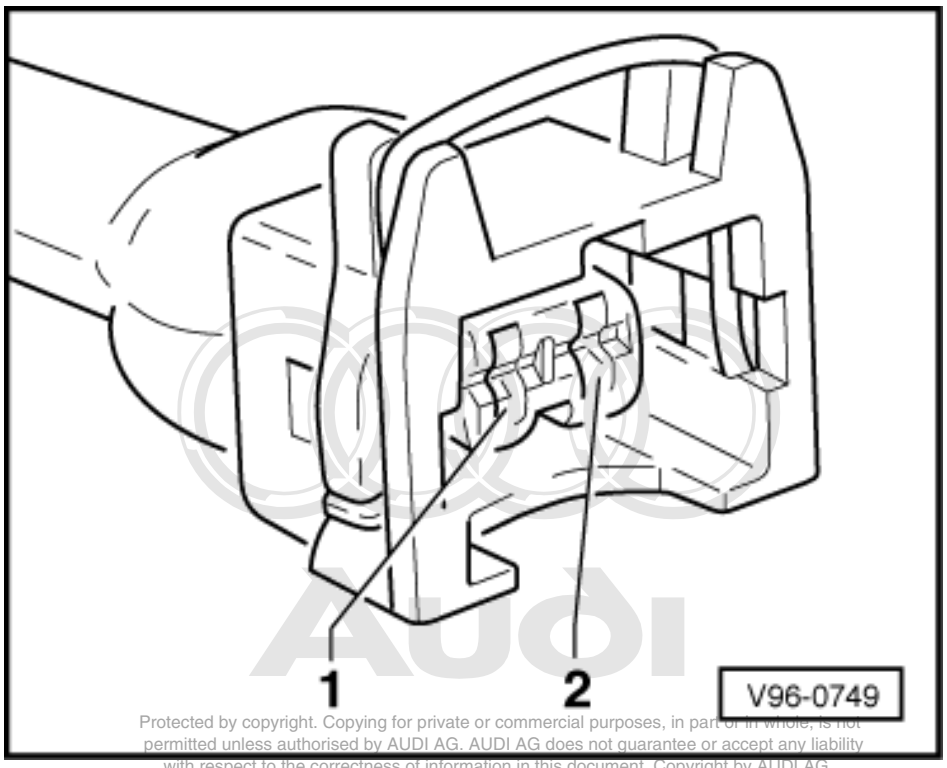
- Operate starter briefly.
  - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):



- -> Test fuse No. S234 (in fuse box, socket 34)



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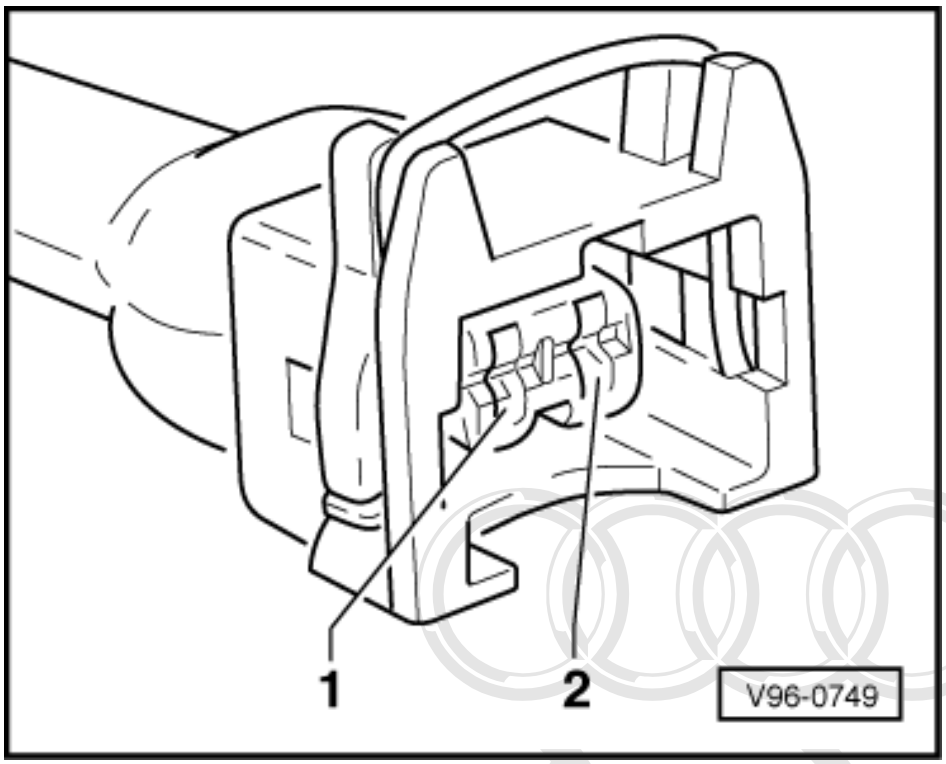
- -> Test for open circuit in wiring from fuel pump relay to connector contact 1 via fuse -S234 (socket 34 in fuse box):

=> Current flow diagrams, Electrical fault finding and Fitting locations

- Test fuel pump relay

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation

Testing activation



- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2 using auxiliary cables from V.A.G 1594 A.

- Start final control diagnosis and select secondary air inlet valve -N112.

=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis

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-> Indicated on display:

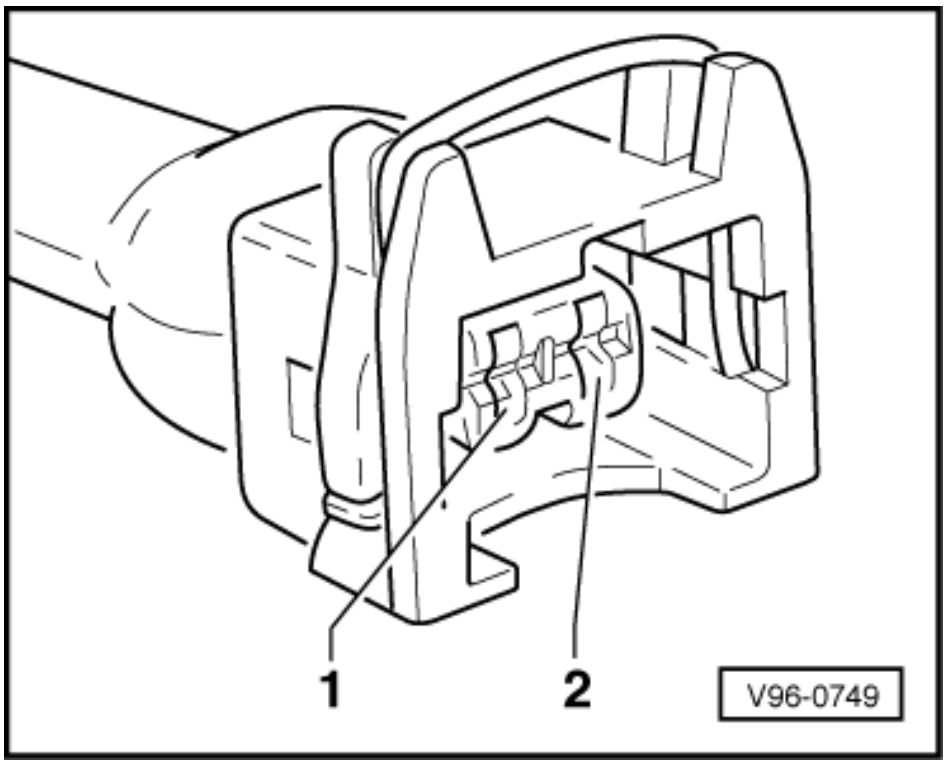
```
Final control diagnosis
Secondary air inlet valve -N112
```

- The LED should flash.

If the LED lamp does not flash or if it lights up continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit.Do notconnect to the engine control unit itself.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
2	44

- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Fit a new engine control unit.

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Renewing engine control unit Servicing Motronic injection system Renewing engine control unit

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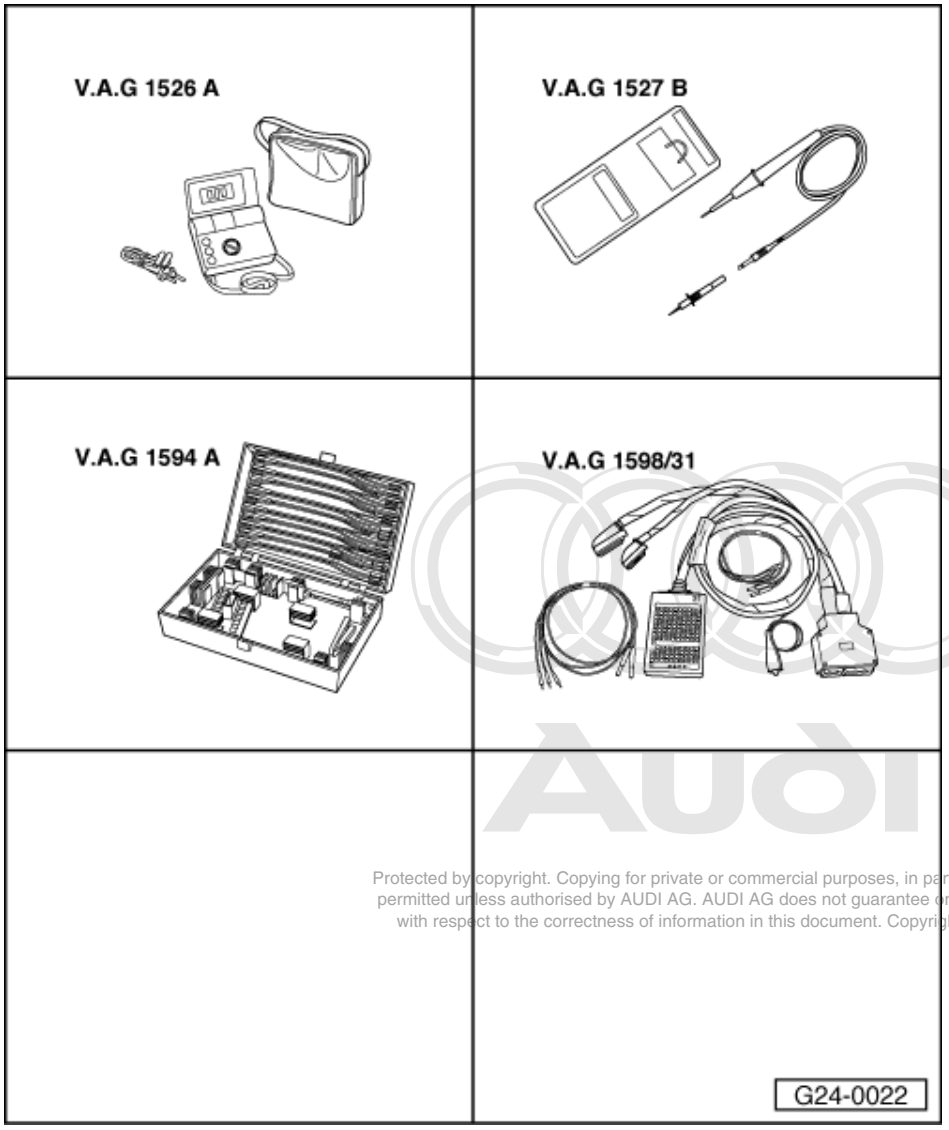
3.5 - Testing secondary air pump relay -J299 and activation



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Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598/31

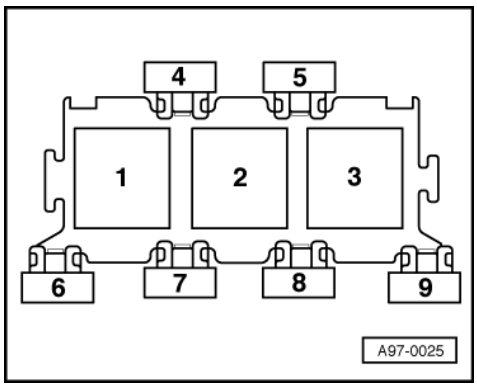
Fitting location=>Fitting locations overview

=> Motronic injection and ignition system; Repair group 24; Servicing Motronic injection system; Fitting locations overview Servicing Motronic injection system Fitting locations overview

Test sequence

- Start final control diagnosis and select secondary air pump relay -J299

=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis



- -> The secondary air pump relay should pick up and secondary air pump motor -V101 should run intermittently. (Relay is located in relay position 2 in 3-way relay carrier in electronics box on left side of plenum chamber).

A - If the relay does not pick up:

- Test voltage supply of secondary air pump relay => Page 258 .
- Test activation of secondary air pump relay => Page 259 .

B - If the relay picks up but the secondary air pump motor does not run:

- Test voltage supply of secondary air pump motor =>Page 260 .

Testing voltage supply of secondary air pump relay

- Switch off ignition.
- Disconnect secondary air pump relay.
- Connect multimeter (voltage measurement range) as follows:

3-way relay carrier (electronics box in plenum chamber) socket position 2: contact	Test against
8	Engine earth

- Specification: approx. battery voltage

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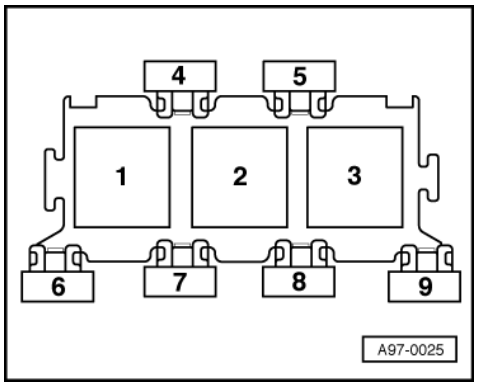
If the specification is not obtained:



- Carry out the following tests (marked with dots):

- -> Test fuse No. S130 (40 A) in 3-way relay carrier in electronics box, in plenum chamber, socket position 7
- Test for open circuit in wiring from battery + (terminal 30) via fuse No. S130 to secondary air pump relay - J299 (located in socket position 2 of 3-way relay carrier in electronics box in plenum chamber.)

=> Current flow diagrams, Electrical fault finding and Fitting locations

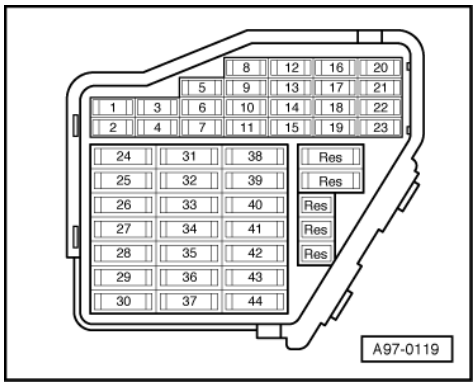
- Connect multimeter (voltage measurement range) as follows:

3-way relay carrier (electronics box in plenum chamber) socket position 2: contact	Test against
4	Engine earth

- Operate starter briefly.
  - Specification: approx. battery voltage

If the specification is not obtained:

- Carry out the following tests (marked with dots):



- -> Test fuse No. S234 (in fuse box, socket 34).
- Test for open circuit in wiring from fuel pump relay to secondary air pump relay -J299 (located in 3-way relay carrier in electronics box in plenum chamber) via fuse No. S234 (socket 34 in fuse box):

=> Current flow diagrams, Electrical fault finding and Fitting locations

Testing activation of secondary air pump relay

- Switch off ignition.
- Disconnect secondary air pump relay.
- Connect voltage tester V.A.G 1527 B as follows:

3-way relay carrier (electronics box in plenum chamber) socket position 2: contact	Test against
6	Battery positive

- Start final control diagnosis and select secondary air pump relay -J299.

=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis

  - The LED should flash.

If the LED does not flash:

- Switch off ignition.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit.Do notconnect to the engine control unit itself.

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=> Motronic ignition and injection system; Repair group 24; Servicing Motronic injection system; Testing fuel pump relay and activation Servicing Motronic injection system Testing fuel pump relay and activation

- Test for open circuit and short to positive or earth in the following wiring connection:

3-way relay carrier (electronics box in plenum chamber) socket position 2: contact	Test box V.A.G 1598/31 socket
6	46

- Rectify any open/short circuit as necessary.

If no fault is found:

- Fit a new secondary air pump relay -J299.

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Testing voltage supply to secondary air pump motor

- Unplug connector from secondary air pump motor -V101.
- Connect voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis and select secondary air pump relay -J299.

=> Motronic injection and ignition system; Repair group 01; Final control diagnosis Final control diagnosis

- The LED should flash.

If the LED does not flash:

- Carry out the following tests (marked with dots):

• Test for open circuit in wiring from connector for secondary air pump motor -V101 to secondary air pump relay -J299 (located in 3-way relay carrier in electronics box in plenum chamber, socket position 2)

=> Current flow diagrams, Electrical fault finding and Fitting locations

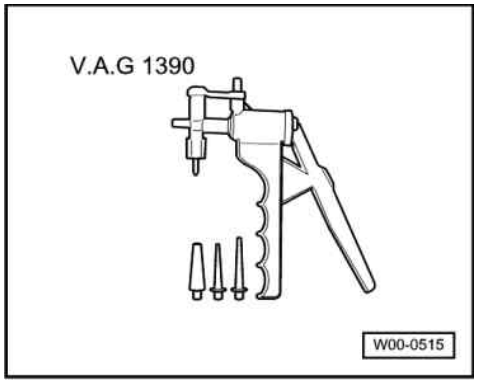
• Test for open circuit in wiring from connector on motor -V101 to earth connection 1 in engine compartment wiring harness:

=> Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found:

- Renew secondary air pump motor -V101.

3.6 - Testing combination valve

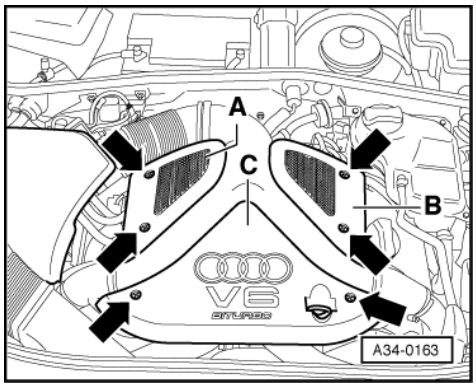


Special tools and workshop equipment required

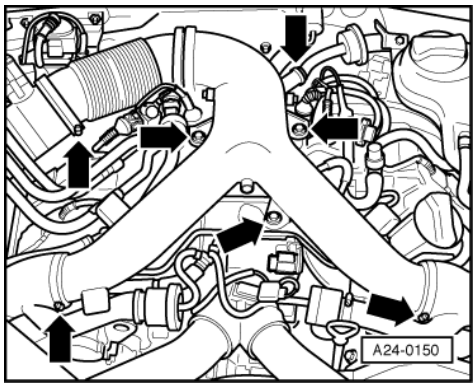
◆ Hand vacuum pump V.A.G 1390

Requirements for test:

- No leaks in vacuum lines and hose connections.
- No obstructions in vacuum lines.

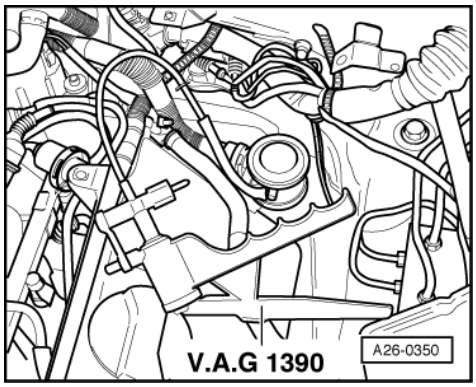


- -> Unscrew bolts -arrows- and remove engine cover panels -A...C-.



- -> Remove air duct -arrows-.

Checking for leaks



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- -> Detach hose from secondary air pump motor and blow into hose lightly (do not use compressed air).

◆ Both combination valves should be closed; it should not be possible to blow through the hose.

If it is possible to blow through the hose:

- Disconnect connecting line between secondary air motor and combination valve from one of the combination valves and close connecting line by hand. Blow through the hose again.

If it is still possible to blow through the hose:

- Renew the combination valve still fitted to the connecting line.

If it is not possible to blow through the hose:

- Renew the combination valve detached from the connecting line.

Checking function

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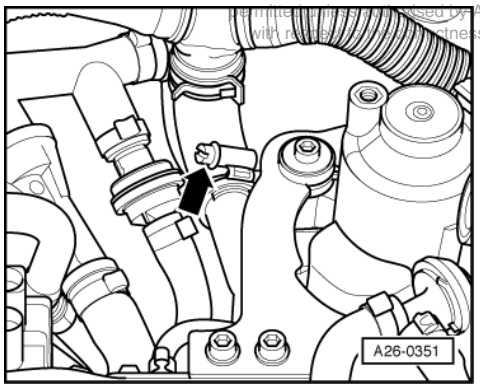
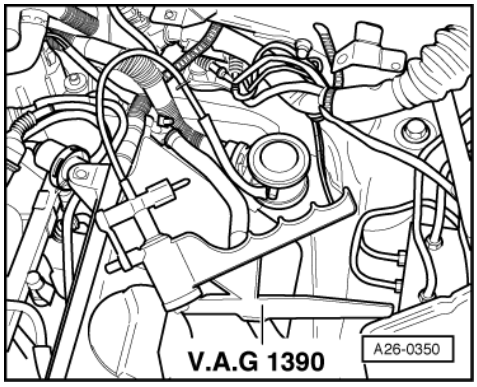


- -> Detach vacuum hose from the combination valve which is to be checked and connect vacuum pump V.A.G 1390 to combination valve.



- -> Disconnect hose from secondary air pump motor and blow into hose lightly (do not use compressed air).
- Operate hand vacuum pump.

◆ The relevant hand combination valve should open; it should now be possible to blow through the hose.

If the relevant combination valve does not open:

- Renew combination valve.

If the relevant combination valve opens:

- Repeat function check on the second combination valve.

Note:

- Use special tool 3231 and Hazet carburettor spanner 4530 for removing and installing the left combination valve.
- There is no special tool required for removing and installing the right-hand combination valve.