

Audi 100 1991 ➤

6-cyl. Engine, (5-Valve), Mechanical Components								
Engine ID	ACK							

Edition 02.2002



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List of Workshop Manual Repair GroupsList of Workshop Manual
Repair GroupsList of Workshop Manual Repair Groups
Audi 100 1991 ➤

6-cyl. Engine, (5-Valve), Mechanical Components
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Repair Group

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- 10 - Removing and installing engine
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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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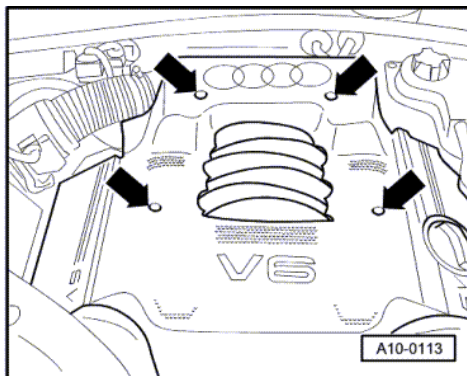
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00 - Technical data

1 - Technical data

1.1 - Technical data

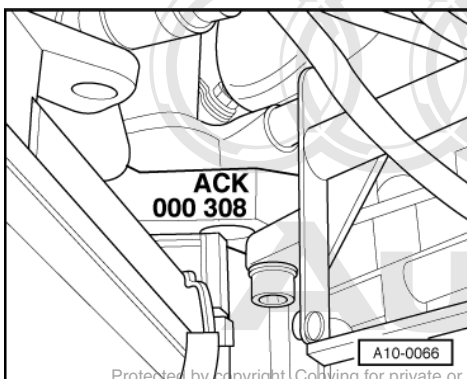
1.2 - Engine number



Note:

The engine number will only become visible after preliminary operations.

- -> Remove engine cover -arrows-.



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-> The engine number ("engine code" and "serial number") is stamped on the right inner side of the cylinder block between cylinder head and power steering vane pump.

There is also a sticker on the air duct showing the "engine code" and "serial number".

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



1.3 - Engine data

Code		ACK
Capacity	l	2.771
Output	kW at rpm	142/6000
Torque	Nm at rpm	280/3200
Bore	ø in mm	82.5
Stroke	mm	86.4
Compression		10.6
RON		98 1)
Injection-/Ignition system		Bosch Motronic
Firing order		1-4-3-6-2-5
Knock control		yes
Catalytic converter		yes
Turbocharging		no
Exhaust gas recirculation system		no
Intake manifold changeover		yes
Camshaft timing control		yes

- 1) Premium unleaded petrol RON 95 can be used but will cause a slight loss of power.

Code	ACK
Valve timing 2)	
Inlet opens after TDC	12°
Inlet closes after BDC	42°
Exhaust opens before BDC	39°
Exhaust closes before TDC	8°

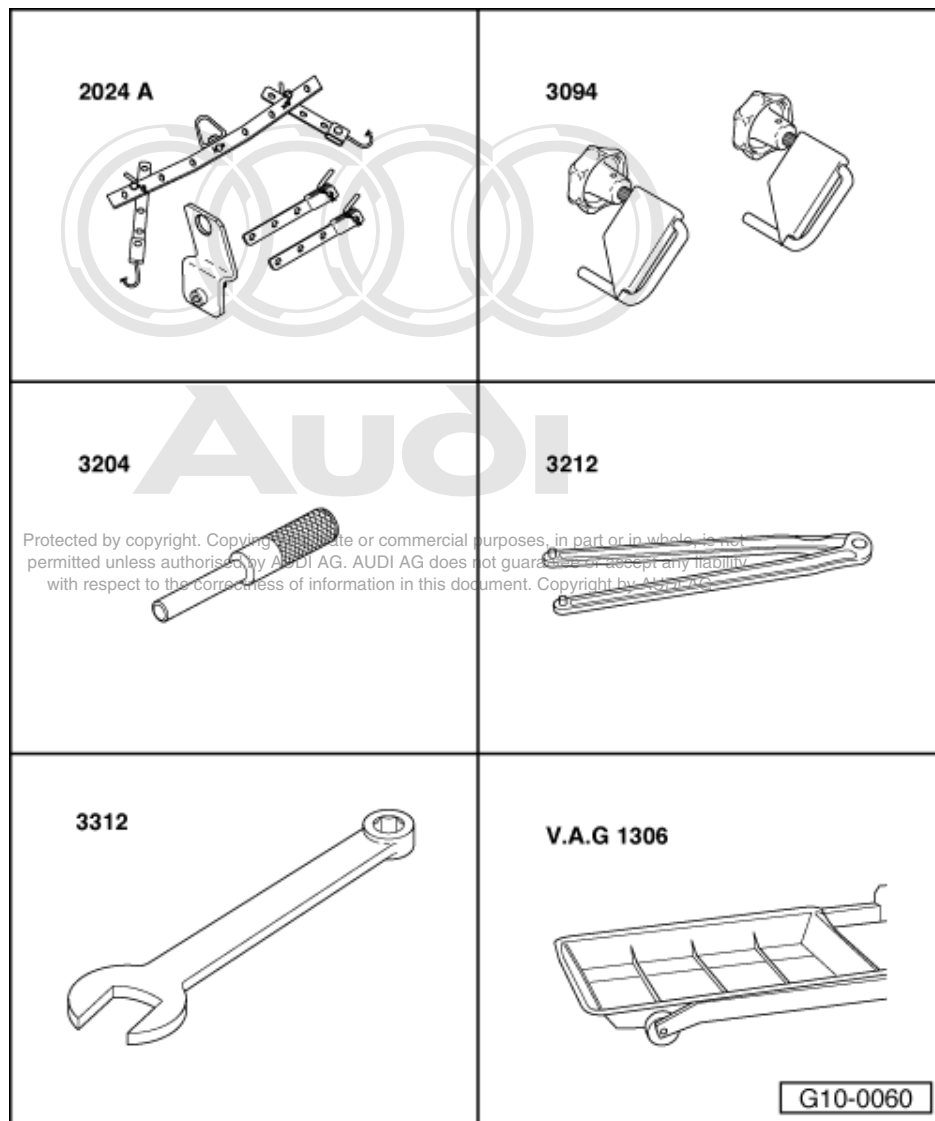
- 2) With 1 mm valve lift and 0 mm valve play

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10 - Removing and installing engine

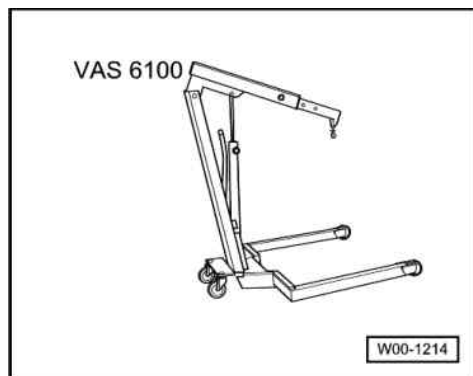
1 - Removing and installing engine

1.1 - Removing and installing engine

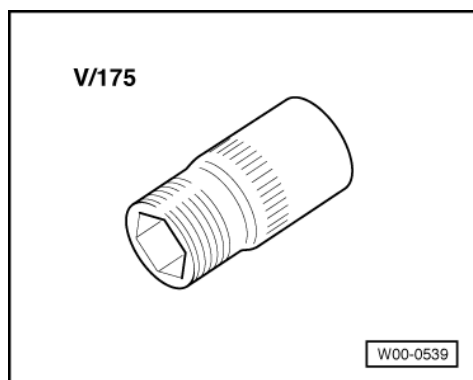


Special tools and workshop equipment required

- ◆ Lifting tackle 2024 A
- ◆ Hose clamps 3094
- ◆ Mandrel 3204
- ◆ Pin wrench 3212
- ◆ Open-ended spanner 3312
- ◆ Drip tray V.A.G 1306



- ♦ Workshop crane VAS 6100



- ♦ 15 mm socket insert Matra V/175
(Vehicles with automatic gearbox)

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1.2 - Removing

Notes:

- ♦ Remove engine upwards without gearbox.
- ♦ Replace all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- ♦ Heat insulating sleeves removed during removal of the engine must be refitted in the same position when installing the engine.
- ♦ Collect drained coolant in a clean container for re use or disposal.
- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

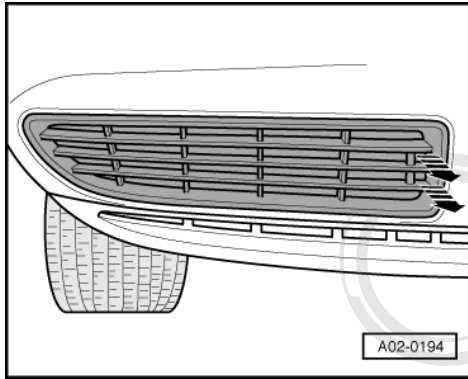
=> General Body Assembly; Repair group 72

- Disconnect earth strap at battery with ignition switched off.

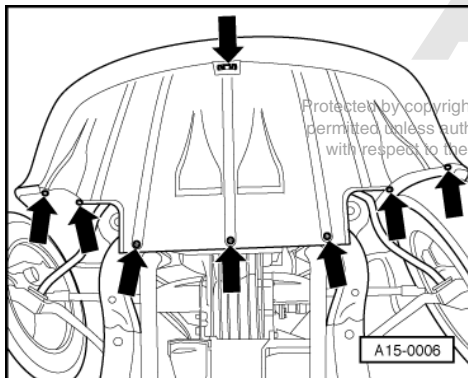
Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

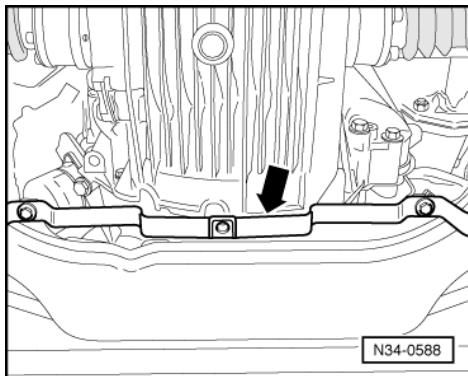
- Open the cover of the coolant expansion tank



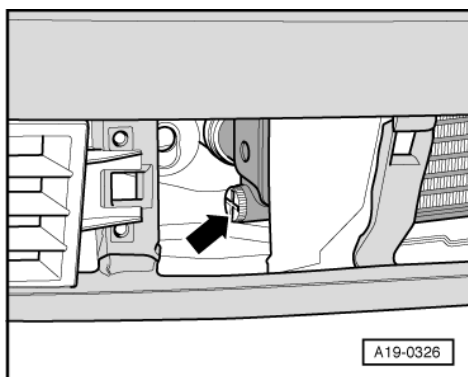
- -> Pull back retainer catch -arrows- and remove air intake grille.



- -> Remove the noise insulation -arrows-.



- -> Unbolt bracket for noise insulation -arrow-.



- Place drip tray V.A.G 1306 below engine.



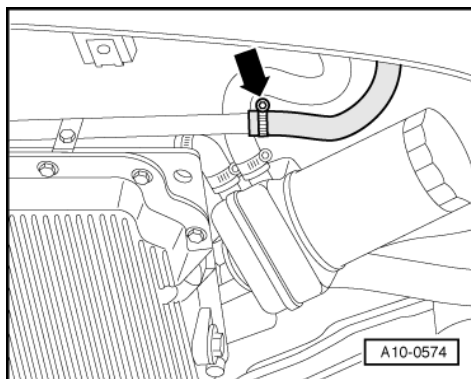
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.



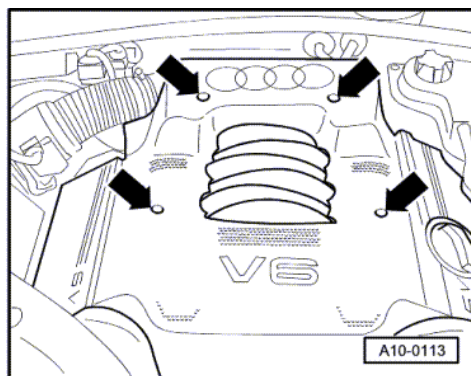
- -> Also open the coolant drain plug on rear left of engine -arrow-.

Note:

Replace O-ring.



- -> Also disconnect coolant hose -arrow-, and drain off remaining coolant.

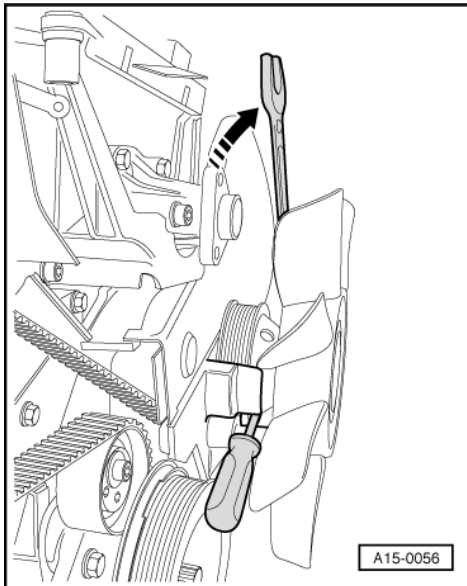


- -> Remove engine cover -arrows-.



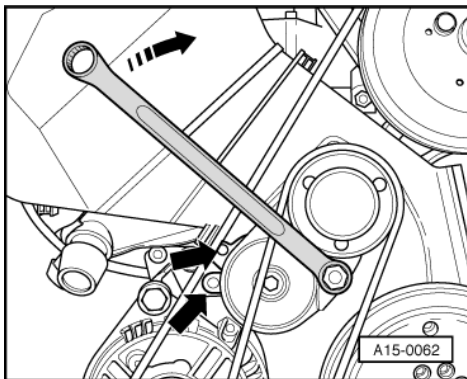
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- -> Counterhold pulley for viscous fan with 2-hole pin wrench 3212 and unscrew viscous fan with wrench 3312 (left-hand thread).
- Unscrew radiator cowl for viscous fan.
- Lift out the viscous fan with radiator cowl upwards.

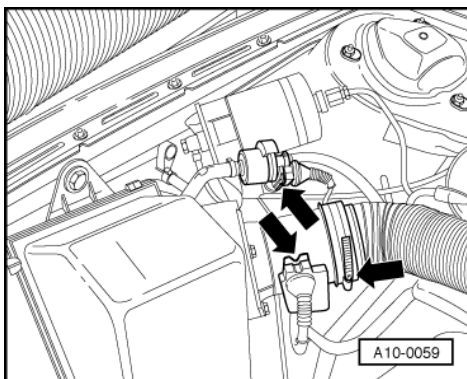
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Note:

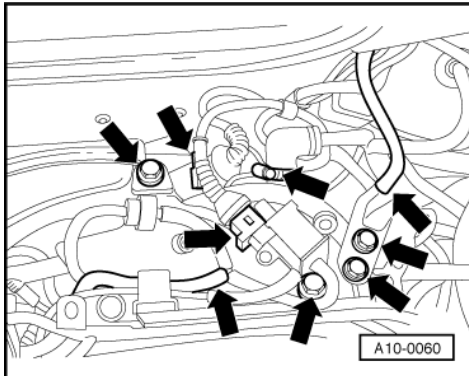
Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- -> To slacken ribbed belt, turn tensioner in direction of arrow using ring spanner (17 mm A/F).
- Insert mandrel 3204 into securing holes to lock tensioner in position.
- Remove ribbed belt.

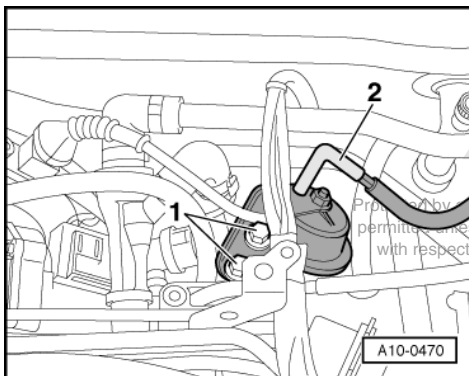




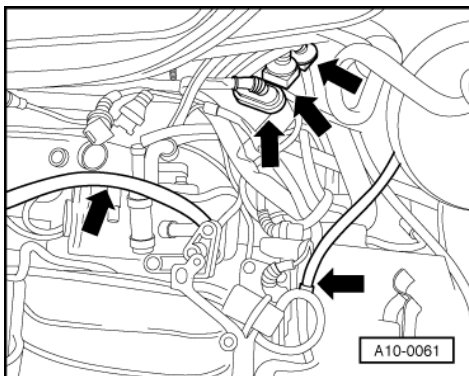
- -> Unplug the connectors at:
 - Air mass meter
 - Solenoid valve 1 for activated charcoal filter -N80
- Remove air intake hose between air mass meter and engine.
- Remove the upper section of the air cleaner housing.



- -> Unplug the connectors at:
 - Intake manifold changeover valve -N156 (blue connector)
 - Intake air temperature sender -G42 (grey connector)
- Detach the black vacuum hose to the vacuum reservoir at the T-piece.
- Cut through cable tie.
- Lay wiring aside.

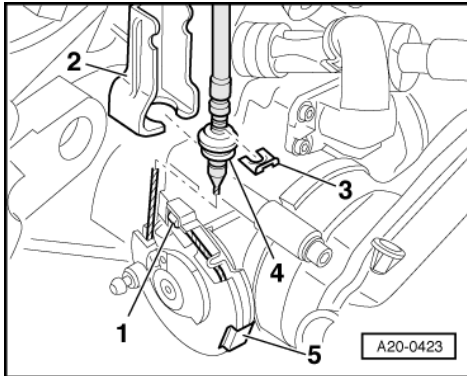


- -> Detach vacuum hose -2- vacuum unit from CCS.
- Unscrew bolts -1- and remove vacuum unit downwards.

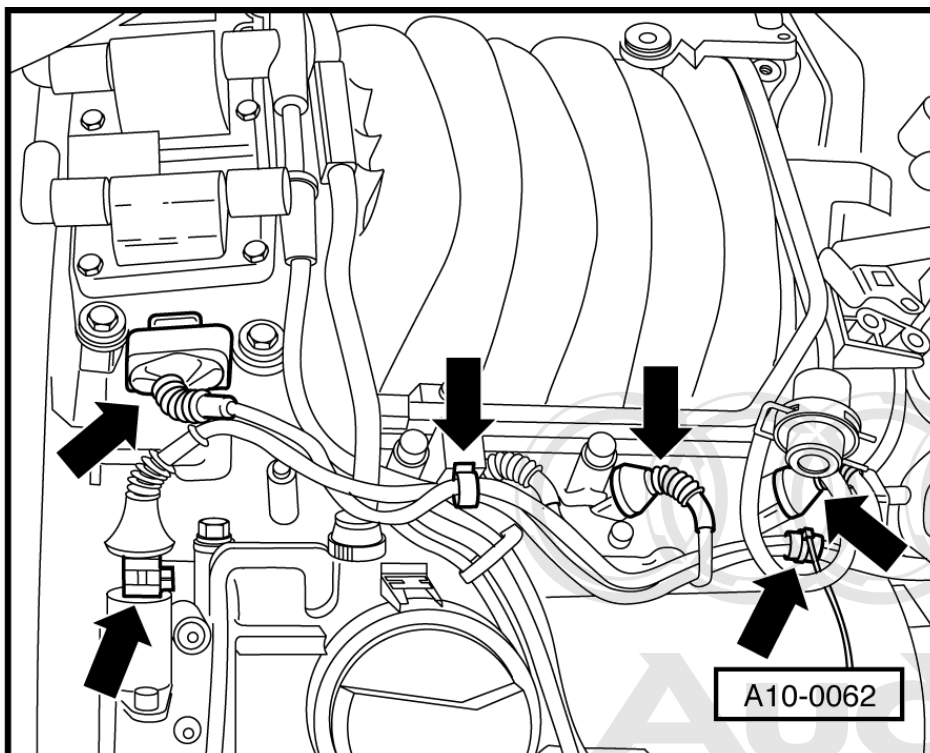


- -> Unplug the connectors at:

- Coolant temperature sender (at left rear on coolant pipe)
- Hall sender on left
- Detach the vacuum pipe from the fuel pressure regulator to the plenum chamber at the T-piece.
- Unplug the 3 connectors at the plenum chamber on the left.
- Cut open cable tie at bracket for connectors.
- Remove connectors from retainer and lay wiring aside.
- Unscrew the vacuum pipe to the ACF valve at the throttle valve unit.
- Unplug connector at throttle valve control unit.



- -> Detach retaining clip -5-.
- Detach nipple -1- at throttle cable end from cable disc.
- Detach the throttle cable with rubber bush -4- out of the support bracket -2- (do not remove locking pin -3-).
- Detach supply and return hose for heating system heat exchanger at rear at engine.

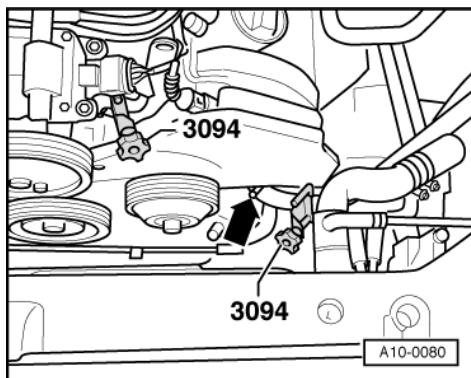


- -> Unplug the connectors at:
 - Injectors on left
 - Power end stage of the ignition coils
 - Camshaft adjustment valve
- Unclip pipe holder from fuel rail pipe.
- Cut open cable tie at the cylinder head cover.
- Place the lines to the rear.

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- Disconnect coolant hose on left leading to radiator at the engine.

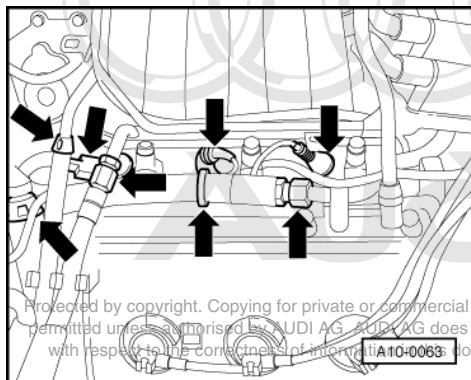


- -> Clamp off both hoses at the hydraulic supply pipe for power steering with hose clamps 3094.
- Place a cloth under the supply pipe below the left cylinder head and unscrew the line -arrow-.
- Unplug the connectors at:
 - A/C compressor (green connector)
 - Radiator fan (brown connector at longitudinal member on left)

- Lay wiring aside.
- Remove lock carrier:

=> General Body Assembly; Repair group 50; Front body Front body

- Remove air intake pipe leading to air cleaner at radiator.
- Unbolt air guide scoop from the top of the radiator and lift up and out.
- Remove the toothed belt guard.
- Unplug connector at Hall sender on right.



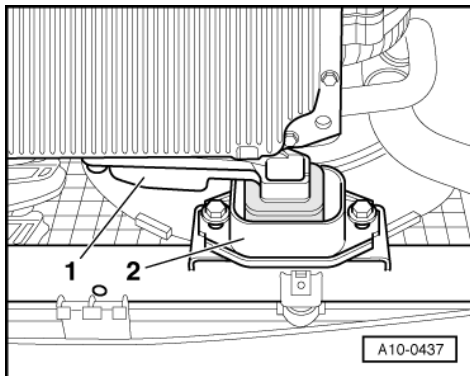
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Important

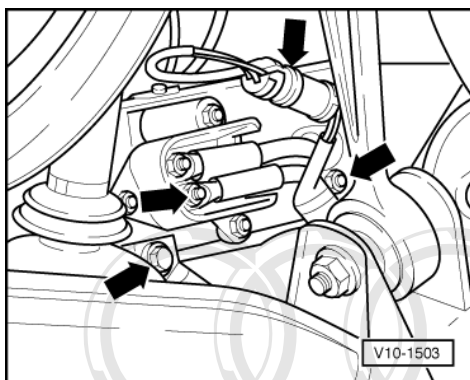
The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- -> Unscrew the fuel supply pipe and the fuel return pipe.
- Detach the hydraulic pump pressure pipe.
- Cut open cable tie at the hydraulic system pipe.
- Unscrew the hydraulic system pipe from coolant pipe at rear.
- Unplug the connectors at:
 - Injectors on right
 - Camshaft adjustment valve
- Cut open cable tie on coolant pipe at rear.

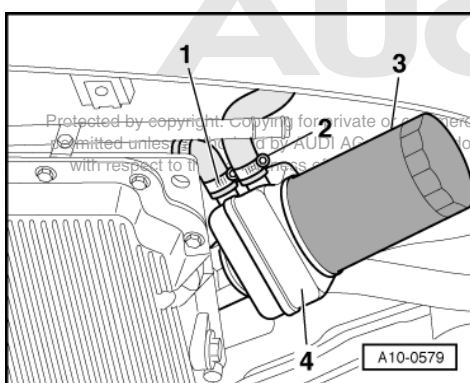
- Lay wiring aside.
- Unplug connector from dual thermoswitch at the coolant pipe at the rear.
- Detach the 3 connectors at the plenum chamber on the right.
- Take connectors out of retainer.
- Detach the two coolant hoses on the right from engine.



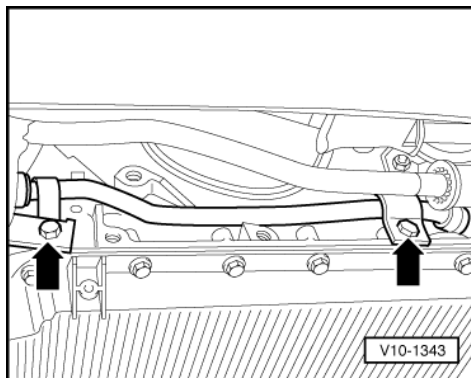
- -> Unscrew torque reaction support -1- and the torque reaction support stop -2-.



- -> Disconnect electrical connections for alternator and starter from the longitudinal member at the bottom right and disconnect earth strap.
- Unscrew pipe holder from engine mounting and oil pan.



- Place drip tray under engine to catch engine oil.
- Drain engine oil.
- -> Remove oil filter -3-.
- Place drip tray V.A.G 1306 below engine.
- Detach coolant hoses -1- and -2- from oil cooler.
- Remove oil cooler -4-.

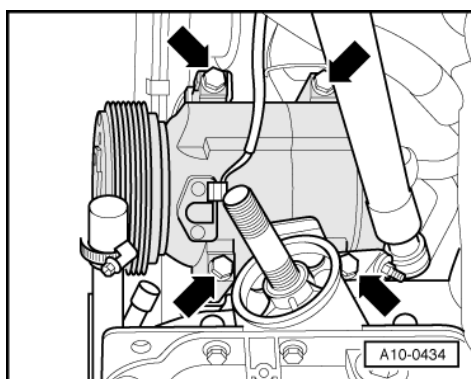


Vehicles with air conditioner:

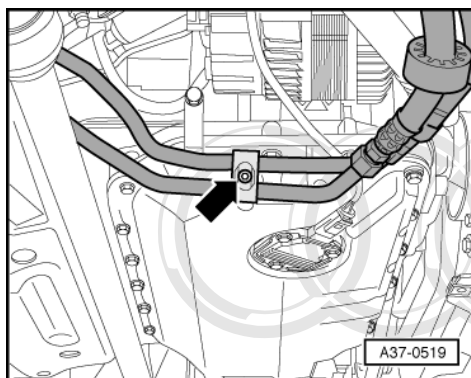
Important

The air conditioner refrigerant circuit must not be opened.

- -> Unscrew front refrigerant pipe holder at oil pan -right arrow-.
- If fitted, remove coolant pipe from oil pan -arrow on left and right-.



- Unfasten refrigerant pipe heat insulating sleeve
- -> Unbolt A/C compressor from bracket -arrows-.
- Attach air conditioner compressor onto longitudinal member, leaving lines connected.



Vehicles with automatic gearbox:

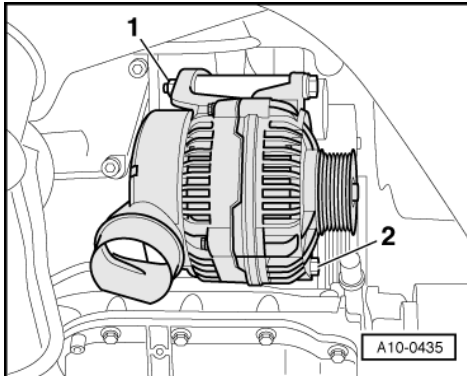
Note:

Observe cleanliness rules when working on the automatic gearbox.

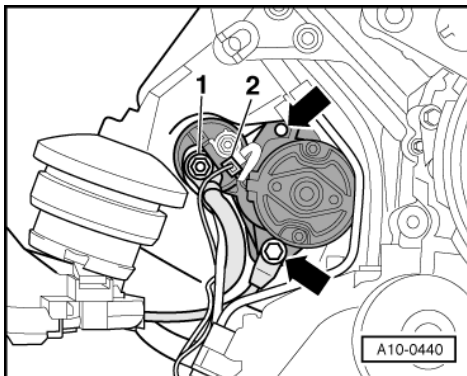
=> Automatic Gearbox 01K Front-wheel drive; Repair group 37

=> Automatic Gearbox 01F 4WD; Repair group 37

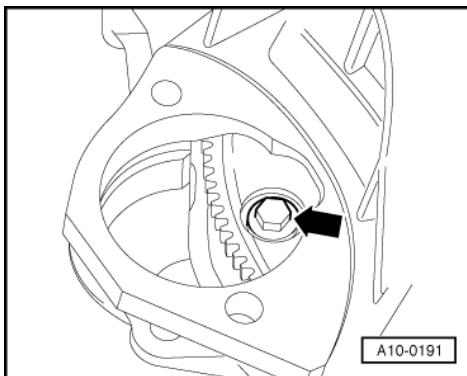
- -> Unscrew the ATF line at the oil pan -arrow-.
- Unscrew ATF line from gearbox.
- Move ATF lines to side.



- Unclip the alternator air duct.
- > Unscrew bolt -2-.
- Loosen the nut -1-.
- Swing the alternator to one side and unscrew the lines.
- Remove alternator.



- -> Remove wiring -1- and -2- from starter, remove insulator from positive connection of starter.
- Unscrew starter bolts -arrows- working from gearbox side, and remove starter.

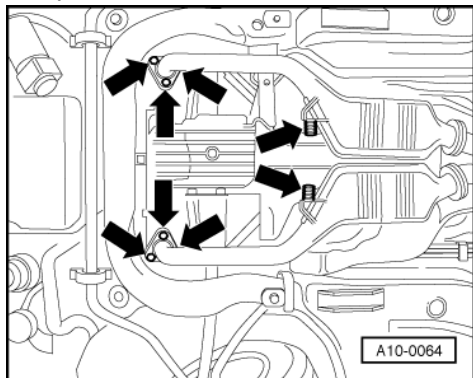


- -> Use 15 mm wrench socket Matra V/175 15 NF to screw out 3 bolts of torque converter in opening in removed starter (give crankshaft 1/3 of a turn in each case).



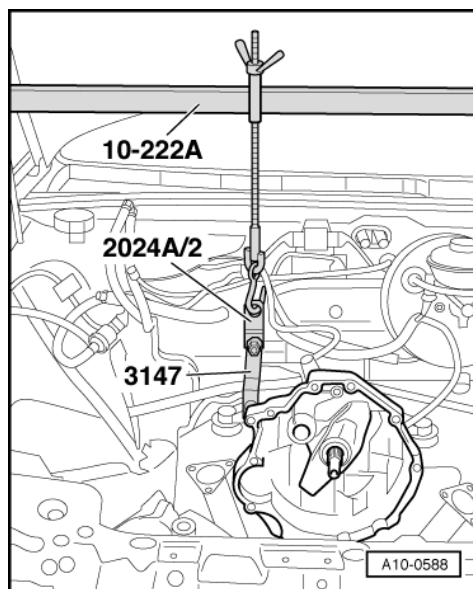
Note:

When loosening torque converter bolts, counterhold crankshaft by applying spanner to central bolt on vibration damper.



All models:

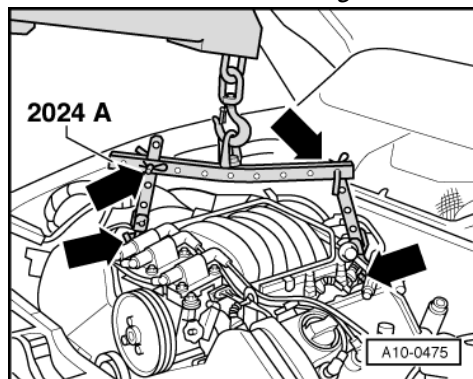
- -> Unscrew the front exhaust pipe on left and right from exhaust manifold.
- Unscrew both retainers on the gearbox.
- Unscrew engine/gearbox securing bolts. Leave one bolt in place at top (hand tight).



- -> Position support bar 10-222 A behind gas pressure spring onto wing bolt edge. Spindle is at front.
- Engage gearbox support 3147 in bolt hole in bell housing as shown in the illustration.
- Connect gearbox support 3147 to support bar 10-222 A using lug 2024 A/2. Secure bolt with nut and washer.

Note:

Shown in illustration with engine removed.



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- -> Attach lifting tackle 2024 A to engine and workshop lifter 1202 A.

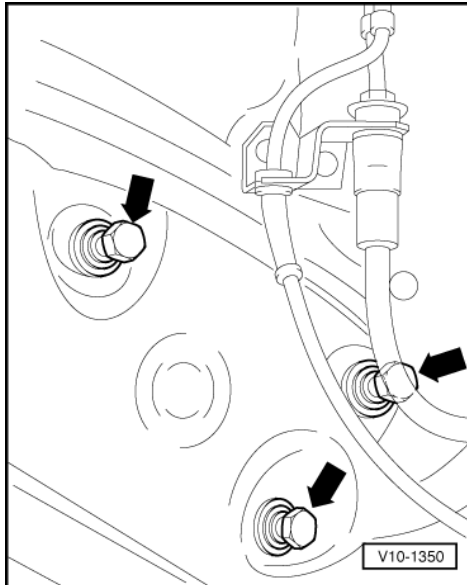
Note:

To balance the centre of gravity of the engine, position the hook attachments as shown in the illustration.

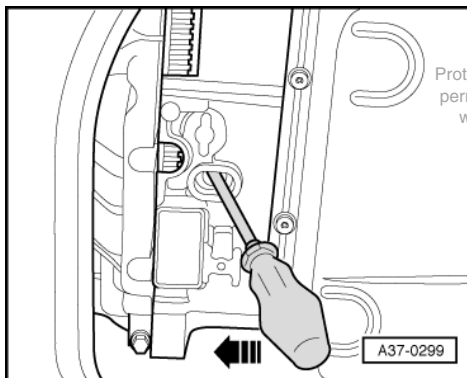
Important

The hooks and locating pins of the lifting tackle must be secured with locking pins -arrows in illustration-.

- Unscrew last engine/gearbox securing bolt.
- Carefully raise engine.



- Loosen left wheel housing liner at the front.
- -> Unscrew engine console from body on left -arrows-.
- Lift engine over studs of right engine mount.
- Tighten spindle of support bar 10-222 A.



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Vehicles with automatic gearbox:

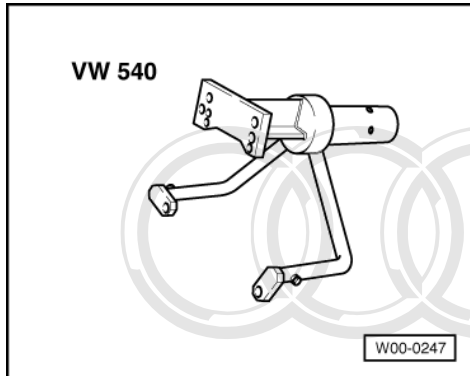
- -> Press gearbox off engine, while also pressing the torque converter off the drive plate.

All models:

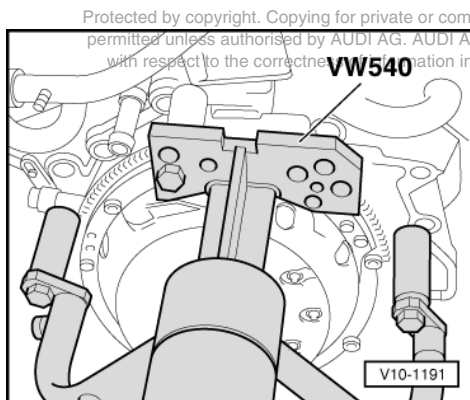
- Pull engine from gearbox and raise it until arm of workshop crane is just below the bonnet.
- Guide the engine carefully while lifting it to avoid damaging bonnet, radiator or lock carrier.

Vehicles with automatic gearbox:

- If necessary, secure torque converter in gearbox with wire to prevent it falling out.

1.3 - Attaching engine to repair stand**Special tools and workshop equipment required**

- ♦ Engine and gearbox support VW 540

**Procedure**

- -> For work on the engine, attach engine to repair stand using engine mount VW 540 and special tool VW 540/1.

1.4 - Installing

Installation is carried out in the reverse order; note the following:

Notes:

- ♦ When installing the engine all cable ties must be fitted in the same position.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ♦ Heat insulating sleeves removed during removal of the engine must be refitted in the same position when installing the engine.
- ♦ When performing installation procedures always replace self-locking nuts and bolts.

- ♦ Replace seals, gaskets, and bolts which have a specified tightening angle.
- Check whether the dowel sleeves for centralising engine/gearbox are in the cylinder block, install if necessary.
- When fitting the engine onto the gearbox ensure that the speed sender is not damaged.

Vehicles with manual gearbox:

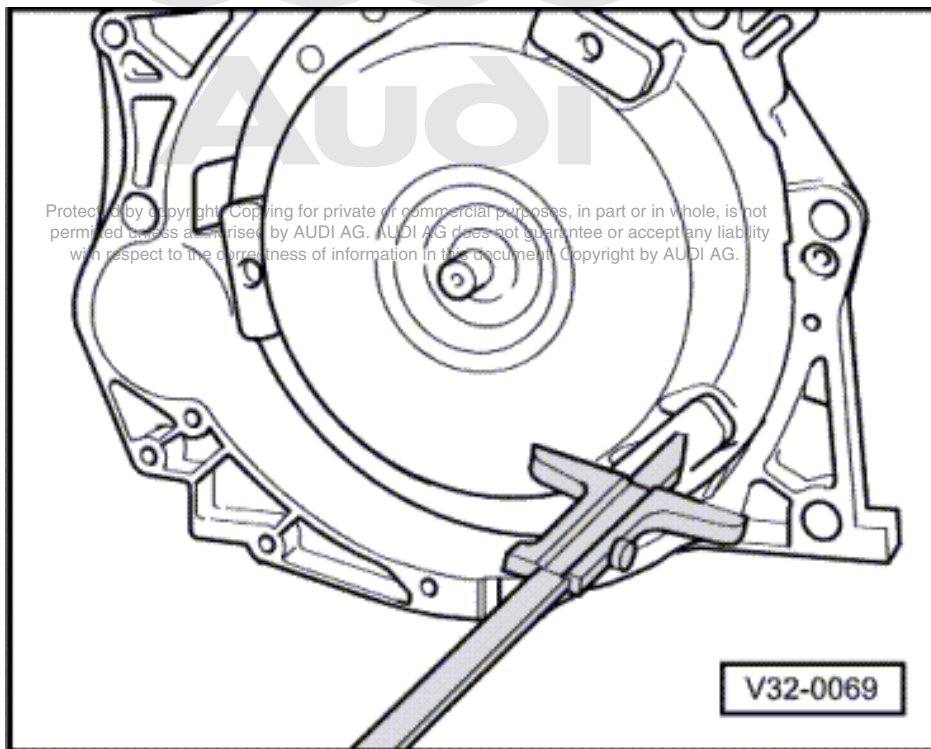
- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Do not grease guide sleeve.
- Check clutch release bearing for wear, replace if necessary.
- If necessary, check that clutch plate is properly centred.
- A needle bearing must be fitted in the flywheel on vehicles with manual gearbox. Install needle bearing if necessary => Page 52.

Vehicles with automatic gearbox:

- Short engines are supplied without bushes in the crankshaft. Before installing the drive plate drive in the bush => Fig. 58.
- To secure torque converter on drive plate. only use correct bolts as specified in parts catalogue (same as original equipment).

=> Parts List

- Use 15 mm wrench socket (Matra V/175) to fasten nuts of torque converter.



Checking the installation dimension of torque converter - Automatic gearbox 01F/01K

-> If the torque converter has been correctly installed, the distance between the bottom contact surfaces at the threaded holes in the torque converter and the contact surface of the torque converter bell housing (with automatic gearbox) is at least 19 mm.

If the torque converter has not been completely inserted, this distance will be approx. 14 mm.



Important

On vehicles with automatic gearbox 01F/01K, continually check that the torque converter behind the drive plate can be turned before and during tightening of bolts at engine/gearbox flange. If the converter cannot be turned, it must be assumed that it has not been installed correctly and the drive plate of the converter or the ATF pump will be damaged during final tightening of bolted connections.

All models:

- Attach gearbox to engine => Page 19 onwards.
- Installing engine mounts free of stress. Ensure that engine mounts are free of stress by shaking engine to align it before tightening engine mounts.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight. and tighten bolts to 40 Nm.
- Install the A/C compressor =>Page 23 .
- Installation and stress-free alignment of exhaust system => Page 192.
- Install ribbed belt =>Page 28.
- Check throttle cable setting

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism Servicing throttle mechanism

- Electrical connections and routing:

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Notes:

- ♦ When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is activated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

=> Motronic Injection and Ignition System; Repair group 24

- Check oil level => Page 145 .
- Top up coolant => Page 151 .

Notes:

- ♦ Drained coolant may only be used again if the original cylinder head and cylinder block are re installed.
- ♦ Coolant must not be used again if it is dirty.

- Top up power steering fluid and bleed steering system:

=> Running Gear, FWD and 4WD; Repair group 48

Important

Do not use charging unit for boost starting. There is danger of damaging the vehicle control units.

- To interrogate fault memory:

=> Motronic Injection and Ignition System (6-cylinder); Repair group 01; Interrogating and erasing fault memory
Interrogating and erasing fault memory

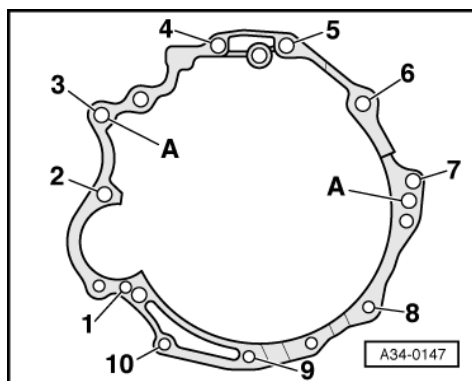
Note:

Faults will have been recorded in the fault memory because the connectors have been unplugged. Therefore interrogate and erase fault memory after installing engine.

1.5 - Tightening torques

Notes:

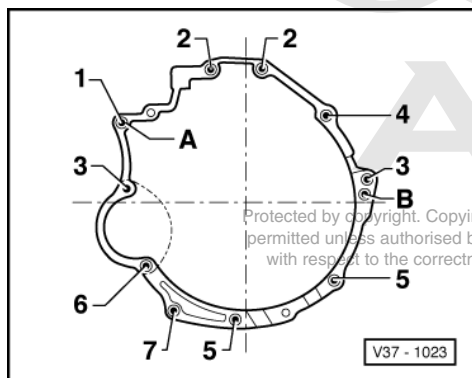
- ♦ The tightening torques listed on this page apply only to lightly greased, oiled, phosphated, or black finished nuts and bolts.
- ♦ Additional lubricant such as engine or gearbox oil may be used, but do not use graphite lubricant.
- ♦ Do not use degreased parts.
- ♦ Tightening torque tolerance $\pm 15\%$.



-> Engine/gearbox mountings (manual gearbox)

Item	Bolt	Nm
1	M10 x 135	45
2	M12 x 110	65
3, 4, 5	M12 x 67	65
6	M12 x 90 1)	65
7	M12 x 80	65
8	M10 x 50	45
9	M10 x 38	45
10	M8 x 40	20

- 1) Bolt with washer
A: Centring sleeves



-> Securing engine to gearbox in vehicles with automatic gearbox 01F/01K

Item	Bolt	Nm
1	M12 x 50	65
2	M12 x 67	65



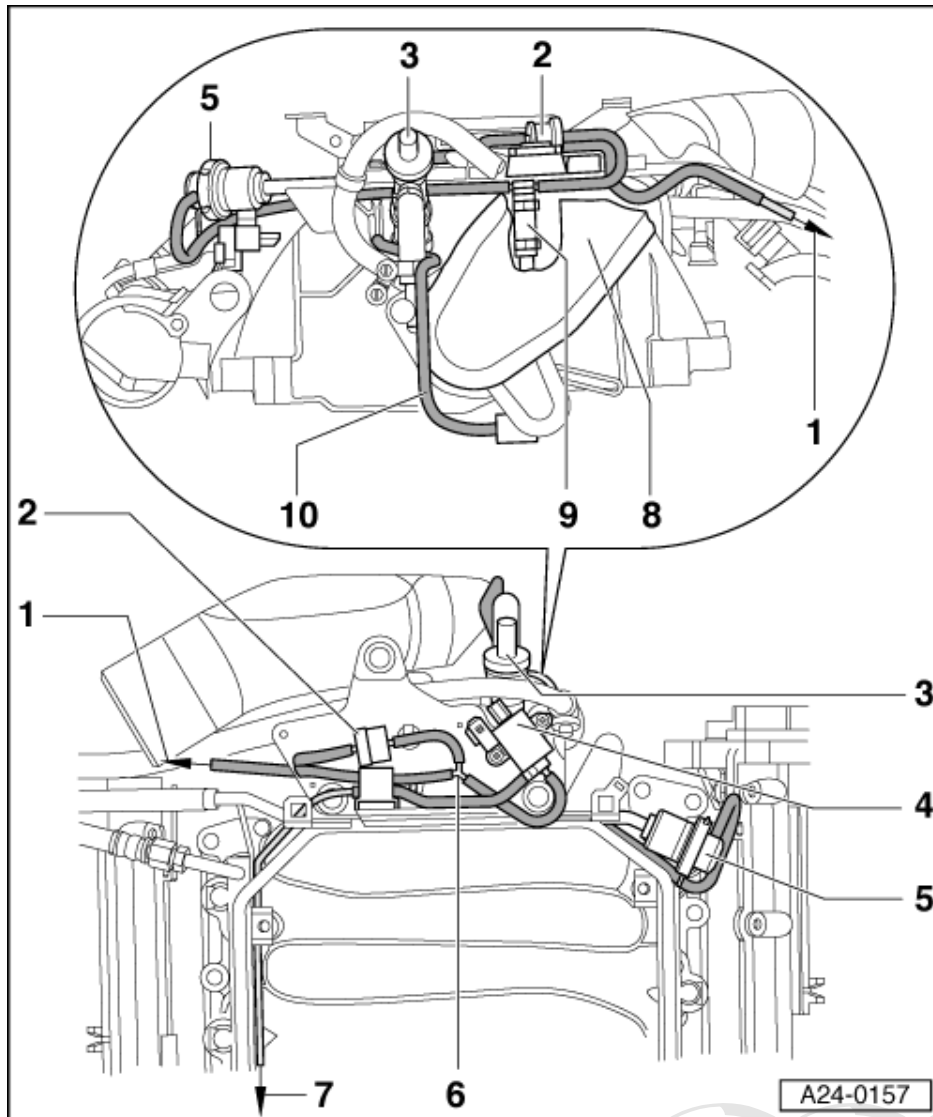
Item	Bolt	Nm
3	M12 x 80	65
4	M12 x 100	65
5	M10 x 38	45
6	M10 x 80	45
7	M8 x 40	20

A, B: Centring sleeves

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Drive plate to torque converter	M10 x1	85
Coolant drain plug to cylinder block		20
Alternator to engine	M8	22
	M10	45
Engine console to longitudinal member		45
Engine mounting to engine support		25
ATF line to oil pan		10
A/C compressor to bracket		25
Oil cooler to engine		30
Buffer for torque reaction support to lock carrier		40
Torque rod to engine		42
Power steering pressure line to pressure hose		40
Fuel lines to fuel rail or fuel pressure regulator		25
CCS unit to bracket		15
Hose clamps for coolant hoses		2

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1.6 - Vacuum connections

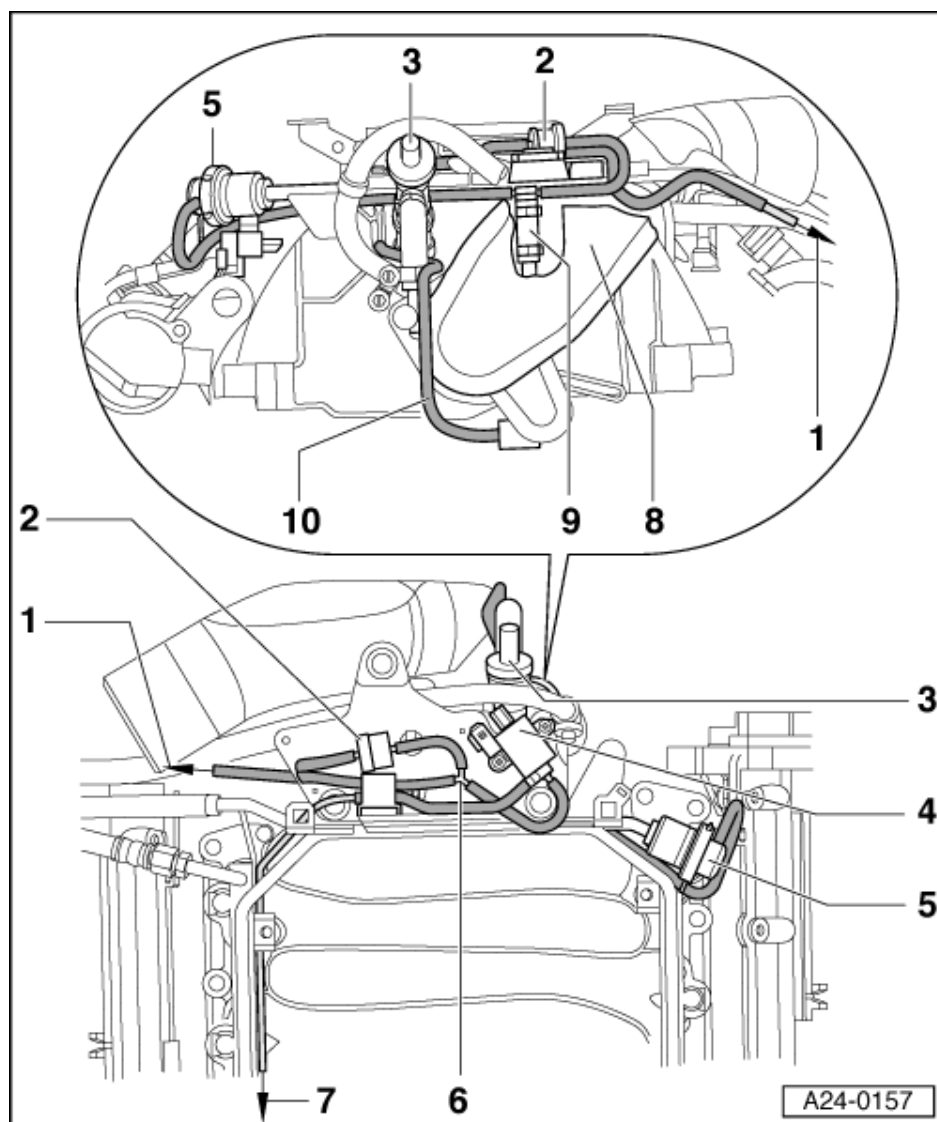


Top part of Fig. - back of engine

Bottom part of Fig. - top view of engine

- 1 To vacuum reservoir
- 2 Non-return valve
- 3 Suction jet pump
- 4 Intake manifold changeover valve -N156
- 5 Fuel pressure regulator
- 6 Y-piece

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- 7 To vacuum unit
♦ For intake manifold changeover
- 8 Air intake elbow
- 9 Pipe to intake manifold connection
- 10 Connecting hose
♦ Air intake elbow/throttle valve unit

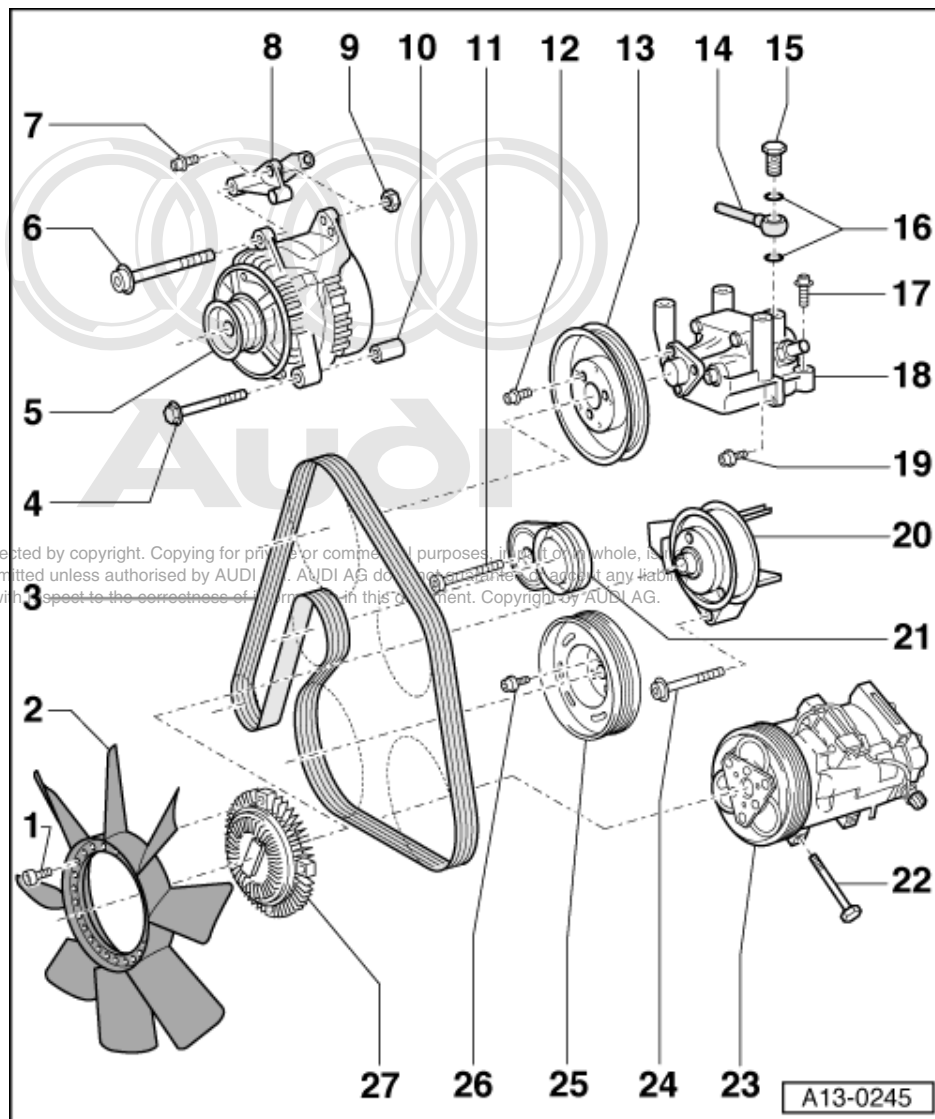


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13 - Crankshaft group

1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine



1.2 - Ribbed belt drive for vane pump, alternator and AC compressor

Note:

Mark the running direction with chalk or felt pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

1 10 Nm

2 Fan wheel

- ♦ For viscous fan
- ♦ Removing and installing

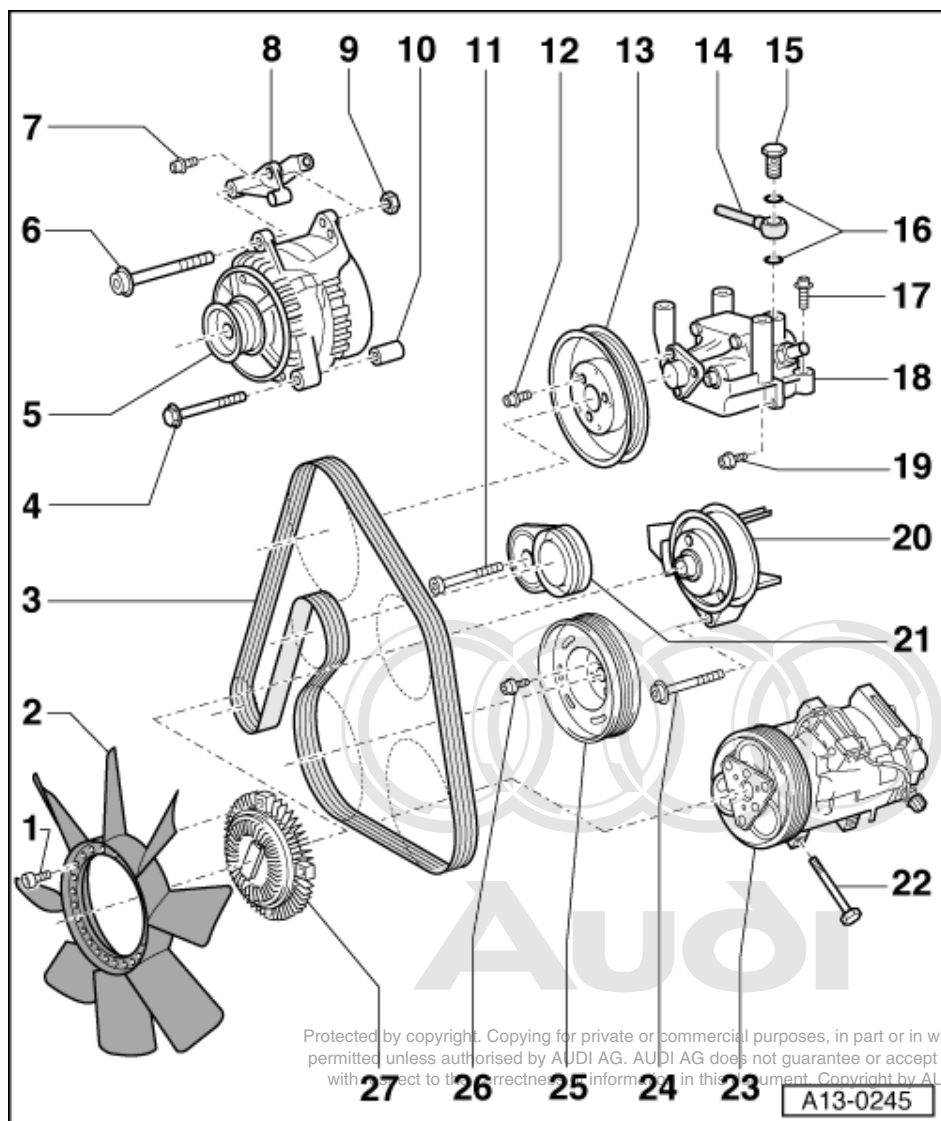


=>Page 170 .

3 Ribbed belt

- ♦ Removing and installing

=>Page 27 .

**4 22 Nm****5 Alternator**

- ♦ Removing:

=> Electrical System; Repair group 27; Removing and installing alternator Removing and installing alternator

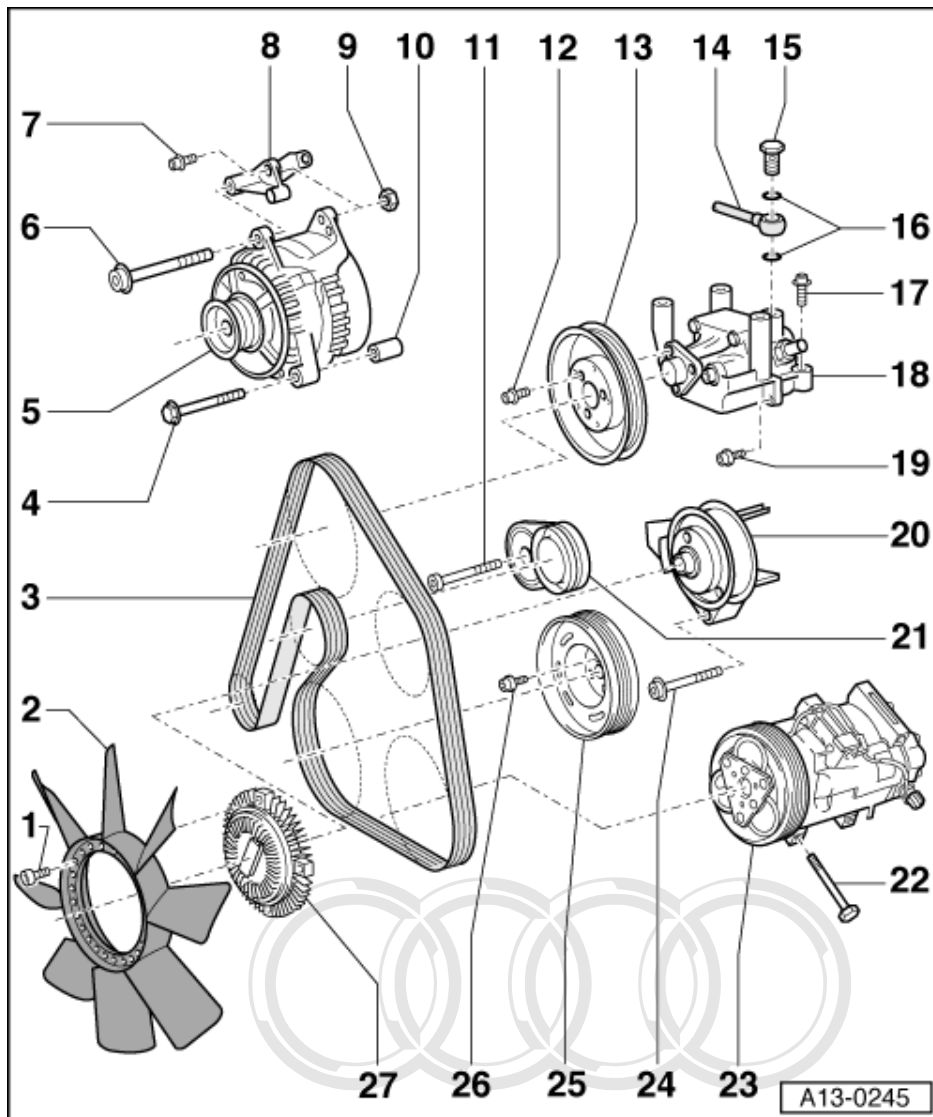
6 45 Nm**7 22 Nm****8 Bracket**

- ♦ For alternator

9 45 Nm**10 Spacer sleeve****11 55 Nm****12 22 Nm****13 Belt pulley**

- ♦ For vane pump

- ♦ Counterhold with special tool 3212 for removing and installing



14 Pressure pipe

- ♦ To power steering

15 Banjo bolt - 40 Nm

16 Sealing ring

- ♦ Replace

17 22 Nm

18 Vane pump with bracket

- ♦ For power steering
- ♦ Removing and installing:

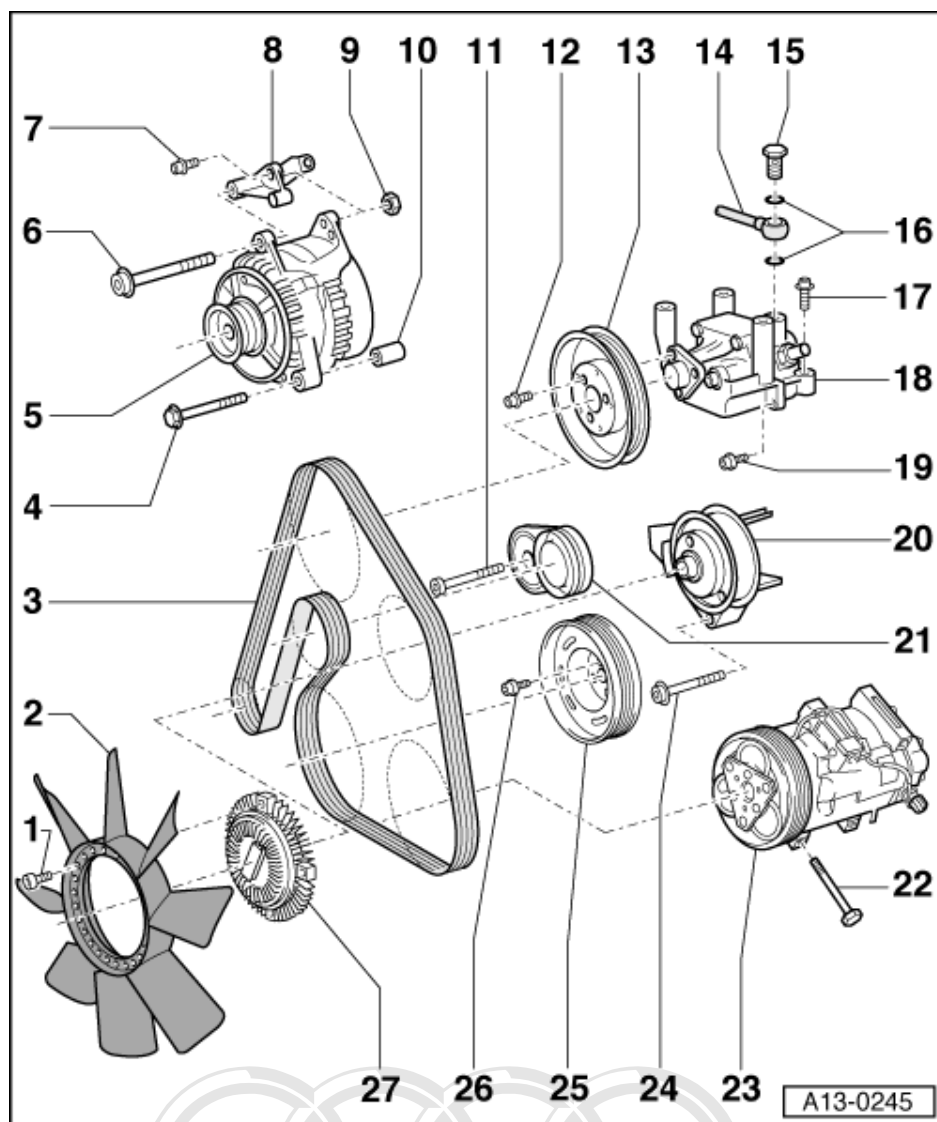
=> Running Gear, FWD and 4WD; Repair group 48

19 22 Nm

20 Pulley with bracket

- ♦ For viscous fan
- ♦ Removing and installing =>Fig. 1

21 Tensioner for ribbed belt

**22 25 Nm****23 Air conditioner compressor**

- ◆ Do not unscrew or disconnect refrigerant hoses or pipes.
- ◆ After removing compressor from mountings, secure to chassis side member with wire or similar. Do not leave compressor suspended on refrigerant hoses.

24 M6 = 10 Nm**M8 = 22 Nm**

- ◆ Removing and installing =>Fig. 1

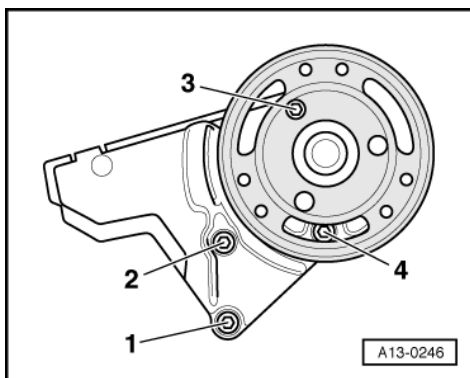
25 Vibration damper

- ◆ Removing and installing
=>Page 29.

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26 22 Nm**27 Viscous coupling**

- ◆ For viscous fan
- ◆ Removing and installing
=>Page 170.



➔ Fig.1 Removing and installing pulley for viscous fan

Removing

- Remove bolts -1-, 4-.

Note:

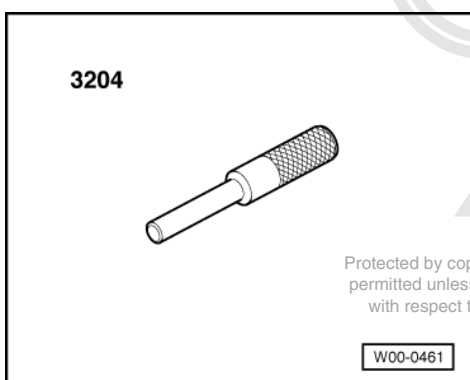
Bolts -3- and -4- cannot be detached.

Installing

Installation is carried out in the reverse order; note the following:

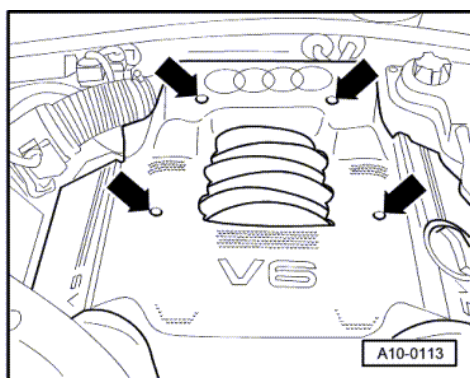
- Tighten bolt -3- (hexagon socket head bolt 5 mm) to 10 Nm.
- Tighten bolts -1, 2 and 4- (hexagon socket head bolt 6 mm) to 22 Nm.

1.3 - Removing and installing ribbed belt



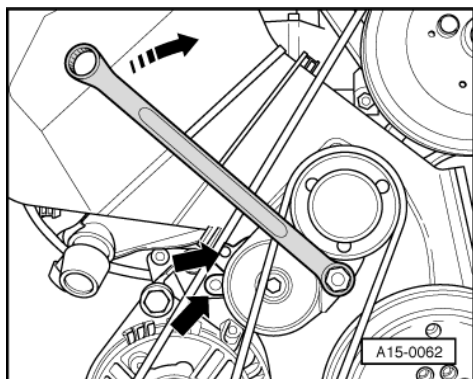
Special tools and workshop equipment required

- ◆ Mandrel 3204



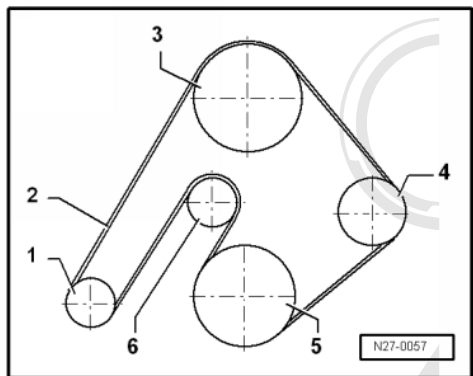
**Removing**

- -> Remove engine cover -arrows-.

**Note:**

Mark direction of rotation of belt with chalk or felt pen before removing ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

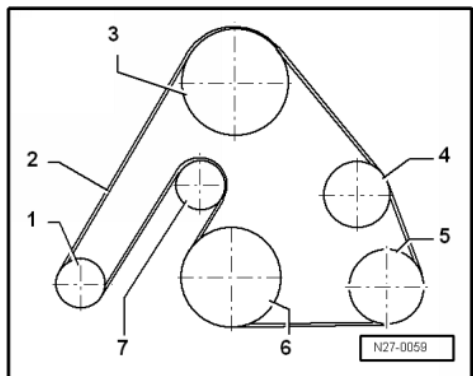
- -> To slacken ribbed belt, turn tensioner in direction of arrow using ring spanner (17 mm A/F).
- Insert mandrel 3204 into holes -arrows- to stop tensioner from turning.
- Guide the ribbed belt over the viscous fan and remove it.

**Installing**

Installation is carried out in the reverse order; note the following:

- First place ribbed belt over crankshaft pulley. Then push belt onto tensioning roller.
- -> Ribbed belt routing on vehicles without air conditioner

- 1 - Alternator
- 2 - Ribbed belt
- 3 - Vane pump for power steering
- 4 - Viscous fan
- 5 - Crankshaft
- 6 - Tensioning roller



- -> Ribbed belt routing on vehicles with air conditioner
 - 1 - Alternator
 - 2 - Ribbed belt
 - 3 - Vane pump for power steering
 - 4 - Viscous fan
 - 5 - Air conditioner compressor
 - 6 - Crankshaft
 - 7 - Tensioning roller
- Install viscous fan => Page 170 .

Note:

Ensure that the ribbed belt is properly seated on the pulleys when installing.

- Start engine and check belt running.

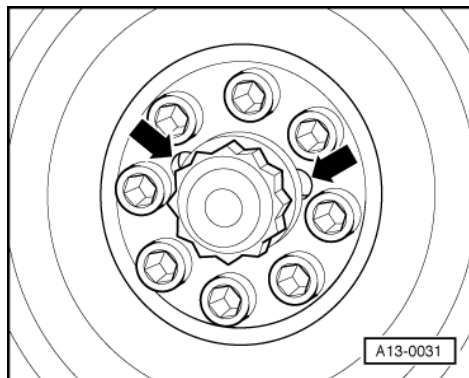
1.4 - Removing and installing vibration damper

Removing

- Ribbed belt must be removed =>Page 27
- Unscrew fan cowl for viscous fan.
- Unbolt vibration damper.

Note:

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



Installing

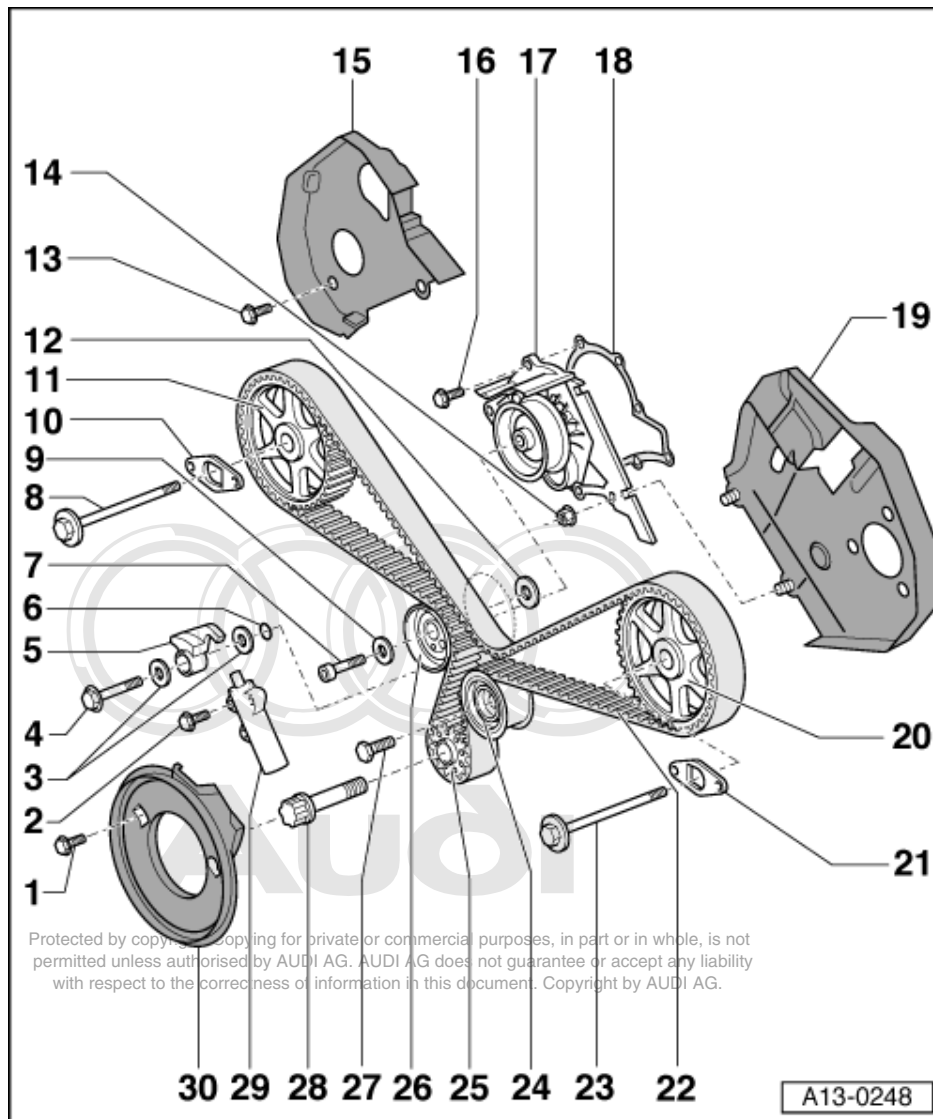
- -> When installing ensure that the notches -arrows- in the vibration damper are aligned with the locking lugs on the toothed belt sprocket.

Tightening torque

Component	Nm
Vibration damper to crankshaft	22



1.5 - Toothed belt drive

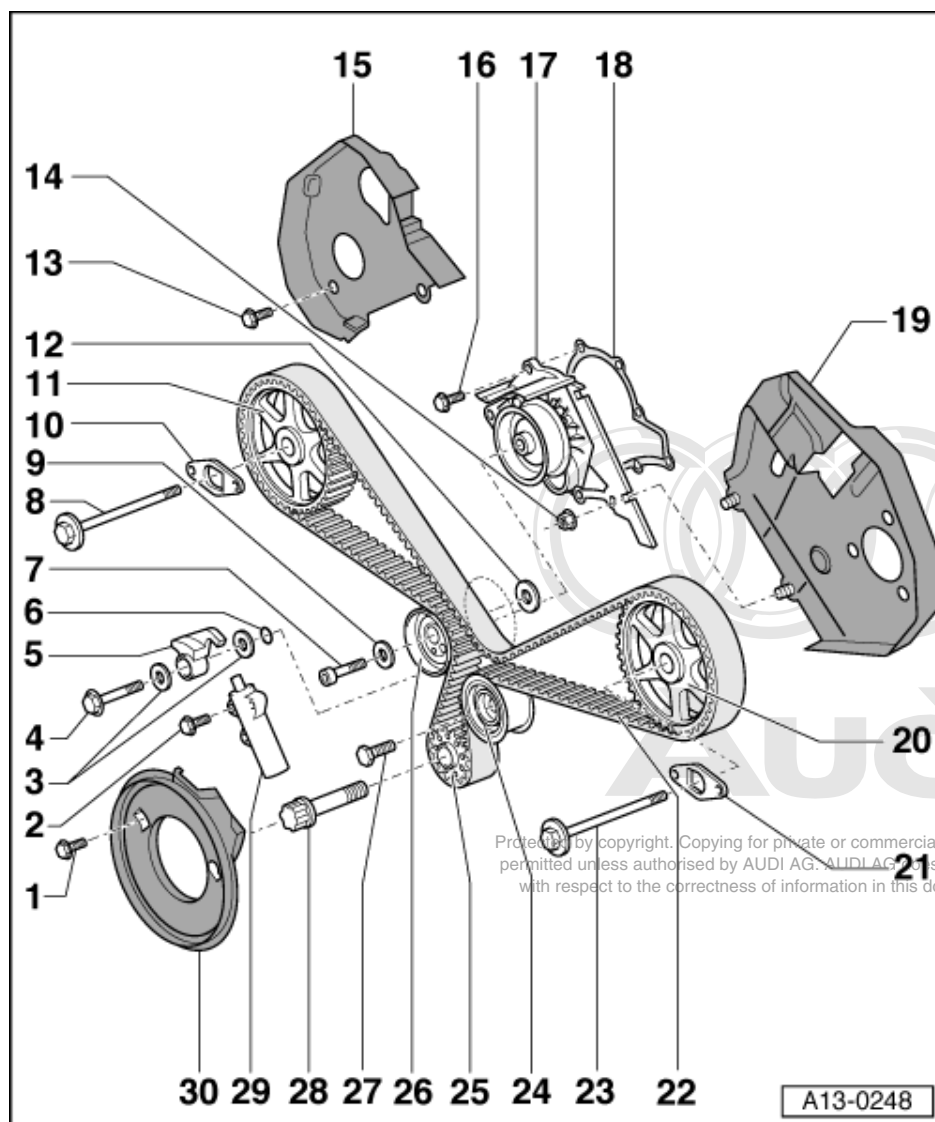
**Note:**

Mark the running direction with chalk or felt pen before removing the toothed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- 1 10 Nm
- 2 10 Nm
 - ♦ Install using locking compound
 - ♦ Locking compound

=> Parts List

- 3 Washer
- 4 22 Nm
- 5 Tensioning lever
 - ♦ With bush



6 O-ring

- ♦ Replace if damaged
- ♦ Secures -Item 3, 4 and 5 - as assembly

7 22 Nm

8 55 Nm

9 Washer

10 Fixing plate

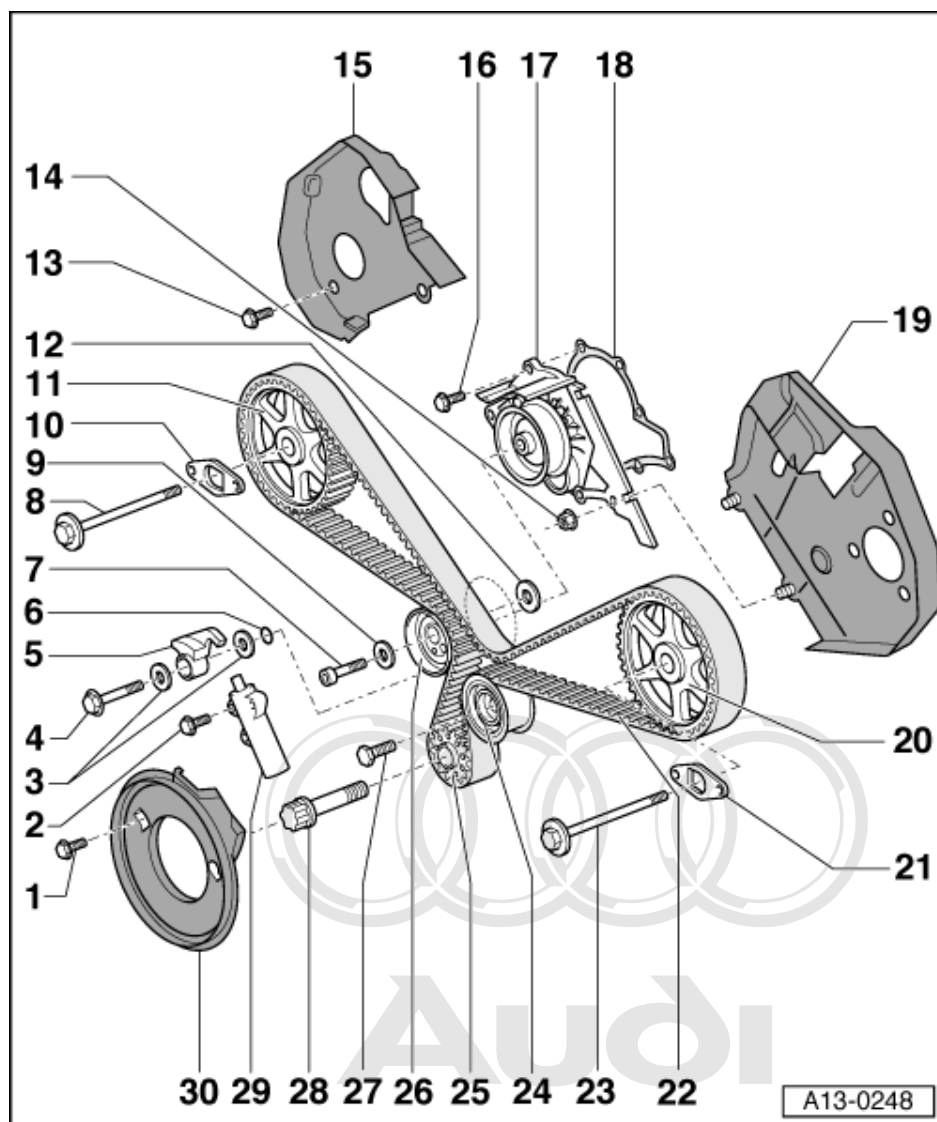
- ♦ Labelled side "rear hinten" points backwards

11 Right camshaft sprocket

- ♦ Remove toothed belt in order to remove and install =>Page 35.
- ♦ Detach with special tool T40001

12 Spacer

13 10 Nm



14 10 Nm

15 Toothed belt guard, rear right

16 10 Nm

17 Coolant pump

- ♦ Removing and installing
=> Page 155

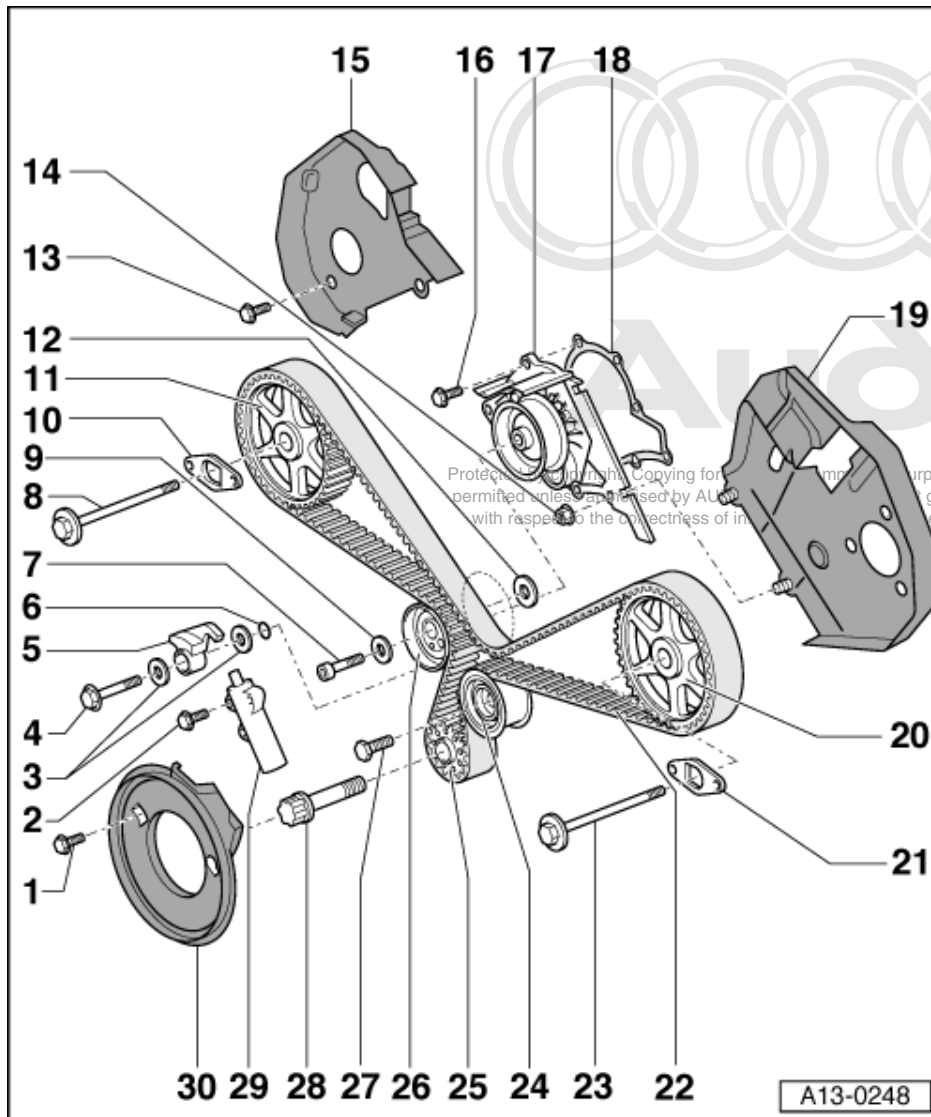
18 Seal

- ♦ Replace

19 Toothed belt guard, rear left

20 Left camshaft pulley

- ♦ Remove toothed belt in order to remove and install =>Page 35 .
- ♦ Detach with special tool T40001



21 Fixing plate

- ♦ Labelled side "rear hinten" points backwards

22 Toothed belts

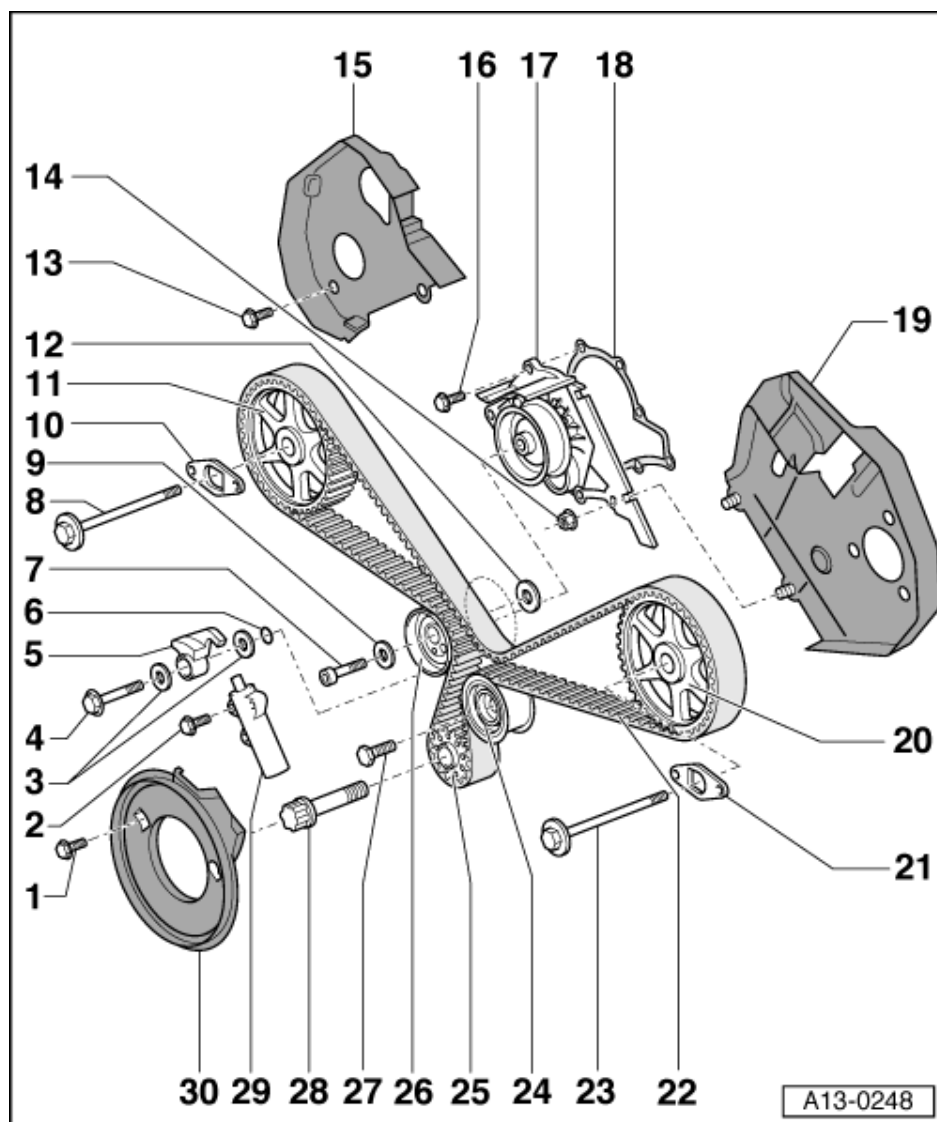
- ♦ Mark running direction with chalk or felt pen before removing
- ♦ Check for wear
- ♦ Removing => Page 35
- ♦ Install (adjust valve timing) => Page 39 .

23 55 Nm

24 Idler roller

25 Crankshaft sprocket

- ♦ Contact surface between sprocket and crankshaft must be free of oil
- ♦ Can only be installed in one position

**26 Tensioning roller**

- ◆ With mounting bush

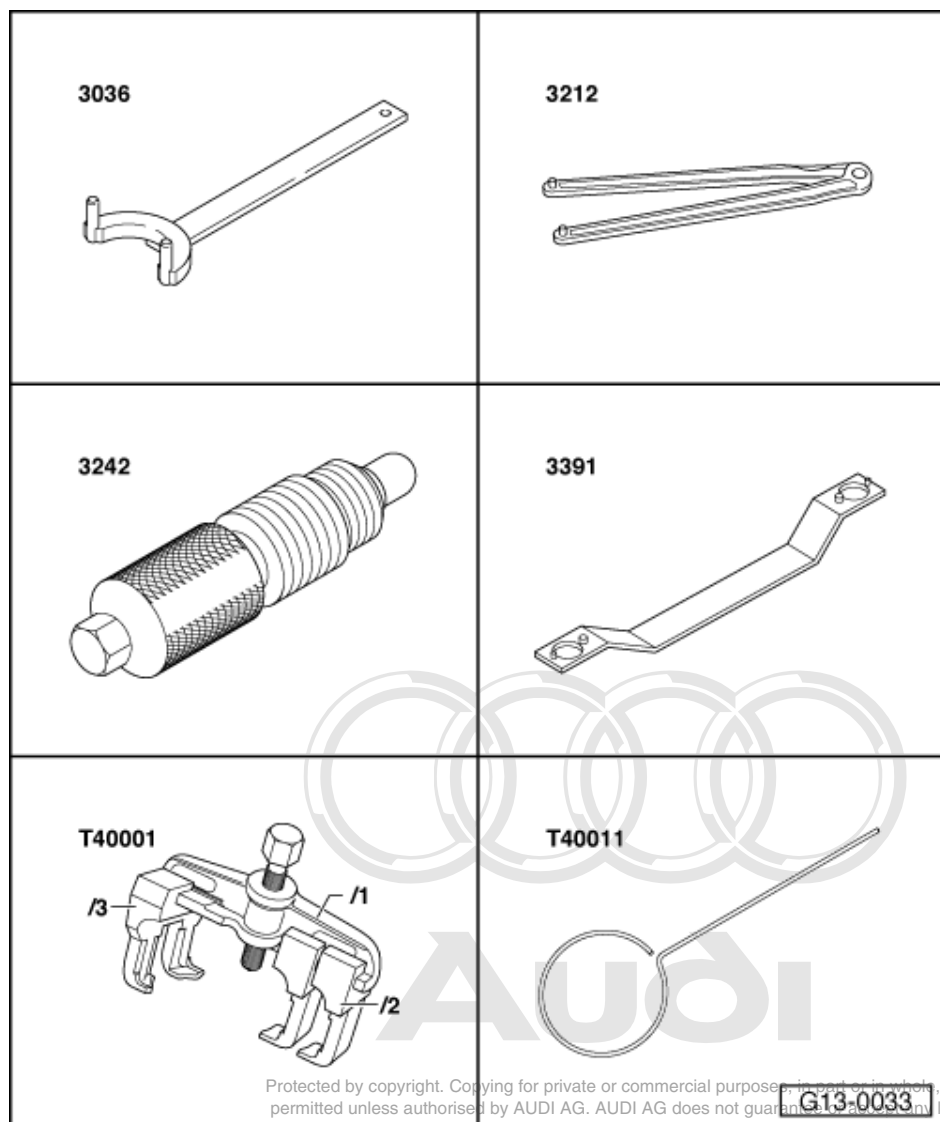
27 43 Nm**28 200 Nm + 1/2 turn (180°) further**

- ◆ Replace
- ◆ Do not use additional oil
- ◆ Use clamping bolt 3242 to loosen and tighten
- ◆ Screwing in clamping bolt 3242 => Page 46

29 Tensioner**30 Toothed belt guard - lower**

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1.6 - Removing and installing toothed belt

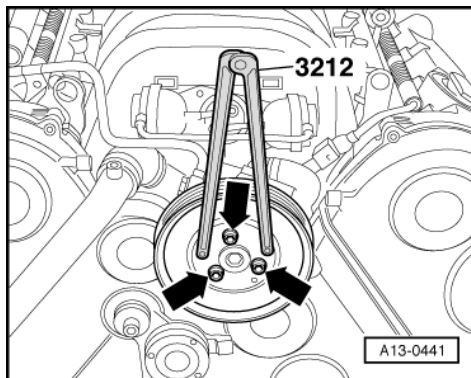


Special tools and workshop equipment required

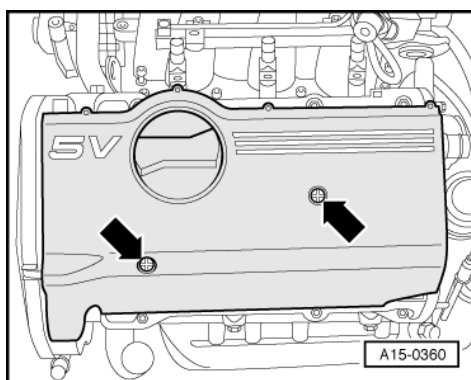
- ◆ Counterhold 3036
- ◆ Pin wrench 3212
- ◆ Clamping bolt 3242
- ◆ Camshaft retainer 3391
- ◆ Special tool T40001 with claws T40001/2
- ◆ Pin T40011

Removing toothed belt

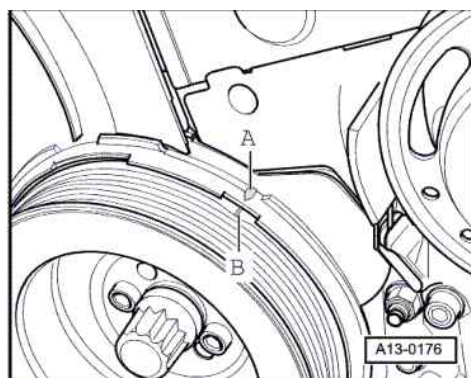
- Engine in vehicle
- Remove the viscous fan => Page 170 .
- Unscrew radiator cowl for viscous fan.
- Remove ribbed belt => Page 28
- Remove tensioner for ribbed belt.



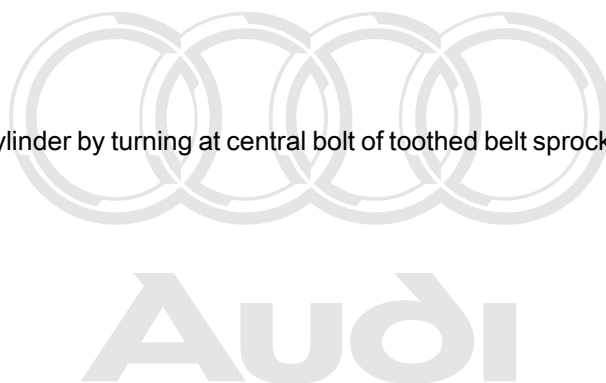
- -> Unbolt ribbed belt pulley on vane pump -arrows-, using pin wrench 3212 as a counterhold.



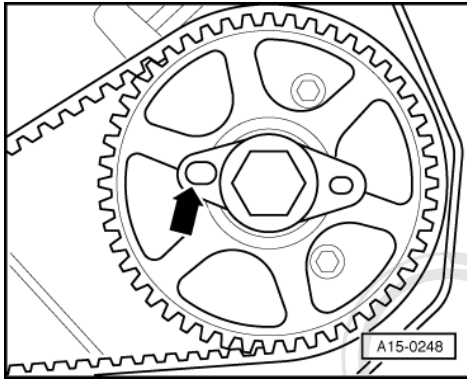
- -> Remove covers for cylinder head cover on left and right -arrows-.
- Remove left and right toothed belt guard.



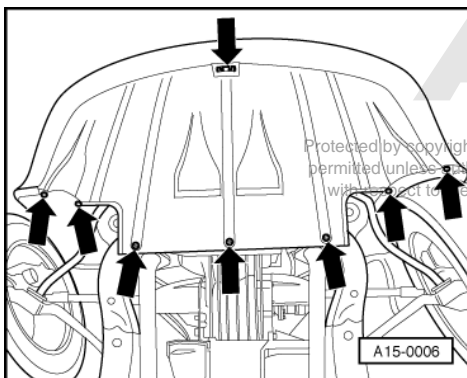
- Set crankshaft to TDC marking of No. 1 cylinder by turning at central bolt of toothed belt sprocket in direction of engine rotation.
- -> Notch -B- opposite mark -A-



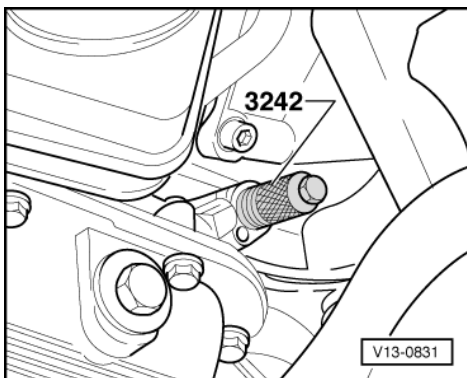
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- Check the position of the camshafts:
 - -> The large holes -arrow- for the fixing plates at the camshaft sprockets must face each other inwards
- Otherwise turn crankshaft one revolution further.



- -> Remove the noise insulation -arrows-.



- Unscrew plug for TDC marking from cylinder block.

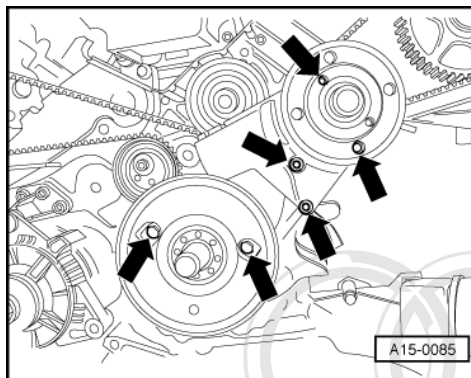
Note:

There is a TDC bore in the crankshaft directly behind the plug (it is possible to feel the hole).

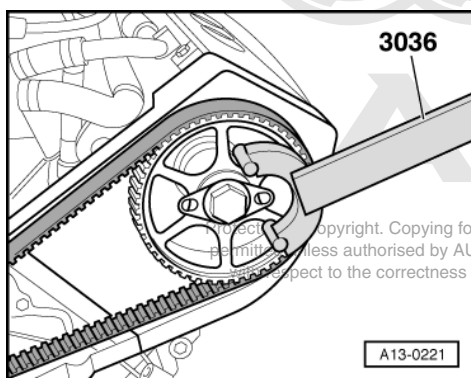
Important

Do not rotate the crankshaft while feeling for the TDC hole with your finger - risk of injury.

- -> Screw clamping bolt 3242 into threaded hole where plug has been removed. and tighten.
- Remove vibration damper => Page 29 .



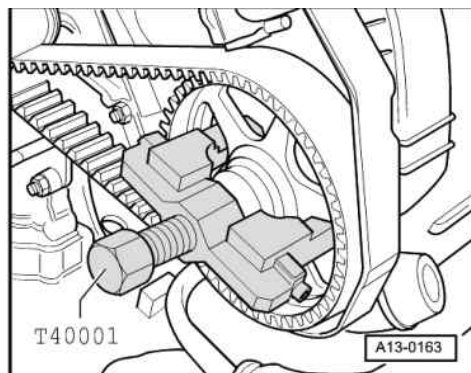
- -> Unbolt the lower toothed belt guard and the idler wheel for the ribbed V-belt -arrows-.



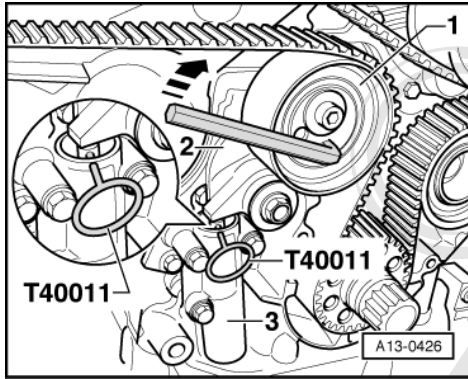
- -> Loosen bolts on both camshaft sprockets, using special tool 3036 as a counterhold.

Note:

Loosen bolts but do not remove.



- -> Pull left and right camshaft sprockets off their tapers using special tool T40001 with claws T40001/2 from cone.



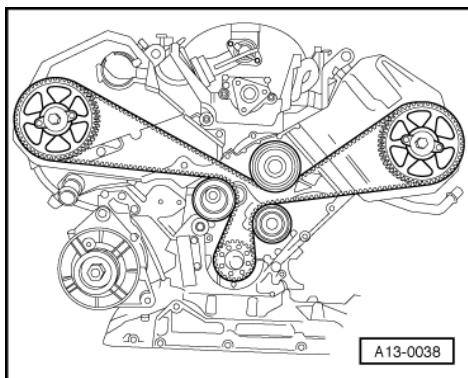
Notes:

- ♦ Mark the running direction with chalk or felt pen before removing the toothed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ♦ The toothed belt tensioner is oil damped and can only be compressed slowly by applying continuous pressure.
- -> Turn toothed belt tensioning roller -1- to the right in direction of arrow with 8 mm Allen key until the tensioning lever -2- has compressed the tensioner -3- sufficiently to enable the pressure piston to be secured with pin T40011.
- Remove toothed belt.

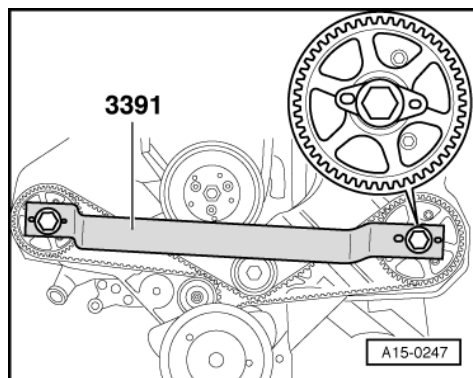
Installing (adjusting valve timing)

Notes:

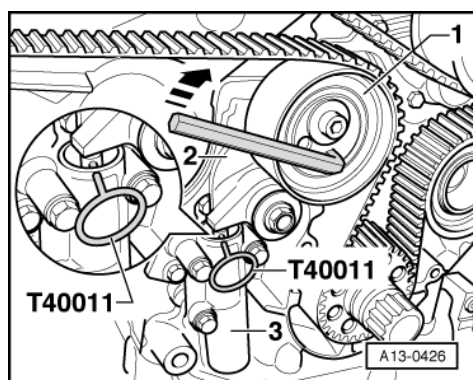
- ♦ When turning the camshaft, the crankshaft must not be at TDC at any cylinder. Danger of damage to valves/piston crown.
- ♦ After repairs, the valve timing must be adjusted as described below, even if the toothed belt has only been taken off the camshaft sprocket:
- Crankshaft held in position with clamping bolt 3242.
- Camshaft sprockets are able to turn.
- Both camshaft sprockets attached with fixing plates, washers and bolts.
- Tighten the two camshaft sprocket bolts until the sprockets can still just be turned, but do not move axially.



- -> Place toothed belt, as shown in the illustration, on all wheels, lastly on the tensioning roller.



- -> Insert camshaft retainer 3391 into fixing plates of the two camshafts.



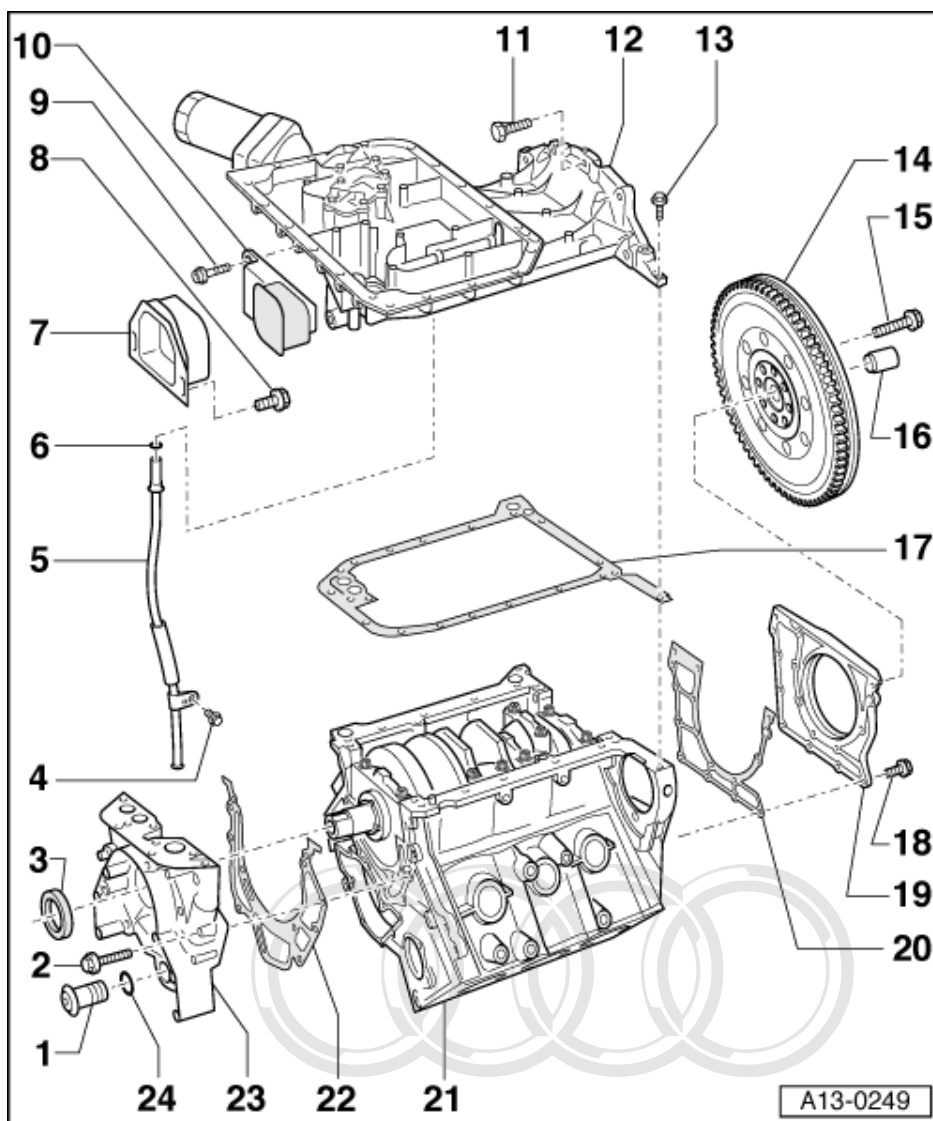
- -> Using an 8 mm Allen key, turn toothed belt tensioning roller -1- to the right in the direction of the arrow until pin T40011 can be taken out.
- Before starting engine for the first time, pre-tension tensioning roller as follows:
 - Fit torque wrench to hexagon socket of tensioning roller.
 - Turn tensioning roller to 15 Nm in tensioning direction. The tensioning roller is now pre-tensioned.
- Tighten the camshaft sprockets to 30 Nm.
- Remove camshaft retainer 3391.
- Finally tighten the camshaft sprockets (to 55 Nm). Counterhold with 3036.
- Install vibration damper =>Page 29 .
- Remove clamping bolt 3242.
- Screw plug for TDC marking into cylinder block with new O-ring seal.
- Install ribbed belt =>Page 28 .
- Install viscous fan => Page 170 .

Tightening torques

Component	Nm
Camshaft sprocket to camshaft	55
Vibration damper to crankshaft sprocket	22
Ribbed belt tensioner to cylinder block	55
Plug in cylinder block	10
Lower section of toothed belt guard to cylinder block	10
Bracket for viscous fan to cylinder block	M6 10 M8 22

2 - Removing and installing sealing flange and flywheel/drive plate

2.1 - Removing and installing sealing flange and flywheel/drive plate



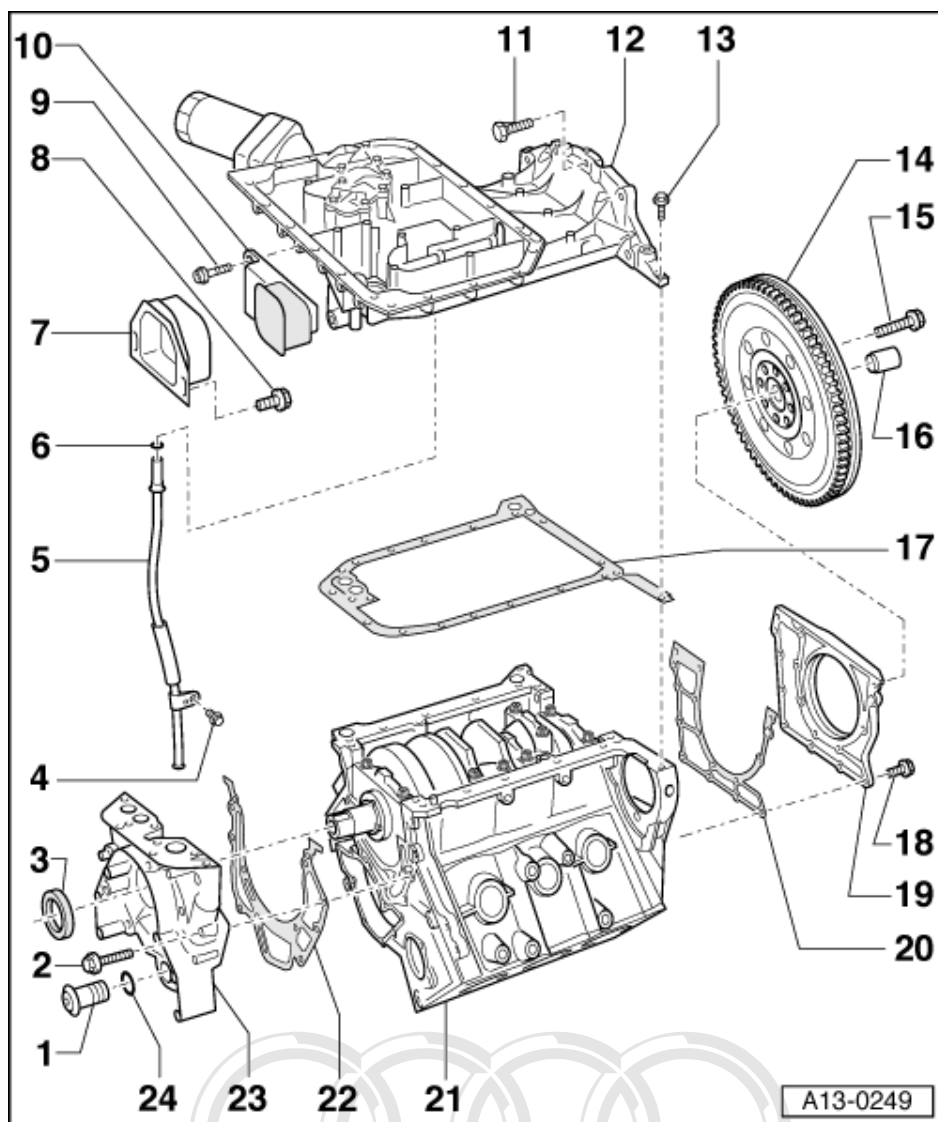
Note:

Repairs to the clutch.

=> 5-speed Manual Gearbox 012/01W, FWD; Repair group 30; Servicing clutch Servicing clutch

=> 5-speed Manual Gearbox 01A, 4WD; Repair group 30; Servicing clutch Servicing clutch

- 1 Spray nozzle valve- 40 Nm
- 2 M6 = 10 Nm
M8 = 30 Nm
- 3 Oil seal
 - ♦ For crankshaft
 - ♦ Removing and installing
=>Page 46 .



4 10 Nm

5 Guide tube for oil dipstick

6 O-ring

♦ Replace

7 Stop plate

♦ For torque reaction support

8 40 Nm

9 42 Nm

10 Torque reaction support

11 45 Nm

12 Oil pan (upper section)

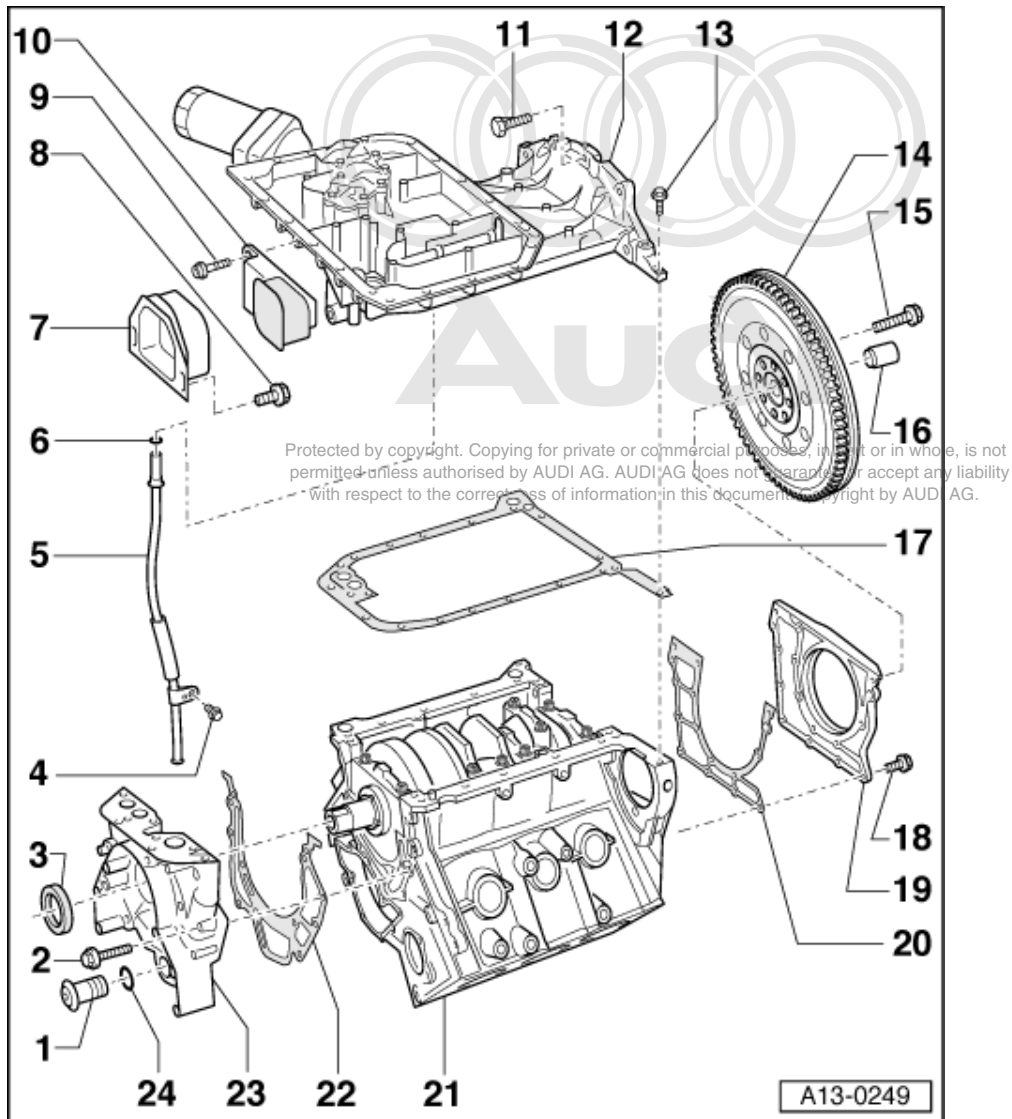
♦ Removing and installing

=>Page 133.

13 M6 = 10 Nm

M8 = 20 Nm

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**14 Dual-mass flywheel/drive plate**

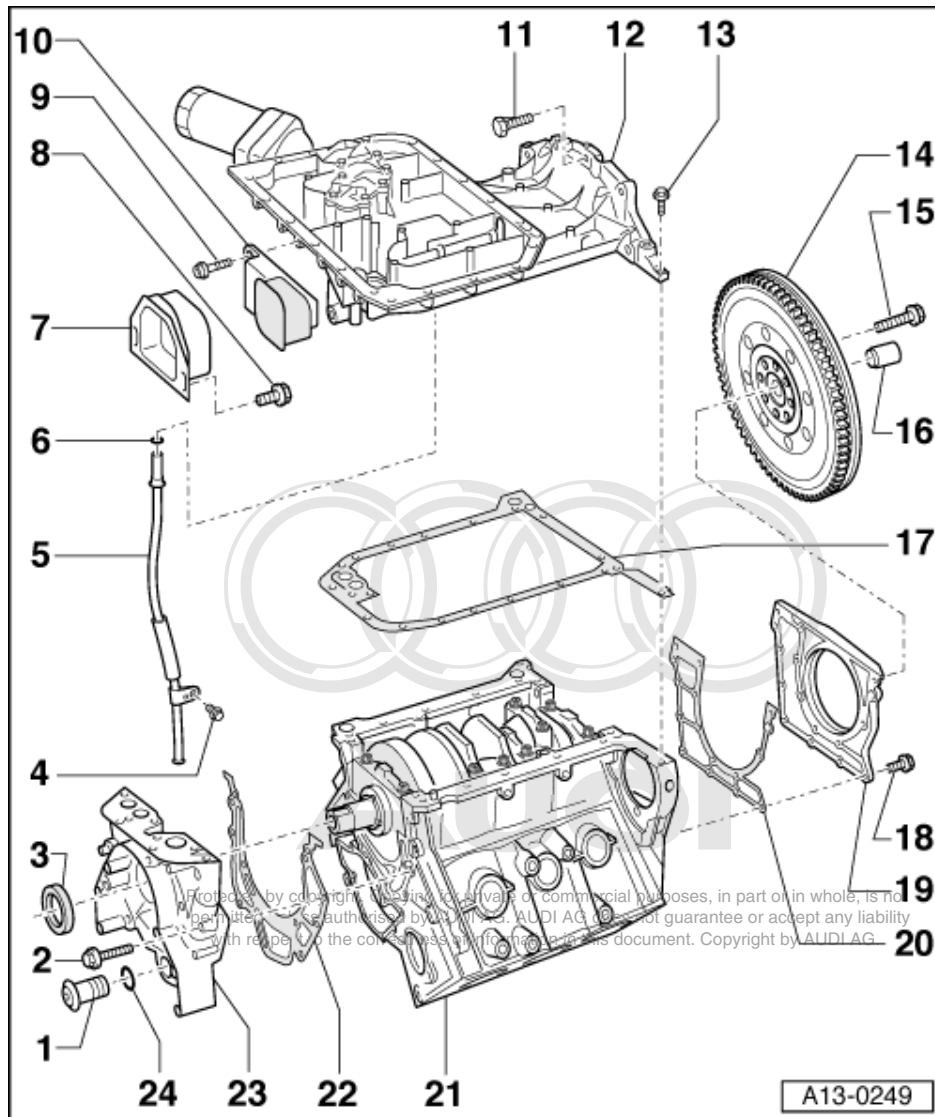
- ◆ Removing and installing dual mass flywheel=> Page 48
- ◆ Removing and installing drive plate => Page 50

15 Bolt (special type)

- ◆ Replace
- ◆ Tightening torque =>Page 52

16 Needle bearing

- ◆ Only for manual gearboxes
- ◆ Pulling out and driving in
=>Page 52.
- ◆ For automatic gearboxes, a mounting bush is pressed into the crankshaft, instead of the needle bearing in the dual-mass flywheel => Fig. 58

**17 Seal**

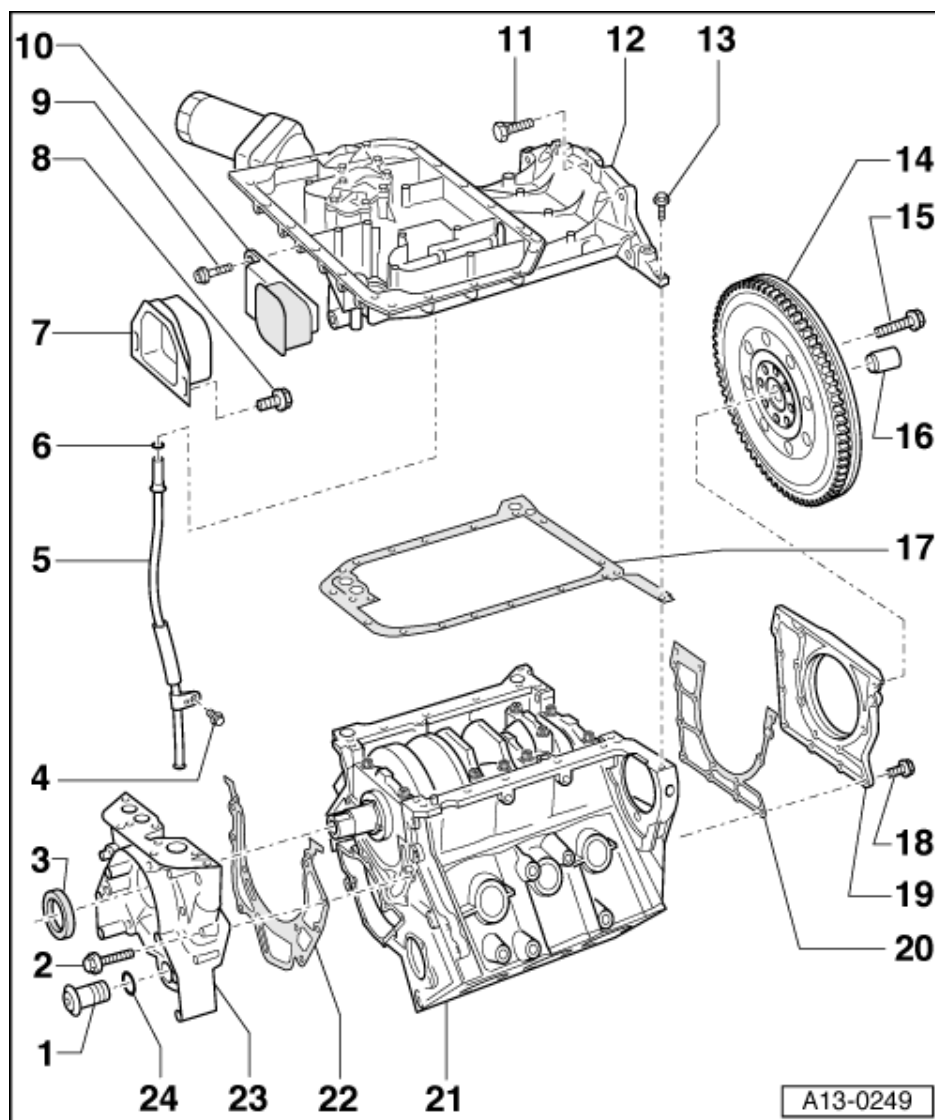
- ◆ Replace
- ◆ Install dry
- ◆ No additional sealant is required

18 10 Nm**19 Rear sealing flange with oil seal**

- ◆ Remove upper section of oil pan in order to remove and install =>Page 133 .
- ◆ Lightly oil sealing lip of oil seal
- ◆ When installing, push guide sleeve from repair kit onto crankshaft.

20 Seal

- ◆ Replace



21 Cylinder block

- ♦ Removing and installing crankshaft=> Page 54
- ♦ Dismantling and assembling pistons and conrods => Page 60

22 Seal

- ♦ Replace

23 Oil pump

- ♦ Removing and installing
=>Page 138 .

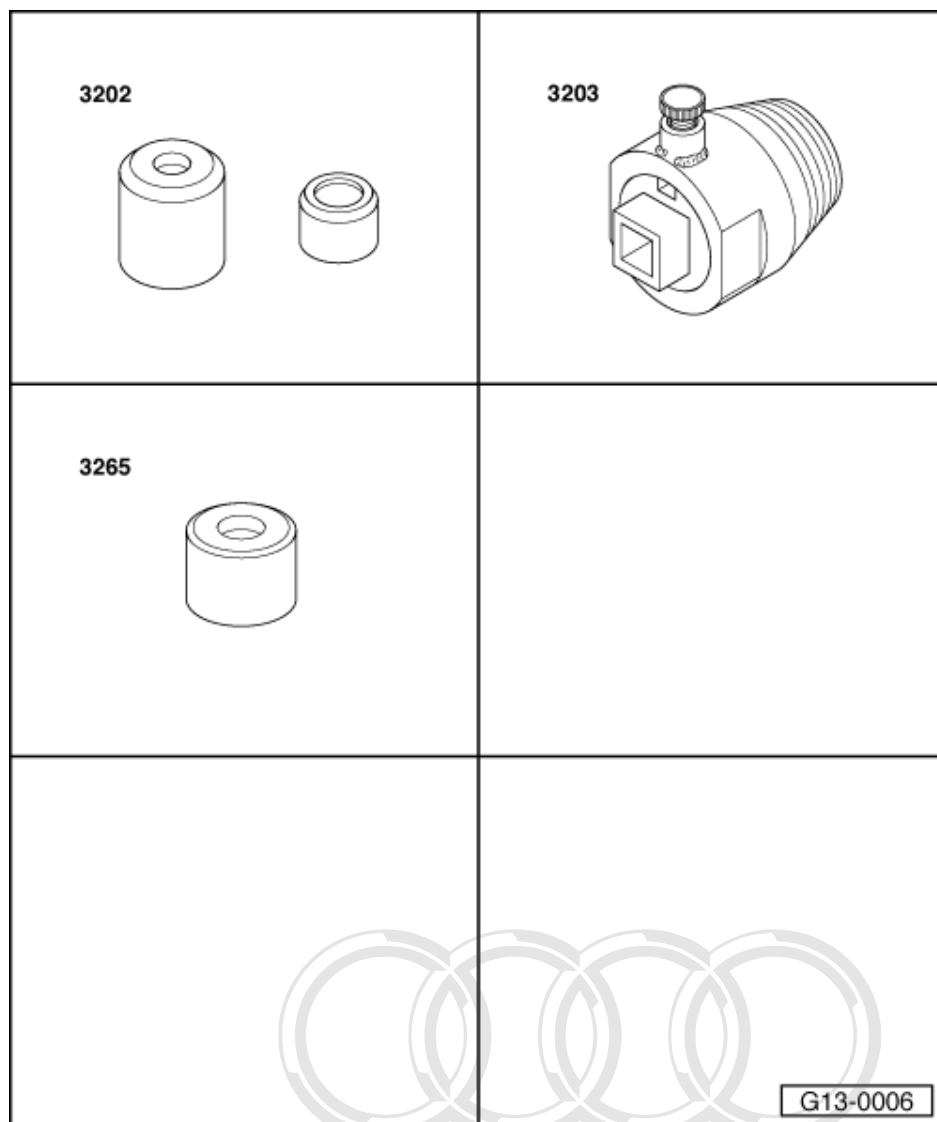
24 O-ring

- ♦ Replace

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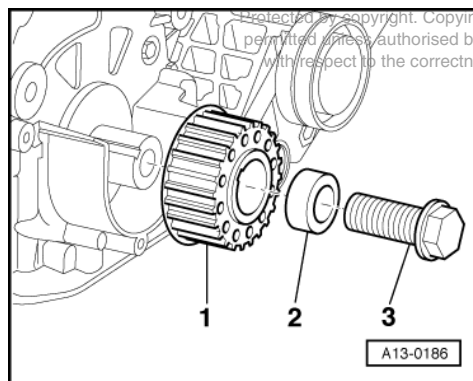


2.2 - Replacing crankshaft oil seal on pulley end



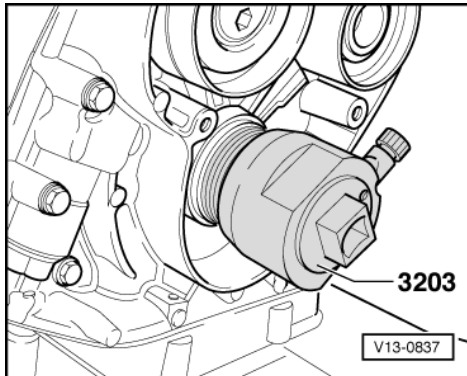
Special tools and workshop equipment required

- ♦ Fitting sleeve 3202/1
- ♦ Oil seal extractor 3203
- ♦ Insertion sleeve 3265

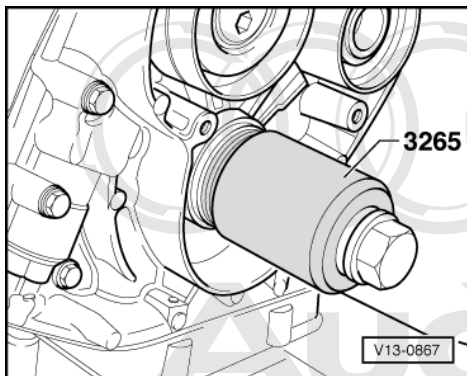


Removing

- Engine in vehicle
- Remove toothed belt => Page 35 .
- -> Unscrew central bolt -3- for crankshaft toothed belt sprocket -1-.
- Remove spacer -2- and toothed belt sprocket.

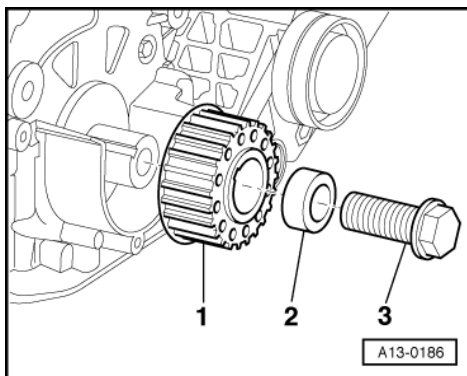


- Unscrew inner section of oil seal extractor 3203 three turns out of outer section and lock with knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.



Installing

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- Push on oil seal using fitting sleeve 3202/1. Copyright by AUDI AG.
 - -> Press in oil seal flush with insertion sleeve 3265 and central bolt.





- -> Install crankshaft toothed belt sprocket -1- with spacer -2- and new central bolt -3-.

Notes:

- ♦ Contact surface between sprocket and crankshaft must be free of oil.
 - ♦ Do not use additional oil on bolt for crankshaft toothed belt sprocket.
- Install toothed belt (adjust valve timing) => Page 39 .

Note:

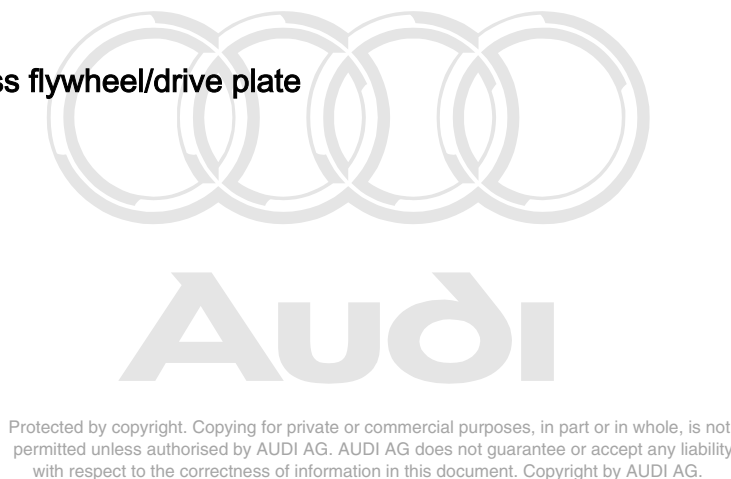
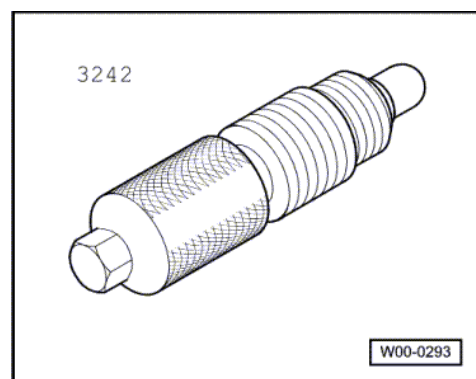
Note all instructions on removing and installing the toothed belt =>Page 35 .

Tightening torque

Component	Nm
Toothed belt sprocket to crankshaft	200 + 180°1)2)

- 1) Replace bolt
- 2) 180°= 1 / 2 turn

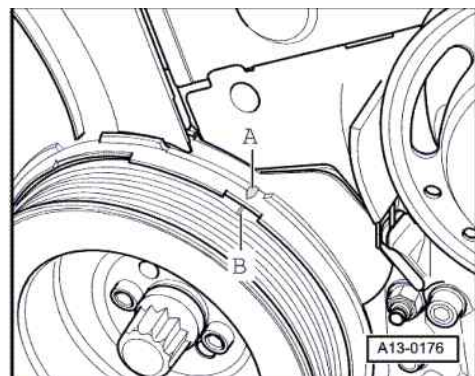
2.3 - Removing and installing dual mass flywheel/drive plate



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Special tools and workshop equipment required

- ♦ Clamping bolt 3242



Removing dual mass flywheel

- Gearbox removed

Important

The engine must only be turned at the crankshaft, in the direction of engine rotation (clockwise).

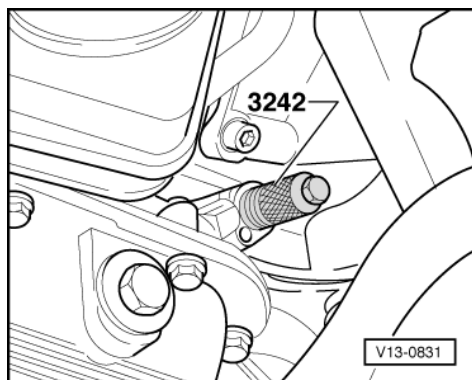
- Set crankshaft to TDC marking of No. 3 cylinder by turning at central bolt of toothed belt sprocket in direction of engine rotation.
 - -> Notch -B- opposite mark -A-
- Unscrew plug for TDC marking from cylinder block.

Note:

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There is a TDC bore in the crankshaft directly behind the plug (it is possible to feel the hole).

Important

Do not rotate the crankshaft while feeling for the TDC hole with your finger - risk of injury.



- -> Screw clamping bolt 3242 into the hole of the removed plug and tighten.
- Remove clutch thrust plate.

=> Manual Gearbox; Repair group 30

- Mark position of dual mass flywheel relative to engine.
- Unbolt dual mass flywheel.

Installing

Installation is carried out in the reverse order; note the following:

Note:

The needle bearing is located in the flywheel and must be driven in if a new flywheel is installed =>Page 52.

- Fit new bolts and tighten.
- Install clutch thrust plate.

=> Manual Gearbox; Repair group 30

- Remove clamping bolt 3242.
- Screw plug for TDC marking into cylinder block with new O-ring seal.

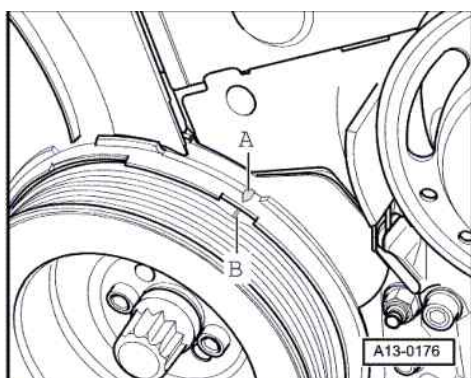
**Tightening torques:**

Component	Nm
Flywheel to crankshaft	
Bolt length 22.5 mm	60 + 90°1)2)
Bolt length 35.0 mm	60 + 180°2)3)
Bolt length 43.0 mm	60 + 180°2)3)
Plug in cylinder block	10

1) 90° corresponds to a quarter of a turn

2) Replace bolts

3) 180° = 1 / 2 turn

**Removing drive plate**

- Gearbox removed

Important

The engine must only be turned at the crankshaft, in the direction of engine rotation (clockwise).

- Set crankshaft to TDC marking of No. 3 cylinder by turning at central bolt of toothed belt sprocket in direction of engine rotation.
- -> Notch -B- opposite mark -A-
- Unscrew plug for TDC marking from cylinder block.

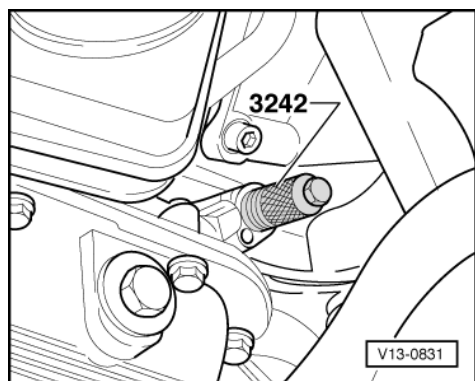
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Note:

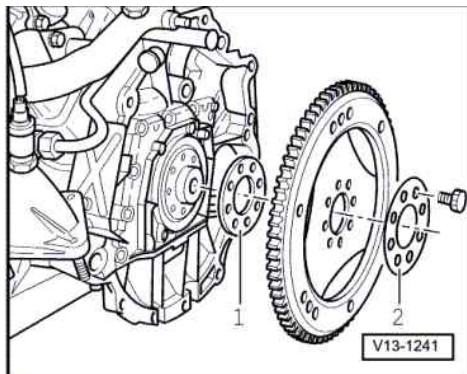
There is a TDC bore in the crankshaft directly behind the plug (it is possible to feel the hole).

Important

Do not rotate the crankshaft while feeling for the TDC hole with your finger - risk of injury.

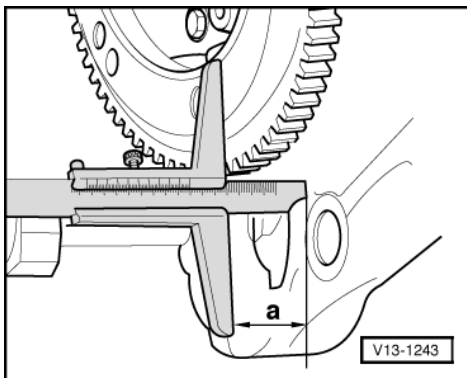


- -> Screw clamping bolt 3242 into the hole of the removed plug and tighten.
- Mark position of drive plate relative to engine.
- Unbolt drive plate.



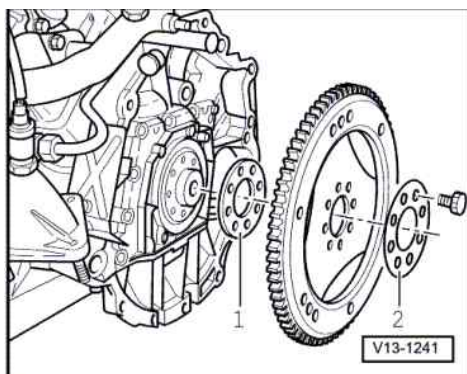
Installing

- -> Fit drive plate with packing plate -2- and 3.0 mm or 4.0 mm shim -1-.
- Insert at least 3 of the old securing bolts and tighten to 30 Nm.



- -> Measure dimension -a- at three points and calculate average value.
- Specification for automatic gearbox 01F/01K: 18.1 ... 19.7 mm

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If specification is not attained:

- -> Remove drive plate again and fit with different shim -1-. Retighten bolts to 30 Nm.
- Measure distance again.

If specification is attained:

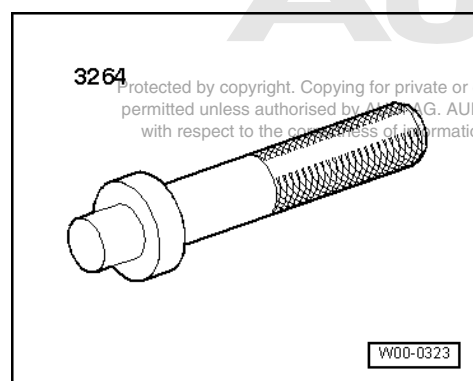
- Fit new bolts and tighten.
- Remove clamping bolt 3242.
- Screw plug for TDC marking into cylinder block with new O-ring seal.

Tightening torques:

Component	Nm
Drive plate to crankshaft	
Bolt length 22.5 mm	60 + 90°1)2)
Plug in cylinder block	25

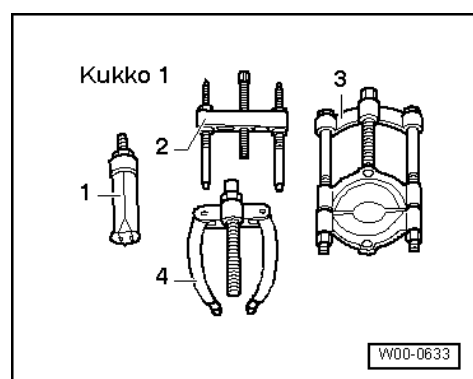
- 1) 90° corresponds to a quarter of a turn
- 2) Replace bolts

2.4 - Removing and installing needle bearing in dual mass flywheel

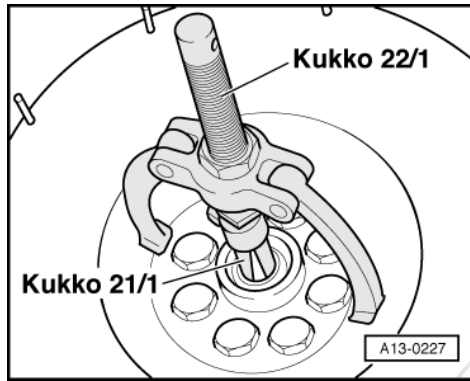


Special tools and workshop equipment required

- ♦ Fitting drift 3264



- ♦ 1 - Internal puller Kukko 21/1
- ♦ 4 - Counter support Kukko 22/1



Removing

- -> Pull out needle bearing with Kukko 21/1 and Kukko 22/1.

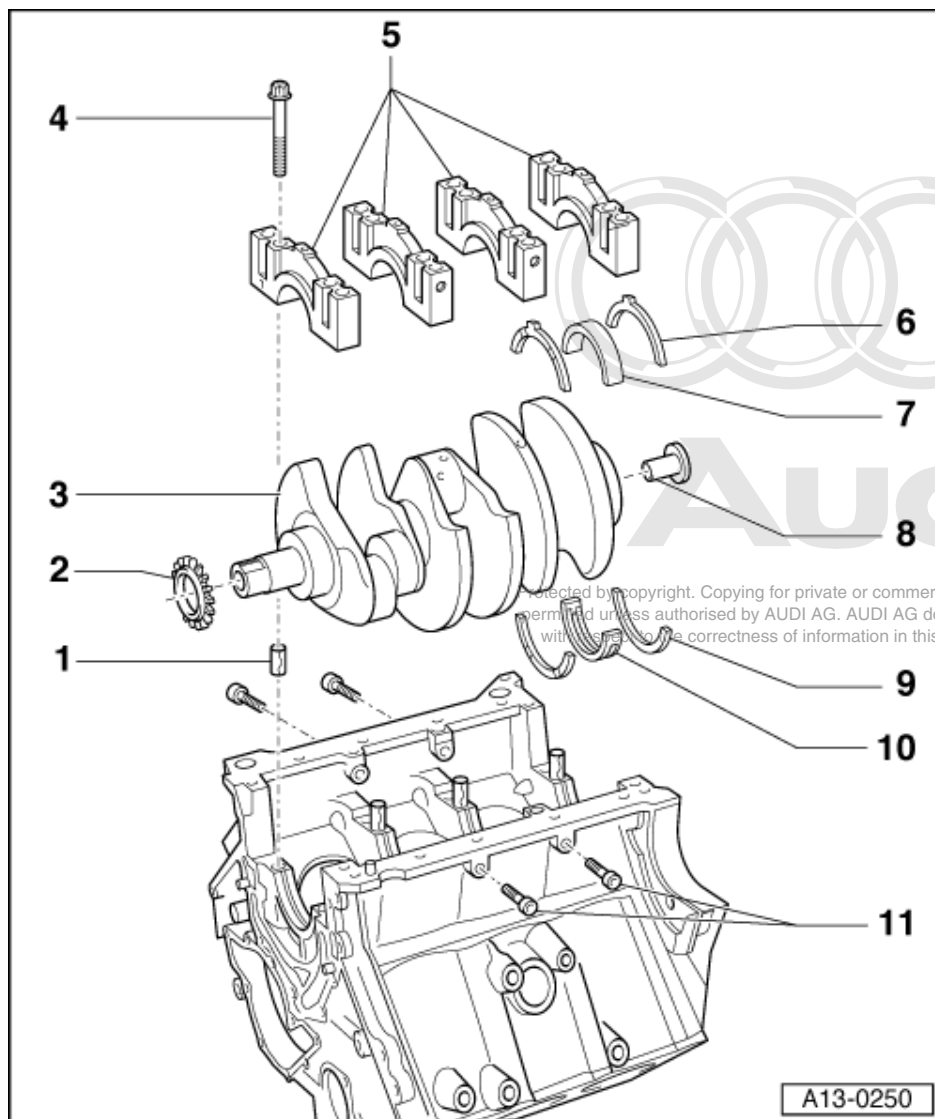
Installing

- Drive in until flush using fitting drift 3264.

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3 - Removing and installing crankshaft

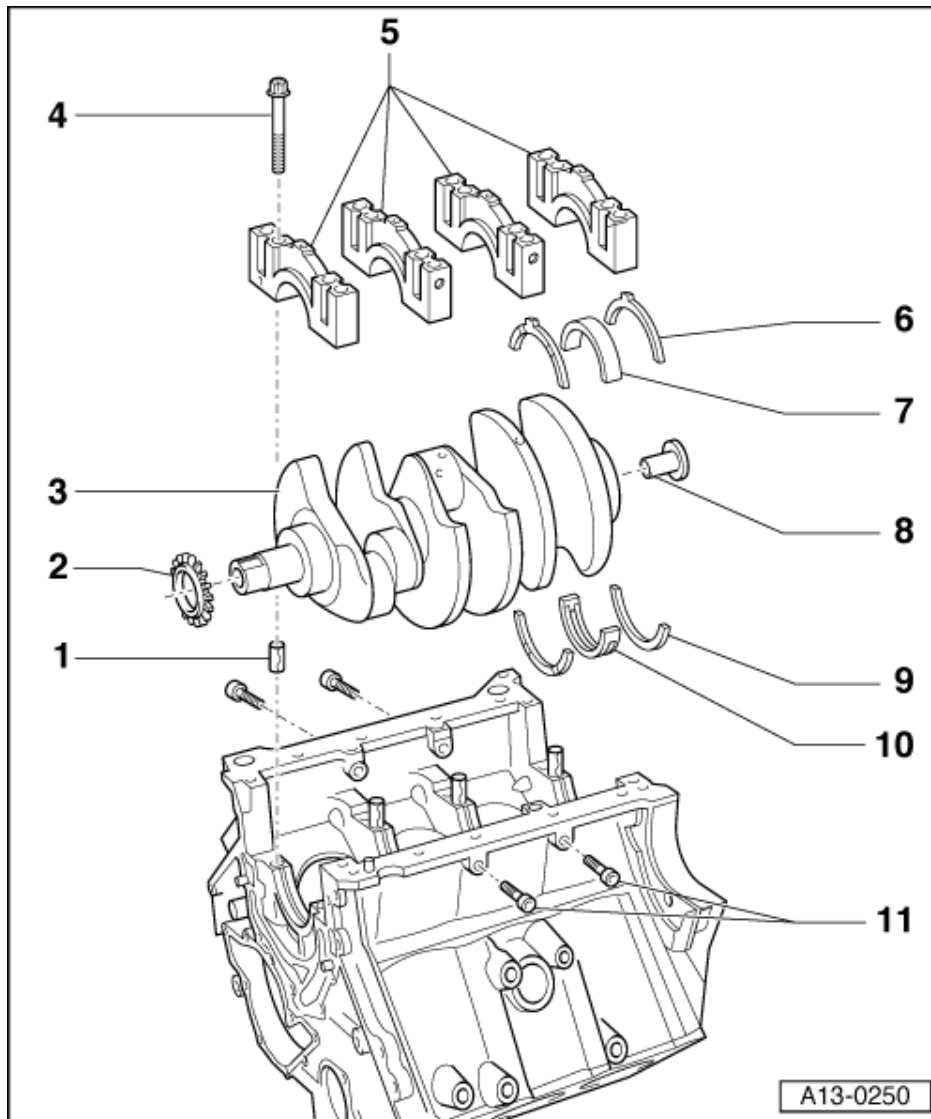
3.1 - Removing and installing crankshaft



Note:

The engine must be attached to the repair stand with engine and gearbox mount VAS 6095 for the performance of assembly work => Page 16.

- 1 Dowel sleeve
 - ◆ Insert in cylinder block
- 2 Not installed
- 3 Crankshaft
 - ◆ Measuring axial and radial play
=>Page 58
 - ◆ Do not rotate the crankshaft when checking the radial play.
 - ◆ Crankshaft dimensions
=>Page 58.



4 Bolts

- ◆ For bearing cap
- ◆ Replace
- ◆ Tightening sequence =>Fig. 2

5 Bearing cap

- ◆ Note identification markings
=> Fig. 1
- ◆ Installing => Fig. 2

6 Thrust washer

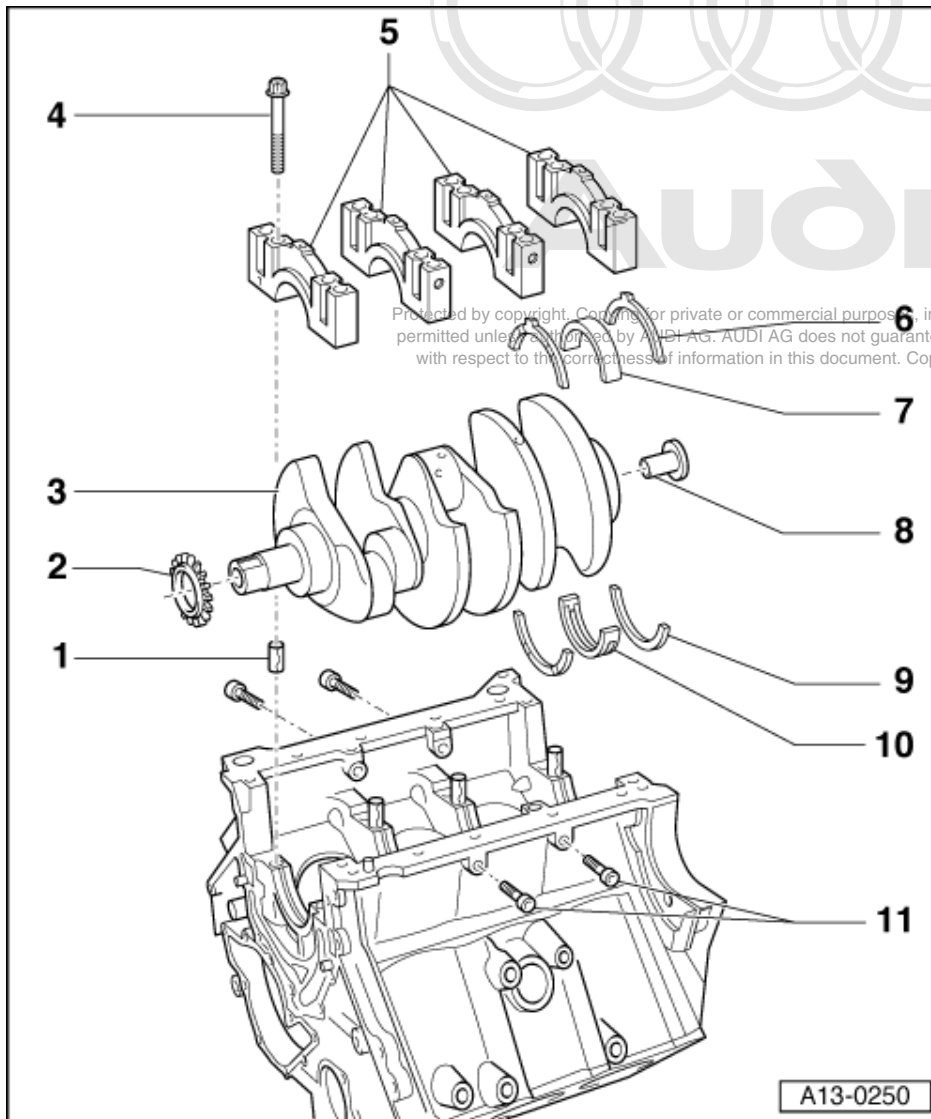
- ◆ On 4th crankshaft bearing only
- ◆ Oil grooves face outwards
- ◆ Note fixing arrangement
- ◆ Measuring axial play of crankshaft =>Page 58

7 Bearing shell

- ◆ For bearing cap without oil groove
- ◆ Do not interchange used bearing shells (mark).



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8 Bush

- ◆ Only for automatic gearboxes
- ◆ Driving in =>Fig. 3

9 Thrust washer

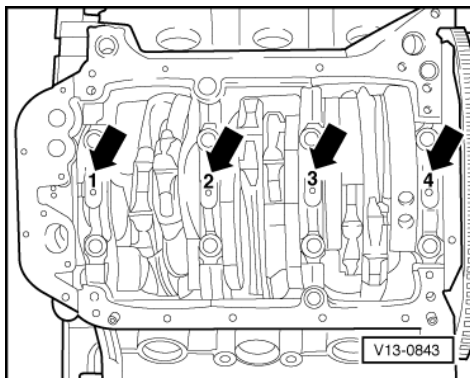
- ◆ On 4th crankshaft bearing only
- ◆ Oil grooves face outwards
- ◆ Measuring axial play of crankshaft =>Page 58

10 Bearing shell

- ◆ For cylinder block with oil groove
- ◆ Do not interchange used bearing shells (mark).

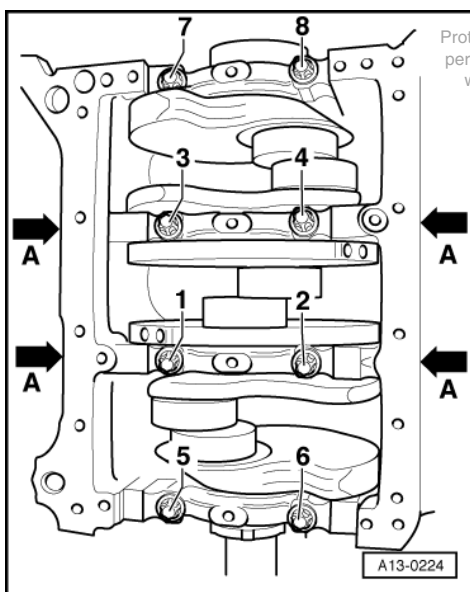
11 Bolts

- ◆ For bearing cap
- ◆ Tightening sequence =>Fig. 2



-> Fig.1 Markings on crankshaft bearing caps

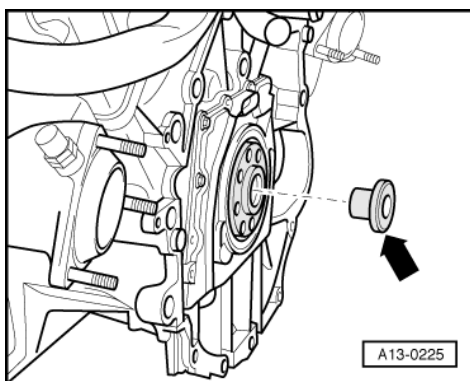
- ◆ Bearing 1 is on pulley end
- ◆ Bearing 4 is on flywheel end



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-> Fig.2 Installing crankshaft bearing cap

- Tighten bolts -1 ... 8-
- Insert dowel sleeves in cylinder block.
- Tighten bearing cap bolts in the following sequence:
 1. - Screw in bolts -A- hand-tight.
 2. - Tighten bolts 1 ... 8 to 60 Nm.
 3. - Turn nuts -1 ...8- further using rigid wrench 90°(1/4 turn).
 4. - Tighten bolts -A- to 25 Nm.





-> Fig.3 Bearing bush for torque converter

Note:

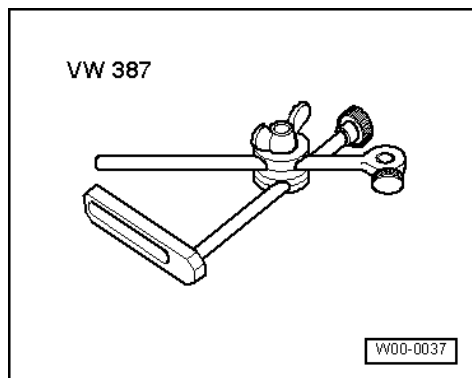
Short-blocks and replacement engines as well as new and replacement crankshafts are supplied without a bush -arrow-. Before installing the drive plate vehicles with automatic gearboxes must have the bush fitted. The bush must not be fitted to vehicles with manual gearboxes.

3.2 - Crankshaft dimensions

(in mm)

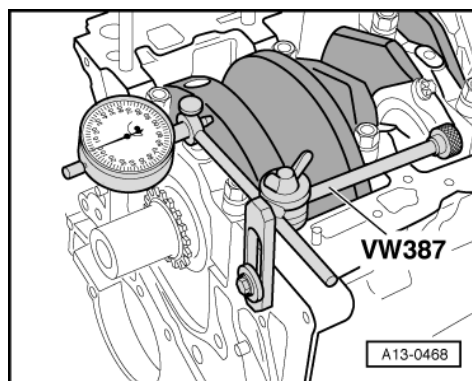
Honing dimension	Crankshaft pivot pin $\varnothing$	Crankshaft con-rod pin $\varnothing$
Basic dimension	- 0.022 65.00 - 0.042	- 0.022 54.00 - 0.042
Step 1	- 0.022 64.75 - 0.042	- 0.022 53.75 - 0.042
Step 2	- 0.022 64.50 - 0.042	- 0.022 53.50 - 0.042
Step 3	- 0.022 64.25 - 0.042	- 0.022 53.25 - 0.042

3.3 - Measuring axial and radial play



Special tools and workshop equipment required

- ♦ Universal dial gauge bracket VW 387
- ♦ Dial gauge



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Axial play

- -> Bolt dial gauge onto cylinder block with universal dial gauge bracket VW 387 and bring into contact with crank web.
- Press crankshaft against dial gauge by hand and set gauge to -0-.
- Press crankshaft away from front dial gauge.
- Note dial gauge reading:

Play when new	Wear limit
0.07...0.23 mm	0.25 mm

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Radial play

Notes:

- ◆ Do not interchange used bearing shells.
- ◆ Bearing shells worn down to nickel layer must be replaced.

Auxiliary equipment required

- ◆ Plastigage

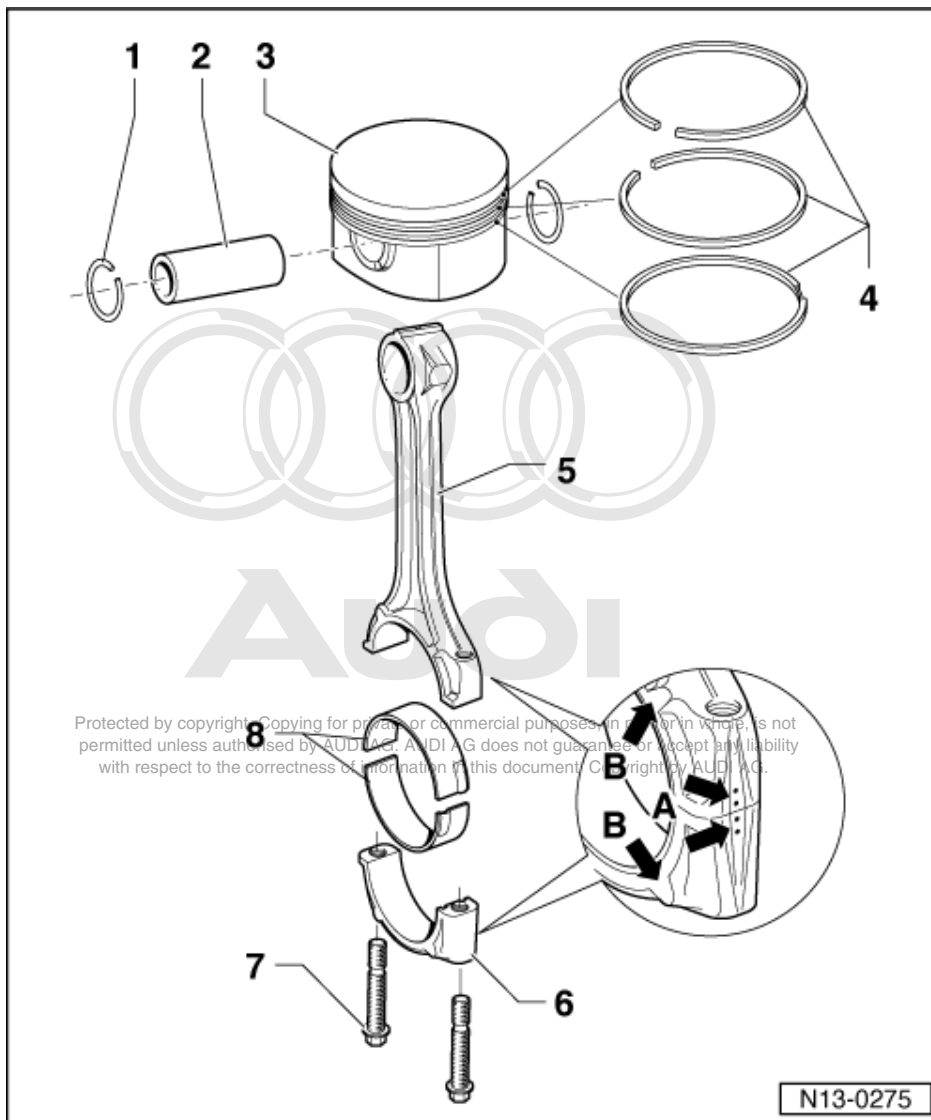
Test sequence

- Remove main bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage of corresponding width on the bearing journal or in the bearing shells
 - The length of Plastigage must rest in the middle of the bearing shell
- Fit main bearing cap and tighten to 30 Nm. Do not turn crankshaft.
- Remove main bearing cap again.
- Compare width of Plastigage with calibrated scale.
- Note dial gauge reading:

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

4 - Dismantling and assembling pistons and conrods

4.1 - Dismantling and assembling pistons and conrods



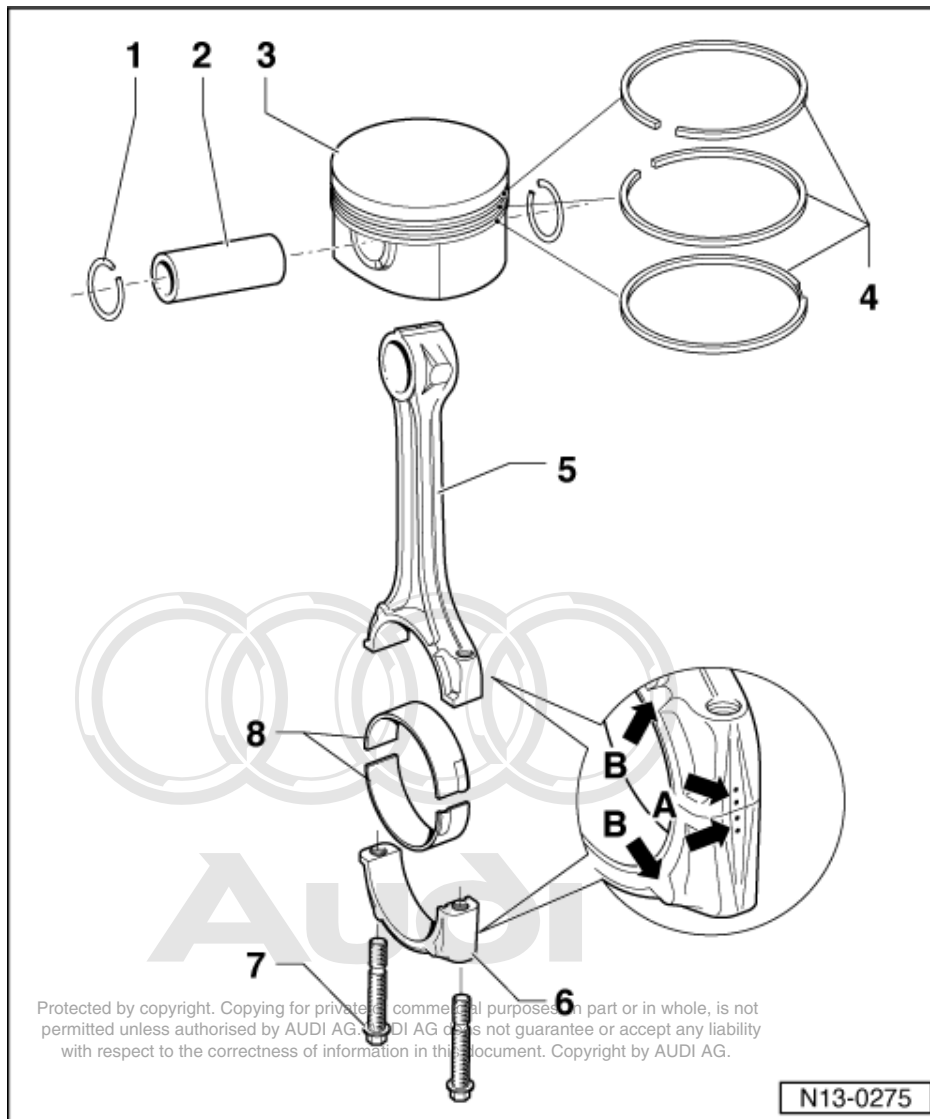
1 Circlip

2 Piston pin

- ♦ If difficult to remove, heat piston to approx. 60 °C.
- ♦ Remove and install with VW 222a

3 Piston

- ♦ Mark installation position and cylinder number.
- ♦ Arrow on piston crown points to pulley end.
- ♦ Checking => Fig. 3
- ♦ Install using piston ring clamp.
- ♦ Piston and cylinder dimensions
=>Page 65.
- ♦ Checking cylinder bore
=> Fig. 4



4 Piston rings

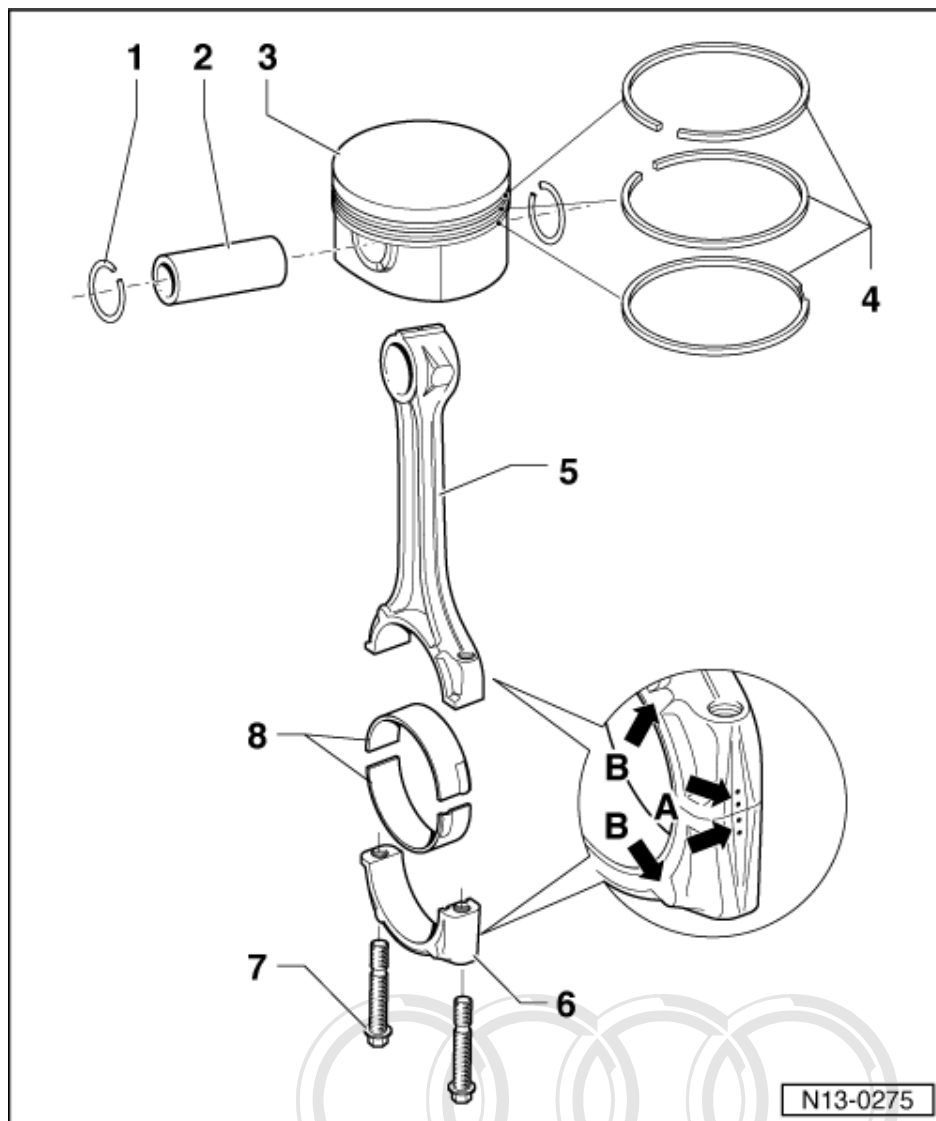
- ◆ Offset gaps by 120°
- ◆ Remove and install with piston ring pliers.
- ◆ "TOP" must face piston crown.
- ◆ Checking ring gap => Fig. 1
- ◆ Checking ring to groove clearance=> Fig. 2

5 Conrod

- ◆ Only replace as a set
- ◆ Mark cylinder number -A=> Fig. 6
- ◆ Installation position:
Show markings -B-:
Cyl. 1...3 to pulley end
Cyl. 4...6 to flywheel end

6 Conrod bearing cap

- ◆ Note installation position



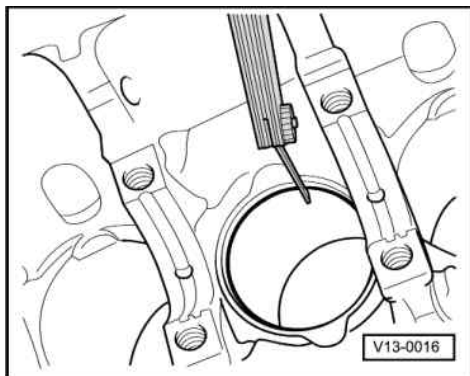
7 Conrod bolt - 30 Nm + 1/4 turn (90°) further

- ◆ Replace
- ◆ Oil threads and contact surface
- ◆ To measure radial play tighten to 30 Nm but not further

8 Bearing shell

- ◆ Note installation position
- ◆ Do not interchange used bearing shells (mark).
- ◆ Measuring radial play=>Page 66 .
- ◆ When measuring radial play, tighten bolts -Item 7 - to 30 Nm but do not turn further

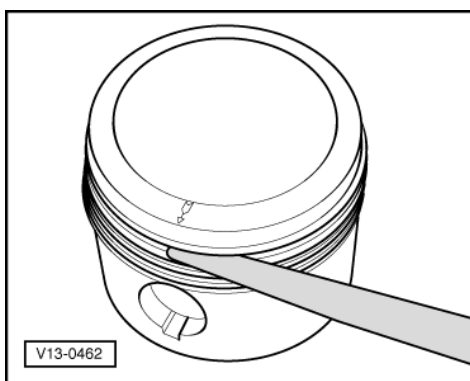
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-> Fig.1 Checking piston ring gap

- Push ring squarely from above down into the lower cylinder aperture approx. 15 mm from the cylinder edge.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.35...0.50	1.0
2nd compression ring	0.50...0.70	1.4
Oil scraper ring	0.25...0.50	0.8

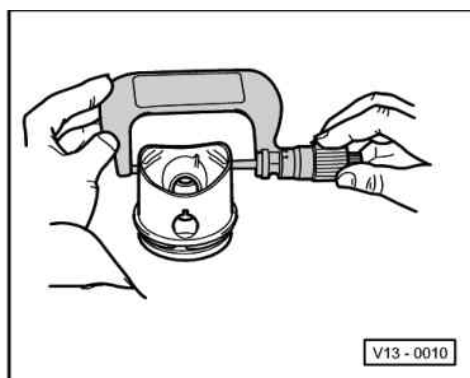


-> Fig.2 Checking ring to groove play

- Clean groove before checking play

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Piston ring Dimensions in mm	New	Wear limit
Compression rings	0.02...0.08	0.10
Oil scraper ring	0.02...0.08	0.10

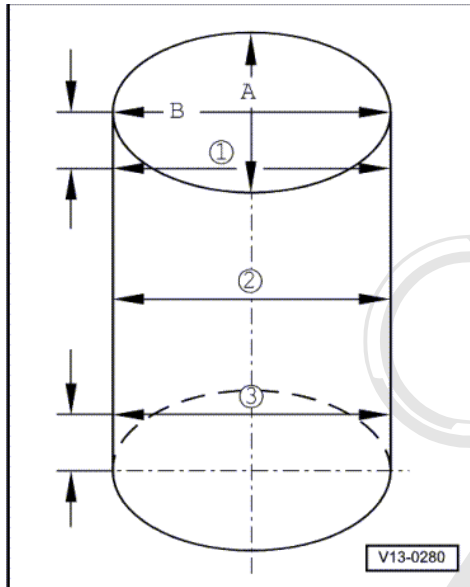


-> Fig.3 Checking piston

Special tools and workshop equipment required

- ♦ Outer micrometer 75...100 mm
- Measure approx. 10 mm from the lower edge, offset by 90 ° to the piston pin axis.
 - Permissible deviation from nominal dimension: no more than 0.04 mm.

Nominal dimension => Page **65** ; Piston and cylinder dimensions



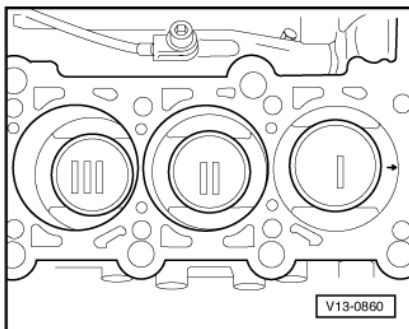
-> Fig.4 Checking cylinder bores

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Special tools and workshop equipment required

- ♦ Use internal dial gauge 50...100 mm.
- Take measurements at 3 positions in both lateral direction -A- and longitudinal direction -B-.
 - Permissible deviation from nominal dimension: no more than 0.08 mm.

Nominal dimension => Page **65** ; Piston and cylinder dimensions



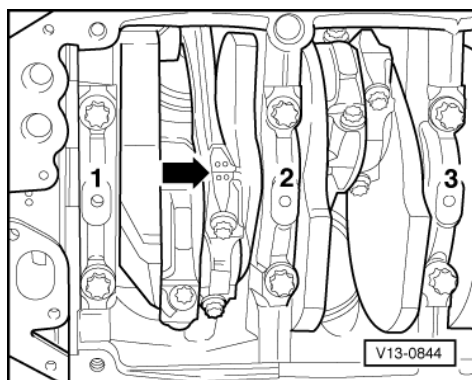
-> Fig.5 Piston installation position and arrangement of piston/cylinder

- Mark cylinder no. on piston crown with waterproof felt pen.

Note:

Do not mark with a centre punch as this can cause damage (cracks).

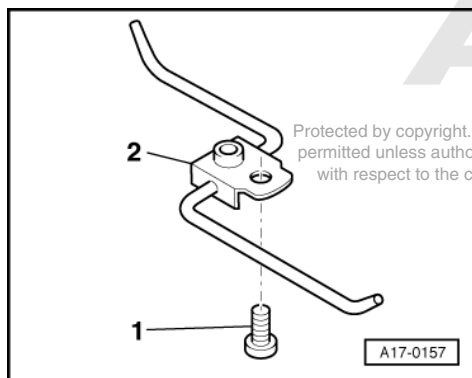
- Installation position:
Arrow on piston crown points to pulley end



-> Fig.6 Marking conrods

Notes:

- ♦ Only replace conrods as a set.
- ♦ Do not interchange conrod bearings.
- Before removing, mark mating positions of conrods and conrod bearing caps with coloured pen -arrow-.



-> Fig.7 Oil spray jet for piston cooling

- 1 - Bolt - 10 Nm
- 2 - Oil spray jet for piston cooling

4.2 - Piston and cylinder dimensions

Honing dimension		Piston $\varnothing$	Cylinder bore $\varnothing$
Basic dimension	mm	82.485	82.51
1st undersize	mm	82.735	82.76



2nd undersize	mm	82.985	83.01
---------------	----	--------	-------

Note:

Only pistons with basic dimensions are available as replacement parts.

4.3 - Checking radial play of conrods

Auxiliary equipment required

- ♦ Plastigage

Test sequence

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage of corresponding width on the bearing journal or in the bearing shells
 - The length of Plastigage must rest in the middle of the bearing shell
- Fit conrod bearing cap and tighten to 30 Nm. Do not turn crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with calibrated scale.

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

- Replace bolts for conrod bearings.



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15 - Cylinder head, Valve gear

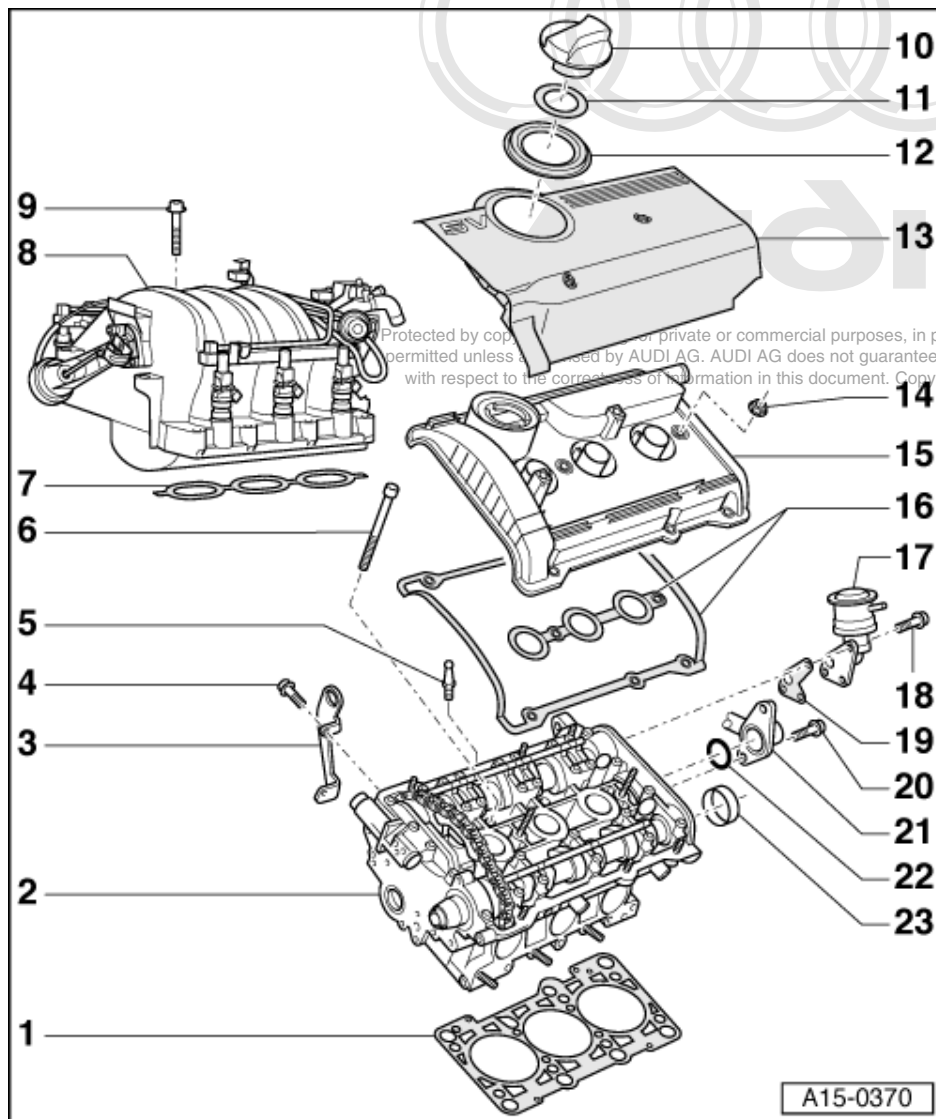
1 - Removing and installing cylinder head

1.1 - Removing and installing cylinder head

Notes:

- ◆ Replace the cylinder head bolts.
- ◆ When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ◆ When installing a replacement cylinder head with the camshafts fitted, the contact surfaces between bucket tappet and cam running surface must be oiled after installation of the cylinder head.
- ◆ The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.
- ◆ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ◆ When using a replacement cylinder head without camshafts, drive in a sealing cap on the appropriate front side of the head => Fig. 73 .
- ◆ 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.

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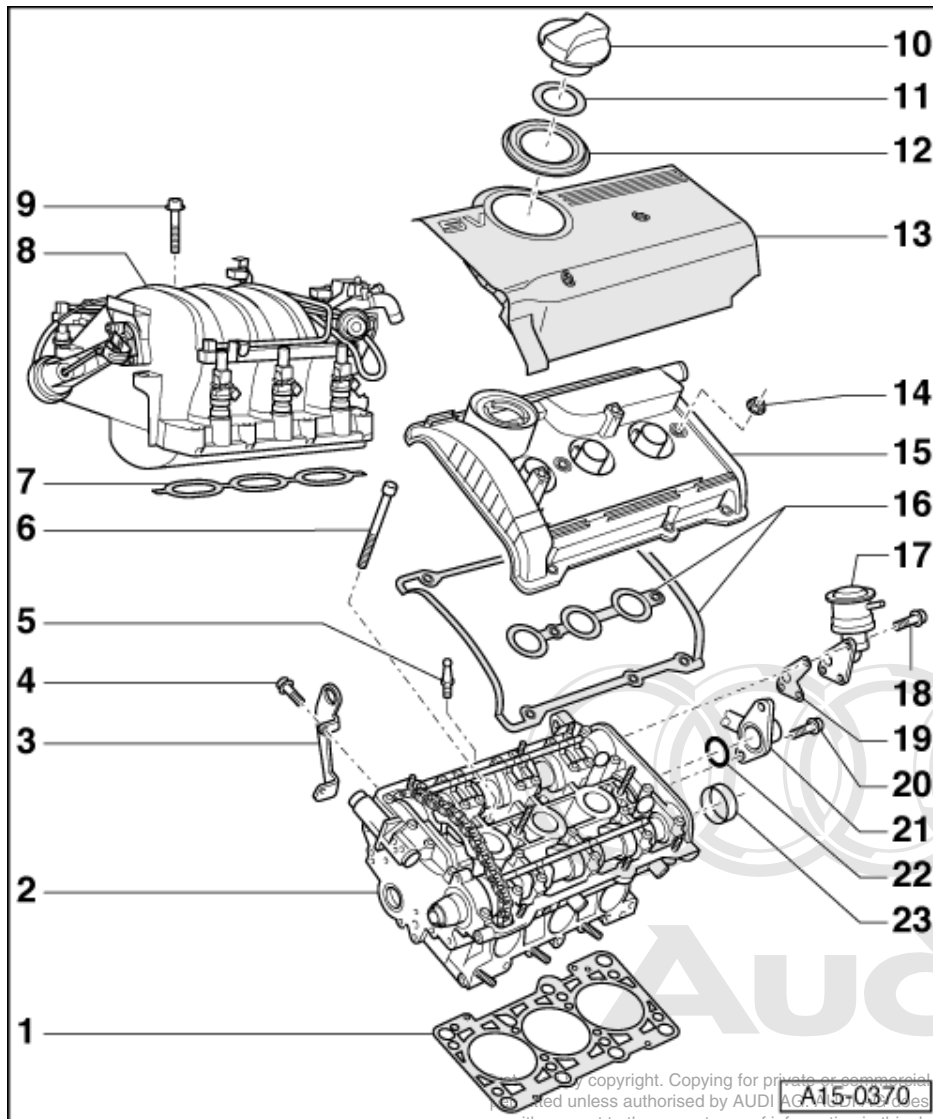
1 Cylinder head gasket

- ◆ Replace => Removing cylinder head. from Page 82 onwards
- ◆ Installation position: Part No. to cylinder head
- ◆ After replacing, fill with fresh coolant

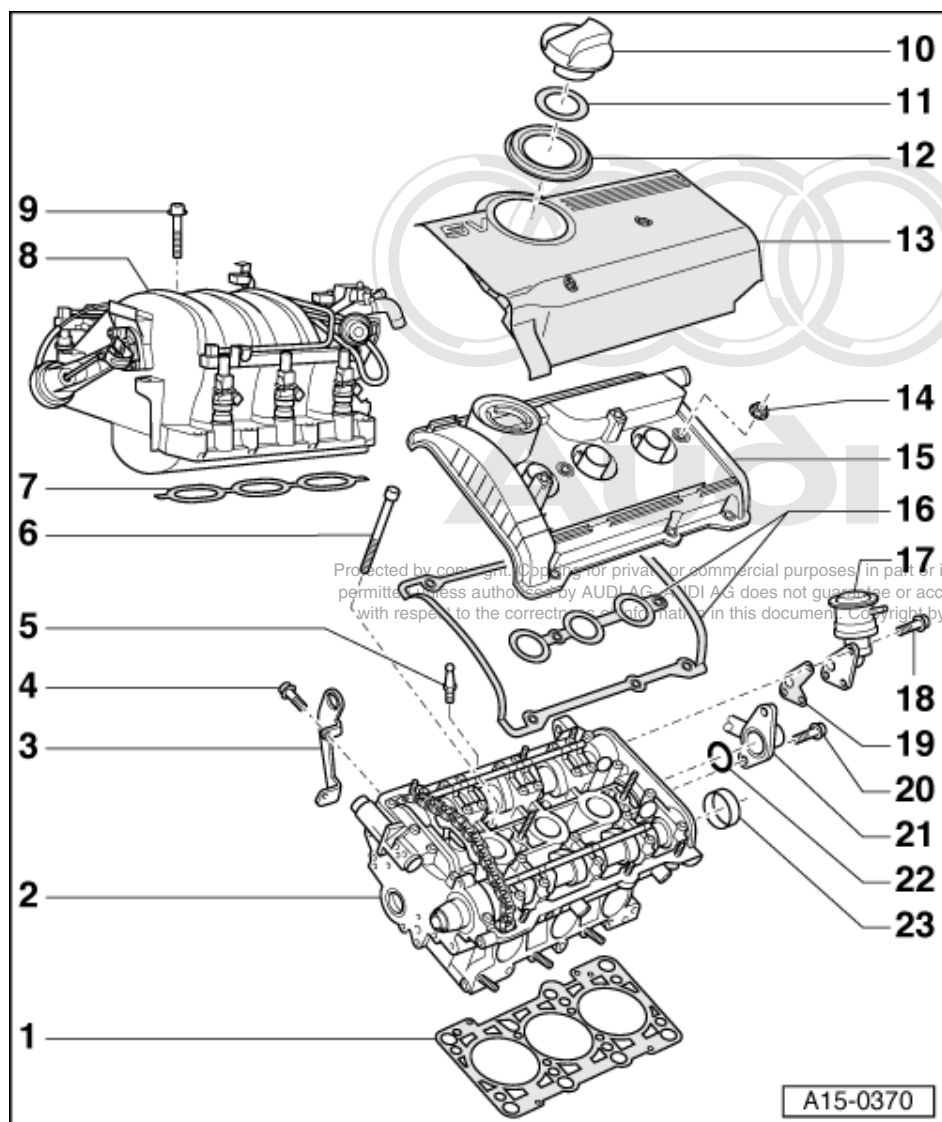
2 Cylinder head

- ◆ Removing left cylinder head => Page 82
- ◆ Removing right cylinder head => Page 84
- ◆ Check for distortion => Fig. 1
- ◆ Reworking limit => Fig. 2
- ◆ Driving sealing cap into cylinder head => Fig. 5
- ◆ Installing => Page 86
- ◆ After replacing, fill with fresh coolant

3 Lifting eye



- 4 25 Nm
- 5 Centring bolt
- ♦ For intake manifold
- 6 Cylinder head bolt
- ♦ Replace
 - ♦ Different bolts => Fig. 3
 - ♦ Note sequence when loosening
=> Page 84
 - ♦ Note sequence when tightening
=> Page 88
- 7 Seal
- ♦ For intake manifold
 - ♦ Replace
- 8 Intake manifold
- ♦ Removing and installing
=> Page 74.
- 9 10 Nm
- ♦ Tighten in stages and in diagonal sequence



10 Cap

11 Seal

- ♦ Replace if damaged or leaking

12 Washer

13 Cover

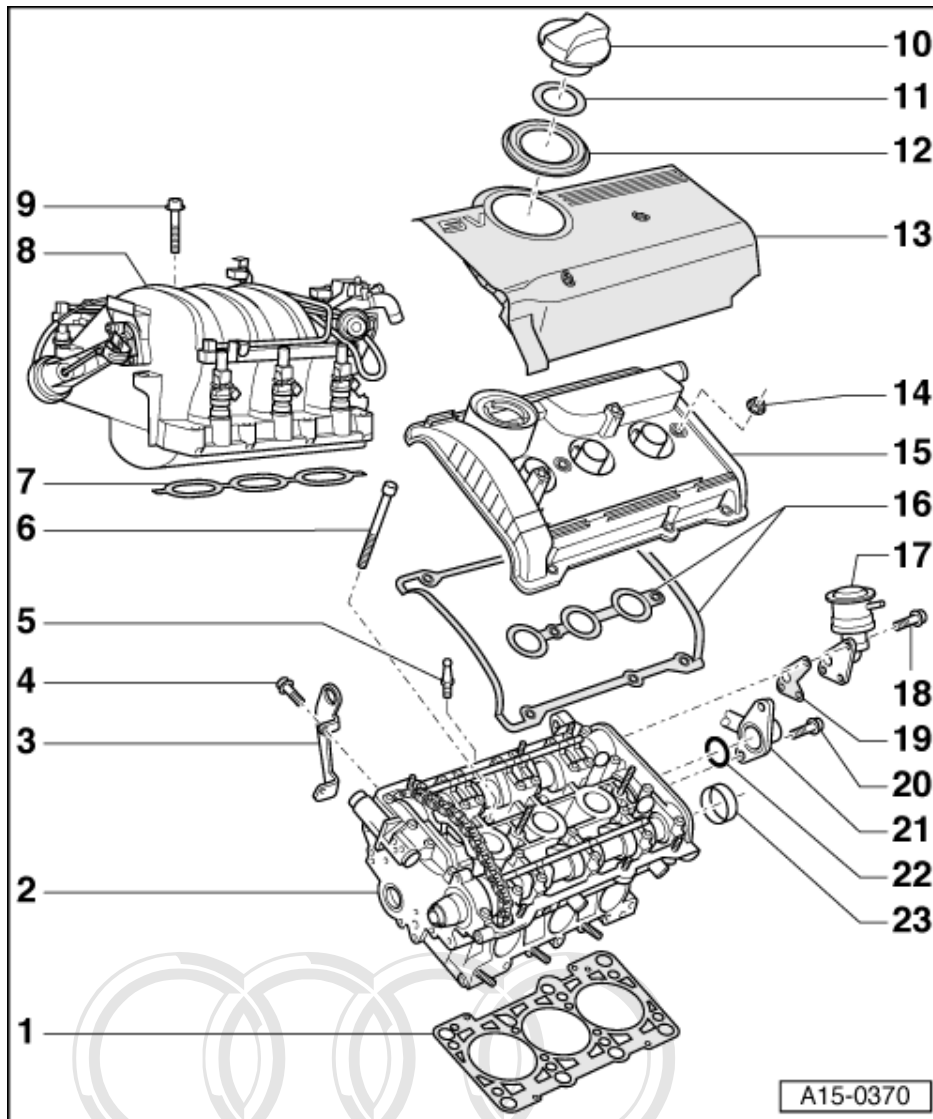
- ♦ For cylinder head cover

14 10 Nm

- ♦ Note sequence when tightening => Page 82

15 Cylinder head cover

- ♦ Removing and installing left cylinder head cover => Page 77
- ♦ Removing and installing right cylinder head cover => Page 79

**16 Cylinder head cover gasket**

- ◆ Replace if damaged or leaking
- ◆ Before fitting gasket apply sealant at sealing points => Fig. 73
- ◆ Sealants

=> Parts List

17 Not installed

18 Not installed

19 Not installed

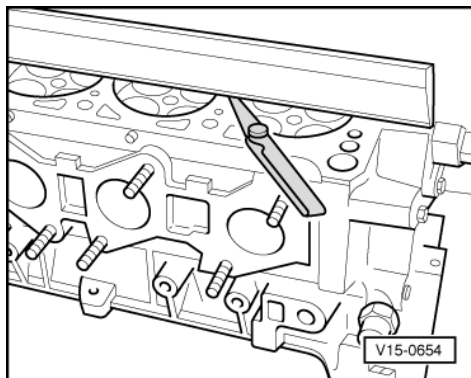
20 Not installed

21 Not installed

22 Not installed

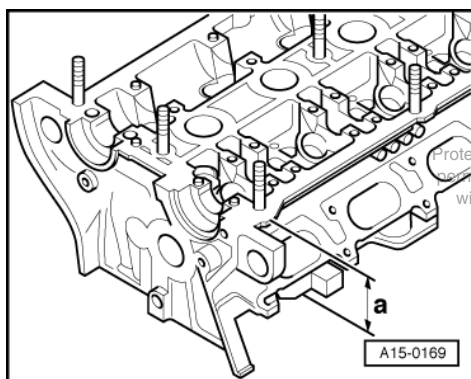
23 Cap

- ◆ Removing and installing
=>Page 102 .



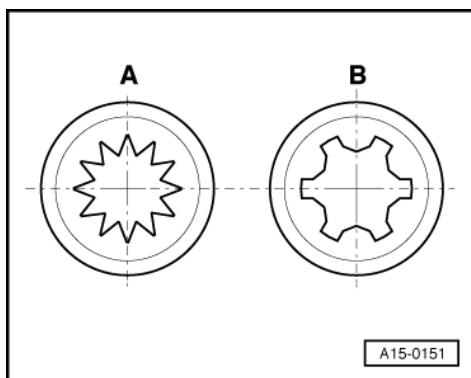
-> Fig.1 Checking cylinder head for distortion

- Use straightedge and feeler gauge to measure at several points.
 - Max. permissible distortion: 0.1 mm



-> Fig.2 Reworking dimension for cylinder head

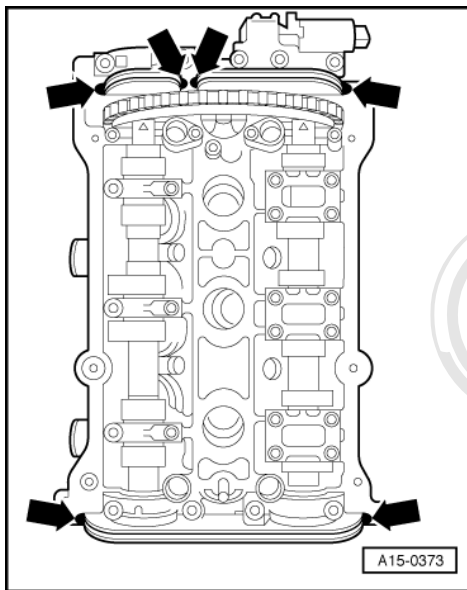
- Reworking the cylinder head (grinding) is only permitted down to minimum dimension a.
 - Minimum dimension a = 139.25 mm



-> Fig.3 Different cylinder head bolts

The cylinder head bolts have been progressively superseded by internal multi-tooth to Polydrive. To loosen or tighten the cylinder head bolts, first check which screw head is present:

- ♦ A - Internal multi-tooth screw head (use wrench 3410)
- ♦ B - Polydrive screw head (use wrench 3452)

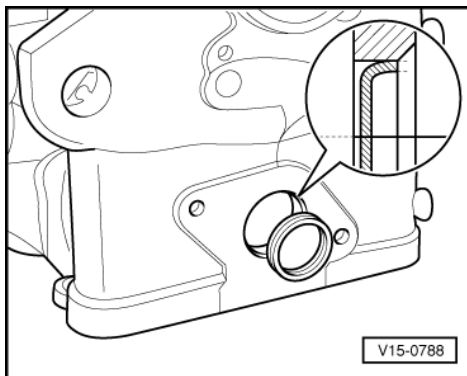


-> Fig.4 Sealing points for bearing caps on cylinder head

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- Apply a small quantity of sealant to joints -arrows- on upper sealing surface of cylinder head.
- Sealants

=> Parts List



-> Fig.5 Driving sealing cap into cylinder head

Special tools and workshop equipment required

- ◆ Drift VW 295

The cylinder heads without camshafts, available as spare parts, can be used both left and right and must be fitted with a sealing cap on the appropriate front side.

- Coat the edge of the sealing cap with sealing paste.
- Sealing paste

=> Parts List

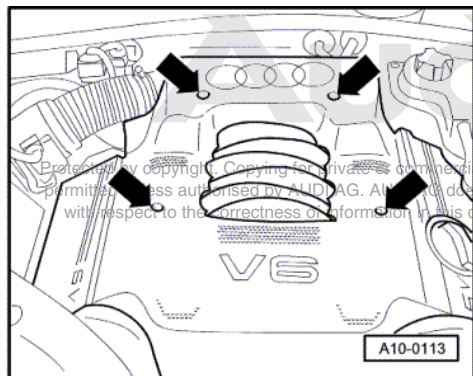
- Use drift VW 295 to knock in sealing cap until the outer edge of the sealing cap is flush with the chamfered end on the cylinder head.



1.2 - Removing and installing intake manifold

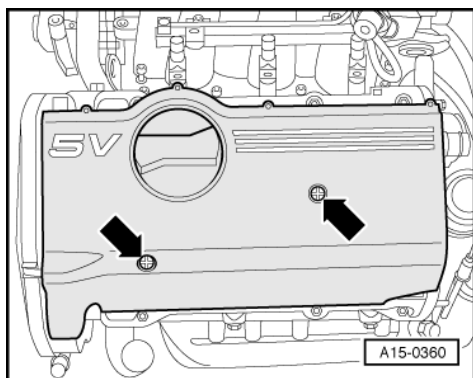
Note:

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

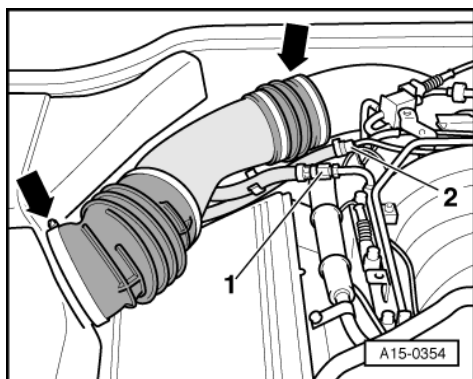


Removing

- Drain off coolant from engine =>Page 149 .
- -> Remove engine cover -arrows-.



- -> Remove covers on left and right -arrows-.

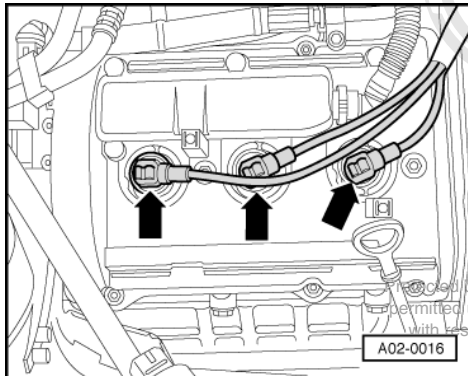


- -> Remove air duct hose between air mass meter and intake manifold -arrows-.

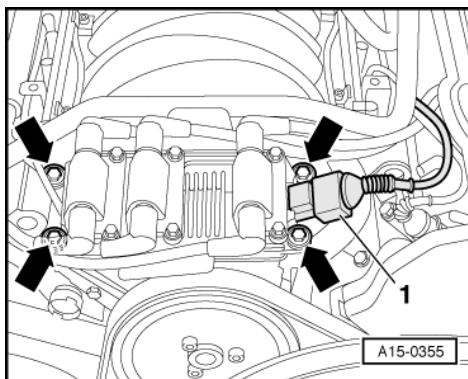
Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

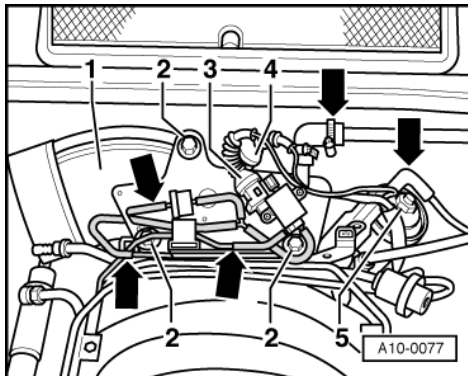
- Detach fuel supply line -1- and fuel return line -2-.



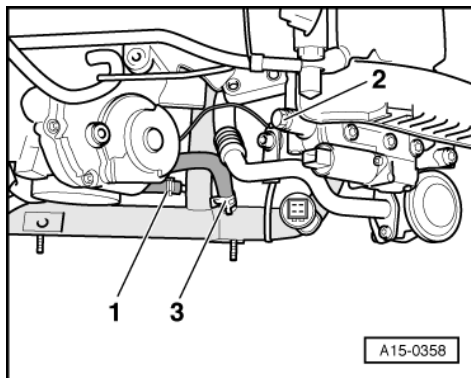
- -> Detach all 6 spark plug connectors -arrows-.



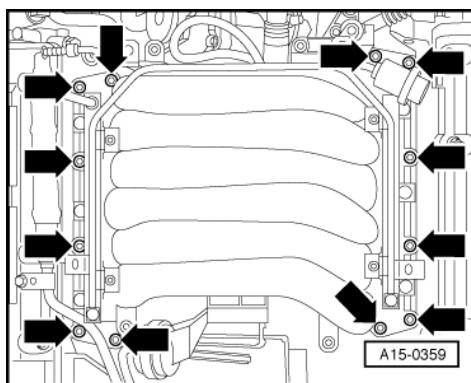
- -> Unscrew the ignition coils -arrows- and remove out with the ignition wiring.
- Remove hose of crankcase breather from right cylinder head cover.



- -> Carefully disconnect vacuum hoses -arrows-.
- Unplug connectors at intake manifold changeover valve -3- and at intake air temperature sender -4-.
- Remove bolts -2- on retainer plate for intake manifold changeover valve.
- Remove retainer plate and disconnect hose from air inlet connection.
- Remove bolt -1- on air inlet connection and disconnect inlet connection.
- Unscrew nuts -5- and remove vacuum unit downwards.
- Disengage actuating rod for CCS at throttle valve control unit.
- Detach throttle cable at throttle valve connection and support bracket (do not remove retainer). Move throttle cable to the side.



- -> Unscrew earth wire -2- from rear of right cylinder head.
- Disconnect coolant hoses -1- and -3- from throttle valve control unit and from rear coolant pipe.
- Unplug connectors from all injectors.
- Lay wiring harness and pipe for crankcase breather aside from intake manifold.



- -> Unbolt intake manifold -arrows- and remove.

Note:

Plug intake ports on cylinder heads with clean cloths.

Installing

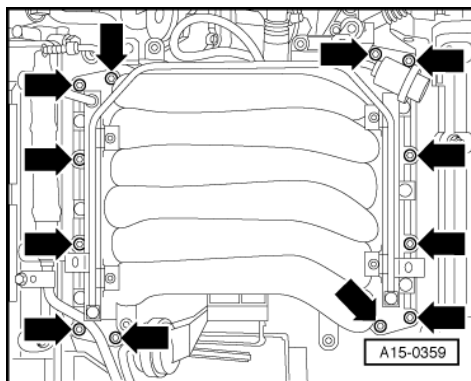
Installation is carried out in the reverse order; note the following.

Notes:

- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ♦ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- ♦ Replace seals and gaskets.



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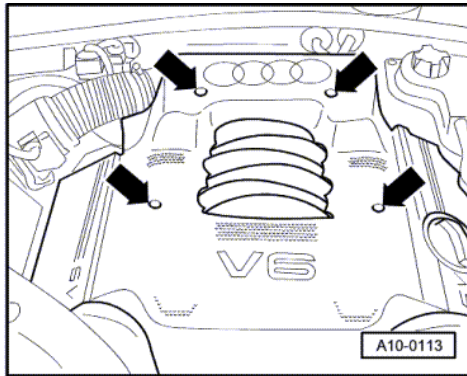
- -> Screw on the intake manifold in a diagonal sequence in stages -arrows-.
- Connect vacuum pipes => Page 10-23.
- Top up coolant => Page 151 .
- Check throttle cable setting

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism Servicing throttle mechanism

Tightening torques

Component	Nm
Intake manifold to cylinder head	10
Fuel lines to fuel rail or fuel pressure regulator	23
Air duct to intake manifold	10

1.3 - Removing and installing left cylinder head cover

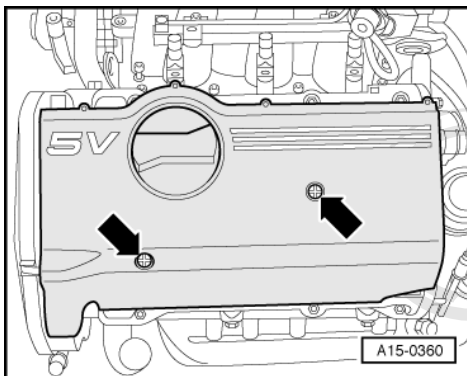


Removing

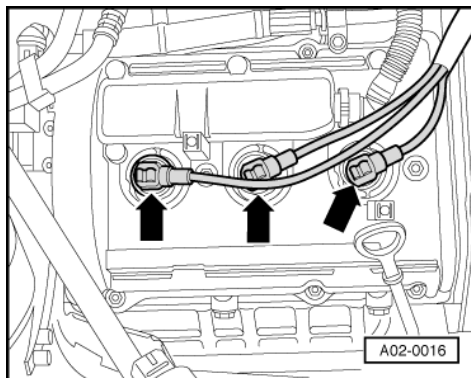
Note:

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

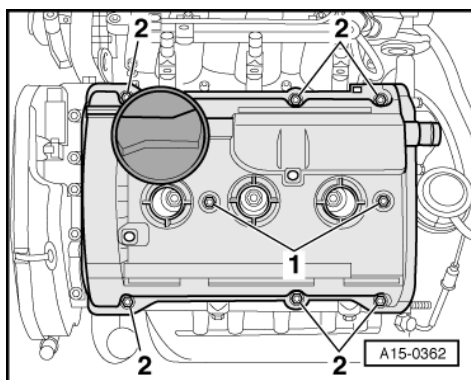
- -> Remove engine cover -arrows-.



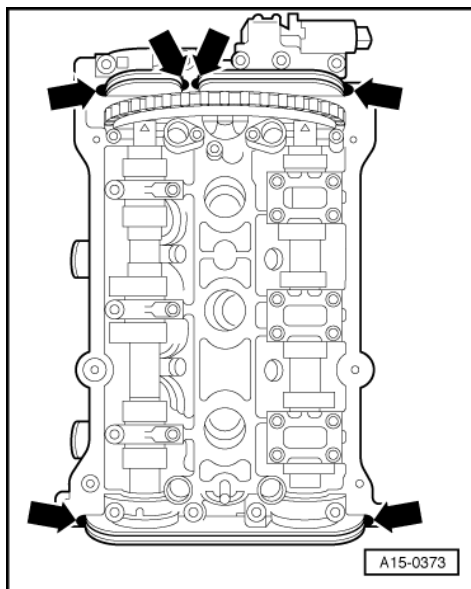
- -> Remove cover for left cylinder head cover -arrows-.



- -> Detach spark plug connector -arrows-.
- Remove hose of crankcase breather from cylinder head cover.
- Loosen cable tie and lay wiring aside.



- -> Unscrew the nuts -1- and -2- for cylinder head cover and remove the cylinder head cover.



Installing

Installation is carried out in the reverse order; note the following:



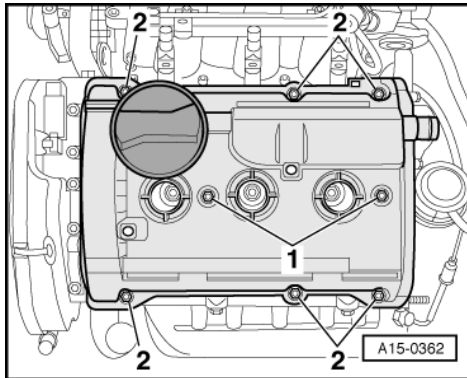
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Note:

Replace cylinder head cover gaskets if damaged.

- Apply a small quantity of sealant to joints -arrows- on upper sealing surface of cylinder head.
- Sealants

=> Parts List

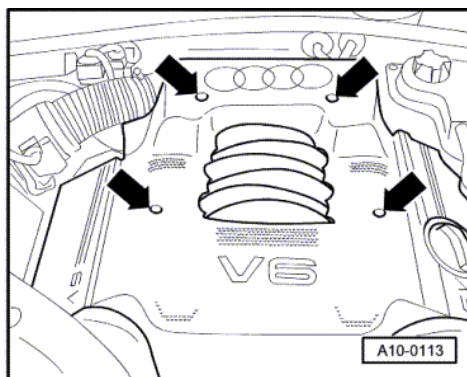


- -> Tighten internal nuts -1- for cylinder head cover.
- Then fully tighten external nuts -2- in stages and in diagonal sequence.

Tightening torque

Component	Nm
Cylinder head cover to cylinder head	10

1.4 - Removing and installing right cylinder head cover

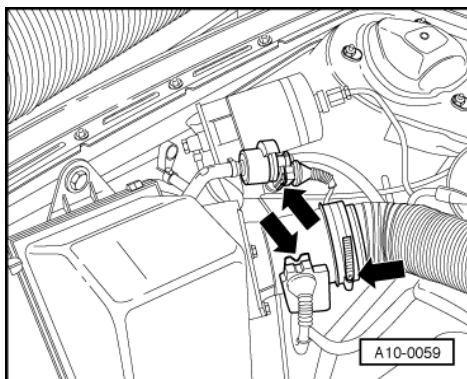


Removing

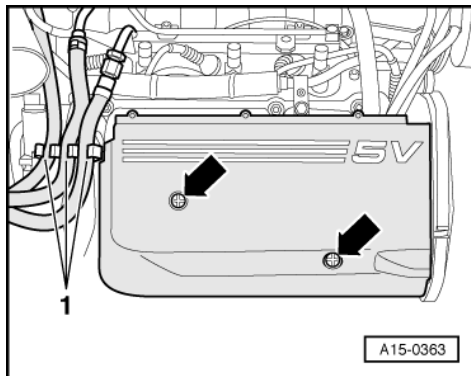
Note:

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

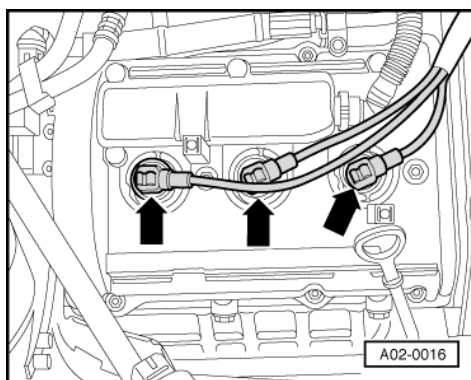
- -> Remove engine cover panel -arrows-.



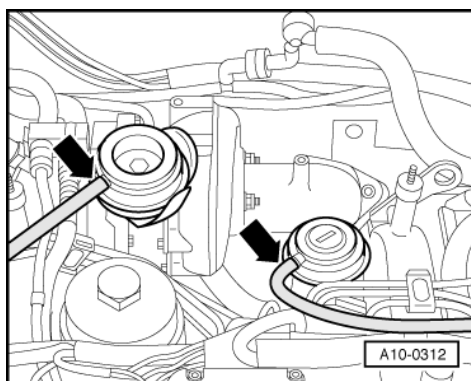
- -> Unplug the connectors at:
 - Air mass meter
 - Solenoid valve 1 for activated charcoal filter -N80
- Remove air intake hose between air mass meter and engine.



- -> Detach the hoses -1- from the bracket at the cylinder head cover.
- Remove the cover for right cylinder head cover -arrows-.
- Unbolt bracket for hydraulic line from cylinder head cover.



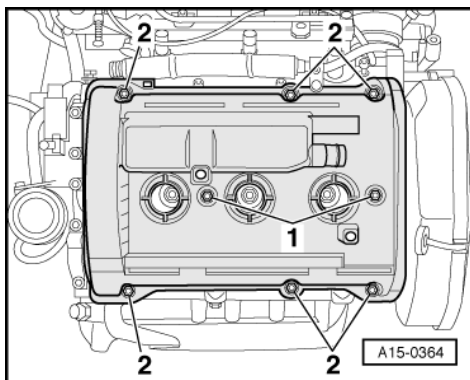
- -> Detach spark plug connector -arrows-.



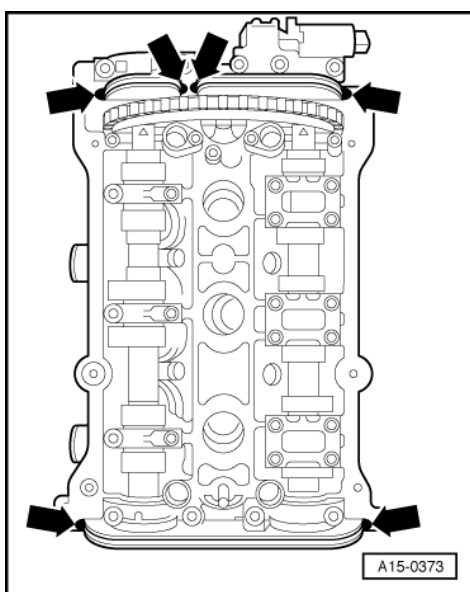
- -> Unbolt dipstick guide tube on cylinder head -arrow-.

Note:

The guide tube for engine oil dipstick must not be lifted out completely, as otherwise the O-ring at the base of guide tube will have to be replaced.



- Remove hose of crankcase breather from cylinder head cover.
- Loosen cable tie and lay wiring aside.
- -> Unscrew the nuts -1- and -2- for cylinder head cover and remove the cylinder head cover.



Installing

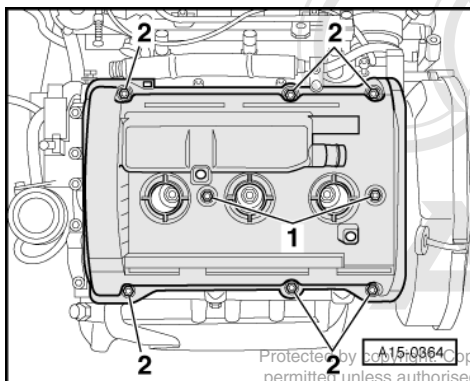
Installation is carried out in the reverse order; note the following:

Note:

Replace cylinder head cover gasket if damaged.

- Apply a small quantity of sealant to joints -arrows- on upper sealing surface of cylinder head.
- Sealants

=> Parts List



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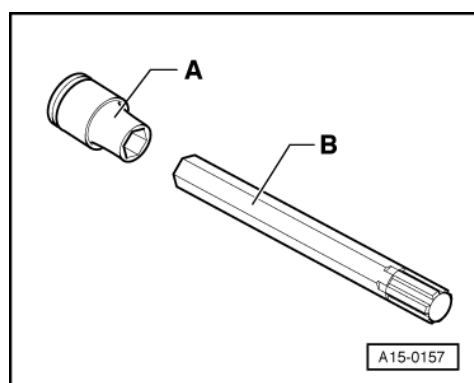


- -> Tighten internal nuts -1- for cylinder head cover.
- Then fully tighten external nuts -2- in stages and in diagonal sequence.

Tightening torques

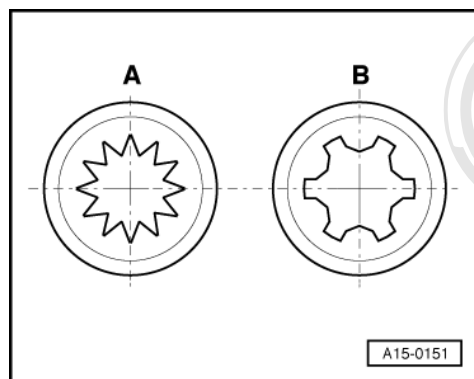
Component	Nm
Cylinder head cover to cylinder head	10
Dipstick guide tube to cylinder head.	22
Bracket for power steering line to cylinder head	10

1.5 - Removing left cylinder head



Special tools and workshop equipment required

- ♦ A - Socket attachment 10 mm (commercially available)
- ♦ B - Wrench 3410 or 3452



Note:

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The cylinder head bolts have been progressively superseded by internal multi-tooth to Polydrive. To loosen or tighten the cylinder head bolts, first check which screw head is present:

- ♦ -> A - Internal multi-tooth screw head (use wrench 3410)
- ♦ B - Polydrive screw head (use wrench 3452)

Procedure

- Engine in vehicle

Notes:

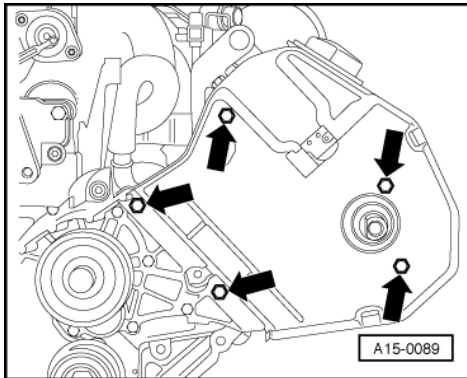
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

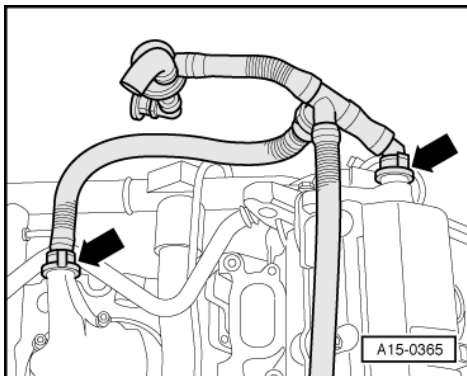
- ◆ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

=> General Body Assembly; Repair group 72

- Disconnect earth strap at battery with ignition switched off.
- Drain coolant => Page 149
- Remove left front exhaust pipe.
- Remove toothed belt => Page 35 .
- Remove camshaft sprocket.



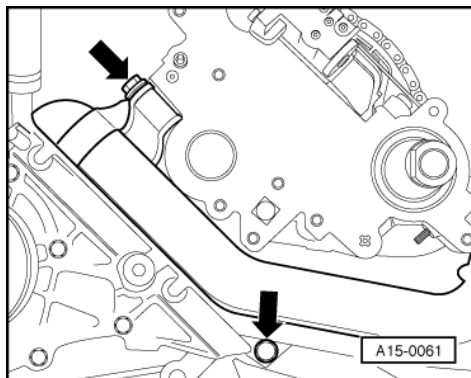
- -> Unscrew toothed belt guard rear left -arrows-.
- Remove intake manifold => Page 74 .



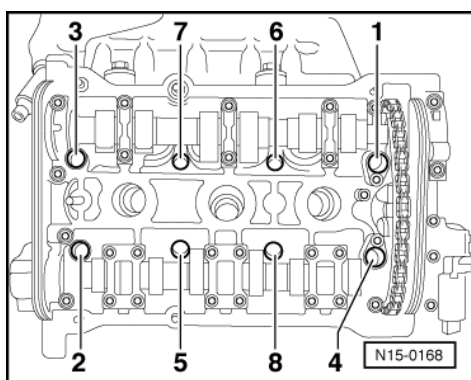
- -> Remove the crankcase breather hose -arrows-.
- Unplug the connectors at:
 - Hall sender on left
 - Camshaft adjustment valve
- Unscrew rear coolant pipe from cylinder head.

Note:

The coolant pipe remains installed.



- -> Unbolt coolant pipe at front of cylinder head -arrows-.
- Remove left cylinder head cover =>Page 77 .

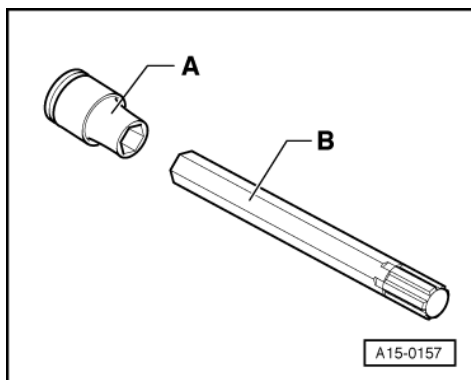


- -> Maintain sequence when loosening cylinder head bolts.
- Carefully remove cylinder head.



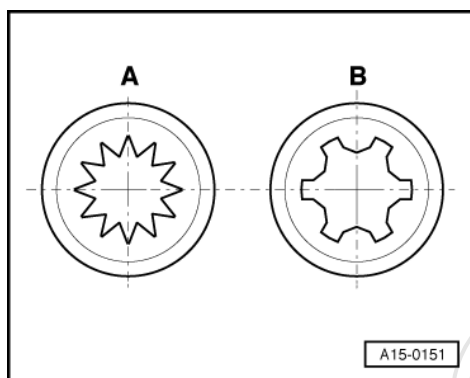
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1.6 - Removing right cylinder head



Special tools and workshop equipment required

- ♦ A - Socket attachment 10 mm (commercially available)
- ♦ B - Wrench 3410 or 3452



Note:

The cylinder head bolts have been progressively superseded by internal multi-tooth to Polydrive. To loosen or tighten the cylinder head bolts, first check which screw head is present:

- ◆ -> A - Internal multi-tooth screw head (use wrench 3410)
- ◆ B - Polydrive screw head (use wrench 3452)

Procedure

- Engine in vehicle

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Notes:

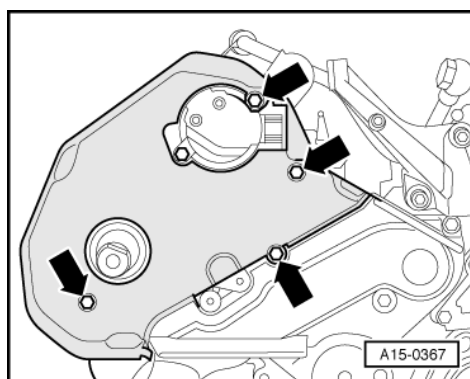
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ◆ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

=> General Body Assembly; Repair group 72

- Disconnect earth strap at battery with ignition switched off.
- Drain coolant => Page 149 .
- Remove right front exhaust pipe.
- Remove toothed belt => Page 35 .
- Remove camshaft sprocket.



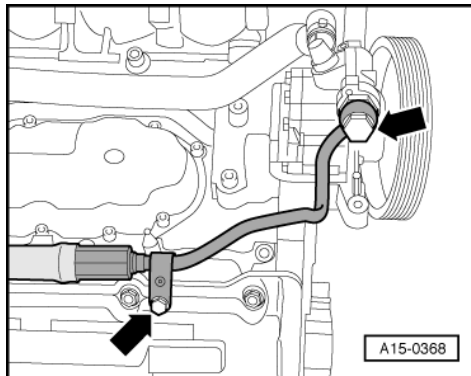
- -> Unscrew toothed belt guard rear right -arrows-.
- Remove intake manifold => Page 74 .

- Unscrew rear coolant pipe from cylinder head.

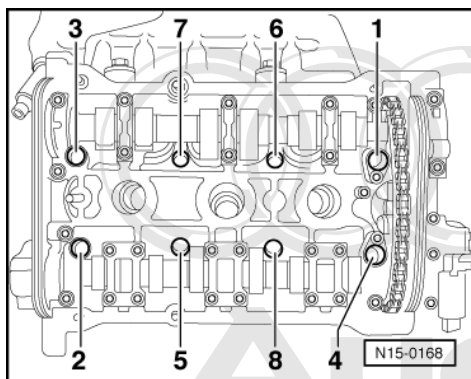
Note:

The coolant pipe remains installed.

- Unplug the connectors at:
 - Hall sender on right
 - Camshaft adjustment valve



- -> Detach pressure pipe for power steering at vane pump and at cylinder head cover -arrows-.
- Remove right cylinder head cover =>Page 79 .



- -> Maintain sequence when loosening cylinder head bolts.
- Carefully remove cylinder head.

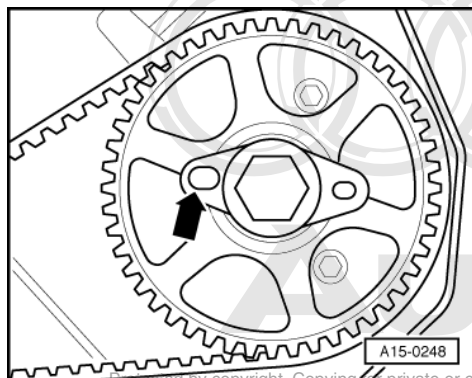
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1.7 - Installing cylinder head

Notes:

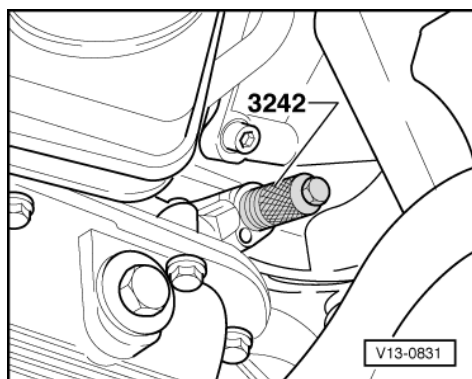
- ◆ Replace the cylinder head bolts.
- ◆ When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ◆ If repairing, carefully remove any remains of gasket material from the cylinder head and cylinder block. Make sure that no long scores or scratches are made on the surfaces.
- ◆ Carefully remove any remaining emery and abrasive material.
- ◆ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder head.
- ◆ Remove new cylinder head gasket from packaging, just before installation.
- ◆ Handle gasket extremely carefully. Damaging the silicone layer or the indented area will lead to leaks.
- ◆ Position cylinder head gasket on dowel pins. Marking -top- or part number must face cylinder head

- ♦ When using a replacement cylinder head without camshafts, drive in a sealing cap on the appropriate front side of the head => Fig. 73 .
- ♦ When working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

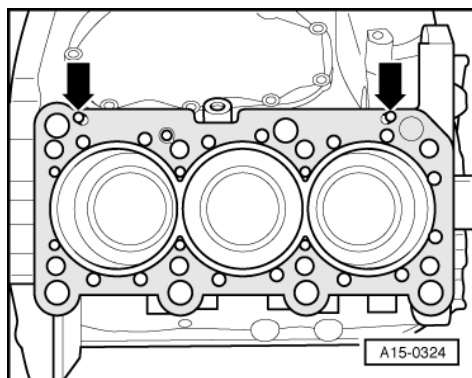


Installation is carried out in the reverse order; note the following:

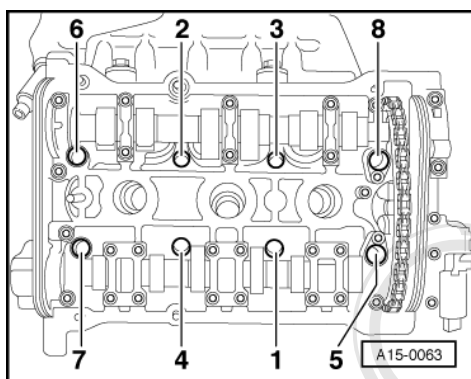
- -> Before positioning cylinder head, set crankshaft and camshafts to TDC of No. 1 cylinder: The large holes -arrow- for the fixing plates at the camshaft sprocket must face each other inwards ...



- -> ... and clamping bolt 3242 must be screwed in.



- -> Place cylinder head gasket in position.
- Note position of centring pins in cylinder block -arrows-.
- Check installation position of cylinder head gasket: mark "top" or the part No. must face cylinder head.
- Position cylinder head.
- Insert cylinder head bolts and tighten by hand.



- ➔ Tighten cylinder head bolts in two stages in sequence shown as follows:
- Tighten using torque wrench:
 - 1st Stage: 60 Nm
- Tighten with rigid wrench:
 - 2nd Stage: 180°(1/2 turn) further)

Notes:

- ♦ It is permissible to torque by 2 x 90°.
- ♦ It is not necessary to re-tighten the cylinder head bolts.
- Screw in centring pin for intake manifold.
- Install intake manifold => Page 76 .
- Connect the vacuum hoses => Page 10-23.
- Install cylinder head cover => Page 81 .
- Install toothed belt (adjust valve timing) => Page 39 .

Note:

Note all instructions on removing and installing the toothed belt =>Page 35 .

- Install ribbed belt =>Page 28 .
- Fit front exhaust pipe.
- Installation and stress-free alignment of exhaust system => Page 192 .

Notes:

- ♦ When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is activated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

=> Motronic Injection and Ignition System; Repair group 24

- Replace coolant => Page 151 .
- Top up power steering fluid and bleed steering system:

=> Running Gear, FWD and 4WD; Repair group 48

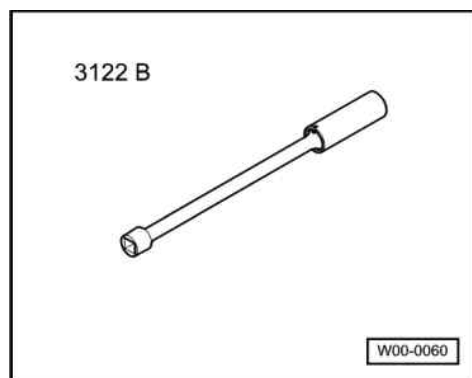
Tightening torques

Component	Nm
Rear coolant pipe to cylinder head	10
Combination valve to cylinder head	10
Connecting pipe to combination valve	10
Connecting pipe to cylinder head	M6 10
	M8 22
Connection to coolant pipe rear	15

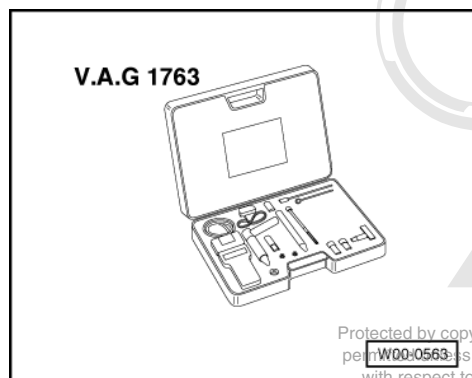
Coolant pipe (front section)	M6	10
to cylinder head	M8	22
Power steering pressure pipe to hydraulic pump		40
Power steering pressure pipe to cylinder head		10
Dipstick guide tube to cylinder head.		22
Rear toothed belt guard to cylinder head		10
Rear coolant pipe to cylinder head		10

1.8 - Checking compression

Special tools and workshop equipment required



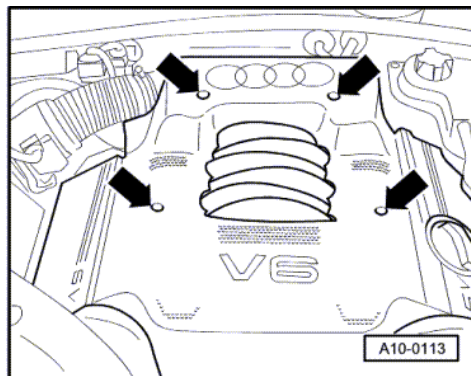
- ♦ Spark plug socket 3122 B



- ♦ Compression tester V.A.G 1381/V.A.G 1763.

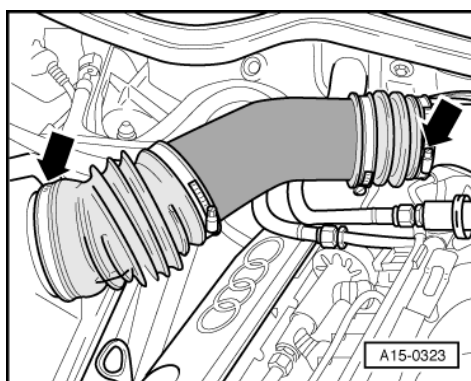
Test requirements:

- Engine oil temperature at least 30 °C
- Battery voltage at least 12 V

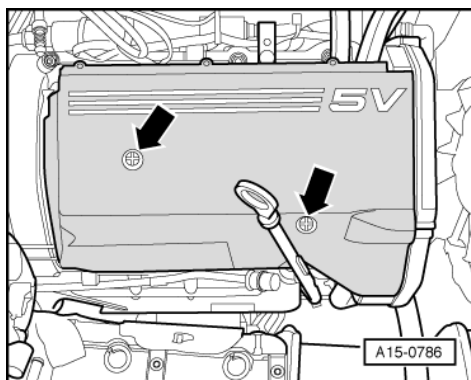


Test sequence

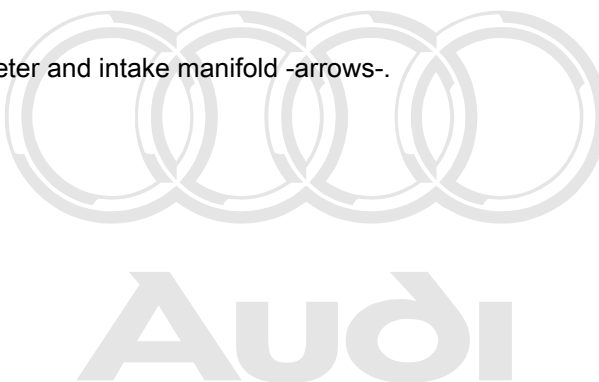
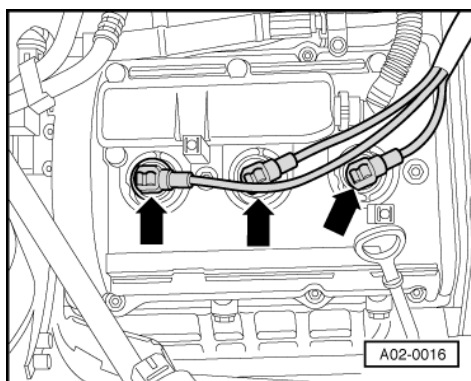
- -> Remove engine cover -arrows-.



- -> Remove air duct hose between air mass meter and intake manifold -arrows-.

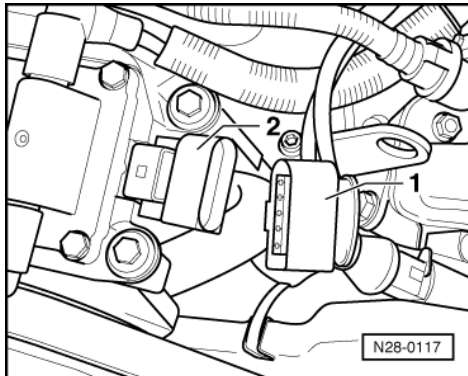


- -> Remove covers on left and right -arrows-.



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- -> Detach all 6 spark plug connectors -arrows-.
- Remove spark plugs using spark plug socket 3122 B.



- -> Detach 5-pin connector -1- from output stage of ignition coils -2-.
- Unplug connectors from all injectors.
- Depress accelerator pedal fully and hold down.
- Check compression with compression tester V.A.G 1381/ V.A.G 1763.

Note:

Using the compression tester

=> Operating Instructions

- Operate starter until tester shows no further pressure increase.

Compression values:

New pressure in bar	Wear limit pressure in bar	Permissible difference between cyl. pressure in bar
9.0...14.0	7.5	max. 3.0

- Install spark plugs.

Carry out the following step after the compression test:

- Interrogate and if necessary delete the fault memory.

To do this use vehicle diagnostic, testing and information system VAS 5051.

Tightening torque

Component	Nm
Spark plugs in cylinder head	30

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2 - Servicing valve gear

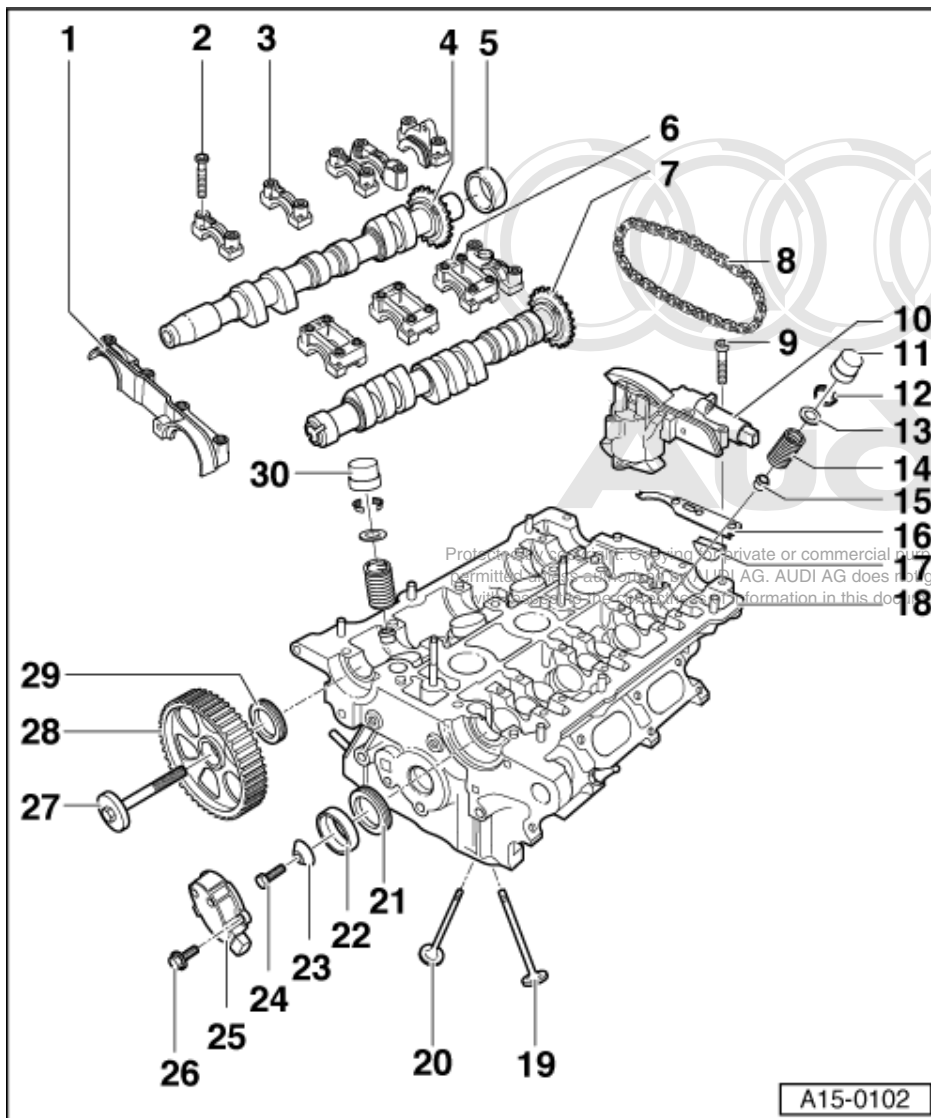
2.1 - Servicing valve gear

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.
- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).



- ♦ When working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- ♦ Replace seals and gaskets.
- ♦ The following illustration shows the right cylinder head.



1 Double bearing cap

- ♦ Lightly coat contact surfaces of front and rear bearing caps with sealant before installation => Fig. 2
- ♦ Sealants

=> Parts List

2 10 Nm

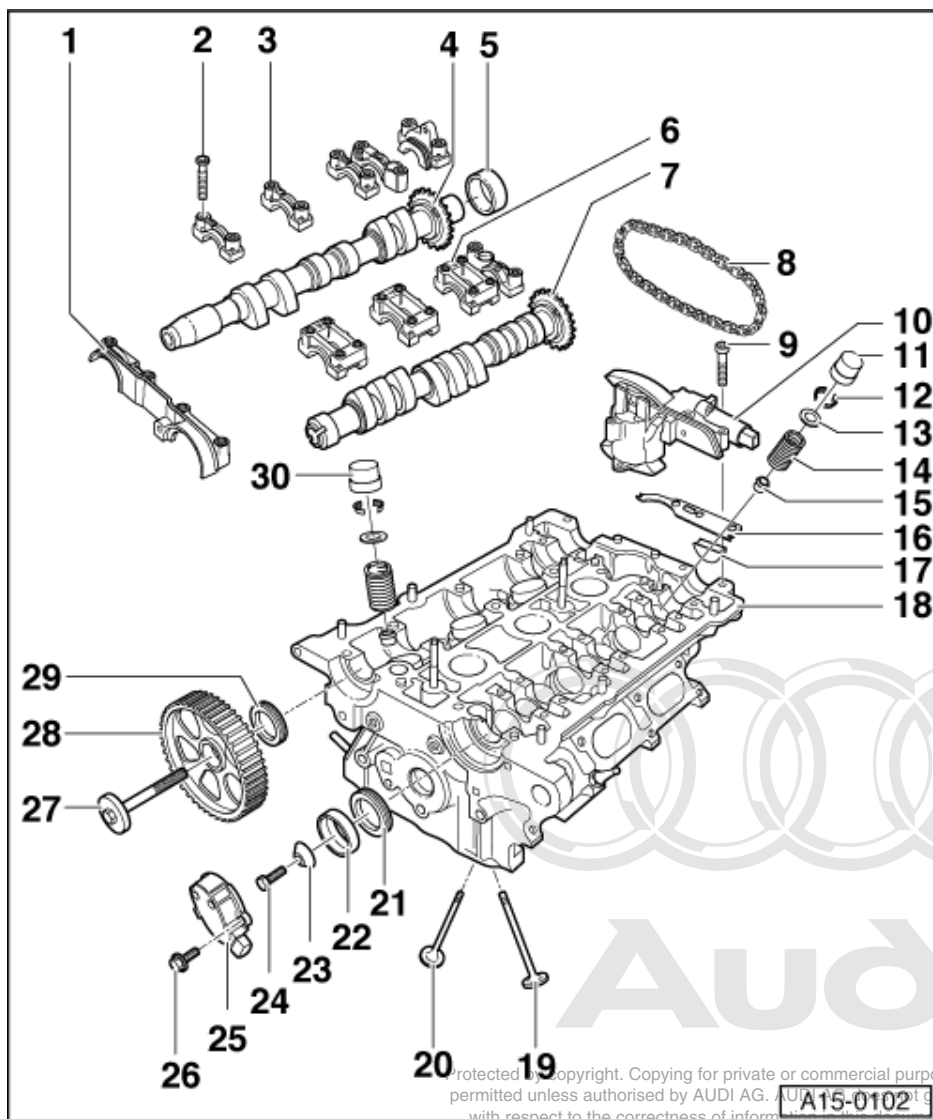
3 Exhaust camshaft bearing cap

- ♦ Push dowel sleeve
- ♦ Observe installation position and allocation =>Page 108

4 Exhaust camshaft

- ♦ Checking axial play =>Page 99 .
- ♦ Removing and installing
=>Page 106 .
- ♦ Check radial play with plastigage (bucket tappets not installed).
Wear limit 0.1mm

Runout 0.01 mm



5 Cap

- ♦ Replacing => Page 102 .

6 Inlet camshaft bearing cap

- ♦ Note dowel sleeve
- ♦ Observe installation position and allocation =>Page 108

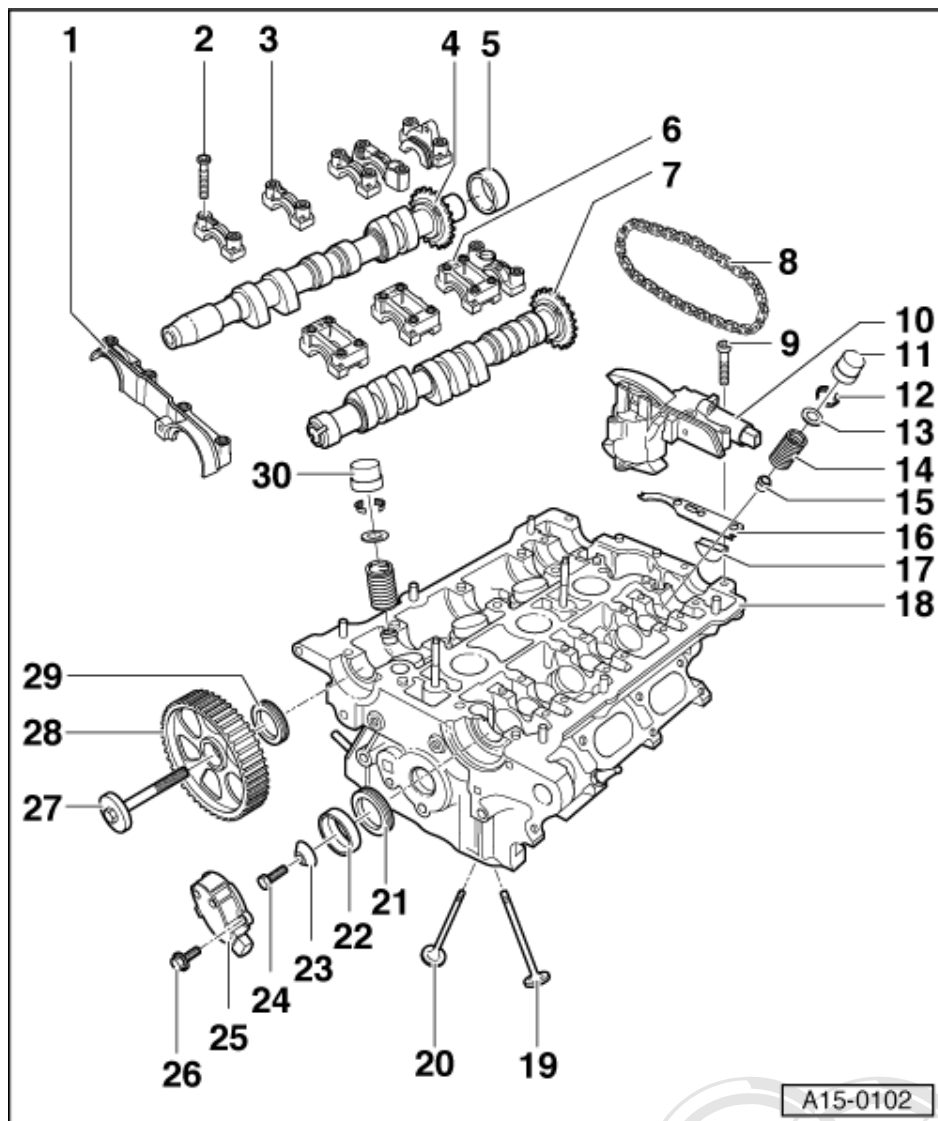
7 Inlet camshaft

- ♦ Checking axial play =>Page 99 .
- ♦ Removing and installing
=>Page 106 .
- ♦ Check radial play with plastigage (bucket tappets not installed).
Wear limit 0.1mm
Runout 0.01 mm

8 Drive chain

- ♦ Installing =>Page 109

9 10 Nm

**10 Mechanical camshaft adjuster**

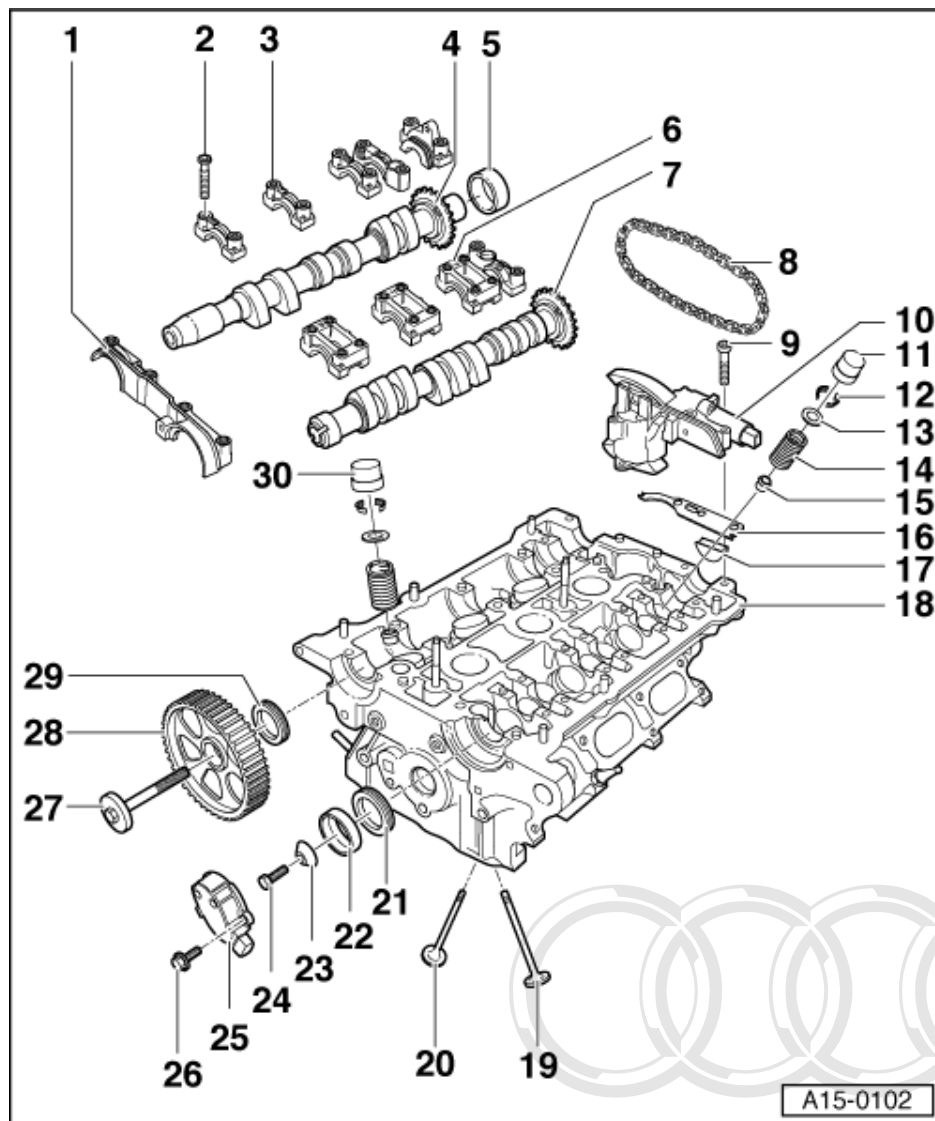
- ◆ With solenoid valve for camshaft adjustment -N205
- ◆ Secure with special tool V.A.G 3366 before removing =>Page 106

11 Hydraulic bucket tappet (inlet valve)

- ◆ Checking => Page 111
- ◆ Removing and installing
=>Page 113.
- ◆ Do not interchange
- ◆ Store with cam contact surface downwards
- ◆ Before installing check camshaft axial play =>Page 99.
- ◆ Oil contact surface

12 Valve cotter pins**13 Valve spring plate**

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14 Valve springs

15 Valve stem seal

- ♦ Replacing => Page 113 .

16 Metal/rubber gasket

- ♦ Replace

17 Seal

- ♦ Replace

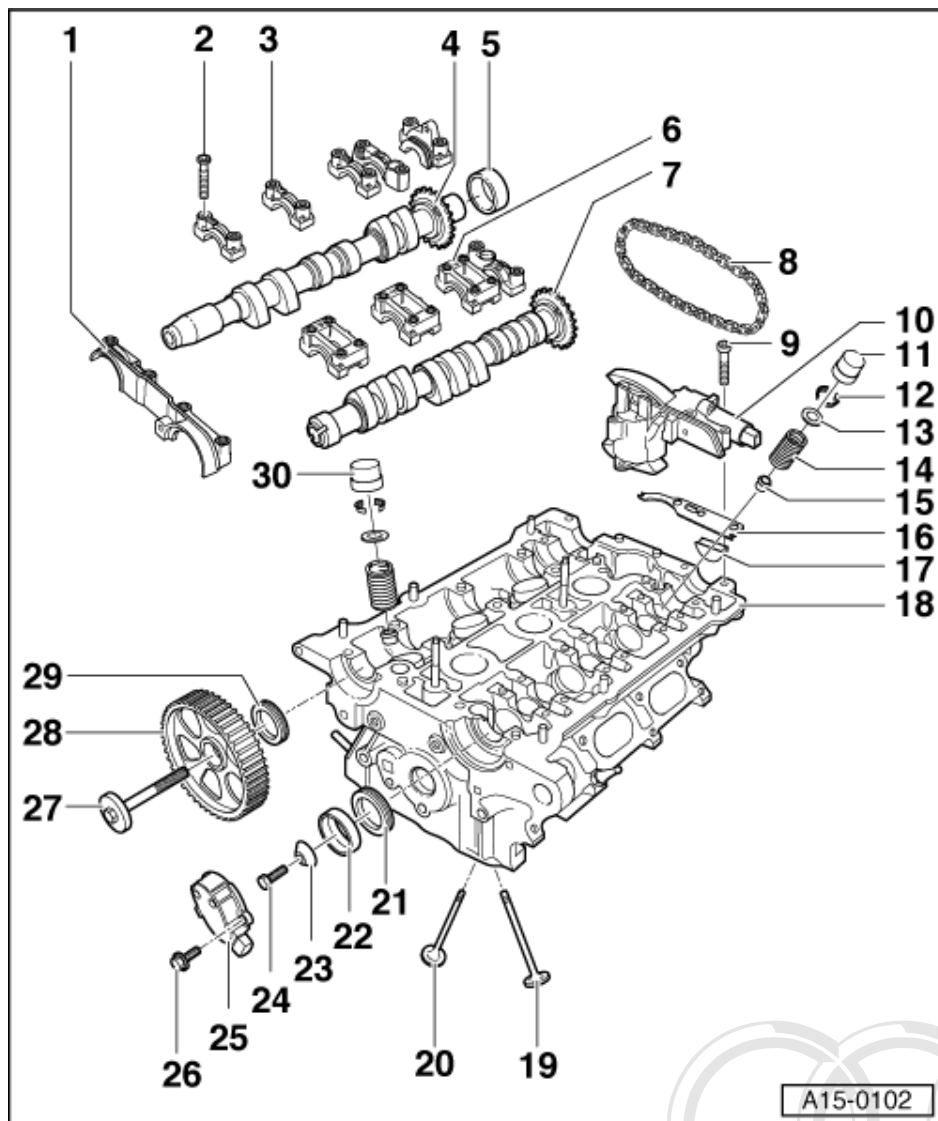
18 Cylinder head

- ♦ See note =>Page 91 .
- ♦ Checking valve guides, grinding in valve seats =>Page 117 .
- ♦ Rework valve seats =>Page 118 .

19 Exhaust valve

- ♦ Do not rework, only grinding in is permitted
- ♦ Valve dimensions => Fig. 1
- ♦ Checking valve guides, grinding in valve seats =>Page 117 .

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**20 Inlet valve**

- ◆ Do not rework, only grinding in is permitted
- ◆ Valve dimensions => Fig. 1
- ◆ Checking valve guides, grinding in valve seats =>Page 117 .

21 Oil seal

- ◆ Note rotation direction
- ◆ Replacing =>Page 103

22 Hall sender rotor

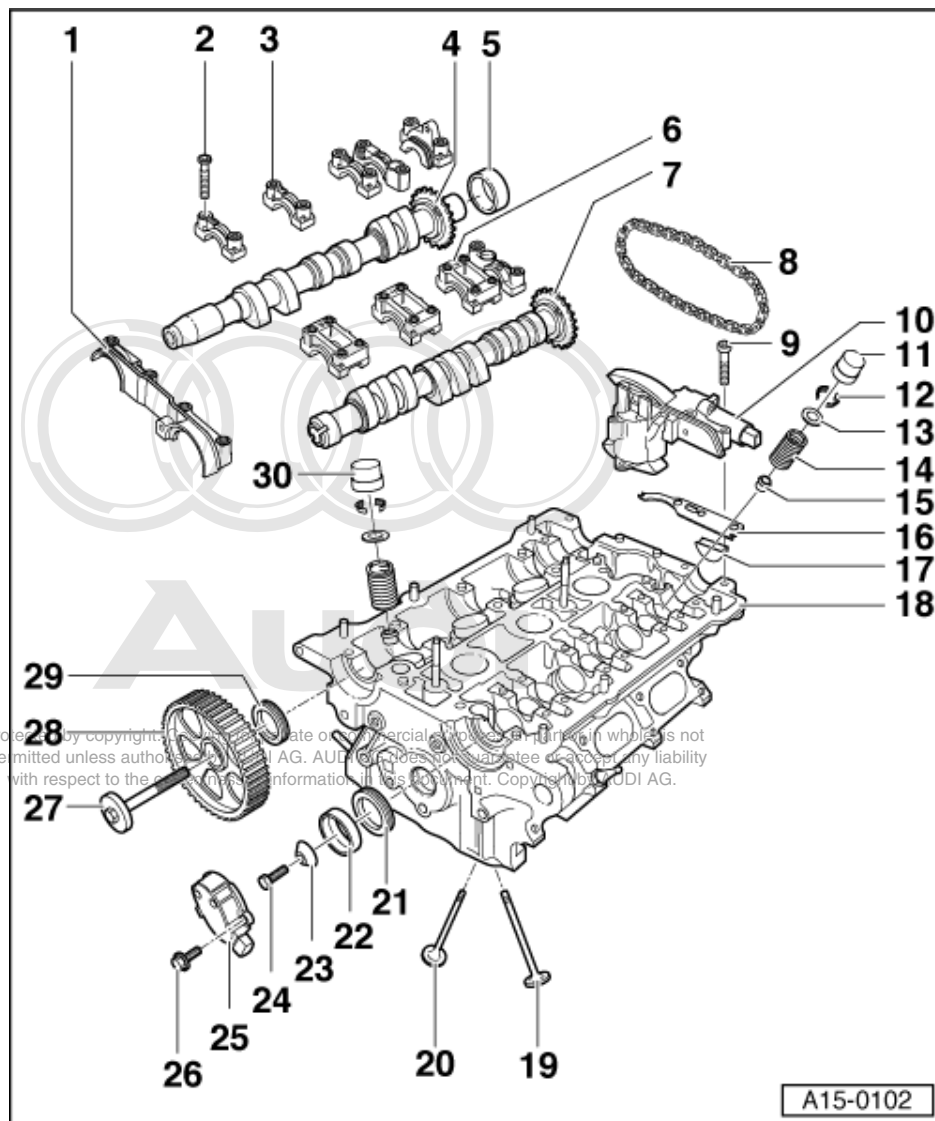
- ◆ Note installation position, notch in camshaft

23 Washer

- ◆ Tapered

24 25 Nm**25 Hall sender**

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26 10 Nm

27 55 Nm

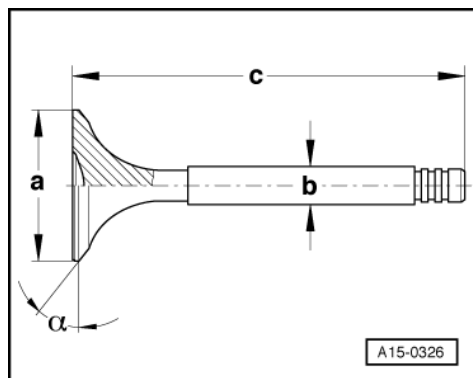
28 Camshaft sprocket

29 Oil seal

- ♦ Note rotation direction
- ♦ Replacing => Page 100 .

30 Hydraulic bucket tappet (exhaust valve)

- ♦ Checking => Page 111
- ♦ Removing and installing
=>Page 113 .
- ♦ Do not interchange
- ♦ Store with cam contact surface downwards
- ♦ Before installing check camshaft axial play =>Page 99 .
- ♦ Oil contact surface



-> Fig.1 Valve dimensions

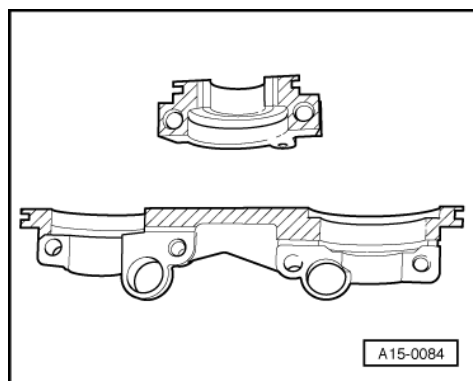
Note:

Valves must not be reworked. Only grinding in is permitted.

Dim.	Inlet valve	Exhaust valve
øa mm	26.80...27.00	29.80...30.00
øb mm	5.96...5.97	5.94...5.95
c mm	104.84...105.34	103.64...104.14
α <°	45	45

Important

- ♦ Worn exhaust valves with sodium filling must not be disposed of until they have been treated as follows:
- ♦ The valves must be sawn into two sections with a metal saw at a point between the centre of the shaft and the valve head. They 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). Then step back because a chemical reaction occurs when the sodium filling burns.
- ♦ After this treatment the valves can be disposed of in the normal way.



-> Fig.2 Coating bearing cap with sealant

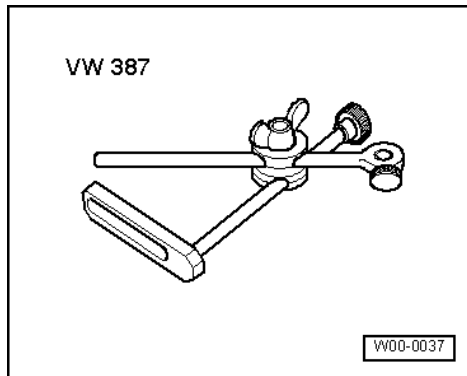
- Coat the hatched area of the double bearing cap and the bearing cap on the outside next to the camshaft adjuster thinly with sealant and install bearing cap (note dowel sleeves).
- Sealants

=> Parts List



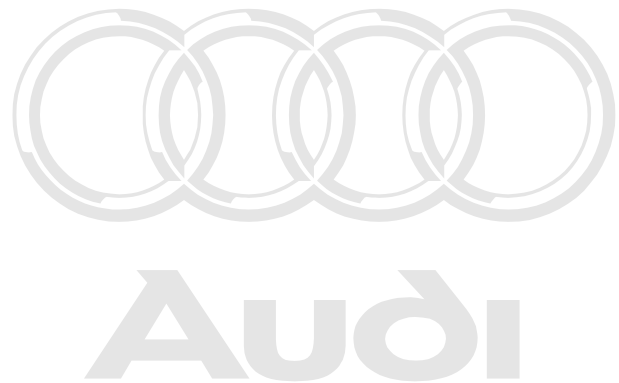
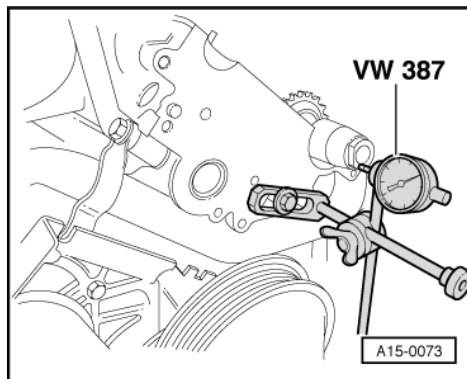
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2.2 - Checking camshaft axial play



Special tools and workshop equipment required

- ◆ Universal dial gauge bracket VW 387
- ◆ Dial gauge



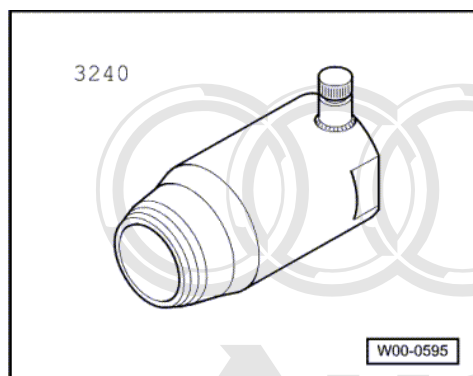
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Test sequence

- Removing camshafts => Page 106 .
- Remove bucket tappets.
- Insert camshafts without chain into cylinder head and bolt tight with bearing caps 2 and 4.
- -> Attach dial gauge with universal dial gauge holder VW 387 to cylinder head.
- Press camshaft to be checked against the dial gauge by hand.
- Set dial gauge to -0-
- Press crankshaft away from dial gauge.
- Note dial gauge reading:

New	Wear limit
0.05...0.15 mm	0.20 mm

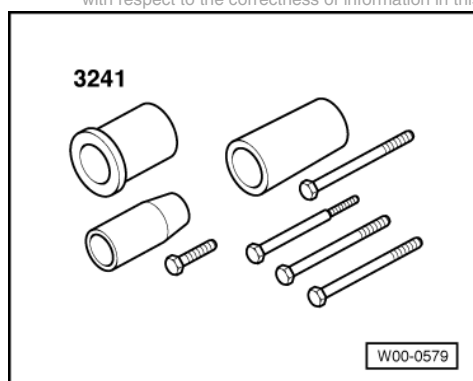
2.3 - Replacing camshaft oil seals



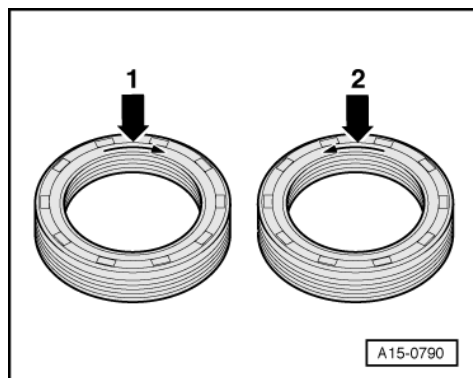
Special tools and workshop equipment required

♦ Special tool 3240

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♦ Fitting tool 3241



Notes:

- ♦ For vehicles in the Audi 100/A6 series, standard oil seals (with annular spring) are fitted as standard. The following must be noted when using PTFE oil seals:
- ♦ The PTFE oil seals are allocated to the rotation direction of the shaft (see arrow marking on sealing ring). Wrong rotation direction causes oil leakage.
- ♦ -> Oil seals at the front on the engine have a "right" rotation direction -arrow 1-. Oil seals at the rear on the engine have a "left" rotation direction -arrow 2-.

Removing

- Remove toothed belt => Page 35 .

- Remove camshaft sprockets.

Note:

If one of the oil seals is leaking, replace seals on both cylinder heads.

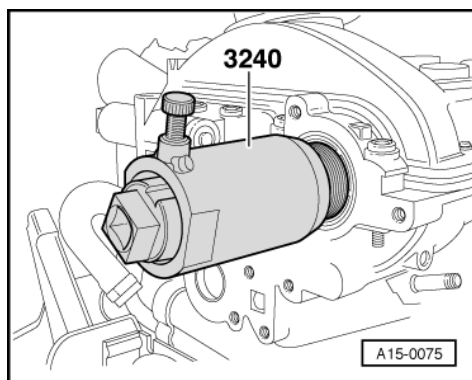
- Adjust inner section of oil seal extractor 3240 until it is flush with the outer section.

Left cylinder head:

- Unscrew inner section of oil seal extractor 5 turns and lock with knurled screw.

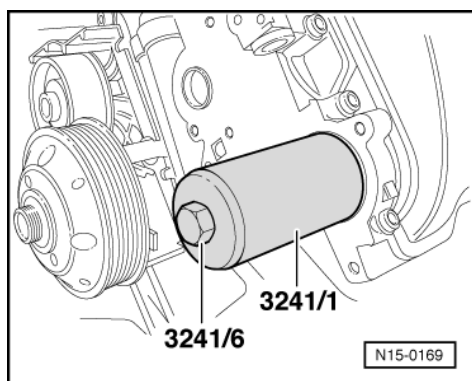
Right cylinder head:

- Unscrew inner section of oil seal extractor 11 turns and lock with knurled screw.



Continued for both sides of the vehicle:

- -> Lubricate threaded head of oil seal extractor 3240, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.



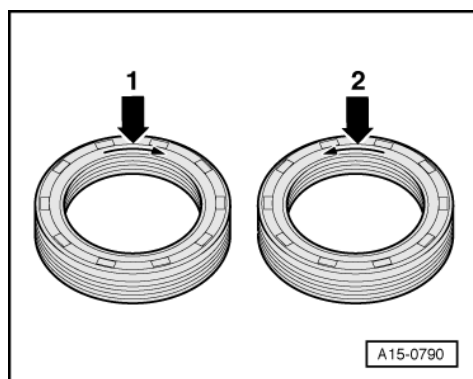
Installing

- Before installing PTFE oil seals, check the rotation direction of the oil seal.
 - Rotation direction, "right" (arrow on the oil seal)
- Push oil seal over taper on camshaft.
- -> Press in oil seal until flush using pressure sleeve 3241/1 and bolt 3241/6.
- Install toothed belt (adjust valve timing) => Page 39

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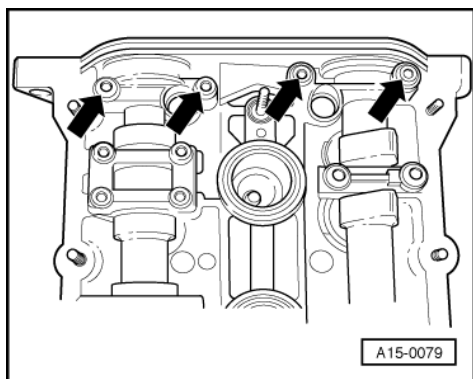


2.4 - Replacing oil seal for Hall sender and sealing cap - left cylinder head



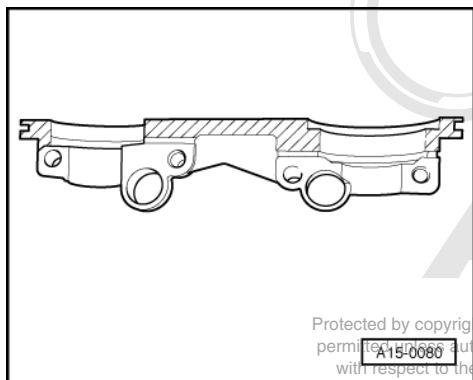
Notes:

- ♦ For vehicles in the Audi 100/A6 series, standard oil seals (with annular spring) are fitted as standard. The following must be noted when using PTFE oil seals:
- ♦ The PTFE oil seals are allocated to the rotation direction of the shaft (see arrow marking on oil seal). Wrong rotation direction causes oil leakage.
- ♦ -> Oil seals at the front on the engine have a "right" rotation direction -arrow 1-. Oil seals at the rear on the engine have a "left" rotation direction -arrow 2-.



Removing

- Engine in vehicle
- Remove cylinder head cover on left => Page 77 .
- Remove the Hall sender -Item 96 .
- -> Unscrew double bearing cap -arrows-.
- Remove oil seal and sealing cap.



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Installing

Installation is carried out in the reverse order; note the following:

- Clean running and sealing surfaces as well as the contact surfaces of the double bearing cap.
- -> Coat the hatched area of the double bearing cap thinly with sealant.
 - Sealants

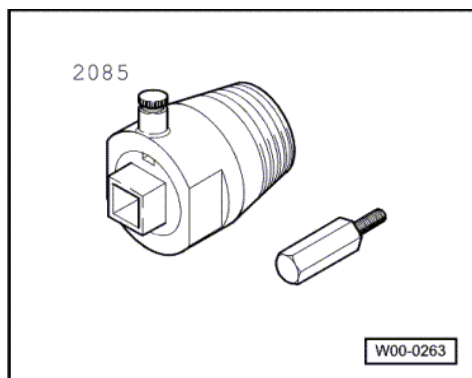
=> Parts List

- Before installing PTFE oil seals rings, check the rotation direction of the oil seal.
 - Rotation direction, "left" (arrow on the oil seal)
- Position the oil seal and install the double bearing cap.
- Press in the sealing cap with an assembly lever.

Note:

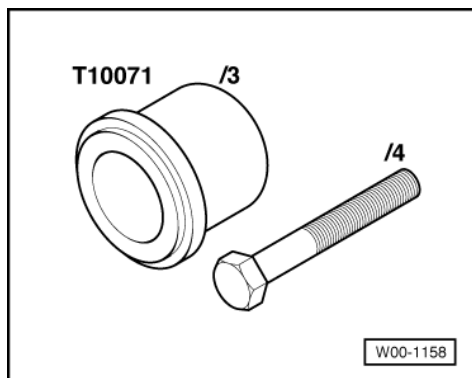
When the engine is removed, the bearing cap can remain installed while replacing the oil seal and the sealing cap. Procedure => Page 103.

2.5 - Replacing oil seal for Hall sender - right cylinder head



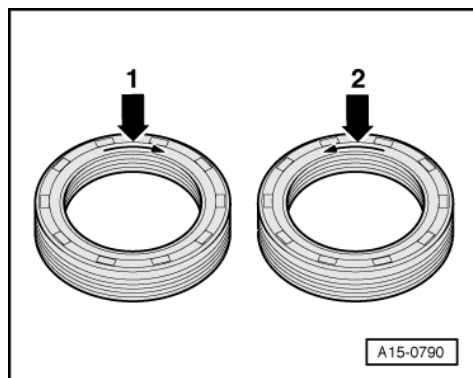
Special tools and workshop equipment required

- ◆ Oil seal extractor 2085



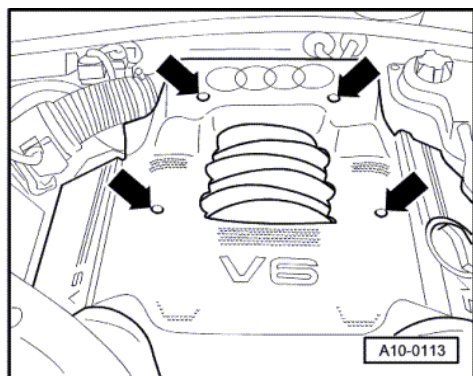
- ◆ Assembly tool T10071
- ◆ Bolt M8 x 50:
- ◆ Bolt M8 x 60:

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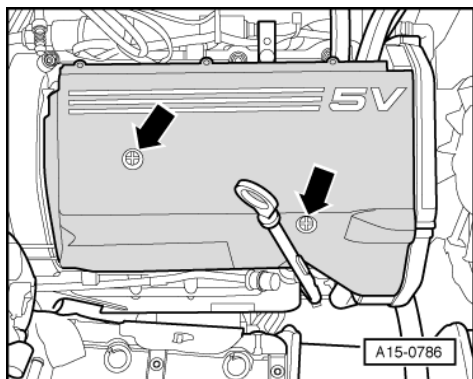
Notes:

- ♦ For vehicles in the Audi 100/A6 series, standard oil seals (with annular spring) are fitted as standard. The following must be noted when using PTFE sealing rings:
- ♦ The PTFE oil seals are allocated to the rotation direction of the shaft (see arrow marking on sealing ring). Wrong rotation direction causes oil leakage.
- ♦ -> Oil seals at the front on the engine have a "right" rotation direction -arrow 1-. Oil seals at the rear on the engine have a "left" rotation direction -arrow 2-.



Removing

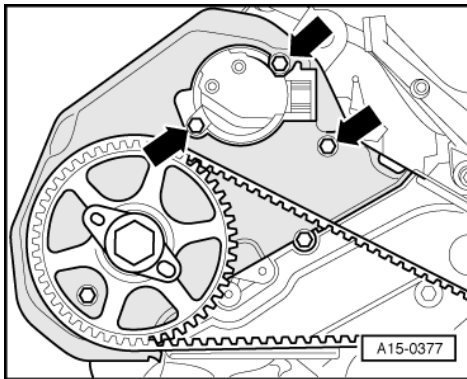
- -> Remove engine cover -arrows-.



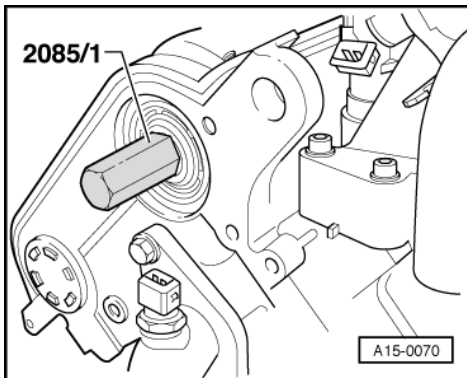
- -> Remove cover for right cylinder head cover -arrows-.
- Remove upper toothed belt guard on right.



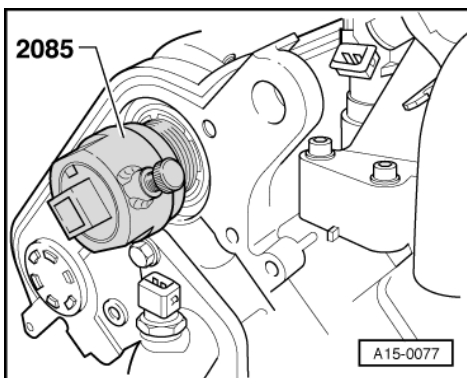
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- Detach connector from Hall sender.
- -> Unscrew bolts -arrows-.
- Pull toothed belt guard forwards slightly and remove Hall sender.
- Remove Hall sender trim -Item 96 .

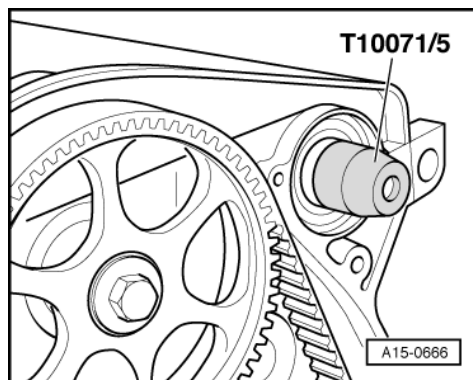


- -> Screw in bolts for oil seal extractor 2085/1.
- Adjust inner section of oil seal extractor 2085 until it is flush with the outer section.
- Unscrew inner section of oil seal extractor 3 turns and lock with knurled screw.



- -> Lubricate threaded head of oil seal extractor 2085, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Unscrew bolts for oil seal extractor 2085/1.
- Clean contact surface and sealing surface.

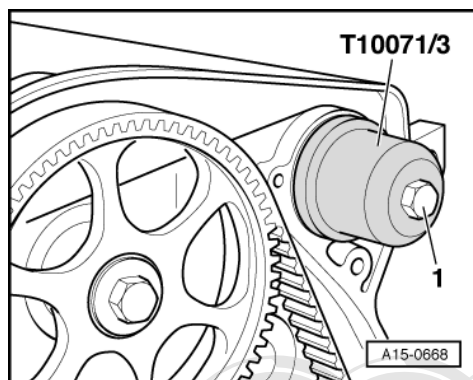
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Installing

Installation is carried out in the reverse order; note the following:

- -> Place guide sleeve T10071/5 onto crankshaft journal and secure with bolt M8 x 50.
- Before installing PTFE oil seals, check the rotation direction of the sealing ring.
 - Rotation direction, "right" (arrow on the sealing ring)
- Push oil seal via guide sleeve onto shaft journal.
- Remove guide sleeve.



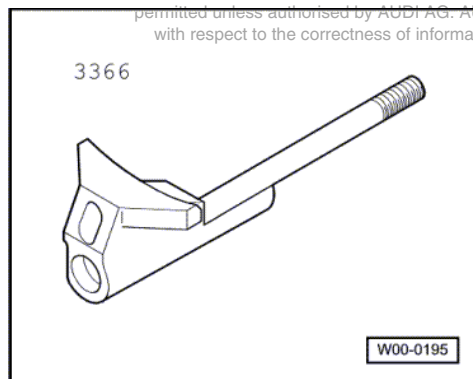
- -> Press oil seal in using thrust sleeve T10071/3 and bolt M8 x 60 up to stop.
- Install Hall sender => Page 96 .
- Install toothed belt guard (upper section).

Tightening torques

Component	Nm
Hall sender rotor to camshaft	25
Hall sender housing to cylinder head	10

2.6 - Removing and installing camshafts and camshaft adjuster

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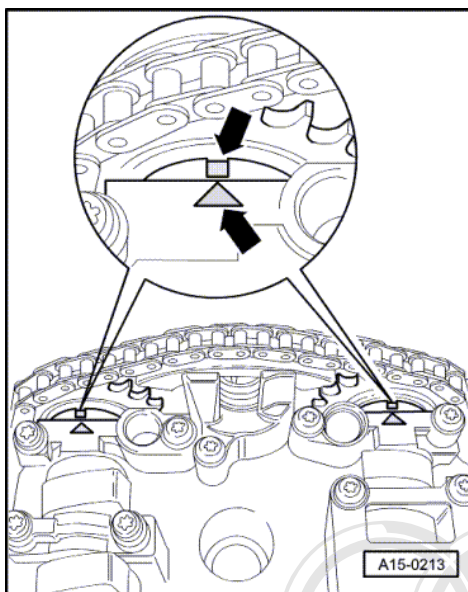
Special tools, workshop equipment, and other items required

- ♦ Retainer for chain tensioner 3366
- ♦ Sealants

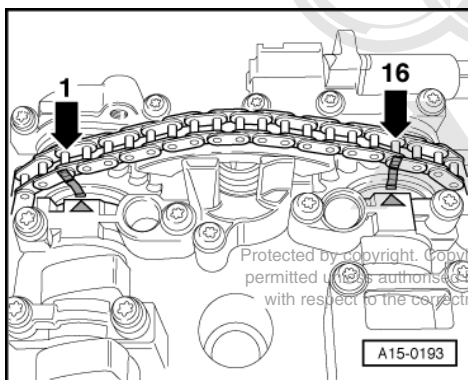
=> Parts List

Removing

- Remove toothed belt => Page 35 .
- Remove camshaft sprocket.
- Remove cylinder head cover => Page 79 .
- Unbolt rear toothed belt guard.
- Detach connector on camshaft adjuster.
- Remove the Hall sender -Item 96 .
- Turn crankshaft approx. 45° anti-clockwise at the securing bolt for the toothed belt sprocket, so that no piston is still at TDC.



- -> Re-check TDC position of camshafts:
- The marks on the two camshafts must align with the arrows on the bearing caps.



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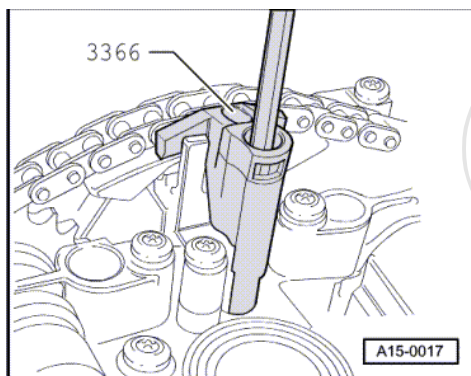
When reusing the old drive chain:

- Clean chain and camshaft sprockets opposite the two arrows on the bearing caps and mark installation position with colour marks.
- -> The distance between the two arrows or the colour markings are 16 rollers on the drive chain.
- The notch on the exhaust camshaft is offset slightly towards the inside in relation to chain roller -1-.



Note:

Do not mark chain with a centre punch or by making a notch or similar!



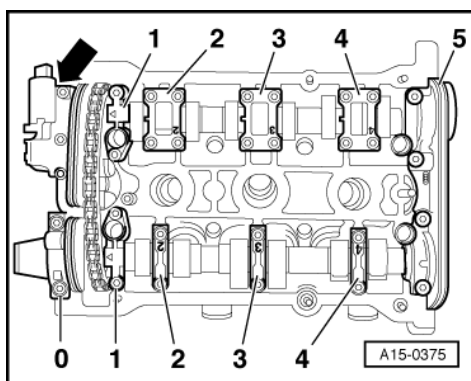
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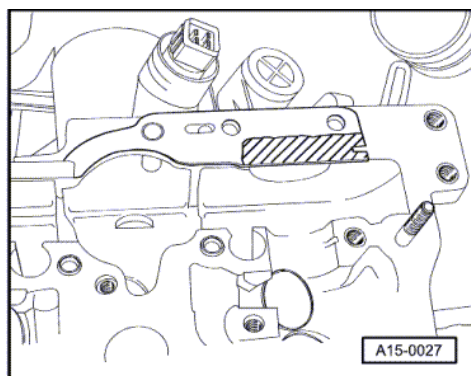
- -> Hold camshaft adjuster in position with bracket for chain tensioner 3366.

Note:

If the bracket for chain tensioner is tightened excessively, this can damage the camshaft adjuster.



- -> Mark sequence and installation position of all bearing caps as illustrated independent from the available markings on the bearing caps.
- Unscrew the securing bolts for the camshaft adjuster -arrow-.
- Unscrew bearing cap 0
- Unscrew bearing caps 1, 3 and 5 and lay onto clean surface according to sequence.
- Slacken off bearing caps 2 and 4 of inlet and exhaust camshafts alternately and diagonally, and remove.
- Lift out both camshafts together with the camshaft adjuster.



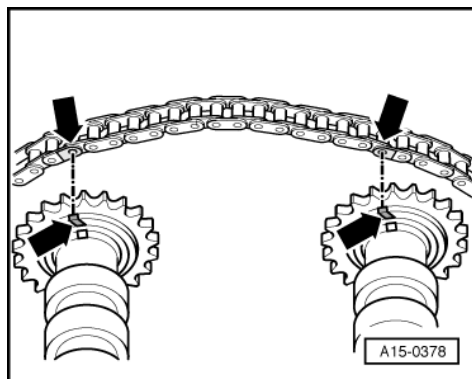
Installing

Installation is carried out in the reverse order; note the following:

- Replace the semi-circular sealing plug.
- -> Replace rubber/metal gasket for camshaft adjuster and apply a thin coat of sealant to the hatched area.
- Sealants

=> Parts List

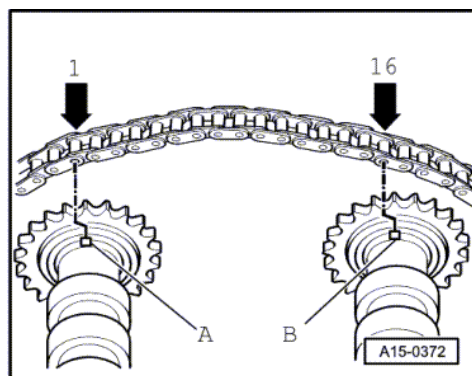
- Fit drive chain on camshaft sprockets as follows:



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When reusing the old drive chain:

- -> Move coloured markings -arrows- to cap.



When using a new drive chain:

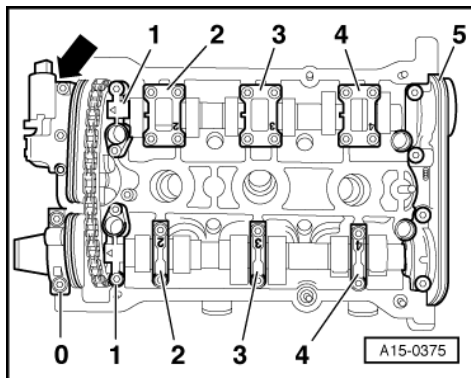
- -> The distance between the notches -A- and -B- on the camshafts must be 16 rollers at the drive chain. The illustration shows the exact positions of the 1st and 16th rollers on the sprockets.
- The chain rollers -1- and -16- are opposite the notches -A- and -B- and are misaligned by 1/2 tooth width towards left.

Continued:

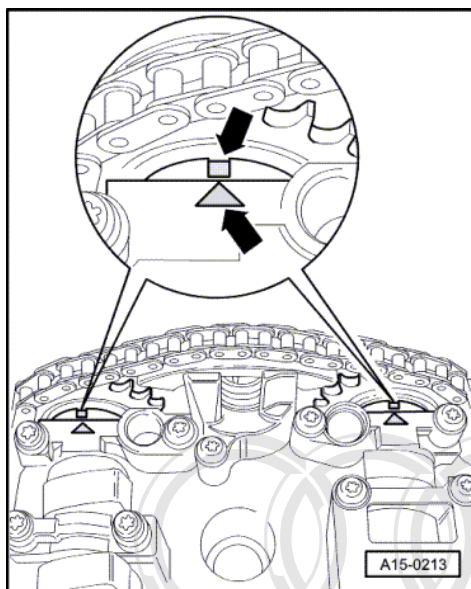
- Push camshaft adjuster between drive chain (2nd mechanic required).
- Position camshafts together with drive chain and camshaft adjuster on cylinder head.
- Oil running surfaces of both camshafts.

Note:

Dowel sleeves for bearing caps and camshaft adjuster must be located in cylinder head.



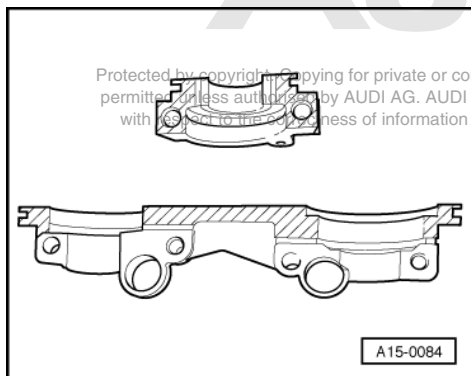
- -> Tighten camshaft adjuster -arrow- (note dowel sleeves).
- Install bearing caps 2 and 4 according to marking.
- Tighten bearing caps 2 and 4 of inlet and exhaust camshafts alternately and in diagonal sequence (note dowel sleeves).
- Fit the two bearing caps -1- to the chain sprockets on the inlet and exhaust camshafts.
- Remove holder for chain tensioner 3366.



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

Note:

In order for both markings to be okay, turn camshaft backwards or forwards slightly, if necessary.



- -> Coat the hatched area of the double bearing cap and the external bearing cap next to the camshaft adjuster thinly with sealant and install bearing cap (note dowel sleeves).

- Sealants

=> Parts List

- Fit the remaining bearing caps (note position of dowel sleeves).
- Replacing and installing new inlet and exhaust camshaft oil seals => Page 103 .
- Tighten the other bearing caps.
- Turn crankshaft approx. 45° clockwise at the securing bolt for the toothed belt sprocket back to TDC and secure crankshaft with clamping bolt.
- Install toothed belt (adjust valve timing) => Page 39 .
- Install cylinder head cover => Page 81 .

Notes:

- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ When working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

Tightening torques

Component	Nm
Bearing cap to cylinder head	10
Camshaft adjuster to cylinder head	10
Hall sender rotor to camshaft	25
Hall sender housing to cylinder head	10
Toothed belt guard at rear to cylinder head/cylinder block	10 1)

- 1) Install using locking compound; locking compound

=> Parts List

2.7 - Checking hydraulic bucket tappets

Special tools and workshop equipment required

- ♦ Feeler gauge
- ♦ Wood or plastic wedge

Notes:

- ♦ Hydraulic tappets cannot be adjusted or repaired.
- ♦ Irregular valve noise during starting is normal.

Test sequence

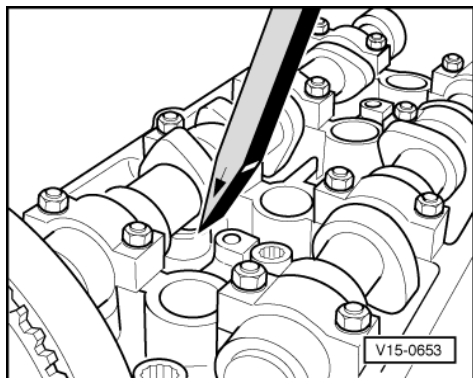
- Start engine and leave it running until coolant temperature has reached approx. 80 °C.
- Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

Note:

If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be fitted. Oil retention valve fitting location: Under the cover on the intake manifold => Page 141 .

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

- Remove cylinder head cover => Page 79 .



- Rotate crankshaft at the central bolt for toothed belt sprocket in clockwise direction until the cams of the cylinder to be checked are facing upwards.
- Determine play between cam and tappet.
- -> Use a wooden or plastic wedge to push down bucket tappet. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, replace tappet.
- Replacing bucket tappet => Removing camshafts, Page 106 .

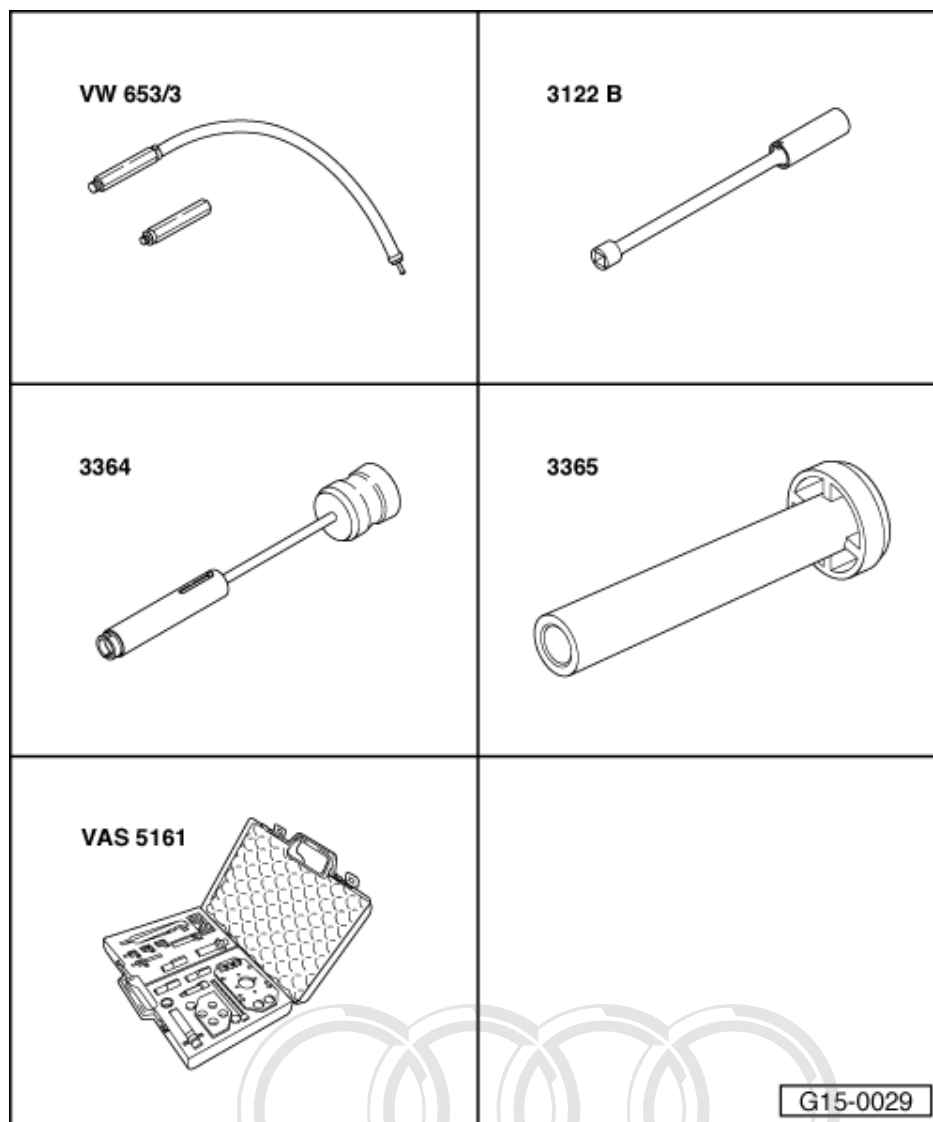
Notes:

- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ When working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.



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2.8 - Replacing valve stem seals



Special tools and workshop equipment required

- ◆ Pressure hose VW 653/3
- ◆ Spark plug socket 3122 B
- ◆ Puller 3364
- ◆ Fitting tool 3365
- ◆ Disassembly and assembly tool VAS 5161

Removing

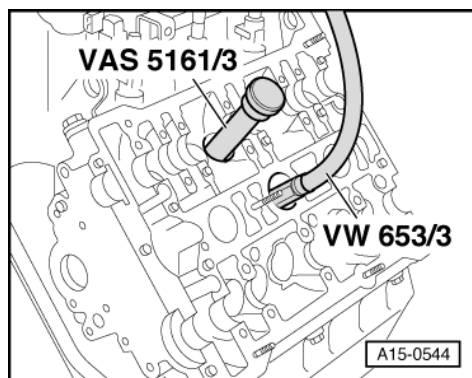
- **Cylinder head installed**
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- Removing camshafts => Page 106 .

Notes:

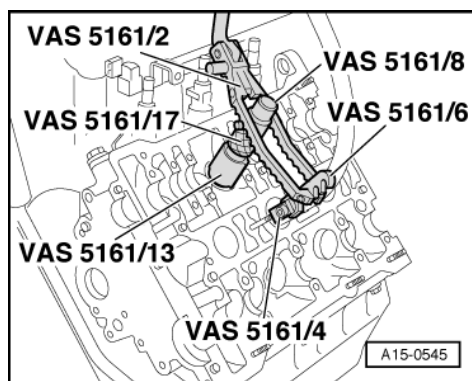
- ◆ Make sure that the bucket tappets are not interchanged.
- ◆ Mark allocation of bucket tappets on rear with a waterproof felt-tip pen.
- Remove the bucket tappets from guides and put them down with the contact surface downwards.
- Remove spark plugs with spark plug spanner 3122B.



- Set piston of appropriate cylinder to "bottom dead centre".

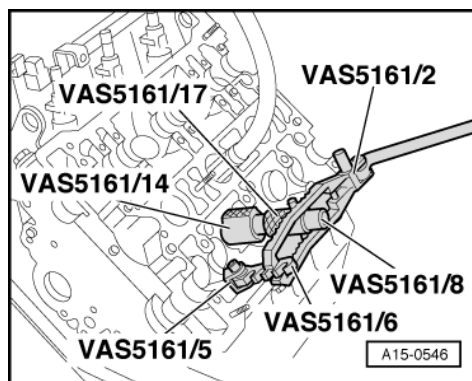


- -> Screw in the pressure hose VW 653/3 into spark plug thread and put under constant pressure; at least 6 bar pressure.
- Install pin VAS 5161/3 into bucket tappet guide.
- Loosen the valve wedges on all five valves with plastic hammer.



Inlet side:

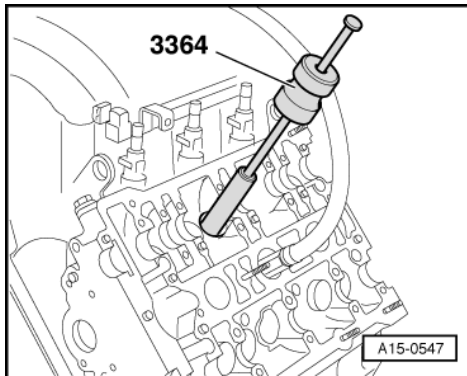
- -> Screw the catch part VAS 5161/6 with insertion fork VAS 5161/4 onto a stud on the cylinder head.
- Push guide bush VAS 5161/13 into bucket tappet guide of the valve to be removed until limit stop.
 - Installation position: Corrugated surfaces are transverse to the driving direction.
- Push knurled distance ring VAS 5161/17 onto the assembly cartridge VAS 5161/8.
- Push the assembly cartridge into the guide sleeve.
- Attach pressure fork VAS 5161/2 to catch part VAS 5161/6 and push assembly cartridge down.
- At the same time turn knurled screw of assembly cartridge towards the right until the tips of the valve wedges engage.
- Slightly move the knurled screw back and forth. This causes the valve wedges to be pressed apart and taken into the cartridge.
- Release the pressure fork.
- Remove assembly cartridge with spacer ring, guide bush, valve plate and valve spring.



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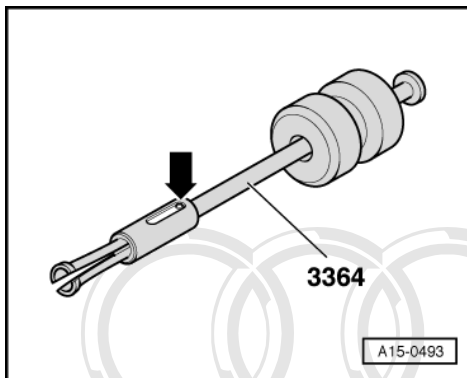
Exhaust side

- -> Screw in catch part VAS 5161/6 with attachment fork VAS 5161/5 into a threaded bore on the cylinder head.
- Push guide bush VAS 5161/14 into bucket tappet guide of the valve to be removed until limit stop.
 - Installation position: Corrugated surfaces are transverse to the driving direction.
- Push knurled distance ring VAS 5161/17 onto the assembly cartridge VAS 5161/8.
- Push the assembly cartridge into the guide sleeve.
- Attach pressure fork VAS 5161/2 to catch part VAS 5161/6 and push assembly cartridge down.
- At the same time turn knurled screw of assembly cartridge towards the right until the tips of the valve wedges engage.
- Slightly move the knurled screw back and forth. This causes the valve wedges to be pressed apart and taken into the cartridge.
- Release the pressure fork.
- Remove assembly cartridge with spacer ring, guide bush, valve plate and valve spring.



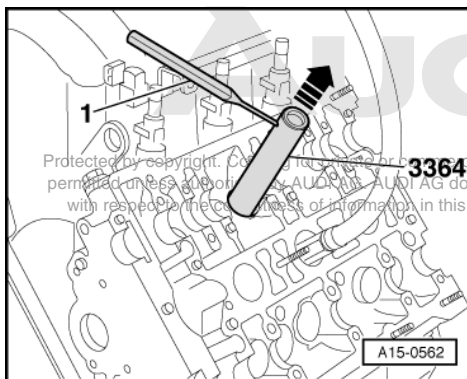
Continued for both sides of the vehicle:

- -> Use 3364 to remove valve stem seals.



If the puller tool 3364 cannot be used due to tight space in some of the valve stem seals proceed as follows:

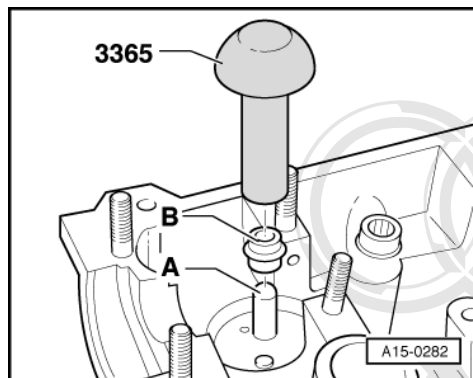
- -> Drive out spring pin -arrow- of the puller tool 3364 using a drift and remove puller attachment.



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- -> Attach lower part of puller tool 3364 to valve stem seal.
- Secure puller tool 3364 with a drift or pin punch -1-, as illustrated.
- Attach an assembly lever at puller tool 3364 and remove valve stem seal -arrow-.



Installing

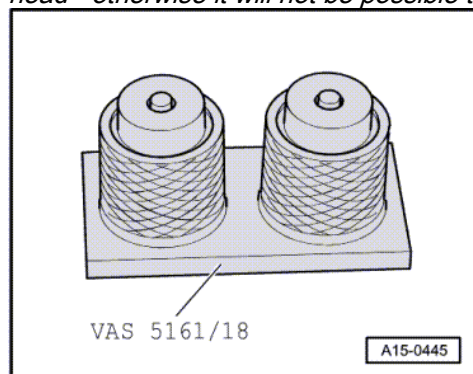
Note:

A plastic sleeve -A- is included with the new valve stem seals.

- -> To prevent damage to the new valve stem seals -B-, place plastic sleeve -A- on valve stem.
- Lightly lubricate sealing lip of valve stem seal.
- Push valve stem seal onto plastic sleeve.
- Carefully press the valve stem seal onto valve guide using press tool 3365.
- Remove plastic sleeve again.

Note:

When inserting the valve springs for the exhaust valves, ensure that they are seated correctly in the cylinder head - otherwise it will not be possible to continue assembly.

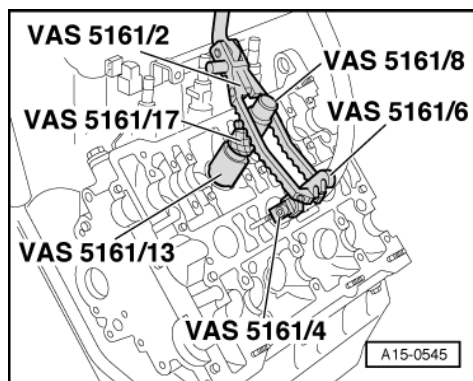


- -> If the valve wedges were taken out of the assembly cartridge they must first be inserted into the installing tool VAS 5161/18.

Note:

The large diameter of the valve wedges points upwards.

- Push assembly cartridge VAS 5161/8 from the top onto installing tool and take up the valve wedges.



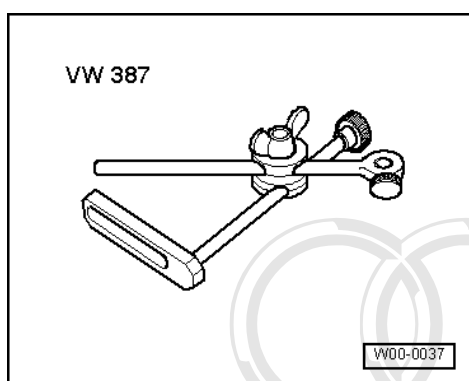
- -> Insert the assembly cartridge VAS 5161/8 into guide bush VAS 5161/13 or VAS 5161/14 again.
- Push pressure fork down and pull knurled screw upwards by turning to left and right - thus the valve wedges are installed.
- Take load of the pressure fork when knurled screw is still tight.
- Insert bucket tappet.

- Removing and installing camshafts and camshaft adjuster => Page 109

Notes:

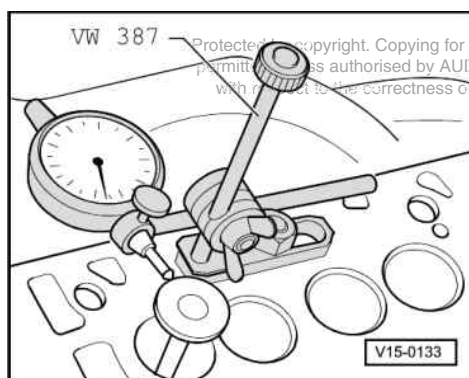
- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

2.9 - Checking valve guides



Special tools and workshop equipment required

- ♦ Universal dial gauge bracket VW 387
- ♦ Dial gauge



Test sequence

- -> Set valve in guide. The end of the valve stem is flush with guide. Due to the slight difference in stem diameters. Ensure that only an inlet valve is used in the inlet guide and an exhaust valve in the exhaust guide.
- Determine rock.



Wear limit

Inlet valve guide	Exhaust valve guide
0.80 mm	0.80 mm

Notes:

- ♦ If the wear limit is exceeded, repeat the measurement with new valves. If the wear limit is again exceeded, replace the cylinder head. The valve guides cannot be replaced.
- ♦ If the valve must be replaced as part of a repair, use a new valve for the calculation.

2.10 - Checking valves

- Visually inspect stem and seat for scoring. Replace valves in the case of severe scoring.

2.11 - Reworking valve seats

Note:

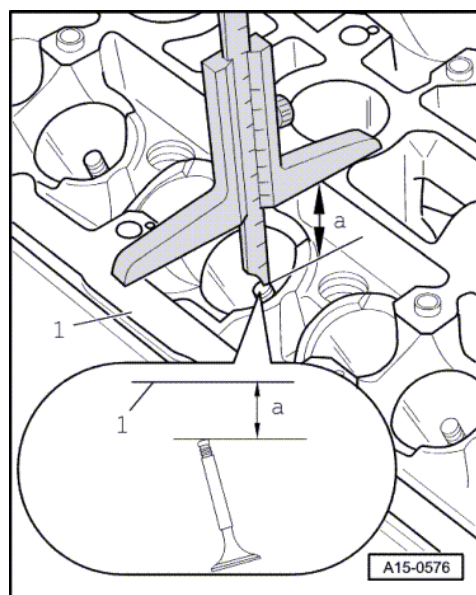
If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (re-worked):

Special tools and workshop equipment required

- ♦ Depth gauge
- ♦ Valve seat machining tool

Notes:

- ♦ When repairing engines with leaking valves, it is not sufficient to reface the valve seats and replace the valves. The valve guides must also be checked for wear. This is particularly important on high mileage engines => Page 117 .
- ♦ Only rework the valve seats as far as is necessary to ensure a good seating pattern.
- ♦ Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.
- ♦ If the maximum reworking dimension is exceeded, the hydraulic tappets will not work properly and the cylinder head will have to be replaced.



Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

Note:

If the valve must be replaced as part of a repair, use a new valve for the calculation.

- -> Measure distance -a- between valve shaft end (upper edge) and upper cylinder head area with a depth gauge.
- Calculate max. permissible reworking dimension from measured distance and minimum dimension.

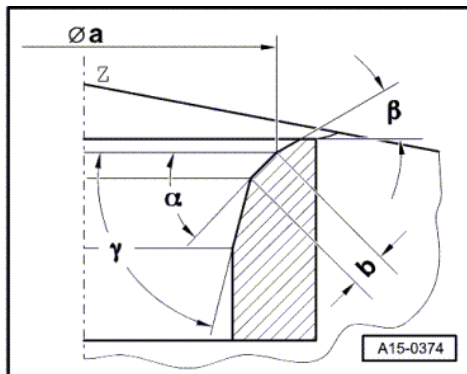
Minimum dimensions		
Outer inlet valves	Central inlet valve	Exhaust valves
31.0 mm	32.2 mm	31.9 mm

Measured distance minus minimum dimension
= max. permissible reworking dimension.

Example (for outer inlet valve):	
Measured distance	31.4 mm
- Minimum dimension	-31.0 mm
= Max. permissible reworking dim.	= 0.4 mm

Note:

If the maximum permissible reworking dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the measured result is again 0 mm or less than 0 mm, replace the cylinder head.



-> Rework valve seats

Inlet valve seat	
a	= $\varnothing 26.2$ mm
b	= 1.5...1.8 mm
Z	= Lower surface of cylinder head
α	= 45° valve seat angle
β	= 30° upper correction angle
γ	= 60° lower correction angle

Exhaust valve seat	
a	= $\varnothing 29.0$ mm
b	= approx. 1.8 mm
Z	= Lower surface of cylinder head



Exhaust valve seat

α = 45° valve seat angle

β = 30° upper correction angle

γ = 60° lower correction angle

3 - Checking camshaft timing control

3.1 - Checking camshaft timing control

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The adjustment of the intake camshaft is dependent on the engine load and engine speed. Oil pressure is applied to the camshaft adjuster (mechanical adjustment device) via the electrical solenoid valve for camshaft adjustment.

Note:

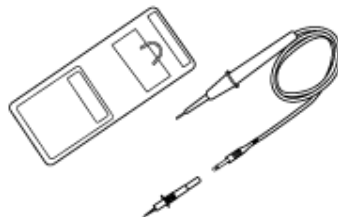
Camshaft timing control only becomes active 25 seconds after starting engine.

3.2 - Checking camshaft adjustment solenoid valves

V.A.G 1526 A



V.A.G 1527 B



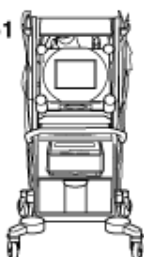
V.A.G 1594 A



V.A.G 1598/22



VAS 5051



G15-0056

Special tools and workshop equipment required

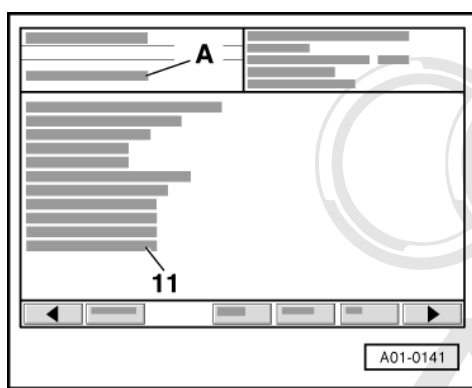
- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

Test requirements:

- Vehicle diagnostic, testing and information system VAS 5051 connected, vehicle self-diagnosis and vehicle system "01 - Engine electronics" selected.

Test sequence

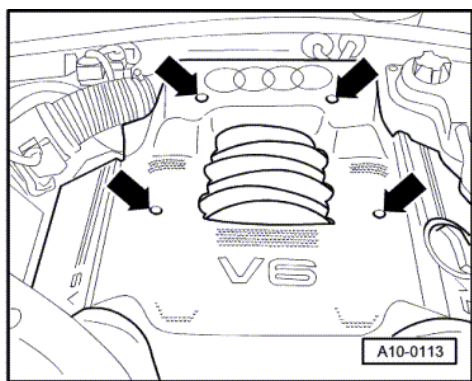
- Initiate the final control diagnosis and actuate solenoid valves for inlet camshaft adjuster.



-> Display on VAS 5051:

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- A - 11th control element in test
 - 11 - Camshaft adjuster 1 (camshaft adjustment valve 1 -N205 and camshaft adjustment valve 2 -N208)

- ♦ Both camshaft adjustment solenoid valves are actuated (click).
- Exit function "03 - Final control diagnosis" by pressing the ◀ key.



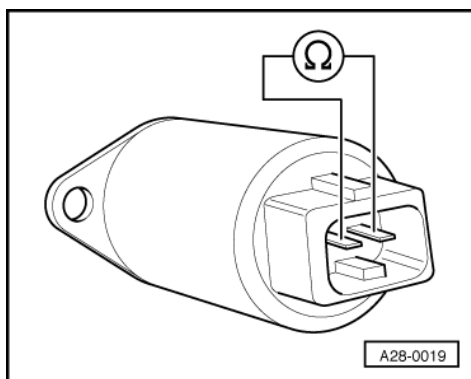
If one of the valves is not actuated (does not click):

Electrical test of the camshaft adjustment solenoid valves

- Switch ignition off.
- -> Remove engine cover -arrows-.



- Remove air duct hose between air mass meter and air duct at intake manifold.



Checking internal resistance

- Detach relevant plug from solenoid valve.
- ➔ Connect multimeter to injector to measure resistance.
 - Specification: 10...18 Ω

If specification is not attained:

- Replace valve.

Checking power supply

Test requirements:

- Fuse for solenoid valve for camshaft adjustment OK

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

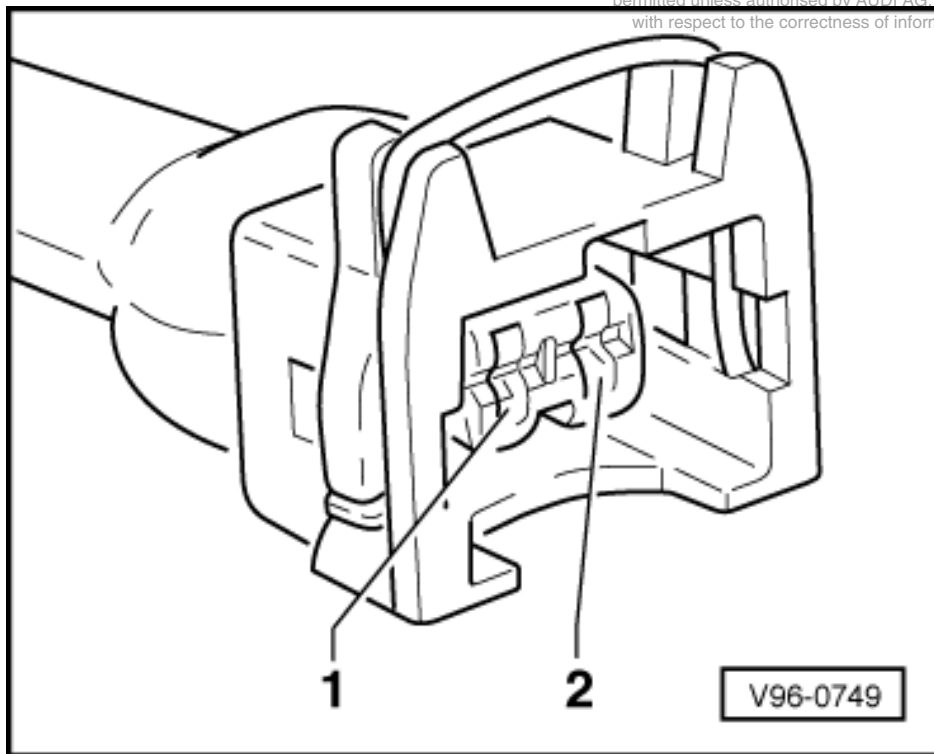
- Fuel pump relay OK.

Note:

Power for the camshaft adjustment solenoid valves is supplied via the fuel pump relay.

- Unplug connector from relevant solenoid valve.

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

Connector Contact	Measure to
1	Engine earth

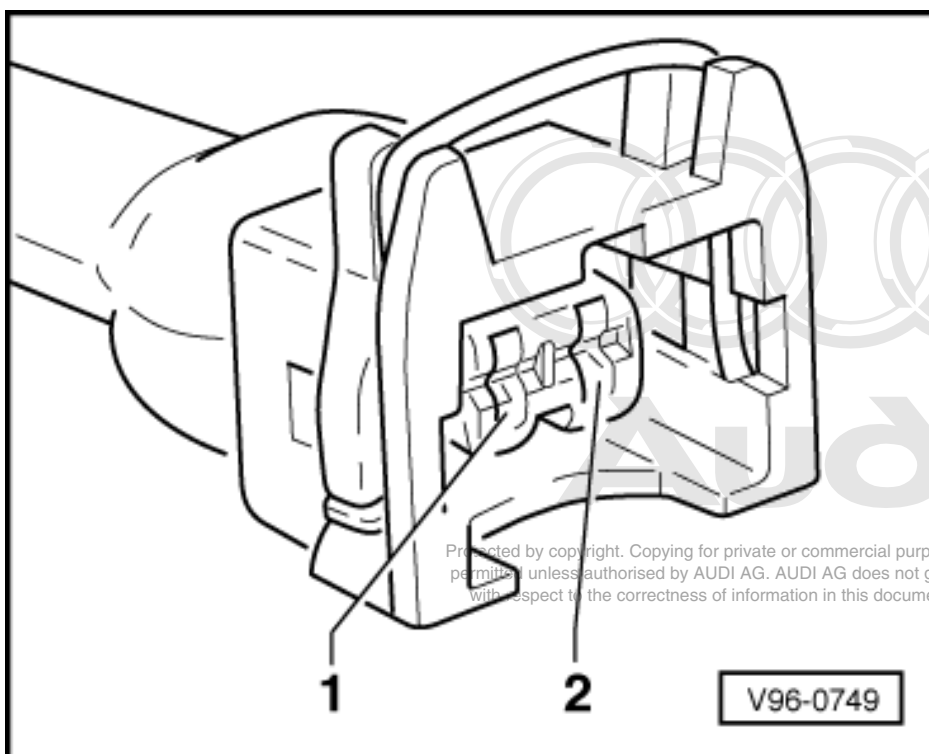
- Operate starter briefly.
 - The LED should illuminate.

If the LED does not illuminate:

- Check the wiring from contact 1 on the connector via the fuse to the fuel pump relay for an open circuit:

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify open circuit, if necessary.



Checking actuation

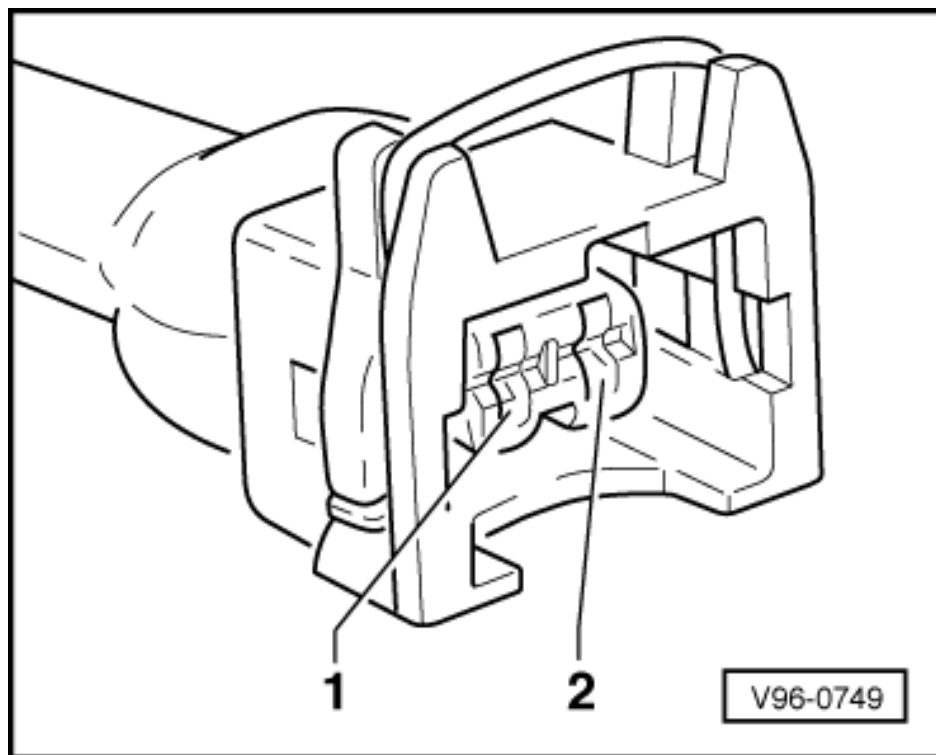
If the LED illuminates:

- -> Connect voltage tester V.A.G 1527 B to contacts 1 (positive) and 2 of the connector.
- Initiate the final control diagnosis and actuate camshaft adjustment valves:
 - The LED should flash.

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

- Connect test box V.A.G 1598/22 or V.A.G 1598/31 to wiring harness leading to engine control unit; the engine control unit should not be connected.

=> Motronic Injection and Ignition System; Repair group 24



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

Connector Contact	Test box V.A.G 1598/22 Socket
2	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- If necessary, rectify short circuit to earth or open circuit.

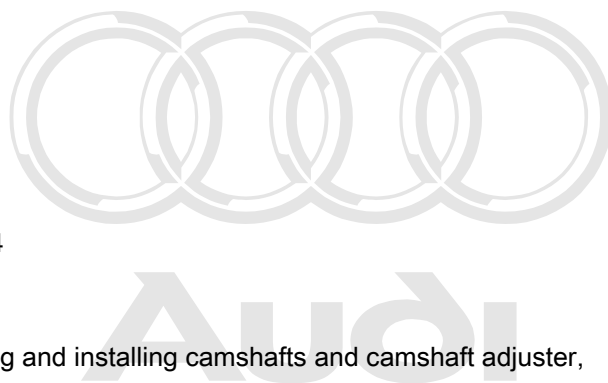
If the wiring is OK:

- Fit a new engine control unit:

=> Motronic Injection and Ignition System; Repair group 24

If no fault is found:

- Replace the mechanical camshaft adjuster => Removing and installing camshafts and camshaft adjuster, Page 106 .



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17 - Lubrication

1 - Removing and installing parts of the lubrication system

1.1 - Removing and installing parts of the lubrication system

Notes:

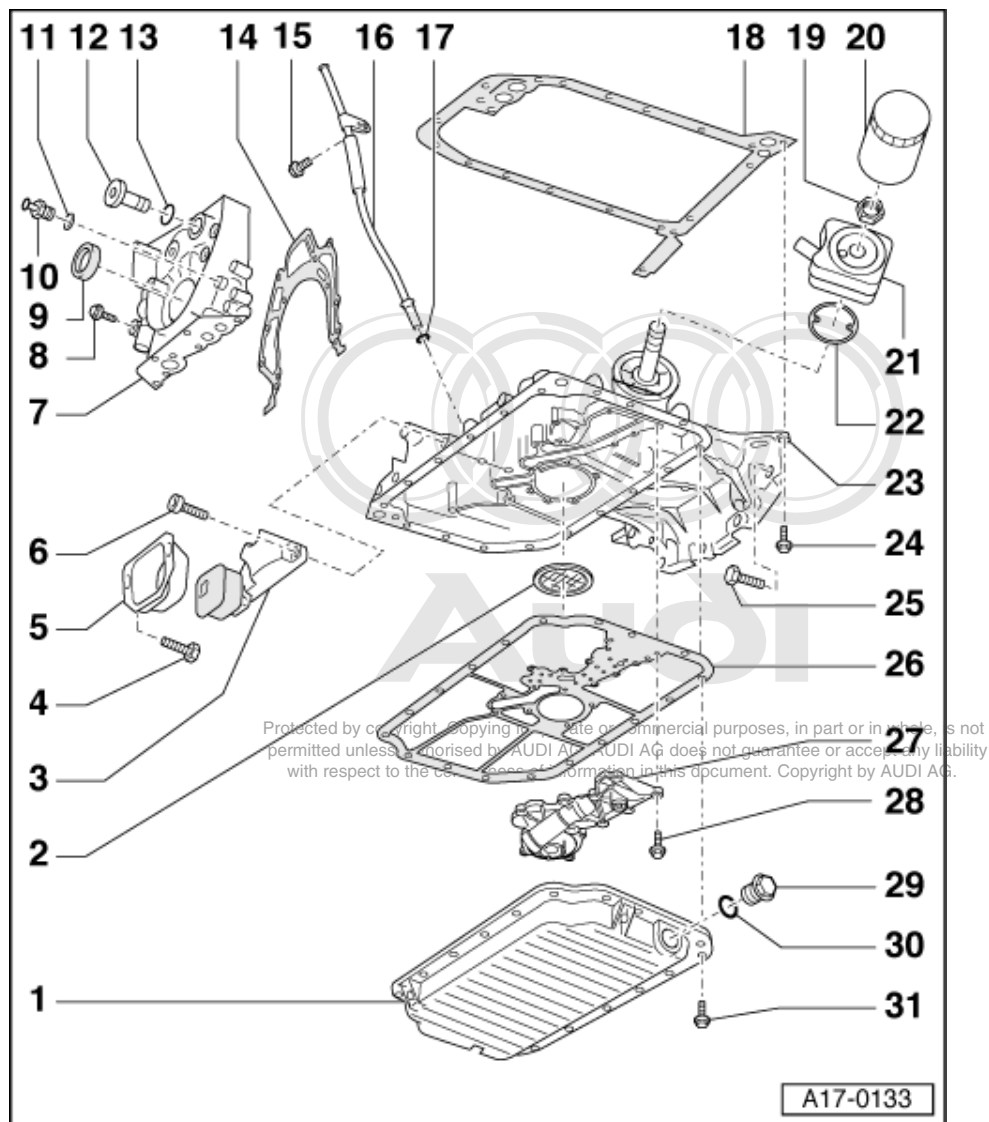
- ♦ If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler replaced in order to prevent further damage occurring later.
- ♦ The oil level must not be above max. mark on dipstick - danger of damage to catalytic converter.
- ♦ Oil spray jet for piston cooling
=> Fig. 130.

Viscosity grades and oil specifications:

=> Maintenance Manual

Oil system capacity:

=> Exhaust Emission Test binder



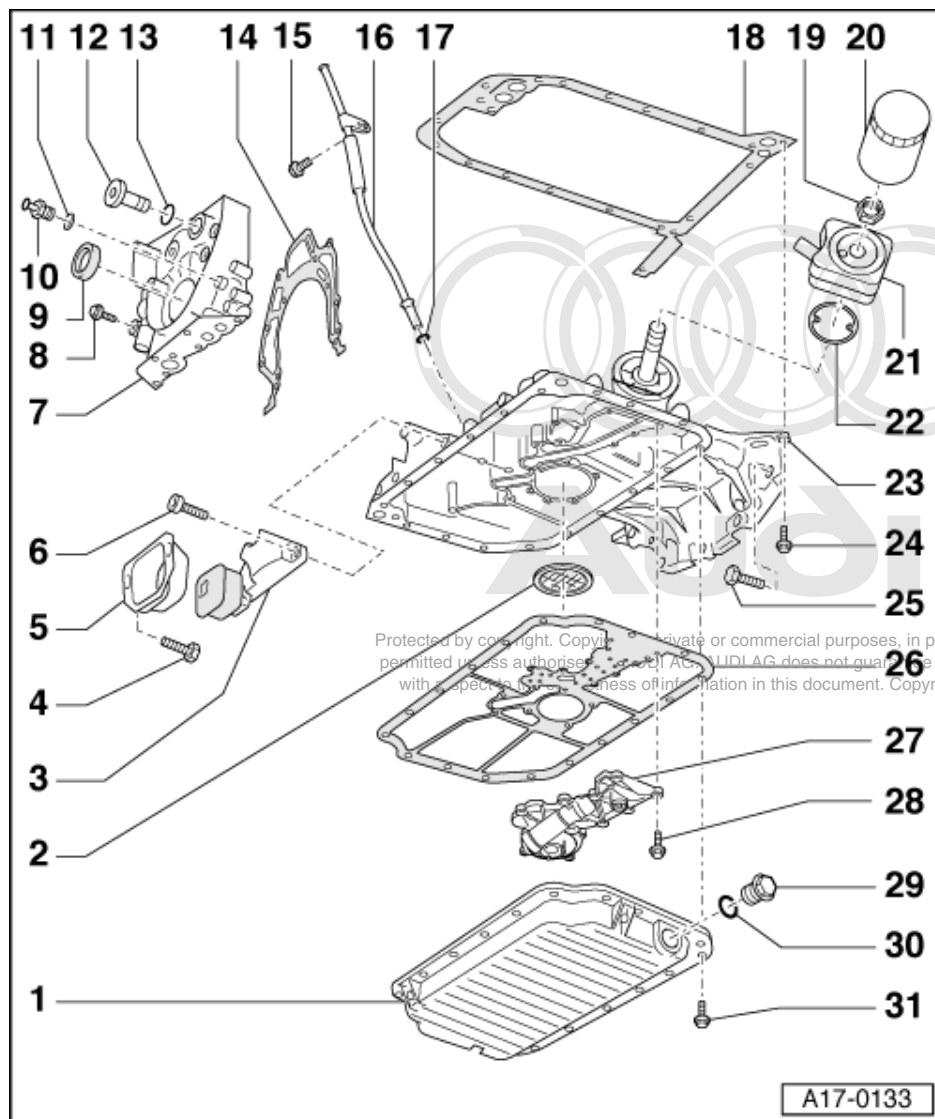
-
- 11 12 13 14 15 16 17 18 19 20
- 10 9 8 7
- 6 5 4 3 2
- 21 22 23 24 25 26 27 28 29 30 31
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- A17-0133

- 126 17 - Lubrication

11 Sealing ring

- ♦ If seal is leaking, cut open and replace.

12 Spray nozzle valve - 40 Nm



13 O-ring

- ♦ Replace

14 Seal

- ♦ Replace

15 10 Nm

16 Guide tube

- ♦ For dipstick

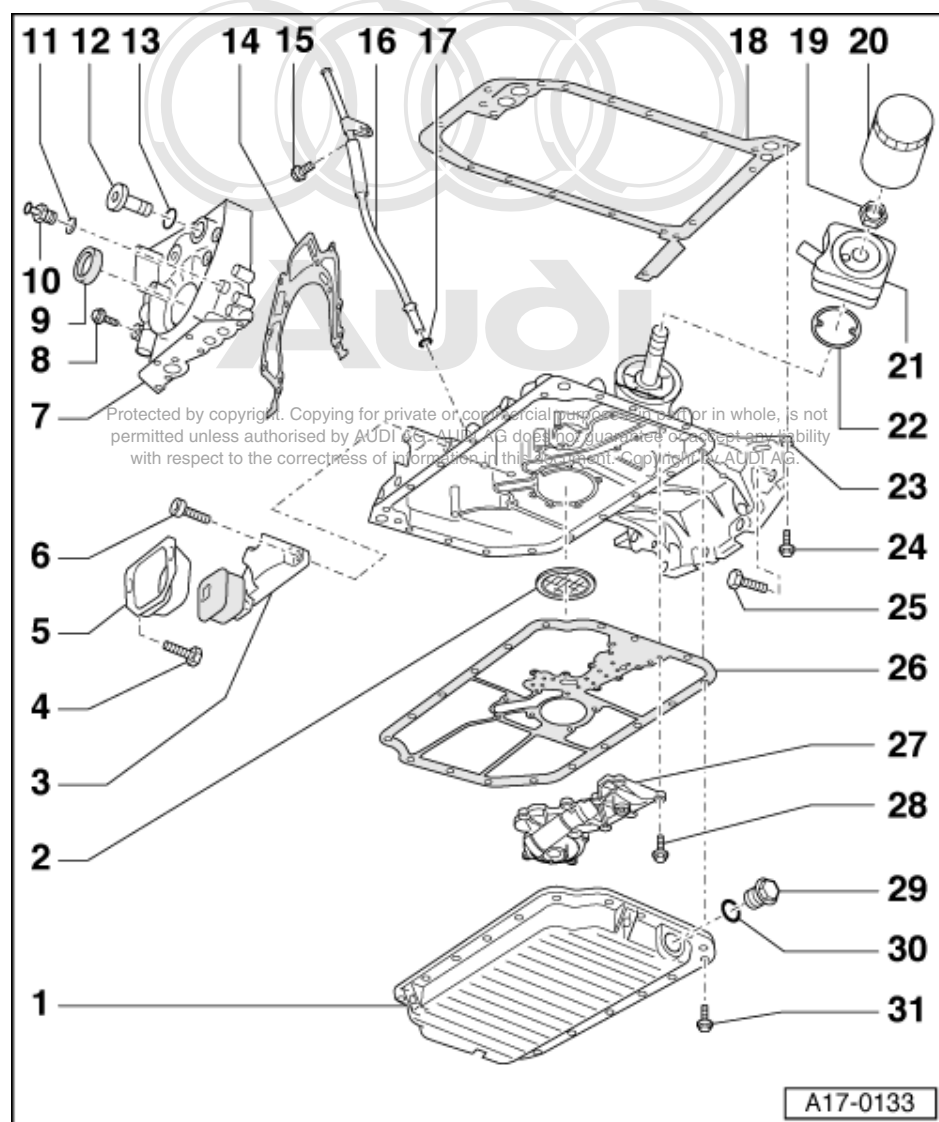
17 O-ring

- ♦ Replace

18 Seal

- ♦ Replace
- ♦ Install dry
- ♦ no additional sealant is required

19 30 Nm

**20 Oil filter**

- ♦ Observe change intervals

=> Maintenance Manual

- ♦ Loosen with oil filter wrench 3417
- ♦ Observe installation instructions on oil filter
- ♦ Tighten to 20 Nm

21 Fluid cooler

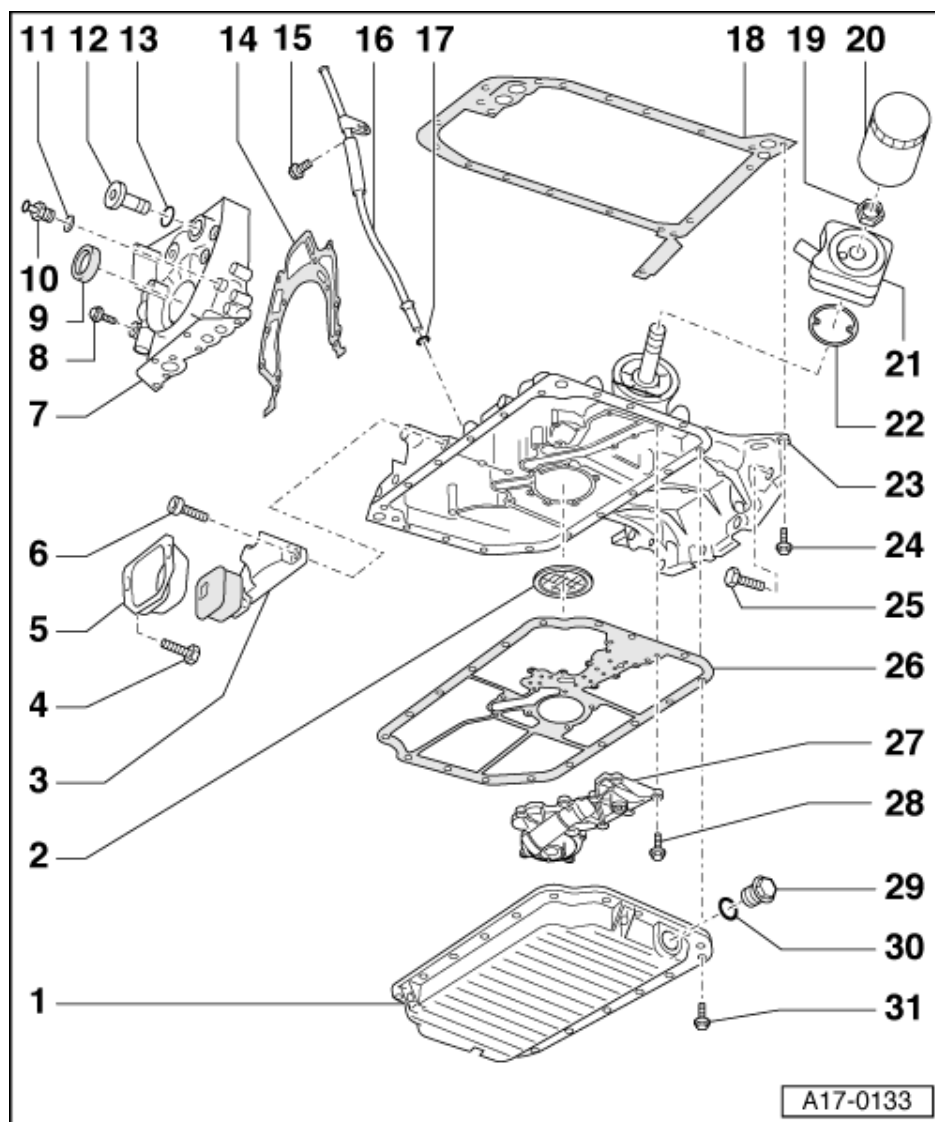
- ♦ See note =>Page **125** .

22 Seal

- ♦ Replace
- ♦ Engage in projections on oil cooler

23 Oil pan (upper section)

- ♦ Removing and installing
=>Page **133** .



24 10 Nm

- ♦ Tighten in stages and in diagonal sequence

25 M8 - 25 Nm

M10 - 45 Nm

26 Seal

- ♦ Replace
- ♦ To replace, remove -Item 27 -

27 Cap

28 10 Nm

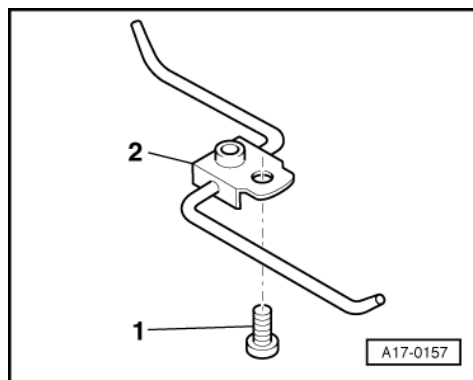
29 Oil drain plug, 40 Nm

30 Sealing ring

- ♦ Replace

31 10 Nm

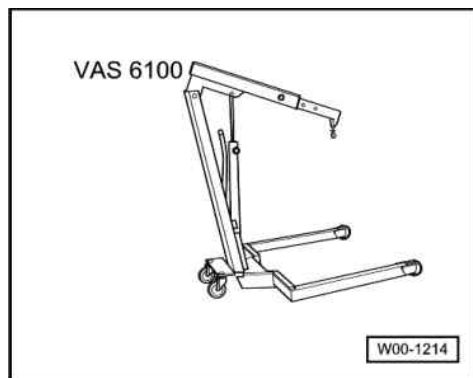
- ♦ Tighten in stages and in diagonal sequence
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-> Fig.1 Oil spray jet for piston cooling

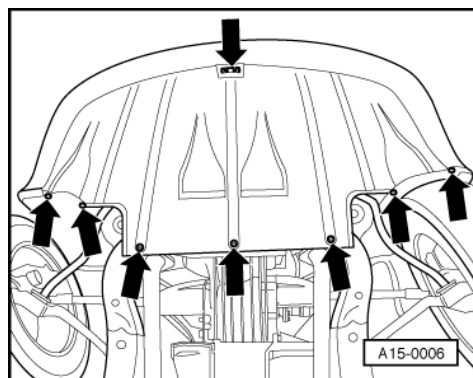
- 1 - Bolt - 10 Nm
- 2 - Oil spray jet for piston cooling

1.2 - Removing and installing lower section of oil pan



Special tools and workshop equipment required

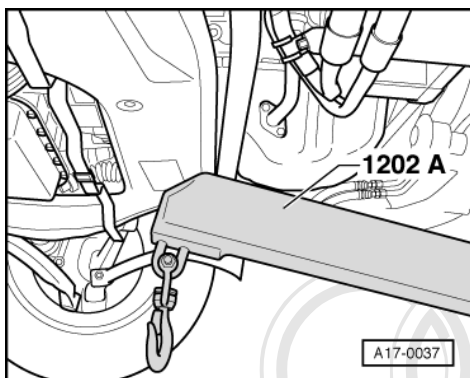
- ♦ Workshop crane VAS 6100
- or
- ♦ Workshop crane V.A.G 1202 A



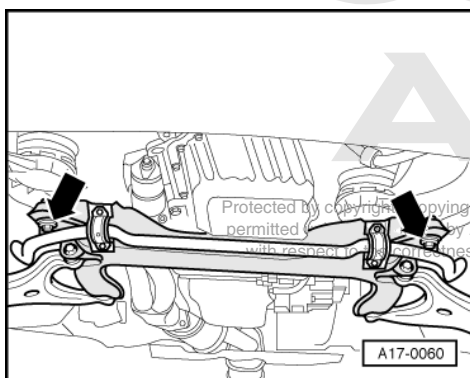
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Removing

- -> Remove the noise insulation -arrows-.
- Drain engine oil.



- -> Support subframe with workshop crane VAS 6100 or V.A.G 1202 A.



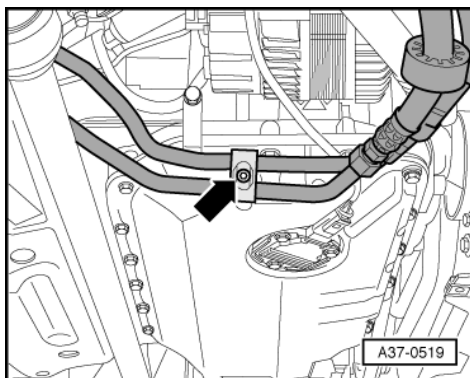
- -> Unscrew front bolts -arrows- of subframe.
- Slowly lower subframe with workshop crane VAS 6100 or V.A.G 1202 A.

Important

The subframe is lowered by releasing the bolts approx. 100 mm.

Note:

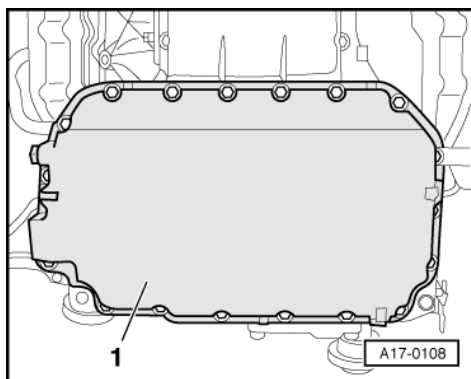
The subframe should be detached and lowered at the front only, otherwise it will be necessary to check wheel alignment.





Vehicles with automatic gearbox:

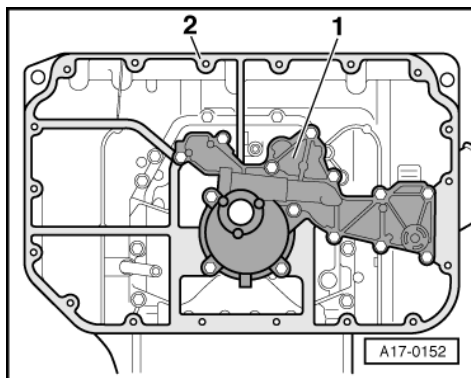
- -> Unscrew the ATF line at the oil pan -arrow-.



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All models:

- -> Unbolt lower section of oil pan -1- and remove carefully.



- Place drip tray underneath.
- -> Remove sealing cap - 1-.
- Remove seal -2-.

Installing

Installation is carried out in the reverse order; note the following:

Note:

Replace seals and gaskets.

- Clean sealing surfaces before installing lower section of oil pan.
- Apply seal -2- for lower section of oil pan.
- Screw on sealing cap -1-.
- Fit lower section of oil pan and tighten all bolts initially to 5 Nm in diagonal sequence.
- Then tighten bolts securing lower section of oil pan to 10 Nm in diagonal sequence.
- Fitting subframe with new bolts:

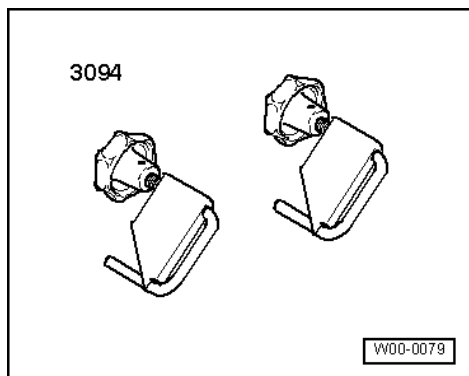
=> Running Gear, FWD and 4WD; Repair group 40

- Fill up with engine oil and check oil level.

Tightening torques

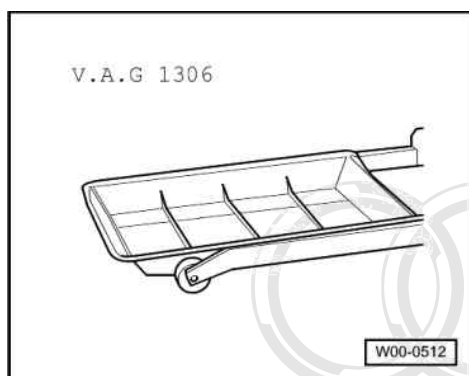
Component	Nm
Sealing cap to upper section of oil pan	10
Lower section of oil pan to upper section of oil pan	10
Oil drain plug	40

1.3 - Removing and installing upper section of oil pan

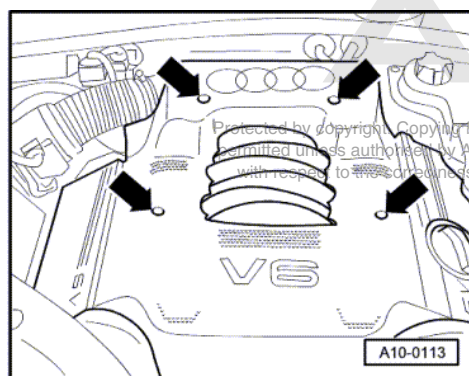


Special tools and workshop equipment required

- ◆ Hose clamps 3094



- ◆ Drip tray V.A.G 1306
- ◆ Drip tray



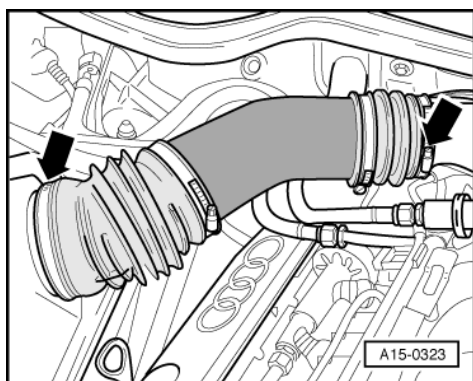


Removing

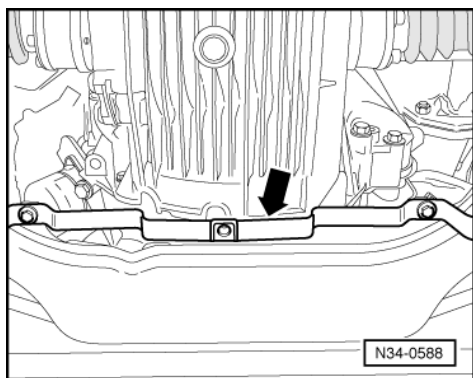
- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

=> General Body Assembly; Repair group 72

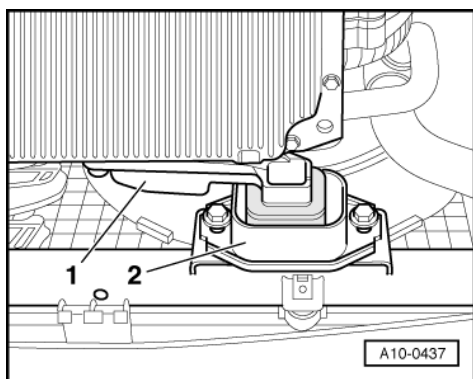
- Disconnect earth strap at battery with ignition switched off.
- -> Remove engine cover -arrows-.



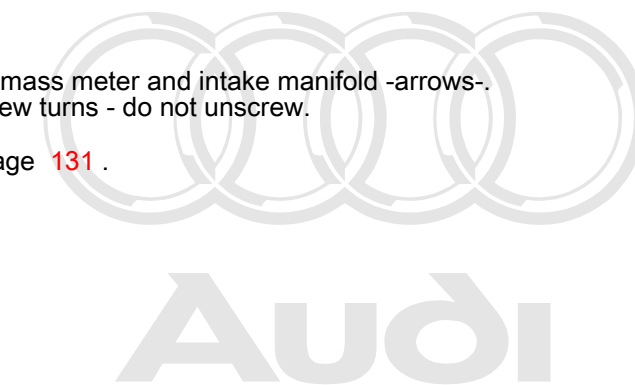
- -> Remove air duct hose between air mass meter and intake manifold -arrows-.
- Loosen upper starter securing bolt a few turns - do not unscrew.
- Pull out oil dipstick.
- Remove lower section of oil pan =>Page 131 .



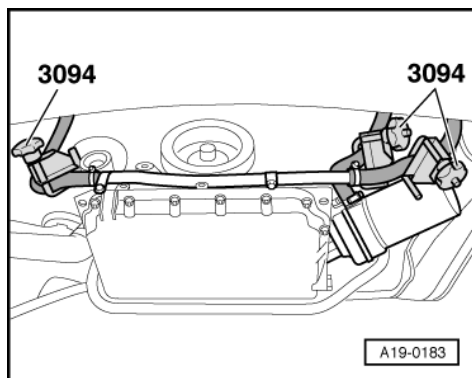
- -> Unbolt bracket for noise insulation -arrow-.



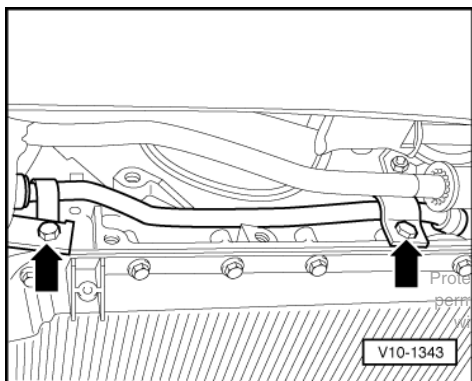
- -> Unscrew torque reaction support -1- and the torque reaction support stop -2-.



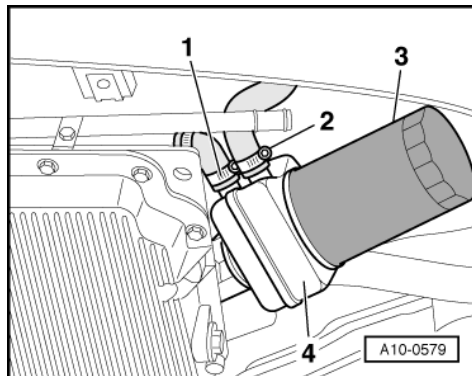
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- -> Clamp off coolant hoses to oil cooler and coolant pipe using 3 hose clamps 3094.



- -> Unscrew coolant pipe from oil pan -arrows-.

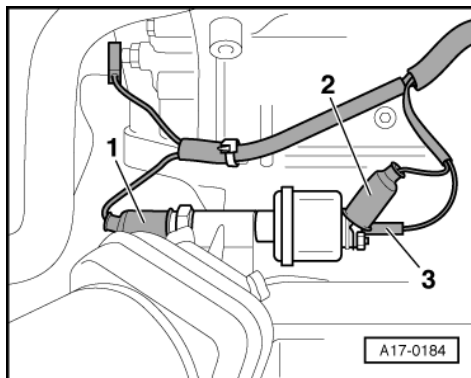


- Place drip tray V.A.G 1306 below engine.
- -> Detach hoses -1- and -2- from oil cooler -4-.

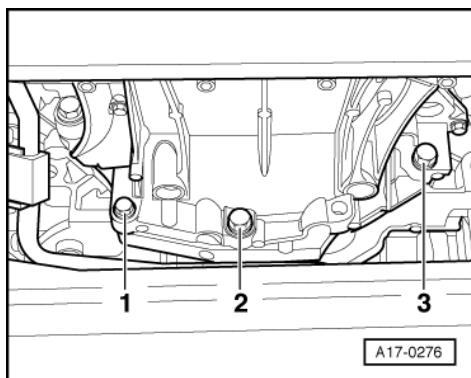
Note:

If the same oil pan upper section is re-installed, the oil filter and oil cooler need not be removed. Otherwise:

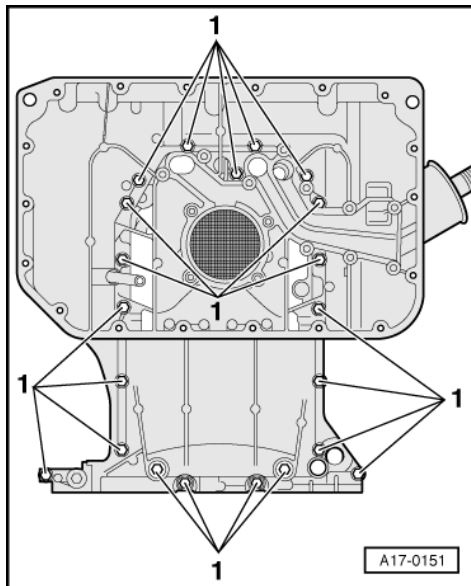
- Place drip tray underneath.
- Remove oil filter -3-.
- Remove oil cooler.
- Unscrew lower starter securing bolt and leave starter suspended from upper securing bolt.



- -> Disconnect wires -1...3-.



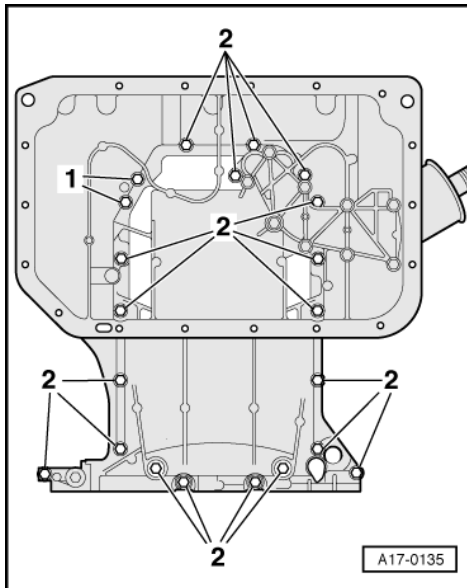
- -> Unscrew connecting bolts -1 ... 3- for engine/gearbox in oil pan upper section area.



- -> Unscrew bolts -1- for upper section of oil pan.
- Press upper section of oil pan off dowel sleeves on cylinder block.
- Remove upper section of oil pan.



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Installing

Installation is carried out in the reverse order; note the following:

Note:

Always replace self-locking nuts, seals and gaskets.

- Clean sealing surfaces before installing upper section of oil pan.
- Replace the O-ring on the dipstick guide tube.
- -> Fit upper section of oil pan and tighten bolts -1- and -2- securing upper section of oil pan to cylinder block initially to 5 Nm in diagonal sequence.
- Check that the dipstick guide tube is correctly located in the oil pan upper section.
- Tighten bolts securing oil pan upper section to gearbox.
 - Tightening torque for bolts M8: 25 Nm
 - M10 bolt tightening torque: 45 Nm
- Tighten bolts on upper section of oil pan/cylinder block in diagonal sequence to 10 Nm.
- Install lower section of oil pan =>Page 132 .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts to 40 Nm.
- Fill up with engine oil and check oil level.
- Top up coolant => Page 151 .

Notes:

- ◆ When the battery is reconnected make sure that the vehicle equipment (radio, clock, electrical window lifter) is activated according to the operating instructions.
- ◆ Further measures after reconnection of voltage supply:

=> Motronic Injection and Ignition System; Repair group 24

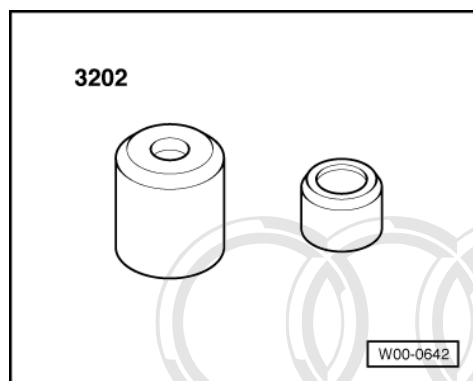
Tightening torques

Component		Nm
Upper section of oil pan to cylinder block		10
Upper section of oil pan to gearbox	M8	25
	M10	45
Oil cooler to upper section of oil pan		30
Torque reaction support to upper section of oil pan		42



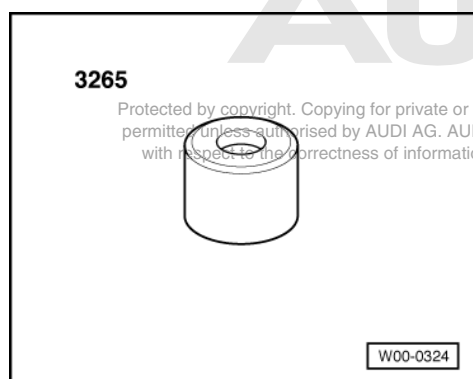
Component		Nm
Torque reaction support limit stop to body		40
Starter to engine/gearbox	M10	45
	M12	65

1.4 - Removing and installing oil pump

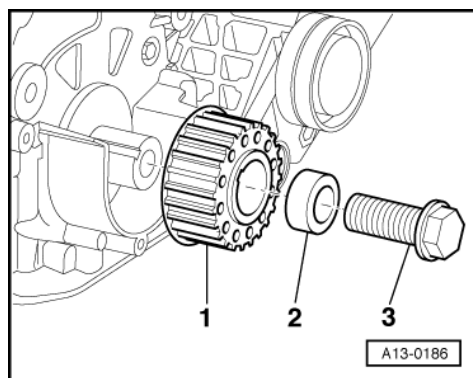


Special tools and workshop equipment required

- ♦ Fitting sleeve 3202/1



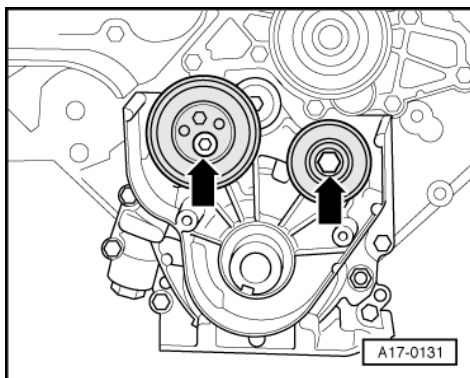
- ♦ Insertion sleeve 3265



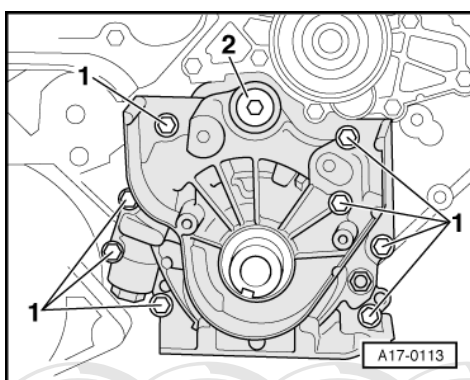
Removing

- Remove toothed belt => Page 35 .
- -> Unscrew central bolt -3- for crankshaft toothed belt sprocket -1-.
- Remove spacer -2- and toothed belt sprocket.

- Remove upper section of oil pan =>Page 133 .



- -> Unscrew the idler wheel and tensioning roller -arrows-.



- -> Remove bolts -1- and -2-.
- Detach front oil pump.
- Drive out oil seal with oil pump removed.

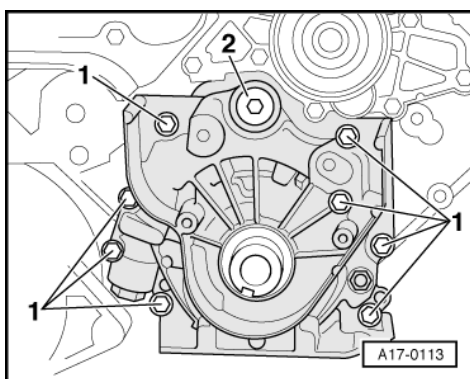
Installing

Installation is carried out in the reverse order; note the following:

Note:

If the oil pump is installed with the oil seal already fitted, place fitting sleeve 3202/1 on end of crankshaft before installing oil pump.

- Clean sealing surfaces before installing oil pump.
- Set up oil pump, so that it engages in the actuating arms on the crankshaft.

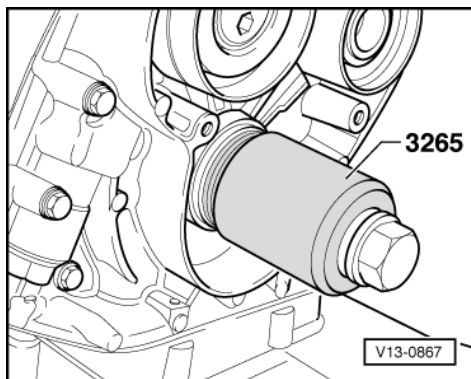


- -> Tighten bolts -1- and -2-:



- 1 - 10 Nm
- 2 - 40 Nm (spray nozzle valve)

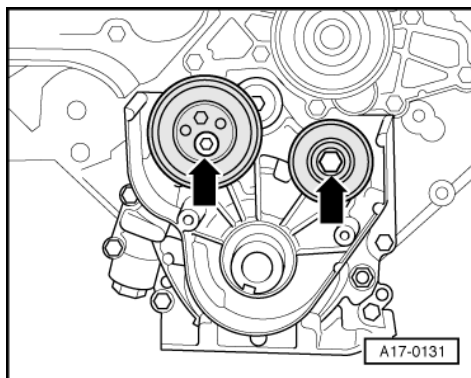
- Do not lubricate sealing lip or outer circumference of seal before pressing in.
- Push on oil seal using fitting sleeve 3202/1.



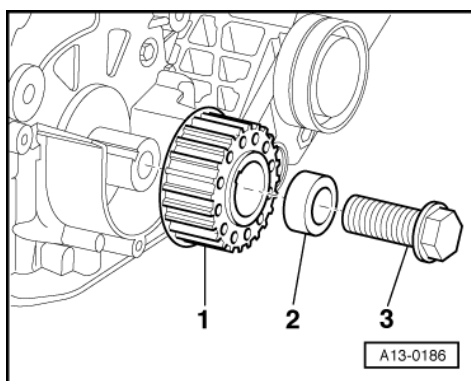
- -> Press in oil seal flush with insertion sleeve 3265 and central bolt.

Note:

Fit spacer under central bolt.



- -> Install tensioning roller -left arrow-.
- Install idler wheel -right arrow-.
- Installation position: recess in mounting hole (for bolt head) faces to front.



- -> Install crankshaft sprocket -1- with spacer sleeve -2- and new central bolt -3-.

Notes:

- ♦ Contact surface between sprocket and crankshaft must be free of oil.



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- ♦ Do not use additional oil on bolt for crankshaft toothed belt sprocket.
- Install toothed belt =>Page 39 .
- Install upper section of oil pan =>Page 137 .

Tightening torques

Component		Nm
Oil pump to cylinder block	M6	10
	Spray nozzle valve	40
Toothed belt sprocket to crankshaft		200 + 180°1)2)
Toothed belt tensioning pulley	M8	22
	M10	43
Idler roller	M8	22
	M10	43

- 1) Replace bolt
- 2) 180°= 1 / 2 turn

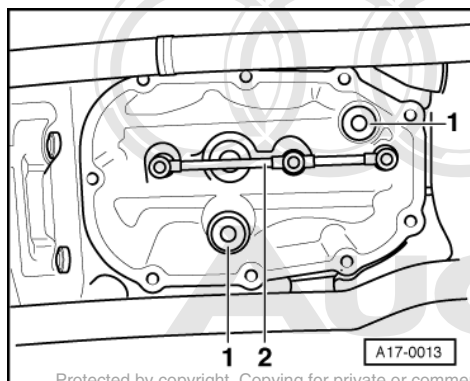
1.5 - Replacing oil retention valves

Note:

If there are irregular valve noises which stop after the car is driven for a long time, but recur repeatedly during short trips, replace the oil retention valves.

Removing

- Remove intake manifold => Page 74 .
- Unscrew cover under intake manifold.



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- 1 - Oil retention valve - 25 Nm
- 2 - Oil pipe of spray nozzle valve for spray jets of piston cooling - 15 Nm

Installing

Installation is carried out in the reverse order; note the following:

Note:

Fit new O-rings.

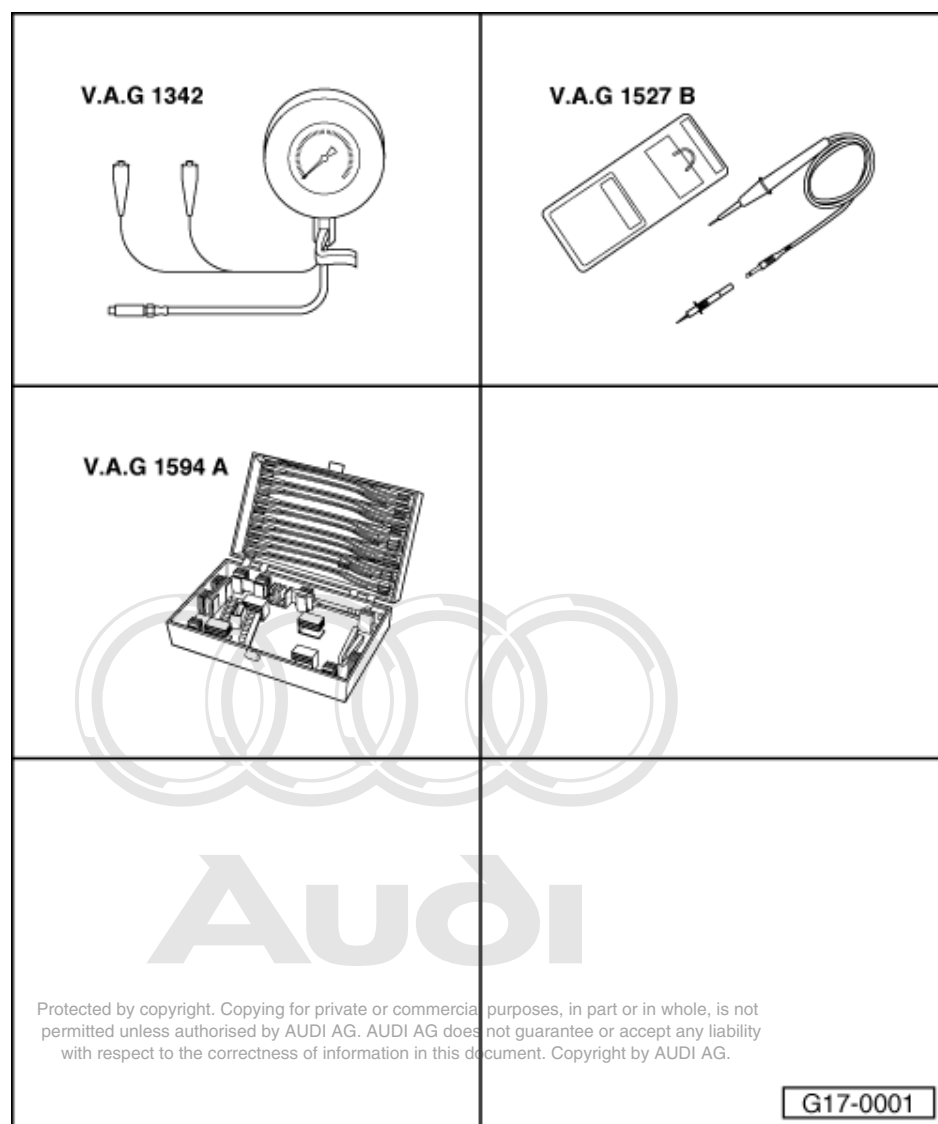


- Install intake manifold => Page 76 .

Tightening torque

Component	Nm
Cover to cylinder block	10

1.6 - Checking oil pressure and oil pressure switch



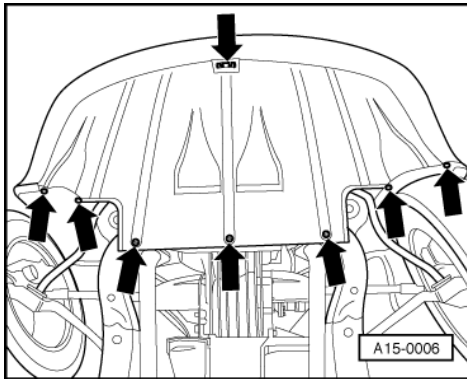
Special tools and workshop equipment required

- ♦ V.A.G 1342
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A

Test requirements:

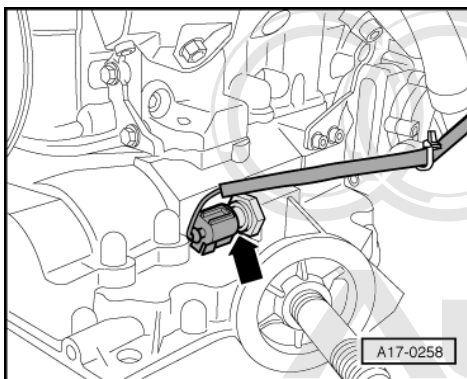
- Oil level OK.
- Oil pressure warning lamp K3 must come on when ignition is switched on.
- In vehicles with auto check system the "OK" display must appear (call up symbol).

- Engine oil temperature approx. 80 °C.



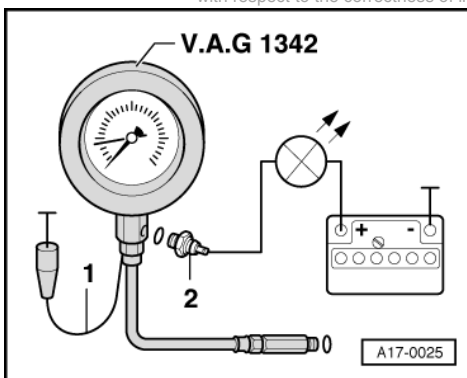
Procedure

- -> Remove the noise insulation -arrows-.



- -> Unplug connector on oil pressure switch -arrow-.

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Checking oil pressure switch 0.3 bar (brown) or 0.25 bar (blue)

- Disconnect wire from oil pressure switch.
- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Connect brown wire 1 of tester to earth (-).
- Connect voltage tester V.A.G 1527 B to oil pressure switch and positive side of battery (+) using test leads from V.A.G 1594 A.
 - The LED should illuminate.
- If the LED does not illuminate, fit a new oil pressure switch.



- Start the engine.

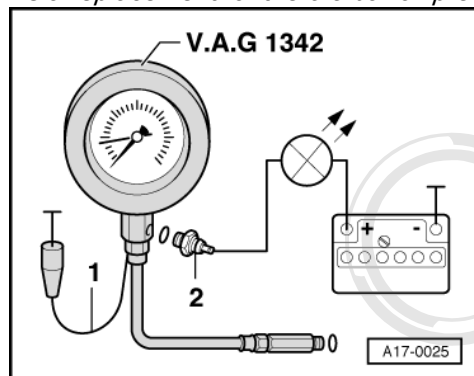
Note:

The switching point of the oil pressure switch can be reached when the engine is cranked on the starter motor, so watch the tester and the LED while starting the engine.

- At 0.15... 0.45 bar the LED should extinguish
- If the LED does not extinguish, fit a new oil pressure switch.

Note:

As a replacement for the 0.3 bar oil pressure switch (brown) a 0.25 bar oil pressure switch (blue) is supplied.



Check 1.4 bar (black), 1.8 bar (white) and 2.5 bar (red) oil pressure switches

- Disconnect wire from oil pressure switch.
- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Connect brown wire 1 of tester to earth (-).
- Connect voltage tester V.A.G 1527 B to oil pressure switch and positive side of battery (+) using test leads from V.A.G 1594 A.
- LED should not illuminate.
- If the LED lights up, fit a new oil pressure switch.
- Start the engine.

Note:

The switching point of the oil pressure switch can be reached when the engine is cranked on the starter motor, so watch the tester and the LED while starting the engine.

Red oil pressure switch:

- At 2.3... 2.7 bar.

White oil pressure switch:

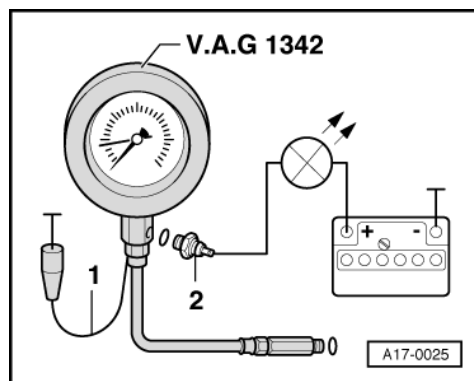
- At 1.6... 2.0 bar.

Black oil pressure switch:

- At 1.2... 1.6 bar.

All models:

- If the LED does not illuminate, fit a new oil pressure switch.



Checking oil pressure

- Disconnect wire from oil pressure switch.
- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Start engine (engine oil temperature approx. 80 °C).
 - Oil pressure at idling speed: at least 1.5 bar
 - Oil pressure at 2000 rpm: at least 2.5 bar

If the specifications are not obtained:

- Pressure relief valve or oil pump defective, replace oil pump => Page 138 .

Note:

If the fault "no oil pressure" occurs, check the contact surfaces of cylinder 1 camshaft bearing, crankshaft bearing no. 4 and both thrust washers for damage. If no damage can be found, fit a new oil pump.

1.7 - Engine oil

The engine is filled with a high quality multigrade oil at the factory which can be used all year round, except in extremely cold climates.

Viscosity grades and oil specifications

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=> Maintenance Manual

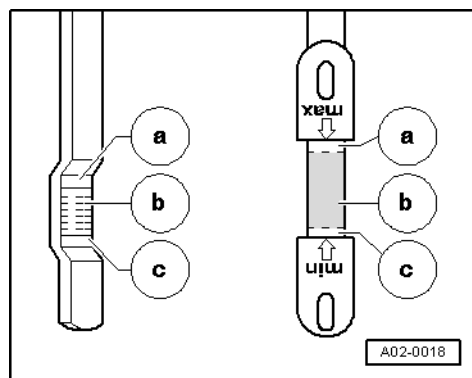
1.8 - Checking oil level

Test requirements:

- Engine oil temperature at least 60 °C
- Vehicle must be level (horizontal)
- Wait a few minutes after switching off the engine to allow the oil to flow back into the oil pan.

Test sequence

- Pull out the dipstick, wipe with a clean cloth and insert again to stop.
- Pull out the dipstick again and read off the oil level.



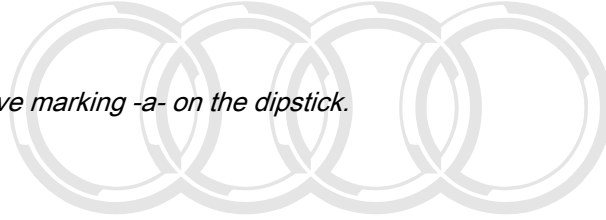


-> Markings on oil dipstick:

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

Note:

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



Audi

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19 - Cooling system

1 - Removing and installing parts of the cooling system

1.1 - Removing and installing parts of the cooling system

Important

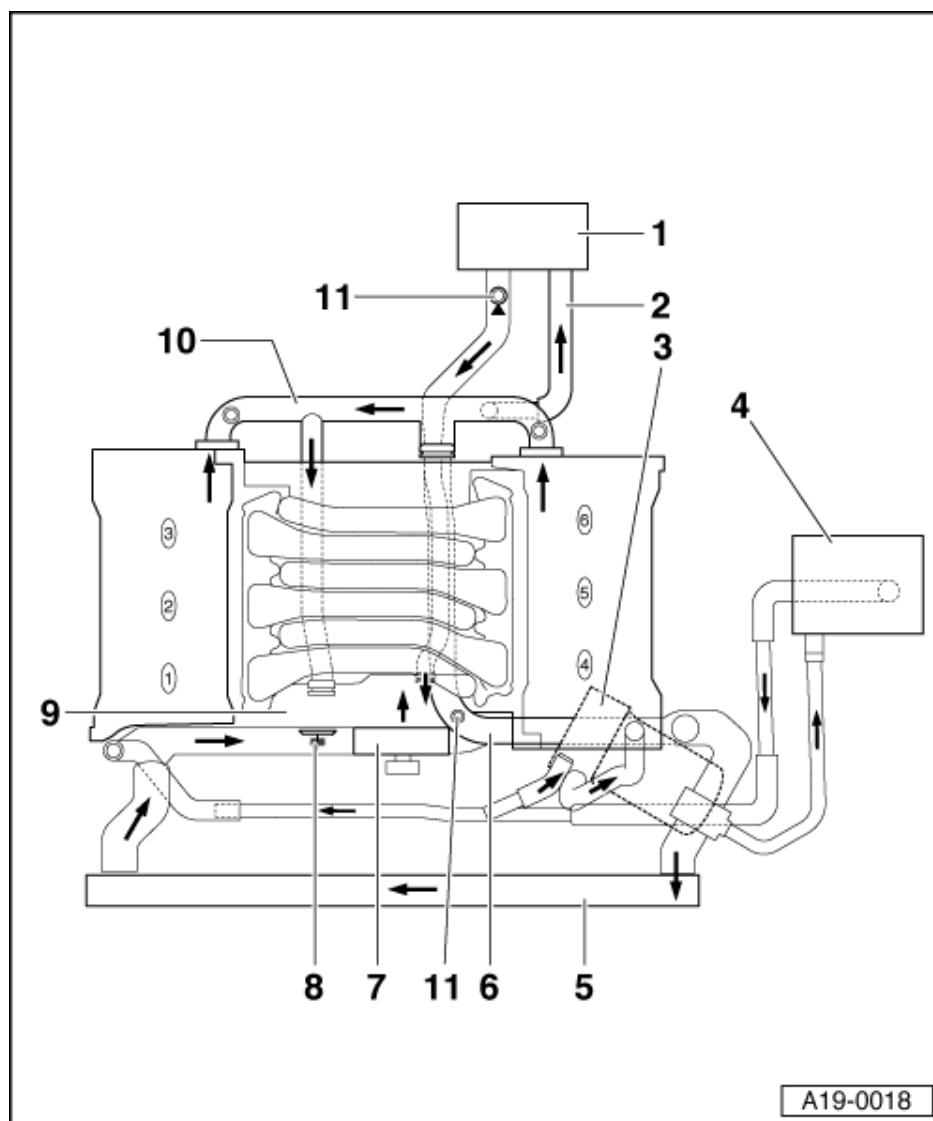
Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

Notes:

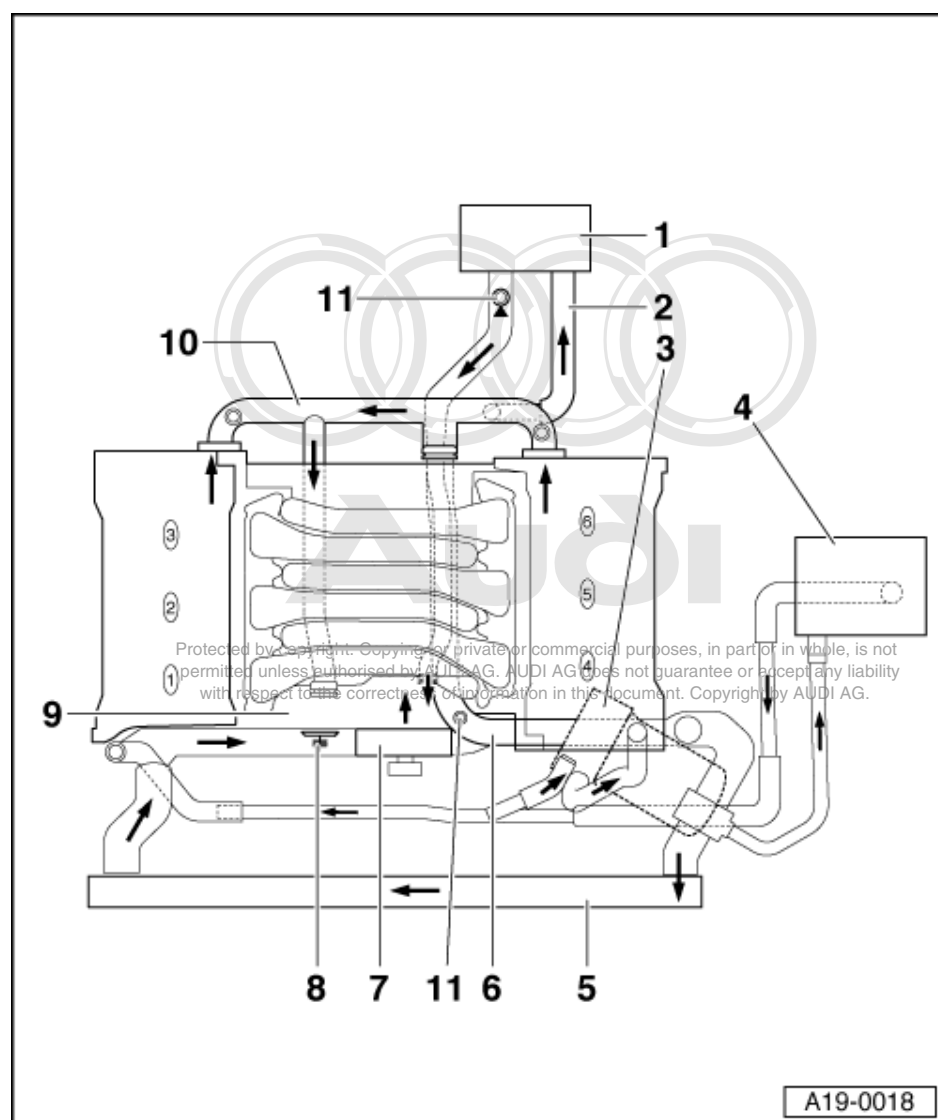
- ◆ When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ◆ Hose clamp pliers V.A.G 1921 are recommended when installing spring clamps.
- ◆ Replace all gaskets and seals.
- ◆ The arrow markings on the coolant pipes and on the ends of the hoses must align.



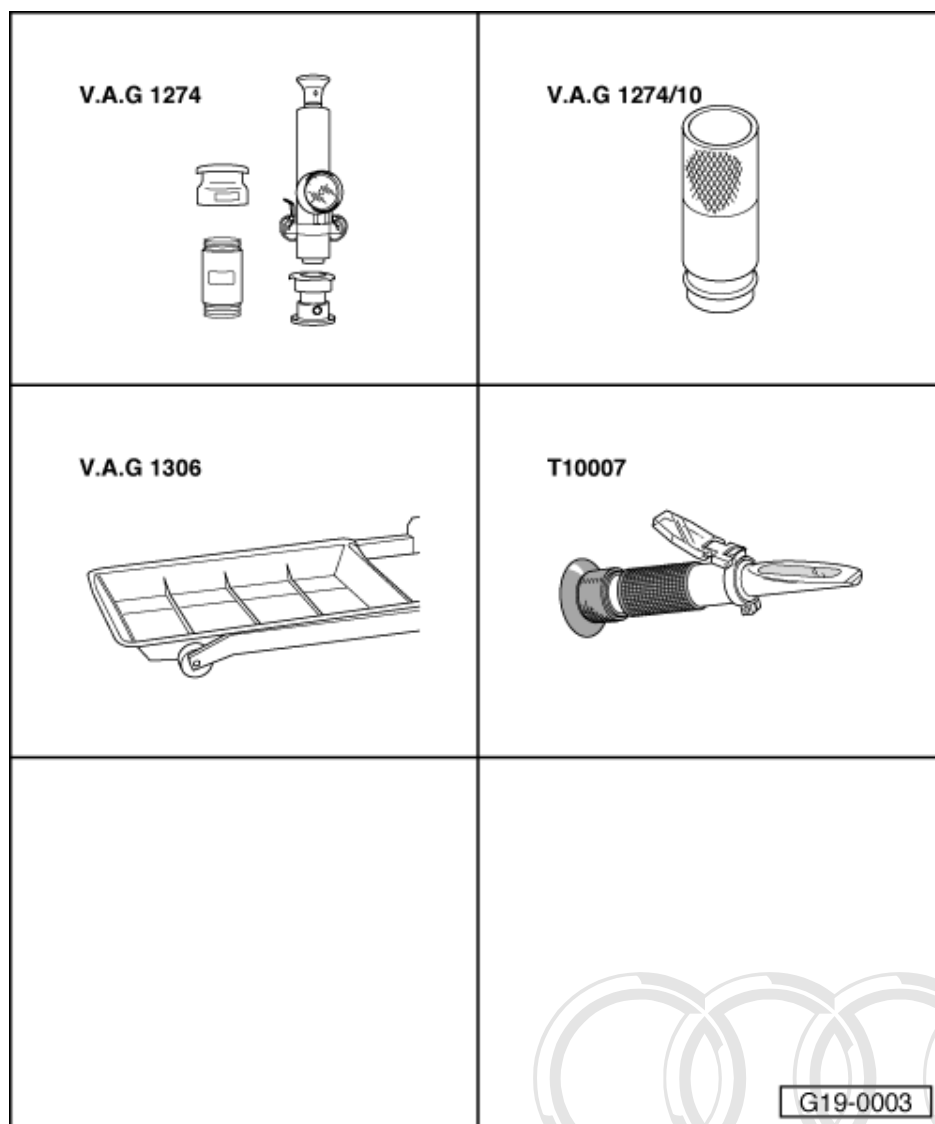
- 1 **Heating system heat exchanger**
 - ♦ After replacing, fill with fresh coolant
- 2 **Supply pipe**
 - ♦ To heating system heat exchanger
- 3 **Fluid cooler**
- 4 **Expansion tank**
 - ♦ With filler cap
 - ♦ Check pressure relief valve in sealing cap => Page 173
- 5 **Radiator**
 - ♦ Removing and installing=>Page 166
 - ♦ After replacing, fill with fresh coolant
- 6 **Coolant pipe (front section)**
 - ♦ Removing and installing
=>Page 163.



- 7 **Coolant pump**
 - ♦ Removing and installing
=> Page 155
 - ♦ Check for ease of movement
- 8 **Thermostat**
 - ♦ Removing and installing
=>Page 156.
 - ♦ Checking => Page 160

- ♦ Installation position => Fig. 155
- 9 Intake manifold
- 10 Coolant pipe, rear
 - ♦ Removing and installing
=>Page 165 .
- 11 Bleed screw

1.2 - Draining and filling cooling system



Special tools and workshop equipment required

- ♦ V.A.G 1274/1
- ♦ V.A.G 1274/10
- ♦ V.A.G 1306
- ♦ Special tool T10007

Draining

Notes:

- ♦ Collect drained coolant in a clean container for re use or disposal.

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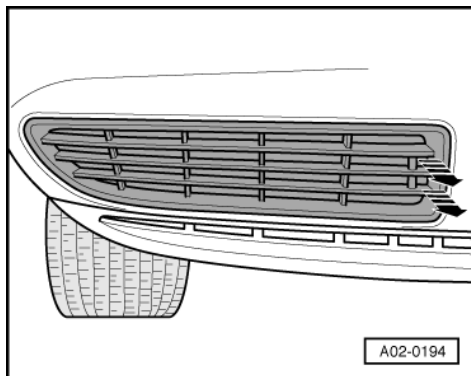


- ♦ Only use clean drinking water to mix the coolant.

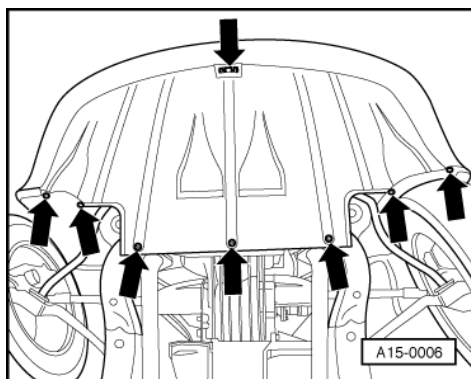
Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

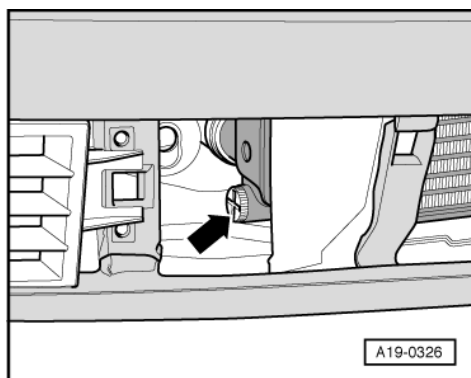
- Open the cover of the coolant expansion tank



- -> Pull back retainer catch -arrows- and remove air intake grille.



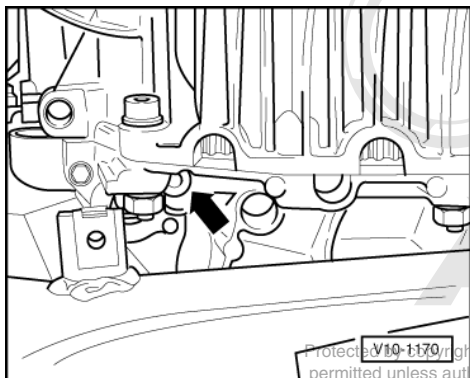
- -> Remove the noise insulation -arrows-.



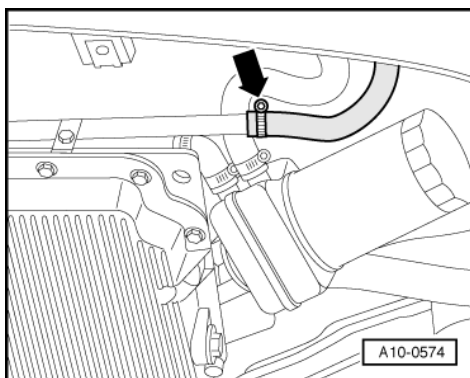
- Place drip tray V.A.G 1306 below engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.



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- -> Also open the coolant drain plug on rear left of engine -arrow-.



- -> Also disconnect coolant hose -arrow-, and drain off remaining coolant.

Filling

Notes:

- ◆ The cooling system is filled all year round with a mixture of water and antifreeze/corrosion protection agent.
- ◆ Coolant additive G 011 A8 C (green) is used in vehicles up to 06.96.
- ◆ Only coolant additive G 012 A8 D (red) is used in vehicles from 07.96 onwards.

Important

The two different coolant additives G 011 A8 C and G 012 A8 D must not be mixed together. Otherwise, this can result in serious damage to the engine.

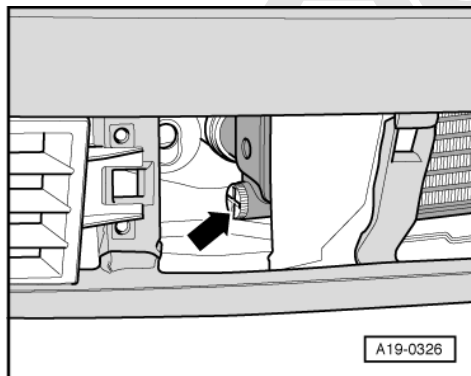
- ◆ If the fluid in the expansion tank is brown, this means G 012 A8 D has been mixed with another type of coolant. In this case, flush out the cooling system and fill with fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove as much of the old coolant as possible.
- ◆ G 011 A8 C and G 012 A8 D and coolant additives marked meeting specification TL VW 774 C or meeting specification TL VW 774 D prevent frost and corrosion damage, stop scaling and at the same time raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct anti freeze and anti corrosion additive.
- ◆ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Protection against frost must be assured to about -25 °C (in countries with an arctic climate to about -35 °C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40 %.
- ◆ If greater frost protection is required in very cold climates, the amount of G 011 A8 C or G 012 A8 D can be increased, but only up to 60 % (this gives frost protection to around -40 °C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.



- ♦ If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.

Recommended mixture ratios:

Frost protection to	Antifreeze concentration	G11/G12 1)	Water 1)
- 25 °C	40 %	2.8 l	5.7 l
- 35 °C	50 %	4.25 l	4.25 l



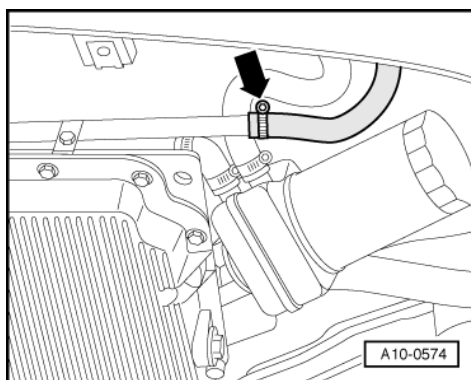
- -> Close drain plug -arrow- on radiator.



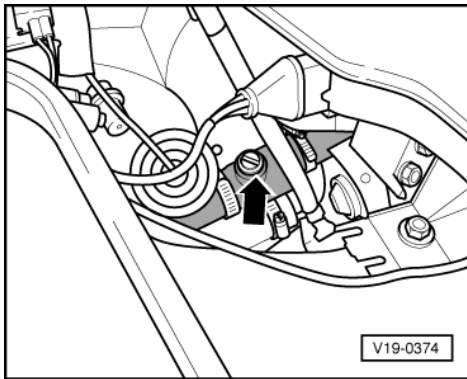
- -> Close coolant drain plug on rear left of engine -arrow- (20 Nm).

Note:

Replace O-ring.



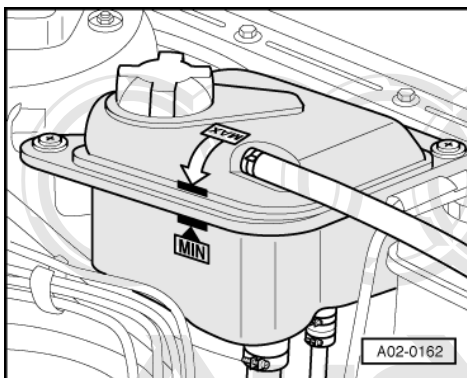
- -> Connect coolant hose -arrow-.



- Remove plenum chamber cover.
- -> Open bleed screw -arrow- on heating hose to heat exchanger approx. 2 turns.
- Top up coolant until it runs out at the bleed screw.
- Close the bleed screw.
- Fit expansion tank cap.
- Start engine and maintain an engine speed of about 2000 rpm for approx. 30 seconds.
- Then allow engine to run at idling speed until the lower coolant hose on radiator becomes hot.

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.



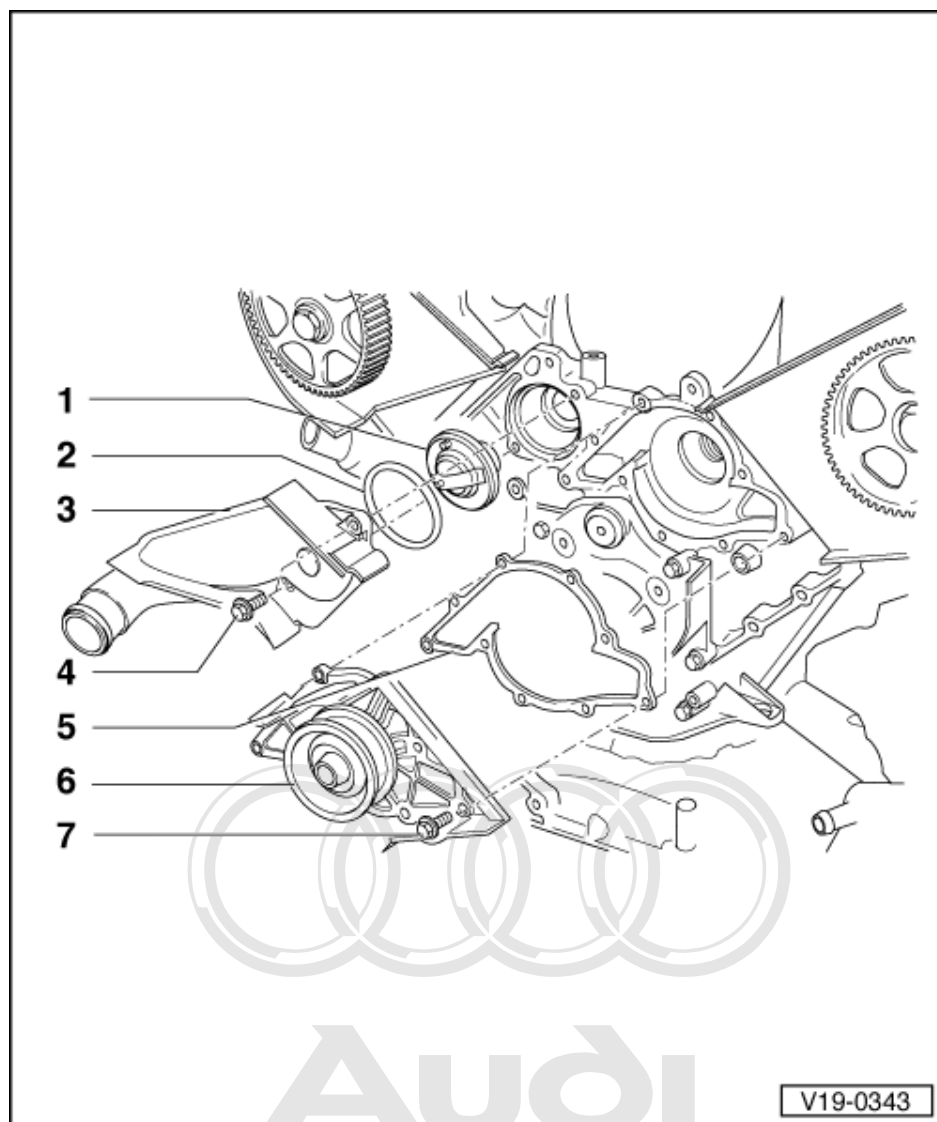
- -> Check the coolant level and top up if necessary. If the engine is warm, the coolant level should be at the max. mark; if cold, between the min. and max. marks.
- Stop engine.

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Tightening torque

Component	Nm
Drain plug to cylinder block.	20

1.3 - Coolant pump and coolant thermostat



1 Thermostat

- ♦ Removing and installing
=> Page 156
- ♦ Checking => Page 160
- ♦ Installation position => Fig. 1 .

2 Sealing ring

- ♦ Replace

3 Coolant thermostat housing

4 10 Nm

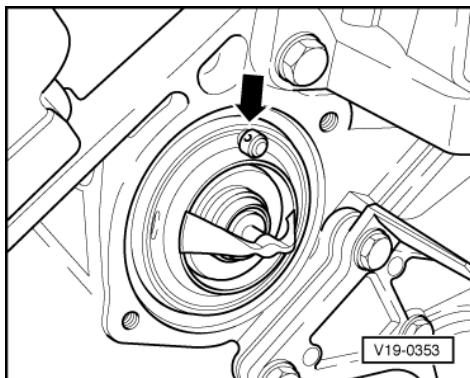
5 Seal

- ♦ Replace

6 Coolant pump

- ♦ Removing and installing
=> Page 155
- ♦ Check for ease of movement

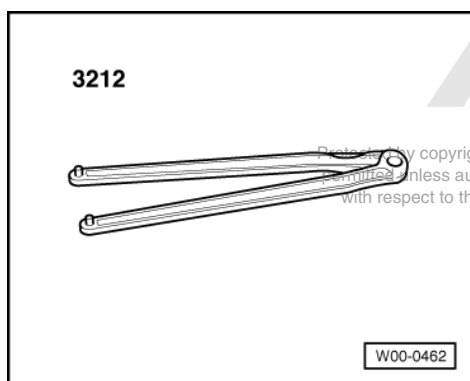
7 10 Nm



-> Fig.1 Installation position of thermostat

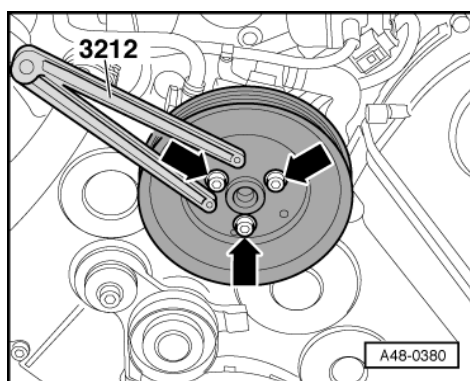
- ◆ Vent valve -arrow- faces upwards
- ◆ Seal on housing side

1.4 - Removing and installing coolant pump



Special tools and workshop equipment required

- ◆ Pin wrench 3212

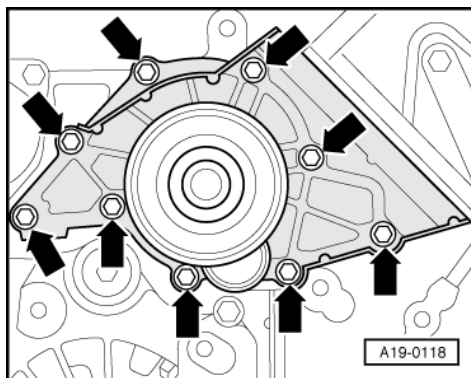


Removing

- Drain coolant => Page 149 .
- Remove ribbed belt => Page 27 .
- -> Counterhold hydraulic pump pulley with 2-hole pin wrench 3212 and unscrew pulley.



- Remove toothed belt => Page 35 .



- -> Unscrew coolant pump securing bolts -arrow- and remove coolant pump.

Installing

Installation is carried out in the reverse order; note the following:

Note:

Replace seals and gaskets.

- Clean sealing surfaces before installing coolant pump.
- Install toothed belt (adjust valve timing) => Page 39 .

Note:

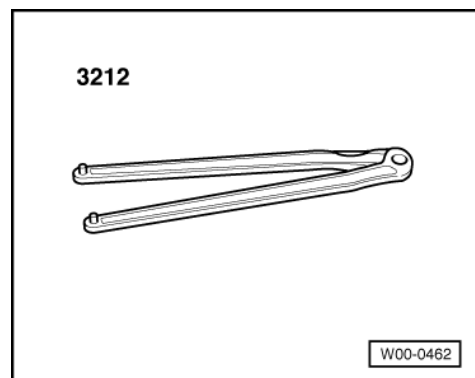
Note all instructions on removing and installing the toothed belt =>Page 35 .

- Top up coolant => Page 151 .

Tightening torques

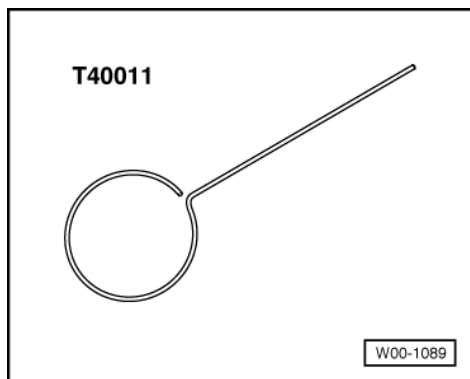
Component	Nm
Coolant pump to cylinder block	10
Pulley to hydraulic pump	25

1.5 - Removing, installing and checking coolant thermostat

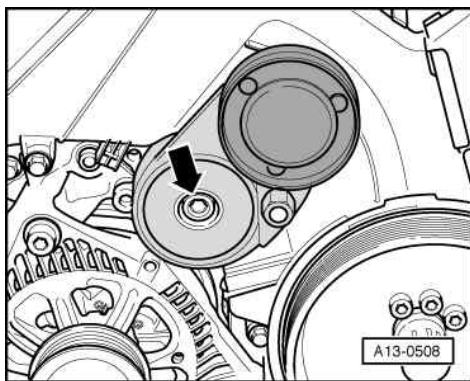


Special tools and workshop equipment required

- ♦ Pin wrench 3212



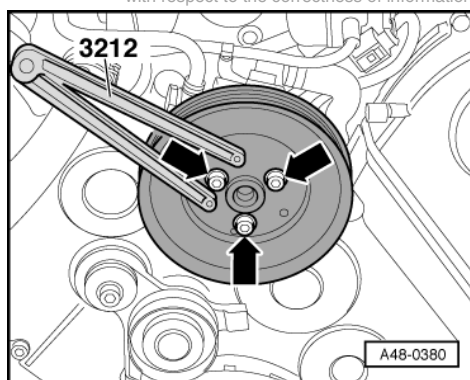
- ♦ Pin T40011



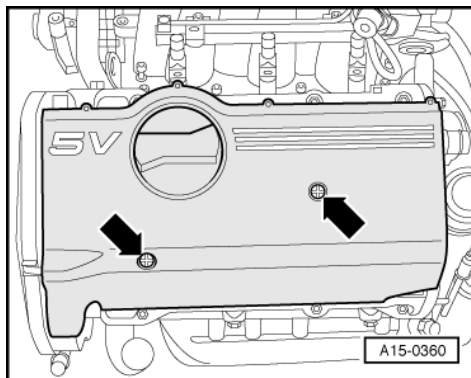
Removing

- Drain coolant => Page 149.
- Remove ribbed belt => Page 27.
- -> Remove screw -arrow- and detach ribbed belt tensioner.

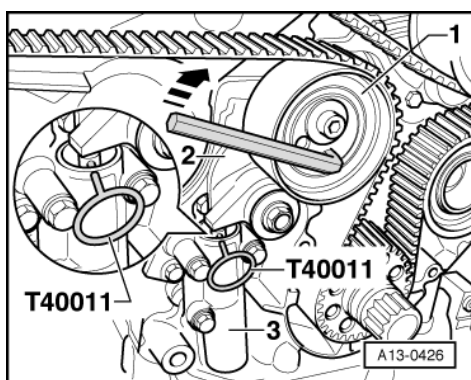
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- -> Unbolt ribbed belt pulley on vane pump -arrows-, using pin wrench 3212 as a brace.



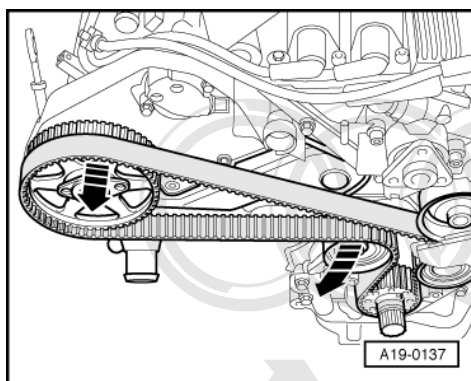
- -> Remove covers for cylinder head cover on left and right -arrows-.
- Remove left and right toothed belt guard.



Note:

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

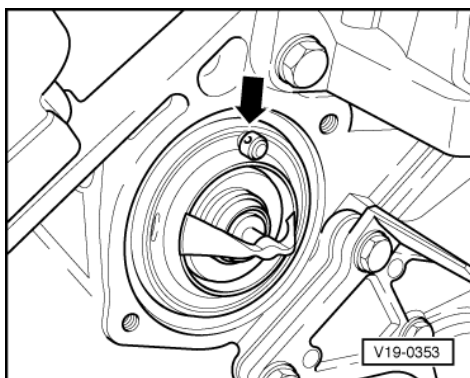
- -> Turn toothed belt tensioning roller -1- to the right in direction of arrow with 8 mm Allen key until the tensioning lever -2- has compressed the tensioner -3- sufficiently to enable the pressure piston to be secured with pin T40011.
- Insert pin T40011 and release toothed belt tensioning roller.



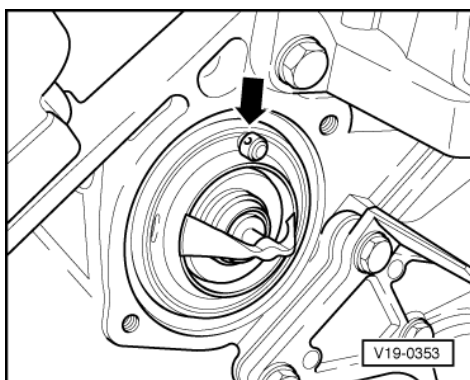
- -> Pull toothed belt forward slightly on tensioning roller and right camshaft toothed belt sprocket -arrows- do not detach completely.

Important

If the toothed belt has slipped off the tensioning roller, the valve timing will have to be adjusted => Installing toothed belt (Adjusting valve timing), Page 35



- Detach the coolant hoses on the thermostat housing.
- Unscrew bolts and remove thermostat housing.
- Remove O-ring and thermostat.



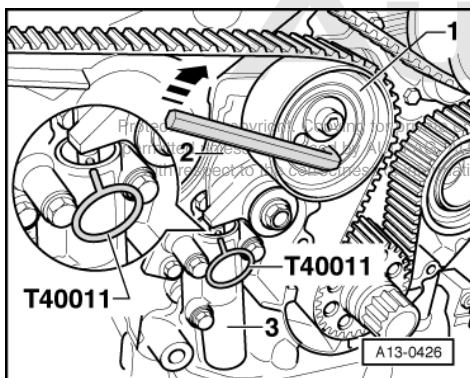
Installing

Installation is carried out in the reverse order; note the following:

Note:

Replace O-ring.

- Before installing, clean and smooth down sealing surface for O-ring.
- Install thermostat.
 - -> Installation position:
 - Vent valve -arrow- faces upwards
 - Sealing ring to housing
- Install thermostat housing.





Important

If the toothed belt has slipped off the tensioning roller, the valve timing will have to be adjusted => Installing toothed belt (Adjusting valve timing), Page 35

- -> Using an 8 mm Allen key, turn toothed belt tensioning roller -1- to the right in the direction of the arrow until pin T40011 can be taken out.
- Before starting engine for the first time, pre-tension tensioning roller as follows:
 - Fit torque wrench to hexagon socket of tensioning roller.
 - Turn tensioning roller to 15 Nm in tensioning direction. The tensioning roller is now pre-tensioned.
- Install ribbed belt => Page 28.
- Top up coolant => Page 151.

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Tightening torque

Component	Nm
Thermostat housing to cylinder block	10

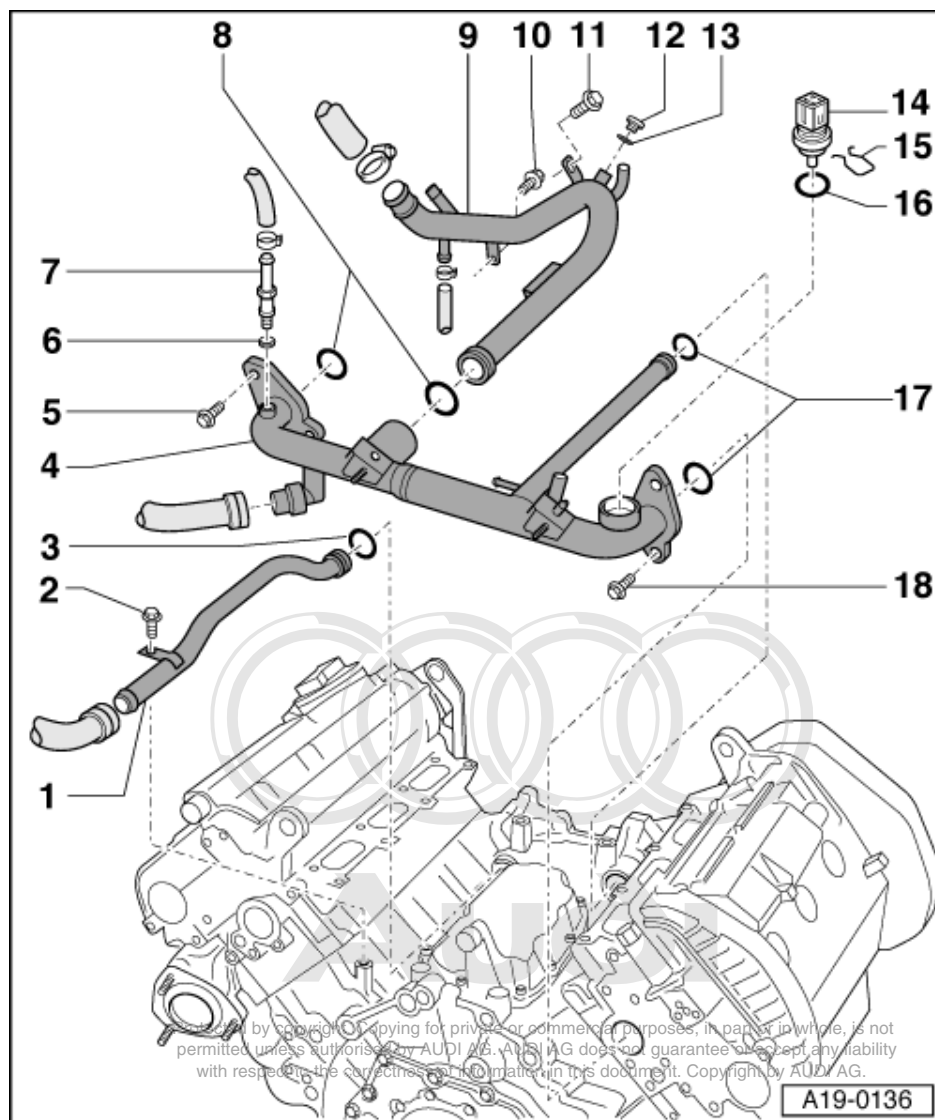
Check coolant thermostat

- Heat thermostat in water bath.

Starts to open	Fully open	Opening travel
approx. 87°C	approx. 102°C 1)	at least 8 mm

- 1) cannot be tested

1.6 - Coolant pipes - overview



1 Small coolant pipe

- ♦ Removing and installing
=>Page 164.

2 10 Nm

3 O-ring

- ♦ Replace

4 Coolant pipe, rear

- ♦ Removing and installing
=>Page 165.

5 10 Nm

6 Sealing ring

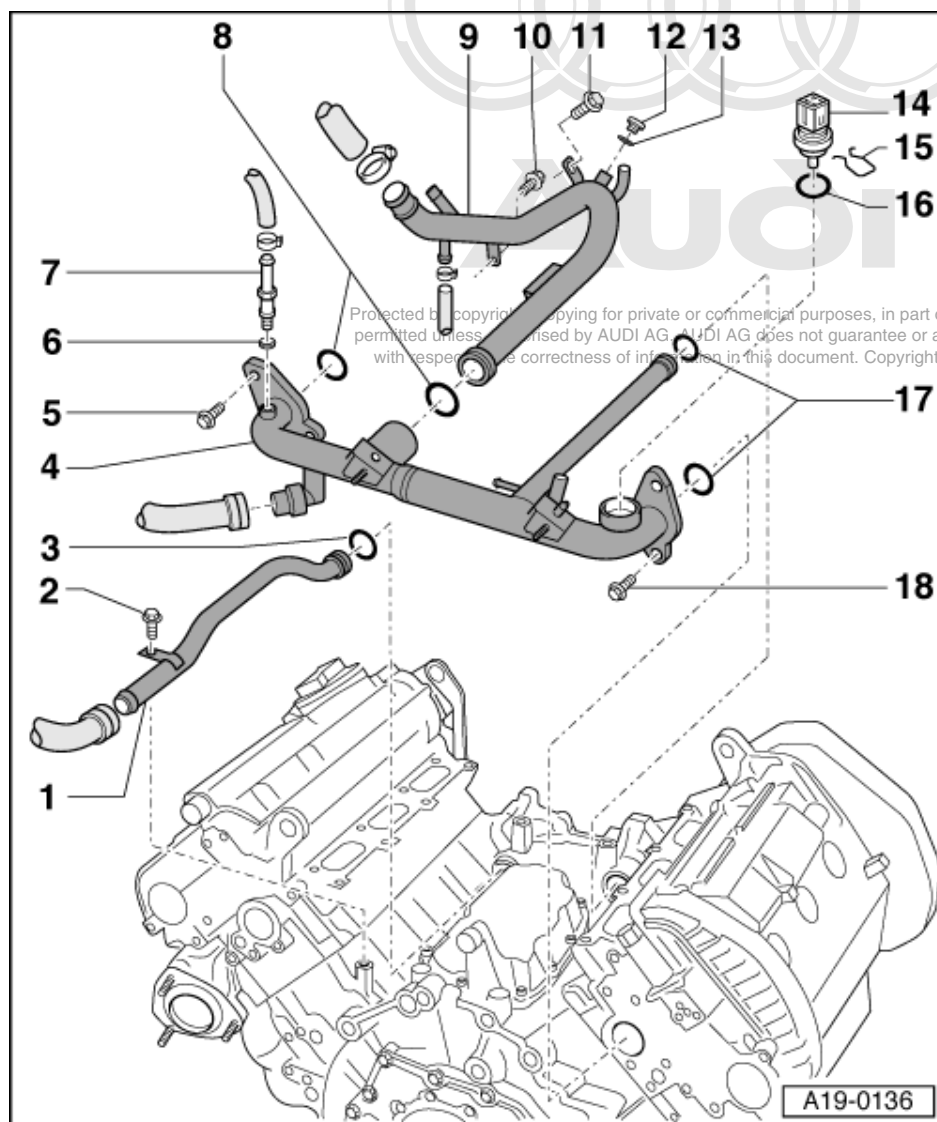
- ♦ Cut open and replace

7 Pipe union

- ♦ Tighten to 15 Nm

8 O-ring

- ♦ Replace



9 Coolant pipe (front section)

- ♦ Removing and installing
=>Page 163.

10 10 Nm

11 22 Nm

12 Bleed screw - 15 Nm

13 Sealing ring

- ♦ Cut open and replace

**14 Coolant temperature sender
-G2/-G62**

15 Bracket

16 O-ring

- ♦ Replace

17 O-ring

- ♦ Replace

18 10 Nm

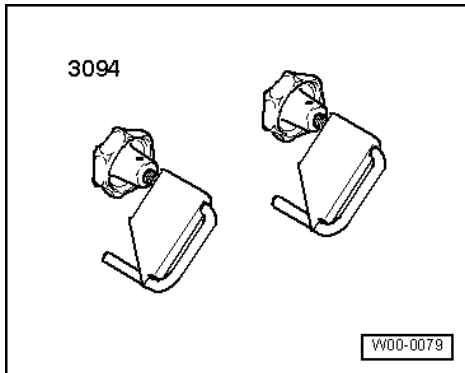
1.7 - Removing and installing front section of coolant pipe

Notes:

- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

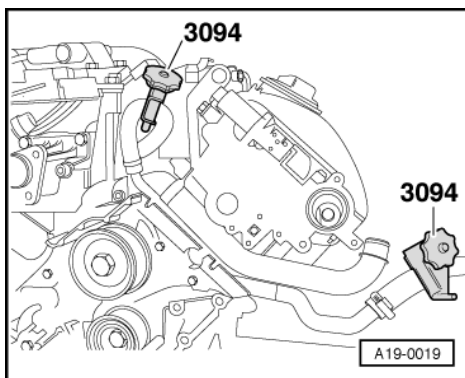
=> Parts List

- ◆ All cable ties which are released or cut open when removing must be fitted in the same position when installing.



Special tools and workshop equipment required

- ◆ Hose clamps 3094



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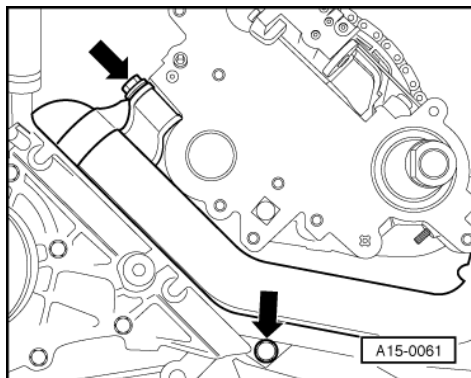
Removing

- Drain off coolant from engine =>Page 149 .
- Remove intake manifold => Page 74 .
- Remove coolant pump=> Page 155 .
- Remove camshaft sprocket.
- Unbolt toothed belt guard at the rear left.
- -> Disconnect both hoses on the supply pipe for hydraulic fluid with hose clamps 3094.
- Detach both hydraulic lines from intermediate pipe.

Note:

Place a rag below the pipes to be disconnected as oil flows out.

- Detach coolant hose from coolant pipe at front.



- -> Unscrew bolts -arrows-.
- Lay aside wiring at air coolant pipe.
- Pull coolant pipe off from front.

Installing

Installation is carried out in the reverse order; note the following:

Note:

Always replace seals and O-rings.

- Before installing, clean and smooth down sealing surface for O-ring.
- Lubricate new O-ring with G11/G12 and push onto coolant pipe.
- Push coolant pipe into opening in coolant pipe at rear.
- Install intake manifold => Page 76 .
- Install coolant pump=> Page 156 .
- Top up coolant => Page 151 .
- Top up power steering fluid and bleed steering system:

=> Running Gear, FWD and 4WD; Repair group 48

Tightening torques

Component		Nm
Coolant pipe (front section)	M6	10
to cylinder head	M8	22
Bracket for power steering lines to cylinder head		10

1.8 - Removing and installing small coolant pipe

Note:

Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- Remove front coolant pipe =>Page 163
- Disconnect rear coolant hose from small coolant pipe.
- Unscrew the retaining bolt.
- Pull small coolant pipe off to rear.
- Take off coolant pipe upwards.

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Installing

Installation is carried out in the reverse order; note the following:

Note:

Always replace seals and O-rings.

- Before installing, clean and smooth down sealing surface for O-ring.
- Lubricate new O-ring with G11/G12 and push onto coolant pipe.
- Push coolant pipe into opening in cylinder block.
- Install front coolant pipe => Page 164 .
- Top up coolant => Page 151 .

Tightening torque

Component	Nm
Small coolant pipe to cylinder block	10

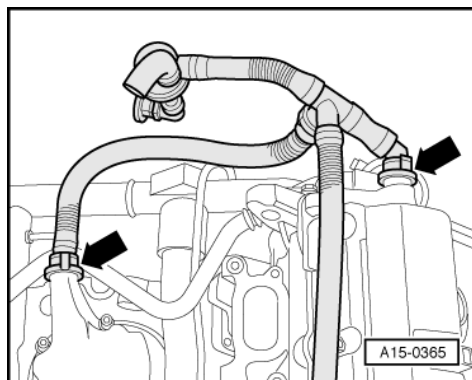
1.9 - Removing and installing rear coolant pipe

Notes:

- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

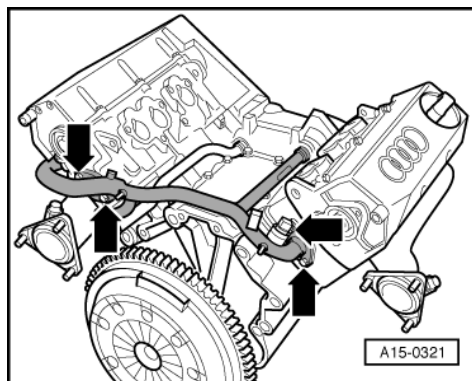
=> Parts List

- ◆ All cable ties which are released or cut open when removing must be fitted in the same position when installing.



Removing

- Drain off coolant from engine => Page 149 .
- Remove intake manifold => Page 74 .
- -> Remove the crankcase breather hose -arrows-.
- Unplug connector at coolant temperature sender -G2/-G62.
- Disconnect coolant hose to expansion tank.
- Detach the coolant hose leading to the heating system heat exchanger at the coolant pipe at the rear.
- Move wiring at coolant pipe at rear aside.





- -> Unscrew coolant pipe from cylinder heads -arrows-.
- Pull coolant pipe back and out of cylinder block.

Installing

Installation is carried out in the reverse order; note the following:

Note:

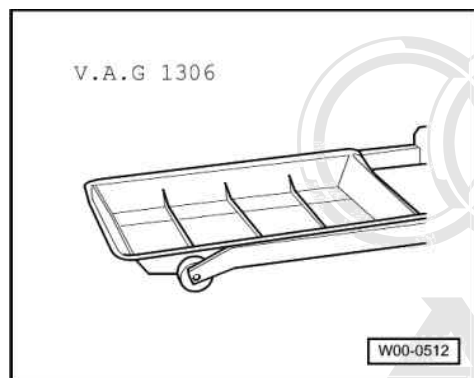
Always replace seals and O-rings.

- Before installing, clean and smooth down sealing surface for O-rings as required.
- Lubricate new O-rings with G11/G12 and push onto coolant pipe.
- Install intake manifold => Page 76 .
- Top up coolant => Page 151 .

Tightening torque

Component	Nm
Rear coolant pipe to cylinder head	10

1.10 - Removing and installing radiator



Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306
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Removing

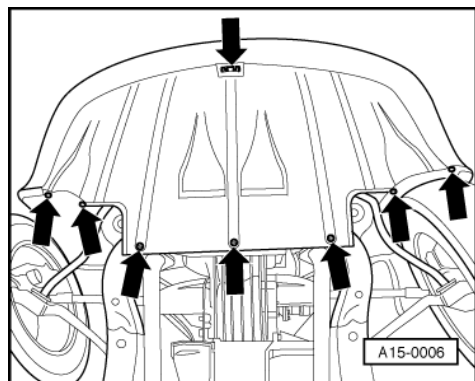
Note:

Collect drained coolant in a clean container for re use or disposal.

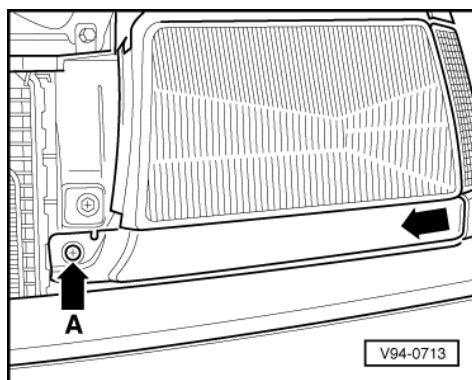
Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank



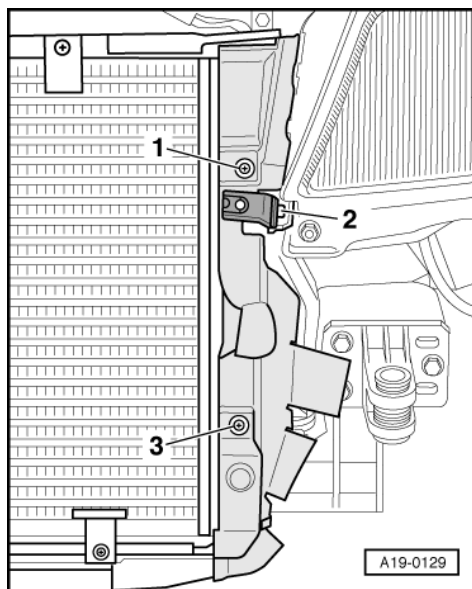
- -> Remove the noise insulation -arrows-.



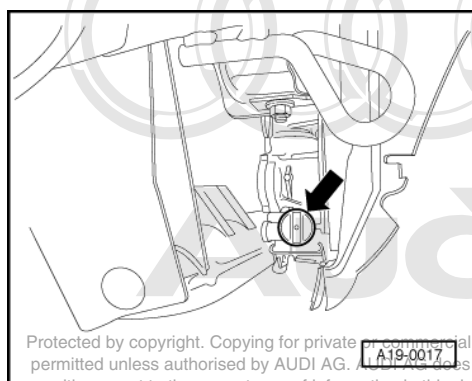
- Remove the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Remove rubber sealing lip from top of lock carrier.
- -> Remove fastening screw -arrow A- and pull out headlight trim in direction of arrow.



- -> Unscrew securing bolt of retaining clip -2- for headlight trim at housing.
- Unscrew air ducts from radiator -1- and -3- (left and right).



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- Place drip tray V.A.G 1306 below engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.

- Detach coolant hose from bottom of radiator.

Vehicles with air conditioner:

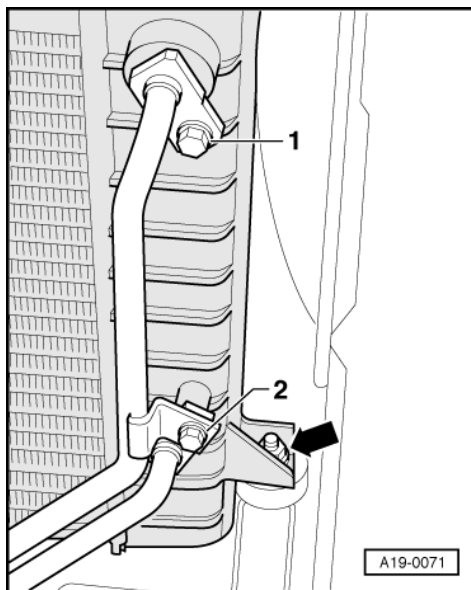
Important

The air conditioner refrigerant circuit must not be opened.

- Remove refrigerant pipe under radiator from brackets.

All models:

- Detach connector from thermostatic switch for radiator fan -F54.
- Detach top left coolant hose from radiator.
- Remove air duct to air cleaner at lock carrier.



Vehicles with automatic gearbox:

Note:

Observe cleanliness rules when working on the automatic gearbox:

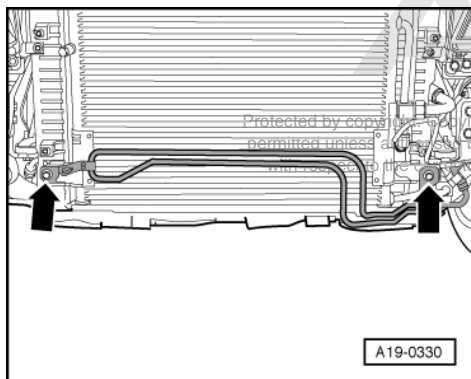
=> Automatic Gearbox 01K Front-wheel drive; Repair group 37

=> Automatic Gearbox 01F 4WD; Repair group 37

- -> Detaching ATF lines from radiator (bolts -1- and -2-):

Note:

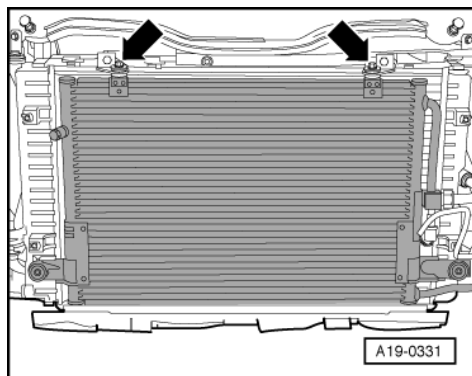
The nut -arrow- at lower right radiator fastening point must not be loosened.



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All models:

- -> Detach cooling coil for power steering hydraulic fluid -arrows-.



Vehicles with air conditioner:

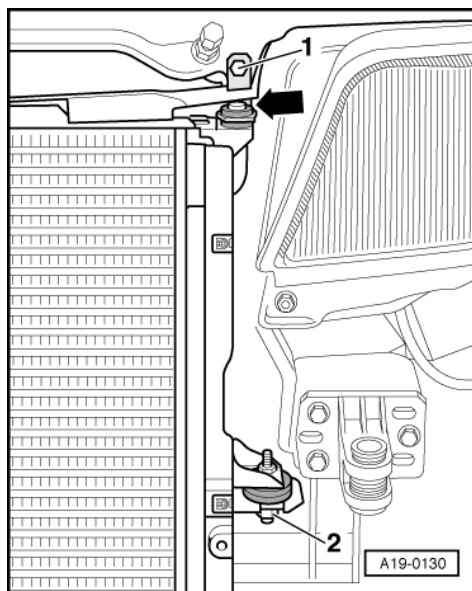
Important
The air conditioner refrigerant circuit must not be opened.

- -> Remove the securing bolts for the condenser.

Note:

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

- Leave condenser with connected refrigerant pipes/hoses in installation position.
- Unscrew radiator cowl at rear of radiator -arrows-.
- Remove radiator cowl from brackets and tie it to lock carrier.



- -> Unscrew nuts -2- at bonded rubber mounting.
- Pull radiator forwards at lower edge, so that it can be removed from the support at the top -arrow-.

Note:

On vehicles with air conditioner also unscrew bolt -1- at the top, if applicable.

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Installing

Installation is carried out in the reverse order; note the following:

- Install the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Top up coolant => Page 151 .

Note:

All coolant must be replaced when a new radiator is fitted.

Vehicles with automatic gearbox:

- Attach ATF lines.

=> Automatic Gearbox 01K Front-wheel drive; Repair group 37

=> Automatic Gearbox 01F 4WD; Repair group 37

- Check ATF level:

=> Automatic Gearbox 01K Front-wheel drive; Repair group 37

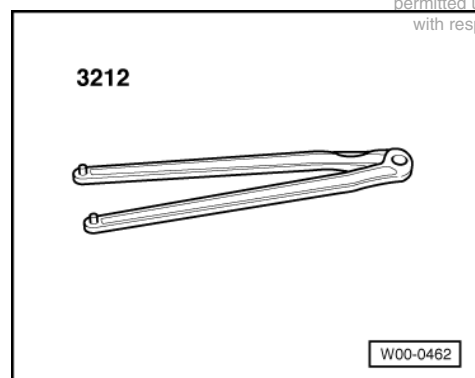
=> Automatic Gearbox 01F 4WD; Repair group 37

Tightening torques

Component		Nm
Radiator to lock carrier	M6	10
	M8	20
Radiator cowl to radiator		10
Condenser to radiator		10
Power steering cooling coil to radiator		10

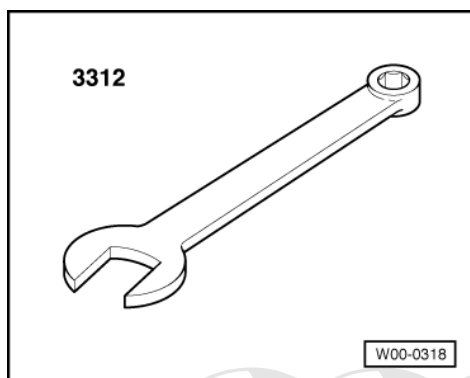
1.11 - Removing and installing viscous fan

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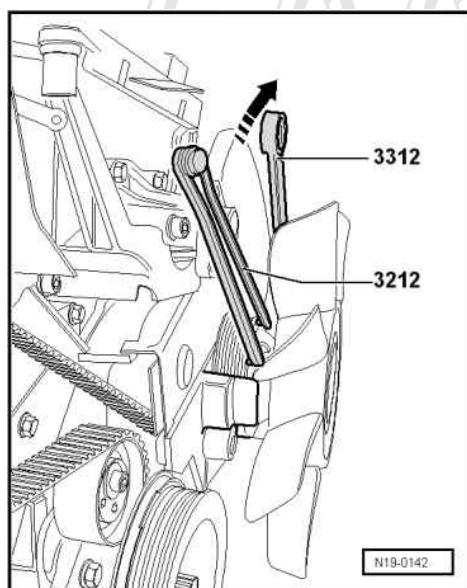


Special tools and workshop equipment required

- ♦ Pin wrench 3212



- ♦ Open-ended spanner 3312



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Removing

- -> Counterhold pulley for viscous fan with 2-hole pin wrench 3212 and unscrew viscous fan with wrench 3312 (left-hand thread).
- Lift out the viscous fan upwards.

Note:

Removing and installing pulley for viscous fan => Fig. 27.

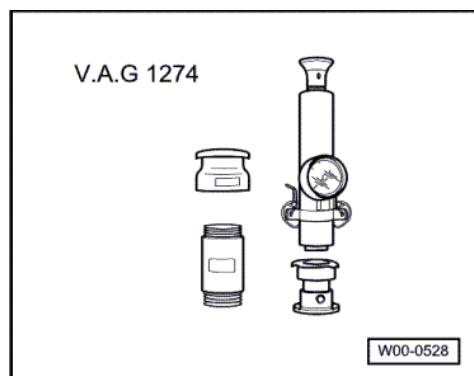
Installing

Installation is carried out in the reverse order; note the following:

- When installing viscous fan with open-ended spanner 3312, tighten to 37 Nm.



1.12 - Checking cooling system for leaks

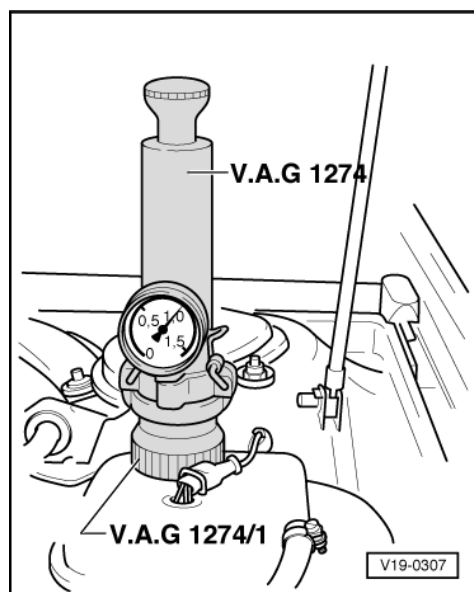


Special tools and workshop equipment required

- ♦ V.A.G 1274 with V.A.G 1274/1

Test requirements:

- Engine at operating temperature.



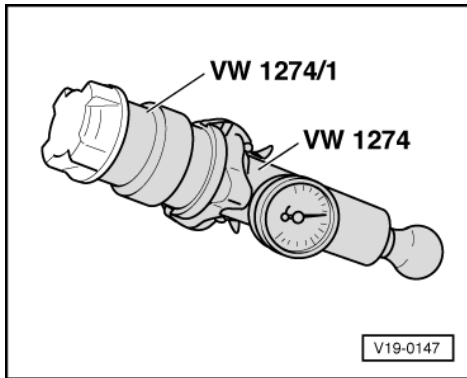
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Test sequence

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank
- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/1 onto expansion tank.
- Using hand pump on tester, build up a pressure of approx. 1.0 bar.
- If this pressure is not maintained, locate and rectify leaks.



Checking pressure relief valve in filler cap

- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/1 (2 parts) onto filler cap.
- Operate hand pump.
 - The pressure relief valve should open at a pressure of 1.2 ... 1.5 bar.



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26 - Exhaust system

1 - Removing and installing parts of exhaust system

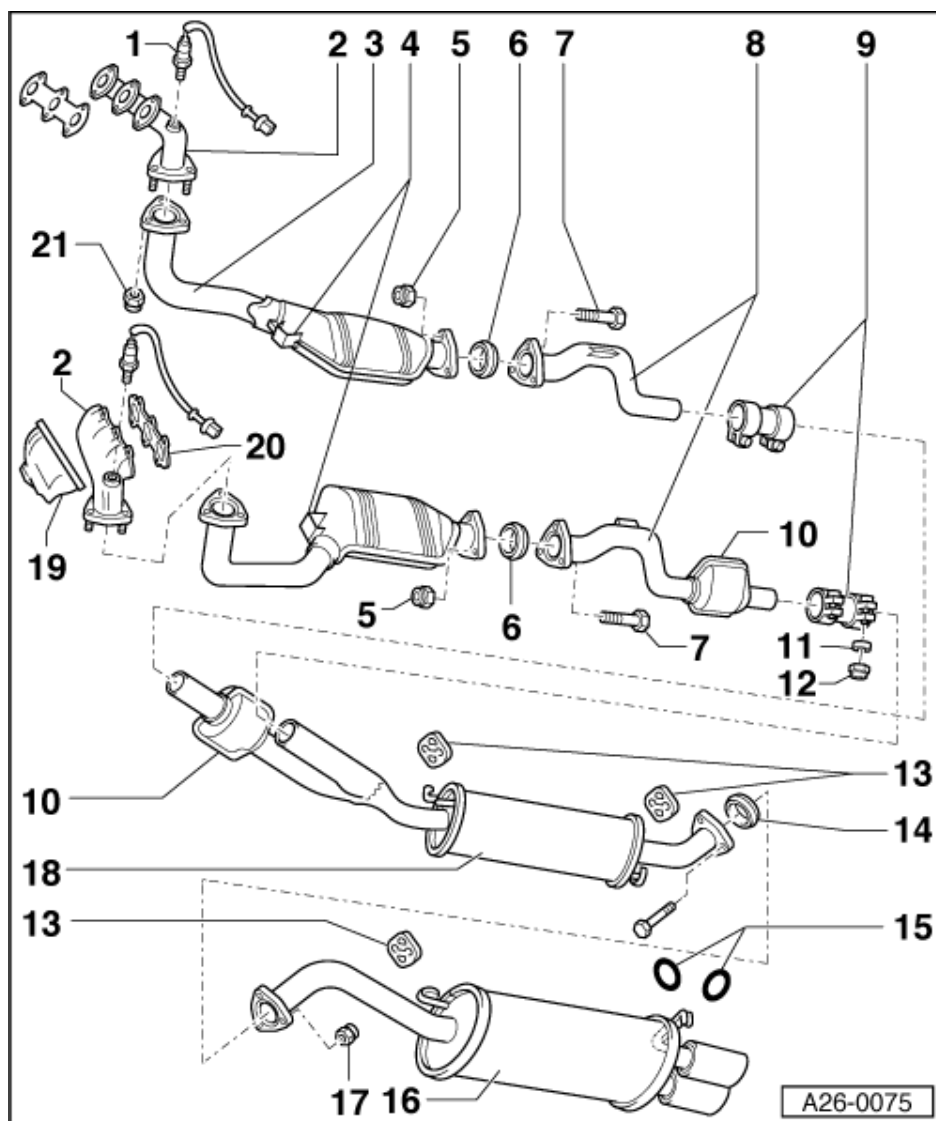
1.1 - Removing and installing parts of exhaust system

Notes:

- ♦ Always replace seals, gaskets and self-locking nuts.
- ♦ After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the body. If necessary, loosen clamping sleeves and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.
- ♦ The isolating element in front exhaust pipe must not be deflected more than 10 °to avoid damage.

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1.2 - Vehicles with front-wheel drive



1 Lambda probe - 55 Nm

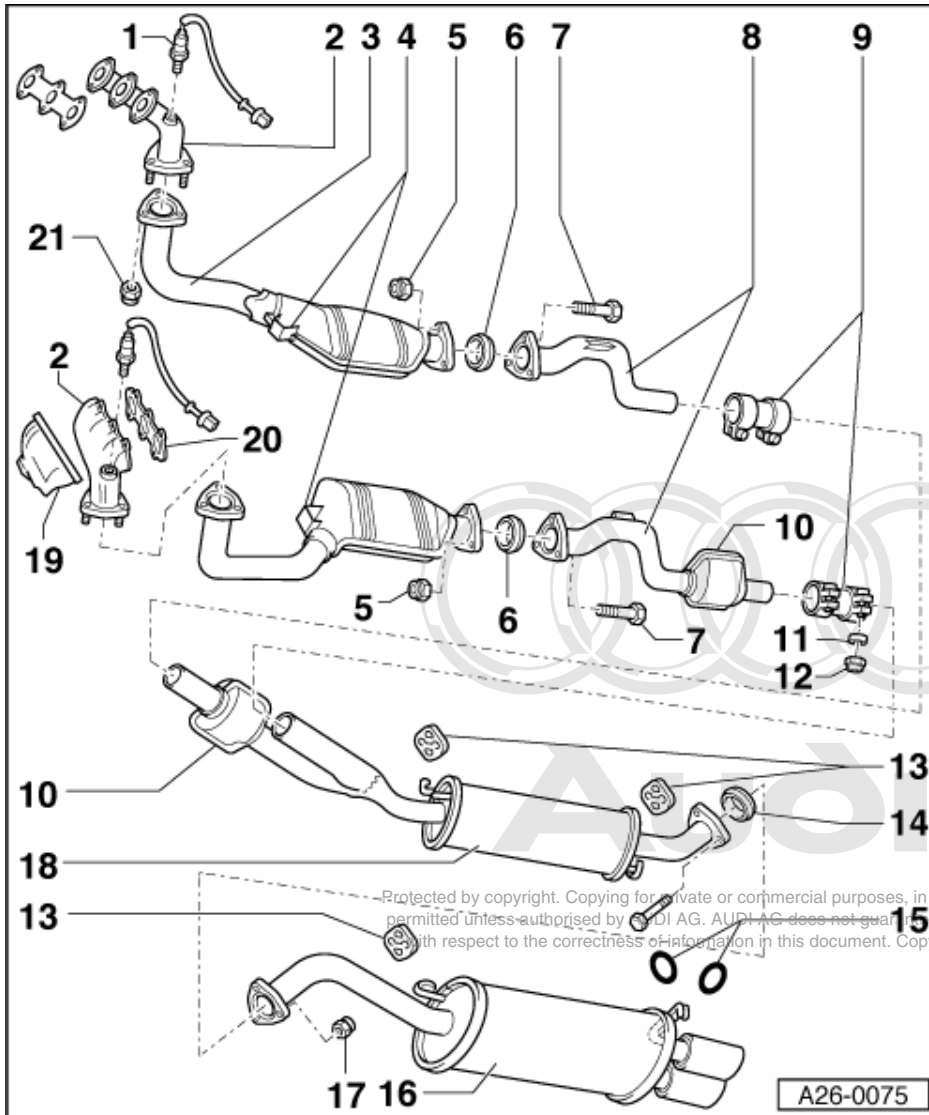
- ♦ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ♦ High-temperature lubricant

=> Parts List

2 Exhaust manifold

3 Front exhaust pipe

- ♦ With catalytic converter
- ♦ Protect from damage by knocks and impact
- ♦ Installing stress-free =>Page 182



4 Catalytic converter mounting

- ♦ Mountings on vehicles with manual gearbox =>Fig. 1
- ♦ Mountings on vehicles with automatic gearbox =>Fig. 6

5 25 Nm

- ♦ Replace

6 Sealing ring

- ♦ Replace

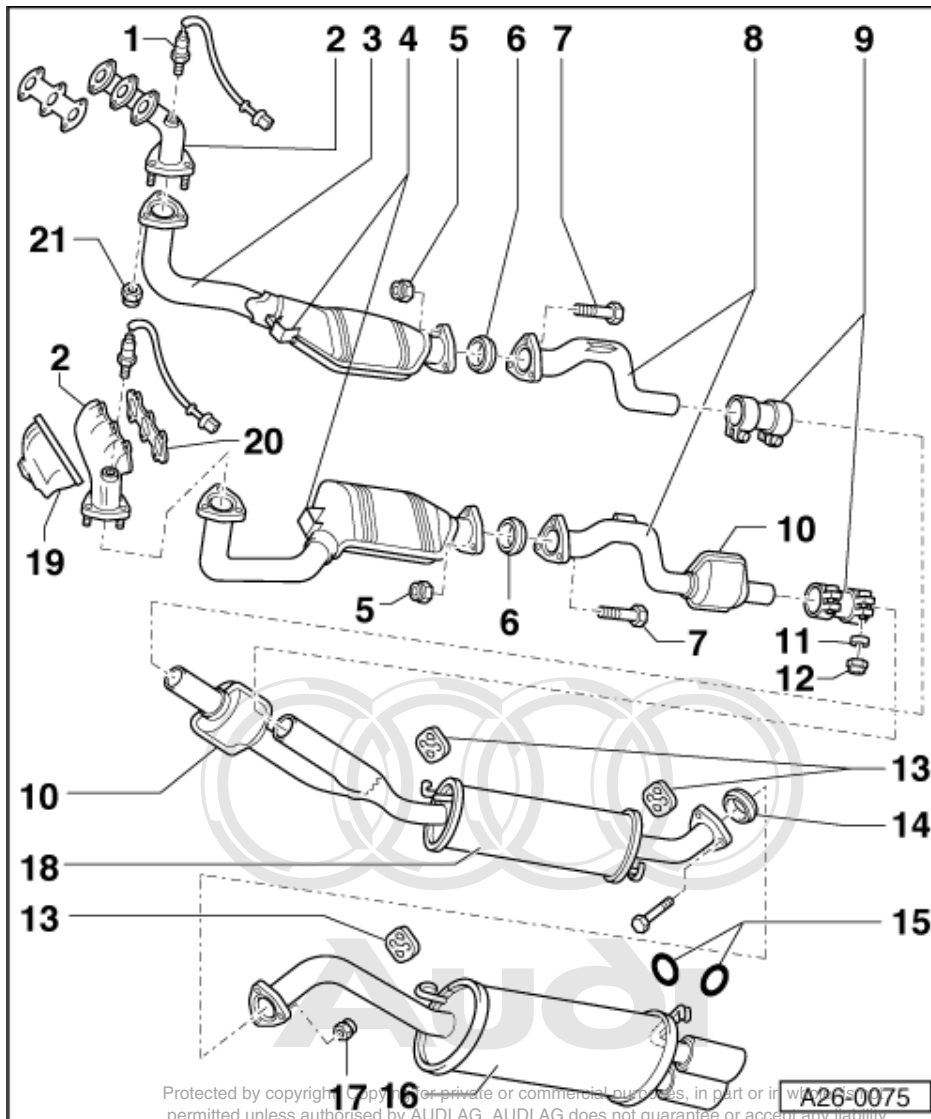
7 Bolt

8 Intermediate pipe

- ♦ Installing stress-free =>Page 182



9 Clamp

**10 Front silencer**

- ◆ Gradual introduction during model year 1996
- ◆ Installation position => Page 184

11 Shim**12 40 Nm**

- ◆ Tighten evenly

13 Retainer**14 Sealing ring****15 Retaining ring**

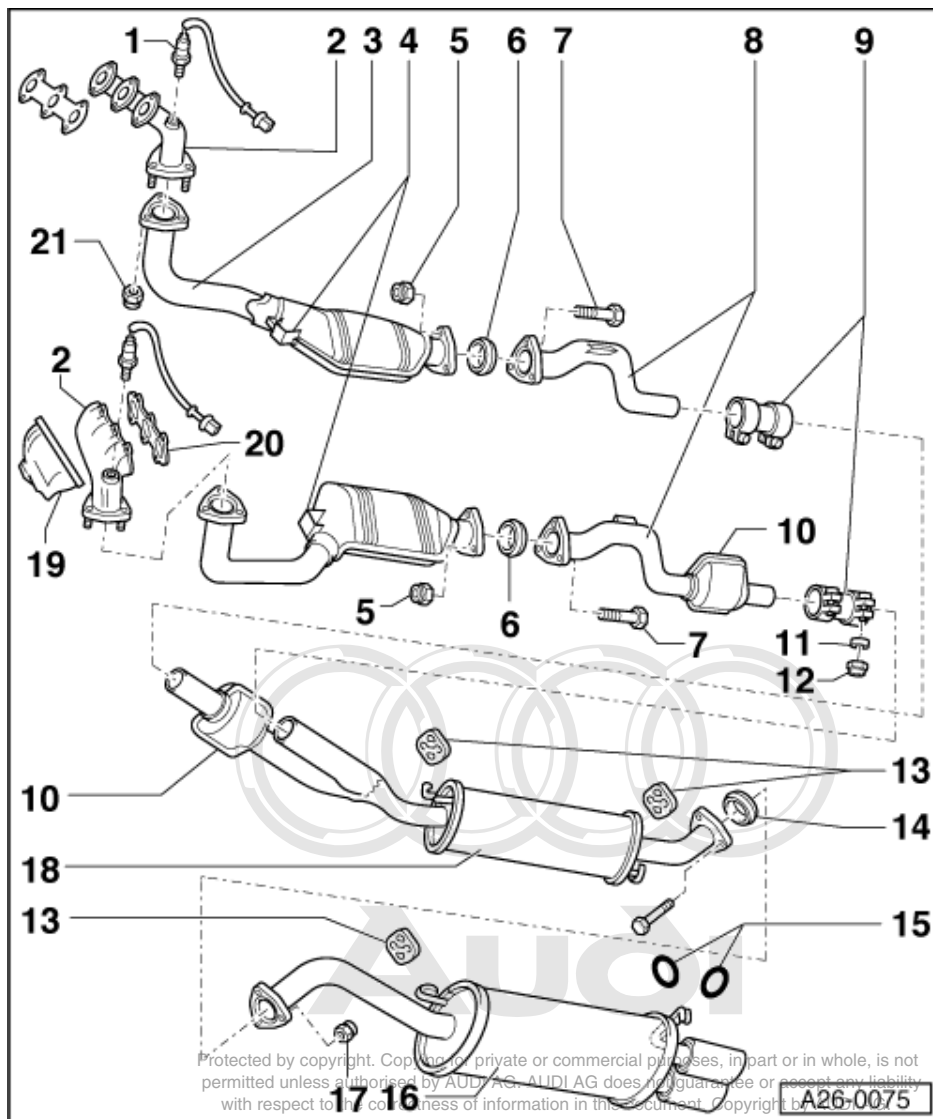
- ◆ Replace if damaged
- ◆ Bending over securing tabs
=> Fig. 182

16 Rear silencer

- ◆ Installing stress-free =>Page 182

17 25 Nm

- ◆ Replace



18 Centre silencer

- ♦ Installing stress-free =>Page 182

19 Heat shield

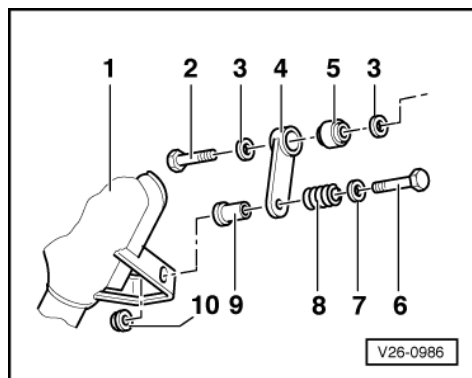
- ♦ Securing to cylinder head: 9 Nm (nuts)
- ♦ Connection of top/bottom heat shield: 5 Nm (bolts)

20 Seal

- ♦ Replace

21 30 Nm

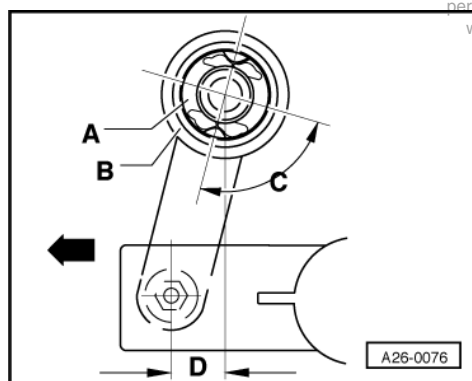
- ♦ Observe the tightening method => Page 183



-> Fig.1 Components of left mounting for vehicles with manual gearbox

- 1 - Catalytic converter
- 2 - Bolt - 25 Nm
- 3 - Plate
- 4 - Shackle - Installation position => Fig. 2
- 5 - Rubber bush - Installation position => Fig. 2
- 6 - Bolt
- 7 - Plate
- 8 - Pressure spring
- 9 - Spacer
- 10 - Nut, self-locking - 25 Nm

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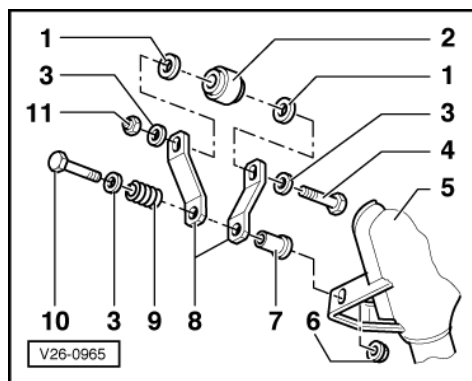


-> Fig.2 Installation position of rubber bush on left-hand side and location of shackle

- Press rubber bush -A- into shackle -B- until flush, as shown in the illustration.
 - Angle C = $90^\circ \pm 2^\circ$
 - Dimension D = 16 ± 2 mm

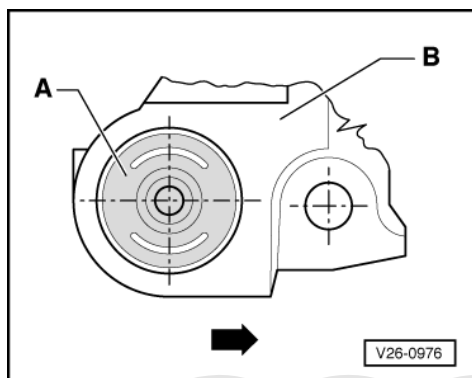
Note:

Arrow points in direction of travel.



-> Fig.3 Components of right mounting for vehicles with manual gearbox

- 1 - Plate
- 2 - Rubber bush - Installation position => Fig. 4
- 3 - Plate
- 4 - Bolt - Installation position => Fig. 5
- 5 - Catalytic converter
- 6 - Nut, self-locking - 25 Nm
- 7 - Spacer
- 8 - Plate
- 9 - Pressure spring
- 10 - Bolt
- 11 - Nut, self-locking - 25 Nm

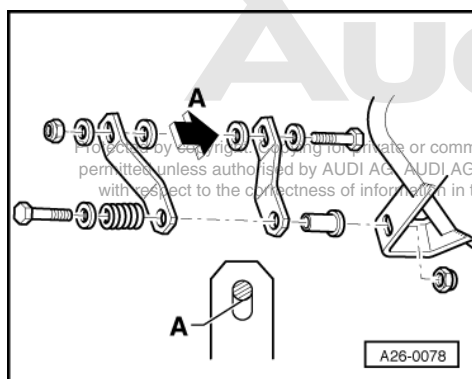


-> Fig.4 Installation position of rubber bush

- Rubber bush -A- must be pressed into gearbox support -B- until flush, as shown in the illustration.

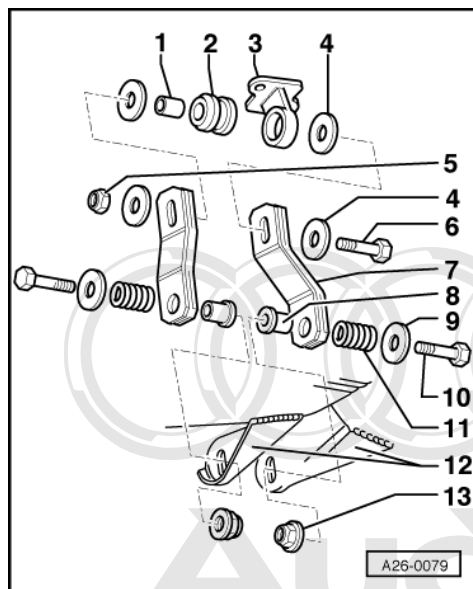
Note:

Arrow points in direction of travel.



-> Fig.5 Installation position of bolt

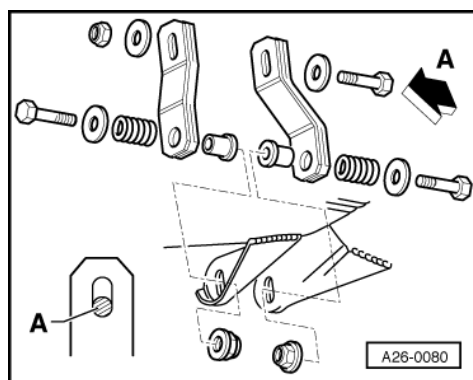
- ◆ A = Location of bolt when being tightened
- ◆ Bolt must be located at the top limit of the slot



-> Fig.6 Individual parts of mounting for vehicles with automatic gearbox

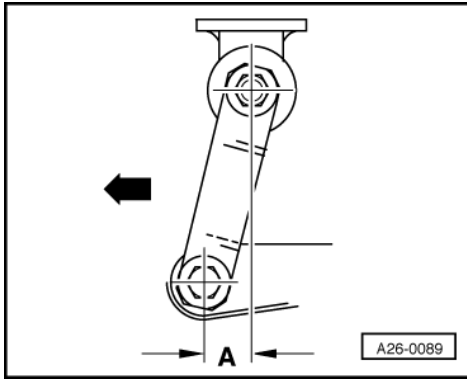
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- 1 - Spacer
- 2 - Buffer
- 3 - Bracket
- 4 - Plate
- 5 - Nut, self-locking - 23 Nm
- 6 - Bolt - Installation position => Fig. 7
- 7 - Shackle - Installation position => Fig. 8
- 8 - Spacer
- 9 - Plate
- 10 - Bolt
- 11 - Pressure spring
- 12 - Catalytic converter
- 13 - Nut, self-locking - 25 Nm



-> Fig.7 Installation position of bolt

- ♦ A = Location of bolt when being tightened
- ♦ Bolt must be located at the bottom limit of the slot.

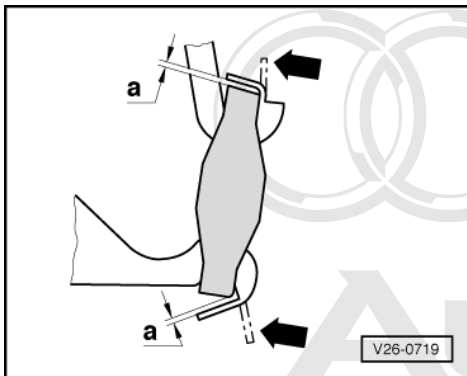


-> Fig.8 Installation position of shackle

- ◆ Dimension A = 26... 30 mm

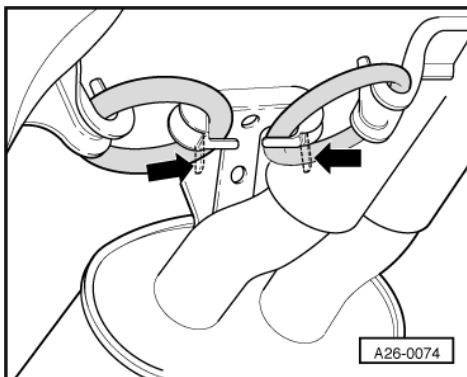
Note:

Arrow points in direction of travel.



-> Fig.9 Bending over securing tabs on brackets of front mounting

- Centre and rear silencers
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm



-> Fig.10 Bending over securing tabs on brackets of rear mounting

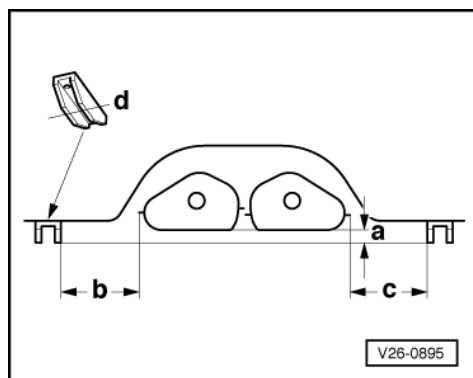
- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.

1.3 - Installing exhaust system stress-free - vehicles with front-wheel drive

Note:

The exhaust system must be aligned when cold.

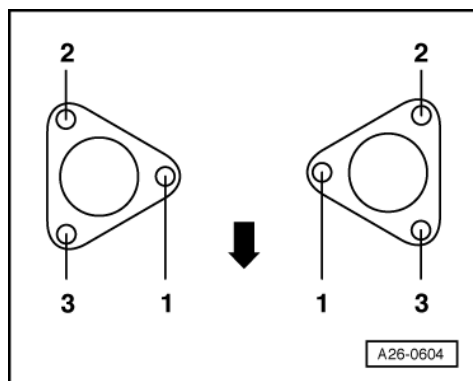
- Centre and rear silencers installed.
- Mountings for exhaust system to gearbox installed => Fig. 179 .
- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
 - Front exhaust pipe/exhaust manifold (left and right)
 - Exhaust system intermediate pipe/catalytic converter (left and right)
 - Front clamps
 - Flange between centre and rear silencers



- -> Align the catalytic converters to dimensions -a...c-.
 - Dimension a = 8 ... 12 mm
 - Dimension b = 174 ... 179 mm
 - Dimension c = 163 ... 168 mm

Notes:

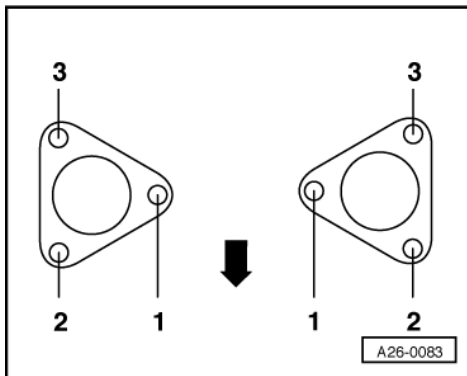
- ♦ The measurements should be carried out in the middle -d- of the catalytic converter collision guard.
- ♦ Illustration shows rear view of catalytic converters.



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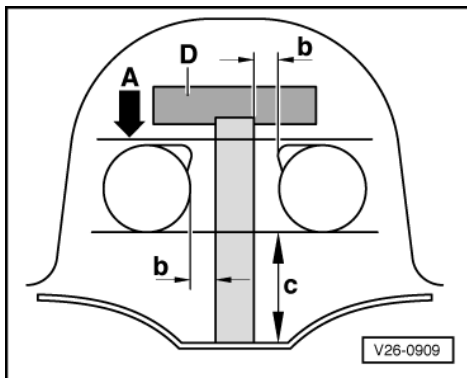
Vehicles with manual gearbox:

- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



Vehicles with automatic gearbox:

- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



- -> Align intermediate pipes so that the measuring angles of the intermediate pipes are horizontal and at the same height -arrow A-.

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Note:

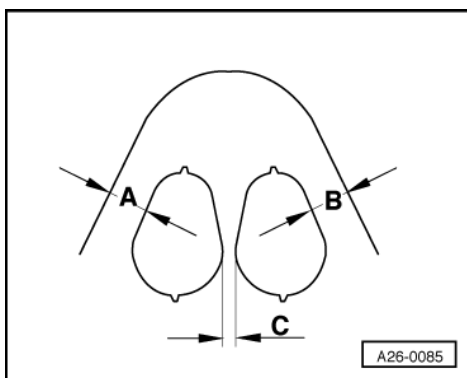
The bump stop -D- must not be damaged. The exhaust system must not be resting on the bump stop.

Distances from buffer stop -D-:

- Dimension b = 15 mm

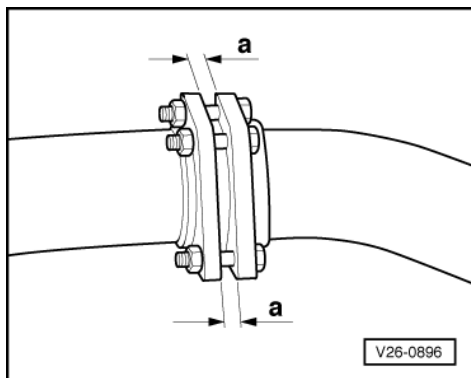
Distance from cross-piece:

- Dimension c = 70 mm

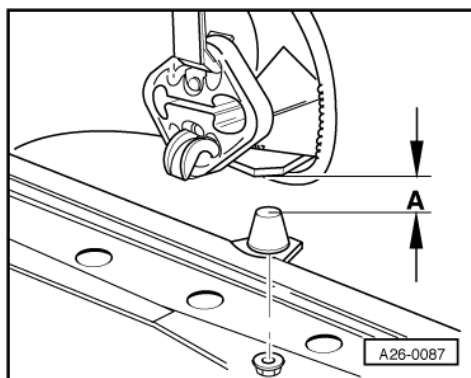




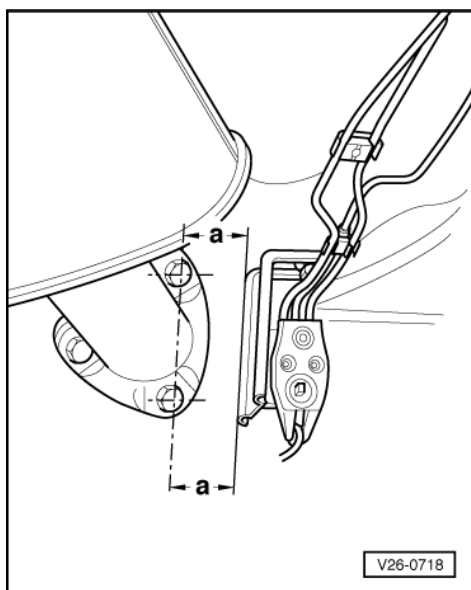
- Align front silencer.
 - Dimension A = approx. 24 mm
 - Dimension B = approx. 25.5 mm
 - Dimension C = 7 ... 9 mm



- -> Tighten the bolted connection at the catalytic converter/intermediate exhaust pipe flange connection (left and right) initially only hand-tight. The flange projections must be the same distance apart all the way round.
 - Dimension a at bottom = dimension a at top



- -> Check the location of the centre silencer with respect to the stop buffer (bolted onto the crossmember).
 - Dimension A = 18 ... 24 mm

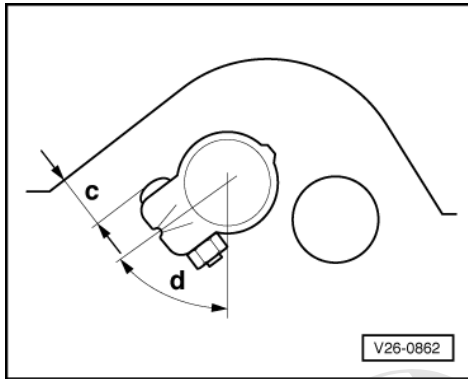


- -> Check that the bolted connections on the flange between centre and rear silencer are parallel to the brake pressure regulator bracket.
 - Dimension a at bottom = dimension a at top



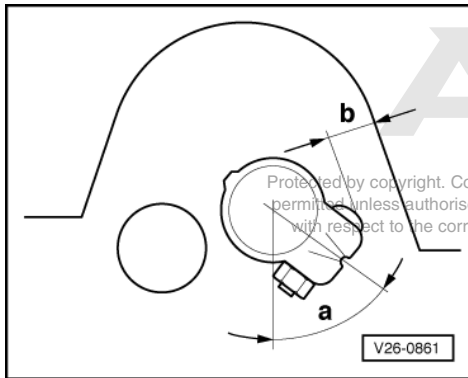
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- Tighten bolted connections at flange between centre and rear silencers (25 Nm).

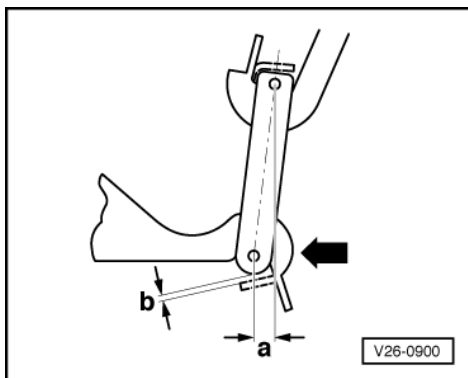


Align clamps as follows:

- -> The bolted connections of left clamp point to left.
 - Dimension $c = 25 \pm 5 \text{ mm}$
 - Angle $d = 41^\circ$



- -> The bolted connections of right clamp point to right.
 - Angle $a = 60^\circ$
 - Dimension $b = 25 \pm 5 \text{ mm}$
- Tighten the bolted connection at the catalytic converter/intermediate exhaust pipe flange connection (left and right) to final tightening torque (25 Nm).



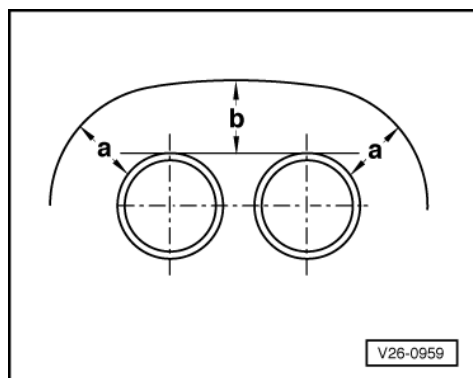
- -> Push exhaust system towards front of vehicle until front mounting of centre silencer is preloaded by $a = 7 \dots 9 \text{ mm}$.
- Tighten front bolted connections on clamp evenly to 40 Nm.

Notes:

- ♦ The securing tabs at the brackets should be bent over about 90° after installing the retainers.



- ♦ The distance -b- between the retainer and the locking tabs should be at least 2 mm.



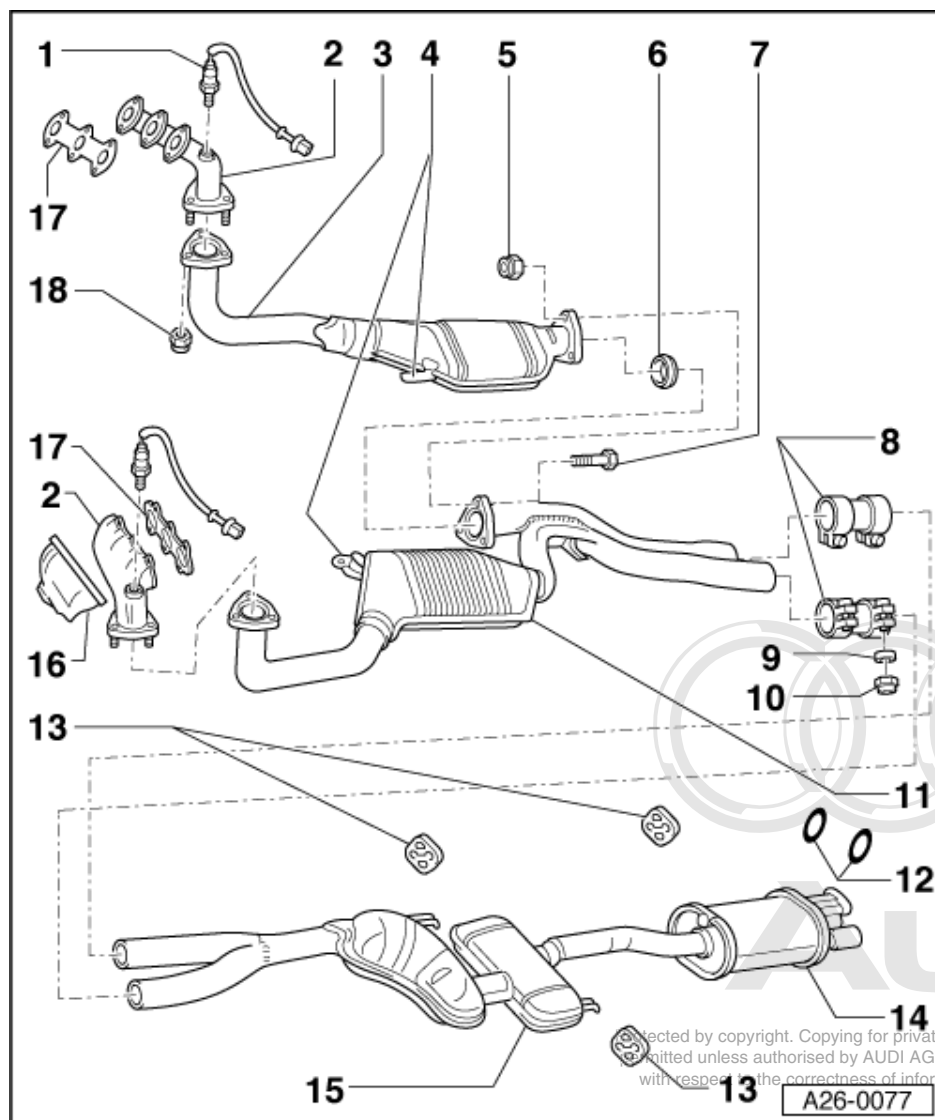
Aligning tailpipes

- -> Align tailpipes so that distance -a- is the same on both sides.
- At the same time, distance -b- must be obtained between bumper cut-out and tailpipe:
 - Dimension b = approx. 38 mm



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1.4 - Vehicles with four-wheel drive



1 Lambda probe - 55 Nm

- ♦ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ♦ High-temperature lubricant

=> Parts List

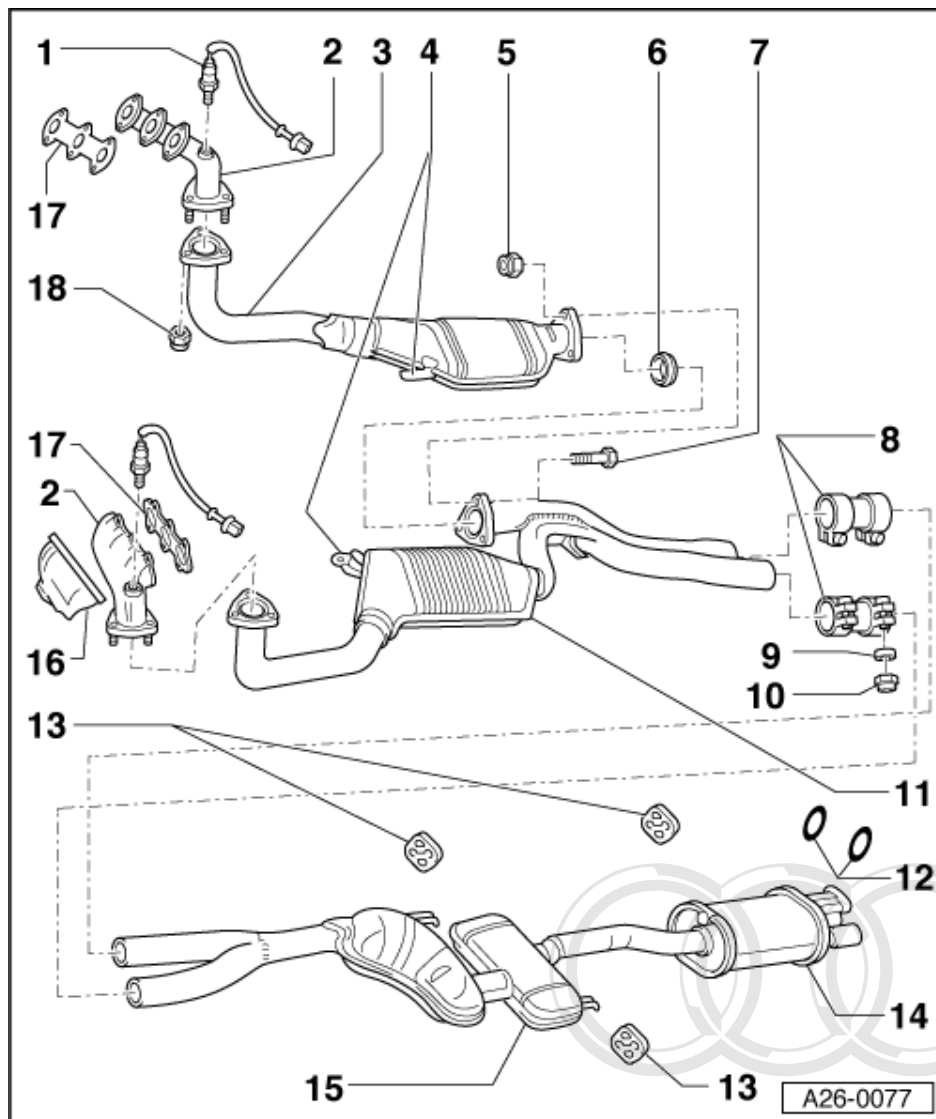
2 Exhaust manifold

3 Front exhaust pipe

- ♦ With catalytic converter
- ♦ Protect from damage by knocks and impact
- ♦ Installing stress-free =>Page 192 .

4 Catalytic converter mounting

- ♦ Components of mounting =>Fig. 1



5 25 Nm

- ♦ Replace

6 Sealing ring

- ♦ Replace

7 Bolt

8 Front clamping sleeves

- ♦ Installation position => Page 195

9 Shim

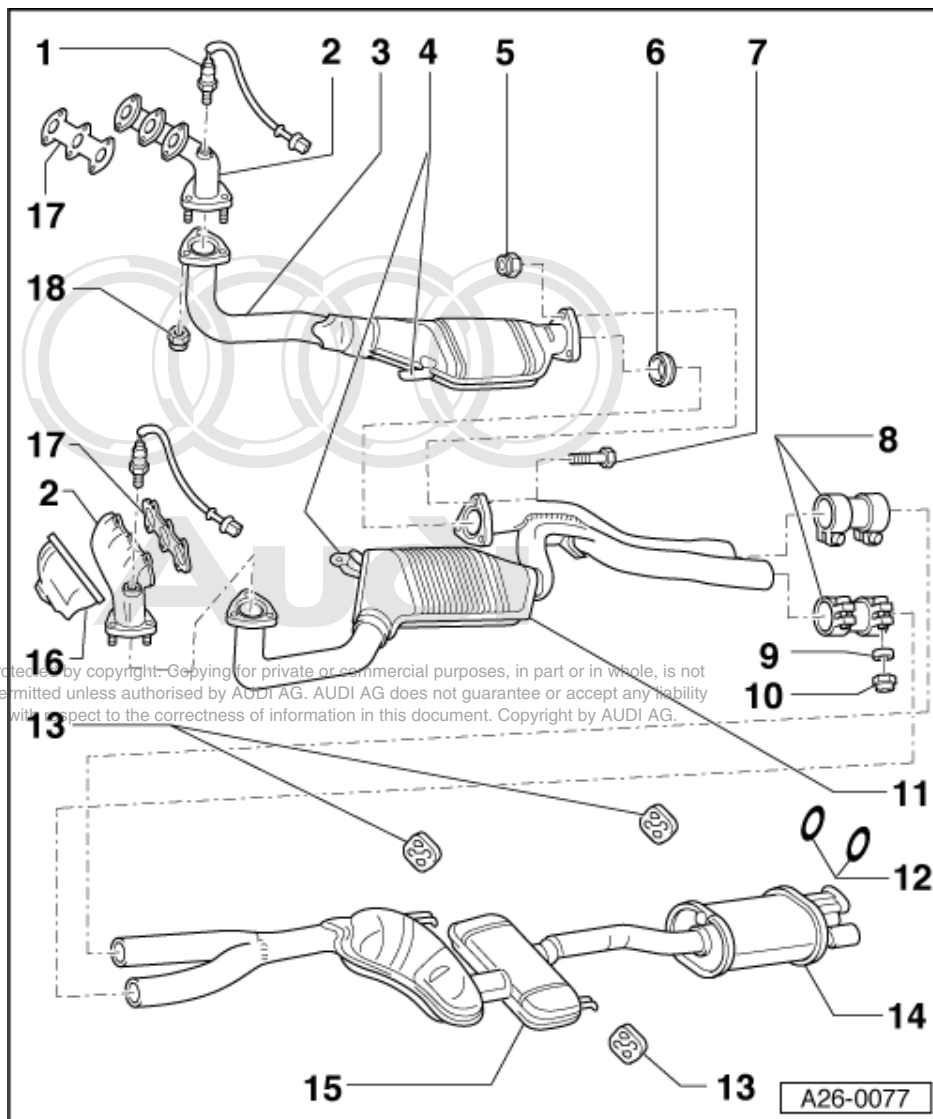
10 40 Nm

- ♦ Tighten evenly

11 Front exhaust pipe

- ♦ With catalytic converter and intermediate pipe
- ♦ Protect from damage by knocks and impact
- ♦ Installing stress-free =>Page 192 .

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12 Retaining ring

- ♦ Replace if damaged

13 Retainer

14 Rear silencer

- ♦ Installing stress-free =>Page 192 .

15 Centre silencer

- ♦ Installing stress-free =>Page 192 .

16 Heat shield

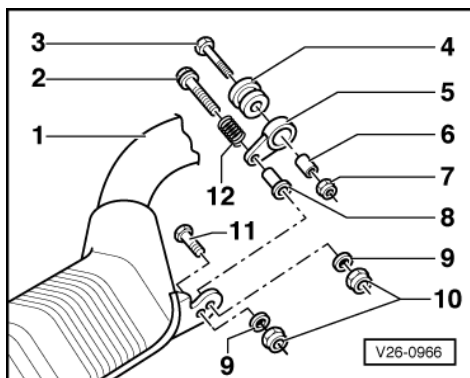
- ♦ Securing to cylinder head: 9 Nm (nuts)
- ♦ Connection of top/bottom heat shield: 5 Nm (bolts)

17 Seal

- ♦ Replace

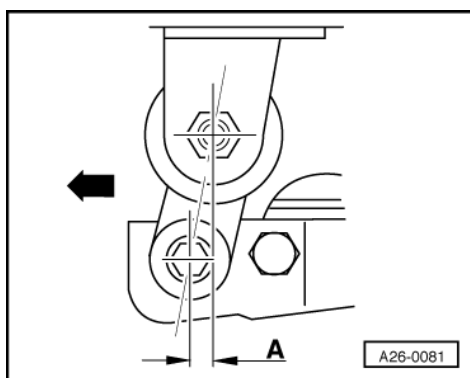
18 30 Nm

- ♦ Observe the tightening method => Page 195



-> Fig.1 Components of front mounting for catalytic converter

- 1 - Catalytic converter
- 2 - Combi bolt
- 3 - Bolt
- 4 - Buffer
- 5 - Shackle - Installation position => Fig. 2 or 3
- 6 - Tubular spacer
- 7 - Nut, self-locking - 25 Nm
- 8 - Spacer
- 9 - Plate
- 10 - Nut, self-locking - 25 Nm
- 11 - Bolt
- 12 - Pressure spring

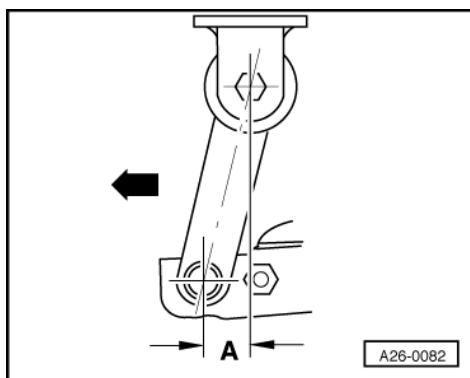


-> Fig.2 Installation position of shackle for vehicles with manual gearbox

- ♦ When cold the dimension -A- 7 ± 2 mm

Note:

Arrow points in direction of travel.



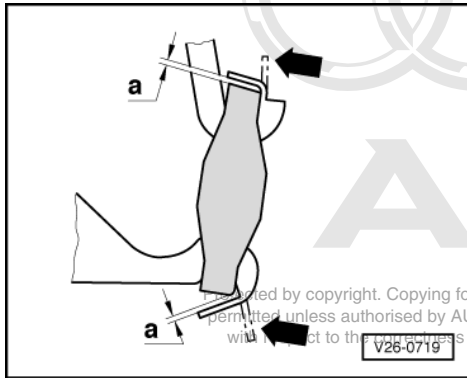
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-> Fig.3 Installation position of shackle for vehicles with automatic gearbox

- ♦ When cold the dimension -A- 21.8 ± 2 mm

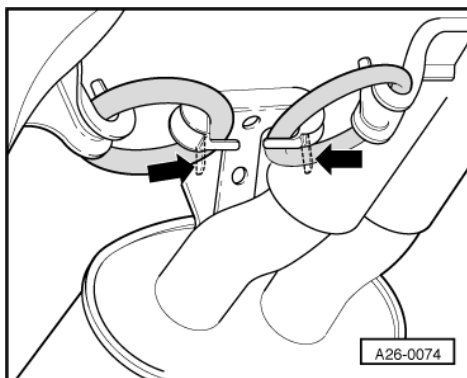
Note:

Arrow points in direction of travel.



-> Fig.4 Bending over securing tabs on brackets of front mounting

- Centre and rear silencers
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm

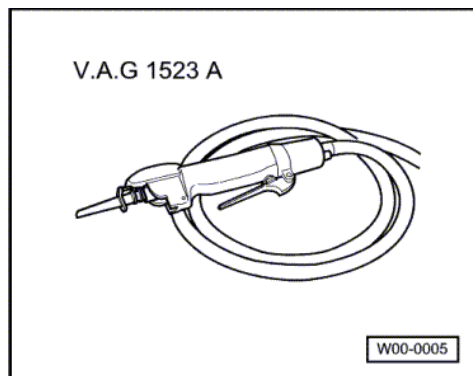


-> Fig.5 Bending over securing tabs on brackets of rear mounting

- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.

1.5 - Separating centre and rear silencers - Vehicles with four-wheel drive

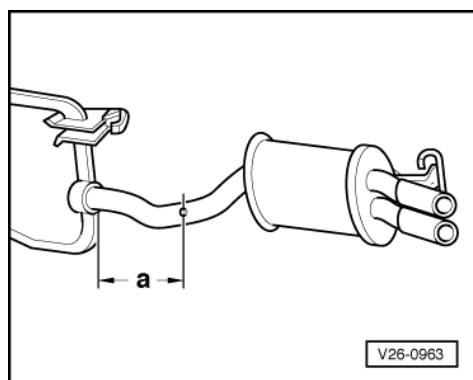
- ♦ The connecting pipe can be cut through at the cutting point in order to replace the centre and rear silencers separately.
- ♦ The cutting point is marked with an indentation on the outside of the exhaust pipe.



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Special tools and workshop equipment required

- ♦ Body saw V.A.G 1523 A
- ♦ Protective goggles



Procedure

Important
Wear protective goggles.

- -> Cut through exhaust pipe at right angles at specified cutting point using body saw e.g. V.A.G 1523 A.
- Dimension a = 220 mm

Note:

A short clamp is provided for connecting the main and rear silencers when performing repairs.

- When installing, position clamping sleeve centrally over saw cut.
 - Installation position of clamp => Page 26-32
- Stress-free alignment of exhaust system => Page 192
- Tighten bolted connections on clamp evenly to 40 Nm.

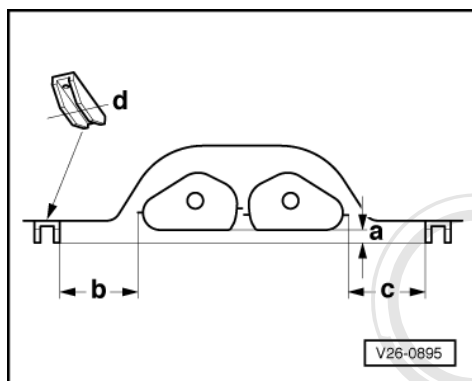
1.6 - Installing exhaust system stress-free - vehicles with four-wheel drive

Note:

The exhaust system must be aligned when cold.

- Centre and rear silencers installed.

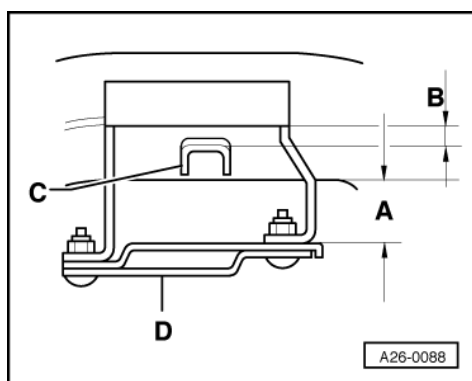
- Mountings for exhaust system to gearbox installed => Fig. 190 .
- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
 - Front exhaust pipe/exhaust manifold (left and right)
 - Flange to right catalytic converter
 - Clamping sleeves between catalytic converter and centre silencer
 - Clamping sleeve at rear, where applicable



- -> Align the catalytic converters to dimensions -a...c-.
 - Distance a = 18 ... 22 mm
 - Dimension b = 182 ... 185 mm
 - Dimension c = 182 ... 185 mm

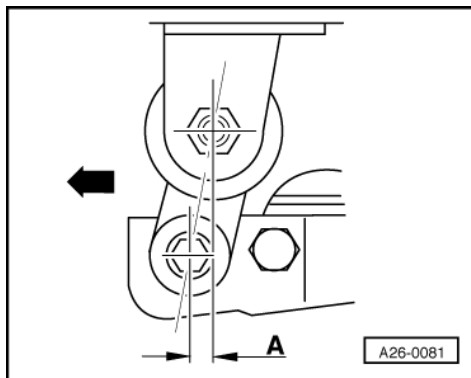
Notes:

- ♦ The measurements should be carried out in the middle -d- of the catalytic converter collision guard.
- ♦ Illustration shows rear view of catalytic converters.



Vehicles with manual gearbox:

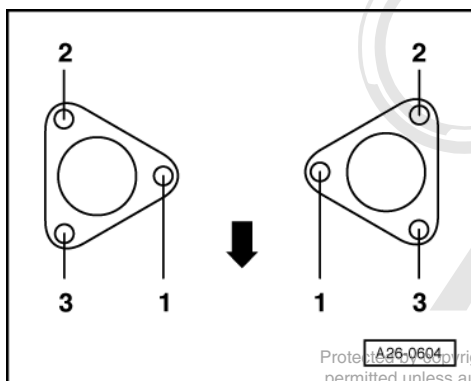
- -> Align the stop -C- at the intermediate pipe with respect to the stop bracket on the crossmember -D-.
 - Dimension A = 36...40 mm
 - Dimension B = approx. 15 mm



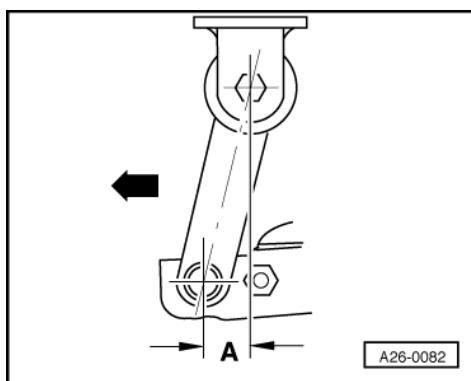
- -> Check installation position of shackle on gearbox support.
- When cold the dimension -A- 7 ± 2 mm

Note:

Arrow points in direction of travel.



- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially; then tighten to their final tightening torque of 30 Nm in the same sequence.

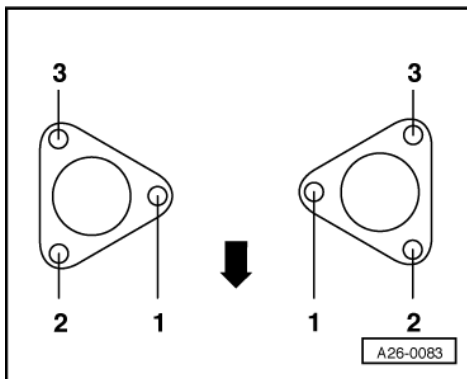


Vehicles with automatic gearbox:

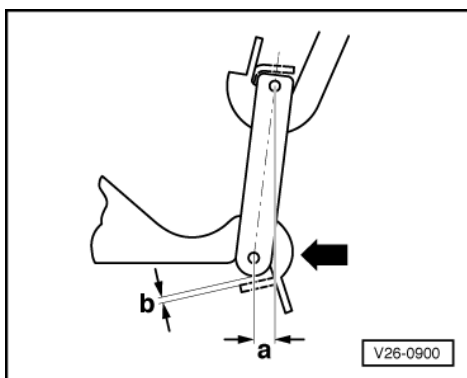
- -> Check installation position of shackle on gearbox support.
- When cold the dimension -A- 21.8 ± 2 mm

Note:

Arrow points in direction of travel.



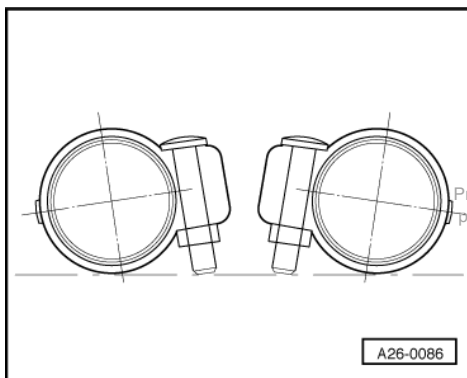
- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



- -> Push exhaust system towards front of vehicle until front mounting of centre silencer is preloaded by $a = 7 \dots 10$ mm.

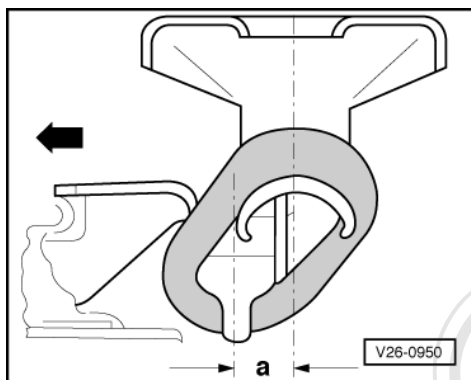
Notes:

- ◆ The securing tabs at the brackets should be bent over about 90° after installing the retainers.
- ◆ The distance -b- between the retainer and the locking tabs should be at least 2 mm.



Align clamping sleeves at front as follows:

- -> Ends of bolts must not protrude over bottom edge of clamping sleeve.
- Tighten front bolted connections on clamp evenly to 40 Nm.



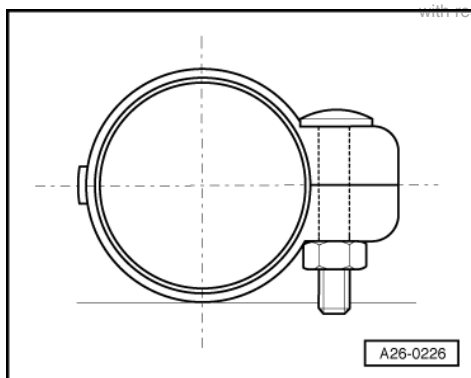
Vehicles with clamp between centre and rear silencers:

Note:

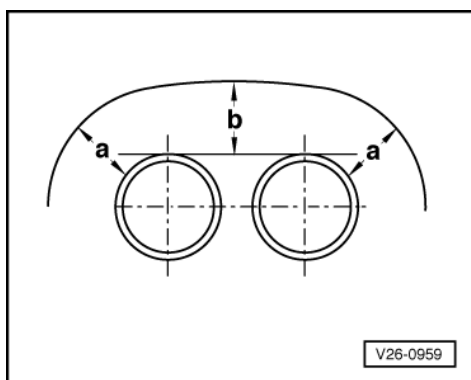
It is only necessary to additionally align the rear silencer on vehicles with a clamping sleeve between the centre silencer and the rear silencer.

- -> Push rear silencer towards front of vehicle -arrow- until rear mounting on rear silencer is preloaded by $a = 12 \dots 14 \text{ mm}$.

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- -> Note installation position of clamp at rear:
 - Bolted connection faces right
- Tighten bolted connections on clamp evenly to 40 Nm.



All models:

Aligning tailpipes

- -> Align tailpipes so that distance -a- is the same on both sides.
- At the same time, distance -b- must be obtained between bumper cut-out and tailpipe:

- Dimension b = approx. 38 mm



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