

Workshop Manual Audi A3 2004 ➤

4-cylinder direct petrol injection engine (1.6 ltr. 4-valve), mechanics

Engine ID	BAG	BLP	BLF						
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Edition 12.2005



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List of Workshop Manual Repair Groups

Repair Group

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- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 26 - Exhaust system



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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00 – Technical data

1 Technical data

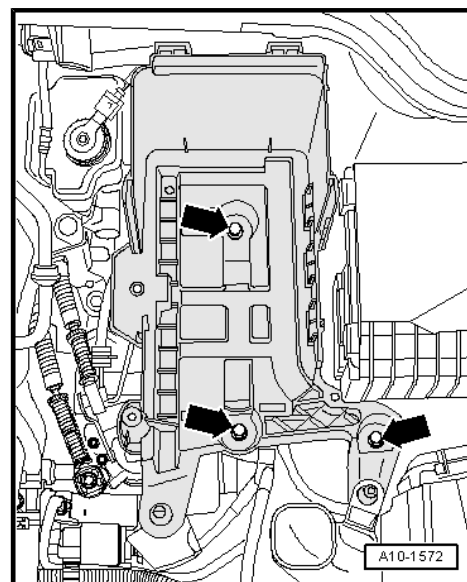
1.1 Engine number

There is a sticker on the timing chain cover indicating the "Engine code" and "Serial number" -arrow-.

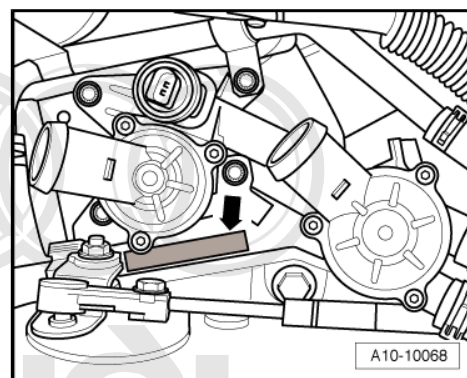
The engine code is also indicated on the vehicle data stickers.

If the sticker is missing, perform the following work steps to read off the "Engine code" and the "Serial number":

- Remove battery ⇒ Rep. Gr. 27 .
- Remove battery tray -arrows-.



- Read off the engine code letters and serial number on the left-side of the cylinder block -arrow-.



1.2 Engine data

Code letters		BAG	BLF	BLP
Capacity	ltr.	1.598	1.598	1.598
Power output	kW at rpm	85/6000	85/4000	85/6000



Code letters		BAG	BLF	BLP
Torque	Nm at rpm	155/4000	155/4000	155/4000
Bore	Ø in mm	76.5	76.5	76.5
Stroke	mm	86.9	86.9	86.9
Compression ratio		12.0	12.0	12.0
RON		98 ¹⁾	95 ²⁾	98 ¹⁾
Firing order		1-3-4-2	1-3-4-2	1-3-4-2
Exhaust gas recirculation		yes	yes	yes
Variable valve timing		yes	yes	yes
Intake manifold change-over		no	no	no
Secondary air system		no	no	no
• ¹⁾ Unleaded petrol RON 95 can also be used, but results in reduced power • ²⁾ Unleaded petrol RON 91 can also be used, but results in reduced power				

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2 General repair instructions

2.1 Safety precautions



WARNING

*The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ **page 4**. A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

To avoid any risk of injuries to persons and/or damage to the fuel injection and ignition system, always observe the following safety precautions.

- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ Certain tests may lead to a fault being detected by the control unit and stored. After completing all tests and repair work therefore interrogate fault memory and erase, if necessary. If you have erased fault memory, you must then generate readiness code in engine control unit in "Guided fault finding" mode.
- ◆ Always switch off the ignition before cleaning the engine.



Caution

- ◆ *Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.*
- ◆ *Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27.*

2.2 Rules for cleanliness when working on the injection system

Even small amounts of dirt can cause faults in the injection system. When working on the fuel supply/injection system, pay careful attention to the following basic rules:

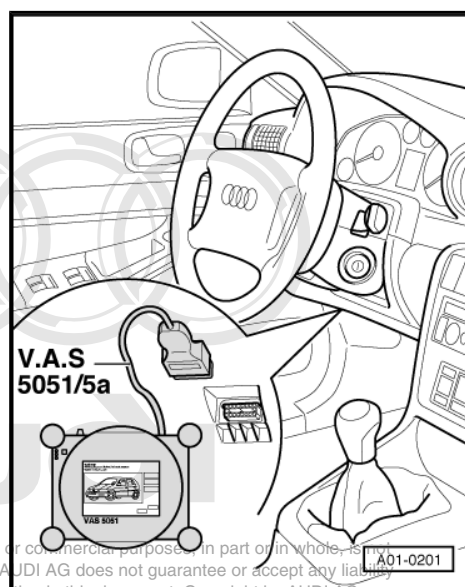
- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and allow to dry thoroughly before opening.
- ◆ Plug open lines and connections with suitable protective caps immediately.
- ◆ Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.

2.3 Important: Required procedure prior to opening high-pressure injection system

The injection system consists of a high-pressure section (maximum approx. 110 bar) and a low-pressure section (approx. 6 bar).

Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail (bottom section of intake manifold), injectors, intake manifold flap motor for air-flow control, a fuel line, or any other component located in the high-pressure zone of the injection system) the fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 8 bar. The procedure is described below.

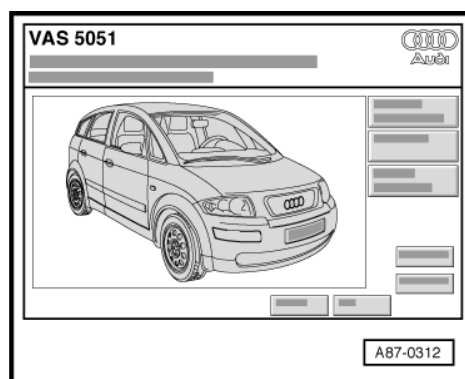
- Unplug electrical connector at solenoid valve 1 for activated charcoal filter system -N80- .
- Start engine and run at idling speed.
- Connect vehicle diagnostic, testing and information system - VAS 5051- with diagnostic cable -VAS 5051/5 A- .



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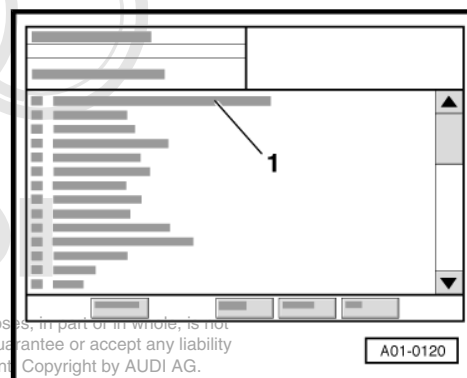
Display on -VAS 5051- :

- Press the "Vehicle self-diagnosis" key.



Display on -VAS 5051- :

- From list -1- select vehicle system "01 Engine electronics".
- Wait until next display appears on tester.

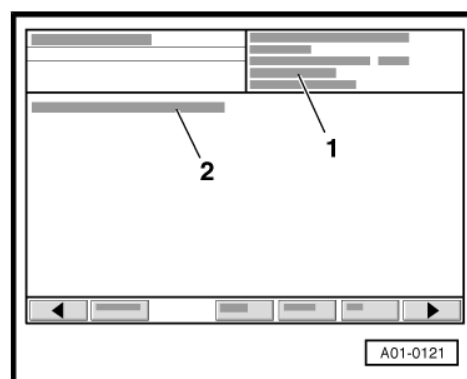


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Display on -VAS 5051- :

1 - Engine control unit identification.

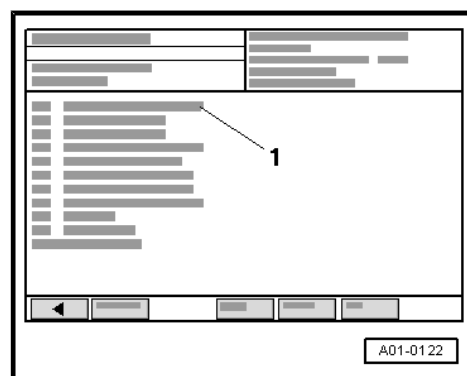
- Press the  key.



Display on -VAS 5051- :

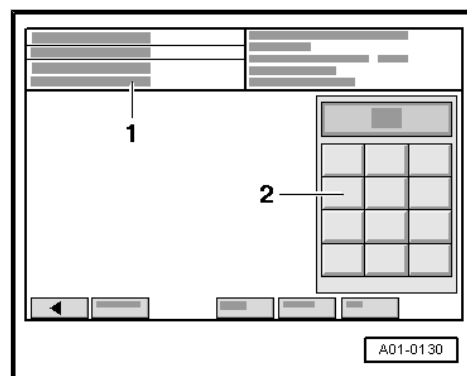
1 - Selection of diagnostic functions

- From the list -1- select diagnostic function "08 - Read measured value block".



Display on -VAS 5051- :

- In zone -2- enter "140" for "display group 140" and confirm the entry by pressing the  key.



Display on -VAS 5051- :

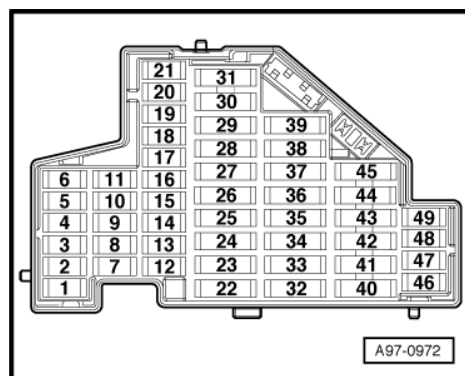
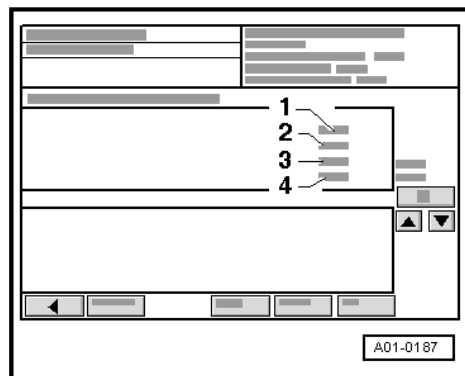
- Check fuel pressure in zone -3-:
- With engine idling the figure displayed will be approx. 35 bar. The display shows the actual pressure in the fuel rail which is being generated by the high-pressure pump.



Note

Display zone -2- shows the required pressure (specification). Actual pressure should match specification.

- Remove fuse -27- for fuel pump control unit -J538- from fuse holder on dash panel (left-side).



- Leave engine running and observe fuel pressure displayed in zone -3- of -VAS 5051-.

- The fuel pressure will decrease very quickly because the mechanical high-pressure pump is no longer being supplied with fuel from the fuel tank by the electric fuel pump.
- Switch off ignition as soon as fuel pressure has dropped to approx. 8 bar.



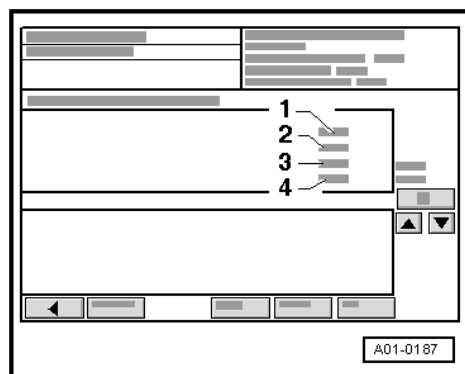
Note

Fuel pressure must not fall below 6 bar, otherwise the engine will stall (this could damage the catalytic converter).

The fuel rail (bottom section of intake manifold) is still filled with fuel, however it is no longer under high pressure.

Components or lines can now be opened. A clean cloth must be wrapped around the connections. Any discharged fuel must be collected.

- Re-insert fuse for electric fuel pump control unit.
- Interrogate and, if necessary, erase fault memory of engine control unit upon completion of repair work.
- Generate readiness code in engine control unit in "Guided fault finding" mode.

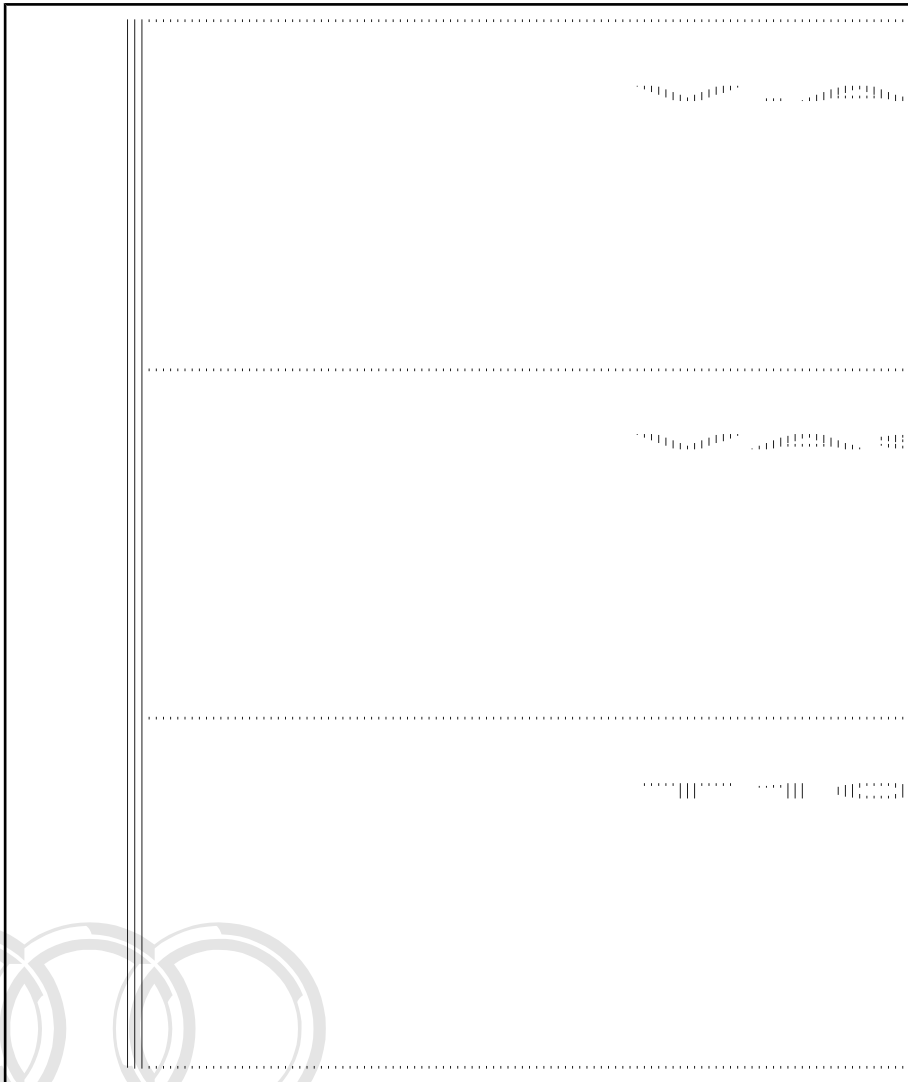


10 – Removing and installing engine

1 Removing and installing engine

Special tools and workshop equipment required

- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Stepladder -VAS 5085-
- ◆ Drip tray for workshop hoist -VAS 6208-
- ◆ Wedge -T10161-
- ◆ Engine support -T40075-



1.1 Removing engine



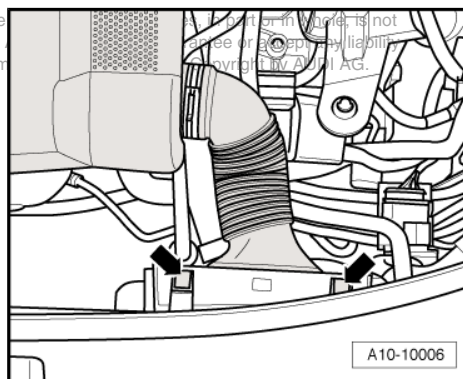
Note

- ◆ *The engine is removed from underneath together with the gearbox.*
- ◆ *Renew all cable ties which are released or cut open when removing the engine. Refit in the same position when installing the engine.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*

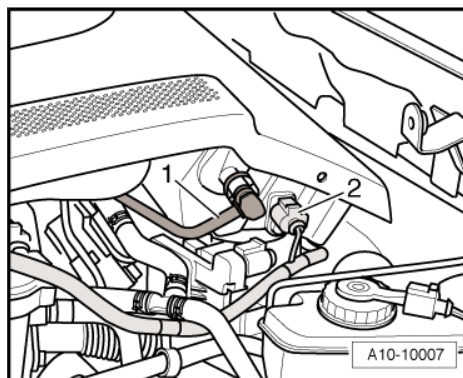

WARNING

- ◆ *The fuel system operates under high pressure.*
- ◆ *Do not open high-pressure section when removing engine. When removing the engine for repair procedures during which the high-pressure section must be opened (e.g. when removing the cylinder head), the fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure ⇒ **page 4**. A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

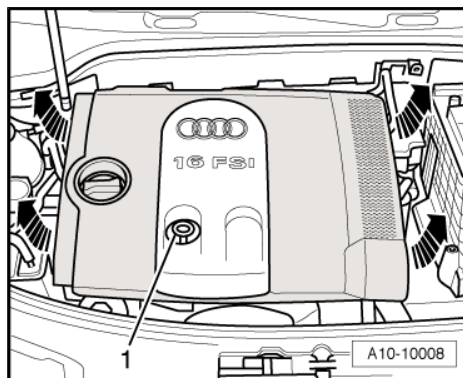
- Unclip air intake hose from air duct -arrows-



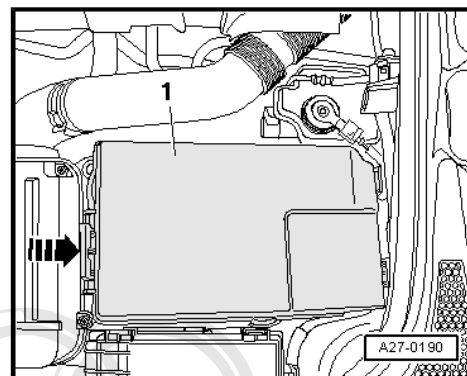
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.

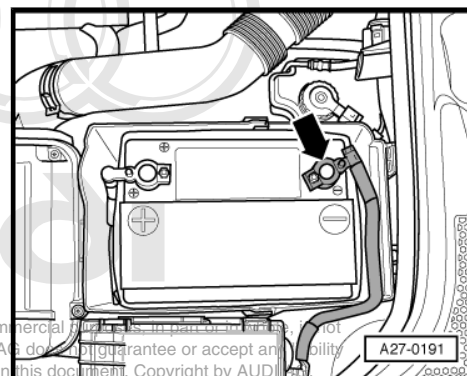


- Remove cover -1- over battery. To do so, press release tab -arrow-.

**Caution**

Observe notes on procedure for disconnecting the battery → Rep. Gr. 27.

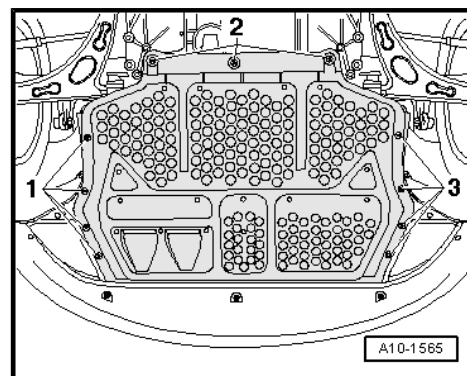
- With ignition switched off, disconnect battery earth cable -arrow-.

**WARNING**

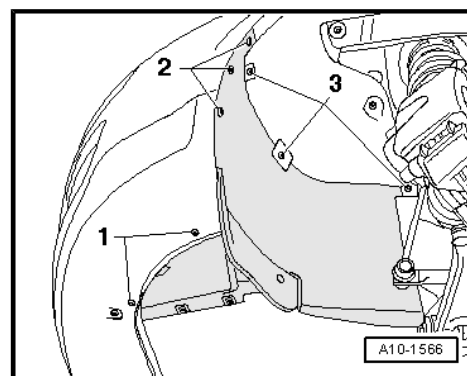
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

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- Open filler cap on coolant expansion tank.
- Remove both front wheels.
- Remove centre noise insulation -fasteners 1 ... 3-.



- Remove noise insulation (left and right) -fasteners 1 ... 3-.



- Unplug electrical connector -1- at radiator outlet coolant temperature sender -G83- .
- Place drip tray for workshop hoist -VAS 6208- under engine.

Vehicles with drain plug:

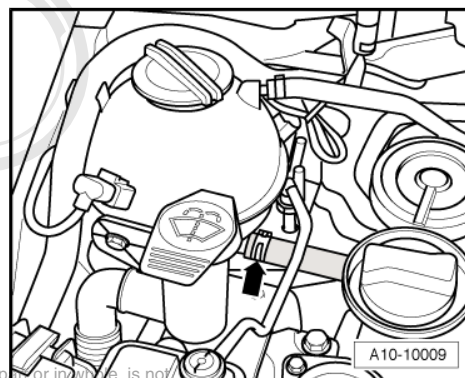
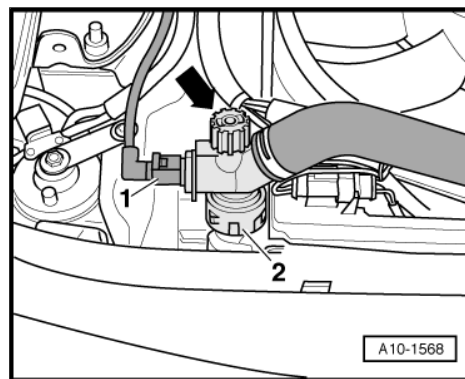
- Turn drain plug -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.

Vehicles without drain plug:

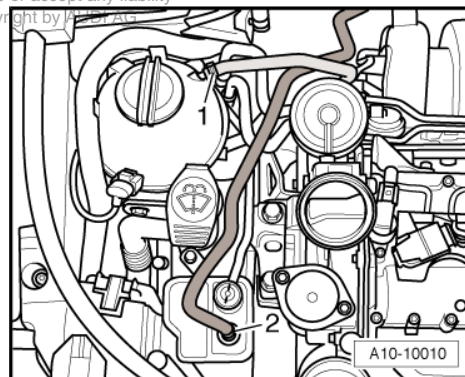
- Remove bottom coolant hose -2- from radiator by pulling off retaining clip.

All models:

- Drain off coolant.
- Detach coolant hose -arrow- at coolant expansion tank and guide downwards to drain off remaining coolant.



- Detach coolant hose -1- at expansion tank.
- Disconnect vacuum hose -2- from activated charcoal filter and move hose clear.



- Disconnect fuel supply pipe -3- by pulling release ring.

Vehicles with engine code letters BAG:

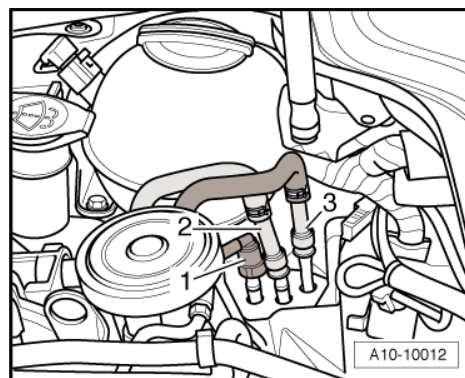
- Disconnect fuel return pipe -2- by pulling release ring.

All models:

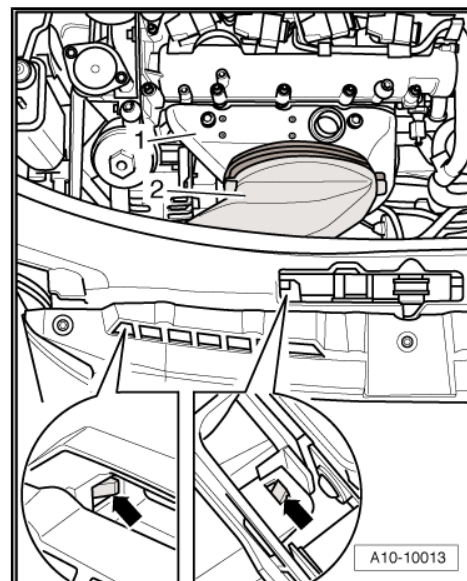


Note

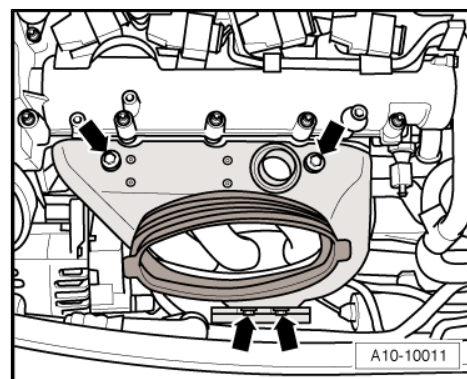
Disregard -item 1-.



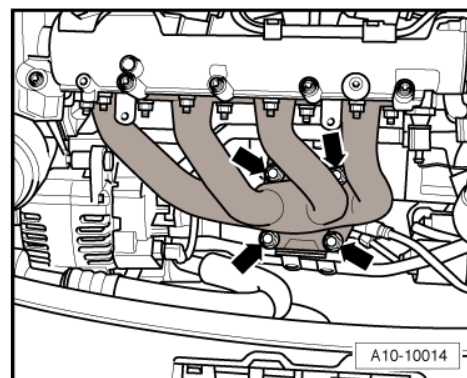
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



- Unbolt hot air collector plate -arrows-.

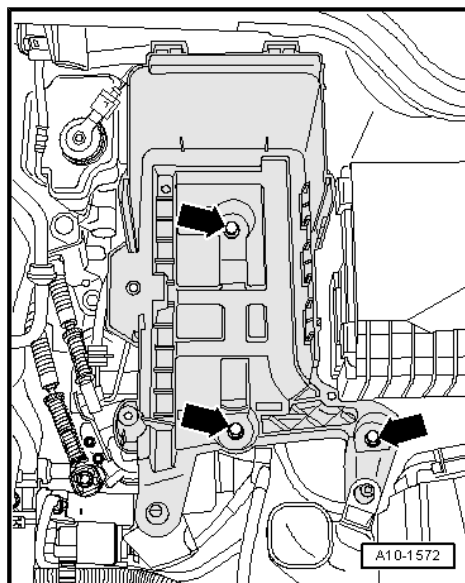


- Unbolt front exhaust pipe from exhaust manifold -arrows-.

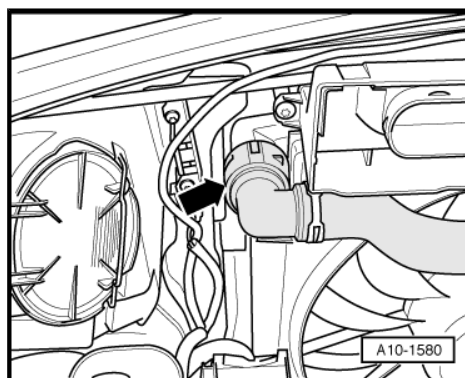


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- Remove battery ⇒ Rep. Gr. 27 .
- Remove battery tray -arrows-.



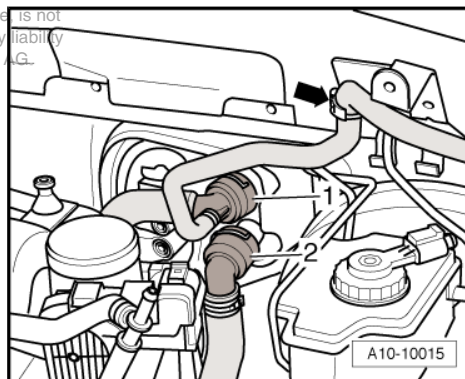
- Detach top coolant hose from radiator -arrow-.



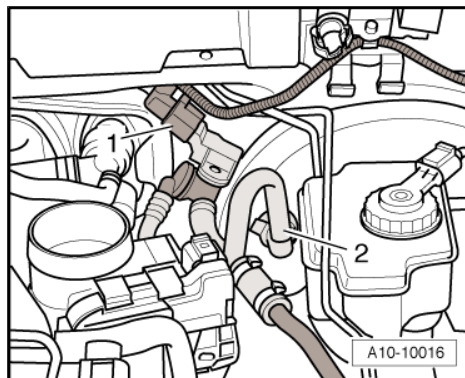
- Detach coolant hoses -1- and -2- going to heat exchanger at bulkhead.

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- Unclip coolant hose at bracket -arrow-.

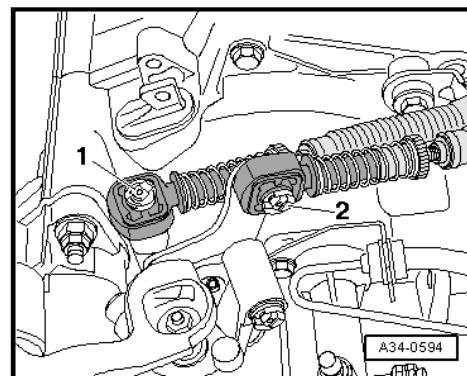


- Detach vacuum hose -2- at brake servo.
- Unplug electrical connector -1- at brake servo pressure sensor -G294- .

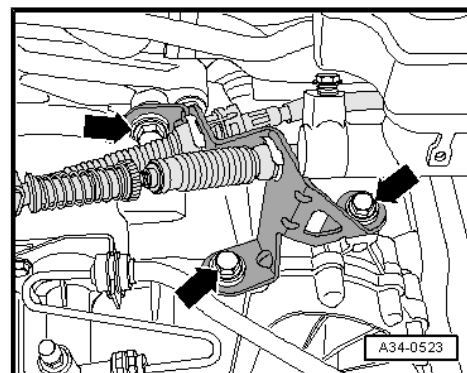


Vehicles with manual gearbox:

- Unclip securing clips -1- and -2- from both selector cables.
- Pull off selector cable end-pieces from gearbox selector lever and relay lever.



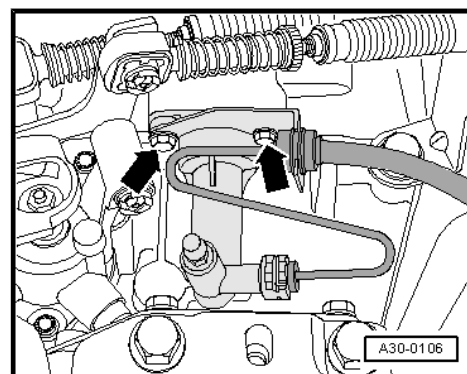
- Remove cable support bracket from gearbox -arrows- and place to one side.



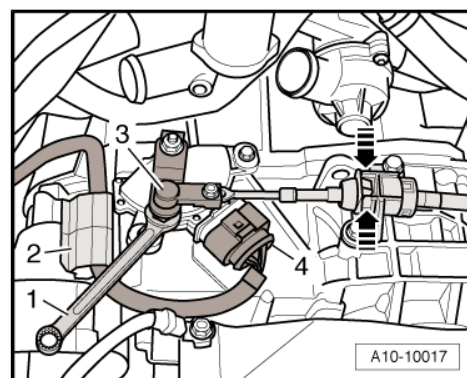
- Detach slave cylinder -arrows- and place to one side. Do not open pipes.

**Caution**

Do not press clutch pedal after removing slave cylinder.

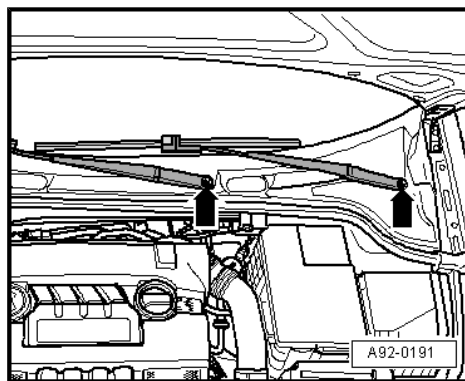
**Vehicles with automatic gearbox:**

- Pry off selector lever cable -3- from lever for selector shaft using a 10 mm open-end spanner -Item 1-, or similar.
- Press together the retaining tabs on support bracket for selector lever cable -arrows- and pull selector lever cable out of support bracket on gearbox.
- Unplug electrical connector -4- and move electrical wire clear at bracket -2-.

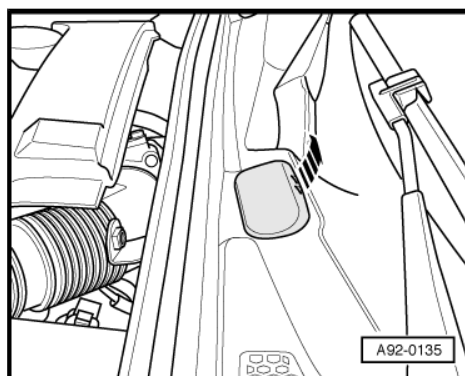


All models:

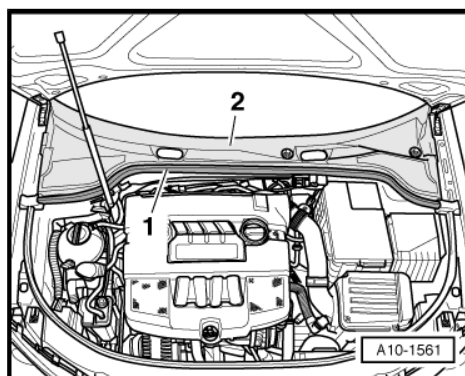
- Lever off caps on windscreen wiper arms with a screwdriver.
- Loosen hexagon nuts -arrows- several turns.
- Loosen wiper arms from wiper shafts by tilting slightly, remove nuts and take off wiper arms.



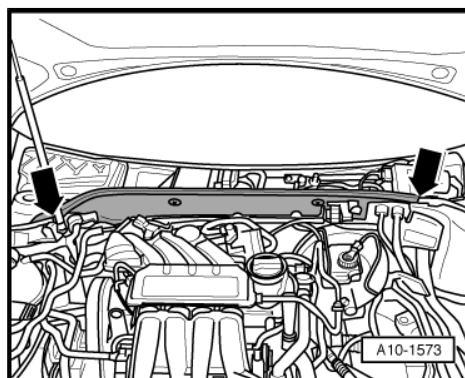
- Unclip washer jets -arrow-.
- Push washer jets through assembly opening back into plenum chamber, leaving hoses connected.



- Pull off rubber seal -1- on plenum chamber cover.
- Detach plenum chamber cover -2-.



- Detach engine wiring harness at rear of plenum chamber intermediate plate.
- Remove plenum chamber intermediate plate -arrows-.



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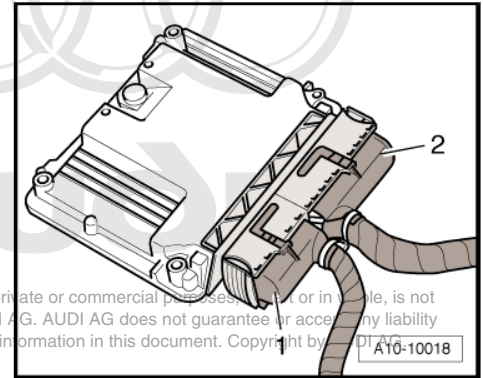
- Detach cover for engine control unit ⇒ Rep. Gr. 24 .
- Unplug engine wiring harness connector -1-.



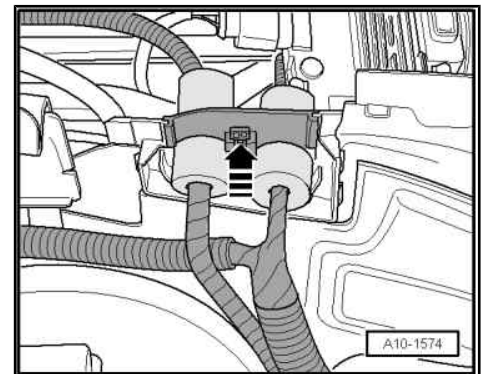
Note

The electrical connector -2- remains connected.

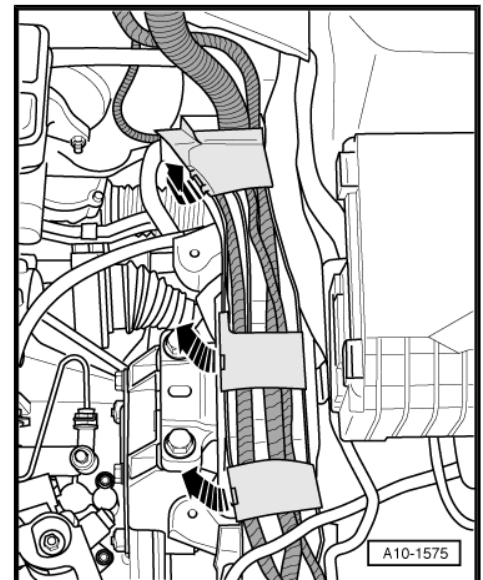
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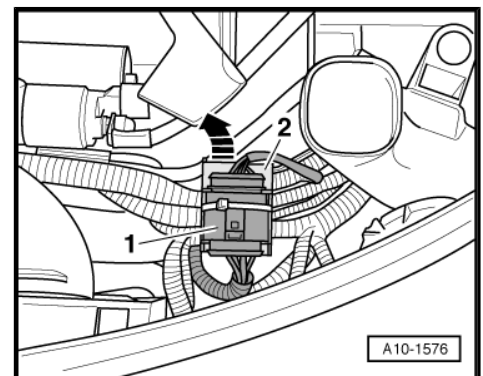
- Release wiring protector for engine wiring harness -arrow- and lift off.



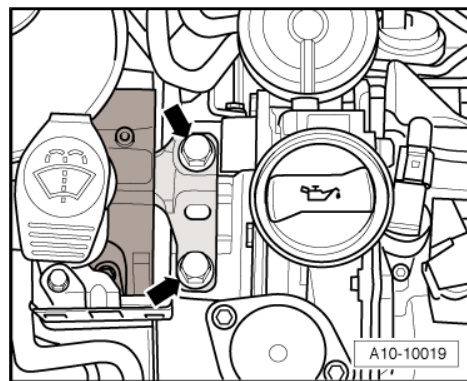
- Open wiring duct brackets -arrows-.



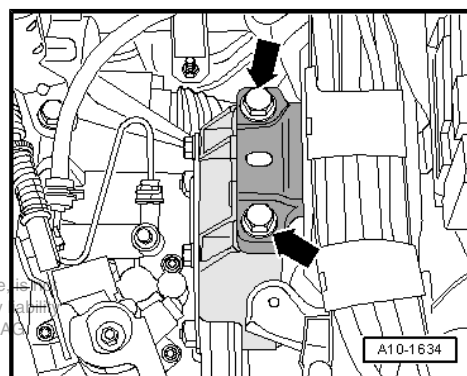
- Move electrical connector -1- clear and disconnect.
- Open wiring duct bracket located below -2- -arrow-.
- Remove engine control unit wiring harness from wiring duct.



- Loosen bolts -arrows- of assembly mounting for engine approx. 2 turns.



- Loosen bolts -arrows- of assembly mounting for gearbox approx. 2 turns.



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Vehicles with manual gearbox:

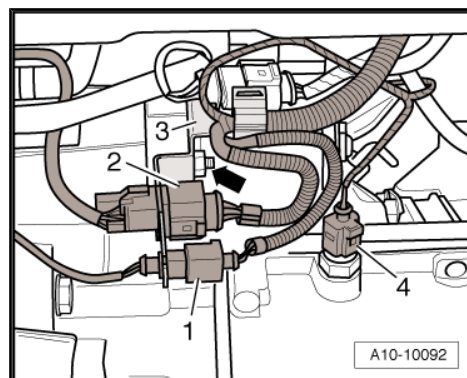
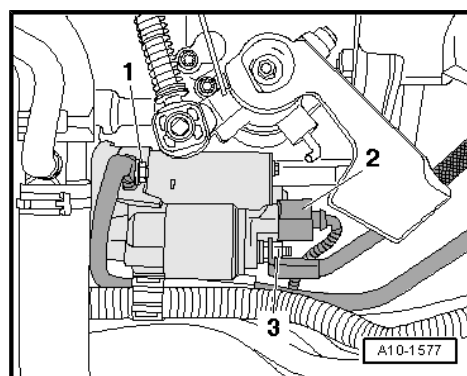
- Disconnect earth cable -1-.



Note

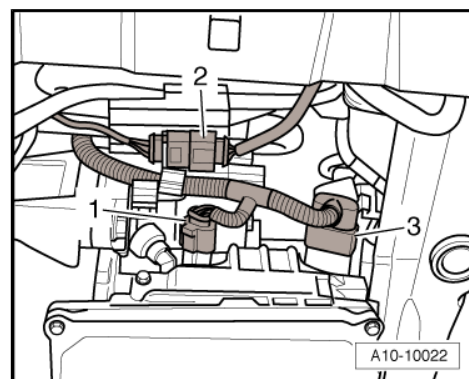
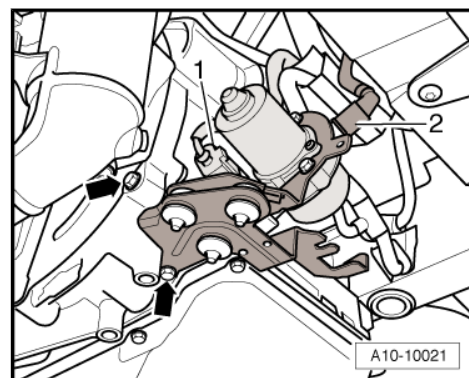
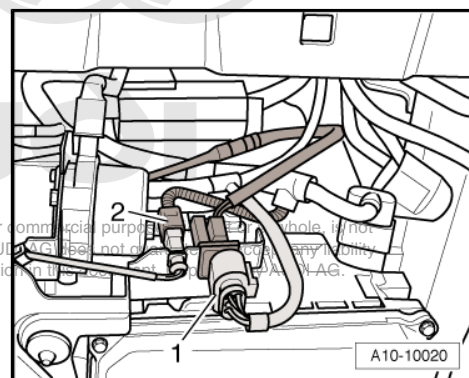
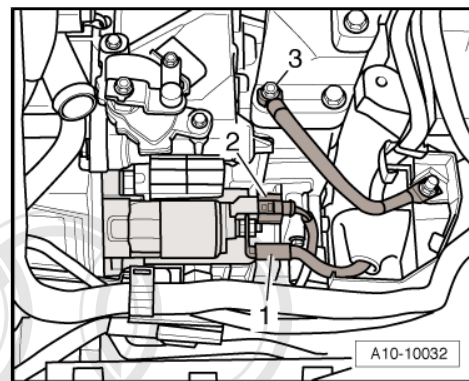
On some versions the earth wire may be attached to the engine mounting.

- Detach wires -2- and -3- at starter and move wires clear.
- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Unplug electrical connector -4- for reversing light switch -F4- .
- Move engine wiring harness at bracket -3- clear.
- Unscrew nut -arrow- and remove bracket with wiring from stud.



Vehicles with automatic gearbox:

- Disconnect earth cable -3-.
- Detach wires -1- and -2- at starter and move clear.
- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Detach electrical connector -1-.
- Detach vacuum hose -2-.
- Unscrew bolts -arrows- and remove vacuum pump for brake servo.
- Unplug electrical connectors -1- and -3- at automatic gearbox.
- Unplug electrical connector -2- and move electrical wire clear.



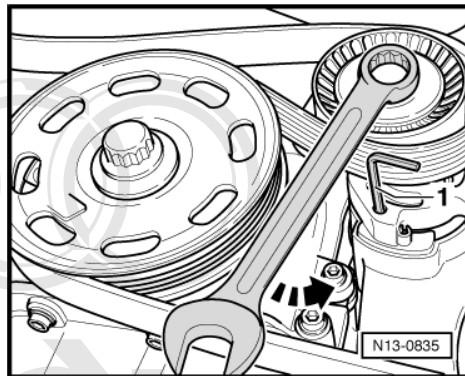
All models:



Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Lock the belt tensioner with a 4 mm angled Allen key -Item 1-.
- Remove poly V-belt.



WARNING

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The air conditioner refrigerant circuit must not be opened.

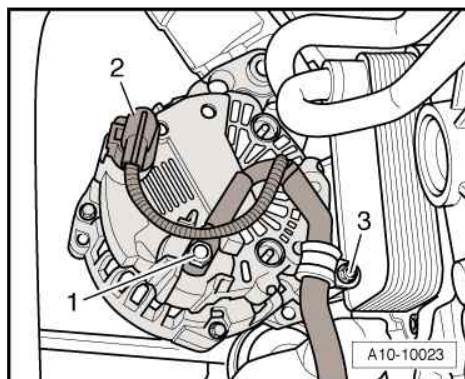
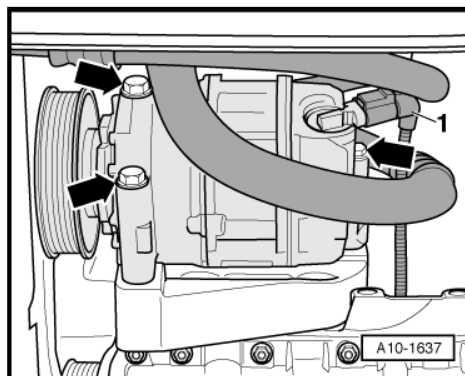
- Unplug electrical connector -1- for magnetic clutch of air conditioner compressor.
- Remove bolts -arrows- for air conditioner compressor.



Note

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

- Tie air conditioner compressor up to lock carrier.
- Detach electrical connector -2-.
- Unscrew wire -1- at alternator.
- Unbolt wire clamp -3- at alternator and move wiring harness clear.

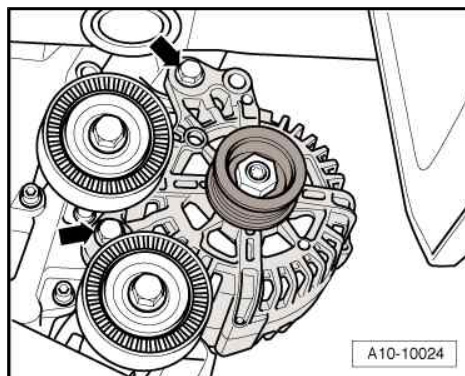


- Unscrew bolts -arrows- and remove alternator.

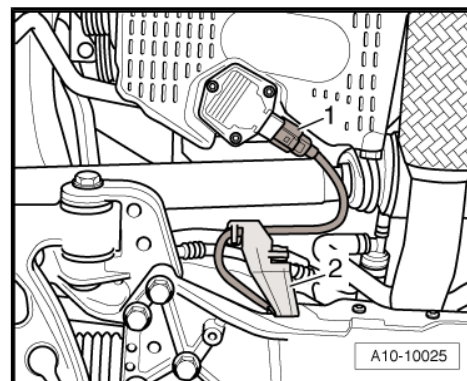


Note

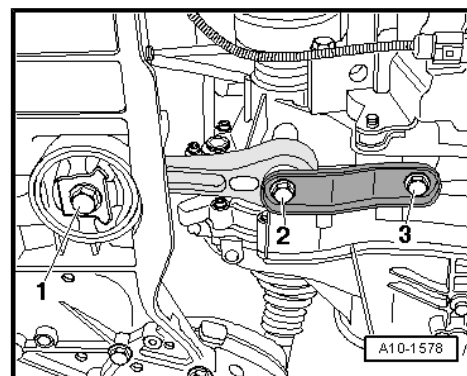
- ◆ If alternator sticks in its bracket, screw bolt back in again down to the last 2 turns.
- ◆ Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.



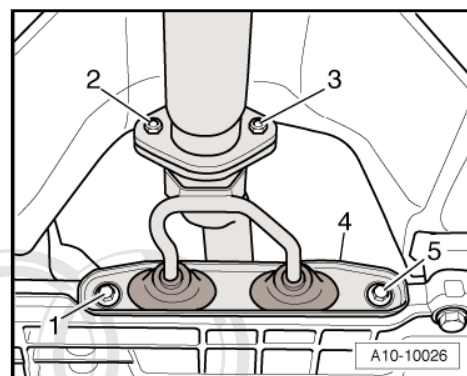
- Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
- Unclip bracket -2- for wire to oil level and oil temperature sender -G266- at subframe.



- Unscrew bolts -1 ... 3- and remove pendulum support.



- Remove nuts -2- and -3- at exhaust pipe flange.
- Separate exhaust system at flange.
- Remove bolts -1- and -5-.
- Pull off bracket -4- for exhaust system from pins on front exhaust pipe.



Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.

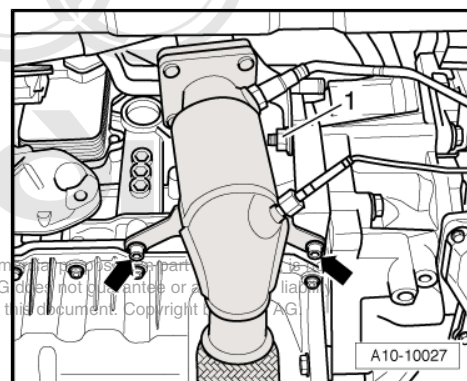
Vehicles with engine code letters BAG:

- Unscrew bolts -arrows-.
- Swing front exhaust pipe forwards and remove.

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Note

Disregard -item 1-.



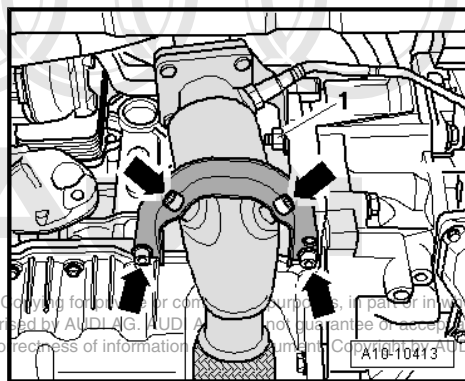
Vehicles with engine code letters BLF, BLP:

- Unscrew bolts -arrows- and remove bracket for front exhaust pipe.
- Swing front exhaust pipe forwards and remove.



Note

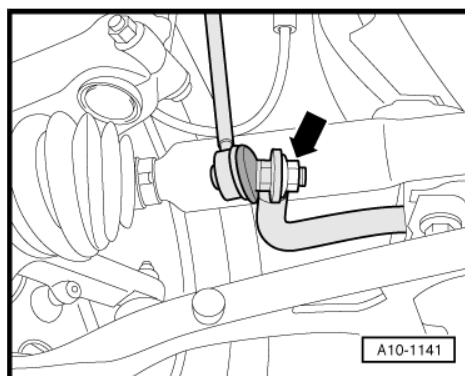
Disregard -item 1-.



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All models:

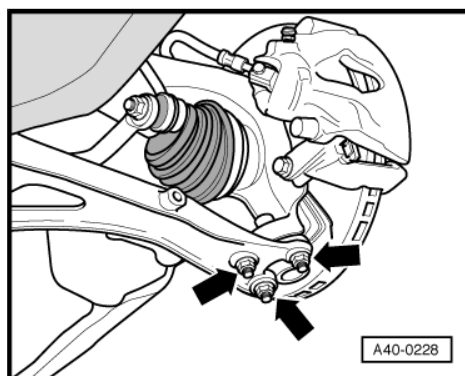
- Unscrew nuts -arrow- on both sides of vehicle and detach coupling rods from anti-roll bar.



- Unscrew nuts -arrows- at swivel joint (left-side).
- If fitted, loosen nut at bracket for front left vehicle level sender -G78-.
- Detach swivel joint from transverse link.

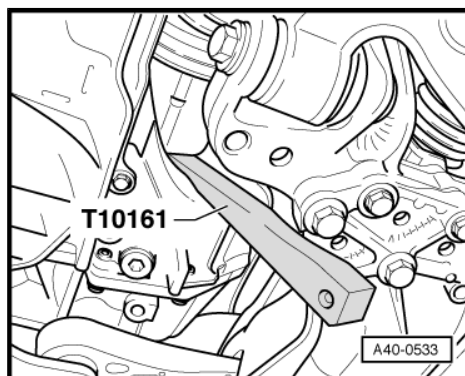
Vehicles with manual gearbox:

- Unbolt drive shafts (left and right) from gearbox flanges.



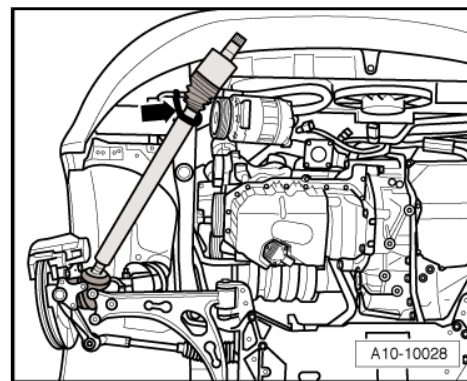
Vehicles with automatic gearbox:

- Swing suspension strut outwards and at the same time press drive shaft out of wheel bearing unit using wedge -T10161- (tapping lightly if necessary).

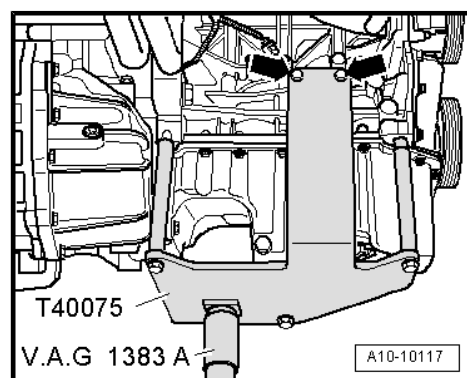


All models:

- Pivot drive shaft forwards; to do so, push the engine/gearbox assembly forwards.
- Secure the drive shaft to longitudinal member -arrow-.
- Repeat procedure on opposite side of vehicle.

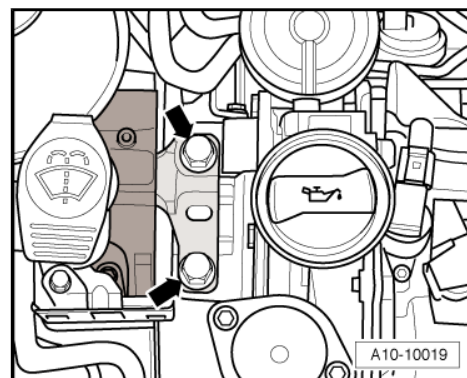


- Fit engine support -T40075- onto engine and gearbox jack - V.A.G 1383 A-.
- Secure engine support -T40075- to rear of cylinder block and tighten to approx. 20 Nm -arrows-.
- Lift engine/gearbox assembly slightly.

**Note**

To unscrew bolts for assembly mounting use stepladder - VAS 5085-.

- Loosen bolts -arrows- of assembly mounting on engine.

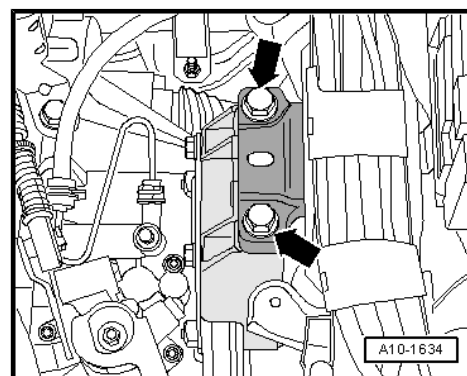


- Loosen bolts -arrows- of assembly mounting on gearbox.

**Note**

- ♦ *Check that all hoses, pipes and wiring connections between engine, gearbox and body have been detached.*
- ♦ *Carefully guide engine/gearbox assembly when lowering to avoid damage.*

- Pull engine/gearbox assembly as far forward as possible, and lower gradually.



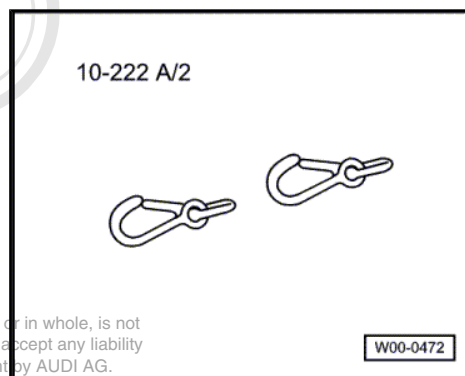
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1.2 Separating engine and gearbox

Special tools and workshop equipment required

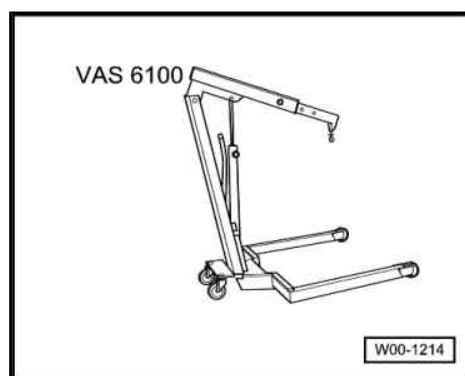


◆ Shackle -10-222 A/2-



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◆ Workshop hoist -VAS 6100-

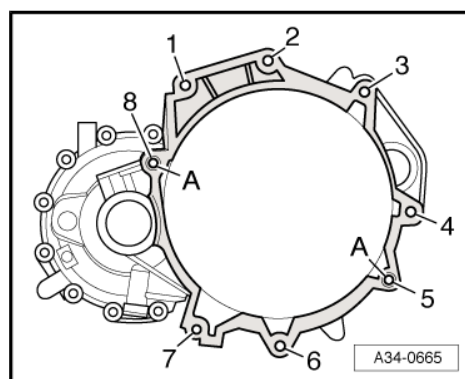


Procedure

- Engine/gearbox assembly removed.

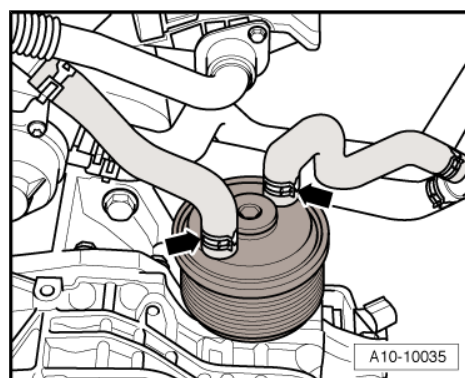
Vehicles with manual gearbox:

- Remove bracket for electrical wire from bottom securing bolt for starter.
- Remove bolts -1 ... 8- on engine/gearbox flange.
- Separate gearbox from engine.

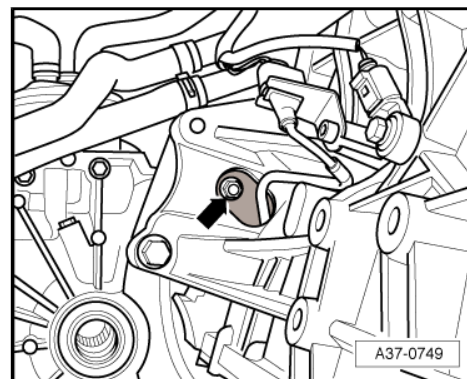


Vehicles with automatic gearbox:

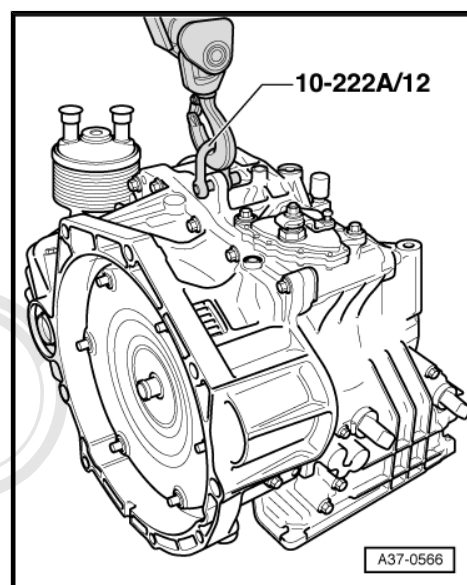
- Disconnect coolant hoses -arrows- at ATF cooler.



- Remove cover cap for torque converter nuts from cylinder block.
- Unscrew 6 nuts -arrow- for torque converter through opening in gearbox (turn crankshaft $\frac{1}{6}$ turn each time).



- Secure the gearbox to workshop crane using shackle -10-222 A/2- .



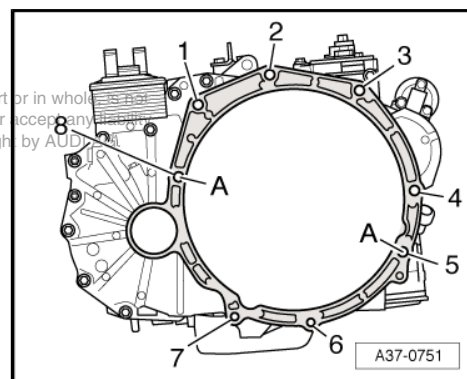
- Remove bolts -1 ... 8- on engine/gearbox flange.

**Note**

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The starter remains installed.

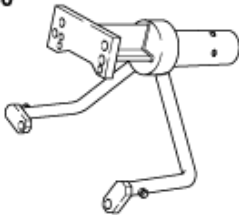
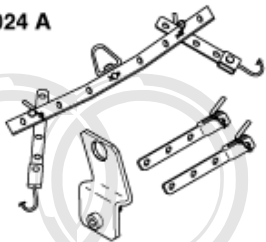
- Separate gearbox from engine.



1.3 Securing engine to assembly stand

Special tools and workshop equipment required

- ◆ Support clamp -VW 313-
- ◆ Engine and gearbox support -VW 540-
- ◆ Lifting tackle -2024 A-
- ◆ Workshop hoist - VAS 6100- or workshop crane -V.A.G 1202 A-

VW 313 	VW 540 
2024 A 	V.A.G 1202 A 
	G10-0037

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Procedure

- Gearbox detached from engine.
- Detach crankcase breather hose from oil filler neck.
- To transport engine, engage lifting tackle -2024 A- on engine and workshop hoist -VAS 6100- .



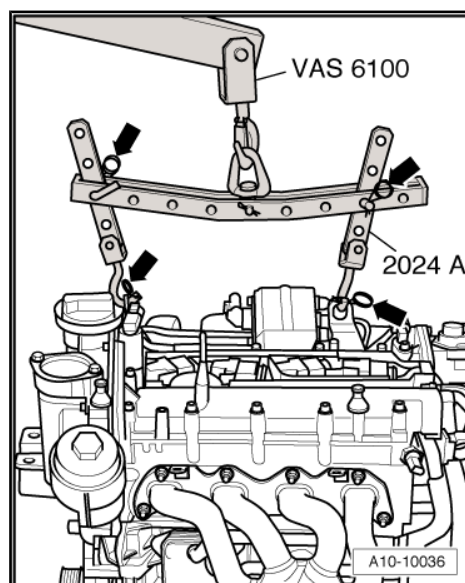
Note

To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks must be positioned as shown.

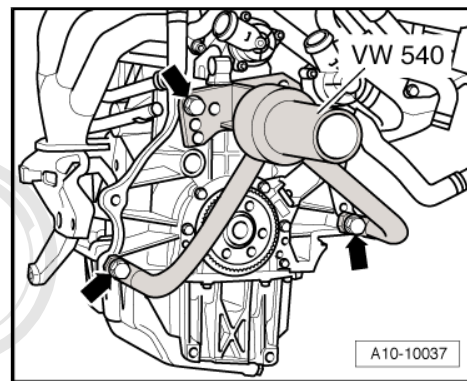


WARNING

The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.



- To carry out repair work, secure the engine with engine and gearbox support -VW 540- to support clamp -VW 313- or engine stand -VAS 6095- -arrows-.



1.4 Installing engine

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



Note

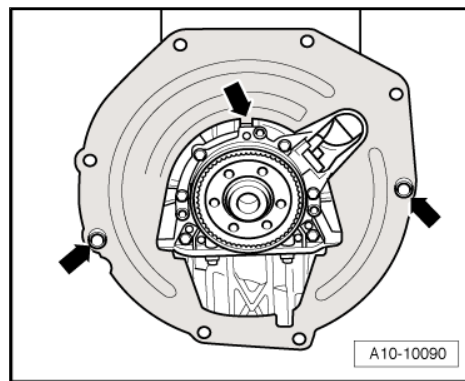
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- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
- ◆ *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ *Tolerance for tightening torques $\pm 15\%$.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) $\Rightarrow$ Parts catalogue.*
- ◆ *Reinstall all cable ties in the same locations when assembling.*

- Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install if necessary.
- Engage intermediate plate on sealing flange and slip onto dowel sleeves -arrows-.

Vehicles with manual gearbox:

- Clean splines of input shaft and (on used clutch plates) splines of hub.
- Remove any traces of corrosion and apply a very thin coat of grease -G 000 100- onto splines.
- Then move clutch plate back and forth on input shaft until the hub moves smoothly on the shaft. Remove any excess grease.
- Check that clutch plate is correctly centred ⇒ Rep. Gr. 30 .
- Check clutch release bearing for wear, renew if necessary.
- Bolt gearbox to engine.



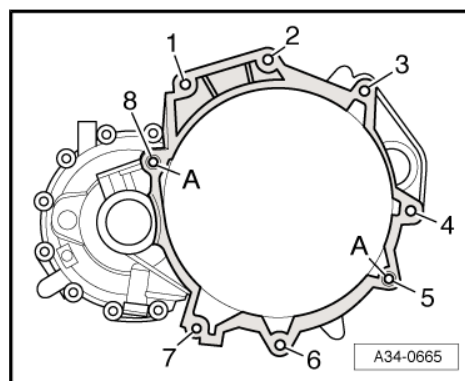
Note

- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ *Tolerance for tightening torques $\pm 15\%$.*

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Securing engine to manual gearbox

Item	Bolt	Nm
1, 2, 5	M12x65	80
3	M12x135	80
4	M12x150	80
6, 7	M10x60	40
8	M12x80	80
A	Dowel sleeves for centralising	



Vehicles with automatic gearbox:

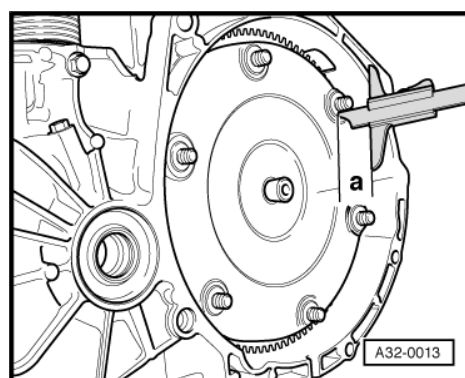
Checking installation depth of torque converter:

If the torque converter has been correctly installed, the distance between the contact surfaces at the bottom of the studs on the torque converter and the joint surface on the torque converter bell housing (with automatic gearbox) -a- is at least 19.5 mm.



Caution

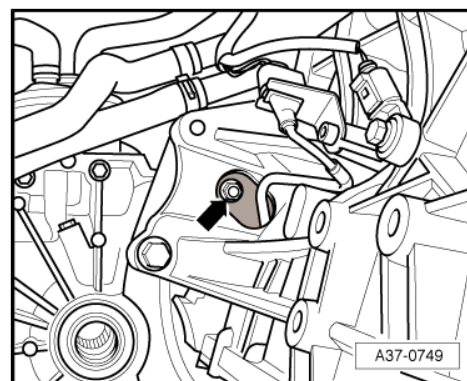
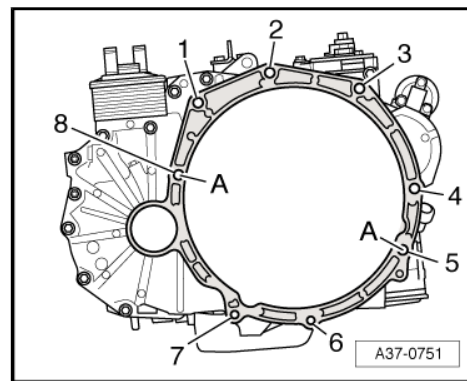
If the torque converter is not installed correctly, the drive lugs of the torque converter and the ATF pump will be seriously damaged when the gearbox is joined to the engine.



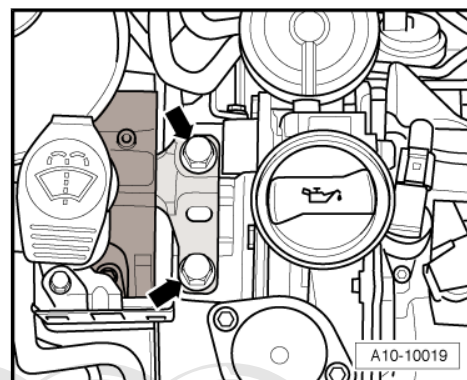
Securing engine to automatic gearbox

Item	Bolt	Nm
1, 2, 3	M12x55	80
4	M12x180	80
5, 8	M12x80	80
6, 7	M10x50	40
A	Dowel sleeves for centralising	

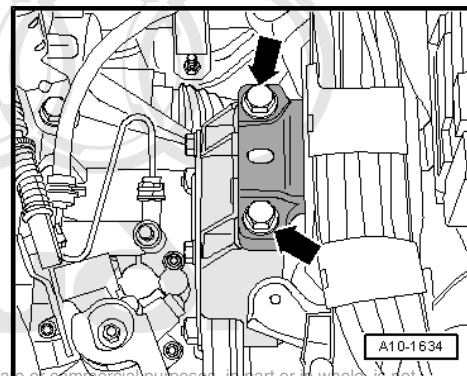
- To secure torque converter on drive plate, use only new nuts of the correct type (same as original equipment) as specified in ⇒ Parts catalogue .
- Tighten the 6 securing nuts -arrow- for torque converter in a diagonal sequence.

**All models:**

- Guide engine/gearbox assembly into the body.
- Tighten bolts of assembly mounting on engine -arrows- initially finger-tight.
- Use new bolts for securing.



- Tighten bolts of assembly mounting on gearbox -arrows- initially finger-tight.
- Use new bolts for securing.

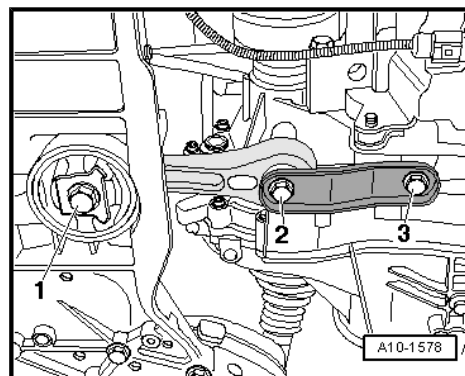
**Note**

The bolts are tightened to final torque only after adjusting the engine mountings ⇒ [page 30](#) .

- Install drive shafts ⇒ Rep. Gr. 40 .
- Install exhaust system and align free of stress ⇒ [page 182](#)

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- Secure pendulum support with bolts -1 ... 3- to gearbox and subframe.
- Install swivel joint and anti-roll bar ⇒ Rep. Gr. 40 .
- Install alternator ⇒ Rep. Gr. 27 .
- Install air conditioner compressor ⇒ Rep. Gr. 87 .
- Install poly V-belt ⇒ [page 35](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Adjust engine mountings ⇒ [page 30](#) .



Vehicles with manual gearbox:

- Install slave cylinder for hydraulic clutch mechanism ⇒ Rep. Gr. 30 .
- Attach and adjust selector mechanism at gearbox ⇒ Rep. Gr. 34 .

Vehicles with automatic gearbox:

- Install selector lever cable ⇒ Rep. Gr. 37 .

All models:

- Install battery ⇒ Rep. Gr. 27 .



Caution

Never use battery charging equipment for boost starting. There is danger of damaging the vehicle's control units.

- Install and adjust wiper arms ⇒ Rep. Gr. 92 .
- Check oil level ⇒ [page 140](#) .
- Fill cooling system ⇒ [page 146](#) .

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Note

- ◆ *Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.*
- ◆ *Contaminated or dirty coolant must not be used again.*

Tightening torques



Note

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

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	20
	M10	40
	M12	65
Except for the following:		
Torque converter to drive plate		57
Pendulum support to gearbox		40 + 90° ¹⁾²⁾
Pendulum support to subframe		100 + 90° ¹⁾²⁾
Air-conditioner compressor to bracket for air conditioner compressor.		25
Terminal B+ to starter		16
Hot air collector plate to exhaust manifold		10
Earth wire to gearbox		23
• ¹⁾ Renew nuts/bolts. • ²⁾ 90° = one quarter turn.		



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2 Adjusting engine mountings

2.1 Checking adjustment

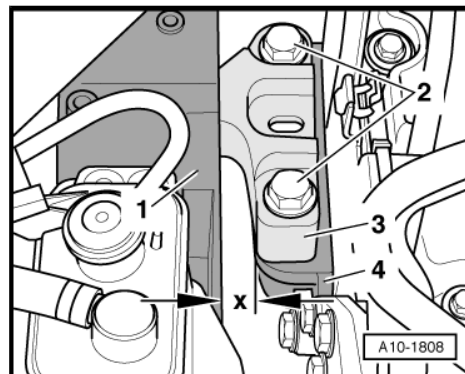
- Check the following dimensions at engine/gearbox assembly mounting (right-side):
- Both bolt heads -2- must be parallel to the edge of the support arm -3-.
- There must be a distance of -x- = 12 mm between engine console -1- and engine support -4-.



Note

Distance -x- = 12 mm can also be checked with a metal rod of suitable size.

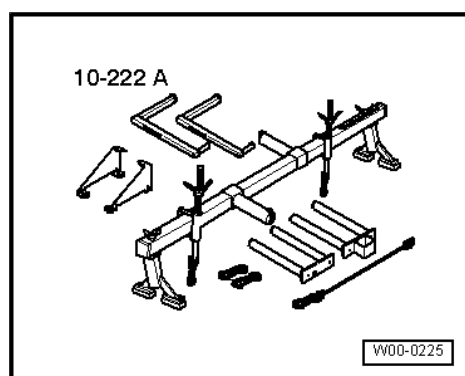
If the distance measured is too large or small, the engine mountings must be adjusted ⇒ [page 30](#).



2.2 Adjusting engine mountings

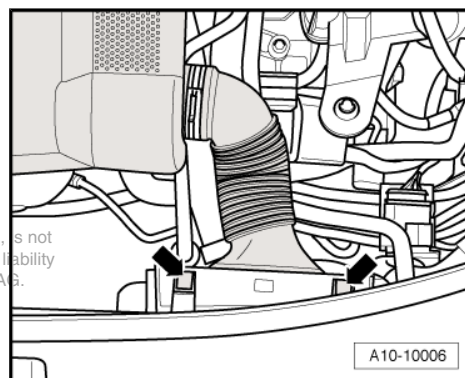
Special tools and workshop equipment required

- ◆ Support bracket -10-222 A-



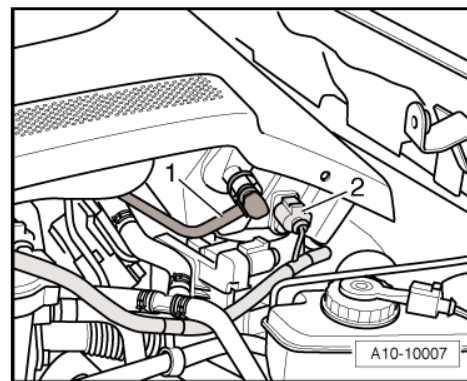
Procedure

- Unclip air intake hose from air duct -arrows-.

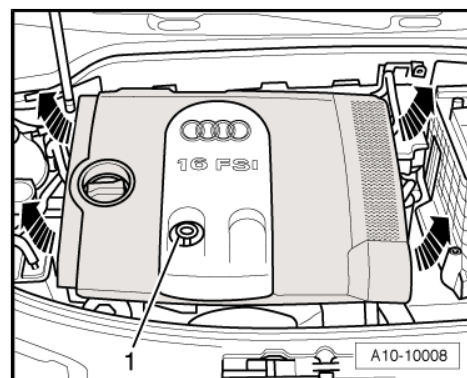


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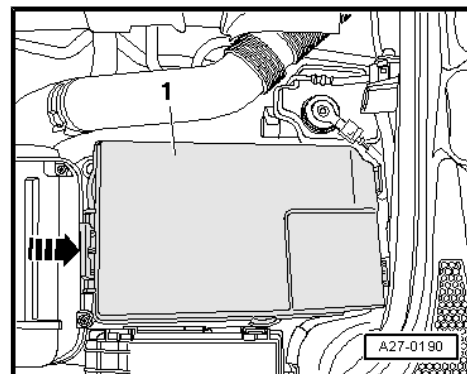
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



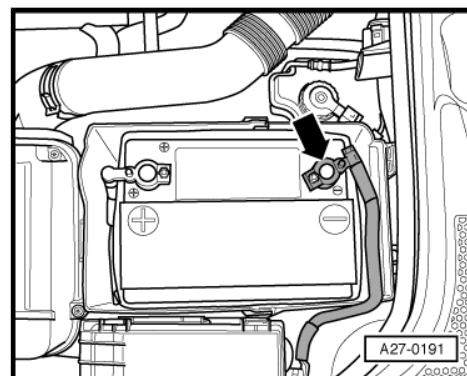
- Remove cover -1- over battery. To do so, press release tab -arrow-.

**Caution**

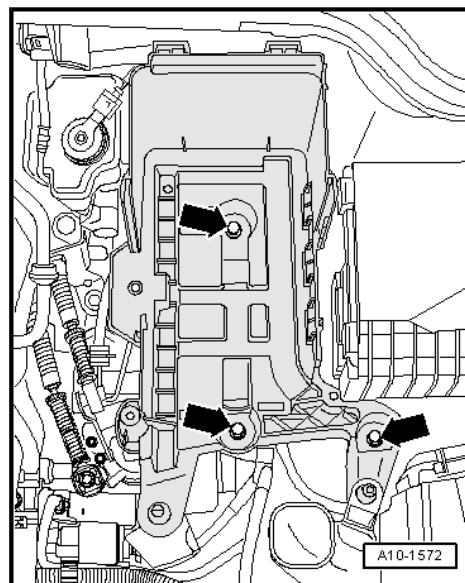
Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .

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- **With ignition switched off, disconnect battery earth cable -arrow-.**

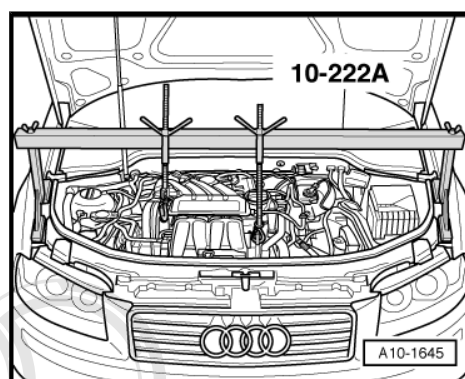


- Remove battery ⇒ Rep. Gr. 27 .
- Remove battery tray -arrows-.
- Detach battery tray from front of air duct.



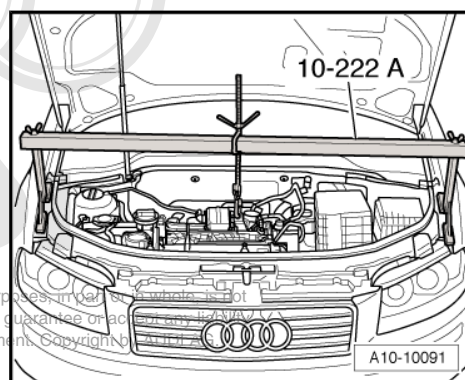
Vehicles with manual gearbox:

- Set up support bracket -10-222 A- on wing panel flanges.
 - The spindles face forwards.
- Detach crankcase breather hose from oil filler neck.
- Attach hooks of spindles to lifting eyes.
- Take up weight of engine evenly with both spindles (but do not raise engine).



Vehicles with automatic gearbox:

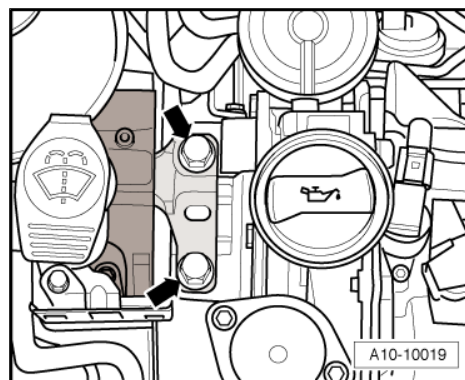
- Set up support bracket -10-222 A- on wing panel flanges.
- Hook spindle of lifting tackle onto left-side engine lifting eye.
- Take up weight of engine with the spindle, but do not lift.



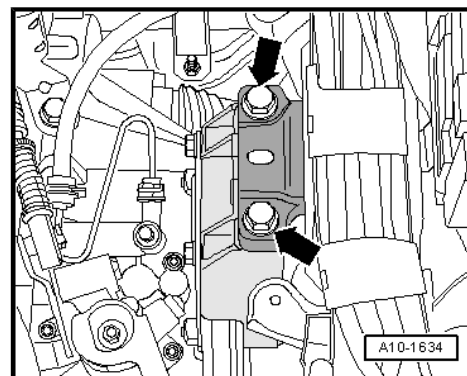
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All models:

- Renew the bolts for assembly mounting at engine -arrows- one by one (if not already renewed when engine was installed).
- Screw in new bolts initially finger-tight.



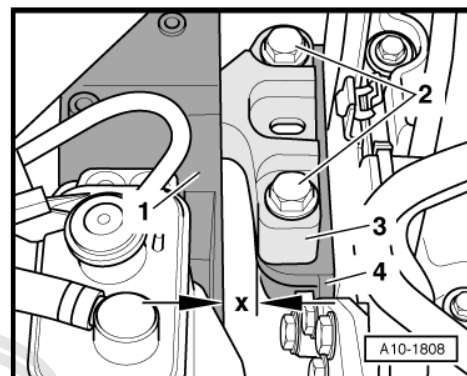
- Renew the bolts for assembly mounting at gearbox -arrows- one by one (if not already renewed when engine was installed).
- Screw in new bolts initially finger-tight.



- Using a tyre iron, adjust engine between engine console -1- and support arm -3- until the specifications listed below are obtained:
 - Both bolt heads -2- must be parallel to the edge of the support arm -3-.
 - There must be a distance of -x- = 12 mm between engine console -1- and engine support -4-.

**Note**

Distance -x- = 12 mm can also be checked with a metal rod of suitable size.



- Tighten the bolts for engine assembly mounting.
- On the gearbox side, check that the edges of the support arm -2- and gearbox support -1- are parallel (distance -x- = distance -x-).
- Tighten the bolts for gearbox assembly mounting.

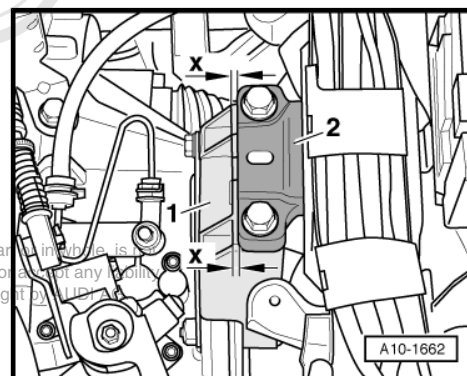
Installation is carried out in the reverse order; note the following:

- Install battery ⇒ Rep. Gr. 27 .

Tightening torques

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Component	Nm
Support arm to engine support	60 + 90° 1)2)
Support arm to gearbox support	60 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	



13 – Crankshaft group

1 Servicing work on pulley end

1.1 Poly V-belt drive - exploded view of components

1 - Poly V-belt

- ☐ Check for wear
- ☐ Do not kink
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Removing and installing ⇒ [page 35](#)
- ☐ Position of poly V-belt on vehicles with air conditioner ⇒ Fig. ⇒ [page 36](#)
- ☐ Position of poly V-belt on vehicles without air conditioner ⇒ Fig. ⇒ [page 36](#)

2 - 150 Nm + 180° (1/2 turn) further

- ☐ Renew
- ☐ Coat with oil before inserting
- ☐ To loosen and tighten, lock pulley using counterhold - T10172- with - T10172/2- .

3 - Pulley for crankshaft

- ☐ Removing and installing ⇒ [page 37](#)

4 - 20 Nm

- ☐ To loosen and tighten, counterhold using water pump wrench -V.A.G 1590- ; wrench -V.A.G 1590- must be reworked as described on ⇒ [page 49](#)

5 - Pulley for coolant pump

- ☐ Removing and installing ⇒ [page 37](#)

6 - 9 Nm

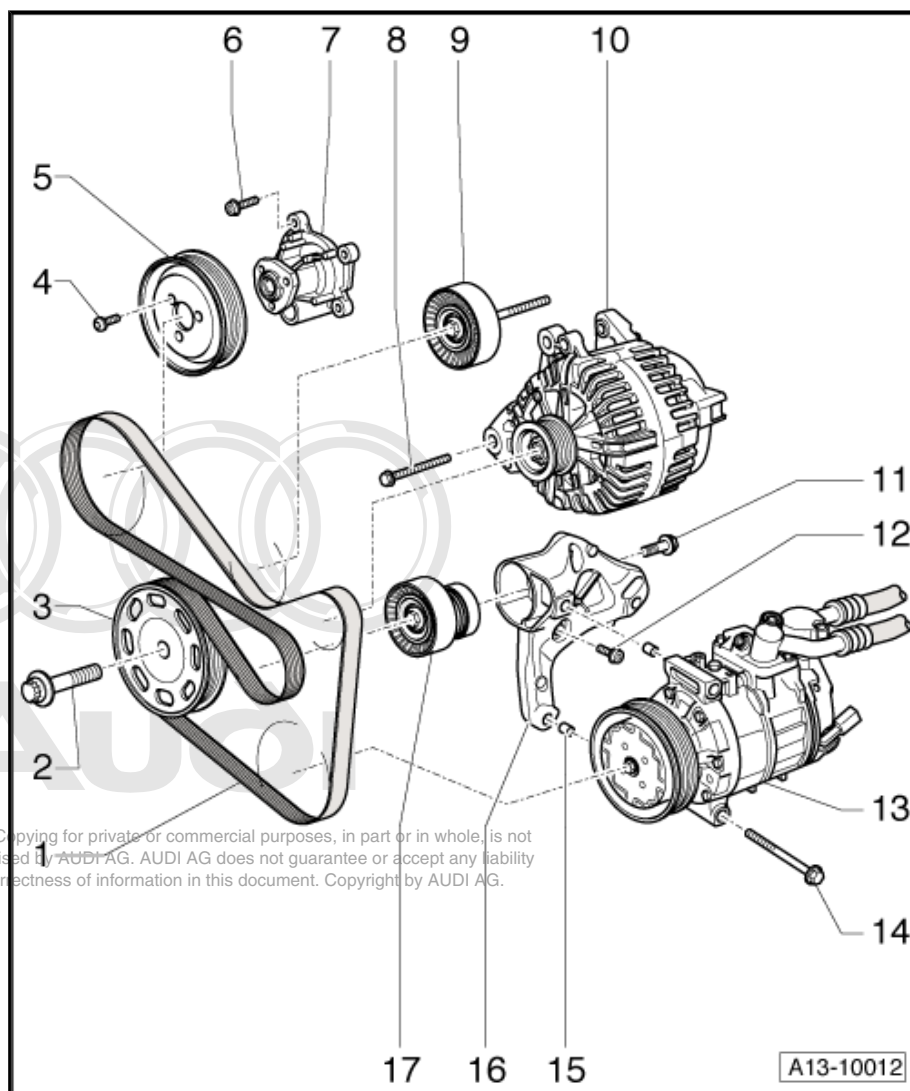
7 - Coolant pump

- ☐ Removing and installing ⇒ [page 150](#)

8 - 25 Nm

9 - Idler roller

- ☐ Tightening torque 40 Nm



10 - Alternator

- ☐ Removing and installing ⇒ Electrical system; Rep. Gr. 27

11 - 20 Nm + 90° (1/4 turn) further

- ☐ Renew

12 - 25 Nm**13 - Air conditioner compressor**

- ☐ Removing and installing ⇒ Air conditioning system; Rep. Gr. 87

14 - 25 Nm**15 - Bush**

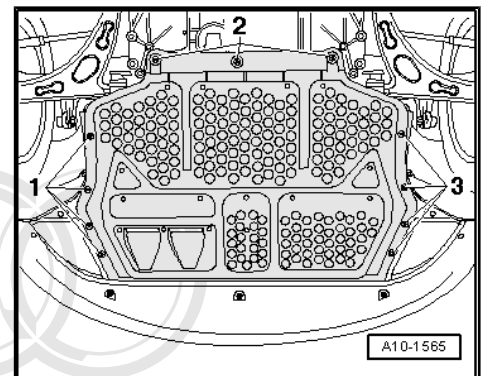
- ☐ 2 x

16 - Bracket for air conditioner compressor**17 - Tensioner for poly V-belt**

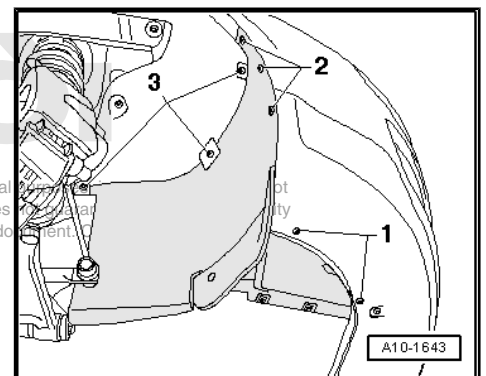
- ☐ Pivot with open-end spanner to slacken poly V-belt
- ☐ Lock tensioning element with an angled Allen key (4 mm).
- ☐ To remove, unscrew bolt ⇒ [Item 11 \(page 35\)](#)

1.2 Removing and installing poly V-belt**Removing**

- Remove centre noise insulation -fasteners 1 ... 3-.



- Remove noise insulation (right-side) -fasteners 1 ... 3-.



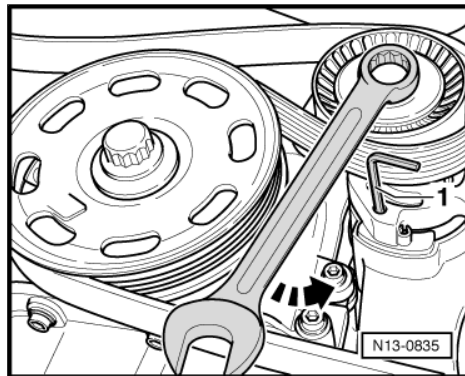
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Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Lock the belt tensioner with a 4 mm angled Allen key -Item 1-.
- Remove poly V-belt.



Installing

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



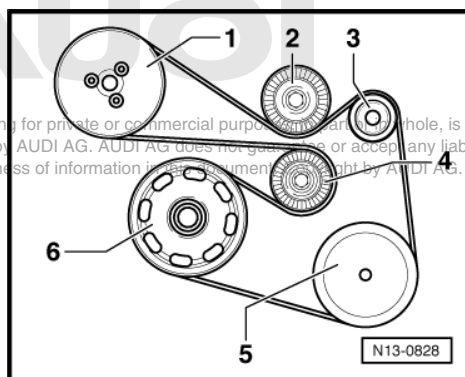
Note

Before fitting poly V-belt, make sure all mechanical units (e.g. alternator and air conditioner compressor) are firmly in position.

- Place poly V-belt onto pulleys as shown in illustration.

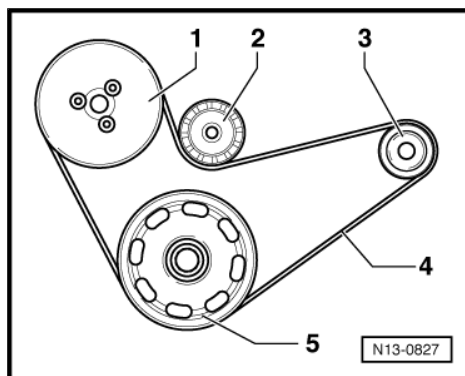
Vehicles with air conditioner:

- 1 - Pulley for coolant pump
- 2 - Idler roller
- 3 - Pulley for alternator
- 4 - Tensioning roller
- 5 - Air conditioner compressor
- 6 - Pulley for crankshaft



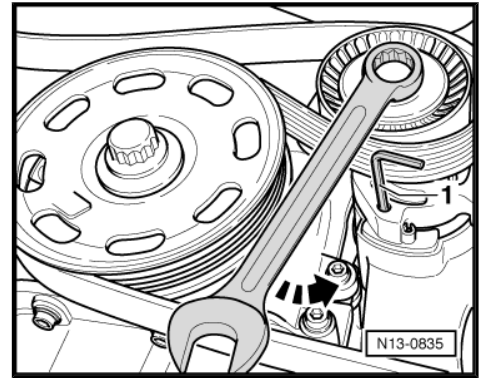
Vehicles without air conditioner:

- 1 - Pulley for coolant pump
- 2 - Tensioning roller
- 3 - Pulley for alternator
- 4 - Poly V-belt
- 5 - Pulley for crankshaft



All models:

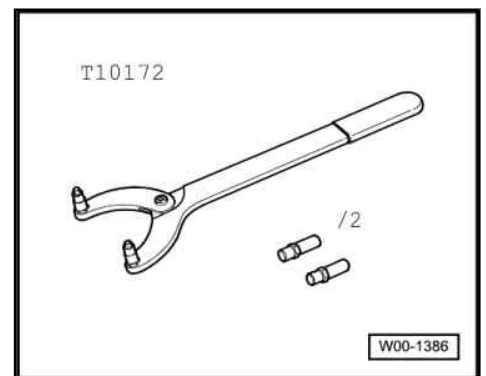
- To tension the poly V-belt, pivot tensioner in the direction of the -arrow-, take out angled Allen key -Item 1- and release tensioner.
- Check poly V-belt for proper seating.
- Start engine and check that belt runs properly.



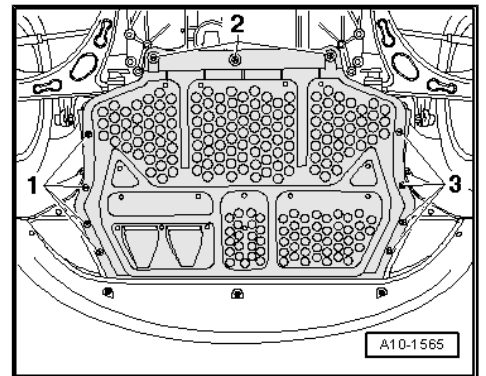
1.3 Removing and installing crankshaft pulley

Special tools and workshop equipment required

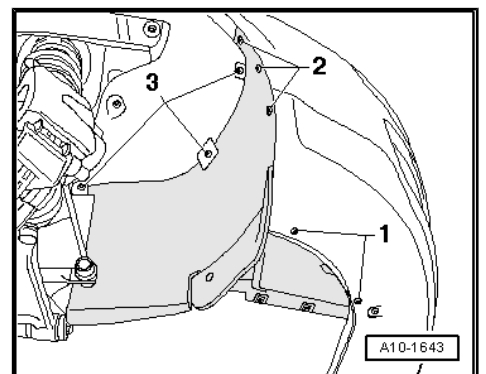
- ◆ Counterhold tool -T10172- with -T10172/2-

**Removing**

- Remove centre noise insulation -fasteners 1 ... 3-



- Remove noise insulation (right-side) -fasteners 1 ... 3-



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Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Lock the belt tensioner with a 4 mm angled Allen key -Item 1-.
- Remove poly V-belt.
- Remove crankshaft pulley; use tool -T10172- with -T10172/2- to counterhold.

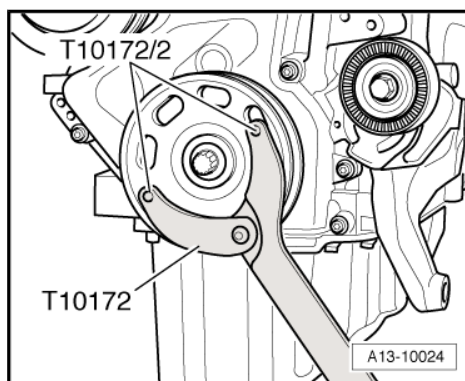
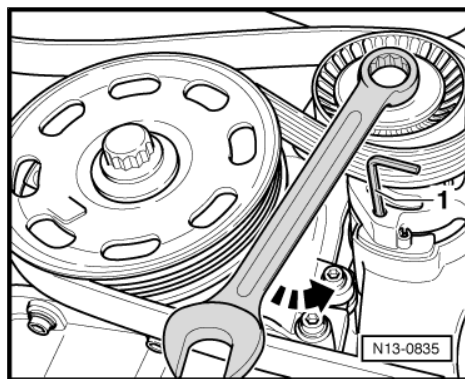
Installing

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

- Install crankshaft pulley using a new bolt.
- Install poly V-belt ⇒ [page 35](#) .

Tightening torque

Component	Nm
Pulley to crankshaft	150 + 180° 1)2)
• 1) Renew bolt. • 2) 180° = one half turn.	



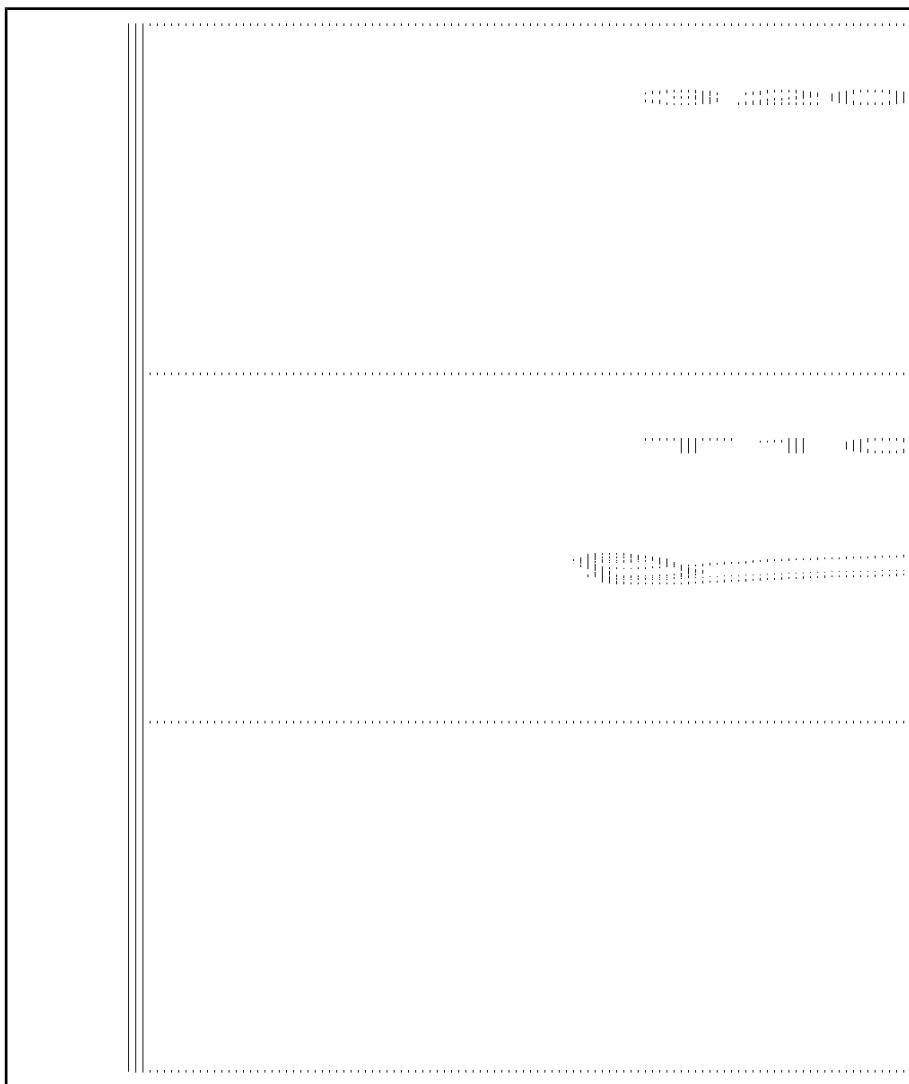
1.4 Renewing crankshaft oil seal



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Special tools and workshop equipment required

- ◆ Oil seal extractor -3203-
- ◆ Assembly tool -T10117-
- ◆ Counterhold -T10172- with adapter -T10172/2-

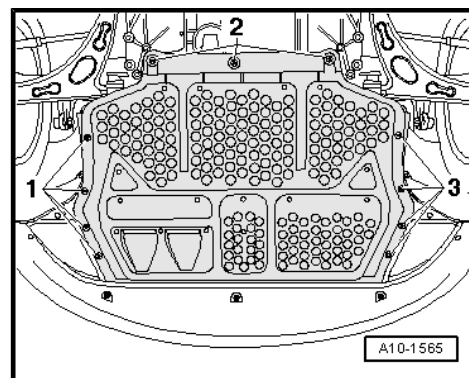


Procedure

- Remove centre noise insulation -fasteners 1 ... 3-.

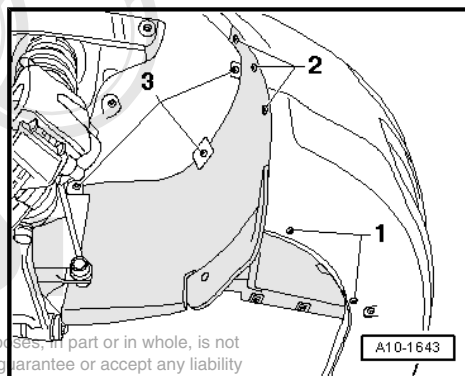


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- Remove noise insulation (right-side) -fasteners 1 ... 3-.



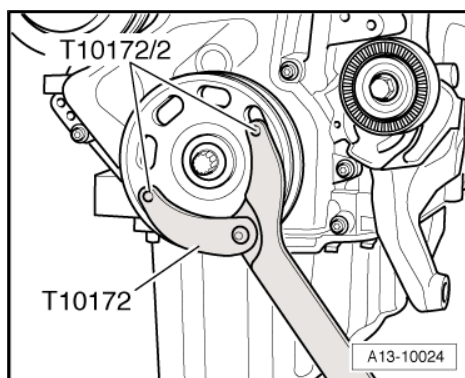
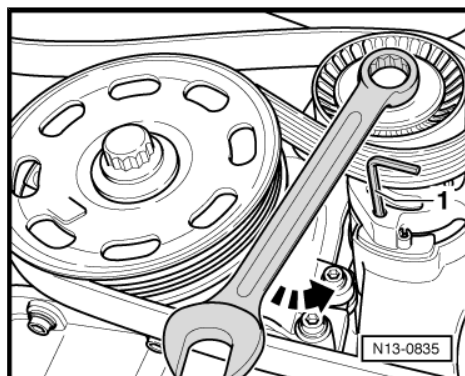
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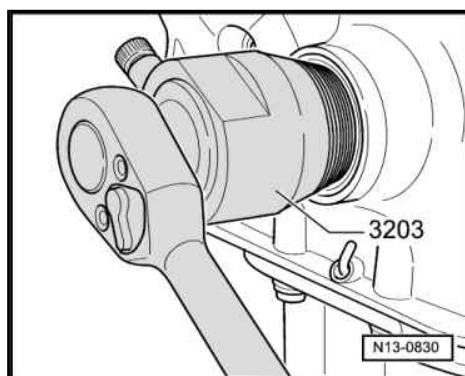
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Lock the belt tensioner with a 4 mm Allen key -item 1-.
- Remove poly V-belt.
- Remove crankshaft pulley; use tool -T10172- with -T10172/2- to counterhold.



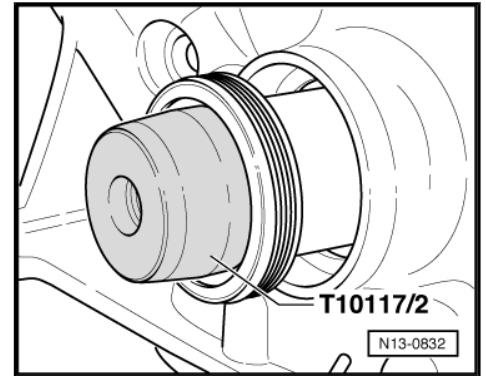
- Adjust inner part of oil seal extractor -3203- so that it is level with the outer part and lock in position with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner part towards crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove seal.
- Clean running surface and sealing surface.



Note

Do not lubricate sealing lip and outer rim of oil seal before pressing in.

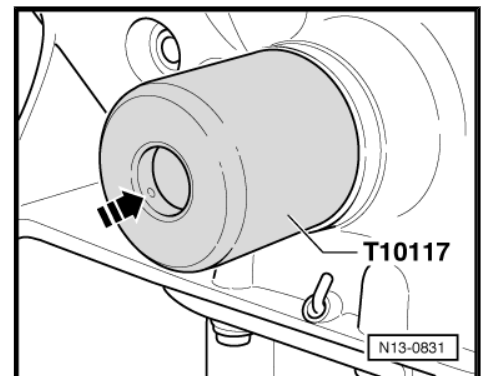
- Fit guide sleeve -T10117/2- onto crankshaft bush and slide oil seal over guide sleeve.
- Detach guide sleeve.



- Drive in oil seal carefully as far as stop using assembly tool - T10117- and a hammer.

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

- Install crankshaft pulley ⇒ [page 37](#) .
- Install poly V-belt ⇒ [page 35](#) .



1.5 Timing chain cover - exploded view of components

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1 - 150 Nm + 180° (1/2 turn) further

- ☐ Renew
- ☐ Coat with oil before inserting
- ☐ When loosening and tightening, lock pulley using counterhold -3415-

2 - Pulley

- ☐ When loosening and tightening, lock pulley using counterhold - T10172-
- ☐ Removing and installing poly V-belt ⇒ [page 35](#)

3 - Timing chain cover

- ☐ Removing and installing ⇒ [page 43](#)

4 - 50 Nm

5 - O-ring

- ☐ Renew

6 - Pressure control valve for crankcase breather system

7 - 10 Nm

8 - O-ring

- ☐ Renew

9 - Cap

10 - Seal

- ☐ Renew if damaged or leaking

11 - Filler cap

12 - O-rings

- ☐ Available in different sizes
- ☐ Renew

13 - 5 Nm

14 - Oil separator

15 - Pin, 6 Nm

- ☐ For engine cover panel with air cleaner housing

16 - Gasket

- ☐ Renew

17 - Seals

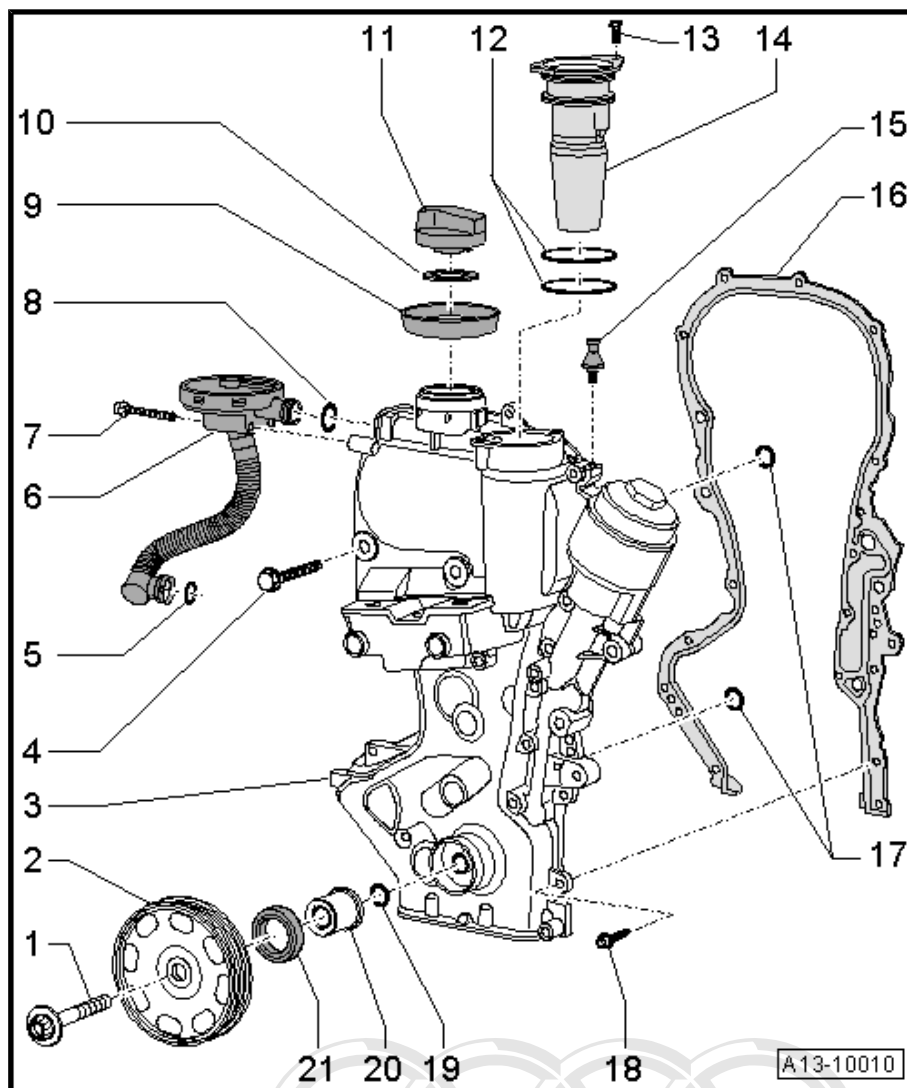
- ☐ Fitted from rear into timing chain cover
- ☐ Renew

18 - 10 Nm

- ☐ Tighten in diagonal sequence

19 - O-ring

- ☐ Inserted into bush ⇒ [Item 20 \(page 43\)](#)
- ☐ Renew



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20 - Bush

- ☐ Installation position: side with collar faces engine

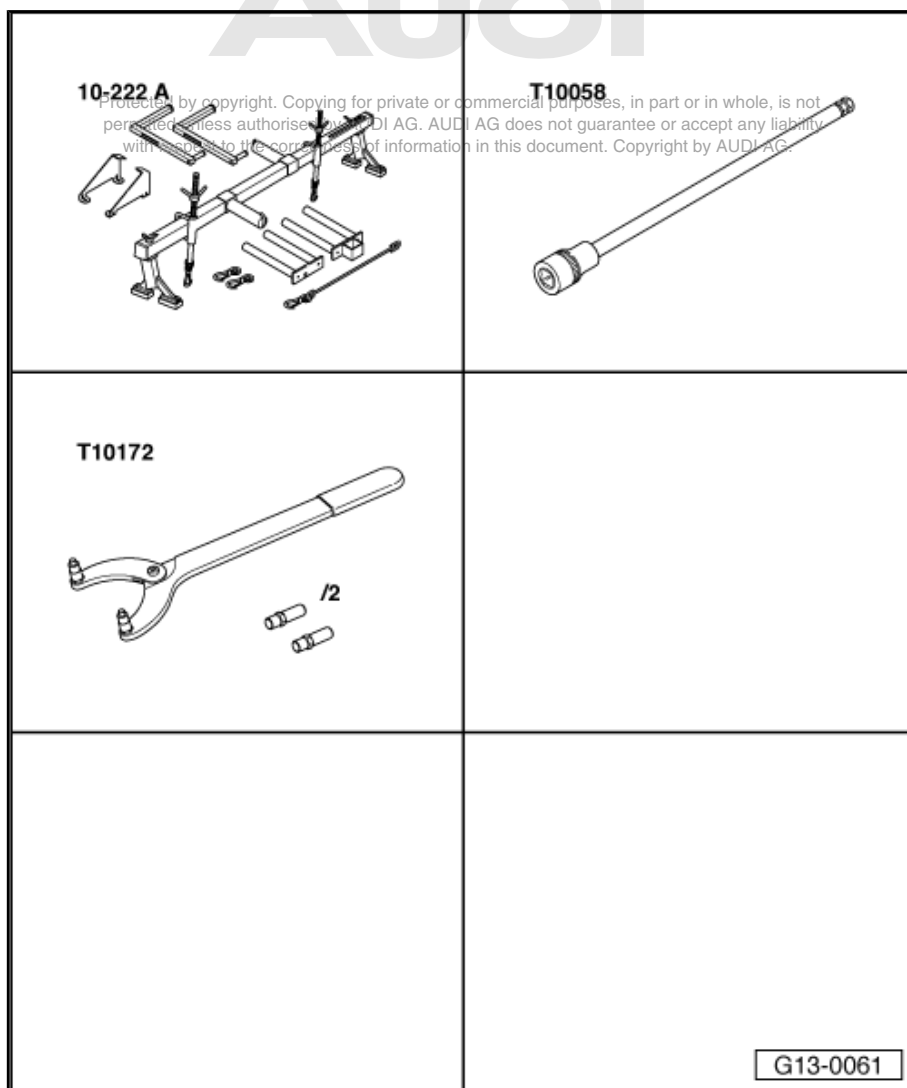
21 - Oil seal

- ☐ Renew

1.6 Removing and installing timing chain cover

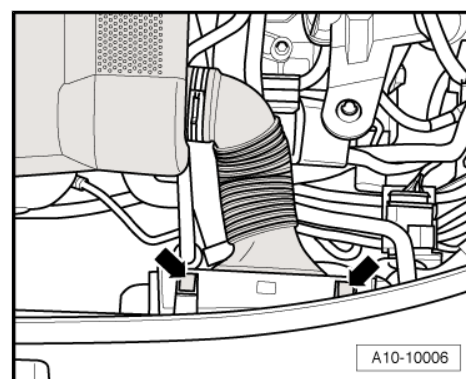
Special tools and workshop equipment required

- ◆ Support bracket -10-222 A-
- ◆ Allen key (long reach) - T10058-
- ◆ Counterhold tool -T10172-

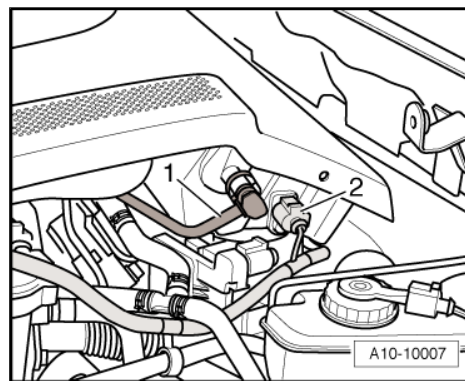


Removing

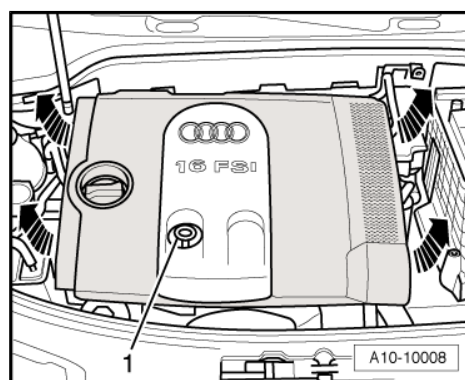
- Unclip air intake hose from air duct -arrows-.



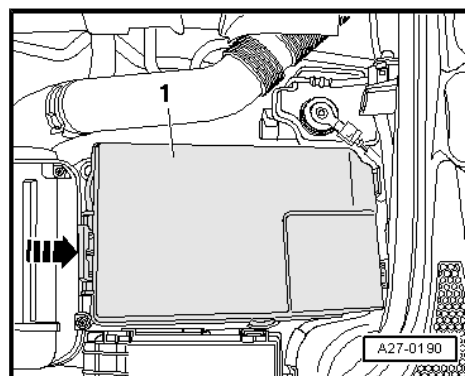
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



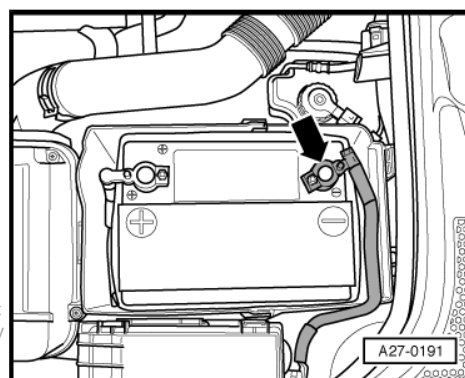
- Remove cover -1- over battery. To do so, press release tab -arrow-.



Caution

Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .

- With ignition switched off, disconnect battery earth cable -arrow-.



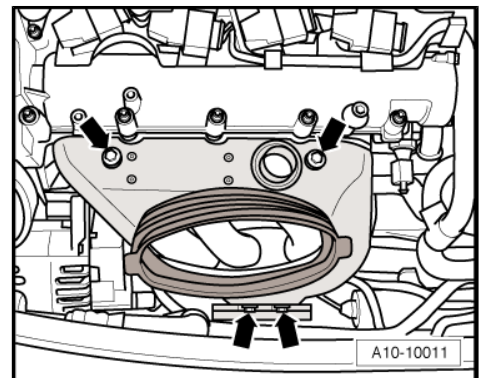
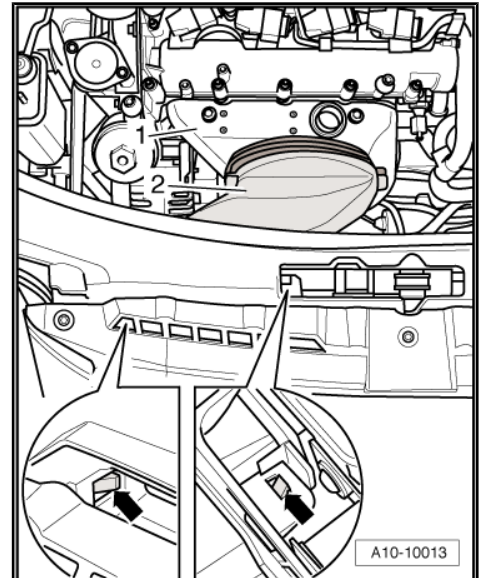
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- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.

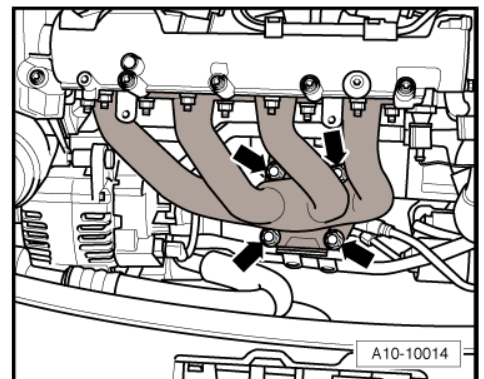


- Unbolt hot air collector plate -arrows-.

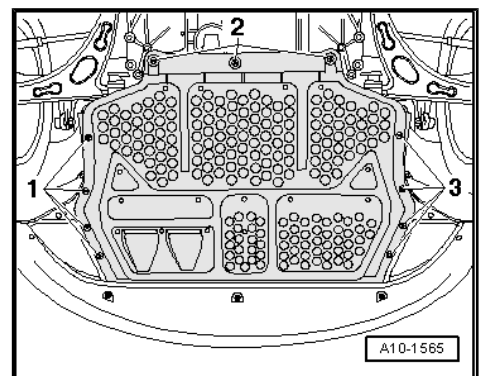
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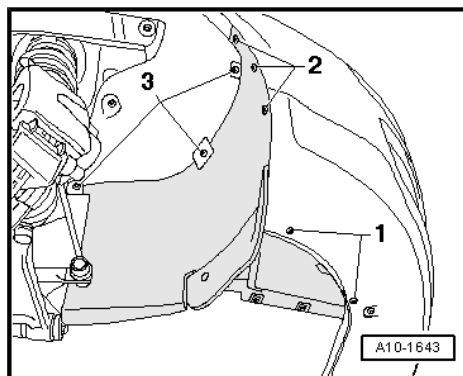
- Unbolt front exhaust pipe from exhaust manifold -arrows-.



- Remove centre noise insulation -fasteners 1 ... 3-.



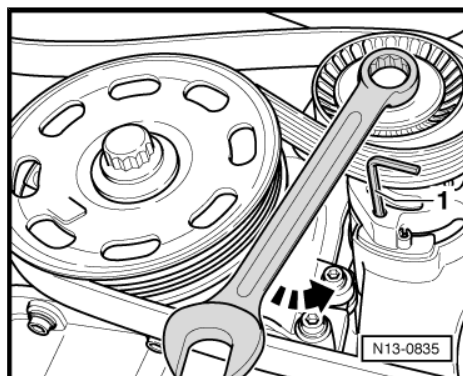
- Remove noise insulation (right-side) -fasteners 1 ... 3-.
- Place used oil collection and extraction unit -V.A.G 1782- under engine.
- Drain off engine oil.



Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Lock the belt tensioner with a 4 mm Allen key -item 1-.
- Remove poly V-belt.



WARNING

The air conditioner refrigerant circuit must not be opened.

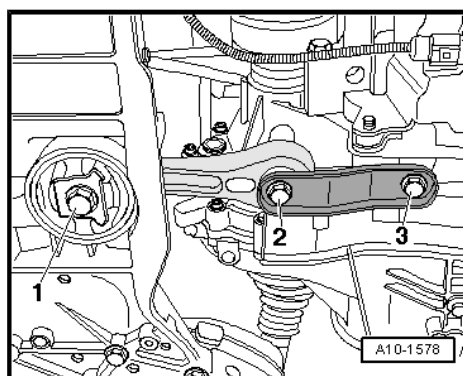
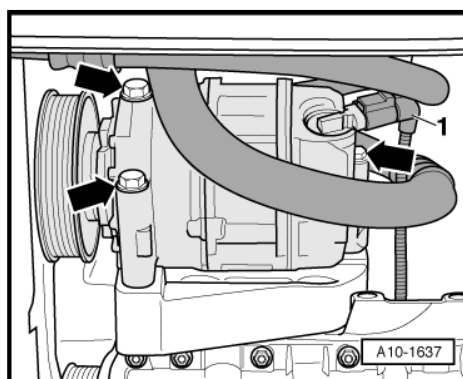
- Unplug electrical connector -1- for magnetic clutch of air conditioner compressor.
- Remove bolts -arrows- for air conditioner compressor.



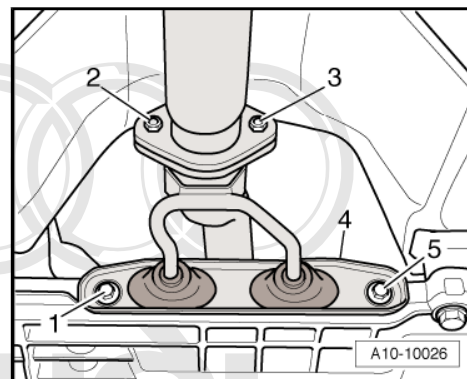
Note

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

- Tie air conditioner compressor up to lock carrier.
- Unscrew bolts -1 ... 3- and remove pendulum support.



- Remove nuts -2- and -3- at exhaust pipe flange.
- Separate exhaust system at flange.
- Remove bolts -1- and -5-.
- Pull off bracket -4- for exhaust system from pins on front exhaust pipe.



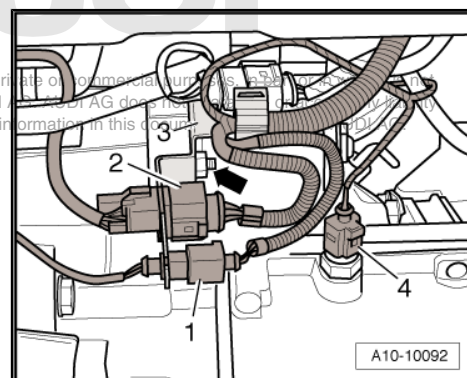
Vehicles with manual gearbox:

- Unplug electrical connector -2- for Lambda probe -G39-.
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Remove all electrical connectors from the bracket.



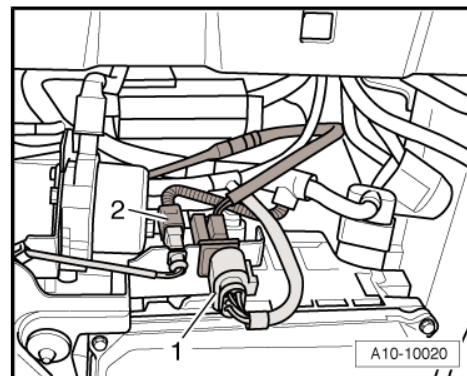
Note

Disregard items marked -3- and -4-.



Vehicles with automatic gearbox:

- Unplug electrical connector -2- for Lambda probe -G39-.
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Remove all electrical connectors from the bracket.



All models:



Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.

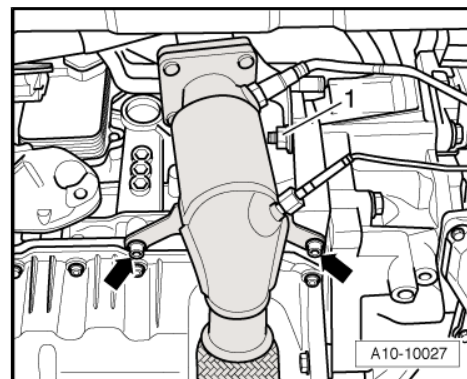
Vehicles with engine code letters BAG:

- Unscrew bolts -arrows-.
- Swing front exhaust pipe forwards and remove.



Note

Disregard -item 1-.



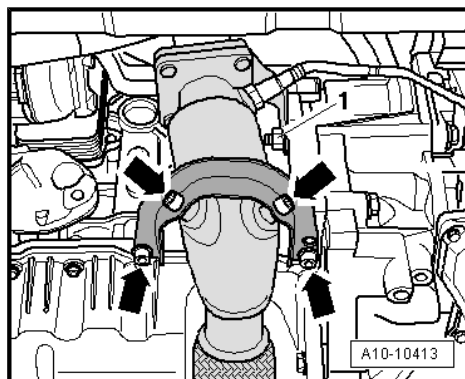
Vehicles with engine code letters BLF, BLP:

- Unscrew bolts -arrows- and remove bracket for front exhaust pipe.
- Swing front exhaust pipe forwards and remove.



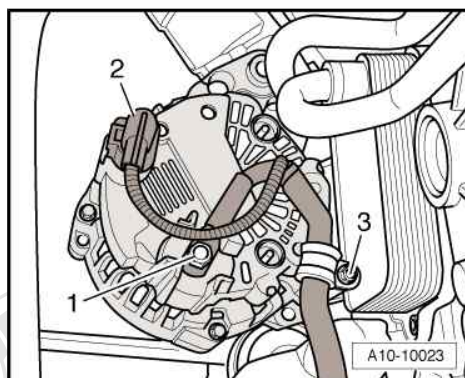
Note

Disregard -item 1-.



All models:

- Detach electrical connector -2-.
- Unscrew wire -1- at alternator.
- Unbolt wire clamp -3- at alternator and move wiring harness clear.

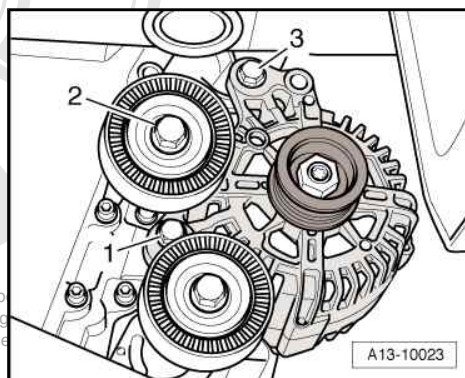


- Unscrew idler roller -2-.
- Unscrew bolts -1- and -3- and remove alternator.

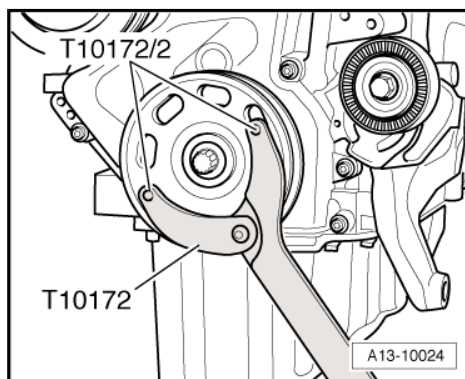


Note

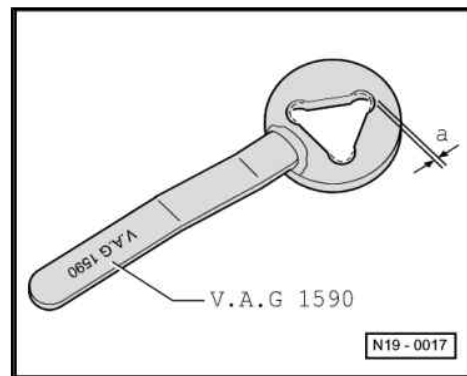
- ◆ If alternator sticks in its bracket, screw bolt back in again down to the last 2 turns.
- ◆ Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.



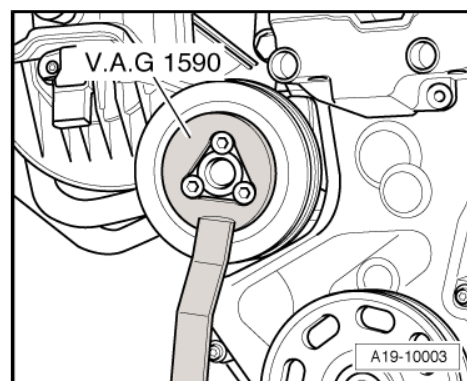
- Unbolt crankshaft pulley; use tool -T10172- with -T10172/2- to counterhold.



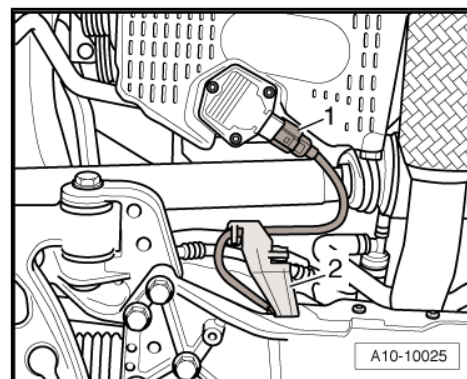
- File down the 3 round corners on the water pump wrench - V.A.G 1590- to dimension -a-.
- Dimension -a- = 1 mm.



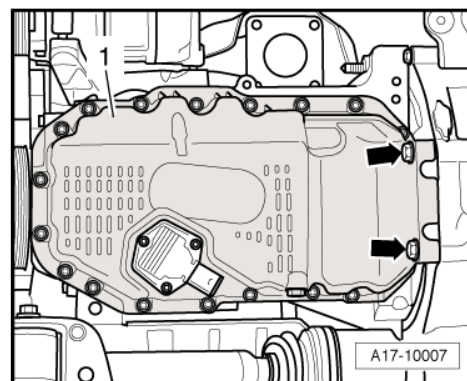
- Unbolt coolant pump pulley; use water pump wrench - V.A.G 1590- to counterhold.



- Unplug electrical connector -1- at oil level and oil temperature sender -G266-.
- Unclip bracket -2- for wire to oil level and oil temperature sender -G266- at subframe.



- Unscrew sump/gearbox bolts -arrows-.
- Unscrew bolts for sump -1- in diagonal sequence and remove.
- Take off sump; if necessary loosen it by striking lightly with a rubber hammer.



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- Disconnect fuel supply pipe -3- by pulling release ring.

Vehicles with engine code letters BAG:

- Disconnect fuel return pipe -2- by pulling release ring.

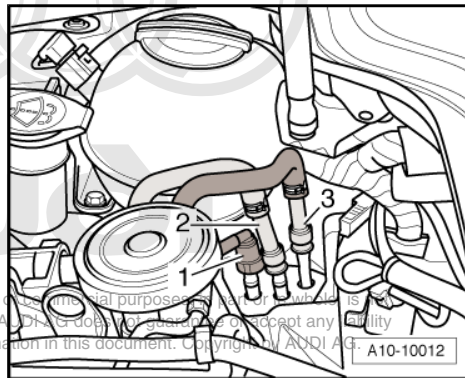
All models:



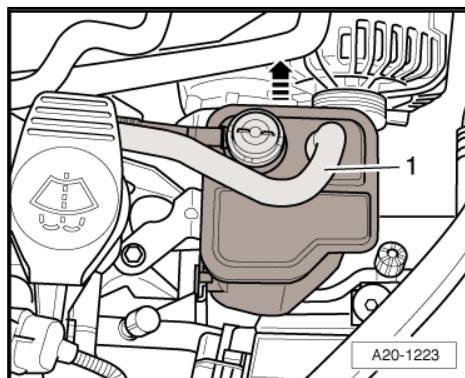
Note

Disregard -item 1-.

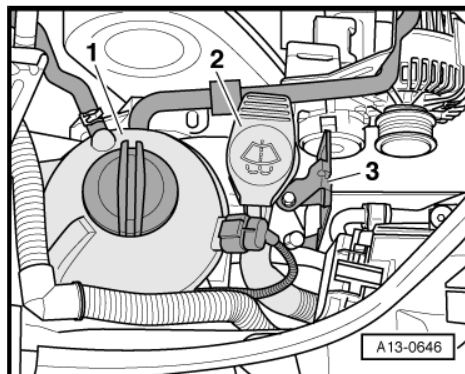
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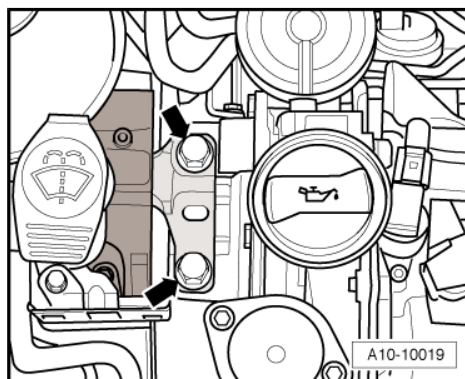
- Disconnect vacuum pipe -1- from activated charcoal filter.
- Pull the activated charcoal filter upwards out of the retainer -arrow-.



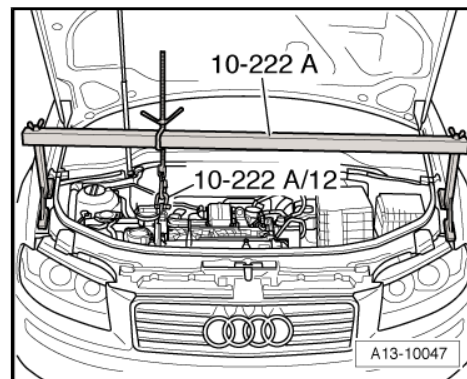
- Unscrew bracket -3- for activated charcoal filter.
- Unscrew bolt at filler neck -2- for washer fluid reservoir.
- Disconnect the electrical connector at coolant shortage indicator switch -F66- (on coolant expansion tank) and move electrical wire clear.
- Unscrew coolant expansion tank -1- and place on top of engine with the hoses attached (secure if necessary).



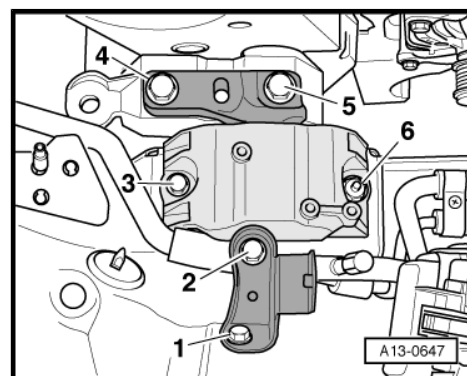
- Loosen bolts -arrows- of assembly mounting for engine approx. 2 turns.



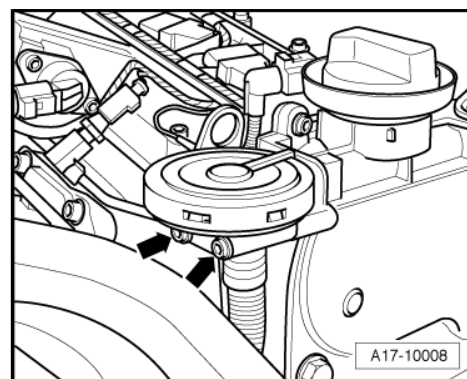
- Attach the shackle -10-222 A/12- to the right-side engine lifting eye.
- Set up support bracket -10-222 A- on wing panel flanges.
 - The spindle is located at rear.
- Attach spindle hook to shackle.
- Pretension the spindle slightly.



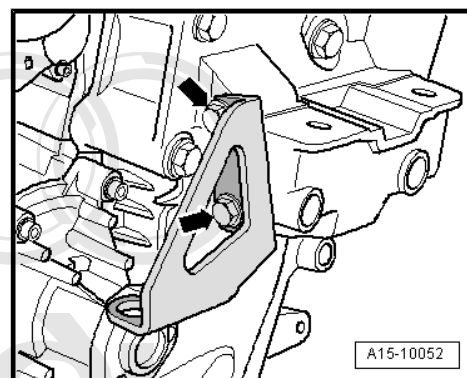
- Unscrew bolts -1- and -2- and detach connecting bracket.
- Remove bolts -3 ... 6- and detach engine mounting.



- Unbolt pressure control valve for crankcase breather system -arrows-.

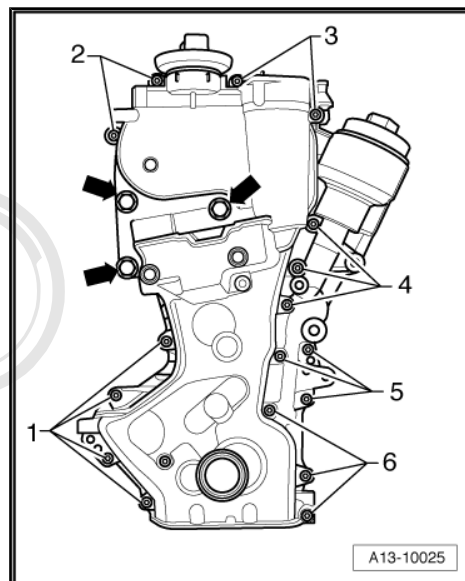


- Unscrew bolts -arrows-.
- Remove engine lifting eye.



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- Unscrew hexagon socket head bolts -1 ... 6- for timing chain cover and hexagon bolts -arrows-.
- Raise engine slightly and remove timing chain cover.
- Use drift to drive out oil seal.



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Installing

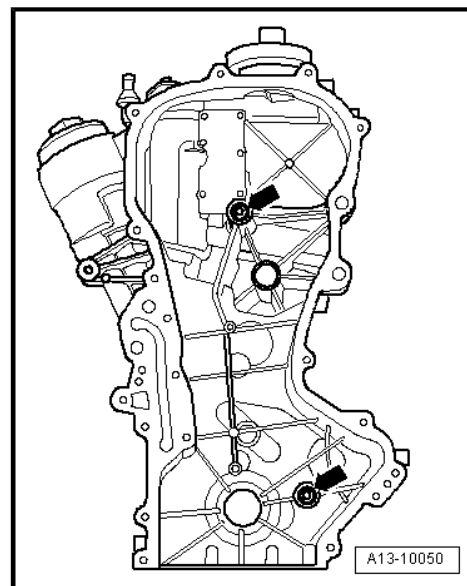
- Clean sealing surfaces carefully; they must be free of oil and grease.
- Insert new seals -arrows- onto rear of timing chain cover.
- Fit new gasket onto cylinder block dowel pins.
- Screw in 2 studs M6x80 into cylinder head and cylinder block to help guide.
- Carefully fit timing chain cover onto studs and dowel pins.
- Tighten securing bolts for timing chain cover evenly in a diagonal sequence.

Installation is carried out in the reverse order. Note the following:

- Renew crankshaft oil seal ⇒ [page 38](#) .
- Install crankshaft pulley ⇒ [page 37](#) .
- Install sump ⇒ [page 128](#) .
- Install exhaust system and align free of stress ⇒ [page 182](#) .
- Install alternator ⇒ Rep. Gr. 27 .
- Adjust engine mountings ⇒ [page 30](#) .
- Install poly V-belt ⇒ [page 35](#) .

Tightening torques

Component		Nm
Timing chain cover to	M6	10
cylinder block and cylinder head	M10	50
Engine lifting eye to timing chain cover		20
Pressure control valve for crankcase breather system to timing chain cover		10
Engine mounting to body		50
Connecting bracket to engine mounting/body	20 + 90° 1)2)	
Coolant pump pulley to coolant pump		20
Idler roller to engine		40
Hot air collector plate to exhaust manifold		10
• 1) Renew bolts. • 2) 90° = one quarter turn.		



1.7 Camshaft timing chain - exploded view of components

1 - 10 Nm

2 - Chain tensioner

- ☐ Exerts spring pressure
- ☐ Before removing, lock in place using locking pin - T40011-

3 - Tensioning rail for timing chain

4 - Guide pin, 18 Nm

5 - 40 Nm + 90° (1/4 turn) further



Caution

Bolt with left-hand thread!

- ☐ Renew
- ☐ When loosening and tightening, lock camshaft adjuster using counterhold -T10172-

6 - Camshaft adjuster for inlet camshaft

- ☐ Must not be dismantled
- ☐ Removing and installing ⇒ [page 57](#)

7 - Camshaft timing chain

- ☐ Before removing, mark running direction with paint
- ☐ Removing and installing ⇒ [page 57](#)

8 - Bearing bush

- ☐ For camshaft adjuster

9 - Camshaft housing

10 - Chain sprocket for exhaust camshaft

- ☐ Removing and installing ⇒ [page 57](#)

11 - 50 Nm + 90° (1/4 turn) further

- ☐ Renew
- ☐ When loosening and tightening, lock sprocket using counterhold -T10172-

12 - Guide pin, 18 Nm

13 - Guide rail for camshaft timing chain

- ☐ Removing and installing ⇒ [page 57](#)

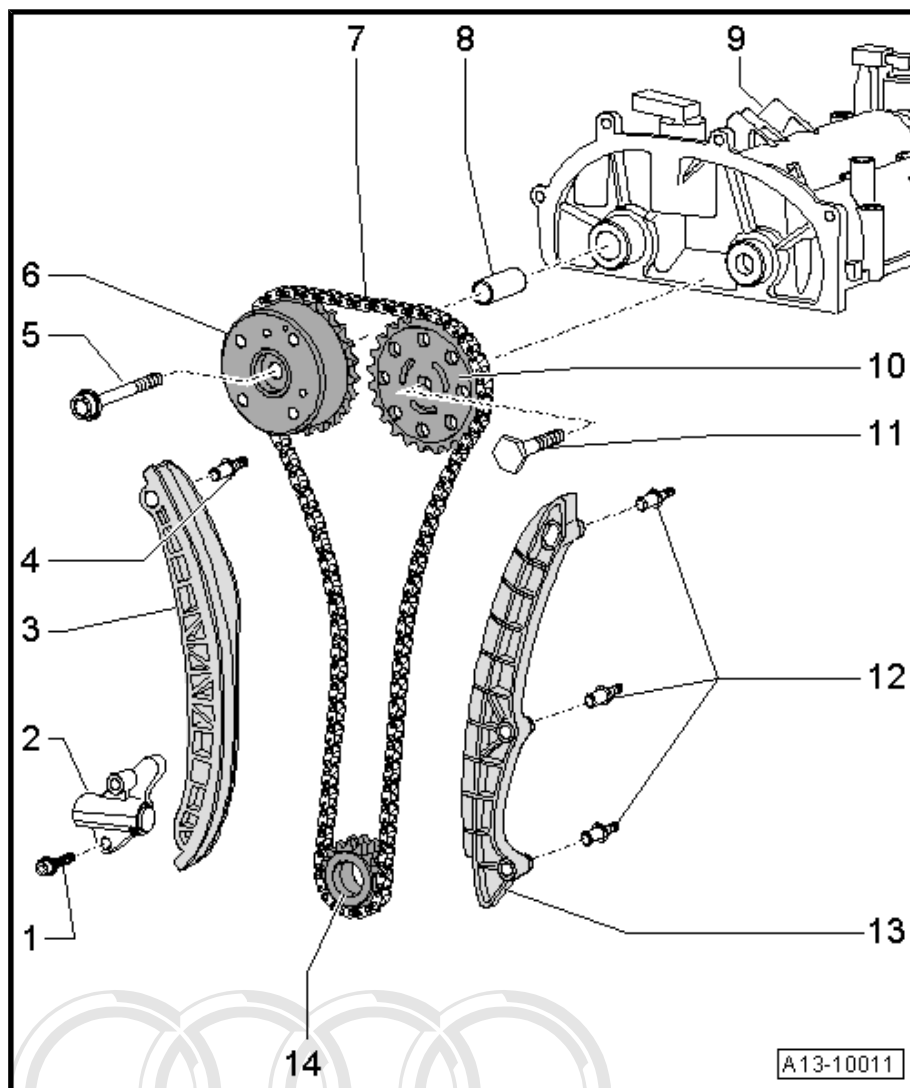
14 - Chain sprocket

- ☐ Fitted onto crankshaft



Caution

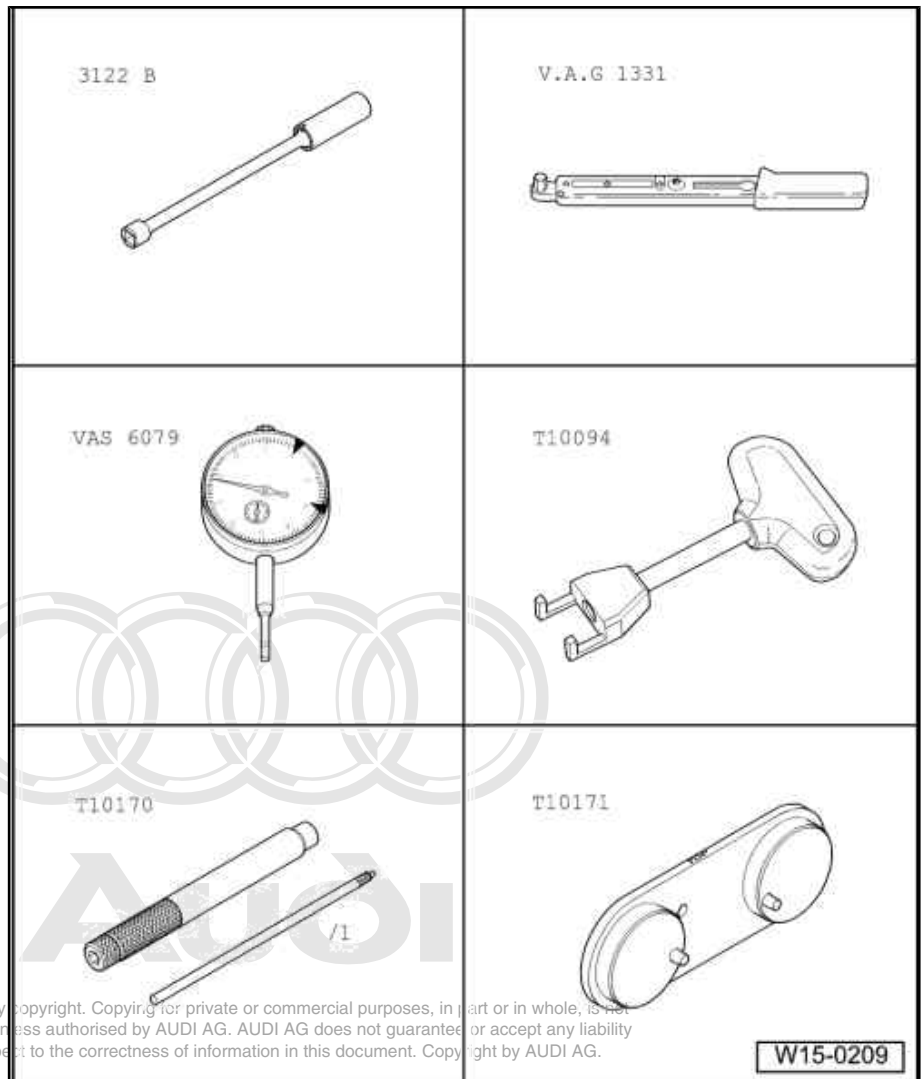
Note correct position: slot must engage with drive lug on crankshaft.



1.8 Checking valve timing

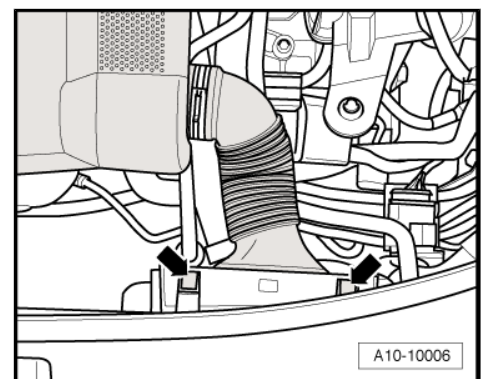
Special tools and workshop equipment required

- ◆ Spark plug socket and extension -3122 B-
- ◆ Torque wrench - V.A.G 1331-
- ◆ Dial gauge -VAS 6079-
- ◆ Puller -T10094-
- ◆ Adapter for dial gauge - T10170-
- ◆ Camshaft clamp -T10171-

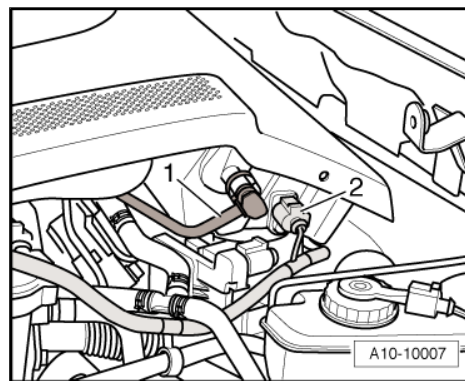


Test sequence

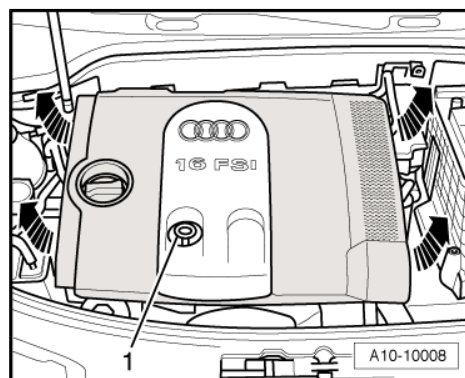
- Engine in vehicle.
- Unclip air intake hose from air duct -arrows-.



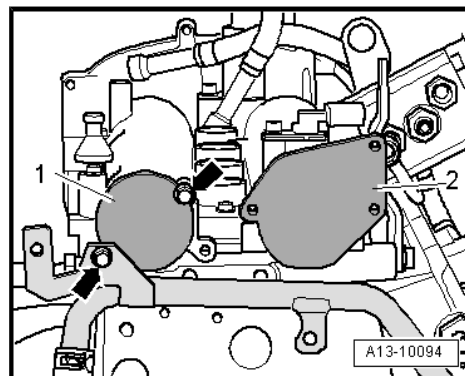
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



- Remove exhaust gas recirculation valve -N18- ⇒ [page 199](#) .
- Unscrew bolts -arrows-.
- Detach sealing caps -1- and -2-.



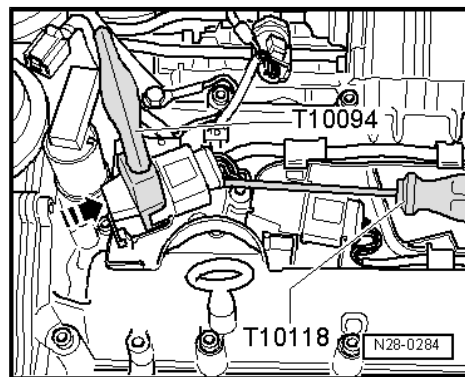
- Apply puller -T10094- at ignition coil for cylinder 1 -arrow- and pull out ignition coil.



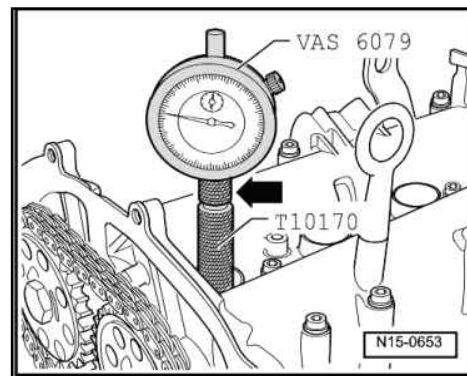
Note

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- Remove spark plug for cylinder 1 with spark plug socket and extension -3122 B- .



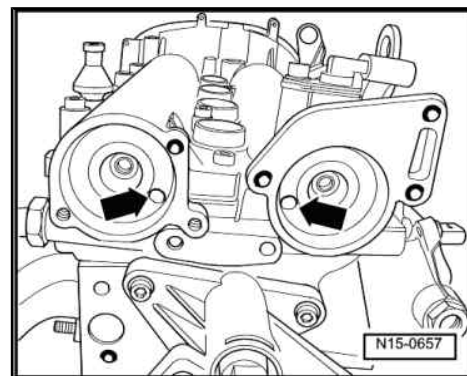
- Screw adapter for dial gauge -T10170- into spark plug hole as far as the stop.
- Insert dial gauge -VAS 6079- with extension -T10170/1- as far as the stop and secure using locking nut -arrow-.
- Turn crankshaft in normal direction of rotation to TDC position. Note the position of the small dial gauge needle.



- The holes -arrows- in the camshafts must be positioned as shown in illustration; turn crankshaft another full rotation (360°) if necessary.

**Note**

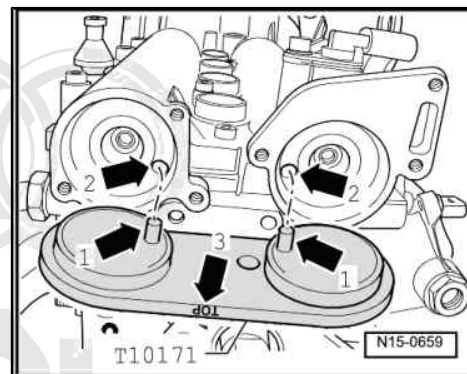
- ◆ If the crankshaft is more than 0.01 mm beyond TDC, you must turn the crankshaft approx. 45° in opposite direction of rotation. Then turn crankshaft in normal direction of rotation to TDC.
- ◆ Permissible deviation from TDC: ± 0.01 mm.



- Insert the camshaft clamp -T10171- into the openings in the camshafts as far as the stop.
- The locking pins -arrows 1- must engage in the holes -arrows 2-. The marking "TOP" -arrow 3- should be legible from above.

If the camshaft clamp -T10171- cannot be inserted into the openings in the camshafts as far as the stop, the valve timing is not correct.

- Adjust the valve timing
 ⇒ ["1.9 Removing and installing camshaft timing chain", page 57](#).

**Assembling****Note**

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Renew gaskets and seals.

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

- Renew seals for camshaft sealing caps and lubricate with oil before installing.
- Install exhaust gas recirculation valve -N18- ⇒ [page 199](#).

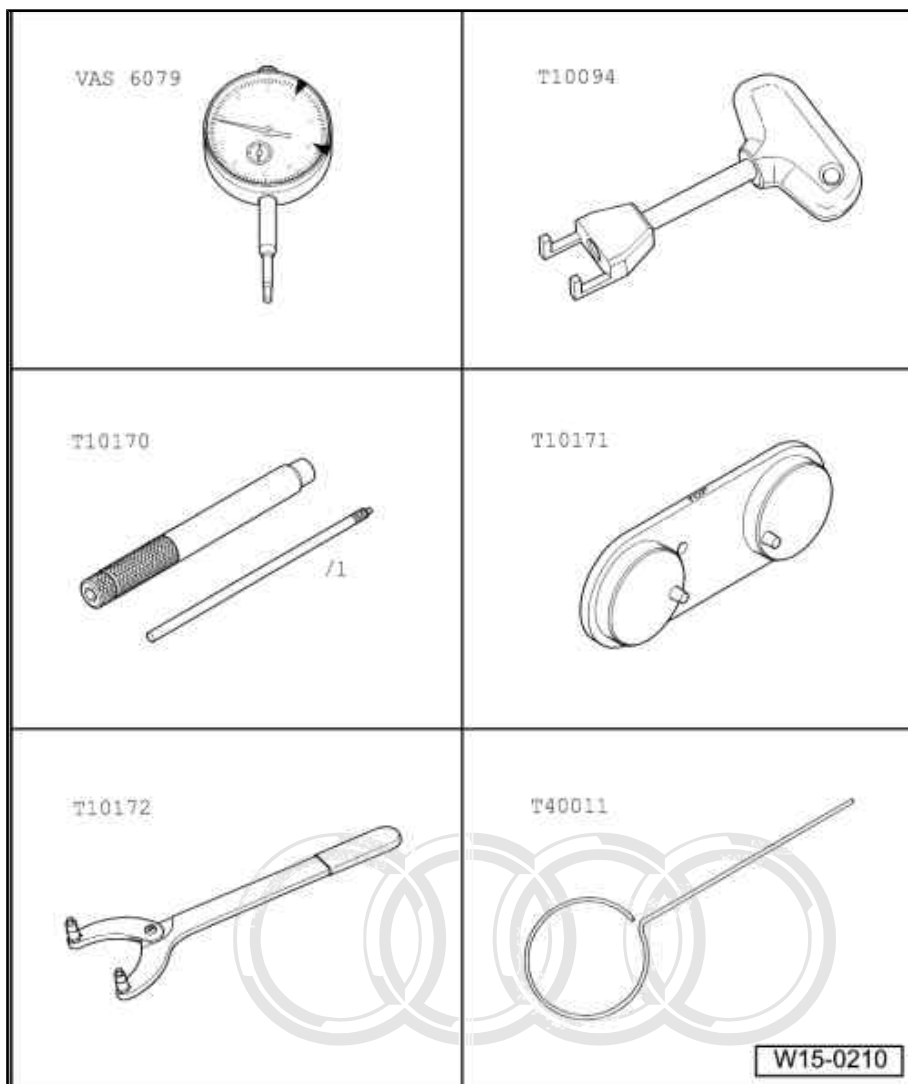
Tightening torque

Component	Nm
Sealing caps to camshaft housing	10

1.9 Removing and installing camshaft timing chain

Special tools and workshop equipment required

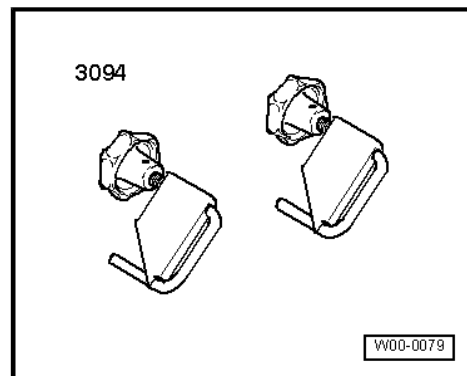
- ◆ Dial gauge -VAS 6079-
- ◆ Puller -T10094-
- ◆ Adapter for dial gauge - T10170-
- ◆ Camshaft clamp -T10171-
- ◆ Counterhold tool -T10172-
- ◆ Locking pin -T40011-



- ◆ Spark plug socket and extension -3122 B-



- ◆ Hose clamps for hoses up to 25 mm Ø -3094-



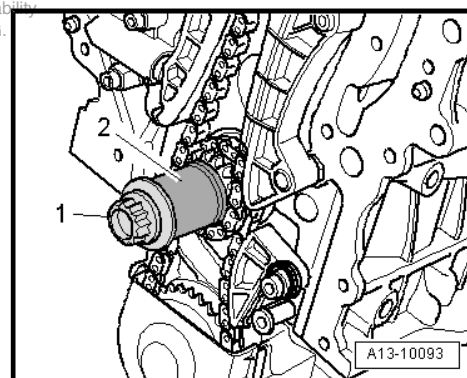
Removing

- Remove cover for timing chain [⇒ page 43](#).
- Fit central bolt -1- with mounting bush -2- to rotate crankshaft.

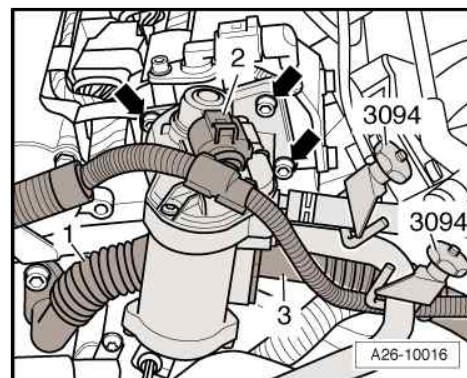


Note

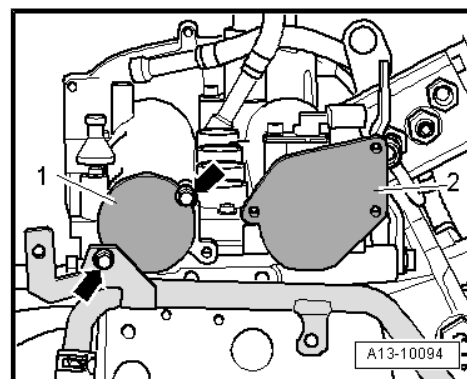
Before tightening central bolt, lock crankshaft by inserting a suitable block of wood at crank web.



- Clamp off hoses at exhaust gas recirculation valve -N18- using hose clamps -3094- and disconnect hoses.
- Detach electrical connector -2-.
- Unscrew connecting pipes for exhaust gas recirculation -1- and -3- (front and rear) at exhaust gas recirculation valve -N18-.
- Unscrew bolts -arrows- and remove exhaust gas recirculation valve -N18-.



- Unscrew bolts -arrows-.
- Detach sealing caps -1- and -2-.



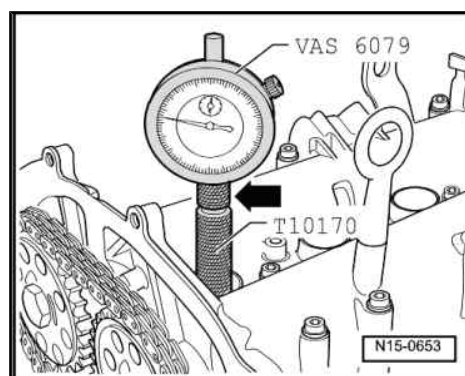
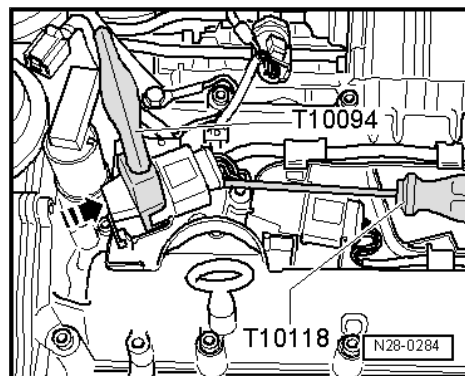
- Apply puller -T10094- at ignition coil for cylinder 1 -arrow- and pull out ignition coil.



Note

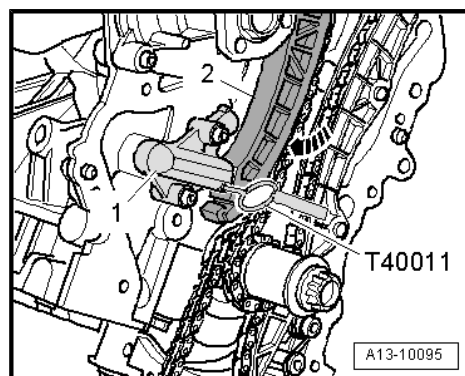
The assembly tool -T10118- is only required if the electrical connector needs to be unplugged.

- Remove spark plug for cylinder 1 with spark plug socket and extension -3122 B- .
- Screw adapter for dial gauge -T10170- into spark plug hole as far as the stop.
- Insert dial gauge -VAS 6079- with extension -T10170/1- as far as the stop and secure using locking nut -arrow-.
- Turn crankshaft in normal direction of rotation to TDC position. Note the position of the small dial gauge needle.
- Then turn crankshaft back 45° in the opposite direction of normal rotation.



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- Press the tensioning rail -2- in the direction of the arrow and lock piston of chain tensioner -1- using locking pin -T40011- .



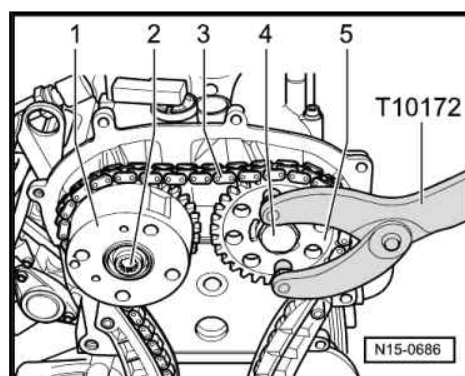
- Mark the rotation direction of the timing chain -3- with a coloured pen.



Caution

- ◆ The camshaft clamp -T10171- must not be used as a counterhold.
- ◆ The centre bolt -2- for the camshaft adjuster has left-hand threads.

- Unscrew bolts -2- and -4- using counterhold tool -T10172- .
- Remove camshaft sprocket -5- and camshaft adjuster -1- together with timing chain -3-.



Installing

- Fit camshaft adjuster -1- and camshaft sprocket -4- without timing chain onto camshafts.

**Caution**

The centre bolt -2- for the camshaft adjuster has left-hand threads.

- Renew bolts -2- and -3- and tighten to 20 Nm using counterhold tool -T10172-.
- Turn the inlet and exhaust camshafts until the camshaft clamp -T10171- can be inserted all the way into the camshaft openings.
- The locking pins -arrows 1- must engage in the holes -arrows 2-. The marking "TOP" -arrow 3- should be legible from above.

**Caution**

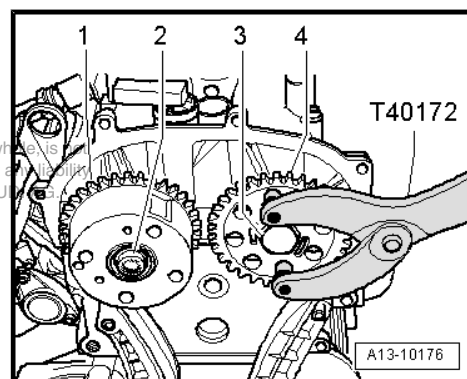
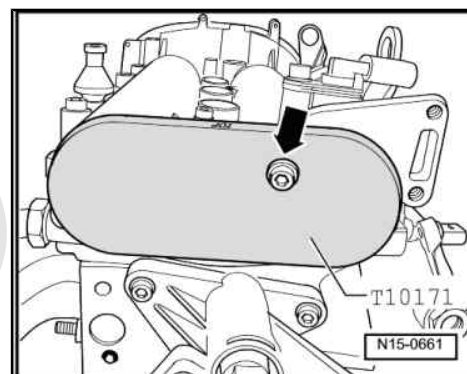
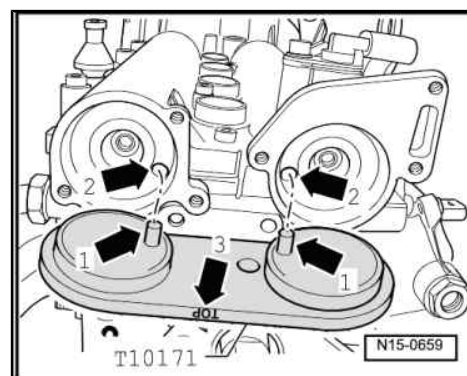
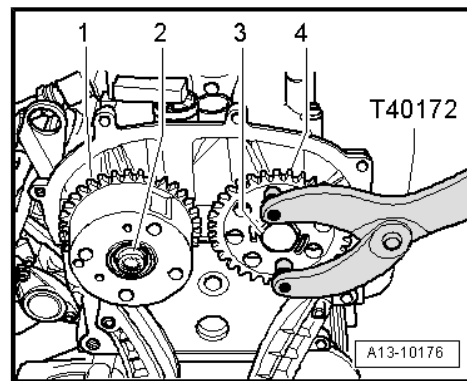
The camshafts must not be moved axially when turning.

- To secure the camshaft clamp -T10171-, screw in an M6 bolt -arrow- finger-tight, but do not tighten.

**Caution**

The camshaft clamp -T10171- must not be used as a counterhold.

- Loosen securing bolts for camshaft sprockets. Counterhold using tool -T10172-.
- Unscrew bolt -3- and loosen bolt -2-.
- Remove camshaft sprocket -4-.



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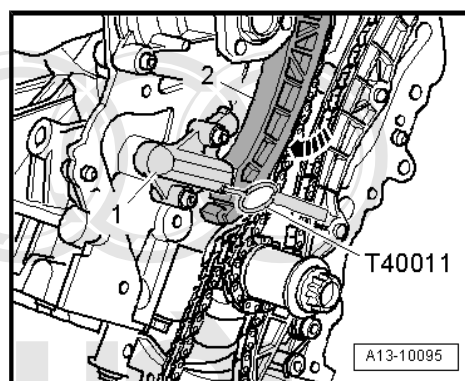
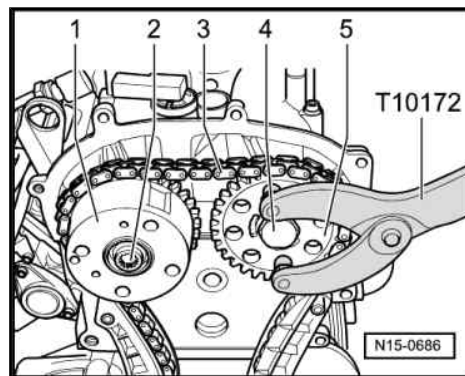
- Fit timing chain -3- onto crankshaft and camshaft adjuster -1- noting direction of rotation.
- Fit camshaft sprocket -5- together with timing chain.



Caution

The centre bolt -2- for the camshaft adjuster has left-hand threads.

- Screw in bolts -2- and -4- until camshaft sprocket and camshaft adjuster can just be turned on the camshafts and do not tilt.
- Tension the timing chain by removing the locking pin -T40011- from the chain tensioner -1-.



- Turn crankshaft in normal direction of rotation to TDC position.
- Permissible deviation from TDC: ± 0.01 mm.



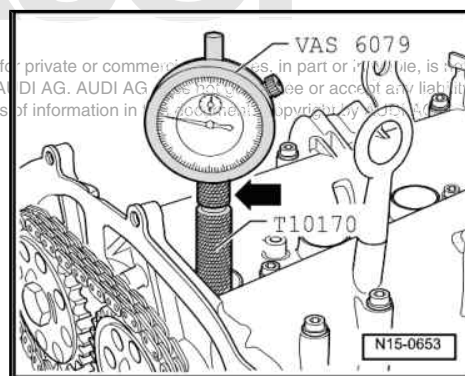
Note

If the crankshaft is more than 0.01 mm beyond TDC, you must turn the crankshaft approx. 45° in opposite direction of rotation. Then turn crankshaft in normal direction of rotation to TDC.



Caution

The centre bolt -2- for the camshaft adjuster has left-hand threads.



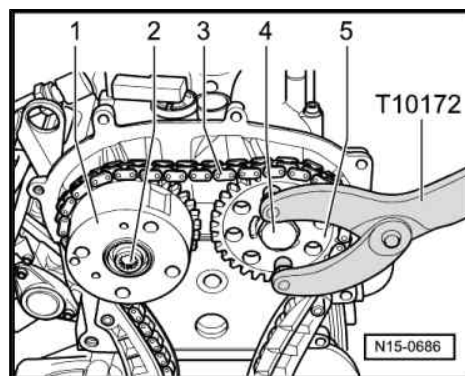
- Hold camshaft adjuster -1- and camshaft sprocket -5- in this position using counterhold tool -T10172- and tighten bolt -2- to 40 Nm and bolt -4- to 50 Nm.



Note

When tightening the camshaft bolts, the crankshaft must not turn and the timing chain -3- must remain tensioned on both sides.

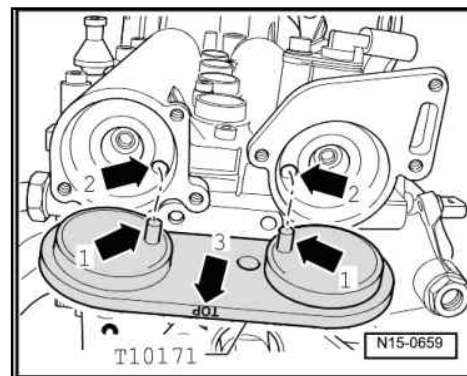
- Remove the camshaft clamp -T10171- .
- Turn crankshaft two turns in normal direction of rotation to TDC position.
- Permissible deviation from TDC: ± 0.01 mm.



- Insert the camshaft clamp -T10171- into the openings in the camshafts as far as the stop.

If the camshaft clamp -T10171- cannot be inserted:

- Repeat adjustment.



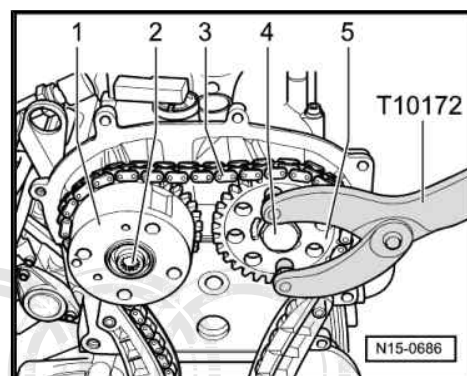
If the camshaft clamp -T10171- can be inserted:



Caution

The centre bolt -2- for the camshaft adjuster has left-hand threads.

- Remove camshaft clamp -T10171- , lock camshaft adjuster -1- and camshaft sprocket -5- using counterhold tool -T10172- and turn bolts -2- and -4- with a rigid wrench $\frac{1}{4}$ turn further (90°).
- Turn crankshaft two turns in normal direction of rotation to TDC position for a second time.
- Permissible deviation from TDC: ± 0.01 mm.



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- Insert the camshaft clamp -T10171- into the openings in the camshafts as far as the stop.

If the camshaft clamp -T10171- cannot be inserted:

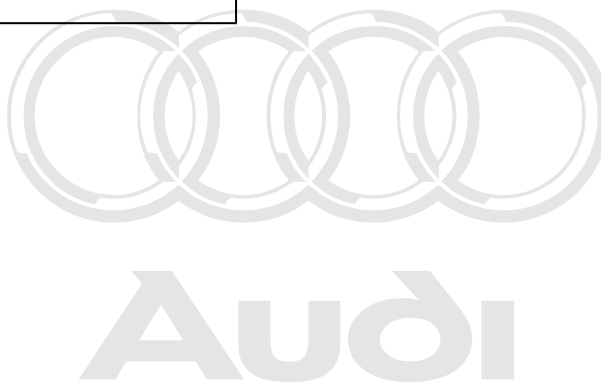
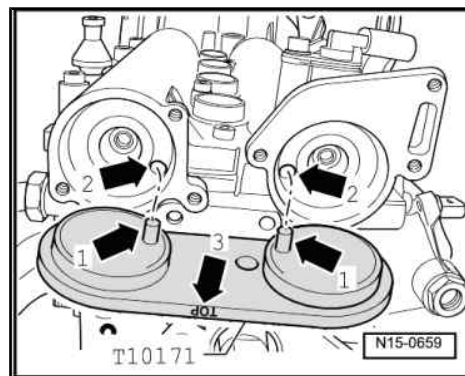
- Repeat adjustment.

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

- Install timing chain cover ⇒ [page 43](#) .
- Renew crankshaft oil seal ⇒ [page 38](#) .
- Install crankshaft pulley ⇒ [page 37](#) .
- Install sump ⇒ [page 128](#) .
- Renew seals for camshaft sealing caps and lubricate with oil before installing.
- Install exhaust gas recirculation valve -N18- ⇒ [page 199](#) .

Tightening torques

Component	Nm
Camshaft adjuster to camshaft	40 + 90° 1)2)3)
Camshaft sprocket to camshaft	50 + 90° 2)3)
Spark plugs in cylinder head	30
Sealing caps to camshaft housing	10
• 1) The central bolt for the camshaft adjuster has a left-hand thread. • 2) Renew bolts. • 3) 90° = one quarter turn.	



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2 Servicing work on flywheel end



Note

Servicing clutch ⇒ Rep. Gr. 30

2.1 Flywheel/drive plate and sealing flange - exploded view of components



Caution

- ◆ *The crankshaft must not be removed. Even loosening the main bearing cap bolts will cause deformation of the cylinder block bearing pedestals. This will result in reduced bearing clearance. Even if bearing shells are not renewed, a change in bearing clearance can cause bearing damage.*
- ◆ *If the bearing cap bolts are loosened, the cylinder block must be renewed together with the crankshaft.*
- ◆ *Crankshaft bearing clearance cannot be measured using workshop equipment.*



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1 - 60 Nm + 90° (1/4 turn) further

- ☐ Renew

2 - Flywheel/drive plate

- ☐ Removing and installing flywheel ⇒ [page 67](#)
- ☐ Removing and installing drive plate ⇒ [page 67](#)

3 - Sender wheel

- ☐ For engine speed sender -G28-
- ☐ Removing and installing:
⇒ "2.4 Renewing sealing flange - vehicles up to VIN 8P_4_103000", [page 68](#) or
⇒ "2.5 Renewing sealing flange - vehicles from VIN 8P_4_103001 onwards", [page 75](#)

4 - 12 Nm

5 - Intermediate plate

- ☐ Must be positioned on dowel sleeves
- ☐ Do not damage/bend when assembling
- ☐ Is fitted on sealing flange ⇒ [page 66](#)

6 - Protective cap

- ☐ Seals the engine speed sender -G28- on the cylinder block.

7 - Engine speed sender -G28-

8 - 5 Nm

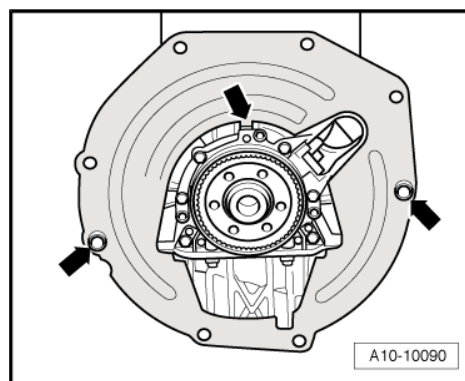
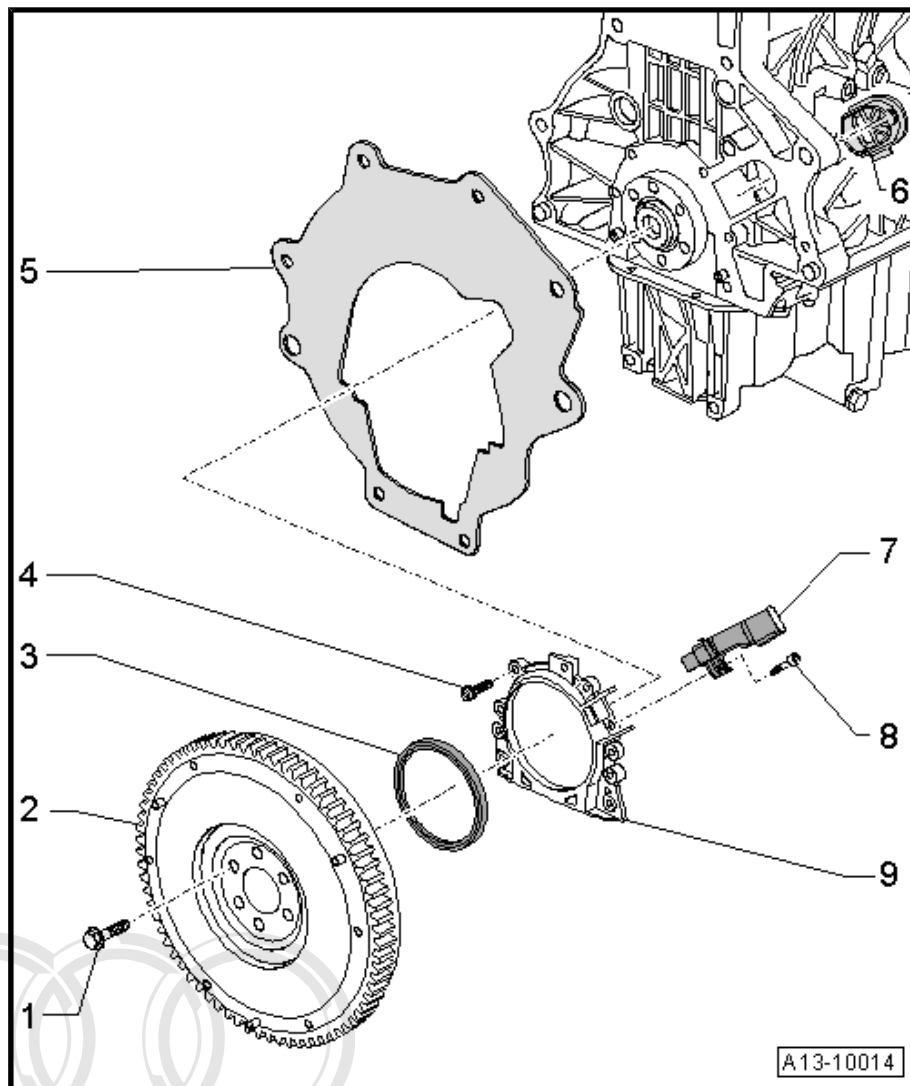
9 - Sealing flange

- ☐ With oil seal
- ☐ Renewing: Vehicles up to VIN 8P_4_103000 ⇒ [page 68](#) , vehicles from VIN 8P_4_103001 onwards ⇒ [page 75](#)

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Engaging intermediate plate on sealing flange

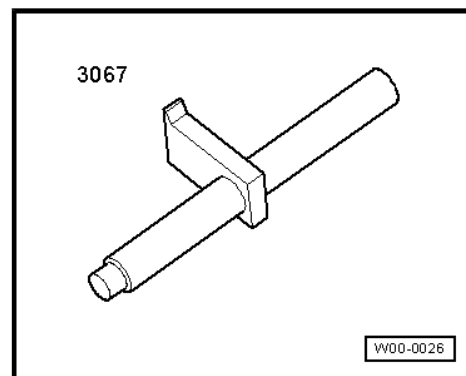
- Ensure that the intermediate plate is engaged on the sealing flange and pushed onto the dowel sleeves -arrows-.



2.2 Removing and installing flywheel

Special tools and workshop equipment required

- ◆ Counterhold tool -3067-



Removing

- Gearbox removed.
- Remove clutch pressure plate ⇒ Rep. Gr. 30.
- Mark installation position of flywheel on crankshaft.
- Attach counterhold tool -3067- in order to loosen bolts.
- Unbolt flywheel.

Installing

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

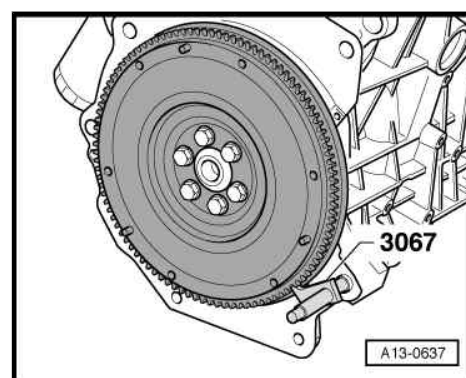
- Use new bolts for securing.
- Fit counterhold tool -3067- the other way round to tighten bolts.

- Install clutch pressure plate ⇒ Rep. Gr. 30.

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Tightening torque

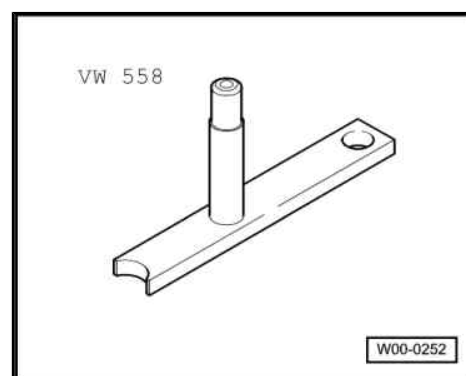
Component	Nm
Flywheel to crankshaft	
Bolt length 19.5 mm	60 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	



2.3 Removing and installing drive plate

Special tools and workshop equipment required

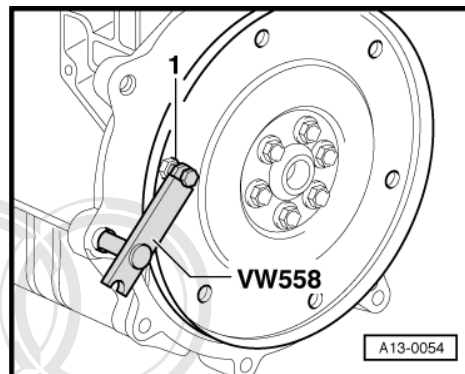
- ◆ Counterhold for clutch -VW 558-



- ◆ Hexagon bolt M8x45 and hexagon nut M10 (2x)
- ◆ Depth gauge

Removing

- Gearbox removed.
- Secure counterhold tool for clutch -VW 558- to drive plate using hexagon bolt M8x45. Insert two M10 hexagon nuts -1- between counterhold tool and drive plate.
- Mark installation position of drive plate on crankshaft.
- Unbolt drive plate.

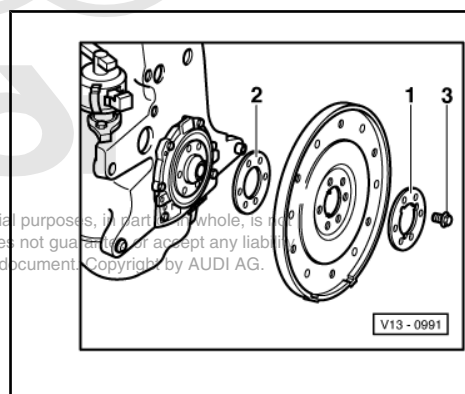


Installing

- Fit drive plate with shim -2- (thickness 1.2 mm) and washer -1- (thickness 0.5 mm).
- Secure drive plate with new bolts.

Tightening torque

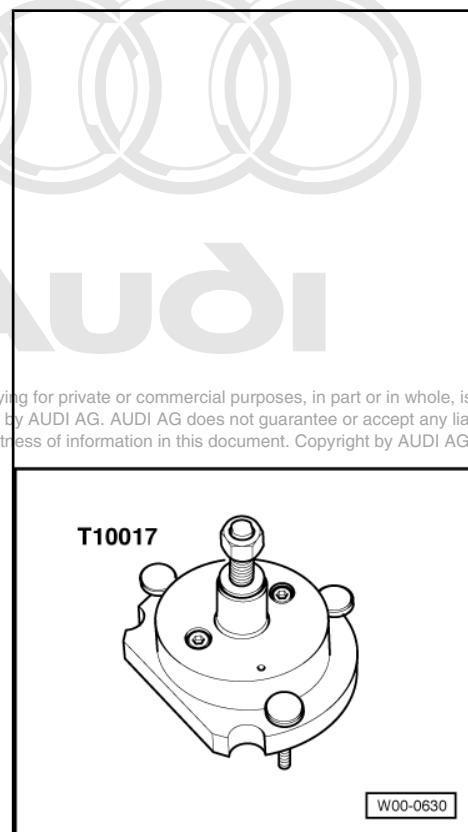
Component	Nm
Drive plate to crankshaft	60 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	



2.4 Renewing sealing flange - vehicles up to VIN 8P_4_103000

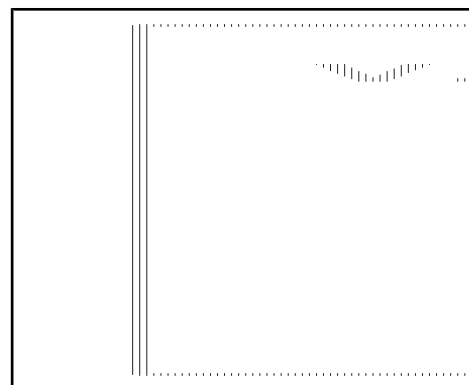
Special tools and workshop equipment required

- ◆ Assembly tool -T10017-



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- ◆ Open ring spanner -V.A.G 1332/11-



- ◆ Hexagon bolt M6×35 mm (3x)
- ◆ Feeler gauge
- ◆ Depth gauge

Pressing sealing flange with sender wheel off crankshaft

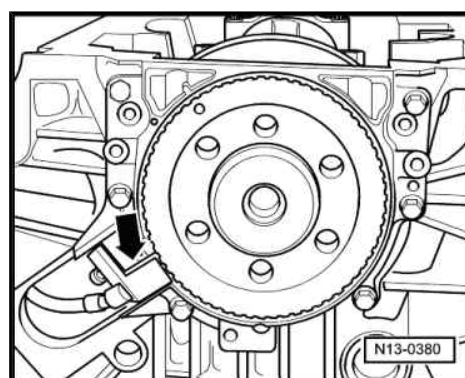
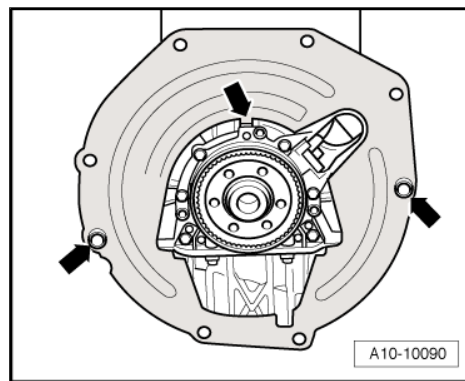
- Gearbox removed.



Note

Shown in illustrations with engine removed.

- Remove the flywheel ⇒ [page 67](#) or the drive plate ⇒ [page 67](#) .
- Remove intermediate plate -arrows-.
- Rotate engine to TDC
⇒ [“1.8 Checking valve timing”, page 55](#) .
- Remove sump ⇒ [page 123](#) .
- Remove engine speed sender -G28- -arrow-.



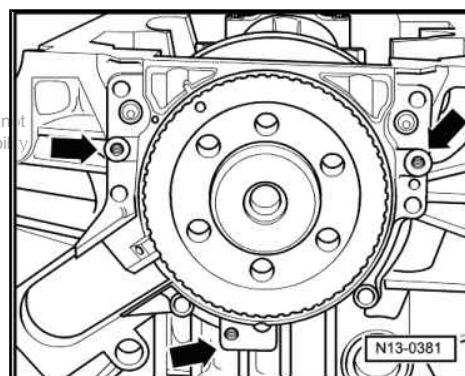
- Unscrew securing bolts for sealing flange.



Note

The sealing flange is pressed off the crankshaft together with the sender wheel.

- To press out, screw in 3 bolts M6x35 -arrows- alternately into sealing flange not more than $\frac{1}{2}$ turn at a time.
- Remove sealing flange together with sender wheel.



Pressing in sealing flange with sender wheel

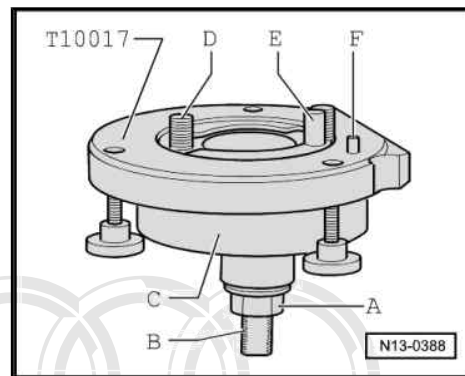


Note

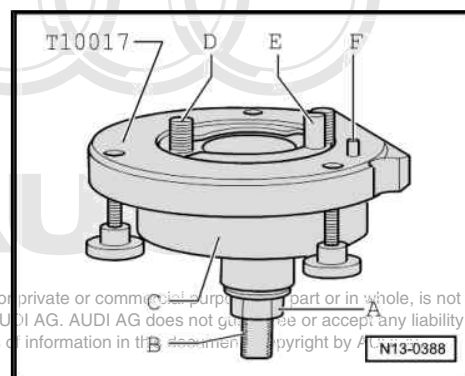
- ◆ *The sealing flange with PTFE oil seal is fitted with a sealing lip support ring. This support ring acts as an assembly sleeve and must not be removed before installation.*
- ◆ *Sealing flange and sender wheel must not be separated or rotated out of position after removal from packaging.*
- ◆ *The sender wheel is held in its installation position by a locating pin on the assembly tool -T10017- .*
- ◆ *The sealing flange and oil seal are one unit and can only be replaced together with the sender wheel.*
- ◆ *The assembly tool -T10017- is held in the correct position relative to the crankshaft by a guide pin which is inserted into a hole in the crankshaft.*

Construction of assembly tool -T10017-

- A - Hexagon nut
- B - Tightening flats
- C - Assembly housing
- D - Hexagon socket-head bolt
- E - Guide pin
- F - Locating pin

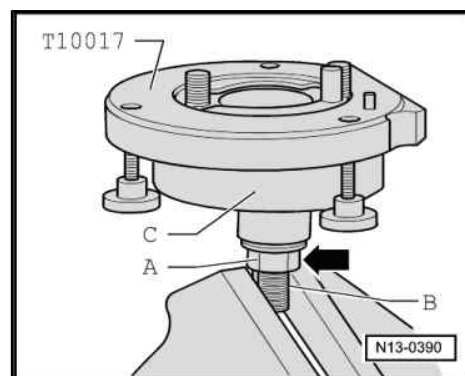
**A - Fitting oil seal with sender wheel onto assembly tool -T10017-:**

- Screw hexagon nut -A- to shortly before the tightening flats -B- on the threaded spindle.



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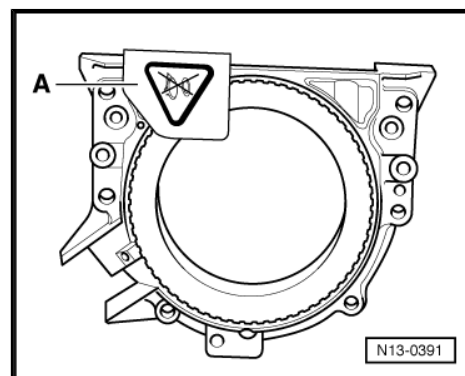
- Clamp assembly tool -T10017- in a vice on tightening flats -B- of threaded spindle.
- Press the assembly housing -C- downwards so that it lies on the hexagon nut -A- -arrow-.
- Inner part of assembly device and assembly housing must align (be level) with each other.



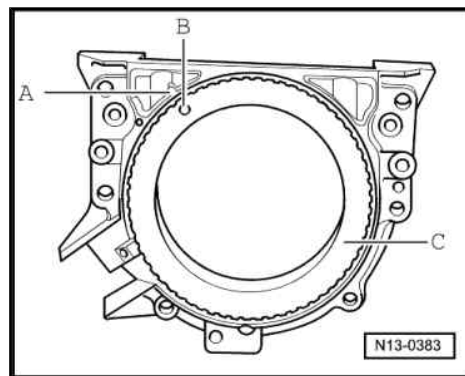
- Remove the securing clip -A- from new sealing flange.

**Note**

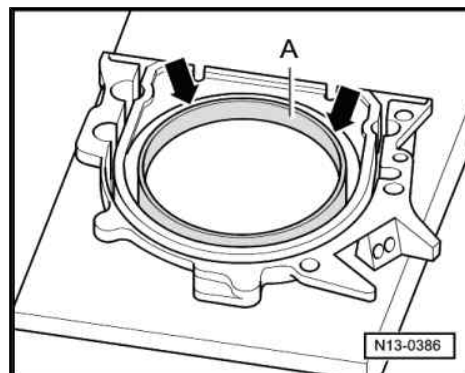
The sender wheel must not be taken out of the sealing flange or rotated out of position.



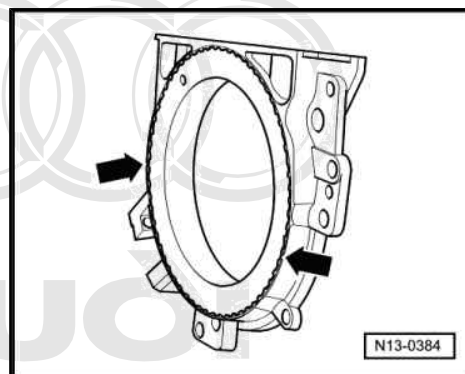
- The locating hole -B- on the sender wheel -C- must align with the marking -A- on the sealing flange.



- Place the sealing flange (with the front side downwards) on a clean flat surface.
- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



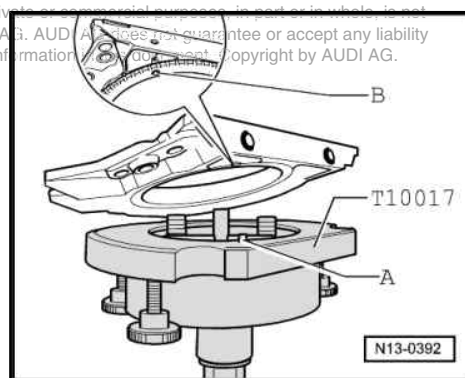
- The upper edge of the sender wheel and the front edge of the sealing flange must align -arrows-.



- Place the sealing flange with the front side on the assembly tool -T10017-, so that the locating pin -A- can be inserted in the sender wheel hole -B-.

Note

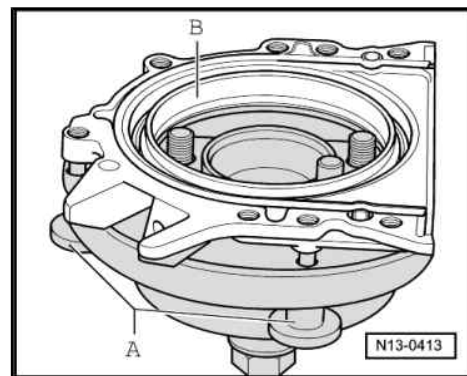
Ensure the sealing flange lies flat on the assembly tool.



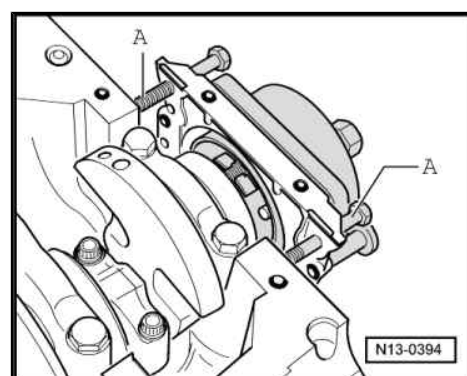
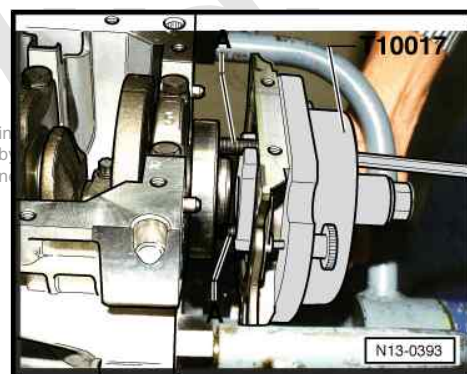
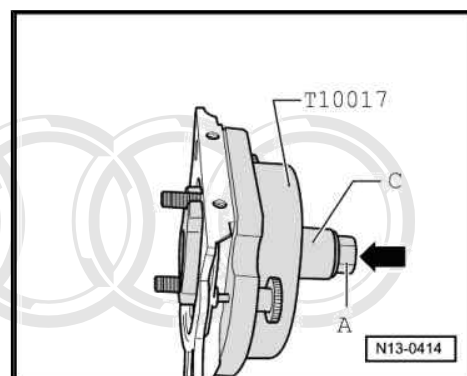
- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool -T10017- while tightening the 3 knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.

**Note**

Ensure that the sender wheel remains fixed on the assembly tool when installing the sealing flange.

**B - Installing assembly tool -T10017- with sealing flange on crankshaft flange:**

- Crankshaft flange free of oil and grease.
- Engine is at TDC position.
- Screw hexagon nut -A- to end of threaded spindle.
- Press the threaded spindle of assembly tool -T10017- in direction of -arrow- until the hexagon nut -A- lies on the assembly housing -C-.
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.
- Secure assembly tool -T10017- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.
- Screw two bolts M6×35 mm -item A- into cylinder block to guide sealing flange.

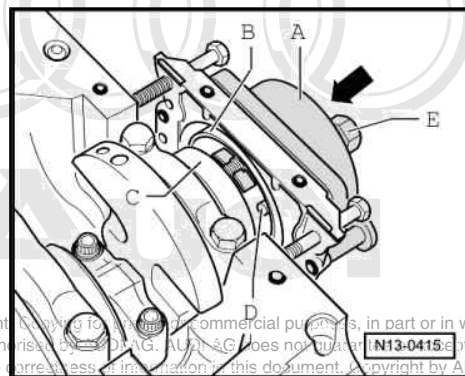


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C - Fitting assembly tool -T10017- onto crankshaft flange:

- Press the assembly housing -A- by hand in the direction of the -arrow- until the sealing lip support ring -B- lies on the surface of the crankshaft flange -C-.
- Insert the guide pin -D- into hole in crankshaft. This ensures that the sender wheel reaches its final installation position.
- Tighten the 2 hexagon socket head bolts on assembly tool finger-tight.
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -A-.



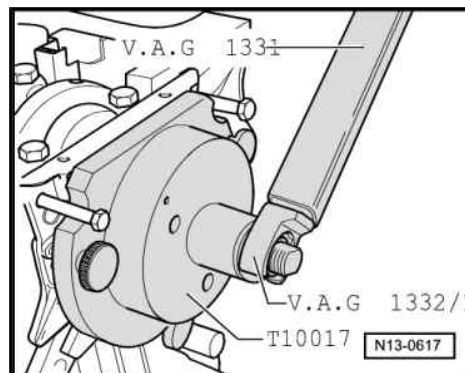
D - Pressing sender wheel onto crankshaft flange with assembly tool -T10017- :

- Tighten hexagon nut of assembly tool -T10017- to 35 Nm.



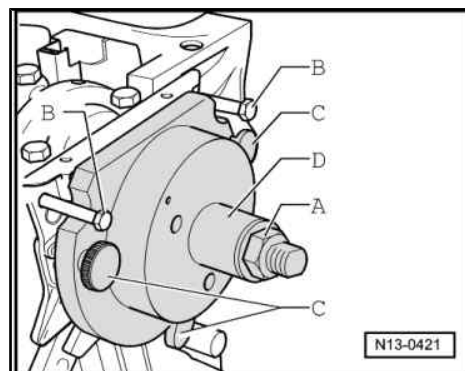
Note

A small air gap must be present between cylinder block and sealing flange after tightening hexagon nut to 35 Nm.

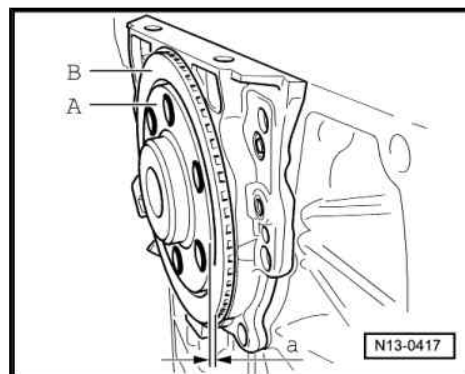


E - Checking installation position of sender wheel on crankshaft:

- Screw hexagon nut -A- to end of threaded spindle.
- Unscrew the 2 bolts -B- out of cylinder block.
- Unscrew the 3 knurled screws -C- from sealing flange.
- Remove assembly tool -T10017- .
- Remove sealing lip support ring.



- The sender wheel is positioned correctly on the crankshaft if the distance -a- between the crankshaft flange -A- and sender wheel -B- is 0.5 mm.



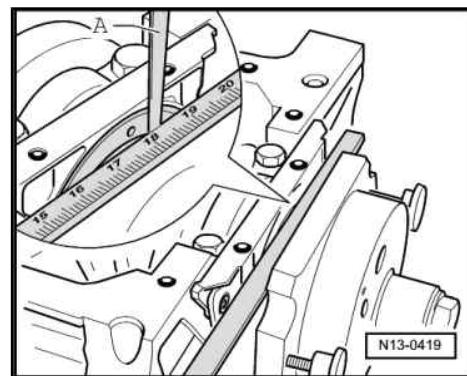
- Place a depth gauge against the crankshaft flange.
- Using a feeler gauge -A-, measure distance -a- between crankshaft flange and sender wheel.

If distance -a- is too small:

- Press in the sender wheel further ⇒ [page 75](#) .

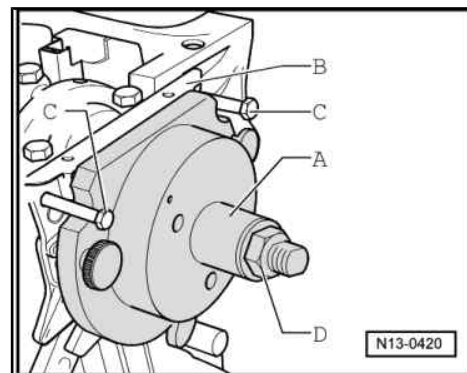
When distance -a- is achieved:

- Continue with assembly ⇒ [page 75](#) .



F - Pressing sender wheel in further:

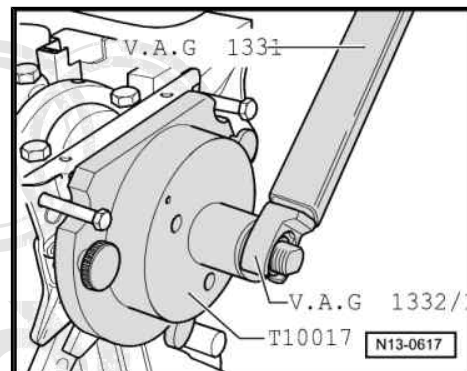
- Slide assembly housing -A- to sealing flange -B- by hand.
- Screw two M6×35 mm bolts -C- into cylinder block to guide sealing flange -B-.
- Screw hexagon nut -D- onto threaded spindle by hand until it lies against the assembly housing -A-.



- Tighten hexagon nut of assembly tool -T10017- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 74](#) .

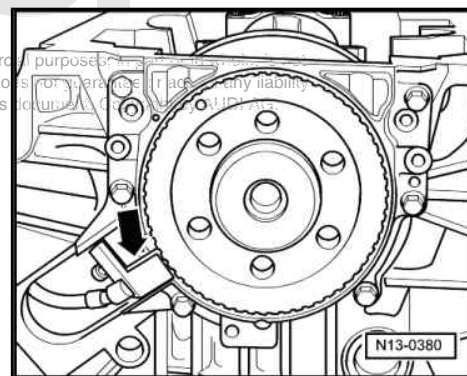
If distance -A- is still too small:

- Tighten hexagon nut of assembly tool -T10017- to 45 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 74](#) .



Assembling:

- Tighten the new securing bolts for sealing flange in diagonal sequence.
- Secure engine speed sender -G28- -arrow-.
- Install sump ⇒ [page 128](#) .
- Engage intermediate plate on sealing flange and slip onto dowel sleeves.
- Install the flywheel ⇒ [page 67](#) or the drive plate ⇒ [page 67](#) .



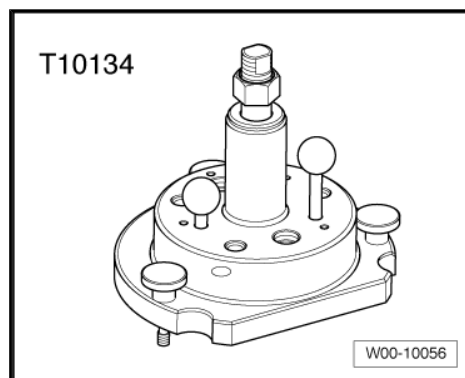
Tightening torques

Component	Nm
Sealing flange to cylinder block	12
Engine speed sender -G28- to cylinder block	5

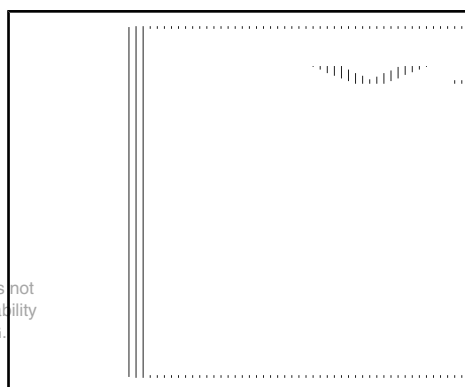
2.5 Renewing sealing flange - vehicles from VIN 8P_4_103001 onwards

Special tools and workshop equipment required

- ◆ Assembly tool -T10134-



- ◆ Open ring spanner -V.A.G 1332/11-



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- ◆ Hexagon bolt M6×35 mm (3x)
- ◆ Feeler gauge
- ◆ Depth gauge

Pressing sealing flange with sender wheel off crankshaft

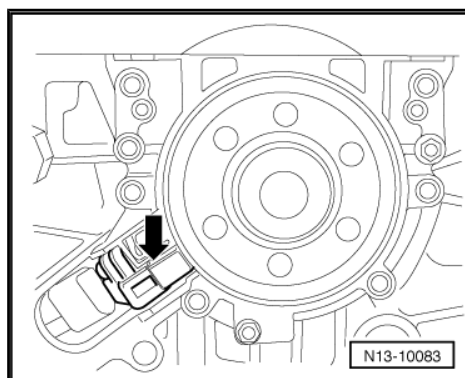
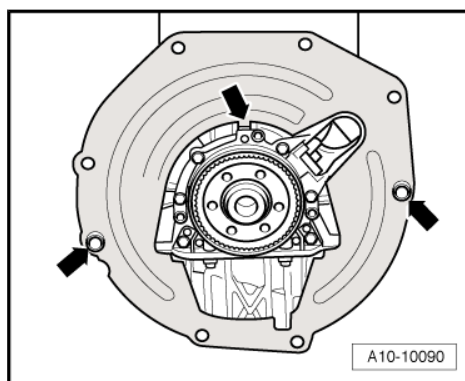
- Gearbox removed.



Note

Shown in illustrations with engine removed.

- Remove the flywheel ⇒ [page 67](#) or the drive plate ⇒ [page 67](#) .
- Remove intermediate plate -arrows-.
- Rotate engine to TDC
⇒ ["1.8 Checking valve timing", page 55](#) .
- Remove sump ⇒ [page 123](#) .
- Remove engine speed sender -G28- -arrow-.



- Unscrew securing bolts for sealing flange.

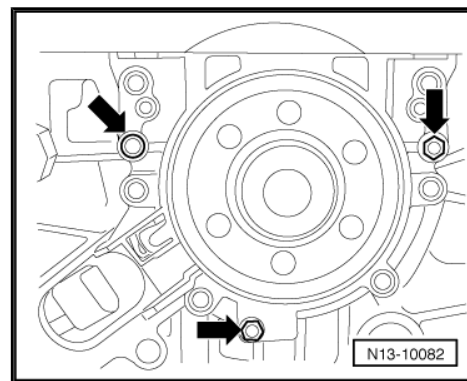
**Note**

The sealing flange is pressed off the crankshaft together with the sender wheel.

- To press out, screw in 3 bolts M6x35 -arrows- alternately into sealing flange not more than $\frac{1}{2}$ turn at a time.
- Remove sealing flange together with sender wheel.

Pressing in sealing flange with sender wheel**Note**

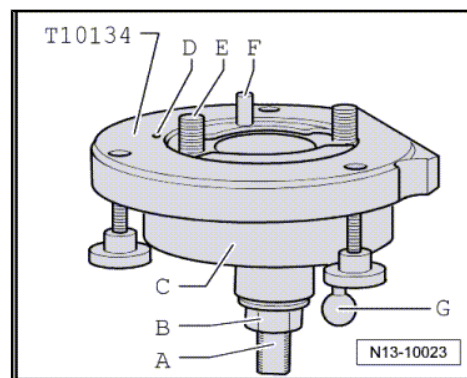
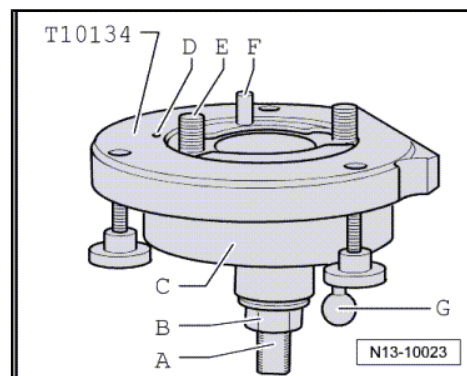
- ◆ *The sealing flange with PTFE oil seal is fitted with a sealing lip support ring. This support ring acts as an assembly sleeve and must not be removed before installation.*
- ◆ *Sealing flange and sender wheel must not be separated or rotated out of position after removal from packaging.*
- ◆ *The sender wheel is held in its installation position by a locating pin on the assembly tool -T10134-.*
- ◆ *The sealing flange and oil seal are one unit and can only be replaced together with the sender wheel.*
- ◆ *The assembly tool -T10134- is held in the correct position relative to the crankshaft by a guide pin which is inserted into a hole in the crankshaft.*

**Construction of assembly tool -T10134-**

- A - Tightening flats
- B - Hexagon nut
- C - Assembly housing
- D - Locating pin
- E - Hexagon socket-head bolt
- F - Guide pin for diesel engines (black handle)
- G - Guide pin for petrol engines (red handle)

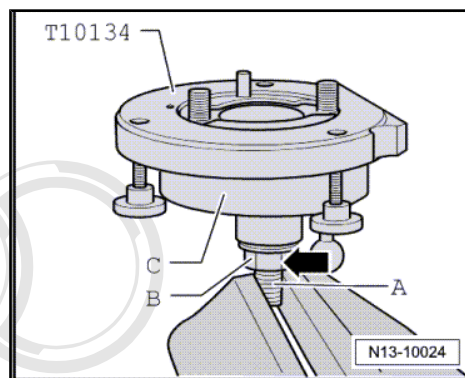
A - Fitting oil seal with sender wheel onto assembly tool -T10134- :

- Screw hexagon nut -B- to shortly before the tightening flats -A- on the threaded spindle.



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- Clamp assembly tool -T10134- in a vice on tightening flats -A- of threaded spindle.
- Press the assembly housing -C- downwards so that it lies on the hexagon nut -B- -arrow-.
- Inner part of assembly device and assembly housing must align (be level) with each other.



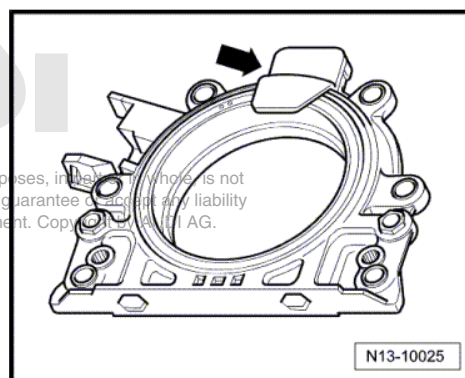
- Remove the securing clip -arrow- from new sealing flange.



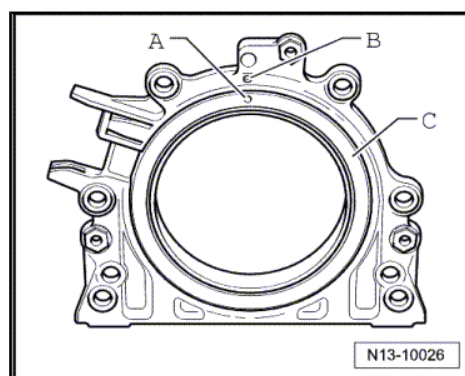
Note

The sender wheel must not be taken out of the sealing flange or rotated out of position.

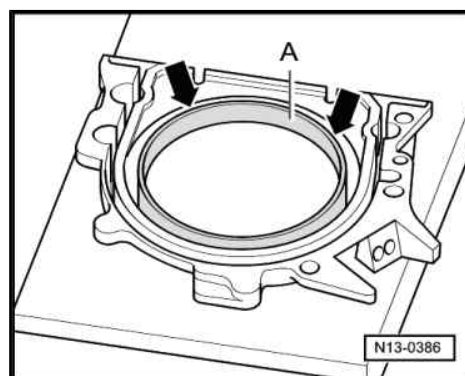
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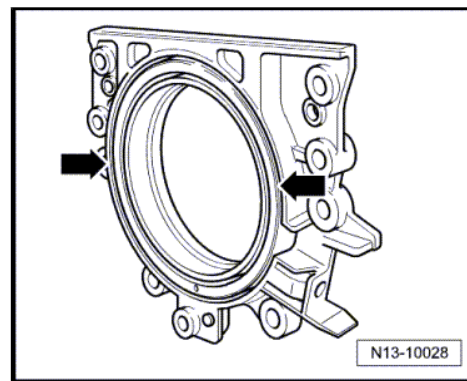
- The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.



- Place the sealing flange (with the front side downwards) on a clean flat surface.
- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



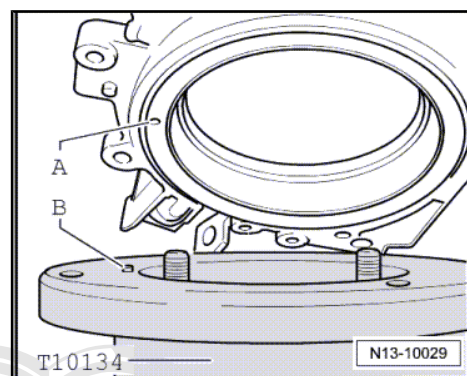
- The upper edge of the sender wheel and the front edge of the sealing flange must align -arrows-.



- Place front side of sealing flange on assembly tool -T10134-, so that locating pin -B- can be inserted in hole -A- in sender wheel.

**Note**

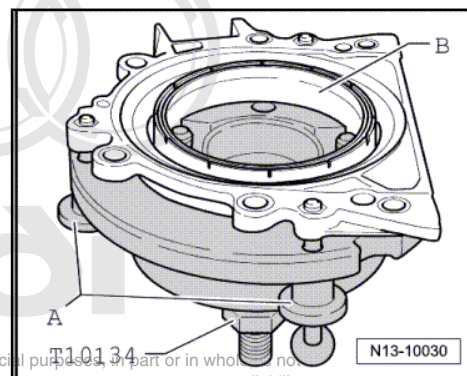
Ensure the sealing flange lies flat on the assembly tool.



- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool -T10134- while tightening the 3 knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.

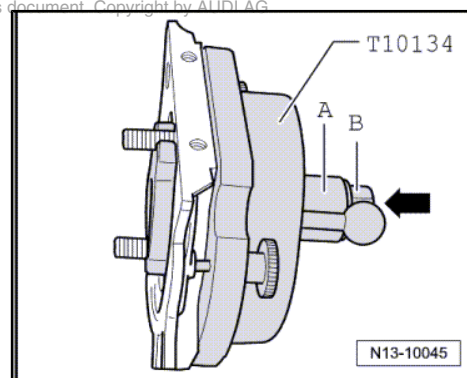
**Note**

Ensure that the sender wheel remains fixed on the assembly tool when installing the sealing flange.

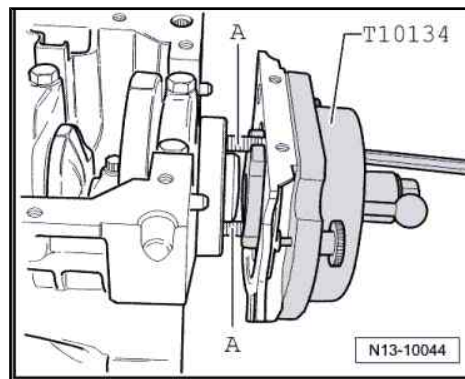


B - Installing assembly tool -T10134- with sealing flange on crankshaft flange:

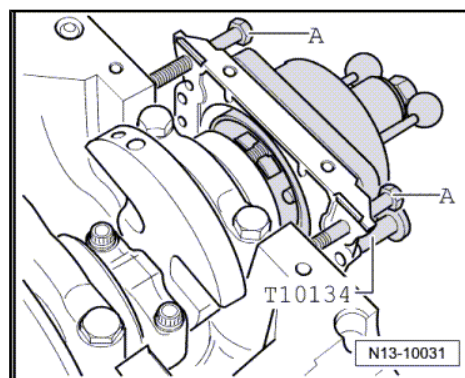
- Crankshaft flange free of oil and grease.
- Engine is at TDC position.
- Screw hexagon nut -B- to end of threaded spindle.
- Press the threaded spindle of assembly tool -T10134- in direction of -arrow- until the hexagon nut -B- lies on the assembly housing -A-.
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.



- Secure assembly tool -T10134- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.

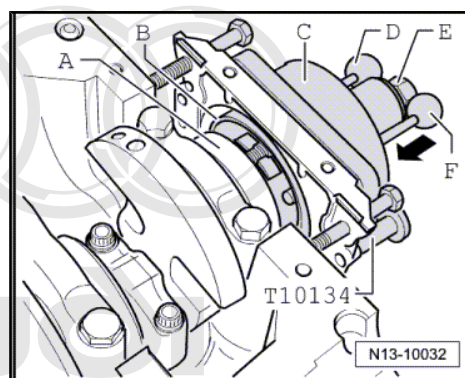


- Screw two bolts M6×35 mm -item A- into cylinder block to guide sealing flange.



C - Fitting assembly tool -T10134- onto crankshaft flange:

- Press the assembly housing -C- by hand in the direction of the -arrow- until the sealing lip support ring -B- lies on the surface of the crankshaft flange -A-.
- Press the guide pin for petrol engines (red handle) -F- into aperture in crankshaft. This ensures that the sender wheel reaches its final installation position.



Note

The guide pin for diesel engines (black handle) -D- must not be inserted into threaded hole in crankshaft.

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- Tighten the 2 hexagon socket head bolts on assembly tool finger-tight.
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.

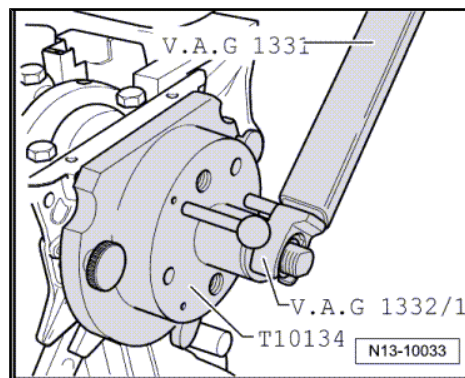
D - Pressing sender wheel onto crankshaft flange with assembly tool -T10134- :

- Tighten hexagon nut of assembly tool -T10134- to 35 Nm.



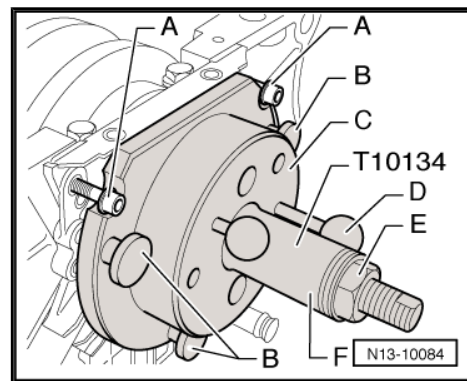
Note

A small air gap must be present between cylinder block and sealing flange after tightening hexagon nut to 35 Nm.

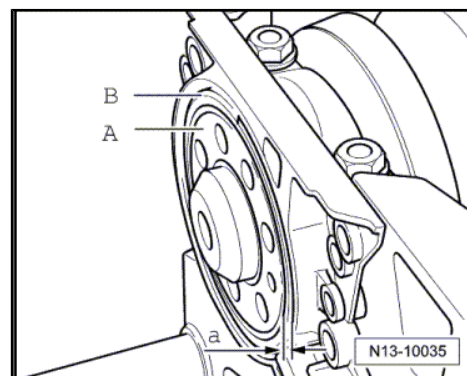


E - Checking installation position of sender wheel on crankshaft:

- Screw hexagon nut -E- to end of threaded spindle.
- Unscrew the 2 bolts -A- out of cylinder block.
- Unscrew the 3 knurled screws -B- from sealing flange.
- Remove assembly tool -T10134- .
- Remove sealing lip support ring.



- The sender wheel is positioned correctly on the crankshaft if the distance -a- between the crankshaft flange -A- and sender wheel -B- is 0.5 mm.



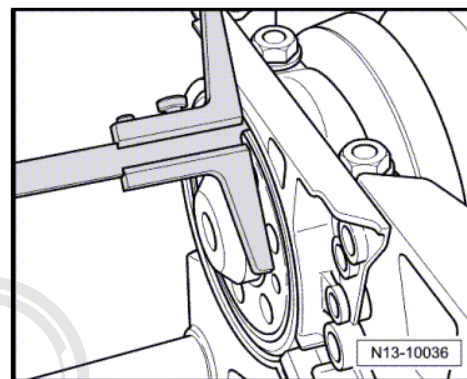
- Apply a depth gauge on the crankshaft flange.
- Measure distance between crankshaft flange and sender wheel.

If dimension "a" is too small:

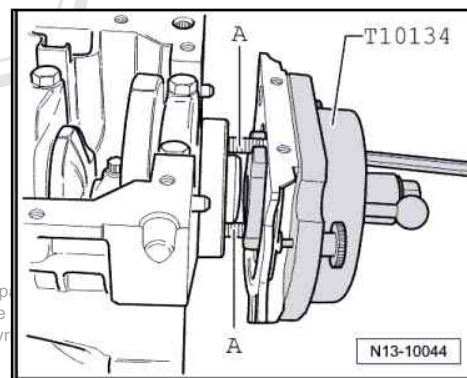
- Press in the sender wheel further ⇒ [page 81](#) .

When dimension "a" is achieved:

- Continue with assembly ⇒ [page 82](#) .

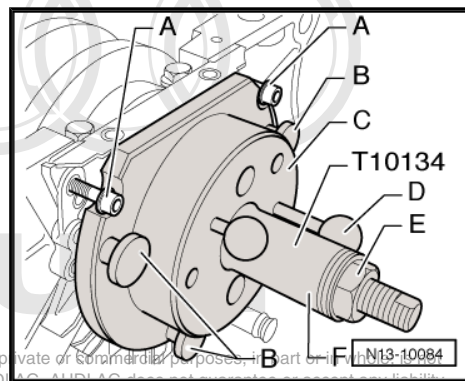
**F - Pressing sender wheel in further:**

- Secure assembly tool -T10134- to crankshaft flange by tightening hexagon socket head bolts -A- hand-tight.
- Press the assembly tool -T10134- towards the sealing flange by hand.



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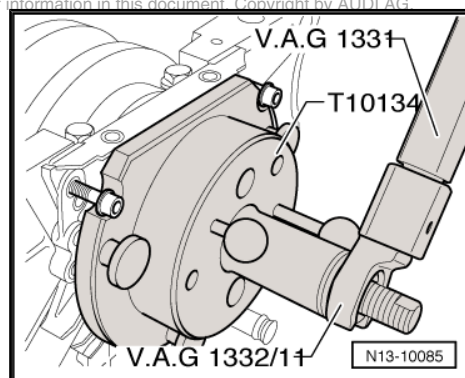
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.



- Tighten hexagon nut of assembly tool -T10134- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 81](#) .

If dimension “a” is too small again:

- Tighten hexagon nut of assembly tool -T10134- to 45 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 74](#) .

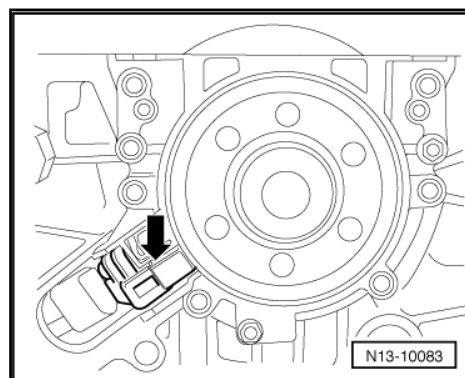


Assembling:

- Tighten the new securing bolts for sealing flange in diagonal sequence.
- Secure engine speed sender -G28- -arrow-.
- Install sump ⇒ [page 128](#) .
- Engage intermediate plate on sealing flange and slip onto dowel sleeves.
- Install the flywheel ⇒ [page 67](#) or the drive plate ⇒ [page 67](#) .

Tightening torques

Component	Nm
Sealing flange to cylinder block	15
Engine speed sender -G28- to cylinder block	5



3 Removing and installing crankshaft



Caution

- ◆ *The crankshaft must not be removed. Even loosening the main bearing cap bolts will cause deformation of the cylinder block bearing pedestals. This will result in reduced bearing clearance. Even if bearing shells are not renewed, a change in bearing clearance can cause bearing damage.*
- ◆ *If the bearing cap bolts are loosened, the cylinder block must be renewed together with the crankshaft.*
- ◆ *Crankshaft bearing clearance cannot be measured using workshop equipment.*



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4 Dismantling and assembling pistons and conrods

4.1 Pistons and conrods - exploded view of components

1 - Conrod bolt

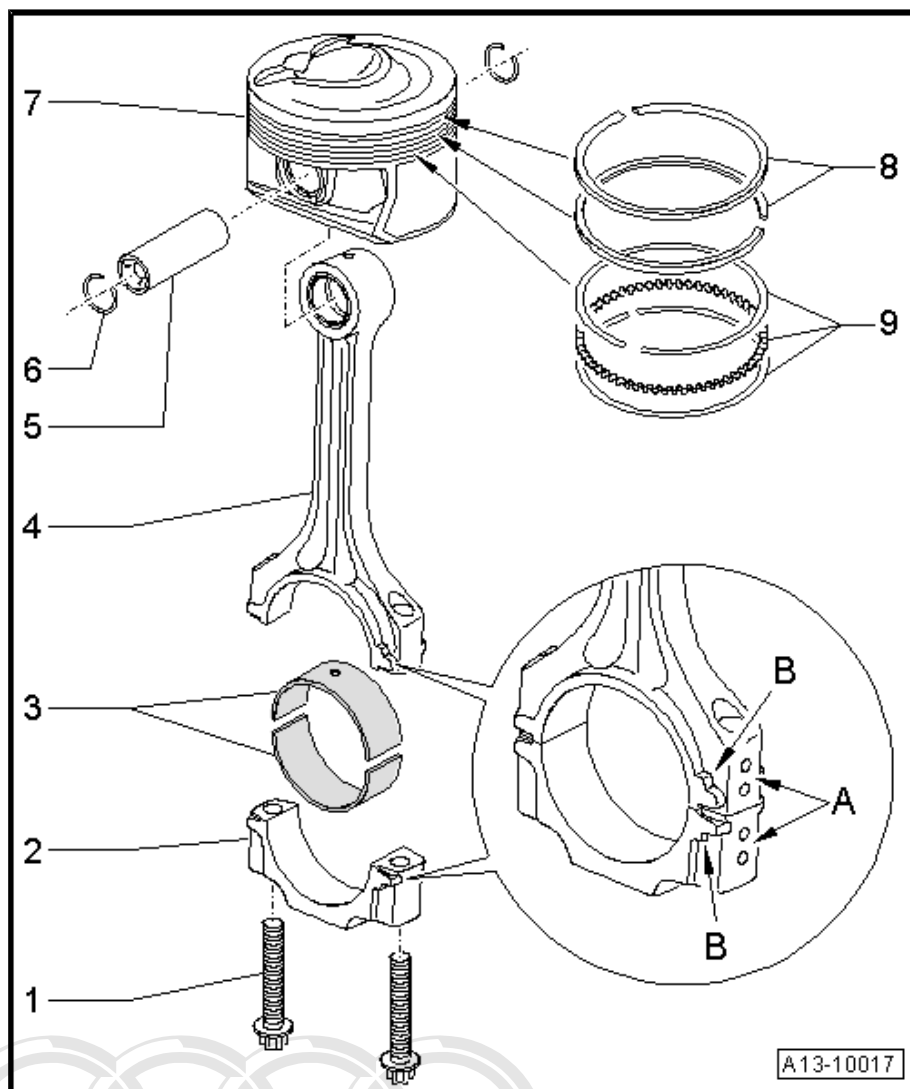
- ☐ 30 Nm + 90° (1/4 turn) further
- ☐ Renew
- ☐ Lubricate threads and contact surface
- ☐ Use old bolt for measuring radial clearance
- ☐ To measure radial clearance, tighten to specified torque, but do not turn further

2 - Conrod bearing cap

- ☐ Mark cylinder allocation -A-
- ☐ Installation position: Marking -B- faces towards pulley end

3 - Bearing shells

- ☐ Upper bearing shell with oil hole for piston pin lubrication
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Check radial clearance with Plastigage
- ☐ Do not rotate crankshaft when checking radial clearance
- ☐ Radial clearance when new: 0.020 ... 0.060 mm; Wear limit 0.090 mm



4 - Conrod

- ☐ Only renew as a complete set
- ☐ Mark cylinder allocation -A-
- ☐ Installation position: Marking -B- faces towards pulley end
- ☐ Guided axially via piston

5 - Piston pin

- ☐ If difficult to move, heat piston to approx. 60 °C
- ☐ Remove and install using drift -10-14-

6 - Circlip

7 - Piston

- ☐ Checking ⇒ [page 85](#)
- ☐ Mark installation position and cylinder allocation
- ☐ Arrow on piston crown points to pulley end

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- ☐ Install using piston ring clamp
- ☐ Checking cylinder bore [⇒ page 86](#)
- ☐ Piston and cylinder dimensions [⇒ page 86](#)

8 - Compression rings

- ☐ Offset gaps by 120°
- ☐ Remove and install using piston ring clamp
- ☐ "TOP" must face towards piston crown
- ☐ Checking ring gap [⇒ page 85](#)
- ☐ Checking ring-to-groove clearance [⇒ page 85](#)

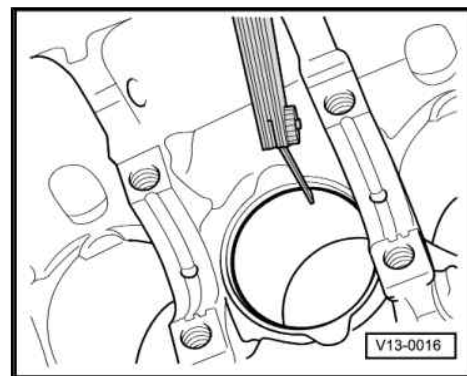
9 - Oil scraper ring

- ☐ 3 pieces
- ☐ Offset gap of top steel element of piston ring by 120° to next compression ring
- ☐ Offset gaps of individual parts of oil scraper ring
- ☐ Checking ring gap [⇒ page 85](#)
- ☐ Ring-to-groove clearance cannot be checked

Checking piston ring gap

- Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. To do so, use a piston without rings.

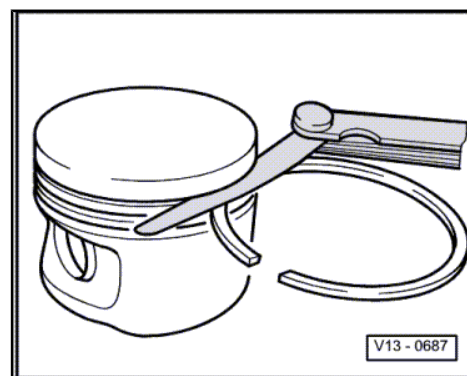
Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.20 ... 0.50	1.00
2nd compression ring	0.40 ... 0.60	1.00
Steel elements of oil scraper ring	0.20 ... 1.10	— ¹⁾
• ¹⁾ No wear limit specified		



Checking ring-to-groove clearance

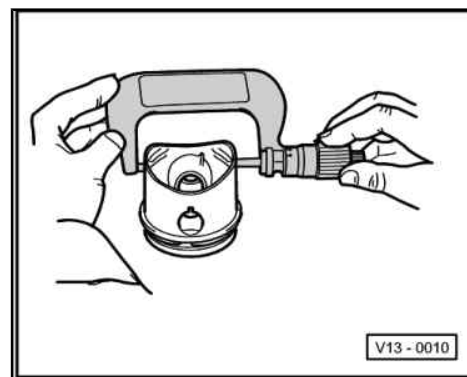
- Clean groove in piston before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.04 ... 0.08	0.15
2nd compression ring	0.02 ... 0.06	0.15
Oil scraper rings	Cannot be measured	



Checking piston

- Measure approx. 10 mm from the bottom edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.



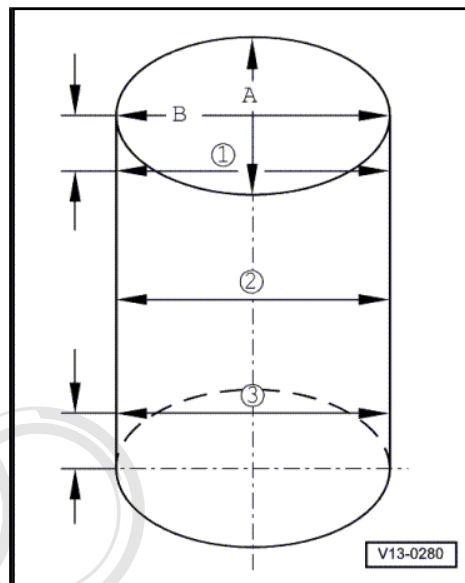
Checking cylinder bore

- Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.08 mm.



Note

Measuring the cylinder bores must not be done when the cylinder block is mounted to the engine and gearbox stand -VAS 6095-, as incorrect measurements may result.



4.2 Piston and cylinder dimensions

Honing dimension (in mm)	Piston Ø ¹⁾	Cylinder bore Ø
Basic dimension	76.475 ²⁾	76.510
Repair oversize I	76.725 ²⁾	76.760
Repair oversize II	76.975 ²⁾	77.010

• ¹⁾ Measure approx. 12 mm from bottom edge of piston.
 • ²⁾ Dimensions including graphite coating (thickness 0.01 mm). The graphite coating will wear down in service.

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15 – Cylinder head, valve gear

1 Removing and installing cylinder head

1.1 Cylinder head - exploded view of components

1 - Cylinder head

- ☐ Removing ⇒ [page 89](#)
- ☐ Checking for distortion ⇒ [page 88](#)
- ☐ Machining sealing surface ⇒ [page 88](#)
- ☐ Installing ⇒ [page 98](#)
- ☐ If renewed, refill system with fresh coolant

2 - Guide pin, 18 Nm

3 - 20 Nm

4 - Lifting eye

5 - Supporting element

- ☐ With hydraulic valve clearance compensation
- ☐ Do not interchange (mark allocation)

6 - Securing clip

7 - Roller rocker finger

- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surface
- ☐ Clip onto supporting element using retaining clip

8 - Oil strainer

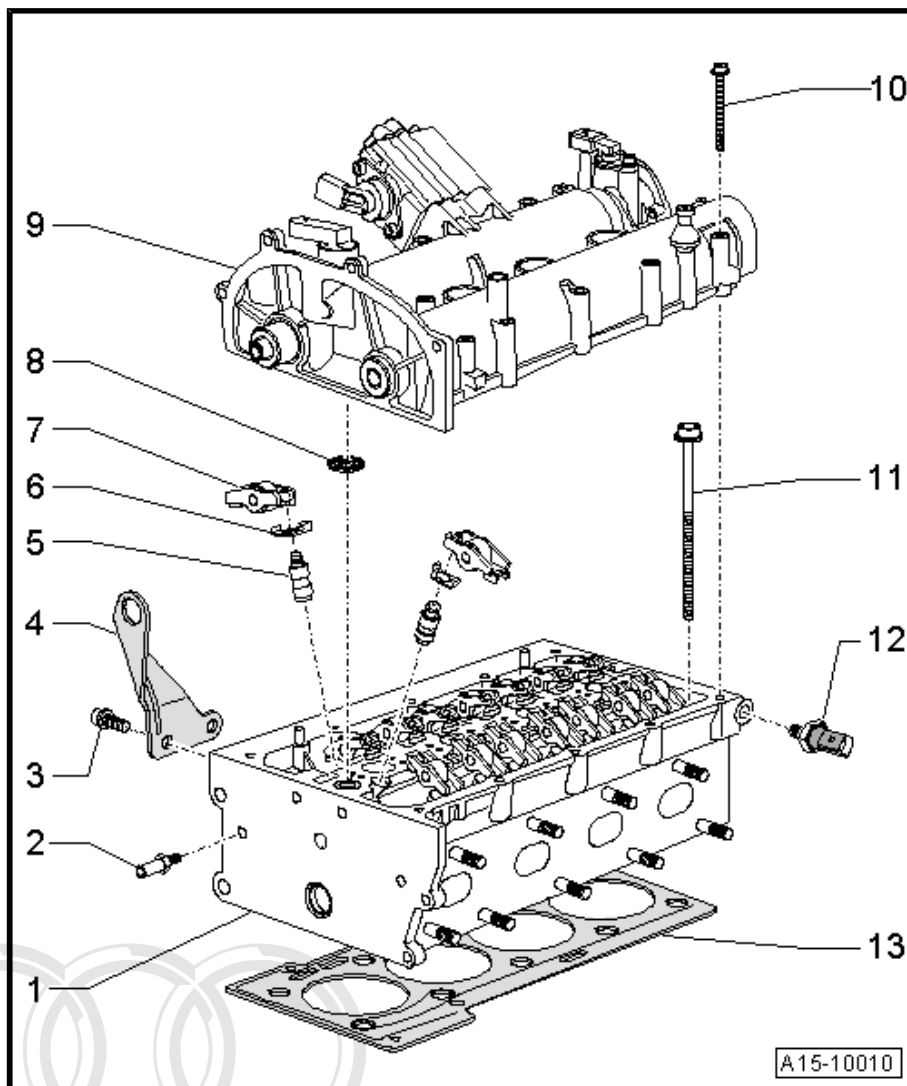
- ☐ Inserted into cylinder head
- ☐ Renew

9 - Camshaft housing

- ☐ With integrated camshaft bearings
- ☐ Removing and installing ⇒ [page 108](#)
- ☐ Remove old sealant residues
- ☐ Carefully clean sealing surfaces; they must be free of oil and grease.
- ☐ Coat with sealing paste before installing; Sealing paste ⇒ Parts catalogue
- ☐ Installing: fit vertically from above onto studs and dowel pins

10 - Camshaft housing bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 97](#)
- ☐ Note correct sequence when tightening ⇒ [page 100](#)



11 - Cylinder head bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 98](#)
- ☐ Note correct sequence when tightening ⇒ [page 99](#)

12 - Oil pressure switch -F1- , 0.3 ... 0.7 bar

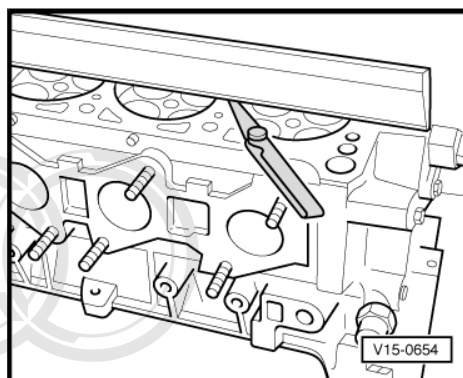
- ☐ Tighten to 25 Nm

13 - Cylinder head gasket

- ☐ Renewing ⇒ [“1.2 Removing and installing cylinder head”, page 89](#)
- ☐ Installation position: Part number points towards cylinder head, and must be legible from the inlet side
- ☐ If renewed, refill system with fresh coolant

Checking cylinder head for distortion

- Use straight edge and feeler gauge to measure for distortion at several points.
- Max. permissible distortion: 0.05 mm



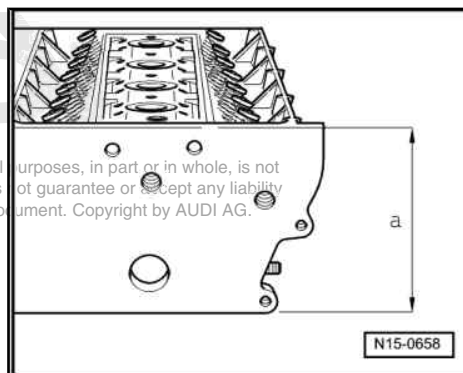
Machining cylinder head sealing surface

- Cylinder head machining dimension: -a- = at least 108.25 mm



Note

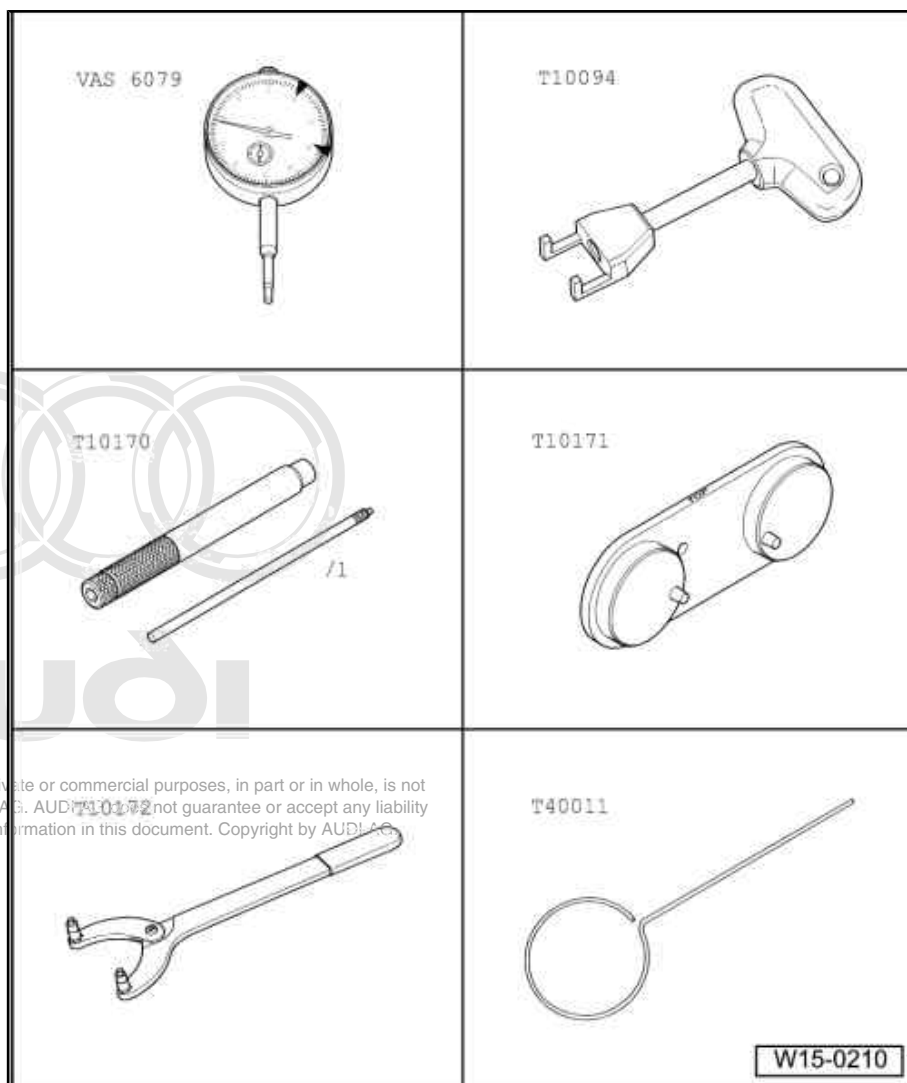
If the bottom sealing surface is machined, the valves must be set deeper by the same dimension (machine valve seat inserts), otherwise the valves will strike the pistons. When doing so, ensure that the minimum permissible dimension is maintained ⇒ [page 120](#).



1.2 Removing and installing cylinder head

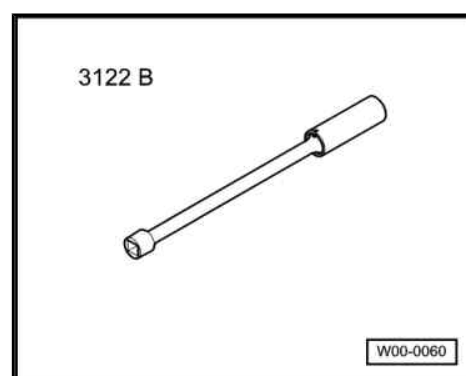
Special tools and workshop equipment required

- ◆ Dial gauge -VAS 6079-
- ◆ Puller -T10094-
- ◆ Adapter for dial gauge - T10170-
- ◆ Camshaft clamp -T10171-
- ◆ Counterhold tool -T10172-
- ◆ Locking pin -T40011-

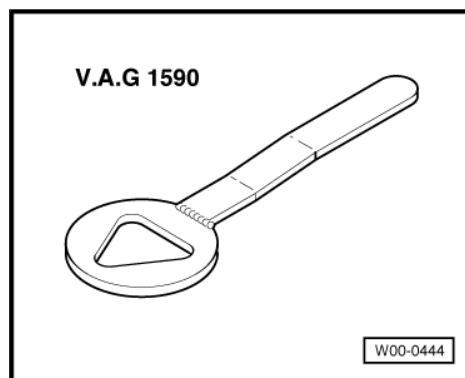


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- ◆ Spark plug socket and extension -3122 B-



- ◆ Water pump spanner -V.A.G 1590-



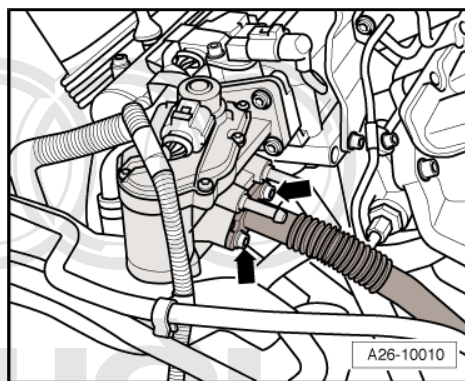
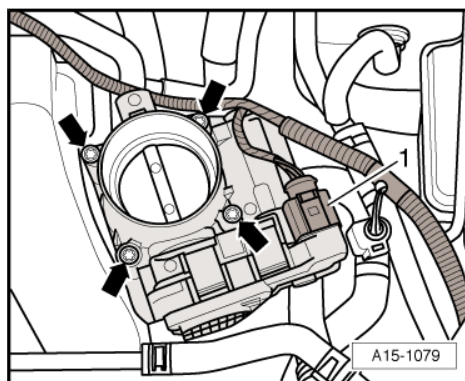
Removing



WARNING

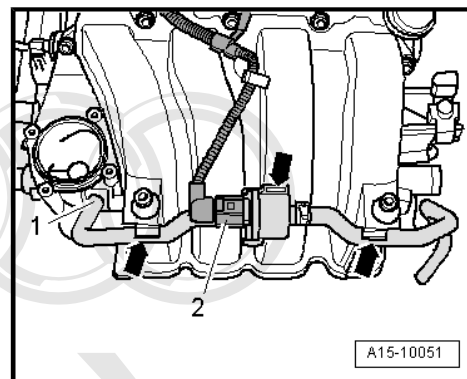
The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ [page 4](#) . A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.

- Remove engine ⇒ [page 7](#) .
- Unplug electrical connector -1- at throttle valve module - J338- .
- Unscrew bolts -arrows- and remove throttle valve module - J338- .
- Remove bolts -arrows- for connecting pipe for exhaust gas recirculation at exhaust gas recirculation valve -N18- and remove gasket.

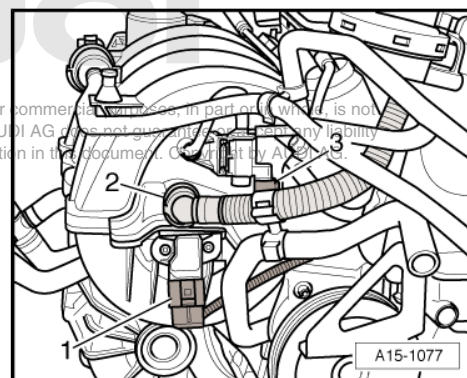


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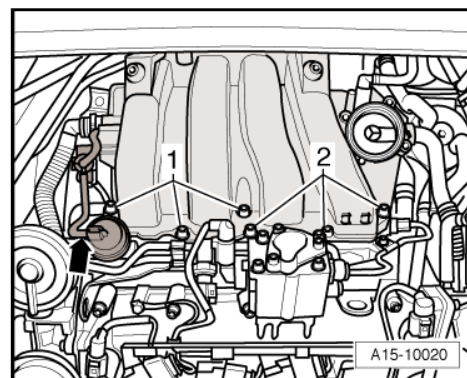
- Unplug electrical connector -2- at activated charcoal filter system solenoid valve 1 -N80- .
- Detach vacuum hose -1- at intake manifold.
- Detach solenoid valve 1 for activated charcoal filter -N80- from its retainers -arrows- and remove with vacuum hoses attached.



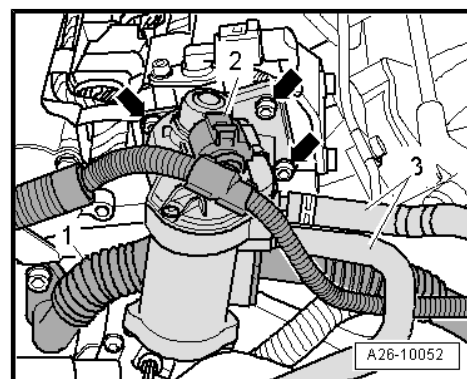
- Disconnect hose -2- for crankcase breather system at intake manifold by pressing release tabs.
- Unplug electrical connectors at intake manifold pressure sender -G71- -item 1- and intake manifold flap air flow control valve -N316- -item 3-.



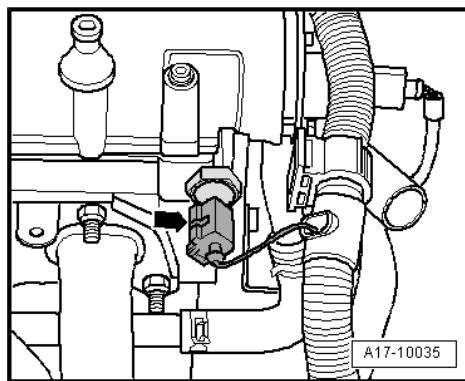
- Disconnect vacuum hose -arrow- at actuator for intake manifold change-over.
- Unscrew bolts -1- and -2- and detach intake manifold.



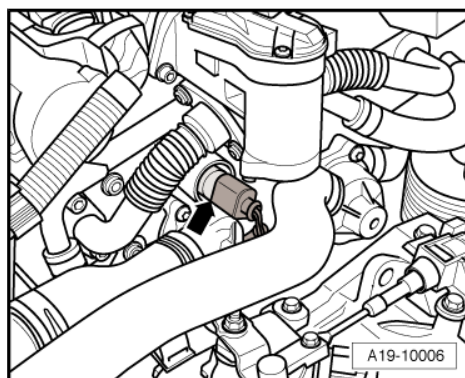
- Detach electrical connector -2-.
- Detach connecting pipe for exhaust gas recirculation -1- (front) at exhaust gas recirculation valve -N18- .
- Disconnect coolant hoses -3- at exhaust gas recirculation valve -N18- .
- Remove bolts -arrows- and detach exhaust gas recirculation valve -N18- .



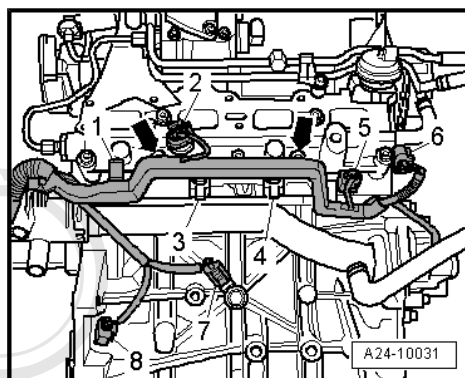
- Unplug electrical connector -arrow- at oil pressure switch.



- Unplug electrical connector -arrow- at coolant temperature sender -G62- .

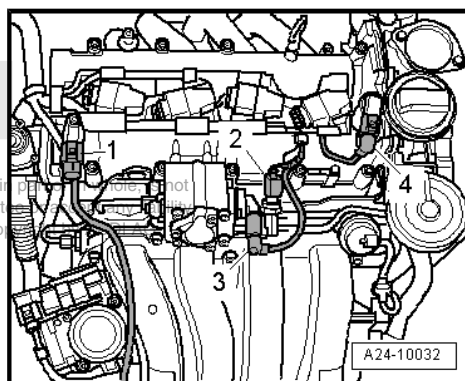


- Unplug electrical connectors -1 ... 5- at injectors and at fuel pressure sender -G247- .
 - Unscrew bolts -arrows- and remove wiring guide.
 - Detach electrical connectors at following components:
- 6 - Intake manifold flap potentiometer -G336-
 - 7 - Knock sensor 1 -G61-
 - 8 - Engine speed sender -G28-



- Detach electrical connectors at following components:

- 1 - Hall sender -G40-
- 2 - If fitted: fuel pressure sender, low pressure -G410-
- 3 - High-pressure pump (fuel pressure regulating valve - N276-)
- 4 - Inlet camshaft control valve -N205-



- Unscrew earth cable from camshaft housing.
- Remove ignition coils by applying puller -T10094- at each ignition coil -arrow- and pulling out ignition coils one by one.

**Note**

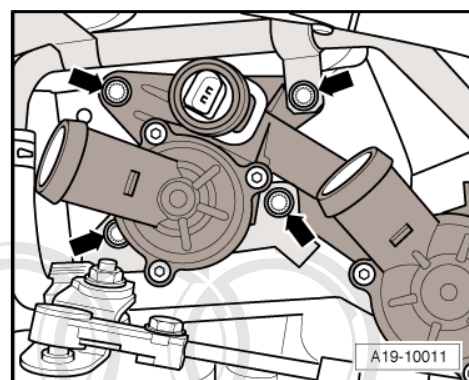
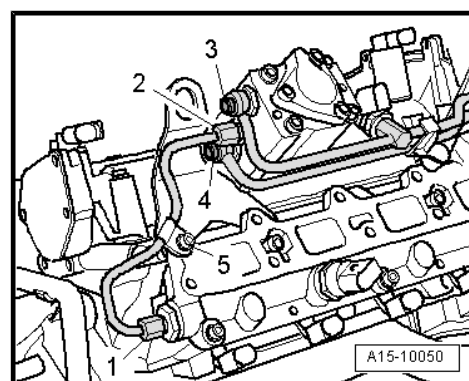
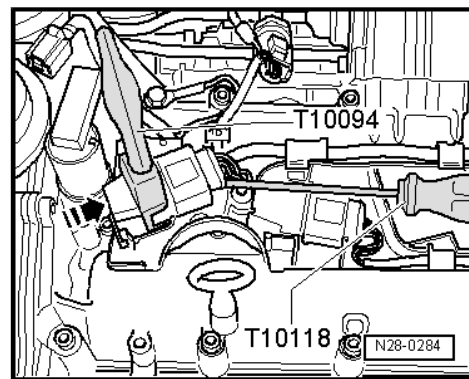
The assembly tool -T10118- is only required if the electrical connector needs to be unplugged.

- Detach wiring guide together wiring harness from camshaft housing.
- Move engine wiring harness clear and detach.
- Remove spark plugs with spark plug socket -3122 B- .
- Remove high pressure pipe by unscrewing securing bolt -5- and union nuts -1- and -2-.
- Unscrew banjo bolts -3- and -4- and detach fuel pipes at high-pressure pump.

**Note**

The fuel pipes remain attached to the engine.

- Pull out oil dipstick.
- Remove bolts -arrows- for thermostat housing.

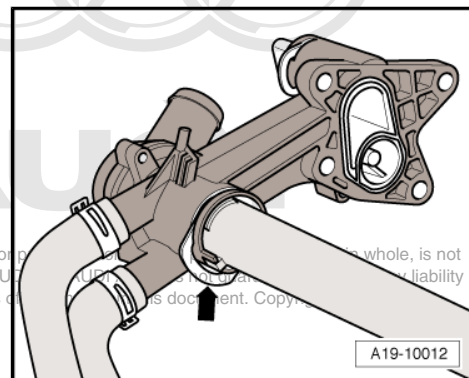


- Remove retaining clip for coolant pipe -arrow-.

**Note**

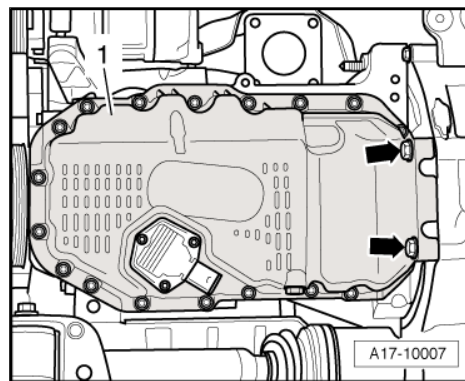
Shown in illustration with thermostat removed.

- Detach thermostat housing from coolant pipe.

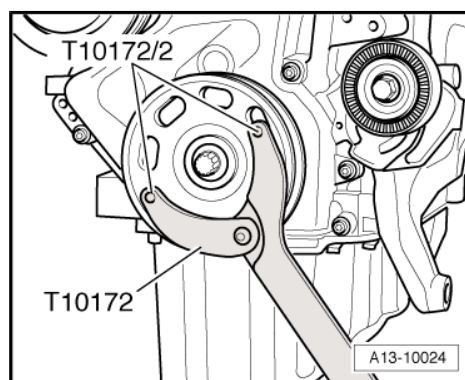


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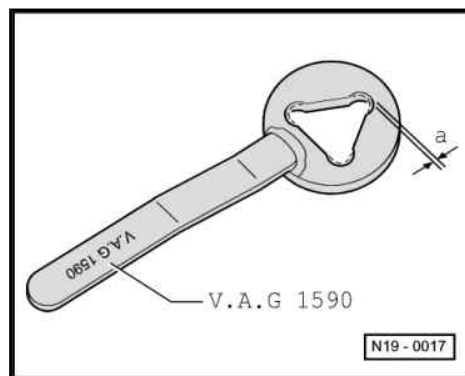
- Place used oil collection and extraction unit -V.A.G 1782- under engine.
- Drain off engine oil.
- Unscrew sump/gearbox bolts -arrows-.
- Unscrew bolts for sump -1- in diagonal sequence and remove.
- Take off sump; if necessary loosen it by striking lightly with a rubber hammer.



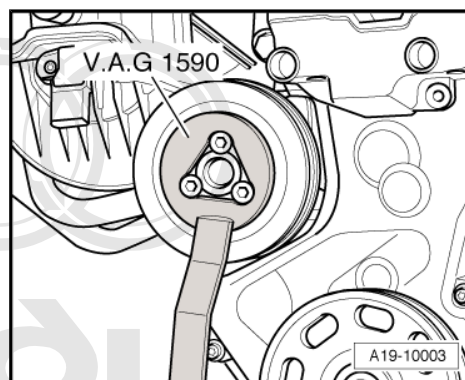
- Unbolt crankshaft pulley; use tool -T10172- with -T10172/2- to counterhold.



- File out the 3 round corners on the water pump wrench - V.A.G 1590- to dimension -a-.
- Dimension -a- = 1 mm.

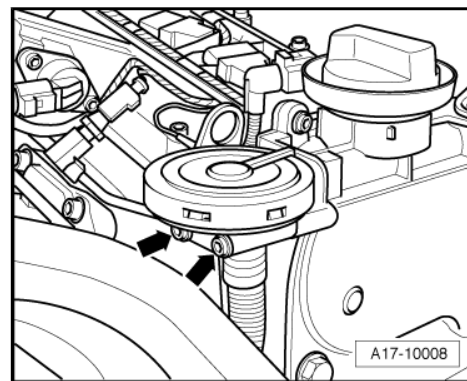


- Unbolt coolant pump pulley; use water pump wrench - V.A.G 1590- to counterhold.

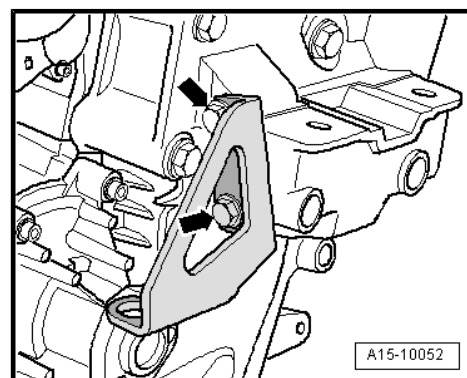


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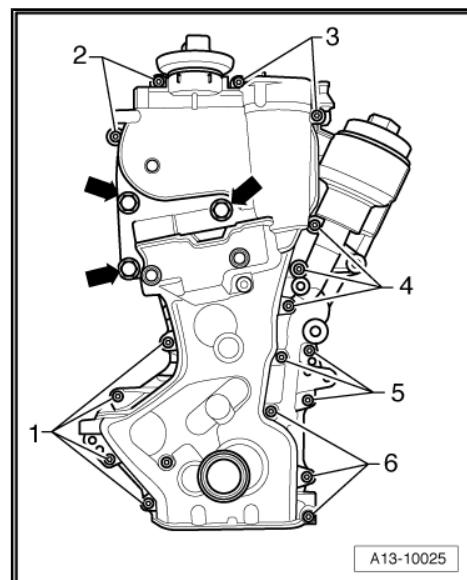
- Unbolt pressure control valve for crankcase breather system -arrows-.



- Unscrew bolts -arrows- and remove engine lifting eye.



- Unscrew hexagon socket head bolts -1 ... 6- for timing chain cover and hexagon bolts -arrows-.
- Detach timing chain cover.
- Use drift to drive out oil seal.

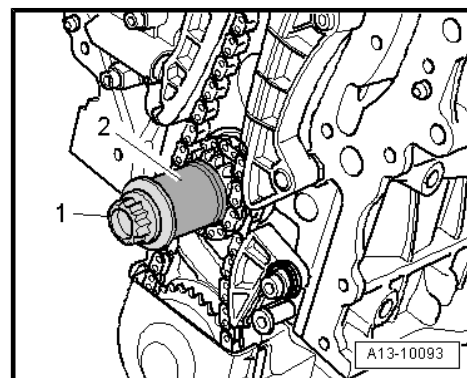


- Fit central bolt -1- with mounting bush -2- to rotate crankshaft.

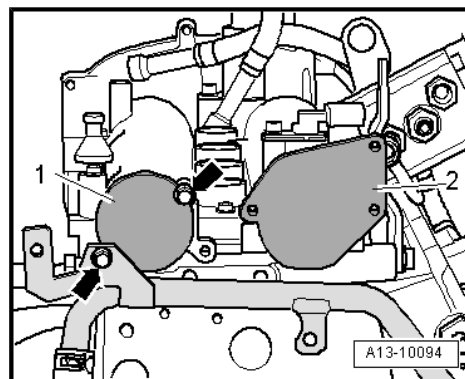


Note

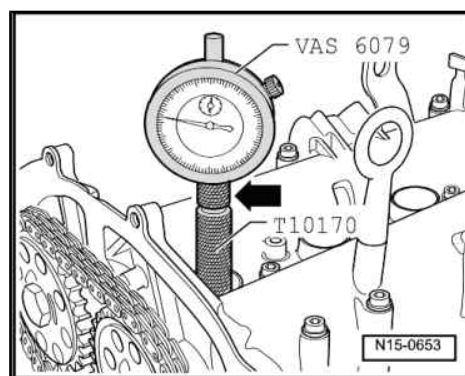
Before tightening central bolt, lock crankshaft by inserting a suitable block of wood at crank web.



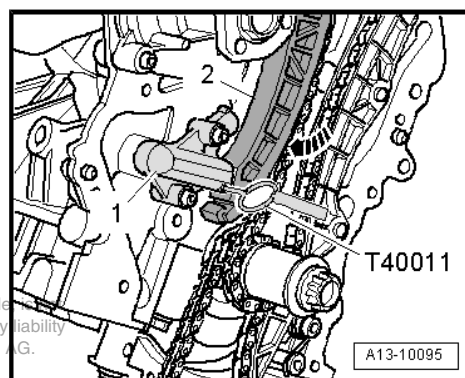
- Unscrew bolts -arrows-.
- Detach sealing caps -1- and -2-.



- Screw adapter for dial gauge -T10170- into spark plug hole as far as the stop.
- Insert dial gauge -VAS 6079- with extension -T10170/1- as far as the stop and secure using locking nut -arrow-.
- Turn crankshaft in normal direction of rotation to TDC position. Note the position of the small dial gauge needle.
- Then turn crankshaft back 45° in the opposite direction of normal rotation.



- Press the tensioning rail -2- in the direction of the arrow and lock piston of chain tensioner -1- using locking pin -T40011-.

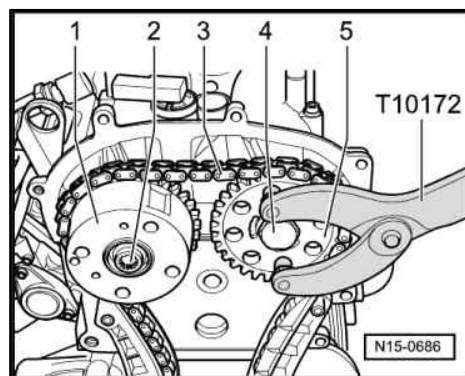


- Mark the rotation direction of the timing chain -3- with a coloured pen.



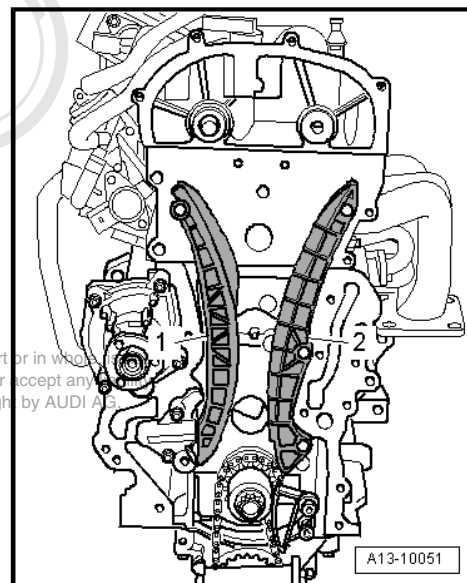
Caution

- ◆ **The camshaft clamp -T10171- must not be used as a counterhold.**
- ◆ **The centre bolt -2- for the camshaft adjuster has left-hand threads.**



- Unscrew bolts -2- and -4- using counterhold tool -T10172-.
- Remove camshaft sprocket -5- and camshaft adjuster -1- together with timing chain -3-.

- Pull off the tensioning rail -1- and the guide rail -2- from mounting pins.



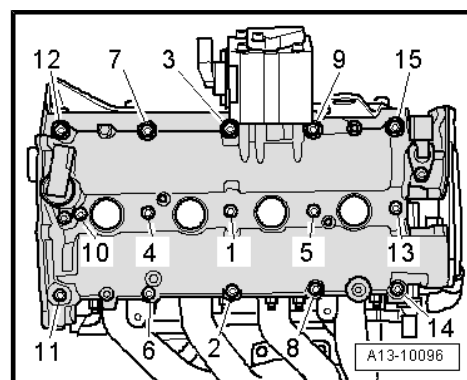
- Unscrew camshaft housing bolts in the sequence -15 ... 1-.



Note

The bolt -item 9- (below high-pressure pump) remains in the camshaft housing.

- Carefully remove camshaft housing.
- Mark the allocation of the roller rocker fingers and supporting elements for reinstallation.
- Remove roller rocker fingers together with the supporting elements and place down on a clean surface.



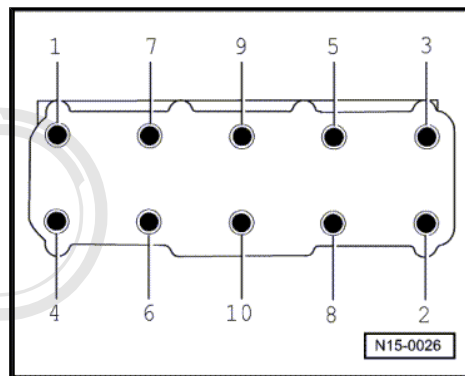
- Loosen cylinder head bolts in the sequence -1 ... 10-.
- Take off cylinder head and place it on a soft surface (such as foam plastic).

Installing



Note

- ◆ *Renew the cylinder head bolts.*
- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
- ◆ *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- ◆ *If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure 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 block.*
- ◆ *When installing an exchange cylinder head, the contact surfaces between supporting elements, roller rocker fingers and cams must be oiled before installing the camshaft housing.*
- ◆ *All bearings and running surfaces must be oiled before installing.*
- ◆ *The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*
- ◆ *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- ◆ *Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.*
- ◆ *Position cylinder head gasket on dowel sleeves. The word -oben- (top) or the Part No. must face towards cylinder head.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ◆ *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.*
- ◆ *All cable ties which are released or cut open when removing must be refitted in the same position when installing.*
- ◆ *When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and refill with new coolant.*



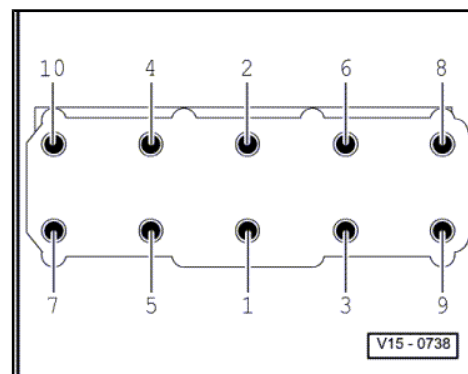
- Turn the crankshaft to TDC and then back again approx. 45° in the opposite direction of normal rotation.
- Fit new cylinder head gasket.
 - The inscription (part No.) must be legible.
- Fit cylinder head; make sure that dowel sleeves are seated safely in cylinder block.
- Insert new cylinder head bolts and tighten finger-tight.

- Tighten cylinder head bolts in 3 stages in the sequence indicated:

1. Tighten with torque wrench to 30 Nm.
2. Turn 90° (1/4 turn) further using a rigid wrench.
3. Turn 90° (1/4 turn) further using a rigid wrench.

**Note**

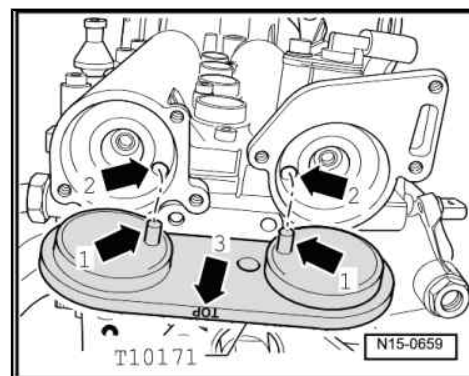
Cylinder head bolts do not have to be torqued down again later after repair work.



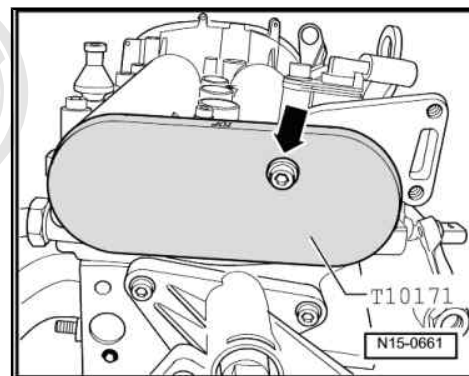
- Turn the inlet and exhaust camshafts in the removed camshaft housing by hand until the camshaft clamp -T10171- can be inserted all the way into the camshaft openings.
- The locking pins -arrows 1- must engage in the holes -arrows 2-. The marking "TOP" -arrow 3- should be legible from above.

**Caution**

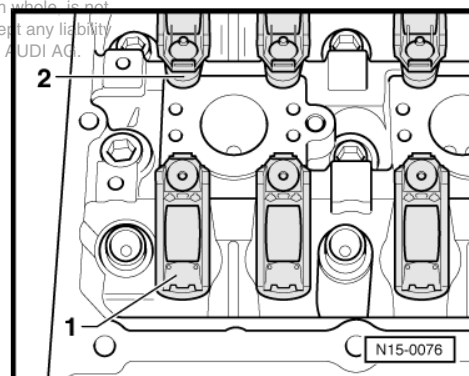
The camshafts must not be moved axially when turning.



- To secure the camshaft clamp -T10171-, screw in an M6 bolt -arrow- finger-tight, but do not tighten.



- Ensure all roller rocker fingers contact the valve ends -1- correctly and are clipped into their respective support elements -2-.

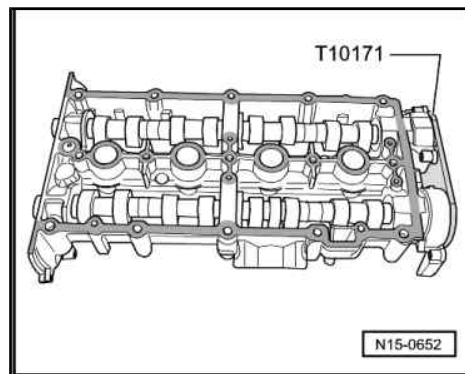


- Apply a thin and even layer of sealant to the clean sealing surface of the camshaft housing -hatched area-.

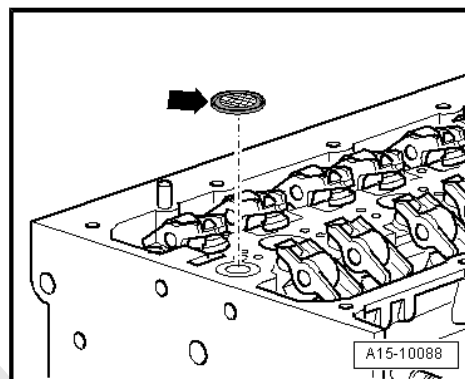


Note

The sealant must not be applied too thick; otherwise excess sealant can get into the oil channels and obstruct the strainer in the oil intake pipe.



- Renew oil strainer -arrow- and insert in cylinder head.



- Before fitting camshaft housing, screw in 2 studs M6x80 -arrows- into the cylinder head.
- Carefully fit the camshaft housing vertically onto the studs and dowel pins on cylinder head from above.



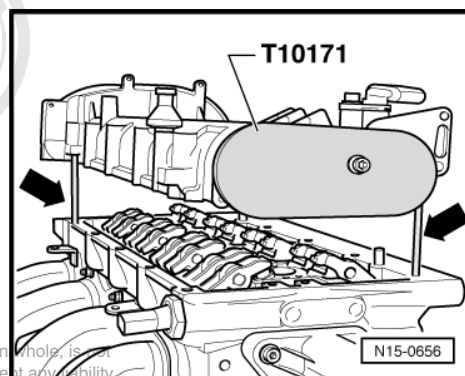
Note

Be sure that no oil residue can drip onto the sealing surfaces.

- Screw in new bolts for camshaft housing finger-tight.
- Tighten camshaft housing bolts in 2 stages in the sequence shown:

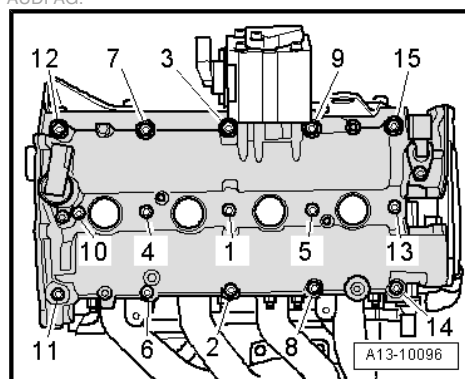
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1. Tighten with torque wrench to 10 Nm.
2. Turn 90° (1/4 turn) further using a rigid wrench.



Note

- ◆ Be sure that camshaft housing is not canted.
- ◆ After installing the camshaft housing, wait about 30 minutes for the sealant to dry.

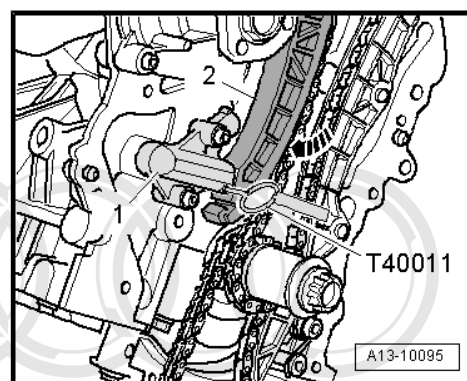
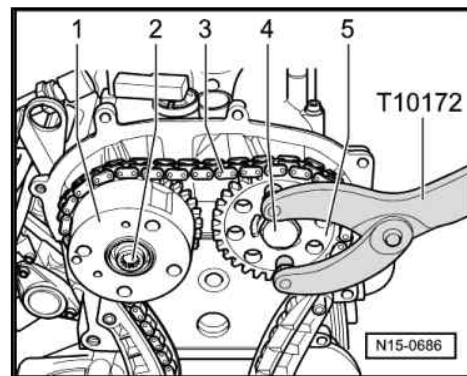


- Fit timing chain onto crankshaft and camshaft adjuster -1- noting direction of rotation.
- Fit camshaft sprocket -5- together with timing chain.

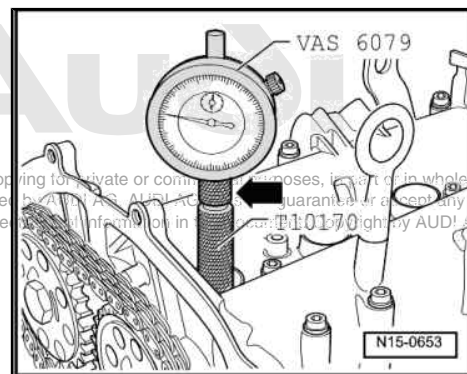
**Caution**

The centre bolt -2- for the camshaft adjuster has left-hand threads.

- Renew bolts -2- and -4- and screw in until camshaft sprocket and camshaft adjuster can just be turned on the camshaft and do not tilt.
- Tension the timing chain by removing the locking pin -T40011- from the tensioner -1-.



- Screw adapter for dial gauge -T10170- into spark plug hole as far as the stop.
- Insert dial gauge -VAS 6079- with extension -T10170/1- as far as the stop and secure using locking nut -arrow-.
- Turn crankshaft in normal direction of rotation to TDC position.
- Permissible deviation from TDC: ± 0.01 mm.

**Note**

If the crankshaft is more than 0.01 mm beyond TDC, you must turn the crankshaft approx. 45° in opposite direction of rotation. Then turn crankshaft in normal direction of rotation to TDC.

**Caution**

The centre bolt -2- for the camshaft adjuster has left-hand threads.

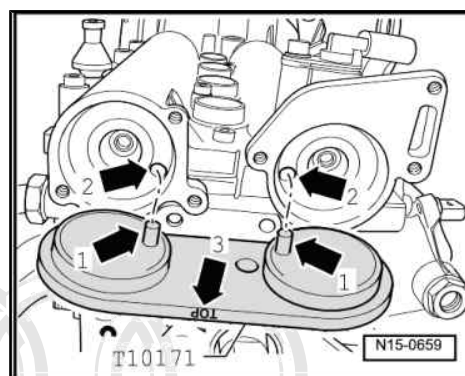
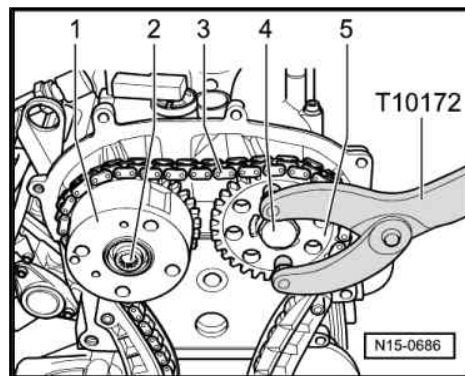
- Hold camshaft adjuster -1- and camshaft sprocket -5- in this position using counterhold tool -T10172- and tighten bolts -2- and -4-.



Note

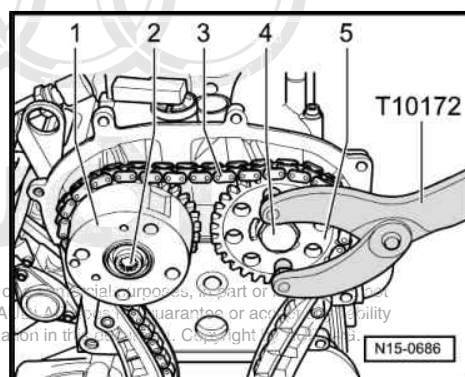
When tightening the camshaft bolts, the crankshaft must not turn and the timing chain -3- must remain tensioned on both sides.

- Remove the camshaft clamp -T10171- .
 - Turn crankshaft two turns in normal direction of rotation to TDC position.
 - Permissible deviation from TDC: ± 0.01 mm.
 - Insert the camshaft clamp -T10171- into the openings in the camshafts as far as the stop.
- If the camshaft clamp -T10171- cannot be inserted:
- Repeat adjustment.



If the camshaft clamp -T10171- can be inserted:

- Remove camshaft clamp -T10171- , lock camshaft adjuster -1- and camshaft sprocket -5- using counterhold tool -T10172- and turn bolts -2- and -4- with a rigid wrench $\frac{1}{4}$ turn further (90°).
- Turn crankshaft two turns in normal direction of rotation to TDC position for a second time.
- Permissible deviation from TDC: ± 0.01 mm.



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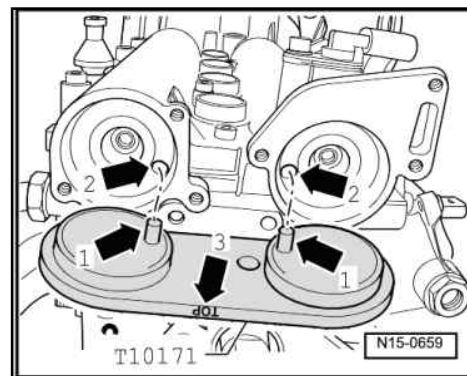
- Insert the camshaft clamp -T10171- into the openings in the camshafts as far as the stop.

If the camshaft clamp -T10171- cannot be inserted:

- Repeat adjustment.

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

- Install timing chain cover ⇒ [page 43](#) .
- Renew crankshaft oil seal ⇒ [page 38](#) .
- Install crankshaft pulley ⇒ [page 37](#) .
- Install sump ⇒ [page 128](#) .
- Renew seals for camshaft sealing caps and lubricate with oil before installing.
- Install exhaust gas recirculation valve -N18- ⇒ [page 199](#) .
- Install intake manifold ⇒ Rep. Gr. 24 .
- Install engine ⇒ [page 25](#) .



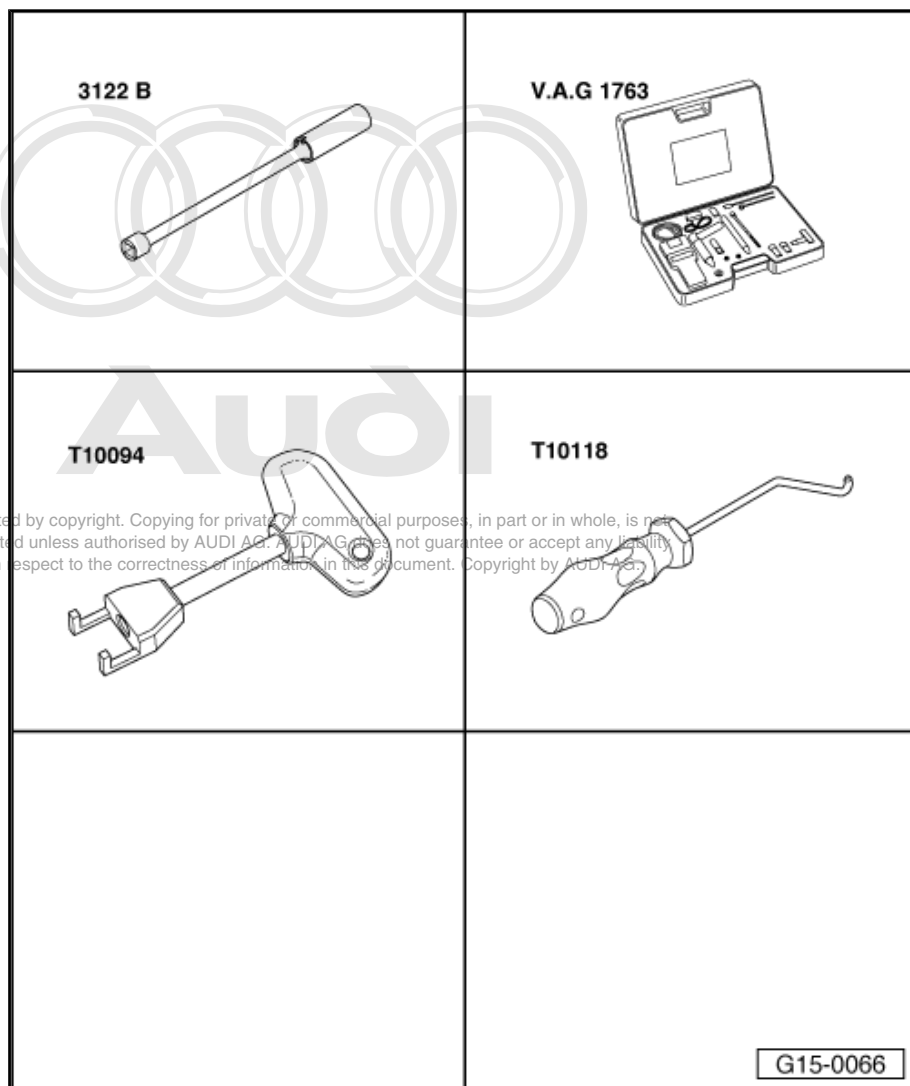
Tightening torques

Component	Nm
Camshaft adjuster to camshaft	40 + 90° 1)2)3)
Camshaft sprocket to camshaft	50 + 90° 2)3)
Spark plugs in cylinder head	30
Sealing caps to camshaft housing	10
Engine lifting eye to timing chain cover	20
Pressure control valve for crankcase breather system to timing chain cover	10
Coolant pump pulley to coolant pump	20
Thermostat housing to cylinder head	10
High-pressure pipes to: High-pressure pump	15
Fuel rail	15
High-pressure pump bracket	7
EGR connecting pipe to exhaust gas recirculation valve -N18-	8
Throttle valve module -J338- to intake manifold	7
• 1) The central bolt for the camshaft adjuster has a left-hand thread. • 2) Renew bolts. • 3) 90° = one quarter turn.	

1.3 Checking compression

Special tools and workshop equipment required

- ◆ Spark plug socket and extension -3122 B-
- ◆ Compression tester - V.A.G 1763-
- ◆ Puller -T10094-
- ◆ Assembly tool -T10118-



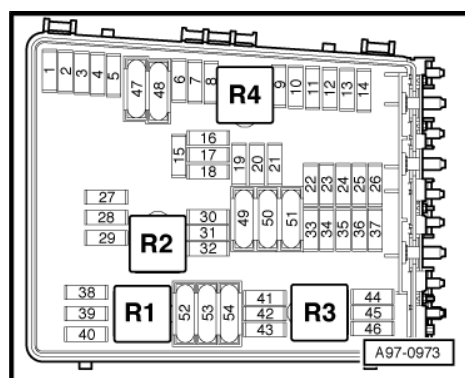
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Test conditions

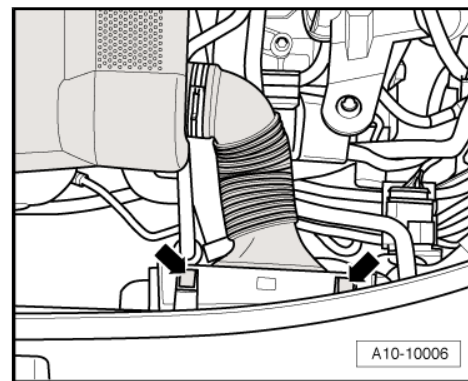
- Engine oil temperature at least 30 °C.
- Battery voltage at least 12.5 V

Test sequence

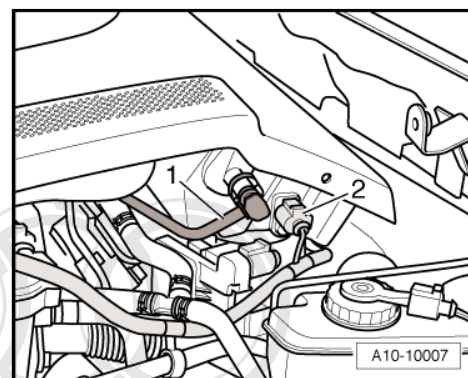
- Switch off ignition.
- Open lid of electronics box in engine compartment and remove fuse -26- for Motronic current supply relay -J271- .



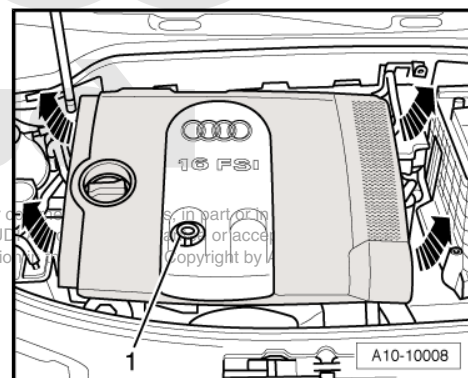
- Unclip air intake hose from air duct -arrows-.



- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.

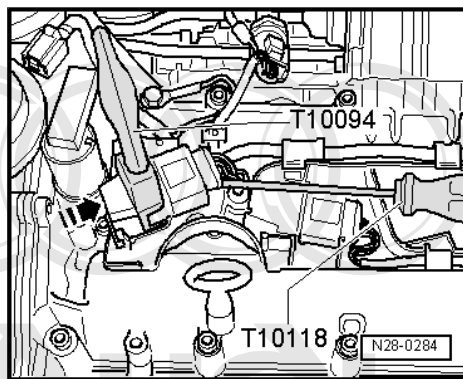


- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



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- Apply puller -T10094- at ignition coil -arrow- and pull out ignition coil slightly.
- Detach electrical connectors at ignition coils by releasing tab -arrow- with assembly tool -T10118- and carefully pulling connector.
- Remove ignition coils.
- Remove spark plugs with spark plug socket -3122 B- .
- Test the compression pressure with the compression tester - V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions .

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- Have a 2nd mechanic press down the accelerator pedal completely and simultaneously operate the starter until the pressure no longer increases on the tester display.

Compression pressure	bar
When new	10.0 ... 15.0
Wear limit	7.0
Difference between cylinders	max. 3.0

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

- Install spark plugs ⇒ Rep. Gr. 28 .
- Interrogate and erase the fault memory for engine control unit, as faults are stored when the connectors are unplugged ⇒ Vehicle diagnosis, testing and information system VAS 5051.

2 Servicing valve gear

2.1 Camshaft housing - exploded view of components

1 - Exhaust camshaft

- ☐ Lubricate with oil before installing (also lubricate collar of axial bearing)

2 - Inlet camshaft

- ☐ With cam for high pressure pump -arrow-
- ☐ Before removing, remove bucket tappet for high-pressure pump
- ☐ Lubricate with oil before installing (also lubricate collar of axial bearing)

3 - Guide sleeve

4 - Oil strainer

- ☐ Inserted in cylinder head
- ☐ Renew

5 - Camshaft housing

- ☐ Removing and installing
⇒ [page 108](#)
- ☐ Remove old sealant residues
- ☐ Coat with sealing paste before installing; Sealing paste ⇒ Parts catalogue
- ☐ Installing: fit vertically from above onto studs and dowel pins

6 - O-ring

- ☐ Renew

7 - Inlet camshaft control valve 1 -N205-

8 - 8 Nm

9 - 10 Nm

10 - Mechanical single-plunger high-pressure pump with fuel pressure regulating valve -N276-

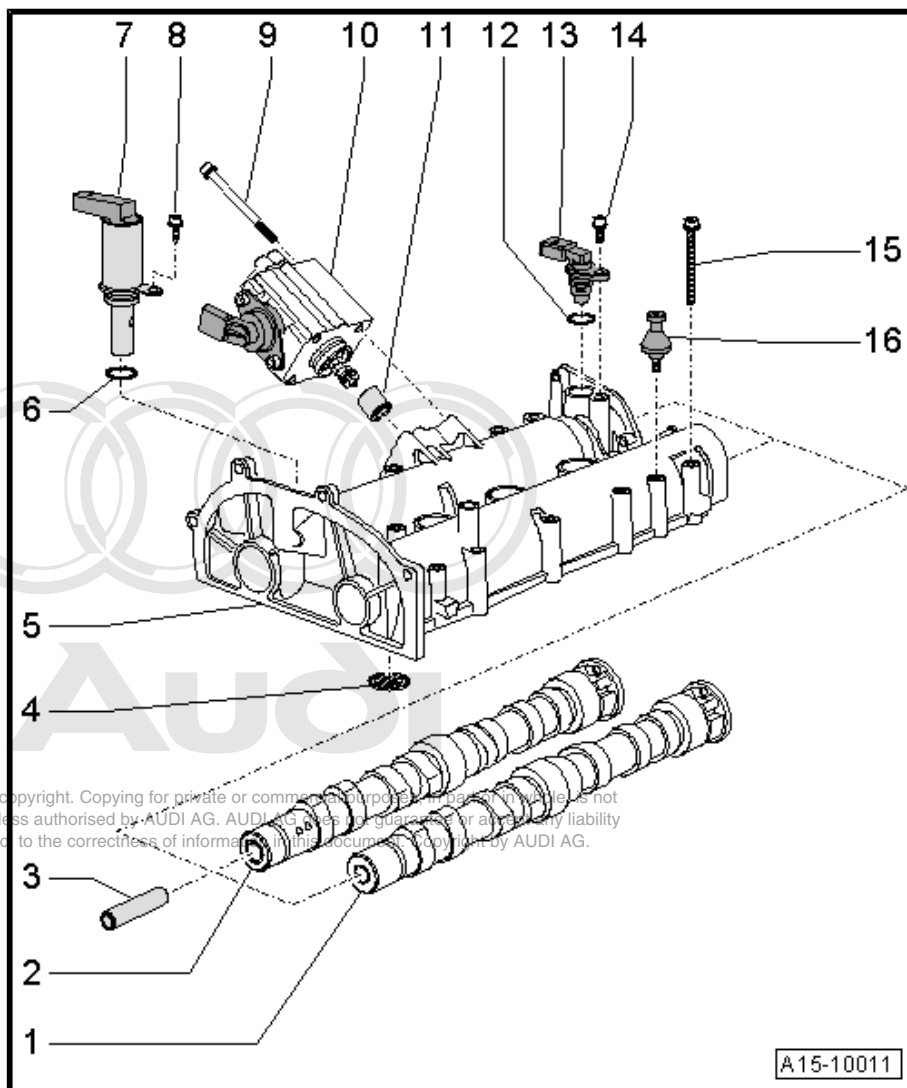
- ☐ Removing and installing ⇒ Rep. Gr. 24
- ☐ Renew bucket tappet for high-pressure pump after removal
- ☐ When installing the high-pressure fuel pump, it is essential to ensure that no dirt particles enter the fuel system

11 - Bucket tappet for high-pressure pump

- ☐ Renew after removing

12 - O-ring

- ☐ Renew



13 - Hall sender -G40-

14 - 8 Nm

15 - Camshaft housing bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 97](#)
- ☐ Note correct sequence when tightening ⇒ [page 100](#)

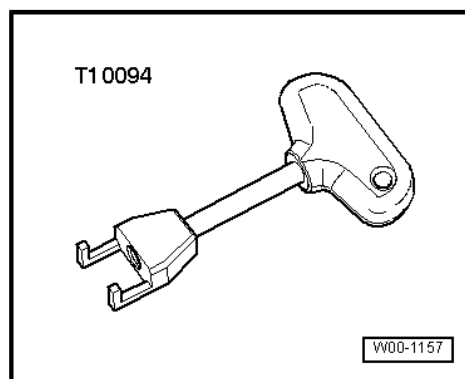
16 - Pin, 6 Nm

- ☐ For engine cover panel with air cleaner housing

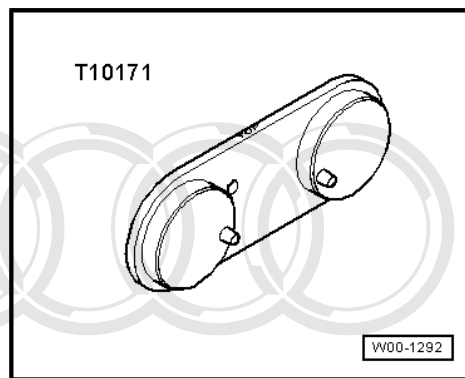
2.2 Removing and installing camshaft housing

Special tools and workshop equipment required

- ◆ Puller -T10094-



- ◆ Camshaft clamp -T10171-



- ◆ Stud M6x80 (2x)
- ◆ Sealant ⇒ Parts catalogue

Removing



WARNING

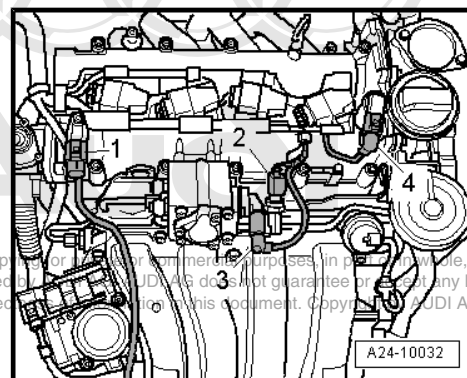
The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ [page 4](#) . A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.

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- Remove cover for timing chain ⇒ [page 43](#) .
- Remove exhaust gas recirculation valve -N18- ⇒ [page 199](#) .

- Remove camshaft timing chain ➔ [page 57](#) .
- Detach electrical connectors at following components:
 - 1 - Hall sender -G40-
 - 2 - If fitted: fuel pressure sender, low pressure -G410-
 - 3 - High-pressure pump (fuel pressure regulating valve - N276-)
 - 4 - Inlet camshaft control valve 1 -N205-

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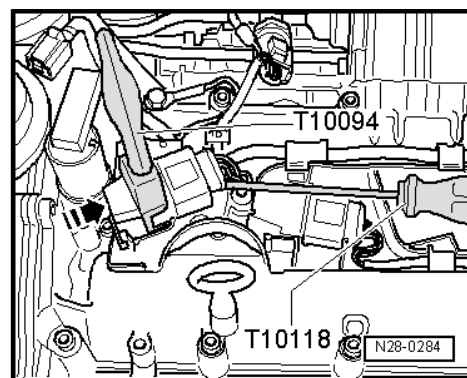
- Unscrew earth cable from camshaft housing.
- Remove remaining ignition coils by applying puller -T10094- at each ignition coil -arrow- and pulling out ignition coils one by one.



Note

The assembly tool -T10118- is only required if the electrical connector needs to be unplugged.

- Detach wiring guide together wiring harness from camshaft housing.
- Move engine wiring harness clear.



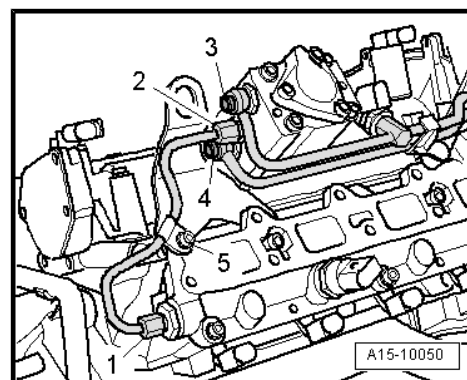
Vehicles with engine code letters BAG:

- Remove high pressure pipe by unscrewing securing bolt -5- and union nuts -1- and -2-.
- Unscrew banjo bolts -3- and -4- and detach fuel pipes at high-pressure pump.



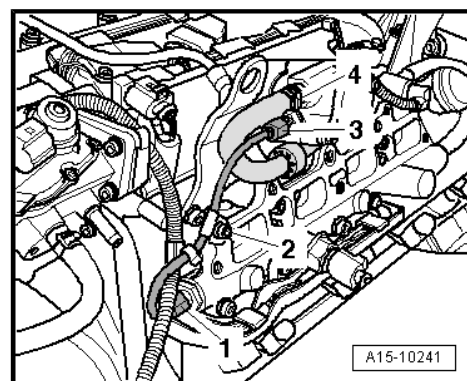
Note

The fuel pipes remain attached to the engine.



Vehicles with engine code letters BLF, BLP:

- Remove high pressure pipe by unscrewing securing bolt -2- and union nuts -1- and -3-.
- Disconnect fuel pipe -4- at high pressure pump.



All models:

- Pull out oil dipstick.
- Unscrew camshaft housing bolts in the sequence -15 ... 1-.



Note

The bolt -item 9- (below high-pressure pump) remains in the camshaft housing.

- Carefully remove camshaft housing.
- Mark the allocation of the roller rocker fingers and supporting elements for reinstallation.
- Remove roller rocker fingers together with the supporting elements and place down on a clean surface.

Installing

- No cylinder at TDC.
- Remove sealant residue on cylinder head and camshaft housing using commercially available sealant remover.



Caution

Be sure that no dirt or sealant residue falls into cylinder head.

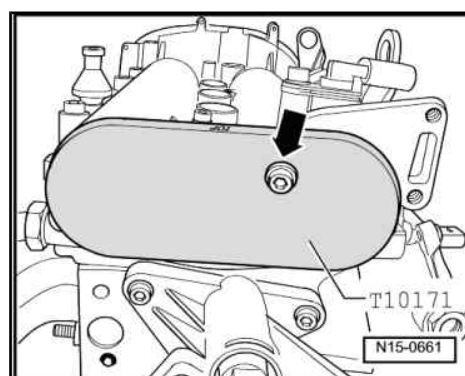
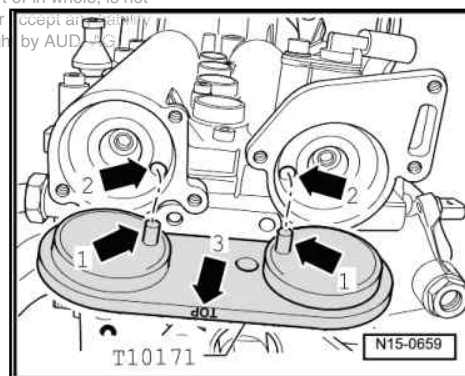
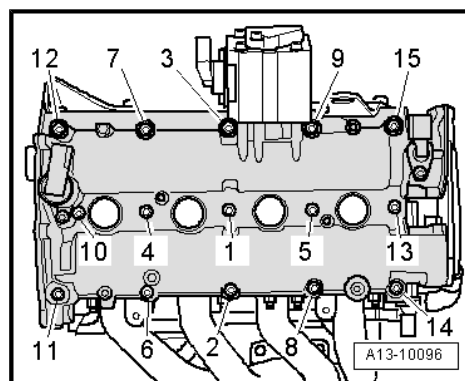
- Clean sealing surfaces carefully; they must be free of oil and grease.
- Turn the inlet and exhaust camshafts in the removed camshaft housing by hand until the camshaft clamp -T10171- can be inserted all the way into the camshaft openings.
- The locking pins -arrows 1- must engage in the holes -arrows 2-. The marking "TOP" -arrow 3- should be legible from above.



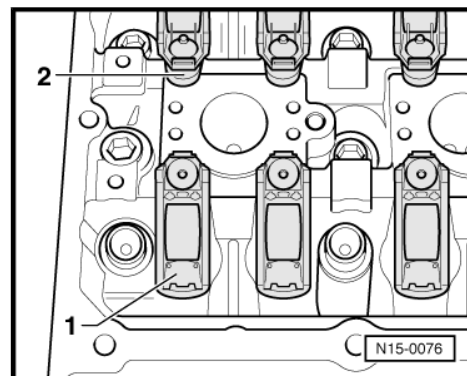
Caution

The camshafts must not be moved axially when turning.

- To secure the camshaft clamp -T10171- , screw in an M6 bolt -arrow- finger-tight, but do not tighten.



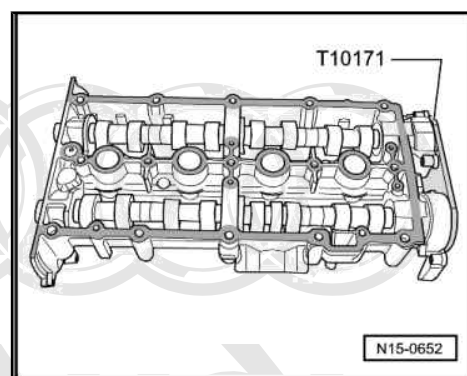
- Ensure all roller rocker fingers contact the valve ends -1- correctly and are clipped into their respective support elements -2-.



- Apply a thin and even layer of sealant to the clean sealing surface of the camshaft housing -hatched area-.

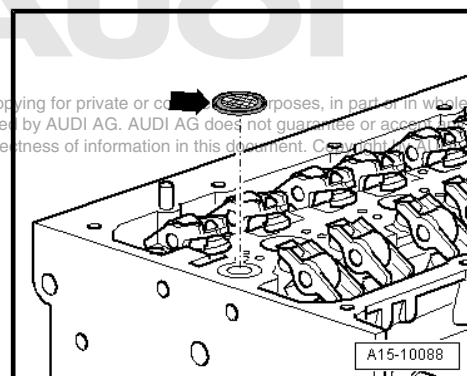
**Note**

The sealant must not be applied too thick; otherwise excess sealant can get into the oil channels and obstruct the strainer in the oil intake pipe.



- Renew oil strainer -arrow- and insert in cylinder head.

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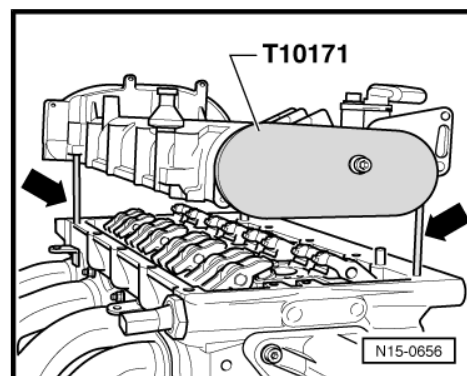


- Before fitting camshaft housing, screw in 2 studs M6x80 -arrows- into the cylinder head.
- Carefully fit the camshaft housing vertically onto the studs and dowel pins on cylinder head from above.

**Note**

Be sure that no oil residue can drip onto the sealing surfaces.

- Screw in new bolts for camshaft housing and tighten finger-tight.



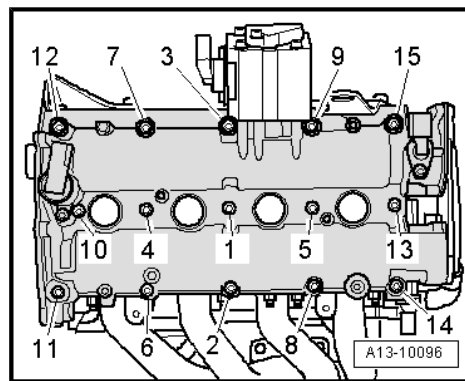
- Tighten camshaft housing bolts in 2 stages in the sequence shown:

1. Tighten with torque wrench to 10 Nm.
2. Turn 90° (1/4 turn) further using a rigid wrench.



Note

- ◆ Be sure that camshaft housing is not canted.
- ◆ After installing the camshaft housing, wait about 30 minutes for the sealant to dry.



Remaining installation steps are carried out in reverse sequence; note the following:

- Install camshaft timing chain ⇒ [page 61](#) .
- Install timing chain cover ⇒ [page 43](#) .
- Renew crankshaft oil seal ⇒ [page 38](#) .
- Install crankshaft pulley ⇒ [page 37](#) .
- Install exhaust gas recirculation valve -N18- ⇒ [page 199](#) .

Tightening torques

Component		Nm
High-pressure pipes	High-pressure pump	15
to:	Fuel rail	15
High-pressure pump bracket		7

2.3 Valves - exploded view of components



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1 - Inlet valve

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Valve dimensions
⇒ [page 119](#)
- ☐ Checking valve guides
⇒ [page 117](#)
- ☐ Machining valve seats
⇒ [page 119](#)

2 - Exhaust valve

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Valve dimensions
⇒ [page 119](#)
- ☐ Checking valve guides
⇒ [page 117](#)
- ☐ Machining valve seats
⇒ [page 119](#)

3 - Cylinder head**4 - Oil strainer**

- ☐ Inserted into cylinder head
- ☐ Renew

5 - Supporting element

- ☐ With hydraulic valve clearance compensation
- ☐ Do not interchange
- ☐ Lubricate contact surface

6 - Securing clip**7 - Roller rocker finger**

- ☐ Do not interchange
- ☐ Check roller bearing
- ☐ Lubricate contact surface
- ☐ Assembly: attach to supporting element using securing clip ⇒ [Item 6 \(page 113\)](#)

8 - Valve cotters

- ☐ Removing and installing with cylinder head installed ⇒ ["2.4 Renewing valve stem oil seals", page 114](#)
- ☐ Use hold-down tool for valve springs -3362- to remove and install with cylinder head removed

9 - Valve spring plate

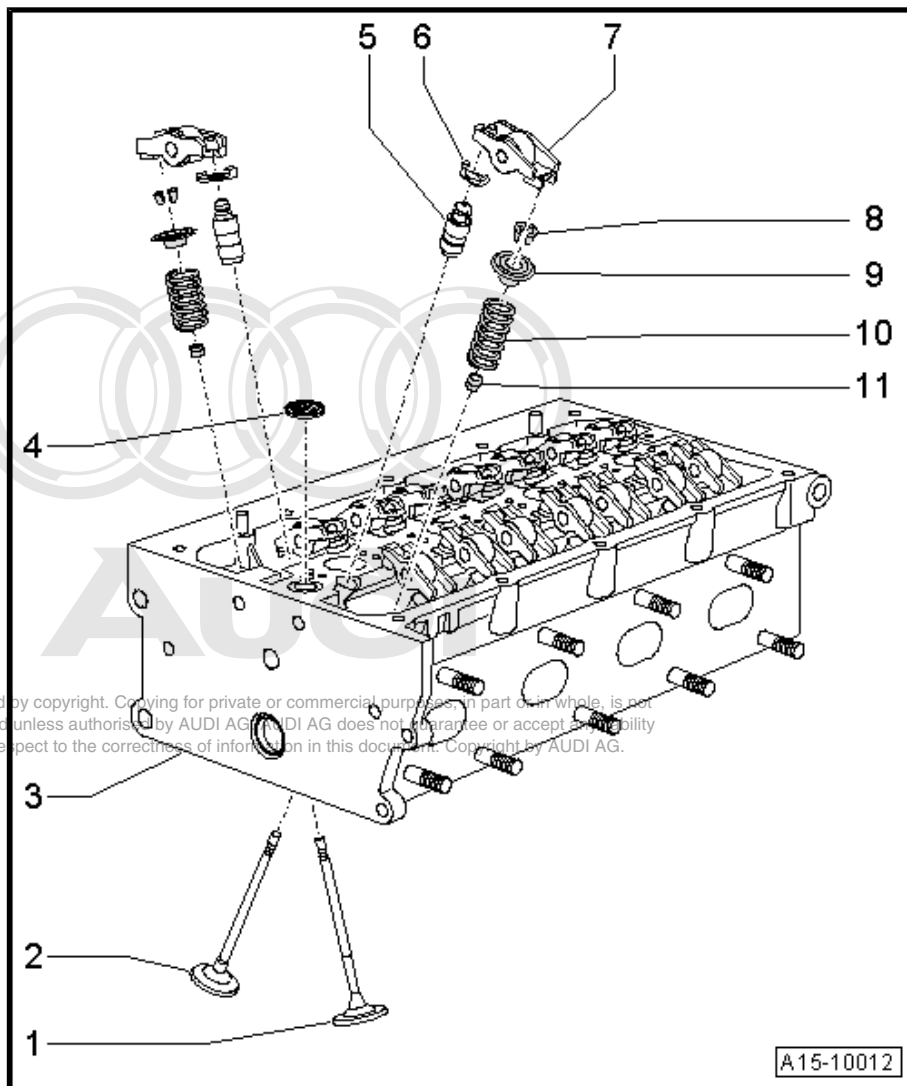
- ☐ Removing and installing with cylinder head installed ⇒ ["2.4 Renewing valve stem oil seals", page 114](#)
- ☐ Use hold-down tool for valve springs -3362- to remove and install with cylinder head removed

10 - Valve springs

- ☐ Removing and installing with cylinder head installed ⇒ ["2.4 Renewing valve stem oil seals", page 114](#)
- ☐ Use hold-down tool for valve springs -3362- to remove and install with cylinder head removed

11 - Valve stem oil seal

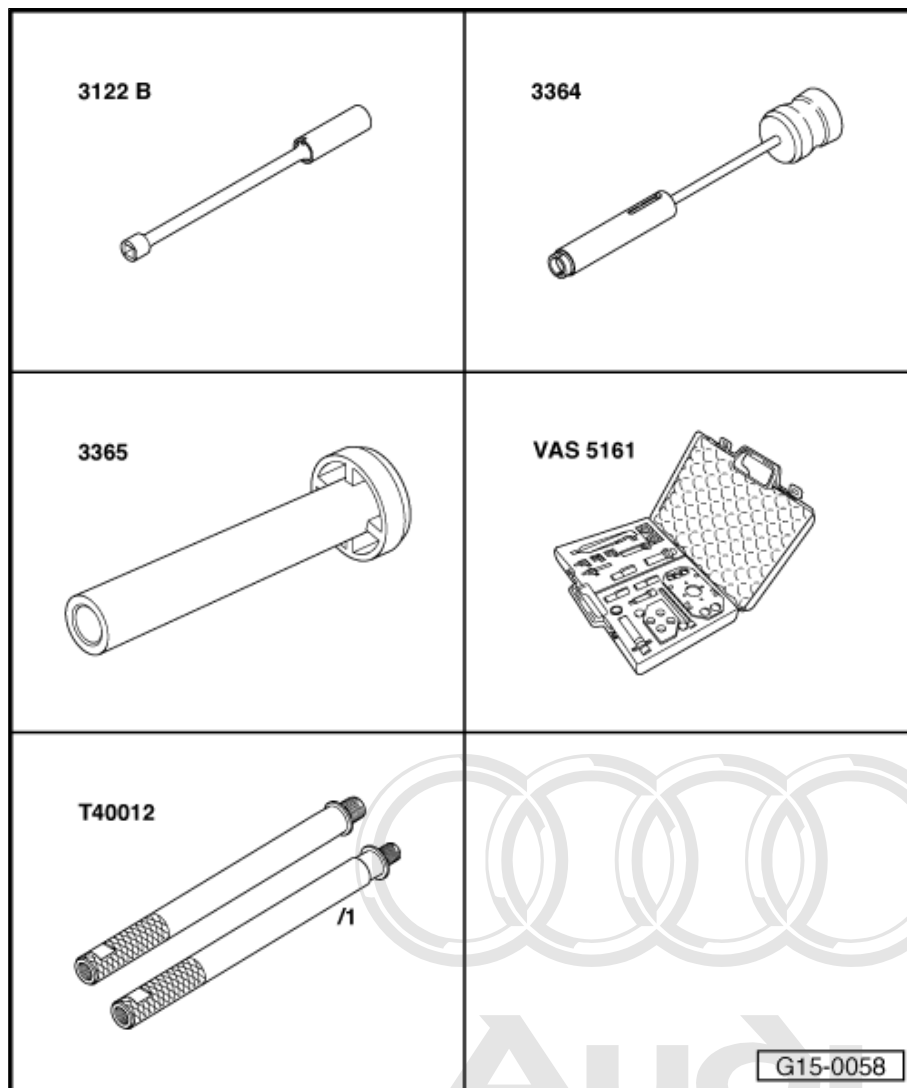
- ☐ Renewing ⇒ [page 114](#)



2.4 Renewing valve stem oil seals

Special tools and workshop equipment required

- ◆ Spark plug socket and extension -3122 B-
- ◆ Valve stem seal puller -3364-
- ◆ Valve stem seal fitting tool -3365-
- ◆ Disassembly and assembly tool -VAS 5161-
- ◆ Adapter -T40012-



Procedure



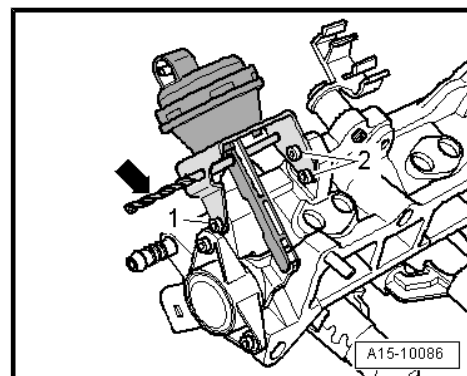
WARNING

The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ [page 4](#) . A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.

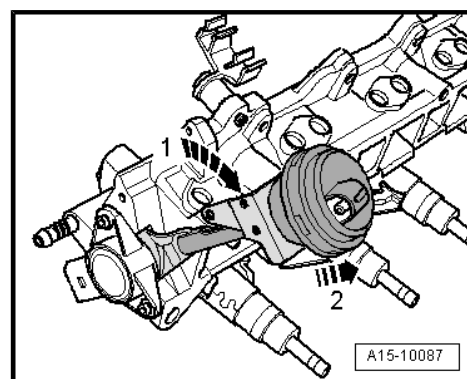
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- Remove engine ⇒ [page 7](#) .
- Remove intake manifold ⇒ Rep. Gr. 24 .
- Remove cover for timing chain ⇒ [page 43](#) .
- Remove camshaft timing chain ⇒ [page 57](#) .
- Remove camshaft housing ⇒ [page 108](#) .

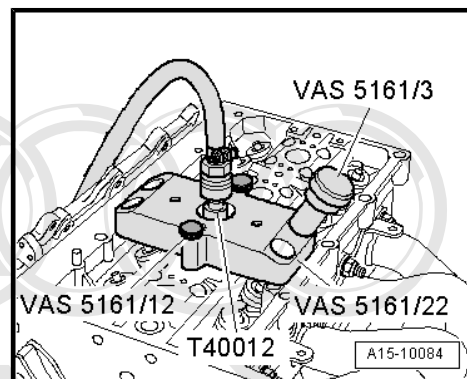
- Remove fuel rail (bottom section of intake manifold) from cylinder head ⇒ Rep. Gr. 24 .
- Unscrew both lifting eyes from cylinder head.
- Wrap insulating tape around tip and shaft of 2.5 mm Ø drill bit to avoid cuts.
- Press operating rod of vacuum unit towards vacuum unit and lock with 2.5 mm drill -arrow-.
- Remove bolts -1- and -2-.



- Move vacuum unit to side -arrow 1- and detach from operating rod for intake manifold flap -arrow 2-.
- Unscrew bracket for high-pressure pipes from fuel rail (bottom section of intake manifold).
- Screw fuel rail (bottom section of intake manifold) back onto cylinder head.
- Remove spark plugs with spark plug socket -3122 B- .
- Set piston of the respective cylinder to "bottom dead centre".
- Screw adapter -T40012- into the spark plug hole of the relevant cylinder.
- Connect adapter -T40012- to compressed air and apply air pressure throughout the procedure.
- Air pressure: at least 6 bar

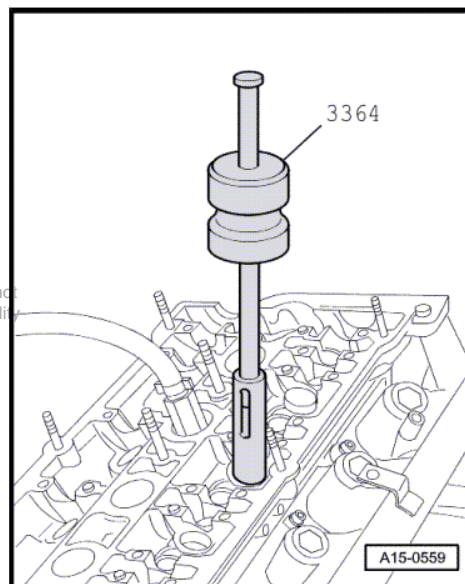
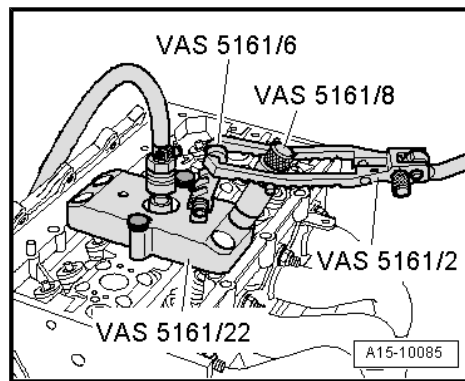


- Fit guide plate -VAS 5161/22- onto cylinder head.
- Secure guide plate -VAS 5161/22- using the knurled screws -VAS 5161/12- .
- Insert drift -VAS 5161/3- into guide plate -VAS 5161/22- and knock valve cotters loose using a plastic hammer.



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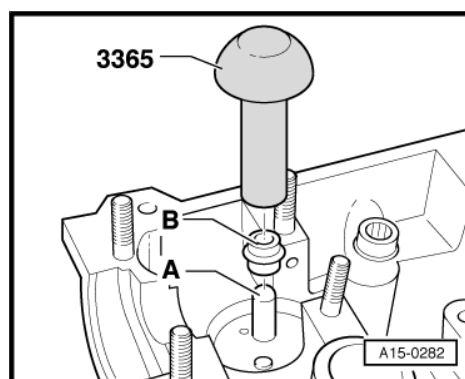
- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate -VAS 5161/22- .
- Insert assembly cartridge -VAS 5161/8- into guide plate - VAS 5161/22- .
- Attach pressure fork -VAS 5161/2- to snap-in device - VAS 5161/6- and push assembly cartridge -VAS 5161/8- down.
- At the same time, turn knurled screw of assembly cartridge - VAS 5161/8- clockwise until ends engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and enter into cartridge.
- Release the pressure fork.
- Remove assembly cartridge -VAS 5161/8- .
- Unbolt guide plate -VAS 5161/22- and move to side.
- The compressed air hose remains connected.
- Remove valve spring with valve spring plate.
- Remove valve stem oil seals using the valve stem seal puller -3364- .



Note

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

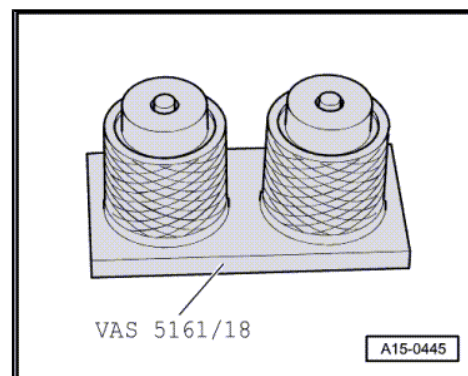
- Insert plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
- Remove the plastic sleeve.



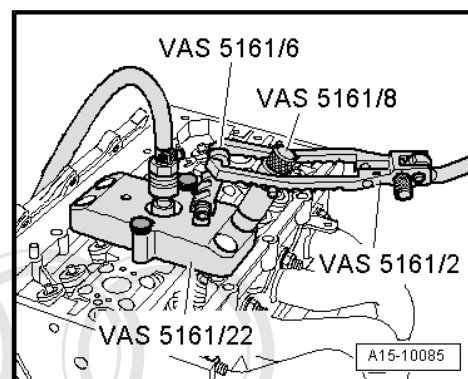
- If valve cotters have been removed from assembly cartridge, they need to be put into insertion device -VAS 5161/18- first.

i Note

Larger diameter of valve cotters faces upwards.



- Insert valve spring and valve spring plate.
- Screw guide plate -VAS 5161/22- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/8- into guide plate -VAS 5161/22-.
- Push pressure fork down and pull knurled screw upwards while turning to left and right - this will insert the valve cotters.
- Release the pressure fork with knurled screw still in pulled position.
- Renew seals and O-rings for injectors ⇒ Rep. Gr. 24.
- Install fuel rail (bottom section of intake manifold) ⇒ Rep. Gr. 24.
- Install camshaft housing ⇒ [page 108](#).
- Install camshaft timing chain ⇒ [page 57](#).
- Install timing chain cover ⇒ [page 43](#).
- Renew crankshaft oil seal ⇒ [page 38](#).
- Install crankshaft pulley ⇒ [page 37](#).
- Install intake manifold ⇒ Rep. Gr. 24.
- Install engine ⇒ [page 25](#).



i Note

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.

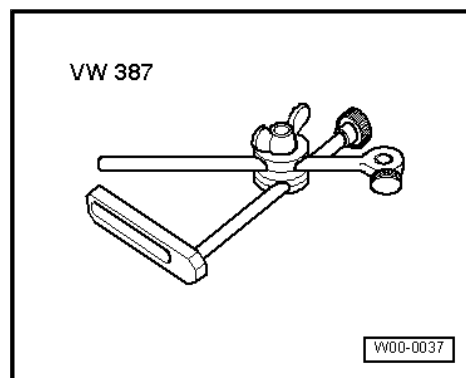
Tightening torque

Component	Nm
Vacuum unit to fuel rail (bottom section of intake manifold)	3
Engine lifting eye to cylinder head	20

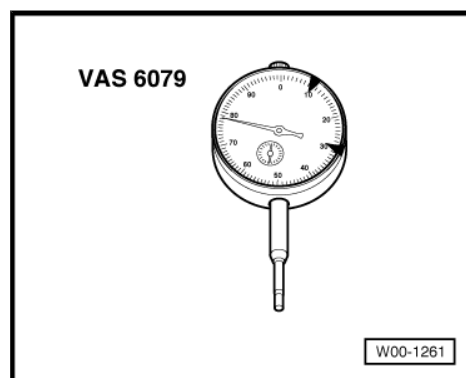
2.5 Checking valve guides

Special tools and workshop equipment required

◆ Universal dial gauge bracket -VW 387-

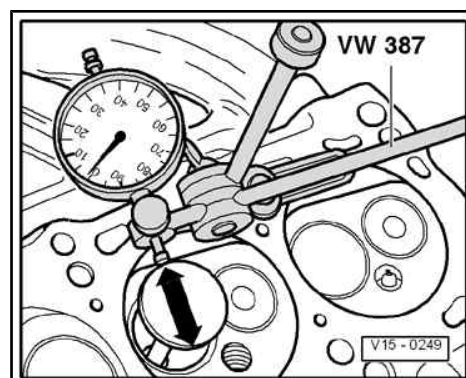


◆ Dial gauge -VAS 6079-



Test sequence

- Insert valve into valve guide. Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.
- End of valve stem must be flush with valve guide.
- Determine amount of sideways play.
- Wear limit: 0.8 mm.

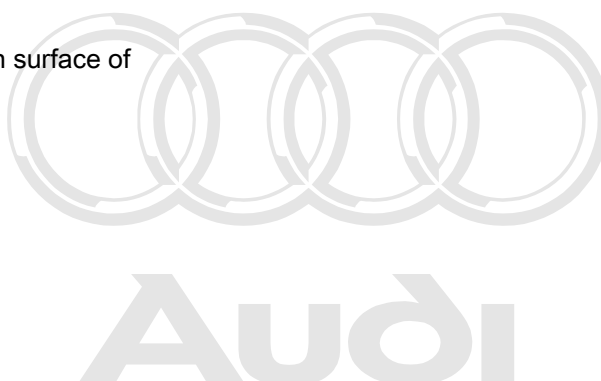


2.6 Checking valves

- Visually inspect for scoring on valve stem and on surface of seat.

If scoring is clearly visible:

- Renew the relevant valve.



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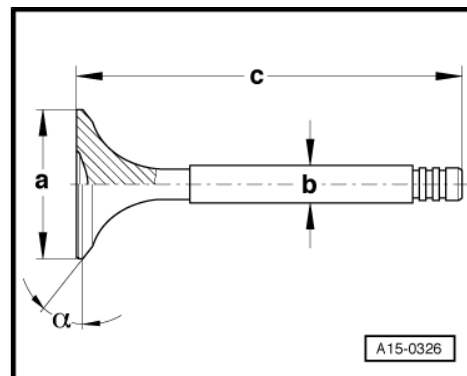
2.7 Valve dimensions



Note

Inlet and exhaust valves must not be machined. Only grinding-in is permitted.

Dimension		Inlet valve	Exhaust valve
$\varnothing a$	mm	29.5	26.0
$\varnothing b$	mm	5.973	5.953
c	mm	100.9	100.5
α	$^{\circ}$	45	45



2.8 Machining valve seats



Note

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

Special tools and workshop equipment required

◆ Depth gauge

◆ Valve seat machining tool

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Note

- ◆ *When servicing engines with leaking valves, it is not sufficient to machine (reface) the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high-mileage engines ⇒ [page 117](#).*
- ◆ *Valve seats should only be machined to the extent required to give a proper seating pattern.*
- ◆ *Calculate the maximum permissible machining dimension before machining.*
- ◆ *If the machining dimension is exceeded, the function of the hydraulic valve clearance compensation can no longer be ensured and the cylinder head must be renewed.*

Calculating maximum permissible machining dimension

- Insert valve and press firmly against valve seat.



Note

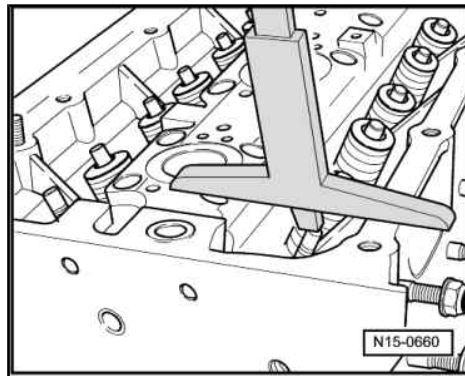
If the valve has to be renewed as part of a repair, use a new valve for the measurement.

- Measure distance between end of valve stem (upper edge) and upper surface of cylinder head with a depth gauge.
- Calculate max. permissible machining dimension from measured distance and minimum dimension.
- Minimum dimension for inlet valve and exhaust valve: 7.6 mm.

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

Example:

Measured distance	8.0 mm
Minimum dimension	– 7.6 mm
Max. permissible machining dimension	= 0.4 mm



Note

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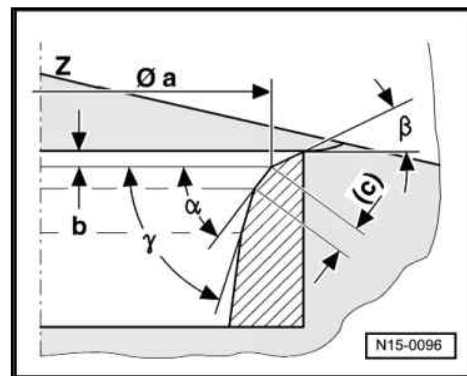
If the maximum permissible machining dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the result is again 0 mm or less than 0 mm, renew the cylinder head.

Machining valve seats**Inlet valve seat**a - $\varnothing$ 28.5 mm

b - Max. permissible machining dimension

c - 1.5 ... 1.8 mm

Z - Lower edge of cylinder head

 α - 45° valve seat angle β - 30° upper correction angle γ - 60° lower correction angle**Exhaust valve seat**a - $\varnothing$ 25.0 mm

b - Max. permissible machining dimension

c - approx. 1.8 mm

Z - Lower edge of cylinder head

 α - 45° valve seat angle β - 30° upper correction angle γ - 60° lower correction angle**Note**

Calculating maximum permissible machining dimension
 ⇒ [page 120](#).



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17 – Lubrication

1 Removing and installing parts of lubrication system



Note

- ◆ If large quantities of metal particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler renewed in order to prevent further damage.
- ◆ The oil level must not be above max. mark on dipstick – danger of damage to catalytic converter.

Viscosity grades and oil specifications ⇒ Maintenance ; Booklet 808 .

Oil capacities ⇒ Maintenance tables .

1.1 Oil pump, sump (bottom section) - exploded view of components

1 - Oil level and oil temperature sender -G266-

2 - Seal

- ☐ Renew

3 - Sump

- ☐ Removing and installing ⇒ [page 123](#)

4 - 13 Nm

- ☐ When loosening and tightening the bolts on the flywheel end, use hexagon key (long reach) -T10058-

5 - 14 Nm + 90° (1/4 turn) further

- ☐ Renew

6 - Chain sprocket for oil pump

- ☐ Sprocket can only be fitted on oil pump shaft in one position.
- ☐ Lock using counterhold -T10172-

7 - 20 Nm + 90° (1/4 turn) further

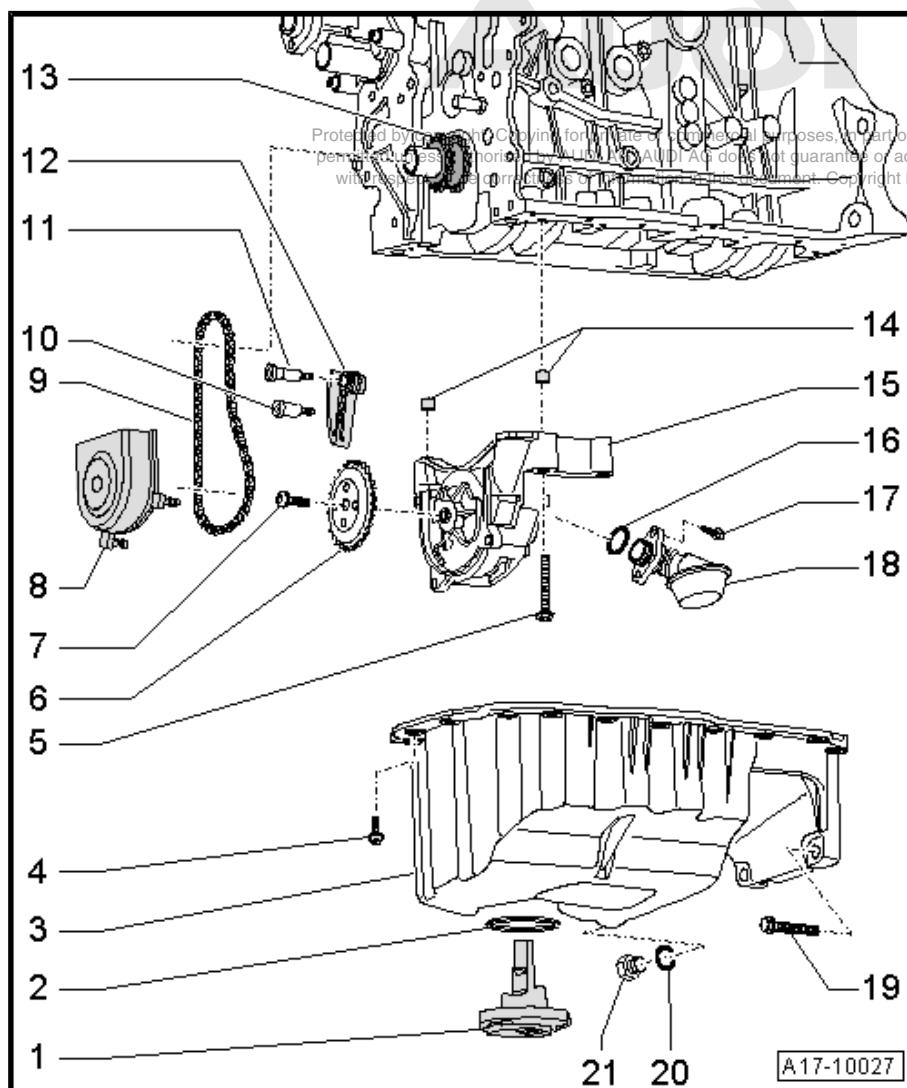
- ☐ Renew

8 - Chain sprocket cover

- ☐ Clipped onto oil pump

9 - Drive chain for oil pump

- ☐ Before removing mark rotation direction (installation position)



- ☐ Check for wear

10 - Stop bolt, 8 Nm

- ☐ For chain tensioner

11 - Mounting pin, 18 Nm

- ☐ For chain tensioner

12 - Chain tensioner

- ☐ For oil pump chain
- ☐ With tensioning spring
- ☐ Do not dismantle
- ☐ Note installation position
- ☐ When installing, pre-tension spring and engage

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13 - Chain sprocket

- ☐ Fitted onto crankshaft
- ☐ Note correct position: slot must engage with drive lug on crankshaft

14 - Dowel sleeves

- ☐ 2 x

15 - Oil pump

- ☐ With pressure relief valve
- ☐ Removing and installing ⇒ [page 129](#)
- ☐ Before installing, check that the two dowel sleeves for centring oil pump/cylinder block are fitted

16 - O-ring

- ☐ Renew

17 - 10 Nm**18 - Intake pipe**

- ☐ Clean strainer if dirty

19 - 40 Nm**20 - Seal**

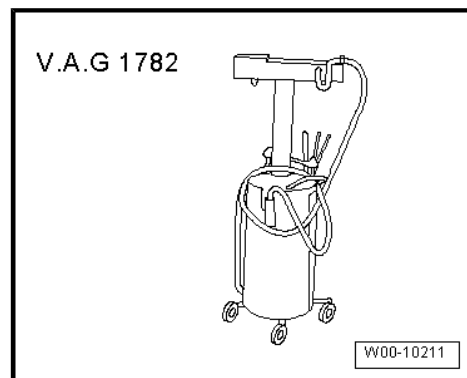
- ☐ Renew

21 - 30 Nm

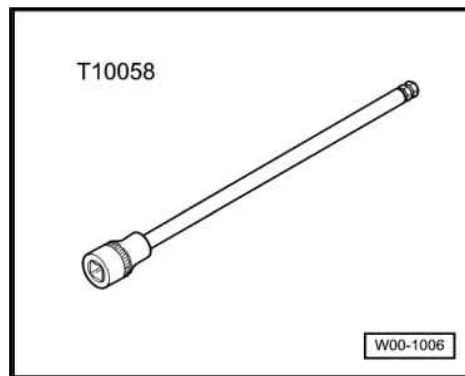
1.2 Removing and installing sump

Special tools and workshop equipment required

- ◆ Used oil collection and extraction unit -V.A.G 1782-



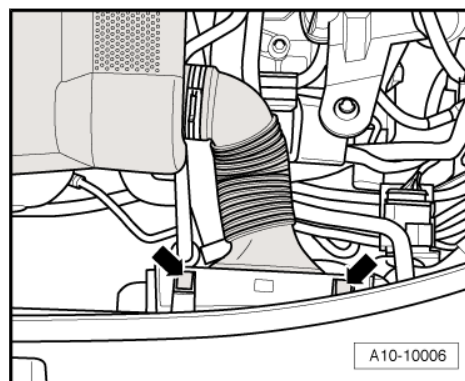
- ◆ Allen key (long reach) -T10058-



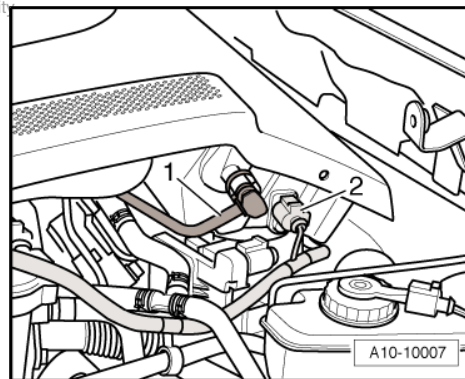
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Parts catalogue

Removing

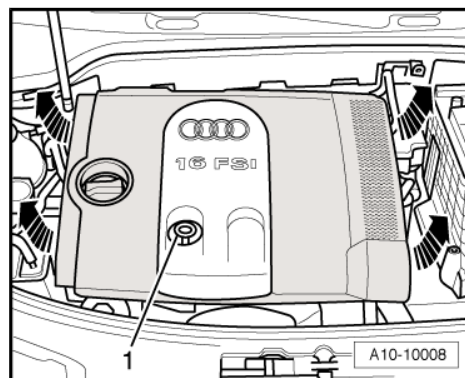
- Unclip air intake hose from air duct -arrows-.



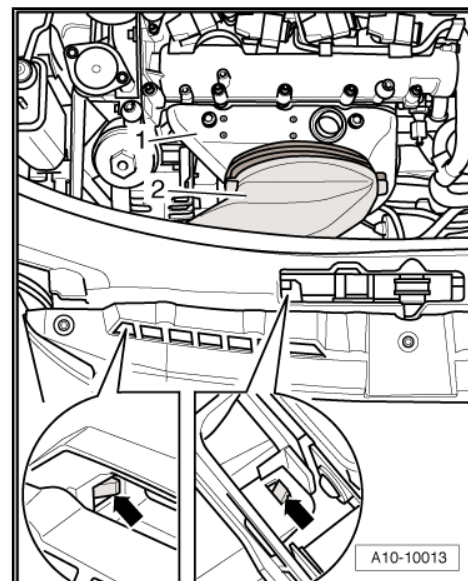
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



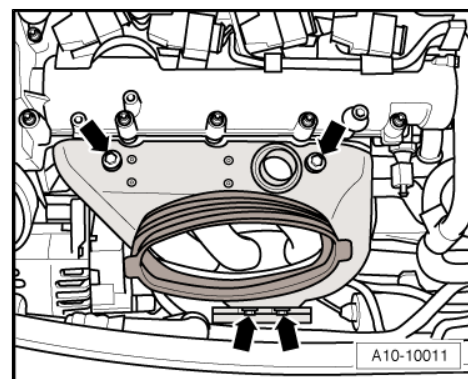
- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



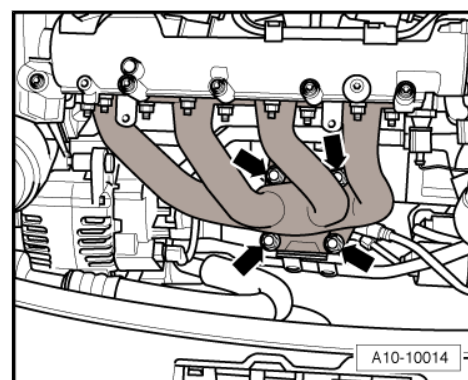
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



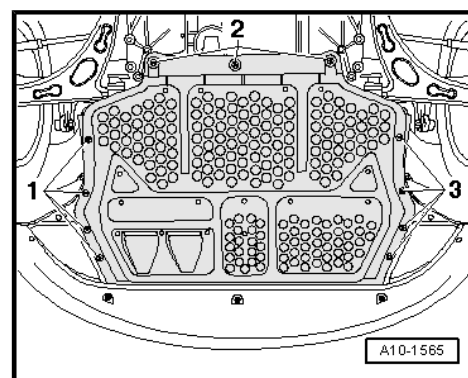
- Unbolt hot air collector plate -arrows-.



- Unbolt front exhaust pipe from exhaust manifold -arrows-.

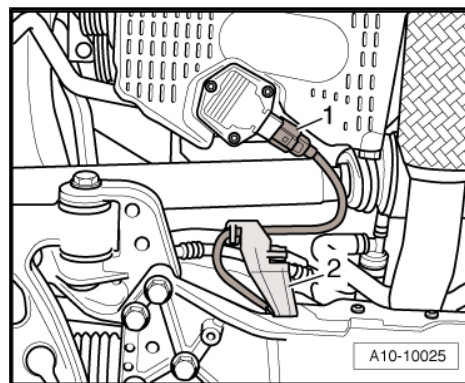


- Remove centre noise insulation -fasteners 1 ... 3-.

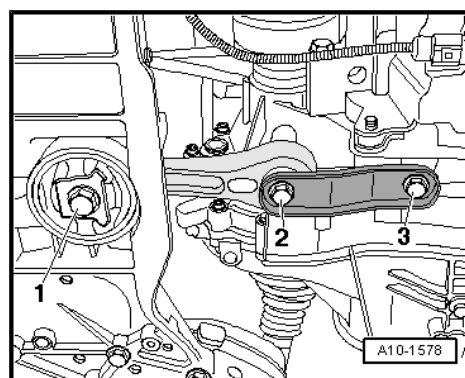


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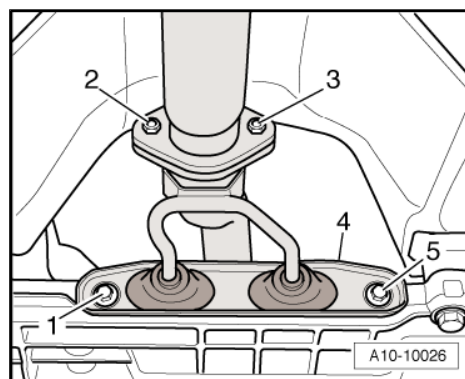
- Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
- Unclip bracket -2- for wire to oil level and oil temperature sender -G266- at subframe.



- Unscrew bolts -1 ... 3- and remove pendulum support.



- Remove nuts -2- and -3- at exhaust pipe flange.
- Separate exhaust system at flange.
- Remove bolts -1- and -5-.
- Pull off bracket -4- for exhaust system from pins on front exhaust pipe.



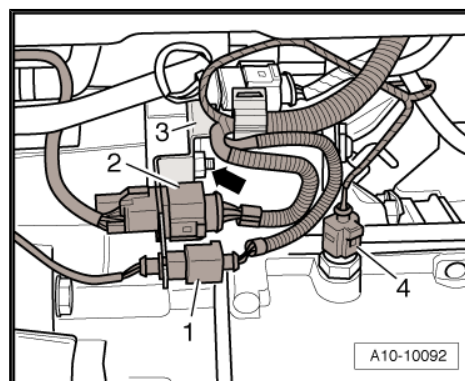
Vehicles with manual gearbox:

- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).



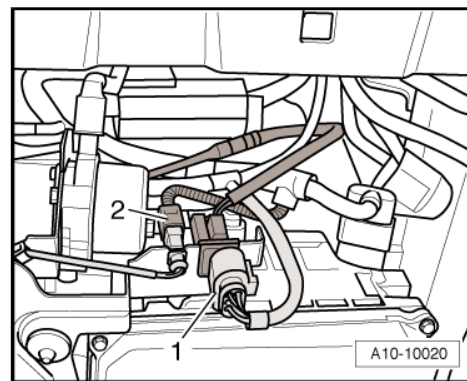
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Disregard items marked -3- and -4-.



Vehicles with automatic gearbox:

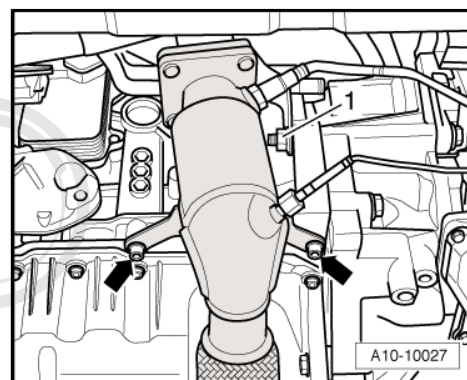
- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).

**All models:****Note**

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.

Vehicles with engine code letters BAG:

- Unscrew bolts -arrows-.
- Swing front exhaust pipe forwards and remove.

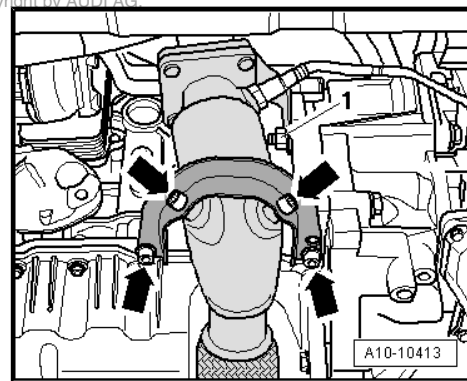
**Note**

Disregard -item 1-.

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Vehicles with engine code letters BLF, BLP:

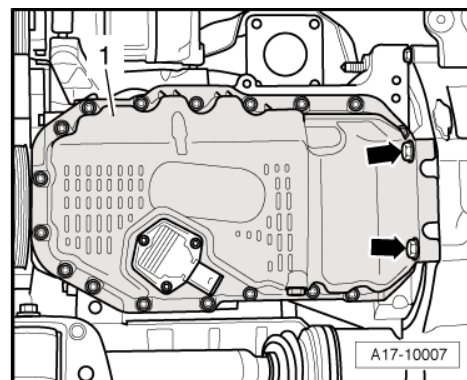
- Unscrew bolts -arrows- and remove bracket for front exhaust pipe.
- Swing front exhaust pipe forwards and remove.

**Note**

Disregard -item 1-.

All models:

- Place used oil collection and extraction unit -V.A.G 1782- under engine.
- Drain off engine oil.
- Unscrew sump/gearbox bolts -arrows-.
- Unscrew bolts for sump -1- in diagonal sequence and remove.
- Take off sump; if necessary loosen it by striking lightly with a rubber hammer.



Installing

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

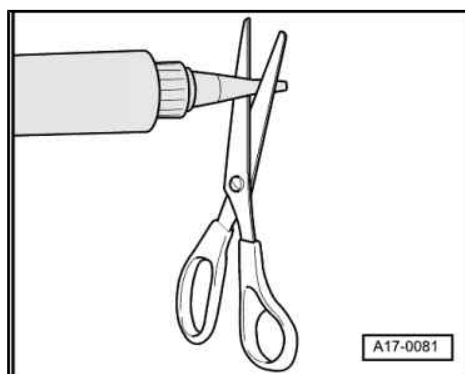
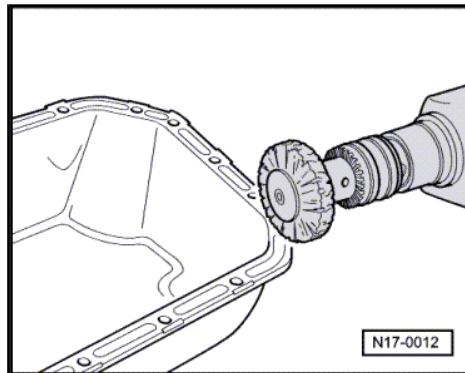
- Carefully remove sealant residues from cylinder block. For this purpose, remove baffle plate.



WARNING

Wear safety goggles.

- Remove sealant residue from sump, e.g. with rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Cut off tube nozzle at front marking (nozzle approx. 2 mm Ø).



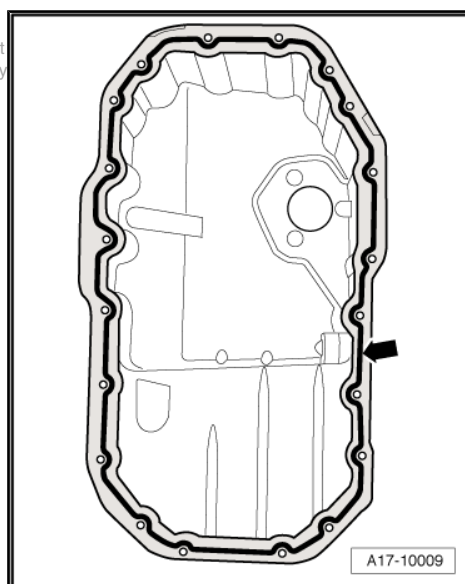
- Apply the sealant onto the clean sealing surface of the sump as illustrated -arrow-

- Thickness of sealant bead: 2 ... 3 mm



Note

- ◆ *The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump and obstruct the strainer in the oil intake pipe.*
- ◆ *Take particular care when applying sealant bead in area of rear sealing flange.*
- ◆ *The sump must be installed within 5 minutes after applying sealant.*

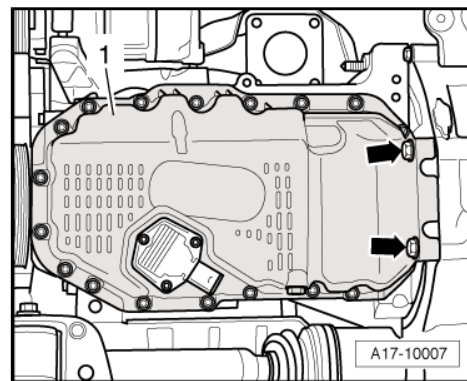


- Install sump -1- immediately and tighten bolts in the following sequence:

 1. Tighten securing bolts for sump/engine in diagonal sequence initially to 5 Nm.
 2. Tighten sump/gearbox bolts -arrows- to 40 Nm.
 3. Tighten securing bolts for sump/engine in diagonal sequence to 13 Nm.

i Note

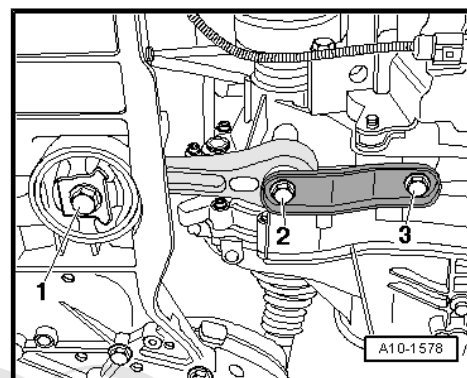
- ◆ *When installing sump with engine removed from vehicle, ensure that sump is positioned flush with cylinder block at fly-wheel end.*
- ◆ *After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.*



- Secure pendulum support with bolts -1 ... 3- to gearbox and subframe.
- Install exhaust system and align free of stress ⇒ [page 182](#) .
- Fill up with engine oil and check oil level ⇒ [page 140](#) .

Tightening torques

Component	Nm
Sump to cylinder block	13
Sump to gearbox	40
Oil drain plug	30
Pendulum support to gearbox	40 + 90° ¹⁾²⁾
Pendulum support to subframe	100 + 90° ¹⁾²⁾
Hot air collector plate to exhaust manifold	10
• ¹⁾ Renew bolts. • ²⁾ 90° = one quarter turn.	

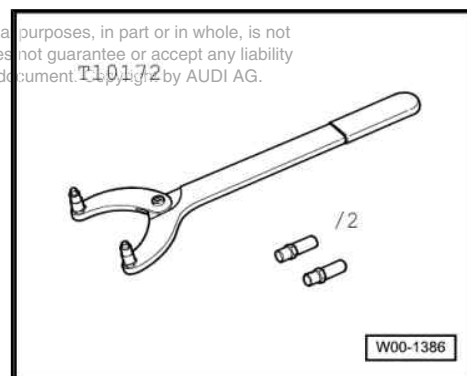


1.3 Removing and installing oil pump

Special tools and workshop equipment required

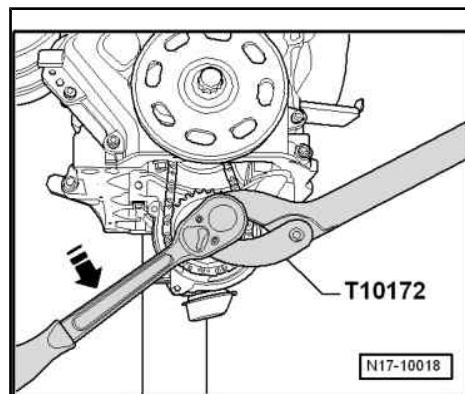
- ◆ Counterhold tool -T10172-

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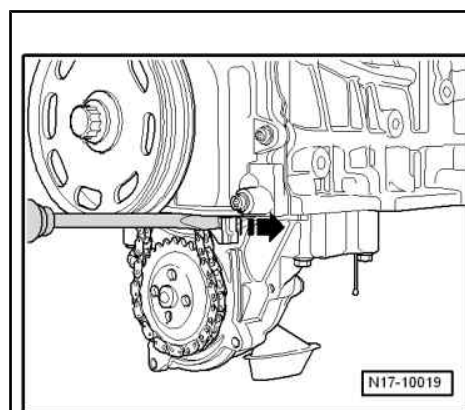


Removing

- Remove sump ⇒ [page 123](#) .
- Loosen securing bolt of oil pump chain sprocket several turns; use counterhold tool -T10172- to counterhold at chain sprocket.



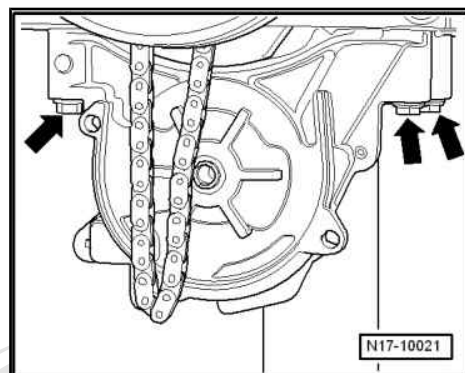
- Press chain tensioner in -direction of arrow- using a screw-driver.
- Unscrew securing bolt for chain sprocket.
- Remove chain sprocket from oil pump and take out off chain.



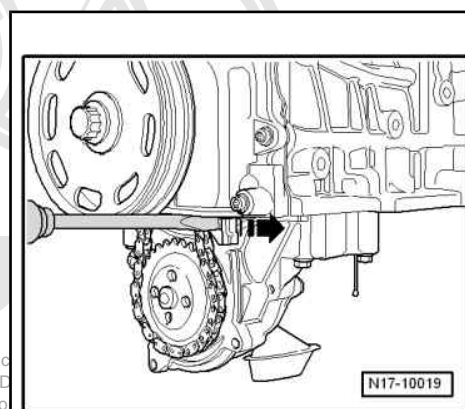
- Unscrew the oil pump -arrows-.

Installing

- Secure oil pump to cylinder block with new bolts.

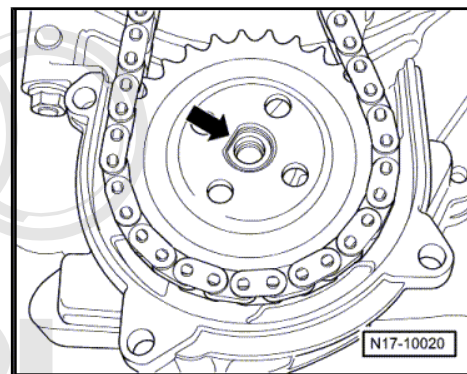


- Press chain tensioner in -direction of arrow- using a screw-driver.

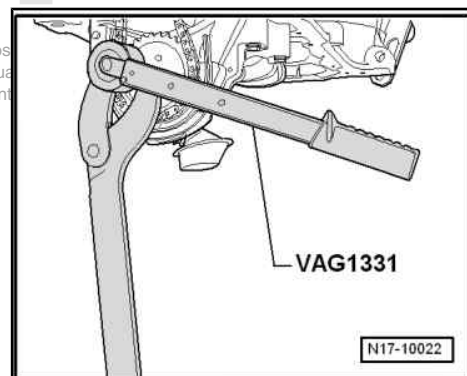


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- Fit chain sprocket to oil pump; note installation position on oil pump shaft -arrow-.
- Renew securing bolt for chain sprocket.



- Tighten securing bolt of oil pump chain sprocket; use counterhold tool -T10172- to counterhold at chain sprocket.
- Install sump ⇒ [page 123](#).



Tightening torques

Component	Nm
Chain sprocket to oil pump	20 + 90° ¹⁾²⁾
Oil pump to cylinder block	14 + 90° ¹⁾²⁾
• ¹⁾ Renew bolts. • ²⁾ 90° = one quarter turn.	

1.4 Oil filter housing - exploded view of components

1 - Sealing cap, 25 Nm

2 - O-ring

- ☐ Renew

3 - Oil filter element

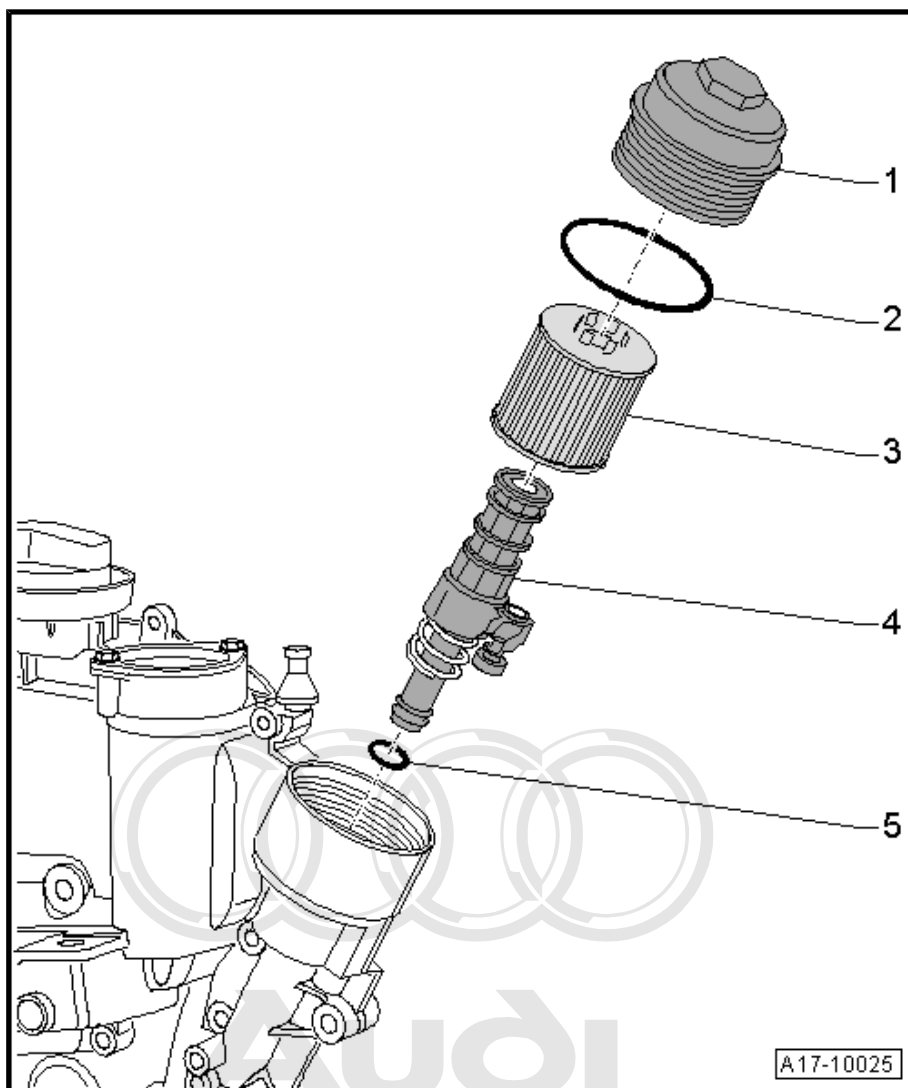
- ☐ Detach from sealing cap
⇒ [Item 1 \(page 132\)](#)
- ☐ Renew O-ring
⇒ [Item 2 \(page 132\)](#)
when changing filter
- ☐ Note installation position
- ☐ Observe change intervals ⇒ Maintenance ;
Booklet 808

4 - Valve unit

- ☐ With filter bypass valve,
1.8 bar
- ☐ With non-return valve
- ☐ To remove, press release tab and turn anti-clockwise
- ☐ Cannot be renewed separately

5 - O-ring

- ☐ Renew



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1.5 Oil cooler - exploded view of components

1 - Oil cooler

- ☐ See note ⇒ [page 122](#)
- ☐ Removing and installing
⇒ [page 133](#)

2 - Gasket

- ☐ Renew

3 - O-rings

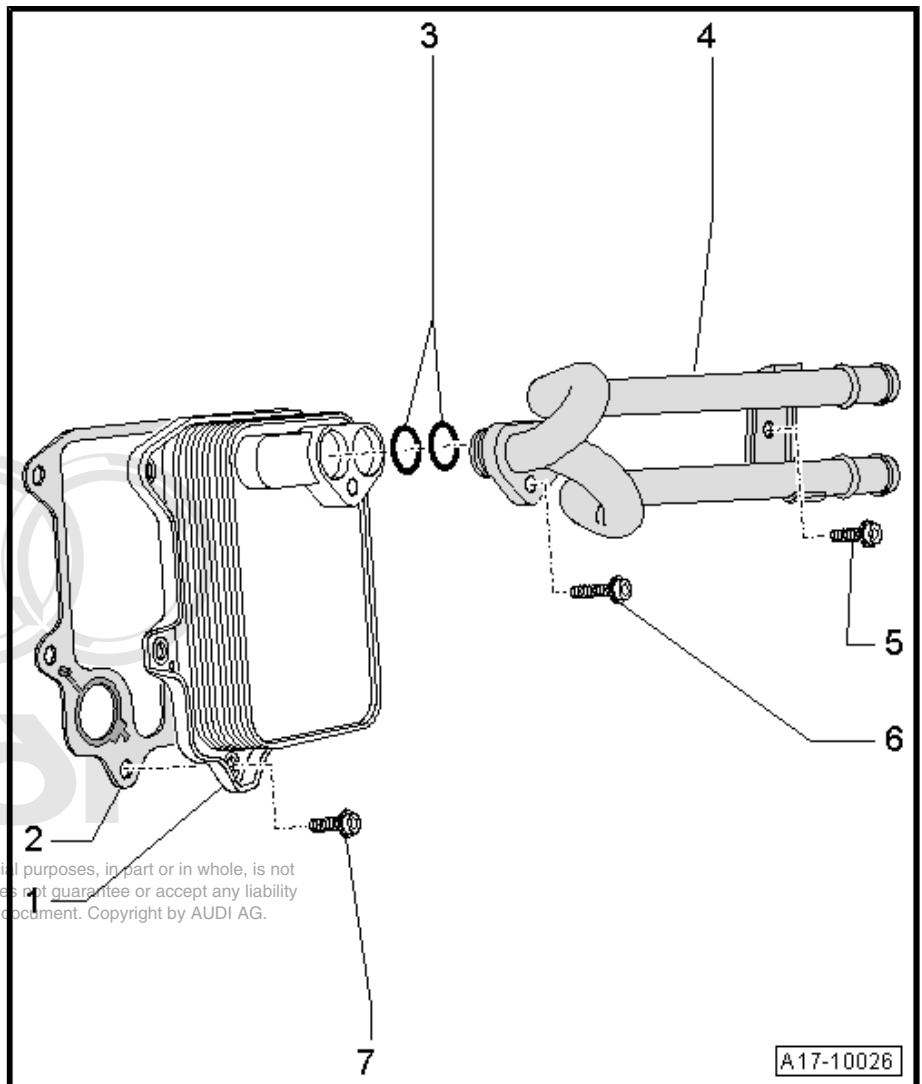
- ☐ Renew

4 - Coolant pipes

5 - 8 Nm

6 - 8 Nm

7 - 8 Nm

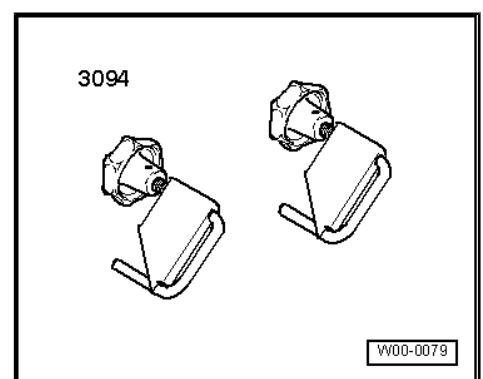


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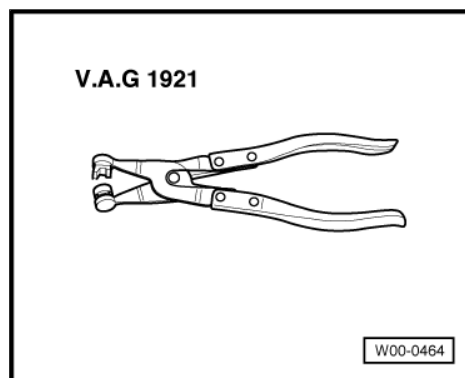
1.6 Removing and installing oil cooler

Special tools and workshop equipment required

- ◆ Hose clamps for hoses up to 25 mm Ø -3094-



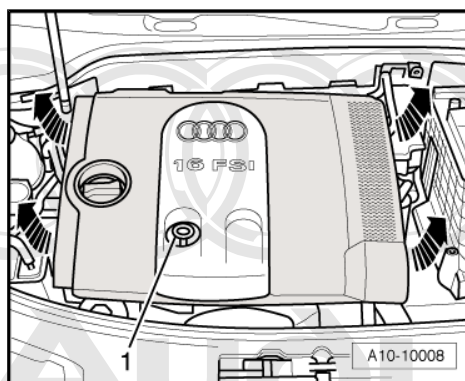
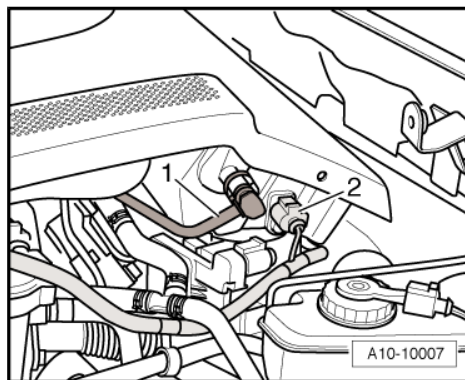
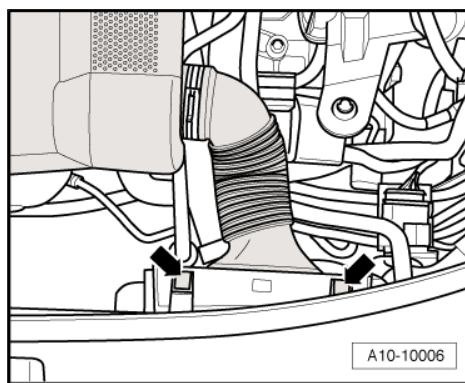
- ◆ Hose clip pliers -V.A.G 1921-



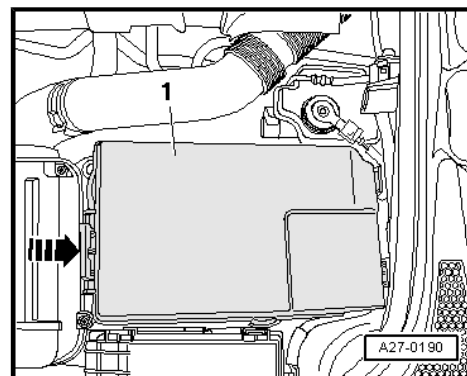
- ◆ Drip tray

Removing

- Unclip air intake hose from air duct -arrows-.
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.
- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



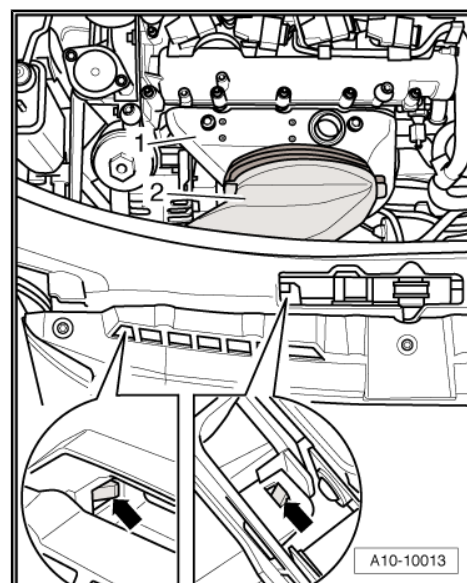
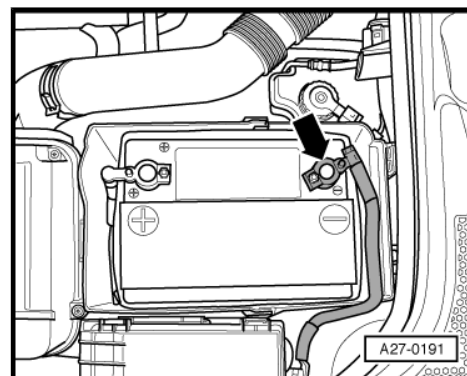
- Remove cover -1- over battery. To do so, press release tab -arrow-.



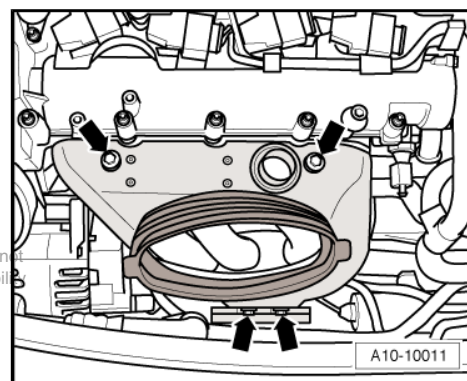
Caution

Observe notes on procedure for disconnecting the battery → Rep. Gr. 27.

- With ignition switched off, disconnect battery earth cable -arrow-.
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



- Unbolt hot air collector plate -arrows-.



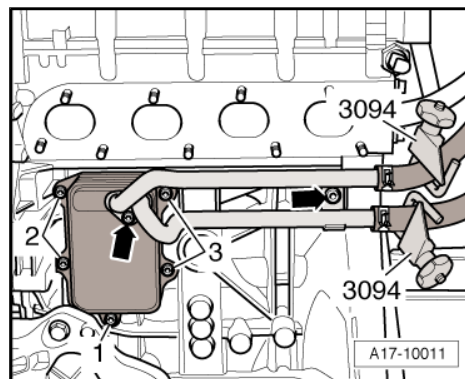
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- Clamp off coolant hoses at oil cooler with hose clamps -3094- .
- Unscrew securing bolts -arrows- for coolant pipes at cylinder block and at oil cooler (accessible from above).

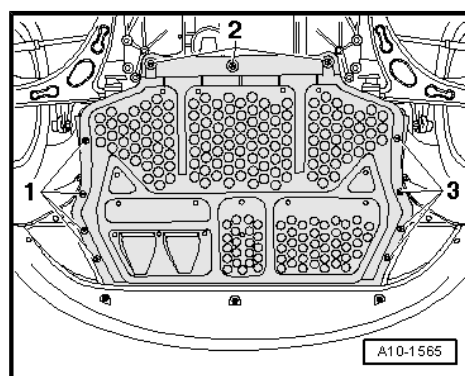


Note

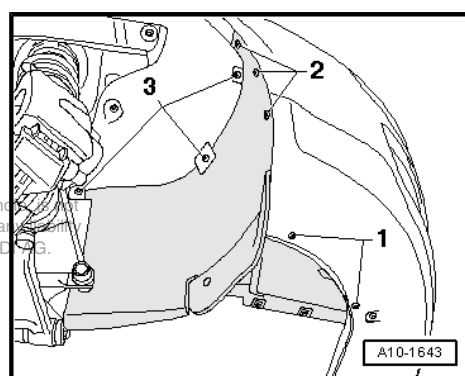
Disregard -items 1 ... 3-.



- Remove centre noise insulation -fasteners 1 ... 3-.



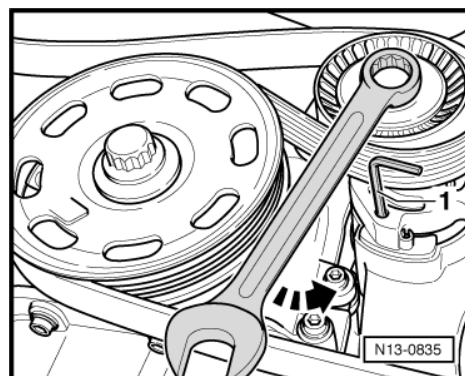
- Remove noise insulation (right-side) -fasteners 1 ... 3-.



Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Lock the belt tensioner with a 4 mm Allen key -item 1-.
- Remove poly V-belt.



WARNING

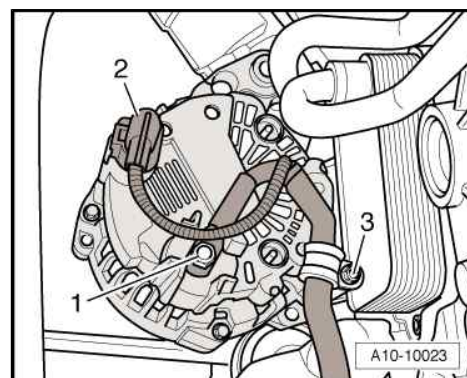
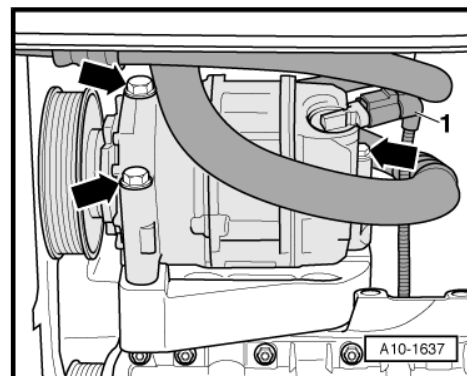
The air conditioner refrigerant circuit must not be opened.

- Unplug electrical connector -1- for magnetic clutch of air conditioner compressor.
- Remove bolts -arrows- for air conditioner compressor.

**Note**

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

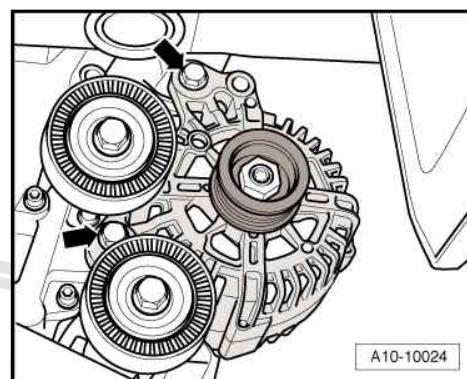
- Tie air conditioner compressor up to lock carrier.
- Detach electrical connector -2-.
- Unscrew wire -1- at alternator.
- Unbolt wire clamp -3- at alternator and move wiring harness clear.



- Unscrew bolts -arrows- and remove alternator.

**Note**

- ◆ *If alternator sticks in its bracket, screw bolt back in again down to the last 2 turns.*
- ◆ *Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.*



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- Place drip tray underneath.
- Pull coolant pipes forwards out of oil cooler.
- Remove bolts -1 ... 3- and detach oil cooler from cylinder block.



Note

Ignore -arrows-.

Installing

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

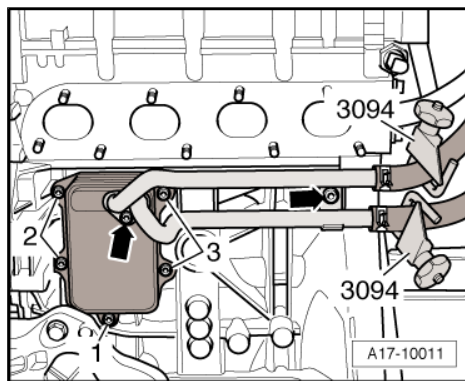


Note

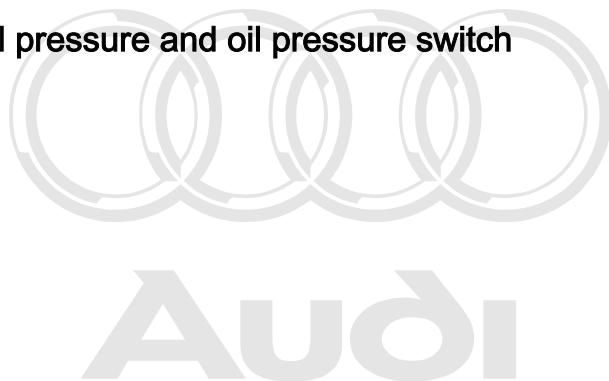
- ◆ Renew O-ring.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.
- Install alternator ⇒ Rep. Gr. 27 .
- Install air conditioner compressor ⇒ Rep. Gr. 87 .
- Observe notes on procedure for connecting the battery ⇒ Rep. Gr. 27 .
- Install poly V-belt ⇒ [page 35](#) .
- Fill up cooling system (or change coolant if the oil cooler has been renewed) ⇒ [page 146](#) .

Tightening torques

Component	Nm
Coolant pipes for oil cooler	8
Oil cooler to cylinder block	8
Hot air collector plate to exhaust manifold	10



1.7 Checking oil pressure and oil pressure switch

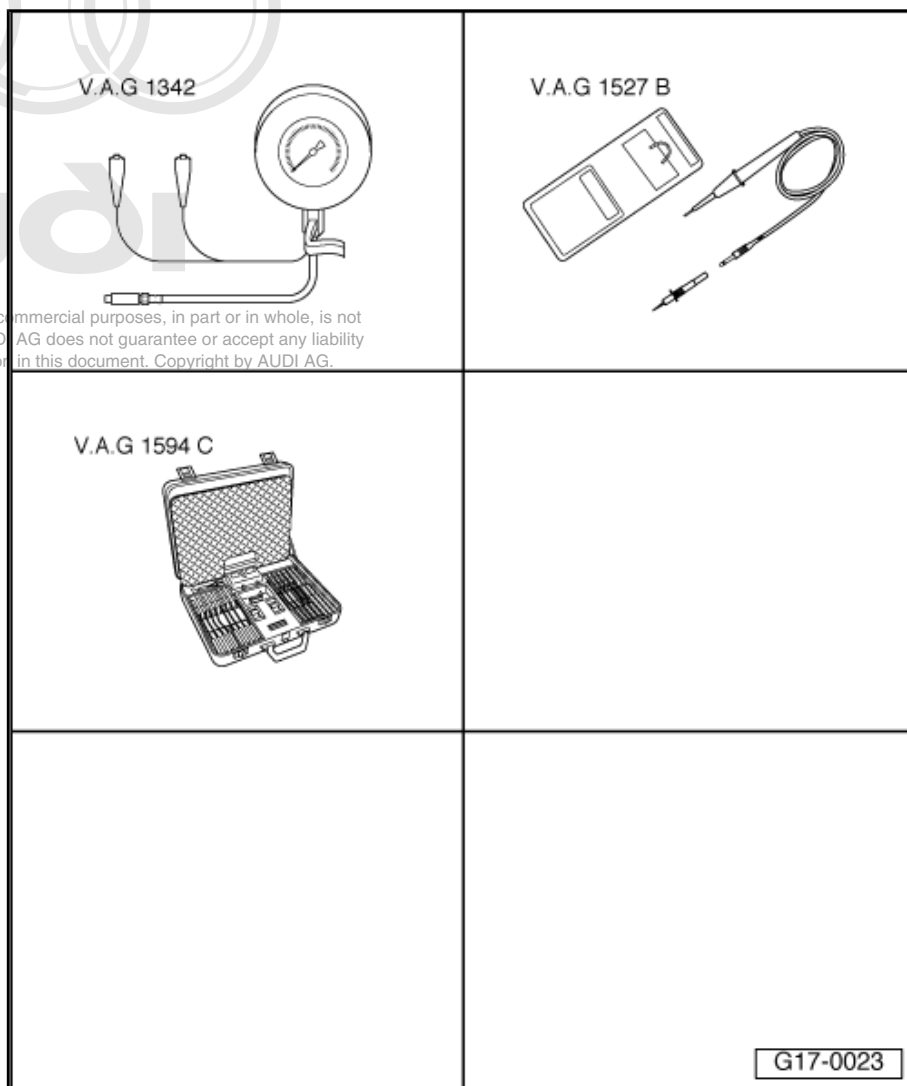


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Special tools and workshop equipment required

- ◆ Oil pressure tester -V.A.G 1342- with adapter -V.A.G 1342/14-
- ◆ Voltage tester - V.A.G 1527 B-
- ◆ Auxiliary measuring set - V.A.G 1594 C-

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Test conditions

- Oil level OK
- Engine oil temperature approx. 80 °C

Test sequence

- Unplug electrical connector at oil pressure switch -F1- -arrow-.
- Unscrew oil pressure switch.



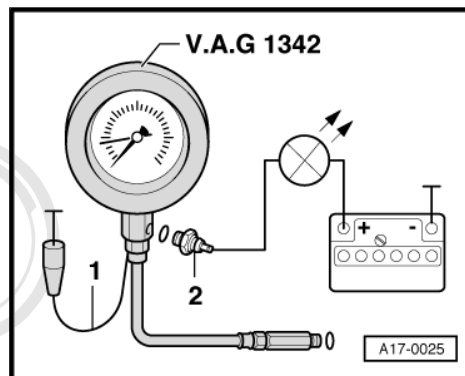
- Connect oil pressure tester -V.A.G 1342- to threaded hole for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester - V.A.G 1342- .
- Connect brown wire -1- of oil pressure tester to earth (-).

Checking oil pressure switch

- Connect voltage tester -V.A.G 1527 B- with test leads from auxiliary measuring set -V.A.G 1594 C- to oil pressure switch and battery positive (+).
- LED should not light up.

If the LED lights up:

- Renew oil pressure switch.
- Start engine.



Note

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Observe tester and LED while starting, as switching point of oil pressure switch may already be exceeded when starting.

- Test lamp should light up at 0.3 ... 0.7 bar.

If LED does not light up:

- Renew oil pressure switch.

Checking oil pressure

- Start engine.
- Minimum oil pressure at 2000 rpm: 2.0 bar
- Maximum oil pressure at higher engine speeds: 7.0 bar

The pressure relief valve or oil pump is defective if the specifications are not attained.

- Renew oil pump ⇒ [page 129](#) .

Assembling

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



Note

Renew seal when installing oil pressure switch.

1.8 Engine oil

Viscosity grades and oil specifications ⇒ Maintenance ; Booklet 808 .

Oil capacities ⇒ Maintenance tables .

1.9 Checking oil level



Note

The oil level must not be above max. mark on dipstick - danger of damage to catalytic converter.

Test conditions

- 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 sump.

Test sequence

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

Markings on oil dipstick:

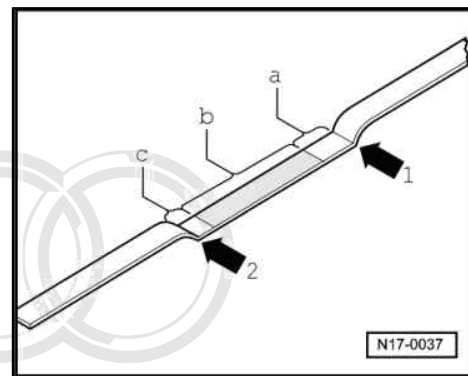
a - Do not top up oil.

b - Oil may be topped up.

c - Oil must be topped up.

**Note**

The oil level must not be above the MAX marking -arrow 1- and not below the MIN marking -arrow 2-.



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19 – Cooling

1 Removing and installing parts of cooling system



WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.



Note

- ◆ *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ◆ *Renew gaskets and seals.*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*

1.1 Diagram of coolant hose connections

1 - Expansion tank**2 - Coolant hose**

- ☐ From exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212-

3 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212-**4 - Heat exchanger**

- ☐ If renewed, refill system with fresh coolant

5 - Gearbox oil cooler

- ☐ Automatic gearbox only

6 - Coolant hose

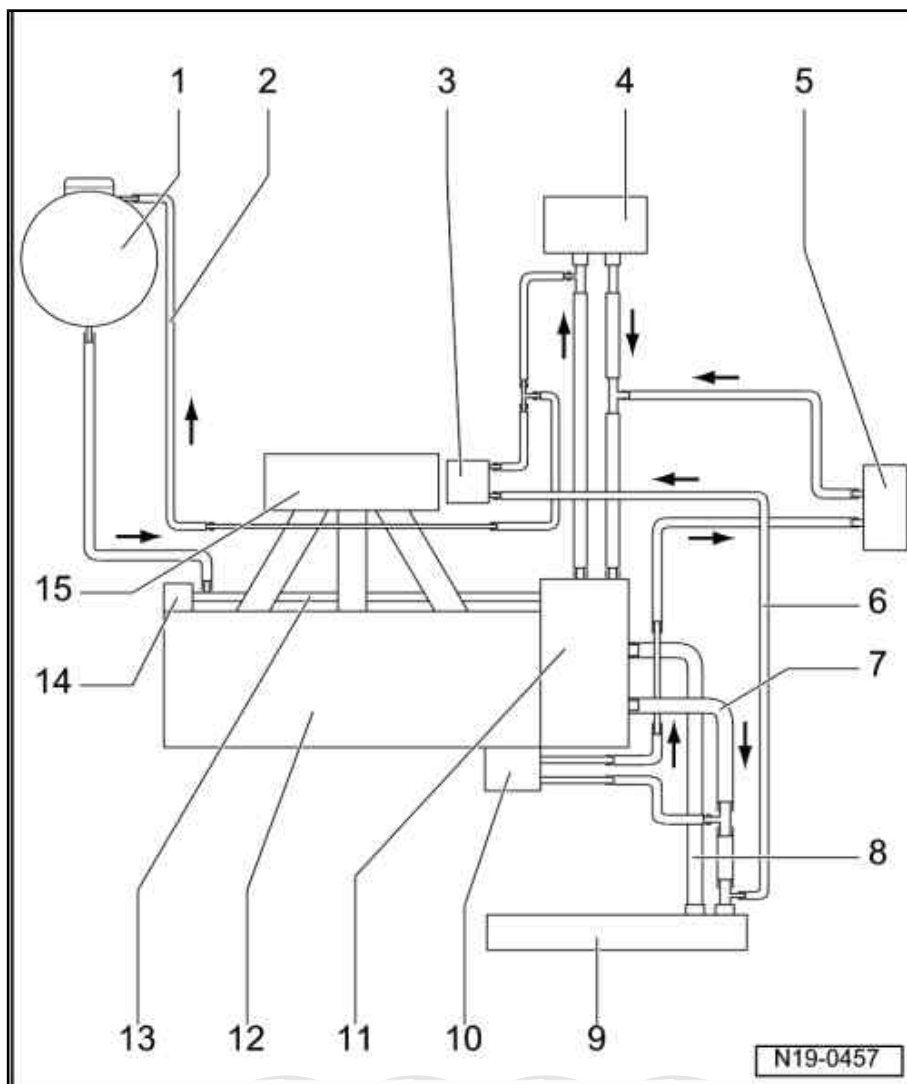
- ☐ To exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212-

7 - Coolant hose (top)**8 - Coolant hose (bottom)****9 - Radiator**

- ☐ Removing and installing
⇒ [page 164](#)
- ☐ If renewed, refill system with fresh coolant

10 - Engine oil cooler**11 - Thermostat housing****12 - Cylinder head/cylinder block**

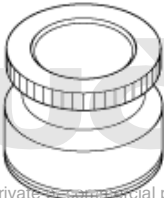
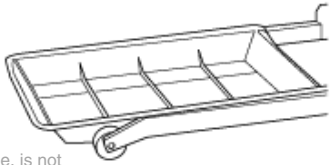
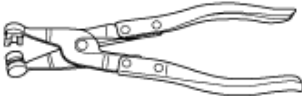
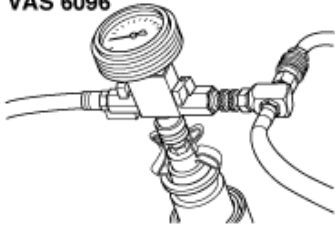
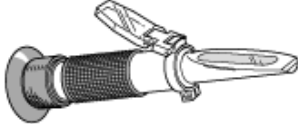
- ☐ If renewed, refill system with fresh coolant

13 - Coolant pipe**14 - Coolant pump****15 - Intake manifold**

1.2 Draining and filling cooling system

Special tools and workshop equipment required

- ◆ Adapter for cooling system tester -V.A.G 1274/8-
- ◆ Drip tray for workshop hoist -VAS 6208- or drip tray - V.A.G 1306-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Cooling system charge unit -VAS 6096- with - VAS 6096/1-
- ◆ Refractometer -T10007-

V.A.G 1274/8 	V.A.G 1306 
V.A.G 1921 	VAS 6096 
T10007 	G19-0016

Draining



Note

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

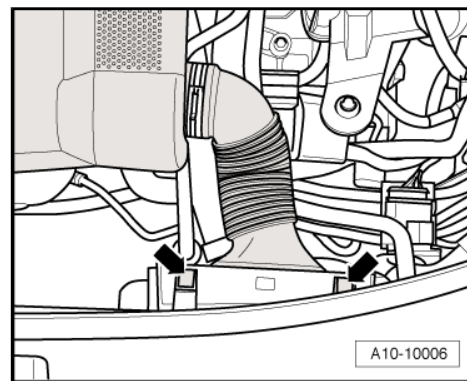


WARNING

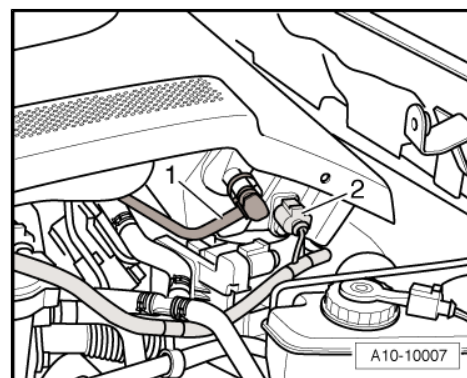
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.

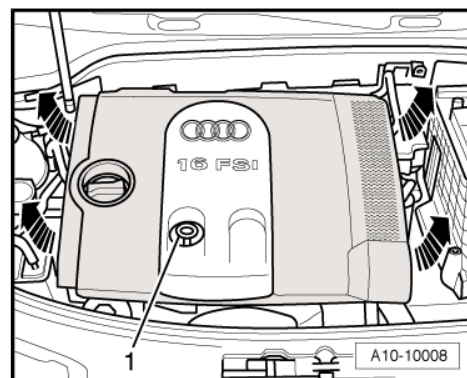
- Unclip air intake hose from air duct -arrows-.



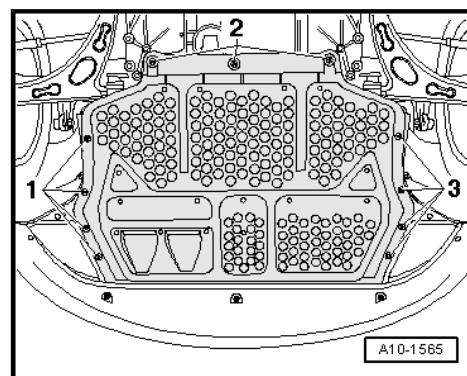
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



- Remove centre noise insulation -fasteners 1 ... 3-.



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- Place drip tray for workshop hoist -VAS 6208- under engine.

Vehicles with drain plug:

- Turn drain plug -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.

Vehicles without drain plug:

- Remove bottom coolant hose -2- from radiator by pulling off retaining clip.

All models:

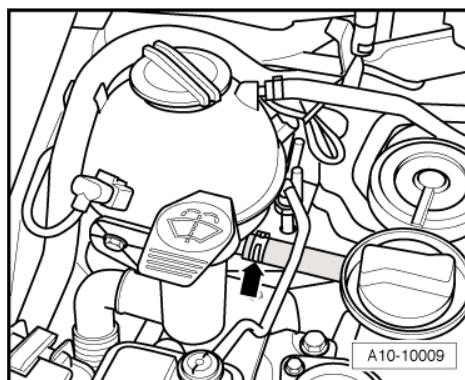
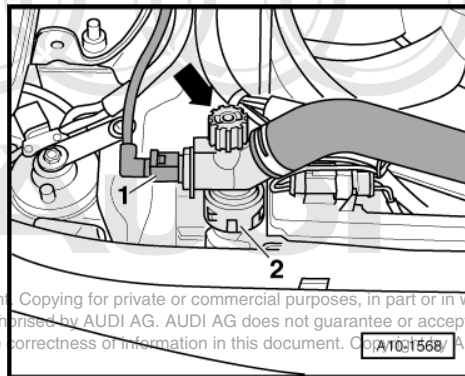
- Drain off coolant.
- Detach coolant hose -arrow- at coolant expansion tank and guide downwards to drain off remaining coolant.

Filling



Note

- ◆ *The cooling system is filled all year round with a mixture of water and radiator antifreeze/anti-corrosion agent.*
- ◆ *It is important to use only coolant additive Plus -G 012 A8F A1- (also designated as "G12+") "meeting specification TL VW 774 F". Other coolant additives could seriously impair in particular the anticorrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- ◆ *Coolant additive "G12+" may be mixed with additives "G11" and "G12".*
- ◆ *"G12+" and coolant additives marked "Meets specification TL VW 774 F" prevent frost and corrosion damage and stop scale from forming. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct antifreeze and anticorrosion additive.*
- ◆ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *Frost protection is required down to about -25 °C (in countries with arctic climate: down to about -35 °C).*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze percentage must be at least 40 %.*
- ◆ *If greater frost protection is required in very cold climates, the amount of "G 12+" can be increased, but only up to 60 % (this gives frost protection to about -40 °C). If the antifreeze percentage exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.*
- ◆ *Use only clean tap water for mixing coolant.*
- ◆ *If radiator, heat exchanger, cylinder head, cylinder head gasket or cylinder block have been renewed, do not re-use old coolant.*
- ◆ *Contaminated or dirty coolant must not be used again.*
- ◆ *To check frost protection level of coolant additive "G12+" you must use a refractometer -T10007-.*



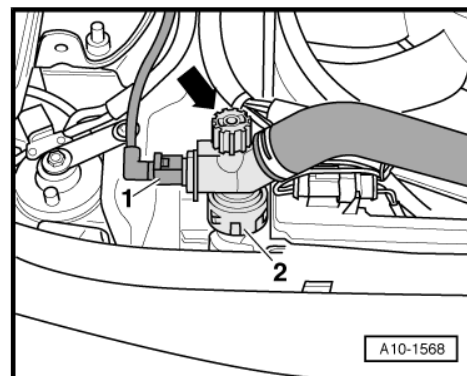
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Vehicles with drain plug:

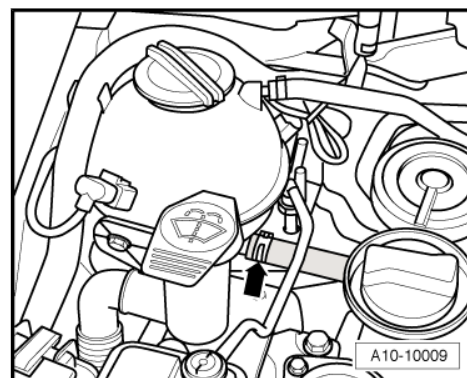
- Close drain plug -arrow-.

Vehicles without drain plug:

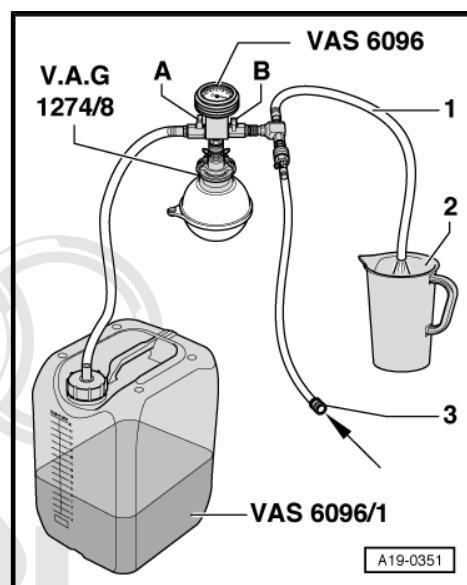
- Push coolant hose onto connection on radiator (bottom).

**All models:**

- Connect coolant hose to expansion tank -arrow-.



- Fill reservoir -VAS 6096/1- with at least 8 litres of premixed coolant (based on recommended ratio):
 - “G12+” (40 %) and water (60 %) for frost protection to –25°C
 - “G12+” (50 %) and water (50 %) for frost protection to –35 °C
 - “G12+” (60 %) and water (40 %) for frost protection to –40 °C
- Screw adapter for cooling system tester -V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit -VAS 6096- onto adapter -V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
- Close the two valves -A- and -B- by setting lever at right angle to direction of flow.
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



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- Open valve -B- by setting lever in direction of flow.

The suction jet pump generates a partial vacuum in the cooling system.

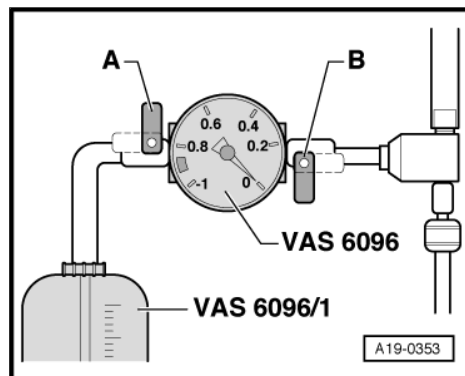
- The needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir -VAS 6096/1- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

If the needle does not reach the green zone, repeat the process.

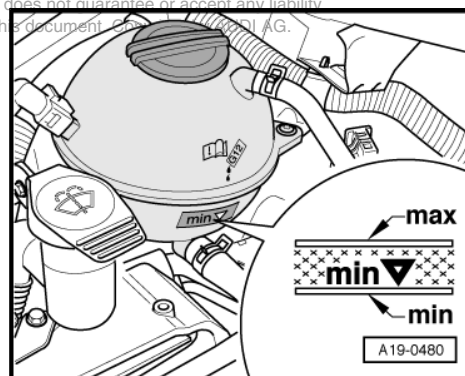
If the vacuum level drops, there is a leak in the cooling system.

- Detach compressed air hose.
- Open valve -A-.

The partial vacuum in the cooling system causes the coolant to be drawn up out of the reservoir -VAS 6096/1- ; the cooling system is then filled.



- Check the coolant level and top up coolant as far as the max mark.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Tighten filler cap on expansion tank.
- Start engine, run for 2 minutes (maximum) at approx. 1500 rpm and top up coolant to overflow hole on expansion tank with engine running.
- Run engine until radiator fan cuts in.
- Switch engine off.



WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Check coolant level and top up if necessary.
- When the engine is at normal operating temperature, coolant level must be at MAX mark, when engine is cold it must be between MIN and MAX marks.

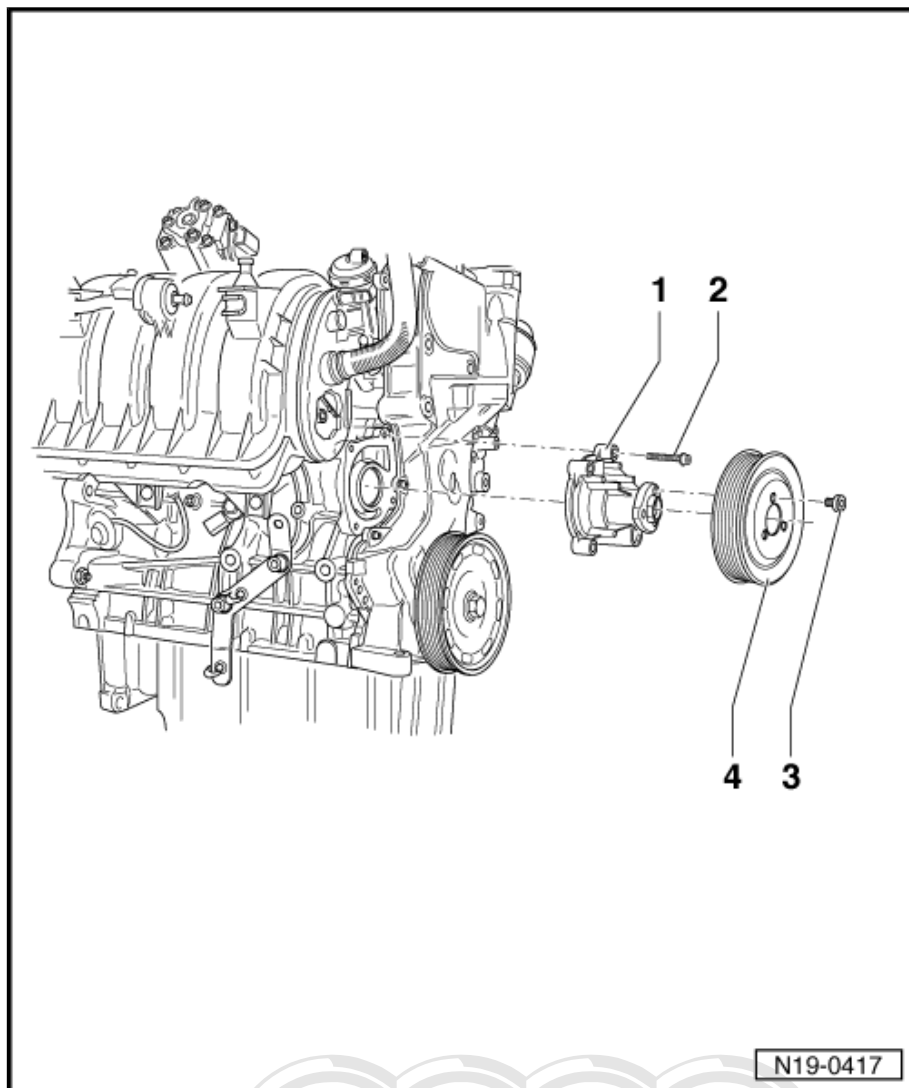
1.3 Coolant pump - Overview of components

1 - Coolant pump

- ☐ Removing and installing
⇒ [page 150](#)
- ☐ With integral seal
- ☐ If damaged or leaking,
renew as complete unit

2 - 9 Nm**3 - 20 Nm****4 - Pulley**

- ☐ Removing and installing
⇒ ["1.4 Removing and installing coolant pump",
page 150](#)



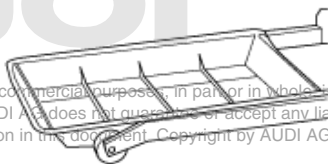
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1.4 Removing and installing coolant pump

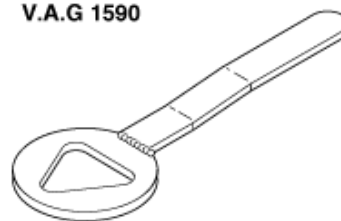
Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist -VAS 6208- or -V.A.G 1306-
- ◆ Water pump spanner - V.A.G 1590-
- ◆ Hose clip pliers - V.A.G 1921-

V.A.G 1306



V.A.G 1590



V.A.G 1921



G19-0029

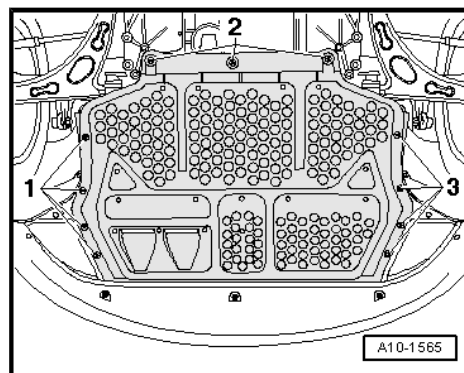
Removing



WARNING

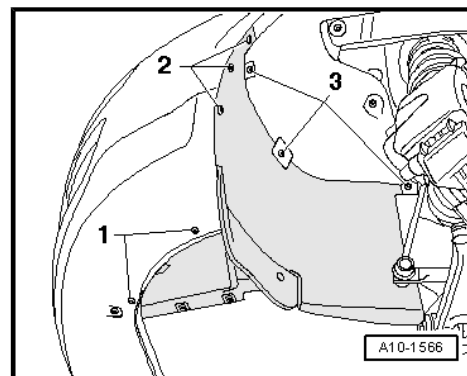
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Remove centre noise insulation -fasteners 1 ... 3-.



A10-1565

- Remove noise insulation (right-side) -fasteners 1 ... 3-.



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- Place drip tray for workshop hoist -VAS 6208- under engine.

Vehicles with drain plug:

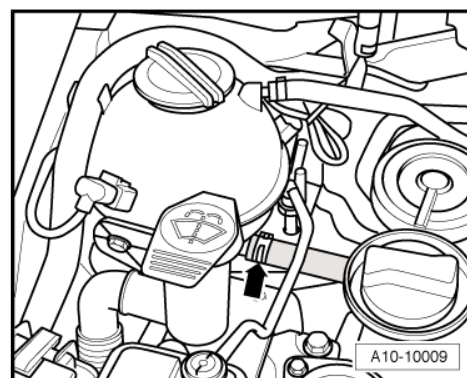
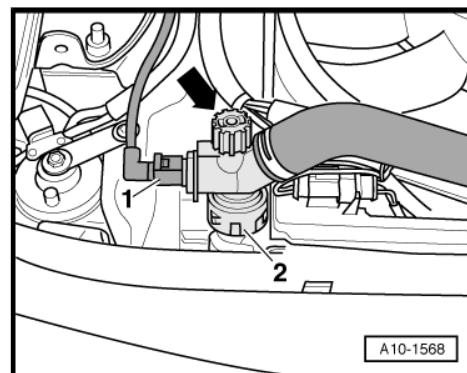
- Turn drain plug -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.

Vehicles without drain plug:

- Remove bottom coolant hose -2- from radiator by pulling off retaining clip.

All models:

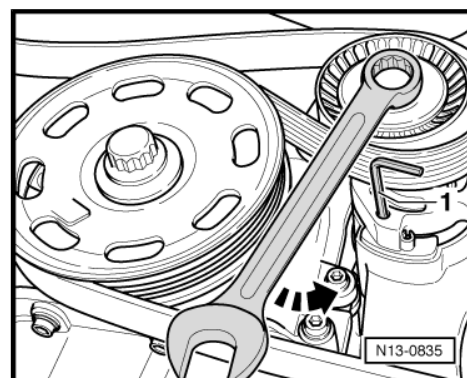
- Drain off coolant.
- Detach coolant hose -arrow- at coolant expansion tank and guide downwards to drain off remaining coolant.



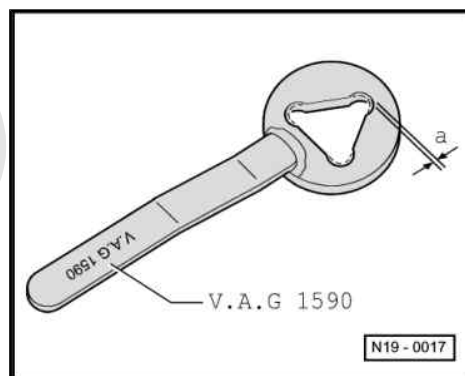
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Lock the belt tensioner with a 4 mm Allen key -item 1-.
- Remove poly V-belt.

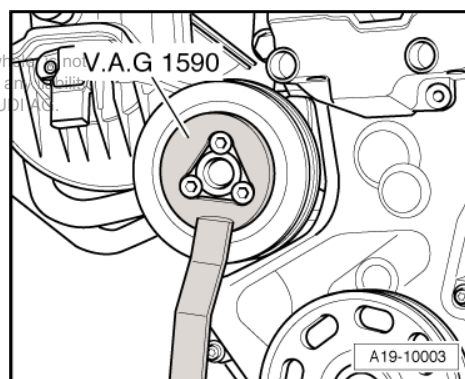


- File out the 3 round corners on the water pump wrench - V.A.G 1590- to dimension -a-.
- Dimension -a- = 1 mm.



- Unbolt coolant pump pulley; use water pump wrench - V.A.G 1590- to counterhold.

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- Unscrew bolts -arrows- and remove coolant pump.

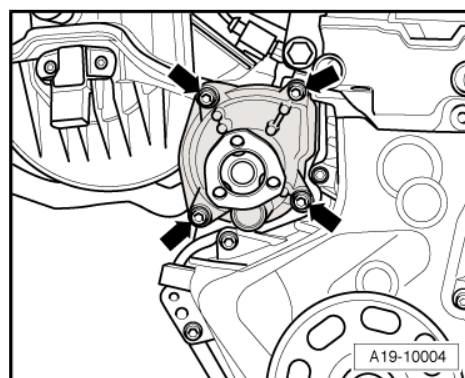
Installing

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

- Clean and smoothen sealing surface for O-ring as required.
- Lubricate new O-ring -3- with coolant additive "G12+".
- Install poly V-belt ⇒ [page 35](#) .
- Fill cooling system ⇒ [page 146](#) .

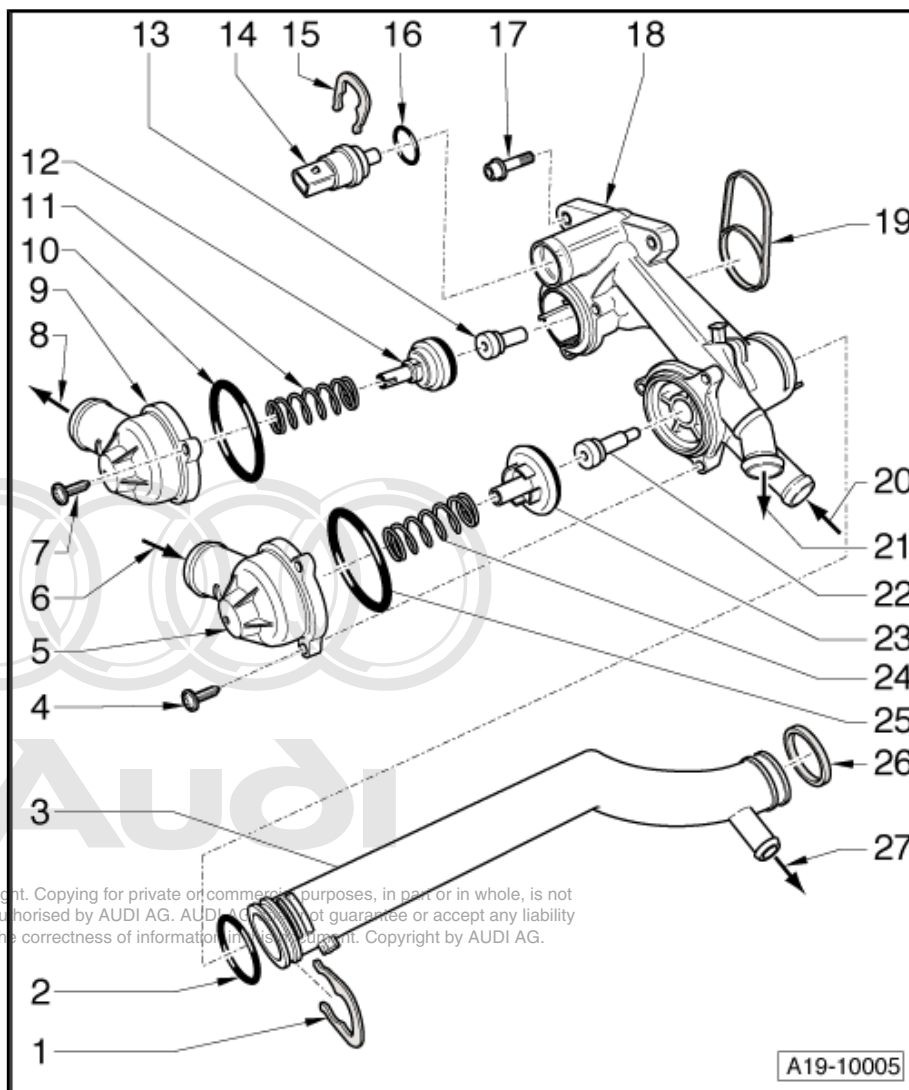
Tightening torques

Component	Nm
Coolant pump to cylinder block	9
Coolant pump pulley to coolant pump	20



1.5 Thermostat housing - exploded view of components

- 1 - Retaining clip for coolant pipe**
- 2 - O-ring**
 - ☐ Renew
- 3 - Coolant pipe**
 - ☐ Removing and installing ⇒ [page 154](#)
 - ☐ Diagram of coolant hose connections ⇒ [page 142](#)
- 4 - 5 Nm**
- 5 - Hose connection**
- 6 - From bottom of radiator**
 - ☐ Diagram of coolant hose connections ⇒ [page 142](#)
- 7 - 5 Nm**
- 8 - To top of radiator**
 - ☐ Diagram of coolant hose connections ⇒ [page 142](#)
- 9 - Hose connection**
- 10 - O-ring**
 - ☐ Renew
- 11 - Compression spring**
- 12 - Thermostat plunger**
 - ☐ Removing and installing ⇒ [page 158](#)
- 13 - Temperature element for thermostat (short)**
 - ☐ Removing and installing ⇒ [page 158](#)
- 14 - Coolant temperature sender -G62-**
 - ☐ Dissipate cooling system pressure before removal if necessary
- 15 - Retaining clip**
 - ☐ Check for firm attachment
- 16 - O-ring**
 - ☐ Renew
- 17 - 10 Nm**
- 18 - Thermostat housing**
 - ☐ Removing and installing ⇒ [page 158](#)
- 19 - Gasket**
 - ☐ Renew
- 20 - From heat exchanger**
- 21 - To heat exchanger**
- 22 - Temperature element for thermostat (long)**
 - ☐ Removing and installing ⇒ [page 158](#)
- 23 - Thermostat plunger**
 - ☐ Removing and installing ⇒ [page 158](#)

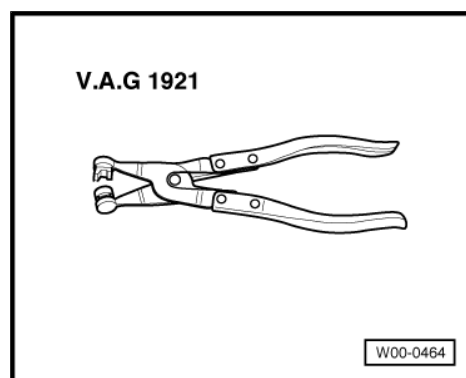


24 - Compression spring**25 - O-ring**☐ Renew**26 - Seal**☐ Renew**27 - To coolant expansion tank**

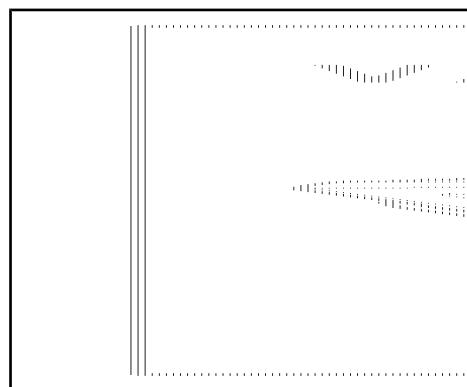
1.6 Removing and installing thermostat

Special tools and workshop equipment required

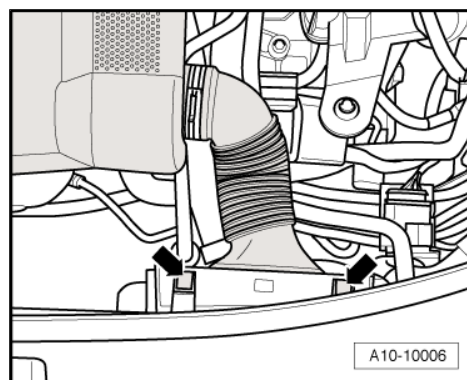
◆ Hose clip pliers -V.A.G 1921-



◆ Drip tray for workshop hoist -VAS 6208-

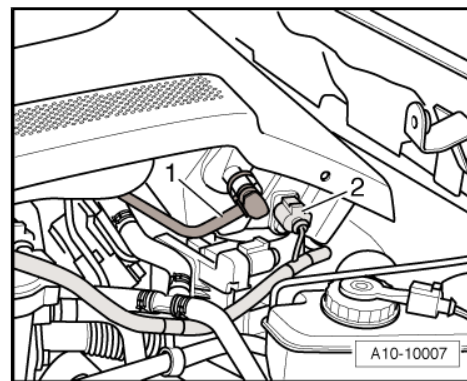
**Removing**

– Unclip air intake hose from air duct -arrows-.



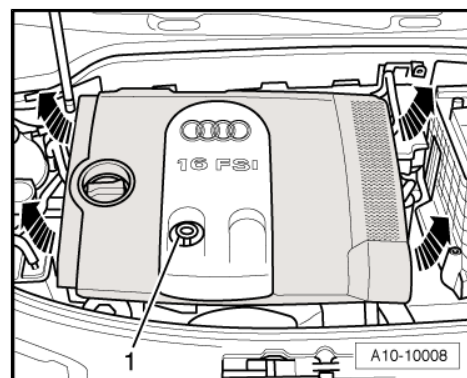
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- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.

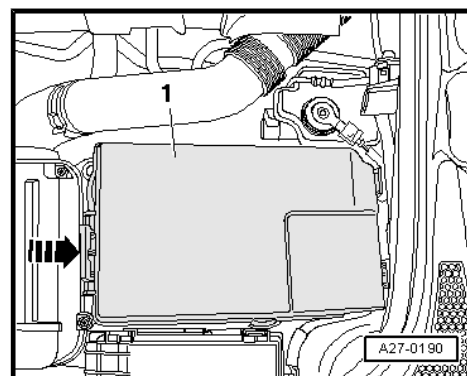


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- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



- Remove cover -1- over battery. To do so, press release tab -arrow-.

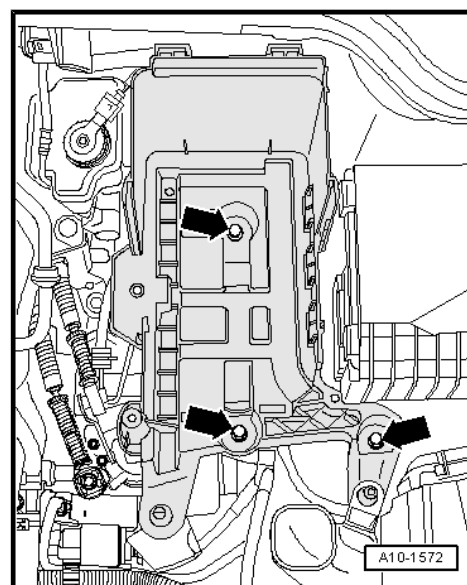


- Remove battery ⇒ Rep. Gr. 27 .
- Remove battery tray -arrows-.

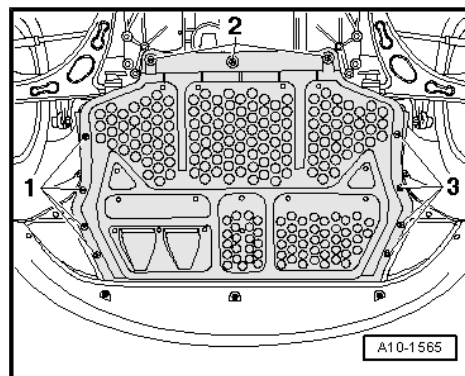
**WARNING**

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.



- Remove centre noise insulation -fasteners 1 ... 3-.



- Place drip tray for workshop hoist -VAS 6208- under engine.

Vehicles with drain plug:

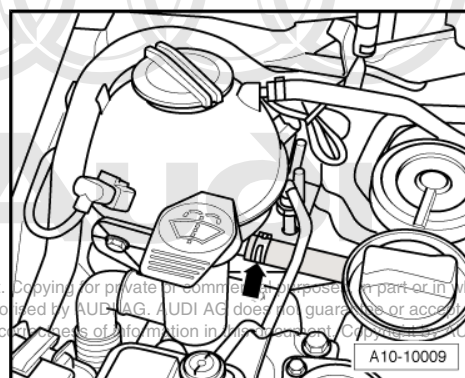
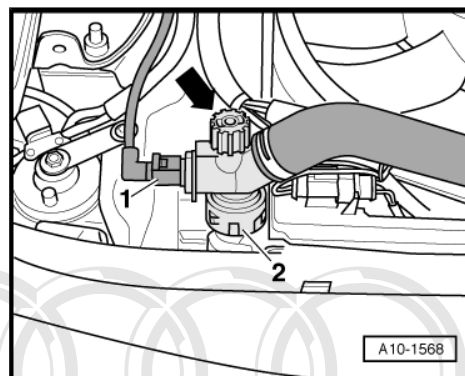
- Turn drain plug -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.

Vehicles without drain plug:

- Remove bottom coolant hose -2- from radiator by pulling off retaining clip.

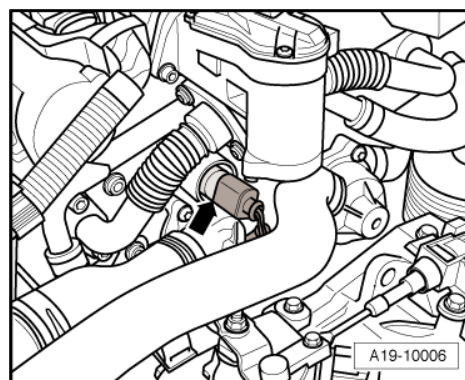
All models:

- Drain off coolant.
- Detach coolant hose -arrow- at coolant expansion tank and guide downwards to drain off remaining coolant.

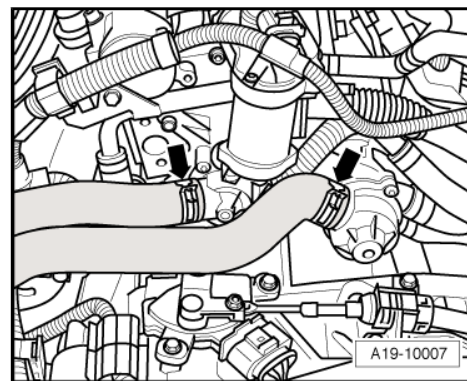


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- Unplug electrical connector -arrow- at coolant temperature sender -G62- .

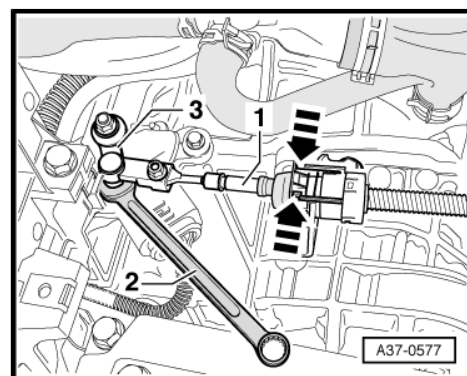


- Remove both coolant hoses from thermostat housing -arrows-.



Vehicles with automatic gearbox:

- Pry off selector lever cable -1- from lever for selector shaft -3- using a 10 mm open-end spanner -item 2-, or similar.
- Press together the retaining tabs on support bracket for selector lever cable -arrows- and pull selector lever cable out of support bracket on gearbox.



All models:

- Unscrew bolts -arrows- and remove corresponding connection.
- Remove springs, plungers and thermostats.

Installing

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



Note

Renew O-rings.

- Clean and smoothen sealing surface for O-ring as required.
- Insert thermostat.
- Installation position: the hole in the thermostat plunger must face upwards.
- Moisten new O-ring with coolant additive "G12+".

Vehicles with automatic gearbox:

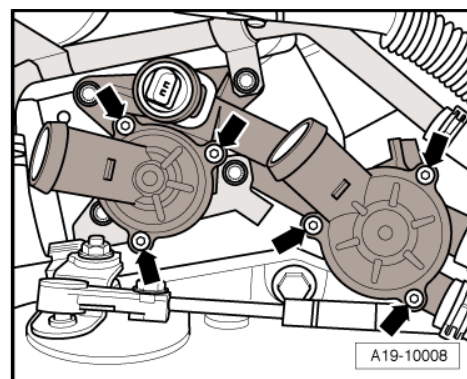
- Install selector lever cable ⇒ Rep. Gr. 37 .

All models:

- Install battery ⇒ Rep. Gr. 27 .
- Fill cooling system ⇒ [page 146](#) .

Tightening torque

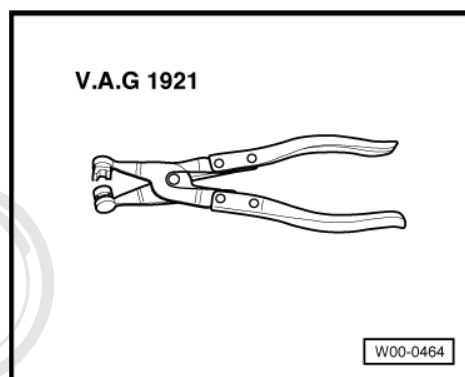
Component	Nm
Connection to thermostat housing	5



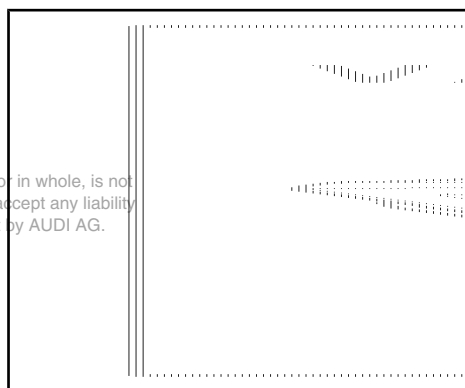
1.7 Removing and installing thermostat housing and coolant pipe

Special tools and workshop equipment required

- ◆ Hose clip pliers -V.A.G 1921-



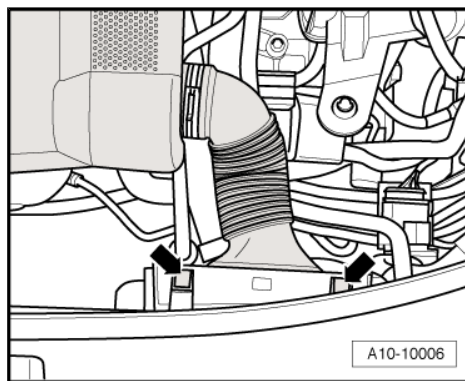
- ◆ Drip tray for workshop hoist -VAS 6208-



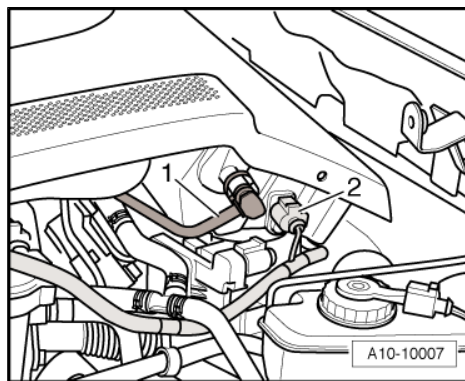
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Removing

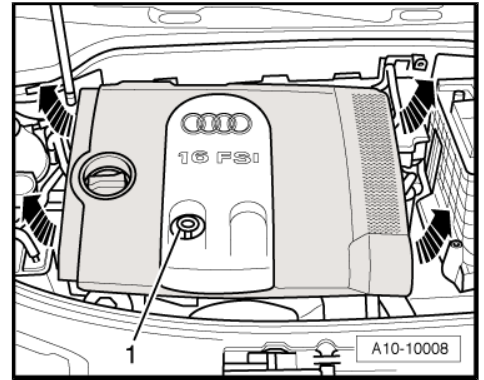
- Unclip air intake hose from air duct -arrows-.



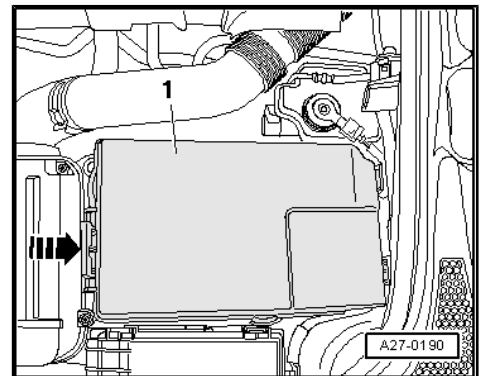
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



- Remove cover -1- over battery. To do so, press release tab -arrow-.

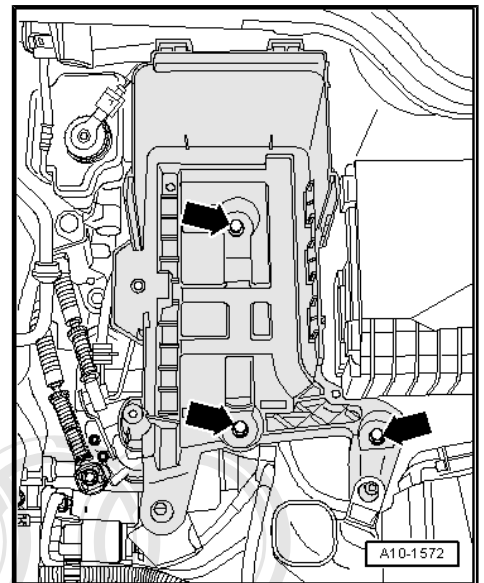


- Remove battery ⇒ Rep. Gr. 27 .
- Remove battery tray -arrows-.

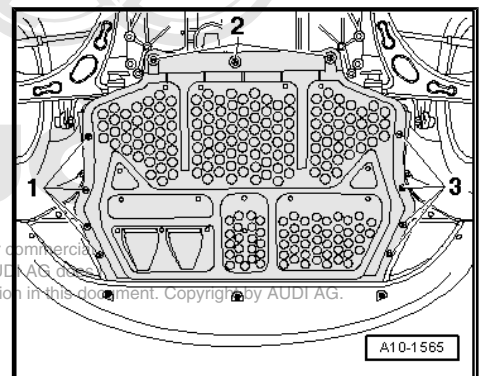
**WARNING**

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.



- Remove centre noise insulation -fasteners 1 ... 3-.



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- Place drip tray for workshop hoist -VAS 6208- under engine.

Vehicles with drain plug:

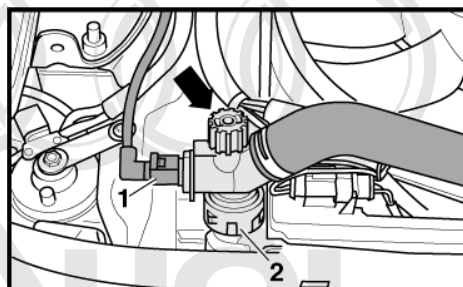
- Turn drain plug -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.

Vehicles without drain plug:

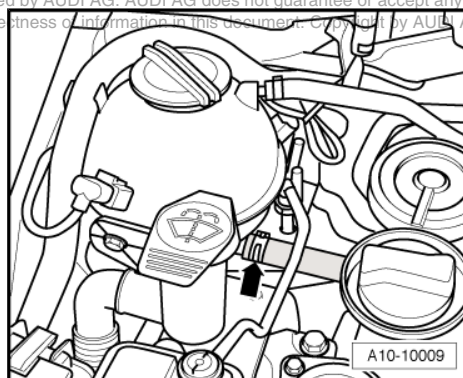
- Remove bottom coolant hose -2- from radiator by pulling off retaining clip.

All models:

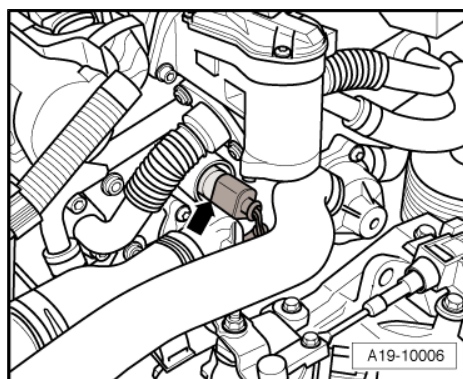
- Drain off coolant.
- Detach coolant hose -arrow- at coolant expansion tank and guide downwards to drain off remaining coolant.
- Unplug electrical connector -arrow- at coolant temperature sender -G62- .
- Remove the coolant hoses from thermostat housing -arrows-.



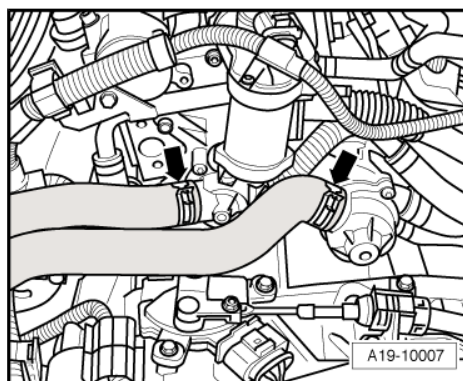
A10-1568



A10-10009

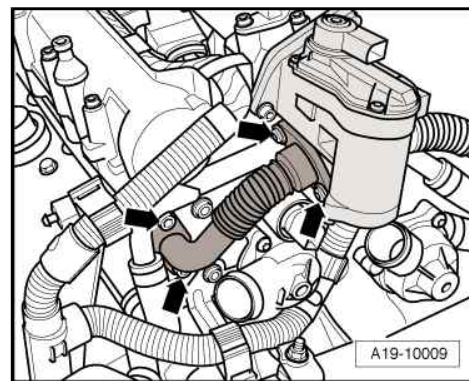


A19-10006



A19-10007

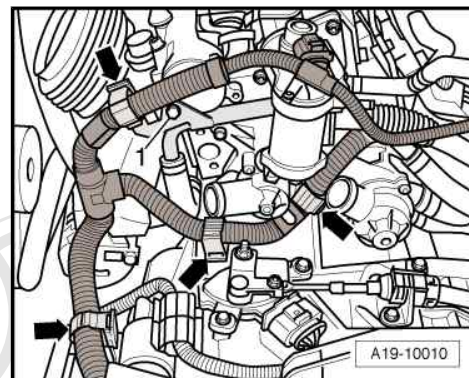
- Remove connecting pipe for exhaust gas recirculation -arrows-.



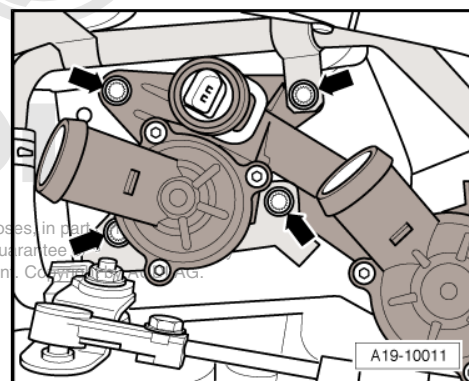
- Unplug electrical connector at oil pressure switch -F1- -arrow-.



- Remove bolt -1-.
- Detach electrical wiring harness from brackets -arrows-.



- Remove bolts -arrows- for thermostat housing.



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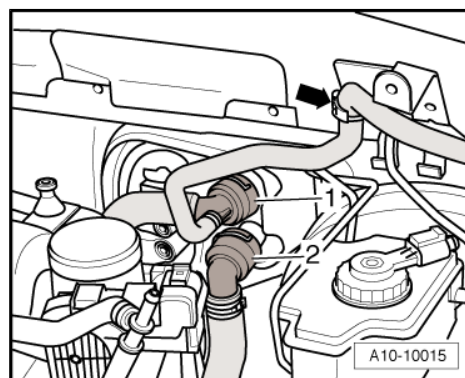
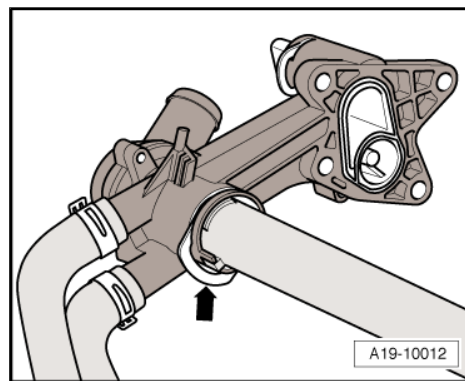
- Remove retaining clip for coolant pipe -arrow-.



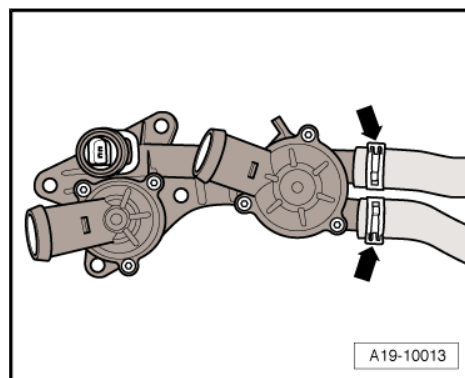
Note

Shown in illustration with thermostat removed.

- Detach thermostat housing from coolant pipe.
- Detach coolant hoses -1- and -2- going to heat exchanger at bulkhead.
- Unclip coolant hose at bracket -arrow-.



- Pull the thermostat housing slightly forwards.
- Mark installation position of coolant hoses at thermostat housing and then detach.



- Detach coolant pipe from cylinder block.

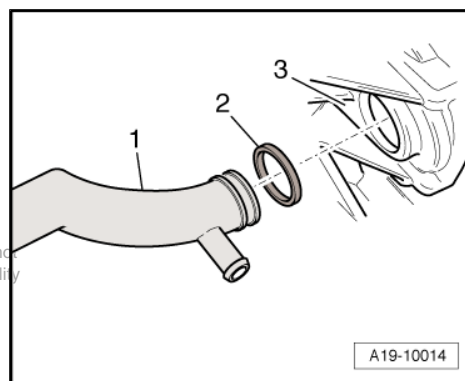
Installing



Note

Renew gaskets, seals and O-rings.

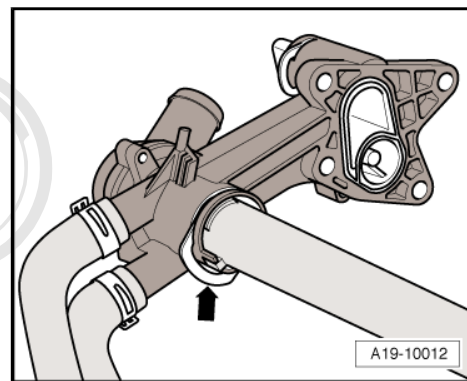
- Clean and smoothen sealing surface for O-ring as required.
- Moisten new O-ring with coolant additive "G12+".
- Attach the coolant hoses to thermostat housing according to the markings made when removing.



- After tightening the thermostat housing, insert coolant pipe into housing as far as the stop and only then insert the retaining clip.
- Check that the coolant pipe is firmly secured in the thermostat housing.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install connecting pipe for exhaust gas recirculation ⇒ [page 196](#).
- Install battery ⇒ Rep. Gr. 27.
- Fill cooling system ⇒ [page 146](#).



Tightening torque

Component	Nm
Thermostat housing to cylinder block	10

1.8 Radiator and radiator fan - exploded view of components

1 - Radiator fan -V7-

- ☐ Removing and installing ⇒ [page 169](#)
- ☐ With radiator fan control unit -J293-

2 - 10 Nm

3 - Coolant hose (bottom)

- ☐ To connection for thermostat

4 - Retaining clip

5 - Radiator fan thermal switch -F18-

6 - O-ring

- ☐ Renew

7 - O-ring

- ☐ Renew if damaged

8 - Coolant hose (top)

- ☐ To hose connection on cylinder head

9 - O-ring

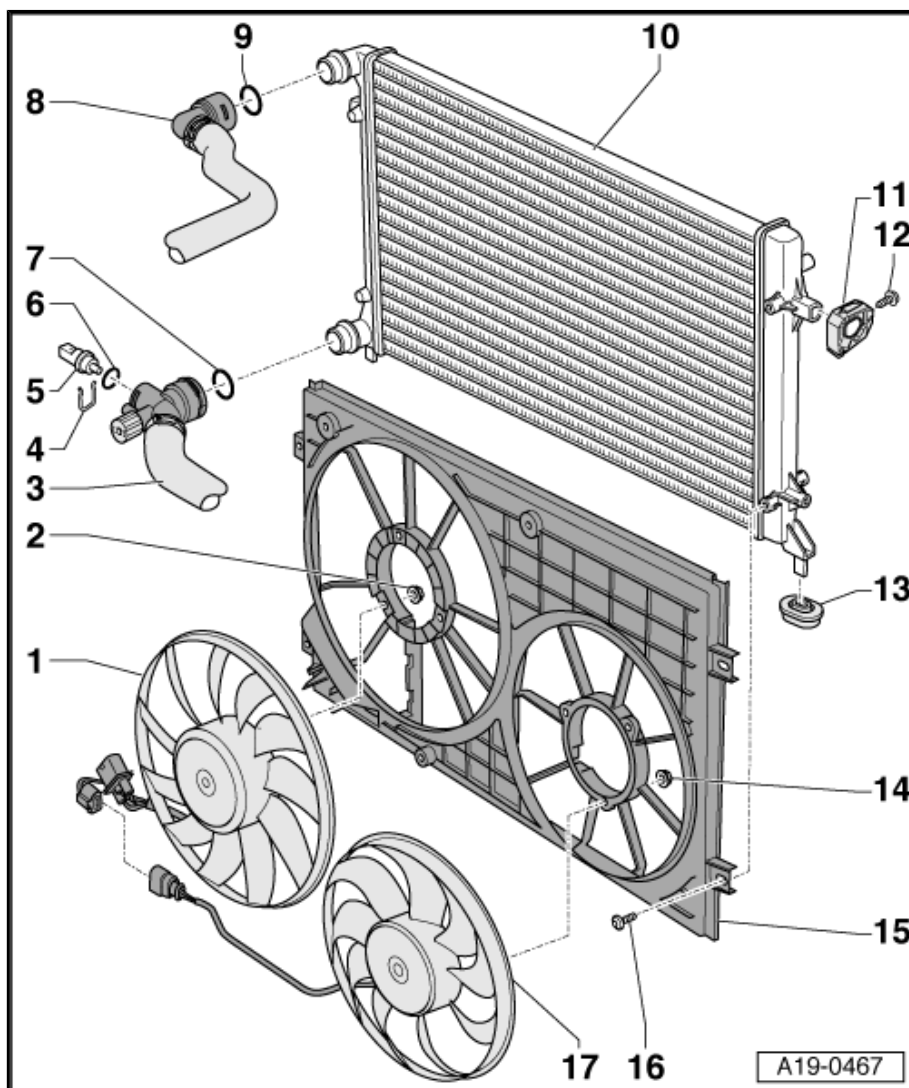
- ☐ Renew if damaged

10 - Radiator

- ☐ Removing and installing ⇒ [page 164](#)
- ☐ If renewed, change coolant in entire system

11 - Bracket

- ☐ For radiator



12 - 5 Nm

13 - Mounting

14 - 10 Nm

15 - Radiator cowl

16 - 5 Nm

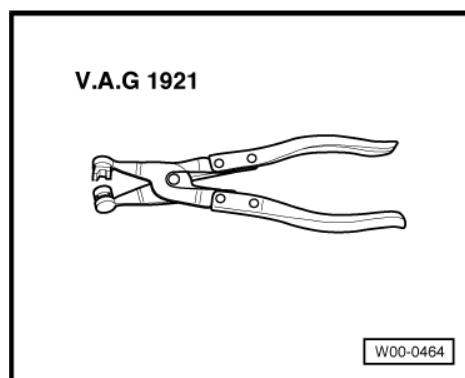
17 - Radiator fan 2 -V177-

- Removing and installing ⇒ [page 169](#)

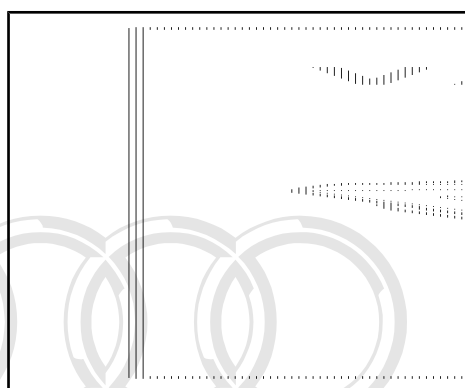
1.9 Removing and installing radiator

Special tools and workshop equipment required

- ◆ Hose clip pliers -V.A.G 1921-



- ◆ Drip tray for workshop hoist -VAS 6208-



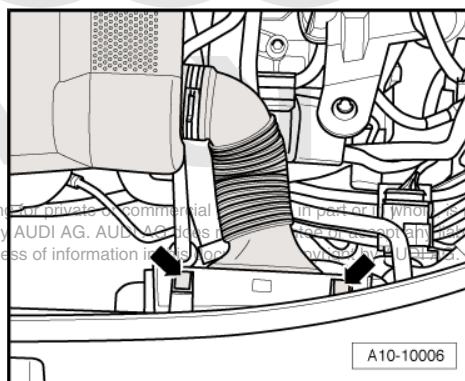
Removing



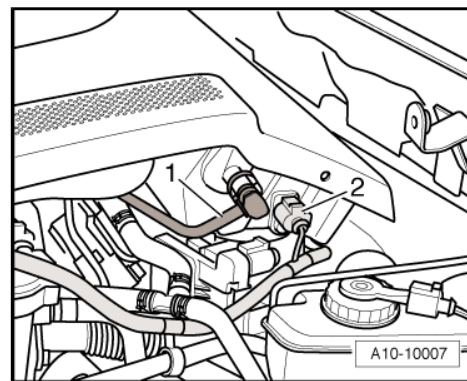
WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

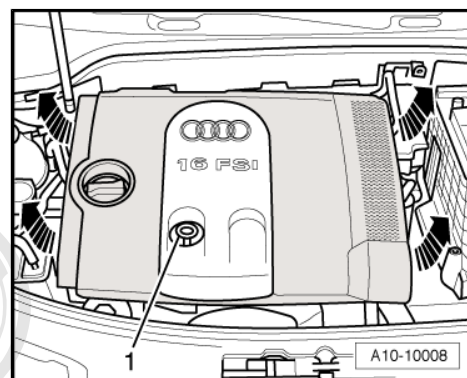
- Open filler cap on coolant expansion tank.
- Unclip air intake hose from air duct -arrows-.



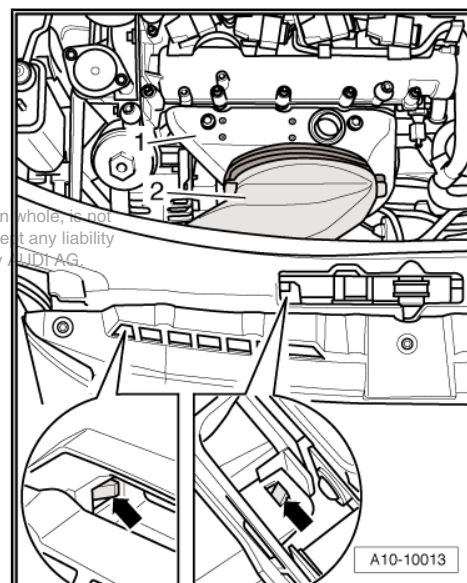
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



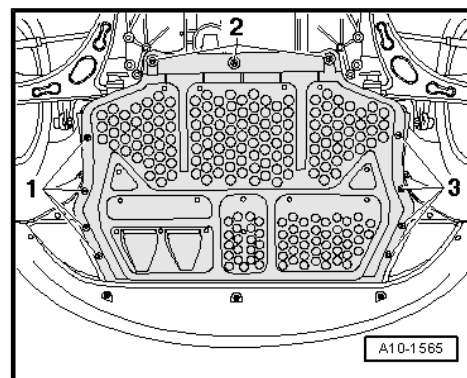
- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



- Remove centre noise insulation -fasteners 1 ... 3-.



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- Place drip tray for workshop hoist -VAS 6208- under engine.

Vehicles with drain plug:

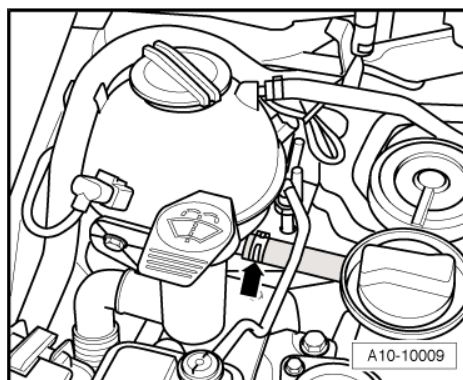
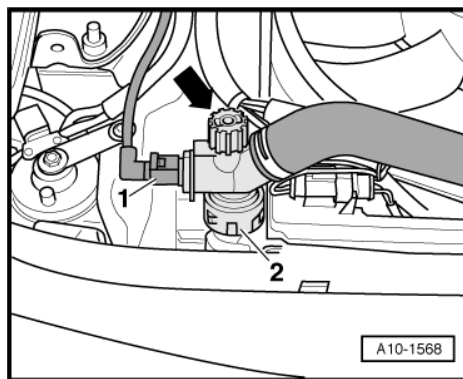
- Turn drain plug -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.

Vehicles without drain plug:

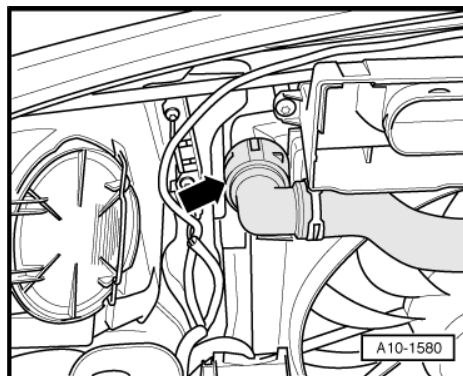
- Remove bottom coolant hose -2- from radiator by pulling off retaining clip.

All models:

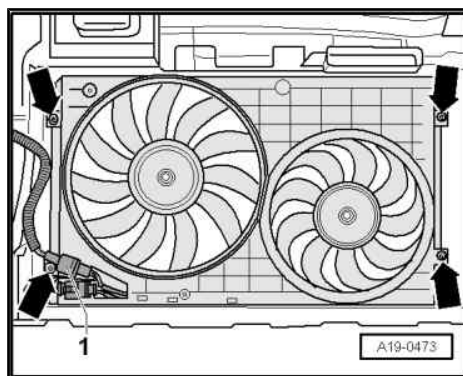
- Drain off coolant.
- Detach coolant hose -arrow- at coolant expansion tank and guide downwards to drain off remaining coolant.
- Remove bumper cover (front) ⇒ Rep. Gr. 63 .



- Detach top coolant hose from radiator -arrow-.



- Detach electrical connector -1-.
- Unscrew the bolts -arrows- and remove radiator cowl from below.
- Remove the left and right-hand air ducts from the radiator.



WARNING

The air conditioner refrigerant circuit must not be opened.

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**Note**

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

- Unscrew securing bolts -2- for the condenser.
- Remove bolts -1- at radiator.
- Swivel radiator slightly towards rear.
- Detach radiator upwards and take it out from below.

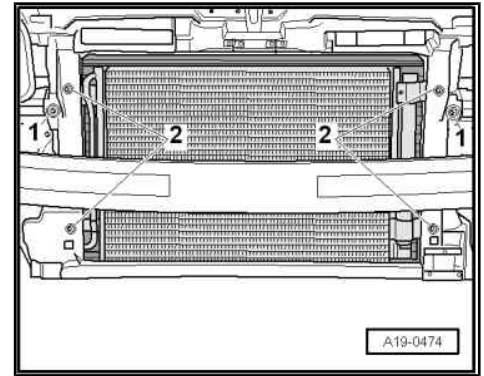
Installing

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

- Install bumper cover (front) ⇒ Rep. Gr. 63 .
- Fill cooling system ⇒ [page 146](#) .

Tightening torques

Component	Nm
Radiator to bracket	10
Condenser to radiator	10
Radiator cowl to radiator	10



1.10 Checking cooling system for leaks



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Special tools and workshop equipment required

- ◆ Cooling system tester - V.A.G 1274-
- ◆ Adapter for cooling system tester -V.A.G 1274/8-
- ◆ Adapter for cooling system tester -V.A.G 1274/9-

V.A.G 1274 	V.A.G 1274/8 
V.A.G 1274/9 	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
	G19-0002

Test condition

- Engine must be warm.

Test sequence



WARNING

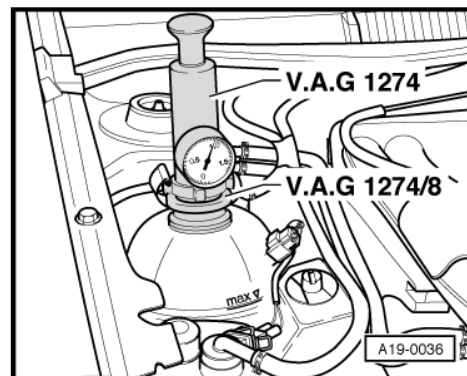
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.

- Attach cooling system tester -V.A.G 1274- with adapter - V.A.G 1274/8- to expansion tank.
- Use hand pump on cooling system tester -V.A.G 1274- to create a pressure of approx. 1.0 bar.

If the pressure drops:

- Trace leak and repair.

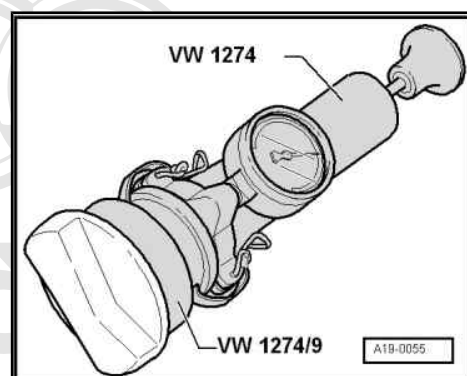


Checking pressure relief valve in filler cap

- Attach cooling system tester -V.A.G 1274- with adapter - V.A.G 1274/9- to filler cap.
- Operate hand pump.
- The pressure relief valve should open at pressure of 1.4 ... 1.6 bar.

If the relief valve does not open as described:

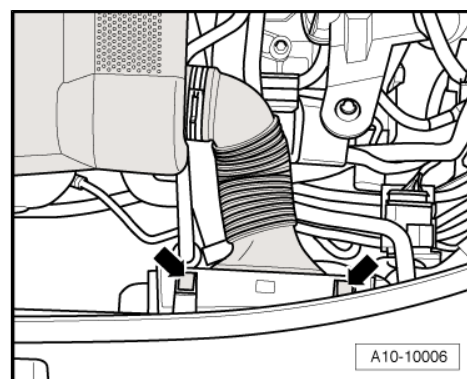
- Renew filler cap.



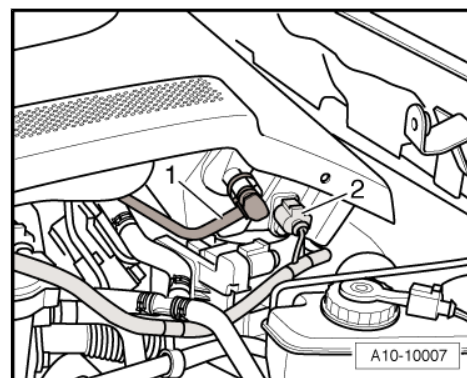
1.11 Removing and installing radiator fan - V7- and radiator fan 2 -V177-

Removing

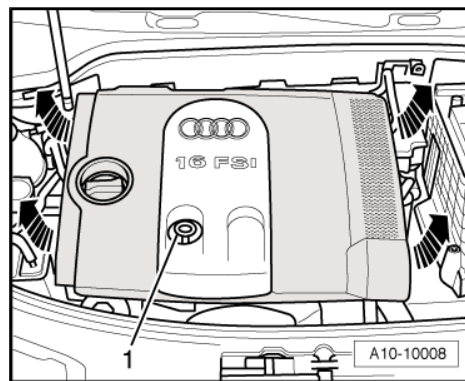
- Unclip air intake hose from air duct -arrows-.



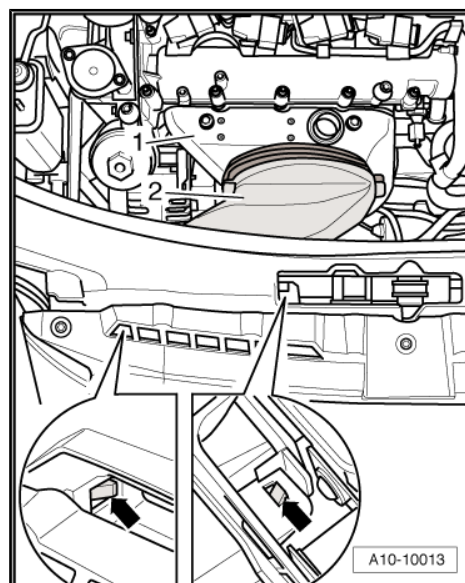
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



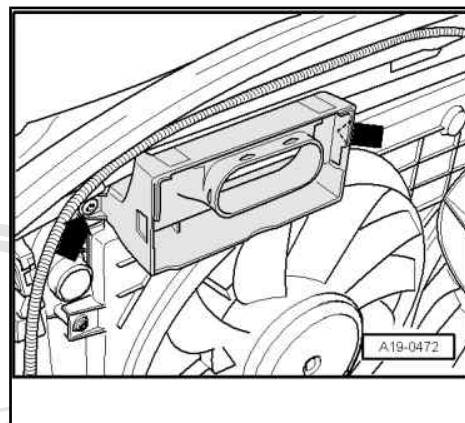
- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



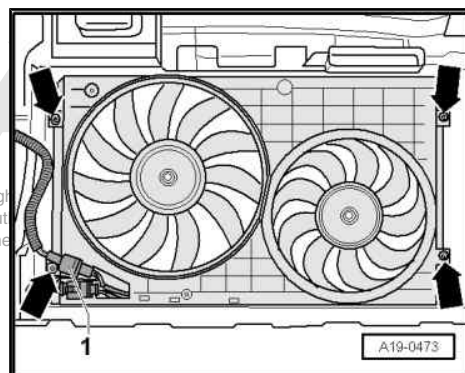
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



- Unscrew air duct at lock carrier -arrows-.



- Detach electrical connectors -1- for radiator fans at bottom of radiator cowl.
- Unscrew bolts -arrows-.
- Remove the radiator cowl with both fans from below.



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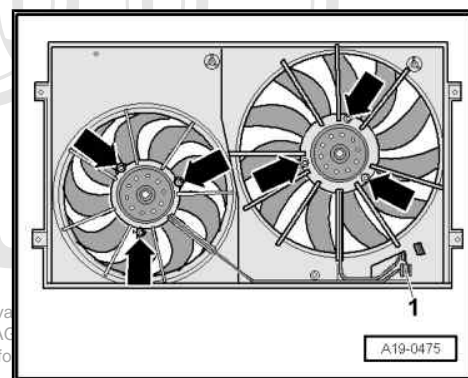
- Detach electrical connector -1-.
- Move wiring clear.
- Unscrew nuts -arrows- and remove fans.

Installing

Install in reverse order.

Tightening torques

Component	Nm
Radiator fan to radiator cowl	10
Radiator cowl to radiator	10



26 – Exhaust system

1 Removing and installing parts of exhaust system - vehicles with engine code letters BAG



Note

- ◆ *Renew 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 clamp and align silencers and exhaust pipe so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.*
- ◆ *To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.*

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1.1 Exhaust system - exploded view of components

1 - Hot air collector plate

2 - 10 Nm

3 - Exhaust manifold

- Removing and installing
⇒ [page 179](#)

4 - Gasket

- Renew

5 - 25 Nm

- Renew

6 - 40 Nm

- Renew

7 - Washer

8 - Bracket

9 - 60 Nm

10 - 25 Nm

11 - Mounting

12 - 22 Nm

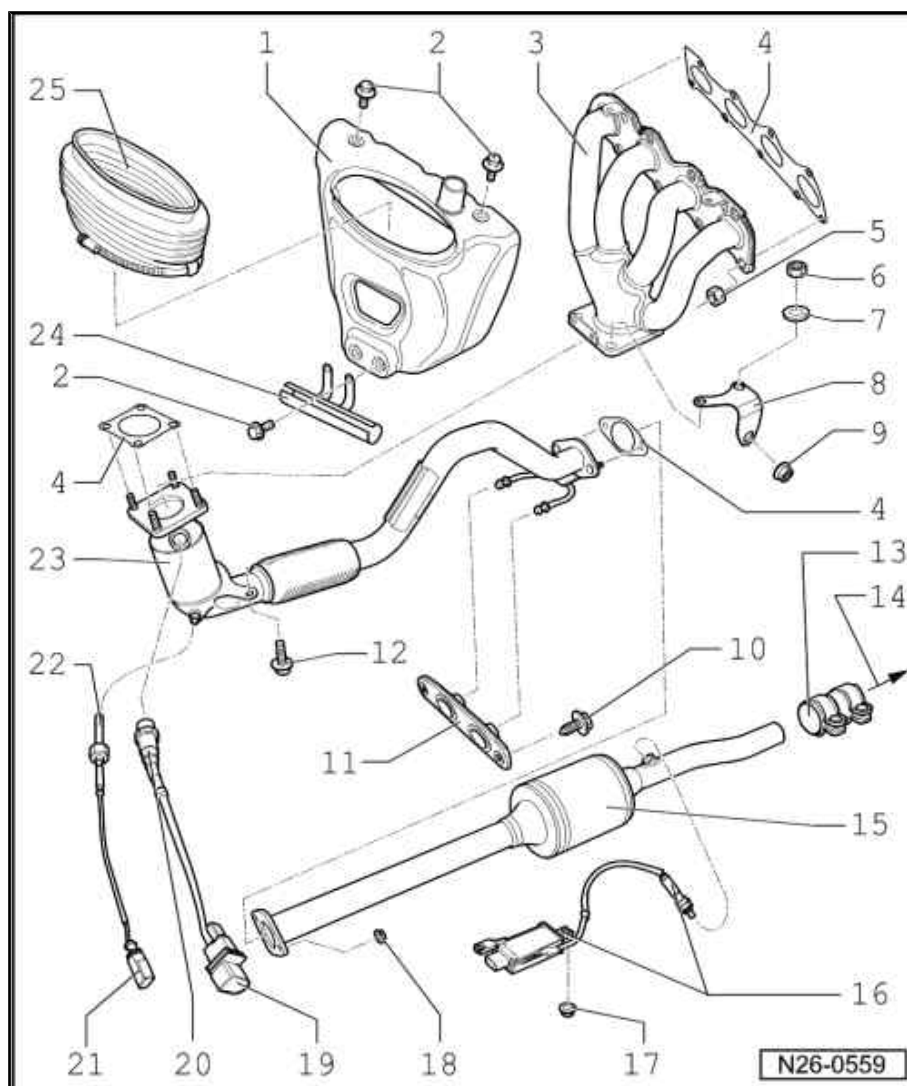
13 - Clamp

- Installation position
⇒ [page 173](#)
- Tighten screw connections evenly to 23 Nm

14 - To front silencer

15 - Exhaust pipe with main catalytic converter

- Protect against knocks and impact



16 - NOx sensor control unit -J583- with NOx sender -G295-

- ☐ Installation position: on vehicle underbody
- ☐ Remove and install using ring spanner for Lambda probe -3337-
- ☐ The threads are already greased with assembly paste; the paste must not get into the slots on the probe body
- ☐ When re-using the old part, grease thread with high-temperature paste; the paste must not come into contact with the probe body. High-temperature paste ⇒ Parts catalogue
- ☐ Tighten to 55 Nm

17 - Nut**18 - 25 Nm****19 - 6-pin electrical connector**

- ☐ Black
- ☐ For Lambda probe -G39- and Lambda probe heater -Z19-

20 - Lambda probe -G39-

- ☐ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ☐ When re-using the old sender, grease thread with high-temperature paste; the paste must not come into contact with the probe body. High-temperature paste ⇒ Parts catalogue
- ☐ Remove and install using ring spanner for Lambda probe -3337-
- ☐ Tighten to 55 Nm

21 - 2-pin electrical connector

- ☐ Black
- ☐ For exhaust gas temperature sender 1 -G235-

22 - Exhaust gas temperature sender 1 -G235-

- ☐ Tighten to 45 Nm

23 - Front exhaust pipe with starter catalytic converter

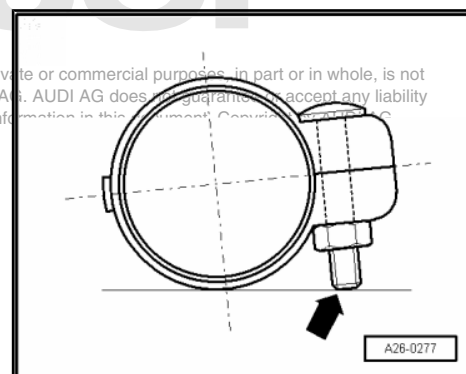
- ☐ Removing and installing ⇒ [page 174](#)
- ☐ Protect against knocks and impact

24 - Cable guide

- ☐ For alternator cable

25 - Boot**Installation position of clamp**

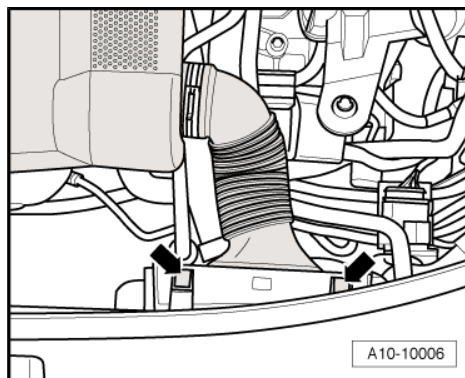
- When fitting clamp, make sure ends of bolts do not project below bottom of clamp -arrow-.
- Bolt connection faces to right.



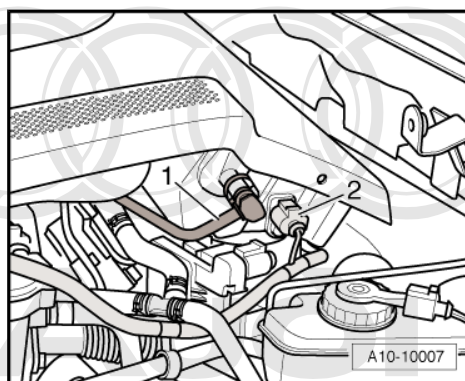
1.2 Removing and installing front exhaust pipe with starter catalytic converter

Removing

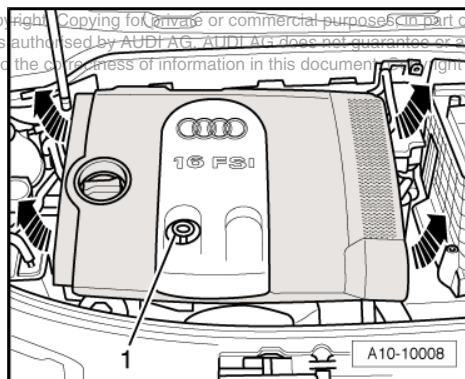
- Unclip air intake hose from air duct -arrows-.



- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.

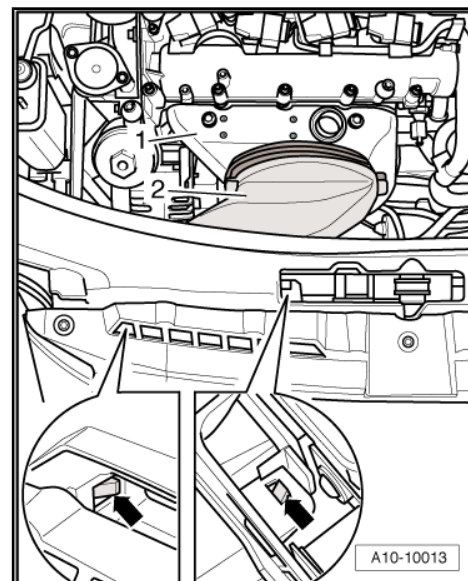


- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.

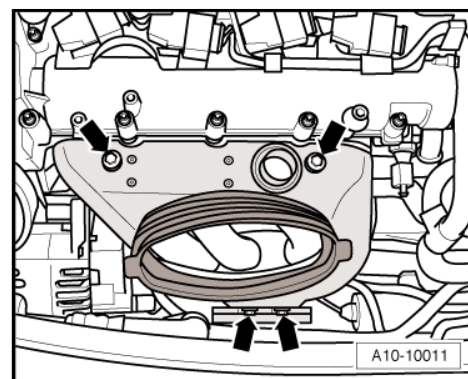


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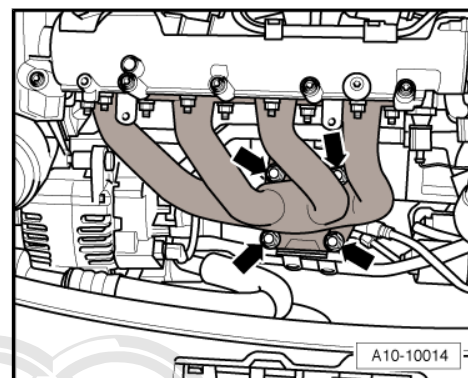
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



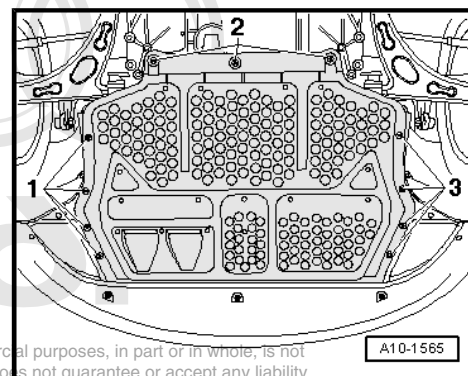
- Unbolt hot air collector plate -arrows-.



- Unbolt front exhaust pipe from exhaust manifold -arrows-.



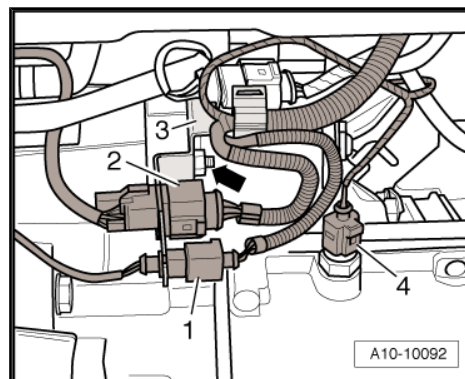
- Remove centre noise insulation -fasteners 1 ... 3-.



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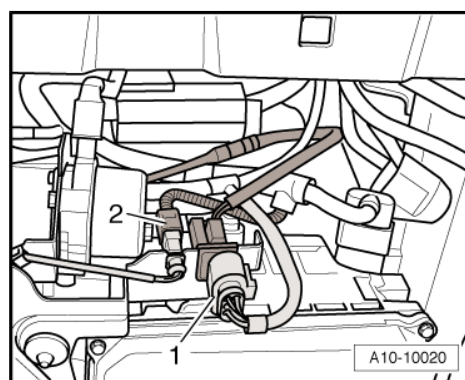
Vehicles with manual gearbox:

- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Unplug electrical connector -4- for reversing light switch -F4- .
- Move engine wiring harness at bracket -3- clear.
- Unscrew nut -arrow- and remove bracket with wiring from stud.



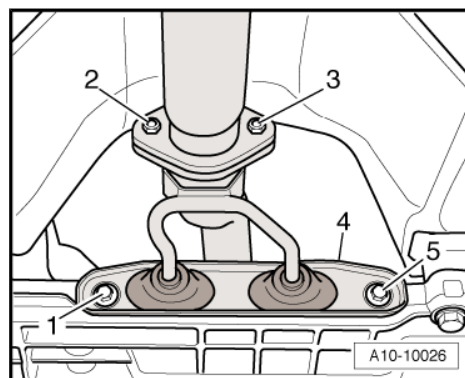
Vehicles with automatic gearbox:

- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Remove all electrical connectors from the bracket.



All models:

- Remove nuts -2- and -3- at exhaust pipe flange.
- Separate exhaust system at flange.
- Remove bolts -1- and -5-.
- Pull off bracket -4- for exhaust system from pins on front exhaust pipe.



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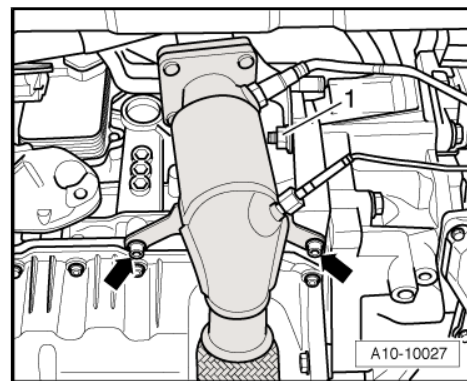
 Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.

- Unscrew bolts -arrows-.
- Swing front exhaust pipe forwards and remove.

 Note

Disregard -item 1-.



Installing

Install in reverse order.

Tightening torques

Component	Nm
Front exhaust pipe to cylinder block	22
Front exhaust pipe to main catalytic converter	25 ¹⁾
Front exhaust pipe to exhaust manifold	40 ¹⁾
Bracket for exhaust system to subframe	25
Hot air collector plate to exhaust manifold	10
• ¹⁾ Renew bolts/nuts.	

1.3 Centre and rear silencers - exploded view of components



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1 - Rubber mounting

- ☐ Renew if damaged

2 - 25 Nm

3 - Bracket

- ☐ Note installation position

4 - Centre silencer

- ☐ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point
⇒ [page 179](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 182](#)

5 - 25 Nm

6 - Bracket

- ☐ Note installation position

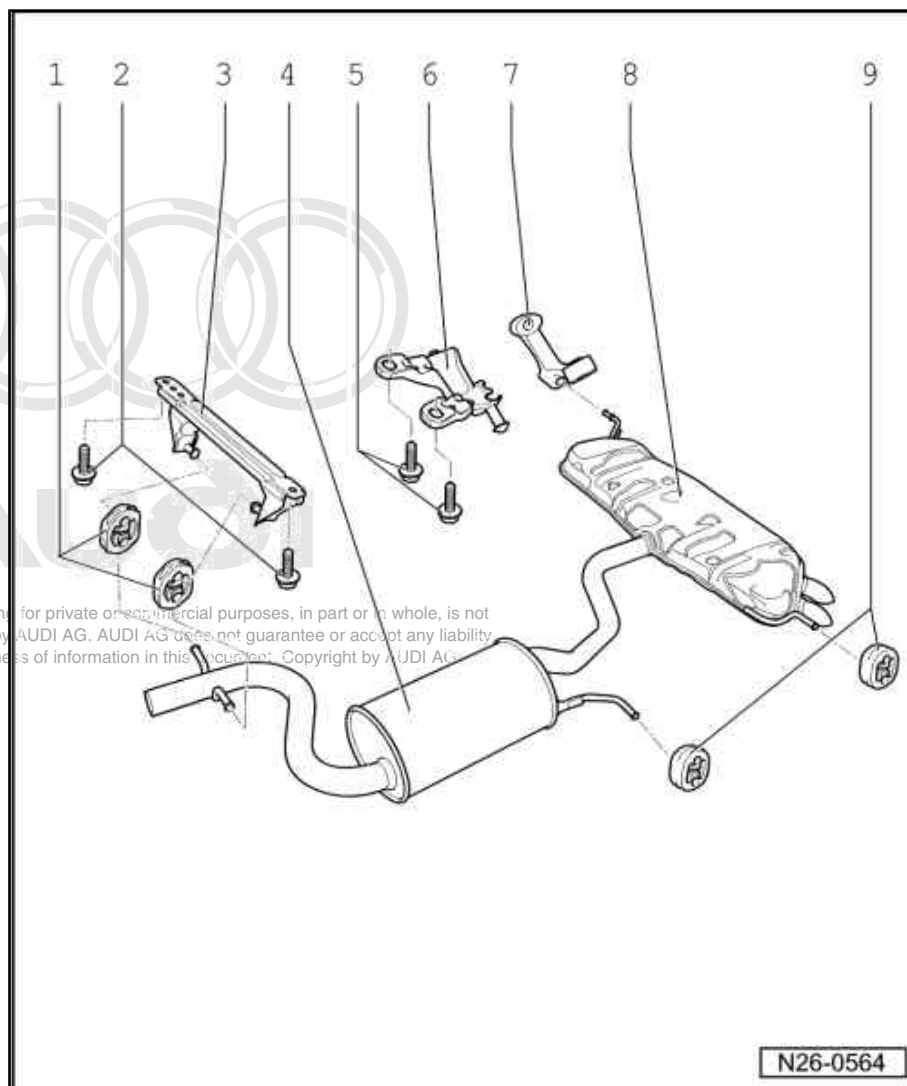
7 - Mounting

8 - Rear silencer

- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point
⇒ [page 179](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 182](#)

9 - Rubber mounting

- ☐ Renew if damaged

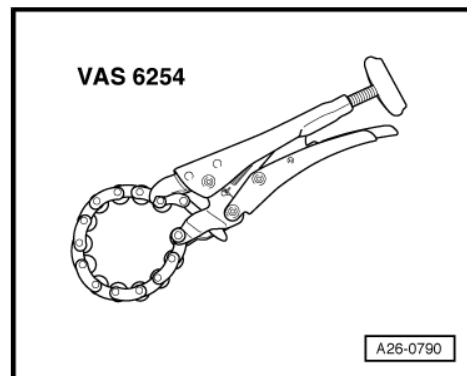
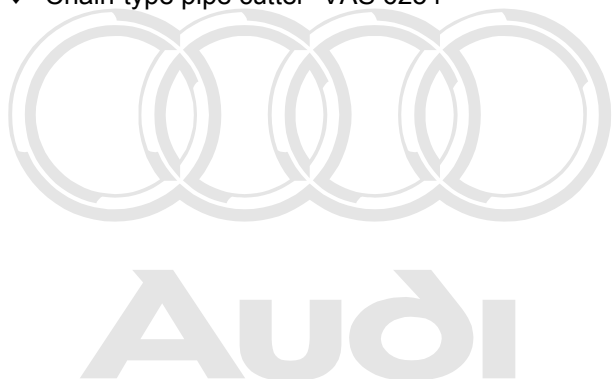


1.4 Separating centre and rear silencers

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

Special tools and workshop equipment required

◆ Chain-type pipe cutter -VAS 6254-

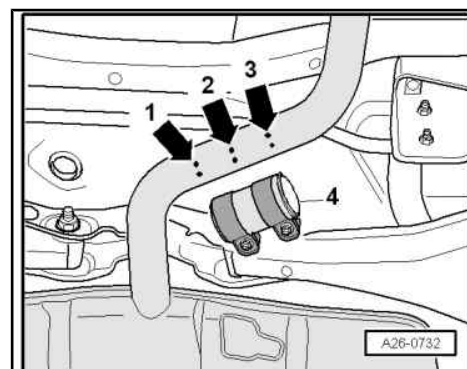


Procedure

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– Cut through exhaust pipe at a right angle at cutting point -arrow 2- using chain-type pipe cutter -VAS 6254-.

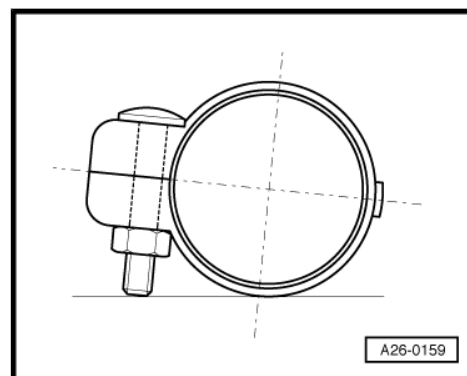
– When installing, position clamp -4- at the marks -1- and -3-.



– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

• Bolt connection faces to rear

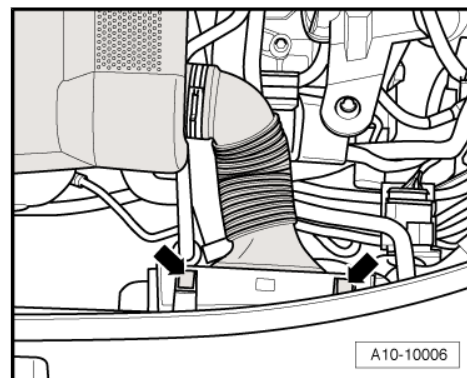
– Align exhaust system so it is free of stress ⇒ [page 182](#).



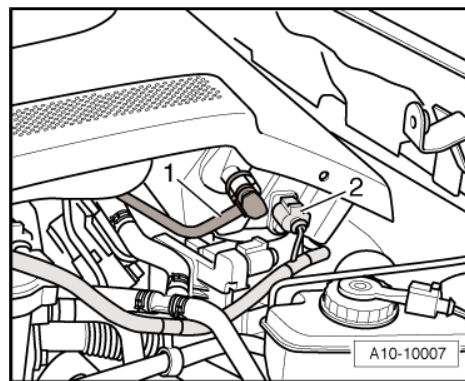
1.5 Removing and installing exhaust manifold

Removing

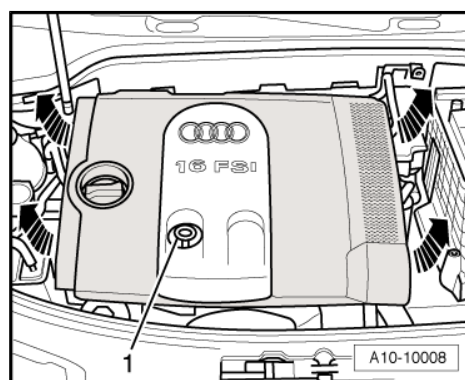
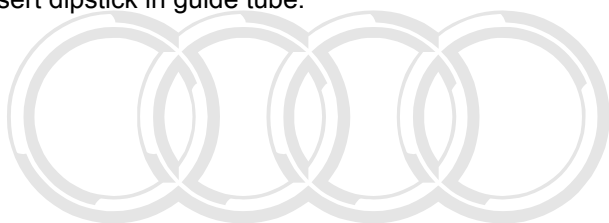
– Unclip air intake hose from air duct -arrows-.



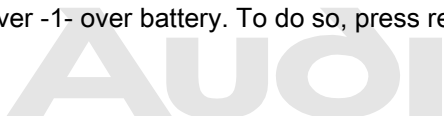
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



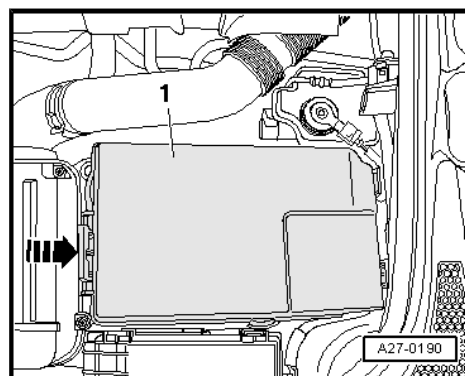
- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



- Remove cover -1- over battery. To do so, press release tab -arrow-.



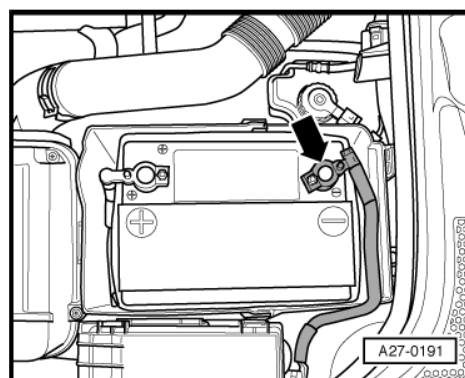
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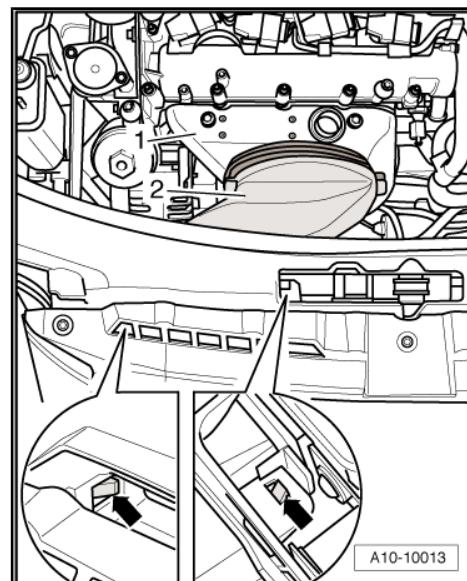
Caution

Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .

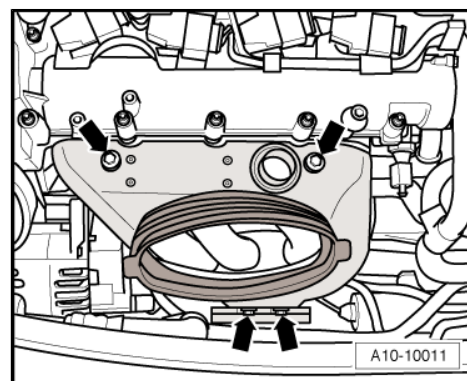
- With ignition switched off, disconnect battery earth cable -arrow-.



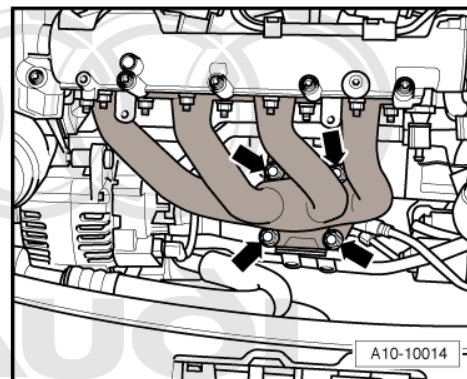
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



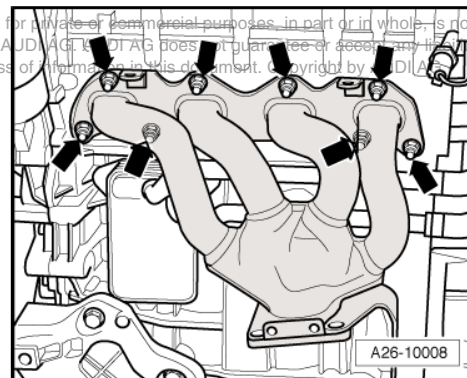
- Unbolt hot air collector plate -arrows-.



- Unbolt front exhaust pipe from exhaust manifold -arrows-.

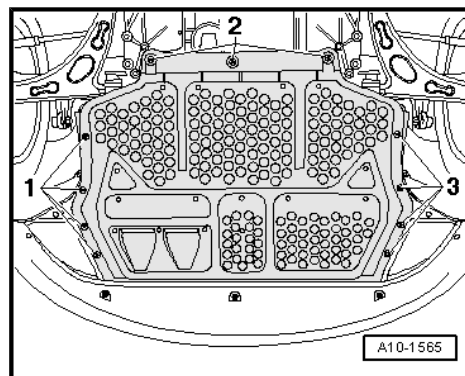


- Unbolt exhaust manifold from cylinder head -arrows-.



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- Remove centre noise insulation -fasteners 1 ... 3-.



- Unscrew bolts -arrows- approx. 15 mm.
- Unscrew nut -1- and detach bracket for exhaust manifold.
- Detach exhaust manifold and gasket upwards.

Installing

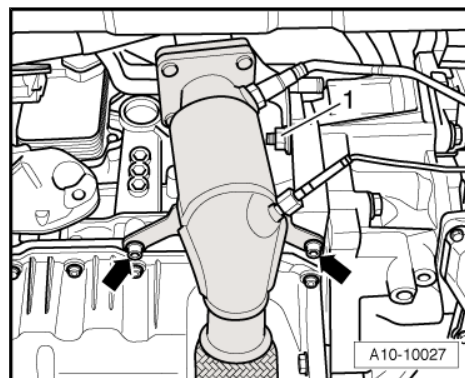
Installation is carried out in the reverse order; note the following:



Note

Renew gaskets and self-locking nuts.

- Observe notes on procedure for connecting the battery ⇒ Rep. Gr. 27 .



Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25 ¹⁾
Hot air collector plate to exhaust manifold	10
Front exhaust pipe to exhaust manifold	40 ¹⁾
Front exhaust pipe to cylinder block	22
Bracket for exhaust manifold to cylinder block	60
• ¹⁾ Renew self-locking nuts.	

1.6 Stress-free alignment of exhaust system

Procedure

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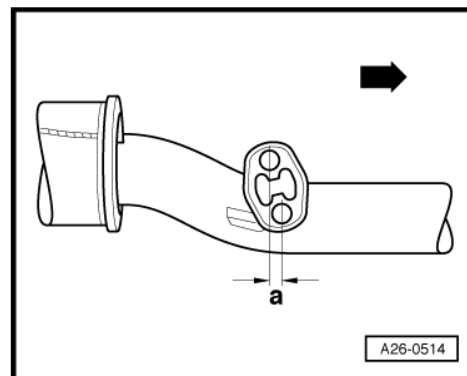


Note

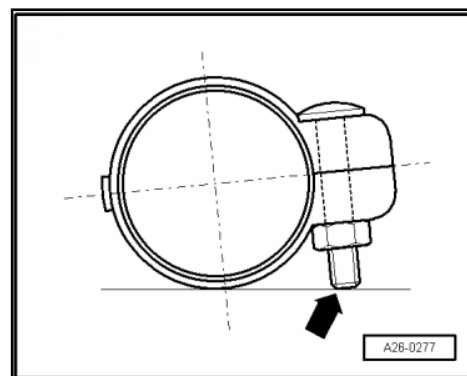
The exhaust system must be aligned when it is cool.

- Loosen bolts of clamp ⇒ [Item 13 \(page 172\)](#) .

- Push rear section of exhaust system towards front of vehicle -arrow-, so that rear rubber mounting for centre silencer is preloaded by -a- = 13 ... 17 mm.

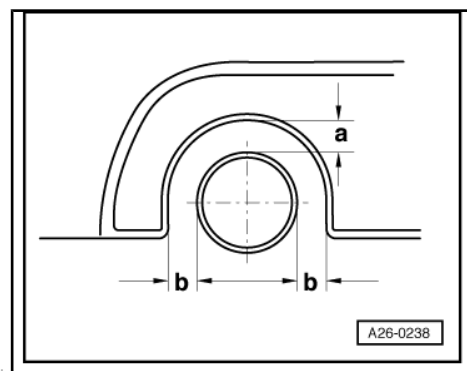


- When fitting clamp, make sure ends of bolts do not project below bottom of clamp -arrow-.
- Bolt connection faces to right.
- Tighten bolts on clamp evenly to 23 Nm.
- Align tailpipe.



Tailpipe alignment

- Align rear silencer so that distances -a- and -b- between bumper cut-out and tailpipe are equal.
- Loosen the mounting of the rear silencer to align the tailpipe if necessary.



1.7 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug the tailpipe (e. g. with rags or stopper) and leave plugged until the check is complete.
- Listen for noise at connection points (cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe, etc.) to locate any leaks.
- Rectify any leaks that are found.

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2 Removing and installing parts of exhaust system - vehicles with engine code letters BLF, BLP

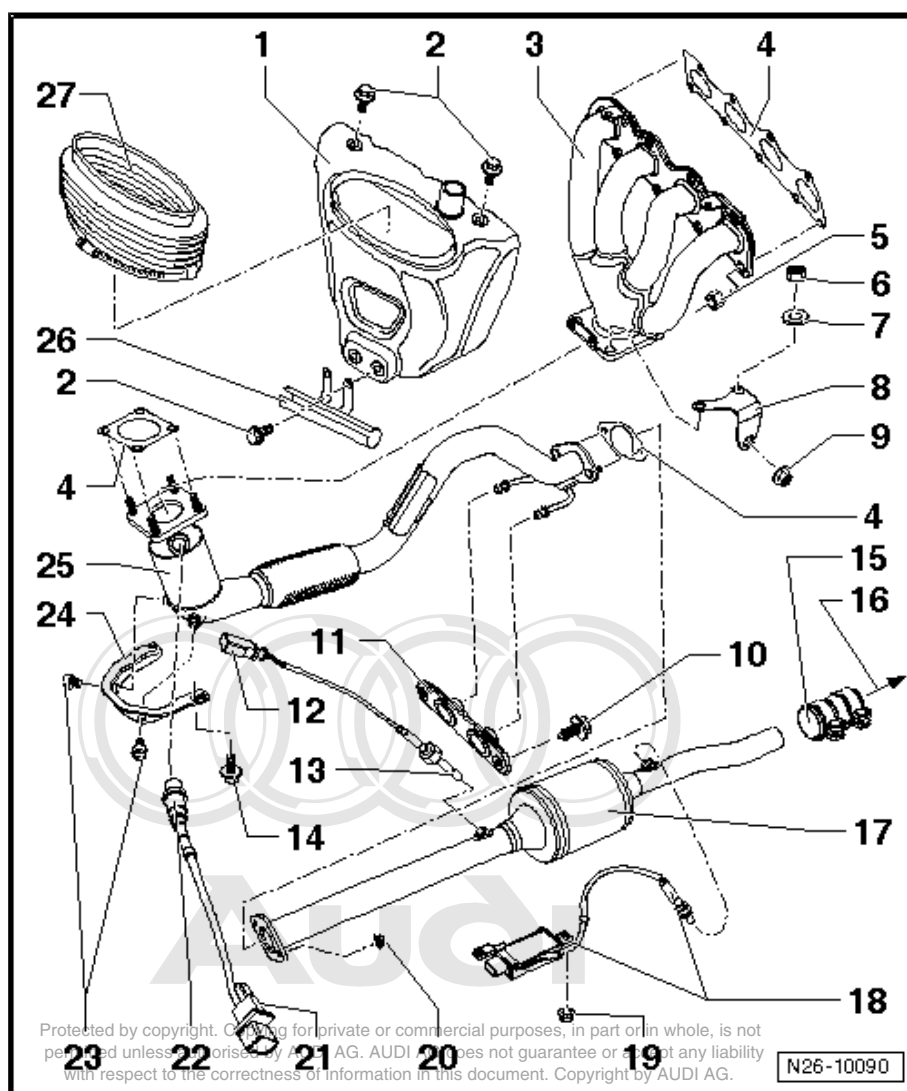


Note

- ◆ Renew 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 clamp and align silencers and exhaust pipe so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.
- ◆ To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.

2.1 Exhaust system - exploded view of components

- 1 - Hot air collector plate
- 2 - 10 Nm
- 3 - Exhaust manifold
 - ☐ Removing and installing
⇒ [page 191](#)
- 4 - Gasket
 - ☐ Renew
- 5 - 25 Nm
 - ☐ Renew
- 6 - 40 Nm
 - ☐ Renew
- 7 - Washer
- 8 - Bracket
- 9 - 60 Nm
- 10 - 25 Nm
- 11 - Mounting
- 12 - 2-pin electrical connector
 - ☐ Black
 - ☐ For exhaust gas temperature sender 1 - G235-
- 13 - Exhaust gas temperature sender 1 - G235-
 - ☐ Tighten to 45 Nm
- 14 - 23 Nm
- 15 - Clamp
 - ☐ Installation position
⇒ [page 185](#)



16 - To front silencer**17 - Exhaust pipe with main catalytic converter**

- ☐ Protect against knocks and impact

18 - Engines with code letters BLF: NOx sensor control unit -J583- with NOx sender -G295- ; engines with code letters BLP: Lambda probe after catalytic converter -G130-

- ☐ Installation position: on vehicle underbody
- ☐ Remove and install using ring spanner for Lambda probe -3337-
- ☐ The threads are already greased with assembly paste; the paste must not get into the slots on the probe body
- ☐ When re-using the old part, grease thread with high-temperature paste; the paste must not come into contact with the probe body. High-temperature paste ⇒ Parts catalogue
- ☐ Tighten to 55 Nm

19 - Nut**20 - 25 Nm****21 - 6-pin electrical connector**

- ☐ Black
- ☐ For Lambda probe -G39- and Lambda probe heater -Z19-

22 - Lambda probe -G39-

- ☐ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ☐ When re-using the old sender, grease thread with high-temperature paste; the paste must not come into contact with the probe body. High-temperature paste ⇒ Parts catalogue
- ☐ Remove and install using ring spanner for Lambda probe -3337-
- ☐ Tighten to 55 Nm

23 - 40 Nm**24 - Bracket****25 - Front exhaust pipe with starter catalytic converter**

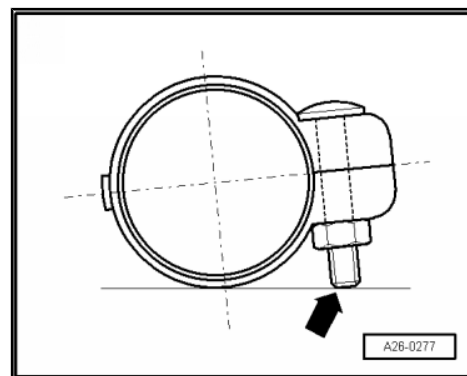
- ☐ Removing and installing ⇒ [page 186](#)
- ☐ Protect against knocks and impact

26 - Cable guide

- ☐ For alternator cable

27 - Boot**Installation position of clamp**

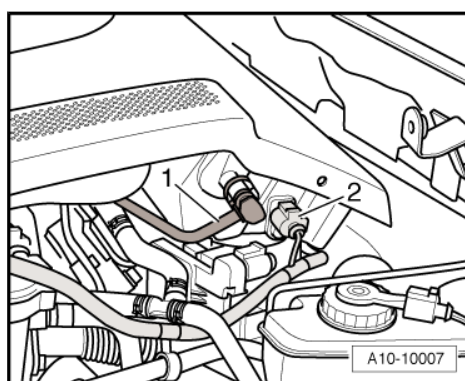
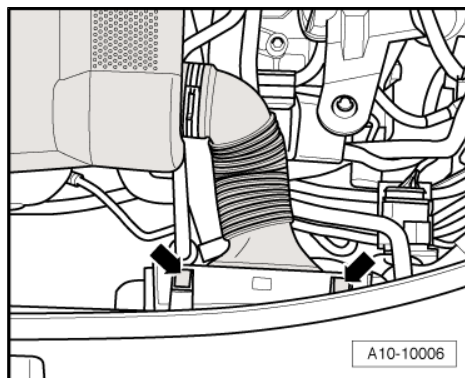
- When fitting clamp, make sure ends of bolts do not project below bottom of clamp -arrow-.
- Bolt connection faces to right.



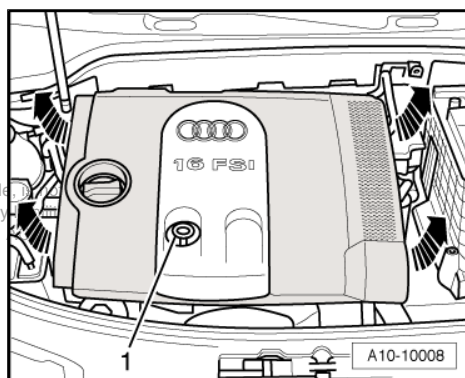
2.2 Removing and installing front exhaust pipe with starter catalytic converter

Removing

- Unclip air intake hose from air duct -arrows-.
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.

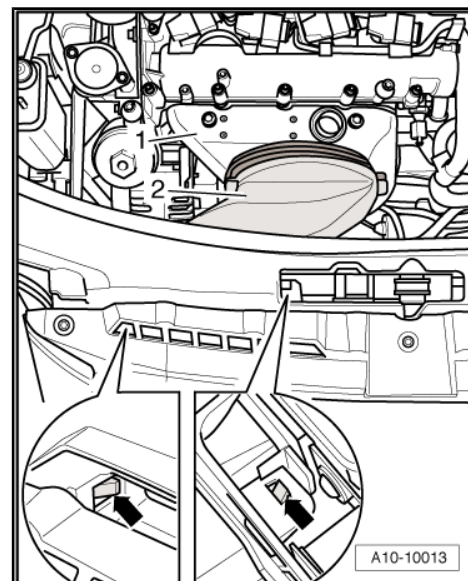


- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.

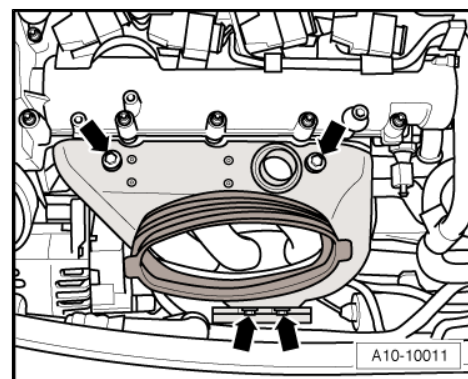


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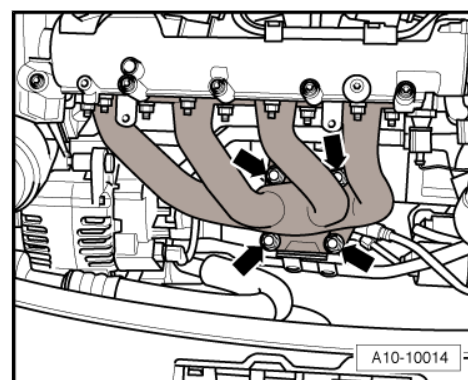
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



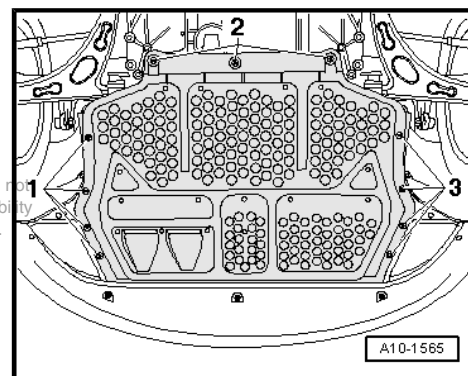
- Unbolt hot air collector plate -arrows-.



- Unbolt front exhaust pipe from exhaust manifold -arrows-.



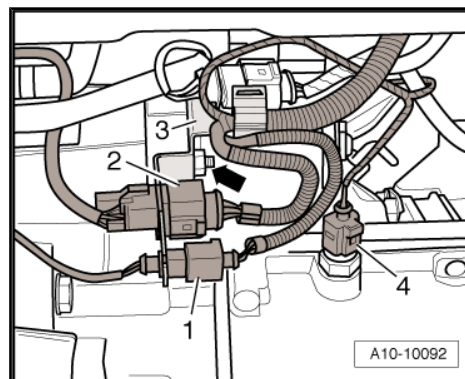
- Remove centre noise insulation -fasteners 1 ... 3-.



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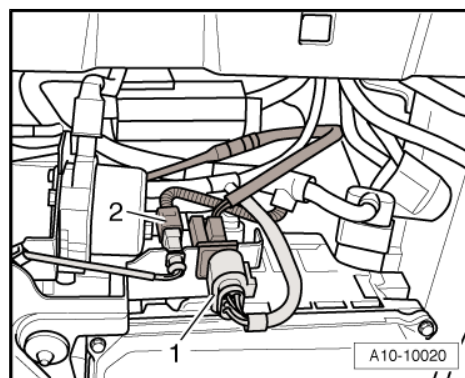
Vehicles with manual gearbox:

- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Unplug electrical connector -4- for reversing light switch -F4- .
- Move engine wiring harness at bracket -3- clear.
- Unscrew nut -arrow- and remove bracket with wiring from stud.



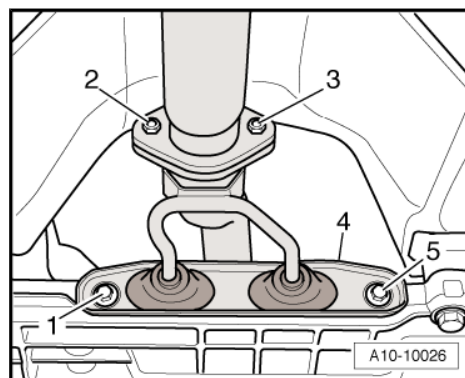
Vehicles with automatic gearbox:

- Unplug electrical connector -2- for Lambda probe -G39- .
- Unplug electrical connector -1- for exhaust gas temperature sender 1 -G235- (if fitted).
- Remove all electrical connectors from the bracket.

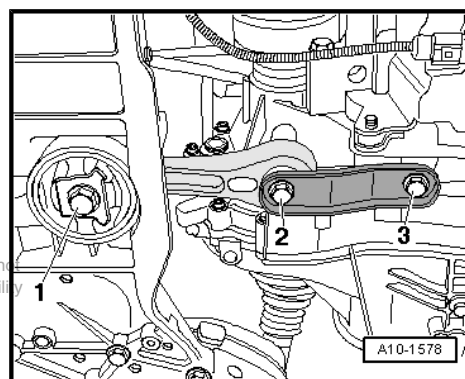


All models:

- Remove nuts -2- and -3- at exhaust pipe flange.
- Separate exhaust system at flange.
- Remove bolts -1- and -5-.
- Pull off bracket -4- for exhaust system from pins on front exhaust pipe.



- Unscrew bolts -1 ... 3- and remove pendulum support.



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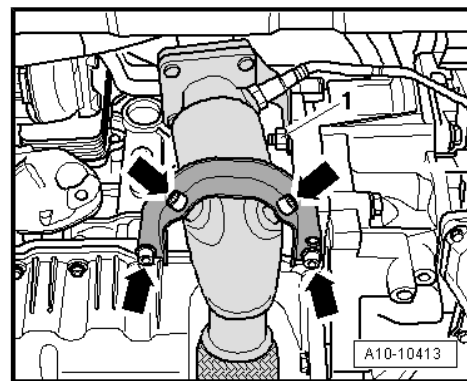
i Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.

- Unscrew bolts -arrows- and remove bracket for front exhaust pipe.
- Swing front exhaust pipe forwards and remove.

i Note

Disregard -item 1-.

**Installing**

Install in reverse order.

Tightening torques

Component	Nm
Front exhaust pipe to cylinder block	22
Front exhaust pipe to main catalytic converter	25 ¹⁾
Front exhaust pipe to exhaust manifold	40 ¹⁾
Bracket for exhaust system to subframe	25
Hot air collector plate to exhaust manifold	10
• ¹⁾ Renew bolts/nuts.	

2.3 Centre and rear silencers - exploded view of components



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1 - Rubber mounting

- ☐ Renew if damaged

2 - 25 Nm

3 - Bracket

- ☐ Note installation position

4 - Centre silencer

- ☐ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point
⇒ [page 191](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 194](#)

5 - 25 Nm

6 - Bracket

- ☐ Note installation position

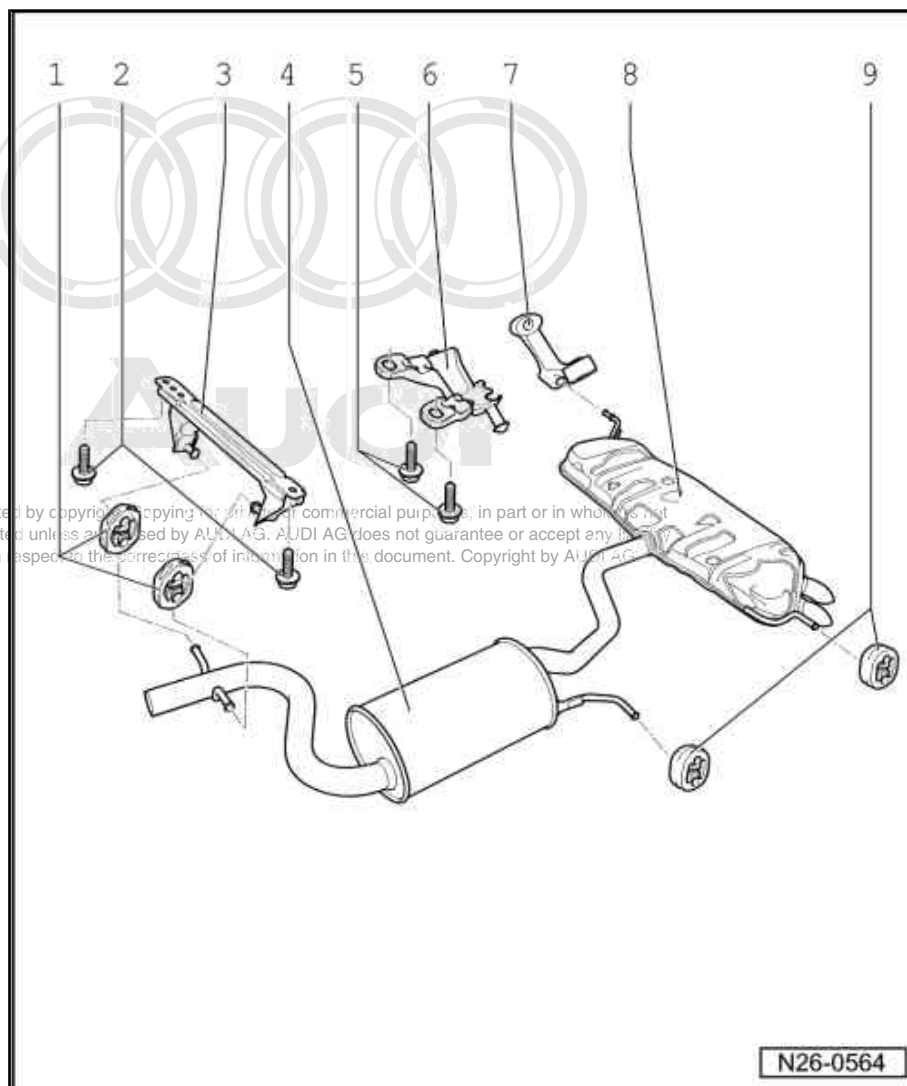
7 - Mounting

8 - Rear silencer

- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point
⇒ [page 191](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 194](#)

9 - Rubber mounting

- ☐ Renew if damaged

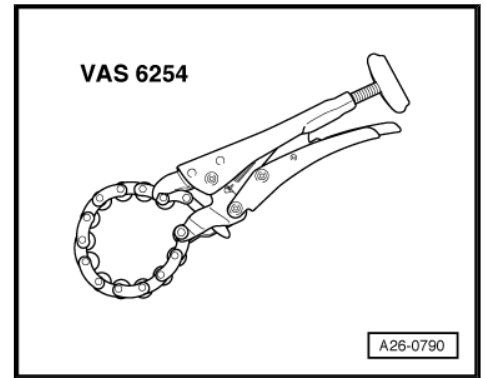


2.4 Separating centre and rear silencers

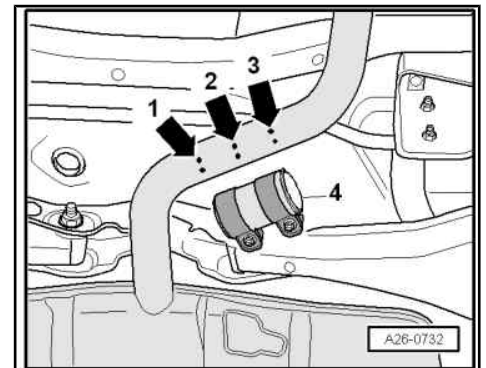
- ◆ The connecting pipe can be cut through at the cutting point provided in order to renew the centre and rear silencers separately.
- ◆ The cutting point is marked by an indentation on the outside of the exhaust pipe.

Special tools and workshop equipment required

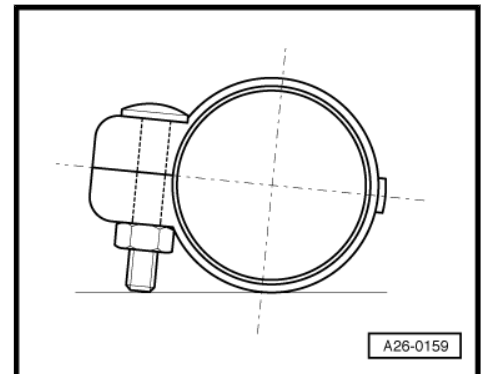
◆ Chain-type pipe cutter -VAS 6254-

**Procedure**

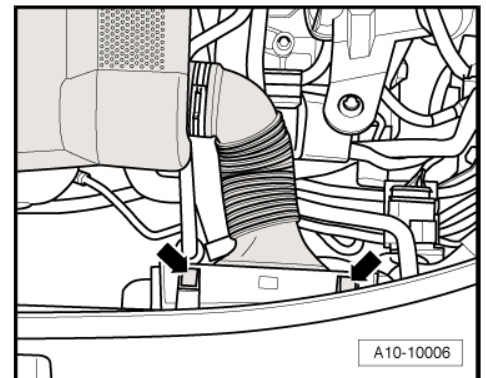
- Cut through exhaust pipe at a right angle at cutting point -arrow 2- using chain-type pipe cutter -VAS 6254- .
- When installing, position clamp -4- at the marks -1- and -3-.



- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to rear
- Align exhaust system so it is free of stress ⇒ [page 182](#) .

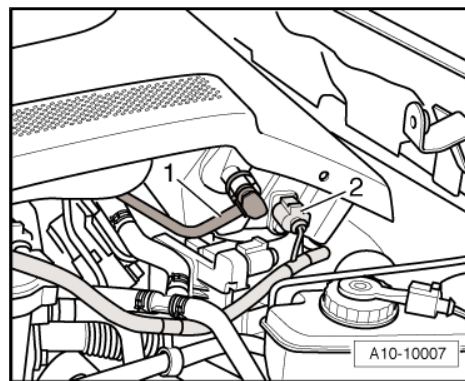
**2.5 Removing and installing exhaust manifold****Removing**

- Unclip air intake hose from air duct -arrows-.

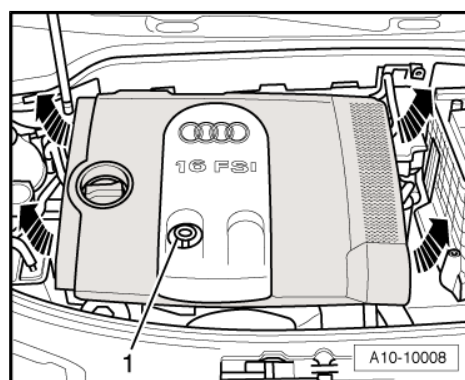


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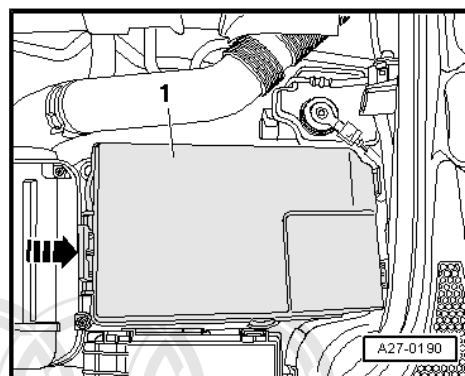
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.



- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



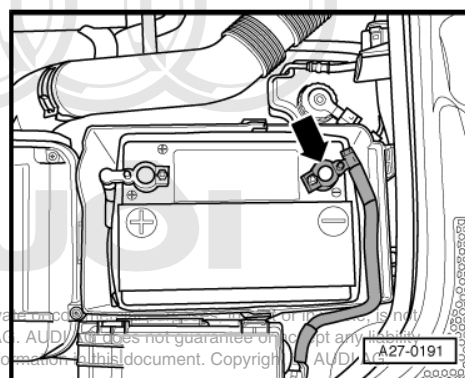
- Remove cover -1- over battery. To do so, press release tab -arrow-.



Caution

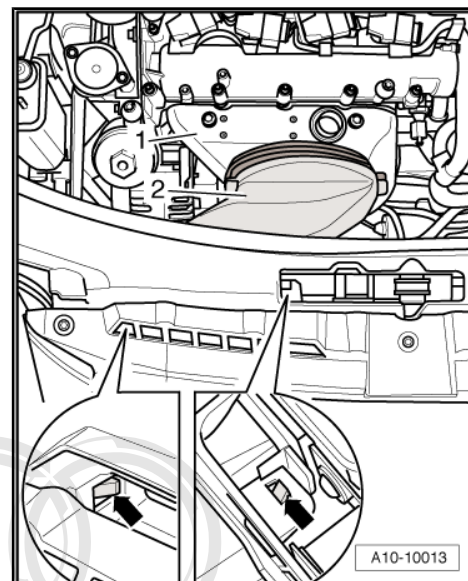
Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .

- With ignition switched off, disconnect battery earth cable -arrow-.

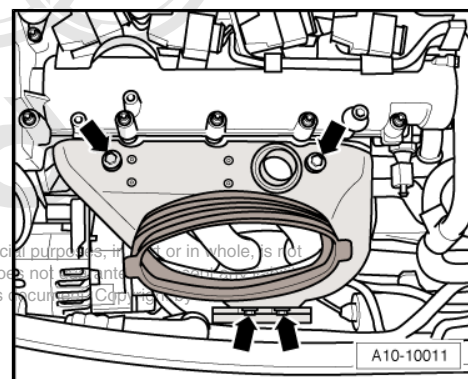


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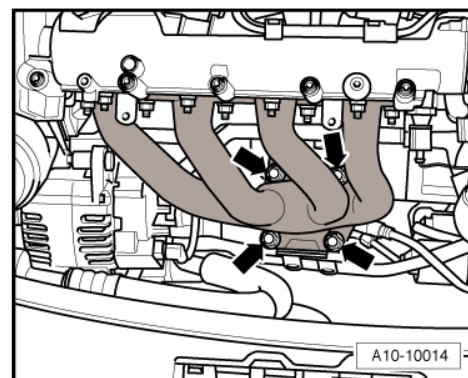
- Detach rubber bellows -1- from air duct -2-.
- Release both retainers -arrows- and detach air duct.



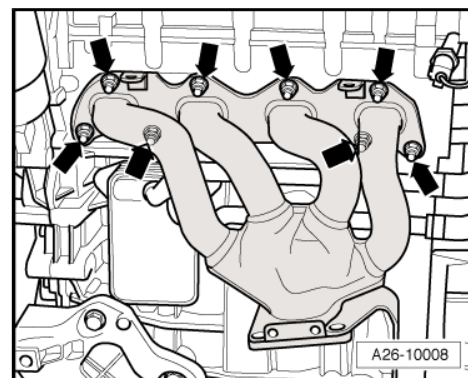
- Unbolt hot air collector plate -arrows-.



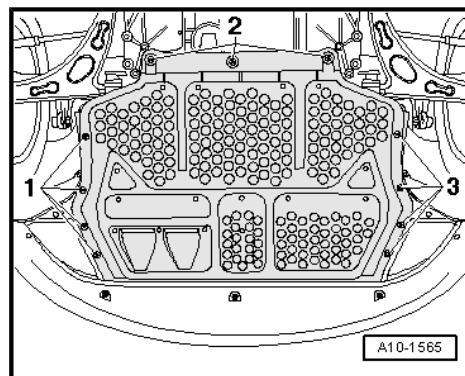
- Unbolt front exhaust pipe from exhaust manifold -arrows-.



- Unbolt exhaust manifold from cylinder head -arrows-.



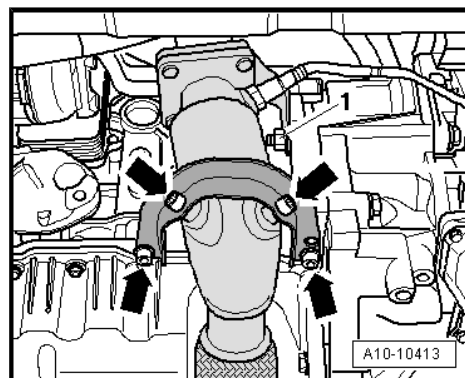
- Remove centre noise insulation -fasteners 1 ... 3-.



Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 30°.

- Remove bolts -arrows- at bottom of bracket for front exhaust pipe.
- Swing front exhaust pipe forwards and remove.



Note

Disregard -item 1-.

- Detach exhaust manifold and gasket upwards.

Installing

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



Note

Renew gaskets and self-locking nuts.

- Observe notes on procedure for connecting the battery ⇒ Rep. Gr. 27 .

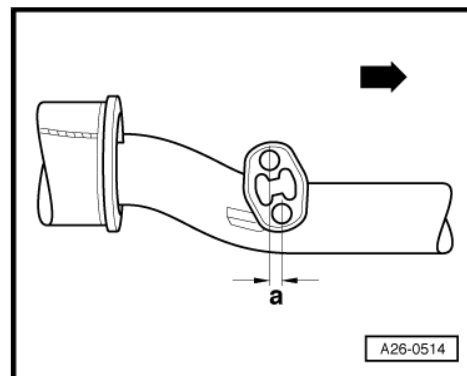
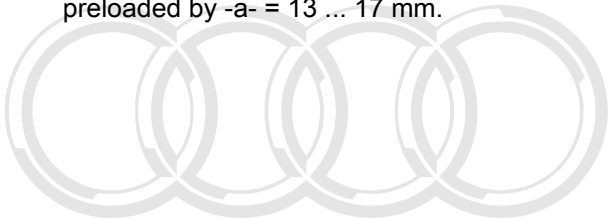
Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25 ¹⁾
Hot air collector plate to exhaust manifold	10
Front exhaust pipe to exhaust manifold	40 ¹⁾
Front exhaust pipe to cylinder block	22
Bracket for exhaust manifold to cylinder block	60
• ¹⁾ Renew self-locking nuts.	

2.6 Stress-free alignment of exhaust system

- The exhaust system must be aligned when it is cool.
- Loosen bolts of clamp ⇒ [Item 15 \(page 184\)](#) .

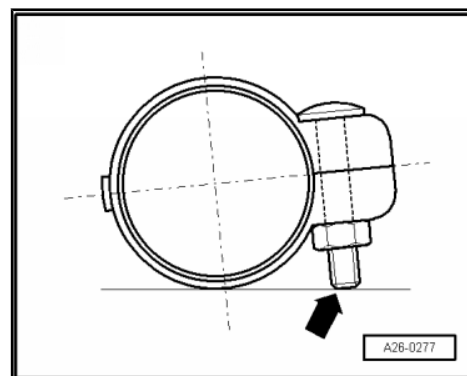
- Push rear section of exhaust system towards front of vehicle -arrow-, so that rear rubber mounting for centre silencer is preloaded by $-a- = 13 \dots 17 \text{ mm}$.



- When fitting clamp, make sure ends of bolts do not project below bottom of clamp -arrow-.

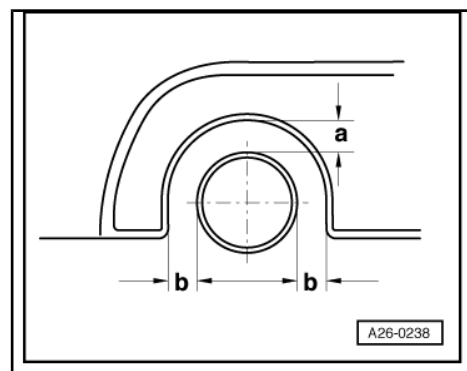
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- Bolt connection faces to right.
- Tighten bolt connections on clamp evenly to 25 Nm.
- Align tailpipe.



Tailpipe alignment

- Align rear silencer so that distances $-a-$ and $-b-$ between bumper cut-out and tailpipe are equal.
- Loosen the mounting of the rear silencer to align the tailpipe if necessary.



2.7 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug the tailpipe (e. g. with rags or stopper) and leave plugged until the check is complete.
- Listen for noise at connection points (cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe, etc.) to locate any leaks.
- Rectify any leaks that are found.

3 Exhaust gas recirculation system



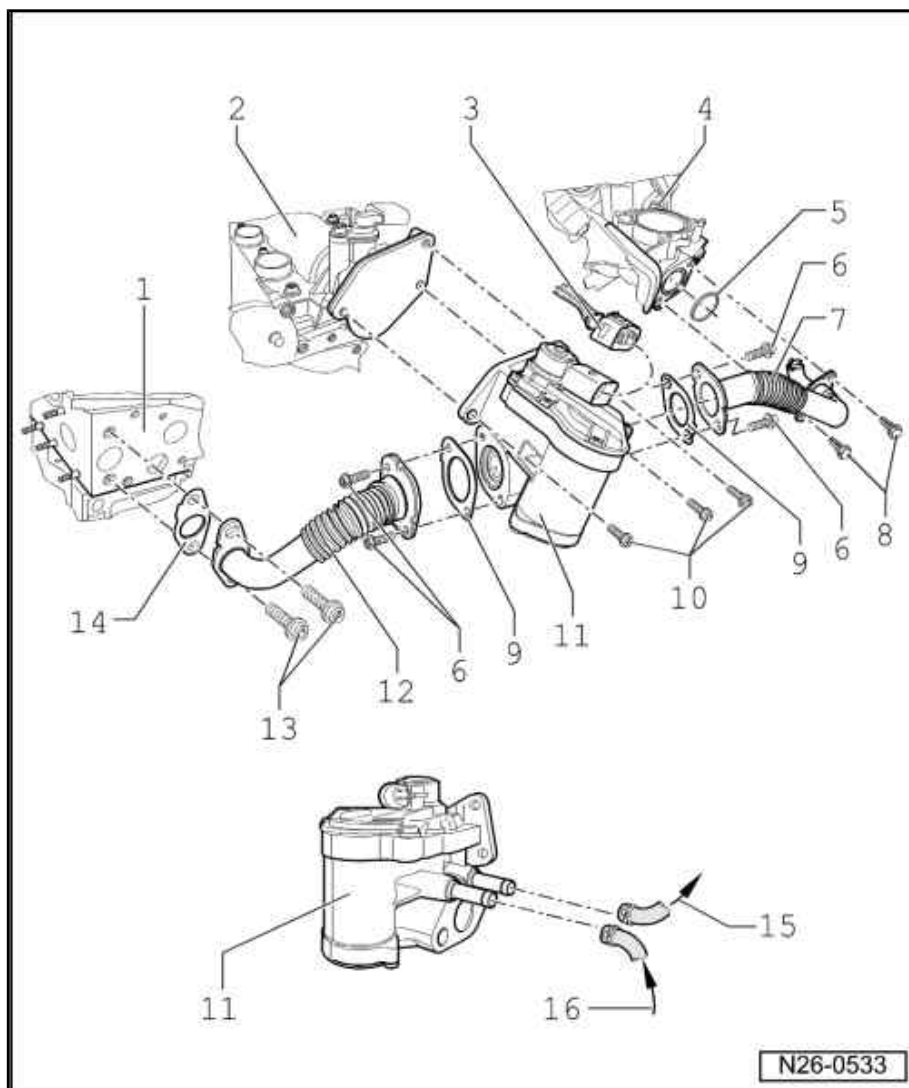
Note

- ◆ *Under certain operating conditions, exhaust gas is fed into the intake air via the exhaust gas recirculation valve -N18-. By means of this mixture, a lowering of the combustion temperature and consequently an improvement of the exhaust gas composition is achieved.*
- ◆ *The exhaust gas recirculation valve -N18- is activated by the engine control unit.*
- ◆ *Pulsed actuation makes it possible to obtain any required valve position.*
- ◆ *The exhaust gas recirculation potentiometer -G212- signals the current position of the exhaust gas recirculation valve -N18- to the engine control unit. The valve and the potentiometer are integrated in a single component.*
- ◆ *If the exhaust gas recirculation valve -N18- is blocked in the open position, this is noticeable due to poor idling characteristics.*

3.1 Exhaust gas recirculation system – exploded view of components

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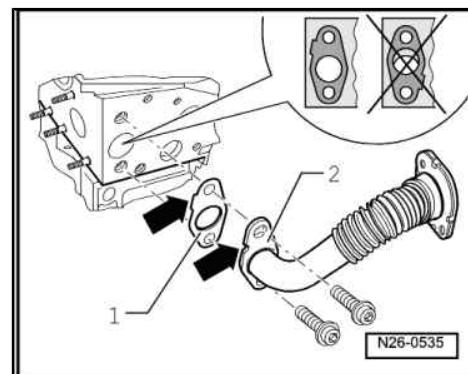
- 1 - Cylinder head
- 2 - Camshaft housing
- 3 - 6-pin electrical connector
 - ☐ Grey
- 4 - Intake manifold
- 5 - Gasket
 - ☐ Renew
- 6 - 8 Nm
- 7 - Connecting pipe
 - ☐ Tighten free of stress
- 8 - 7 Nm
- 9 - Gasket
 - ☐ Renew
- 10 - 10 Nm
- 11 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer - G212-
 - ☐ Removing and installing
⇒ [page 199](#)
 - ☐ After renewing, perform
adaption of exhaust gas
recirculation valve to en-
gine control unit
⇒ [page 198](#)
- 12 - Connecting pipe
 - ☐ Tighten free of stress
- 13 - 18 Nm
- 14 - Gasket
 - ☐ Renew
 - ☐ Installation position ⇒ [page 197](#)
- 15 - From coolant expansion tank
 - ☐ Diagram of coolant hose connections ⇒ [page 142](#)
- 16 - To T-piece
 - ☐ Diagram of coolant hose connections ⇒ [page 142](#)



Installation position of gasket between connecting pipe and cylinder head

- The projection on the gasket -1- must align with the recess on the connecting pipe -2- -arrows-.

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3.2 Checking adaption of zero position for exhaust gas recirculation valve -N18-

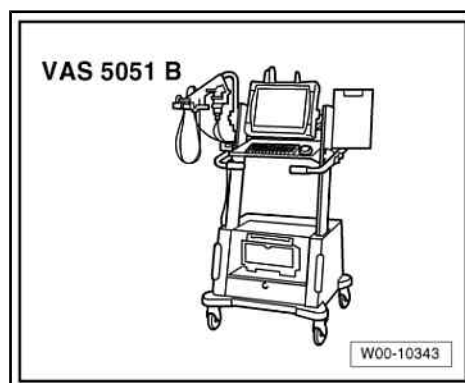


Note

- ◆ After replacing the engine control unit or the exhaust gas recirculation valve -N18-, the engine control unit and the exhaust gas recirculation valve must be adapted to one another
⇒ Rep. Gr. 24.
- ◆ Check the adaption status and the zero position before performing repair measures.

Special tools and workshop equipment required

- ◆ Vehicle diagnostic, testing and information system -VAS 5051- with diagnosis lead -VAS 5051/5A-



Test sequence

- Connect up vehicle diagnostic, testing and information system -VAS 5051- with diagnosis lead -VAS 5051/5A- and select vehicle system "01 - Engine electronics" from list. Engine must be idling.

Display on -VAS 5051- :

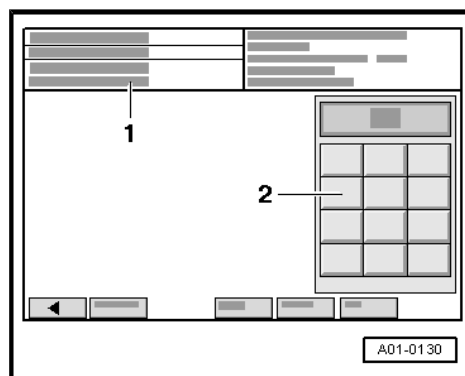
- From list 1 select diagnostic function "04 - Basic setting"



Display on -VAS 5051- :

- Enter "074" on keypad -2- for "display group 074" and confirm your entry by pressing the  key.

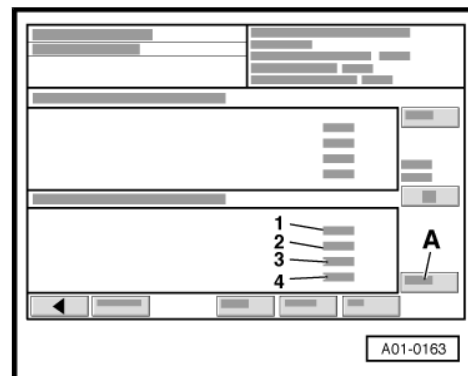
1 - Enter display group



Display on -VAS 5051- :

- Activate basic setting by touching button **A**.
- Check display in zone -4-.

Display zone	Readout	Specification
-4-	Adaption status: ADP. runs ADP. O.K. ERROR	ADP. OK ¹⁾
• ¹⁾ If the specification is not attained, check the exhaust gas recirculation valve -N18- for dirt and foreign objects; renew valve if necessary.		



Note

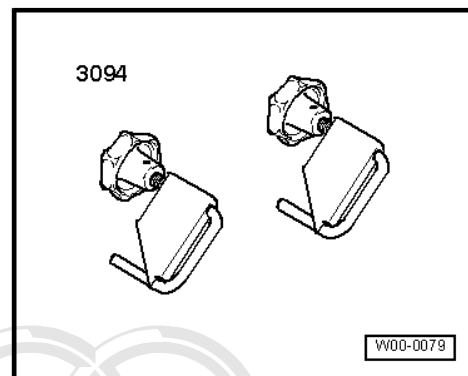
The abbreviation "ADP" stands for adaption.

- End function "04 - Basic setting" by pressing the **ESC** key.
- Press "06 - End output".
- Switch off ignition.

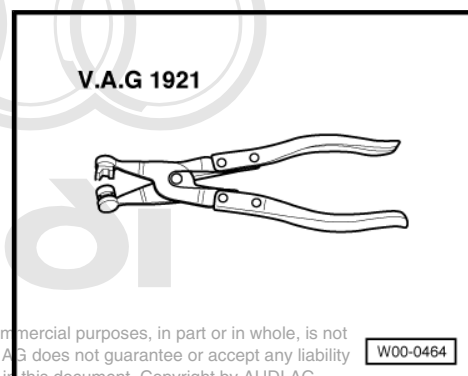
3.3 Removing and installing exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

Special tools and workshop equipment required

- ◆ Hose clamps for hoses up to 25 mm Ø -3094-



- ◆ Hose clip pliers -V.A.G 1921-

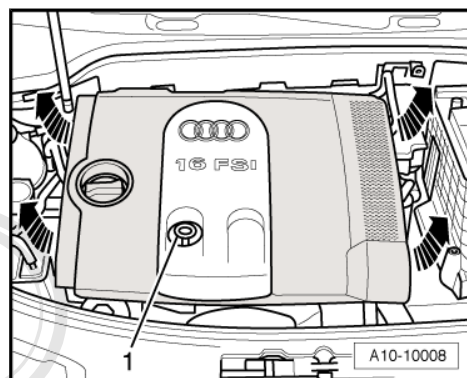
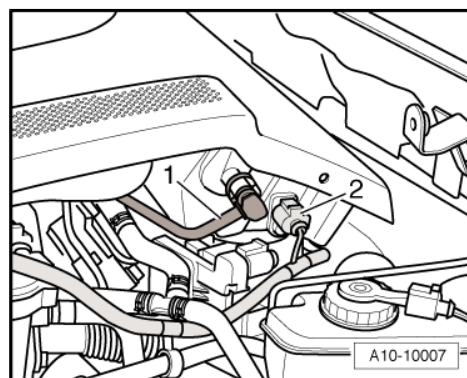
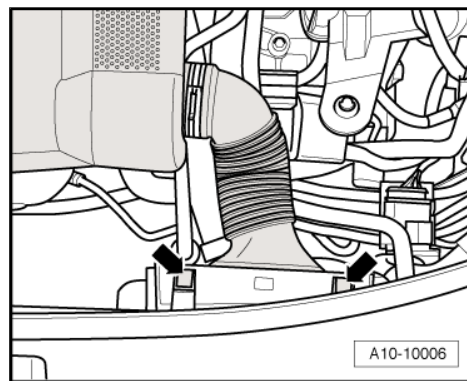


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- ◆ Drip tray

Removing

- Unclip air intake hose from air duct -arrows-.
- Unplug electrical connector at intake air temperature sender 2 -G299- -item 2-.
- Detach vacuum hose -1- from actuator for intake air preheater.
- Pull dipstick -1- out of guide tube.
- Remove the engine cover together with air cleaner housing -arrows-.
- Re-insert dipstick in guide tube.



- Clamp off hoses at exhaust gas recirculation valve -N18- using hose clamps -3094- and disconnect hoses.
- Detach electrical connector -2-.
- Unscrew connecting pipes for exhaust gas recirculation -1- and -3- (front and rear) at exhaust gas recirculation valve -N18- .
- Unscrew bolts -arrows- and remove exhaust gas recirculation valve -N18- .

Installing

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



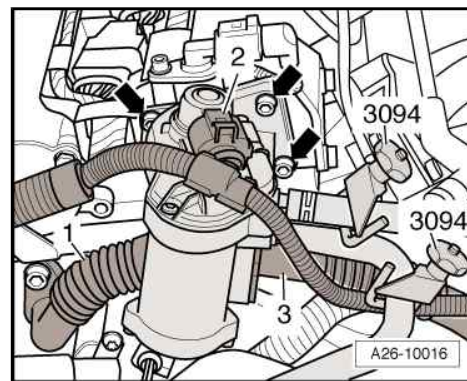
Note

Renew seals and gaskets.

- After renewing, perform adaption of engine control unit to exhaust gas recirculation valve -N18- → [page 198](#)

Tightening torques

Component	Nm
Connecting pipes to exhaust gas recirculation valve -N18-	8
Exhaust gas recirculation valve -N18- to cylinder head	10



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