

## Workshop Manual Audi A8 2003 ➤

12-cylinder engine (6.0 ltr. 4-valve), mechanics

Engine ID	BHT	BSB	BTE						
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Edition 10.2014



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## List of Workshop Manual Repair Groups

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- 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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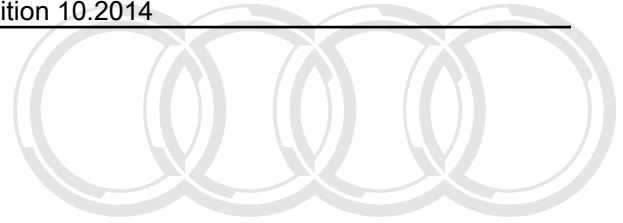
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Audi A8 2003 ►

**Audi** 12-cylinder engine (6.0 ltr. 4-valve), mechanics - Edition 10.2014

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# 00 – Technical data

## 1 Technical data

(ARL003067; Edition 10.2014)

⇒ [“1.1 Engine identification number and engine data”, page 1](#)

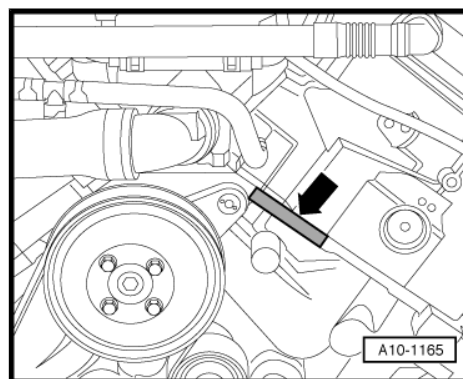
### 1.1 Engine identification number and engine data

#### Engine number

The engine number (“Engine code” and “Serial number”) can be found on the front of the cylinder block beneath the left-side cylinder head.

There is also a sticker on the cylinder head cover (right-side) showing the “engine code” and “serial number”.

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



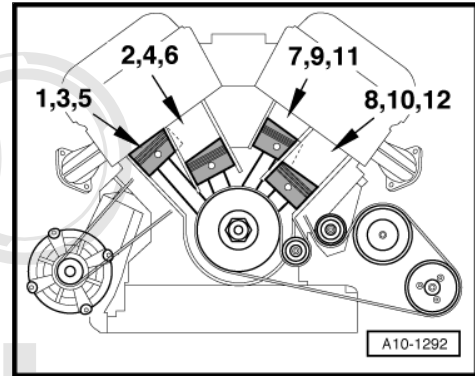
#### Engine data

Code letters	BHT	BSB	BTE
Capacity ltr.	5.998	5.998	5.998
Power output kW at rpm	331/6200	331/6200	331/6200
Torque Nm at rpm	580/4000 ... 4500	580/4000 ... 4500	580/4000 ... 4500
Bore Ø mm	84	84	84
Stroke mm	90.2	90.2	90.2
Compression ratio	11.0	11.0	11.0
RON at least	98 <sup>1)</sup>	98 <sup>1)</sup>	98 <sup>1)</sup>
Injection/ignition system	Motronic	Motronic	Motronic
Firing order	1-12-5-8-3-10-6-7-2-11-4-9	1-12-5-8-3-10-6-7-2-11-4-9	1-12-5-8-3-10-6-7-2-11-4-9
Exhaust gas recirculation	no	no	no
Turbocharging/supercharging	no	no	no
Knock control	yes	yes	yes
Variable valve timing	yes	yes	yes
Intake manifold change-over	no	no	no
Secondary air system	yes	yes	yes

1) Unleaded premium RON 95 can also be used, but results in reduced power



### Cylinder arrangement on W12 engine



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## 2 General repair instructions

⇒ [“2.1 Rules for cleanliness when working on the injection system”, page 3](#)

⇒ [“2.2 Checking for leaks in the fuel system”, page 3](#)

### 2.1 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 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. Do not use fluffy 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.

### 2.2 Checking for leaks in the fuel system

- Start the engine and let it run at medium speed for a few minutes.
- Switch off ignition.
- Check the entire fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Then carry out a road test with at least one full-power acceleration.
- Then check high-pressure part of fuel system again for leakage.

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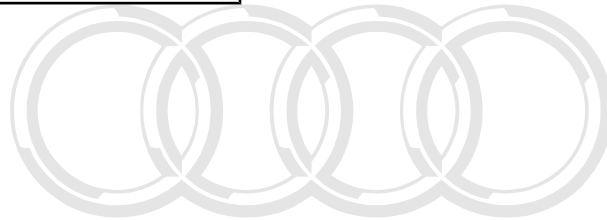
### 3 Contact corrosion!

- ◆ Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).
- ◆ For this reason, only fasteners with a special surface coating are used. These parts can be identified by their greenish colour.
- ◆ In addition, all rubber parts, plastic parts and adhesives are made of non-conductive materials.
- ◆ Always fit new components when in doubt about whether old components can be reused.



#### Caution

- ◆ *Only use genuine Audi parts.*
- ◆ *Accessories must be approved by AUDI AG.*
- ◆ *Damage caused by contact corrosion is not covered under warranty.*



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## 10 – Removing and installing engine

### 1 Removing and installing engine

⇒ [“1.1 Removing and installing engine”, page 5](#)

⇒ [“1.2 Removing engine”, page 6](#)

⇒ [“1.3 Separating engine and gearbox”, page 23](#)

⇒ [“1.4 Securing engine to assembly stand”, page 30](#)

⇒ [“1.5 Installing engine”, page 32](#)

⇒ [“1.6 Wire routing on engine”, page 39](#)

⇒ [“1.7 Removing and installing mounting for torque reaction support”, page 40](#)



### 1.1 Removing and installing engine

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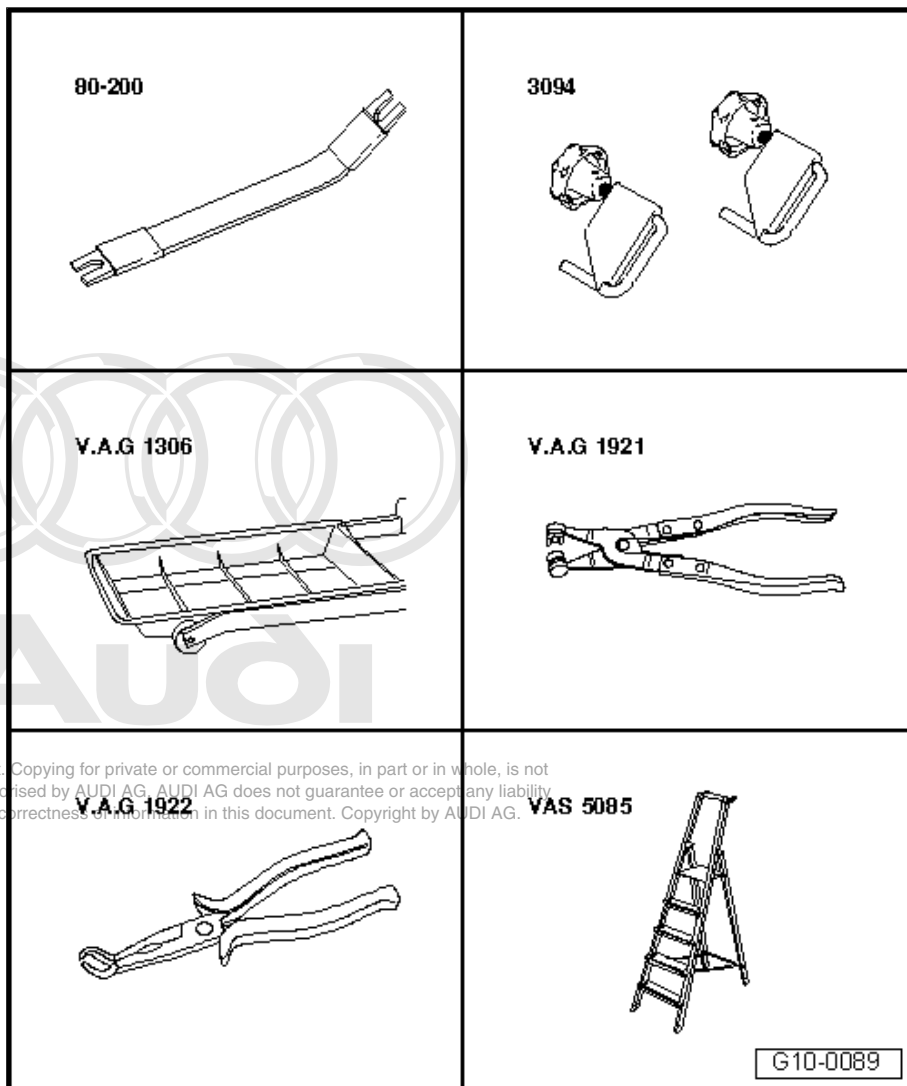
#### Note

- ◆ *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- ◆ *Before starting work, make sure you have the support element - VAS 6131/10-12- available for the scissor-type assembly platform - VAS 6131- in addition to the existing support set for Audi - VAS 6131/10- .*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*



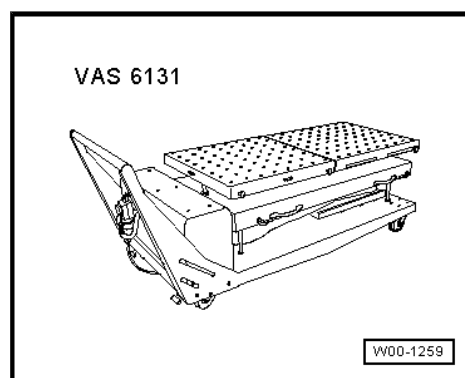
**Special tools and workshop equipment required**

- ◆ Removal lever - 80-200-
- ◆ Hose clamps up to Ø 25 mm - 3094-
- ◆ Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Spark plug connector pliers - V.A.G 1922-
- ◆ Stepladder - VAS 5085-



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- ◆ Scissor-type assembly platform - VAS 6131- with support set for Audi - VAS 6131/10- , additional support element - VAS 6131/10-12- and support set for Audi - VAS 6131/11- .



## 1.2 Removing engine

- Discharge the refrigerant system ⇒ Air conditioner system - with refrigerant R134a .
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .



**Caution**

*Observe notes on procedure for disconnecting the battery → Electrical system; Rep. gr. 27 .*

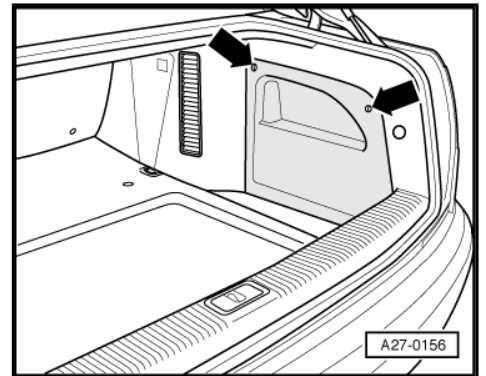
- Switch off ignition.



**Note**

*To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.*

- Remove luggage compartment side trim cover (right-side) -arrows-.

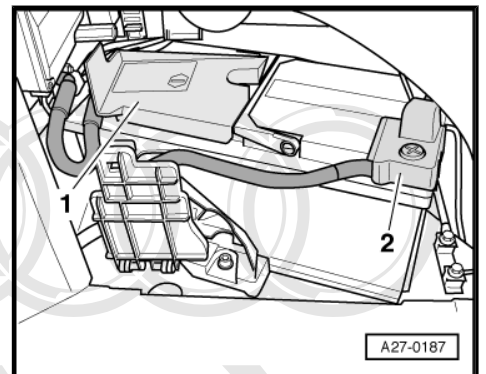


- Remove cover -1- over battery.

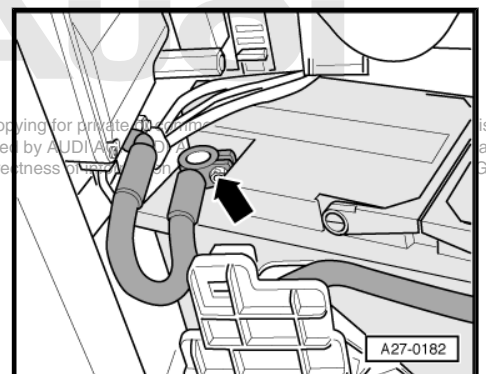


**Note**

*Disregard -item 2-.*



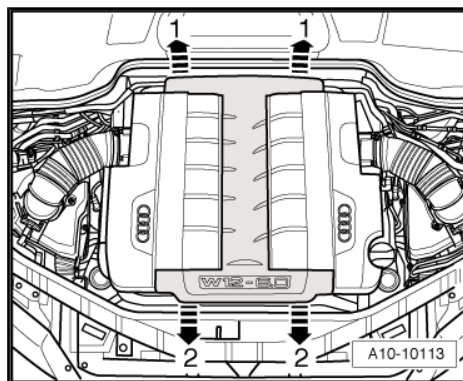
- Disconnect earth cable -arrow- at battery.




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- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.

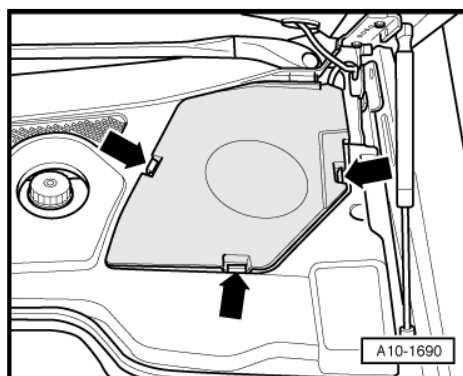


- Remove cover above coolant expansion tank -arrows-.



**WARNING**

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

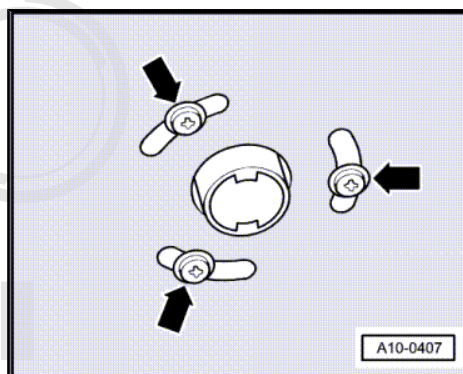


- Open filler cap on coolant expansion tank.

- Remove both front wheels.

 **Note**

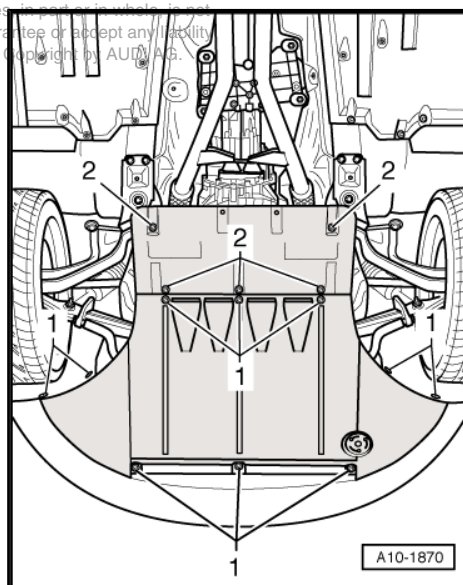
*Secure brake discs with wheel bolts.*



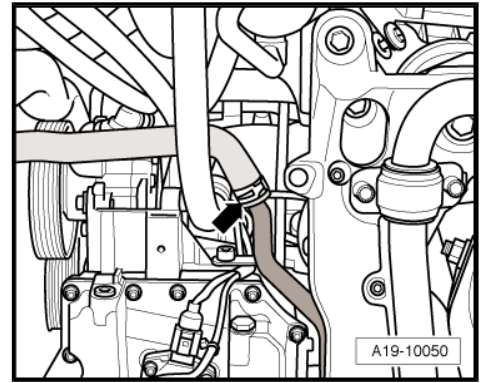
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.

- Release quick-release fasteners -1- and -2- and take off noise insulation.

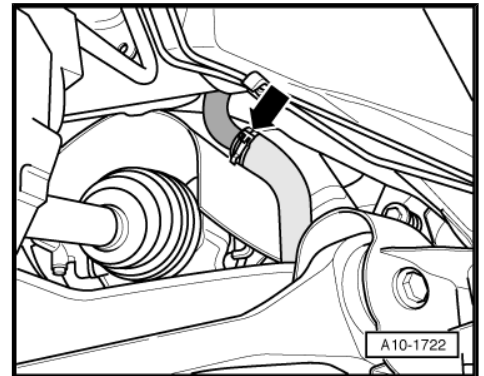
- Remove front and rear sections of wheel housing liner (front left and front right) => General body repairs, exterior; Rep. gr. 66 .



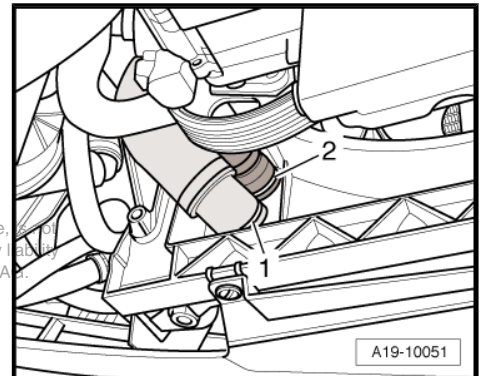
- Place drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208- under engine.
- Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.



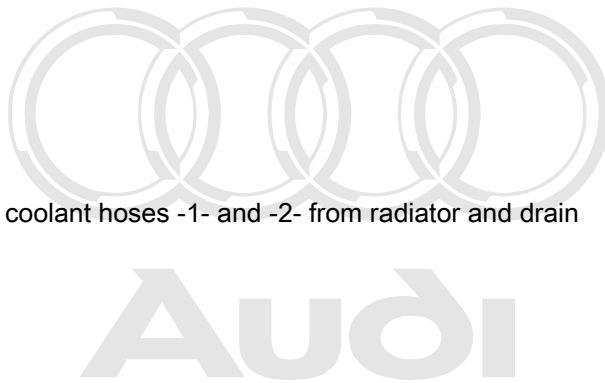
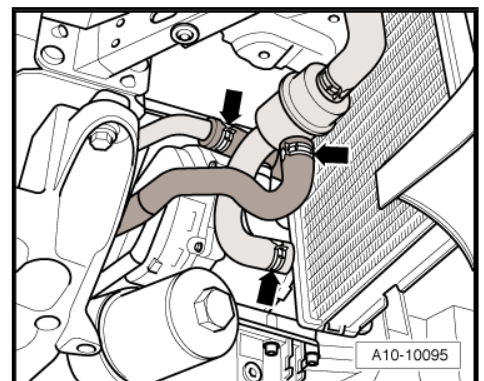
- Disconnect coolant hose next to drive shaft (left-side) from coolant pipe -arrow- and drain off coolant.



- Disconnect coolant hoses -1- and -2- from radiator and drain off coolant.



- Disconnect coolant hoses -arrows- and drain off remaining coolant.



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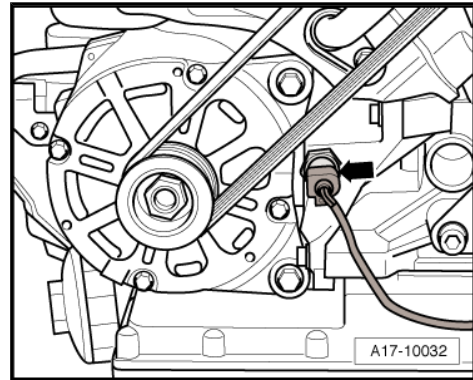


- Unplug electrical connector -arrow- at oil pressure switch - F1- .



**Note**

*Shown in illustration with lock carrier removed.*

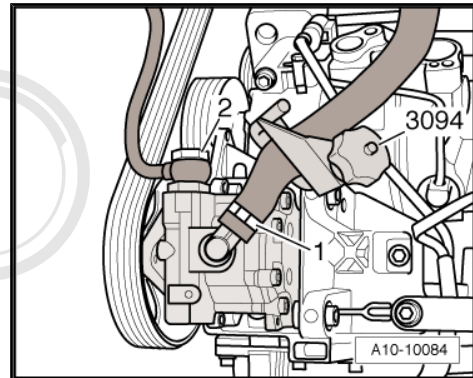


- Clamp off return hose for power steering pump using a hose clamp up to 25 mm - 3094- .
- Disconnect return hose -1- from power steering pump.



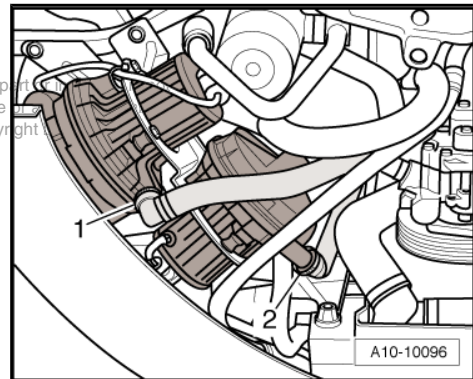
**Note**

*Disregard -item 2-.*

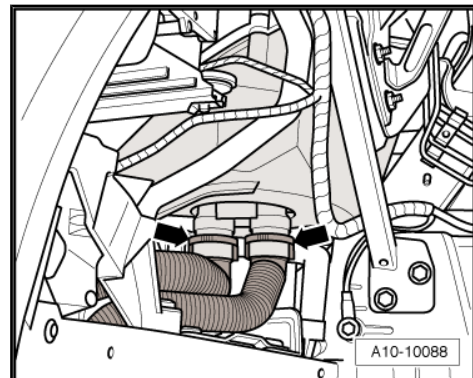


- Detach air hoses -1- and -2- at secondary air pumps by pressing release tabs.

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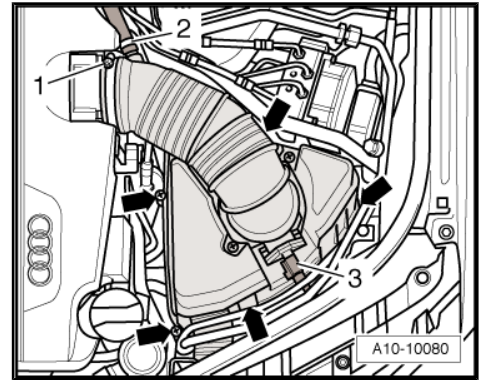


- Press release tabs to detach the two air intake hoses (bottom) -arrows- at bottom section of air cleaner housing (left-side).

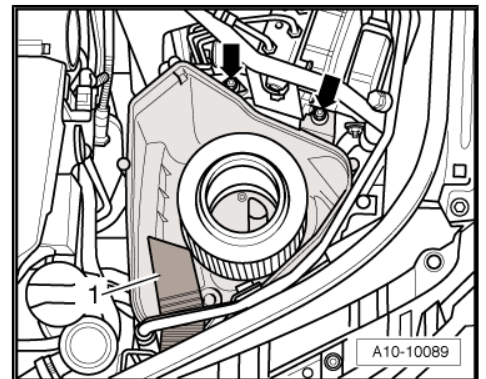




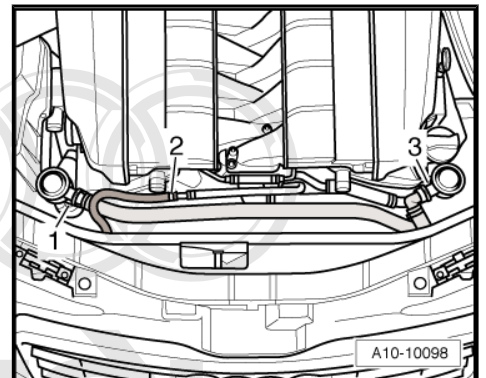
- Detach electrical connector -3- for air mass meter 2 - G246- .
- Detach hose -2- from air intake hose.
- Detach air intake hose -1- from intake manifold.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (left-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (left-side).



- Disconnect coolant hose at the position marked -2-.
- Disconnect coolant hoses -1- and -3- from combination valves.
- Pull air hoses upwards out of engine compartment.



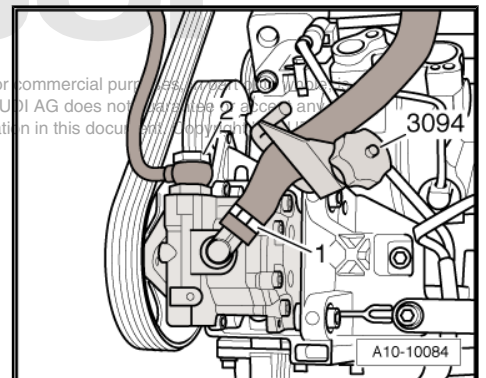
 **Note**

*Lay a cloth under the hydraulic pipe to catch any escaping hydraulic fluid.*

- Unbolt hydraulic line -2- from power steering pump and place hydraulic line on top of longitudinal member.

 **Note**

*Disregard -item 1-.*

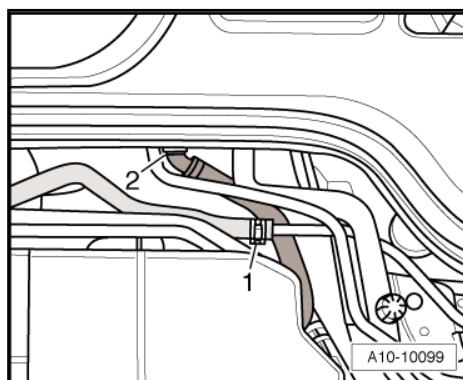
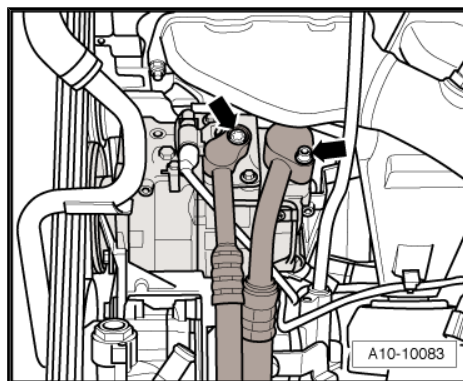




**Note**

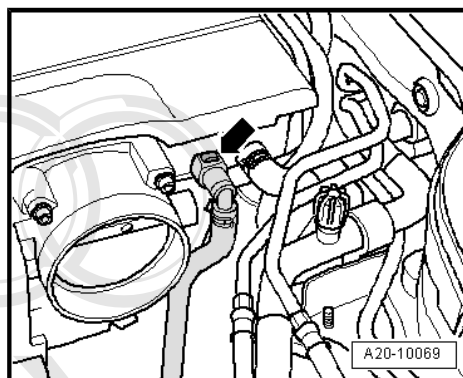
*To prevent damage to the air conditioner compressor and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.*

- Detach refrigerant lines from air conditioner compressor -arrows-.
- Plug the openings in the air conditioner compressor.
- Disconnect coolant hose -1-.
- Detach vacuum hose -2- going to brake servo.



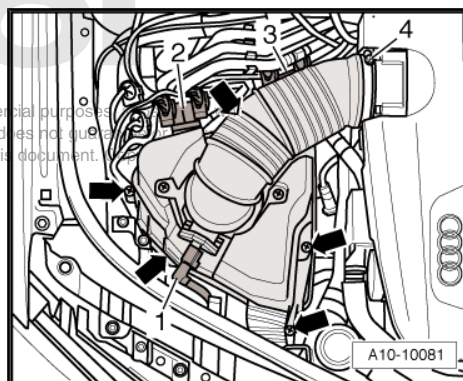
**USA vehicles:**

- Detach vacuum hose -arrow- leading to fuel system diagnostic pump - V144- from intake manifold.

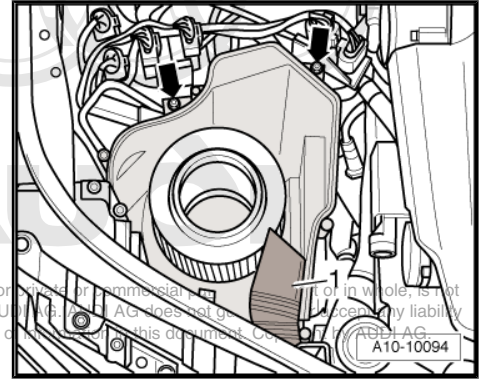


**All vehicles:**

- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



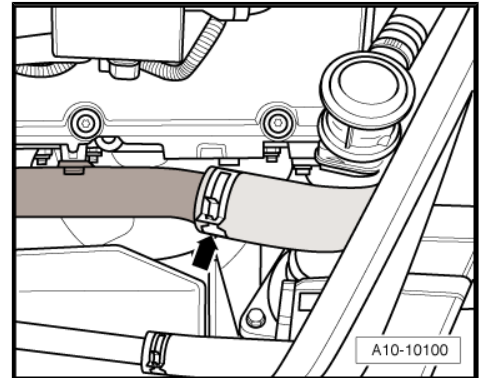
- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).



**i** Note

*Lay a cloth under the connection to catch escaping coolant.*

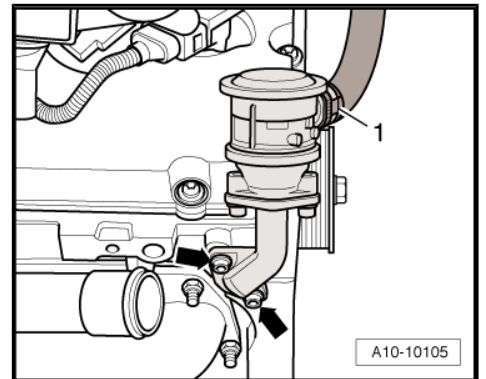
- Detach coolant hose (right-side) -arrow- at engine.



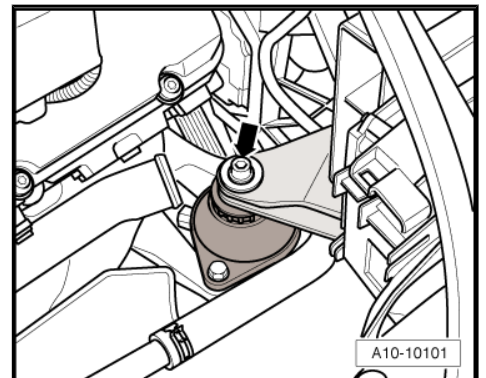
- Unscrew bolts -arrows- and remove the combination valve (right-side) for secondary air supply.

**i** Note

*Disregard -item 1-.*



- Remove bolt -arrow- on mounting for torque reaction support.

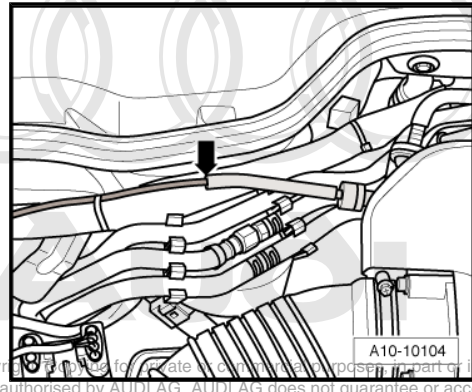


- Disconnect vacuum hose going to intake manifold -arrow-.



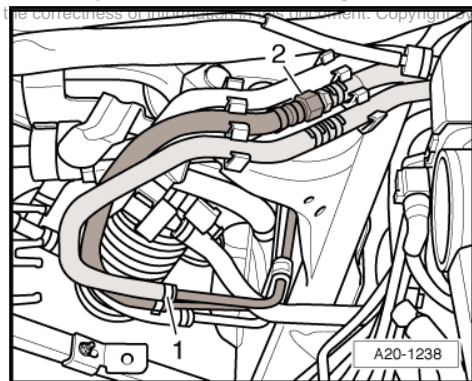
**WARNING**

- ◆ *Rules for cleanliness when working on the injection system ⇒ [page 3](#).*
- ◆ *The fuel system is pressurised. Wrap a cloth around the connection before opening the system. Then release pressure by carefully loosening the connection.*

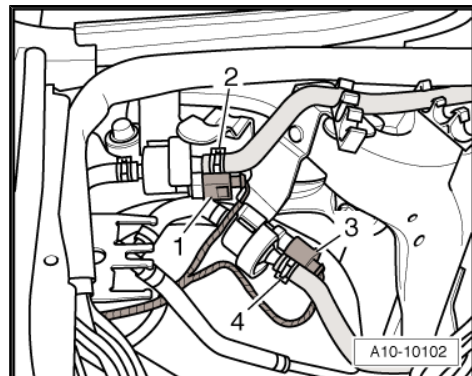


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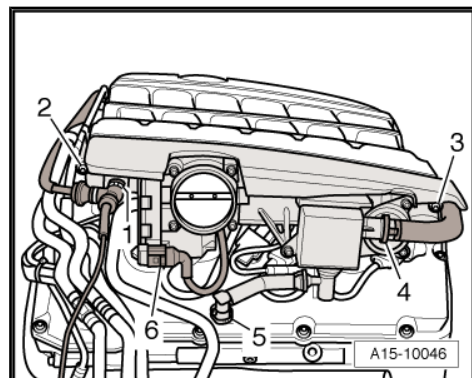
- Disconnect fuel return line -1- and fuel supply line -2-.



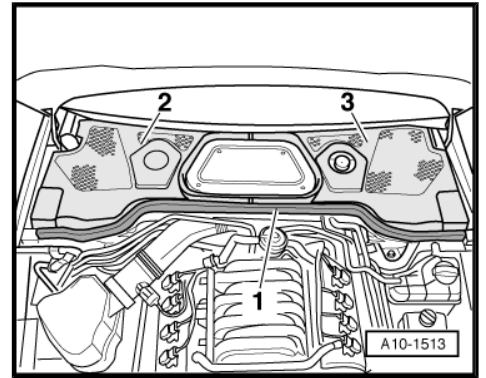
- Unplug electrical connectors -1- and -3-.
- Move wiring clear.
- Disconnect vacuum hoses -2- and -4- at solenoid valve 1 for activated charcoal filter system - N80- and at solenoid valve 2 for activated charcoal filter system - N333- .
- Move vacuum hoses clear.



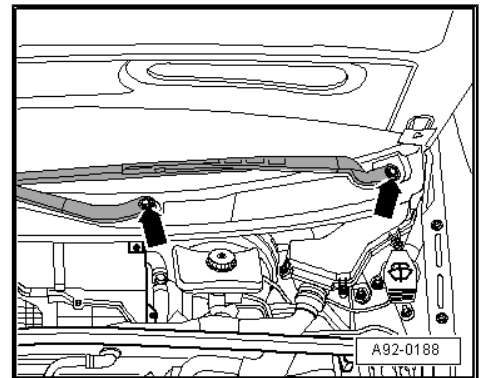
- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect hoses for crankcase breather system -4- and -5-.
- Remove bolts -2- and -3-.
- Remove right section of intake manifold.



- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



- 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 hexagon nuts and take off wiper arms.

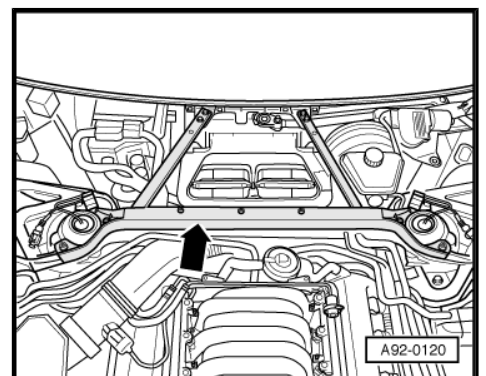
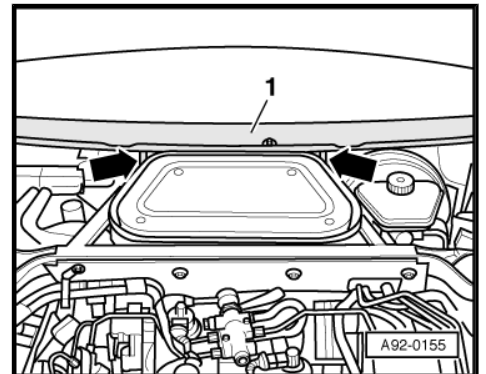


- Remove dust/pollen filter; to do so, open the four quick-release fasteners.

 **Note**

*Cover air duct at air conditioner housing with clean cloth to prevent anything falling in.*

- Remove bolts -arrows- for cowl panel trim -1- on both sides.
- Carefully pull cowl panel trim off retainer at windscreen.
- Unscrew body brace -arrow-.



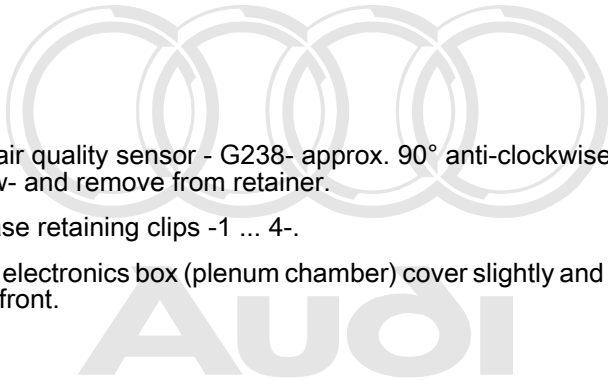


- Unscrew bolts -1- and -2- and detach retaining clips.
- Release retaining tabs -arrows- and detach both engine control units.



**Note**

*The electrical wires remain connected.*



- Turn air quality sensor - G238- approx. 90° anti-clockwise -arrow- and remove from retainer.
- Release retaining clips -1 ... 4-.
- Open electronics box (plenum chamber) cover slightly and pull off to front.

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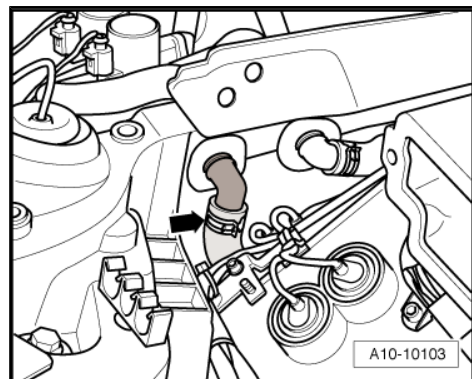
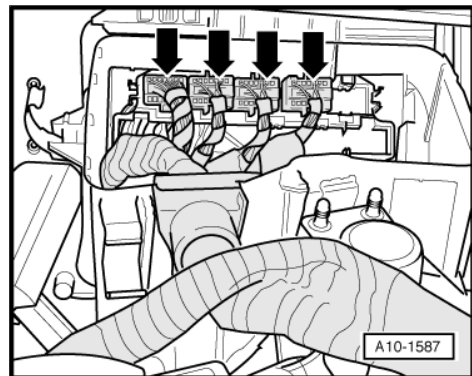
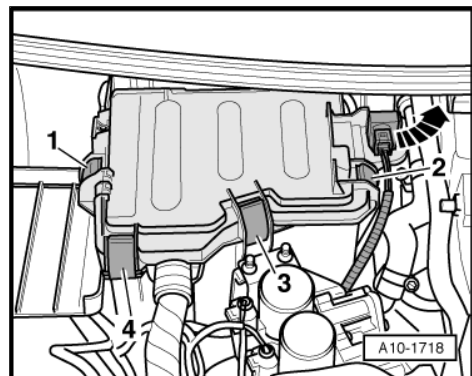
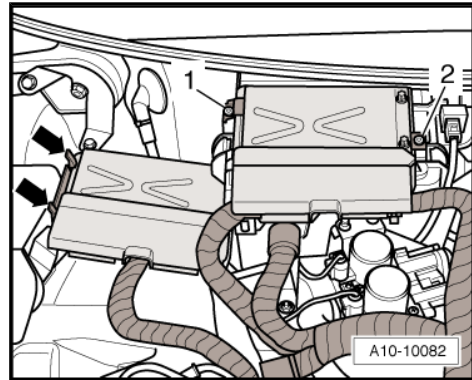
- Disconnect the electrical multi-pin connectors -arrows- using spark plug connector pliers - V.A.G 1922- .
- Detach engine wiring harness at electronics box and at bulk-head.
- Place engine control units with wiring harness attached on top of engine.



**Note**

*Secure the engine control units to prevent them falling.*

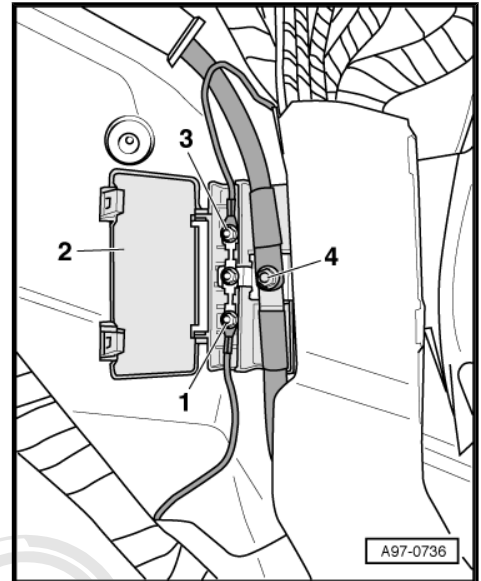
- Disconnect coolant hose at plenum chamber partition panel -arrow-.



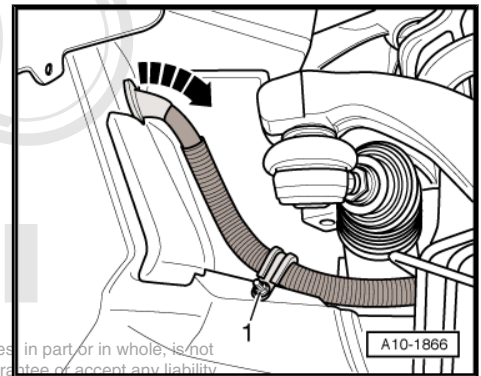
- Remove A-pillar trim (right-side) ⇒ General body repairs, interior; Rep. gr. 70 .
- Fold back floor covering.
- Unbolt protective cover above main fuse holder.
- Fold cover -2- to side.
- Remove nut -4-.
- Detach terminal 30 wire to starter.

**i** Note

Disregard items -1- and -3-.

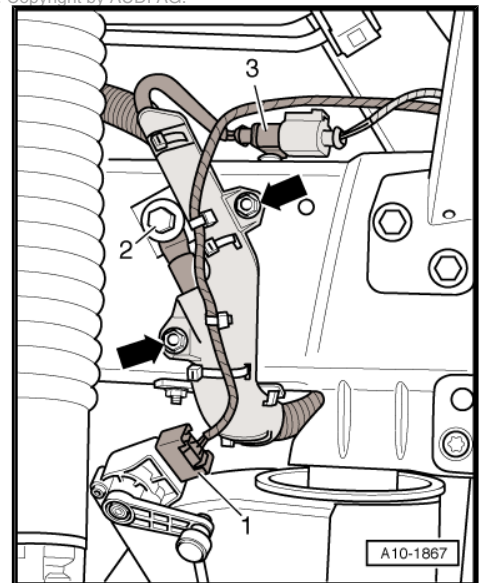


- Unscrew wiring clamp -1- in wheel housing (front right).
- Pull wiring harness out from interior -arrow-.



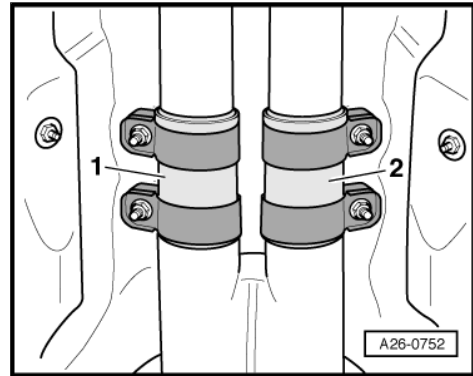
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- Unplug electrical connectors -1- and -3-.
- Unbolt earth cable -2- at longitudinal member.
- Unscrew bracket for wiring harness at longitudinal member -arrows- and move wiring harness clear.

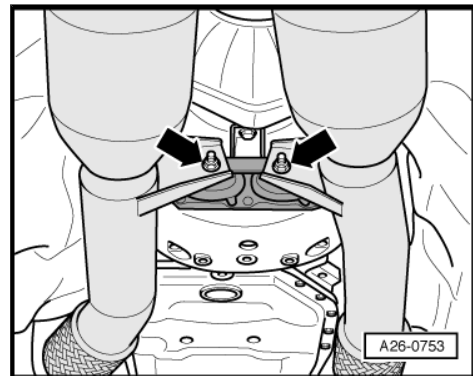




- Loosen clamps -1- and -2-.



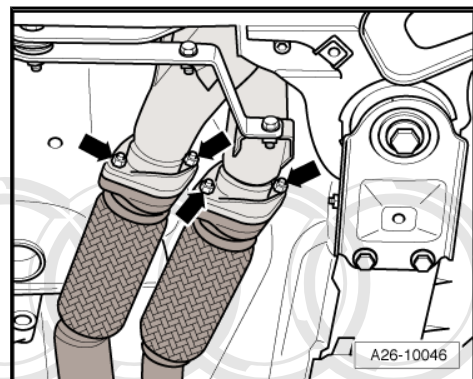
- Unscrew nuts -arrows- on brackets for front silencer (left and right).



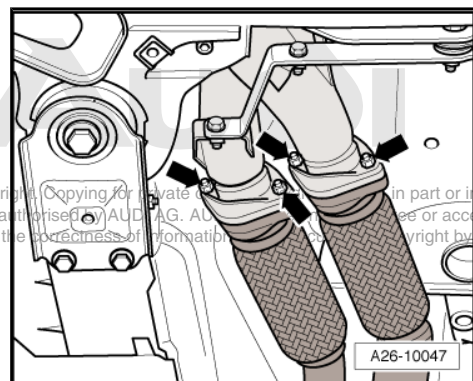
**Note**

*To avoid damage, the flexible joints on the front silencer must not be bent more than 10°.*

- Unscrew nuts -arrows-.
- Remove front silencer (left-side) together with flexible joints.



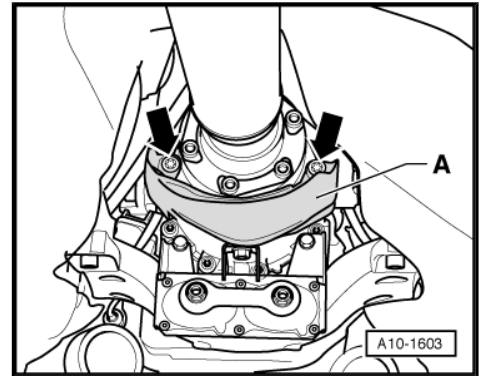
- Unscrew nuts -arrows-.
- Remove front silencer (right-side) together with flexible joints.



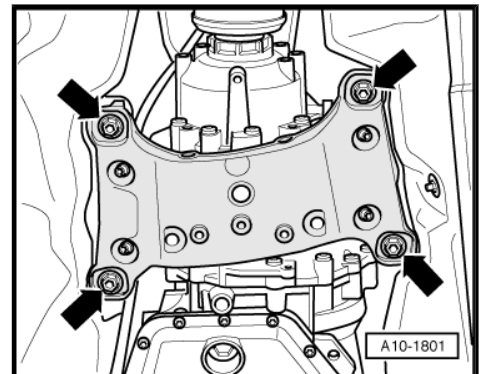
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- Unbolt heat shield for propshaft -A - -arrows-.
- Unscrew bolts at gearbox/propshaft flange.
- Push propshaft back towards rear final drive. The constant velocity joints can be moved axially.
- Tie up propshaft to body.



- Remove bolts -arrows- at tunnel cross member.



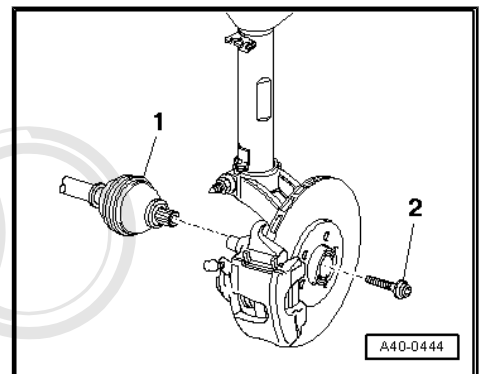
- Have a 2nd mechanic press the brake pedal.



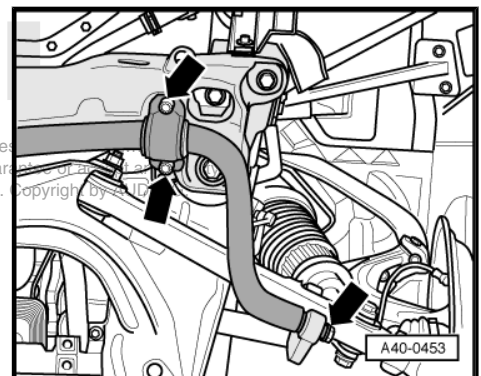
**Caution**

*When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).*

- Unscrew flange bolt -2- from drive shaft -1- (left and right).



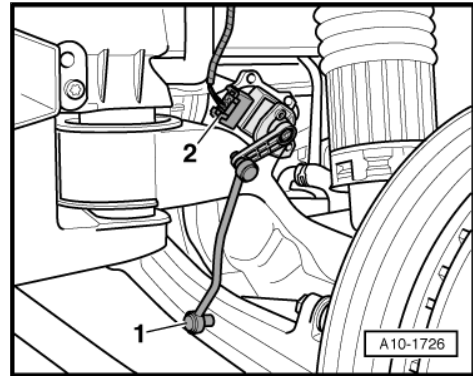
- Unscrew bolts (left and right) -arrows- evenly.
- Take out anti-roll bar.



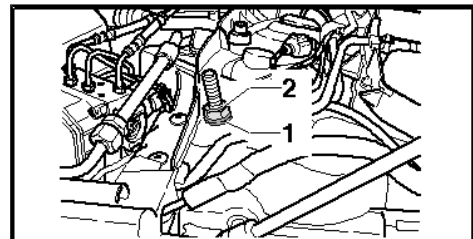
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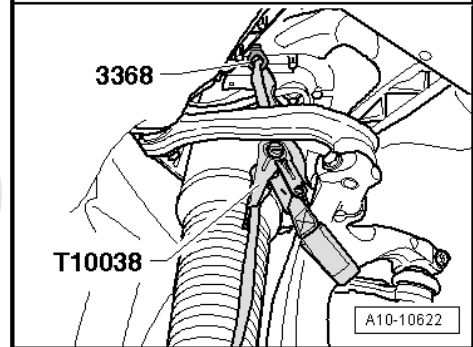
- Unplug electrical connector -2- at vehicle level sender.
- Detach coupling rod -1- at track control link.
- Repeat procedure on other side of vehicle.



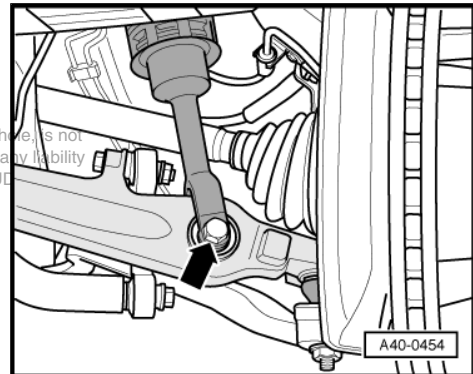
- Fit eye-head bolt - 3368- from below in bore on suspension turret on both sides.
- Secure eye-head bolts - 3368- with nut -2- and washer -1- (screw down nut several turns but not all the way down).
- Tie up wheel bearing housing on each side using tensioning strap - T10038- as illustrated.



**Caution**  
*To prevent damage to the joints on the upper links, the weight of the wheel bearing housings must be supported before slackening the bottom securing bolts for the suspension struts.*

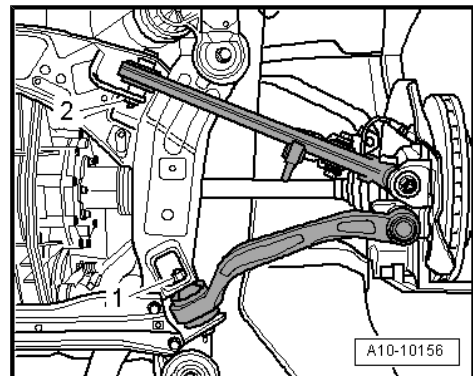


- Unbolt air spring strut from track control link -arrow-.



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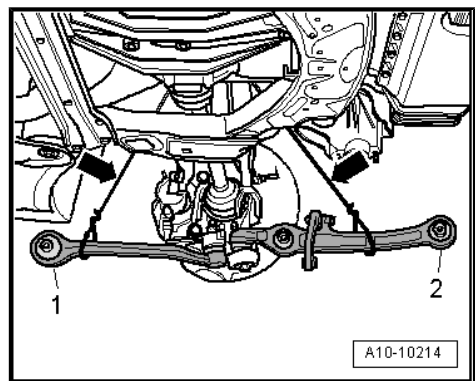
- Unbolt guide link -1- and track control link -2- at subframe.



- Pivot guide link -1- and track control link -2- outwards.

**Caution**

*The guide link and track control link must not be allowed to hang down without support. Tie up both links to wheel bearing housing as illustrated -arrows-.*

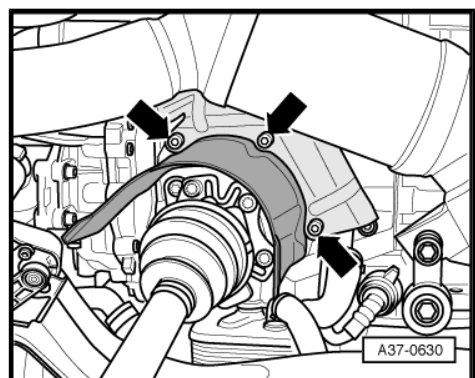


- Repeat procedure on other side of vehicle.

- Unbolt heat shield above drive shaft from gearbox -arrows-.
- Unbolt drive shaft from gearbox flange.

**Caution**

*Take care not to damage brake hose.*

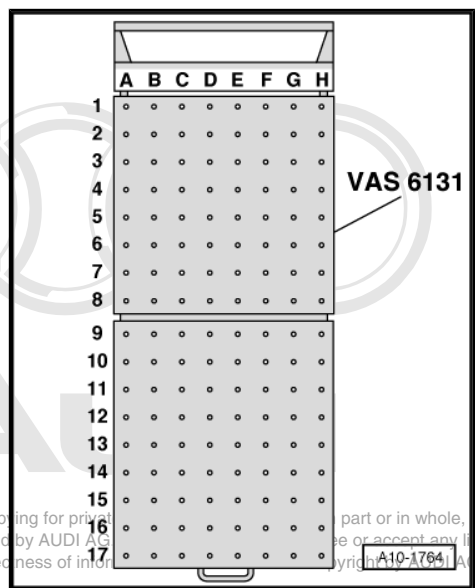


- Pivot wheel bearing housing outwards and remove drive shaft.
- Repeat procedure on other side of vehicle.

**Set up the scissor-type assembly platform as follows:**

- Set up scissor-type assembly platform - VAS 6131- with support set for Audi - VAS 6131/10- and -VAS 6131/11- as follows:

Platform coordinates	Parts of support set for Audi - VAS 6131/10- and - VAS 6131/11-			
C3	/10-1	/10-4	/10-5	/11-1 <sup>2)</sup>
G3	/10-1	/10-4	/10-5	/11-1 <sup>2)</sup>
B6	/10-1	/10-3	/10-5	/10-7
G6	/10-1	/10-3	/10-5	/10-7
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
D16	/10-1	/10-4	/10-5	/10-9
G15	/10-1	/10-4	/10-5	/10-12



2) A washer must also be placed onto the support element.

- Initially tighten the support elements on the assembly platform only hand-tight.
- Adjust the scissor-type assembly platform - VAS 6131- so that it is horizontal.
- Take note of spirit level (bubble gauge).
- Place scissor-type assembly platform - VAS 6131- under engine/gearbox assembly.

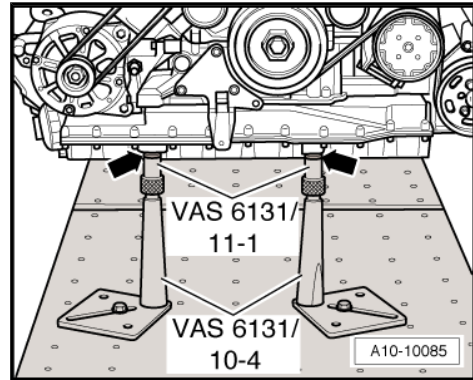


- Position the support elements from -VAS 6131/10- or -VAS 6131/11- at front of engine, as shown in the illustration.

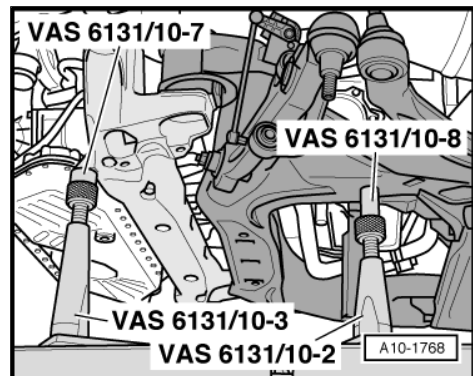


Note

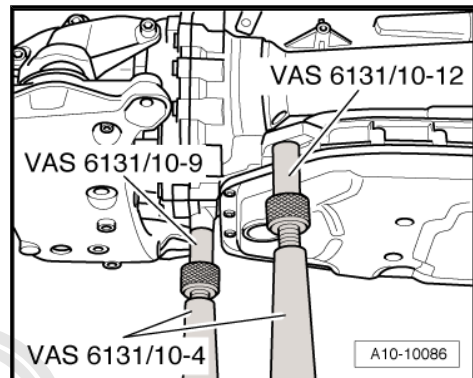
Place a washer between the support elements - VAS 6131/11-1- and the sump on both sides -arrows-.



- Position support elements from -VAS 6131/10- on engine cross member and subframe (left and right), as shown in the illustration.



- Position support elements from -VAS 6131/10- at rear of gear-box, as shown in illustration.
- Turn all spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131- .

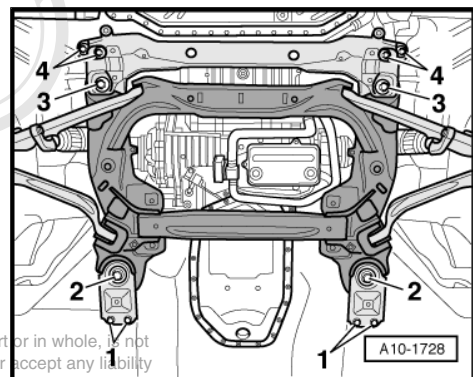


- Mark installation position of subframe and engine cross member on longitudinal members with felt-tip pen.
- Remove bolts -1- and -4-.
- Remove bolts -2- and -3- in a diagonal sequence and in stages.

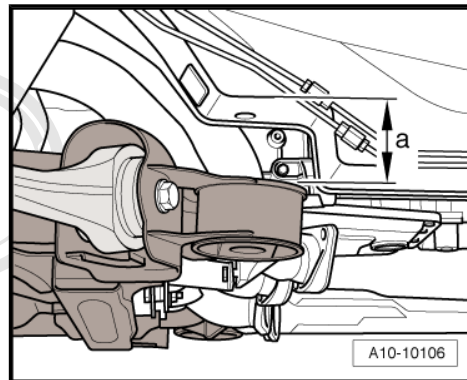


Note

- ◆ Check that all hoses and wiring connections between engine, gearbox, subframe and body have been detached.
- ◆ Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering to avoid damage.

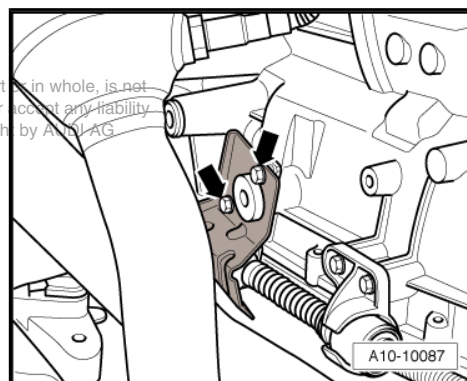


- Lower the engine/gearbox assembly using scissor-type assembly platform - VAS 6131- initially only as far as distance -a-.
- Dimension -a- = 80 mm

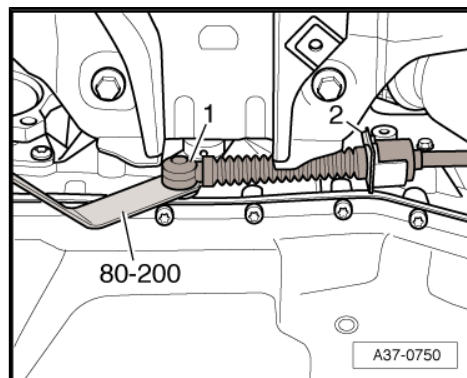


- Remove the heat shield for selector lever cable (left-side) at gearbox -arrows-.

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- Push ball socket -1- of selector lever cable off gearbox selector lever using removal lever - 80-200- .
- Unclip retaining clip -2- at support bracket for selector lever cable.
- Move selector lever cable clear.



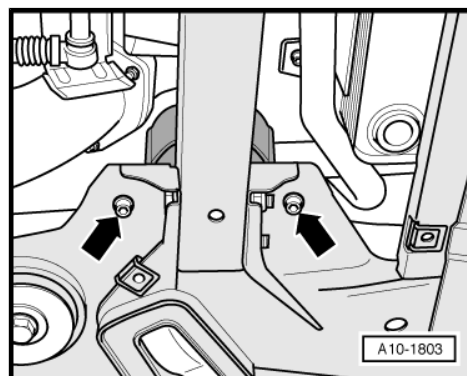
**i Note**

*Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering to avoid damage.*

- Lower engine/gearbox assembly gradually.
- Pull out scissor-type assembly platform - VAS 6131- from under the vehicle.

### 1.3 Separating engine and gearbox

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131- .
- Remove bolts -arrows- for front gearbox mounting (left and right).



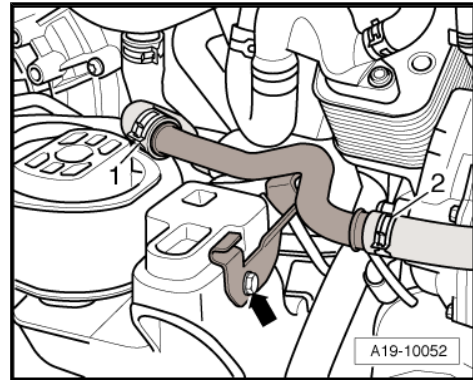


- Remove bolt -arrow-.
- Detach coolant pipe (bottom right) from coolant hose -1-.



**Note**

*Disregard -item 2-.*

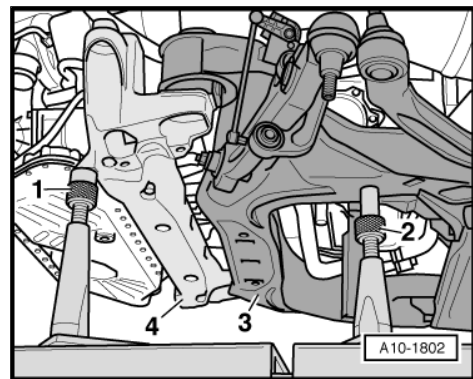


- Screw down spindles of support elements -2- (left and right) at subframe as far as possible.
- Remove locating lugs from spindles.
- Take out subframe -3- from the side.

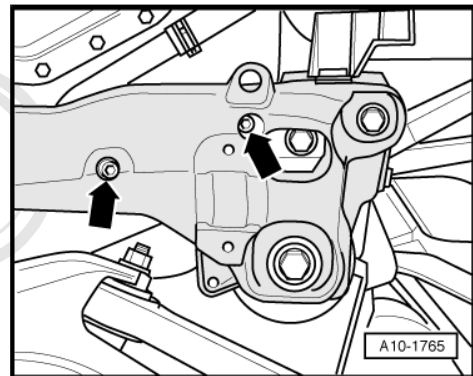


**Note**

*A second mechanic is required for removing the subframe.*



- Screw down spindles of support elements -1- (left and right) at engine cross member -4- as far as possible.
- Remove bolts -arrows- for engine mounting (left and right-side)
- Take out engine cross member.
- Unscrew the 4 base plates for support elements (for engine cross member and subframe) at assembly platform - VAS 6131- .



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**i** Note

The mounting points for engine (front) and gearbox (rear) remain unchanged.

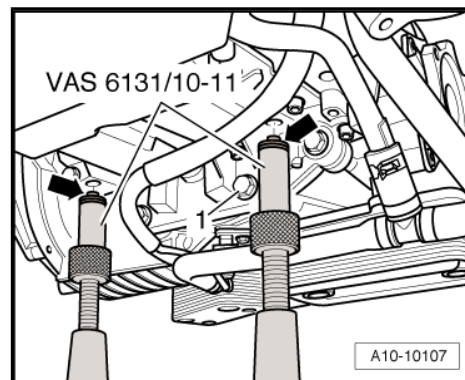
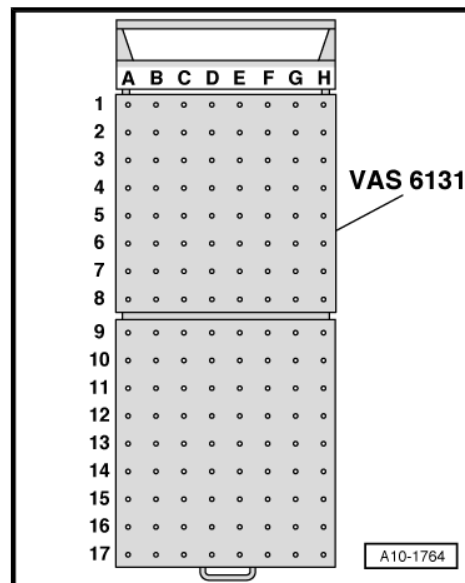
- Set up scissor-type assembly platform - VAS 6131- with support set for Audi - VAS 6131/10- as follows:

Platform coordinates	Parts of support set for Audi - VAS 6131/10-			
C3 <sup>3)</sup>	/10-1	/10-4	/10-5	/11-1
G3 <sup>3)</sup>	/10-1	/10-4	/10-5	/11-1
C7	/10-1	/10-4	/10-5	/10-11 <sup>4)</sup>
F7	/10-1	/10-4	/10-5	/10-11 <sup>4)</sup>
B11	/10-1	/10-4	/10-5	/10-12
G10	/10-1	/10-3	/10-5	/10-13
D16 <sup>3)</sup>	/10-1	/10-4	/10-5	/10-9
G15 <sup>3)</sup>	/10-1	/10-4	/10-5	/10-12

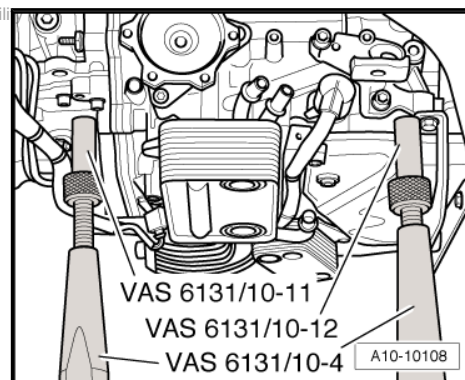
3) Support elements remain unchanged.

4) Two washers (total height: 3 mm) must also be placed on the support element.

- Remove bolt -1- on engine/gearbox flange (bottom left).
- Place two washers -arrows- (total height: 3 mm) on locating lugs for support elements -VAS 6131/10-11- at rear of engine.

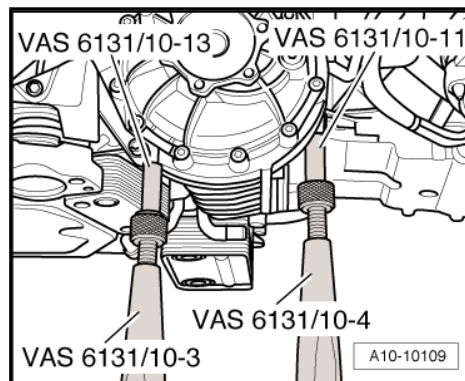


- Position support elements from -VAS 6131/10- at left of engine/gearbox assembly, as shown in illustration.





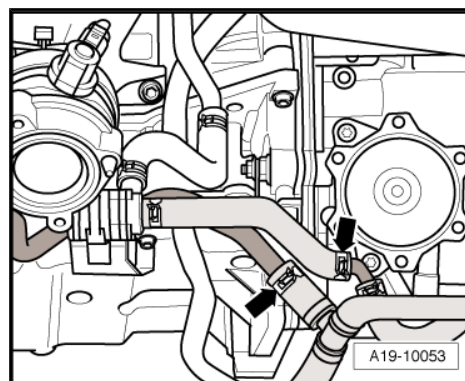
- Position support elements from -VAS 6131/10- at right of engine/gearbox assembly, as shown in illustration.
- Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131- .



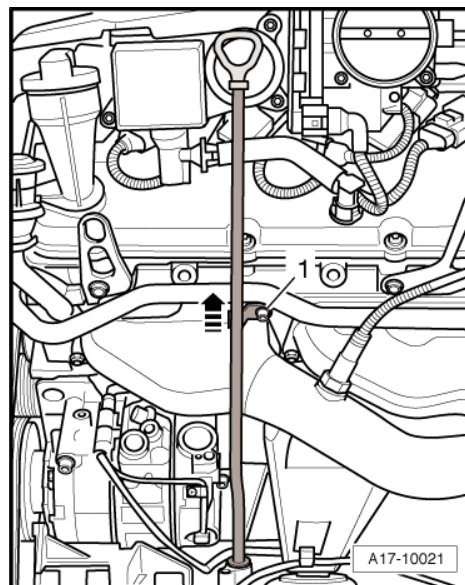
**Note**

*Lay a cloth under the connection to catch escaping coolant.*

- Detach coolant hoses -arrows- from coolant pipes (left-side).



- Remove bolt -1-.
- Pull the guide tube for oil dipstick out upwards -arrow-.



**Audi**

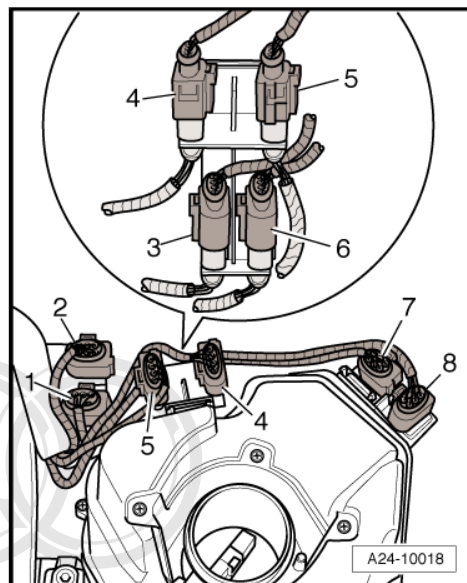
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- Unplug electrical connectors -1 ... 8- for Lambda probes.

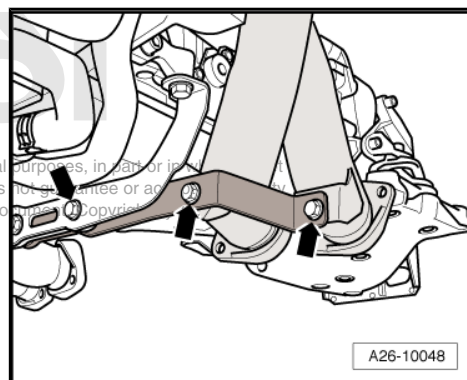
**i** Note

To unplug electrical connectors -3- and -6-, detach bracket for connectors from air cleaner housing and turn (see detail in illustration).

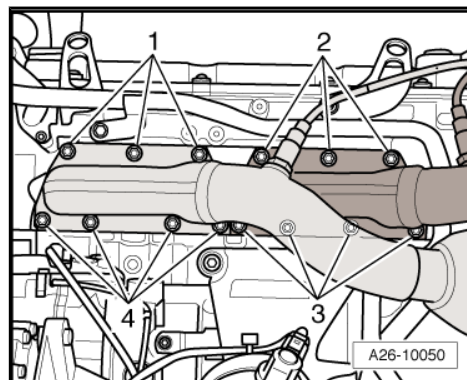


- Unscrew bolts -arrows- and swivel the bracket for exhaust manifold with catalytic converters (left-side) downwards.

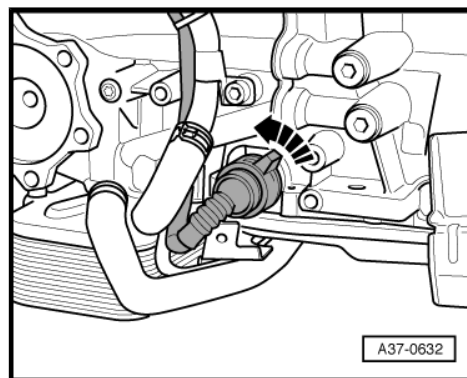
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- Unscrew nuts -1 ... 4- and remove both exhaust manifolds with catalytic converters (left-side).

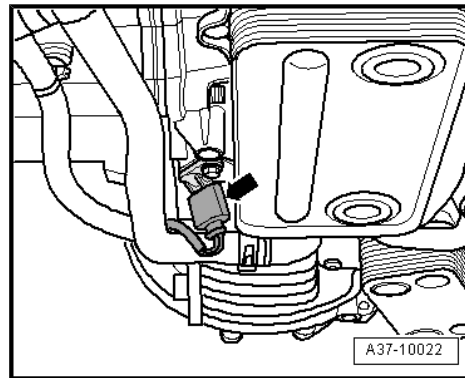


- Turn retainer catch anti-clockwise -arrow- and unplug electrical connector (left-side) at gearbox.





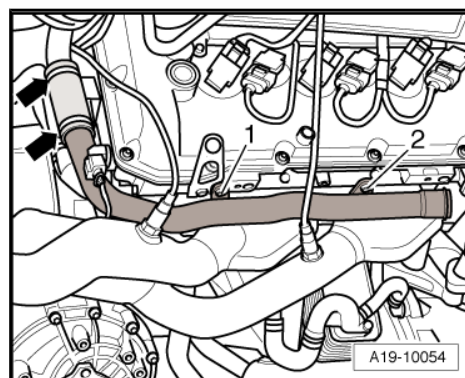
- Unplug electrical connector -arrow- at gearbox input speed sender - G182- .



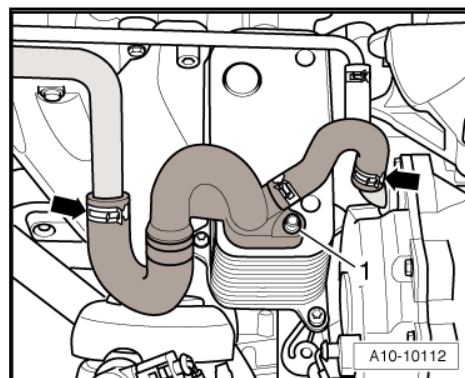
- Unscrew both bolts -1- and -2- for coolant pipe (top right).

**i** Note

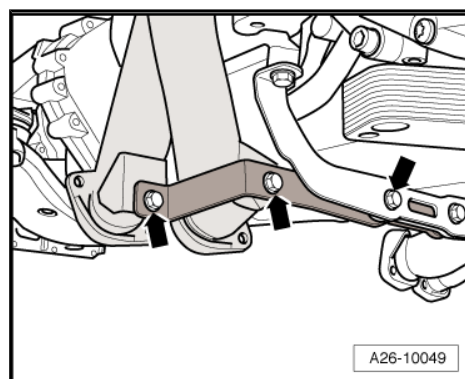
- ◆ Disregard -arrows-.
- ◆ Leave the coolant pipe in installation position.



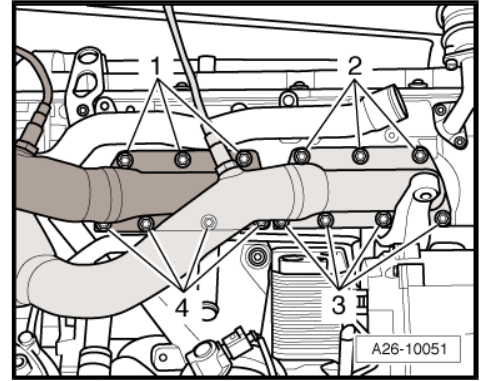
- Disconnect coolant hoses -arrows-.
- Remove bolt -1-.
- Remove coolant hose/pipe connection at engine oil cooler.



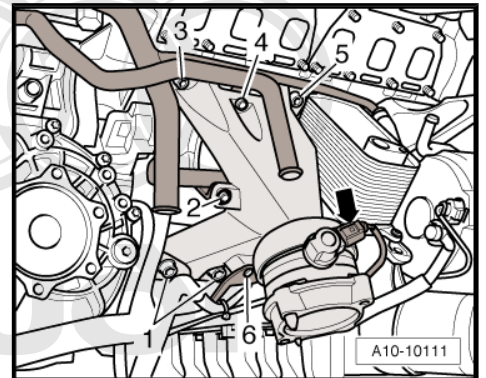
- Unscrew bolts -arrows- and swivel the bracket for exhaust manifold with catalytic converters (right-side) downwards.



- Unscrew nuts -1 ... 4- and remove both exhaust manifolds with catalytic converters (right-side).

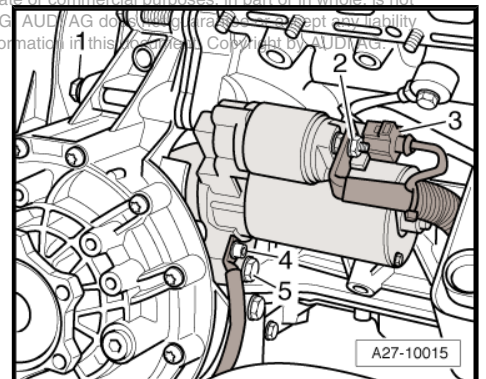


- Unplug electrical connector -arrow- at engine mounting (right-side).
- Remove bolts -1 ... 6-.
- Remove engine support with engine mounting.



- Unbolt earth cable -4- at starter.
- Detach electrical wires -2- and -3- at starter.
- Remove bolts -1- and -5- and detach starter.

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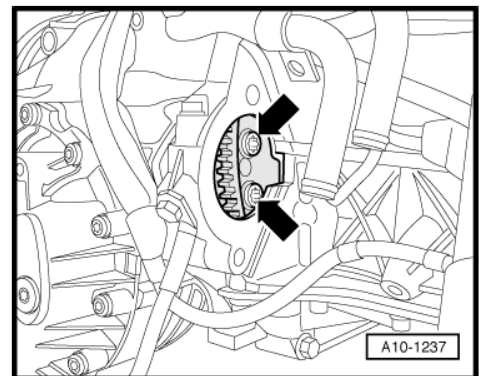


- Unscrew 6 bolts -arrows- for torque converter through opening for starter motor (turn crankshaft 1/3 turn each time).

**i** Note

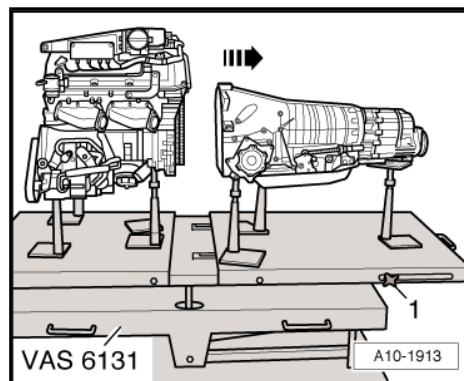
*When loosening torque converter bolts, counterhold at the crankshaft central bolt.*

- Unscrew securing bolts for engine/gearbox.





- Loosen clamping bolts -1- on sides of scissor-type assembly platform - VAS 6131- and pull rear section of platform together with gearbox towards the rear -arrow-; simultaneously separate the torque converter from the drive plate through the opening.



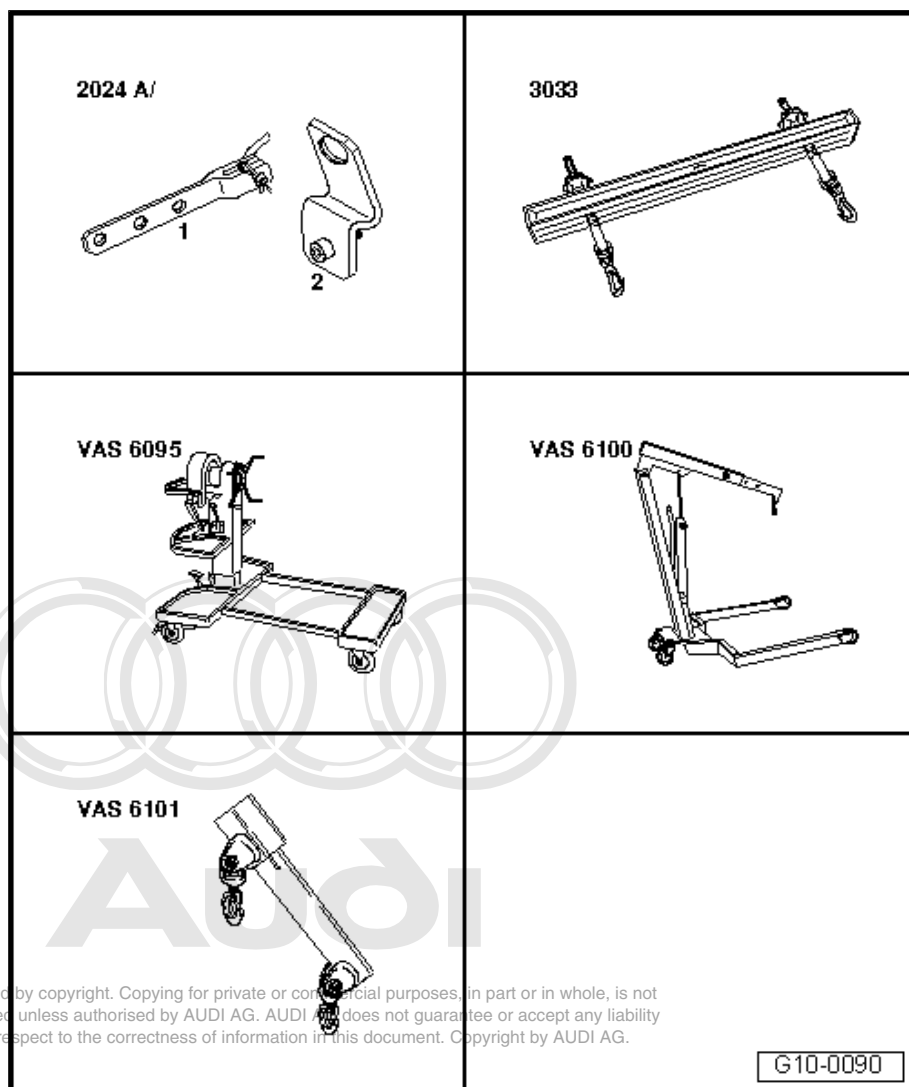
**Note**

- ◆ *The engine must not be placed down on its sump after removing it from the scissor-type assembly platform - VAS 6131- .*
- ◆ *In order to perform repairs, lift engine using workshop hoist - VAS 6100- and secure engine to engine/gearbox stand - VAS 6095- => [page 30](#) .*

### 1.4 Securing engine to assembly stand

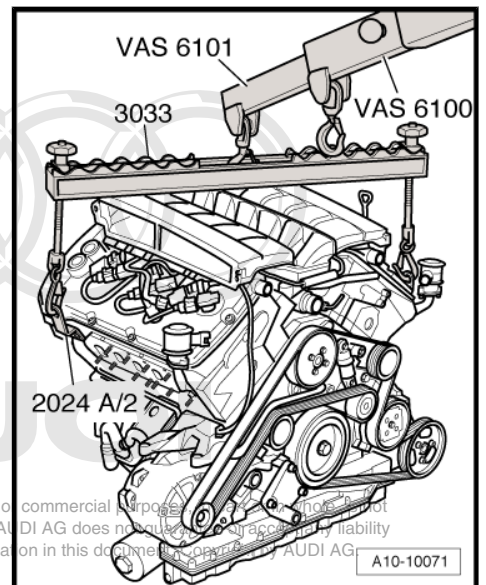
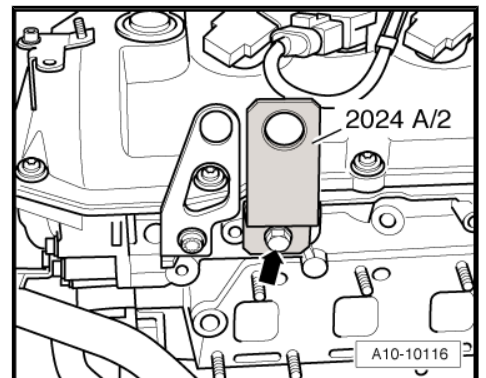
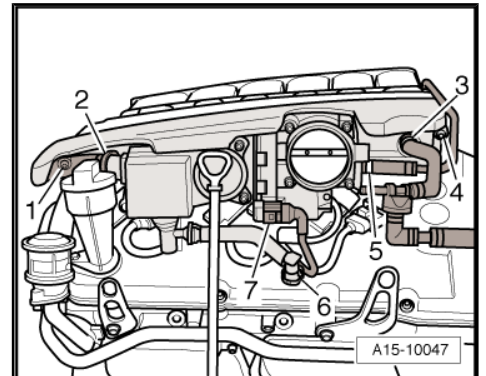
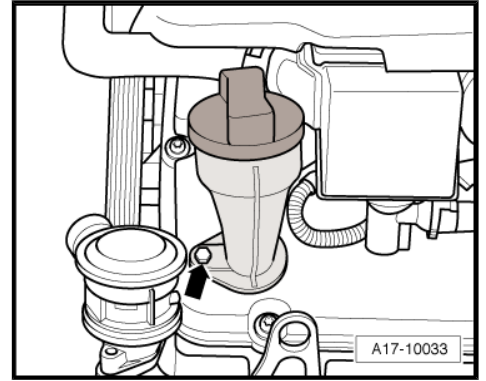
#### Special tools and workshop equipment required

- ◆ Bracket - 2024 A/2-
- ◆ Lifting tackle - 3033-
- ◆ Engine and gearbox support - VAS 6095- with support bracket for W12 engine - VAS 6095/1-1-
- ◆ Workshop hoist - VAS 6100-
- ◆ Lift arm extension (workshop hoist) - VAS 6101-
- ◆ Bolt M8x20



**Procedure**

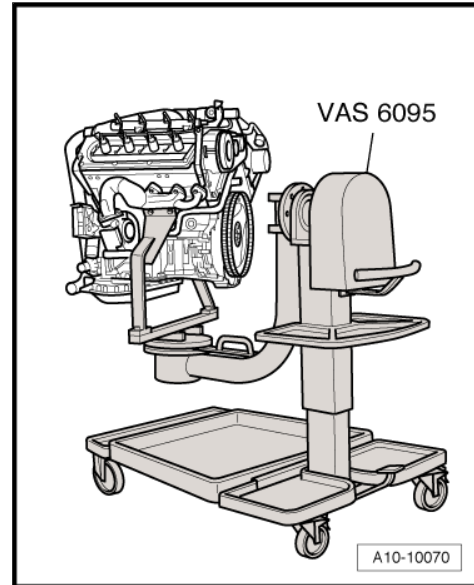
- Engine separated from gearbox ⇒ [page 23](#) .
- Remove bolt -arrow-.
- Detach oil filler neck at cylinder head cover.
  
- Detach electrical connector -7- at throttle valve module 2 - J544- .
- Disconnect vacuum hoses -3- and -5-.
- Disconnect hoses for crankcase breather system -2- and -6-.
- Remove bolts -1- and -4-.
- Remove left section of intake manifold.
  
- Secure bracket - 2024 A/2- to engine (right-side) using bolt M8x20 -arrow-: tightening torque 20 Nm.
  
- Attach lift arm extension - VAS 6101- to workshop hoist - VAS 6100- .
- Attach the lifting tackle - 3033- to workshop hoist - VAS 6100- with lift arm extension (workshop hoist) - VAS 6101- as shown in the illustration.
- Lift engine off the support elements on scissor-type assembly platform - VAS 6131- .
- Unbolt engine support (left-side) from cylinder block.



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- Secure engine to engine and gearbox support - VAS 6095- with support bracket for W12 engine - VAS 6095/1-1- , as shown in illustration.

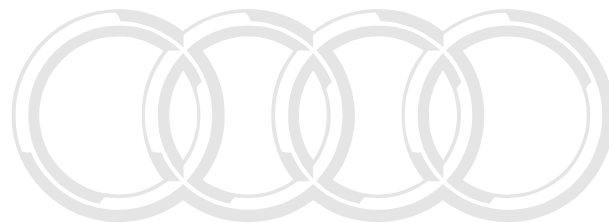


## 1.5 Installing engine



### Note

- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
- ◆ *Renew bolts which are tightened to a specified angle as well as seals, gaskets and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) → Parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install dowel sleeves if necessary.
- Press intermediate plate between engine and gearbox onto dowel sleeves.

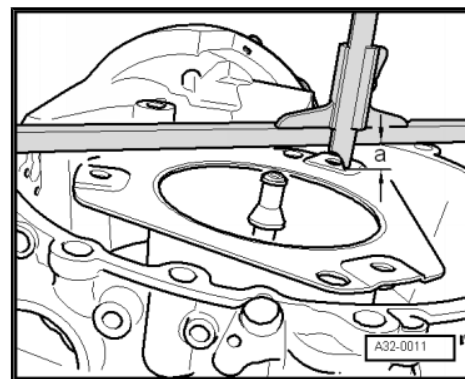


# Audi

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### Checking installation depth of torque converter

If the torque converter has been correctly installed, the distance -a- between the contact surfaces at the threaded holes in the torque converter and the joint surface on the torque converter bell-housing for automatic gearbox 09E is at least 6 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.*

- Before joining engine and gearbox, turn torque converter and drive plate on engine so that holes for bolts are in line with opening for starter motor.

**Caution**

*Before and during tightening of bolts on engine/gearbox flange, continually check that the torque converter behind the drive plate can be turned. If the converter cannot be turned, it must be assumed that it has not been installed correctly and the drive lugs for the ATF pump and consequently the gearbox will be damaged during final tightening of bolt connections.*

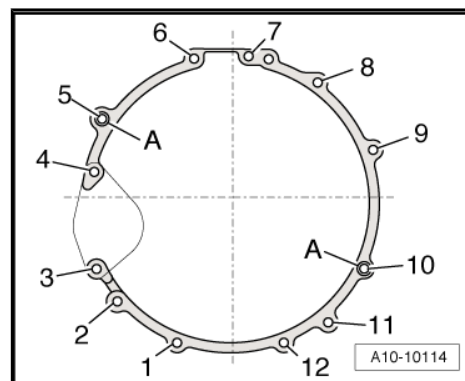
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- Bolt gearbox to engine

**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: ± 15%.*

### Securing engine to gearbox

Item	Bolt	Nm
1, 8, 11, 12	M12x62	65
2	M12x105	65
3	M12x55	45
4	M10x150	65 <sup>5)</sup>
5	M12x95	65
6, 7	M12x90	65
9	M12x67	65
10	M12x70	65
A	Dowel sleeves for centralising	



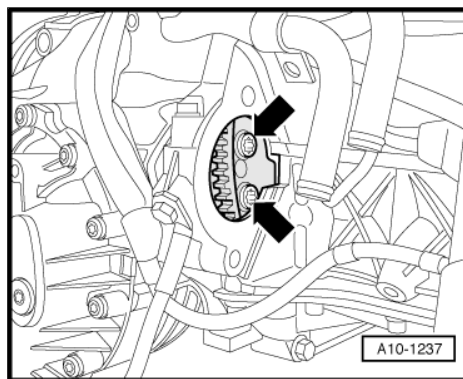
5) Property class 10.9



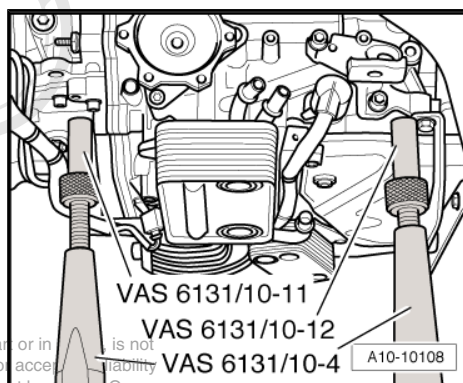
- Use new ribbed bolts for securing torque converter to drive plate.
- Screw in the 6 bolts -arrows- for torque converter through opening for starter motor initially finger-tight (turn crankshaft 1/3 turn each time).
- Then tighten torque converter bolts to final torque (turn crankshaft 1/3 turn each time).

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

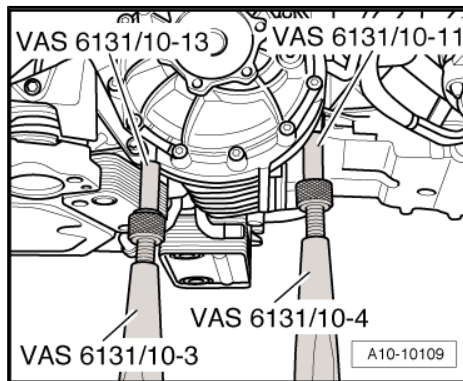
- Install exhaust manifolds together with catalytic converters: left-side => [page 234](#) , right-side => [page 235](#) .
- Check wire routing on engine => [page 39](#) .
- Prior to assembly, always use a thread tap to remove remaining locking fluid from the tapped holes in the flange shaft for the propshaft on the gearbox.
- Screw down the spindles for support elements - VAS 6131/10-11- and -VAS 6131/10-12- (left-side) at engine/gearbox assembly.
- Unscrew both base plates for support elements (left-side) at scissor-type assembly platform - VAS 6131- .



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- Screw down the spindles for support elements - VAS 6131/10-11- and -VAS 6131/10-13- (right-side) at engine/gearbox assembly.
- Unscrew both base plates for support elements (right-side) at scissor-type assembly platform - VAS 6131- .



**Note**

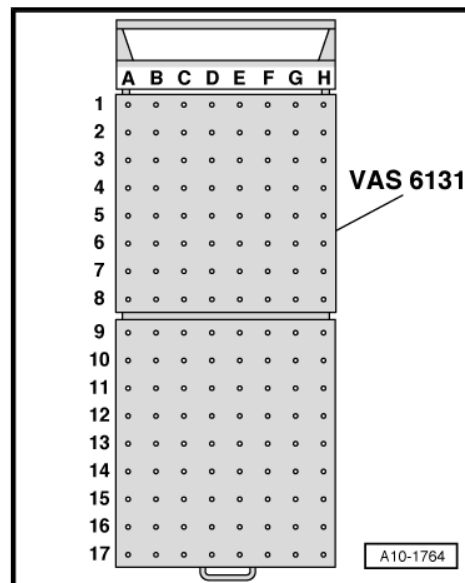
*The mounting points for engine (front) and gearbox (rear) remain unchanged.*



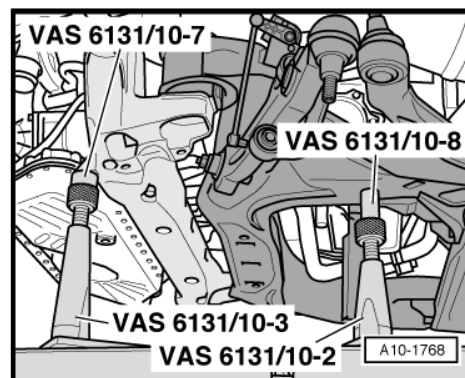
- Set up scissor-type assembly platform - VAS 6131- with support set for Audi - VAS 6131/10- as follows:

Platform coordinates	Parts of support set for Audi - VAS 6131/10-			
C3 <sup>6)</sup>	/10-1	/10-4	/10-5	/11-1
G3 <sup>6)</sup>	/10-1	/10-4	/10-5	/11-1
B6	/10-1	/10-3	/10-5	/10-7
G6	/10-1	/10-3	/10-5	/10-7
B10	/10-1	/10-2	/10-5	/10-8 <sup>7)</sup>
G10	/10-1	/10-2	/10-5	/10-8 <sup>7)</sup>
D16 <sup>6)</sup>	/10-1	/10-4	/10-5	/10-9
G15 <sup>6)</sup>	/10-1	/10-4	/10-5	/10-12

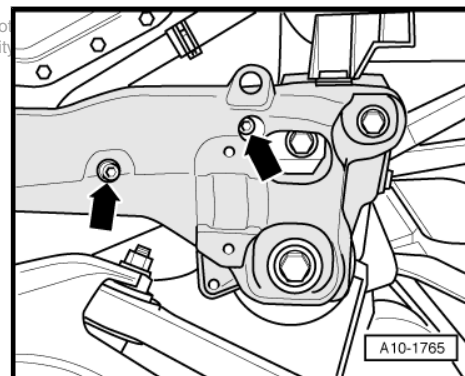
- 6) Support elements remain unchanged.
- 7) Secure support elements only after installing the subframe.



- Position engine cross member on the two support elements - VAS 6131/10-7- .
- Screw up the spindles for support elements - VAS 6131/10-7- on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131- .



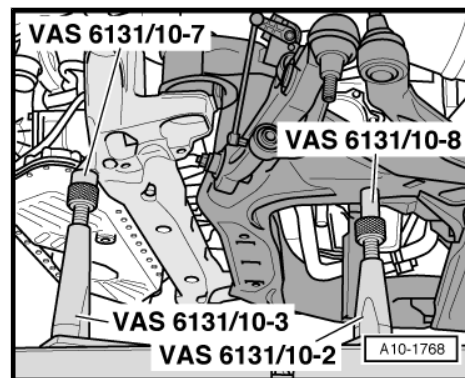
- Tighten bolts, arrows for engine mountings on both sides.



**Note**


*A second mechanic is required for positioning the subframe on the support elements.*

- Fit subframe onto the two support elements -VAS 6131/10-8- .
- Screw up spindles for support elements -VAS 6131/10-8- on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131- .

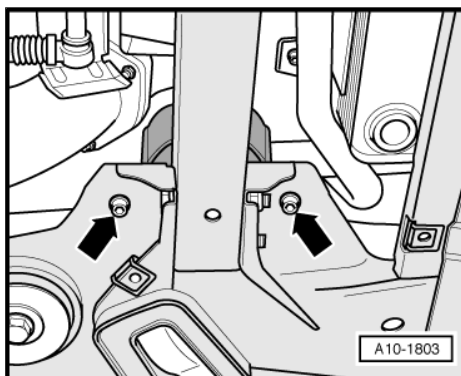




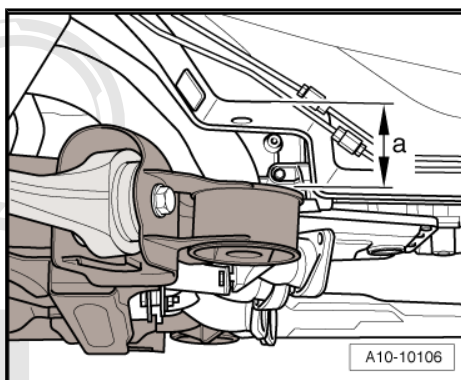
- Tighten bolts for gearbox mountings -arrows- on both sides.
- Guide engine/gearbox assembly together with subframe and engine cross member into the body slowly from below using scissor-type assembly platform - VAS 6131- .

 **Caution**

*Make sure that the selector lever cable is guided over the rear gearbox mounting so that it does not become pinched when installing.*




- Raise engine/gearbox assembly only until distance between subframe and body equals dimension -a-.
- Dimension -a- = 80 mm
- Install selector lever cable at gearbox => Automatic gearbox 09E, four-wheel drive; Rep. gr. 37 .

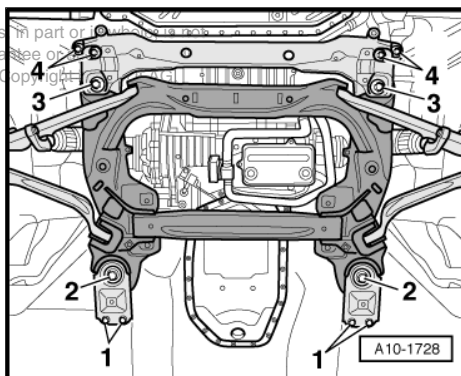


- Adjust the subframe according to the markings previously made on the longitudinal members.
- Only tighten bolts for subframe to the specified torque (do not turn further); tighten bolts only after performing alignment check.

- 1 - 50 Nm
- 2 - 150 Nm
- 3 - 150 Nm

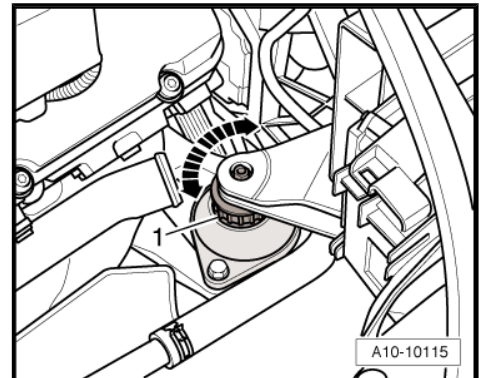
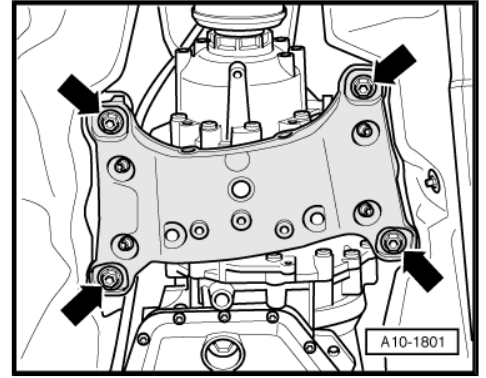
 **WARNING**

*The vehicle must not be driven at this stage.*



- Tighten bolts -4- for engine cross member.

- Tighten bolts -arrows- at tunnel cross member.
- Install propshaft ⇒ Rear final drive 01R; Rep. gr. 39 .
- Align exhaust system so it is free of stress ⇒ [page 238](#) .
- Install guide link, track control link and anti-roll bar ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install drive shafts ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install refrigerant lines ⇒ Air conditioning system; Rep. gr. 87
- Install side section of intake manifold: vehicles in rest-of-world ⇒ ["2.2 Removing and installing left section of intake manifold", page 102](#) or ⇒ ["2.3 Removing and installing right section of intake manifold", page 104](#) ; USA vehicles ⇒ ["3.2 Removing and installing left section of intake manifold", page 111](#) or ⇒ ["3.3 Removing and installing right section of intake manifold", page 113](#) .
- Install body brace ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Adjust mounting for torque reaction support before tightening torque reaction support.
- To do this, turn adjuster ring -1- anti-clockwise until it comes into contact with torque reaction support.
- Then turn adjuster ring one turn clockwise.



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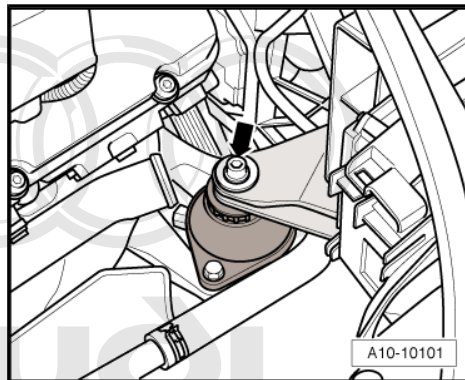


- Tighten bolt -arrow- on mounting for torque reaction support.
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .



**Caution**

*Do not use a battery charger to boost starting. There is danger of damaging the vehicle's control units.*



- Check oil level ⇒ [page 170](#) .
- Fill cooling system ⇒ [page 180](#) .

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**Note**

*Do not reuse coolant.*

- Top up power steering fluid and bleed steering system: ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 48
- Charge the refrigerant system ⇒ Air conditioner system - with refrigerant R134a .
- Install and adjust wiper arms ⇒ Electrical system; Rep. gr. 92 .
- Check adjustment of selector lever cable ⇒ Automatic gear-box 09E, four-wheel drive; Rep. gr. 37 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Perform wheel alignment check ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 44 .



**WARNING**

*Tighten bolts for subframe to final setting after performing wheel alignment check.*

- Check fuel system for leaks ⇒ [page 3](#) .

**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	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Drive plate to torque converter	M10x1	85 <sup>8)</sup>
Engine mounting to engine cross member		23
Gearbox mounting to subframe		23
Terminal B+ to starter		16
Earth cable to starter		20
Coolant pipe to engine cross member		10
Coolant hose/pipe connection to engine oil cooler		10
Engine support to engine		40
Engine cross member to longitudinal member		68
Drive shaft heat shield to gearbox		23
Tunnel cross member to body		40
Earth cable to longitudinal member		20
Battery cable to fuse box		20
Combination valve for secondary air system to cylinder head		10
Hydraulic line to power steering pump		47
Bracket for torque reaction support to mounting for torque reaction support		40
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

8) Renew bolts.

## 1.6 Wire routing on engine

**1 - Heat insulation sleeve**

- Attach to Hall sender 4 - G301-

**2 - Electrical wiring for camshaft adjuster**

- Clip into retaining clips

**3 - Cable tie with clip**

- Clip into bore in bracket

**4 - Retaining clamp**

- Tighten to 9 Nm

**5 - Earth cable**

- Tighten to 9 Nm

**6 - Cable tie for Lambda probe wire**

- Secure to wiring for ignition coils for cyl. 1 ... 3 and cyl. 4 ... 6

**7 - Cable tie for Lambda probe wire**

- Clip into bore in bracket

**8 - Retaining clamp**

- Tighten to 9 Nm

**9 - Electrical wiring for camshaft adjuster**

- Clip into retaining clips

**10 - Heat insulation sleeve**

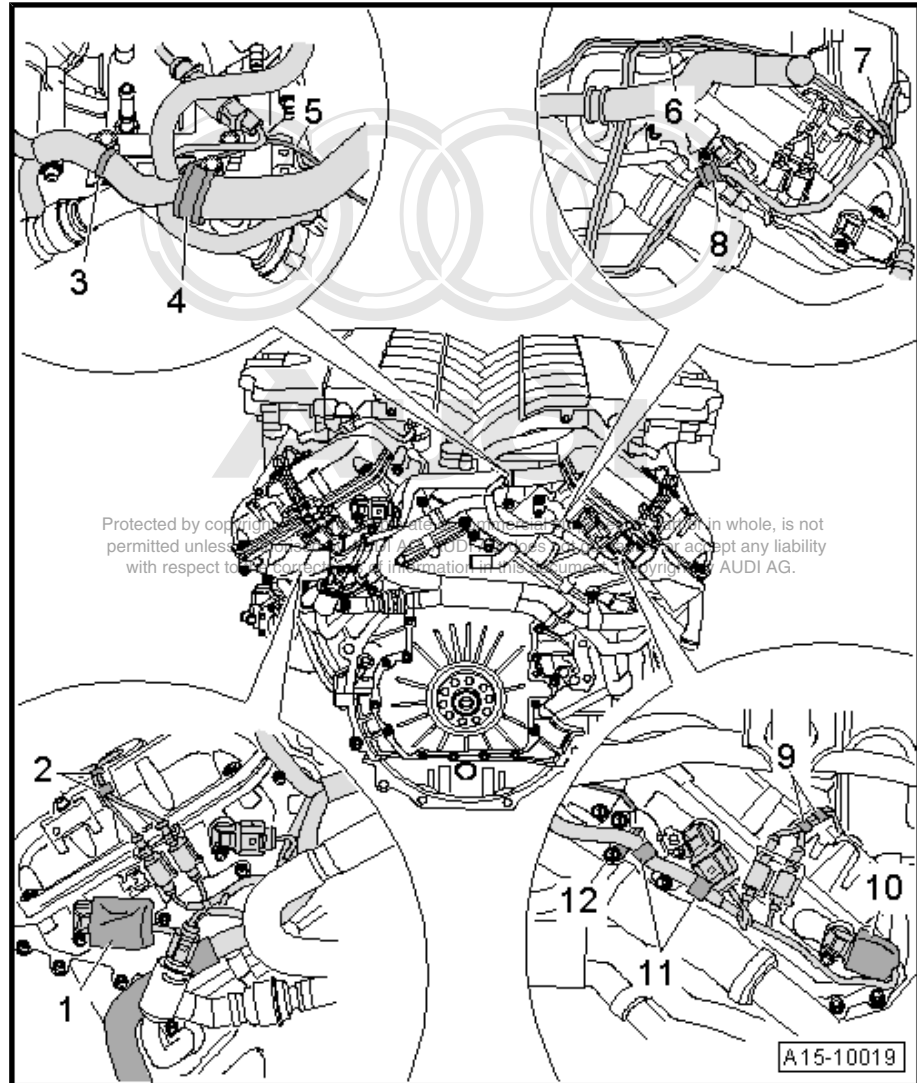
- Attach to Hall sender 3 - G300-

**11 - Wiring clips**

- Clip into bores

**12 - Earth cable**

- Tighten to 9 Nm



## 1.7 Removing and installing mounting for torque reaction support

### Special tools and workshop equipment required

- ◆ Electric drill
- ◆ Stepped centre bit ( $\varnothing$  24 mm)

### Removing

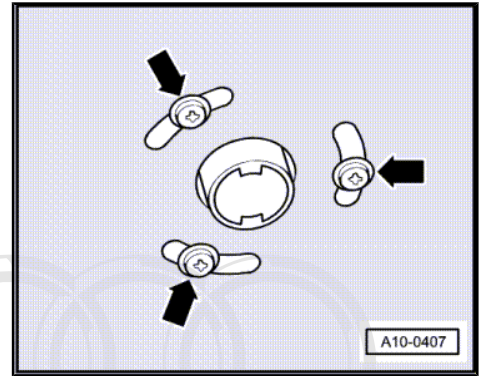
- Switch off ignition and remove ignition key.
- Turn light switch to position "0".

- Remove both front wheels.

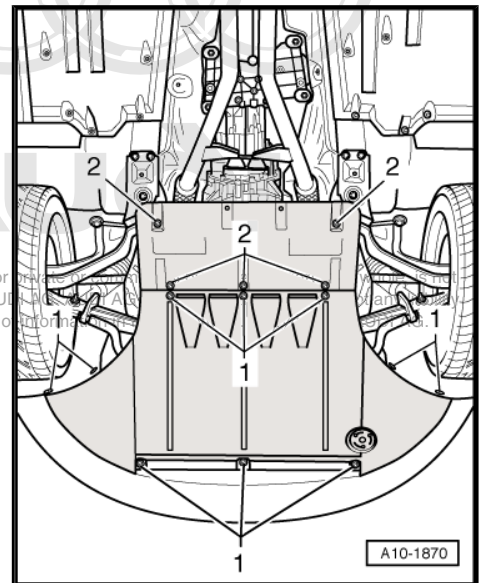
 **Note**

*Secure brake discs with wheel bolts.*

- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.

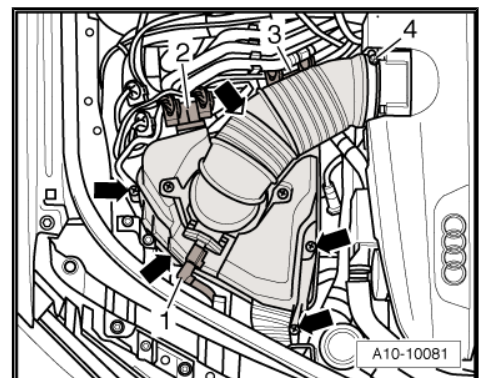


- Open quick-release fasteners -1- and remove noise insulation (front). Leave rear noise insulation in position.
- Remove front section of wheel housing liner (front left and front right) ⇒ General body repairs, exterior; Rep. gr. 66 .
- Remove front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .

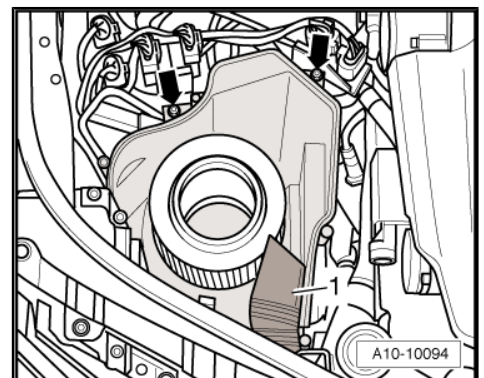


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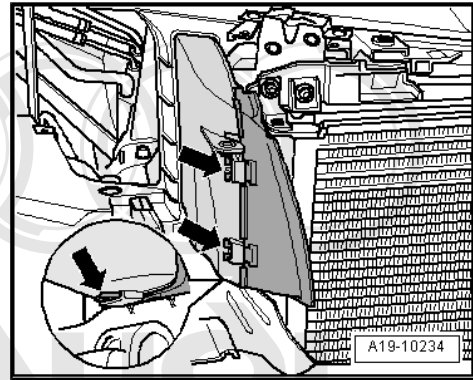
- Detach electrical connector -1- for air mass meter - G70- (right-side).
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).
- Remove headlight (right-side) ⇒ Electrical system; Rep. gr. 94 .

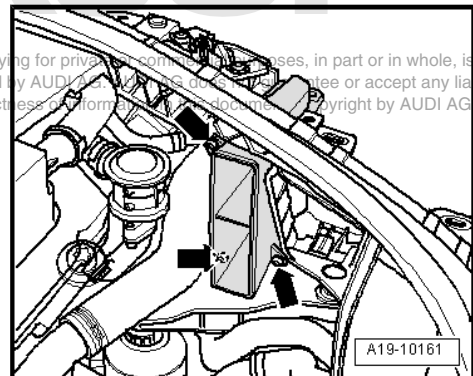


- Compress retainer catches -arrows- and detach air duct from lock carrier (front right).



- Remove bolts -arrows-.
- Detach air duct from lock carrier (rear right).

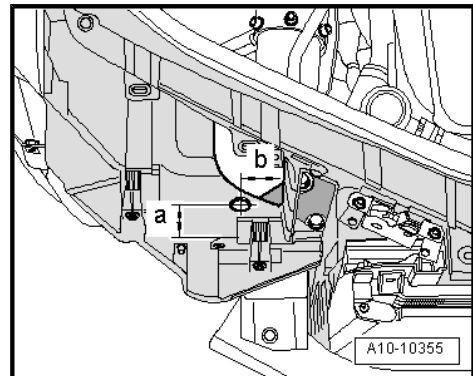
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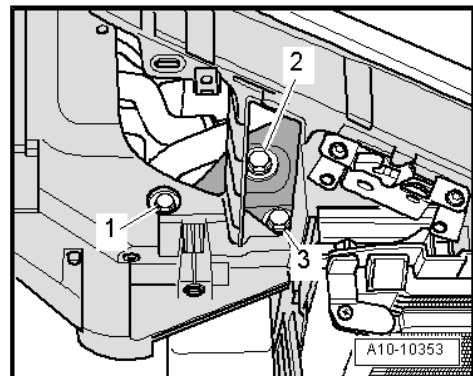
- Mark out drilling on lock carrier as illustrated according to dimensions -a- and -b-.
- Dimension -a- = 40 mm
- Dimension -b- = 55 mm
- Drill a hole of 24 mm dia.

**Note**

*Drill a pilot hole and then drill out to 24 mm dia using the stepped centre bit.*

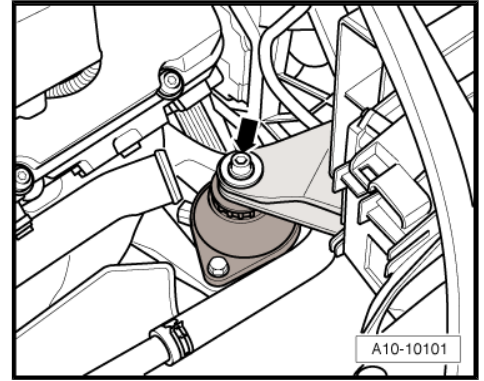


- Remove bolts -1- and -2- on bracket for torque reaction support.
- Slacken bolt -3- a few turns.



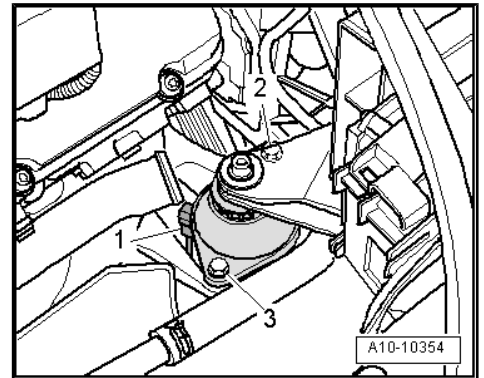


- Remove bolt -arrow- on mounting for torque reaction support.

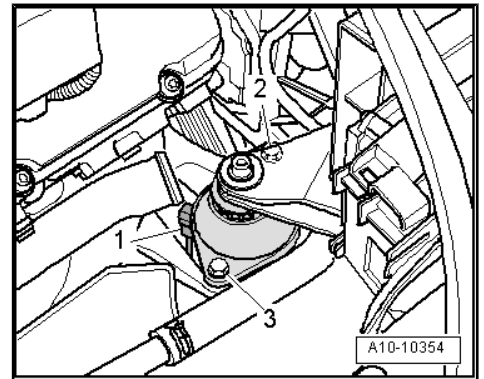


- Remove bolts -2- and -3-.
- Pivot mounting for torque reaction support to one side and unplug electrical connector -1-.
- Take out mounting for torque reaction support.

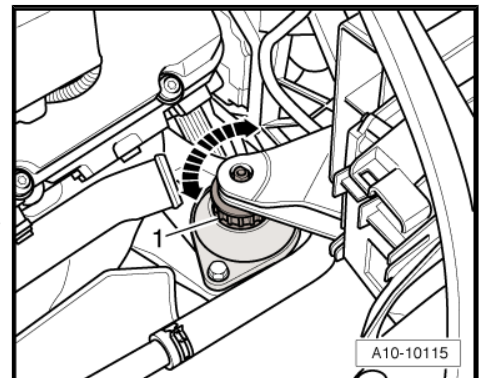
### Installing



- Plug in electrical connector -1- on mounting for torque reaction support.
- Fit mounting for torque reaction support and tighten bolts -2- and -3-.

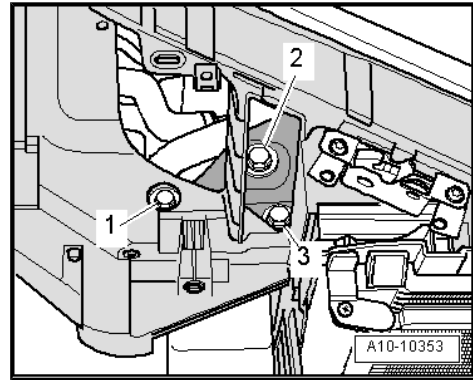


- Turn adjuster ring -1- on mounting for torque reaction support clockwise to stop.

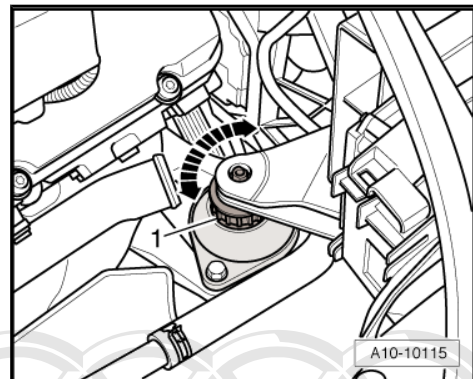


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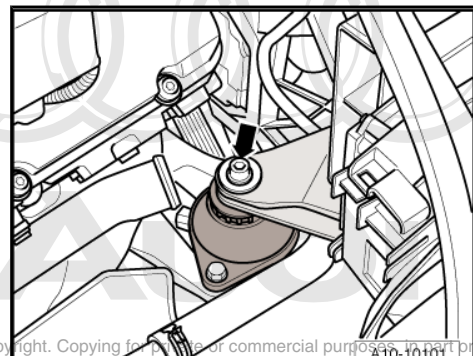
- Tighten bolts -1- to -3- for bracket for torque reaction support.



- Turn adjuster ring -1- by hand anti-clockwise until it comes into contact with torque reaction support.
- Then turn adjuster ring one turn clockwise.



- Tighten bolt -arrow- on mounting for torque reaction support.
- Installation is carried out in the reverse order; note the following:
- Install air ducts (front and rear) on lock carrier.
  - Install headlight ⇒ Electrical system; Rep. gr. 94
  - Install front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .
  - Check headlight adjustment ⇒ Maintenance ; Booklet 404 .



**Tightening torques**

Component	Nm
Mounting for torque reaction support to torque reaction support	23
Bracket for torque reaction support to longitudinal member	40
Mounting for torque reaction support to bracket for torque reaction support	40

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## 13 – Crankshaft group

### 1 Dismantling and assembling engine

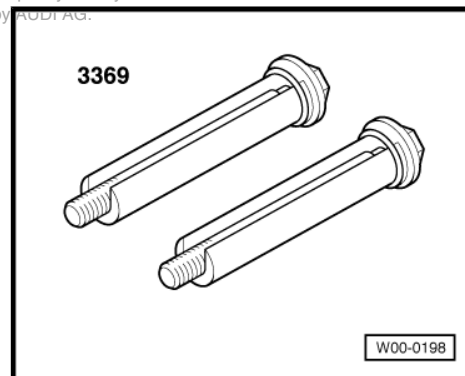
⇒ [“1.1 Moving lock carrier into service position”, page 45](#)

⇒ [“1.2 Lowering subframe for repair and assembly work”, page 47](#)

#### 1.1 Moving lock carrier into service position

##### Special tools and workshop equipment required

- ◆ Front-end service sleeves - 3369-



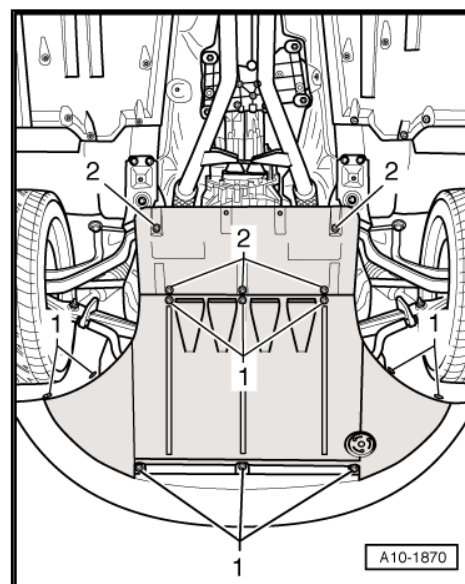
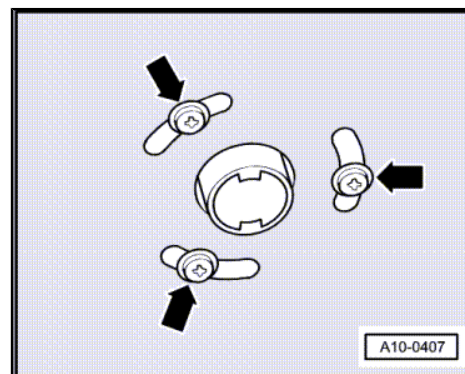
##### Removing

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Remove both front wheels.

##### Note

*Secure brake discs with wheel bolts.*

- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.
- Open quick-release fasteners -1- and remove noise insulation (front).
- Remove front section of wheel housing liner (front left and front right) ⇒ General body repairs, exterior; Rep. gr. 66 .
- Remove front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .



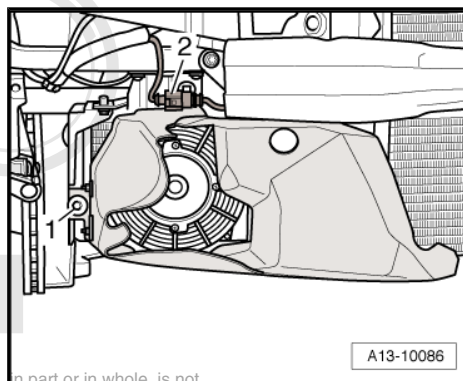


- Unplug the electrical connector -2- and move wiring clear.
- Remove bolt -1-.
- Detach air duct for auxiliary radiator.



**WARNING**

*The air conditioner refrigerant circuit must not be opened.*



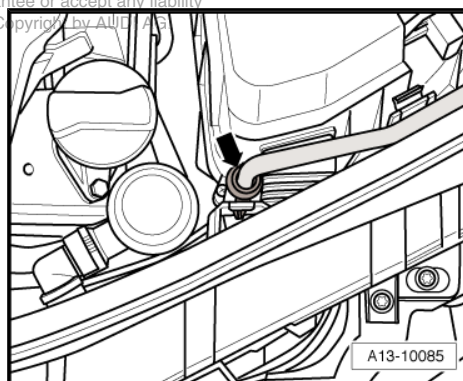
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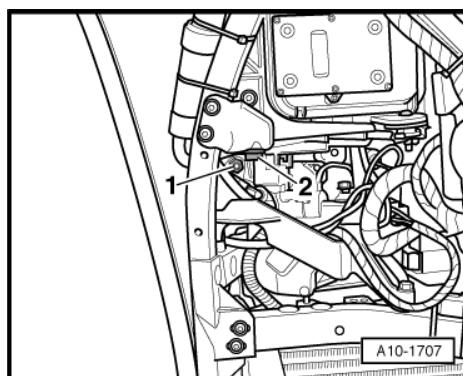
**Note**

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

- Unclip refrigerant line at lock carrier -arrow-.
- Move bonnet cable (front left) at lock carrier clear.



- Working from wheel housing, remove one nut -1- and one bolt -2- for lock carrier on each side.

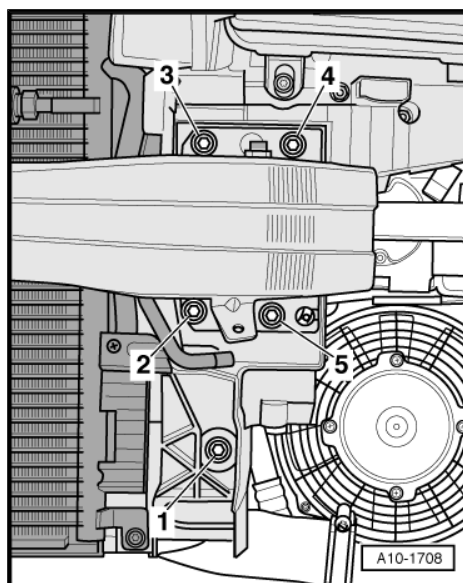


- Unscrew bolts -1 ... 5- on both sides of vehicle.

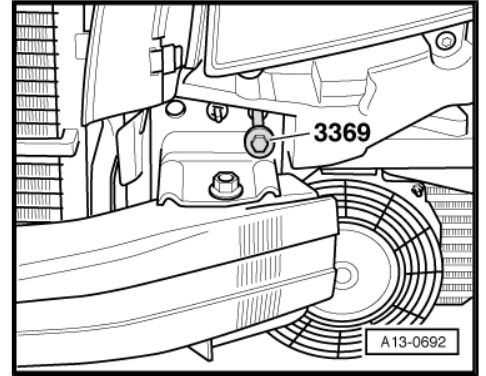


**Note**

*First unscrew one bolt on each side and mark the installation location of the lock carrier through the holes with a felt-tip pen.*



- Remove bolts from front-end service sleeves - 3369- (special tool).
- Screw bolts from front-end service sleeves - 3369- into top bolt holes for impact damper (left and right sides).

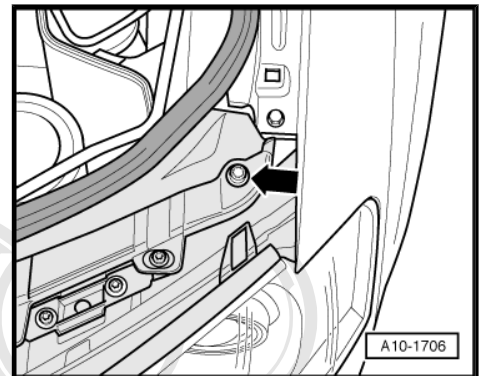


- Pull off bonnet seal at both wing panels.
- Remove one bolt -arrow- on each side from top of lock carrier.
- Carefully pull the lock carrier forward.

### Installing

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

- Install lock carrier with attachments ⇒ General body repairs, exterior; Rep. gr. 50 .
- Install front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Check headlight adjustment ⇒ Maintenance ; Booklet 404 .



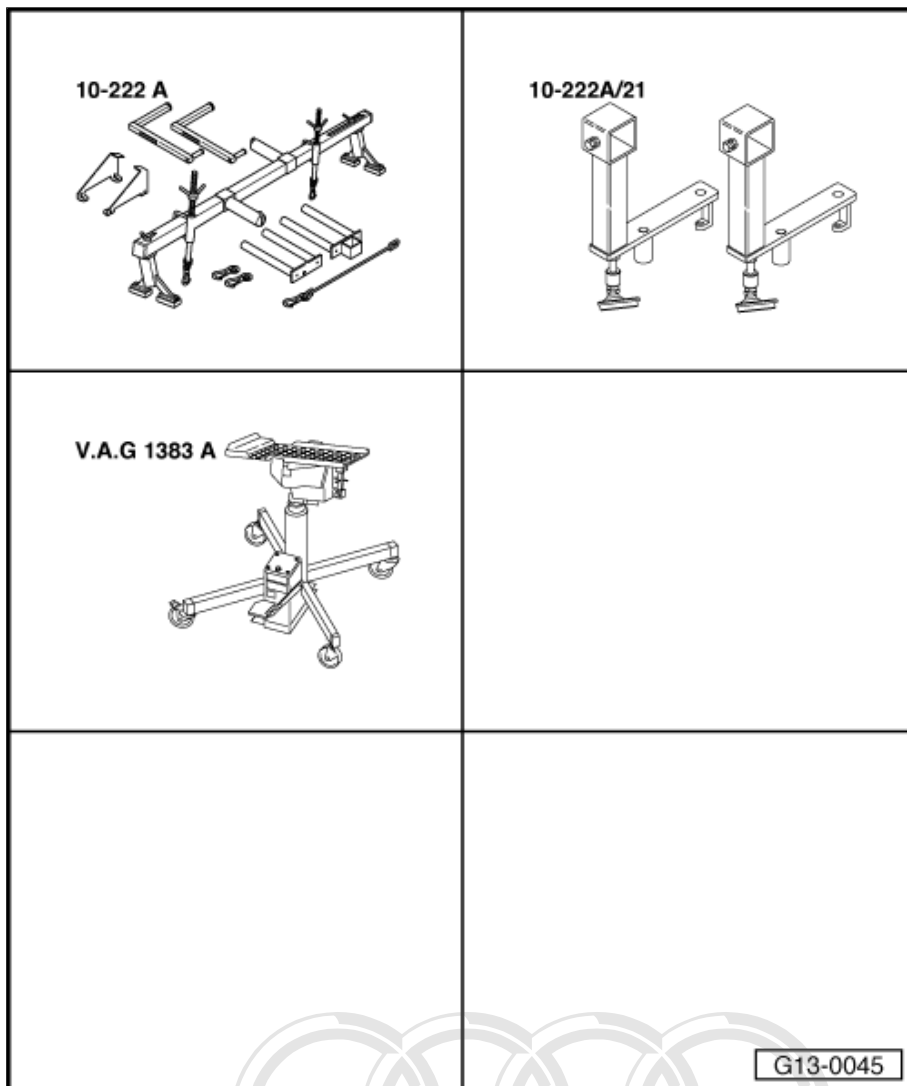
## 1.2 Lowering subframe for repair and assembly work

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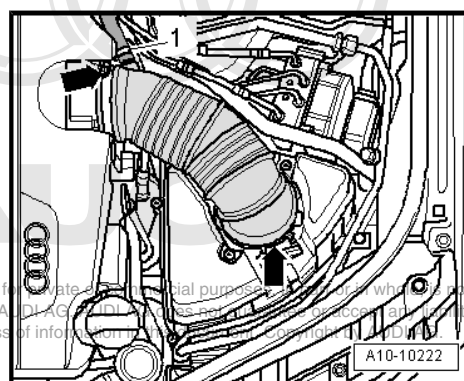
**Special tools and workshop equipment required**

- ◆ Support bracket - 10-222 A-
- ◆ Support - 10-222 A/21-
- ◆ Engine and gearbox jack - V.A.G 1383 A-



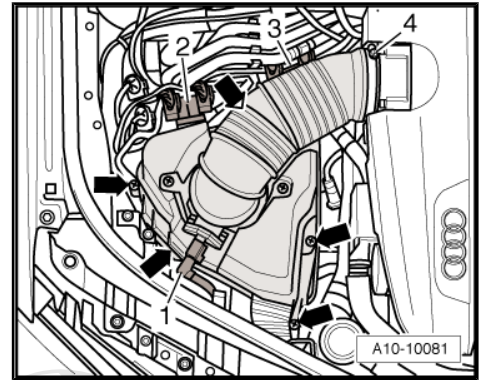
**Removing**

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Detach hose -1- from air intake hose.
- Remove air hose (left-side) -arrows-.



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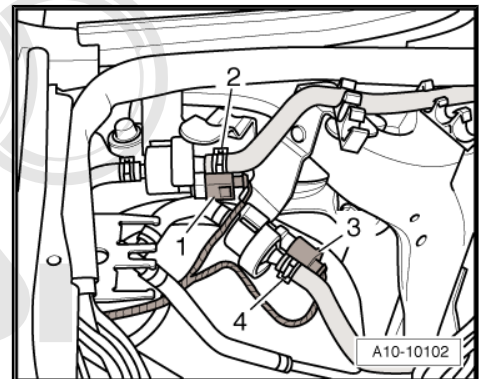
- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



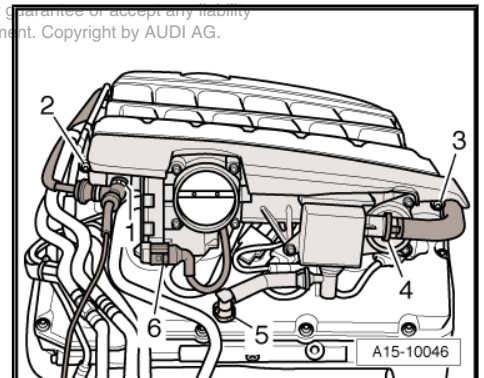
- Disconnect vacuum hoses -2- and -4- at solenoid valve 1 for activated charcoal filter system - N80- and at solenoid valve 2 for activated charcoal filter system - N333- .

**i Note**

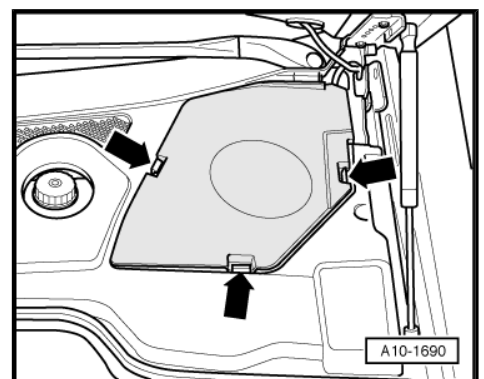
Disregard items -1- and -3-.



- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect hoses for crankcase breather system -4- and -5-.
- Remove bolts -2- and -3-.
- Remove right section of intake manifold.

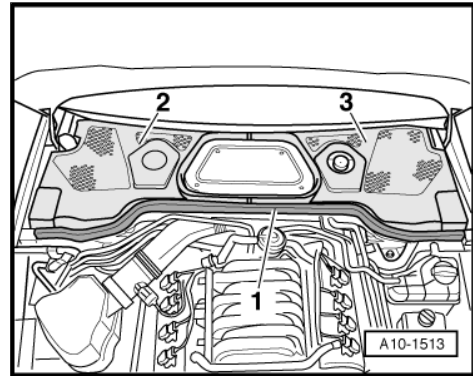


- Remove cover above coolant expansion tank -arrows-.

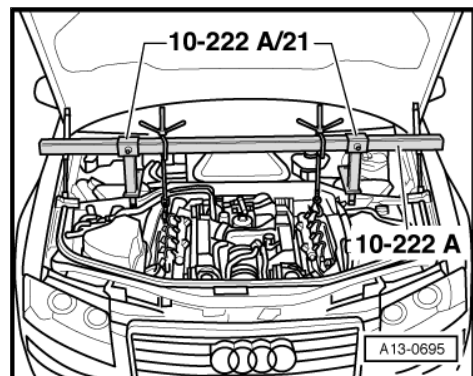
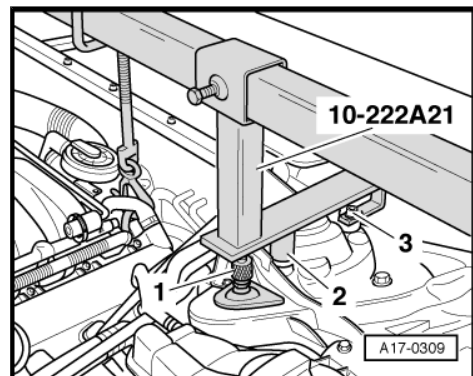




- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



- Unclip fuel lines from retainer at suspension turret.
- Unscrew rear bolts -3- for body brace.
- Attach the support bracket - 10-222 A- with support - 10-222 A/21- onto the suspension turrets.
- Supports are marked for left and right side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The supports - 10-222 A/21- are attached to rear securing bolts -3- for body brace.
- The knurled screw -1- must be screwed down until support plate rests on suspension turret.
- Secure spindles of support bracket - 10-222 A- to rear engine lifting eyes.
- Take up weight of engine on spindles of support bracket (considerable weight has to be supported).



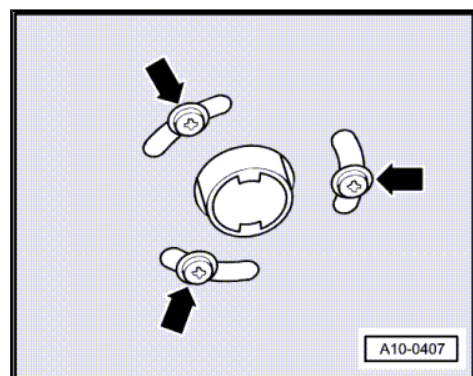
- Remove both front wheels.



**Note**

*Secure brake discs with wheel bolts.*

- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



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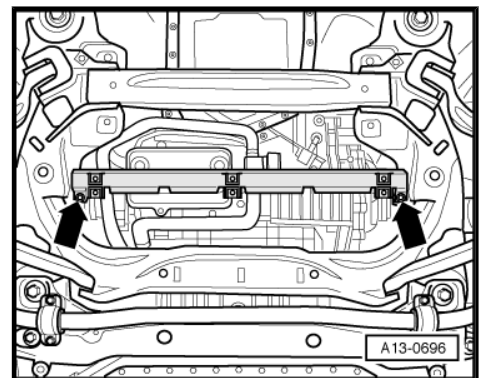
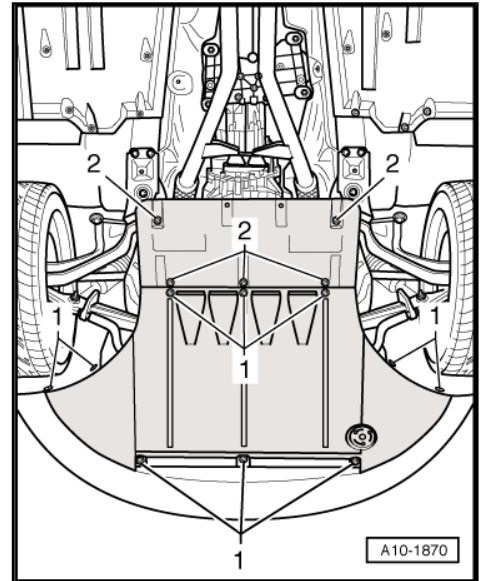


- Release quick-release fasteners -1- and -2- and take off noise insulation panels.

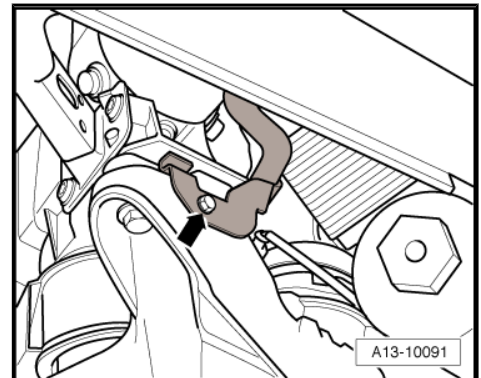


- Unbolt bracket for noise insulation -arrows-.

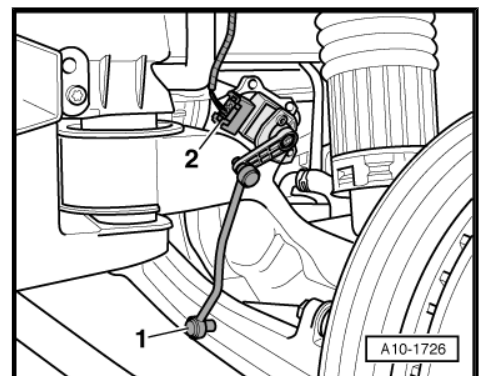
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- Unscrew bolt -arrow- at bottom on coolant pipe (right-side).

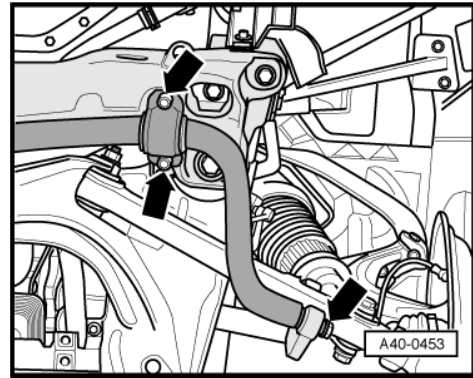


- Unplug electrical connector -2- at vehicle level sender.
- Detach coupling rod -1- at track control link.
- Repeat procedure on other side of vehicle.

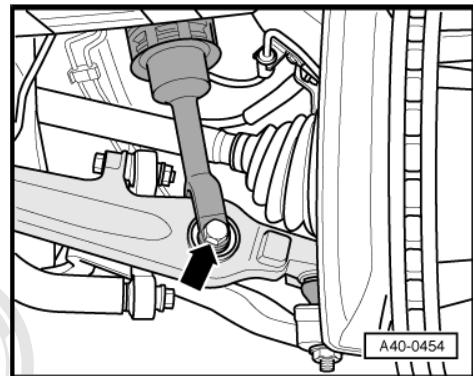




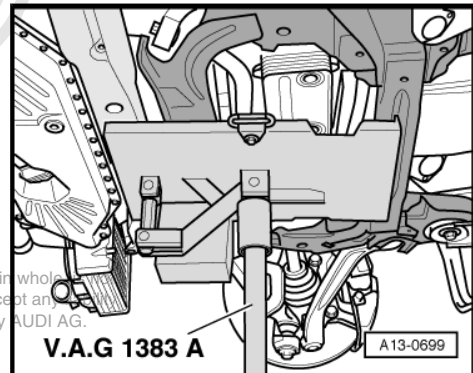
- Unscrew bolts (left and right) -arrows- evenly.
- Take out anti-roll bar.



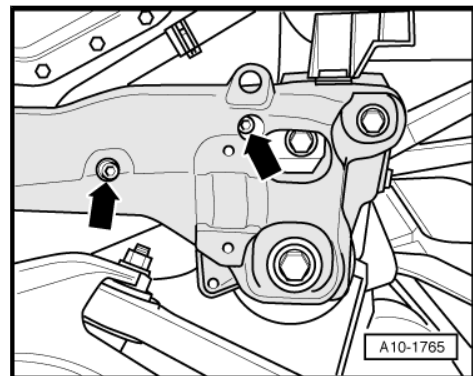
- Unbolt air spring struts (left and right) from track control links -arrow-.



- Support engine cross member and subframe using engine and gearbox jack - V.A.G 1383 A- as shown in illustration.

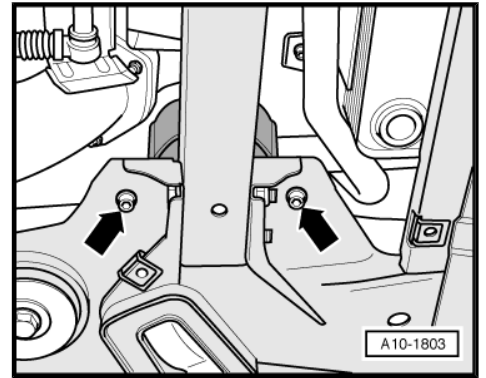


- Remove bolts -arrows- for engine mounting (left and right-side)



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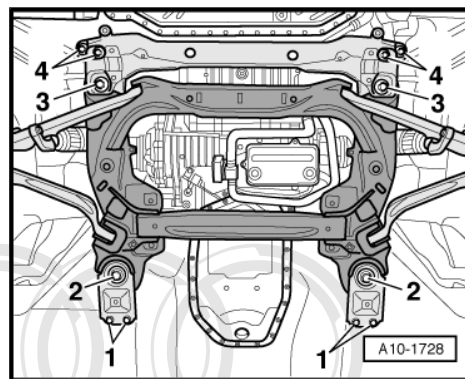
- Remove bolts -arrows- for front gearbox mounting (left and right).



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- Mark installation position of subframe and engine cross member on longitudinal members with felt-tip pen.
- Remove bolts -1- and -4-.
- Remove bolts -2- and -3- in a diagonal sequence and in stages.
- Slowly lower the subframe together with the engine cross member downwards.
- Take out engine cross member.



### Installing

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

- Only tighten bolts for subframe to the specified torque (do not turn further); tighten bolts only after performing alignment check ⇒ Running gear, front-wheel and four-wheel drive; Rep. gr. 40 .



### WARNING

*The vehicle must not be driven at this stage.*

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- Install air spring strut ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install anti-roll bar ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install right-side section of intake manifold: vehicles in rest-of-world ⇒ [page 104](#) ; USA vehicles ⇒ [page 113](#) .
- Install body brace ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Perform wheel alignment check ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 44 .



### WARNING

*Tighten bolts for subframe to final setting after performing wheel alignment check.*

### Tightening torques

Component	Nm
Engine mounting to engine cross member	23
Engine cross member to longitudinal member	68
Gearbox mounting to subframe	23
Coolant pipe (bottom) to engine cross member	10
Bracket for noise insulation to subframe	10

## 2 Servicing work on pulley end

⇒ [“2.1 Exploded view - poly V-belt drive for power steering pump, alternator and air conditioner”, page 55](#)

⇒ [“2.2 Removing and installing poly V-belt”, page 57](#)

⇒ [“2.3 Checking alignment of pulleys for power steering pump and air conditioner compressor”, page 58](#)

⇒ [“2.4 Removing and installing vibration damper”, page 60](#)

⇒ [“2.5 Renewing crankshaft oil seal \(pulley end\)”, page 61](#)

### 2.1 Exploded view - poly V-belt drive for power steering pump, alternator and air conditioner

#### 1 - Poly V-belt

- 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 57](#)
- Check for wear

#### 2 - 23 Nm

#### 3 - Alternator

- Removing and installing ⇒ Electrical system; Rep. gr. 27

#### 4 - Cover cap for idler roller (right-side)

#### 5 - Idler roller (right-side) for poly V-belt

- Tighten to 32 Nm

#### 6 - 23 Nm

#### 7 - Tensioning spring for tensioning roller

- With hydraulic damper
- Installation position: inscription “TOP” faces upwards

#### 8 - 8 Nm

#### 9 - Pulley for coolant pump

#### 10 - 10 Nm

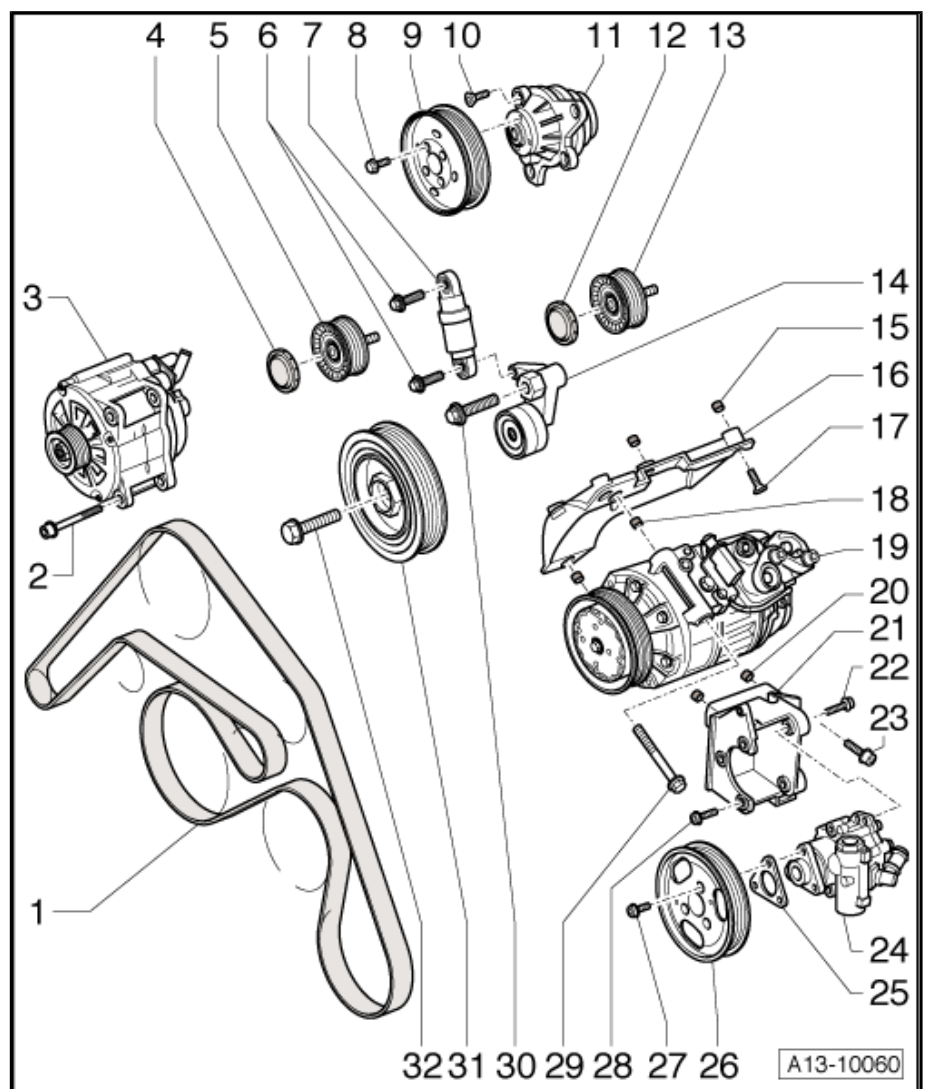
#### 11 - Coolant pump

- Removing and installing ⇒ [page 184](#)

#### 12 - Cover cap for idler roller (left-side)

#### 13 - Idler roller (left-side) for poly V-belt

- Tighten to 32 Nm





#### 14 - Tensioning roller with relay lever

#### 15 - Dowel sleeve

- 2x

#### 16 - Bracket for air conditioner compressor

- Pay attention to dowel sleeves ⇒ [Item 15 \(page 56\)](#) when installing
- After replacing, check alignment of pulleys on power steering pump and air conditioner compressor ⇒ [page 58](#)

#### 17 - 23 Nm

#### 18 - Dowel sleeves

- 2x

#### 19 - Air conditioner compressor

- Removing and installing ⇒ Air conditioning system; Rep. gr. 87
- Pay attention to dowel sleeves ⇒ [Item 18 \(page 56\)](#) when installing

#### 20 - Dowel sleeve

- 2x

#### 21 - Bracket for power steering pump

- Pay attention to dowel sleeves ⇒ [Item 20 \(page 56\)](#) when installing
- After replacing, check alignment of pulleys on power steering pump and air conditioner compressor ⇒ [page 58](#)

#### 22 - 23 Nm

#### 23 - 32 Nm

#### 24 - Power steering pump

- Removing and installing ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 48
- After replacing, check alignment of pulleys on power steering pump and air conditioner compressor ⇒ [page 58](#)

#### 25 - Shim

- Different thicknesses
- Check alignment of pulleys for power steering pump and air conditioner compressor after renewing power steering pump, air conditioner compressor, bracket for power steering pump, bracket for air conditioner compressor or sump (top section) ⇒ [page 58](#)

#### 26 - Pulley for power steering pump

#### 27 - 23 Nm

#### 28 - 23 Nm

#### 29 - 23 Nm

#### 30 - 32 Nm + 90° (1/4 turn) further

- Renew

#### 31 - Vibration damper

- With pulley for poly V-belt
- Removing and installing ⇒ [page 60](#)

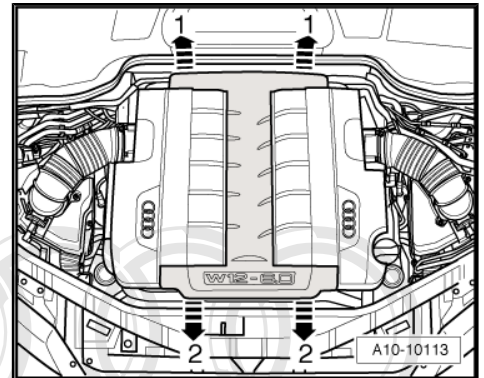
#### 32 - 100 Nm + 90° (1/4 turn) further

- Renew
- Use counterhold tool - T10069- when loosening and tightening

## 2.2 Removing and installing poly V-belt

### Removing

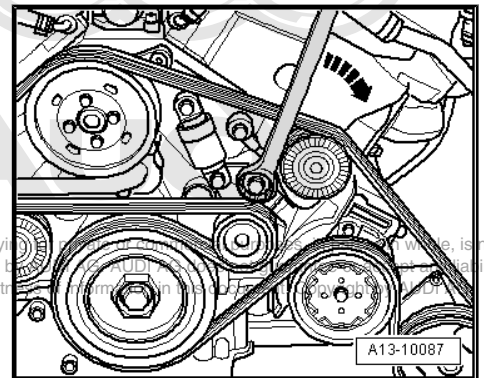
- Move lock carrier to service position ⇒ [page 45](#) .
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



### **i** Note

*Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip 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- using a 30 mm ring spanner to slacken the poly V-belt.
- Remove poly V-belt and release pressure from the tensioner.





## Installing

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

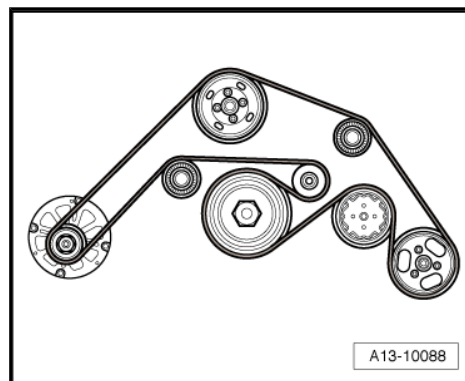
- First fit poly V-belt onto pulley for vibration damper, then onto other pulleys and finally onto tensioning roller.



### Note

*When installing poly V-belt, make sure it is properly seated on pulleys.*

- After renewing any of the following components, it is necessary to check the alignment of the pulleys for power steering pump and air conditioner compressor ⇒ [page 58](#) .
- ◆ Power steering pump
- ◆ Bracket for power steering pump
- ◆ Air conditioner compressor
- ◆ Bracket for air conditioner compressor
- ◆ Sump (top section)
- Install lock carrier with attachments ⇒ General body repairs, exterior; Rep. gr. 50 .
- Install front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Start engine and check that belt runs properly.
- Check headlight adjustment ⇒ Maintenance ; Booklet 404 .



## 2.3 Checking alignment of pulleys for power steering pump and air conditioner compressor



### Note

*To prevent damage to the poly V-belt, check the alignment of the pulleys for air conditioner compressor and power steering pump.*

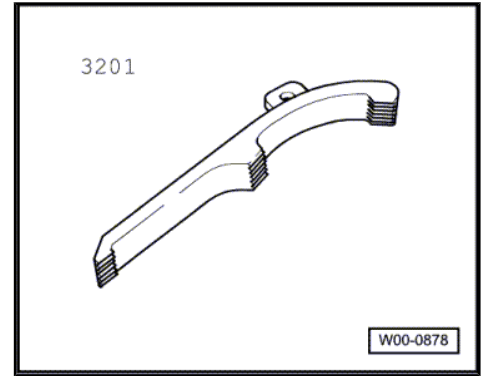
After renewing any the following components, it is necessary to check the alignment of the pulleys.

- ◆ Power steering pump
- ◆ Bracket for power steering pump
- ◆ Air conditioner compressor
- ◆ Bracket for air conditioner compressor
- ◆ Sump (top section)

### Special tools and workshop equipment required

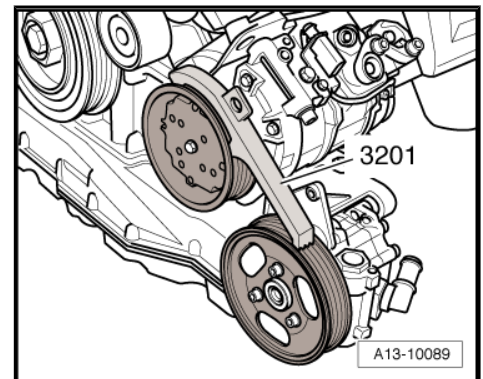


◆ Alignment gauge - 3201-



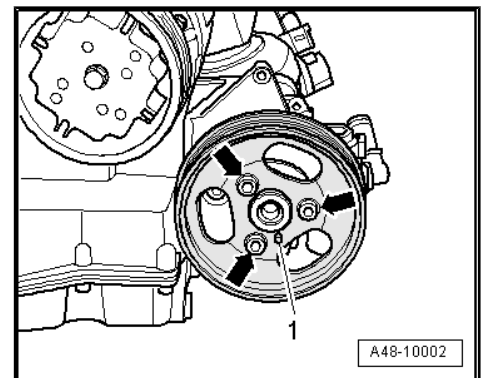
**Test sequence**

- Poly V-belt removed.
- Apply alignment gauge - 3201- onto poly V-belt pulley for air conditioner compressor.
- Determine centre position of shaft for power steering pump by moving pump shaft back and forth axially.
- When in the centre position, the poly V-belt pulley for the power steering pump must align with the poly V-belt pulley for the air conditioner compressor.



If the two poly V-belt pulleys are not aligned:

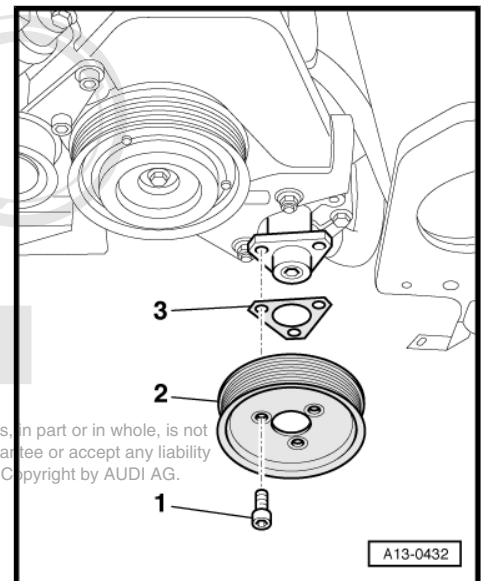
- Unscrew bolts -arrows- at pulley for power steering pump.
- Installation position: lug -1- on the poly V-belt pulley faces the direction of travel.



- Use shims -3- of various thicknesses to align pulley for power steering pump -2- with pulley for air conditioner compressor. Part number ⇒ Parts catalogue .
- Tighten bolt -1-.
- Then check alignment of pulleys using alignment gauge - 3201- . Repeat adjustment if necessary.

**Tightening torque**

Component	Nm
Pulley to power steering pump	23

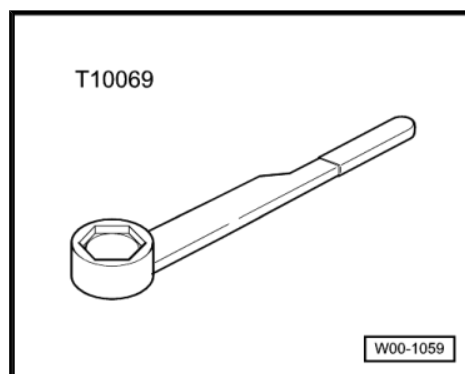


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## 2.4 Removing and installing vibration damper

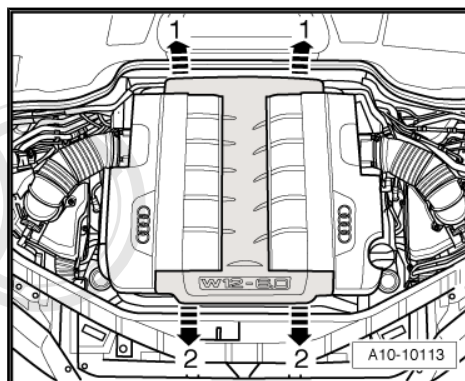
### Special tools and workshop equipment required

- ◆ Counterhold tool - T10069-



### Removing

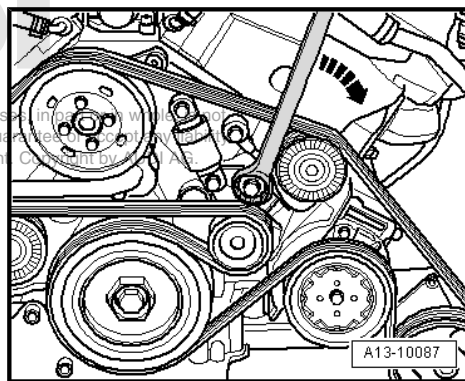
- Move lock carrier to service position ⇒ [page 45](#).
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



### Note

*Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip 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- using a 30 mm ring spanner to slacken the poly V-belt.
- Remove poly V-belt and release pressure from the tensioner.



- Loosen the central bolt -1- for vibration damper; to do so, use counterhold - T10069- to lock vibration damper.
- Remove vibration damper.

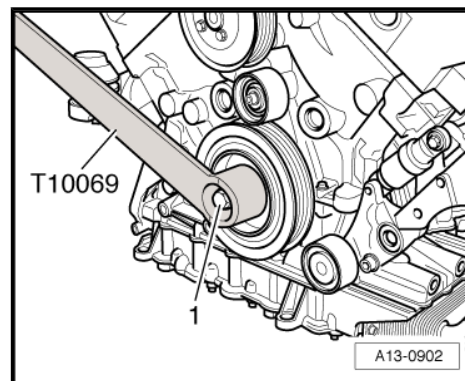
**Installing**

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

- Use a new central bolt for securing.

 **Note**

- ◆ *The contact surfaces between vibration damper and crankshaft must be free of oil.*
- ◆ *Do not additionally lubricate the central bolt for vibration damper.*
- Install poly V-belt ⇒ [page 57](#) .
- Install lock carrier with attachments ⇒ General body repairs, exterior; Rep. gr. 50 .
- Install front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Check headlight adjustment ⇒ [Maintenance; Booklet 404](#)



**Tightening torque**

Component	Nm
Vibration damper to crankshaft	100 + 90° <sup>9)</sup> <sup>10)</sup>

9) Renew bolt.

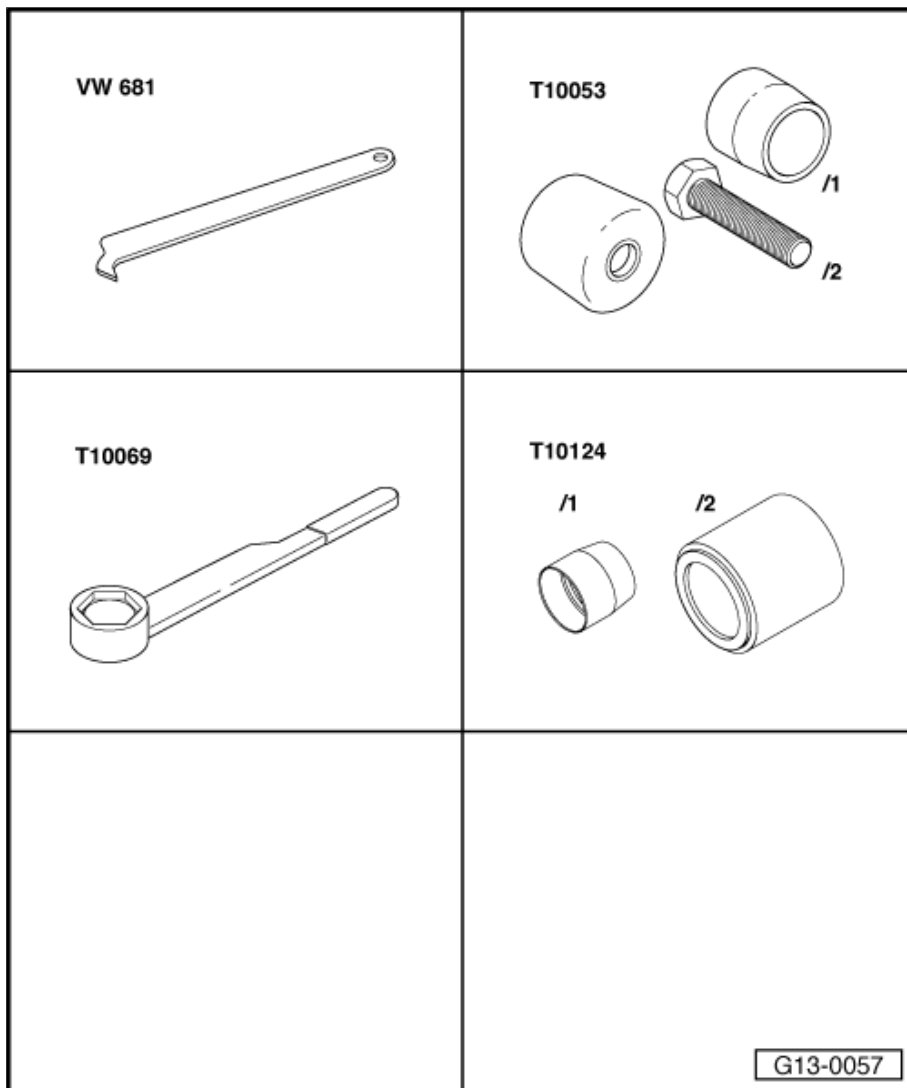
10) 90° equals a 1/4 turn.

**2.5 Renewing crankshaft oil seal (pulley end)**



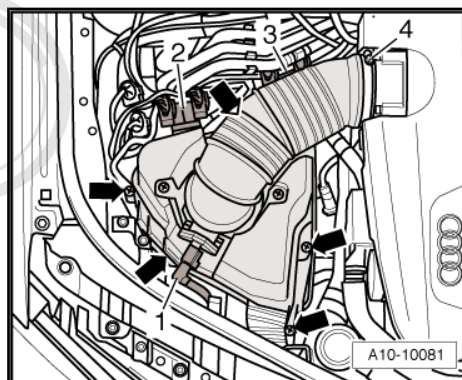
**Special tools and workshop equipment required**

- ◆ Oil seal extractor lever - VW 681-
- ◆ Assembly tool - T10053-
- ◆ Counterhold tool - T10069-
- ◆ Assembly tool - T10124-



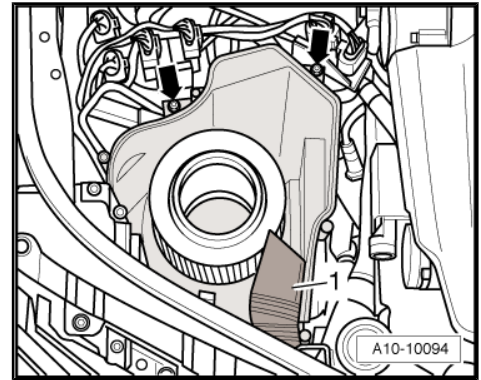
**Procedure**

- Drain off coolant ⇒ [page 178](#) .
- Move lock carrier to service position ⇒ [page 45](#) .
- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



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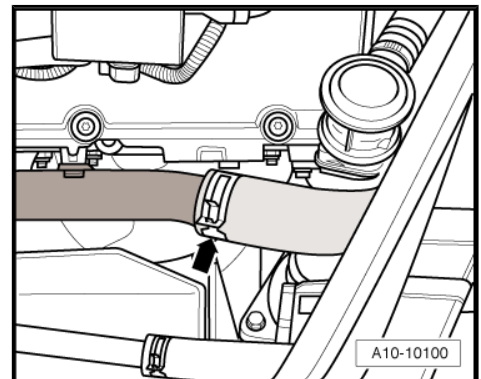
- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).



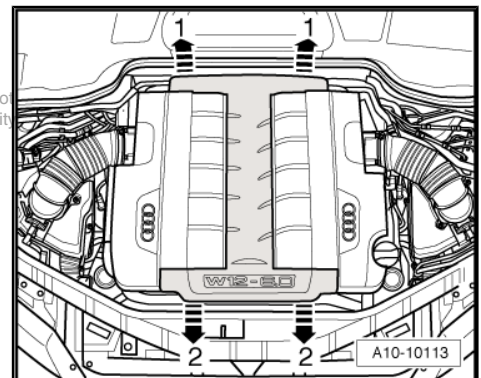
**i** Note

*Lay a cloth under the connection to catch escaping coolant.*

- Detach coolant hose (right-side) -arrow- at engine.



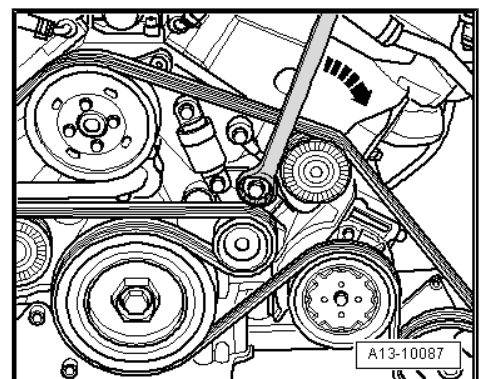
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



**i** Note

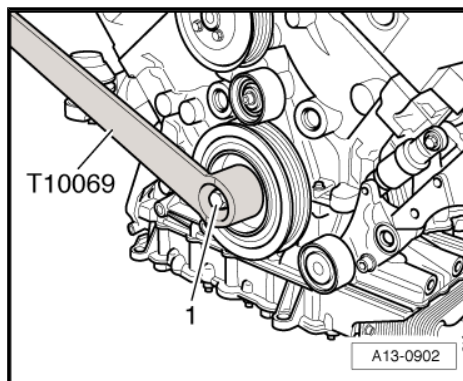
*Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.*

- Turn the tensioner in the direction of the -arrow- using a 30 mm ring spanner to slacken the poly V-belt.
- Remove poly V-belt and release pressure from the tensioner.





- Loosen the central bolt -1- for vibration damper; to do so, use counterhold - T10069- to lock vibration damper.
- Remove vibration damper.

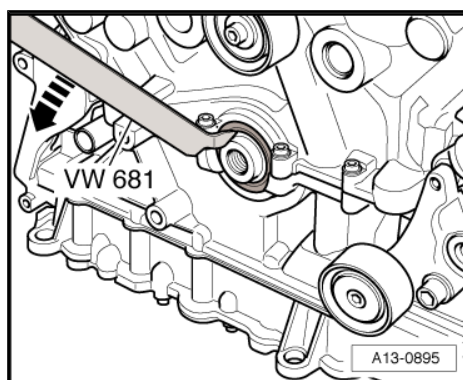


- Pry out the oil seal using the oil seal extractor lever - VW 681- .
- Clean running surface and sealing surface.

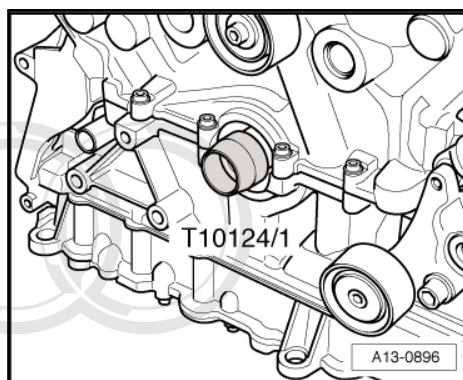


**Note**

- ◆ Do not lubricate sealing lip and outer circumference of oil seal before pressing in.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) => Parts catalogue .



- Push on oil seal using fitting sleeve - T10124/1- .



- Press oil seal on as far as the stop using fitting sleeve - T10124/2- and bolt - T10053/2- .

- Install vibration damper => [page 61](#) .

- Install poly V-belt => [page 57](#) .

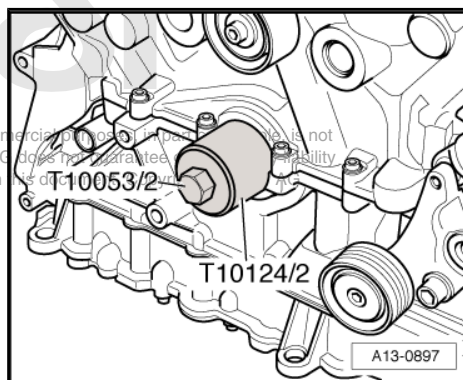
- Install lock carrier with attachments => General body repairs, exterior; Rep. gr. 50 .

- Install front bumper cover => General body repairs, exterior; Rep. gr. 63 .

- Deactivate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

- Fill cooling system => [page 180](#) .

- Check headlight adjustment => Maintenance ; Booklet 404 .



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### 3 Servicing work on timing chain end

- ⇒ ["3.1 Exploded view - drive plate", page 65](#)
- ⇒ ["3.2 Removing and installing drive plate", page 66](#)
- ⇒ ["3.3 Exploded view - timing chain covers", page 67](#)
- ⇒ ["3.4 Renewing crankshaft oil seal \(timing chain end\)", page 69](#)
- ⇒ ["3.5 Renewing seals for studs", page 71](#)
- ⇒ ["3.6 Removing and installing timing chain covers", page 71](#)
- ⇒ ["3.7 Removing and installing timing chains for camshaft drive", page 77](#)
- ⇒ ["3.8 Exploded view - timing chains for camshaft drive", page 78](#)
- ⇒ ["3.9 Removing and installing camshaft timing chains", page 80](#)
- ⇒ ["3.10 Exploded view - drive chain", page 88](#)
- ⇒ ["3.11 Removing and installing drive chain", page 89](#)

#### 3.1 Exploded view - drive plate

##### 1 - Drive plate

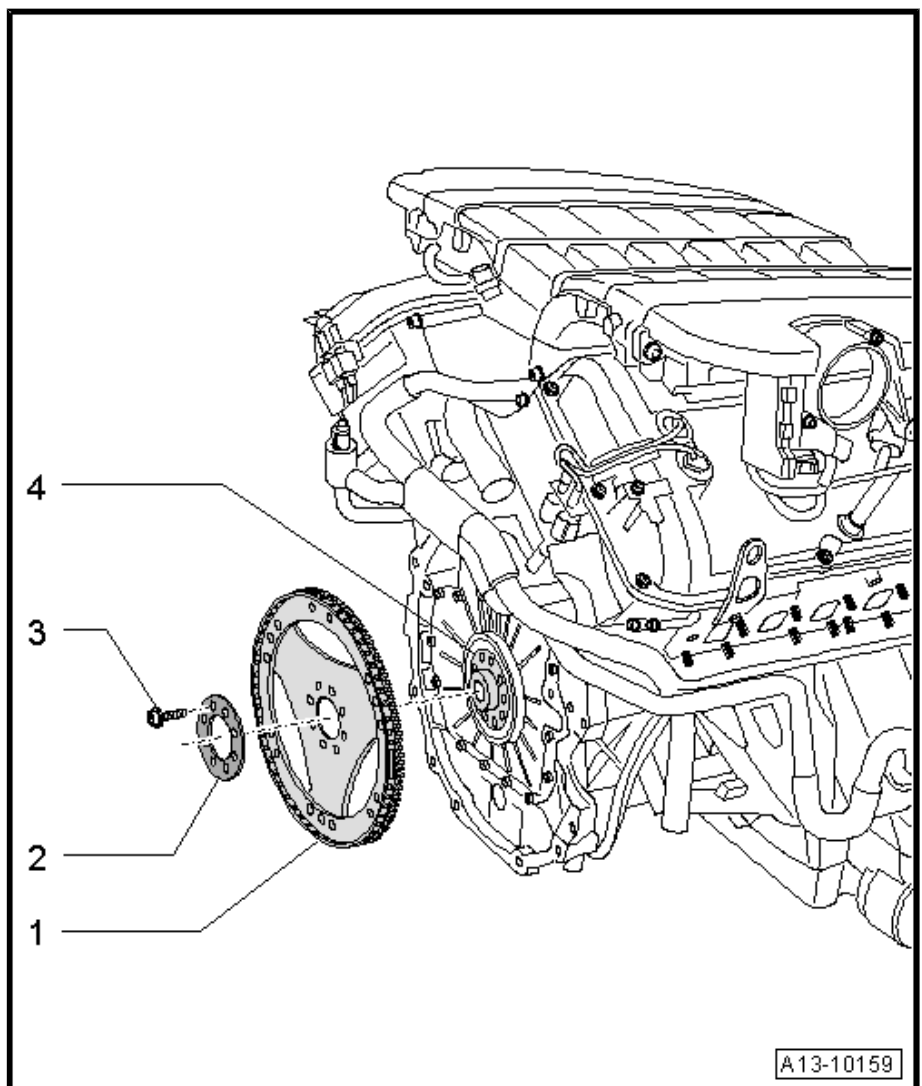
- Removing and installing  
⇒ [page 66](#)
- Mark installation position for re-installation

##### 2 - Washer

- Mark installation position for re-installation

##### 3 - 60 Nm + 90° (1/4 turn) further

- Renew



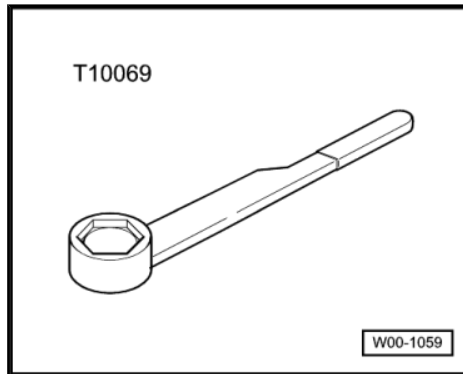


## 4 - Crankshaft

### 3.2 Removing and installing drive plate

#### Special tools and workshop equipment required

- ◆ Counterhold tool - T10069-



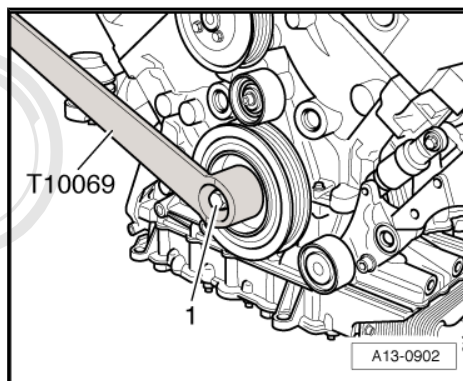
#### Removing

- Engine removed
- Engine separated from gearbox.
- Counterhold crankshaft using the counterhold tool - T10069- at the vibration damper.



#### Note

Disregard -item 1-



- Mark installation position of drive plate on crankshaft with a felt-tip pen.
- Unbolt drive plate -arrow-

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#### Installing

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

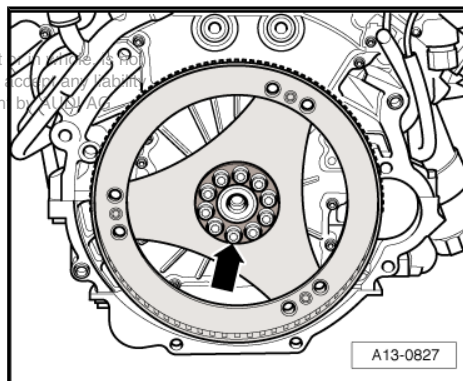
- Use new securing bolts.

#### Tightening torque

Component	Nm
Drive plate to crankshaft	60 + 90° <sup>11)</sup> <sup>12)</sup>

11) Renew bolts.

12) 90° equals a 1/4 turn.





### 3.3 Exploded view - timing chain covers

**1 - Crankshaft oil seal (on timing chain end)**

- Renew
- Removing and installing ⇒ [page 69](#)

**2 - Seals**

- Renew
- Removing and installing ⇒ [page 71](#)

**3 - 20 Nm**

**4 - 10 Nm**

- Observe correct tightening sequence ⇒ [page 76](#)

**5 - 9 Nm**

- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**6 - Hall sender 4 - G301-**

- For exhaust camshaft, cylinder bank 2 (left-side)

**7 - O-ring**

- Renew

**8 - 9 Nm**

- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**9 - Hall sender 2 - G163-**

- For inlet camshaft, cylinder bank 2 (left-side)

**10 - O-ring**

- Renew

**11 - 10 Nm**

- Observe correct tightening sequence ⇒ [page 76](#)

**12 - Timing chain cover (left-side)**

- After removing, replace timing chain cover (with threaded nipple) with new version (without threaded nipple).

**13 - 9 Nm**

- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**14 - Hall sender - G40-**

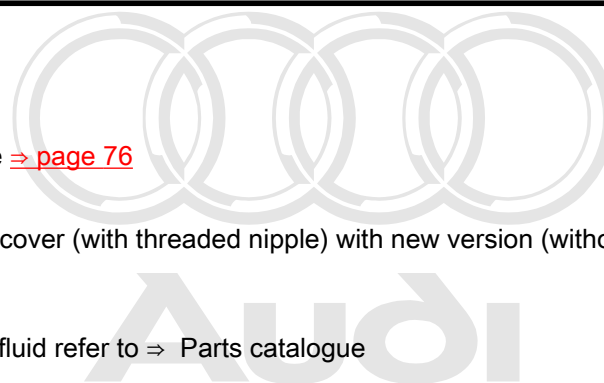
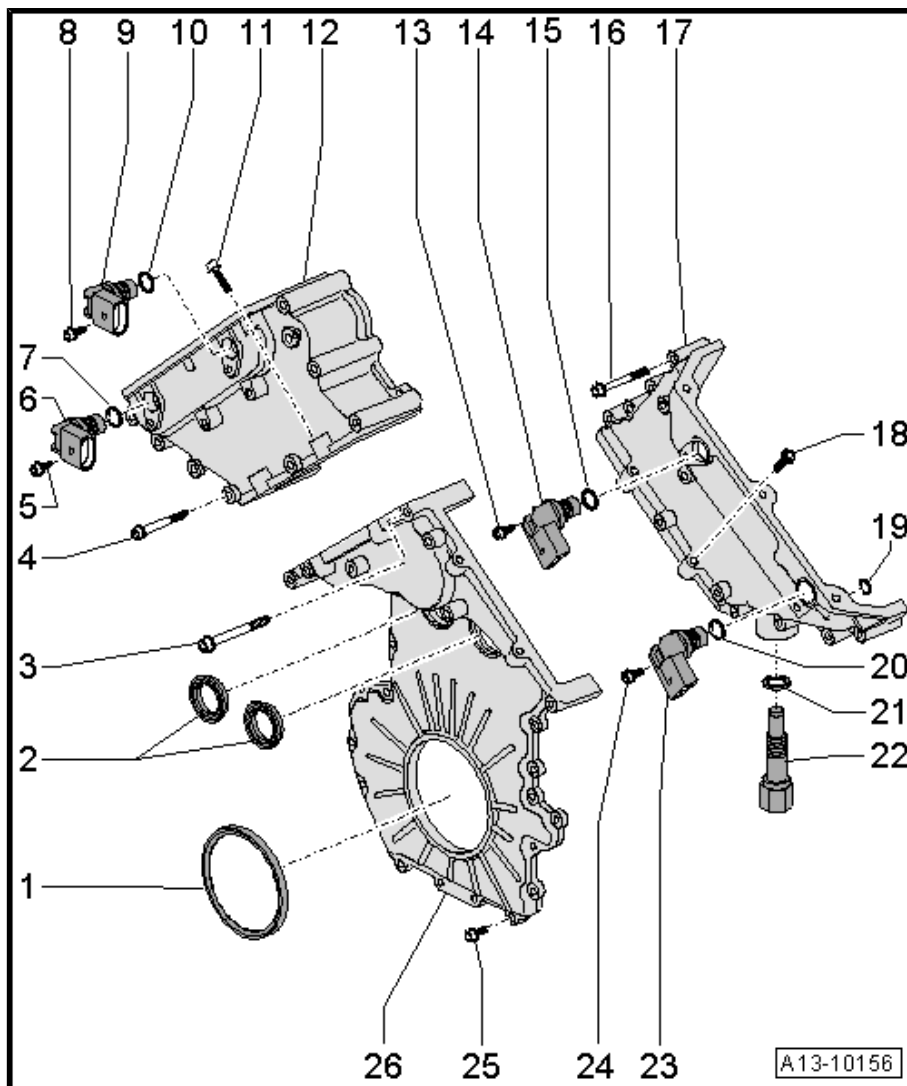
- For inlet camshaft, cylinder bank 1 (right-side)

**15 - O-ring**

- Renew

**16 - 10 Nm**

- Observe correct tightening sequence ⇒ [page 77](#)



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**17 - Timing chain cover (right-side)**

**18 - 10 Nm**

- Observe correct tightening sequence ⇒ [page 77](#)

**19 - O-ring**

- Renew
- Insert into timing chain cover ⇒ [Item 17 \(page 68\)](#)

**20 - O-ring**

- Renew

**21 - Seal**

**22 - Chain tensioner for timing chain (right-side)**

- Tighten to 60 Nm

**23 - Hall sender 3 - G300-**

- For exhaust camshaft, cylinder bank 1 (right-side)

**24 - 9 Nm**

- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**25 - 10 Nm**

**26 - Timing chain cover (bottom)**



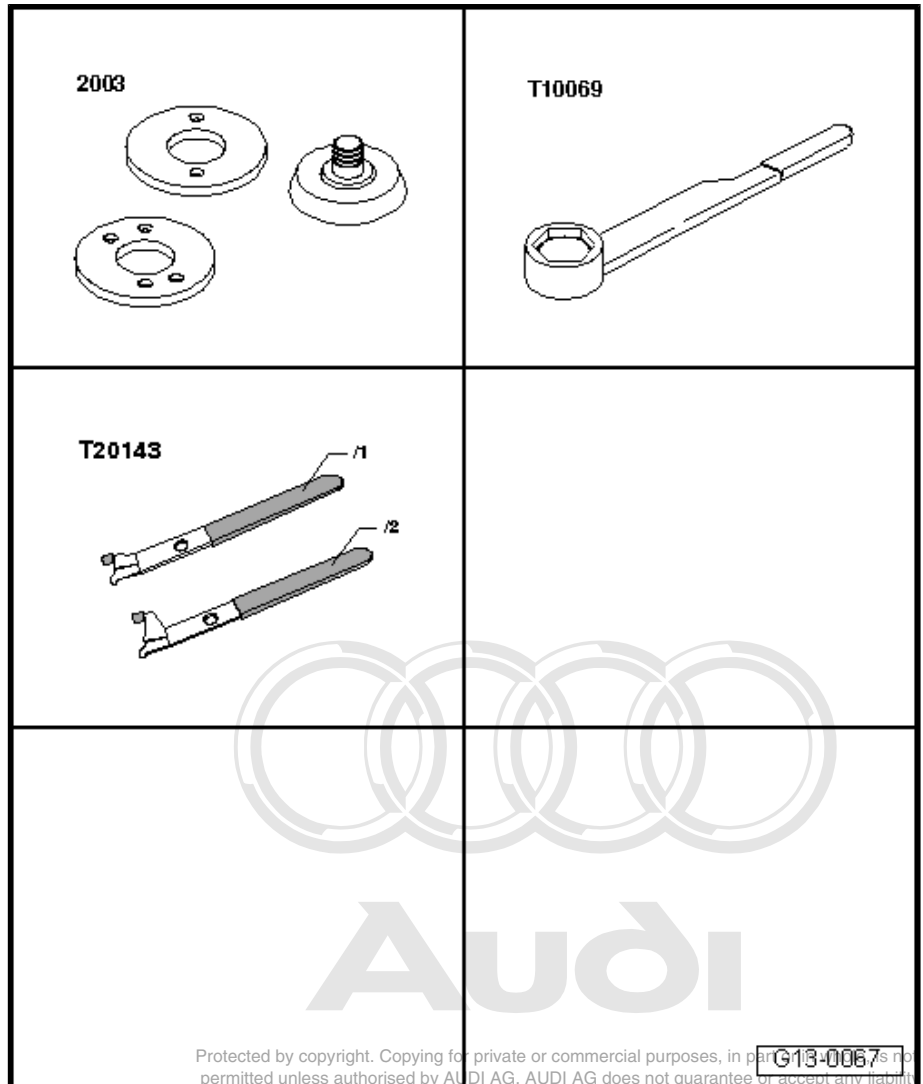
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### 3.4 Renewing crankshaft oil seal (timing chain end)

#### Special tools and workshop equipment required

- ◆ Fitting tool - 2003-
- ◆ Counterhold tool - T10069-
- ◆ Extractor tool - T20143/2-



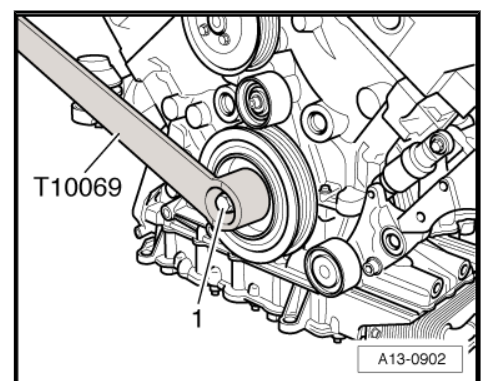
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#### Procedure

- Engine removed
- Engine separated from gearbox.
- Counterhold crankshaft using the counterhold tool - T10069- at the vibration damper.

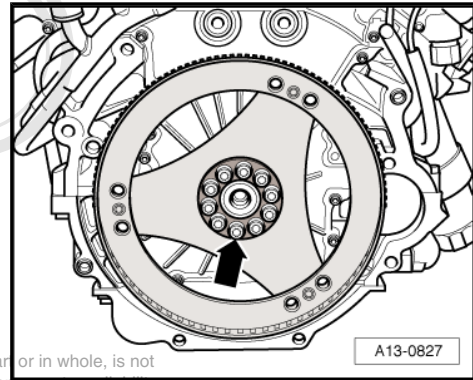
#### Note

Disregard -item 1-.

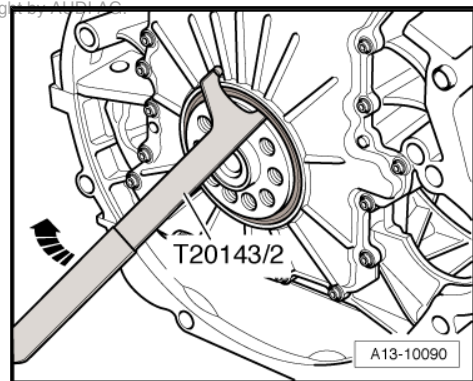




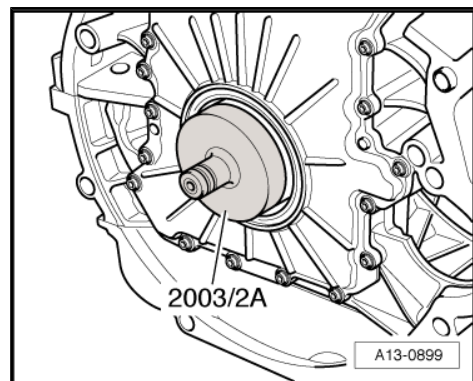
- Mark installation position of drive plate on crankshaft with a felt-tip pen.
- Unbolt drive plate -arrow-.



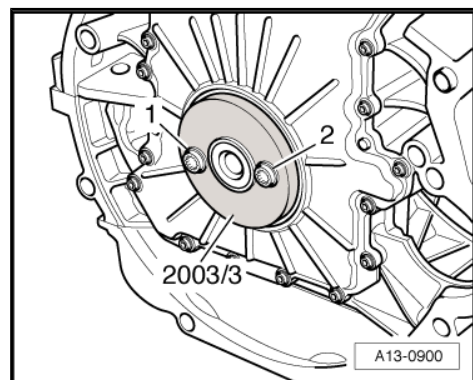
- Pry out the oil seal using the extractor hook - T20143/2 -arrow-.
- Clean running surface and sealing surface.



- Push new oil seal onto crankshaft using fitting sleeve - 2003/2 A- .



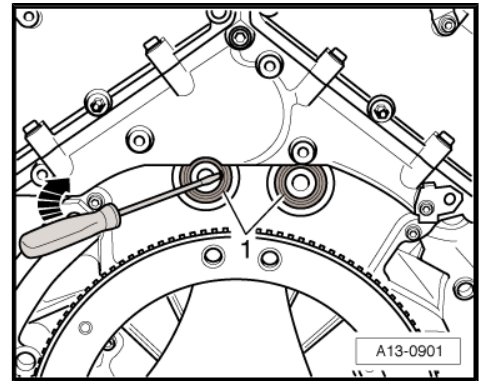
- Press in new oil seal as far as the stop using fitting ring - 2003/3- and bolts -1- and -2- for drive plate.
- Install drive plate => [page 66](#) .



### 3.5 Renewing seals for studs

#### Procedure

- Engine removed
- Engine separated from gearbox.
- Use screwdriver to pry out seals -1-
- Clean sealing surfaces; they must be clean and free of grease.
- Press in the new seals as far as the stop using a 24 mm socket.



### 3.6 Removing and installing timing chain covers

#### Special tools and workshop equipment required

- ◆ Adhesive sealant → Parts catalogue
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles



#### Caution

*The engine must not be turned when the timing chain cover (top right) is removed. The installed chain tensioner (right-side) and timing chain cover (top right) are what prevent the timing chain from slipping.*

#### Removing

- Engine removed
- Engine separated from gearbox.

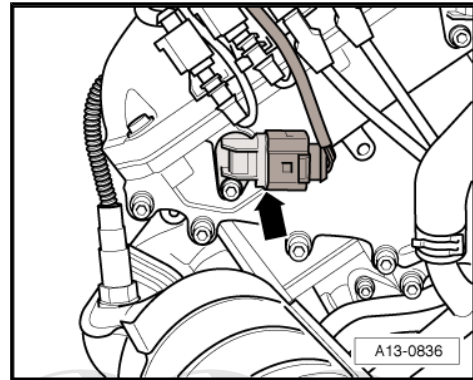


#### Note

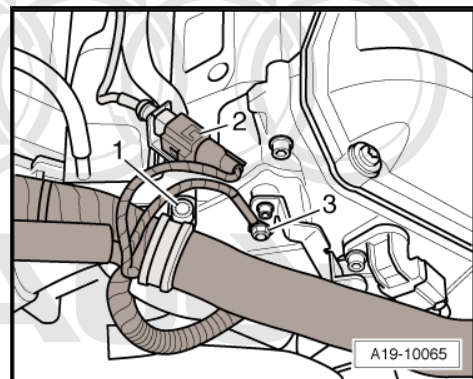
- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- Remove drive plate ⇒ [page 66](#) .
- Remove top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Remove bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Remove cylinder head covers ⇒ [page 94](#) .



- Pull back the heat insulation sleeves on Hall senders for exhaust camshaft on both cylinder heads.
- Unplug the electrical connectors at Hall senders for exhaust camshaft -arrow- and inlet camshaft on both cylinder heads.

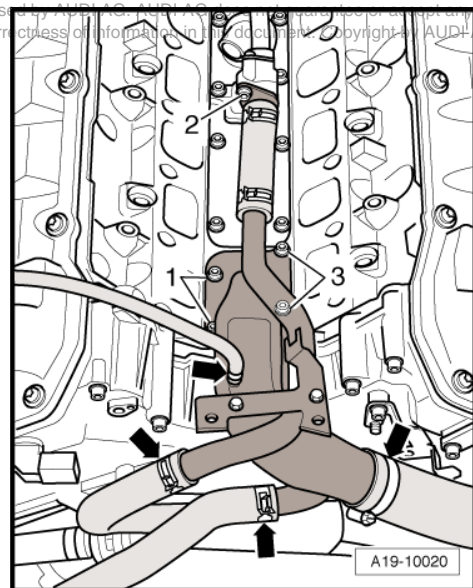


- Unplug connector -2- at map-controlled engine cooling thermostat - F265- .
- Unbolt earth cable -3- at cylinder head.
- Unscrew clamp -1- and lay wiring harness at coolant pipe (top) clear.

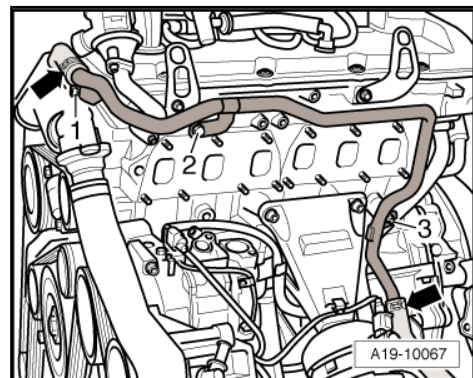


- Remove bolts -1 ... 3-.
- Detach coolant hoses at coolant pipe (top) -arrows-.
- Detach coolant pipe (top).

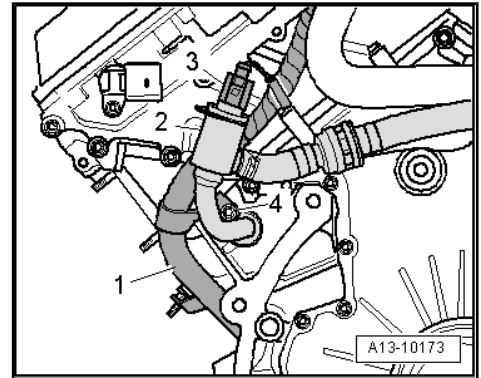
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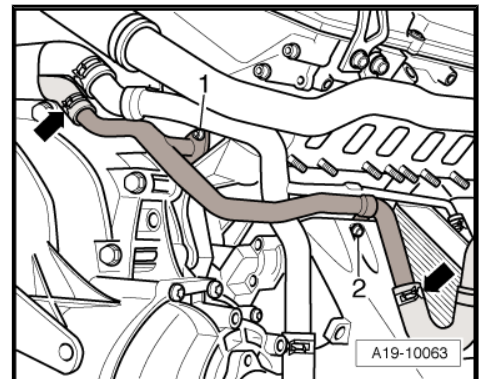
- Disconnect the coolant hoses -arrows- at the coolant pipe (top left).
- Unscrew bolts -1- and -2- and nut -3-.
- Detach coolant pipe (top left).



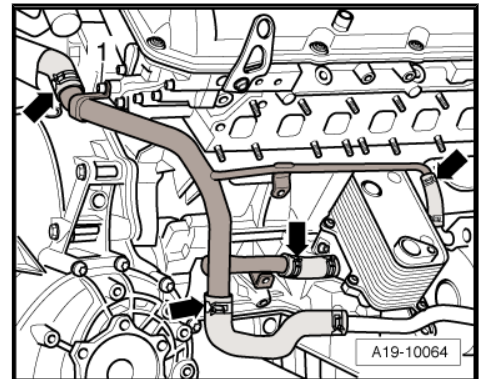
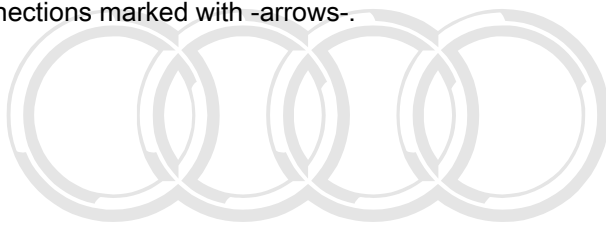
- Unplug electrical connector -3- at coolant temperature sender - G62- .
- Unscrew bolt -4- and detach guide tube -1- for wiring harness from engine.
- Detach pipe connection -2- at cylinder block.



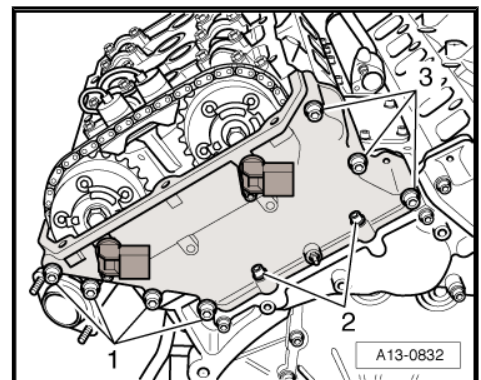
- Disconnect coolant hoses -arrows- at coolant pipe (bottom right).
- Remove bolts -1- and -2-.
- Pull coolant pipe (bottom right) off cylinder head towards rear.



- Remove bolt -1-.
- Detach coolant pipe (centre right) from coolant hoses at the connections marked with -arrows-.



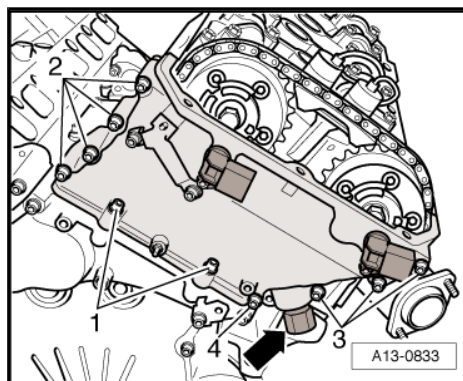
- Unscrew bolts -1 ... 3- and remove timing chain cover (left-side).



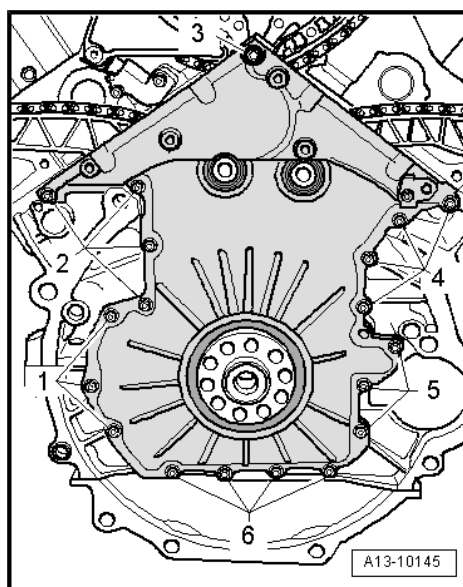
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- Unscrew chain tensioner -arrow- for camshaft timing chain.
- Unscrew bolts -1 ... 4- and remove timing chain cover (right-side).



- Unscrew bolts -1 ... 6- and remove timing chain cover (bottom).
- Press out crankshaft oil seal (timing chain end) from the timing chain cover (bottom).



- Use screwdriver to pry out seals -1- for studs.

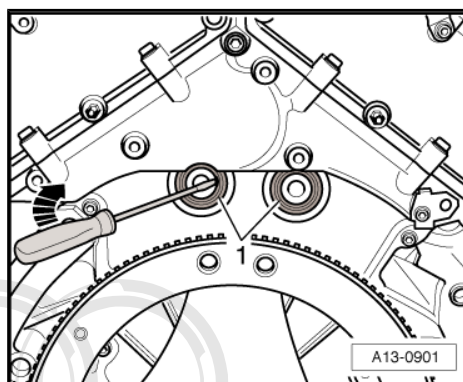
### Installing

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



#### Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Reinstall heat insulation sleeves in the same locations when assembling.*
- ◆ *Fit all cable ties in the original positions when installing.*



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- Remove remaining sealant on timing chain covers and cylinder block / cylinder head using rotating plastic brush or similar.

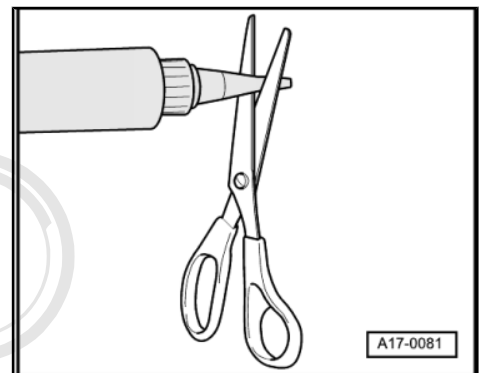
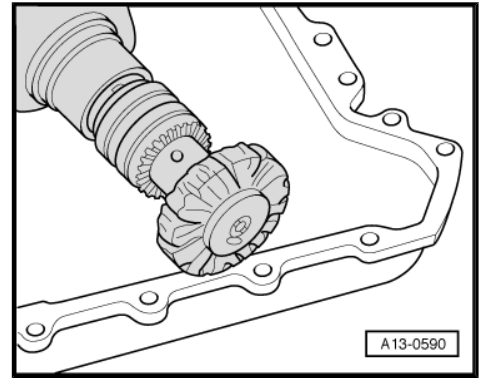
**! WARNING**  
*Wear safety goggles.*

- Clean sealing surfaces; they must be free of oil and grease.

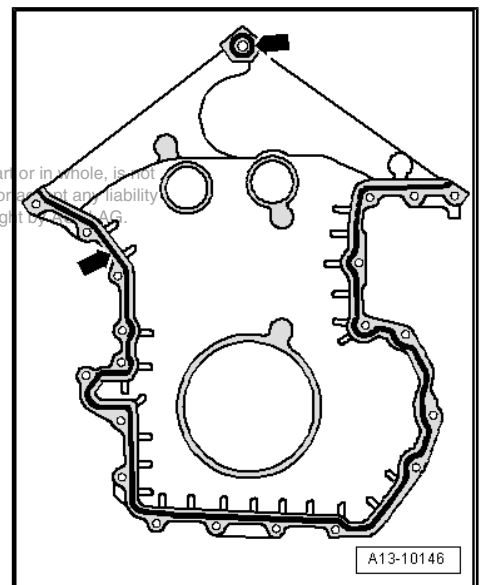
**i Note**

*The timing chain covers must be installed within 15 minutes after applying sealant.*

- Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).



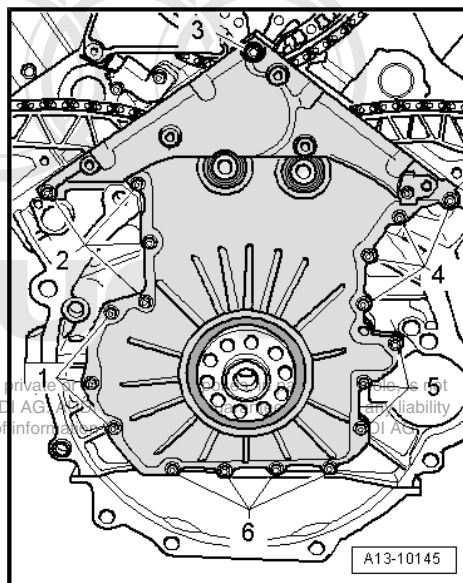
- Apply the bead of sealant onto the clean sealing surface of the timing chain cover (bottom) as illustrated -arrows-.
- Thickness of sealant bead: 1.5 ... 2.0 mm



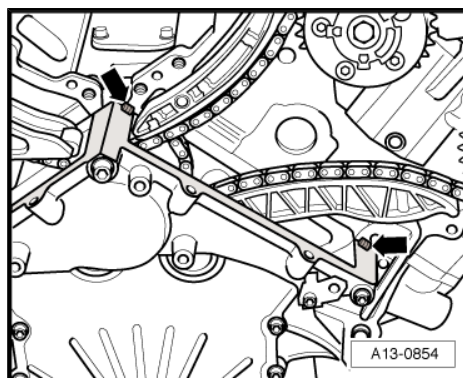
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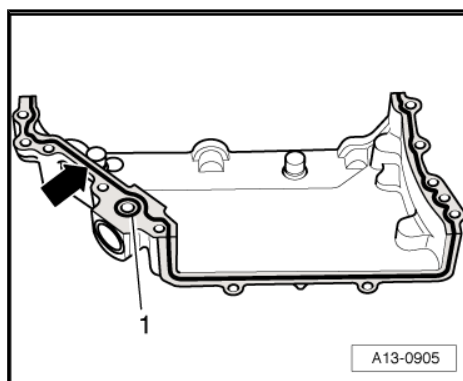
- Attach timing chain cover (bottom) and tighten bolts -1 ... 6- in stages in a diagonal sequence.



- Apply a thin bead of sealant at the edges between the timing chain cover (bottom) and the timing chain covers (right and left) -arrows-.

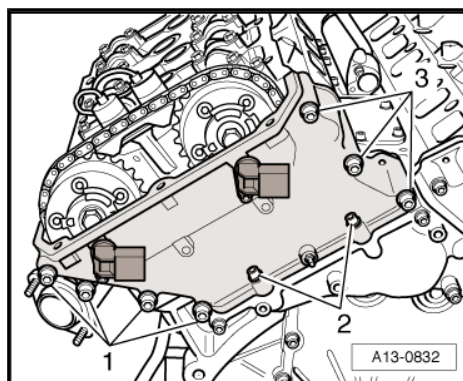


- Apply the bead of sealant -arrow- onto the clean sealing surface of the timing chain covers (right and left) as illustrated.
- Thickness of sealant bead: 1.5 ... 2.0 mm
- Insert the O-ring -1- in the timing chain cover (right-side).

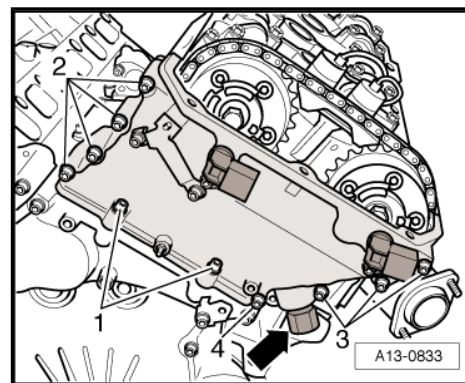



- Install timing chain cover (left-side) and tighten bolts in the following sequence:

- 1 - Tighten bolts -1- and -3- to 5 Nm.
- 2 - Tighten bolts -2- to 10 Nm.
- 3 - Tighten bolts -1- and -3- to 10 Nm.



- Install timing chain cover (right-side) and tighten bolts in the following sequence:
  - 1 - Tighten bolts -2-, -3- and -4- to 5 Nm.
  - 2 - Tighten bolts -1- to 10 Nm.
  - 3 - Tighten bolts -2-, -3- and -4- to 10 Nm.
- Secure chain tensioner -arrow- for camshaft timing chain using a new seal.
- Install crankshaft oil seal (timing chain end) ⇒ [page 69](#) .
- Install the seals for studs ⇒ [page 71](#) .
- Install coolant pipe (right-side, centre) ⇒ [page 212](#) .
- Install coolant pipe (bottom right) ⇒ [page 213](#) .
- Install coolant pipe (top left) ⇒ [page 199](#) .
- Install coolant pipe (top) ⇒ [page 199](#) .
- Install cylinder head covers ⇒ [page 96](#) .





**Caution**


*Take note of the correct routing of the electrical wiring at engine ⇒ [page 39](#) .*

- Install bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Install top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Install drive plate ⇒ [page 66](#) .

**Tightening torques**

Component	Nm
Timing chain cover (bottom) to cylinder block	10
Timing chain cover (left and right)	20
Chain tensioner for camshaft timing chain	10
	60

### 3.7 Removing and installing timing chains for camshaft drive



**Caution**

*The crankshaft and camshafts may only be turned when the engine is completely assembled and only via the crankshaft. This means that the timing chain covers and the chain tensioner for camshaft timing chain (right-side) must be installed.*



**Note**

- ◆ The locking pin - 3242- / -T40237- is only used for locking the crankshaft at TDC. Use tool - T10069- to counterhold.
- ◆ The camshaft bar - T10068- is only used for locking the camshafts at TDC. Use a 32 mm open-end spanner to counterhold at hexagon flats of camshaft.

### 3.8 Exploded view - timing chains for camshaft drive

**1 - Chain sprocket for camshaft drive**

- Removing and installing ⇒ [“3.11 Removing and installing drive chain”, page 89](#)

**2 - Mounting pin, 15 Nm**

- For guide rail ⇒ [Item 3 \(page 78\)](#)

**3 - Guide rail**

- For camshaft timing chain ⇒ [Item 6 \(page 78\)](#)

**4 - 60 Nm + 90° (1/4 turn) further**

- Renew
- The contact surfaces between camshaft adjuster and camshaft, as well as bolt head and camshaft adjuster must be free of oil.
- To loosen and tighten, counterhold with 32 mm open-end spanner on camshaft

**5 - Camshaft adjuster (exhaust)**

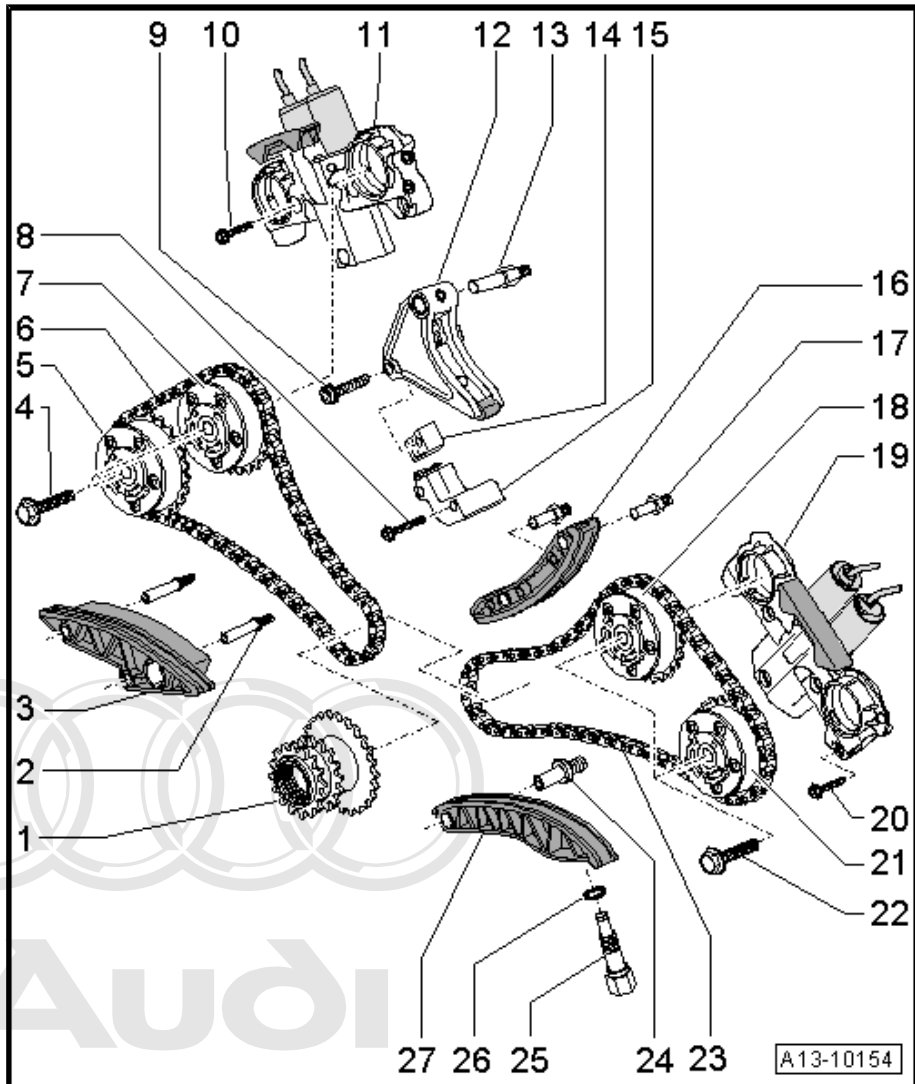
- For cylinder bank 2 (left-side)
- Identification: B2 / plastic end face
- Removing and installing ⇒ [“5.2 Removing and installing camshaft adjuster”, page 128](#)

**6 - Camshaft timing chain**

- For cylinder bank 2 (left-side)

**7 - Camshaft adjuster (inlet)**

- For cylinder bank 2 (left-side)
- Identification: B2 / A2
- Removing and installing ⇒ [“5.2 Removing and installing camshaft adjuster”, page 128](#)



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**8 - 9 Nm**

**9 - 20 Nm**

**10 - 9 Nm**

- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**11 - Housing for camshaft control valves**

- For cylinder bank 2 (left-side)
- Removing and installing ⇒ [“5.2 Removing and installing camshaft adjuster”, page 128](#)

**12 - Tensioning rail**

- For camshaft timing chain ⇒ [Item 6 \(page 78\)](#)
- For cylinder bank 2 (left-side)

**13 - Mounting pin, 42 Nm**

- For tensioning rail ⇒ [Item 12 \(page 79\)](#)
- With hexagon flats
- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**14 - Slide**

- For chain tensioner ⇒ [Item 15 \(page 79\)](#)

**15 - Chain tensioner**

- For camshaft timing chain ⇒ [Item 6 \(page 78\)](#)
- Lock chain tensioner with drill bit (∅ 3.5 mm)

**16 - Guide rail**

- For camshaft timing chain ⇒ [Item 23 \(page 79\)](#)
- With hexagon flats

**17 - Mounting pin, 15 Nm**

- For guide rail ⇒ [Item 16 \(page 79\)](#)

**18 - Camshaft adjuster (inlet)**

- For cylinder bank 1 (right-side)
- Identification: B1 / A2
- Removing and installing ⇒ [“5.2 Removing and installing camshaft adjuster”, page 128](#)

**19 - Housing for camshaft control valves**

- For cylinder bank 1 (right-side)
- Removing and installing ⇒ [“5.2 Removing and installing camshaft adjuster”, page 128](#)

**20 - 9 Nm**

- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**21 - Camshaft adjuster (exhaust)**

- For cylinder bank 1 (right-side)
- Identification: B1 / plastic end face
- Removing and installing ⇒ [“5.2 Removing and installing camshaft adjuster”, page 128](#)

**22 - 60 Nm + 90° (1/4 turn) further**

- Renew
- The contact surfaces between camshaft adjuster and camshaft, as well as bolt head and camshaft adjuster must be free of oil.
- To loosen and tighten, counterhold with 32 mm open-end spanner on camshaft

**23 - Camshaft timing chain**

- For cylinder bank 1 (right-side)

**24 - Mounting pin, 25 Nm**

- For tensioning rail ⇒ [Item 27 \(page 80\)](#)



- With collar
- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

### 25 - Chain tensioner

- For camshaft timing chain ⇒ [Item 23 \(page 79\)](#)
- Tighten to 60 Nm

### 26 - Seal

- Renew

### 27 - Tensioning rail

- For camshaft timing chain ⇒ [Item 23 \(page 79\)](#)

## 3.9 Removing and installing camshaft timing chains



### Caution

*The crankshaft and camshafts may only be turned when the engine is completely assembled and only via the crankshaft. This means that the timing chain covers and the chain tensioner for camshaft timing chain (right-side) must be installed.*

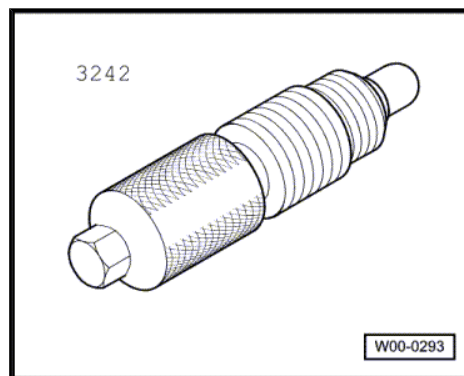


### Note

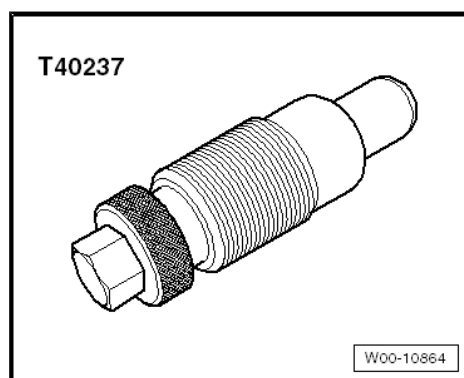
*The camshaft bar - T10068- is only used for locking the camshafts at TDC. Use a 32 mm open-end spanner to counterhold at hexagon flats of camshaft.*

### Special tools and workshop equipment required

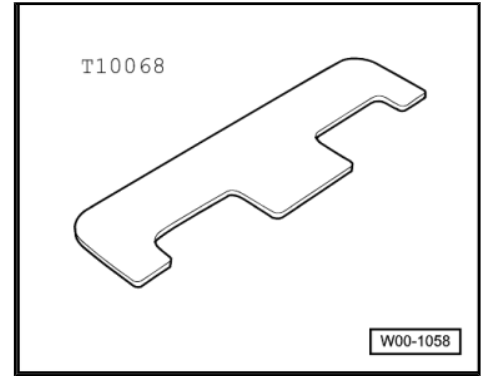
- ◆ Locking pin - 3242-



- ◆ or locking pin - T40237-



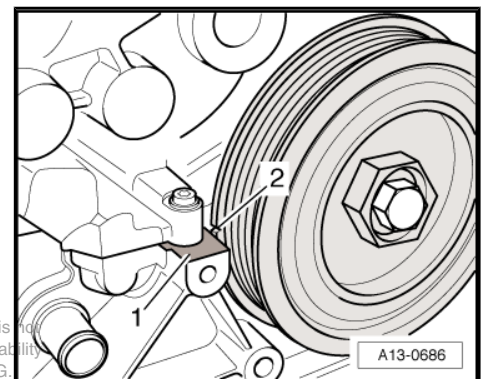
◆ Camshaft bar - T10068-



◆ Drill bit,  $\varnothing$  3.5 mm

**Removing**

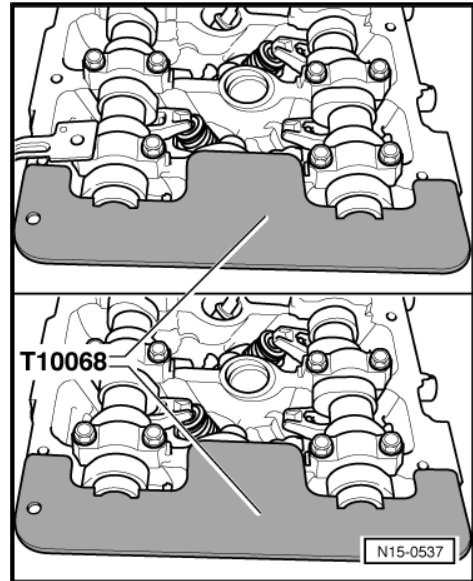
- Engine removed
- Engine separated from gearbox.
- Remove drive plate [⇒ page 66](#) .
- Remove top section of intake manifold: vehicles in rest-of-world [⇒ page 105](#) ; USA vehicles [⇒ page 115](#) .
- Remove bottom section of intake manifold: vehicles in rest-of-world [⇒ page 108](#) ; USA vehicles [⇒ page 118](#) .
- Remove cylinder head covers [⇒ page 94](#) .
- Turn the crankshaft via the central bolt in the normal direction of rotation to TDC.
- The marking -2- on vibration damper must align with the housing joint -1-.



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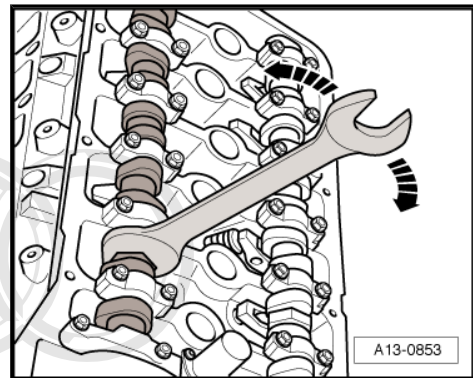


- You should then be able to insert the camshaft bar - T10068- in the slots in both camshafts.
- If necessary, turn crankshaft 1 turn further.



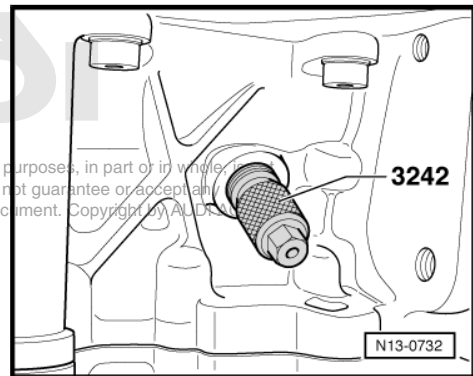
**Note**

*It may be necessary to turn the camshafts back and forth slightly using a 32 mm open-end spanner. The camshaft bar - T10068- must not be in place when doing this.*



- Remove sealing plug from cylinder block (left-side).
- Screw locking pin - 3242- or -T40237- into hole (20 Nm).

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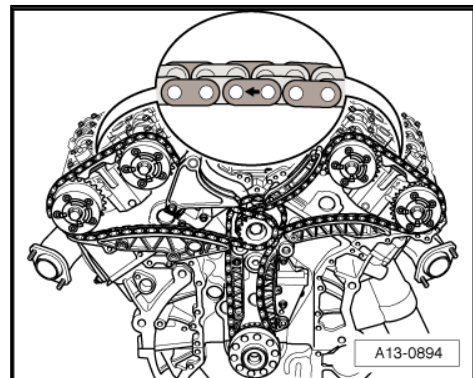


- Remove all timing chain covers => [page 71](#) .
- If the old timing chains are going to be reused, mark the allocation (left and right) and the direction of rotation with a paint pen.



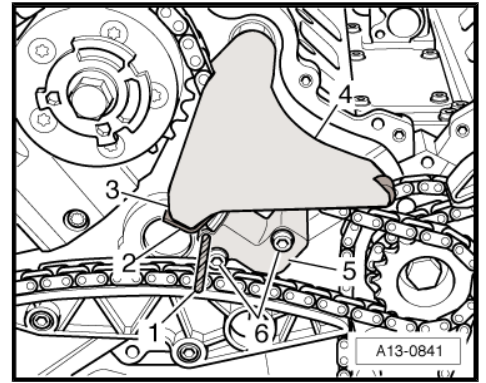
**Caution**

***It is always necessary to remove and install both timing chains; otherwise you will not be able to position the installation markings correctly.***

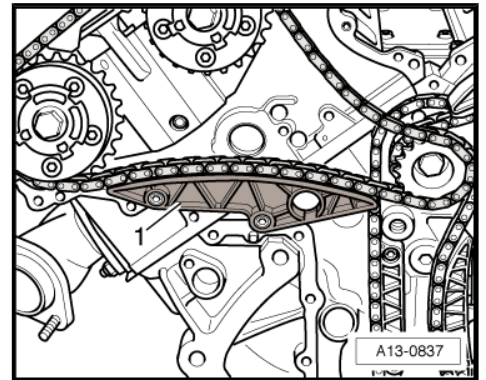




- Press down on chain tensioner for camshaft timing chain (cylinder bank 2, left-side) and lock in place using drill bit  $\varnothing$  3.5 mm -item 1-.
- Unscrew bolts -6- and remove chain tensioner -5-.
- Unscrew bolt -3- and remove slide -2-.
- Pull tensioning rail -4- off mounting pin.



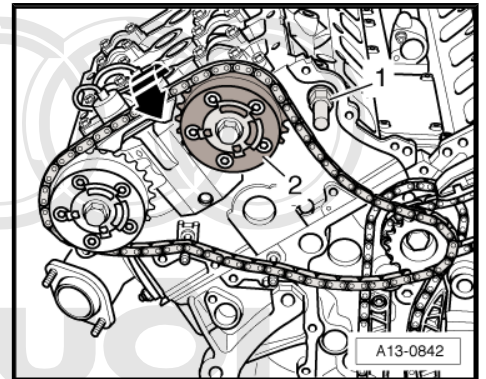
- Pull guide rail -1- off mounting pins.



- Unscrew mounting pin -1-.
- Take off timing chain for cylinder bank 2 (left-side) starting on the inlet camshaft adjuster -2-.

**i** Note

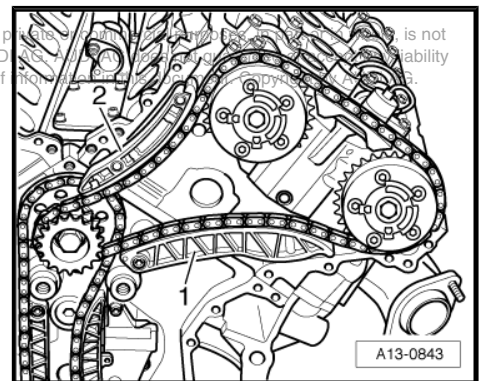
*Turn the camshaft adjusters back and forth slightly to ease removal of timing chain.*



- Pull off the tensioning rail -1- and the guide rail -2- from mounting pins on cylinder bank 1 (right-side).

**i** Note

*To ease removal of guide rail, turn inlet camshaft on flats slightly to the left (take note of the camshaft bar).*





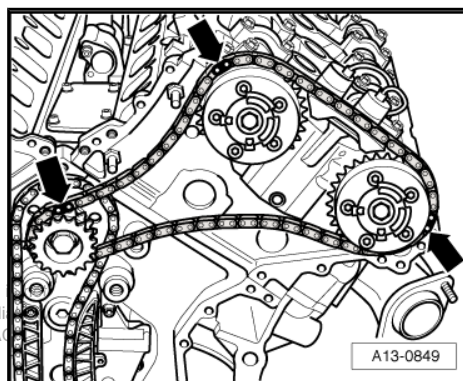
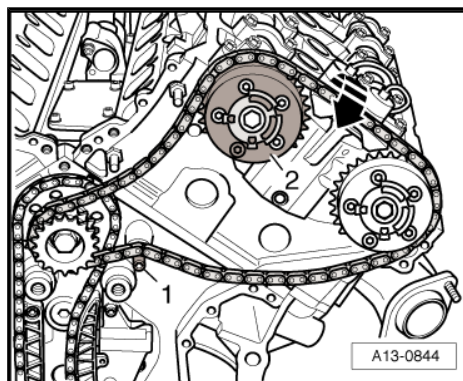
- Unscrew mounting pin -1-.
- Take off timing chain for cylinder bank 1 (right-side) starting on the inlet camshaft adjuster -2-.

**Note**

Turn the camshaft adjusters back and forth slightly to ease removal of timing chain.

**Installing**

- Camshafts locked in TDC position with camshaft bar - T10068- .
- Crankshaft locked in TDC position with locking pin - 3242- or -T40237- .
- Drive chain installed ⇒ [page 91](#) .
- Place camshaft timing chain for cylinder bank 1 (right-side) onto sprocket for camshaft drive and onto camshaft adjusters.
- The copper-coloured chain links face towards the gearbox.
- The copper-coloured chain links must be positioned in relation to the sprockets, as shown in the illustration.
- The exact positions are shown in the following illustrations.



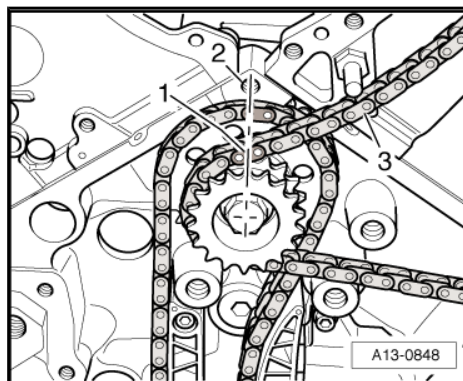
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**Chain sprocket for camshaft drive**

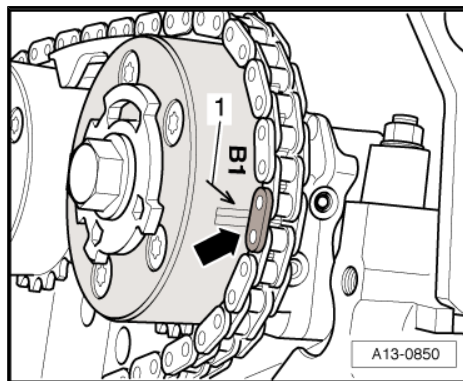
- The copper-coloured chain link -1- must be aligned centrally with the threaded hole -2- when the camshaft timing chain -3- is tensioned.

**Note**

The copper-coloured chain link on the drive chain (which is behind the timing chain) is only in the position shown in the illustration when the drive chain is installed for the first time. If the drive chain has not been removed, the position of the copper-coloured chain link is irrelevant.

**Camshaft adjuster for exhaust camshaft**

- The copper-coloured chain link -arrow- must align with the marking -1- on the exhaust camshaft adjuster.



### Camshaft adjuster for inlet camshaft

- The copper-coloured chain link -arrow- must align with the marking -1- on the inlet camshaft adjuster.



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- Fit ~~guide rail -2-~~ onto mounting pins.
- Install mounting pin with locking fluid; locking fluid ⇒ Parts catalogue .
- Fit tensioning rail -1-.

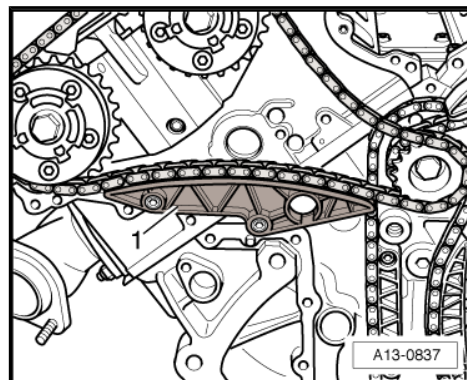
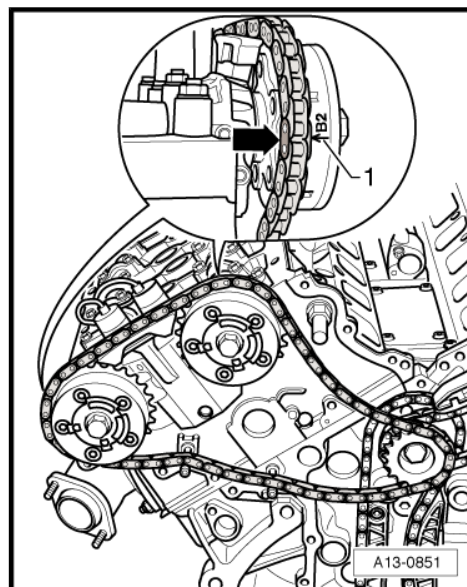
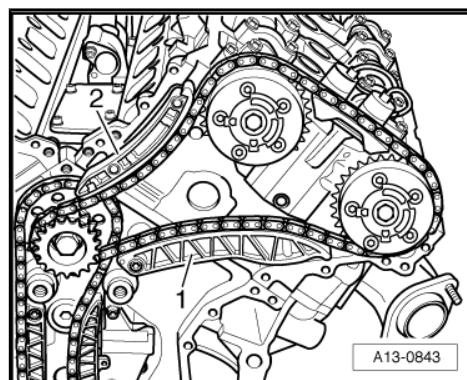
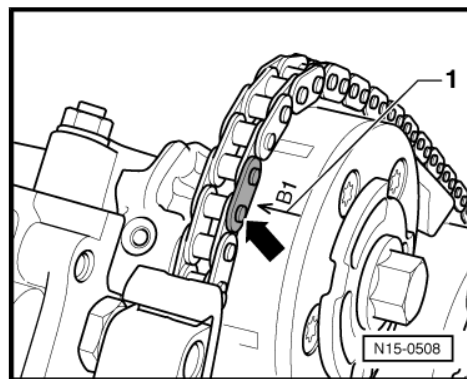


#### Note

*If the guide rail cannot be attached with ease, turn the inlet camshaft adjuster slightly to the left (take note of the camshaft bar).*

- Place camshaft timing chain for cylinder bank 2 (left-side) onto sprocket for camshaft drive and onto camshaft adjusters.
- The copper-coloured chain links face the engine.
- The copper-coloured chain links must be positioned on the sprockets, as shown in the illustration.
- The exact positions are shown in the following illustrations.

- Attach the guide rail -1- before checking the chain position.





### Chain sprocket for camshaft drive

- The copper-coloured chain link -1- must be aligned centrally with the threaded hole -3- when the camshaft timing chain -2- is tensioned.

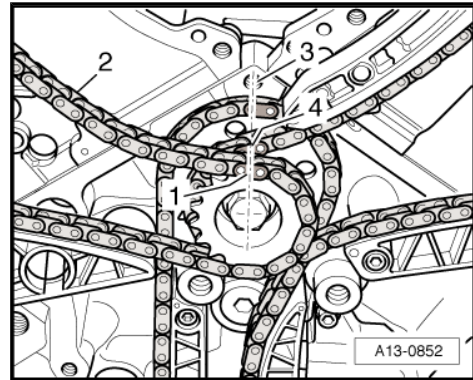


#### Note

For illustration purposes, the copper-coloured chain link -4- is shown facing outwards. However, it faces the engine when in its correct installed position.

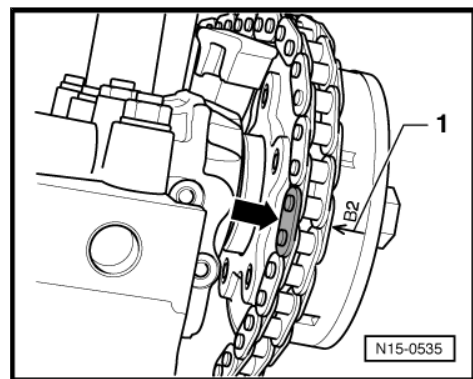
Check:

- The copper-coloured chain links -1- and -4- on the camshaft timing chains (left and right cylinder bank) must align exactly with each other and centrally with the threaded hole -3-.



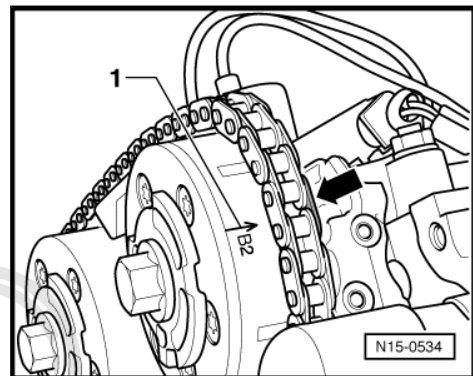
### Camshaft adjuster for exhaust camshaft

- The copper-coloured chain link -arrow- must align with the marking -1- on the exhaust camshaft adjuster.



### Camshaft adjuster for inlet camshaft

- The copper-coloured chain link -arrow- must align with the marking -1- on the inlet camshaft adjuster.



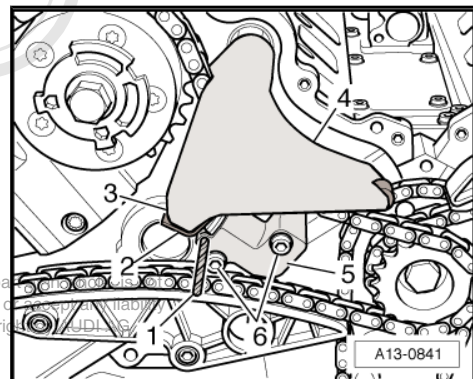
- Attach the mounting pin and the tensioning rail -4-
- Secure the slide -2- using bolt -3-.
- Secure chain tensioner -5- using bolts -6-.
- Pull drill bit (Ø 3.5 mm) -item 1- out of hole; this releases chain tensioner.



#### Note

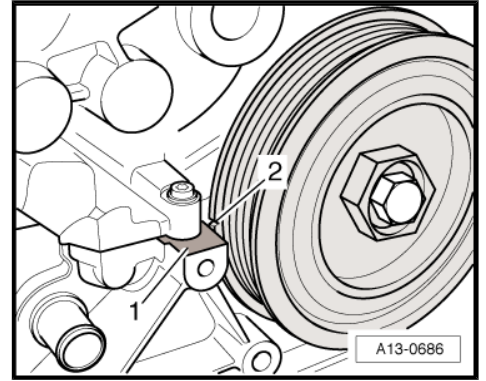
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Before continuing, check the installation position of the chain links (alignment with markings).

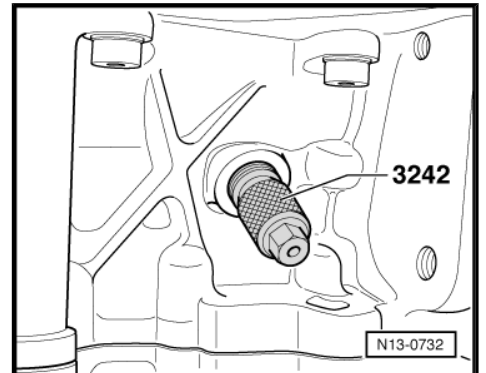


- Install timing chain covers => [page 71](#) .
- Remove locking pin - 3242- / -T40237- .

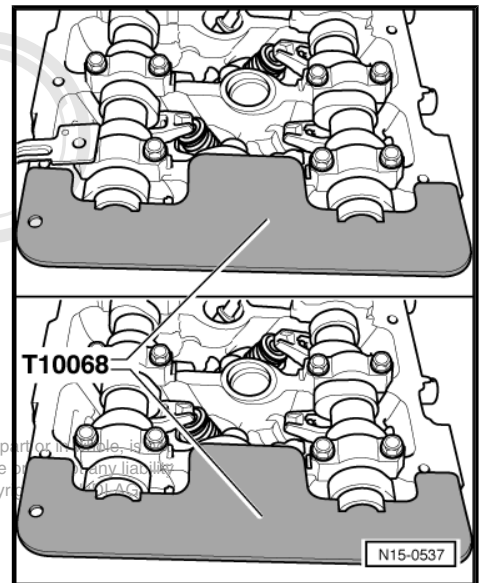
- Turn crankshaft two rotations in direction of engine rotation until marking -2- on vibration damper aligns with housing joint -1-.



- Screw locking pin - 3242- or -T40237- into hole (20 Nm).



- You must be able to insert the camshaft bar - T10068- in both camshaft grooves.



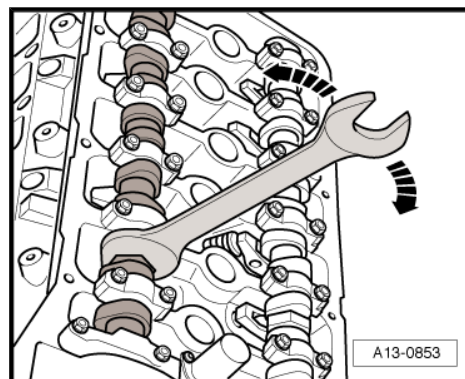
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- It may be necessary to turn the camshafts back and forth slightly using a 32 mm open-end spanner. The camshaft bar - T10068- must not be in place when doing this.
- Remove camshaft bars - T10068- .
- Remove locking pin - 3242- / -T40237- .
- Screw plug for the TDC mark into retaining frame with a new seal.

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

- Install cylinder head covers ⇒ [page 96](#) .
- Install bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Install top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Install drive plate ⇒ [page 66](#) .



#### Tightening torques

Component	Nm
Mounting pin for tensioning rail (cylinder bank 1) to cylinder block	25 <sup>13)</sup>
Mounting pin for tensioning rail (cylinder bank 2) to cylinder head	42 <sup>13)</sup>
Slide to tensioning rail (cylinder bank 2)	20
Chain tensioner (cylinder bank 2) to cylinder head	9
Screw plug in retaining frame	30

13) Install using locking fluid; locking fluid ⇒ Parts catalogue .

### 3.10 Exploded view - drive chain



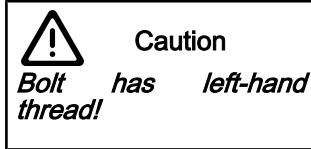
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**1 - Mounting pin, 15 Nm**

- Without collar
- For guide rail  
 ⇒ [Item 2 \(page 89\)](#)

**2 - Guide rail**

**3 - 60 Nm + 90° (1/4 turn) further**



- Renew

**4 - Mounting pin**

**5 - Chain sprocket for camshaft drive**

- With needle bearings
- Renew chain sprocket if needle bearings are defective
- Removing and installing  
 ⇒ ["3.11 Removing and installing drive chain", page 89](#)

**6 - Cross-head countersunk screw, 10 Nm**

- Renew
- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**7 - Bush**

**8 - Gasket**

- Renew

**9 - Chain tensioner with tensioning rail**

- For drive chain
- Lock chain tensioner with drill bit (Ø 3.5 mm)

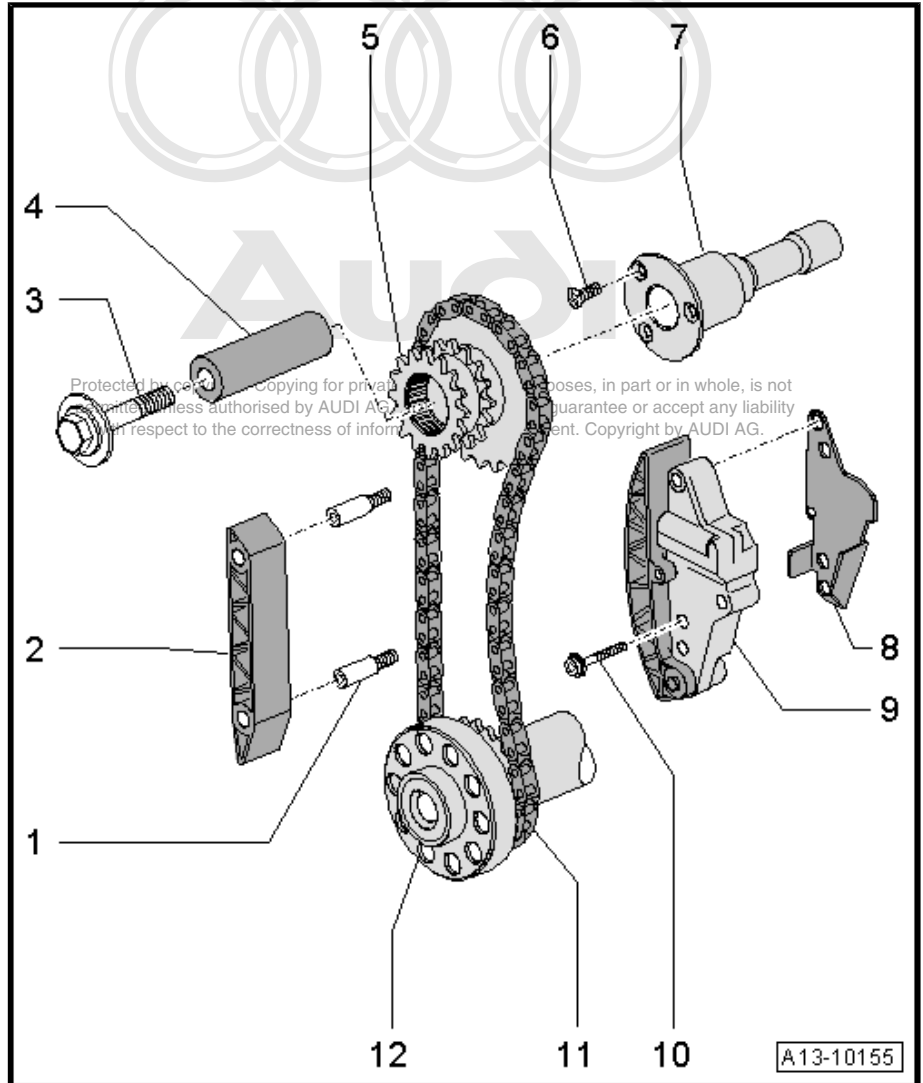
**10 - 9 Nm**

**11 - Timing chain**

- Crankshaft / intermediate shaft

**12 - Drive chain sprocket**

- Integral part of crankshaft

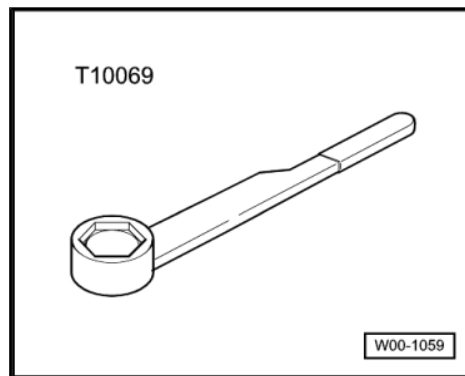


### 3.11 Removing and installing drive chain

Special tools and workshop equipment required



- ◆ Counterhold tool - T10069-



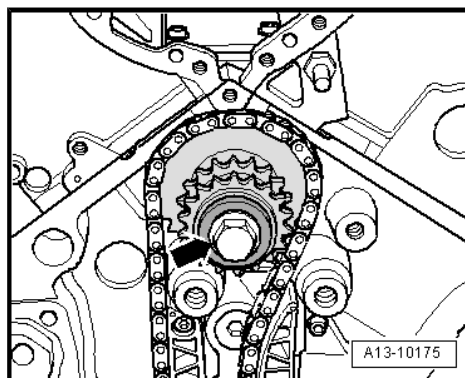
### Removing

- Engine removed
- Engine separated from gearbox.
- Remove camshaft timing chains => [page 80](#) .
- Remove bolt -arrow-.

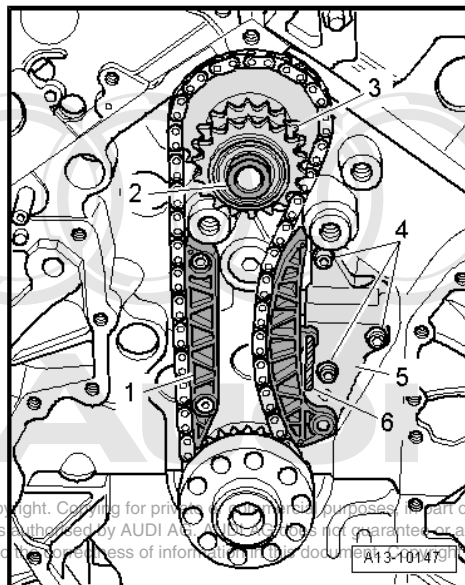


Caution

***Bolt has left-hand thread!***



- Press down chain tensioner for drive chain and secure in position using drill bit  $\varnothing$  3.5 mm -Item 6-.
- Unscrew bolts -4- and remove chain tensioner -5- as well as the gasket behind it.
- Pull guide rail -1- off mounting pins.
- Pull out the bearing pin -2- and remove the camshaft drive chain sprocket -3-.



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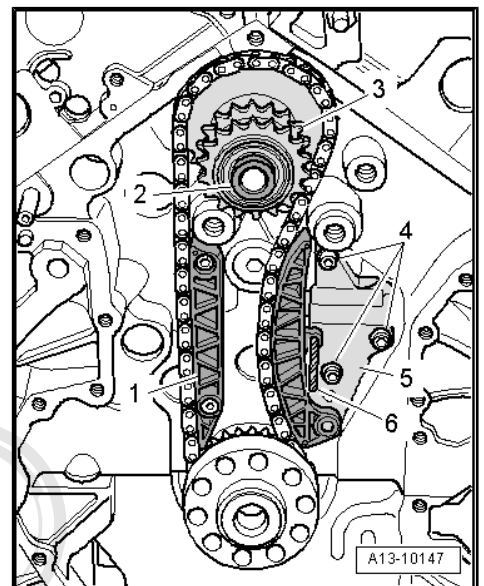
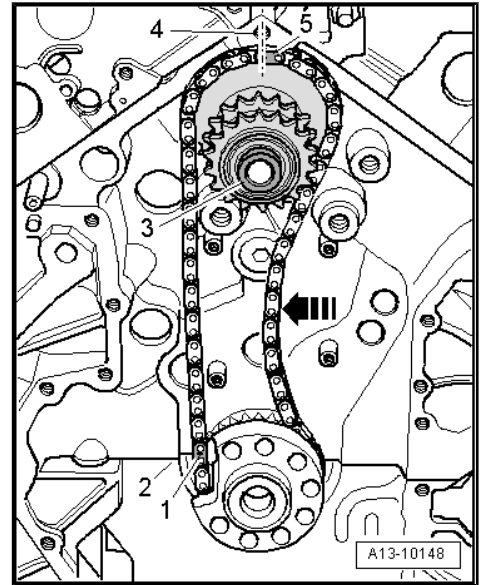


## Installing

### Note

#### *Renew gasket.*

- Engine set to TDC.
- Crankshaft locked in TDC position with locking pin - 3242- or -T40237- .
- Place drive chain onto crankshaft sprocket and camshaft drive chain sprocket.
- The copper-coloured chain links -1-and -5- must face towards gearbox.
- The bottom copper-coloured chain link -1- must align centrally with the housing joint -2-.
- The copper-coloured chain link -5- must be positioned so that the left link pin aligns with the threaded hole above it -4-.
- When attaching camshaft drive chain sprocket, insert the bearing pin -3- into sprocket and intermediate shaft.
- To check for correct fitting of chain, press the right-side of chain by hand in the direction of the -arrow-.
- Insert guide rail -1- onto mounting pins.
- Renew gasket beneath chain tensioner -5-.
- Secure chain tensioner using bolts -4-.
- Pull drill bit ( $\varnothing$  3.5 mm) -item 6- out of hole; this releases chain tensioner.



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- Secure camshaft drive chain sprocket using bolt -arrow-.



**Caution**

***Bolt has left-hand thread!***

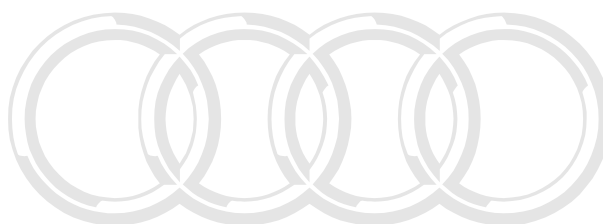
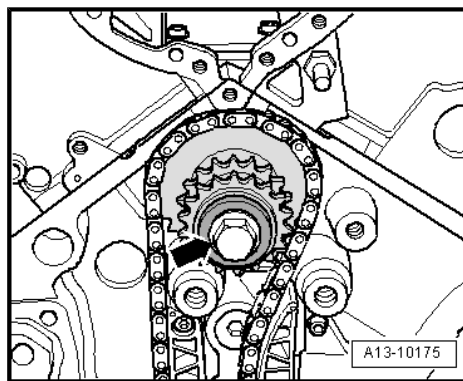
- Install camshaft timing chain ⇒ [page 84](#) .

**Tightening torques**

Component	Nm
Chain tensioner for drive chain to cylinder block	9
Chain sprocket for camshaft drive to intermediate shaft	60 + 90° <sup>14)</sup> <sup>15)</sup>

14) Renew bolt.

15) 90° equals a 1/4 turn.



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## 15 – Cylinder head, valve gear

### 1 Removing and installing cylinder head

⇒ [“1.1 Exploded view - cylinder head”, page 93](#)

⇒ [“1.2 Removing and installing cylinder head cover”, page 94](#)

⇒ [“1.3 Removing and installing cylinder head”, page 97](#)

#### 1.1 Exploded view - cylinder head



#### Note

Illustration shows cylinder head, bank 1 (right-side).

1 - 23 Nm

2 - Lifting eye

3 - Cylinder head

- Removing ⇒ [page 97](#)
- Checking for distortion ⇒ [page 94](#)
- Installing ⇒ [page 98](#)
- If renewed, refill system with fresh coolant

4 - Mounting pin, 15 Nm

- For guide rail
- For cylinder head (right-side)

5 - Cylinder head bolt

- Different lengths; short bolts are for outer holes
- Renew
- Note sequence when loosening: right-side ⇒ [page 97](#), left-side ⇒ [page 98](#)
- Note sequence when tightening: right-side ⇒ [page 100](#), left-side ⇒ [page 99](#)

6 - Cylinder head cover

- Removing and installing ⇒ [page 94](#)

7 - Seals

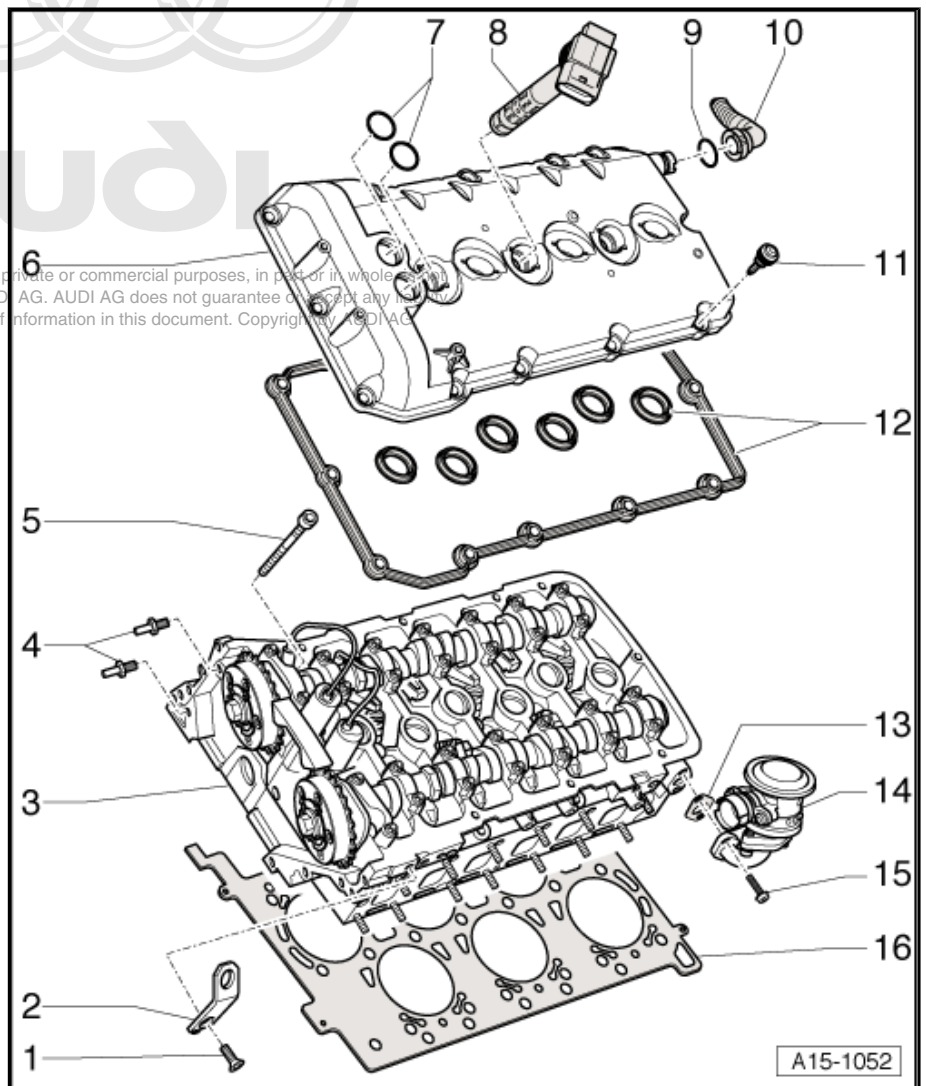
- Renew if damaged or leaking

8 - Ignition coil

- Remove with puller - T10166- ⇒ [page 94](#)

9 - O-ring

- Renew





## 10 - Crankcase breather pipe

## 11 - Special bolt, 8 Nm

- Renew if damaged or leaking
- Note correct sequence when tightening => [page 97](#)

## 12 - Gasket/seals for cylinder head cover

- Renew if damaged or leaking

## 13 - Seal

- Renew

## 14 - Combination valve for secondary air system

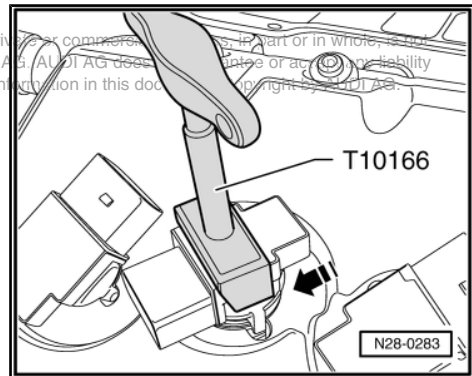
## 15 - 10 Nm

## 16 - Cylinder head gasket

- Different versions for cylinder bank 1 (right-side) and cylinder bank 2 (left-side)
- Renewing => ["1.3 Removing and installing cylinder head", page 97](#)
- Installation position: part number must face cylinder head
- If renewed, change coolant in entire system

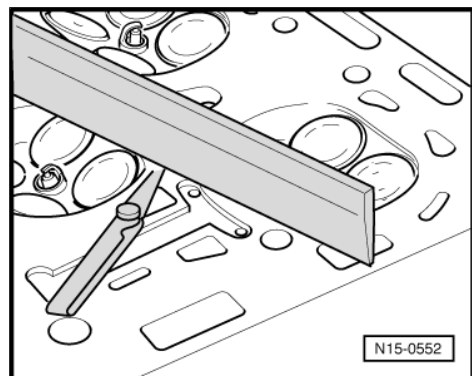
## Removing ignition coils

- Disconnect the ignition coils from the spark plugs using puller - T10166- .



## Checking cylinder head for distortion

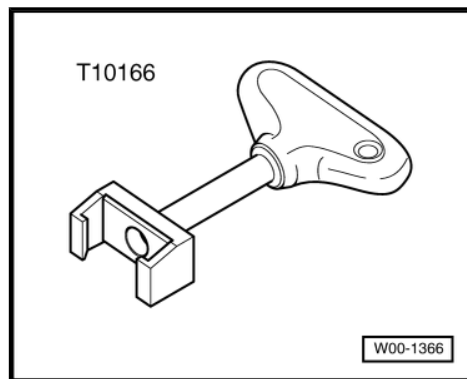
- Use straight edge and feeler gauge to measure for distortion at several points.
- Maximum permissible distortion: 0.05 mm



## 1.2 Removing and installing cylinder head cover

Special tools and workshop equipment required

◆ Puller - T10166-



◆ Sealant ⇒ Parts catalogue

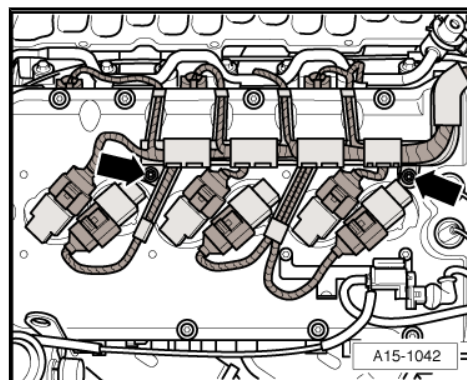
Removing



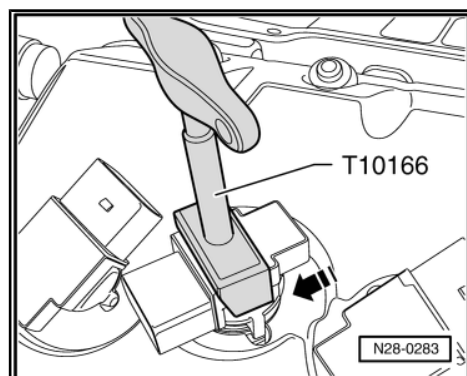
Note

- ◆ *The following description applies to cylinder head, bank 2 (left-side) with the engine removed.*
- ◆ *The procedure for the cylinder head on bank 1 (right-side) is basically the same.*

- Remove top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Remove bolts -arrows-.



- Disconnect the ignition coils from the spark plugs using puller - T10166- .
- Place wiring harness with ignition coils to side.



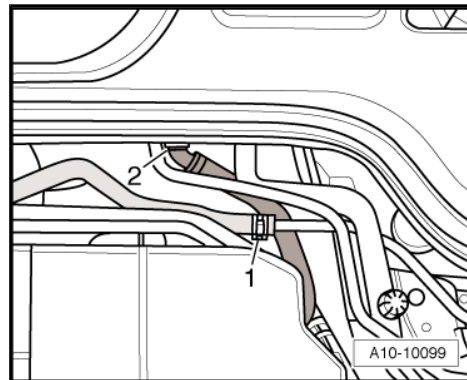


- Detach vacuum hose -2- going to brake servo.

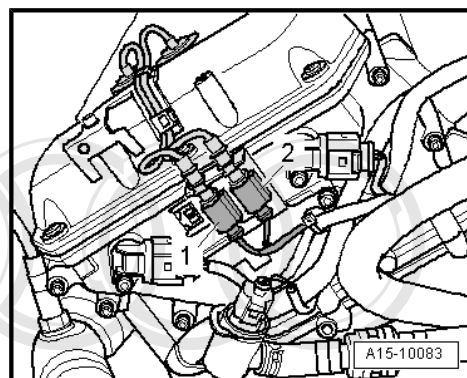


**Note**

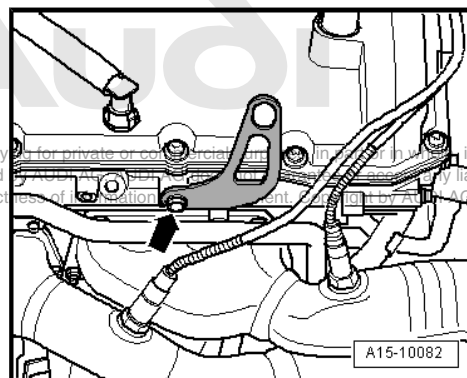
Disregard -item 1-.



- Unbolt bracket for electrical connectors (rear) at cylinder head cover.
- Detach electrical connectors -1- and -2- for camshaft control valves from bracket and unplug connectors.



- Loosen bolt -arrow- for engine lifting eye (rear left) several turns.



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- Unscrew cylinder head cover bolts (left-side) in the sequence -1 ... 12-.
- Remove cylinder head cover.

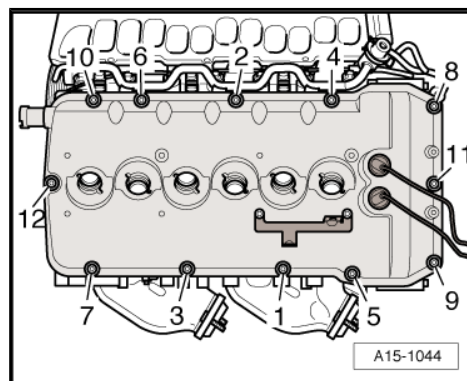
**Installing**

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

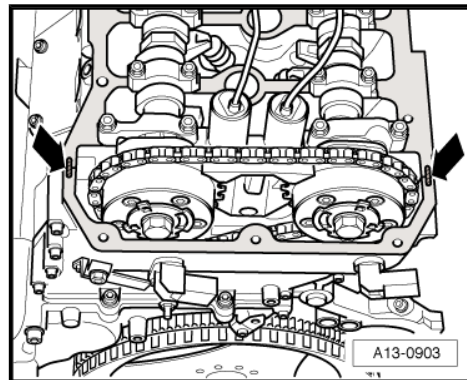


**Note**

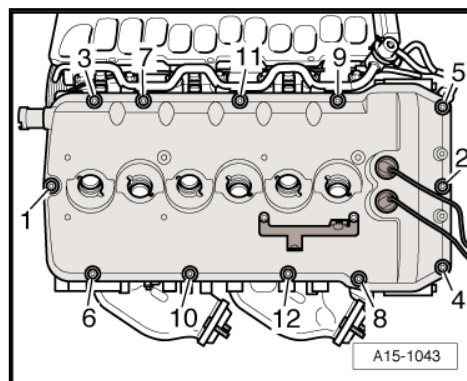
- ◆ Renew cylinder head cover gaskets if damaged.
- ◆ Renew securing bolts if damaged or leaking occurs.



- Apply a small amount of sealant at joints -arrows- between timing chain cover and cylinder head; sealant => Parts catalogue .



- Tighten bolts for cylinder head cover in the sequence -1 ... 12-.
- Install top section of intake manifold: vehicles in rest-of-world => [page 105](#) ; USA vehicles => [page 115](#) .



**Tightening torques**

Component	Nm
Cylinder head cover to cylinder head	8
Engine lifting eye to cylinder head	23

### 1.3 Removing and installing cylinder head

**Removing**

- Engine removed
- Engine separated from gearbox.
- Remove drive plate => [page 66](#) .
- Remove top section of intake manifold: vehicles in rest-of-world => [page 105](#) ; USA vehicles => [page 115](#) .
- Remove bottom section of intake manifold: vehicles in rest-of-world => [page 108](#) ; USA vehicles => [page 118](#) .
- Remove cylinder head covers => [page 94](#) .
- Remove camshaft timing chains => [page 80](#) .

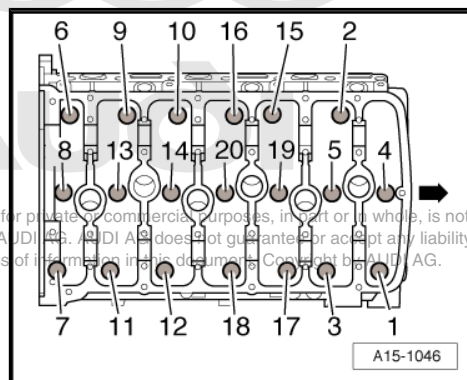
**Cylinder bank 1 (right-side):**

- Follow the sequence -1 ... 20- for loosening the cylinder head bolts.

**Note**

*Arrow points in direction of travel.*

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**Cylinder bank 2 (left-side):**

- Follow the sequence -1 ... 21- for loosening the cylinder head bolts.



**Note**

Arrow points in direction of travel.

**Continued for both cylinder banks:**

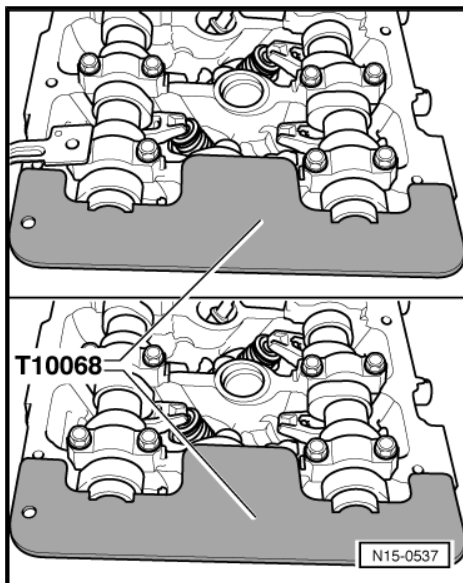
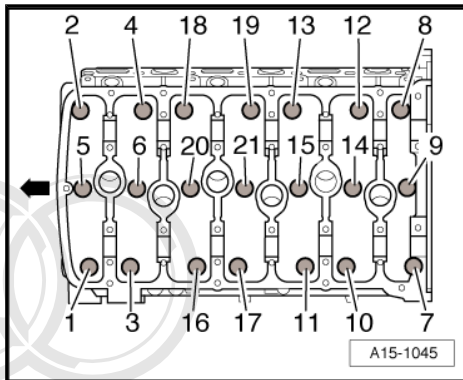
- Carefully remove cylinder head.

**Installing**



**Note**

- ◆ *Renew the cylinder head bolts.*
- ◆ *During assembly, renew oil seals and gaskets as well as self-locking nuts and bolts that are tightened by turning through to a specified angle.*
- ◆ *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.*
- ◆ *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.*
- ◆ *When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and refill with new coolant.*

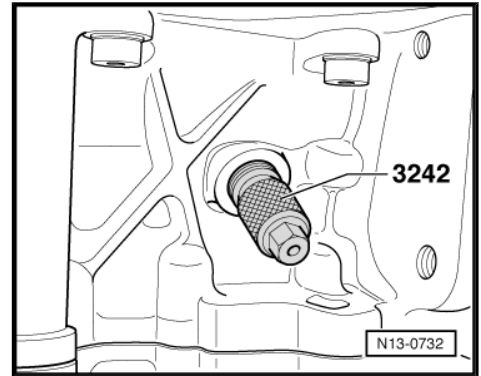


Installation is carried out in the reverse order; note the following:

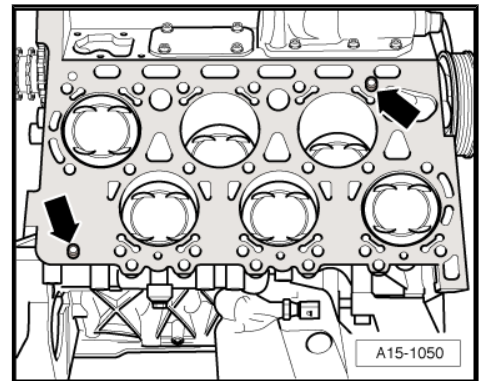
- Before fitting cylinder heads, set crankshaft and camshafts to TDC:
- You must be able to insert the camshaft bar -T10068- in both camshaft grooves.



- The locking pin - 3242- / -T40237- must be screwed in.



- Fit new cylinder head gasket.
- Note centring sleeves -arrows- in cylinder block.
- Note installation position of cylinder head gasket: the word "oben" (top) or the part number should face towards the cylinder head.
- Fit cylinder head.
- Insert new cylinder head bolts and tighten hand-tight.
- Allocation: short bolts are screwed into outer holes.
- Tighten cylinder head bolts in 4 stages in the sequence indicated:
  1. Tighten with torque wrench to 30 Nm.
  2. Tighten with torque wrench to 50 Nm.
  3. Turn 90° (1/4 turn) further using a rigid wrench.
  4. Turn 90° (1/4 turn) further using a rigid wrench.



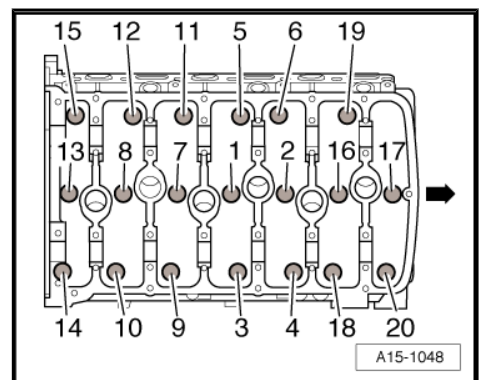
**i** Note

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

**Tightening sequence for cylinder bank 1 (right-side):**

**i** Note

*Arrow points in direction of travel.*



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**Tightening sequence for cylinder bank 2 (left-side):**

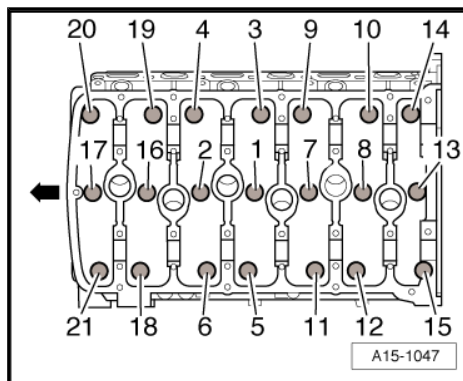


**Note**

*Arrow points in direction of travel.*

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

- Install camshaft timing chains ⇒ [page 84](#) .
- Install cylinder head covers ⇒ [page 96](#) .
- Install bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Install top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Install drive plate ⇒ [page 66](#) .



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## 2 Removing and installing intake manifold - rest-of-world vehicles

⇒ [“2.1 Exploded view - intake manifold”, page 101](#)

⇒ [“2.2 Removing and installing left section of intake manifold”, page 102](#)

⇒ [“2.3 Removing and installing right section of intake manifold”, page 104](#)

⇒ [“2.4 Removing and installing intake manifold \(top section\)”, page 105](#)

⇒ [“2.5 Removing and installing intake manifold \(bottom section\)”, page 108](#)

### 2.1 Exploded view - intake manifold

#### 1 - Bottom section of intake manifold

- Removing and installing  
⇒ [page 108](#)

#### 2 - 9 Nm

#### 3 - Gasket

- Renew

#### 4 - Fuel rail

- Removing and installing  
⇒ Rep. gr. 24

#### 5 - 9 Nm

#### 6 - Seal

- Renew
- Lubricate lightly with engine oil “0 W 30” before installing

#### 7 - 22 Nm

#### 8 - Side section of intake manifold

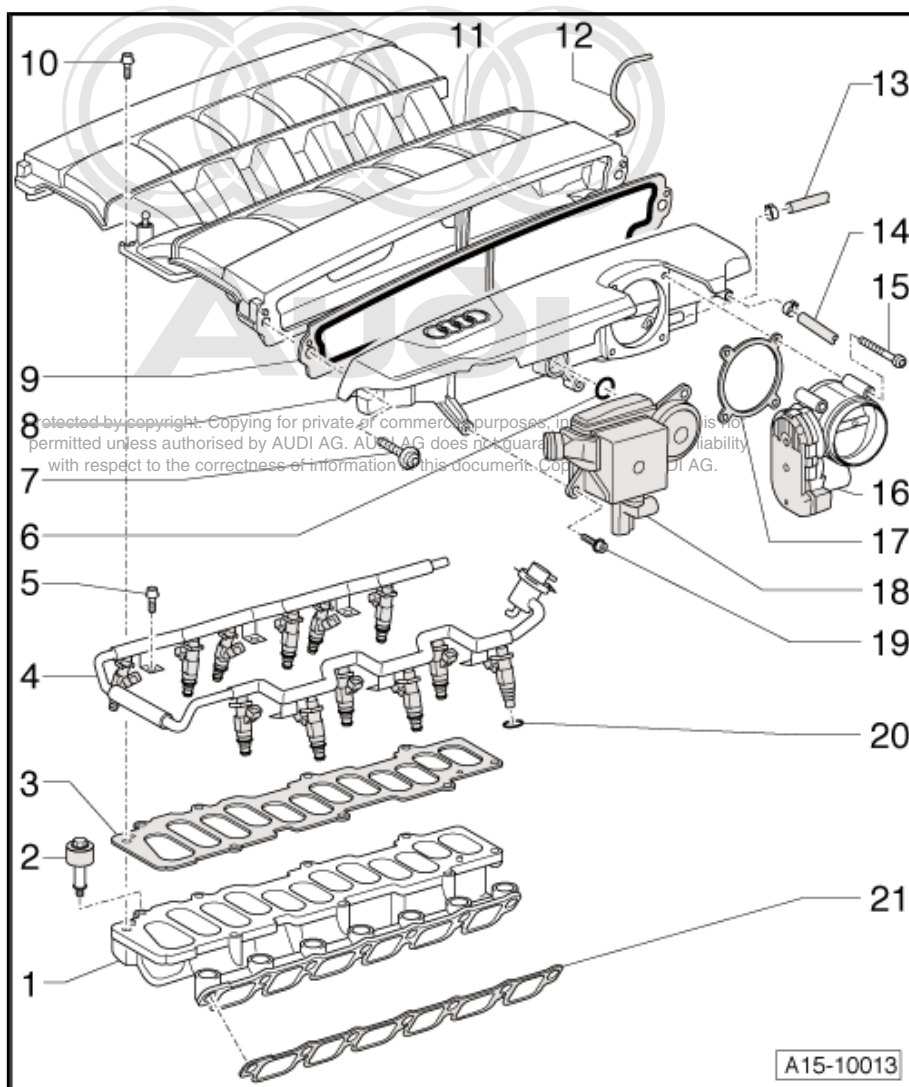
- Removing and installing left section of intake manifold ⇒ [page 102](#)
- Removing and installing right section of intake manifold ⇒ [page 104](#)
- A small amount of oil residue in side section of intake manifold is permissible

#### 9 - Gasket

- Renew if damaged

#### 10 - 7 Nm + 180° (1/2 turn) further

- Renew
- Coat with engine oil when installing
- Starting from the centre, tighten in stages and in diagonal sequence





### 11 - Intake manifold (top section)

- Removing and installing ⇒ [page 105](#)

### 12 - Vacuum hose

- To fuel pressure regulator

### 13 - Vacuum hose

- To activated charcoal filter solenoid valve 2 - N333-

### 14 - Vacuum hose

- To vacuum booster for brake servo

### 15 - 9 Nm

### 16 - Throttle valve module

- Cylinder bank 1 (right-side): throttle valve module - J338-
- Cylinder bank 2 (left-side) throttle valve module 2 - J544-

### 17 - Gasket

- Renew

### 18 - Pressure control valve for crankcase breather system

- With oil separator

### 19 - 9 Nm

### 20 - O-ring

- Renew
- Lubricate with fuel when installing
- Do not use lubricants containing silicone

### 21 - Gasket

- Renew if damaged
- Press lugs of gasket into cylinder head

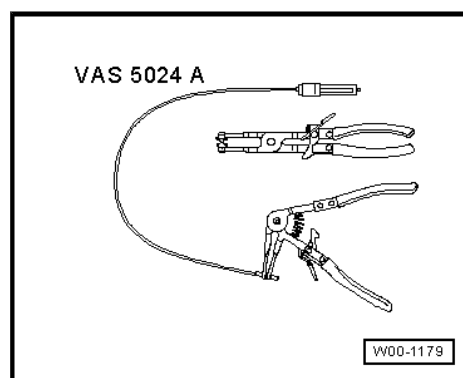


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## 2.2 Removing and installing left section of intake manifold

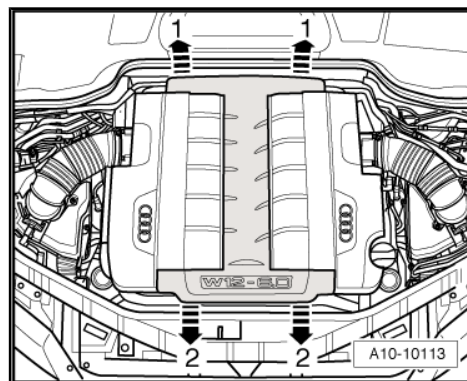
### Special tools and workshop equipment required

- ◆ Spring type clip pliers - VAS 5024 A-

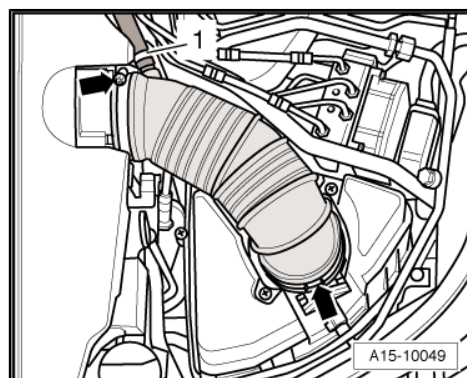


### Removing

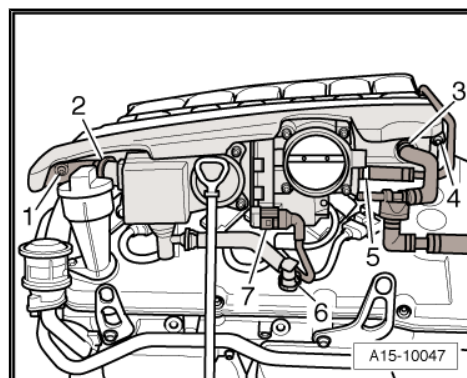
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



- Pull hose -1- off air intake hose.
- Remove air intake hose (left-side) -arrows-.



- Detach electrical connector -7- at throttle valve module 2 - J544- .
- Disconnect vacuum hoses -3- and -5-.
- Disconnect hoses for crankcase breather system -2- and -6-.
- Remove bolts -1- and -4-.
- Remove left section of intake manifold.



**i** Note

A small amount of oil residue in side section of intake manifold is permissible.

### Installing

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

**i** Note

- ◆ Renew O-rings.
- ◆ Renew seals and gaskets if damaged
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .

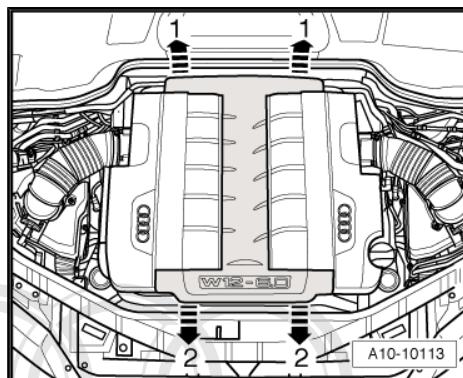
### Tightening torque

Component	Nm
Side section of intake manifold to top section of intake manifold	22

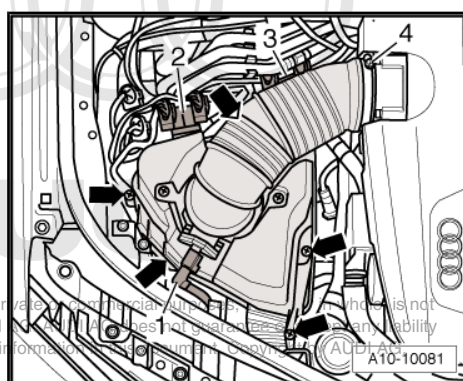
## 2.3 Removing and installing right section of intake manifold

### Removing

- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



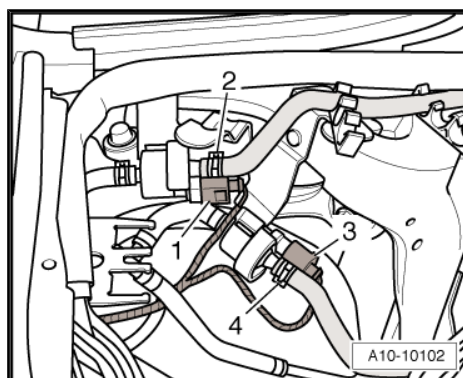
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- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system - N80- .

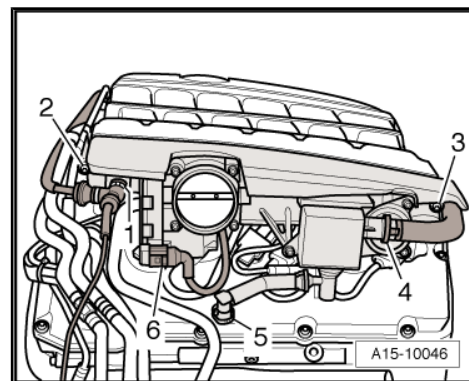


### Note

Disregard items -1 ... 3-.



- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect hoses for crankcase breather system -4- and -5-.
- Remove bolts -2- and -3-.
- Remove right section of intake manifold.



**i** Note

*A small amount of oil residue in side section of intake manifold is permissible.*

**Installing**

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

**i** Note

- ◆ *Renew O-rings.*
- ◆ *Renew seals and gaskets if damaged*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) => Parts catalogue .*

**Tightening torque**

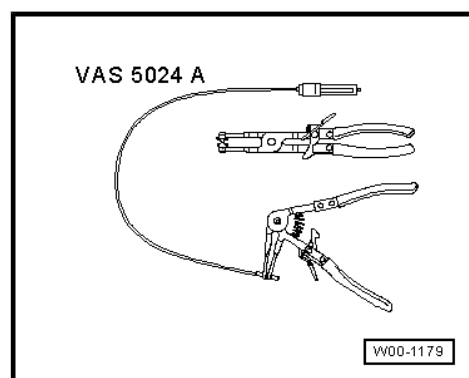
Component	Nm
Side section of intake manifold to top section of intake manifold	22

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## 2.4 Removing and installing intake manifold (top section)

**Special tools and workshop equipment required**

- ◆ Spring type clip pliers - VAS 5024 A-





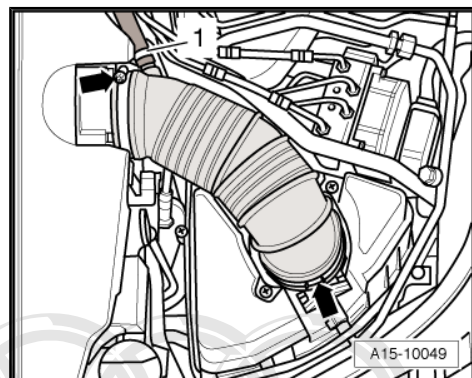
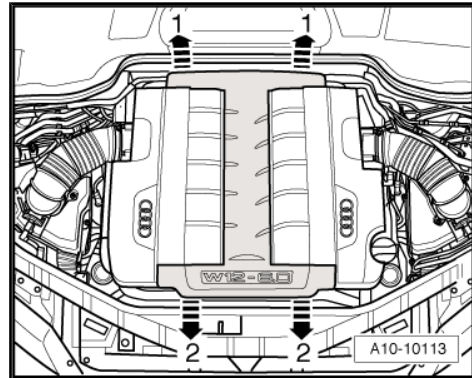
### Removing



#### Note

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

- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.
- Pull hose -1- off air intake hose.
- Remove air intake hose (left-side) -arrows-.

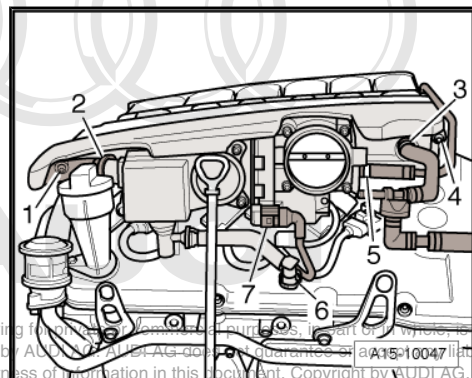


- Detach electrical connector -7- at throttle valve module 2 - J544- .
- Disconnect vacuum hoses -3- and -5-.
- Disconnect hoses for crankcase breather system -2- and -6-.

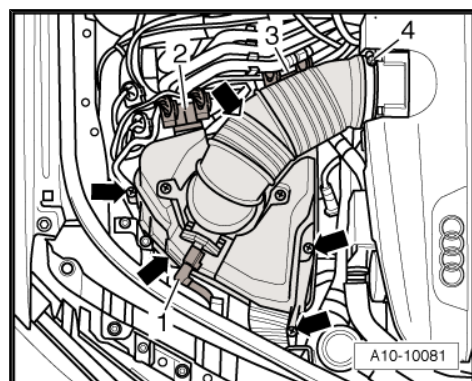


#### Note

Disregard items -1- and -4-.



- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



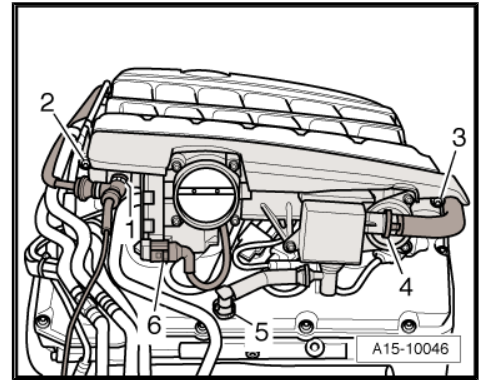
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- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect crankcase breather hoses -4- and -5-.

**i** Note

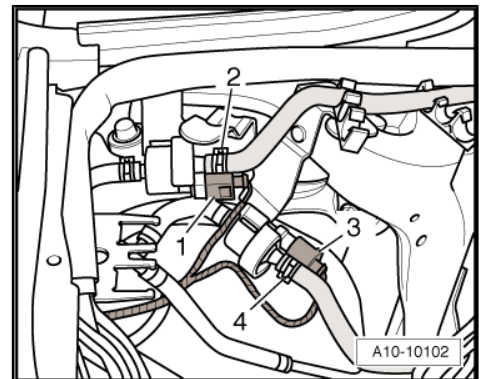
*Disregard items -2- and -3-.*



- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system - N80- .

**i** Note

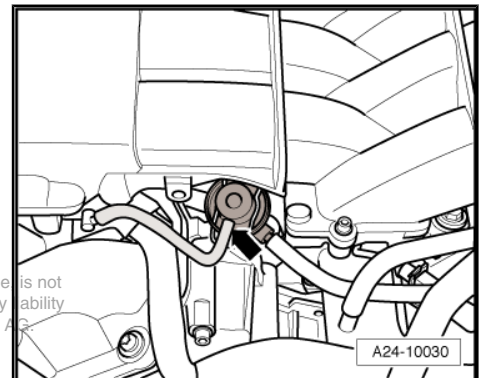
*Disregard items -1 ... 3-.*



- Detach vacuum hose -arrow- from fuel pressure regulator.

**i** Note

*Shown from rear in illustration.*



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- Remove bolts -arrows-.
- Unscrew bolts -1- and -2- and detach top section of intake manifold.

**Note**

Seal intake ports on cylinder heads with clean cloths.

**Installing**

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

**Note**

- ◆ Renew gaskets, seals and O-rings.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .
- ◆ Fit all cable ties in the original positions when installing.

**Tightening torques**

Component	Nm
Intake manifold (top section) to intake manifold (bottom section)	7 + 180° <sup>16) 17)</sup> <sub>18)</sub>
Pipe to top section of intake manifold	9
Side section of intake manifold to top section of intake manifold	22

16) Note different bolt lengths

17) Renew bolts.

18) 180° = one half turn.

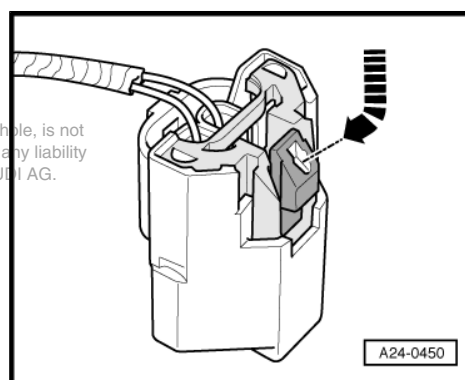
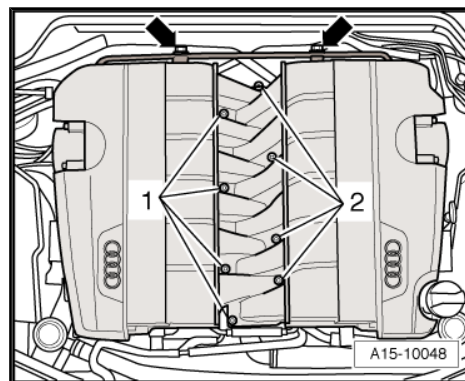
## 2.5 Removing and installing intake manifold (bottom section)

**Removing****Note**

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

- Remove intake manifold (top section) ⇒ [page 105](#) .
- Unplug electrical connectors on injectors by pressing release tab down and then inwards -arrow-.



- Unscrew bolts for fuel rail -1-
- Unbolt bottom section of intake manifold -2-
- Remove bottom section of intake manifold together with fuel rail upwards; the fuel hoses remain connected.

**i** Note

*Seal intake ports on cylinder heads with clean cloths.*

**Installing**

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

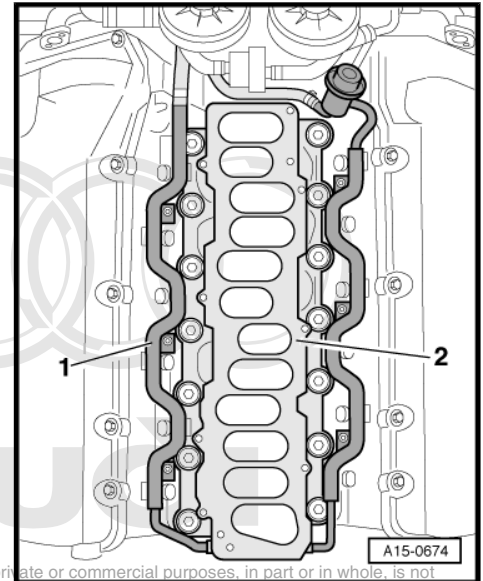
**i** Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Fit all cable ties in the original positions when installing.*

- Press lugs of gasket for bottom section of intake manifold into holes on cylinder heads.
- Install bottom section of intake manifold together with fuel rail.
- Install intake manifold (top section) ⇒ [page 108](#) .

**Tightening torques**

Component	Nm
Bottom section of intake manifold to cylinder heads	9
Fuel rail to cylinder heads	9



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### 3 Removing and installing intake manifold - USA vehicles

⇒ [“3.1 Exploded view - intake manifold”, page 110](#)

⇒ [“3.2 Removing and installing left section of intake manifold”, page 111](#)

⇒ [“3.3 Removing and installing right section of intake manifold”, page 113](#)

⇒ [“3.4 Removing and installing intake manifold \(top section\)”, page 115](#)

⇒ [“3.5 Removing and installing intake manifold \(bottom section\)”, page 118](#)

#### 3.1 Exploded view - intake manifold

##### 1 - Bottom section of intake manifold

- Removing and installing  
⇒ [page 118](#)

##### 2 - 9 Nm

##### 3 - Gasket

- Renew

##### 4 - Fuel rail

- Removing and installing  
⇒ Rep. gr. 24

##### 5 - 9 Nm

##### 6 - Seal

- Renew
- Lubricate lightly with engine oil “0 W 30” before installing

##### 7 - 22 Nm

##### 8 - Side section of intake manifold

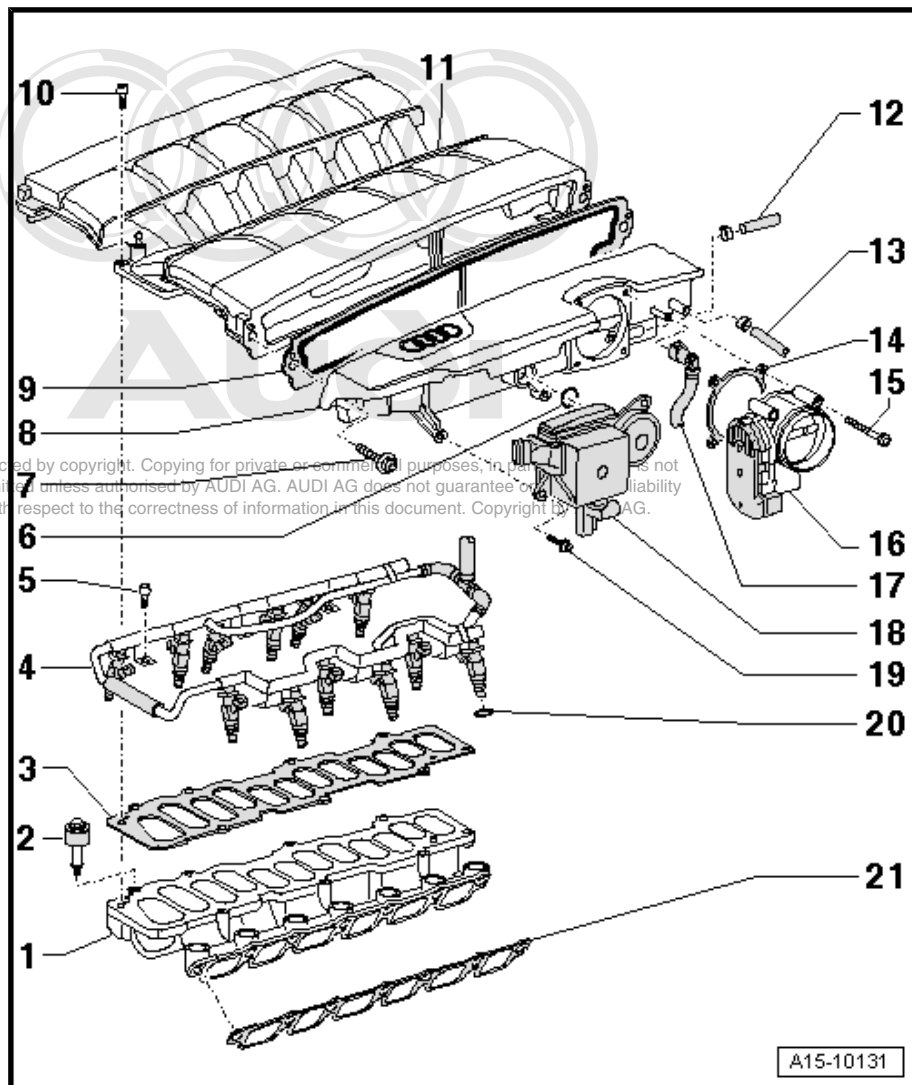
- Removing and installing left section of intake manifold ⇒ [page 111](#)
- Removing and installing right section of intake manifold ⇒ [page 113](#)
- A small amount of oil residue in side section of intake manifold is permissible

##### 9 - Gasket

- Renew if damaged

##### 10 - 7 Nm + 180° (1/2 turn) further

- Renew
- Coat with engine oil when installing
- Starting from the centre, tighten in stages and in diagonal sequence



**11 - Intake manifold (top section)**

- Removing and installing => [page 115](#)

**12 - Vacuum hose**

- To activated charcoal filter solenoid valve 2 - N333-

**13 - Vacuum hose**

- To vacuum booster for brake servo

**14 - Gasket**

- Renew

**15 - 9 Nm**

**16 - Throttle valve module**

- Cylinder bank 1 (right-side): throttle valve module - J338-
- Cylinder bank 2 (left-side) throttle valve module 2 - J544-

**17 - Vacuum hose**

- To fuel system diagnostic pump - V144-

**18 - Pressure control valve for crankcase breather system**

- With oil separator

**19 - 9 Nm**

**20 - O-ring**

- Renew
- Lubricate with fuel when installing
- Do not use lubricants containing silicone

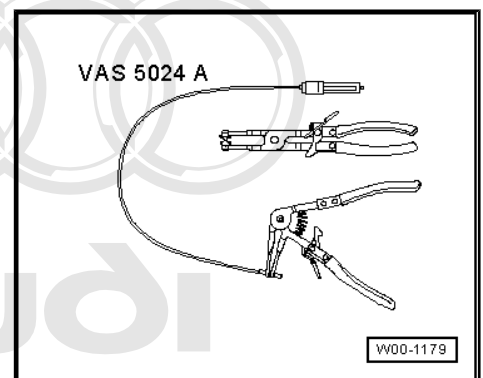
**21 - Gasket**

- Renew if damaged
- Press lugs of gasket into cylinder head

**3.2 Removing and installing left section of intake manifold**

**Special tools and workshop equipment required**

- ◆ Spring type clip pliers - VAS 5024 A-

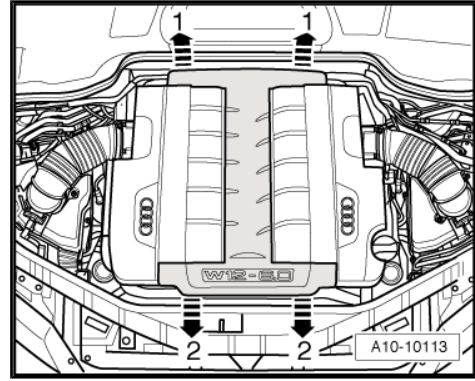


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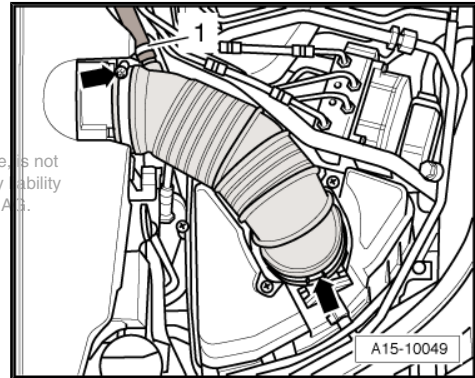


## Removing

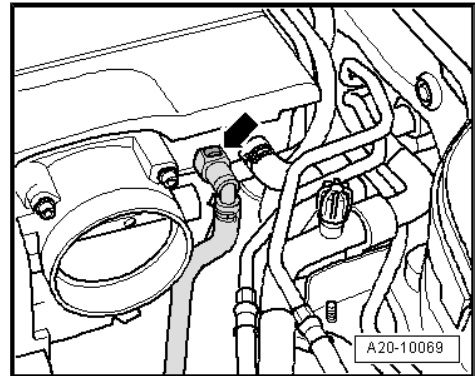
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



- Pull hose -1- off air intake hose.
- Remove air intake hose (left-side) -arrows-.

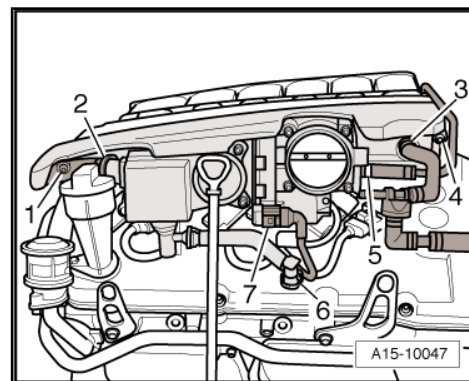


- Detach vacuum hose -arrow- leading to fuel system diagnostic pump - V144- from intake manifold.



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- Detach electrical connector -7- at throttle valve module 2 - J544- .
- Disconnect vacuum hoses -3- and -5-.
- Disconnect hoses for crankcase breather system -2- and -6-.
- Remove bolts -1- and -4-.
- Remove left section of intake manifold.



**i** Note

*A small amount of oil residue in side section of intake manifold is permissible.*

**Installing**

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

**i** Note

- ◆ *Renew O-rings.*
- ◆ *Renew gasket for side section of intake manifold if damaged.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

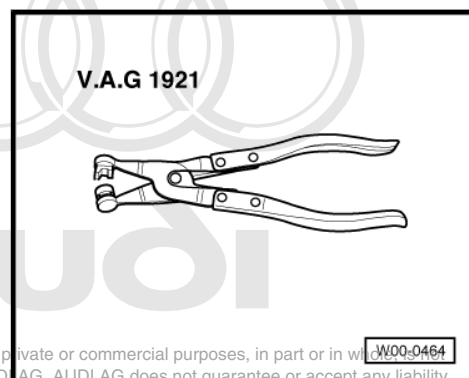
**Tightening torque**

Component	Nm
Side section of intake manifold to top section of intake manifold	22

### 3.3 Removing and installing right section of intake manifold

**Special tools and workshop equipment required**

- ◆ Hose clip pliers - V.A.G 1921-



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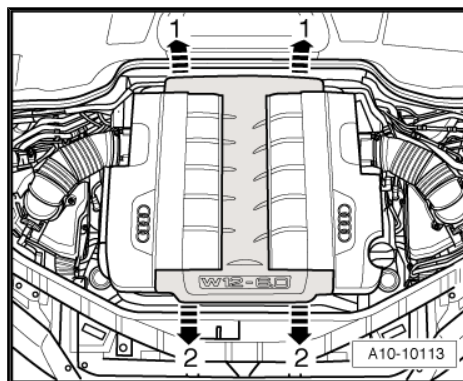
### Removing



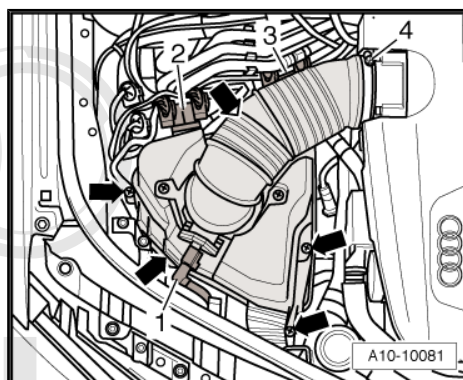
#### Note

Fit all heat insulation sleeves in the original position when installing.

- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



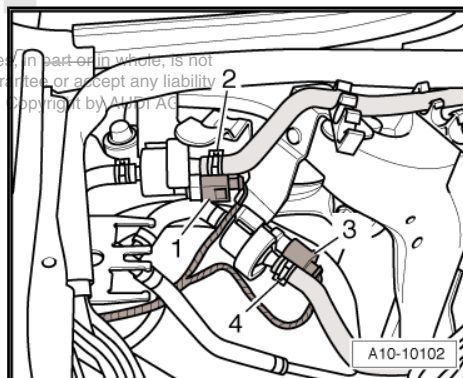
- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system - N80-

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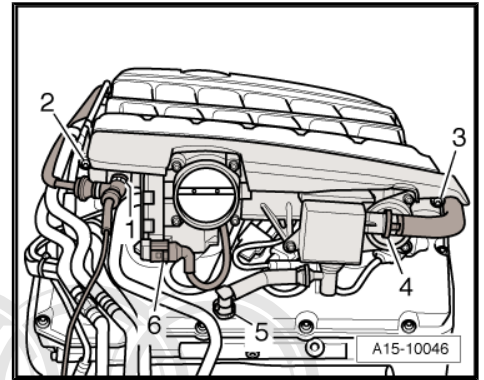
#### Note

Disregard items -1 ... 3-.





- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect hoses for crankcase breather system -4- and -5-.
- Remove bolts -2- and -3-.
- Remove right section of intake manifold.



**i** Note

*A small amount of oil residue in side section of intake manifold is permissible.*

**Installing**

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

**i** Note

- ◆ *Renew O-rings.*
- ◆ *Renew gasket for side section of intake manifold if damaged.*
- ◆ *Reinstall heat insulation sleeves in the same locations when assembling.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

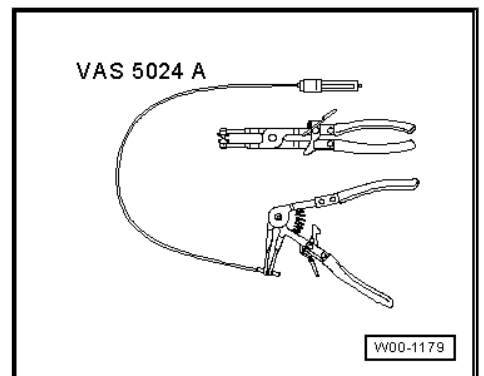
**Tightening torque**

Component	Nm
Side section of intake manifold to top section of intake manifold	22

**3.4 Removing and installing intake manifold (top section)**

**Special tools and workshop equipment required**

- ◆ Spring type clip pliers - VAS 5024 A-





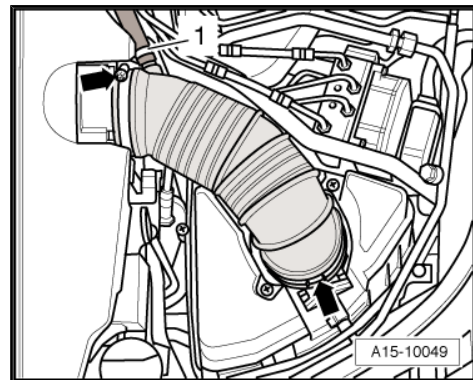
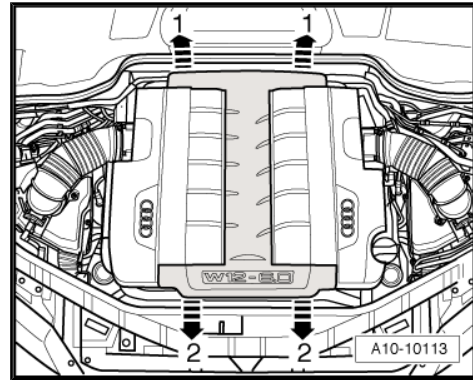
### Removing



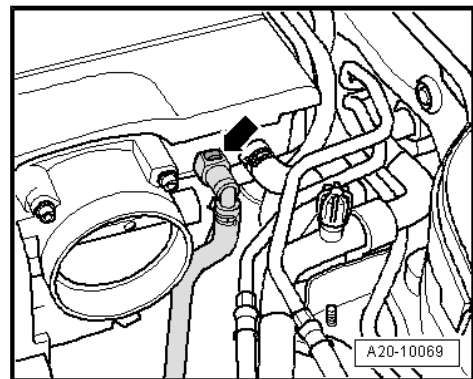
#### Note

- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

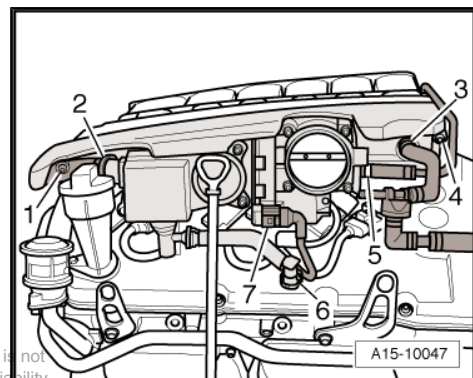
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.
- Pull hose -1- off air intake hose.
- Remove air intake hose (left-side) -arrows-.



- Detach vacuum hose -arrow- leading to fuel system diagnostic pump - V144- from intake manifold.



- Detach electrical connector -7- at throttle valve module 2 - J544- .
- Disconnect vacuum hoses -3- and -5-.
- Disconnect hoses for crankcase breather system -2- and -6-.

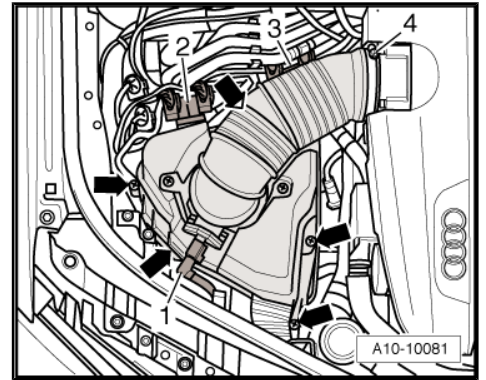


#### Note

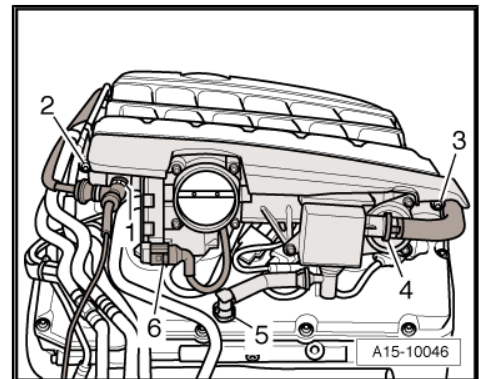
Disregard items -1- and -4-.

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- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect crankcase breather hoses -4- and -5-.



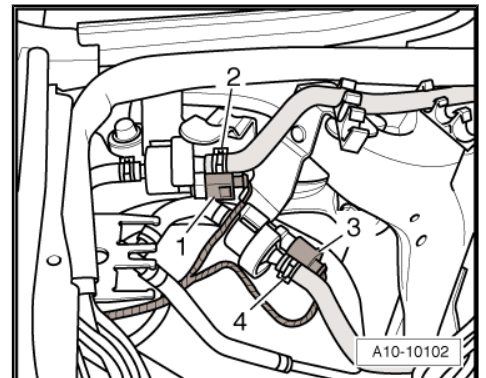
 **Note**

*Disregard items -2- and -3-.*

- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system - N80-

 **Note**

*Disregard items -1 ... 3-.*





- Remove bolts -arrows-.
- Unscrew bolts -1- and -2- and detach top section of intake manifold.

**Note**

Seal intake ports on cylinder heads with clean cloths.

**Installing**

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

**Note**

- ◆ Renew gaskets, seals and O-rings.
- ◆ Reinstall heat insulation sleeves in the same locations when assembling.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .
- ◆ Fit all cable ties in the original positions when installing.

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**Tightening torques**

Component	Nm
Intake manifold (top section) to intake manifold (bottom section)	7 + 180° <sup>19) 20)</sup> <sub>21)</sub>
Pipe to top section of intake manifold	9
Side section of intake manifold to top section of intake manifold	22

19) Note different bolt lengths

20) Renew bolts.

21) 180° = one half turn.

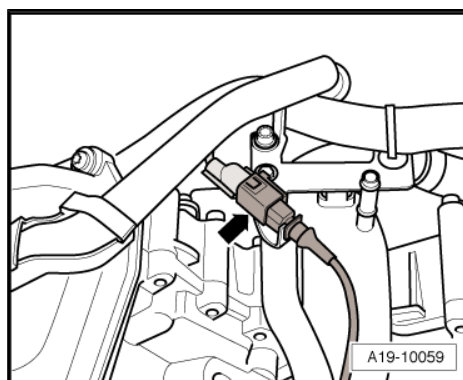
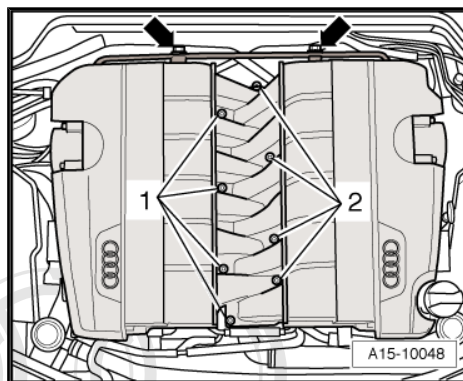
### 3.5 Removing and installing intake manifold (bottom section)

**Removing**

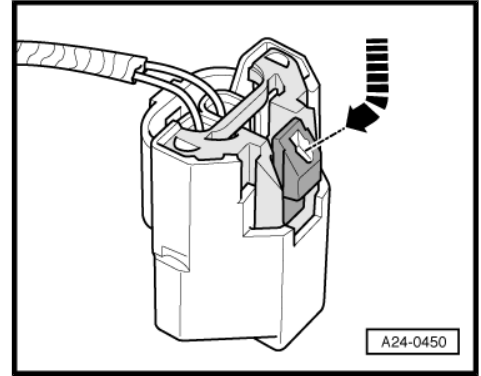
- Remove intake manifold (top section) ⇒ [page 115](#) .
- Unplug electrical connector -arrow-.

**Note**

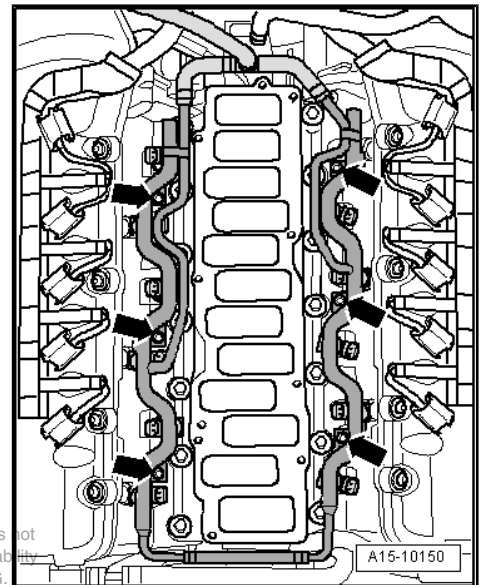
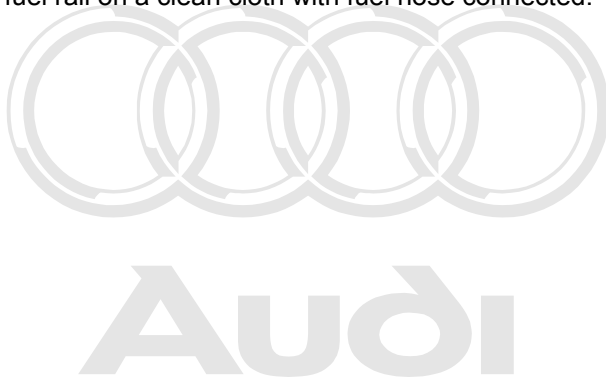
Illustration shows bottom section of intake manifold after removal.



- Unplug electrical connectors on injectors by pressing release tab down and then inwards -arrow-.



- Unscrew bolts for fuel rail -arrows-.
- Detach fuel rail by pulling it off upwards together with injectors.
- Put down fuel rail on a clean cloth with fuel hose connected.



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- Remove bolts -arrows-.
- Detach bottom section of intake manifold.



**Note**

Seal intake ports on cylinder heads with clean cloths.

**Installing**

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



**Note**

- ◆ Renew O-rings.
- ◆ Renew gaskets for bottom section of intake manifold if damaged.

- Press lugs of gaskets for bottom section of intake manifold into holes in cylinder heads.

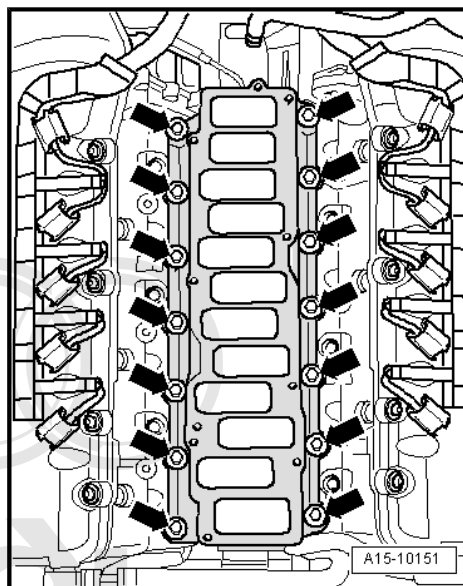
- Install intake manifold (top section) => [page 115](#)

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**Tightening torques**

Component	Nm
Bottom section of intake manifold to cylinder heads	9 <sup>22)</sup>
Fuel rail to cylinder heads	9 <sup>22)</sup>

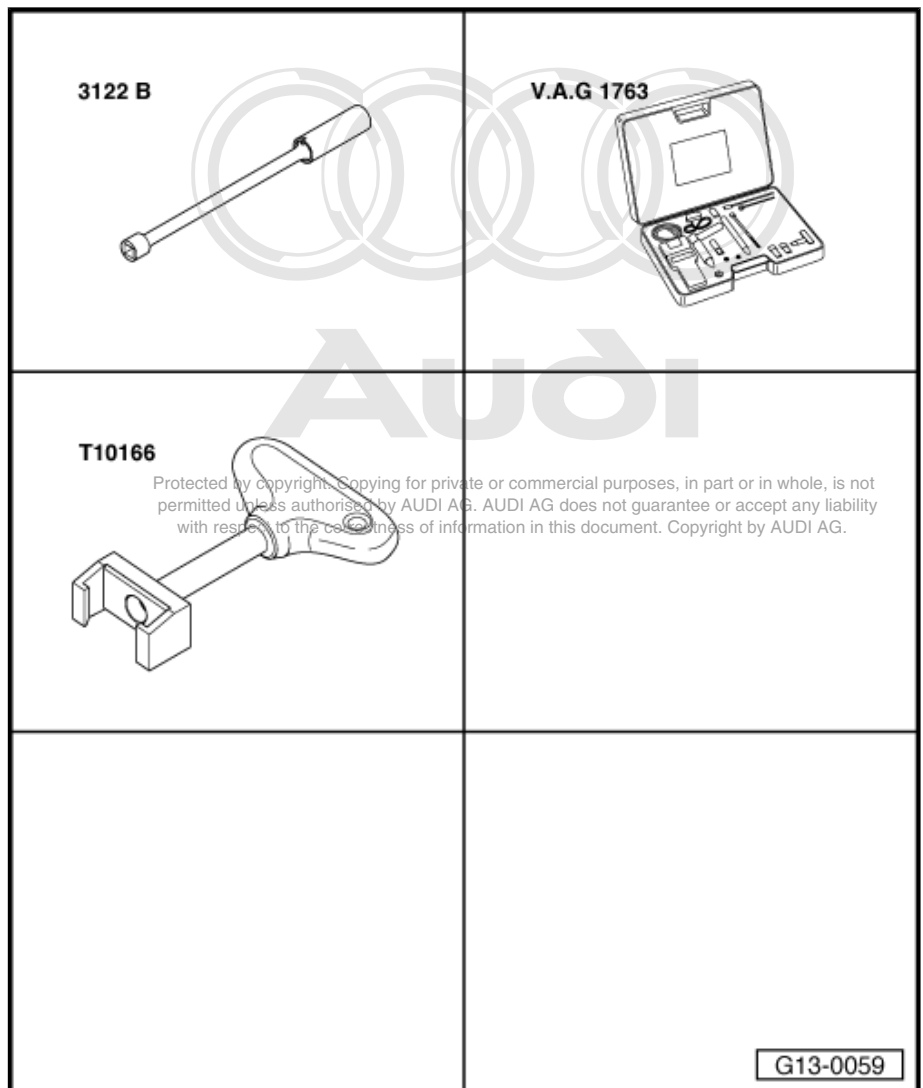
22) Tighten in stages and in diagonal sequence



## 4 Checking compression

### Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-
- ◆ Compression tester - V.A.G 1763-
- ◆ Puller - T10166-

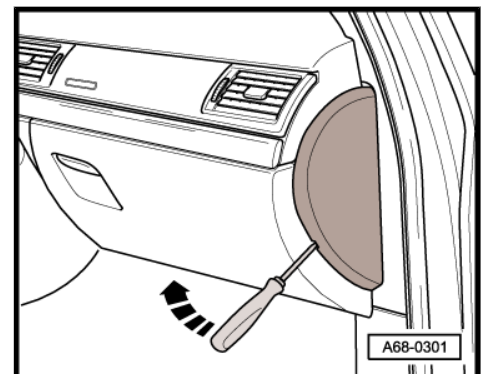


### Test conditions

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

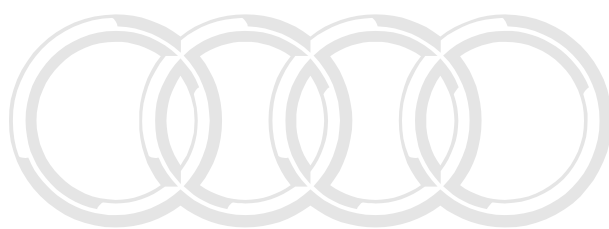
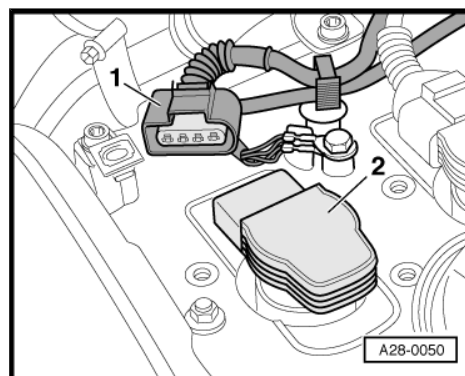
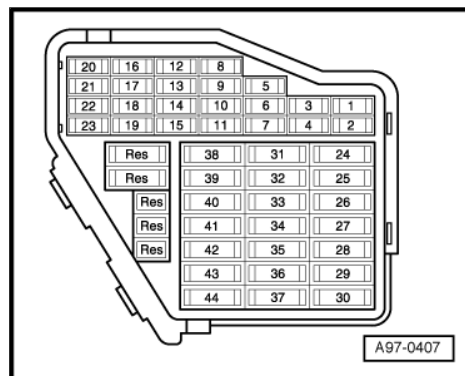
### Test sequence

- Switch off ignition.
- Use screwdriver to pry off cover (right-side) at dash panel -arrow-.





- Remove injector fuse - SC29- at relay and fuse holder (right-side of dash panel, position -29-).
- Remove side sections of intake manifold: vehicles in rest-of-world
  - ⇒ [“2.2 Removing and installing left section of intake manifold”, page 102](#) or
  - ⇒ [“2.3 Removing and installing right section of intake manifold”, page 104](#) ; USA vehicles
  - ⇒ [“3.2 Removing and installing left section of intake manifold”, page 111](#) or
  - ⇒ [“3.3 Removing and installing right section of intake manifold”, page 113](#) .
- Unplug electrical connectors -1- on ignition coils -2-.



**Audi**

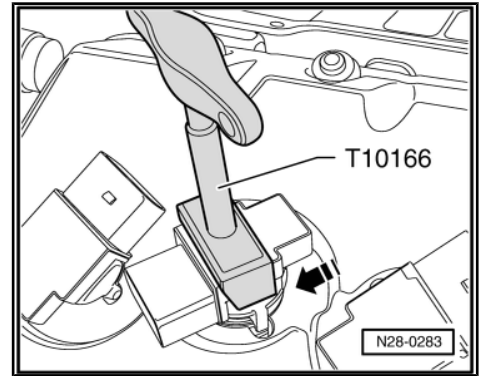
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- Disconnect the ignition coils from the spark plugs using puller - T10166- .
- Remove spark plugs with spark plug socket - 3122 B- .
- Test the compression pressure with the compression tester - V.A.G 1763- .

 **Note**

*Using the compression tester ⇒ Operating instructions .*



- 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	11.0 ... 13.0
Wear limit	10.0
Maximum permissible difference between cylinders	3.0

- Install spark plugs and ignition coils ⇒ Rep. gr. 28 .
- Install side sections of intake manifold: vehicles in rest-of-world  
 ⇒ ["2.2 Removing and installing left section of intake manifold", page 102](#) or  
 ⇒ ["2.3 Removing and installing right section of intake manifold", page 104](#) ; USA vehicles  
 ⇒ ["3.2 Removing and installing left section of intake manifold", page 111](#) or  
 ⇒ ["3.3 Removing and installing right section of intake manifold", page 113](#)
- Finally, interrogate and erase event memory of engine control unit as entries are stored when fuse is removed and connectors are unplugged ⇒ Vehicle diagnostic tester.

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## 5 Servicing valve gear



### Note

- ◆ *The following illustration shows cylinder head, bank 1 (right-side).*
- ◆ *After installing camshafts, wait for approx. 30 minutes before starting engine. The hydraulic compensation elements must settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

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### Caution

*The engine must not be turned when the timing chain cover (right-side) is removed. The installed chain tensioner (right-side) and timing chain cover (right-side) are what prevent the timing chain from slipping.*

- ⇒ [“5.1 Exploded view - camshafts”, page 124](#)
- ⇒ [“5.2 Removing and installing camshaft adjuster”, page 128](#)
- ⇒ [“5.3 Removing and installing housing for variable valve timing”, page 129](#)
- ⇒ [“5.4 Removing and installing camshafts”, page 130](#)
- ⇒ [“5.5 Renewing valve stem oil seals”, page 135](#)
- ⇒ [“5.6 Checking axial clearance of camshafts”, page 139](#)
- ⇒ [“5.7 Checking valve guides”, page 140](#)
- ⇒ [“5.8 Checking valves”, page 141](#)
- ⇒ [“5.9 Valve dimensions”, page 142](#)
- ⇒ [“5.10 Machining valve seats”, page 142](#)

### 5.1 Exploded view - camshafts

**1 - Camshaft adjuster (exhaust)**

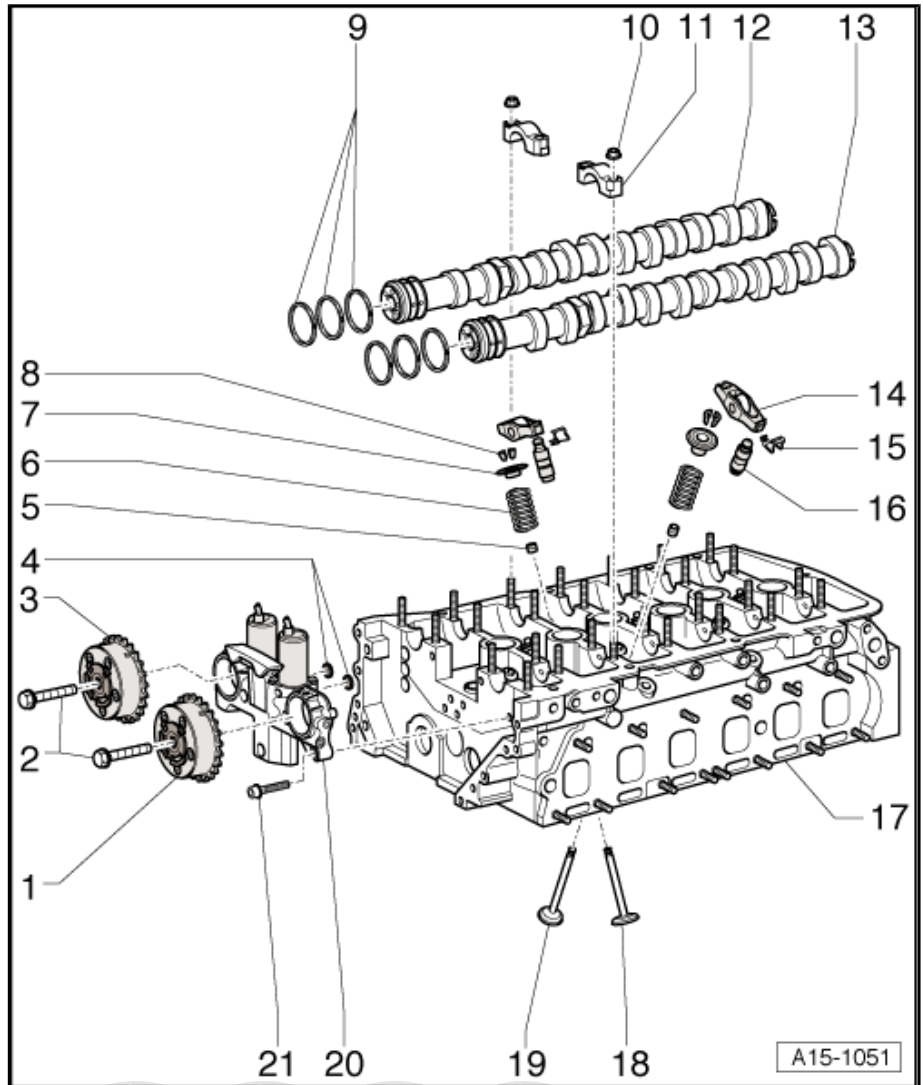
- For cylinder bank 1 (right-side), identification: B1 / plastic end face
- For cylinder bank 2 (left-side), identification: B2 / plastic end face
- Removing and installing ⇒ ["5.2 Removing and installing camshaft adjuster"](#), page 128

**2 - 60 Nm + 90° (1/4 turn) further**

- Renew
- The contact surfaces between camshaft adjuster and camshaft, as well as bolt head and camshaft adjuster must be free of oil.
- To loosen and tighten, counterhold with 32 mm open-end spanner on camshaft

**3 - Camshaft adjuster (inlet)**

- For cylinder bank 1 (right-side), identification: B1 / A1
- For cylinder bank 2 (left-side), identification: B2 / A2
- Removing and installing ⇒ ["5.2 Removing and installing camshaft adjuster"](#), page 128



**4 - Strainer**

- 2x
- Clean

**5 - Valve stem oil seal**

- Renewing ⇒ [page 135](#)

**6 - Valve spring**

- Installation position: larger diameter faces cylinder head

**7 - Valve spring plate**

**8 - Valve cotter**

**9 - Piston rings for camshaft adjuster**

- Offset gaps by 120°
- Lubricate contact surfaces
- When inserting, only open out piston rings slightly

**10 - 5 Nm + 45° (1/8 turn) further**

- Note tightening sequence: cylinder head (right-side) ⇒ [page 131](#) , cylinder head (left-side) ⇒ [page 132](#)

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**11 - Bearing cap**

- Mark bearing caps 6 and 9
- Note installation position and tightening sequence: cylinder head (right-side) ⇒ [page 131](#) , cylinder head (left-side) ⇒ [page 132](#)
- On bearing caps for axial bearings, thinly coat contact surface with lubricating paste ⇒ [page 127](#)

**12 - Inlet camshaft**

- Checking axial clearance ⇒ [page 139](#)
- Check radial clearance with Plastigage (roller rocker fingers removed)
- Radial clearance: wear limit: 0.1 mm
- Runout: max. 0.01 mm
- Removing and installing ⇒ [page 128](#)
- Identification ⇒ [page 127](#) and ⇒ [page 127](#)

**13 - Exhaust camshaft**

- Checking axial clearance ⇒ [page 139](#)
- Check radial clearance with Plastigage (roller rocker fingers removed)
- Radial clearance: wear limit: 0.1 mm
- Runout: max. 0.01 mm
- Removing and installing ⇒ [page 128](#)
- Identification ⇒ [page 127](#) and ⇒ [page 127](#)

**14 - Roller rocker finger**

- Do not interchange
- Check roller bearings for ease of movement
- Lubricate contact surface
- Assembly: attach to supporting element using securing clip ⇒ [Item 15 \(page 126\)](#)

**15 - Securing clip**

- Check for firm attachment

**16 - Supporting element**

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

**17 - Cylinder head**

- Checking valve guides ⇒ [page 140](#)

**18 - Exhaust valve**

- Mark installation position
- Must not be machined; only grinding-in is permissible
- Valve dimensions ⇒ [page 142](#)
- Checking valve guides ⇒ [page 140](#)
- Machining valve seats ⇒ [page 142](#)

**19 - Inlet valve**

- Mark installation position
- Must not be machined; only grinding-in is permissible
- Valve dimensions ⇒ [page 142](#)
- Checking valve guides ⇒ [page 140](#)
- Machining valve seats ⇒ [page 142](#)

**20 - Valve timing housing**

- Removing and installing ⇒ [page 128](#)
- When installing, lightly oil contact surfaces of piston rings



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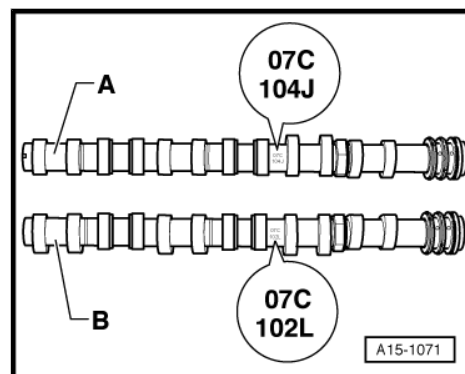
**21 - 9 Nm**

- Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

**Camshaft identification, cylinder bank 1 (right-side)**

A - Exhaust camshaft; identification 07C - index 104 J

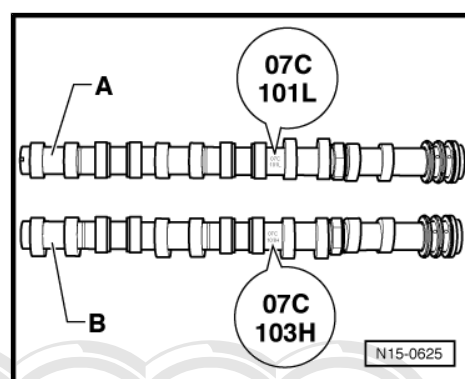
B - Inlet camshaft; identification 07C - index 102 L



**Camshaft identification, cylinder bank 2 (left-side)**

A - Inlet camshaft; identification 07C - index 101 L

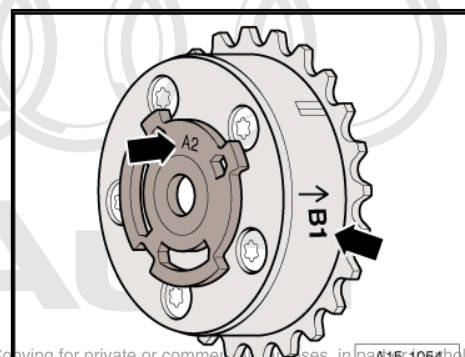
B - Exhaust camshaft; identification 07C - index 103 H



**Identification for camshaft adjusters**

The camshaft adjusters -arrows- are marked as follows:

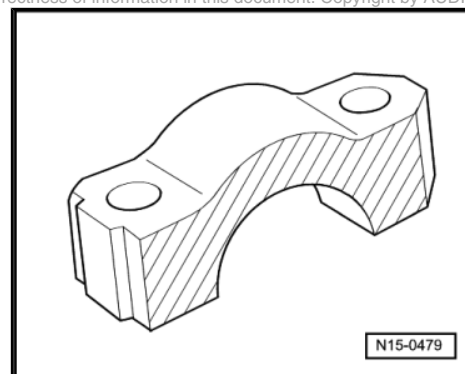
- ◆ Inlet camshaft adjuster, cylinder bank 1 (right-side): B1 / A2
- ◆ Exhaust camshaft adjuster, cylinder bank 1 (right-side): B1 / plastic end face
- ◆ Inlet camshaft adjuster, cylinder bank 2 (left-side): B2 / A2
- ◆ Exhaust camshaft adjuster, cylinder bank 2 (left-side): B2 / plastic end face



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**Coating contact surfaces of bearing caps for axial bearings with lubricating paste**

- Thinly coat contact surfaces -hatched surface in illustration- of bearing caps 7, 8, 27 and 28 for axial bearings using lubricating paste - G 052 723 A2- ⇒ Parts catalogue .



## 5.2 Removing and installing camshaft adjuster

### Removing



#### Note

- ◆ *The camshafts and crankshaft must not be turned when the timing drive is disassembled.*
- ◆ *The camshaft bar - T10068- is only used for locking the camshafts at TDC. Use a 32 mm open-end spanner to counterhold at hexagon flats of camshaft.*
- Engine removed
- Engine separated from gearbox.
- Remove camshaft timing chains => [page 77](#) .
- To loosen securing bolt for camshaft adjuster, counterhold on hexagon flats -arrow- of camshaft using a 32 mm open-end spanner.
- Remove camshaft adjuster.

### Installing



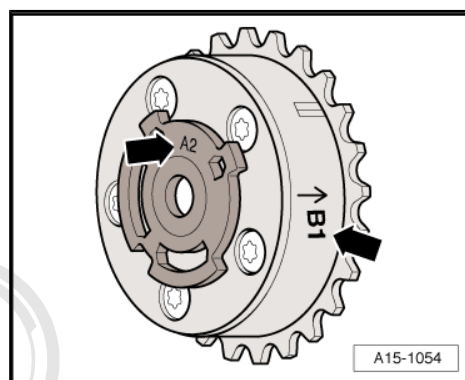
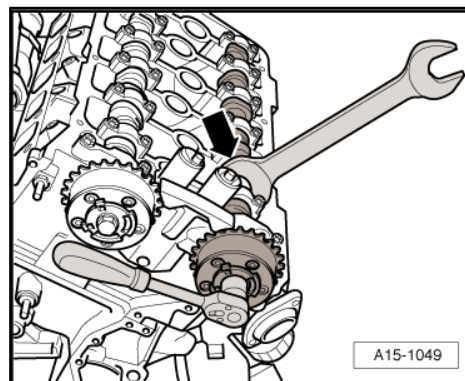
#### Note

- ◆ *The contact surfaces between camshaft adjuster and camshaft, as well as bolt head and camshaft adjusters must be free of oil.*
- ◆ *Note the dowel pin in camshaft adjuster.*
- ◆ *Use new bolts for securing camshaft adjuster.*
- Note identification of camshaft adjusters -arrows- when installing.
- ◆ Inlet camshaft adjuster, cylinder bank 1 (right-side): B1 / A2
- ◆ Exhaust camshaft adjuster, cylinder bank 1 (right-side): B1 / plastic end face
- ◆ Inlet camshaft adjuster, cylinder bank 2 (left-side): B2 / A2
- ◆ Exhaust camshaft adjuster, cylinder bank 2 (left-side): B2 / plastic end face



#### Note

- ◆ *The camshaft bar - T10068- is only used for locking the camshafts at TDC. Use a 32 mm open-end spanner to counterhold at hexagon flats of camshaft.*
- ◆ *Contact surfaces between camshaft adjuster/camshaft and between bolt head/camshaft adjusters must be free of oil.*



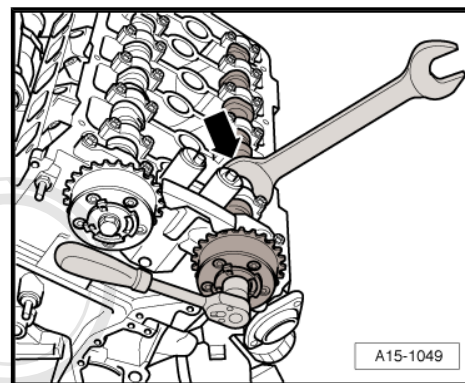
- To tighten securing bolt for camshaft adjuster, counterhold on hexagon flats -arrow- of camshaft using an open-end spanner.
- Install the camshaft timing chains => [page 77](#) .

**Tightening torque**

Component	Nm
Camshaft adjuster to camshaft	60 + 90° <sup>23)</sup> <sup>24)</sup>

23) 90° equals a 1/4 turn.

24) Renew bolts.



### 5.3 Removing and installing housing for variable valve timing

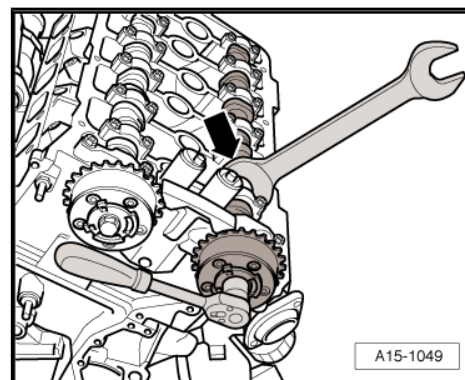
**Removing**



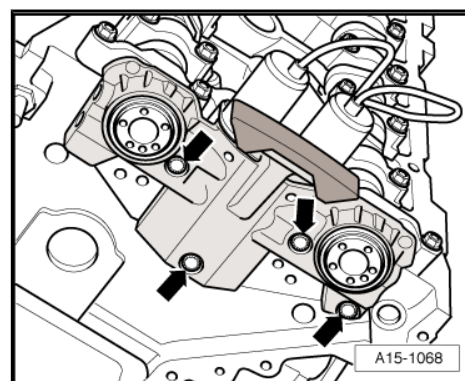
**Note**

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- ◆ *The camshafts and crankshaft must not be turned when the timing drive is disassembled.*
- ◆ *The camshaft bar - T10068- is only used for locking the camshafts at TDC. Use a 32 mm open-end spanner to counterhold at hexagon flats of camshaft.*
- Engine removed
- Engine separated from gearbox.
- Remove camshaft timing chains => [page 77](#) .
- To loosen securing bolt for camshaft adjuster, counterhold on hexagon flats -arrow- of camshaft using a 32 mm open-end spanner.
- Remove camshaft adjuster.



- Unscrew bolts -arrows- and remove housing for variable valve timing.





## Installing

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

- Clean the strainers -arrows- on reverse side of housing for variable valve timing.
- Thinly coat contact surfaces for piston rings in housing for variable valve timing.



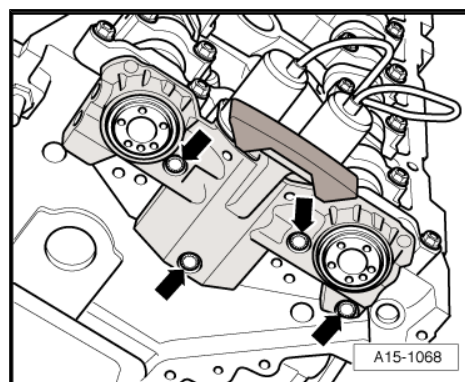
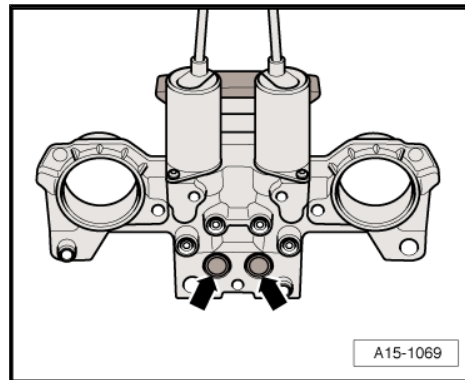
### Note

- ◆ *Make sure that the piston rings on camshafts do not become damaged when installing housing for variable valve timing.*
- ◆ *The ends of the piston rings must be offset by 120°.*
- Attach housing for variable valve timing onto camshafts.
- Tighten bolts -arrows- in diagonal sequence.
- Install camshaft adjusters ⇒ [page 128](#).
- Install the camshaft timing chains ⇒ [page 77](#).

### Tightening torque

Component	Nm
Housing for variable valve timing to cylinder head	9 <sup>25)</sup>

25) Install using locking fluid; locking fluid ⇒ Parts catalogue .



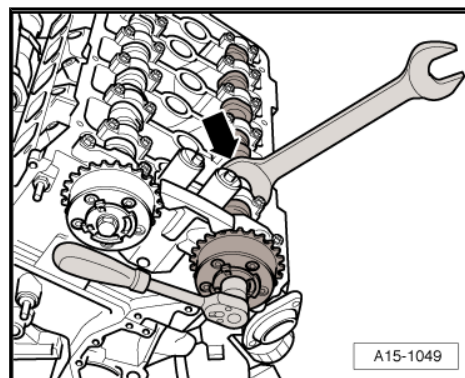
## 5.4 Removing and installing camshafts

### Removing



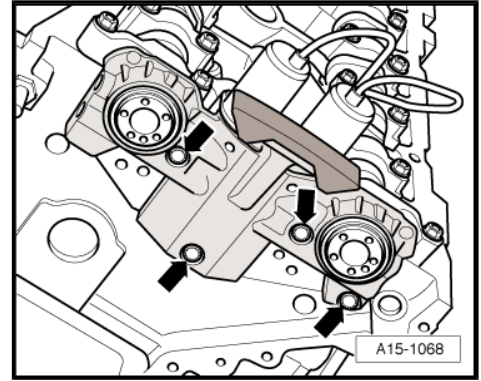
### Note

- ◆ *The camshafts and crankshaft must not be turned when the timing drive is disassembled.*
- ◆ *The camshaft bar - T10068- is only used for locking the camshafts at TDC. Use a 32 mm open-end spanner to counterhold at hexagon flats of camshaft.*
- Engine removed
- Engine separated from gearbox.
- Remove camshaft timing chains ⇒ [page 77](#).
- To loosen securing bolts for camshaft adjusters, counterhold on hexagon flats -arrow- of camshaft using a 32 mm open-end spanner.
- Remove camshaft adjuster.





- Unscrew bolts -arrows- and remove housing for variable valve timing.



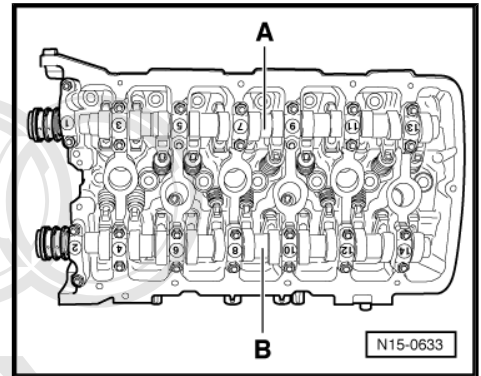
**Cylinder bank 1 (right-side)**

- Remove the inlet camshaft -A- as follows:

- 1 - Unbolt bearing caps 1 and 13.
- 2 - Unbolt bearing caps 5 and 9.
- 3 - Unbolt bearing cap 7.
- 4 - Loosen bearing caps 3 and 11 alternately in a diagonal sequence and remove.

- Remove the exhaust camshaft -B- as follows:

- 1 - Unbolt bearing caps 2 and 14.
- 2 - Unbolt bearing caps 6 and 10.
- 3 - Unbolt bearing cap 8.
- 4 - Loosen bearing caps 4 and 12 alternately in a diagonal sequence and remove.

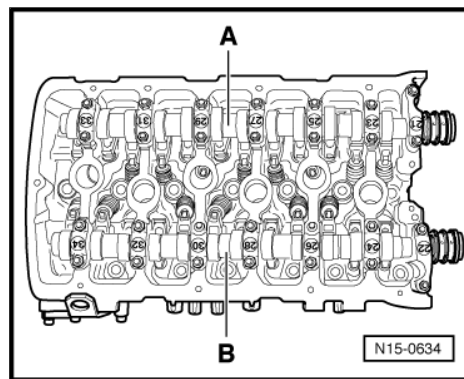


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### Cylinder bank 2 (left-side)

- Remove the inlet camshaft -A- as follows:
  - 1 - Unbolt bearing caps 21 and 33.
  - 2 - Unbolt bearing caps 25 and 29.
  - 3 - Unbolt bearing cap 27.
  - 4 - Loosen bearing caps 23 and 31 alternately in a diagonal sequence and remove.
- Remove the exhaust camshaft -B- as follows:
  - 1 - Unbolt bearing caps 22 and 34.
  - 2 - Unbolt bearing caps 26 and 30.
  - 3 - Unbolt bearing cap 28.
  - 4 - Loosen bearing caps 24 and 32 alternately in a diagonal sequence and remove.



### Continued for both cylinder banks

- Carefully remove the camshafts and place them down on a clean surface.



### Note

*Ensure that the rocker fingers and the supporting elements are not interchanged.*

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- If necessary, remove roller rocker fingers together with supporting elements and place down on a clean surface.

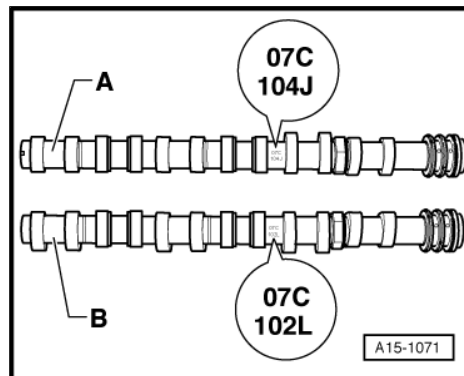
### Installing

- Crankshaft locked in TDC position with locking pin - 3242- or -T40237- .
- Insert supporting elements together with roller rocker fingers into cylinder head.
- When installing roller rocker fingers, make sure that they make contact with valve stems.
- Lubricate running surfaces of camshafts.
- Insert the respective camshaft in the camshaft bearings of cylinder head.

### Camshaft identification, cylinder bank 1 (right-side)

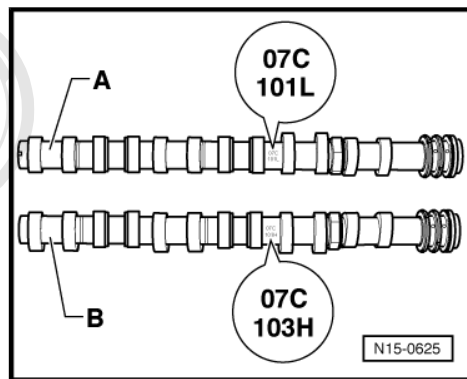
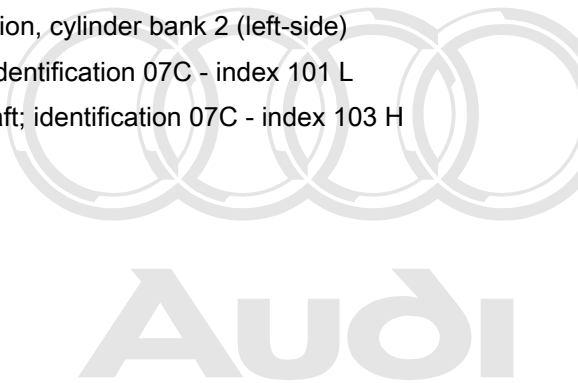
A - Exhaust camshaft; identification 07C - index 104 J

B - Inlet camshaft; identification 07C - index 102 L

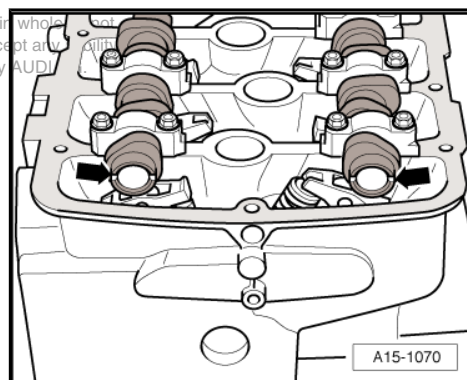


Camshaft identification, cylinder bank 2 (left-side)

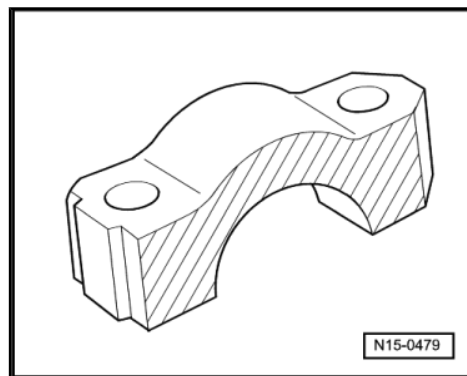
- A - Inlet camshaft; identification 07C - index 101 L
- B - Exhaust camshaft; identification 07C - index 103 H



- Insert the camshafts into the cylinder head so that they are located at TDC.
- The slits -arrows- at front of the camshafts must be parallel to and at the same height as the top edge of cylinder head.

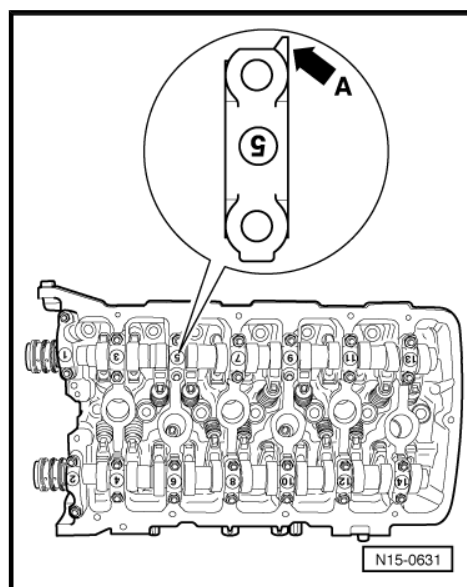


- Thinly coat contact surfaces -hatched surface in illustration- of bearing caps 7, 8, 27 and 28 for axial bearings using lubricating paste - G 052 723 A2- .



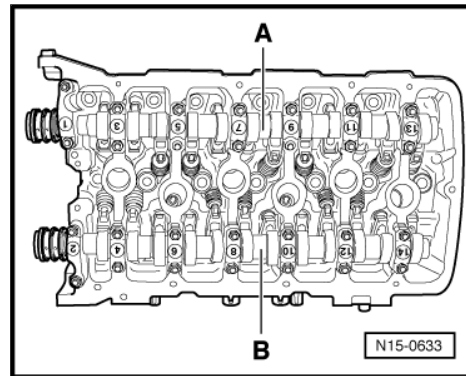
Cylinder bank 1 (right-side)

- Insert camshaft bearing caps according to their identification numbers:
- The pointed section -arrow A- of the bearing caps for inlet and exhaust camshafts faces outwards.
- The identification markings for the bearing caps are legible from the inlet side.



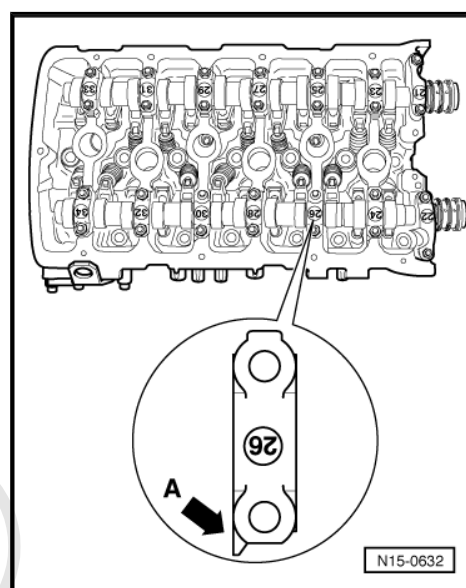


- Install the inlet camshaft -A- as follows:
  - 1- Tighten bearing caps 3 and 11 alternately in diagonal sequence and then tighten to final torque.
  - 2- Tighten bearing cap 7.
  - 3- Tighten bearing caps 5 and 9.
  - 4- Tighten bearing caps 1 and 13.
- Install the exhaust camshaft -B- as follows:
  - 1- Tighten bearing caps 4 and 12 alternately in diagonal sequence and then tighten to final torque.
  - 2- Tighten bearing cap 8.
  - 3- Tighten bearing caps 6 and 10.
  - 4- Tighten bearing caps 2 and 14.



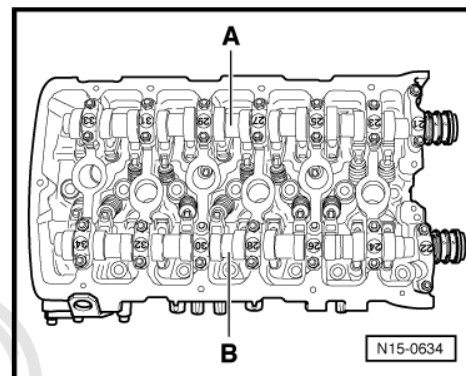
### Cylinder bank 2 (left-side)

- Insert camshaft bearing caps according to their identification numbers:
  - The pointed section -arrow A- of the bearing caps for inlet and exhaust camshafts faces outwards.
  - The identification markings for the bearing caps are legible from the inlet side.



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- Install the inlet camshaft -A- as follows:
  - 1- Tighten bearing caps 23 and 31 alternately in diagonal sequence and then tighten to final torque.
  - 2- Tighten bearing cap 27.
  - 3- Tighten bearing caps 25 and 29.
  - 4- Tighten bearing caps 21 and 33.
- Install the exhaust camshaft -B- as follows:
  - 1- Tighten bearing caps 24 and 32 alternately in diagonal sequence and then tighten to final torque.
  - 2- Tighten bearing cap 28.
  - 3- Tighten bearing caps 26 and 30.
  - 4- Tighten bearing caps 22 and 34.
- Install the housing for variable valve timing ⇒ [page 129](#) .
- Install camshaft adjusters ⇒ [page 128](#) .





**Caution**

**The camshafts and crankshaft must not be turned when the timing drive is disassembled.**

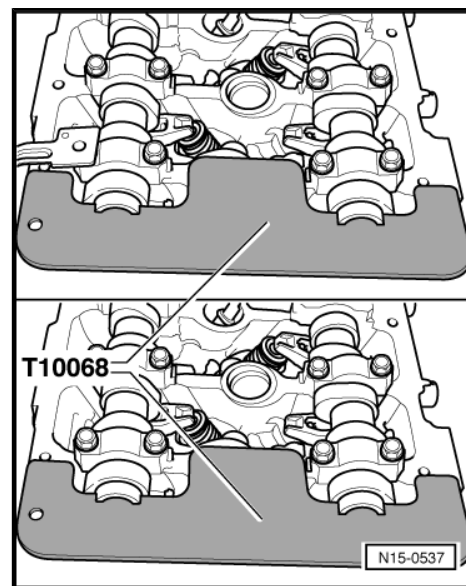
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- Before continuing assembly, check that the camshafts are in TDC position.
- You should be able to insert the camshaft bar - T10068- in the slots in both camshafts.
- Install the camshaft timing chains ⇒ [page 77](#) .

**Tightening torque**

Component	Nm
Bearing cap to cylinder head	5 + 45° <sup>26)</sup>

26) 45° equals 1/8 turn.

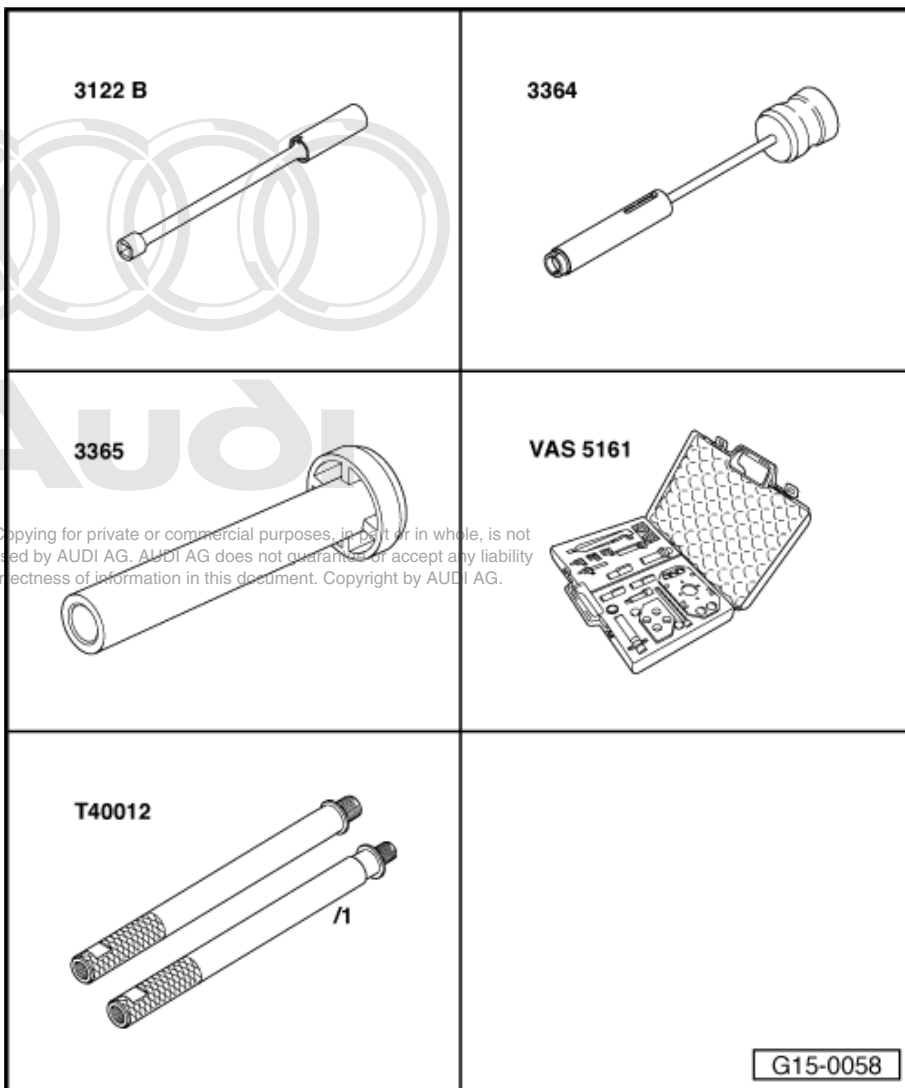


## 5.5 Renewing valve stem oil seals



**Special tools and workshop equipment required**

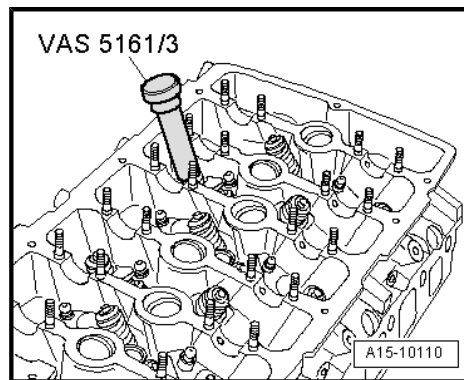
- ◆ Spark plug socket and extension - 3122 B-
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal / installing device for valve cotters - VAS 5161- with guide plate - VAS 5161/25-
- ◆ Adapters - T40012-



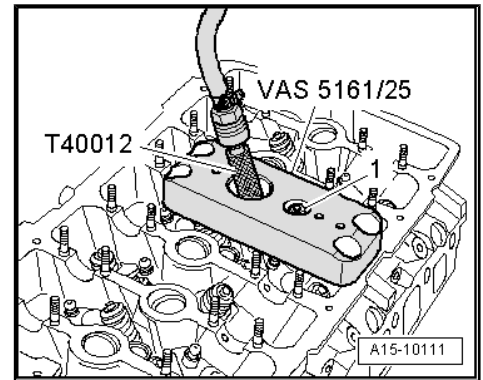
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**Procedure**

- Engine removed
- Remove camshafts ⇒ [page 130](#) .
- Remove spark plugs with spark plug socket - 3122 B- .
- Apply drift - VAS 5161/3- to valve spring plate and knock valve cotters loose using a plastic hammer.

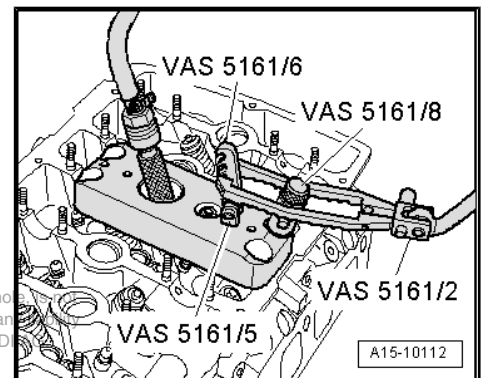


- Fit guide plate - VAS 5161/25- from removal and installation device for valve cotters - VAS 5161- on cylinder head.
- Secure guide plate with one nut.
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread and apply a steady pressure.
- Minimum pressure: 6 bar



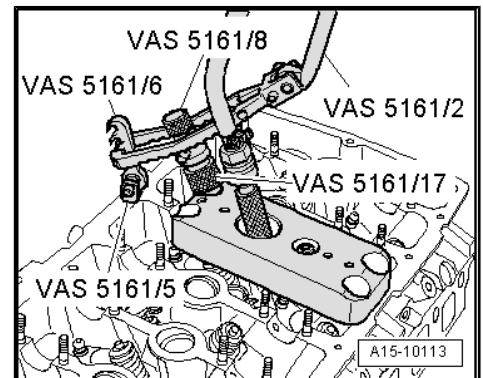
**Procedure for outer rows of valves:**

- Screw snap-in device - VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge - VAS 5161/8- into guide plate.
- Attach pressure fork - VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Remove assembly cartridge.
- Detach guide plate and turn to one side.
- The compressed air hose remains connected.
- Remove valve spring with valve spring plate.



**Procedure for inner rows of valves:**

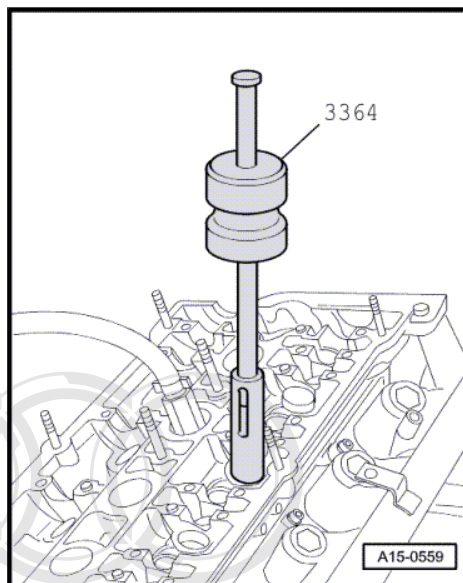
- Screw snap-in device - VAS 5161/6- with engaging fork - VAS 5161/5- onto cylinder head.
- Slide knurled spacer ring - VAS 5161/17- onto assembly cartridge - VAS 5161/8- .
- Insert assembly cartridge into guide plate.
- Attach pressure fork - VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Remove assembly cartridge.
- Detach guide plate and turn to one side.
- The compressed air hose remains connected.
- Remove valve spring with valve spring plate.





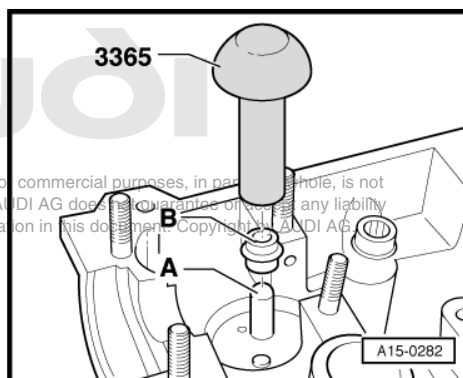
All valves (continued):

- Remove valve stem oil seals using the valve stem seal puller - 3364- .



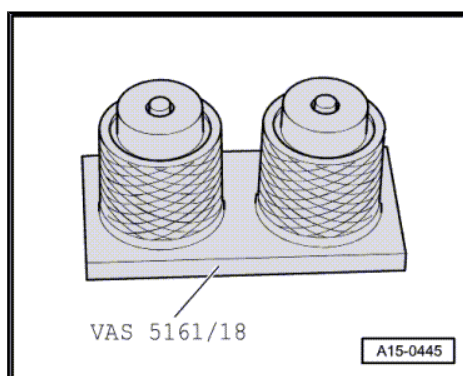
Note

- ◆ To press on the green-coloured valve stem seals (as currently supplied), the valve stem oil seal fitting tool - 3365- must be drilled out to  $\varnothing 10.5$  mm.
  - ◆ Mark the drilled-out fitting tool so it can be used again later.
  - ◆ A plastic sleeve -A- is included with the new valve stem oil seals.
- Fit 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 the valve stem oil seal onto valve guide using fitting tool -3365- .
  - Remove plastic sleeve.



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

- Larger diameter of valve cotters faces upwards.

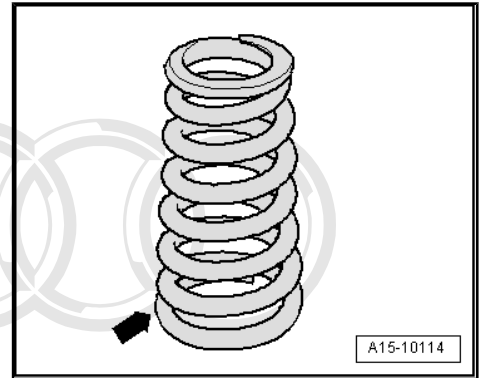




- Install valve spring and valve spring plate.

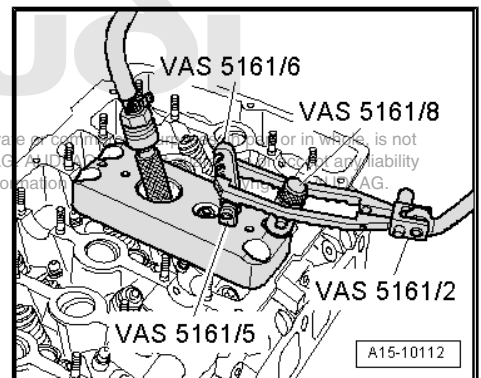
Position of valve spring:

- The larger diameter -arrow- faces the cylinder head.



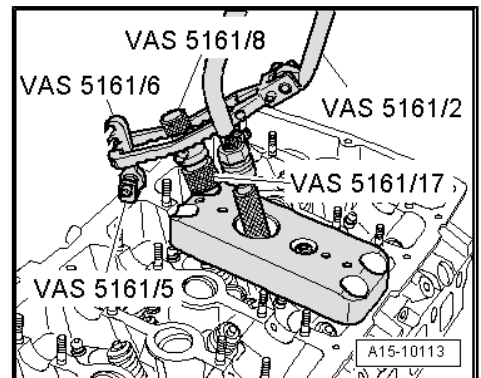
**Procedure for outer rows of valves:**

- Bolt guide plate onto cylinder head again, as shown in the illustration.
- Insert assembly cartridge into guide plate.
- Push pressure fork down and pull knurled screw upwards while turning to left and right – this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.



**Procedure for inner rows of valves:**

- Insert assembly cartridge with knurled spacer ring into guide plate.
- Push pressure fork down and pull knurled screw upwards while turning to left and right – this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Install camshafts => [page 132](#) .



**Note**

- ◆ After installing camshafts, wait for approx. 30 minutes before starting engine. The hydraulic compensation elements must settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

**Tightening torque**

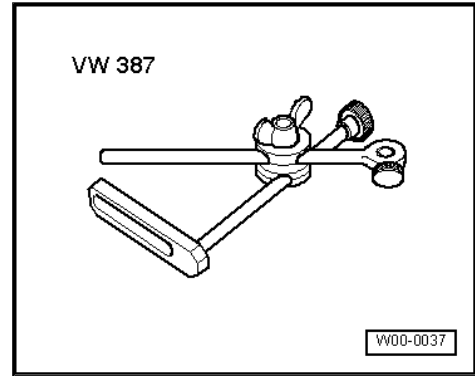
Component	Nm
Spark plugs in cylinder head	30

**5.6 Checking axial clearance of camshafts**

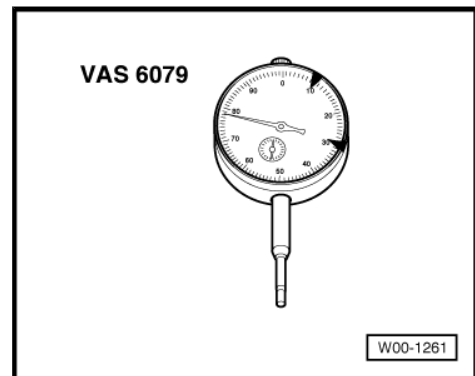
Special tools and workshop equipment required



- ◆ Universal dial gauge bracket - VW 387-

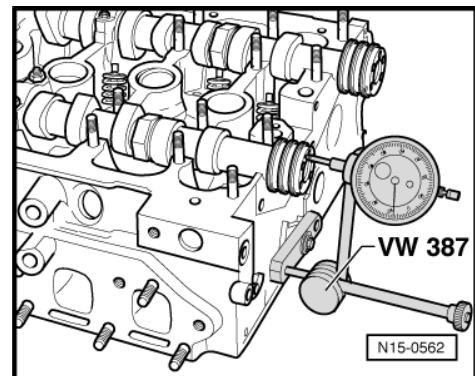


- ◆ Dial gauge - VAS 6079-



#### Test sequence

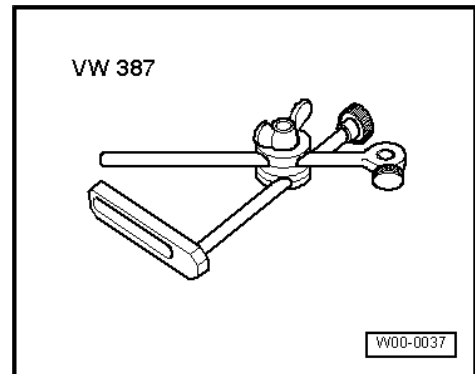
- Perform measurement with roller rocker fingers and supporting elements removed. Axial bearing cap for appropriate camshaft remains attached.
- Secure universal dial gauge bracket - VW 387- with dial gauge - VAS 6079- to cylinder head.
- Determine axial clearance.
- Axial clearance: wear limit: 0.10 mm



## 5.7 Checking valve guides

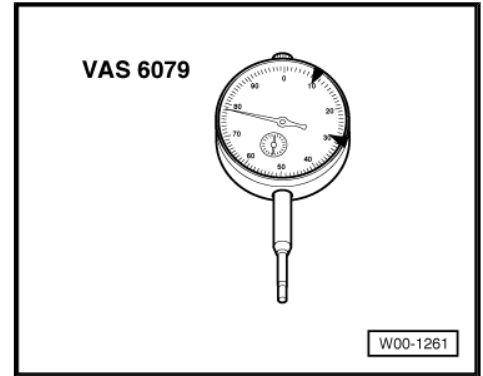
### Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



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◆ Dial gauge - VAS 6079-



**Test sequence**

- Insert valve into valve guide.
- End of valve stem must be flush with valve guide.

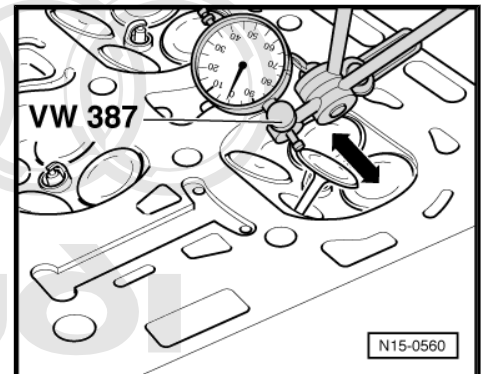
**i Note**

*Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.*

- Determine amount of sideways play.
- Wear limit (sideways play): 0.8 mm

**i Note**

- ◆ *If the wear limit is exceeded, repeat the measurement with new valves.*
- ◆ *Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.*
- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*



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## 5.8 Checking valves

- Visually inspect for scoring on valve stem and on seating surface.
- Renew valves with significant score marks.



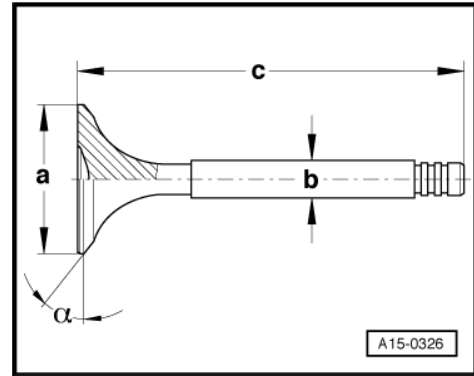
## 5.9 Valve dimensions



### Note

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

Dimension	Short inlet valve	Long inlet valve	Short exhaust valve	Long exhaust valve
$\varnothing$ a mm	31.00	31.00	27.00	27.00
$\varnothing$ b mm	5.96	5.96	5.94	5.94
c mm	102.20	136.10	102.50	136.40
$\alpha$ °	45	45	45	45



## 5.10 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



### 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 140.
- ◆ Valve seats should only be machined to the extent required to give a proper seating pattern.
- ◆ The maximum permissible machining dimension must be calculated before starting work.
- ◆ 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.

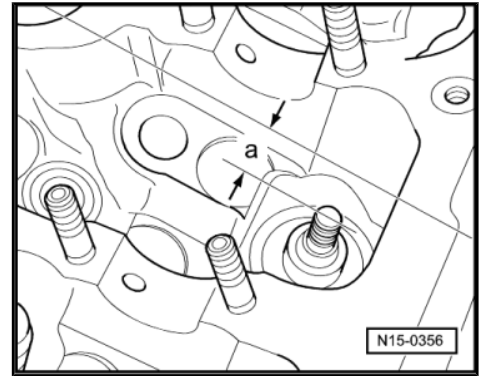
- Measure distance -a- between end of valve stem and upper cylinder head surface with a depth gauge.
- Calculate the maximum permissible machining dimension using the measured distance and the minimum dimension.

Minimum dimensions			
Short inlet valve	Long inlet valve	Short exhaust valve	Long exhaust valve
32.2 mm	10.6 mm	32.2 mm	10.6 mm

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

**Example for long inlet valve:**

Measured distance	10.8 mm
- Minimum dimension	- 10.4 mm
= Maximum permissible machining dimension	= 0.4 mm

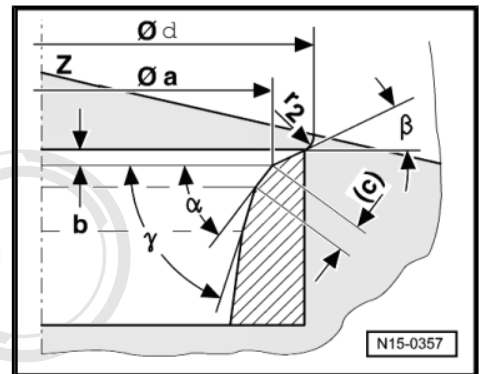


 **Note**

*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 inlet valve seat**

- a -  $\varnothing$  30.3 mm
- b - Maximum permissible machining dimension
- c - 0.9 ... 1.5 mm
- d - Max.  $\varnothing$  35.0 mm
- r2 - Radius 2.0 mm
- Z - Bottom surface of cylinder head
- $\alpha$  - 45° valve seat angle
- $\beta$  - 30° upper correction angle
- $\gamma$  - 60° lower correction angle



 **Note**

*Calculating maximum permissible machining dimension*  
 ⇒ [page 142](#).

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### Machining exhaust valve seat

a -  $\varnothing$  26.7 mm

b - Maximum permissible machining dimension

c - 1.2 ... 1.7 mm

d - Max.  $\varnothing$  29.0 mm

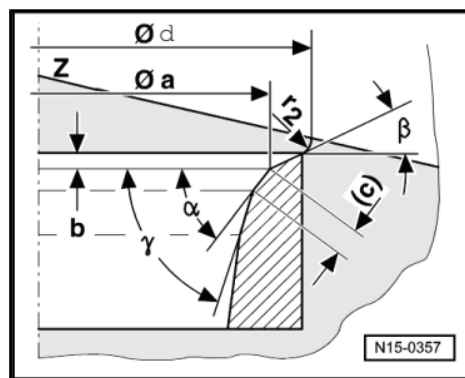
r2 - Radius 2.0 mm

Z - Bottom surface of cylinder head

$\alpha$  - 45° valve seat angle

$\beta$  - 30° upper correction angle

$\gamma$  - 60° lower correction angle



### Note

*Calculating maximum permissible machining dimension*  
*⇒ [page 142](#).*

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## 17 – Lubrication

### 1 Removing and installing parts of lubrication system

 Note

- ◆ *If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the engine oil cooler must be renewed in order to prevent further damage occurring later.*
- ◆ *The oil level must not be above the max. mark – otherwise the catalytic converter can be damaged.*

Viscosity grades and oil specifications ⇒ Maintenance ; Booklet 404 .

Oil capacities ⇒ Maintenance tables .

⇒ [“1.1 Exploded view - sump, sump \(bottom section\)”, page 145](#)

⇒ [“1.2 Removing and installing sump \(bottom section\)”, page 147](#)

⇒ [“1.3 Removing and installing oil pump”, page 149](#)

⇒ [“1.4 Removing and installing sump \(top section\)”, page 150](#)

⇒ [“1.5 Exploded view - oil filter bracket”, page 157](#)

⇒ [“1.6 Removing and installing oil filter housing”, page 158](#)

⇒ [“1.7 Removing and installing engine oil cooler”, page 164](#)

⇒ [“1.8 Removing and installing oil pipe \(front\)”, page 165](#)

⇒ [“1.9 Checking oil pressure and oil pressure switch”, page 166](#)

⇒ [“1.10 Engine oil”, page 169](#)

⇒ [“1.11 Checking oil level”, page 170](#)

#### 1.1 Exploded view - sump, sump (bottom section)

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**1 - 9 Nm**

- Tighten in stages and in diagonal sequence

**2 - Sump (bottom section)**

- With oil level and oil temperature sender - G266- => [page 147](#)

**3 - 20 Nm****4 - Seal**

- Renew

**5 - Oil line****6 - 20 Nm****7 - Oil pump**

- Do not dismantle
- With pressure control valve
- Removing and installing => [page 149](#)

**8 - Chain tensioner**

- Before removing, lock in place using locking pin - T40011-
- Do not dismantle
- Removing and installing => "1.3 Removing and installing oil pump", [page 149](#)

**9 - Sump (top section)**

- Removing and installing => [page 150](#)

**10 - Drive chain for oil pump****11 - Chain sprocket for oil pump**

- Integral part of crankshaft

**12 - Bolt**

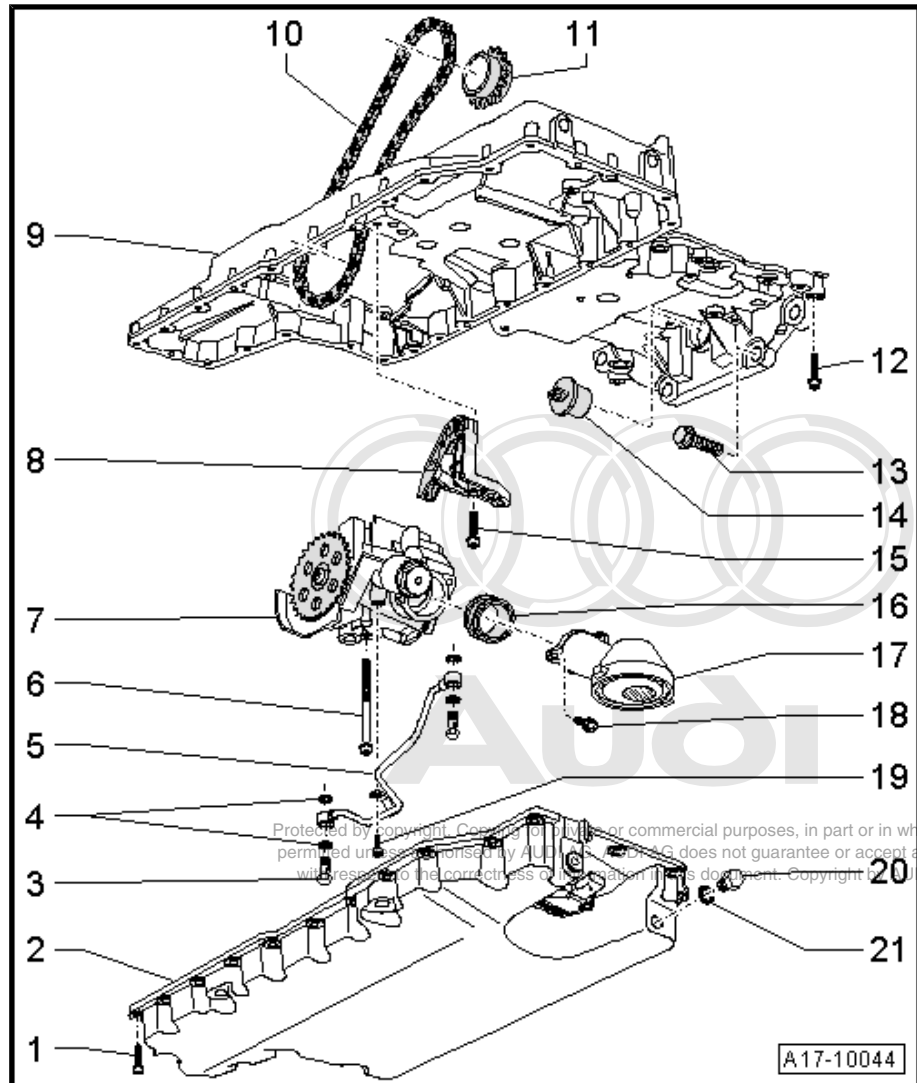
- Note different lengths
- Tightening sequence and tightening torque => [page 156](#)

**13 - 45 Nm****14 - Sealing plug****15 - M6 = 9 Nm; M8 = 20 Nm****16 - Pulsation damper****17 - Suction pipe**

- Clean strainer if dirty

**18 - 9 Nm****19 - 9 Nm****20 - Oil drain plug, 30 Nm****21 - Seal**

- Renew

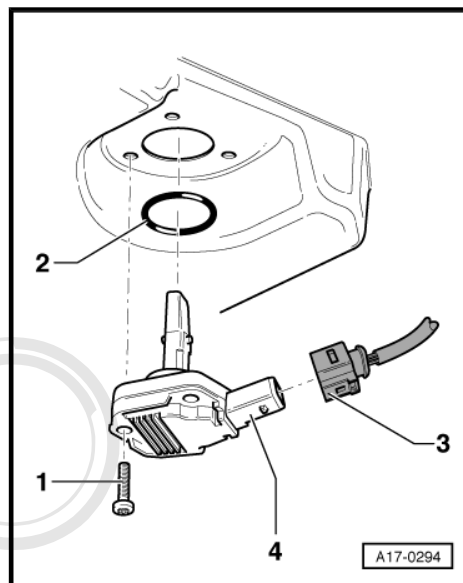


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**Oil level and oil temperature sender - G266-**

- 1 - Install bolt (10 Nm) using locking fluid; for locking fluid refer to ⇒ Parts catalogue .
- 2 - Seal; renew
- 3 - Electrical connector
- 4 - Oil level and oil temperature sender - G266-

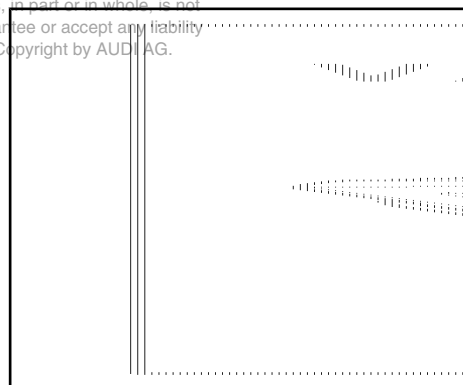


**1.2 Removing and installing sump (bottom section)**

**Special tools and workshop equipment required**

- ◆ Drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306-

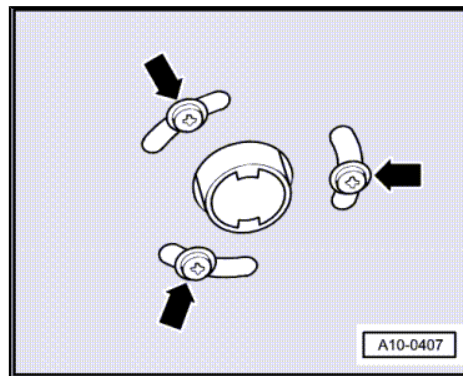
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- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Parts catalogue

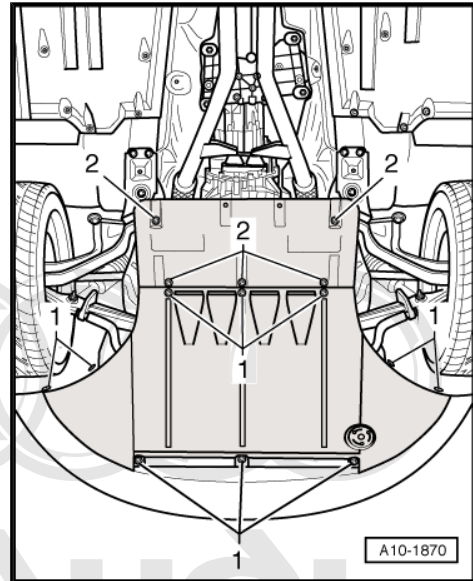
**Removing**

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



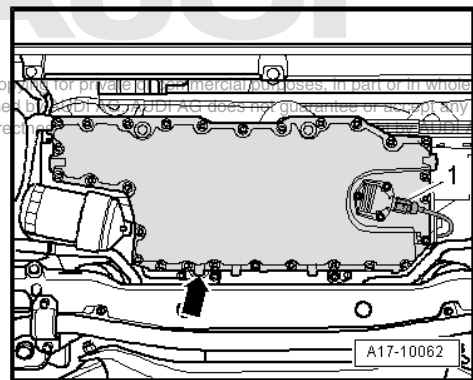


- Open quick-release fasteners -1- and remove noise insulation (front).



- Place drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306- under engine.
- Drain off engine oil.
- Unplug electrical connector at oil level/temperature sender - G266- -item 1-.
- Unbolt sump (bottom section) -arrow-.

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### Installing

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



#### Note

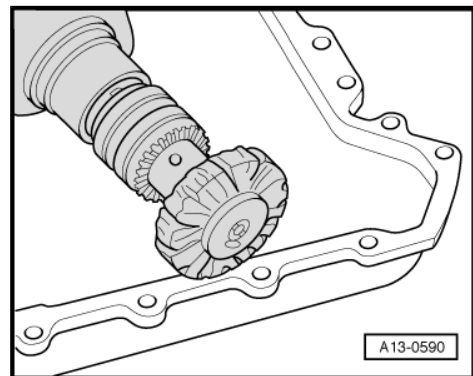
*Renew seal.*

- Remove remaining sealant on bottom and top section of sump with a rotating plastic brush or similar.



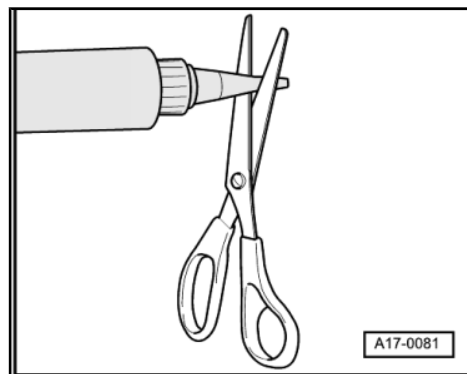
#### WARNING

***Wear safety goggles.***



- Clean sealing surfaces; they must be free of oil and grease.

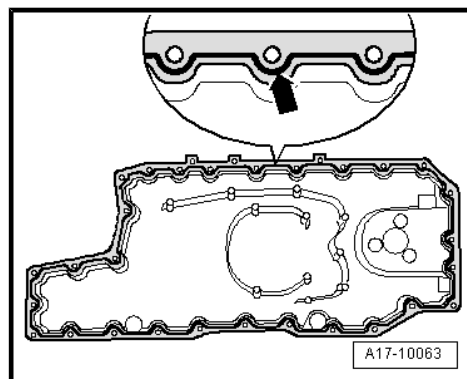
- Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).



- Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as illustrated.
- Width of sealant bead: 2 mm.

**i** Note

- ◆ *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- ◆ *The sump (bottom section) must be installed within 5 minutes after applying sealant.*



- Fit sump (bottom section) and tighten all bolts initially to 5 Nm in diagonal sequence.
- Tighten bolts on sump (bottom section) in diagonal sequence.
- Fill up with engine oil and check oil level ⇒ [page 170](#) .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

**Tightening torques**

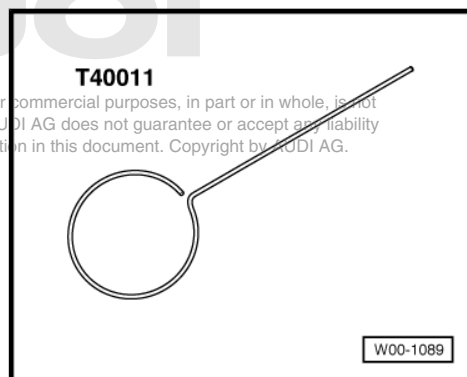
Component	Nm
Sump (bottom section) to sump (top section)	9
Oil drain plug to sump	30

### 1.3 Removing and installing oil pump

**Special tools and workshop equipment required**

- ◆ Locking pin - T40011-

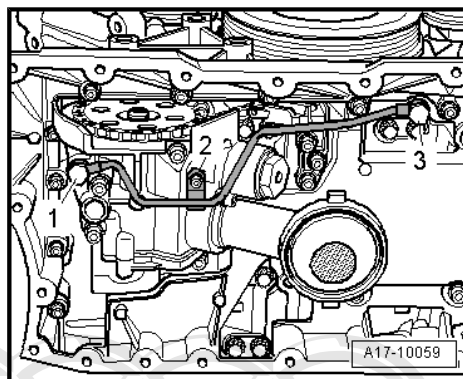
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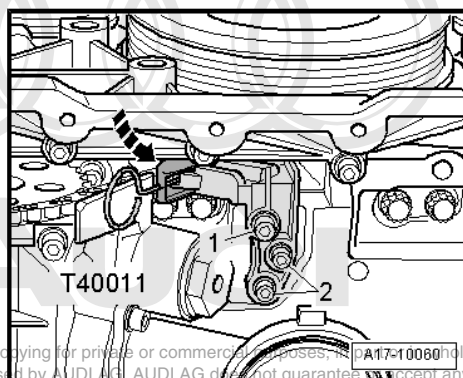


## Removing

- Remove sump (bottom section) ⇒ [page 147](#) .
- Unscrew bolts -1 ... 3- and remove oil line.

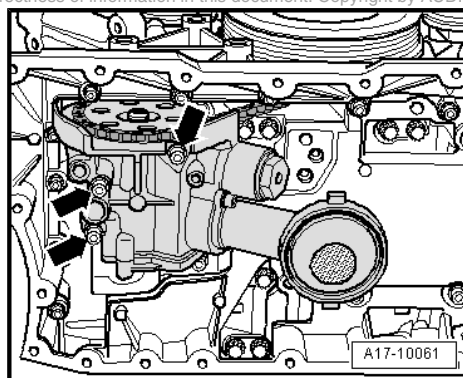


- Press chain tensioner in direction of -arrow- and lock in place using locking pin - T40011- .
- Remove bolts -1- and -2-.
- Remove chain tensioner.



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- Remove bolts -arrows-.
- Remove oil pump and drive chain for oil pump; to do so pivot oil pump to side.



## Installing

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



### Note

*Renew seals.*

- Observe dowel pins when installing.
- Install sump (bottom section) ⇒ [page 147](#) .
- Fill up with engine oil and check oil level ⇒ [page 170](#) .

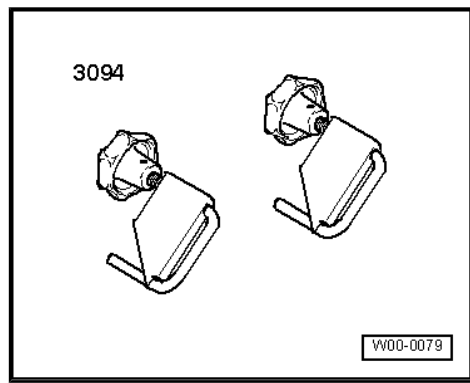
## Tightening torques

Component		Nm
Oil pump to cylinder block		20
Chain tensioner to:	M6	9
Sump (top section)	M8	20
Oil line	M6	9
	Banjo bolt	20

## 1.4 Removing and installing sump (top section)

### Special tools and workshop equipment required

- ◆ Hose clamps up to Ø 25 mm - 3094-



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

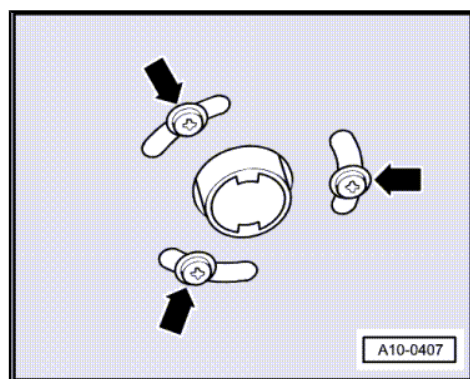
**Removing**

- Remove both front wheels.

**i Note**

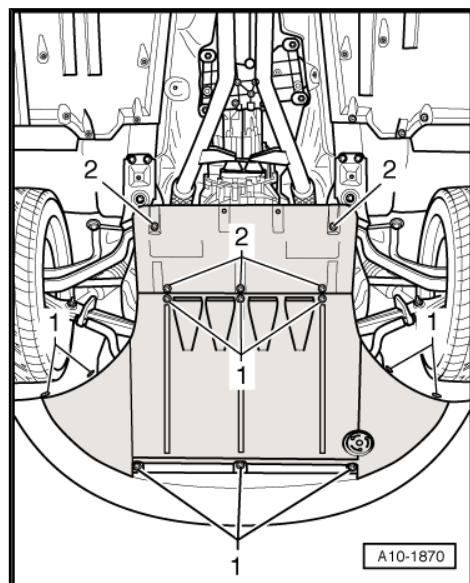
*Secure brake discs with wheel bolts.*

- Remove front section of wheel housing liner (front left) => General body repairs, exterior; Rep. gr. 66 .
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



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- Release quick-release fasteners -1- and -2- and take off noise insulation.



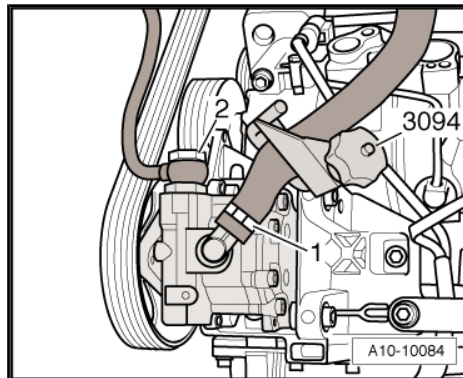


- Clamp off return hose for power steering pump using a hose clamp - 3094- .
- Disconnect return hose -1- from power steering pump.

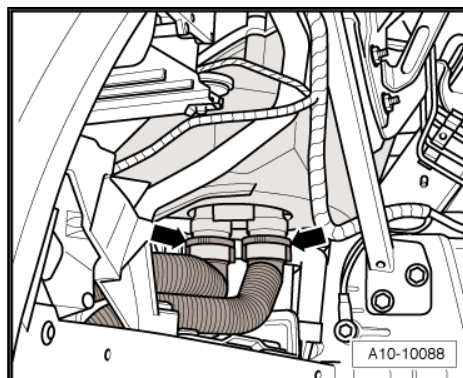


**Note**

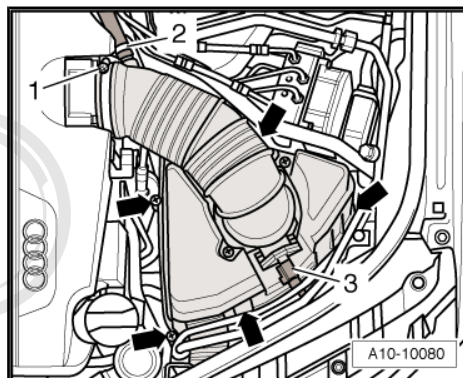
*Disregard -item 2-.*



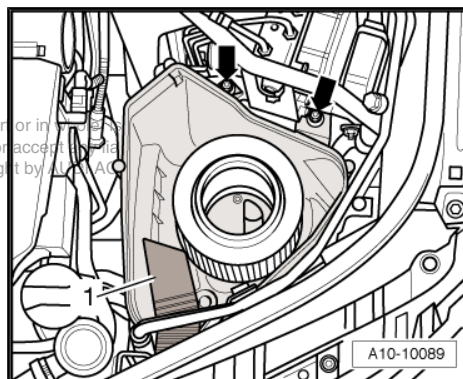
- Press release tabs to detach the two air intake hoses (bottom) -arrows- at bottom section of air cleaner housing (left-side).



- Detach electrical connector -3- for air mass meter 2 - G246- .
- Detach hose -2- from air intake hose.
- Detach air intake hose -1- from intake manifold.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (left-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (left-side)

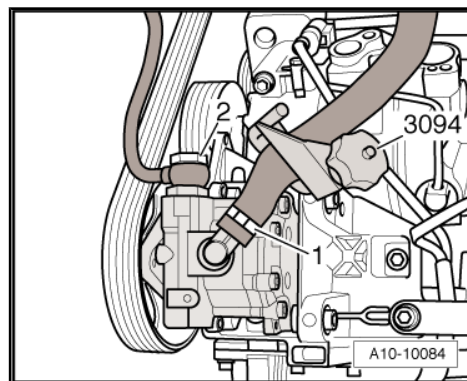


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**i** Note

Lay a cloth under the hydraulic pipe to catch any escaping hydraulic fluid.

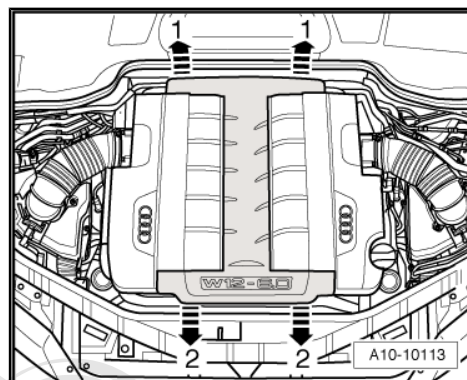
- Unbolt hydraulic line -2- from power steering pump and place hydraulic line on top of longitudinal member.



**i** Note

Disregard -item 1-.

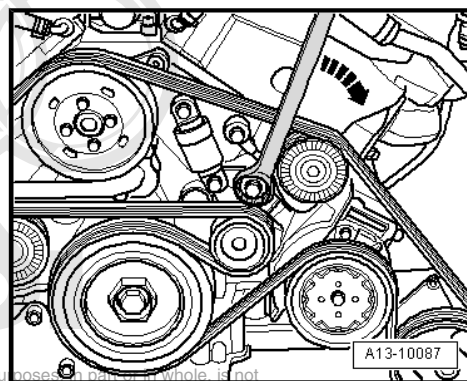
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



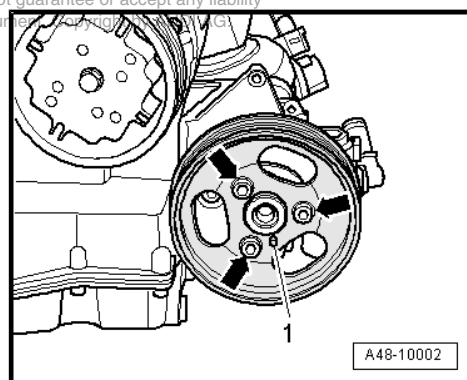
- Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
- Detach poly V-belt from pulley for power steering pump and release pressure from tensioner.

**i** Note

The poly V-belt can remain fitted on the other pulleys.



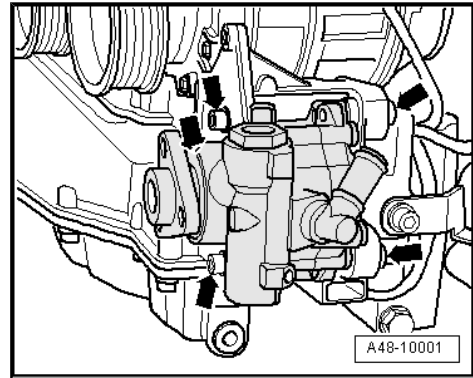
- Remove pulley -1- for power steering pump -arrows-.



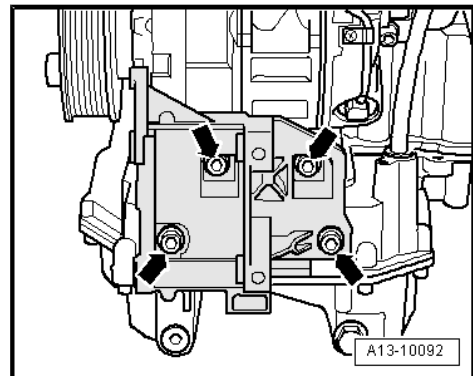
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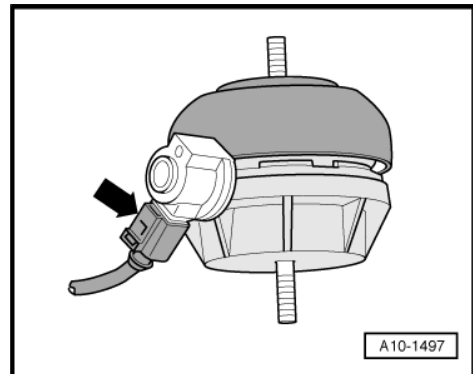
- Unscrew bolts -arrows- and detach power steering pump.



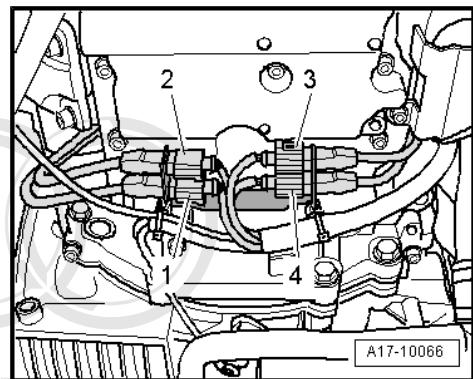
- Remove bracket for power steering pump -arrows-.
- Lower subframe ⇒ [page 47](#) .
- Remove sump (bottom section) ⇒ [page 147](#) .
- Remove oil pump ⇒ [page 149](#) .



- Unplug electrical connector -arrow- at engine mounting (left-side) and move wiring clear.



- Unbolt bracket for electrical connectors -1 ... 4- from sump (top section).
- Unplug electrical connectors -1 ... 4-.
- Unscrew engine/gearbox securing bolts in area of sump (top section).
- Remove bolts for sump (top section).
- Remove sump (top section).



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### Installing

- Remove remaining sealant from sump (top section) and retaining frame using rotating plastic brush or similar.



#### WARNING

*Wear safety goggles.*

- Clean sealing surfaces; they must be free of oil and grease.
- Cut off tube nozzle at front marking (diameter of nozzle approx. 2 mm).

- Apply bead of sealant -arrow- onto clean sealing surface of sump (top section) as illustrated.
- Thickness of sealant bead: 1.5 ... 2 mm

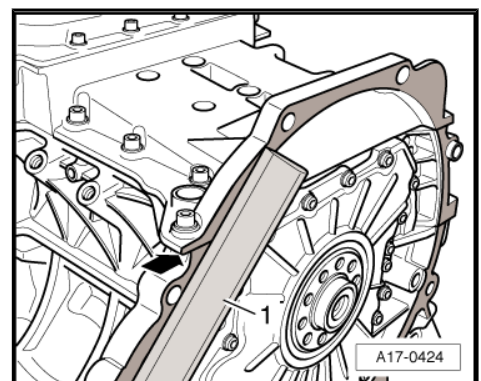
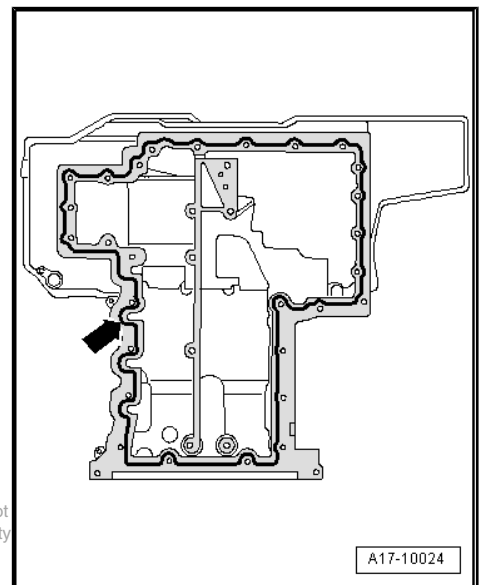
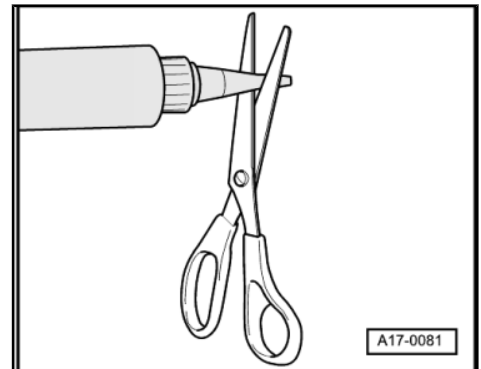
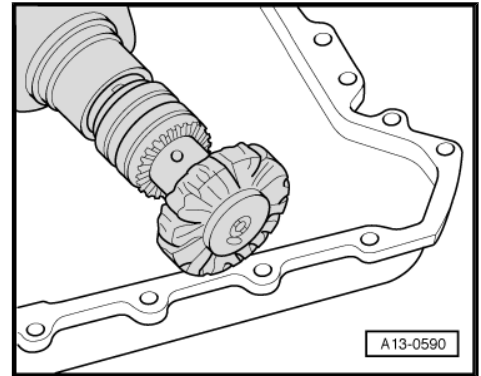


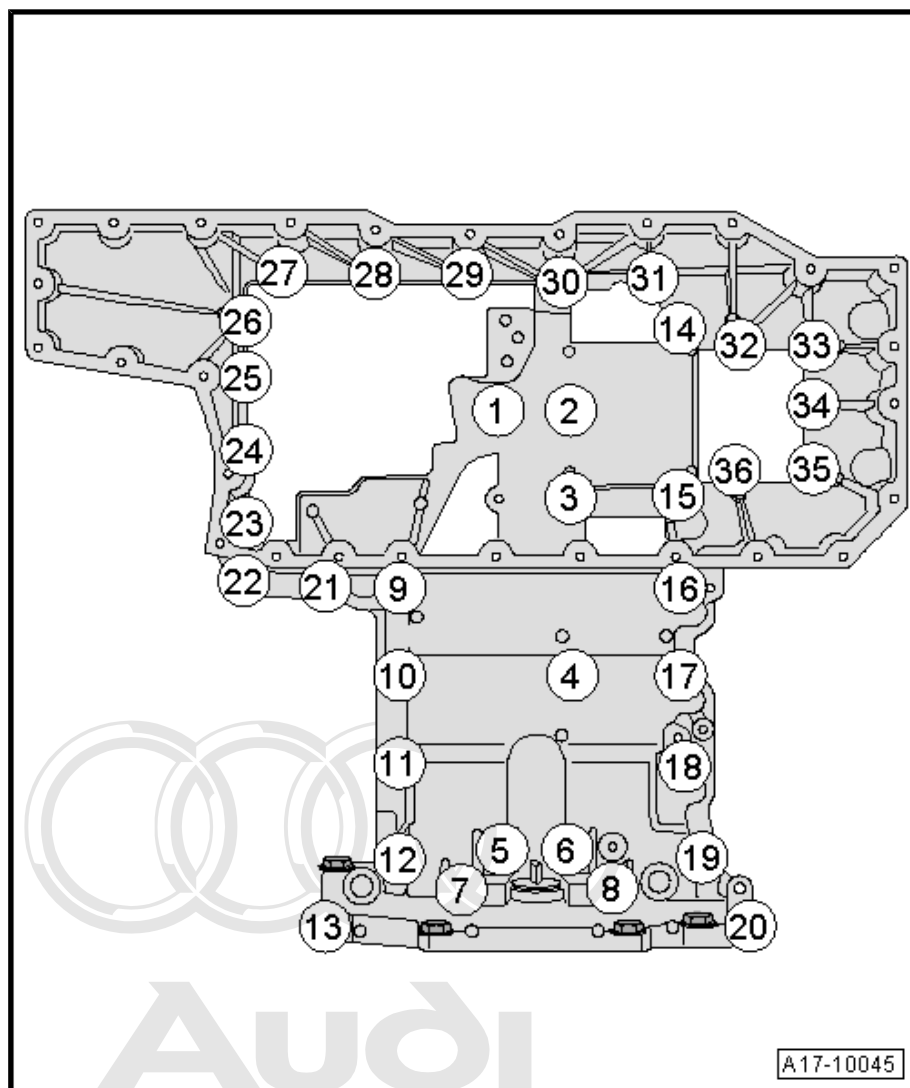
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#### Note

- ◆ *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- ◆ *The sump (top section) must be installed within 5 minutes after applying sealant.*
- ◆ *When engine is removed, make sure that contact surfaces of cylinder block and sump (top section) align with gearbox -arrow-.*





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- Fit sump (top section) and tighten all bolts for sump initially to 5 Nm in the sequence -1 ... 36-.
- Tighten bolts for sump (top section) / gearbox -shaded dark in illustration- to 45 Nm.
- Tighten bolts -1 ... 36- to 9 Nm.
- Tighten bolts M8 -1 ... 20- to 20 Nm.

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

- Install oil pump ⇒ [page 149](#) .
- Install sump (bottom section) ⇒ [page 147](#) .
- Fill up with engine oil and check oil level ⇒ [page 170](#) .
- Install subframe ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install power steering pump ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 48 .

**i** Note

After renewing sump (top section), check alignment of pulleys for power steering pump and air conditioner compressor  
 ⇒ [page 58](#).

– Install poly V-belt ⇒ [page 57](#).

**Tightening torques**

Component		Nm
Sump (top section) to cylinder block	M6	9
	M8	20
Bracket for power steering pump to engine		32

**1.5 Exploded view - oil filter bracket**

**1 - Oil filter housing**

- Use 36 mm socket for loosening and tightening
- Tighten to 25 Nm

**2 - O-ring**

- Renew

**3 - Hose connection for coolant hose**

- Tighten to 10 Nm

**4 - 10 Nm**

**5 - O-ring**

- Renew

**6 - Hose connection for coolant hose**

- Tighten to 10 Nm

**7 - 10 Nm**

**8 - Engine oil cooler**

- Integrated into oil filter housing
- With bypass valve
- Removing and installing ⇒ [page 164](#)
- If renewed, refill system with fresh coolant

**9 - 10 Nm**

**10 - Seals**

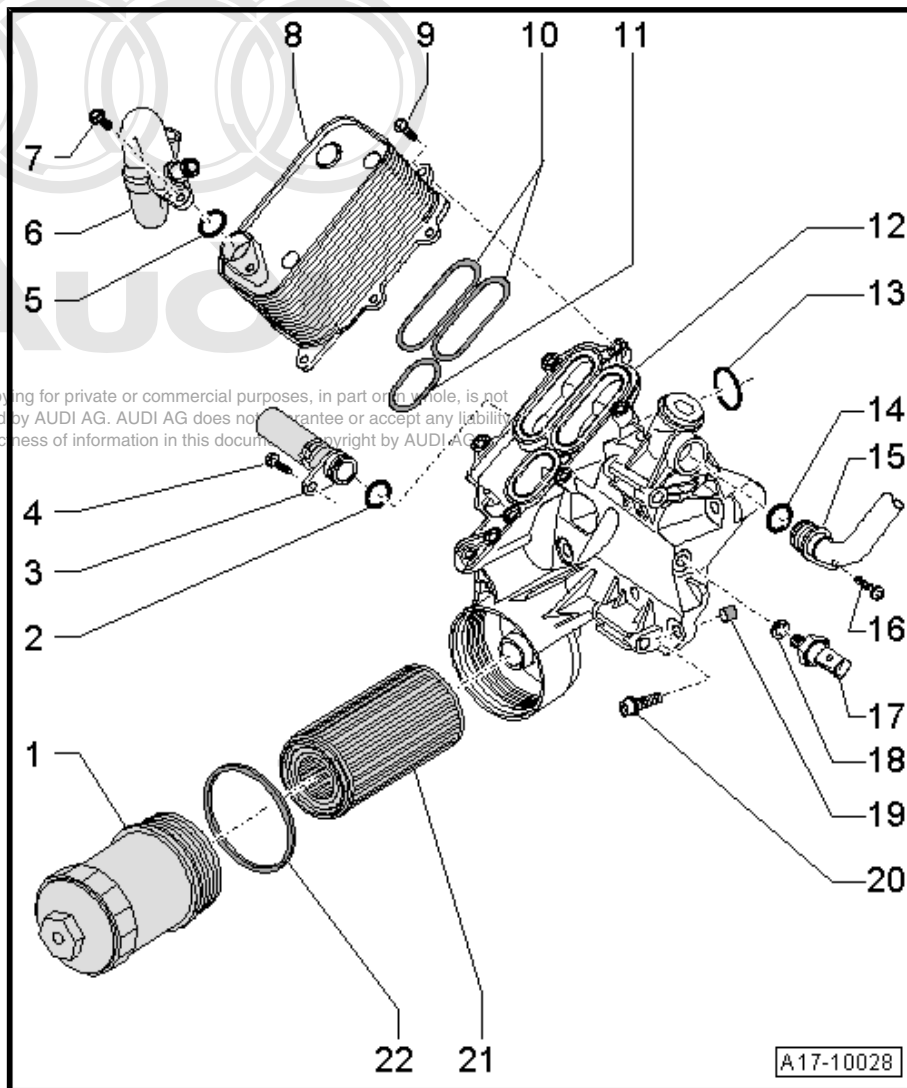
- Renew

**11 - Oil filter bracket**

- With filter bypass valve
- Removing and installing ⇒ [page 158](#)

**12 - Seal**

- Renew





**13 - O-ring**

- Renew

**14 - O-ring**

- Renew

**15 - Oil pipe (front)**

- Removing and installing ⇒ [page 165](#)

**16 - 10 Nm**

**17 - Oil pressure switch - F1- , 1.4 bar**

- Tighten to 25 Nm
- Black insulation
- Removing, installing and checking ⇒ [page 166](#)

**18 - Seal**

- Renew

**19 - Dowel sleeve**

- 2x

**20 - 22 Nm**

**21 - Oil filter element**

- Pull off of oil filter housing ⇒ [Item 1 \(page 157\)](#)
- Renew O-ring ⇒ [Item 2 \(page 157\)](#) when changing filter
- Observe change intervals ⇒ Maintenance ; Booklet 404

**22 - O-ring**

- Renew

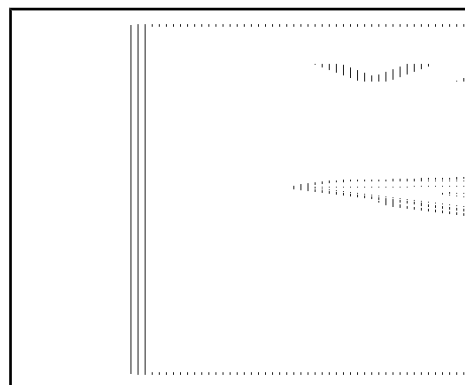


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## 1.6 Removing and installing oil filter housing

### Special tools and workshop equipment required

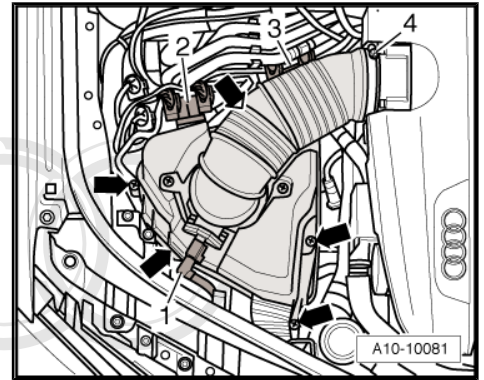
- ◆ Drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306-



### Removing

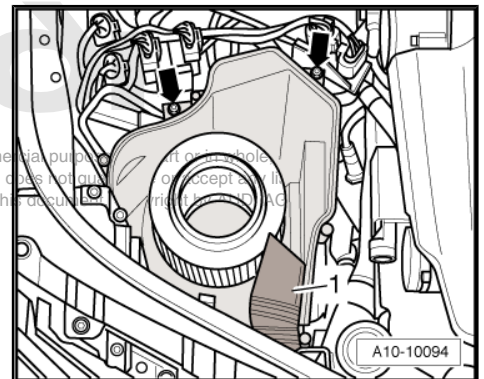
- Drain off coolant ⇒ [page 178](#) .
- Move lock carrier to service position ⇒ [page 45](#) .

- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).

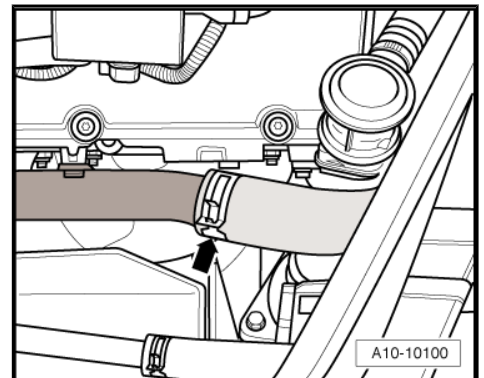
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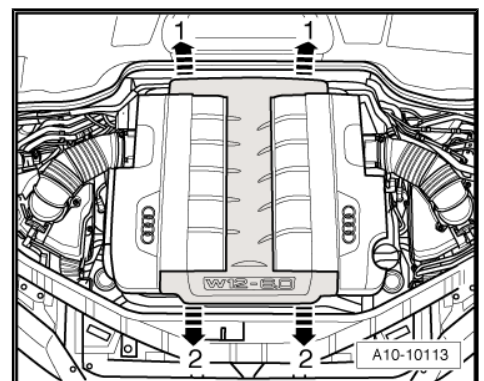
**i** Note

*Lay a cloth under the connection to catch escaping coolant.*

- Detach coolant hose (right-side) -arrow- at engine.



- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.

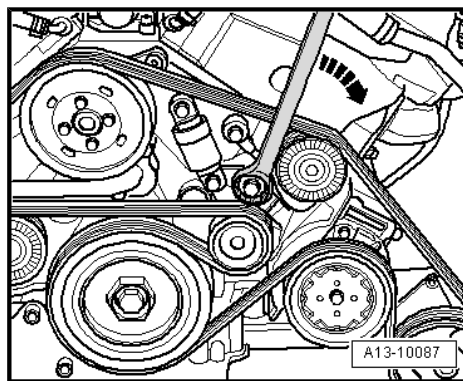




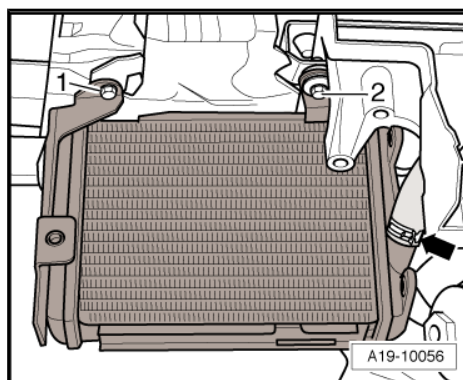
Note

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

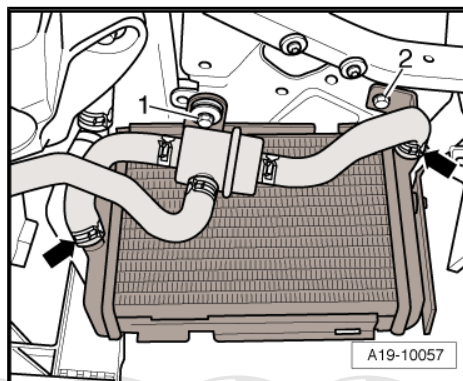
- To slacken the poly V-belt, turn the tensioner in the direction of the -arrow-.
- Remove poly V-belt and release tensioner.



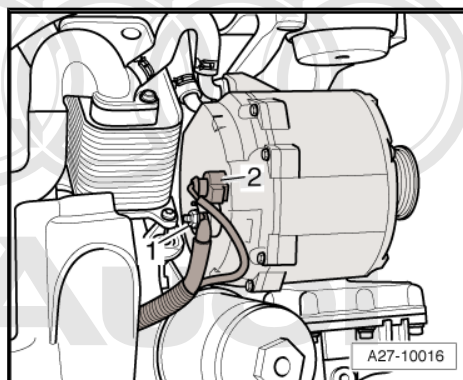
- Detach coolant hose (front) from auxiliary radiator -arrow-.
- Remove bolts -1- and -2-.



- Disconnect coolant hoses -arrows-.
- Remove bolts -1- and -2-.
- Remove auxiliary radiator.



- Unscrew wire -1- at alternator.
- Unplug electrical connector -2-.



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- Remove bolts -arrows-.
- Pivot alternator slightly downwards to left.

 **Note**

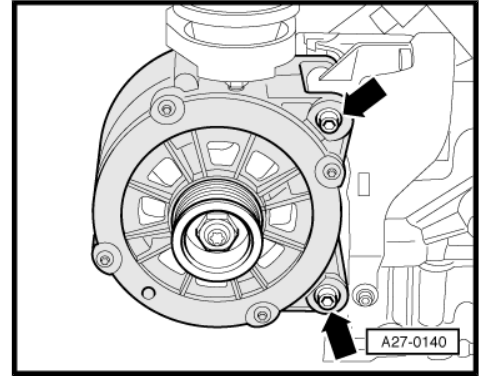
*A second mechanic is required for the further removal of the alternator.*



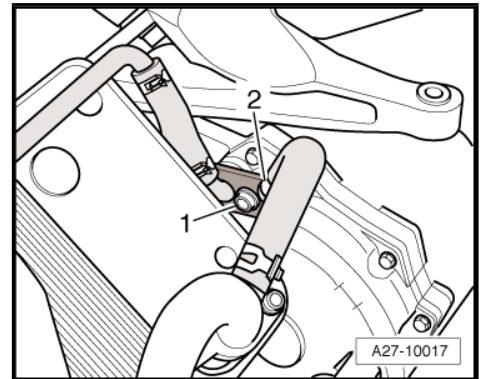
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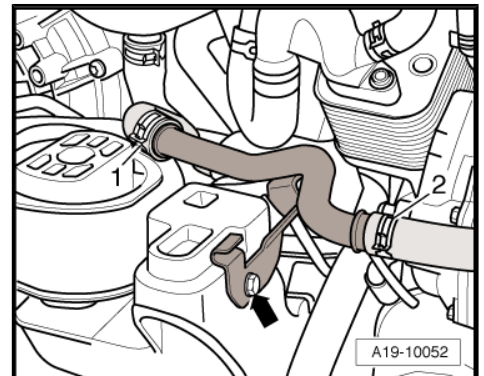
**Coolant will drain out.**



- Detach coolant hose -2- from hose connection at alternator.
- Mark installation position of hose connection on alternator.
- Unscrew bolt -1- and remove bracket.
- Detach both hose connections from alternator.
- Remove alternator.
- Lower subframe ⇒ [page 47](#) .



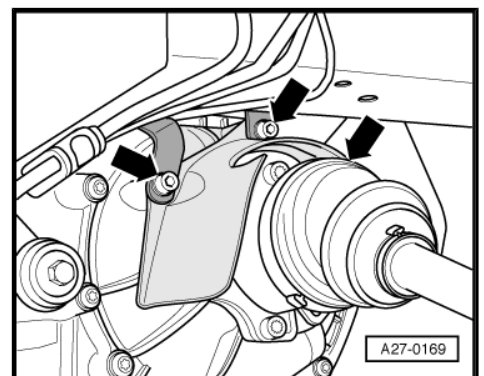
- Disconnect coolant hoses -1- and -2- at coolant pipe (bottom right).
- Remove coolant pipe (front right).



 **Note**

*Disregard -arrow-.*

- Unbolt heat shield above drive shaft (right-side) from gearbox -arrows-.



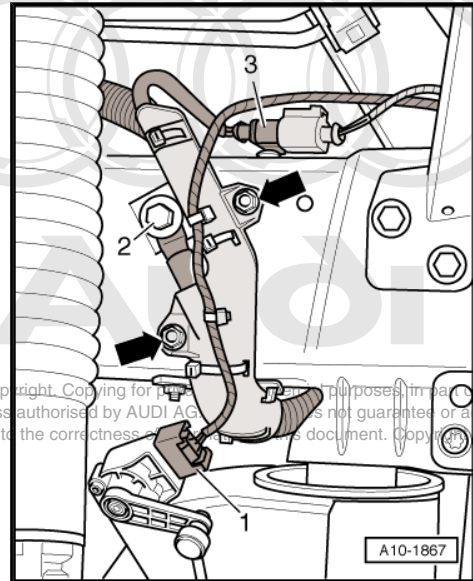


- Unplug electrical connector -3-.
- Unbolt earth cable -2- at longitudinal member.
- Unscrew bracket for wiring harness at longitudinal member -arrows- and move wiring harness clear.



**Note**

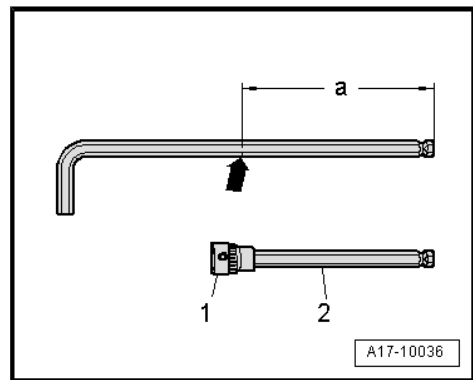
Disregard -item 1-.



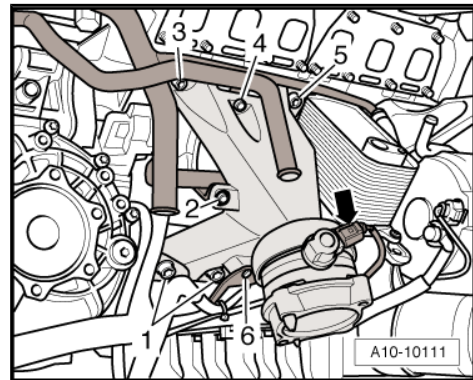
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To loosen the securing bolt (top rear) at the engine support, you must make a special tool as follows:

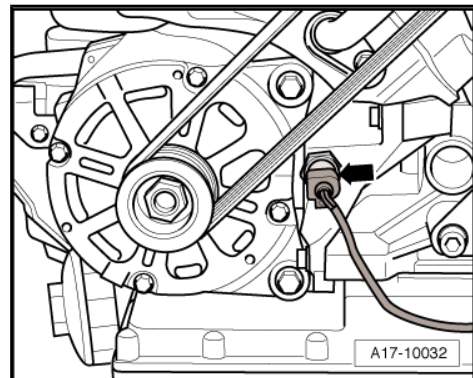
- Saw a long 8 mm hexagon key with ball head at the point marked with an -arrow-.
- Dimension -a- = 103 mm
- Insert the sawn-off end -2- in a 8 mm socket insert -item 1-.



- Unplug electrical connector -arrow- at engine mounting (right-side).
- Remove bolts -1 ... 6-.
- Remove engine support with engine mounting.

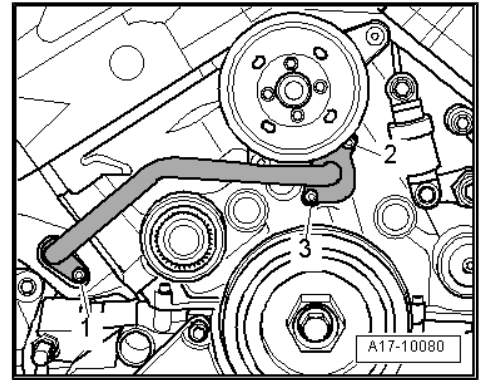


- Unplug electrical connector -arrow- at oil pressure switch -F1-.





- Remove bolts -1 ... 3-.
- Detach oil pipe (front).

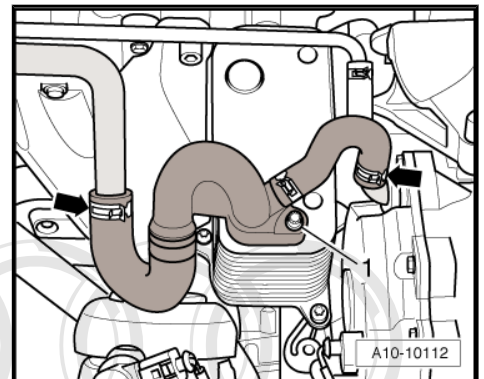


- Disconnect coolant hose -left arrow-.

 **Note**

*Disregard -arrow- on right-side of illustration.*

- Remove bolt -1-.
- Remove hose connection at engine oil cooler.



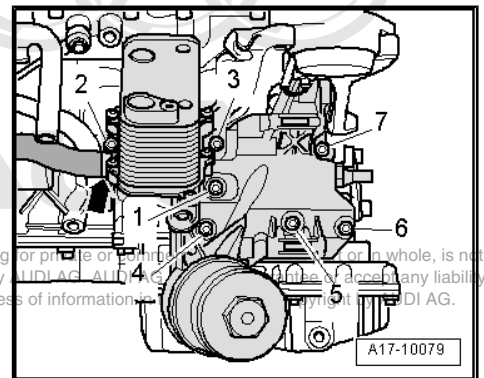
- Place drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208- under engine.
- Disconnect coolant hose -arrow-.
- Remove bolts in the sequence: -1 ... 7-.
- Remove oil filter housing.

**Installing**

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

 **Note**

- ◆ *Renew seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- Tighten bolts for oil filter housing in the sequence -1 ... 7-.
- Install oil pipe (front) ⇒ [page 165](#) .

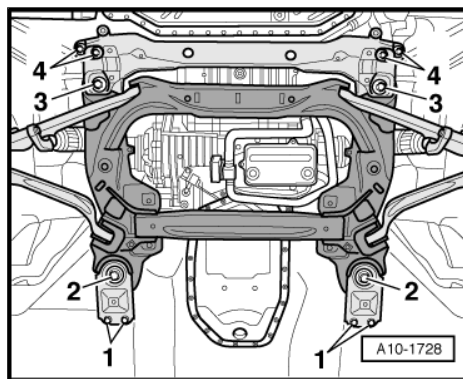


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- Adjust the subframe according to the markings previously made on the longitudinal members.
- Only tighten bolts for subframe to the specified torque (do not turn further); tighten bolts only after performing alignment check.

- 1 - 50 Nm
- 2 - 150 Nm
- 3 - 150 Nm



**WARNING**

*The vehicle must not be driven at this stage.*

- Install air spring strut ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install anti-roll bar ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install alternator ⇒ Electrical system; Rep. gr. 27
- Install lock carrier with attachments ⇒ General body repairs, exterior; Rep. gr. 50 .
- Fill up with engine oil and check oil level ⇒ [page 170](#)
- Fill cooling system ⇒ [page 180](#)
- Perform wheel alignment check ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 44 .



**WARNING**

*Tighten bolts for subframe to final setting after performing wheel alignment check.*

- Check headlight adjustment ⇒ Maintenance ; Booklet 404 .

**Tightening torques**

Component	Nm
Engine cross member to longitudinal member	68
Oil filter housing to engine	22
Coolant hose/pipe connection to engine oil cooler	10
Engine support to engine	40
Coolant pipe to engine support	10
Earth cable to longitudinal member	20
Drive shaft heat shield (right-side) to gearbox	23

## 1.7 Removing and installing engine oil cooler

### Removing

- Remove oil filter housing ⇒ [page 158](#) .

 **Note**

Place a cloth below the oil filter housing to catch escaping oil and coolant.

- Remove bolts -arrows-.
- Remove engine oil cooler.

**Installing**

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

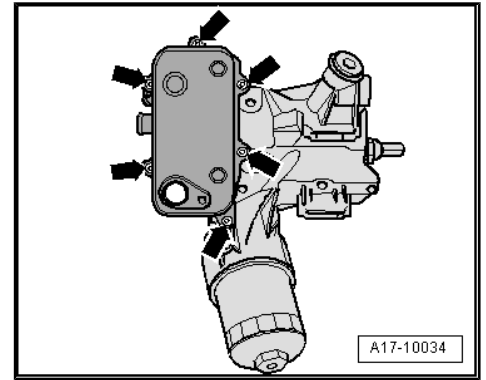
 **Note**

Renew seals.

- Install oil filter housing => [page 163](#) .

**Tightening torque**

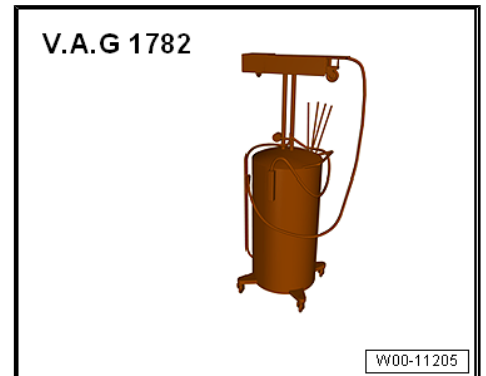
Component	Nm
Engine oil cooler to oil filter bracket	10



**1.8 Removing and installing oil pipe (front)**

**Special tools and workshop equipment required**

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



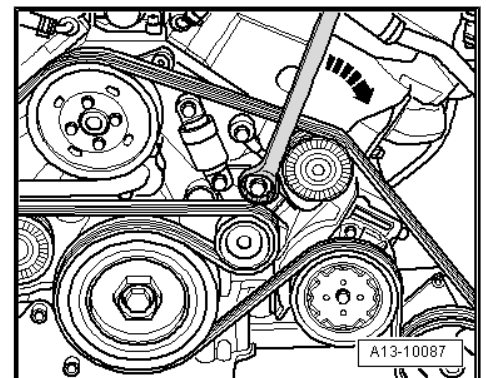
**Removing**

- Move lock carrier to service position => [page 45](#) .

 **Note**

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

- To slacken the poly V-belt, turn the tensioner in the direction of the -arrow-.
- Remove poly V-belt and release tensioner.





- Place used oil collection and extraction unit - V.A.G 1782- under engine.
- Remove bolts -1 ... 3-
- Detach oil pipe (front).

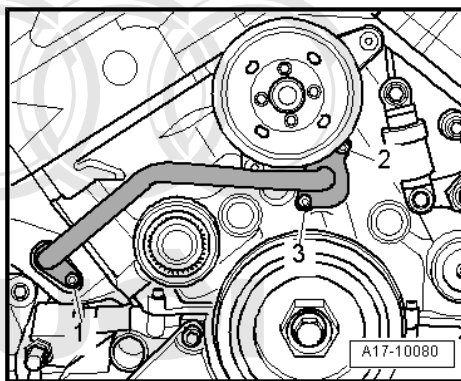
**Installing**

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



**Note**

*Renew O-rings.*



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- Tighten bolts for oil pipe (front) in the sequence -1 ... 3-
- Install poly V-belt => [page 57](#) .
- Install lock carrier with attachments => General body repairs, exterior; Rep. gr. 50 .
- Install front bumper cover => General body repairs, exterior; Rep. gr. 63 .
- Deactivate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Check headlight adjustment => Maintenance ; Booklet 404 .

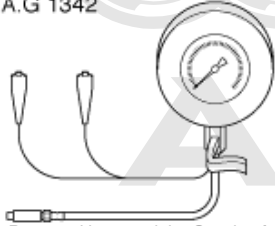
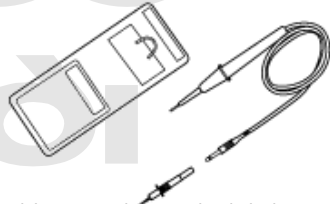

**Tightening torque**

Component	Nm
Oil pipe (front) to cylinder block / oil filter housing	10

**1.9 Checking oil pressure and oil pressure switch**

**Special tools and workshop equipment required**

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

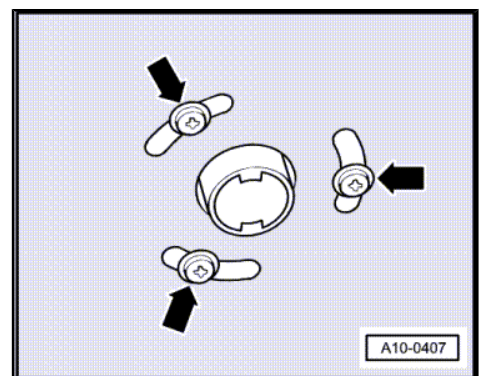
<p>V.A.G 1342</p>  <p>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.</p>	<p>V.A.G 1527 B</p> 
<p>V.A.G 1594 C</p> 	
	<p style="text-align: right;">G17-0023</p>

**Test conditions**

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

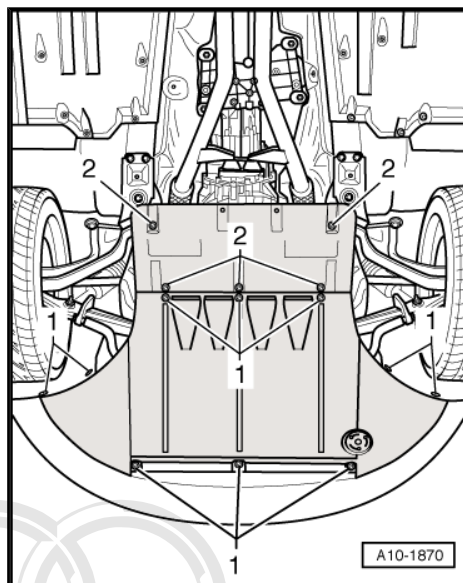
**Test sequence**

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.

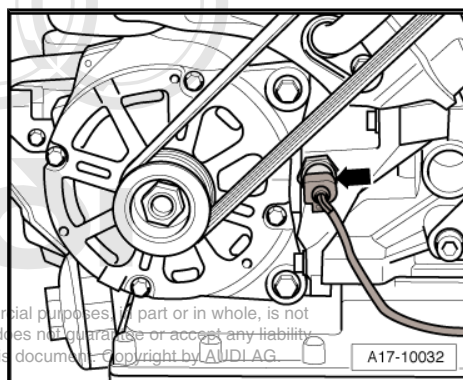




- Open quick-release fasteners -1- and remove noise insulation (front).



- Unplug electrical connector -arrow- at oil pressure switch - F1- .
- Unscrew oil pressure switch.
- Screw adapter - V.A.G 1342/14- into hole for oil pressure switch.



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- Connect oil pressure tester - V.A.G 1342- to adapter - V.A.G 1342/14- .
- Screw oil pressure switch -2- into oil pressure tester - V.A.G 1342- .
- Connect brown wire of oil pressure tester to earth ("–").

**Checking oil pressure switch**

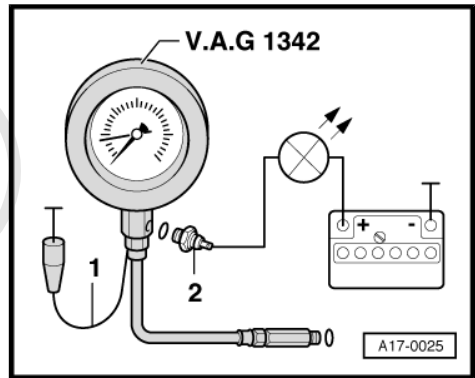
- Connect voltage tester - V.A.G 1527 B- -item 1- with adapter leads from auxiliary measuring set - V.A.G 1594 C- to oil pressure switch and battery positive ("+").

- LED should not light up.

If the LED lights up:

- Renew oil pressure switch.

- Start engine. 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.



**i Note**

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

- LED should light up at 1.2 ... 1.6 bar.

If LED does not light up:

- Renew oil pressure switch.

**Checking oil pressure**

- Start engine.
- Oil pressure at idling speed: at least 0.8 bar
- Minimum oil pressure at 2000 rpm: 3.0 bar.
- Oil pressure at higher engine speeds: max. 7.0 bar

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

- Renew the oil pump.

**Assembling**

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

**i Note**

*Renew seal.*

- Deactivate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

**Tightening torque**

Component	Nm
Oil pressure switch to engine	25

**1.10 Engine oil**

**Viscosity grades and oil specifications**

=> Maintenance ; Booklet 404 .



Oil capacities => Maintenance tables .

## 1.11 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. The oil level may rise as far as area -a- after topping up.

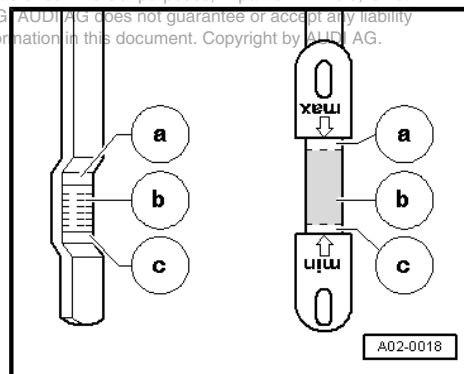
c - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping up.



### Note

*The oil level must not be above the max. marking -a- or below the min. marking -c-.*

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## 19 – Cooling

### 1 Removing and installing parts of cooling system

⇒ [“1.1 Parts of cooling system”, page 172](#)

⇒ [“1.1.1 Cooling system without auxiliary heater \(cold climate countries, long wheelbase version\)”, page 172](#)

⇒ [“1.1.2 Cooling system without auxiliary heater \(warm climate countries and USA, long-wheelbase version\)”, page 174](#)

⇒ [“1.1.3 Cooling system without auxiliary heater \(very warm climate countries, standard wheelbase version\)”, page 175](#)

⇒ [“1.1.4 Cooling system without auxiliary heater \(cold and warm climate countries, standard wheelbase version\)”, page 176](#)

⇒ [“1.1.5 Cooling system with auxiliary heater and towing bracket \(cold and warm climate countries, long-wheelbase version\)”, page 177](#)



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- ⇒ ["1.2 Draining and filling cooling system", page 178](#)
- ⇒ ["1.3 Removing and installing coolant pump", page 184](#)
- ⇒ ["1.4 Removing and installing continued coolant circulation pump V51", page 186](#)
- ⇒ ["1.5 Checking thermostat", page 192](#)
- ⇒ ["1.6 Removing and installing thermostat", page 194](#)
- ⇒ ["1.7 Removing and installing coolant pipe \(top\)", page 195](#)
- ⇒ ["1.8 Removing and installing coolant pipe \(top left\)", page 199](#)
- ⇒ ["1.9 Removing and installing coolant pipe \(bottom left\)", page 201](#)
- ⇒ ["1.10 Removing and installing coolant pipe \(front right\)", page 203](#)
- ⇒ ["1.11 Removing and installing coolant pipe \(top right\)", page 209](#)
- ⇒ ["1.12 Removing and installing coolant pipe \(centre right\)", page 210](#)
- ⇒ ["1.13 Removing and installing coolant pipe \(bottom right\)", page 212](#)
- ⇒ ["1.14 Exploded view - radiator and radiator fans", page 213](#)
- ⇒ ["1.15 Removing and installing radiator", page 214](#)
- ⇒ ["1.16 Removing and installing radiator cowl", page 219](#)
- ⇒ ["1.17 Removing and installing radiator fans", page 220](#)
- ⇒ ["1.18 Removing and installing auxiliary radiator", page 221](#)
- ⇒ ["1.19 Checking cooling system for leaks", page 223](#)

## 1.1 Parts of cooling system

- ⇒ ["1.1.1 Cooling system without auxiliary heater \(cold climate countries, long wheelbase version\)", page 172](#)
- ⇒ ["1.1.2 Cooling system without auxiliary heater \(warm climate countries and USA, long-wheelbase version\)", page 174](#)
- ⇒ ["1.1.3 Cooling system without auxiliary heater \(very warm climate countries, standard wheelbase version\)", page 175](#)
- ⇒ ["1.1.4 Cooling system without auxiliary heater \(cold and warm climate countries, standard wheelbase version\)", page 176](#)
- ⇒ ["1.1.5 Cooling system with auxiliary heater and towing bracket \(cold and warm climate countries, long-wheelbase version\)", page 177](#)

### 1.1.1 Cooling system without auxiliary heater (cold climate countries, long wheelbase version)

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**1 - Alternator**

**2 - Engine oil cooler**

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

**3 - Bleeder screw**

**4 - Bleeder screw**

**5 - Heat exchanger for heater**

- If renewed, refill system with fresh coolant

**6 - ATF cooler**

- If renewed, refill system with fresh coolant

**7 - Coolant expansion tank**

- With filler cap
- Checking pressure relief valve in filler cap ⇒ [page 225](#)

**8 - Thermostat**

- For ATF cooler and gear oil cooler for transfer box

**9 - Coolant temperature sender - G62-**

**10 - Gear oil cooler for transfer box**

- If renewed, refill system with fresh coolant

**11 - Thermostat**

- Checking ⇒ [page 192](#)
- Removing and installing ⇒ [page 194](#)

**12 - Coolant pump**

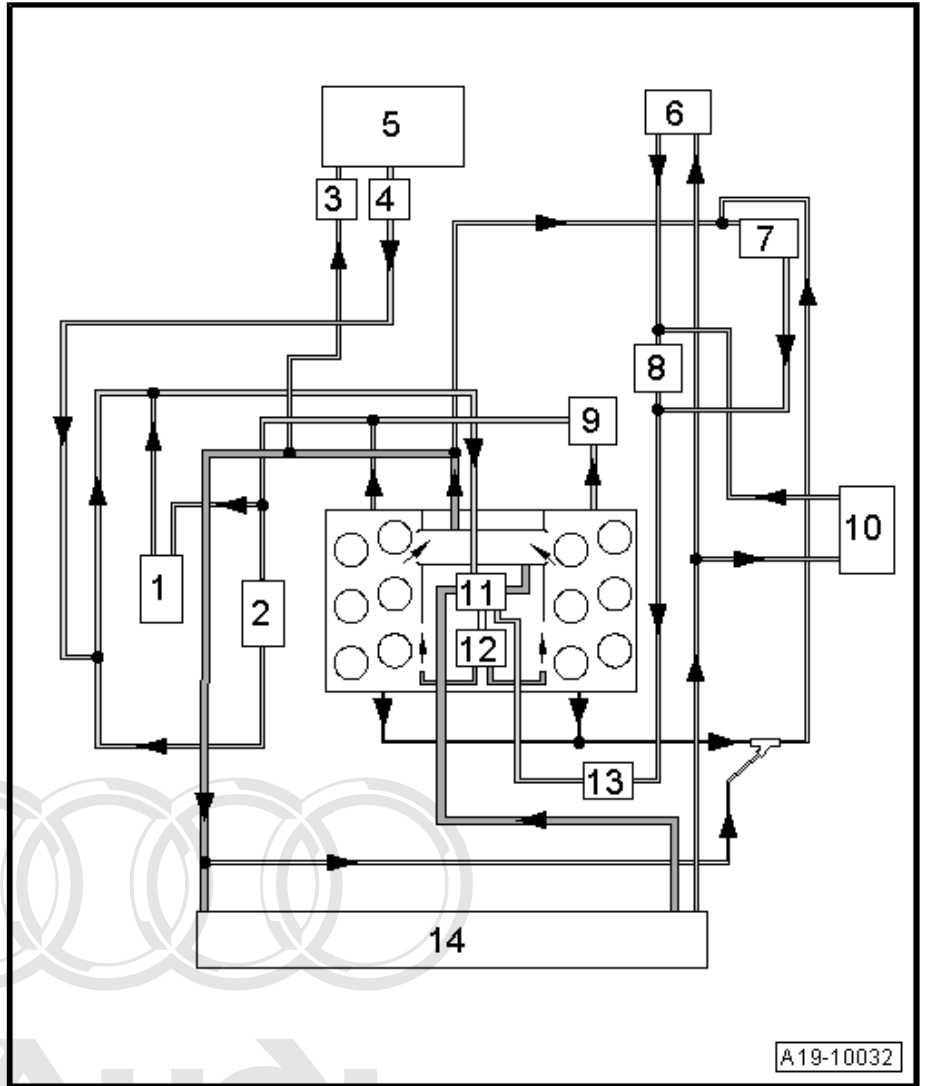
- Removing and installing ⇒ [page 184](#)

**13 - Continued coolant circulation pump - V51-**

- Removing and installing ⇒ [page 186](#)

**14 - Radiator**

- Removing and installing ⇒ [page 214](#)
- If renewed, refill system with fresh coolant



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## 1.1.2 Cooling system without auxiliary heater (warm climate countries and USA, long-wheelbase version)

### 1 - Auxiliary radiator

- Removing and installing ⇒ [page 221](#)
- If renewed, refill system with fresh coolant

### 2 - Thermostat for auxiliary radiator

### 3 - Alternator

### 4 - Engine oil cooler

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

### 5 - Bleeder screw

### 6 - Bleeder screw

### 7 - Heat exchanger for heater

- If renewed, refill system with fresh coolant

### 8 - ATF cooler

- If renewed, refill system with fresh coolant

### 9 - Coolant expansion tank

- With filler cap

- Checking pressure relief valve in filler cap** ⇒ [page 225](#)

### 10 - Thermostat

- For ATF cooler and gear oil cooler for transfer box

### 11 - Coolant temperature sender - G62-

### 12 - Gear oil cooler for transfer box

- If renewed, refill system with fresh coolant

### 13 - Thermostat

- Checking ⇒ [page 192](#)
- Removing and installing ⇒ [page 194](#)

### 14 - Coolant pump

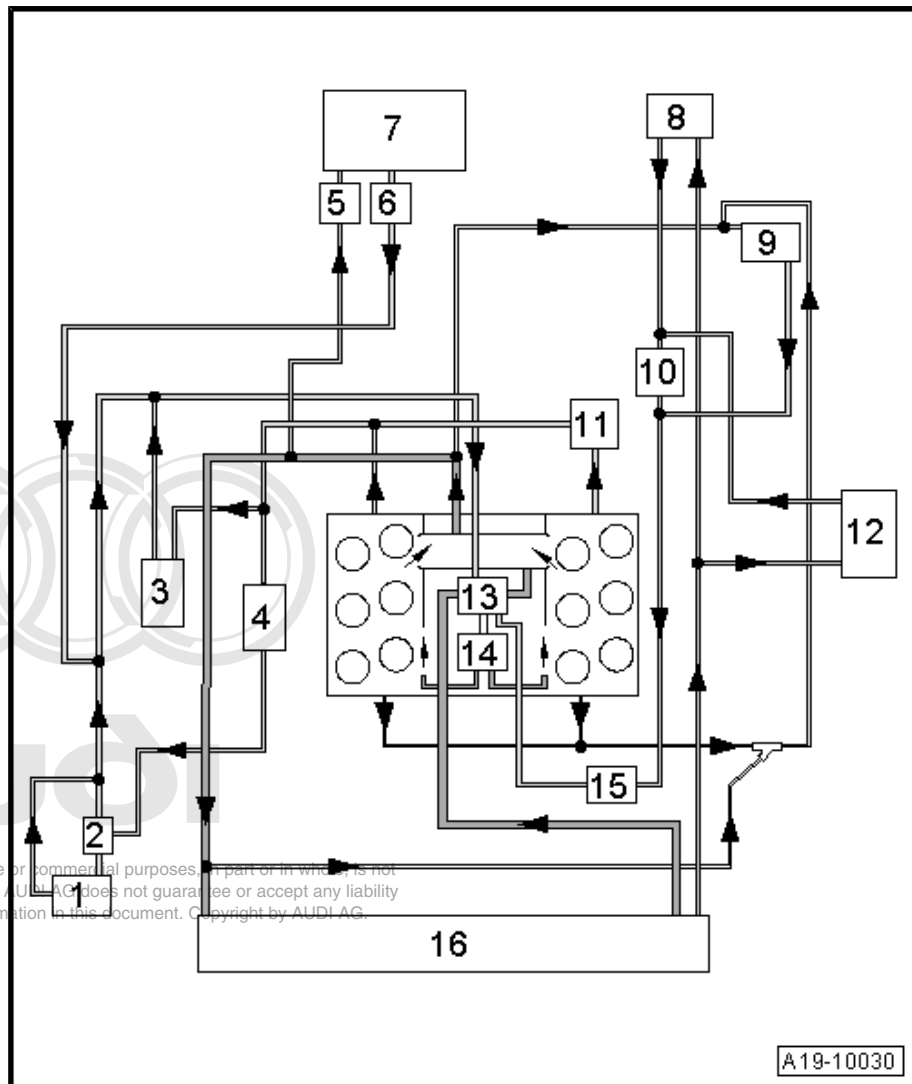
- Removing and installing ⇒ [page 184](#)

### 15 - Continued coolant circulation pump - V51-

- Removing and installing ⇒ [page 186](#)

### 16 - Radiator

- Removing and installing ⇒ [page 214](#)
- If renewed, refill system with fresh coolant



A 19-10030

### 1.1.3 Cooling system without auxiliary heater (very warm climate countries, standard wheelbase version)

#### 1 - Auxiliary radiator

- Removing and installing ⇒ [page 221](#)
- If renewed, refill system with fresh coolant

#### 2 - Thermostat for auxiliary radiator

#### 3 - Alternator

#### 4 - Engine oil cooler

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

#### 5 - Bleeder screw

#### 6 - Bleeder screw

#### 7 - Heat exchanger for heater

- If renewed, refill system with fresh coolant

#### 8 - ATF cooler

- If renewed, refill system with fresh coolant

#### 9 - Coolant expansion tank

- With filler cap
- Checking pressure relief valve in filler cap ⇒ [page 225](#)

#### 10 - Thermostat

- For ATF cooler and gear oil cooler for transfer box

#### 11 - Coolant temperature sender - G62-

#### 12 - Gear oil cooler for transfer box

- If renewed, refill system with fresh coolant

#### 13 - Thermostat

- Checking ⇒ [page 192](#)
- Removing and installing ⇒ [page 194](#)

#### 14 - Coolant pump

- Removing and installing ⇒ [page 184](#)

#### 15 - Continued coolant circulation pump - V51-

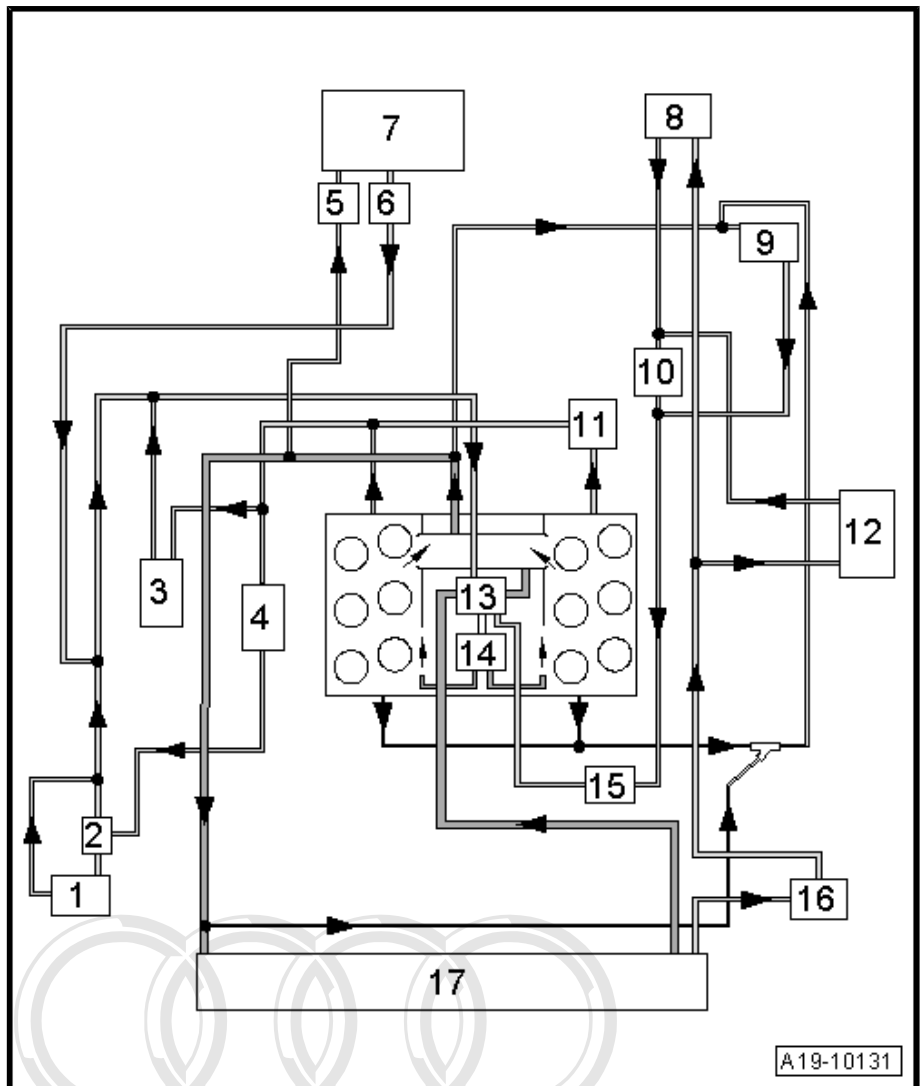
- Removing and installing ⇒ [page 186](#)

#### 16 - Auxiliary radiator

- Removing and installing ⇒ [page 221](#)
- If renewed, refill system with fresh coolant

#### 17 - Radiator

- Removing and installing ⇒ [page 214](#)



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- If renewed, refill system with fresh coolant

### 1.1.4 Cooling system without auxiliary heater (cold and warm climate countries, standard wheelbase version)

#### 1 - Auxiliary radiator

- Removing and installing ⇒ [page 221](#)
- If renewed, refill system with fresh coolant

#### 2 - Engine oil cooler

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

#### 3 - Alternator

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#### 4 - Bleeder screw

#### 5 - Bleeder screw

#### 6 - Heat exchanger for heater

- If renewed, refill system with fresh coolant

#### 7 - ATF cooler

- If renewed, refill system with fresh coolant

#### 8 - Coolant expansion tank

- With filler cap
- Checking pressure relief valve in filler cap ⇒ [page 225](#)

#### 9 - Thermostat

- For ATF cooler and gear oil cooler for transfer box

#### 10 - Coolant temperature sender - G62-

#### 11 - Gear oil cooler for transfer box

- If renewed, refill system with fresh coolant

#### 12 - Thermostat

- Checking ⇒ [page 192](#)
- Removing and installing ⇒ [page 194](#)

#### 13 - Coolant pump

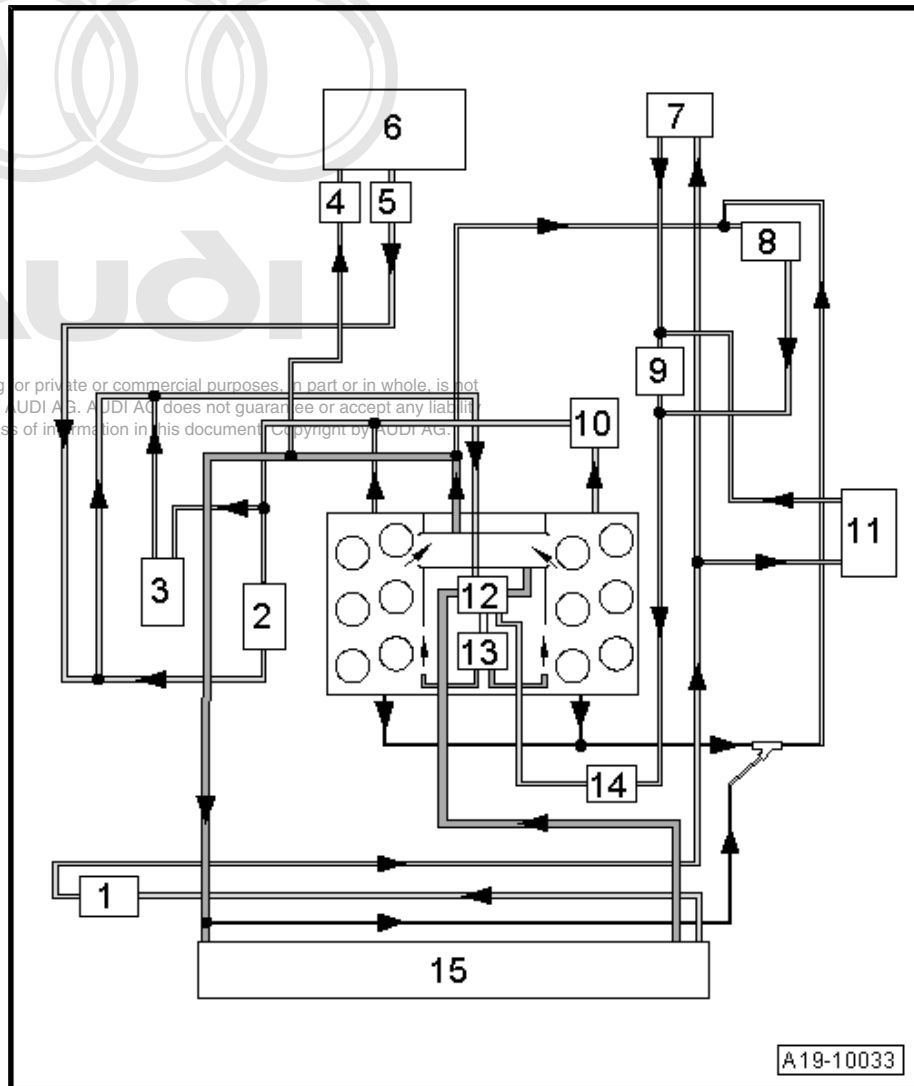
- Removing and installing ⇒ [page 184](#)

#### 14 - Continued coolant circulation pump - V51-

- Removing and installing ⇒ [page 186](#)

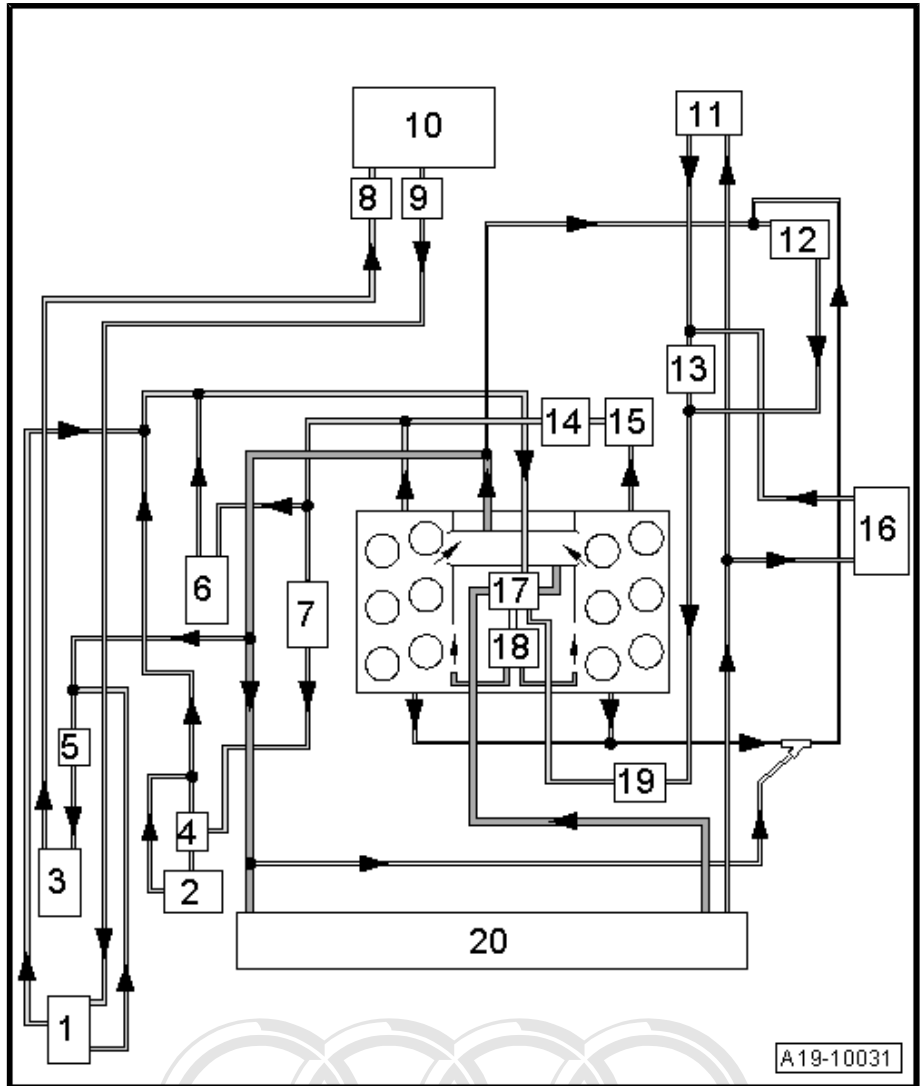
#### 15 - Radiator

- Removing and installing ⇒ [page 214](#)
- If renewed, refill system with fresh coolant



### 1.1.5 Cooling system with auxiliary heater and towing bracket (cold and warm climate countries, long-wheelbase version)

- 1 - Heater coolant shut-off valve - N279-**
- 2 - Auxiliary radiator**
  - Removing and installing ⇒ [page 221](#)
  - If renewed, refill system with fresh coolant
- 3 - Auxiliary heater**
- 4 - Thermostat for auxiliary radiator**
- 5 - Circulation pump - V55- for auxiliary heater**
- 6 - Alternator**
- 7 - Engine oil cooler**
  - Removing and installing ⇒ [page 164](#)
  - If renewed, refill system with fresh coolant
- 8 - Bleeder screw**
- 9 - Bleeder screw**
- 10 - Heat exchanger for heater**
  - If renewed, refill system with fresh coolant
- 11 - ATF cooler**
  - If renewed, refill system with fresh coolant
- 12 - Coolant expansion tank**
  - With filler cap
  - Checking pressure relief valve in filler cap ⇒ [page 225](#)
- 13 - Thermostat**
  - For ATF cooler and gear oil cooler for transfer box
- 14 - Non-return valve**
- 15 - Coolant temperature sender - G62-**
- 16 - Gear oil cooler for transfer box**
  - If renewed, refill system with fresh coolant
- 17 - Thermostat**
  - Checking ⇒ [page 192](#)
  - Removing and installing ⇒ [page 194](#)
- 18 - Coolant pump**
  - Removing and installing ⇒ [page 184](#)
- 19 - Continued coolant circulation pump - V51-**
  - Removing and installing ⇒ [page 186](#)



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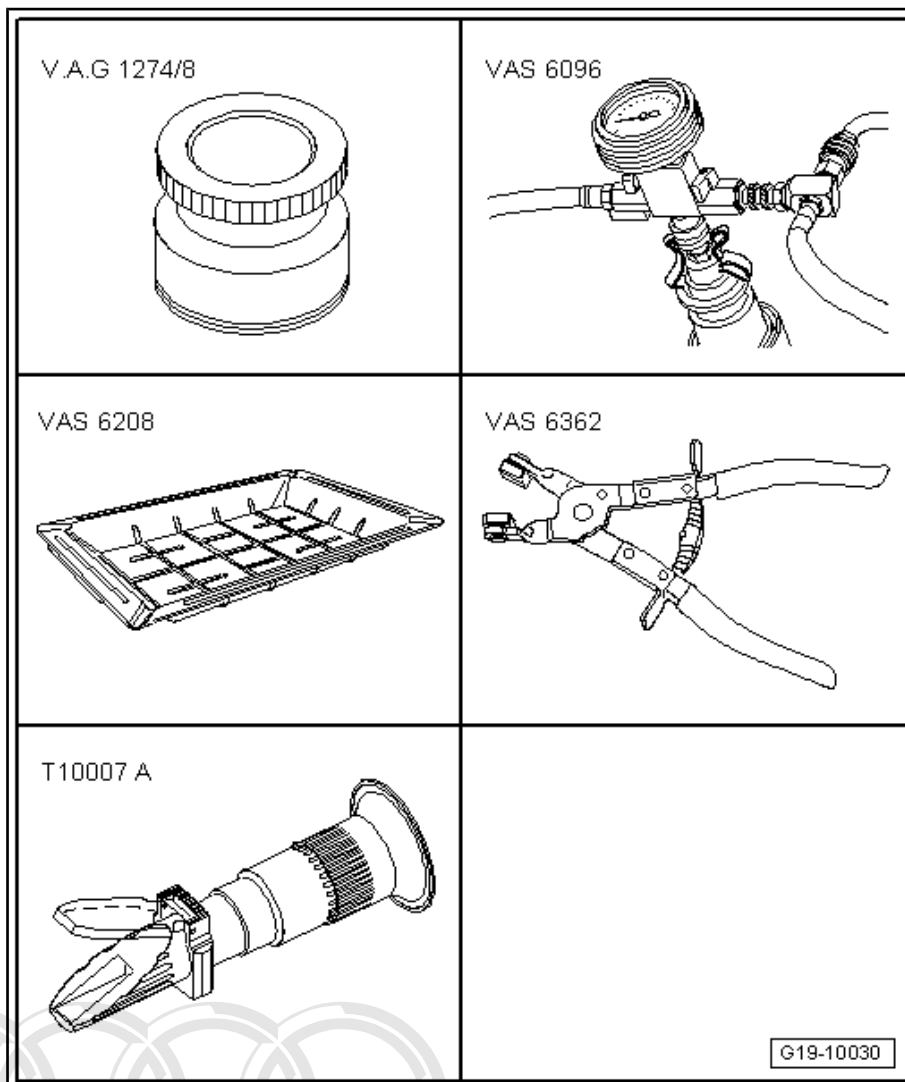
## 20 - Radiator

- Removing and installing ⇒ [page 214](#)
- If renewed, refill system with fresh coolant

## 1.2 Draining and filling cooling system

### Special tools and workshop equipment required

- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Cooling system charge unit - VAS 6096-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Refractometer - T10007 A-
- ◆ Safety goggles
- ◆ Protective gloves



### Draining

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .



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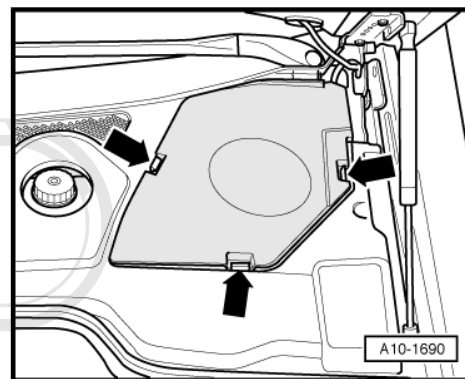


- Remove cover above coolant expansion tank -arrows-.

**! WARNING**

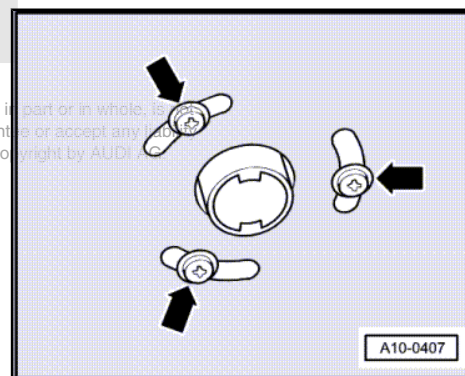
*Hot steam/hot coolant can escape - risk of scalding.*

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*

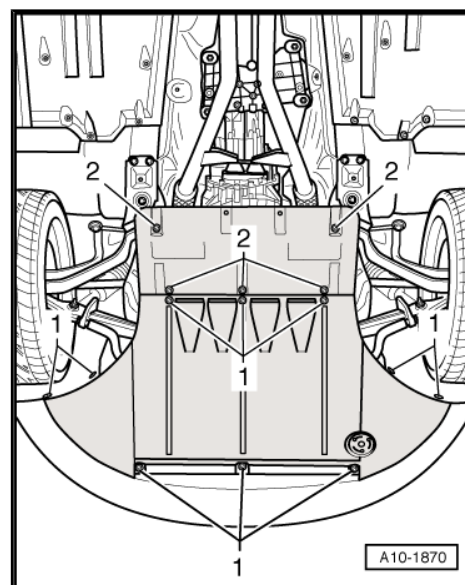


- Open filler cap on coolant expansion tank.
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.

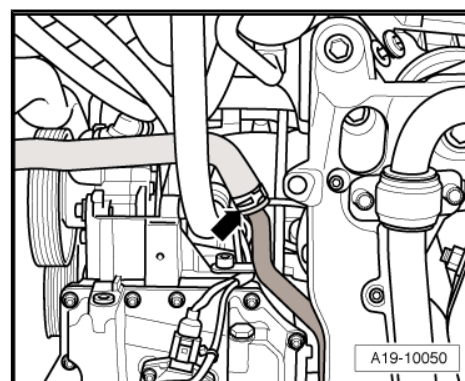
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- Open quick-release fasteners -1- and remove noise insulation (front).



- Place drip tray - V.A.G 1306- or drip tray - VAS 6208- under engine.
- Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.





- Disconnect coolant hose (bottom right) from auxiliary radiator -arrow- and drain off remaining coolant.

#### Filling



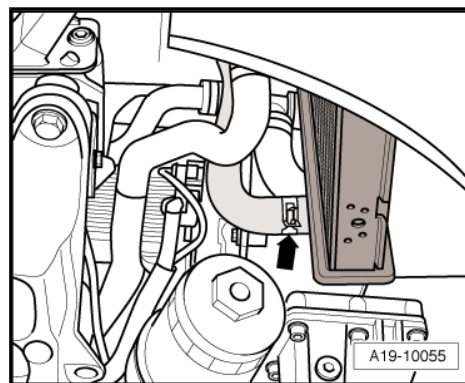
#### Caution

- ◆ *Always use cooling system charge unit - VAS 6096- when filling the cooling system. Otherwise, the automatic gear-box could malfunction.*



#### Caution

*Always use distilled water for mixing coolant additives as this ensures optimum corrosion protection.*



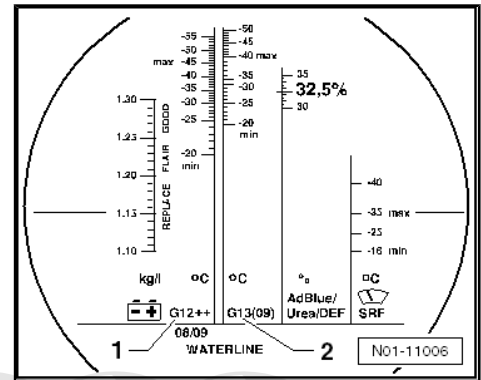
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### Note

- ◆ *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- ◆ *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- ◆ *Coolant with the recommended mixture ratio prevents frost and corrosion damage and stops scaling. At the same time it raises the boiling point of the fluid in the system. For this reason the cooling system must be filled all year round with the correct coolant additive.*
- ◆ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *The refractometer - T10007A- MUST be used to determine the current level of frost protection.*
- ◆ *The mixture must guarantee frost protection down to at least -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze should only be increased if greater frost protection is required in very cold climates. This must only be down to -48 °C, however, as otherwise the cooling efficiency of the coolant is impaired.*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be provided to at least -25 °C.*
- ◆ *Read off the level of frost protection on the scale for the relevant coolant additive.*
- ◆ *The temperature indicated on the refractometer - T10007A- corresponds to the temperature at which the first ice crystals can form in the coolant.*
- ◆ *Do not reuse coolant.*
- ◆ *Only use water/coolant additive as a lubricant for coolant hoses.*



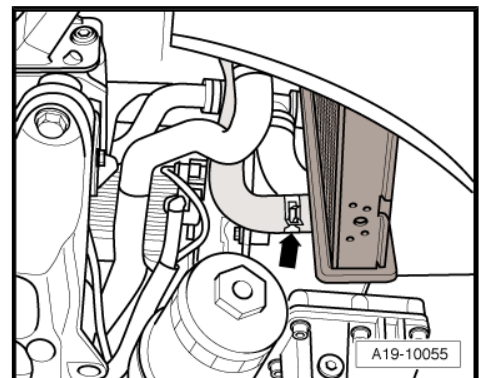
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### Conditions

- Ignition off.

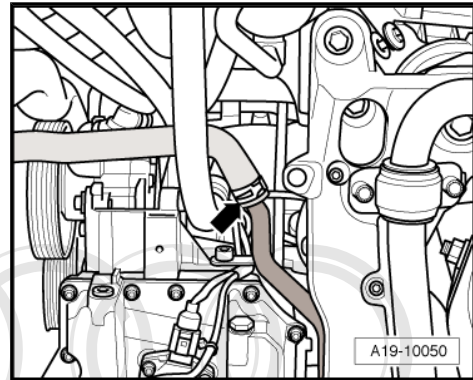
### Procedure

- Attach coolant hose (bottom right) at auxiliary radiator -arrow-.





- Attach coolant hose (bottom) at coolant pipe -arrow-.



- Fill reservoir - VAS 6096/1- with at least 15 litres of premixed coolant (based on recommended ratio):

- Coolant (40 %) and water (60 %) for frost protection to -25 °C
- Coolant (50 %) and water (50 %) for frost protection to -36 °C
- Coolant ⇒ Electronic parts catalogue

- Screw adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.

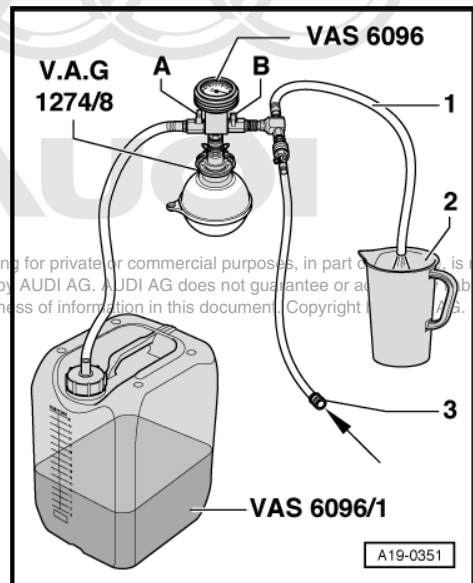
- Attach cooling system charge unit - VAS 6096- onto adapter - V.A.G 1274/8- .

- 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.

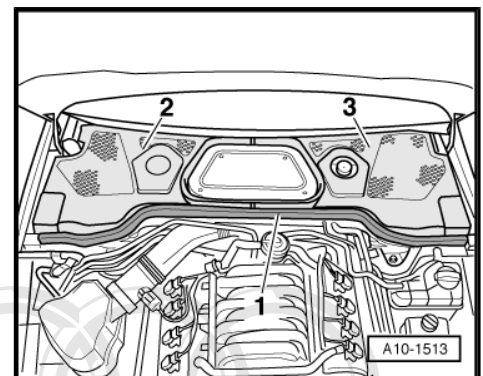
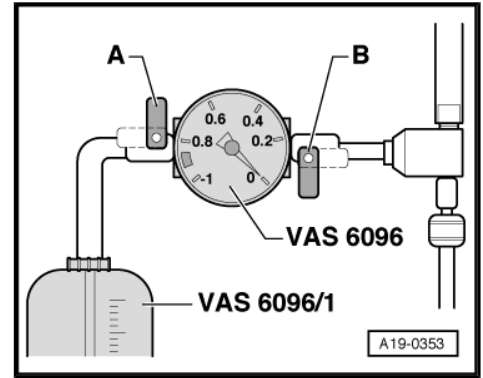
- Detach compressed air hose.
- Open valve -A-.

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.

- Detach cooling system charge unit - VAS 6096- from coolant expansion tank.
- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber cover -2-.

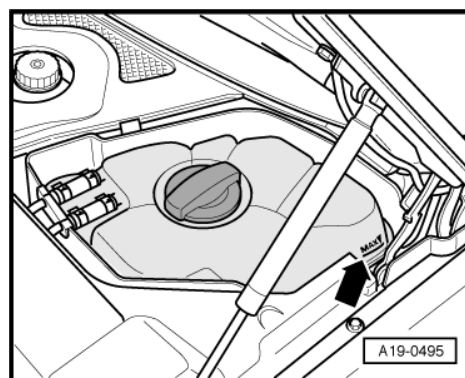
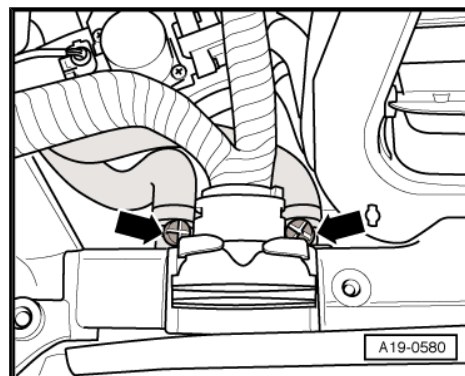
 **Note**

*Disregard -item 3-.*





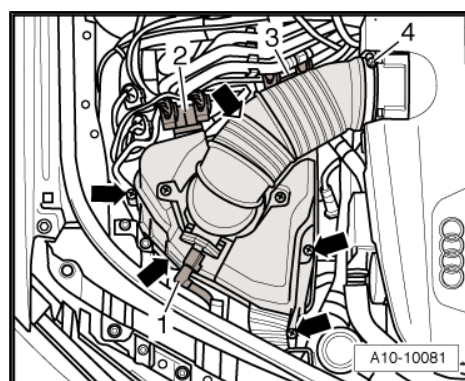
- Open bleeder screws -arrows-.
- Fill up with coolant until it flows out at bleeder holes in coolant hoses.
- Close the bleeder screws.
- Tighten filler cap on expansion tank.
- Make sure that the auxiliary heater is switched off.
- Start engine.
- Set heater/air conditioner on both sides to "HI".
- Run the engine for 3 minutes at 2000 rpm.
- Allow the engine to run at idling speed until the two large coolant hoses at main radiator become warm.
- Run the engine for 1 minute at 2000 rpm.
- Switch off ignition and allow engine to cool down.
- Check coolant level.
  - The coolant level must be at the MAX marking when the engine is cold.
  - The coolant level can be above the MAX marking when the engine is warm.
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension



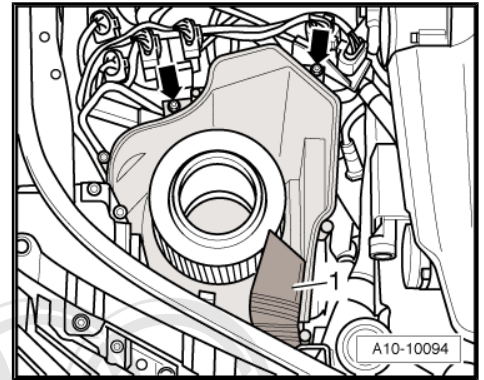
### 1.3 Removing and installing coolant pump

#### Removing

- Drain off coolant ⇒ [page 178](#) .
- Move lock carrier to service position ⇒ [page 45](#) .
- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



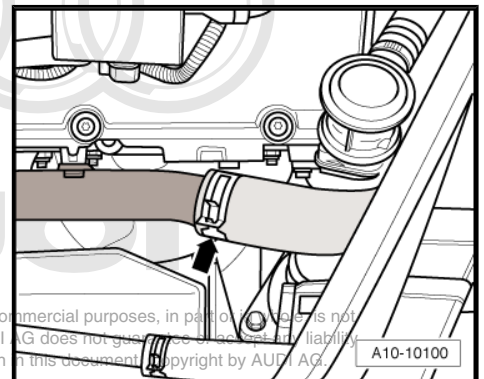
- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).



**i** Note

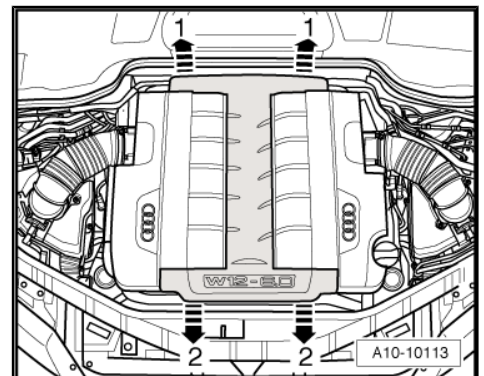
*Lay a cloth under the connection to catch escaping coolant.*

- Detach coolant hose (right-side) -arrow- at engine.



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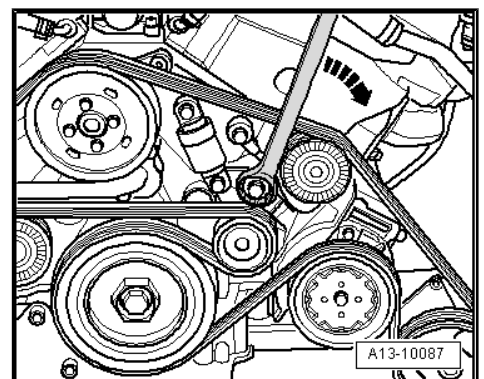
- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.



**i** Note

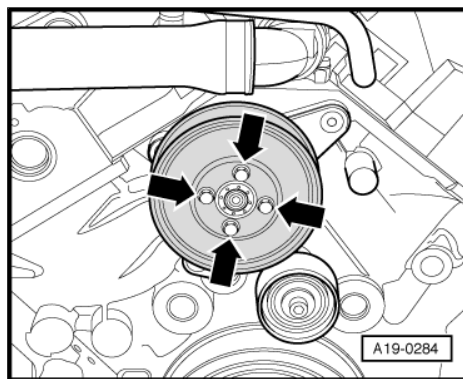
*Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.*

- Turn the tensioner in the direction of the -arrow- using a 30 mm ring spanner to slacken the poly V-belt.
- Remove poly V-belt and release tensioner.





- Unscrew bolts -arrows- and remove pulley.



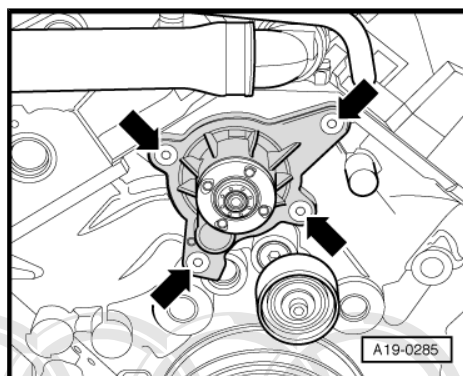
- Unscrew securing bolts -arrows- for coolant pump and remove coolant pump.

### Installing

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

 **Note**

- ◆ *Renew seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*



- Install poly V-belt ⇒ [page 57](#) .
- Install lock carrier with attachments ⇒ General body repairs, exterior; Rep. gr. 50 .
- Install front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Fill cooling system ⇒ [page 180](#) .
- Check headlight adjustment ⇒ Maintenance ; [Booklet 404](#) .

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### Tightening torques

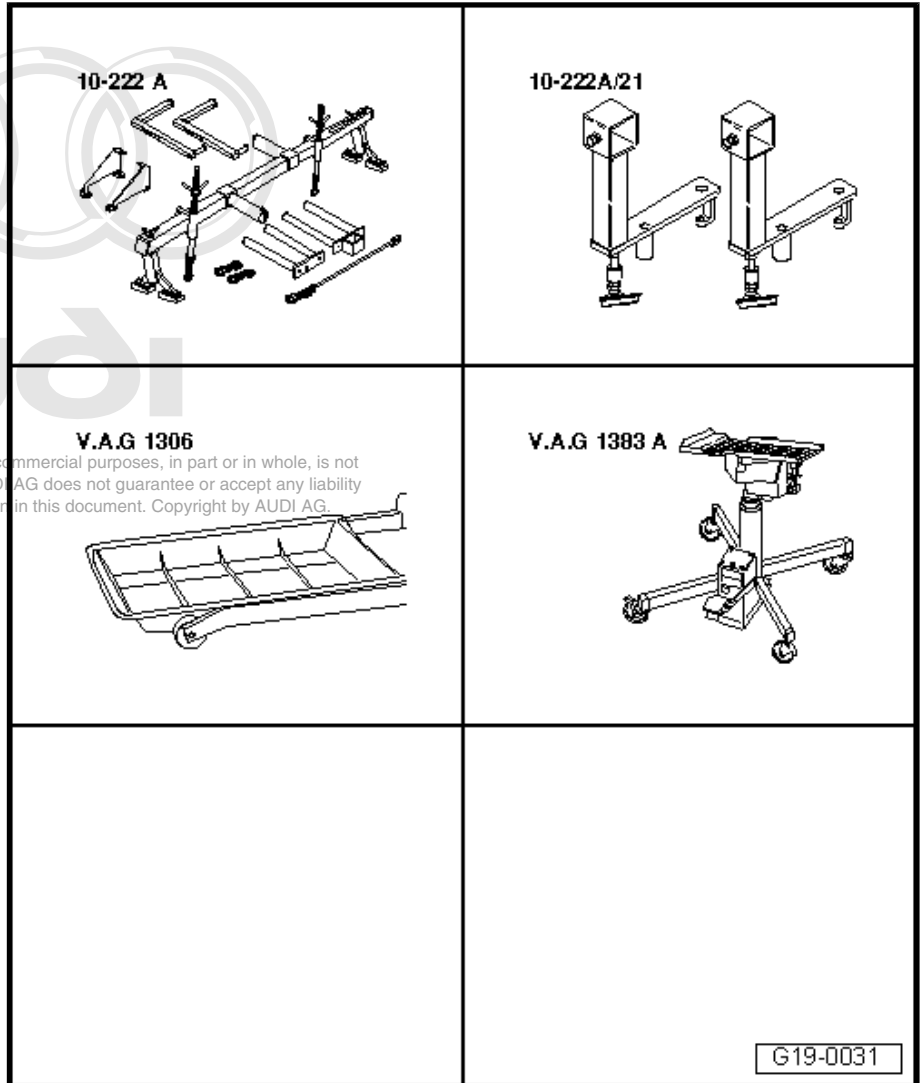
Component	Nm
Coolant pump to cylinder block	10
Pulley to coolant pump	8

## 1.4 Removing and installing continued coolant circulation pump - V51-



**Special tools and workshop equipment required**

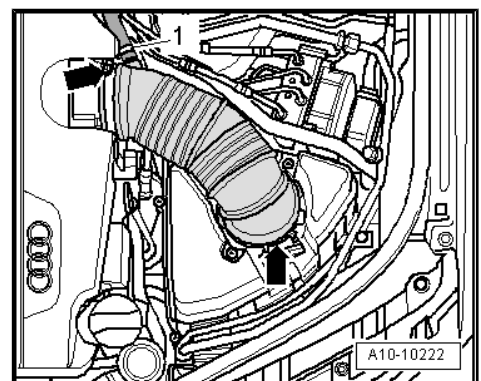
- ◆ Support bracket - 10-222 A-
- ◆ Support - 10-222 A/21-
- ◆ Drip tray - V.A.G 1306- or drip tray - VAS 6208-
- ◆ Engine and gearbox jack - V.A.G 1383 A-



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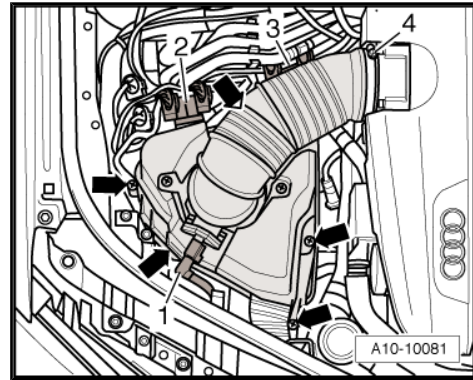
**Removing**

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Detach hose -1- from air intake hose.
- Remove air hose (left-side) -arrows-.





- Detach electrical connector -1- for air mass meter - G70- (right-side) at air cleaner housing.
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).

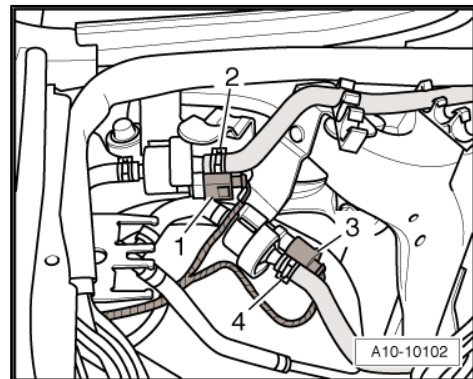


- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system - N80- .

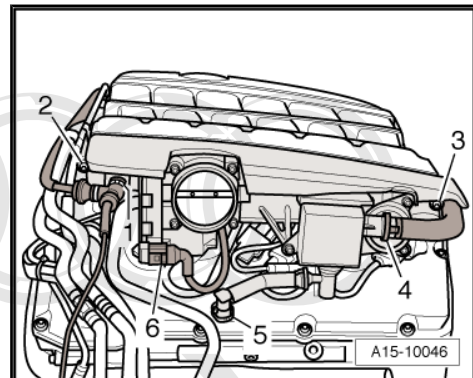


**Note**

*Disregard items -1 ... 3-.*



- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect crankcase breather hoses -4- and -5-.
- Remove bolts -2- and -3-.
- Remove right section of intake manifold.



- Remove cover above coolant expansion tank -arrows-.

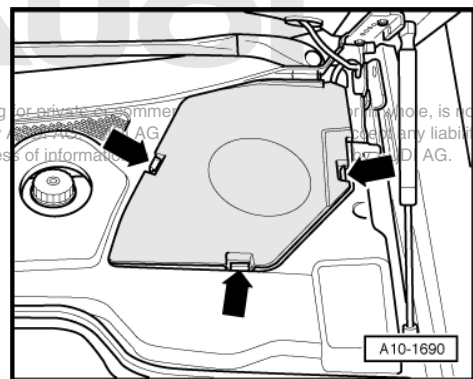


**WARNING**

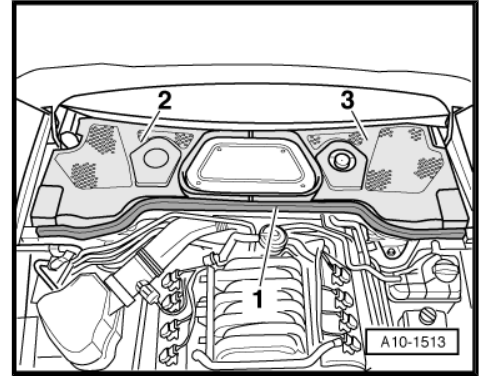
**Hot steam or hot coolant can escape when coolant expansion tank is opened; cover filler cap with cloth and open carefully.**

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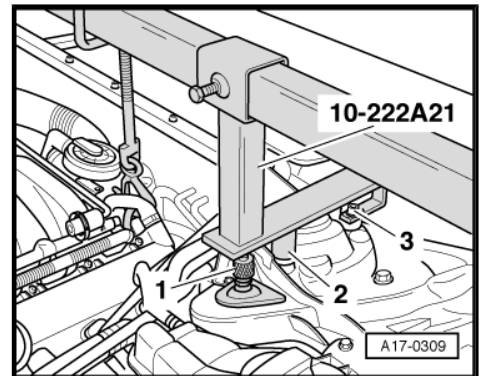
- Open filler cap on coolant expansion tank.



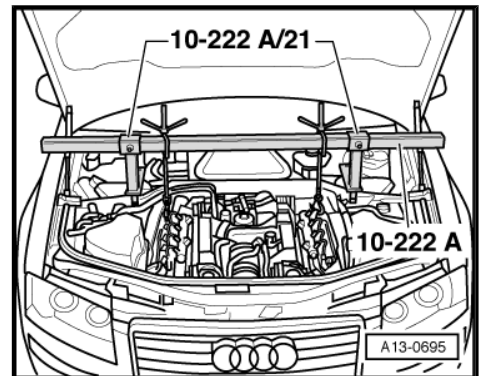
- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



- Unclip fuel lines from retainer at suspension turret.
- Unscrew rear bolts -3- for body brace.
- Attach the support bracket - 10-222 A- with support - 10-222 A/21- onto the suspension turrets.
  - Supports are marked for left and right side of vehicle.
  - The centre resting point -2- of supports is positioned on front bolts for body brace.
  - The supports - 10-222 A/21- are attached to rear securing bolts -3- for body brace.
  - The knurled screw -1- must be screwed down until support plate rests on suspension turret.



- Secure spindles of support bracket - 10-222 A- to rear engine lifting eyes.
- Take up weight of engine on spindles of support bracket (considerable weight has to be supported).

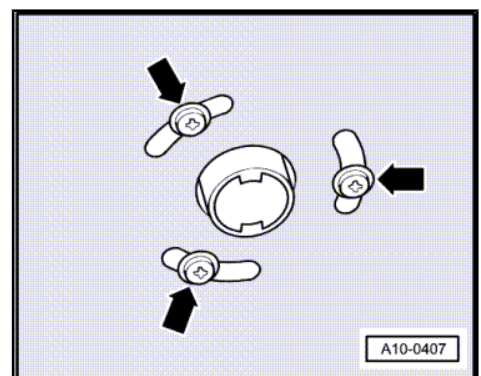


- Remove both front wheels.

**i** Note

Secure brake discs with wheel bolts.

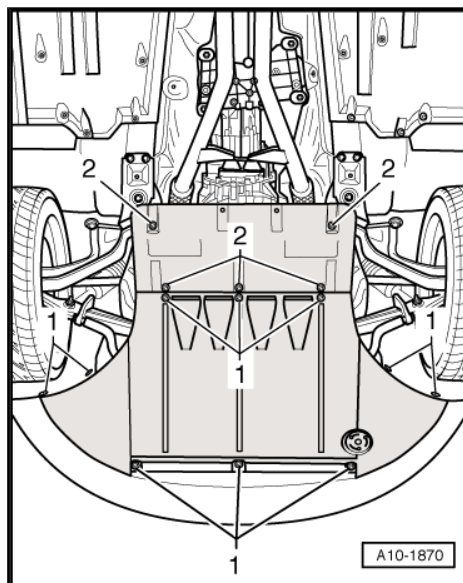
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



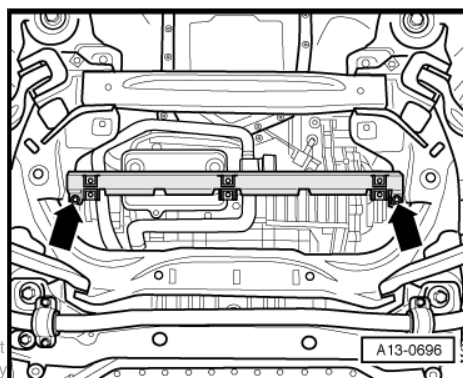
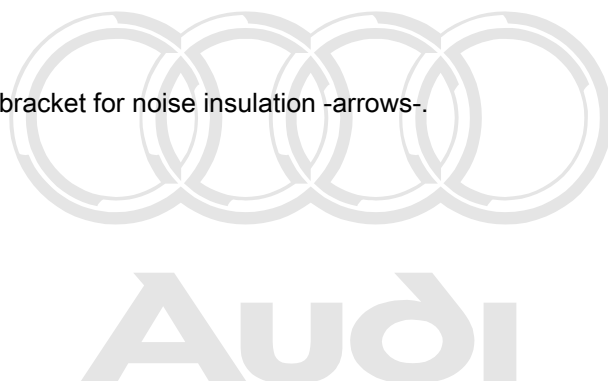
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- Release quick-release fasteners -1- and -2- and take off noise insulation panels.

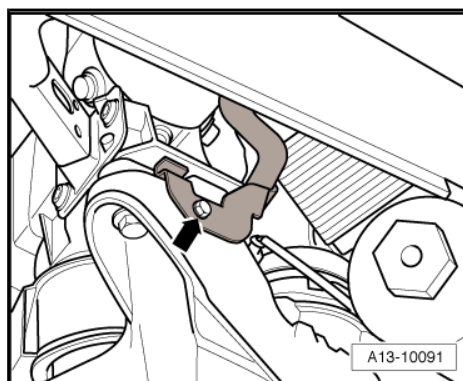


- Unbolt bracket for noise insulation -arrows-.



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- Unscrew bolt -arrow- at bottom on coolant pipe (right-side).

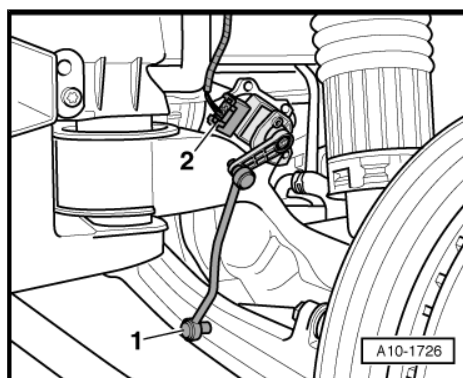


- Unplug electrical connector -2- at vehicle level sender (left and right).

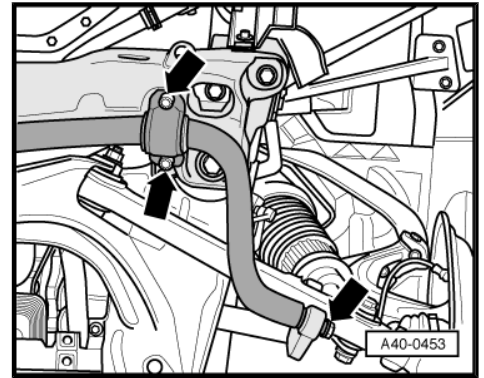


**Note**

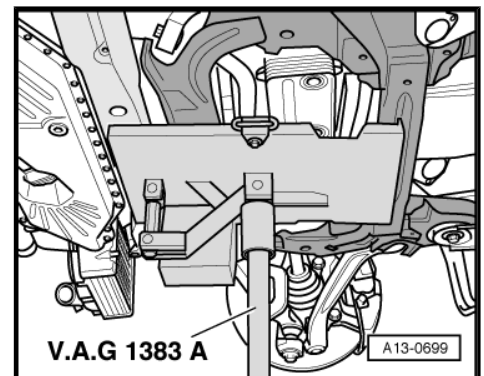
*Disregard -item 1-.*



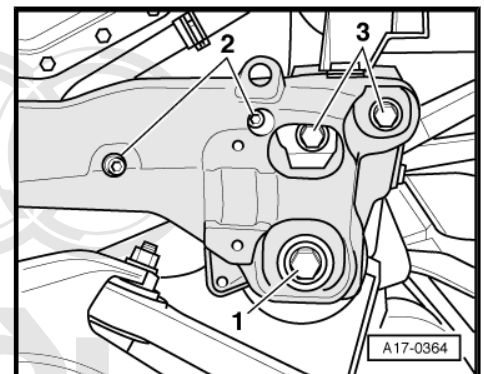
- Unscrew bolts (left and right) -arrows- evenly.
- Take out anti-roll bar.



- Support engine cross member and subframe using engine and gearbox jack - V.A.G 1383 A- as shown in illustration.



- Unscrew bolts -2- and -3- on both sides of vehicle.
- Then unscrew bolts -1- alternately on both sides of the vehicle.
- Take out engine cross member.



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- Place drip tray - V.A.G 1306- or drip tray - VAS 6208- under engine.
- Disconnect coolant hoses -2- and -3- at continued circulation coolant pump - V51- and drain off coolant.
- Unplug electrical connector -1-.
- Remove bolt -arrow-.
- Remove continued circulation coolant pump - V51- .

### Installing

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



### Note

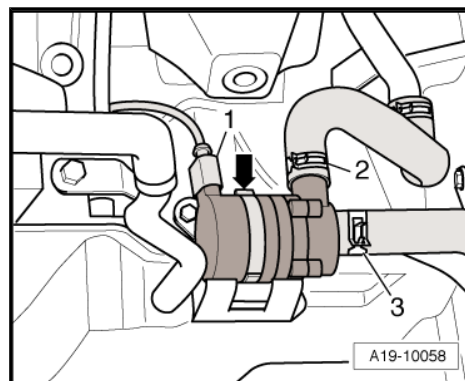
Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .

- Install subframe ⇒ Running gear front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install anti-roll bar ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install right-side section of intake manifold: vehicles in rest-of-world ⇒ [page 104](#) ; USA vehicles ⇒ [page 113](#) .
- Install body brace ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Fill cooling system ⇒ [page 180](#) .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

### Tightening torques


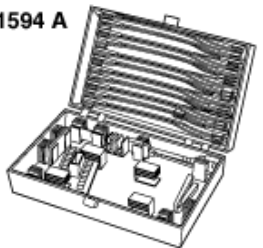
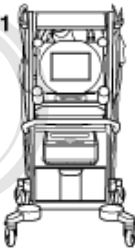
Component	Nm
Continued coolant circulation pump - V51- to engine	10
Engine mounting to engine cross member	23
Engine cross member to longitudinal member	68
Coolant pipe (bottom) to engine cross member	10
Bracket for noise insulation to subframe	10

## 1.5 Checking thermostat



**Special tools and workshop equipment required**

- ◆ Hand-held multimeter - V.A.G 1526 A-
- ◆ Auxiliary measuring set - V.A.G 1594 A-
- ◆ Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead - VAS 5051/5A-

<p>V.A.G 1526 A</p> 	<p>V.A.G 1594 A</p> 
<p>VAS 5051</p> 	
	<p>G19-0027</p>

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**Test condition**

- Engine cold.

**Testing internal resistance of heating element**

**i** Note

*The map-controlled engine cooling thermostat - F265- and the wiring connections are monitored by the engine control unit.*



- Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead - VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system "01 - Engine electronics" is selected. When doing this, the ignition must be switched on.
- Read out event memory of engine control unit.

If a fault is displayed concerning the map-controlled engine cooling thermostat - F265- :



- Carefully lift off engine cover panel first at rear and then in middle -arrows 1-.
- Then pull engine cover panel forwards off intake manifold -arrows 2-.

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- Unplug the 2-pin electrical connector -arrow- at map-controlled engine cooling thermostat - F265- .



**Note**

*Electrical connector is shown in illustration with intake manifold removed.*

- Connect multimeter to thermostat to measure resistance.
- Specification: 14 ... 16 Ω at a temperature of 25 °C.

If specification is not obtained:

- Renew map-controlled engine cooling thermostat - F265- ⇒ [page 194](#) .

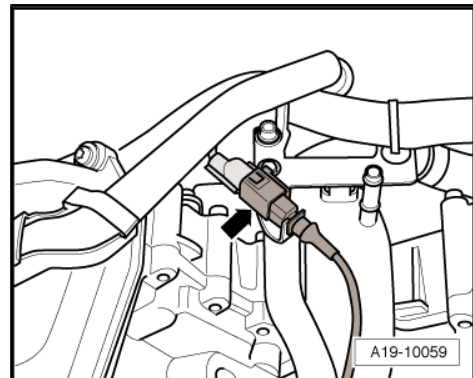
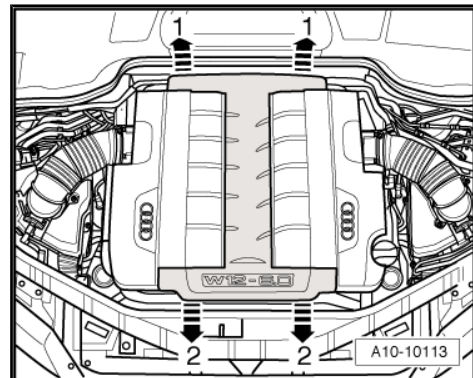
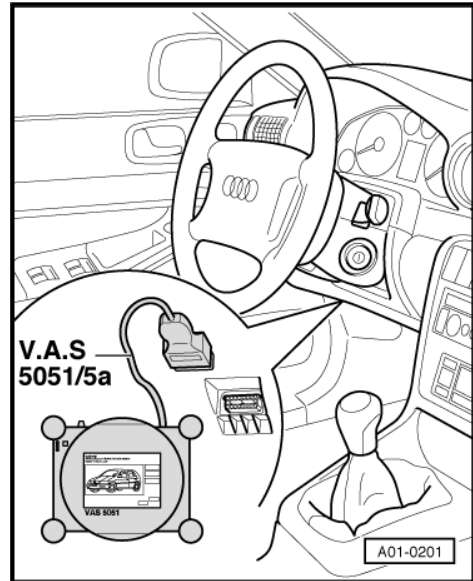
If specification is obtained:

- Use current flow diagram to check wiring.

## 1.6 Removing and installing thermostat

### Removing

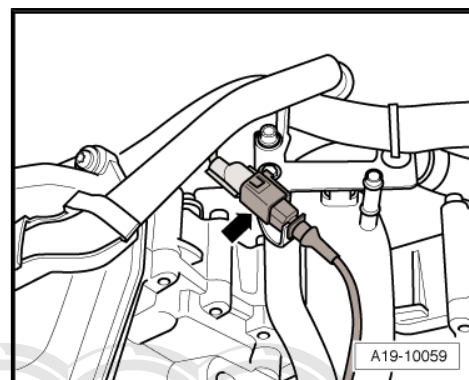
- Drain off coolant ⇒ [page 178](#) .



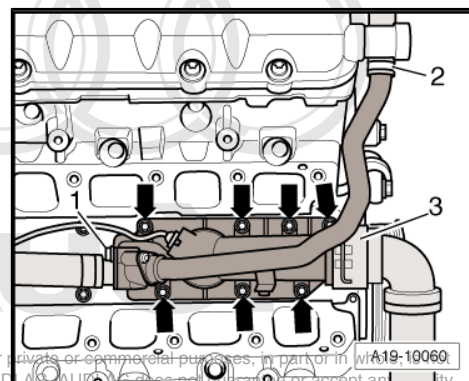


**i** Note

- ◆ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- ◆ The coolant must be completely drained, otherwise there is a danger of coolant entering into intake ports.
- Remove top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Remove bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Unplug electrical connector -arrow-.
- Move wiring clear.



- Detach coolant hoses -2- and -3-.
- Unscrew bolt -1- and remove pipe connection at housing.
- Unscrew bolts -arrows- and remove thermostat housing.



**Installing**

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

**i** Note

- ◆ Renew gaskets, seals and O-rings.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue* .
- ◆ Fit all cable ties in the original positions when installing.
- Install bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Install top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Fill cooling system ⇒ [page 180](#) .

**Tightening torques**

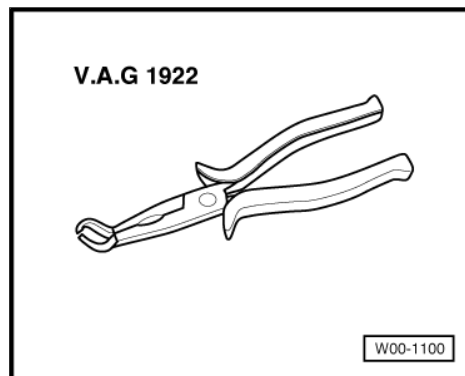
Component	Nm
Thermostat housing to cylinder block	8
Coolant pipe to thermostat housing	8

## 1.7 Removing and installing coolant pipe (top)

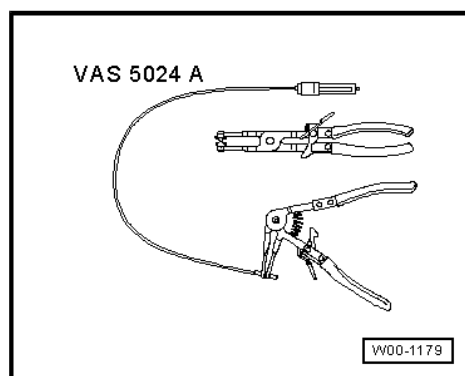
Special tools and workshop equipment required



- ◆ Spark plug connector pliers - V.A.G 1922-



- ◆ Spring type clip pliers - VAS 5024 A-



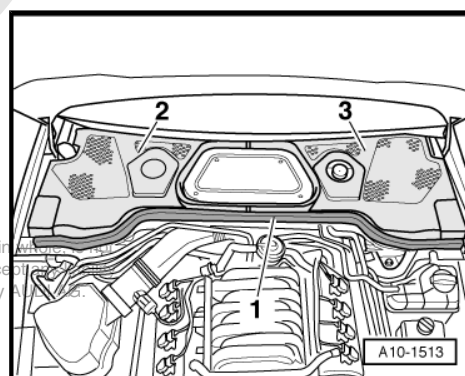
## Removing



### Note

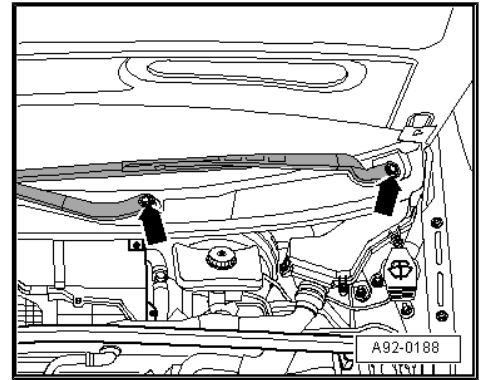
*All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

- Drain off coolant ⇒ [page 178](#) .
- Remove top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Remove bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



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- 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 hexagon nuts and take off wiper arms.

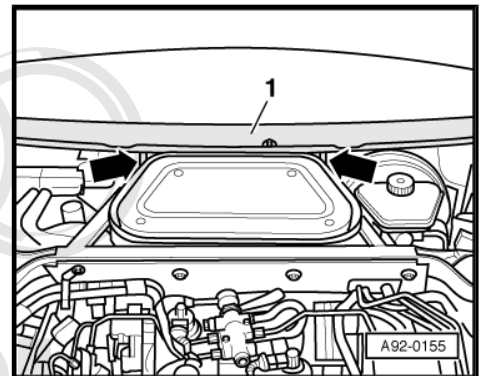


- Remove dust/pollen filter; to do so, open the four quick-release fasteners.

**i** Note

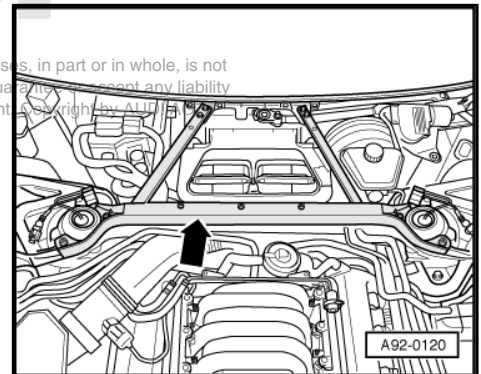
*Cover air duct at air conditioner housing with clean cloth to prevent anything falling in.*

- Remove bolts -arrows- for cowl panel trim -1- on both sides.
- Carefully pull cowl panel trim off retainer at windscreen.



- Unscrew body brace -arrow-.

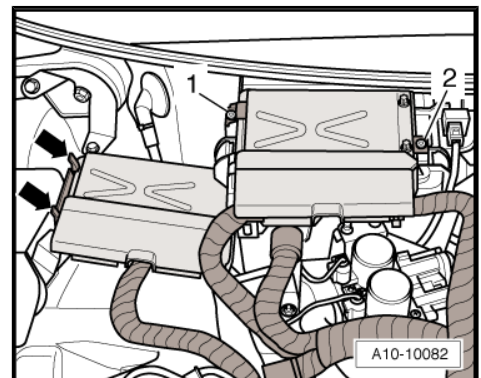
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- Unscrew bolts -1- and -2- and detach retaining clips.
- Release retaining tabs -arrows- and detach both engine control units.

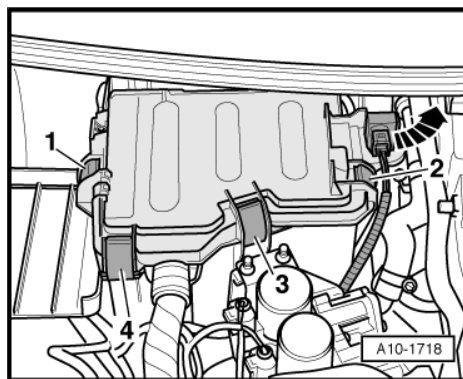
**i** Note

*The electrical wires remain connected.*

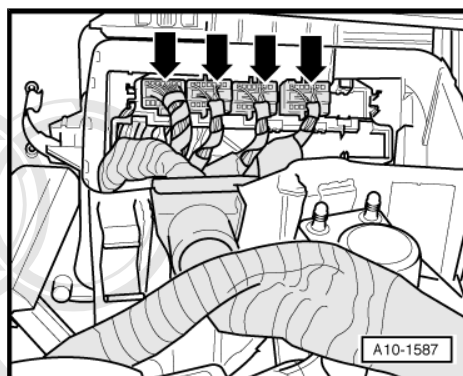




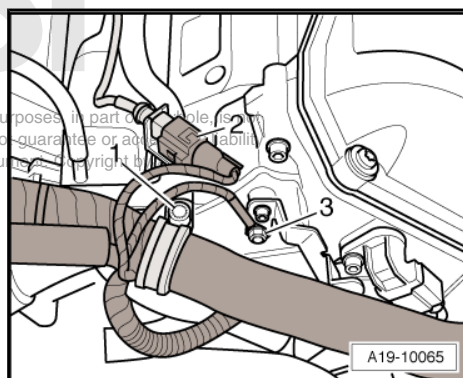
- Turn air quality sensor - G238- approx. 90° anti-clockwise -arrow- and remove from retainer.
- Release retaining clips -1 ... 4-.
- Open electronics box (plenum chamber) cover slightly and pull off to front.



- Disconnect the electrical multi-pin connectors -arrows- using spark plug connector pliers - V.A.G 1922- .
- Detach engine wiring harness at electronics box and at bulk-head.
- Place engine control units with wiring harness attached on top of engine.



- Unplug connector -2- for map-controlled engine cooling thermostat - F265- .
- Move wire clear.
- Unbolt earth cable -3- at cylinder head.
- Unbolt wiring clamp -1- and remove wiring harness from coolant pipe.



**Note**

*Shown from rear for illustration purposes.*

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- Remove bolts -1 ... 3-
- Detach coolant hoses at coolant pipe -arrows-

**i** Note

*Shown from rear for illustration purposes.*

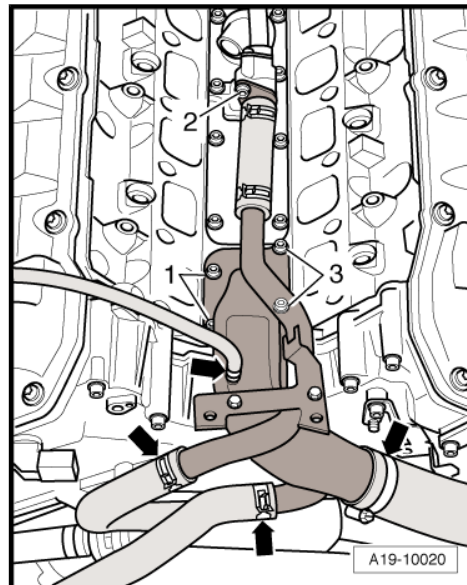
- Remove coolant pipe.

**Installing**

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

**i** Note

- ◆ *Renew seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install body brace ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install and adjust wiper arms ⇒ Electrical system; Rep. gr. 92 .
- Install bottom section of intake manifold: vehicles in rest-of-world ⇒ [page 108](#) ; USA vehicles ⇒ [page 118](#) .
- Install top section of intake manifold: vehicles in rest-of-world ⇒ [page 105](#) ; USA vehicles ⇒ [page 115](#) .
- Fill cooling system ⇒ [page 180](#) .



**Tightening torques**

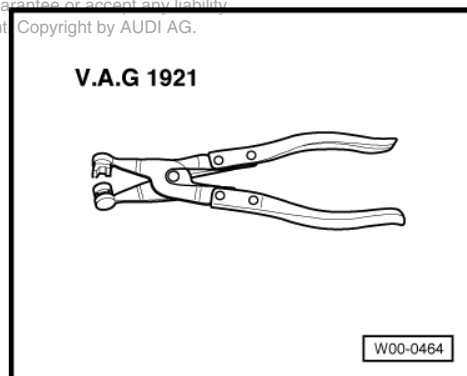
Component	Nm
Coolant pipe to engine	10
Coolant pipe to thermostat housing	10
Earth cable to cylinder head	10
Retaining clip to coolant pipe	10

**1.8 Removing and installing coolant pipe (top left)**

**Special tools and workshop equipment required**

- ◆ Hose clip pliers - V.A.G 1921

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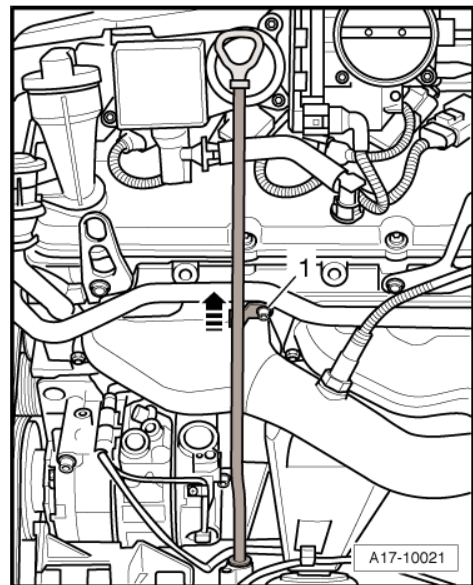


### Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131- .
- Remove bolt -1-.
- Pull the guide tube for oil dipstick out upwards -arrow-.



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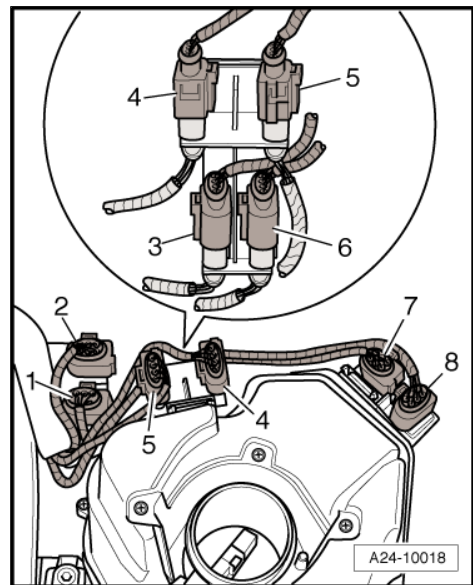
- Unplug electrical connector -2- for Lambda probe 4 - G286- .



#### Note

*Ignore other items.*

- Move electrical wiring to Lambda probe clear.

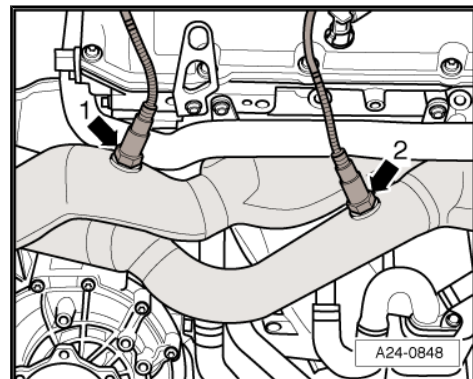


- Unscrew Lambda probe 4 - G286- -arrow 2- using Lambda probe open ring spanner set - 3337- .



#### Note

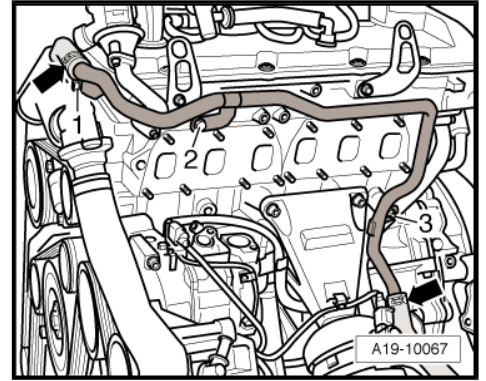
*Disregard -arrow 1-.*



- Disconnect the coolant hoses -arrows- at the coolant pipe (top left).
- Unscrew bolts -1- and -2- and nut -3-.
- Remove coolant pipe (top left) upwards.

**i** Note

*Shown in illustration with exhaust manifolds / catalytic converters removed.*



**Installing**

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

**i** Note

*Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- Install Lambda probe 4 - G286- ⇒ Rep. gr. 24 .
- Install engine/gearbox assembly ⇒ [page 32](#) .

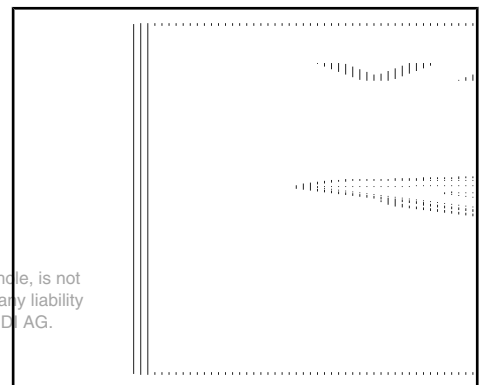
**Tightening torques**

Component		Nm
Coolant pipe	M6	10
to engine	M8	20
Guide tube for dipstick to cylinder head		10

**1.9 Removing and installing coolant pipe (bottom left)**

**Special tools and workshop equipment required**

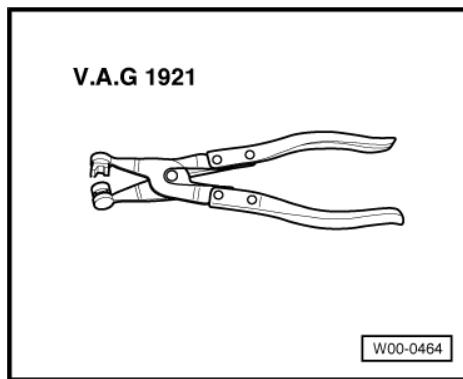
- ◆ Drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306-



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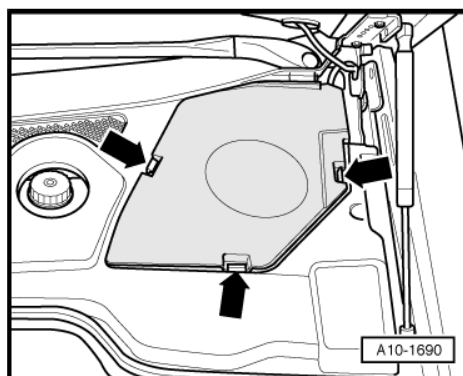



◆ Hose clip pliers - V.A.G 1921-



**Removing**

- Activate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Remove cover above coolant expansion tank -arrows-.

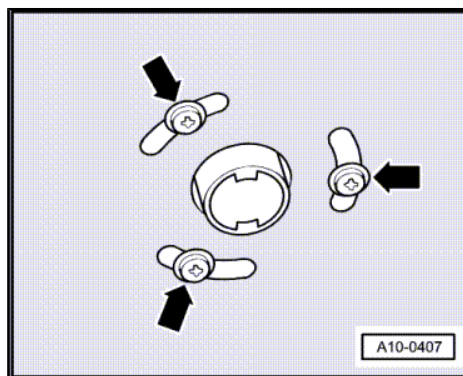




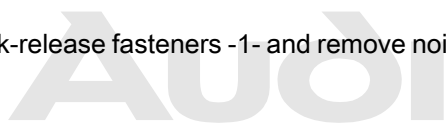
**WARNING**

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

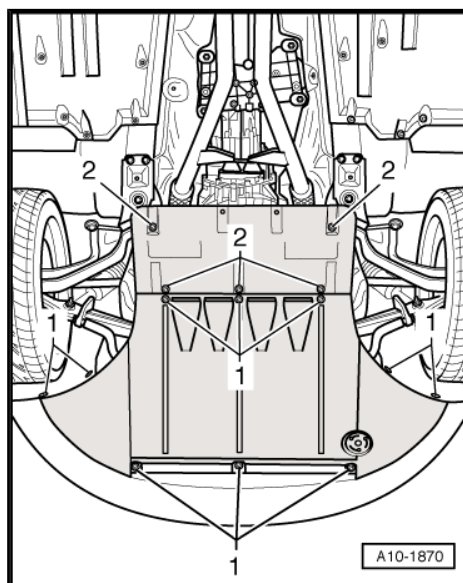
- Open filler cap on coolant expansion tank.
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



- Open quick-release fasteners -1- and remove noise insulation (front).

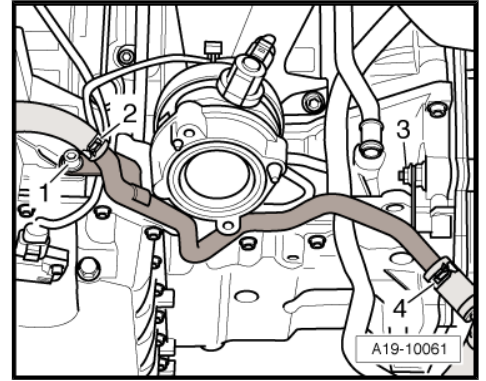


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- Place drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306- under engine.
- Disconnect coolant hose -2- from coolant pipe (bottom left) and drain off coolant.
- Remove bolt -1- and nut -3-.
- Detach coolant pipe (bottom left) from coolant hose -4-.



### Installing

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

#### Note

*Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- Fill cooling system ⇒ [page 180](#) .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

### Tightening torques

Component		Nm
Coolant pipe to engine	M6	10
	M8	20

## 1.10 Removing and installing coolant pipe (front right)

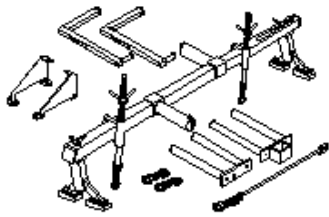
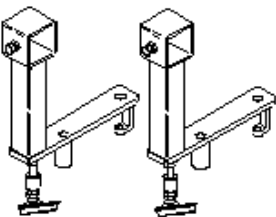
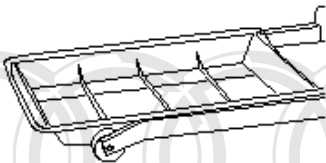
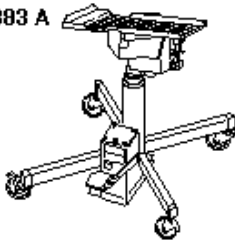


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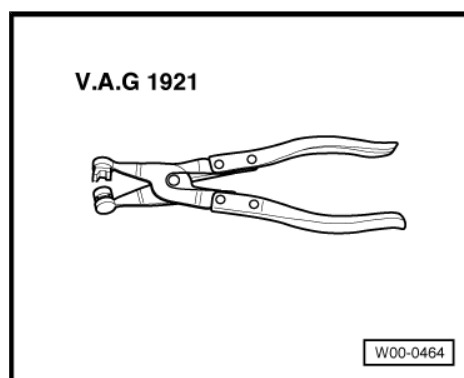


**Special tools and workshop equipment required**

- ◆ Support bracket - 10-222 A-
- ◆ Support - 10-222 A/21-
- ◆ Drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208-
- ◆ Engine and gearbox jack - V.A.G 1383 A-

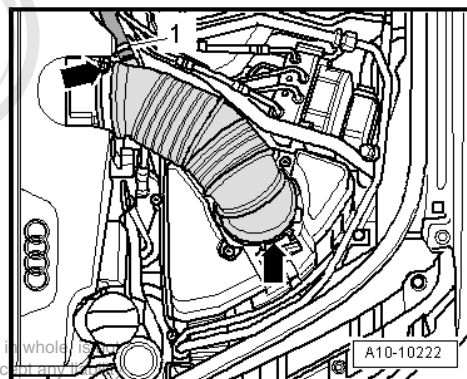
<p><b>10-222 A</b></p> 	<p><b>10-222A/21</b></p> 
<p><b>V.A.G 1306</b></p> 	<p><b>V.A.G 1383 A</b></p> 
<p style="text-align: center;"><b>Audi</b></p> <p style="text-align: center;">Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised 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.</p> <p style="text-align: right;">G19-0031</p>	

- ◆ Hose clip pliers - V.A.G 1921-

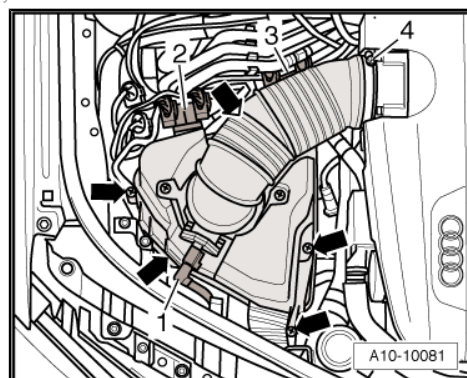


## Removing

- Detach hose -1- from air intake hose.
- Remove air hose (left-side) -arrows-.



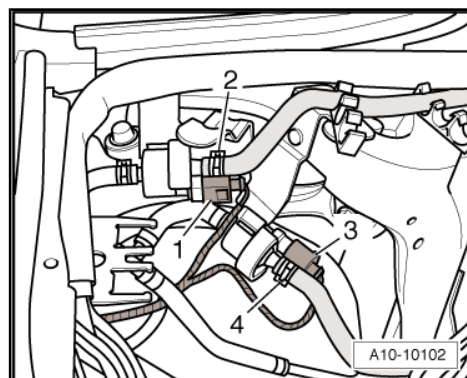
- Detach electrical connector -1- for air mass meter - G70- (right-side) at air cleaner housing.
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



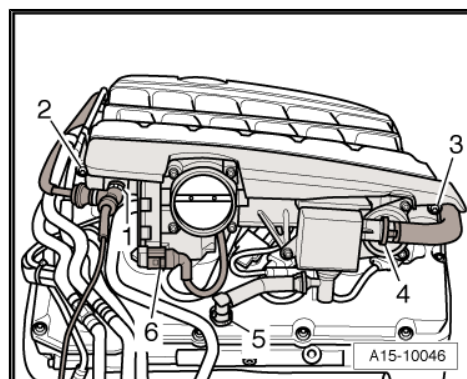
- Detach vacuum hose -4- at solenoid valve 1 for activated charcoal filter system - N80- .

### Note

*Disregard items -1 ... 3-.*



- Unplug electrical connector -6- at throttle valve module - J338- .
- Unplug vacuum hose -1-.
- Disconnect hoses for crankcase breather system -4- and -5-.
- Remove bolts -2- and -3-.
- Remove right section of intake manifold.



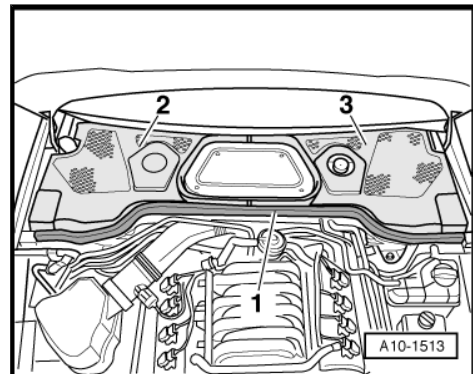
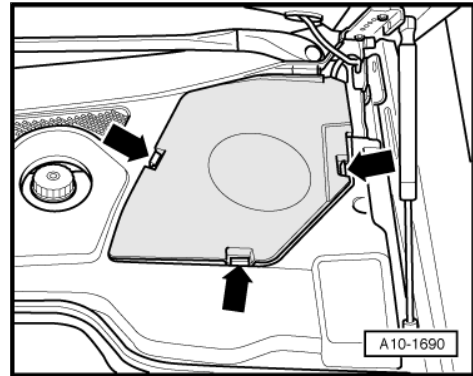


- Remove cover above coolant expansion tank -arrows-.

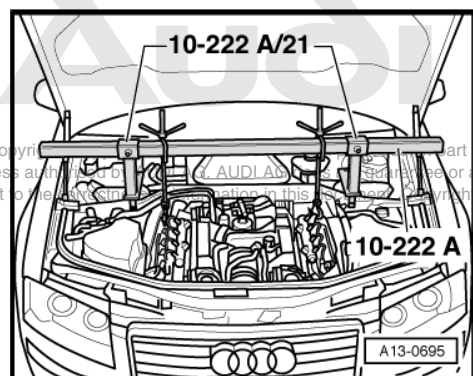
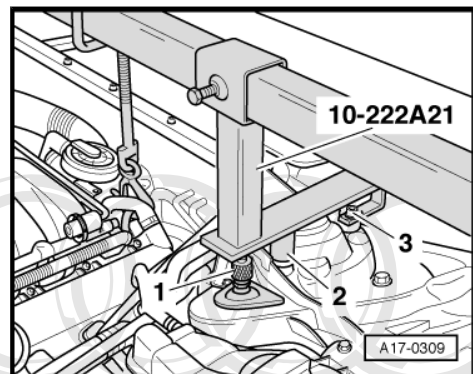
**WARNING**

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

- Open filler cap on coolant expansion tank.
- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



- Unclip fuel lines from retainer at suspension turret.
- Unscrew rear bolts -3- for body brace.
- Attach the support bracket - 10-222 A- with support - 10-222 A/21- onto the suspension turrets.
- Supports are marked for left and right side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The supports - 10-222 A/21- are attached to rear securing bolts -3- for body brace.
- The knurled screw -1- must be screwed down until support plate rests on suspension turret.
- Secure spindles of support bracket - 10-222 A- to rear engine lifting eyes.
- Partly take up weight of engine with spindles of support bracket.



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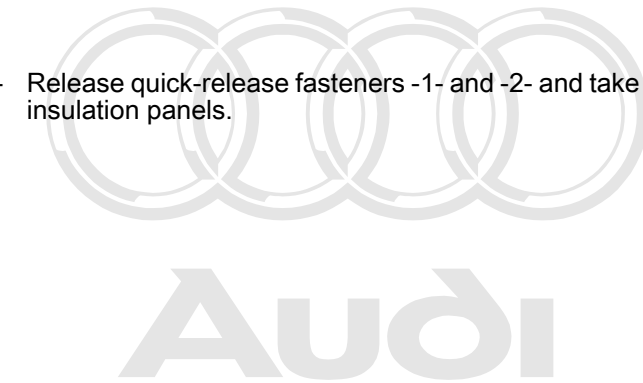
- Remove both front wheels.

**i** Note

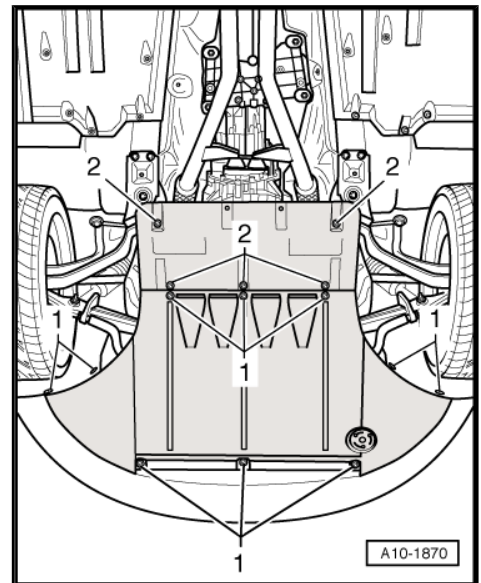
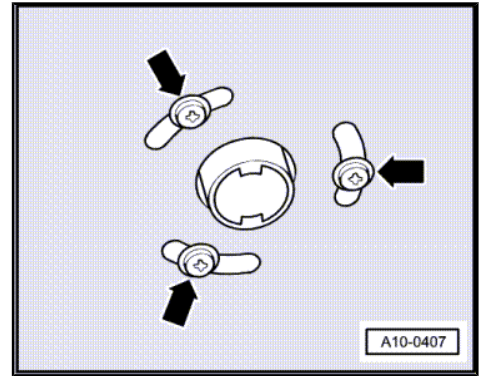
Secure brake discs with wheel bolts.

- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.

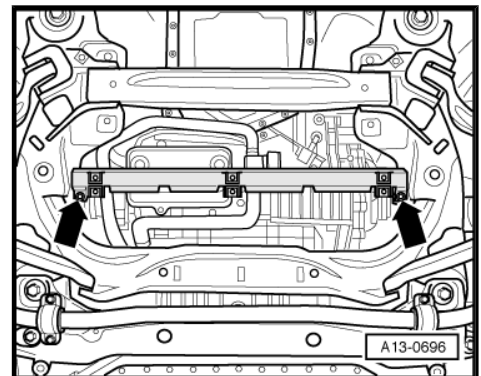
- Release quick-release fasteners -1- and -2- and take off noise insulation panels.



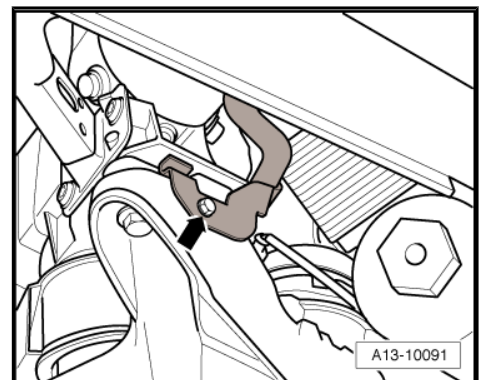
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- Unbolt bracket for noise insulation -arrows-.



- Unscrew bolt -arrow- at bottom on coolant pipe (right-side).





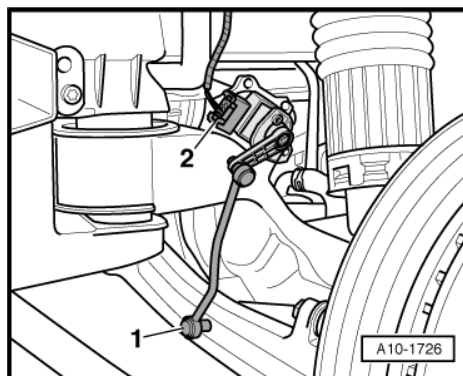
- Unplug electrical connector -2- at vehicle level sender (left and right).



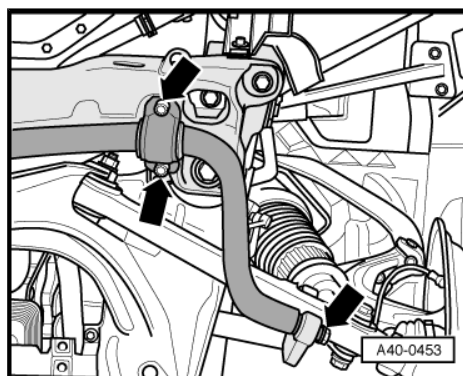
**Note**

*Disregard -item 1-.*

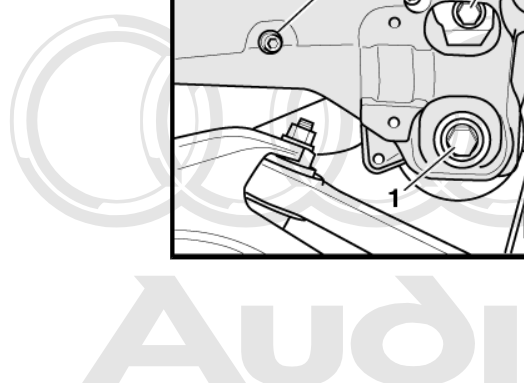
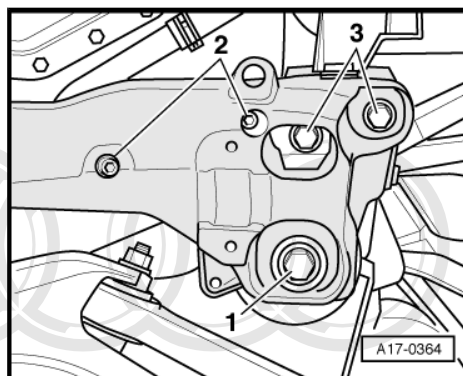
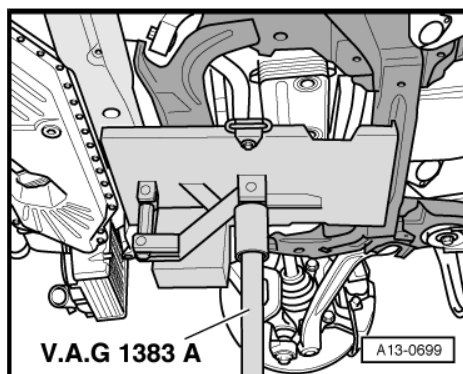
- Unscrew bolts -arrows- evenly on both sides of vehicle.
- Take out anti-roll bar.



- Support engine cross member and subframe using engine and gearbox jack - V.A.G 1383 A- as shown in illustration.



- Unscrew bolts -2- and -3- on both sides of vehicle.
- Then unscrew bolts -1- alternately on both sides of the vehicle.
- Take out engine cross member.



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- Place drip tray - V.A.G 1306- or drip tray for workshop hoist - VAS 6208- under engine.
- Disconnect coolant hose -2- from coolant pipe and drain off coolant.
- Detach coolant pipe from coolant hose -1-.

 **Note**

*Disregard -arrow-.*

**Installing**

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

 **Note**

*Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- Install subframe ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install anti-roll bar ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install right-side section of intake manifold: vehicles in rest-of-world ⇒ [page 104](#) ; USA vehicles ⇒ [page 113](#) .
- Install body brace ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Fill cooling system ⇒ [page 180](#) .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

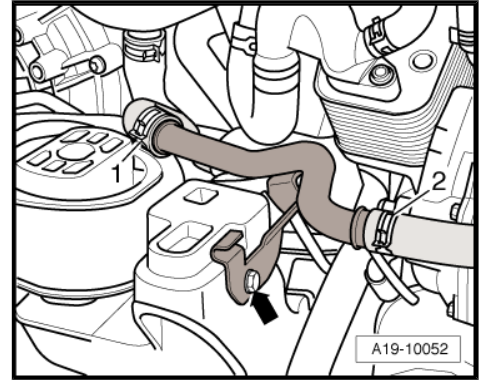
**Tightening torques**

Component	Nm
Engine mounting to engine cross member	23
Engine cross member to longitudinal member	68
Coolant pipe (bottom) to engine cross member	10
Bracket for noise insulation to subframe	10

**1.11 Removing and installing coolant pipe (top right)**

**Removing**

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131- .



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- Unscrew bolts -1- and -2- for coolant pipe (top right).
- Loosen the hose clips -arrows-, pivot the coolant pipe upwards and remove.

### Installing

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



#### Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue* .

- Install engine/gearbox assembly ⇒ [page 32](#) .

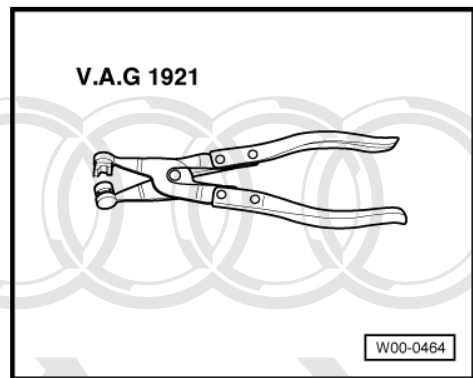
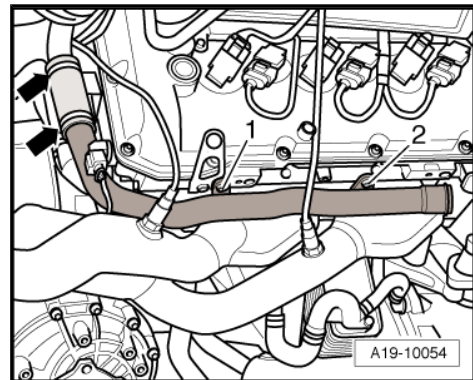
### Tightening torque

Component	Nm
Coolant pipe (top right) to cylinder head	20

## 1.12 Removing and installing coolant pipe (centre right)

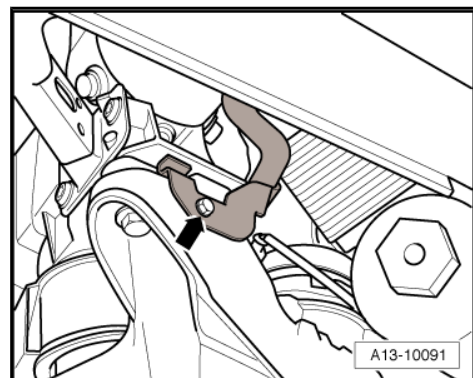
### Special tools and workshop equipment required

- ◆ Hose clip pliers - V.A.G 1921-



### Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131- .
- Remove exhaust manifolds with catalytic converters (right side) ⇒ [page 234](#) .
- Unscrew bolt -arrow- at bottom on coolant pipe (front right).



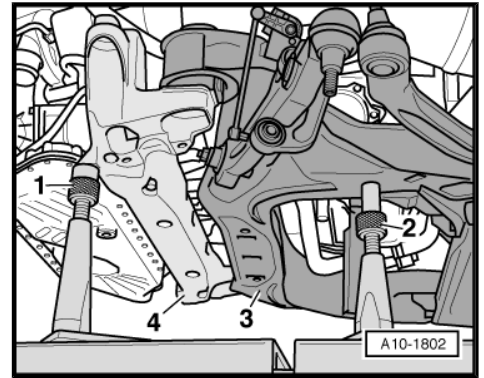
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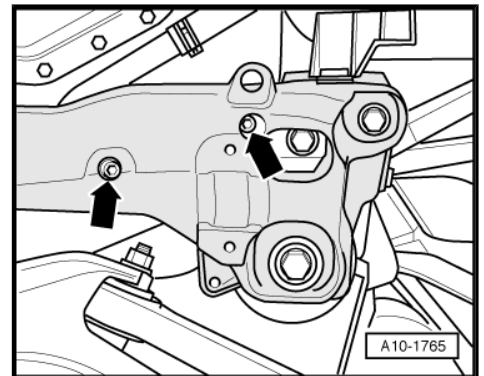
- Screw down spindles of support elements -1- (left and right) at engine cross member -4- as far as possible.

**i** Note

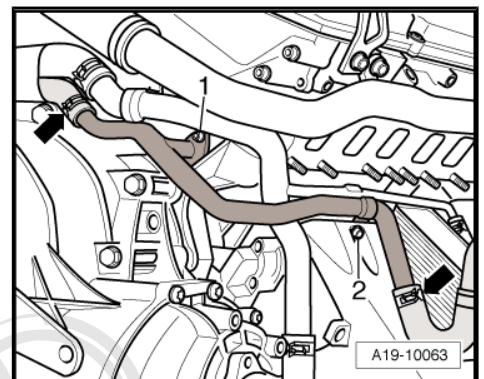
*Disregard items -2- and -3-.*



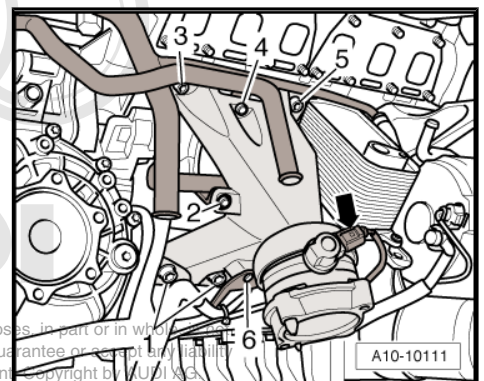
- Remove bolts -arrows- for engine mounting (left and right-side)
- Take out engine cross member.



- Disconnect coolant hoses -arrows- at coolant pipe (bottom right).
- Remove bolts -1- and -2-.
- Pull coolant pipe (bottom right) off cylinder head towards rear.



- Unplug electrical connector -arrow- at engine mounting (right-side).
- Remove bolts -1 ... 6-.
- Remove engine support with engine mounting.



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- Remove bolt -1-.
- Detach coolant pipe (centre right) from coolant hoses at the connections marked with -arrows-.

### Installing

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



#### Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue* .

- Install coolant pipe (bottom right) ⇒ [page 213](#) .
- Install exhaust manifolds with catalytic converters (right-side) ⇒ [page 235](#) .
- Install engine/gearbox assembly ⇒ [page 32](#) .

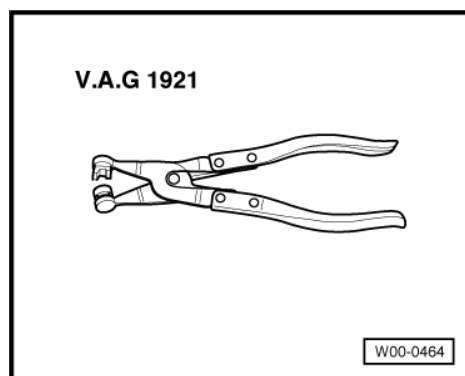
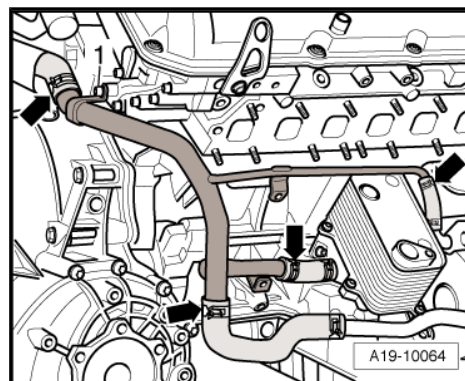
### Tightening torque

Component	Nm
Coolant pipe (right-side, centre) to cylinder head	10

## 1.13 Removing and installing coolant pipe (bottom right)

### Special tools and workshop equipment required

- ◆ Hose clip pliers - V.A.G 1921-



### Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131- .
- Remove exhaust manifolds with catalytic converters (right-side) ⇒ [page 234](#) .



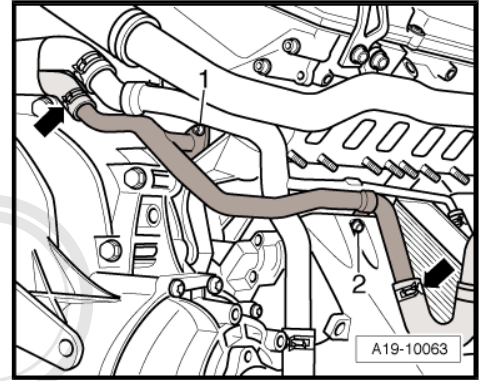
- Disconnect coolant hoses -arrows- at coolant pipe.
- Remove bolts -1- and -2-.
- Pull coolant pipe off cylinder head towards rear.

**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 exhaust manifolds with catalytic converters (right-side) => [page 235](#) .
- Install engine/gearbox assembly => [page 32](#) .



**Tightening torques**

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Component	Nm
Coolant pipe (bottom right) to cylinder head	10
Coolant pipe (bottom right) to engine support	10

**1.14 Exploded view - radiator and radiator fans**



**1 - Radiator fan - V7-**

- With radiator fan control unit - J293-
- Removing and installing ⇒ [page 220](#)

**2 - Coolant hose**

- To detach, release retaining clip

**3 - O-ring**

- Renew

**4 - Coolant hose**

- To detach, release retaining clip

**5 - Radiator**

- Removing and installing ⇒ [page 214](#)
- If renewed, change coolant in entire system

**6 - 6 Nm**

**7 - Mounting for radiator**

**8 - O-ring**

- Renew

**9 - Coolant hose**

- To detach, release retaining clip

**10 - Radiator fan -2- - V177-**

- With radiator fan control unit 2 - J671-
- Removing and installing ⇒ [page 220](#)

**11 - Retaining pin**

**12 - Rubber buffer**

- Use screwdriver to release and pull off

**13 - 10 Nm**

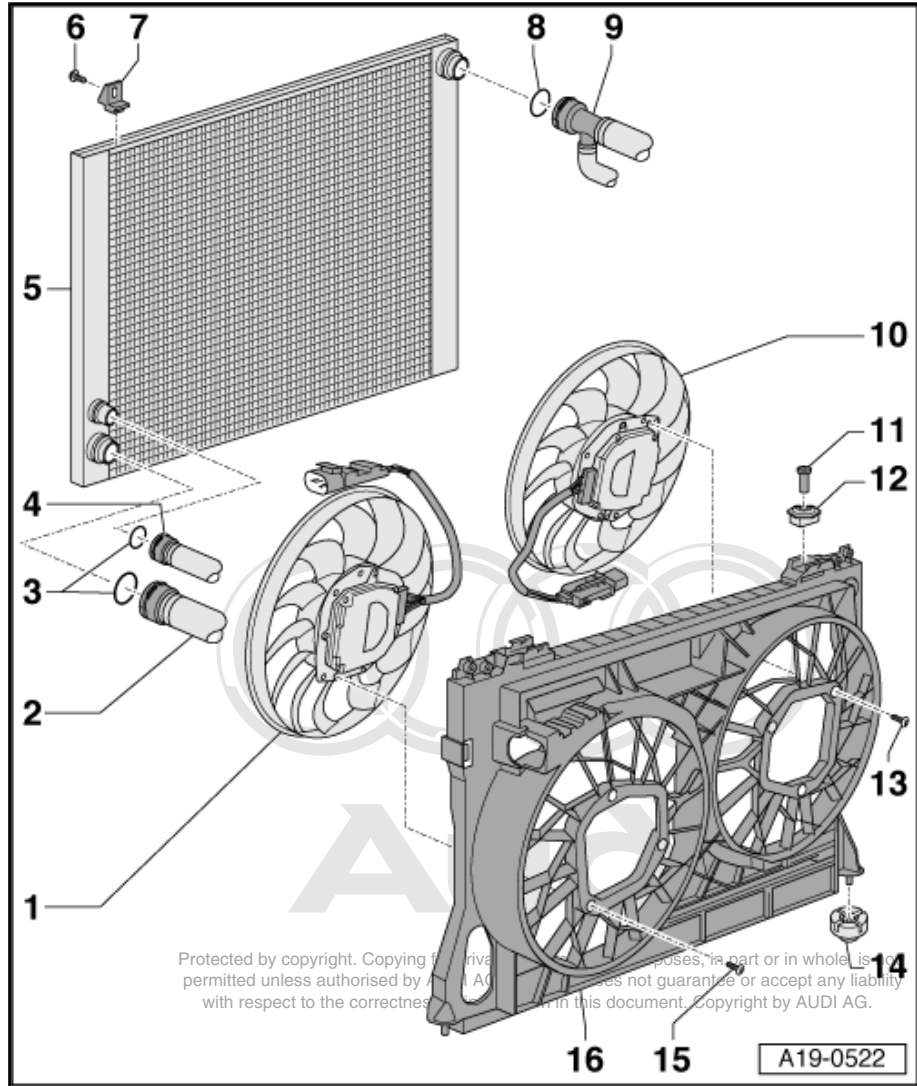
**14 - Rubber mounting**

**15 - 10 Nm**

- Renew

**16 - Radiator cowl**

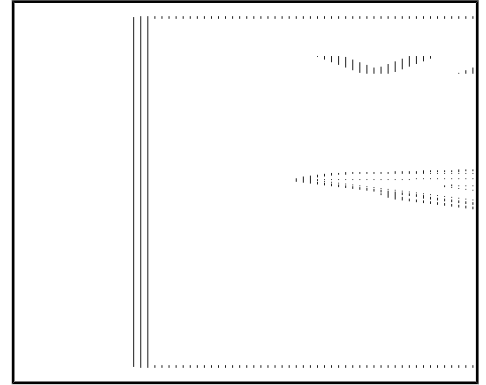
- Removing and installing ⇒ [page 219](#)



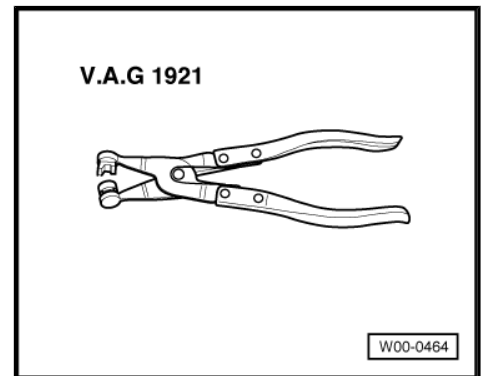
**1.15 Removing and installing radiator**

Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306-



- ◆ Hose clip pliers - V.A.G 1921-



## Removing



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

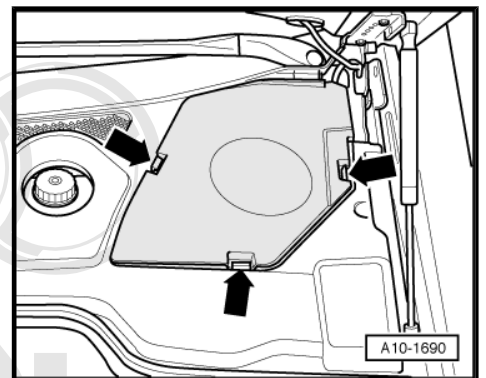
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Remove cover above coolant expansion tank -arrows-.



### WARNING

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

- Open filler cap on coolant expansion tank.



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- Remove both front wheels.

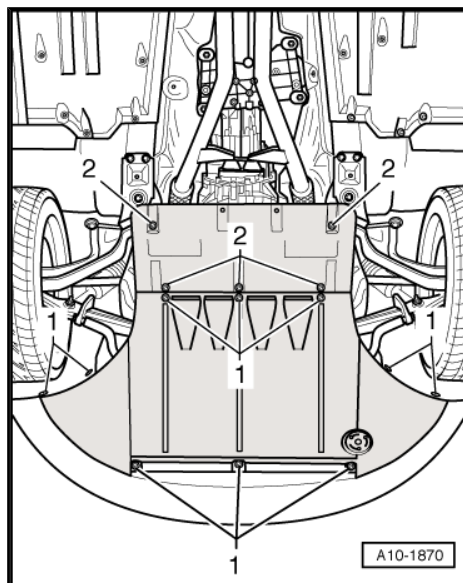
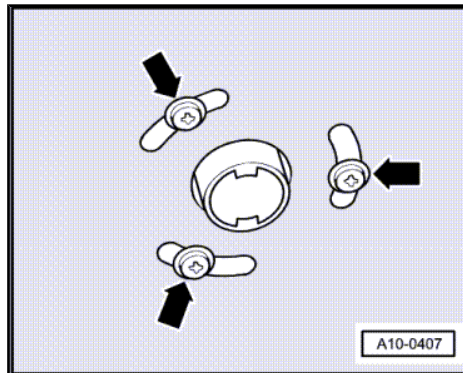


**Note**

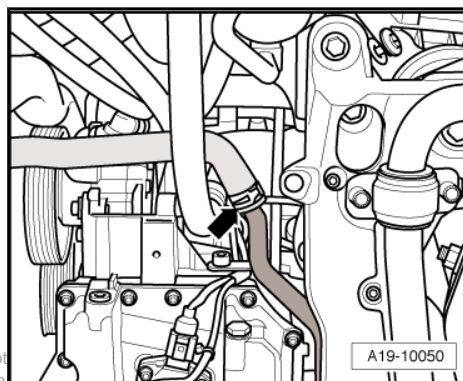
*Secure brake discs with wheel bolts.*

- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.

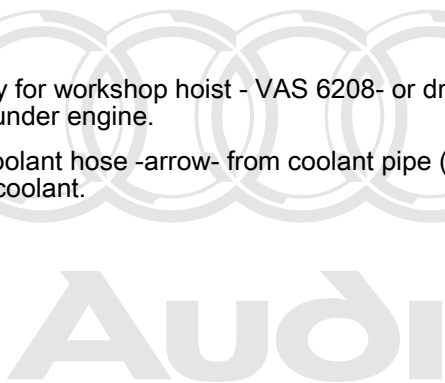
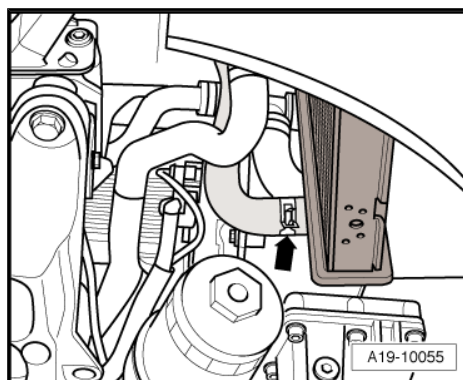
- Open quick-release fasteners -1- and remove noise insulation (front).



- Place drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306- under engine.
- Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.

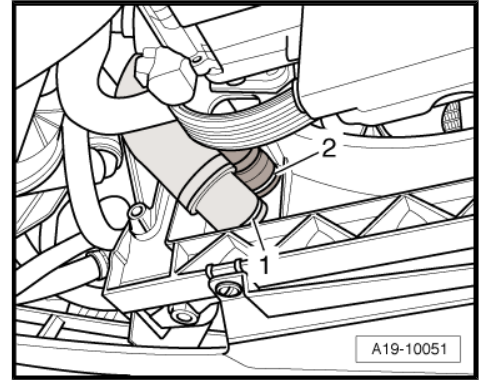


- Disconnect coolant hose -arrow- (bottom right) at auxiliary radiator and drain off remaining coolant.

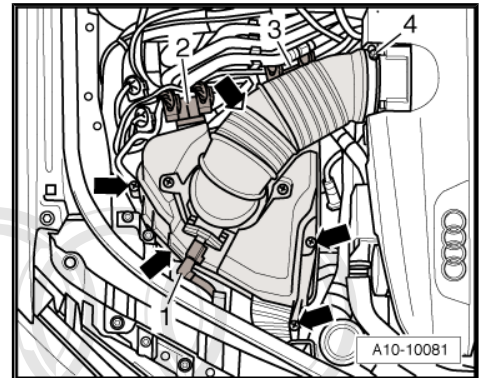


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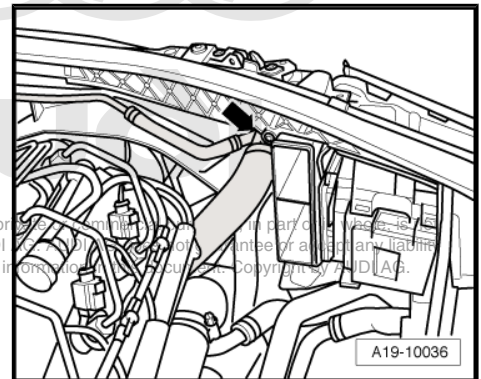
- Release retaining clips and disconnect coolant hoses -1- and -2- at radiator.
- Remove front section of wheel housing liner (front left and front right) ⇒ General body repairs, exterior; Rep. gr. 66 .
- Remove front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .



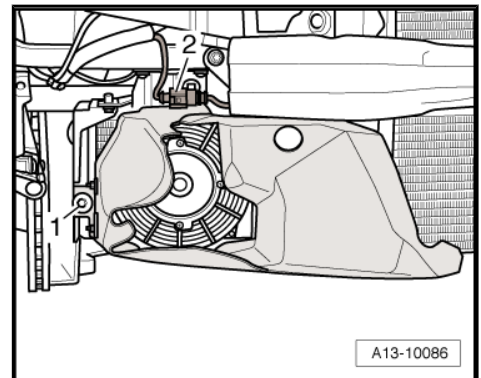
- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



- Release retaining clip and remove top coolant hose -arrow- from radiator.



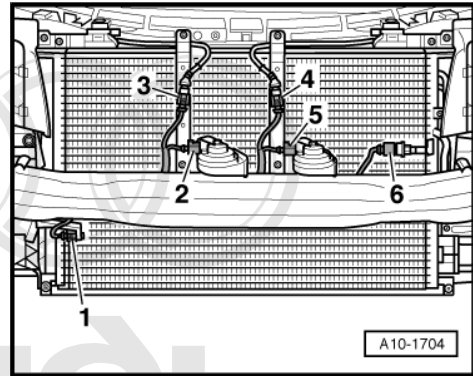
- Unplug the electrical connector -2- and move wiring clear.
- Remove bolt -1-.
- Detach air duct for auxiliary radiator.



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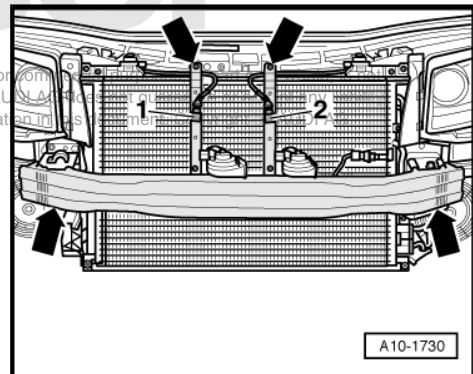


- Unplug electrical connectors -1 ... 6- and move wiring clear.
- Remove bracket for ambient temperature sensor - G17- by turning bracket 90° in clockwise direction and then detaching it.



- Unplug electrical connectors -1- and -2- from struts.
- Remove bolts -arrows-.
- Remove bumper together with struts.

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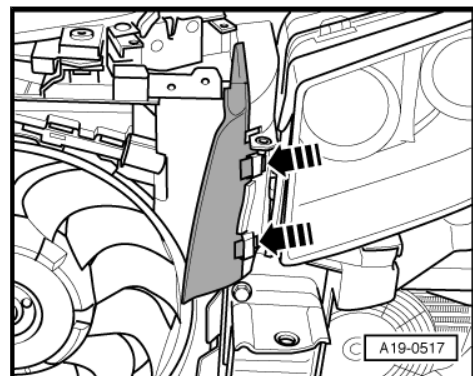


- Remove air duct (left and right) -arrows-.

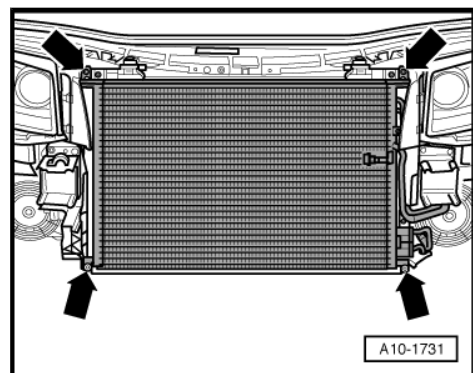
**! WARNING**  
*The air conditioner refrigerant circuit must not be opened.*

**i 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.*



- Remove bolts -arrows-.
- Pivot condenser downwards together with cooler for power steering.
- Tie up condenser on body.





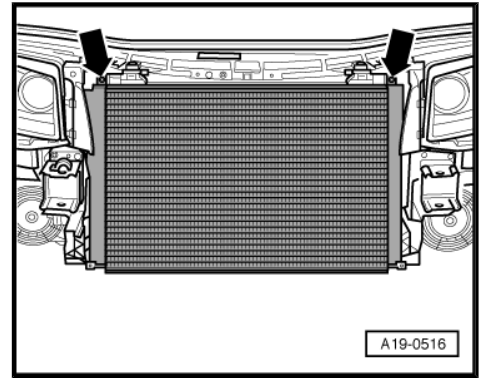
- Remove the two brackets for radiator -arrows-.
- Tilt top of radiator forwards slightly and lift out of lock carrier.

**Installing**

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

 **Note**

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Fill cooling system ⇒ [page 180](#) .



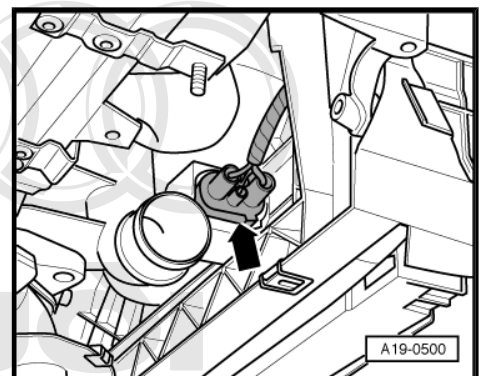
**Tightening torques**

Component	Nm
Bracket for radiator to lock carrier	6
Condenser to lock carrier	6
Struts to lock carrier	9
Bumper to impact damper	23
Air duct to auxiliary radiator	10

**1.16 Removing and installing radiator cowl**

**Removing**

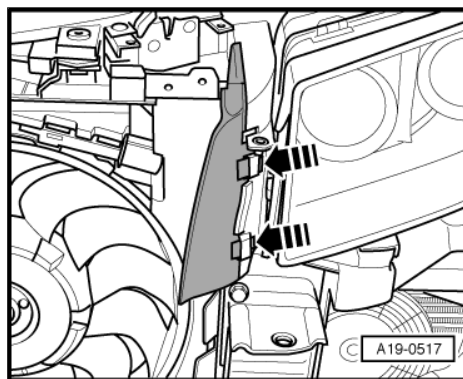
- Drain off coolant ⇒ [page 178](#) .
- Remove radiator ⇒ [page 214](#) .
- Unplug electrical connector -arrow- going to radiator fans.
- Move wires clear at rear of lock carrier.



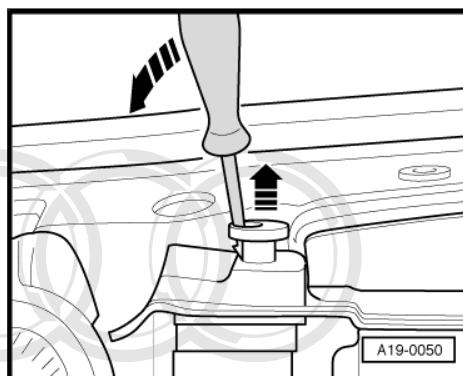
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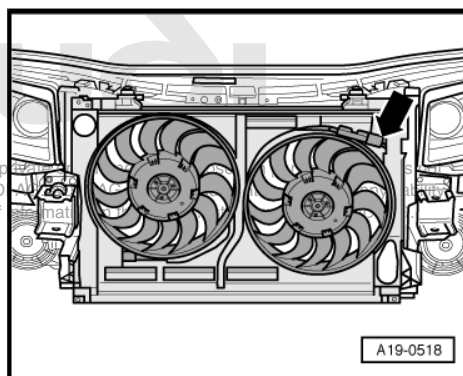
- Remove air duct (left and right) -arrows-.



- Release both retaining pins for radiator cowl and pull out upwards -arrows-.
- Tilt top edge of radiator cowl forwards.



- Reach behind radiator cowl and unplug electrical connector -arrow- for radiator fans.
- Remove radiator cowl.



**Installing**

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

- Install radiator => [page 219](#) .
- Fill cooling system => [page 180](#) .

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## 1.17 Removing and installing radiator fans

### Removing

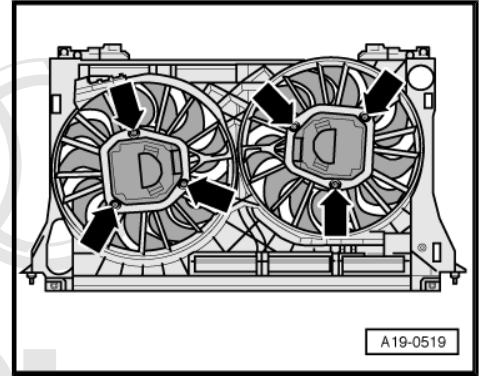
- Drain off coolant => [page 178](#) .
- Remove radiator => [page 214](#) .
- Remove radiator cowl => [page 219](#) .

- Remove bolts -arrows-.
- Unclip electrical connectors and lay wiring aside.
- Remove radiator fans.

**Installing**

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

- Install radiator cowl => [page 220](#) .
- Install radiator => [page 219](#) .
- Fill cooling system => [page 180](#) .



**Tightening torque**

Component	Nm
Radiator fan to radiator cowl	10 <sup>27)</sup>

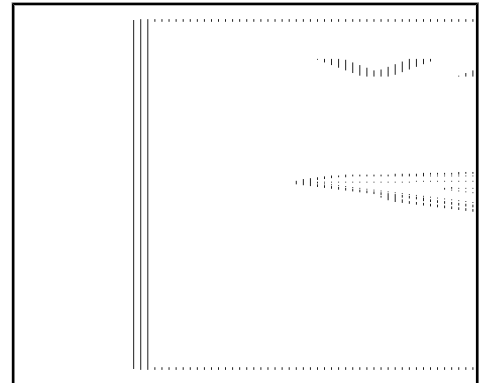
27) Renew bolt.

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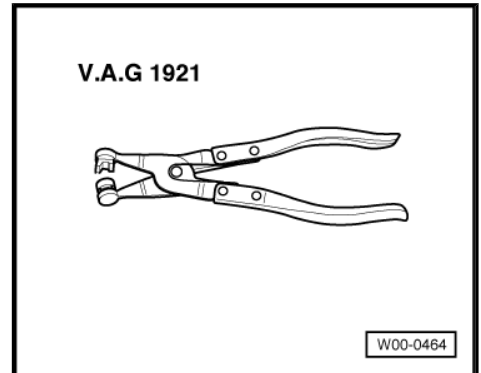
## 1.18 Removing and installing auxiliary radiator

**Special tools and workshop equipment required**

- ◆ Drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306-



- ◆ Hose clip pliers - V.A.G 1921-



**Removing**

 **Note**

*The following describes the removal and installation of auxiliary radiator (right-side). The procedure is basically the same for the auxiliary radiator (left-side).*

- Remove front bumper cover => General body repairs, exterior; Rep. gr. 63 .



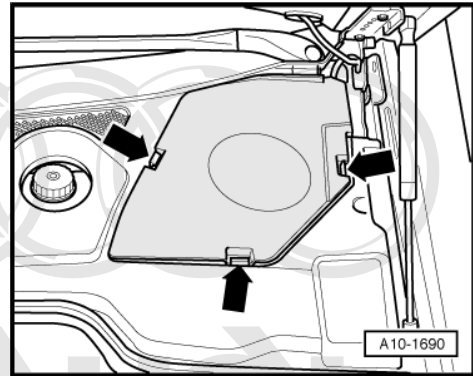
- Remove cover above coolant expansion tank -arrows-.



**WARNING**

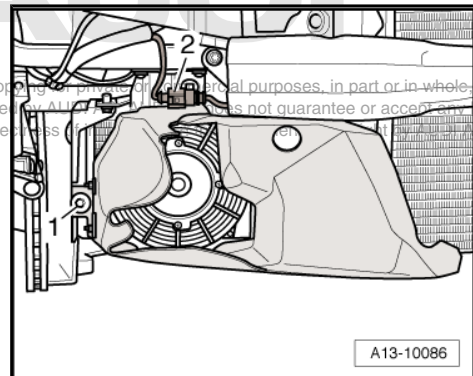
*Hot steam or hot coolant can escape when coolant expansion tank is opened; cover filler cap with cloth and open carefully.*

- Open filler cap on coolant expansion tank.

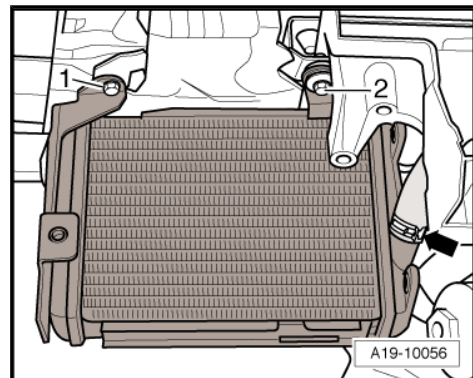


- Unplug the electrical connector -2- and move wiring clear.
- Remove bolt -1-.
- Detach air duct for auxiliary radiator.

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- Place drip tray for workshop hoist - VAS 6208- or drip tray - V.A.G 1306- under engine.
- Disconnect coolant hose (front) from auxiliary radiator -arrow- and drain off coolant.
- Remove bolts -1- and -2-.



- Disconnect coolant hoses -arrows-.
- Remove bolts -1- and -2-.
- Remove auxiliary radiator.

### Installing

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

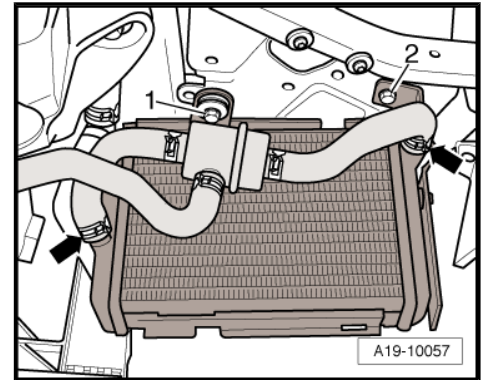
 **Note**

*Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- Install front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 .
- Fill cooling system ⇒ [page 180](#) .

### Tightening torques

Component	Nm
Air duct to auxiliary radiator	10
Auxiliary radiator to bracket	10



## 1.19 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-

<p>V.A.G 1274</p> 	<p>V.A.G 1274/8</p> 
<p>V.A.G 1274/9</p> 	
	<p style="text-align: right;">G19-0002</p>


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**Test condition**

- Engine must be warm.

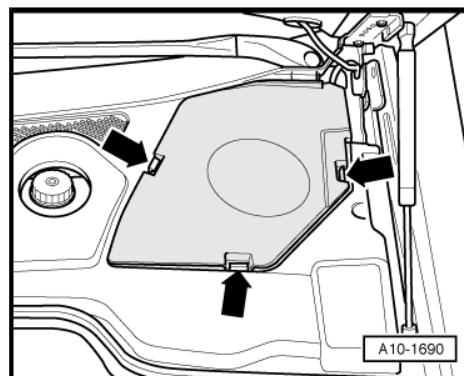
**Test sequence**

- Remove cover above coolant expansion tank -arrows-.

 **WARNING**

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

- Open filler cap on coolant expansion tank.



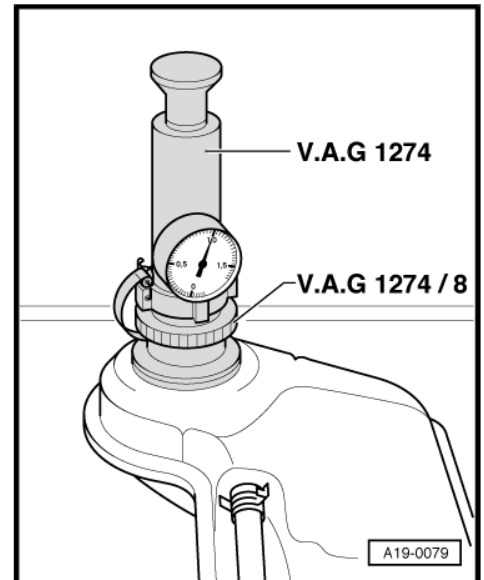
- Attach cooling system tester - V.A.G 1274- with adapter - V.A.G 1274/8- to coolant expansion tank.
- Use hand pump on cooling system tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

- Trace leak and repair.

# Audi

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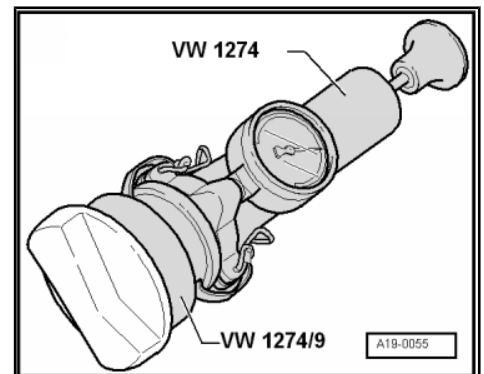


### Checking pressure relief valve in filler cap

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

If the pressure relief valve does not open as described:

- Renew filler cap.



## 26 – Exhaust system

### 1 Removing and installing parts of exhaust system



#### 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 clamps and align silencers and exhaust pipes 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 exhaust pipes for front silencers must not be bent more than 10°.*
- ◆ *The illustration shows the exhaust manifolds with catalytic converters and front silencer for left-side cylinder bank.*

⇒ [“1.1 Exploded view - exhaust system”, page 226](#)

⇒ [“1.2 Removing and installing front silencer \(left-side\)”, page 229](#)

⇒ [“1.3 Removing and installing front silencer \(right-side\)”, page 231](#)

⇒ [“1.4 Removing and installing exhaust manifolds with catalytic converters \(left-side\)”, page 232](#)

⇒ [“1.5 Removing and installing exhaust manifolds with catalytic converters \(right-side\)”, page 234](#)

⇒ [“1.6 Removing and installing centre silencer and rear silencer”, page 235](#)

⇒ [“1.7 Separating centre and rear silencers”, page 237](#)

⇒ [“1.8 Stress-free alignment of exhaust system”, page 238](#)

⇒ [“1.9 Checking exhaust system for leaks”, page 239](#)

#### 1.1 Exploded view - exhaust system

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**1 - 23 Nm**

- Renew

**2 - Exhaust manifold with catalytic converter**

- Front left
- Removing and installing ⇒ [page 234](#)
- Protect against knocks and impact
- Mounting components ⇒ [page 228](#)

**3 - Gasket**

- Renew

**4 - Lambda probe (before catalytic converter), 55 Nm**

- Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the Lambda probe body
- When re-using the old Lambda probe, grease thread with high-temperature paste; the paste must not get into the slots of the probe body. High-temperature paste ⇒ Parts catalogue
- Removing and installing ⇒ Rep. gr. 24

**5 - Lambda probe (after catalytic converter), 55 Nm**

- Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the Lambda probe body
- When re-using the old Lambda probe, grease thread with high-temperature paste; the paste must not get into the slots of the probe body. High-temperature paste ⇒ Parts catalogue
- Removing and installing ⇒ Rep. gr. 24

**6 - Exhaust manifold with catalytic converters**

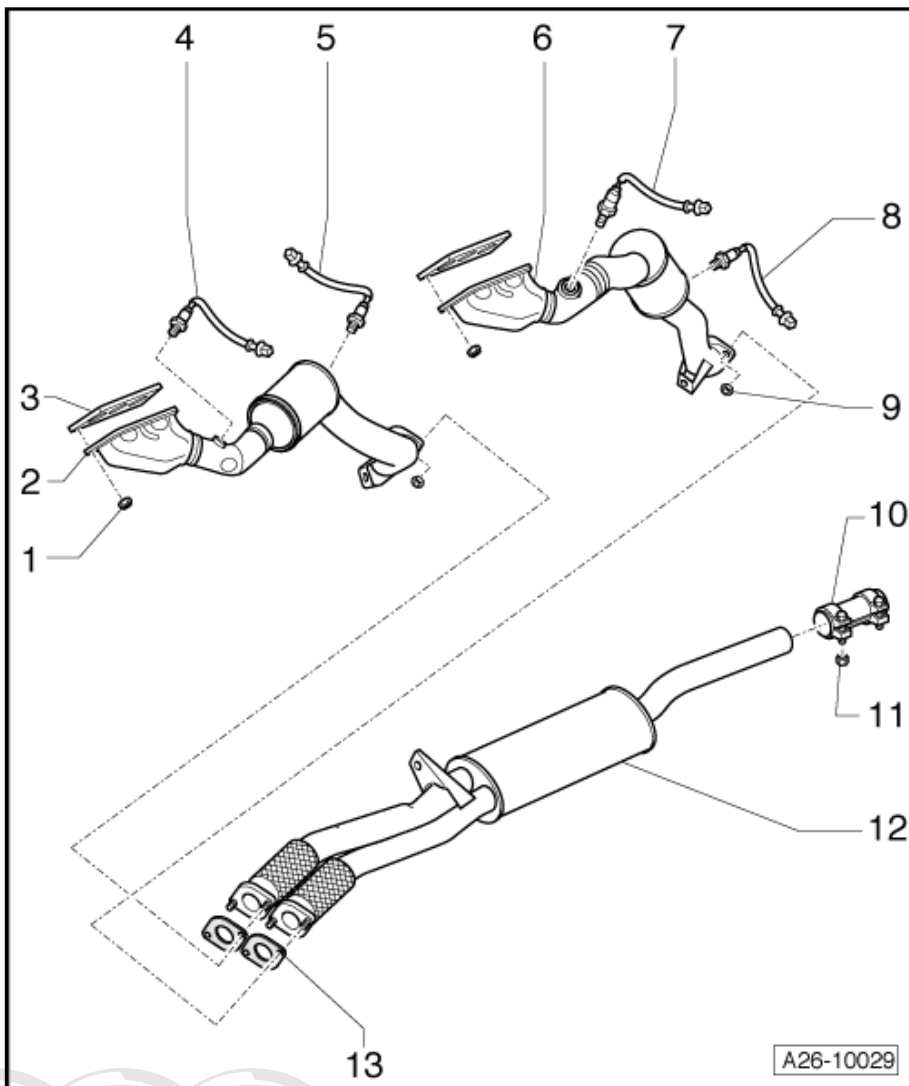
- Rear left
- Removing and installing ⇒ [page 232](#)
- Protect against knocks and impact
- Mounting components ⇒ [page 228](#)

**7 - Lambda probe (before catalytic converter), 55 Nm**

- Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the Lambda probe body
- When re-using the old Lambda probe, grease thread with high-temperature paste; the paste must not get into the slots of the probe body. High-temperature paste ⇒ Parts catalogue
- Removing and installing ⇒ Rep. gr. 24

**8 - Lambda probe (after catalytic converter), 55 Nm**

- Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the Lambda probe body
- When re-using the old Lambda probe, grease thread with high-temperature paste; the paste must not get into the slots of the probe body. High-temperature paste ⇒ Parts catalogue
- Removing and installing ⇒ Rep. gr. 24



## 9 - 25 Nm

- Renew

## 10 - Clamp (front)

- Align exhaust system so it is free of stress before tightening clamp ⇒ [page 238](#)
- Installation position of bolts ⇒ [page 229](#)
- Tighten bolt connections evenly; at the same time push exhaust pipes of centre silencer upwards slightly

## 11 - 23 Nm

## 12 - Front silencer

- With flexible joints
- Do not bend flexible joints more than 10° - otherwise they could become damaged
- Removing, installing and adjusting front silencer (left-side) ⇒ [page 229](#)
- Removing, installing and adjusting front silencer (right-side) ⇒ [page 231](#)
- Mounting components ⇒ [page 228](#)

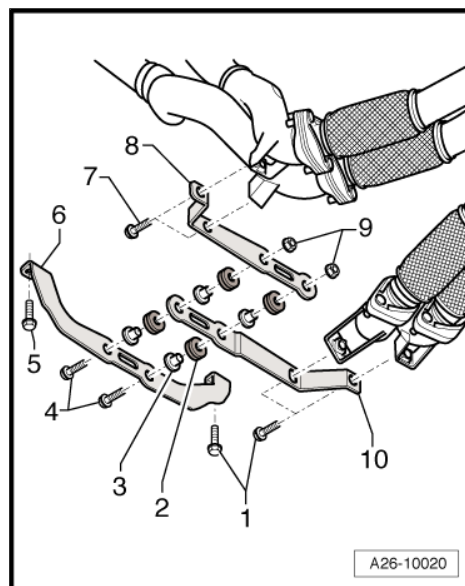
## 13 - Gasket

- Renew

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## Components of mounting for exhaust manifolds with catalytic converters

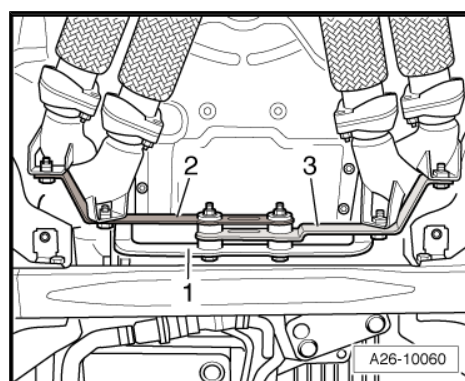
- 1 - Bolt, 25 Nm
- 2 - Rubber grommet
- 3 - Bush
- 4 - Bolt
- 5 - Bolt, 25 Nm
- 6 - Bracket (front), installation position ⇒ [page 228](#)
- 7 - Bolt, 25 Nm
- 8 - Bracket (left-side), installation position ⇒ [page 228](#)
- 9 - Nut, 25 Nm
- 10 - Bracket (right-side), installation position ⇒ [page 228](#)



## Installation position for brackets (front, left, right)

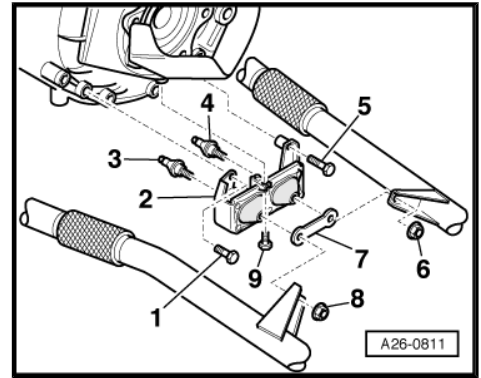
- Note installation position for brackets (front, left, right) to ensure exhaust system is free of stress.

- 1 - Bracket (front)
- 2 - Bracket (left)
- 3 - Bracket (right)



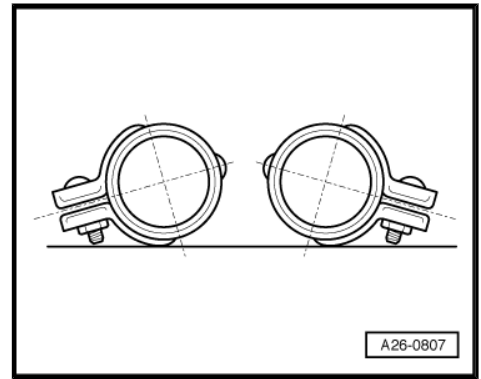
### Components for bracket (rear)

- 1 - Bolt, 22 Nm
- 2 - Bracket
- 3 - Stud
- 4 - Stud
- 5 - Bolt, 22 Nm
- 6 - Nut, self-locking, 25 Nm
- 7 - Plate
- 8 - Nut, self-locking, 25 Nm
- 9 - Bolt, 22 Nm



### Installation position of front clamps

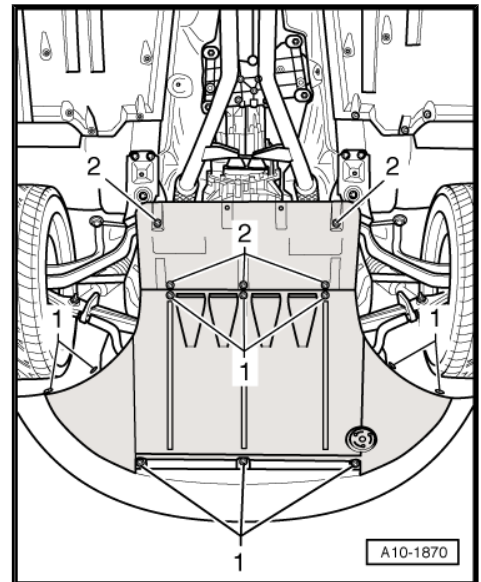
- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.



## 1.2 Removing and installing front silencer (left-side)

### Removing

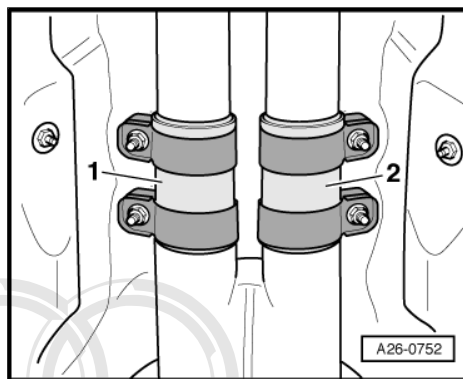
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Open quick-release fasteners -2- and remove rear noise insulation.



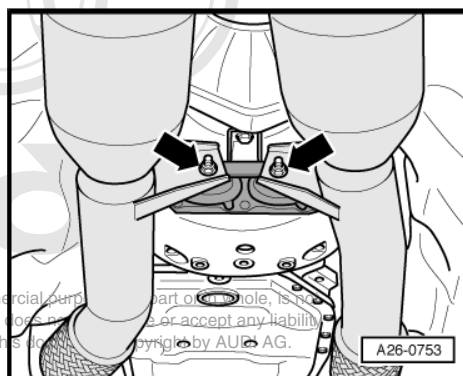
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- Loosen clamp (left-side) -1-.



- Unscrew nut -left arrow- at mounting bracket for front exhaust pipe (left-side).



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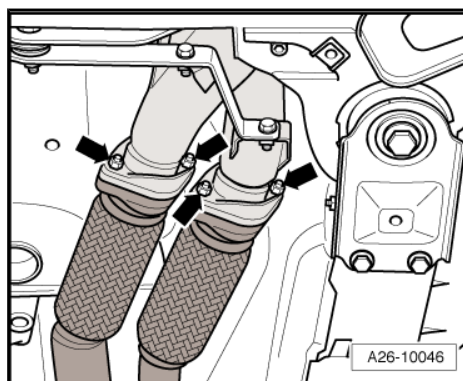
**Note**

To avoid damage, the flexible joints on the front silencer must not be bent more than 10°.

- Unscrew nuts -arrows-.
- Remove front silencer (left-side) together with flexible joints.

**Installing**

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



**Note**

Renew gaskets and self-locking nuts.

- Align exhaust system so it is free of stress => [page 238](#) .
- Deactivate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

**Tightening torques**

Component	Nm
Front silencer to exhaust manifolds with catalytic converters	25 <sup>28)</sup>
Front silencer to bracket	25 <sup>28)</sup>

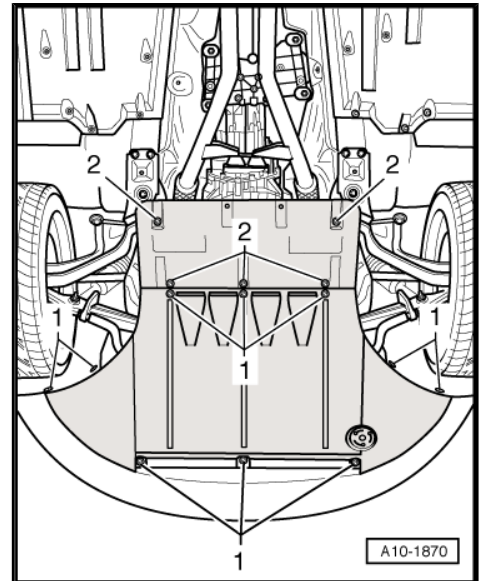
28) Renew self-locking nuts.

### 1.3 Removing and installing front silencer (right-side)

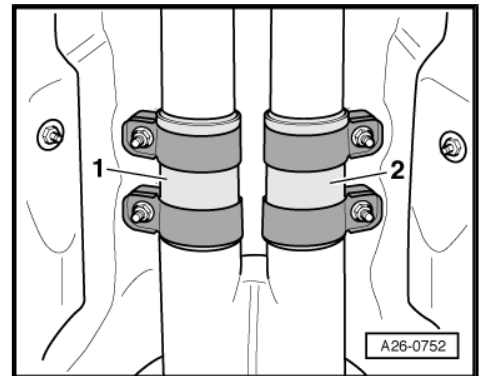
#### Removing

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Open quick-release fasteners -2- and remove rear noise insulation.

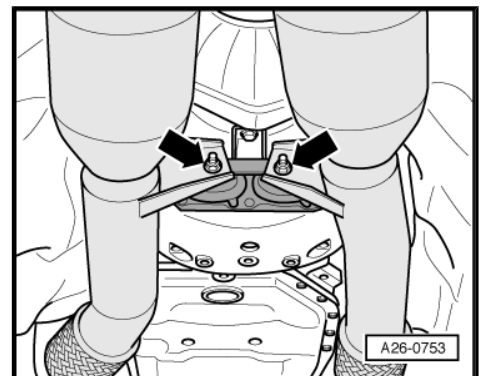
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- Loosen clamp (right-side) -2-.



- Unscrew nut -right arrow- at mounting bracket for front exhaust pipe (right-side).



**Note**

To avoid damage, the flexible joints on the front silencer must not be bent more than 10°.

- Unscrew nuts -arrows-.
- Remove front silencer (right-side) together with flexible joints.

**Installing**

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

**Note**

Renew gaskets and self-locking nuts.

- Align exhaust system so it is free of stress ⇒ [page 238](#) .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

**Tightening torques**

Component	Nm
Front silencer to exhaust manifolds with catalytic converters	25 <sup>29)</sup>
Front silencer to bracket	25 <sup>29)</sup>

29) Renew self-locking nuts.

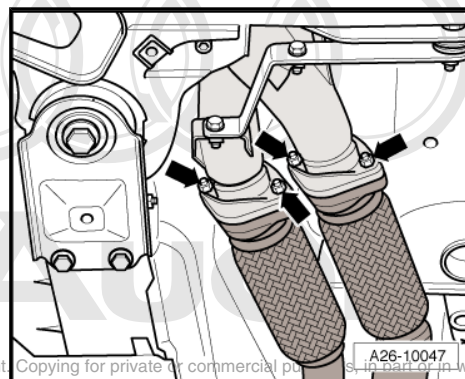
## 1.4 Removing and installing exhaust manifolds with catalytic converters (left-side)

**Removing**

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131- .

**Note**

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

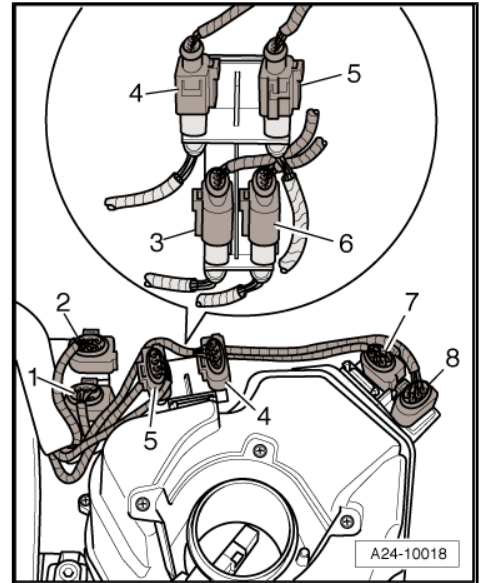


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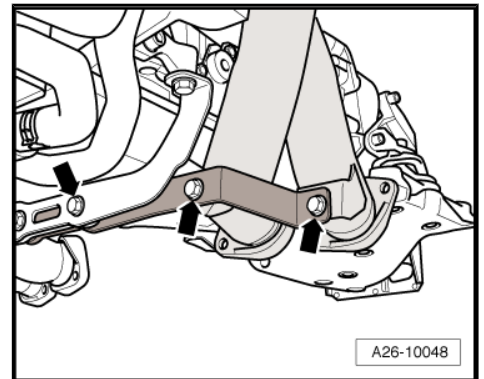
- Unplug the following electrical connectors for Lambda probes:
  - 1 - Lambda probe 3 - G285- (6-pin, black)
  - 2 - Lambda probe 4 - G286- (6-pin, brown)
  - 3 - Lambda probe 3 after catalytic converter - G287- (4-pin, green)
  - 6 - Lambda probe 4 after catalytic converter - G288- (4-pin, grey)

 **Note**

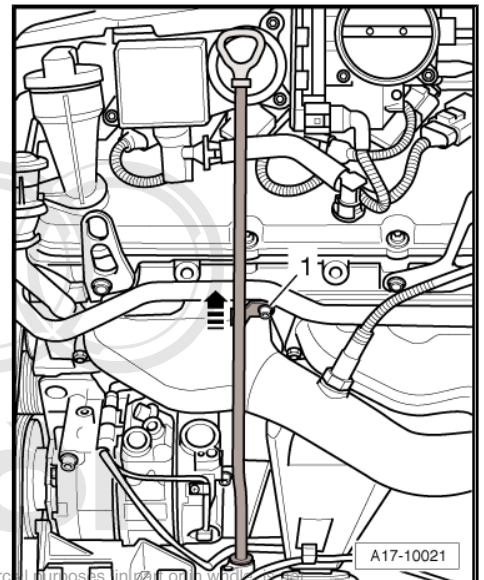
- ◆ *To unplug electrical connectors -3- and -6-, detach bracket for connectors from air cleaner housing and turn (see detail in illustration).*
- ◆ *Ignore other items.*



- Unscrew bolts -arrows- and swivel the bracket for exhaust manifold with catalytic converters (left-side) downwards.



- Remove bolt -1-.
- Pull the guide tube for oil dipstick out upwards -arrow-.



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- Unscrew nuts -1 ... 4- and remove both exhaust manifolds with catalytic converters (left-side).

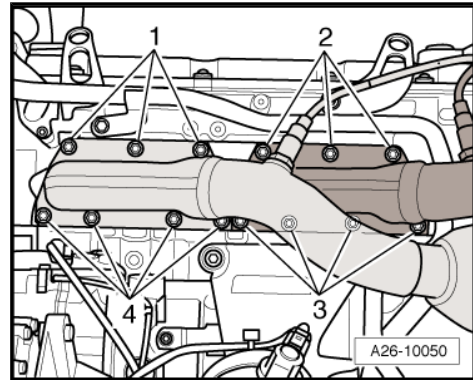
### Installing

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



#### Note

- ◆ Renew self-locking nuts.
- ◆ Renew gaskets, seals and O-rings.
- ◆ Fit all cable ties in the original positions when installing.



### Tightening torque

Component	Nm
Exhaust manifolds with catalytic converters to cylinder head	23 <sup>30)</sup>
Exhaust manifolds with catalytic converters to bracket	25
Guide tube for dipstick to cylinder head	10

30) Renew self-locking nuts.

## 1.5 Removing and installing exhaust manifolds with catalytic converters (right-side)

### Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131- .



#### Note

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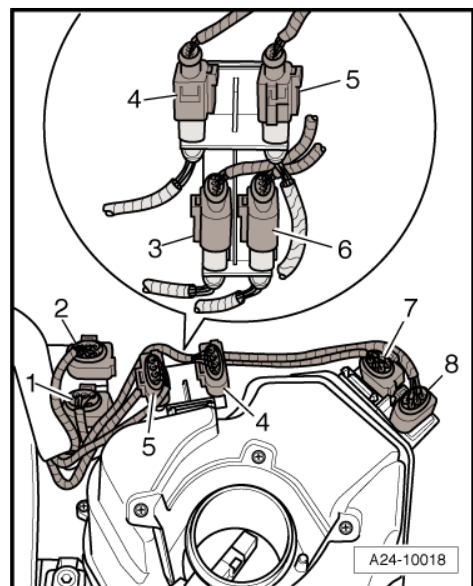
*All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

- Unplug the following electrical connectors for Lambda probes:
  - 4 - Lambda probe after catalytic converter - G130- (4-pin, black)
  - 5 - Lambda probe 2 after catalytic converter - G131- (4-pin, brown)
  - 7 - Lambda probe 2 - G108- (6-pin, brown)
  - 8 - Lambda probe - G39- (6-pin, black)



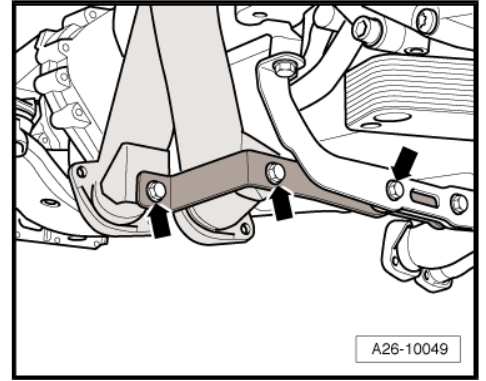
#### Note

*Ignore other items.*





- Unscrew bolts -arrows- and swivel the bracket for exhaust manifold with catalytic converters (right-side) downwards.



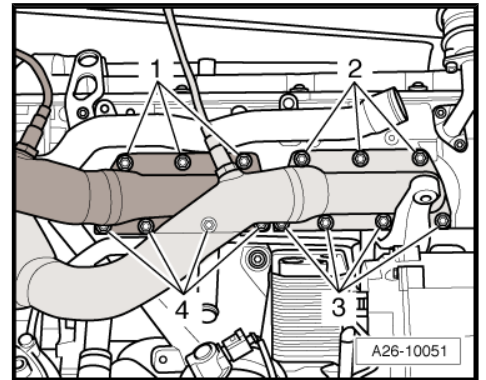
- Unscrew nuts -1 ... 4- and remove both exhaust manifolds with catalytic converters (right-side).

### Installing

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

**i** Note

- ◆ Renew self-locking nuts.
- ◆ Renew seals and gaskets.
- ◆ Fit all cable ties in the original positions when installing.



### Tightening torque

Component	Nm
Exhaust manifolds with catalytic converters to cylinder head	23 <sup>31)</sup>
Exhaust manifolds with catalytic converters to bracket	25

31) Renew self-locking nuts.

## 1.6 Removing and installing centre silencer and rear silencer



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**1 - 23 Nm****2 - Clamp (front)**

- Align exhaust system so it is free of stress before tightening clamp  
⇒ [page 238](#)
- Installation position of bolts ⇒ [page 229](#)
- Tighten bolt connections evenly; at the same time push exhaust pipes of centre silencer upwards slightly

**3 - Centre silencer**

- Align exhaust system so it is free of stress  
⇒ [page 238](#)

**4 - Rubber mounting**

- Check preloading, refer to "Stress-free alignment of exhaust system" ⇒ [page 238](#)

**5 - 23 Nm****6 - Bolt****7 - Rear silencer**

- For left side of vehicle
- With exhaust flap
- Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes

- Cutting point  
⇒ [page 238](#)

- With protective cover (depending on version)

- When renewing a single rear silencer, remove protective cover at the opposite rear silencer  
⇒ [page 237](#).

- Align exhaust system so it is free of stress ⇒ [page 238](#)

- Checking exhaust flap ⇒ [page 249](#)

**8 - Rubber mounting**

- Check preload ⇒ ["1.8 Stress-free alignment of exhaust system", page 238](#)

**9 - Mounting****10 - 22 Nm****11 - Vacuum hose**

- For exhaust flap
- From exhaust flap valve

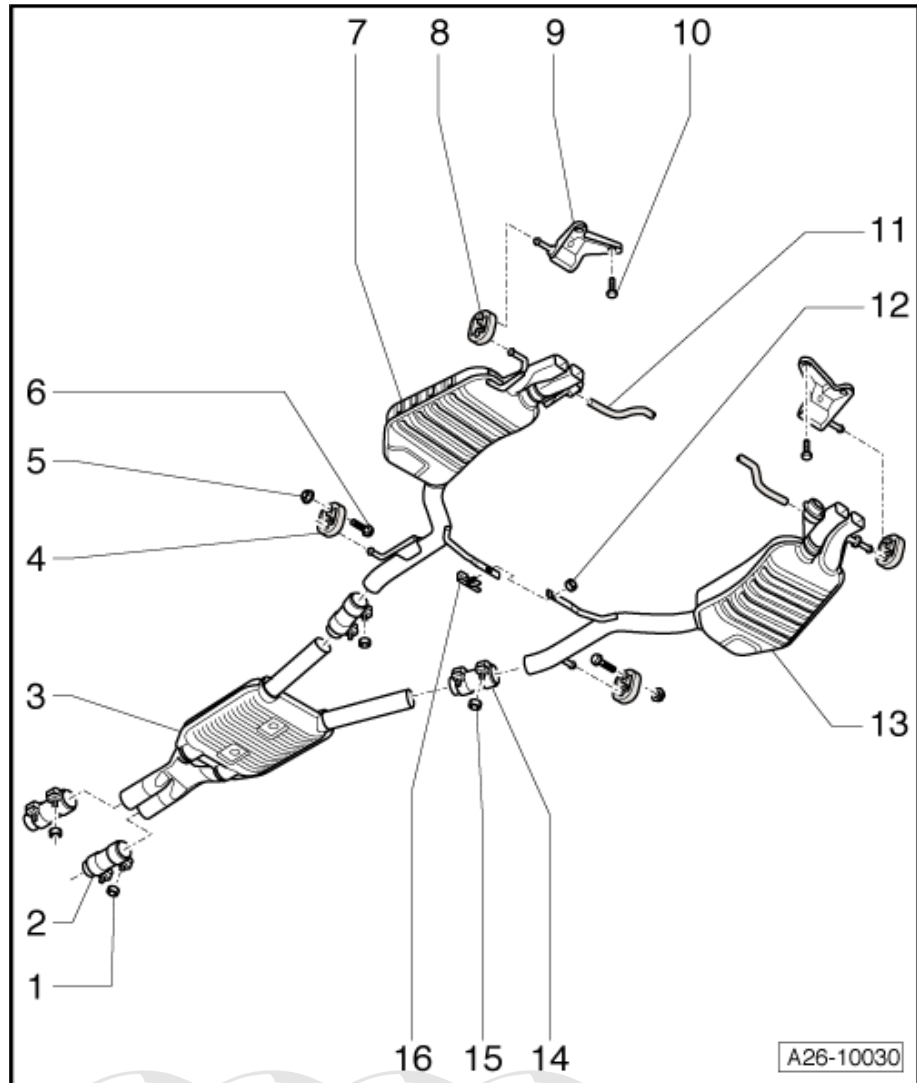
**12 - 23 Nm**

- Renew

**13 - Rear silencer**

- For right side of vehicle
- With exhaust flap

- Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes



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- Cutting point ⇒ [page 238](#)
- With protective cover (depending on version)
- When renewing a single rear silencer, remove protective cover at the opposite rear silencer ⇒ [page 237](#) .
- Align exhaust system so it is free of stress ⇒ [page 238](#)
- Checking exhaust flap ⇒ [page 249](#)

#### 14 - Clamp (rear)

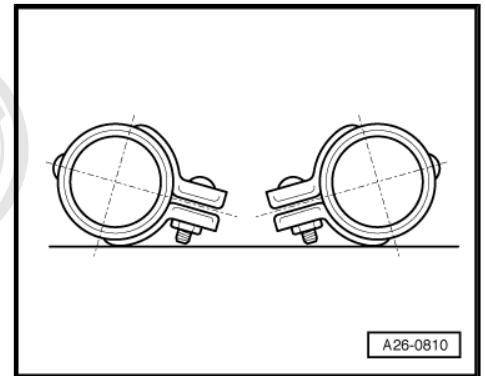
- For separate replacement of centre and rear silencers
- Before tightening, align exhaust system so it is free of stress ⇒ [page 238](#)
- Installation position ⇒ [page 237](#)
- Tighten bolted connections evenly

#### 15 - 23 Nm

#### 16 - Connecting bracket

#### Installation position of rear clamps

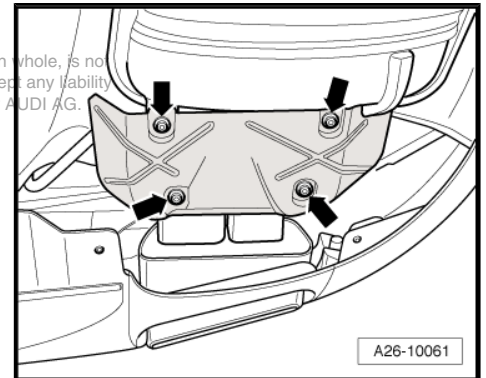
- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face one another.



#### Protective cover at rear silencer

Depending on the version, the rear silencers may be equipped with a protective cover.

- When renewing a single rear silencer, remove the protective cover at the opposite rear silencer -arrows-.



### 1.7 Separating centre and rear silencers

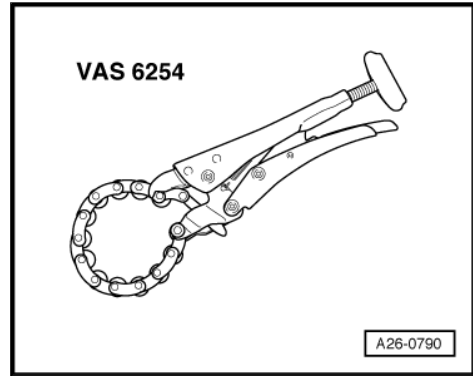
The connecting pipe can be cut through at the cutting point provided in order to renew the centre and rear silencers separately.

The cutting point is marked by an indentation on the outside of the exhaust pipe.

#### Special tools and workshop equipment required

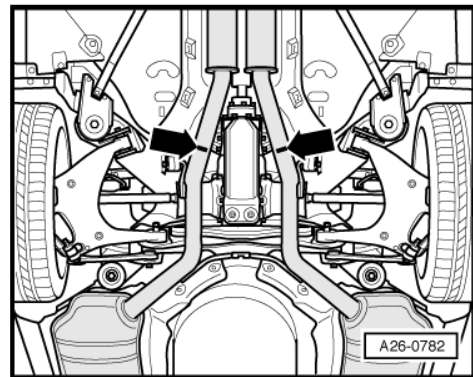


◆ Chain pipe cutter - VAS 6254-

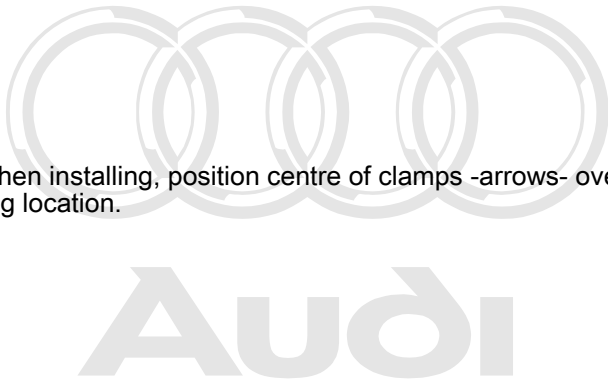
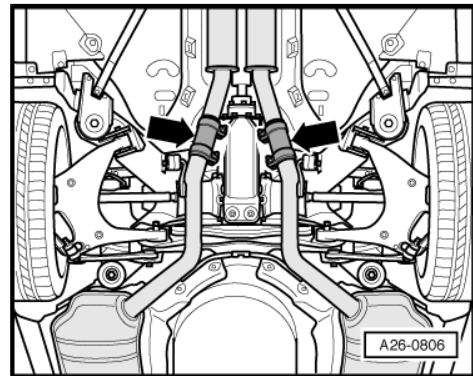


**Procedure**

- Activate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Cut through exhaust pipes at right angles at the position marked -arrow- using chain-type pipe cutter - VAS 6254-

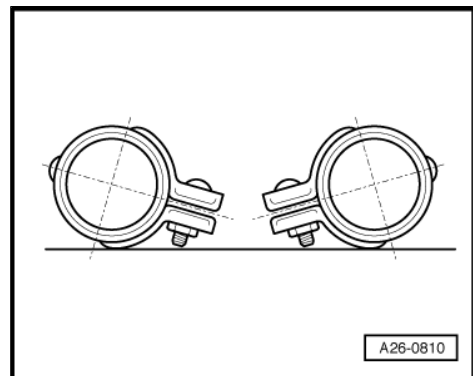


- When installing, position centre of clamps -arrows- over cutting location.



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- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face one another.
- Align exhaust system so it is free of stress => [page 238](#) .
- Deactivate jacking mode => Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .



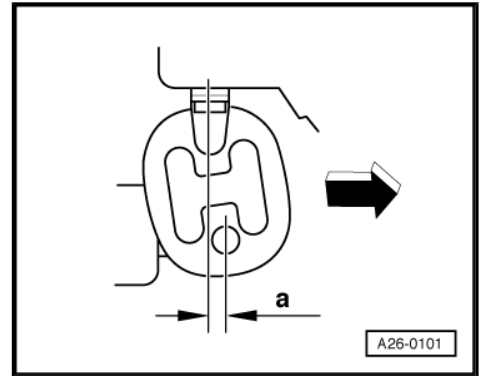
## 1.8 Stress-free alignment of exhaust system

**i** Note

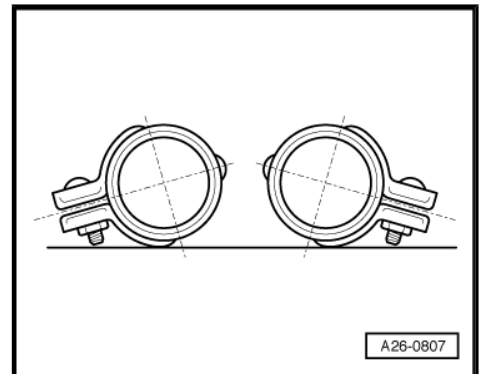
*The exhaust system must be aligned when it is cool.*

- Loosen bolt connections of all exhaust system clamps.

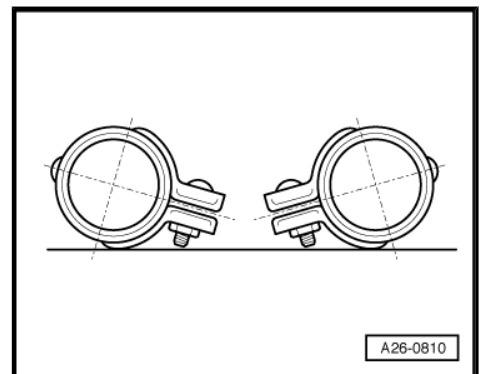
- Push rear silencers forwards -arrow- until preload at rubber mountings is as follows:
  - Rubber mounting (front): -a- = 11 mm.
  - Rubber mounting (rear): -a- = 14 mm.
- Align rear silencer horizontally.



- Position clamps so that they align with centre of cutting locations.
- Align front clamp so that ends of bolts do not protrude beyond bottom of clamp.

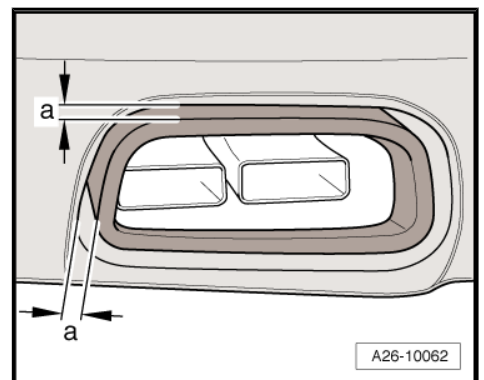


- Align rear clamps so that ends of bolts do not protrude beyond bottom of clamps.
- Tighten bolts on clamps evenly to 23 Nm.



### Aligning trim for tailpipes

- Check that there is equal clearance between tailpipe trim and bumper all round.
  - Distance -a- = distance -a-
- If necessary, loosen nuts on reverse side of bumper and adjust tailpipe trim.

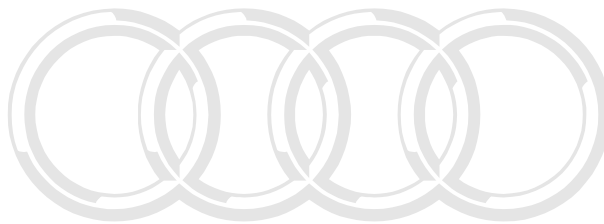


## 1.9 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes during leak test (e.g. with cloth or plug).
- Listen for noise at all connection points (cylinder head/exhaust manifolds with catalytic converters, exhaust manifolds with catalytic converters/front silencer, etc.) to locate any leaks.



- Repair any leaks that are found.



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## 2 Servicing secondary air system

The secondary air system is designed to enable the catalytic converter to heat up and reach its operating temperature more quickly after a cold start.

⇒ [“2.1 Principle and function”, page 241](#)

⇒ [“2.2 Exploded view - secondary air system”, page 243](#)

⇒ [“2.3 Checking combination valves for secondary air system for correct operation and leakage”, page 244](#)

⇒ [“2.4 Removing and installing secondary air pumps”, page 245](#)

⇒ [“2.5 Removing and installing combination valve for secondary air system \(left-side\)”, page 246](#)

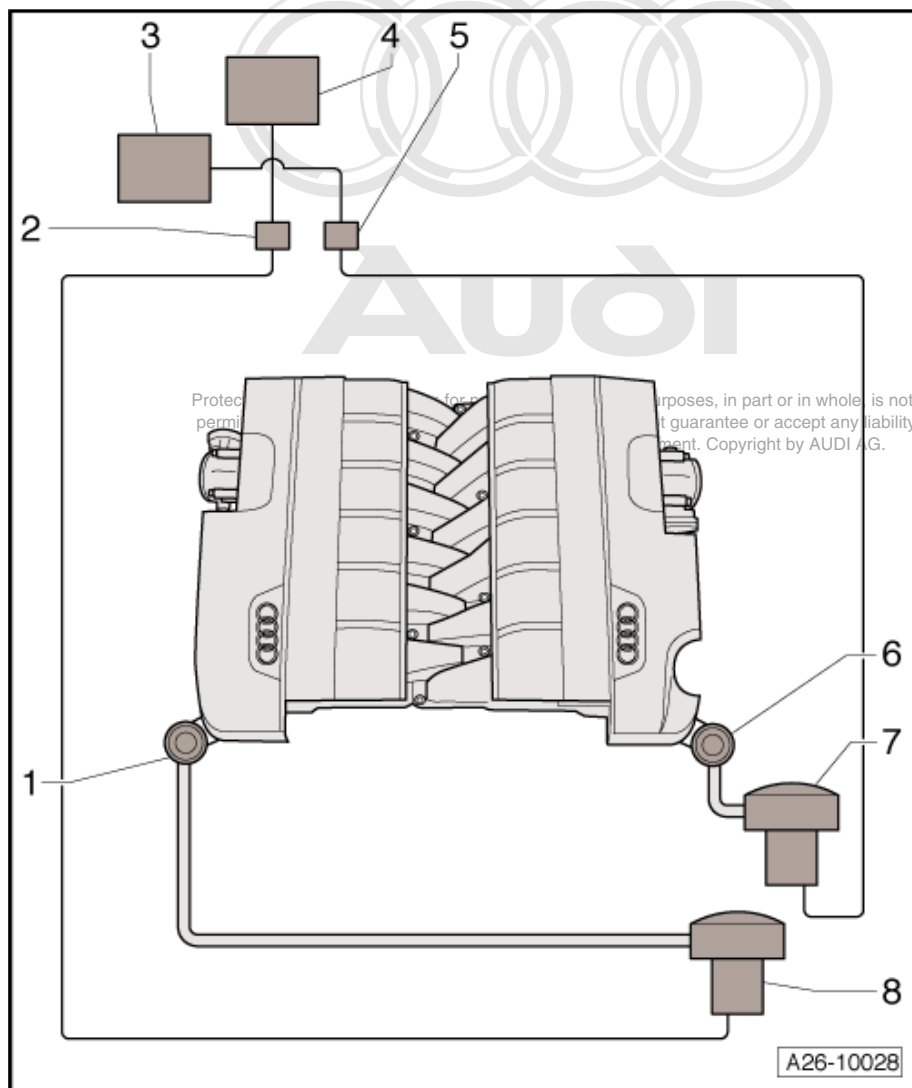
⇒ [“2.6 Removing and installing combination valve for secondary air system \(right-side\)”, page 248](#)

### 2.1 Principle and function

#### Principle

Because of the over-enrichment of the mixture in the cold start phase, the proportion of unburned hydrocarbons in the exhaust gas is higher. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and thus reduces toxic emissions. The heat generated by oxidation accelerates the "light off" of the catalytic converter and significantly improves exhaust gas quality during warm-up.

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### How the system works

In the cold-running phase the engine control units -3- and -4- activate the secondary air pumps -7- and -8- via both secondary air pump relays -2- and -5-. The stream of air from the secondary air pump opens the combination valve for secondary air and lets air flow into the exhaust system upstream of the catalytic converter.



## 2.2 Exploded view - secondary air system

### 1 - Combination valve for secondary air system (right-side)

- Fitting location: at front right of engine
- Checking ⇒ [page 244](#)
- Removing and installing ⇒ [page 248](#)

### 2 - Secondary air pump relay - J299-

- Fitting location ⇒ [page 244](#)

### 3 - Engine control unit 2 - J624-

- Installation position: to right of electronics box

### 4 - Engine control unit - J623-

- Installation position: to left above electronics box

### 5 - Relay for secondary air pump 2 - J545-

- Fitting location ⇒ [page 244](#)

### 6 - Combination valve for secondary air system (left-side)

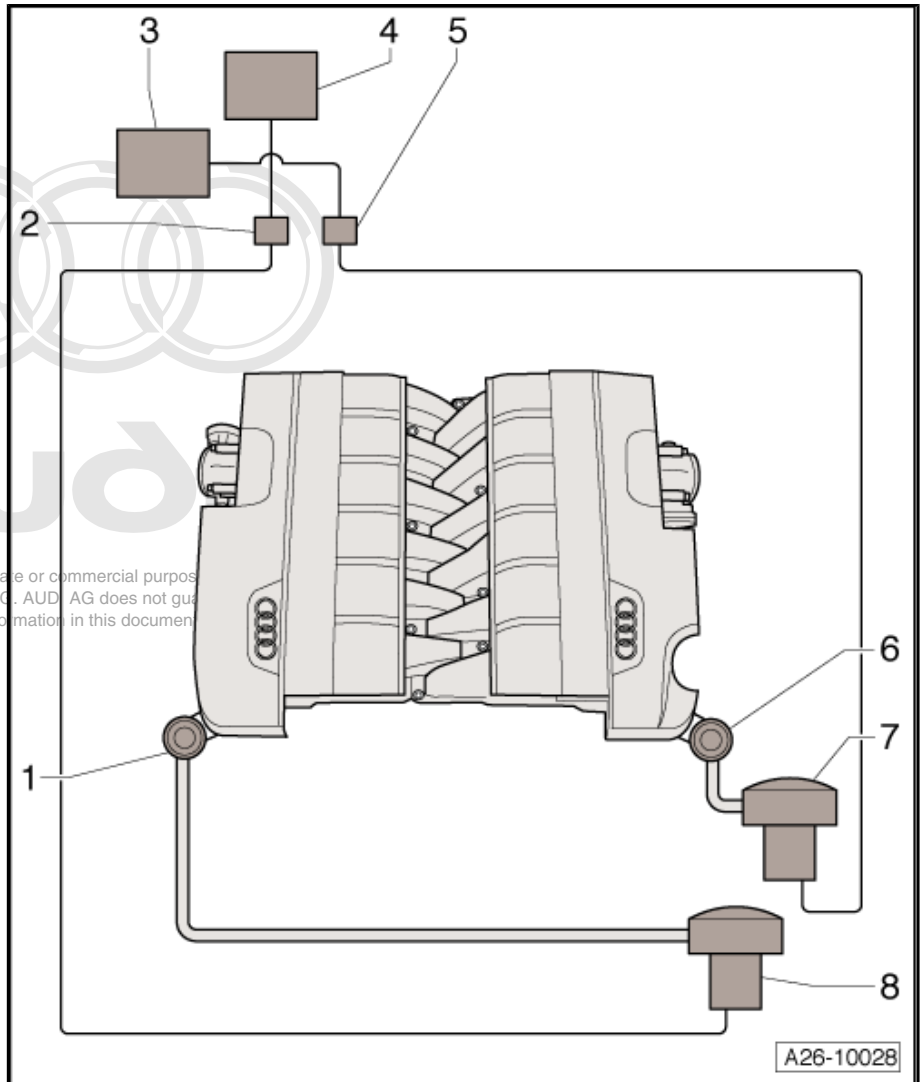
- Fitting location: at front left of engine
- Checking ⇒ [page 244](#)
- Removing and installing ⇒ [page 246](#)

### 7 - Secondary air pump motor 2 - V189-

- For cylinder bank 2 (left-side)
- Fitting location ⇒ [page 244](#)
- Removing and installing ⇒ ["2.4 Removing and installing secondary air pumps", page 245](#)

### 8 - Secondary air pump motor - V101-

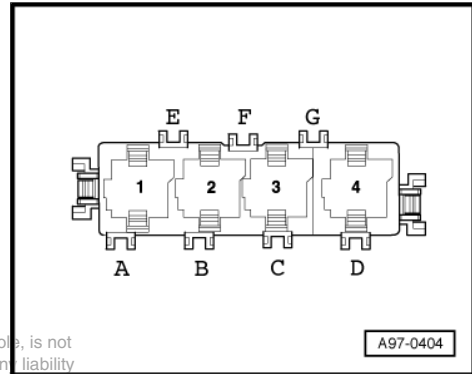
- For cylinder bank 1 (right-side)
- Fitting location ⇒ [page 244](#)
- Removing and installing ⇒ ["2.4 Removing and installing secondary air pumps", page 245](#)



**Installation position of relays and fuses for secondary air pump**

◆ In electronics box (plenum chamber)

- 1 - Secondary air pump relay - J299-
- 2 - Relay for secondary air pump 2 - J545-
- B - Secondary air pump fuse - S130- (50 amp)
- C - Secondary air pump fuse 2 - S284- (50 amp)

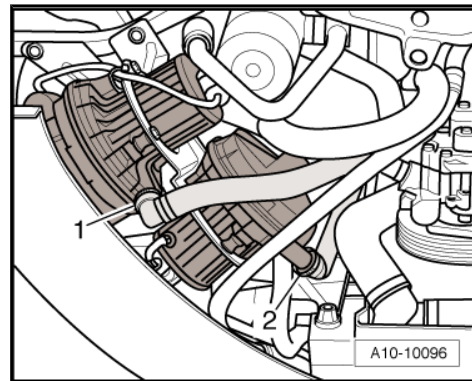


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**Fitting location of secondary air pump motor - V101- and secondary air pump motor 2 - V189-**

◆ Front left behind bumper

- 1 - Secondary air pump motor - V101-
- 2 - Secondary air pump motor 2 - V189-



## 2.3 Checking combination valves for secondary air system for correct operation and leakage

**Test sequence**

- Disconnect pressure hose -1- at combination valve for secondary air.

**Note**

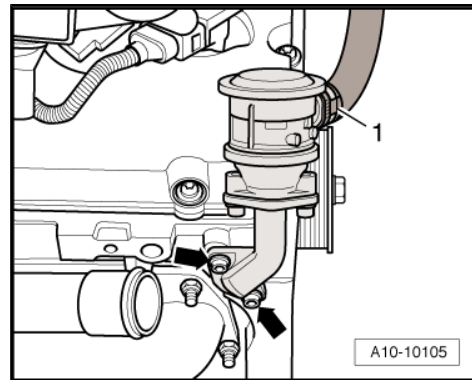
*Disregard -arrows-.*

Connect a suitable test hose at combination valve.

- Blow lightly into test hose with your mouth (do not use compressed air).
  - The combination valve should be closed; it should not be possible to blow through the valve.
- Blow into test hose with your mouth using more force (do not use compressed air).
  - The combination valve should open; it should now be possible to blow through the hose.

If you cannot determine the switching point:

- Renew combination valve: left-side ⇒ [page 246](#) , right-side ⇒ [page 248](#) .



## 2.4 Removing and installing secondary air pumps

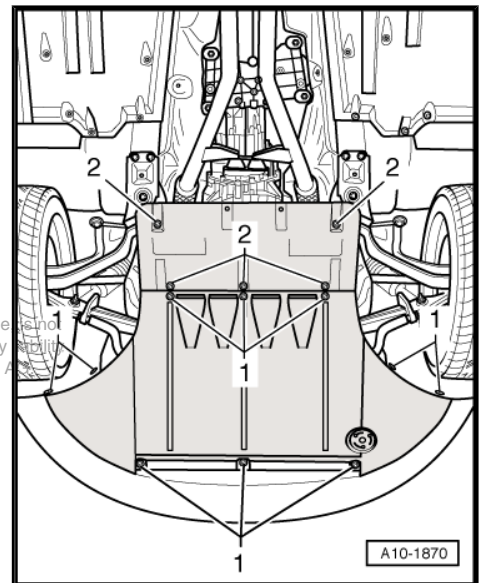
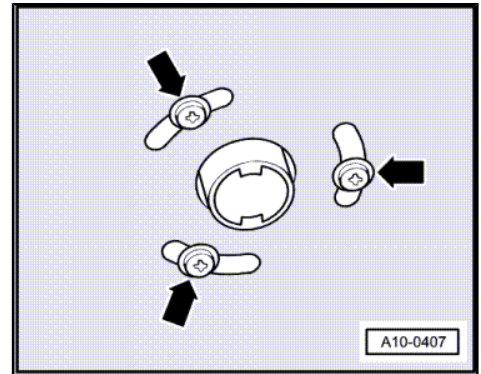
### Removing

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Remove front left wheel.

### Note

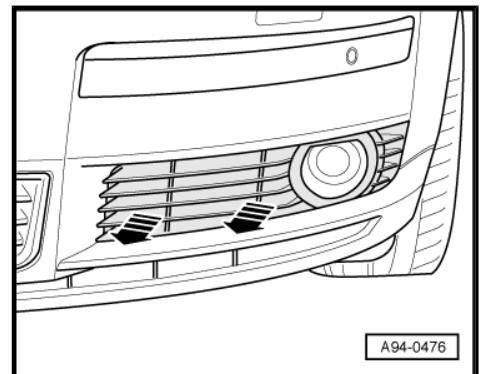
Secure brake disc with wheel bolts.

- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.
- Open quick-release fasteners -1- and remove noise insulation (front).
- Remove front section of wheel housing liner (front left) ⇒ General body repairs, exterior; Rep. gr. 66 .



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- Pull out air inlet grille (left-side) from bumper -arrows-.





- Unplug electrical connectors -1- and -5-.
- Release retaining tabs and disconnect hoses -2-, -3-, -6- and -7- at secondary air pumps -4- and -8-.
- Unbolt secondary air pumps from bracket.

**Installing**

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

**Note**

- ◆ *Renew O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

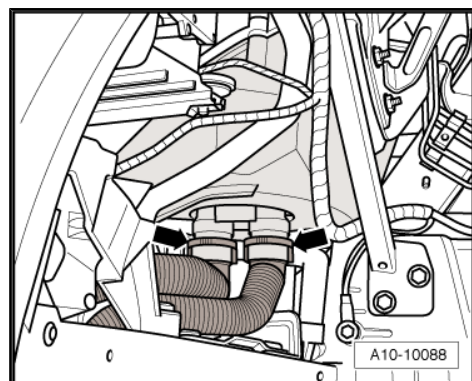
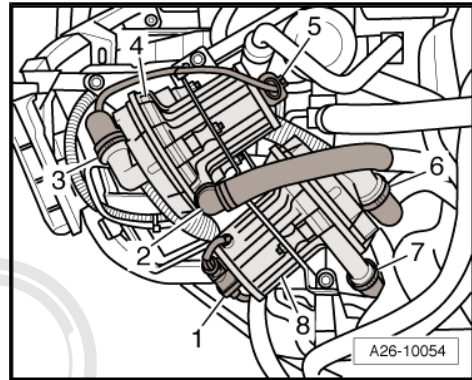
**Tightening torque**

Component	Nm
Secondary air pump to bracket	10

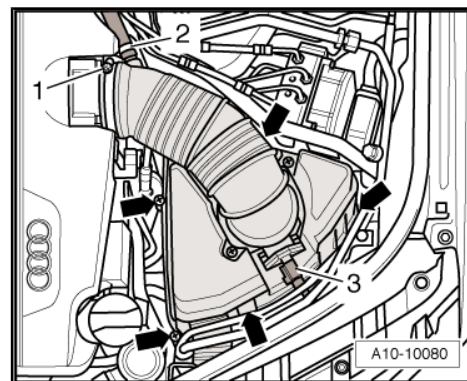
## 2.5 Removing and installing combination valve for secondary air system (left-side)

**Removing**

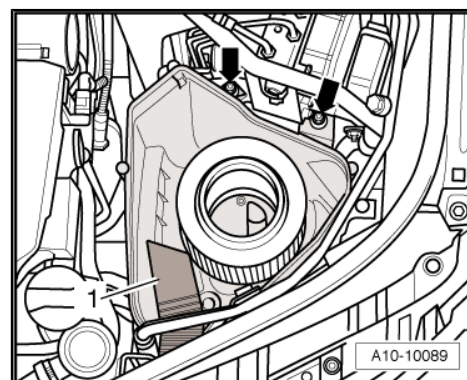
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .
- Remove front left wheel.
- Remove front section of wheel housing liner (front left) ⇒ General body repairs, exterior; Rep. gr. 66 .
- Press release tabs to detach the two air intake hoses (bottom) -arrows- at bottom section of air cleaner housing (left-side).



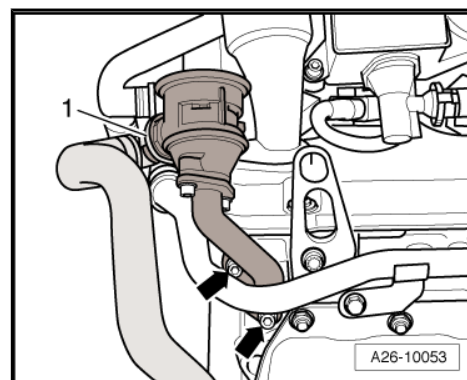
- Detach electrical connector -3- for air mass meter 2 - G246- .
- Detach hose -2- from air intake hose.
- Detach air intake hose -1- from intake manifold.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (left-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (left-side).



- Disconnect hose -1- at combination valve (left-side) for secondary air.
- Unscrew bolts -arrows- and remove the combination valve (left-side) for secondary air supply.



### Installing

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

#### Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 43 ; Operating the air suspension .

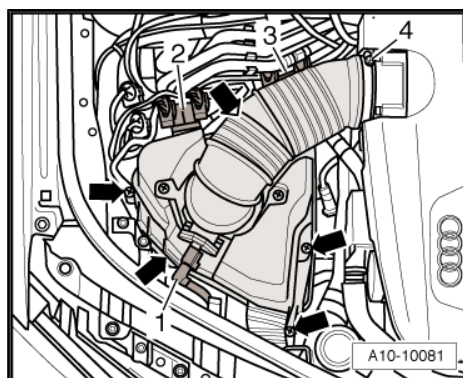
### Tightening torque

Component	Nm
Combination valve for secondary air system to cylinder head	10

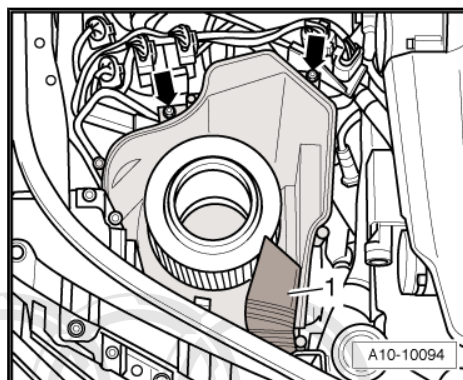
## 2.6 Removing and installing combination valve for secondary air system (right-side)

### Removing

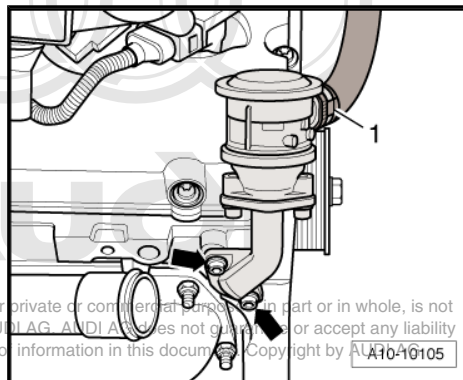
- Detach electrical connector -1- for air mass meter - G70- .
- Detach air intake hose -4- from intake manifold.
- Unhook bracket for connectors -2- and -3- at top section of air cleaner housing.
- Remove bolts -arrows-.
- Detach top section of air cleaner housing (right-side).



- Remove air duct -1-.
- Remove bolts -arrows-.
- Remove bottom section of air cleaner housing (right-side).



- Disconnect hose -1- at combination valve (right-side) for secondary air.
- Unscrew bolts -arrows- and remove the combination valve (right-side) for secondary air supply.



### Installing

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



#### Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

### Tightening torque

Component	Nm
Combination valve for secondary air system to cylinder head	10

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### 3 Exhaust flaps

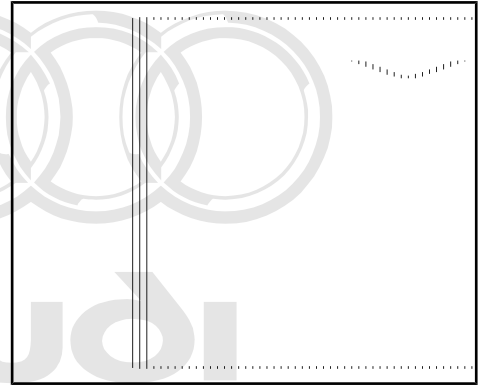
⇒ [“3.1 Checking exhaust flaps”, page 249](#)

⇒ [“3.2 Checking vacuum unit for exhaust flap”, page 250](#)

#### 3.1 Checking exhaust flaps

##### Special tools and workshop equipment required

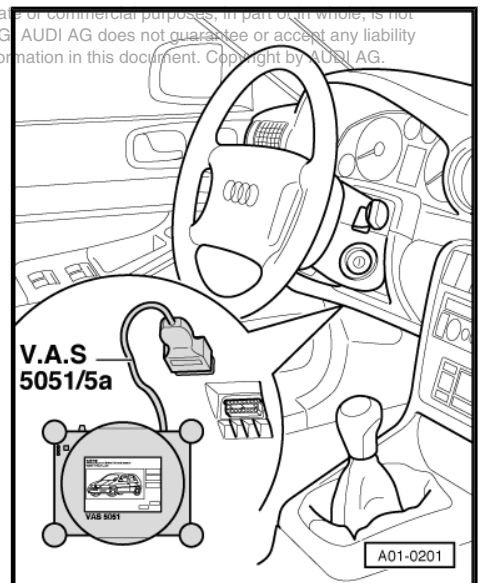
- ◆ Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead - VAS 5051/5A-



##### Test sequence

- Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead - VAS 5051/5A- connected.
- Run engine briefly to ensure the vacuum necessary for testing is present in vacuum reservoir.
- Switch engine off and ignition on.
- Select Vehicle Self-Diagnosis and vehicle system “01 - Engine electronics”.

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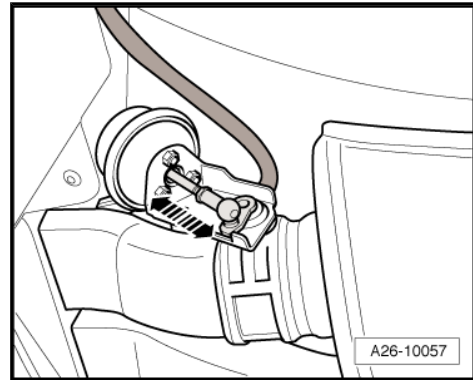


Display on -VAS 5051 A- :

- From the menu -1- select the diagnostic function “03 - Final control diagnosis”.

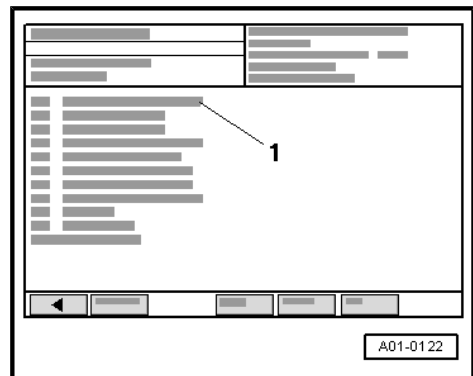


- Press key repeatedly until exhaust flap valve - N321- is activated.
- The exhaust flap operating rod (right-side) should move up and down.
- Press key to exit "03 - Final control diagnosis" function.
- Press "06 - End output".
- Select vehicle system "11 - Engine electronics II".

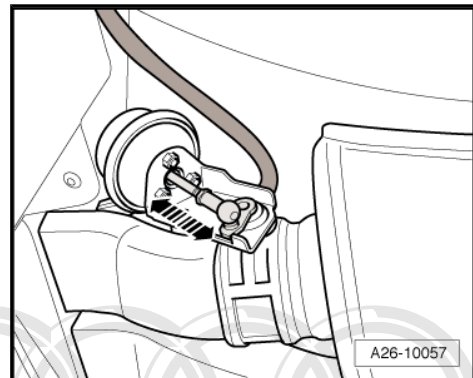


Display on -VAS 5051 A- :

- From the menu -1- select the diagnostic function "03 - Final control diagnosis".



- Press key repeatedly until exhaust flap valve 2 - N322- is activated.
- The exhaust flap operating rod (left-side) should move up and down.
- Press key to exit "03 - Final control diagnosis" function.
- Press "06 - End output".
- Switch off ignition.



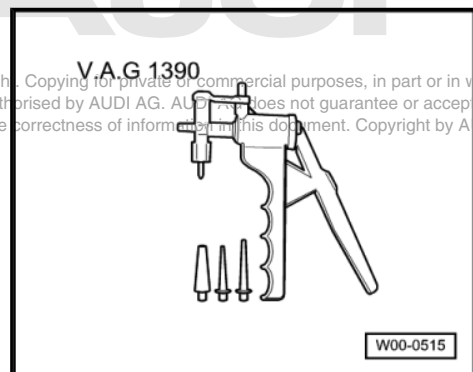
If the operating rod does not move:

- Check vacuum unit of exhaust flap ⇒ [page 250](#) .
- Check vacuum line leading from vacuum reservoir to corresponding exhaust flap valve (rear) on underbody.
- Check exhaust flap valve - N321- and -N322- in "Guided Fault Finding".

## 3.2 Checking vacuum unit for exhaust flap

### Special tools and workshop equipment required

- ◆ Hand vacuum pump with accessories - V.A.G 1390-



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### Test sequence

- Disconnect hose at vacuum unit for exhaust flap on rear silencer.
- Connect hand vacuum pump - V.A.G 1390- to vacuum unit.
- Use hand vacuum pump to generate vacuum.
  - The linkage should move upwards.
- Vent hand vacuum pump.
  - Linkage should move downwards.

If the linkage does not move:

**Check linkage for ease of movement and check vacuum unit for leaks.**  
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