

## Workshop Manual Audi A6 2005 ➤

**6-cylinder direct injection engine (2.8 ltr. 4-valve),  
mechanics**

|           |     |          |          |  |  |  |  |  |  |
|-----------|-----|----------|----------|--|--|--|--|--|--|
| Engine ID | BDX | CCD<br>A | CCE<br>A |  |  |  |  |  |  |
|-----------|-----|----------|----------|--|--|--|--|--|--|

Edition 05.2015

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## List of Workshop Manual Repair Groups

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



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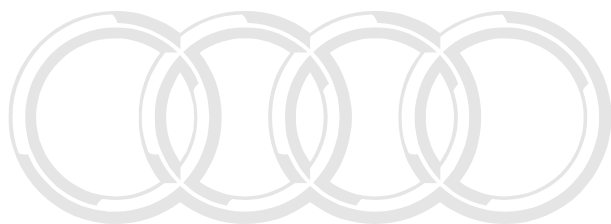
Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of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

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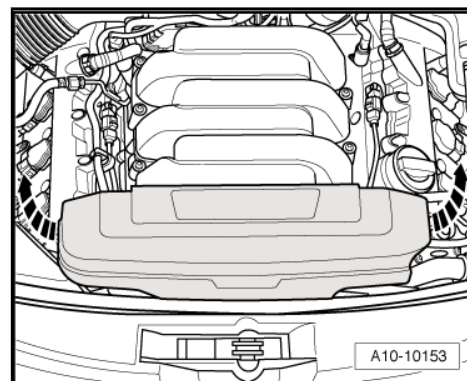
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## 00 – Technical data

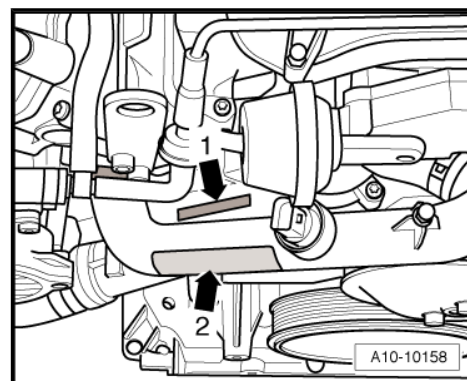
### 1 Engine number

(ARL004270; Edition 05.2015)

- Pull off engine cover panel (front) -arrows-.



- ◆ The engine number ("engine code" and "serial number") can be found on the front of the cylinder block beneath the cylinder head (right-side) -arrow 1-.
- ◆ Additionally there is a sticker on the coolant pipe (front) -arrow 2- showing the "engine code" and "serial number".
- ◆ The engine code is also included on the vehicle data sticker.



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## 2 Engine data

| Code letters                                                                                                                                                                                                                             |           | BDX               | CCDA              | CCEA              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------|-------------------|-------------------|
| Capacity                                                                                                                                                                                                                                 | ltr.      | 2.773             | 2.773             | 2.773             |
| Power output                                                                                                                                                                                                                             | kW at rpm | 154/6000          | 140/5000          | 162/5000          |
| Torque                                                                                                                                                                                                                                   | Nm at rpm | 270/3000 ... 5000 | 280/3200 ... 5000 | 280/3200 ... 5000 |
| Bore                                                                                                                                                                                                                                     | Ø mm      | 84.5              | 84.5              | 84.5              |
| Stroke                                                                                                                                                                                                                                   | mm        | 82.4              | 82.4              | 82.4              |
| Compression ratio                                                                                                                                                                                                                        |           | 12.0              | 12.0              | 12.0              |
| RON                                                                                                                                                                                                                                      | at least  | 98 <sup>1)</sup>  | 95 <sup>2)</sup>  | 95 <sup>2)</sup>  |
| Injection/ignition system                                                                                                                                                                                                                |           | Simos             | Simos             | Simos             |
| Firing order                                                                                                                                                                                                                             |           | 1-4-3-6-2-5       | 1-4-3-6-2-5       | 1-4-3-6-2-5       |
| Exhaust gas recirculation                                                                                                                                                                                                                |           | no                | no                | no                |
| Turbocharging/supercharging                                                                                                                                                                                                              |           | no                | no                | no                |
| Knock control                                                                                                                                                                                                                            |           | Inlet and exhaust | Inlet and exhaust | Inlet and exhaust |
| Variable valve timing                                                                                                                                                                                                                    |           | yes               | yes               | yes               |
| Intake manifold change-over                                                                                                                                                                                                              |           | yes               | yes               | yes               |
| Secondary air system                                                                                                                                                                                                                     |           | no                | yes               | yes               |
| Valves per cylinder                                                                                                                                                                                                                      |           | 4                 | 4                 | 4                 |
| <ul style="list-style-type: none"> <li>• <sup>1)</sup> Unleaded premium RON 95 can also be used, but results in reduced power</li> <li>• <sup>2)</sup> Unleaded premium RON 91 can also be used, but results in reduced power</li> </ul> |           |                   |                   |                   |

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### 3 Safety precautions

⇒ [“3.1 Safety precautions when working on the fuel supply system”, page 3](#)

⇒ [“3.2 Safety precautions when working on vehicles with start/stop system”, page 3](#)

⇒ [“3.3 Safety precautions when using testers and measuring instruments during a road test”, page 4](#)

⇒ [“3.4 Safety precautions when working on the ignition system”, page 4](#)

⇒ [“3.5 Safety precautions when working on the cooling system”, page 4](#)

⇒ [“3.6 Safety precautions when working on the exhaust system”, page 5](#)

#### 3.1 Safety precautions when working on the fuel supply system

##### Risk of injury - fuel system operates under high pressure

The fuel system is pressurised. There is a risk of injury as fuel may spray out.

Before opening the fuel system:

- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap clean cloth around connection and open connection carefully).

##### Risk of fire due to escaping fuel

If the battery is connected, the door contact switch activates the fuel pump when the driver's door is opened. Escaping fuel may ignite, causing a fire.

- Before opening the fuel system, disconnect power supply to fuel pump.

#### 3.2 Safety precautions when working on vehicles with start/stop system

##### Risk of injury - engine may start unexpectedly

On vehicles with the start/stop system activated, the engine may start unexpectedly. If the start/stop system is activated, this is indicated by a message on the dash panel insert.

- Deactivate start/stop system by switching off ignition.



### 3.3 Safety precautions when using testers and measuring instruments during a road test

#### Risk of injury if test equipment is not secured

If an accident occurs and the front passenger's airbag is triggered, test equipment which is not secured adequately may be catapulted through the vehicle with potentially serious consequences.

- Secure test equipment on the rear seat with a strap.

Or

- Have a second mechanic operate test equipment on the rear seat.



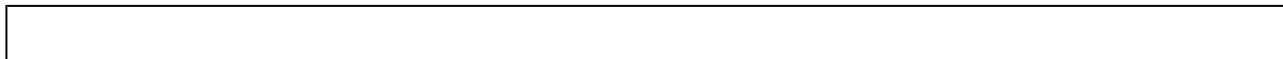
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### 3.4 Safety precautions when working on the ignition system

#### Risk of injury caused by electric shock

When the engine is running, there are high voltage levels in the ignition system. There is a risk of electric shock when touching the ignition system!

- Never touch or disconnect ignition wiring when the engine is running or being turned at cranking speed.



#### Risk of damage to components

Washing the engine or connecting/disconnecting electrical wiring may result in components being damaged if the engine is running.

- Switch off ignition before connecting/disconnecting electrical wiring.
- Switch off ignition before cleaning engine.

### 3.5 Safety precautions when working on the cooling system

#### Risk of scalding as hot coolant can escape

The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

- Wear protective gloves.
- Wear safety goggles.
- Release pressure (cover filler cap on coolant expansion tank with a cloth and open carefully).

### 3.6 Safety precautions when working on the exhaust system

When working on the exhaust system please note the following:



#### Caution

*Risk of damage to flexible joint.*

- ◆ *Do not bend flexible joint more than 10°.*
- ◆ *Install flexible joint so that it is not under tension.*
- ◆ *Take care not to damage wire mesh on flexible joint.*

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## 4 General repair instructions

⇒ ["4.1 Rules for cleanliness when working on fuel supply system and injection system", page 6](#)

⇒ ["4.2 Checking fuel system for leaks", page 6](#)

⇒ ["4.3 Foreign particles in engine", page 6](#)

⇒ ["4.4 Contact corrosion!", page 7](#)

⇒ ["4.5 Routing and attachment of pipes, hoses and wiring", page 7](#)

⇒ ["4.6 Checking vacuum system", page 7](#)

⇒ ["4.7 Installing radiators and condensers", page 8](#)

### 4.1 Rules for cleanliness when working on fuel supply system and injection system

Even small amounts of dirt can cause malfunctions. For this reason, please observe the following rules when working on the fuel supply system and injection system:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- ◆ Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- ◆ Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- ◆ When the system is open, do not work with compressed air and do not move the vehicle.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

### 4.2 Checking fuel system for leaks

- Allow engine to run for several minutes at moderate rpm.
- Switch off ignition.
- Check complete fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Road-test vehicle and accelerate with full throttle at least once.
- Then inspect high-pressure section of fuel system again for leaks.

### 4.3 Foreign particles in engine

- ◆ When working on the engine, all open inlet and exhaust ports must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122- ) to prevent foreign particles from entering the engine.
- ◆ In the event of mechanical damage to one of the cylinder banks, the intake and exhaust systems and combustion cham-

bers of the opposite cylinder bank must always be examined for foreign particles to prevent further damage occurring later.

#### 4.4 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.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

##### Note the following:

- ◆ We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- ◆ We recommend the use of Audi accessories.
- ◆ Damage caused by contact corrosion is not covered under warranty.

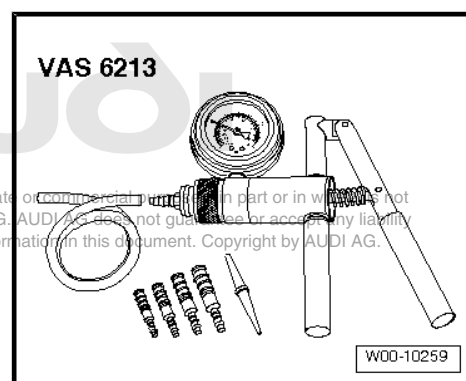
#### 4.5 Routing and attachment of pipes, hoses and wiring

- ◆ Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.
- ◆ To prevent damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (little space in engine compartment).

#### 4.6 Checking vacuum system

##### Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



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##### Procedure

- Check all vacuum lines in the complete vacuum system for:
  - ◆ Cracks
  - ◆ Traces of animal bites
  - ◆ Kinked or crushed lines
  - ◆ Lines porous or leaking
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.



- If a fault is stored in the memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines in the system.
- If it is not possible to build up a vacuum with the hand vacuum pump - VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

## 4.7 Installing radiators and condensers

Even when the radiator and condenser are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator or the condenser.



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## 10 – Removing and installing engine

### 1 Removing and installing engine - vehicles with manual gearbox

⇒ "1.1 Removing engine", page 9

⇒ "1.2 Separating engine and manual gearbox", page 27

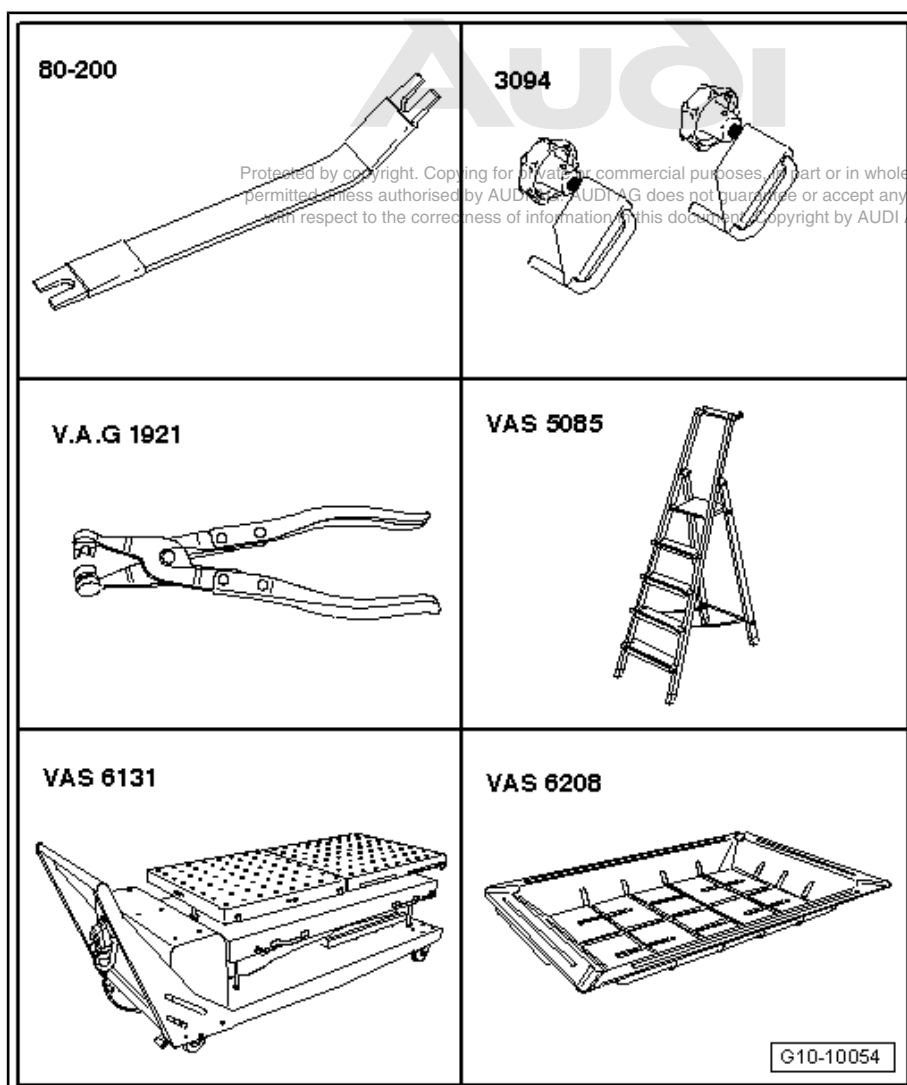
⇒ "1.3 Securing engine to engine and gearbox support", page 31

⇒ "1.4 Installing engine", page 33

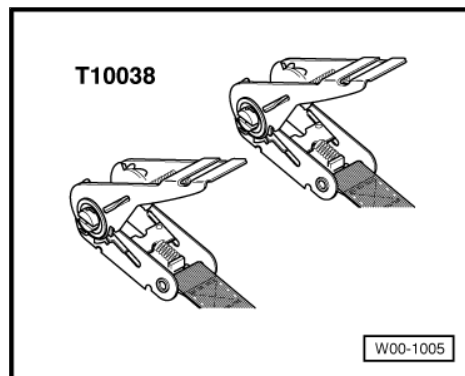
#### 1.1 Removing engine

##### Special tools and workshop equipment required

- ◆ Removal lever - 80-200-
- ◆ Hose clamps up to Ø 25 mm - 3094-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Stepladder - VAS 5085-
- ◆ Scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , -VAS 6131/11- and -VAS 6131/12-
- ◆ Drip tray for workshop hoist - VAS 6208-



## ◆ Tensioning strap - T10038-



## Procedure



## Note

- ◆ *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*

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## WARNING

***Make sure the vehicle cannot tip over when the engine is removed.***

- ◆ ***Secure the vehicle, to do so, the luggage compartment must be empty.***



## Caution

***To prevent irreparable damage to the electronic components when disconnecting the battery:***

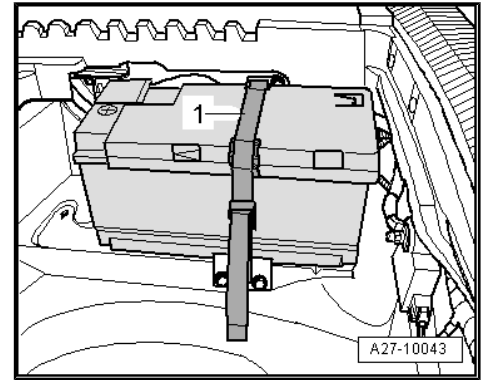
- ◆ ***Observe notes on procedure for disconnecting the battery.***



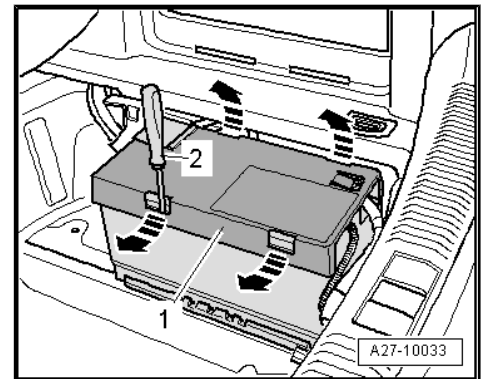
## Note

- ◆ *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.*
- ◆ *On four-wheel drive vehicles, the electromechanical parking brake must be released before disconnecting the battery so that the propshaft can be turned during removal.*

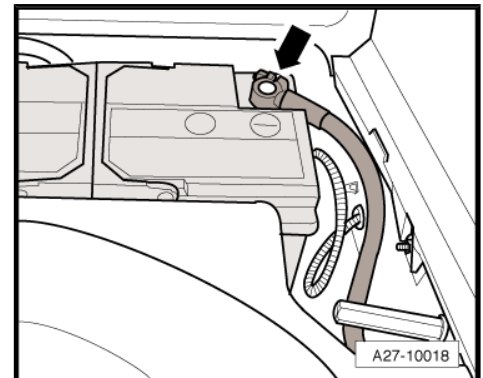
- Take out luggage compartment floor trim.
- Release battery retaining strap -1- (if fitted).



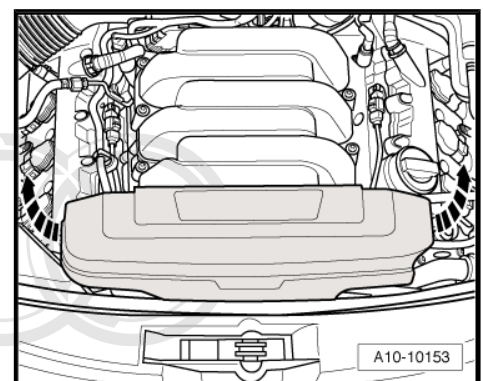
- Use screwdriver -2- to release retaining clips -arrows- and detach cover -1-.



- Disconnect earth cable -arrow- at battery.



- Pull off engine cover panel (front) -arrows-.



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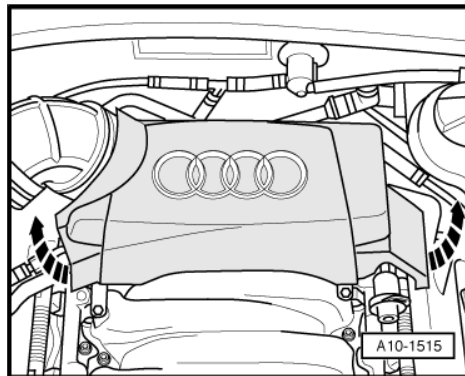
- Pull off engine cover panel (rear) -arrows-.



### WARNING

*Hot steam/hot coolant can escape - risk of scalding.*

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.*



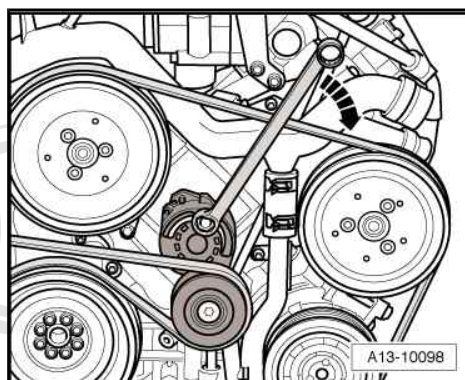
- Open filler cap on coolant expansion tank.



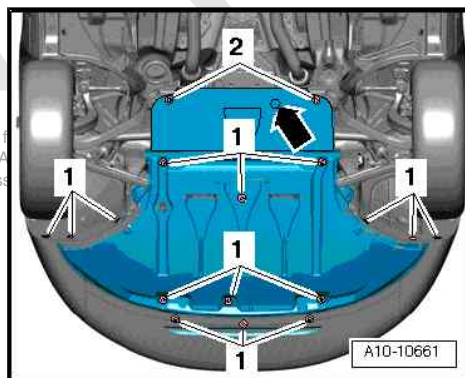
### Note

*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 poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt and release pressure from the tensioner.
- Remove both front wheels.

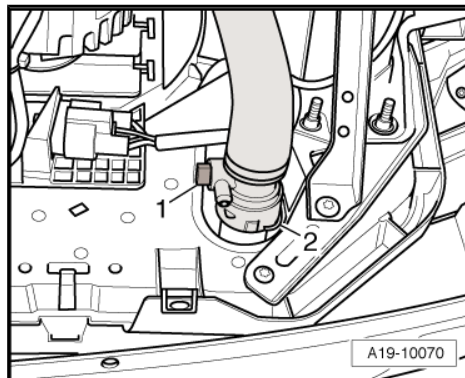


- Release fasteners -1, 2, arrow- and remove noise insulation.

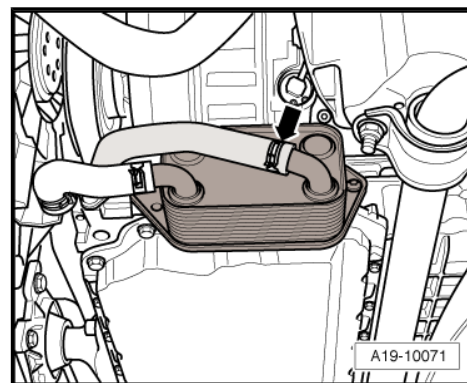


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- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Open drain plug -1- and let coolant drain.
- Then disconnect coolant hose -2- from radiator.



- Disconnect coolant hose -arrow- at engine oil cooler and drain off remaining coolant.

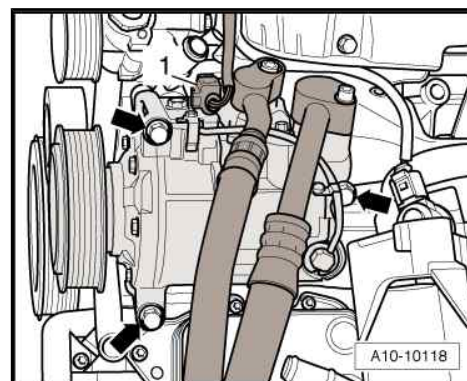


- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**WARNING**

*Risk of injury caused by refrigerant.*

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



- Unscrew air conditioner compressor from bracket -arrows-.

**Caution**

*Danger of damage to refrigerant lines and hoses.*

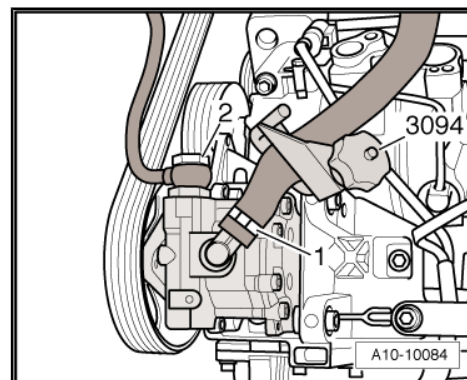
- ◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*

- Tie up air conditioner compressor with lines attached to left-side of vehicle.

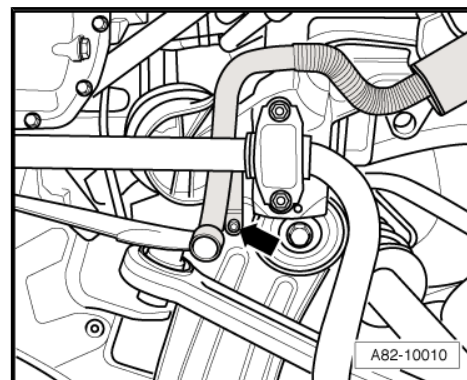
**Note**

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

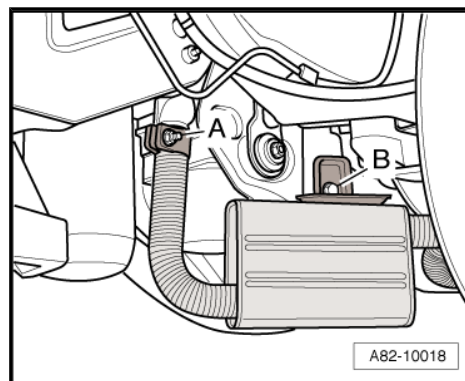
- Clamp off hydraulic hose -1- for power steering pump using hose clamps up to 25 mm - 3094- .
- Disconnect hydraulic hose from power steering pump.
- Unbolt hydraulic pressure line -2- at power steering pump and lay pressure line on top of longitudinal member.

**Vehicles with auxiliary heater:**

- Detach wheel housing liner (front left) at the front ⇒ Rep. gr. 66 .
- Remove bolt -arrow- for corrugated exhaust pipe.

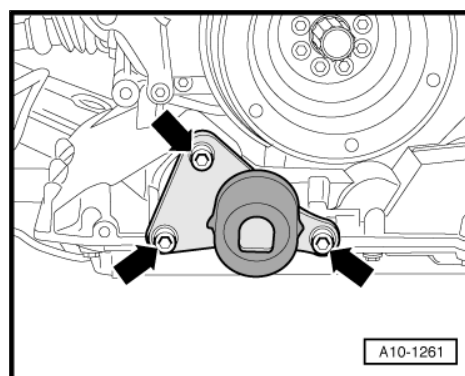


- Slacken nut -A- on clamp for corrugated exhaust pipe.
- Remove bolt -B- and detach exhaust silencer with corrugated exhaust pipes.

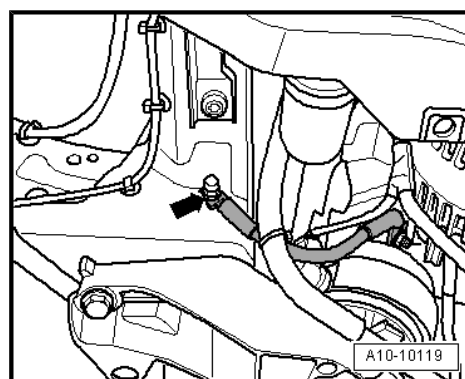


#### All vehicles (continued):

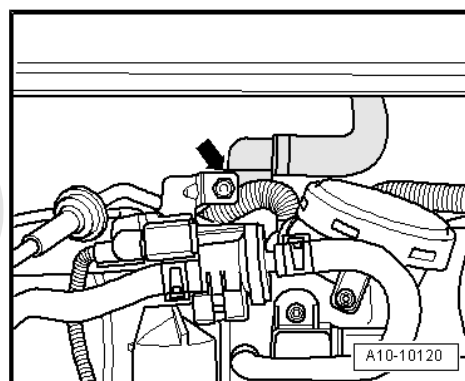
- Unscrew bolts -arrows- and remove torque reaction support from engine.



- Unbolt earth cable -arrow- at longitudinal member (right-side).

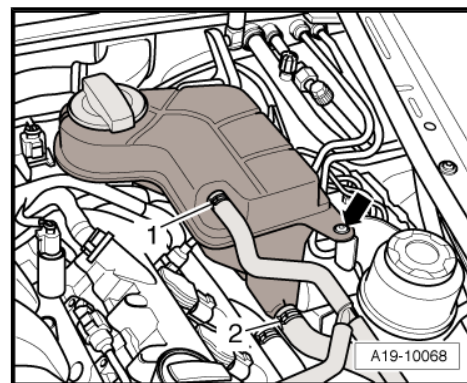


- Detach coolant hose -arrow- from heat exchanger at rear of engine.

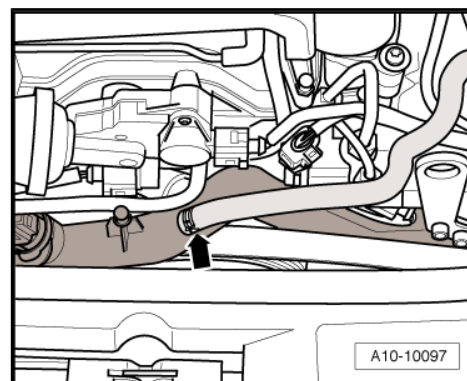


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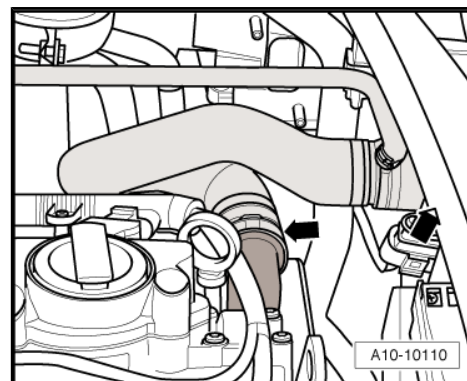
- Detach coolant hoses -1- and -2- from coolant expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank (bottom).



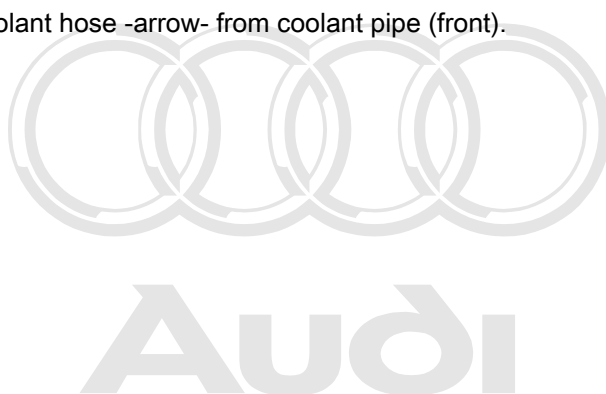
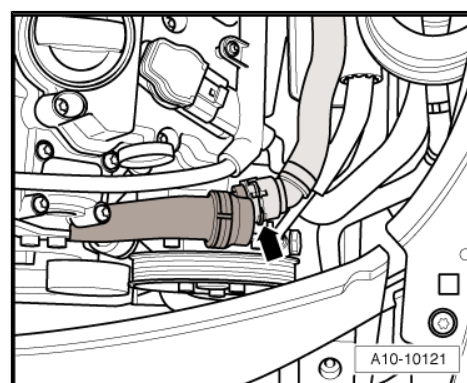
- Detach coolant hose -arrow- from coolant pipe (front).



- Remove coolant hose (front left) in engine compartment -arrows-.



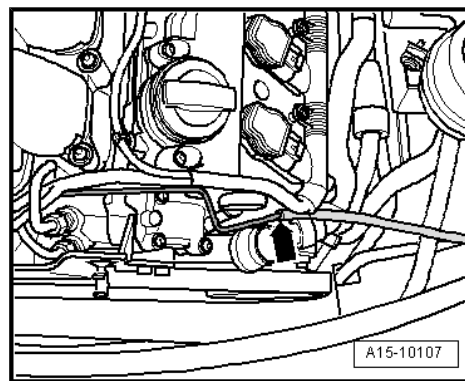
- Detach coolant hose -arrow- from coolant pipe (front).



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### USA models:

- Disconnect vacuum hose -arrow- leading to leak diagnostic pump.



### All vehicles (continued):

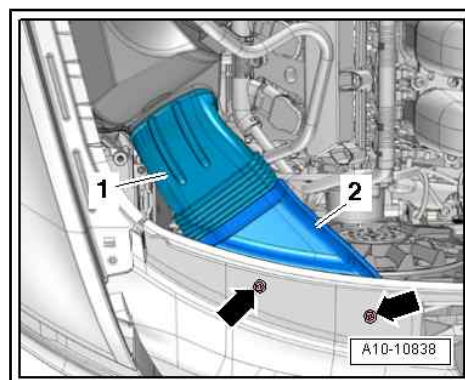
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



### Caution

Take care to keep components clean.

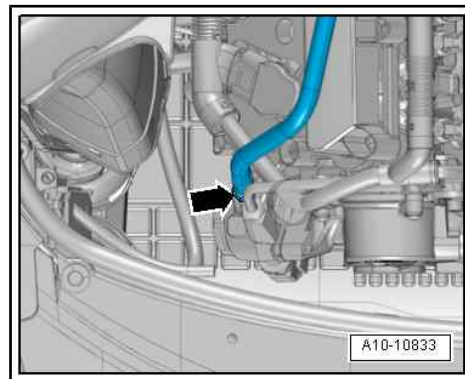
- ◆ Rules for cleanliness when working on the injection system ⇒ [page 6](#).



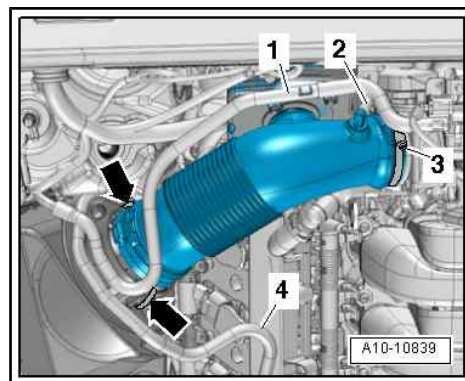
### WARNING

Risk of injury caused by fuel.

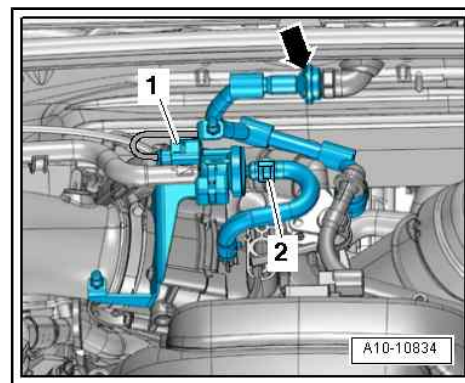
- ◆ To allow the fuel pressure to dissipate, wrap a clean cloth around the connection and carefully loosen the connection before opening the fuel system.



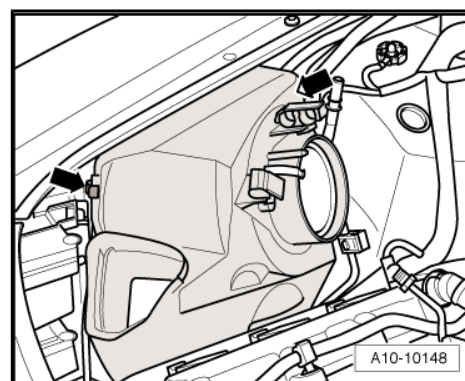
- Detach fuel supply hose from high-pressure pump -arrow- and move clear.
- Move fuel line -4- and line -1- leading to activated charcoal filter clear on air cleaner housing and air pipe.
- Disconnect vacuum hose -2- from connection on air hose.
- Remove air pipe. To do so, release hose clip -3- and clamps -arrows-.



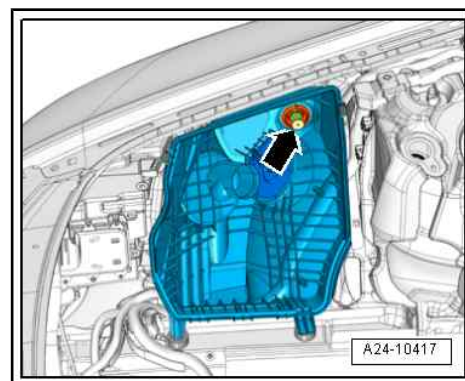
- Unplug electrical connector -1- at activated charcoal filter solenoid valve 1 - N80- and detach vacuum hose -2-.
- Detach activated charcoal filter solenoid valve 1 - N80- from bracket and move it clear to the side with hose still attached.
- Detach non-return valve -arrow- for brake servo from plenum chamber partition panel.



- Release clamps -arrows- and detach air cleaner (top section).



- Pull out pin of fastener -arrow- and detach air cleaner (bottom section).

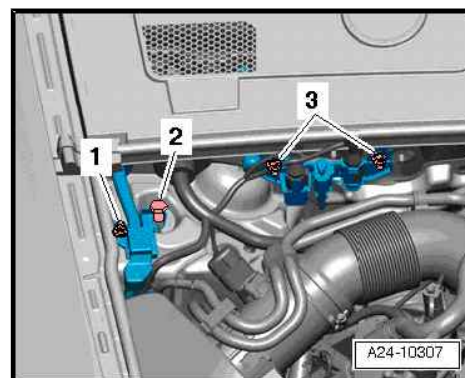


- Unscrew nuts -3- and detach bracket for connectors (right-side) from plenum chamber partition panel.

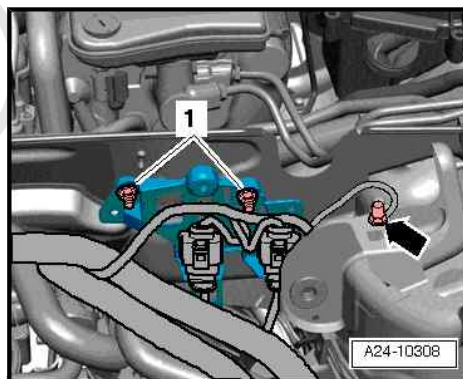
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- Unscrew nut -1- on positive terminal.

- Unscrew earth stud -2-.

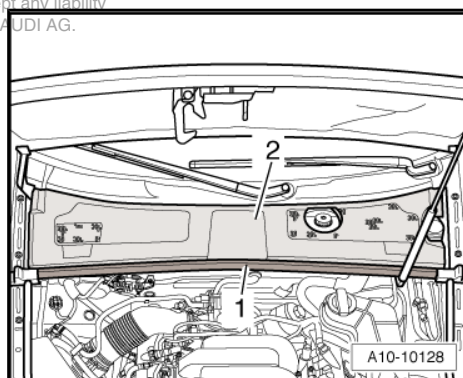


- Unscrew nuts -1- and detach bracket for connectors (left-side) from plenum chamber partition panel.
- Unbolt earth cable -arrow- at suspension turret (left-side).



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

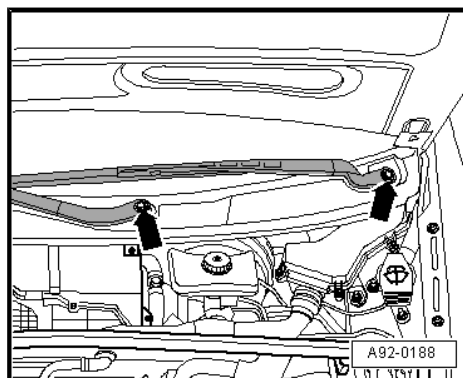


- Pry off caps on windscreen wiper arms with a screwdriver.
- Loosen nuts -arrows- several turns.
- Tilt windscreen wiper arms one by one and loosen from wiper shafts.
- Remove nuts completely and take off wiper arms.



### Note

Use puller (commercially available) to remove wiper arm if necessary.



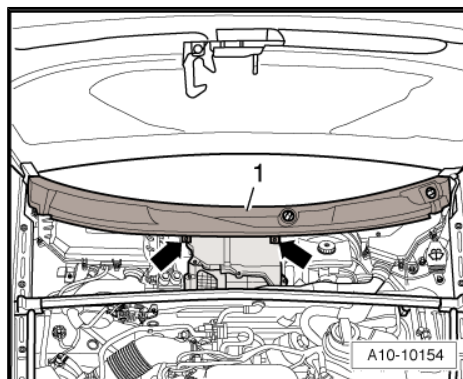
- Unscrew bolts -arrows- for cowl panel trim -1-.



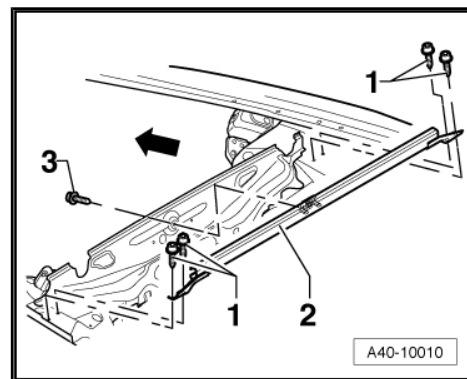
### Caution

To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.

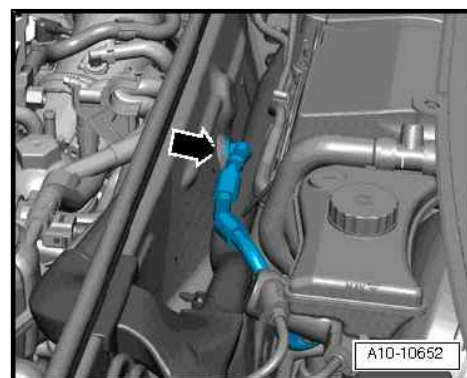
- Pull cowl panel trim off windscreen.



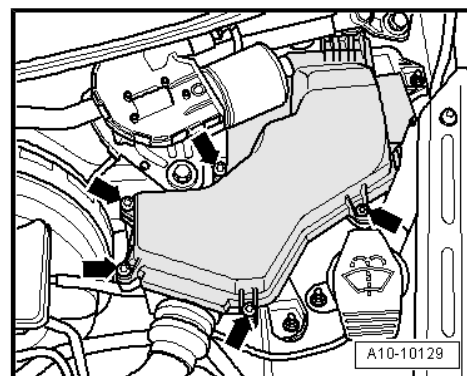
- If fitted, unscrew bolts -1- and -3- and remove body brace -2-.



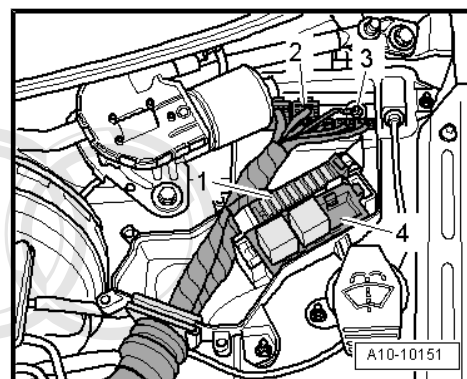
- Detach vacuum line -arrow- going to brake servo at plenum chamber partition panel.



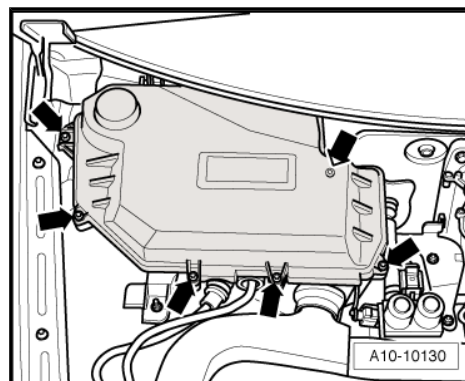
- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



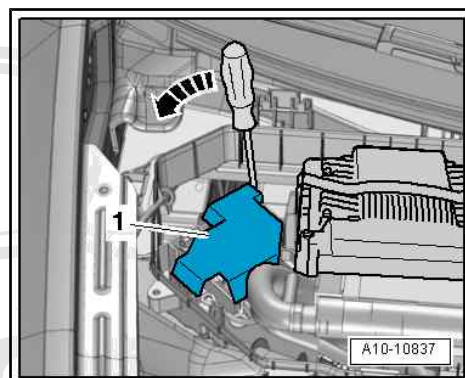
- Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
- Unscrew electrical wiring -3-.
- Unplug electrical connectors -2- at rear of connector console.
- Disengage engine wiring harness at electronics box and move it clear.



- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).



- Open cover -1- with screwdriver -arrow- and detach.



# WARNING

**Risk of burns at the pump valve unit for the heating system (left-side in front of electronics box).**

- ◆ **Wear protective gloves when working near the pump valve unit for the heating system.**

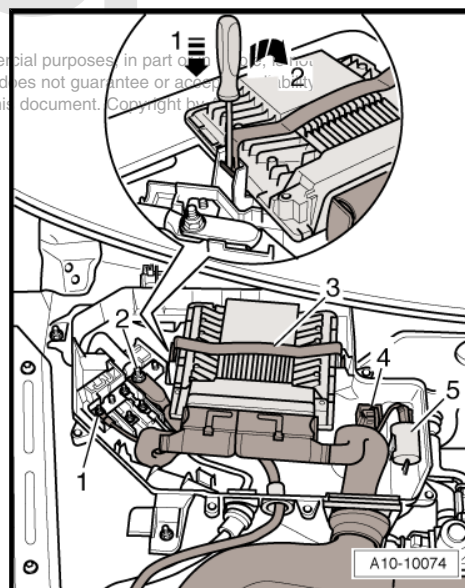
- Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.



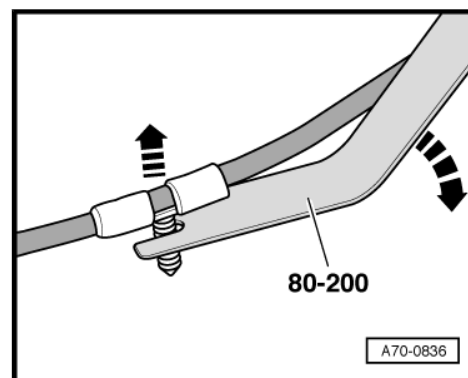
# Note

*The engine control unit remains connected to the wiring harness.*

- Unclip suppressor capacitor -5- and take out of retainer in electronics box.
- Unplug electrical connector -4- at rear of connector console.
- Unscrew electrical wiring connections -1- and -2-.



- Release electrical wiring up to the alternator using removal lever - 80 - 200- .
- Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.

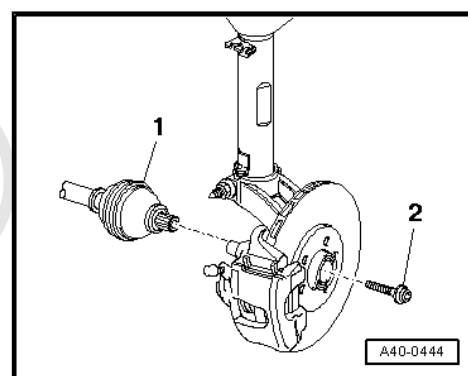


- Have a 2nd mechanic press the brake pedal.

**Caution**

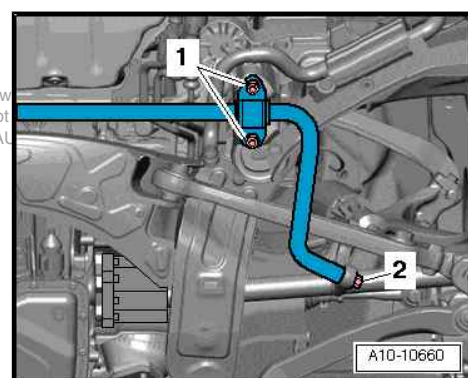
*Risk of damage to wheel bearing.*

- ◆ *When slackening the flange bolt securing the drive shaft, the vehicle must not be standing on its wheels.*

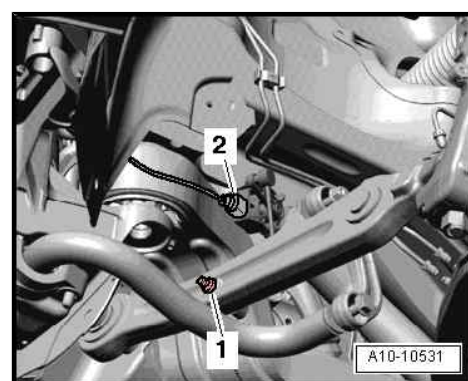


- Unscrew flange bolt -2- from drive shaft -1- (left and right).
- Unscrew nuts -1- evenly on both sides.
- Remove bolts -2- (left and right) and detach anti-roll bar.

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- Unplug electrical connector -2- at vehicle level sender.
- Detach coupling rod -1- at track control link.



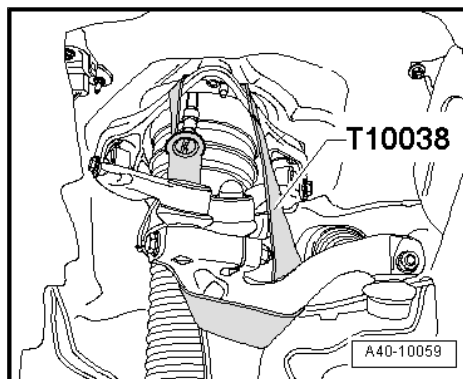


### Caution

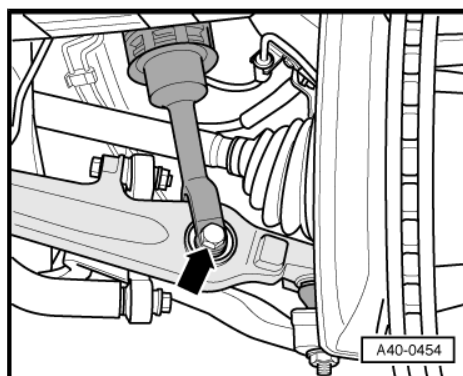
***Danger of damage to the swivel joints of the upper links.***

◆ ***Support wheel bearing housing.***

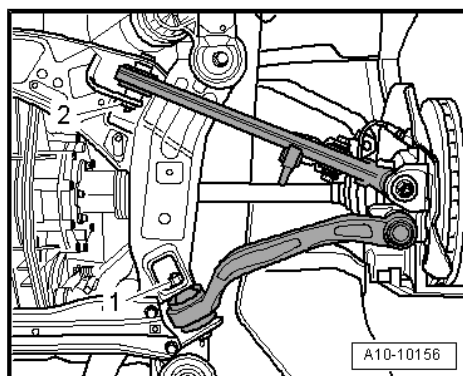
- Tie up wheel bearing housing using tensioning strap - T10038- as illustrated.



- Unbolt suspension strut from track control link -arrow-.



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



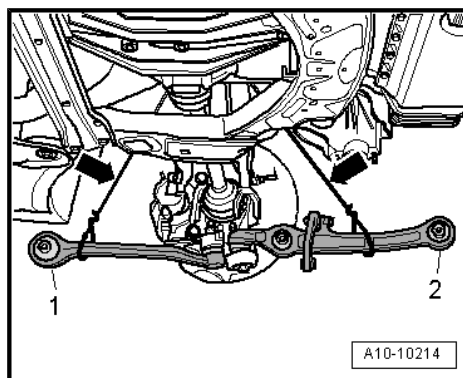
- Pivot guide link -1- and track control link -2- outwards.



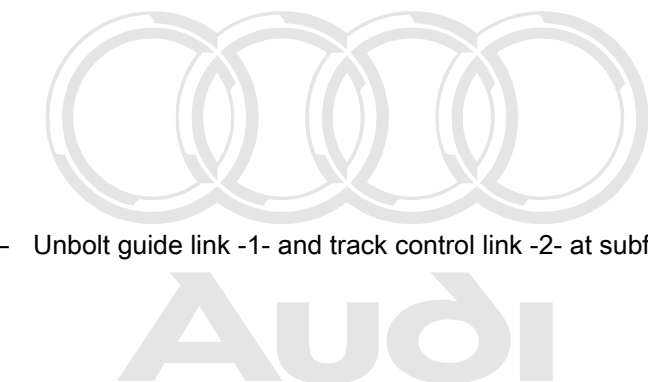
### Caution

***Risk of damage if guide link and track control link are allowed to drop without support.***

◆ ***Tie up guide link and track control link to wheel bearing housing -arrows- as shown in illustration.***



- Repeat procedure on other side of vehicle.



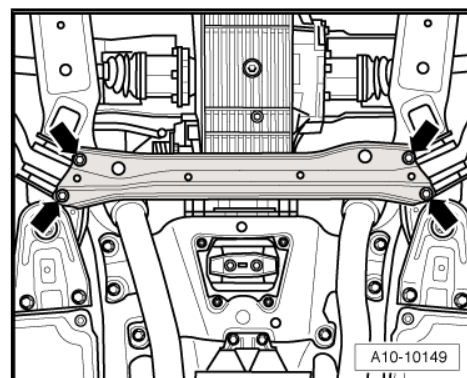
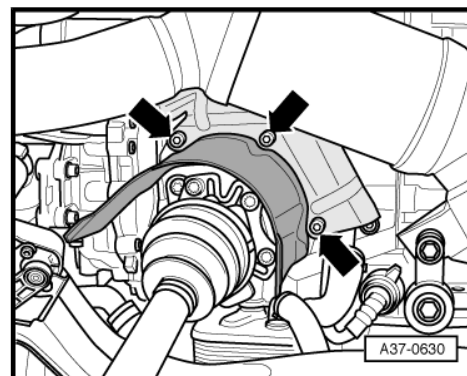
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- Unbolt heat shield for drive shaft -arrows-.
- Unbolt drive shaft from flange shaft on gearbox.

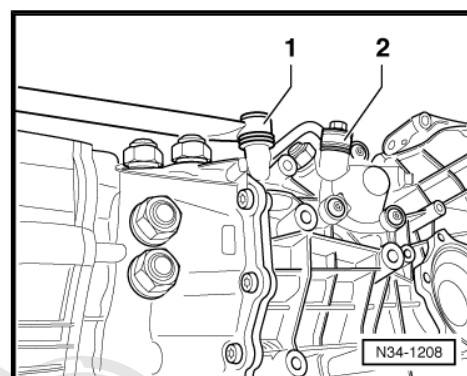
**Caution**

*Take care not to damage brake hose.*

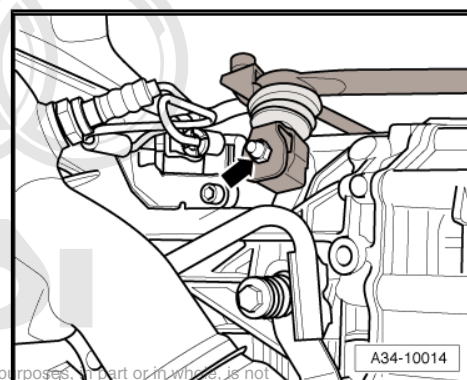
- Pivot wheel bearing housing outwards and remove drive shaft.
- Repeat procedure on other side of vehicle.
- Unbolt cross piece from subframe -arrows-.



- Unscrew connecting rod -2- of selector rod.
- Unbolt push rod -1- using hexagon key (8 mm) to remove bolt.

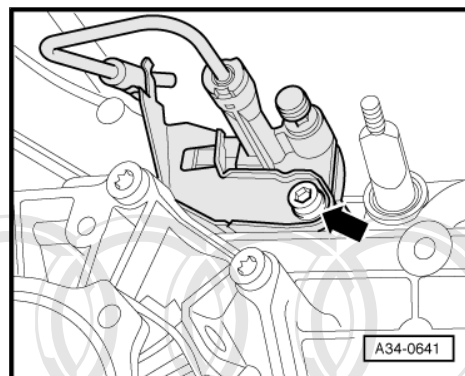


- Unscrew nut -arrow- and pull gearbox selector lever off selector shaft.

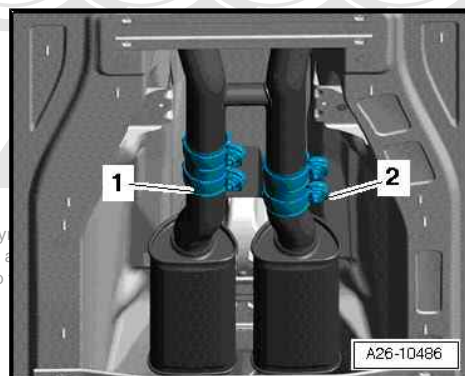


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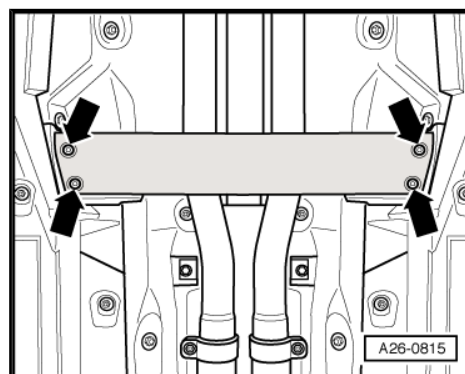
- Remove clutch slave cylinder -arrow- and tie up with wire. Do not open pipes.



- Loosen clamps -1- and -2-.

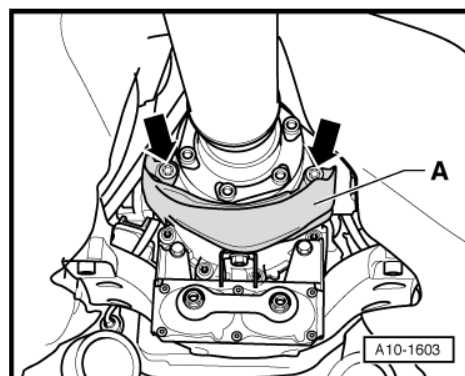


- Unbolt cross piece (front) -arrows-.

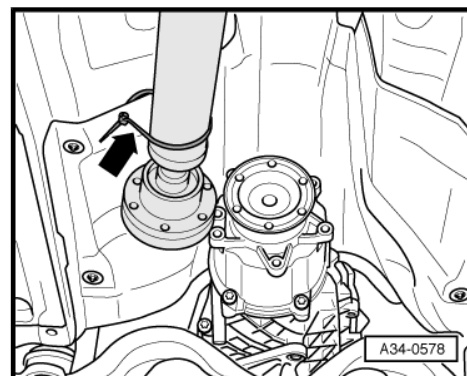


#### Vehicles with four-wheel drive:

- If fitted, unscrew heat shield -A- for propshaft -arrows-.
- Unscrew bolts at gearbox/propshaft flange.
- Push propshaft back towards rear final drive. The constant velocity joints can be moved axially.



- Tie propshaft up to side of heat shield -arrow-.



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

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

| Platform coordinates | Parts from support set for Audi - VAS 6131/10- |       |       |        |
|----------------------|------------------------------------------------|-------|-------|--------|
| B4                   | /10-1                                          | /10-4 | /10-5 | /10-13 |
| F4                   | /10-1                                          | /10-4 | /10-5 | /10-12 |
| B10                  | /10-1                                          | /10-2 | /10-5 | /10-8  |
| G10                  | /10-1                                          | /10-2 | /10-5 | /10-8  |
| C12                  | /10-1                                          | /10-4 | /10-5 | /10-6  |
| F13                  | /10-1                                          | /10-4 | /10-5 | /10-9  |
| D16                  | /10-1                                          | /10-3 | /10-5 | /10-6  |

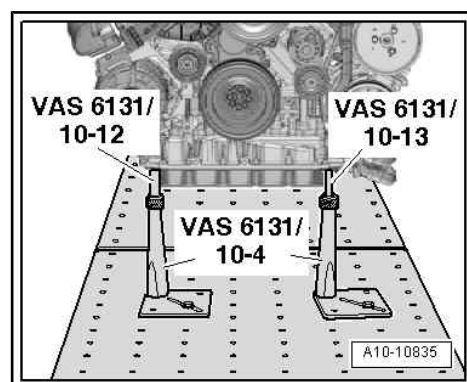
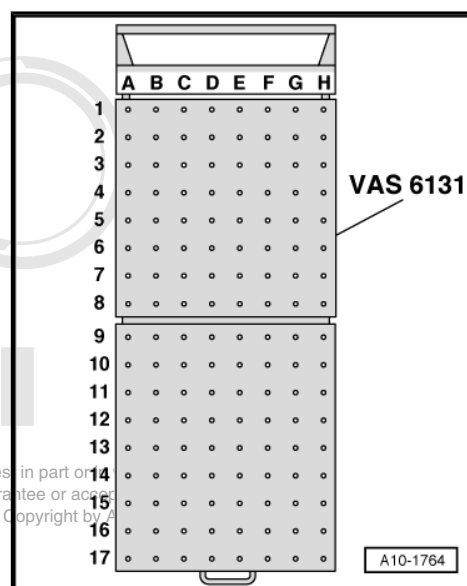
- Initially hand-tighten the support elements on the scissor-type assembly platform.

- Position scissor-type assembly platform - VAS 6131 A- horizontally.

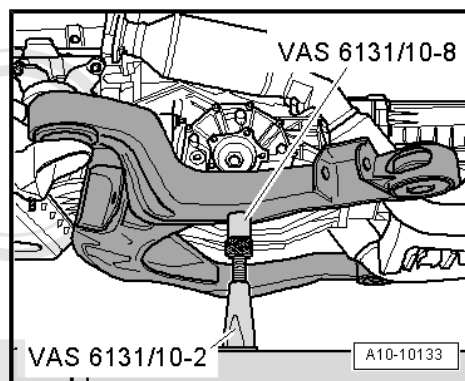
- Take note of spirit level (bubble gauge).

- Position scissor-type assembly platform - VAS 6131 A- below engine/gearbox assembly.

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

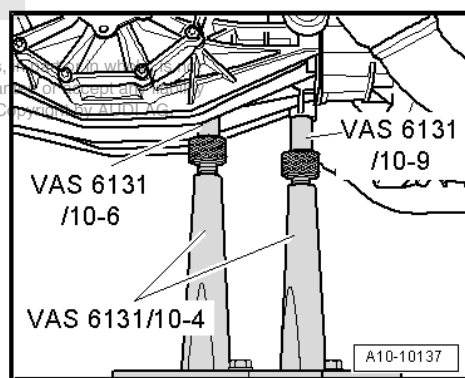


- Position support elements from -VAS 6131/10- at left and right of subframe, as shown in illustration.

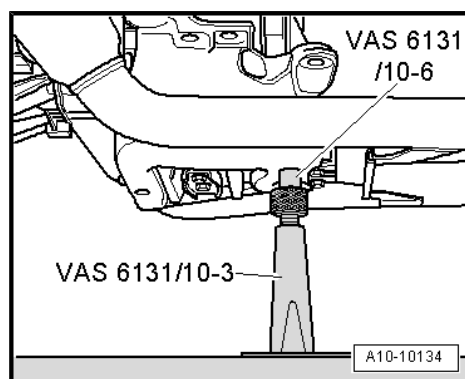


- Position support elements from -VAS 6131/10- at rear of gear-box, as shown in illustration.

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- Position the support elements from -VAS 6131/10- at rear of tunnel cross member, 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 A- .

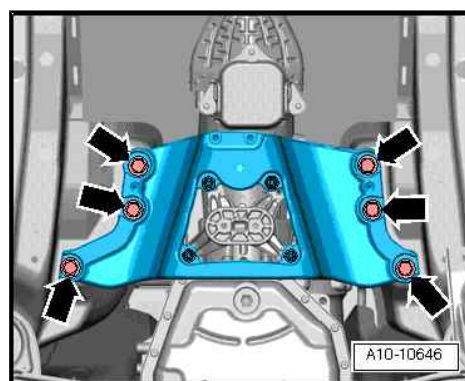


- Remove bolts -arrows- at tunnel cross member.



### Note

For illustration purposes, the installation position is shown with the front exhaust pipes removed.

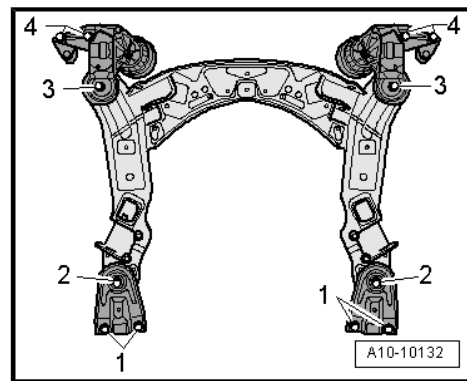


- Remove bolts -1-.
- Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
- Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.

**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.

- Carefully lower engine/gearbox assembly.
- Pull out scissor-type assembly platform - VAS 6131 A- from under the vehicle.



## 1.2 Separating engine and manual gearbox

### Special tools and workshop equipment required

- ◆ Plate - VAS 6131/10-1- , support set for Audi - VAS 6131/11- and -VAS 6131/12- .

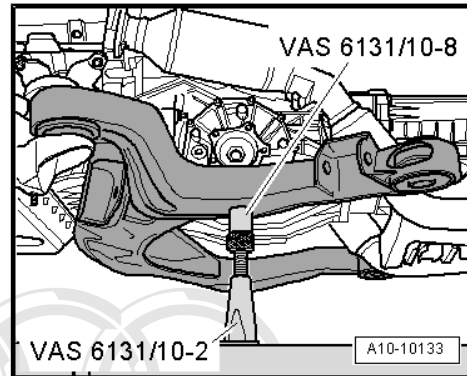
### Procedure

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A- .
- Screw down spindles of the support elements (left and right) at subframe as far as possible.
- Remove locating lugs from spindles.
- Remove subframe to the side.

**Note**

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

- Unscrew the two base plates for support elements (for subframe) on scissor-type assembly platform - VAS 6131 A- .

**Note**

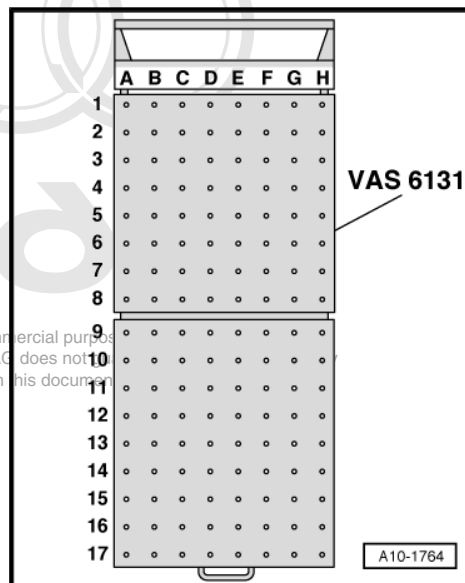
*The mounting points for engine (front), gearbox (rear) and tunnel cross members remain unchanged.*

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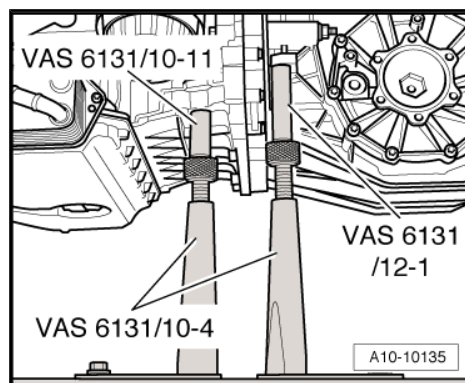
- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , -VAS 6131/11- and - VAS 6131/12- as follows:

| Platform coordinates | Parts of support set for Audi - VAS 6131/10- , - VAS 6131/11- and -VAS 6131/12- |       |       |        |
|----------------------|---------------------------------------------------------------------------------|-------|-------|--------|
| B4 <sup>1)</sup>     | /10-1                                                                           | /10-4 | /10-5 | /10-13 |
| F4 <sup>1)</sup>     | /10-1                                                                           | /10-4 | /10-5 | /10-12 |
| B7                   | /10-1                                                                           | /10-4 | /10-5 | /10-11 |
| F7                   | /10-1                                                                           | /10-4 | /10-5 | /10-10 |
| B10                  | /10-1                                                                           | /10-4 | /10-5 | /12-1  |
| F10                  | /10-1                                                                           | /10-3 | /10-5 | /11-3  |
| C12 <sup>1)</sup>    | /10-1                                                                           | /10-4 | /10-5 | /10-6  |
| F13 <sup>1)</sup>    | /10-1                                                                           | /10-4 | /10-5 | /10-9  |
| D16 <sup>1)</sup>    | /10-1                                                                           | /10-3 | /10-5 | /10-6  |

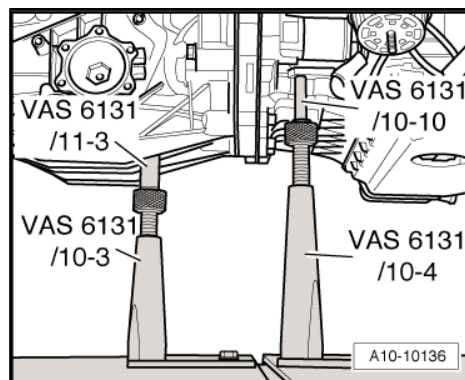
• <sup>1)</sup> Support elements remain unchanged.



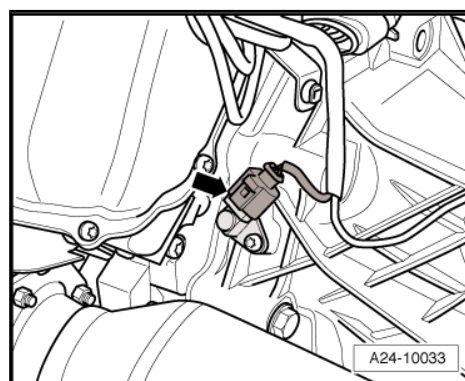
- Position the support elements from -VAS 6131/10- and - VAS 6131/12- at left of engine/gearbox assembly as shown in illustration.



- Position the support elements from -VAS 6131/10- and - VAS 6131/11- 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 A- .



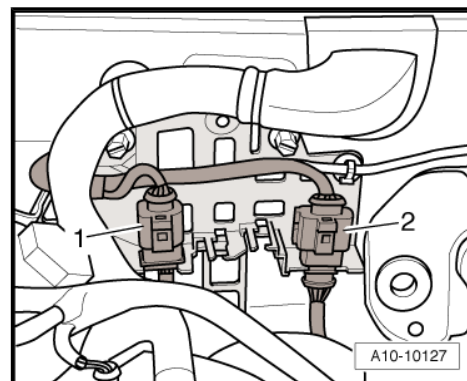
- Unplug electrical connector -arrow- for engine speed sender - G28- .



- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter - G131- and move wiring clear.

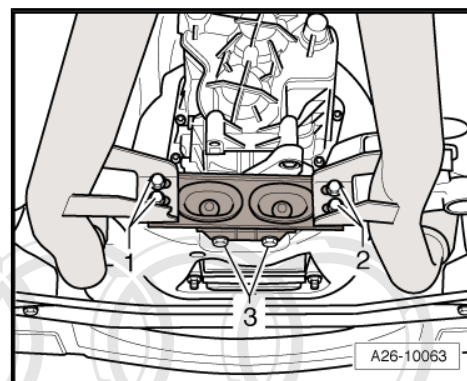
**Note**

- ◆ *Illustration shows electrical connector when installed.*
- ◆ *Disregard item -1-.*

**Caution**

*Risk of damage to flexible joints in front silencer.*

- ◆ *Do NOT bend the flexible joints in the front silencer more than 10°.*

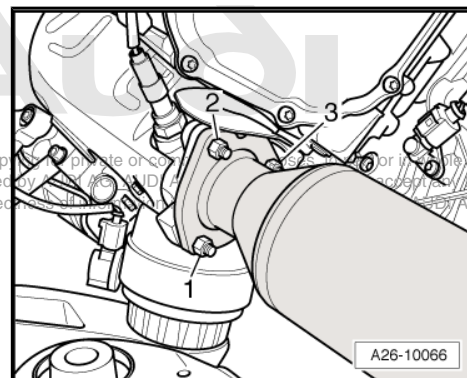


- Remove bolts -1- on bracket (rear) for exhaust system.

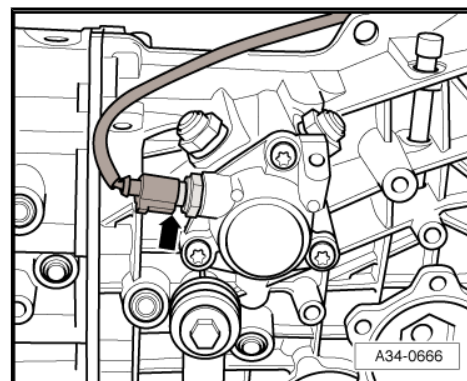
**Note**

*Disregard -items 2 and 3-.*

- Unscrew nuts -1 ... 3-.
- Detach front exhaust pipe (left-side) with catalytic converter.



- Unplug electrical connector -arrow- for reversing light switch - F4- and move electrical wire clear.

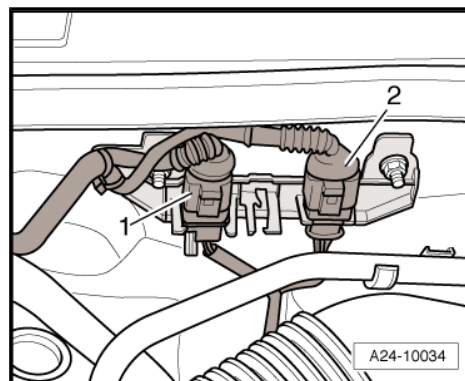


- Unplug electrical connector -2- for Lambda probe after catalytic converter - G130- and move wiring clear.



### Note

- ◆ Illustration shows electrical connector when installed.
- ◆ Disregard item -1-.



A24-10034



### Caution

**Risk of damage to flexible joints in front silencer.**

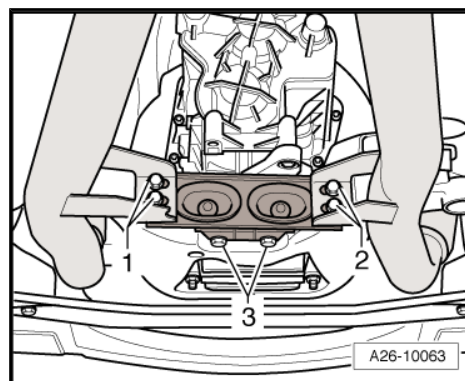
- ◆ Do NOT bend the flexible joints in the front silencer more than 10°.

- Remove bolts -2- on bracket (rear) for exhaust system.



### Note

Disregard -items 1 and 3-.



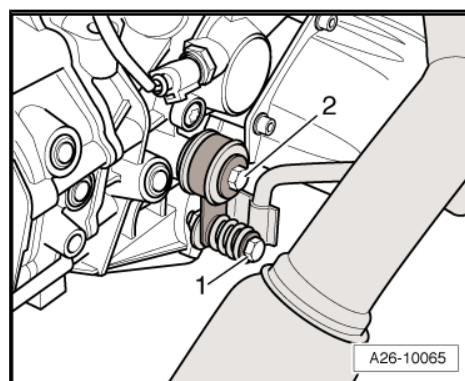
A26-10063

- Remove bolt -1- on bracket (right-side) for front exhaust pipe.



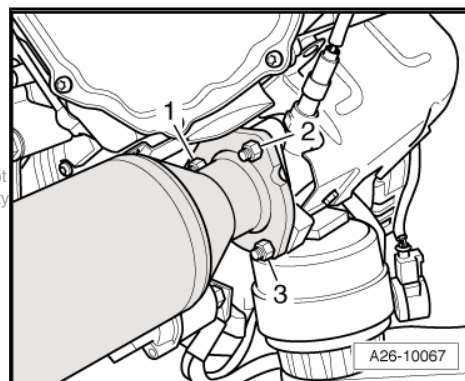
### Note

Disregard item -2-.



A26-10065

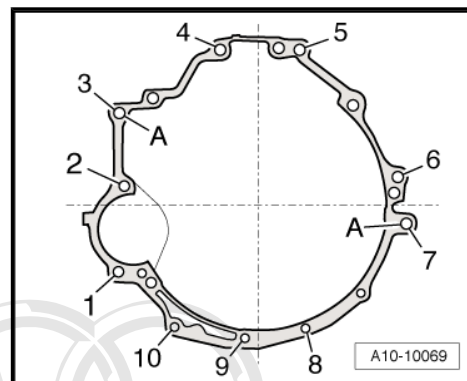
- Unscrew nuts -1 ... 3-.
- Detach front exhaust pipe (right-side) with catalytic converter.



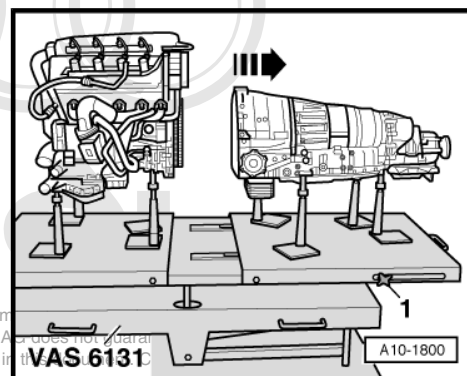
A26-10067

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- Remove bolts -1 ... 10- securing gearbox to engine.



- Loosen clamping bolts -1- on sides of scissor-type assembly platform - VAS 6131 A- and pull rear section of platform together with gearbox towards rear -arrow-.

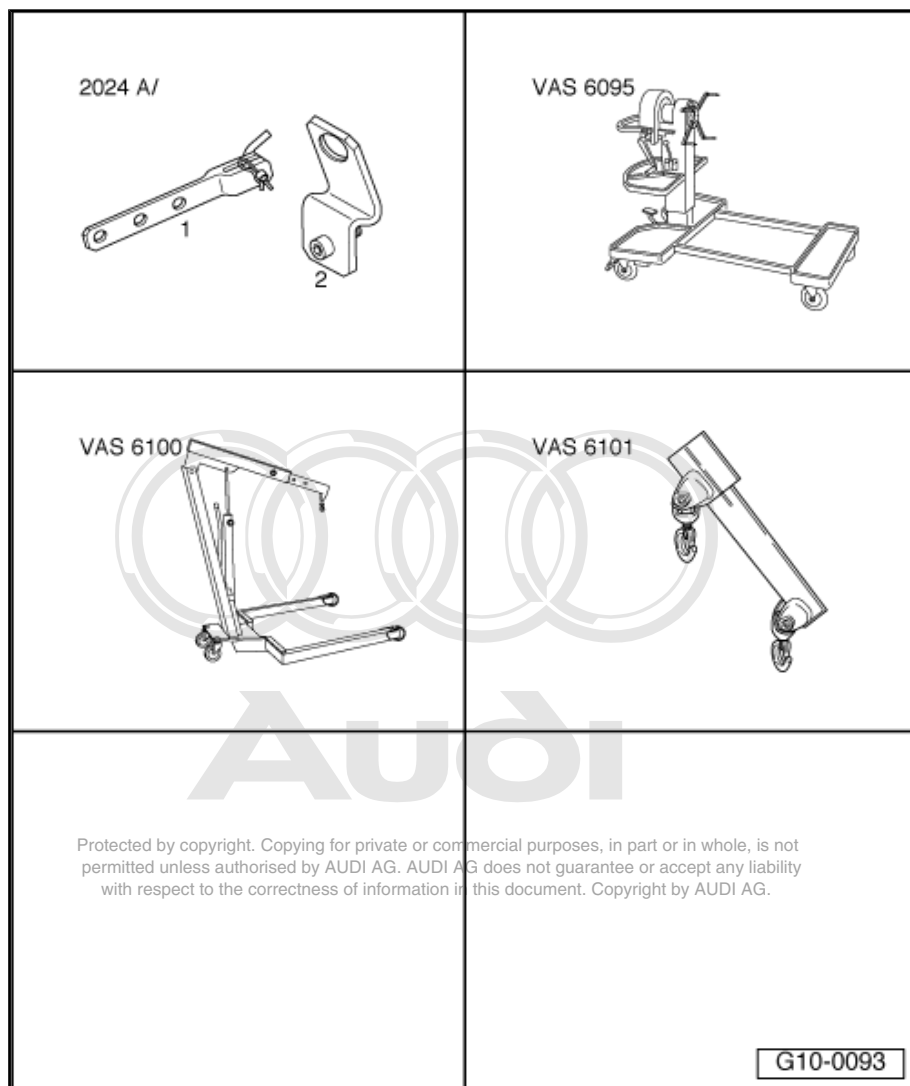


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### 1.3 Securing engine to engine and gearbox support

### Special tools and workshop equipment required

- ◆ Lifting tackle - 2024 A/-
- ◆ Engine and gearbox support - VAS 6095- with bracket -VAS 6095/1-5-
- ◆ Workshop hoist - VAS 6100-
- ◆ Lift arm extension (workshop hoist) - VAS 6101-



### Procedure

- Engine separated from gearbox ⇒ [page 27](#) .
- Attach lifting tackle - 2024 A/- to engine and workshop hoist - VAS 6100- with lift arm extension (workshop hoist) - VAS 6101- as shown in illustration.



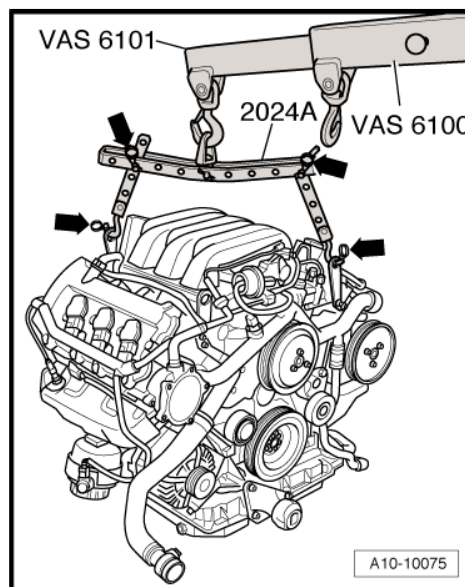
#### Note

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



#### WARNING

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

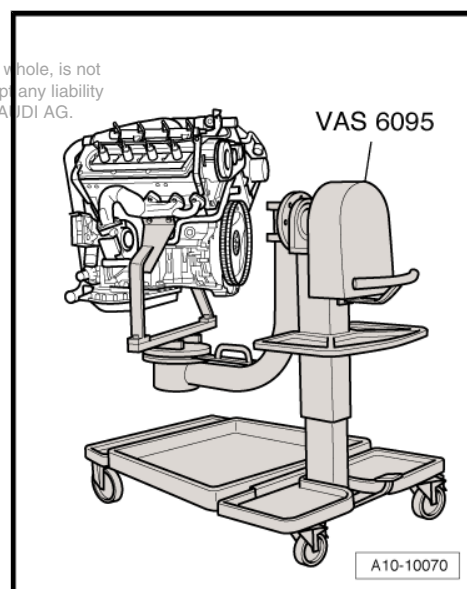
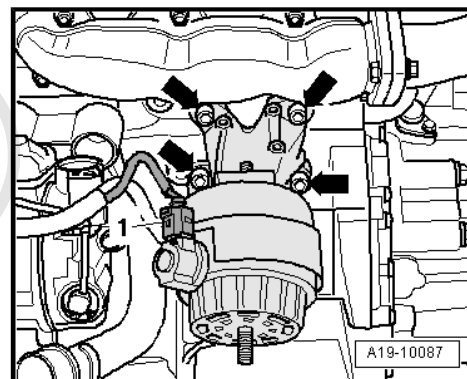


- Unplug electrical connector -1- from engine mounting (left-side).
- Remove bolts -arrows- and detach engine support (left-side).

 **Note**

*Shown in illustration without console for engine mounting.*

- Repeat procedure on other side of engine.
- Secure engine with bracket -VAS 6095/1-5- to engine and gearbox support - VAS 6095- as shown in illustration. Tightening torque: 40 Nm.



## 1.4 Installing engine

### 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:  $\pm 15\%$ .*

| Component                                          |     | Nm |
|----------------------------------------------------|-----|----|
| Bolts/nuts                                         | M6  | 9  |
|                                                    | M8  | 20 |
|                                                    | M10 | 40 |
|                                                    | M12 | 65 |
| Except for the following:                          |     |    |
| Engine support to cylinder block                   |     | 40 |
| Console for engine mounting to longitudinal member |     | 75 |
| Tunnel cross member to body                        |     | 40 |



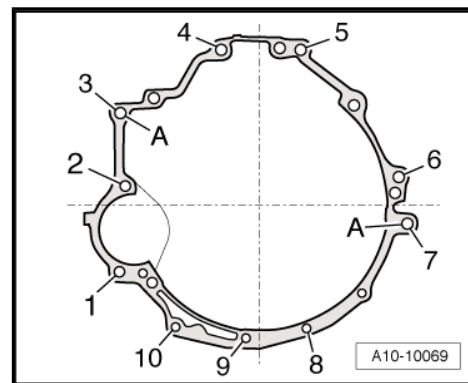
| Component                                        | Nm  |
|--------------------------------------------------|-----|
| Torque reaction support to engine                | 40  |
| Stop for torque reaction support to lock carrier | 23  |
| Hose clips (9 mm wide)                           | 3   |
| Hose clips (13 mm wide)                          | 5.5 |



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## Securing manual gearbox to engine

| Item                                 | Bolt                           | Nm               |
|--------------------------------------|--------------------------------|------------------|
| 1                                    | M12x130                        | 65               |
| 2                                    | M12x140                        | 65               |
| 3, 4, 5                              | M12x105                        | 65               |
| 6                                    | M12x120                        | 65               |
| 7                                    | M10x150                        | 65 <sup>1)</sup> |
| 8, 9, 10                             | M10x70                         | 45               |
| A                                    | Dowel sleeves for centralising |                  |
| • <sup>1)</sup> Property class 10.9. |                                |                  |



## Procedure



### Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- When fitting a new clutch plate together with a used pressure plate (self-adjusting clutch), the adjuster ring in the pressure plate has to be reset by turning it back as far as it will go. If this is not done, the pressure plate will operate with reduced clamping force, causing clutch slip ⇒ Rep. gr. 30 .



### Note

- ◆ *If the clutch plate is not being replaced, it is not necessary to reset the adjuster ring.*
- ◆ *New SAC pressure plates are already pre-set accordingly, and do not have to be reset.*
- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease for clutch plate splines - G 000 100- to the splines. Do not lubricate guide sleeve.
- Check that the clutch plate is properly centralised (only necessary if you have carried out other work on the clutch).
- Check clutch release bearing for wear and make sure that plastic ring is securely seated ⇒ Rep. gr. 30 .
- A needle bearing must be fitted in the crankshaft on vehicles with manual gearbox; install needle bearing if not already fitted ⇒ [page 108](#) .
- Check whether dowel sleeves for centring the engine and the gearbox are fitted in the cylinder block; install missing dowel sleeves.
- Press intermediate plate between engine and gearbox onto dowel sleeves.
- Bolt gearbox to engine.

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

- Install front exhaust pipes: left-side ⇒ [page 272](#) , right-side ⇒ [page 275](#) .
- 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 spindles of support elements on left side of engine/gearbox assembly.
- Unscrew both base plates for support elements (left-side) at scissor-type assembly platform - VAS 6131 A- .
- Screw down spindles of support elements on right side of engine/gearbox assembly.
- Unscrew both base plates for support elements (right-side) at scissor-type assembly platform - VAS 6131 A- .



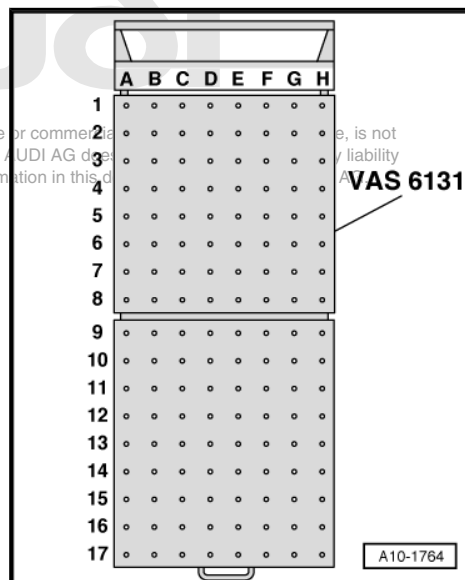
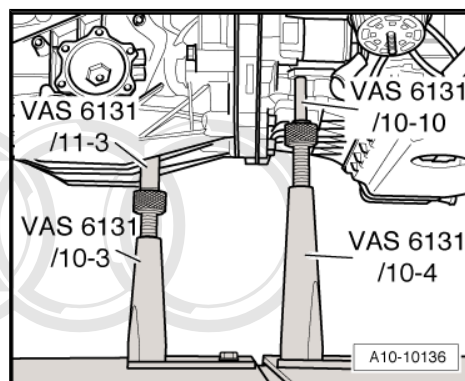
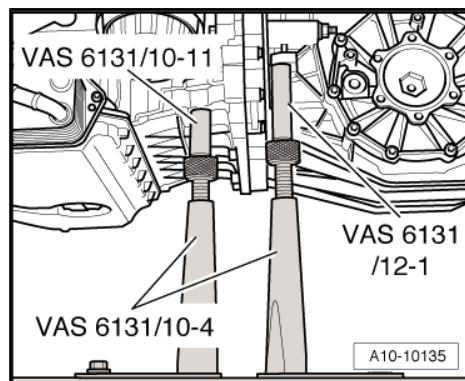
#### Note

The mounting points for engine (front), gearbox (rear) and tunnel cross members remain unchanged.

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

| Platform coordinates | Parts from support set for Audi - VAS 6131/10- |       |       |                     |
|----------------------|------------------------------------------------|-------|-------|---------------------|
| B4 <sup>1)</sup>     | /10-1                                          | /10-4 | /10-5 | /10-13              |
| F4 <sup>1)</sup>     | /10-1                                          | /10-4 | /10-5 | /10-12              |
| B10                  | /10-1                                          | /10-2 | /10-5 | /10-8 <sup>2)</sup> |
| G10                  | /10-1                                          | /10-2 | /10-5 | /10-8 <sup>2)</sup> |
| C12 <sup>1)</sup>    | /10-1                                          | /10-4 | /10-5 | /10-6               |
| F13 <sup>1)</sup>    | /10-1                                          | /10-4 | /10-5 | /10-9               |
| D16 <sup>1)</sup>    | /10-1                                          | /10-3 | /10-5 | /10-6               |

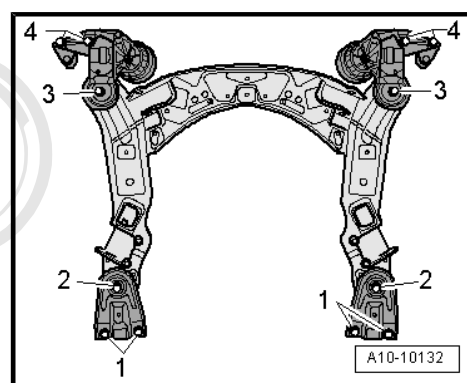
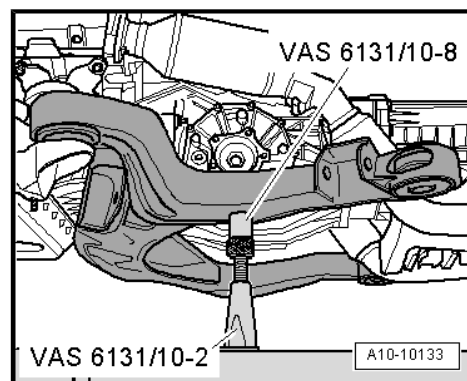
- <sup>1)</sup> Support elements remain unchanged.
- <sup>2)</sup> Secure support elements only after installing the subframe.



 **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 the spindles for support elements on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .
- Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform - VAS 6131 A- .
- Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
- Tighten bolts for subframe and consoles for engine mountings only to specified torque (do not turn further); the bolts are only fully tightened after performing the wheel alignment check → Rep. gr. 40 .

**WARNING**

*Risk of accident because of loose bolted connections.*

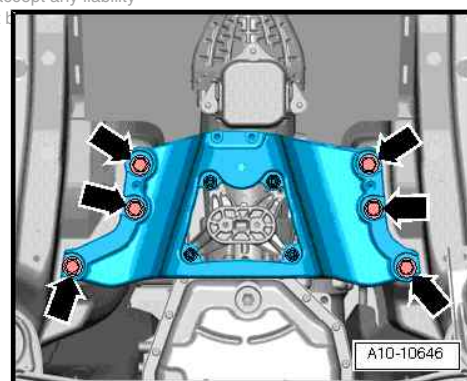
- ◆ **Do NOT drive the vehicle unless the subframe bolts have been tightened to their final torque.**

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- Tighten bolts -arrows- for tunnel cross member.

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

- Install clutch slave cylinder → Rep. gr. 30 .
- Fit selector linkage to gearbox → Rep. gr. 34 .
- Install drive shafts → Rep. gr. 40 .
- Install guide links, track control links, anti-roll bar and suspension struts → Rep. gr. 40 .
- Install cross piece for subframe → Rep. gr. 40 .
- Install cross piece (front) → Rep. gr. 50 .
- Install propshaft → Rear final drive 01R; Rep. gr. 39 .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .
- Install air conditioner compressor → Rep. gr. 87 .
- Install hydraulic pressure pipe for power steering pump → Rep. gr. 48 .
- Install fuel supply hose → Rep. gr. 24 .
- Install poly V-belt ⇒ [page 101](#) .



- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedure for connecting the battery ⇒ Rep. gr. 27 .

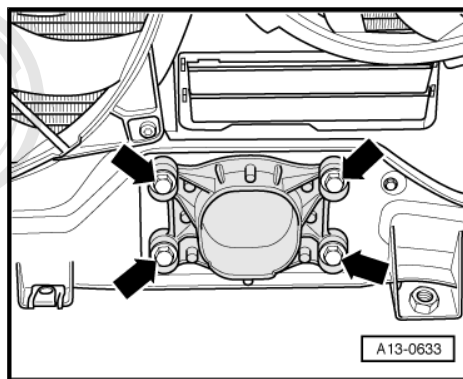


### Caution

**Risk of irreparable damage to control units because of excessive voltage.**

- ◆ **Never use battery charging equipment for boost starting.**

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- Install and adjust wiper arms ⇒ Rep. gr. 92 .
- Install body brace ⇒ Rep. gr. 40 .
- Check oil level ⇒ [page 237](#) .
- Bleed fuel system ⇒ Rep. gr. 24 .
- Fill cooling system ⇒ [page 242](#) .



### Note

- ◆ *Do not use drained coolant again if:*
  - ◆ *the cylinder head or cylinder block have been renewed.*
  - ◆ *the coolant is contaminated or dirty.*
- Top up power steering fluid and bleed steering system ⇒ Rep. gr. 48 .
- Adjust subframe and the two consoles for engine mountings ⇒ Rep. gr. 40 .
- Perform wheel alignment check ⇒ Rep. gr. 44 .



### WARNING

**Risk of accident because of loose bolted connections.**

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

## 2 Removing and installing engine - vehicles with multitronic gearbox

⇒ [“2.1 Removing engine”, page 39](#)

⇒ [“2.2 Detaching multitronic gearbox from engine”, page 56](#)

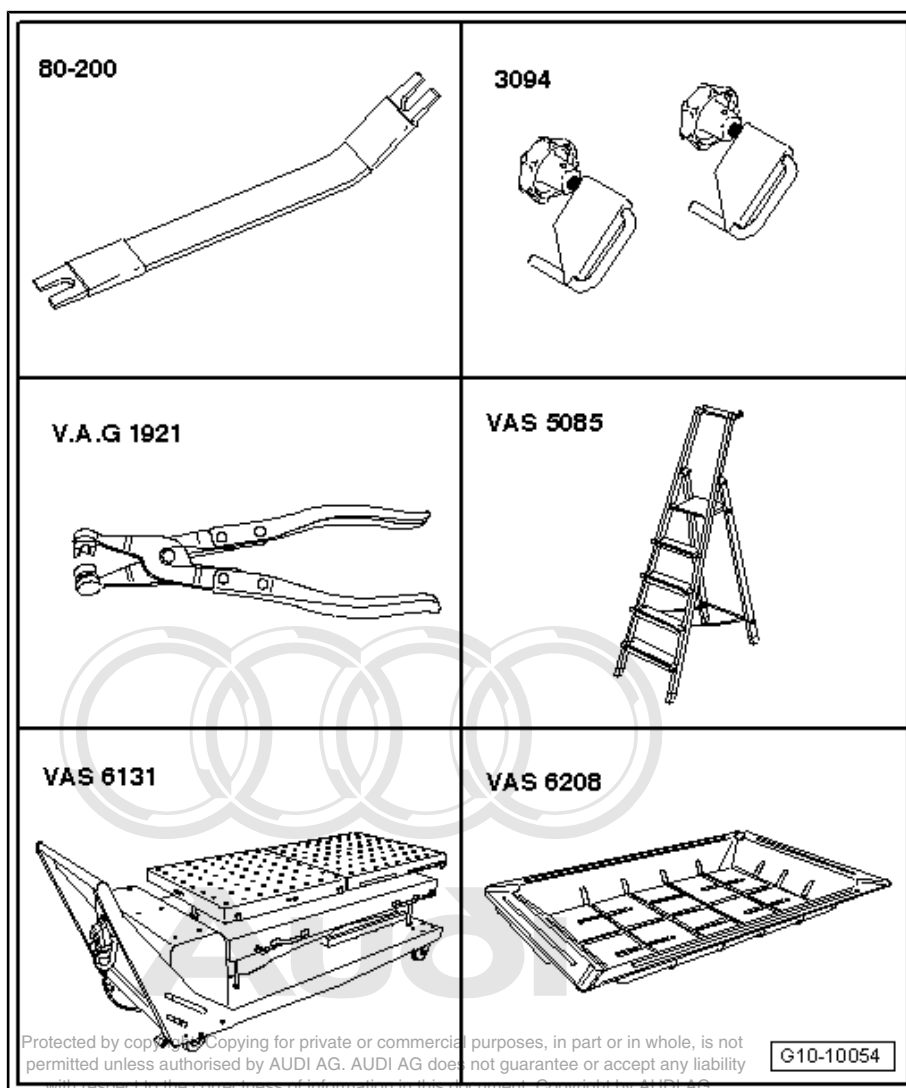
⇒ [“2.3 Securing engine to engine and gearbox support”, page 60](#)

⇒ [“2.4 Installing engine”, page 62](#)

### 2.1 Removing engine

#### Special tools and workshop equipment required

- ◆ Removal lever - 80-200-
- ◆ Hose clamps up to Ø 25 mm - 3094-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Stepladder - VAS 5085-
- ◆ Scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10-, -VAS 6131/11- and -VAS 6131/12-
- ◆ Drip tray for workshop hoist - VAS 6208-

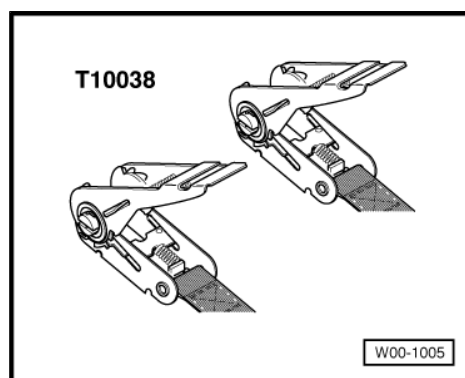
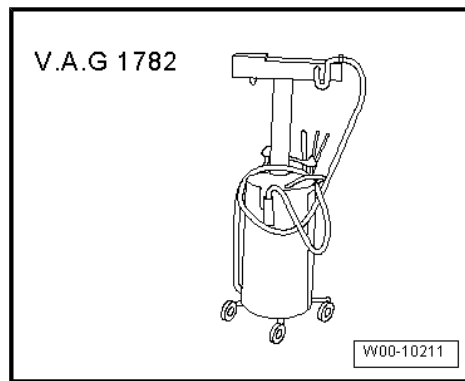


- ◆ Used oil collection and extraction unit - V.A.G 1782-



- ◆ Tensioning strap - T10038-

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## Procedure



### Note

- ◆ *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*



### WARNING

***Make sure the vehicle cannot tip over when the engine is removed.***

- ◆ ***Secure the vehicle, to do so, the luggage compartment must be empty.***



### Caution

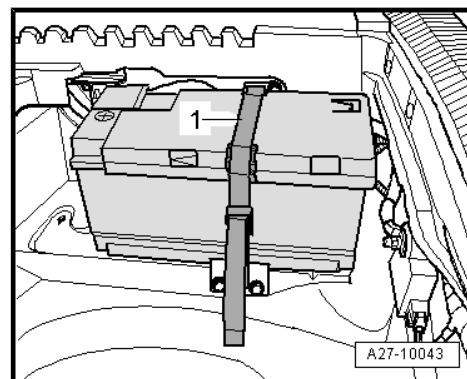
***To prevent irreparable damage to the electronic components when disconnecting the battery:***

- ◆ ***Observe notes on procedure for disconnecting the battery.***

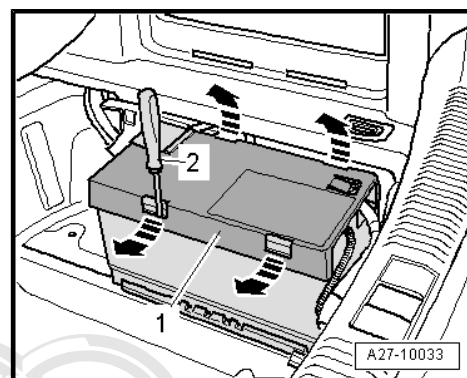
 **Note**

*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.*

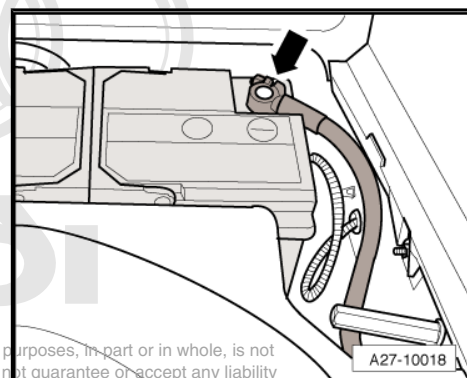
- Take out luggage compartment floor trim.
- Release battery retaining strap -1- (if fitted).



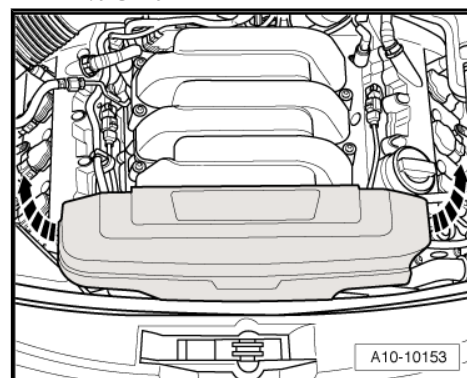
- Use screwdriver -2- to release retaining clips -arrows- and detach cover -1-.



- Disconnect earth cable -arrow- at battery.



- Pull off engine cover panel (front) -arrows-.



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- Pull off engine cover panel (rear) -arrows-.



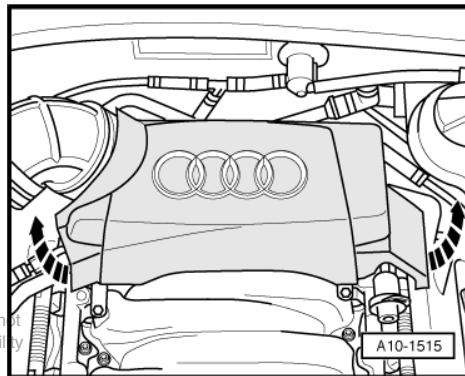
### WARNING

**Hot steam/hot coolant can escape - risk of scalding.**

- ◆ **The cooling system is under pressure when the engine is hot.**
- ◆ **Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.**

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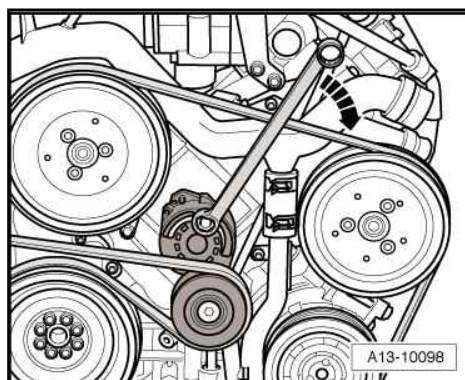
- Open filler cap on coolant expansion tank.



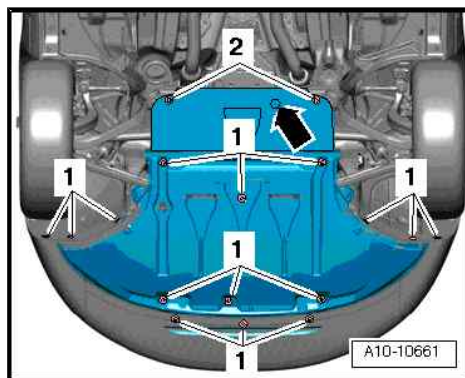
### Note

*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.*

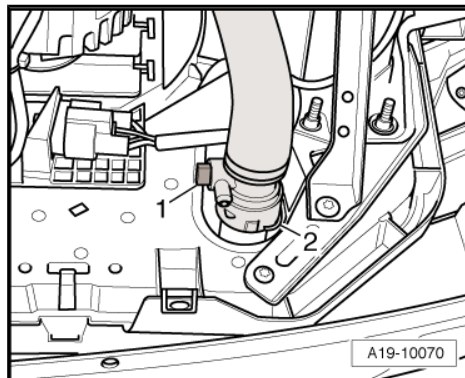
- To slacken poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt and release pressure from the tensioner.
- Remove both front wheels.



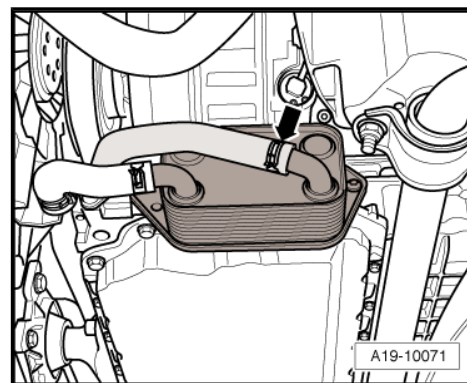
- Release fasteners -1, 2, arrow- and remove noise insulation.



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Open drain plug -1- and let coolant drain.
- Then disconnect coolant hose -2- from radiator.



- Disconnect coolant hose -arrow- at engine oil cooler and drain off remaining coolant.



- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**WARNING**

*Risk of injury caused by refrigerant.*

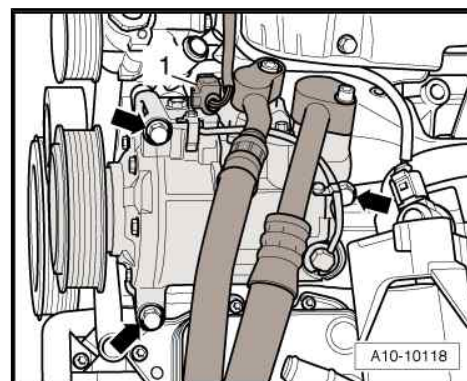
♦ *The air conditioner refrigerant circuit must not be opened.*

- Unscrew air conditioner compressor from bracket -arrows-.

**Caution**

*Danger of damage to refrigerant lines and hoses.*

♦ *Do NOT stretch, kink or bend refrigerant lines and hoses.*

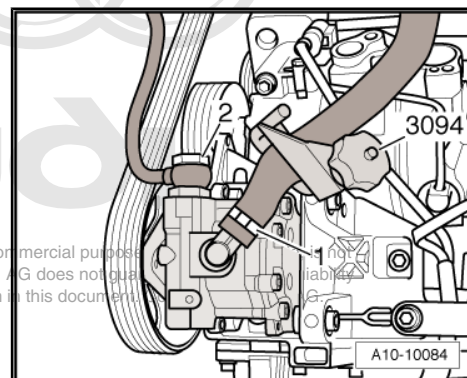


- Tie up air conditioner compressor with lines attached to left-side of vehicle.

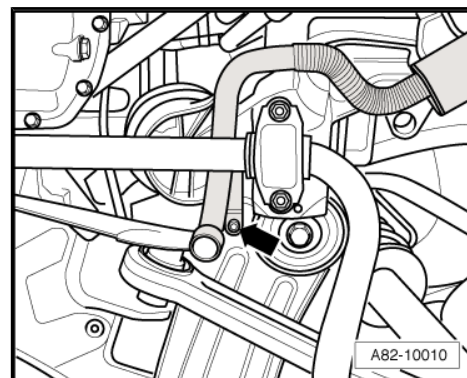
**Note**

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

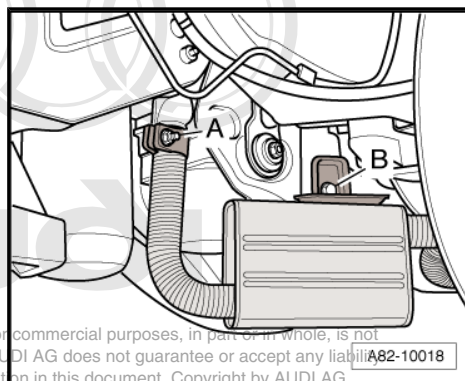
- Clamp off hydraulic hose -1- for power steering pump using hose clamps up to 25 mm - 3094-
- Disconnect hydraulic hose from power steering pump
- Unbolt hydraulic pressure line -2- at power steering pump and lay pressure line on top of longitudinal member.

**Vehicles with auxiliary heater:**

- Detach wheel housing liner (front left) at the front ⇒ Rep. gr. 66 .
- Remove bolt -arrow- for corrugated exhaust pipe.



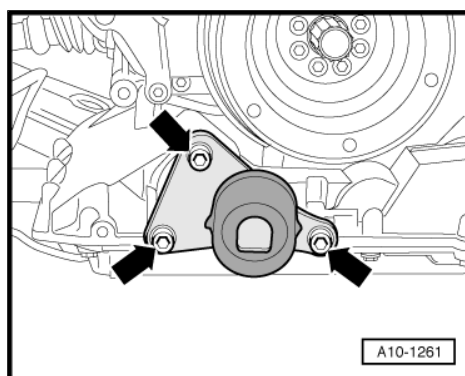
- Slacken nut -A- on clamp for corrugated exhaust pipe.
- Remove bolt -B- and detach exhaust silencer with corrugated exhaust pipes.



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### All vehicles (continued):

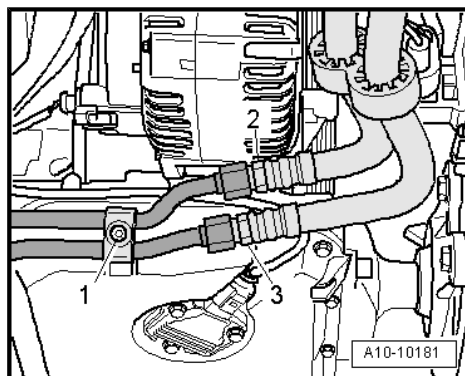
- Unscrew bolts -arrows- and remove torque reaction support from engine.



### Note

Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00.

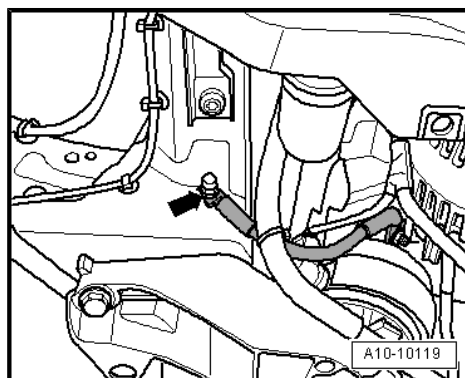
- Position used oil collection and extraction unit - V.A.G 1782- below connection point.
- Loosen union nuts and disconnect ATF lines -2- and -3-.



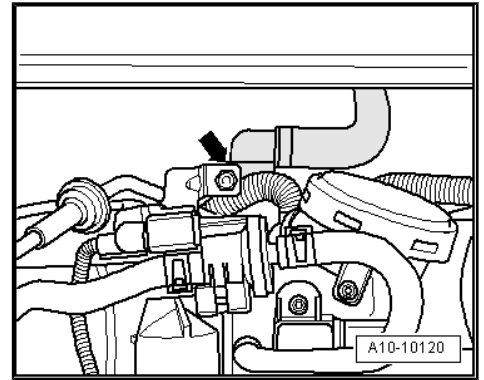
### Note

Disregard item -1-.

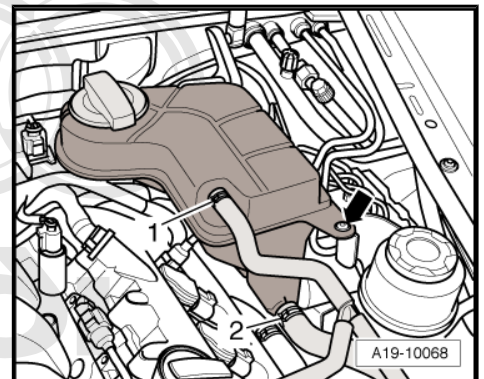
- Unbolt earth cable -arrow- at longitudinal member (right-side).



- Detach coolant hose -arrow- from heat exchanger at rear of engine.

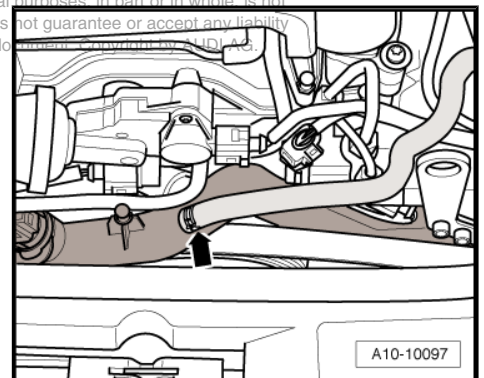


- Detach coolant hoses -1- and -2- from coolant expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank (bottom).

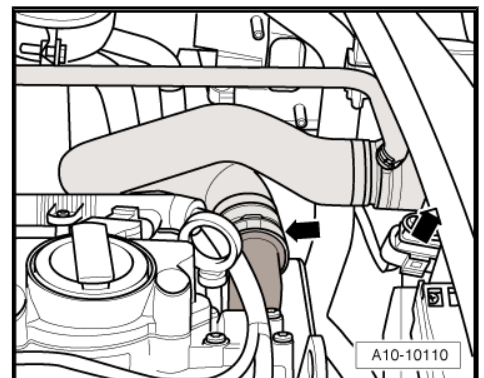


- Detach coolant hose -arrow- from coolant pipe (front).

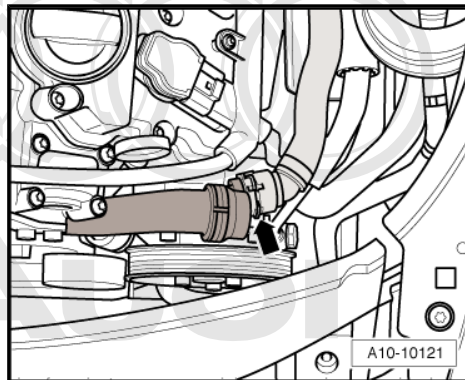
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- Remove coolant hose (front left) in engine compartment -arrows-.

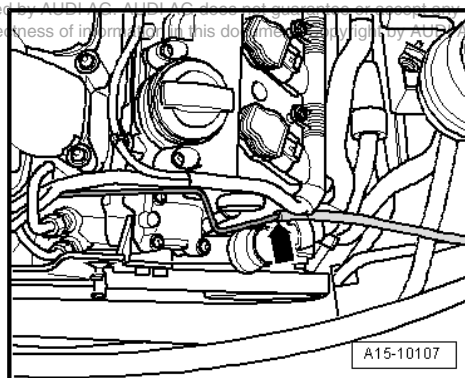


- Detach coolant hose -arrow- from coolant pipe (front).



#### USA models:

- Disconnect vacuum hose -arrow- leading to leak diagnostic pump.



#### All vehicles (continued):

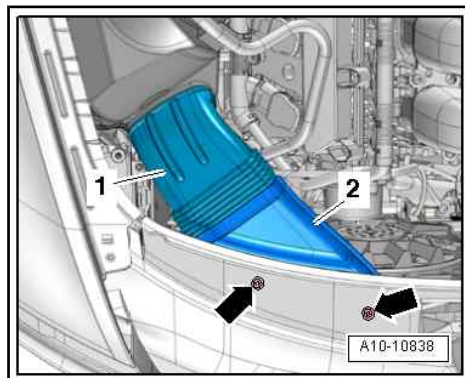
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



#### Caution

*Take care to keep components clean.*

- ◆ *Rules for cleanliness when working on the injection system ⇒ [page 6](#).*

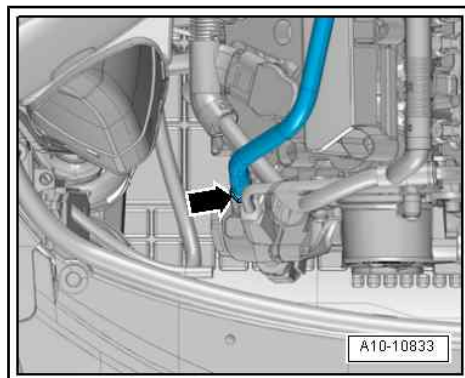


#### WARNING

*The fuel system is pressurised.*

*Risk of injury as fuel may spray out.*

- *Wear safety goggles.*
- *Wear protective gloves.*
- *Release pressure (wrap clean cloth around connection and open connection carefully).*

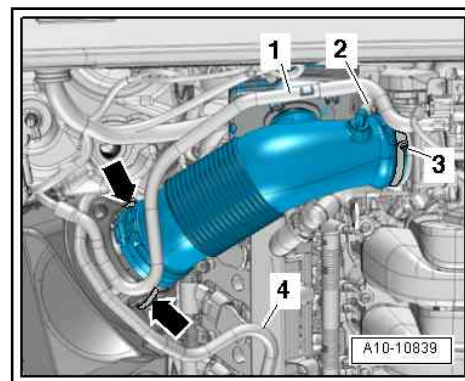


- Detach fuel supply hose from high-pressure pump -arrow- and move clear.

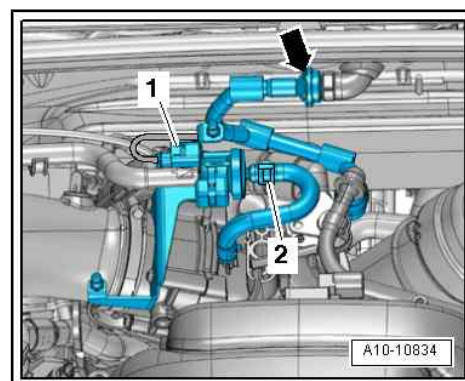
- Move fuel line -4- and line -1- leading to activated charcoal filter clear on air cleaner housing and air pipe.
- Disconnect vacuum hose -2- from connection on air hose.
- Remove air pipe. To do so, release hose clip -3- and clamps -arrows-.

**Note**

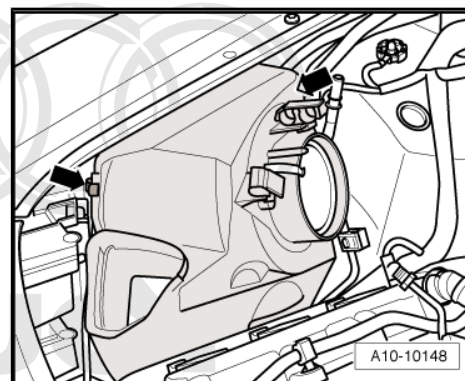
*Disregard item -4-.*



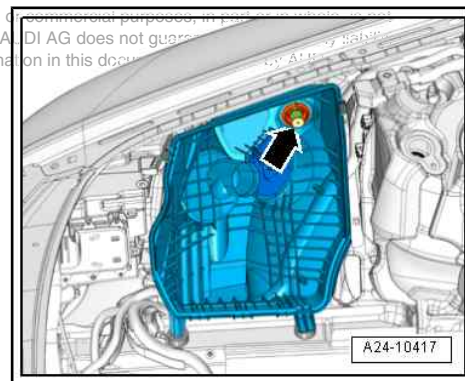
- Unplug electrical connector -1- at activated charcoal filter solenoid valve 1 - N80- and detach vacuum hose -2-.
- Detach activated charcoal filter solenoid valve 1 - N80- from bracket and move it clear to the side with hose still attached.
- Detach non-return valve -arrow- for brake servo from plenum chamber partition panel.



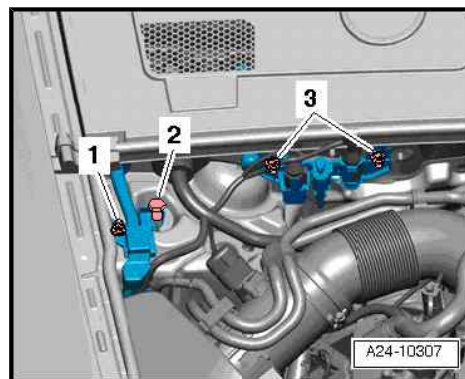
- Release clamps -arrows- and detach air cleaner (top section).



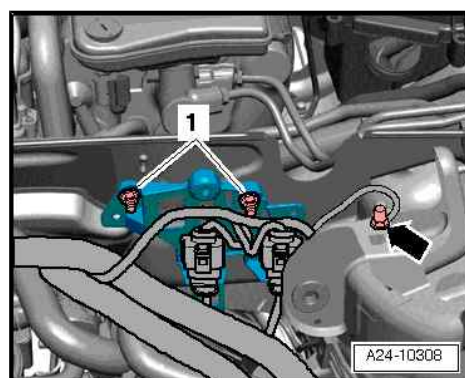
- Pull out pin of fastener -arrow- and detach air cleaner (bottom section).



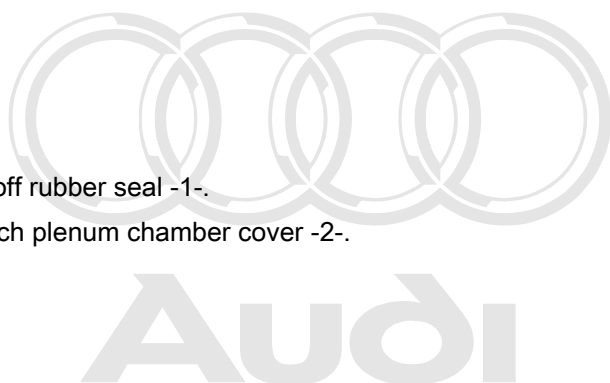
- Unscrew nuts -3- and detach bracket for connectors (right-side) from plenum chamber partition panel.
- Unscrew nut -1- on positive terminal.
- Unscrew earth stud -2-.



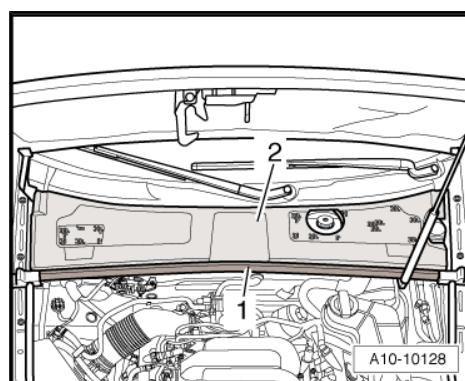
- Unscrew nuts -1- and detach bracket for connectors (left-side) from plenum chamber partition panel.
- Unbolt earth cable -arrow- at suspension turret (left-side).



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



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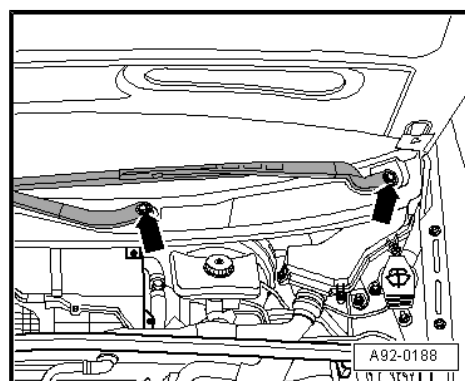


- Pry off caps on windscreen wiper arms with a screwdriver.
- Loosen nuts -arrows- several turns.
- Tilt windscreen wiper arms one by one and loosen from wiper shafts.
- Remove nuts completely and take off wiper arms.



#### Note

Use puller (commercially available) to remove wiper arm if necessary.



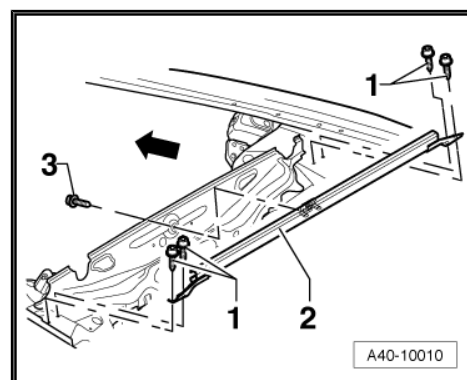
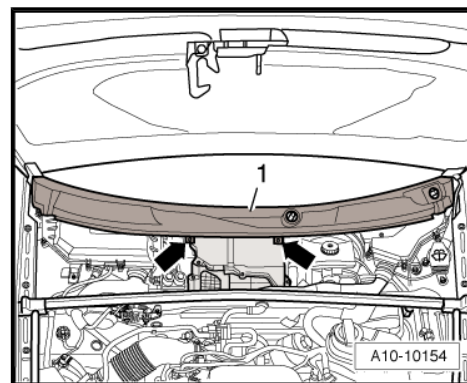
- Unscrew bolts -arrows- for cowl panel trim -1-.



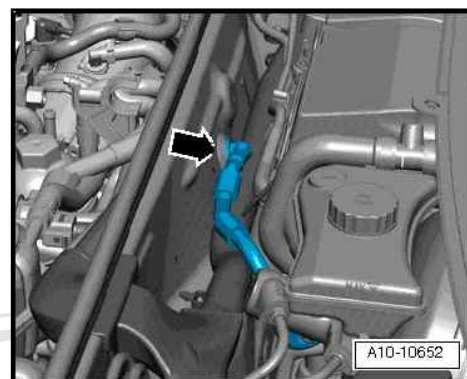
### Caution

*To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.*

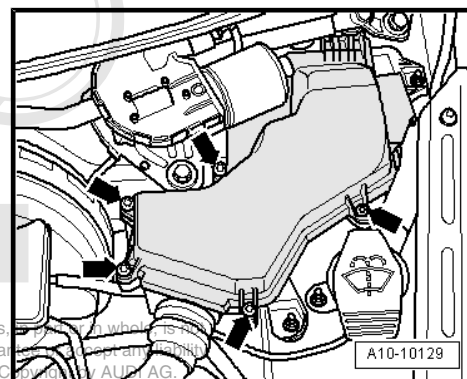
- Pull cowl panel trim off windscreen.
- If fitted, unscrew bolts -1- and -3- and remove body brace -2-.



- Detach vacuum line -arrow- going to brake servo at plenum chamber partition panel.

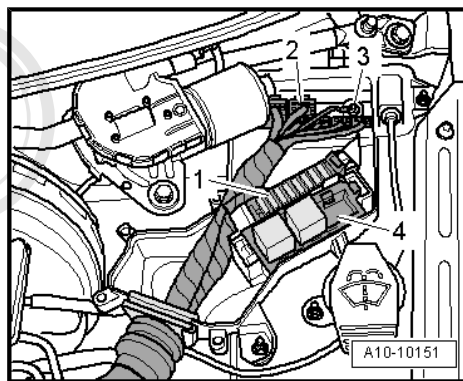


- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).

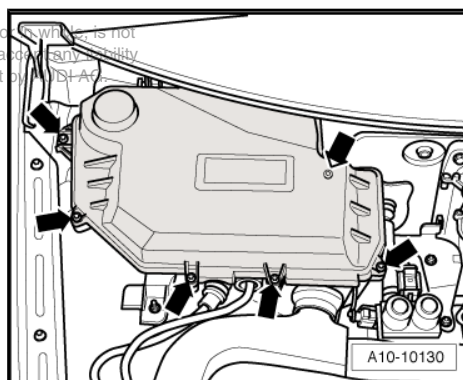


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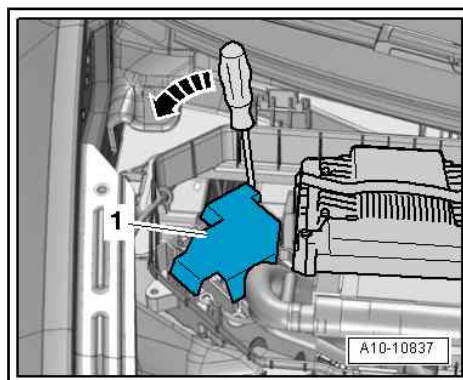
- Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
- Unscrew electrical wiring -3-.
- Unplug electrical connectors -2- at rear of connector console.
- Disengage engine wiring harness at electronics box and move it clear.



- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).



- Open cover -1- with screwdriver -arrow- and detach.



**WARNING**

*Risk of burns at the pump valve unit for the heating system (left-side in front of electronics box).*

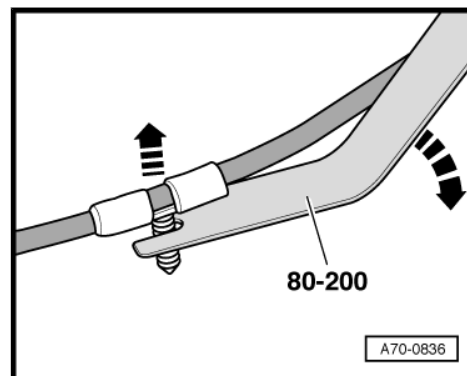
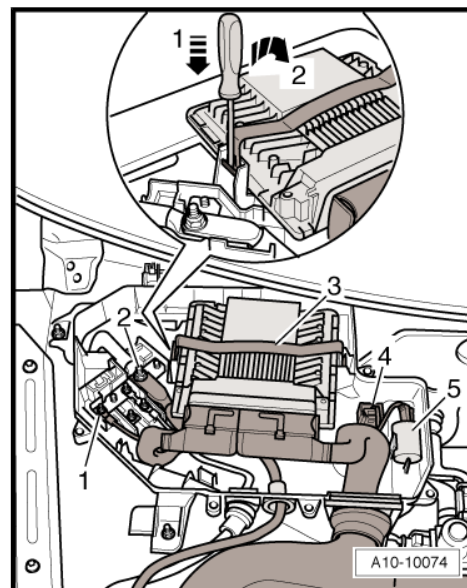
- ◆ *Wear protective gloves when working near the pump valve unit for the heating system.*

- Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.

**Note**

*The engine control unit remains connected to the wiring harness.*

- Unclip suppressor capacitor -5- and take out of retainer in electronics box.
- Unplug electrical connector -4- at rear of connector console.
- Unscrew electrical wiring connections -1- and -2-.
- Release electrical wiring up to the alternator using removal lever - 80 - 200 - .
- Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.



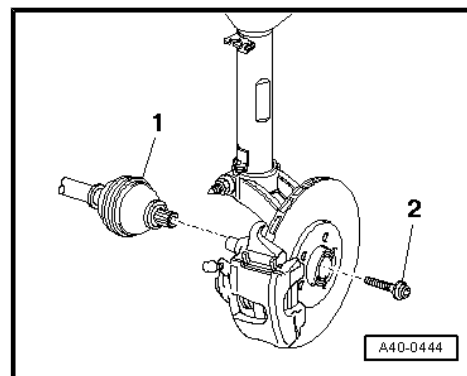
- Have a 2nd mechanic press the brake pedal.

**Caution**

*Risk of damage to wheel bearing.*

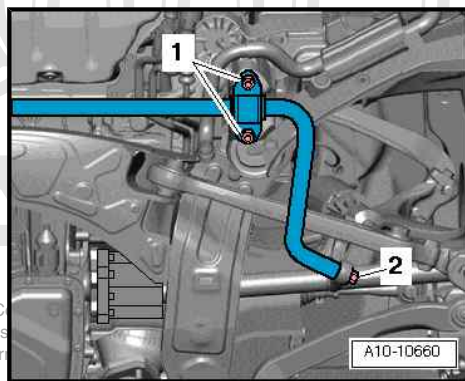
- ◆ *When slackening the flange bolt securing the drive shaft, the vehicle must not be standing on its wheels.*

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



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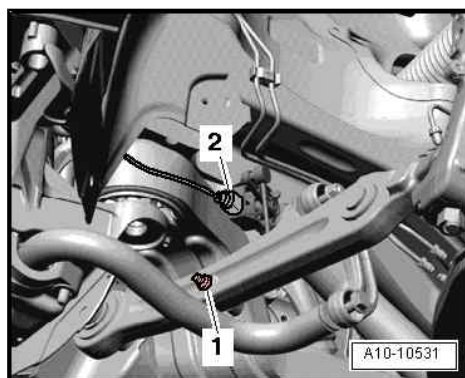
- Unscrew nuts -1- evenly on both sides.
- Remove bolts -2- (left and right) and detach anti-roll bar.



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- Unplug electrical connector -2- at vehicle level sender.
- Detach coupling rod -1- at track control link.

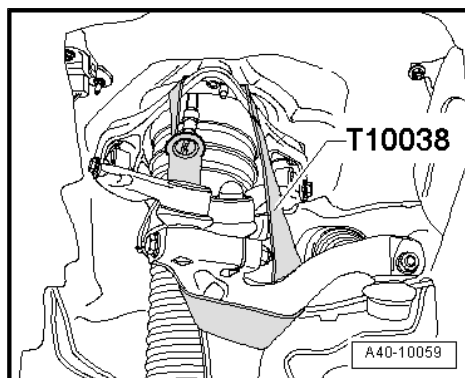


### Caution

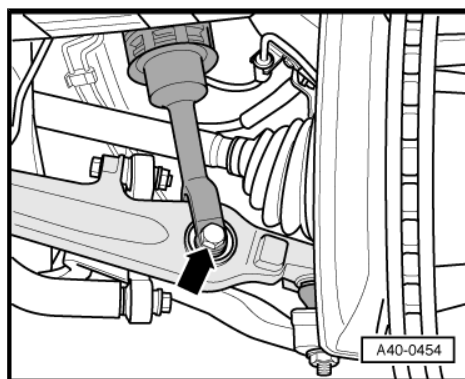
*Danger of damage to the swivel joints of the upper links.*

◆ *Support wheel bearing housing.*

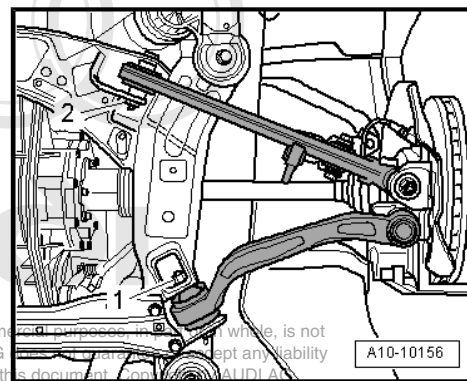
- Tie up wheel bearing housing using tensioning strap - T10038- as illustrated.



- Unbolt suspension strut from track control link -arrow-.



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

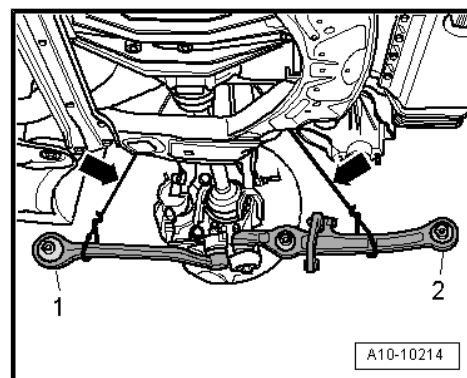


- Pivot guide link -1- and track control link -2- outwards.

**Caution**

*Risk of damage if guide link and track control link are allowed to drop without support.*

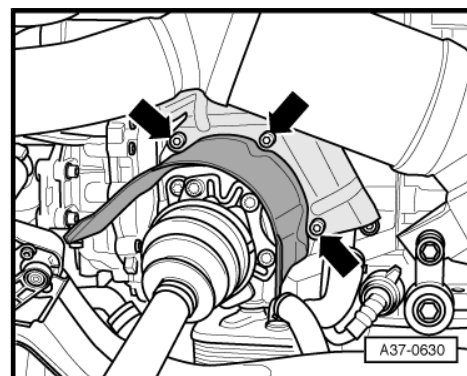
- ◆ *Tie up guide link and track control link to wheel bearing housing -arrows- as shown in illustration.*



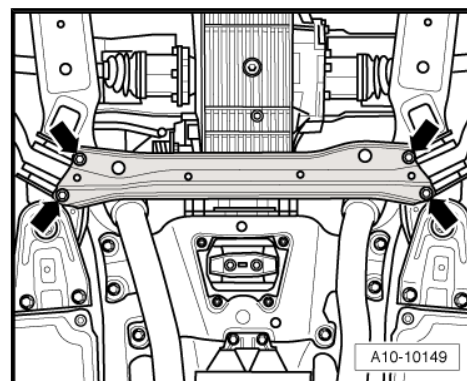
- Repeat procedure on other side of vehicle.
- Unbolt heat shield for drive shaft -arrows-.
- Unbolt drive shaft from flange shaft on gearbox.

**Caution**

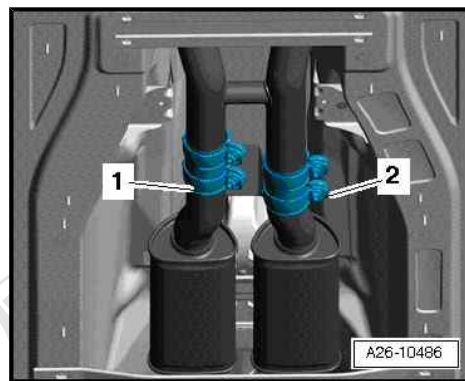
*Take care not to damage brake hose.*



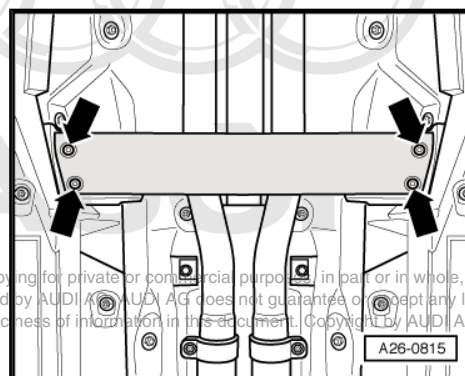
- Pivot wheel bearing housing outwards and remove drive shaft.
- Repeat procedure on other side of vehicle.
- Unbolt cross piece from subframe -arrows-.



- Loosen clamps -1- and -2-.



- Unbolt cross piece (front) -arrows-.



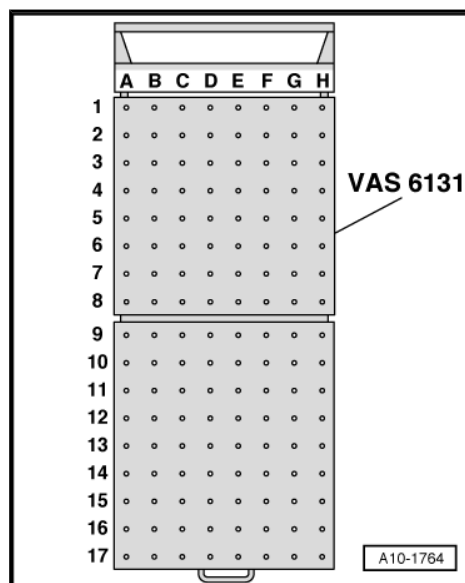
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### Set up the scissor-type assembly platform as follows:

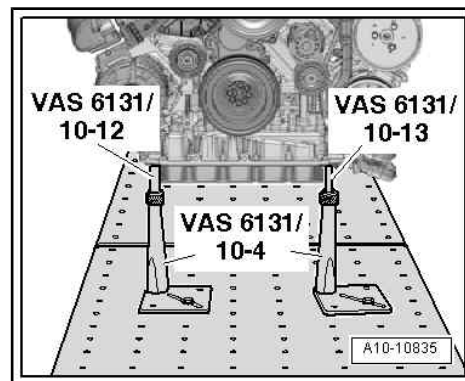
- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- as follows:

| Platform coordinates | Parts from support set for Audi - VAS 6131/10- |       |       |        |
|----------------------|------------------------------------------------|-------|-------|--------|
| B4                   | /10-1                                          | /10-4 | /10-5 | /10-13 |
| G4                   | /10-1                                          | /10-4 | /10-5 | /10-12 |
| B10                  | /10-1                                          | /10-2 | /10-5 | /10-8  |
| G10                  | /10-1                                          | /10-2 | /10-5 | /10-8  |
| E13                  | /10-1                                          | /10-3 | /10-5 | /10-6  |
| D16                  | /10-1                                          | /10-3 | /10-5 | /10-6  |

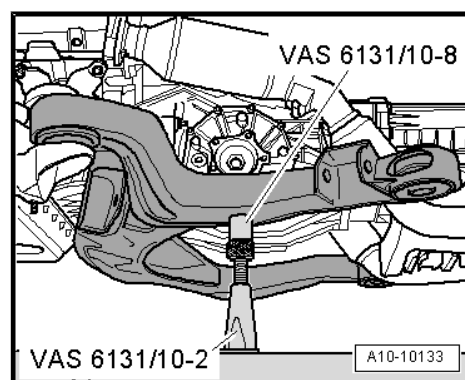
- Initially hand-tighten the support elements on the scissor-type assembly platform.
- Position scissor-type assembly platform - VAS 6131 A- horizontally.
- Take note of spirit level (bubble gauge).
- Position scissor-type assembly platform - VAS 6131 A- below engine/gearbox assembly.



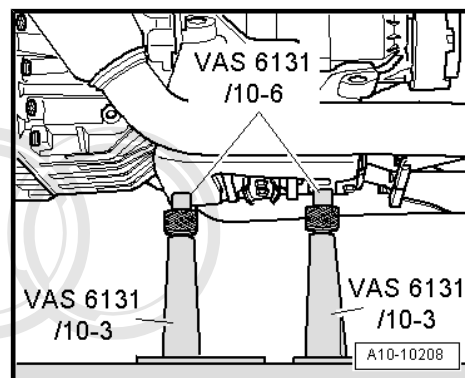
- Position the support elements from -VAS 6131/10- at front of engine, as shown in illustration.



- Position support elements from -VAS 6131/10- at left and right of subframe, as shown in illustration.



- Position the support elements from -VAS 6131/10- at rear of tunnel cross member, 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 A- .

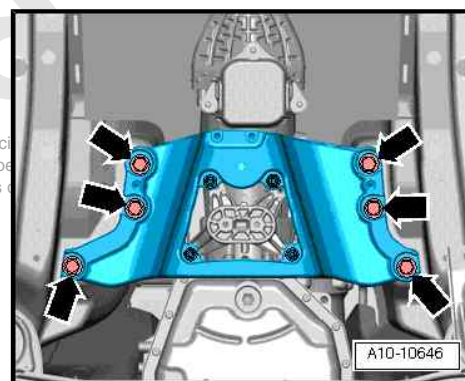


- Remove bolts -arrows- at tunnel cross member.



#### Note

For illustration purposes, the installation position is shown with the front exhaust pipes removed.



- Remove bolts -1-.
- Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
- Unscrew bolts -2-, -3- and -4- 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.

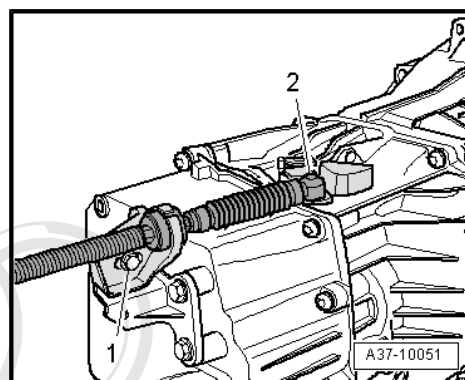
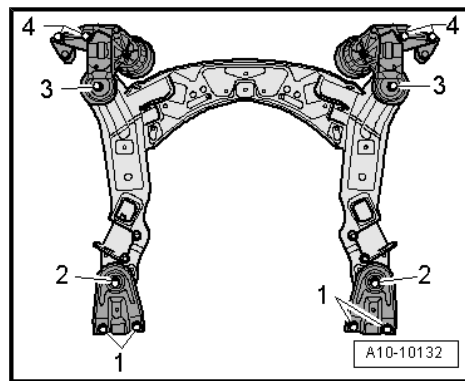
- Lower engine/gearbox assembly gradually (approx. 10 cm).
- Mark installation position of support bracket for selector lever cable.
- Unscrew bolt -1- for support bracket for selector lever cable.
- Push ball socket -2- of selector lever cable off gearbox selector lever.



### Note

Take care not to bend or kink selector lever cable.

- Lower the scissor-type assembly platform - VAS 6131 A- completely and pull it out together with engine/gearbox assembly from beneath the vehicle.



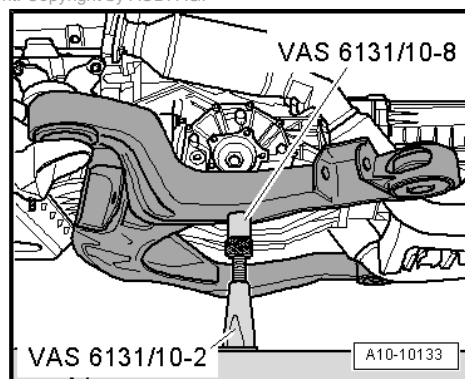
## 2.2 Detaching multitronic gearbox from engine

### Special tools and workshop equipment required

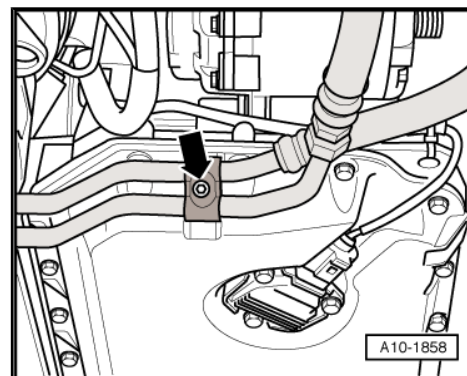
- ◆ Support set for Audi - VAS 6131/10- and supplementary set - VAS 6131/12-

### Procedure

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-
- Screw down spindles of the support elements (left and right) at subframe as far as possible.
- Remove locating lugs from spindles.
- Remove subframe to the side.
- Unscrew the two base plates for support elements (for subframe) on scissor-type assembly platform - VAS 6131 A- .



- Remove bracket -arrow- for ATF lines.



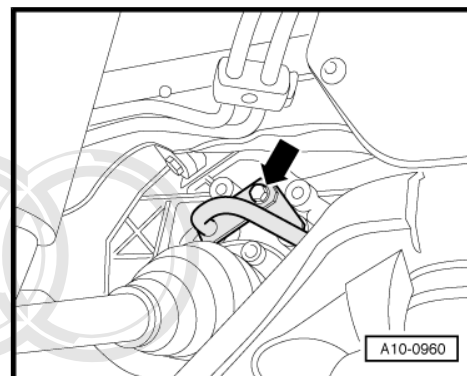
**i** Note

Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00.

- Unscrew bolt -arrow- and detach ATF lines from gearbox.

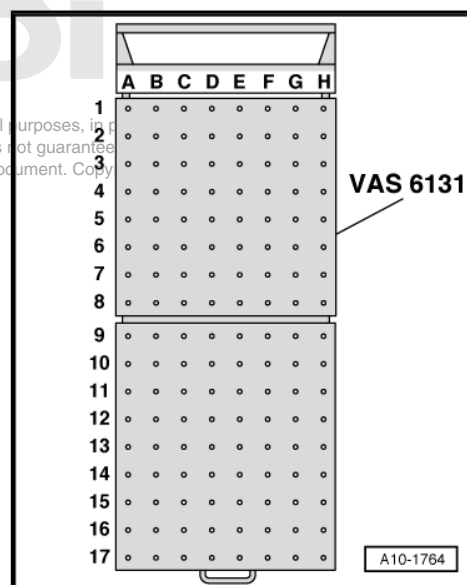
**i** Note

The mounting points for engine (front) and tunnel cross member remain unchanged.

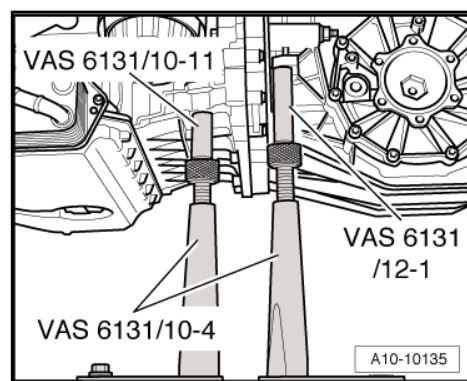


- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- and supplementary set - VAS 6131/12- as follows:

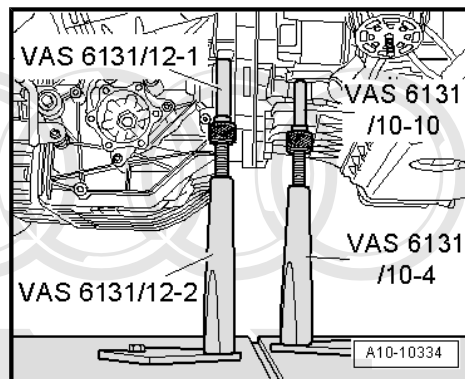
| Platform coordinates                               | Parts of support set - VAS 6131/10- and supplementary set - VAS 6131/12- |       |       |        |
|----------------------------------------------------|--------------------------------------------------------------------------|-------|-------|--------|
| B4 <sup>1)</sup>                                   | /10-1                                                                    | /10-4 | /10-5 | /10-13 |
| G4 <sup>1)</sup>                                   | /10-1                                                                    | /10-4 | /10-5 | /10-12 |
| B7                                                 | /10-1                                                                    | /10-4 | /10-5 | /10-11 |
| G7                                                 | /10-1                                                                    | /10-4 | /10-5 | /10-10 |
| C10                                                | /10-1                                                                    | /10-4 | /10-5 | /12-1  |
| G10                                                | /10-1                                                                    | /12-2 | /10-5 | /12-1  |
| E13 <sup>1)</sup>                                  | /10-1                                                                    | /10-3 | /10-5 | /10-6  |
| D16 <sup>1)</sup>                                  | /10-1                                                                    | /10-3 | /10-5 | /10-6  |
| • <sup>1)</sup> Support elements remain unchanged. |                                                                          |       |       |        |



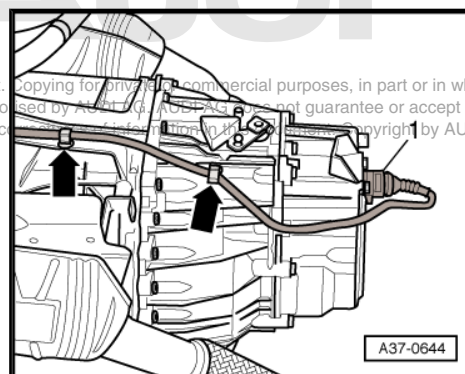
- Position the support elements from -VAS 6131/10- and -VAS 6131/12- at left of engine/gearbox assembly as shown in illustration.



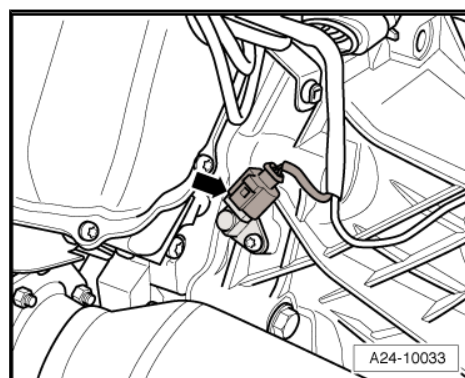
- Position the support elements from -VAS 6131/10- and -VAS 6131/12- at right of engine/gearbox assembly, as shown in the illustration.
- Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .



- Release electrical connector -1- and detach from gearbox.
- Move wiring harness going to engine clear -arrows-.



- Unplug electrical connector -arrow- for engine speed sender -G28- .

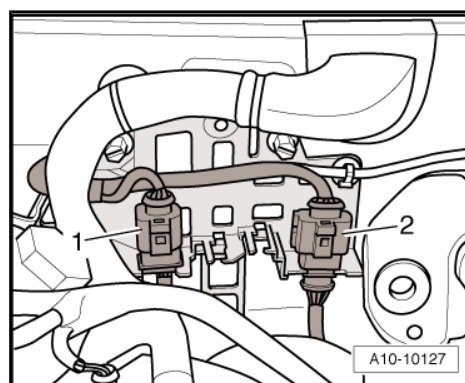


- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter -G131- and move wiring clear.



### Note

- ◆ Illustration shows electrical connector when installed.
- ◆ Disregard item -1-.



**Caution**

*Risk of damage to flexible joints in front silencer.*

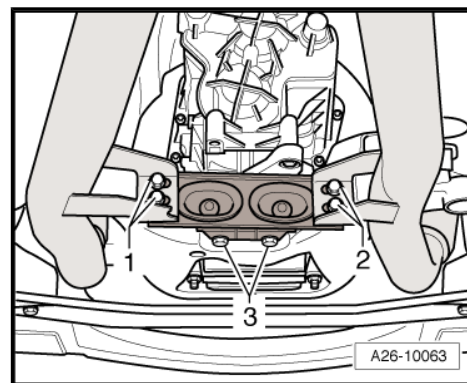
- ◆ *Do NOT bend the flexible joints in the front silencer more than 10°.*

- Remove bolts -1- on bracket (rear) for exhaust system.

**Note**

*Disregard -items 2 and 3-.*

- Unscrew nuts -1 ... 3-.
- Detach front exhaust pipe (left-side) with catalytic converter.

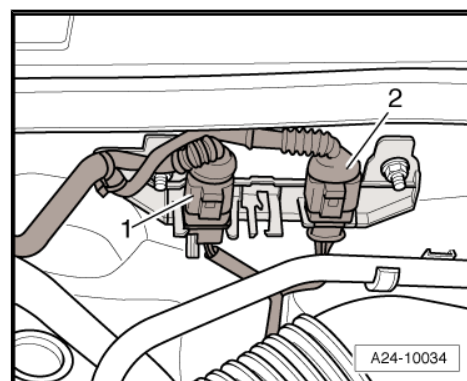
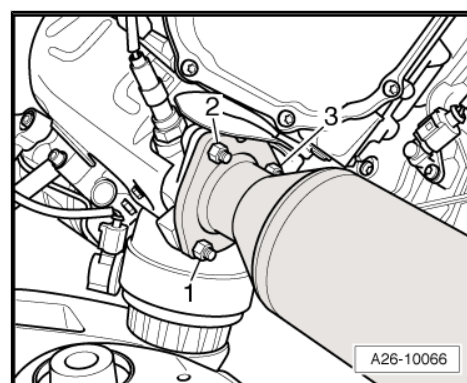


- Unplug electrical connector -2- for Lambda probe after catalytic converter - G130- and move wiring clear.

**Note**

- ◆ *Illustration shows electrical connector when installed.*

- ◆ *Disregard item -1-.*
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**Caution**

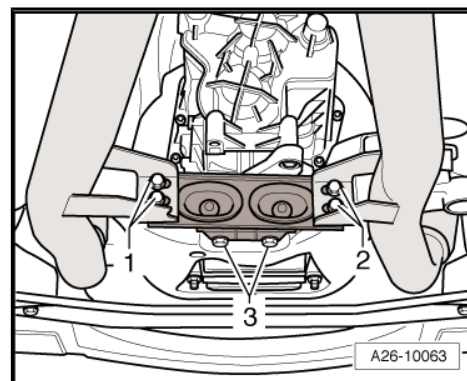
*Risk of damage to flexible joints in front silencer.*

- ◆ *Do NOT bend the flexible joints in the front silencer more than 10°.*

- Remove bolts -2- on bracket (rear) for exhaust system.

**Note**

*Disregard -items 1 and 3-.*

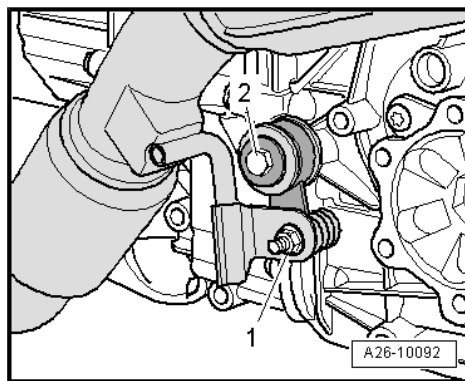


- Remove bolt -1- on bracket (right-side) for front exhaust pipe.

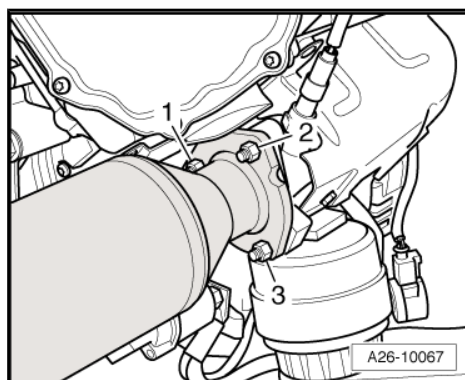


### Note

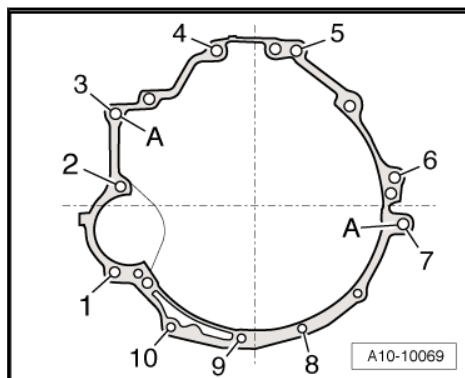
Disregard item -2-.



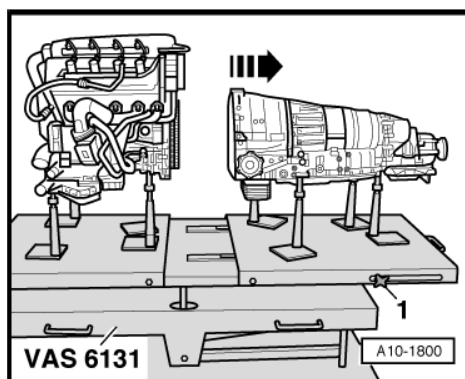
- Unscrew nuts -1 ... 3-.
- Detach front exhaust pipe (right-side) with catalytic converter.



- Remove bolts -1 ... 10- securing gearbox to engine.



- Loosen clamping bolts -1- on sides of scissor-type assembly platform - VAS 6131 A- and pull rear section of platform together with gearbox towards rear -arrow-.

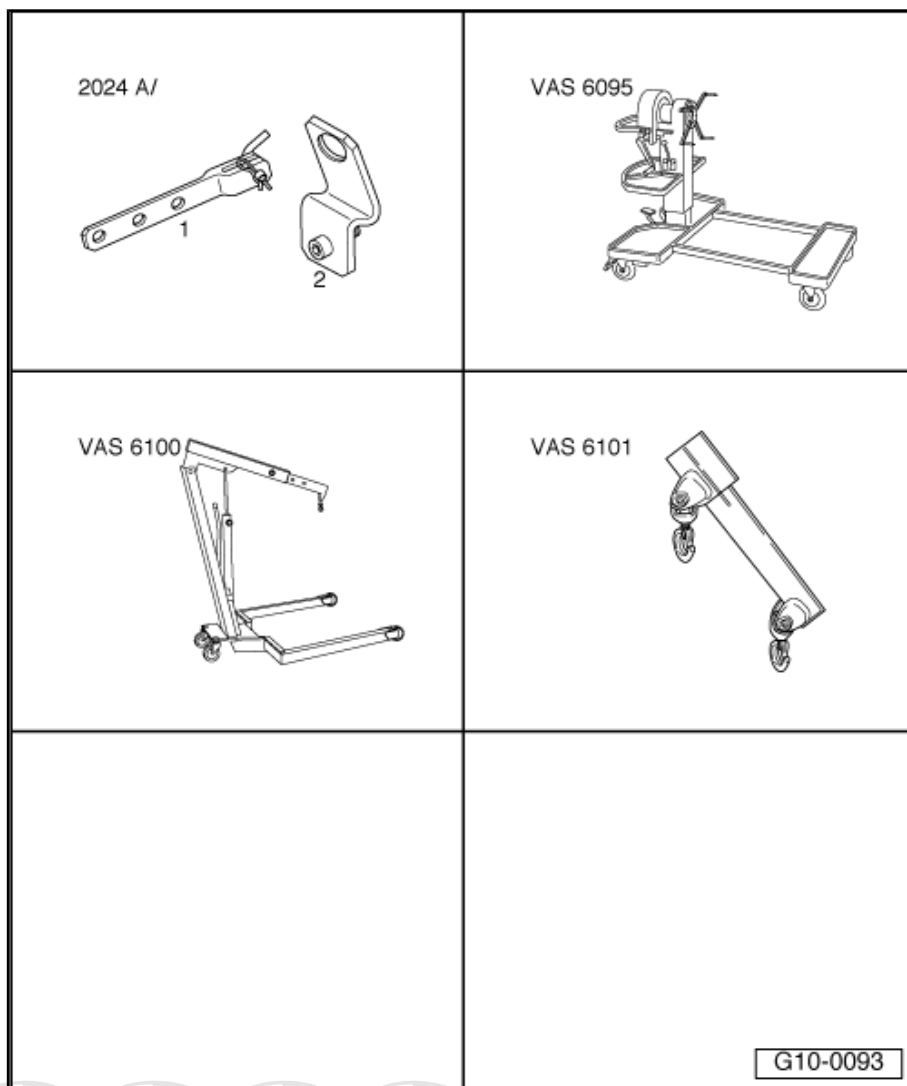


## 2.3 Securing engine to engine and gearbox support

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**Special tools and workshop equipment required**

- ◆ Lifting tackle - 2024 A-
- ◆ Engine and gearbox support - VAS 6095- with bracket -VAS 6095/1-5-
- ◆ Workshop hoist - VAS 6100-
- ◆ Lift arm extension (workshop hoist) - VAS 6101-

**Procedure**

- Engine separated from gearbox ⇒ [page 56](#) .
- Attach lifting tackle - 2024 A- to engine and workshop hoist - VAS 6100- with lift arm extension (workshop hoist) - VAS 6101- as shown in illustration.

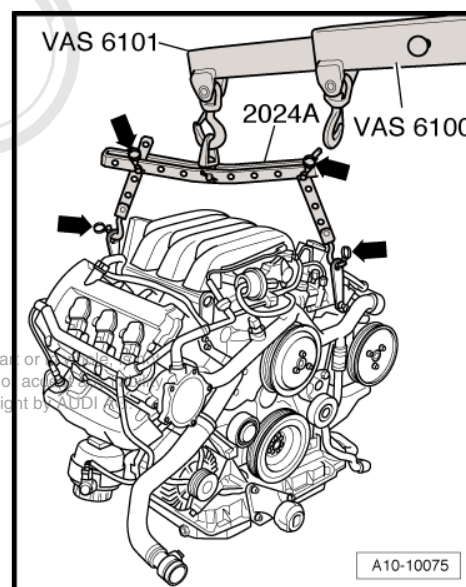
**Note**

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

**WARNING**

**Accident risk from loose components of lifting tackle.**

- ◆ **The support hooks and retaining pins must be secured with locking pins -arrows-.**



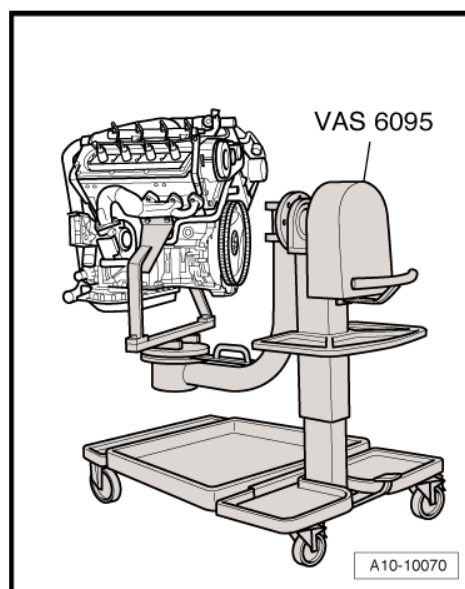
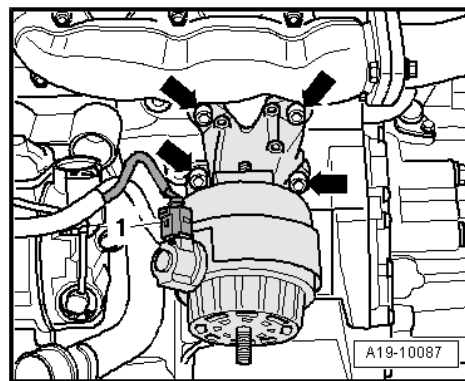
- Unplug electrical connector -1- from engine mounting (left-side).
- Remove bolts -arrows- and detach engine support (left-side).



### Note

Shown in illustration without console for engine mounting.

- Repeat procedure on other side of engine.
- Secure engine with bracket -VAS 6095/1-5- to engine and gearbox support - VAS 6095- as shown in illustration. Tightening torque: 40 Nm.



## 2.4 Installing engine

### 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:  $\pm 15\%$ .

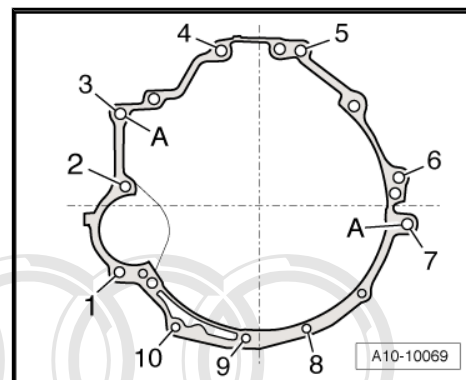
| Component                                          |     | Nm |
|----------------------------------------------------|-----|----|
| Bolts/nuts                                         | M6  | 9  |
|                                                    | M8  | 20 |
|                                                    | M10 | 40 |
|                                                    | M12 | 65 |
| Except for the following:                          |     |    |
| Engine support to cylinder block                   |     | 40 |
| Console for engine mounting to longitudinal member |     | 75 |
| Tunnel cross member to body                        |     | 40 |

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| Component                                        | Nm  |
|--------------------------------------------------|-----|
| Torque reaction support to engine                | 40  |
| Stop for torque reaction support to lock carrier | 23  |
| Hose clips (9 mm wide)                           | 3   |
| Hose clips (13 mm wide)                          | 5.5 |

### Securing multitronic gearbox to engine

| Item                                                                                                                            | Bolt <sup>1)</sup>             | Nm               |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------|
| 1, 7                                                                                                                            | M10x100                        | 65 <sup>2)</sup> |
| 2                                                                                                                               | M12x120                        | 65               |
| 3, 5                                                                                                                            | M12x100                        | 65               |
| 4, 6                                                                                                                            | M12x95                         | 65               |
| 8, 9, 10                                                                                                                        | M10x70                         | 45               |
| A                                                                                                                               | Dowel sleeves for centralising |                  |
| <ul style="list-style-type: none"><li>• 1) Renew bolts for securing engine/gearbox.</li><li>• 2) Property class 10.9.</li></ul> |                                |                  |



### Procedure



#### Note

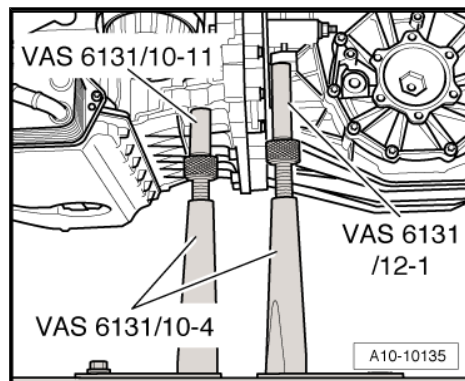
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*

- Clean input shaft splines on gearbox and splines of damper unit on flywheel; remove corrosion and apply only a very thin coating of grease for clutch plate splines - G 000 100- to the splines. Remove any excess grease.
- Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install dowel sleeves if necessary.
- Bolt gearbox to engine (use new bolts).

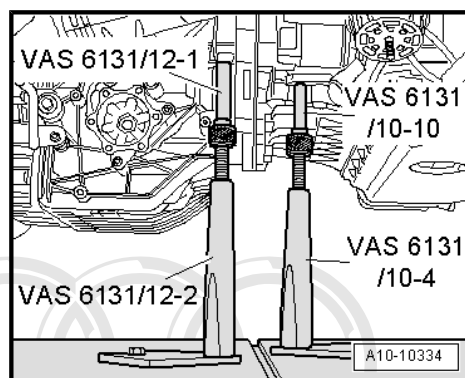
Installation is carried out in the reverse order; note the following:

- Secure ATF lines ⇒ Rep. gr. 37 .
- Install front exhaust pipes: left-side ⇒ [page 272](#) , right-side ⇒ [page 275](#) .
- 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 spindles of support elements on left side of engine/gearbox assembly.
- Unscrew both base plates for support elements (left-side) at scissor-type assembly platform - VAS 6131 A- .



- Screw down spindles of support elements on right side of engine/gearbox assembly.
- Unscrew both base plates for support elements (right-side) at scissor-type assembly platform - VAS 6131 A- .



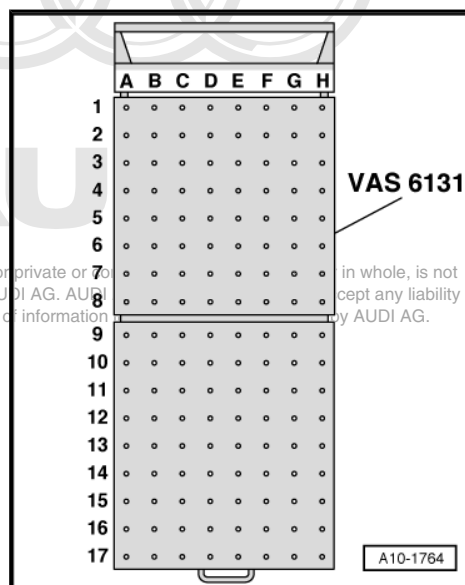
### Note

The mounting points for engine (front) and tunnel cross member remain unchanged.

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

| Platform coordinates | Parts of support set for Audi - VAS 6131/10- |       |       |                     |
|----------------------|----------------------------------------------|-------|-------|---------------------|
| B4 <sup>1)</sup>     | /10-1                                        | /10-4 | /10-5 | /10-13              |
| G4 <sup>1)</sup>     | /10-1                                        | /10-4 | /10-5 | /10-12              |
| B10                  | /10-1                                        | /10-2 | /10-5 | /10-8 <sup>2)</sup> |
| G10                  | /10-1                                        | /10-2 | /10-5 | /10-8 <sup>2)</sup> |
| E13 <sup>1)</sup>    | /10-1                                        | /10-3 | /10-5 | /10-6               |
| D16 <sup>1)</sup>    | /10-1                                        | /10-3 | /10-5 | /10-6               |

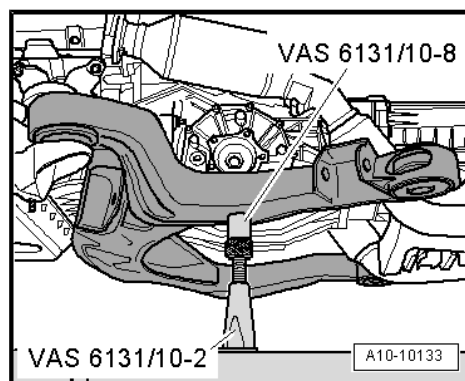
- <sup>1)</sup> Support elements remain unchanged.
- <sup>2)</sup> Secure support elements only after installing the subframe.



### 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 the spindles for support elements on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .
- Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform - VAS 6131 A- .

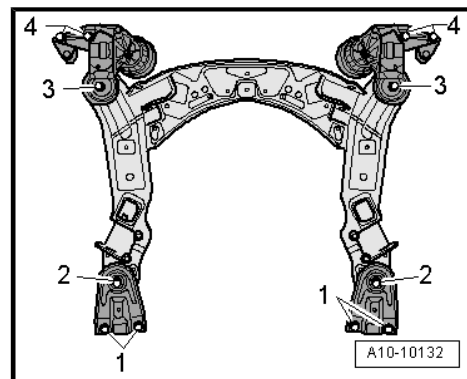


- Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
- Tighten bolts for subframe and consoles for engine mountings only to specified torque (do not turn further); the bolts are only fully tightened after performing the wheel alignment check ⇒ Rep. gr. 40 .

**WARNING**

*Risk of accident because of loose bolted connections.*

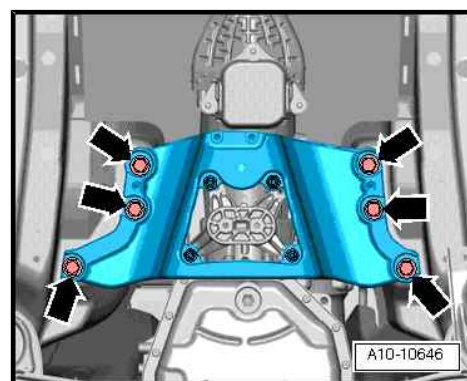
- ◆ **Do NOT drive the vehicle unless the subframe bolts have been tightened to their final torque.**



- Tighten bolts -arrows- for tunnel cross member.

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

- Install selector lever cable and check adjustment if necessary ⇒ Rep. gr. 37 .
- Install drive shafts ⇒ Rep. gr. 40 .
- Install guide links, track control links, anti-roll bar and suspension struts ⇒ Rep. gr. 40 .
- Install cross piece for subframe ⇒ Rep. gr. 40 .
- Install cross piece (front) ⇒ Rep. gr. 50 .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install hydraulic pressure pipe for power steering pump ⇒ Rep. gr. 48 .
- Install fuel supply hose ⇒ Rep. gr. 24 .
- Install poly V-belt ⇒ [page 101](#) .



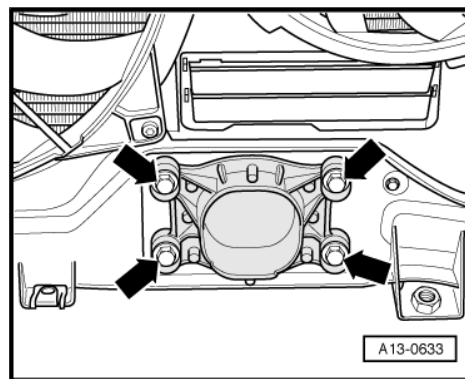
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedure for connecting the battery ⇒ Rep. gr. 27 .



### Caution

**Risk of irreparable damage to control units because of excessive voltage.**

- ◆ **Never use battery charging equipment for boost starting.**



- Install and adjust wiper arms ⇒ Rep. gr. 92 .
- Install body brace ⇒ Rep. gr. 40 .
- Check oil level ⇒ [page 237](#) .
- Bleed fuel system ⇒ Rep. gr. 24 .
- Fill cooling system ⇒ [page 242](#) .



### Note

- ◆ *Do not use drained coolant again if:*
- ◆ *the cylinder head or cylinder block have been renewed.*
- ◆ *the coolant is contaminated or dirty.*
- Top up power steering fluid and bleed steering system ⇒ Rep. gr. 48 .
- Check ATF level ⇒ Rep. gr. 37 .
- Adjust subframe and the two consoles for engine mountings ⇒ Rep. gr. 40 .
- Perform wheel alignment check ⇒ Rep. gr. 44 .



### WARNING

**Risk of accident because of loose bolted connections.**

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

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### 3 Removing and installing engine - vehicles with automatic gearbox 09L

⇒ ["3.1 Removing engine", page 67](#)

⇒ ["3.2 Separating engine from automatic gearbox 09L", page 85](#)

⇒ ["3.3 Securing engine to engine and gearbox support", page 91](#)

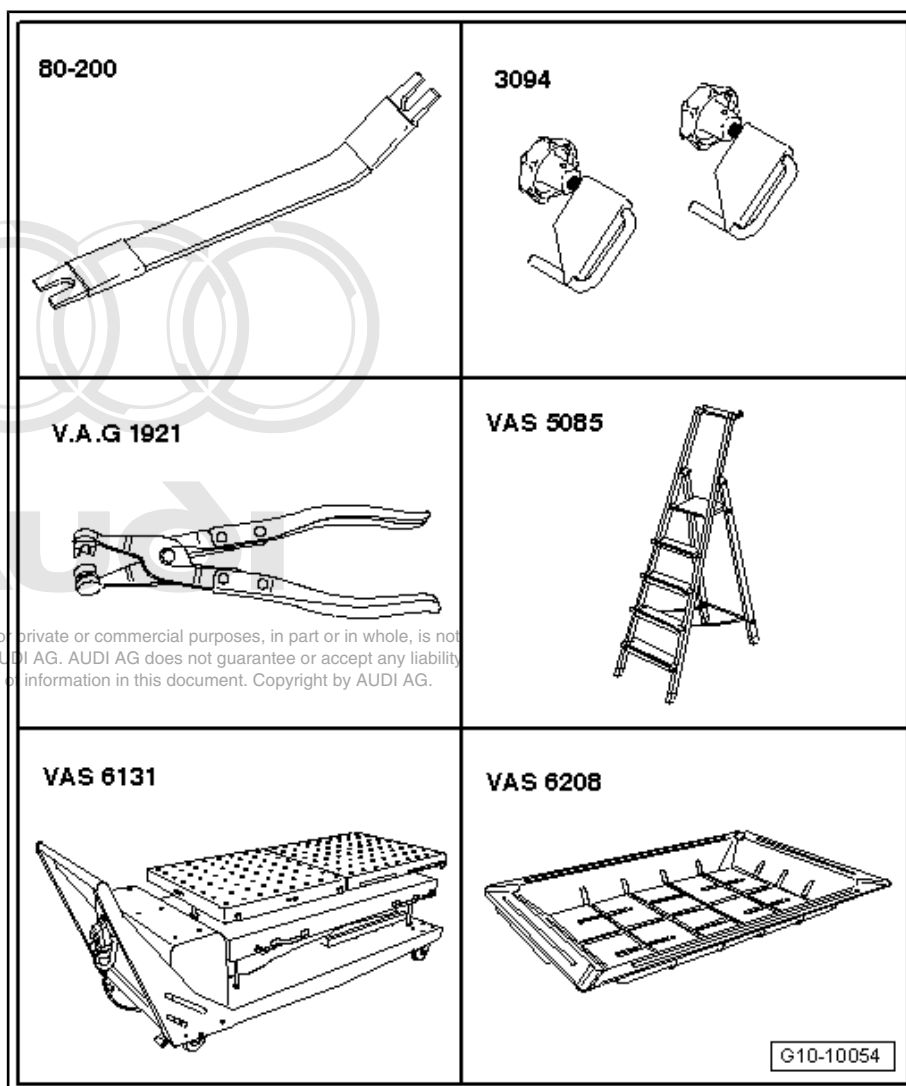
⇒ ["3.4 Installing engine", page 93](#)

#### 3.1 Removing engine

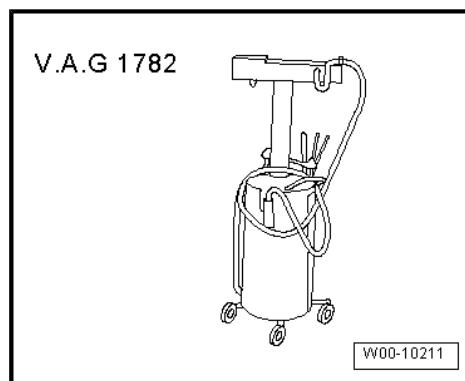
##### Special tools and workshop equipment required

- ◆ Removal lever - 80-200-
- ◆ Hose clamps up to Ø 25 mm - 3094-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Stepladder - VAS 5085-
- ◆ Scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , -VAS 6131/11- and -VAS 6131/12-
- ◆ Drip tray for workshop hoist - VAS 6208-

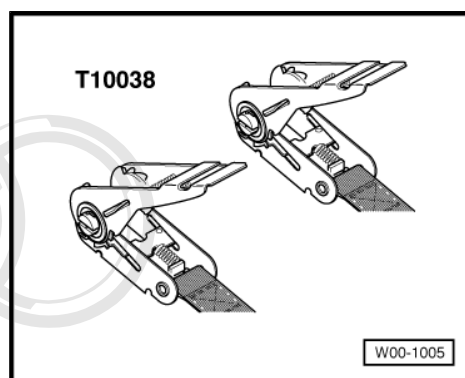
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- ◆ Used oil collection and extraction unit - V.A.G 1782-



- ◆ Tensioning strap - T10038-



## Procedure



### Note

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- ◆ *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*



### WARNING

***Make sure the vehicle cannot tip over when the engine is removed.***

- ◆ *Secure the vehicle, to do so, the luggage compartment must be empty.*



### Caution

***To prevent irreparable damage to the electronic components when disconnecting the battery:***

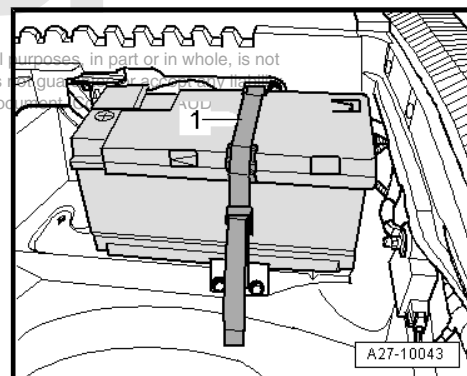
- ◆ *Observe notes on procedure for disconnecting the battery.*

 Note

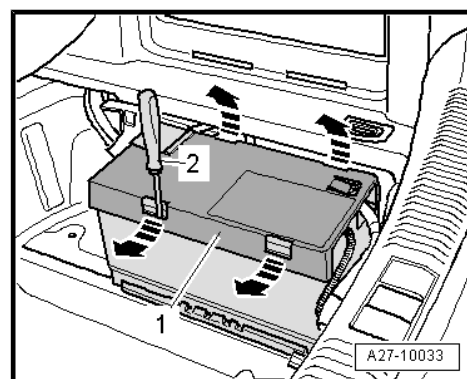
- ◆ *To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.*
- ◆ *On four-wheel drive vehicles, the electromechanical parking brake must be released before disconnecting the battery so that the propshaft can be turned during removal.*

– Take out luggage compartment floor trim.

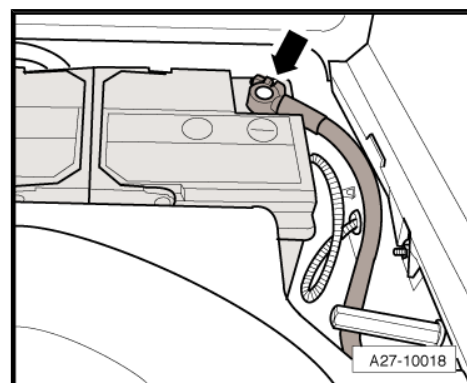
– Release battery retaining strap -1- (if fitted).



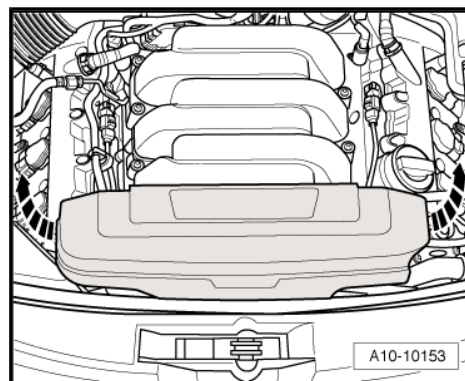
– Use screwdriver -2- to release retaining clips -arrows- and detach cover -1-.



– Disconnect earth cable -arrow- at battery.



- Pull off engine cover panel (front) -arrows-.



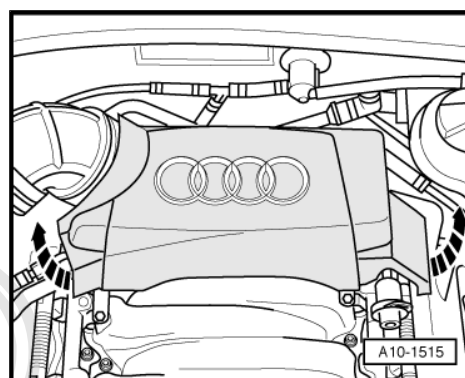
- Pull off engine cover panel (rear) -arrows-.



### WARNING

*Hot steam/hot coolant can escape - risk of scalding.*

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.*



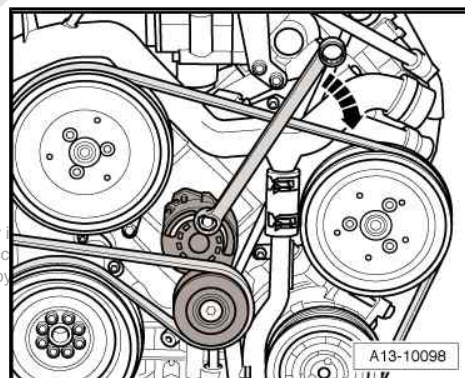
- Open filler cap on coolant expansion tank.



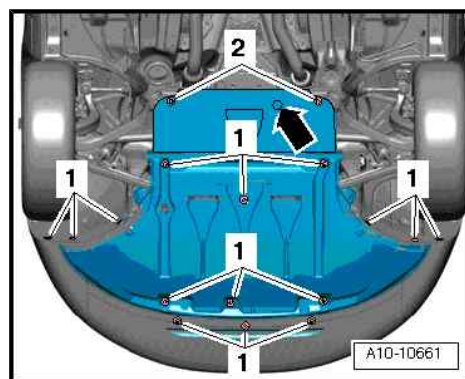
### Note

*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.*

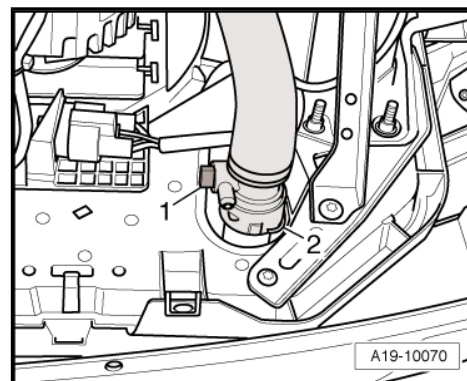
- To slacken poly V-belt turn tensioner in direction of arrow.
- Remove poly V-belt and release pressure from the tensioner.
- Remove both front wheels.



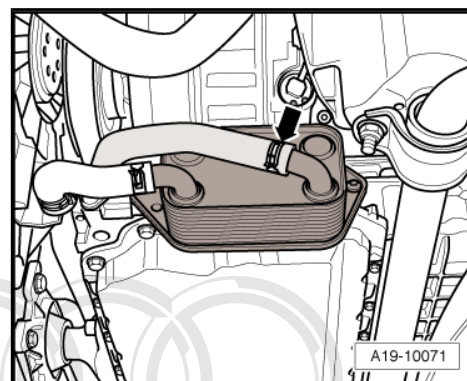
- Release fasteners -1, 2, arrow- and remove noise insulation.



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Open drain plug -1- and let coolant drain.
- Then disconnect coolant hose -2- from radiator.



- Disconnect coolant hose -arrow- at engine oil cooler and drain off remaining coolant.

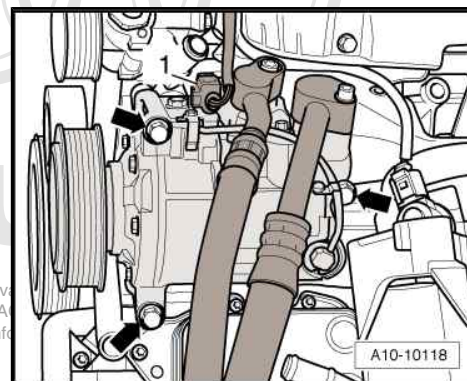


- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**WARNING**

*Risk of injury caused by refrigerant.*

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



- Unscrew air conditioner compressor from bracket -arrows-.

**Caution**

*Danger of damage to refrigerant lines and hoses.*

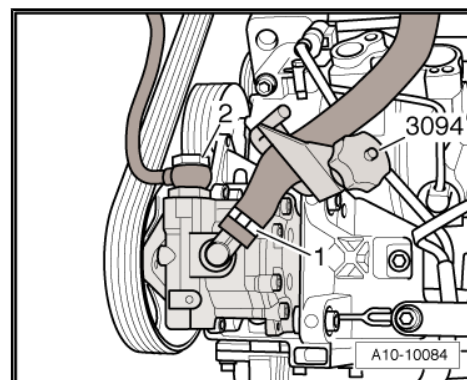
- ◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*

- Tie up air conditioner compressor with lines attached to left-side of vehicle.

**Note**

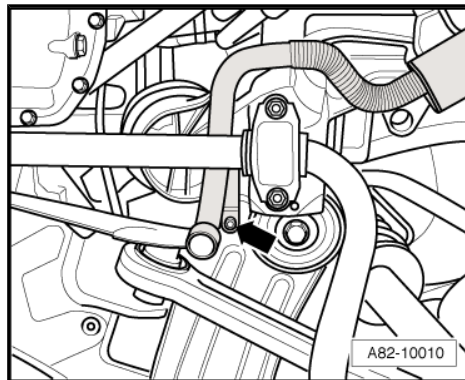
*Lay a cloth under the hydraulic lines to catch escaping hydraulic fluid.*

- Clamp off hydraulic hose -1- for power steering pump using hose clamps up to 25 mm - 3094- .
- Disconnect hydraulic hose from power steering pump.
- Unbolt hydraulic pressure line -2- at power steering pump and lay pressure line on top of longitudinal member.

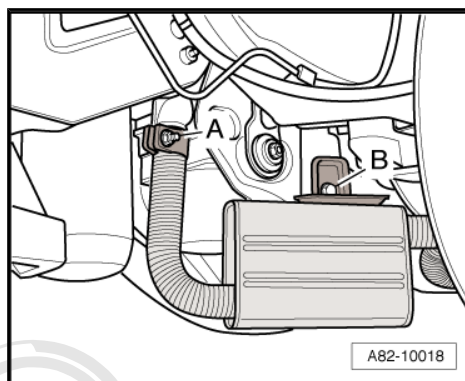


### Vehicles with auxiliary heater:

- Detach wheel housing liner (front left) at the front ⇒ Rep. gr. 66 .
- Remove bolt -arrow- for corrugated exhaust pipe.

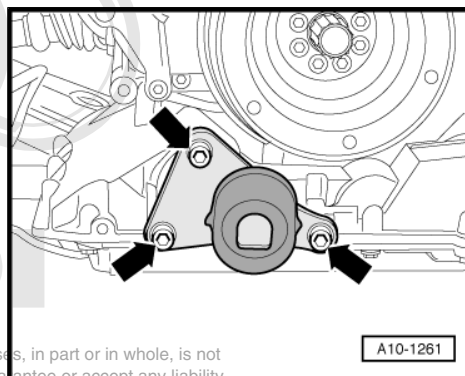


- Slacken nut -A- on clamp for corrugated exhaust pipe.
- Remove bolt -B- and detach exhaust silencer with corrugated exhaust pipes.



### All vehicles (continued):

- Unscrew bolts -arrows- and remove torque reaction support from engine.



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### Note

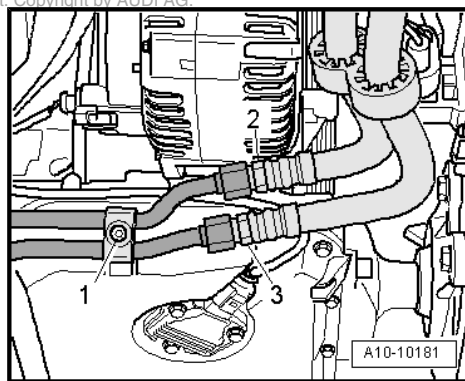
Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00 .

- Position used oil collection and extraction unit - V.A.G 1782- below connection point.
- Loosen union nuts and disconnect ATF lines -2- and -3-.

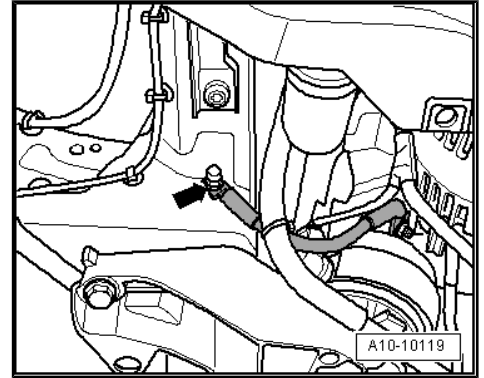


### Note

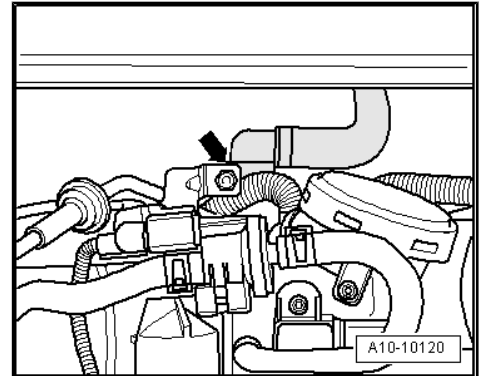
Disregard item -1-.



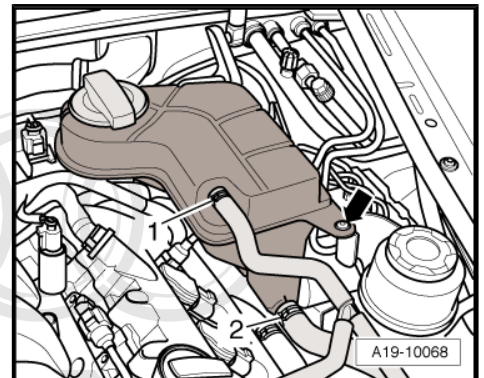
- Unbolt earth cable -arrow- at longitudinal member (right-side).



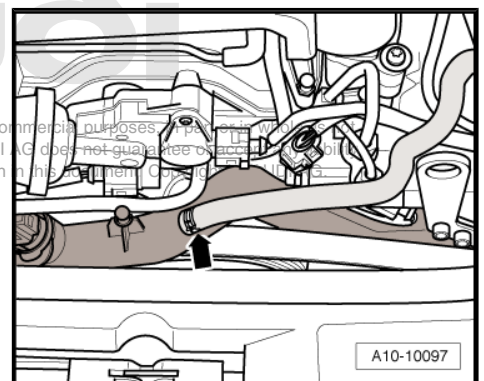
- Detach coolant hose -arrow- from heat exchanger at rear of engine.



- Detach coolant hoses -1- and -2- from coolant expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank (bottom).

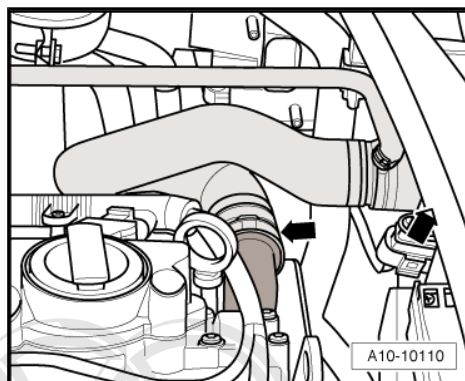


- Detach coolant hose -arrow- from coolant pipe (front).

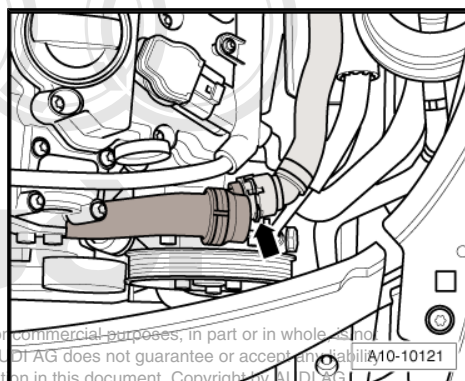


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- Remove coolant hose (front left) in engine compartment -arrows-.



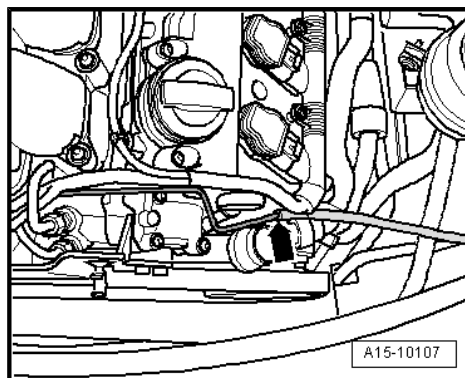
- Detach coolant hose -arrow- from coolant pipe (front).



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#### USA models:

- Disconnect vacuum hose -arrow- leading to leak diagnostic pump.



#### All vehicles (continued):

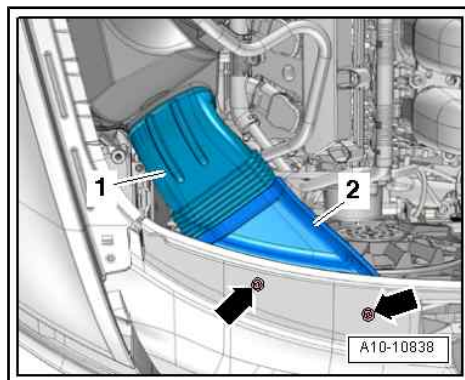
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



#### Caution

*Take care to keep components clean.*

- ◆ *Rules for cleanliness when working on the injection system ⇒ [page 6](#).*

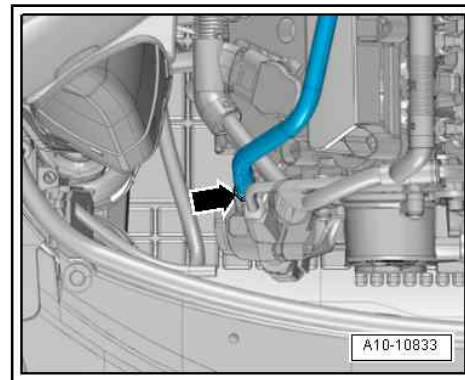


**WARNING**

*The fuel system is pressurised.*

*Risk of injury as fuel may spray out.*

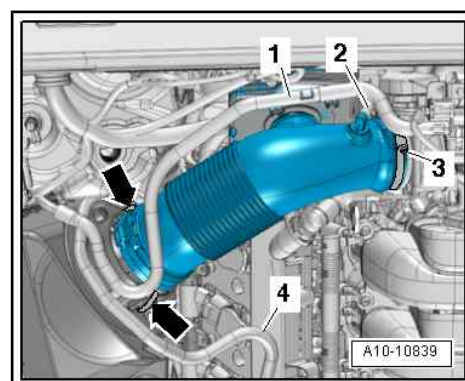
- *Wear safety goggles.*
- *Wear protective gloves.*
- *Release pressure (wrap clean cloth around connection and open connection carefully).*



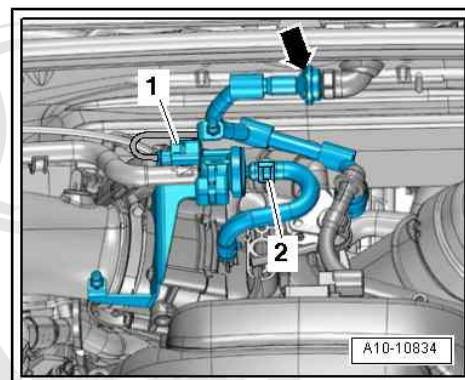
- Detach fuel supply hose from high-pressure pump -arrow- and move clear.
- Move fuel line -4- and line -1- leading to activated charcoal filter clear on air cleaner housing and air pipe.
- Disconnect vacuum hose -2- from connection on air hose.
- Remove air pipe. To do so, release hose clip -3- and clamps -arrows-.

**Note**

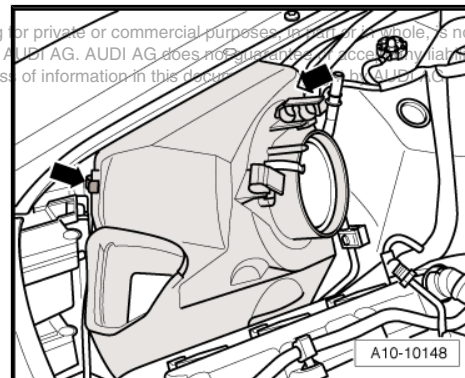
*Disregard item -4-.*



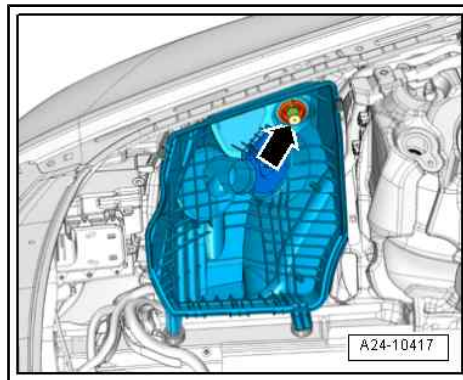
- Unplug electrical connector -1- at activated charcoal filter solenoid valve 1 - N80- and detach vacuum hose -2-.
- Detach activated charcoal filter solenoid valve 1 - N80- from bracket and move it clear to the side with hose still attached.
- Detach non-return valve -arrow- for brake servo from plenum chamber partition panel.



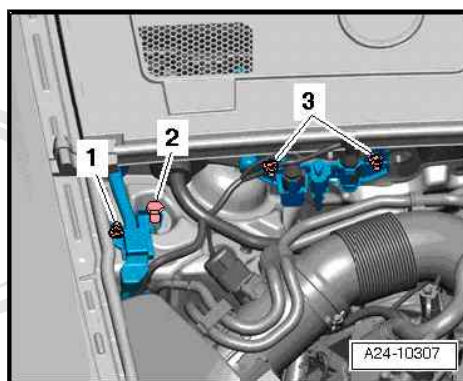
- Release clamps -arrows- and detach air cleaner (top section).



- Pull out pin of fastener -arrow- and detach air cleaner (bottom section).

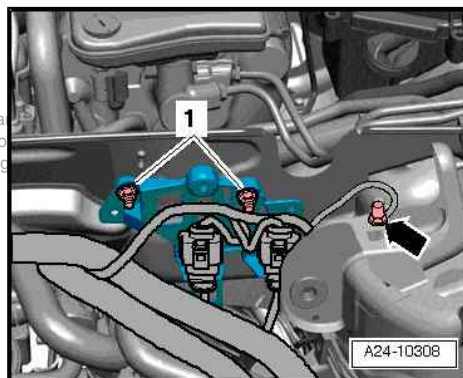


- Unscrew nuts -3- and detach bracket for connectors (right-side) from plenum chamber partition panel.
- Unscrew nut -1- on positive terminal.
- Unscrew earth stud -2-.

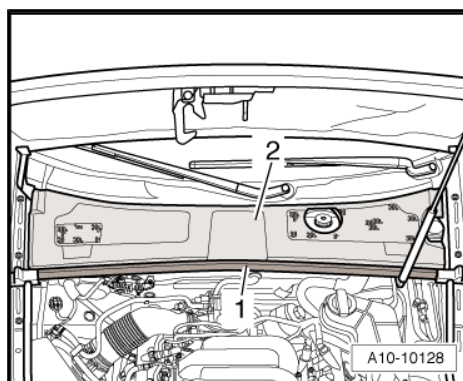


- Unscrew nuts -1- and detach bracket for connectors (left-side) from plenum chamber partition panel.
- Unbolt earth cable -arrow- at suspension turret (left-side).

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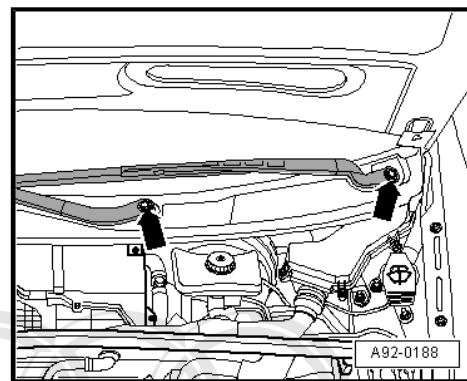
- Pull off rubber seal -1-.
- Detach plenum chamber cover -2-.



- Pry off caps on windscreen wiper arms with a screwdriver.
- Loosen nuts -arrows- several turns.
- Tilt windscreen wiper arms one by one and loosen from wiper shafts.
- Remove nuts completely and take off wiper arms.

**Note**

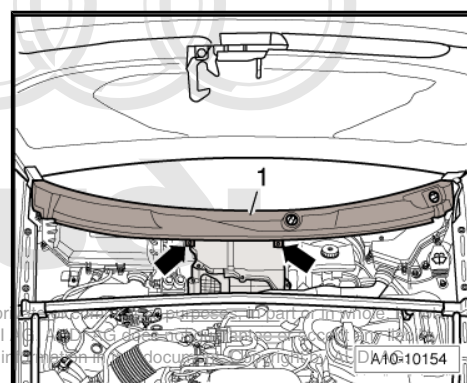
Use puller (commercially available) to remove wiper arm if necessary.



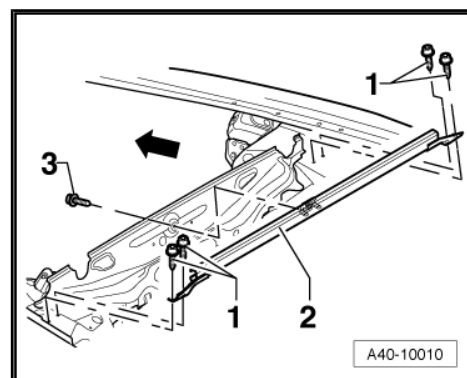
- Unscrew bolts -arrows- for cowl panel trim -1-.

**Caution**

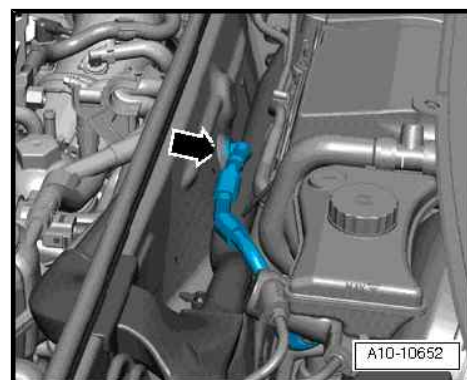
To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.



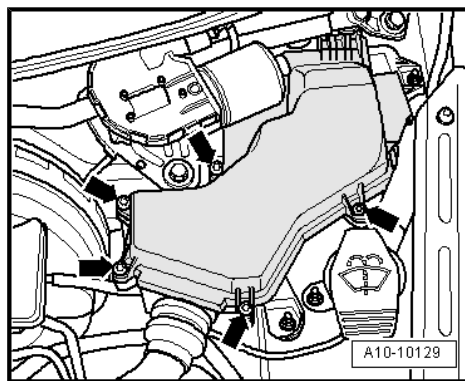
- Pull cowl panel trim off windscreen.
- If fitted, unscrew bolts -1- and -3- and remove body brace -2-.



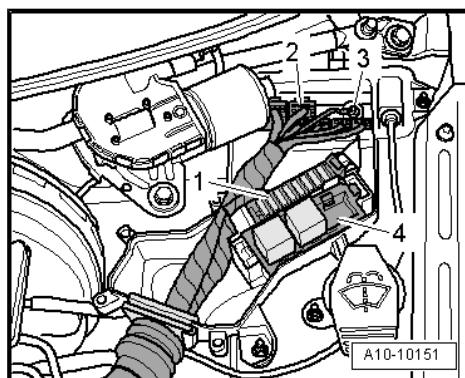
- Detach vacuum line -arrow- going to brake servo at plenum chamber partition panel.



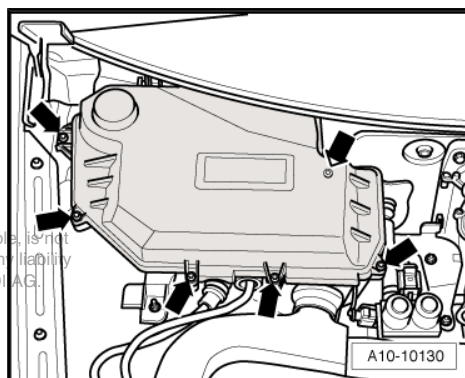
- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



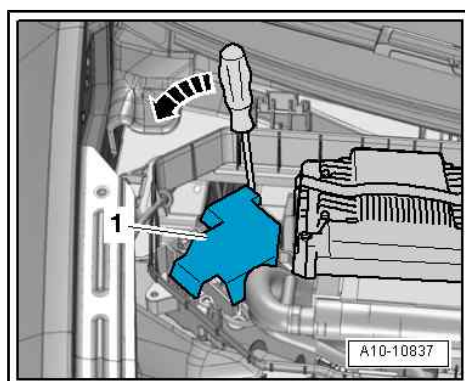
- Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
- Unscrew electrical wiring -3-.
- Unplug electrical connectors -2- at rear of connector console.
- Disengage engine wiring harness at electronics box and move it clear.



- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).



- Open cover -1- with screwdriver -arrow- and detach.



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**WARNING**

*Risk of burns at the pump valve unit for the heating system (left-side in front of electronics box).*

- ◆ *Wear protective gloves when working near the pump valve unit for the heating system.*

- Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.

**Note**

*The engine control unit remains connected to the wiring harness.*

- Unclip suppressor capacitor -5- and take out of retainer in electronics box.
- **Unplug electrical connector 4 at rear of connector console.**
- Unscrew electrical wiring connections -1- and -2-.
- Release electrical wiring up to the alternator using removal lever - 80 - 200 - .
- Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.

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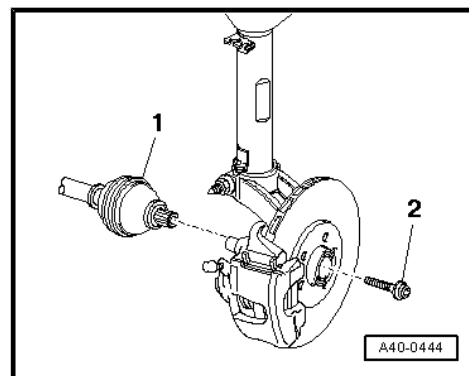
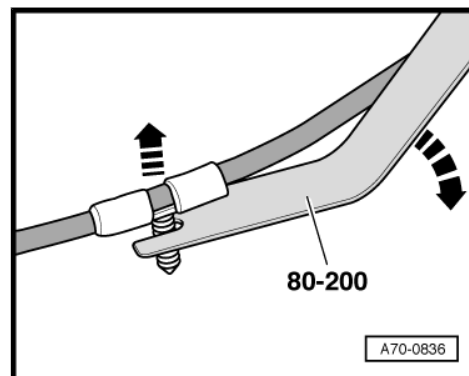
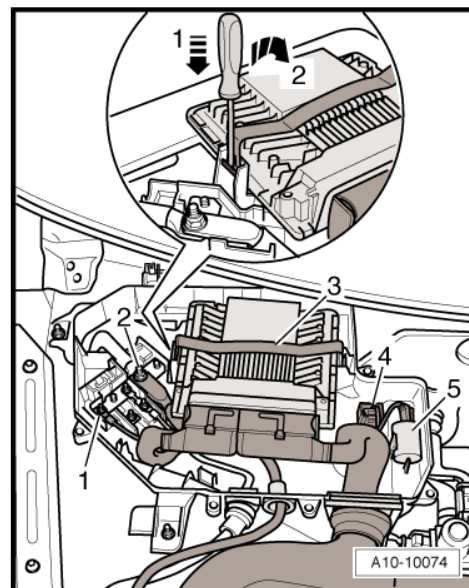
- Have a 2nd mechanic press the brake pedal.

**Caution**

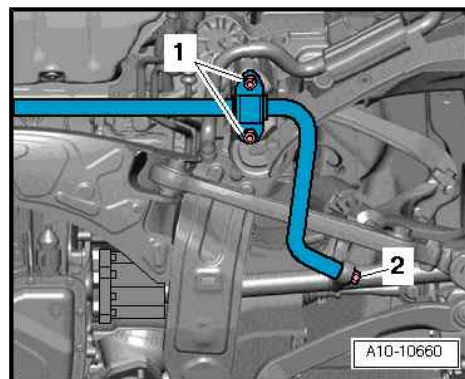
*Risk of damage to wheel bearing.*

- ◆ *When slackening the flange bolt securing the drive shaft, the vehicle must not be standing on its wheels.*

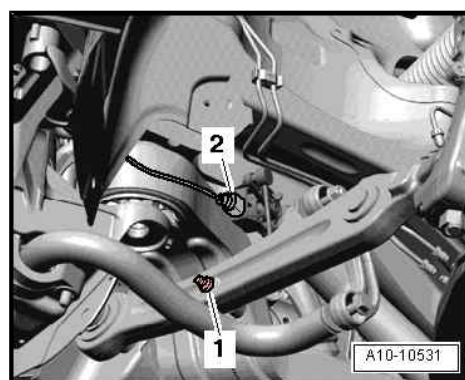
- Unscrew flange bolt -2- from drive shaft -1- (left and right).



- Unscrew nuts -1- evenly on both sides.
- Remove bolts -2- (left and right) and detach anti-roll bar.



- Unplug electrical connector -2- at vehicle level sender.
- Detach coupling rod -1- at track control link.



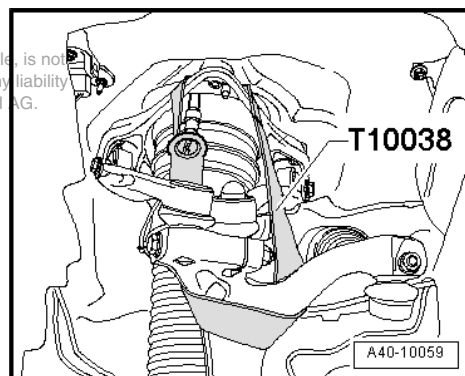
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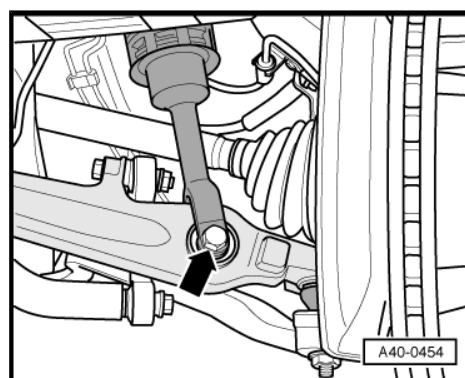
***Danger of damage to the swivel joints of the upper links.***

- ◆ ***Support wheel bearing housing.***

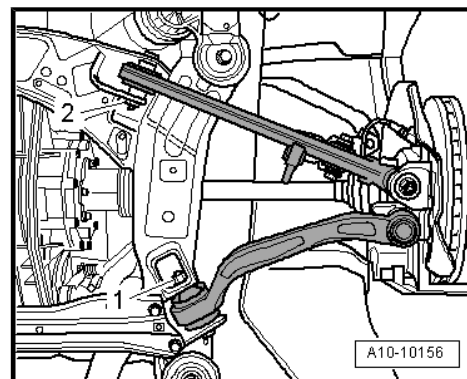
- Tie up wheel bearing housing using tensioning strap - T10038- as illustrated.



- Unbolt suspension strut from track control link -arrow-.



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

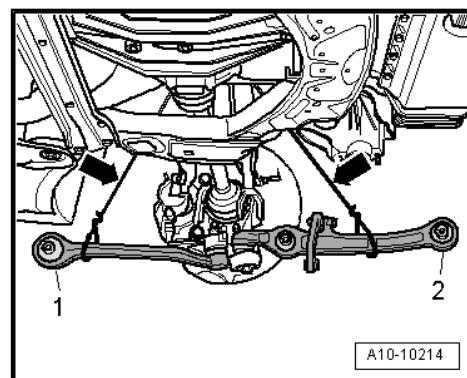


- Pivot guide link -1- and track control link -2- outwards.

**Caution**

*Risk of damage if guide link and track control link are allowed to drop without support.*

- ◆ *Tie up guide link and track control link to wheel bearing housing -arrows- as shown in illustration.*

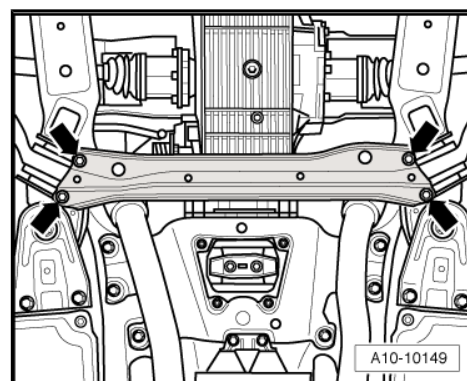


- Repeat procedure on other side of vehicle.
- Unbolt drive shaft from flange shaft on gearbox.

**Caution**

*Take care not to damage brake hose.*

- Pivot wheel bearing housing outwards and remove drive shaft.
- Repeat procedure on other side of vehicle.
- Unbolt cross piece from subframe -arrows-.



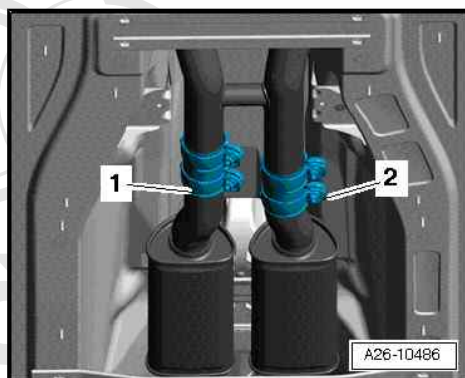
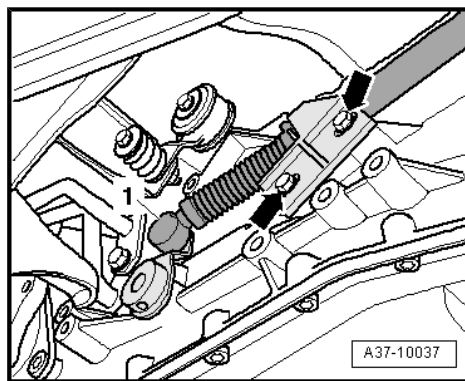
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# Note

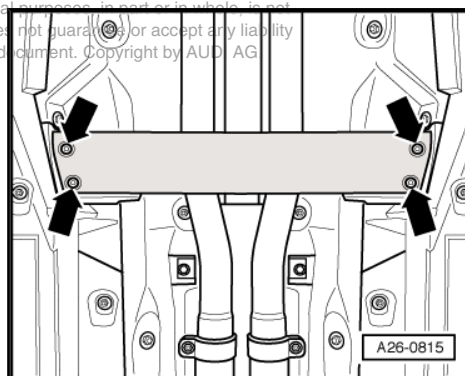
Mark installation position of support bracket for selector lever cable with a felt-tip pen.

- Push ball socket -1- of selector lever cable off gearbox selector lever.
- Unbolt cable support bracket from gearbox -arrows-.
- Move selector lever cable clear.
- Loosen clamps -1- and -2-.

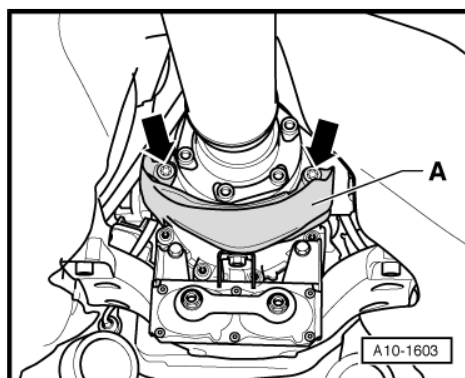


- Unbolt cross piece (front) -arrows-.

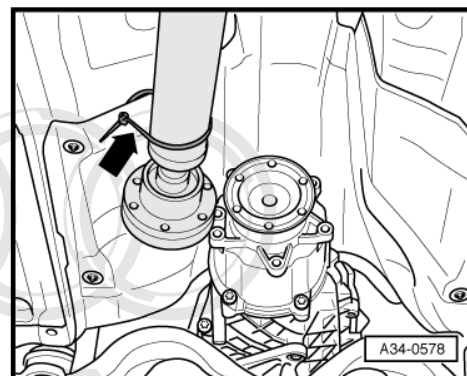
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- If fitted, unscrew heat shield -A- for propshaft -arrows-.
- Unscrew bolts at gearbox/propshaft flange.
- Push propshaft back towards rear final drive. The constant velocity joints can be moved axially.



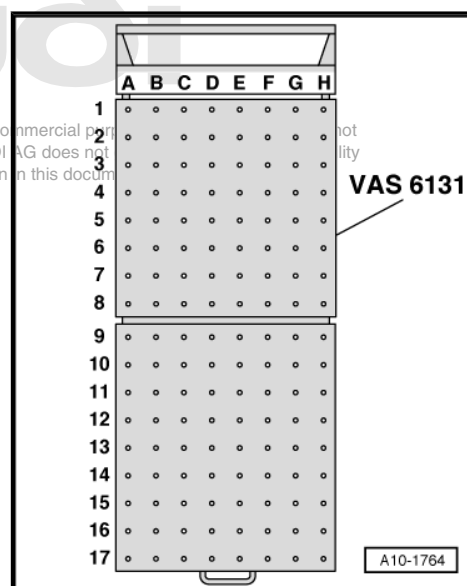
- Tie propshaft up to side of heat shield -arrow-.



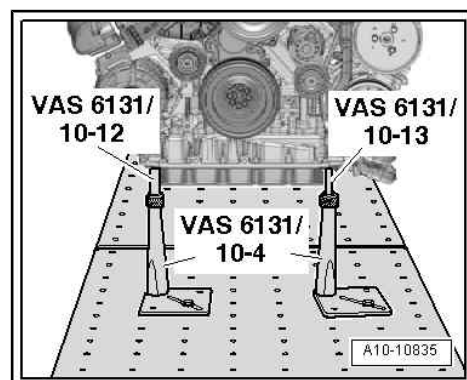
Set up the scissor-type assembly platform as follows:

- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- and supplementary set - VAS 6131/11- and -VAS 6131/12- as follows:

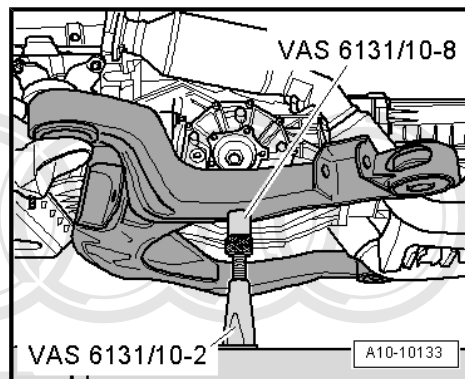
| Platform coordinates | Parts of support set for Audi - VAS 6131/10-, supplementary set -VAS 6131/11- and supplementary set -VAS 6131/12- |       |       |        |
|----------------------|-------------------------------------------------------------------------------------------------------------------|-------|-------|--------|
| B5                   | /10-1                                                                                                             | /10-4 | /10-5 | /10-13 |
| F5                   | /10-1                                                                                                             | /10-4 | /10-5 | /10-12 |
| B11                  | /10-1                                                                                                             | /10-2 | /10-5 | /10-8  |
| G11                  | /10-1                                                                                                             | /10-2 | /10-5 | /10-8  |
| E9                   | /10-1                                                                                                             | /10-3 | /10-5 | /11-3  |
| D10                  | /10-1                                                                                                             | /10-2 | /10-5 | /12-1  |
| F14                  | /10-1                                                                                                             | /10-4 | /10-5 | /10-12 |
| D16                  | /10-1                                                                                                             | /10-3 | /10-5 | /10-6  |



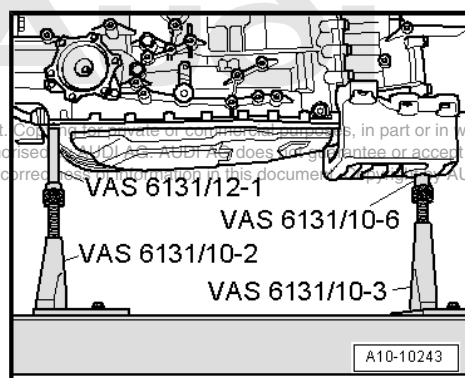
- Initially hand-tighten the support elements on the scissor-type assembly platform.
- Position scissor-type assembly platform - VAS 6131 A- horizontally.
- Take note of spirit level (bubble gauge).
- Position scissor-type assembly platform - VAS 6131 A- below engine/gearbox assembly.
- Position the support elements from -VAS 6131/10- at front of engine, as shown in illustration.



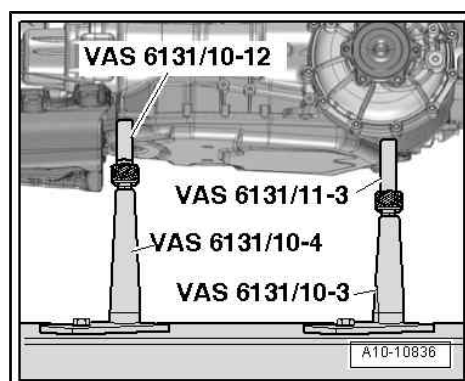
- Position support elements from -VAS 6131/10- at left and right of subframe, as shown in illustration.



- Position the support elements from -VAS 6131/10- and -VAS 6131/12- at left of gearbox and tunnel cross member, as shown in illustration.



- Position support elements from -VAS 6131/10- and -VAS 6131/11- at right of gearbox, 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 A- .

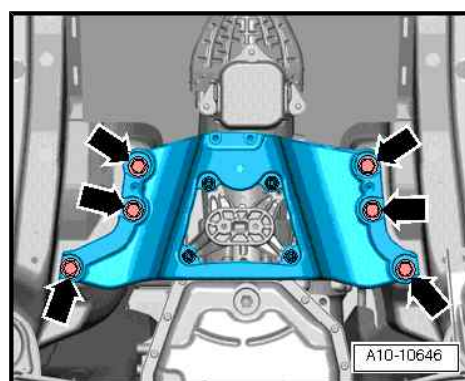


- Remove bolts -arrows- at tunnel cross member.



### Note

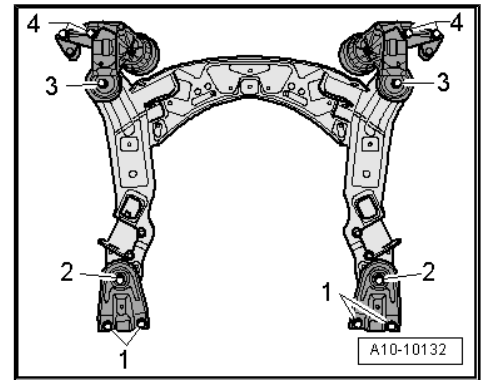
For illustration purposes, the installation position is shown with the front exhaust pipes removed.



- Remove bolts -1-.
- Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
- Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.

**Note**

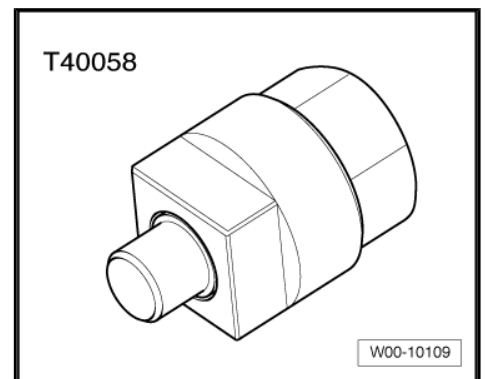
- ◆ *Check that all hoses and wiring connections between engine, gearbox, subframe and body have been detached.*
- ◆ *Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering to avoid damage.*
- Carefully lower engine/gearbox assembly.
- Pull out scissor-type assembly platform - VAS 6131 A- from under the vehicle.



### 3.2 Separating engine from automatic gearbox 09L

#### Special tools and workshop equipment required

- ◆ Adapter - T40058-



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## Procedure

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-
- Screw down spindles of the support elements (left and right) at subframe as far as possible.
- Remove locating lugs from spindles.



### Note

A second mechanic is required for removing the subframe.

- Remove subframe to the side.
- Unscrew the two base plates for support elements (for subframe) on scissor-type assembly platform - VAS 6131 A- .



### Note

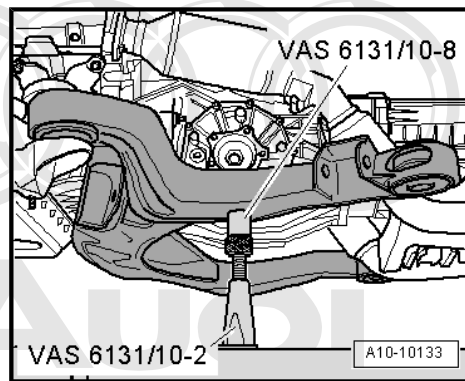
The mounting points for engine (front), gearbox and tunnel cross member remain unchanged.

- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , supplementary set - VAS 6131/11- and -VAS 6131/12- as follows:

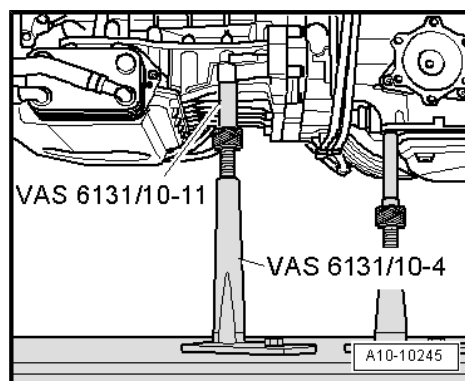
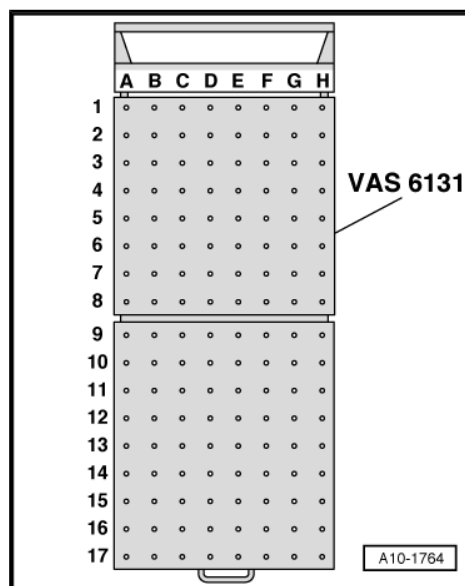
| Platform coordinates | Parts of support set for Audi - VAS 6131/10- , supplementary set -VAS 6131/11- and supplementary set -VAS 6131/12- |       |       |        |
|----------------------|--------------------------------------------------------------------------------------------------------------------|-------|-------|--------|
| B5 <sup>1)</sup>     | /10-1                                                                                                              | /10-4 | /10-5 | /10-13 |
| F5 <sup>1)</sup>     | /10-1                                                                                                              | /10-4 | /10-5 | /10-12 |
| B8                   | /10-1                                                                                                              | /10-4 | /10-5 | /10-11 |
| G8                   | /10-1                                                                                                              | /10-4 | /10-5 | /10-10 |
| E9 <sup>1)</sup>     | /10-1                                                                                                              | /10-3 | /10-5 | /11-3  |
| D10 <sup>1)</sup>    | /10-1                                                                                                              | /10-4 | /10-5 | /12-1  |
| F14 <sup>1)</sup>    | /10-1                                                                                                              | /10-4 | /10-5 | /10-12 |
| D16 <sup>1)</sup>    | /10-1                                                                                                              | /10-3 | /10-5 | /10-6  |

- <sup>1)</sup> Support elements remain unchanged.

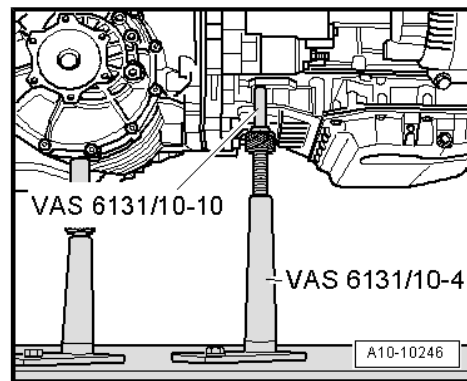
- Position support elements from -VAS 6131/10- at left of engine, as shown in illustration.



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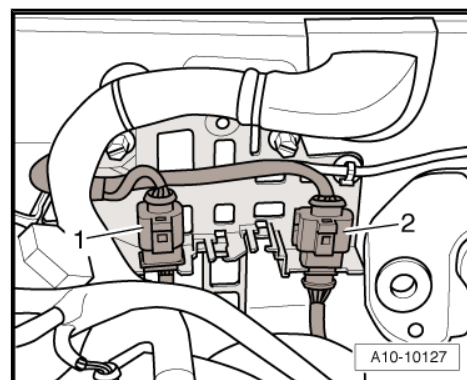
- Position the support elements from -VAS 6131/10- at right of engine, as shown in illustration.
- Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS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



- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter - G131- and move wiring clear.

**Note**

- ◆ Illustration shows electrical connector when installed.
- ◆ Disregard item -1-.

**Caution**

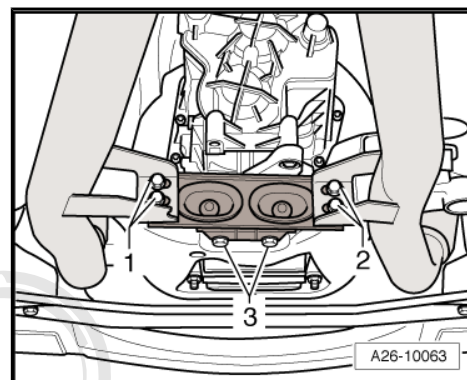
**Risk of damage to flexible joints in front silencer.**

- ◆ **Do NOT bend the flexible joints in the front silencer more than 10°.**

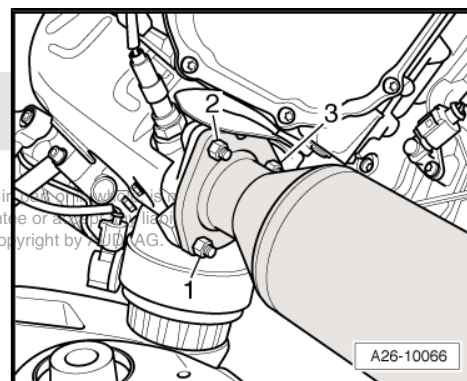
- Remove bolts -1- on bracket (rear) for exhaust system.

**Note**

Disregard -items 2 and 3-.



- Unscrew nuts -1 ... 3-.
- Detach front exhaust pipe (left-side) with catalytic converter.



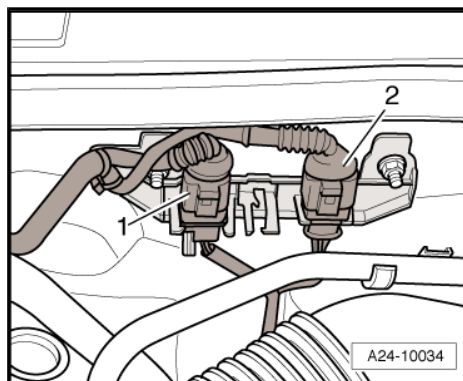
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- Unplug electrical connector -2- for Lambda probe after catalytic converter - G130- and move wiring clear.



### Note

- ◆ *Illustration shows electrical connector when installed.*
- ◆ *Disregard item -1-.*

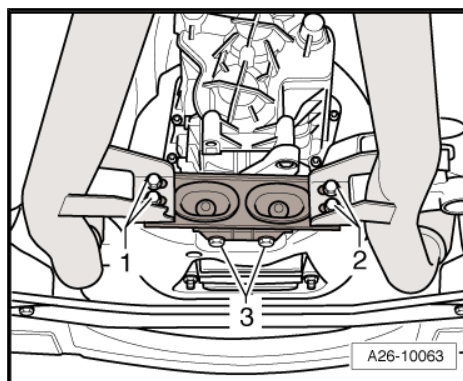


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### Risk of damage to flexible joints in front silencer.

- ◆ **Do NOT bend the flexible joints in the front silencer more than 10°.**



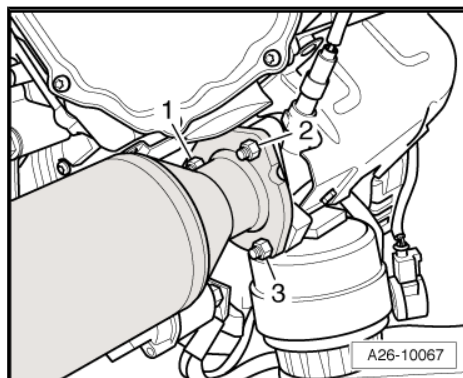
- Remove bolts -2- on bracket (rear) for exhaust system.



### Note

*Disregard -items 1 and 3-.*

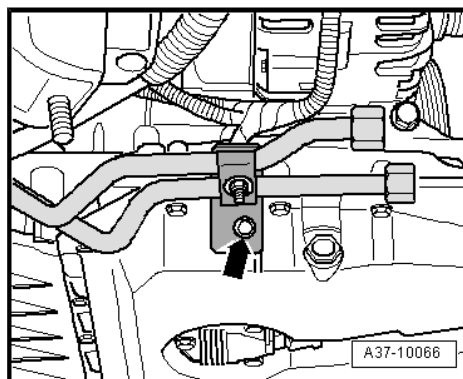
- Unscrew nuts -1 ... 3-.
- Detach front exhaust pipe (right-side) with catalytic converter.



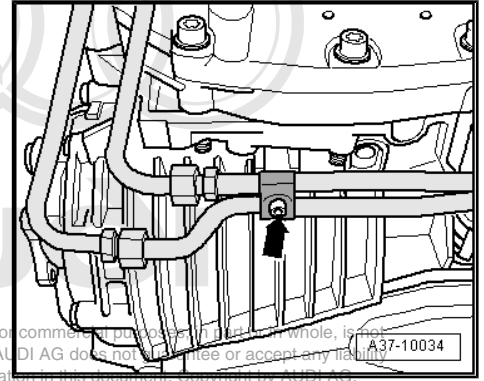
### Note

*Observe rules for cleanliness when working on automatic gear-box ⇒ Rep. gr. 00.*

- Detach bracket -arrow- for ATF lines from sump.



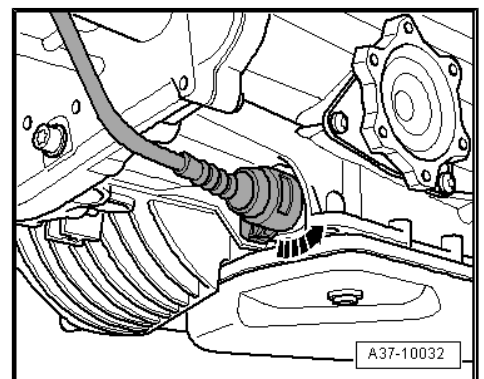
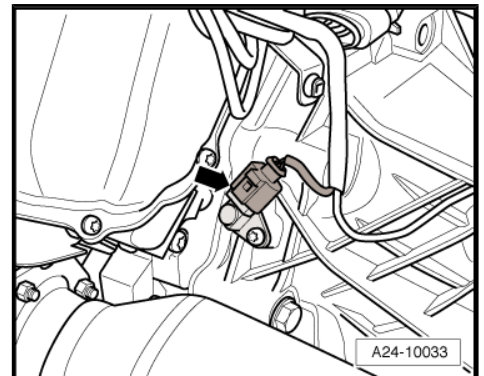
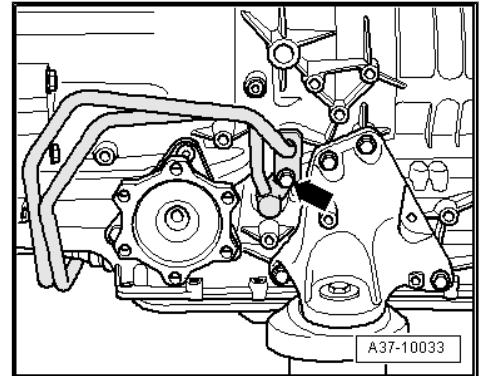
- Unbolt bracket -arrow- for ATF lines at gearbox (bottom).



**Note**

*Lay a cloth under the ATF lines to catch escaping ATF.*

- Remove bolt -arrow-.
- Detach ATF lines from gearbox.
- Unplug electrical connector -arrow- for engine speed sender - G28- .
- Turn retainer catch anti-clockwise -arrow- and unplug electrical connector at gearbox.

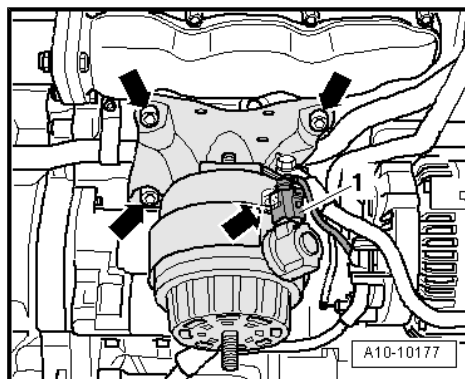


- Unplug electrical connector -1- at engine mounting (right-side).
- Move wiring clear at console for engine mounting.
- Remove bolts -arrows- and detach engine support (right-side).

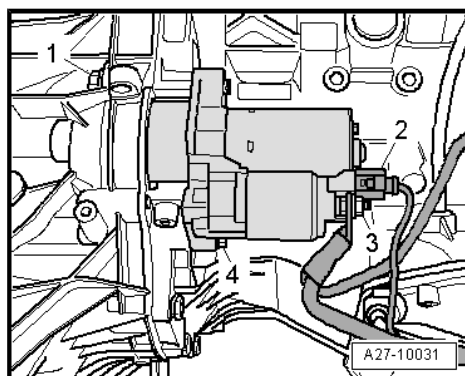


### Note

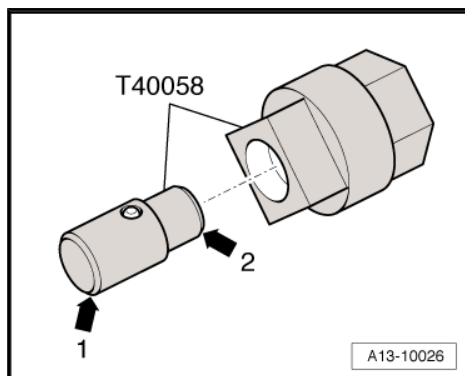
Shown in illustration without console for engine mounting.



- Detach electrical wires -2- and -3- at starter.
- Remove bolts -1- and -4- and detach starter.



- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.

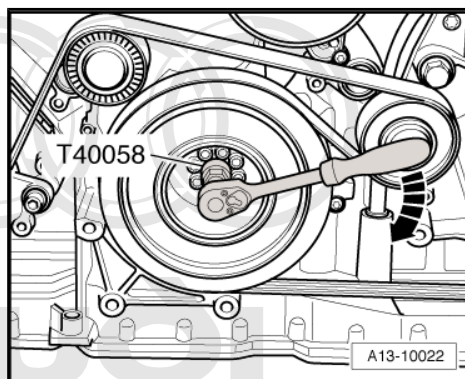


- When loosening torque converter bolts, counterhold crankshaft using adapter - T40058- .



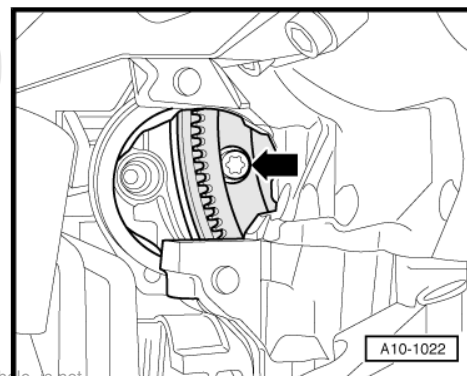
### Note

Disregard -arrow-.

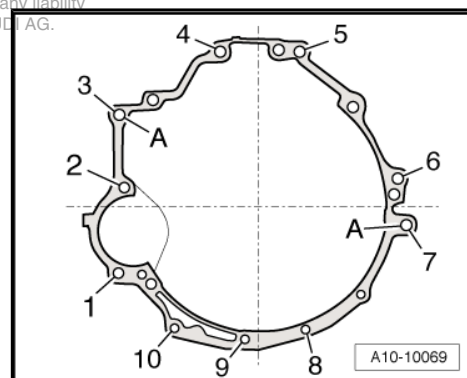


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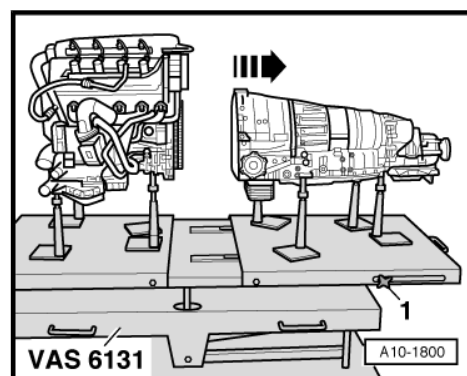
- Unscrew 3 bolts -arrows- for torque converter, working through opening of removed starter (turn crankshaft  $\frac{1}{3}$  turn each time).



- Remove bolts 3, 10- securing gearbox to engine.



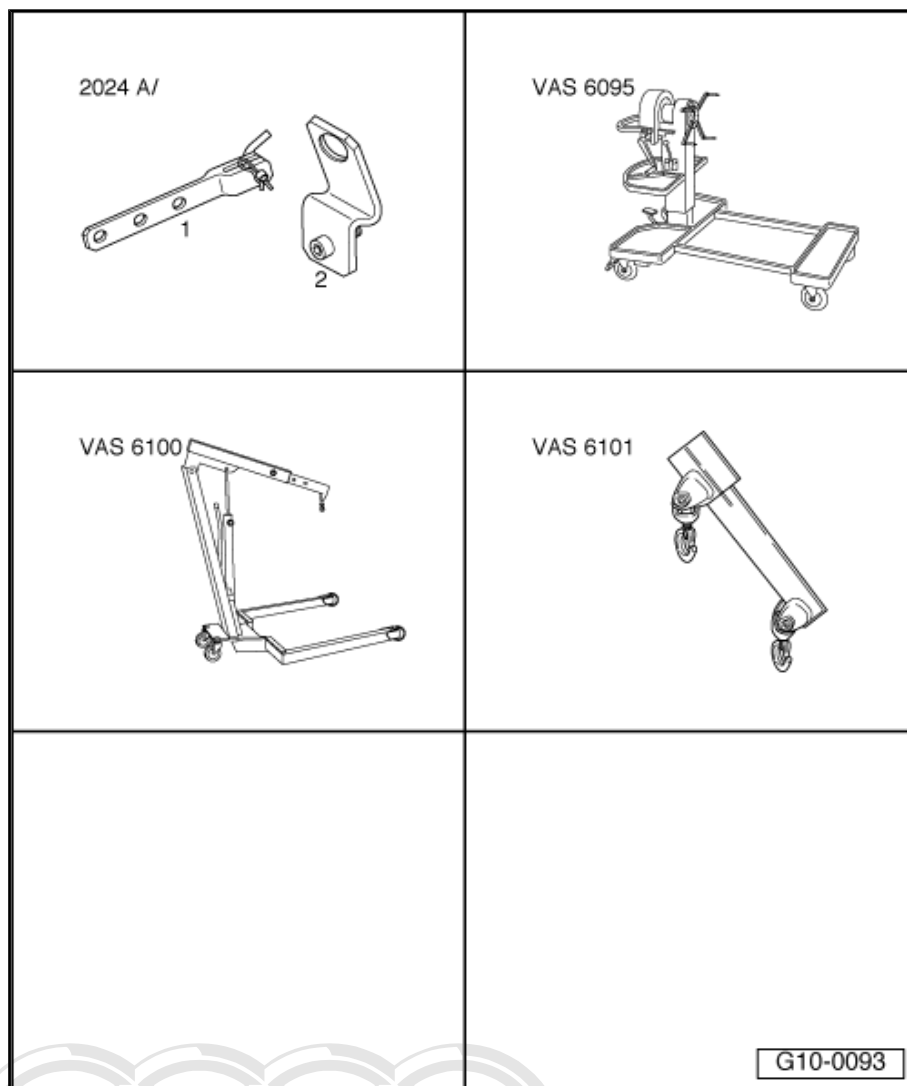
- Loosen clamping bolts -1- on sides of scissor-type assembly platform - VAS 6131 A- and pull rear section of platform together with gearbox towards the rear -arrow-; simultaneously separate the torque converter from the drive plate through the opening.
- Secure the torque converter in the gearbox to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



### 3.3 Securing engine to engine and gearbox support

# Special tools and workshop equipment required

- ◆ Lifting tackle - 2024 A-
- ◆ Engine and gearbox support - VAS 6095- with bracket -VAS 6095/1-5-
- ◆ Workshop hoist - VAS 6100-
- ◆ Lift arm extension (workshop hoist) - VAS 6101-



## Procedure

- Engine separated from gearbox ⇒ [page 85](#) .
- Attach lifting tackle - 2024 A- to engine and workshop hoist - VAS 6100- with lift arm extension (workshop hoist) - VAS 6101- as shown in illustration.



### Note

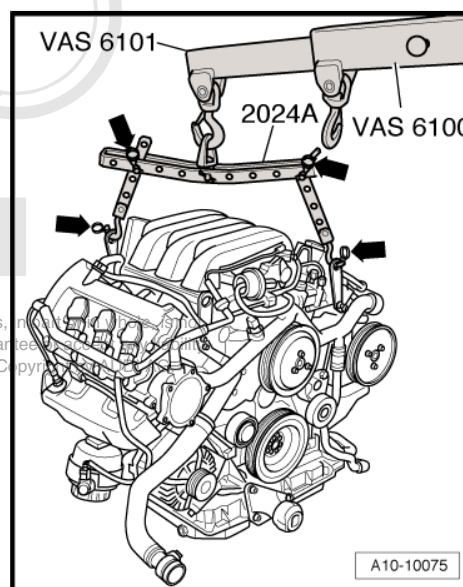
To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks **must be positioned as shown**.



### WARNING

**Accident risk from loose components of lifting tackle.**

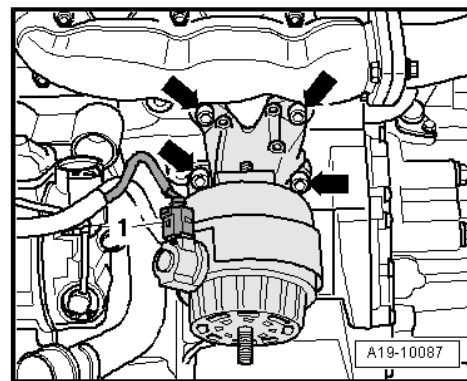
- ◆ The support hooks and retaining pins must be secured with locking pins -arrows-.



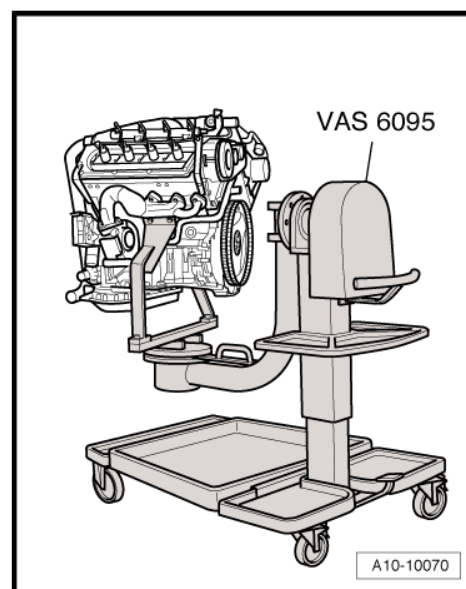
- Unplug electrical connector -1- from engine mounting (left-side).
- Remove bolts -arrows- and detach engine support (left-side).

 **Note**

*Shown in illustration without console for engine mounting.*



- Secure engine with bracket -VAS 6095/1-5- to engine and gearbox support - VAS 6095- as shown in illustration. Tightening torque: 40 Nm.



### 3.4 Installing engine

#### Special tools and workshop equipment required

- ◆ Depth gauge

#### 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:  $\pm 15\%$ .*

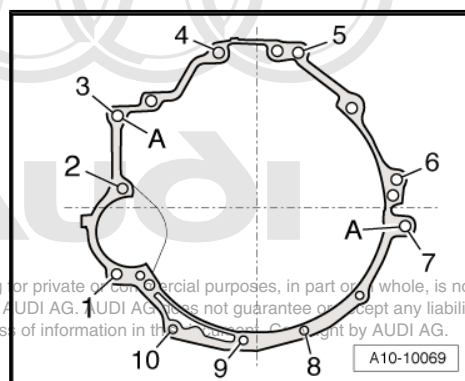
| Component                        |     | Nm               |
|----------------------------------|-----|------------------|
| Bolts/nuts                       | M6  | 9                |
|                                  | M8  | 20               |
|                                  | M10 | 40               |
|                                  | M12 | 65               |
| Except for the following:        |     |                  |
| Drive plate to torque converter  |     | 85 <sup>1)</sup> |
| Engine support to cylinder block |     | 40               |

| Component                                                                                                                                                   | Nm  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Console for engine mounting to longitudinal member                                                                                                          | 75  |
| Tunnel cross member to body                                                                                                                                 | 40  |
| Torque reaction support to engine                                                                                                                           | 40  |
| Stop for torque reaction support to lock carrier                                                                                                            | 23  |
| Hose clips (9 mm wide)                                                                                                                                      | 3   |
| Hose clips (13 mm wide)                                                                                                                                     | 5.5 |
| <ul style="list-style-type: none"> <li>1) Renew ribbed bolts; use only genuine bolts (same as original equipment) ⇒ Electronic parts catalogue .</li> </ul> |     |

### Securing automatic gearbox 09L to engine

| Item     | Bolt                           | Nm               |
|----------|--------------------------------|------------------|
| 1        | M10x100                        | 65 <sup>1)</sup> |
| 2, 6     | M12x120                        | 65               |
| 3, 4, 5  | M12x105                        | 65               |
| 7        | M12x130                        | 65               |
| 8, 9, 10 | M10x80                         | 45               |
| A        | Dowel sleeves for centralising |                  |

- <sup>1)</sup> Property class 10.9.



### Procedure

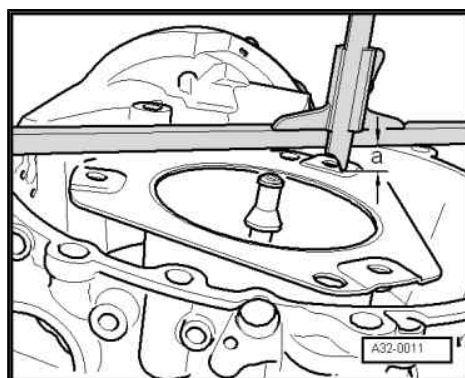


#### Note

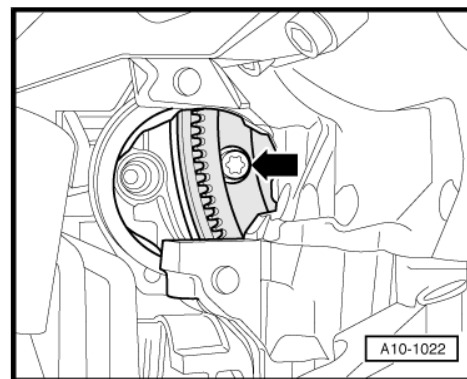
- ◆ Renew the bolts tightened with specified tightening angle.
- ◆ Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .
- ◆ Fit all cable ties in the original positions when installing.

### Checking installation depth of torque converter

- If the torque converter has been correctly installed, the distance between the contact surfaces at the threaded holes in the torque converter and the contact surface on the torque converter bell housing (with automatic gearbox 09L) is at least 19 mm.



- Before bringing engine and gearbox together, turn torque converter and drive plate on engine so that the holes for one securing bolt are in line with the opening for the starter motor -arrow-.
- To secure torque converter on drive plate, use only new ribbed bolts of the correct type (same as original equipment) as specified in ⇒ Electronic parts catalogue .
- 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.
- Bolt gearbox to engine.

**Caution**

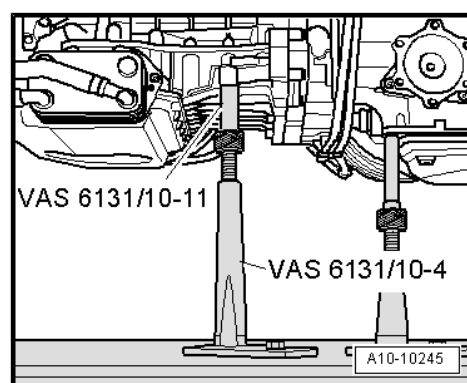
***Risk of damage to gearbox if torque converter is installed incorrectly.***

- ◆ ***Before and while tightening the bolts securing the engine to the gearbox, continually check that the torque converter behind the drive plate can be turned.***
- ◆ ***If the torque converter cannot be turned, the drive lugs of the ATF pump and consequently the gearbox will be damaged when the bolts are finally tightened.***

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

- Install starter ⇒ Rep. gr. 27
- Secure ATF lines ⇒ Rep. gr. 37 .
- Install front exhaust pipes: left-side ⇒ [page 272](#) , right-side ⇒ [page 275](#) .
- 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 spindle for support element (left-side) at engine downwards.
- Unscrew base plate for support element (left-side) at scissor-type assembly platform - VAS 6131 A- .

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- Screw spindle for support element (right-side) at engine downwards.
- Unscrew base plates for support element (right-side) at scissor-type assembly platform - VAS 6131 A- .



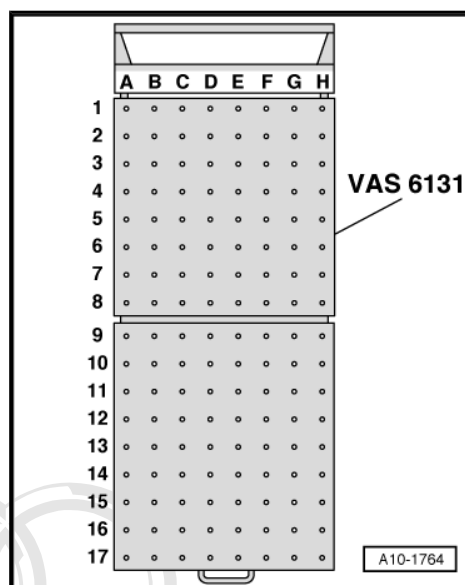
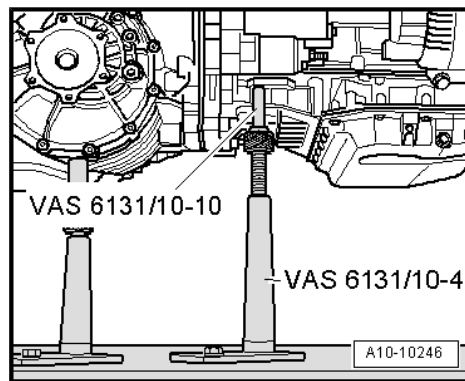
### Note

The mounting points for engine (front), gearbox and tunnel cross member remain unchanged.

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

| Platform coordinates | Parts from support set for Audi - VAS 6131/10- |       |       |                     |
|----------------------|------------------------------------------------|-------|-------|---------------------|
| B5 <sup>1)</sup>     | /10-1                                          | /10-4 | /10-5 | /10-13              |
| F5 <sup>1)</sup>     | /10-1                                          | /10-4 | /10-5 | /10-12              |
| B11                  | /10-1                                          | /10-2 | /10-5 | /10-8 <sup>2)</sup> |
| G11                  | /10-1                                          | /10-2 | /10-5 | /10-8 <sup>2)</sup> |
| E9 <sup>1)</sup>     | /10-1                                          | /10-3 | /10-5 | /11-3               |
| D10 <sup>1)</sup>    | /10-1                                          | /10-2 | /10-5 | /12-1               |
| F14 <sup>1)</sup>    | /10-1                                          | /10-4 | /10-5 | /10-12              |
| D16 <sup>1)</sup>    | /10-1                                          | /10-3 | /10-5 | /10-6               |

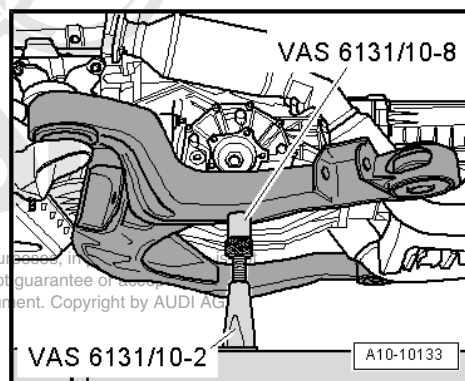
<sup>1)</sup> Support elements remain unchanged.  
<sup>2)</sup> Secure support elements only after installing the subframe.



### 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 the spindles for support elements on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .
- Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform - VAS 6131 A- .

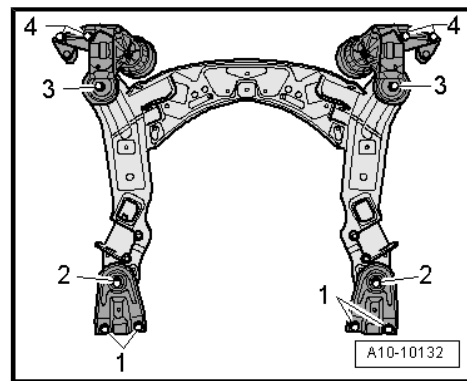


- Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
- Tighten bolts for subframe and consoles for engine mountings only to specified torque (do not turn further); the bolts are only fully tightened after performing the wheel alignment check ⇒ Rep. gr. 40 .

**WARNING**

*Risk of accident because of loose bolted connections.*

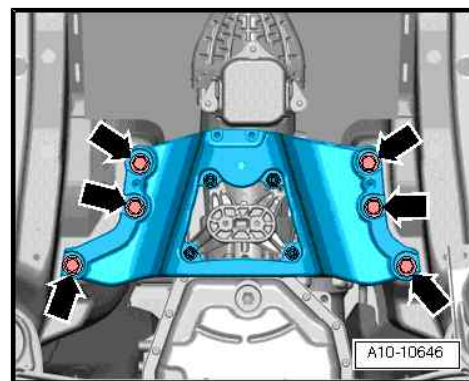
- ◆ **Do NOT drive the vehicle unless the subframe bolts have been tightened to their final torque.**



- Tighten bolts -arrows- for tunnel cross member.

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

- Install selector lever cable and check adjustment if necessary ⇒ Rep. gr. 37 .
- Install drive shafts ⇒ Rep. gr. 40 .
- Install guide links, track control links, anti-roll bar and suspension struts ⇒ Rep. gr. 40 .
- Install cross piece for subframe ⇒ Rep. gr. 40 .
- Install cross piece (front) ⇒ Rep. gr. 50 .
- Install propshaft ⇒ Rear final drive 01R; Rep. gr. 39 .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .



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- **Install air conditioner compressor ⇒ Rep. gr. 87**
- **Install hydraulic pressure pipe for power steering pump ⇒ Rep. gr. 48 .**
- Install fuel supply hose ⇒ Rep. gr. 24 .
- Install poly V-belt ⇒ [page 101](#) .

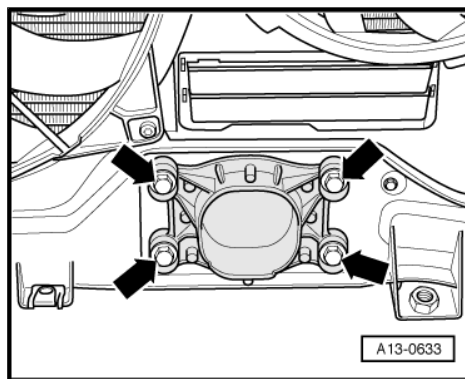
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedure for connecting the battery ⇒ Rep. gr. 27 .



### Caution

***Risk of irreparable damage to control units because of excessive voltage.***

- ◆ ***Never use battery charging equipment for boost starting.***



- Install and adjust wiper arms ⇒ Rep. gr. 92 .
- Install body brace ⇒ Rep. gr. 40 .
- Check oil level ⇒ [page 237](#) .
- Bleed fuel system ⇒ Rep. gr. 24 .
- Fill cooling system ⇒ [page 242](#) .



### Note

- ◆ ***Do not use drained coolant again if:***
  - ◆ ***the cylinder head or cylinder block have been renewed.***
  - ◆ ***the coolant is contaminated or dirty.***
- Top up power steering fluid and bleed steering system ⇒ Rep. gr. 48 .
- Check ATF level ⇒ Rep. gr. 37 .
- Adjust subframe and the two consoles for engine mountings ⇒ Rep. gr. 40 .
- Perform wheel alignment check ⇒ Rep. gr. 44 .



### WARNING

***Risk of accident because of loose bolted connections.***

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



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## 13 – Crankshaft group

### 1 Cylinder block (pulley end)

⇒ [“1.1 Exploded view - poly V-belt drive”, page 99](#)

⇒ [“1.2 Removing and installing poly V-belt”, page 101](#)

⇒ [“1.3 Removing and installing vibration damper”, page 102](#)

⇒ [“1.4 Renewing sealing flange \(pulley end\) with crankshaft oil seal”, page 102](#)

#### 1.1 Exploded view - poly V-belt drive

##### 1 - Poly V-belt

- ☐ Check for wear
- ☐ Removing and installing  
⇒ [page 101](#)
- ☐ When installing, make sure it is properly seated on pulleys

##### 2 - Bolt

- ☐ Renew
- ☐ 20 Nm + turn 90° further

##### 3 - Bolt

- ☐ 22 Nm

##### 4 - Alternator

- ☐ Removing and installing  
⇒ Rep. gr. 27

##### 5 - Cover cap for idler roller

##### 6 - Idler roller for poly V-belt

- ☐ 40 Nm

##### 7 - Bolt

- ☐ Tightening torque  
⇒ [page 247](#)

##### 8 - Poly V-belt pulley for coolant pump

##### 9 - Bolt

- ☐ Tightening torque  
⇒ [page 247](#)

##### 10 - Coolant pump

- ☐ Removing and installing  
⇒ [page 248](#)

##### 11 - Cover cap for tensioner

##### 12 - Poly V-belt tensioner

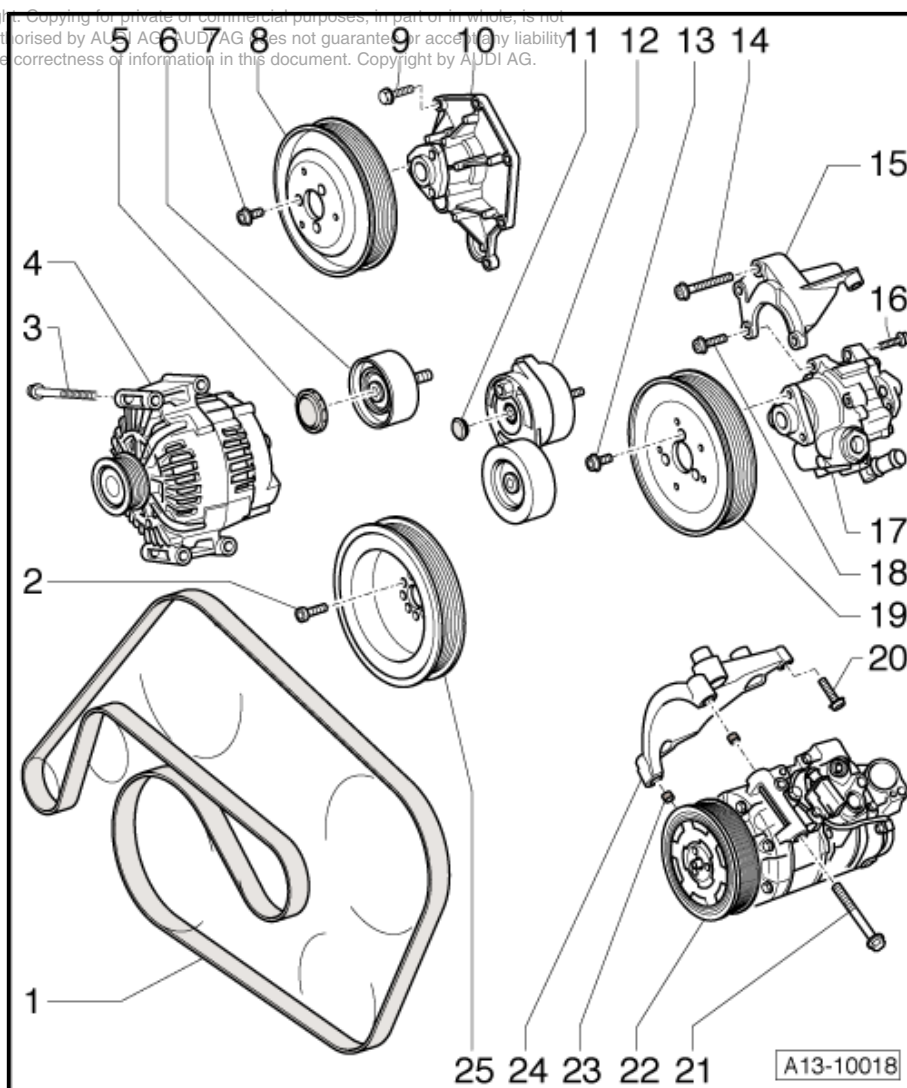
- ☐ Tighten to 40 Nm

##### 13 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 48

##### 14 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 48



## 15 - Bracket for power steering pump

### 16 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 48

### 17 - Power steering pump

- ☐ Removing and installing ⇒ Rep. gr. 48

### 18 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 48

### 19 - Poly V-belt pulley for power steering pump

- ☐ Removing and installing ⇒ Rep. gr. 48

### 20 - Bolt

- ☐ 20 Nm

### 21 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 87

### 22 - Air conditioner compressor

- ☐ Do not unscrew or disconnect refrigerant hoses or pipes
- ☐ Removing and installing ⇒ Rep. gr. 87
- ☐ When installing check dowel sleeves -item 23-

### 23 - Dowel sleeve

- ☐ 2x

### 24 - Bracket for air conditioner compressor

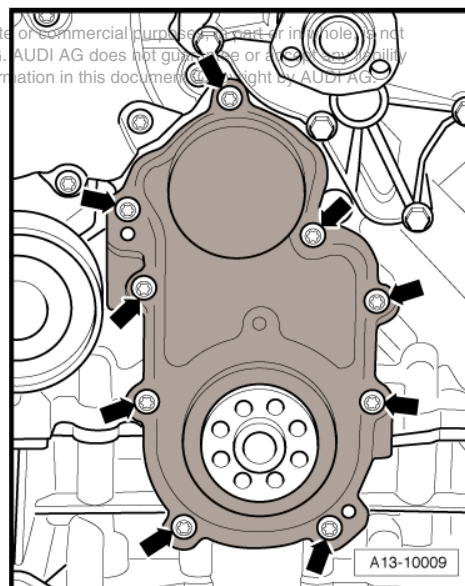
- ☐ When installing check dowel sleeves -item 23-

### 25 - Vibration damper

- ☐ With pulley for poly V-belt
- ☐ Different versions. Allocation ⇒ Electronic parts catalogue
- ☐ Removing and installing ⇒ [page 102](#)

## Tightening torque for sealing flange (pulley end)

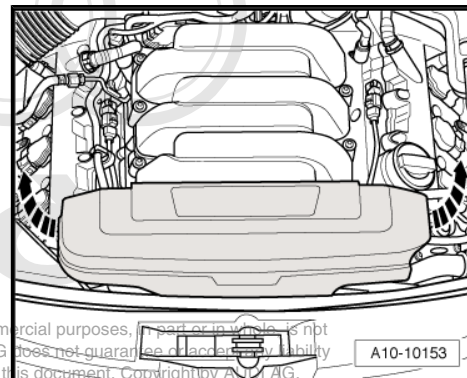
- Tighten bolts -arrows- in stages and in diagonal sequence; final torque 9 Nm.



## 1.2 Removing and installing poly V-belt

### Removing

- Pull off engine cover panel (front) -arrows-.



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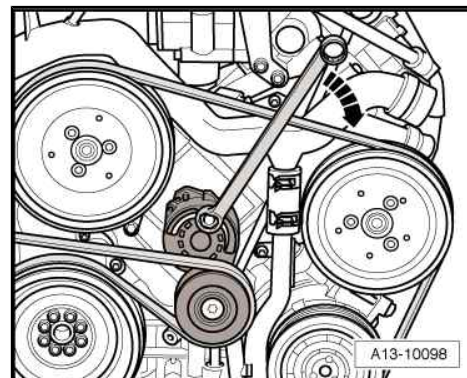


### Caution

*If a used belt runs in the opposite direction when it is refitted, this can cause breakage.*

- ◆ *Mark direction of rotation of poly V-belt with chalk or felt-tip pen for re-installation.*

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

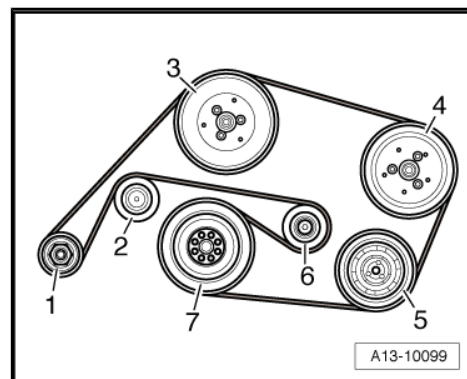


### Installing

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

- Fit poly V-belt on pulleys as shown in illustration.

- 1 - Alternator
- 2 - Idler roller
- 3 - Coolant pump
- 4 - Power steering pump
- 5 - Air conditioner compressor
- 6 - Tensioner for poly V-belt
- 7 - Vibration damper



### Note

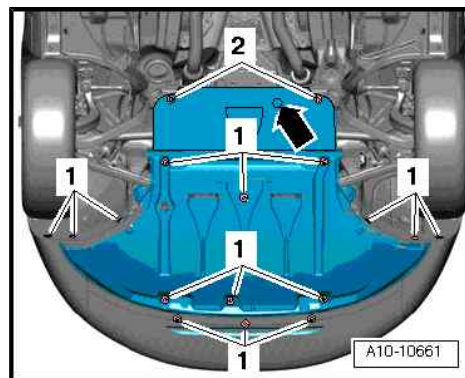
*When installing poly V-belt, make sure it is properly seated on pulleys.*

- Start engine and check that belt runs properly.

## 1.3 Removing and installing vibration damper

### Removing

- Remove poly V-belt ⇒ [page 101](#) .
- Release fasteners -1, 2, arrow- and remove noise insulation.



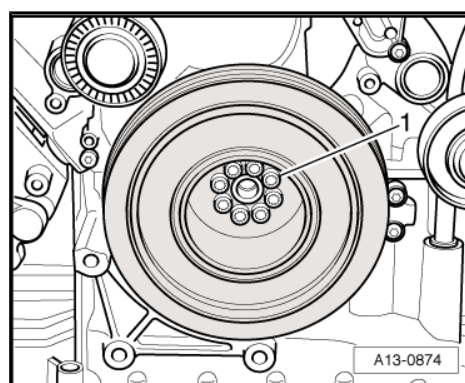
- Mark position of vibration damper for re-installation.
- Remove bolts -1-.
- Remove vibration damper.

### Installing

- Tightening torque ⇒ [page 99](#)

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

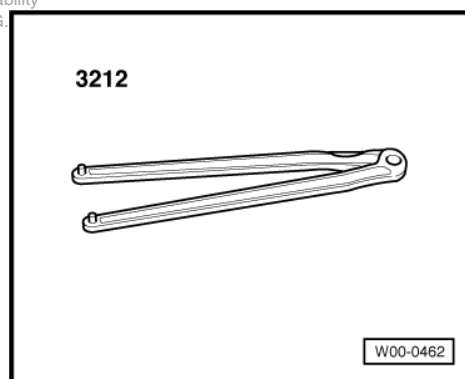
- Install poly V-belt ⇒ [page 101](#) .



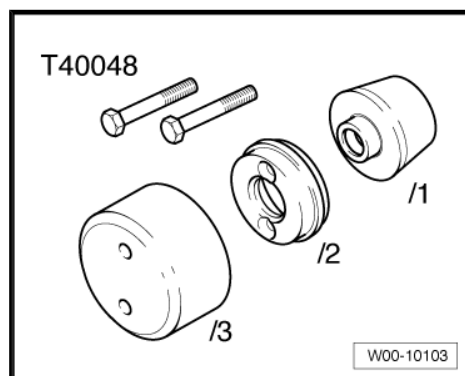
## 1.4 Renewing sealing flange (pulley end) with crankshaft oil seal

### Special tools and workshop equipment required

- ◆ Pin wrench - 3212-



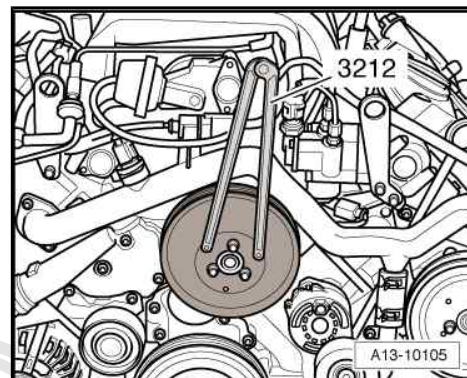
- ◆ Assembly tool - T40048-



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

#### Procedure

- Tightening torque ⇒ [page 100](#)
- Remove vibration damper ⇒ [page 102](#).
- Unbolt coolant pump pulley (brace pulley with pin wrench - 3212-).

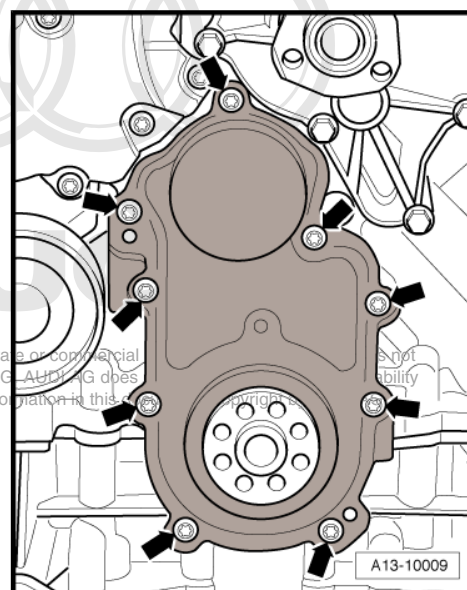


- Remove bolts -arrows-.
- Pull off sealing flange (pulley end).



#### Note

*Renew sealing flange (pulley end).*



#### Caution

*Protect lubrication system against contamination.*

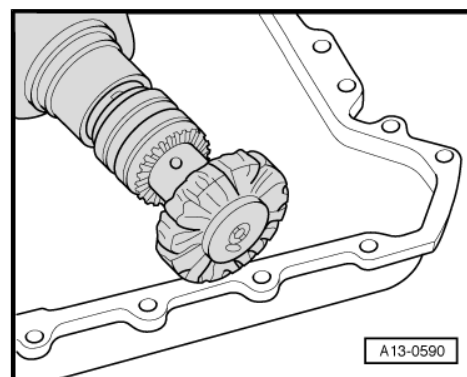
- ◆ *Cover exposed parts of the engine.*



#### WARNING

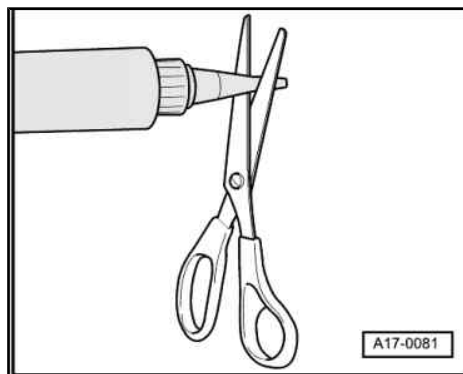
*Risk of eye injury.*

- ◆ *Wear safety goggles.*



- Remove sealant residue on cylinder block / sump (top section), e.g. using a rotating plastic brush.
- Clean sealing surfaces; they must be free of oil and grease.

- Cut off nozzle of tube at front marking ( $\varnothing$  of nozzle approx. 2 mm).



### Caution

**Make sure lubrication system is not clogged by excess sealant.**

- ◆ **The bead of sealant must not be thicker than specified.**

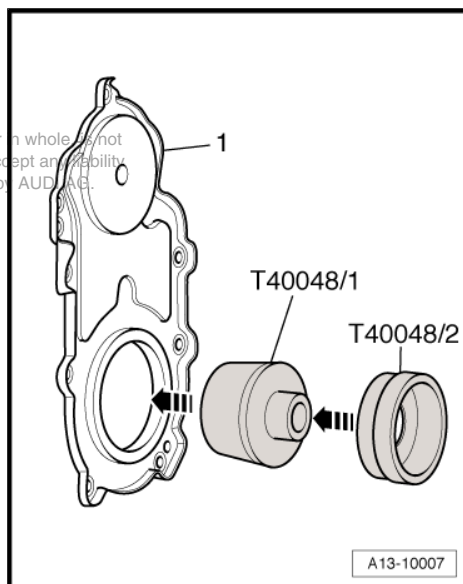
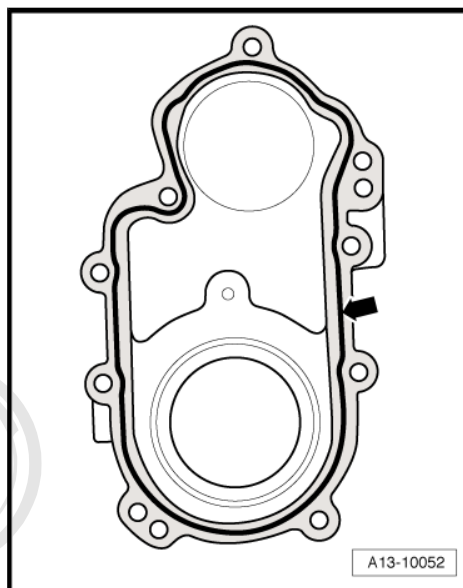
- Apply bead of sealant onto clean sealing surface of new sealing flange as illustrated.
- The groove -arrow- on the sealing surface must be completely filled with sealant.
- The bead of sealant must project 1.5 ... 2.0 mm above the sealing surface.



### Note

*Fit sealing flange within 5 minutes after applying sealant.*

- Fit assembly aid -T40048/1- onto assembly sleeve -T40048/2- and slide sealing flange -1- onto assembly sleeve.
- Take off assembly aid.

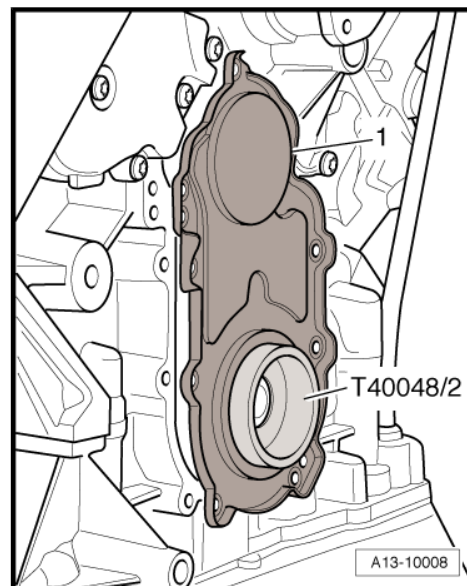


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- First position sealing flange (with assembly sleeve -T40048/2-inserted) on crankshaft.
- Keep sealing flange straight while pushing it onto engine sealing surface. Then bolt on.

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

- Install vibration damper ⇒ [page 102](#) .
- Install poly V-belt pulley for coolant pump ⇒ [page 247](#) .
- Install poly V-belt ⇒ [page 101](#) .



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## 2 Cylinder block (gearbox end)

⇒ [“2.1 Dual-mass flywheel on vehicles with manual gearbox - exploded view”, page 106](#)

⇒ [“2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 107](#)

⇒ [“2.3 Extracting and driving in needle bearing for dual-mass flywheel - vehicles with manual gearbox”, page 108](#)

⇒ [“2.4 Flywheel for vehicles with multitronic gearbox - exploded view”, page 110](#)

⇒ [“2.5 Removing and installing damper unit”, page 111](#)

⇒ [“2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 112](#)

⇒ [“2.7 Exploded view - drive plate, vehicles with automatic gearbox 09L”, page 113](#)

⇒ [“2.8 Removing and installing drive plate - vehicles with automatic gearbox 09L”, page 114](#)

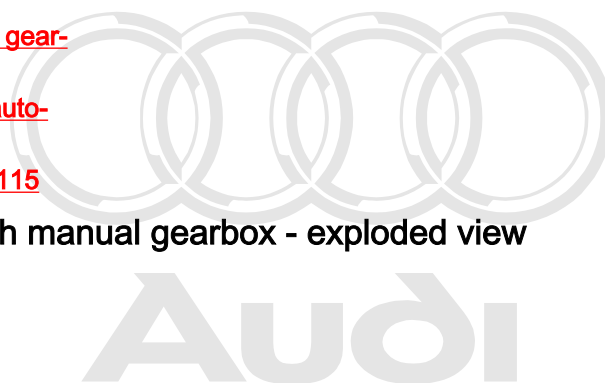
⇒ [“2.9 Renewing crankshaft oil seal \(gearbox end\)”, page 115](#)

### 2.1 Dual-mass flywheel on vehicles with manual gearbox - exploded view



#### Note

*Servicing clutch ⇒ Rep. gr. 30*



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### 1 - Dual-mass flywheel

- ☐ Removing and installing  
⇒ [page 107](#)

### 2 - Bolt

- ☐ Renew
- ☐ 60 Nm + turn 90° further

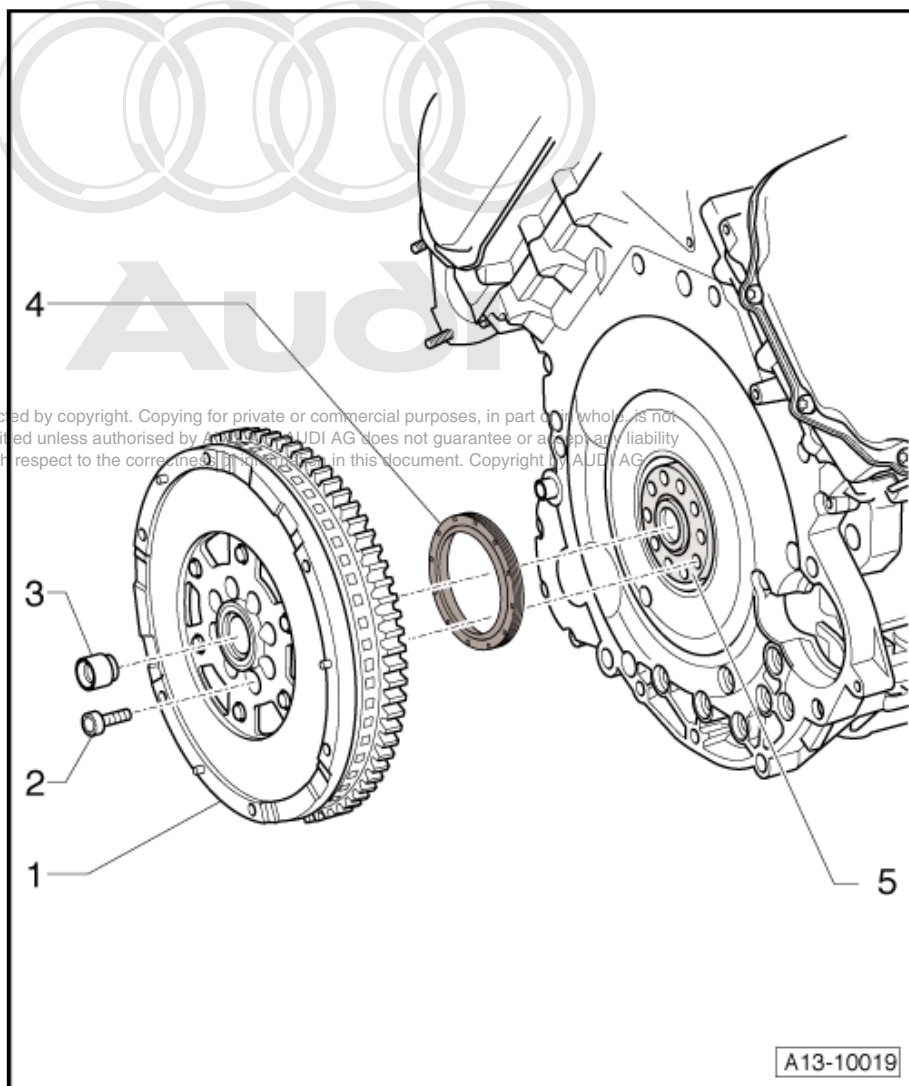
### 3 - Needle bearing

- ☐ Extracting and driving in  
⇒ [page 108](#)

### 4 - Crankshaft oil seal (gearbox end)

- ☐ Renewing ⇒ [page 115](#)

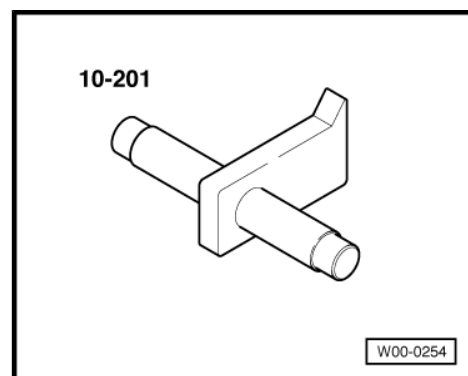
### 5 - Crankshaft



## 2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox

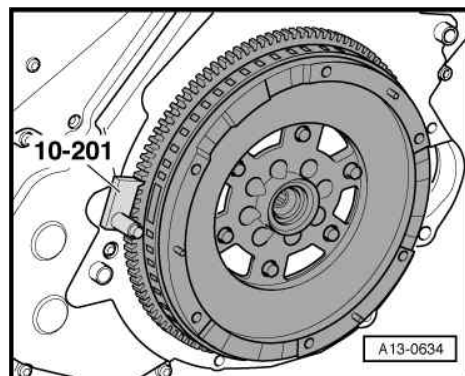
### Special tools and workshop equipment required

- ◆ Counterhold tool - 10 - 201-



## Removing

- Remove gearbox ⇒ Rep. gr. 34 .
- Remove clutch pressure plate ⇒ Rep. gr. 30 .
- Mark position of dual-mass flywheel in relation to crankshaft.
- Insert counterhold tool - 10 - 201- to slacken bolts.

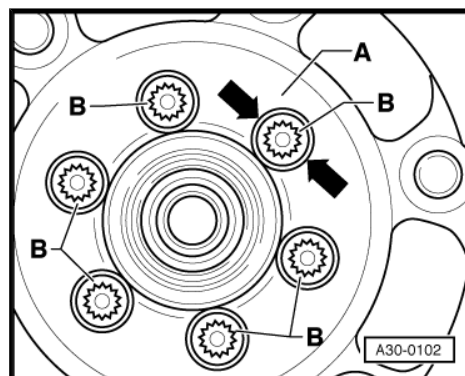


### Caution

**Make sure dual-mass flywheel is not damaged on removal.**

- ◆ **Remove bolts -B- using normal hand tools (do not use pneumatic wrench or impact driver, etc.). The bolts may only be removed by hand using conventional tools.**

- Rotate the dual-mass flywheel -A- so that the bolts align with the holes -arrows-.
- When unscrewing the bolts, make sure that the bolt heads do not come into contact with the dual-mass flywheel; the flywheel will otherwise be damaged as the bolts are screwed out.



## Installing

- Tightening torque ⇒ [page 106](#)

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



### Note

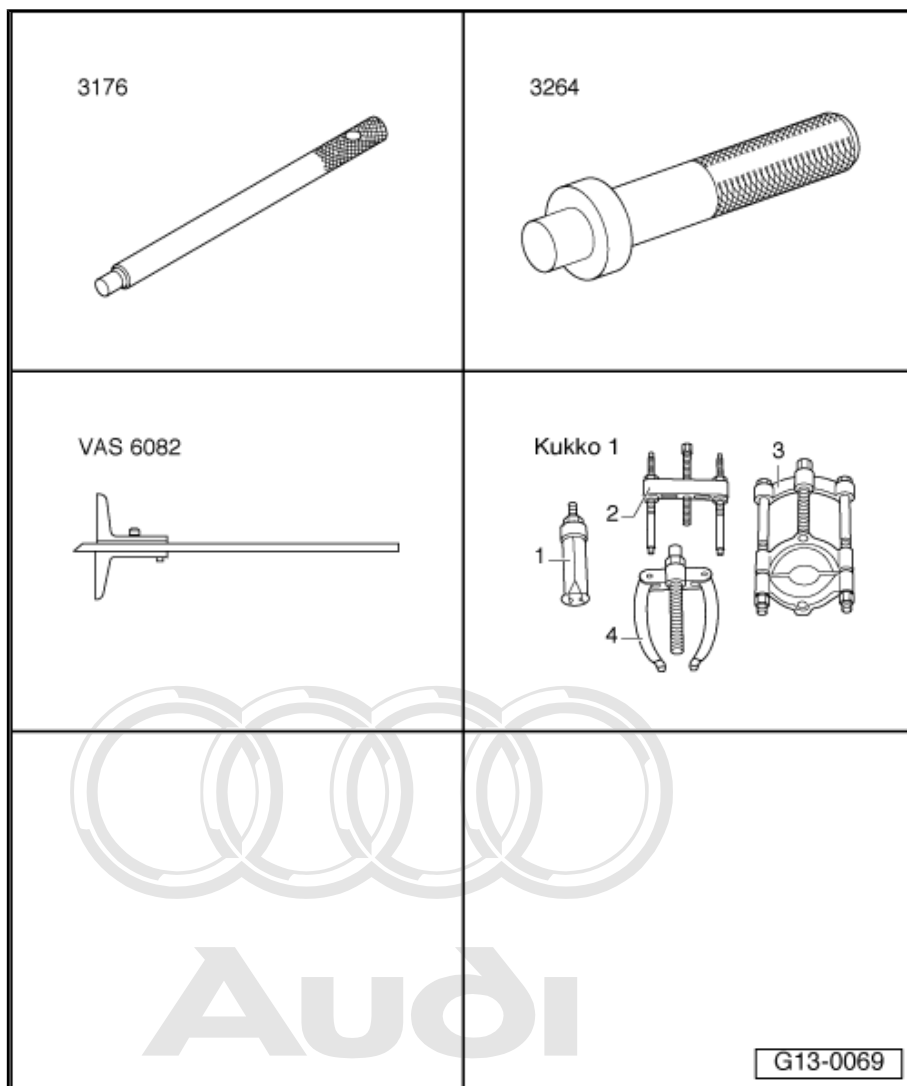
- ◆ **Renew bolts for dual-mass flywheel.**
- ◆ **A needle bearing is fitted in the dual-mass flywheel; knock in the needle bearing when fitting a new flywheel ⇒ [page 108](#) .**
- Fit counterhold tool - 10 - 201- the other way round to tighten bolts.
- Install clutch pressure plate ⇒ Rep. gr. 30 .
- Install gearbox ⇒ Rep. gr. 34 .

## 2.3 Extracting and driving in needle bearing for dual-mass flywheel - vehicles with manual gearbox

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**Special tools and workshop equipment required**

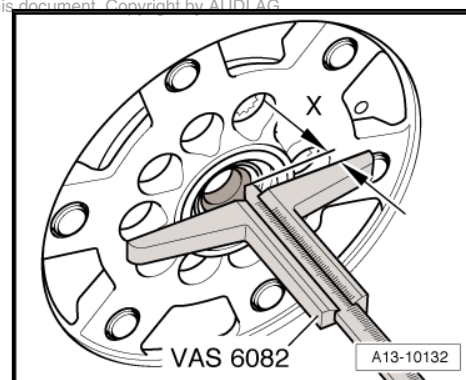
- ◆ Centring mandrel - 3176-
- ◆ Punch - 3264-
- ◆ Depth gauge - VAS 6082-
- ◆ -1- Internal puller Kukko 21/2
- ◆ -4- Counter-support Kukko 22/1



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**Procedure**

- Remove gearbox ⇒ Rep. gr. 34 .
- Remove clutch pressure plate ⇒ Rep. gr. 30 .
- Measure and make a note of insertion depth -dimension x- of needle bearing in dual-mass flywheel, as it will be required when re-installing the bearing.



- Remove needle bearing using internal puller Kukko 21/2 and counter-support Kukko 22/1.



### Note

*The plastic ring in the dual-mass flywheel is sensitive to knocks. Renew dual-mass flywheel if plastic ring is damaged.*

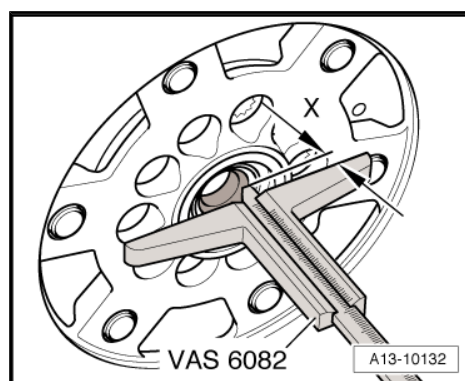
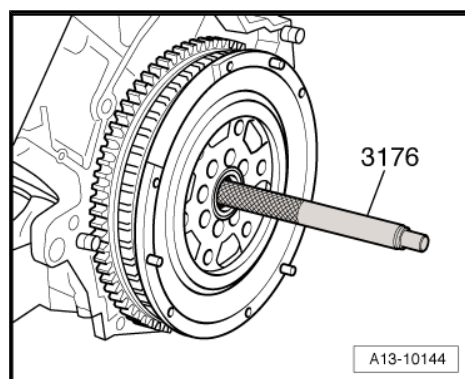
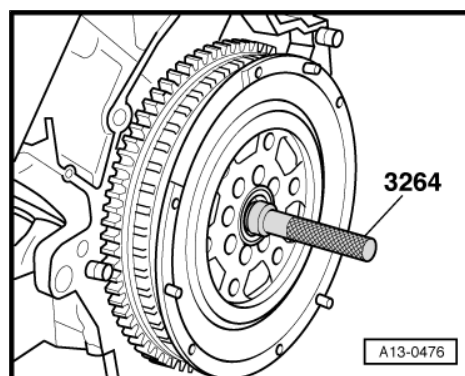
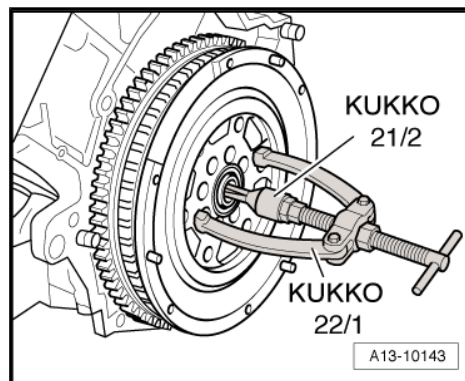


### Caution

**Make sure plastic ring in dual-mass flywheel is not damaged.**

- ◆ **When installing the needle bearing, make sure the punch does not come in contact with the plastic ring.**

- Drive needle bearing into dual-mass flywheel using punch - 3264- .
- Use back of centring mandrel -3176- to press needle bearing in as far as previously measured insertion depth.
- Finally, check insertion depth -dimension x- of needle bearing in dual-mass flywheel.
- Install clutch pressure plate ⇒ Rep. gr. 30 .
- Install gearbox ⇒ Rep. gr. 34 .



## 2.4

## Flywheel for vehicles with multitronic gearbox - exploded view

**1 - Damper unit**

- ☐ Removing and installing  
⇒ [page 111](#)

**2 - Bolt**

- ☐ 22 Nm

**3 - Flywheel**

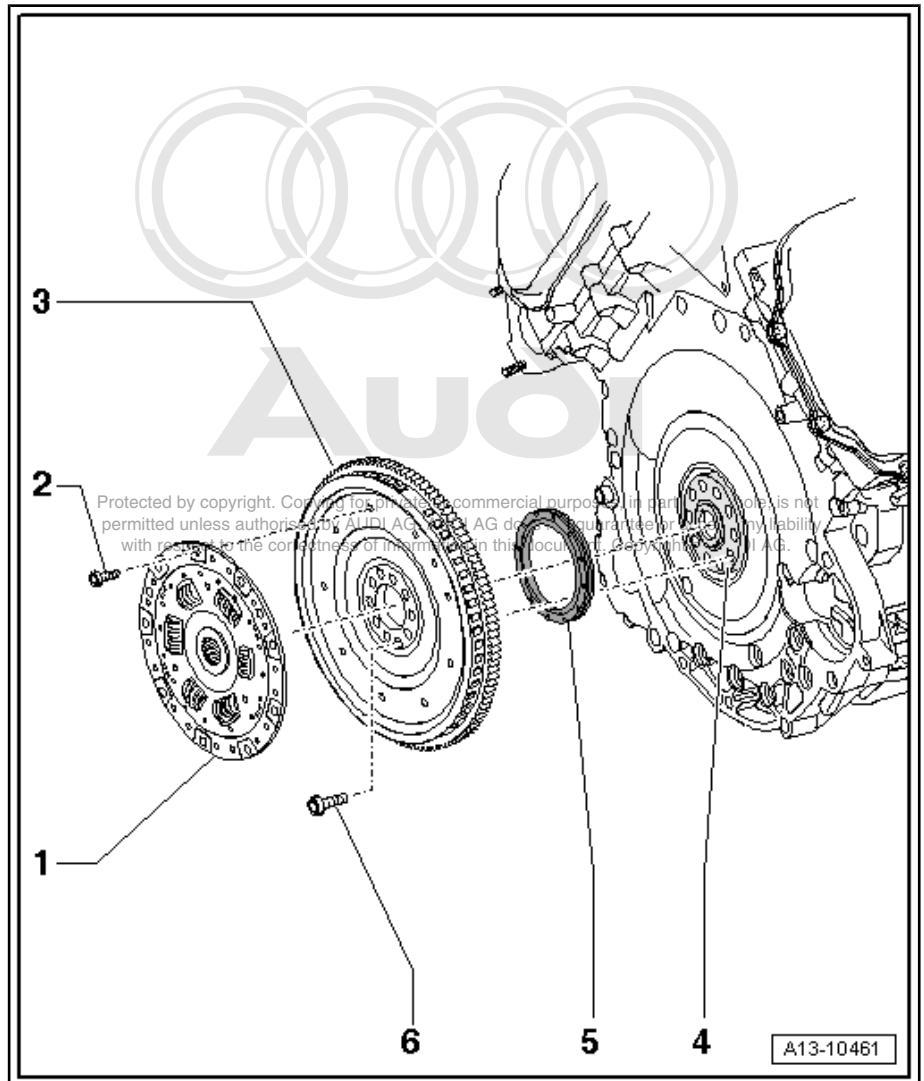
- ☐ Removing and installing  
⇒ [page 112](#)

**4 - Crankshaft****5 - Crankshaft oil seal (gearbox end)**

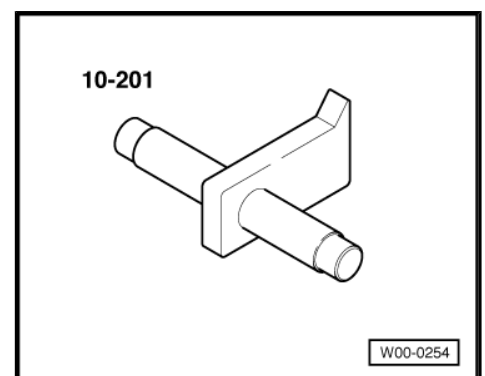
- ☐ Renewing ⇒ [page 115](#)

**6 - Bolt**

- ☐ Renew
- ☐ 60 Nm + turn 90° further

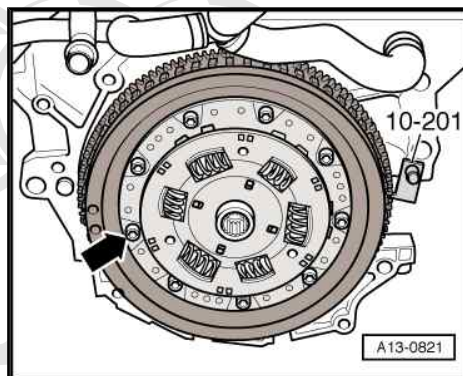
**2.5 Removing and installing damper unit****Special tools and workshop equipment required**

- ◆ Counterhold tool - 10 - 201-



## Removing

- Remove multitronic gearbox ⇒ Rep. gr. 37 .
- Attach counterhold tool - 10 - 201- in order to loosen bolts -arrows-.



- Unscrew bolts -1- and remove damper unit -A- from flywheel -B-.

## Installing

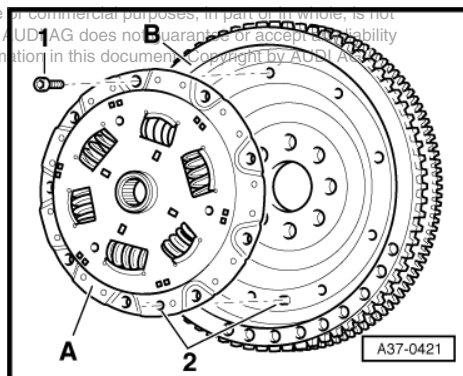
- Tightening torque ⇒ [page 110](#)

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



### Note

*The part number of the damper unit is assigned to the gearbox code letters; for correct allocation refer to ⇒ Electronic parts catalogue .*

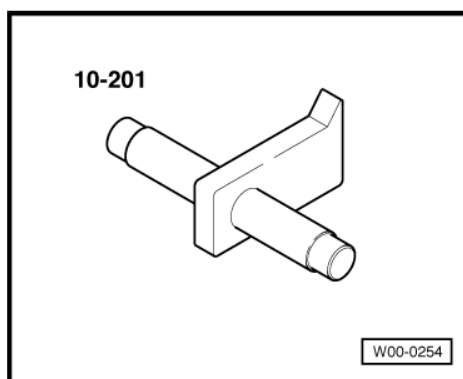


- Align the damper unit -A- and flywheel -B-.
- The two lugs -2- must align.
- Fit bolts -1- hand-tight and tighten in diagonal sequence.
- Install multitronic gearbox ⇒ Rep. gr. 37 .

## 2.6 Removing and installing flywheel - vehicles with multitronic gearbox

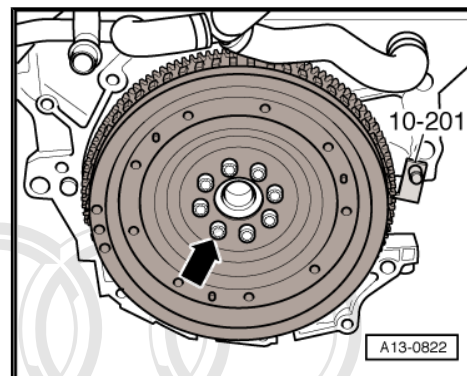
### Special tools and workshop equipment required

- ◆ Counterhold tool - 10 - 201-



### Removing

- Remove multitronic gearbox ⇒ Rep. gr. 37 .
- Remove damper unit ⇒ [page 111](#) .
- Mark position of flywheel in relation to crankshaft.
- Attach counterhold tool - 10 - 201- in order to loosen bolts -arrows-.
- Remove bolts and take off flywheel.



### Installing

- Tightening torque ⇒ [page 110](#)

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



#### Note

*Renew bolts for flywheel.*

- Reverse position of counterhold tool - 10 - 201- in order to tighten bolts.
- Install damper unit ⇒ [page 111](#) .
- Install multitronic gearbox ⇒ Rep. gr. 37 .

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## 2.7 Exploded view - drive plate, vehicles with automatic gearbox 09L

# 1 - Drive plate

- ☐ Removing and installing  
⇒ [page 114](#)

# 2 - Washer

# 3 - Bolt

- ☐ Renew
- ☐ 60 Nm + turn 90° further

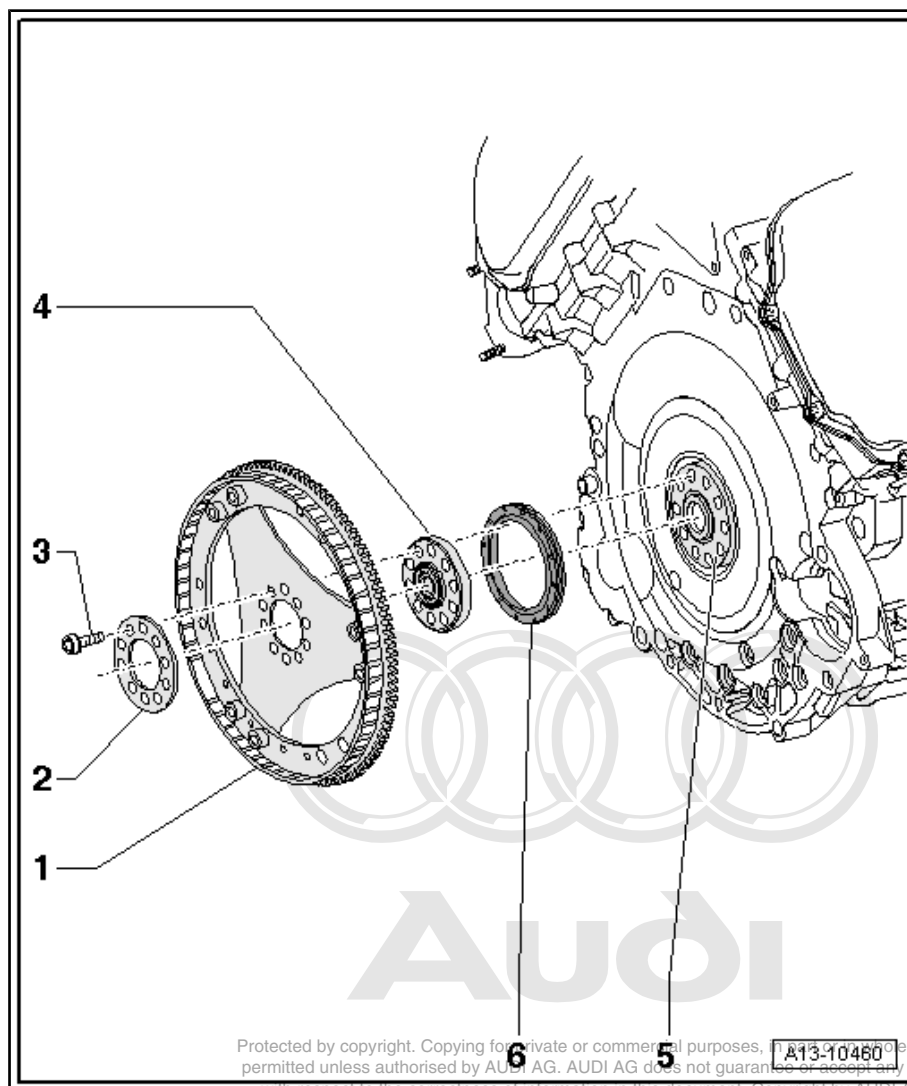
# 4 - Centralising disc

- ☐ Installation position  
⇒ [page 115](#)

# 5 - Crankshaft

# 6 - Crankshaft oil seal (gearbox end)

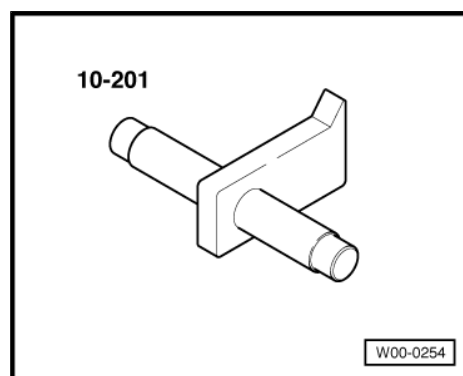
- ☐ Renewing ⇒ [page 115](#)



## 2.8 Removing and installing drive plate - vehicles with automatic gearbox 09L

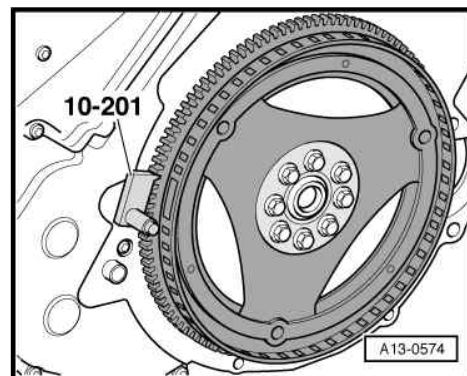
### Special tools and workshop equipment required

- ◆ Counterhold tool - 10 - 201-



## Removing

- Remove automatic gearbox ⇒ Rep. gr. 37 .
- Insert counterhold tool - 10 - 201- to slacken bolts.
- Mark installation position of drive plate on crankshaft.
- Unbolt drive plate.
- Take out centralising disc located behind.



## Installing

- Tightening torque ⇒ [page 113](#)

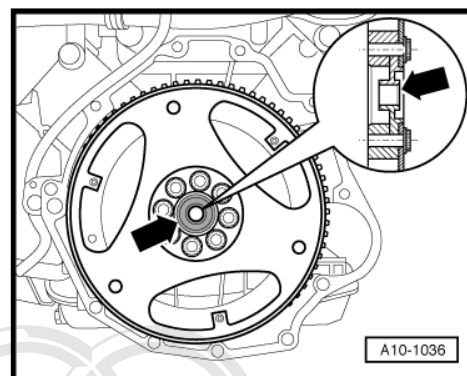
Installation is carried out in the reverse order; note the following:



### Note

*Renew bolts for drive plate.*

- Install drive plate with centralising disc -arrow- and washer.
- Reverse position of counterhold tool - 10 - 201- in order to tighten bolts.
- Install automatic gearbox ⇒ Rep. gr. 37 .

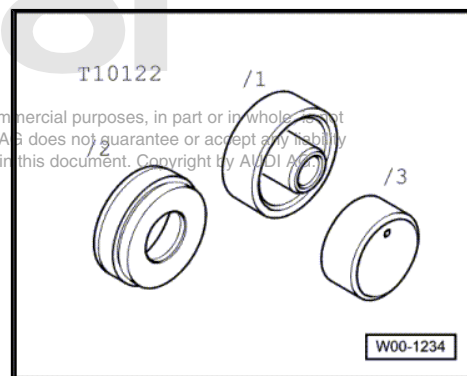


## 2.9 Renewing crankshaft oil seal (gearbox end)

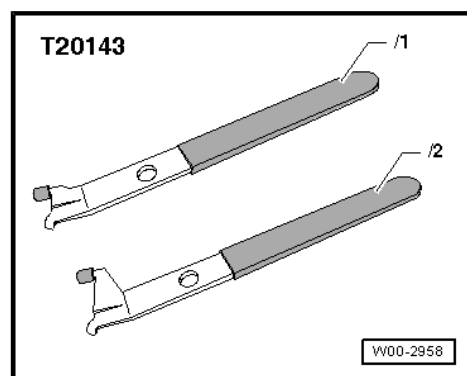
### Special tools and workshop equipment required

- ◆ Fitting tool - T10122-

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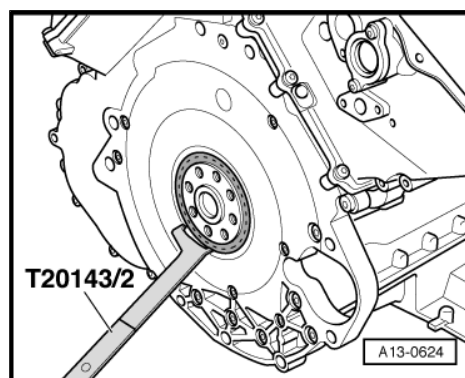


- ◆ Extractor lever -T20143/2-

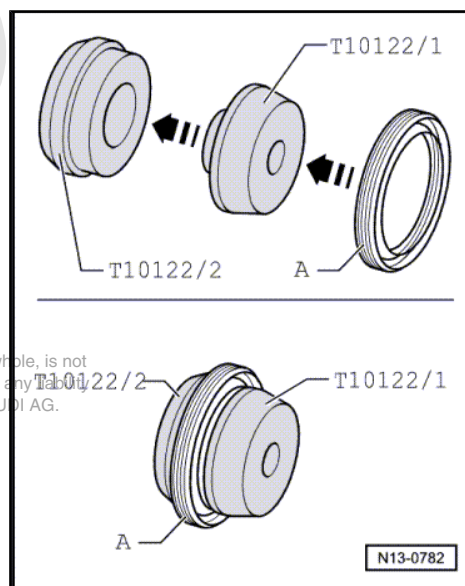


## Procedure

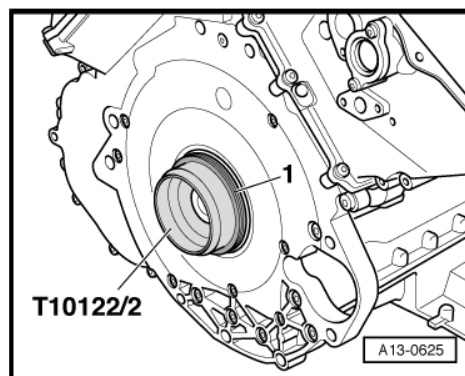
- Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Vehicles with manual gearbox: remove clutch pressure plate  
⇒ Rep. gr. 30 and dual-mass flywheel ⇒ [page 107](#) .
- Vehicles with multitronic gearbox: Remove damper unit  
⇒ [page 111](#) and flywheel ⇒ [page 112](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate  
⇒ [page 114](#) .
- Pry out oil seal using extractor tool -T20143/2- .
- Clean contact surface and sealing surface.



- Fit assembly aid -T10122/1- onto assembly sleeve -T10122/2- and slide oil seal -A- onto assembly sleeve.
- Detach assembly aid -T10122/1- .



- Fit assembly sleeve -T10122/2- with oil seal -1- onto crankshaft.

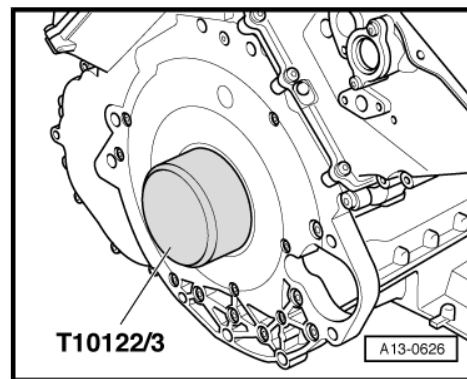


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- Press in oil seal uniformly until flush all round using press sleeve -T10122/3- .

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

- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 107](#) and pressure plate ⇒ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 112](#) and damper unit ⇒ [page 111](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 114](#) .
- Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .



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### 3 Removing and installing crankshaft

⇒ "3.1 Exploded view - crankshaft", page 118

⇒ "3.2 Crankshaft dimensions", page 121

⇒ "3.3 Measuring axial clearance", page 121

⇒ "3.4 Measuring radial clearance", page 122

#### 3.1 Exploded view - crankshaft

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#### Note

When carrying out repairs, secure engine to engine and gearbox support - VAS 6095- : vehicles with manual gearbox ⇒ [page 31](#) , vehicles with multitronic gearbox ⇒ [page 60](#) or vehicles with automatic gearbox 09L ⇒ [page 91](#) .

#### 1 - Sealing flange (pulley end)

- ☐ Removing and installing  
⇒ [page 102](#)

#### 2 - Bolt

- ☐ 9 Nm
- ☐ Tighten in stages and in diagonal sequence

#### 3 - Crankshaft

- ☐ Measuring axial clearance  
⇒ [page 121](#)
- ☐ Measuring radial clearance  
⇒ [page 122](#)
- ☐ Do not rotate the crankshaft when checking the radial clearance
- ☐ Crankshaft dimensions  
⇒ [page 121](#)

#### 4 - Dowel sleeve

- ☐ 4x
- ☐ Inserting in retaining frame  
⇒ [page 120](#)

#### 5 - Seal

- ☐ Renew

#### 6 - Bolt

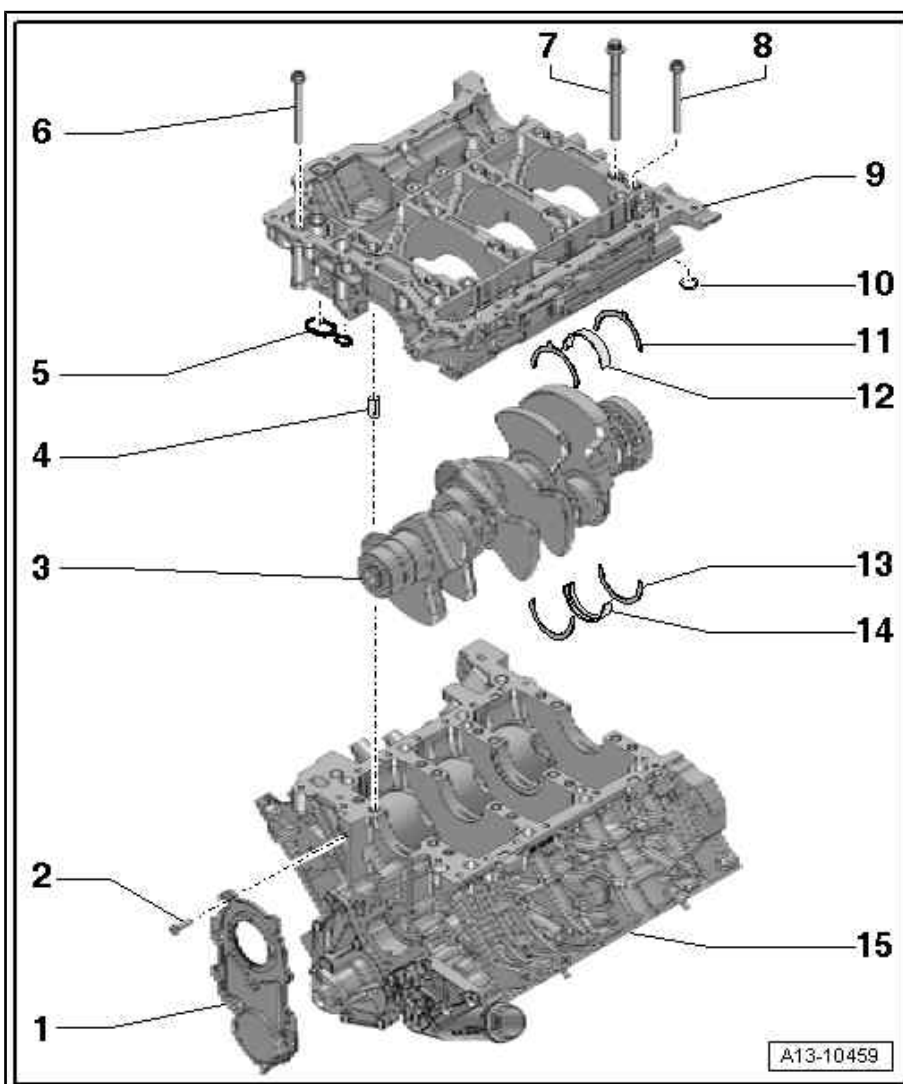
- ☐ For sealing surfaces: cylinder block/retaining frame
- ☐ Differing bolt lengths and bolt heads
- ☐ Tightening sequence  
⇒ [page 120](#)

#### 7 - Bolt (long, large collar)

- ☐ For retaining frame (inner row)
- ☐ Tightening sequence ⇒ [page 120](#)

#### 8 - Bolt (short, small collar)

- ☐ For retaining frame (outer row)



- ☐ Tightening sequence ⇒ [page 120](#)

## 9 - Retaining frame

- ☐ With valve for oil pressure control - N428- ⇒ [page 119](#)
- ☐ To remove, detach guide rail ⇒ [Item 1 \(page 154\)](#) for drive chain for valve gear
- ☐ Applying sealant ⇒ [page 120](#)
- ☐ Tightening sequence ⇒ [page 120](#)
- ☐ Removing and installing valve for oil pressure control - N428- ⇒ [page 233](#)

## 10 - Seal

- ☐ Renew

## 11 - Thrust washer

- ☐ Only fitted on 3rd crankshaft bearing
- ☐ Oil grooves face outwards
- ☐ Make sure it engages in retaining frame
- ☐ Measuring axial clearance of crankshaft ⇒ [page 121](#)

## 12 - Bearing shell

- ☐ For retaining frame (without oil groove)
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Note installation position
- ☐ Install new bearing shells for retaining frame with correct coloured markings ⇒ [page 121](#)

## 13 - Thrust washer

- ☐ Only fitted on 3rd crankshaft bearing
- ☐ Oil grooves face outwards
- ☐ Make sure it engages in cylinder block

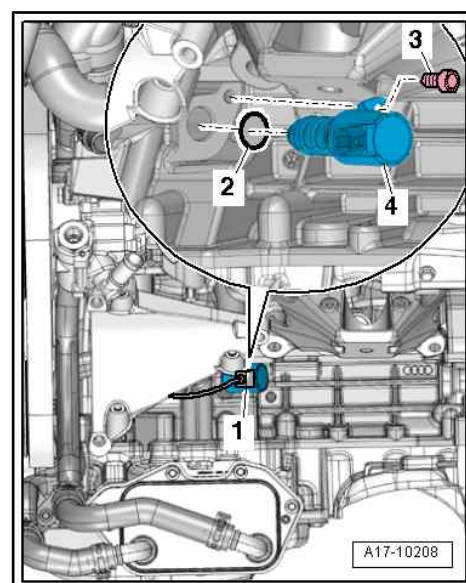
## 14 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Note installation position
- ☐ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ [page 121](#)

## 15 - Cylinder block

### Valve for oil pressure control - N428-

- 1 - Electrical connector
- 2 - O-ring - renew
- 3 - Bolt, 9 Nm
- 4 - Valve for oil pressure control - N428-

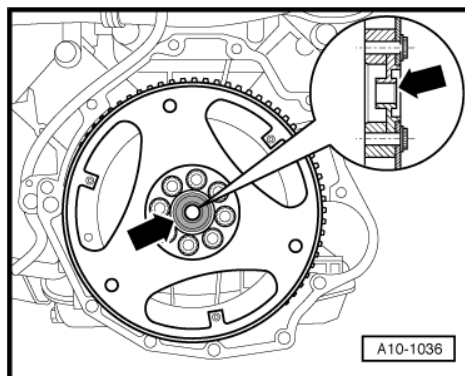


## Centralising disc for drive plate on vehicles with automatic gearbox 09L



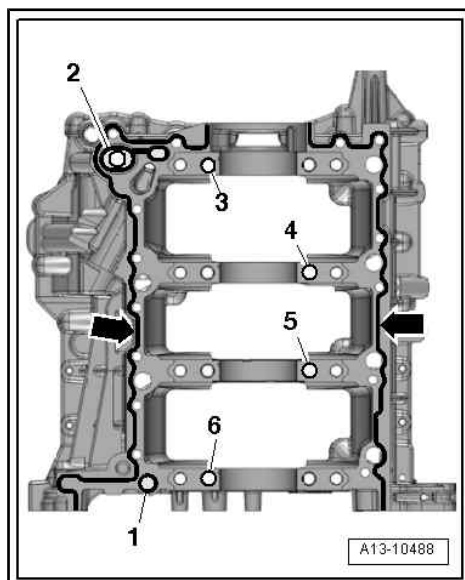
### Note

In vehicles with automatic gearbox 09L the drive plate is bolted to the crankshaft with a centralising disc -arrow-.



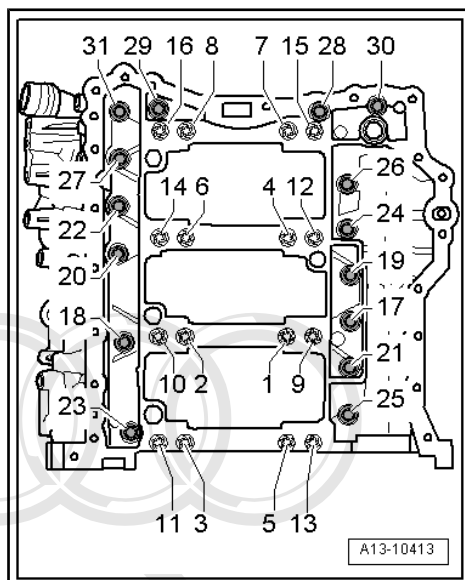
## Applying sealant to retaining frame, position of dowel sleeves

- Clean sealing surfaces (top and bottom); they must be free of oil and grease.
- Apply beads of sealant -arrows- onto clean sealing surfaces of retaining frame as shown in illustration.
- The groove on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 ... 2.0 mm above the sealing surface.
- Fit seals -1- and -2-.
- Check that dowel sleeves -3 ... 6- are inserted in retaining frame at positions shown in illustration.



## Installing retaining frame

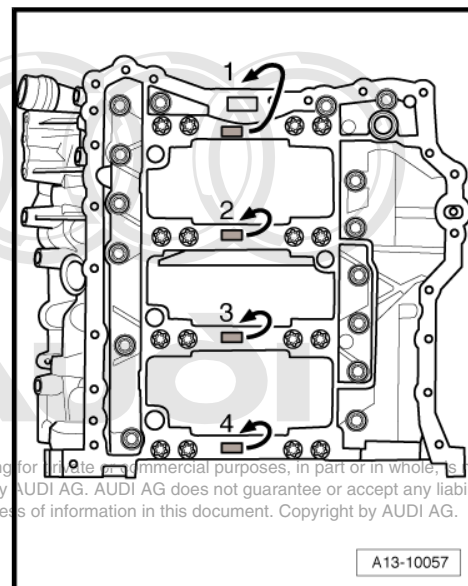
- Renew bolts -1 ... 16- for retaining frame.
  - Install long bolts in inner row on retaining frame.
  - Tighten bolts -1 ... 31- in 3 stages as follows:
1. Tighten bolts in the sequence -1 ... 16- to 50 Nm.
  2. Turn bolts 90° further in the sequence -1 ... 16-.
  3. Tighten bolts for sealing surfaces (retaining frame / cylinder block) in the sequence -17 ... 31- to 23 Nm.



**Matching crankshaft bearing shells to bearings in cylinder block**

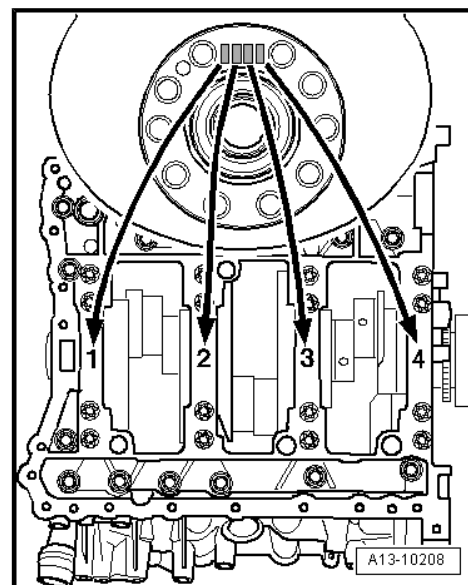
- ◆ Bearing shells of the correct thickness are matched to the bearings in the cylinder block at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- ◆ The allocation of the bearing shells to the bearing positions in the cylinder block is indicated by a code letter at the relevant bearing on the retaining frame.

| Code letter on retaining frame | Colour coding of bearing |
|--------------------------------|--------------------------|
| R =                            | Red                      |
| G =                            | Yellow                   |
| B =                            | Blue                     |
| S =                            | Black                    |

**Matching crankshaft bearing shells to bearings in retaining frame**

- ◆ Bearing shells of the correct thickness are matched to the bearings in the retaining frame at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- ◆ The allocation of the bearing shells to the bearing positions in the retaining frame is indicated by a sequence of letters on the flywheel flange on the crankshaft. The first letter in the sequence stands for bearing "1", the second letter for bearing "2", etc.

| Letter on crankshaft | Colour coding of bearing |
|----------------------|--------------------------|
| R =                  | Red                      |
| G =                  | Yellow                   |
| B =                  | Blue                     |
| S =                  | Black                    |

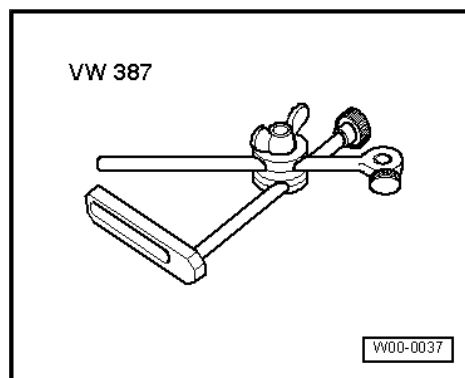
**3.2 Crankshaft dimensions**

| Honing dimension (in mm) | Crankshaft main bearing journal Ø | Crankshaft conrod journal Ø |
|--------------------------|-----------------------------------|-----------------------------|
| Basic dimension          | 58.00 – 0.022<br>– 0.042          | 54.00 – 0.022<br>– 0.042    |

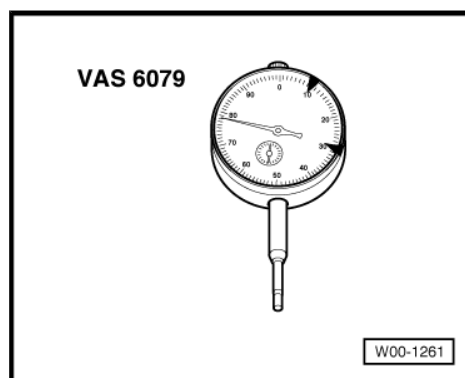
**3.3 Measuring axial clearance**

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

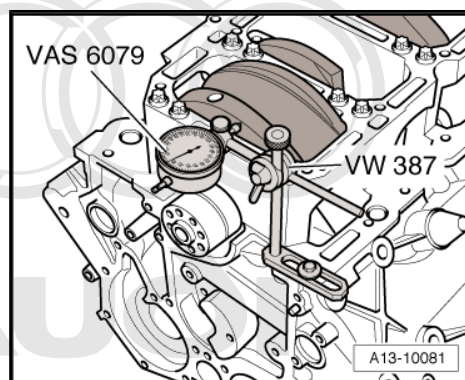


- ◆ Dial gauge - VAS 6079-



#### Procedure

- Bolt dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- onto cylinder block and set it against crank web.
- Press crankshaft against dial gauge by hand and set gauge to -0-.
- Push crankshaft away from dial gauge and read off value.
- Axial clearance: 0.15 ... 0.25 mm



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### 3.4 Measuring radial clearance

#### Special tools and workshop equipment required

- ◆ Plastigage

#### Procedure



#### Note

- ◆ *Mark used bearing shells for re-installation.*
- ◆ *If bearing shells are worn down to nickel layer they must be renewed.*
- Remove retaining frame and clean bearing journals.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.
- The Plastigage must be positioned in the centre of the bearing shell.

- Fit retaining frame and tighten with old bolts. Do not rotate crankshaft.
- Remove retaining frame again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

- Radial clearance (new): 0.015 ... 0.055 mm
- Wear limit: 0.08 mm.

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## 4 Dismantling and assembling pistons and conrods

⇒ [“4.1 Exploded view - pistons and conrods”, page 124](#)

⇒ [“4.2 Measuring radial clearance of conrods”, page 127](#)

⇒ [“4.3 Piston and cylinder dimensions”, page 127](#)

### 4.1 Exploded view - pistons and conrods



Note

Oil spray jet for piston cooling ⇒ [page 127](#).

#### 1 - Bolt

- ☐ Renew
- ☐ Lubricate threads and contact surface
- ☐ 30 Nm + turn 90° further
- ☐ Use old bolts when measuring radial clearance

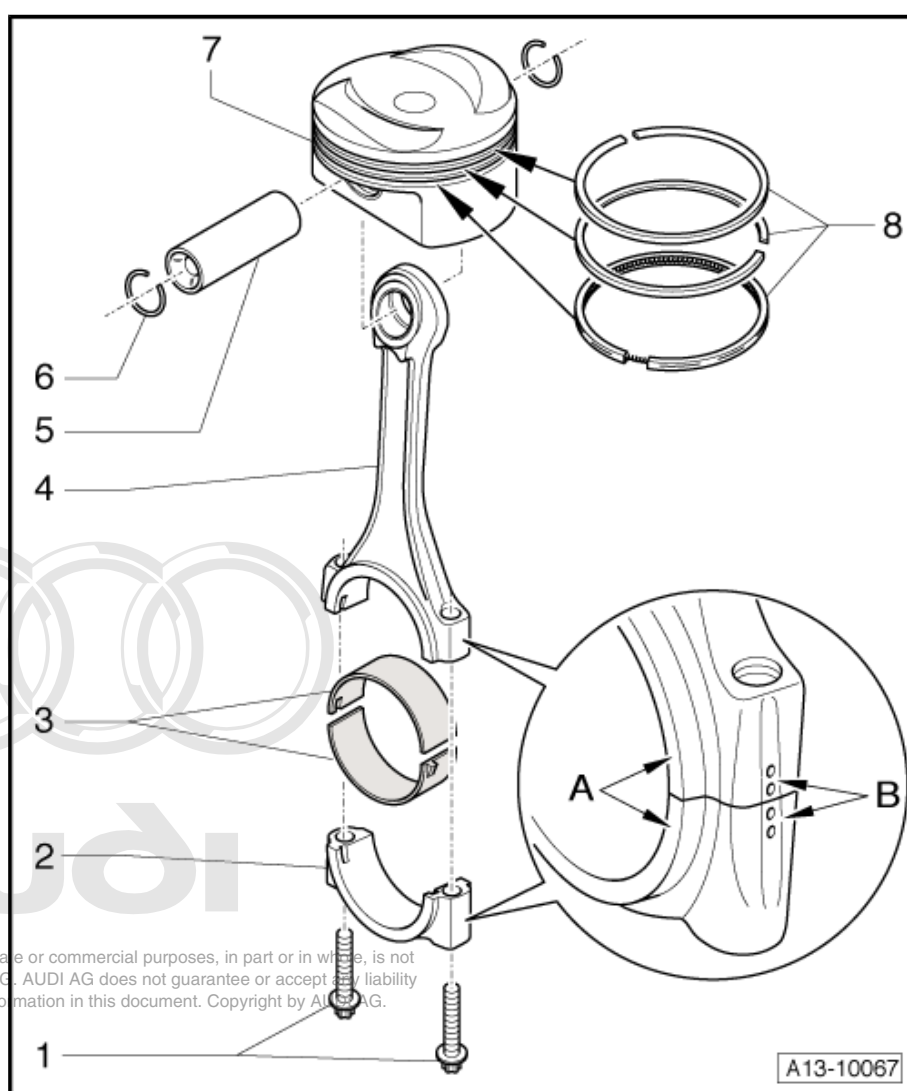
#### 2 - Conrod bearing cap

- ☐ Do not interchange
- ☐ Mark cylinder allocation with a coloured pen -B- ⇒ [page 126](#)
- ☐ Note when fitting bearing cap: the wide contact shoulder -A- must point towards same side on conrod and conrod bearing cap
- ☐ Installation position of conrod pairs ⇒ [page 127](#)

#### 3 - Bearing shell

Different types may be fitted, depending on version:

- ☐ Lower bearing shell (for bearing cap); identification: shell is a dark colour. Upper bearing shell (for conrod); more wear-resistant material; identification: shell is a light colour.



or

- ☐ Bearing shells are the same: no special identification
- ☐ Ensure that retaining lugs are securely seated.
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Measuring radial clearance ⇒ [page 127](#)
- ☐ For measuring radial clearance, tighten bolts -item 1- to 30 Nm but not further

**4 - Conrod**

- ☐ Only renew as a complete set
- ☐ Mark cylinder allocation in colour -B- ⇒ [page 126](#)
- ☐ Note when fitting bearing cap: the wide contact shoulder -A- must point towards same side on conrod and conrod bearing cap
- ☐ Installation position of conrod pairs ⇒ [page 127](#)

**5 - Piston pin**

- ☐ If difficult to move, heat piston to approx. 60 °C
- ☐ Remove and install using drift **VW 222 A**

**6 - Circlip**

- ☐ Renew

**7 - Piston**

- ☐ Installation position and allocation of piston/cylinder ⇒ [page 126](#)
- ☐ Arrow on piston crown points to pulley end
- ☐ Checking ⇒ [page 126](#)
- ☐ Install using piston ring clamp
- ☐ Piston and cylinder dimensions ⇒ [page 127](#)
- ☐ Checking cylinder bore ⇒ [page 126](#)

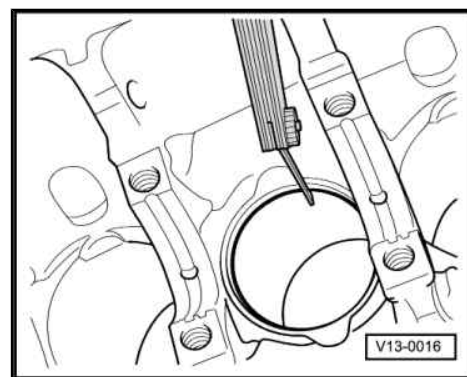
**8 - Piston rings**

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers to remove and install
- ☐ Marking "TOP" or side with identification mark must face piston crown
- ☐ Checking ring gap ⇒ [page 125](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 125](#)

**Checking piston ring gap**

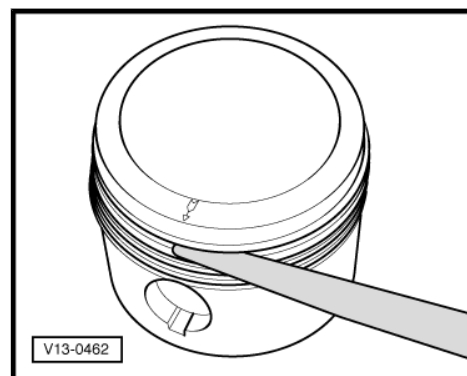
- Insert piston ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. To do so, use a piston without rings.

| Piston ring<br>Dimensions in mm | New           | Wear limit |
|---------------------------------|---------------|------------|
| 1st compression ring            | 0.20 ... 0.35 | 0.8        |
| 2nd compression ring            | 0.50 ... 0.70 | 1.0        |
| Oil scraper ring                | 0.20 ... 0.40 | 0.8        |

**Checking ring-to-groove clearance**

- Clean groove in piston before checking clearance.

| Piston ring<br>Dimensions in mm | New           | Wear limit |
|---------------------------------|---------------|------------|
| Compression rings               | 0.02 ... 0.08 | 0.20       |
| Oil scraper ring                | 0.02 ... 0.08 | 0.15       |

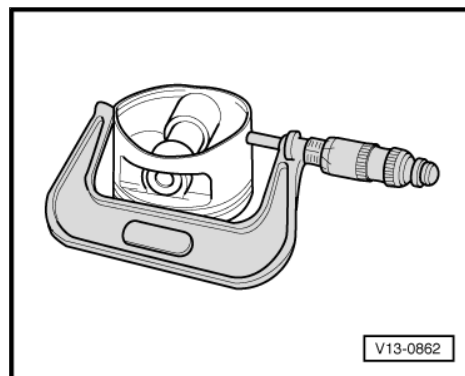


## Checking piston

- Using a micrometer (75 ... 100 mm), measure approx. 10 mm from the lower edge, at 90° to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.

Nominal dimension

⇒ ["4.3 Piston and cylinder dimensions", page 127](#).



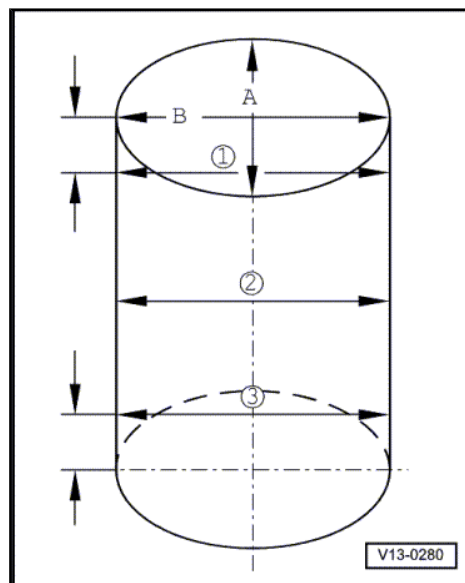
## Checking cylinder bore

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

Nominal dimension

⇒ ["4.3 Piston and cylinder dimensions", page 127](#).

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## Piston installation position and piston/cylinder allocation

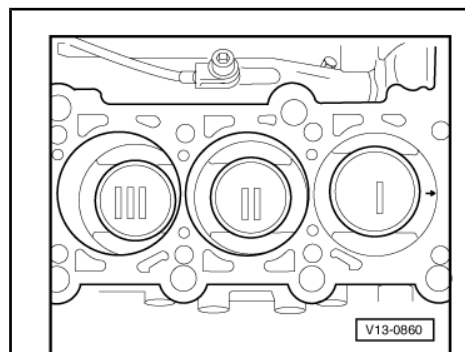


### Caution

**Do not damage the coating of the piston crown.**

- ◆ **Use a coloured pen to mark piston/cylinder allocation on piston crown for re-installation. Do not mark piston crown by means of centre punch, notch or the like.**

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

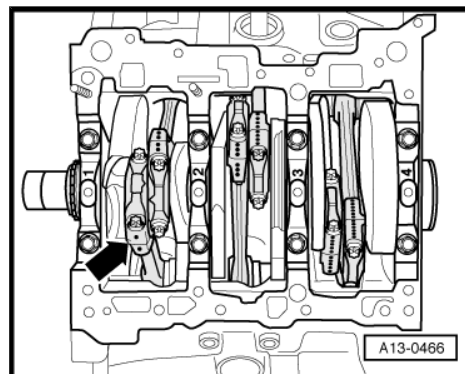


## Marking conrods



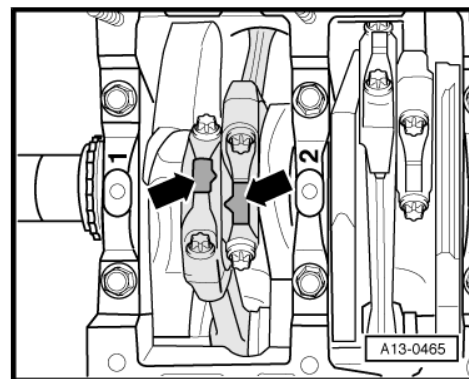
### Note

- ◆ **Only renew conrods as a complete set.**
- ◆ **Do not interchange conrod bearings.**
- Use a coloured pen to mark matching conrods and conrod bearing caps with cylinder numbers -arrow- for re-installation.



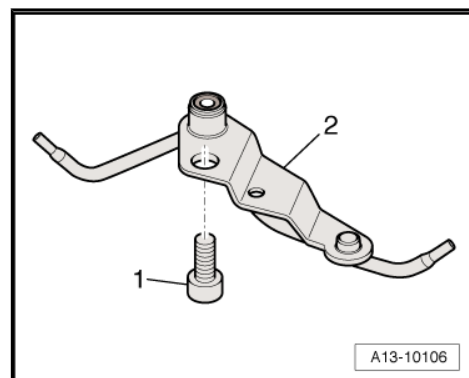
### Conrod installation position

- The cast lugs -arrows- on the ground surfaces of the conrod pairs "1 and 2", "3 and 4", and "5 and 6" must face each other.



### Oil spray jet for piston cooling

- 1 - Apply locking fluid to bolt when installing; for locking fluid refer to ⇒ Electronic parts catalogue . Tighten to 9 Nm.
- 2 - Oil spray jet with spray nozzle valve



## 4.2 Measuring radial clearance of conrods

### Special tools and workshop equipment required

- ◆ Plastigage

### Procedure

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

### Radial clearance

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- New: 0.010 .. 0.052 mm.

- Wear limit: 0.12 mm.

- Renew conrod bolts.

## 4.3 Piston and cylinder dimensions

| Honing dimension (in mm)                                                                                                                                 | Piston Ø            | Cylinder bore Ø |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------|
| Basic dimension                                                                                                                                          | 84.49 <sup>1)</sup> | 84.51           |
| <ul style="list-style-type: none"> <li><sup>1)</sup> Dimensions including coating (thickness 0.02 mm). The coating will wear down in service.</li> </ul> |                     |                 |

## 15 – Cylinder head, valve gear

### 1 Chain drive

⇒ [“1.1 Exploded view - timing chain covers”, page 128](#)

⇒ [“1.2 Removing and installing timing chain covers \(left and right\)”, page 130](#)

⇒ [“1.3 Removing and installing timing chain cover \(bottom\)”, page 135](#)

⇒ [“1.4 Exploded view - camshaft timing chains”, page 140](#)

⇒ [“1.5 Removing timing chains from camshafts”, page 143](#)

⇒ [“1.6 Removing and installing camshaft timing chains”, page 150](#)

⇒ [“1.7 Exploded view - drive chain for valve gear”, page 153](#)

⇒ [“1.8 Removing and installing drive chain for valve gear”, page 155](#)

⇒ [“1.9 Exploded view - drive chain for auxiliary drives”, page 157](#)

⇒ [“1.10 Removing and installing drive chain for auxiliary drives”, page 158](#)

⇒ [“1.11 Exploded view - balance shaft”, page 161](#)

⇒ [“1.12 Removing and installing balance shaft”, page 162](#)

#### 1.1 Exploded view - timing chain covers

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**1 - Bolt**

- ☐ Tightening torque and sequence  
⇒ Fig. [“Timing chain cover \(bottom\) - tightening torque and sequence”](#), page 130

**2 - Crankshaft oil seal (gearbox end)**

- ☐ Renewing ⇒ [page 115](#)

**3 - Dowel sleeve**

- ☐ 2x

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

- ☐ Removing and installing  
⇒ [page 135](#)

**5 - Cylinder head gasket (left-side)****6 - Bolt**

- ☐ Renew
- ☐ Tightening torque and sequence  
⇒ Fig. [“Timing chain cover \(left-side\) - tightening torque and sequence”](#), page 130

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

- ☐ Removing and installing  
⇒ [page 130](#)

**8 - Bolt**

- ☐ Tightening torque and sequence  
⇒ Fig. [“Timing chain cover \(bottom\) - tightening torque and sequence”](#), page 130

**9 - Bolt**

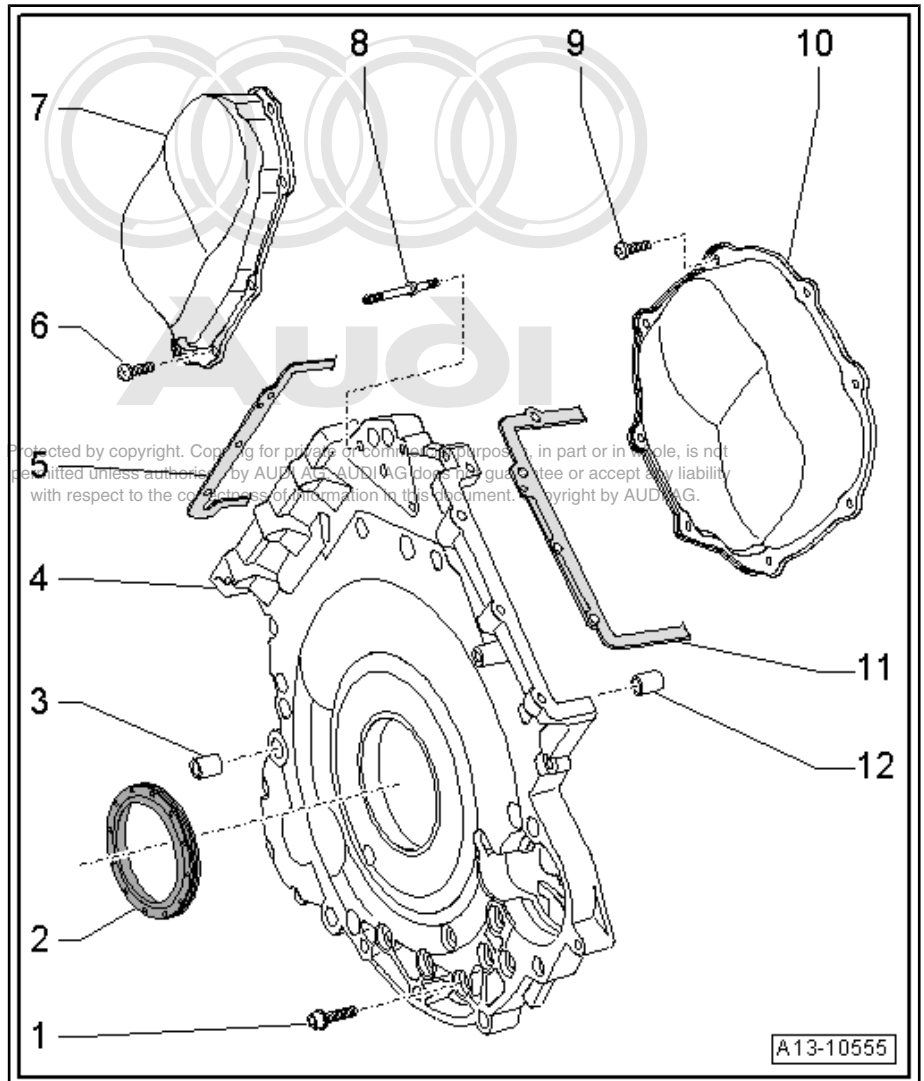
- ☐ Renew
- ☐ Tightening torque and sequence  
⇒ Fig. [“Timing chain cover \(right-side\) - tightening torque and sequence”](#), page 130

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

- ☐ Removing and installing ⇒ [page 130](#)

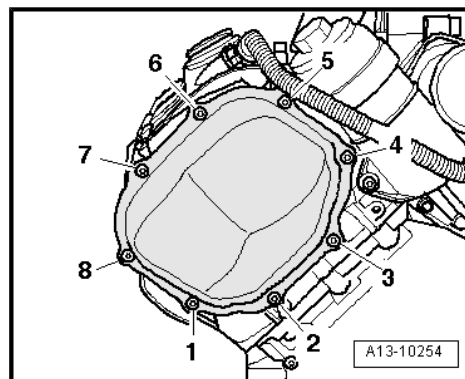
**11 - Cylinder head gasket (right-side)****12 - Dowel sleeve**

- ☐ 2x



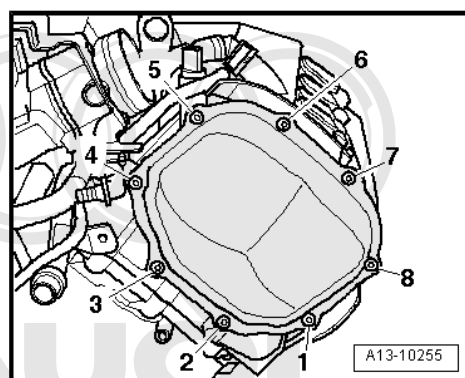
### Timing chain cover (left-side) - tightening torque and sequence

- Renew bolts for timing chain cover.
- Tighten bolts in the sequence -1 ... 8- in 2 stages as follows:
  1. Tighten to 5 Nm.
  2. Turn 90° further.



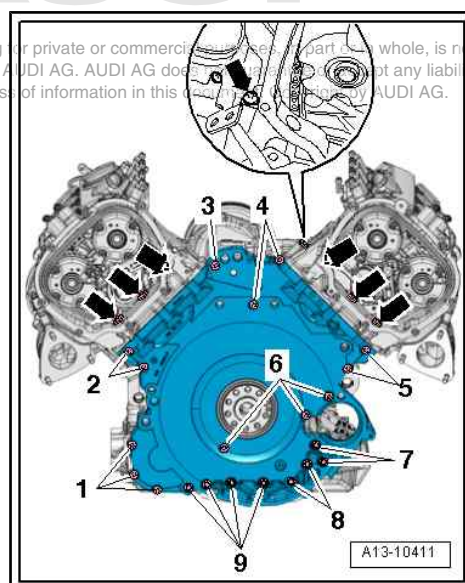
### Timing chain cover (right-side) - tightening torque and sequence

- Renew bolts for timing chain cover.
- Tighten bolts in the sequence -1 ... 8- in 2 stages as follows:
  1. Tighten to 5 Nm.
  2. Turn 90° further.



### Timing chain cover (bottom) - tightening torque and sequence

- Tighten bolts in 5 stages as follows:
  1. Fit bolts -arrows- and initially tighten to 5 Nm.
  2. Tighten bolts -1 ... 9- to 9 Nm in diagonal sequence.
  3. Tighten bolts -arrows- to 9 Nm.
  4. Tighten bolts -7, 8, 9- to 20 Nm.
  5. Tighten stud -3- to 16 Nm.



## 1.2 Removing and installing timing chain covers (left and right)

### Special tools and workshop equipment required

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

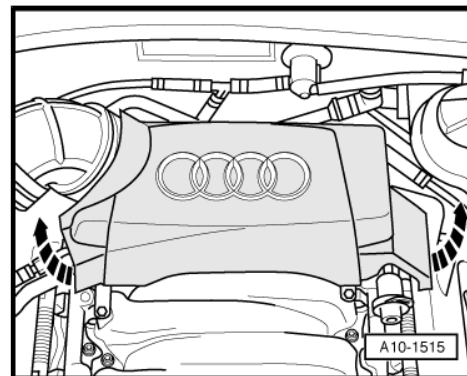
## Removing



### Note

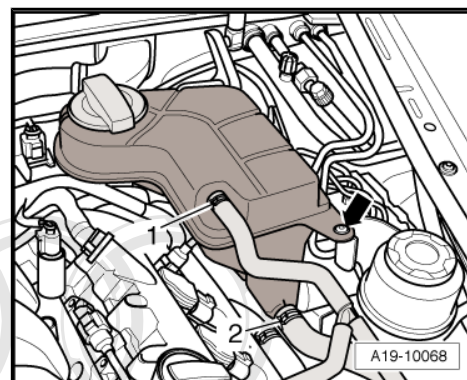
*Fit all cable ties in the original positions when installing.*

- Pull off engine cover panel (rear) -arrows-.

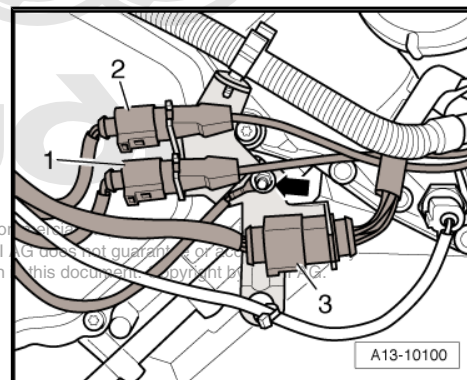


### Timing chain cover (left-side):

- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



- Unplug electrical connectors -1 ... 3-.
- Remove nut -arrow-.
- Remove bracket for electrical connector -3-.
- Unscrew centre hex stud located beneath the bracket.
- Remove bracket for electrical connectors -1- and -2-.



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- Unplug electrical connector -3-.
- Remove bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (left-side).

#### Rest-of-world vehicles:

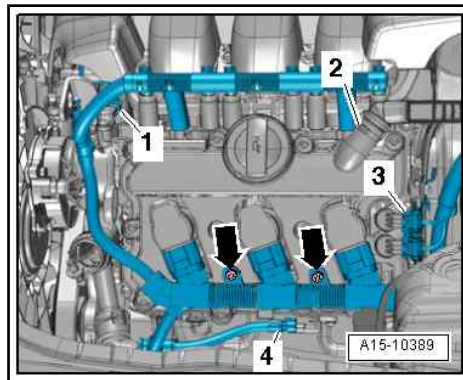
- Disconnect crankcase breather hose -2- and move clear.



#### Caution

*Risk of violating emission legislation applying to USA models.*

- ◆ **Do NOT open hose connection -2- for crankcase breather system.**



- Remove cylinder head cover (left-side) (crankcase breather hose remains connected) ⇒ [page 168](#).

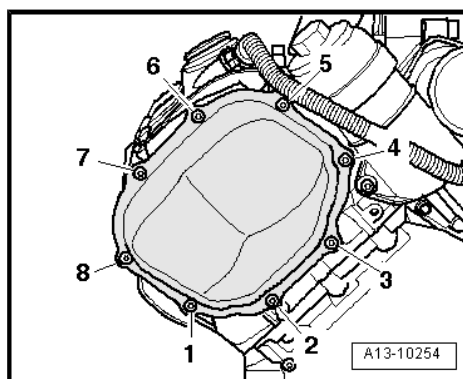
#### All vehicles (continued):



#### Note

*Disregard -items 1 and 4-.*

- Move wiring clear.
- Remove bolts -1 ... 8- and detach timing chain cover (left-side).



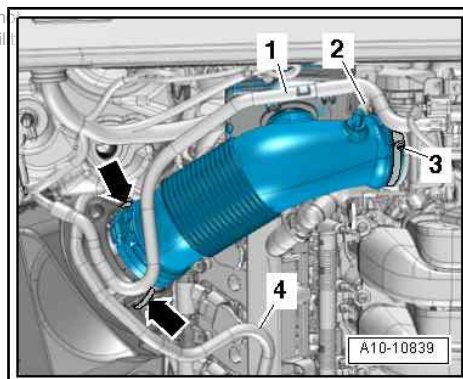
#### Timing chain cover (right-side)

- Move line -1- leading to activated charcoal filter clear.
- Detach vacuum hose -2- from air hose.
- Remove air pipe. To do so, release hose clip -3- and clamps -arrows-.

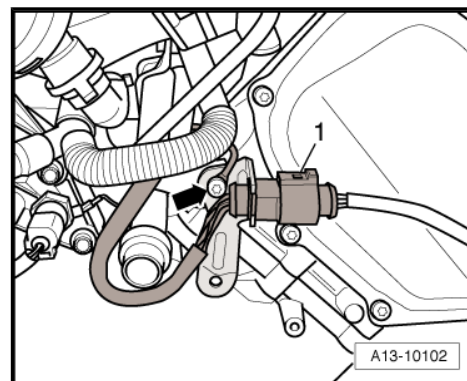


#### Note

*Disregard item -4-.*



- Detach electrical connector -1- from bracket and unplug.



- Remove bolts -1 ... 8- and detach timing chain cover (right-side).

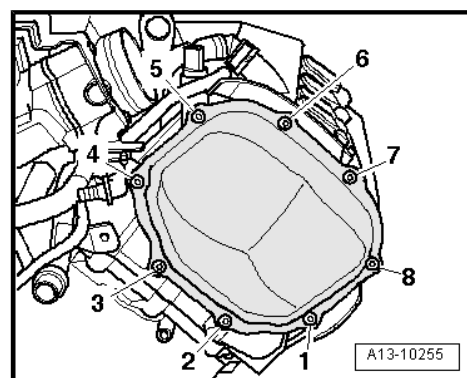
### Installing

- Tightening torques ⇒ [page 130](#) , ⇒ [page 130](#) .



### Note

*Fit all cable ties in the original positions when installing.*



### WARNING

*Risk of eye injury.*

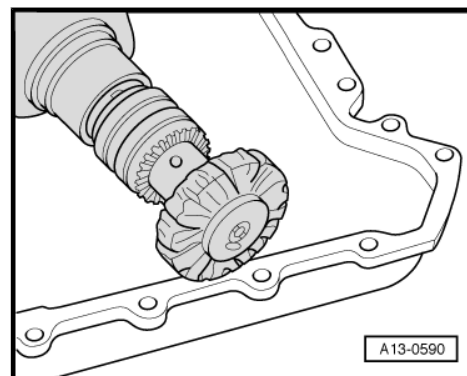
◆ *Wear safety goggles.*



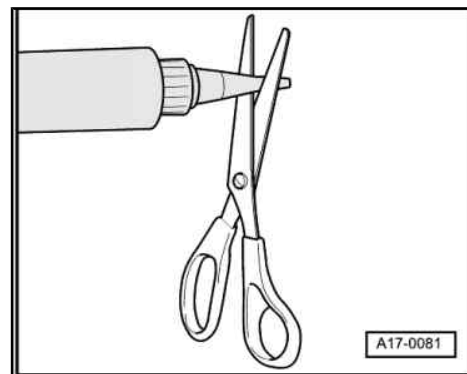
### Caution

*Protect lubrication system against contamination.*

◆ *Cover exposed parts of the engine.*



- Remove remaining sealant on timing chain covers and cylinder block / cylinder head using rotating plastic brush or similar.
- Clean sealing surfaces (top and bottom); they must be free of oil and grease.
- Cut off nozzle of tube at front marking (Ø of nozzle approx. 2 mm).



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### Caution

**Make sure lubrication system is not clogged by excess sealant.**

- ◆ **The bead of sealant must not be thicker than specified.**

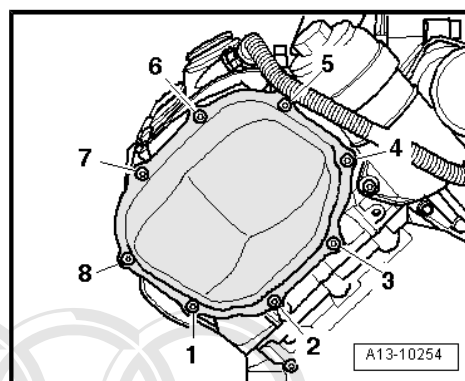
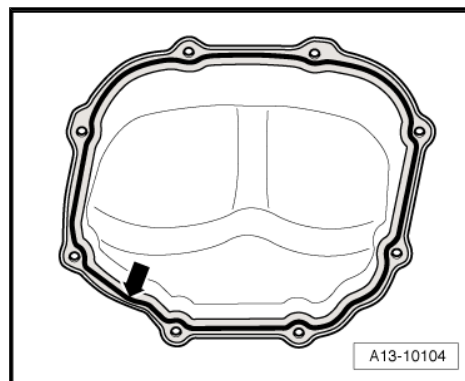
- Apply sealant bead -arrow- onto the clean sealing surface of the timing chain cover (left-side) as illustrated.
- Width of sealant bead: 2.5 mm.



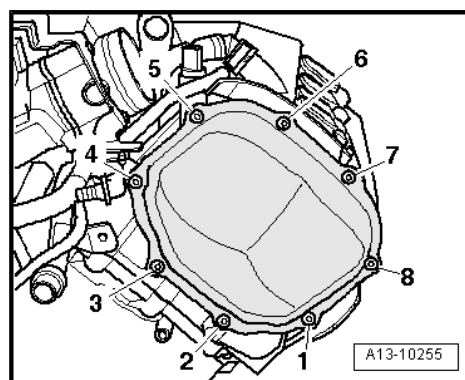
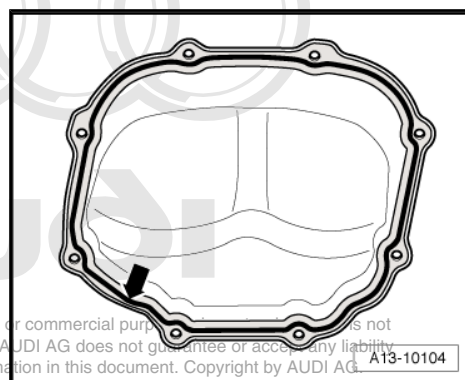
### Note

*The timing chain covers must be installed within 5 minutes after applying sealant.*

- Fit timing chain cover (left-side) and tighten bolts in the sequence -1 ... 8- ⇒ [page 130](#) .



- Apply sealant bead -arrow- onto the clean sealing surface of the timing chain cover (right-side) as illustrated.
- Width of sealant bead: 2.5 mm.



- Fit timing chain cover (right-side) and tighten bolts in the sequence -1 ... 8- ⇒ [page 130](#) .

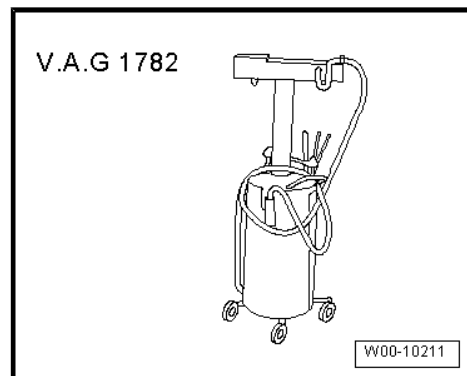
The remaining installation steps are carried out in the reverse sequence.

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### 1.3 Removing and installing timing chain cover (bottom)

#### Special tools and workshop equipment required

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



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

#### Removing



#### WARNING

##### *Injury risk.*

- ◆ ***The lock carrier must be installed and the torque reaction support must be secured.***

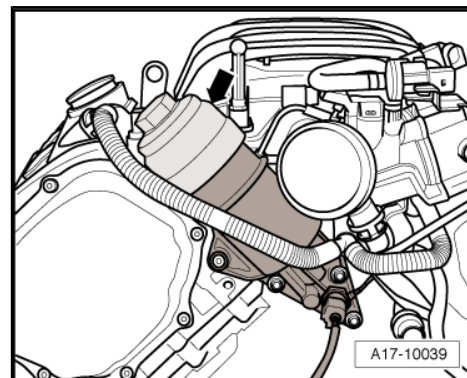
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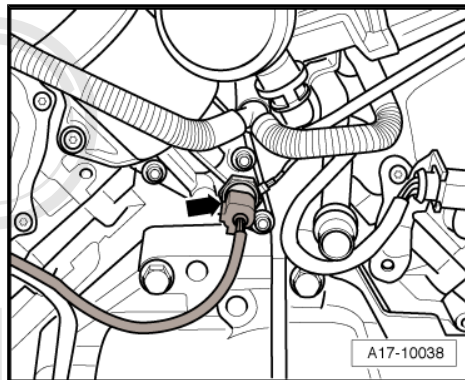
#### Note

*Fit all cable ties in the original positions when installing.*

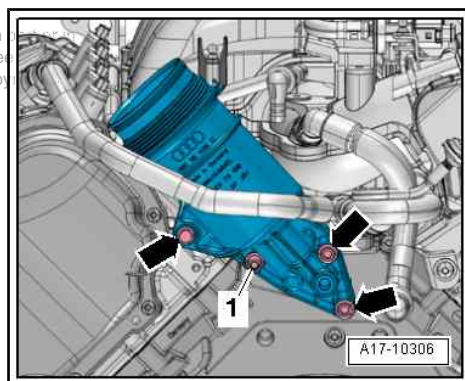
- Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. gr. 30 and dual-mass flywheel ⇒ [page 107](#) .
- Vehicles with multitronic gearbox: Remove damper unit ⇒ [page 111](#) and flywheel ⇒ [page 112](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate ⇒ [page 114](#) .
- Remove timing chain covers (left and right) ⇒ [page 130](#) .
- Detach sealing cap -arrow- for oil filter housing and remove oil filter element ⇒ Maintenance ; Booklet 405 .
- Extract engine oil from oil filter housing using used oil collection and extraction unit - V.A.G 1782- .



- Unplug electrical connector on oil pressure switch - F22-  
-arrow-.



- Remove bolts -arrows- and nut -1-.
- Remove oil filter housing.
- Place used oil collection and extraction unit - V.A.G 1782- be-  
low engine and drain off engine oil.



- Remove bolts -arrows-.



### Note

*Different versions of the coolant pipe (top)  
⇒ [Item 15 \(page 250\)](#) were fitted in production. Depending on the  
version, the bolt -detail in illustration- may not be accessible due  
to the positioning of the coolant pipe (top). If this is the case, re-  
move coolant pipe (top) ⇒ [page 256](#) .*

- Unscrew bolts -1 ... 9- and remove timing chain cover (bottom).
- Press crankshaft oil seal (gearbox end) out of timing chain  
cover (bottom).

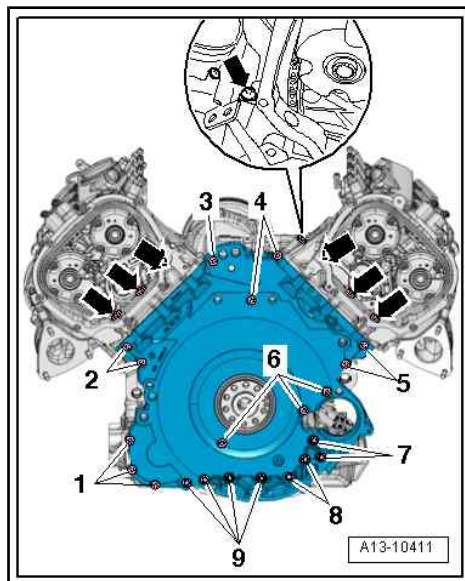
### Installing

- Tightening torques ⇒ [page 130](#)



### Note

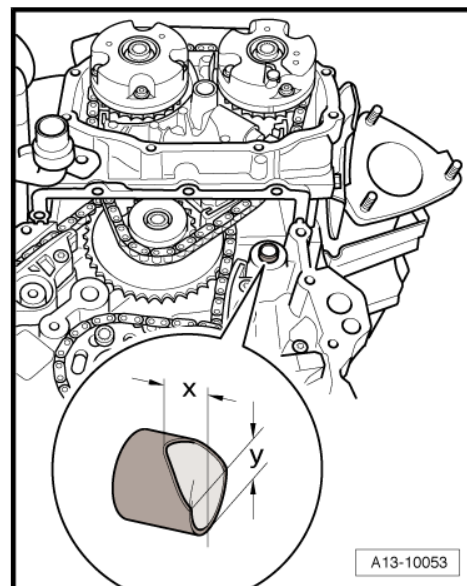
- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Fit all cable ties in the original positions when installing.*



- Pull dowel sleeve (top right) out of cylinder block.
- Bevel the dowel sleeve with a file, as illustrated.
- Dimension -x- = 6.5 mm.
- Dimension -y- = 8 mm.
- Fit dowel sleeve on cylinder block in such a way that the bevelled side points upwards.

**Note**

*Bevelling the dowel sleeve makes it easier to fit the timing chain cover (bottom) with the cylinder head installed.*

**WARNING**

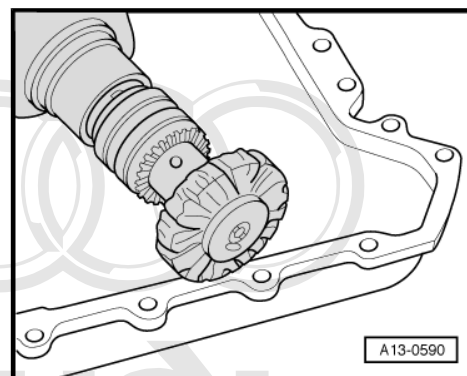
*Risk of eye injury.*

◆ *Wear safety goggles.*

**Caution**

*Protect lubrication system against contamination.*

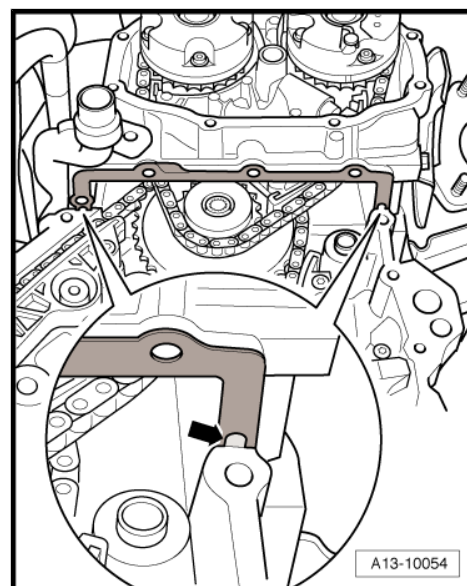
◆ *Cover exposed parts of the engine.*



- Remove remaining sealant on timing chain cover and cylinder block / cylinder head using rotating plastic brush or similar.
- Clean sealing surfaces (top and bottom); they must be free of oil and grease.
- Clean any old sealing compound from the bores -arrow- in the cylinder head gaskets.

**Note**

*With the cylinder head installed the holes in the cylinder head gasket are only half visible.*





### Caution

**Avoid damage to cylinder head gasket.**

- ◆ **Only bend the ends of the cylinder head gaskets slightly and do not kink.**



### Note

*If the cylinder head gasket has been bent and kinked it must be renewed.*

- Carefully bend the ends of the cylinder head gaskets down very slightly -arrows-, just far enough to be able to clean the upper sealing surface on the gasket and cylinder head.
- Clean both cylinder head gaskets (top and bottom); they must be free of oil and grease.
- Cut off nozzle of tube at front marking ( $\varnothing$  of nozzle approx. 2 mm).



### Note

*The sealant must be applied at several points on the engine as described below.*



### Caution

**Avoid damage to cylinder head gasket.**

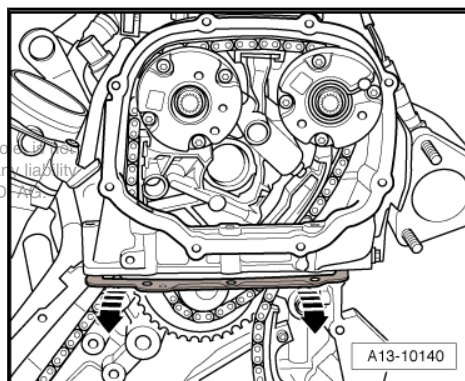
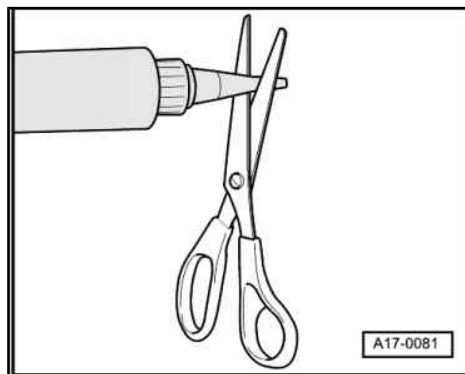
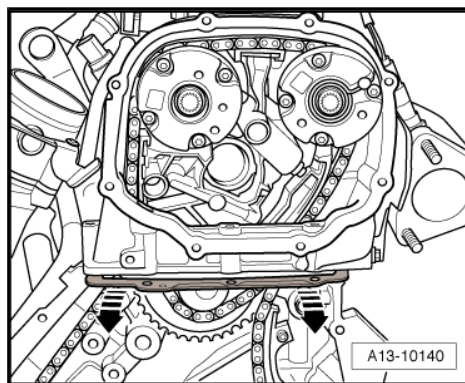
- ◆ **Only bend the ends of the cylinder head gaskets slightly and do not kink.**



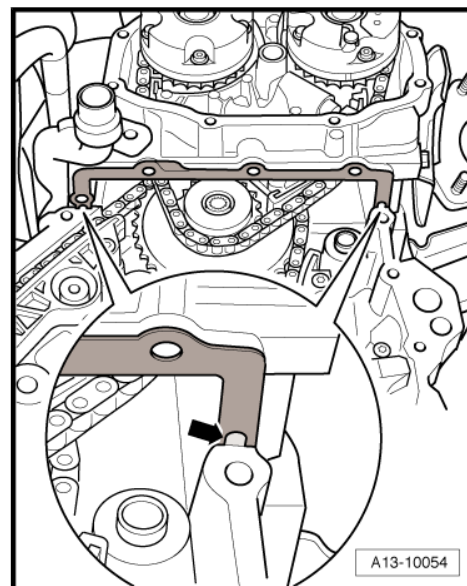
### Note

*If the cylinder head gasket has been bent and kinked it must be renewed.*

- Apply a small amount of sealant to sealing surfaces of cylinder head gaskets (top and bottom). To do so, you again have to bend cylinder head gaskets down very slightly -arrows-.
- Use a flat object (e.g. a feeler gauge) to apply sealant to the area between cylinder head and gasket.



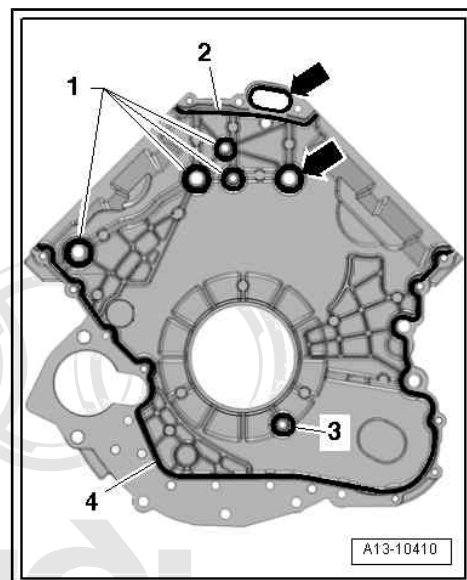
- Fill cleaned holes -arrow- in cylinder head gaskets with sealant.

**Caution**

***Make sure lubrication system is not clogged by excess sealant.***

- ◆ ***The bead of sealant must not be thicker than specified.***

- Apply sealant beads -1 ... 4- onto the clean sealing surfaces of the timing chain cover (bottom) as illustrated.
- The groove on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 ... 2.0 mm above the sealing surface.
- The sealant -2- must be applied in a continuous bead as shown in the illustration (although the groove is not continuous).

**Note**

***The timing chain cover must be installed within 5 minutes after applying sealant.***

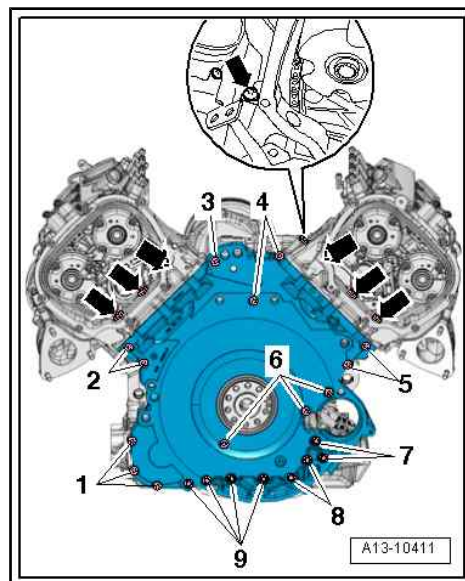
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- Insert seals -arrows- in grooves on timing chain cover (bottom).

- Fit timing chain cover (bottom), guiding it towards the sealing surface on cylinder block and cylinder head at an angle and from below.
- Take care not to damage the cylinder head gaskets when fitting the cover. Renew gaskets if damaged.
- Tighten bolts ⇒ [page 130](#) .

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

- Install timing chain covers (left and right) ⇒ [page 133](#) .
- Install oil filter housing ⇒ [page 229](#) .
- Install oil filter element ⇒ Maintenance ; Booklet 405 .
- Install crankshaft oil seal (gearbox end) ⇒ [page 115](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 107](#) and pressure plate ⇒ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 112](#) and damper unit ⇒ [page 111](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 114](#) .
- Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Fill up with engine oil and check oil level ⇒ [page 237](#) .



## 1.4 Exploded view - camshaft timing chains

### Camshaft timing chain (left-side)



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**1 - Bolt**

- ☐ Renew
- ☐ 80 Nm + turn 90° further

**2 - Bolt**

- ☐ Renew
- ☐ 80 Nm + turn 90° further

**3 - Camshaft adjuster for exhaust camshaft**

- ☐ Identification "Exhaust"
- ☐ Removing and installing  
⇒ ["1.5 Removing timing chains from camshafts", page 143](#)

**4 - Camshaft adjuster for inlet camshaft**

- ☐ Identification "Intake"
- ☐ Removing and installing  
⇒ ["1.5 Removing timing chains from camshafts", page 143](#)

**5 - Camshaft timing chain (left-side)**

- ☐ Removing and installing  
⇒ [page 143](#)

**6 - Bolt**

- ☐ 9 Nm

**7 - Slide****8 - Chain tensioner for camshaft timing chain (left-side)**

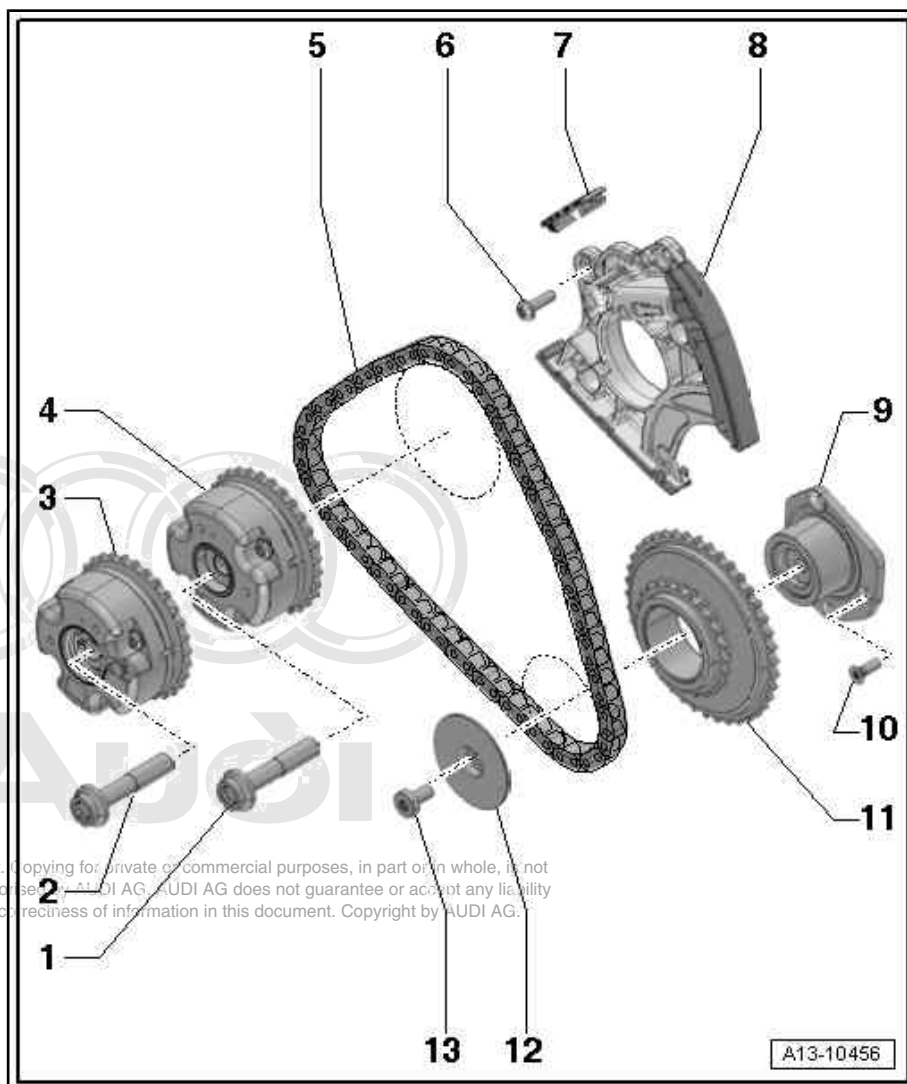
- ☐ Removing and installing  
⇒ ["1.5 Removing timing chains from camshafts", page 143](#)

**9 - Bearing bracket for drive sprocket****10 - Bolt**

- ☐ Renew
- ☐ 8 Nm + turn 45° further

**11 - Drive sprocket for camshaft timing chain (left-side)****12 - Thrust washer for drive sprocket****13 - Bolt**

- ☐ Renew
- ☐ 6 Nm + turn 60° further

**Camshaft timing chain (right-side)**

**1 - Bolt**

- ☐ Renew
- ☐ 80 Nm + turn 90° further

**2 - Camshaft adjuster for exhaust camshaft**

- ☐ Identification "Exhaust"
- ☐ Removing and installing  
⇒ ["1.5 Removing timing chains from camshafts", page 143](#)

**3 - Bolt**

- ☐ Renew
- ☐ 80 Nm + turn 90° further

**4 - Camshaft adjuster for inlet camshaft**

- ☐ Identification "Intake"
- ☐ Removing and installing  
⇒ ["1.5 Removing timing chains from camshafts", page 143](#)

**5 - Bolt**

- ☐ 30 Nm + turn 90° further

**6 - Bearing mounting for drive sprocket**

- ☐ For camshaft timing chain (right-side)
- ☐ Asymmetric version
- ☐ Installation position  
⇒ [page 155](#)

**7 - Drive sprocket for camshaft timing chain (right-side)**

- ☐ Installation position  
⇒ [page 155](#)

**8 - Camshaft timing chain (right-side)**

- ☐ Removing and installing ⇒ [page 143](#)

**9 - Thrust washer for drive sprocket**

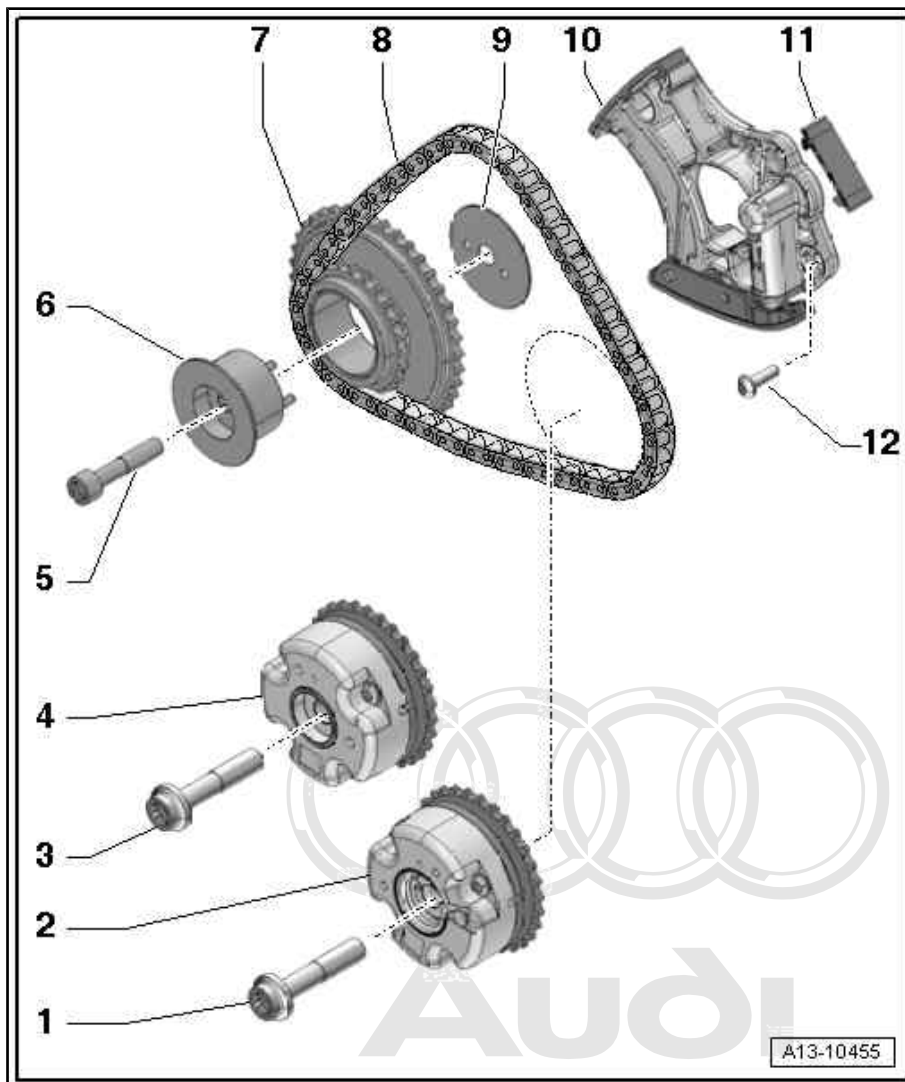
- ☐ For camshaft timing chain (right-side)
- ☐ Asymmetric version
- ☐ Installation position ⇒ [page 155](#)

**10 - Chain tensioner for camshaft timing chain (right-side)**

- ☐ Removing and installing ⇒ ["1.5 Removing timing chains from camshafts", page 143](#)

**11 - Slide**
**12 - Bolt**

- ☐ 9 Nm

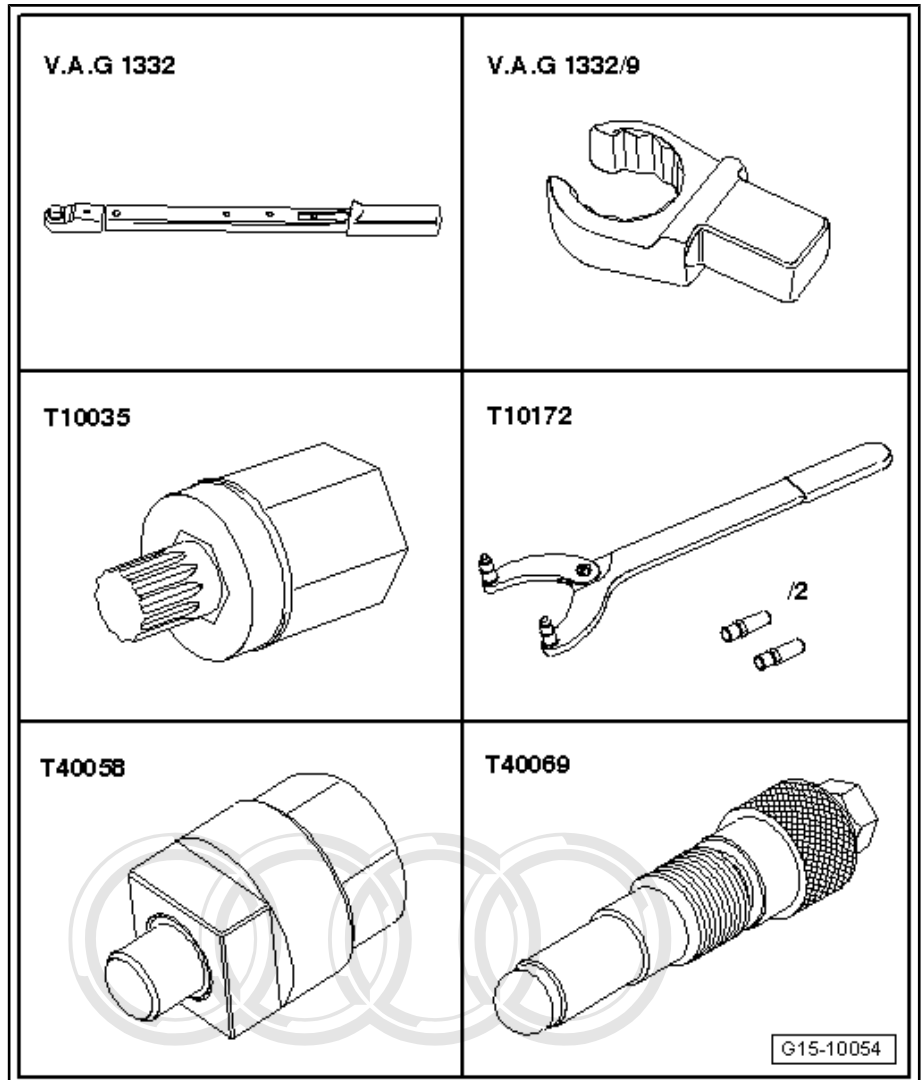


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## 1.5 Removing timing chains from camshafts

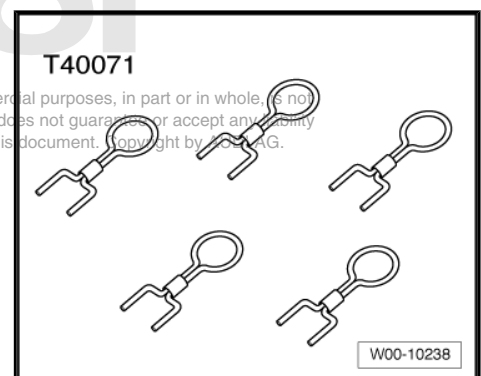
### Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1332-
- ◆ Open ring spanner insert - V.A.G 1332/9-
- ◆ Special wrench - T10035-
- ◆ Counterhold tool - T10172-
- ◆ Adapter - T40058-
- ◆ Locking pin - T40069-

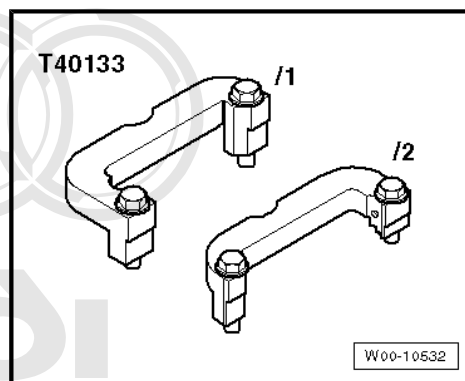


- ◆ 2x Locking pin - T40071-

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# ◆ 2x Camshaft clamp - T40133-



## Removing

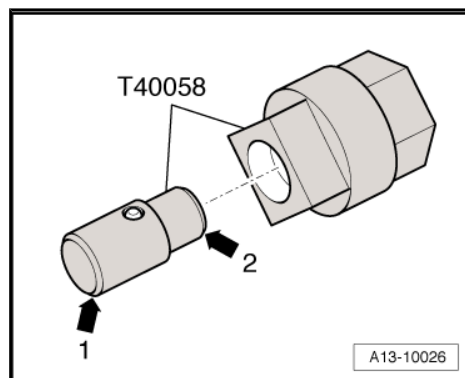
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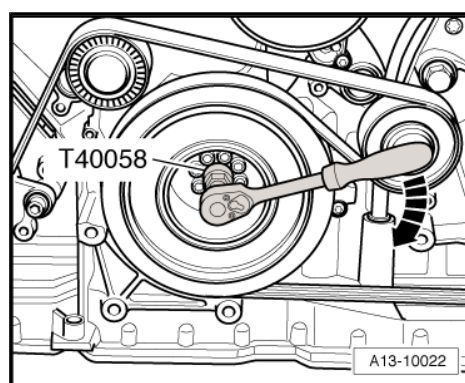
### Note

*In the following procedure the camshaft timing chains remain on the engine.*

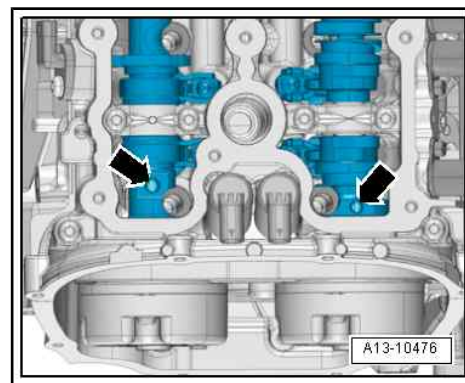
- Remove cylinder head covers: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#) .
- Remove timing chain covers (left and right) ⇒ [page 130](#) .
- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.



- Using adapter - T40058- turn the crankshaft in the normal direction of rotation -arrow- to “TDC”.



- The threaded holes -arrows- in the camshafts must face upwards.

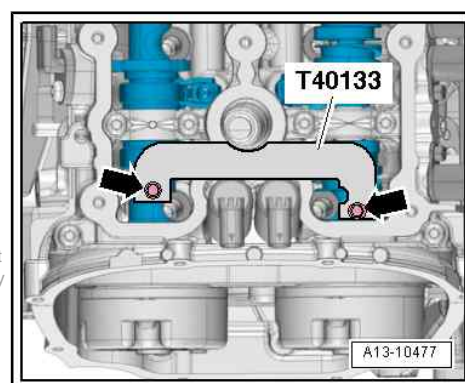


- Fit camshaft clamps - T40133- onto both cylinder heads and tighten bolts -arrows- to 25 Nm.

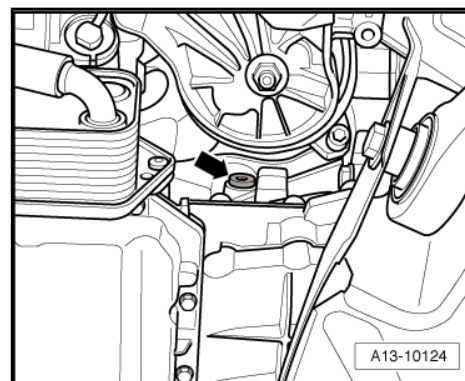
**Note**

*The illustration shows the left-side cylinder head.*

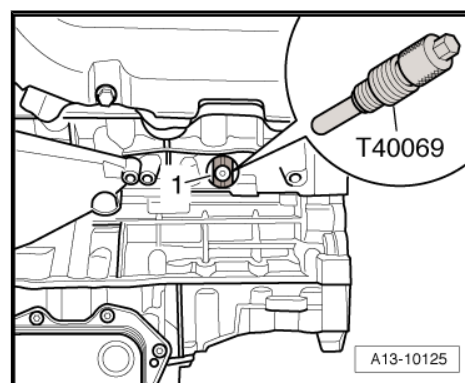
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- Unscrew plug -arrow- for “TDC” marking from sump (top section).



- Screw locking pin - T40069- into bore (tightening torque: 20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.

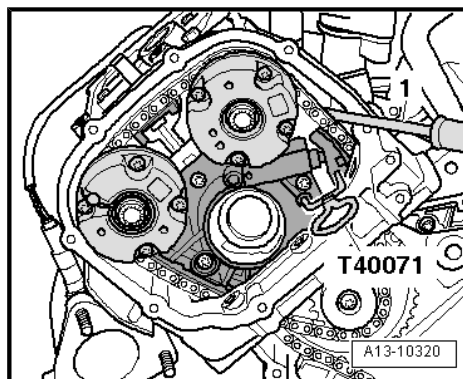


- Press guide rail of chain tensioner for camshaft timing chain (left-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .



### Note

*The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.*

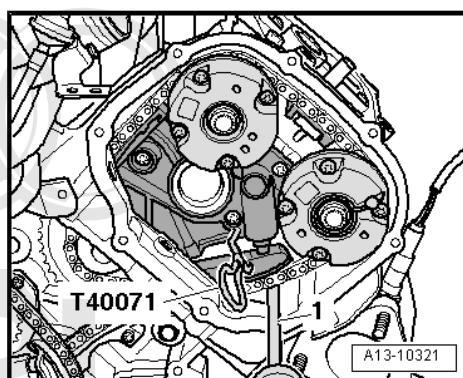


- Press guide rail of chain tensioner for camshaft timing chain (right-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .



### Note

*The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.*

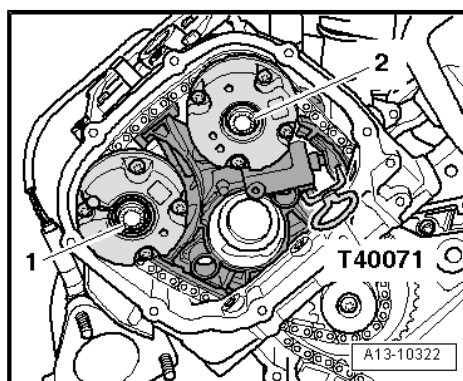
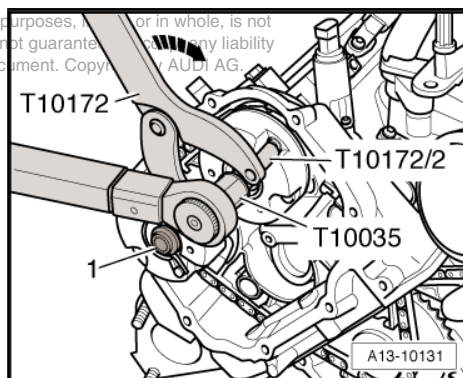


### Caution

**Risk of damage to camshaft.**

- ◆ **Do NOT use camshaft clamp - T40133- as a counterhold tool when loosening camshaft adjuster bolts -1-.**

- Fit counterhold tool - T10172- with pin -T10172/2- to counterhold on corresponding camshaft adjuster and loosen with special wrench - T10035- .
- Mark positions of camshaft adjusters with paint for re-installation.
- Unscrew bolts -1- and -2- on cylinder head (left-side) and remove both camshaft adjusters.



- Mark positions of camshaft adjusters with paint for re-installation.
- Unscrew bolts -1- and -2- on cylinder head (right-side) and remove both camshaft adjusters.

### Installing

- Tightening torques ➔ [page 140](#) , ➔ [page 216](#) .



### Note

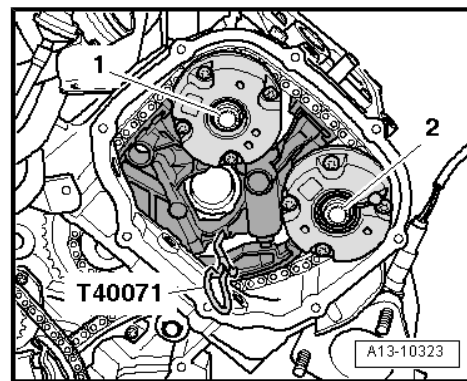
Renew the bolts tightened with specified tightening angle.



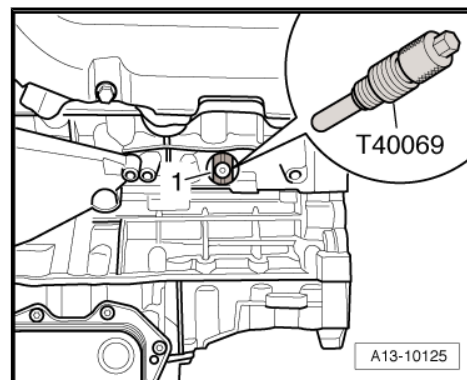
### Caution

**Risk of damage to valves and piston crowns.**

- ◆ **The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.**



- Drive chain for valve gear installed ➔ [page 155](#)
- Crankshaft locked in "TDC" position with locking pin - T40069- .

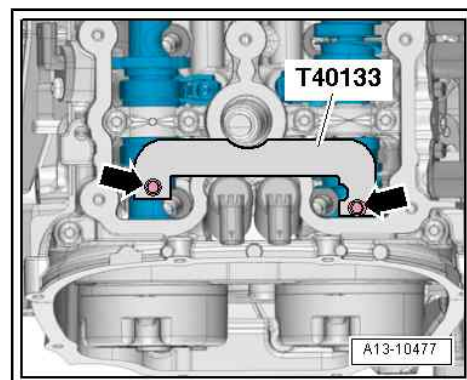


Camshaft clamps -T40133- installed on both cylinder heads and tightened to 25 Nm -arrows-.



### Note

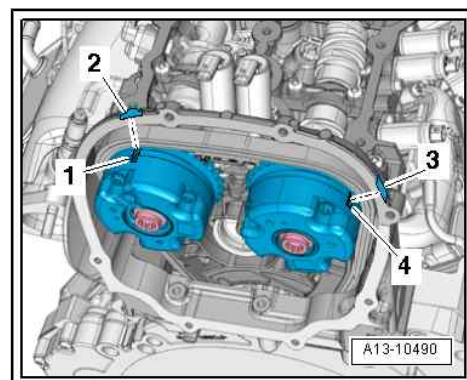
The illustration shows the left-side cylinder head.



### Caution

**Risk of damage to engine.**

- ◆ **When performing the following steps, make sure to fit camshaft adjusters so that the grooves -1- and -4- are aligned with the adjustment areas (ground surfaces) -2- and -3-.**

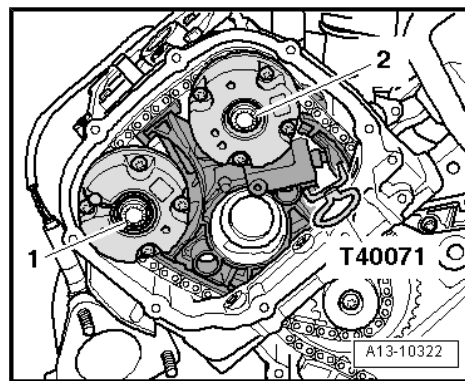




## Note

Re-install camshaft adjusters on cylinder head (left-side) in the same position as before (pay attention to marks applied when removing).

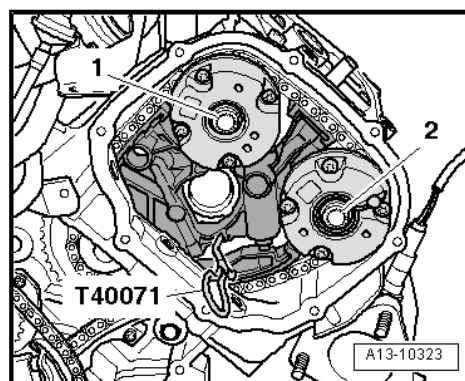
- Fit timing chain (left-side) onto drive chain sprocket and camshaft adjusters and fit bolts -1- and -2- without tightening.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
- Remove locking pin - T40071- .



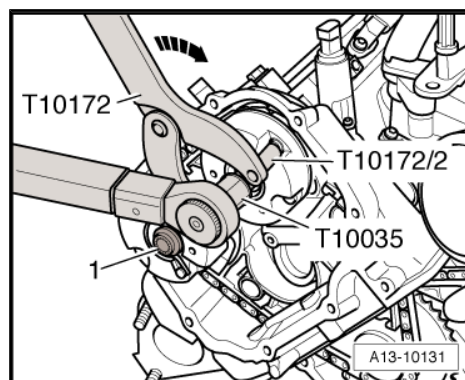
## Note

Re-install camshaft adjusters on cylinder head (right-side) in the same position as before (pay attention to marks applied when removing).

- Fit timing chain (right-side) onto drive chain sprocket and camshaft adjusters and fit bolts -1- and -2- without tightening.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
- Remove locking pin - T40071- .

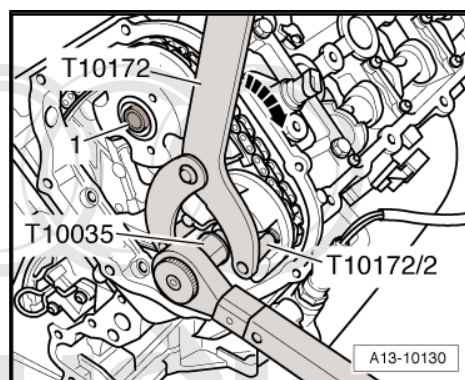


- Fit counterhold tool - T10172- with pin -T10172/2- onto camshaft adjuster of inlet camshaft (left-side).
- Have a 2nd mechanic apply tension to camshaft timing chain by pressing counterhold tool in direction of -arrow-.
- Tighten bolts as follows while keeping camshaft adjuster under tension:



1. Pre-tighten bolt on inlet camshaft to 80 Nm.
2. Pre-tighten bolt -1- on exhaust camshaft to 80 Nm.

- Fit counterhold tool - T10172- with pin -T10172/2- onto camshaft adjuster of exhaust camshaft (right-side).
- Have a 2nd mechanic apply tension to camshaft timing chain by pressing counterhold tool in direction of -arrow-.
- Tighten bolts as follows while keeping camshaft adjuster under tension:

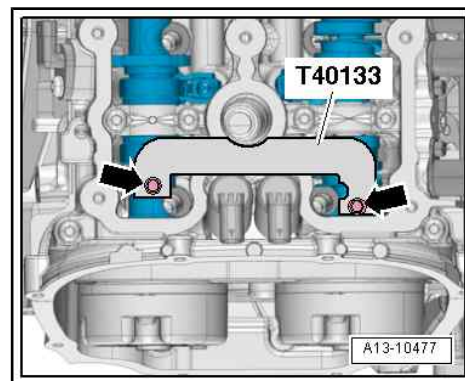


1. Pre-tighten bolt on exhaust camshaft to 80 Nm.
2. Pre-tighten bolt -1- on inlet camshaft to 80 Nm.

- Remove camshaft clamps - T40133- from both cylinder heads -arrows-.

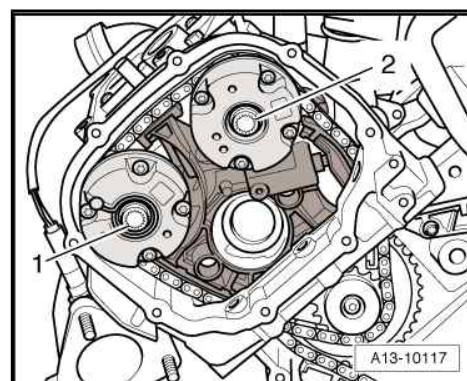
**Note**

*The illustration shows the left-side cylinder head.*



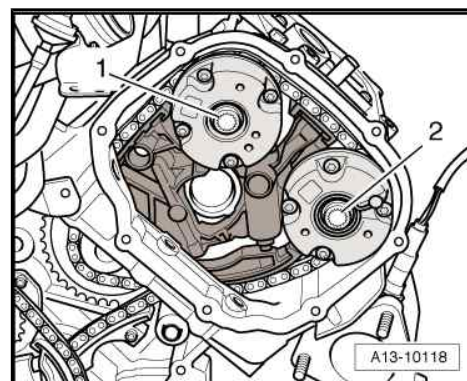
- Tighten camshaft adjuster bolts on cylinder head (left-side) as follows:

1. Tighten bolt -1- on inlet camshaft to final tightening torque.
2. Tighten bolt -2- on exhaust camshaft to final tightening torque.

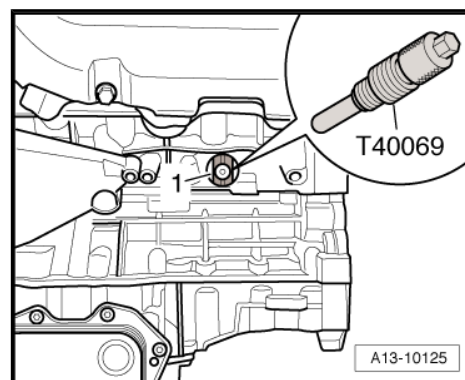


- Tighten camshaft adjuster bolts on cylinder head (right-side) as follows:

1. Tighten bolt -1- on inlet camshaft to final tightening torque.
2. Tighten bolt -2- on exhaust camshaft to final tightening torque.



- Remove locking pin - T40069- .

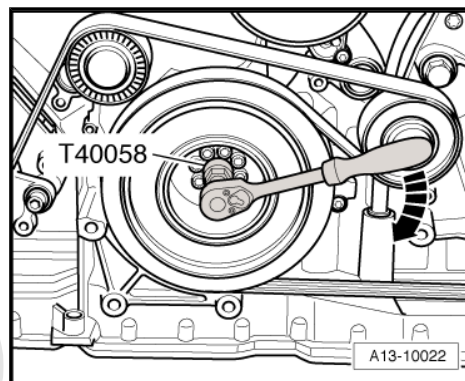


- Using adapter - T40058- , turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is at “TDC” again.

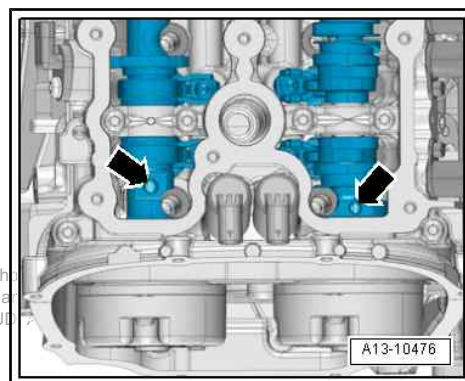


### Note

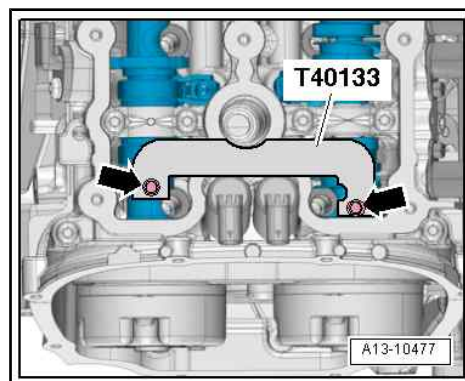
If you turned the crankshaft beyond “TDC”, turn it back approx. 30° and set to “TDC” again.



- The threaded holes -arrows- in the camshafts must face upwards.



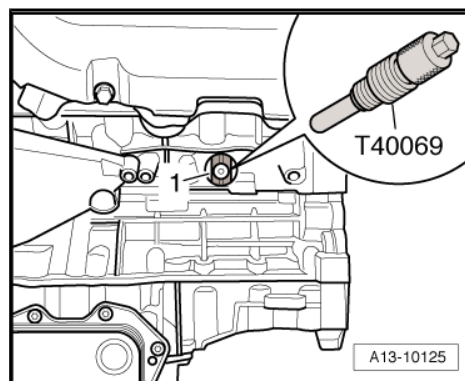
- Fit camshaft clamps - T40133- onto both cylinder heads and tighten bolts -arrows- to 25 Nm.



- Screw the locking pin - T40069- directly into the hole.
- The locking pin - T40069- must engage in the locating hole in crankshaft -1-. If it does not, reset valve timing.
- Remove camshaft clamps from both cylinder heads.
- Remove locking pin.

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

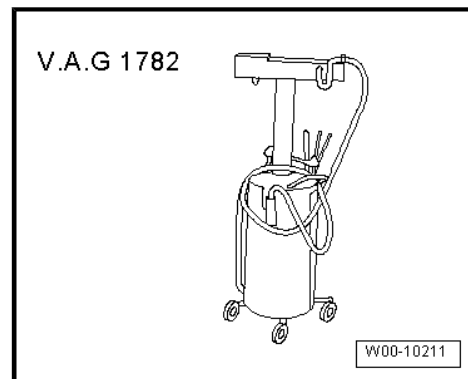
- Install timing chain covers (left and right) ⇒ [page 130](#) .
- Install cylinder head cover: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#) .



## 1.6 Removing and installing camshaft timing chains

Special tools and workshop equipment required

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



### Removing

- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.
- Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. gr. 30 and dual-mass flywheel ⇒ [page 107](#) .
- Vehicles with multitronic gearbox: Remove damper unit ⇒ [page 111](#) and flywheel ⇒ [page 112](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate ⇒ [page 114](#) .
- Remove cylinder head cover: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#) .
- Remove timing chain covers (left and right) ⇒ [page 130](#) .
- Remove intake manifold (top section) ⇒ Rep. gr. 24 .
- Remove oil filter housing ⇒ [page 229](#) .
- Remove timing chain cover (bottom) ⇒ [page 135](#) .
- Remove timing chains from camshafts ⇒ [page 143](#) .

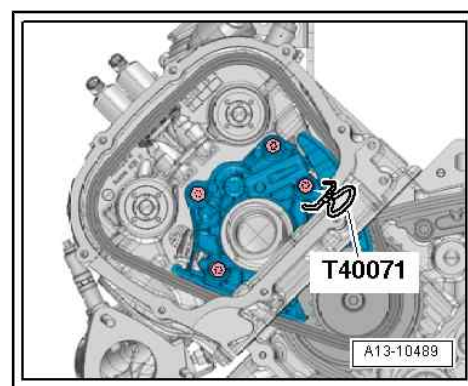


### Caution

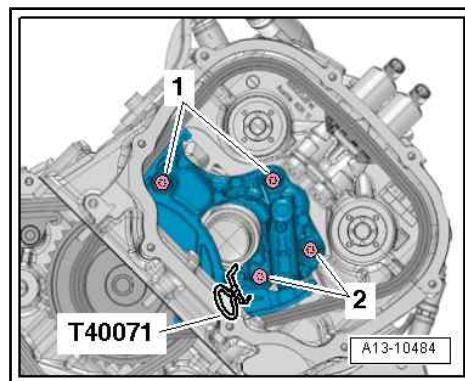
***If a used timing chain rotates in the opposite direction when it is refitted, this can cause breakage.***

- ◆ ***Mark running direction of timing chains (left and right) with paint for re-installation. Do not mark timing chain by means of centre punch, notch or the like.***

- Remove locking pin - T40071- and detach camshaft timing chain (left-side).



- Remove bolts -1- and -2- and take off chain tensioner (right-side).



- Press guide rail of chain tensioner for drive chain for valve gear in direction of -arrow- and lock chain tensioner by inserting locking pin - T40071- .
- Slacken off bolt -1- for drive sprocket approx. 1 turn.
- Tilt drive sprocket with bearing mounting slightly to one side and lift off camshaft timing chain (right-side).

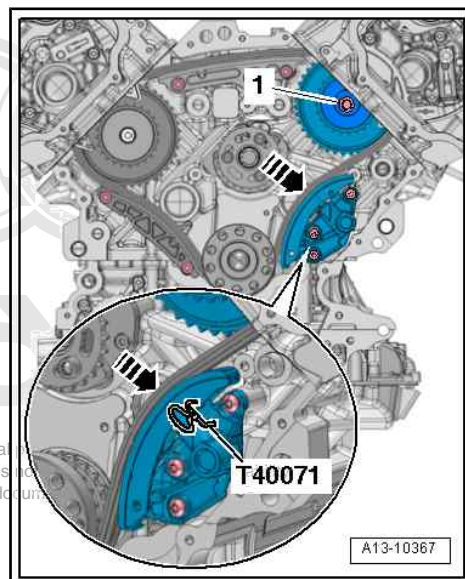
#### Installing

- Tightening torque ⇒ [page 140](#)



#### Note

- ♦ *Note the correct installation position if the tensioning element has been removed from the chain tensioner: drilling in base of housing faces chain tensioner and piston faces tensioner rail.*
- ♦ *Renew the bolts tightened with specified tightening angle.*

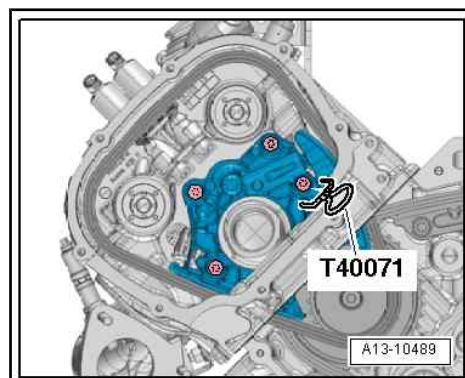


#### Caution

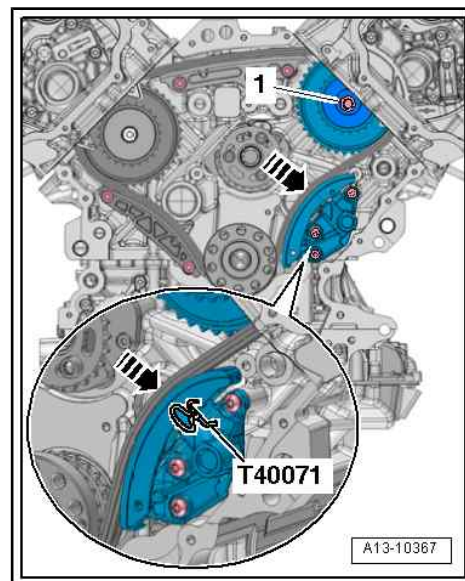
**Risk of damage to valves and piston crowns.**

- ♦ *The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.*

- Position timing chain (left-side) as shown in the illustration (according to marks applied during removal).
- Press down guide rail of chain tensioner for timing chain (left-side) and lock chain tensioner by inserting locking pin - T40071- .



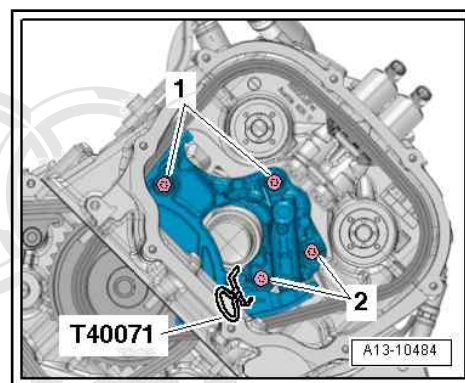
- Guide timing chain (right-side) past bearing mounting for drive sprocket (note marks applied when removing).
- Tighten bolt -1- for bearing mounting.
- Remove locking pin - T40071- .



- Fit chain tensioner on cylinder head (right-side) and position timing chain.
- Tighten bolts -1- and -2-.

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

- Fit timing chains on camshafts ⇒ [page 147](#) .
- Install timing chain cover (bottom) ⇒ [page 135](#) .
- Install crankshaft oil seal (gearbox end) ⇒ [page 115](#) .
- Install oil filter housing ⇒ [page 229](#) .
- Install intake manifold (top section) ⇒ Rep. gr. 24 .
- Install timing chain covers (left and right) ⇒ [page 133](#) .
- Install cylinder head cover: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 107](#) and pressure plate ⇒ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 112](#) and damper unit ⇒ [page 111](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 114](#) .
- Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Fill up with engine oil and check oil level ⇒ [page 237](#) .



## 1.7 Exploded view - drive chain for valve gear

**1 - Guide rail**
**2 - Bolt**

- ☐ Renew
- ☐ 10 Nm + turn 90° further

**3 - Bolt**

- ☐ Renew
- ☐ 6 Nm + turn 60° further

**4 - Thrust washer for drive sprocket**
**5 - Drive sprocket for timing chain (left-side)**
**6 - Bolt**

- ☐ Renew
- ☐ 10 Nm + turn 90° further

**7 - Drive chain for valve gear**

- ☐ Removing and installing  
⇒ [page 155](#)

**8 - Guide rail**
**9 - Bolt**

- ☐ Renew
- ☐ 10 Nm + turn 90° further

**10 - Bolt**

- ☐ Renew
- ☐ 8 Nm + turn 45° further

**11 - Bearing bracket for drive sprocket**

- ☐ For camshaft timing chain (right-side)
- ☐ Asymmetric version
- ☐ Installation position ⇒ [page 155](#)

**12 - Thrust washer**

- ☐ Asymmetric version
- ☐ Installation position ⇒ [page 155](#)

**13 - Drive sprocket for timing chain (right-side)**

- ☐ Installation position ⇒ [page 155](#)

**14 - Bearing mounting for drive sprocket**

- ☐ Asymmetric version
- ☐ Installation position ⇒ [page 155](#)

**15 - Bolt**

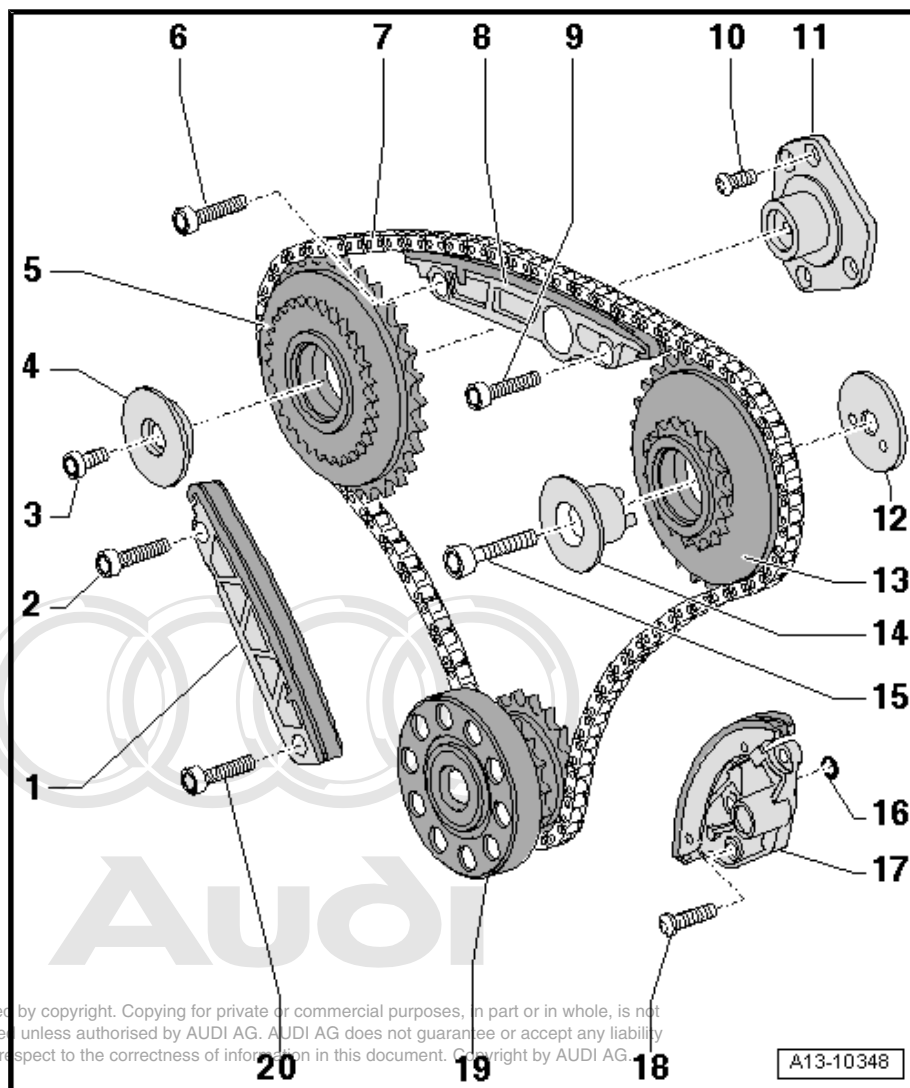
- ☐ Tightening torque ⇒ [page 141](#)

**16 - O-ring**

- ☐ Renew

**17 - Chain tensioner**
**18 - Bolt**

- ☐ 9 Nm



A13-10348

## 19 - Crankshaft

### 20 - Bolt

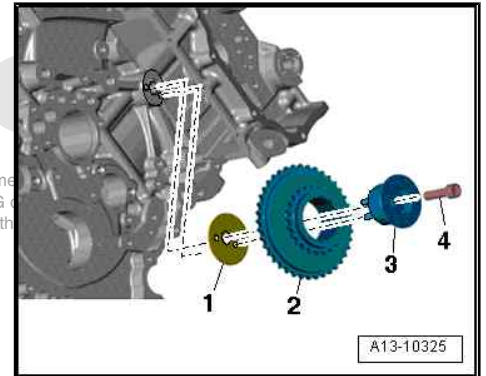
- ☐ Renew
- ☐ 10 Nm + turn 90° further

#### Installation position: bearing mounting for drive sprocket for camshaft timing chain (right-side)

- Dowel pins in bearing mounting -3- for drive sprocket for camshaft timing chain (right-side) must engage in drillings in thrust washer -1- and in cylinder block drillings.

#### 2 - Drive sprocket for camshaft timing chain (right-side)

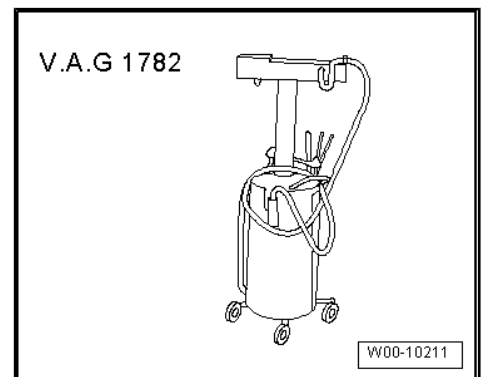
#### 4 - Bolt



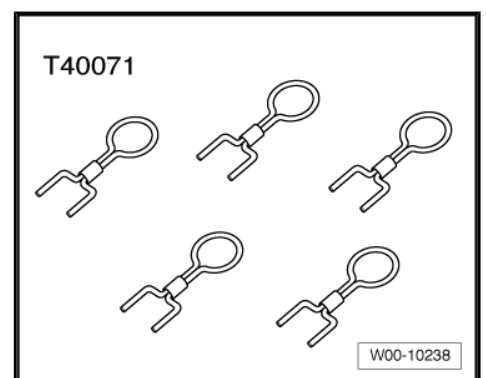
## 1.8 Removing and installing drive chain for valve gear

#### Special tools and workshop equipment required

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



- ◆ Locking pin - T40071-



#### Removing



#### WARNING

#### Injury risk.

- ◆ *The lock carrier must be installed and the torque reaction support must be secured.*

- Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Vehicles with manual gearbox: remove clutch pressure plate  
⇒ Rep. gr. 30 and dual-mass flywheel ⇒ [page 107](#) .
- Vehicles with multitronic gearbox: Remove damper unit  
⇒ [page 111](#) and flywheel ⇒ [page 112](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate  
⇒ [page 114](#) .
- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.
- Remove timing chain covers (left and right) ⇒ [page 130](#) .
- Remove timing chain cover (bottom) ⇒ [page 135](#) .
- Remove timing chains from camshafts ⇒ [page 143](#) .
- Remove drive chain for auxiliary drives ⇒ [page 158](#) .
- Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting locking pin - T40071- .



### Caution

*If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.*

- ◆ *Mark running direction of drive chain with paint for re-installation. Do not mark drive chain by means of centre punch, notch or the like.*

- Unscrew bolts -1- and remove guide rail.
- Unscrew bolts -2- and remove chain tensioner.
- Detach drive chain for valve gear.

### Installing

- Tightening torques ⇒ [page 153](#)

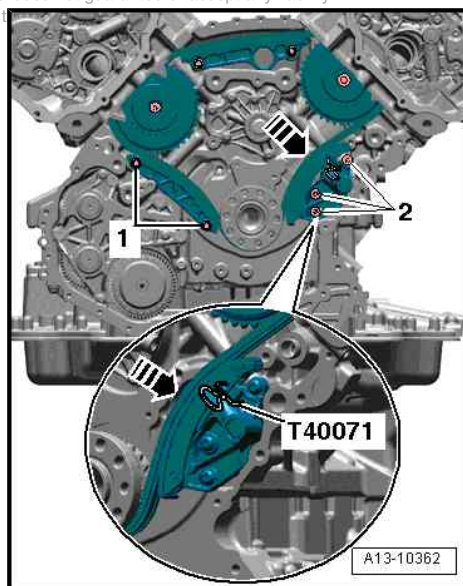
Installation is carried out in the reverse order; note the following:



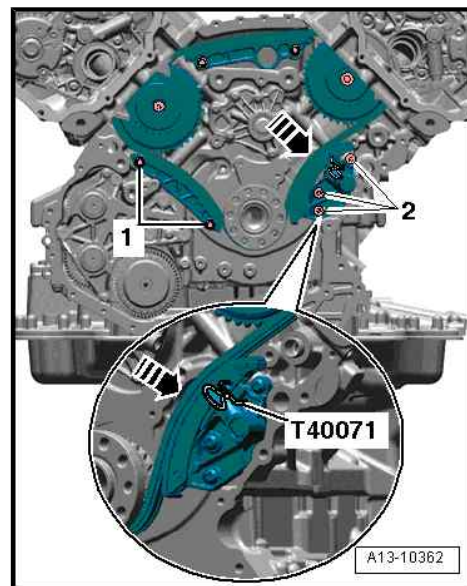
### Note

*Renew the bolts tightened with specified tightening angle.*

- Position drive chain for valve gear onto drive chain sprockets (according to marks applied when removing).



- Install guide rail and tighten bolts -1-.
- Install chain tensioner and tighten bolts -2-.
- Push guide rail of chain tensioner for drive chain in direction of -arrow- and pull locking pin - T40071- out of chain tensioner.
- Install drive chain for auxiliary drives ➔ [page 158](#) .
- Fit timing chains on camshafts ➔ [page 147](#) .
- Install timing chain cover (bottom) ➔ [page 135](#) .
- Install timing chain covers (left and right) ➔ [page 130](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ➔ [page 107](#) and pressure plate ➔ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ➔ [page 112](#) and damper unit ➔ [page 111](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ➔ [page 114](#) .
- Install gearbox ➔ Rep. gr. 34 or ➔ Rep. gr. 37 .
- Fill up with engine oil and check oil level ➔ [page 237](#) .



## 1.9 Exploded view - drive chain for auxiliary drives

### 1 - Crankshaft

### 2 - Drive chain for auxiliary drives

- ☐ Before removing, mark running direction with paint
- ☐ Removing and installing ➔ [page 158](#)

### 3 - Drive chain sprocket for oil pump

- ☐ Installation position:  
Side with lettering faces engine

### 4 - Bolt

- ☐ Renew
- ☐ 30 Nm + turn 90° further

### 5 - Compression spring

### 6 - Bolt

- ☐ Renew
- ☐ 15 Nm + turn 90° further

### 7 - Chain sprocket for balance shaft

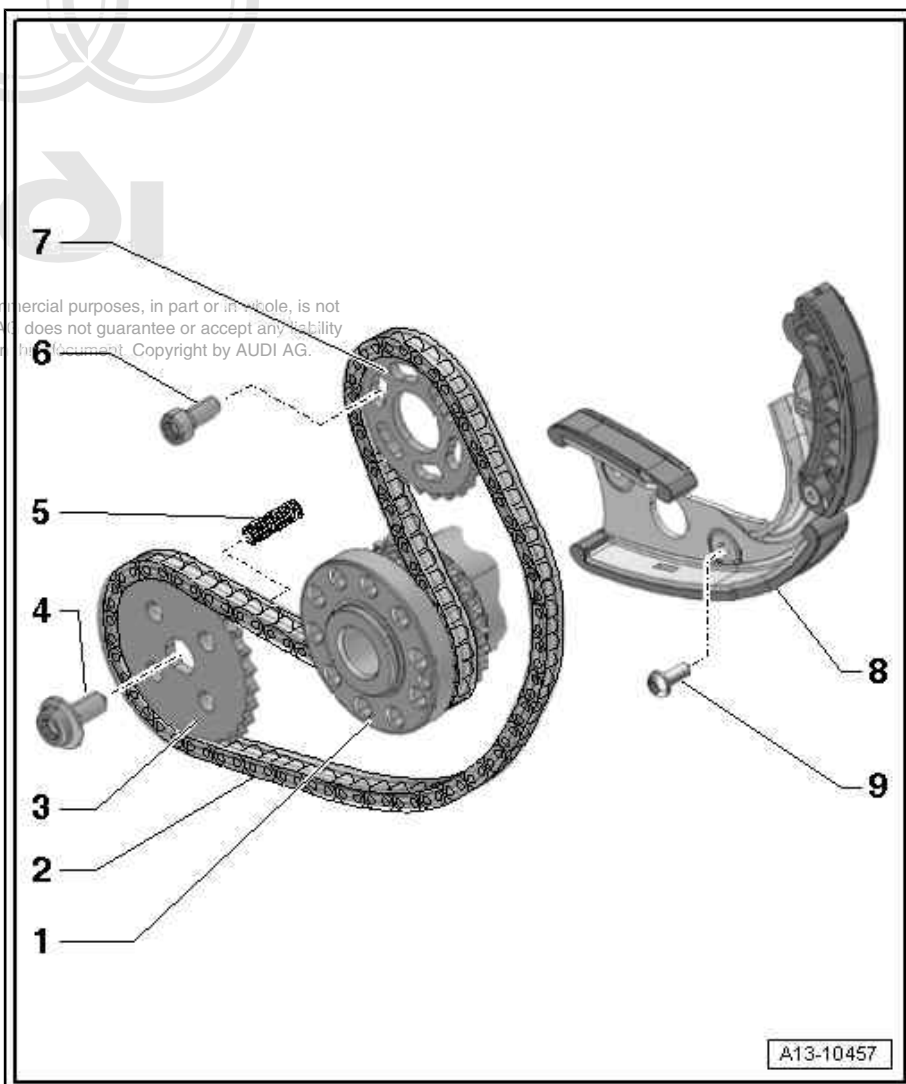
- ☐ Installation position:  
Side with lettering faces gearbox

### 8 - Chain tensioner

- ☐ With guide rail

### 9 - Bolt

- ☐ Renew
- ☐ 10 Nm + turn 45° further

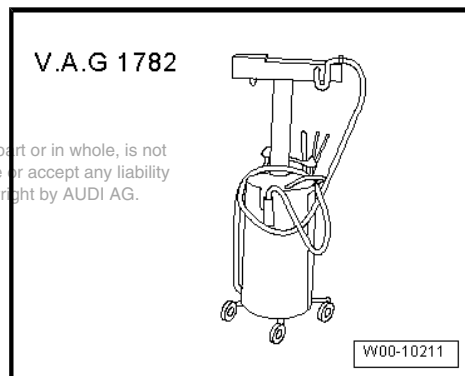


## 1.10 Removing and installing drive chain for auxiliary drives

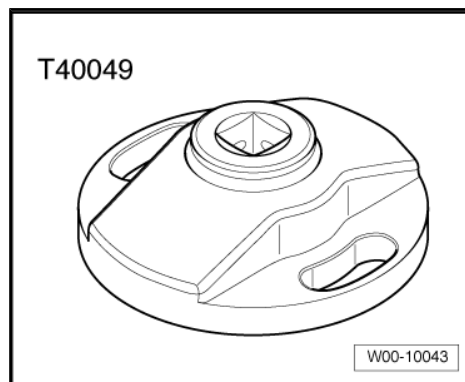
### Special tools and workshop equipment required

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

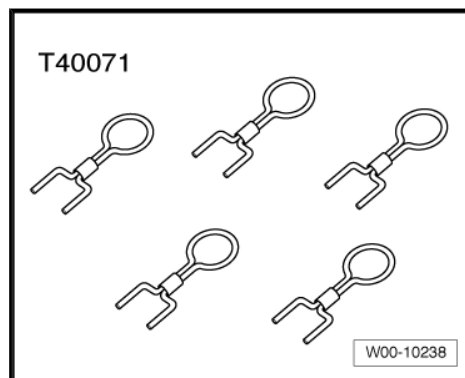
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- ◆ Special wrench - T40049-



- ◆ Locking pin - T40071-



- ◆ Drill bit, Ø 8 mm

### Removing



#### WARNING

*Injury risk.*

- ◆ *The lock carrier must be installed and the torque reaction support must be secured.*

- Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. gr. 30 and dual-mass flywheel ⇒ [page 107](#) .

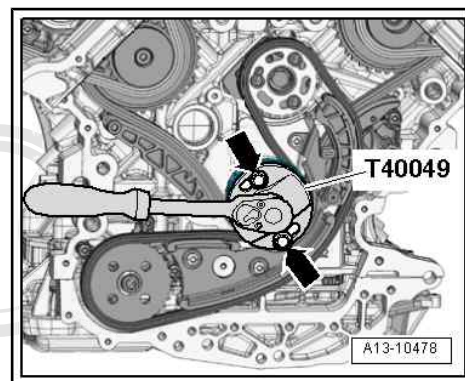
- Vehicles with multitronic gearbox: Remove damper unit  
⇒ [page 111](#) and flywheel ⇒ [page 112](#).
- Vehicles with automatic gearbox 09L: Remove drive plate  
⇒ [page 114](#).
- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.
- Remove timing chain cover (bottom) ⇒ [page 135](#).

**Caution**

***Make sure drive chain is not damaged.***

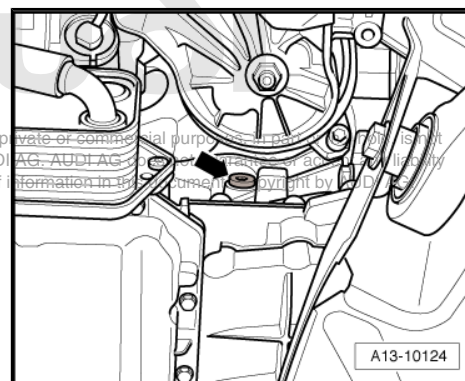
- ◆ ***Place a washer under the bolt heads to make sure the drive chain does not get trapped by the bolts.***

- Attach special wrench - T40049- at rear end of crankshaft using two old securing bolts for dual-mass flywheel.

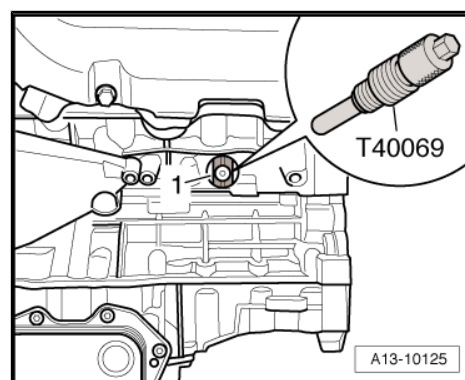


- Unscrew plug -arrow- for "TDC" marking from sump (top section).
- Turn crankshaft in normal direction of rotation to "TDC" position.

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- Screw locking pin - T40069- into bore (tightening torque: 20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



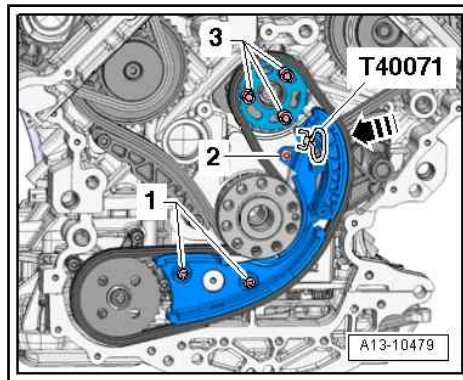
- Press guide rail of chain tensioner in direction of -arrow- and lock chain tensioner by inserting locking pin - T40071- .



### Caution

*If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.*

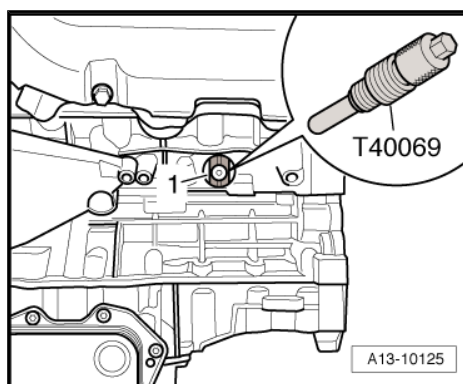
- ◆ **Mark running direction of drive chain with paint for re-installation. Do not mark drive chain by means of centre punch, notch or the like.**



- Unscrew bolts -3- and detach chain sprocket from balance shaft.
- Remove bolts -1- and -2- and take off chain tensioner with chain.

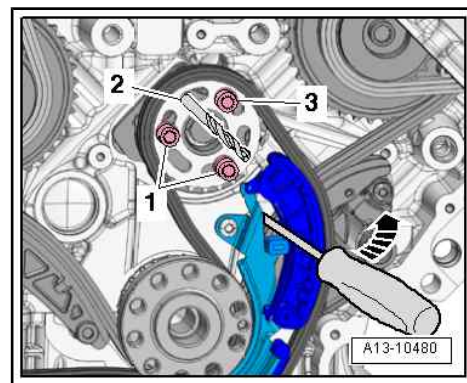
### Installing

- Tightening torques ⇒ [page 153](#) , ⇒ [page 216](#) .
- Crankshaft -1- locked in “TDC” position with locking pin - T40069- .



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- Install chain tensioner with chain and balance shaft sprocket.
- Wrap insulating tape around tip and shaft of 8 mm Ø drill bit to avoid cuts.
- Lock balance shaft in “TDC” position with 8 mm Ø drill bit -item 2-.
- The elongated holes in the balance shaft sprocket must be aligned centrally over the threaded holes in the balance shaft. If necessary move chain one tooth further.
- Tighten bolts for chain tensioner.
- Fit bolts -1- and -3- for chain sprocket but do not tighten.
- It should just be possible to turn the sprocket on the balance shaft without axial movement.
- Pull locking pin - T40071- out to release chain tensioner.
- Press against guide rail of chain tensioner -arrow- using a screwdriver, and at the same time tighten bolts -1- and -3- securing chain sprocket.
- Pull drill bit -2- out of balance shaft.



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

- Install timing chain cover (bottom) ⇒ [page 135](#) .
- Install timing chain covers (left and right) ⇒ [page 130](#) .
- Install crankshaft oil seal (gearbox end) ⇒ [page 115](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 107](#) and pressure plate ⇒ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 112](#) and damper unit ⇒ [page 111](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 114](#) .
- Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Fill up with engine oil and check oil level ⇒ [page 237](#) .

## 1.11 Exploded view - balance shaft

## 1 - Balance shaft

- ☐ Removing and installing  
⇒ [page 162](#)

## 2 - Bolt

- ☐ 60 Nm
- ☐ Use  $\varnothing$  8 mm drill bit as counterhold when loosening and tightening

## 3 - Balance weight (gearbox end)

- ☐ Can only be fitted on balance shaft in one position.

## 4 - Bearing plate

## 5 - Bolt

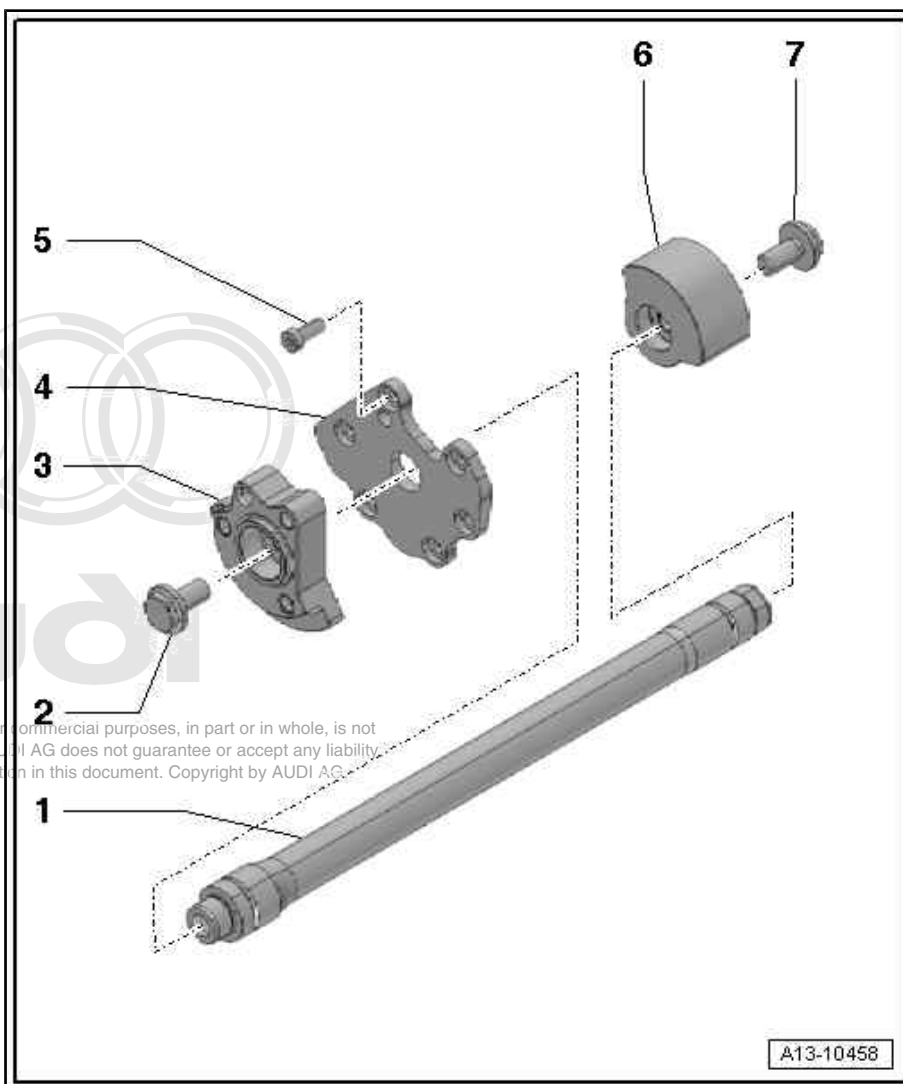
- ☐ 13 Nm
- ☐ Property class 10.9

## 6 - Balance weight (pulley end)

- ☐ Can only be fitted on balance shaft in one position.

## 7 - Bolt

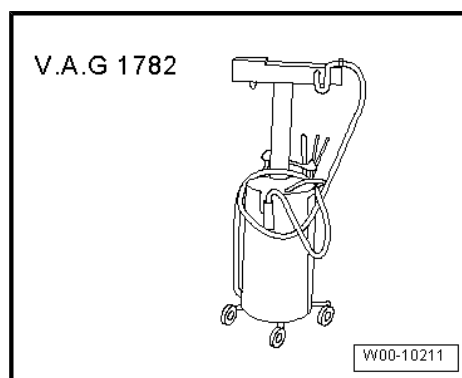
- ☐ 60 Nm
- ☐ Use  $\varnothing$  8 mm drill bit as counterhold when loosening and tightening



## 1.12 Removing and installing balance shaft

### Special tools and workshop equipment required

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



## Removing

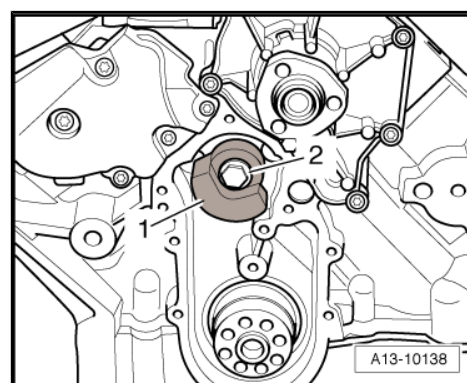
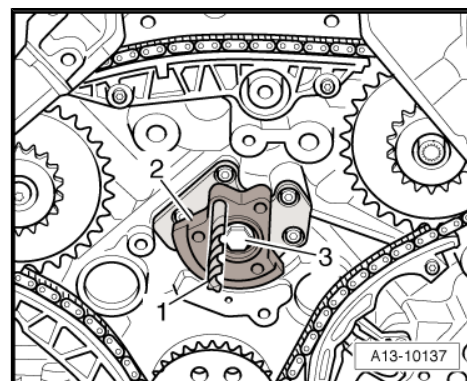


### WARNING

#### *Injury risk.*

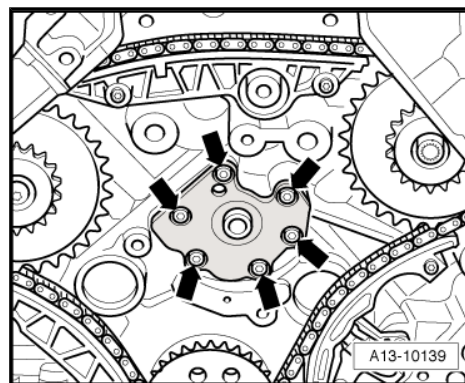
- ◆ *The lock carrier must be installed and the torque reaction support must be secured.*

- Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. gr. 30 and dual-mass flywheel ⇒ [page 107](#) .
- Vehicles with multitronic gearbox: Remove damper unit ⇒ Rep. gr. 13 and flywheel ⇒ [page 112](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate ⇒ [page 114](#) .
- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.
- Remove sealing flange (pulley end) ⇒ [page 102](#) .
- Remove timing chain cover (bottom) ⇒ [page 135](#) .
- Remove drive chain for auxiliary drives ⇒ [page 158](#) .
- Wrap insulating tape around tip and shaft of 8 mm Ø drill bit to avoid cuts.
- Hold balance weight -2- in position at rear of engine using Ø 8 mm drill bit -item 1-.
- Unscrew bolt -3- and detach balance weight from balance shaft.



- Unscrew bolt -2- (counterhold balance weight -1- with a suitable pin) and detach balance weight at front of engine from balance shaft.

- Unscrew bolts -arrows- and detach bearing plate for balance shaft at rear of engine.
- Pull balance shaft to rear out of cylinder block.



### Installing

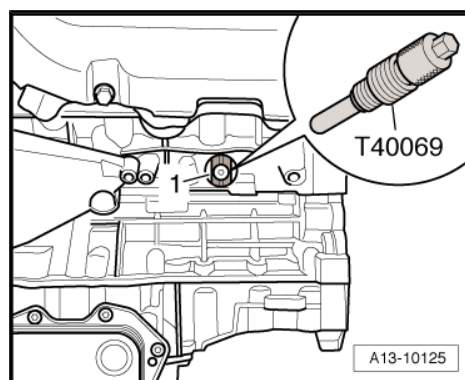
- Tightening torques ⇒ [page 161](#) , ⇒ [page 216](#) .
- Crankshaft -1- locked in "TDC" position with locking pin - T40069- .

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



### Note

*Balance weights can only be fitted on balance shaft in one position.*



- Install drive chain for auxiliary drives ⇒ [page 158](#) .
- Install timing chain cover (bottom) ⇒ [page 135](#) .
- Install sealing flange (pulley end) ⇒ [page 102](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 107](#) and pressure plate ⇒ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 112](#) and damper unit ⇒ Rep. gr. 13 .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 114](#) .
- Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Fill up with engine oil and check oil level ⇒ [page 237](#) .



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## 2 Removing and installing cylinder head

⇒ "2.1 Exploded view - cylinder head", page 165

⇒ "2.2 Removing and installing cylinder head cover (left-side)", page 168

⇒ "2.3 Removing and installing cylinder head cover (right-side)", page 170

⇒ "2.4 Removing and installing cylinder heads", page 173

⇒ "2.5 Checking compression", page 190

### 2.1 Exploded view - cylinder head



#### Note

- ◆ The diagram shows the cylinder head on cylinder bank 2 (left-side).
- ◆ Both cylinder heads can be removed and installed with the engine still installed.

#### 1 - Cylinder head gasket

- ☐ Renewing  
⇒ "2.4 Removing and installing cylinder heads", page 173
- ☐ Installation position: part number must face cylinder head
- ☐ If renewed, change coolant and engine oil

#### 2 - Cylinder head

- ☐ Removing ⇒ page 173
- ☐ ⇒ Fig. "Checking cylinder head for distortion", page 167
- ☐ ⇒ Fig. "Cylinder head machining limit", page 168
- ☐ Installing ⇒ page 184
- ☐ If renewed, change coolant and engine oil

#### 3 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 47

#### 4 - Vacuum pump

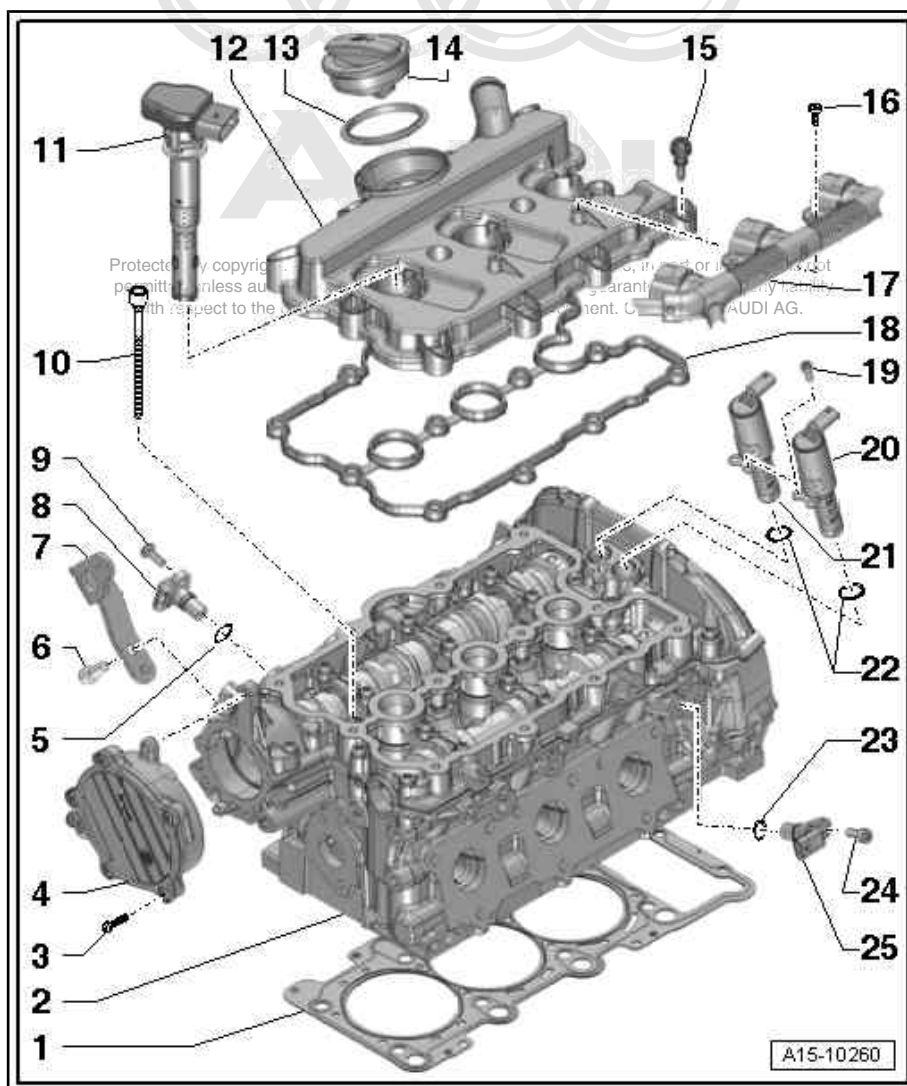
- ☐ Removing and installing ⇒ Rep. gr. 47

#### 5 - O-ring

- ☐ Renew

#### 6 - Bolt

- ☐ 20 Nm





## 7 - Lifting eye

## 8 - Hall sender for inlet camshaft

- ☐ Cylinder bank 1 (right-side): Hall sender - G40-
- ☐ Cylinder bank 2 (left-side): Hall sender 2 - G163-

## 9 - Bolt

- ☐ Renew
- ☐ 8 Nm + turn 90° further

## 10 - Bolt

- ☐ Procedure when loosening ⇒ [page 177](#) .
- ☐ Renew
- ☐ Procedure when tightening ⇒ [page 185](#) .
- ☐ Tighten in three stages:
  1. Tighten to 40 Nm
  2. Turn 90° further
  3. Turn 90° further

## 11 - Ignition coil

- ☐ Remove with puller - T40039-

## 12 - Cylinder head cover

- ☐ Removing and installing: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#)

## 13 - Seal

- ☐ Renew if damaged or leaking

## 14 - Filler cap

## 15 - Bolt

- ☐ Renew if seal is damaged
- ☐ Tightening torque and sequence  
⇒ [Fig. "Cylinder head cover \(left-side\) - tightening torque and sequence"](#) , [page 167](#) or  
⇒ [Fig. "Cylinder head cover \(right-side\) - tightening torque and sequence"](#) , [page 167](#)

## 16 - Bolt

## 17 - Connector rail

- ☐ For ignition coils

## 18 - Gasket for cylinder head cover

- ☐ Renew if damaged or leaking

## 19 - Bolt

- ☐ 2.5 Nm

## 20 - Solenoid valve for camshaft control (exhaust side)

- ☐ Cylinder bank 1 (right-side): exhaust camshaft control valve 1 - N318-
- ☐ Cylinder bank 2 (left-side): exhaust camshaft control valve 2 - N319-

## 21 - Solenoid valve for camshaft control (inlet side)

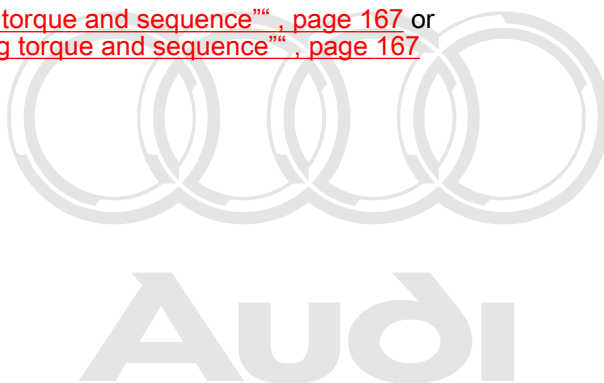
- ☐ Cylinder bank 1 (right-side): camshaft control valve 1 - N205-
- ☐ Cylinder bank 2 (left-side): camshaft control valve 2 - N208-

## 22 - O-rings

- ☐ Renew

## 23 - O-ring

- ☐ Renew



## 24 - Bolt

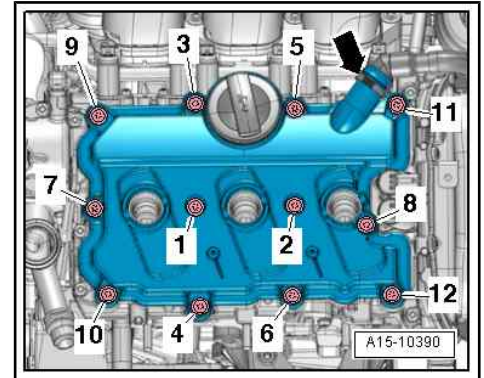
- ☐ Renew
- ☐ 8 Nm + turn 90° further

## 25 - Hall sender for exhaust camshaft

- ☐ Cylinder bank 1 (right-side): Hall sender 3 - G300-
- ☐ Cylinder bank 2 (left-side): Hall sender 4 - G301-

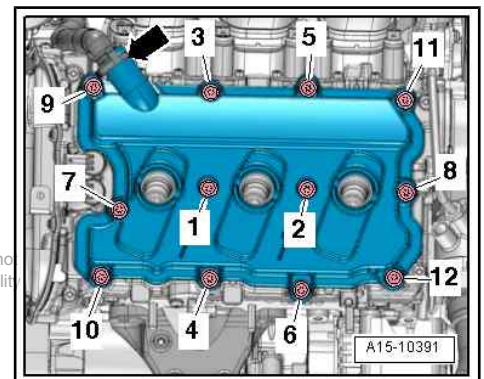
## Cylinder head cover (left-side) - tightening torque and sequence

- Tighten bolts in the sequence -1 ... 12- to 9 Nm.



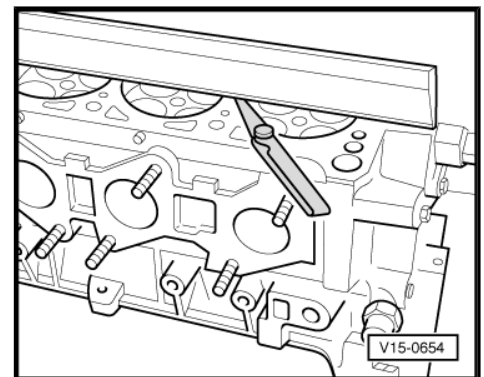
## Cylinder head cover (right-side) - tightening torque and sequence

- Tighten bolts in the sequence -1 ... 12- to 9 Nm.



## Checking cylinder head for distortion

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

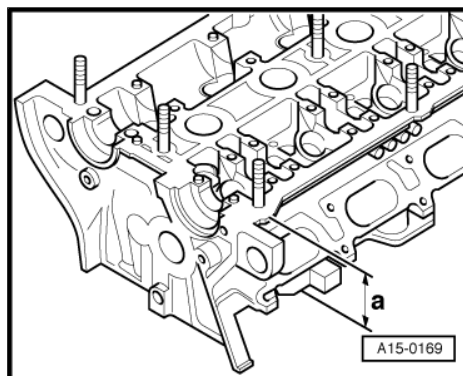


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## Cylinder head machining limit

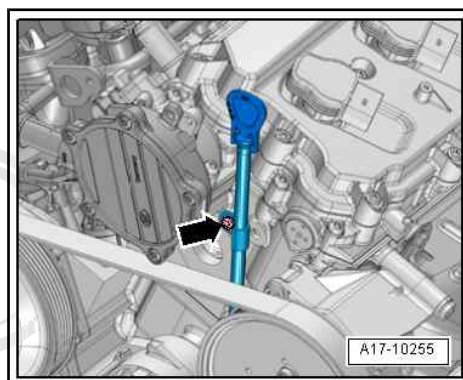
Machining of the cylinder head (surface grinding) is only permissible down to the minimum dimension -a-.

- Minimum dimension: -a- = 139.20 mm



## Guide tube for oil dipstick - tightening torque

- Tighten bolt -arrow- to 9 Nm.



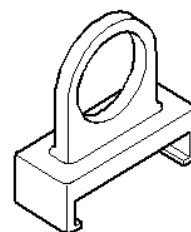
## 2.2 Removing and installing cylinder head cover (left-side)

### Special tools and workshop equipment required

- ♦ Puller - T40039-

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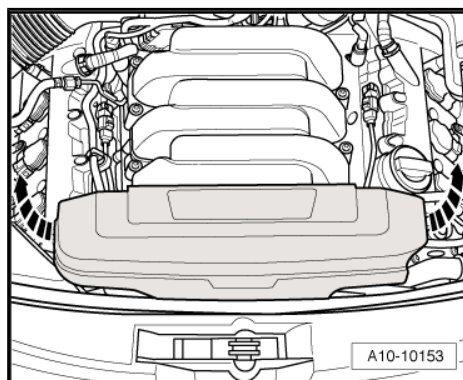
T40039



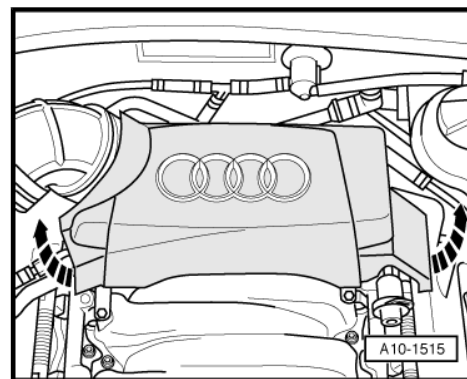
W00-1303

### Removing

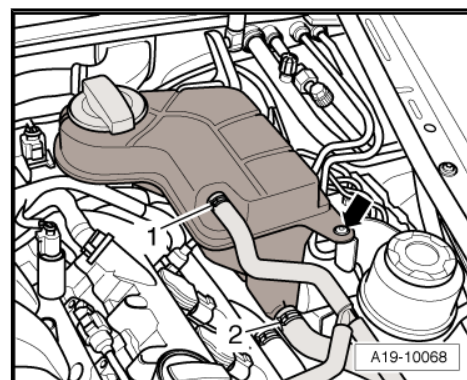
- Pull off engine cover panel (front) -arrows-.



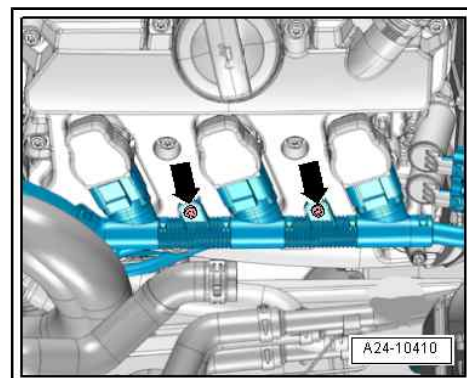
- Pull off engine cover panel (rear) -arrows-.



- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.

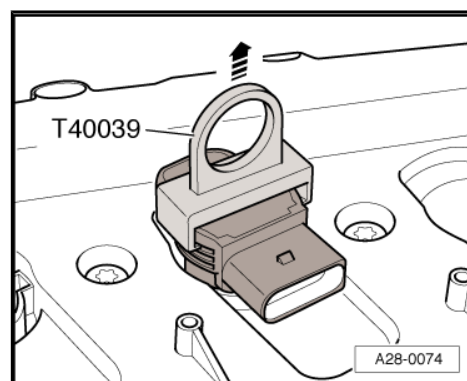


- Remove bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (left-side).
- Move wiring harness clear to the side.



- Pull ignition coils out with puller - T40039- .

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### Rest-of-world vehicles:

- Disconnect crankcase breather hose -arrow- by pressing release tabs.
- Unscrew bolts for cylinder head cover (left-side) in the sequence -12 ... 1- and remove cylinder head cover.

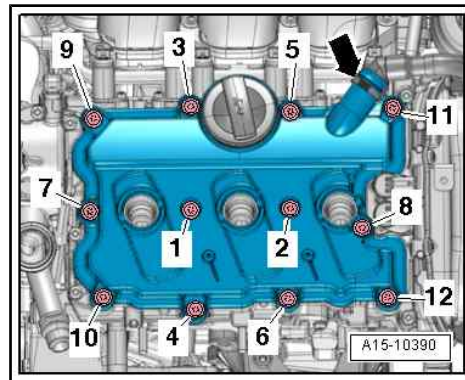
### USA models:



#### Caution

*Risk of violating emission legislation applying to USA models.*

- ◆ **Do NOT open hose connection -arrow-.**



- Remove bolts for cylinder head cover (left-side) in the sequence -12 ... 1- and move cylinder head cover clear to one side (crankcase breather hose -arrow- remains connected).

### Installing

- Tightening torque ⇒ [page 167](#)

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



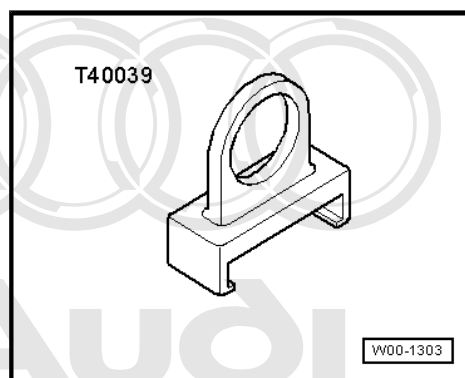
#### Note

- ◆ *Renew cylinder head cover gaskets if damaged.*
- ◆ *Renew cylinder head cover bolt if seal on bolt is damaged.*
- Clean sealing surfaces; they must be free of oil and grease.
- Tighten bolts for cylinder head cover (left-side) in the sequence -1 ... 12- ⇒ [page 167](#).

## 2.3 Removing and installing cylinder head cover (right-side)

### Special tools and workshop equipment required

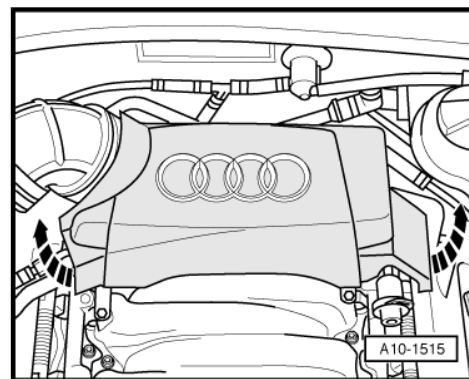
- ◆ Puller - T40039-



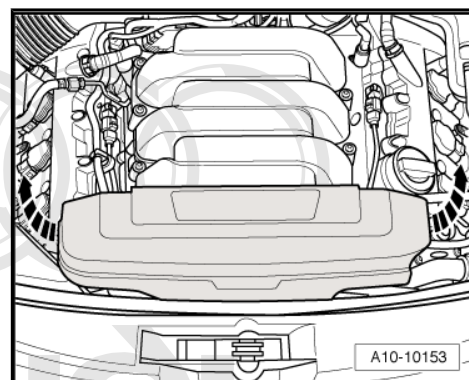
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**Removing**

- Pull off engine cover panel (rear) -arrows-.

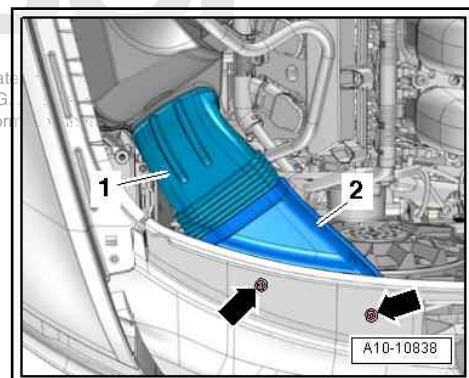


- Pull off engine cover panel (front) -arrows-.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

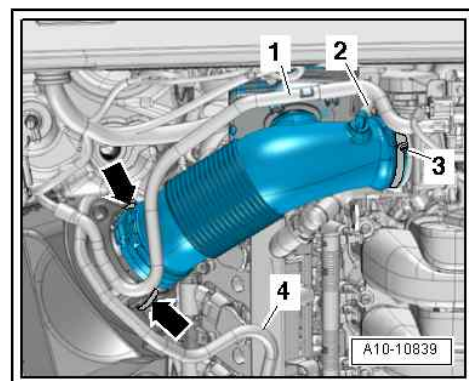
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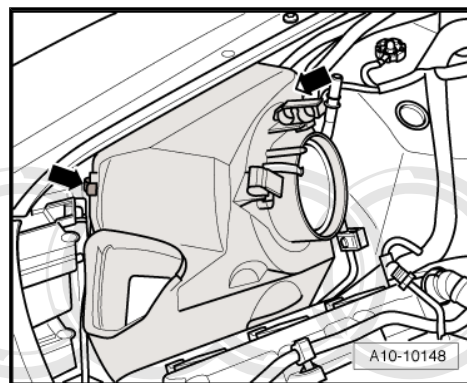
- Move line -1- leading to activated charcoal filter clear.
- Detach vacuum hose -2- from air hose.
- Remove air hose. To do so, release hose clip -3- and clamps -arrows-.

**Note**

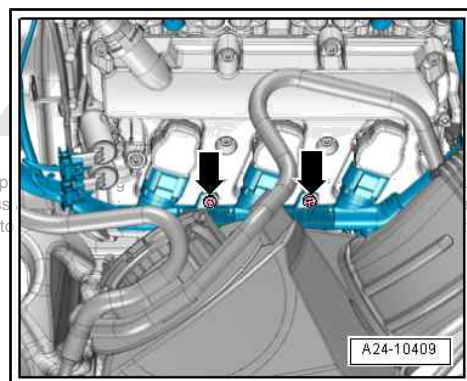
*Disregard item -4-.*



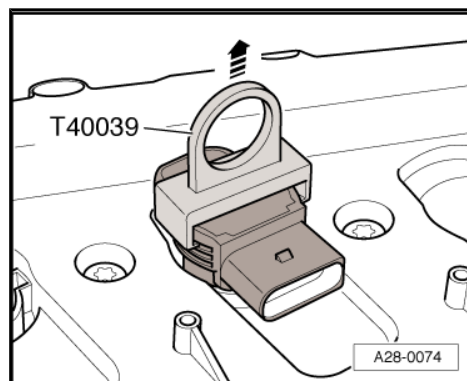
- Release clamps -arrows- and detach air cleaner (top section).



- Remove bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (right-side).
- Move wiring harness clear to the side.



- Pull ignition coils out with puller - T40039- .



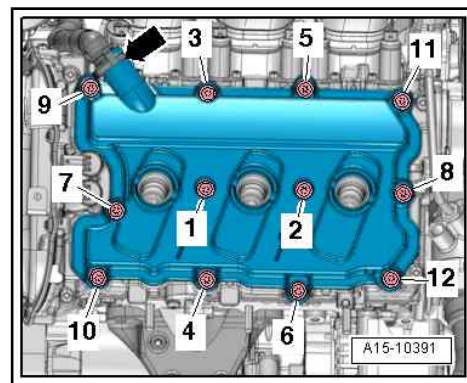
**Rest-of-world vehicles:**

- Disconnect crankcase breather hose -arrow- by pressing release tabs.
- Unscrew bolts for cylinder head cover (right-side) in the sequence -12 ... 1- and remove cylinder head cover.

**USA models:****Caution**

*Risk of violating emission legislation applying to USA models.*

- ◆ *Do NOT open hose connection -arrow-.*



- Remove bolts for cylinder head cover (right-side) in the sequence -12 ... 1- and move cylinder head cover clear to one side (crankcase breather hose -arrow- remains connected).

**Installing**

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- Tightening torque [⇒ page 167](#)

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

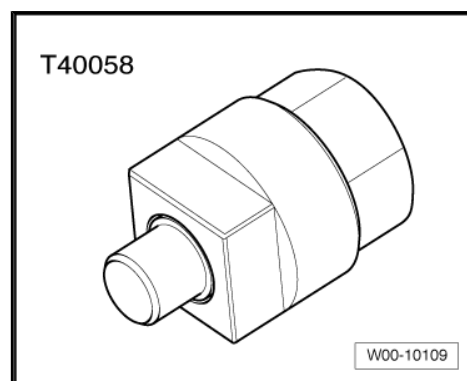
**Note**

- ◆ *Renew cylinder head cover gaskets if damaged.*
- ◆ *Renew cylinder head cover bolt if seal on bolt is damaged.*
- Clean sealing surfaces (top and bottom); they must be free of oil and grease.
- Tighten bolts for cylinder head cover (right-side) in the sequence -1 ... 12- [⇒ page 167](#).

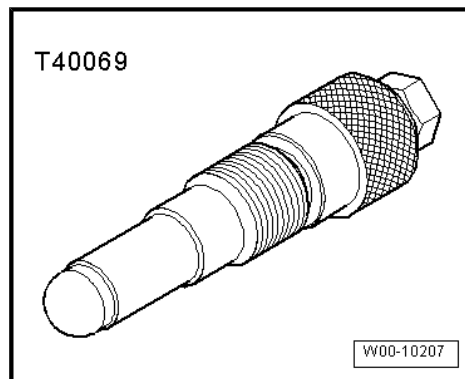
## 2.4 Removing and installing cylinder heads

### Special tools and workshop equipment required

- ◆ Adapter - T40058-



- ◆ Locking pin - T40069-



- ◆ Camshaft clamp - T40133-

### Removing

- Engine in vehicle.



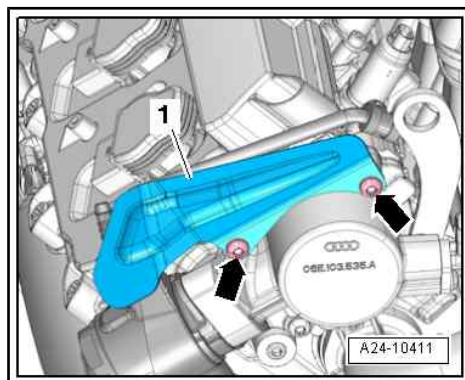
### Note

- ◆ The following chapter describes how to remove both cylinder heads together.

- ◆ If only one of the cylinder heads is to be removed, refer to the corresponding procedure described in this chapter.

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- Drain off coolant ⇒ [page 241](#) .
- Remove front exhaust pipe: left-side ⇒ [page 272](#) , right-side ⇒ [page 275](#) .
- Remove poly V-belt ⇒ [page 101](#) .
- Remove coolant pipe (front) ⇒ [page 251](#) .
- Remove intake manifold (top section) ⇒ Rep. gr. 24 .
- Remove both intake manifold bottom sections ⇒ Rep. gr. 24 .
- Unplug electrical connectors at injectors.
- Remove guard plate -1- for high-pressure pipe -arrows-.

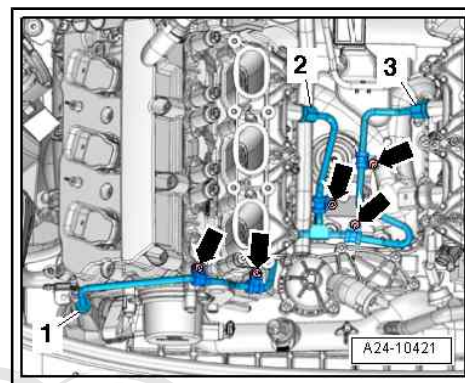


**WARNING**

*The fuel system is pressurised.*

*Risk of injury as fuel may spray out.*

- *Wear safety goggles.*
- *Wear protective gloves.*
- *Release pressure (wrap clean cloth around connection and open connection carefully).*



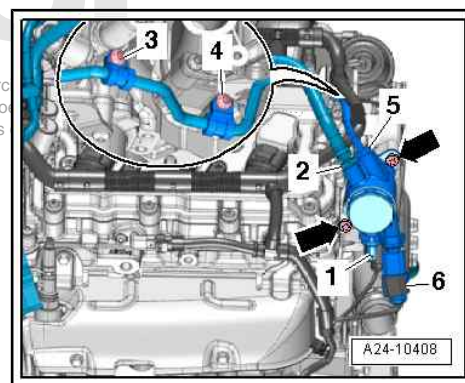
- Unscrew connection -1-.
- Unscrew bolts -arrows- on retaining clips and detach high-pressure pipe.

**Note**

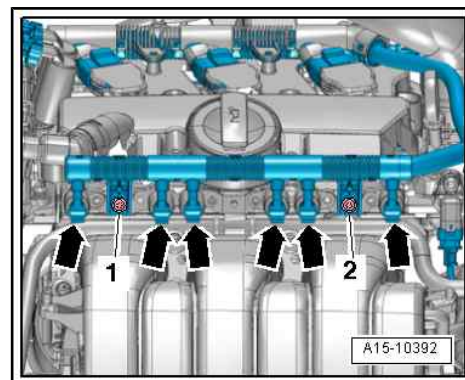
*Disregard -items 2 and 3-.*

- Unscrew connection -2- and move fuel supply hose clear to one side.
- Unplug electrical connectors -1- and -6-.

Disregard items marked -3, 4, 5- and -arrows-.



- Unplug electrical connectors (left and right) -arrows- at actuators for camshaft adjustment.
- Remove bolts -1- and -2- and move wiring harness clear.
- Remove cylinder head cover: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#) .



- Unplug electrical connectors on cylinder head (left-side):

1 - Hall sender 2 - G163-

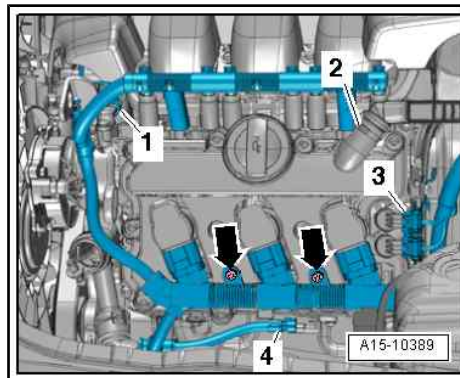
4 - Hall sender 4 - G301-



### Note

Disregard items marked -2- and -arrows-.

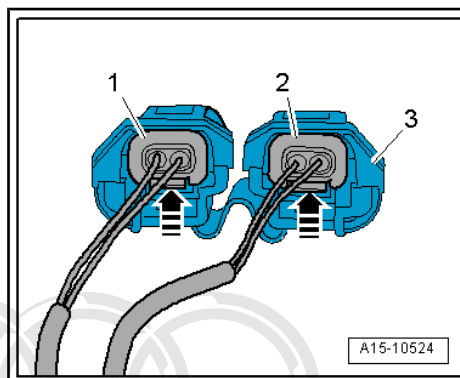
- Unplug electrical connectors -3- on inlet camshaft control valve 2 - N208- and exhaust camshaft control valve 2 - N319- , observing the following note.



### Note

The connecting piece -3- on the electrical connectors -1- and -2- for the camshaft control valves is intended to prevent the connectors from being interchanged by mistake; it should therefore not be separated from the connectors.

- To unplug the connectors, press both catches -arrows- and pull both connectors together off inlet camshaft control valve 2 - N208- and exhaust camshaft control valve 2 - N319- .
- Move electrical wiring harness clear to side.



- Unplug electrical connectors on cylinder head (right-side):

1 - Camshaft control valve 1 - N205- and exhaust camshaft control valve 1 - N318-

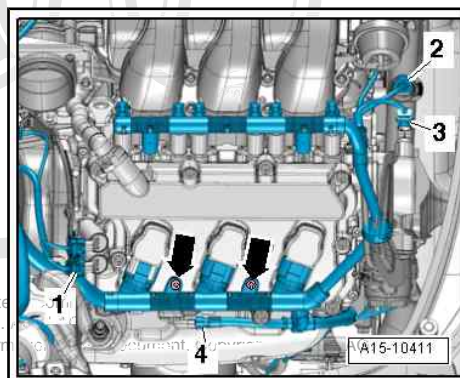
2 - Coolant temperature sender - G62-

3 - Hall sender - G40-

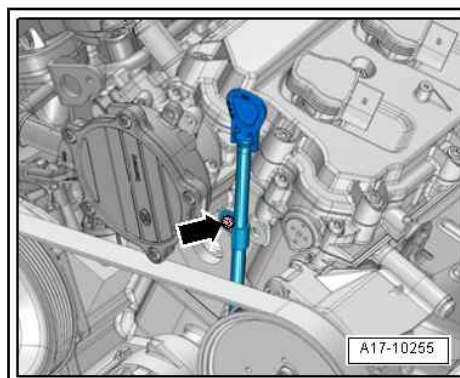
4 - Hall sender 3 - G300-

- Move electrical wiring harness clear to side.

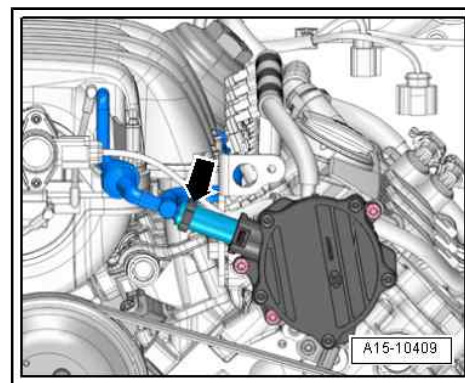
- Remove timing chain covers (left and right) → [page 130](#)



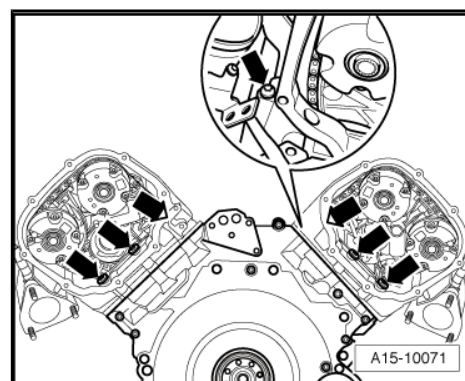
- Remove bolt -arrow- and pull out guide tube with oil dipstick.



- Detach vacuum hose from vacuum pump -arrow- and move clear.



- Unscrew bolts -arrows- at rear of cylinder head.
- ◆ Cylinder head (left-side): 3 bolts
- ◆ Cylinder head (right-side): 4 bolts

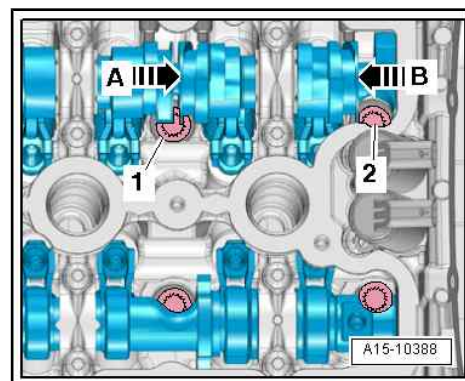


#### Note

- ◆ The cams on the inlet camshaft prevent access to some of the cylinder head bolts – in this example bolts -1- and -2-.
- ◆ Use a plastic wedge to press the slider on the camshaft in direction of -arrow A- to remove bolt -1-.

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- ◆ Use a plastic wedge to press the slider on the camshaft in direction of -arrow B- to remove bolt -2-.



#### Caution

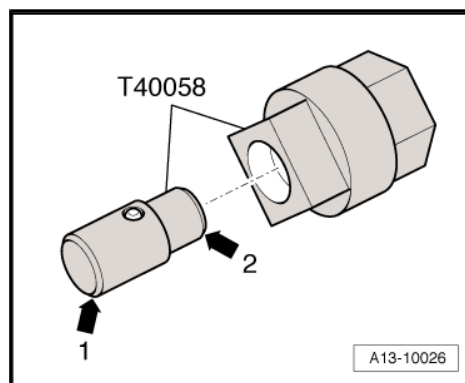
##### Risk of damage.

- ◆ Move the sliders only when the rocker fingers are not under load from the cams (i.e. when they are in contact only with the base of the cam). For this reason it is important to keep to sequence described in the following when loosening the cylinder head bolts.

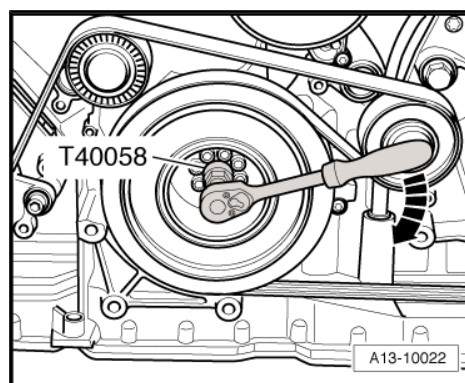
##### Risk of breakage

- ◆ Do not apply pressure to the thin webs when moving the sliders.

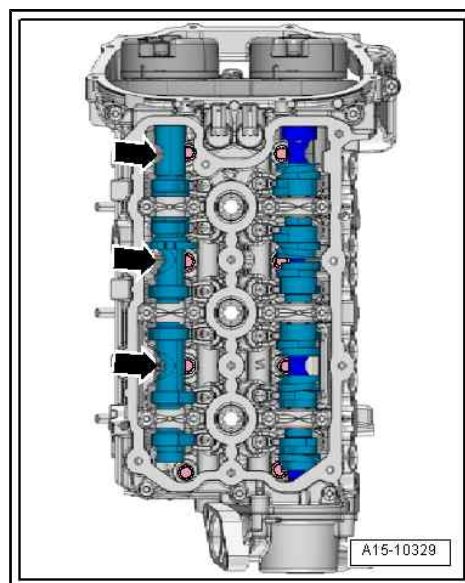
- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.



- Use adapter - T40058- to turn crankshaft in direction of engine rotation -arrow- until the camshaft position shown in the following illustration is attained.



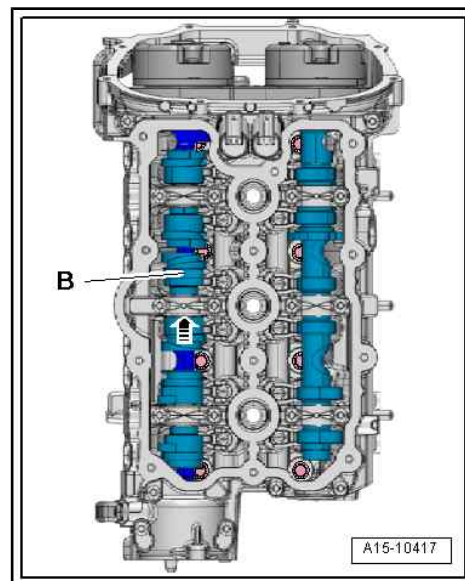
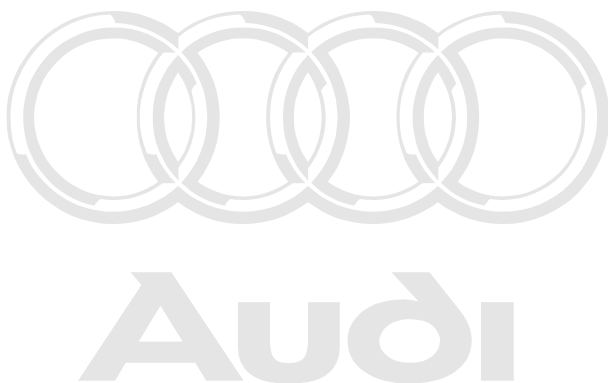
- The recesses -arrows- on the exhaust camshaft must point towards the outside of the engine as shown in the illustration.



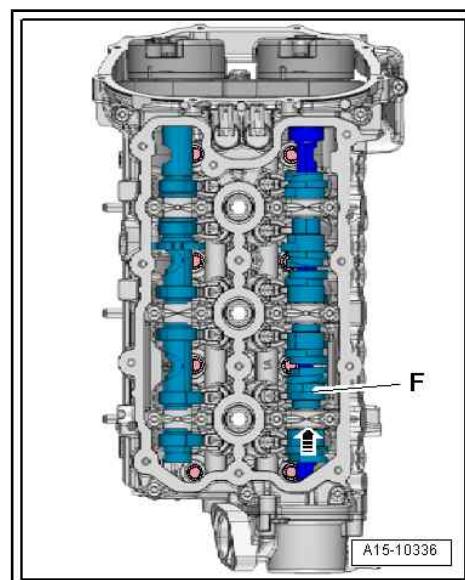
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**Cylinder head (left-side):**

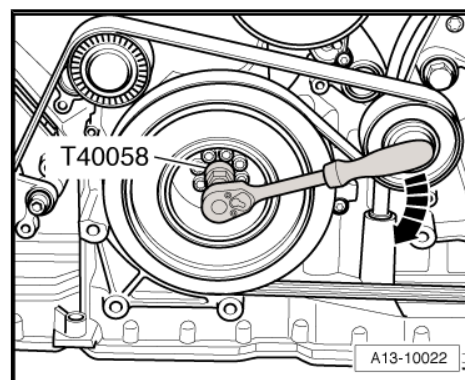
- Press slider -B- as far as stop in direction of -arrow- (slider should not be under load).

**Cylinder head (right-side):**

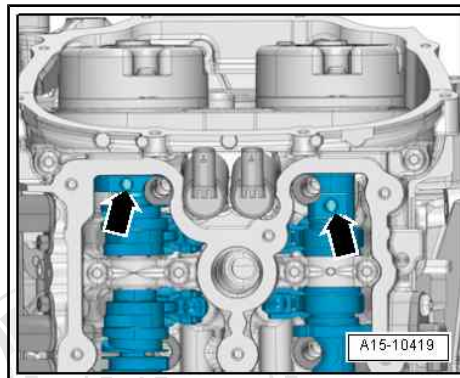
- Press slider -F- as far as stop in direction of -arrow- (slider should not be under load).

**Continued for both cylinder heads:**

- Use adapter - T40058- to turn crankshaft one full turn (360°) in direction of engine rotation -arrow-.

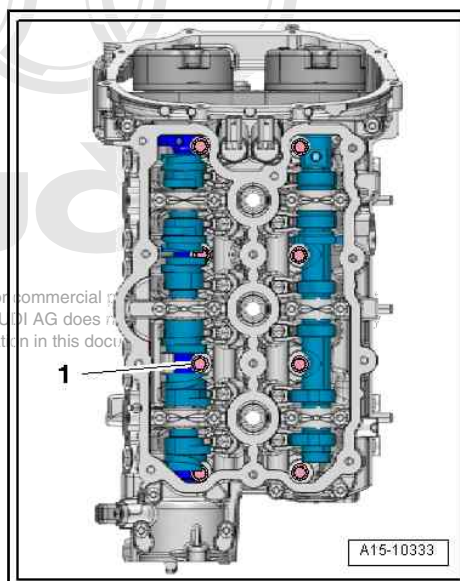


- The threaded holes -arrows- in the camshafts must face upwards.



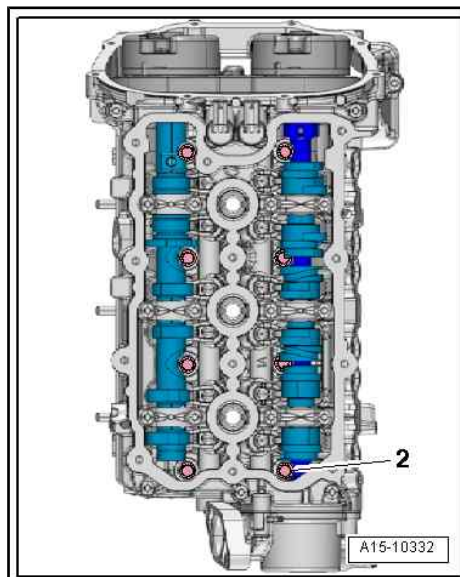
### Cylinder head (left-side):

- Unscrew bolt -1- and remove.



### Cylinder head (right-side):

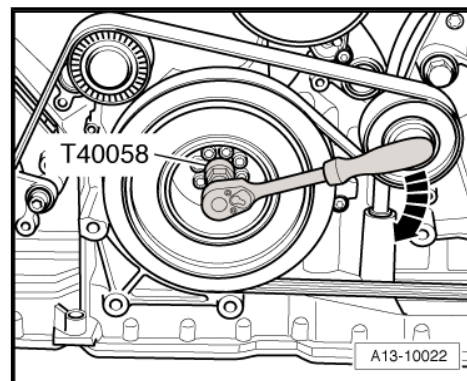
- Unscrew bolt -2- and remove.



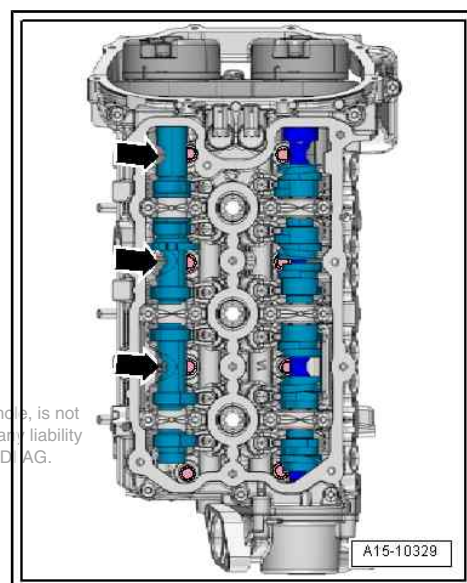
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**Continued for both cylinder heads:**

- Use adapter - T40058- to turn crankshaft one full turn (360°) in direction of engine rotation -arrow-.



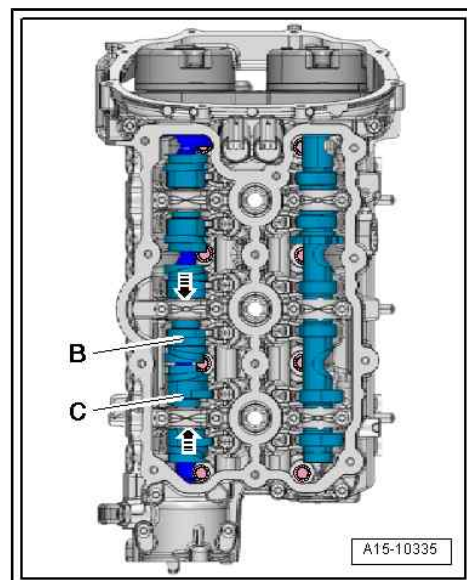
- The recesses -arrows- on the exhaust camshaft must point towards the outside of the engine.



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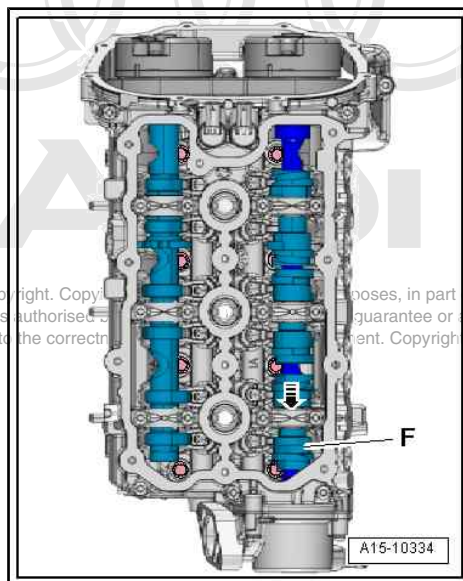
**Cylinder head (left-side):**

- Press sliders -B- and -C- as far as stop in direction of -arrow- (sliders should not be under load).



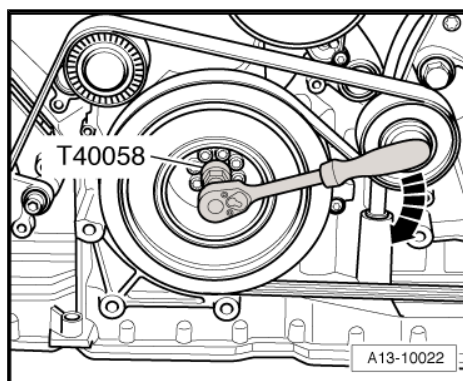
### Cylinder head (right-side):

- Press slider -F- as far as stop in direction of -arrow- (slider should not be under load).



### Continued for both cylinder heads:

- Use adapter - T40058- to turn crankshaft one full turn (360°) in direction of engine rotation -arrow-.



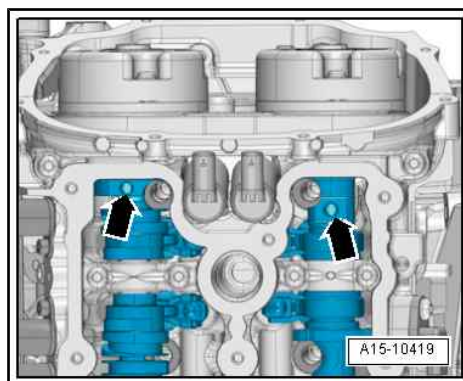
- The threaded holes -arrows- in the camshafts must face upwards.
- Remove camshaft timing chains from camshafts  
⇒ [page 143](#) .



### Caution

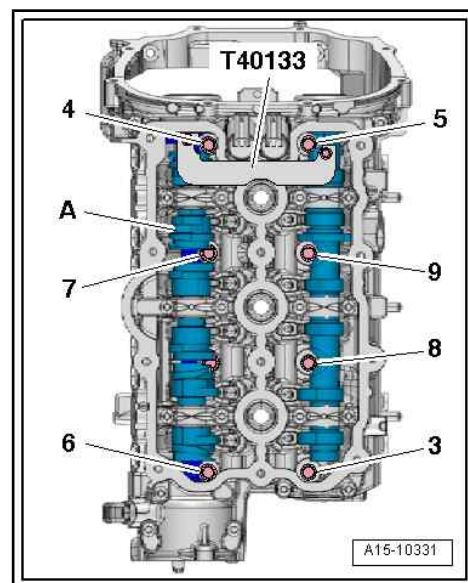
**Risk of damage to valves and piston crowns.**

- ◆ **Do not turn crankshaft if one or both of the camshaft timing chains has been removed from the cylinder head(s).**



### Cylinder head (left-side):

- Move slider -A- as required (slider should not be under load) and unscrew and remove bolts -3 ... 9-.
- Take off cylinder head.



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### Cylinder head (right-side):

- Move sliders -D- and -E- as required (sliders should not be under load) and unscrew and remove bolts -10 ... 16-.
- Take off cylinder head.

### Installing

- Tightening torques ⇒ [page 165](#)



### Caution

#### *Risk of damage to sealing surfaces.*

- ◆ *Carefully remove sealant residue from cylinder head and cylinder block.*
- ◆ *Ensure that no long scores or scratches are made on the surfaces.*

#### *Risk of damage to cylinder block.*

- ◆ *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*

#### *Ensure that cylinder head gasket seals properly:*

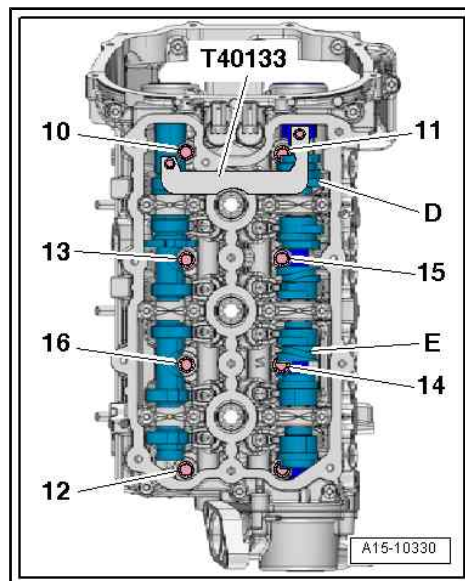
- ◆ *Carefully remove any remaining emery and abrasive material.*
- ◆ *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- ◆ *Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.*

#### *Risk of damage to open valves.*

- ◆ *When installing an exchange cylinder head, the plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*

#### *Risk of damage to valves and piston crowns after working on valve gear.*

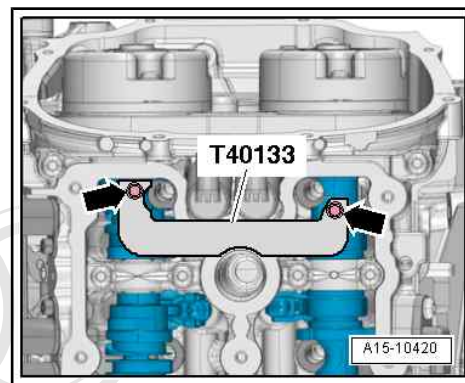
- ◆ *Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*



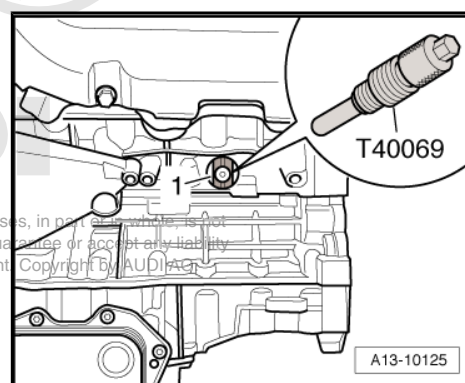
### Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew seals, gaskets and self-locking nuts.*
- ◆ *Note the different sealants for sealing surfaces and cylinder head bolts.*
- ◆ *When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the cylinder head cover.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *After fitting a new cylinder head or cylinder head gasket, change the engine oil and coolant.*

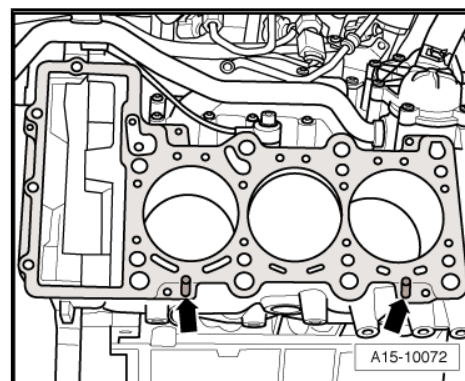
- Before fitting cylinder head set crankshaft and camshafts to “TDC”. To do so, fit camshaft clamps - T40133- to both cylinder heads and tighten to 25 Nm -arrows-.
- The camshaft clamp - T40133- is positioned correctly if the holes for the cylinder head bolts remain free.



- The locking pin - T40069- must be screwed into the crankshaft.

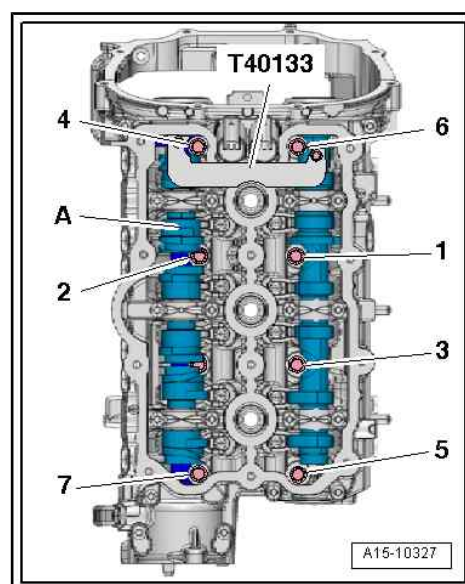


- Fit cylinder head gasket.
- Note position of centring pins -arrows- in cylinder block.
- Note installation position of cylinder head gasket: the word “oben” (top) or the part number should face towards the cylinder head.
- Fit cylinder head.



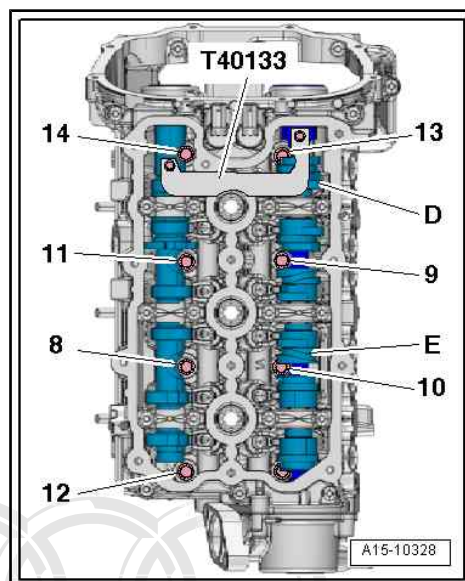
#### Cylinder head (left-side):

- Move slider -A- as required (slider should not be under load) and fit bolts -1 ... 7-.
- Tighten bolts in the sequence -1 ... 7- in 3 stages  
⇒ [page 165](#).



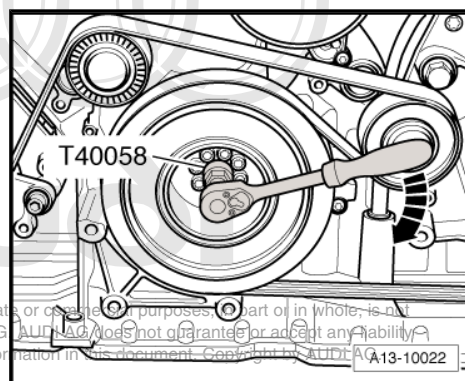
### Cylinder head (right-side):

- Move sliders -D- and -E- as required (sliders should not be under load) and fit bolts -8 ... 14-.
- Tighten bolts in the sequence -8 ... 14- in 3 stages  
⇒ [page 165](#).

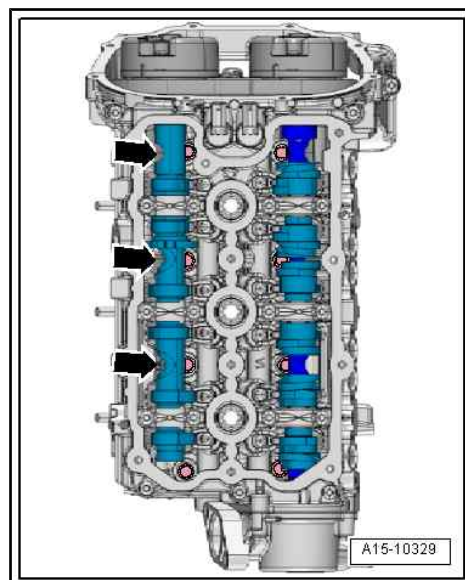


### Continued for both cylinder heads:

- Fit timing chains on camshafts ⇒ [page 147](#).
- Remove camshaft clamp - T40133- and locking pin - T40069-.
- Use adapter - T40058- to turn crankshaft one full turn (360°) in direction of engine rotation -arrow-.



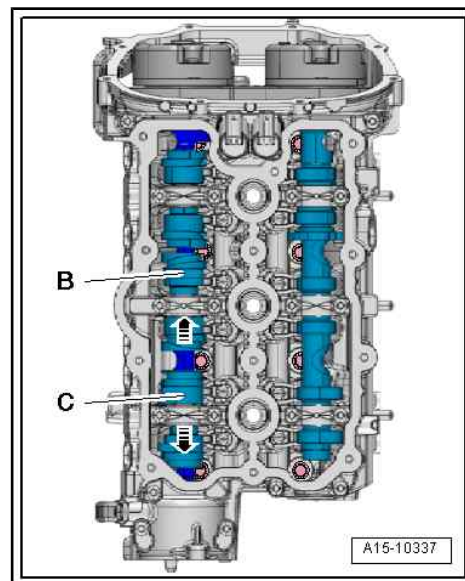
- The recesses -arrows- on the exhaust camshaft must point towards the outside of the engine.



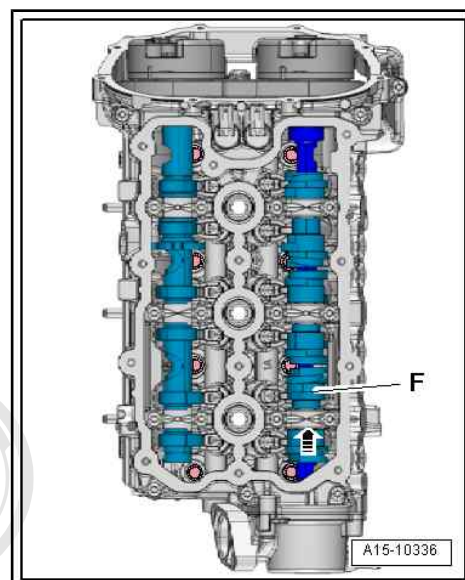
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**Cylinder head (left-side):**

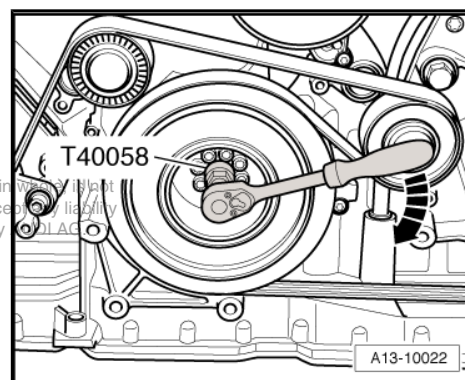
- Press sliders -B- and -C- as far as stop in direction of -arrow- (sliders should not be under load).

**Cylinder head (right-side):**

- Press slider -F- as far as stop in direction of -arrow- (slider should not be under load).

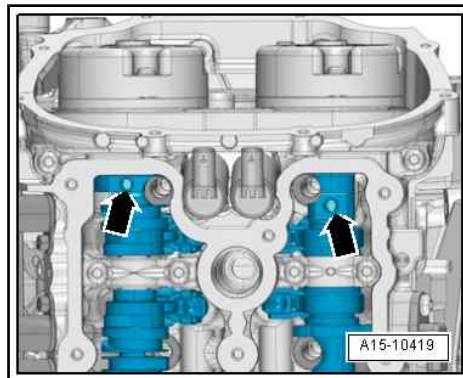
**Continued for both cylinder heads:**

- Use adapter - T40058- to turn crankshaft one full turn (360°) in direction of engine rotation -arrow-.



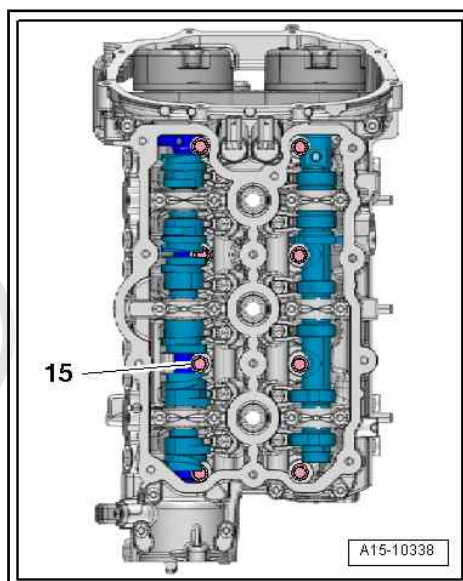
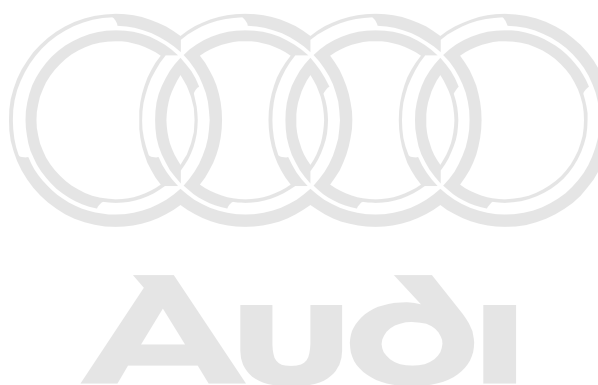
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- The threaded holes -arrows- in the camshafts must face upwards.



### Cylinder head (left-side):

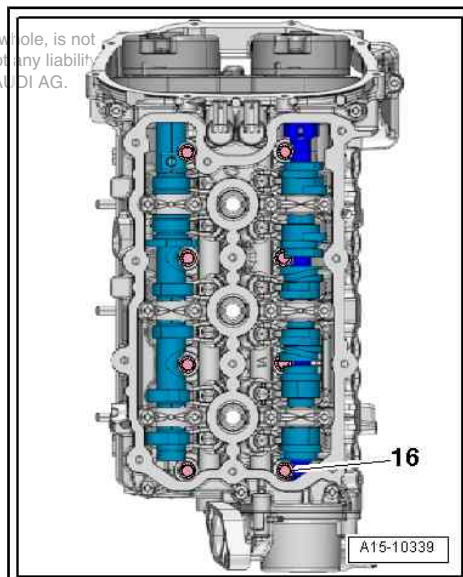
- Fit bolt -15- and tighten in three stages ⇒ [page 165](#) .



### Cylinder head (right-side):

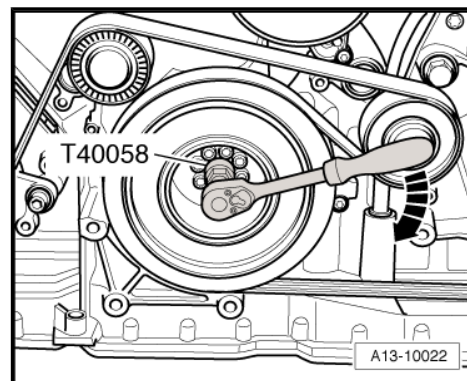
- Fit bolt -16- and tighten in three stages ⇒ [page 165](#) .

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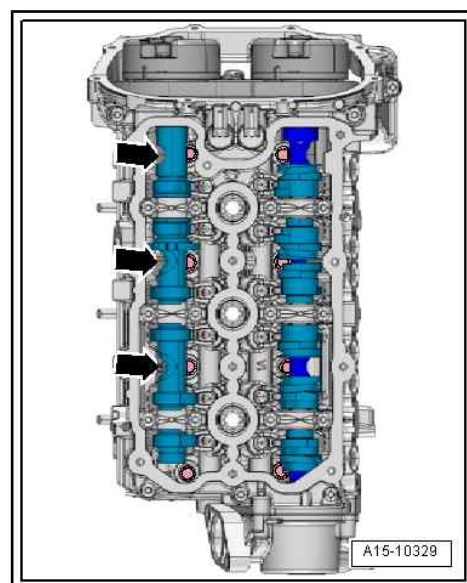


**Continued for both cylinder heads:**

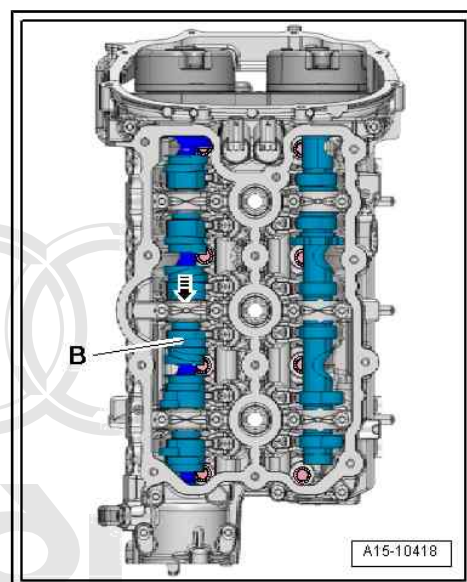
- Use adapter - T40058- to turn crankshaft one full turn (360°) in direction of engine rotation -arrow-.



- The recesses -arrows- on the exhaust camshaft must point towards the outside of the engine.

**Cylinder head (left-side):**

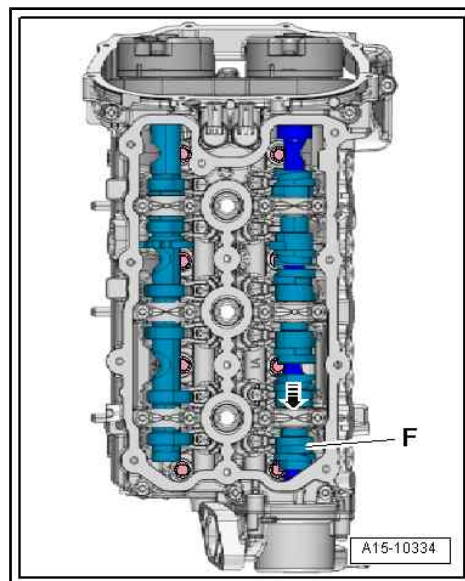
- Press slider -B- as far as stop in direction of -arrow- (slider should not be under load).



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### Cylinder head (right-side):

- Press slider -F- as far as stop in direction of -arrow- (slider should not be under load).



### Continued for both cylinder heads:

- Tighten bolts -arrows-.
- ◆ Cylinder head (left-side): 3 bolts
- ◆ Cylinder head (right-side): 4 bolts

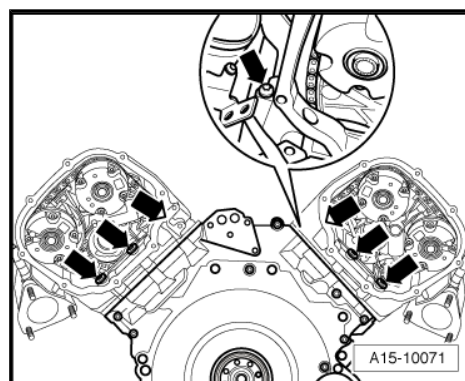


#### Note

*Bolts do not have to be torqued down again later after repair work.*

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

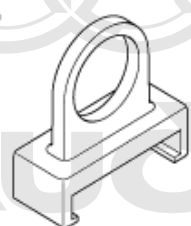
- Install timing chain covers (left and right) ⇒ [page 133](#) .
- Install cylinder head cover: left-side ⇒ [page 168](#) ; right-side ⇒ [page 170](#) .
- Install intake manifold (bottom sections) ⇒ Rep. gr. 24 .
- Install intake manifold (top section) ⇒ Rep. gr. 24 .
- Install coolant pipe (front) ⇒ [page 251](#) .
- Install poly V-belt ⇒ [page 101](#) .
- Install front exhaust pipe together with catalytic converter: left-side ⇒ [page 272](#) , right-side ⇒ [page 275](#) .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .
- Change engine oil ⇒ Maintenance ; Booklet 405 .
- Fill cooling system with fresh coolant ⇒ [page 241](#) .



## 2.5 Checking compression

### Special tools and workshop equipment required

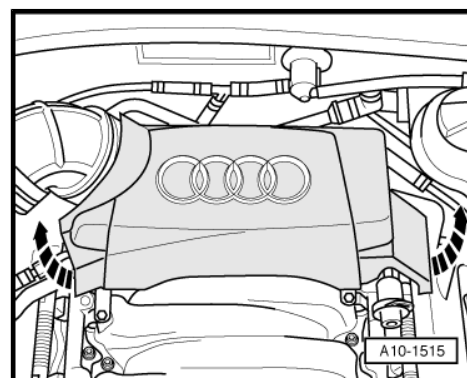
- ◆ Spark plug socket and extension - 3122 B-
- ◆ Compression tester - V.A.G 1763-
- ◆ Puller - T40039-

|                                                                                                 |                                                                                                       |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <p>3122 B</p>  | <p>V.A.G 1763</p>  |
| <p>T40039</p>  |                                                                                                       |
|                                                                                                 | <p>G15-0070</p>                                                                                       |

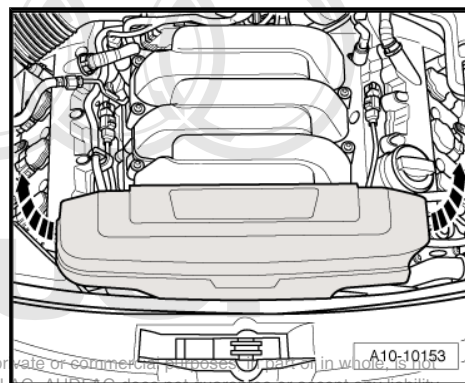
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### Procedure

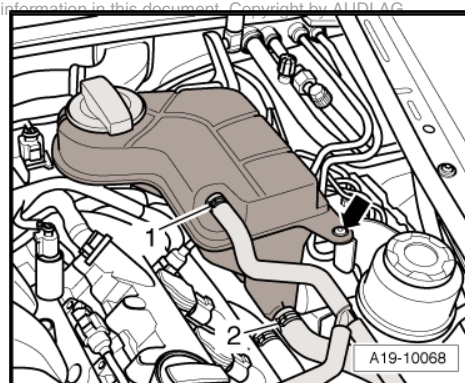
- Engine oil temperature at least 30 °C.
- Battery voltage at least 12.5 V
- Switch off ignition.
- Pull off engine cover panel (rear) -arrows-.



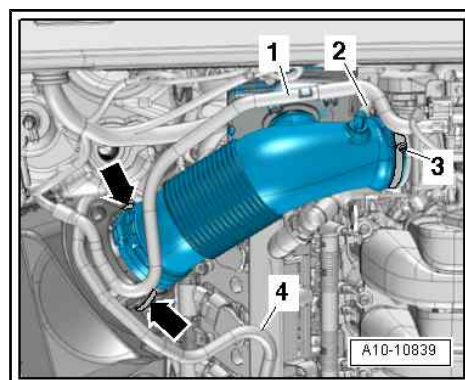
- Pull off engine cover panel (front) -arrows-.



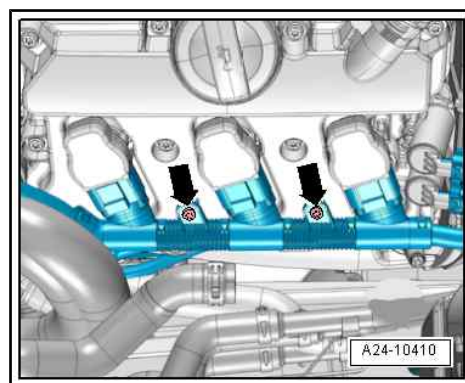
- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



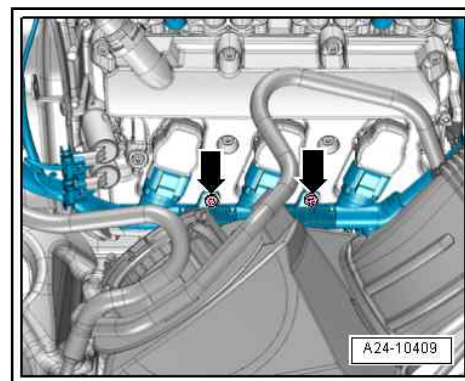
- Move fuel line -4- and line -1- leading to activated charcoal filter clear on air cleaner housing and air pipe.
- Detach vacuum hose -2- from air hose.
- Remove air pipe. To do so, release hose clip -3- and clamps -arrows-.



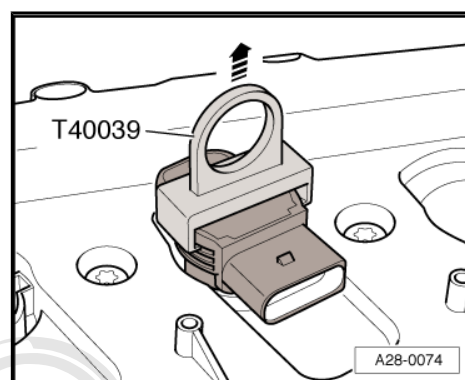
- Remove bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (left-side).
- Press electrical wiring harness down slightly.



- Remove bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (right-side).
- Press electrical wiring harness down slightly.



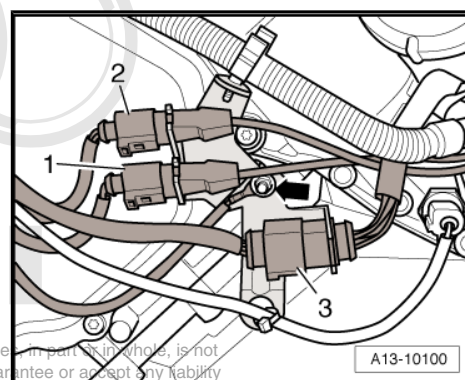
- Pull ignition coils out with puller - T40039- .



- Unplug electrical connector -3- leading to injectors at rear of cylinder head (left-side).

**Note**

Disregard items marked -1, 2 and arrow-.



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- Unplug electrical connector -1- leading to injectors at rear of cylinder head (right-side).



### Note

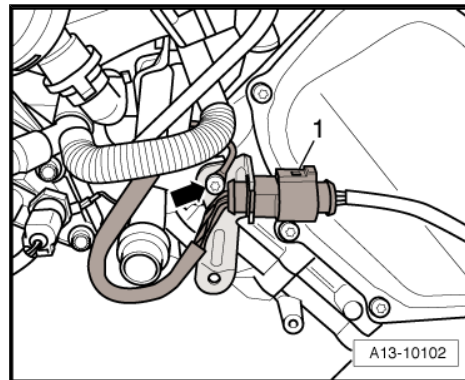
Disregard -arrow-.

- Remove spark plugs with spark plug socket and extension - 3122 B- .
- Check compression pressure with compression tester - V.A.G 1763- (see ⇒ operating instructions for details of how to use tester).
- Have a second mechanic press down the accelerator pedal completely and at the same time operate the starter until the pressure on the tester display no longer increases.
- Repeat procedure on each cylinder.

| Compression pressure         | bar           |
|------------------------------|---------------|
| When new                     | 11.0 ... 14.0 |
| Wear limit                   | 10.0          |
| Difference between cylinders | 3.0 (maximum) |

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

- Tightening torque ⇒ [page 165](#)
- Install spark plugs ⇒ Maintenance ; Booklet 405 .
- Connect vehicle diagnostic, testing and information system - VAS 5051B- .
- Start “Guided Functions” mode.
- Generate readiness code in engine control unit.



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### 3 Servicing valve gear



#### Caution

*Risk of damage to valves and piston crowns after working on valve gear.*

- ◆ *The hydraulic tappets have to settle; wait for approx. 30 minutes after installing camshafts before starting engine.*
- ◆ *Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*



#### Note

*Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.*

⇒ ["3.1 Exploded view - valve gear", page 195](#)

⇒ ["3.2 Checking axial clearance of camshafts", page 198](#)

⇒ ["3.3 Removing and installing camshafts", page 198](#)

⇒ ["3.4 Checking hydraulic valve compensation elements", page 204](#)

⇒ ["3.5 Renewing valve stem oil seals with cylinder head installed", page 205](#)

⇒ ["3.6 Renewing valve stem oil seals with cylinder head removed", page 208](#)

⇒ ["3.7 Valve dimensions", page 212](#)

⇒ ["3.8 Checking valve guides", page 212](#)

⇒ ["3.9 Checking valves", page 213](#)

#### 3.1 Exploded view - valve gear



#### Note

*The diagram shows the cylinder head on cylinder bank 2 (left-side).*

# 1 - Sealing plug

- ☐ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

# 2 - Cylinder head

- ☐ Checking valve guides ⇒ [page 212](#)

# 3 - Valve stem oil seal

- ☐ Renewing with cylinder head installed ⇒ [page 205](#)
- ☐ Renewing with cylinder head removed ⇒ [page 208](#)

# 4 - Valve spring

- ☐ Installation position ⇒ [page 198](#)

# 5 - Hydraulic compensation elements

- ☐ Checking ⇒ [page 204](#)
- ☐ Do not interchange
- ☐ Lubricate contact surface

# 6 - Valve spring plate

# 7 - Valve cotters

# 8 - Roller rocker finger

- ☐ Different versions for inlet side and exhaust side, do not interchange
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surface

# 9 - Securing clip

- ☐ Different versions for inlet side and exhaust side, do not interchange
- ☐ Check for firm attachment

# 10 - Inlet camshaft

- ☐ With 3 sliders
- ☐ Do not dismantle
- ☐ Checking axial clearance ⇒ [page 198](#)
- ☐ Removing and installing ⇒ [page 198](#)
- ☐ Check radial clearance with Plastigage (roller rocker fingers removed)
- ☐ Radial clearance when bearing  $\varnothing$  is 24 mm: 0.024 ... 0.066 mm
- ☐ Radial clearance when bearing  $\varnothing$  is 36 mm: 0.032 ... 0.078 mm
- ☐ Runout: max. 0.04 mm

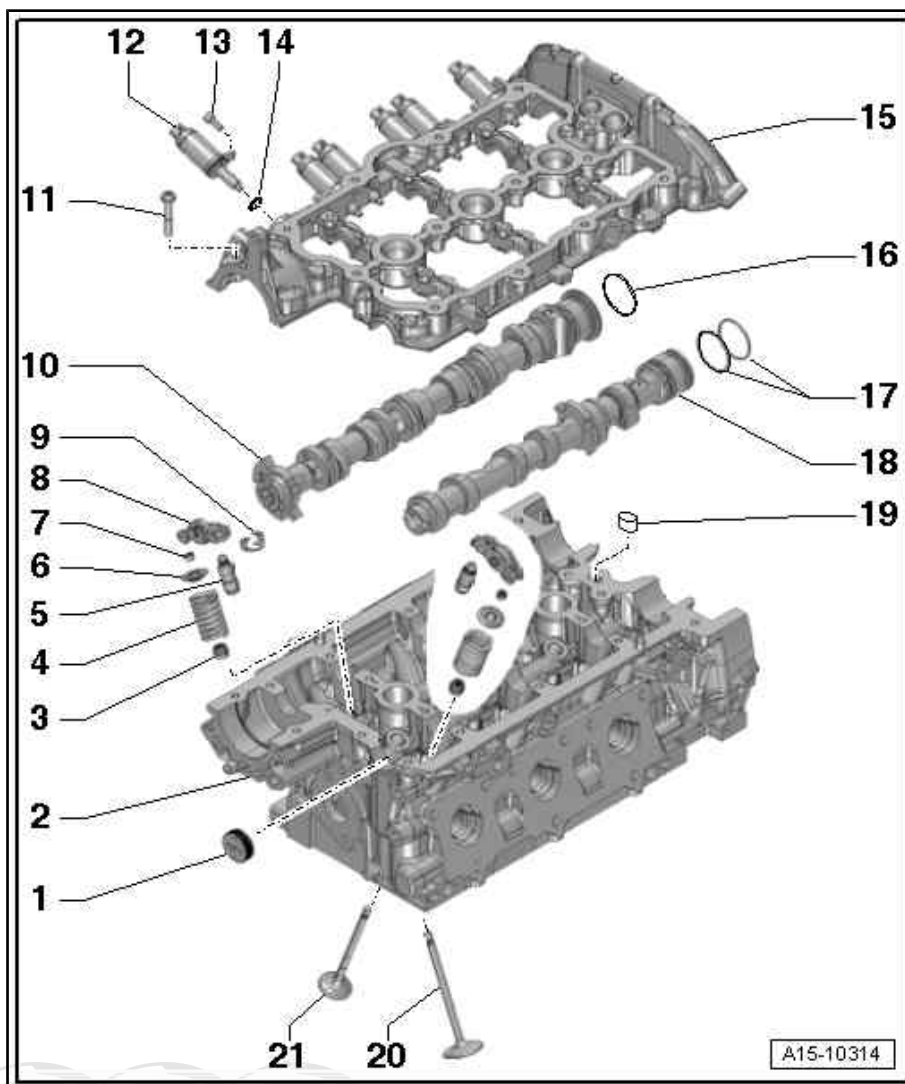
# 11 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 197](#)

# 12 - Actuator for variable valve timing

# 13 - Bolt

- ☐ 5 Nm



**14 - O-ring**

- ☐ Renew

**15 - Retaining frame**

- ☐ With integrated camshaft bearings
- ☐ Removing and installing ⇒ [“3.3 Removing and installing camshafts”, page 198](#)

**16 - Compression ring****17 - Rectangular section seals****18 - Exhaust camshaft**

- ☐ Checking axial clearance ⇒ [page 198](#)
- ☐ Removing and installing ⇒ [page 198](#)
- ☐ Check radial clearance with Plastigage (roller rocker fingers removed)
- ☐ Radial clearance when bearing  $\varnothing$  is 24 mm: 0.024 ... 0.066 mm
- ☐ Radial clearance when bearing  $\varnothing$  is 36 mm: 0.032 ... 0.078 mm
- ☐ Runout: max. 0.04 mm

**19 - Oil strainer****20 - Inlet valve**

- ☐ Do not machine, only grinding-in is permitted
- ☐ Mark installation position for re-installation
- ☐ Valve dimensions ⇒ [page 212](#)
- ☐ Checking valve guides ⇒ [page 212](#)

**21 - Exhaust valve**

- ☐ Do not machine, only grinding-in is permitted
- ☐ Mark installation position for re-installation
- ☐ Valve dimensions ⇒ [page 212](#)
- ☐ Checking valve guides ⇒ [page 212](#)

**Retaining frame for camshafts - tightening torque and sequence**

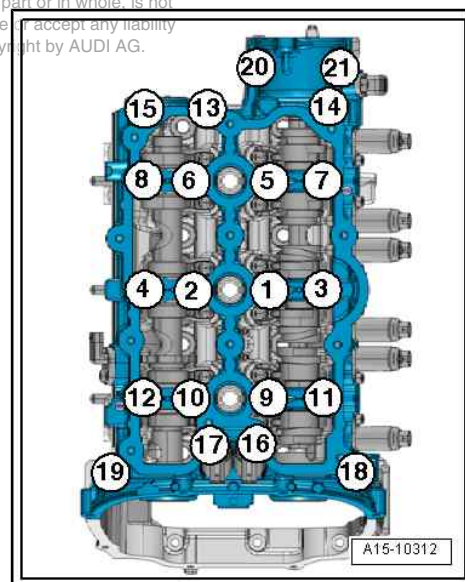
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**Note**

*The illustration shows the retaining frame for cylinder head (left-side).*

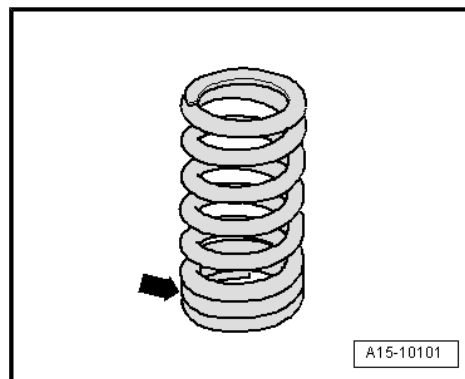
– Tighten bolts in the sequence -1 ... 21- in 3 stages as follows:

1. Tighten bolts hand tight.
  - The retaining frame should make contact with the cylinder head over the full surface.
2. Tighten bolts to 8 Nm.
3. Turn bolts 90° further.



### Position of valve spring

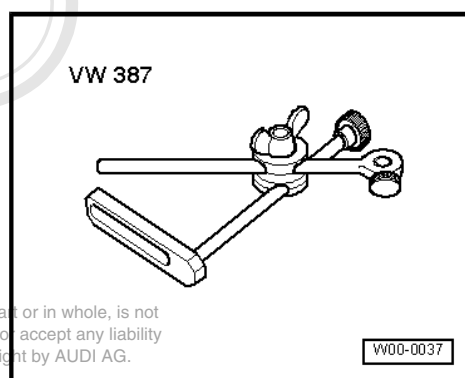
- Closely spaced spring coils -arrow- face towards cylinder head.



## 3.2 Checking axial clearance of camshafts

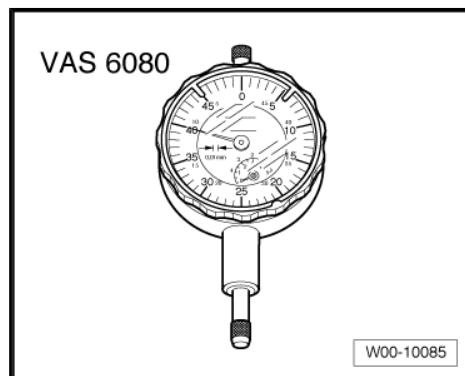
### Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



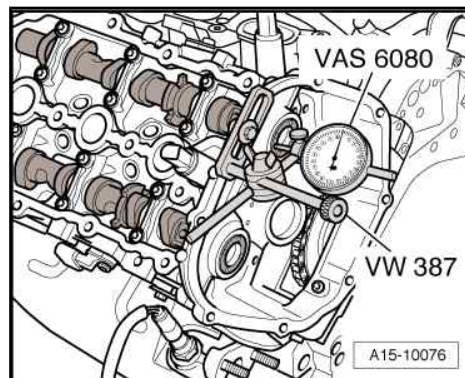
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- ◆ Dial gauge - VAS 6080-



### Procedure

- Perform measurement with roller rocker fingers and hydraulic compensation elements removed.
- Secure universal dial gauge bracket - VW 387- with dial gauge - VAS 6080- to cylinder head.
- Determine axial clearance.
- Axial clearance: 0.100 ... 0.191 mm



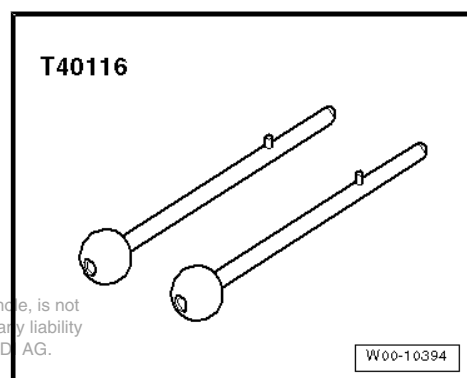
## 3.3 Removing and installing camshafts

### Special tools and workshop equipment required

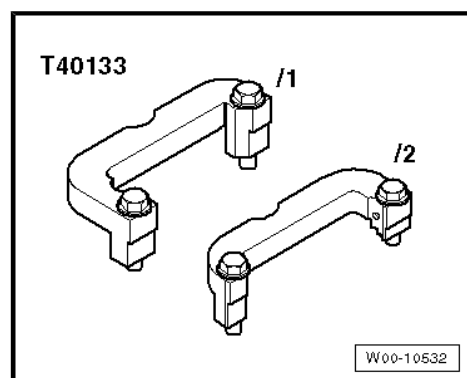
- ◆ Impact extractor attachment -T10133/3- from tool set for FSI engines - T10133-



- ◆ Locating pins 1 set = 2x - T40116-



- ◆ Camshaft clamp - T40133-

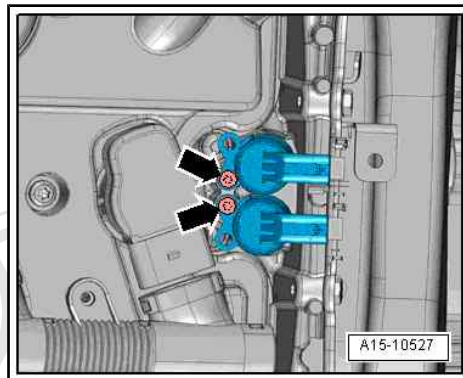


- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

### Removing

- Remove cylinder head cover: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#) .
- Remove timing chain covers (left and right) ⇒ [page 130](#) .
- Remove timing chains from camshafts ⇒ [page 143](#) .
- To remove the camshafts in cylinder head (left-side) you must first remove the vacuum pump for brake servo ⇒ Rep. gr. 47 .
- To remove camshafts in cylinder head (right-side), first remove high-pressure pump and housing for high-pressure pump drive ⇒ Rep. gr. 24 .

- Remove bolts -arrows- and detach camshaft control valves.



- Slacken retaining frame bolts in the sequence -21 ... 1-.

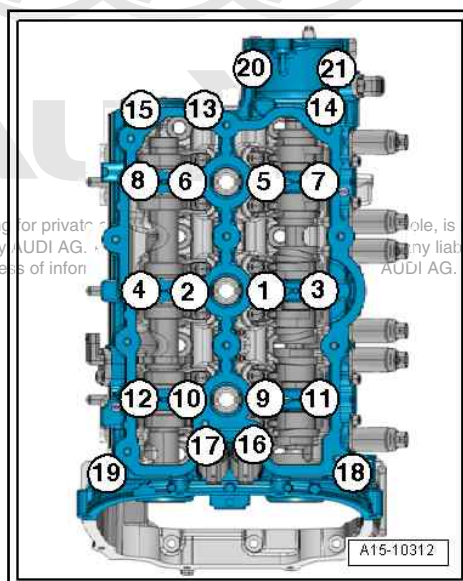


### Note

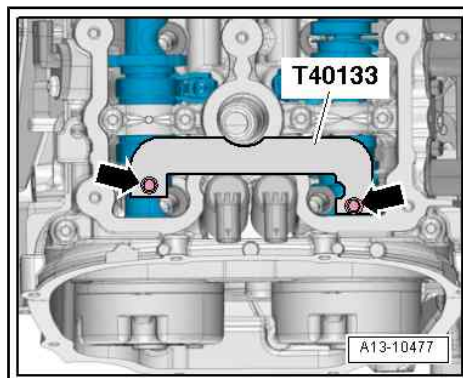
The illustration shows the retaining frame for cylinder head (left-side).

- Carefully remove retaining frame and set it down on a soft surface on workbench.

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- Remove camshaft clamp - T40133- .
- Mark and remove camshafts.



## Installing

- Tightening torque ⇒ [page 197](#)



### Note

*Renew seals and gaskets.*

- Crankshaft -1- locked in position with locking pin - T40069- .



### WARNING

*Risk of eye injury.*

- ◆ *Wear safety goggles.*

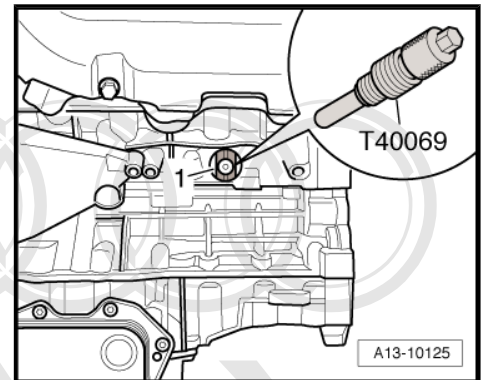


### Caution

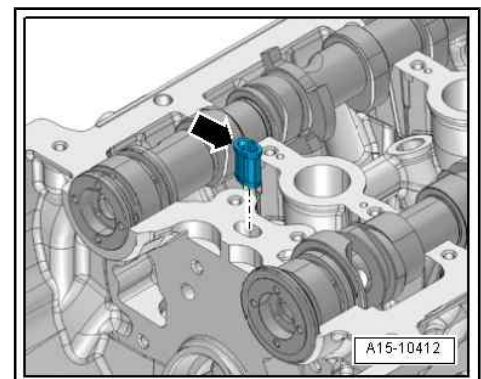
*Protect lubrication system and bearings against contamination.*

- ◆ *Cover exposed parts of the engine.*

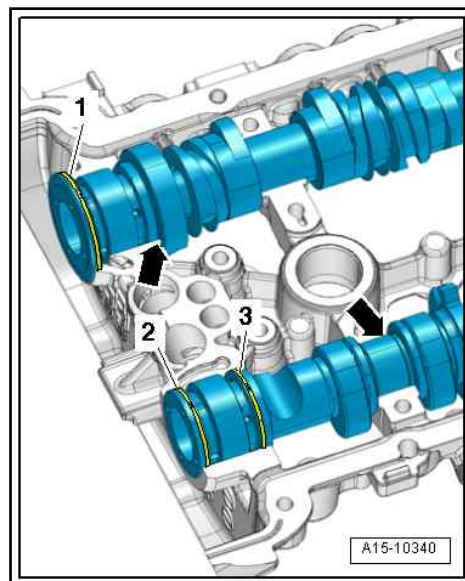
- Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Check strainer -arrow- for dirt and clean as necessary.
- Oil running surfaces of both camshafts.



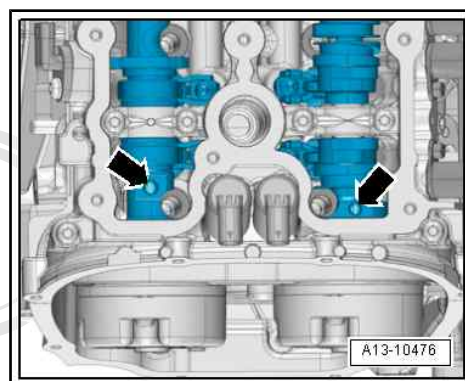
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- Fit camshafts in retaining frame.
- Camshafts must be in correct position in axial bearings -arrows- in retaining frame.
- The ends of the rectangular section seals -1, 2, 3- must point up or down, never to the side.
- Turn retaining frame upside down with camshafts inserted, keeping hold of the camshafts in the retaining frame.

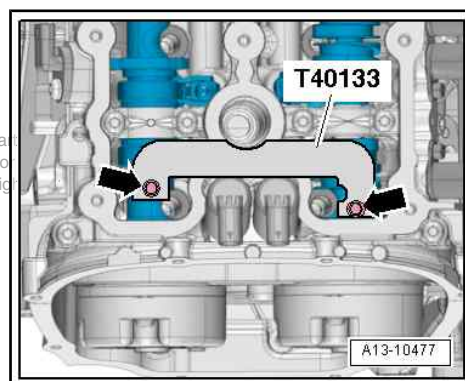


- Turn the camshafts until the threaded holes -arrows- point upwards.
- Check that camshafts are still in correct position in axial bearings in retaining frame.

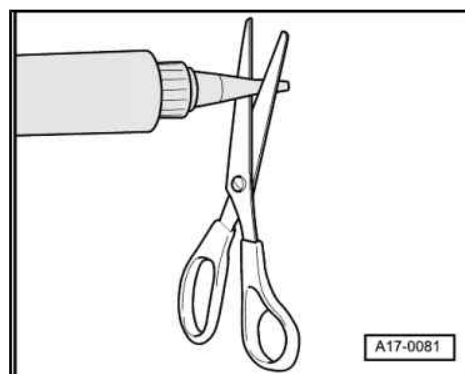


- Fit camshaft clamp - T40133- and tighten bolts -arrows- to 25 Nm.

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- Cut off nozzle of tube at front marking (Ø of nozzle approx. 2.0 mm).



- Turn retaining frame back up.

**Caution**

*Make sure lubrication system is not clogged by excess sealant.*

- ◆ *The sealant beads must not be thicker than specified.*

- Apply the beads of sealant -4 ... 8- onto the clean sealing surfaces of the retaining frame as illustrated.
- Width of sealant bead: 2.0 mm.
- Apply the beads of sealant -1 ... 3- onto the clean sealing surfaces of the retaining frame as illustrated.
- Width of sealant bead: 2.5 mm.

**Note**

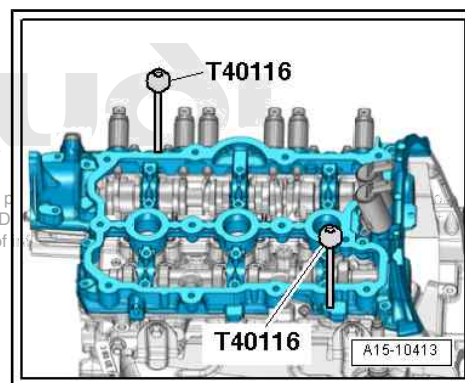
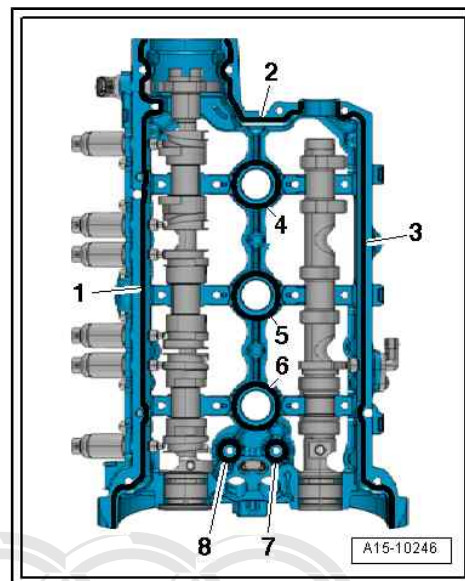
*Fit and secure the retaining frame without delay, as the sealant starts hardening immediately.*

- Fit retaining frame onto cylinder head.
- Insert locating pins -T40116- in retaining frame and cylinder head.

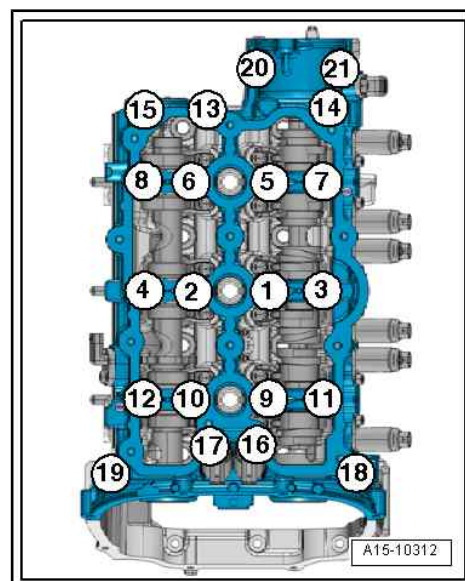
**Note**

*After installing the retaining frame, the sealant must dry for approx. 30 minutes.*

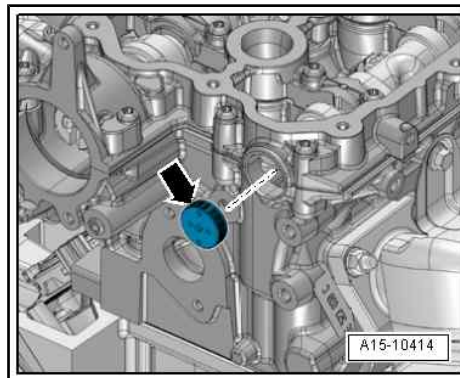
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- Tighten retaining frame bolts in the sequence -1 ... 21- ➔ [page 197](#).



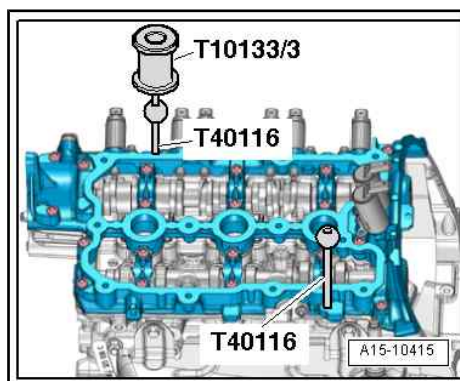
- Clean bore for sealing plug in cylinder head; it must be free of oil and grease.
- Coat outer circumference of sealing plug -arrow- with sealant; for sealant refer to ⇒ Electronic parts catalogue .
- Drive in sealing plug until flush.



- Use impact extractor attachment -T40116- to pull out locating pins -T10133/3- .

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

- Install vacuum pump for brake servo ⇒ Rep. gr. 47 .
- Install housing for high-pressure pump drive and high-pressure pump ⇒ Rep. gr. 24 .
- Fit timing chains on camshafts ⇒ [page 147](#) .
- Install timing chain covers (left and right) ⇒ [page 130](#) .
- Install cylinder head cover: left-side ⇒ [page 168](#) , right-side ⇒ [page 170](#) .



#### Caution

**Risk of damage to valves and piston crowns after working on valve gear.**

- ◆ *The hydraulic tappets have to settle; wait for approx. 30 minutes after installing camshafts before starting engine.*
- ◆ *Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

### 3.4 Checking hydraulic valve compensation elements



#### Note

- ◆ *The hydraulic compensation elements cannot be serviced.*
- ◆ *Irregular valve noises when starting engine are normal.*

#### Special tools and workshop equipment required

- ◆ Feeler gauge

#### Procedure

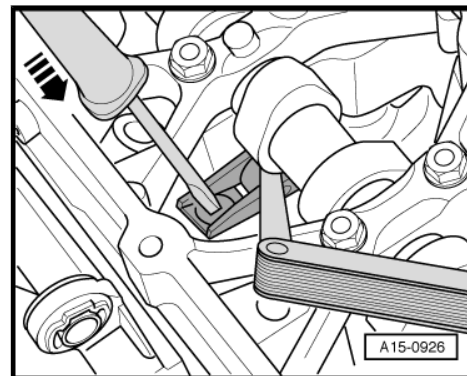
- Start engine and run until radiator fan has started up once.
- Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).
- If the compensation elements are still noisy, locate the defective compensation element as follows:

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- Remove cylinder head cover: left-side ⇒ [page 168](#) ; right-side ⇒ [page 170](#) .
- Turn crankshaft until cam of hydraulic compensation element to be tested is at top:
- ◆ Vehicles with manual gearbox: push vehicle forwards with 4th gear engaged and ignition switched off.
- ◆ Vehicles with multitronic gearbox or automatic gearbox 09L: Turn crankshaft clockwise at central bolt for poly V-belt pulley.
- Determine clearance between cam and roller rocker finger.
- If it is possible to insert a feeler gauge of 0.20 mm between cam and roller rocker finger, renew hydraulic compensation element  
⇒ ["3.3 Removing and installing camshafts"](#), [page 198](#) .

#### Additional steps required

- Install cylinder head cover: left-side ⇒ [page 168](#) ; right-side ⇒ [page 170](#) .

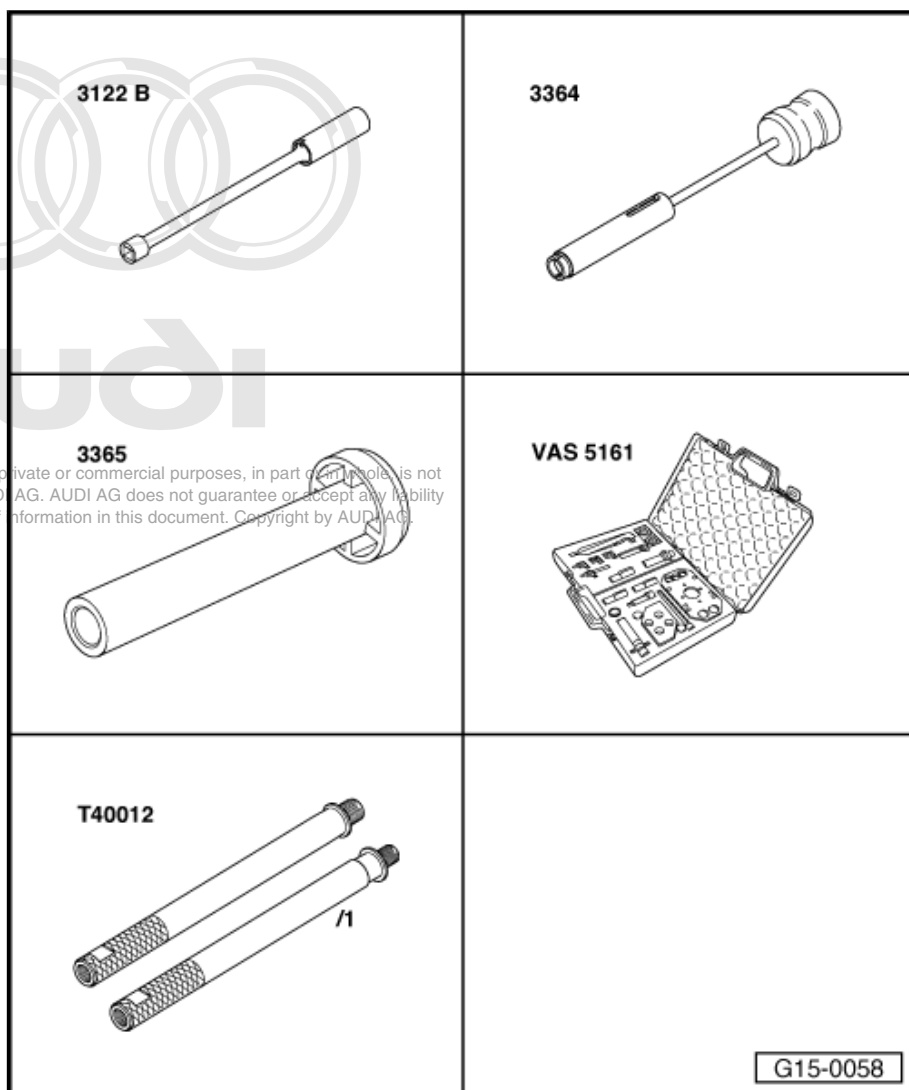


### 3.5 Renewing valve stem oil seals with cylinder head installed

#### Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem seal fitting tool - 3365-
- ◆ -VAS 5161- Removal and installation device for valve cotter - VAS 5161- with guide plate -VAS 5161/19B-

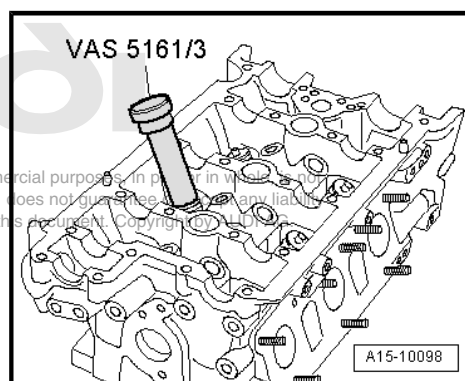
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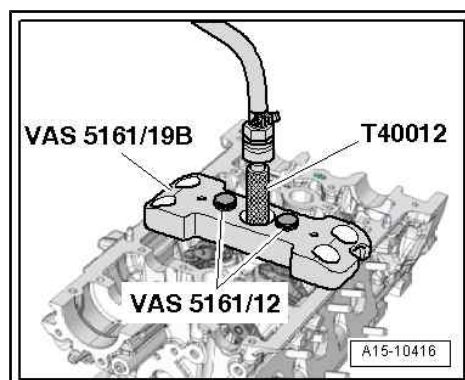
# ◆ Adapters - T40012-

## Procedure

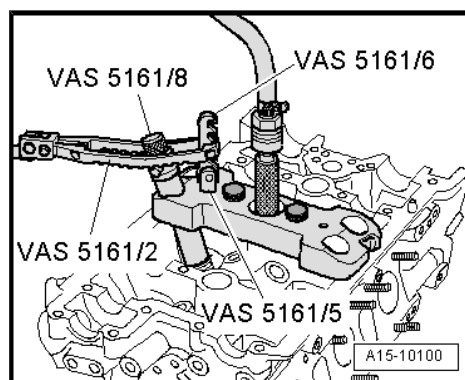
- Remove camshafts ⇒ [page 198](#) .
- Mark allocation of roller rocker fingers and hydraulic compensation elements for reinstallation.
- Remove roller rocker fingers together with hydraulic compensation elements and place on a clean surface.
- Remove spark plugs with spark plug socket - 3122 B- .
- Set piston of appropriate cylinder to “bottom dead centre”.
- Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.



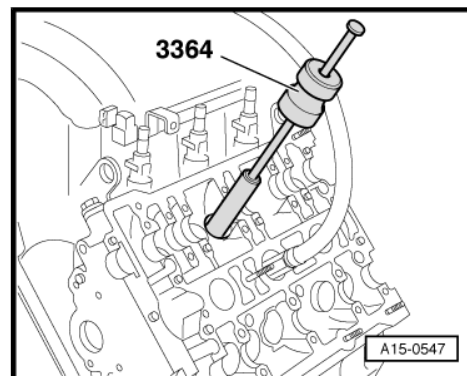
- Fit guide plate -VAS 5161/19B- from removal and installation device for valve cotters - VAS 5161- on cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- .
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.
- Connect hose to compressed air and apply a steady pressure.
- Minimum pressure: 6 bar



- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- in 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.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
- The compressed air hose remains connected.
- Detach valve spring with valve spring plate.

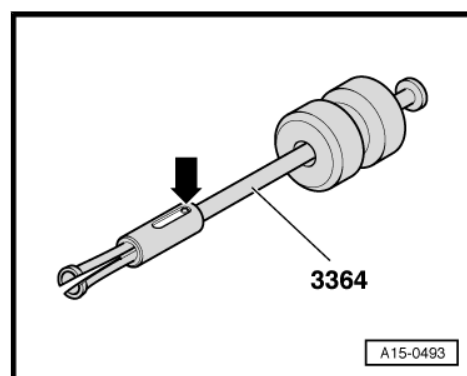


- Pull off valve stem oil seal with valve stem seal puller - 3364- .

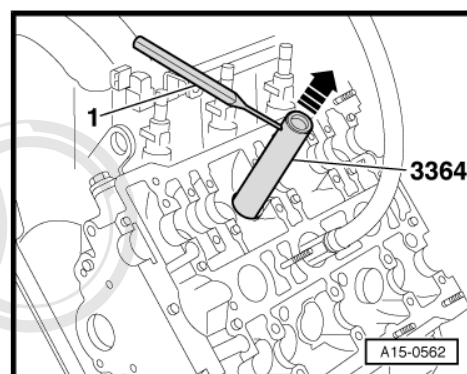


If the puller -3364- cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

- Knock out pin -arrow- of puller using a drift and remove impact extractor attachment.



- Apply bottom section of puller -3364- to valve stem oil seal.
- Secure puller with a punch or roll-pin drift -1-, as shown in illustration.
- Apply assembly lever to puller and pull out valve stem oil seal -arrow-.

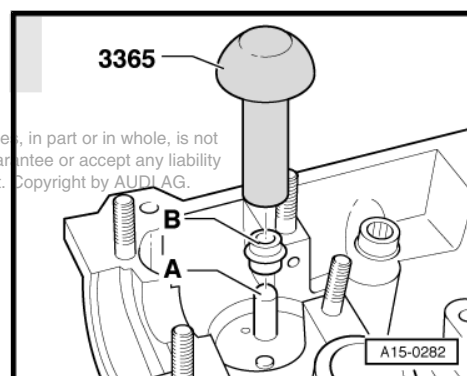


#### Caution

***Make sure valve stem oil seals are not damaged when installing.***

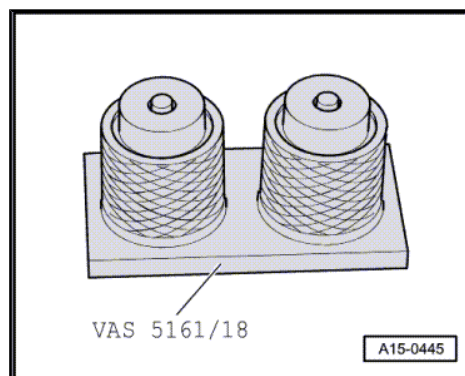
- ◆ ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***

- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.



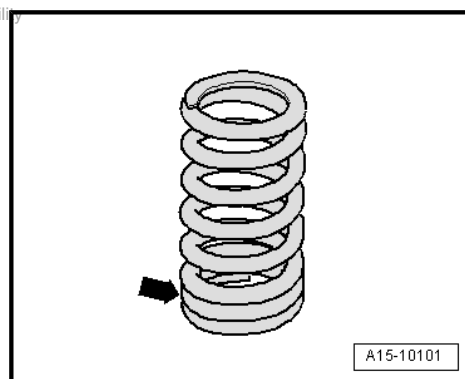
If valve cotters had been removed from assembly cartridge they must first be inserted in insertion device -VAS 5161/18- .

- Larger diameter of valve cotters faces upwards.



- Insert valve spring and valve spring plate.

- The closely spaced spring coils -arrow- face the cylinder head.

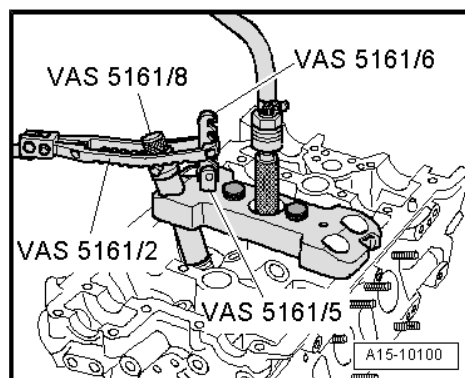


- Secure guide plate back onto cylinder head.
- Insert assembly cartridge in guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

### Assembling

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

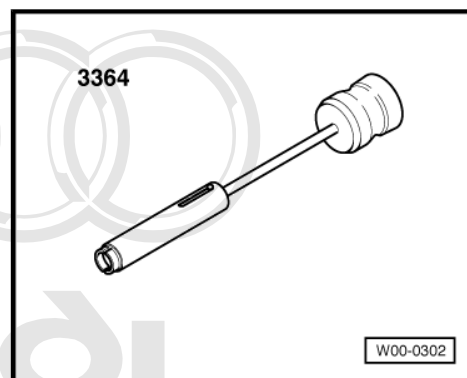
- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 198](#) .
- Install spark plugs ⇒ Maintenance ; Booklet 404 .



## 3.6 Renewing valve stem oil seals with cylinder head removed

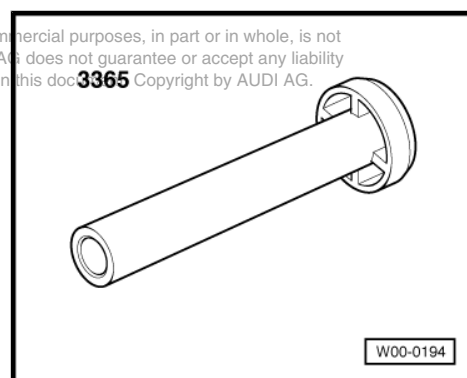
Special tools and workshop equipment required

◆ Valve stem seal puller - 3364-

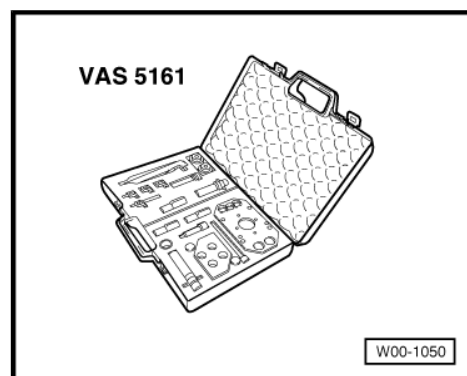


◆ Valve stem seal fitting tool - 3365-

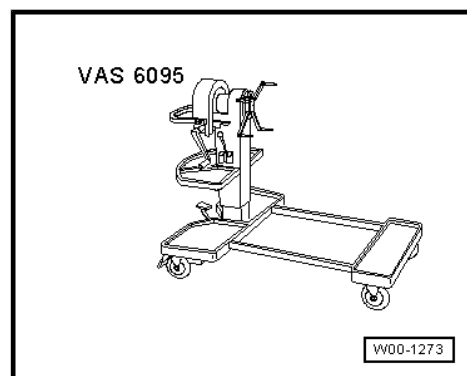
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◆ -VAS 5161- Removal and installation device for valve cotters  
- VAS 5161-



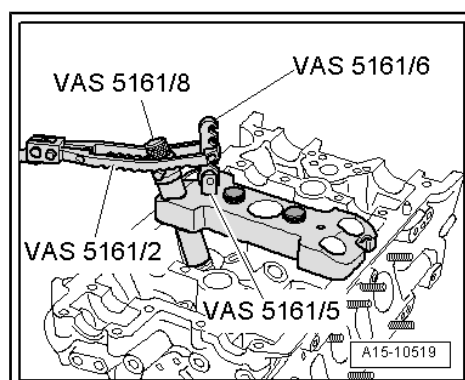
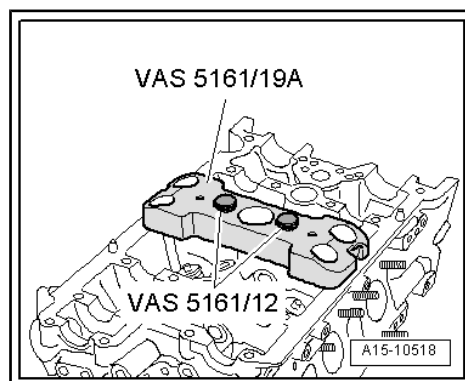
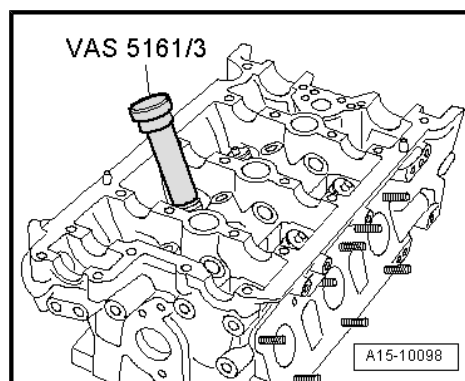
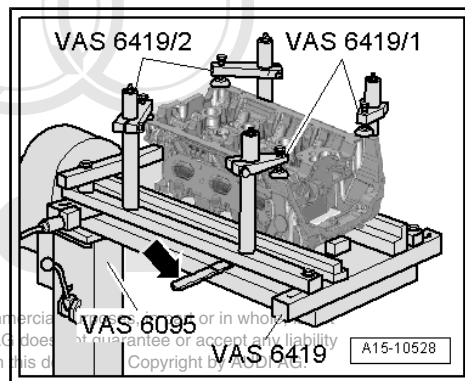
◆ Engine and gearbox support - VAS 6095-



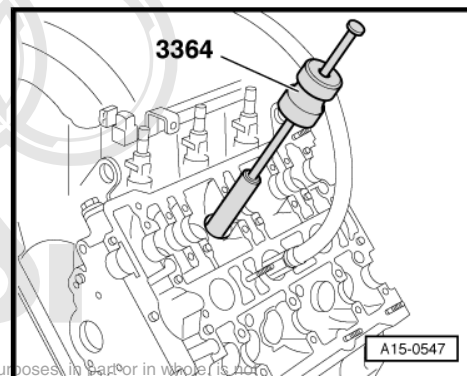
◆ Tensioning device -VAS 6419-

## Procedure

- Remove camshafts ⇒ [page 198](#) .
- Attach tensioning device -VAS 6419- to engine and gearbox support - VAS 6095- .
- Secure cylinder head in tensioning device -VAS 6419- as illustrated.
- Connect compressed air line to tensioning device -VAS 6419- .
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.
- Apply drift - VAS 5161/3- to valve spring plate and knock valve cotter loose using a plastic hammer.
- Fit guide plate - VAS 5161/19 A- from removal and installation device for valve cotter - VAS 5161- on cylinder head.
- Secure guide plate using the knurled screws - VAS 5161/12- .
- 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 cotter.
- Move knurled screw back and forth slightly; the valve cotter is thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Remove assembly cartridge.
- Detach guide plate and turn to one side.
- Remove valve spring with valve spring plate.



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



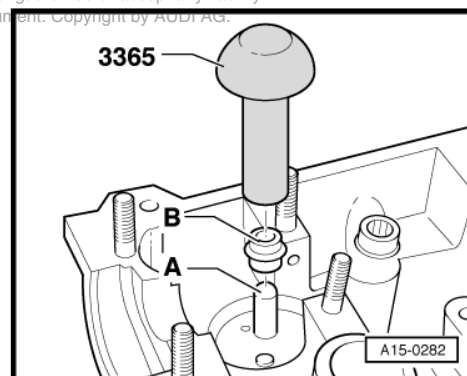
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### Note

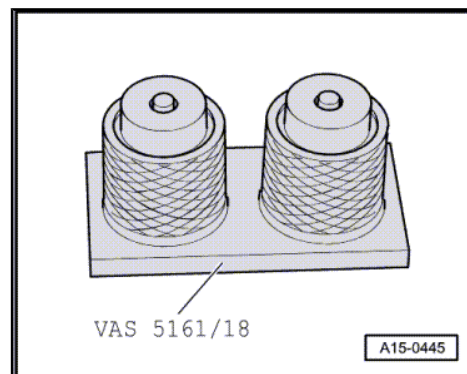
*A plastic sleeve -A- is included with the new valve stem oil seals.*

- 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.

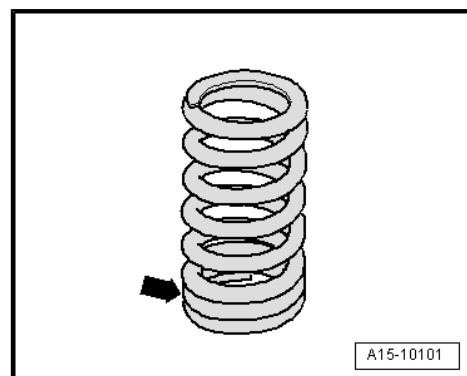


If valve cotters have been removed from assembly cartridge, they need to be put into insertion device - VAS 5161/18- first.

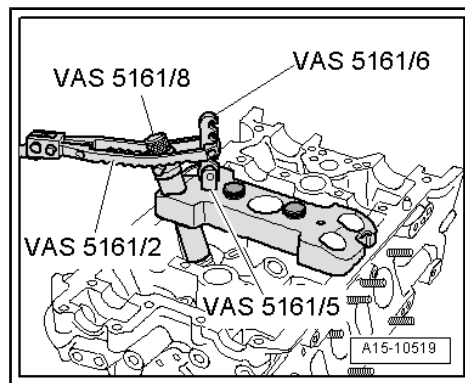
- Larger diameter of valve cotters faces upwards.



- Install valve spring and valve spring plate.
- The closely spaced spring coils -arrow- face the cylinder head.



- Screw guide plate back onto cylinder head.
- 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.
- Ensure that all roller rocker fingers contact the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 198](#) .



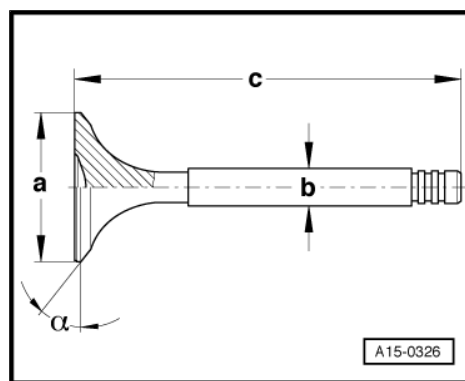
### 3.7 Valve dimensions



#### Note

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

| Dimension |    | Inlet valve  | Exhaust valve |
|-----------|----|--------------|---------------|
| Ø a       | mm | 33.85 ± 0.10 | 28.0 ± 0.1    |
| Ø b       | mm | 5.98 ± 0.01  | 5.96 ± 0.01   |
| c         | mm | 104.0 ± 0.2  | 101.9 ± 0.2   |
| α         | °  | 45           | 45            |



#### WARNING

- ◆ *Care must be taken when disposing of old sodium-cooled exhaust valves.*
- ◆ *The valves must be sawn in two with a metal saw between the centre of the stem and valve head. When doing so, the valves must not come into contact with water. After preparing the valves, throw a maximum of ten into a bucket of water. Then step away immediately, since a chemical reaction will occur in which the sodium filling burns.*
- ◆ *After performing these steps the valves can be disposed of in the normal way.*

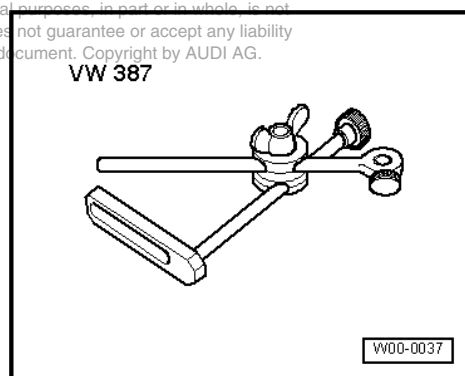
### 3.8 Checking valve guides

#### Special tools and workshop equipment required

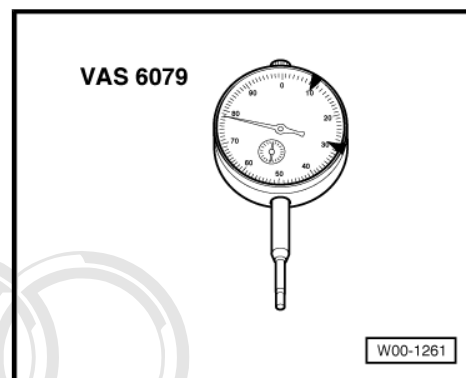
- ◆ Universal dial gauge bracket - **VW 387**

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**VW 387**



- ◆ Dial gauge - VAS 6079-



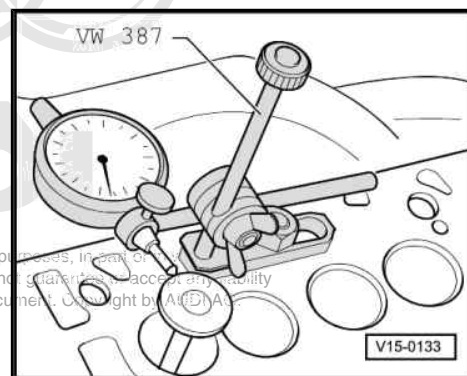
## Procedure



### Note

- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ◆ *Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.*

- Insert valve into guide.
- End of valve stem must be flush with valve guide.
- Measure the amount of sideways play.
- Wear limit: 0.8 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded.



### Note

*Valve guides cannot be renewed.*

## 3.9 Checking valves

- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.

## 17 – Lubrication

### 1 Sump (bottom section), sump (top section), oil pump, engine oil cooler



#### Caution

*Risk of damage to catalytic converter.*

- ◆ *The oil level must not be above the "max" mark on the dipstick.*



#### Note

- ◆ *If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil galleries carefully and renew the oil spray jets, engine oil cooler and oil filter.*
- ◆ *Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.*

⇒ "1.1 Exploded view - sump (bottom section), sump (top section), oil pump, engine oil cooler", page 214

⇒ "1.2 Removing and installing oil level and oil temperature sender G266", page 217

⇒ "1.3 Removing and installing sump (bottom section)", page 218

⇒ "1.4 Removing and installing oil pump", page 221

⇒ "1.5 Removing and installing sump (top section)", page 221

⇒ "1.6 Removing and installing engine oil cooler", page 225

### 1.1 Exploded view - sump (bottom section), sump (top section), oil pump, engine oil cooler



#### Note

*Oil spray jet for piston cooling ⇒ page 217.*



**1 - Nut**

- ☐ 9 Nm

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

- ☐ Removing and installing  
⇒ [page 217](#)

**3 - Seal**

- ☐ Renew

**4 - Sump (bottom section)**

- ☐ Removing and installing  
⇒ [page 218](#)

**5 - Bolt**

- ☐ 9 Nm

**6 - Baffle plate (bottom)****7 - Bolt**

- ☐ 16 Nm
- ☐ Tighten in stages and in diagonal sequence

**8 - Sump (top section)**

- ☐ Removing and installing  
⇒ [page 221](#)

**9 - Dowel sleeve**

- ☐ 2x

**10 - O-ring**

- ☐ Inserted in retaining frame
- ☐ Renew

**11 - Bolt**

- ☐ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ☐ 9 Nm

**12 - Baffle plate (top)****13 - Seal**

- ☐ Inserted in retaining frame
- ☐ Renew

**14 - Gasket**

- ☐ Renew

**15 - Bolt**

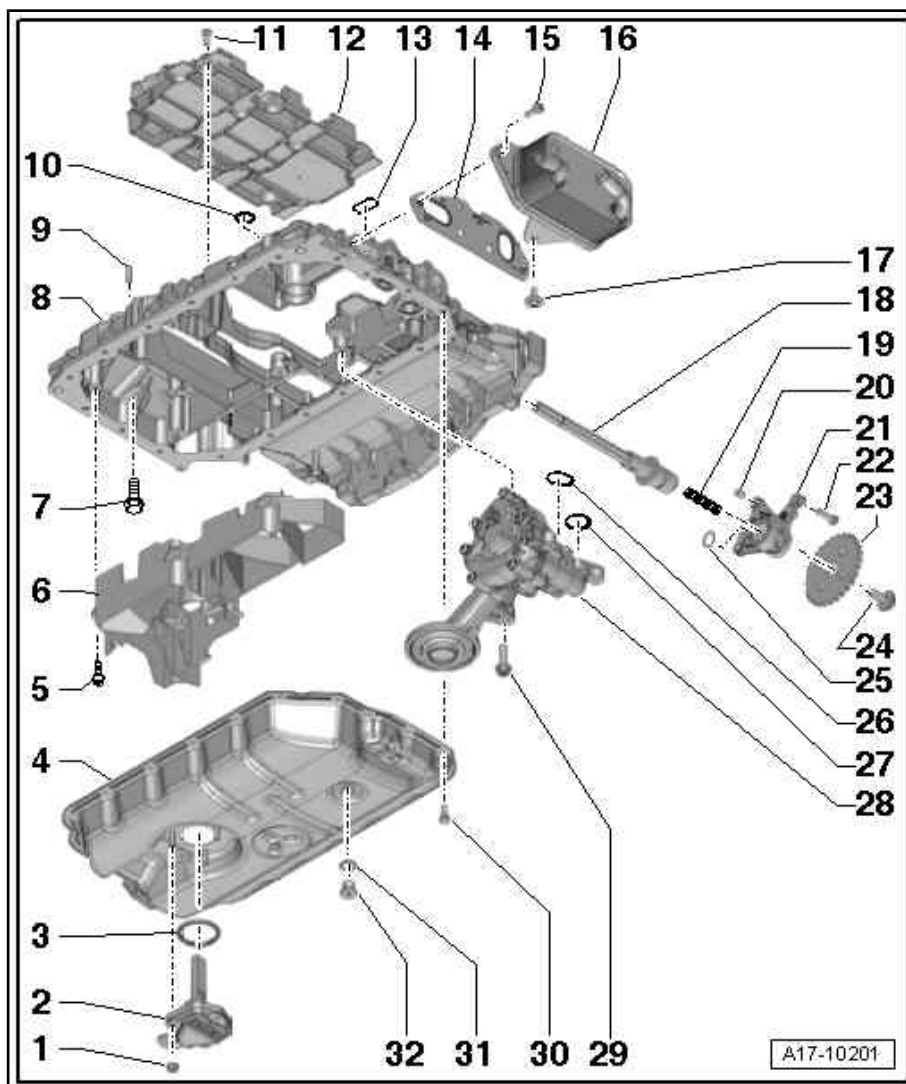
- ☐ 9 Nm

**16 - Engine oil cooler**

- ☐ See note ⇒ [page 214](#)
- ☐ Removing and installing ⇒ [page 225](#)
- ☐ With oil cooler bypass valve

**17 - Bolt**

- ☐ 9 Nm



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**18 - Oil pump drive shaft**

**19 - Compression spring**

**20 - Sleeve**

- ☐ 2x

**21 - Bearing bracket**

**22 - Bolt**

- ☐ 9 Nm

**23 - Chain sprocket for oil pump**

- ☐ Can only be fitted in one position on drive shaft

**24 - Bolt**

- ☐ Renew
- ☐ 30 Nm + turn 90° further
- ☐ To loosen, use pin wrench - 3212- to counterhold chain sprocket

**25 - O-ring**

- ☐ Renew

**26 - Seal**

- ☐ Renew

**27 - O-ring**

- ☐ Renew

**28 - Oil pump**

- ☐ Do not dismantle
- ☐ Removing and installing ⇒ [page 221](#)

**29 - Bolt**

- ☐ 20 Nm

**30 - Bolt**

- ☐ Renew
- ☐ 5 Nm + turn 90° further
- ☐ Tighten in stages and in diagonal sequence

**31 - Seal**

- ☐ Renew

**32 - Oil drain plug**

- ☐ 30 Nm

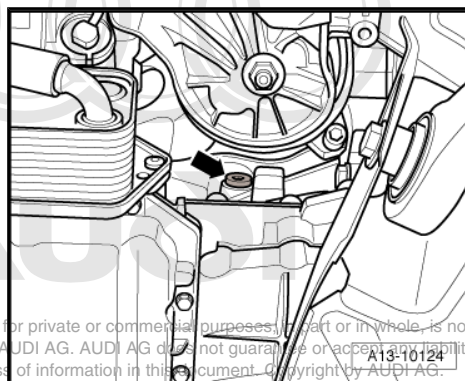
**Plug for "TDC" drilling, tightening torque**



**Note**

*Renew seal.*

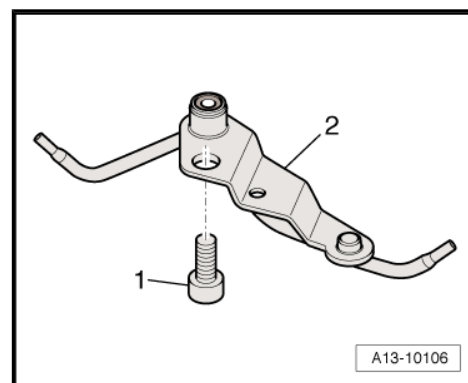
- Tighten plug to 14 Nm.



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**Oil spray jet for piston cooling**

- 1 - Apply locking fluid to bolt when installing; for locking fluid refer to ⇒ Electronic parts catalogue . Tighten to 9 Nm.
- 2 - Oil spray jet with spray nozzle valve

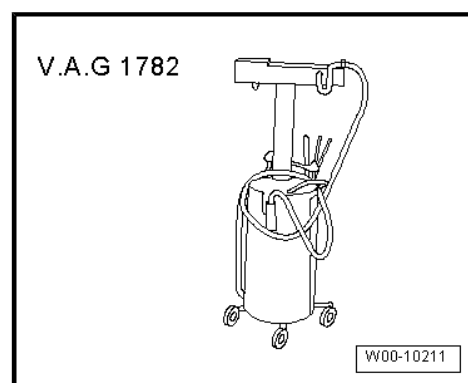


## 1.2 Removing and installing oil level and oil temperature sender - G266-

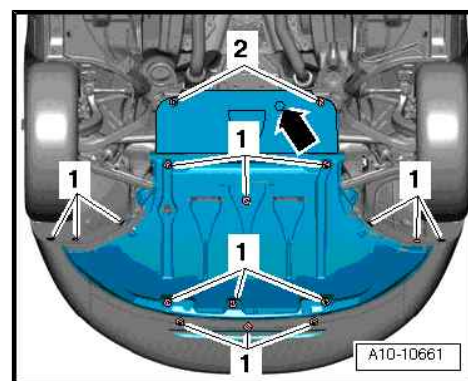
**Special tools and workshop equipment required**

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

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**Removing**

- Release fasteners -1- and remove front noise insulation panel.
- Place used oil collection and extraction unit - V.A.G 1782- underneath engine and drain off engine oil.



- Unplug electrical connector -3-.
- Remove nuts -1- and detach oil level and oil temperature sender - G266- -item 4-.

### Installing

- Tightening torque ⇒ [page 214](#)

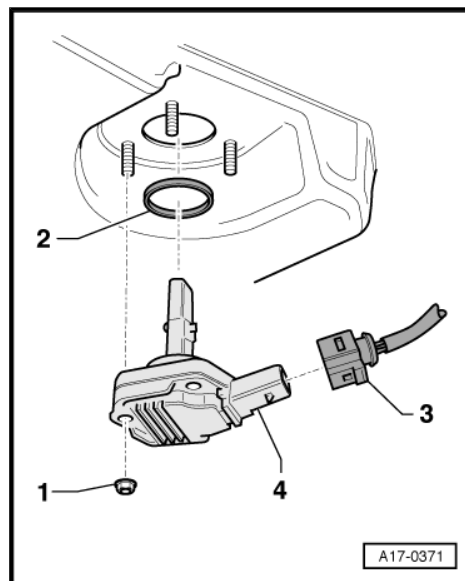
Installation is carried out in the reverse order; note the following:



### Note

Renew seal -2-.

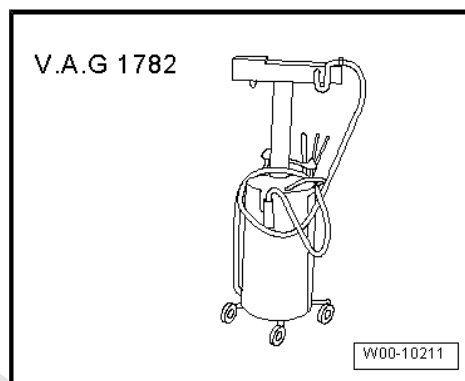
- Fill with engine oil and check oil level ⇒ [page 237](#) .



## 1.3 Removing and installing sump (bottom section)

### Special tools and workshop equipment required

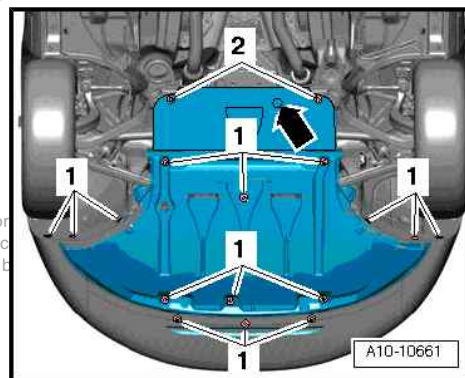
- ◆ Used oil collection and extraction unit - V.A.G 1782-



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

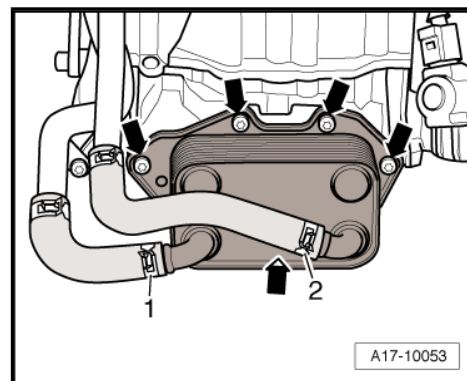
### Removing

- Release fasteners -1- and remove front noise insulation panel.
- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.



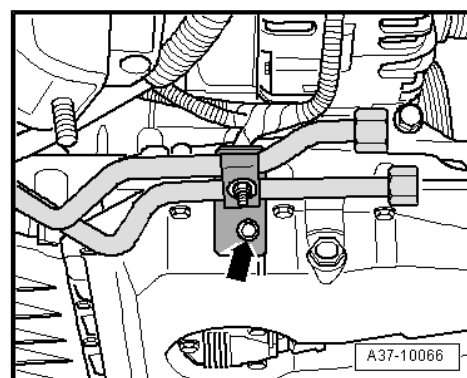
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- Remove bolts -arrows- and remove engine oil cooler (coolant hoses -1- and -2- remain connected).

**Note**

*Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00.*

- Detach bracket -arrow- for ATF lines from sump.



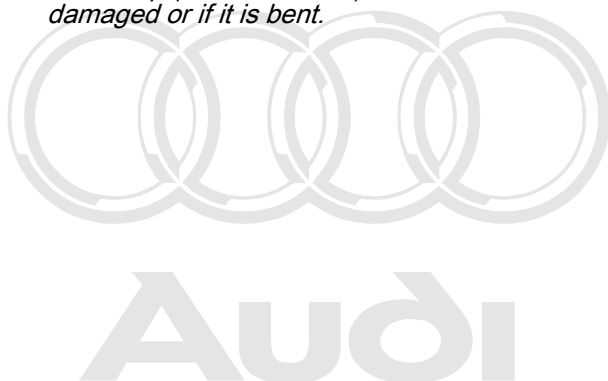
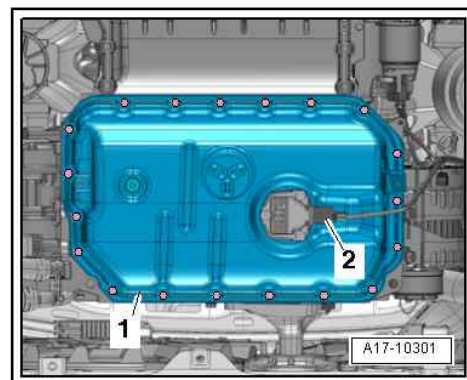
- Unplug electrical connector -2- at oil level and oil temperature sender - G266- and move electrical wiring clear.
- Remove bolts for sump (bottom section) -1-.
- Release sump (bottom section) from bonded joint, taking care not to bend sump.

**Installing**

- Tightening torques ⇒ [page 214](#)

**Note**

- ◆ *Renew seal and gaskets.*
- ◆ *The sump (bottom section) must be renewed if its coating is damaged or if it is bent.*



**WARNING**

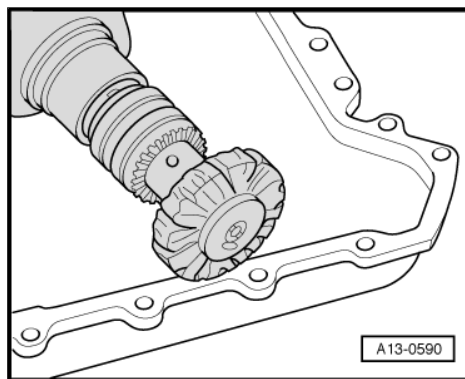
*Risk of eye injury.*

- ◆ *Wear safety goggles.*

**Caution**

*Protect lubrication system and bearings against contamination.*

- ◆ *Cover exposed parts of the engine.*

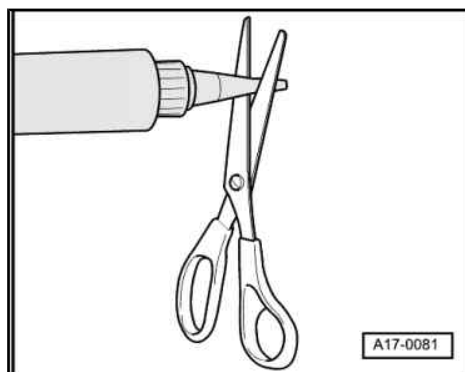


- Remove remaining sealant on bottom and top section of sump with a rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

**Note**

*Take care not to damage the coating on the sump (bottom section).*

- Cut off nozzle of tube at front marking (Ø of nozzle approx. 1 mm).



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**Caution**

***Make sure lubrication system is not clogged by excess sealant.***

- ◆ ***The bead of sealant must not be thicker than specified.***

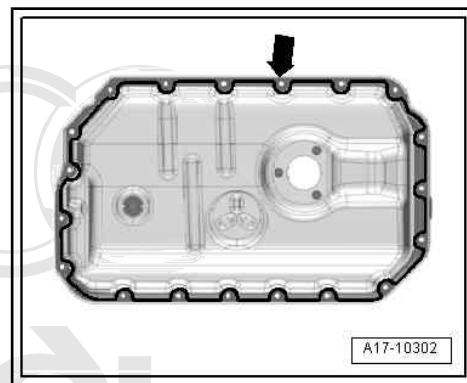
- Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as illustrated.
- The bead of sealant should be approx. 1.5 mm wide.

**Note**

***The sump (bottom section) must be installed within 5 minutes after applying sealant.***

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- Fit sump (bottom section) and tighten all bolts initially to 5 Nm in diagonal sequence.
- Tighten bolts on sump (bottom section) in diagonal sequence
- Install engine oil cooler ⇒ [page 225](#) .
- Fill up with engine oil and check oil level ⇒ [page 237](#) .



## 1.4 Removing and installing oil pump

**Removing**

- Remove sump (bottom section) ⇒ [page 218](#) .
- Remove bolts -arrows-.
- Detach oil pump from drive shaft by pulling it to front, move drive shaft slightly to rear if necessary.

**Installing**

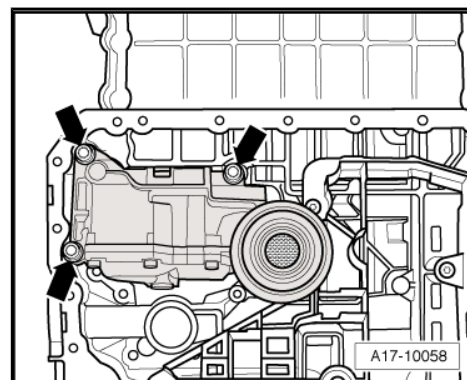
- Tightening torque ⇒ [page 214](#)

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

**Note**

*Fit new O-rings.*

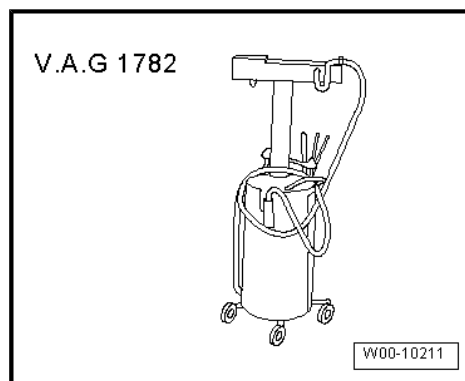
- Fit oil pump onto drive shaft and tighten bolts.
- Install sump (bottom section) ⇒ [page 218](#) .
- Fill up with engine oil and check oil level ⇒ [page 237](#) .



## 1.5 Removing and installing sump (top section)

**Special tools and workshop equipment required**

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



- ◆ Safety goggles
- ◆ Electric drill with plastic brush attachment
- ◆ Sealant → Electronic parts catalogue

### Removing

- Release fasteners -1, 2, arrow- and remove noise insulation.
- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.
- Remove engine:

- ◆ Vehicles with manual gearbox ⇒ [page 9](#) .
- ◆ Vehicles with multitronic gearbox ⇒ [page 39](#) .
- ◆ Vehicles with automatic gearbox 09L ⇒ [page 67](#) .

- Separate engine from gearbox:

- ◆ Vehicles with manual gearbox ⇒ [page 27](#) .
- ◆ Vehicles with multitronic gearbox ⇒ [page 56](#) .
- ◆ Vehicles with automatic gearbox 09L ⇒ [page 85](#) .

- Secure engine to engine stand:

- ◆ Vehicles with manual gearbox ⇒ [page 31](#) .
- ◆ Vehicles with multitronic gearbox ⇒ [page 60](#) .
- ◆ Vehicles with automatic gearbox 09L ⇒ [page 91](#) .

- Vehicles with manual gearbox: remove clutch pressure plate  
⇒ Rep. gr. 30 and dual-mass flywheel ⇒ [page 107](#) .

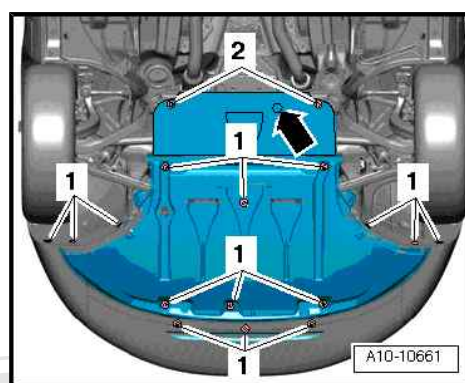
- Vehicles with multitronic gearbox: Remove damper unit  
⇒ [page 111](#) and flywheel ⇒ [page 112](#) .

- Vehicles with automatic gearbox 09L: Remove drive plate  
⇒ [page 114](#) .

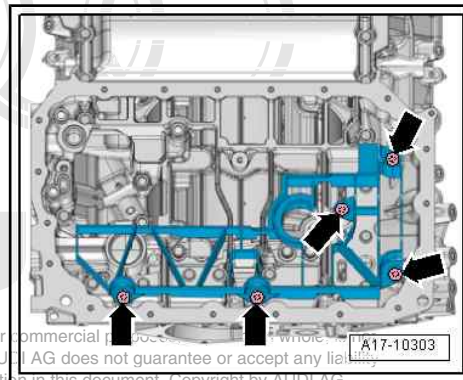
- Remove timing chain cover (bottom) ⇒ [page 135](#) .

- Remove sump (bottom section) ⇒ [page 218](#) .

- Remove oil pump ⇒ [page 221](#) .



- Unscrew bolts -arrows- and remove baffle plate (bottom).



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- Remove bolts -1 ... 6- for sump (top section).
- Press sump (top section) off spring pins on cylinder block.

### Installing

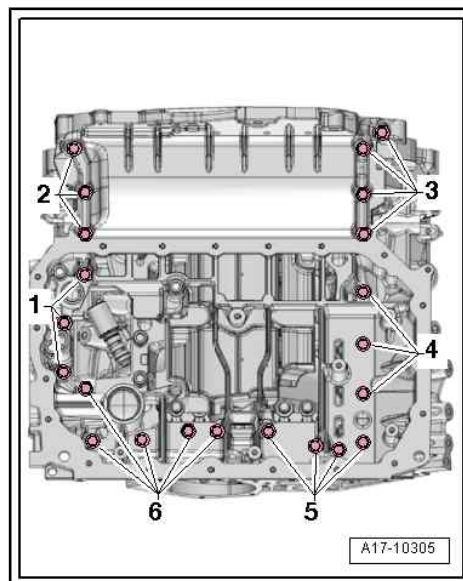
- Tightening torques ⇒ [page 214](#)



### Note

*Renew gaskets, seals and O-rings.*

- Remove old sealant from grooves on sump (top section) and from sealing surfaces.



### WARNING

*Risk of eye injury.*

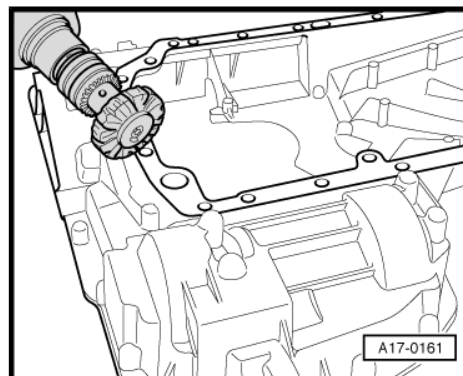
- ◆ *Wear safety goggles.*



### Caution

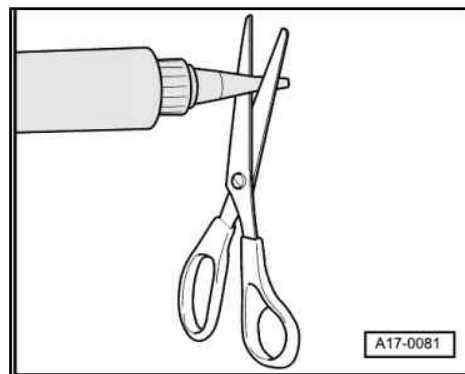
*Protect lubrication system and bearings against contamination.*

- ◆ *Cover exposed parts of the engine.*



- Remove remaining sealant on sump (top section) and cylinder block using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

- Cut off nozzle of tube at front marking ( $\varnothing$  of nozzle approx. 2 mm).



### Caution

***Make sure lubrication system is not clogged by excess sealant.***

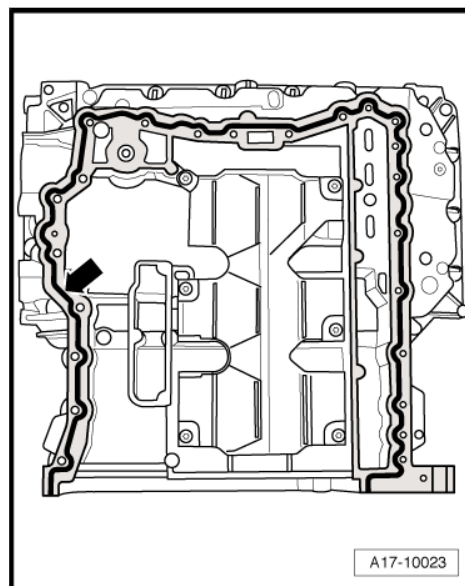
- ◆ ***The bead of sealant must not be thicker than specified.***

- Apply bead of sealant -arrow- onto clean sealing surface of sump (top section) as shown in illustration.
- The grooves on the sealing surfaces must be completely filled with sealant.
- The bead of sealant must project 1.5 ... 2.0 mm above the sealing surface.



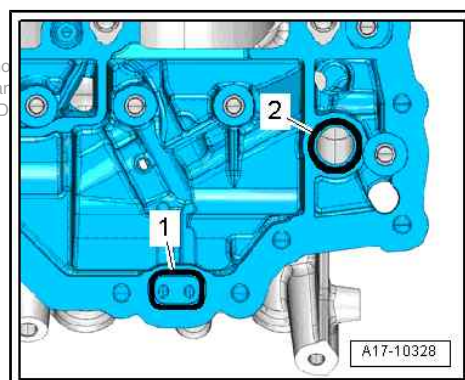
### Note

***The sump (top section) must be installed within 5 minutes after applying sealant.***



- Fit seal -1- and O-ring -2- in retaining frame.

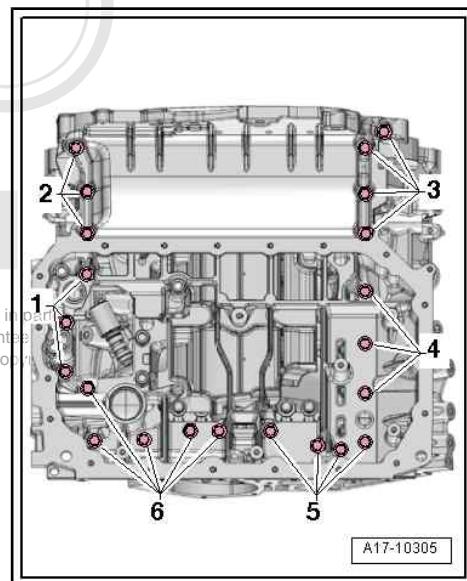
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- Fit sump (top section) and tighten bolts -1 ... 6- in diagonal sequence to 5 Nm.
- Tighten bolts -1 ... 6- in diagonal sequence.

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

- Install oil pump ⇒ [page 221](#) .
- Install sump (bottom section) ⇒ [page 218](#) .
- Install timing chain cover (bottom) ⇒ [page 135](#) .
- Vehicles with manual gearbox: install dual-mass flywheel ⇒ [page 107](#) and pressure plate ⇒ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 112](#) and damper unit ⇒ [page 111](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 114](#) .
- Bolt gearbox to engine and install engine/gearbox assembly:
  - ◆ Vehicles with manual gearbox ⇒ [page 33](#)
  - ◆ Vehicles with multitronic gearbox ⇒ [page 62](#)
  - ◆ Vehicles with automatic gearbox 09L ⇒ [page 93](#)
- Fill up with engine oil and check oil level ⇒ [page 237](#) .

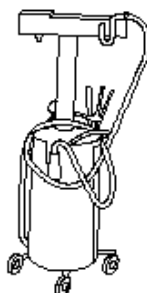


## 1.6 Removing and installing engine oil cooler

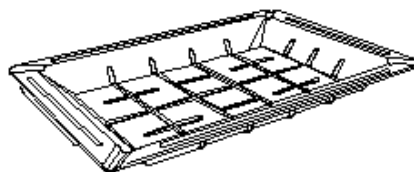
### Special tools and workshop equipment required

- ◆ Used oil collection and extraction unit - V.A.G 1782-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clamps up to Ø 25 mm - 3094-

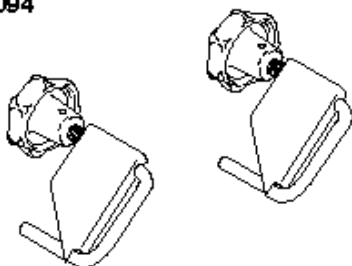
V.A.G 1782



VAS 6208



3094



G17-10011

### Removing



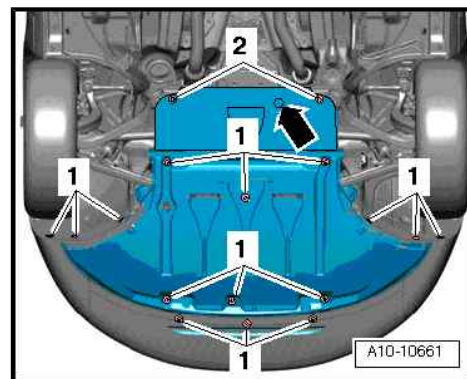
#### WARNING

**Hot steam/hot coolant can escape - risk of scalding.**

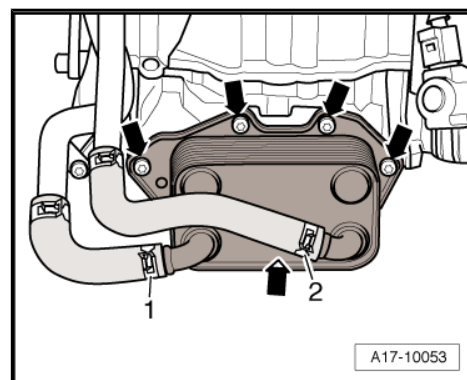
- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.*

- Open filler cap on coolant expansion tank.

- Release fasteners -1, 2, arrow- and remove noise insulation.
- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Clamp off coolant hoses -1- and -2- using hose clamps up to 25 mm - 3094- and disconnect hoses from engine oil cooler.
- Place used oil collection and extraction unit - V.A.G 1782- under engine.
- Unscrew bolts -arrows- and detach engine oil cooler.



### Installing

- Tightening torque ➔ [page 214](#)

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) ➔ Electronic parts catalogue .*
- Fill up with engine oil and check oil level ➔ [page 237](#) .
- Fill cooling system ➔ [page 242](#) .



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## 2 Oil filter housing, oil pressure switch

⇒ ["2.1 Exploded view - oil filter housing, oil pressure switch", page 228](#)

⇒ ["2.2 Removing and installing oil filter housing", page 229](#)

⇒ ["2.3 Removing and installing oil pressure switch F22", page 231](#)

⇒ ["2.4 Removing and installing oil pressure switch for reduced oil pressure F378", page 232](#)

⇒ ["2.5 Removing and installing valve for oil pressure control N428", page 233](#)

⇒ ["2.6 Checking oil pressure", page 234](#)

### 2.1 Exploded view - oil filter housing, oil pressure switch

#### 1 - Bolt

- ☐ 13 Nm

#### 2 - Oil pressure switch - F22-

- ☐ Black insulation
- ☐ Removing and installing ⇒ [page 231](#)
- ☐ 20 Nm

#### 3 - Seal

- ☐ Renew

#### 4 - Flange nut

- ☐ 13 Nm

#### 5 - Bolt

- ☐ 9 Nm

#### 6 - Sleeve

#### 7 - Rubber grommet

#### 8 - Oil filter housing

- ☐ With filter bypass valve
- ☐ With oil retention valve
- ☐ The oil retention valve cannot be renewed

#### 9 - O-ring

- ☐ Renew
- ☐ Installing ⇒ [page 229](#)

#### 10 - Sealing cap

- ☐ 25 Nm

#### 11 - Seal

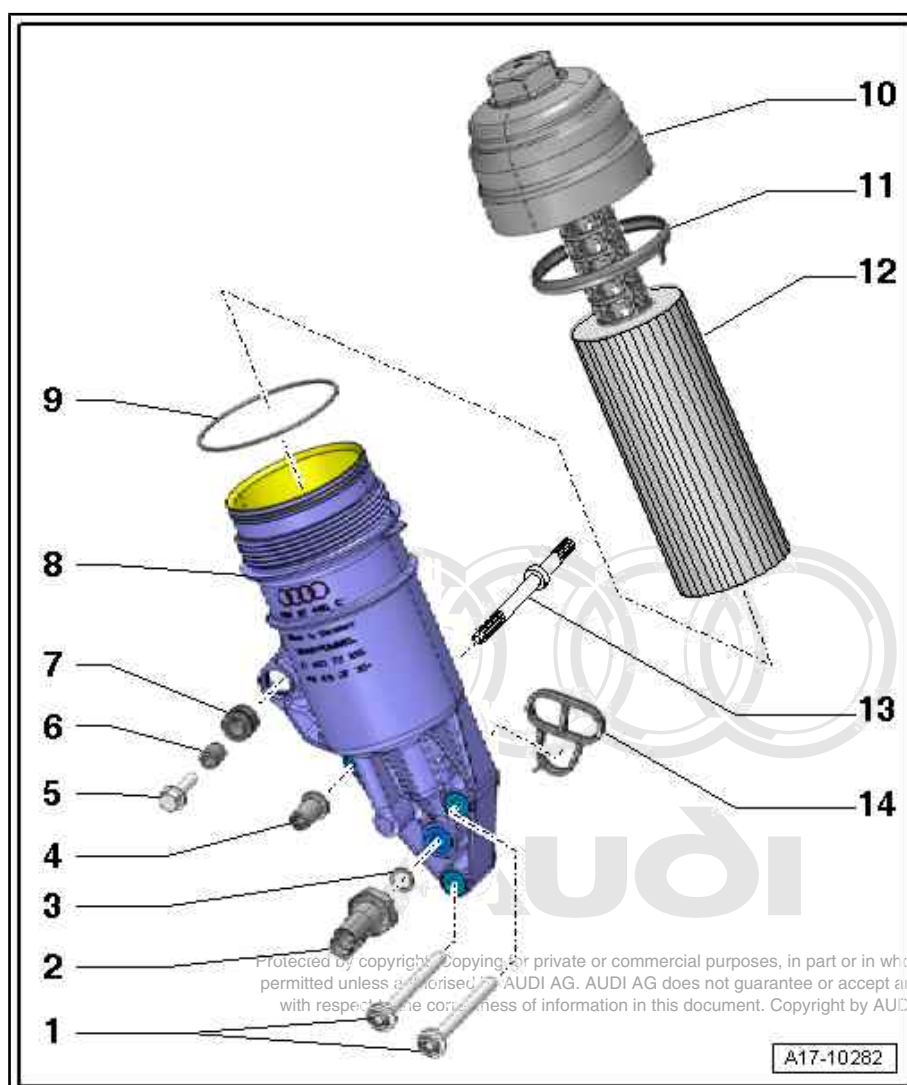
- ☐ Renew
- ☐ Removing and installing ⇒ [page 229](#)

#### 12 - Oil filter element

- ☐ Removing and installing ⇒ Maintenance ; Booklet 405

#### 13 - Stud

- ☐ 16 Nm

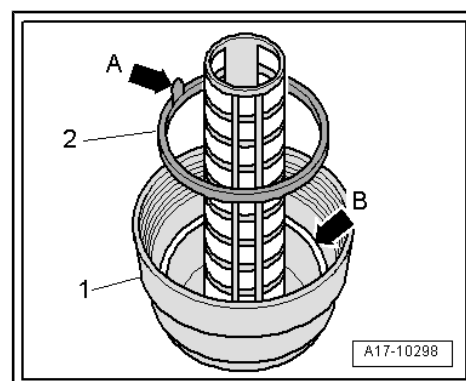


**14 - Gasket**

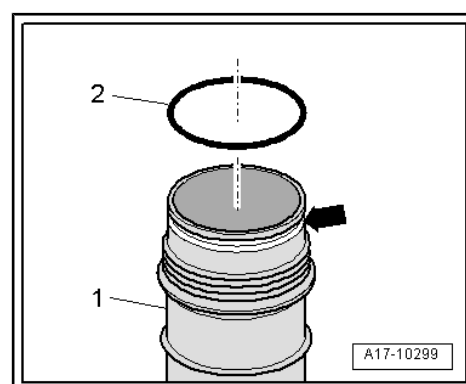
- ☐ Renew

**Renewing seal on sealing cap**

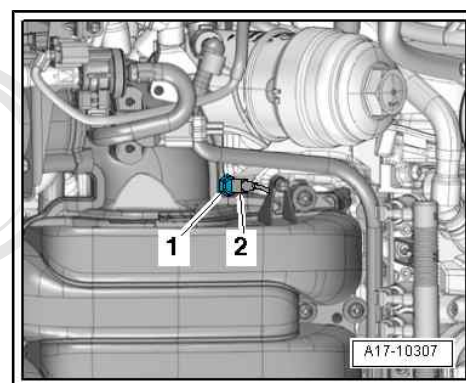
- Take hold of tab -arrow A- and pull seal -2- out of sealing cap -1-.
- Fit new seal with semi-circular profile in groove -arrow B- in sealing cap.
- The tab -arrow A- must face upwards.

**Installing O ring on oil filter housing**

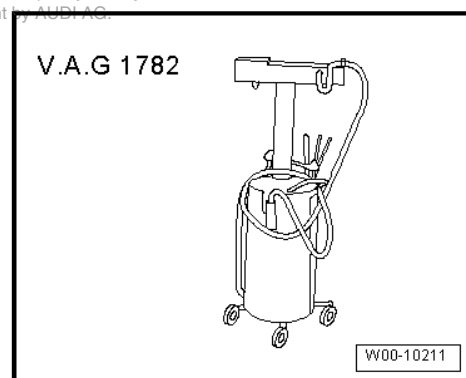
- Install O-ring -2- in groove -arrow- on oil filter housing -1-.

**Oil pressure switch for reduced oil pressure - F378- , tightening torque**

- Tighten oil pressure switch for reduced oil pressure - F378- to 20 Nm.

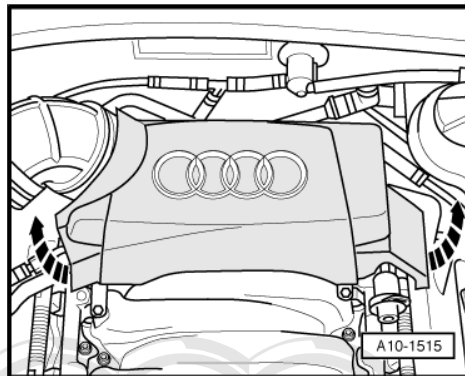
**2.2 Removing and installing oil filter housing****Special tools and workshop equipment required**

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

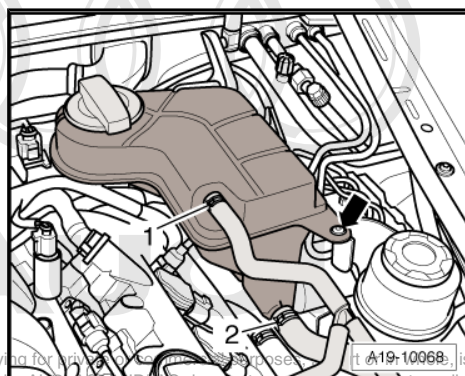


## Removing

- Pull off engine cover panel (rear) -arrows-.



- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



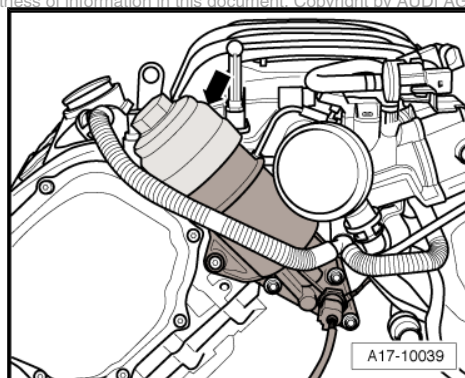
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### Note

*For illustration purposes, the work steps are shown in the following illustrations from the rear with the engine removed.*

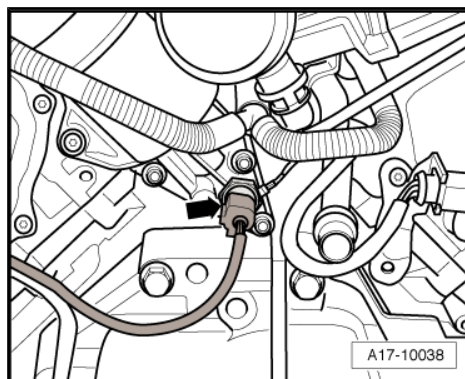
- Unscrew sealing cap -arrow- for oil filter housing.
- Remove oil filter element.
- Extract engine oil from oil filter housing using used oil collection and extraction unit - V.A.G 1782- .



### Note

*Place a cloth below the oil filter housing to catch escaping oil.*

- Unplug electrical connector on oil pressure switch - F22- -arrow-.



- Remove bolts -arrows- and nut -1-.
- Remove oil filter housing.

#### Installing

- Tightening torques ⇒ [page 228](#)

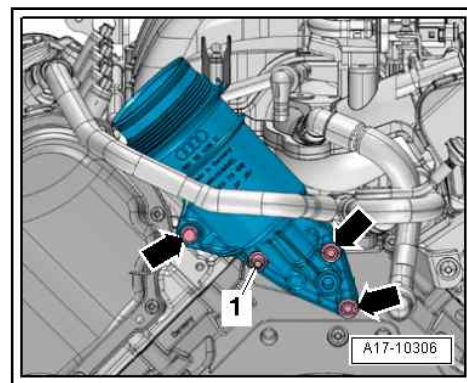
Installation is carried out in the reverse order; note the following:



#### Note

*Renew gaskets, seals and O-rings.*

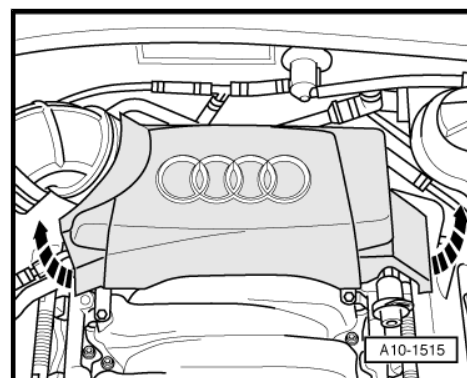
- Fill up with engine oil and check oil level ⇒ [page 237](#).



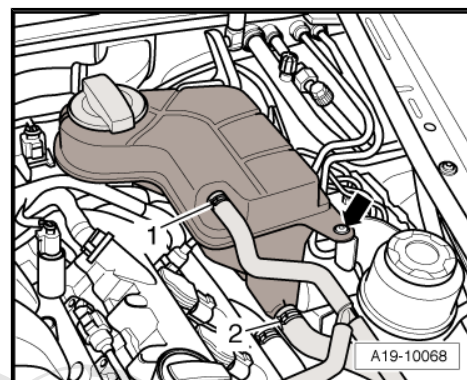
## 2.3 Removing and installing oil pressure switch - F22-

#### Removing

- Pull off engine cover panel (rear) -arrows-.



- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



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### Note

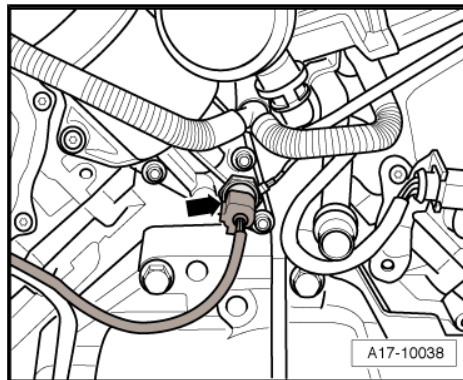
Place a cloth below the oil filter housing to catch escaping oil.

- Unplug electrical connector on oil pressure switch - F22-  
-arrow-.
- Unscrew oil pressure switch - F22- .

### Installing

- Tightening torque ⇒ [page 228](#)

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



### Note

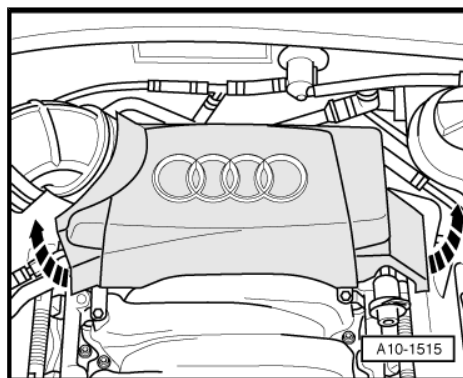
Renew seal.

- Check oil level ⇒ [page 237](#) .

## 2.4 Removing and installing oil pressure switch for reduced oil pressure - F378-

### Removing

- Pull off engine cover panel (rear) -arrows-.

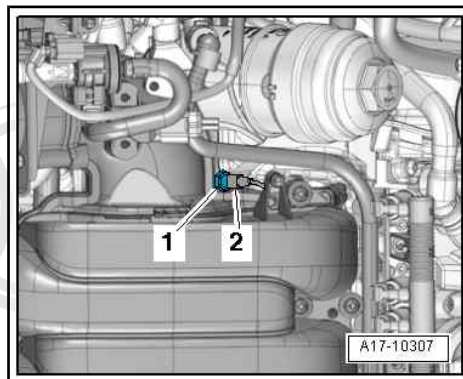


- Unplug electrical connector -2-.
- Remove oil pressure switch for reduced oil pressure - F378-  
-item 1-.

### Installing

- Tightening torque ⇒ [page 229](#)

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



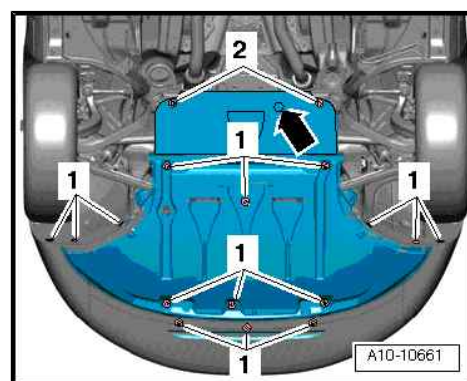
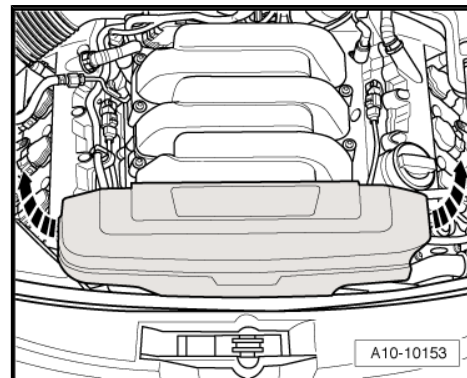
### Note

Renew seal.

## 2.5 Removing and installing valve for oil pressure control - N428-

### Removing

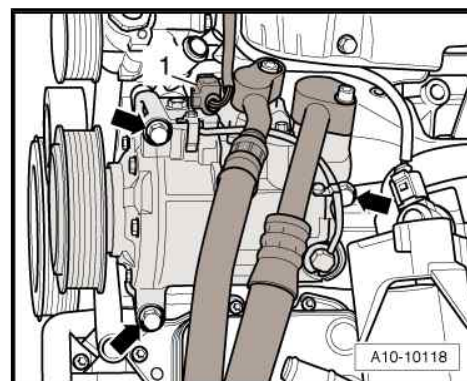
- Pull off engine cover panel (front) -arrows-.
- Remove poly V-belt from air conditioner compressor pulley  
⇒ [“1.2 Removing and installing poly V-belt”, page 101](#).
- Release fasteners -1, 2, arrow- and remove noise insulation.
- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.



### WARNING

*Risk of injury caused by refrigerant.*

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



### Caution

*Danger of damage to refrigerant lines and hoses.*

◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*

- Tie up air conditioner compressor with lines attached to left-side of vehicle.

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- Unplug electrical connector -1-.
- Remove bolt -3- and detach valve for oil pressure control - N428- -item 4-.

### Installing

- Tightening torque ⇒ [page 119](#)

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

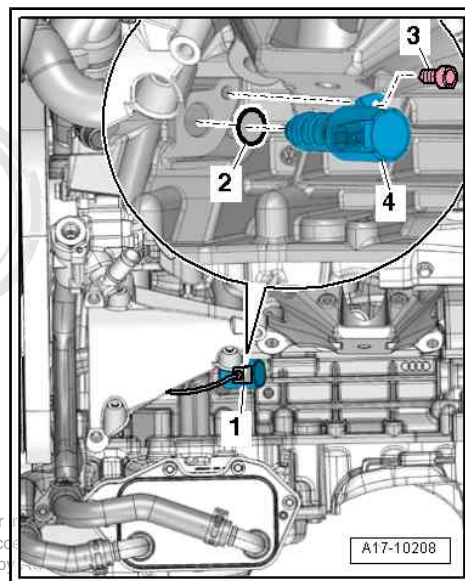


### Note

Fit new O-ring -2-.

- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt ⇒ [page 101](#) .

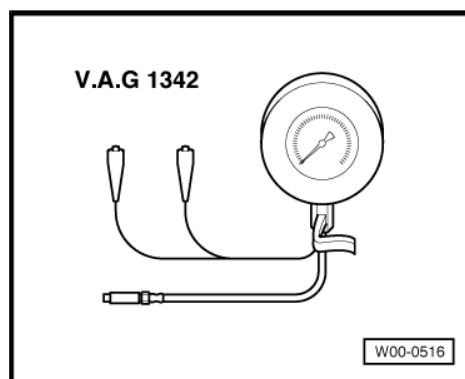
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## 2.6 Checking oil pressure

### Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-



### Procedure

- Oil level OK
- Engine oil temperature approx. 80 °C
- Remove oil pressure switch - F22- ⇒ [page 231](#) .
- Connect oil pressure tester - V.A.G 1342- to threaded hole for oil pressure switch.
- Screw oil pressure switch - F22- into oil pressure tester - V.A.G 1342- .
- Start engine.
- Minimum oil pressure at idling speed: 1.2 bar.
- Minimum oil pressure at 2000 rpm: 1.5 bar.

### Assembling

- Install oil pressure switch - F22- ⇒ [page 231](#) .

### 3 Oil retention valves, oil separator

⇒ [“3.1 Exploded view - oil retention valves, oil separator”, page 235](#)

⇒ [“3.2 Removing and installing crankcase breather hoses - not on USA models”, page 236](#)

⇒ [“3.3 Removing and installing cover with oil separator”, page 237](#)

⇒ [“3.4 Engine oil”, page 237](#)

⇒ [“3.5 Checking oil level”, page 237](#)

#### 3.1 Exploded view - oil retention valves, oil separator

##### 1 - O-ring

- ☐ Renew

##### 2 - Oil retention valve

- ☐ For oil supply to cylinder head (right-side)
- ☐ 20 Nm

##### 3 - Gasket

- ☐ Renew

##### 4 - Cover with oil separator

- ☐ With connection for crankcase breather
- ☐ Removing and installing  
⇒ [page 237](#)

##### 5 - Bolt

- ☐ 9 Nm

##### 6 - Bolt

- ☐ 9 Nm

##### 7 - Bolt

- ☐ 3 Nm

##### 8 - Crankcase breather hose

- ☐ To intake manifold
- ☐ Removing and installing  
⇒ [page 236](#)

##### 9 - Crankcase breather hoses

- ☐ To cylinder head covers
- ☐ Removing and installing  
⇒ [page 236](#)

##### 10 - O-rings

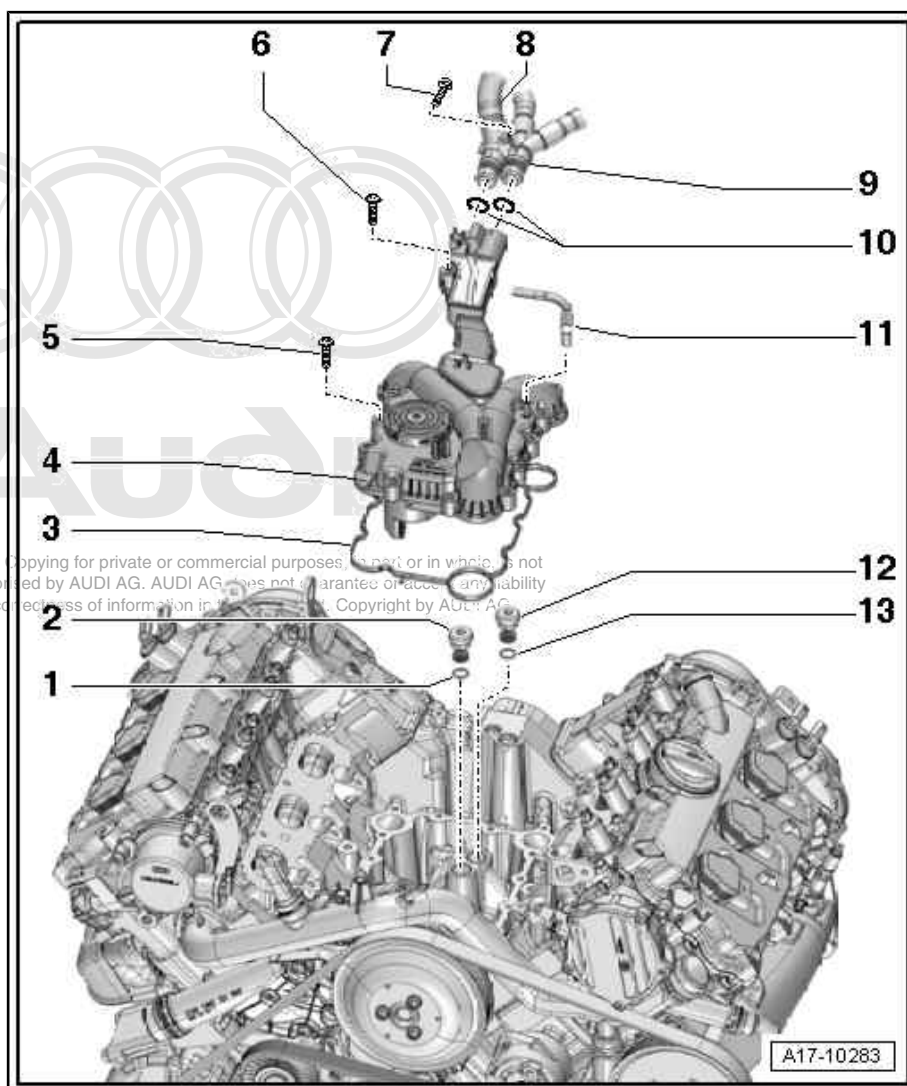
- ☐ Renew

##### 11 - Crankcase breather hose

- ☐ To air pipe

##### 12 - Oil retention valve

- ☐ For oil supply to cylinder head (left-side)
- ☐ 20 Nm



**13 - O-ring**

- ☐ Renew

**3.2 Removing and installing crankcase breather hoses - not on USA models****Removing****Note**

*Fit all cable ties in the original positions when installing.*

- Remove intake manifold (top section) ⇒ Rep. gr. 24 .
- Detach crankcase breather hoses -arrows- from cylinder head covers.
- Move crankcase breather hoses clear.
- Remove bolt -1- and take out hose connection with crankcase breather hoses.

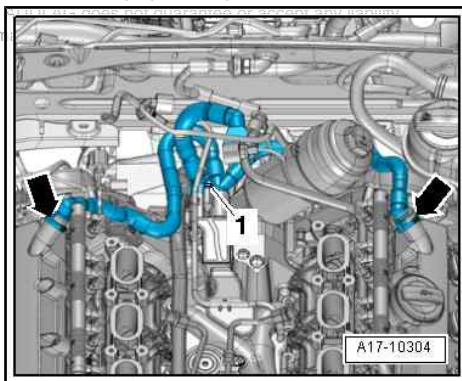
**Installing**

- Tightening torque ⇒ [page 235](#)

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

**Note**

- ◆ *Renew gaskets and O-rings.*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install intake manifold (top section) ⇒ Rep. gr. 24 .



### 3.3 Removing and installing cover with oil separator

#### Removing

- Remove intake manifold (top section) ⇒ Rep. gr. 24 .
- Remove intake manifold bottom section (left-side) ⇒ Rep. gr. 24 .
- Remove coolant pipe (top) ⇒ [page 256](#) .
- Remove bolts -arrows-
- Detach bracket for high-pressure pipes and cover -1- with oil separator.

#### Installing

- Tightening torque ⇒ [page 235](#)

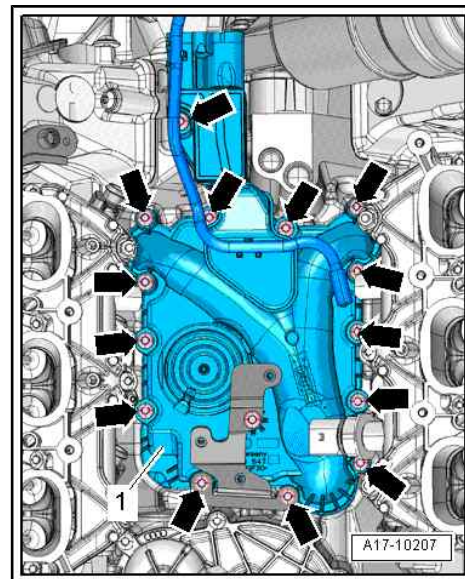
Installation is carried out in the reverse order; note the following:



#### Note

*Renew gasket.*

- Install coolant pipe (top) ⇒ [page 256](#) .
- Install intake manifold bottom section (left-side) ⇒ Rep. gr. 24 .
- Install intake manifold (top section) ⇒ Rep. gr. 24 .



### 3.4 Engine oil

Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.

### 3.5 Checking oil level

#### Procedure

- 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.
- Pull out the oil 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:

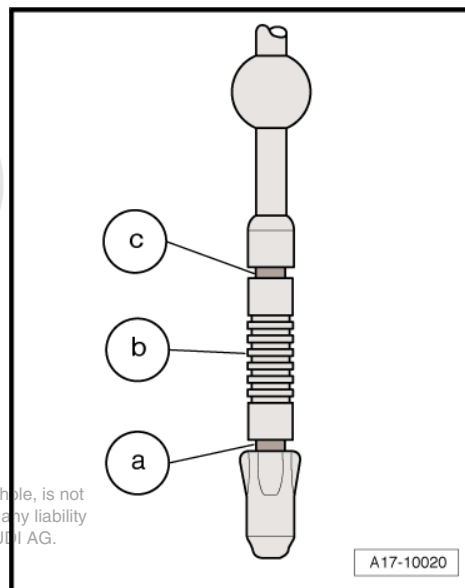
- a - Oil must be topped up.
- b - Oil may be topped up.
- c - Do not top up oil.



**Note**

*The oil level must not be above the "max" marking -c- and not below the "min" marking -a-.*

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## 19 – Cooling

### 1 Cooling system



#### 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.*

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#### Note

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*

⇒ ["1.1 Connection diagram - coolant hoses", page 239](#)

⇒ ["1.2 Draining and filling cooling system", page 241](#)

#### 1.1 Connection diagram - coolant hoses

# 1 - Radiator

- ☐ Removing and installing  
⇒ [page 259](#)
- ☐ If renewed, refill system  
with fresh coolant

# 2 - Coolant pump

- ☐ Removing and installing  
⇒ [page 248](#)

# 3 - Coolant temperature sender - G62-

- ☐ Removing and installing  
⇒ [page 251](#)

# 4 - Thermostat

- ☐ Removing and installing  
⇒ [page 249](#)

# 5 - Heat exchanger for heater

- ☐ Removing and installing  
⇒ Rep. gr. 80 or ⇒ Rep.  
gr. 87
- ☐ If renewed, refill system  
with fresh coolant

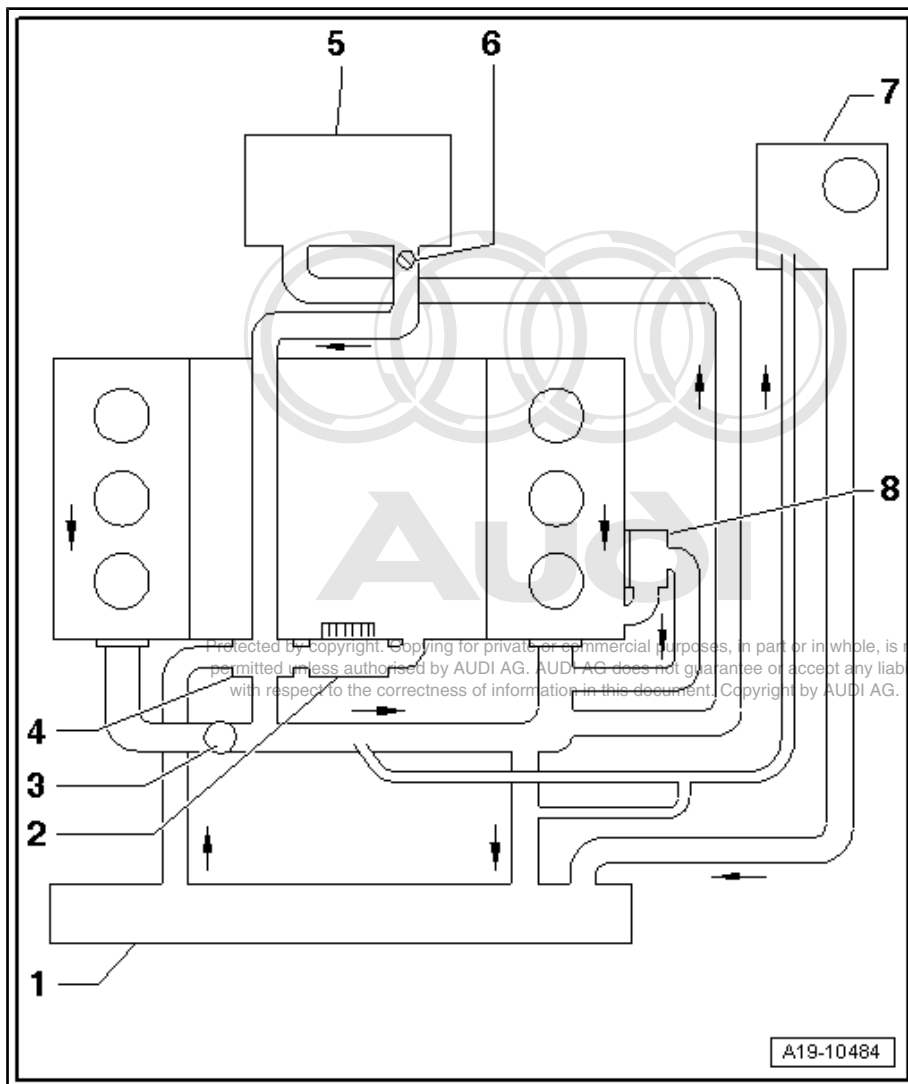
# 6 - Bleeder screw

# 7 - Coolant expansion tank

- ☐ With filler cap
- ☐ Checking pressure re-  
lief valve in filler cap  
⇒ [page 266](#)

# 8 - Engine oil cooler

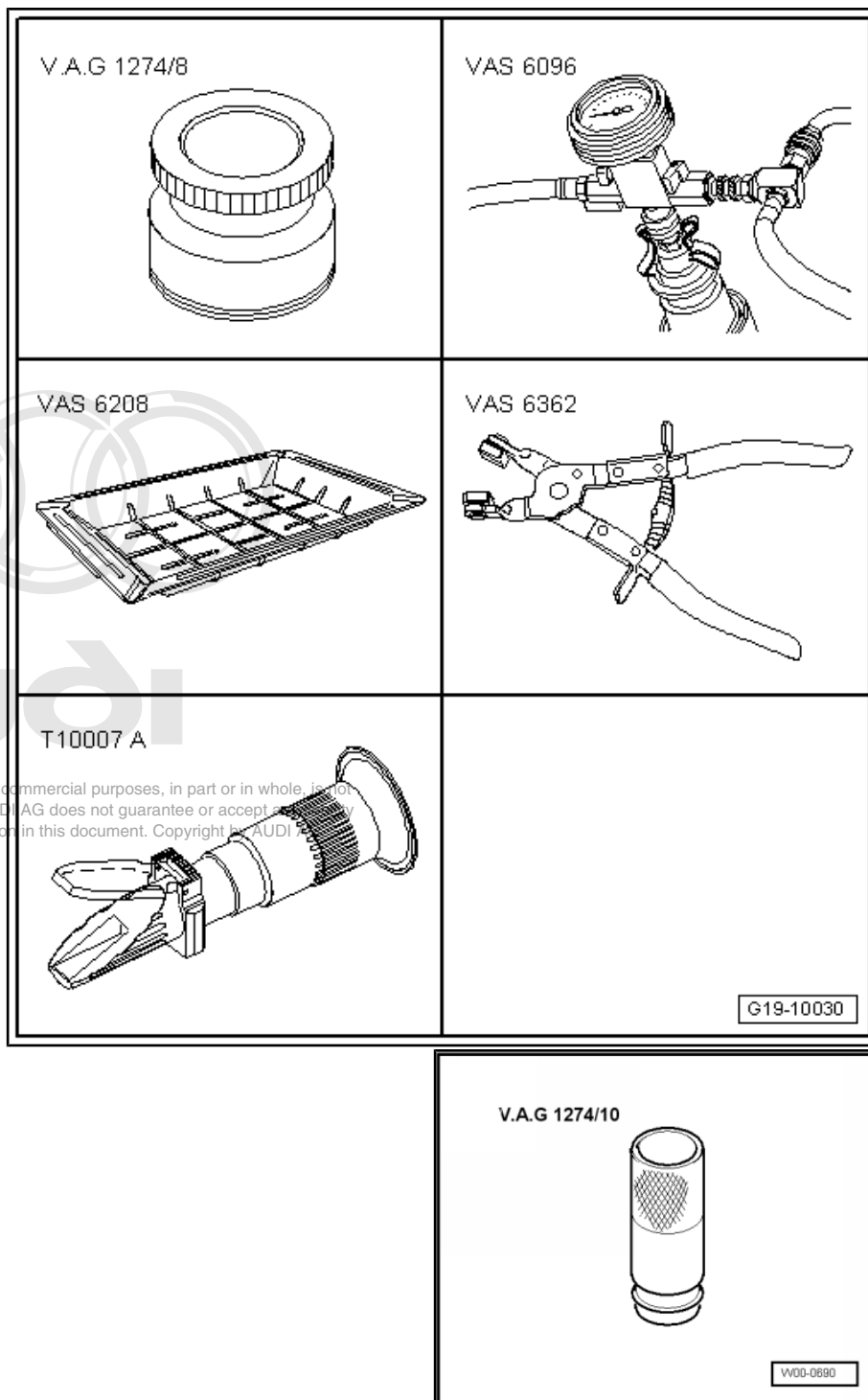
- ☐ Removing and installing  
⇒ [page 225](#)
- ☐ If renewed, refill system  
with fresh coolant



## 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- with - VAS 6096/1-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Refractometer - T10007 A-
- ◆ Pipe for cooling system tester - V.A.G 1274/10-



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### Draining



#### Note

Collect drained coolant in a container for disposal.

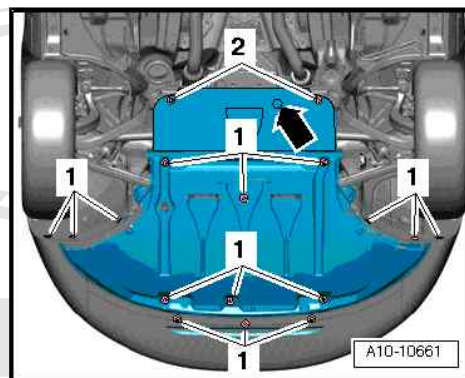


# WARNING

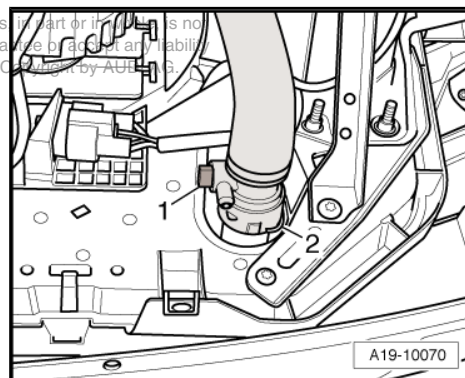
*Hot steam/hot coolant can escape - risk of scalding.*

- ◆ *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.
- Release fasteners -1, 2, arrow- and remove noise insulation.



- Place drip tray for workshop hoist -VAS 6208- beneath engine.
- Open drain plug -1- and let coolant drain.



# Note

*Disregard item -2-.*

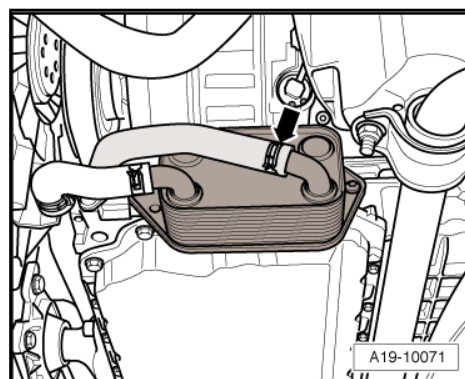
- Disconnect coolant hose -arrow- from engine oil cooler and drain off coolant.

# Filling



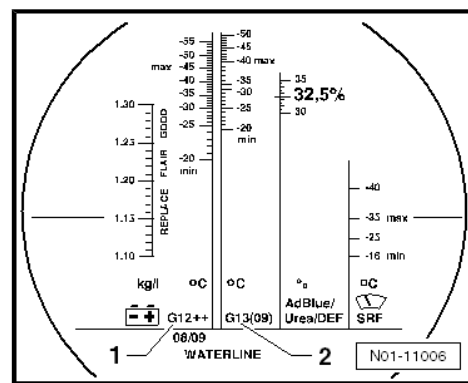
# Caution

*Always use distilled water for mixing coolant additives as this ensures optimum corrosion protection.*



**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.*

**Recommended mixture ratio for coolant**

- 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

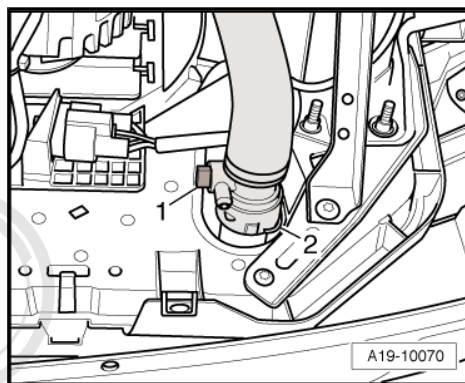
## Procedure

- Close drain plug -1-.

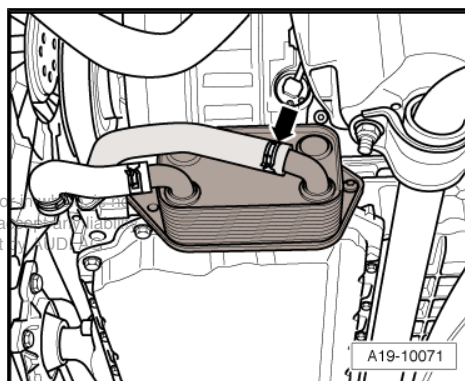


### Note

Disregard item -2-.



- Connect coolant hose to engine oil cooler -arrow-.



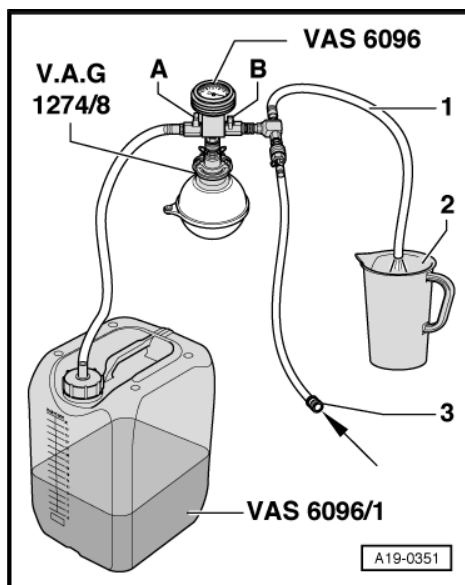
- Fill reservoir of -VAS 6096- with 12 litres of premixed coolant (according to recommended ratio):
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-.



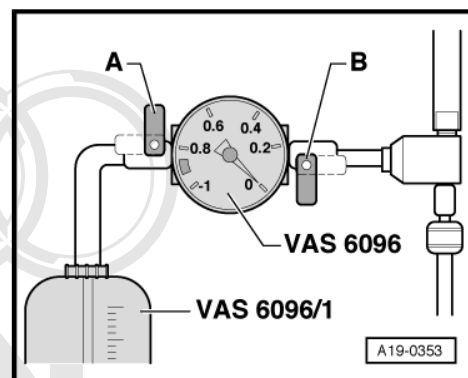
### Note

The vented air draws along a small amount of coolant, which should be collected.

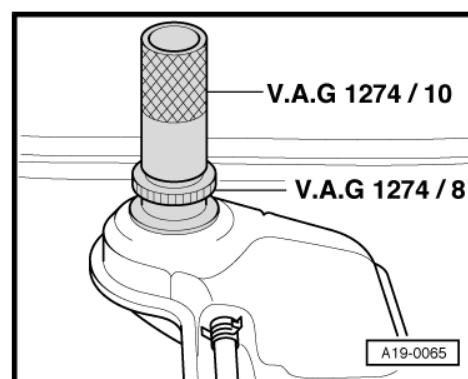
- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



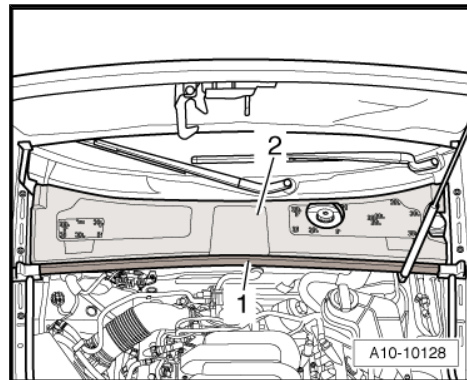
- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump continues to generate 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.

**Note**

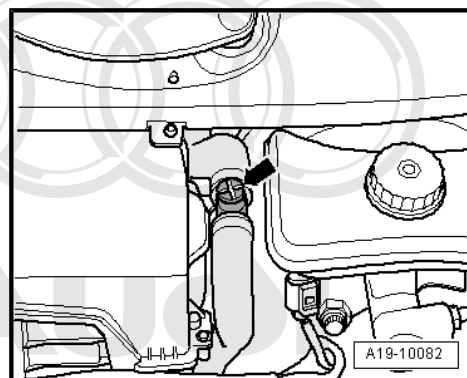
- ◆ *If the needle does not reach the green zone, repeat the process.*
- ◆ *Check cooling system for leaks if the vacuum is not maintained.*
- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.
- Detach cooling system charge unit - VAS 6096- from adapter -V.A.G 1274/8- on coolant expansion tank.
- Fit pipe for cooling system tester - V.A.G 1274/10- onto adapter.



- Pull off rubber seal -1- and remove plenum chamber cover -2-.



- Open bleeder screw -arrow-.
- Fill up with coolant until it flows out at bleeder hole in coolant hose.
- Close bleeder screw.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Tighten filler cap on expansion tank.
- Start engine.
- Set temperature to “HI” in all zones.
- Switch off air conditioner compressor; to do so, press **ECON** or **AC** button (depending on version).

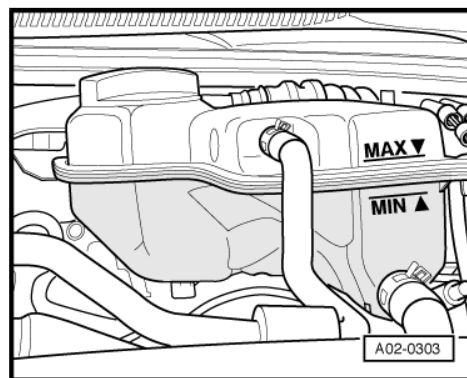


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### Note

- ◆ **ECON** button: LED must light up.
- ◆ **AC** button: LED must not light up.
- 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.



## 2 Coolant pump, thermostat, coolant pipes

⇒ [“2.1 Exploded view - coolant pump, thermostat and connection”, page 247](#)

⇒ [“2.2 Removing and installing coolant pump”, page 248](#)

⇒ [“2.3 Removing and installing thermostat”, page 249](#)

⇒ [“2.4 Exploded view - coolant pipes”, page 249](#)

⇒ [“2.5 Removing and installing coolant temperature sender G62”, page 251](#)

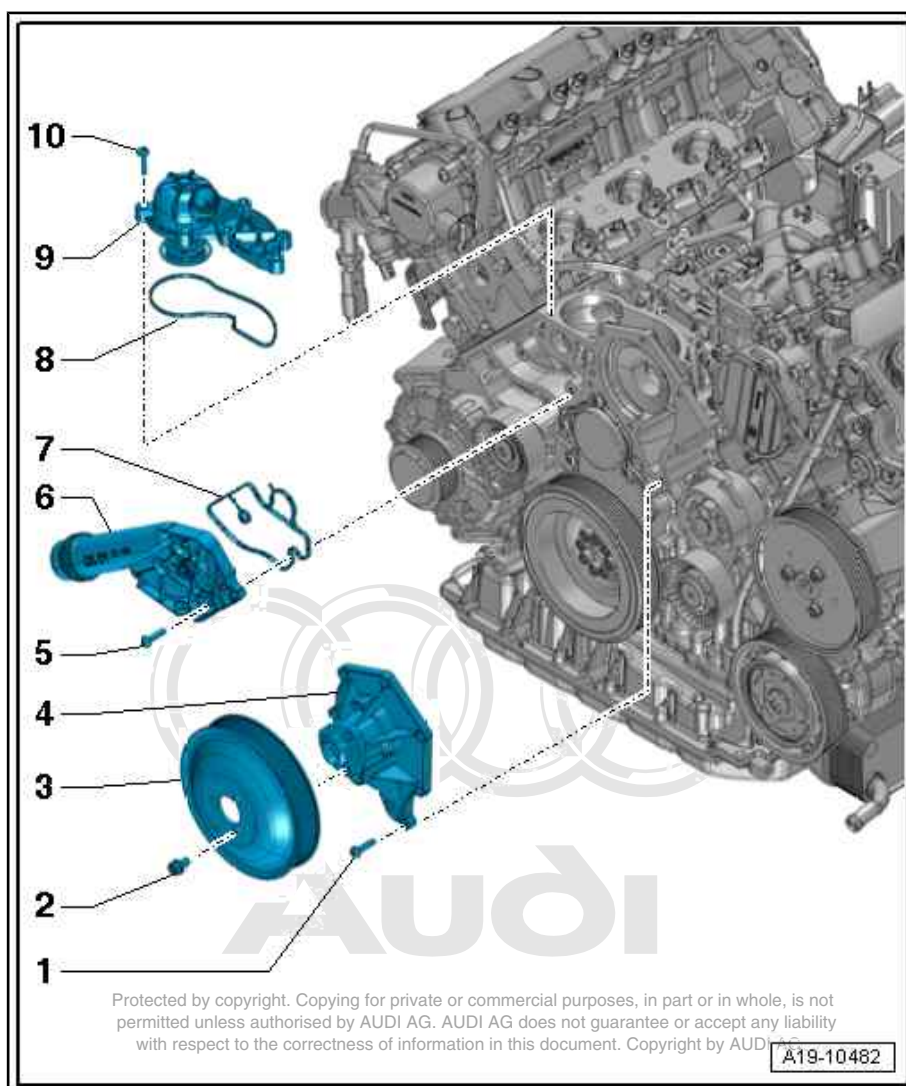
⇒ [“2.6 Removing and installing coolant pipe \(front\)”, page 251](#)

⇒ [“2.7 Removing and installing coolant pipes \(left-side\)”, page 253](#)

⇒ [“2.8 Removing and installing coolant pipe \(top\)”, page 256](#)

### 2.1 Exploded view - coolant pump, thermostat and connection

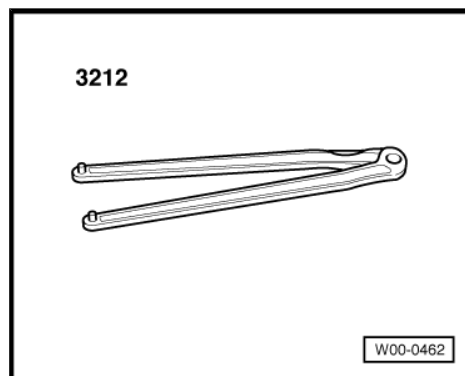
- 1 - Bolt
  - ☐ 9 Nm
- 2 - Bolt
  - ☐ 20 Nm
- 3 - Poly V-belt pulley for coolant pump
- 4 - Coolant pump
  - ☐ With gasket
  - ☐ Removing and installing  
⇒ [page 248](#)
- 5 - Bolt
  - ☐ 9 Nm
- 6 - Connection
  - ☐ For coolant hose
- 7 - Gasket
  - ☐ Renew
- 8 - Gasket
  - ☐ Renew
- 9 - Thermostat
  - ☐ Removing and installing  
⇒ [page 249](#)
- 10 - Bolt
  - ☐ 9 Nm



## 2.2 Removing and installing coolant pump

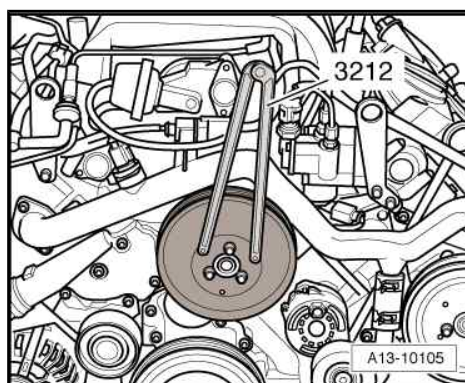
### Special tools and workshop equipment required

- ◆ Pin wrench - 3212-

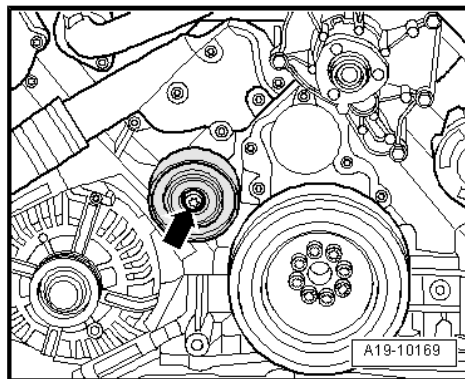


### Removing

- Drain off coolant ⇒ [page 241](#) .
- Remove poly V-belt from pulley on coolant pump  
⇒ [“1.2 Removing and installing poly V-belt”, page 101](#) .
- Unbolt coolant pump pulley (brace pulley with pin wrench - 3212- ).



- Prise off cap.
- Unscrew bolt -arrow- and detach idler roller.



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**Note**

*Place a cloth underneath to catch any escaping coolant.*

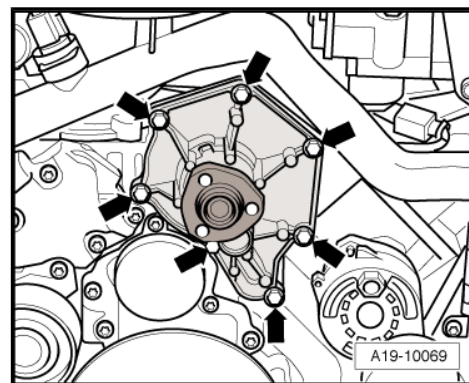
- Unscrew bolts -arrows- for coolant pump and detach coolant pump.

**Installing**

- Tightening torques ➔ [page 247](#)

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

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

**Note**

*If the old coolant pump is to be re-installed, clean the sealing surface and apply an approx. 1.5 mm thick bead of sealant in addition to the vulcanised seal.*

- Install poly V-belt ➔ [page 101](#) .
- Fill cooling system ➔ [page 242](#) .

## 2.3 Removing and installing thermostat

**Removing**

- Drain off coolant ➔ [page 241](#) .
- Remove intake manifold (top section) ➔ Rep. gr. 24 .
- Remove coolant pipe (front) ➔ [page 251](#) .

**Note**

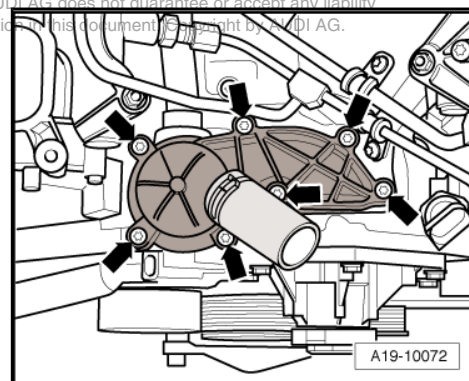
*Place a cloth underneath to catch any escaping coolant.*

- Remove bolts -arrows-.
- Detach thermostat with hose connection.

**Installing**

- Tightening torque ➔ [page 247](#)

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

**Note**

*Renew seals and/or gaskets.*

- Install coolant pipe (front) ➔ [page 251](#) .
- Install intake manifold (top section) ➔ Rep. gr. 24 .
- Fill cooling system ➔ [page 242](#) .

## 2.4 Exploded view - coolant pipes

**1 - Coolant pipe (left-side)**

- ☐ Remove and install together with -item 17-  
⇒ [page 253](#)

**2 - Bolt**

- ☐ 9 Nm

**3 - O-ring**

- ☐ Renew

**4 - Connecting hose**
**5 - Bolts**

- ☐ 9 Nm

**6 - Coolant pipe (front)**

- ☐ Removing and installing  
⇒ [page 251](#)

**7 - Bolts**

- ☐ 9 Nm

**8 - Retaining clip**
**9 - Coolant temperature sender - G62-**

- ☐ Removing and installing  
⇒ [page 251](#)

**10 - O-ring**

- ☐ Renew

**11 - Seal**

- ☐ Renew

**12 - Coolant hose**
**13 - Seal**

- ☐ Renew

**14 - O-ring**

- ☐ Renew

**15 - Coolant pipe (top)**

- ☐ Removing and installing ⇒ [page 256](#)

**16 - Bolt**

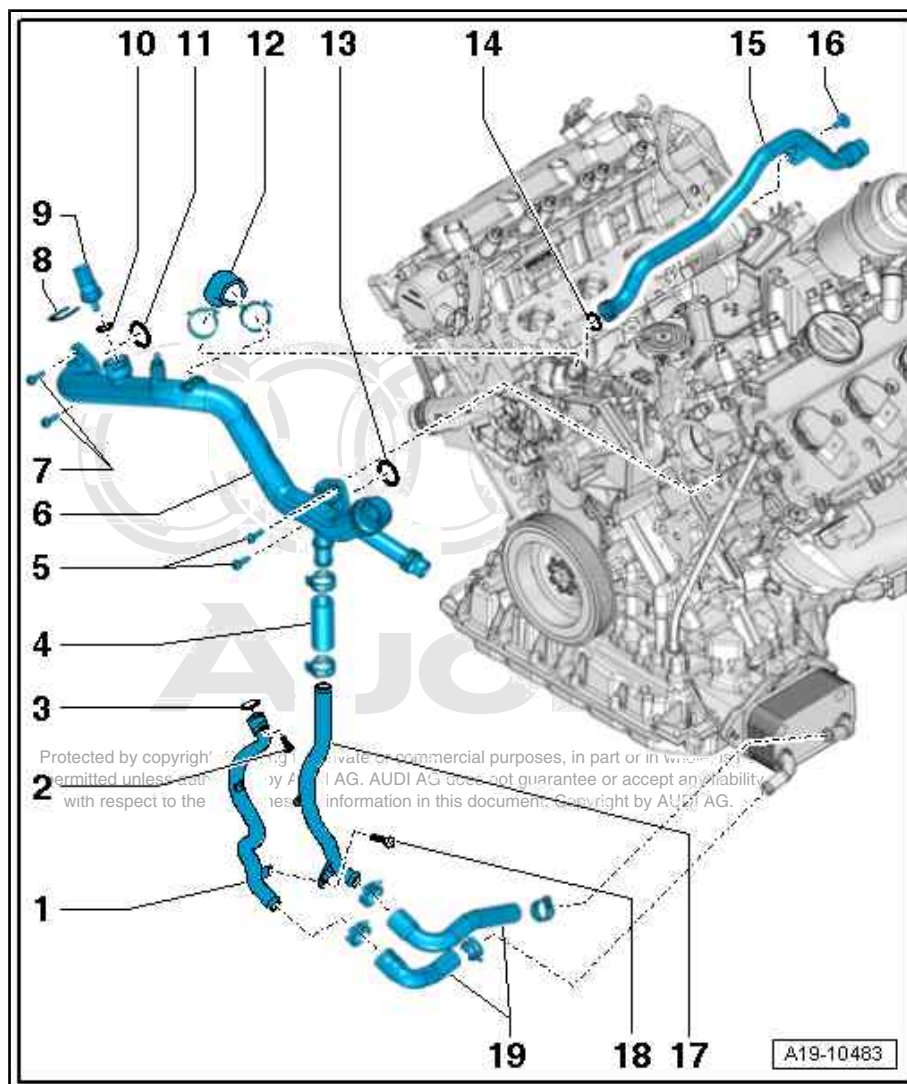
- ☐ 9 Nm

**17 - Coolant pipe (left-side)**

- ☐ Remove and install together with -item 1- ⇒ [page 253](#)

**18 - Bolt**

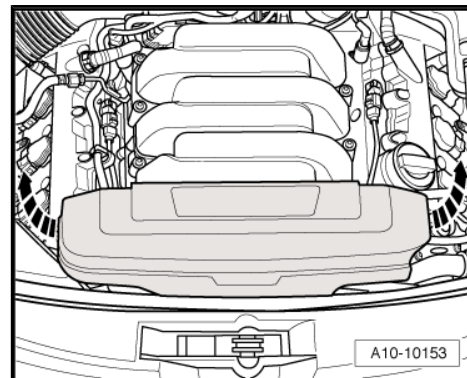
- ☐ 9 Nm

**19 - Coolant hoses**


## 2.5 Removing and installing coolant temperature sender - G62-

### Removing

- Engine cold.
- Open filler cap on coolant expansion tank briefly to release residual pressure in cooling system.
- Pull off engine cover panel (front) -arrows-.



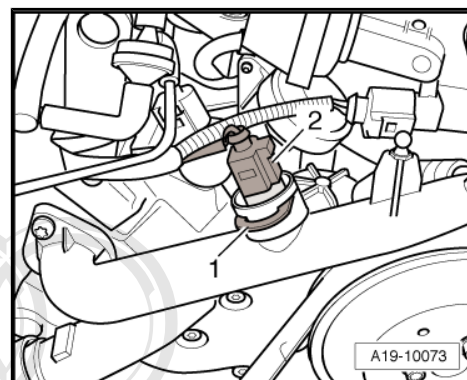
- Unplug electrical connector -2- at coolant temperature sender - G62- .



### Note

*Place a cloth underneath to catch escaping coolant.*

- Pull off retaining clip -1- and detach coolant temperature sender - G62- .



### Installing

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



### Note

- ◆ *Fit new O-ring.*
- ◆ *Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.*

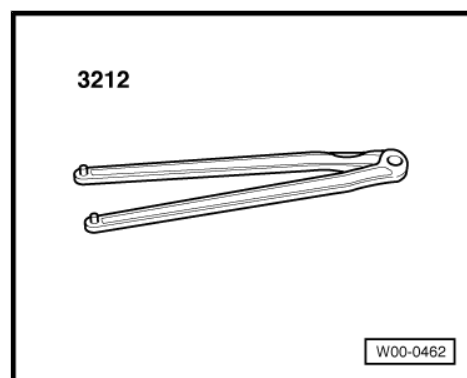
- Check coolant level [⇒ page 246](#).

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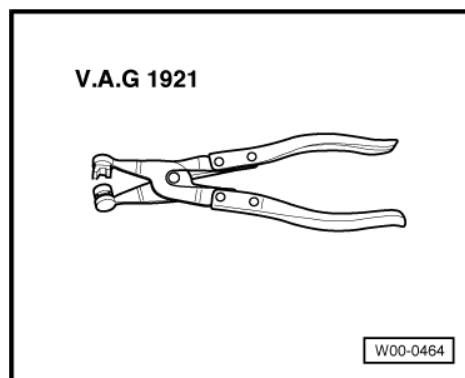
## 2.6 Removing and installing coolant pipe (front)

### Special tools and workshop equipment required

- ◆ Pin wrench - 3212-

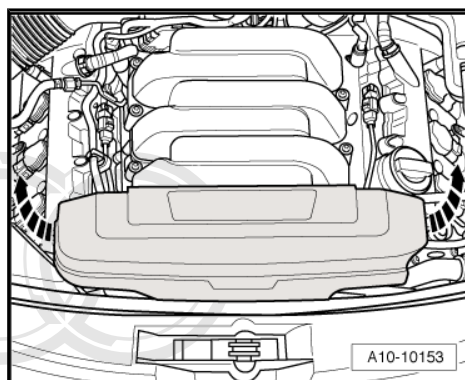


Hose clip pliers - V.A.G 1921-

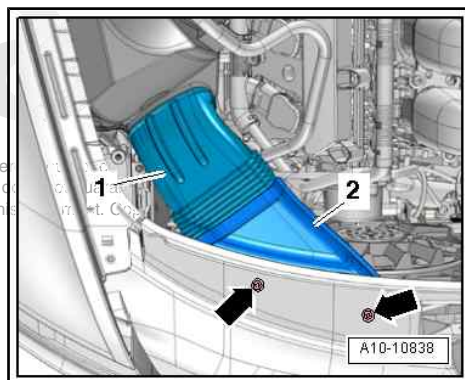


### Removing

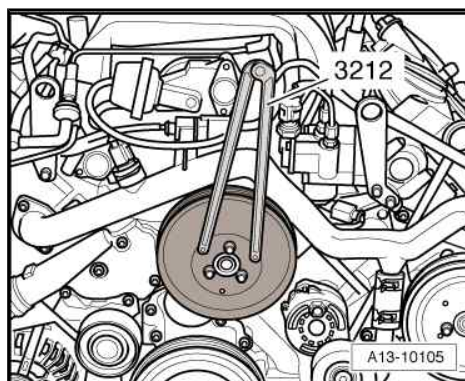
- Drain off coolant ⇒ [page 241](#) .
- Pull off engine cover panel (front) -arrows-.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Remove poly V-belt from pulley on coolant pump  
⇒ [“1.2 Removing and installing poly V-belt”, page 101](#) .
- Unbolt coolant pump pulley (brace pulley with pin wrench - 3212- ).
- Remove vacuum pump for brake servo ⇒ Rep. gr. 47 .



- Unplug electrical connector -3-.
- Unscrew bolts -1, 2, 4, 5- and remove front coolant pipe.
- Detach front coolant pipe from coolant hoses -arrows-.

### Installing

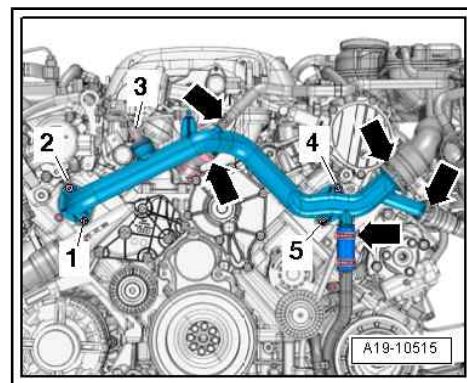
- Tightening torques ⇒ [page 247](#) , ⇒ [page 249](#) .

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



### Note

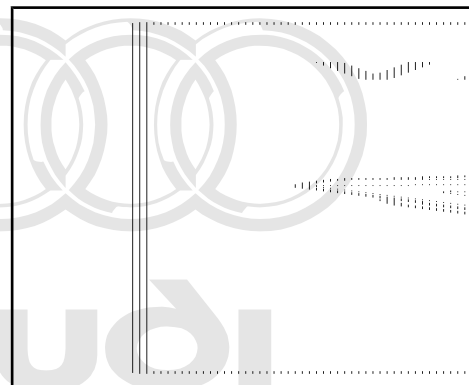
- ◆ *Renew seals.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Before installing, clean and smooth down sealing surfaces for seals as required.
- Lubricate seals with coolant additive and slide onto coolant pipe.
- Install vacuum pump for brake servo ⇒ Rep. gr. 47 .
- Install poly V-belt ⇒ [page 101](#) .
- Fill cooling system ⇒ [page 242](#) .



## 2.7 Removing and installing coolant pipes (left-side)

### Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - V.A.G 1921-

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V.A.G 1921



W00-0464

## Removing

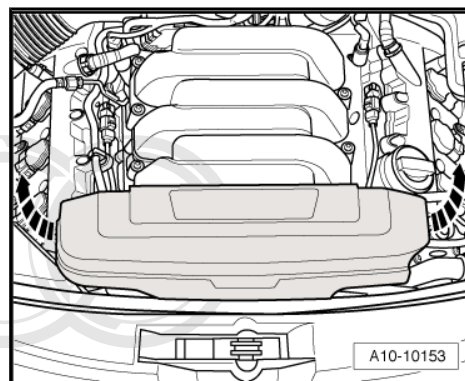


### WARNING

*Hot steam/hot coolant can escape - risk of scalding.*

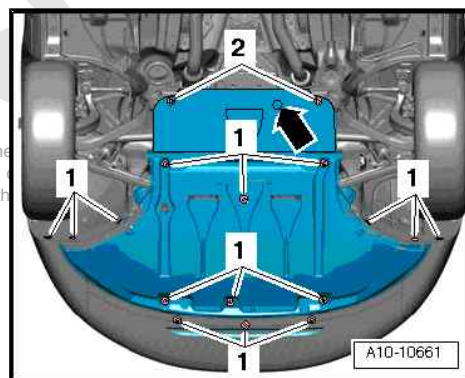
- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*

- Pull off engine cover panel (front) -arrows-.
- Open filler cap on coolant expansion tank.
- Drain off coolant ⇒ [page 241](#) .
- Remove poly V-belt ⇒ [page 101](#) .

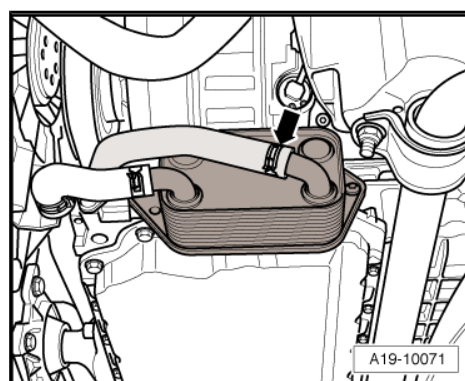


- Release fasteners -1, 2, arrow- and remove noise insulation.

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- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Disconnect coolant hose -arrow- from engine oil cooler and drain off coolant.

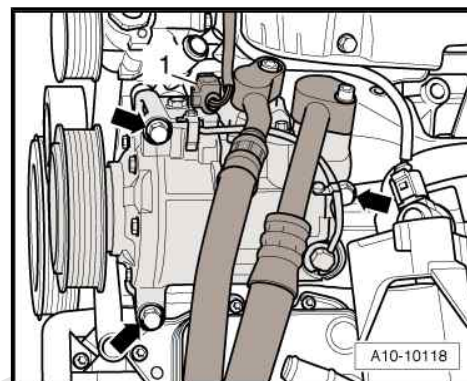


- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**WARNING**

*Risk of injury caused by refrigerant.*

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



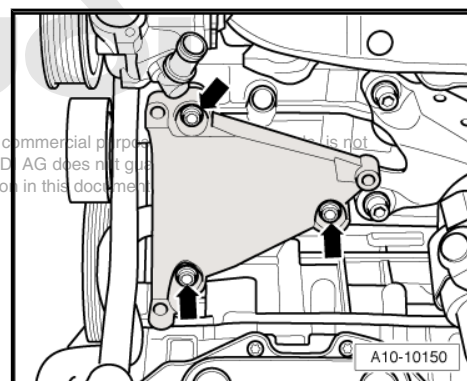
- Unscrew air conditioner compressor from bracket -arrows-.

**Caution**

*Danger of damage to refrigerant lines and hoses.*

- ◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*

- Tie up air conditioner compressor with lines attached to left-side of vehicle.
- Remove bolts -arrows- and detach bracket for AC compressor.



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- Remove bolts -arrows-.
- Disconnect coolant pipes from coolant hoses -1- and -2-.



### Note

For illustration purposes, the installation position is shown with the power steering pump removed.

### Installing

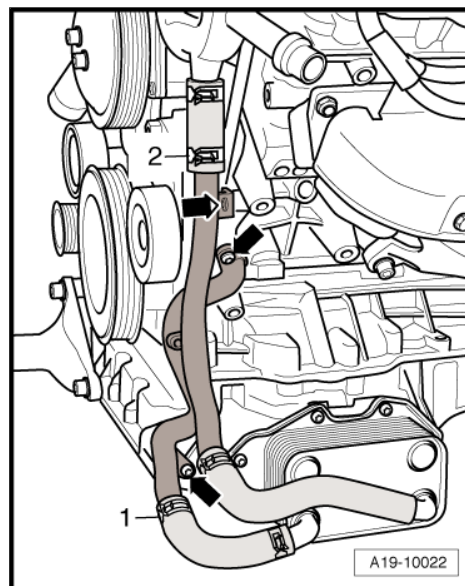
- Tightening torque ⇒ [page 249](#)

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



### Note

- ◆ Fit new O-rings.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate O-ring with coolant additive and slide onto coolant pipe.
- Install air conditioner compressor ⇒ Rep. gr. 87.
- Install poly V-belt ⇒ [page 101](#).
- Fill cooling system ⇒ [page 242](#).



## 2.8 Removing and installing coolant pipe (top)

### Removing



### Note

Fit all cable ties in the original positions when installing.

- Drain off coolant ⇒ [page 241](#).
- Remove intake manifold (top section) ⇒ Rep. gr. 24.

### Rest-of-world vehicles:

- Detach crankcase breather hoses from cylinder head covers and move clear ⇒ [page 236](#).

### USA models:

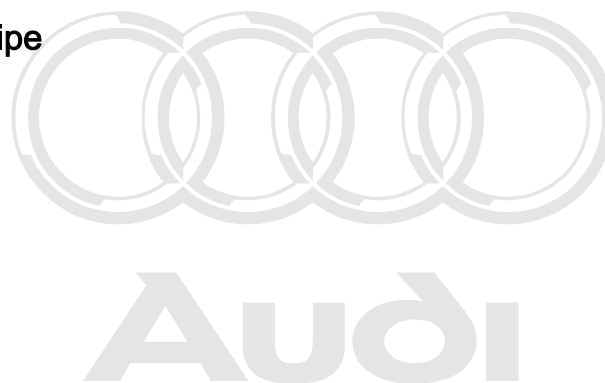


### Caution

**Risk of violating emission legislation applying to USA models.**

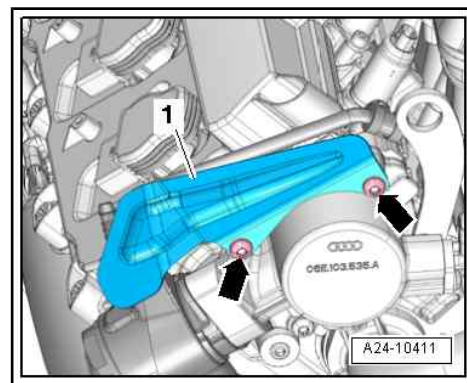
- ◆ Do NOT open hose connections for crankcase breather system.

- Remove cylinder head cover (left-side) (crankcase breather hose remains connected) ⇒ [page 168](#).



**All vehicles (continued):**

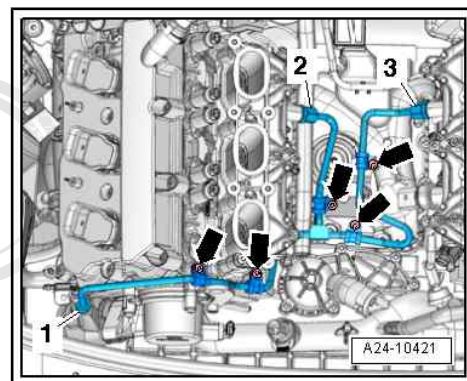
- Remove guard plate -1- for high-pressure pipe -arrows-.

**WARNING**

*The fuel system is pressurised.*

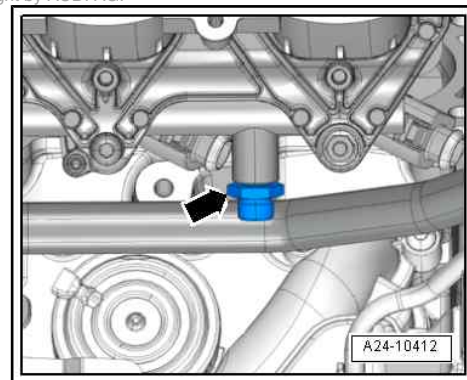
*Risk of injury as fuel may spray out.*

- *Wear safety goggles.*
- *Wear protective gloves.*
- *Release pressure (wrap clean cloth around connection and open connection carefully).*



- Unscrew connection -1- and union nuts -2- and -3-.
- Unscrew bolts -arrows- on retaining clips and detach high-pressure pipe.
- Unscrew connection -arrow-.

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### Note

Place a cloth under coolant pipe to catch escaping coolant.

- Detach coolant hose -2- from coolant pipe.
- Unscrew bolt -1- and pull coolant pipe out of cylinder block towards the rear -arrow-.

### Installing

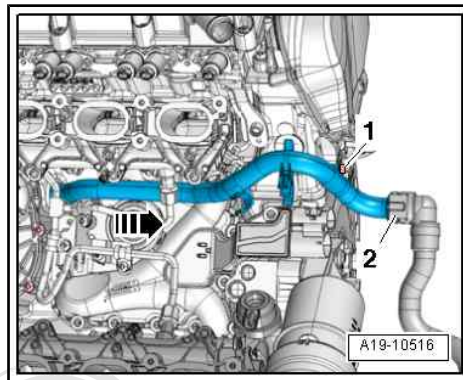
- Tightening torque ⇒ [page 249](#)

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



### Note

- ◆ Fit new O-ring.
- ◆ Fit all cable ties in the original positions when installing.
- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate O-ring with coolant additive and slide onto coolant pipe.
- Install high-pressure pipe ⇒ Rep. gr. 24.
- Install crankcase breather hoses ⇒ [page 236](#).
- Install intake manifold (top section) ⇒ Rep. gr. 24.
- Fill cooling system ⇒ [page 242](#).



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### 3 Radiator and radiator fan



#### WARNING

*Risk of injury as the radiator fan may start up automatically.*

- ◆ *Unplug electrical connectors before starting to work in the area of radiator cowl.*

⇒ [“3.1 Removing and installing radiator”, page 259](#)

⇒ [“3.2 Removing and installing radiator cowl”, page 263](#)

⇒ [“3.3 Removing and installing radiator fan”, page 264](#)

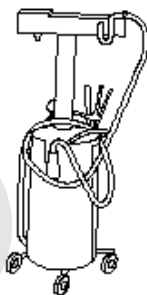
⇒ [“3.4 Checking cooling system for leaks”, page 265](#)

#### 3.1 Removing and installing radiator

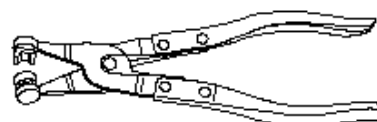
##### Special tools and workshop equipment required

- ◆ Used oil collection and extraction unit - V.A.G 1782-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Drip tray for workshop hoist - VAS 6208-

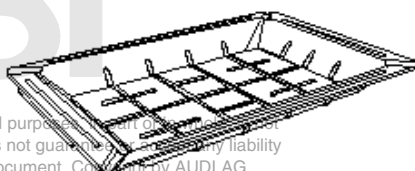
V.A.G 1782



V.A.G 1921



VAS 6208



G19-10003

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## Removing



### 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.*

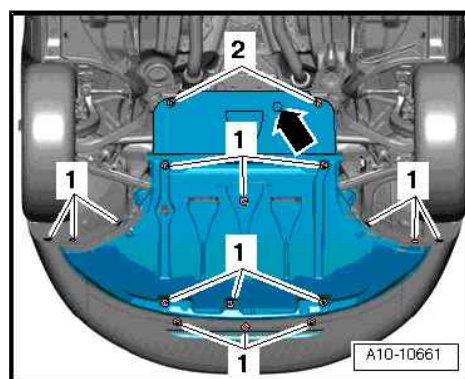


### Note

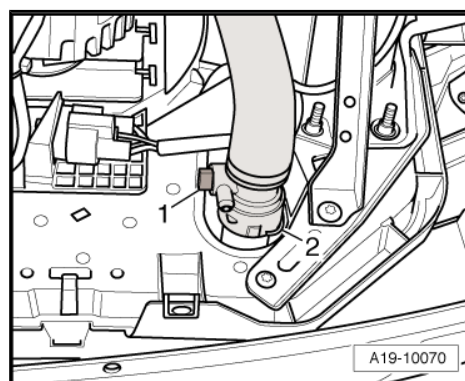
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*Even when the radiator and condenser are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator or the condenser.*

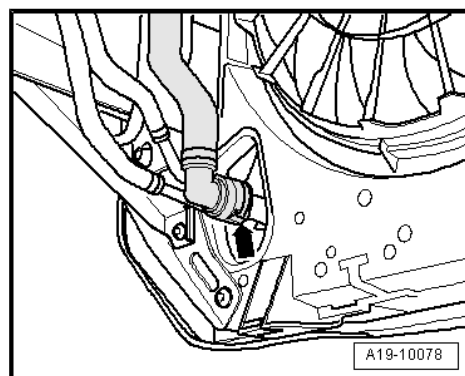
- Open filler cap on coolant expansion tank.
- Release fasteners -1, 2, arrow- and remove noise insulation.
- Remove front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Open drain plug -1- and let coolant drain.
- Then disconnect coolant hose -2- from radiator.



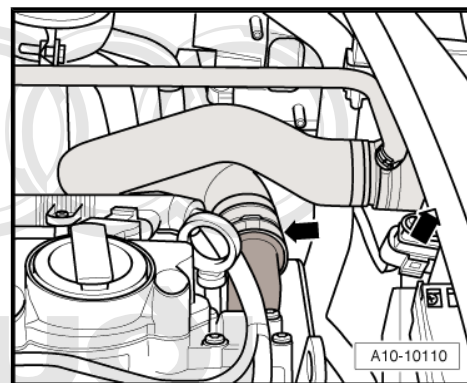
- Detach coolant hose at bottom left of radiator -arrow-.



- Detach coolant hose (top) -arrow on right- from radiator.

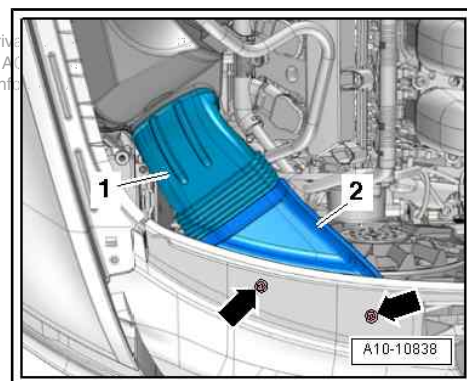
**Note**

*Disregard -left arrow-.*

**Vehicles with multitronic gearbox or automatic gearbox 09L:**

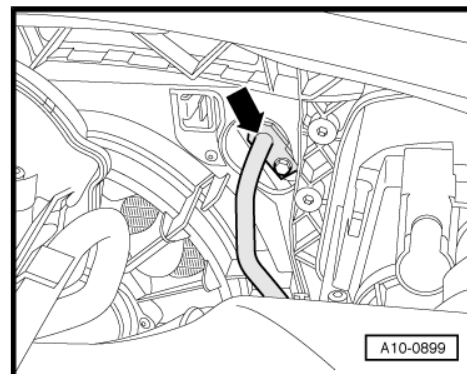
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

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**Note**

*Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. gr. 00.*

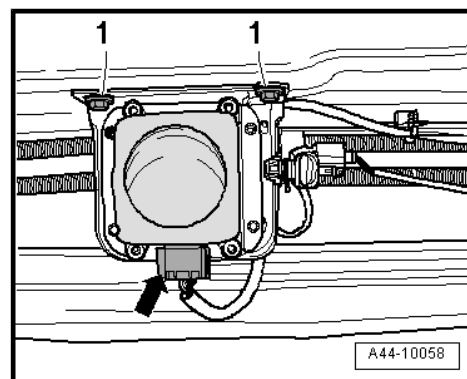
- Position used oil collection and extraction unit - V.A.G 1782- below connection point.
- Remove ATF lines (top -arrow- and bottom) from radiator: ⇒ Rep. gr. 37.
- Tie ATF lines up onto longitudinal member to prevent fluid escaping.

**All vehicles (continued):**

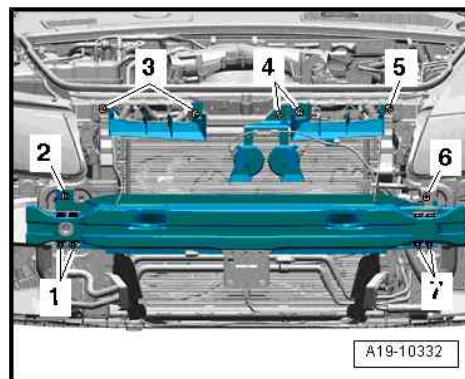
- On vehicles with adaptive cruise control, unplug electrical connector -arrow- at adaptive cruise control unit - J428-.

**Note**

*Disregard item -1-.*



- Unscrew bolts -3- and -5- and remove air ducts.
- Unscrew bolts -4- and remove bracket for horns; electrical wiring remains attached.
- Unscrew brackets -2- and -6- for headlights.
- Unscrew nuts -1- and -7- and remove bumper.

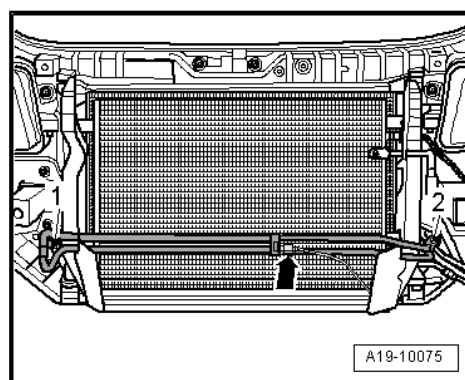


- Unclip ambient temperature sensor - G17- -arrow- from bracket.
- Unscrew bolts -1- and -2- for power steering cooling pipe; the hydraulic hoses remain attached.
- Detach air ducts (left and right) from radiator.


**WARNING**

*Risk of injury caused by refrigerant.*

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

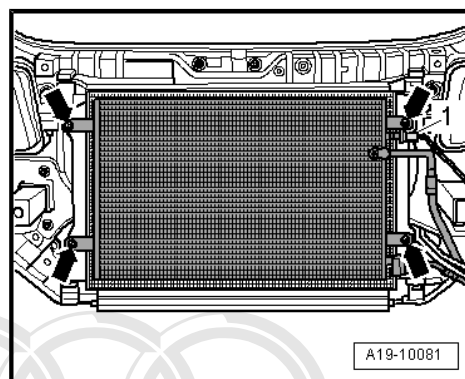


- Unplug electrical connector -1-.
- Remove bolts -arrows-.

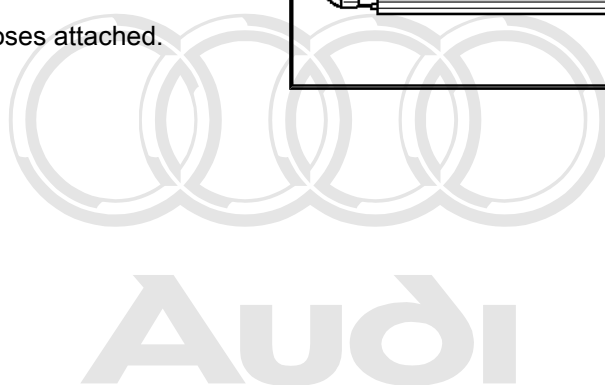

**Caution**

*Risk of damage to condenser and refrigerant pipes/hoses.*

- ◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*



- Pivot condenser downwards with pipes/hoses attached.



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- Release two retaining pins for radiator and pull out upwards -arrows-.
- Swivel radiator forwards and lift off.

### Installing

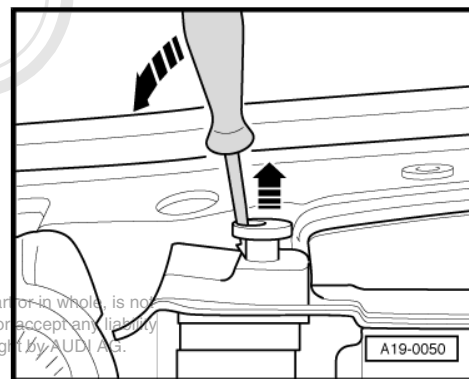
Installation is carried out in the reverse order; note the following:



#### Note

*Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue.*

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- Install condenser ⇒ Rep. gr. 87 .
- Install cooling pipe for power steering ⇒ Rep. gr. 487 .
- Install bracket for horns ⇒ Rep. gr. 96 .
- Install ATF lines ⇒ Rep. gr. 37 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Install front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
- Fill cooling system ⇒ [page 242](#) .



#### Note

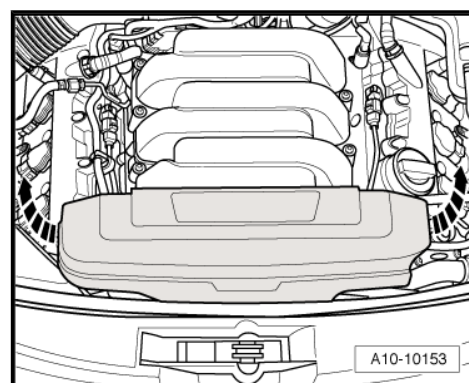
*The coolant in the entire system must be changed if the radiator is renewed.*

- Check ATF level ⇒ Rep. gr. 37 .
- Adjustment must be performed in “Guided Functions” after renewing adaptive cruise control unit - J428- ⇒ Rep. gr. 44 and ⇒ Vehicle diagnostic tester.

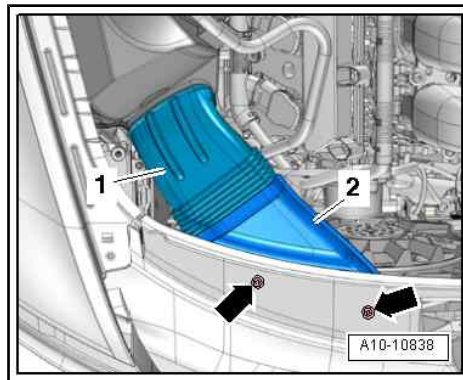
## 3.2 Removing and installing radiator cowl

### Removing

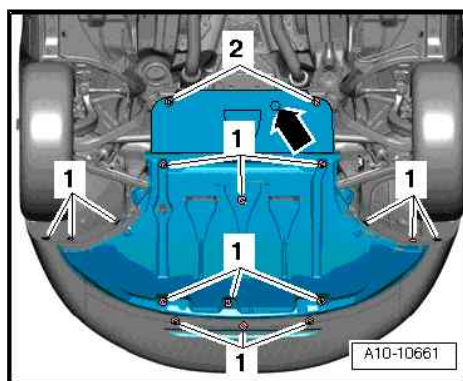
- Pull off engine cover panel (front) -arrows-.



- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Release fasteners -1, 2, arrow- and remove noise insulation.



#### WARNING

*Risk of injury as the radiator fan may start up automatically.*

- ◆ *Unplug electrical connectors before starting to work in the area of radiator cowl.*

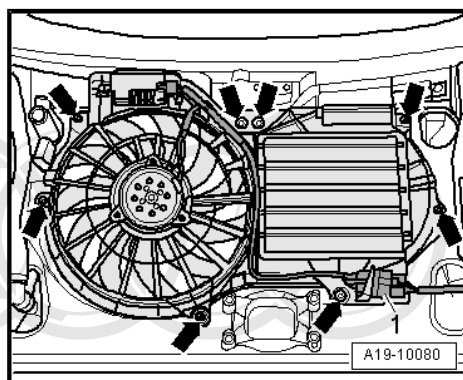
- Unplug electrical connector -1- for radiator fan.
- Unscrew bolts -arrows- and lift out radiator cowl.

#### Installing

Install in reverse order.

#### Tightening torques

| Component        |            | Nm |
|------------------|------------|----|
| Radiator cowl to | M6         | 11 |
| Lock carrier     | Panel bolt | 2  |



### 3.3 Removing and installing radiator fan

#### Removing

- Remove radiator cowl ⇒ [page 263](#) .
- Move wiring clear.

- Remove bolts -1 ... 5-.
- Detach radiator fan with control unit.

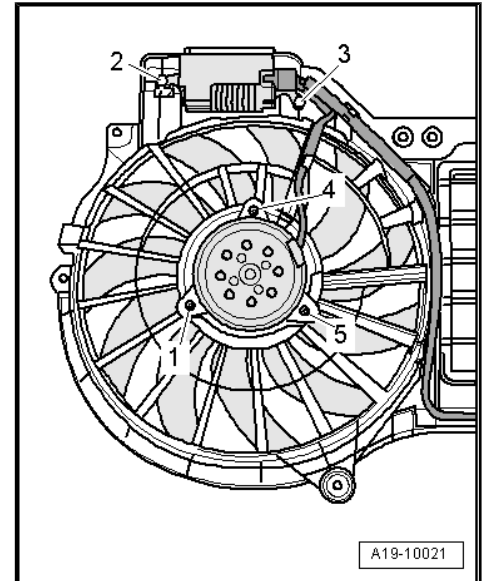
### Installing

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

- Install radiator cowl [⇒ page 263](#) .

### Tightening torque

| Component                        |            | Nm  |
|----------------------------------|------------|-----|
| Radiator fan<br>to radiator cowl | Single fan | 3   |
|                                  | Dual fan   | 4.5 |

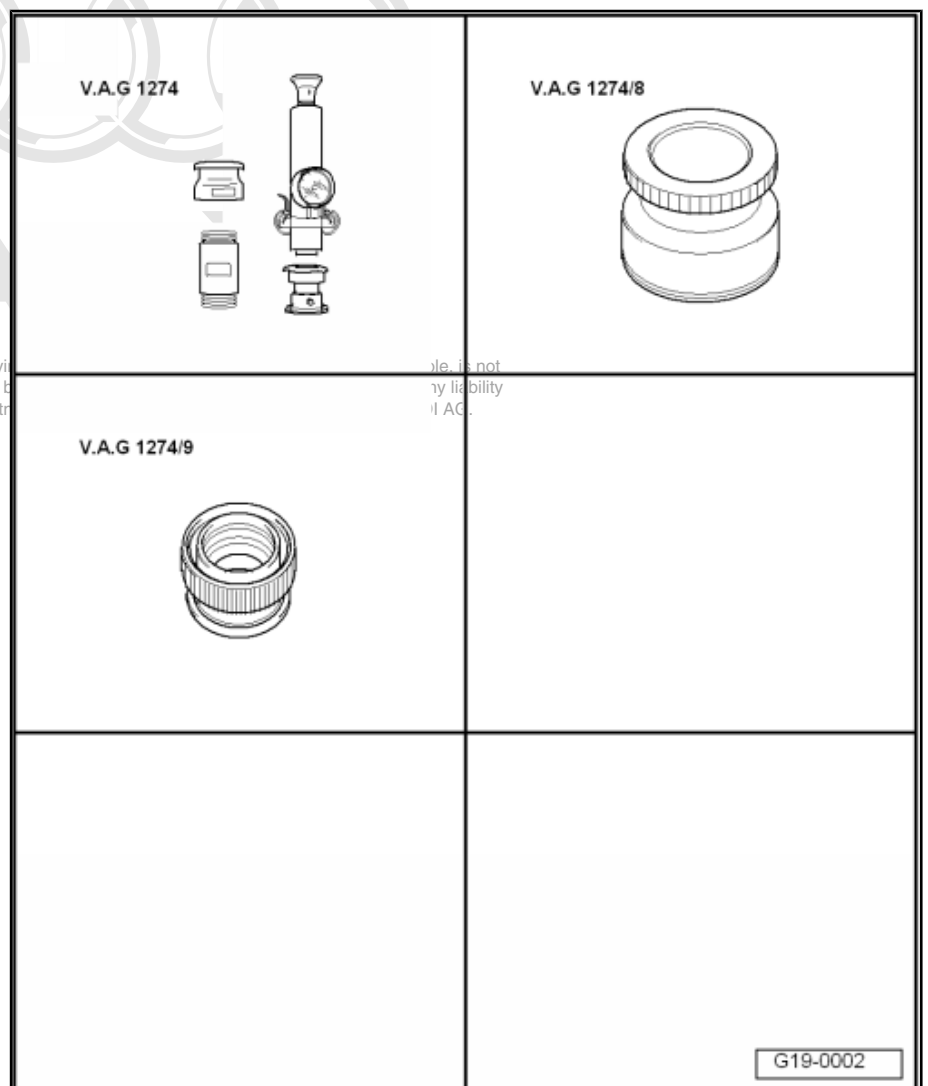


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## 3.4 Checking cooling system for leaks

### 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-



G19-0002

## Procedure

- Engine must be warm.



### WARNING

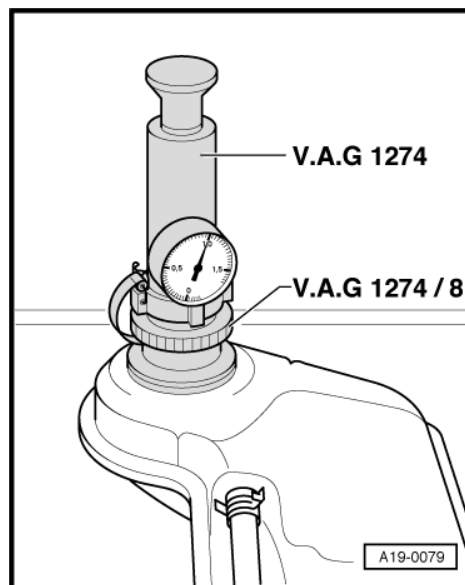
*Hot steam/hot coolant can escape - risk of scalding.*

- ◆ *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.
- 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.

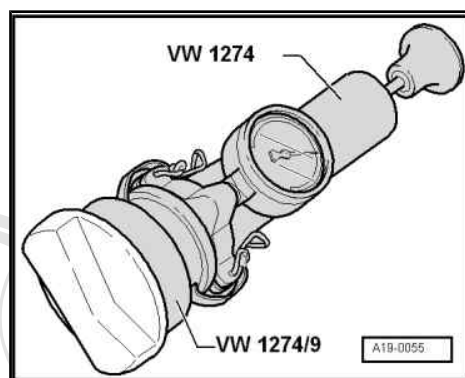


## Checking pressure relief valve in filler cap

- 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 Silencers

⇒ [“1.1 Silencers on vehicles with front-wheel drive - exploded view”, page 267](#)

⇒ [“1.2 Silencers on vehicles with four-wheel drive - exploded view”, page 270](#)

⇒ [“1.3 Removing and installing front exhaust pipe \(left-side\) with catalytic converter”, page 272](#)

⇒ [“1.4 Removing and installing front exhaust pipe \(right-side\) with catalytic converter”, page 275](#)

⇒ [“1.5 Separating centre and rear silencers”, page 277](#)

⇒ [“1.6 Renewing tailpipe”, page 279](#)

⇒ [“1.7 Stress-free alignment of exhaust system”, page 279](#)

⇒ [“1.8 Aligning tailpipes”, page 280](#)

⇒ [“1.9 Checking exhaust system for leaks”, page 281](#)

#### 1.1 Silencers on vehicles with front-wheel drive - exploded view

##### 1 - Bolt

- ☐ 23 Nm

##### 2 - Mounting

- ☐ Renew if damaged

##### 3 - Centre silencer

- ☐ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point  
⇒ [page 278](#)
- ☐ Align exhaust system so it is free of stress  
⇒ [page 279](#)

##### 4 - Exhaust manifold

- ☐ Removing and installing: left-side  
⇒ [page 283](#), right-side  
⇒ [page 285](#)

##### 5 - Gasket

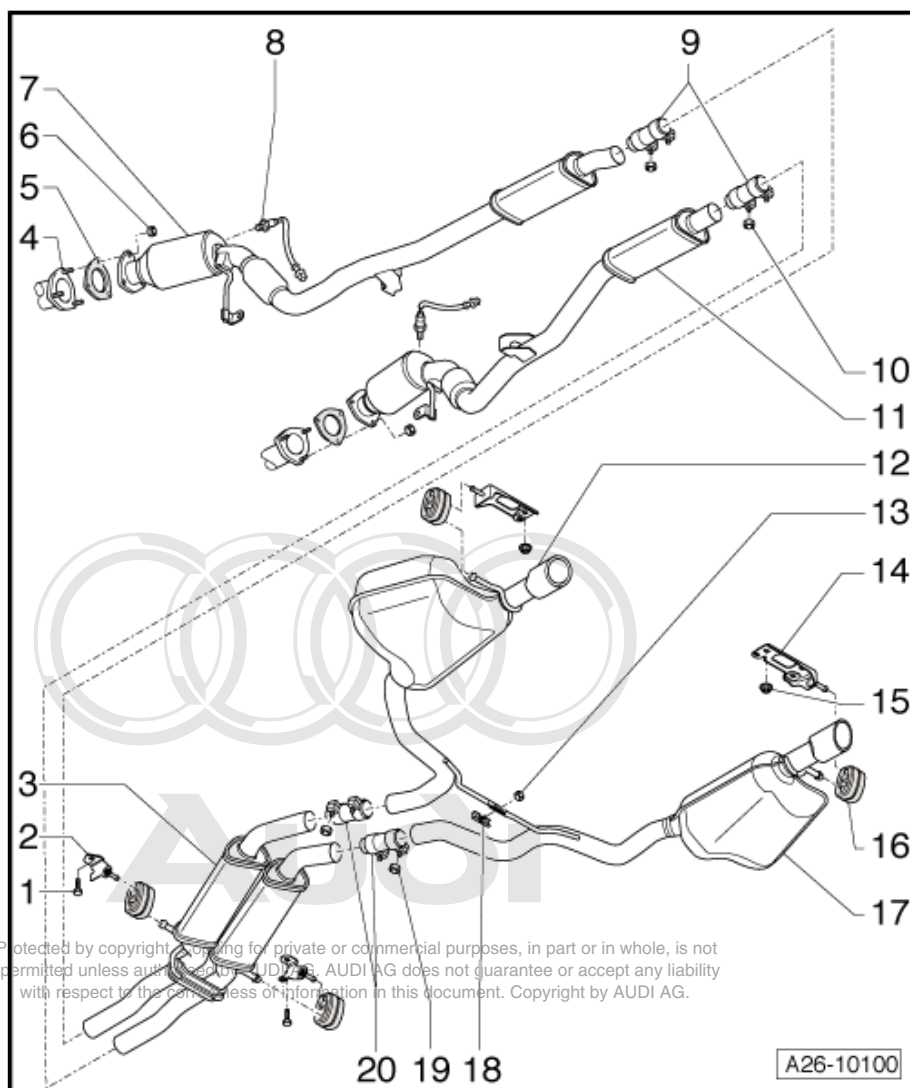
- ☐ Renew

##### 6 - Nut

- ☐ Renew
- ☐ 23 Nm

##### 7 - Front exhaust pipe with catalytic converter and front silencer

- ☐ For cylinder bank 2 (left-side)
- ☐ With flexible joint



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- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 272](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

#### 8 - Lambda probe after catalytic converter

- ☐ The threads on the new Lambda probes are coated with a special assembly paste.
- ☐ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste
- ☐ The assembly paste/high-temperature paste must not get into the slots in the Lambda probe body
- ☐ Removing and installing ⇒ Rep. gr. 24

#### 9 - Clamps (front)

- ☐ Installation position ⇒ [page 269](#)
- ☐ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ [page 279](#)
- ☐ Tighten bolted connections evenly

#### 10 - Nut

- ☐ 23 Nm

#### 11 - Front exhaust pipe with catalytic converter and front silencer

- ☐ For cylinder bank 1 (right-side)
- ☐ With flexible joint
- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 275](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

#### 12 - Rear silencer with tailpipe

- ☐ Left side of vehicle
- ☐ Combined as one unit with centre silencer as original equipment
- ☐ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ☐ Cutting point: centre silencer / rear silencer ⇒ [page 278](#)
- ☐ Cutting point: rear silencer / tailpipe ⇒ [page 279](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

#### 13 - Nut

- ☐ Renew
- ☐ 23 Nm

#### 14 - Mounting

#### 15 - Nut

- ☐ 23 Nm

#### 16 - Mounting

- ☐ Renew if damaged

#### 17 - Rear silencer with tailpipe

- ☐ Right side of vehicle
- ☐ Combined as one unit with centre silencer as original equipment
- ☐ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ☐ Cutting point: centre silencer / rear silencer ⇒ [page 278](#)
- ☐ Cutting point: rear silencer / tailpipe ⇒ [page 279](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

#### 18 - Bracket

#### 19 - Nut

- ☐ 23 Nm



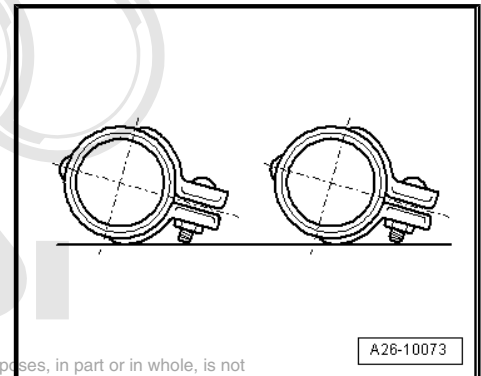
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## 20 - Clamps (rear)

- ☐ For separate replacement of centre and rear silencers
- ☐ Position clamp so that it aligns with centre of cutting location
- ☐ Installation position ⇒ [page 269](#)
- ☐ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ [page 279](#)
- ☐ Tighten bolted connections evenly

### Installation position of front clamps

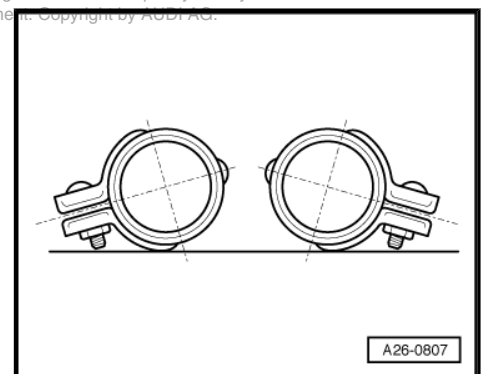
- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face to right.



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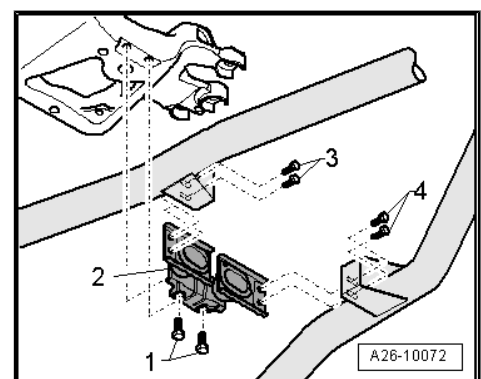
### Installation position of rear clamps

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.



### Mounting components for centre bracket for front exhaust pipes

- 1 - Bolt, 23 Nm
- 2 - Bracket
- 3 - Bolt, 23 Nm
- 4 - Bolt, 23 Nm



## 1.2 Silencers on vehicles with four-wheel drive - exploded view

### 1 - Bolt

- ☐ 23 Nm

### 2 - Mounting

- ☐ Renew if damaged

### 3 - Centre silencer

- ☐ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point  
⇒ [page 278](#)
- ☐ Align exhaust system so it is free of stress  
⇒ [page 279](#)

### 4 - Exhaust manifold

- ☐ Removing and installing: left-side  
⇒ [page 283](#), right-side  
⇒ [page 285](#)

### 5 - Gasket

- ☐ Renew

### 6 - Nut

- ☐ Renew
- ☐ 23 Nm

### 7 - Front exhaust pipe with catalytic converter and front silencer

- ☐ For cylinder bank 2 (left-side)
- ☐ With flexible joint
- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 272](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

### 8 - Lambda probe after catalytic converter

- ☐ The threads on the new Lambda probes are coated with a special assembly paste.
- ☐ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste
- ☐ The assembly paste/high-temperature paste must not get into the slots in the Lambda probe body
- ☐ Removing and installing ⇒ Rep. gr. 24

### 9 - Clamps (front)

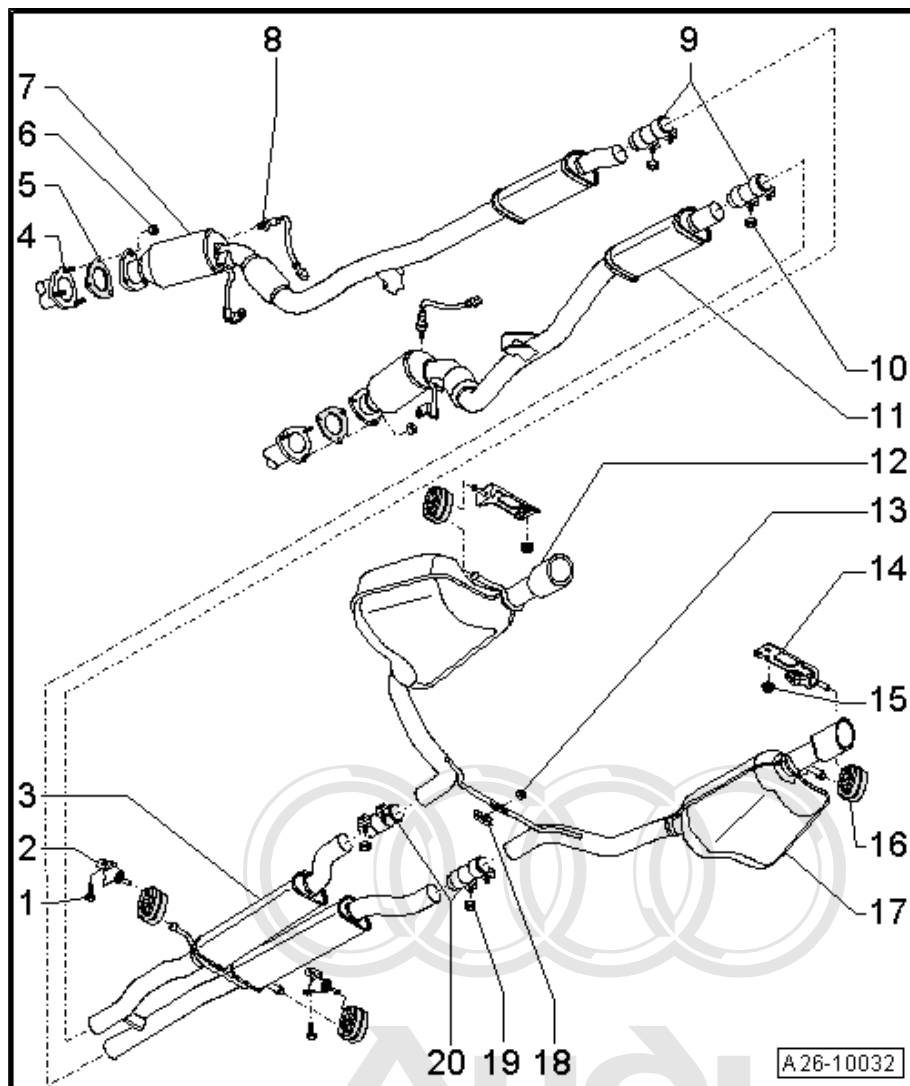
- ☐ Installation position ⇒ [page 271](#)
- ☐ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ [page 279](#)
- ☐ Tighten bolted connections evenly

### 10 - Nut

- ☐ 23 Nm

### 11 - Front exhaust pipe with catalytic converter and front silencer

- ☐ For cylinder bank 1 (right-side)



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- ☐ With flexible joint
- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 275](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

**12 - Rear silencer with tailpipe**

- ☐ Left side of vehicle
- ☐ Combined as one unit with centre silencer as original equipment
- ☐ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ☐ Cutting point: centre silencer / rear silencer ⇒ [page 278](#)
- ☐ Cutting point: rear silencer / tailpipe ⇒ [page 279](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

**13 - Nut**

- ☐ Renew
- ☐ 23 Nm

**14 - Mounting****15 - Nut**

- ☐ 23 Nm

**16 - Mounting**

- ☐ Renew if damaged

**17 - Rear silencer with tailpipe**

- ☐ Right side of vehicle
- ☐ Combined as one unit with centre silencer as original equipment
- ☐ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ☐ Cutting point: centre silencer / rear silencer ⇒ [page 278](#)
- ☐ Cutting point: rear silencer / tailpipe ⇒ [page 279](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

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**18 - Bracket****19 - Nut**

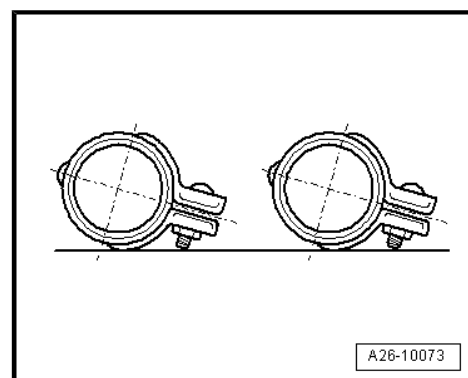
- ☐ 23 Nm

**20 - Clamps (rear)**

- ☐ For separate replacement of centre and rear silencers
- ☐ Position clamp so that it aligns with centre of cutting location
- ☐ Installation position ⇒ [page 272](#)
- ☐ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ [page 279](#)
- ☐ Tighten bolted connections evenly

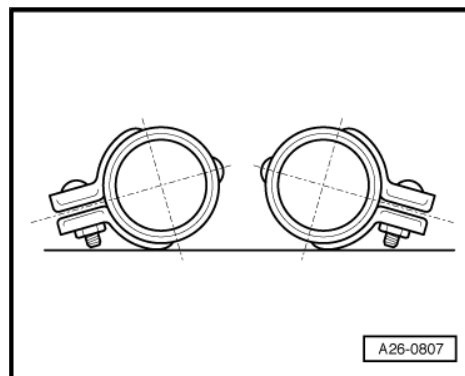
**Installation position of front clamps**

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face to right.



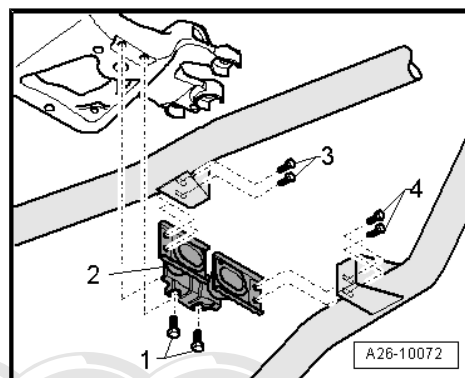
### Installation position of rear clamps

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.



### Mounting components for centre bracket for front exhaust pipes

- 1 - Bolt, 23 Nm
- 2 - Bracket
- 3 - Bolt, 23 Nm
- 4 - Bolt, 23 Nm



## 1.3 Removing and installing front exhaust pipe (left-side) with catalytic converter

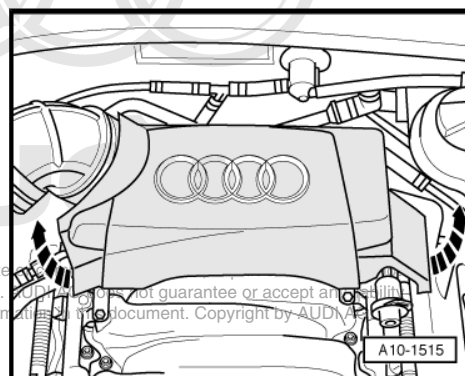
### Removing



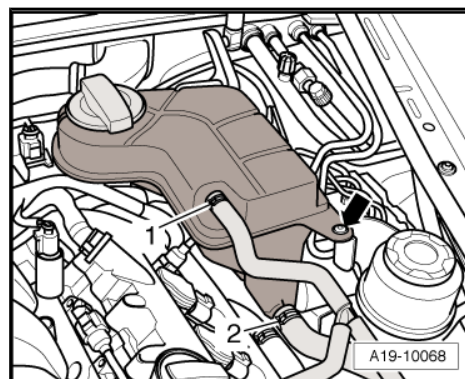
#### Note

Fit all cable ties in the original positions when installing.

- Pull off engine cover panel (rear) -arrows-.



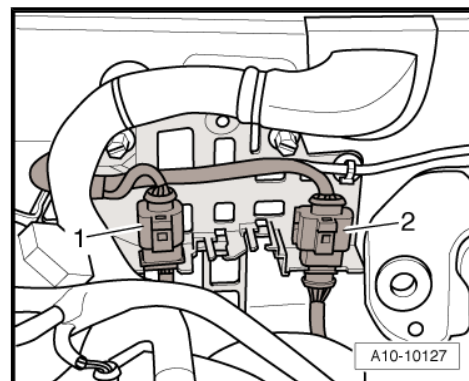
- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter - G131- and move wiring clear (downwards).

**i** Note

Disregard item -1-.



- Unscrew nut (accessible from above) -2- securing front exhaust pipe to exhaust manifold.

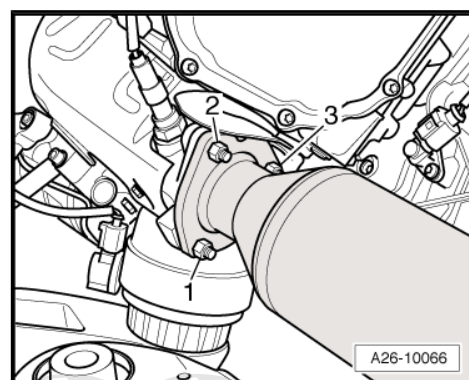
**i** Note

For illustration purposes, the installation position is shown from the rear and with the engine removed.

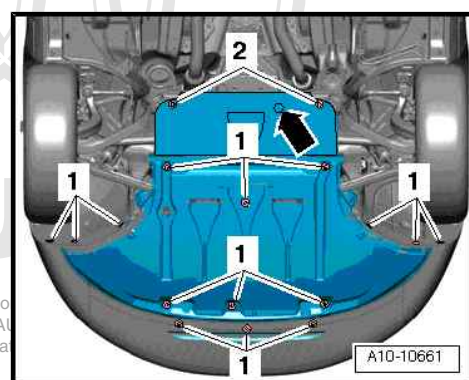
- Remove front left wheel.

**i** Note

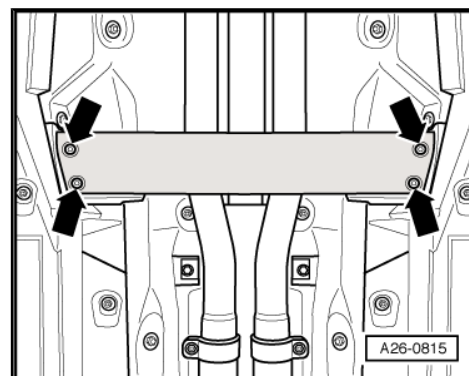
Secure brake disc with one wheel bolt.



- Release fasteners -1, 2, arrow- and remove noise insulation.



- Unbolt cross piece (front) -arrows-.



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### Caution

**Risk of damage to flexible joints in front silencer.**

- ◆ **Do NOT bend the flexible joints in the front silencer more than 10°.**

- Remove bolts -1- on bracket (rear) for front exhaust pipe.



### Note

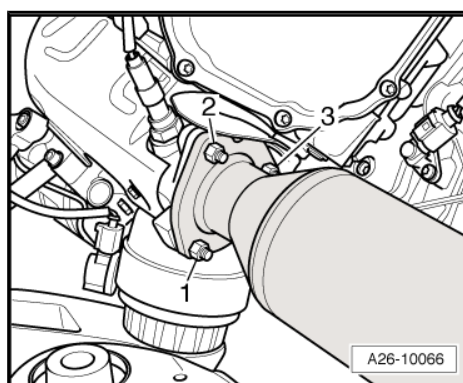
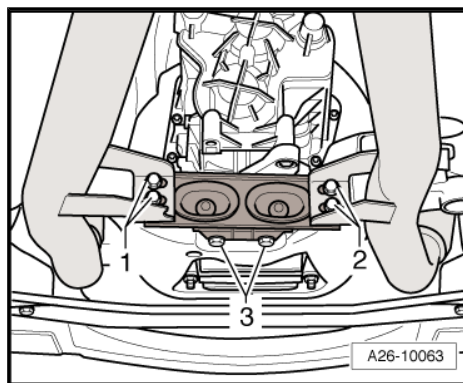
Disregard -items 2 and 3-.

- Unscrew nuts -1- and -3- (accessible from below) securing front exhaust pipe to exhaust manifold.



### Note

For illustration purposes, the installation position is shown from the rear and with the engine removed.



- Loosen clamp (left-side) -1- and move to rear.
- Remove front silencer (left-side) together with catalytic converter.



### Note

Disregard item -2-.

### Installing

- Tightening torques: vehicles with front-wheel drive ⇒ [page 267](#) , vehicles with four-wheel drive ⇒ [page 270](#) .

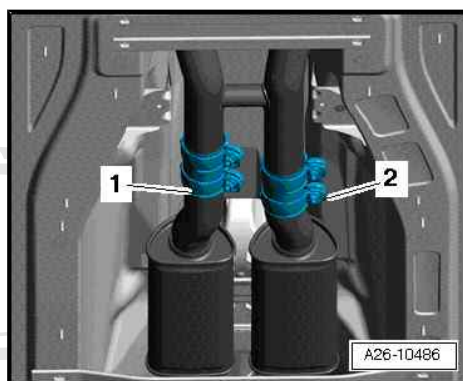
Installation is carried out in the reverse order; note the following:



### Note

- ◆ **Renew seals, gaskets and self-locking nuts.**
- ◆ **Fit all cable ties in the original positions when installing.**
- ◆ **When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.**

- Install cross piece (front) ⇒ Rep. gr. 50 .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .



## 1.4 Removing and installing front exhaust pipe (right-side) with catalytic converter

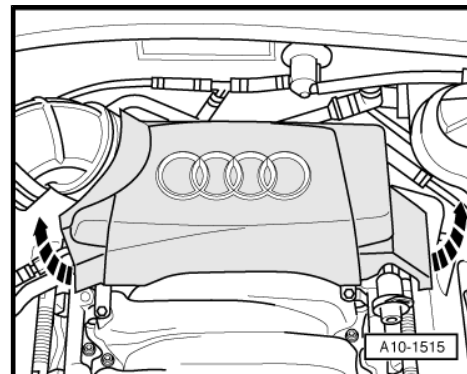
### Removing



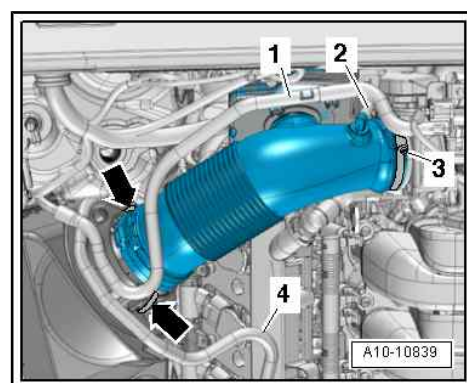
#### Note

*Fit all cable ties in the original positions when installing.*

- Pull off engine cover panel (rear) -arrows-.



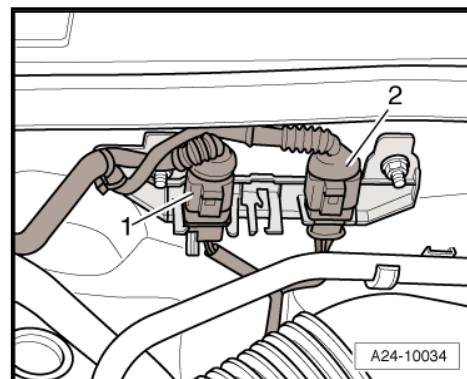
- Move line -1- leading to activated charcoal filter clear.
- Detach vacuum hose -2- from air hose.
- Remove air pipe. To do so, release hose clip -3- and clamps -arrows-.



#### Note

*Disregard item -4-.*

- Unplug electrical connector -2- for Lambda probe after catalytic converter - G130- and move wiring clear.



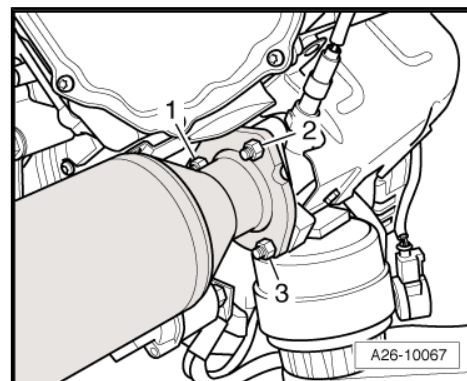
- Unscrew nut (accessible from above) -2- securing front exhaust pipe to exhaust manifold.



#### Note

*For illustration purposes, the installation position is shown from the rear and with the engine removed.*

- Remove front right wheel.

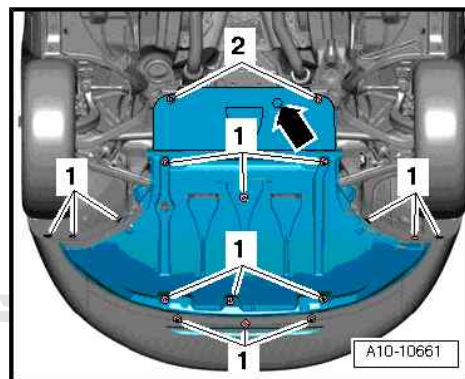


#### Note

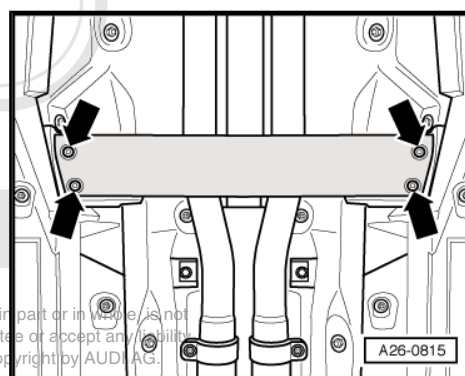
*Secure brake disc with one wheel bolt.*

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- Release fasteners -1, 2, arrow- and remove noise insulation.



- Unbolt cross piece (front) -arrows-.



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### Caution

**Risk of damage to flexible joints in front silencer.**

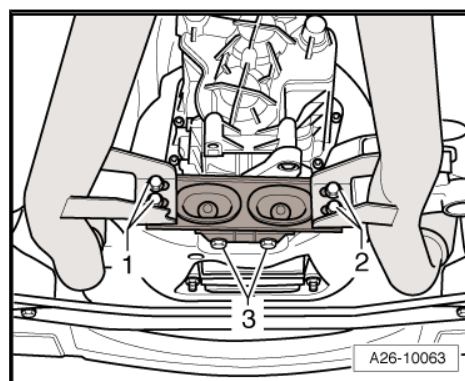
- ◆ **Do NOT bend the flexible joints in the front silencer more than 10°.**

- Remove bolts -2- on bracket (rear) for front exhaust pipe.



### Note

Disregard -items 1 and 3-.

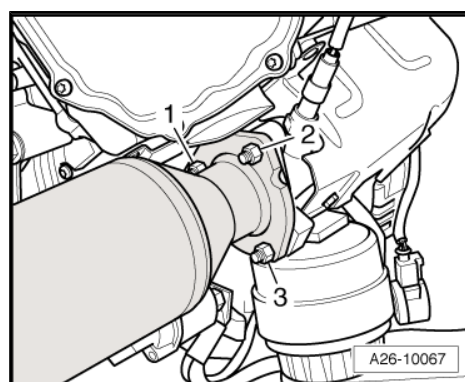


- Unscrew nuts -1- and -3- (accessible from below) securing front exhaust pipe to exhaust manifold.



### Note

For illustration purposes, the installation position is shown from the rear and with the engine removed.



- Loosen clamp (right-side) -2- and move to rear.
- Remove front silencer (right-side) together with catalytic converter.

**Note**

*Disregard item -1-.*

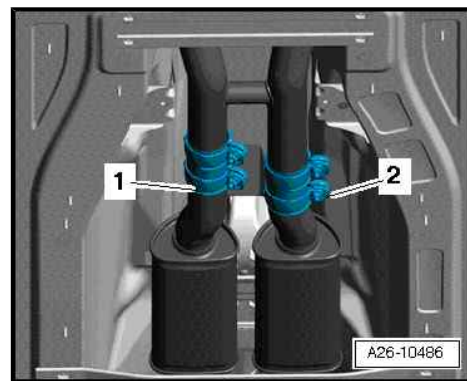
**Installing**

- Tightening torques: vehicles with front-wheel drive  
⇒ [page 267](#) , vehicles with four-wheel drive ⇒ [page 270](#) .

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

**Note**

- ◆ *Renew seals, gaskets and self-locking nuts.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- Install cross piece (front) ⇒ Rep. gr. 50 .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .

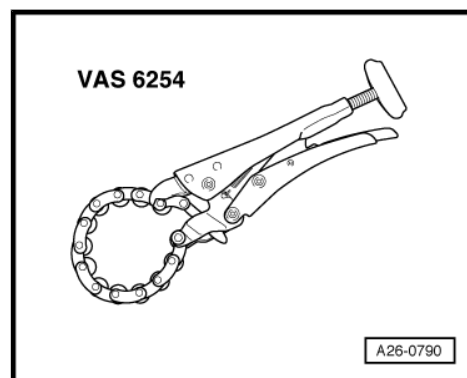


## 1.5 Separating centre and rear silencers

- ◆ 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.

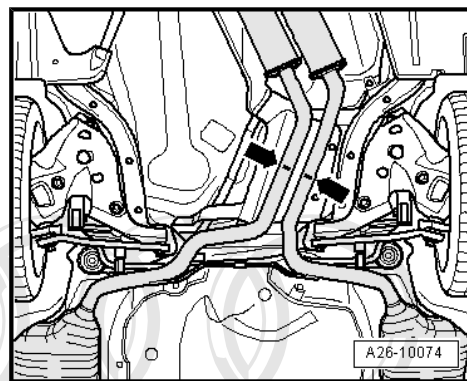
### Special tools and workshop equipment required

- ◆ Chain pipe cutter - VAS 6254-

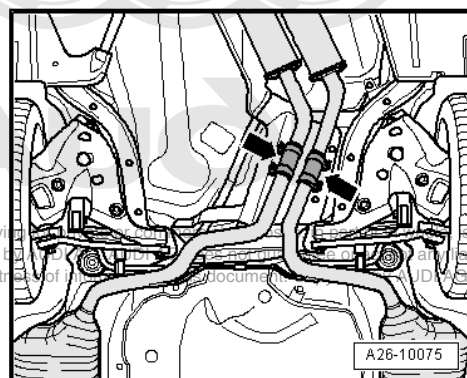


### Vehicles with front-wheel drive:

- Cut through exhaust pipes at right angles at the position marked -arrow- using chain-type pipe cutter - VAS 6254-



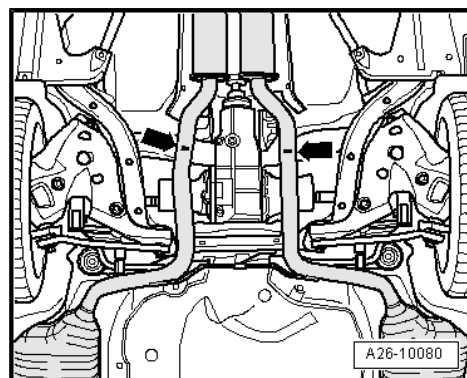
- When installing, position centre of clamps -arrows- over cutting location.



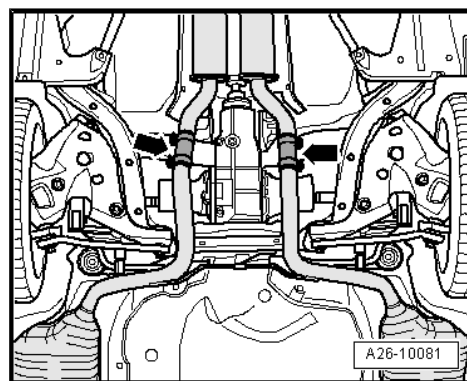
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### Vehicles with four-wheel drive:

- Cut through exhaust pipes at right angles at the position marked -arrow- using chain-type pipe cutter - VAS 6254-

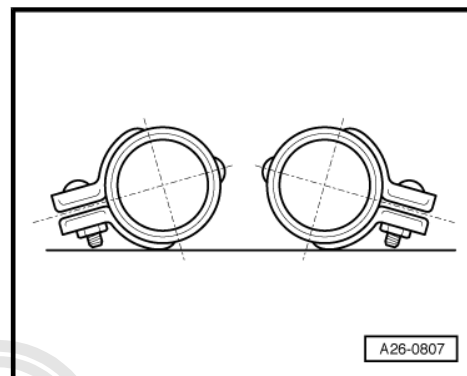


- When installing, position centre of clamps -arrows- over cutting location.

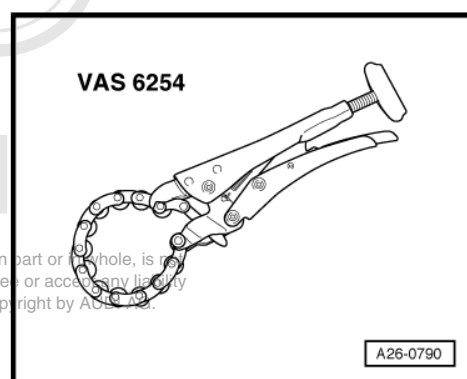


**All vehicles (continued):**

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.
- Align exhaust system so it is free of stress ⇒ [page 279](#) .

**1.6 Renewing tailpipe****Special tools and workshop equipment required**

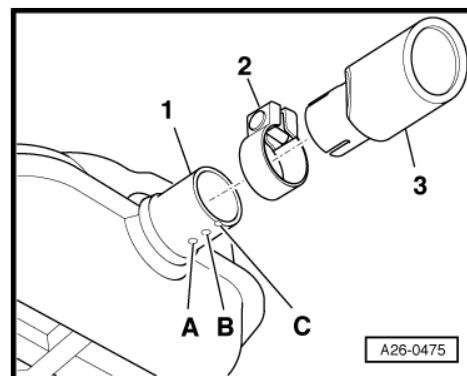
- ◆ Chain pipe cutter - VAS 6254-

**Procedure**

- Cut through old tailpipe -1- at a right angle at cutting point -C- using chain pipe cutter - VAS 6254- .
- Push on new tailpipe -3- as far as marking -A-. Slot on tailpipe should align with marking -B-.
- Fit clamp -2-.

**Tightening torque**

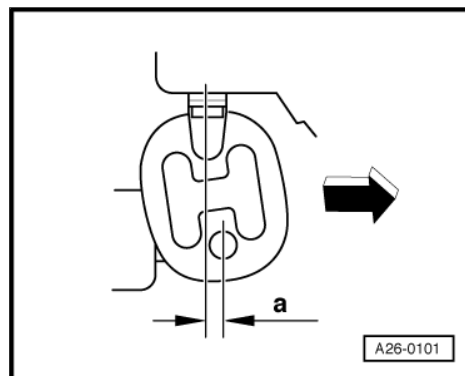
| Component | Nm |
|-----------|----|
| Clamp     | 25 |

**1.7 Stress-free alignment of exhaust system**

- The exhaust system must be aligned when it is cool.
- Tightening torques: vehicles with front-wheel drive ⇒ [page 267](#) , vehicles with four-wheel drive ⇒ [page 270](#) .

## Vehicles without clamps between centre silencer and rear silencer

- Loosen bolted connections on front clamps.
- Push exhaust system towards front of vehicle -arrow-, so that mountings (right-side) for rear silencers are preloaded by -a- = 5 ... 9 mm.
- Tighten bolted connections on clamps evenly.
- Align tailpipe ⇒ [page 280](#) .



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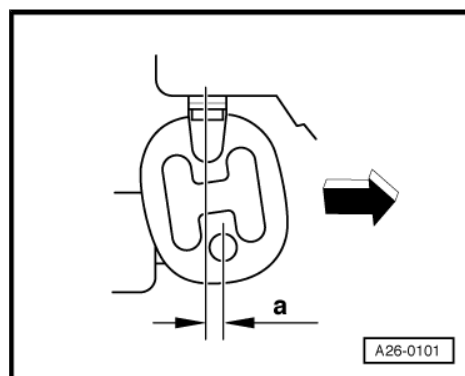
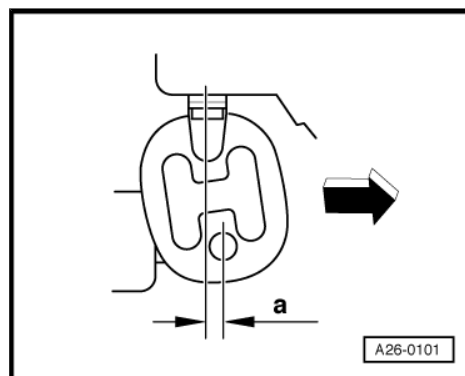
## Vehicles with clamps between centre silencer and rear silencer



### Note

*On vehicles with clamps fitted between centre silencer and rear silencer, it is also necessary to align the centre silencer.*

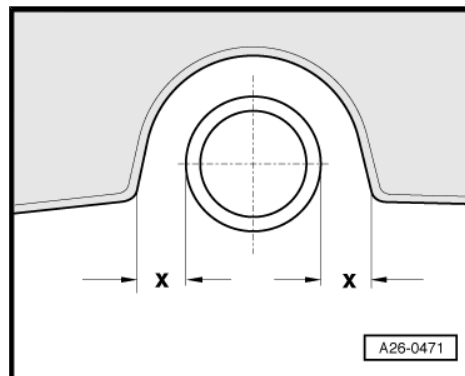
- Loosen bolted connections on front and rear clamps.
- Push front section of exhaust system towards front of vehicle -arrow-, so that mountings for centre silencer are preloaded by -a- = 5 ... 9 mm.
- Tighten bolted connections on front clamps evenly.
- Push rear section of exhaust system towards front of vehicle -arrow-, so that mountings (rear) for rear silencers are preloaded by -a- = 5 ... 9 mm.
- Align rear silencers so they are horizontal.
- Tighten bolted connections on rear clamps evenly.
- Align tailpipe ⇒ [page 280](#) .



## 1.8 Aligning tailpipes

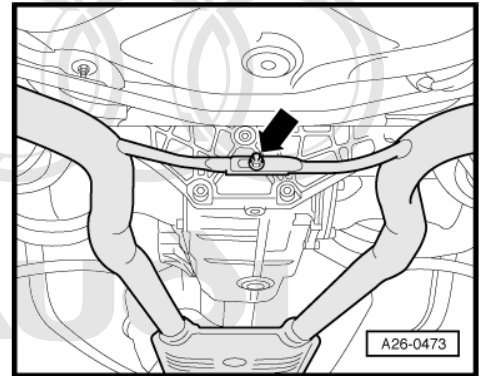
### Procedure

- Tightening torque: vehicles with front-wheel drive ⇒ [page 267](#) , vehicles with four-wheel drive ⇒ [page 270](#) .
- Check clearance between tailpipes and bumper on both sides.
- Dimension -x- (left-side) = dimension -x- (right-side)

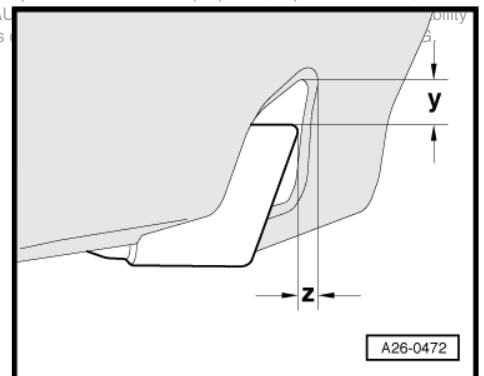


If necessary, correct dimension "x" as follows:

- Slacken bolt connection -arrow- on brace between exhaust pipes.
- Adjust the distance between the rear silencers.
- Tighten bolt connection.



- Check distances -y- and -z- between tailpipes and bumper.
- Dimension -y- = 17 ... 19 mm.
- Dimension -z- =  $0 \pm 2$  mm.
- If necessary, check whether the exhaust system is aligned free of stress [⇒ page 279](#).



## 1.9 Checking exhaust system for leaks

- Start the engine and run at idling speed.
- Plug tailpipes for duration of leak test (e.g. with cloths or plugs).
- Listen for noise at connection points (cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe, etc.) to locate any leaks.
- Rectify any leaks that are found.

## 2 Exhaust manifolds

⇒ ["2.1 Exploded view - exhaust manifold", page 282](#)

⇒ ["2.2 Removing and installing exhaust manifold \(left-side\)", page 283](#)

⇒ ["2.3 Removing and installing exhaust manifold \(right-side\)", page 285](#)

### 2.1 Exploded view - exhaust manifold

#### 1 - Nut

- ☐ Renew
- ☐ Coat with high-temperature paste; for high-temperature paste refer to ⇒ [Electronic parts catalogue](#)
- ☐ Tightening torque  
⇒ [Fig. "Tightening sequence for exhaust manifold \(left-side\)", page 283](#) or  
⇒ [Fig. "Tightening sequence for exhaust manifold \(right-side\)", page 283](#)

#### 2 - Bracket for heat shield

#### 3 - Exhaust manifold

- ☐ Removing and installing: left-side  
⇒ [page 283](#) , right-side  
⇒ [page 285](#)

#### 4 - Gasket

- ☐ Renew

#### 5 - Heat shield

#### 6 - Bolt

- ☐ 10 Nm

#### 7 - Lambda probe

- ☐ Before catalytic converter
- ☐ The threads on the new Lambda probes are coated with a special assembly paste.

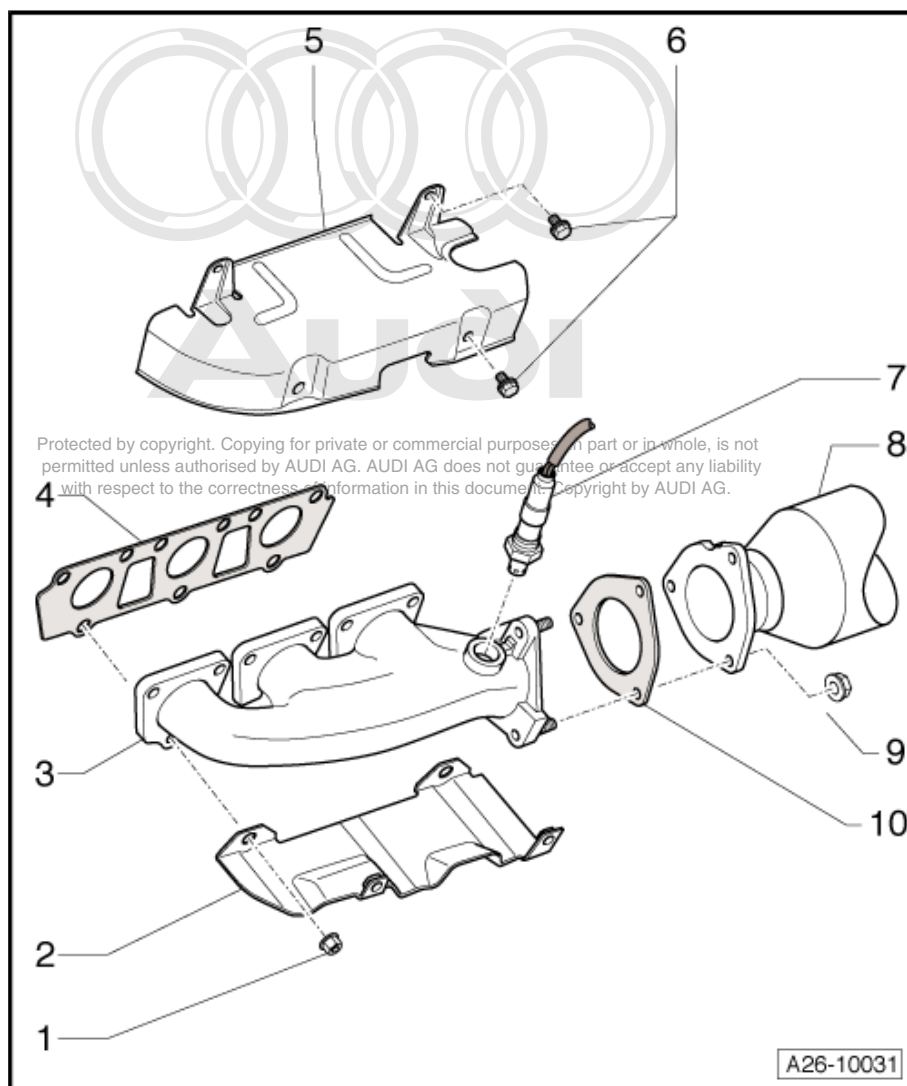
- ☐ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ [Electronic parts catalogue](#) for high-temperature paste
- ☐ The assembly paste/high-temperature paste must not get into the slots in the Lambda probe body
- ☐ Removing and installing ⇒ [Rep. gr. 24](#)

#### 8 - Front exhaust pipe with catalytic converter and front silencer

- ☐ Protect against knocks and impact
- ☐ Removing and installing: left-side ⇒ [page 272](#) , right-side ⇒ [page 275](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

#### 9 - Nut

- ☐ Renew



- ☐ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 23 Nm

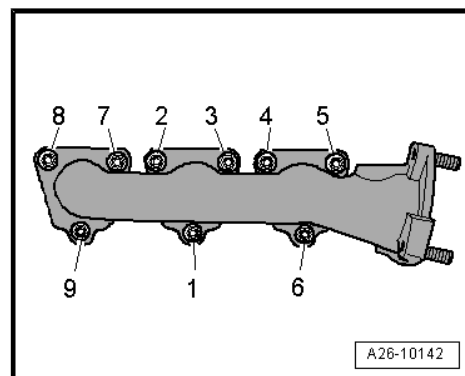
## 10 - Gasket

- ☐ Renew

### Tightening sequence for exhaust manifold (left-side)

- Tighten nuts in the sequence -1 ... 9- in 3 stages as follows:

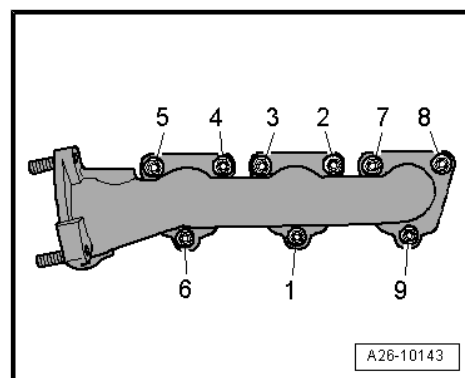
1. Screw in nuts hand-tight.
2. Initially tighten to 15 Nm.
3. Tighten to 25 Nm.



### Tightening sequence for exhaust manifold (right-side)

- Tighten nuts in the sequence -1 ... 9- in 3 stages as follows:

1. Screw in nuts hand-tight.
2. Initially tighten to 15 Nm.
3. Tighten to 25 Nm.



## 2.2 Removing and installing exhaust manifold (left-side)

### Removing

- Remove front exhaust pipe (left-side) together with catalytic converter ⇒ [page 272](#).
- Unplug electrical connector -1- for Lambda probe 2 - G108- and move wiring clear.

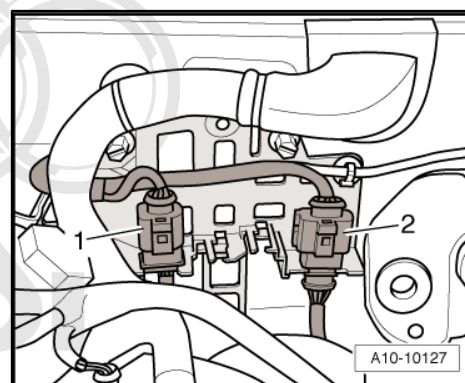


### Note

Disregard item -2-.

- Remove poly V-belt from air conditioner compressor pulley

⇒ ["1.2 Removing and installing poly V-belt", page 101](#)



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- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.



### WARNING

*Risk of injury caused by refrigerant.*

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

- Unscrew air conditioner compressor from bracket -arrows-.

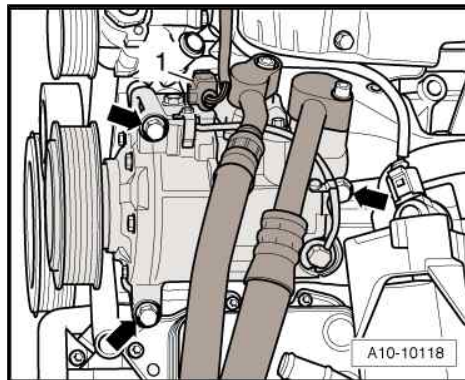


### Caution

*Danger of damage to refrigerant lines and hoses.*

- ◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*

- Tie up air conditioner compressor with lines attached to left-side of vehicle.
- Unscrew bolts -1 ... 4- and remove heat shield.



- Remove nuts -1- and -8- and detach bracket for heat shield.
- Unscrew nuts -2 ... 7- and -9- and remove exhaust manifold.

### Installing

- Tightening torques ⇒ [page 282](#) , ⇒ [page 283](#) .

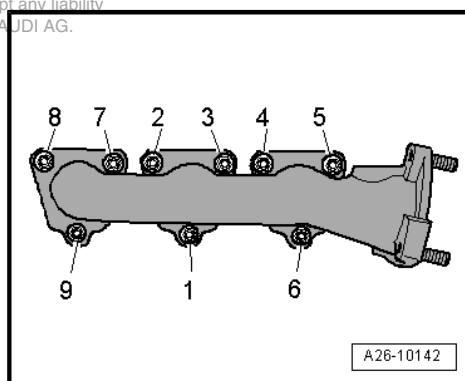
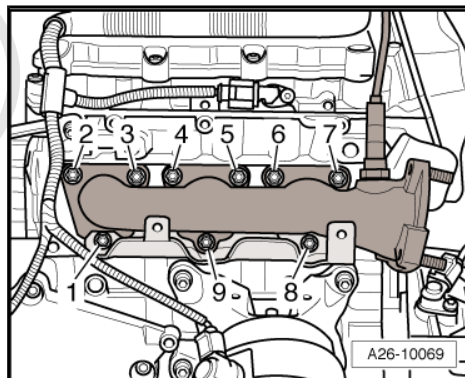
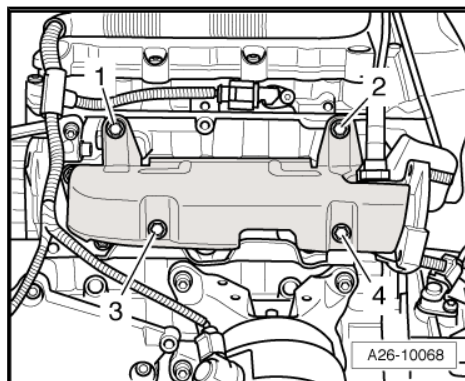
Installation is carried out in the reverse order; note the following:



### Note

*Renew seals, gaskets and self-locking nuts.*

- Tighten nuts for exhaust manifold ⇒ [page 283](#) .
- Install front exhaust pipe (left-side) together with catalytic converter ⇒ [page 272](#) .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt ⇒ [page 101](#) .



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## 2.3 Removing and installing exhaust manifold (right-side)

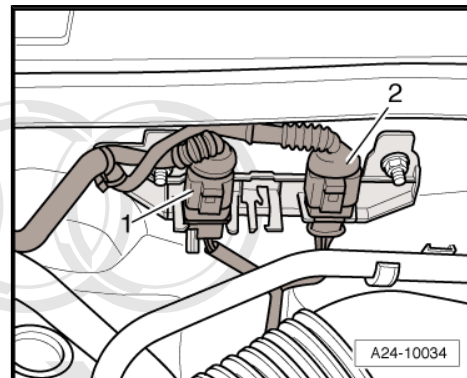
### Removing

- Remove front exhaust pipe (right-side) together with catalytic converter ⇒ [page 275](#) .
- Unplug electrical connector -1- for Lambda probe - G39- and move wiring clear.

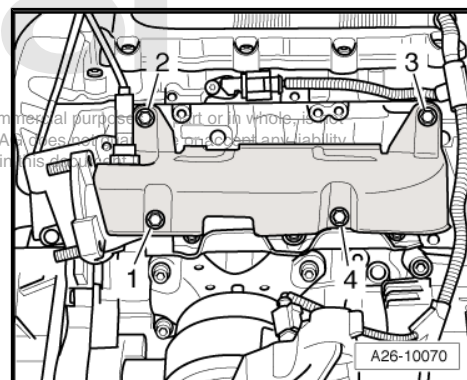


#### Note

Disregard item -2-.



- Unscrew bolts -1 ... 4- and remove heat shield.



- Remove nuts -7- and -9- and detach bracket for heat shield.
- Unscrew nuts -1 ... 6- and -8- and remove exhaust manifold.

### Installing

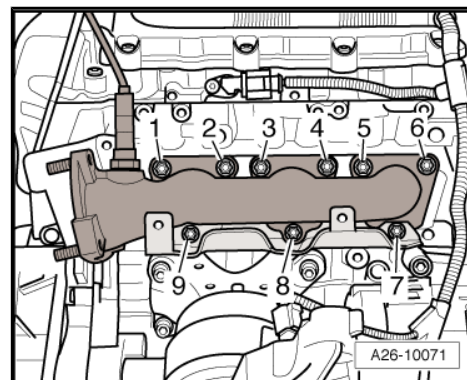
- Tightening torques ⇒ [page 282](#) , ⇒ [page 283](#) .

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

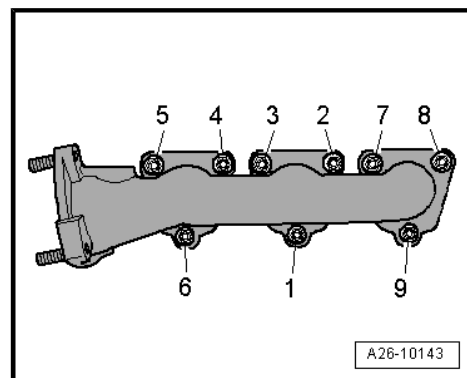


#### Note

Renew seals, gaskets and self-locking nuts.



- Tighten nuts for exhaust manifold ⇒ [page 283](#) .
- Install front exhaust pipe (right-side) together with catalytic converter ⇒ [page 275](#) .
- Align exhaust system so it is free of stress ⇒ [page 279](#) .



### 3 Secondary air system

⇒ ["3.1 Exploded view - secondary air system", page 286](#)

⇒ ["3.2 Removing and installing secondary air pump motor V101 - vehicles without air suspension", page 287](#)

⇒ ["3.3 Removing and installing secondary air pump motor V101 - vehicles with air suspension", page 288](#)

⇒ ["3.4 Checking combination valves for secondary air system for correct operation and leakage", page 289](#)

⇒ ["3.5 Removing and installing combination valve for secondary air system \(left-side\)", page 291](#)

⇒ ["3.6 Removing and installing combination valve for secondary air system \(right-side\)", page 292](#)

#### 3.1 Exploded view - secondary air system

1 - Secondary air hose

2 - O-rings

☐ Renew

3 - Secondary air pump motor - V101-

☐ Removing and installing: vehicles without air suspension  
⇒ [page 287](#)

☐ Removing and installing: vehicles with air suspension  
⇒ [page 288](#)

☐ Clip electrical connector into bracket

☐ Check in "Guided Functions" ⇒ Vehicle diagnostic tester.

4 - Bonded rubber mounting

5 - Bracket

☐ For secondary air pump motor - V101-

6 - Nut

☐ 9 Nm

7 - Bolt

☐ 9 Nm

8 - Gasket

☐ Renew

9 - Bolts

☐ 9 Nm

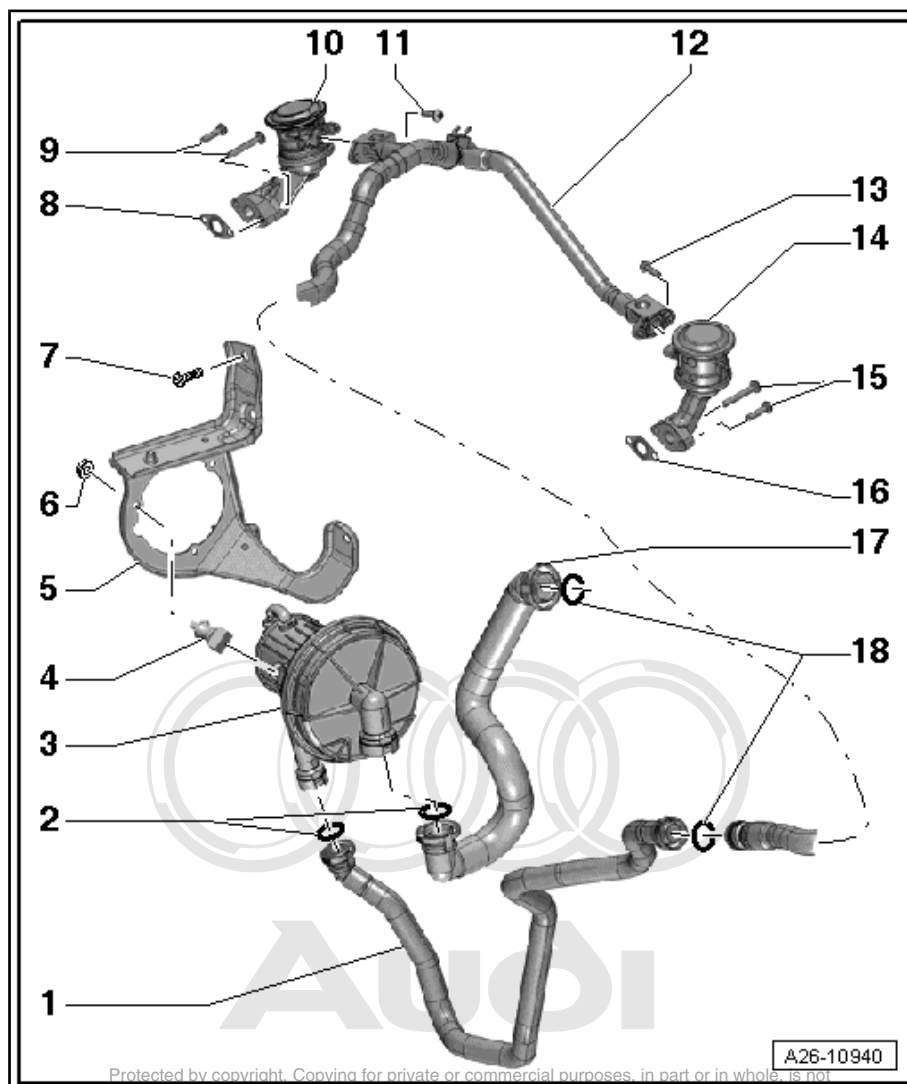
10 - Combination valve for secondary air system (right-side)

☐ Check operation and check for leaks ⇒ [page 289](#)

☐ Removing and installing ⇒ [page 292](#)

11 - Bolt

☐ 9 Nm



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**12 - Secondary air pipe****13 - Bolt**

- ☐ 9 Nm

**14 - Combination valve for secondary air system (left-side)**

- ☐ Check operation and check for leaks ⇒ [page 289](#)
- ☐ Removing and installing ⇒ [page 291](#)

**15 - Bolts**

- ☐ 9 Nm

**16 - Gasket**

- ☐ Renew

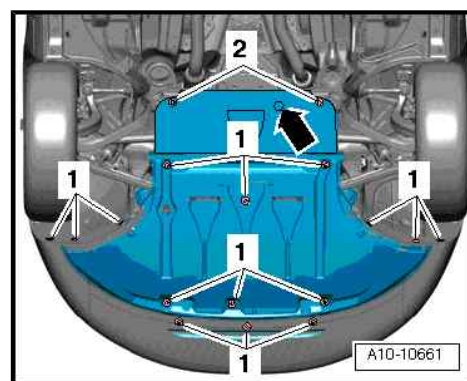
**17 - Secondary air hose****18 - O-rings**

- ☐ Renew

### 3.2 Removing and installing secondary air pump motor - V101- - vehicles without air suspension

**Removing**

- Remove noise insulation panels ⇒ Rep. gr. 50 .



- Press release tabs and detach secondary air hoses -1- and -3- from secondary air pump motor - V101- .
- Unplug electrical connector -2-.
- Remove nuts -arrows- and detach secondary air pump.

**Installing**

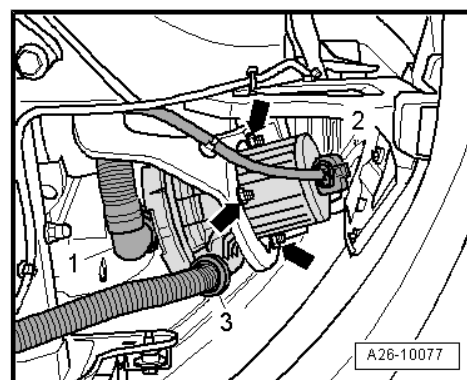
- Tightening torque ⇒ [page 286](#)

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

**Note**

*Fit all cable ties in the original positions when installing.*

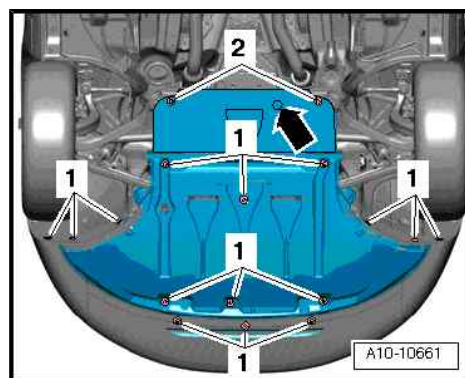
- Install noise insulation panels ⇒ Rep. gr. 50 .



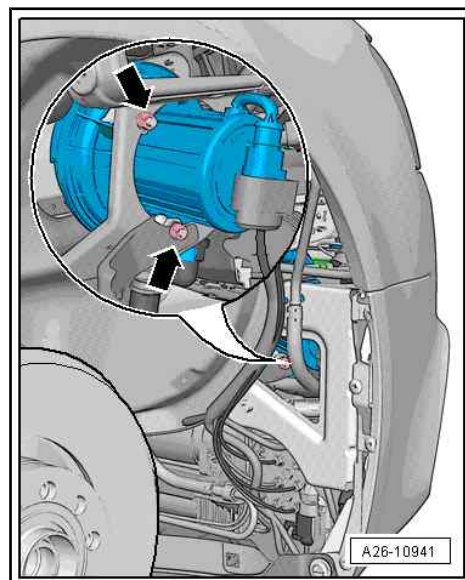
### 3.3 Removing and installing secondary air pump motor - V101- - vehicles with air suspension

#### Removing

- Remove noise insulation panels ⇒ Rep. gr. 50 .
- Remove left wheel housing liner ⇒ Rep. gr. 50 .



- Remove nuts -arrows-.



- Press release tabs and detach secondary air hoses -1- from secondary air pump motor - V101- .
- Unplug electrical connector -2-.
- Unscrew nut -arrows- from below and detach secondary air pump.

#### Installing

- Tightening torque ⇒ [page 286](#)

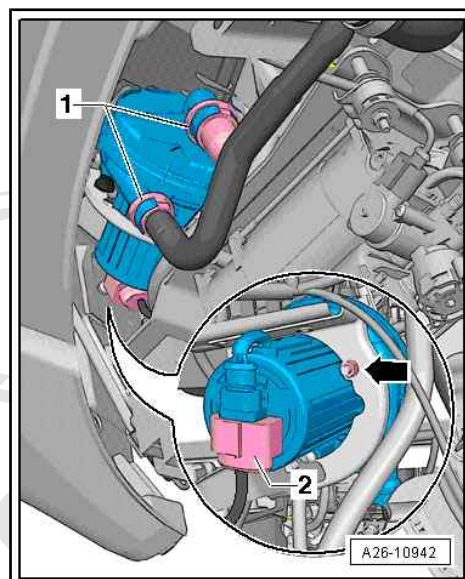
Installation is carried out in the reverse order; note the following:



#### Note

*Fit all cable ties in the original positions when installing.*

- Install noise insulation panels ⇒ Rep. gr. 50 .



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### 3.4 Checking combination valves for secondary air system for correct operation and leakage

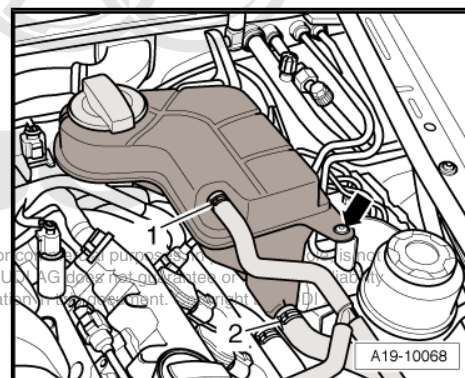
#### Procedure

- No leaks in hose connections.
- Pull off rear engine cover panel -top arrows-.



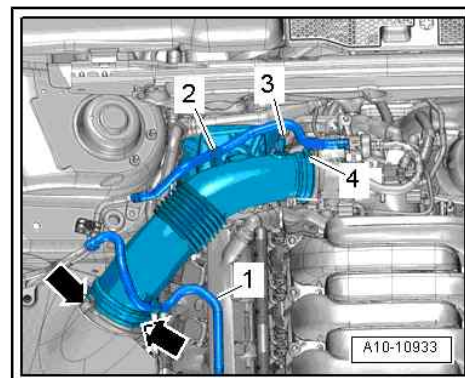
#### Combination valve for secondary air system (left-side):

- Remove bolt -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



#### Combination valve for secondary air system (right-side):

- Move fuel line -1- and line -2- (leading to activated charcoal filter) clear at air pipe.
- Disconnect vacuum hose -3- from connection on air pipe.
- Remove air pipe. To do so, release hose clip -4- and clamps -arrows-.



### Both sides (continued):

- Remove bolts -2- and press secondary air hoses to side.



### Note

Disregard -item 1-.



- Connect suitable hose -arrow- to combination valve for secondary air, as shown in illustration.
- Blow lightly into test hose with your mouth (do not use compressed air).
- The combination valve for secondary air system should be closed; it should not be possible to blow through the hose.
- Blow more firmly (i.e. with greater pressure) into test hose with your mouth (do not use compressed air).
- The combination valve for secondary air system should open; it should now be possible to blow through the hose.
- Renew combination valve for secondary air system if you cannot determine the switching point: (left-side) ⇒ [page 291](#) , (right-side) ⇒ [page 292](#)

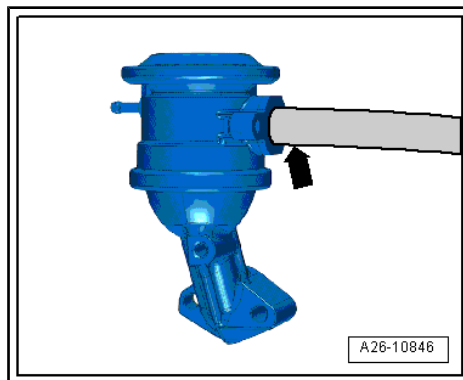
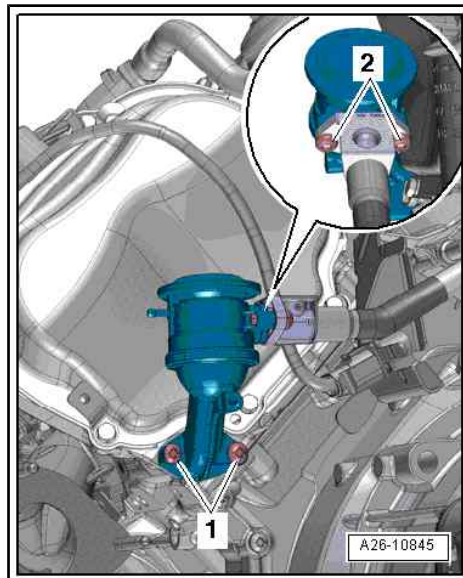
### Assembling

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



### Note

- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*



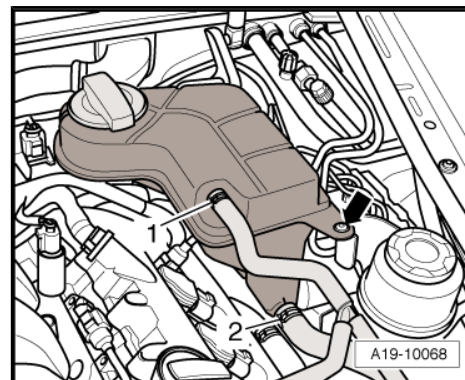
### 3.5 Removing and installing combination valve for secondary air system (left-side)

#### Removing

- Pull off rear engine cover panel -top arrows-.



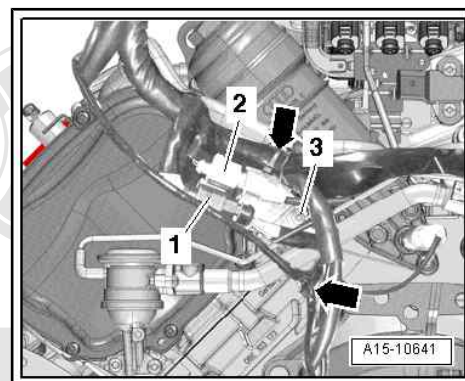
- Remove bolt -arrow-.
- Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



#### Note

*For illustration purposes, the work steps are shown in the following illustrations from the rear with the engine removed.*

- Detach electrical connectors -1- and -2- from bracket and unplug connectors.
- Move electrical wiring clear -arrows-.
- Remove nut -3- and move earth wire clear.
- Remove centre hex stud and remove bracket.



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- Unscrew bolts -1- and -2- and remove combination valve for secondary air system (left-side).

#### Installing

- Tightening torque ⇒ [page 286](#)

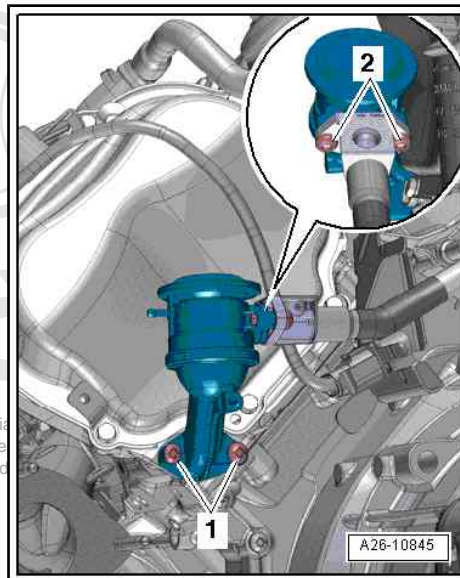
Installation is carried out in the reverse order; note the following:



#### Note

*Renew gasket.*

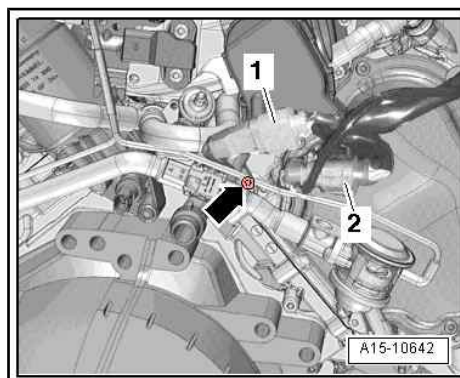
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### 3.6 Removing and installing combination valve for secondary air system (right-side)

#### Removing

- Remove throttle valve module - J338- ⇒ Rep. gr. 24 .
- Unplug electrical connectors -1- and -2- at rear of cylinder head (right-side).
- Remove bolt -arrow- and remove bracket.



- Remove bolts -2-.
- Detach combination valve for secondary air system (right-side) and remove bolts -1- for secondary air hose.

#### Installing

- Tightening torque ⇒ [page 286](#)

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



#### Note

*Renew gasket.*

- Install throttle valve module - J338- ⇒ Rep. gr. 24 .

