

Workshop Manual Audi A6 2005 ➤

6-cylinder direct petrol injection engine (3.2 ltr. 4-valve), mechanics

Engine ID	BKH	AUK	BYU						
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Edition 12.2008



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List of Workshop Manual Repair Groups

Repair Group

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



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

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Audi A6 2005 ►

6-cylinder direct petrol injection engine (3.2 ltr. 4-valve), mechanics - Edition 12.2008



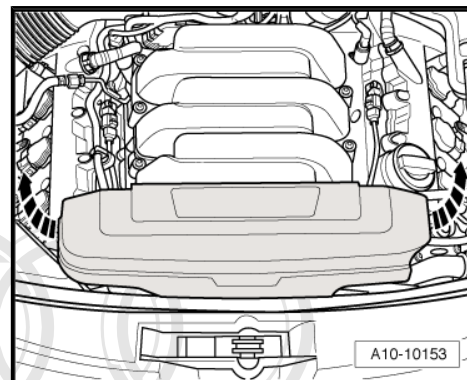
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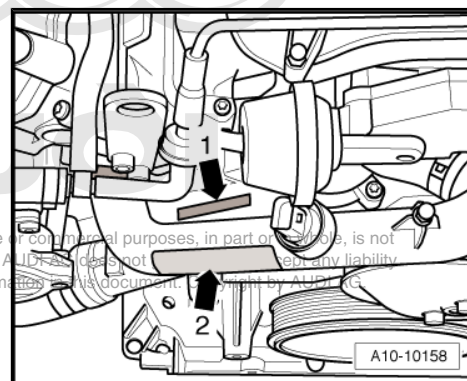
00 – Technical data

1 Engine number

- 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		AUK	BKH	BYU
Capacity	ltr.	3.123	3.123	3.123
Power output	kW at rpm	188/6500	188/6500	183/6500
Torque	Nm at rpm	330/3250	330/3250	330/3250
Bore	Ø in mm	84.5	84.5	84.5
Stroke	mm	92.8	92.8	92.8
Compression ratio		12.5	12.5	12.5
RON	at least	95 ¹⁾	95 ¹⁾	95 ¹⁾
Injection system/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		2 sensors	2 sensors	2 sensors
Lambda control		2 probes before catalytic converter 2 probes after catalytic converter	2 probes before catalytic converter 2 probes after catalytic converter	2 probes before catalytic converter 2 probes after catalytic converter
Variable valve timing		Inlet Exhaust	Inlet Exhaust	Inlet Exhaust
Intake manifold change-over		yes	yes	yes
Secondary air system		no	no	no
Valves per cylinder		4	4	4

• ¹⁾ Unleaded regular grade petrol (RON 91) can also be used, but this will result in a loss of power

3 Safety precautions

When working on the fuel system note the following warnings:



WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

- Procedure before opening high-pressure section of injection system ⇒ Rep. Gr. 24 .

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ Always switch off ignition before washing engine.
- ◆ Faults are stored in engine control unit if electrical connectors were unplugged and engine was started: "Generate readiness code" in "Guided Functions" ⇒ Vehicle diagnosis, testing and information system VAS 5051.



Caution

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

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery.*

- Disconnect battery ⇒ Rep. Gr. 27 .

When working on the cooling system note the following warnings:



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 expansion tank with cloth and open carefully.*

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Note the following if testers and measuring instruments have to be used during a road test:

**WARNING**

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

3.1 Procedure before opening high-pressure section of injection system

**WARNING**

- ◆ *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 6 bar).*
- ◆ *The fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 5 bar prior to opening the system. Procedure ⇒ Rep. Gr. 24.*



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4 General repair instructions

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 been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.
- ◆ 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 performing assembly work on engine, all open passages in the intake and exhaust systems 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 chambers of the opposite cylinder bank must always be examined 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 hydraulic lines, vacuum lines and electrical wiring before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.

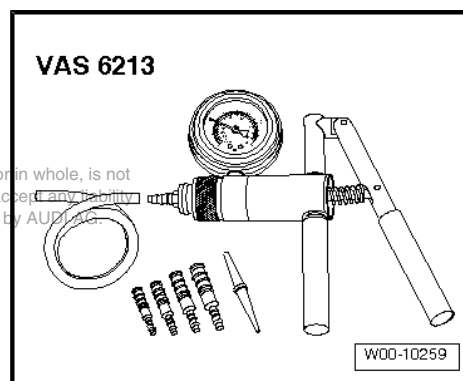
4.6 Installing radiators and condensers

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.

4.7 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 fault 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 pressure with the hand vacuum pump -VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

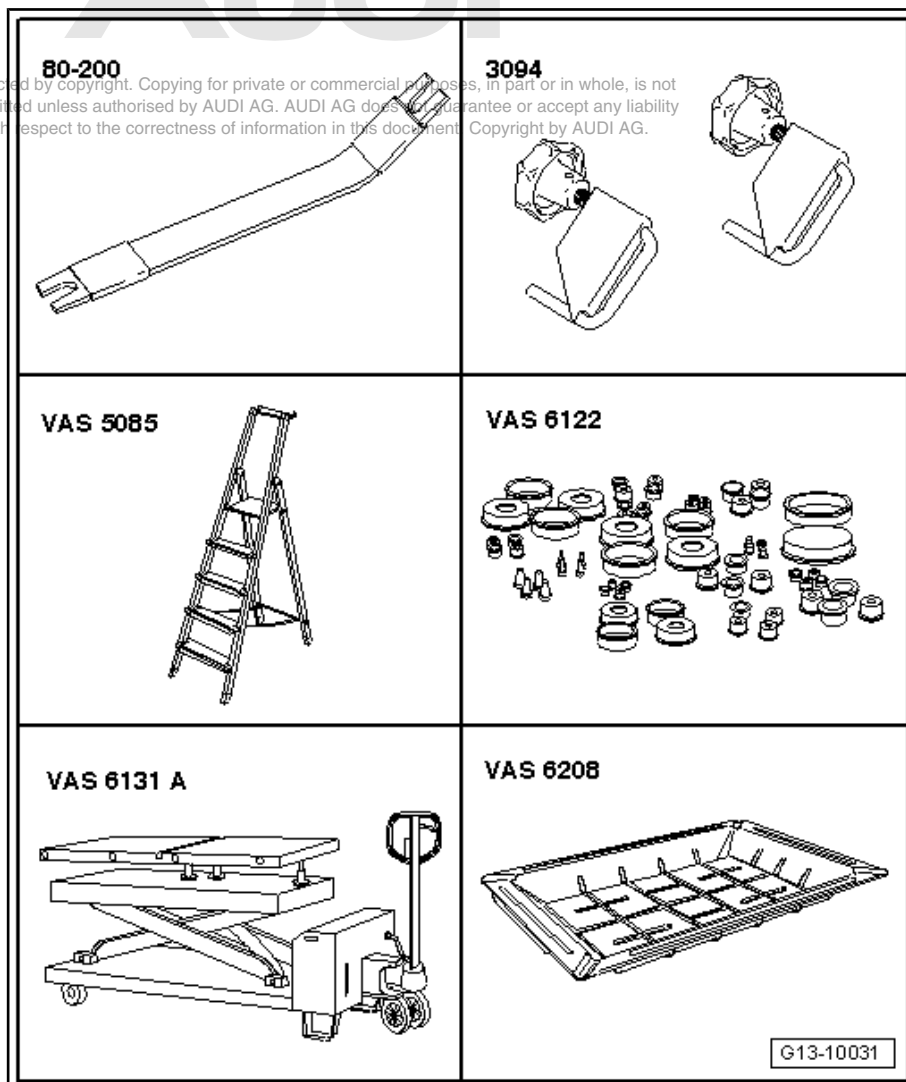
10 – Removing and installing engine

1 Removing and installing engine - vehicles with manual gearbox

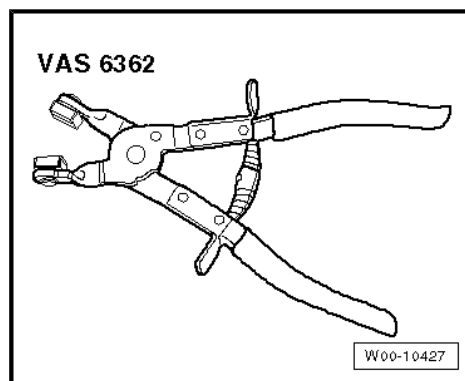
1.1 Removing engine

Special tools and workshop equipment required

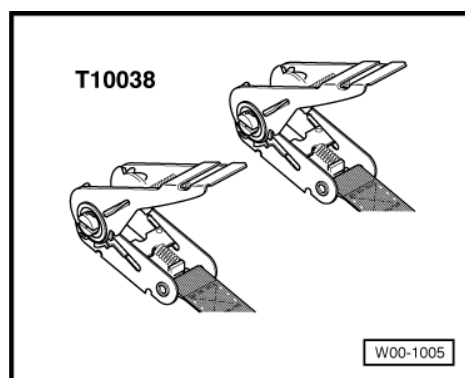
- ◆ Removal lever -80 - 200-
- ◆ Hose clamps for hoses up to 25 mm -3094-
- ◆ Stepladder -VAS 5085-
- ◆ Engine bung set -VAS 6122-
- ◆ Scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10-
- ◆ Drip tray for workshop hoist -VAS 6208-



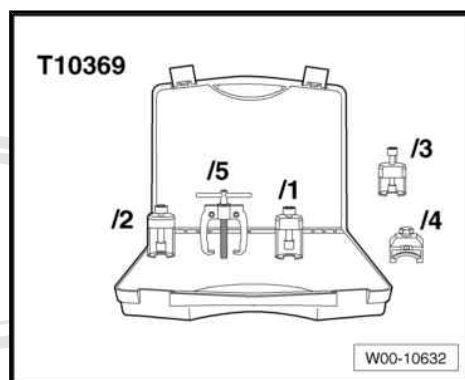
- ◆ Hose clip pliers -VAS 6362-



- ◆ Tensioning strap -T10038-



- ◆ Puller -T10369-



Procedure



Note

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



WARNING

Before removing the engine secure the vehicle against tipping over. To do so, the luggage compartment must be empty.

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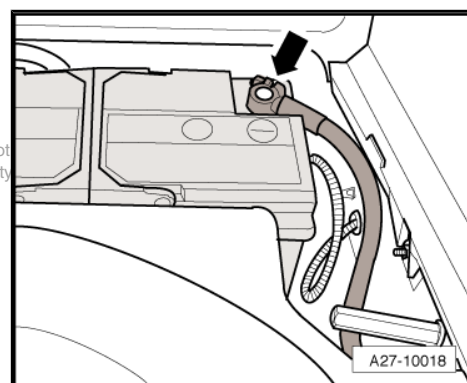
**Caution**

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

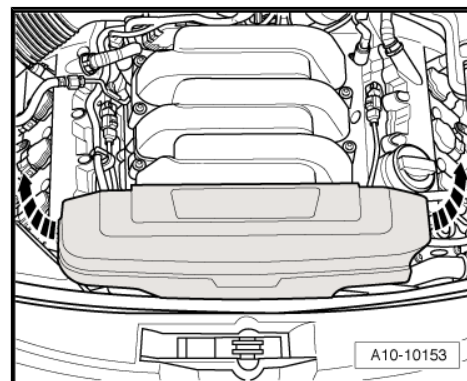
**Note**

- ◆ *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 electronic parking brake must be released before disconnecting the battery, so that the propshaft can be turned during removal.*
- With ignition switched off, disconnect battery earth cable -arrow- ⇒ Rep. Gr. 27.

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

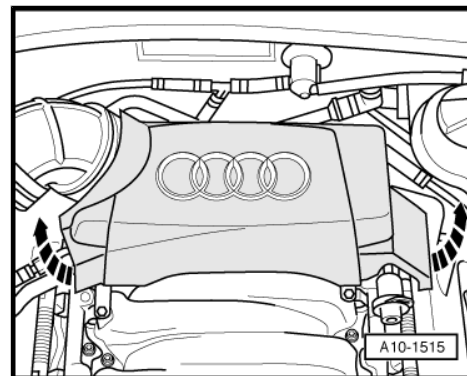


- Pull off engine cover panel (rear) -arrows-.

**WARNING**

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

- Open filler cap on coolant expansion tank.

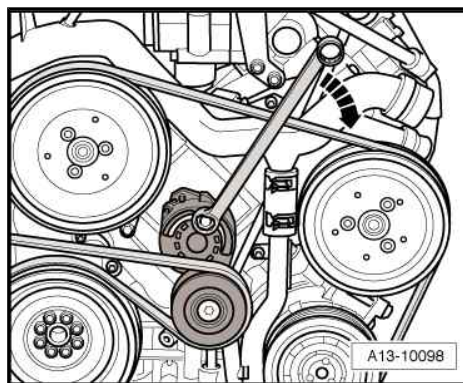




Note

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

- 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.

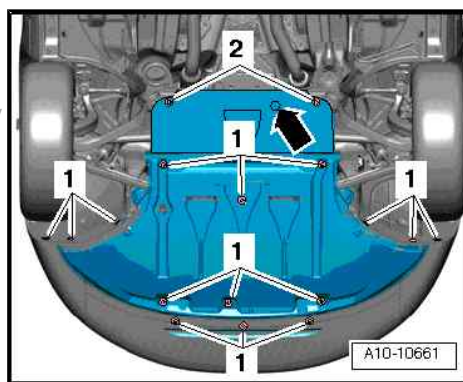


Note

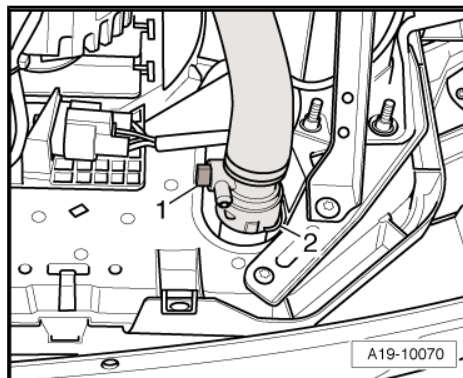
Secure brake discs with wheel bolts.

- Remove noise insulation panels ⇒ Rep. Gr. 50 .

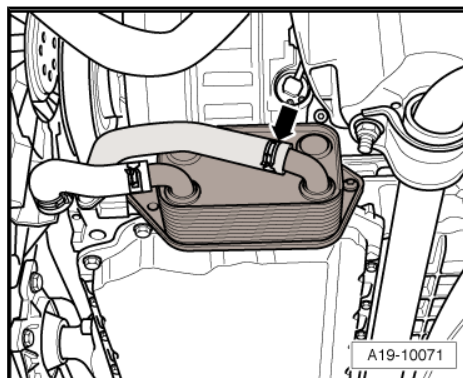
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- Place drip tray for workshop hoist -VAS 6208- under engine.
- Open drain plug -1- and let coolant drain.
- Then disconnect coolant hose -2- from radiator.



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



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

**WARNING**

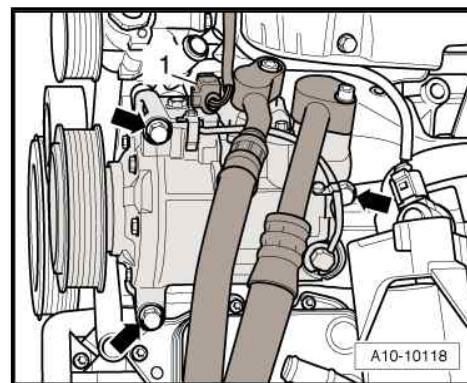
The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.

**Note**

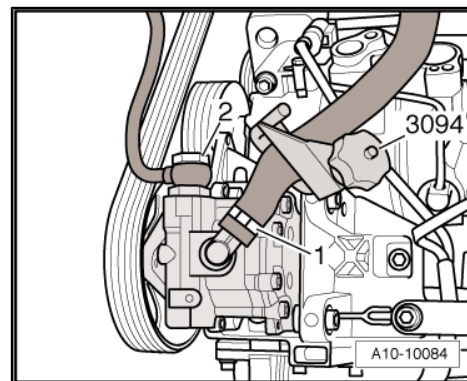
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.

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

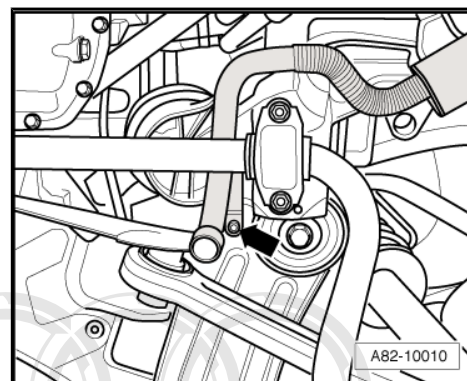
**Note**

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

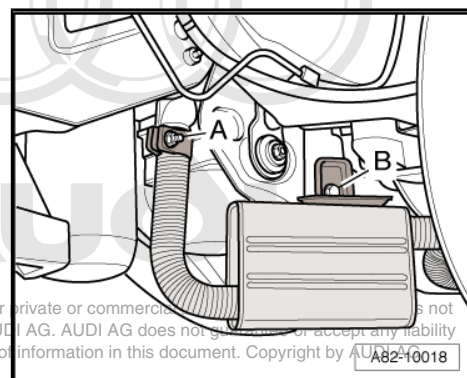
- Clamp off hydraulic hose -1- for power steering pump using a hose clamp -3094-.
- Disconnect hydraulic hose from power steering pump.
- Unbolt hydraulic pressure line -2- at power steering pump and lay pressure line on top of longitudinal member.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122-.

**Vehicles with auxiliary heater:**

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



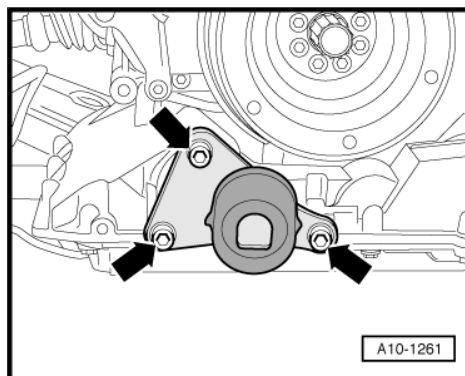
- Loosen nut -A- at clamp for corrugated exhaust pipe.
- Unscrew bolt -B- and remove silencer together with corrugated exhaust pipes.



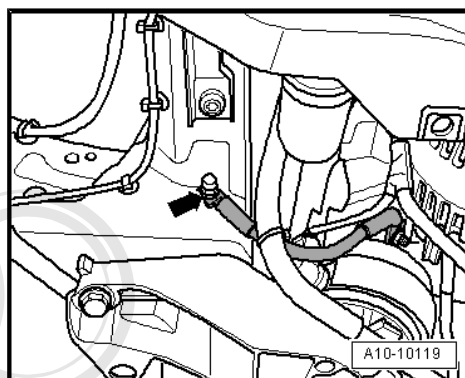
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All vehicles:

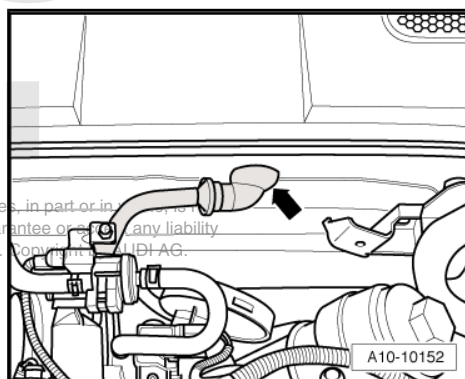
- Unscrew bolts -arrows- and remove torque reaction support from engine.



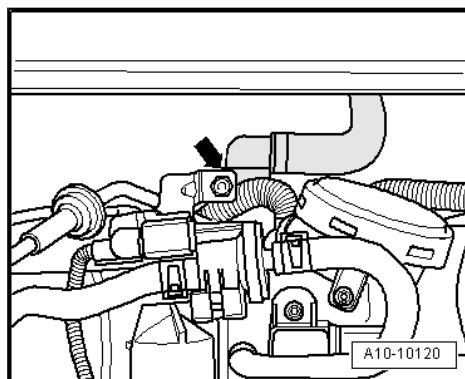
- Unbolt earth cable -arrow- at longitudinal member (right-side).



- Detach brake servo vacuum hose from grommet -arrow- at plenum chamber partition panel.

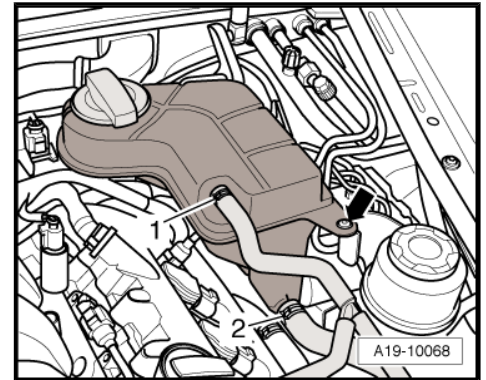


- Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.

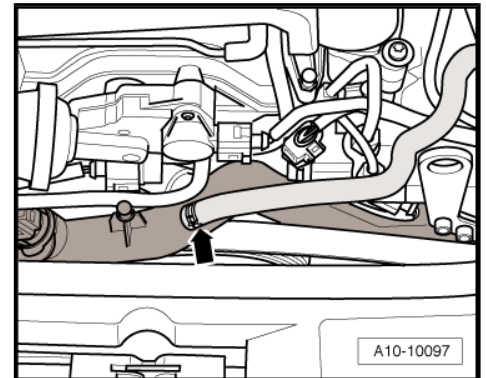


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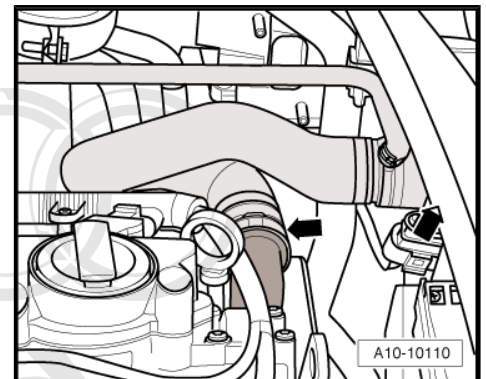
- Disconnect coolant hoses -1- and -2- at coolant expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).



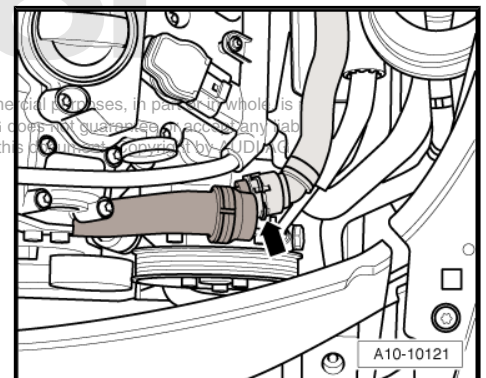
- Detach coolant hose -arrow- from coolant pipe (front).



- 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:



Caution

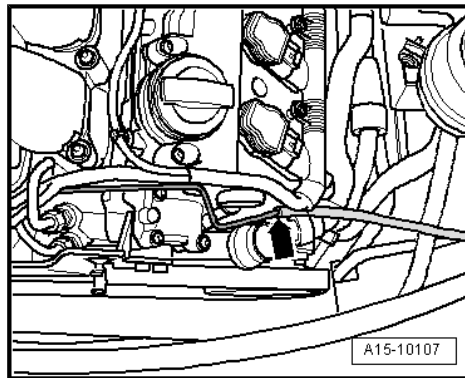
*Rules for cleanliness when working on the injection system
⇒ **page 5**.*



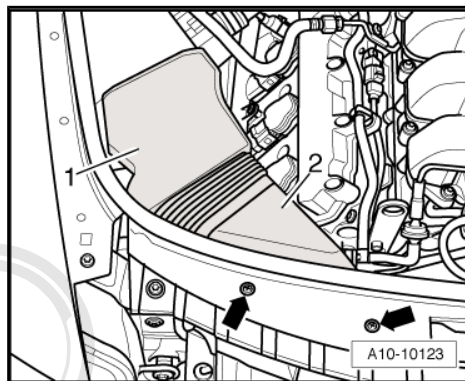
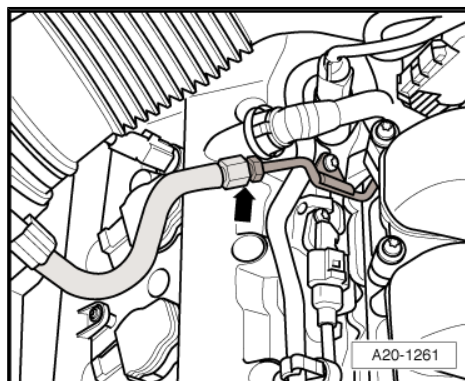
WARNING

The fuel system is pressurised. Before opening the low-pressure part of the injection system a clean cloth must be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.

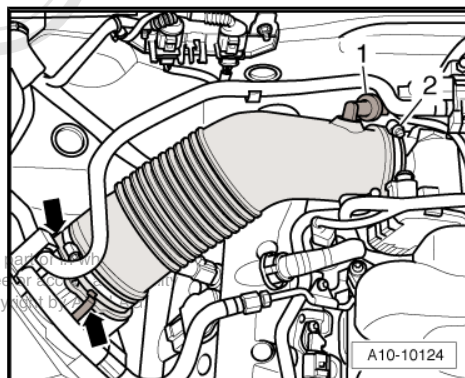
- Disconnect fuel line -arrow- and move clear.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



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

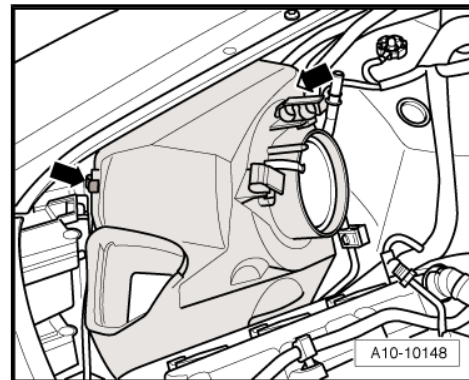


- Pull non-return valve -1- off connection at air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.

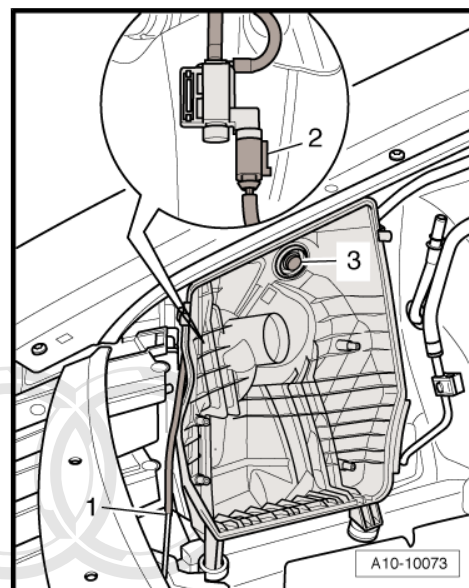


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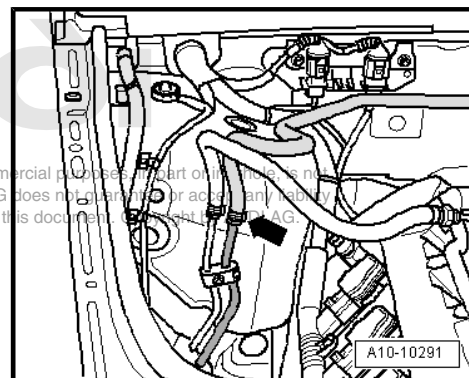
- Release clamps -arrows- and detach air cleaner (top section).



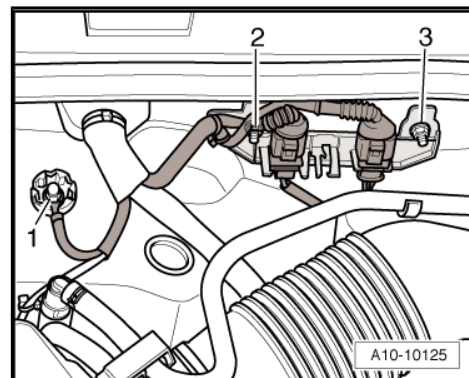
- Disconnect vacuum pipe -1-.
- Pull out pin of fastener -3-.
- Remove air cleaner (bottom section) and unplug electrical connector -2- on reverse side at variable intake manifold changeover valve -N335-.



- Disconnect vacuum hose -arrow- leading to activated charcoal filter.

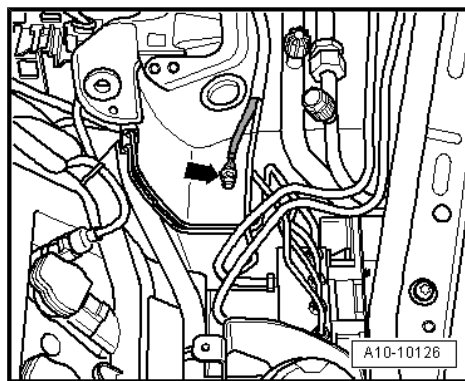


- Unscrew nuts -2- and -3- and remove bracket for connectors (right-side) from plenum chamber partition panel.
- Unbolt earth cable -1- at suspension turret (right-side).



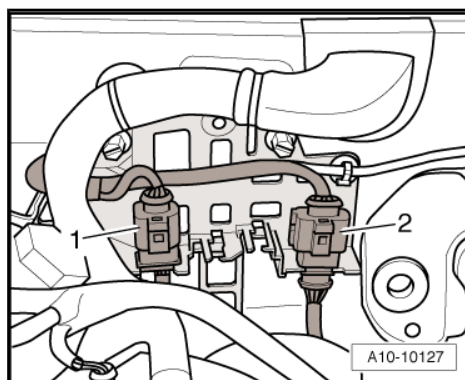
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- Unbolt earth cable -arrow- at suspension turret (left-side).

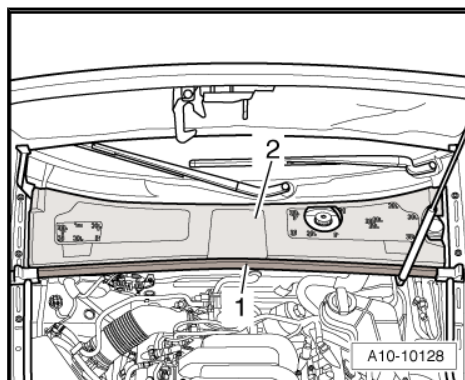


- Remove bracket (left-side) for connectors 1 and 2 from plenum-chamber partition panel.

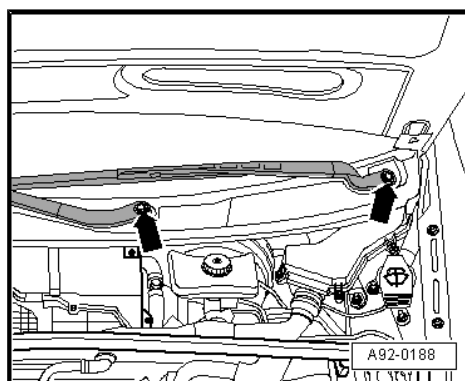
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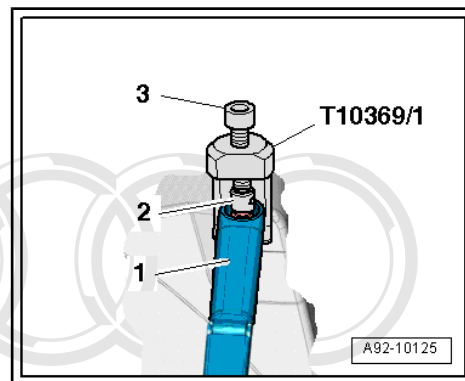
- Pull off rubber seal -1- and remove plenum chamber cover -2-.



- Use screwdriver to pry off caps on wiper arms and slacken off nuts -arrows- several turns.



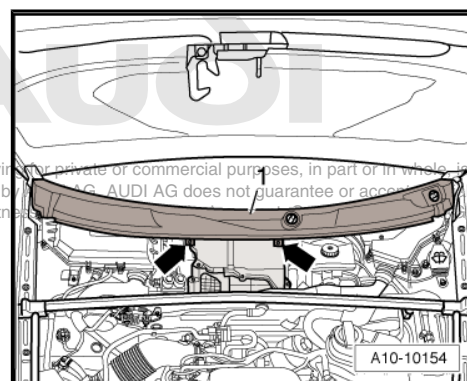
- Apply puller -T10369/1- to wiper arm -1-, as shown in illustration.
- Apply thrust piece -2- onto wiper shaft.
- Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
- Remove nuts completely and take off wiper arms.



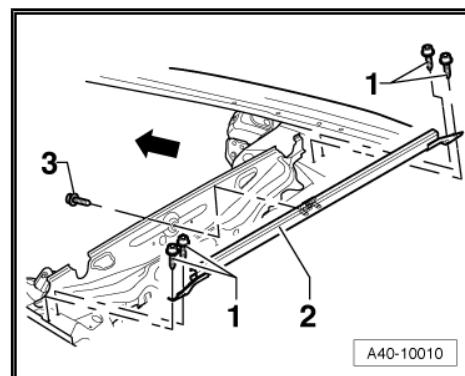
- Unscrew bolts -arrows- for cowl panel trim -1-.

**Caution**

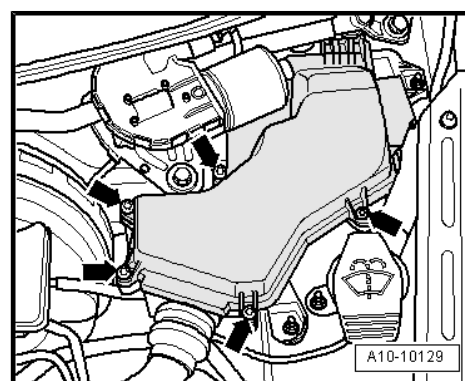
To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.



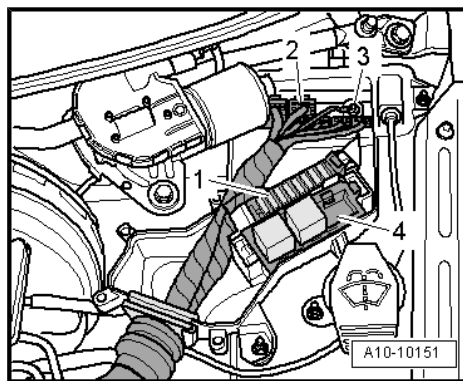
- Pull cowl panel trim off windscreen.
- If fitted, remove bolts -1- and -3- and detach body brace -2-.



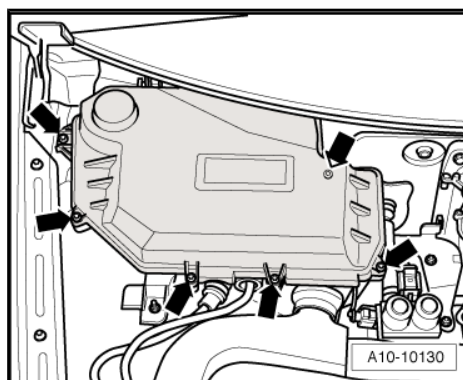
- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



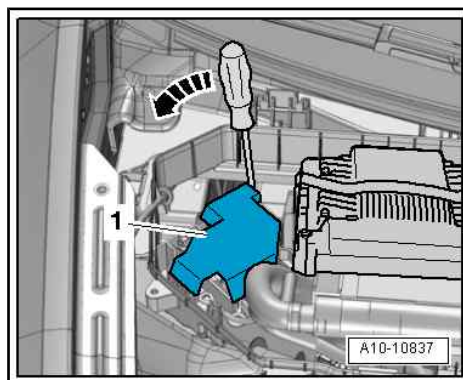
- Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
- Unscrew electrical wiring -3-.
- Unplug all connectors -2- at rear of connector console.
- Disengage engine wiring harness at electronics box and move it clear.



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



- If fitted, open cover -1- with screwdriver -arrow- and detach.



WARNING

The pump valve unit for heating system (left in front of electronics box) gets very hot – risk of burns!

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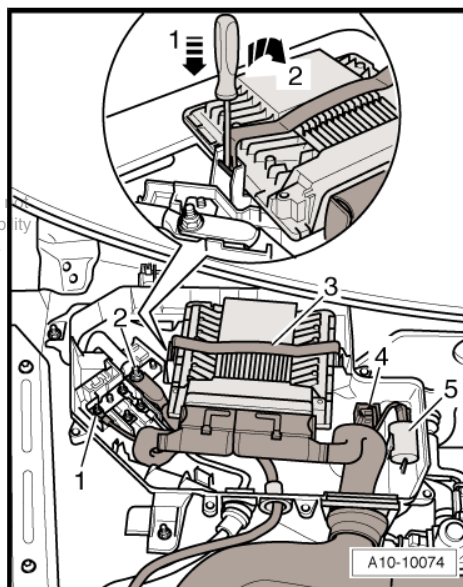
- Carefully lever out the retaining strap 3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.



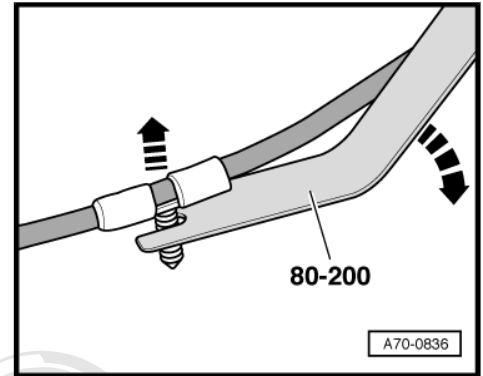
Note

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.

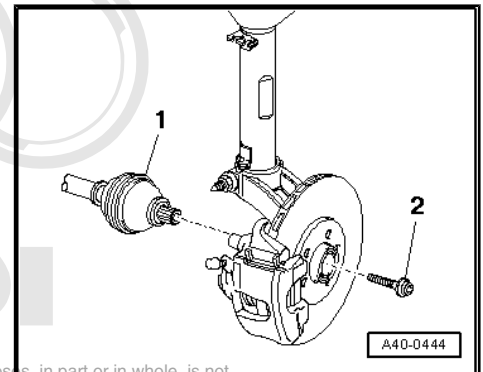


- Have a 2nd mechanic press the brake pedal.

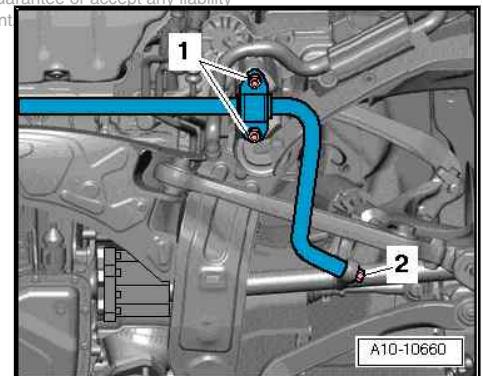
**Caution**

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

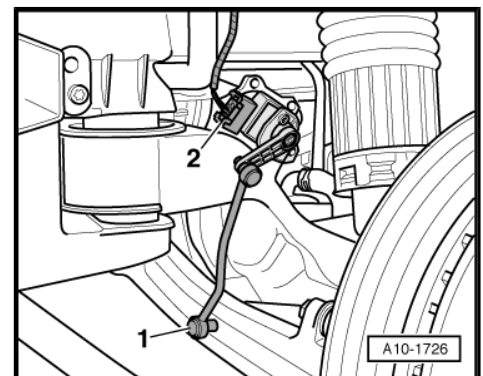
- Unscrew flange bolt -2- from drive shaft -1- (left and right).



- Unscrew 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.



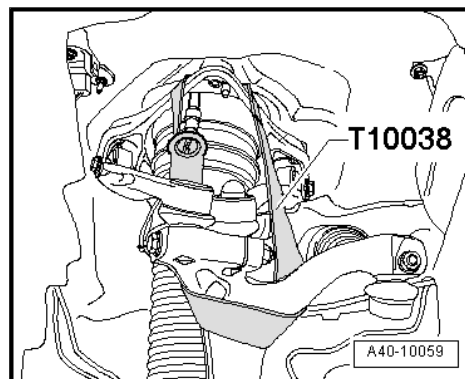


Caution

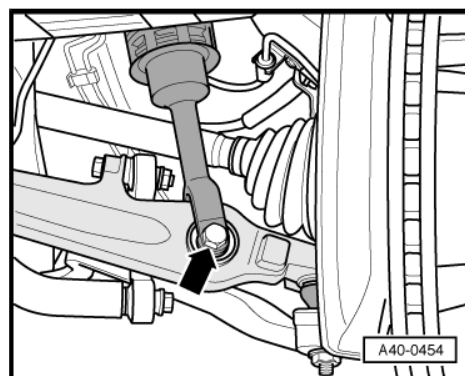
Danger of damage to the swivel joints of the upper links.

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

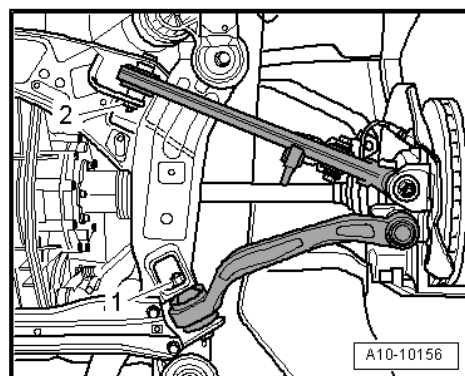
- Tie up wheel bearing housing using tensioning strap -T10038- as illustrated.



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



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



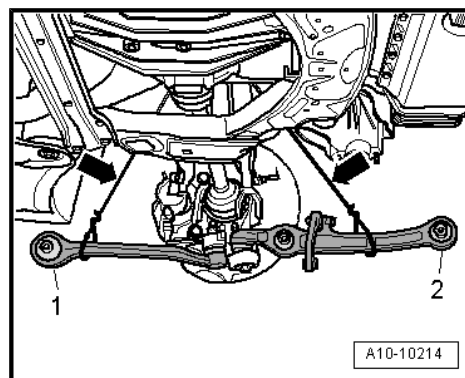
- Pivot guide link -1- and track control link -2- outwards.



Caution

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

- 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**

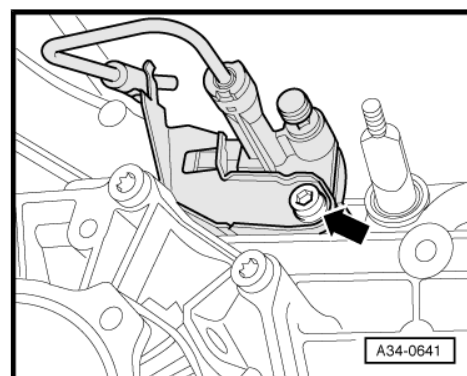
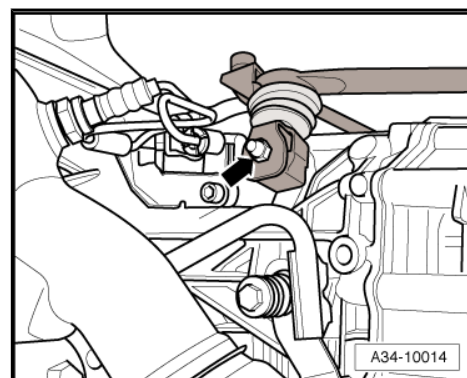
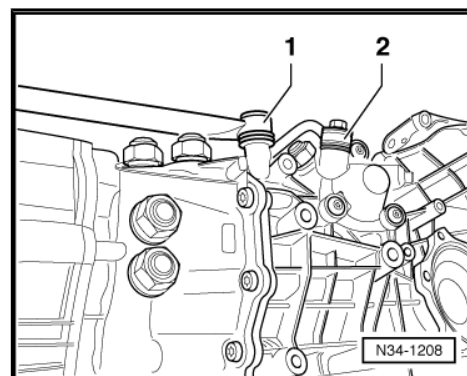
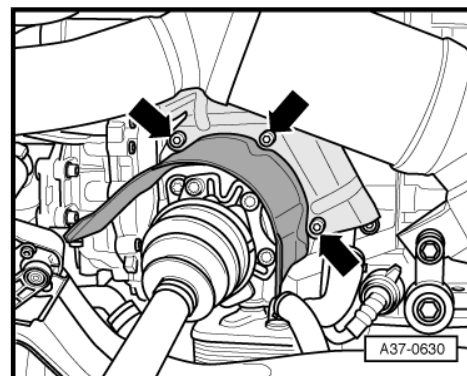
Take care not to damage brake hose.

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

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

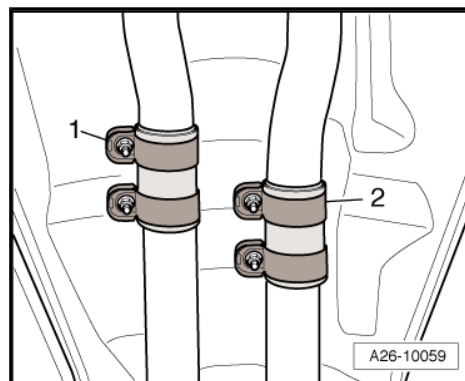
- Unscrew nut -arrow- and pull gearbox selector lever off selector shaft.

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

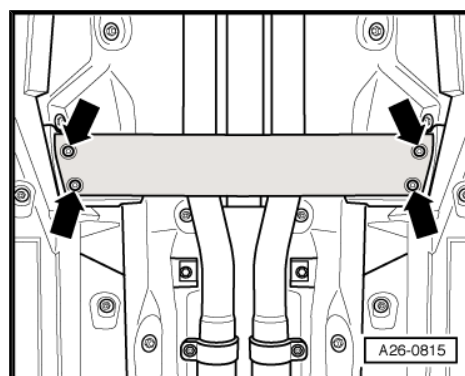


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- Loosen clamps -1- and -2-.

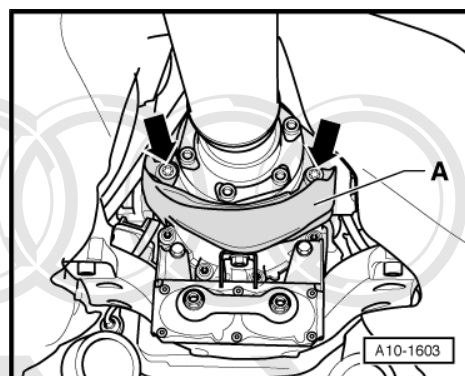


- Unbolt cross piece (front) -arrows-.

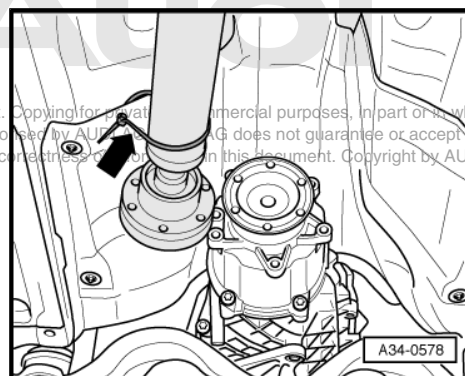


Vehicles with four-wheel drive:

- 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.



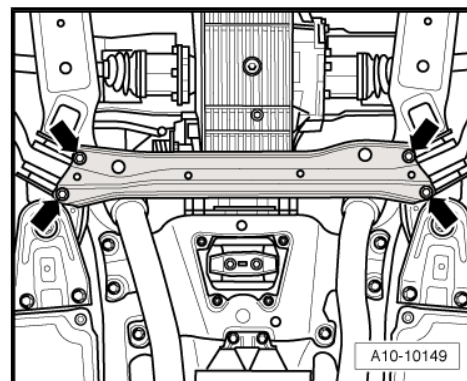
- Tie propshaft up to side of heat shield -arrow-.



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All vehicles:

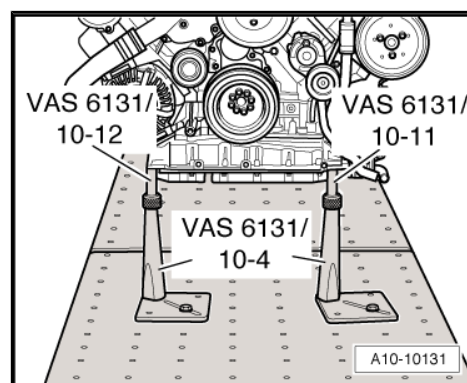
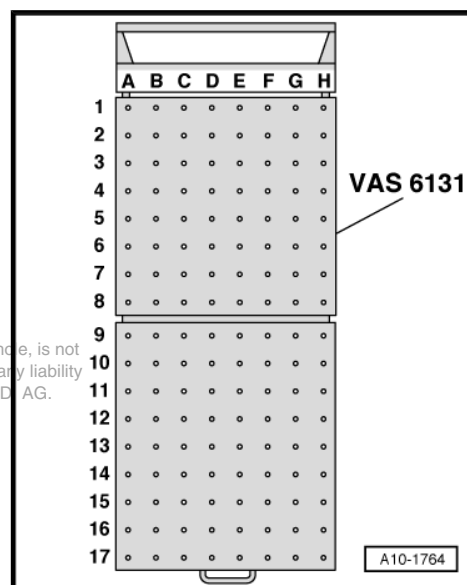
- Unbolt cross piece from subframe -arrows-.

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

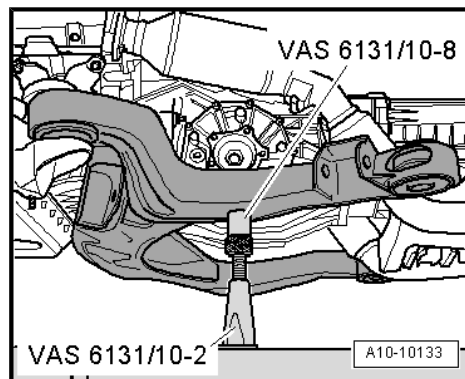
- Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- as follows:

Platform coordinates	Parts of support set for Audi -VAS 6131/10-			
B4	/10-1	/10-4	/10-5	/10-11
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

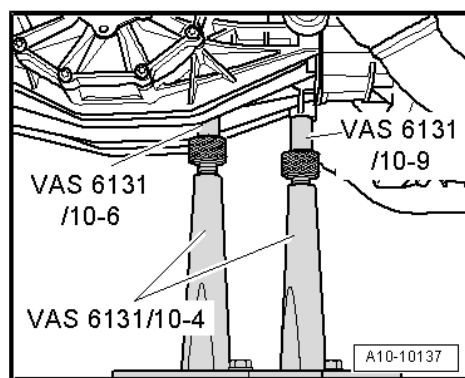
- Initially tighten the support elements on the assembly platform only hand-tight.
- Adjust the scissor-type assembly platform -VAS 6131 A- so that it is horizontal.
- Take note of spirit level (bubble gauge).
- Place scissor-type assembly platform -VAS 6131 A- under engine/gearbox assembly.
- Position support elements from -VAS 6131/10- at front of engine, as shown in illustration.



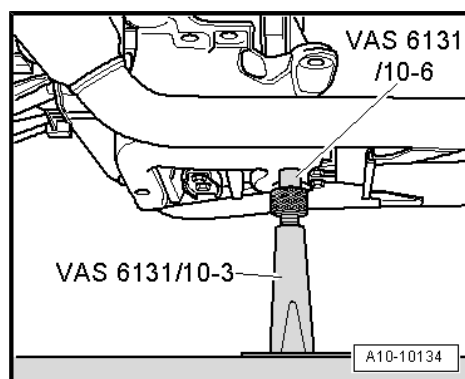
- Position support elements from -VAS 6131/10- at left and right of subframe, as shown in the illustration.



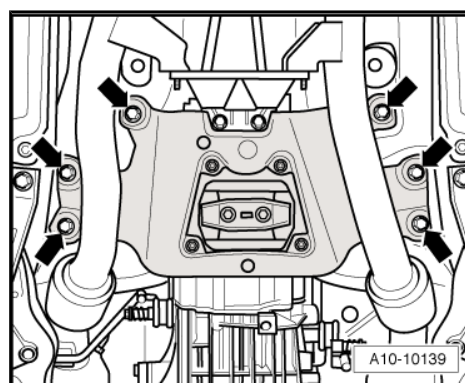
- Position support elements from -VAS 6131/10- at rear of gear-box, as shown in illustration.



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

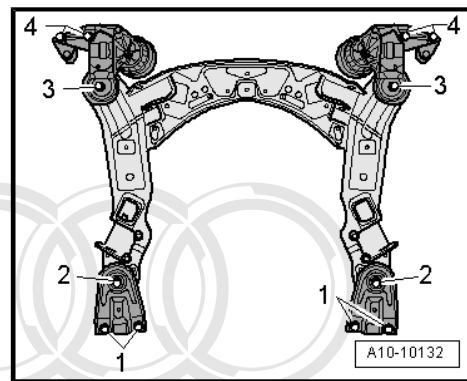


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- Remove bolts -1-.
- Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
- Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.

**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.
- Pull out scissor-type assembly platform -VAS 6131 A- from under the vehicle.



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1.2 Separating engine from manual gearbox

Special tools and workshop equipment required

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

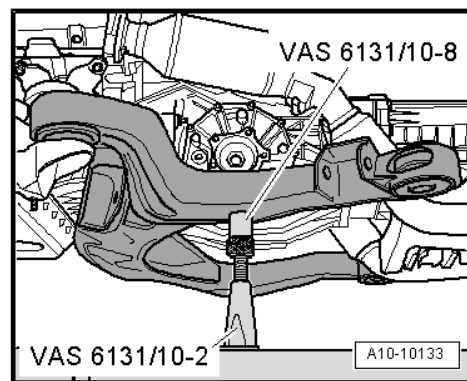
Procedure

- 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- .

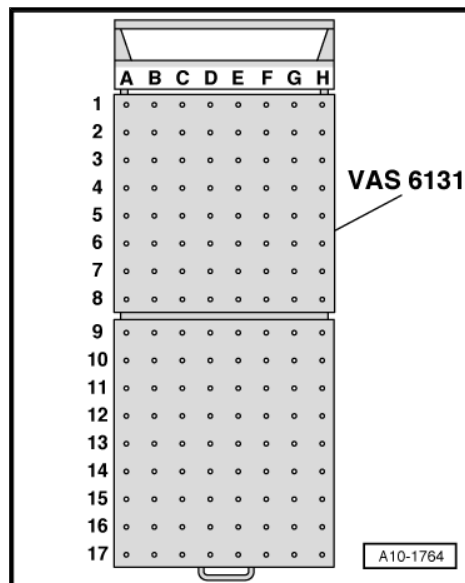
**Note**

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

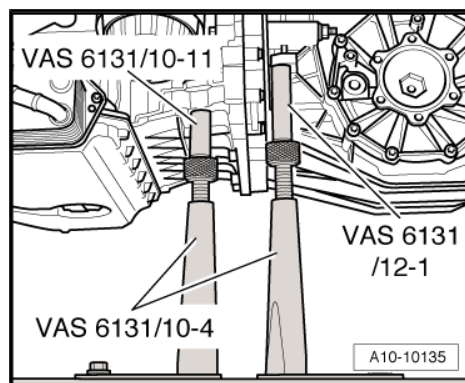
- Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- , -VAS 6131/11- and -VAS 6131/12- as follows:

Platform coordinates	Parts of support set for Audi -VAS 6131/10- , -VAS 6131/11- and -VAS 6131/12-			
B4 ¹⁾	/10-1	/10-4	/10-5	/10-11
F4 ¹⁾	/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 ¹⁾	/10-1	/10-4	/10-5	/10-6
F13 ¹⁾	/10-1	/10-4	/10-5	/10-9
D16 ¹⁾	/10-1	/10-3	/10-5	/10-6

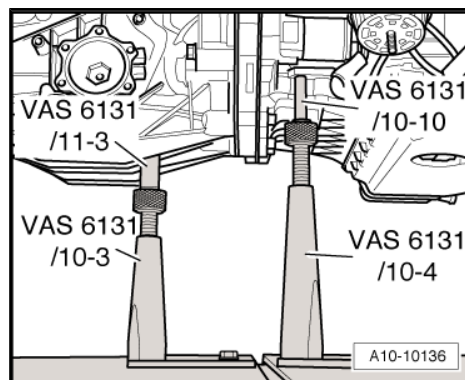
• ¹⁾ Support elements remain unchanged.



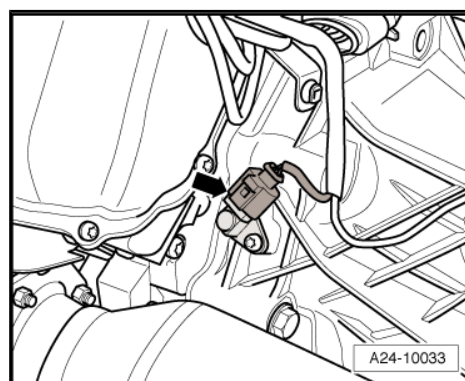
- Position support elements from -VAS 6131/10- and VAS 6131/12- on left side of engine/gearbox assembly, as shown in illustration.



- Position support elements from -VAS 6131/10- and -VAS 6131/11- on right side 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- .



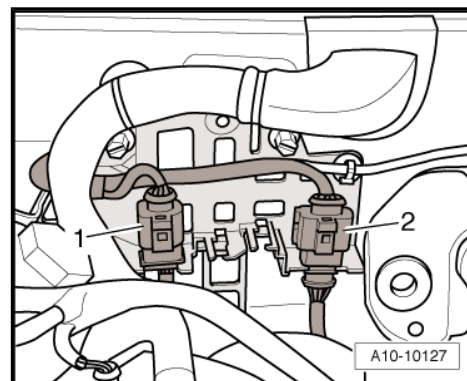
- Unplug electrical connector -arrow- at engine speed sender -G28- .



- 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-.*

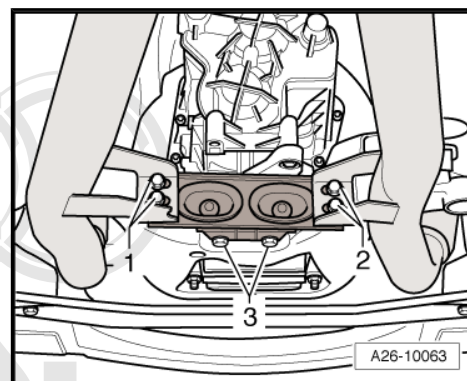
**Note**

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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

**Note**

Disregard items marked -2- and -3-.

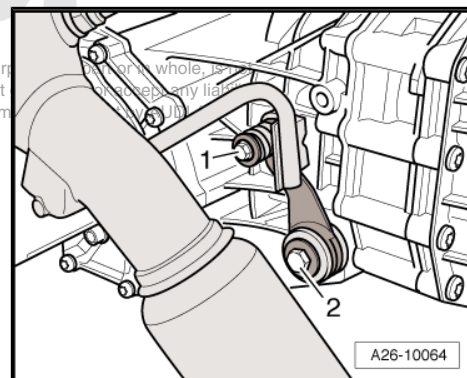


- Remove bolt -1- on bracket (left-side) for front exhaust pipe.

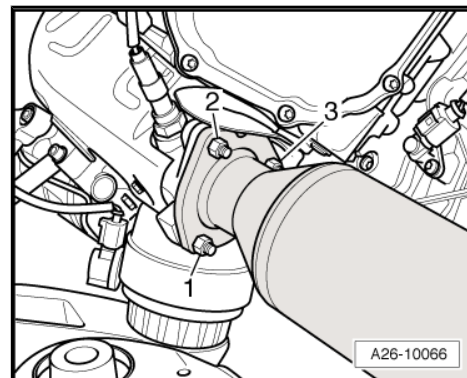
**Note**

Disregard -item 2-.

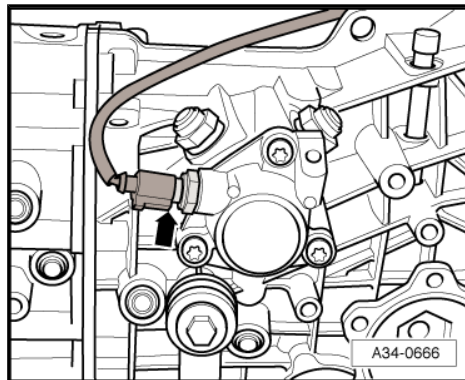
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- Remove nuts -1 ... 3-.
- Detach front exhaust pipe (left-side) with catalytic converter.



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

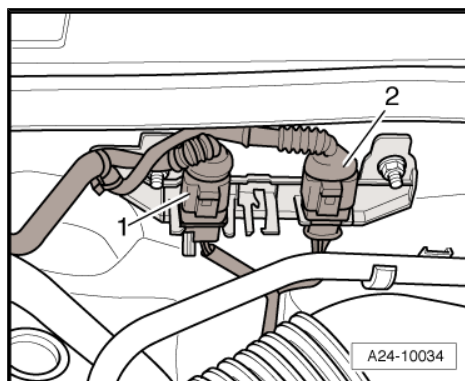


- Unplug electrical connector -2- for Lambda probe after catalytic converter -G130- and move wiring clear.


Note

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

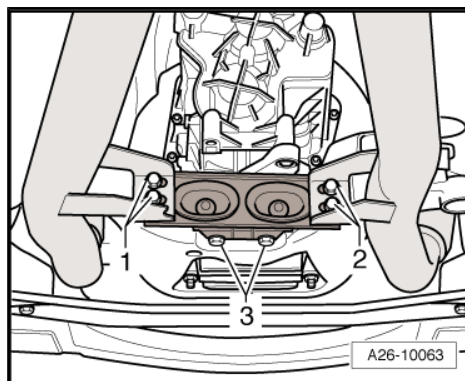

Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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


Note

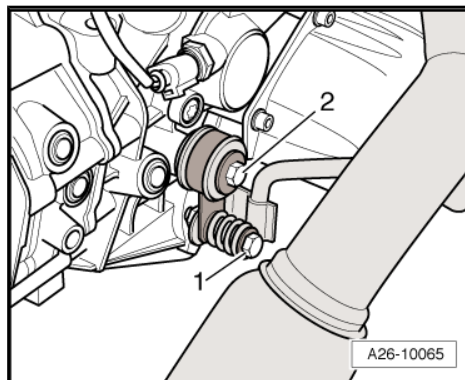
Disregard items marked -1- and -3-.



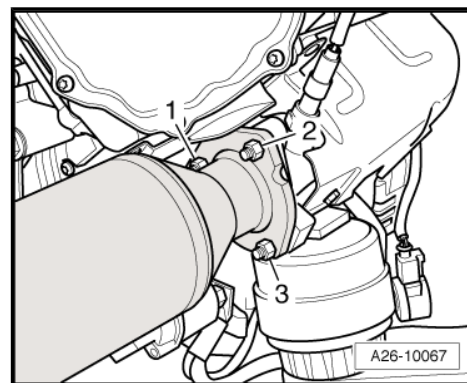
- Remove bolt -1- on bracket (right-side) for front exhaust pipe.


Note

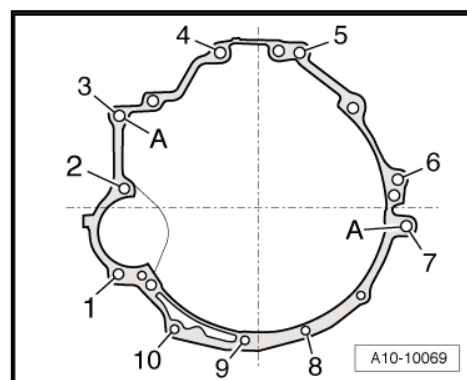
Disregard -item 2-.



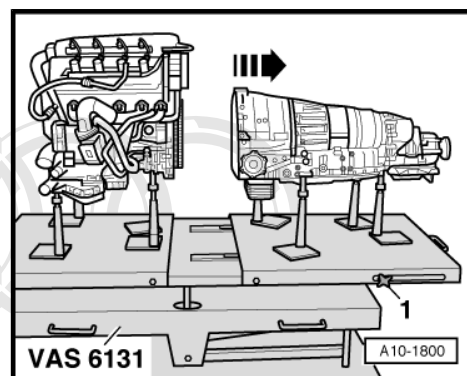
- Remove nuts -1 ... 3-.
- Detach front exhaust pipe (right-side) with catalytic converter.



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



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



1.3 Installing engine



Note

- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
- ◆ *Renew bolts which are tightened to a specified angle as well as seals, gaskets and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install engine supports with engine mountings ⇒ [page 95](#) .
- 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 .

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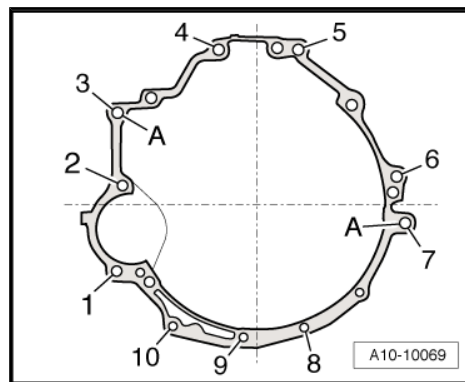
Note

- ◆ *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 -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 115](#) .
- Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
- Press intermediate plate between engine and gearbox onto dowel sleeves.
- Bolt gearbox to engine.



Note

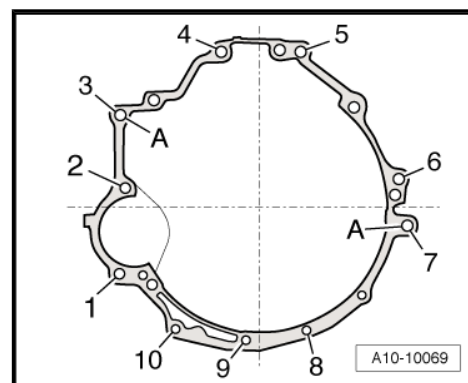
- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ *Tolerance for tightening torques $\pm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



Securing engine to gearbox

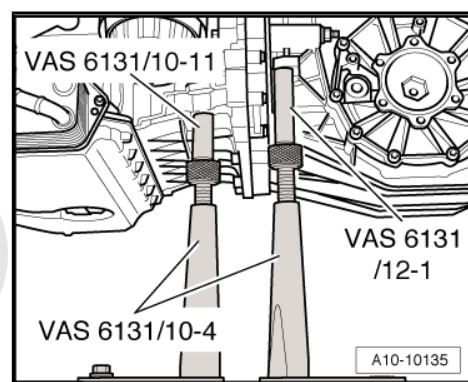
Item	Bolt	Nm
1	M12x130	65
2	M12x140	65
3, 4, 5	M12x105	65
6	M12x120	65
7	M10x150	65 ¹⁾
8, 9, 10	M10x70	45
A	Dowel sleeves for centralising	

• ¹⁾ Bolt strength rating 10.9

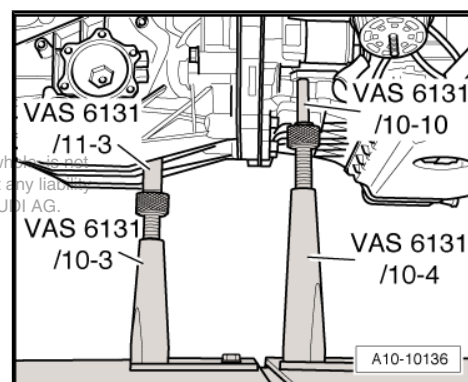


Perform further installation in reverse order, paying attention to the following:

- Install front exhaust pipes: left-side → [page 279](#) , right-side → [page 284](#) .
- Vehicles with four-wheel drive: The threaded holes in the flange shaft for the propshaft on the gearbox must be cleaned with a thread tap to remove remaining locking fluid before assembling.
- 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**

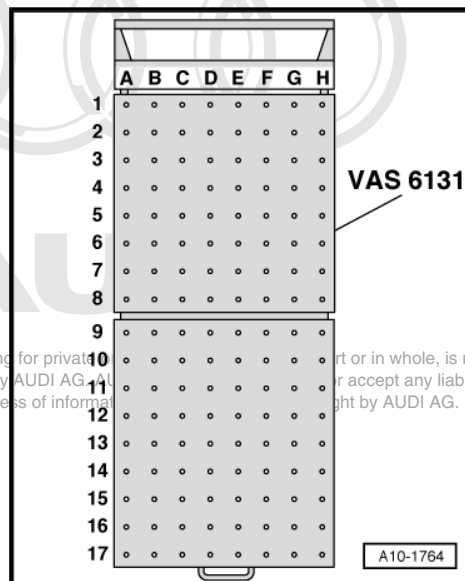
The mounting points for engine (front), gearbox (rear) and tunnel cross members remain unchanged.

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- 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 ¹⁾	/10-1	/10-4	/10-5	/10-11
F4 ¹⁾	/10-1	/10-4	/10-5	/10-12
B10	/10-1	/10-2	/10-5	/10-8 ²⁾
G10	/10-1	/10-2	/10-5	/10-8 ²⁾
C12 ¹⁾	/10-1	/10-4	/10-5	/10-6
F13 ¹⁾	/10-1	/10-4	/10-5	/10-9
D16 ¹⁾	/10-1	/10-3	/10-5	/10-6

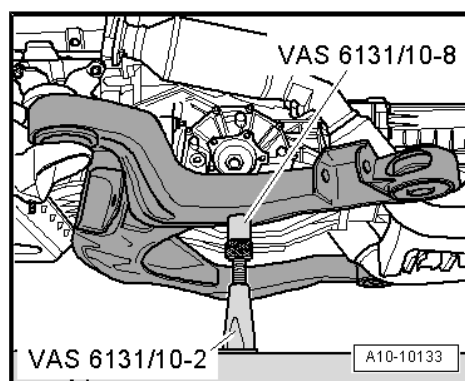
- ¹⁾ Support elements remain unchanged.
- ²⁾ Secure support elements only after installing the subframe.



Note

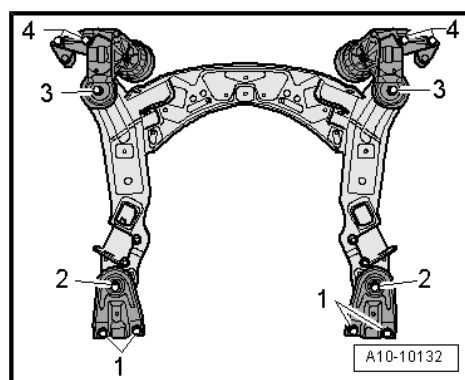
A second mechanic is required for positioning the subframe on the support elements.

- 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.
- Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts to final setting only after performing wheel alignment check ⇒ Rep. Gr. 40 .



WARNING

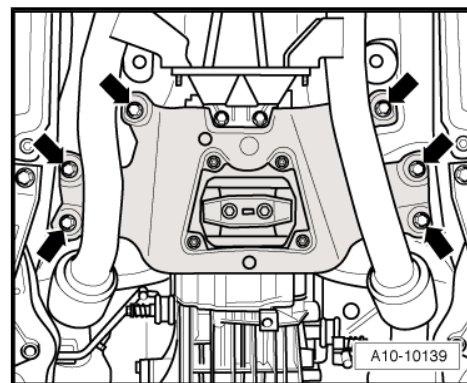
The vehicle must not be driven at this stage.



- Tighten bolts -arrows- for tunnel cross member ⇒ Rep. Gr. 34 .

Perform further installation in reverse order, paying attention to 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 .
- Vehicles with four-wheel drive: Install propshaft ⇒ Rear final drive 01R; Rep. Gr. 39 .
- Align exhaust system so it is free of stress ⇒ [page 293](#) .
- Secure hydraulic pressure line at power steering pump ⇒ Rep. Gr. 48 .
- Install air conditioner compressor ⇒ Rep. Gr. 87 .
- Install poly V-belt ⇒ [page 108](#) .
- Install torque reaction support ⇒ [page 102](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .



Caution

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

- Check oil level ⇒ Maintenance ; Booklet 405 .
- Bleed fuel system ⇒ Rep. Gr. 24 .
- Fill cooling system ⇒ [page 245](#) .



Note

- ◆ ***Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.***
- ◆ ***Contaminated or dirty coolant must not be used again.***
- Top up power steering fluid and bleed steering system ⇒ Rep. Gr. 48 .
- Install and adjust wiper arms ⇒ Rep. Gr. 92 .
- Adjust subframe and the two consoles for engine mountings ⇒ Rep. Gr. 40 .
- Perform wheel alignment check ⇒ Rep. Gr. 44 .

**WARNING**

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

Tightening torques**Note**

- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants 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:	
Fuel hose to fuel line	22
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5

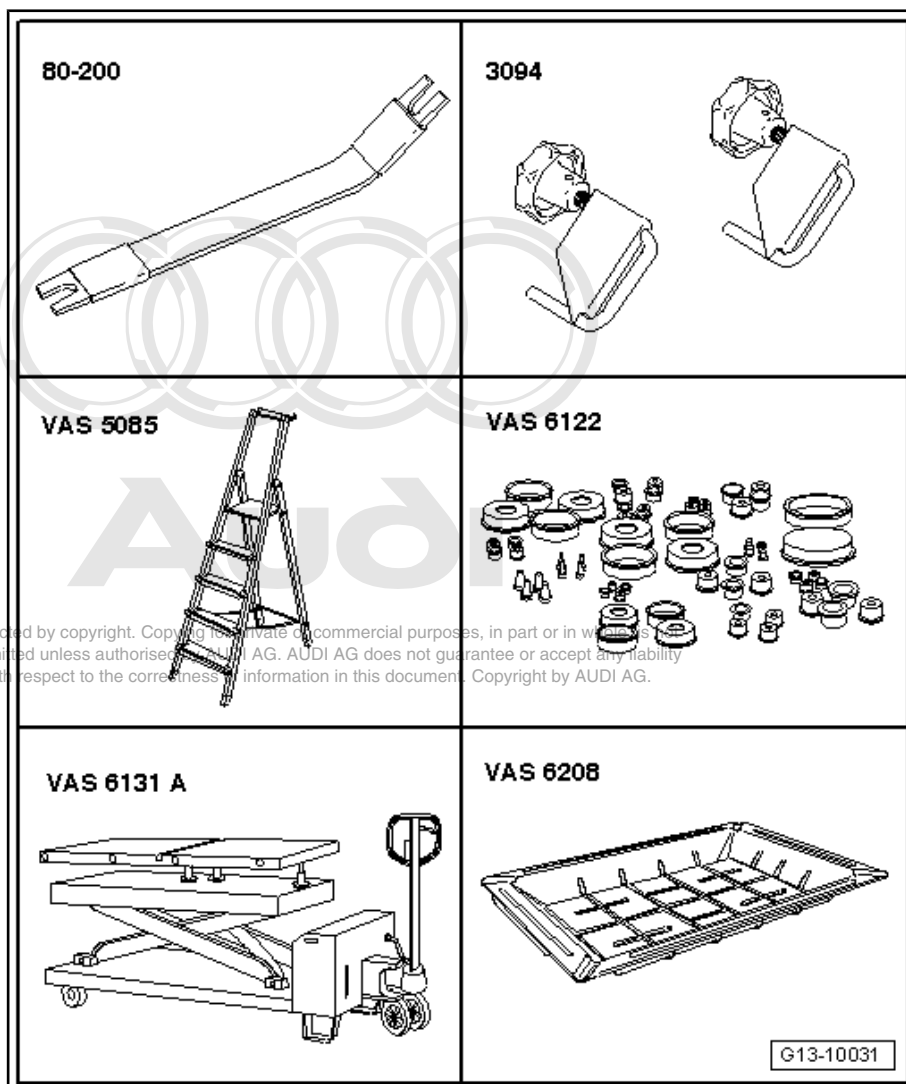
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2 Removing and installing engine - vehicles with multitronic gearbox

2.1 Removing engine

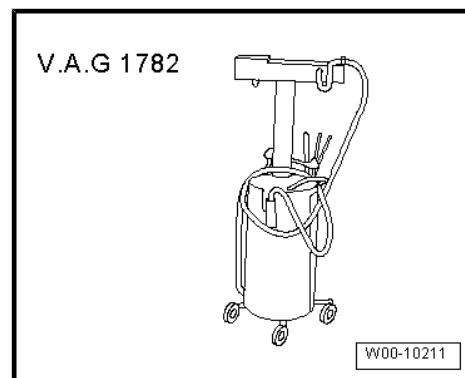
Special tools and workshop equipment required

- ◆ Removal lever -80 - 200-
- ◆ Hose clamps for hoses up to 25 mm -3094-
- ◆ Stepladder -VAS 5085-
- ◆ Engine bung set -VAS 6122-
- ◆ Scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10-
- ◆ Drip tray for workshop hoist -VAS 6208-

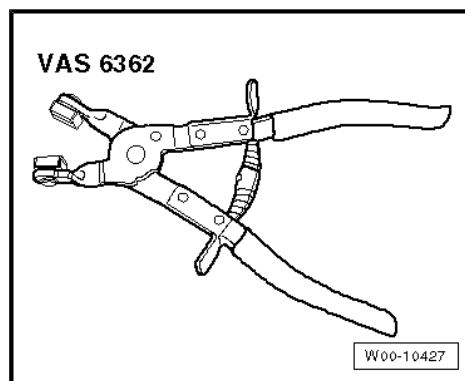


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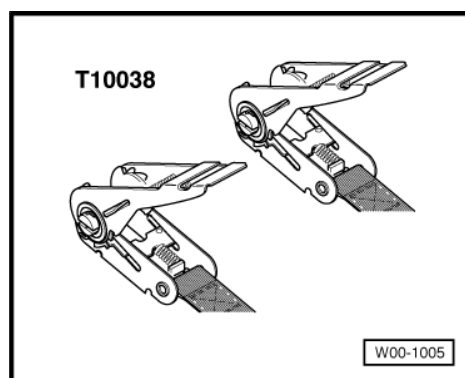
- ◆ Used oil collection and extraction unit -V.A.G 1782-



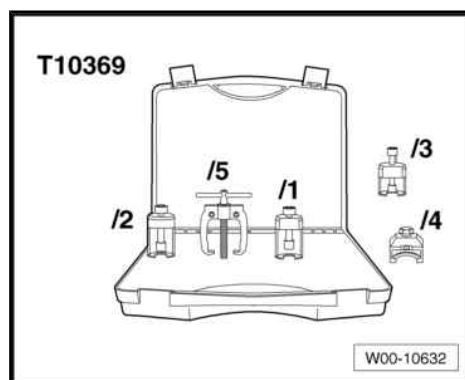
◆ Hose clip pliers -VAS 6362-



◆ Tensioning strap -T10038-



◆ Puller -T10369-



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Procedure



Note

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



WARNING

Before removing the engine secure the vehicle against tipping over. To do so, the luggage compartment must be empty.

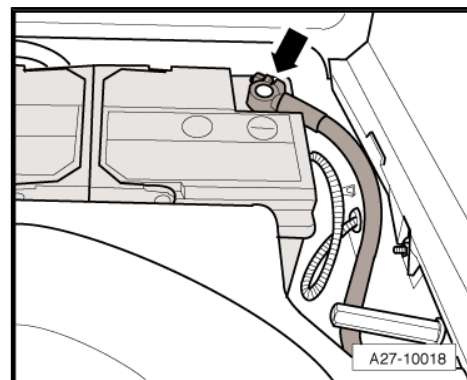
**Caution**

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

**Note**

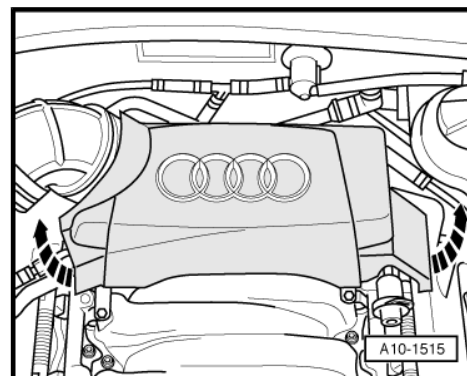
To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.

With ignition switched off, disconnect battery earth cable -arrow- → Rep. Gr. 27.



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

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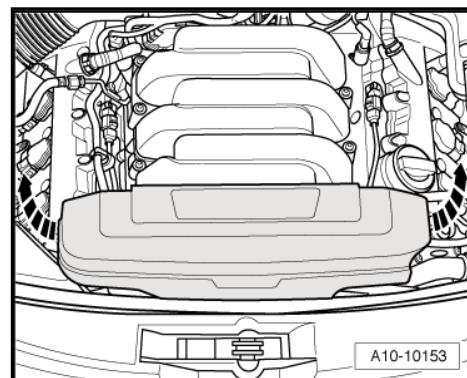


- Pull off engine cover panel (front) -arrows-.

**WARNING**

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

- Open filler cap on coolant expansion tank.

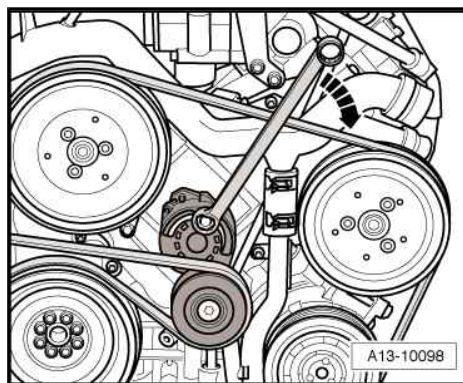




Note

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

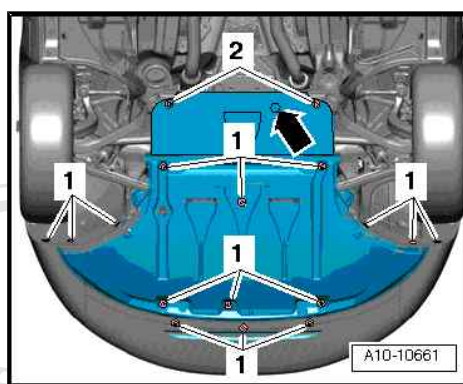
- To slacken poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt and release pressure from the tensioner.
- Remove both front wheels.



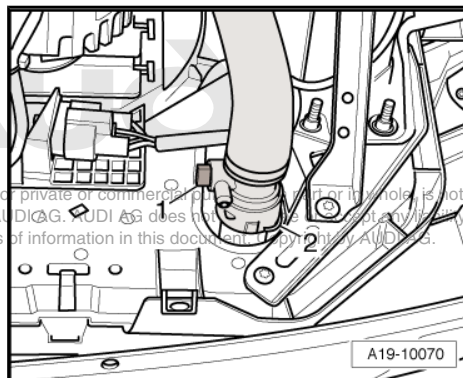
Note

Secure brake discs with wheel bolts.

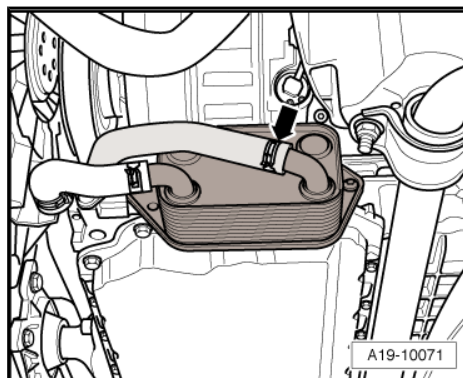
- Remove noise insulation panels ⇒ Rep. Gr. 50 .



- Place drip tray for workshop hoist -VAS 6208- under 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.
- Then remove coolant hose.



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

**WARNING**

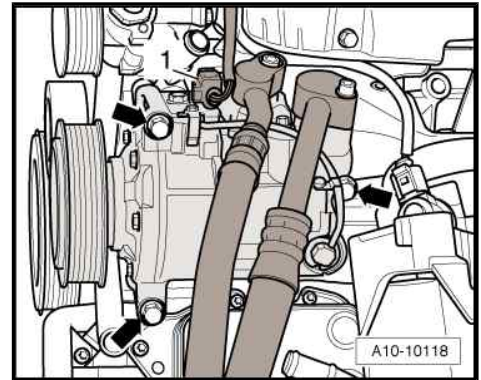
The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.

**Note**

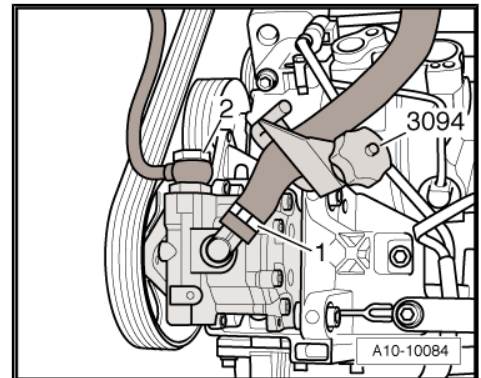
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.

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

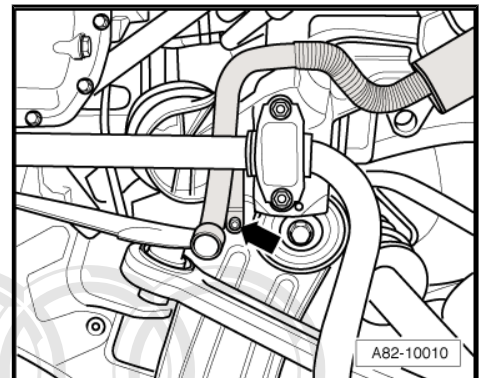
**Note**

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

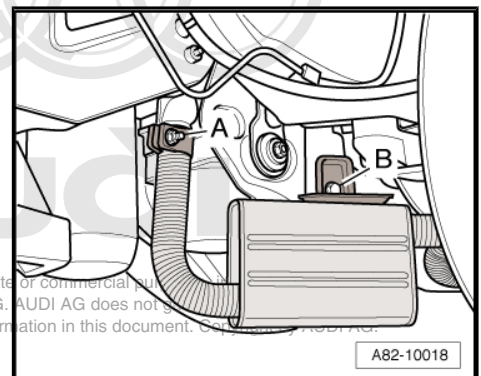
- Clamp off hydraulic hose -1- for power steering pump using a hose clamp -3094- .
- Disconnect hydraulic hose from power steering pump.
- Unbolt hydraulic pressure line -2- at power steering pump and lay onto longitudinal member above.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .

**Vehicles with auxiliary heater:**

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



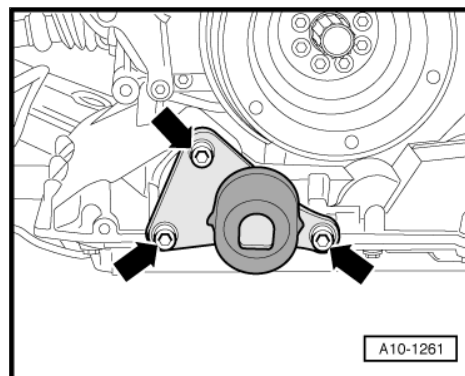
- Loosen nut -A- at clamp for corrugated exhaust pipe.
- Unscrew bolt -B- and remove silencer together with corrugated exhaust pipes.



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All vehicles:

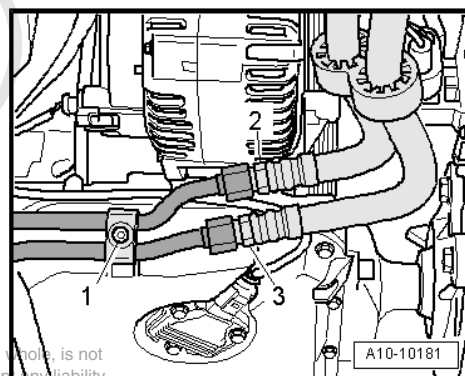
- Unscrew bolts -arrows- and remove torque reaction support from engine.



Note

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

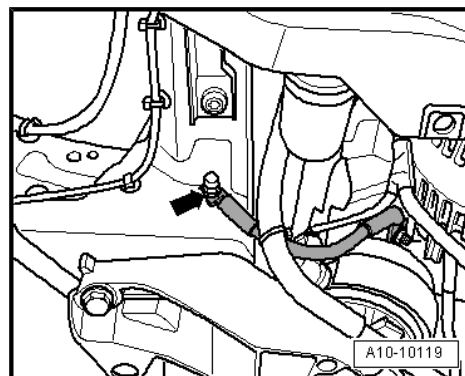
- Position used oil collection and extraction unit -V.A.G 1782- below connection point.
- Unscrew union nuts -2- and -3- and disconnect ATF pipes.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122-



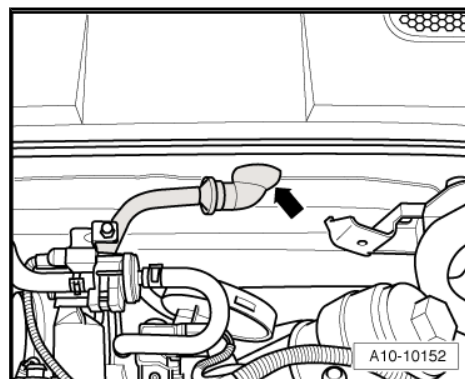
Note

Disregard -item 1-.

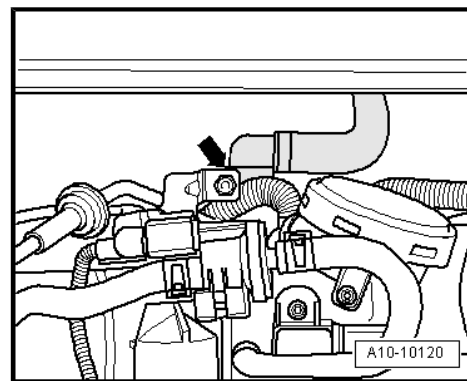
- Unbolt earth cable -arrow- at longitudinal member (right-side).



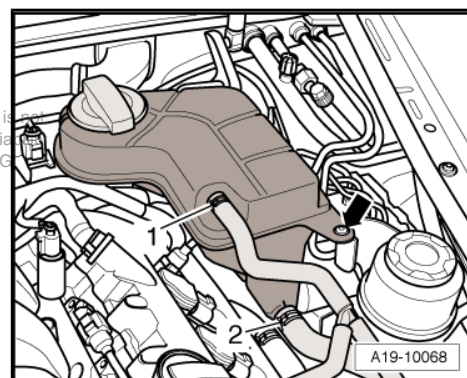
- Detach vacuum hose -arrow- going to brake servo at plenum chamber partition panel.



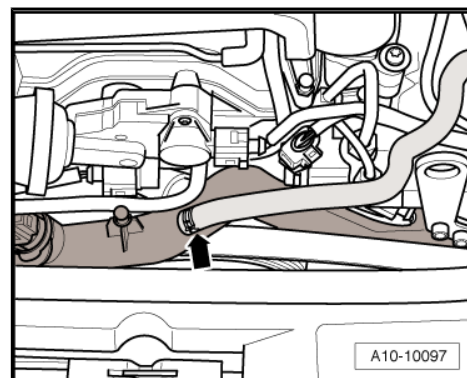
- Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.



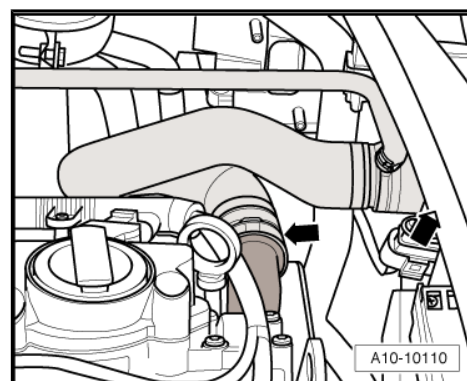
- Disconnect coolant hoses -1- and -2- at coolant expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).



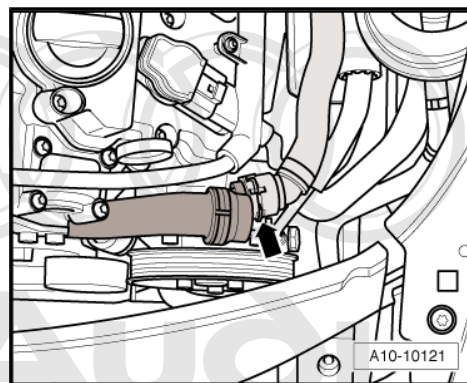
- Detach coolant hose -arrow- from coolant pipe (front).



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



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



USA models:

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

All vehicles:



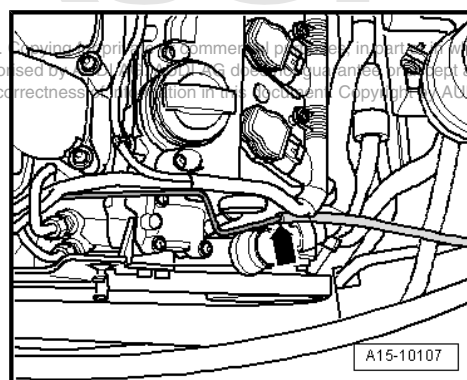
Caution

*Rules for cleanliness when working on the injection system
⇒ [page 5](#).*

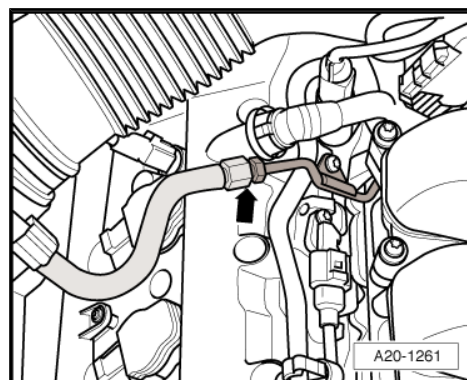


WARNING

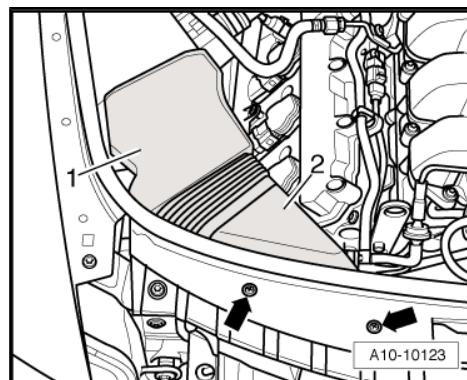
The fuel system is pressurised. Wrap a cloth around the connection before opening the system. Then release pressure by carefully loosening the connection.



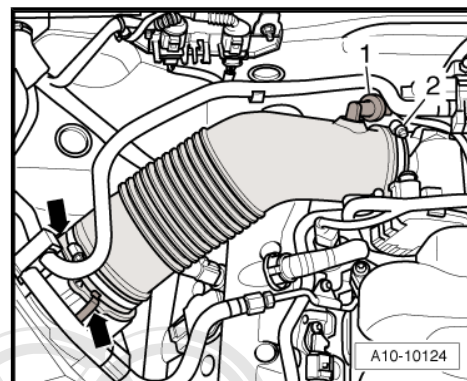
- Disconnect fuel line -arrow- and move clear.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



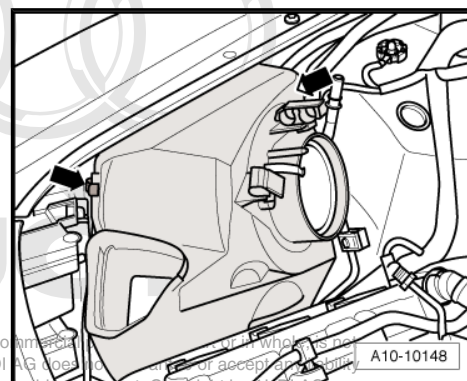
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



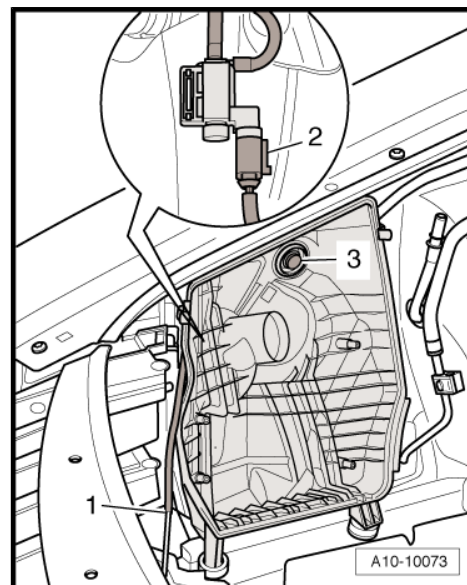
- Pull non-return valve -1- off air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



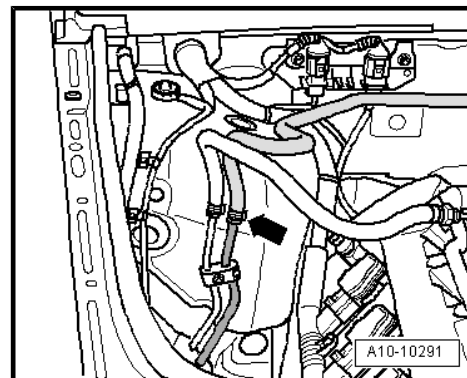
- Release clamps -arrows- and detach air cleaner (top section).



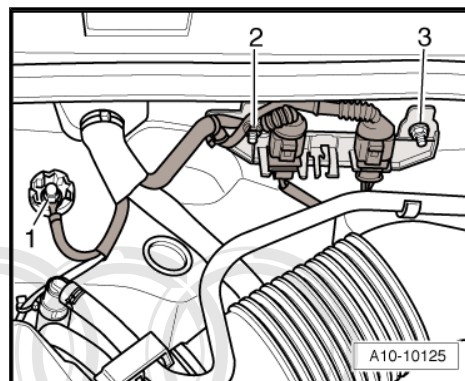
- Disconnect vacuum pipe -1-.
- Pull out pin of fastener -3-.
- Remove air cleaner (bottom section) and unplug electrical connector -2- on reverse side at variable intake manifold changeover valve -N335-.



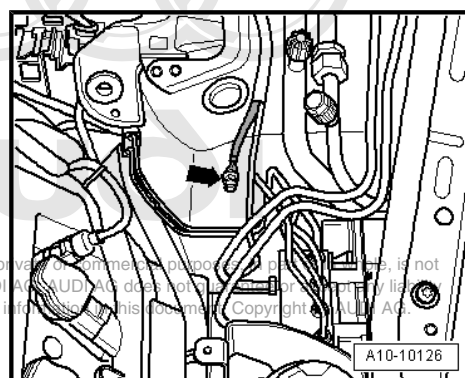
- Disconnect vacuum hose -arrow- leading to activated charcoal filter.



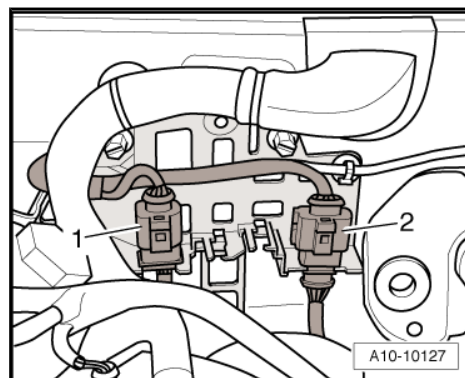
- Unscrew nuts -2- and -3- and remove bracket for connectors (right-side) from plenum chamber partition panel.
- Unbolt earth cable -1- at suspension turret (right-side).



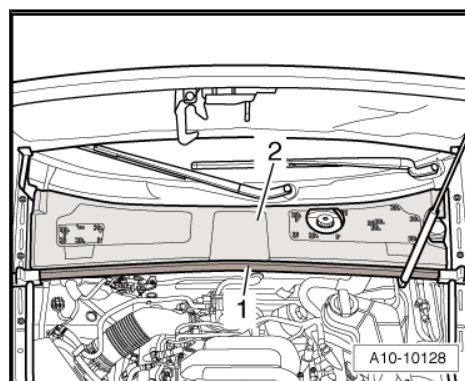
- Unbolt earth cable -arrow- at suspension turret (left-side).



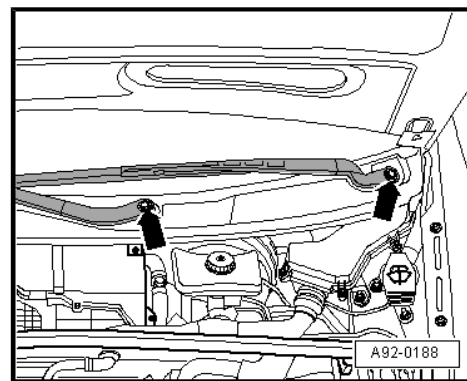
- Remove bracket (left-side) for connectors -1- and -2- from plenum chamber partition panel.



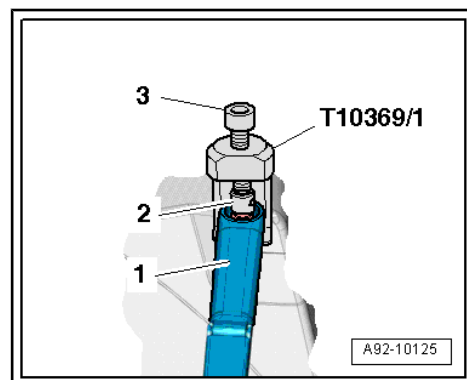
- Pull off rubber seal -1- and remove plenum chamber cover -2-.



- Use screwdriver to pry off caps on wiper arms and slacken off nuts -arrows- several turns.



- Apply puller -T10369/1- to wiper arm -1-, as shown in illustration.
- Apply thrust piece -2- onto wiper shaft.
- Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
- Remove nuts completely and take off wiper arms.

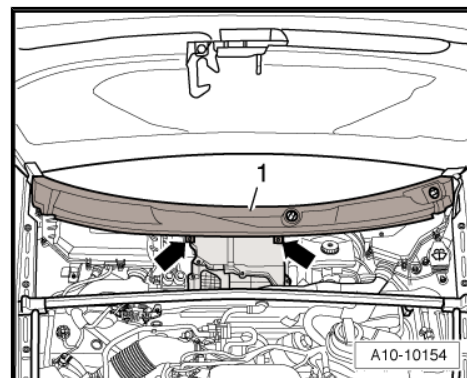


- Unscrew bolts -arrows- for cowl panel trim -1-.

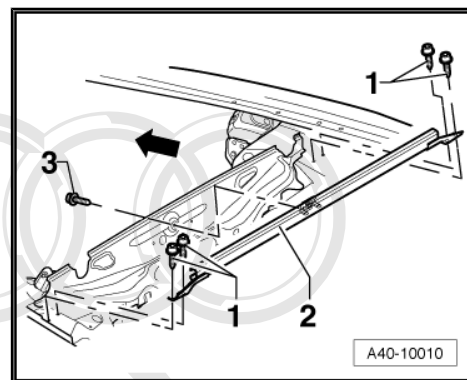


Caution

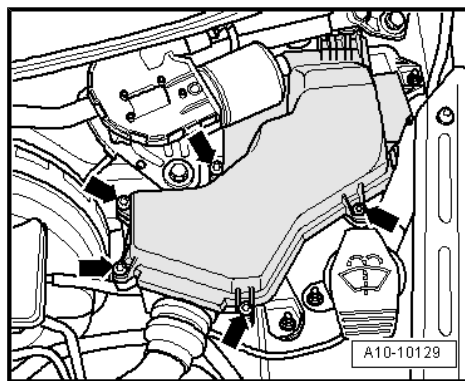
To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.



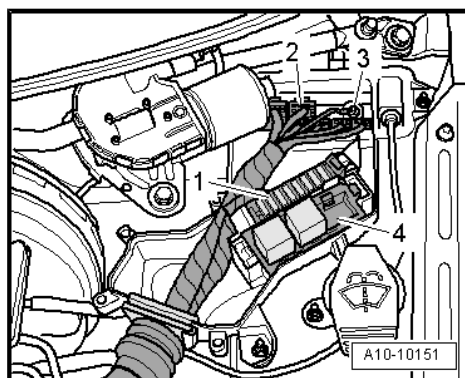
- Pull cowl panel trim off windscreen.
- If fitted, remove bolts -1- and -3- and detach body brace -2-.



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

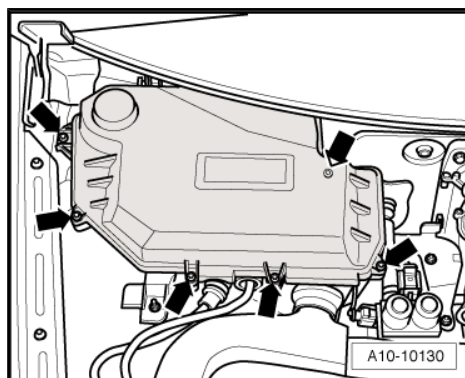


- Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
- Unscrew electrical wiring -3-.
- Unplug all connectors -2- at rear of connector console.
- Disengage engine wiring harness at electronics box and move it clear.

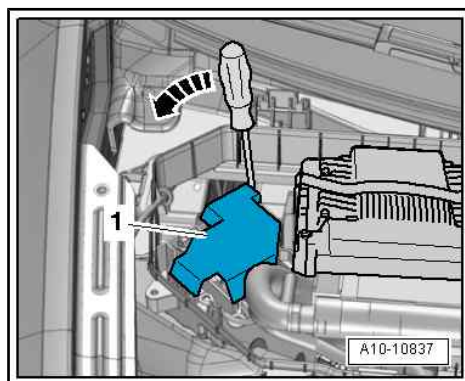


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- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).



- If fitted, open cover -1- with screwdriver -arrow- and detach.



**WARNING**

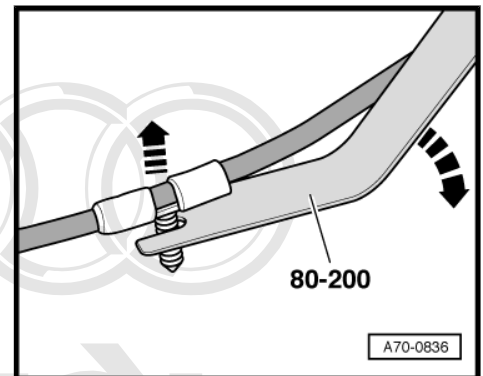
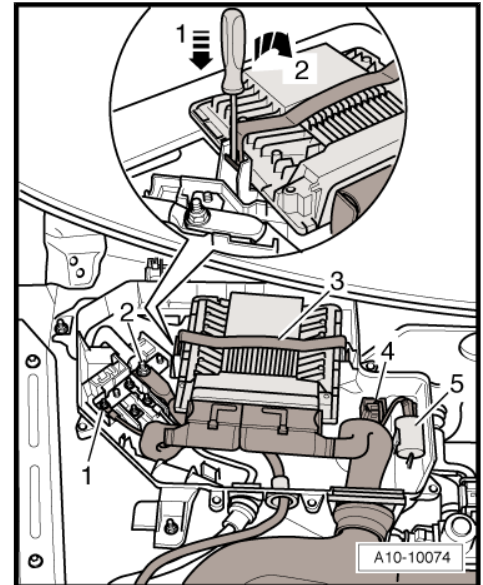
The pump valve unit for heating system (left in front of electronics box) gets very hot – risk of burns!

- 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.

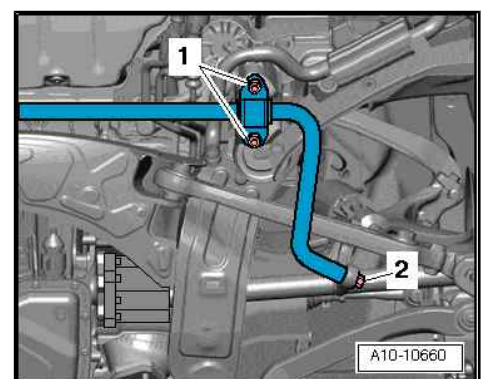
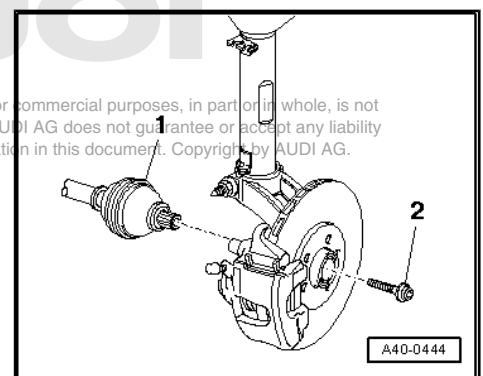


- Have a 2nd mechanic press the brake pedal.

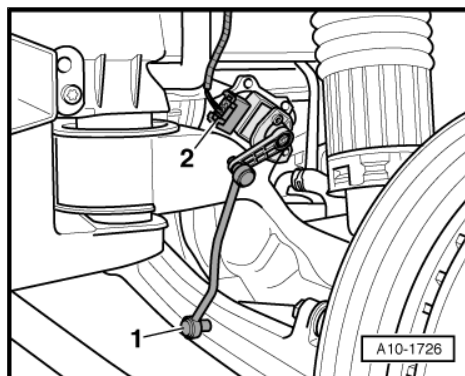
**Caution**

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

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

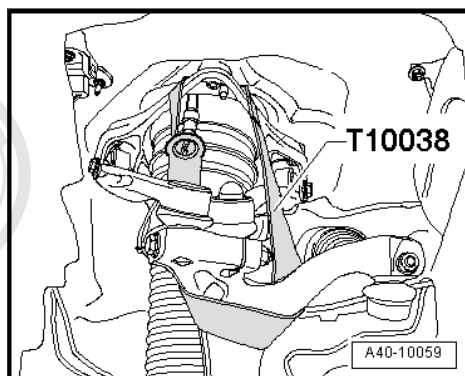


Caution

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

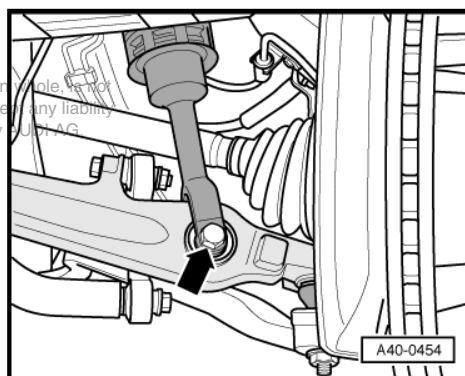
- ◆ *Support wheel bearing housing.*

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

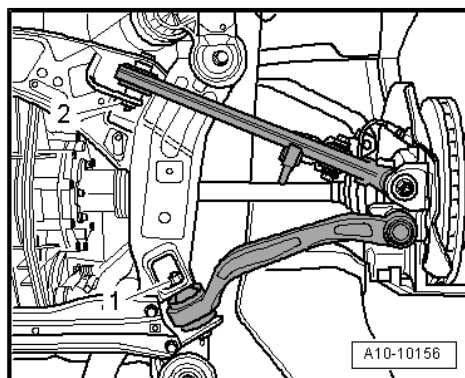


- Unbolt suspension strut from track control link -arrow-.

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



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

**Caution**

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

- Repeat procedure on other side of vehicle.

- Unbolt heat shield for drive shaft -arrows-.

- Unbolt drive shaft from flange shaft on gearbox.

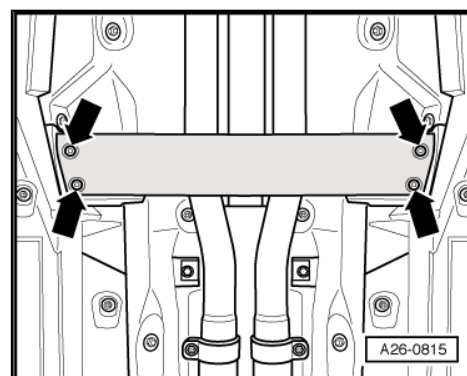
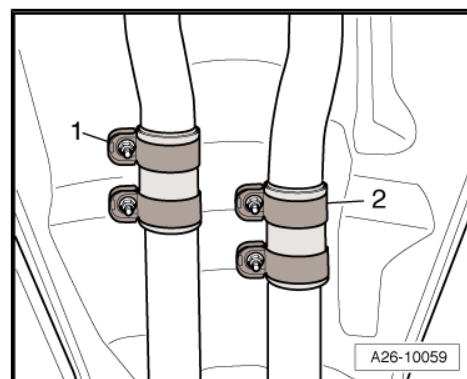
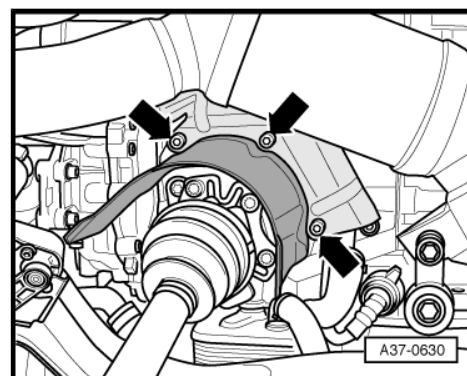
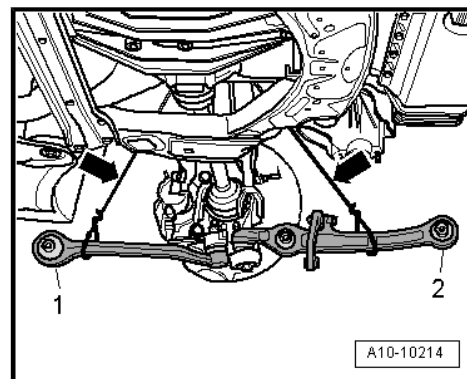
**Caution**

Take care not to damage brake hose.

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

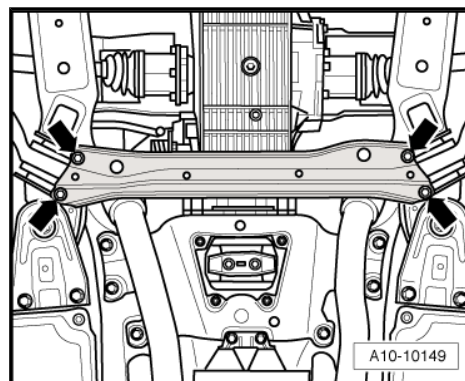
- Loosen clamps -1- and -2-.

- Unbolt cross piece (front) -arrows-.



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- Unbolt cross piece from subframe -arrows-.

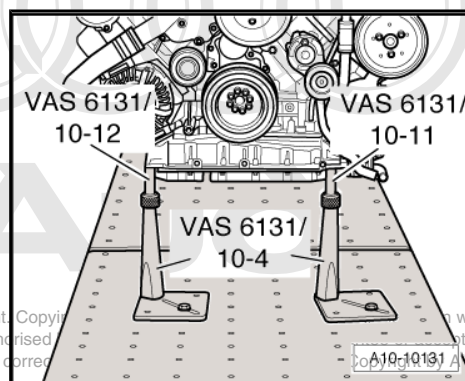
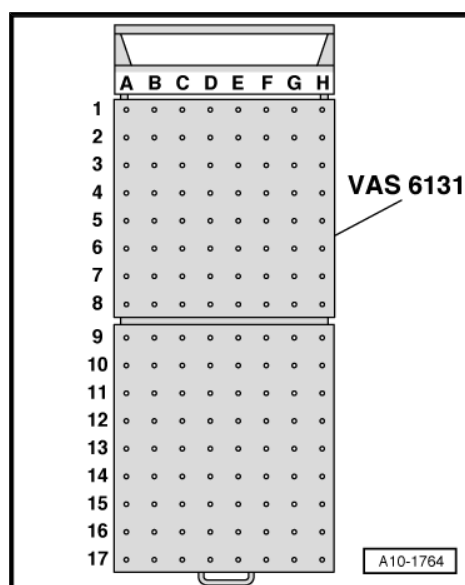


Set up the scissor-type assembly platform as follows:

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

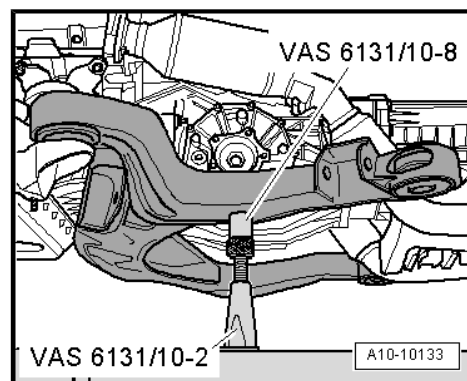
Platform coordinates	Parts of support set for Audi -VAS 6131/10-			
B4	/10-1	/10-4	/10-5	/10-11
G4	/10-1	/10-4	/10-5	/10-12
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
E13	/10-1	/10-3	/10-5	/10-6
D16	/10-1	/10-3	/10-5	/10-6

- Initially tighten the support elements on the assembly platform only hand-tight.
- Adjust the scissor-type assembly platform -VAS 6131 A- so that it is horizontal.
- Take note of spirit level (bubble gauge).
- Place scissor-type assembly platform -VAS 6131 A- under engine/gearbox assembly.
- Position support elements from -VAS 6131/10- at front of engine, as shown in illustration.
- Make sure that threaded spindles are screwed in completely.

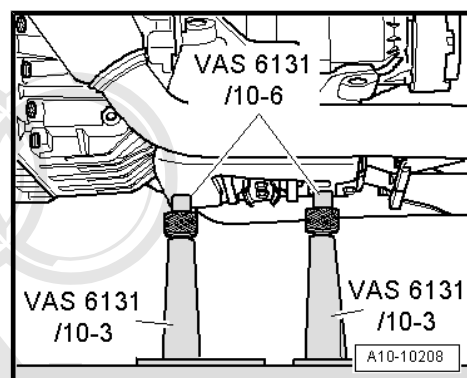


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- Position support elements from -VAS 6131/10- at left and right of subframe, as shown in the illustration.

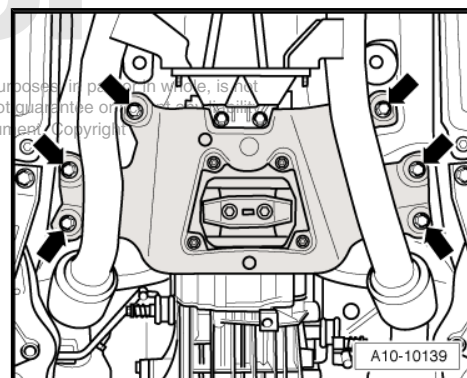


- Position support elements from -VAS 6131/10- at rear of tunnel cross member, as shown in the illustration.
- Turn all spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly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



- Remove bolts -arrows- at tunnel cross member.

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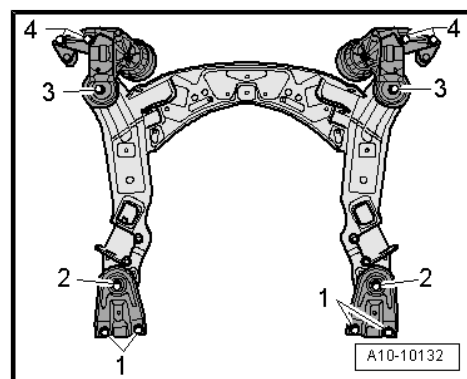


- Remove bolts -1-.
- Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
- Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.



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).



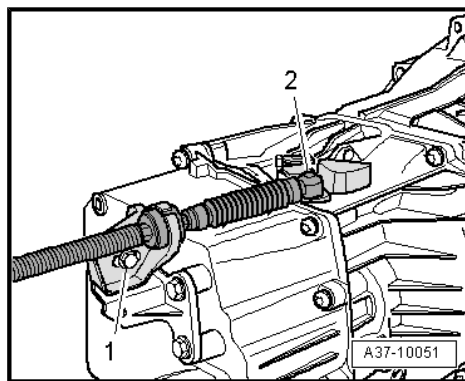
- Mark installation position of support bracket for selector lever cable.
- Unscrew bolt -1- for support bracket for selector lever cable.
- Push ball socket -2- of selector lever cable off gearbox selector lever.



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.



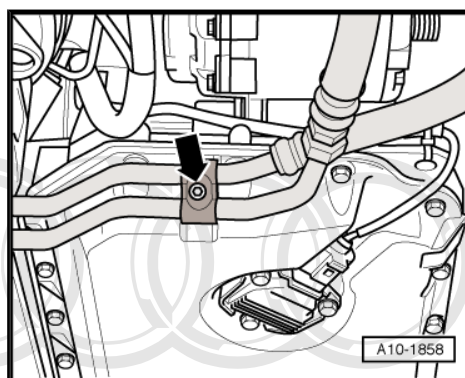
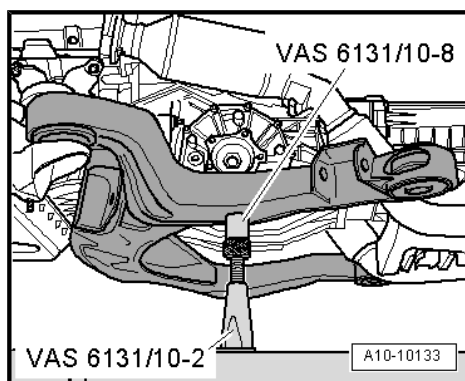
2.2 Detaching multitronic gearbox from engine

Special tools and workshop equipment required

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

Procedure

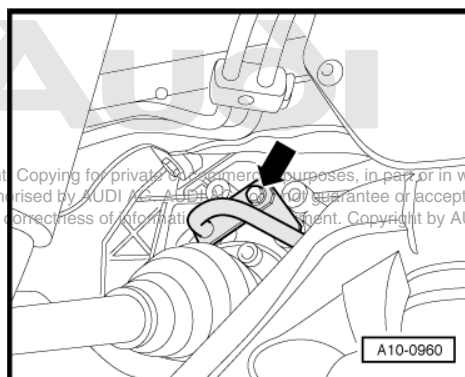
- Engine/gearbox assembly removed and secured to scissor-type assembly platform -VAS 6131 A- .
- Screw down spindles of the support elements (left and right) at subframe as far as possible.
- Remove locating lugs from spindles.
- Remove subframe to the side.
- Unscrew the two base plates for support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



Note

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

- Unscrew bolt -arrow- and detach ATF pipes from gearbox.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



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**Note**

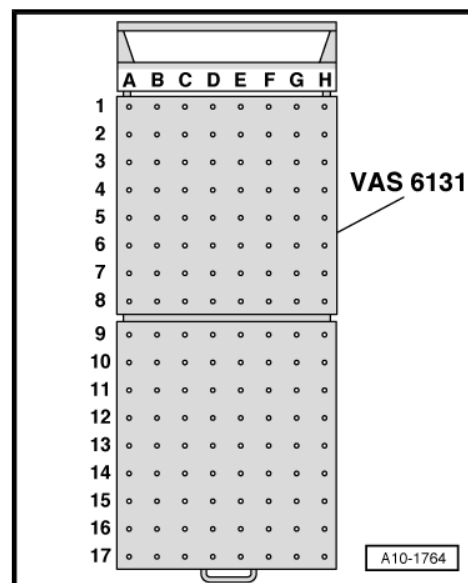
The mounting points for engine (front) and tunnel cross member remain unchanged.

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

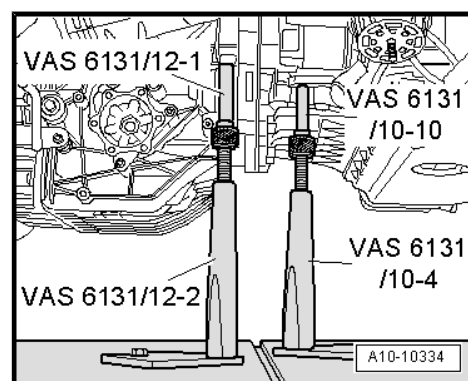
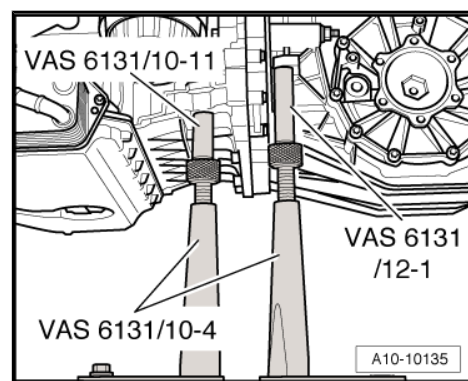
Platform coordinates	Parts of support set -VAS 6131/10- and -VAS 6131/12-			
B4 ¹⁾	/10-1	/10-4	/10-5	/10-11
G4 ¹⁾	/10-1	/10-4	/10-5	/10-12
B7	/10-1	/10-4	/10-5	/10-11
G7	/10-1	/10-4	/10-5	/10-10
C10	/10-1	/10-4	/10-5	/12-1
G10	/10-1	/12-2	/10-5	/12-1
E13 ¹⁾	/10-1	/10-3	/10-5	/10-6
D16 ¹⁾	/10-1	/10-3	/10-5	/10-6

• ¹⁾ Support elements remain unchanged.

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

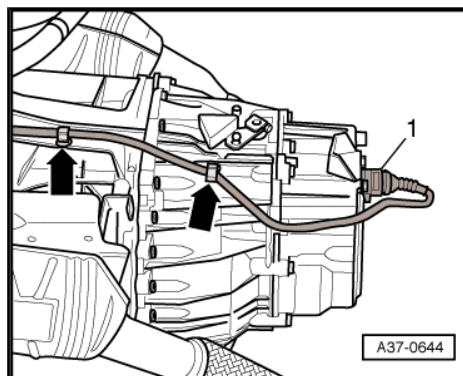


- Position support elements from -VAS 6131/10- and -VAS 6131/12- on right side of engine/gearbox assembly, as shown in illustration.
- Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type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

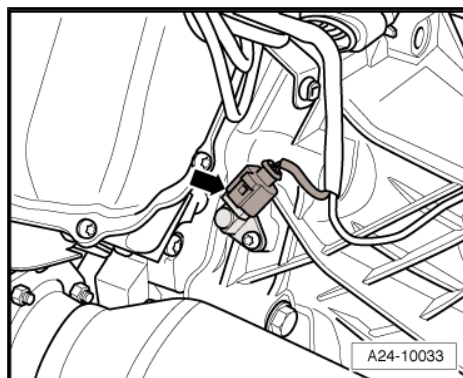


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- Release electrical connector -1- and detach from gearbox.
- Move wiring harness going to engine clear -arrows-.



- Unplug electrical connector -arrow- leading to engine speed sender -G28-.

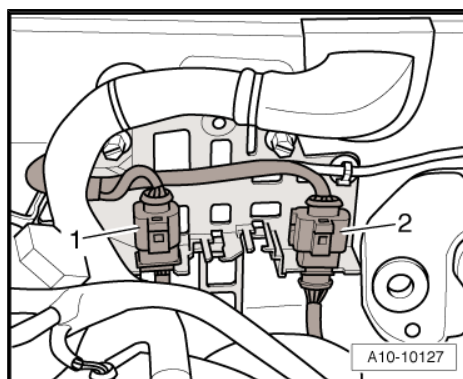


- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter -G131- and move wiring clear.



Note

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



Note

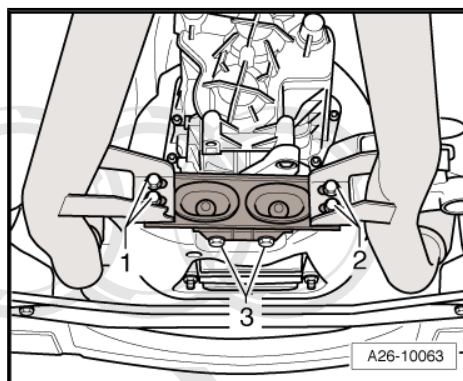
To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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



Note

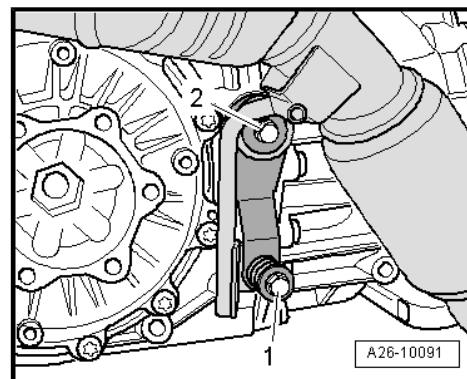
Disregard items marked -2- and -3-.



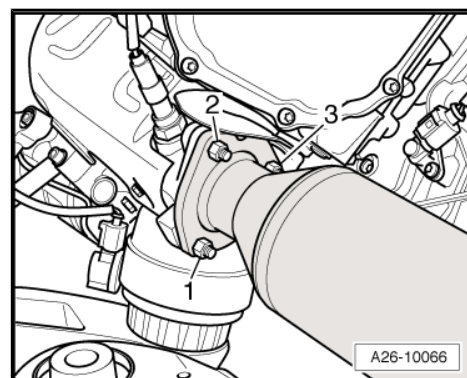
- Remove bolt -1- on bracket (left-side) for front exhaust pipe.

**Note**

Disregard -item 2-.



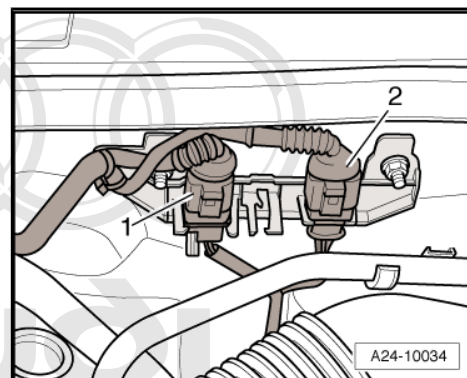
- Remove nuts -1 ... 3-.
- Detach front exhaust pipe (left-side) with catalytic converter.



- 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-.*

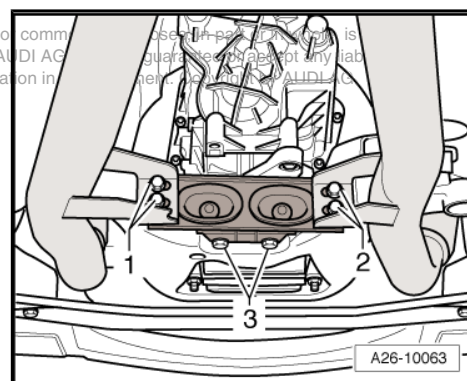
**Note**

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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

**Note**

Disregard items marked -1- and -3-.



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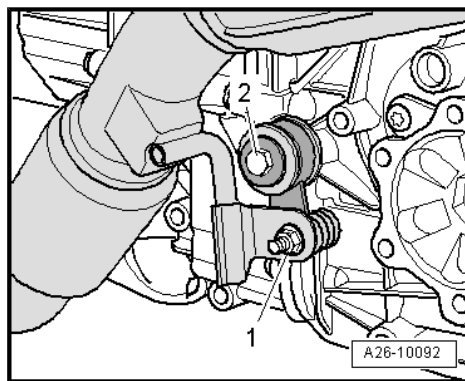
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- Remove bolt -1- on bracket (right-side) for front exhaust pipe.

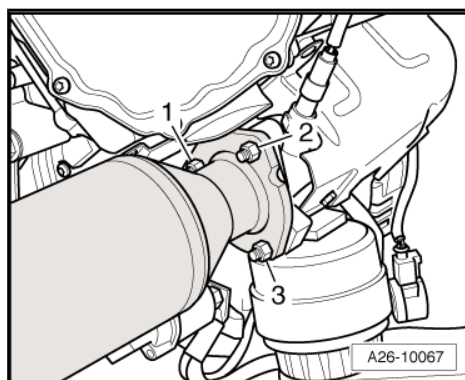


Note

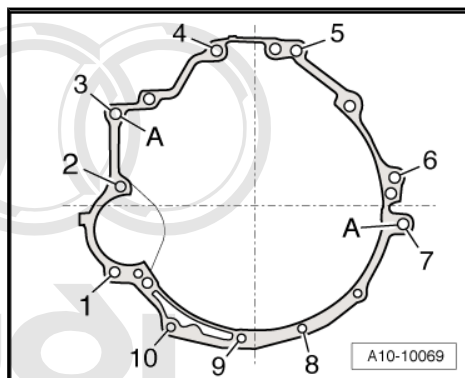
Disregard -item 2-.



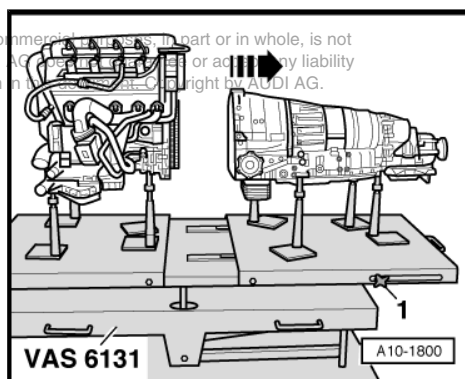
- Remove nuts -1 ... 3-.
- Detach front exhaust pipe (right-side) with catalytic converter.



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



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



2.3 Installing engine



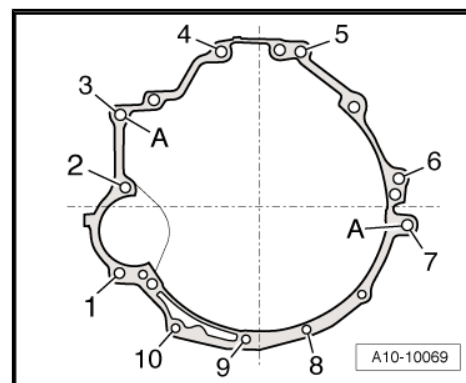
Note

- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
 - ◆ *Renew bolts which are tightened to a specified angle as well as seals, gaskets and O-rings.*
 - ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
 - ◆ *Fit all cable ties in the original positions when installing.*
 - ◆ *Clean input shaft splines and splines of damper unit on fly-wheel; remove corrosion and apply only a very thin coating of grease -G 000 100- to the splines. Remove any excess grease.*
- Install engine supports with engine mountings ⇒ [page 95](#) .
 - Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
 - Bolt gearbox to engine (use new bolts).



Note

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



Securing engine to gearbox

Item	Bolt ¹	Nm
1, 7	M10x100	65 ²⁾
2	M12x120	65
3, 5	M12x100	65
4, 6	M12x95	65
8, 9, 10	M10x70	45
A	Dowel sleeves for centralising	

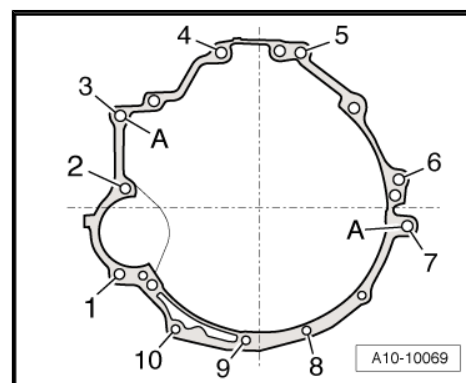
- ¹⁾ Renew bolts for securing engine/gearbox.

- ²⁾ Bolt strength rating 10.9

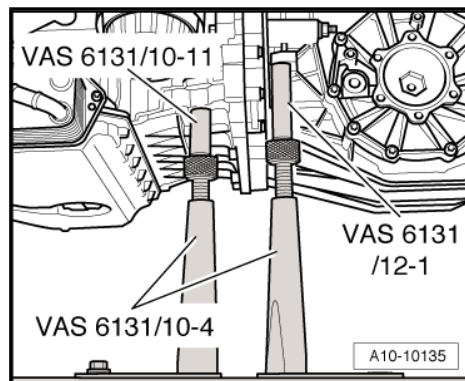
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Perform further installation in reverse order, paying attention to the following:

- Install front exhaust pipes together with catalytic converter: left-side ⇒ [page 279](#) , right-side ⇒ [page 284](#) .
- Secure ATF lines ⇒ Rep. Gr. 37 .



- 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- .

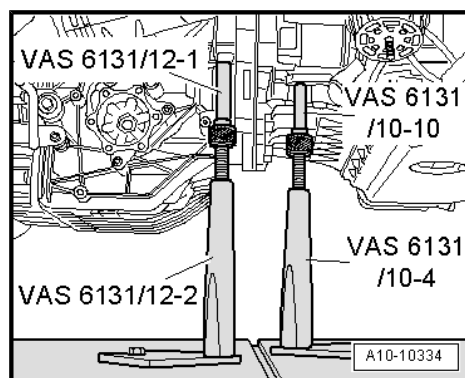


- Screw down spindles of support elements on right side of engine/gearbox assembly.
- Unscrew both base plates for support elements (right-side) at scissor-type assembly platform -VAS 6131 A- .



Note

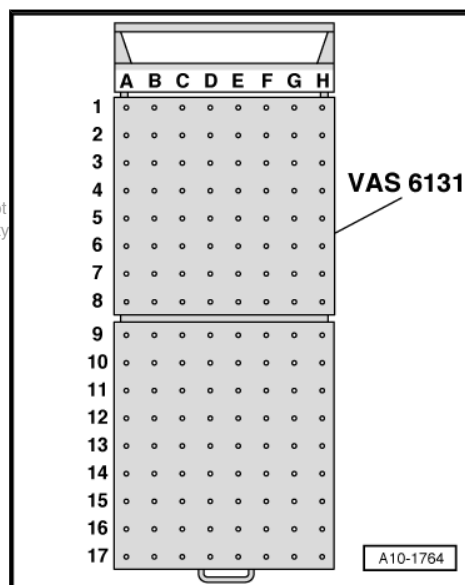
The mounting points for engine (front) and tunnel cross member remain unchanged.



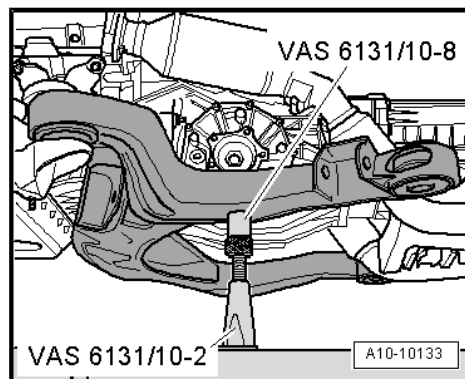
- Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- as follows:

Platform coordinates	Parts of support set for Audi -VAS 6131/10-			
B4 ¹⁾	/10-1	/10-4	/10-5	/10-11
G4 ¹⁾	/10-1	/10-4	/10-5	/10-12
B10	/10-1	/10-2	/10-5	/10-8 ²⁾
G10	/10-1	/10-2	/10-5	/10-8 ²⁾
E13 ¹⁾	/10-1	/10-3	/10-5	/10-6
D16 ¹⁾	/10-1	/10-3	/10-5	/10-6

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



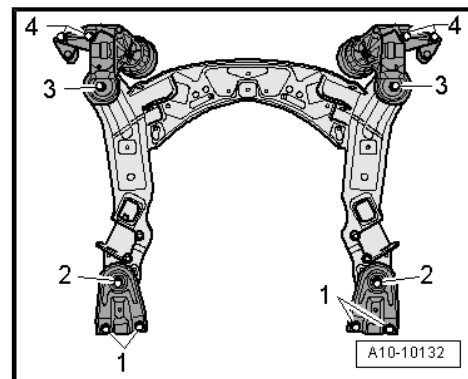
- Fit subframe onto the two support elements -VAS 6131/10-8- .
- Screw up the spindles for support elements on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A- .
- Carefully guide engine/gearbox assembly together with subframe into the body 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.
- Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts only after performing wheel alignment check ⇒ Rep. Gr. 40 .

**WARNING**

The vehicle must not be driven at this stage.

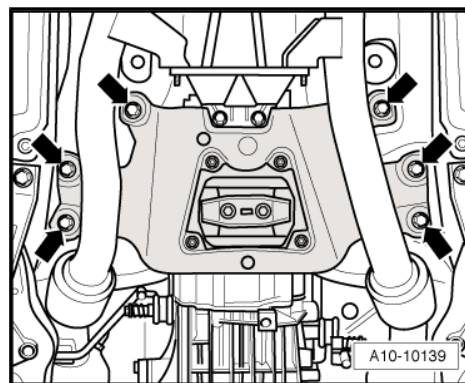


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- Tighten bolts -arrows- at tunnel cross member ⇒ Rep. Gr. 37 .

Perform further installation in reverse order, paying attention to 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 .
- Align exhaust system so it is free of stress ⇒ [page 293](#) .
- Install cross piece (front) ⇒ Rep. Gr. 50 .
- Install cross piece (front) for subframe ⇒ Rep. Gr. 40 .
- Secure hydraulic pressure line at power steering pump ⇒ Rep. Gr. 48 .
- Install air conditioner compressor ⇒ Rep. Gr. 87 .
- Install poly V-belt ⇒ [page 108](#) .
- Install torque reaction support ⇒ [page 102](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .



Caution

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

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- Install and adjust wiper arms ⇒ Rep. Gr. 92 .
- Check oil level ⇒ Maintenance ; Booklet 405 .
- Bleed fuel system ⇒ Rep. Gr. 24 .
- Fill cooling system ⇒ [page 245](#) .



Note

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

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

Tightening torques



Note

- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants 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:		
Fuel hose to fuel line		22
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5



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

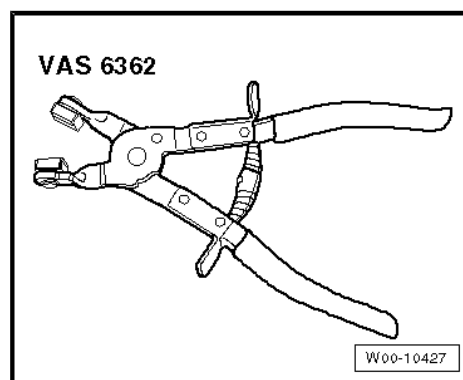
3.1 Removing engine

Special tools and workshop equipment required

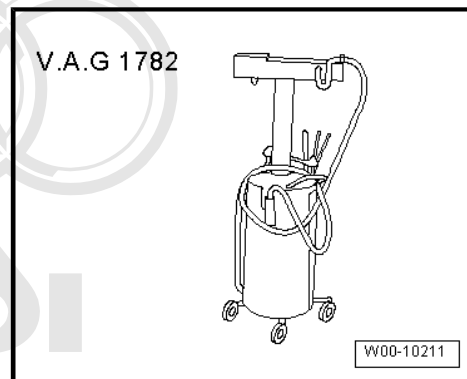
- ◆ Removal lever -80 - 200-
- ◆ Hose clamps for hoses up to 25 mm -3094-
- ◆ Stepladder -VAS 5085-
- ◆ Engine bung set -VAS 6122-
- ◆ Scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10-
- ◆ Drip tray for workshop hoist -VAS 6208-



- ◆ Hose clip pliers -VAS 6362-

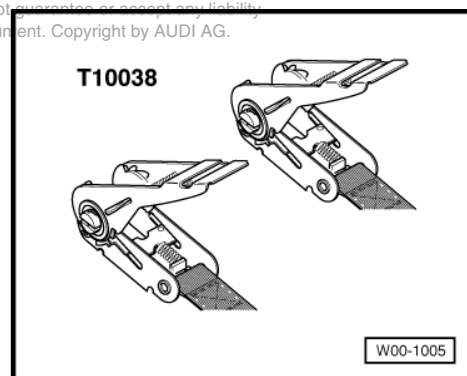


- ◆ Used oil collection and extraction unit -V.A.G 1782-

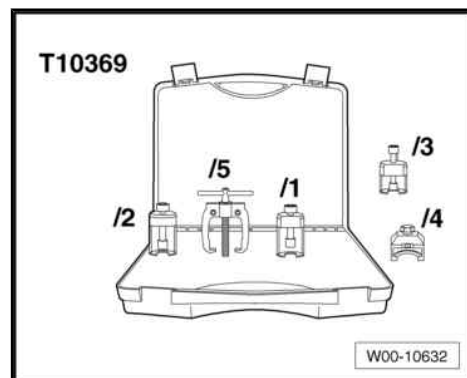


- ◆ Tensioning strap -T10038-

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- ◆ Puller -T10369-



Procedure



Note

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



WARNING

Before removing the engine secure the vehicle against tipping over. To do so, the luggage compartment must be empty.



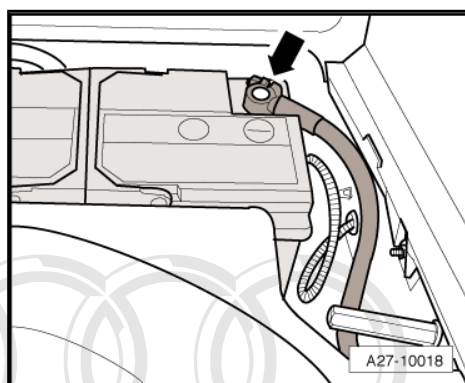
Caution

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

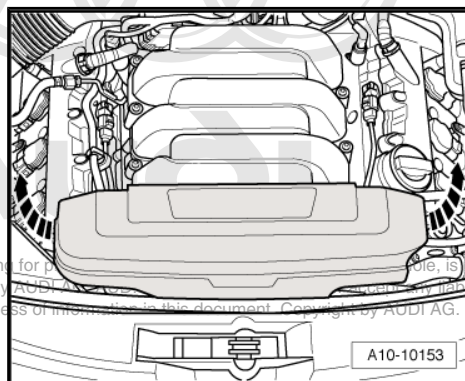


Note

- ◆ *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 electronic parking brake must be released before disconnecting the battery, so that the propshaft can be turned during removal.*
- With ignition switched off, disconnect battery earth cable -arrow- ⇒ Rep. Gr. 27.



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



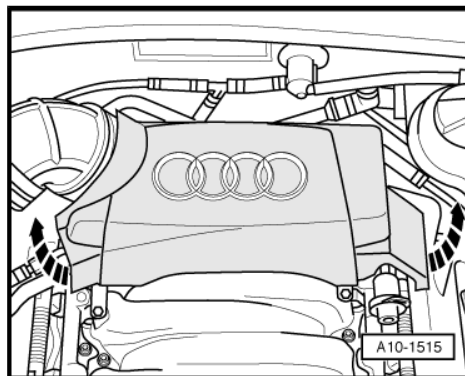
- Pull off engine cover panel (rear) -arrows-.



WARNING

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

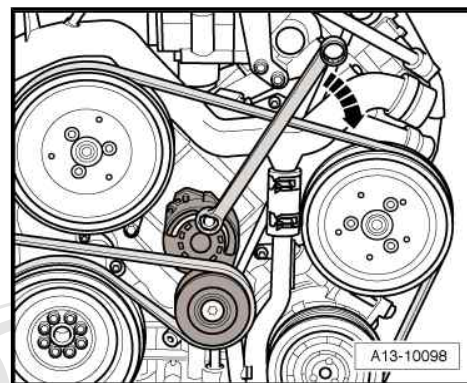
- Open filler cap on coolant expansion tank.



i Note

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

- 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.

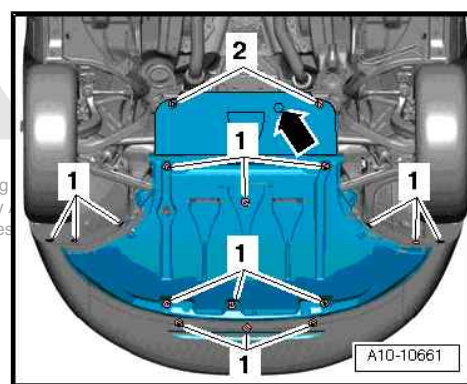


i Note

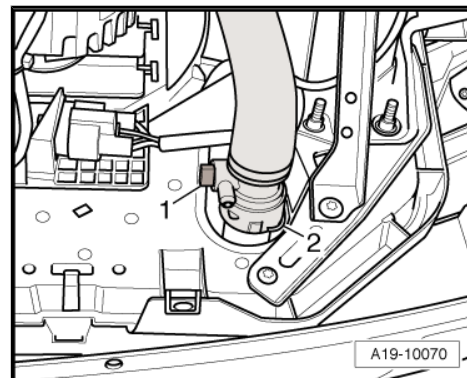
Secure brake discs with wheel bolts.

- Remove noise insulation panels ⇒ Rep. Gr. 50 .

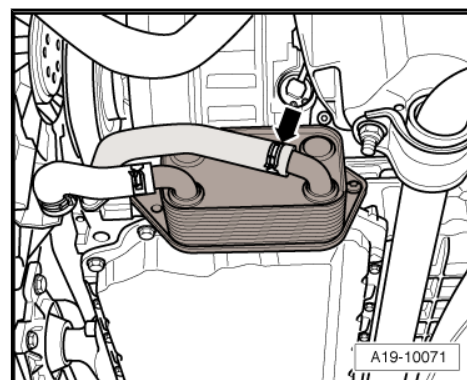
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- Place drip tray for workshop hoist -VAS 6208- under engine.
- Open drain plug -1- and let coolant drain.
- Then disconnect coolant hose -2- from radiator.



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



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


WARNING

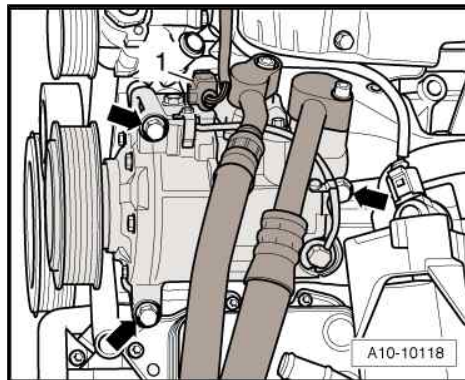
The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.


Note

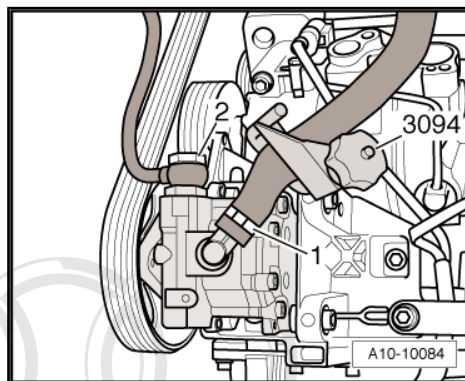
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.

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


Note

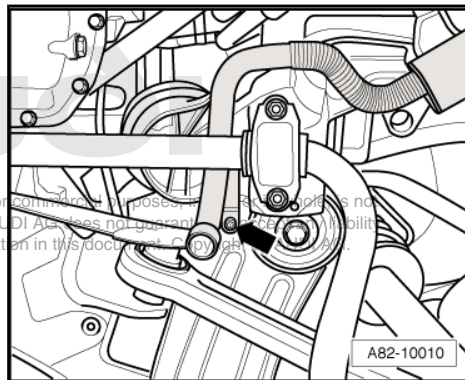
Lay a cloth under the hydraulic lines to catch any escaping hydraulic fluid.

- Clamp off hydraulic hose -1- for power steering pump using a hose clamp -3094- .
- Disconnect hydraulic hose from power steering pump.
- Unbolt hydraulic pressure line -2- at power steering pump and lay onto longitudinal member above.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .

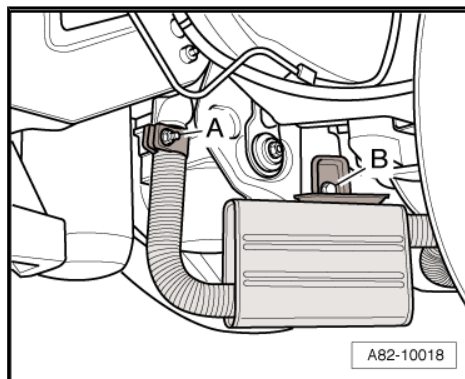

Vehicles with auxiliary heater:

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

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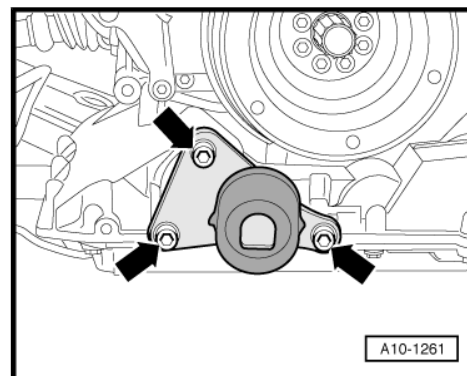


- Loosen nut -A- at clamp for corrugated exhaust pipe.
- Unscrew bolt -B- and remove silencer together with corrugated exhaust pipes.



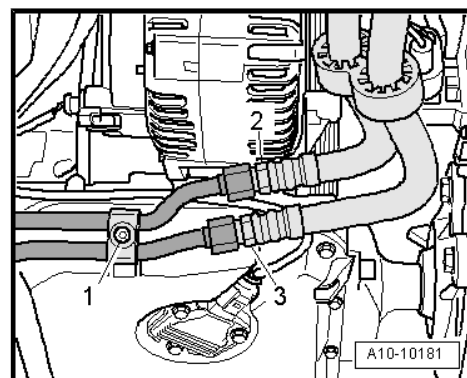
All vehicles:

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

**Note**

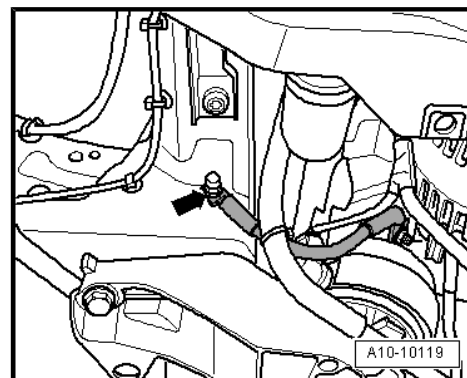
Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. Gr. 00.

- Position used oil collection and extraction unit -V.A.G 1782- below connection point.
- Unscrew union nuts -2- and -3- and disconnect ATF pipes.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122-.

**Note**

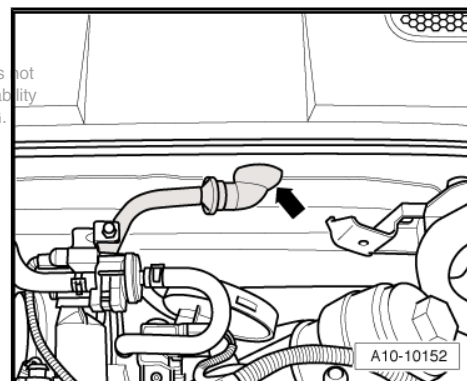
Disregard -item 1-.

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

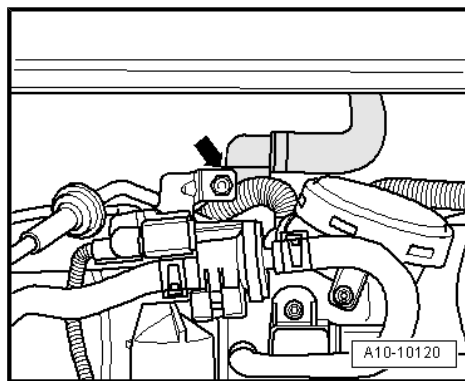


- Detach brake servo vacuum hose from grommet -arrow- at plenum chamber partition panel.

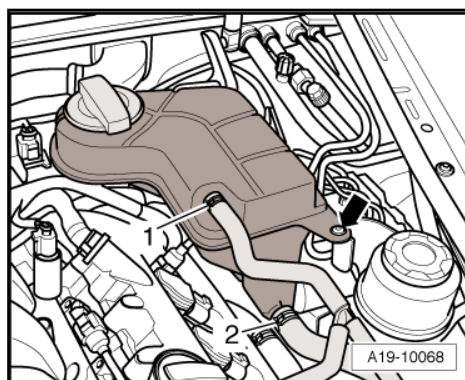
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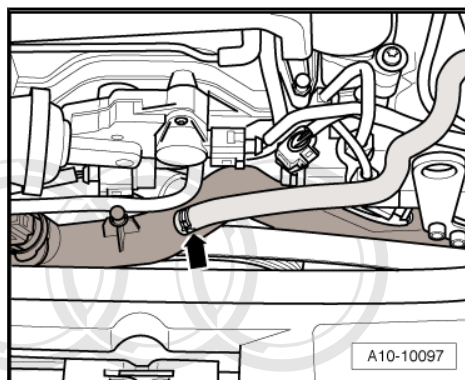
- Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.



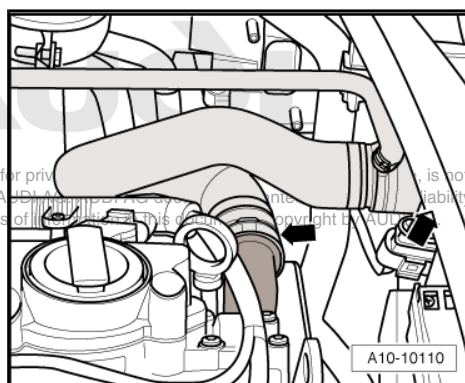
- Disconnect coolant hoses -1- and -2- at coolant expansion tank.
- Unbolt coolant expansion tank -arrow-.
- Detach electrical connector at coolant shortage indicator switch -F66- on coolant expansion tank (bottom).



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

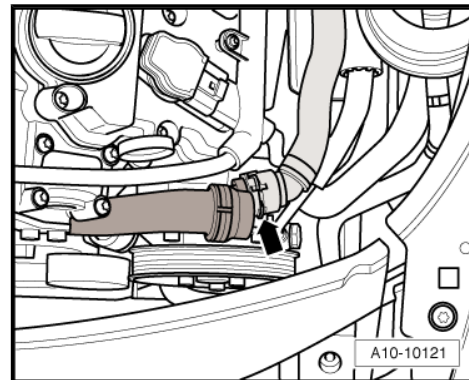


- Remove coolant hose (front left) in engine compartment -arrows-.



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



USA models:

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

All vehicles:



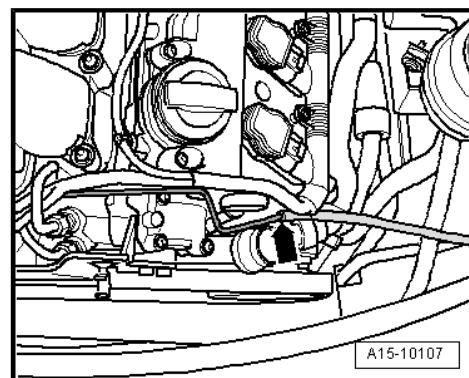
Caution

*Rules for cleanliness when working on the injection system
⇒ page 5.*



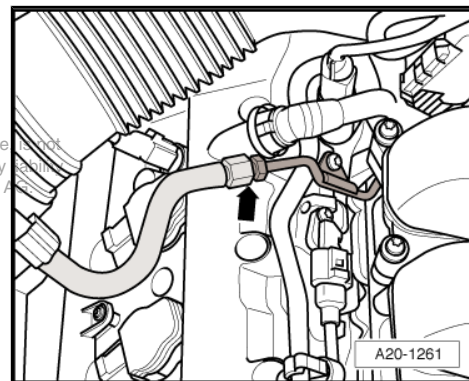
WARNING

The fuel system is pressurised. Before opening the low-pressure part of the injection system a clean cloth must be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.

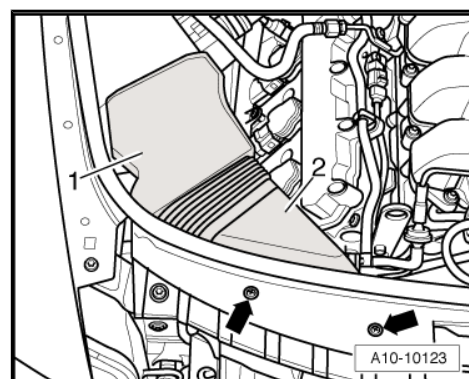


- Disconnect fuel line -arrow- and move clear.
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122-.

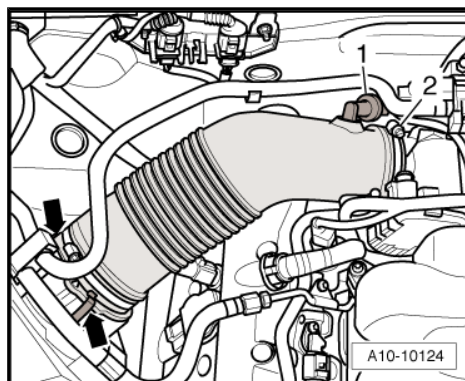
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- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

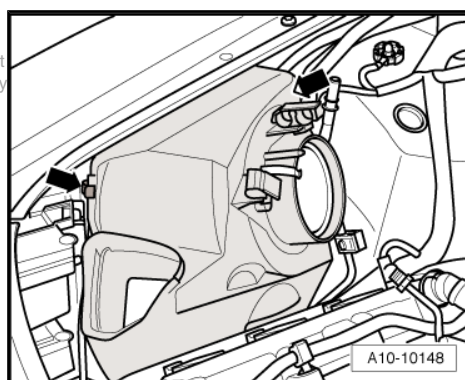


- Pull non-return valve -1- off connection at air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.

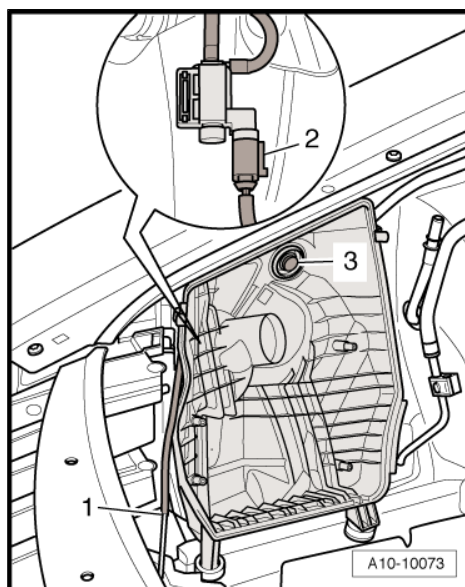


- Release clamps -arrows- and detach air cleaner (top section).

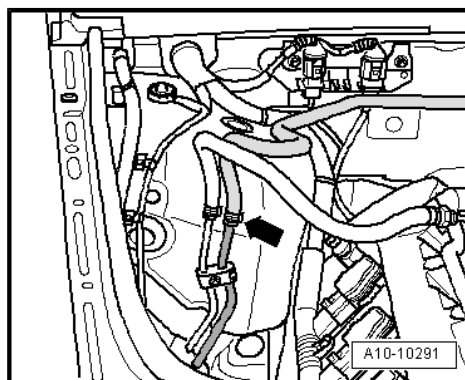
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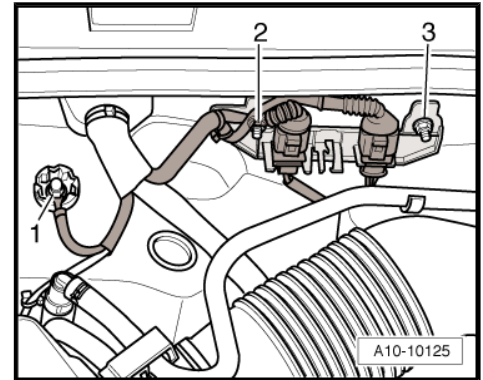
- Disconnect vacuum pipe -1-.
- Pull out pin of fastener -3-.
- Remove air cleaner (bottom section) and unplug electrical connector -2- on reverse side at variable intake manifold changeover valve -N335-.



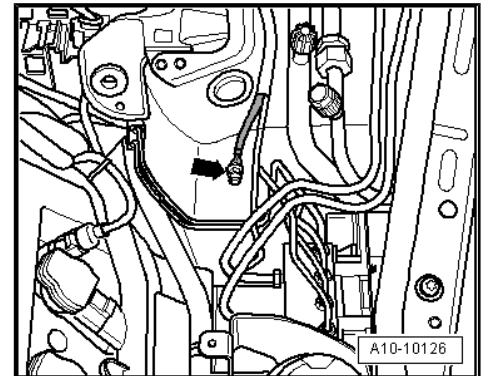
- Disconnect vacuum hose -arrow- leading to activated charcoal filter.



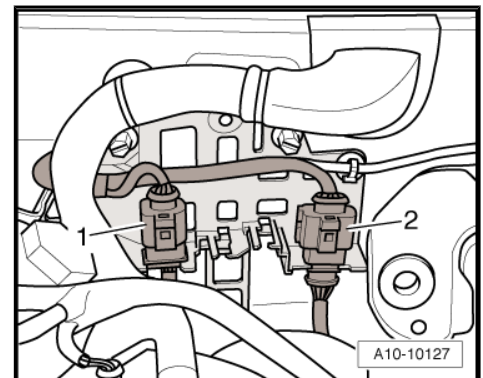
- Unscrew nuts -2- and -3- and remove bracket for connectors (right-side) from plenum chamber partition panel.
- Unbolt earth cable -1- at suspension turret (right-side).



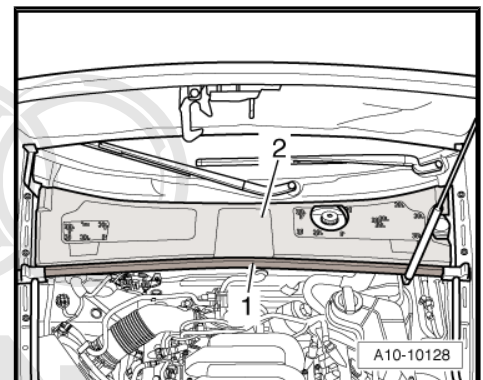
- Unbolt earth cable -arrow- at suspension turret (left-side).



- Remove bracket (left-side) for connectors -1- and -2- from plenum chamber partition panel.

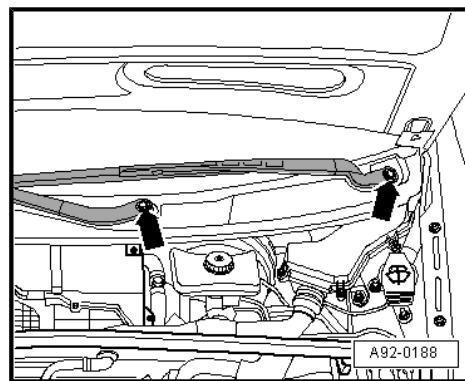


- Pull off rubber seal -1- and remove plenum chamber cover -2-.

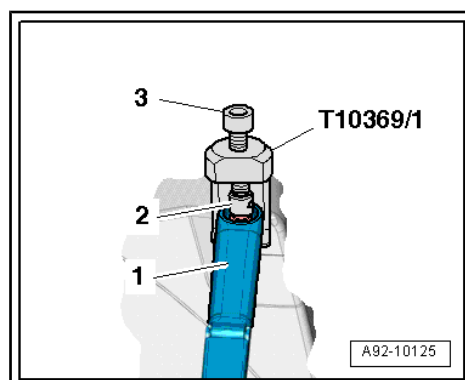


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- Use screwdriver to pry off caps on wiper arms and slacken off nuts -arrows- several turns.



- Apply puller -T10369/1- to wiper arm -1-, as shown in illustration.
- Apply thrust piece -2- onto wiper shaft.
- Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
- Remove nuts completely and take off wiper arms.

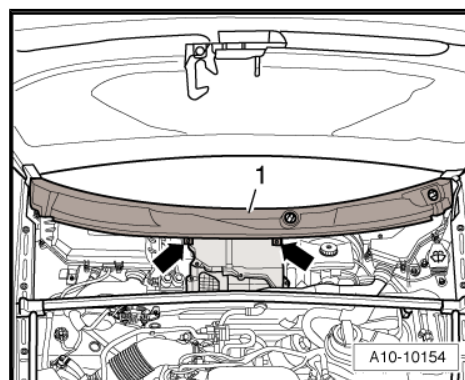


- Unscrew bolts -arrows- for cowl panel trim -1-.

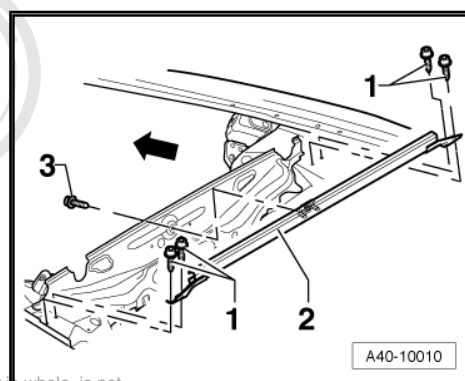


Caution

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.

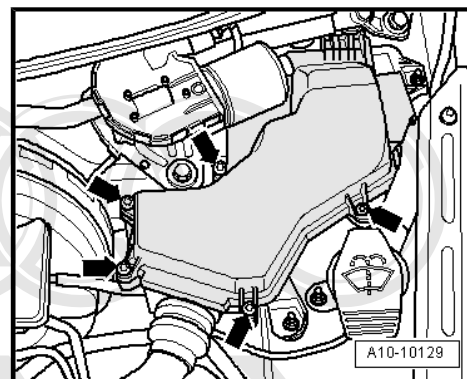


- Pull cowl panel trim off windscreen.
- If fitted, remove bolts -1- and -3- and detach body brace -2-.

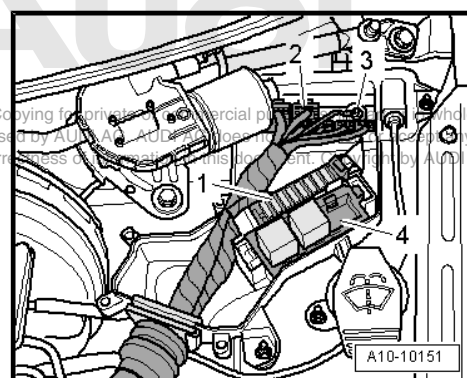


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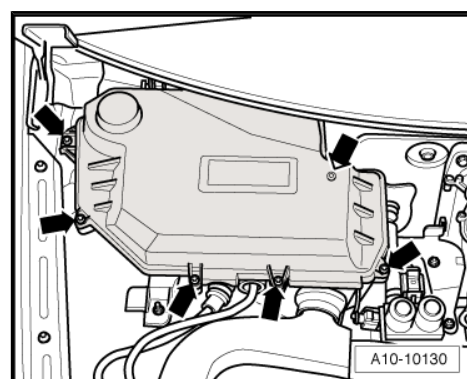
- Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



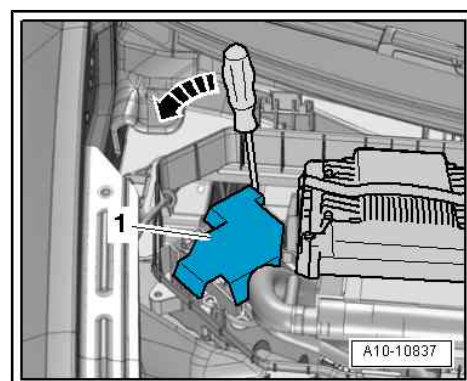
- Release retainers and lift off fuse holder -1-; then lift off 3-position relay carrier -4-.
- Unscrew electrical wiring -3-.
- Unplug all connectors -2- at rear of connector console.
- Disengage engine wiring harness at electronics box and move it clear.



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



- If fitted, open cover -1- with screwdriver -arrow- and detach.





WARNING

The pump valve unit for heating system (left in front of electronics box) gets very hot – risk of burns!

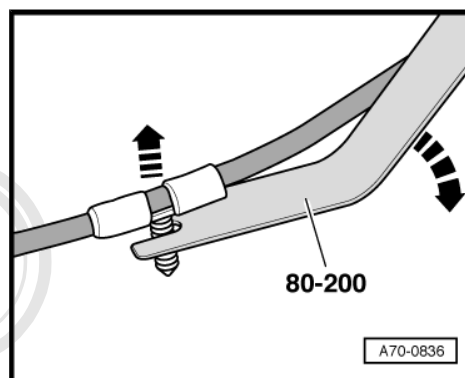
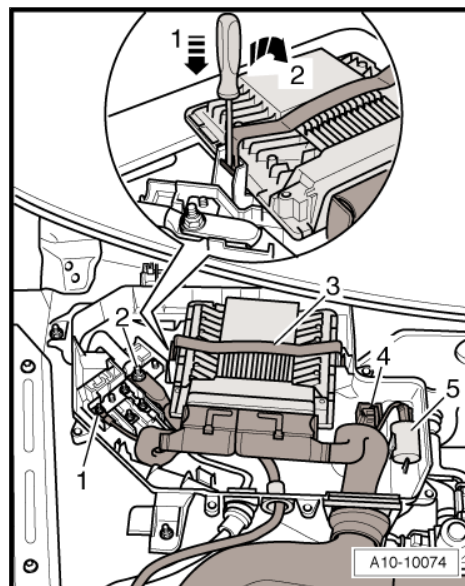
- Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.



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.



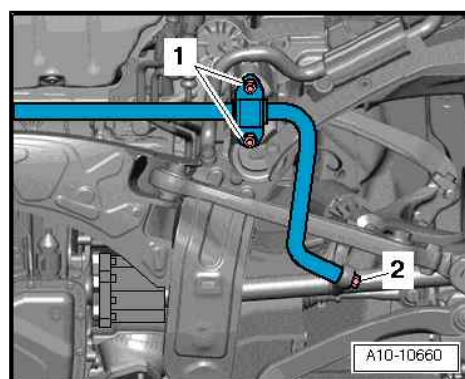
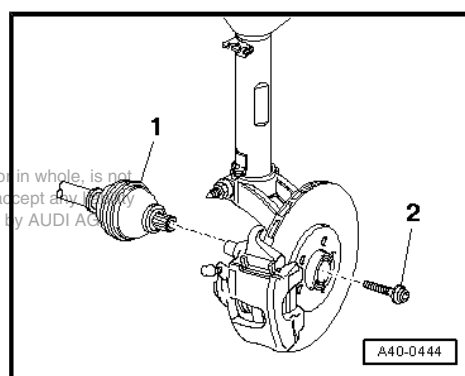
- Have a 2nd mechanic press the brake pedal.



Caution

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

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

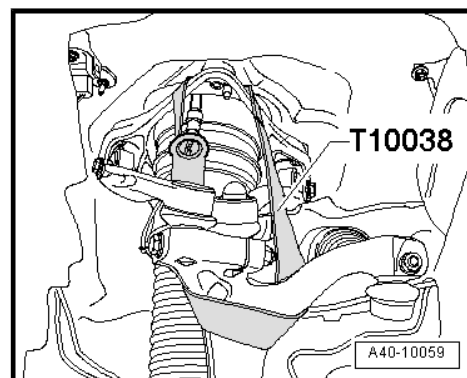
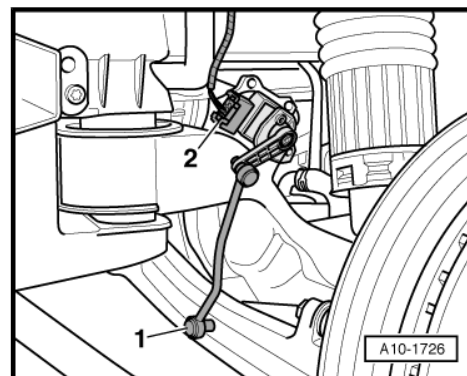
**Caution**

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

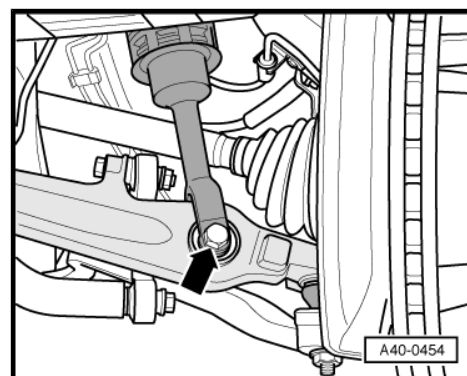
◆ ***Support wheel bearing housing.***

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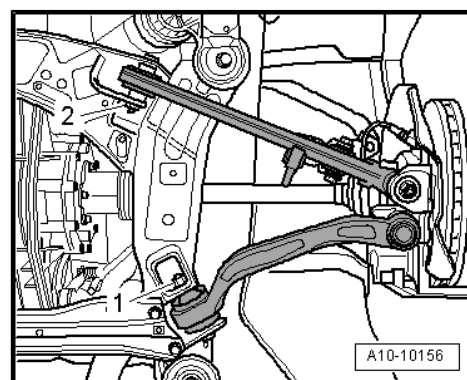
- Tie up wheel bearing housing using tensioning strap -T10038- as illustrated.



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



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



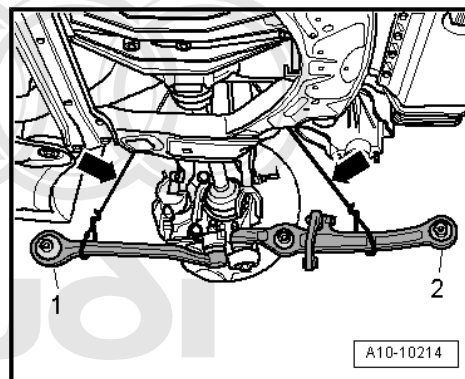
- Pivot guide link -1- and track control link -2- outwards.



Caution

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

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

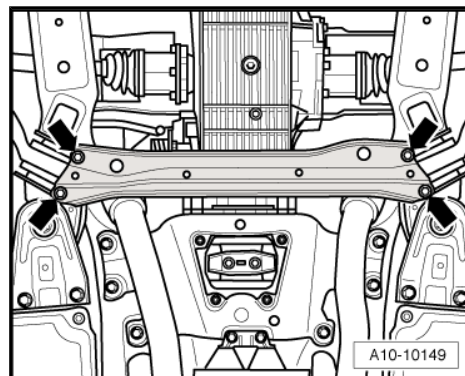


Caution

Take care not to damage brake hose.

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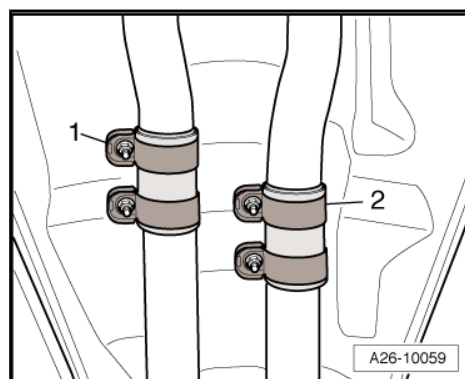
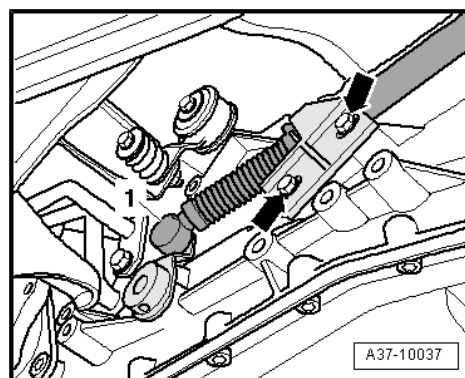
- Pivot wheel bearing housing outwards and remove drive shaft.
- Repeat procedure on other side of vehicle.
- Unbolt cross piece from subframe -arrows-.



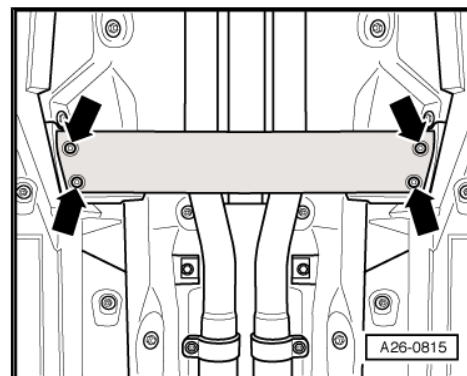
Note

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-.

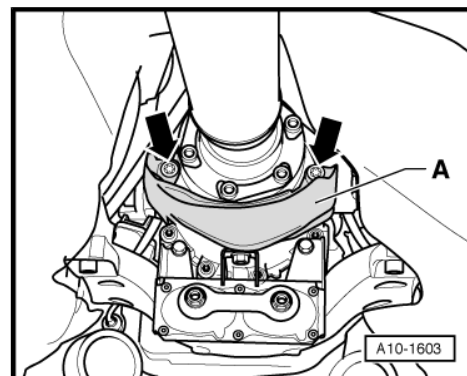


- Unbolt cross piece (front) -arrows-.

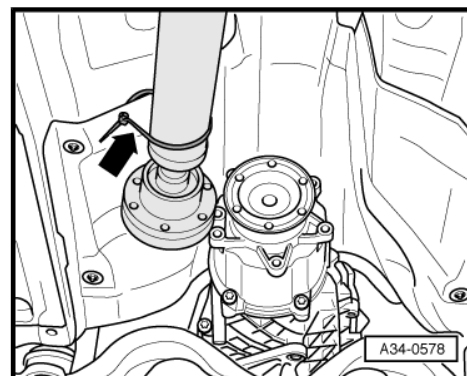


- Unscrew heat shield -A- for propshaft -arrows-.
- Unscrew bolts at gearbox/propshaft flange.
- Push propshaft back towards rear final drive. The constant velocity joints can be moved axially.

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

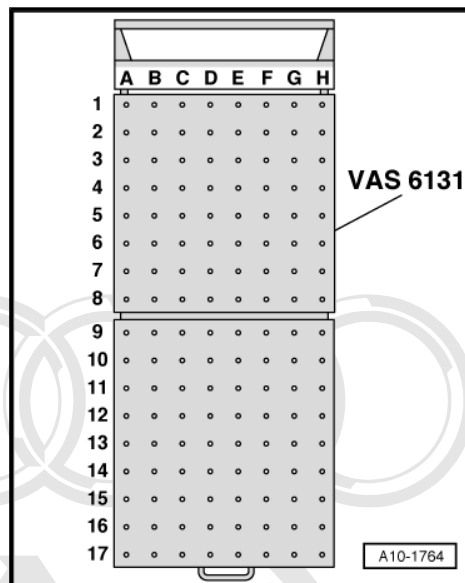


Set up the scissor-type assembly platform as follows:

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

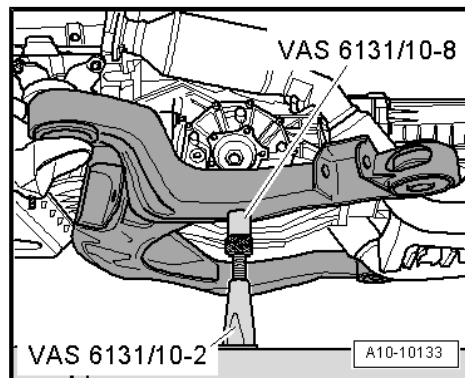
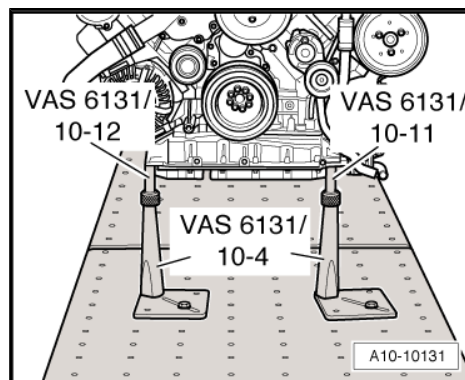
Platform coordinates	Parts of support set for Audi -VAS 6131/10- , -VAS 6131/11- and -VAS 6131/12-			
B5	/10-1	/10-4	/10-5	/10-11
F5	/10-1	/10-4	/10-5	/10-12
B11	/10-1	/10-2	/10-5	/10-8
G11	/10-1	/10-2	/10-5	/10-8
E9	/10-1	/10-3	/10-5	/11-3
D10	/10-1	/10-2	/10-5	/12-1
G14	/10-1	/10-4	/10-5	/10-13
D16	/10-1	/10-3	/10-5	/10-6

- Initially tighten the support elements on the assembly platform only hand-tight.
- Adjust the scissor-type assembly platform -VAS 6131 A- so that it is horizontal.
- Take note of spirit level (bubble gauge).
- Place scissor-type assembly platform -VAS 6131 A- under engine/gearbox assembly.
- Position support elements from -VAS 6131/10- at front of engine, as shown in illustration.

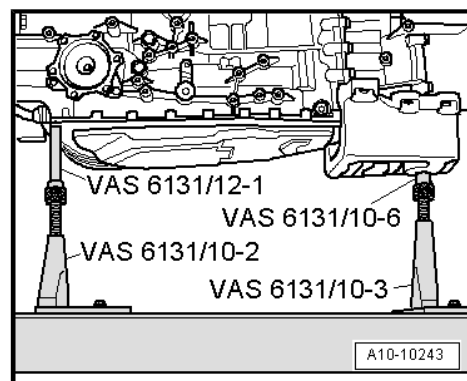


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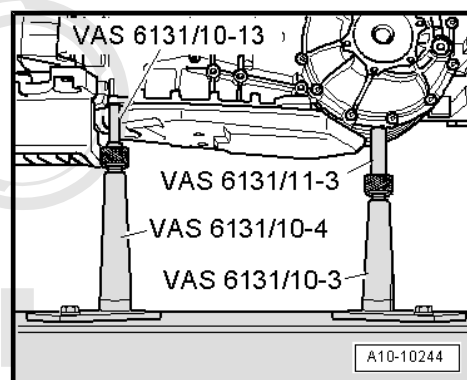
- Position support elements from -VAS 6131/10- at left and right of subframe, as shown in the illustration.



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

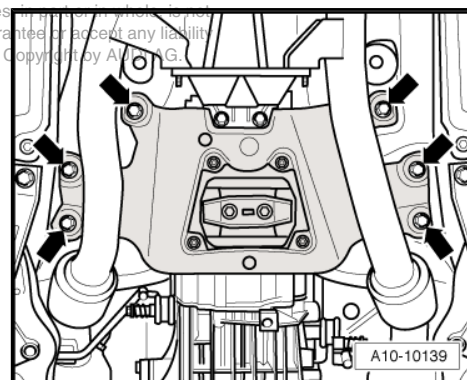


- Position support elements from -VAS 6131/10- and -VAS 6131/11- on right side of gearbox, as shown in illustration.
- Turn all spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform -VAS 6131 A-.



- Remove bolts -arrows- at tunnel cross member.

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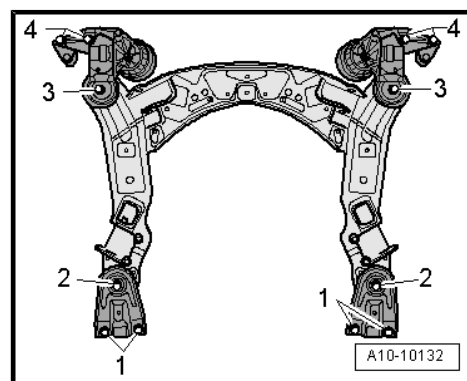


- Remove bolts -1-.
- Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with a felt-tip pen.
- Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.



Note

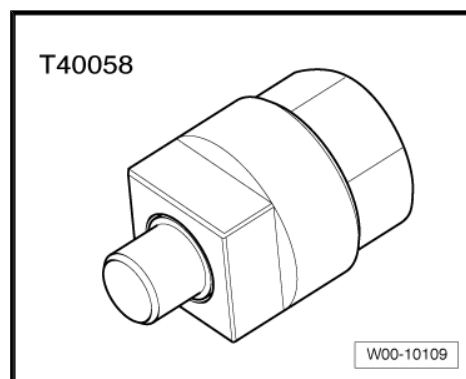
- ♦ Check that all hoses and wiring connections between engine, gearbox, subframe and body have been detached.
- ♦ Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering to avoid damage.
- Lower engine/gearbox assembly gradually.
- Pull out scissor-type assembly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



3.2 Separating engine from automatic gearbox 09L

Special tools and workshop equipment required

- ◆ Adapter -T40058-



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.

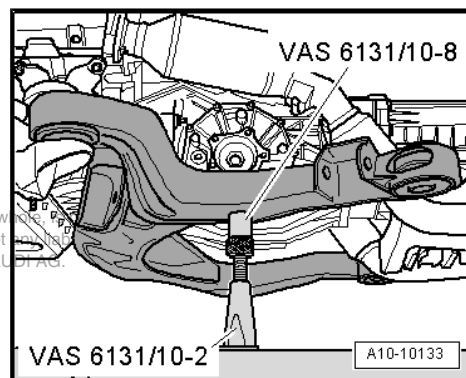


Note

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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- .

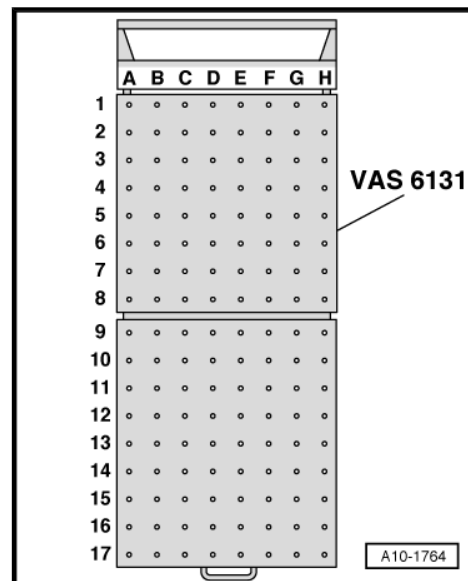


Note

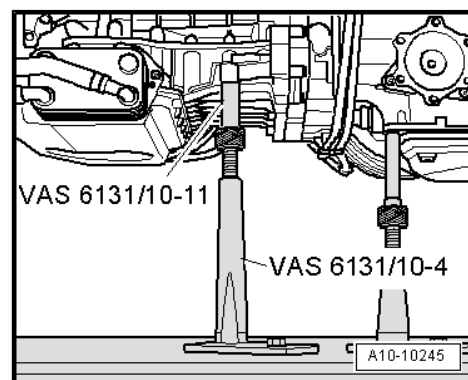
The mounting points for engine (front), gearbox and tunnel cross member remain unchanged.

- 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:

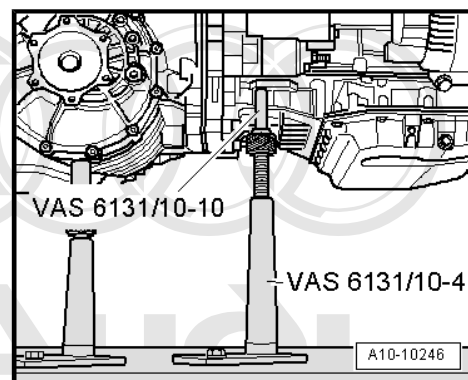
Platform coordinates	Parts of support set for Audi -VAS 6131/10-, -VAS 6131/11- and -VAS 6131/12-			
B5 ¹⁾	/10-1	/10-4	/10-5	/10-11
F5 ¹⁾	/10-1	/10-4	/10-5	/10-12
B8	/10-1	/10-4	/10-5	/10-11
G8	/10-1	/10-4	/10-5	/10-10
E9 ¹⁾	/10-1	/10-3	/10-5	/11-3
D10 ¹⁾	/10-1	/10-4	/10-5	/12-1
G14 ¹⁾	/10-1	/10-4	/10-5	/10-13
D16 ¹⁾	/10-1	/10-3	/10-5	/10-6
• ¹⁾ Support elements remain unchanged.				



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



- Position support elements from -VAS 6131/10- on right side 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-.

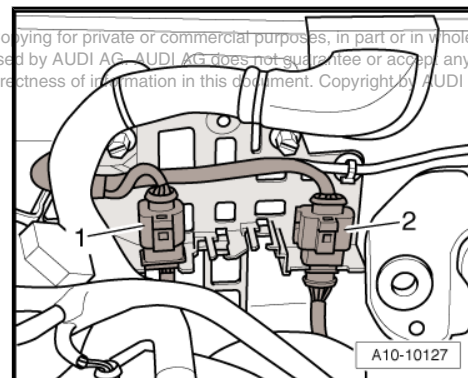


- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter -G131- and move wiring clear.



Note

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





Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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



Note

Disregard items marked -2- and -3-.

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



Note

Ignore other items.

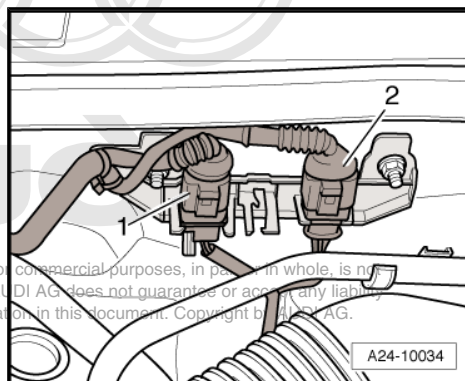
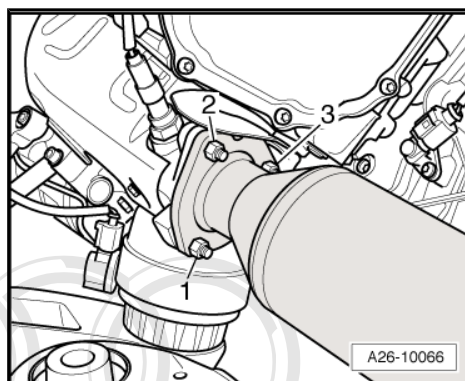
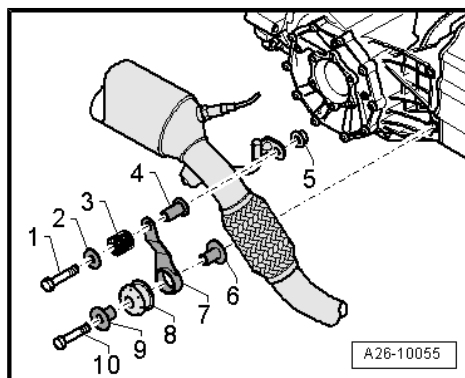
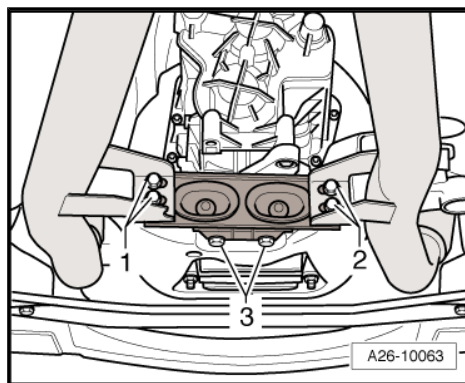
- Remove nuts -1 ... 3-.
- Detach front exhaust pipe (left-side) with catalytic converter.

- 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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i Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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

i Note

Disregard items marked -1- and -3-.

- Remove bolt -6- on bracket (right-side) for front exhaust pipe.

i Note

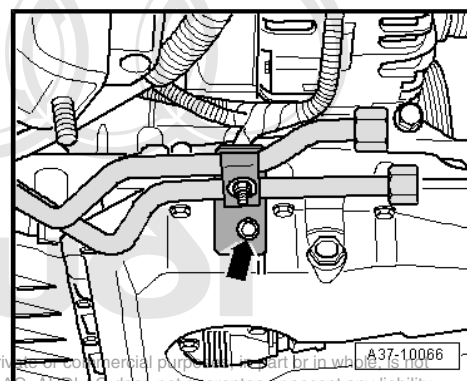
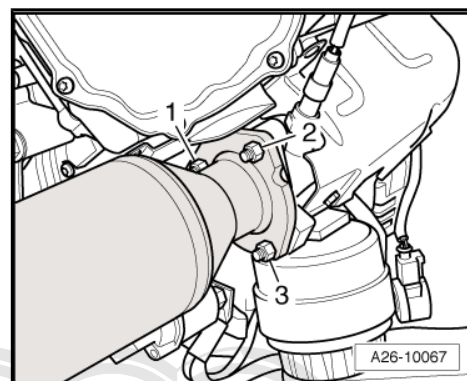
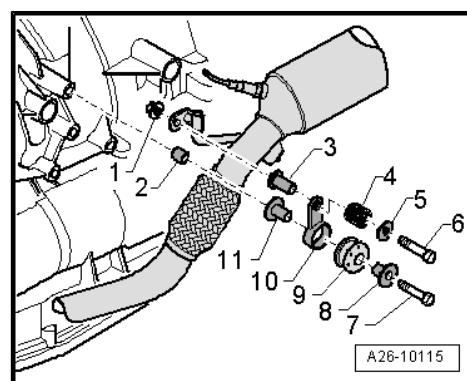
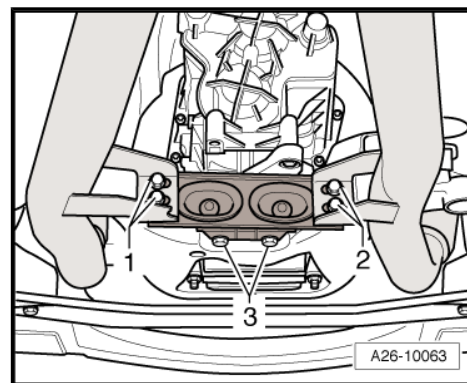
Ignore other items.

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

i Note

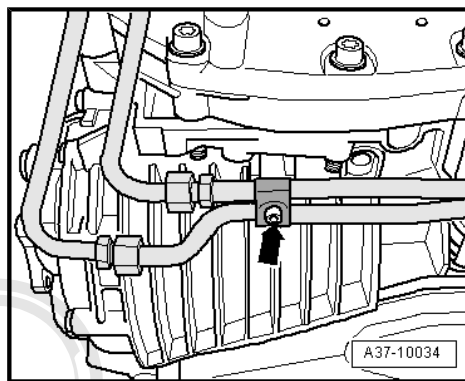
Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. Gr. 00.

- Unbolt bracket -arrow- for ATF lines at sump.



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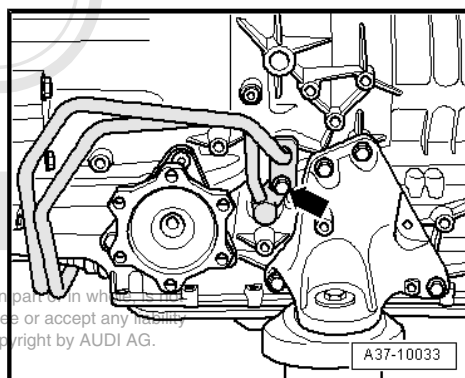
- Unbolt bracket -arrow- for ATF lines at gearbox (bottom).



Note

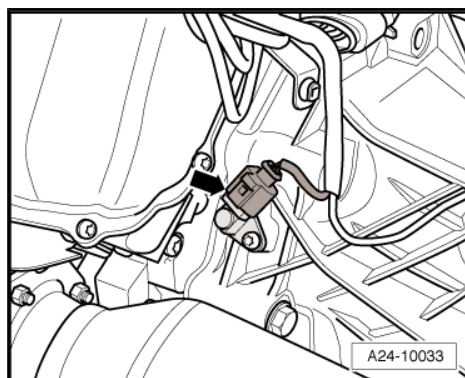
Lay a cloth under the ATF pipes to catch escaping ATF fluid.

- Remove bolt -arrow-.
- Detach ATF lines from gearbox.

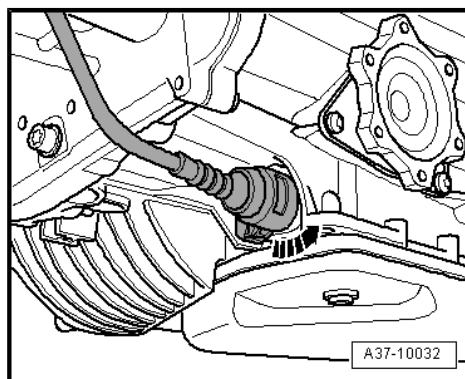


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- Unplug electrical connector -arrow- at engine speed sender - G28- .



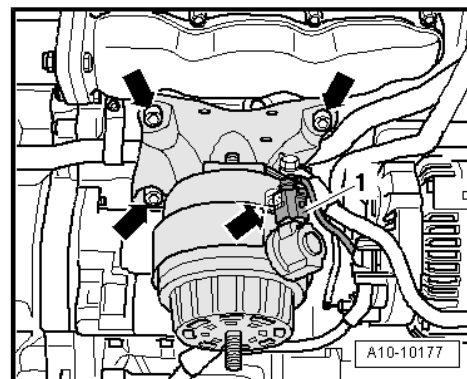
- Turn retainer catch anti-clockwise -arrow- and unplug electrical connector at gearbox.



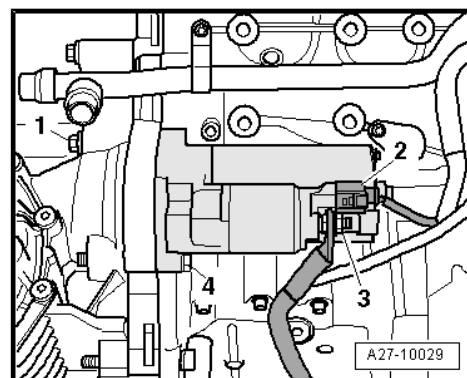
- If fitted, unplug electrical connector -1- on right electrohydraulic engine mounting solenoid valve -N145-.
- Move wiring clear at console for engine mounting.
- Remove bolts -arrows- and detach engine support (right-side).

**Note**

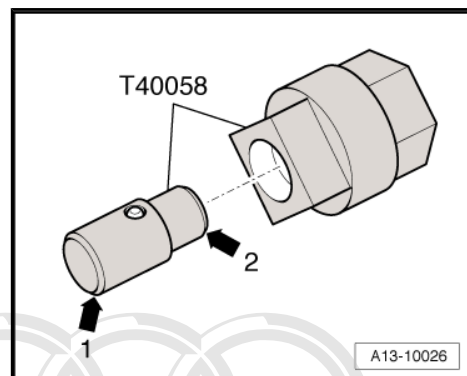
Shown in illustration without console for engine mounting.



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



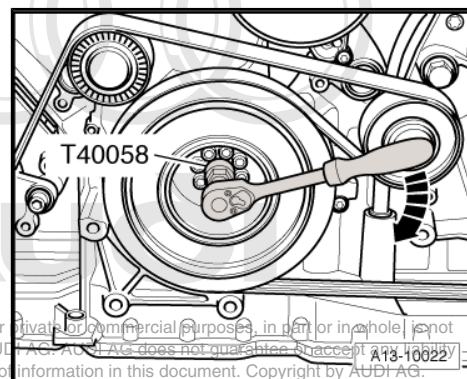
- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.



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

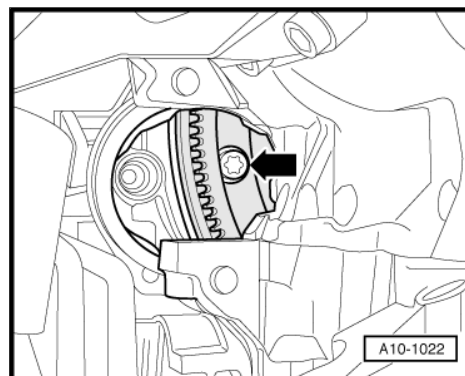
**Note**

Ignore -arrow-.

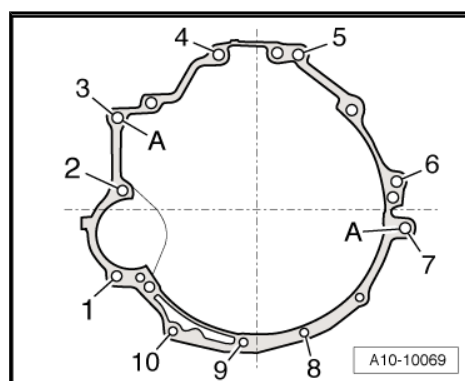


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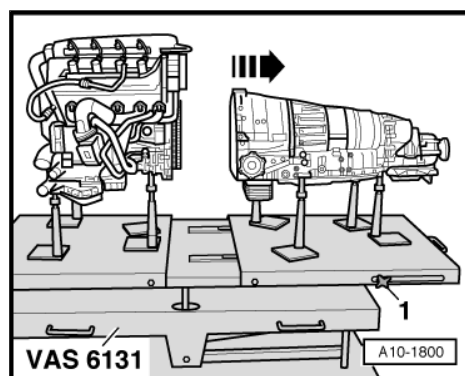
- Unscrew the three bolts -arrows- for torque converter, working through opening of removed starter (turn crankshaft $\frac{1}{3}$ turn each time).



- Remove engine/gearbox securing bolts -3 ... 10-.



- 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.



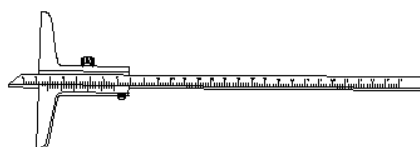
3.3 Installing engine

Special tools and workshop equipment required

- ◆ Depth gauge -VAS 6082-

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VAS 6082



W00-10210

Procedure



Note

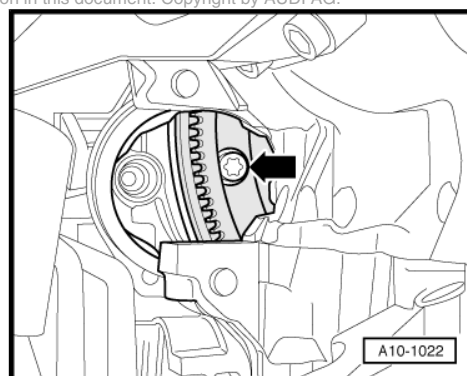
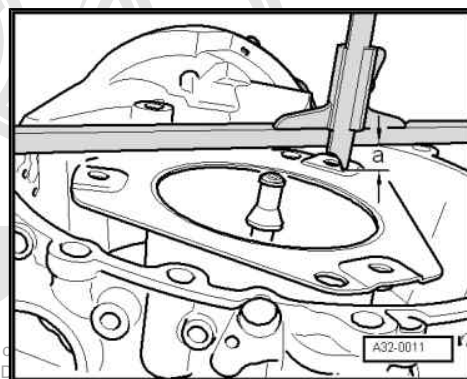
- ◆ *Renew self-locking nuts and bolts when performing assembly work.*
- ◆ *Renew bolts which are tightened to a specified angle as well as seals, gaskets and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install engine supports with engine mountings ⇒ [page 95](#) .
- Check 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.



Caution

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

- Before 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 .

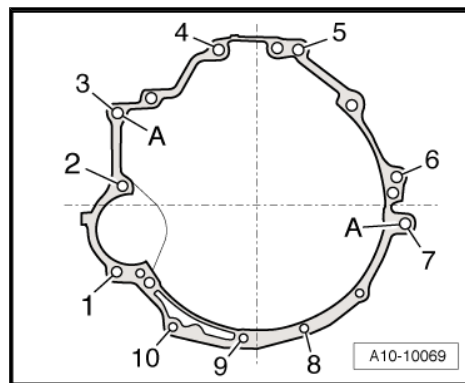


- Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
- Press intermediate plate between engine and gearbox onto dowel sleeves.
- Bolt gearbox to engine.



Caution

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



Note

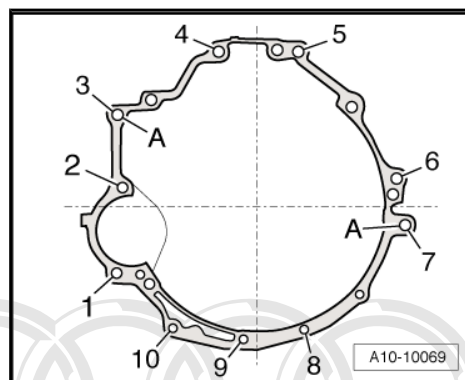
- ◆ Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.
- ◆ Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.
- ◆ Do not use degreased parts.
- ◆ Tolerance for tightening torques $\pm 15\%$.

Securing engine to gearbox

Item	Bolt	Nm
1	M10x100	65 ¹⁾
2, 6	M12x120	65
3, 4, 5	M12x105	65
7	M12x130	65
8, 9, 10	M10x80	45
A	Dowel sleeves for centralising	
• ¹⁾ Bolt strength rating 10.9		

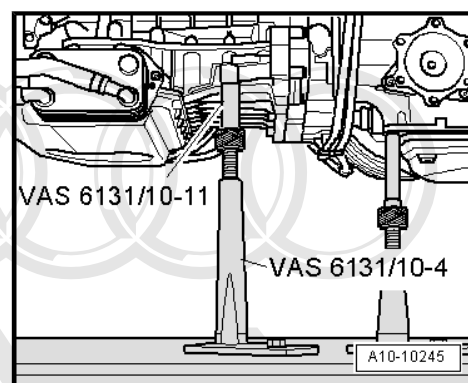
Perform further installation in reverse order, paying attention to the following:

- Secure ATF lines $\Rightarrow$ Rep. Gr. 37 .
- Install front exhaust pipes: left-side $\Rightarrow$ [page 279](#) , right-side $\Rightarrow$ [page 284](#) .
- 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.

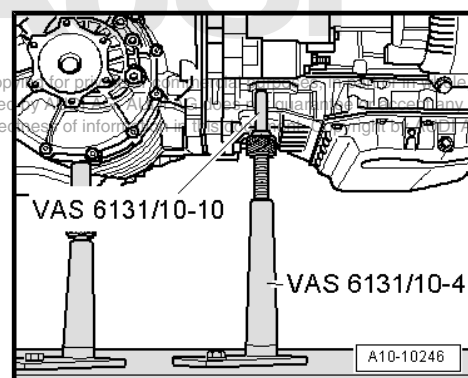


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- Screw spindle for support element (left-side) at engine downwards.
- Unscrew base plate for support element (left-side) at scissor-type assembly platform -VAS 6131 A- .



- 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- .

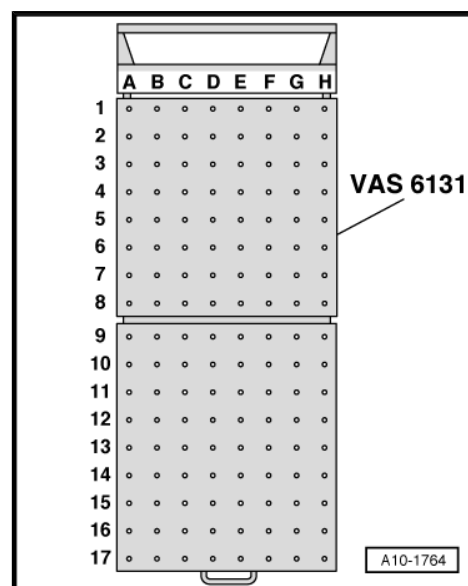
**Note**

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 of support set for Audi -VAS 6131/10-			
B5 ¹⁾	/10-1	/10-4	/10-5	/10-11
F5 ¹⁾	/10-1	/10-4	/10-5	/10-12
B11	/10-1	/10-2	/10-5	/10-8 ²⁾
G11	/10-1	/10-2	/10-5	/10-8 ²⁾
E9 ¹⁾	/10-1	/10-3	/10-5	/11-3
D10 ¹⁾	/10-1	/10-2	/10-5	/12-1
G14 ¹⁾	/10-1	/10-4	/10-5	/10-13
D16 ¹⁾	/10-1	/10-3	/10-5	/10-6

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





Note

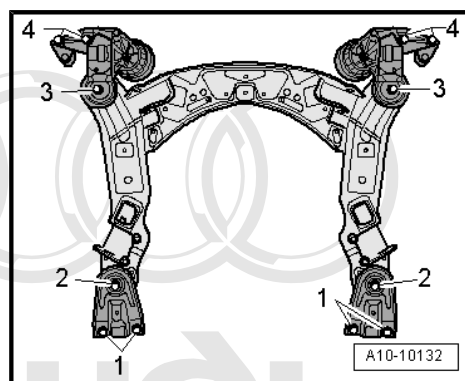
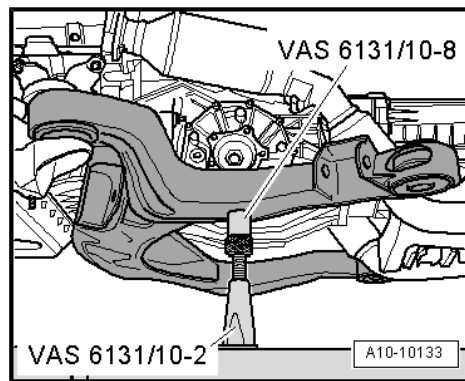
A second mechanic is required for positioning the subframe on the support elements.

- 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.
- Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts only after performing wheel alignment check ⇒ Rep. Gr. 40 .



WARNING

The vehicle must not be driven at this stage.

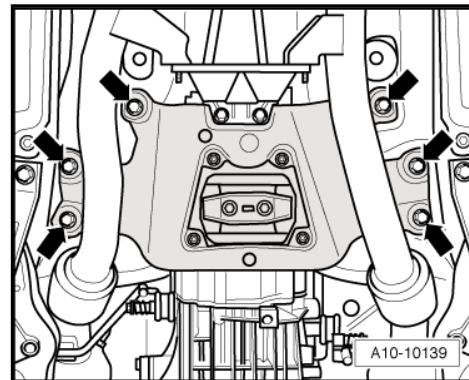


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- Tighten bolts -arrows- for tunnel cross member ⇒ Rep. Gr. 37 .

Perform further installation in reverse order, paying attention to 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 293](#) .
- Secure hydraulic pressure line at power steering pump ⇒ Rep. Gr. 48 .
- Install air conditioner compressor ⇒ Rep. Gr. 87 .
- Install poly V-belt ⇒ [page 108](#) .
- Install torque reaction support ⇒ [page 102](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting battery ⇒ Rep. Gr. 27 .



Caution

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

- Install and adjust wiper arms ⇒ Rep. Gr. 92 .
- Install body brace ⇒ Rep. Gr. 40 .
- Check oil level ⇒ Maintenance ; Booklet 405 .
- Bleed fuel system ⇒ Rep. Gr. 24 .
- Fill cooling system ⇒ [page 245](#) .



Note

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

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

Tightening torques

Note

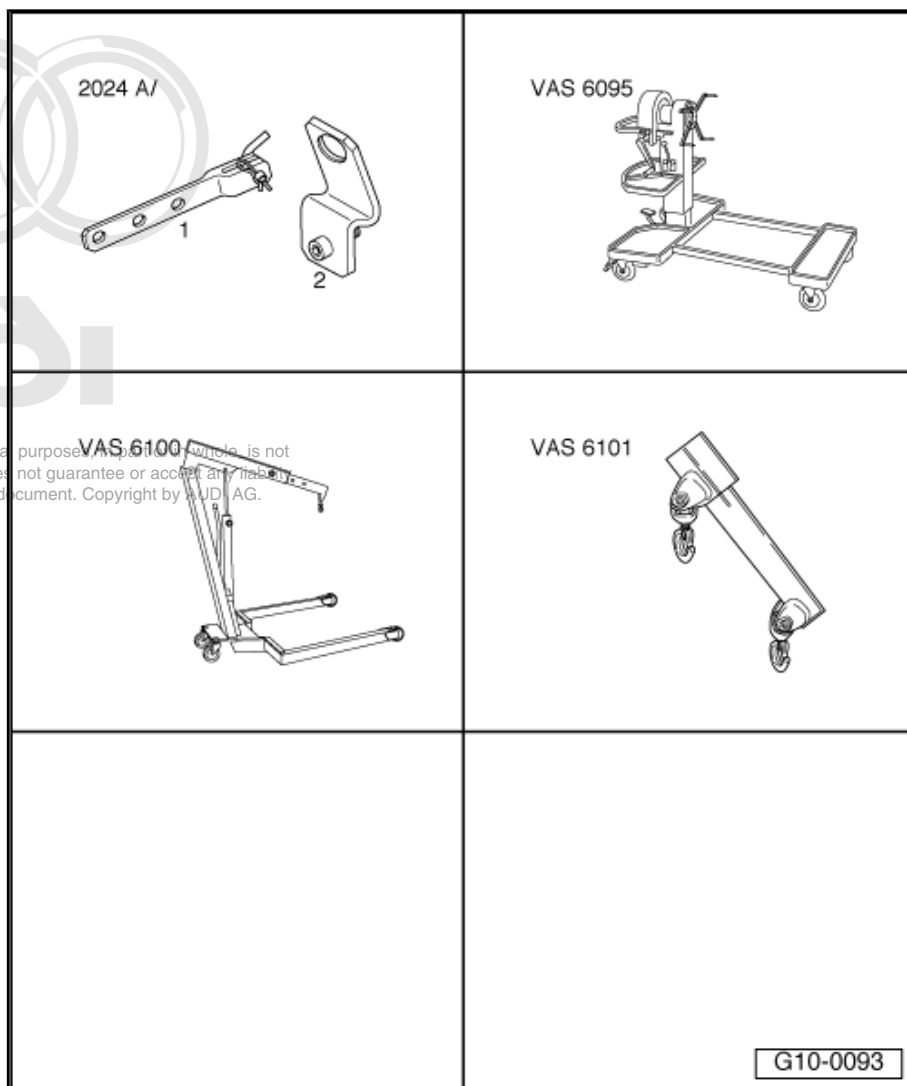
- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ *Tolerance for tightening torques $\pm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

Component	Nm
Bolts/nuts	M6 9
	M8 20
	M10 40
	M12 65
Except for the following:	
Drive plate to torque converter	85 ¹⁾
Terminal B+ to starter	16
Fuel hose to fuel line	22
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5
• ¹⁾ Renew ribbed bolts; use only genuine bolts (same as original equipment) ⇒ Electronic parts catalogue .	

4 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-



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Procedure

- Engine separated from gearbox
 - ⇒ ["1.2 Separating engine from manual gearbox", page 25](#),
 - ⇒ ["2.2 Detaching multitronic gearbox from engine", page 52](#),
 - ⇒ ["3.2 Separating engine from automatic gearbox 09L", page 80](#).

- Attach the lifting tackle -2024 A- to engine and workshop hoist -VAS 6100- with lift arm extension (workshop hoist) - VAS 6101- as shown in the illustration.



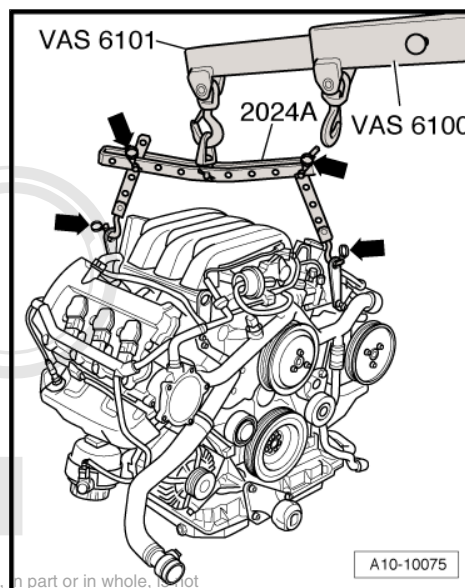
Note

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-.



- If fitted, unplug electrical connector -1- on left electrohydraulic engine mounting solenoid valve -N144- .
- Remove bolts -arrows- and detach engine support (left-side).



Note

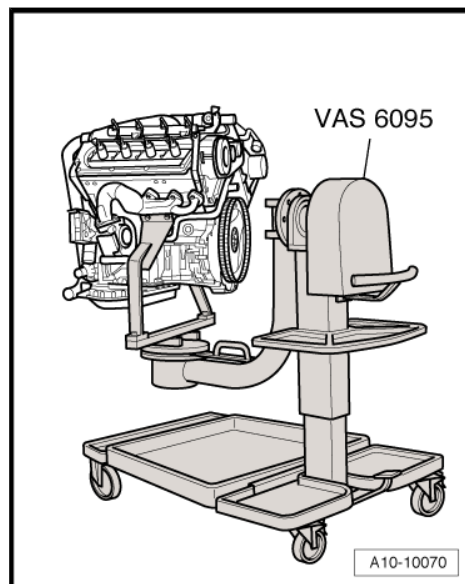
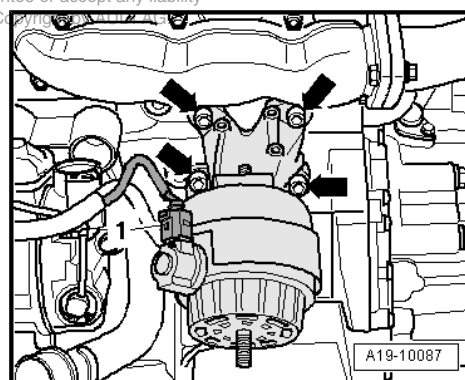
Shown in illustration without console for engine mounting.

Vehicles with manual gearbox or multitronic gearbox:

- Repeat procedure on other side of engine.

All vehicles (continued):

- Using bracket -VAS 6095/1-5- , secure engine to engine and gearbox support -VAS 6095- as shown in the illustration. Tightening torque: 40 Nm.



5 Assembly mountings

5.1 Assembly mountings - exploded view

1 - Stop for torque reaction support

- ☐ Must rest at top and bottom of buffer for torque reaction support, so that there is no play

2 - 40 Nm

3 - Torque reaction support

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

4 - 40 Nm

5 - 75 Nm

6 - Console for engine mounting (right-side)

- ☐ Removing and installing
⇒ ["5.3 Removing and installing engine mounting \(right-side\)", page 99](#)

7 - Engine mounting (right-side)

- ☐ Removing and installing
⇒ [page 99](#)

8 - 40 Nm

9 - 40 Nm

10 - Engine support (right-side)

- ☐ Removing and installing
⇒ [page 99](#)

11 - Engine support (left-side)

- ☐ Removing and installing
⇒ [page 96](#)

12 - 40 Nm

13 - Engine mounting (left-side)

- ☐ Removing and installing ⇒ [page 96](#)

14 - Console for engine mounting (left-side)

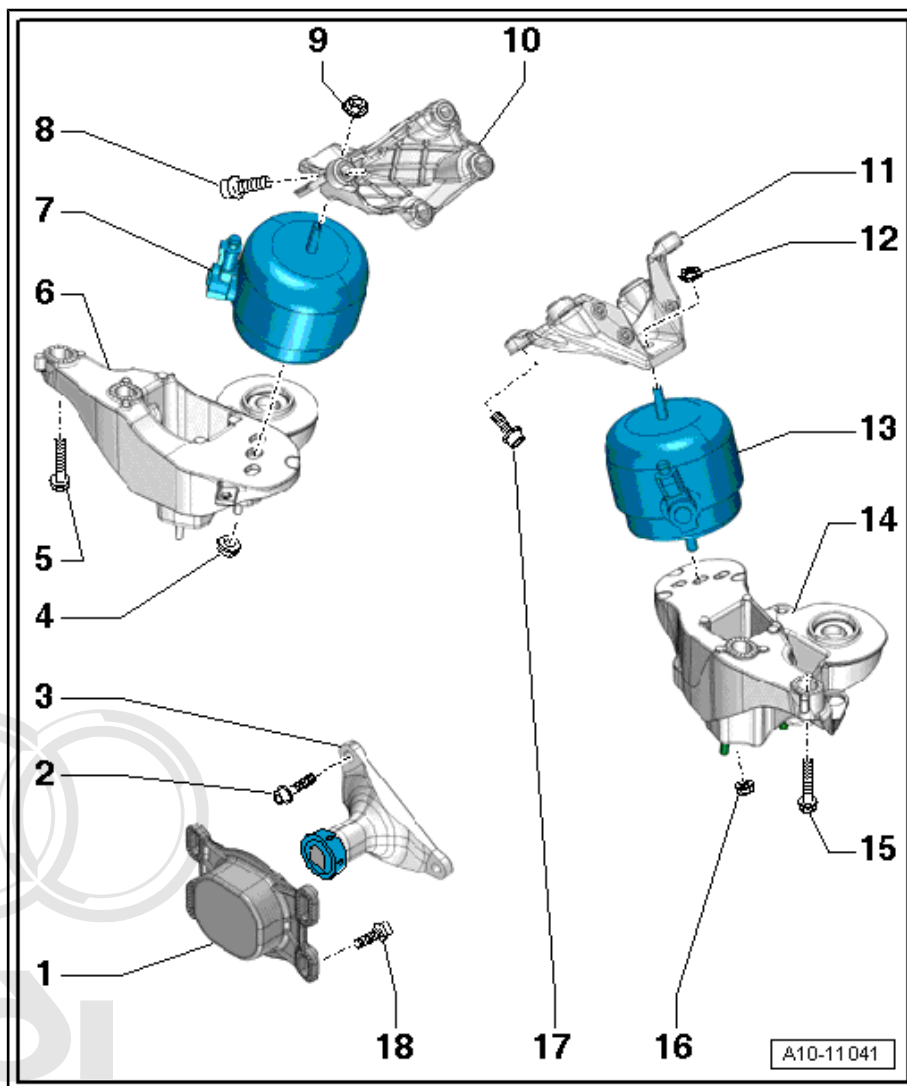
- ☐ Removing and installing ⇒ ["5.2 Removing and installing engine mounting \(left-side\)", page 96](#)

15 - 75 Nm

16 - 40 Nm

17 - 40 Nm

18 - 40 Nm

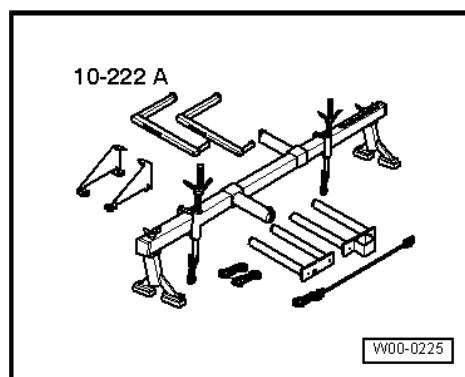


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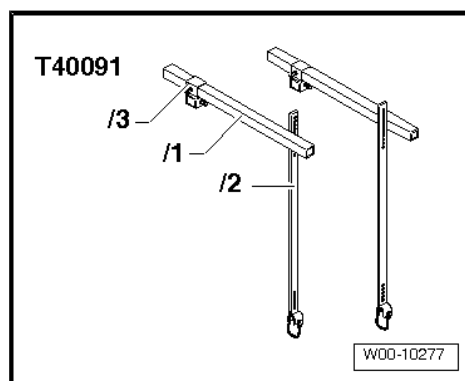
5.2 Removing and installing engine mounting (left-side)

Special tools and workshop equipment required

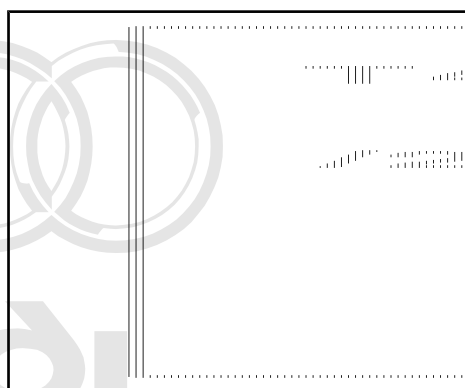
- ◆ Support bracket -10 - 222 A-



- ◆ Engine support bracket (basic set) -T40091-

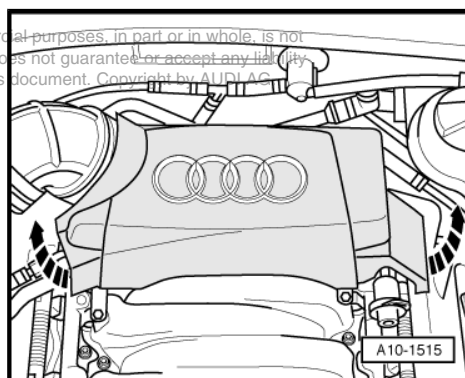


- ◆ Engine support bracket (supplementary set) -T40093-

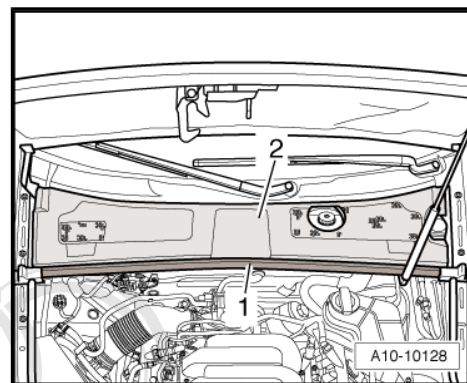


Removing

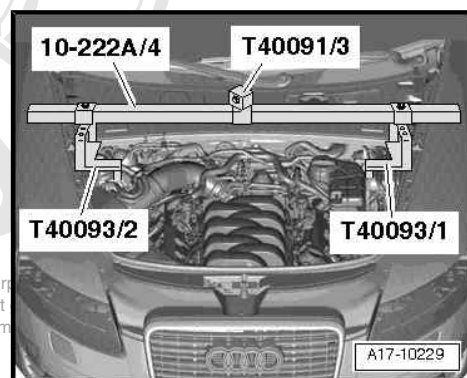
- Pull off engine cover panel (rear) -arrows-



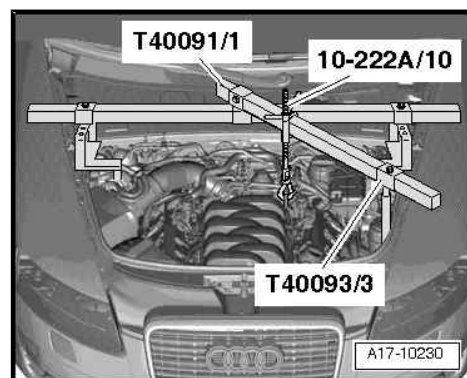
- Pull off rubber seal -1- and remove plenum chamber cover -2-.



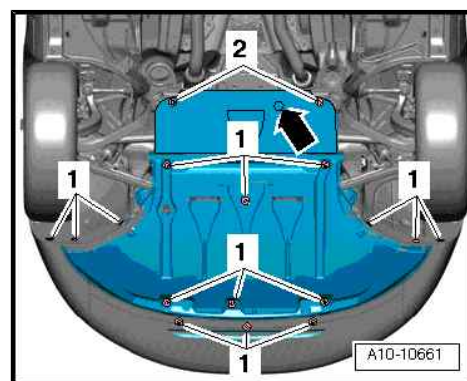
- Set up adapter -10 - 222 A /4- with connecting piece - T40091/3- and supports -T40093/1- and -T40093/2- on suspension turrets as illustrated.
- Supports are marked for left and right side of vehicle.



- Attach further components of support bracket -10 - 222 A- , - T40091- and -T40093- as shown in illustration. Position support -T40093/3- onto flange of longitudinal member.
- Engage hook -10 - 222 A /10- at engine lifting eye (left-side).
- Take up weight of engine with spindle.

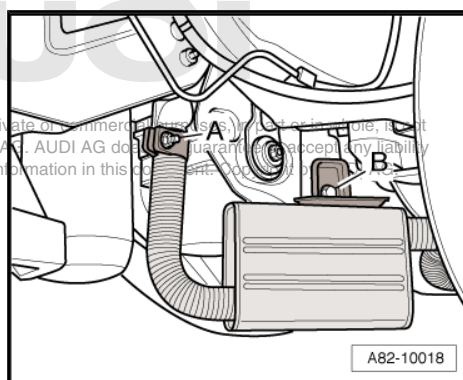
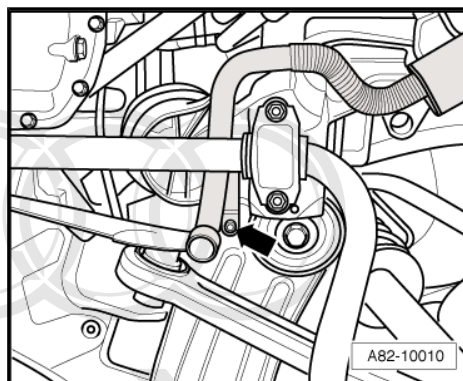


- Remove noise insulation panels => Rep. Gr. 50 .



Vehicles with auxiliary heater:

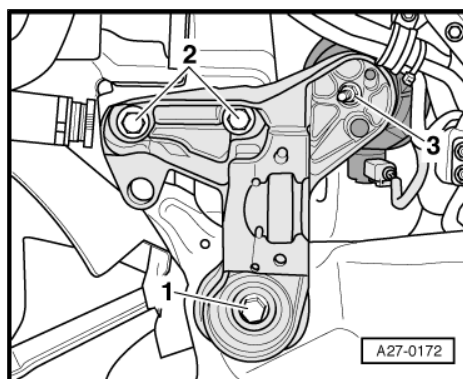
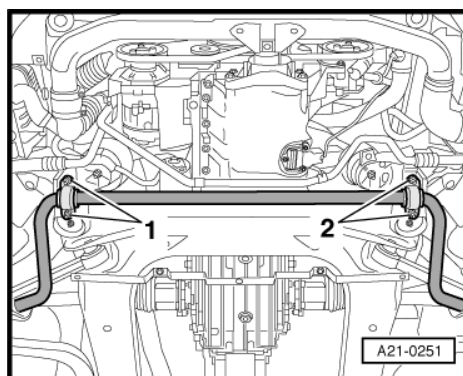
- Remove front left wheel.
- Remove front left wheel housing liner ⇒ Rep. Gr. 66 .
- Remove bolt -arrow- for corrugated exhaust pipe.
- Slacken nut -A- on clamp for corrugated exhaust pipe.
- Remove bolt -B- and detach exhaust silencer with corrugated exhaust pipes.



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All vehicles (continued):

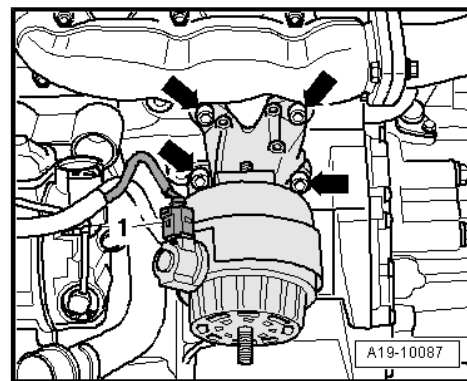
- Remove bolts -1- and -2- for anti-roll bar mounting on both sides and slightly lower anti-roll bar.
- Remove nut -3-.
- Remove bolts -1- and -2- and take off console for engine mounting (left-side).



Note

The procedure is illustrated for the console for engine mounting (right-side).

- If fitted, unplug electrical connector -1- on left electrohydraulic engine mounting solenoid valve -N144- .
- Remove bolts -arrows- and detach engine support with engine mounting.



- Remove nut -arrow- and detach engine mounting from engine support.

Installing

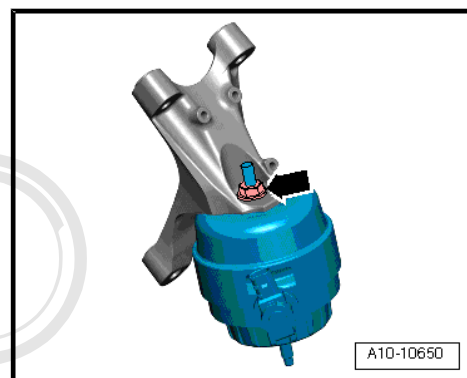
- Tightening torques → [page 95](#)

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



Note

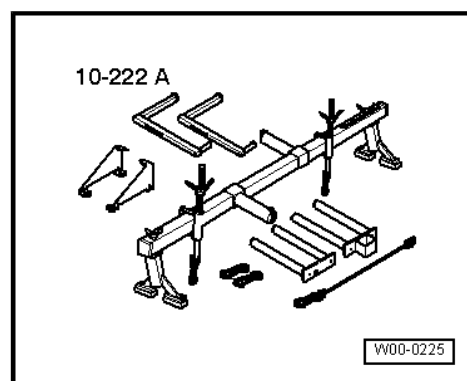
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install subframe and anti-roll bar ⇒ Rep. Gr. 40 .
- On vehicles with auxiliary heater: install exhaust silencer with corrugated exhaust pipes ⇒ Rep. Gr. 82 .



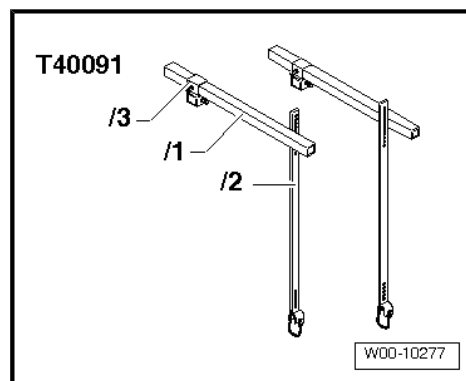
5.3 Removing and installing engine mounting (right-side)

Special tools and workshop equipment required

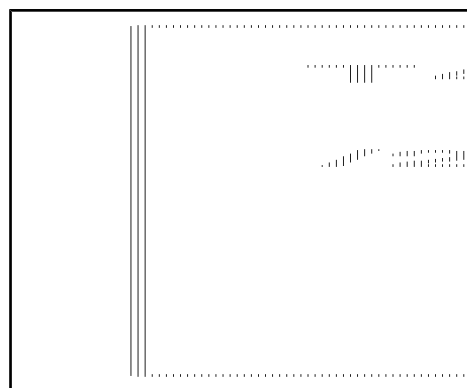
- ◆ Support bracket -10 - 222 A-



◆ Engine support bracket (basic set) -T40091-

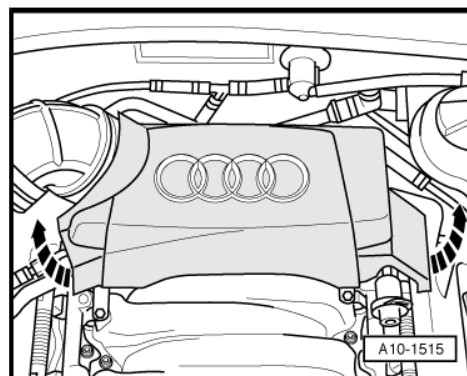


◆ Engine support bracket (supplementary set) -T40093-

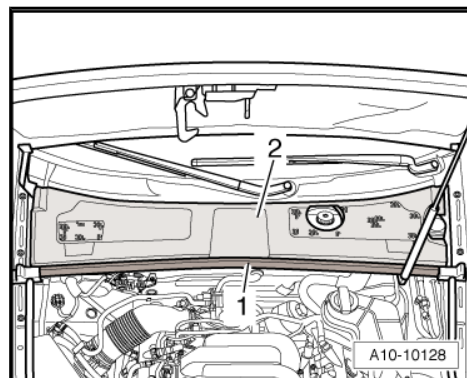


Removing

- Pull off engine cover panel (rear) -arrows-.
- Remove air cleaner housing ⇒ Rep. Gr. 24 .

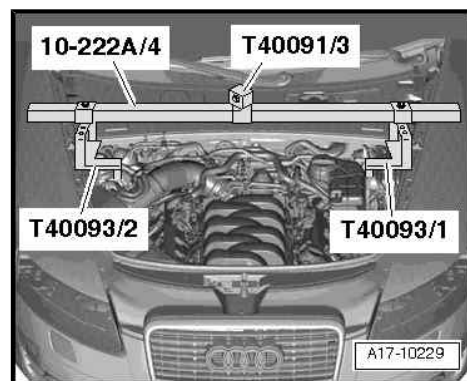


- Pull off rubber seal -1- and remove plenum chamber cover -2-.

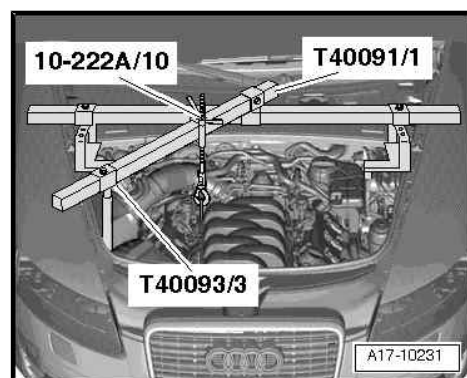


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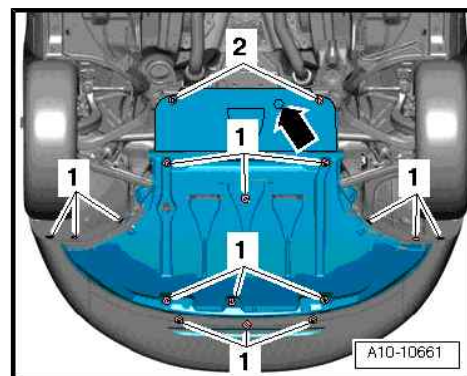
- Set up adapter -10 - 222 A /4- with connecting piece - T40091/3- and supports -T40093/1- and -T40093/2- on suspension turrets.
- Supports are marked for left and right side of vehicle.



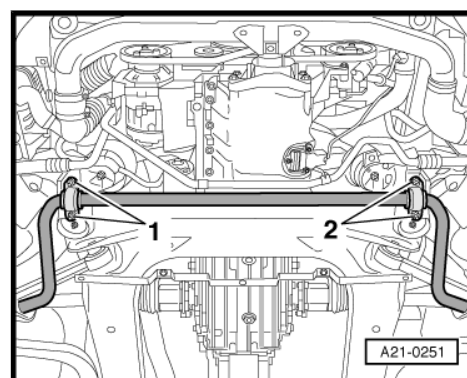
- Attach further components of support bracket -10 - 222 A- , - T40091- and -T40093- as shown in illustration. Position support -T40093/3- onto flange of longitudinal member.
- Engage hook -10 - 222 A /10- at engine lifting eye (left-side).
- Take up weight of engine with spindle.



- Remove noise insulation panels ⇒ Rep. Gr. 50 .

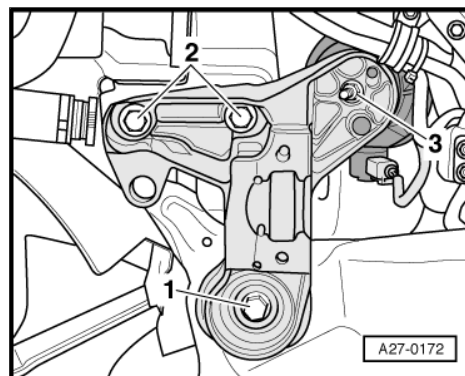


- Remove bolts -1- and -2- for anti-roll bar mounting on both sides and slightly lower anti-roll bar.

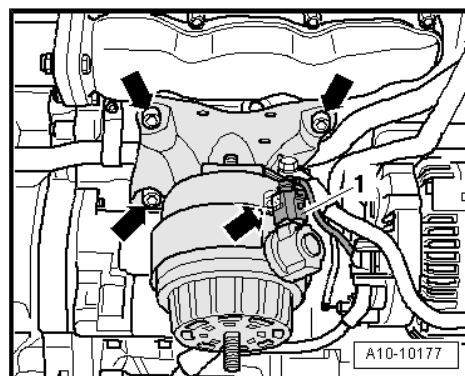


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- Remove nut -3-.
- Remove bolts -1- and -2- and take off console for engine mounting (right-side).



- Unplug electrical connector -1- on right electrohydraulic engine mounting solenoid valve -N145-.
- Remove bolts -arrows- and detach engine support with engine mounting.



- Remove nut -arrow- and detach engine mounting from engine support.

Installing

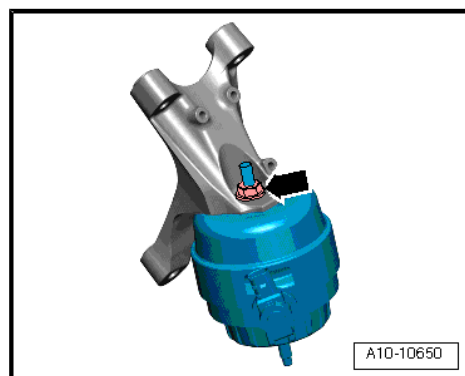
- Tightening torques ⇒ [page 95](#)

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

Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Fit all cable ties in the original positions when installing.*

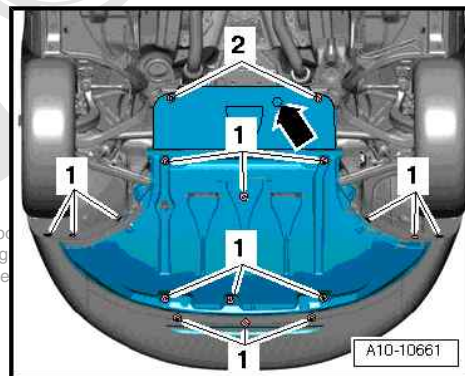
- Install subframe and anti-roll bar ⇒ Rep. Gr. 40 .
- Install air cleaner housing ⇒ Rep. Gr. 24 .



5.4 Removing and installing torque reaction support

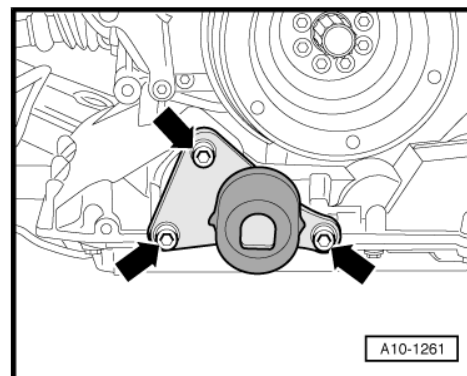
Removing

- Remove noise insulation panels ⇒ Rep. Gr. 50 .



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

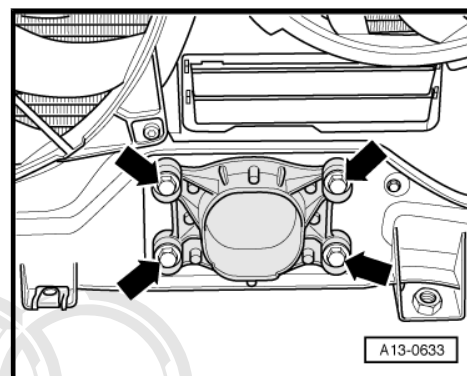


Installing

- Tightening torques ⇒ [page 95](#)

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

- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install noise insulation panels ⇒ Rep. Gr. 50 .



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13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Poly V-belt drive - exploded view

1 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Removing and installing ⇒ [page 108](#)
- ☐ When installing, make sure it is properly seated on pulleys.

2 - 20 Nm + 90° further

- ☐ Renew

3 - 22 Nm

4 - Alternator

- ☐ Removing and installing ⇒ Rep. Gr. 27

5 - Cover cap for idler roller

6 - Idler roller for poly V-belt

- ☐ Tighten to 40 Nm

7 - 20 Nm

8 - Poly V-belt pulley for coolant pump

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

9 - 9 Nm

10 - Coolant pump

- ☐ Removing and installing ⇒ [page 249](#)

11 - Cover cap for tensioner

12 - Poly V-belt tensioner

- ☐ Tighten to 40 Nm

13 - 20 Nm

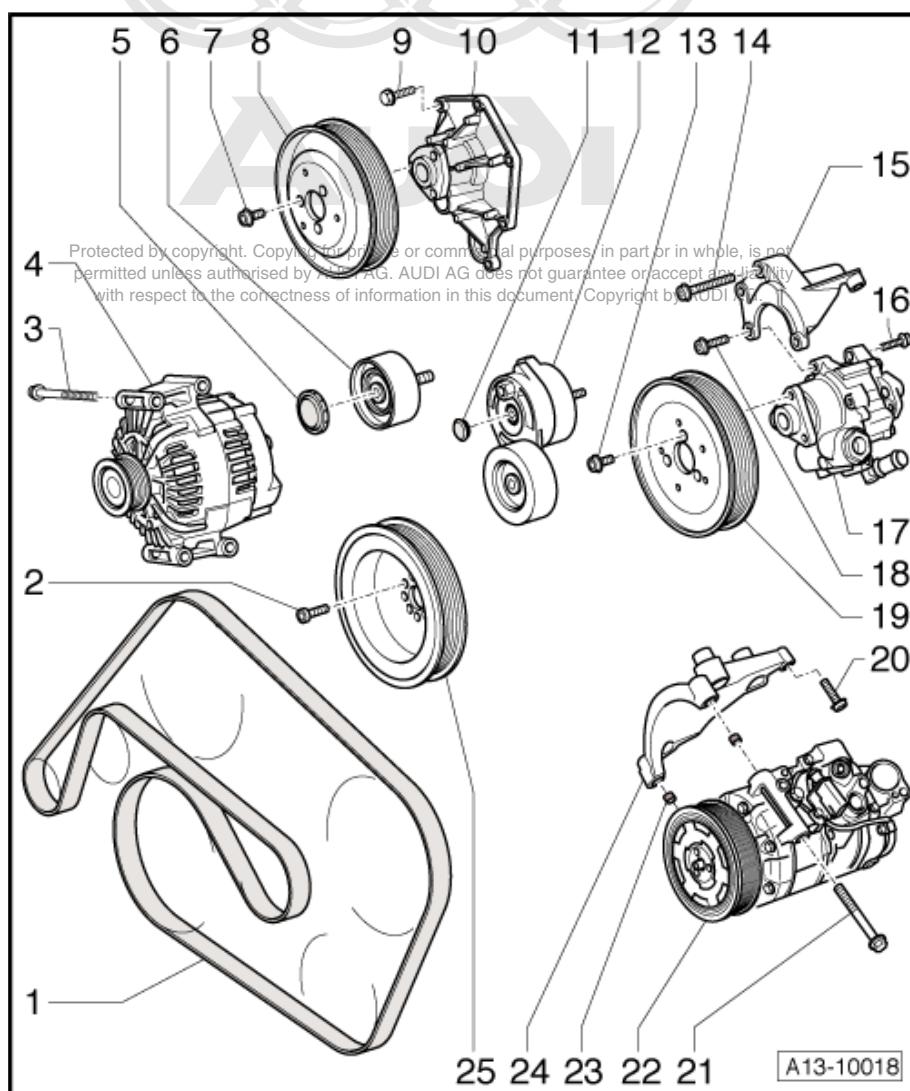
14 - 20 Nm

15 - Bracket for power steering pump

16 - 20 Nm

17 - Power steering pump

- ☐ Removing and installing ⇒ Rep. Gr. 48



18 - 20 Nm

19 - Pulley for power steering pump

- ☐ Removing and installing ⇒ [page 106](#)

20 - 20 Nm

21 - 25 Nm

22 - Air conditioner compressor

- ☐ Do not unscrew or disconnect refrigerant hoses or pipes.
- ☐ Removing and installing ⇒ Rep. Gr. 87
- ☐ Pay attention to dowel sleeves ⇒ [Item 23 \(page 105\)](#) when installing

23 - Dowel sleeve

- ☐ 2x

24 - Bracket for air conditioner compressor

- ☐ Pay attention to dowel sleeves ⇒ [Item 23 \(page 105\)](#) when installing

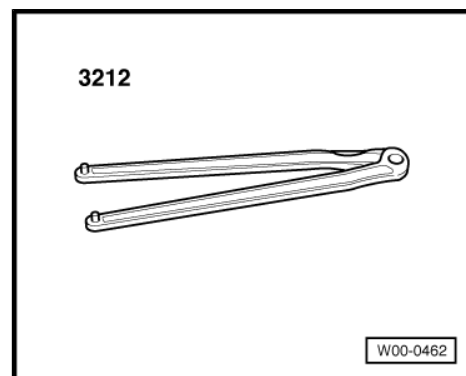
25 - Vibration damper

- ☐ With pulley for poly V-belt
- ☐ Different versions. Allocation ⇒ Electronic parts catalogue
- ☐ Removing and installing ⇒ [page 108](#)

1.2 Removing and installing coolant pump pulley

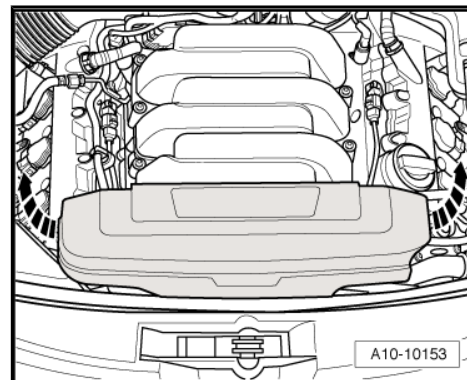
Special tools and workshop equipment required

- ◆ Pin wrench -3212-

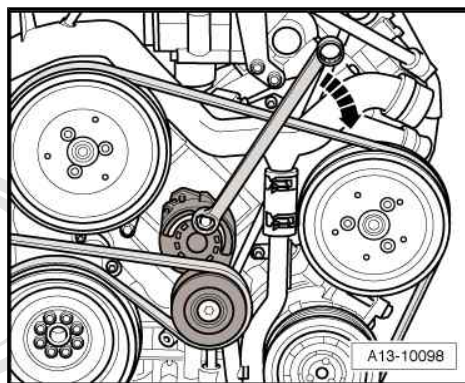


Removing

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



- To slacken poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt from coolant pump pulley.
- Release pressure from the tensioner.



- Unbolt belt pulley from coolant pump.
- Use pin wrench -3212- to counterhold pulley when loosening bolts.

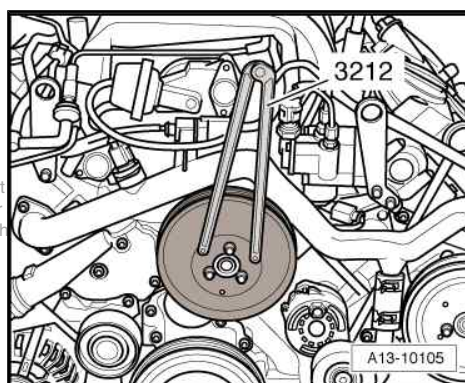
Installing

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



Note

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



- Start engine and check that belt runs properly.

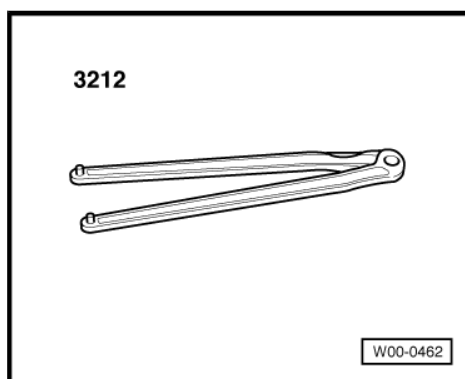
Tightening torque

Component	Nm
Poly V-belt pulley to coolant pump	20

1.3 Removing and installing power steering pump pulley

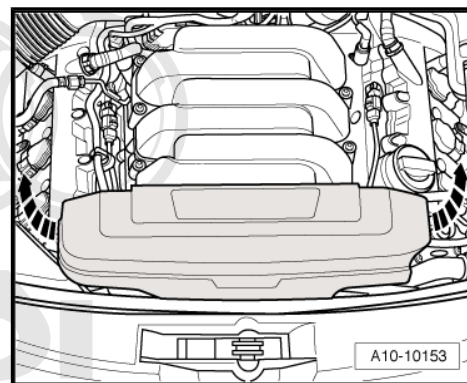
Special tools and workshop equipment required

- ♦ Pin wrench -3212-

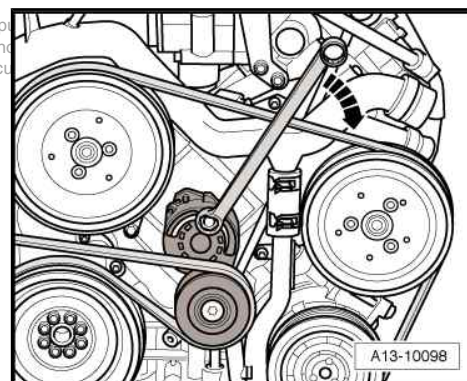


Removing

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



- To slacken poly V-belt turn tensioner in direction of arrow.
- Remove poly V-belt from power steering pump pulley.
- Release pressure from the tensioner.



- Unbolt poly V-belt pulley from power steering pump.
- Use pin wrench -3212- to counterhold pulley when loosening bolts.

Installing

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

- Installation position: marking "vorne" (front) faces in direction of travel.



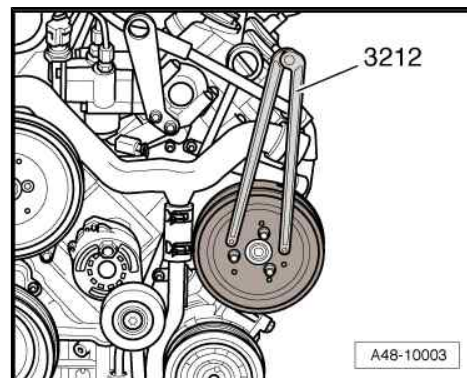
Note

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

- Start engine and check that belt runs properly.

Tightening torque

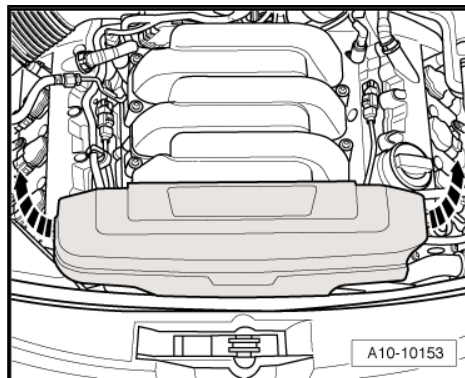
Component	Nm
Poly V-belt pulley to power steering pump	20



1.4 Removing and installing poly V-belt

Removing

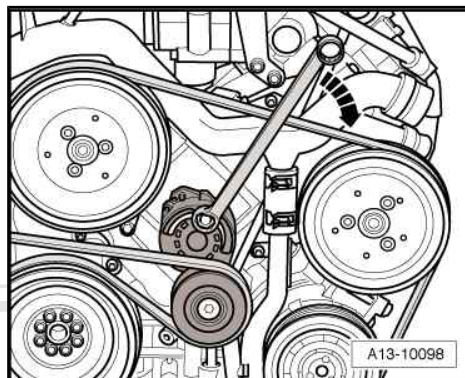
- Pull off engine cover panel (front) -arrows-.



Note

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

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

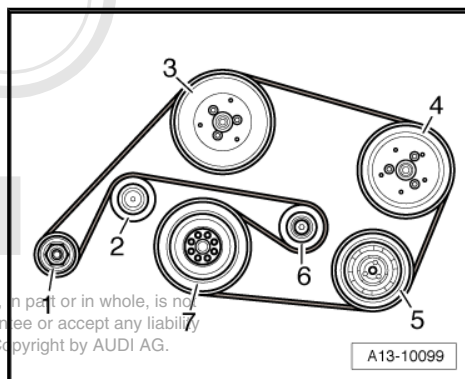


Installing

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

- Fit poly V-belt onto 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.

1.5 Removing and installing vibration damper

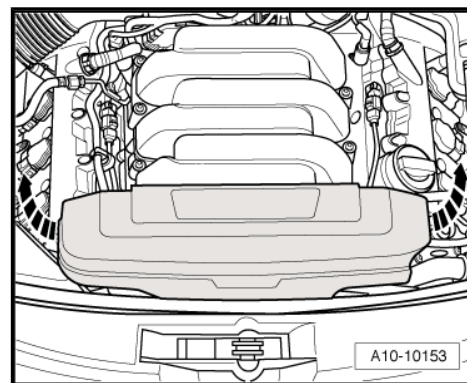


Note

Different types of vibration dampers are fitted depending on engine version; for correct allocation refer to ⇒ Electronic parts catalogue.

Removing

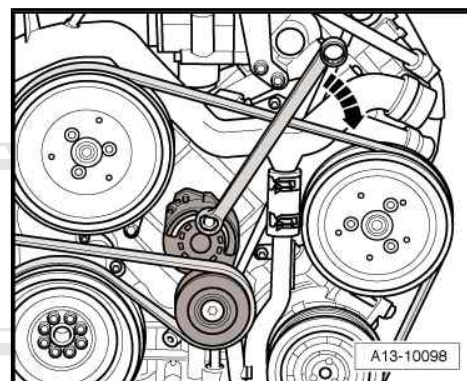
- Pull off engine cover panel (front) -arrows-.



Note

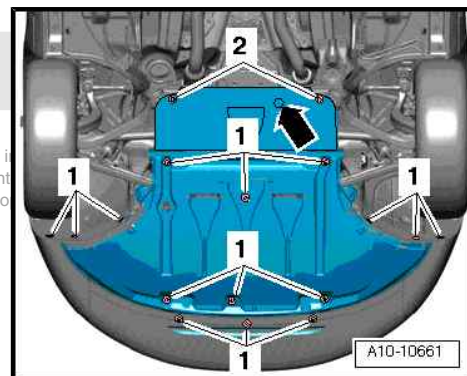
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

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



- Remove noise insulation panels ⇒ Rep. Gr. 50 .

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

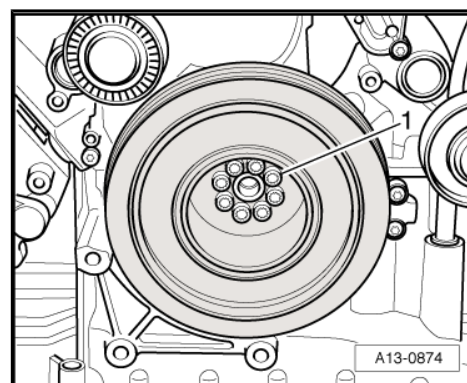
Installing

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

- Install poly V-belt ⇒ [page 108](#) .

Tightening torque

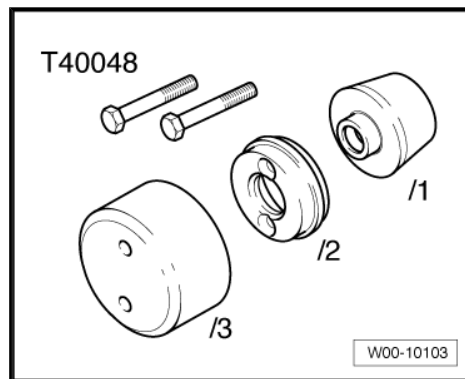
Component	Nm
Vibration damper to crankshaft	20 +90° ¹⁾
• ¹⁾ Renew bolts.	



1.6 Renewing sealing flange (pulley end) with crankshaft oil seal

Special tools and workshop equipment required

- ◆ Assembly tool -T40048-



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

Procedure

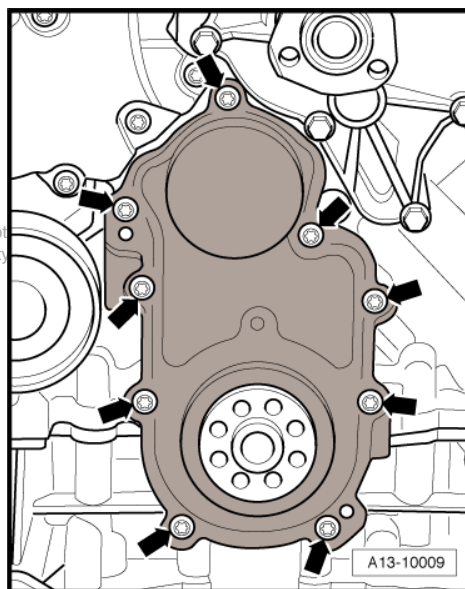
- Unbolt belt pulley from coolant pump ⇒ [page 105](#) .
- Remove vibration damper ⇒ [page 108](#) .
- Remove bolts -arrows-.
- Release sealing flange (pulley end) from bonded joint.



Note

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Renew sealing flange (pulley end).



Caution

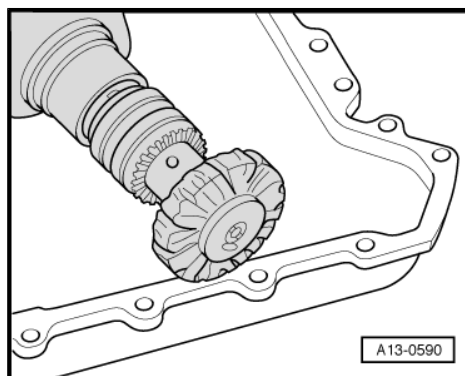
Make sure that no sealant residue gets into the engine.



WARNING

Wear safety goggles.

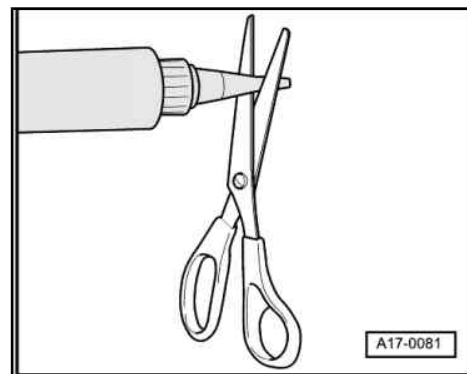
- Remove sealant residue from cylinder block and sump (top section) with rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.



**Note**

Note the use-by date of the sealant.

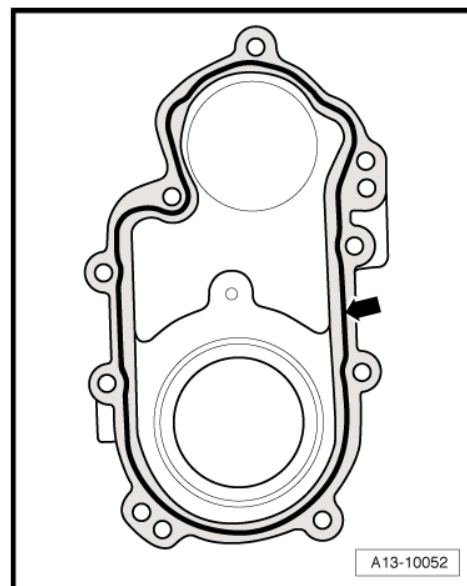
- Cut off nozzle of tube at front marking ($\varnothing$ of nozzle approx. 1.5 mm).



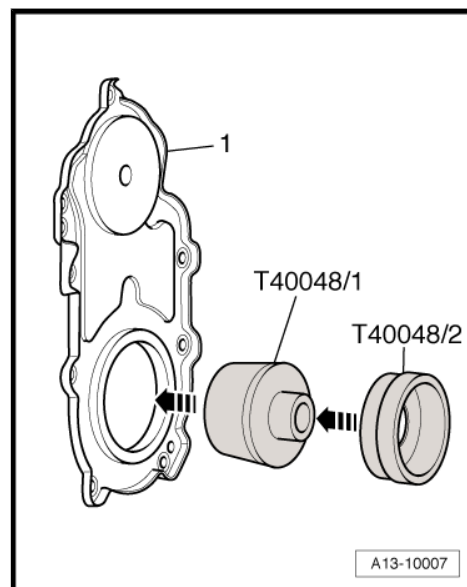
- Apply bead of sealant onto clean sealing surface of sealing flange as illustrated.
- The groove -arrow- on the sealing surface must be completely filled with sealant.
- The bead of sealant must project 1.5 ... 2.0 mm above the sealing surface.

**Note**

- ◆ *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- ◆ *The sealing flange (pulley end) must be installed within 5 minutes after applying silicone 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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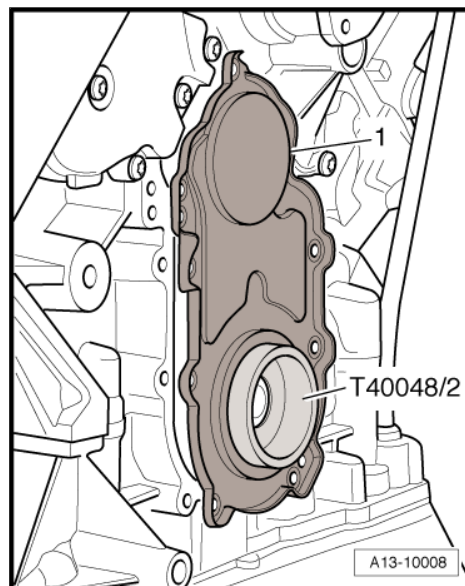
- First position sealing flange (with assembly sleeve -T40048/2- inserted) on crankshaft.
- Keep sealing flange straight while pushing it onto engine sealing surface. Then bolt on.

Perform further installation in reverse order, paying attention to the following:

- Install vibration damper ⇒ [page 108](#) .
- Install poly V-belt pulley for coolant pump ⇒ [page 105](#) .
- Install poly V-belt ⇒ [page 108](#) .

Tightening torque

Component	Nm
Sealing flange (pulley end) to cylinder block	9 ¹⁾
• ¹⁾ Tighten in stages and in diagonal sequence	



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2 Cylinder block (gearbox end)

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



Note

Servicing clutch ⇒ Rep. Gr. 30

1 - Dual-mass flywheel

- ☐ Removing and installing

⇒ [page 113](#)



2 - 60 Nm + 90° further

- ☐ Renew

3 - Needle bearing

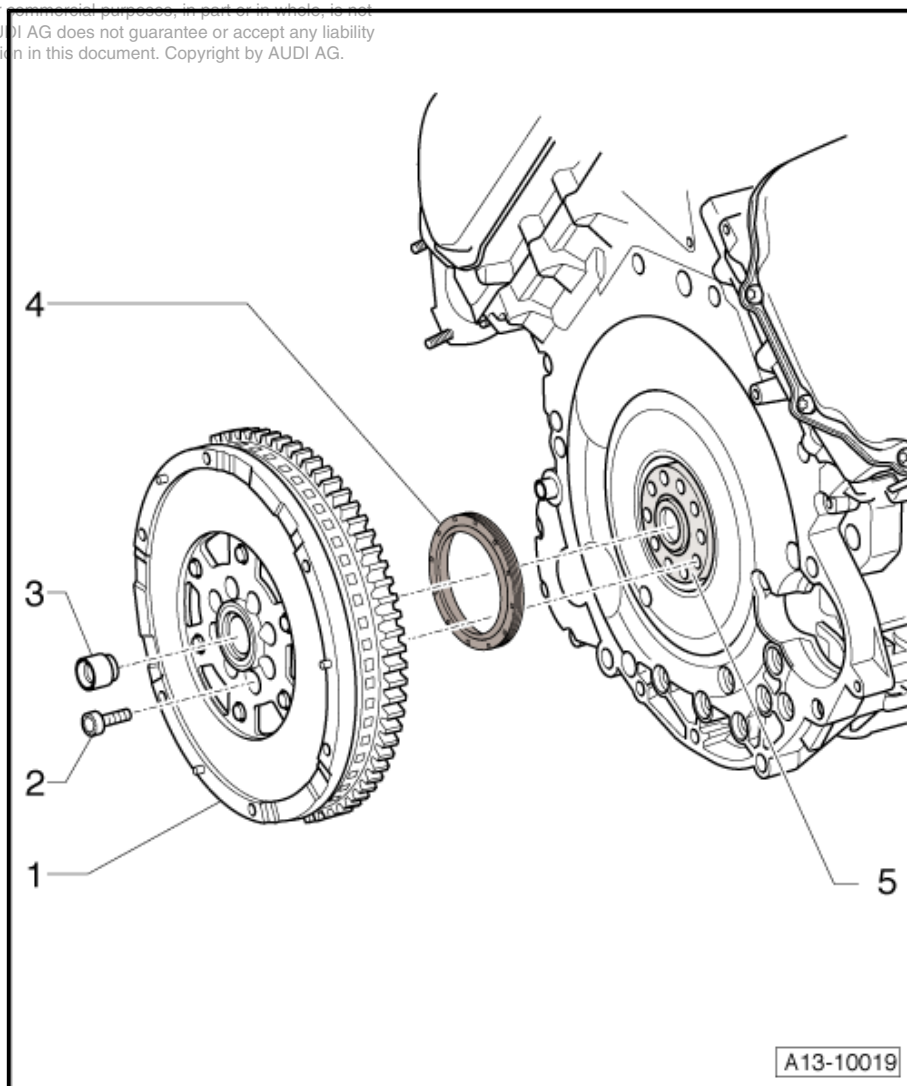
- ☐ Extracting and driving in

⇒ [page 115](#)

4 - Crankshaft oil seal (gearbox end)

- ☐ Renewing ⇒ [page 122](#)

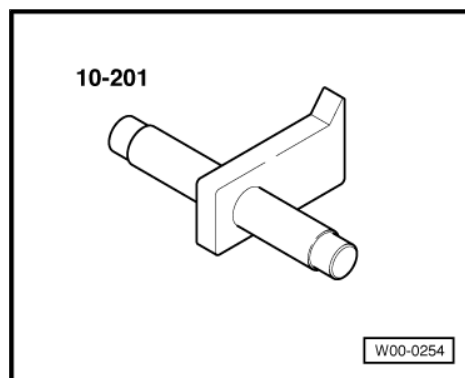
5 - Crankshaft



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

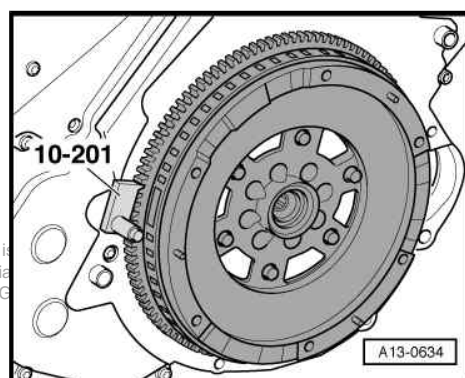
Special tools and workshop equipment required

◆ Counterhold tool -10 - 201-

**Removing**

- Gearbox removed ⇒ Rep. Gr. 34 .
- Remove clutch pressure plate ⇒ Rep. Gr. 30 .
- Mark position of dual-mass flywheel on engine.
- Insert counterhold tool -10 - 201- to slacken bolts.

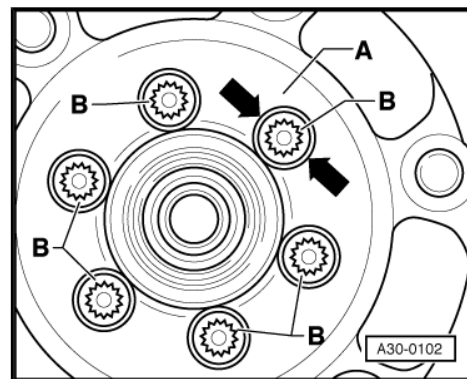
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**Note**

To prevent damage to the dual-mass flywheel when removing, the bolts -B- must not be removed with an impact wrench or similar. 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**

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

**Note**

The needle bearing is located in the flywheel and must be installed accordingly if the flywheel is renewed ⇒ [page 115](#).

- Use new securing bolts.
- Fit counterhold tool -10-201- the other way round to tighten bolts.
- Install clutch pressure plate ⇒ Rep. Gr. 30.

Tightening torque

Component	Nm
Flywheel to crankshaft	60 + 90° ¹⁾
• ¹⁾ Renew bolts.	

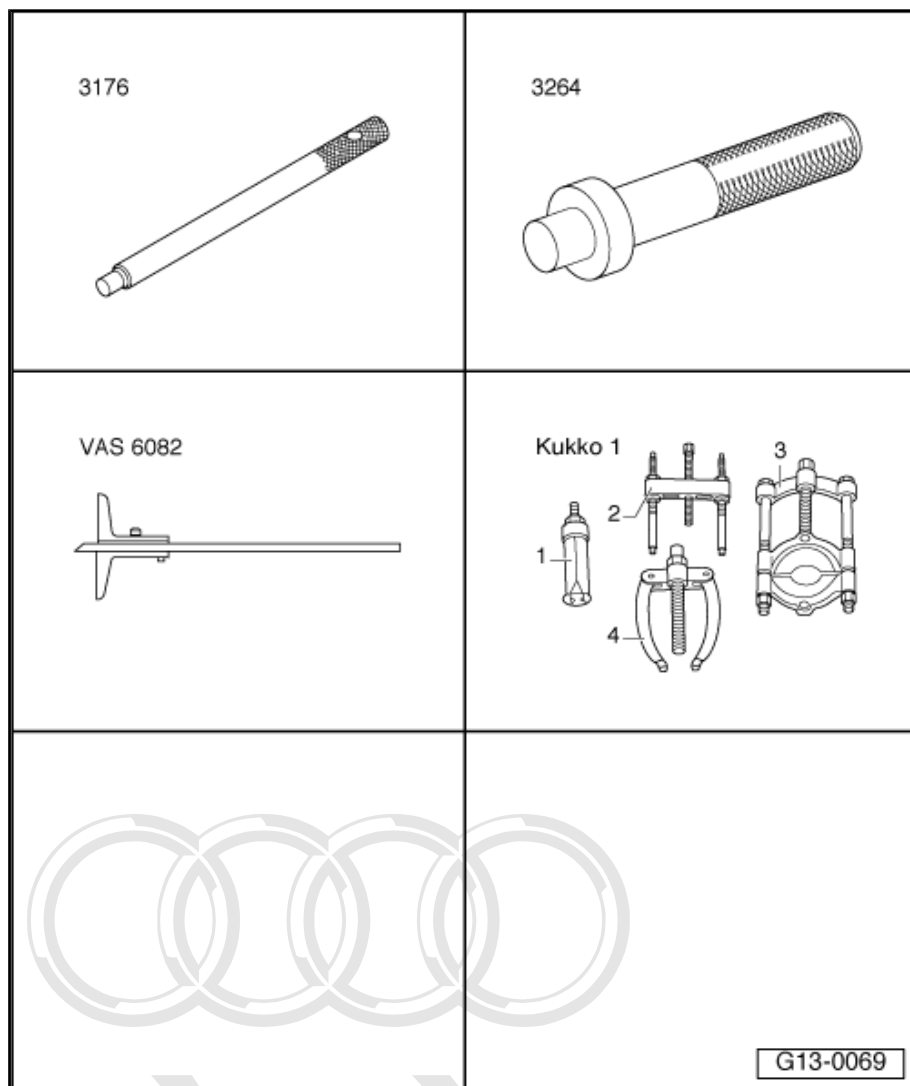
2.3 Extracting and driving in needle bearing for dual-mass flywheel - vehicles with manual gearbox



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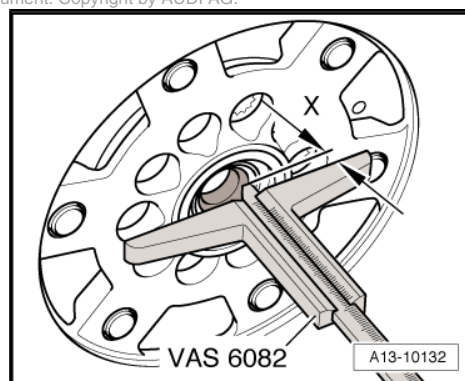
Special tools and workshop equipment required

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



Procedure

- Gearbox removed ⇒ 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.



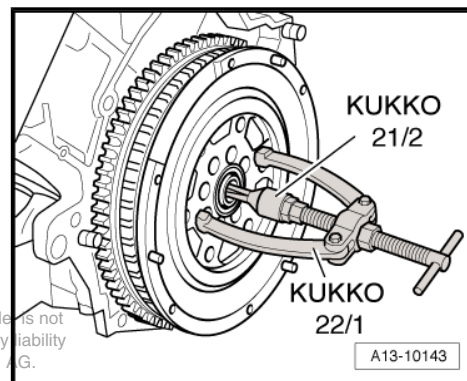
- Remove needle bearing using internal puller -Kukko 21/2- and counter-support -Kukko 22/1- .



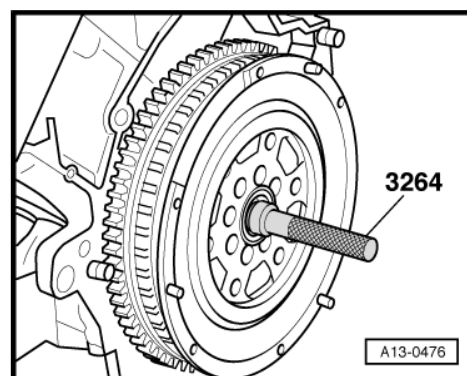
Note

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

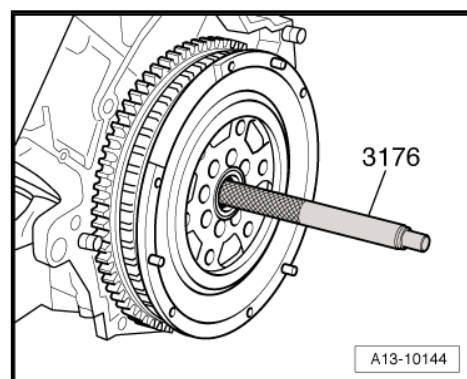
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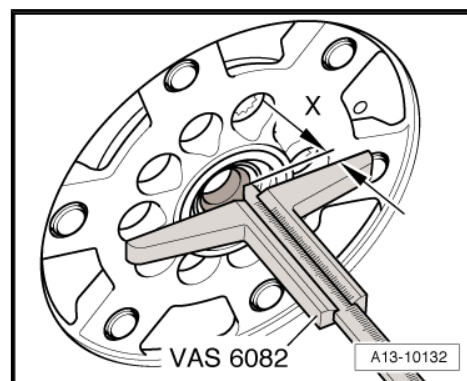
- Drive needle bearing into dual-mass flywheel using punch -3264- .



- 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 .



2.4 Flywheel for vehicles with multitronic gearbox - exploded view

1 - Damper unit

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

2 - 22 Nm

3 - Flywheel

- ☐ Removing and installing
⇒ [page 119](#)

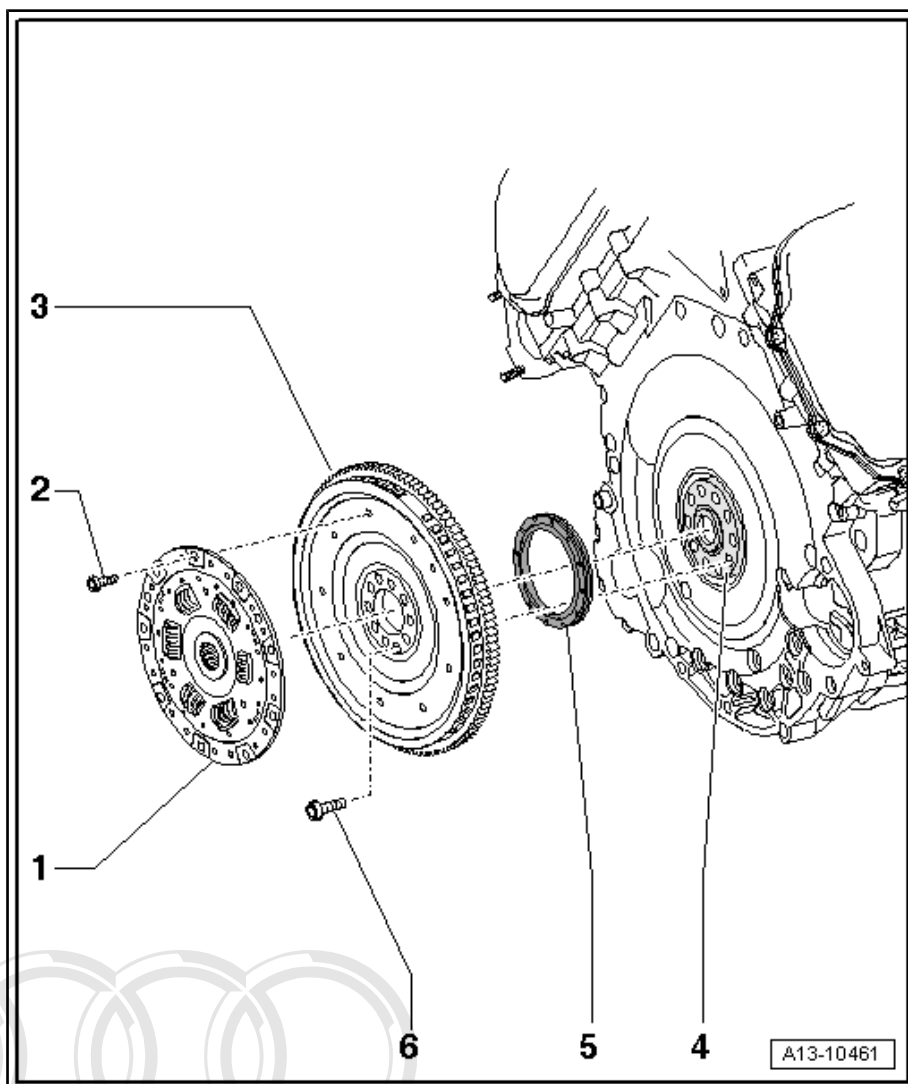
4 - Crankshaft

5 - Crankshaft oil seal (gearbox end)

- ☐ Renewing ⇒ [page 122](#)

6 - 60 Nm + 90° further

- ☐ Renew

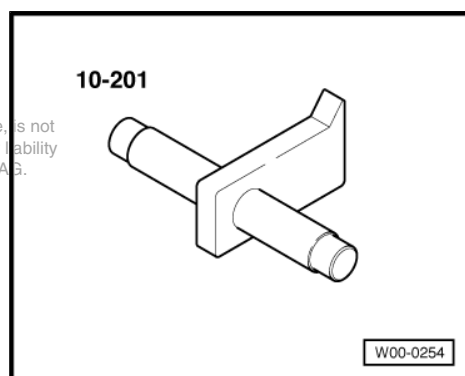


2.5 Removing and installing damper unit

Special tools and workshop equipment required

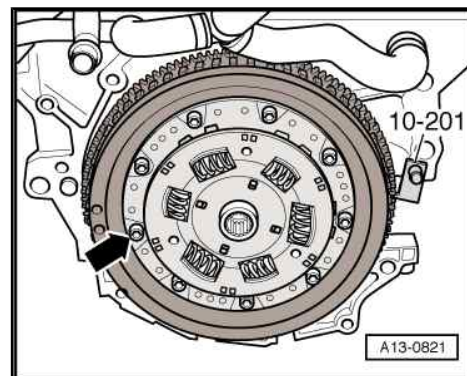
- ◆ Counterhold tool -10 - 201-

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Removing

- Gearbox removed $\Rightarrow$ 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

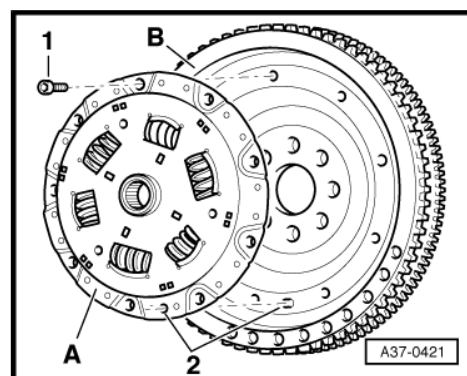
Installation is carried out in the reverse order; note the following:



Note

The part number of the damper unit is assigned to the gearbox code letters; for correct allocation refer to $\Rightarrow$ 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.



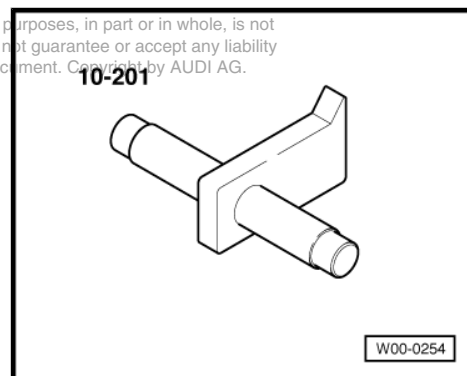
Tightening torque

Component	Nm
Damper unit to flywheel	22

2.6 Removing and installing flywheel - vehicles with multitronic gearbox

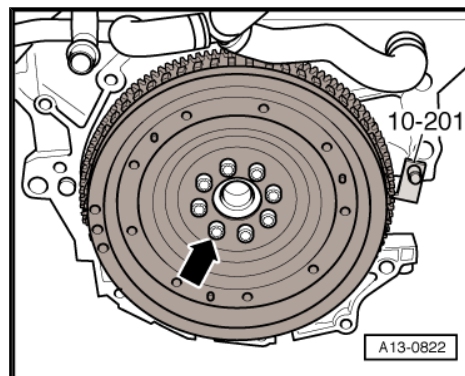
Special tools and workshop equipment required

- ◆ Counterhold tool -10 - 201- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



Removing

- Gearbox removed ⇒ Rep. Gr. 37 .
- Remove damper unit ⇒ [page 118](#) .
- 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

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 118](#) .

Tightening torque

Component	Nm
Flywheel to crankshaft	60 + 90° 1)
• 1) Renew bolts.	

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2.7 Drive plate on vehicles with automatic gearbox 09L - exploded view

1 - Drive plate

- ☐ Removing and installing
⇒ [page 121](#)

2 - Washer**3 - 60 Nm + 90° further**

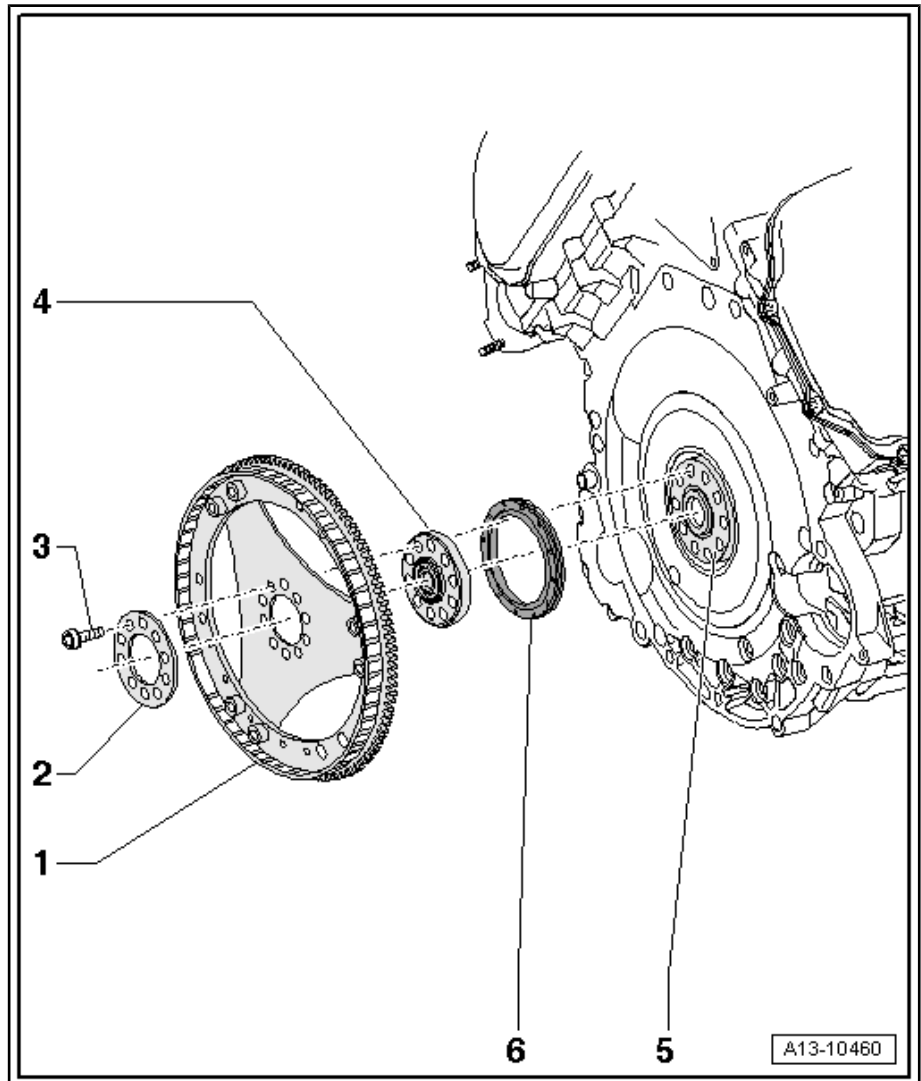
- ☐ Renew

4 - Centralising disc

- ☐ Installation position
⇒ [page 122](#)

5 - Crankshaft**6 - Crankshaft oil seal (gearbox end)**

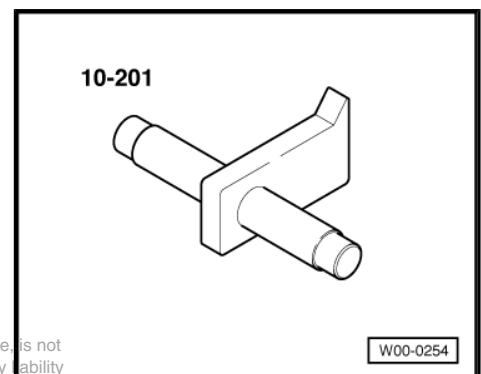
- ☐ Renewing ⇒ [page 122](#)



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

Special tools and workshop equipment required

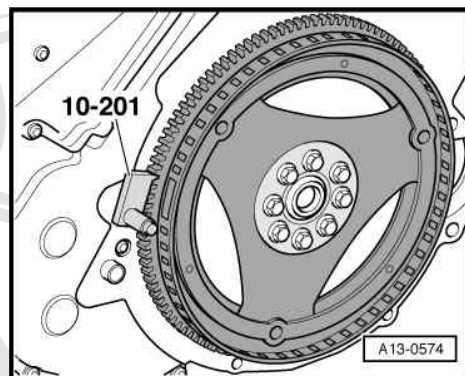
- ◆ Counterhold tool -10 - 201-



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Removing

- Gearbox removed ⇒ Rep. Gr. 37 .
- Insert counterhold tool -10 - 201- to slacken bolts.
- Mark installation position of drive plate on engine.
- Unbolt drive plate.
- Take out centralising disc located behind.



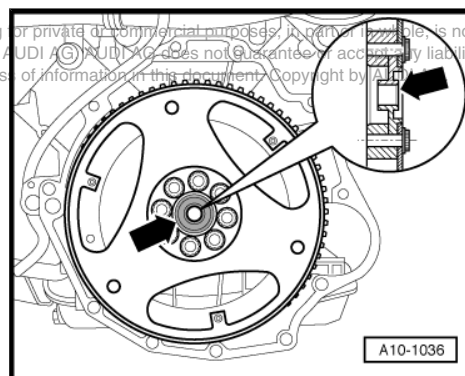
Installing

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

- Install drive plate with centralising disc -arrow- and washer.
- Use new securing bolts.
- Reverse position of counterhold tool -10-201- in order to tighten bolts.

Tightening torque

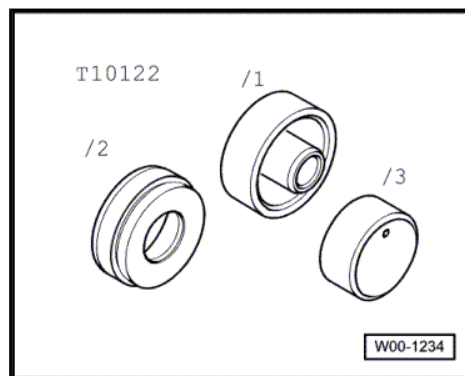
Component	Nm
Drive plate to crankshaft	60 + 90° 1)
• 1) Renew bolts.	



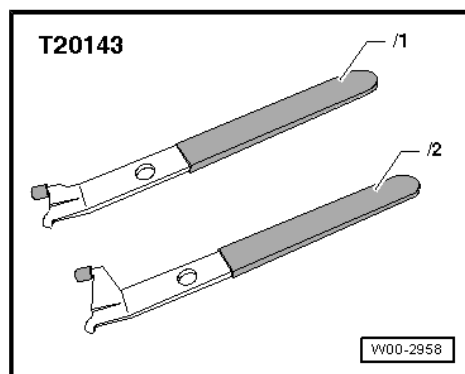
2.9 Renewing crankshaft oil seal (gearbox end)

Special tools and workshop equipment required

- ◆ Fitting tool -T10122-

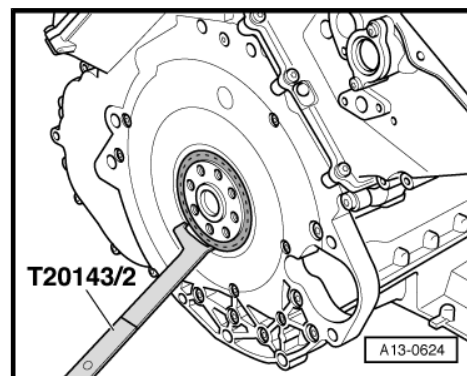


- ◆ Oil seal extractor lever -T20143/2-

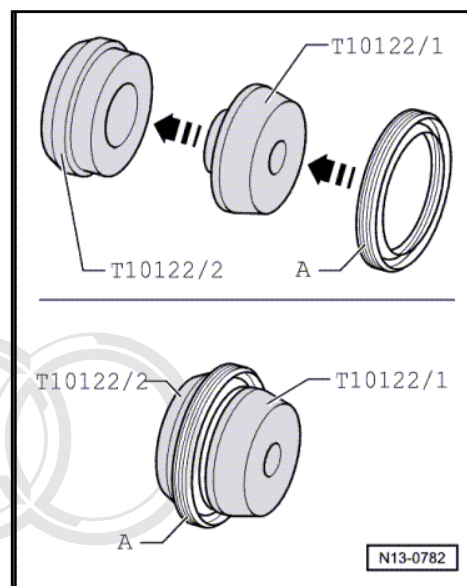


Procedure

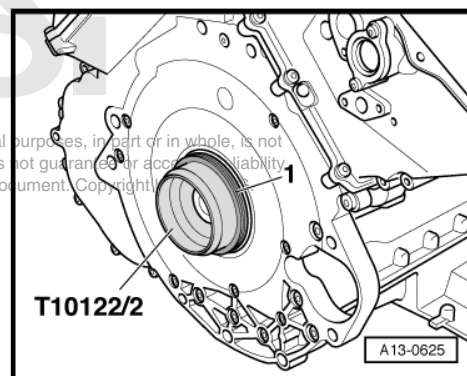
- Gearbox removed ⇒ Rep. Gr. 34 or ⇒ Rep. Gr. 37 .
- Vehicles with manual gearbox: remove clutch pressure plate
⇒ Rep. Gr. 30 and dual-mass flywheel ⇒ [page 113](#) .
- Vehicles with multitronic gearbox: Remove damper unit
⇒ [page 118](#) and flywheel ⇒ [page 119](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate
⇒ [page 121](#) .
- Pry out oil seal using oil seal extractor lever -T20143/2- .
- Clean running surface and sealing surface.



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



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

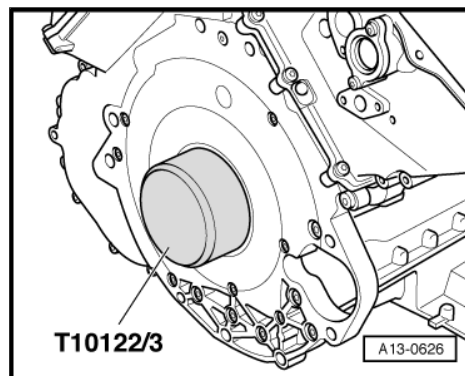


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- Press in oil seal uniformly until flush all round using press sleeve -T10122/3- .

Perform further installation in reverse order, paying attention to the following:

- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 113](#) and pressure plate ⇒ Rep. Gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 119](#) and damper unit ⇒ [page 118](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 121](#) .



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3 Crankshaft



Note

When performing assembly work, secure engine to engine and gearbox support - VAS 6095- [⇒ page 93](#).

3.1 Crankshaft - exploded view

1 - 9 Nm

- ☐ Tighten in stages and in diagonal sequence

2 - Sealing flange (pulley end)

- ☐ Removing and installing [⇒ page 109](#)

3 - Seals

- ☐ Different versions available [⇒ Electronic parts catalogue](#)
- ☐ Renew

4 - Crankshaft

- ☐ Measuring axial clearance [⇒ page 129](#)
- ☐ Measuring radial clearance [⇒ page 130](#)
- ☐ Do not rotate the crankshaft when checking the radial clearance
- ☐ Crankshaft dimensions [⇒ page 129](#)

5 - Dowel sleeve

- ☐ Inserting in retaining frame [⇒ page 127](#)

6 - Retaining frame

- ☐ To remove, detach guide rail [⇒ Item 26 \(page 161\)](#) for drive chain for valve gear
- ☐ Applying sealant [⇒ page 127](#)
- ☐ Tightening sequence for securing bolts [⇒ page 127](#)

7 - Bolt

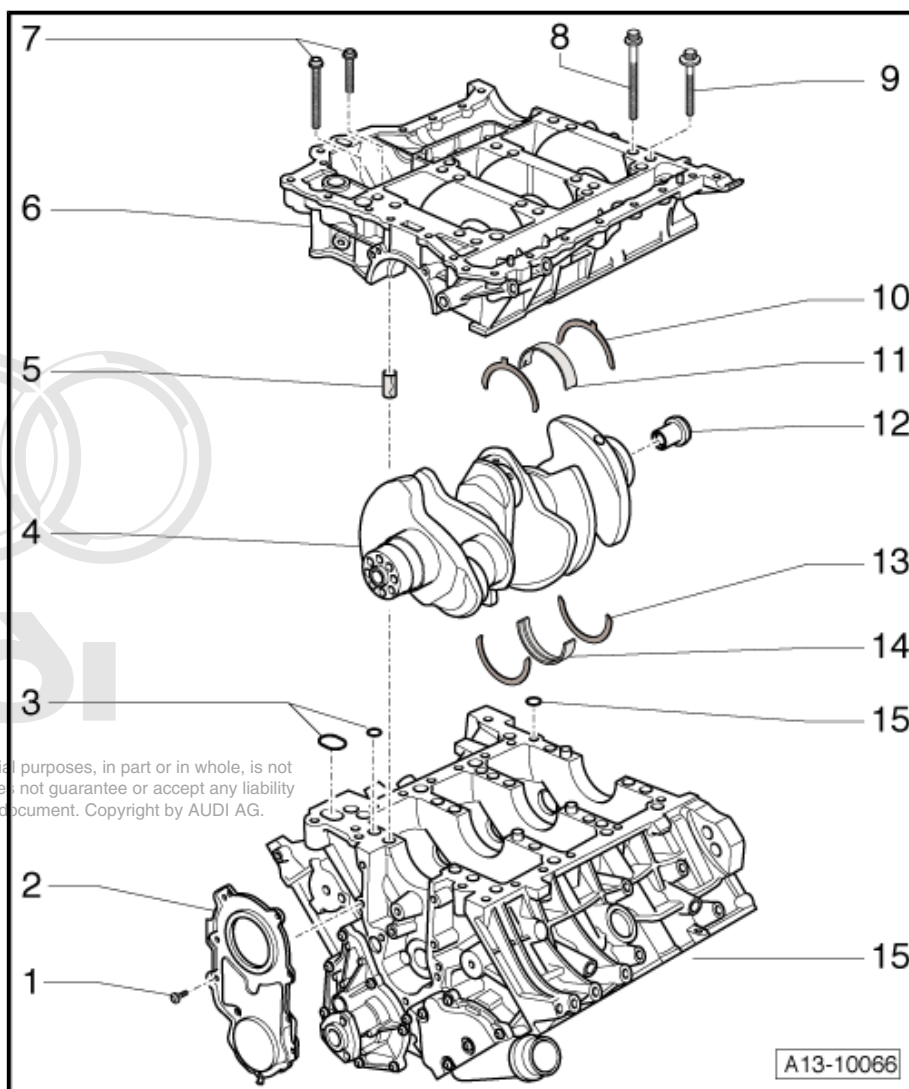
- ☐ For sealing surfaces: cylinder block/retaining frame
- ☐ Differing bolt lengths and bolt heads
- ☐ Tightening sequence [⇒ page 127](#)

8 - Bolt (long, large collar)

- ☐ For retaining frame (inner row)
- ☐ Tightening sequence [⇒ page 127](#)

9 - Bolt (short, small collar)

- ☐ For retaining frame (outer row)



- ☐ Tightening sequence ⇒ [page 127](#)

10 - 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 129](#)

11 - Bearing shell

- ☐ For retaining frame (without oil groove)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed
- ☐ Note installation position
- ☐ Install new bearing shells for retaining frame with correct coloured markings ⇒ [page 129](#)

12 - Centralising disc

- ☐ For vehicles with automatic gearbox 09L ⇒ [page 126](#)

13 - 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 129](#)

14 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed
- ☐ Note installation position
- ☐ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ [page 128](#)

15 - O-ring or seal

- ☐ Depending on version ⇒ Electronic parts catalogue
- ☐ Renew

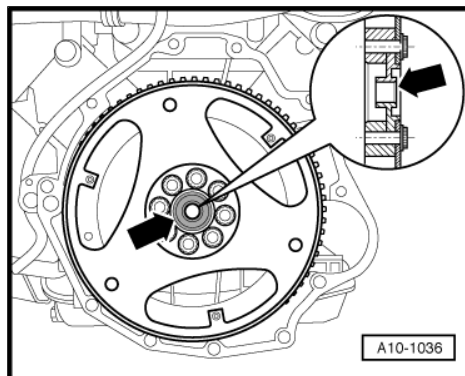
16 - Cylinder block

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-.



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Applying sealant to retaining frame, position of dowel sleeves

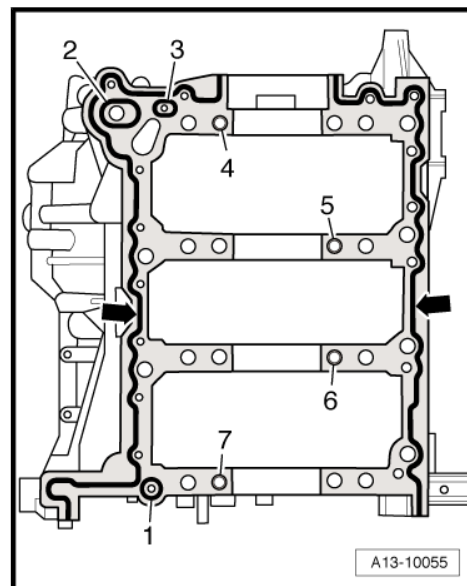
- Clean sealing surfaces, they must be free of oil and grease at top and bottom.
- Apply the beads of sealant -arrows- onto the clean sealing surfaces of the retaining frame as illustrated.
- The groove on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 ... 2.0 mm above the sealing surface.
- Fit seals -1 ... 3-.



Note

On some versions the seals -2- and -3- are connected together.

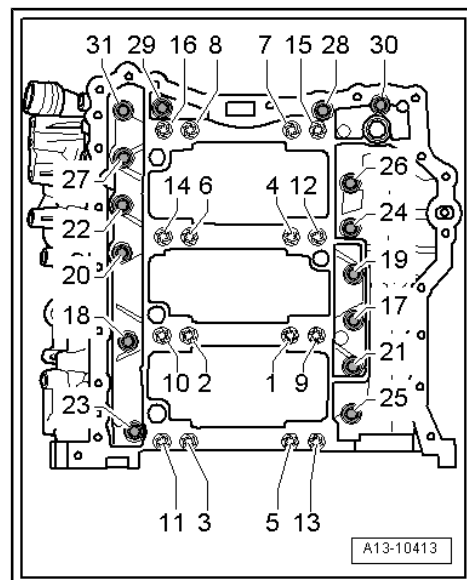
- Check that dowel sleeves -4 ... 7- are inserted in retaining frame at positions shown in illustration.



Installing retaining frame

- Renew bolts -1 ... 16- for retaining frame.
- Install long bolts in inner row on retaining frame.
- Tighten bolts in 3 stages in the sequence shown:

Stage	Bolts	Tightening torque/tightening angle
1.	-1 ... 16-	50 Nm
2.	-1 ... 16-	turn 90° further
3.	-17 ... 31-	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.

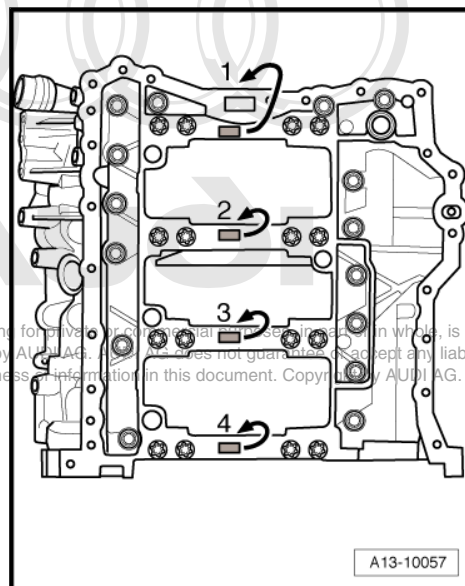
To engine No. AUK 028 000 or BKH 033 000:

For engines up to engine number AUK 028 000 or BKH 033 000, please note that on bearing No. 1 (front) the code letters on the retaining frame and the corresponding colour codes for the bearing shells are not the same as for the other bearings:

Bearing No.	Code letter on retaining frame	Colour coding of bearing
1	G =	Red
	B =	Yellow
	S =	Blue
2 ... 4	G =	Yellow
	B =	Blue
	S =	Black

From engine No. AUK 028 001 or BKH 033 001:

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



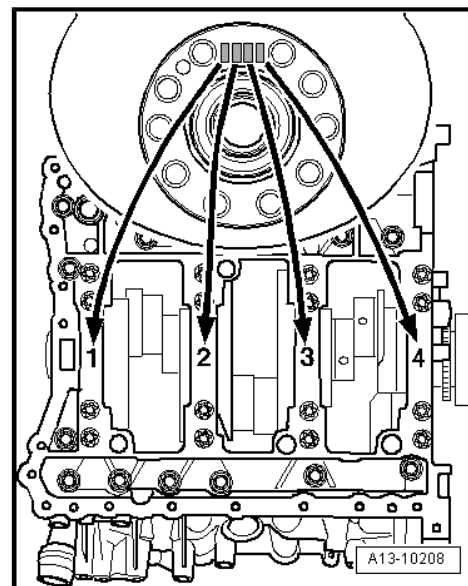
Matching crankshaft bearing shells to bearings in retaining frame

- ◆ 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.

To engine No. AUK 028 000 or BKH 033 000:

For engines up to engine number AUK 028 000 or BKH 033 000, please note that on bearing No. 1 (front) the code letters on the crankshaft and the corresponding colour codes for the bearing shells are not the same as for the other bearings:

Bearing No.	Letter on crankshaft	Colour coding of bearing
1	G =	Red
	B =	Yellow
	S =	Blue
2 ... 4	G =	Yellow
	B =	Blue
	S =	Black

**From engine No. AUK 028 001 or BKH 033 001:**

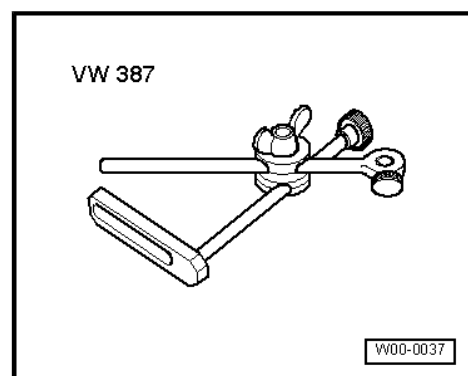
Letter on crankshaft	Colour coding of bearing
R =	Red
G =	Yellow
B =	Blue
S =	Black

3.2 Crankshaft dimensions

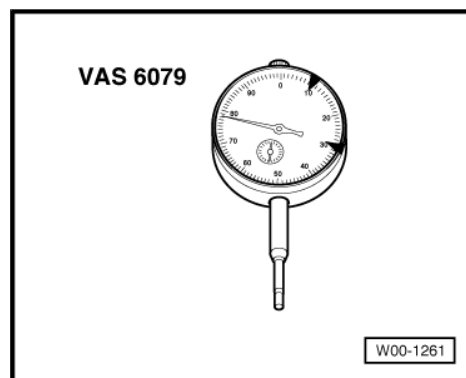
Honing dimension	Crankshaft main bearing journal Ø mm	Crankshaft conrod journal Ø mm
Basic dimension	65.00 – 0.022 – 0.042	56.00 – 0.022 – 0.042

3.3 Measuring axial clearance**Special tools and workshop equipment required**

- ◆ Universal dial gauge bracket -VW 387-

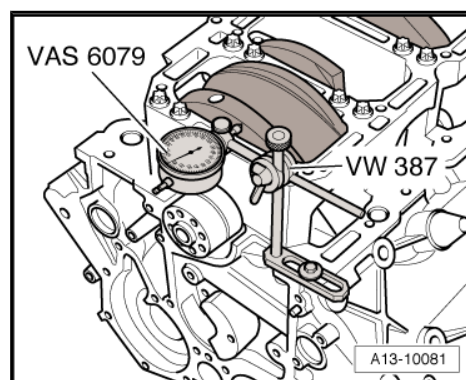


◆ Dial gauge -VAS 6079-



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



3.4 Measuring radial clearance

Special tools and workshop equipment required

- ◆ Plastigage

Procedure



Note

- ◆ *Mark used bearing shells for re-installation, but not on bearing surface.*
- ◆ *Bearing shells worn down to the base layer 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 to 30 Nm. Do not rotate crankshaft.
- Remove retaining frame once more.
- Compare width of Plastigage with measurement scale:
- Radial clearance (new): 0.015 ... 0.055 mm.
- Radial clearance (wear limit): 0.08 mm.

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4 Pistons and conrods



Note

Oil spray jet for piston cooling ⇒ [page 134](#).

4.1 Pistons and conrods - exploded view

1 - 30 Nm + 90° further

- ☐ Renew
- ☐ Lubricate threads and contact surface

2 - Conrod bearing cap

- ☐ Do not interchange
- ☐ Mark cylinder allocation with a coloured pen -B- ⇒ [page 133](#)
- ☐ 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 134](#)

3 - Bearing shell

Different types may be fitted, depending on version:

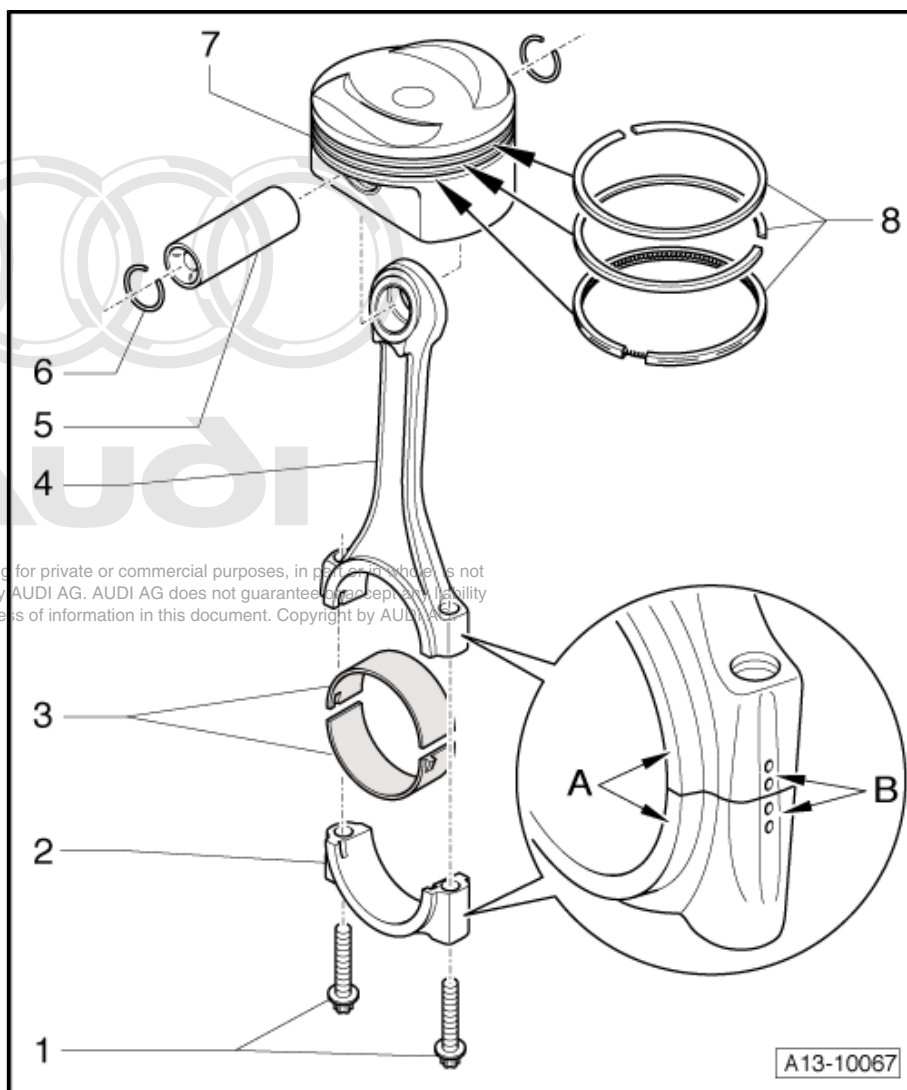
- ☐ Lower bearing shell (for bearing cap); identification: shell is a dark colour. Upper bearing shell (for conrod): more wear-resistant material; identification: shell is a light colour.

Or

- ☐ Bearing shells are the same: no special identification
- ☐ Ensure that retaining lugs are securely seated.
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed

4 - Conrod

- ☐ Only renew as a complete set
- ☐ Mark cylinder allocation in colour -B- ⇒ [page 133](#)
- ☐ 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 134](#)
- ☐ Measuring radial clearance ⇒ [page 134](#)



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 133](#)
- ☐ Arrow on piston crown points to pulley end
- ☐ Checking ⇒ [page 133](#)
- ☐ Install using piston ring clamp
- ☐ Piston and cylinder dimensions ⇒ [page 134](#)
- ☐ Checking cylinder bore ⇒ [page 133](#)

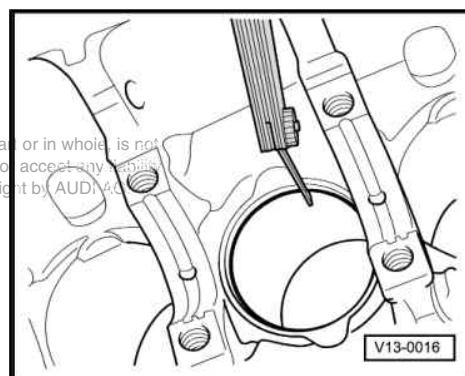
8 - Piston rings

- ☐ 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 132](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 132](#)

Checking piston ring gap

- Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. Use a piston without rings to push ring into bore.

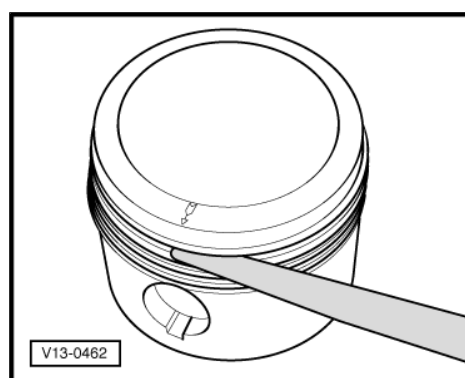
Piston ring	new mm	Wear limit mm
1st compression ring	0.20 ... 0.35	0.8
2nd compression ring	0.50 ... 0.70	1.0
Oil scraper ring	0.20 ... 0.40	0.8



Checking ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
Compression rings	0.02 ... 0.08	0.20
Oil scraper ring	0.02 ... 0.08	0.15

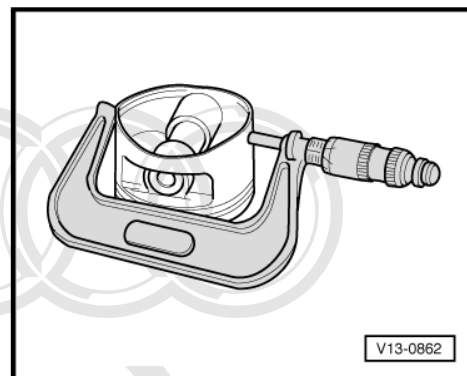


Checking piston

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

Nominal dimension

⇒ "4.2 Piston and cylinder dimensions", page 134 .

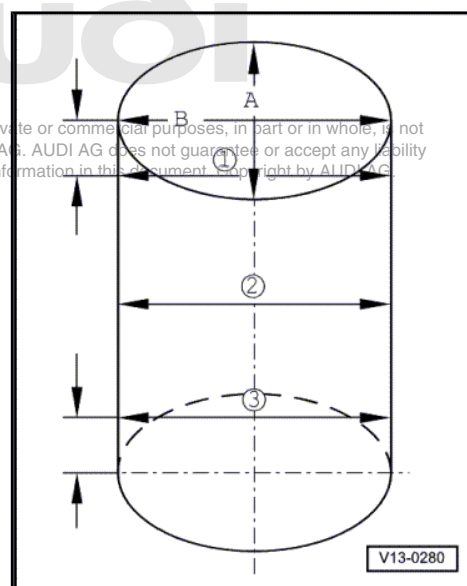


Checking cylinder bore

- 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

⇒ "4.2 Piston and cylinder dimensions", page 134 .



Piston installation position and piston/cylinder allocation

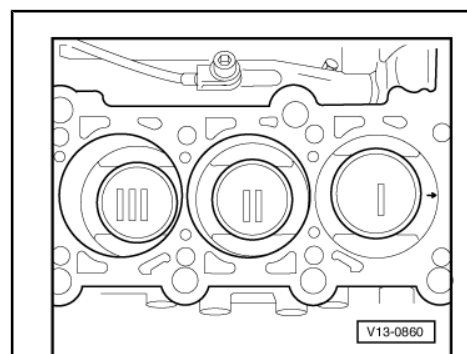
- Use chalk or waterproof felt-tip pen to mark installation position and cylinder allocation on piston crown.



Note

Do not use a centre punch or scribe, as this would damage the coating of the piston crown.

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

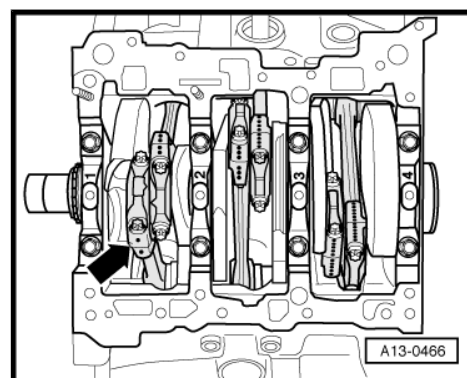


Marking conrods



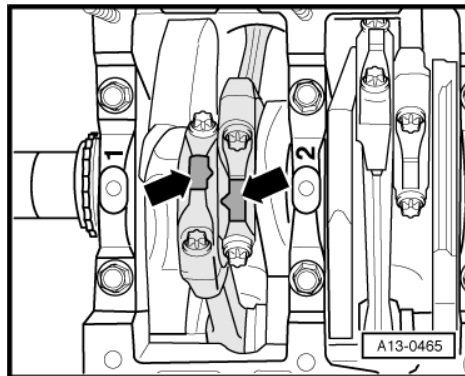
Note

- ◆ Only renew conrods as a complete set.
- ◆ Do not interchange conrod bearings.
- Prior to removal, use a coloured pen to mark conrod and conrod bearing cap relative to one another, as well as to cylinder -arrow-.



Conrod installation position

- The cast lugs -arrows- at ground surfaces of conrod pairs 1 and 2, 3 and 4, and 5 and 6 must face one another.



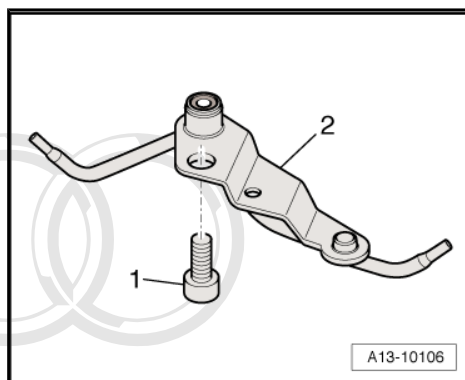
Oil spray jet for piston cooling

- Apply locking fluid when installing bolt (tightening torque 9 Nm); refer to ⇒ Electronic parts catalogue
- Oil spray jet with spray nozzle valve



Caution

- Do not bend oil spray jets.
- Always renew bent oil spray jets.



4.2 Piston and cylinder dimensions

Honing dimension (in mm)	Piston Ø	Cylinder bore Ø
Basic dimension	84.49 ¹⁾	84.51

- ¹⁾ Dimensions including coating (thickness 0.02 mm). The coating will wear down in service.

4.3 Checking radial clearance of conrod bearings

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 to 30 Nm. Do not rotate crankshaft.
- Remove conrod bearing caps once more.
- Compare width of Plastigage with measurement scale:
 - Radial clearance (new): 0.010 ... 0.052 mm
 - Radial clearance: wear limit: 0.12 mm
- Renew bolts for conrod bearings.

15 – Cylinder head, valve gear

1 Chain drive

1.1 Timing chain covers - exploded view

1 - M6: 9 Nm; M8: 20 Nm

- ☐ Observe tightening sequence: vehicles up to 04.2005 ⇒ [page 145](#), vehicles from 05.2005 ⇒ [page 147](#)

2 - Crankshaft oil seal (gearbox end)

- ☐ Renewing ⇒ [page 122](#)

3 - Dowel sleeve

- ☐ 2x

4 - Timing chain cover (bottom)

- ☐ Removing and installing ⇒ [page 139](#)

5 - Cylinder head gasket (left-side)

6 - 5 Nm + 90° further

- ☐ Renew
- ☐ Note correct sequence when tightening ⇒ [page 139](#)

7 - Timing chain cover (left-side)

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

8 - 16 Nm

- ☐ For vehicles from 05.2005

9 - 5 Nm + 90° further

- ☐ Renew
- ☐ Note correct sequence when tightening ⇒ [page 139](#)

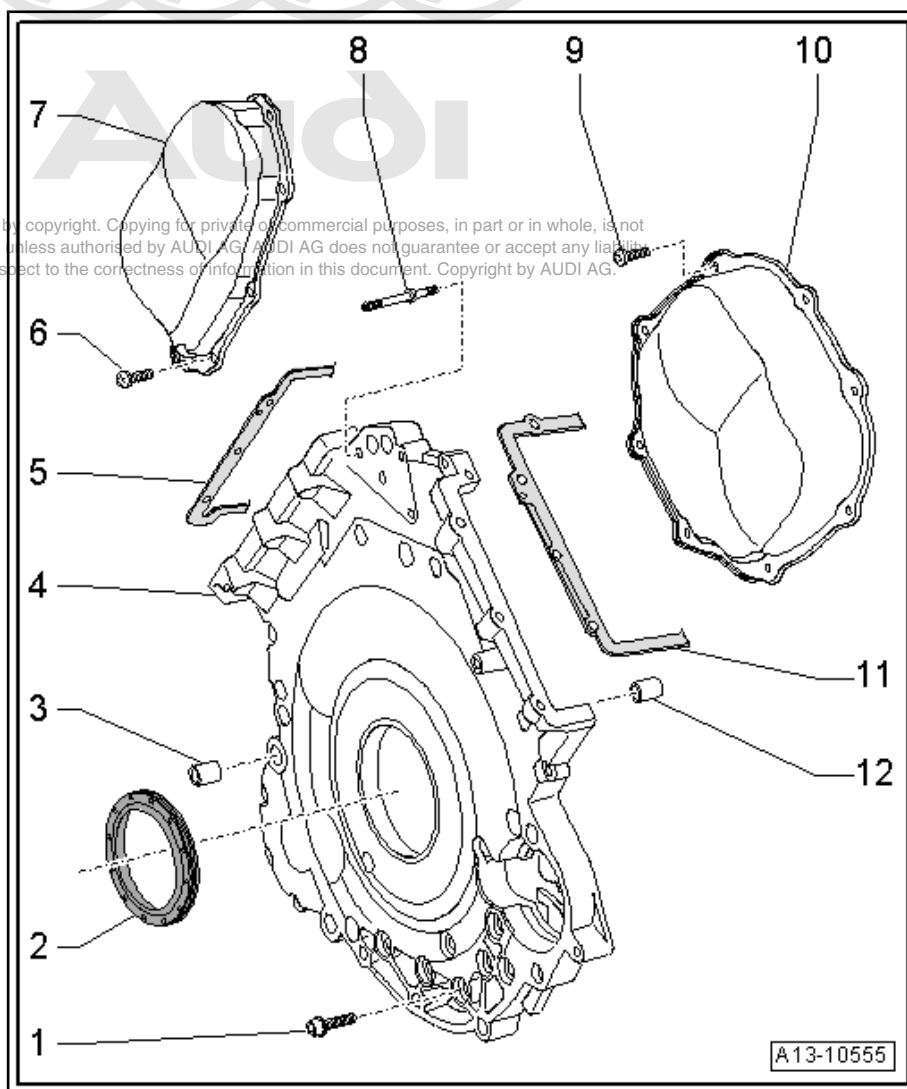
10 - Timing chain cover (right-side)

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

11 - Cylinder head gasket (right-side)

12 - Dowel sleeve

- ☐ 2x



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

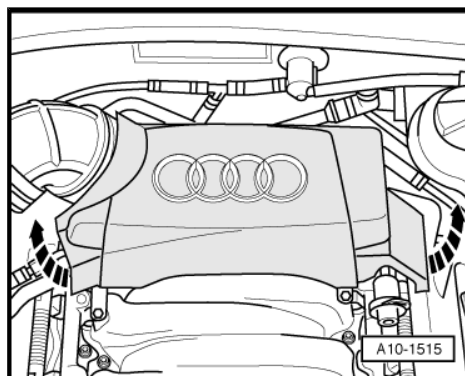
Removing



Note

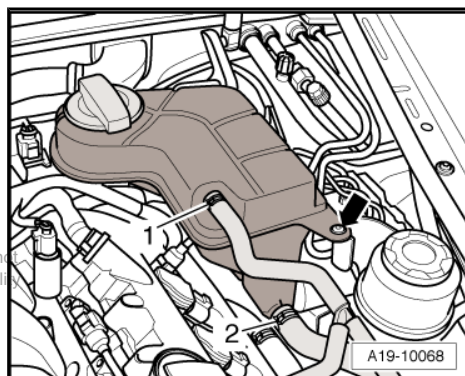
All cable ties which are released or cut open when removing must be refitted in the same position when installing.

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



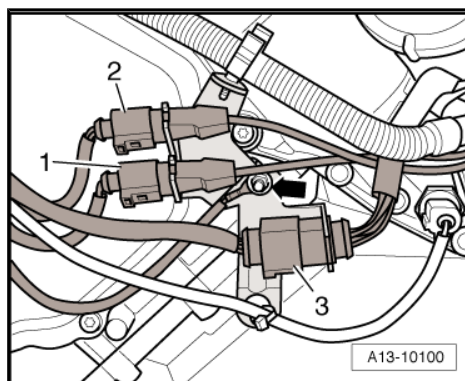
Timing chain cover (left-side):

- 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.



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



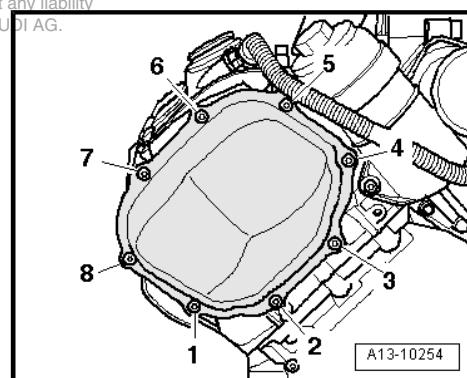
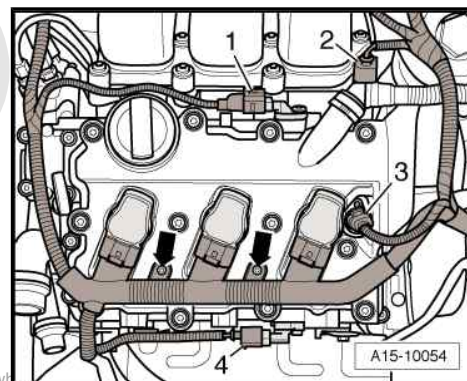
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.

**Note**

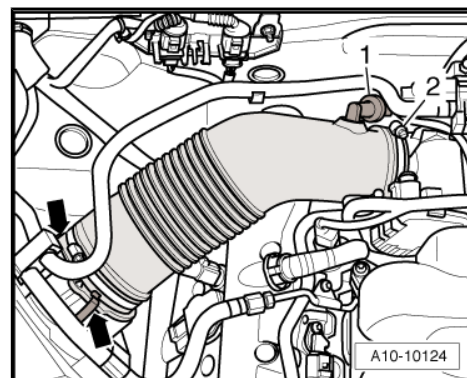
Disregard -items 1 ... 4-.

- Move wiring clear.

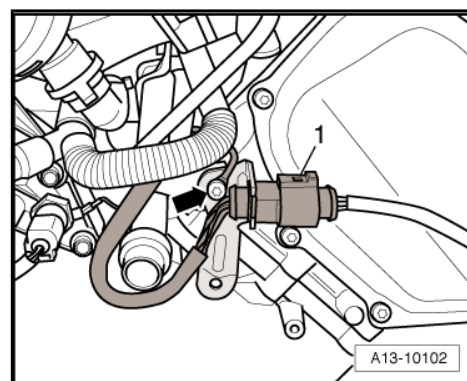
- Remove bolts -1, 8- and release timing chain cover (left-side) from bonded joint.

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

- Pull non-return valve -1- off connection at air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



- Unplug electrical connector -1-.
- Remove bolt -arrow- and detach bracket for electrical connector.



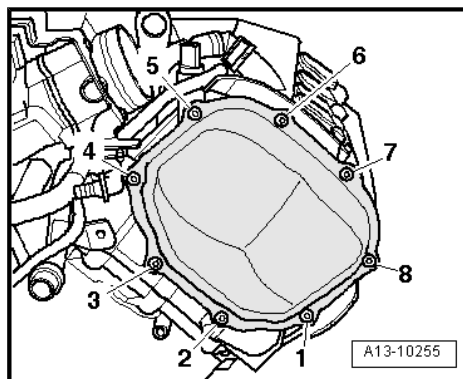
- Remove bolts -1 ... 8- and release timing chain cover (right-side) from bonded joint.

Installing



Note

Fit all cable ties in the original positions when installing.



WARNING

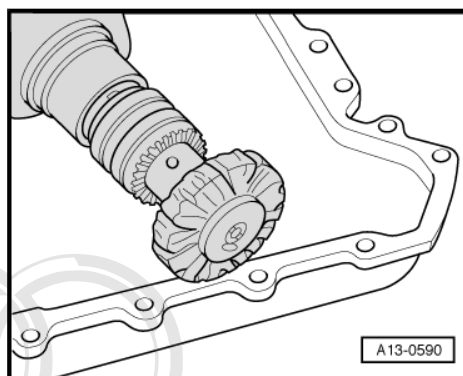
Wear safety goggles.

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



Caution

Make sure that no sealant residue gets into the engine.



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

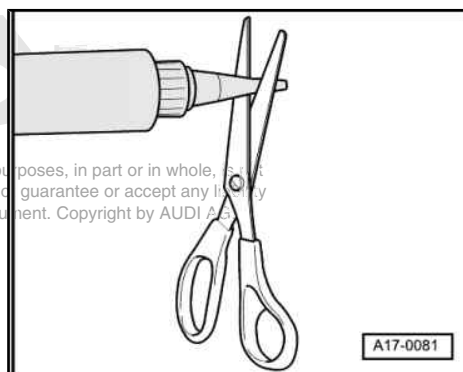


Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (Ø of nozzle approx. 1 mm).

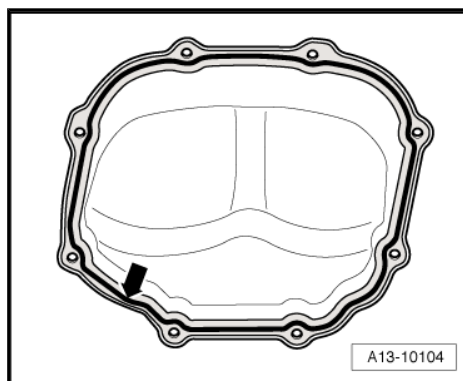
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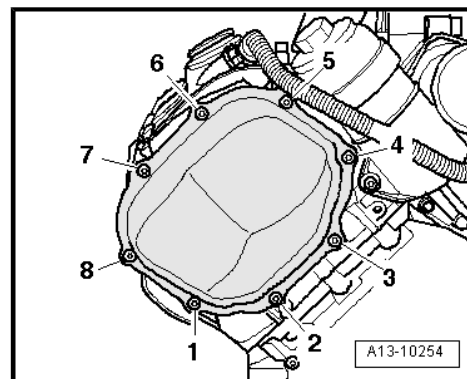
Note

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

- Apply sealant bead -arrow- onto the clean sealing surface of the timing chain cover (left-side) as illustrated.
- The groove 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.

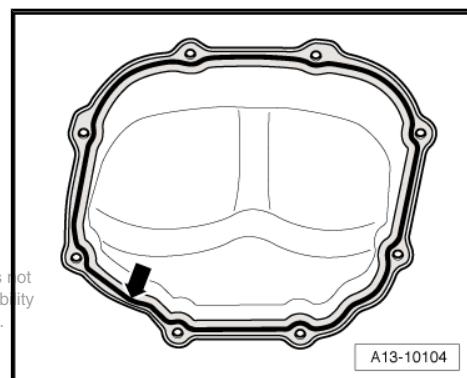


- Fit timing chain cover (left-side) and tighten bolts in sequence -1 ... 8-.



- Apply sealant bead -arrow- onto the clean sealing surface of the timing chain cover (right-side) as illustrated.
- The groove 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.

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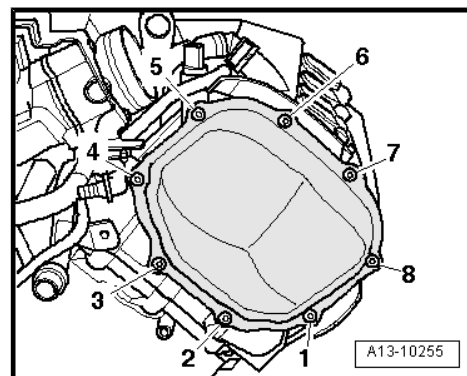


- Fit timing chain cover (right-side) and tighten bolts in sequence -1 ... 8-.

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

Tightening torques

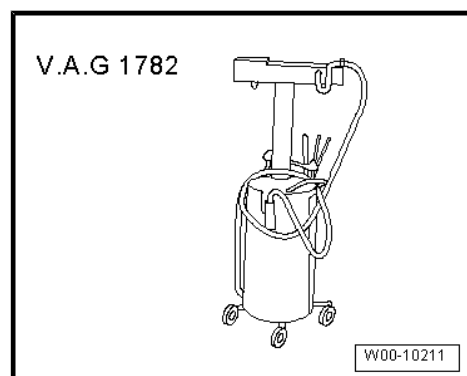
Component	Nm
Timing chain covers (left and right) to engine	5 +90° ¹⁾
Bracket for electrical connectors to cylinder head	9
Hose clips (9 mm wide)	3
• ¹⁾ Renew bolts.	



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

- Gearbox removed ⇒ Rep. Gr. 34 or ⇒ Rep. Gr. 37 .
- Engine oil drained ⇒ Maintenance ; Booklet 405 .



Note

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

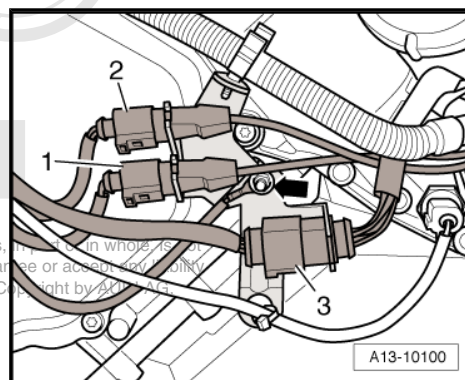


WARNING

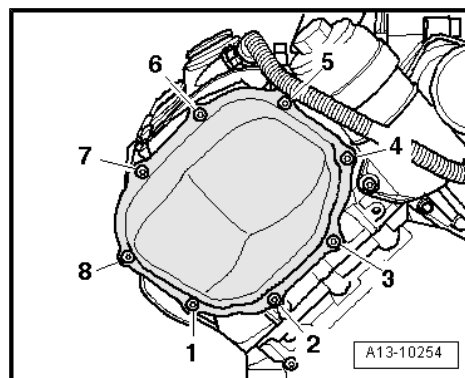
Make sure that the lock carrier is installed and the torque reaction support is secured on the vehicle before performing the following steps.

- Vehicles with manual gearbox: remove clutch pressure plate
⇒ Rep. Gr. 30 and dual-mass flywheel ⇒ [page 113](#) .
- Vehicles with multitronic gearbox: Remove damper unit
⇒ [page 118](#) and flywheel ⇒ [page 119](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate
⇒ [page 121](#) .
- Unplug electrical connectors -1 ... 3-.
- Unscrew nut -arrow-.
- Remove bracket for electrical connector -3-.
- Unscrew centre hex stud located beneath the bracket.
- Remove bracket for electrical connectors -1- and -2-.

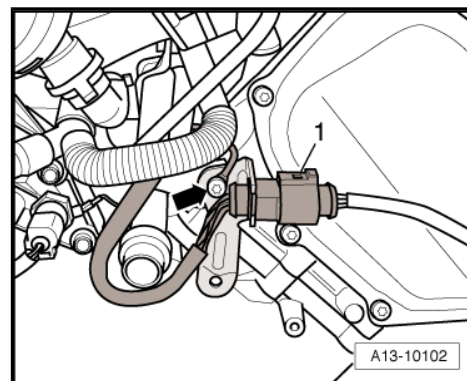
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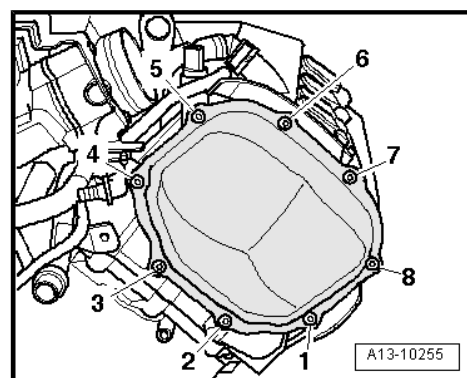
- Remove bolts -1 ... 8- and release timing chain cover (left-side) from bonded joint.



- Unplug electrical connector -1-.
- Remove bolt -arrow- and detach bracket for electrical connector.



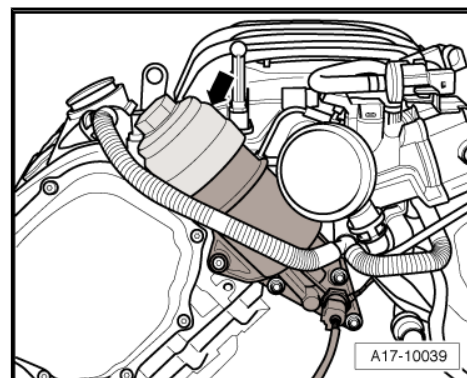
- Remove bolts -1 ... 8- and release timing chain cover (right-side) from bonded joint.



- Unscrew sealing cap -arrow- for oil filter housing.

- Remove oil filter element.

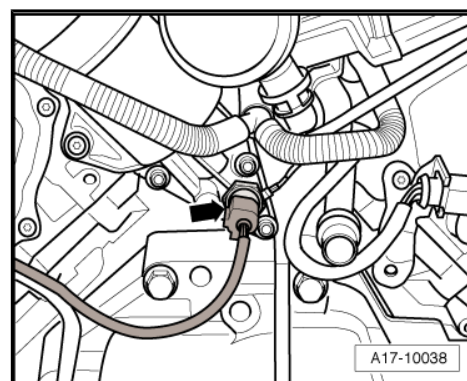
- Extract engine oil from oil filter housing using used oil collection and extraction unit -V.A.G 1782- .



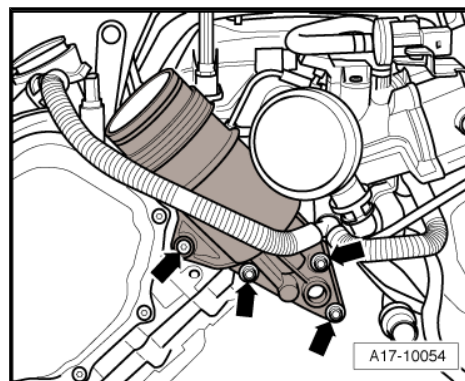
Note

Place a cloth below the oil filter housing to catch escaping oil.

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

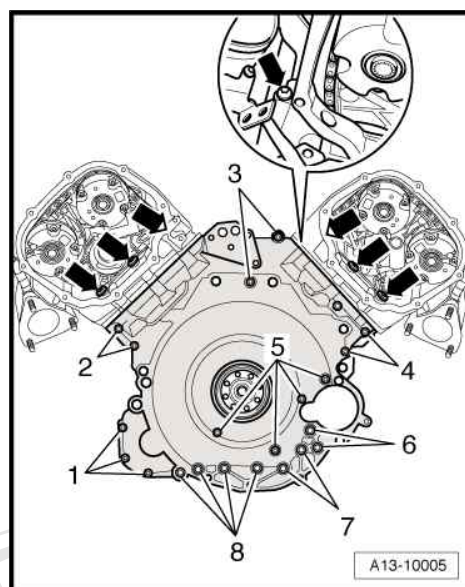


- Remove bolts -arrows-.
- Remove oil filter housing.



Vehicles up to 04.2005:

- Remove bolts -arrows-.
- Remove bolts -1 ... 8- and release timing chain cover (bottom) from bonded joint.



Vehicles from 05.2005:

- Remove bolts -arrows-.
- Remove bolts -1 ... 9- and release timing chain cover (bottom) from bonded joint.

All vehicles:

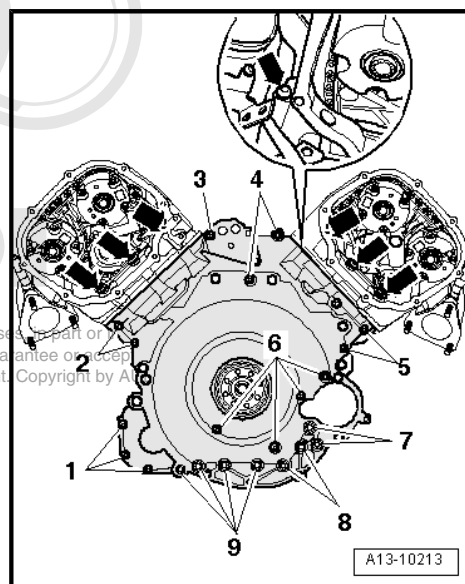
- Press out crankshaft oil seal (rear) from timing chain cover (bottom).

Installing



Note

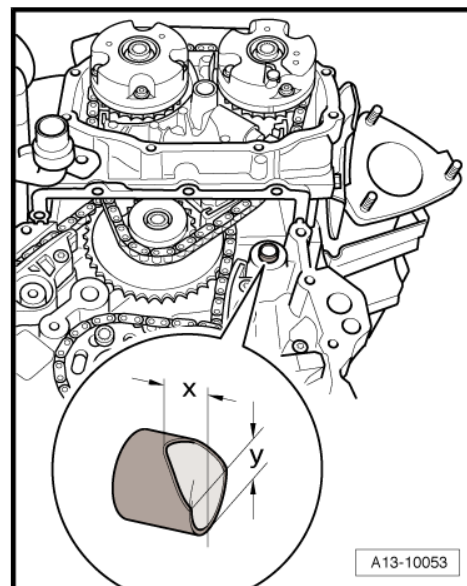
- ◆ Renew gaskets, seals and O-rings.
- ◆ Fit all cable ties in the original positions when installing.



- 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.



A13-10053

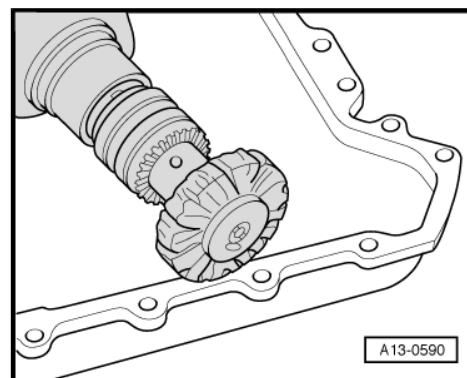
**WARNING**

Wear safety goggles.

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

**Caution**

Make sure that no sealant residue gets into the engine.



A13-0590

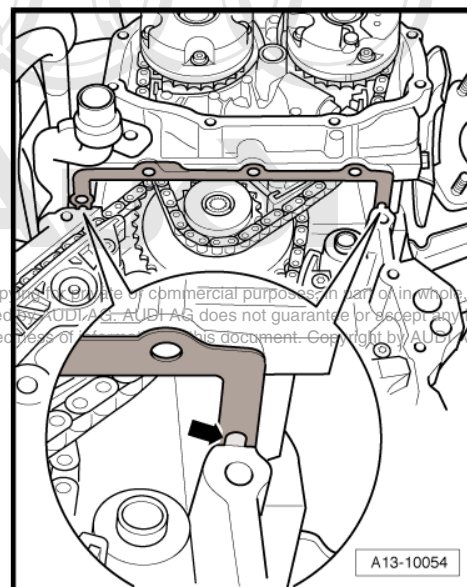
- Clean sealing surfaces; they must be free of oil and grease.
- Clean any old sealing compound from the bores -arrow- in the cylinder head gaskets.

**Note**

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

**Caution**

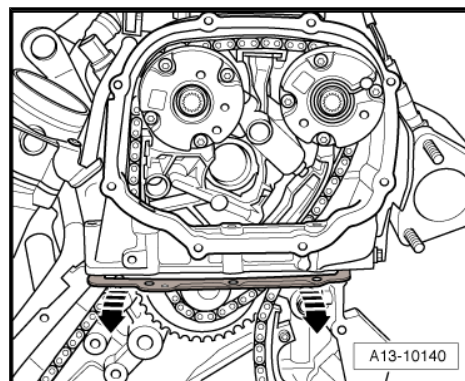
The cylinder head gasket must not to be bent more than a small amount. If the cylinder head gasket has been bent and kinked it must be renewed.



A13-10054

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- 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.



Note

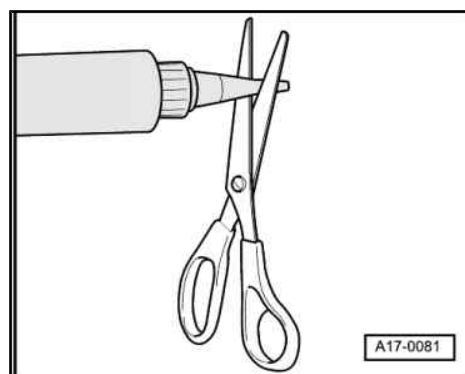
Note the use-by date of the sealant.

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



Note

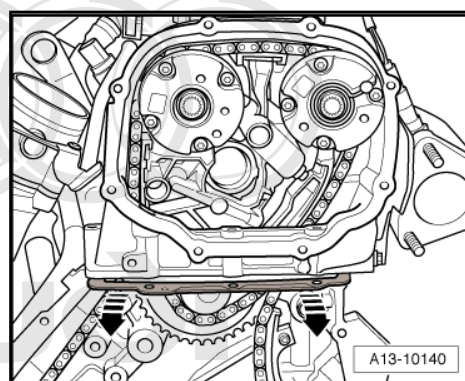
- ♦ *The sealant must be applied at several points on the engine as described below.*
- ♦ *The timing chain cover must be installed within 5 minutes after applying sealant.*



Caution

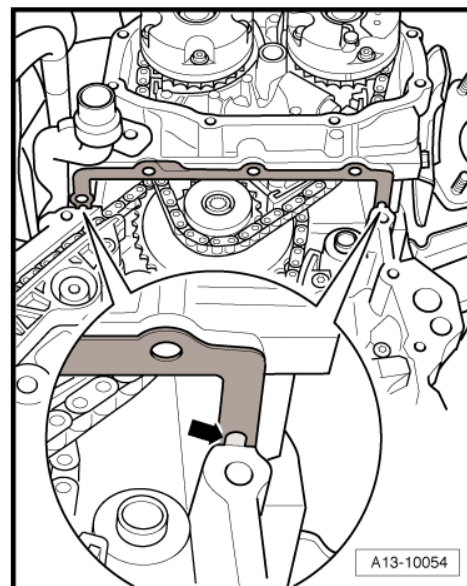
The cylinder head gasket must not to be bent more than a small amount. If the cylinder head gasket has been bent and kinked it must be renewed.

- 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.
- Use a flat object (e.g. a feeler gauge) to apply sealant to area between cylinder head and gasket.



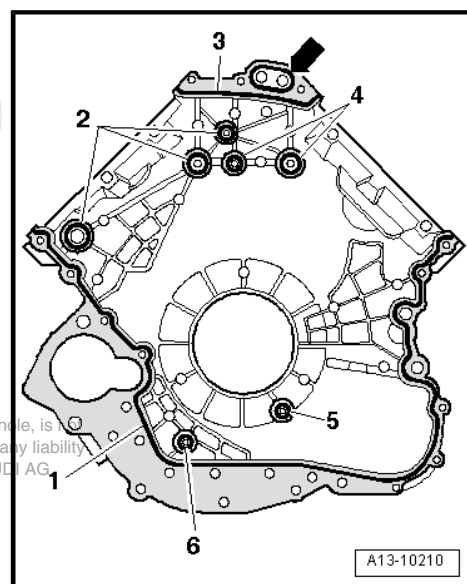
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- Fill cleaned holes -arrow- in cylinder head gasket with sealant.



Vehicles up to 04.2005:

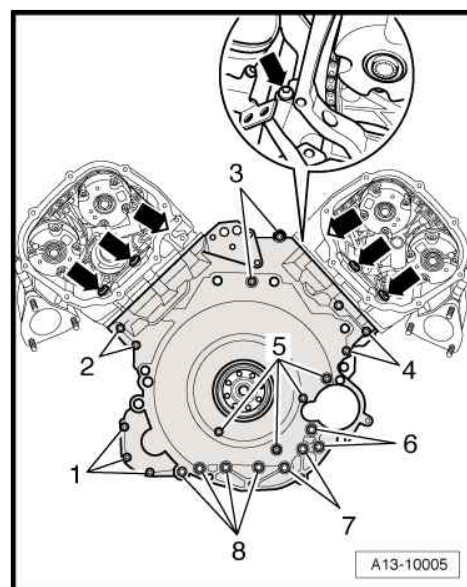
- Apply the beads of sealant -1 ... 6- onto the clean sealing surfaces of the timing chain cover (bottom) as illustrated.
- The groove on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 ... 2.0 mm above the sealing surface.
- The sealant -item 3- must be applied in a continuous bead as shown in the illustration (although the groove is not continuous).
- Insert the O-ring -arrow- in the groove in the bottom timing chain cover.
- Apply a small amount of sealant to hold O-ring in position.



- 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 in 4 stages as follows:

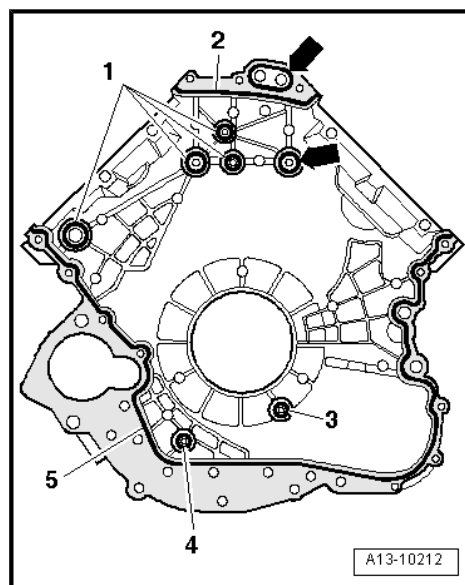
Stage	Bolts	Tightening torque/tightening angle
1.	-arrows-	Apply locking fluid when installing, 5 Nm
2.	-1 ... 8-	9 Nm in diagonal sequence
3.	-arrows-	9 Nm
4.	-6, 7, 8-	20 Nm

- Install oil filter housing immediately ➔ [page 234](#) .



Vehicles from 05.2005:

- Apply the beads of sealant -1 ... 5- 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 -item 2- must be applied in a continuous bead as shown in the illustration (although the groove is not continuous).
- Insert seals -arrows- in grooves on timing chain cover (bottom).



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- 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 in 5 stages as follows:

Stage	Bolts	Tightening torque/tightening angle
1.	-arrows-	Apply locking fluid when installing, 5 Nm
2.	-1 ... 9-	9 Nm in diagonal sequence
3.	-arrows-	9 Nm
4.	-7, 8, 9-	20 Nm
5.	-3-	16 Nm

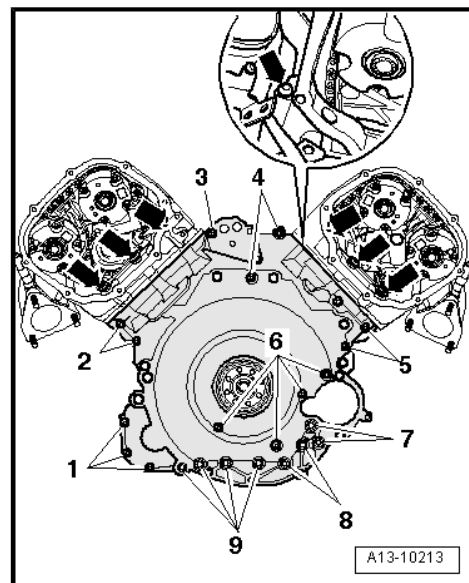
All vehicles:

Perform further installation in reverse order, paying attention to the following:

- Install timing chain covers (left and right) ⇒ [page 138](#) .
- Install oil filter housing ⇒ [page 234](#) .
- Install crankshaft oil seal (gearbox end) ⇒ [page 122](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 113](#) and pressure plate ⇒ Rep. Gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 119](#) and damper unit ⇒ [page 118](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 121](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component		Nm
Timing chain cover (bottom) to engine	M6	9 ¹⁾
	M7	16
	M8	20
Timing chain covers (left and right) to engine		5 +90° ²⁾
Bracket for electrical connectors to cylinder head		9
• ¹⁾ Install securing bolts between cylinder head and timing chain cover (bottom) using locking fluid; locking fluid ⇒ Electronic parts catalogue . • ²⁾ Renew bolts.		



1.4 Camshaft timing chains - exploded view



Note

- ♦ The crankshaft and camshafts must only be turned with the chain drive mechanism fully installed. Otherwise the valves may strike the pistons, causing damage to valves and piston crowns.
- ♦ Mark rotation direction of camshaft chain with paint before removing. If a used chain rotates in the opposite direction when it is refitted, this can cause breakage.

Camshaft timing chain (left-side)

1 - Camshaft adjuster for exhaust camshaft

- ☐ Identification "Exhaust"
- ☐ Removing and installing
⇒ ["1.5 Detaching timing chains from camshafts, removing and installing chain tensioners", page 150](#)

2 - Bolt for camshaft

- ☐ Renew
- ☐ Pre-tightening torque: 40 Nm
- ☐ Final tightening torque: 80 Nm + 90°

3 - Bolt for camshaft

- ☐ Renew
- ☐ Pre-tightening torque: 40 Nm
- ☐ Final tightening torque: 80 Nm + 90°

4 - Camshaft adjuster for inlet camshaft

- ☐ Identification "Intake"
- ☐ Removing and installing
⇒ ["1.5 Detaching timing chains from camshafts, removing and installing chain tensioners", page 150](#)

5 - Camshaft timing chain (left-side)

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

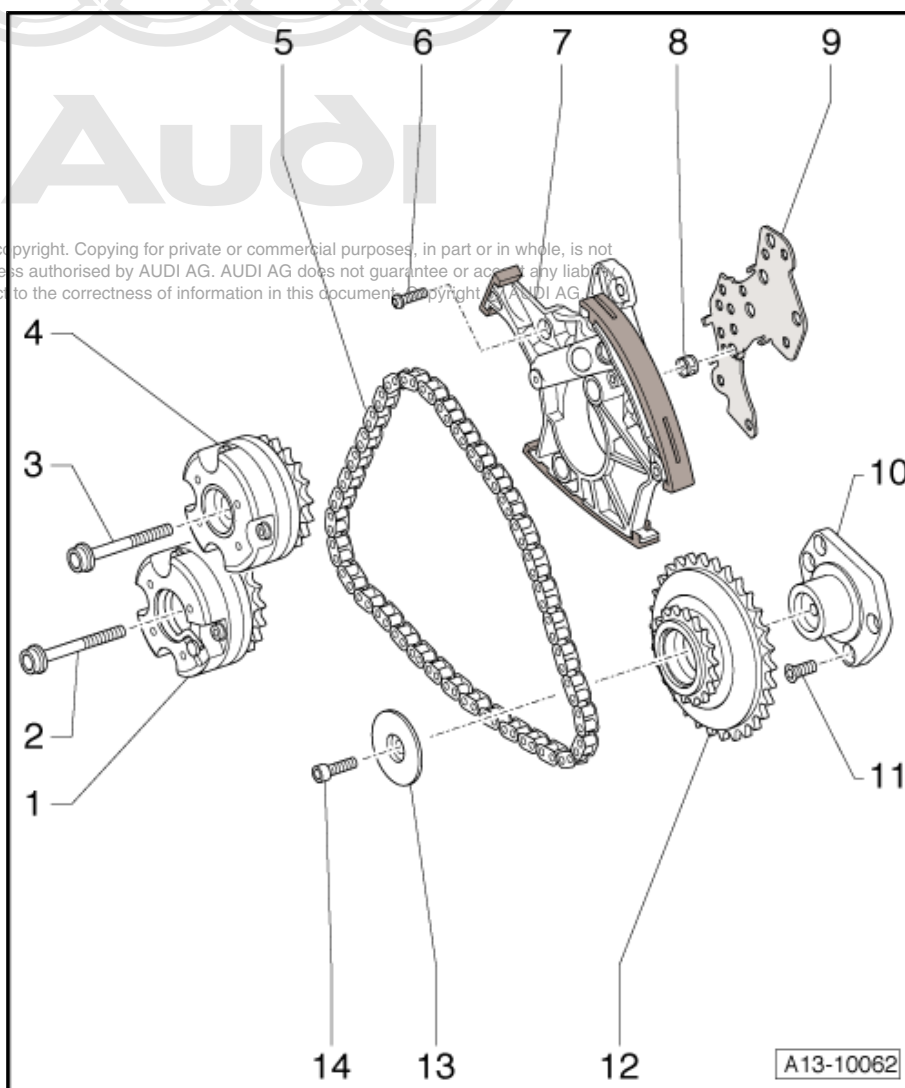
6 - 9 Nm

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

- ☐ Removing and installing
⇒ ["1.5 Detaching timing chains from camshafts, removing and installing chain tensioners", page 150](#)

8 - Oil strainer

- ☐ Inserted in chain tensioner
- ☐ Watch position of locking lug on outer circumference



9 - Gasket

- ☐ Renew
- ☐ Clipped onto chain tensioner

10 - Bearing bracket for drive sprocket**11 - 8 Nm + 45° further**

- ☐ Renew
- ☐ Lubricate with oil before installing

12 - Drive chain sprocket for camshaft timing chain (left-side)**13 - Thrust washer for drive sprocket****14 - 6 Nm + 60° further**

- ☐ Renew

Camshaft timing chain (right-side)**1 - Drive chain sprocket for camshaft timing chain (right-side)****2 - Bearing mounting for drive sprocket****3 - 30 Nm + 90° further****4 - Camshaft timing chain (right-side)**

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

5 - Bolt for camshaft

- ☐ Renew
- ☐ Pre-tightening torque:
40 Nm
- ☐ Final tightening torque:
80 Nm + 90°

6 - Camshaft adjuster for inlet camshaft

- ☐ Identification "Intake"
- ☐ Removing and installing
⇒ ["1.5 Detaching timing chains from camshafts, removing and installing chain tensioners", page 150](#)

7 - Chain tensioner for camshaft timing chain (right-side)

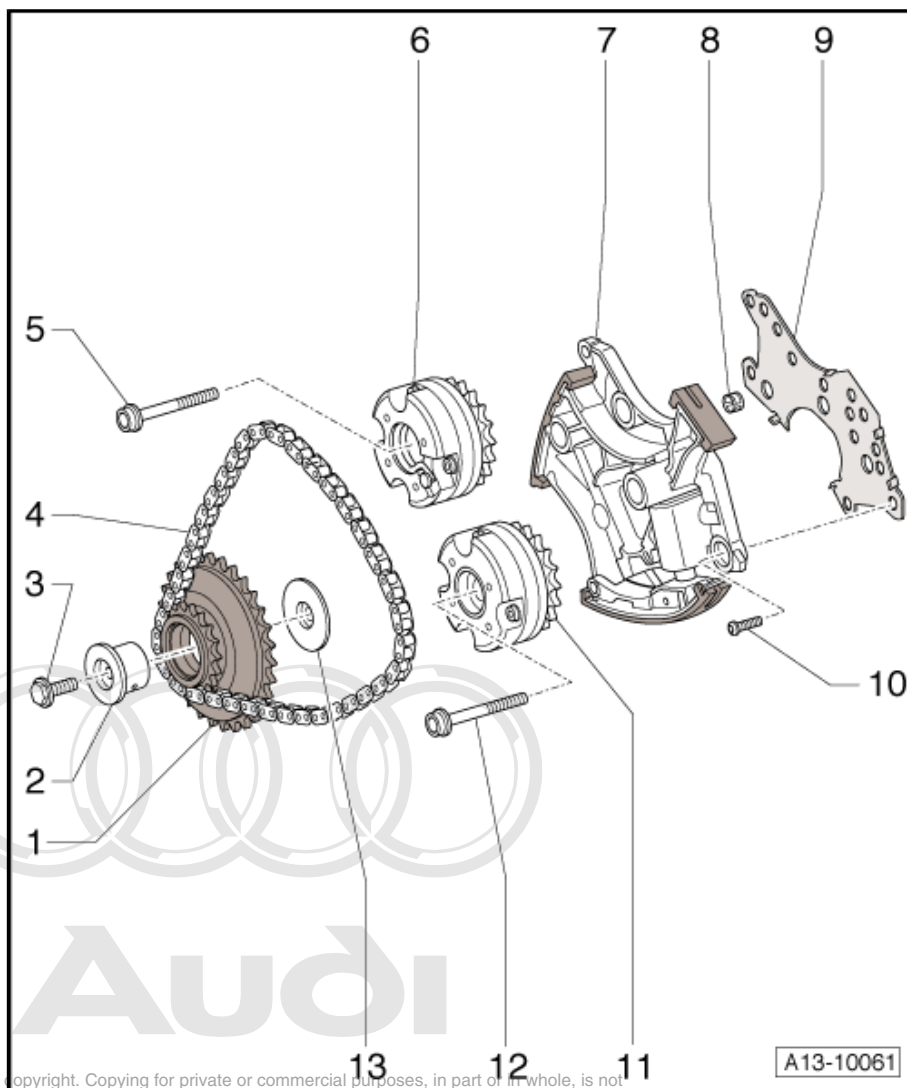
- ☐ Removing and installing
⇒ ["1.5 Detaching timing chains from camshafts, removing and installing chain tensioners", page 150](#)

8 - Oil strainer

- ☐ Inserted in chain tensioner
- ☐ Installation position: locating lug on outer circumference

9 - Gasket

- ☐ Renew



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- ☐ Clipped onto chain tensioner

10 - 9 Nm

11 - Camshaft adjuster for exhaust camshaft

- ☐ Identification "Exhaust"
- ☐ Removing and installing
⇒ ["1.5 Detaching timing chains from camshafts, removing and installing chain tensioners", page 150](#)

12 - Bolt for camshaft

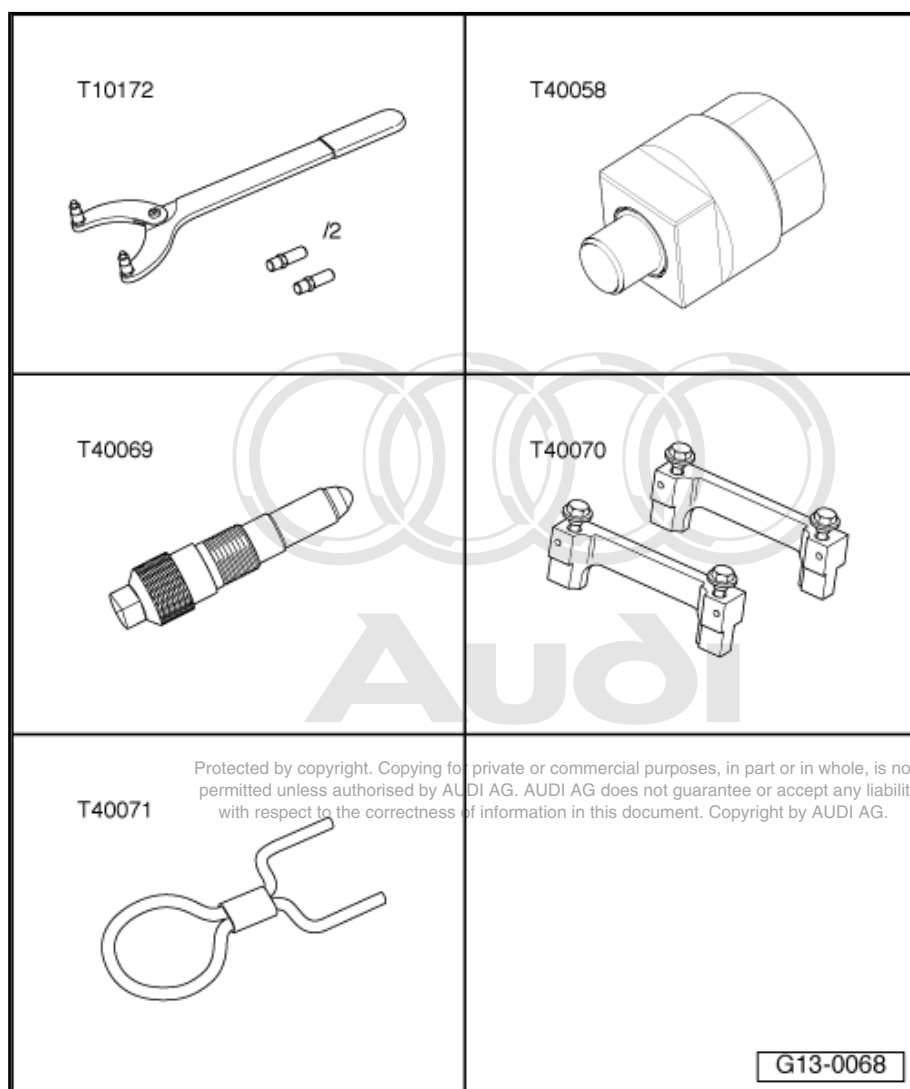
- ☐ Renew
- ☐ Pre-tightening torque: 40 Nm
- ☐ Final tightening torque: 80 Nm + 90°

13 - Thrust washer for drive sprocket

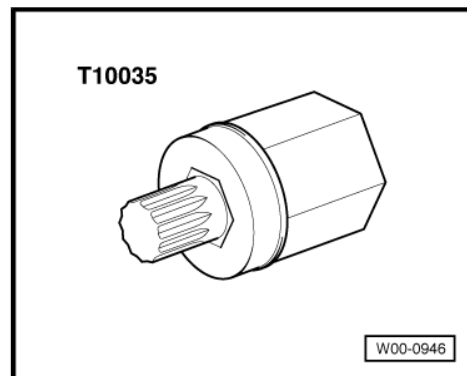
1.5 Detaching timing chains from camshafts, removing and installing chain tensioners

Special tools and workshop equipment required

- ◆ Counterhold tool -T10172- with pin -T10172/2-
- ◆ Adapter -T40058-
- ◆ Locking pin -T40069-
- ◆ Camshaft clamp -T40070- (2x)
- ◆ Locking pin -T40071- (2x)



◆ Special wrench -T10035-



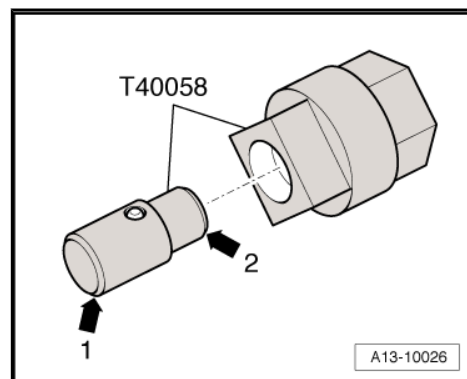
Removing



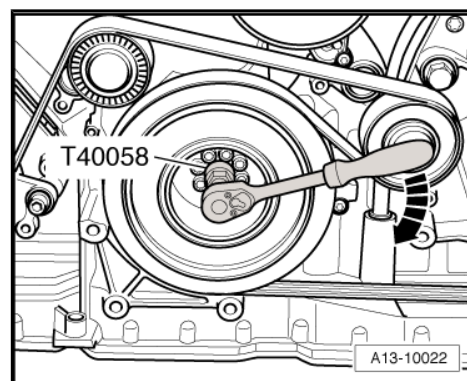
Note

In the following procedure the camshaft timing chains remain on the engine. If you want to detach the camshaft timing chains completely you must also remove the timing chain cover (bottom) ⇒ [page 139](#).

- Remove cylinder head cover: left-side ⇒ [page 178](#) , right-side ⇒ [page 182](#) .
- Remove timing chain covers (left and right) ⇒ [page 135](#) .
- 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.

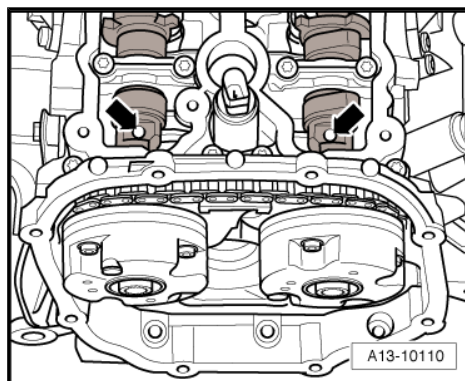


- Using adapter -T40058- turn the crankshaft in the normal direction of rotation -arrow- to TDC.

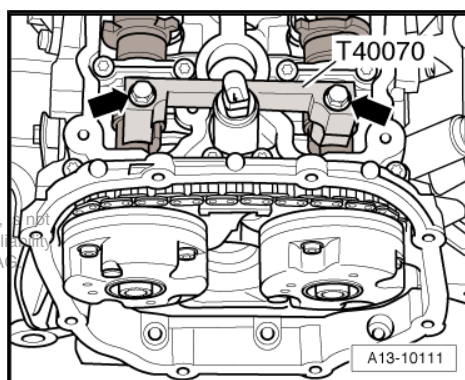


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- The threaded holes -arrows- in the camshafts must face upwards.

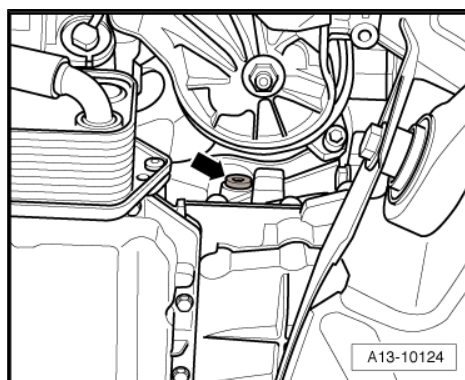


- Fit camshaft clamps -T40070- to both cylinder heads and tighten bolts -arrows- to 20 Nm.
- The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.

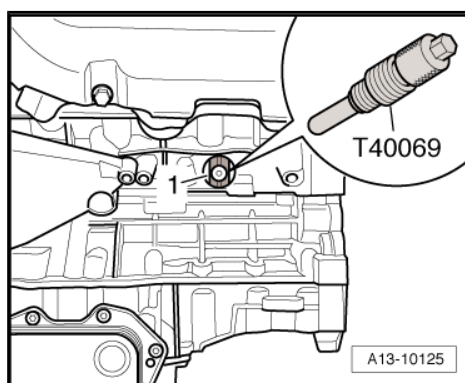


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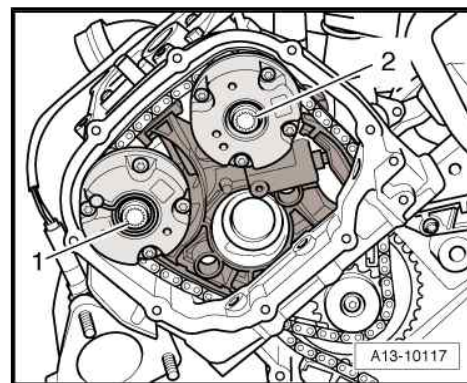
- Unscrew plug -arrow- from cylinder block.



- Screw locking pin -T40069- into bore -1- (tightening torque: 10 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.

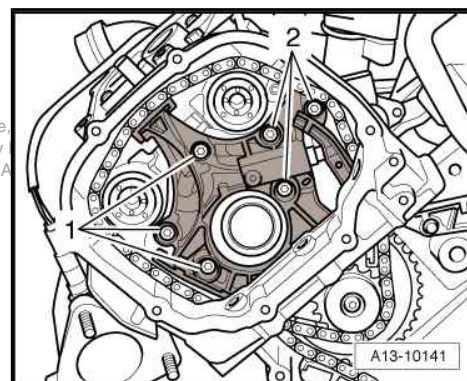


- Mark running direction of camshaft timing chain (left-side) with paint.
- Unscrew bolts -1- and -2- for camshaft adjusters using special wrench -T10035-.
- Remove both camshaft adjusters.

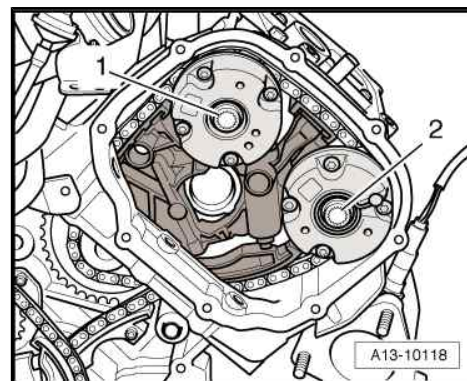


- Unscrew bolts -1- and -2- and remove chain tensioner.

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- Mark running direction of camshaft timing chain (right-side) with paint.
- Unscrew bolts -1- and -2- for camshaft adjusters using special wrench -T10035-.
- Remove both camshaft adjusters.



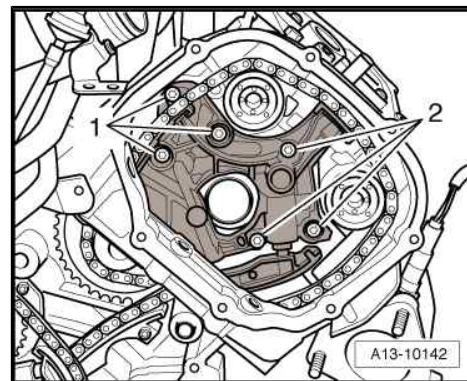
- Unscrew bolts -1- and -2- and remove chain tensioner.

Installing

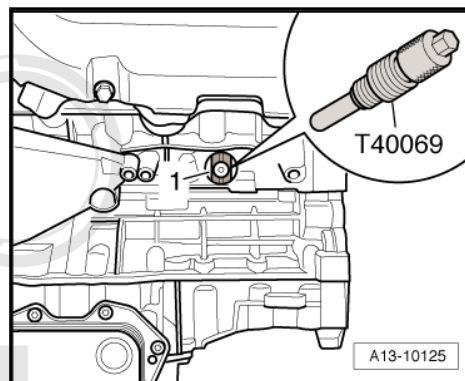


Note

- ◆ *Renew bolts which are tightened to a specified angle as well as seals and gaskets.*
- ◆ *The crankshaft must not be at TDC at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.*

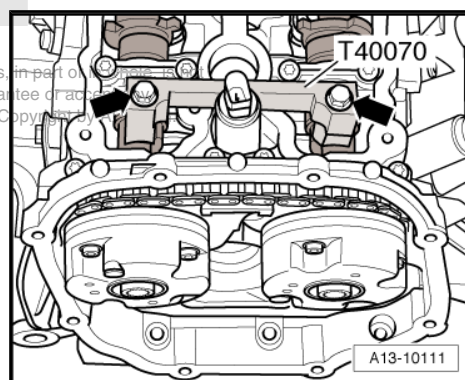


- Drive chain for valve gear installed ⇒ [page 161](#)
- Crankshaft locked in TDC position with locking pin -T40069- .



- Camshaft clamps -T40070- installed on both cylinder heads and tightened to 20 Nm.

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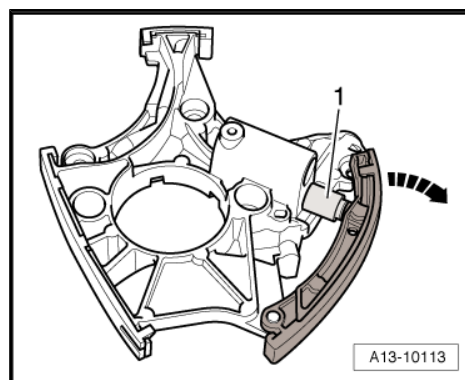


- First completely release guide rail of chain tensioners for camshaft timing chains (left and right) -arrow-.
- The piston -1- of the tensioning element must be fully extended, so that the locking device is released (only possibly when chain tensioner is removed).

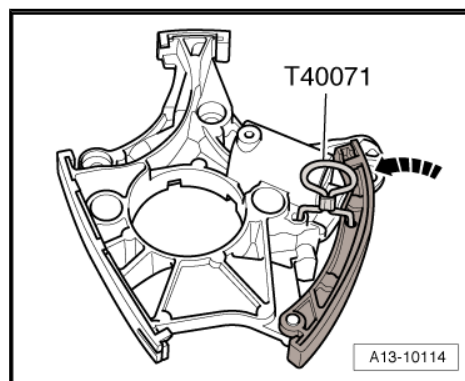


Note

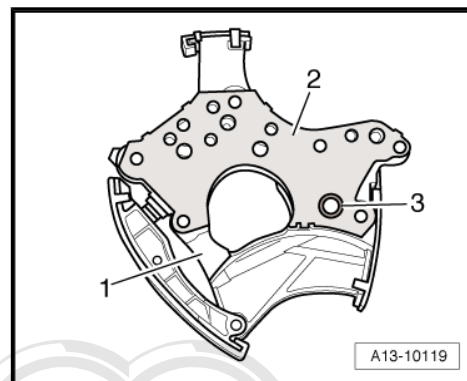
Note the correct installation position if the tensioning element has been removed from the chain tensioner: drilling in base of housing faces chain tensioner and piston faces tensioner rail.



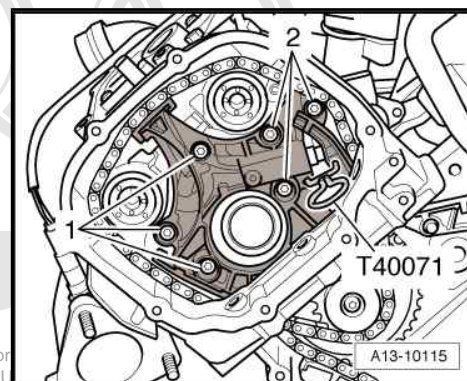
- Press guide rails of chain tensioners for camshaft timing chains (left and right) inwards in direction of -arrow- as far as the stop. Then lock chain tensioners by inserting locking pin -T40071- .



- If necessary, clean oil strainer -3- in both chain tensioners.
- Fit new gasket -2- to rear of chain tensioner -1-.

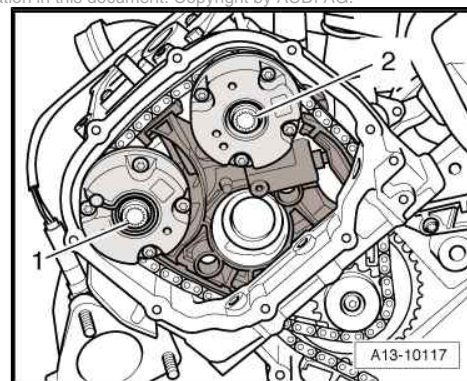


- Install chain tensioner on cylinder head (left-side) and position camshaft timing chain as shown in the illustration.
- Tighten bolts -1- and -2-.

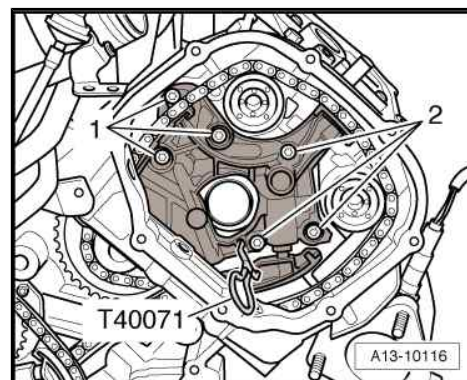


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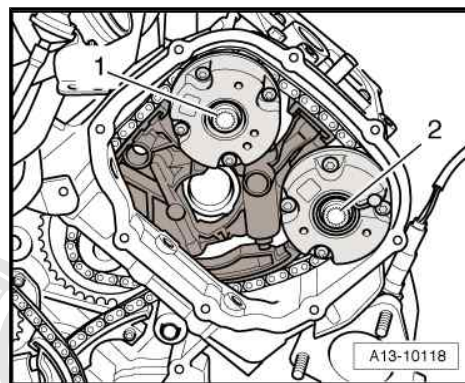
- Renew the camshaft bolts.
- Position camshaft timing chain on drive chain sprocket and camshaft adjusters and loosely screw in bolts -1- and -2-.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
- Remove locking pin -T40071- .



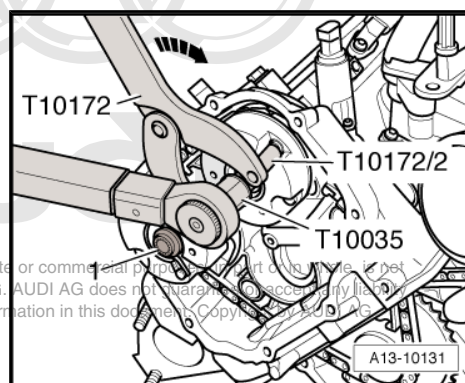
- Install chain tensioner on cylinder head (right-side) and position camshaft timing chain as shown in the illustration.
- Tighten bolts -1- and -2-.



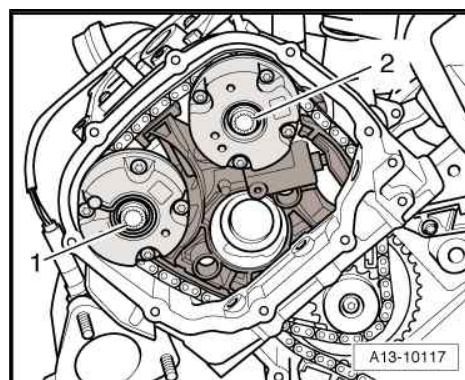
- Renew the camshaft bolts.
- Position camshaft timing chain on drive chain sprocket and camshaft adjusters and loosely screw in bolts -1- and -2-.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
- Remove locking pin -T40071- .



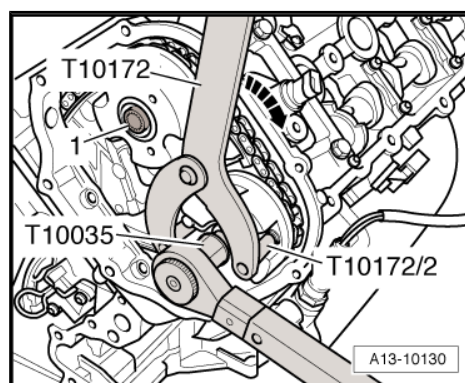
- Fit counterhold tool -T10172- with pin -T10172/2- onto camshaft adjuster of inlet camshaft (left-side).
- Pretension camshaft timing chain by pressing counterhold tool in direction of -arrow-.
- At the same time pre-tighten camshaft bolt using special wrench -T10035- and torque wrench.
- Tightening torque: 40 Nm.
- Maintain tension on inlet camshaft and **pre-tighten bolt -1- on exhaust camshaft.**
- Tightening torque: 40 Nm.



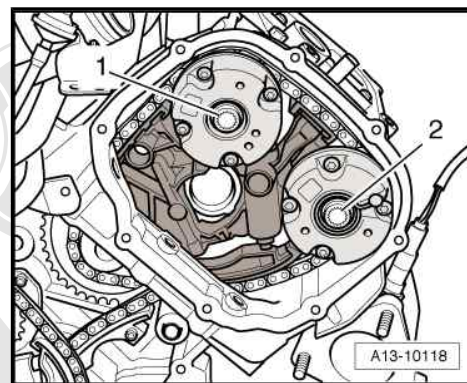
- Tighten camshaft bolts -1- and -2- at cylinder head (left-side) to final torque.
- Tightening torque: 80 Nm + turn 90° further.



- Fit counterhold tool -T10172- with pin -T10172/2- onto camshaft adjuster of exhaust camshaft (right-side).
- Pretension camshaft timing chain by pressing counterhold tool in direction of -arrow-.
- At the same time pre-tighten camshaft bolt using special wrench -T10035- and torque wrench.
- Tightening torque: 40 Nm.
- Maintain tension on exhaust camshaft and pre-tighten bolt -1- on inlet camshaft.
- Tightening torque: 40 Nm.

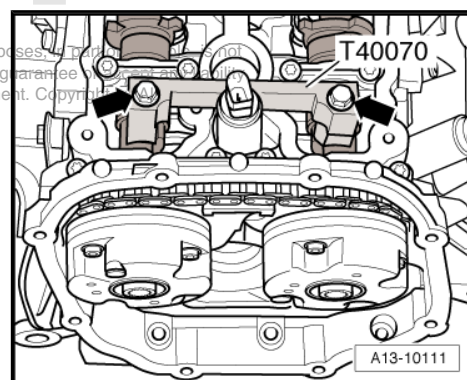


- Tighten camshaft bolts -1- and -2- at cylinder head (right-side) to final torque.
- Tightening torque: 80 Nm + turn 90° further.

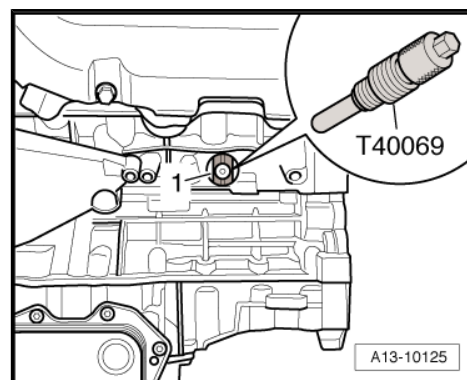


- Remove camshaft clamps -T40070- from both cylinder heads.

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- Remove locking pin -T40069- .

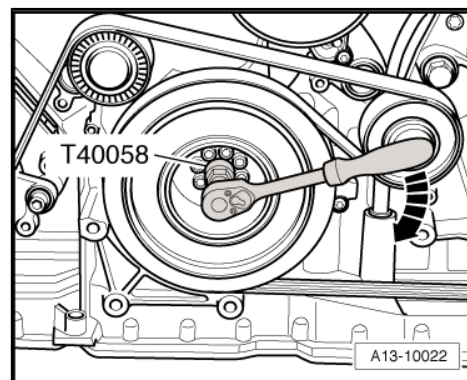


- Using adapter -T40058- , turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is at TDC again.

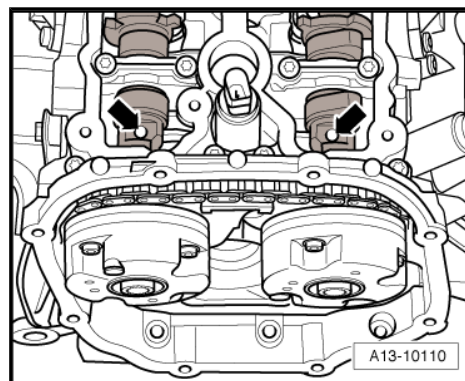


Note

If you turned the crankshaft beyond TDC, turn it back approx. 30° and set to TDC again.

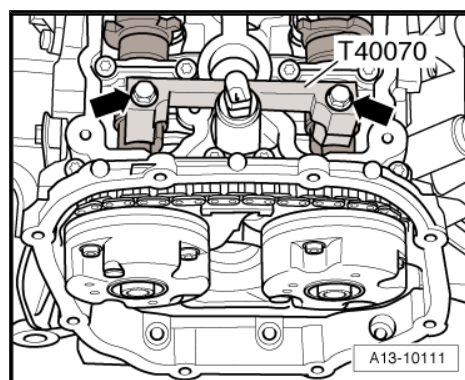


- The threaded holes -arrows- in the camshafts must face upwards.



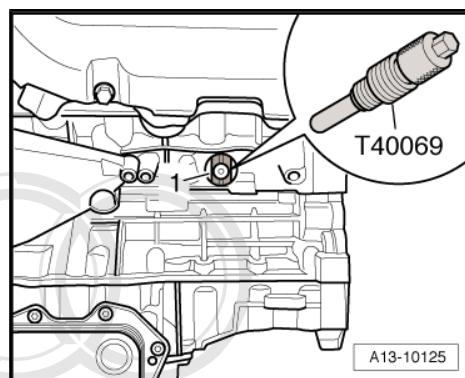
- Fit camshaft clamps -T40070- to both cylinder heads and tighten bolts -arrows- to 20 Nm.

- The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.



- 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.



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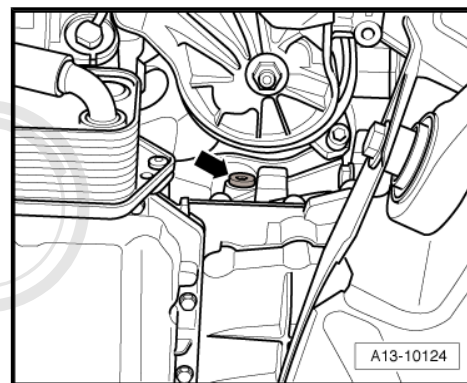
- Remove camshaft clamps from both cylinder heads.
- Remove locking pin.
- Screw plug for the TDC mark into cylinder block with a new seal.

Perform further installation in reverse order, paying attention to the following:

- Install timing chain covers (left and right) ⇒ [page 135](#).
- Install cylinder head cover: left-side ⇒ [page 178](#), right-side ⇒ [page 182](#).

Tightening torques

Component	Nm
Chain tensioner to cylinder head	9
Camshaft bolts	80 + 90° ¹⁾
Screw plug in cylinder block	14 ²⁾
• ¹⁾ Renew bolts. • ²⁾ Install with new seal.	



1.6 Drive chain for valve gear - exploded view

1 - Bearing mounting for drive sprocket

2 - 30 Nm + 90° further

☐ Renew

3 - Bolt

☐ Renew

☐ Types and tightening torque differ depending on version ⇒ [page 161](#)

4 - 6 Nm + 60° further

☐ Renew

5 - Thrust washer for drive sprocket

6 - Bush

☐ Depending on version ⇒ [page 161](#)

7 - Drive chain sprocket for camshaft timing chain (left-side)

8 - Bolt

☐ Renew

☐ Types and tightening torque differ depending on version ⇒ [page 161](#)

9 - Drive chain for valve gear

☐ Before removing, mark running direction with paint

10 - Guide rail

11 - Bolt

☐ Renew

☐ Types and tightening torque differ depending on version ⇒ [page 161](#)

12 - Bush

☐ Depending on version ⇒ [page 161](#)

13 - 8 Nm + 45° further

☐ Renew

☐ Lubricate with oil before installing

14 - Bearing bracket for drive sprocket

15 - Bush

☐ Depending on version ⇒ [page 161](#)

16 - Thrust washer

17 - Drive chain sprocket for camshaft timing chain (right-side)

18 - Bush

☐ Depending on version ⇒ [page 161](#)

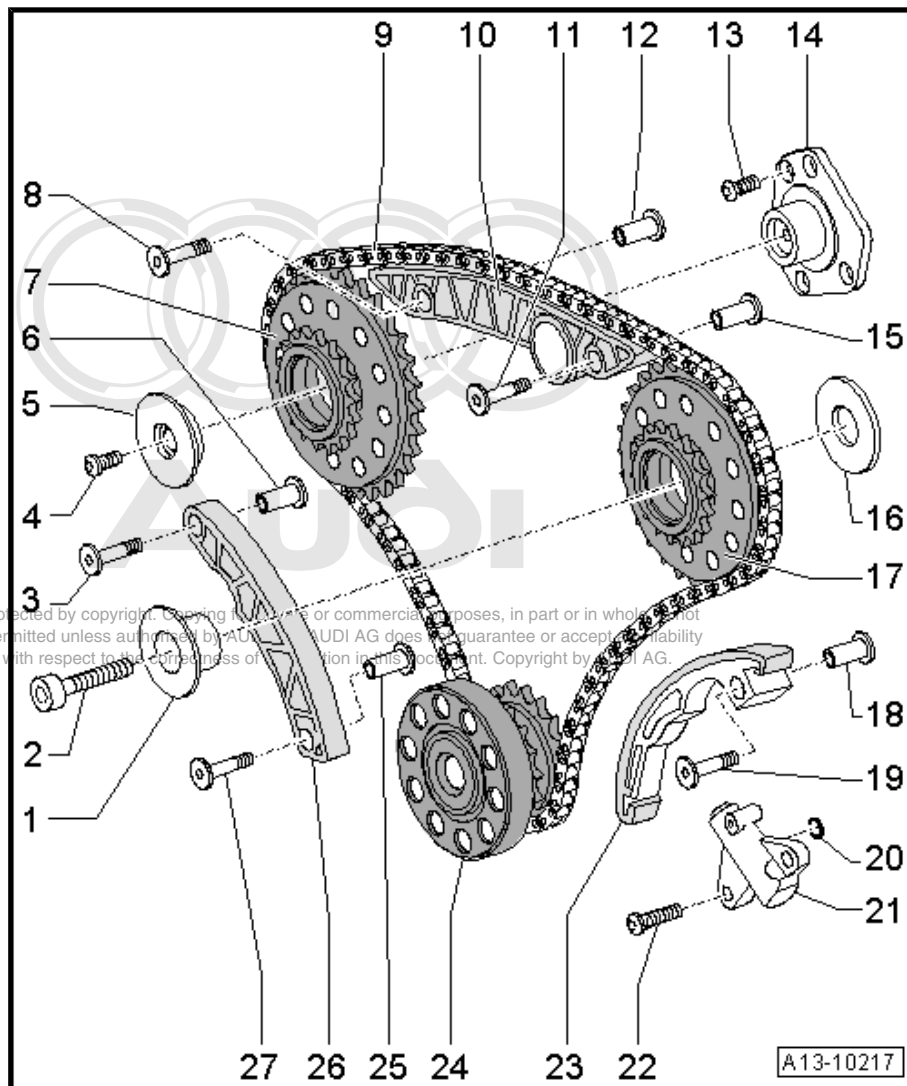
19 - Bolt

☐ Renew

☐ Types and tightening torque differ depending on version ⇒ [page 161](#)

20 - O-ring

☐ Renew



21 - Chain tensioner**22 - 6 Nm + 45° further**

- ☐ Renew

23 - Guide rail for chain tensioner**24 - Crankshaft****25 - Bush**

- ☐ Depending on version ⇒ [page 161](#)

26 - Guide rail

- ☐ Note installation position

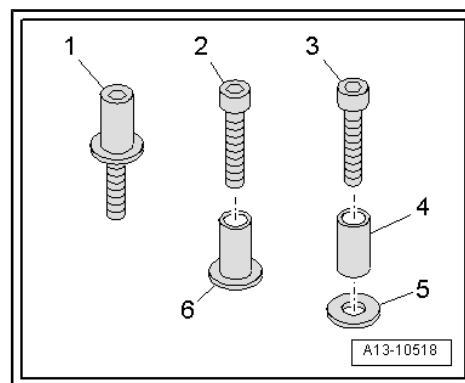
27 - Bolt

- ☐ Renew
- ☐ Types and tightening torque differ depending on version ⇒ [page 161](#)

Different types of bolts securing guide rails

Depending on version, different bolt types are used when securing the timing chain guide rails:

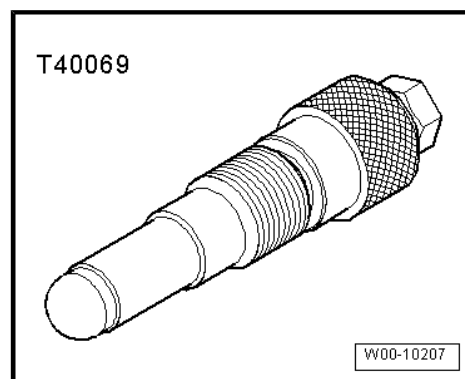
- 1 - Bolt with shaft
 - ◆ Renew
 - ◆ 10 Nm + 30° further
- 2 - Bolt with bush -6- with collar
 - ◆ Renew
 - ◆ 10 Nm + 90° further
- 3 - Bolt with bush -4- and washer -5-
 - ◆ Renew
 - ◆ 10 Nm + 90° further



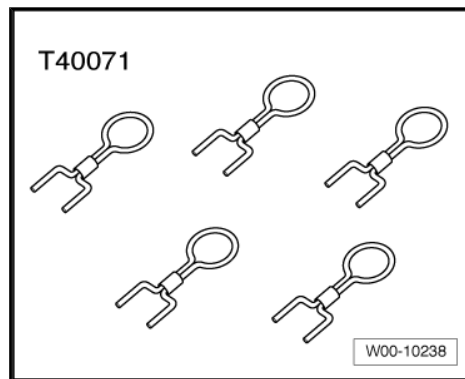
1.7 Removing and installing drive chain for valve gear

Special tools and workshop equipment required

- ◆ Locking pin -T40069-



◆ Locking pin -T40071-



Removing

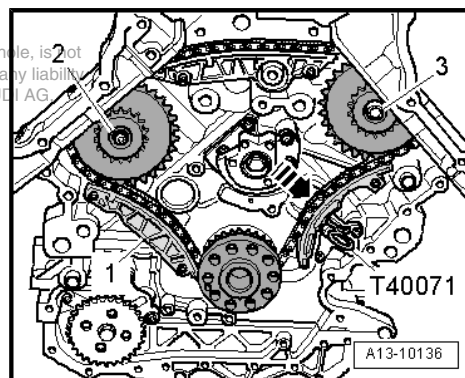
- Gearbox removed ⇒ Rep. Gr. 34 or ⇒ Rep. Gr. 37 .
- Engine oil drained ⇒ Maintenance ; Booklet 405 .



WARNING

Make sure that the lock carrier is installed and the torque reaction support is secured on the vehicle before performing the following steps.

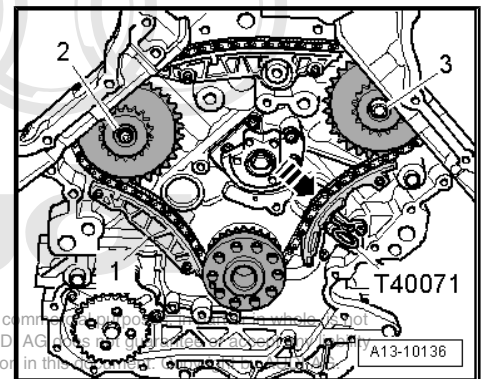
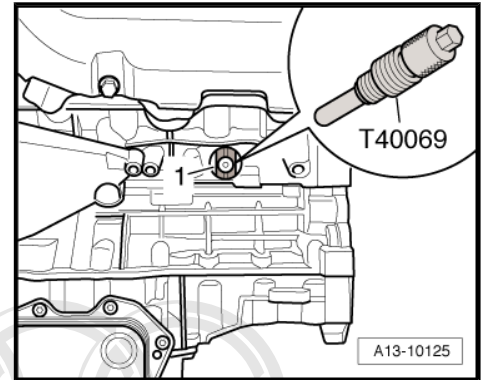
- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. Gr. 30 and dual-mass flywheel ⇒ [page 113](#) .
- Vehicles with multitronic gearbox: Remove damper unit ⇒ [page 118](#) and flywheel ⇒ [page 119](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate ⇒ [page 121](#) .
- Remove timing chain covers (left and right) ⇒ [page 135](#) .
- Remove timing chain cover (bottom) ⇒ [page 139](#) .
- Remove camshaft timing chains from camshafts ⇒ [page 150](#) .
- Remove drive chain for auxiliary drives: vehicles up to 04.2006 ⇒ [page 164](#) , vehicles from 04.2006 onwards ⇒ [page 169](#) .
- Press guide rail of chain tensioner for drive chain in direction of arrow and lock chain tensioner by inserting locking pin T40071- .
- Mark running direction of chain with paint.
- Remove bolts -2- and -3- and detach chain sprockets together with drive chain and guide rail -1-.



Installing

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

- Crankshaft -1- locked in TDC position with locking pin - T40069- .
- First install sprocket for camshaft timing chain (left-side) -2-.
- Install guide rail -1- with drive chain fitted.
- Now install sprocket for camshaft timing chain (right-side) -3-.
- Press 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: vehicles up to 04.2006 ⇒ [page 164](#) , vehicles from 04.2006 onwards ⇒ [page 169](#) .
- Install camshaft timing chains ⇒ [page 153](#) .
- Install timing chain cover (bottom) ⇒ [page 139](#) .
- Install timing chain covers (left and right) ⇒ [page 135](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 113](#) and pressure plate ⇒ Rep. Gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 119](#) and damper unit ⇒ [page 118](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 121](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .



Tightening torques

Component	Nm
Drive chain sprocket (left-side) to bearing bracket	6 +60° ¹⁾
Drive chain sprocket (right-side) to cylinder block	30 +90° ¹⁾
Screw plug in cylinder block	14 ²⁾
• ¹⁾ Renew bolts. • ²⁾ Install with new seal.	

1.8 Drive chain for auxiliary drives on vehicles up to 04.2006 - exploded view

1 - Drive chain for auxiliary drives

- ☐ Before removing, mark running direction with paint
- ☐ Removing and installing
⇒ [page 164](#)

2 - Drive chain sprocket for oil pump

- ☐ Installation position:
Side with lettering faces engine

3 - 30 Nm + 90° further

- ☐ Renew

4 - Compression spring

5 - Crankshaft

6 - 15 Nm + 90° further

- ☐ Renew

7 - Chain sprocket for balance shaft

- ☐ Installation position:
Side with lettering faces gearbox

8 - 6 Nm + 45° further

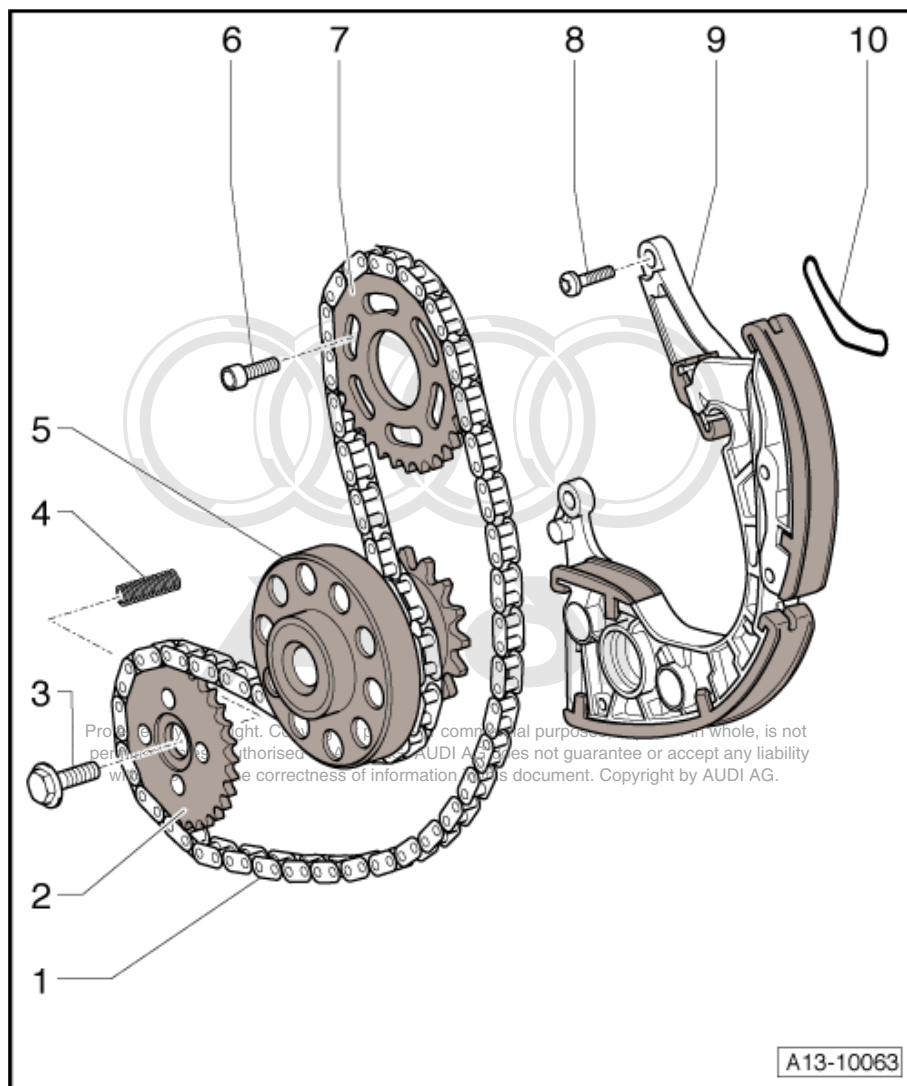
- ☐ Renew

9 - Chain tensioner

- ☐ With guide rail

10 - Seal

- ☐ Depending on version
- ☐ Renew

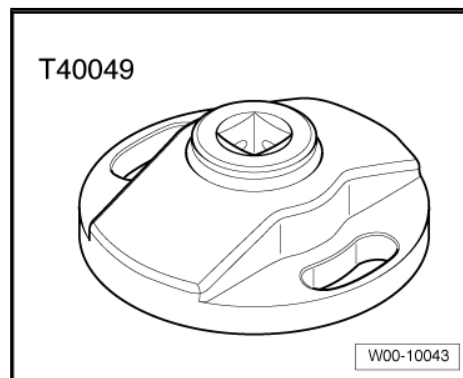


A13-10063

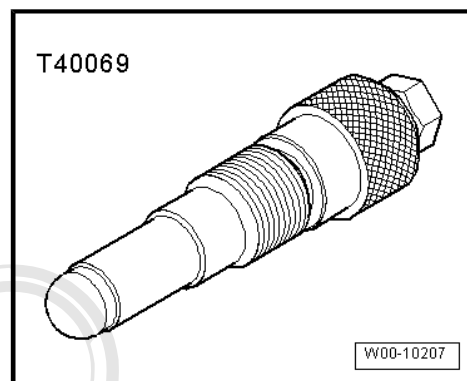
1.9 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006

Special tools and workshop equipment required

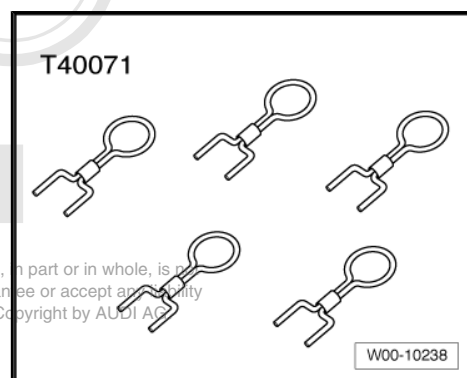
- ◆ Special wrench -T40049-



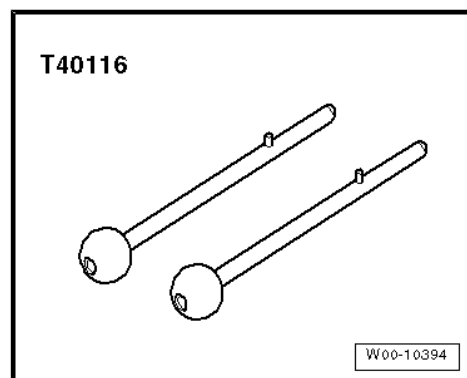
◆ Locking pin -T40069-



◆ Locking pin -T40071-



◆ Locating pins -T40116-

**Removing**

- Gearbox removed ⇒ Rep. Gr. 34 or ⇒ Rep. Gr. 37 .
- Engine oil drained ⇒ Maintenance ; Booklet 405 .

**WARNING**

Make sure that the lock carrier is installed and the torque reaction support is secured on the vehicle before performing the following steps.

- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. Gr. 30 and dual-mass flywheel ⇒ [page 113](#) .
- Vehicles with multitronic gearbox: Remove damper unit ⇒ [page 118](#) and flywheel ⇒ [page 119](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate ⇒ [page 121](#) .
- Remove timing chain cover (bottom) ⇒ [page 139](#) .

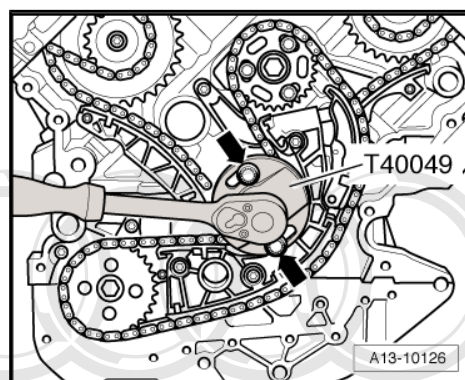
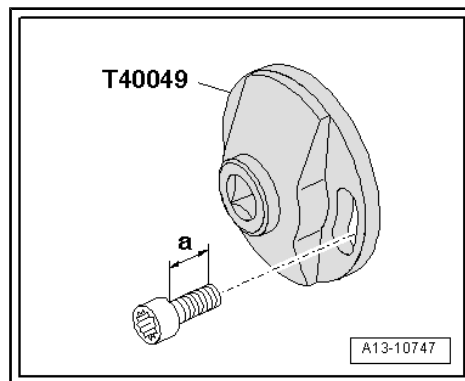


Caution

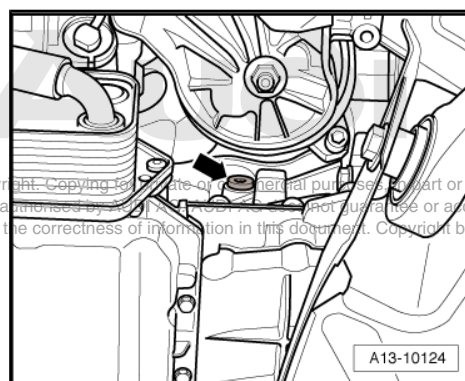
Risk of damage to drive chain if thread of bolt exceeds specified length.

- ◆ Use bolts with a maximum thread length -a- of 22 mm to attach special wrench -T40049-.
- ◆ If no suitable bolts are available, position suitable washer(s) under bolt head so that remaining thread length does not exceed 22 mm.

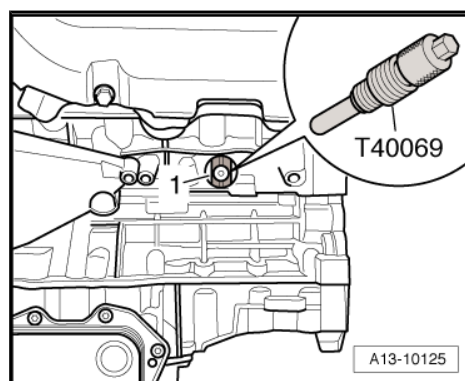
- Attach special wrench -T40049- at rear end of crankshaft using 2 bolts -arrows-.



- Unscrew plug -arrow- from cylinder block.
- Turn crankshaft in normal direction of rotation to TDC position.

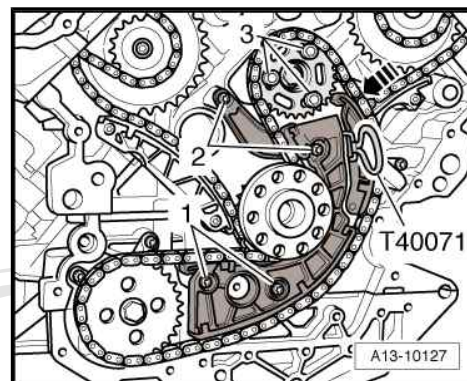


- Screw locking pin -T40069- into bore (tightening torque: 20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.
- Mark running direction of drive chain for auxiliary drives with paint.



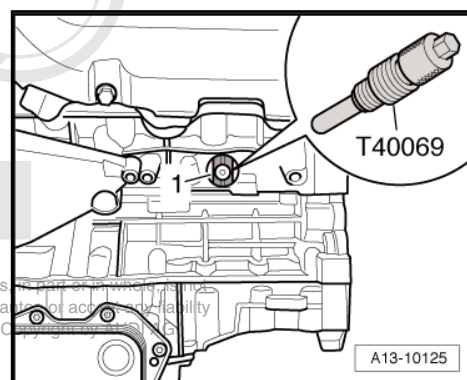
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- Press guide rail of chain tensioner in direction of -arrow- and lock chain tensioner by inserting locking pin -T40071- .
- Remove bolts -1 ... 3- and take out chain tensioner, balance shaft sprocket and chain.



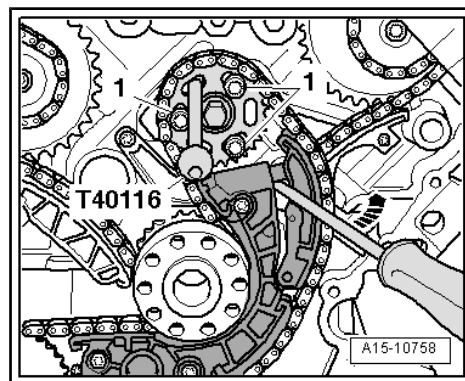
Installing

- Crankshaft -1- locked in TDC position with locking pin - T40069- .



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- Install chain tensioner with chain and balance shaft sprocket.
- Lock balance shaft in TDC position using locating pin - T40116- .
- 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.
- Screw in bolts -1- 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- securing chain sprocket.
- Pull locating pin -T40116- out of balance shaft.



Perform further installation in reverse order, paying attention to the following:

- Install timing chain cover (bottom) ⇒ [page 135](#) .
- Install timing chain covers (left and right) ⇒ [page 135](#) .
- Install crankshaft oil seal (gearbox end) ⇒ [page 122](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 113](#) and pressure plate ⇒ Rep. Gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 119](#) and damper unit ⇒ [page 118](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 121](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Chain tensioner to cylinder block	6 +45° ¹⁾
Chain sprocket for balance shaft to balance weight	15 +90° ¹⁾
Screw plug in cylinder block	14 ²⁾
• ¹⁾ Renew bolts. • ²⁾ Install with new seal.	

1.10 Drive chain for auxiliary drives on vehicles from 04.2006 - exploded view

1 - Crankshaft**2 - Drive chain for auxiliary drives**

- ☐ Before removing, mark running direction with paint
- ☐ Removing and installing
⇒ [page 169](#)

3 - Drive chain sprocket for oil pump

- ☐ Installation position:
Side with lettering faces engine

4 - 30 Nm + 90° further

- ☐ Renew

5 - Compression spring**6 - 15 Nm + 90° further**

- ☐ Renew

7 - Chain sprocket for balance shaft

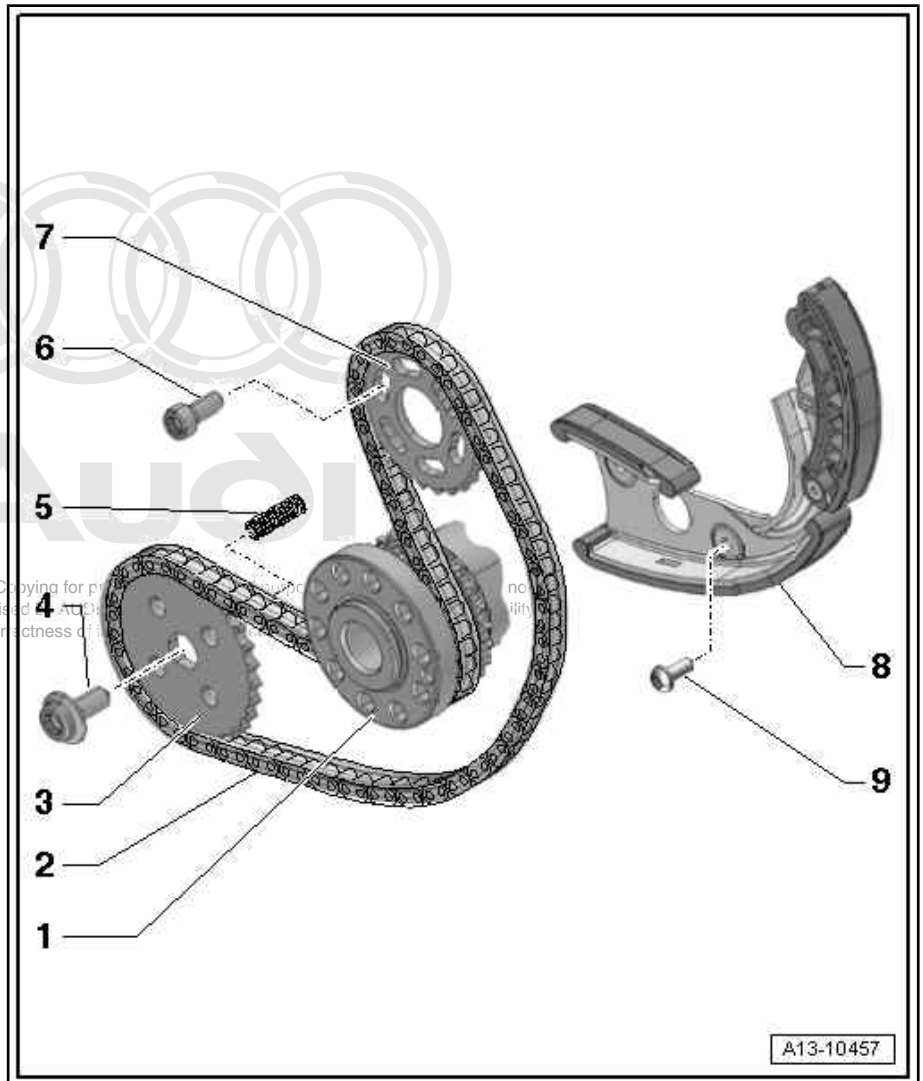
- ☐ Installation position:
Side with lettering faces gearbox

8 - Chain tensioner

- ☐ With guide rail

9 - 10 Nm + 45° further

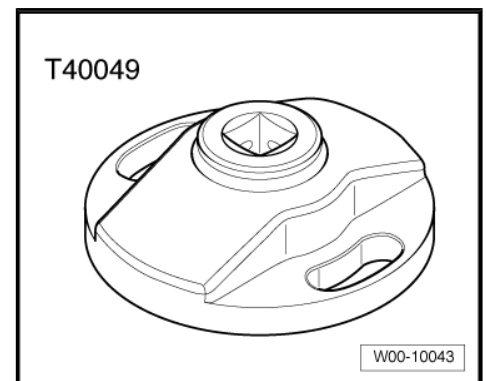
- ☐ Renew



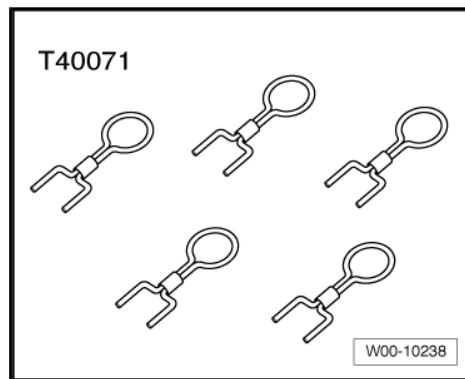
1.11 Removing and installing drive chain for auxiliary drives on vehicles from 04.2006

Special tools and workshop equipment required

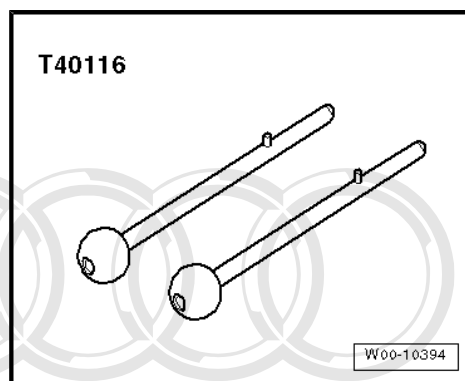
- ◆ Special wrench -T40049-



◆ Locking pin -T40071-



◆ Locating pins -T40116-



Removing

- Gearbox removed ⇒ Rep. Gr. 34 or ⇒ Rep. Gr. 37 .
- Engine oil drained ⇒ Maintenance ; Booklet 405 .



WARNING

Make sure that the lock carrier is installed and the torque reaction support is secured on the vehicle before performing the following steps.

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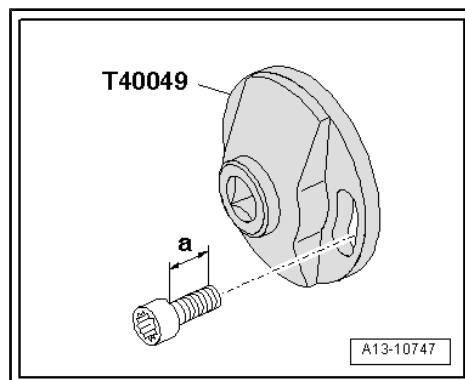
- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. Gr. 30 and dual-mass flywheel ⇒ [page 113](#) .
- Vehicles with multitronic gearbox: Remove damper unit ⇒ [page 118](#) and flywheel ⇒ [page 119](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate ⇒ [page 121](#) .
- Remove timing chain cover (bottom) ⇒ [page 139](#) .



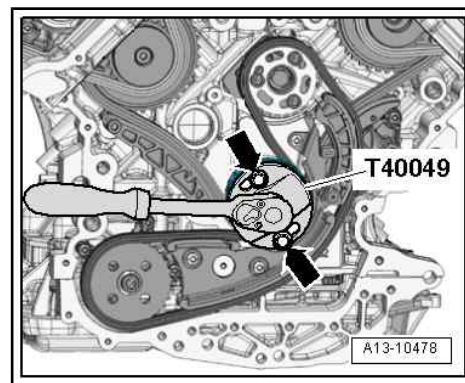
Caution

Risk of damage to drive chain if thread of bolt exceeds specified length.

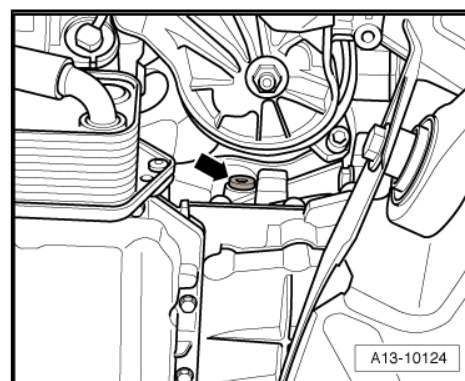
- ◆ ***Use bolts with a maximum thread length -a- of 22 mm to attach special wrench -T40049- .***
- ◆ ***If no suitable bolts are available, position suitable element under bolt head so that remaining thread length does not exceed 22 mm.***



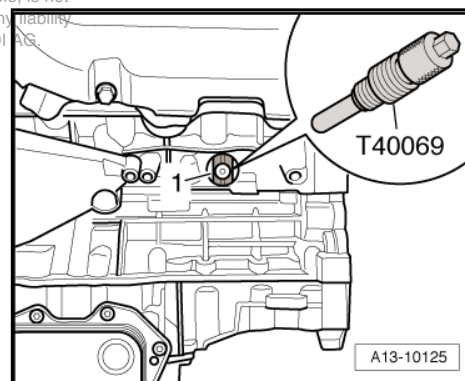
- Attach special wrench -T40049- at rear end of crankshaft using 2 bolts -arrows-.



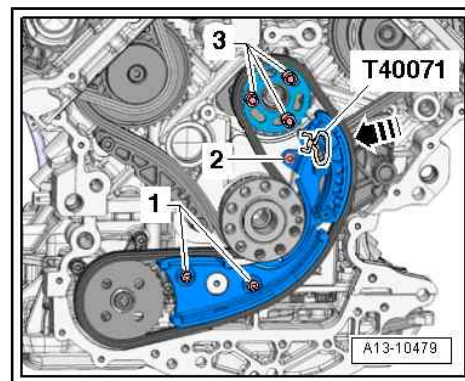
- Unscrew plug -arrow- for “TDC” marking from sump (top section).
- Turn crankshaft in normal direction of rotation to “TDC” position.



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

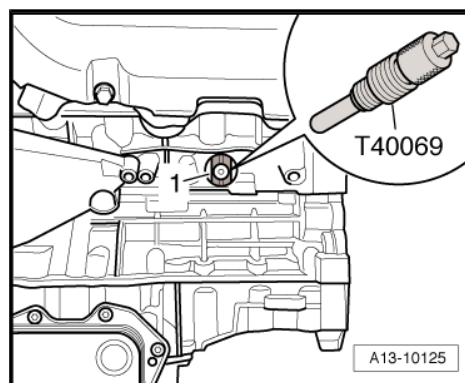


- Mark running direction of drive chain for auxiliary drives with paint.
- Press guide rail of chain tensioner in direction of -arrow- and lock chain tensioner by inserting locking pin -T40071-.
- Unscrew bolts -3- and detach chain sprocket from balance shaft.
- Remove bolts -1- and -2- and take off chain tensioner with chain.

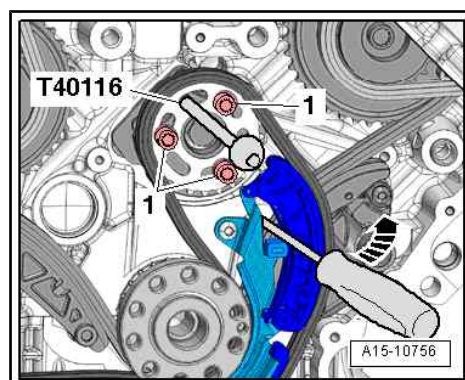


Installing

- Crankshaft -1- locked in "TDC" position with locking pin - T40069- .



- Install chain tensioner with chain and balance shaft sprocket.
- Lock balance shaft in TDC position using locating pin - T40116- .
- 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- for chain sprocket without tightening.
- 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- securing chain sprocket.
- Pull locating pin -T40116- out of balance shaft.



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

- Install timing chain cover (bottom) ⇒ [page 139](#) .
- Install timing chain covers (left and right) ⇒ [page 135](#) .
- Install crankshaft oil seal (gearbox end) ⇒ [page 122](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 113](#) and pressure plate ⇒ Rep. Gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 119](#) and damper unit ⇒ [page 118](#) .
- Vehicles with automatic gearbox-09L: Install drive plate ⇒ [page 121](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Chain tensioner to cylinder block	10 +45° ¹⁾
Chain sprocket for balance shaft to balance weight	15 +90° ¹⁾
Screw plug in cylinder block	14 ²⁾
• ¹⁾ Renew bolts. • ²⁾ Install with new seal.	

1.12 Balance shaft - exploded view

1 - Balance shaft

- ☐ Removing and installing
⇒ [page 173](#)

2 - 60 Nm

- ☐ Use locating pin - T40116- as counterhold when loosening and tightening

3 - Balance weight (gearbox end)

- ☐ Can only be fitted on balance shaft in one position.

4 - Bearing plate

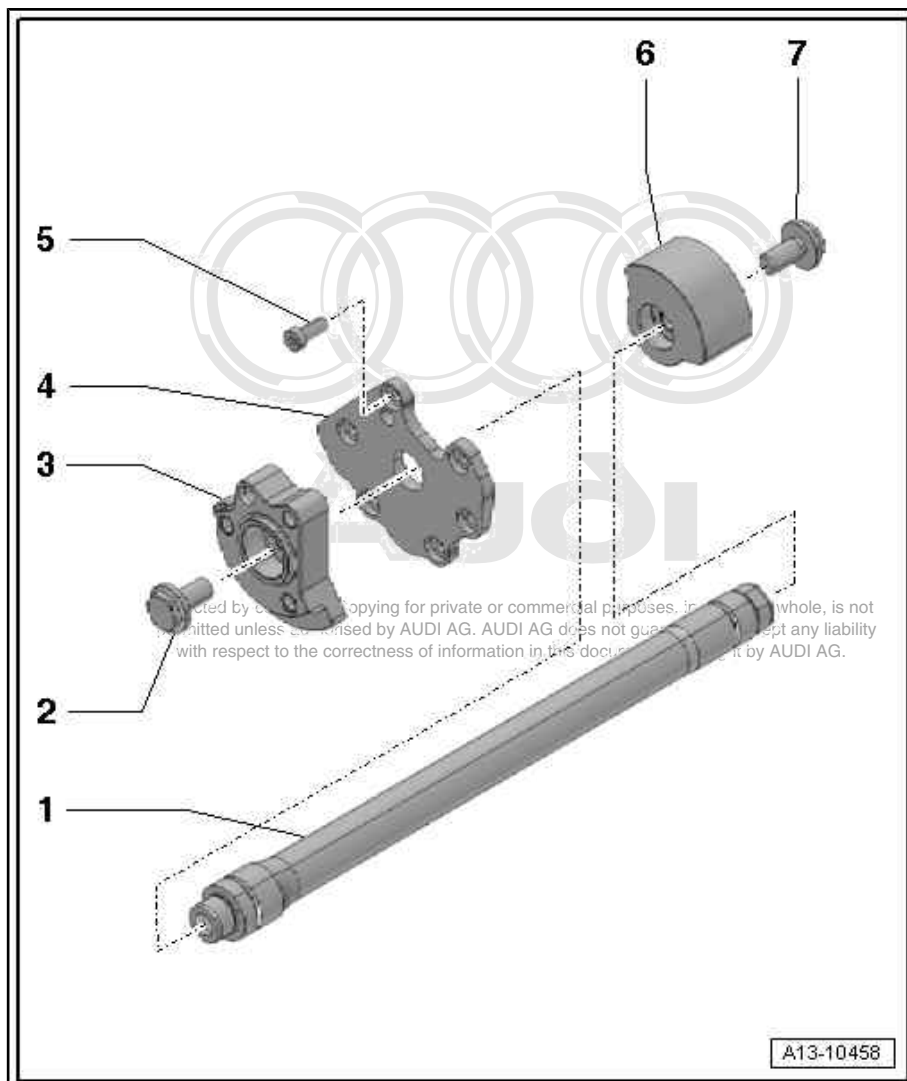
5 - 13 Nm

6 - Balance weight (pulley end)

- ☐ Can only be fitted on balance shaft in one position.

7 - 60 Nm

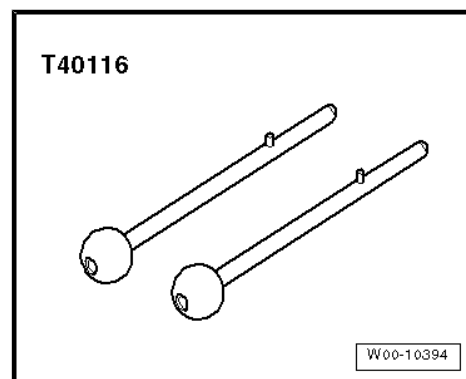
- ☐ Use locating pin - T40116- as counterhold when loosening and tightening



1.13 Removing and installing balance shaft

Special tools and workshop equipment required

- ◆ Locating pins -T40116-



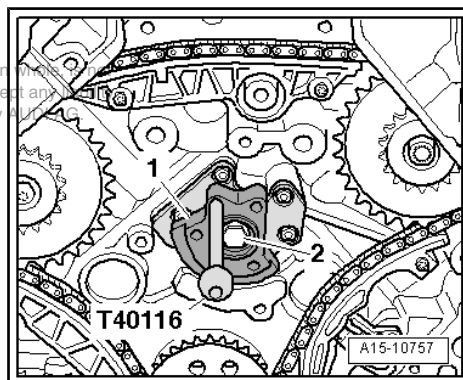
Removing

- Gearbox removed ⇒ Rep. Gr. 34 or ⇒ Rep. Gr. 37 .
- Engine oil drained ⇒ Maintenance ; Booklet 405 .

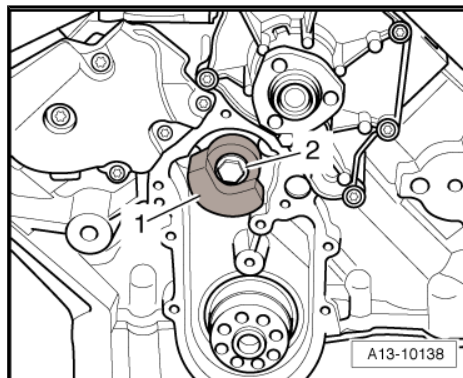

WARNING

Make sure that the lock carrier is installed and the torque reaction support is secured on the vehicle before performing the following steps.

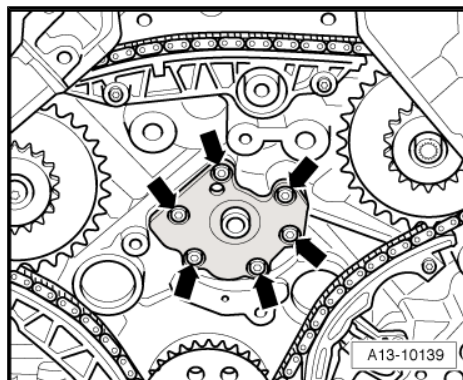
- Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. Gr. 30 and dual-mass flywheel ⇒ [page 113](#) .
- Vehicles with multitronic gearbox: Remove damper unit ⇒ [page 118](#) and flywheel ⇒ [page 119](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate ⇒ [page 121](#) .
- Remove sealing flange (pulley end) ⇒ [page 109](#) .
- Remove timing chain cover (bottom) ⇒ [page 139](#) .
- Remove drive chain for auxiliary drives: vehicles up to 04.2006 ⇒ [page 164](#) , vehicles from 04.2006 onwards ⇒ [page 169](#) .
- Use locating pin -T40116- to lock balance shaft -1- in position at rear of engine.
- Unscrew bolt -2- 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 remove bearing plate for balance shaft at rear of engine.
- Pull balance shaft out of cylinder block towards rear.



Installing

- Crankshaft -1- locked in TDC position with locking pin - T40069- .

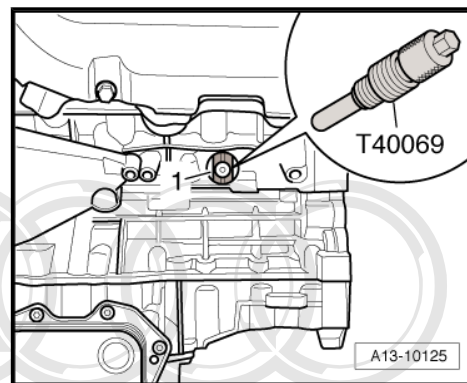
Installation is carried out in the reverse order; note the following:



Note

Balance weights can only be fitted on balance shaft in one position.

- Install drive chain for auxiliary drives: vehicles up to 04.2006 ⇒ [page 164](#) , vehicles from 04.2006 onwards ⇒ [page 169](#) .
- Install timing chain cover (bottom) ⇒ [page 139](#) .
- Install sealing flange (pulley end) ⇒ [page 109](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 113](#) and pressure plate ⇒ Rep. Gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 119](#) and damper unit ⇒ [page 118](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 121](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .



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Tightening torques

Component	Nm
Bearing plate to cylinder block	9
Balance weight to balance shaft	60
Screw plug in cylinder block	14 ¹⁾
• ¹⁾ Install with new seal.	

2 Cylinder head

2.1 Cylinder head - exploded view



Note

- ◆ Illustration shows left cylinder head.
- ◆ Both cylinder heads can be removed and installed with the engine still installed.

1 - High-pressure pump

- ☐ Removing and installing
⇒ Rep. Gr. 24

2 - 9 Nm

3 - 20 Nm

4 - Lifting eye

5 - O-ring

- ☐ Renew

6 - Hall sender for inlet camshaft

- ☐ Cylinder bank 1 (right-side) Hall sender -G40-
- ☐ Cylinder bank 2 (left-side) Hall sender 2 -G163-

7 - 8 Nm + 90° further

- ☐ Renew

8 - O-ring

- ☐ Renew

9 - 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-

10 - 2.5 Nm

11 - Seal

- ☐ Renew if damaged or leaking

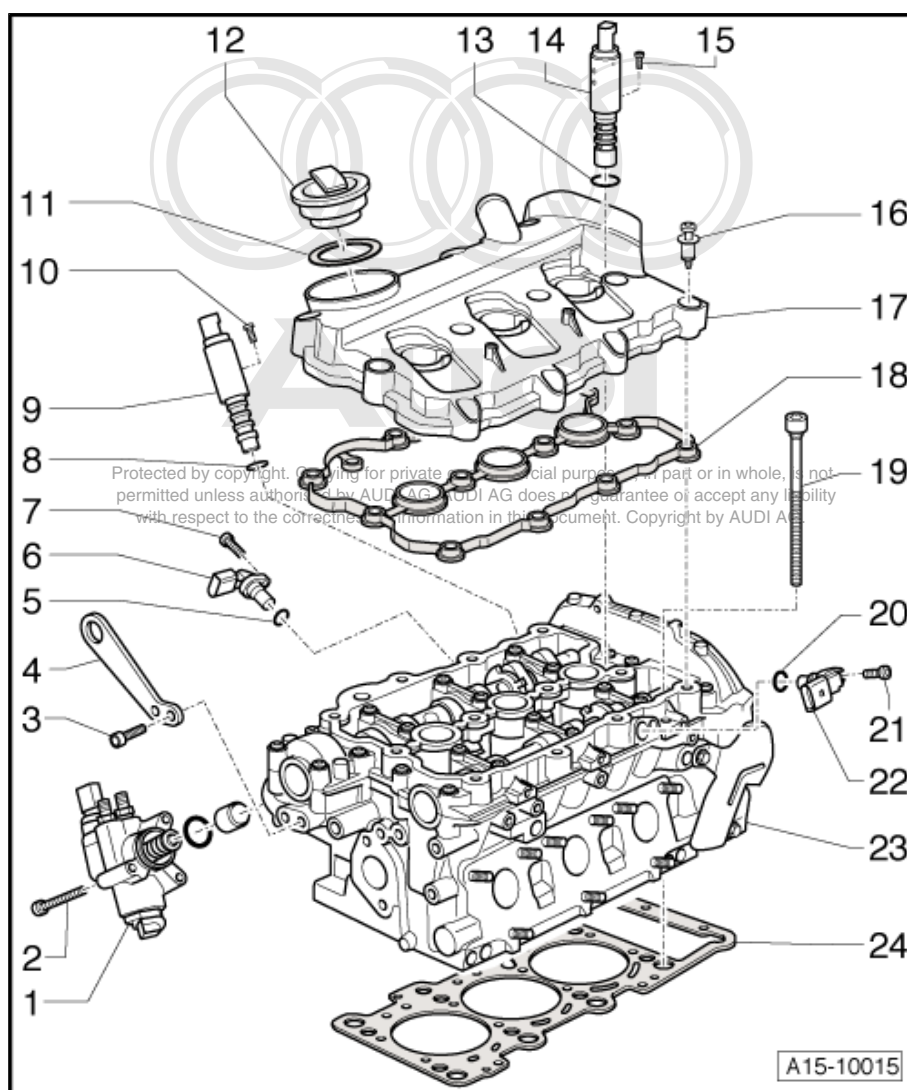
12 - Filler cap

13 - O-ring

- ☐ Renew

14 - 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-



15 - 2.5 Nm**16 - Special bolt, 9 Nm**

- ☐ Renew if damaged or leaking
- ☐ Note correct sequence when tightening ⇒ [page 180](#)

17 - Cylinder head cover

- ☐ Removing and installing cylinder head cover (left-side) ⇒ [page 178](#)
- ☐ Removing and installing cylinder head cover (right-side) ⇒ [page 182](#)

18 - Gasket for cylinder head cover

- ☐ Renew if damaged or leaking

19 - Cylinder head bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 192](#)
- ☐ Note correct sequence when tightening ⇒ [page 193](#)

20 - O-ring

- ☐ Renew

21 - 8 Nm + 90° further

- ☐ Renew

22 - Hall sender for exhaust camshaft

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- ☐ Cylinder bank 1 (right-side) Hall sender 3 - G300-
- ☐ Cylinder bank 2 (left-side) Hall sender 4 - G301-

23 - Cylinder head

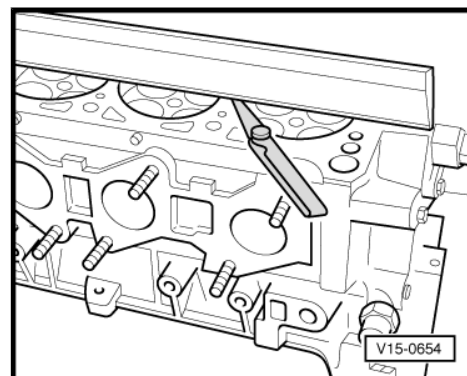
- ☐ Removing ⇒ [page 188](#)
- ☐ Checking for distortion ⇒ [page 177](#)
- ☐ Machining limit ⇒ [page 178](#)
- ☐ Installing ⇒ [page 192](#)
- ☐ If renewed, change coolant and engine oil

24 - Cylinder head gasket

- ☐ Renewing ⇒ [“2.6 Removing and installing cylinder head”, page 188](#)
- ☐ Installation position: Part No. towards cylinder head
- ☐ If renewed, change coolant and engine oil

Checking cylinder head for distortion

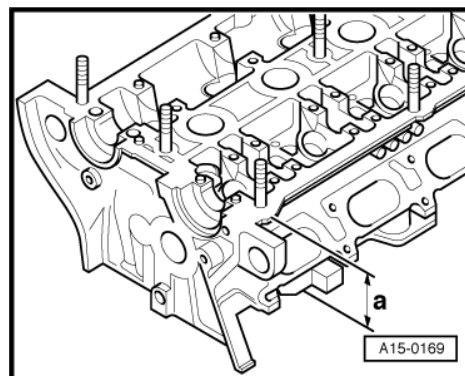
- Use straight edge and feeler gauge to measure for distortion at several points.
- Max. distortion: 0.05 mm



Cylinder head machining limit

Machining of the cylinder head (surface grinding) is only permissible down to the minimum dimension -a-.

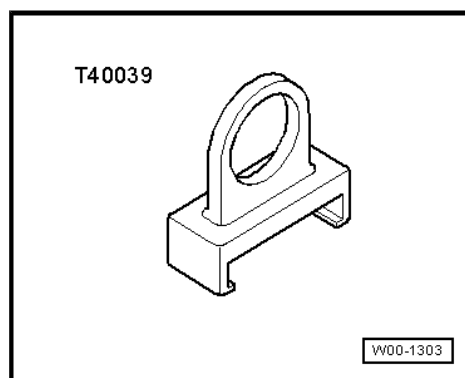
- Minimum dimension: -a- = 139.20 mm



2.2 Removing and installing cylinder head cover (left-side)

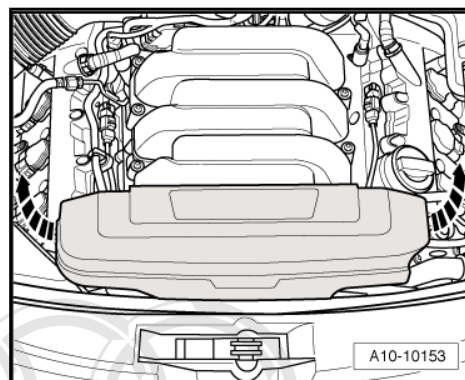
Special tools and workshop equipment required

- ◆ Puller -T40039-

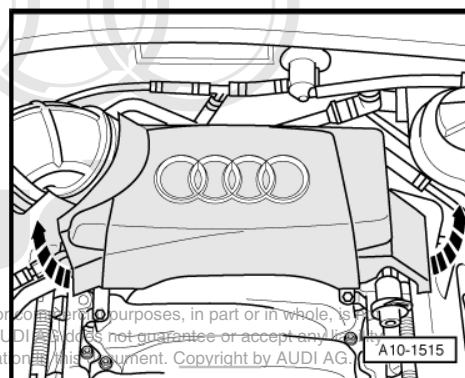


Removing

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

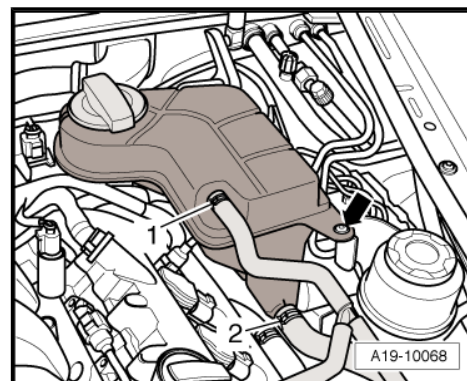


- Pull off engine cover panel (rear) -arrows-.

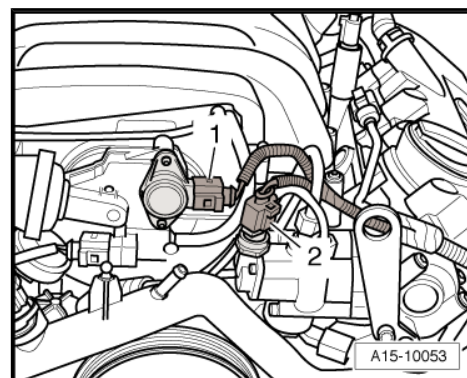


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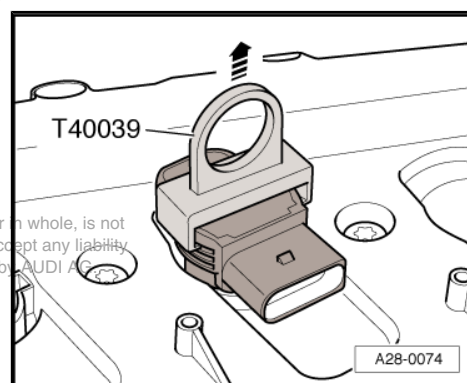
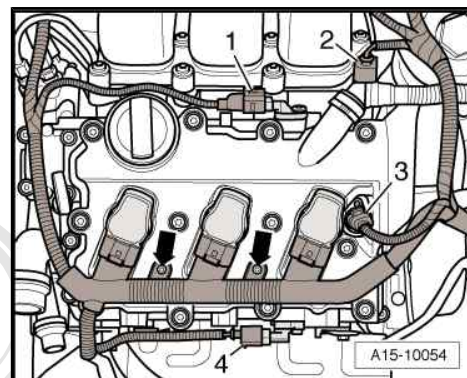
- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



- Unplug electrical connectors.
- 1 - Variable intake manifold position sender -G513-
- 2 - Fuel pressure sender for low-pressure -G410- (if fitted)



- Unplug electrical connectors.
- 1 - Hall sender 2 -G163-
- 2 - Inlet camshaft control valve 2 -N208-
- 3 - Exhaust camshaft control valve 2 -N319-
- 4 - Hall sender 4 -G301-
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.
- Move wiring harness clear.
- Pull ignition coils out with puller -T40039- .



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- Detach crankcase breather hose -arrow-.
- Unscrew cylinder head cover bolts (left-side) in the sequence -12 ... 1-.
- Remove cylinder head cover.

Installing

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

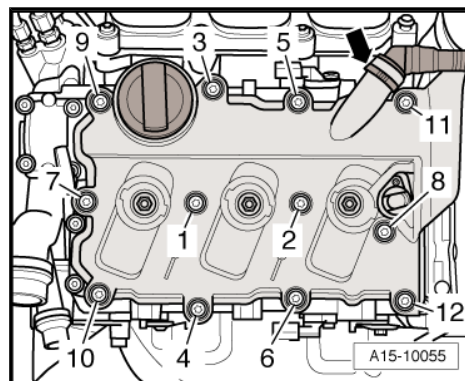


Note

- ◆ *Renew cylinder head cover gaskets if damaged.*
- ◆ *Renew cylinder head cover bolts if gasket is damaged.*
- Clean sealing surfaces; they must be free of oil and grease.
- Tighten bolts for cylinder head cover in the sequence -1 ... 12-.

Tightening torque

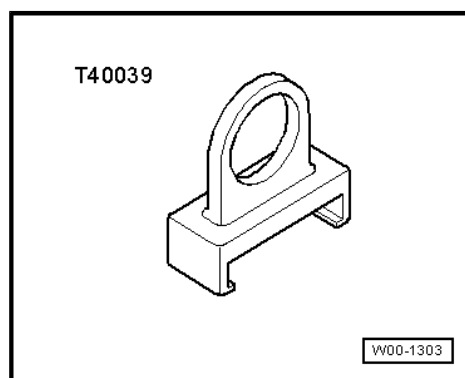
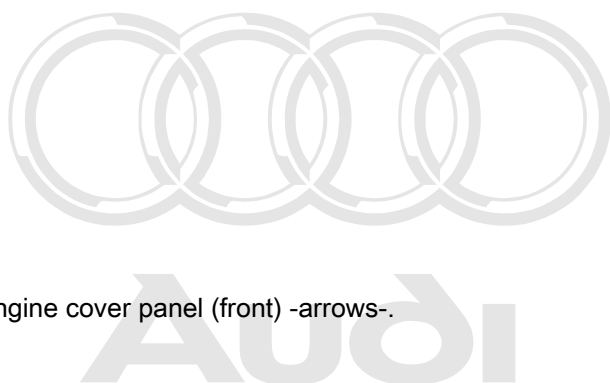
Component	Nm
Cylinder head cover to cylinder head	9



2.3 Removing and installing cylinder head cover (left-side) - USA vehicles

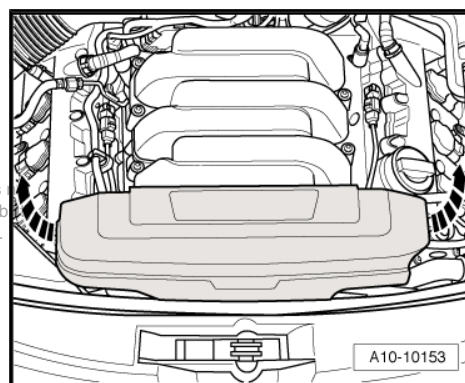
Special tools and workshop equipment required

- ◆ Puller -T40039-



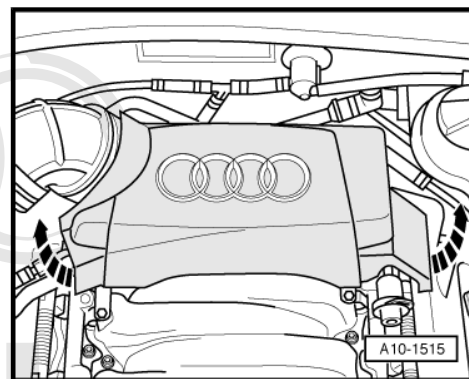
Removing

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

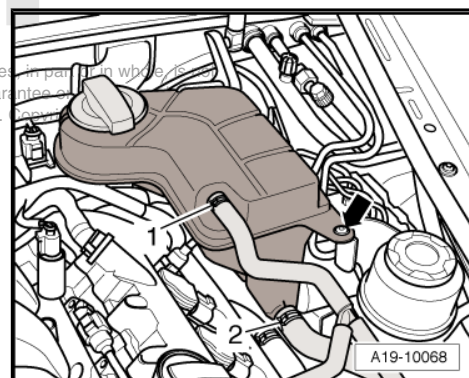


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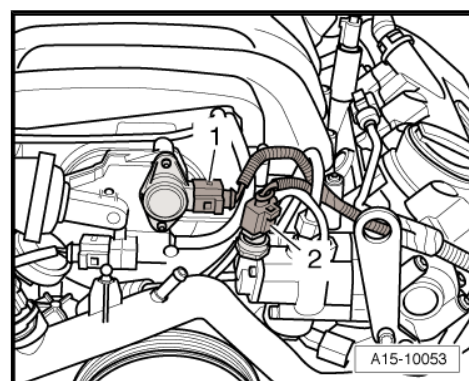
- Pull off engine cover panel (rear) -arrows-.



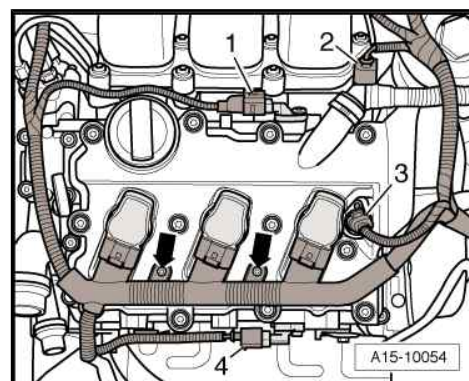
- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



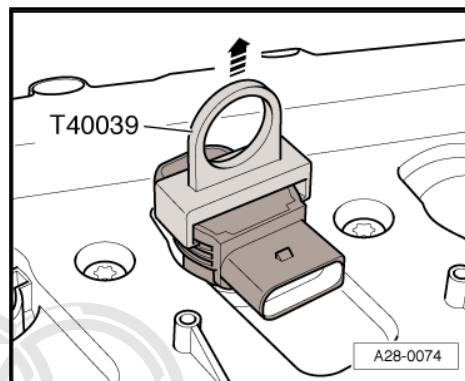
- Unplug electrical connectors.
- 1 - Variable intake manifold position sender -G513-
- 2 - Fuel pressure sender for low-pressure -G410- (if fitted)



- Unplug electrical connectors.
- 1 - Hall sender 2 -G163-
- 2 - Inlet camshaft control valve 2 -N208-
- 3 - Exhaust camshaft control valve 2 -N319-
- 4 - Hall sender 4 -G301-
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.
- Move wiring harness clear.



- Pull ignition coils out with puller -T40039- .



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



Note

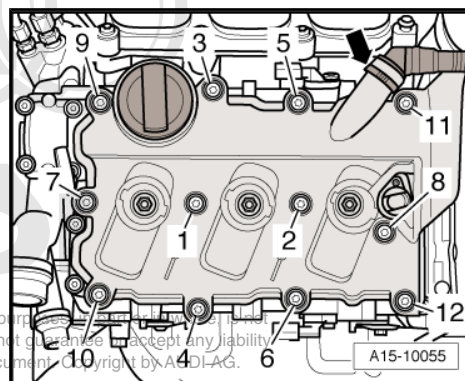
Ignore -arrow-.



Caution

Do not disconnect crankcase breather hose on USA models.

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- Detach cylinder head cover and move clear to one side (crankcase breather hose remains connected).

Installing

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



Note

- ◆ Renew cylinder head cover gaskets if damaged.
- ◆ Renew cylinder head cover bolts if gasket is damaged.
- Clean sealing surfaces; they must be free of oil and grease.
- Tighten bolts for cylinder head cover to final setting in the sequence -1 ... 12-.

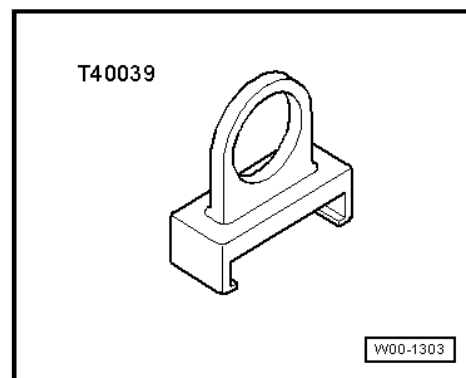
Tightening torque

Component	Nm
Cylinder head cover to cylinder head	9

2.4 Removing and installing cylinder head cover (right-side)

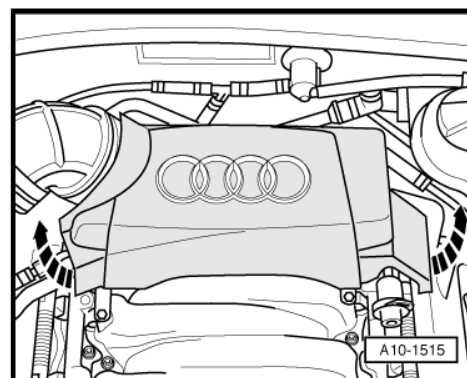
Special tools and workshop equipment required

◆ Puller -T40039-

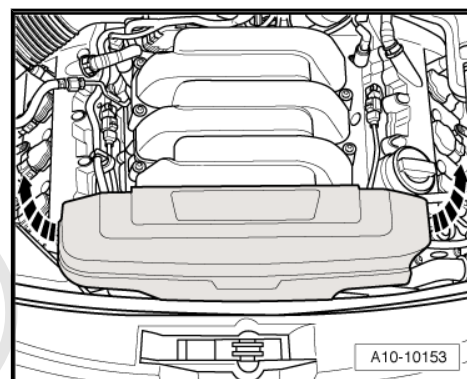


Removing

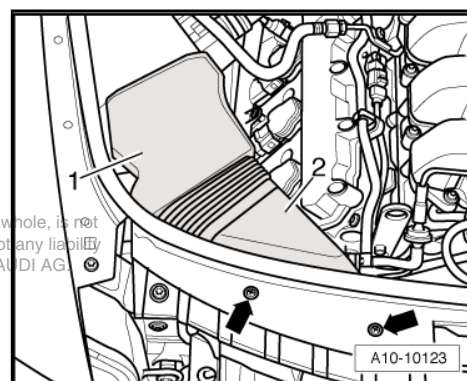
- Pull off engine cover panel (rear) -arrows-.



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

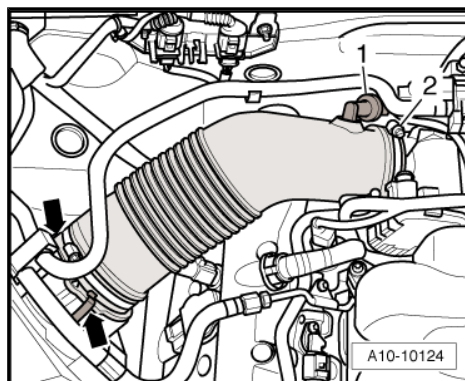


- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.

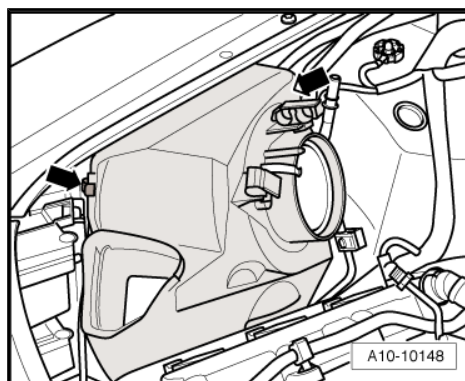


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- Pull non-return valve -1- off air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



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

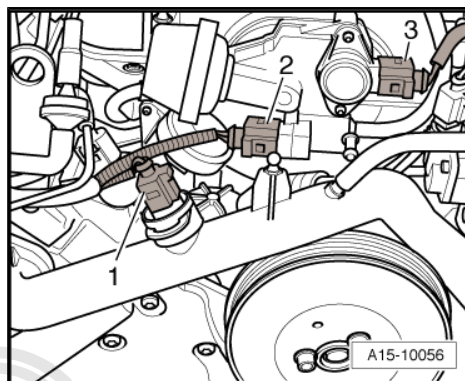


- Unplug electrical connectors.
- 1 - Coolant temperature sender -G62-
- 2 - Variable intake manifold flap change-over valve -N239-



Note

Disregard -item 3-.

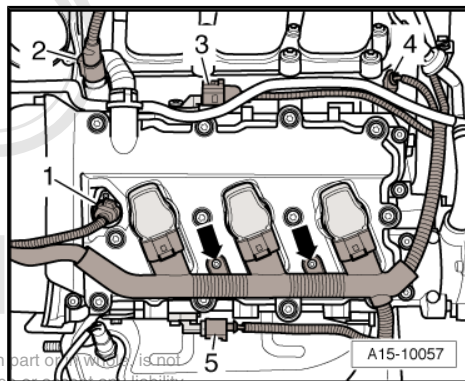


- Unplug electrical connectors.
- 1 - Exhaust camshaft control valve 1 -N318-
- 3 - Hall sender -G40-
- 4 - Intake manifold flap potentiometer -G336-
- 5 - Hall sender 3 -G300-



Note

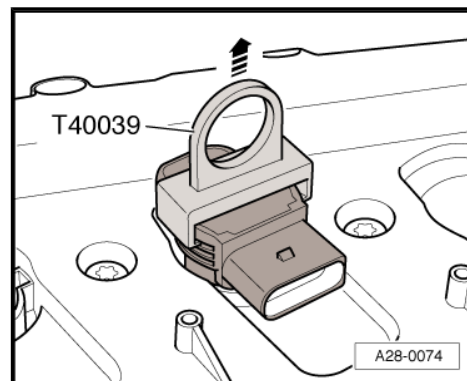
Disregard -item 2-.



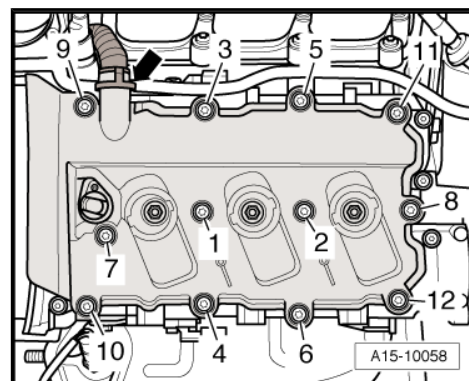
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.
- Move wiring harness clear.

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- Pull ignition coils out with puller -T40039- .



- Unscrew cylinder head cover bolts (right-side) in the sequence -12 ... 1-.
- Detach crankcase breather hose -arrow-.
- Remove cylinder head cover.



Installing

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



Note

- ◆ Renew cylinder head cover gaskets if damaged.
- ◆ Renew cylinder head cover bolts if gasket is damaged.
- Clean sealing surfaces; they must be free of oil and grease.
- Tighten bolts for cylinder head cover to final setting in the sequence -1 ... 12-.

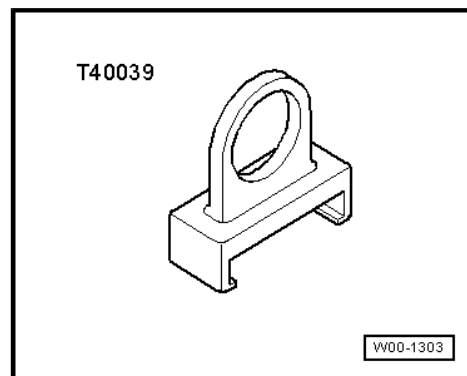
Tightening torques

Component	Nm
Cylinder head cover to cylinder head	9
Hose clips (9 mm wide)	3

2.5 Removing and installing cylinder head cover (right-side) - USA vehicles

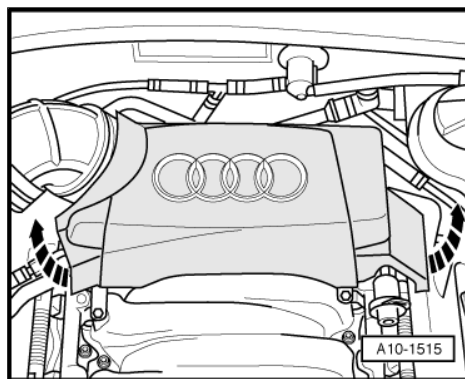
Special tools and workshop equipment required

- ◆ Puller -T40039-

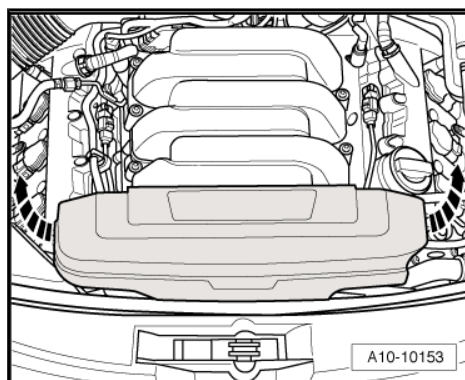


Removing

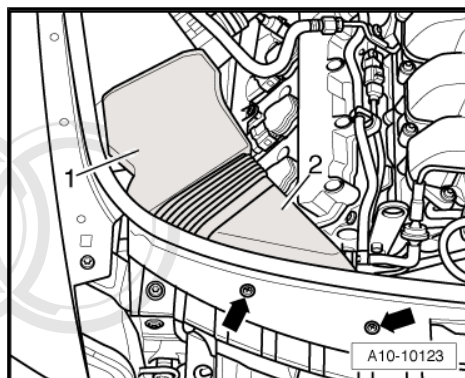
- Pull off engine cover panel (rear) -arrows-.



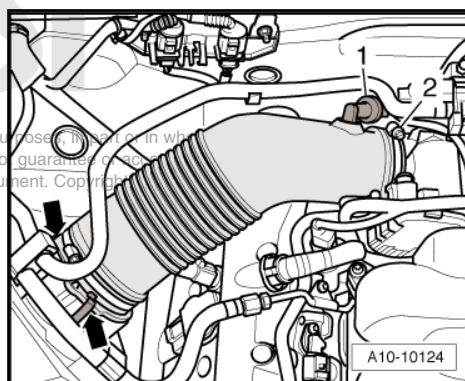
- Pull off engine cover panel (front) -arrows-.



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

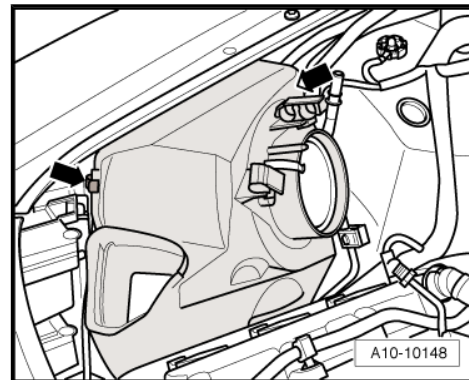


- Pull non-return valve -1- off air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



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



- Unplug electrical connectors.

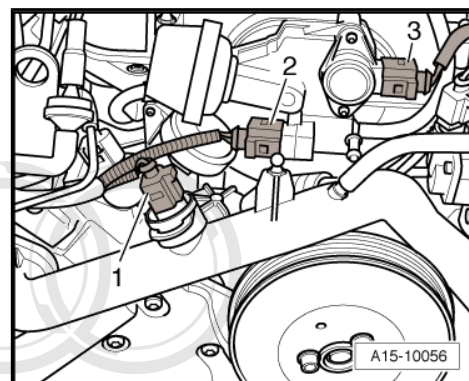
1 - Coolant temperature sender -G62-

2 - Variable intake manifold flap change-over valve -N239-



Note

Disregard -item 3-.



- Unplug electrical connectors.

1 - Exhaust camshaft control valve 1 -N318-

3 - Hall sender -G40-

4 - Intake manifold flap potentiometer -G336-

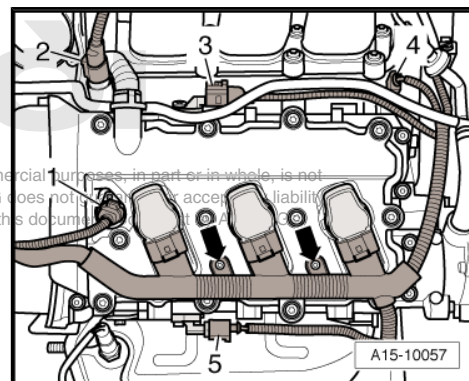
5 - Hall sender 3 -G300-

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Note

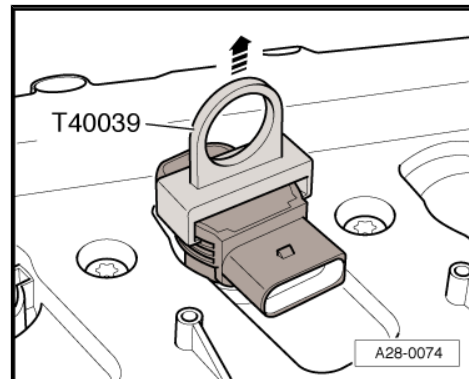
Disregard -item 2-.



- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.

- Move wiring harness clear.

- Pull ignition coils out with puller -T40039- .



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



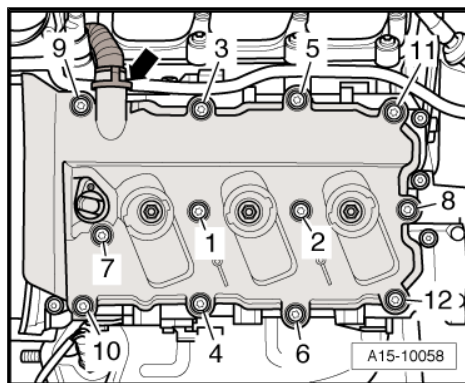
Note

Ignore -arrow-.



Caution

Do not disconnect crankcase breather hose on USA models.



- Detach cylinder head cover and move clear to one side (crankcase breather hose remains connected).

Installing

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



Note

- ◆ Renew cylinder head cover gaskets if damaged.
- ◆ Renew cylinder head cover bolts if gasket is damaged.
- Clean sealing surfaces; they must be free of oil and grease.
- Tighten bolts for cylinder head cover to final setting in the sequence -1 ... 12-.

Tightening torques

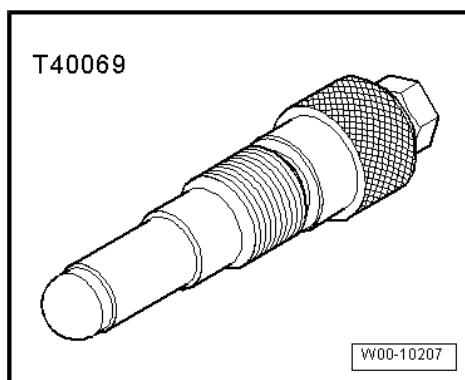
Component	Nm
Cylinder head cover to cylinder head	9
Hose clips (9 mm wide)	3

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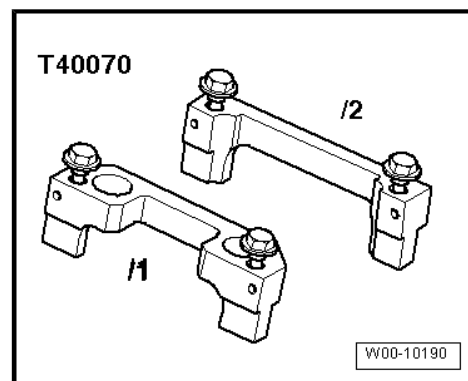
2.6 Removing and installing cylinder head

Special tools and workshop equipment required

- ◆ Locking pin -T40069-



◆ Camshaft clamp -T40070-



Removing

- Engine in vehicle.



Note

The following description shows the removal and installation of the cylinder head (left-side). The procedure for the other side is identical.



WARNING

The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ Rep. Gr. 24 .

- Drain off coolant ⇒ [page 243](#) .
- Remove front exhaust pipe: left-side ⇒ [page 279](#) , right-side ⇒ [page 284](#) .
- Remove poly V-belt ⇒ [page 108](#) .
- Remove coolant pipe (front) ⇒ [page 253](#) .
- Remove power steering pump ⇒ Rep. Gr. 48 .



Note

To remove the cylinder head (right-side) you must first remove the exhaust pump for brake servo ⇒ Rep. Gr. 47 .

- Remove intake manifold (top section) ⇒ Rep. Gr. 24 .
- Remove intake manifold (bottom section) ⇒ Rep. Gr. 24 .
- Detach electrical connectors at injectors.

- Unplug electrical connector -1- for Lambda probe before catalytic converter and move wiring clear towards bottom of vehicle.

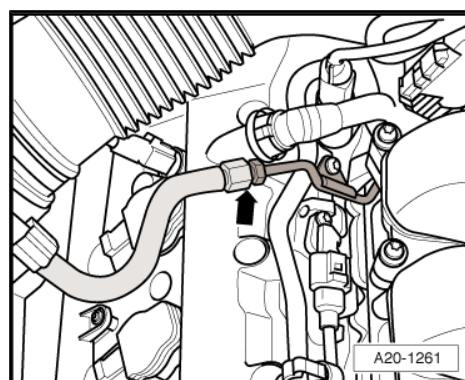
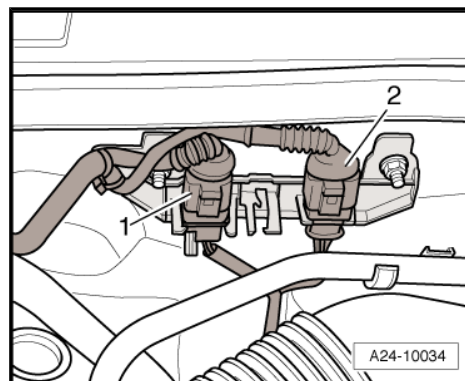


Note

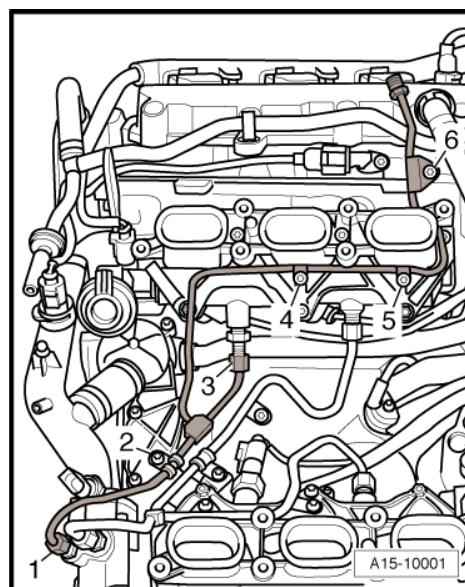
Disregard -item 2-.

- Remove oil filter housing ⇒ [page 234](#) .

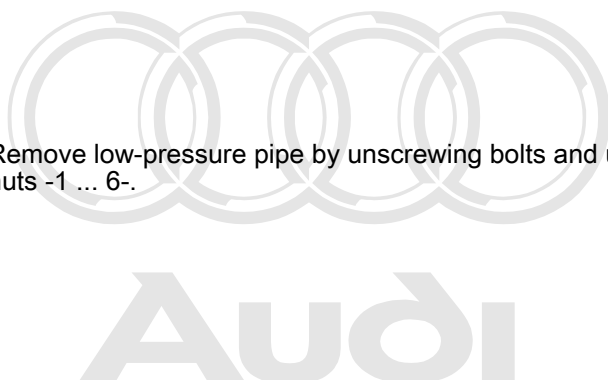
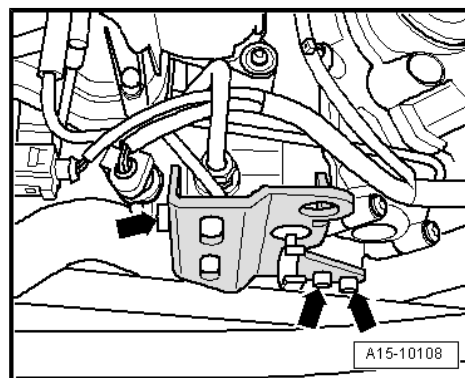
- Disconnect fuel line -arrow-.



- Remove low-pressure pipe by unscrewing bolts and union nuts -1 ... 6-.

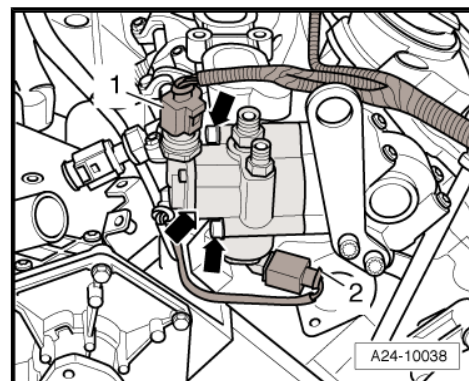


- Remove large lifting eye -arrows- (if fitted).

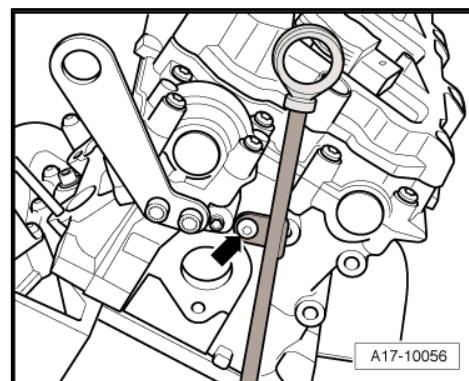


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- Unplug electrical connectors -1- and -2-.
- Remove high-pressure pump from cylinder head (left-side) -arrows- (only necessary if you are planning to carry out further repairs to cylinder head).

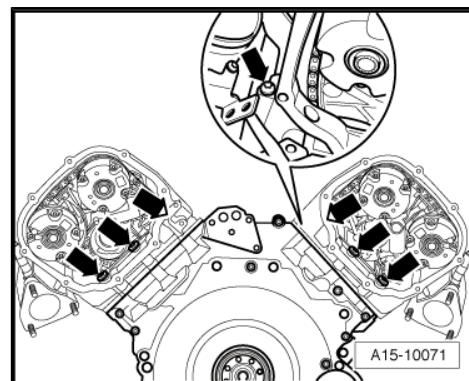


- Remove bolt -arrow- and lift out guide tube for oil dipstick.
- Remove cylinder head cover: left-side ⇒ [page 178](#) , right-side ⇒ [page 182](#) .
- Remove timing chain covers (left and right) ⇒ [page 135](#) .
- Remove camshaft timing chains from camshafts ⇒ [page 150](#) .



- Unscrew bolts -arrows- at rear of cylinder head.
- ◆ Cylinder head (left-side): 3 bolts
- ◆ Cylinder head (right-side): 4 bolts

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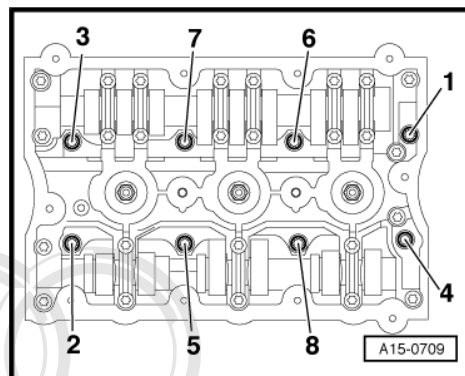
- Loosen cylinder head bolts in the sequence -1 ... 8-.
- Carefully remove the cylinder head.

Installing

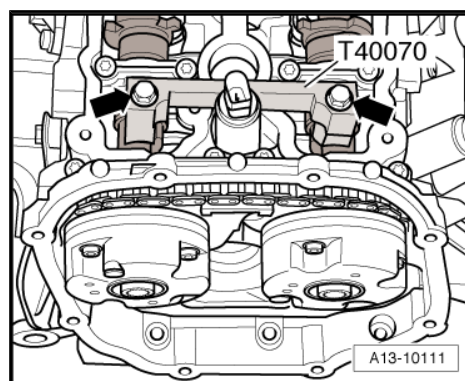


Note

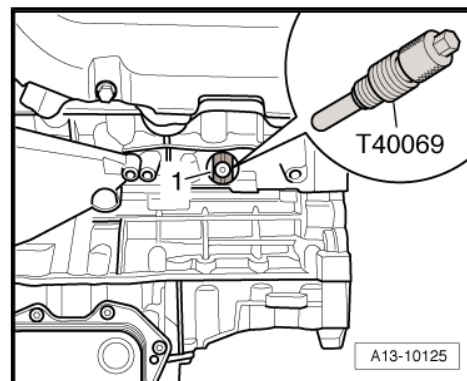
- ◆ Renew the cylinder head bolts.
- ◆ Renew self-locking nuts and bolts when performing assembly work.
- ◆ Renew bolts which are tightened to a specified angle as well as seals and gaskets.
- ◆ If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.
- ◆ Carefully remove any remaining emery and abrasive material.
- ◆ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.
- ◆ Checking cylinder head for distortion [→ page 177](#)
- ◆ Do not remove new cylinder head gasket from packaging until it is ready to be fitted.
- ◆ Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.
- ◆ Position cylinder head gasket on dowel sleeves. The word "oben" (top) or the Part No. should face towards the cylinder head.
- ◆ When installing an exchange cylinder head with fitted camshafts, the contact surfaces between roller rocker fingers and cams must be oiled after installing the head.
- ◆ The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.
- ◆ After fitting a new cylinder head or cylinder head gasket, change the coolant and engine oil.
- ◆ 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.
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.



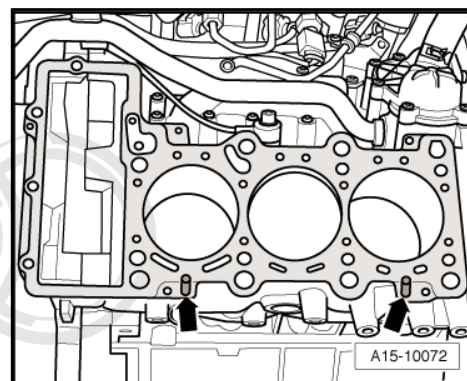
- Before fitting cylinder head set crankshaft and camshafts to TDC. To do so, fit camshaft clamps -T40070- to both cylinder heads and tighten to 20 Nm.
- The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.



- The locking pin -T40069- must be screwed into the crankshaft.

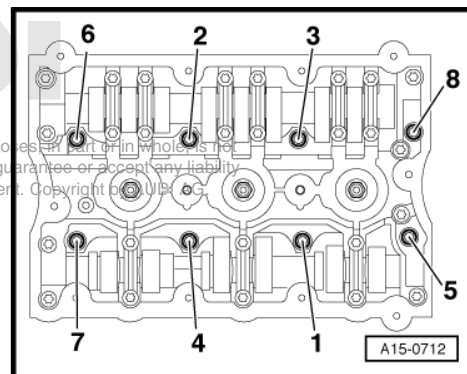


- Fit cylinder head gasket.
- Note position of centering pins -arrows- in cylinder block.
- Check installation position of cylinder head gasket: the word "oben" (top) or the Part No. should face towards the cylinder head.
- Fit the cylinder head.



- Insert new cylinder head bolts and tighten finger-tight.
 - Tighten cylinder head in 3 stages in the following sequence:
1. Tighten to 40 Nm.
 2. Turn 90° further.
 3. Turn 90° further.

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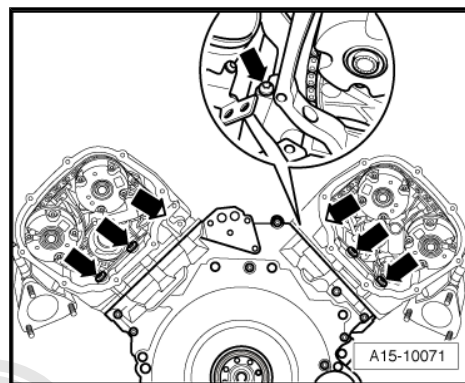
Note

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

- Tighten bolts -arrows- to 9 Nm.
- ◆ Cylinder head (left-side): 3 bolts
- ◆ Cylinder head (right-side): 4 bolts

Perform further installation in reverse order, paying attention to the following:

- Install camshaft timing chains ⇒ [page 153](#) .
- Install timing chain covers (left and right) ⇒ [page 135](#) .
- Install cylinder head cover: left-side ⇒ [page 178](#) , right-side ⇒ [page 182](#) .
- Install high-pressure pump ⇒ Rep. Gr. 24 .
- Install oil filter housing ⇒ [page 234](#) .
- Install intake manifold (bottom section) with high-pressure and low-pressure lines ⇒ Rep. Gr. 24 .
- Install intake manifold (top section) ⇒ Rep. Gr. 24 .
- Install vacuum pump for brake servo ⇒ Rep. Gr. 47 .
- Install power steering pump ⇒ Rep. Gr. 48 .
- Install coolant pipe (front) ⇒ [page 253](#) .
- Install poly V-belt ⇒ [page 108](#) .
- Install front exhaust pipe together with catalytic converter: left-side ⇒ [page 279](#) , right-side ⇒ [page 284](#) .
- Align exhaust system so it is free of stress ⇒ [page 293](#) .
- Change engine oil ⇒ Maintenance ; Booklet 405 .
- Fill cooling system with fresh coolant ⇒ [page 243](#) .
- Top up power steering fluid and bleed steering system ⇒ Rep. Gr. 48 .



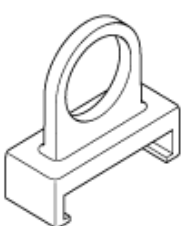
Tightening torques

Component	Nm
Guide tube for dipstick to cylinder head	9
Fuel hose to fuel line	22

2.7 Checking compression

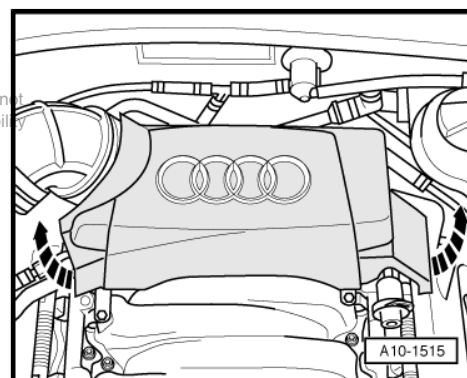
Special tools and workshop equipment required

- ◆ Spark plug socket and extension -3122 B-
- ◆ Compression tester - V.A.G 1763-
- ◆ Puller -T40039-

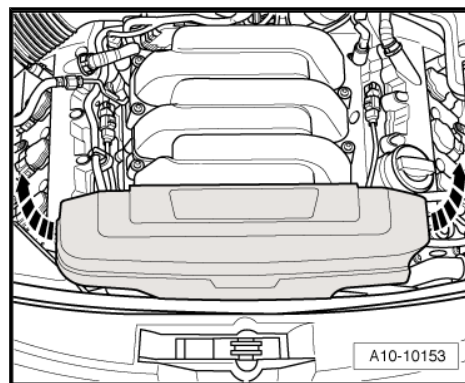
3122 B 	V.A.G 1763 
T40039 	
	G15-0070

Procedure

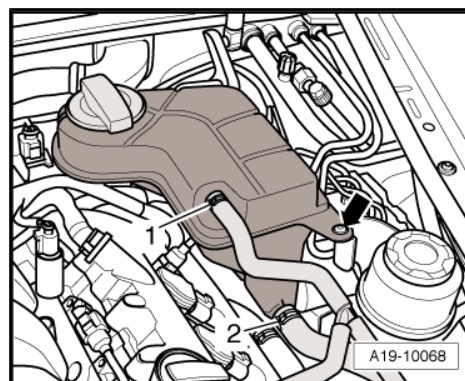
- Engine oil temperature at least 30 °C.
- Battery voltage at least 12,5 V.
- Switch off ignition.
- Pull off engine cover panel (rear) -arrows-.



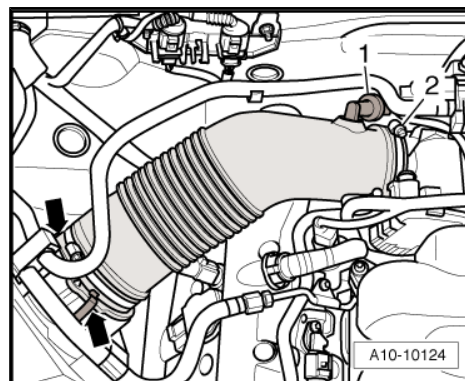
- Pull off engine cover panel (front) -arrows-.



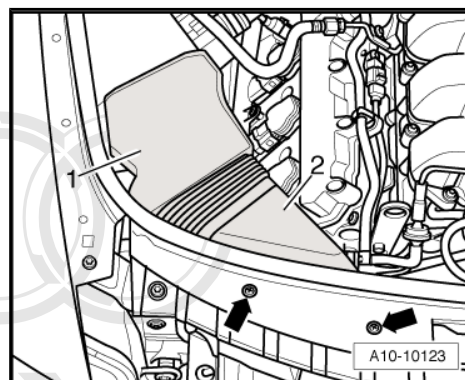
- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



- Pull non-return valve -1- off connection at air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



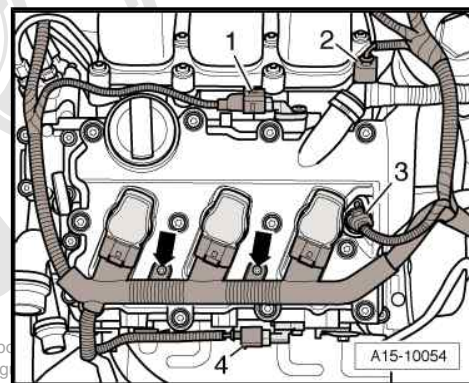
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (left-side).

**Note**

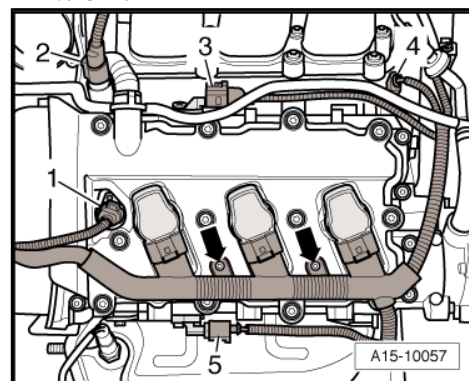
Disregard -items 1 ... 4-.



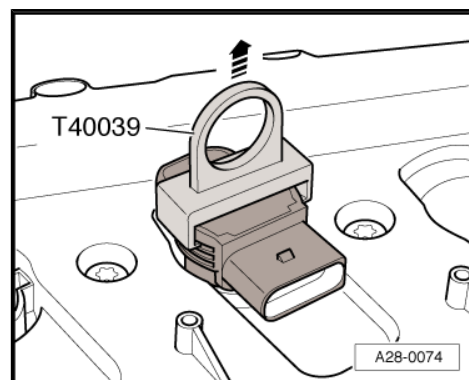
- Unscrew bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (right-side).

**Note**

Disregard -items 1 ... 5-.



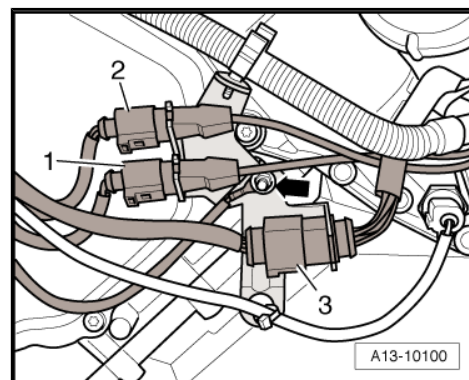
- Pull ignition coils out with puller -T40039- .



- Unplug electrical connector -3- leading to injectors at rear of cylinder head (left-side).

**Note**

Disregard items marked -1-, -2- and -arrow-.



- Unplug electrical connector -1- leading to injectors at rear of cylinder head (right-side).



Note

Ignore -arrow-.

- Remove spark plugs with spark plug socket -3122 B- .
- Test the compression pressure with the compression tester - V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions .

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

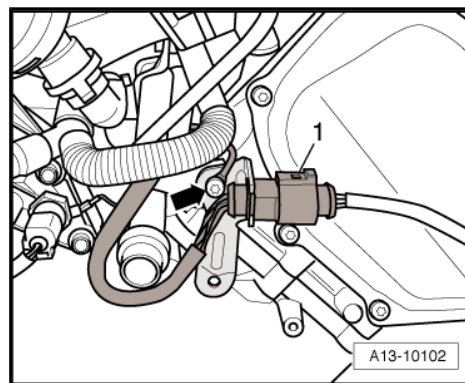
Compression pressure	bar
When new	11.0 ... 14.0
Wear limit	10.0
Difference between cylinders	3.0 (maximum)

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

- Install spark plugs ⇒ Maintenance ; Booklet 405 .
- Faults are stored in engine control units because connectors were unplugged: "Generate readiness code" in "Guided Functions" ⇒ Vehicle diagnosis, testing and information system VAS 5051.

Tightening torque

Component	Nm
Hose clips (9 mm wide)	3



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3 Valve gear



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

3.1 Valve gear - exploded view

1 - Exhaust valve

- ☐ Different versions available ⇒ Electronic parts catalogue
- ☐ Do not machine, only grinding-in is permitted
- ☐ Mark installation position for re-installation
- ☐ Valve dimensions
⇒ [page 216](#)
- ☐ Checking valve guides
⇒ [page 216](#)

2 - Sealing plugs

- ☐ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

3 - Cylinder head

- ☐ Checking valve guides
⇒ [page 216](#)

4 - Hydraulic valve compensation element

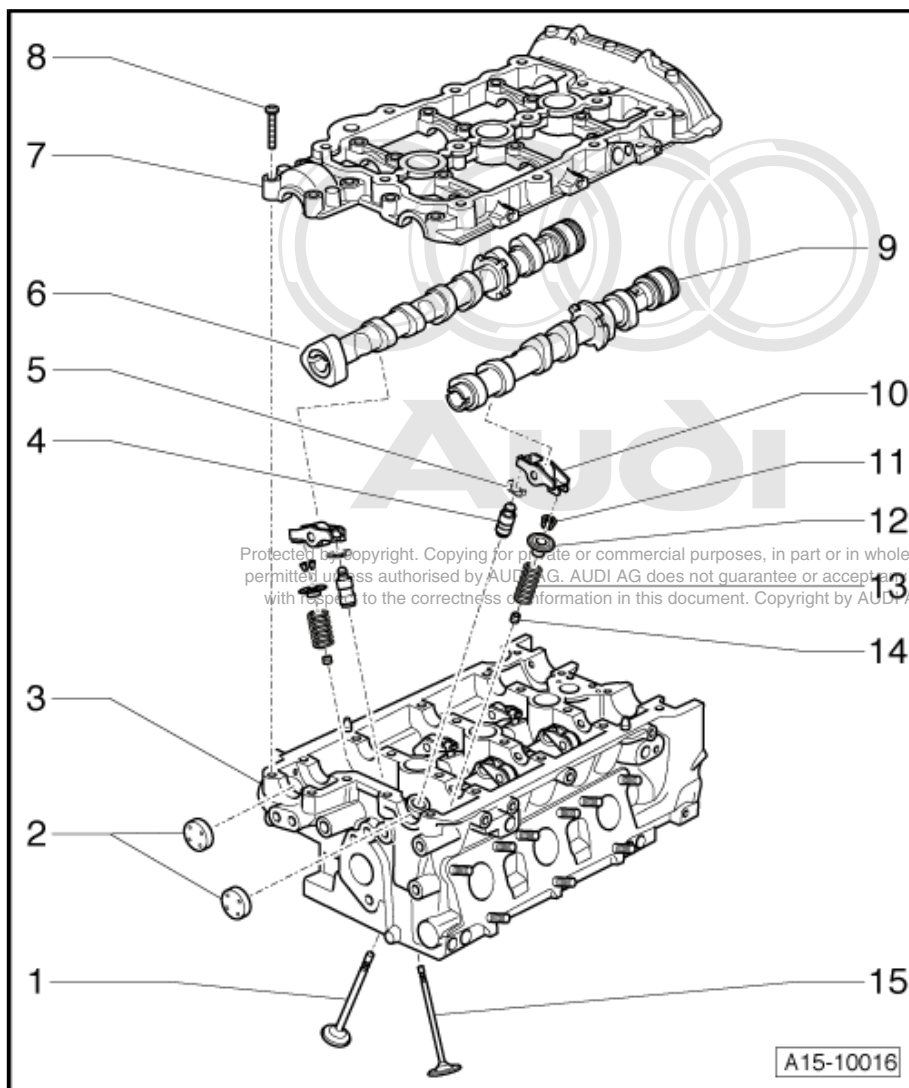
- ☐ Checking ⇒ [page 215](#)
- ☐ Do not interchange
- ☐ Lubricate contact surface

5 - Securing clip

- ☐ Check for firm attachment

6 - Inlet camshaft

- ☐ Removing and installing
⇒ [page 201](#)
- ☐ Measuring axial clearance ⇒ [page 200](#)
- ☐ Measuring radial clearance ⇒ [page 201](#)



- ☐ Runout: max. 0.04 mm

7 - Retaining frame

- ☐ With integrated camshaft bearings
- ☐ Removing and installing ⇒ ["3.4 Removing and installing camshafts", page 201](#)

8 - 8 Nm + 90° further

- ☐ Renew

9 - Exhaust camshaft

- ☐ Removing and installing ⇒ [page 201](#)
- ☐ Measuring axial clearance ⇒ [page 200](#)
- ☐ Measuring radial clearance ⇒ [page 201](#)
- ☐ Runout: max. 0.04 mm

10 - Roller rocker finger

- ☐ Do not interchange
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surface

11 - Valve cotters

12 - Valve spring plate

13 - Valve spring

- ☐ Installation position: the narrow spring coils face the cylinder head

14 - Valve stem oil seal

- ☐ Renewing (cylinder head installed) ⇒ [page 207](#)
- ☐ Renewing (cylinder head removed) ⇒ [page 211](#)

15 - Inlet valve

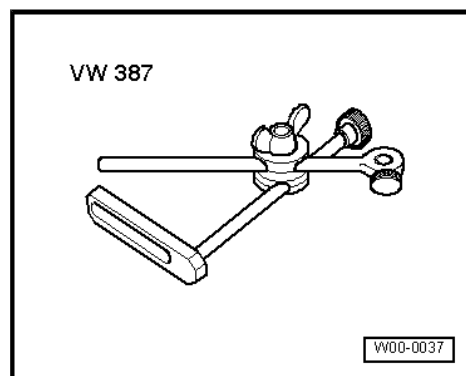
- ☐ Do not machine, only grinding-in is permitted
- ☐ Mark installation position for re-installation
- ☐ Valve dimensions ⇒ [page 216](#)
- ☐ Checking valve guides ⇒ [page 216](#)

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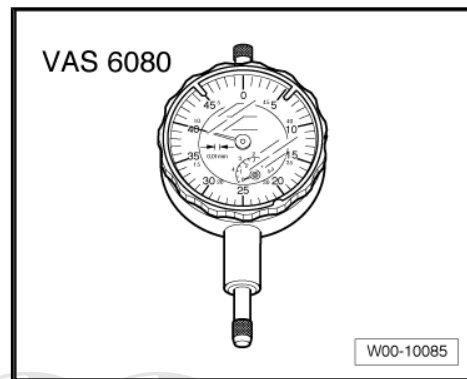
3.2 Measuring axial clearance of camshafts

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket -VW 387-

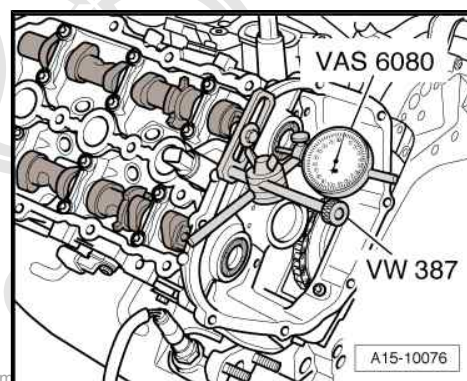


◆ Dial gauge -VAS 6080-



Procedure

- Remove roller rocker fingers and hydraulic compensation elements
⇒ ["3.4 Removing and installing camshafts", page 201](#).
- Secure universal dial gauge bracket -VW 387- with dial gauge -VAS 6080- to cylinder head.
- Press camshaft against dial gauge by hand.
- Set dial gauge to "0".
- Press camshaft away from dial gauge and read off value:
- Axial clearance: 0.100 ... 0.191 mm



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3.3 Measuring radial clearance of camshafts

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

- Remove roller rocker fingers
⇒ ["3.4 Removing and installing camshafts", page 201](#).
- Clean bearing and bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.
- The Plastigage must be positioned in the centre of the bearing.
- Fit retaining frame and tighten to torque (do not turn further) without rotating camshafts ⇒ [page 206](#).
- Remove retaining frame again.
- Compare width of Plastigage with measurement scale.

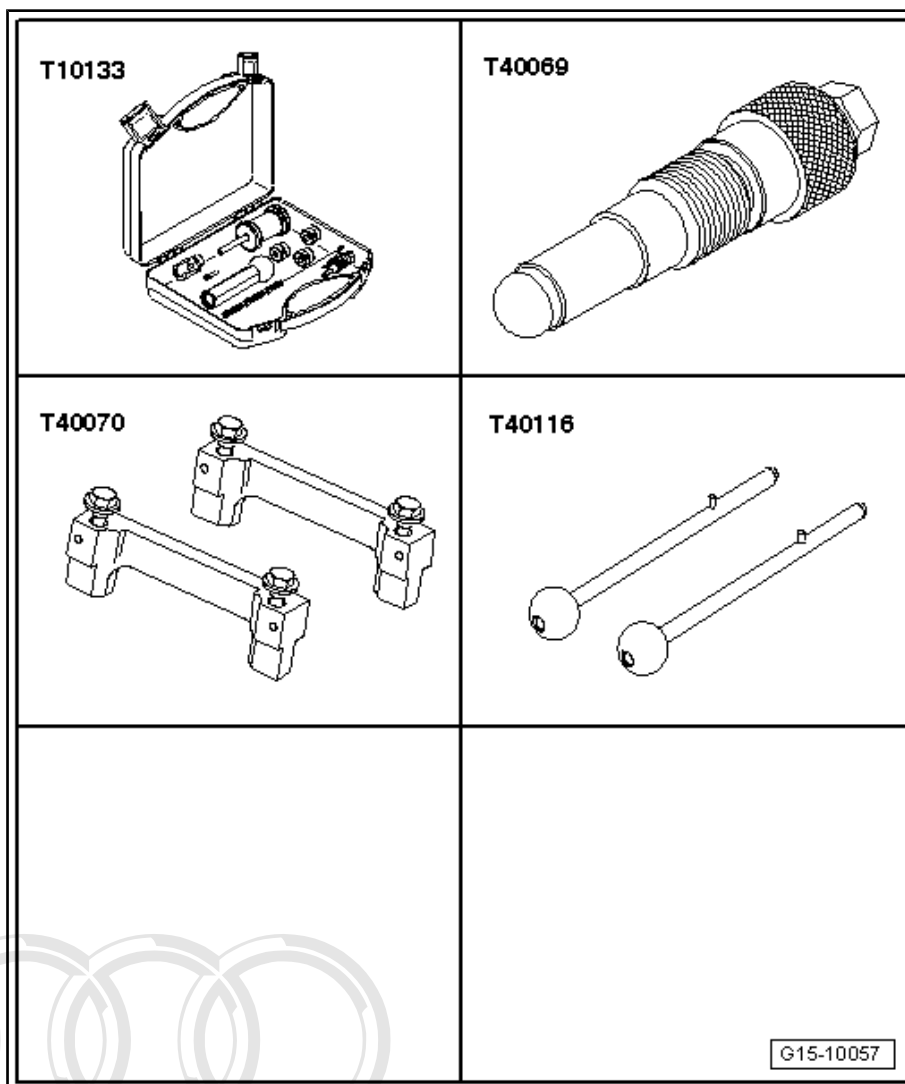
Radial clearance:

- Bearing (Ø 24 mm): 0.024 ... 0.066 mm.
- Bearing (Ø 36 mm): 0.100 ... 0.325 mm.

3.4 Removing and installing camshafts

Special tools and workshop equipment required

- ◆ Impact extractor attachment -T10133/3- from tool set for FSI engines - T10133-
- ◆ Locking pin -T40069-
- ◆ Camshaft clamp -T40070- (2x)
- ◆ Locating pins -T40116-
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue



Removing

- Remove cylinder head cover: left-side ⇒ [page 178](#) , right-side ⇒ [page 182](#) .
- Remove timing chain covers (left and right) ⇒ [page 135](#) .
- Remove camshaft timing chains from camshafts ⇒ [page 150](#) .
- To remove the camshafts (right-side) you must first remove the exhaust pump for brake servo ⇒ Rep. Gr. 47 .

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- Slacken retaining frame bolts in the sequence -22 ... 1-.

**Note**

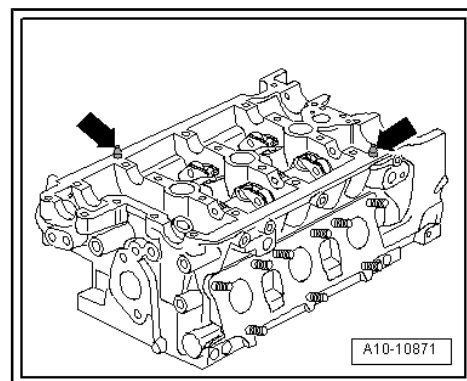
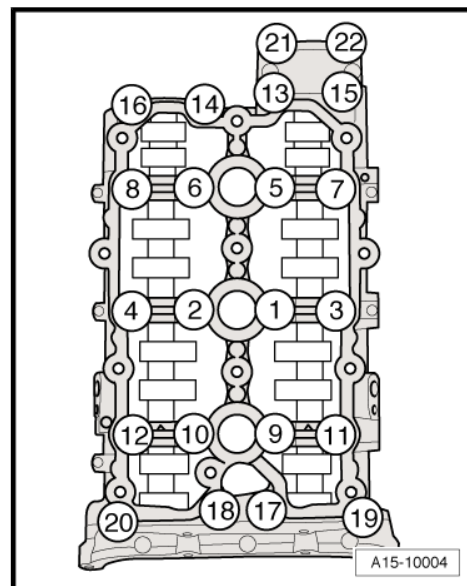
Illustration shows retaining frame of left-side cylinder head.

- Carefully release retaining frame from bonded joint.
- Mark and remove camshafts.

**Note**

To enable the locating pins -T40116- to be attached during installation on engines fitted with dowel pins -arrows- for retaining frame, drive out dowel pins using a suitable drift.

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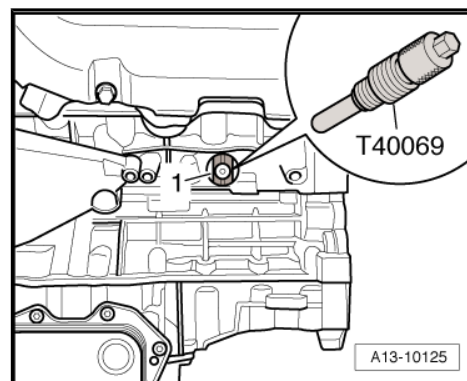
**Installing****Note**

Renew gaskets and seals.

- Crankshaft -1- locked in position with locking pin -T40069- .

**WARNING**

Wear safety goggles.



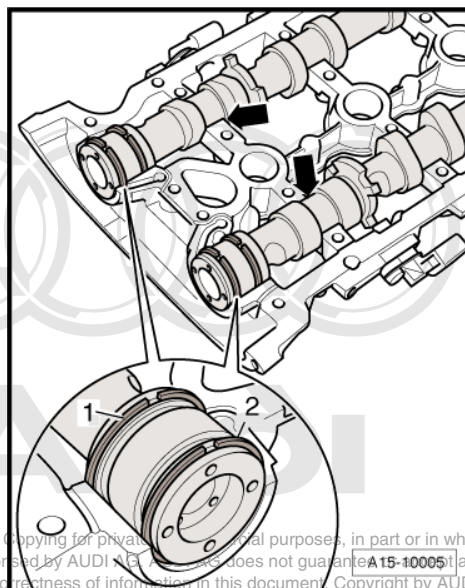
- Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.

**Caution**

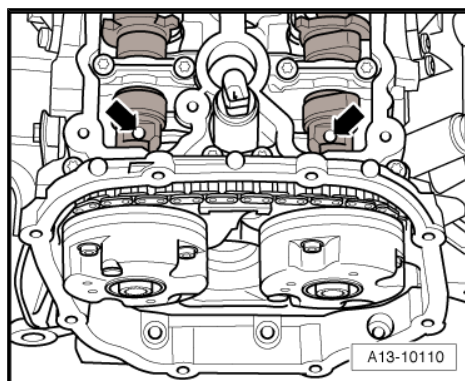
Make sure that no sealant residue gets into the cylinder head or the bearings.

- Clean sealing surfaces; they must be free of oil and grease.
- Lubricate running surfaces of camshafts.
- Lay retaining frame aside onto workbench, on a soft surface.

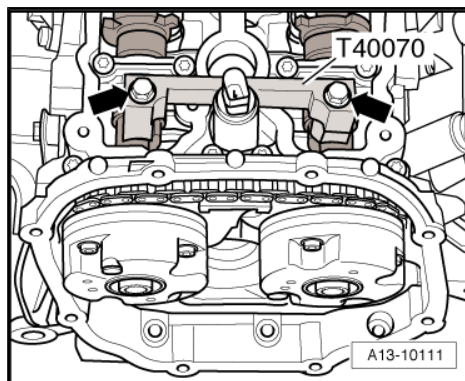
- Insert camshafts into retaining frame.
- Camshafts must be in correct position in axial bearings -arrows- in retaining frame.
- The ends of the piston rings -1- and -2- must point up or down, never to the side.
- Turn retaining frame upside down with camshafts inserted, keeping hold of the camshafts 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.



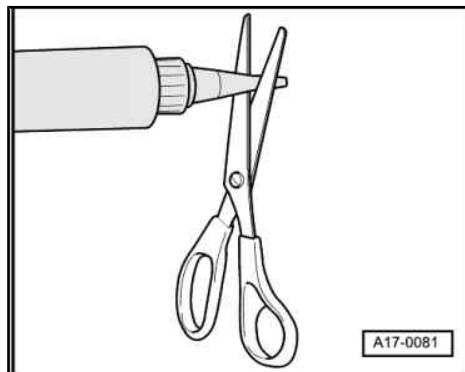
- Fit camshaft clamp -T40070- as shown in illustration and tighten bolts -arrows- to 20 Nm.



Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking ($\varnothing$ of nozzle approx. 1 mm).
- Turn retaining frame back up.

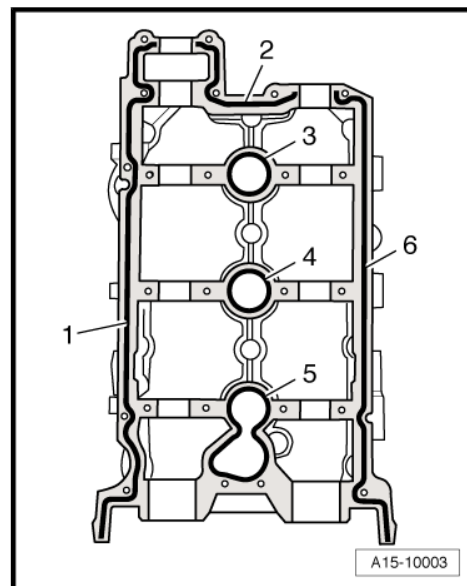


Vehicles up to approx. 08.2004:

- Apply the beads of sealant -1 ... 6- onto the clean sealing surfaces of the retaining frame as illustrated.
- The grooves 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.

**Note**

The beads of sealant must be applied exactly according to these instructions, otherwise excess sealant can get into the camshaft bearings.

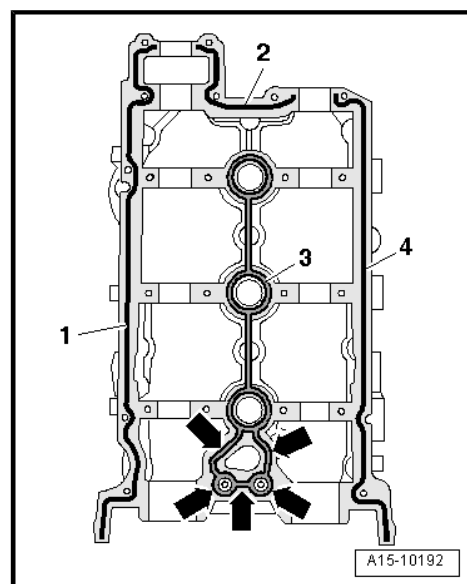
**Vehicles from approx. 08.2004:**

- Apply a small amount of sealant in groove for gasket -3- in area of opening for camshaft control solenoid valve -arrows-.
- Press gasket into retaining frame and wipe off excess sealant from gasket and retaining frame.
- Apply the beads of sealant -1-, -2- and -4- onto the clean sealing surfaces of the retaining frame as illustrated.
- Width of sealant bead: 1.0 mm.

**Note**

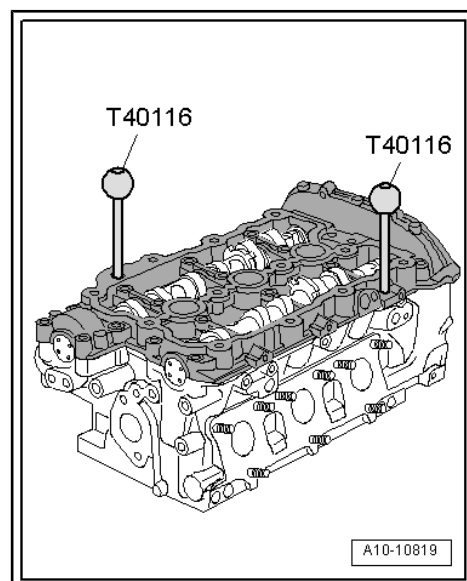
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The beads of sealant must be applied exactly according to these instructions, otherwise excess sealant can get into the camshaft bearings.

**All vehicles:****Note**

The retaining frame must be installed within 5 minutes after applying sealant.

- Fit retaining frame onto cylinder head.
- Insert locating pins -T40116- in retaining frame and cylinder head.

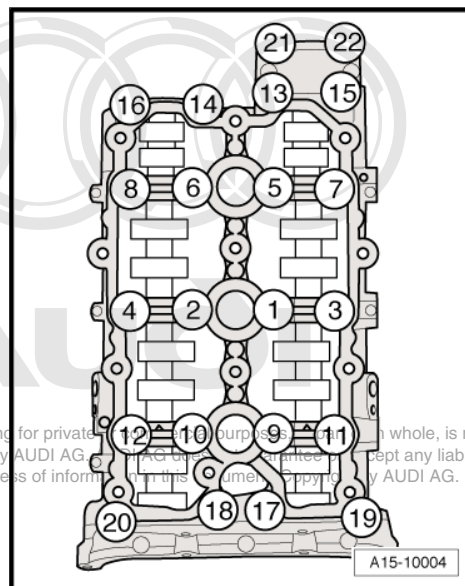


- Fit retaining frame onto cylinder head without delay.
- Tighten retaining frame bolts in the sequence -1 ... 22- evenly, initially only hand-tight.
- The retaining frame should make contact with the cylinder head over the full surface.
- Tighten retaining frame bolts to final torque in the sequence -1 ... 22-.

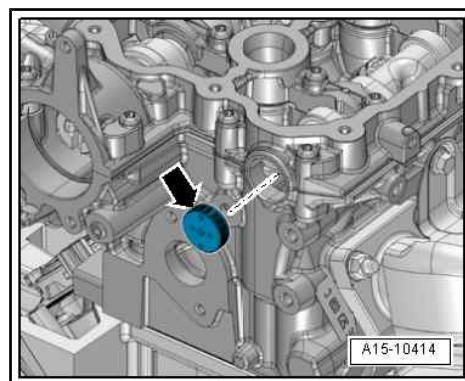


Note

- ◆ *Illustration shows retaining frame of left-side cylinder head.*
- ◆ *After installing the retaining frame, wait about 30 minutes for the sealant to dry.*



- 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 -T10133/3- to pull out locating pins -T40116- .

Perform further installation in reverse order, paying attention to the following:

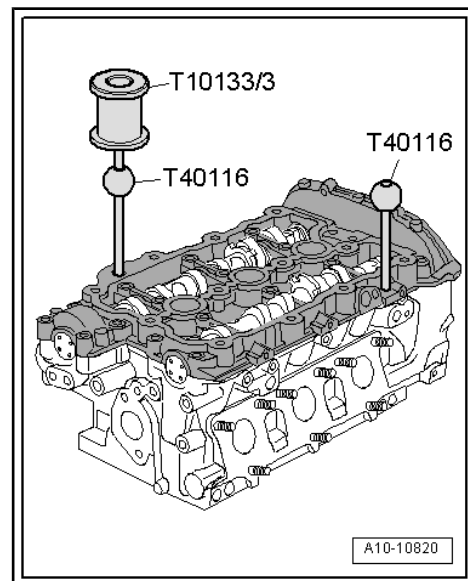


Note

- ◆ *After installing camshafts, wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.*
- Install vacuum pump for brake servo ⇒ Rep. Gr. 47 .
- Install camshaft timing chains ⇒ [page 150](#) .
- Install timing chain covers (left and right) ⇒ [page 135](#) .
- Install cylinder head cover: left-side ⇒ [page 178](#) , right-side ⇒ [page 182](#) .

Tightening torque

Component	Nm
Retaining frame to cylinder head	8 +90° ¹⁾
• ¹⁾ Renew bolts.	

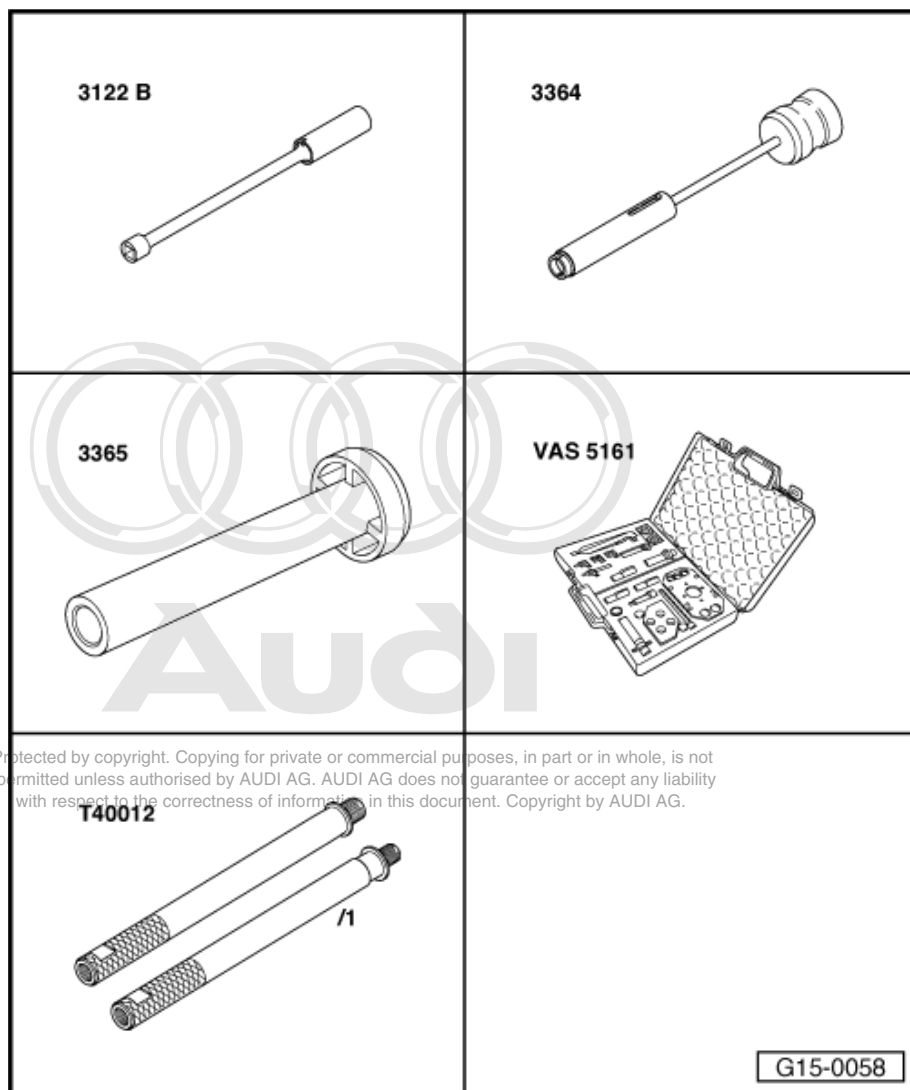


3.5 Renewing valve stem oil seals (cylinder head installed)

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Special tools and workshop equipment required

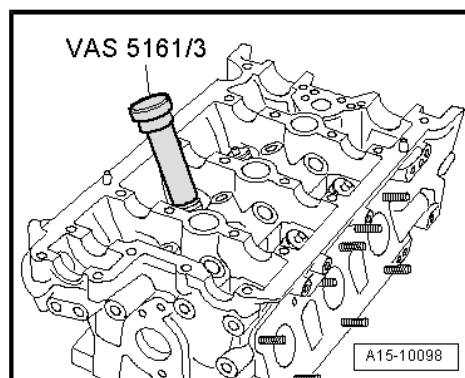
- ◆ Spark plug socket and extension -3122 B-
- ◆ Valve stem seal puller -3364-
- ◆ Valve stem seal fitting tool -3365-
- ◆ Removal / installing device for valve cotters -VAS 5161- with guide plate - VAS 5161/19 A-
- ◆ Adapter -T40012-



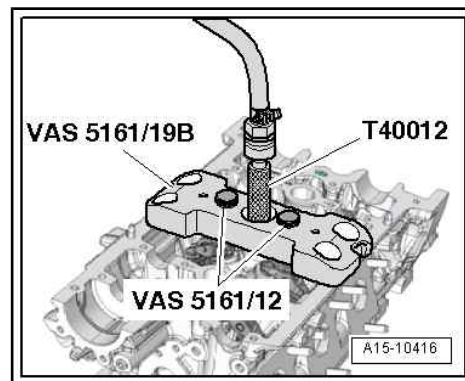
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Procedure

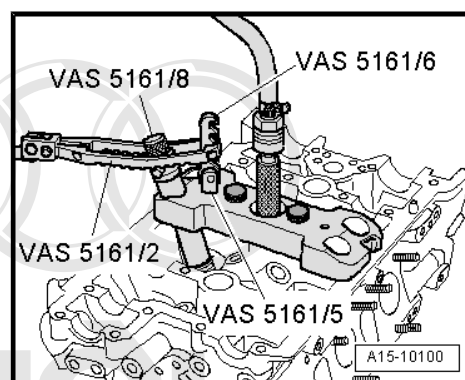
- Remove camshafts ⇒ [page 201](#) .
- Mark allocation of roller rocker fingers and hydraulic compensation elements for reinstallation.
- Remove roller rocker fingers together with hydraulic compensation elements and place on a clean surface.
- Remove spark plugs with spark plug socket -3122 B- .
- Apply drift -VAS 5161/3- to valve spring plate and knock valve cotters loose using a plastic hammer.



- Fit guide plate -VAS 5161/19B- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- .
- Screw adapter -T40012- with seal hand-tight into the corresponding spark plug thread and apply a steady pressure.
- Air pressure: at least 6 bar

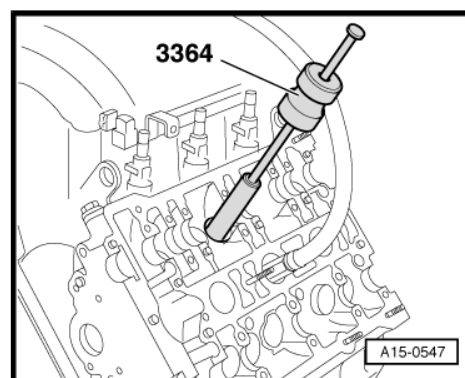


- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- into guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise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



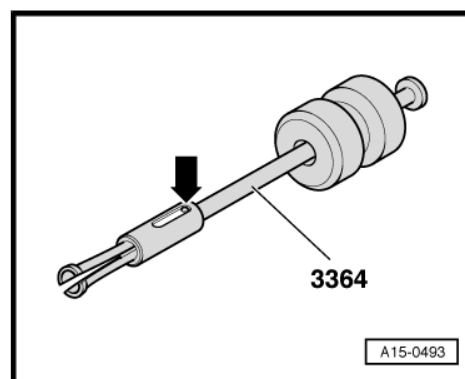
- The compressed air hose remains connected
- Remove valve spring with valve spring plate.
- Remove valve stem oil seals using the valve stem seal puller -3364- .

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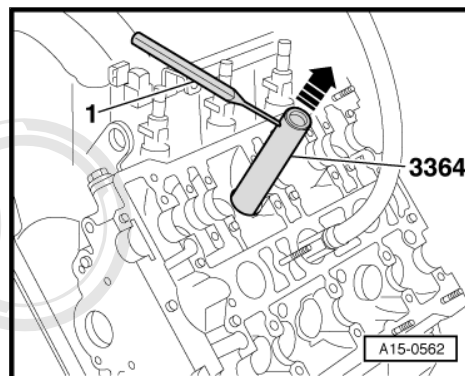


If the puller -3364- cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

- Knock out pin -arrow- of puller -3364- using a drift and remove the extractor attachment.



- Attach lower part of puller -3364- to valve stem oil seal.
- Secure -3364- with drift or roll-pin drift -1- as shown in the illustration.
- Apply an assembly lever to puller -3364- and pull out valve stem oil seal -arrow-.

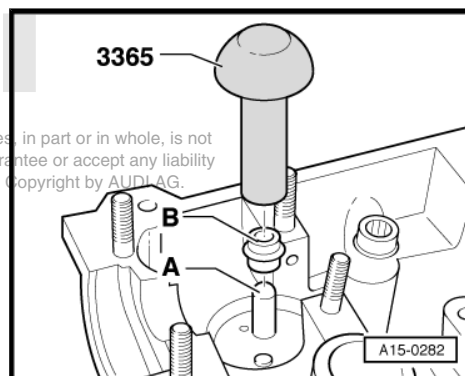


Note

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

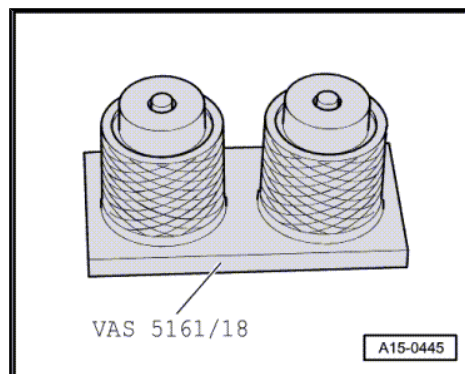
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- Fit plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press the valve stem oil seal onto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

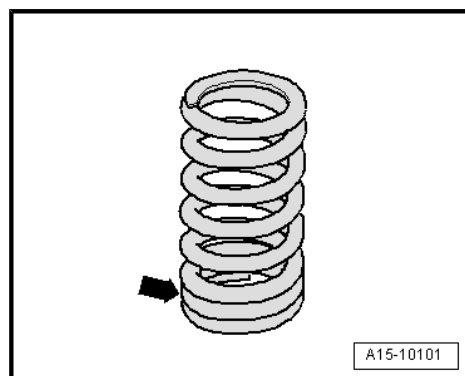


If valve cotters have been removed from assembly cartridge, they need to be put into insertion device for valve cotters -VAS 5161/18- first.

- Larger diameter of valve cotters faces upwards.



- Install valve spring and valve spring plate.
- The closely spaced spring coils -arrow- face the cylinder head.

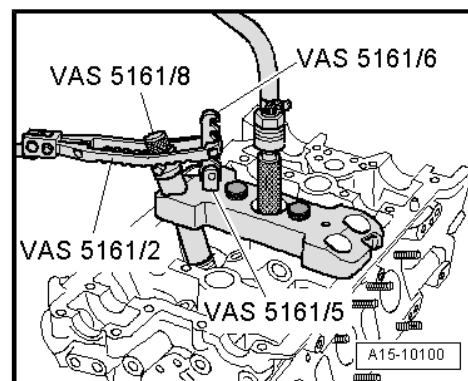


- Screw guide plate back onto cylinder head.
- Insert assembly cartridge into guide plate.
- Push pressure fork down and pull knurled screw upwards while turning to left and right – this will insert the valve cotters.
- Release the pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Ensure that all roller rocker fingers contact the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 201](#) .
- Install spark plugs ⇒ Maintenance ; Booklet 405 .



Note

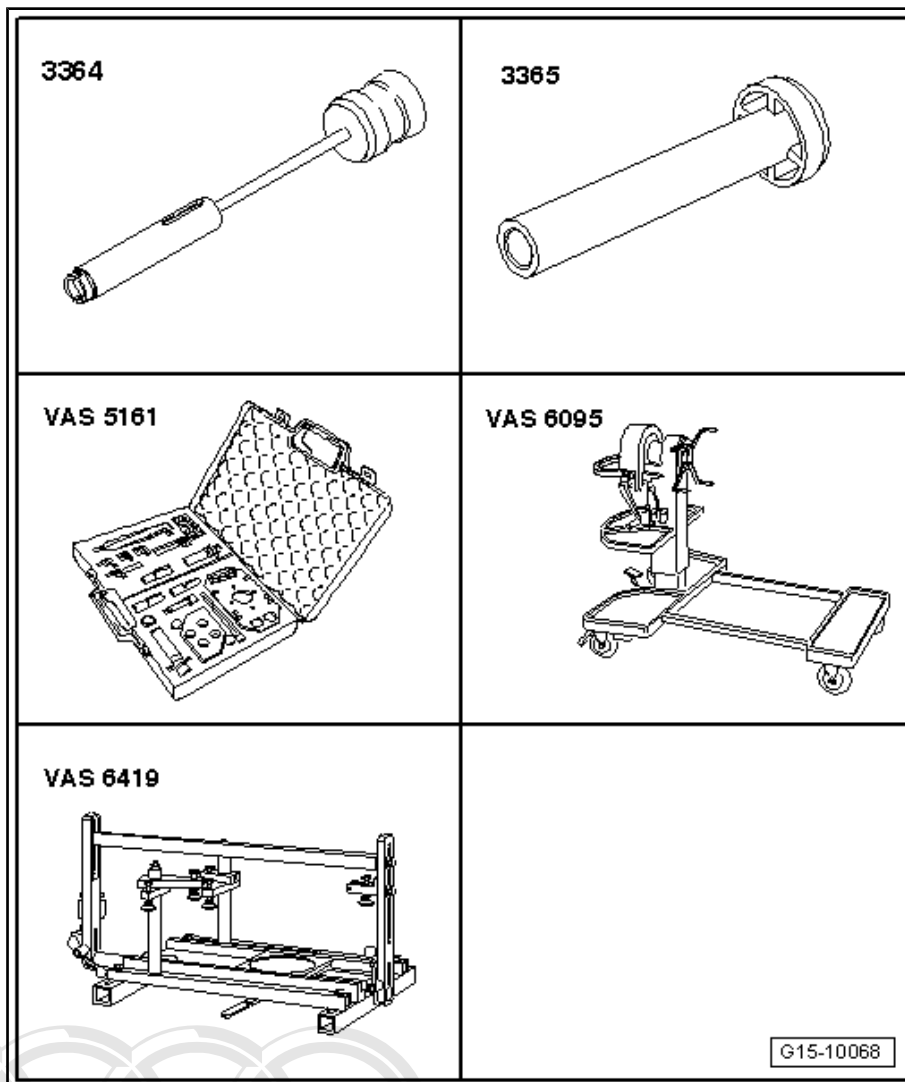
- ◆ *After installing camshafts, wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make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

3.6 Renewing valve stem oil seals (cylinder head removed)

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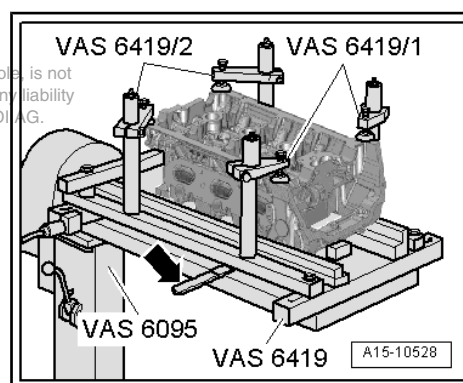
Special tools and workshop equipment required

- ◆ Valve stem seal puller -3364-
- ◆ Valve stem seal fitting tool -3365-
- ◆ Removal / installing device for valve cotters -VAS 5161-
- ◆ Engine and gearbox support -VAS 6095-
- ◆ Cylinder head tensioning device -VAS 6419-

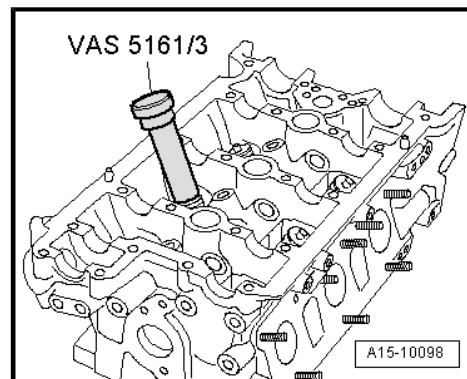


Procedure

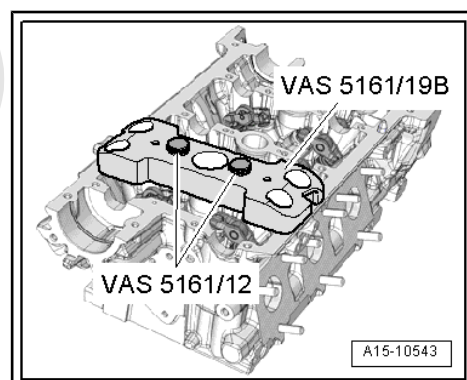
- Remove camshafts ⇒ [page 201](#).
- Mark allocation of roller rocker fingers and hydraulic compensation elements for reinstallation.
- Remove roller rocker fingers together with hydraulic compensation elements and place on a clean surface.
- Insert cylinder head tensioning device -VAS 6419- into engine and gearbox support -VAS 6095-.
- Secure cylinder head in cylinder head tensioning device, as illustrated.
- Connect cylinder head tensioning device to compressed air.
- 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.



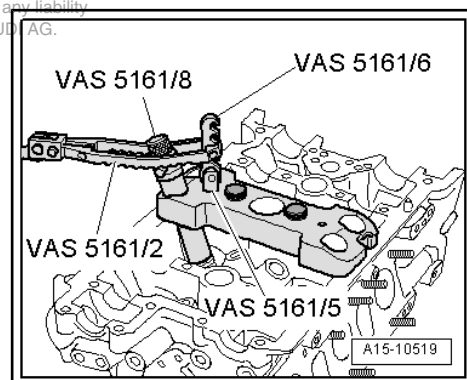
- Apply drift -VAS 5161/3- to valve spring plate and knock valve cotters loose using a plastic hammer.



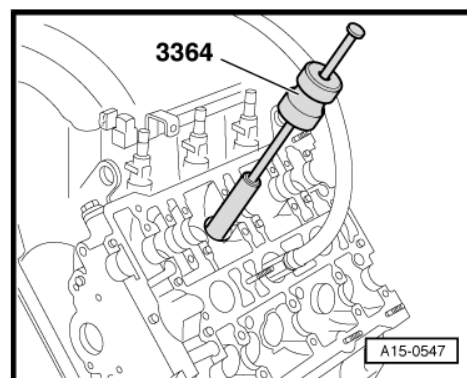
- Fit guide plate -VAS 5161/19B- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- .



- 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 cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release the 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- .





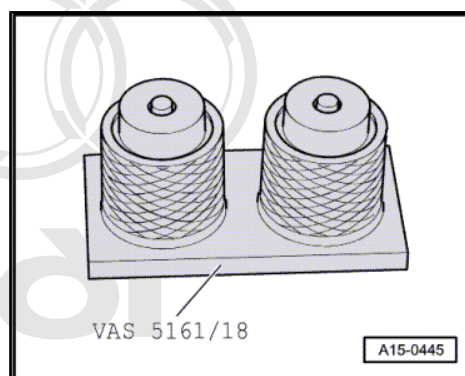
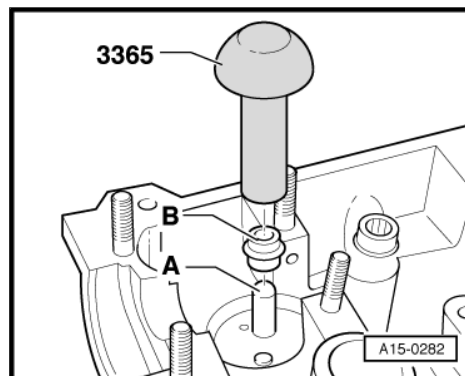
Note

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

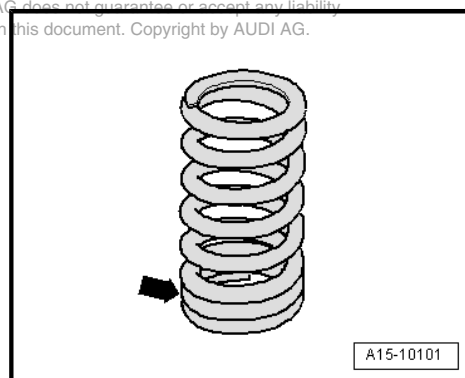
- Fit plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press the valve stem oil seal onto valve guide using fitting tool -3365- .
- Remove the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

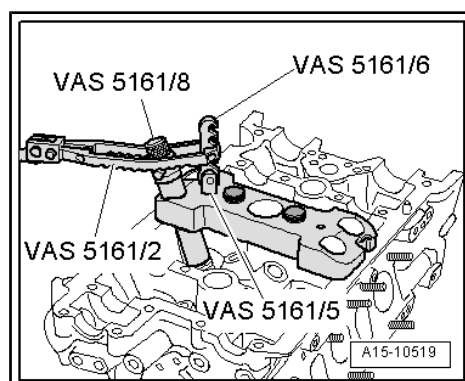


- Screw guide plate back onto cylinder head.
- Insert assembly cartridge into guide plate.
- Push pressure fork down and pull knurled screw upwards while turning to left and right – this will insert the valve cotters.
- Release the pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Ensure that all roller rocker fingers contact the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 201](#) .



3.7 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 let it run until the radiator fan has switched on once.
- Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).



Note

*If the irregular valve noises stop but recur repeatedly during short trips, renew the oil retention valve. The oil retention valve is located in the oil filter housing - version up to 04.2005
⇒ [Item 6 \(page 232\)](#) , from 05.2005 ⇒ [Item 7 \(page 233\)](#) .*

If the hydraulic compensation elements are still noisy, locate the defective element as follows:

- Remove cylinder head cover: left-side ⇒ [page 178](#) , right-side ⇒ [page 182](#) .
- Turn crankshaft until cams of compensation element to be tested are 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.
- Press roller rocker finger down using a screwdriver -arrow-.

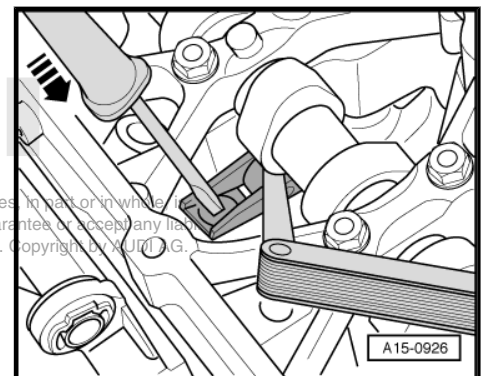
If it is possible to insert a feeler gauge of 0.20 mm between camshaft and roller rocker finger:

- Renew hydraulic valve compensation element
⇒ ["3.4 Removing and installing camshafts", page 201](#)



Note

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



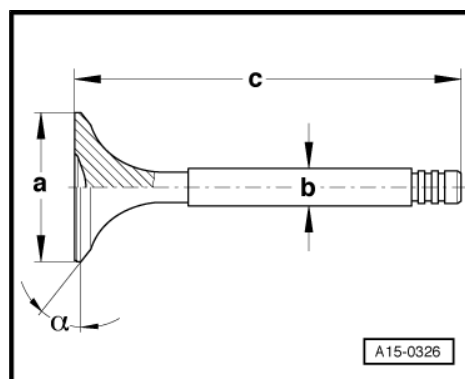
3.8 Valve dimensions



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.

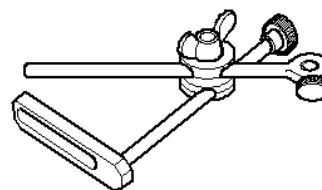
3.9 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket -VW 387-

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VW 387



VW00-0037

- ◆ Dial gauge -VAS 6080-

VAS 6080



W00-10085

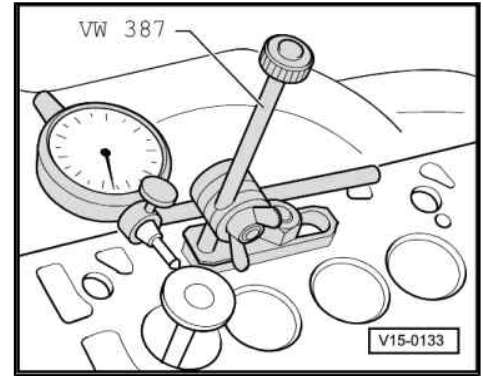
Procedure

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



Note

- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ◆ *If the wear limit is exceeded, repeat the measurement with new valves. Renew cylinder head if wear limit is still exceeded.*



3.10 Checking valves

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

If scoring is clearly visible:

- Renew the relevant valve.



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17 – Lubrication

1 Lubrication system



Note

- ◆ *If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the engine oil cooler must be renewed in order to prevent further damage occurring later.*
- ◆ *The oil level must not be above the max. mark – otherwise the catalytic converter can be damaged.*
- ◆ *Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.*
- ◆ *Oil spray jet for piston cooling ⇒ **page 134** .*

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for the content of this publication. **Oil pump, engine**

1.1 Sump (bottom section), sump (top section), oil pump, engine oil cooler - exploded view

1 - 9 Nm

- ❑ Bolt or nut (depending on version)
- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue

2 - Oil level and oil temperature sender -G266-

- ❑ Removing and installing
⇒ [page 220](#)

3 - Oil drain plug, 30 Nm

4 - 9 Nm

5 - Baffle plate (bottom)

6 - 16 Nm

- Tighten in stages and in diagonal sequence

7 - Sump (top section)

- ❑ Removing and installing
⇒ page 225

8 - O-ring

- ☐
- Renew

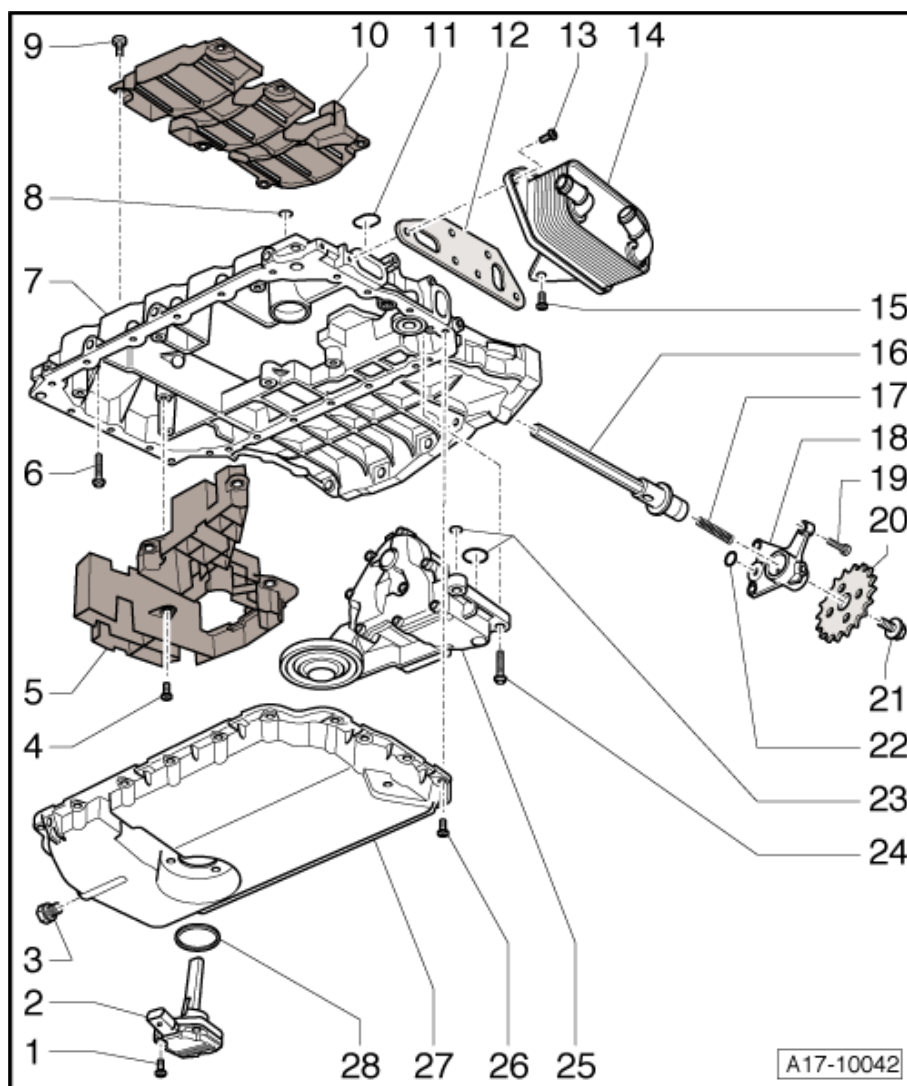
9 - 9 Nm

- Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue

10 - Baffle plate (top)

11 - Gasket

-



12 - Gasket

- ☐ Renew

13 - 9 Nm**14 - Engine oil cooler**

- ☐ See note ⇒ [page 218](#)
- ☐ Removing and installing ⇒ [page 220](#)
- ☐ With oil cooler bypass valve

15 - 9 Nm**16 - Oil pump drive shaft****17 - Compression spring****18 - Mounting bracket****19 - 9 Nm****20 - Chain sprocket for oil pump**

- ☐ Can only be fitted in one position on drive shaft

21 - 30 Nm + 90° further

- ☐ Renew
- ☐ To loosen, use pin wrench -3212- to counterhold chain sprocket

22 - O-ring

- ☐ Renew

23 - O-rings

- ☐ Renew

24 - 20 Nm**25 - Oil pump**

- ☐ Do not dismantle
- ☐ With pressure relief valve for cold condition (11 bar) and pressure control valve (4.3 bar)
- ☐ Removing and installing

26 - Bolt

Sump (bottom section), aluminium version:

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

Sump (bottom section), sheet-metal version:

- ☐ Renew
- ☐ 5 Nm + 90° further
- ☐ Tighten in stages and in diagonal sequence

27 - Sump (bottom section)

- ☐ Different versions available ⇒ Electronic parts catalogue
- ☐ Removing and installing ⇒ [page 222](#)

28 - Seal

- ☐ Renew

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1.2 Removing and installing oil level and oil temperature sender -G266-

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 405 .
- Unplug electrical connector -3-.
- Remove nuts or bolts -1- and detach oil level and oil temperature sender -G266- -item 4-.

Installing

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



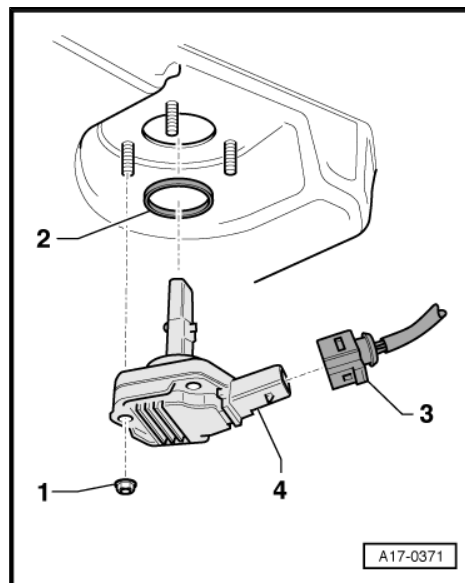
Note

Renew seal -2-.

- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torque

Component	Nm
Oil level and oil temperature sender -G266- to sump (bottom section)	9



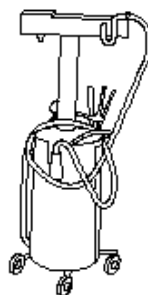
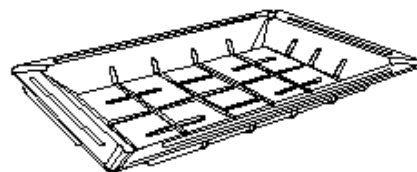
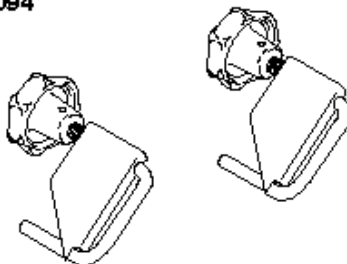
1.3 Removing and installing engine oil cooler



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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 for hoses up to 25 mm -3094-

V.A.G 1782**VAS 6208****3094**

G17-10011

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 405 .


WARNING

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

- Open filler cap on coolant expansion tank.

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- Place drip tray for workshop hoist -VAS 6208- under engine.
- Clamp off coolant hoses -1- and -2- using hose clamps -3094- .
- Disconnect coolant hoses at engine oil cooler and drain off coolant.
- Position used oil collection and extraction unit -V.A.G 1782- below engine.
- Unscrew bolts -arrows- and detach engine oil cooler.

Installing

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



Note

- ◆ *Renew seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .
- Fill cooling system ⇒ [page 245](#) .

Tightening torques

Component	Nm
Engine oil cooler to sump (top section)	9
Oil drain plug	30

1.4 Removing and installing sump (bottom section)

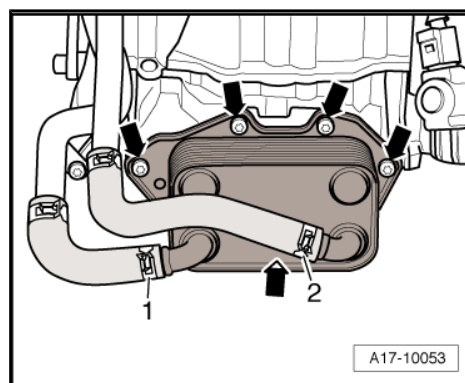
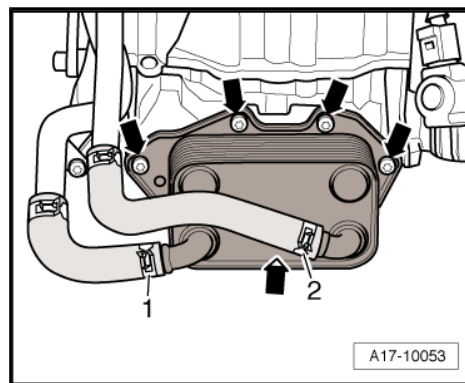
Special tools and workshop equipment required

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

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 405 .
- Unscrew bolts -arrows- and detach engine oil cooler with coolant hoses -1- and -2- attached.



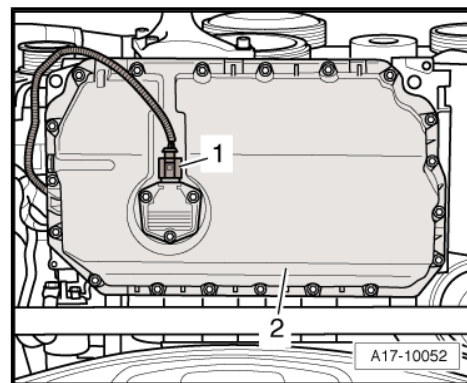
- Unplug electrical connector -1- at oil level and oil temperature sender -G266- -arrow- and move wiring clear.
- Release sump (bottom section) from bonded joint, taking care not to bend sump (sheet-metal version).

Installing



Note

- ◆ *Renew seals and gaskets.*
- ◆ *On the sheet-metal version, the sump (bottom section) must be renewed if its coating is damaged or if it is bent.*



WARNING

Wear safety goggles.

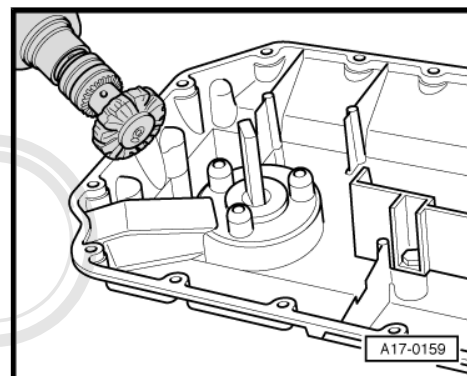
- Remove remaining sealant on sump (bottom and top sections) with a rotating plastic brush or similar.



Note

On the sheet-metal version, take care not to damage the coating on the sump (bottom section).

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

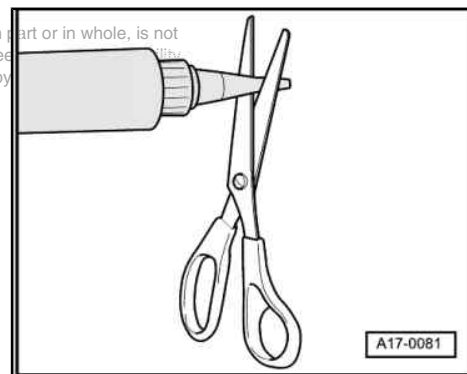


Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (Ø of nozzle approx. 1 mm).

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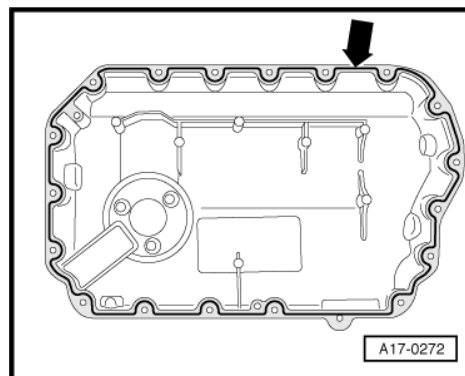


- Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as illustrated.
- The bead of sealant should be approx. 1.5 mm wide.



Note

- ◆ *The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump (bottom section) and obstruct the strainer in the oil intake pipe.*
- ◆ *The sump (bottom section) must be installed within 5 minutes after applying sealant.*
- Fit sump (bottom section) and tighten all bolts initially to 5 Nm in diagonal sequence.
- Tighten bolts on sump (bottom section) in diagonal sequence
- Install engine oil cooler ⇒ [page 220](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .



Tightening torques

Component	Nm
Engine oil cooler to sump (top section)	9
Sump (bottom section), aluminium version to sump (top section)	9 ¹⁾
Sump (bottom section), sheet-metal version to sump (top section)	5 +90° ¹⁾²⁾
Oil drain plug	30
• ¹⁾ Tighten in diagonal sequence. • ²⁾ Renew bolts.	



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1.5 Removing and installing oil pump

Removing

- Remove sump (bottom section) ⇒ [page 222](#) .
- Remove bolts -arrows-.
- Detach oil pump from drive shaft by pulling it to front, move drive shaft slightly to rear if necessary.

Installing

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



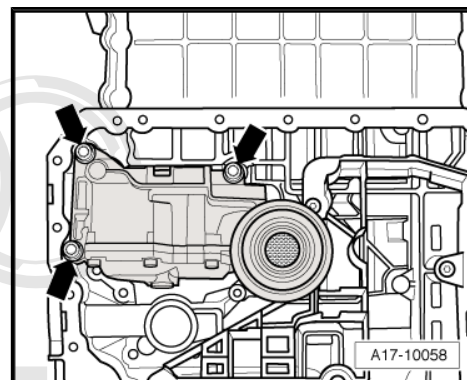
Note

Renew O-rings.

- Fit oil pump onto drive shaft and tighten bolts.
- Install sump (bottom section) ⇒ [page 222](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torque

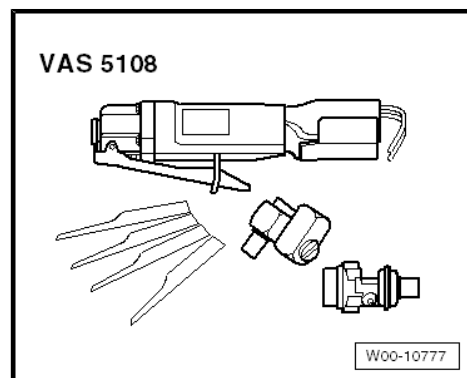
Component	Nm
Oil pump to sump (top section)	20



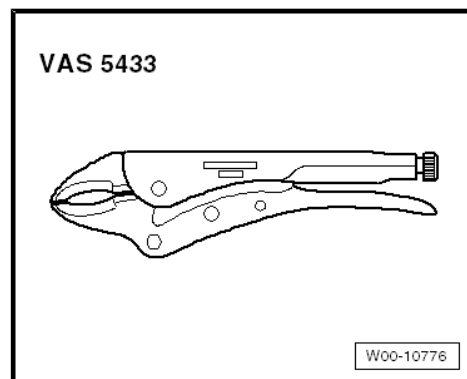
1.6 Removing and installing sump (top section)

Special tools and workshop equipment required

- ◆ Pneumatic jig-saw -VAS 5108-



- ◆ Universal mole grips, 300 mm -VAS 5433-

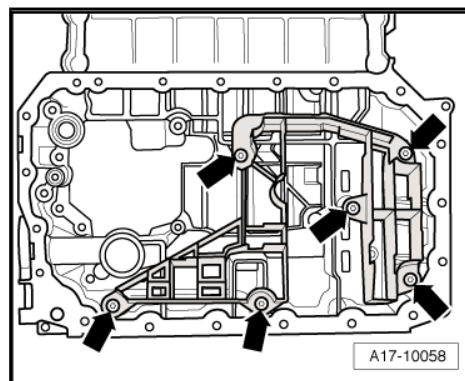


- ◆ Safety goggles

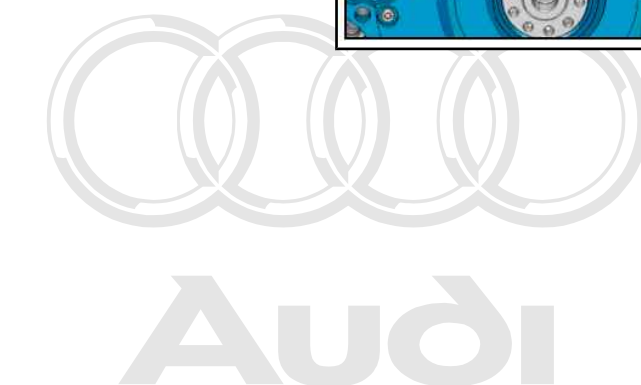
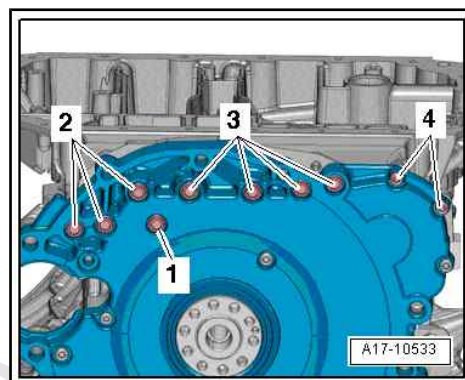
- ◆ Electric drill with plastic brush attachment
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 405 .
- Engine secured to engine and gearbox stand -VAS 6095-
⇒ [page 93](#) .
- Vehicles with manual gearbox: remove clutch pressure plate
⇒ Rep. Gr. 30 and dual-mass flywheel ⇒ [page 113](#) .
- Vehicles with multitronic gearbox: Remove damper unit
⇒ [page 118](#) and flywheel ⇒ [page 119](#) .
- Vehicles with automatic gearbox 09L: Remove drive plate
⇒ [page 121](#) .
- Remove sump (bottom section) ⇒ [page 222](#) .
- Remove oil pump ⇒ [page 225](#) .
- Unscrew bolts -arrows- and remove baffle plate (bottom).

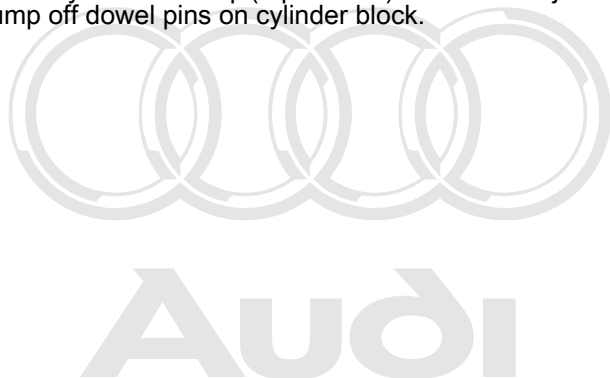


- Unscrew bolts -1 ... 4- from timing chain cover (bottom).

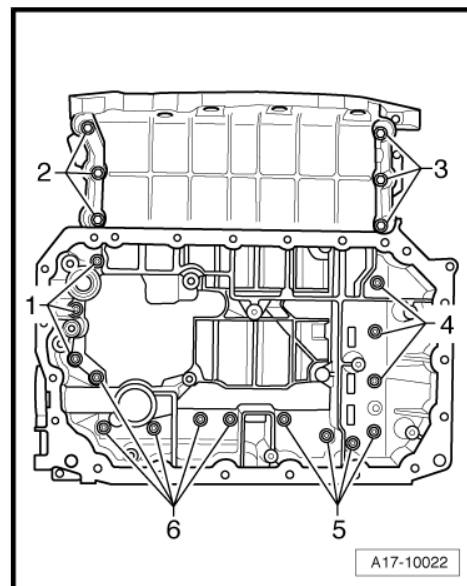


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- Remove bolts -1 ... 6- for sump (top section).
- Carefully release sump (top section) from bonded joint and pry sump off dowel pins on cylinder block.



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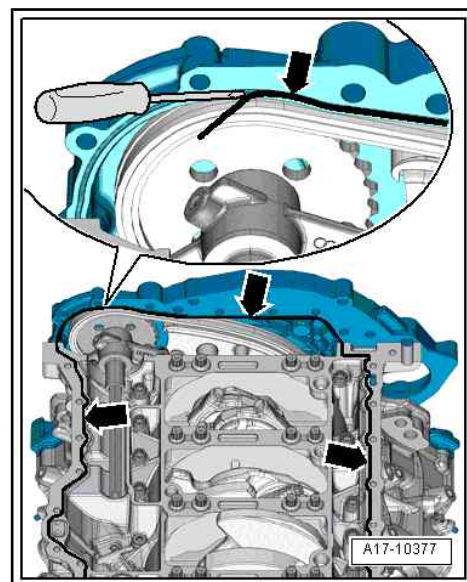
Installing



Note

Renew gaskets, seals and O-rings.

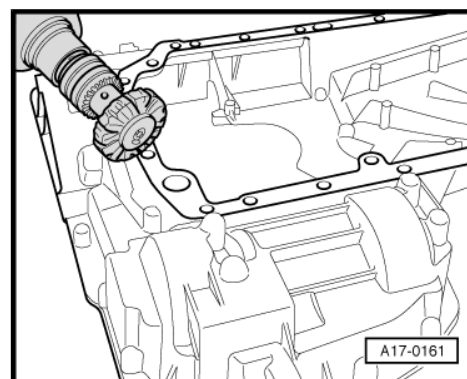
- Remove old sealant from grooves on sump (top section) and on timing chain cover (bottom) -arrows- using a small screw-driver.



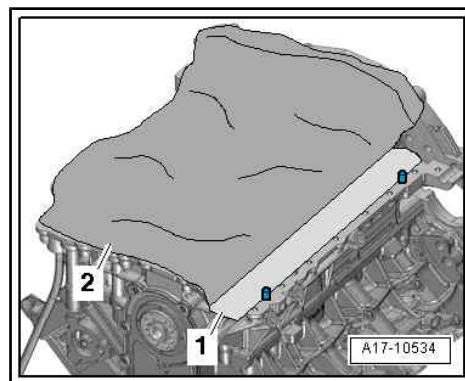
WARNING

Wear safety goggles.

- Remove sealant residue on sump (top section) using rotating plastic brush or similar.



- Mask oil return channel with adhesive tape -1-.
- Cover cylinder block with a cloth -2- to protect against metal shavings.
- Also mask open threaded holes with adhesive tape to protect against metal shavings.

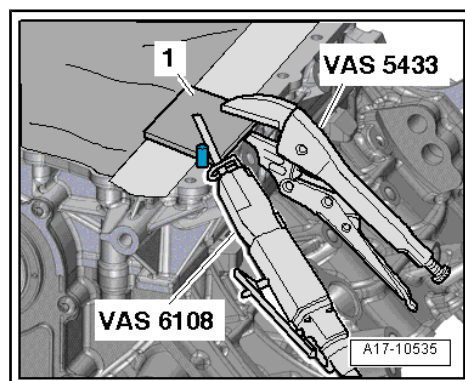


- Secure a strip of sheet metal (2.5 mm thick and approx. 65 x 100 mm) -item 1- next to dowel sleeve using universal mole grips (300 mm) -VAS 5433- .



Note

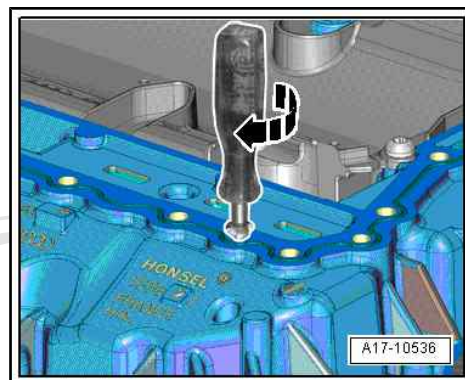
The metal strip serves as a stop when sawing; at the same time it protects the sealing surface of the retaining frame.



WARNING

Wear safety goggles.

- Saw off dowel sleeve so it is flush with metal strip using pneumatic jig-saw -VAS 5108- .
- Repeat procedure for second dowel sleeve.
- Deburr both dowel sleeves.
- Chamfer both holes for dowel sleeves (1.5 mm) on sump (top section) using countersink.
- Clean sealing surfaces on sump (top section) and timing chain cover (bottom); they must be free of oil and grease.

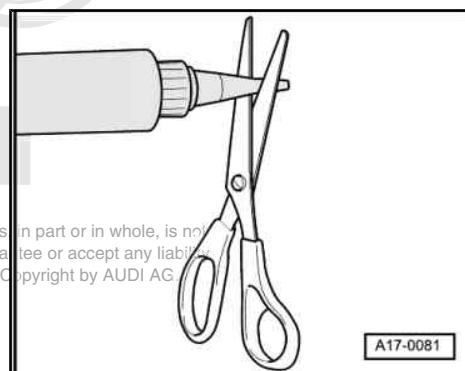


Note

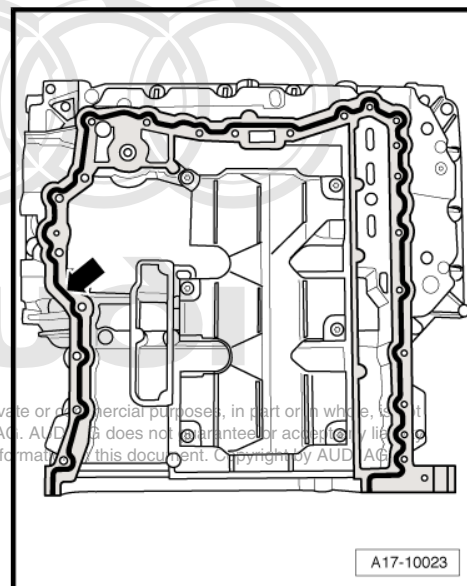
Note the use-by date of the sealant.

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

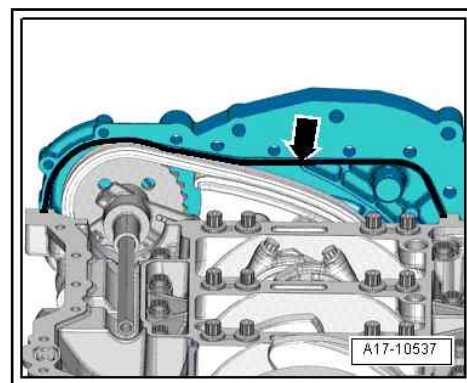
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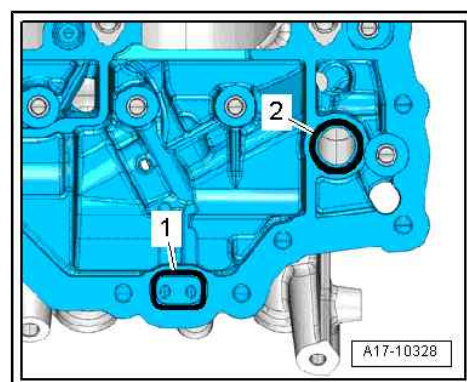
- Apply bead of sealant -arrow- onto clean sealing surface of sump (top section) as illustrated.
- The grooves -arrows- on the sealing surfaces must be completely filled with sealant.
- The bead of sealant must project 1.5 ... 2.0 mm above the sealing surface.



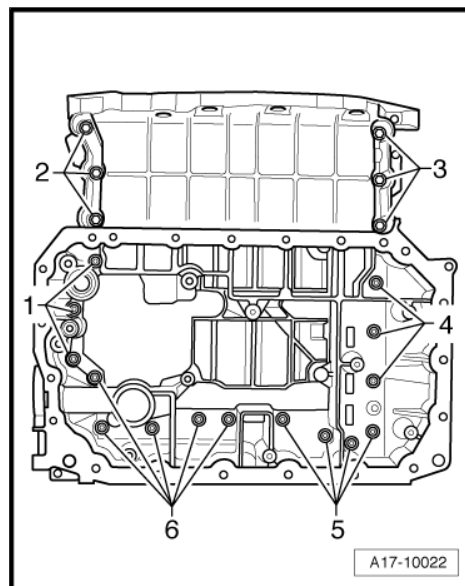
- Apply sealant bead -arrow- onto clean sealing surface of timing chain cover (bottom), as illustrated.
- The groove on the sealing surface must be completely filled with sealant.
- The bead of sealant must project 1.5 ... 2.0 mm above the sealing surface.
- Apply sealant bead all the way into corners.

**Note**

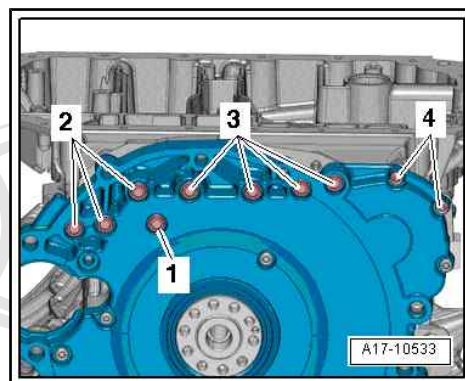
- ◆ *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- ◆ *The sump (top section) must be installed within 5 minutes after applying sealant.*
- Fit seal -1- and O-ring -2- in retaining frame.



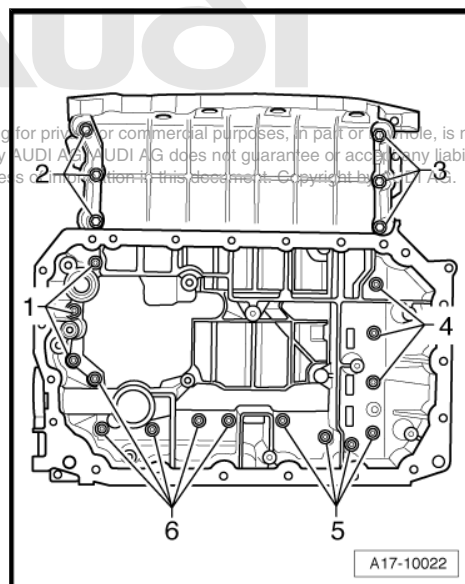
- Fit sump (top section), paying attention to dowel sleeves, and tighten bolts -1 ... 6- in diagonal sequence initially to 5 Nm.



- Pre-tighten bolts -1 ... 4- in diagonal sequence to 5 Nm.



- Tighten bolts -1 ... 6- in diagonal sequence.

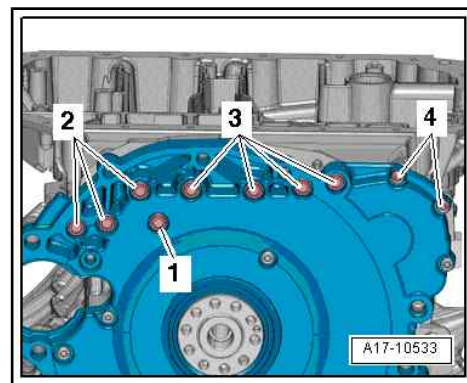


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- Tighten bolts -1 ... 4- in diagonal sequence.

Perform further installation in reverse order, paying attention to the following:

- Install oil pump ⇒ [page 225](#) .
- Install sump (bottom section) ⇒ [page 222](#) .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ [page 113](#) and pressure plate ⇒ Rep. Gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ [page 119](#) and damper unit ⇒ [page 118](#) .
- Vehicles with automatic gearbox 09L: Install drive plate ⇒ [page 121](#) .
- After installing engine, fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 405 .



Tightening torques

Component		Nm
Sump (top section) to cylinder block		16 ¹⁾
Timing chain cover (bottom) to engine	M6	9
	M8	20
Baffle plate (top) to sump (top section)		9 ²⁾
Baffle plate (bottom) to sump (top section)		9
• ¹⁾ Tighten in diagonal sequence. • ²⁾ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue for locking fluid.		

1.7 Oil filter housing - exploded view

Vehicles up to 04.2005

1 - 13 Nm

2 - Oil pressure switch - F1-

- ☐ Black insulation
- ☐ Checking
⇒ ["1.12 Checking oil pressure", page 238](#)
- ☐ Removing and installing
⇒ [page 237](#)
- ☐ Tighten to 20 Nm

3 - 13 Nm

4 - Sleeve

5 - Rubber grommet

6 - Oil filter housing

- ☐ With filter bypass valve, 3.0 bar
- ☐ With oil retention valve
- ☐ The oil retention valve cannot be renewed
- ☐ Removing and installing
⇒ [page 234](#)

7 - O-ring

- ☐ Renew
- ☐ Installing ⇒ [page 234](#)

8 - Sealing cap, 25 Nm

9 - Seal

- ☐ Renew
- ☐ Removing and installing
⇒ [page 233](#)

10 - Oil filter element

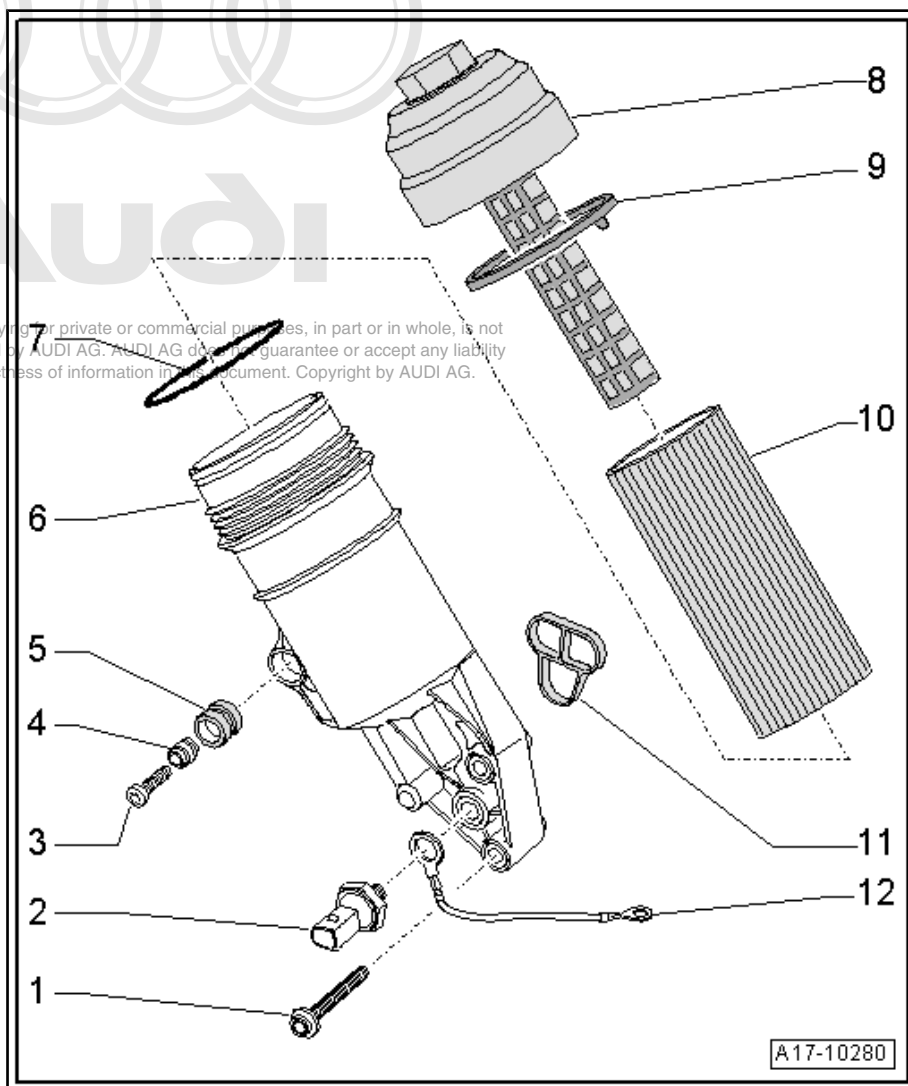
- ☐ Removing and installing
⇒ Maintenance ; Booklet 405

11 - Gasket

- ☐ Renew

12 - Seal with earth wire

- ☐ Renew



Vehicles from 05.2005

1 - 13 Nm

2 - Oil pressure switch - F1-

- ☐ Tighten to 20 Nm
- ☐ Black insulation
- ☐ Removing and installing
⇒ [page 237](#)
- ☐ Checking
⇒ ["1.12 Checking oil pressure", page 238](#)

3 - Multi-point socket flange nut, 13 Nm

4 - 13 Nm

5 - Sleeve

6 - Rubber grommet

7 - Oil filter housing

- ☐ With filter bypass valve, 3.0 bar
- ☐ With oil retention valve
- ☐ The oil retention valve cannot be renewed

8 - O-ring

- ☐ Renew
- ☐ Installing ⇒ [page 234](#)

9 - Sealing cap, 25 Nm

10 - Seal

- ☐ Renew
- ☐ Removing and installing
⇒ [page 233](#)

11 - Oil filter element

- ☐ Removing and installing ⇒ Maintenance ; Booklet 405

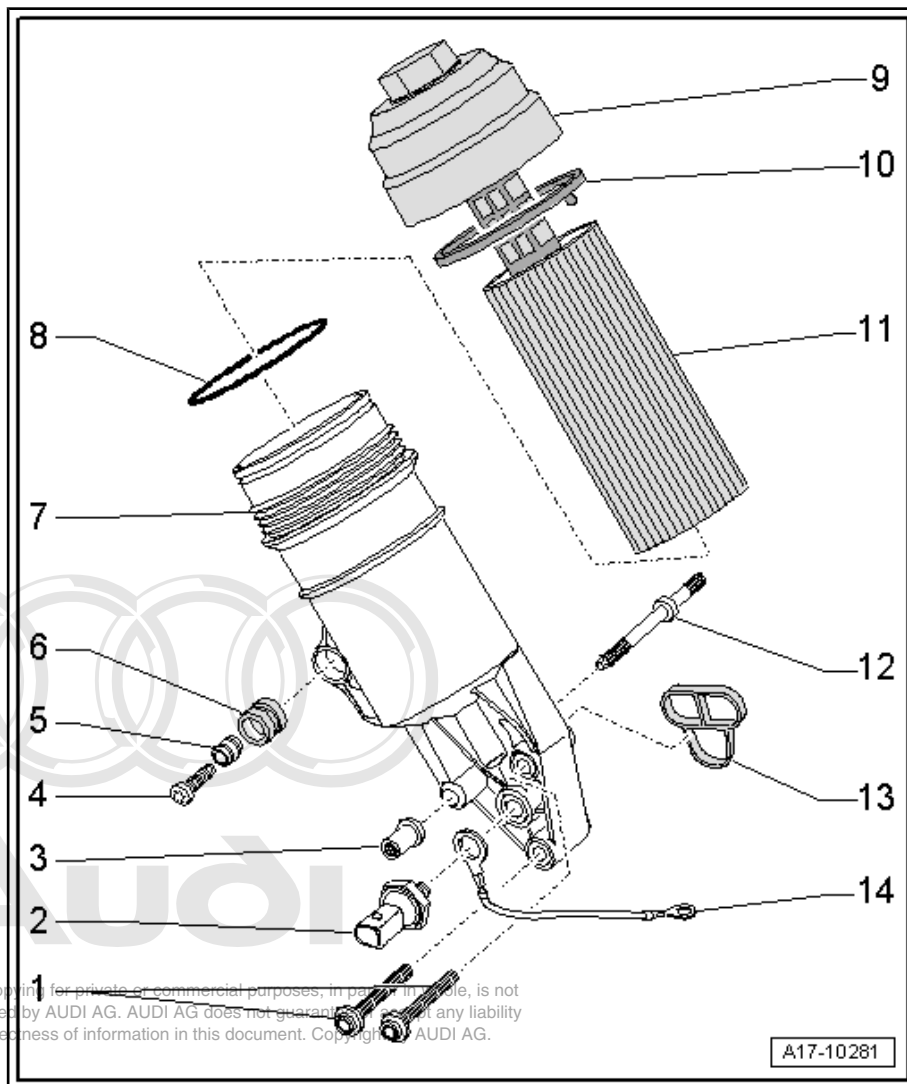
12 - Stud, 16 Nm

13 - Seal

- ☐ Renew

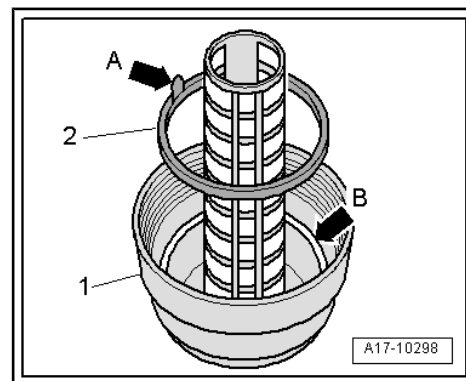
14 - Seal with earth wire

- ☐ Renew



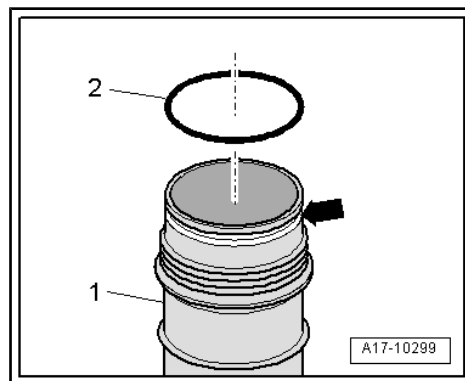
Renewing seal on sealing cap

- 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

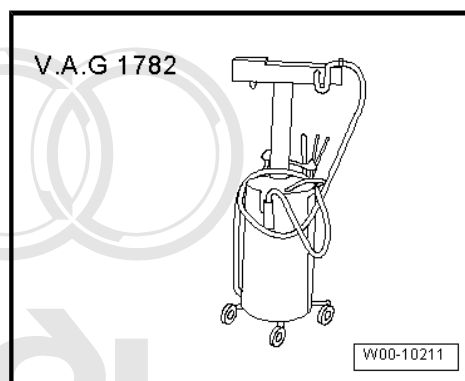
- Install O-ring -2- in groove -arrow- on oil filter housing -1-.



1.8 Removing and installing oil filter housing

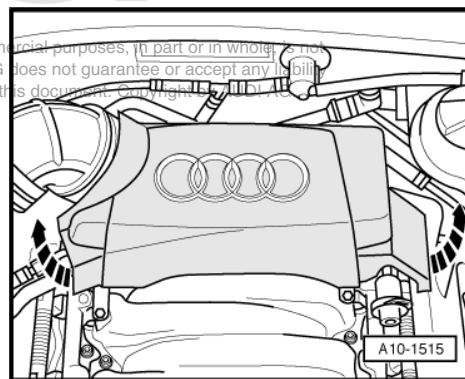
Special tools and workshop equipment required

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

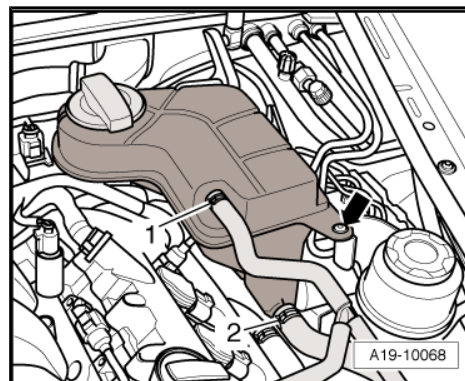


Removing

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



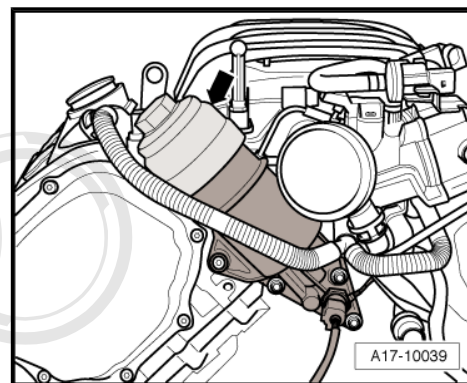
- Unbolt coolant expansion tank -arrow-.
- Unplug electrical connector for coolant shortage indicator switch -F66- at bottom of expansion tank and move expansion tank to one side with coolant hoses -1- and -2- attached.



Note

In the following illustrations the steps to perform are shown from the rear and with the engine removed.

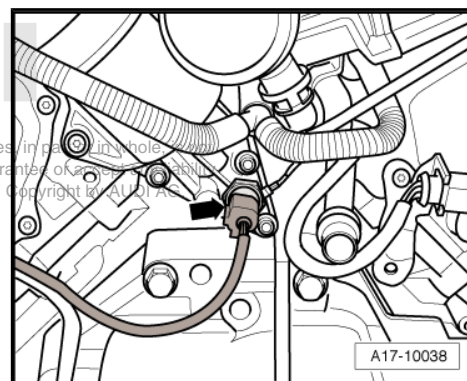
- Unscrew sealing cap -arrow- for oil filter housing.
- Remove oil filter element.
- Extract engine oil from oil filter housing using used oil collection and extraction unit -V.A.G 1782- .



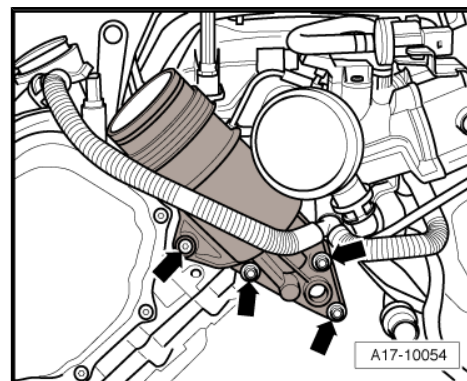
Note

Place a cloth below the oil filter housing to catch escaping oil.

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



- Remove bolts -arrows-.
- On engines from 05.2005, also remove multi-point socket flange nut => [Item 3 \(page 233\)](#) .
- Remove oil filter housing.



Installing

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

Note

Renew gaskets, seals and O-rings.

- Fill with engine oil and check oil level => Maintenance ; Booklet 405 .

Tightening torques

Component	Nm
Oil filter housing to engine	13
Oil pressure switch to oil filter housing	20
Sealing cap on oil filter housing	25

1.9 Oil retention valves, oil separator - exploded view

1 - O-ring

- ☐ Renew

2 - Oil retention valve, 20 Nm

- ☐ For oil supply to cylinder head (right-side)

3 - 9 Nm
4 - Oil separator

- ☐ Bolted into cover
⇒ [Item 6 \(page 236\)](#)
from below

5 - Gasket

- ☐ Renew

6 - Cover

- ☐ With connection for crankcase breather
- ☐ To remove, first remove intake manifold (top section) ⇒ Rep. Gr. 24 and intake manifold (left and right bottom sections) ⇒ Rep. Gr. 24

7 - O-ring

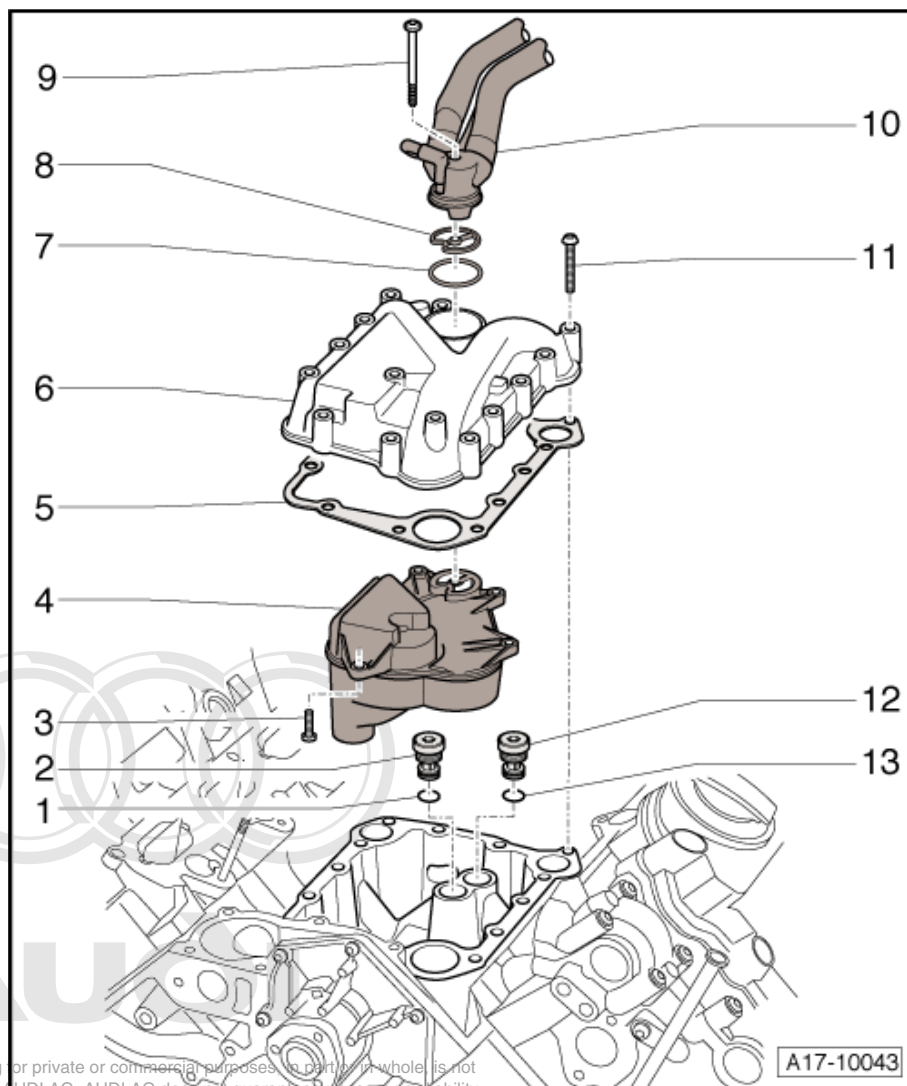
- ☐ Renew

8 - Gasket

- ☐ Renew

9 - 6 Nm
10 - Crankcase breather hoses

- ☐ Removing and installing
⇒ [page 237](#)



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Caution

Do not disconnect crankcase breather hose on USA models.

A17-10043

11 - 9 Nm
12 - Oil retention valve, 20 Nm

- ☐ For oil supply to cylinder head (left-side)

13 - O-ring

- ☐ Renew

1.10 Removing and installing crankcase breather hoses - not applicable for USA vehicles

Removing



Note

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

- Remove intake manifold (top section) ⇒ Rep. Gr. 24 .
- Disconnect crankcase breather hoses -arrows- from cylinder head covers.
- Move the crankcase breather hoses clear.
- Unscrew bolt -1- and take out hose connection with crankcase breather hoses.

Installing

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



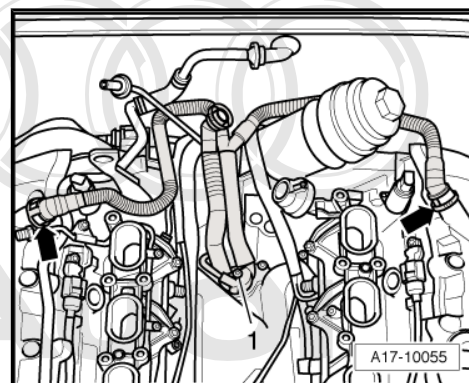
Note

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

- Install intake manifold (top section) ⇒ Rep. Gr. 24 .

Tightening torque

Component	Nm
Hose connection for crankcase breather hoses to cover	6

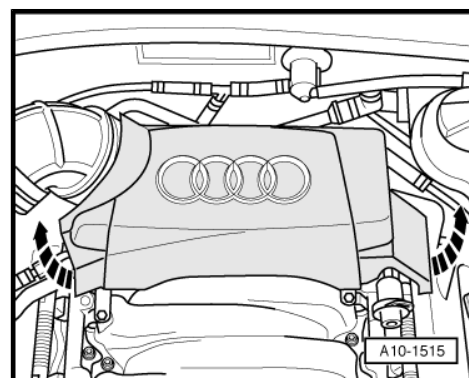


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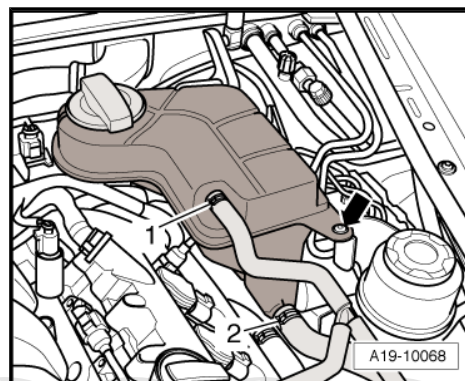
1.11 Removing and installing oil pressure switch -F1-

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.



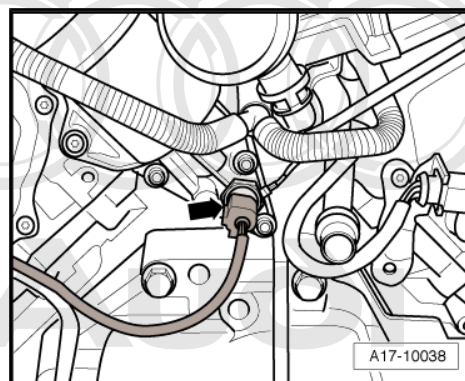
Note

Place a cloth below the oil filter housing to catch escaping oil.

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

Installing

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



Note

Renew seal.

- Check oil level ⇒ Maintenance ; Booklet 405 .

Tightening torque

Component	Nm
Oil pressure switch to oil filter housing	20

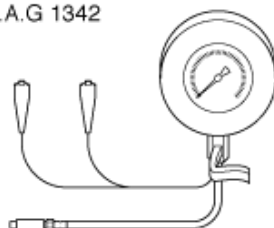
1.12 Checking oil pressure

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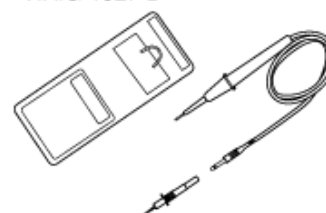
Special tools and workshop equipment required

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

V.A.G 1342



V.A.G 1527 B



V.A.G 1594 C



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G17-0023

Procedure

- Oil level OK
- Engine oil temperature approx. 80 °C
- Remove oil pressure switch ⇒ [page 237](#) .

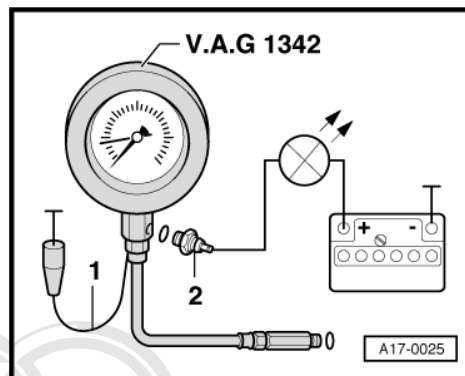
- Connect oil pressure tester -V.A.G 1342- to threaded hole for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester - V.A.G 1342- .

Checking oil pressure switch

- Connect brown wire -1- of oil pressure tester to earth (-).
- Connect voltage tester -V.A.G 1527 B- with test leads from auxiliary measuring set -V.A.G 1594 C- to oil pressure switch and battery positive (+).
- LED should not light up.

If LED lights up now:

- Renew oil pressure switch.
- Start engine.



Note

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

- LED should light up at 1.2 ... 1.6 bar

If LED does not light up:

- Renew oil pressure switch.

Checking oil pressure

- Start engine.
- Minimum oil pressure at idling speed: 1.2 bar
- Minimum oil pressure at 2000 rpm: 3.4 bar.

Assembling

- Install oil pressure switch ⇒ [page 237](#) .

1.13 Engine oil

Refer to ⇒ Maintenance tables for viscosity grades, oil specifications and engine oil capacity.

1.14 Checking oil level

Check oil level ⇒ Maintenance ; Booklet 405 .

19 – Cooling

1 Cooling system



WARNING

Hot steam can escape when opening cap on expansion tank; cover filler cap with a cloth and open carefully.



Note

- ◆ *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- ◆ *Renew gaskets and seals.*
- ◆ *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 Diagram of coolant hose connections



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1 - Radiator

- ☐ Removing and installing
⇒ [page 220](#)
- ☐ If renewed, refill system
with fresh coolant

2 - Coolant pump

- ☐ Removing and installing
⇒ [page 249](#)

3 - Thermostat

- ☐ Removing and installing
⇒ [page 251](#)
- ☐ Checking ⇒ [page 251](#)

4 - Heat exchanger

- ☐ If renewed, refill system
with fresh coolant

5 - Bleeder screw

6 - Expansion tank

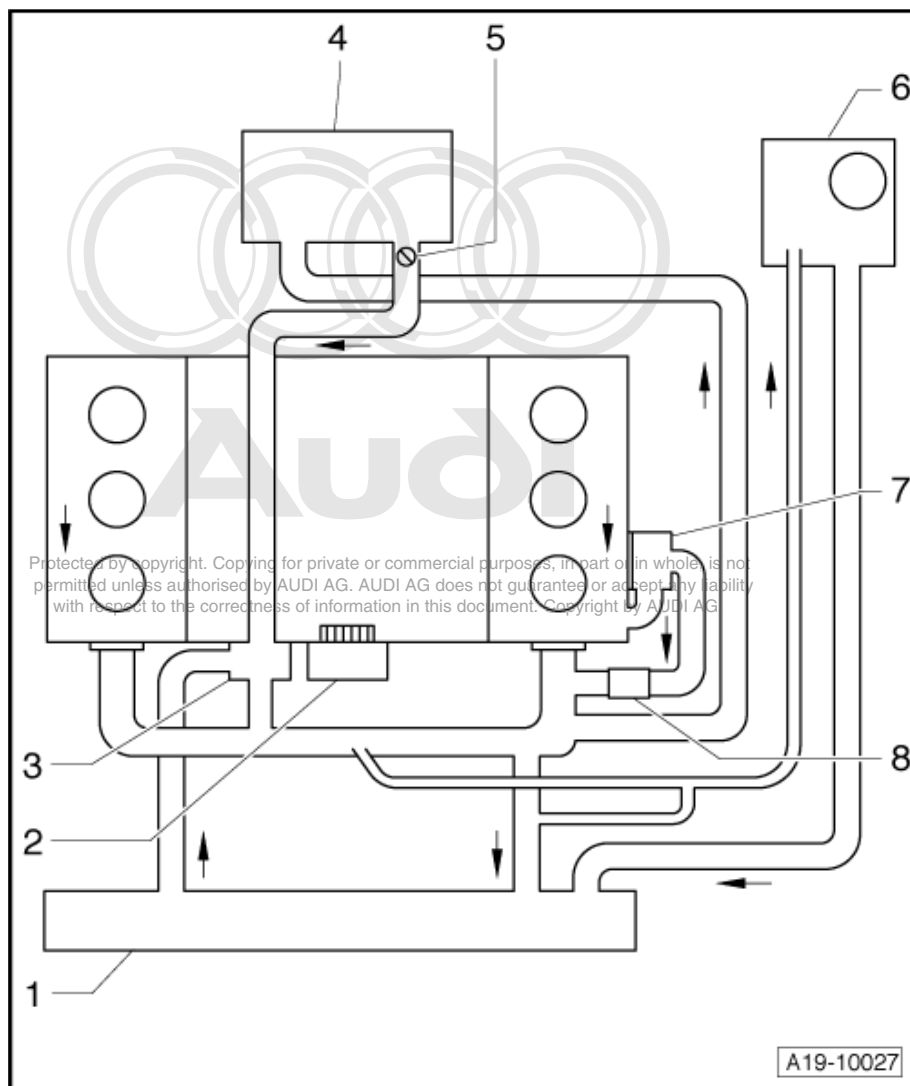
- ☐ With filler cap
- ☐ Checking pressure re-
lief valve in filler cap
⇒ [page 268](#)

7 - Engine oil cooler

- ☐ If renewed, refill system
with fresh coolant
- ☐ Removing and installing
⇒ [page 220](#)

8 - Continued coolant circula- tion pump -V51-

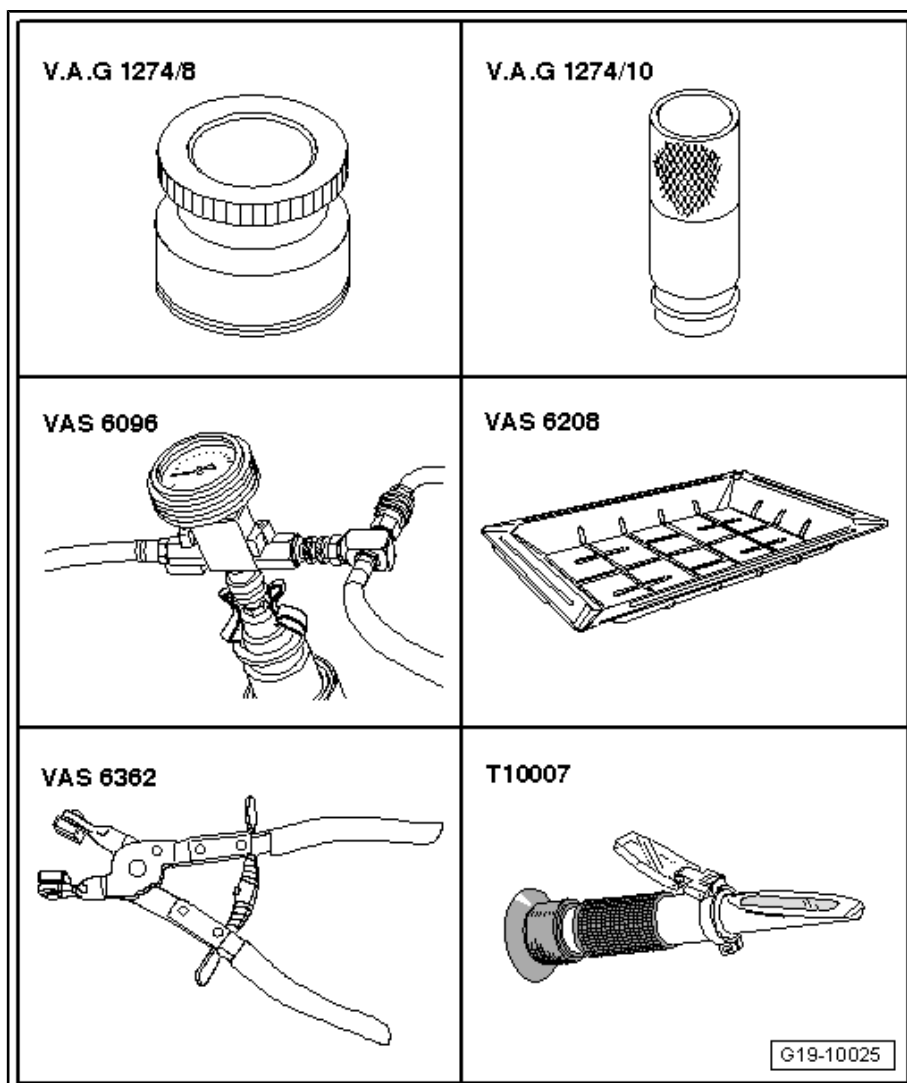
- ☐ Only on vehicles equip-
ped for a hot climate



1.2 Draining and filling cooling system

Special tools and workshop equipment required

- ◆ Adapter for cooling system tester -V.A.G 1274/8-
- ◆ Pipe for cooling system tester -V.A.G 1274/10-
- ◆ Cooling system charge unit -VAS 6096-
- ◆ Drip tray for workshop hoist -VAS 6208-
- ◆ Hose clip pliers -VAS 6362-
- ◆ Refractometer -T10007-



Draining



Note

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



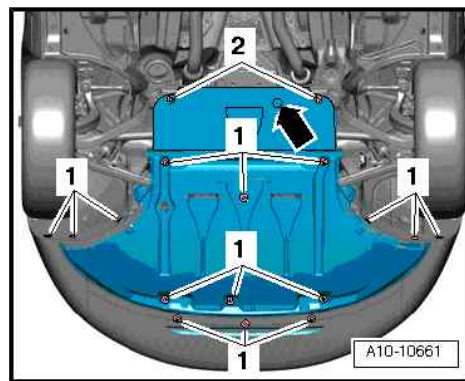
WARNING

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

- Open filler cap on coolant expansion tank.

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- Remove noise insulation panels ⇒ Rep. Gr. 50 .

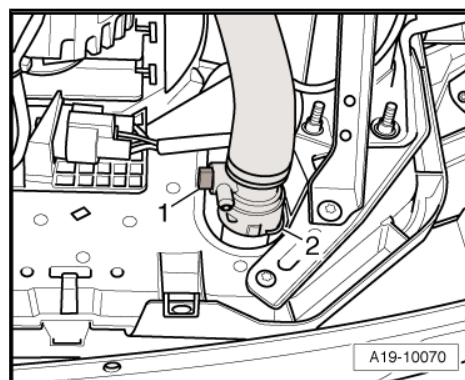


- Place drip tray for workshop hoist -VAS 6208- under engine.
- Open drain plug -1- and let coolant drain.



Note

Disregard -item 2-.



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

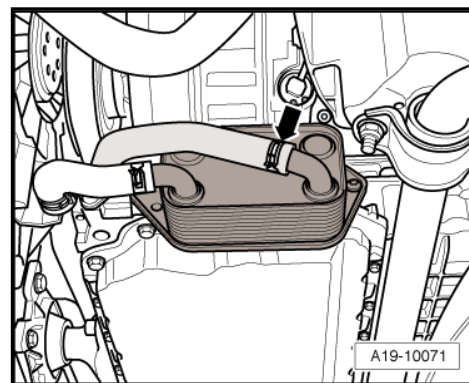
Filling

- Ignition off.



Note

- ◆ The cooling system is filled all year round with a mixture of water and radiator antifreeze/anti-corrosion agent.
- ◆ Use only the radiator antifreeze/anti-corrosion agent approved for this engine ⇒ *Electronic parts catalogue*. Other coolant additives could seriously impair in particular the anticorrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.
- ◆ The specified radiator antifreeze/anti-corrosion agent prevents frost and corrosion damage and stops scaling. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct antifreeze and anticorrosion additive.
- ◆ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Frost protection is required down to about -25°C (in countries with arctic climate: down to about -35°C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze concentration must be at least 40 %.
- ◆ If greater frost protection is required in very cold climates, the concentration of radiator antifreeze/anti-corrosion agent can be increased, but only up to 60% (this gives frost protection to about -40°C). If the concentration exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.
- ◆ Use only clean tap water for mixing coolant.
- ◆ Do not use drained coolant again if:
- ◆ the radiator, heat exchanger for heater, cylinder head, cylinder head gasket or cylinder block have been renewed.
- ◆ the coolant is contaminated or dirty.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
- ◆ For checking anti-freeze protection in cooling system, use refractometer -T10007-.

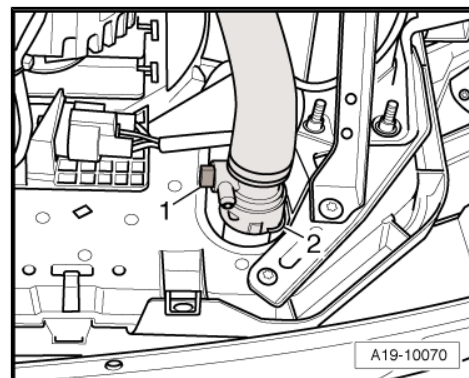


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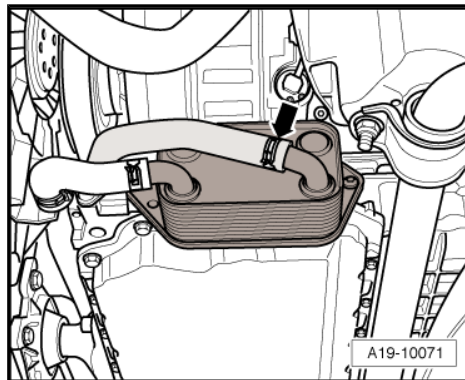


Note

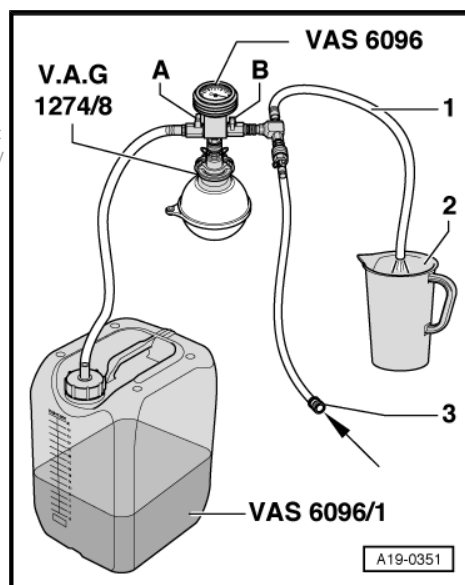
Disregard -item 2-.



- Connect coolant hose to engine oil cooler -arrow-.



- Fill reservoir -VAS 6096/1- with at least 12 litres of premixed coolant (based on recommended ratio):
 - Radiator antifreeze/anti-corrosion agent (40 %) and water (60 %) for frost protection to -25°C .
 - Radiator antifreeze/anti-corrosion agent (50 %) and water (50 %) for frost protection to -35°C .
 - Radiator antifreeze/anti-corrosion agent (60 %) and water (40 %) for frost protection to -40°C .
 - Radiator antifreeze/anti-corrosion agent $\Rightarrow$ Electronic parts catalogue
- Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
- Close the two valves -A- and -B- by setting lever at right angle to direction of flow.
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



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

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

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

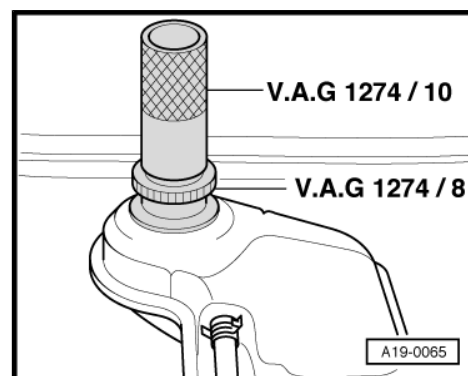
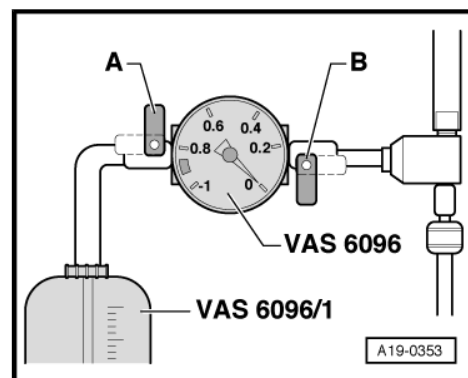
If the needle does not reach the green zone, repeat the process.

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

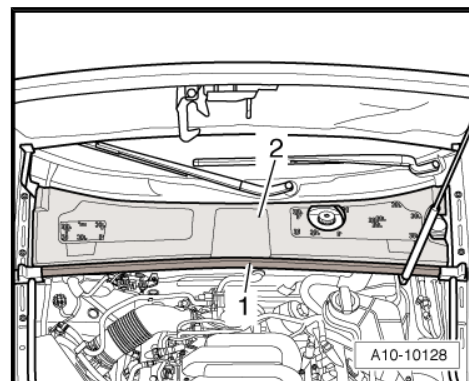
- Detach compressed air hose.
- Open valve -A-.

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

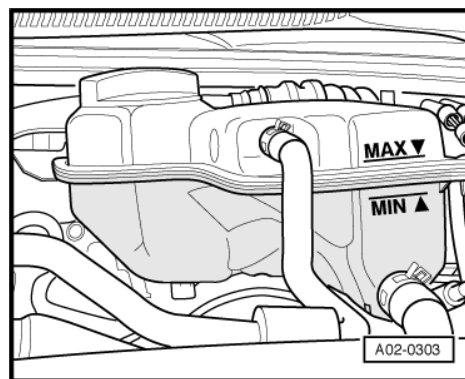
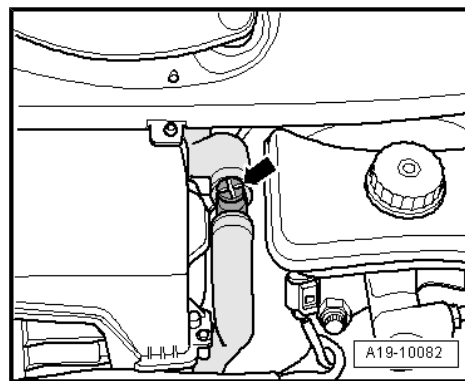
- Detach cooling system charge unit -VAS 6096- from expansion tank.
- Fit pipe -V.A.G 1274/10- onto adapter -V.A.G 1274/8- .



- 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 the 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 (press **ECON** button).
- 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.

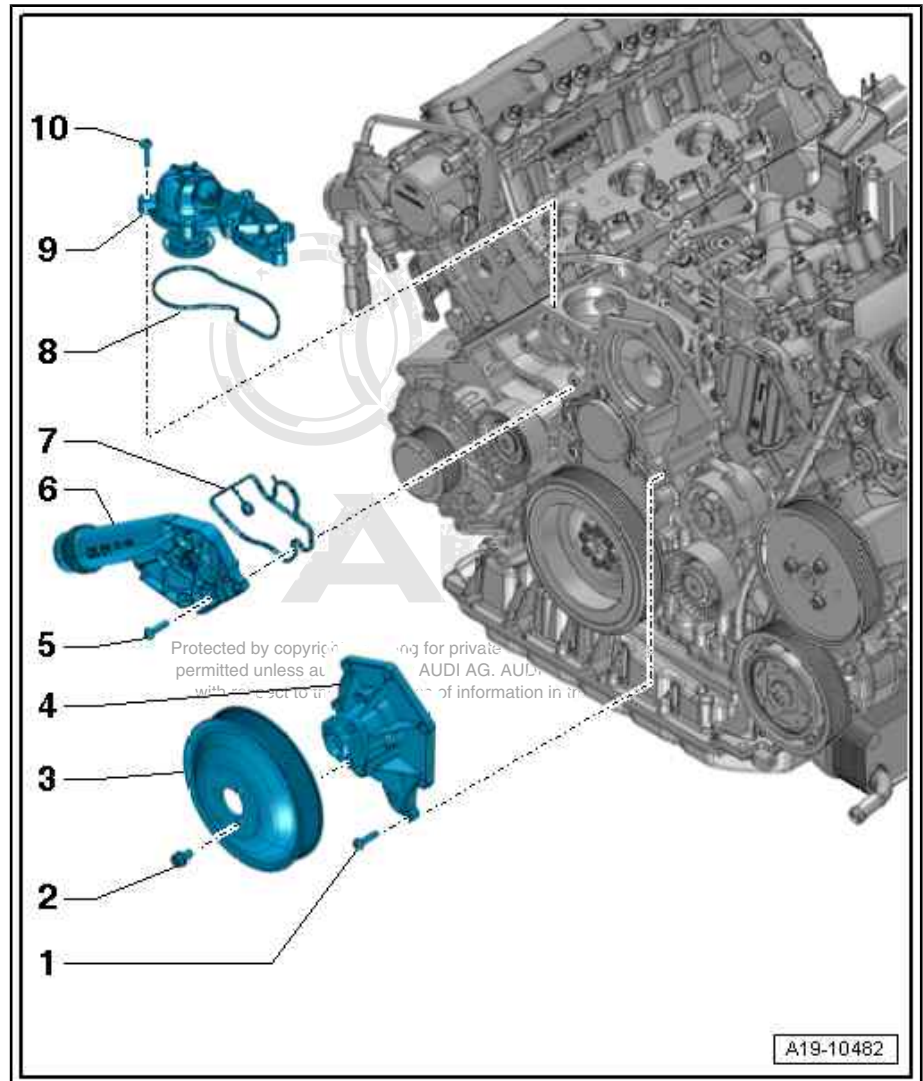


1.3 Thermostat, coolant pump and connection - exploded view



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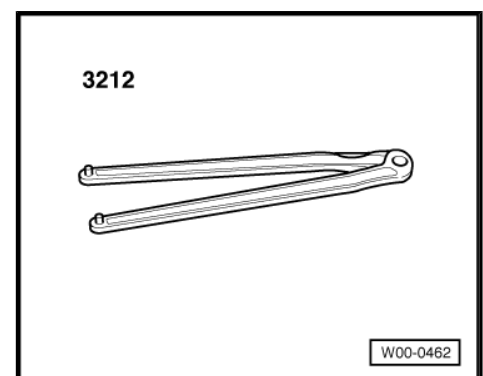
- 1 - 9 Nm
- 2 - 20 Nm
- 3 - Poly V-belt pulley for coolant pump
- 4 - Coolant pump
 - ☐ With seal
 - ☐ Removing and installing
⇒ [page 249](#)
- 5 - 9 Nm
- 6 - Connection
 - ☐ For coolant hose
- 7 - Gasket
 - ☐ Renew
- 8 - Gasket
 - ☐ Different versions available ⇒ Electronic parts catalogue
 - ☐ Renew
- 9 - Thermostat
 - ☐ Removing and installing
⇒ [page 251](#)
 - ☐ Checking ⇒ [page 251](#)
- 10 - 9 Nm



1.4 Removing and installing coolant pump

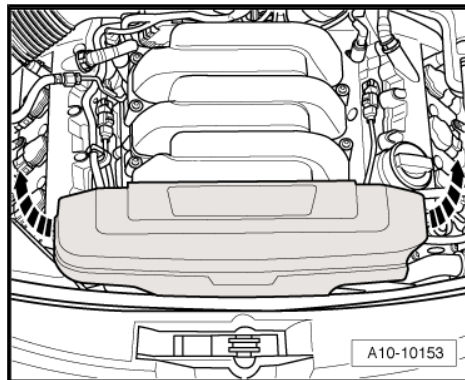
Special tools and workshop equipment required

- ◆ Pin wrench -3212-



Removing

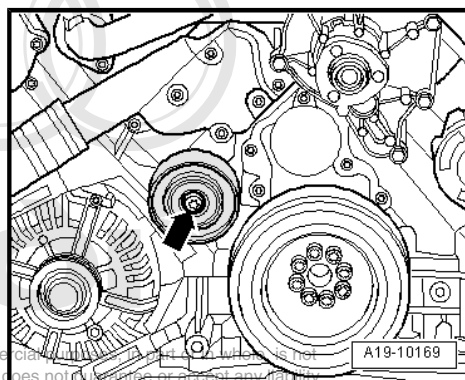
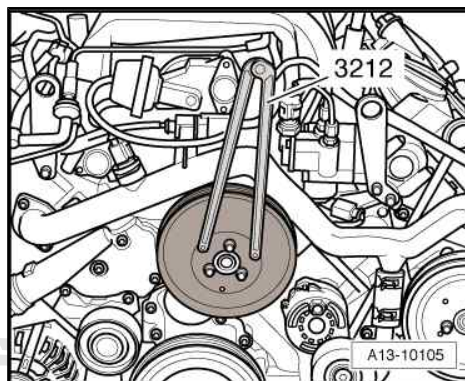
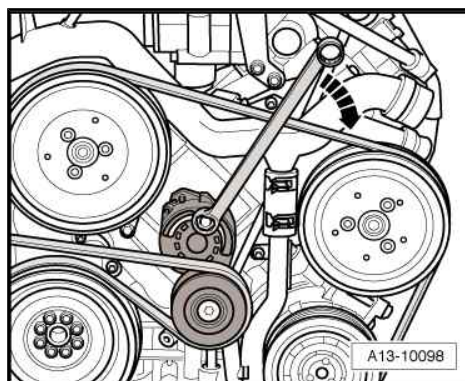
- Drain off coolant ⇒ [page 243](#) .
- Pull off engine cover panel (front) -arrows-.



Note

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

- To slacken poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt from coolant pump.
- Release pressure from the tensioner.
- Unbolt belt pulley from coolant pump.
- Use pin wrench -3212- to counterhold pulley when loosening bolts.
- Prise off cap.
- Unscrew bolt -arrow- and detach idler roller.



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- Unscrew bolts -arrows- for coolant pump and detach coolant pump.

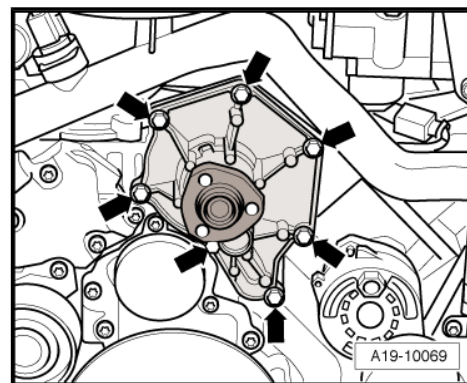
Installing

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

- Clean sealing surfaces; they must be free of oil and grease.
- Install poly V-belt ⇒ [page 108](#) .
- Fill cooling system ⇒ [page 245](#) .

Tightening torques

Component	Nm
Coolant pump to cylinder block	9
Poly V-belt pulley to coolant pump	20
Idler roller to cylinder block	40



1.5 Removing and installing thermostat

Removing

- Drain off coolant ⇒ [page 243](#) .
- Remove intake manifold (top section) ⇒ Rep. Gr. 24 .
- Remove coolant pipe (front) ⇒ [page 253](#) .



Note

Place a cloth underneath to catch any escaping coolant.

- Remove bolts -arrows-.
- Detach thermostat with hose connection.

Installing

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



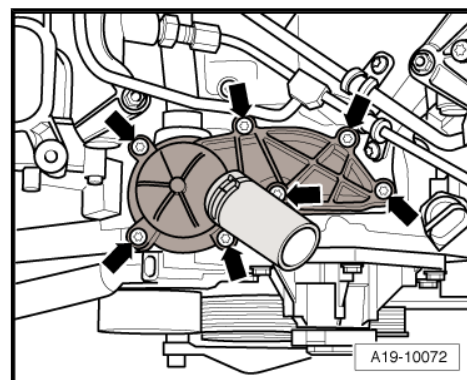
Note

Renew seals and gaskets.

- Install coolant pipe (front) ⇒ [page 253](#) .
- Install intake manifold (top section) ⇒ Rep. Gr. 24 .
- Fill cooling system ⇒ [page 245](#) .

Tightening torque

Component	Nm
Coolant thermostat with hose connection to cylinder block	9



1.6 Checking thermostat

- Heat removed thermostat in water bath.

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

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Starts to open	Fully open	Opening travel
• 1) Cannot be tested.		

1.7 Coolant pipes - exploded view

1 - Coolant pipe (left-side)

- ☐ Remove and install together with
⇒ [Item 16 \(page 252\)](#)
⇒ [page 255](#)

2 - 9 Nm

3 - O-ring

- ☐ Renew

4 - Connecting hose

5 - 9 Nm

6 - Coolant pipe (front)

- ☐ Removing and installing
⇒ [page 253](#)

7 - 9 Nm

8 - O-ring

- ☐ Renew

9 - Coolant temperature sender -G62-

- ☐ Removing and installing
⇒ [page 252](#)

10 - Retaining clip

11 - Seal

- ☐ Renew

12 - O-ring

- ☐ Renew

13 - Coolant pipe (top)

- ☐ Removing and installing
⇒ [page 258](#)

14 - 9 Nm

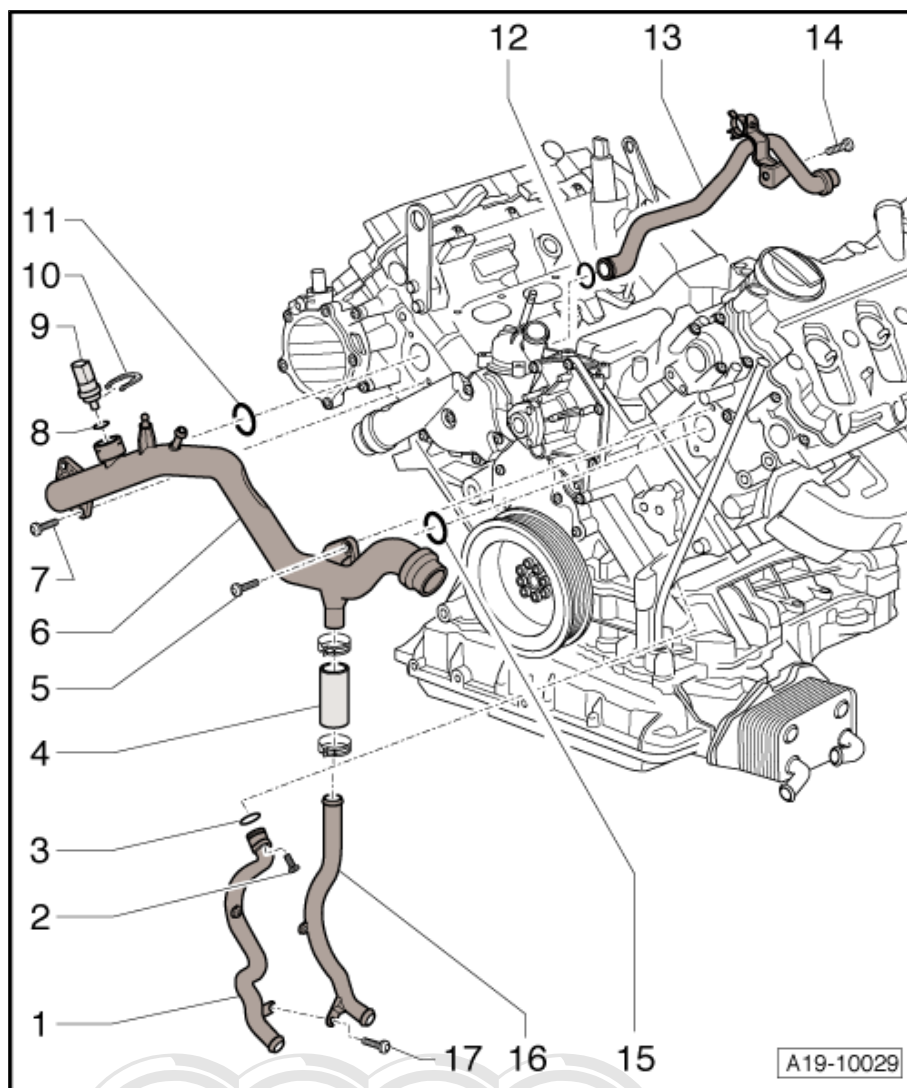
15 - Seal

- ☐ Renew

16 - Coolant pipe (left-side)

- ☐ Remove and install together with ⇒ [Item 1 \(page 252\)](#) ⇒ [page 255](#)

17 - 9 Nm



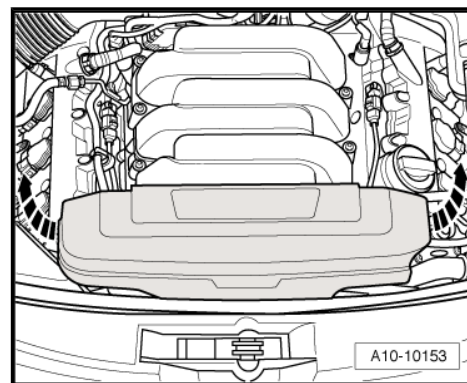
1.8 Removing and installing coolant temperature sender -G62-

Removing

- Drain off coolant ⇒ [page 243](#) .

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



- Unplug electrical connector -2- at coolant temperature sender -G62- .
- Pull off retaining clip -1- and detach coolant temperature sender -G62- .

Installing

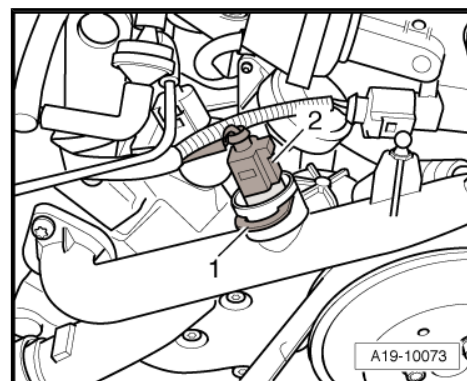
Installation is carried out in the reverse order; note the following:



Note

Renew O-ring.

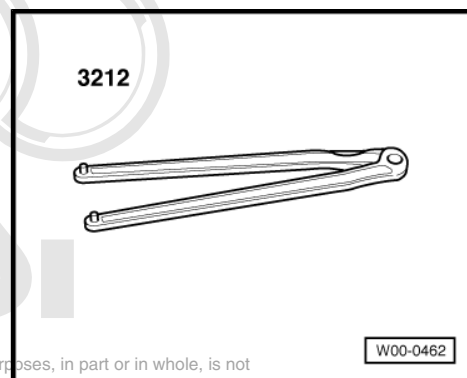
- Fill cooling system ⇒ [page 245](#) .



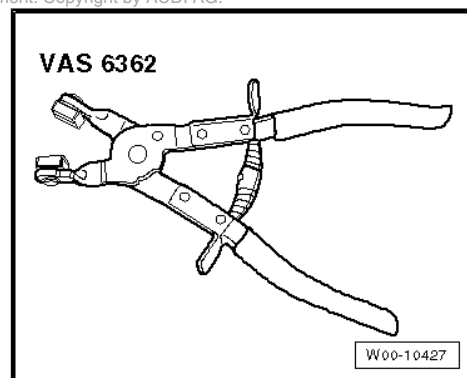
1.9 Removing and installing coolant pipe (front)

Special tools and workshop equipment required

- ◆ Pin wrench -3212-



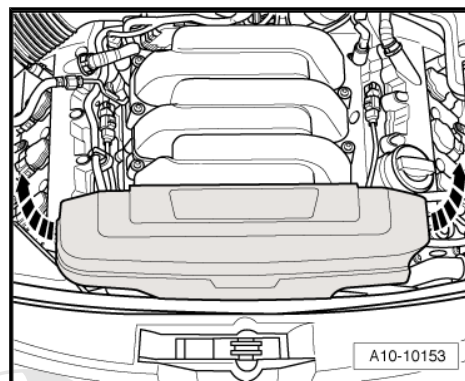
- ◆ Hose clip pliers -VAS 6362-



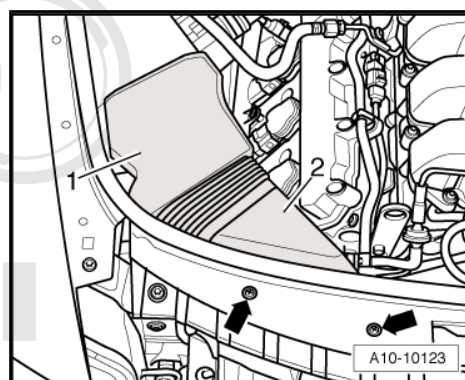
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Removing

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



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



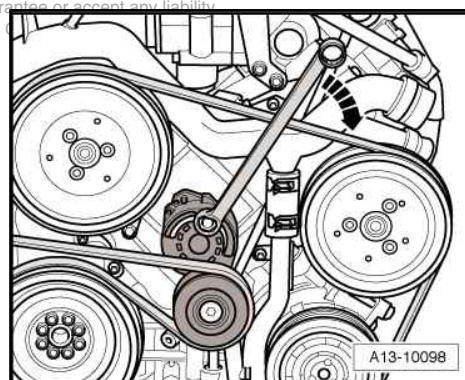
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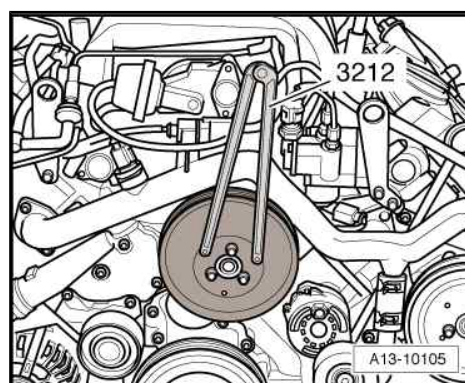
Note

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

- To slacken poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt from coolant pump.
- Release pressure from the tensioner.



- Unbolt belt pulley from coolant pump.
- Use pin wrench -3212- to counterhold pulley when loosening bolts.



- Unplug electrical connector -3-.
- Detach coolant hoses -arrows- from coolant pipe (front).
- Unscrew bolts -1-, -2-, -4- and -5- and remove coolant pipe (front).

Installing

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



Note

- ◆ *Renew seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with coolant and slide onto coolant pipe.
- Install poly V-belt ⇒ [page 108](#) .
- Fill cooling system ⇒ [page 245](#) .

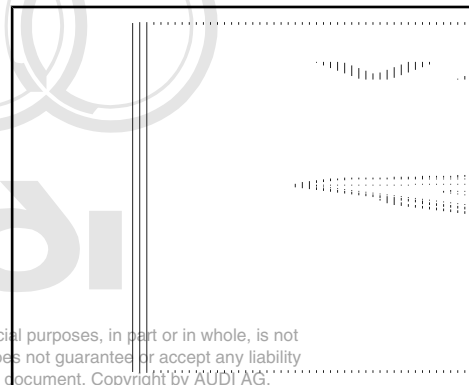
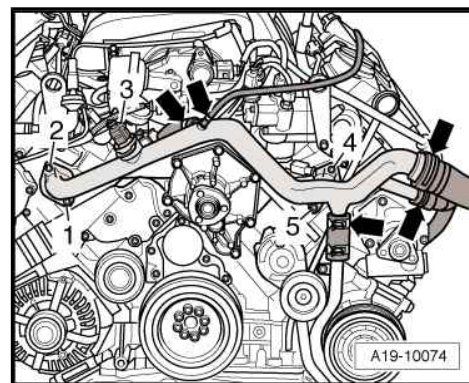
Tightening torques

Component	Nm
Coolant pipe (front) to engine	9
Poly V-belt pulley to coolant pump	20

1.10 Removing and installing coolant pipes (left-side)

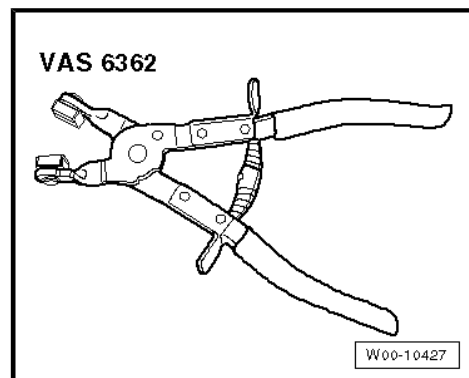
Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist -VAS 6208-



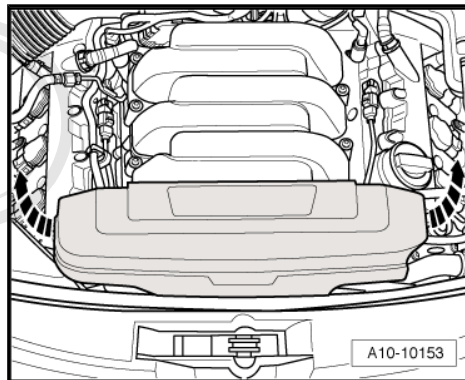
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- ◆ Hose clip pliers -VAS 6362-



Removing

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

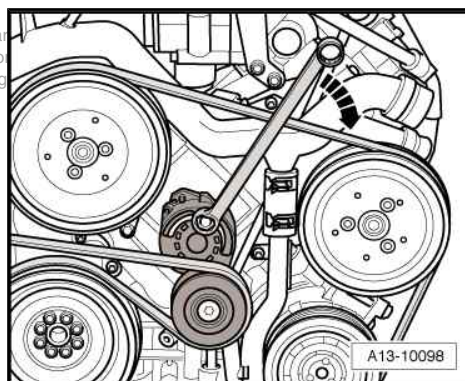


Note

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

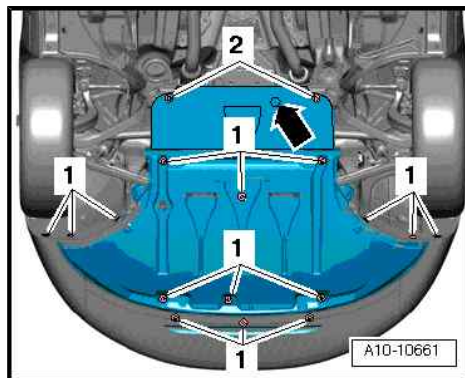
- To slacken poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt from coolant pump.
- Release pressure from the tensioner.



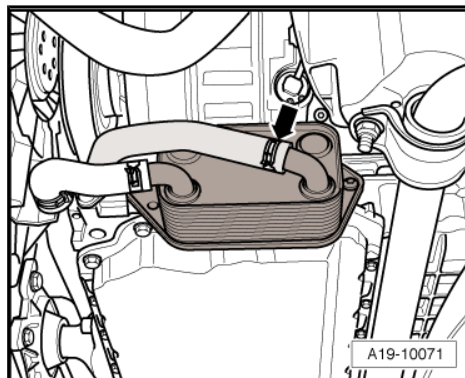
WARNING

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

- Open filler cap on coolant expansion tank.
- Remove noise insulation panels ⇒ Rep. Gr. 50 .



- Place drip tray for workshop hoist -VAS 6208- under engine.
- Disconnect coolant hose -arrow- at engine oil cooler and drain off coolant.



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

**WARNING**

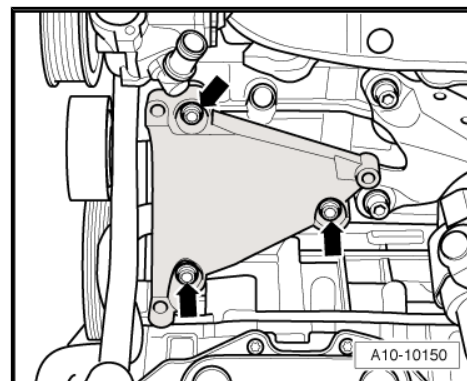
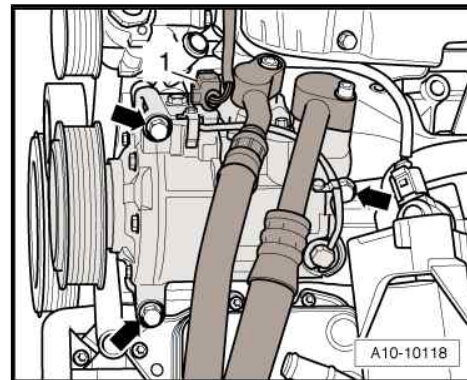
The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.

**Note**

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

- 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

Shown in illustration with power steering pump removed.

Installing

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

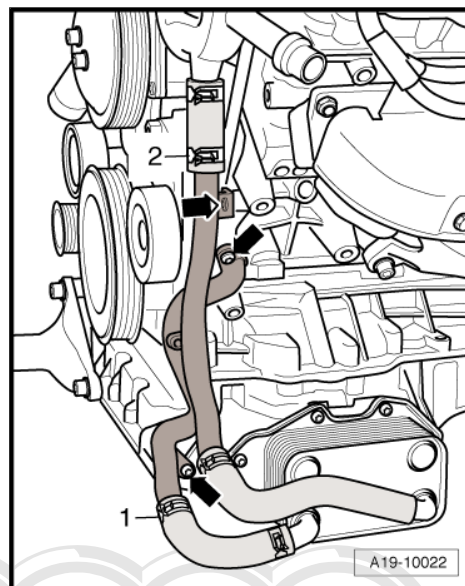


Note

- ◆ Renew O-rings.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with coolant and slide onto coolant pipe.
- Install air conditioner compressor ⇒ Rep. Gr. 87.
- Install poly V-belt ⇒ [page 108](#).
- Fill cooling system ⇒ [page 245](#).

Tightening torque

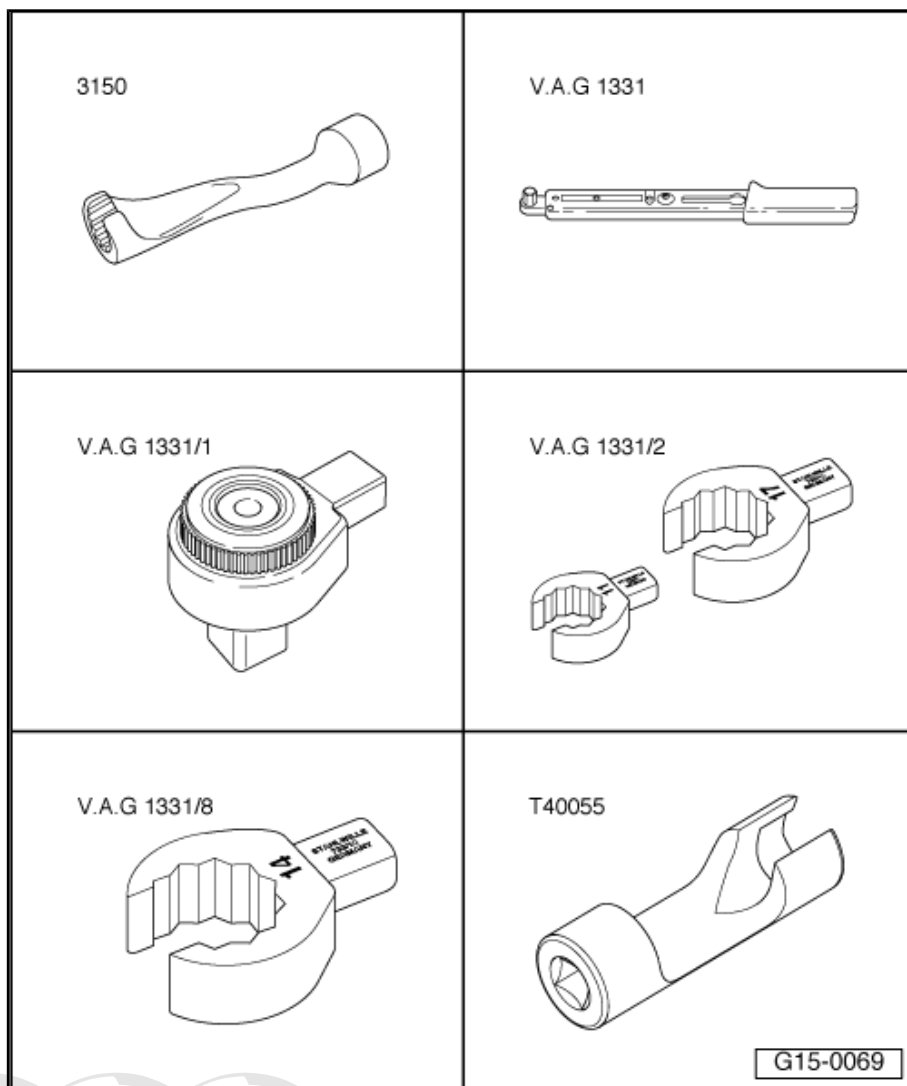
Component	Nm
Coolant pipes to engine	9



1.11 Removing and installing coolant pipe (top)

Special tools and workshop equipment required

- ◆ Socket, 14 mm -3150-
- ◆ Torque wrench -V.A.G 1331-
- ◆ Ratchet -V.A.G 1331/1-
- ◆ Ring insert (open-end; 17 mm) -V.A.G 1331/2-
- ◆ Ring insert (open-end; 14 mm) -V.A.G 1331/8-
- ◆ Socket, 17 mm -T40055-



Removing



Note

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

- Drain off coolant ⇒ [page 243](#) .
- Remove intake manifold (top section) ⇒ Rep. Gr. 24 .



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The fuel system operates under high pressure. The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ Rep. Gr. 24 .

Rest-of-world vehicles:

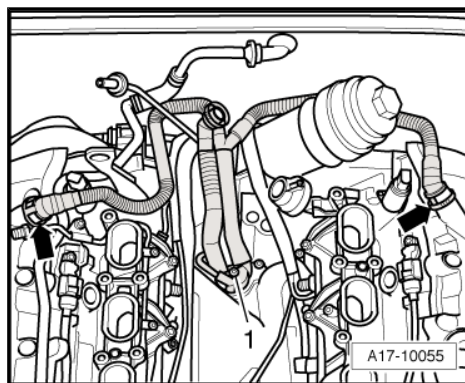
- Disconnect crankcase breather hoses -arrows- from cylinder head covers.
- Move the crankcase breather hoses clear.
- Unscrew bolt -1- and take out hose connection with crankcase breather hoses.

USA models:



Caution

Do not disconnect crankcase breather hose on USA models.

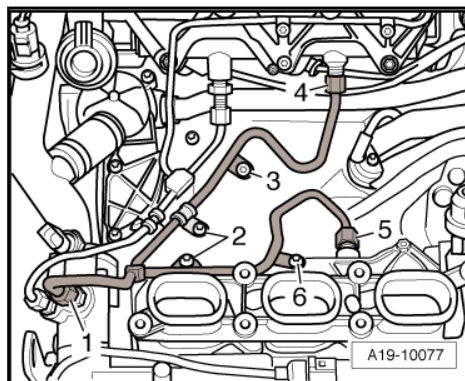


- Detach cylinder head cover (left-side) and move clear to one side (crankcase breather hose remains connected)
⇒ [page 178](#).

All vehicles:

- Remove high-pressure pipe by unscrewing bolts and union nuts -1 ... 6-.

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- Lay a cloth under coolant pipe to catch escaping coolant.
- Detach coolant hose -3- from coolant pipe.
- Unscrew bolts -1- and -2- and pull coolant pipe out of cylinder block towards the rear -arrow-.

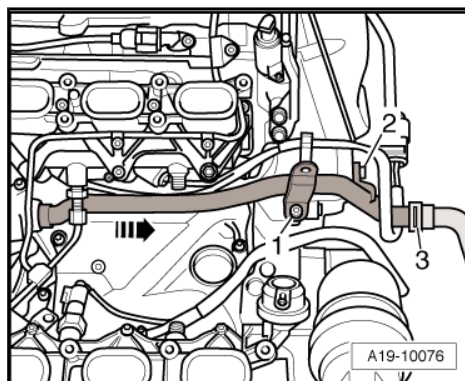
Installing

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

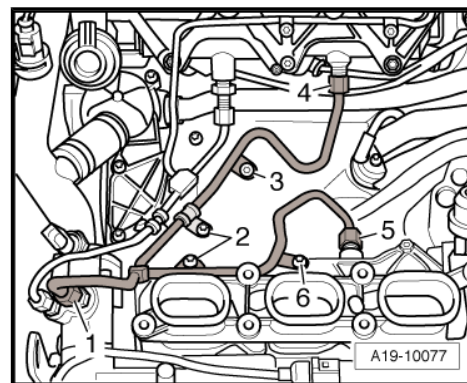


Note

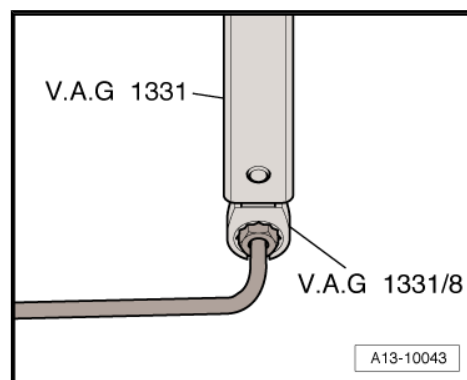
- ◆ *Renew O-ring.*
- ◆ *Fit all cable ties in the original positions when installing.*
- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with coolant and slide onto coolant pipe.



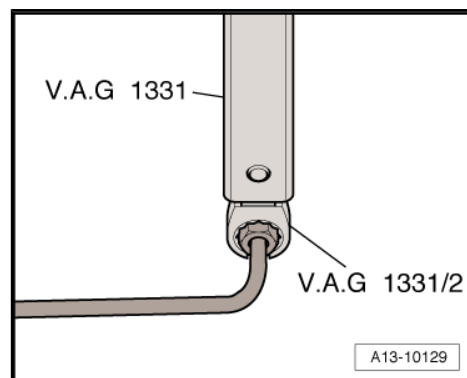
- First hand-tighten union nuts -1-, -4- and -5- for high-pressure pipes, then hand-tighten pipe mountings -2-, -3- and -6-.
- Ensure that high-pressure pipes are not under tension.



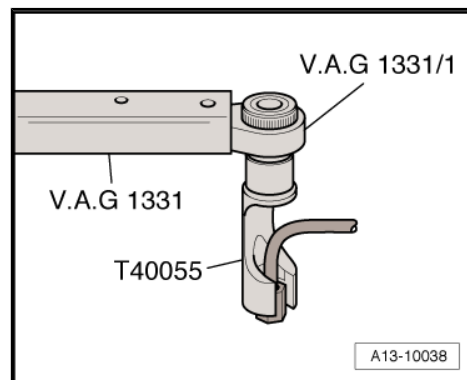
- To secure high-pressure pipe (14 mm) to fuel rail, use torque wrench -V.A.G 1331- with ring insert (open-end, 14 mm) - V.A.G 1331/8- .



- To secure high-pressure pipe (17 mm) to fuel rail, use torque wrench -V.A.G 1331- with ring insert (open-end, 17 mm) - V.A.G 1331/2- .



- To secure high-pressure pipe (17 mm) to high-pressure pump, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 17 mm -T40055- .
- Install intake manifold (top section) ⇒ Rep. Gr. 24 .
- Install high-pressure pipes ⇒ Rep. Gr. 24 .
- Fill cooling system ⇒ [page 245](#) .



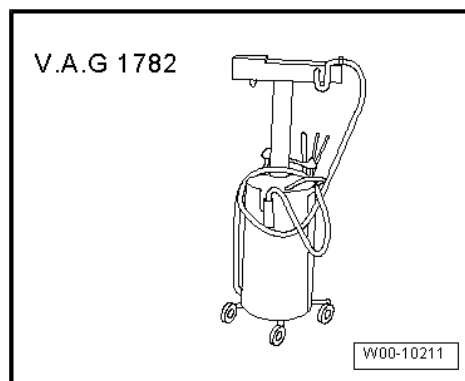
Tightening torques

Component	Nm
Coolant pipe to engine	9
Hose connection for crankcase breather hoses to cover	6

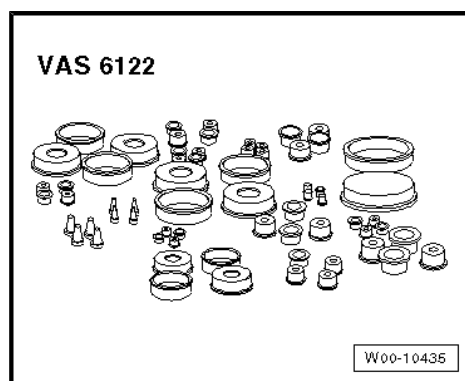
1.12 Removing and installing radiator

Special tools and workshop equipment required

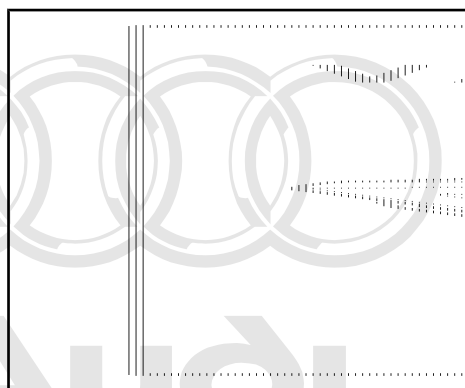
- ◆ Used oil collection and extraction unit -V.A.G 1782-



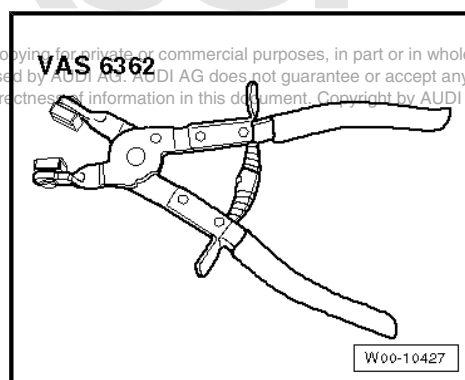
- ◆ Engine bung set -VAS 6122- for vehicles with multitronic gearbox/automatic gearbox 09L



- ◆ Drip tray for workshop hoist -VAS 6208-



- ◆ Hose clip pliers -VAS 6362-



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Removing



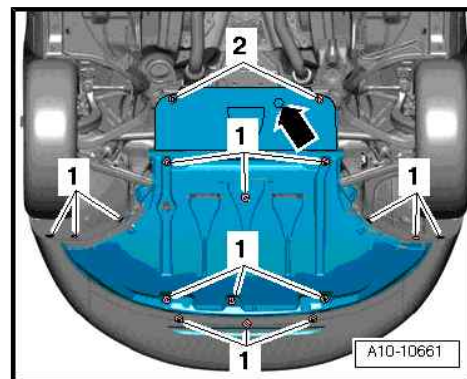
Note

If there are slight impressions on the fins, refer to [⇒ page 6](#).

**WARNING**

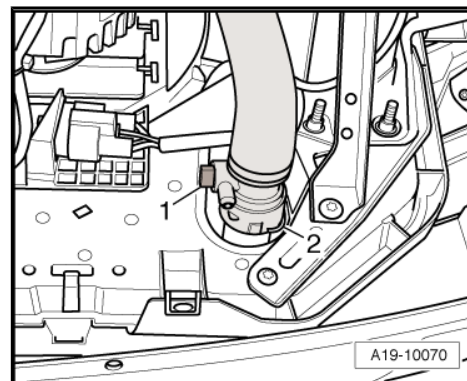
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Remove noise insulation panels ⇒ Rep. Gr. 50 .
- Remove front wheel housing liners (right and left) ⇒ Rep. Gr. 66 .
- Remove bumper cover (front) ⇒ Rep. Gr. 63 .

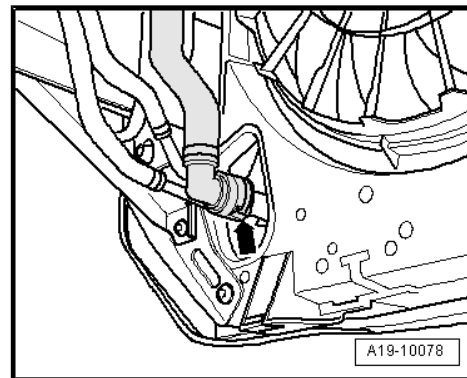


- Place drip tray for workshop hoist -VAS 6208- under engine.
- Open drain plug -1- and let coolant drain.
- Then disconnect coolant hose -2- from radiator.

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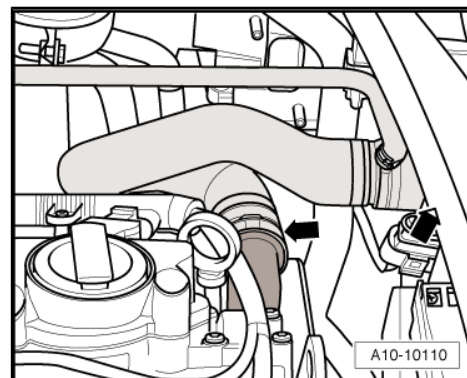
- Disconnect coolant hose -arrow- (bottom left) from radiator (lift retaining clip).



- Detach coolant hose (top) -arrow on right- from radiator.

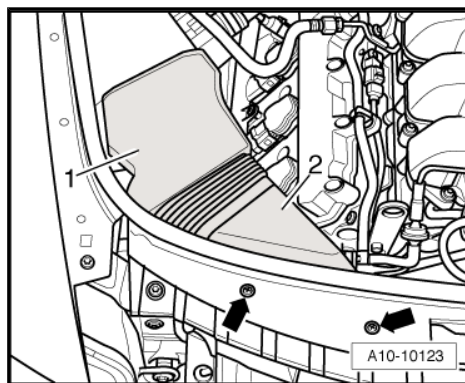
**Note**

Ignore -arrow on left side of illustration-.



Vehicles with multitronic gearbox or automatic gearbox 09L:

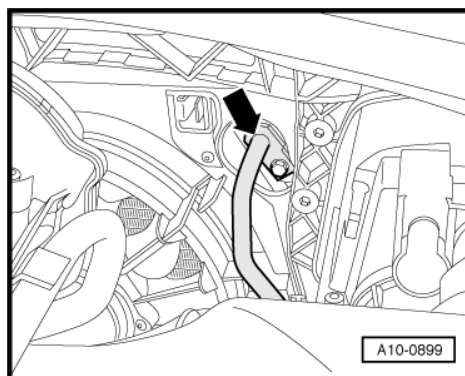
- Remove bolts -arrows-.
- Remove air ducts -1- and -2-.



Note

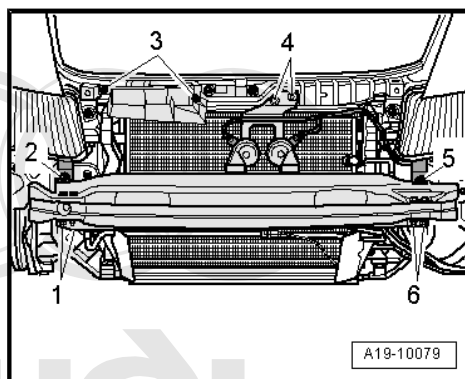
Observe rules for cleanliness when working on automatic gearbox ⇒ Rep. Gr. 00 .

- Position used oil collection and extraction unit -V.A.G 1782- below connection point.
- Detach ATF pipes (top -arrow- and bottom) from radiator: ⇒ Rep. Gr. 37 .
- Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .

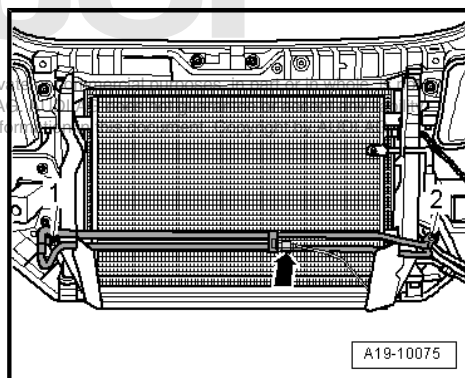


All vehicles:

- Unscrew bolts -3- and detach air duct.
- Unscrew bolts -4- and remove bracket for horns; electrical wiring remains attached.
- Unscrew brackets -2- and -5- for headlights.
- Unscrew nuts -1- and -6- 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

The air conditioner refrigerant circuit must not be opened.

- Unplug electrical connector -1-.
- Remove bolts -arrows-.

**Note**

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

- Pivot condenser downwards with pipes/hoses attached.
- 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 .

- Install ATF pipes ⇒ Rep. Gr. 37 .
- Install bumper cover (front) ⇒ Rep. Gr. 63 .
- Install front wheel housing liners (right and left) ⇒ Rep. Gr. 66 .
- Remove old O-ring -2- from coolant hose -3-.
- Lubricate new O-ring with coolant additive and fit O-ring in coolant hose.
- Press coolant hose onto radiator -1- until it engages with a click.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.
- Fill cooling system ⇒ [page 245](#) .

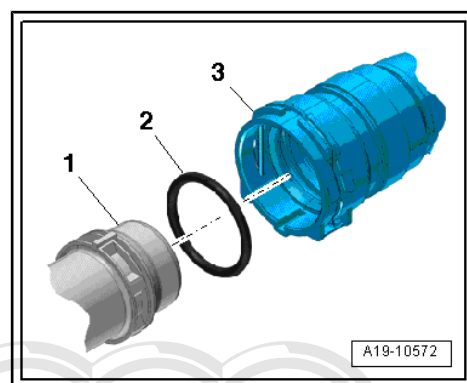
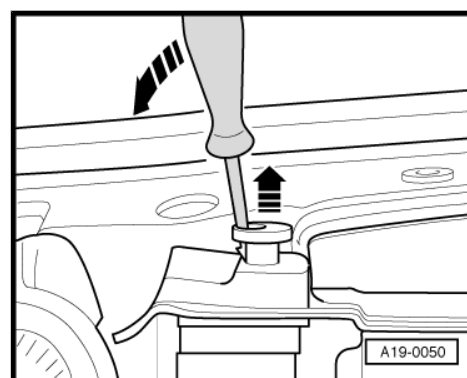
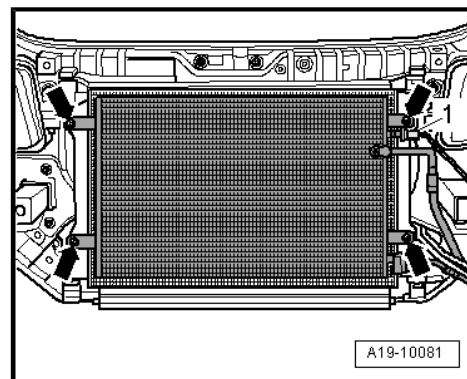
**Note**

The coolant in the entire system must be changed if the radiator is renewed.

- Check ATF level ⇒ Rep. Gr. 37 .

Tightening torques

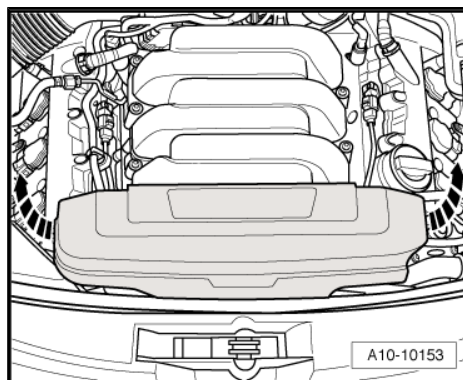
Component	Nm
Condenser to lock carrier	6
Power steering cooling pipe to condenser	9
Bracket for horns to lock carrier	8



1.13 Removing and installing radiator cowl

Removing

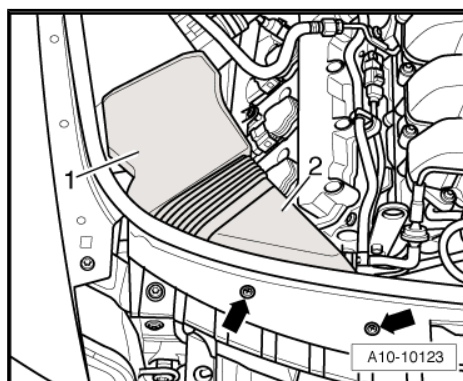
- Pull off engine cover panel (front) -arrows-.



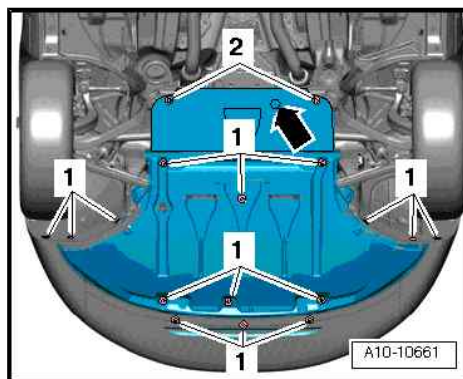
- Remove bolts -arrows-.

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

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- Remove front noise insulation ⇒ Rep. Gr. 50 .



- Unplug electrical connector -1- going to radiator fan.

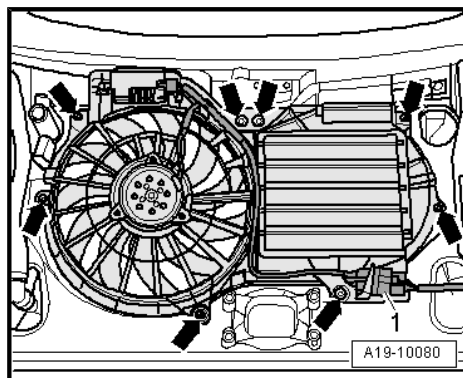
- Unscrew bolts -arrows- and lift out radiator cowl.

Installing

Install in reverse order.

Tightening torques

Component		Nm
Radiator cowl to	M6	11
Lock carrier	Panel bolt	2



1.14 Removing and installing radiator fan

Removing

- Remove radiator cowl ⇒ [page 266](#) .
- Move wiring clear.

- Remove bolts -1 ... 5-.
- Detach radiator fan with control unit.

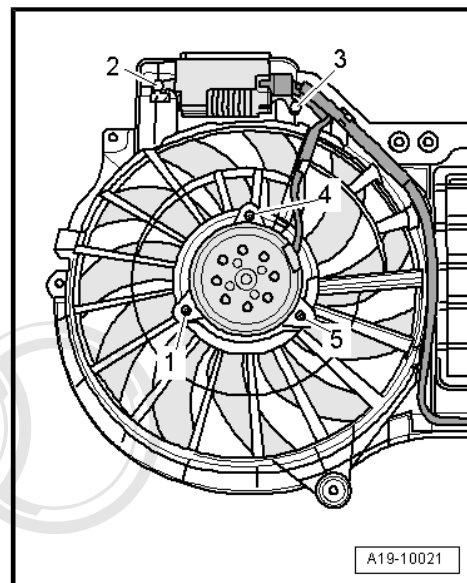
Installing

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

- Install radiator cowl ⇒ [page 266](#) .

Tightening torque

Component		Nm
Radiator fan to radiator cowl	Single fan	3
	Dual fan	4.5

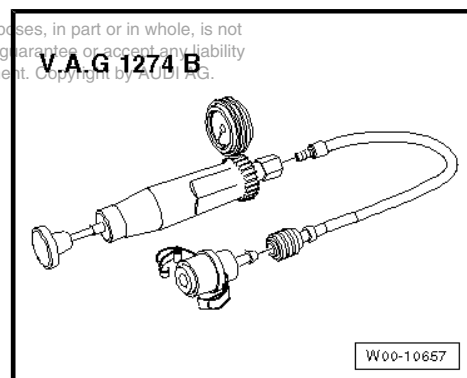


1.15 Checking cooling system for leaks

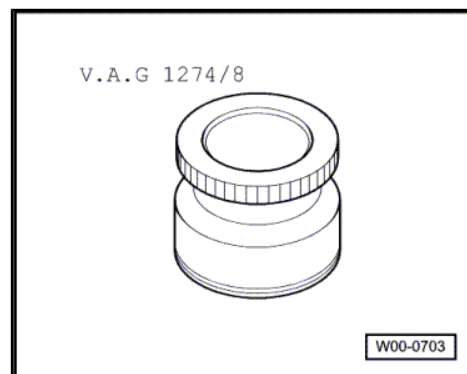
Special tools and workshop equipment required

- ◆ Cooling system tester -V.A.G 1274 B-

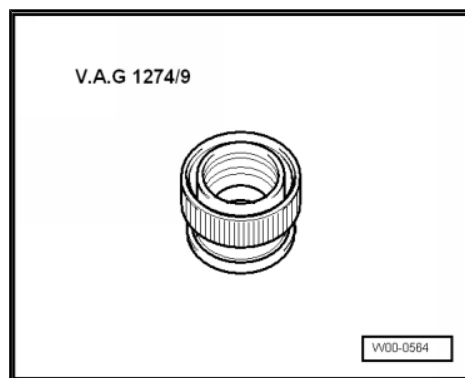
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- ◆ Adapter for cooling system tester -V.A.G 1274/8-



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



Procedure

- Engine must be warm.



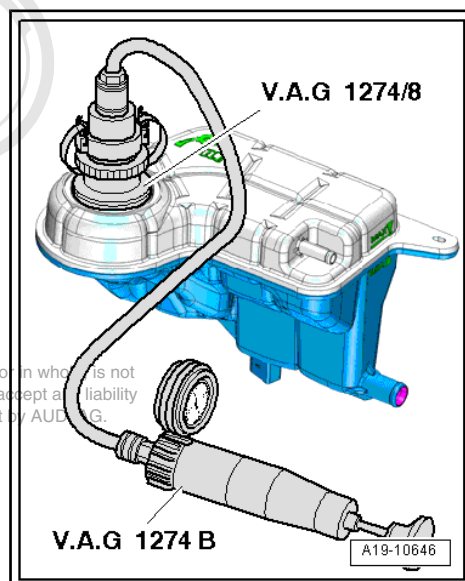
WARNING

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

- Open filler cap on coolant expansion tank.
- Attach cooling system tester -V A G 1274 B- with adapter - V.A.G 1274/8- to 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.

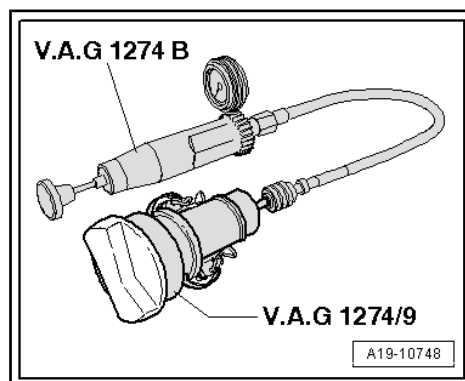


Checking pressure relief valve in filler cap

- Attach cooling system tester -V.A.G 1274 B- 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 Exhaust system



Note

After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.

1.1 Exhaust system on vehicles with front-wheel drive - exploded view

1 - 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 277](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 293](#)

4 - Exhaust manifold

- ☐ Removing and installing: left-side
⇒ [page 289](#), right-side
⇒ [page 291](#)

5 - Gasket

- ☐ Renew

6 - 23 Nm

- ☐ Renew

7 - Front exhaust pipe with catalytic converter and front silencer

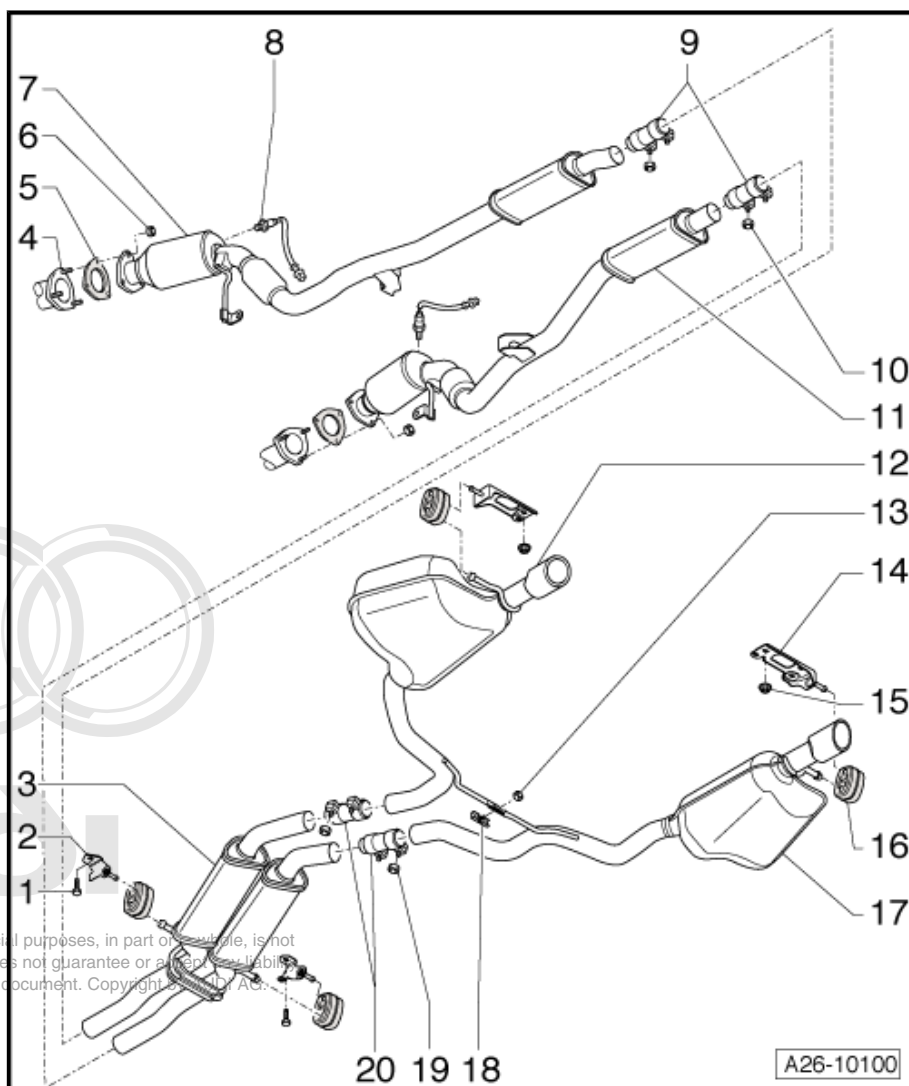
- ☐ For cylinder bank 2 (left-side)
- ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged

- ☐ Protect against knocks and impact

- ☐ Removing and installing ⇒ [page 279](#)

- ☐ Components of exhaust pipe mountings: vehicles with manual gearbox ⇒ [page 271](#), vehicles with multitronic gearbox ⇒ [page 272](#)

- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)



8 - Lambda probe after catalytic converter

- ☐ 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 293](#)
- ☐ Tighten bolt connections evenly

10 - 23 Nm**11 - Front exhaust pipe with catalytic converter and front silencer**

- ☐ For cylinder bank 1 (right-side)
- ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 284](#)
- ☐ Components of exhaust pipe mountings: vehicles with manual gearbox ⇒ [page 272](#) ; vehicles with multitronic gearbox ⇒ [page 272](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)

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 277](#)
- ☐ Cutting point: rear silencer / tailpipe ⇒ [page 278](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)

13 - 23 Nm

- ☐ Renew

14 - Mounting**15 - 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 277](#)
- ☐ Cutting point: rear silencer / tailpipe ⇒ [page 278](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)

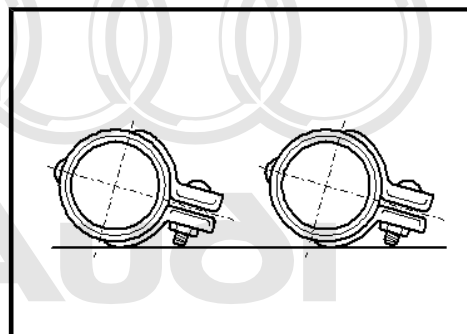
18 - Bracket**19 - 23 Nm****20 - Clamps (rear)**

- ☐ For separate replacement of centre and rear silencers
- ☐ Position clamp so that it aligns with centre of cutting location
- ☐ Installation position ⇒ [page 271](#)
- ☐ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ [page 293](#)
- ☐ Tighten bolt connections evenly

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Installation position of front clamps

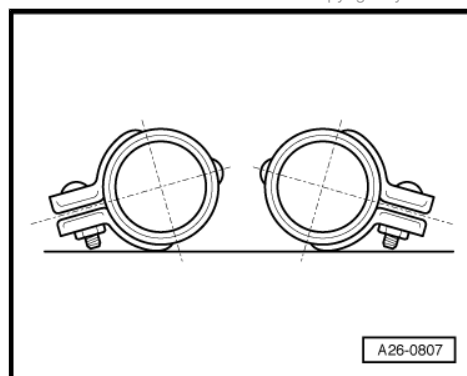
- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face to right.



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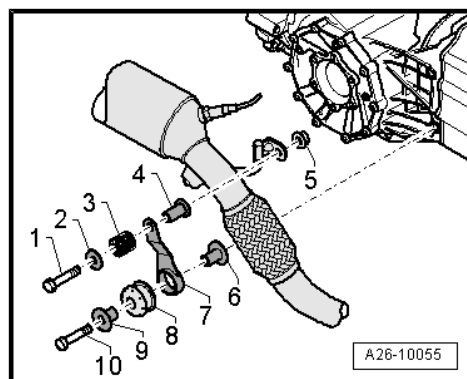
Installation position of rear clamps

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.



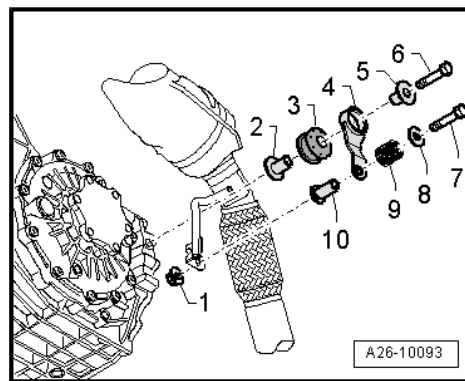
Components of exhaust pipe mountings (left-side) for vehicles with manual gearbox

- 1 - Bolt
- 2 - Washer
- 3 - Compression spring
- 4 - Spacer sleeve
- 5 - Nut, 23 Nm
- 6 - Spacer sleeve
- 7 - Bracket
- 8 - Buffer
- 9 - Spacer sleeve
- 10 - Bolt, 23 Nm



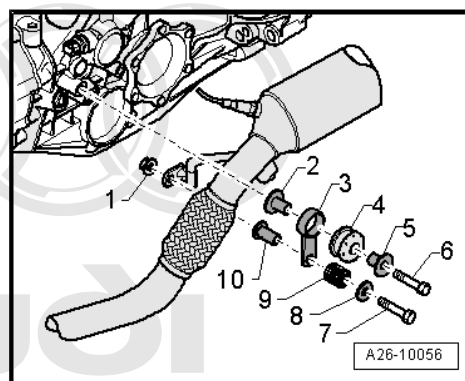
Components of exhaust pipe mountings (left-side) for vehicles with multitronic gearbox

- 1 - Nut, 23 Nm
- 2 - Spacer sleeve
- 3 - Buffer
- 4 - Spacer sleeve
- 5 - Bolt
- 6 - Bolt, 23 Nm
- 7 - Bolt
- 8 - Washer
- 9 - Compression spring
- 10 - Spacer sleeve



Components of exhaust pipe mountings (right-side) for vehicles with manual gearbox

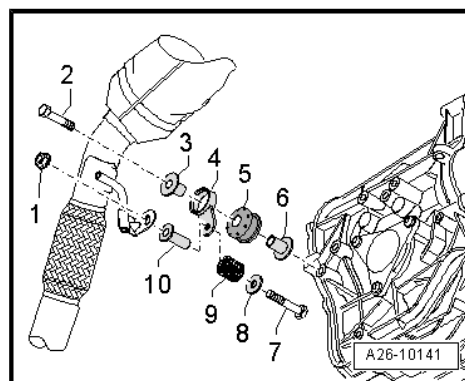
- 1 - Nut, 23 Nm
- 2 - Spacer sleeve
- 3 - Bracket
- 4 - Buffer
- 5 - Spacer sleeve
- 6 - Bolt, 23 Nm
- 7 - Bolt
- 8 - Washer
- 9 - Compression spring
- 10 - Spacer sleeve



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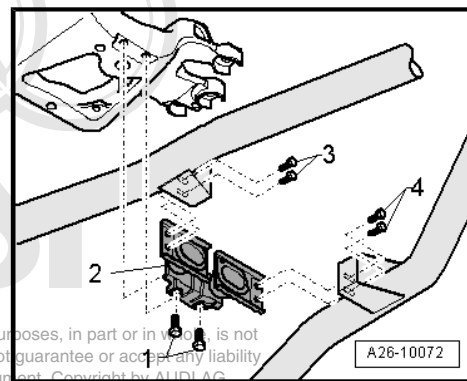
Components of exhaust pipe mountings (right-side) for vehicles with multitronic gearbox

- 1 - Nut, 23 Nm
- 2 - Bolt, 23 Nm
- 3 - Spacer sleeve
- 4 - Bracket
- 5 - Buffer
- 6 - Spacer sleeve
- 7 - Bolt
- 8 - Washer
- 9 - Compression spring
- 10 - Spacer sleeve



Mounting components for centre bracket for front exhaust pipes

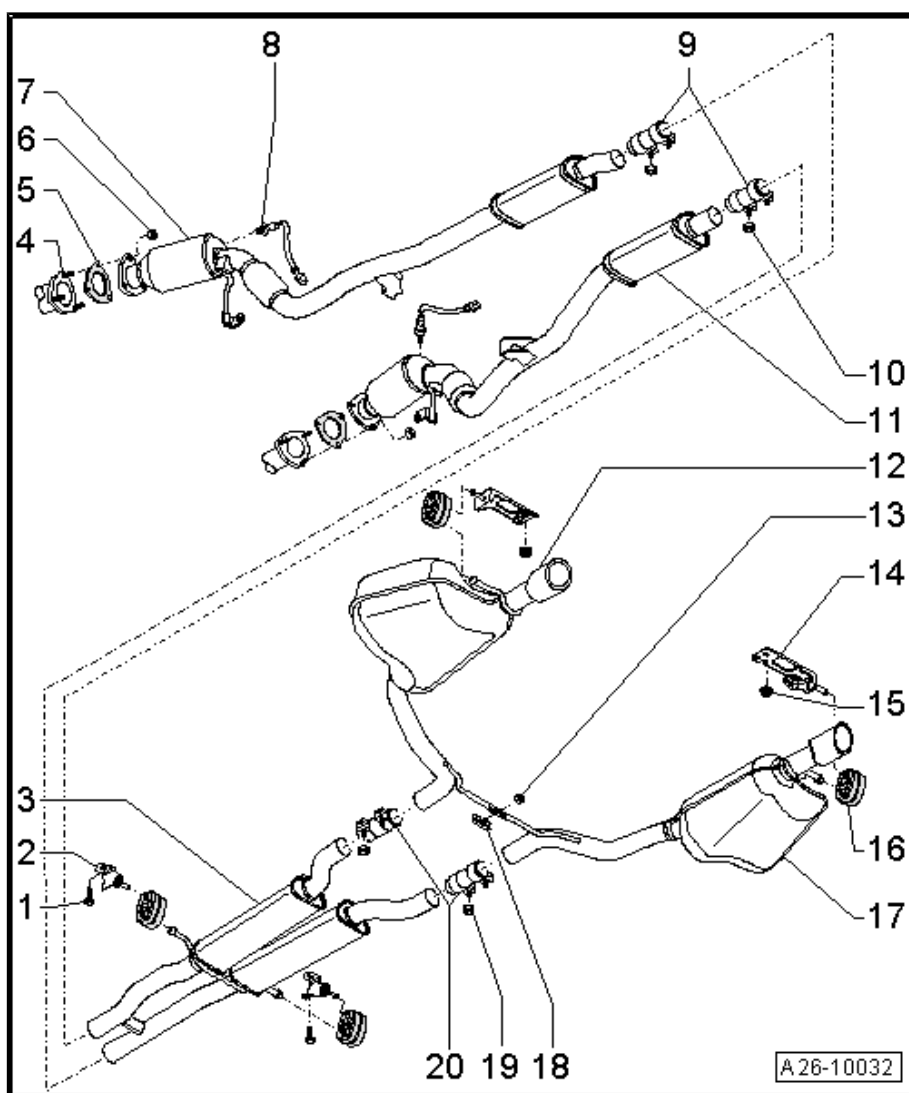
- 1 - 23 Nm
- 2 - Bracket
- 3 - 23 Nm
- 4 - 23 Nm



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1.2 Exhaust system on vehicles with four-wheel drive - exploded view

- 1 - 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 293](#)
- 4 - Exhaust manifold
 - ☐ Removing and installing: left-side
⇒ [page 289](#), right-side
⇒ [page 291](#)
- 5 - Gasket
 - ☐ Renew
- 6 - 23 Nm
 - ☐ Renew
- 7 - Front exhaust pipe with catalytic converter and front silencer
 - ☐ For cylinder bank 2 (left-side)
 - ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
 - ☐ Protect against knocks and impact
 - ☐ Removing and installing ⇒ [page 279](#)
 - ☐ Mounting components ⇒ [page 275](#)
 - ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)
- 8 - Lambda probe after catalytic converter
 - ☐ Removing and installing ⇒ Rep. Gr. 24



9 - Clamps (front)

- ☐ Installation position ⇒ [page 275](#)
- ☐ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ [page 293](#)
- ☐ Tighten bolt connections evenly

10 - 23 Nm**11 - Front exhaust pipe with catalytic converter and front silencer**

- ☐ For cylinder bank 1 (right-side)
- ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 284](#)
- ☐ Mounting components ⇒ [page 276](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)

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 278](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)

13 - 23 Nm

- ☐ Renew

14 - Mounting**15 - 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 278](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)

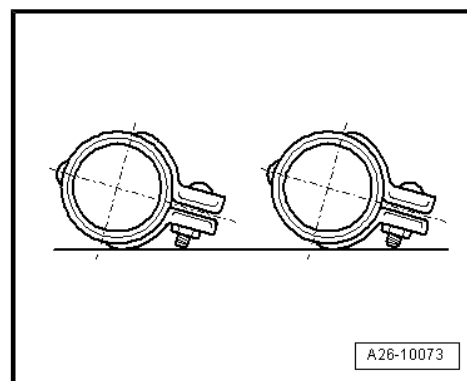
18 - Bracket**19 - 23 Nm****20 - Clamps (rear)**

- ☐ For separate replacement of centre and rear silencers
- ☐ Position clamp so that it aligns with centre of cutting location
- ☐ Installation position ⇒ [page 275](#)
- ☐ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ [page 293](#)
- ☐ Tighten bolt connections evenly

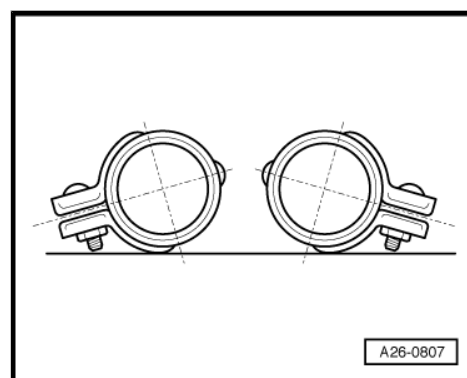
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Installation position of front clamps

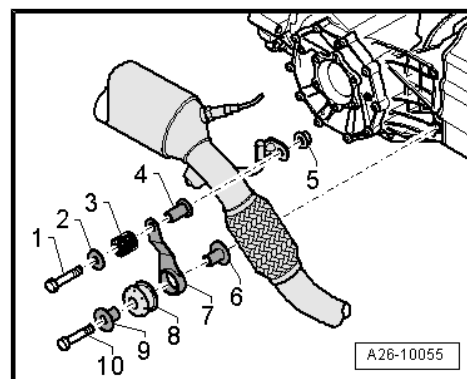
- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face to right.

**Installation position of rear clamps**

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.

**Components of exhaust pipe mountings (left-side) for vehicles with manual gearbox and automatic gearbox 09L**

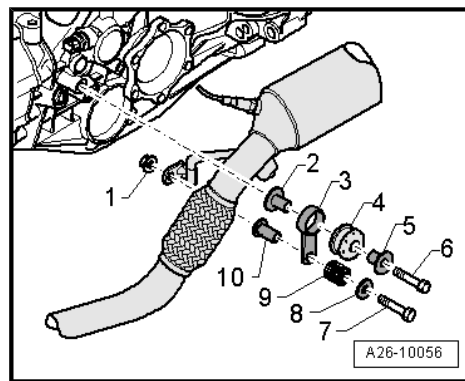
- 1 - Bolt
- 2 - Washer
- 3 - Compression spring
- 4 - Spacer sleeve
- 5 - Nut, 23 Nm
- 6 - Spacer sleeve
- 7 - Bracket
- 8 - Buffer
- 9 - Spacer sleeve
- 10 - Bolt, 23 Nm



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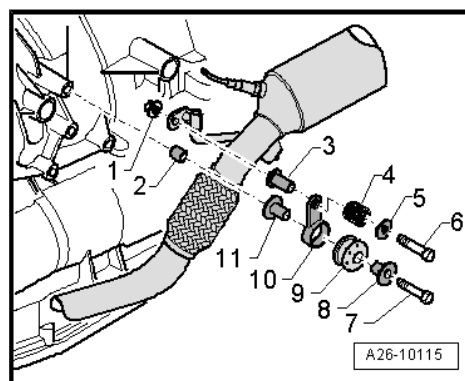
Components of exhaust pipe mountings (right-side) for vehicles with manual gearbox

- 1 - Nut, 23 Nm
- 2 - Spacer sleeve
- 3 - Bracket
- 4 - Buffer
- 5 - Spacer sleeve
- 6 - Bolt, 23 Nm
- 7 - Bolt
- 8 - Washer
- 9 - Compression spring
- 10 - Spacer sleeve



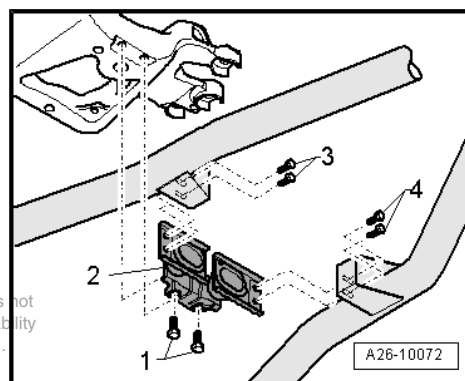
Components of exhaust pipe mountings (right-side) for vehicles with automatic gearbox 09L

- 1 - Nut, 23 Nm
- 2 - Sleeve
- 3 - Spacer sleeve
- 4 - Compression spring
- 5 - Washer
- 6 - Bolt
- 7 - Bolt, 23 Nm
- 8 - Spacer sleeve
- 9 - Buffer
- 10 - Bracket
- 11 - Spacer sleeve



Mounting components for centre bracket for front exhaust pipes

- 1 - 23 Nm
- 2 - Bracket
- 3 - 23 Nm
- 4 - 23 Nm



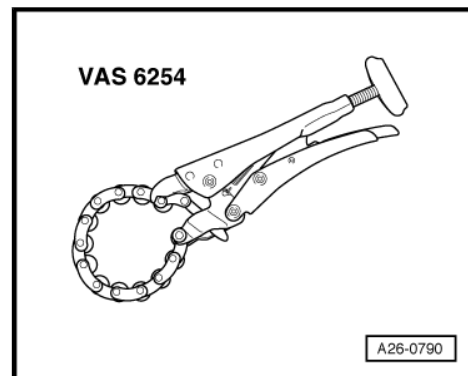
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1.3 Separating centre and rear silencers

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

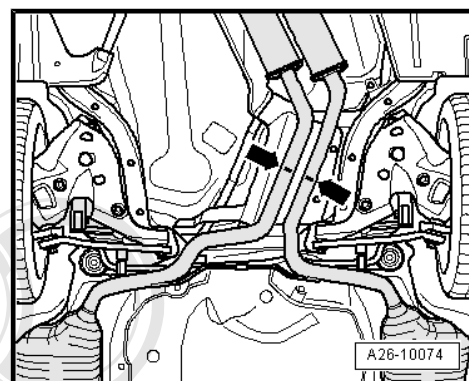
Special tools and workshop equipment required

◆ Chain-type pipe cutter -VAS 6254-

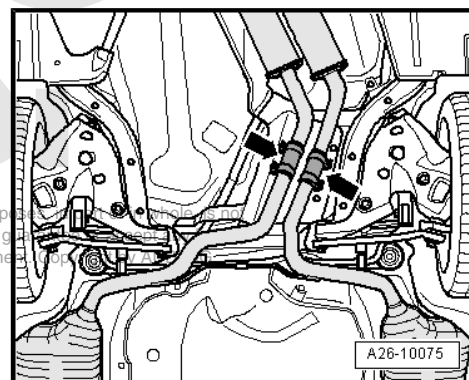


Procedure on vehicles with front-wheel drive

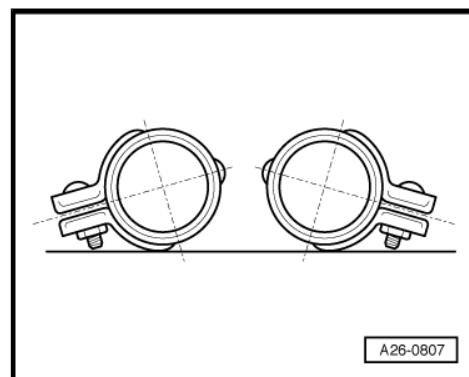
- Cut through exhaust pipes at right angles at the position marked -arrow- using chain-type pipe cutter -VAS 6254-



- When installing, position centre of clamps -arrows- over cutting location.



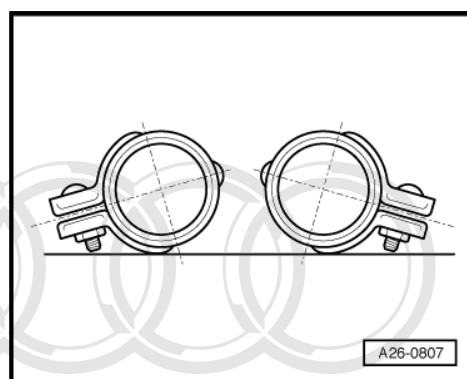
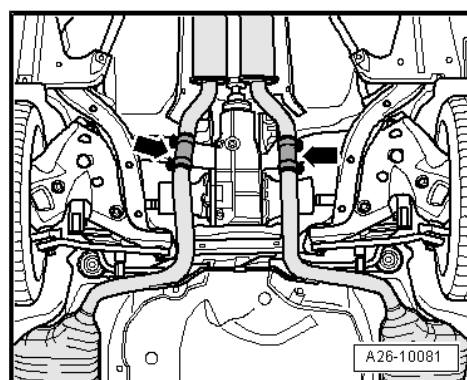
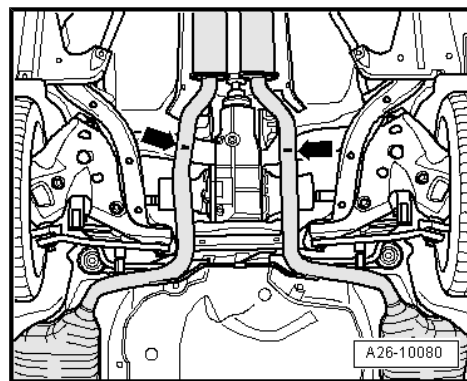
- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face outwards.
- Align exhaust system so it is free of stress ⇒ [page 293](#) .



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Procedure on 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.
- 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 293](#) .

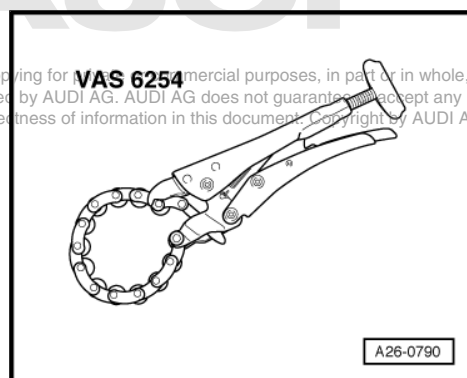


1.4 Renewing tailpipe

Special tools and workshop equipment required

- ◆ Chain-type pipe cutter -VAS 6254-

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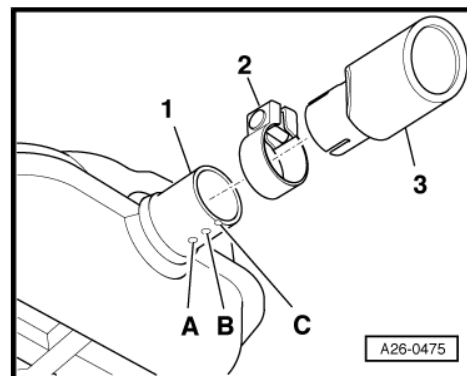


Procedure

- Cut through old tailpipe -1- at a right angle at cutting point -C- using chain pipe cutter -VAS 6254- .
- Push on tailpipe -3- as far as marking -A-. Slot on tailpipe should align with marking -B-.
- Fit clip -2-.

Tightening torque

Component	Nm
Clip	25



1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter

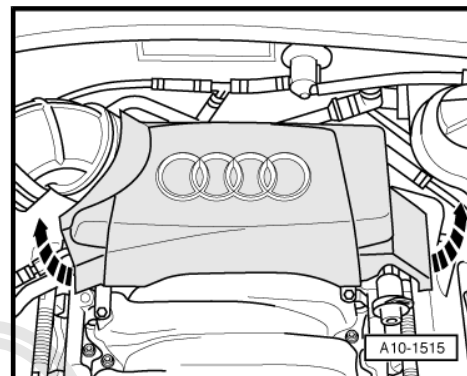
Removing



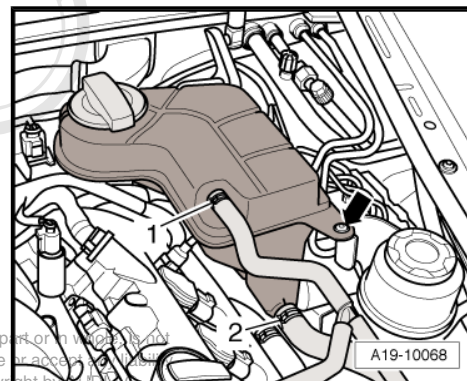
Note

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

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



- Unbolt coolant expansion tank -arrow-.
- Unplug electrical wire 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.



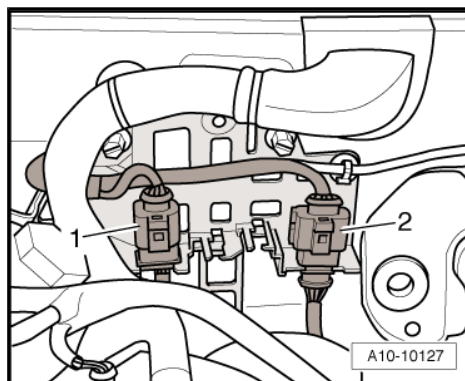
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- Unplug electrical connector -2- for Lambda probe 2 after catalytic converter -G131- and move wiring clear (downwards).



Note

Disregard -item 1-.



- Unscrew nut -2- (accessible from above) connecting front exhaust pipe to exhaust manifold. Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability in this document. Copyright by AUDI AG.



Note

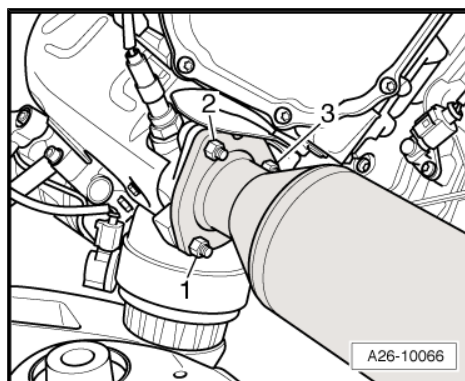
Shown from rear with engine removed for illustration purposes.

- Remove front left wheel.

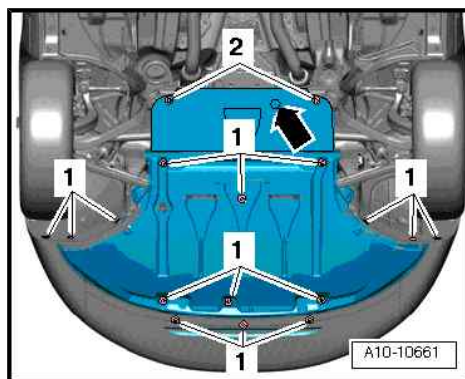


Note

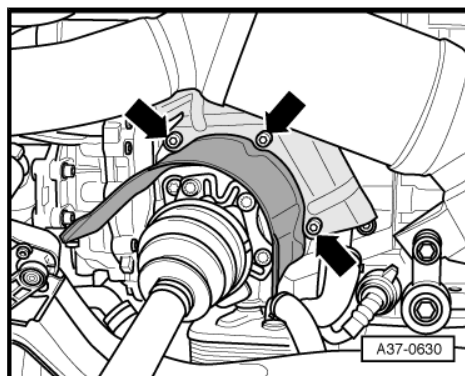
Secure brake disc with one wheel bolt.



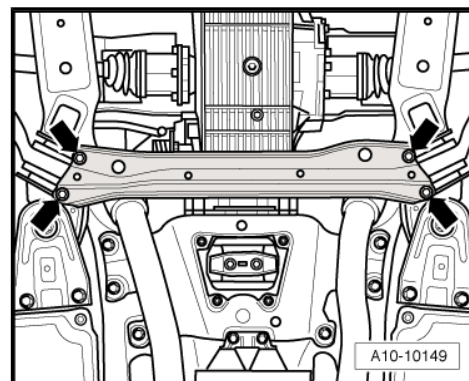
- Remove noise insulation panels ⇒ Rep. Gr. 50 .



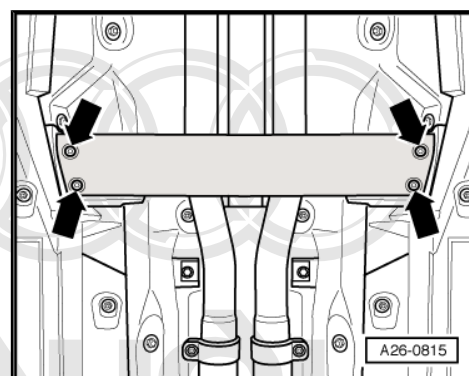
- Unbolt heat shield -arrows- for drive shaft (left-side).



- Unbolt cross piece for subframe -arrows-.



- Unbolt cross piece (front) -arrows-.



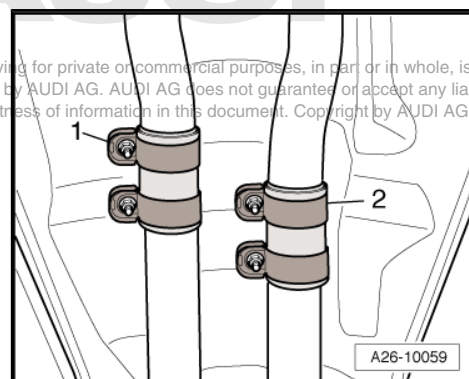
Disconnect exhaust system at clamp (left-side) -2-.



Note

Disregard -item 1-.

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Note

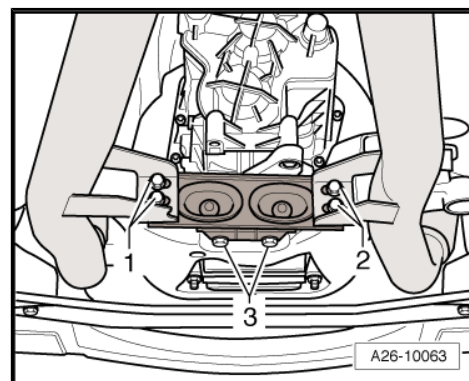
To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

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



Note

Disregard items marked -2- and -3-.

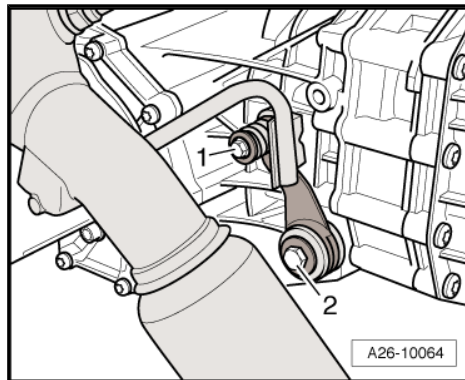


Vehicles with manual gearbox or automatic gearbox 09L:

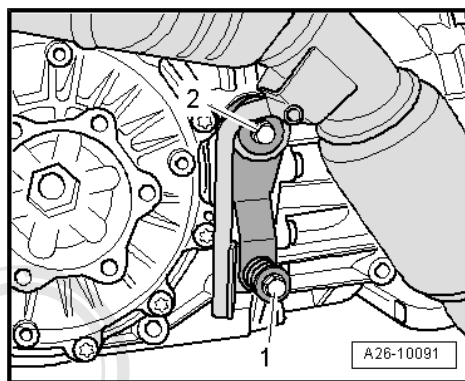
- Remove bolt -1- on bracket (left-side) for front exhaust pipe.

**Note**

- ◆ *Illustration shows vehicle with manual gearbox.*
- ◆ *Disregard -item 2-.*

**Vehicles with multitronic gearbox:**

- Remove bolts -1- and -2-.
- Remove bracket (left-side) for front exhaust pipe.



All vehicles:

- Unscrew nuts -1- and -3- (accessible from below) connecting front exhaust pipe to exhaust manifold.

**Note**

Shown in illustration with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

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

**Note**

- ◆ *Renew 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 for subframe ⇒ Rep. Gr. 40 .
- Install cross piece (front) ⇒ Rep. Gr. 50 .
- Align exhaust system so it is free of stress ⇒ [page 293](#) .

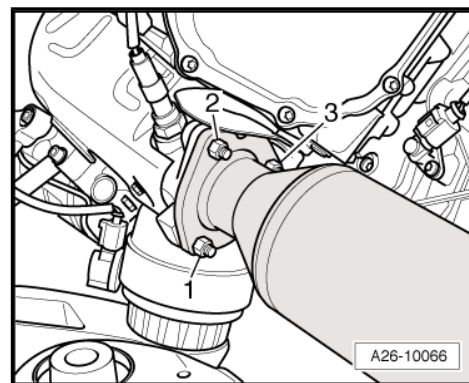
**Note**

Components of exhaust pipe mountings: vehicles with manual gearbox, vehicles with multitronic gearbox ⇒ [page 272](#) , vehicles with automatic gearbox 09L ⇒ [page 275](#) .

Tightening torque

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Component		Nm
Front exhaust pipe with catalytic converter to exhaust manifold		23 ¹⁾²⁾
Mounting bracket to:	Front exhaust pipe	23
	Gearbox	23
Front exhaust pipe to centre bracket		23
Drive shaft heat shield to gearbox		23
• ¹⁾ Renew nuts. • ²⁾ Grease with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste		



1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter

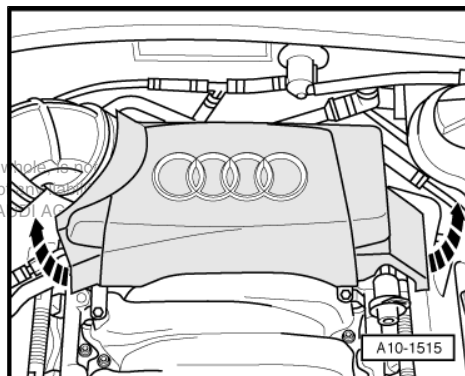
Removing



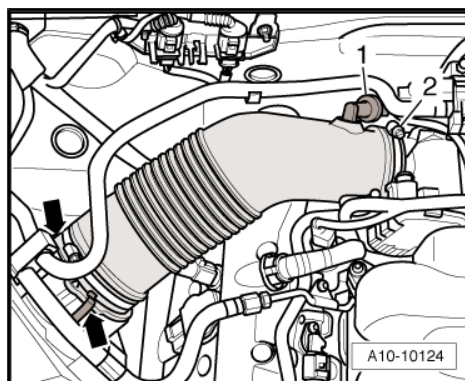
Note

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

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



- Pull non-return valve -1- off connection at air intake hose.
- Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.

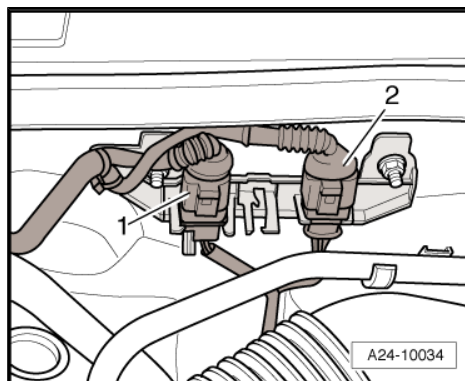


- Unplug electrical connector -2- for Lambda probe after catalytic converter -G130- and move wiring clear (downwards).



Note

Disregard -item 1-.



- Unscrew nut -2- (accessible from above) connecting front exhaust pipe to exhaust manifold.

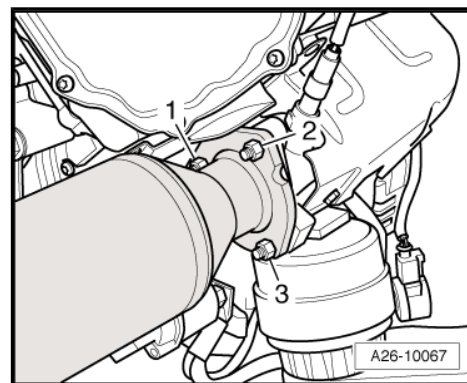
 Note

Shown from rear with engine removed for illustration purposes.

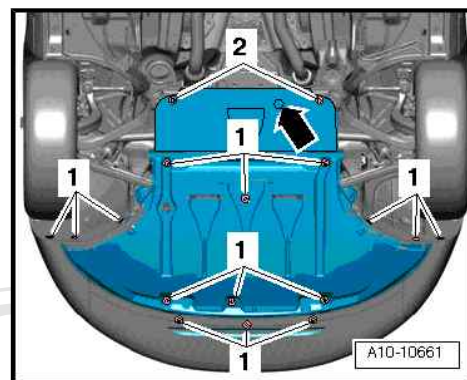
- Remove front right wheel.

 Note

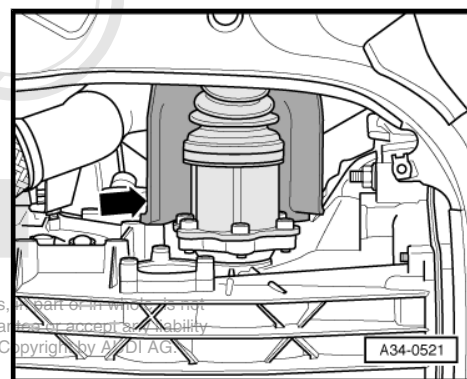
Secure brake disc with one wheel bolt.



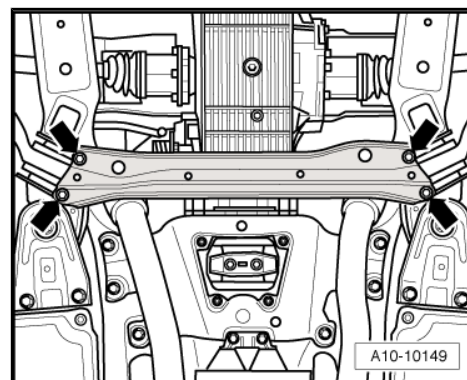
- Remove noise insulation panels ⇒ Rep. Gr. 50 .



- Unbolt heat shield -arrow- for drive shaft (right-side).

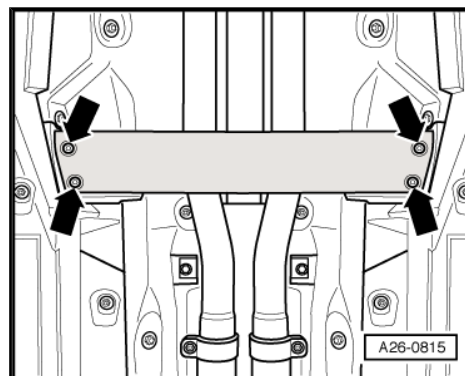


- Unbolt cross piece for subframe -arrows-.



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- Unbolt cross piece (front) -arrows-.

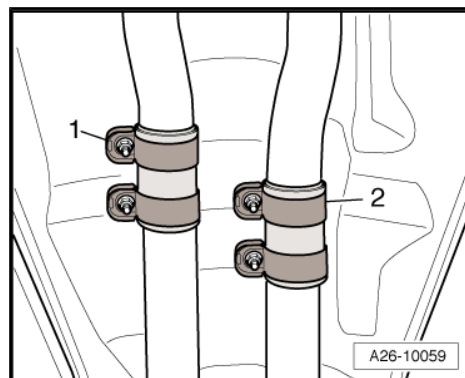


Disconnect exhaust system at clamp (right-side) -1-.



Note

Disregard -item 2-.



Note

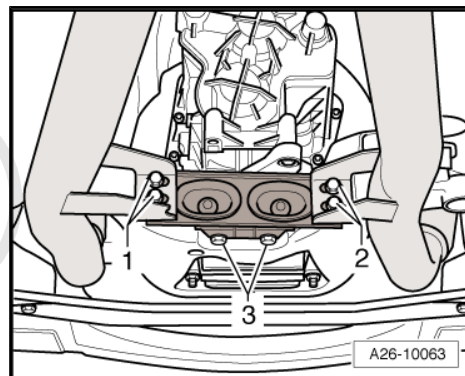
The flexible joint in front exhaust pipe must not be bent more than 10° – damage can otherwise occur.

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



Note

Disregard items marked -1- and -3-.



Vehicles with manual gearbox or automatic gearbox 09L:

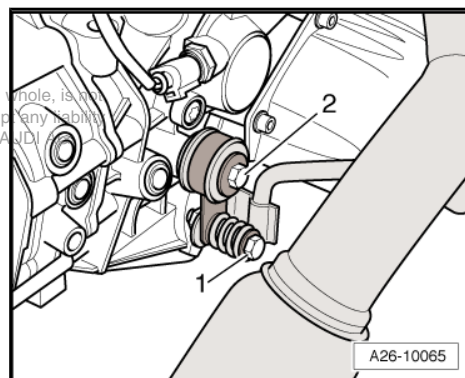
- Remove bolt -1- on bracket (right-side) for front exhaust pipe.



Note

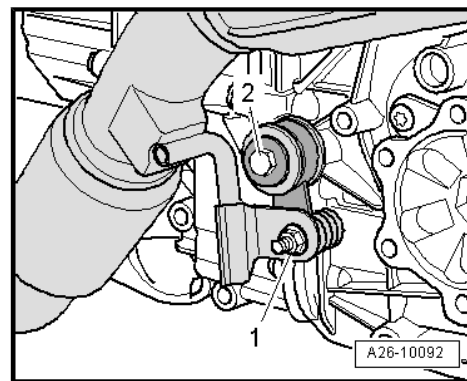
♦ Illustration shows vehicle with manual gearbox.

♦ Disregard -item 2-.



Vehicles with multitronic gearbox:

- Remove nuts -1- and bolts -2-.
- Remove bracket (right-side) for front exhaust pipe.



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All vehicles:

- Unscrew nuts -1- and -3- (accessible from below) connecting front exhaust pipe to exhaust manifold.



Note

Shown in illustration with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

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



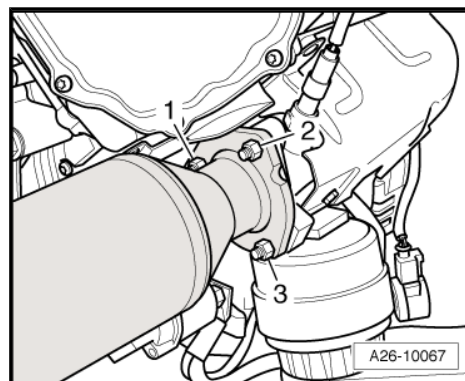
Note

- ◆ Renew gaskets, O-ring 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 for subframe ⇒ Rep. Gr. 40.
- Install cross piece (front) ⇒ Rep. Gr. 50.
- Align exhaust system so it is free of stress ⇒ [page 293](#).



Note

Components of exhaust pipe mountings: vehicles with manual gearbox ⇒ [page 276](#), vehicles with multitronic gearbox ⇒ [page 272](#), vehicles with automatic gearbox 09L ⇒ [page 276](#).



Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	23 ¹⁾²⁾
Mounting bracket to front exhaust pipe	23
Front exhaust pipe to:	
Gearbox	23
Centre bracket	23
Drive shaft heat shield to gearbox	23
Hose clips (9 mm wide)	3
• ¹⁾ Renew nuts. • ²⁾ Grease with high-temperature paste; refer to ⇒ <i>Electronic parts catalogue</i> for high-temperature paste	

1.7 Exhaust manifold - exploded view

1 - 25 Nm

- ☐ Renew
- ☐ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ Note tightening sequence ⇒ [page 291](#) and ⇒ [page 292](#)

2 - Bracket for heat shield**3 - Exhaust manifold**

- ☐ Removing and installing: left-side ⇒ [page 289](#), right-side ⇒ [page 291](#)

4 - Gasket

- ☐ Renew

5 - Heat shield**6 - 10 Nm****7 - Lambda probe before catalytic converter**

- ☐ Removing and installing ⇒ Rep. Gr. 24

8 - Front exhaust pipe

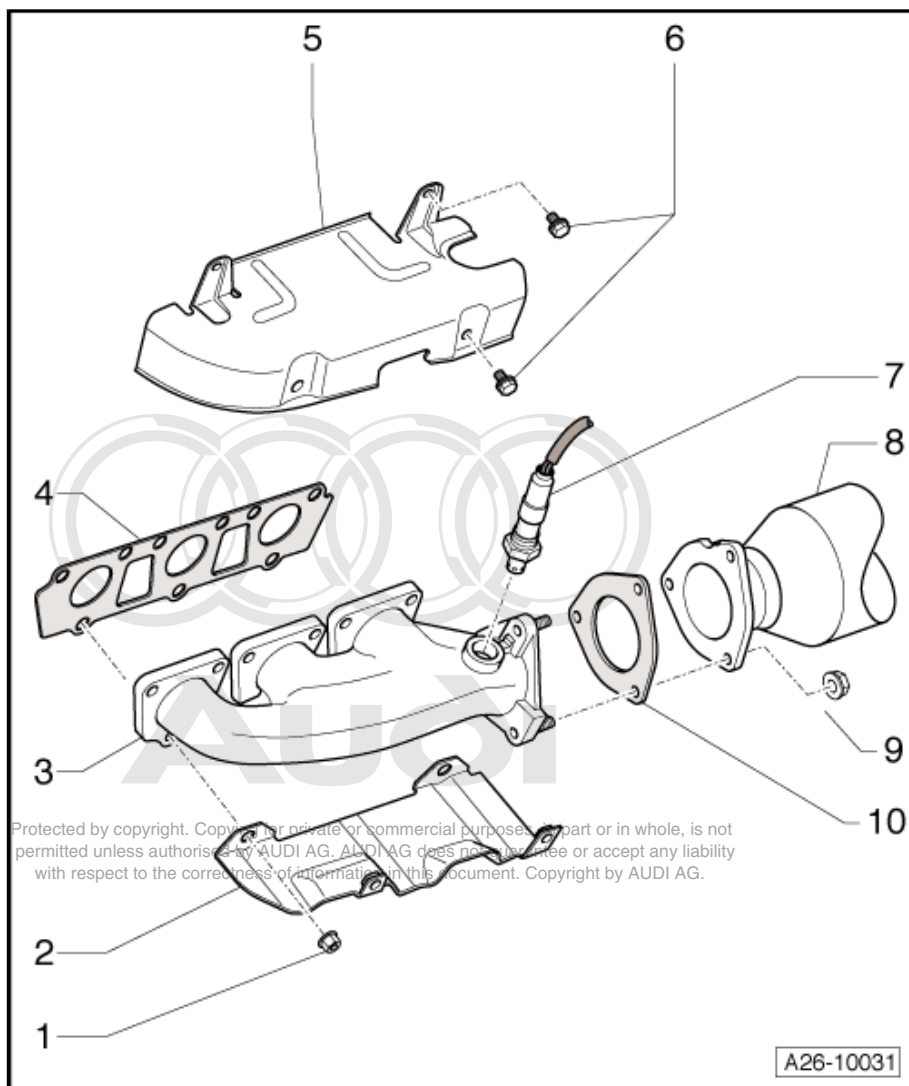
- ☐ For cylinder bank 2 (left-side)
- ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 279](#)
- ☐ Mounting components ⇒ [page 275](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 293](#)

9 - 23 Nm

- ☐ Renew
- ☐ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

10 - Gasket

- ☐ Renew



1.8 Removing and installing exhaust manifold (left-side)

Removing

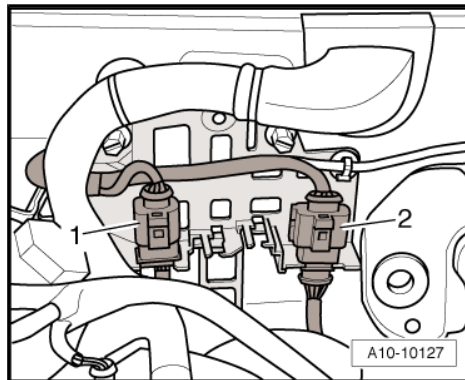
- Remove front exhaust pipe (left-side) together with catalytic converter ⇒ [page 279](#).

- Unplug electrical connector -1- for Lambda probe 2 -G108- and move wiring clear.

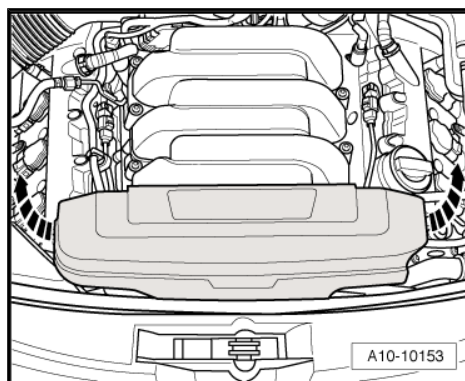


Note

Disregard -item 2-.



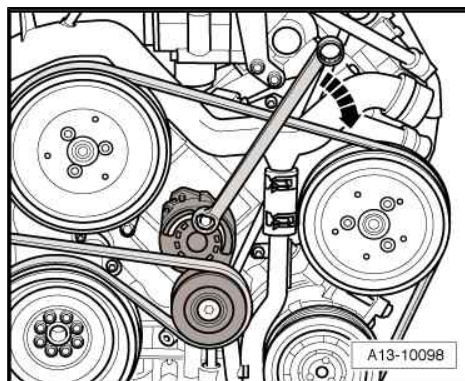
- Pull off engine cover panel (front) -arrows-.



Note

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

- To slacken poly V-belt turn tensioner in direction of -arrow-.
- Remove poly V-belt from pulley for AC compressor.
- Release pressure from the tensioner.



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



WARNING

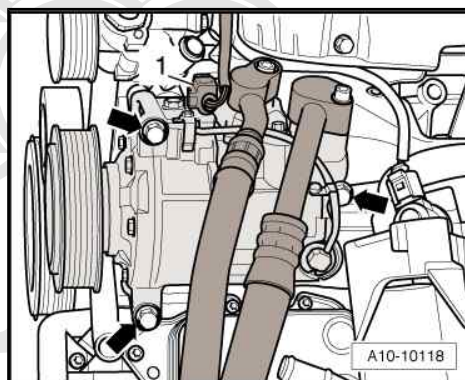
The air conditioner refrigerant circuit must not be opened.

- Unscrew air conditioner compressor from bracket -arrows-.



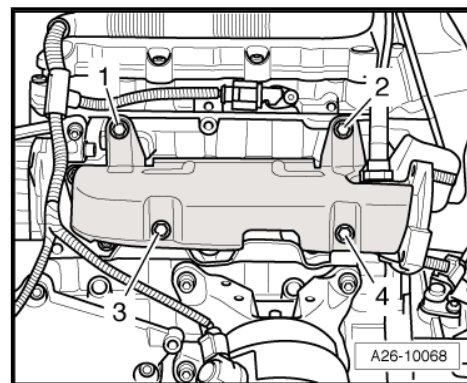
Note

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



- 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

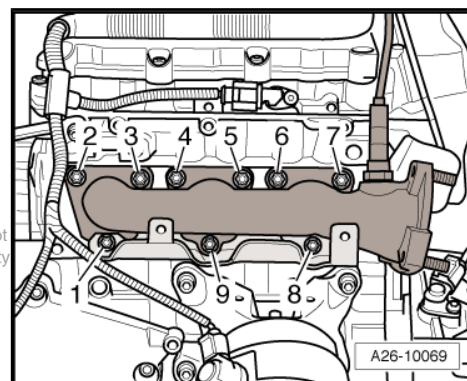
Installation is carried out in the reverse order; note the following:



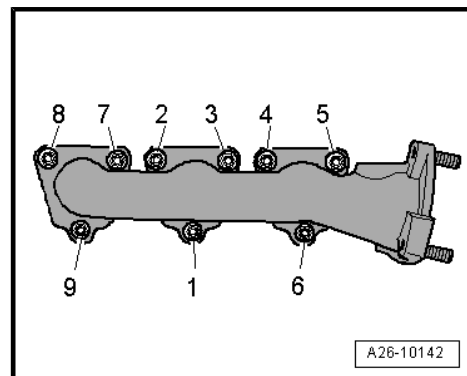
Note

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Renew gaskets and self-locking nuts.



- Tighten exhaust manifold in 2 stages in the following sequence:
 1. Initially tighten to 15 Nm.
 2. Tighten to 25 Nm.
- Install front exhaust pipe (left-side) together with catalytic converter ⇒ [page 279](#) .
- Align exhaust system so it is free of stress ⇒ [page 293](#) .
- Install air conditioner compressor ⇒ Rep. Gr. 87 .
- Install poly V-belt ⇒ [page 108](#) .



Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25 ¹⁾²⁾
Heat shield to bracket for heat shield	10
• ¹⁾ Renew nuts. • ²⁾ Grease with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste	

1.9 Removing and installing exhaust manifold (right-side)

Removing

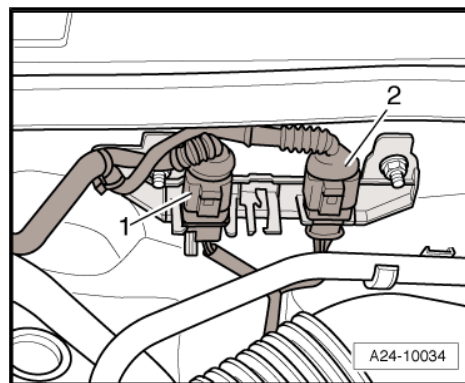
- Remove front exhaust pipe (right-side) together with catalytic converter ⇒ [page 284](#) .

- Unplug electrical connector -1- for Lambda probe -G39- and move wiring clear.

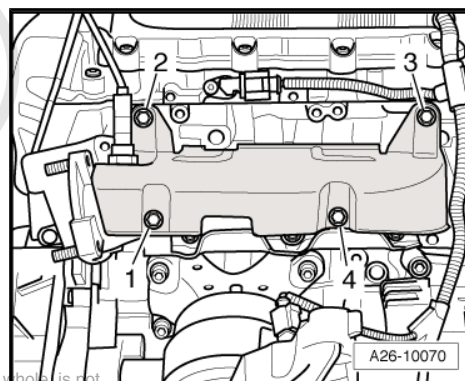


Note

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.

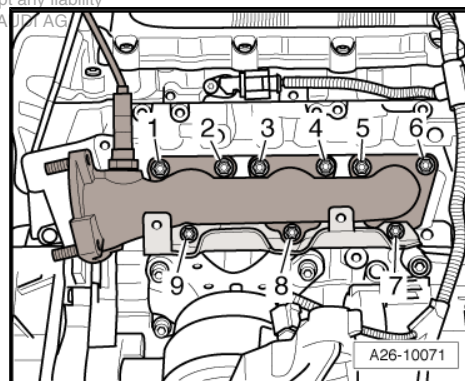
Installing

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



Note

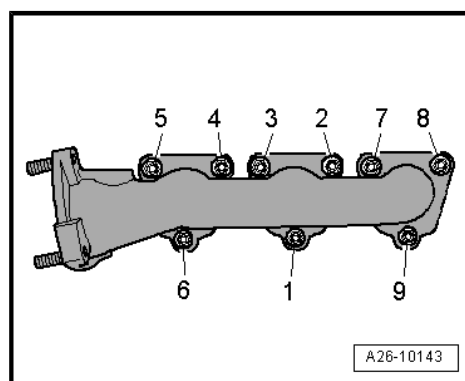
Renew gaskets and self-locking nuts.



- Tighten exhaust manifold in 2 stages in the following sequence:
 1. Initially tighten nuts to 15 Nm.
 2. Tighten nuts to 25 Nm.
- Install front exhaust pipe (right-side) together with catalytic converter ⇒ [page 284](#) .
- Align exhaust system so it is free of stress ⇒ [page 293](#) .

Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25 ¹⁾²⁾
Heat shield to bracket for heat shield	10
• 1) Renew nuts. • 2) Grease with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste	



1.10 Stress-free alignment of exhaust system



Note

The exhaust system must be aligned when it is cool.

Vehicles without clamps between centre silencer and rear silencer

- Loosen bolt connections for clamps ⇒ [Item 9 \(page 270\)](#) .
- Push exhaust system towards front of vehicle -arrow-, so that mountings (right-side) for rear silencers are preloaded by -a- = 5 ... 9 mm.
- Tighten bolt connections of clamps evenly to 23 Nm.
- Align tailpipes ⇒ [page 294](#) .

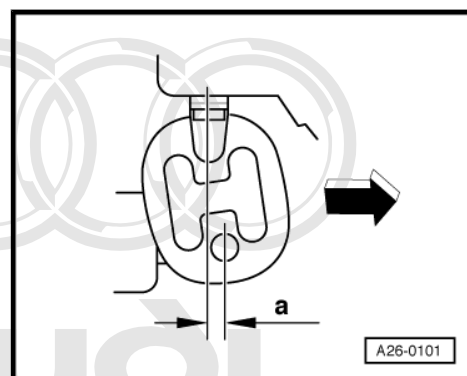
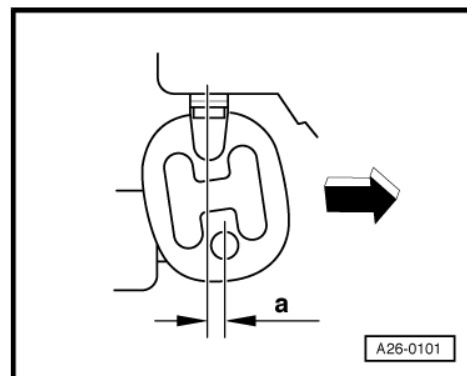
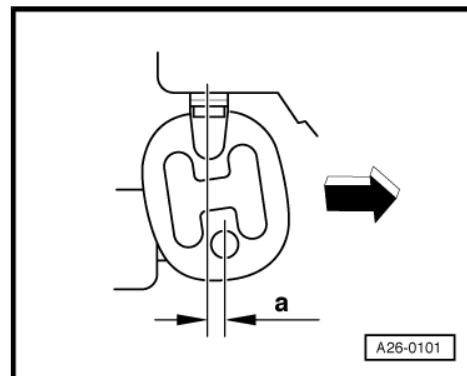
Vehicles with clamps between centre silencer and rear silencer



Note

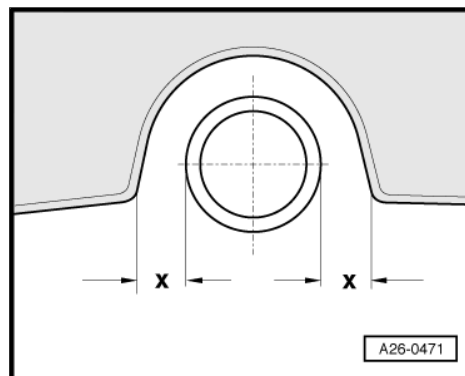
On vehicles with clamps fitted between centre silencer and rear silencer, it is also necessary to align the centre silencer.

- Loosen bolts on clamps ⇒ [Item 9 \(page 270\)](#) and ⇒ [Item 20 \(page 274\)](#) .
- 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 bolt connections for clamps (front) ⇒ [Item 9 \(page 270\)](#) evenly to 23 Nm.
- 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 bolt connections for clamps (rear) ⇒ [Item 20 \(page 274\)](#) evenly to 23 Nm.
- Align tailpipes ⇒ [page 294](#) .



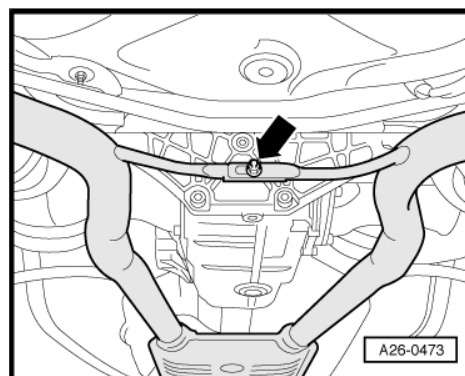
Aligning tailpipes

- Check clearance between tailpipes and bumper on both sides.
- Dimension -x- (left-side) = dimension -x- (right-side)

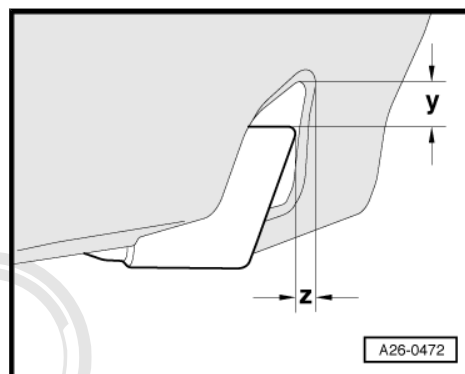


If necessary, correct dimension “x” as follows:

- Slacken bolt connection -arrow- on brace between exhaust pipes.
- Adjust the distance between the rear silencers.
- Tighten bolt connection to 25 Nm.



- Check distances -y- and -z- between tailpipes and bumper:
- Dimension -y- = 17 ... 19 mm.
- Dimension -z- = 0 ... 2 mm.
- If necessary, check whether the exhaust system is aligned free of stress ⇒ [page 293](#) .



1.11 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipe (e. g. with rags or stopper) and leave plugged until the check is complete.
- Listen for noise at connection points (cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe, etc.) to locate any leaks.
- Repair any leaks that are found.

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