Workshop Manual

Audi A6 2005 ➢

6-cylinder injection engine (2.4 ltr. 4-valve), mechanics									
Engine ID	BDW								

Edition 09.2016

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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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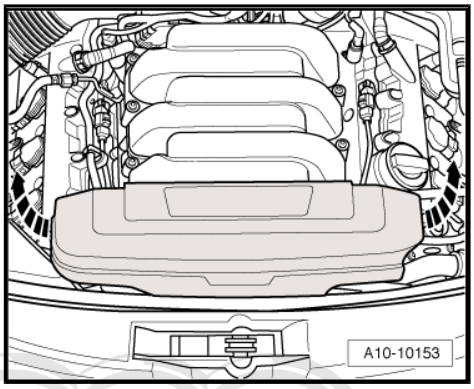
00 – Technical data

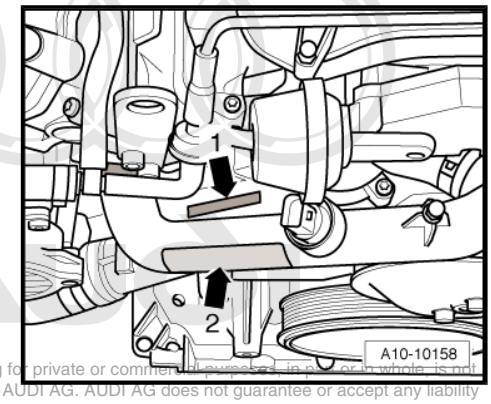
1 Engine number

(ARL004914; Edition 09.2016)

– 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		BDW
Capacity	ltr.	2.393
Power output	kW at rpm	130/6000
Torque	Nm at rpm	230/3000
Bore	∅ mm	81.0
Stroke	mm	77.4
Compression ratio		10.3
RON	min.	95 1)
Injection/ignition system		Simos
Firing order		1-4-3-625
Exhaust gas recirculation		no
Turbocharging/supercharging		no
Knock control		yes
Variable valve timing		yes
Intake manifold change-over		yes
Secondary air system		yes
Valves per cylinder		4

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

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3 Safety precautions

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⇒ “3.2 Safety precautions when working on vehicles with start/stop system”, page 3

⇒ “3.3 Safety precautions when using testers and measuring instruments during a road test”, page 4

⇒ “3.4 Safety precautions when working on the cooling system”, page 4

⇒ “3.5 Safety precautions when working on the ignition system”, page 4

⇒ “3.6 Safety precautions when working on the subframe”, page 5

⇒ “3.7 Safety precautions when working on the exhaust system”, page 5

3.1 Safety precautions when working on the fuel supply system

Risk of injury - fuel system operates under high pressure

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

Before opening the fuel system:

– Put on safety goggles.

– Put on protective gloves.

– Release pressure (wrap a clean cloth around connection and open connection carefully).

Risk of fire due to escaping fuel

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

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

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

Risk of injury - engine may start unexpectedly

On vehicles with the start/stop system activated, the engine may start unexpectedly. A message in the instrument cluster indicates whether the start/stop system is activated.

– Deactivate start/stop system by switching off ignition.

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

Risk of injury if test equipment is not secured

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

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

Or:

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

3.4 Safety precautions when working on the cooling system

Risk of scalding as hot coolant can escape

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

– Put on protective gloves.

– Put on safety goggles.

– Release pressure (cover filler cap on coolant expansion tank with a cloth and open carefully).

3.5 Safety precautions when working on the ignition system

Risk of injury due to electric shock

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

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

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Risk of damage to components

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

– Switch off ignition before connecting/disconnecting electrical wiring.

– Switch off ignition before cleaning engine.

3.6 Safety precautions when working on the subframe

When working on the subframe note the following warnings:

Caution

Risk of damage to running gear components.

- *The vehicle must NOT be lowered onto its wheels if the engine/gearbox mountings, steering rack or subframe cross brace are not properly installed.*
- *The vehicle must NOT be supported by applying a trolley jack or similar to the subframe or subframe cross brace.*

3.7 Safety precautions when working on the exhaust system

When working on the exhaust system please note the following:

Caution

Risk of damage to flexible joint.

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

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4 Repair instructions

⇒ “4.1 Rules for cleanliness”, page 6

⇒ “4.2 Foreign particles in engine”, page 6

⇒ “4.3 Contact corrosion”, page 6

⇒ “4.4 Routing and attachment of pipes, hoses and wiring”, page 7

⇒ “4.5 Installing radiators and condensers”, page 7

4.1 Rules for cleanliness

Even small quantities of dirt can lead to defects. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

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- Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- After removal, place parts on a clean surface and cover them. Use 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.).
- Do not work with compressed air when the system is open. If possible, do not move vehicle.
- Make sure that no fuel runs onto the fuel hoses. Should this occur, the fuel hoses must be cleaned again immediately.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

4.2 Foreign particles in engine

- When performing assembly work on the 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 for foreign particles to prevent further damage occurring later.

4.3 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are fitted.

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 .

Please note:

- 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 by warranty.

4.4 Routing and attachment of pipes, hoses and wiring

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

4.5 Installing radiators and condensers

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

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10 – Removing and installing engine

1 Removing and installing engine - vehicles with manual gearbox

⇒ “1.1 Removing engine”, page 8

⇒ “1.2 Separating engine and manual gearbox”, page 27

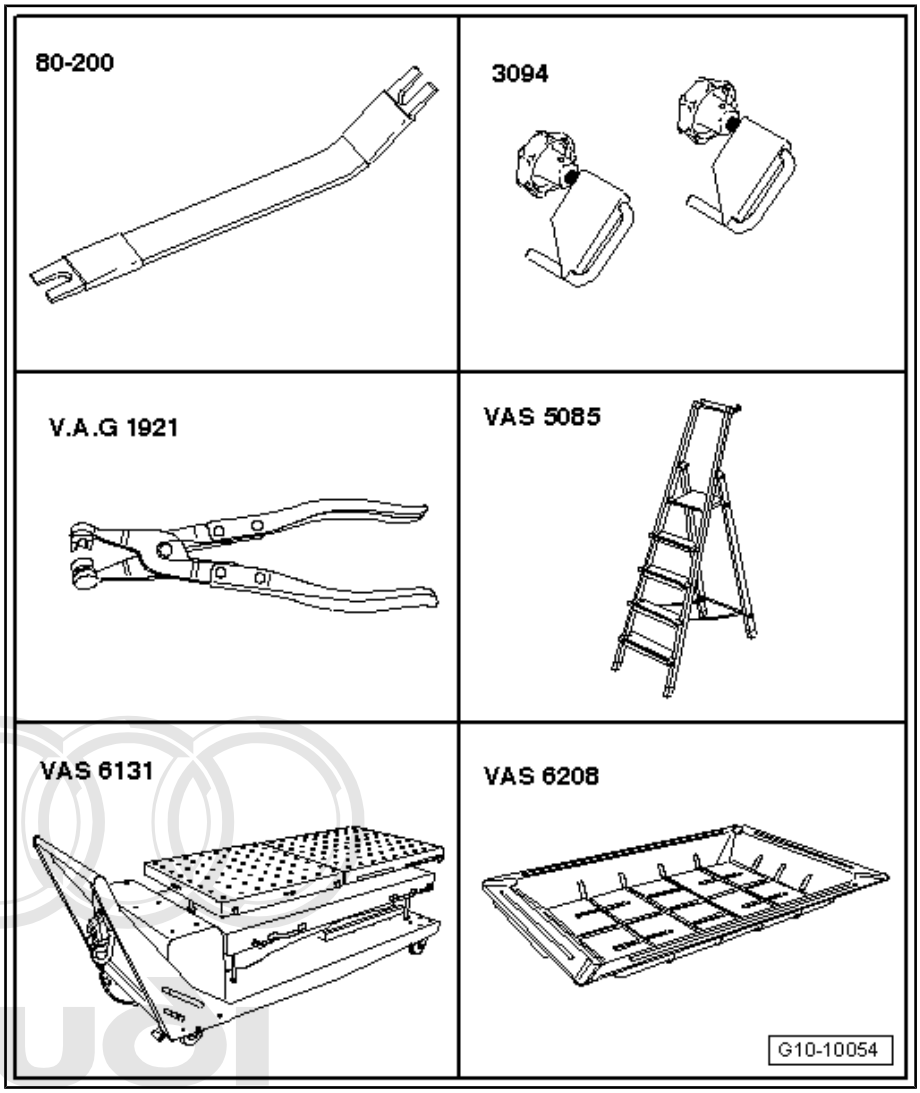
⇒ “1.3 Securing engine to engine and gearbox support”, page 31

⇒ “1.4 Installing engine”, page 33

1.1 Removing engine

Special tools and workshop equipment required

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



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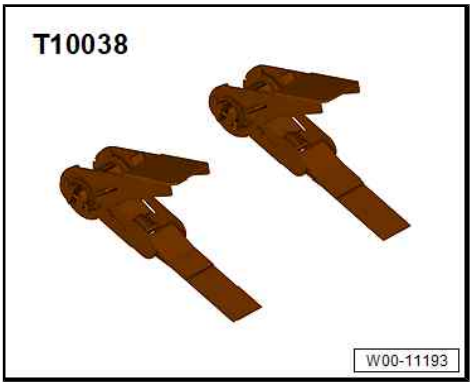
- Tensioning strap - T10038-



Note

If the engine is going to be separated from the gearbox (after the entire assembly is removed), you will additionally need supplementary set - VAS 6131/11- and -VAS 6131/12- .

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

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

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

Caution

Risk of irreparable damage to electronic components.

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

– Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

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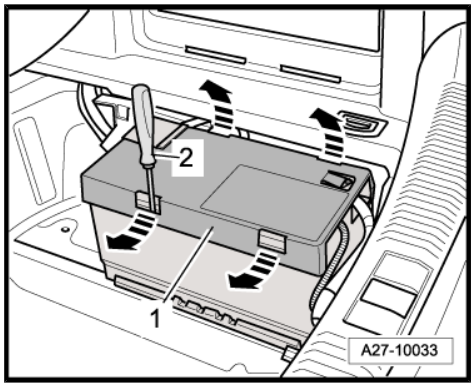
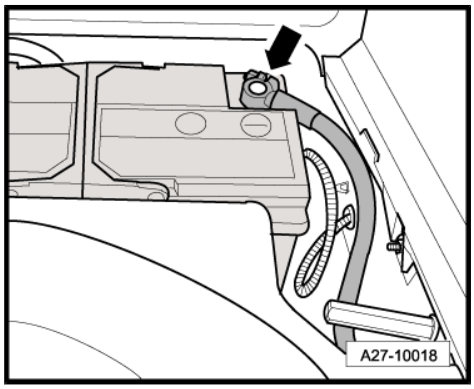
Note

- *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 prop-shaft can be turned during removal.*

– Take out luggage compartment floor trim.



– Use screwdriver -2- to release retaining clips -arrows- and detach cover -1-.
– Disconnect earth wire -arrow- at battery.



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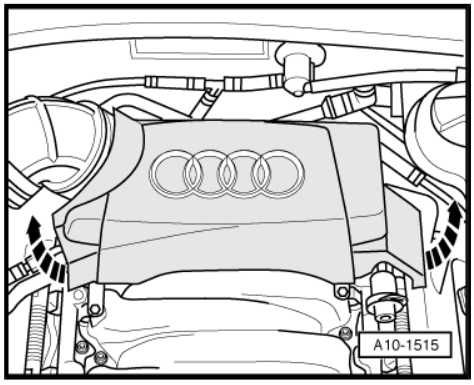
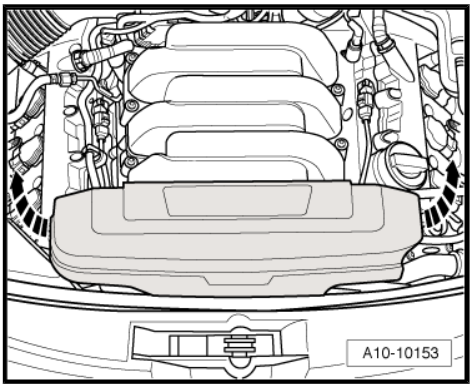
– Pull off engine cover panel (rear) -arrows-.



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



WARNING

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

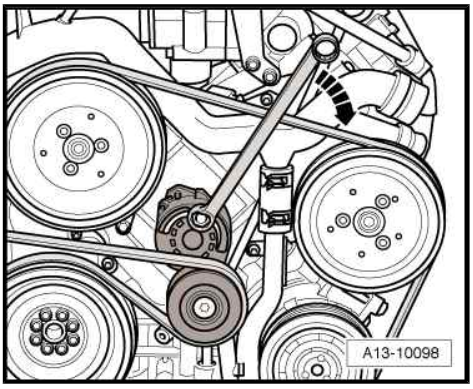
Danger of scalding skin and other parts of the body.

- *Put on protective gloves.*
- *Put on safety goggles.*
- *Release pressure (cover filler cap on coolant expansion tank with a 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-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

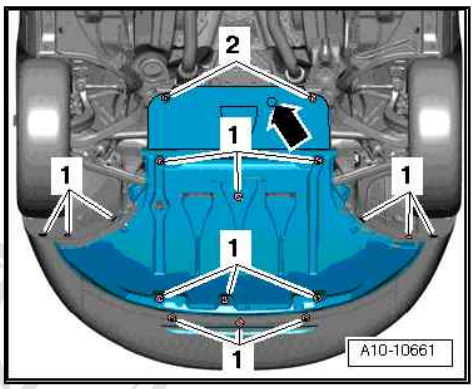


– To slacken poly V-belt turn tensioner in direction of -arrow-.
– Remove poly V-belt and release pressure from the tensioner.
– Remove both front wheels.

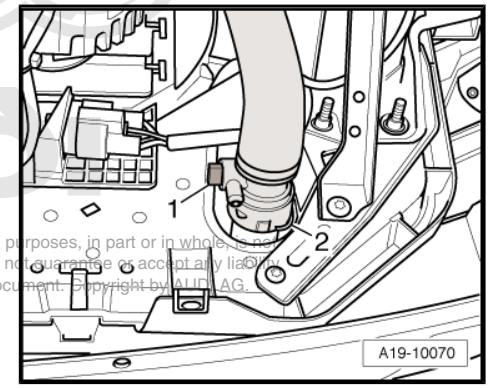
Note

Secure brake discs with wheel bolts.

– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panel.



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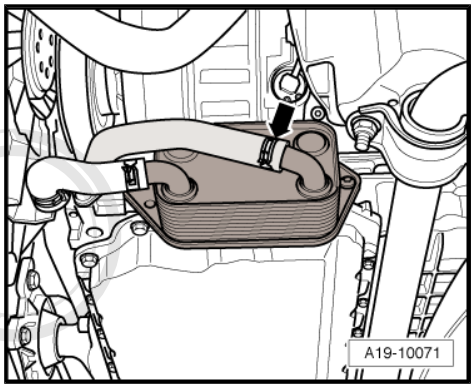
– Disconnect coolant hose -arrow- at oil cooler and drain off remaining coolant.
– Then remove coolant hose.



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

WARNING

The air conditioner refrigerant circuit must not be opened.

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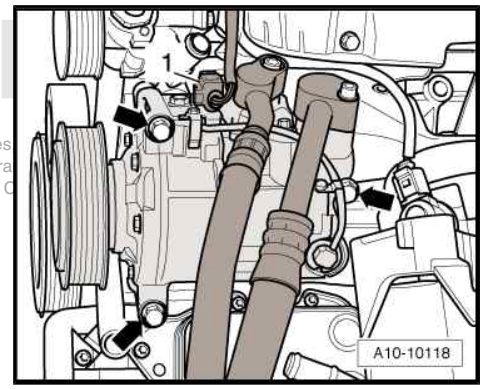


– Unscrew air conditioner compressor from bracket -arrows-.

Note

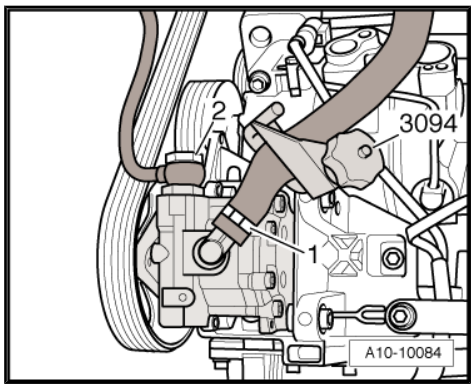
To prevent damage to the refrigerant lines, ensure that the lines and hoses are not stretched, kinked or bent.

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

Note

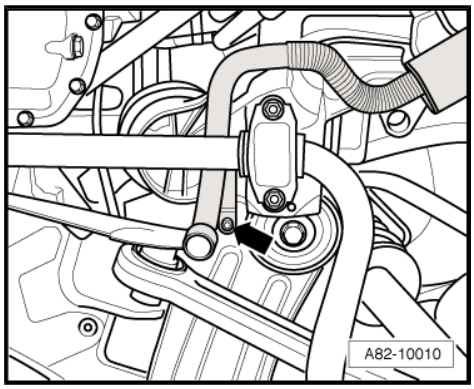
Lay a cloth under the hydraulic lines to catch any escaping hydraulic fluid.

– 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.

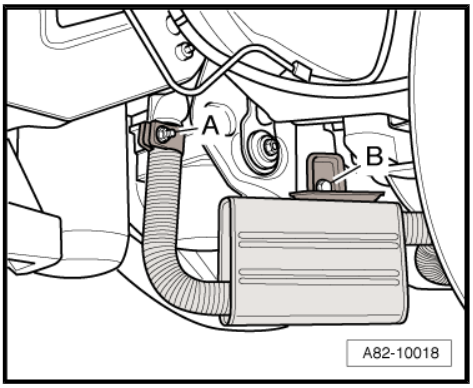


Vehicles with auxiliary heater:

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

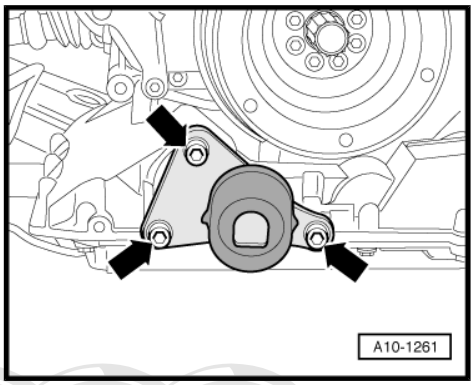


– Loosen nut -A- at clamp for corrugated exhaust pipe.
– Unscrew bolt -B- and remove silencer together with corrugated exhaust pipes.

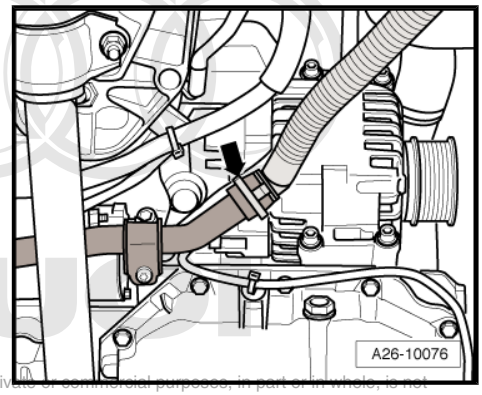


All vehicles:

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



– Detach air hose leading to combination valves for secondary air at the point indicated -arrow-.



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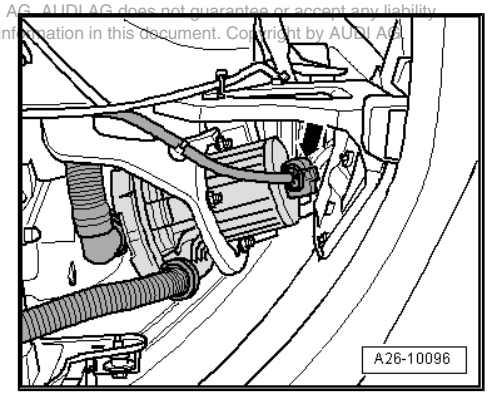
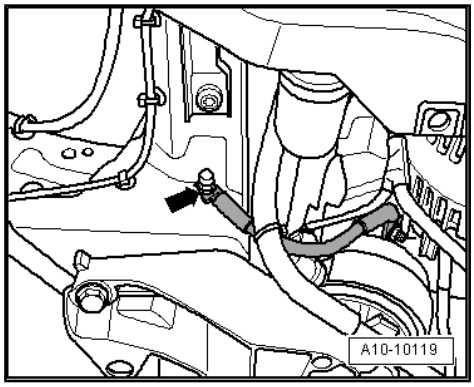
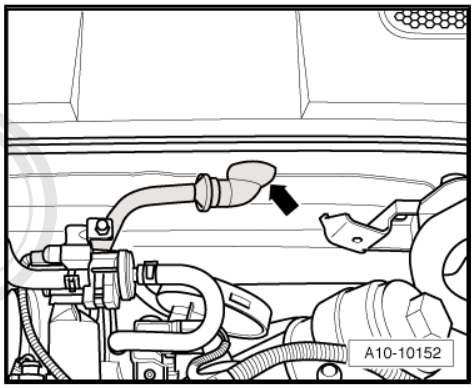
– Unplug electrical connector -arrow- at secondary air pump motor - V101- .



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



– Detach vacuum hose -arrow- for brake servo at bulkhead.



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

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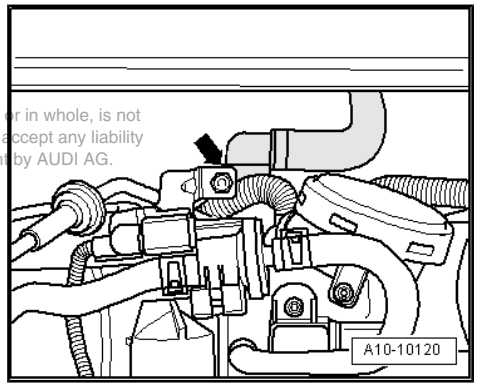
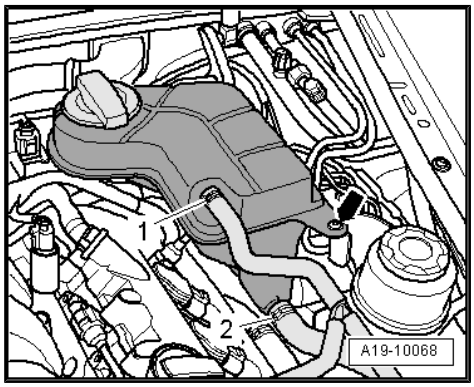
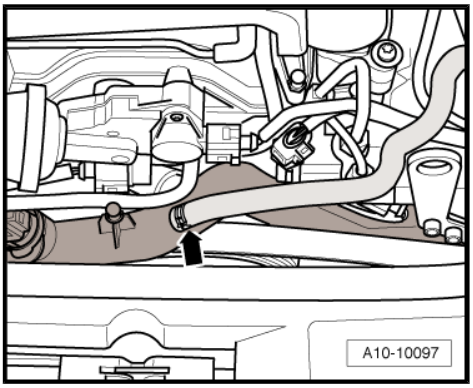


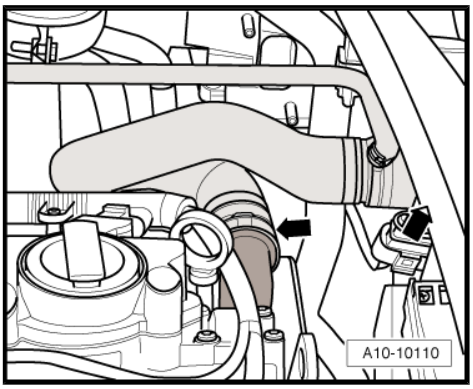
– Disconnect coolant hoses -1- and -2- at coolant expansion tank.
– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank (bottom).



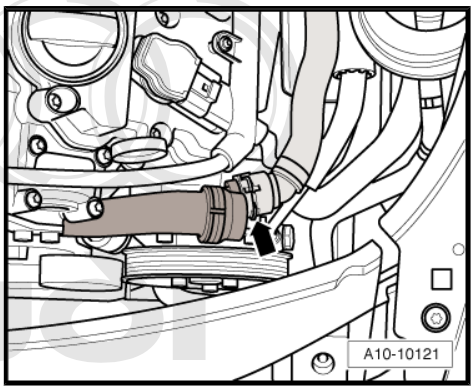
– Detach coolant hose -arrow- from coolant pipe (front).



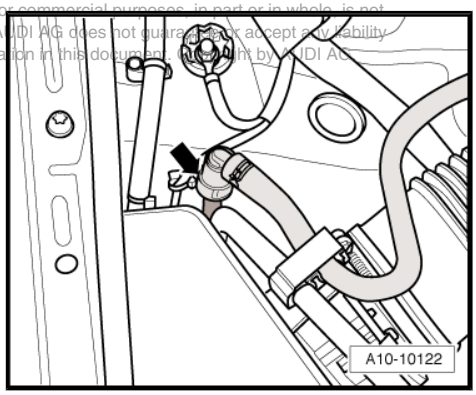
– Remove coolant hose (front left) in engine compartment -arrows-.



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



– Detach vacuum hose -arrow- leading to activated charcoal filter at rear of air cleaner housing and move it clear.



Caution

Rules for cleanliness when working on the injection system ***⇒ "4.1 Rules for cleanliness", page 6*** .

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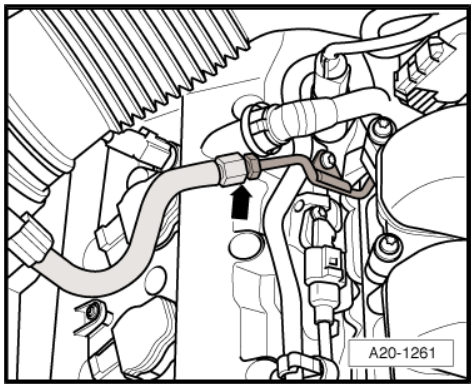
WARNING

The fuel system is pressurised.

Risk of injury as fuel may spray out.

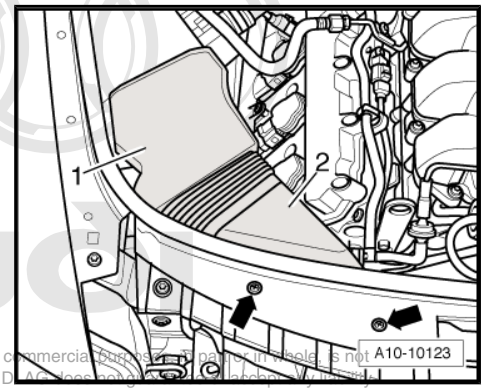
- *Put on safety goggles.*
- *Put on protective gloves.*
- *Release pressure (wrap a clean cloth around connection and open connection carefully).*



– Disconnect fuel line -arrow- and move it clear.

– Remove bolts -arrows-.

– Remove air duct -1- and -2-.



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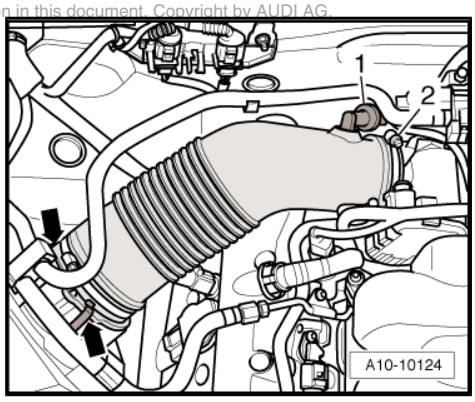
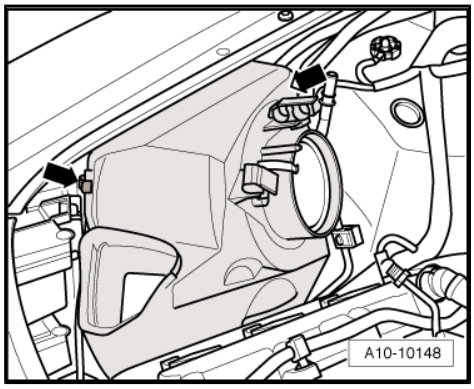
– Detach non-return valve -1- from air intake hose.

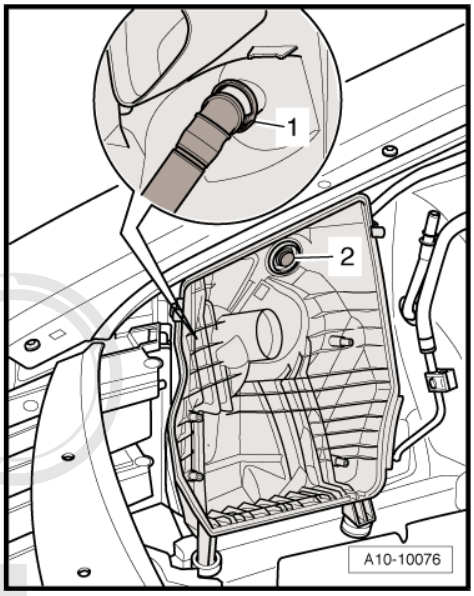
– Remove air hose. To do so, loosen hose clip -2- and release clamps -arrows-.



– Loosen clamps -arrows- and detach top section of air cleaner housing.



– Pull out pin of fastener -2-.
– Remove air cleaner housing (bottom section) and detach hose on reverse side which leads to secondary air pump motor - V101- -item 1-.



– Unscrew nuts -2- and -3- and remove bracket for connectors (right-side) from bulkhead.
– Unbolt earth cable -1- at suspension turret (right-side).

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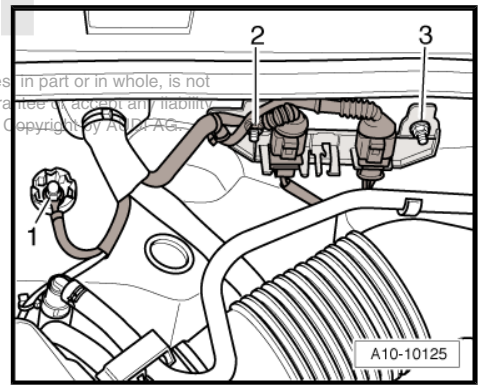
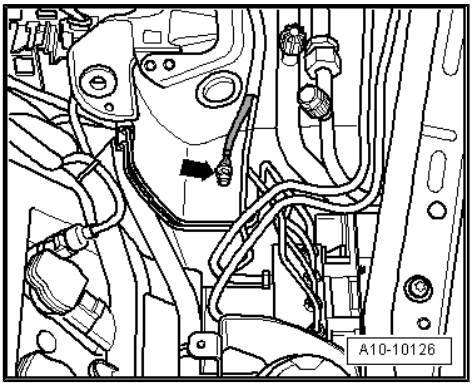
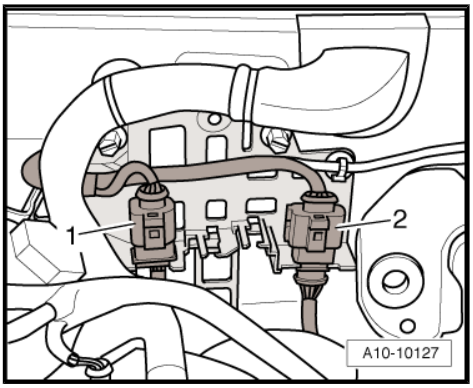


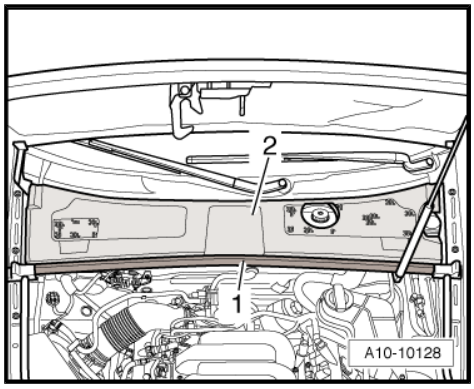
– Unbolt earth cable -arrow- at suspension turret (left-side).



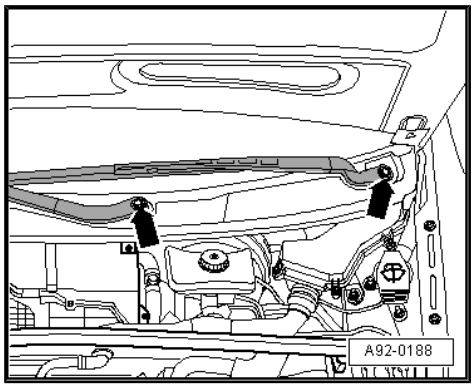
– Unscrew bracket (left-side) for connectors -1- and -2- from bulkhead.



– Detach rubber seal -1- from plenum chamber cover.
– Detach plenum chamber cover -2-.



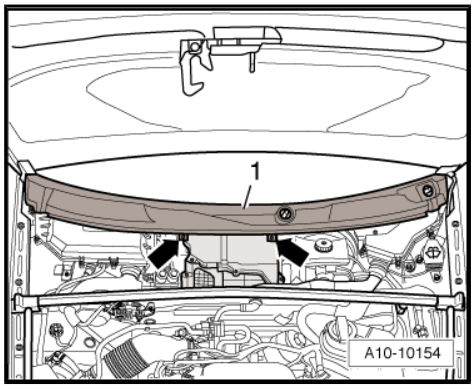
– Prise cover caps off wiper arms using a screwdriver.
– Loosen hexagon nuts -arrows- several turns.
– Release wiper arms from wiper shafts by tilting them slightly. Unscrew and remove hexagon nuts and then detach wiper arms.



– Remove bolts -arrows- for cowl panel grille -1-.

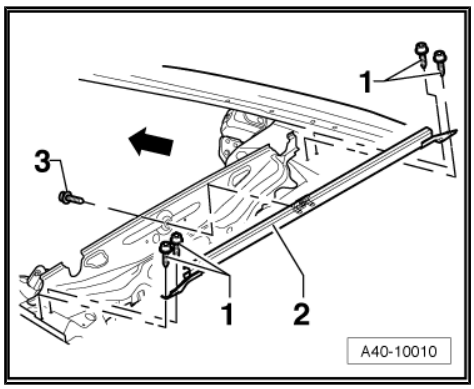
Caution

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



– Pull cowl panel grille off windscreen.

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



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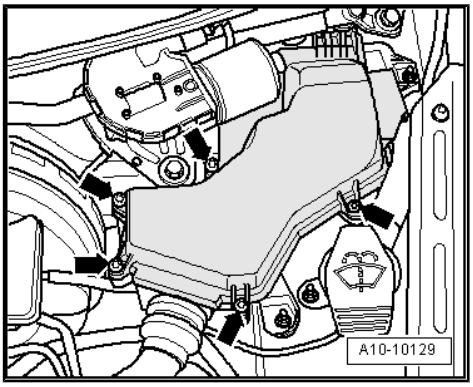
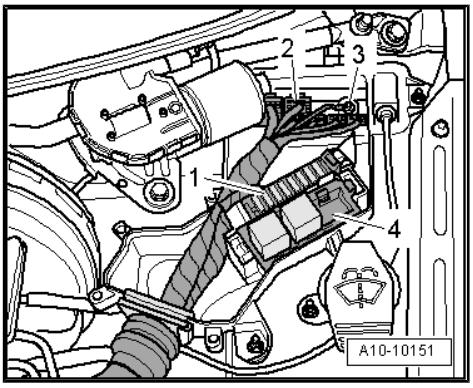
– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



– 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.



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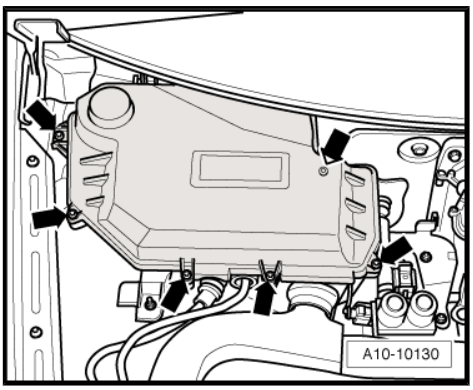
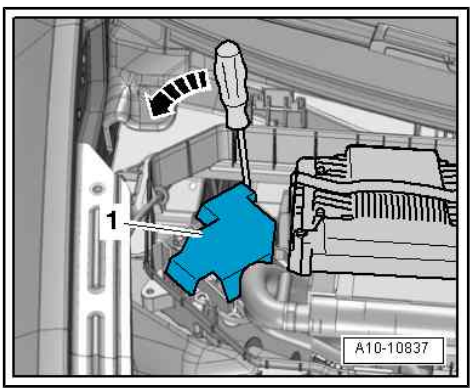
– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (right-side).



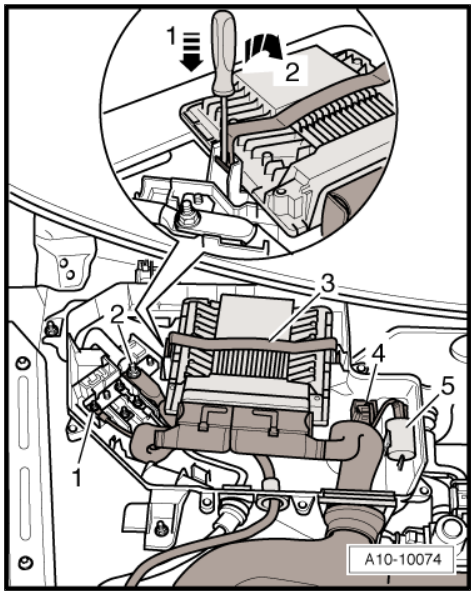
– If fitted, open cover -1- with screwdriver -arrow- and detach.



WARNING

The pump/valve unit of the heating system (on left, in front of electronics box) becomes very hot during operation - risk of burns!

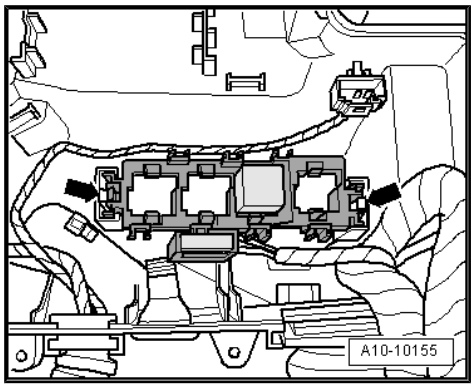
– Carefully lever out the retaining strap -3- using a screwdriver -arrows 1 and 2- and remove the engine control unit from the electronics box.



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 retainers -arrows- and remove the relay carrier upwards.



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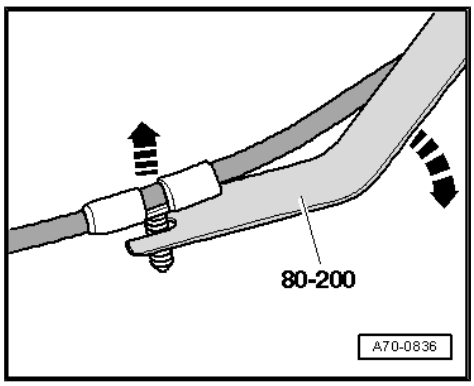
– Release electrical wiring up to the alternator using removal lever - 80-200- .
– Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.

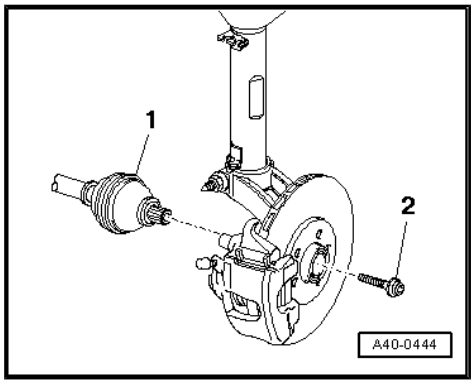


– Have a 2nd mechanic press the brake pedal.

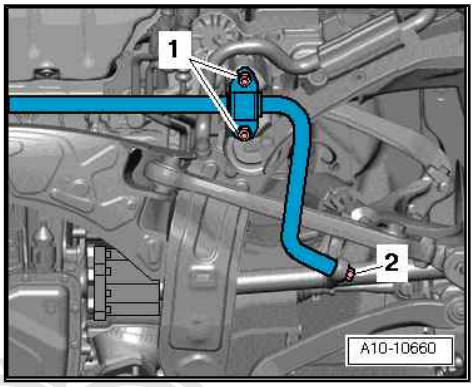
Caution

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).

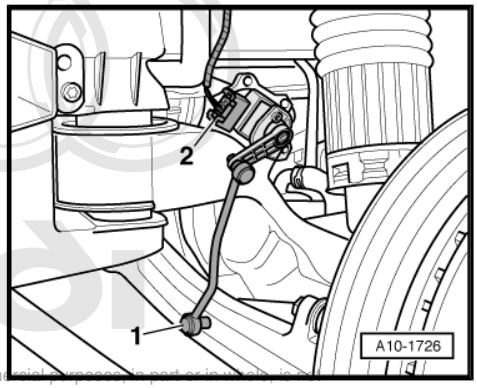
– Unscrew flange bolt -2- from drive shaft -1- (left and right).



– 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.



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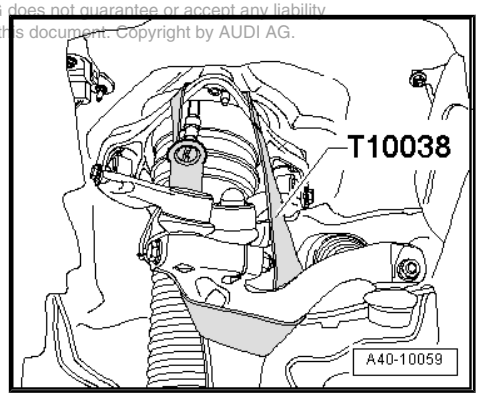
Caution

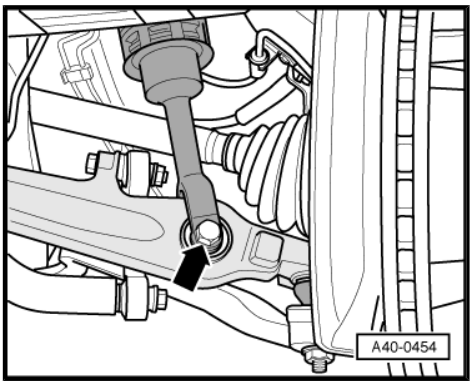
Danger of damage to the swivel joints of the upper links.

- *Support wheel bearing housing.*

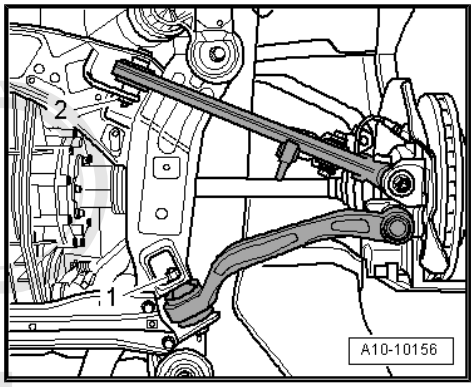
– Tie up wheel bearing housing using tensioning strap - T10038- as illustrated.



– 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 wheel bearing housing as illustrated -arrow-.

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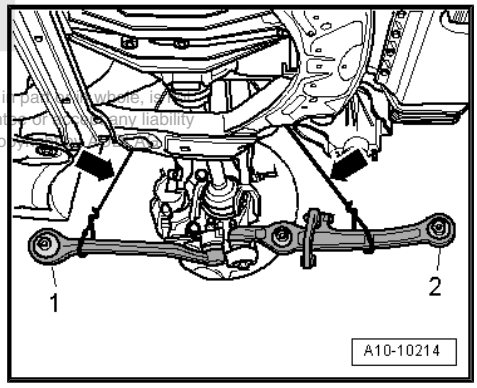
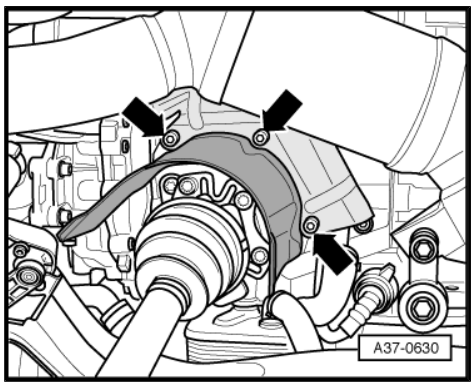


– Repeat procedure on other side of vehicle.

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

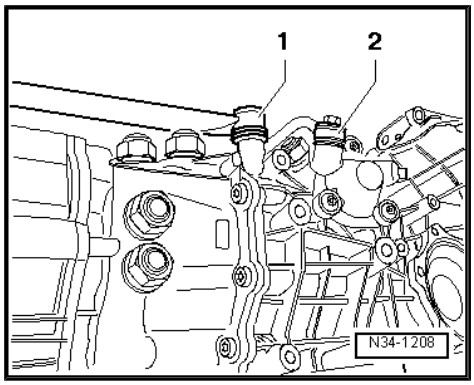
Caution

Take care not to damage brake hose.

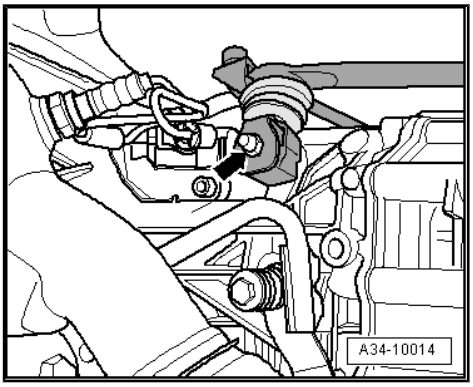


– Pivot wheel bearing housing outwards and remove drive shaft.
– Repeat procedure on other side of vehicle.

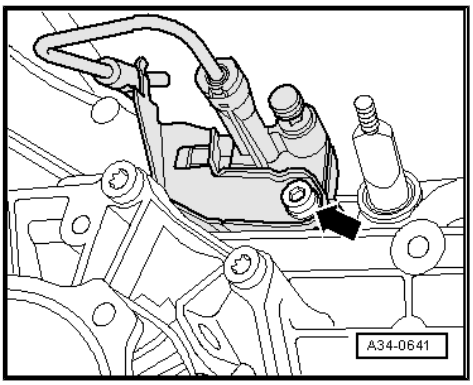
– Unscrew connecting rod -2- of selector rod.
– Unbolt push rod -1- using hexagon key (8 mm) to remove bolt.



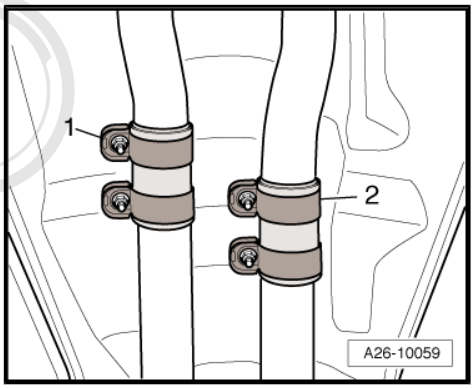
– Unscrew nut -arrow- and pull selector shaft lever off selector shaft.



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



– Loosen clamps -1- and -2-.



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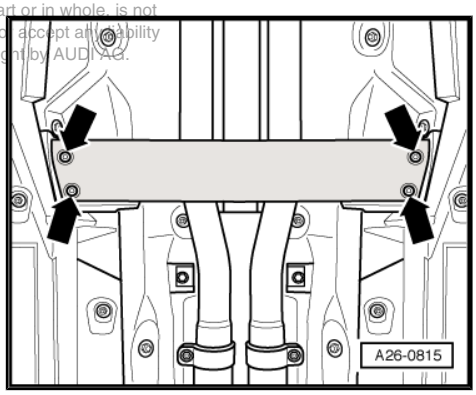
– Unbolt cross piece (front) -arrows-.

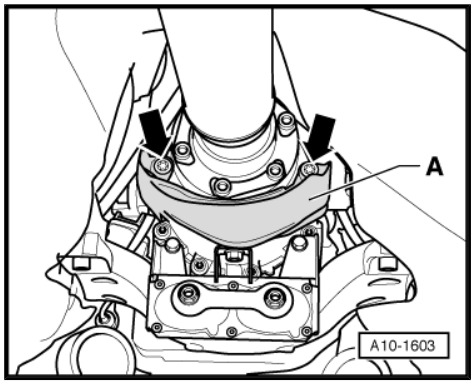


Vehicles with four-wheel drive:

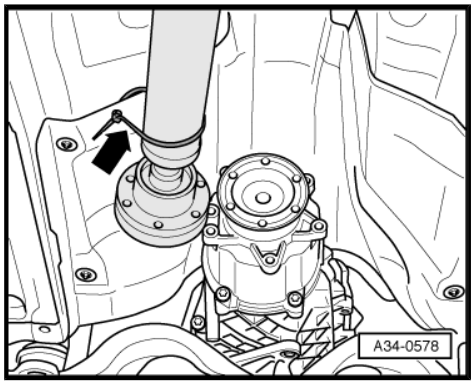
– Unscrew heat shield -A- for propshaft -arrows-.

– Unscrew bolts at gearbox/propshaft flange.

– Push propshaft back towards rear final drive. The constant velocity joints can be moved axially.

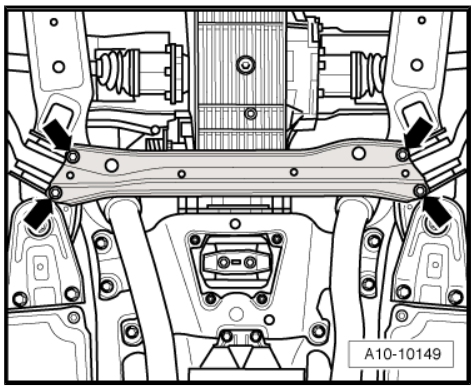


– Tie propshaft up to side of heat shield -arrow-.



All vehicles:

– Unbolt cross piece from subframe -arrows-.



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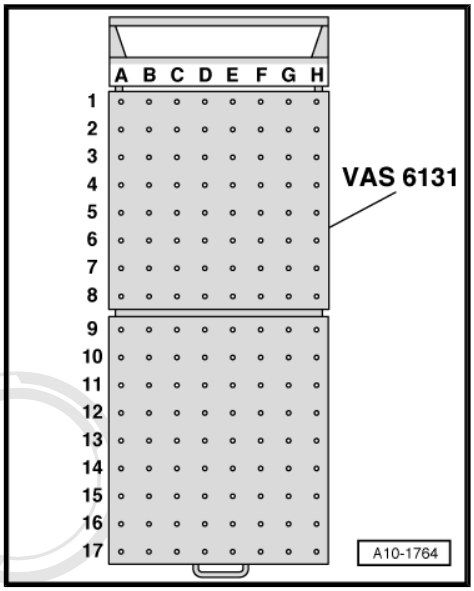
Set up the scissor-type assembly platform as follows:

– Set up scissor-type assembly platform - VAS 6131- with support set for Audi - VAS 6131/10- 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- so that it is horizontal.

• Take note of spirit level (bubble gauge).

– Place scissor-type assembly platform - VAS 6131- 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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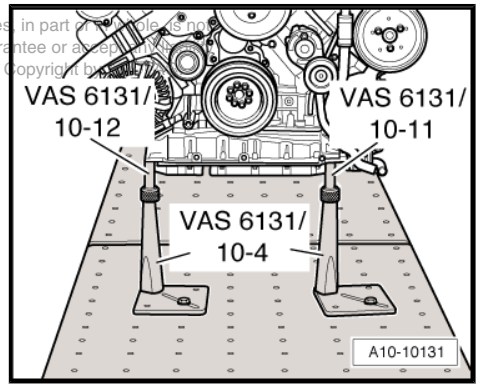
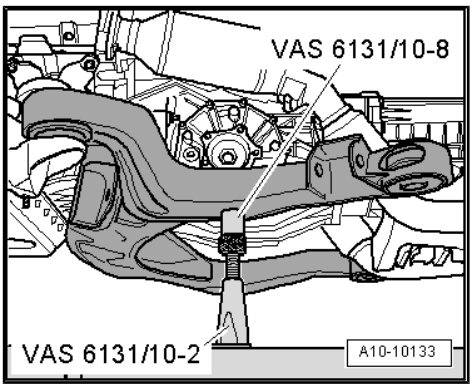
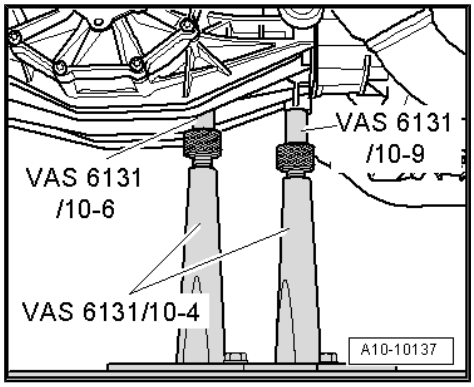


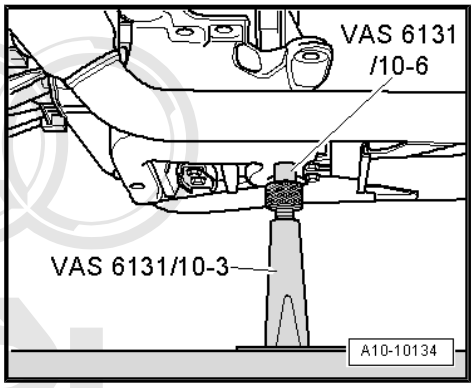
– Position support elements from -VAS 6131/10- at left and right of subframe, as shown in illustration.



– Position support elements from -VAS 6131/10- at rear of gearbox, 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- .



– Remove bolts -arrows- at tunnel cross member.

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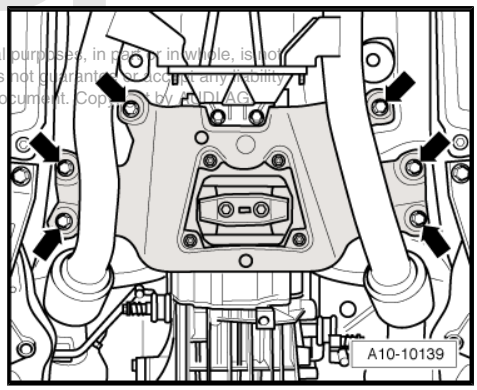
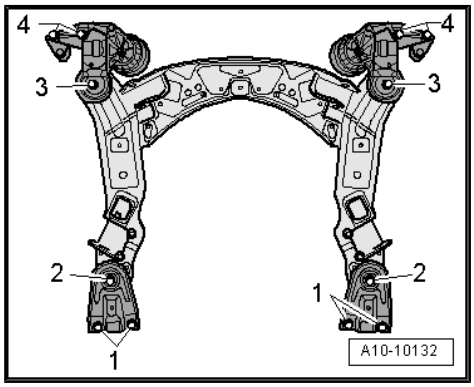


– Remove bolts -1-.
– Mark the installation position of the subframe and the two consoles for engine mountings on the longitudinal members with felt-tip pen.
– Unscrew bolts -2-, -3- and -4- in a diagonal sequence and in stages.



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- from under the vehicle.

1.2 Separating engine and manual gearbox

Special tools and workshop equipment required

- ♦ Support set for Audi - VAS 6131/11- and -VAS 6131/12-

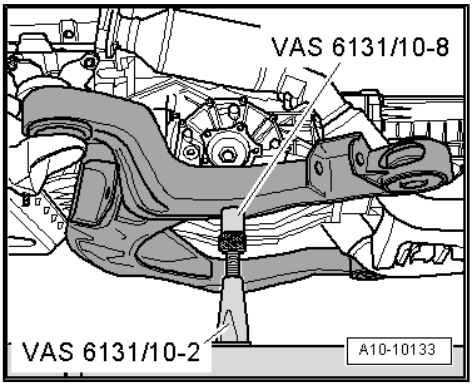
Procedure

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131-

– 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

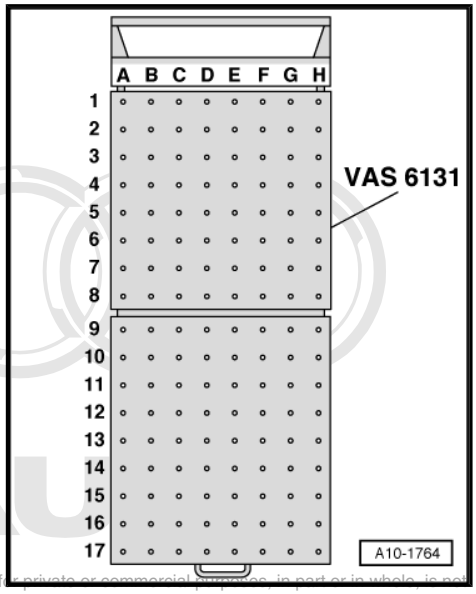
A second mechanic is required for removing the subframe.

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

Note

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

– Set up scissor-type assembly platform - VAS 6131- 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.

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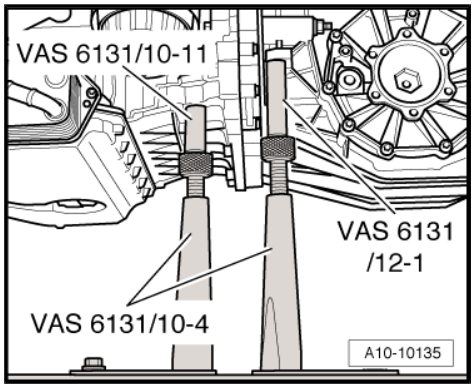
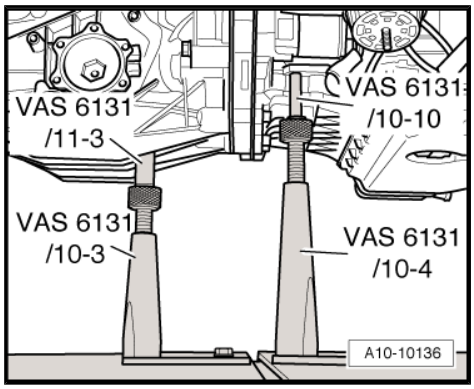
– Position support elements from -VAS 6131/10- and -VAS 6131/12- on left side of engine/gearbox assembly, as shown in illustration.



– 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- .



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

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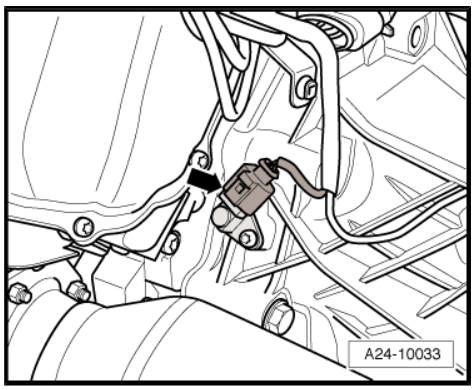
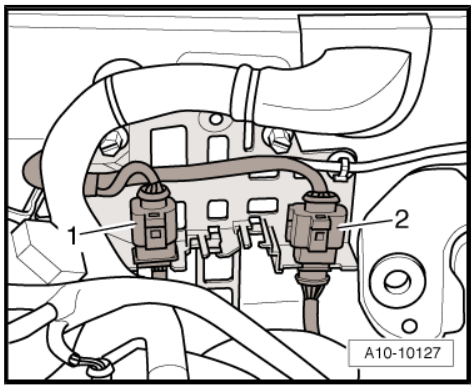


– Unplug electrical connector -2- for Lambda probe 2 after catalytic converter - G131- and move wiring clear.

Note

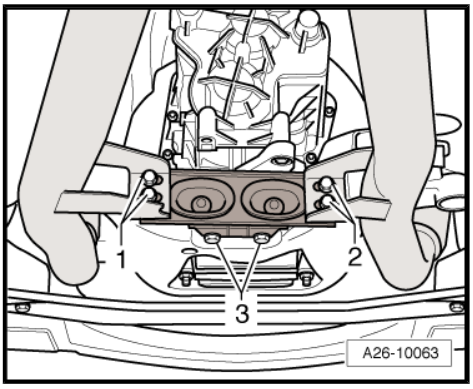
- *Illustration shows electrical connector when installed.*
- *Disregard -item 1-.*



Note

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° – otherwise it can be damaged.

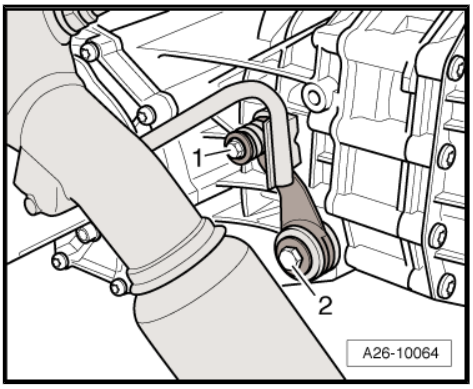
– Remove bolts -1- on bracket (rear) for exhaust system.



Note

Disregard items marked -2- and -3-.

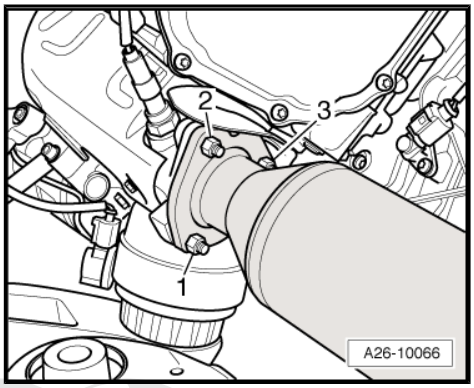
– Remove bolt -1- on bracket (left-side) for front exhaust pipe.



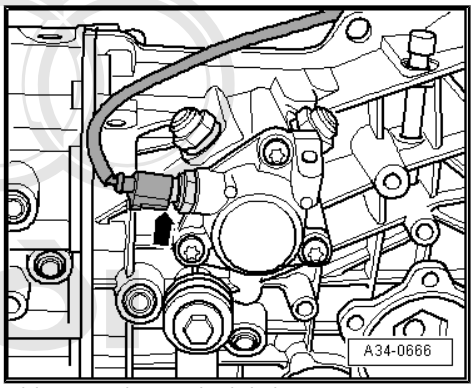
Note

Disregard -item 2-.

– Unscrew 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.



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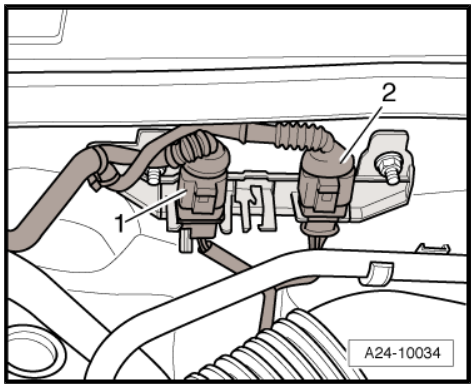
– Unplug electrical connector -2- for Lambda probe after catalytic converter - G130- and move wiring clear.



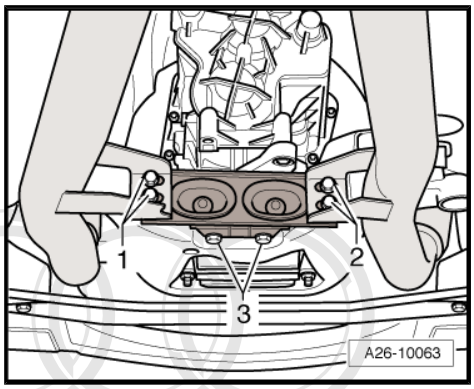
Note

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

Note

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° – otherwise it can be damaged.

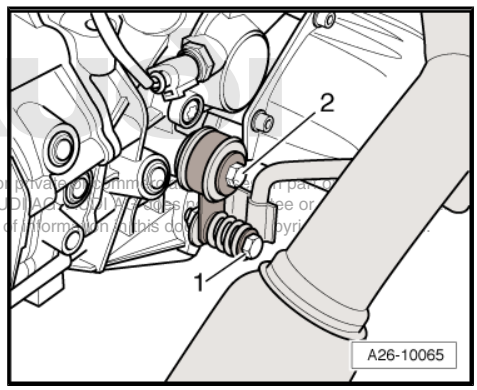
– Remove bolts -2- on bracket (rear) for exhaust system.



Note

Disregard items marked -1- and -3-.

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



Note

Disregard -item 2-.

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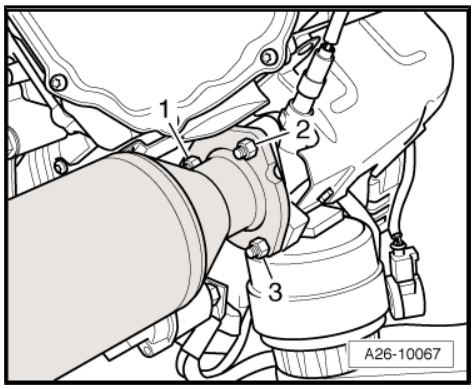
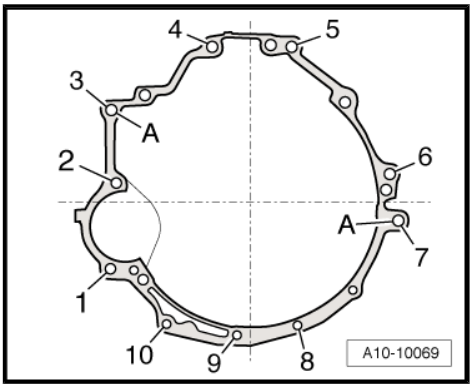
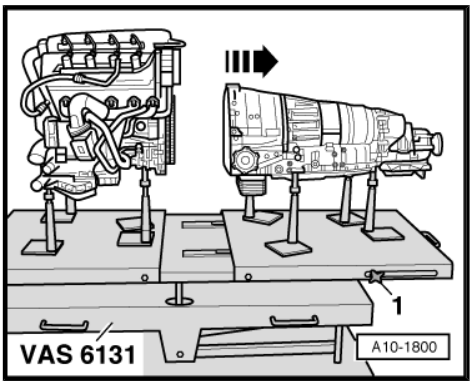
– Unscrew nuts -1 ... 3-.
– Detach front exhaust pipe (right-side) with catalytic converter.



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



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



1.3 Securing engine to engine and gearbox support

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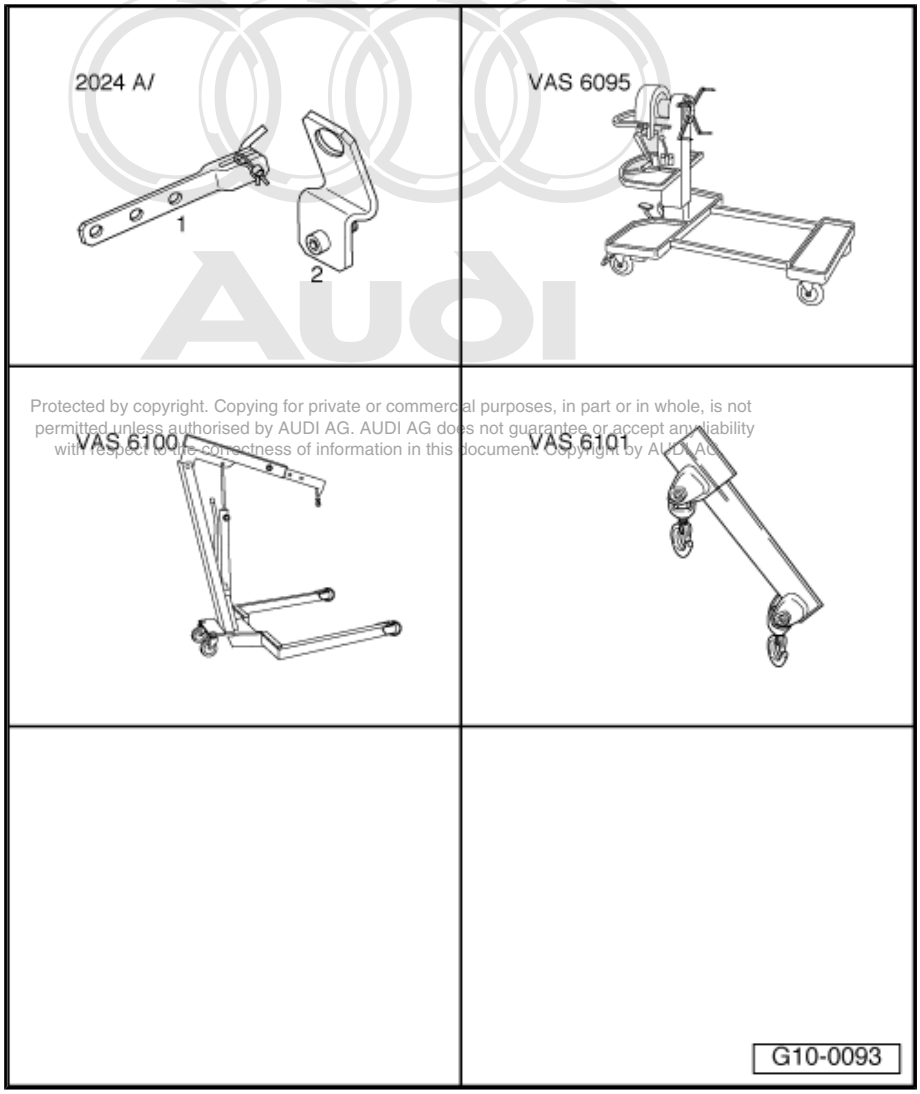
Special tools and workshop equipment required

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



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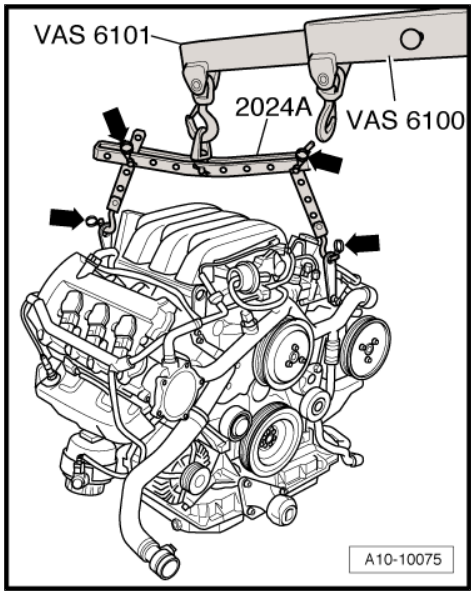
Procedure

- Engine separated from gearbox ⇒ “1.2 Separating engine and manual gearbox”, page 27 .

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



Note

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

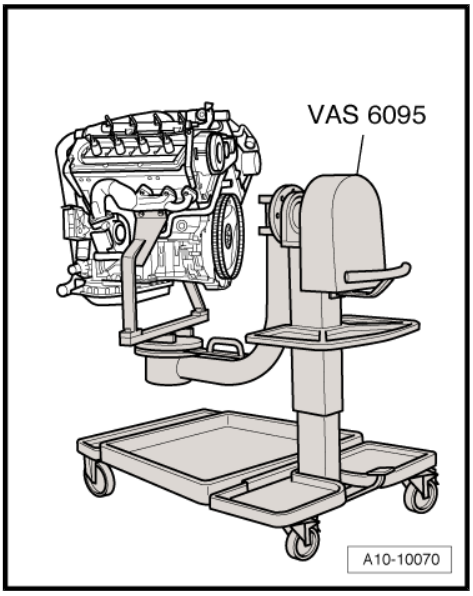
WARNING

Risk of accident.

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

– Unbolt engine supports from cylinder block.

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



1.4 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 oil 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.*

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– When fitting a new clutch plate together with a used pressure plate (self-adjusting clutch), the adjuster ring in the pressure plate has to be reset by turning it back as far as it will go. If this is not done, the pressure plate will operate with reduced clamping force, causing clutch slip ⇒ Rep. gr. 30 .

Note

- *If the clutch plate is not being replaced, it is not necessary to reset the adjuster ring.*
- *New SAC pressure plates are already pre-set accordingly, and do not have to be reset.*

– Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease - 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; renew if necessary.

– If plastic ring of release bearing is loose, glue it back onto release bearing with adhesive - AMV 195 KD1 01- .

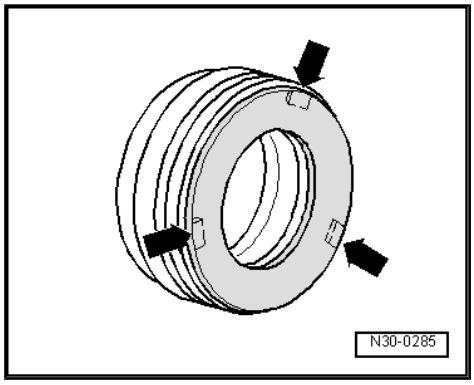
• Three square lugs -arrows- on the plastic ring engage in the recesses in the bearing race.

• The release bearing must be renewed if it has scoring deeper than 0.5 mm.

– Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install dowel sleeves if necessary.

– Press intermediate plate between engine and gearbox onto dowel sleeves.

– Bolt gearbox to engine.



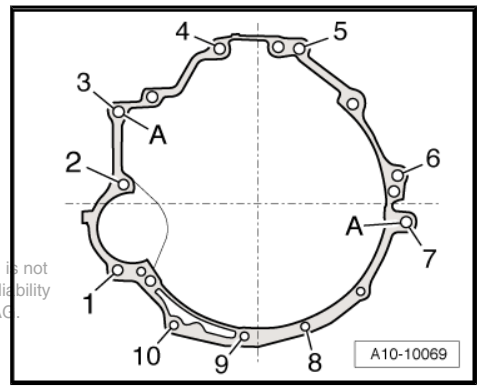
Note

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

Engine/gearbox securing bolts

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) Property class 10.9.



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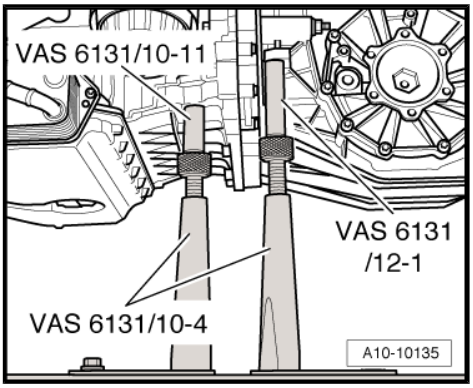
Perform further installation in reverse order, paying attention to the following:

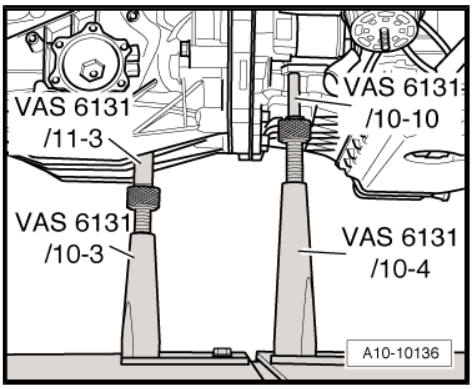
– Install front exhaust pipes: left-side
⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242 , right-side
⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246 .

– 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- .



– 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- .



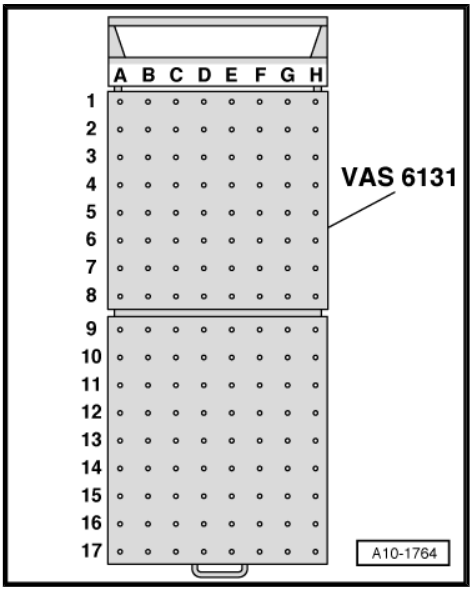
Note

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

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

Platform coordinates	Parts of support set for Audi - VAS 6131/10-			
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

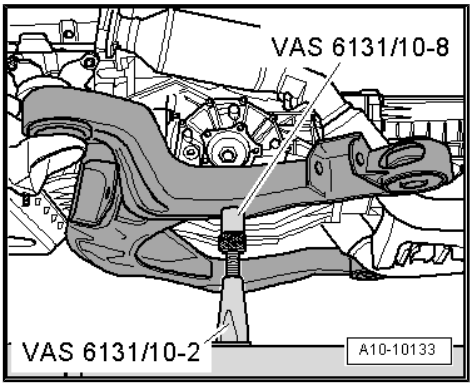
- 1) Support elements remain unchanged.
- 2) Secure support elements only after installing the subframe.



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- .
– Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform - VAS 6131- .



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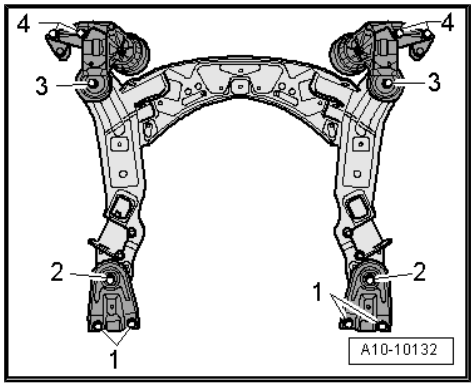
– Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
– Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts only after performing wheel alignment check.

1 - 55 Nm

2 - 115 Nm

3 - 115 Nm

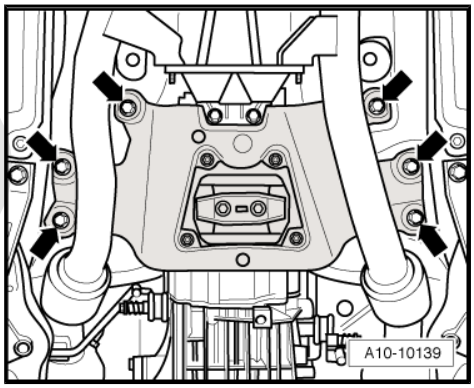
4 - 75 Nm



WARNING

The vehicle must not be driven at this stage.

– Tighten bolts -arrows- at tunnel cross member.



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 ⇒ Rep. gr. 39 .
– Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .
– Install air conditioner compressor ⇒ Rep. gr. 87 .
– Install poly V-belt ⇒ “1.4 Removing and installing poly V-belt”, page 73 .

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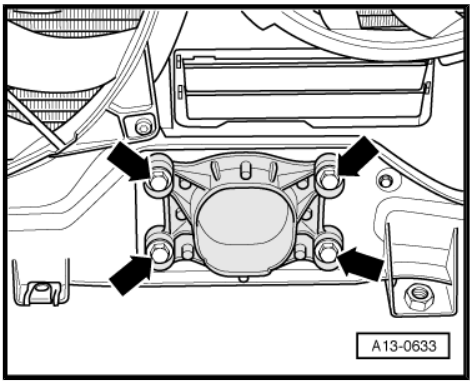

- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting 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 ⇒ “1.13 Checking oil level”, page 202 .
- Bleed fuel system ⇒ Rep. gr. 24 .
- Fill cooling system ⇒ page 207 .
- 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 .
- Install cross piece for subframe ⇒ Rep. gr. 40 .
- Install cross piece (front) ⇒ Rep. gr. 50 .
- 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 lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- *Do not use degreased parts.*
- *Tolerance for tightening torques: ± 15 %.*

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Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Console for engine mounting to longitudinal member		75
Tunnel cross member to body		40
Hydraulic pressure line to power steering pump		47
Fuel hose to fuel line		22
Torque reaction support to engine		40
Stop for torque reaction support to lock carrier		23
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

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2 Removing and installing engine - vehicles with multitronic gearbox

⇒ “2.1 Removing engine”, page 39

⇒ “2.2 Detaching multitronic gearbox from engine”, page 57

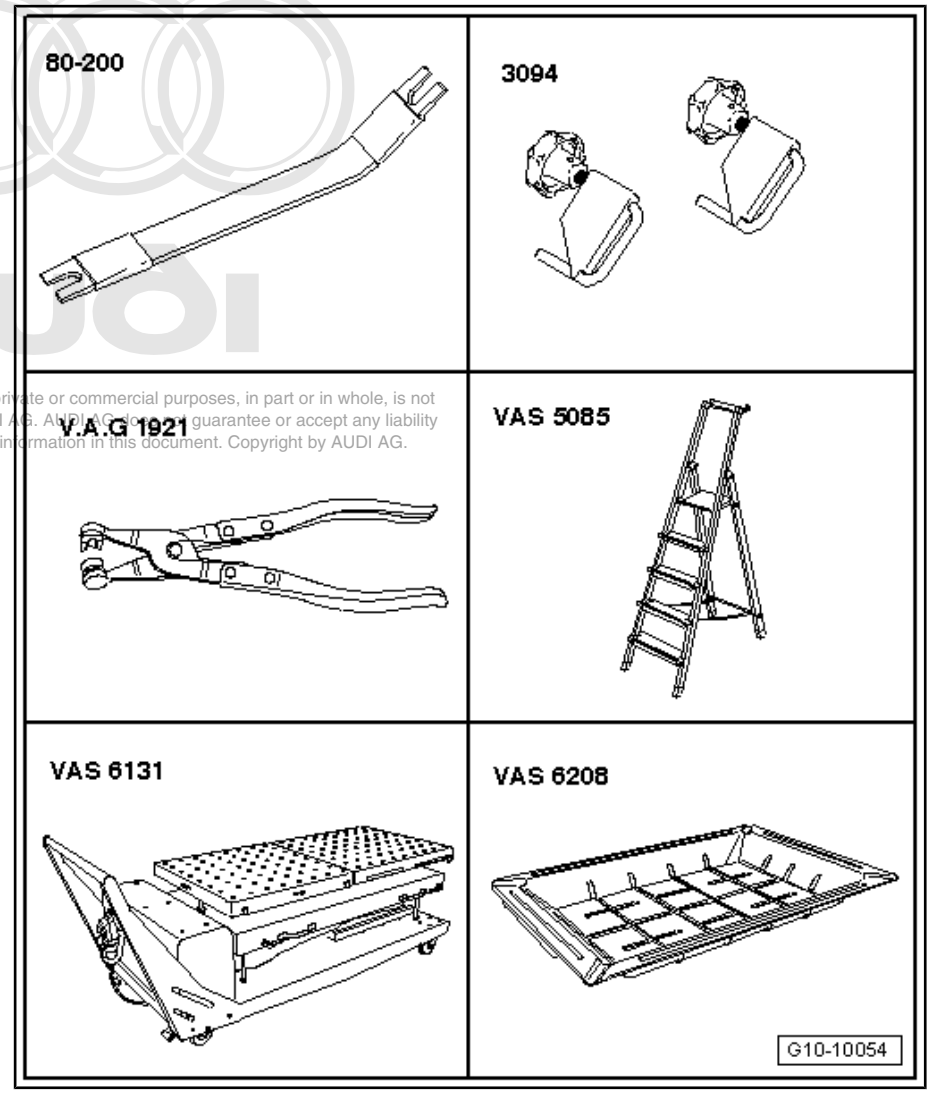
⇒ “2.3 Securing engine to engine and gearbox support”, page 61

⇒ “2.4 Installing engine”, page 63

2.1 Removing engine

Special tools and workshop equipment required

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



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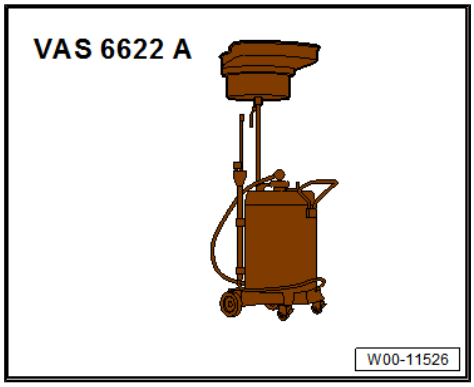
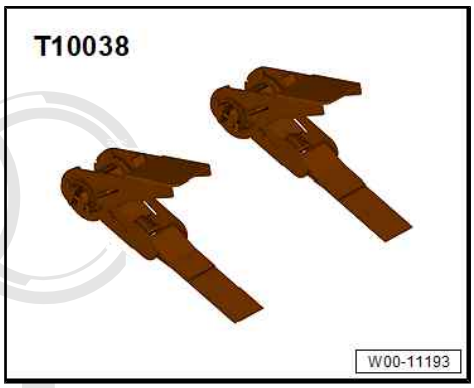
- Used oil collection and extraction unit - VAS 6622A-



- Tensioning strap - T10038-



Note

If the engine is going to be separated from the gearbox (after the entire assembly is removed), you will additionally need supplementary set - VAS 6131/12- .

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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

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

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

Caution

Risk of irreparable damage to electronic components.

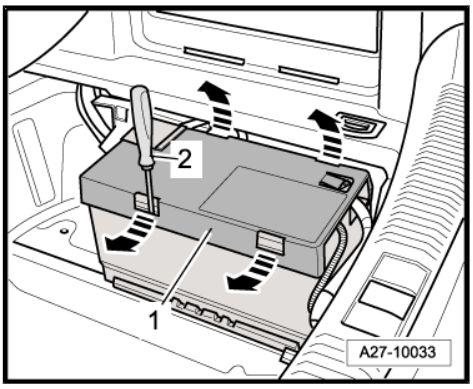
- *Observe notes on procedure for disconnecting the battery.*

– Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

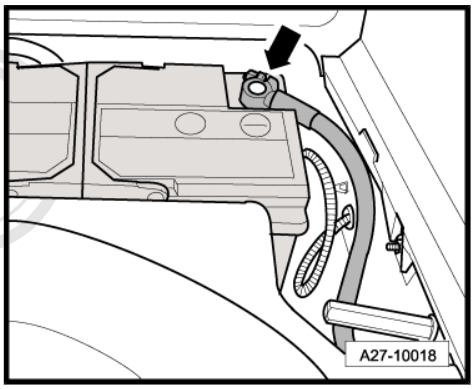
Note

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

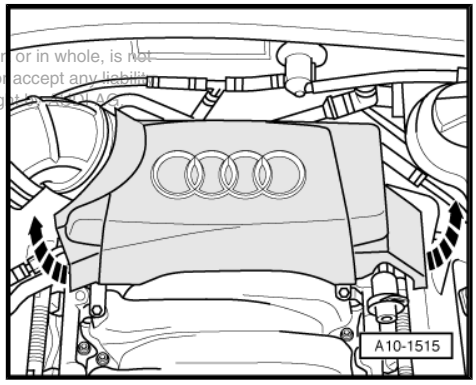
– Take out luggage compartment floor trim.



– Use screwdriver -2- to release retaining clips -arrows- and detach cover -1-.
– Disconnect earth wire -arrow- at battery.



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



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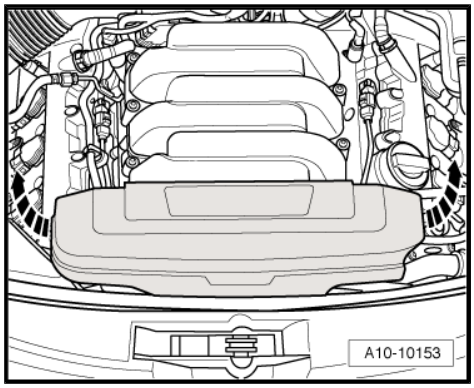
– Pull off engine cover panel (front) -arrows-.



WARNING

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

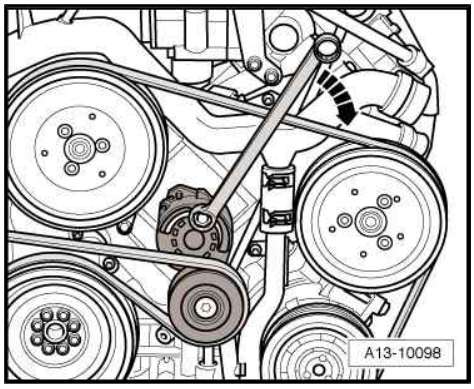
Danger of scalding skin and other parts of the body.

- *Put on protective gloves.*
- *Put on safety goggles.*
- *Release pressure (cover filler cap on coolant expansion tank with a 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-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

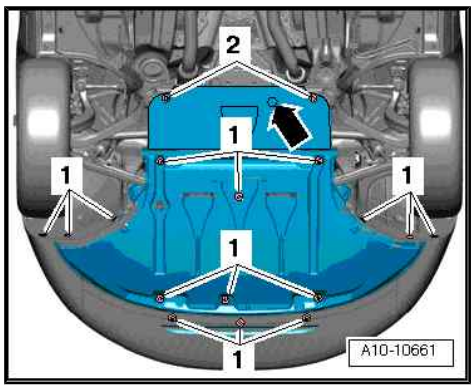


– To slacken poly V-belt turn tensioner in direction of -arrow-.
– Remove poly V-belt and release pressure from the tensioner.
– Remove both front wheels.

Note

Secure brake discs with wheel bolts.

– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panel.



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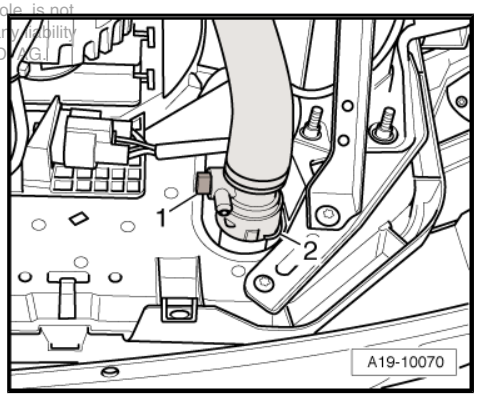
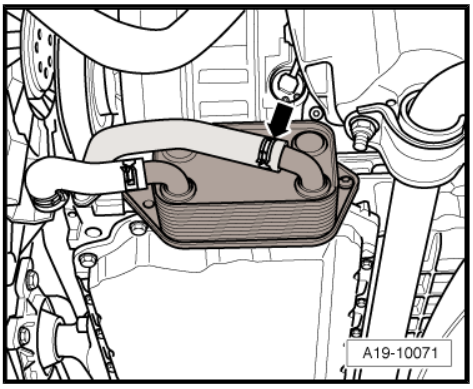
– Place drip tray for workshop hoist - VAS 6208- under engine.
– Open drain plug -1- and let coolant drain.
– Then disconnect coolant hose -2- from radiator.



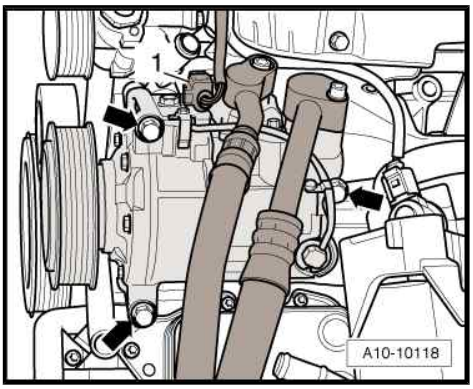
– Disconnect coolant hose -arrow- at oil cooler and drain off remaining coolant.
– Then remove coolant hose.



– 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 lines and hoses are not stretched, kinked or bent.

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

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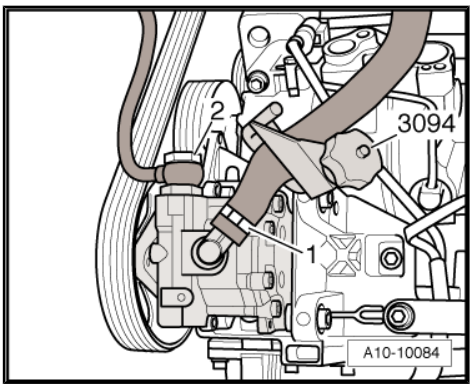
Note

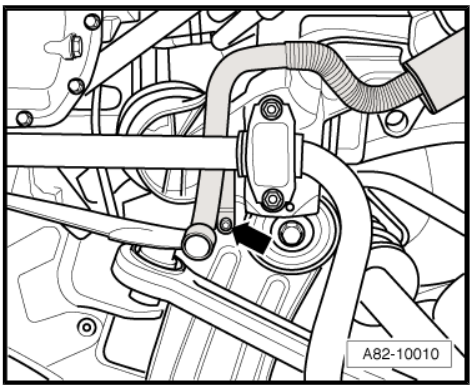
Lay a cloth under the hydraulic lines to catch any escaping hydraulic fluid.

– 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.

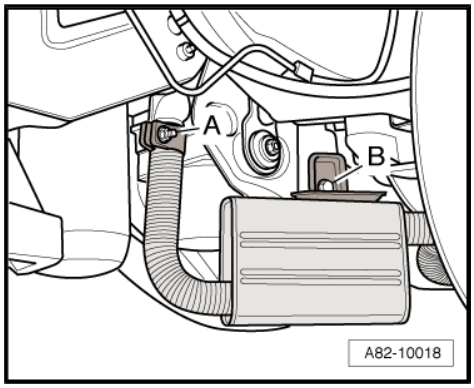


Vehicles with auxiliary heater:

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

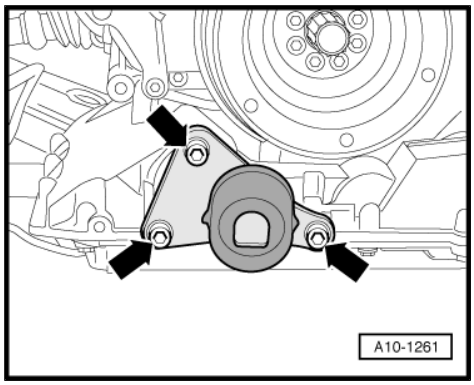


– Loosen nut -A- at clamp for corrugated exhaust pipe.
– Unscrew bolt -B- and remove silencer together with corrugated exhaust pipes.



All vehicles:

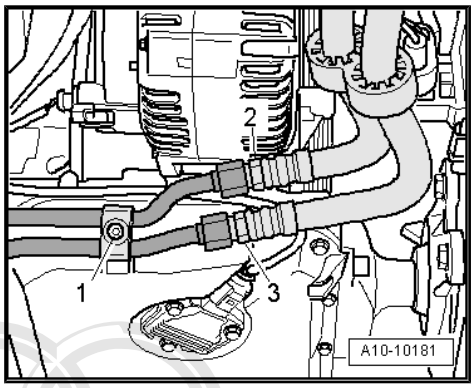
– Unscrew bolts -arrows- and remove torque reaction support from engine.



Note

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

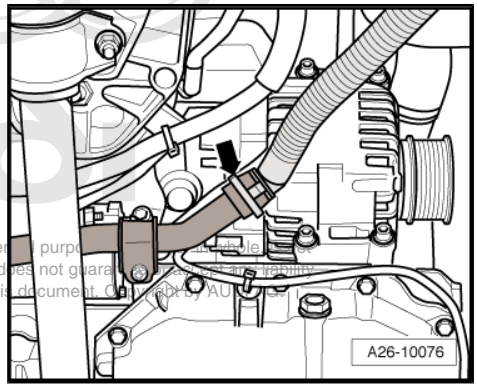
– Place used oil collection and extraction unit - V.A.G 1782- under engine.
– Unscrew union nuts -2- and -3- and disconnect ATF lines.



Note

Disregard -item 1-.

– Detach air hose leading to combination valves for secondary air at the point indicated -arrow-.



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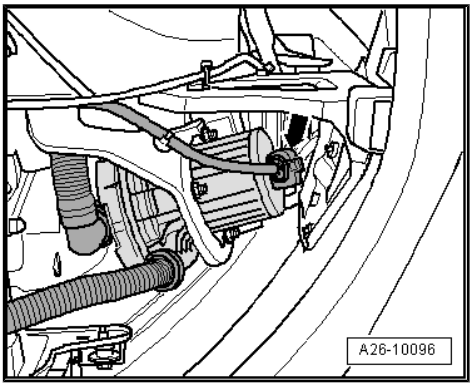
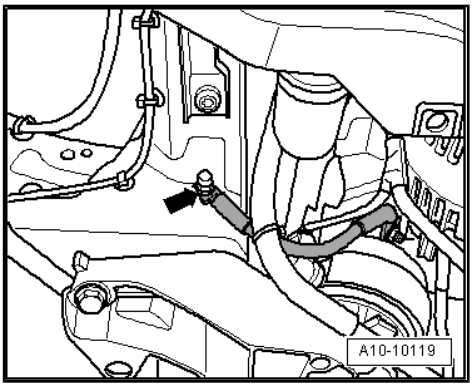
– Unplug electrical connector -arrow- at secondary air pump motor - V101- .
– Move wiring clear.



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



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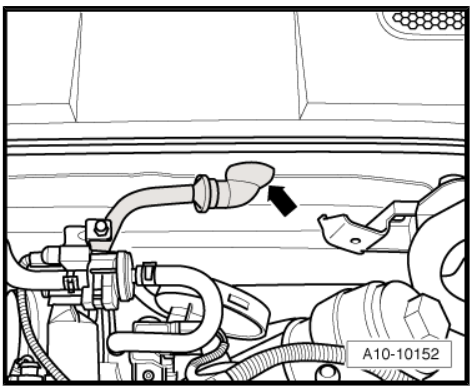
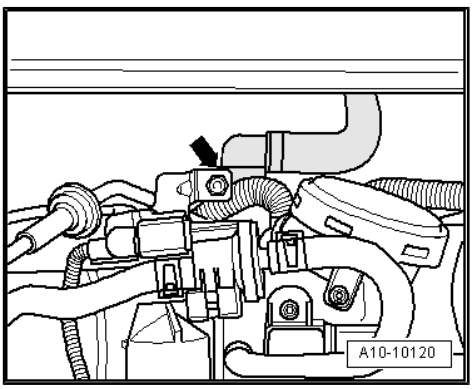
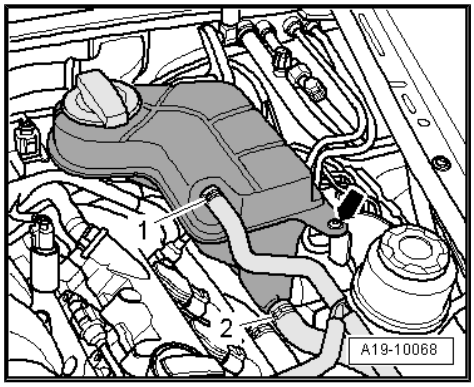
– Detach vacuum hose -arrow- for brake servo at bulkhead.



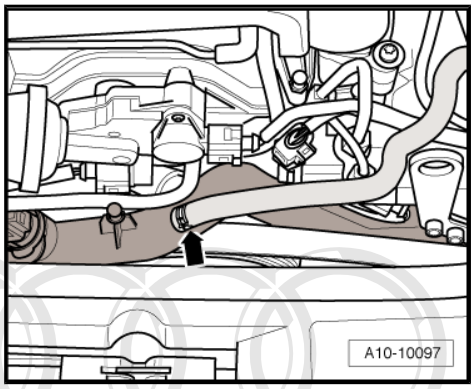
– Disconnect coolant hose -arrow- leading to heat exchanger for heater at rear of engine.



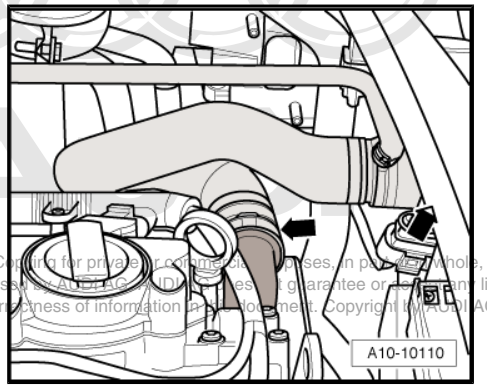
– Disconnect coolant hoses -1- and -2- at coolant expansion tank.
– Unbolt coolant expansion tank -arrow-.
– Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank (bottom).



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



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



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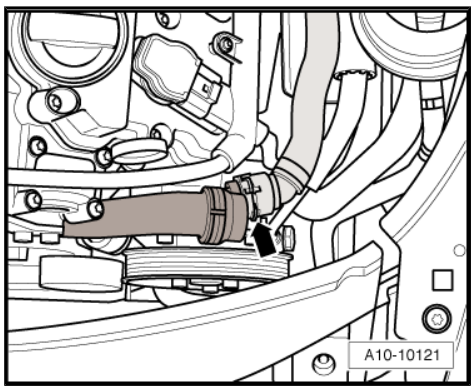
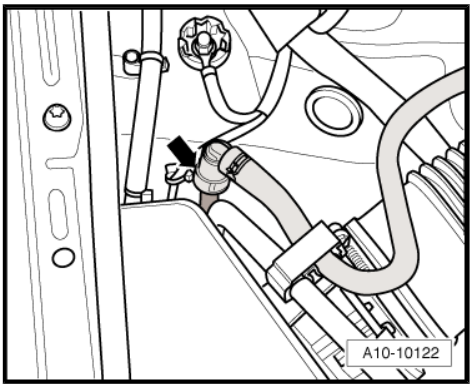
– Detach coolant hose -arrow- from coolant pipe (front).



– Detach vacuum hose -arrow- leading to activated charcoal filter at rear of air cleaner housing and move it clear.



Caution

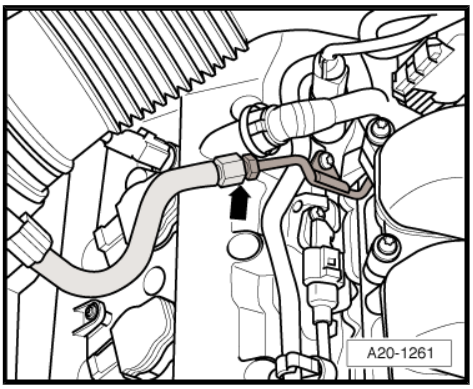
Rules for cleanliness when working on the injection system *⇒ "4.1 Rules for cleanliness", page 6* *.*

WARNING

The fuel system is pressurised.

Risk of injury as fuel may spray out.

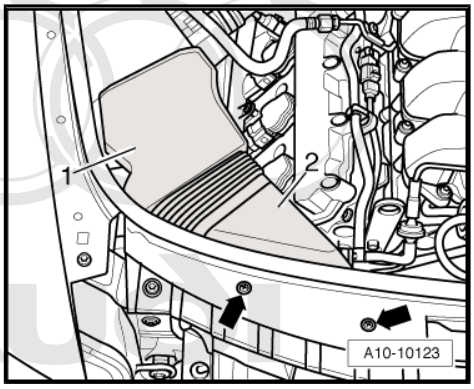
- *Put on safety goggles.*
- *Put on protective gloves.*
- *Release pressure (wrap a clean cloth around connection and open connection carefully).*



– Disconnect fuel line -arrow- and move it clear.

– Remove bolts -arrows-.

– Remove air duct -1- and -2-.



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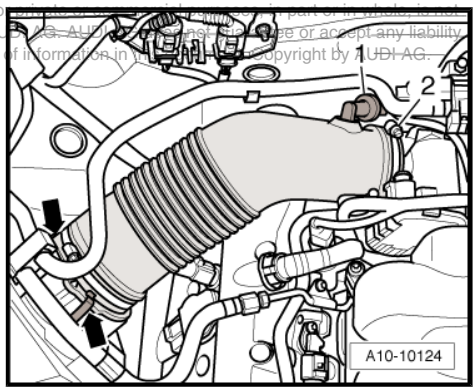
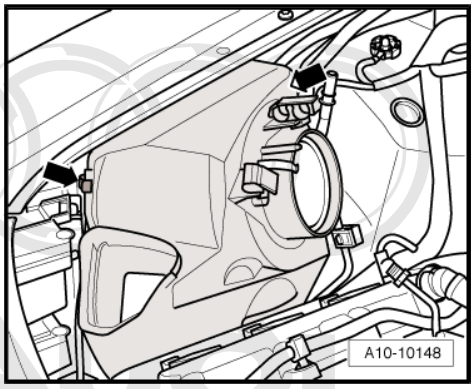
– Detach non-return valve -1- from air intake hose.

– Remove air hose. To do so, loosen hose clip -2- and release retaining clips -arrows-.



– Loosen clamps -arrows- and detach top section of air cleaner housing.



– Pull out pin of fastener -2-.
– Remove air cleaner housing (bottom section) and detach hose on reverse side which leads to secondary air pump motor -V101- -item 1-.

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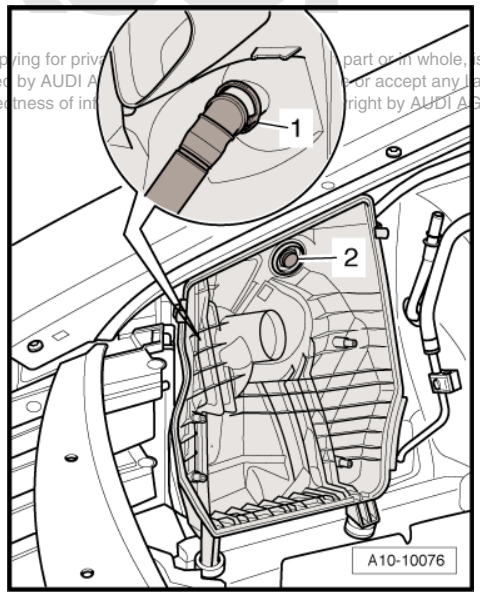
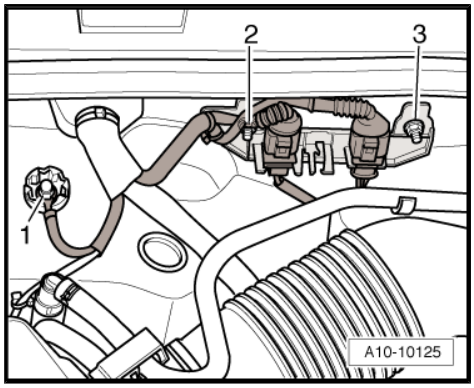
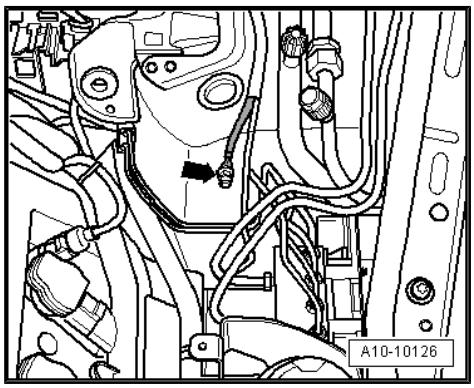


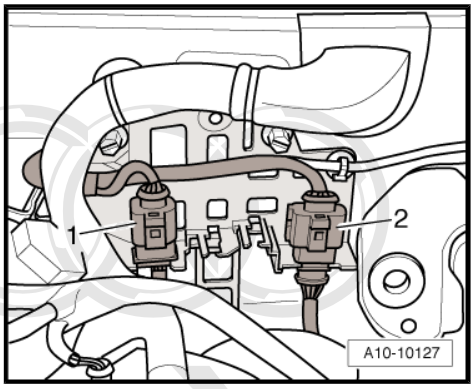
– Unscrew nuts -2- and -3- and remove bracket for connectors (right-side) from bulkhead.
– Unbolt earth cable -1- at suspension turret (right-side).



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



– Unscrew bracket (left-side) for connectors -1- and -2- from bulkhead.



– Detach rubber seal -1- from plenum chamber cover.
– Detach plenum chamber cover -2-.

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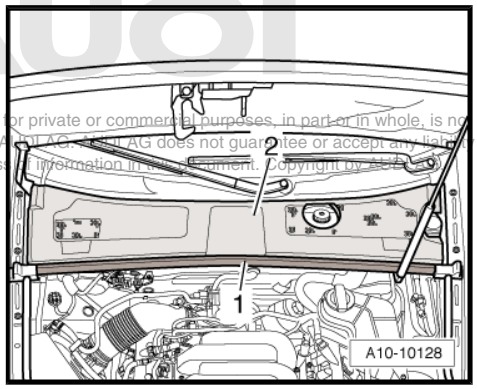
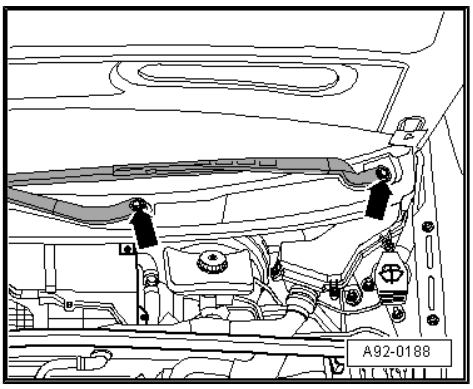


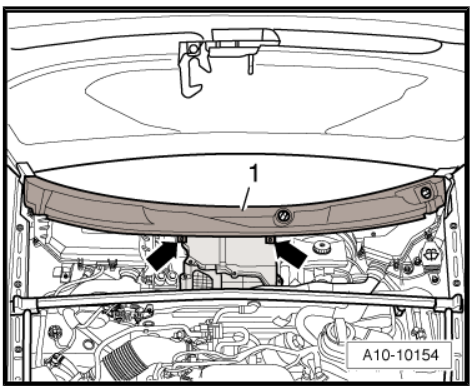
– Prise cover caps off wiper arms using a screwdriver.
– Loosen hexagon nuts -arrows- several turns.
– Release wiper arms from wiper shafts by tilting them slightly. Unscrew and remove hexagon nuts and then detach wiper arms.



– Remove bolts -arrows- for cowl panel grille -1-.

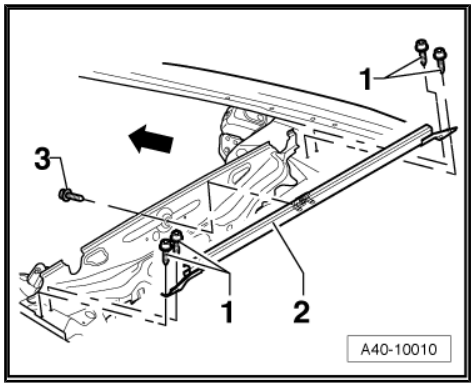
Caution

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

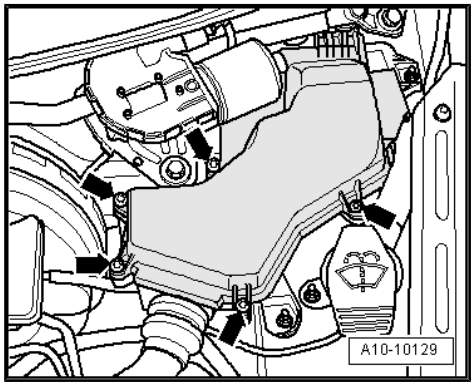


– Pull cowl panel grille off windscreen.

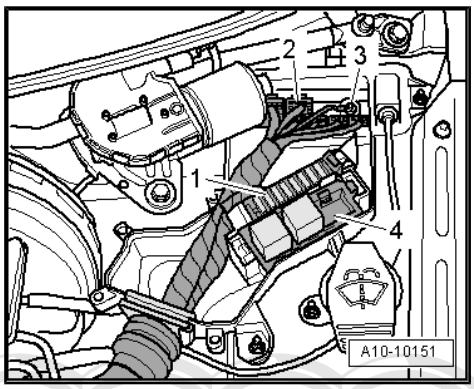
– If fitted, unscrew bolts -1- and -3- and remove body brace -2-.



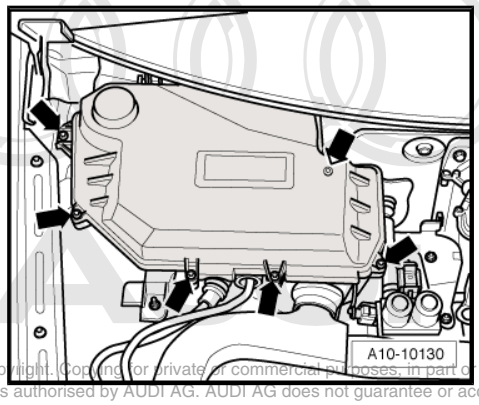
– Unscrew bolts -arrows- and take off cover for electronics box in engine compartment (left-side).



– 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).



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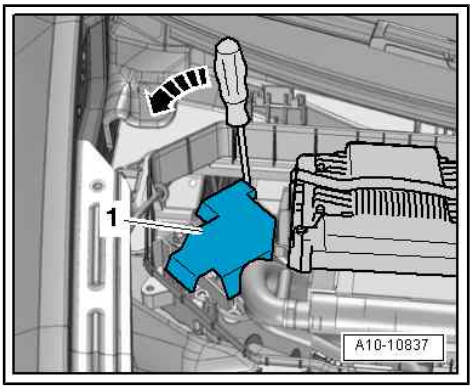
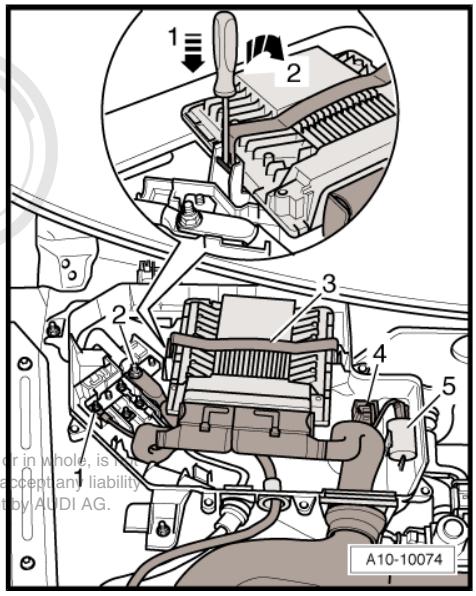
– If fitted, open cover -1- with screwdriver -arrow- and detach.



WARNING

The pump/valve unit of the heating system (on left, in front of electronics box) becomes very hot during operation - 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.

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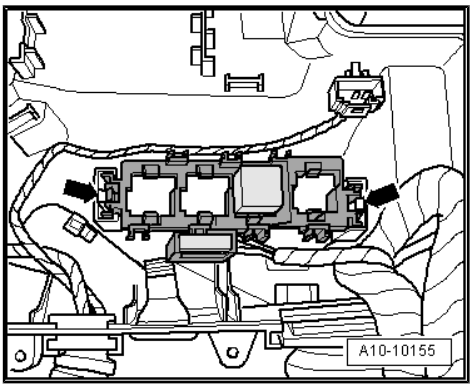
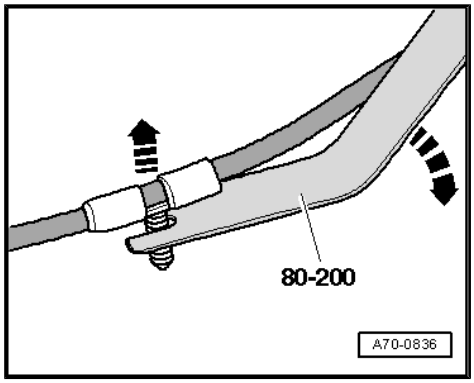
– Unclip suppressor capacitor -5- and take out of retainer in electronics box.
– Unplug electrical connector -4- at rear of connector console.
– Unscrew electrical wiring connections -1- and -2-.

– Release retainers -arrows- and remove the relay carrier upwards.



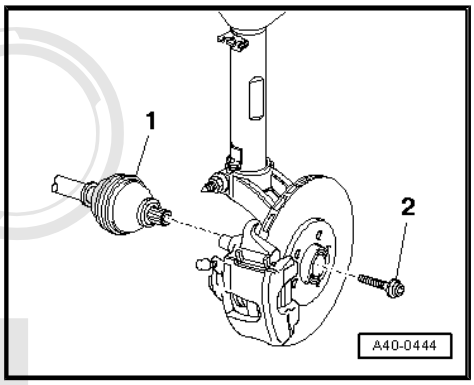
– Release electrical wiring up to the alternator using removal lever - 80-200- .
– Place both wiring harnesses on top of engine and secure the engine control unit to prevent it falling.



– 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.

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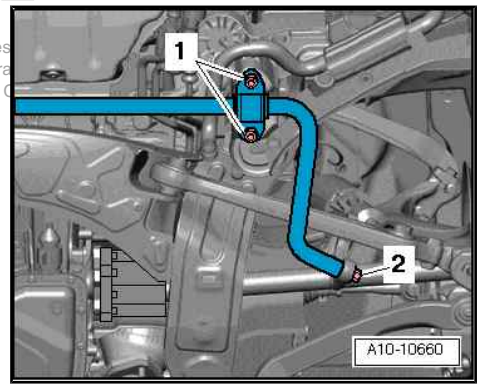
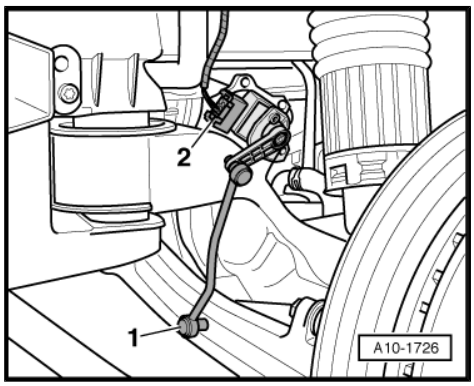


– Unplug electrical connector -2- at vehicle level sender.
– Detach coupling rod -1- at track control link.

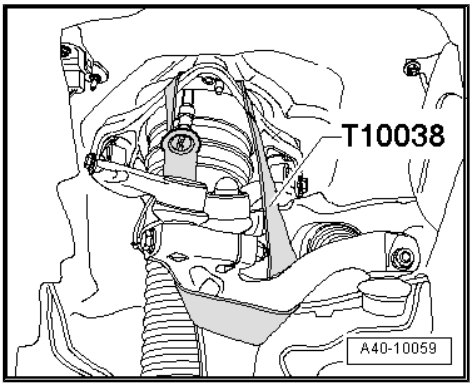


Caution

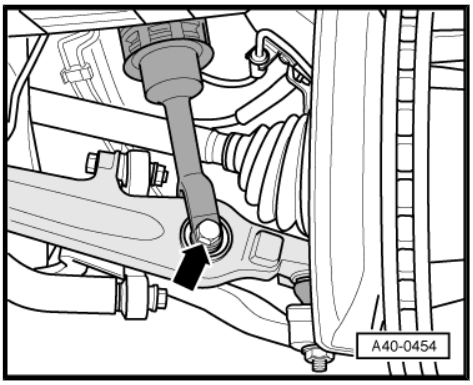
Danger of damage to the swivel joints of the upper links.

- *Support wheel bearing housing.*

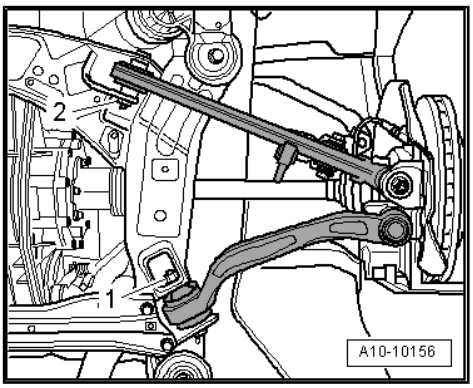
– Tie up wheel bearing housing using tensioning strap - T10038- as illustrated.



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



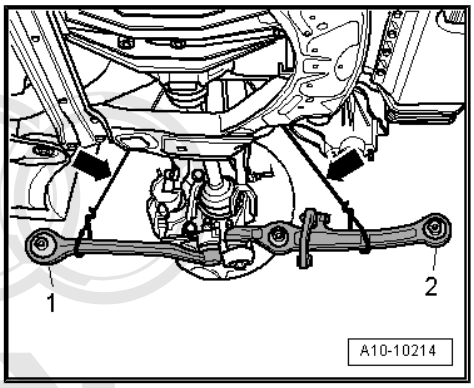
– Unbolt guide link -1- and track control link -2- at subframe.



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

Caution

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 wheel bearing housing as illustrated -arrow-.



– Repeat procedure on other side of vehicle.

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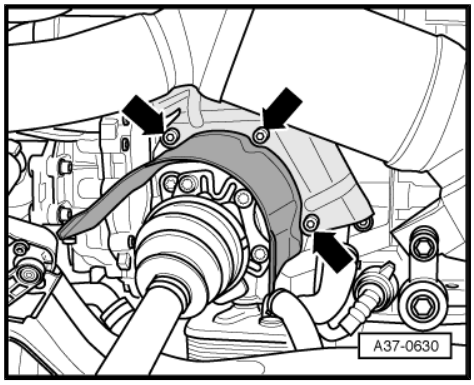
– Unbolt heat shield for drive shaft -arrows-.
– Unbolt drive shaft from flange shaft on gearbox.

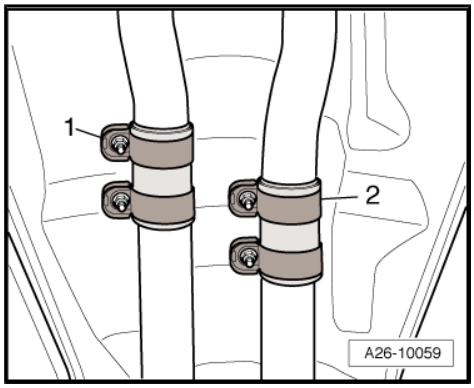


Caution

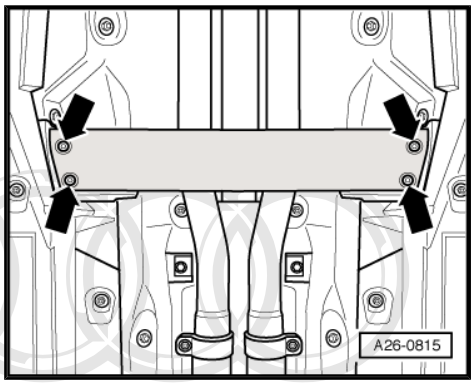
Take care not to damage brake hose.

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

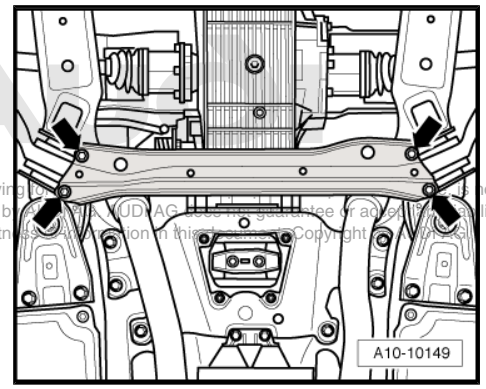
– Loosen clamps -1- and -2-.



– Unbolt cross piece (front) -arrows-.



– Unbolt cross piece from subframe -arrows-.



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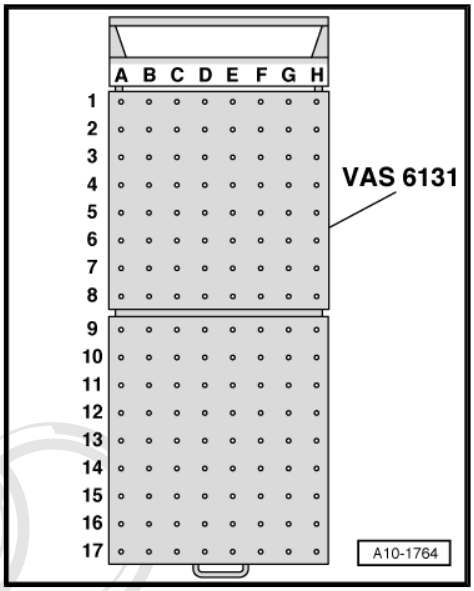
Set up the scissor-type assembly platform as follows:

– Set up scissor-type assembly platform - VAS 6131- with support set - 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- so that it is horizontal.

• Take note of spirit level (bubble gauge).

– Place scissor-type assembly platform - VAS 6131- 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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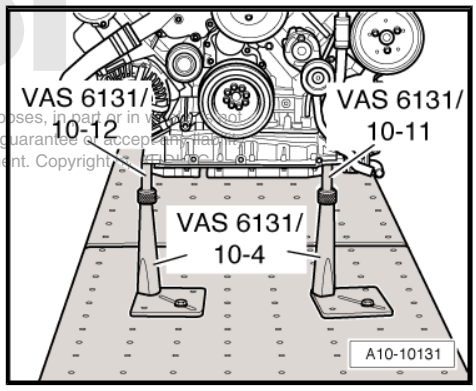
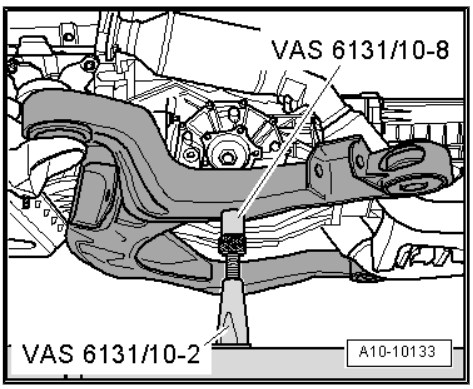
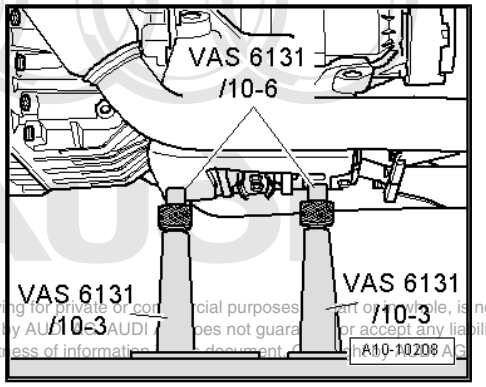


– Position support elements from -VAS 6131/10- at left and right of subframe, as shown in illustration.



– 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- .



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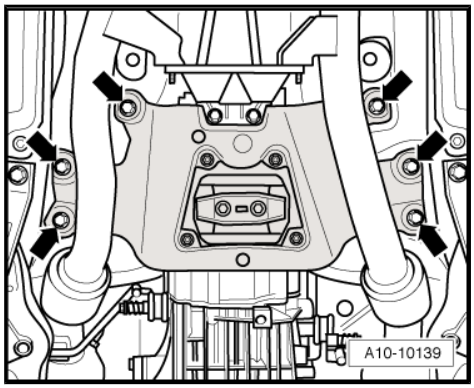
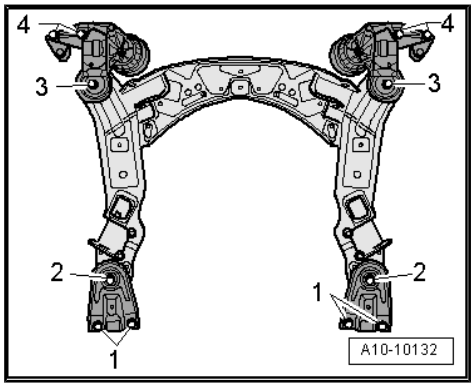
– Remove bolts -arrows- at tunnel cross member.



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

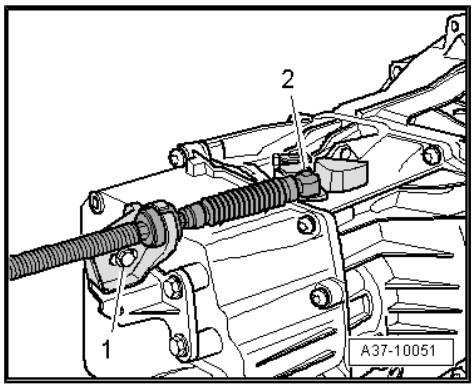


Note

- *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 the installation position of the 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 selector shaft lever.



Note

Take care not to bend or kink selector lever cable.

– Lower the scissor-type assembly platform - VAS 6131- 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 -VAS 6131/12-

Procedure

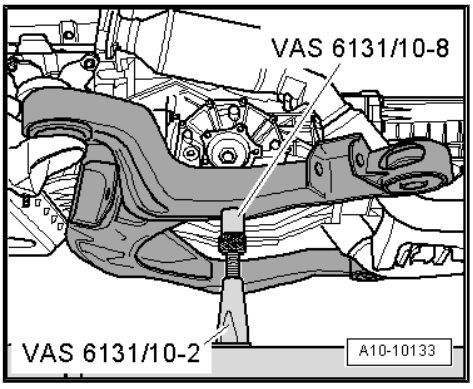
- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131-

– Screw down spindles of support elements from -VAS 6131/10- (left and right) at subframe as far as possible.

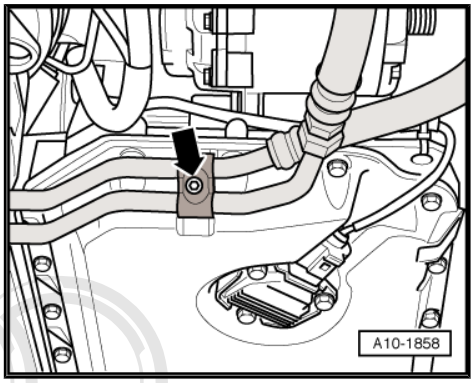
– Remove locating lugs from spindles.

– Remove subframe to the side.

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



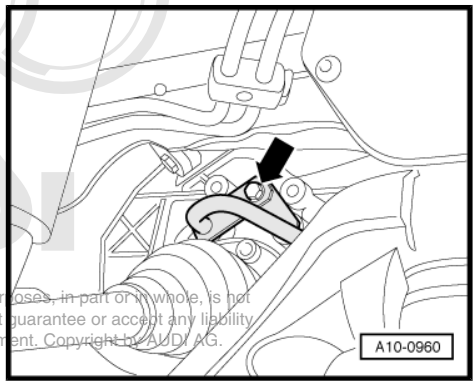
– Remove bracket -arrow- for ATF lines.



Note

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

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



Note

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

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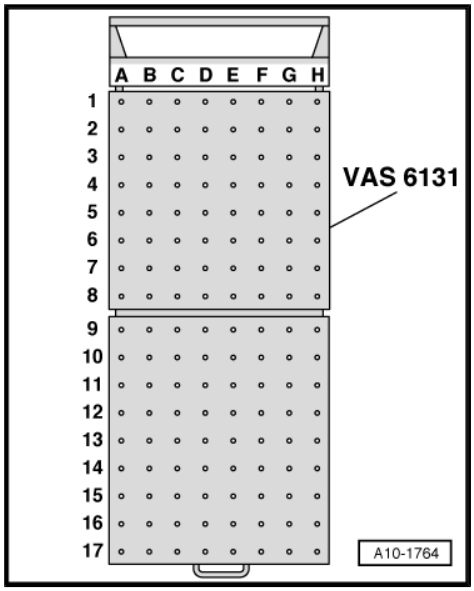
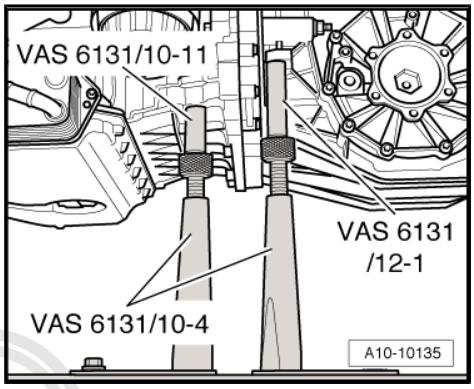
– Set up scissor-type assembly platform - VAS 6131- with support set for Audi - VAS 6131/10- and -VAS 6131/12- as follows:

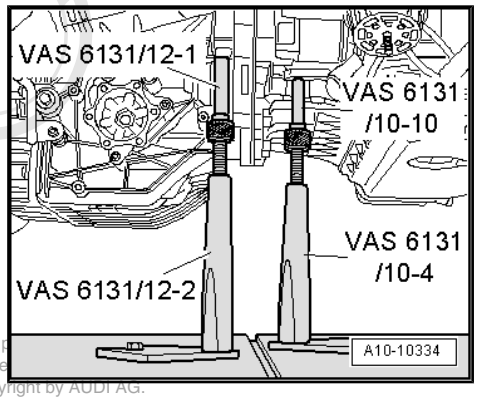
Platform coordinates	Parts of support set - VAS 6131/10- and - VAS 6131/12-			
B4 1)	/10-1	/10-4	/10-5	/10-11
G4 1)	/10-1	/10-4	/10-5	/10-12
B7	/10-1	/10-4	/10-5	/10-11
G7	/10-1	/10-4	/10-5	/10-10
C10	/10-1	/10-4	/10-5	/12-1
G10	/10-1	/12-2	/10-5	/12-1
E13 1)	/10-1	/10-3	/10-5	/10-6
D16 1)	/10-1	/10-3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



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



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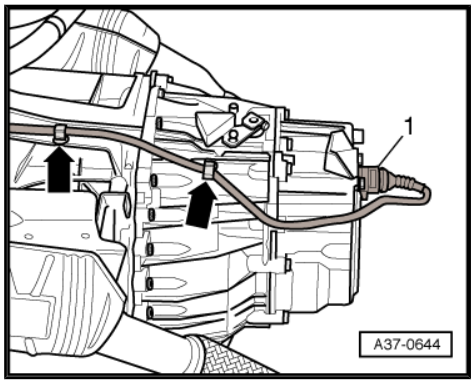
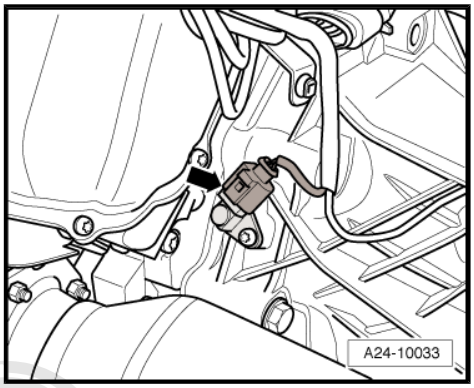
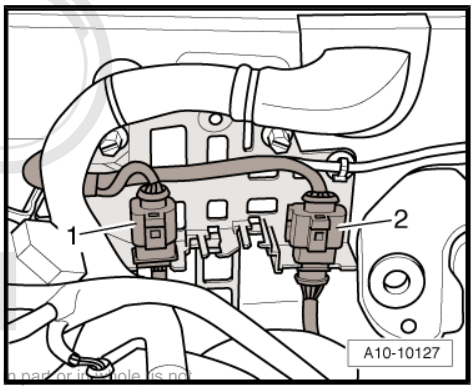
– Release electrical connector -1- and detach from gearbox.
– Move wiring harness going to engine clear -arrows-.



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



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



Note

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

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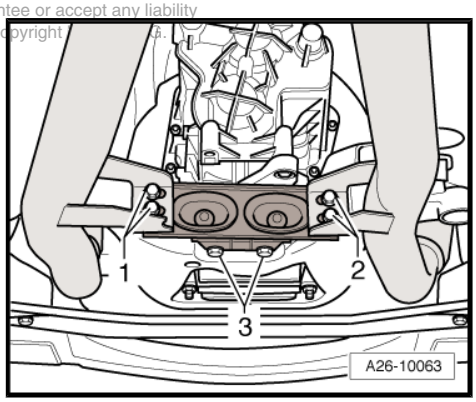
Note

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° – otherwise it can be damaged.

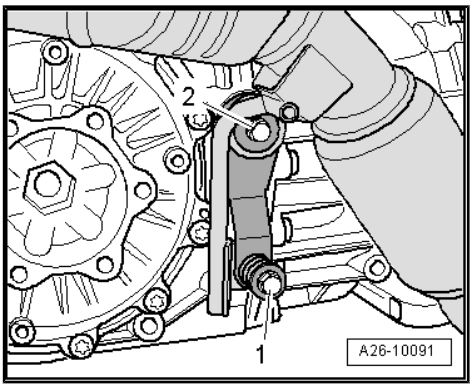
– Remove bolts -1- on bracket (rear) for exhaust system.



Note

Disregard items marked -2- and -3-.

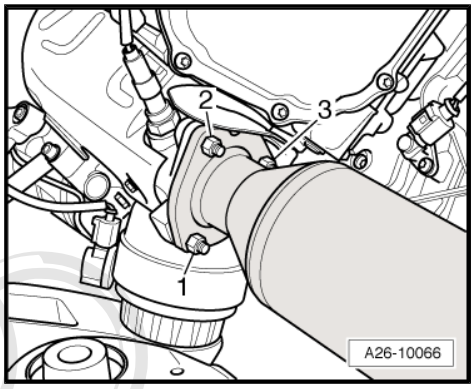
– Remove bolt -1- on bracket (left-side) for front exhaust pipe.



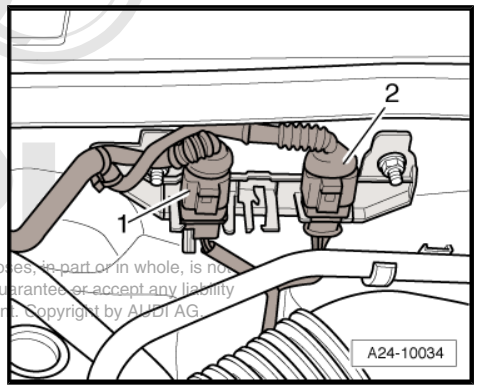
Note

Disregard -item 2-.

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



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



Note

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

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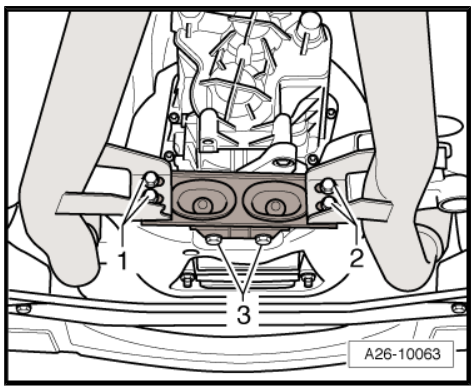
Note

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° – otherwise it can be damaged.

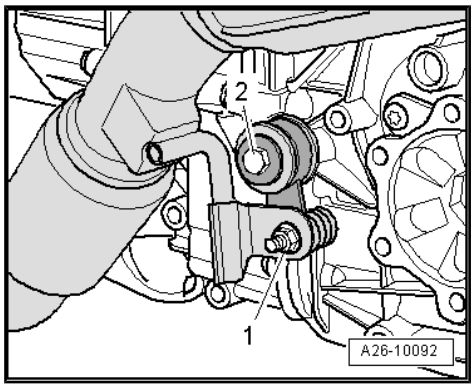
– Remove bolts -2- on bracket (rear) for exhaust system.



Note

Disregard items marked -1- and -3-.

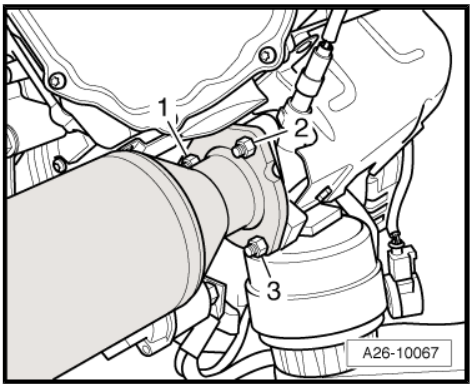
– Remove bolt -1- on bracket (right-side) for front exhaust pipe.



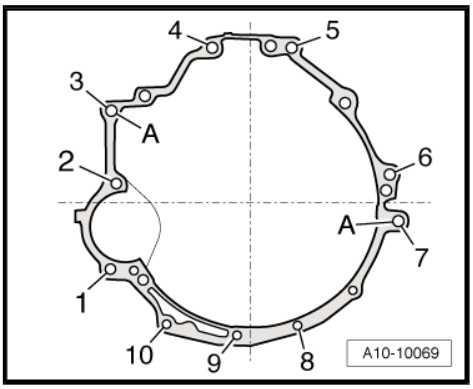
Note

Disregard -item 2-.

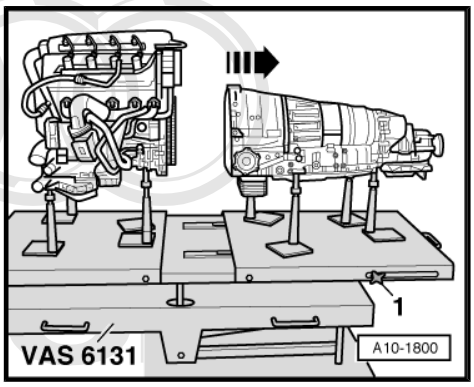
– Unscrew nuts -1 ... 3-.
– Detach front exhaust pipe (right-side) with catalytic converter.



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



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



2.3 Securing engine to engine and gearbox support

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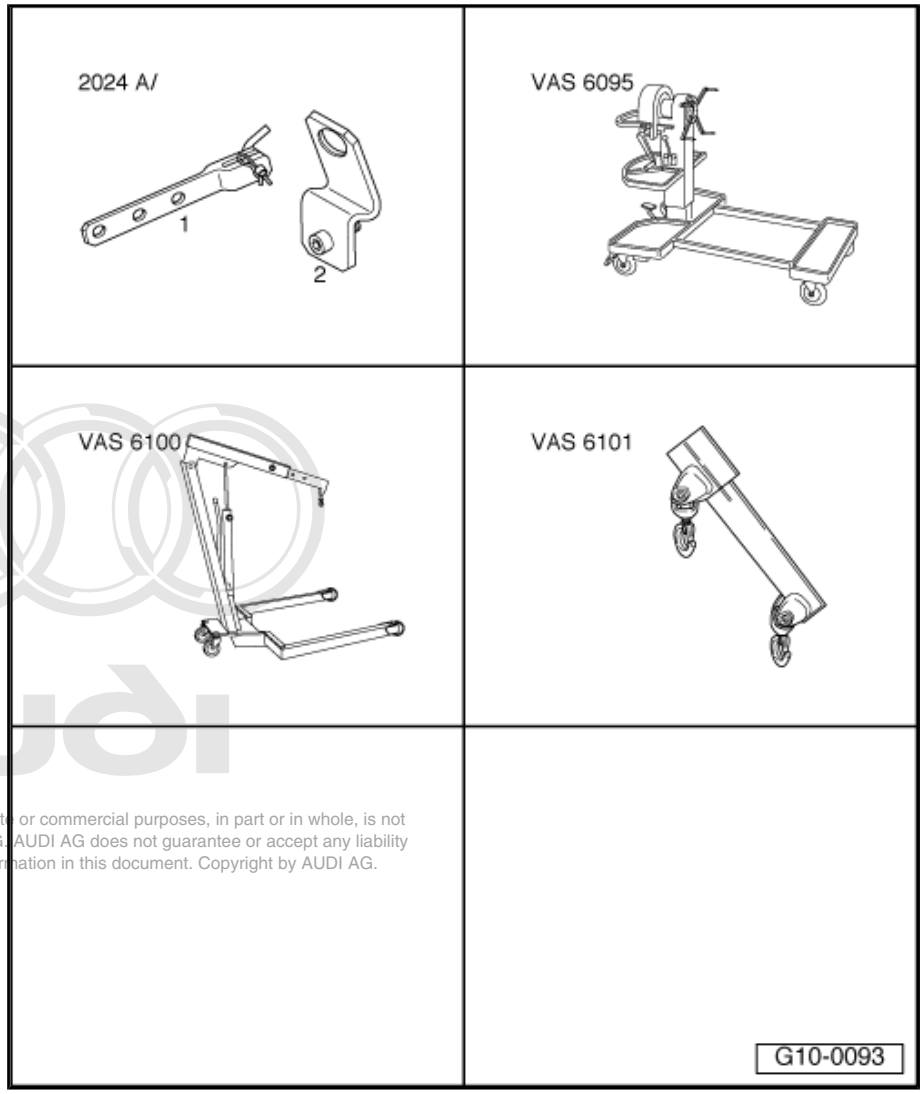
Special tools and workshop equipment required

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



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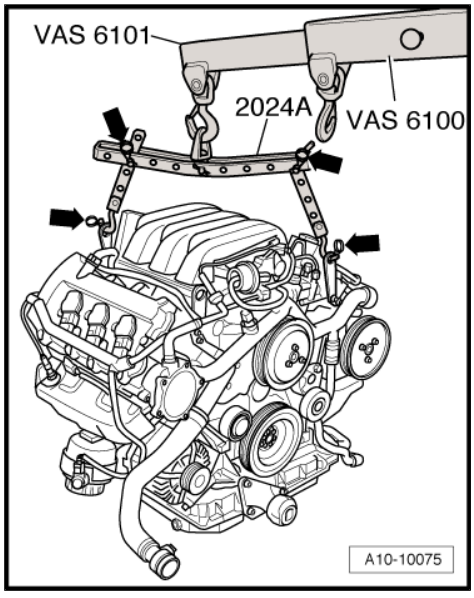
Procedure

- Engine separated from gearbox ⇒ “2.2 Detaching multitronic gearbox from engine”, page 57 .

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



Note

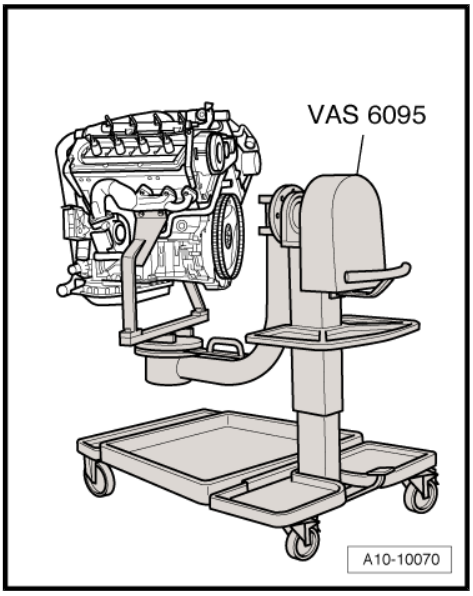
To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks must be positioned as shown.

WARNING

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

– Unbolt engine supports from cylinder block.

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



2.4 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 oil 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 flywheel; remove corrosion and apply only a very thin coating of grease - G 000 100- to the splines. Remove any excess grease.*

– Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install dowel sleeves if necessary.

– Bolt gearbox to engine (use new bolts).

Note

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

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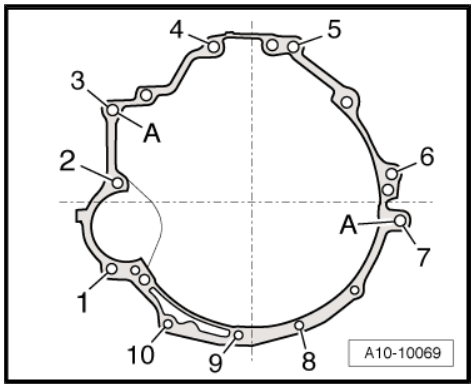
Engine/gearbox securing bolts

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] Property class 10.9.



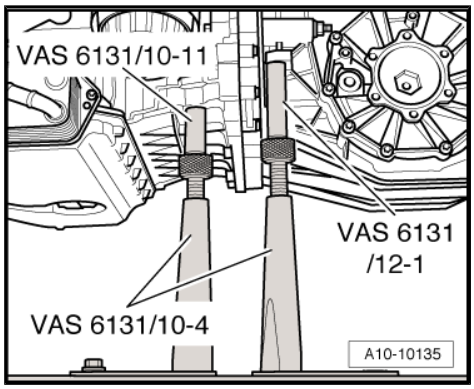
Perform further installation in reverse order, paying attention to the following:

– Install front exhaust pipes together with catalytic converter: left-side
⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242 , right-side
⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246 .

– Secure ATF lines ⇒ Rep. gr. 37 .

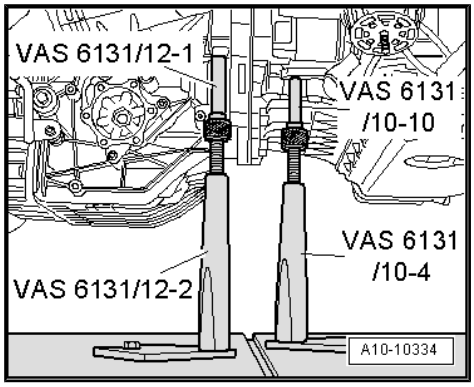
– Screw down spindles of support elements on left side of engine/gearbox assembly.

– Unscrew both base plates for support elements (left-side) at scissor-type assembly platform - VAS 6131- .



– 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- .



Note

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

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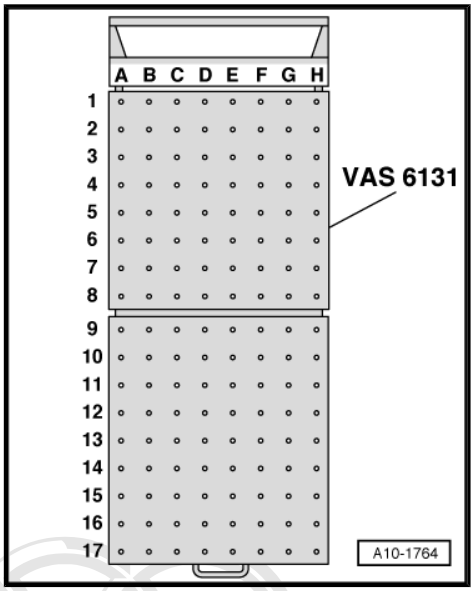
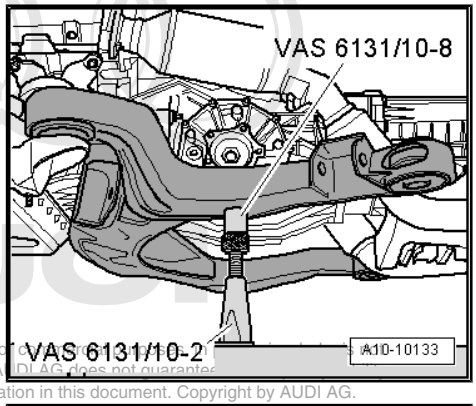
– Set up scissor-type assembly platform - VAS 6131- with support set - VAS 6131/10- as follows:

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- .
– Carefully guide engine/gearbox assembly together with subframe into the body from below using scissor-type assembly platform - VAS 6131- .



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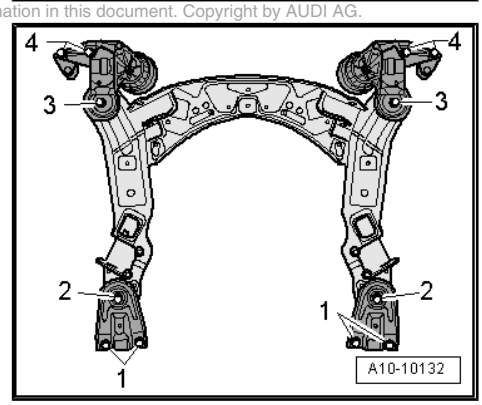
– Adjust the subframe and consoles for engine mountings according to the markings made on the longitudinal members during removal.
– Only tighten bolts for subframe and consoles for engine mountings to the specified torque (do not turn further); tighten bolts only after performing wheel alignment check.

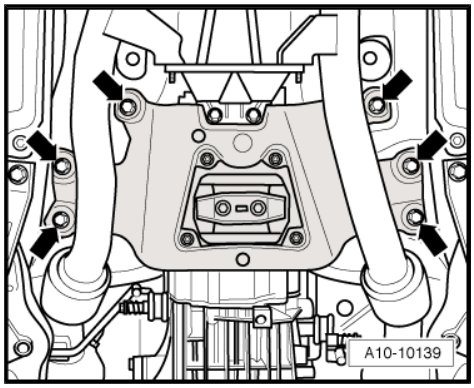
1 - 55 Nm
2 - 115 Nm
3 - 115 Nm
4 - 75 Nm



WARNING

The vehicle must not be driven at this stage.

– Tighten bolts -arrows- at tunnel cross member.



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 ⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .
– Install cross piece (front) ⇒ Rep. gr. 50 .
– Install cross piece (front) for subframe ⇒ Rep. gr. 40 .
– Install air conditioner compressor ⇒ Rep. gr. 87 .
– Install poly V-belt ⇒ “1.4 Removing and installing poly V-belt”, page 73 .

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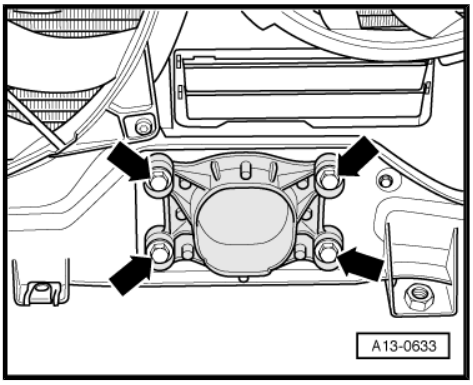

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight and tighten bolts -arrows-.
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Observe notes on procedures required after connecting 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 .
– Check oil level ⇒ “1.13 Checking oil level”, page 202 .
– Bleed fuel system ⇒ Rep. gr. 24 .
– Fill cooling system ⇒ page 207 .
– 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 lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- *Do not use degreased parts.*
- *Tolerance for tightening torques: ± 15 %.*

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Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Console for engine mounting to longitudinal member		75
Tunnel cross member to body		40
Hydraulic pressure line to power steering pump		47
Fuel hose to fuel line		22
Torque reaction support to engine		40
Stop for torque reaction support to lock carrier		23
Hose clips (9 mm wide)		3
Hose clips (13 mm wide)		5.5

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13 – Crankshaft group

1 Servicing work on pulley end

⇒ “1.1 Poly V-belt drive - exploded view”, page 69

⇒ “1.2 Removing and installing coolant pump pulley”, page 70

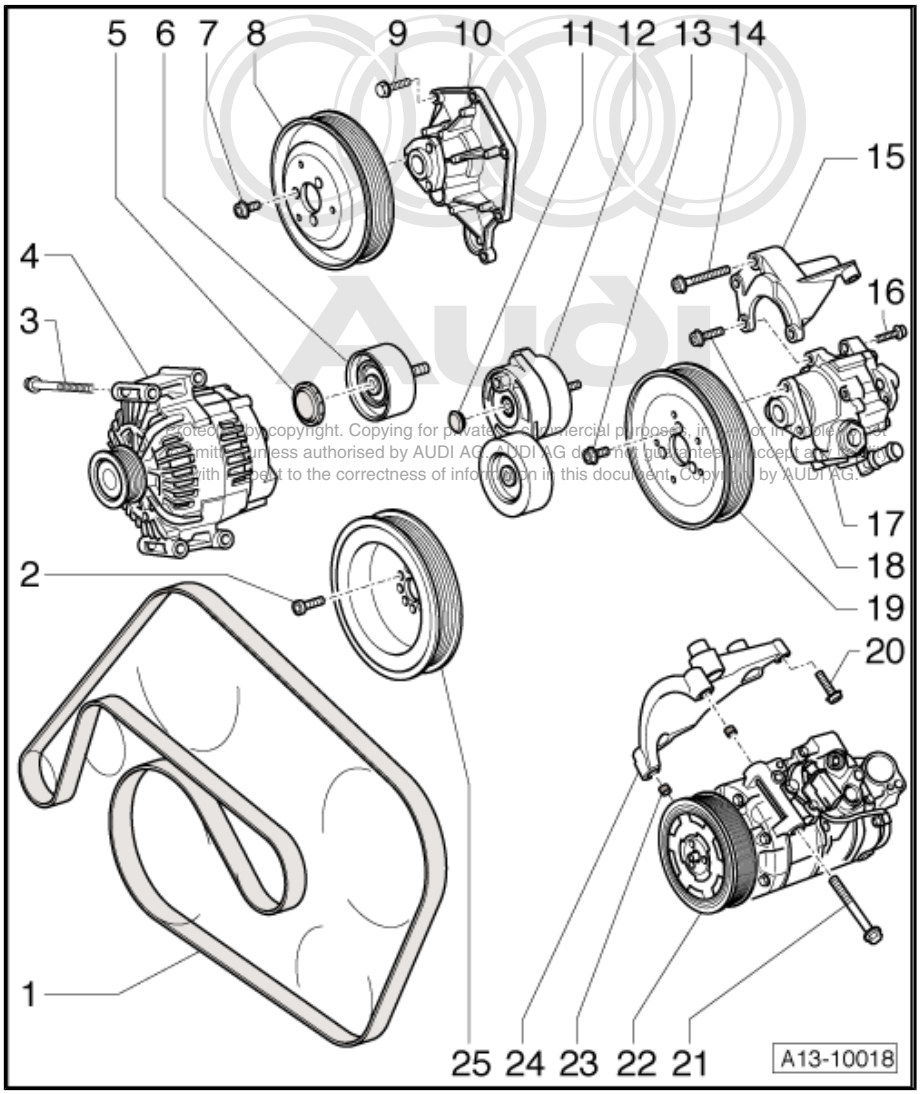
⇒ “1.3 Removing and installing power steering pump pulley”, page 71

⇒ “1.4 Removing and installing poly V-belt”, page 73

⇒ “1.5 Removing and installing poly V-belt pulley for crankshaft”, page 74

⇒ “1.6 Renewing sealing flange (pulley end) with crankshaft oil seal”, page 75

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-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ❑ Removing and installing ⇒ “1.4 Removing and installing poly V-belt”, page 73
- ❑ When installing, make sure it is properly seated on pulleys.

2 - 20 Nm + 90° (1/4 turn) 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 ⇒ “1.2 Removing and installing coolant pump pulley”, page 70

9 - 9 Nm

10 - Coolant pump

- ❑ Removing and installing ⇒ “1.4 Removing and installing coolant pump”, page 212

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 - Poly V-belt pulley for power steering pump

- ❑ Removing and installing

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 70) when installing

23 - Dowel sleeve

- ❑ 2x

24 - Bracket for air conditioner compressor

- ❑ Pay attention to dowel sleeves ⇒ Item 23 (page 70) when installing

25 - Poly V-belt pulley for crankshaft

- ❑ Removing and installing ⇒ “1.5 Removing and installing poly V-belt pulley for crankshaft”, page 74

1.2 Removing and installing coolant pump pulley

Special tools and workshop equipment required

- ♦ Pin wrench - 3212-

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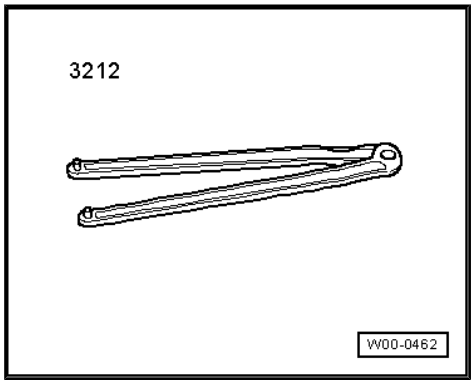
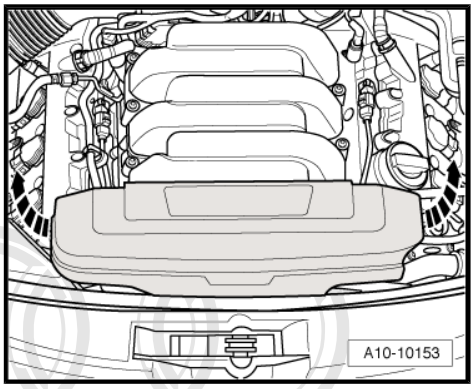
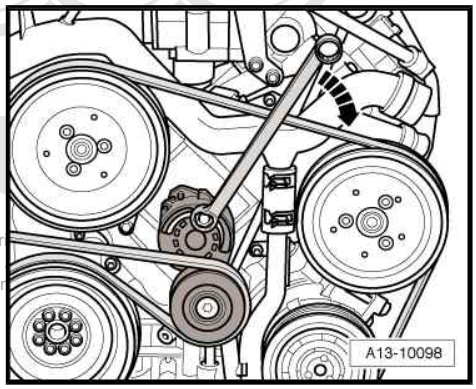


Removing

– 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.



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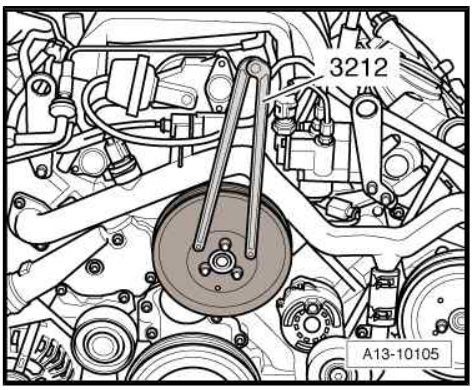
– Unbolt belt pulley from coolant pump.
– Use pin wrench - 3212- to counterhold pulley when loosening bolts.



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.

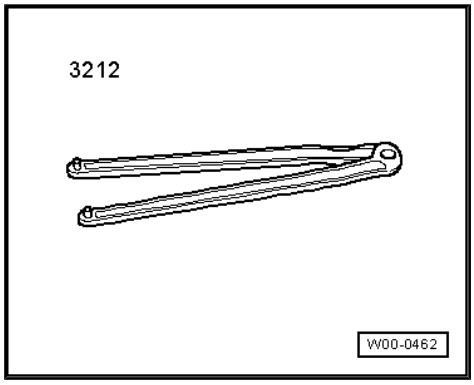
Tightening torque

Component	Nm
Poly V-belt pulley to coolant pump	20

1.3 Removing and installing power steering pump pulley

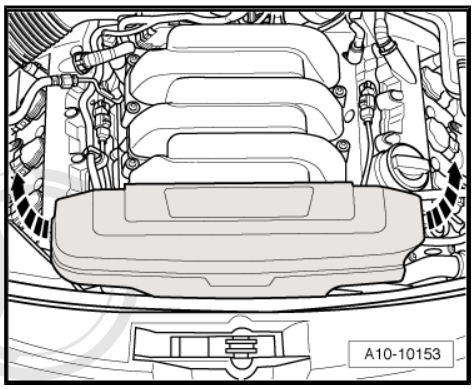
Special tools and workshop equipment required

♦ Pin wrench - 3212-

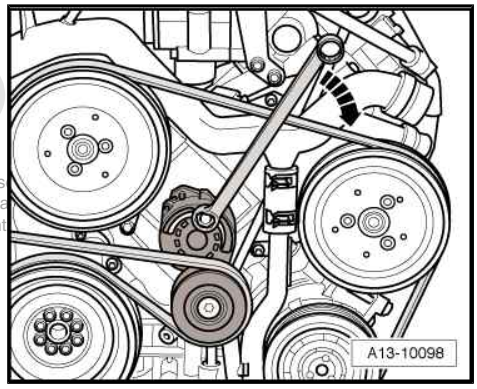


Removing

– 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.



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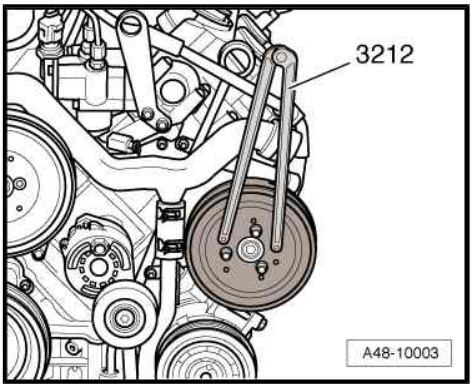
– Unbolt belt pulley from power steering pump.
– Use pin wrench - 3212- to counterhold pulley when loosening bolts.



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.

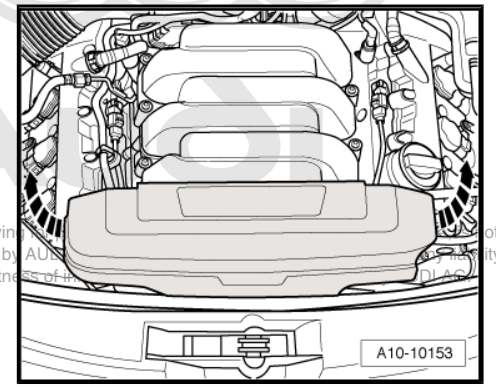
Tightening torque

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-.



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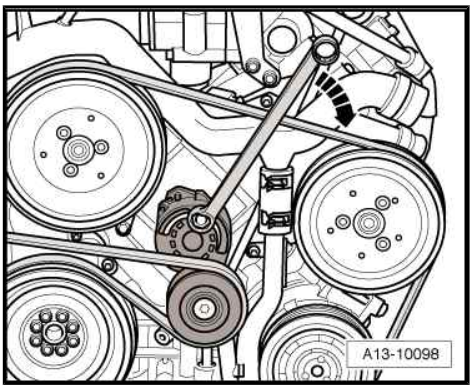
Note

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

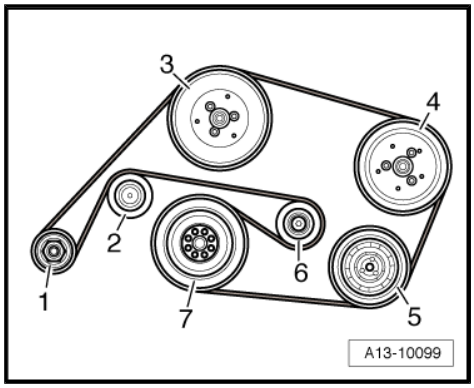


– To slacken poly V-belt turn tensioner in direction of -arrow-.
– Remove poly V-belt and release pressure from the tensioner.

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. Crankshaft

Note

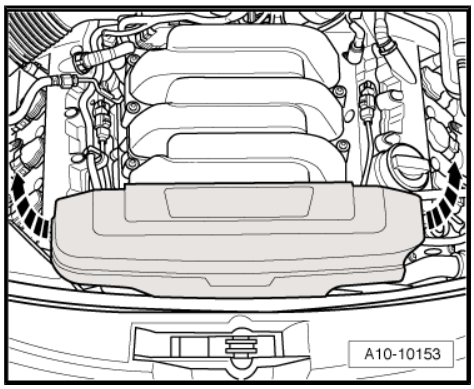
When installing poly V-belt, make sure it is properly seated on pulleys.

– Start engine and check that belt runs properly.

1.5 Removing and installing poly V-belt pulley for crankshaft

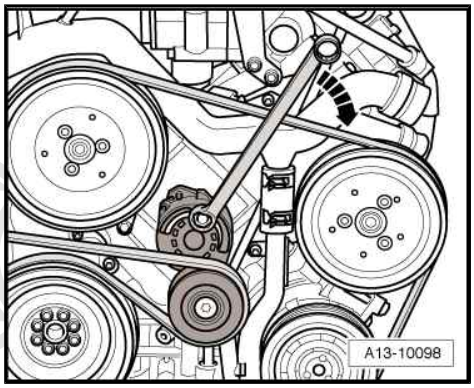
Removing

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



Note

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



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

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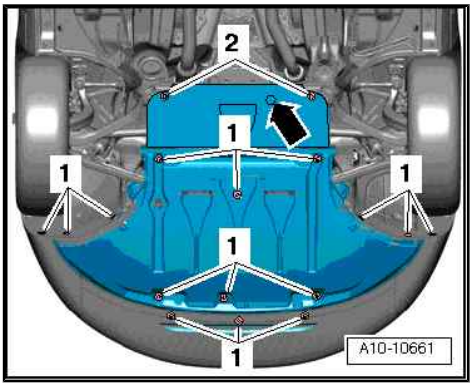
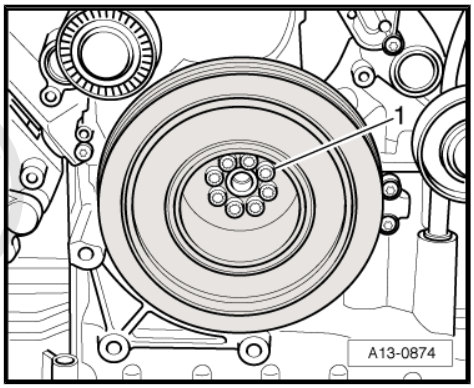
– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.



– Mark position of poly V-belt pulley for crankshaft for re-installation.
– Remove bolts -1-.
– Remove poly V-belt pulley for crankshaft.



Installing

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

– Install poly V-belt
⇒ “1.4 Removing and installing poly V-belt”, page 73 .

Tightening torque

Component	Nm
Poly V-belt pulley to crankshaft	20 + 90° 1)2)

- 1) Renew bolts.
- 2) 90° = one quarter turn.

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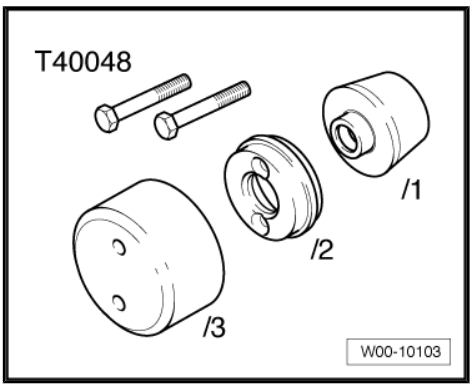
1.6 Renewing sealing flange (pulley end) with crankshaft oil seal

Special tools and workshop equipment required

♦ Assembly tool - T40048-



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

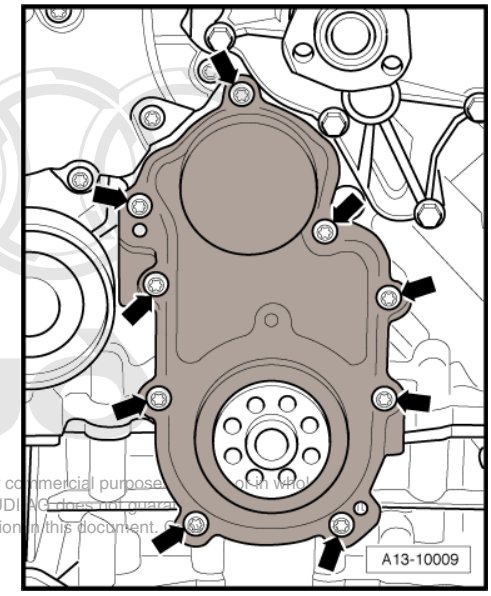
Procedure

– Unbolt belt pulley from coolant pump
⇒ “1.2 Removing and installing coolant pump pulley”, page 70 .

– Remove poly V-belt pulley for crankshaft
⇒ “1.5 Removing and installing poly V-belt pulley for crankshaft”, page 74 .

– Remove bolts -arrows-.

– Remove sealing flange (pulley end).



Note

Renew sealing flange (pulley end).

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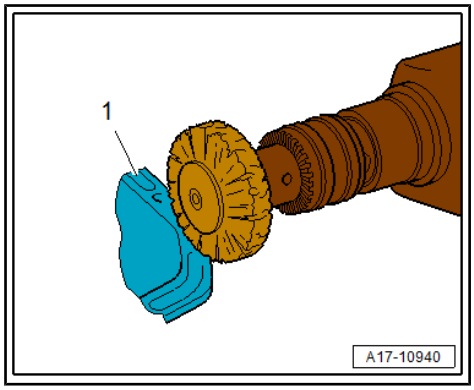
Caution

Protect lubrication system against contamination.

- *Cover exposed parts of the engine.*



WARNING

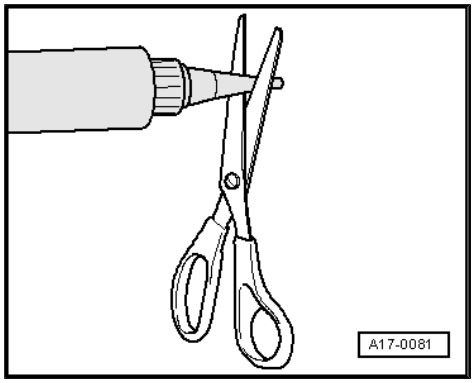
Risk of eye injury.

- *Put on safety goggles.*

– Remove sealant residue from cylinder block and sump (top section) with rotating plastic brush or similar.

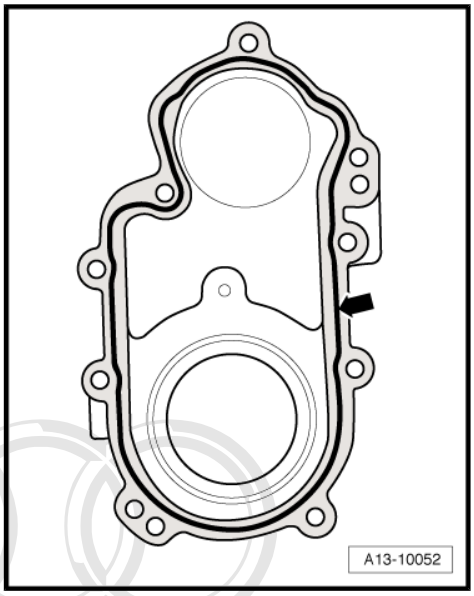
– Clean sealing surfaces; they must be free of oil and grease.

– Cut off nozzle of tube at front marking (∅ 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.

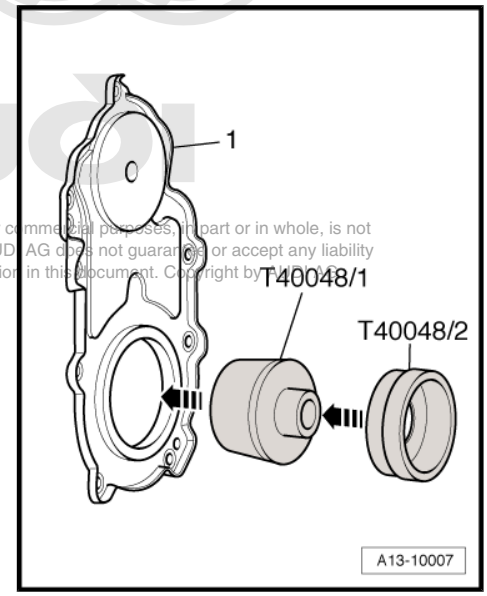


Note

- *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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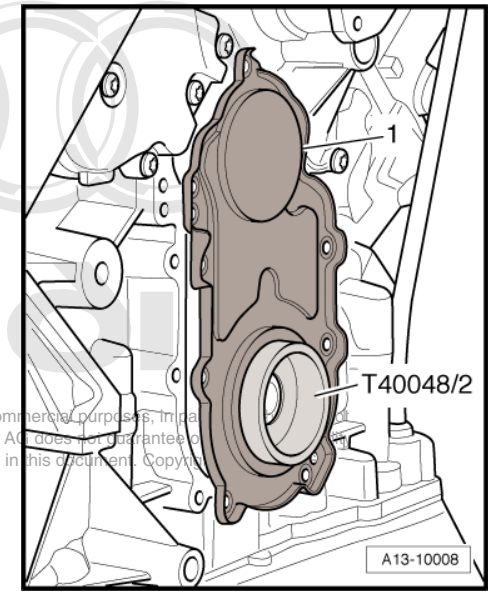
– First position sealing flange -1- (with assembly sleeve - T40048/2- inserted) on crankshaft.
– Keep sealing flange straight while pushing it onto engine sealing surface. Then bolt on.

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

– Install poly V-belt pulley for crankshaft
⇒ “1.5 Removing and installing poly V-belt pulley for crankshaft”, page 74 .
– Install poly V-belt pulley for coolant pump
⇒ “1.2 Removing and installing coolant pump pulley”, page 70 .
– Install poly V-belt
⇒ “1.4 Removing and installing poly V-belt”, page 73 .



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Tightening torque

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

2 Servicing work on timing chain end

⇒ “2.1 Dual-mass flywheel on vehicles with manual gearbox - exploded view”, page 79

⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80

⇒ “2.3 Extracting and driving in needle bearing for dual-mass flywheel - vehicles with manual gearbox”, page 81

⇒ “2.4 Flywheel for vehicles with multitronic gearbox - exploded view”, page 83

⇒ “2.5 Removing and installing damper unit”, page 84

⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85

⇒ “2.7 Renewing crankshaft oil seal (timing chain end)”, page 86

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

Note

Servicing clutch ⇒ Rep. gr. 30

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1 - Dual-mass flywheel

- ❑ Removing and installing ⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80

2 - 60 Nm + 90° (1/4 turn) further

- ❑ Renew

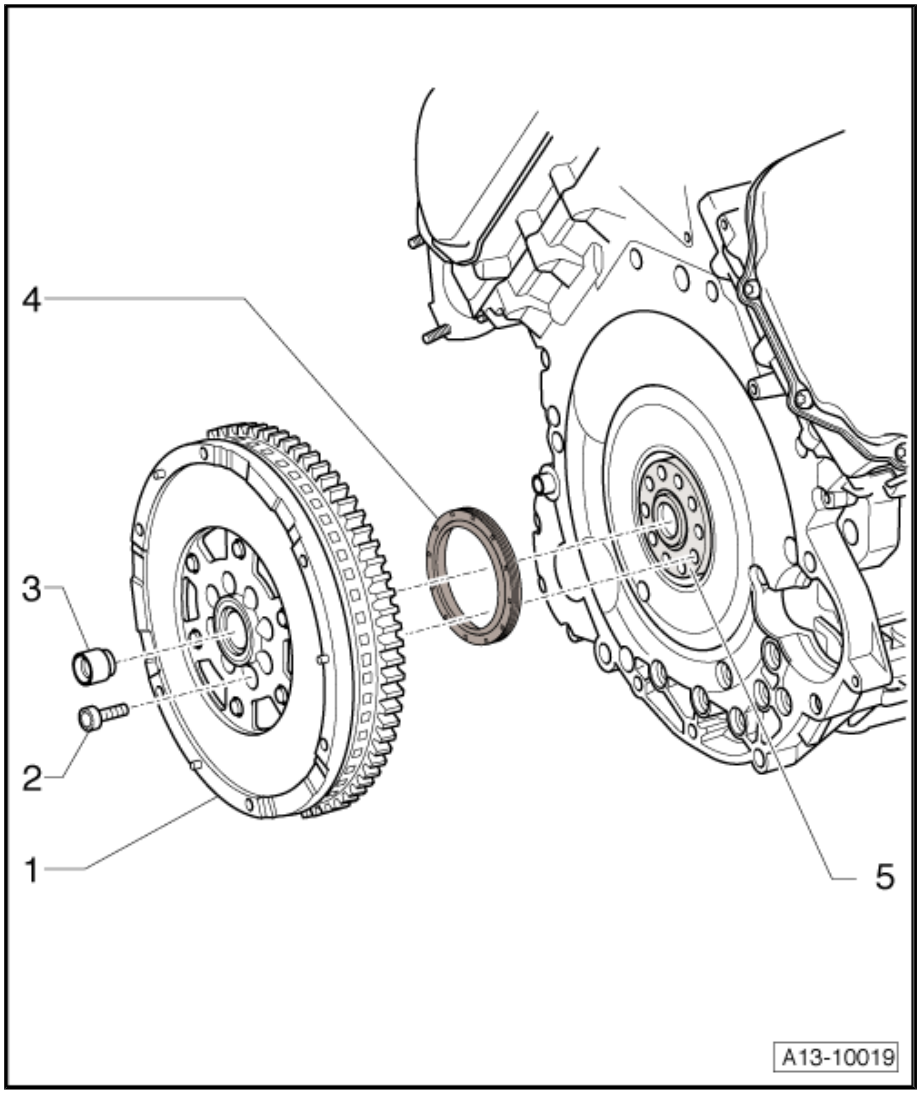
3 - Needle bearing

- ❑ Extracting and driving in ⇒ “2.3 Extracting and driving in needle bearing for dual-mass flywheel - vehicles with manual gearbox”, page 81

4 - Crankshaft oil seal (timing chain end)

- ❑ Renewing ⇒ “2.7 Renewing crankshaft oil seal (timing chain end)”, page 86

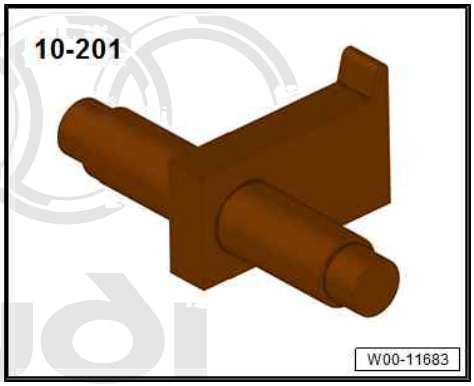
5 - Crankshaft



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

Special tools and workshop equipment required

- ♦ Counterhold tool - 10-201-



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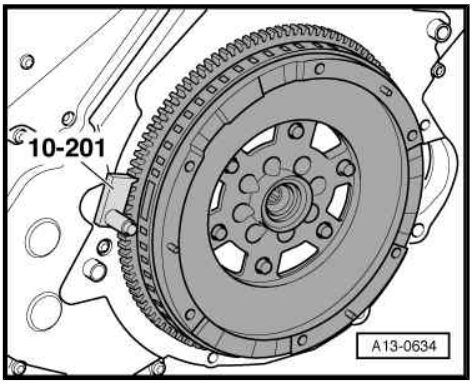
Removing

– Remove gearbox ⇒ Rep. gr. 34 .

– Remove clutch pressure plate ⇒ Rep. gr. 30 .

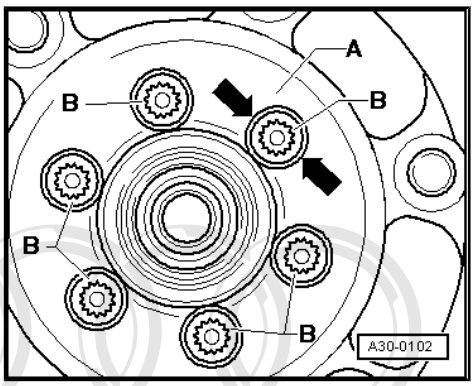
– Mark installation position of dual-mass flywheel in relation to crankshaft.

– Insert counterhold tool - 10-201- to slacken bolts.



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
⇒ "2.3 Extracting and driving in needle bearing for dual-mass flywheel - vehicles with manual gearbox", page 81 .

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– Use new securing bolts.

– Fit counterhold tool - 10-201- the other way round to tighten bolts.

– Install clutch pressure plate ⇒ Rep. gr. 30 .

– Install gearbox ⇒ Rep. gr. 34 .

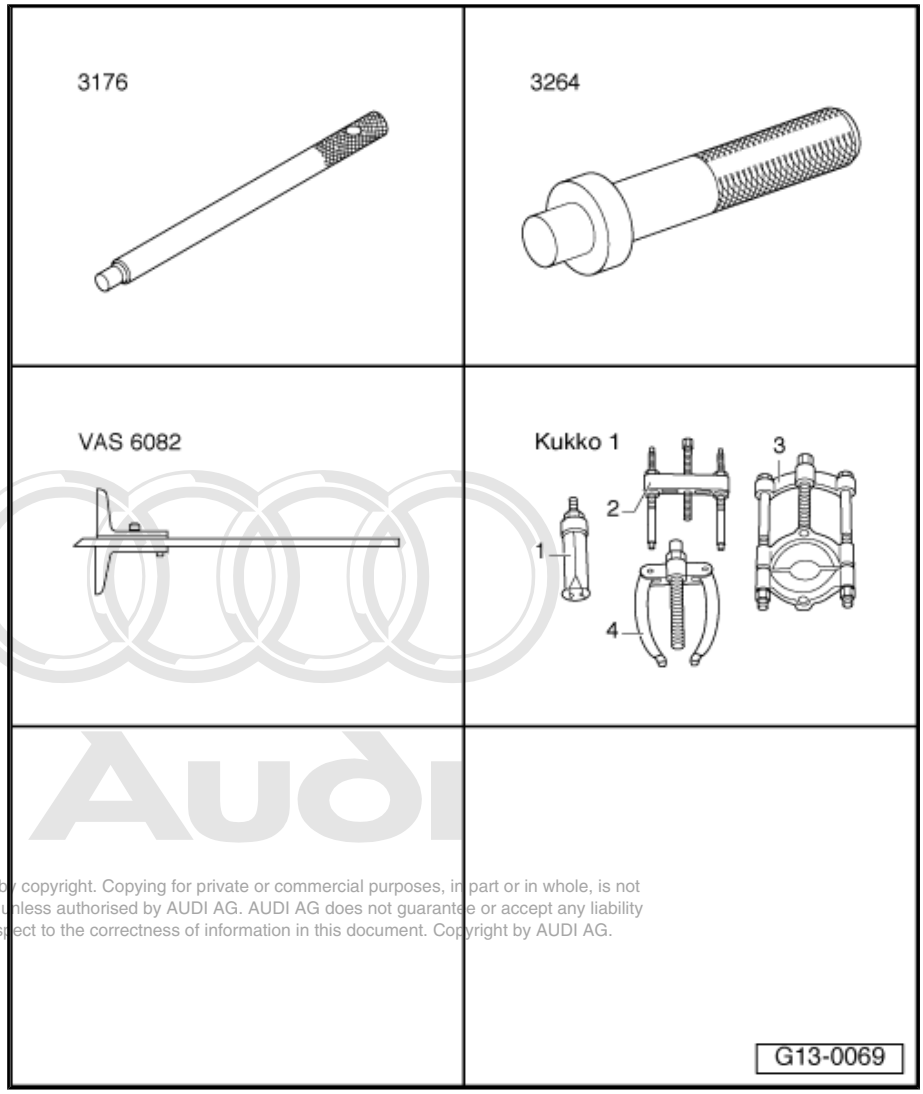
Tightening torques

Component	Nm
Dual-mass flywheel to crankshaft	60 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	

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

Special tools and workshop equipment required

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



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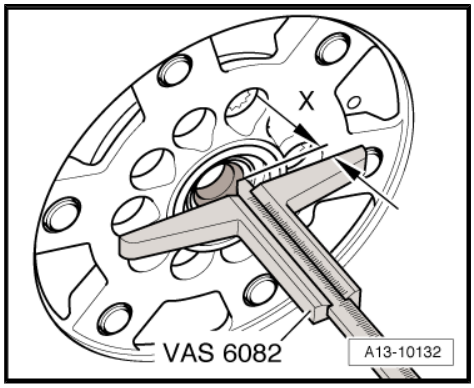
Procedure

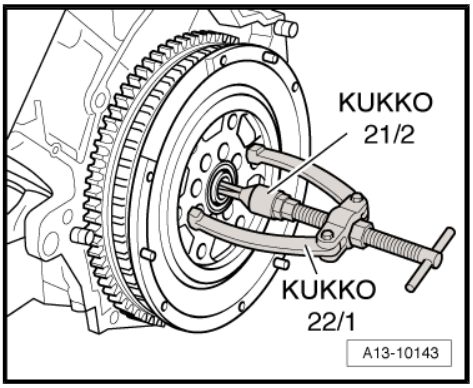
– Remove gearbox ⇒ Rep. gr. 34 .

– Remove clutch pressure plate ⇒ Rep. gr. 30 .

– Measure and make a note of insertion depth -dimension x- of needle bearing in dual-mass flywheel, as it will be required when re-installing the bearing.



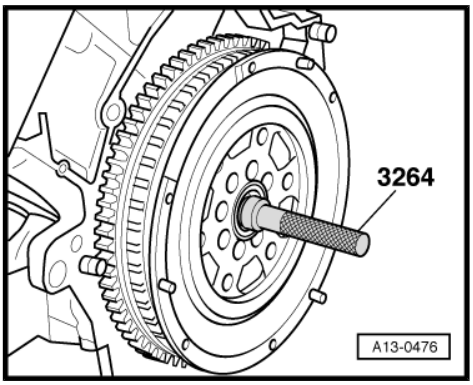
– Remove needle bearing using internal puller - Kukko 21/2- and counter-support - Kukko 22/1- .



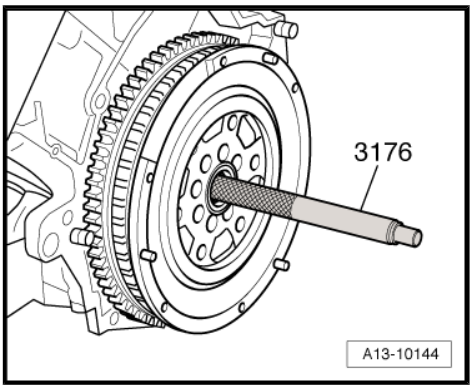
Note

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

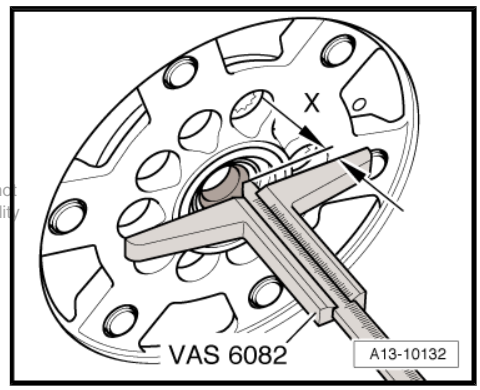
– Drive needle bearing into dual-mass flywheel using punch - 3264- .



– Use back of centring mandrel - 3176- to press needle bearing in as far as previously measured insertion depth.



– Finally, check insertion depth -dimension x- of needle bearing in dual-mass flywheel.
– Install clutch pressure plate ⇒ Rep. gr. 30 .
– Install gearbox ⇒ Rep. gr. 34 .



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2.4 Flywheel for vehicles with multitronic gearbox - exploded view

1 - Damper unit

- ❑ Removing and installing ⇒ “2.5 Removing and installing damper unit”, page 84

2 - 22 Nm

3 - Flywheel

- ❑ Removing and installing ⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85

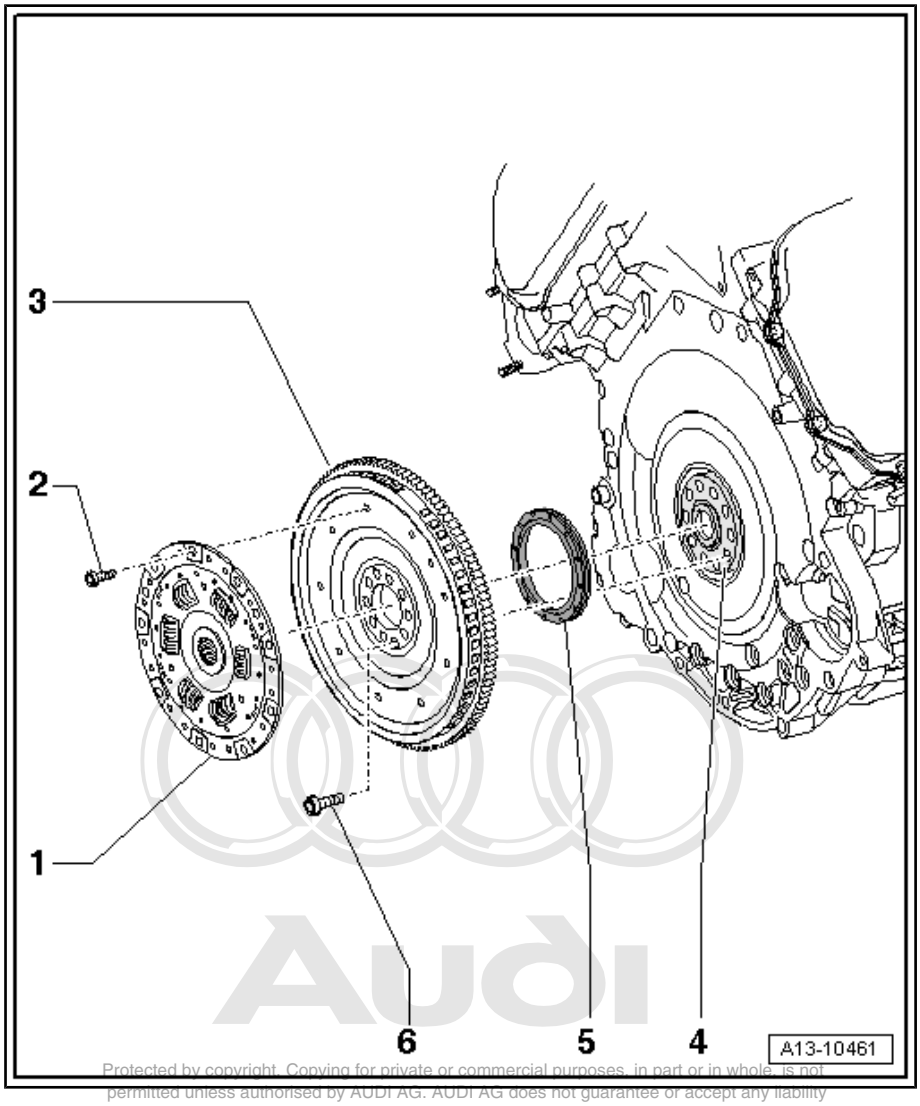
4 - Crankshaft

5 - Crankshaft oil seal (timing chain end)

- ❑ Renewing ⇒ “2.7 Renewing crankshaft oil seal (timing chain end)”, page 86

6 - 60 Nm + 90° (1/4 turn) further

- ❑ Renew



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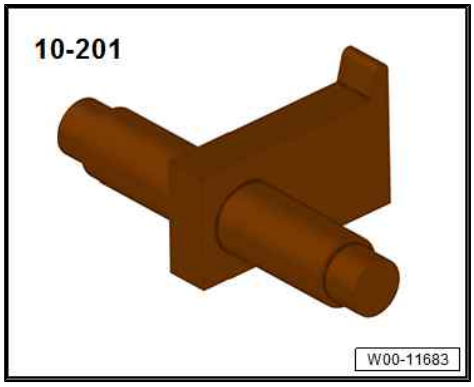
2.5 Removing and installing damper unit

Special tools and workshop equipment required

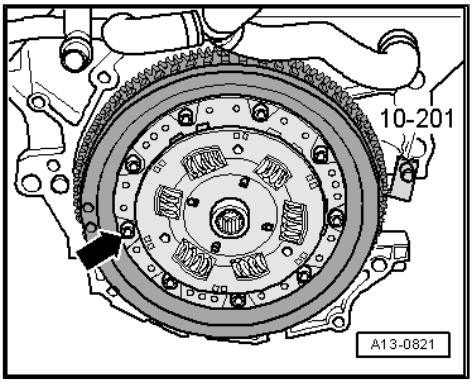
- ♦ Counterhold tool - 10 - 201-



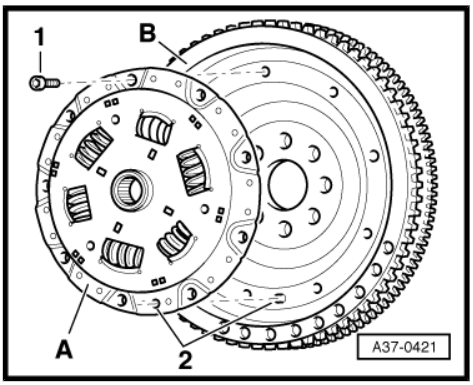
Removing

– Remove multitronic gearbox ⇒ Rep. gr. 37 .

– Attach counterhold tool - 10 - 201- in order to loosen bolts -arrows-.



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



Installing

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

Note

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

– Align the damper unit -A- and flywheel -B-.

• The two lugs -2- must align.

– Fit bolts -1- hand-tight and tighten in diagonal sequence.

– Install multitronic gearbox ⇒ Rep. gr. 37 .

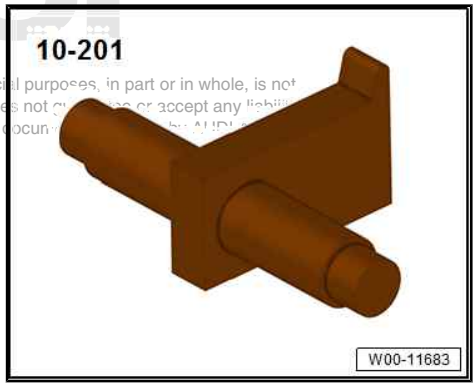
Tightening torque

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-



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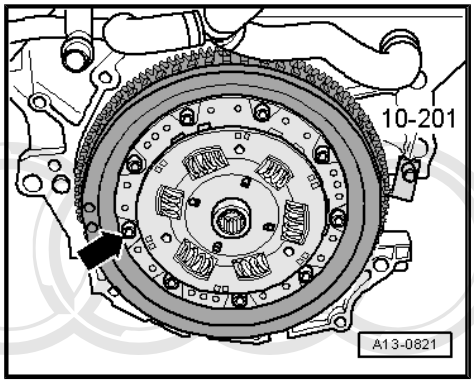
Removing

– Remove multitronic gearbox ⇒ Rep. gr. 37 .

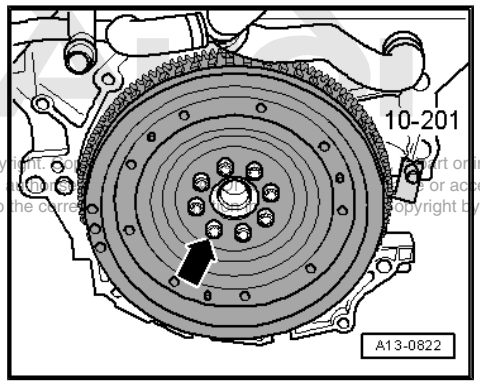
– Remove damper unit -arrow-
⇒ “2.5 Removing and installing damper unit”, page 84 .



– Mark installation position of flywheel on engine -arrow-.

– Attach counterhold tool - 10-201- in order to loosen bolts.

– Unbolt flywheel.



Installing

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

– Use new securing bolts.

– Reverse position of counterhold tool - 10-201- in order to tighten bolts.

– Install damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 .

– Install multitronic gearbox ⇒ Rep. gr. 37 .

Tightening torque

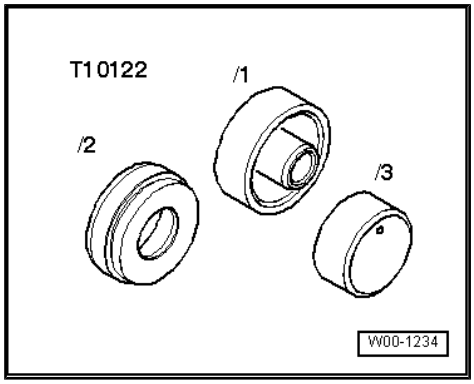
Component	Nm
Flywheel to crankshaft	60 + 90° 1)2)

- 1) Renew bolts.
- 2) 90° = one quarter turn.

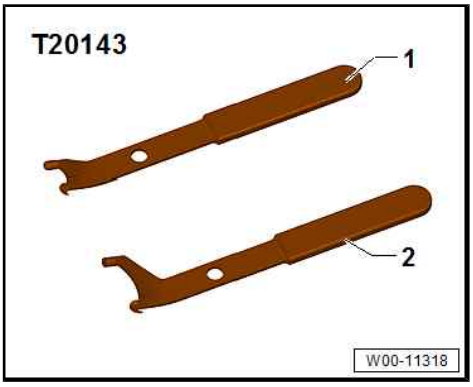
2.7 Renewing crankshaft oil seal (timing chain end)

Special tools and workshop equipment required

◆ Fitting tool - T10122-



♦ Oil seal extractor lever - T20143/2-



Procedure

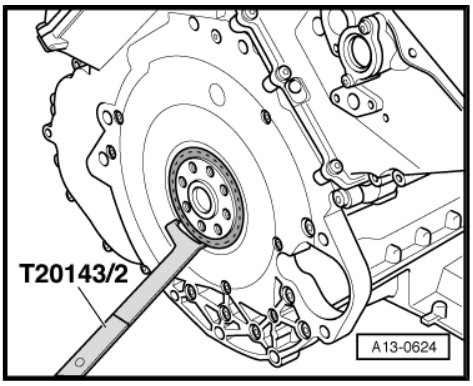
– Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

– Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. gr. 30 and dual-mass flywheel
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 .

– Vehicles with multitronic gearbox: Remove damper unit
⇒ page 84 and flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multi-tronic gearbox”, page 85 .

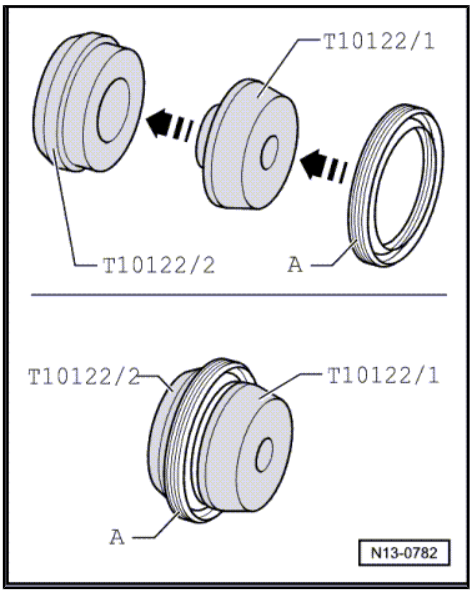
– Pry out oil seal using oil seal extractor lever - T20143/2- .

– 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- .



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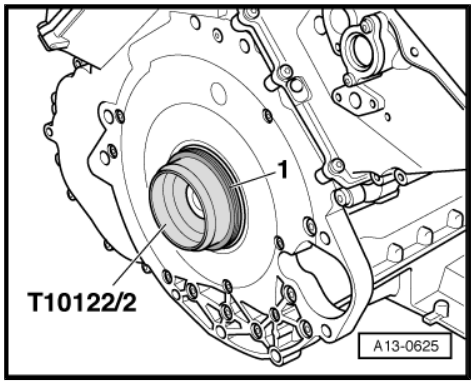
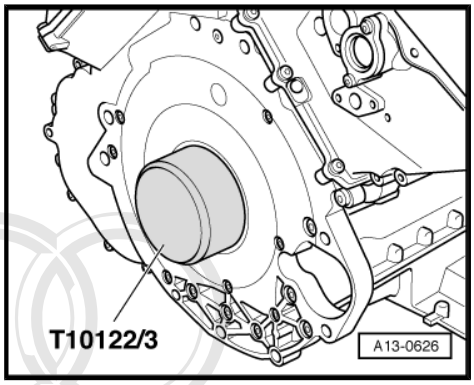
– Fit the assembly sleeve - T10122/2- with oil seal -1- onto crankshaft.



– 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 ⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 and pressure plate ⇒ Rep. gr. 30 .

– Vehicles with multitronic gearbox: Install flywheel ⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 and damper unit ⇒ “2.5 Removing and installing damper unit”, page 84 .

– Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

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3 Timing chain covers

⇒ “3.1 Timing chain covers - exploded view”, page 89

⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90

⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94

3.1 Timing chain covers - exploded view

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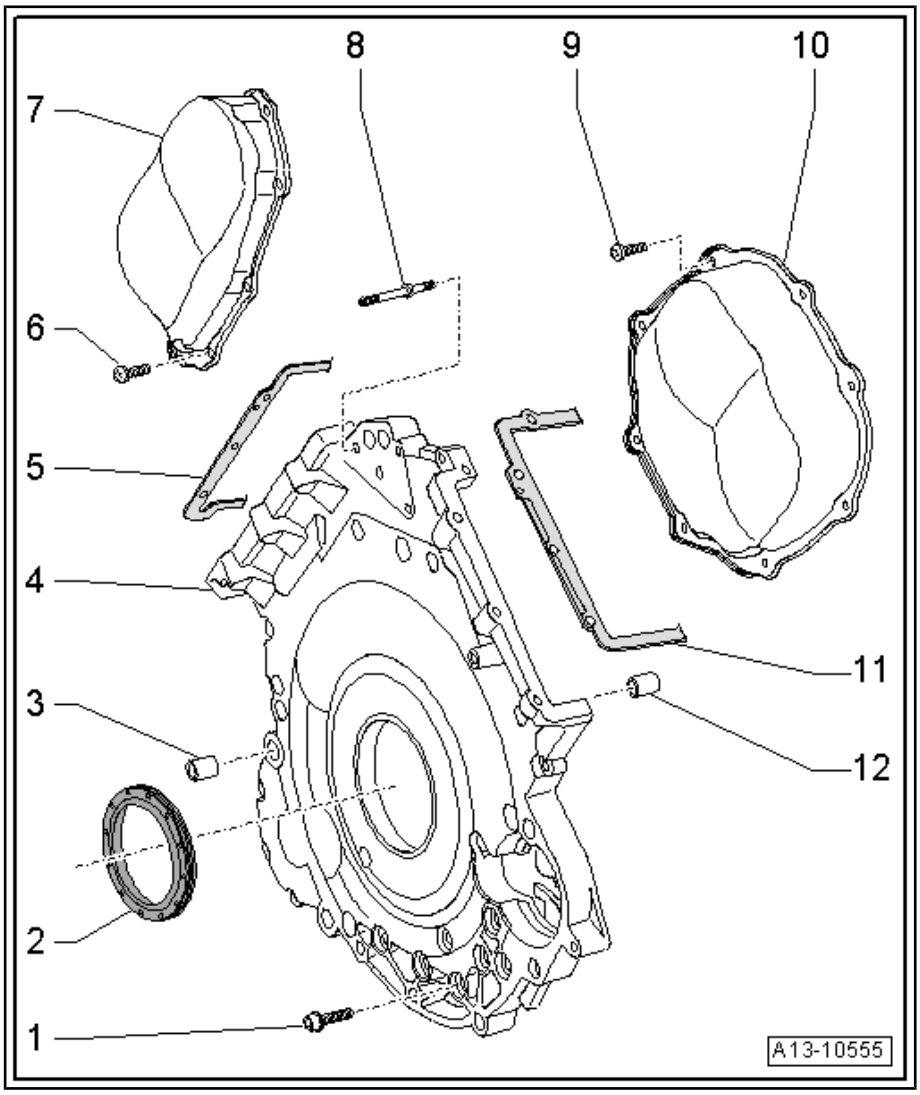


1 - M6 - 9 Nm; M8 - 20 Nm

- ❑ Observe tightening sequence: vehicles up to 04.2005 ⇒ page 100 , vehicles from 05.2005 ⇒ page 102

2 - Oil seal

- ❑ For crankshaft (timing chain end)
- ❑ Renewing ⇒ “2.7 Renewing crankshaft oil seal (timing chain end)”, page 86

3 - Dowel sleeve

- ❑ 2x

4 - Timing chain cover (bottom)

- ❑ Removing and installing ⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94

5 - Cylinder head gasket (left-side)

6 - 5 Nm + 90° (1/4 turn) further

- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 94

7 - Timing chain cover (left-side)

- ❑ Removing and installing ⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90

8 - 16 Nm

- ❑ For vehicles from 05.2005

9 - 5 Nm + 90° (1/4 turn) further

- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 94

10 - Timing chain cover (right-side)

- ❑ Removing and installing ⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90

11 - Cylinder head gasket (right-side)

12 - Dowel sleeve

- ❑ 2x

3.2 Removing and installing timing chain covers (left and right)

Special tools and workshop equipment required

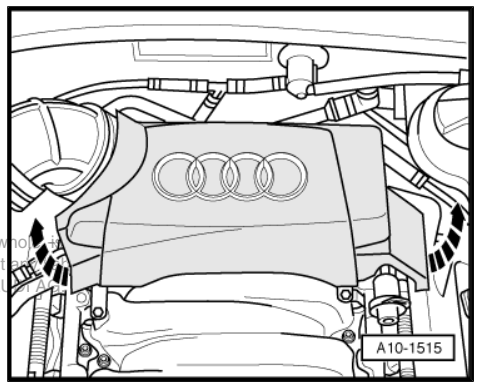
- ♦ Electric drill with plastic brush attachment
- ♦ Safety goggles
- ♦ Sealant ⇒ Electronic parts catalogue

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-.



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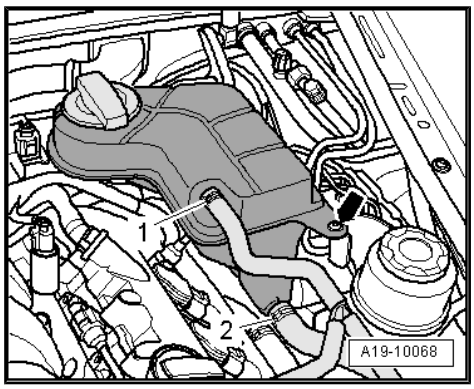
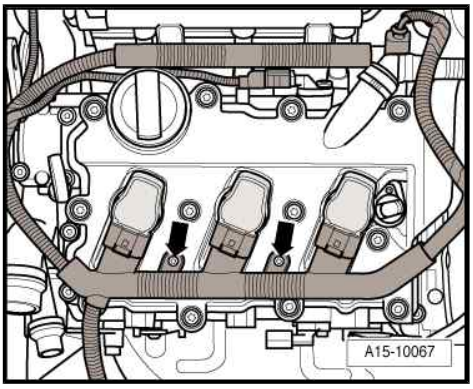
Timing chain cover (left-side):

– Unbolt coolant expansion tank -arrow-.

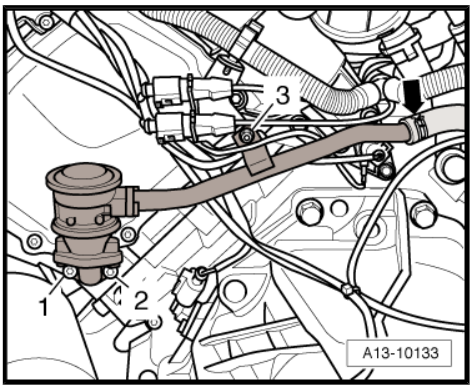
– Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move coolant expansion tank to one side with coolant hoses -1- and -2- attached.



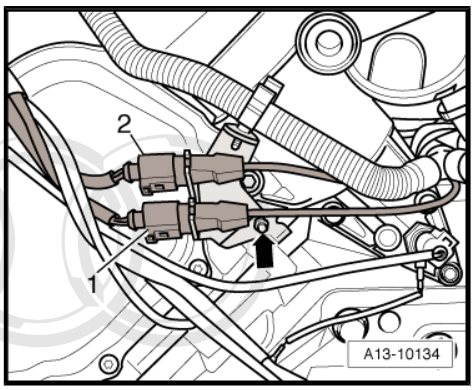
– Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.



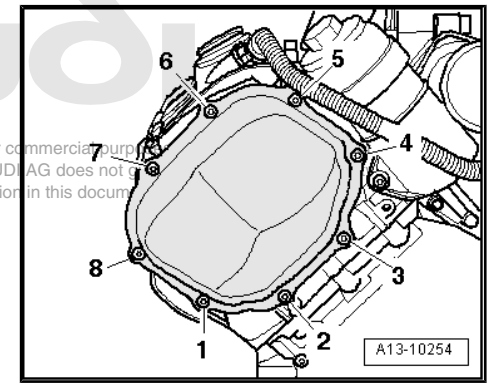
– Remove bolts -1- and -2-.
– Unscrew nut -3-.
– Disconnect air hose -arrow- and remove the combination valve for secondary air.



– Unplug electrical connectors -1- and -2-.
– Remove centre hex stud -arrow- and detach bracket for electrical connectors.



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



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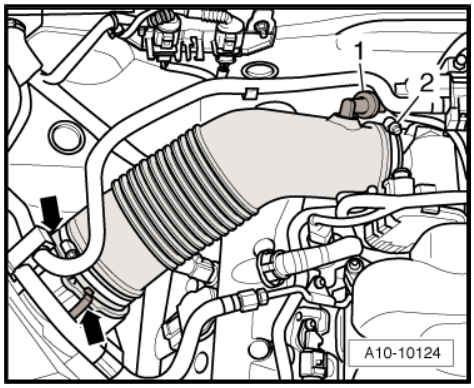
Timing chain cover (right-side):

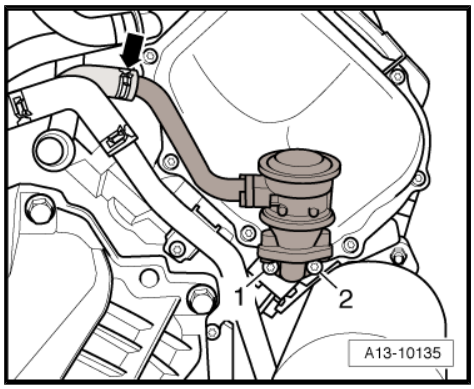
– Detach non-return valve -1- from air intake hose.

– Remove air hose. To do so, loosen hose clip -2- and release retaining clips -arrows-.



– Remove bolts -1- and -2-.

– Disconnect air hose -arrow- and remove the combination valve for secondary air.

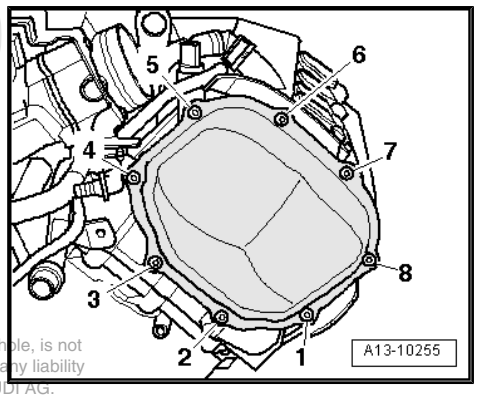


– Remove bolts -1 ... 8- and detach timing chain cover (right-side).

Installing

Note

Fit all cable ties in the original positions when installing.



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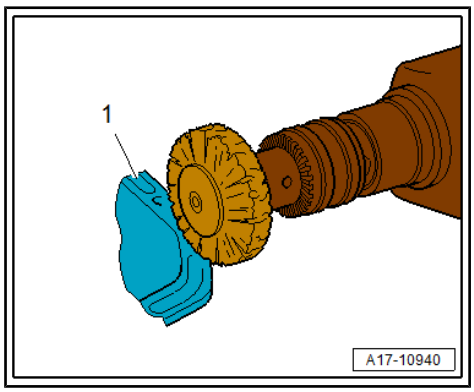
WARNING

Risk of eye injury.

- *Put on safety goggles.*



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

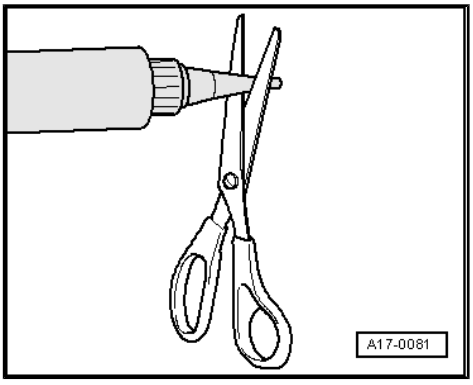
Caution

Protect lubrication system against contamination.

- *Cover exposed parts of the engine.*

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

– Cut off nozzle of tube at front marking (∅ of nozzle approx. 1 mm).

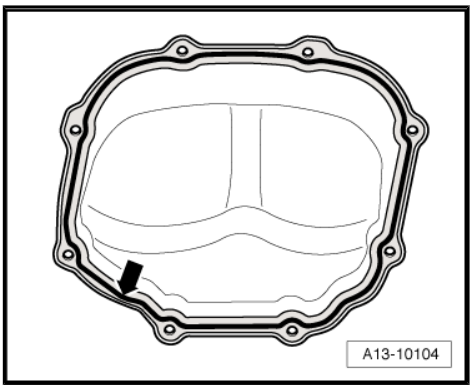


Note

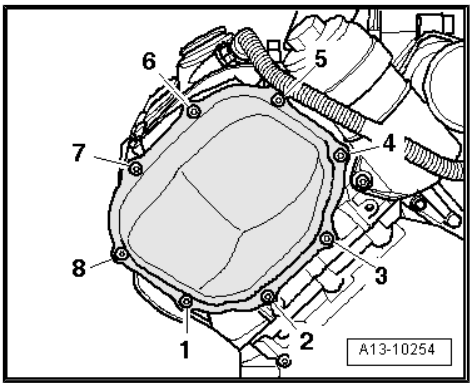
The timing chain covers must be installed within 5 minutes after applying sealant.

– Apply sealant bead -arrow- onto clean sealing surfaces of 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-.



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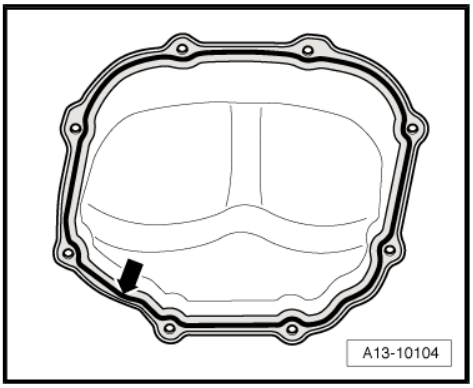
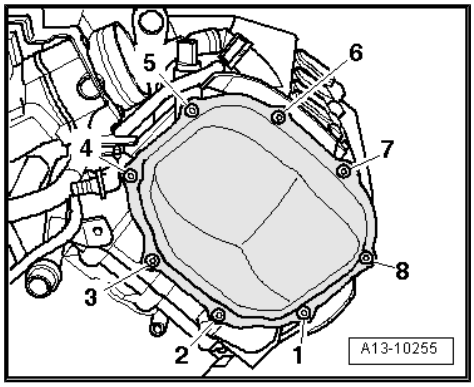
– Apply sealant bead -arrow- onto the clean sealing surface of the timing chain cover (right-side) as illustrated.

- 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.



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



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

– Install combination valves for secondary air system: left-side ⇒ “2.3 Removing and installing combination valve for secondary air system (left-side)”, page 260 , right-side ⇒ “2.4 Removing and installing combination valve for secondary air system (right-side)”, page 261 .

Tightening torques

Component	Nm
Timing chain covers (left and right) to engine	5 + 90° 1)2)
Bracket for electrical connectors to cylinder head	9
Hose clips (9 mm wide)	3

- 1) Renew bolts.
- 2) 90° = one quarter turn.

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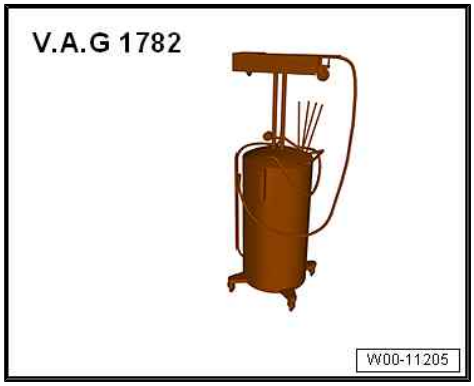
3.3 Removing and installing timing chain cover (bottom)

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

Note

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

– Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

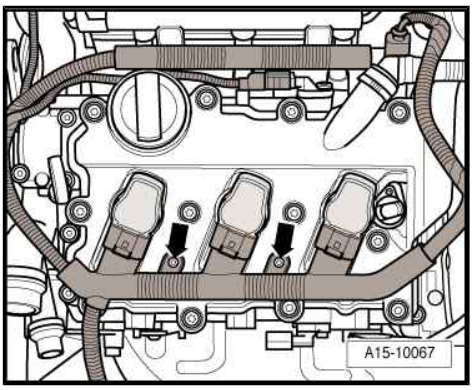
WARNING

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
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 .

– Vehicles with multitronic gearbox: Remove damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 and flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 .

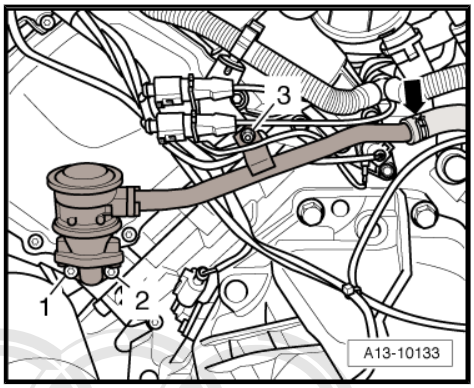
– Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.



– Remove bolts -1- and -2-.

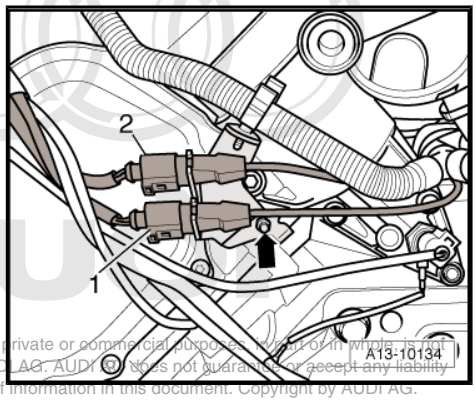
– Unscrew nut -3-.

– Disconnect air hose -arrow- and remove the combination valve for secondary air.



– Unplug electrical connectors -1- and -2-.

– Remove centre hex stud -arrow- and detach bracket for electrical connectors.



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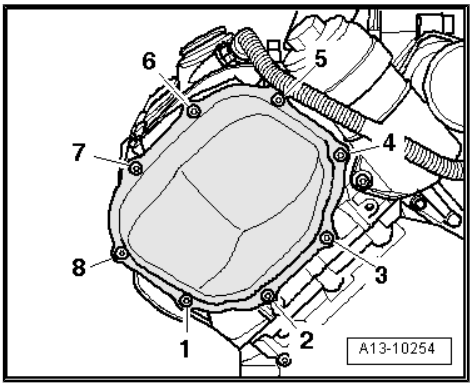
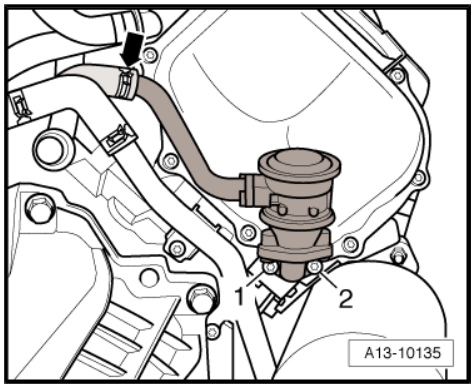
– Remove bolts -1 ... 8- and detach timing chain cover (left-side).



– Remove bolts -1- and -2-.
– Disconnect air hose -arrow- and remove the combination valve for secondary air.



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

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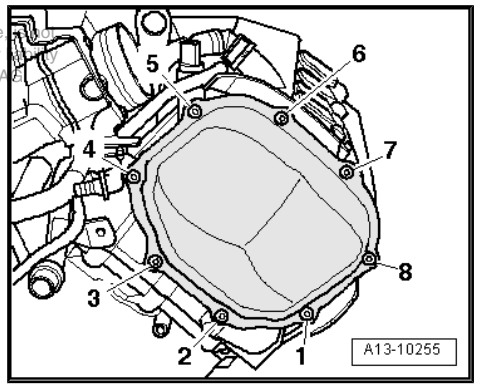
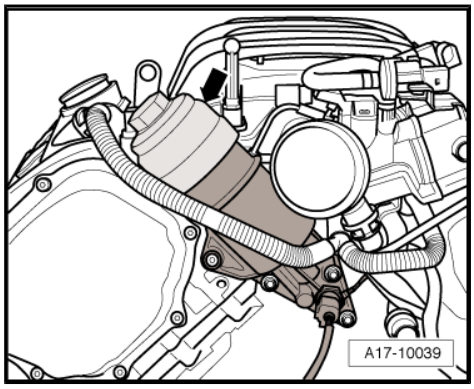


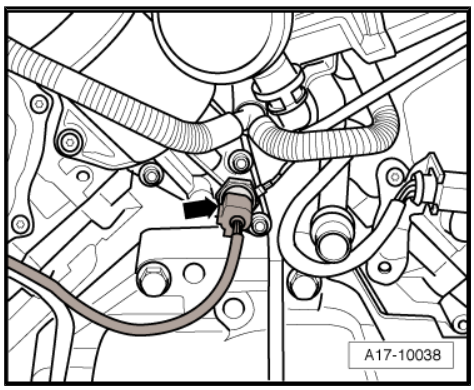
– Unscrew sealing cap -arrow- for oil filter housing.
– Remove oil filter element.
– Extract engine oil from oil filter housing using used oil collection and extraction unit - V.A.G 1782- .



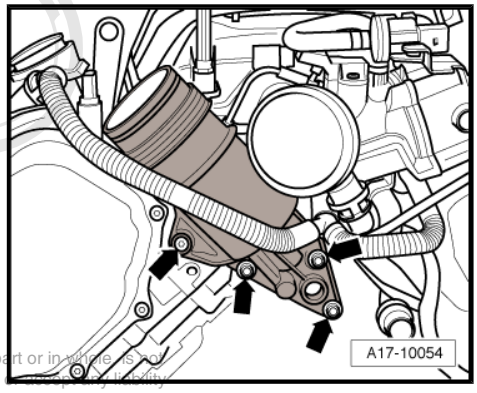
Note

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.
– Place used oil collection and extraction unit - V.A.G 1782- under engine.
– Drain off engine oil.



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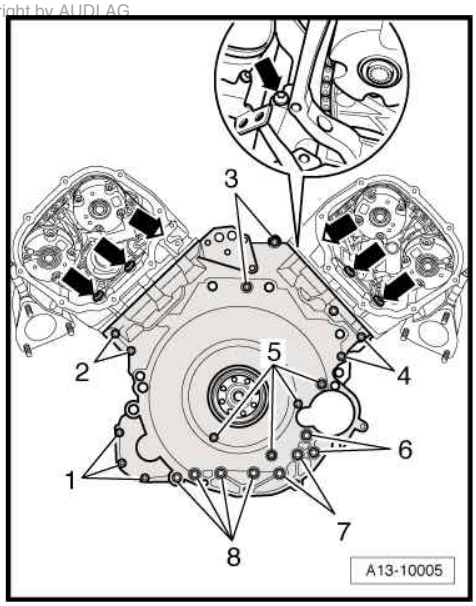
Vehicles up to 04.2005:

– Remove bolts -arrows-.
– Unscrew bolts -1 … 9- and remove timing chain cover (bottom).



Vehicles from 05.2005 onwards:

– Unscrew bolts -1 … 9- and remove timing chain cover (bottom).

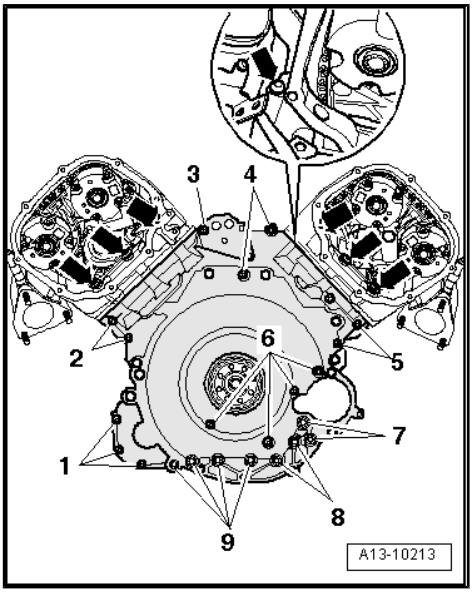
All vehicles:

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

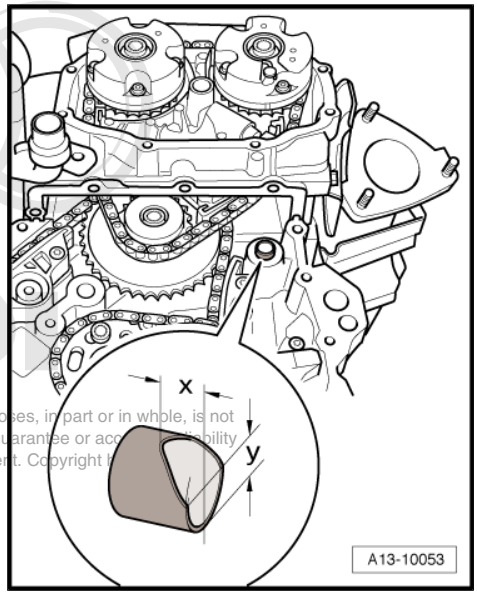
Installing

Note

- *Renew gaskets, oil 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.

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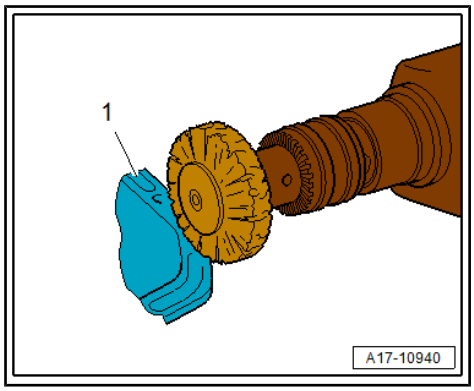
WARNING

Risk of eye injury.

- *Put on safety goggles.*

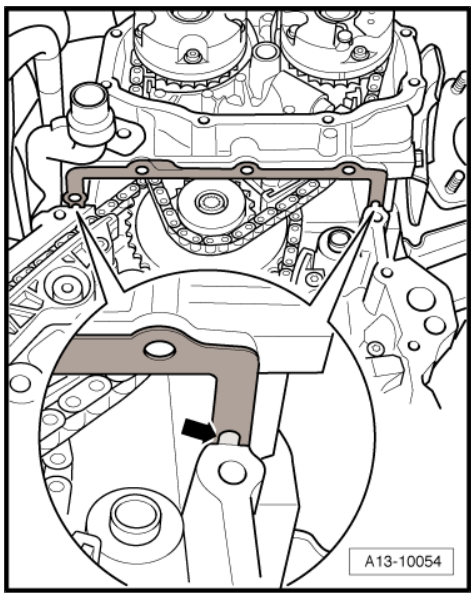


Caution

Protect lubrication system against contamination.

- *Cover exposed parts of the engine.*

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



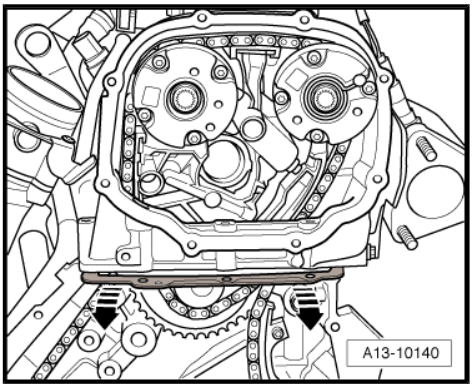
Note

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

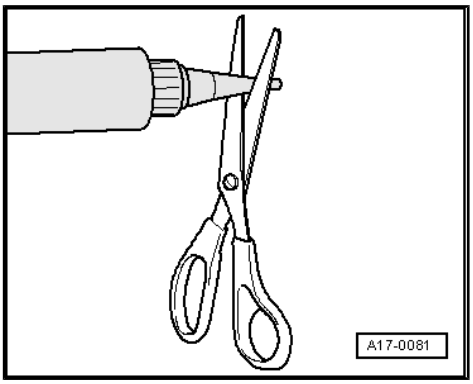
Caution

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.

– Carefully bend the ends of the cylinder head gaskets down very slightly -arrows-, just far enough to be able to clean the upper sealing surface on the gasket and cylinder head.
– Clean both cylinder head gaskets (top and bottom); they must be free of oil and grease.



– Cut off nozzle of tube at front marking (∅ of nozzle approx. 2 mm).



Note

- *The sealant must be applied at several points on the engine as described below.*
- *The sealant hardens within approx. 5 minutes after being applied.*

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.

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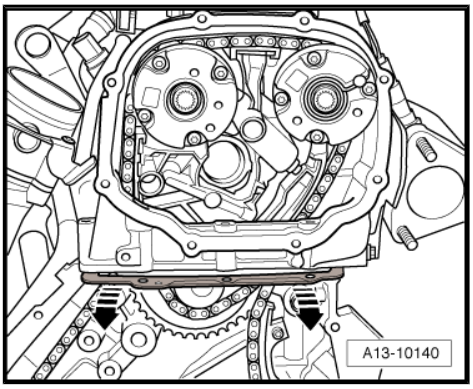
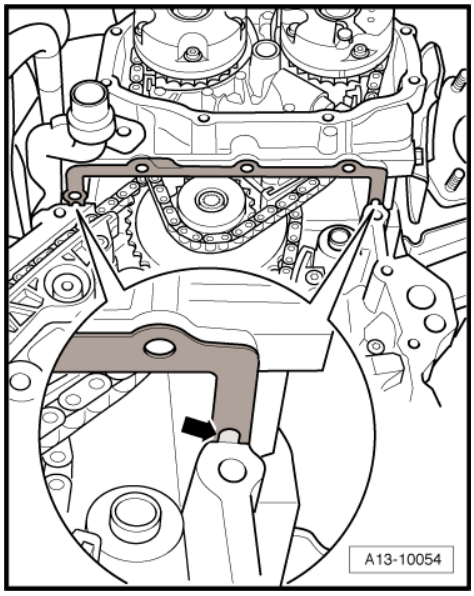
– Apply a small amount of sealant to sealing surfaces of cylinder head gaskets (top and bottom). To do so, you again have to bend cylinder head gaskets down very slightly.
– Use a flat object (e.g. a feeler gauge) to apply sealant to the area between cylinder head and gasket.



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



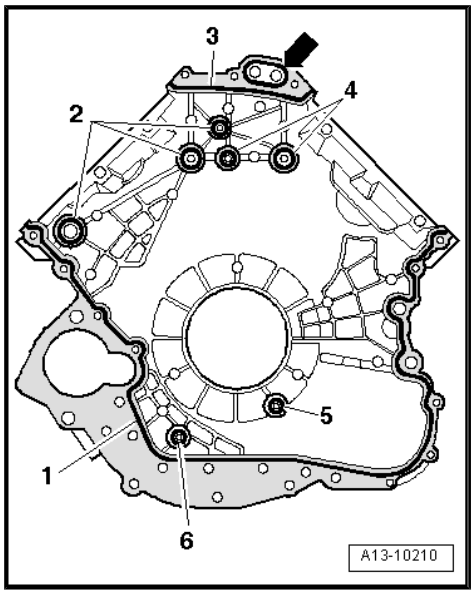
Vehicles up to 04.2005:

– Apply sealant beads -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.



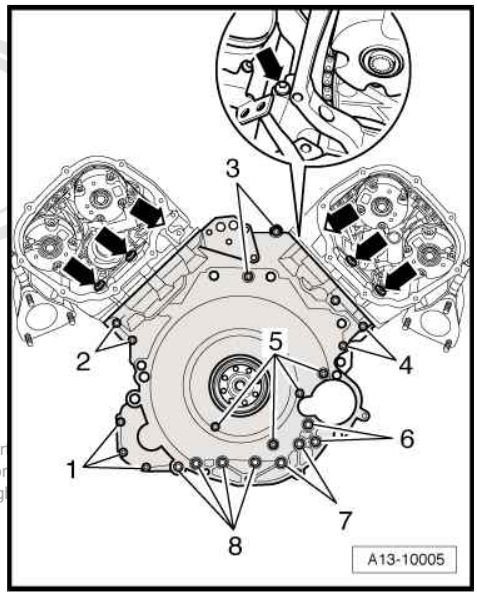
– Fit timing chain cover (bottom), guiding it towards the sealing surface on cylinder block and cylinder head at an angle and from below.

– Take care not to damage the cylinder head gaskets when fitting the cover. Renew gaskets if damaged.

– Tighten bolts as follows.

1. Apply locking fluid to bolts -arrows- and tighten to 5 Nm.
2. Tighten bolts -1 ... 8- to 9 Nm in diagonal sequence.
3. Tighten bolts -arrows- to 9 Nm.
4. Tighten bolts -6-, -7- and -8- to 20 Nm.

– Install oil filter housing immediately ⇒ “1.7 Removing and installing oil filter housing”, page 195.



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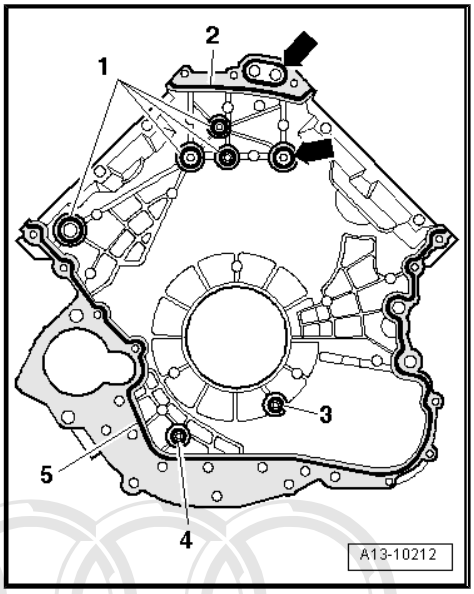
Vehicles from 05.2005 onwards:

– Apply sealant beads -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).

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



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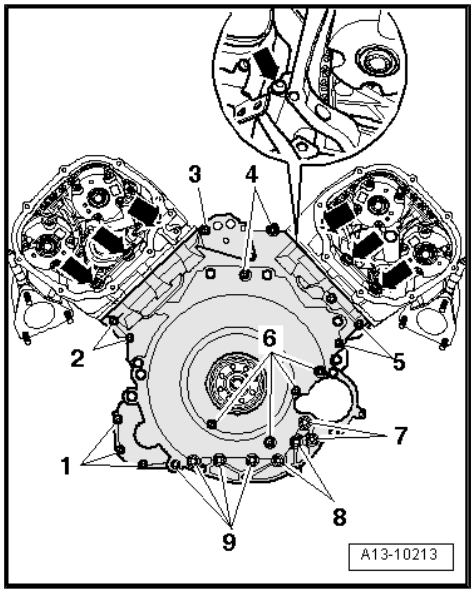
– Fit timing chain cover (bottom), guiding it towards the sealing surface on cylinder block and cylinder head at an angle and from below.
– Take care not to damage the cylinder head gaskets when fitting the cover. Renew gaskets if damaged.
– Tighten bolts as follows.

1. Apply locking fluid to bolts -arrows- and tighten to 5 Nm.
2. Tighten bolts -1 ... 9- to 9 Nm in diagonal sequence.
3. Tighten bolts -arrows- to 9 Nm.
4. Tighten bolts -7-, -8- and -9- to 20 Nm.
5. Tighten stud -3- to 16 Nm.



All vehicles:

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

– Install timing chain covers (left and right) ⇒ page 92 .
– Install oil filter housing ⇒ “1.7 Removing and installing oil filter housing”, page 195 .
– Install crankshaft oil seal (timing chain end) ⇒ “2.7 Renewing crankshaft oil seal (timing chain end)”, page 86 .
– Vehicles with manual gearbox: Install dual-mass flywheel ⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 and pressure plate ⇒ Rep. gr. 30 .
– Vehicles with multitronic gearbox: Install flywheel ⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 and damper unit ⇒ “2.5 Removing and installing damper unit”, page 84 .
– Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
– Fill up with engine oil and check oil level ⇒ “1.13 Checking oil level”, page 202 .

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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)3)
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.
- 3) 90° = one quarter turn.

4 Camshaft drive

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.

⇒ “4.1 Camshaft timing chains - exploded view”, page 103

⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106

⇒ “4.3 Drive chain for valve gear - exploded view”, page 116

⇒ “4.4 Removing and installing drive chain for valve gear”, page 119

⇒ “4.5 Drive chain for auxiliary drives on vehicles up to 04.2006 - exploded view”, page 121

⇒ “4.6 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006”, page 123

⇒ “4.7 Drive chain for auxiliary drives on vehicles from 04.2006 onwards - exploded view”, page 127

⇒ “4.8 Removing and installing drive chain for auxiliary drives on vehicles from 04.2006”, page 127

⇒ “4.9 Balance shaft - exploded view”, page 132

⇒ “4.10 Removing and installing balance shaft”, page 132

4.1 Camshaft timing chains - exploded view

Note

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)

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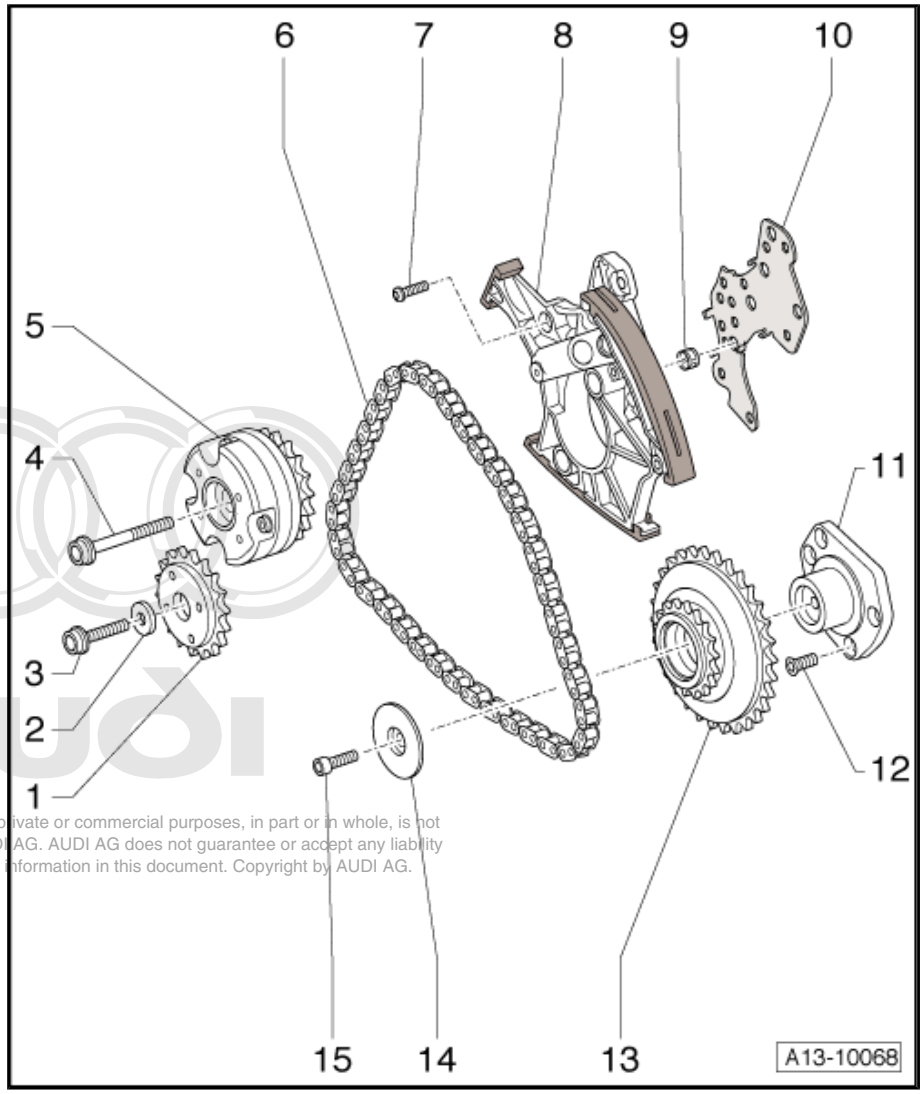

1 - Camshaft chain sprocket

- ❑ For exhaust camshaft

2 - Washer

3 - Bolt for camshaft

- ❑ Renew
- ❑ Pre-tightening torque: 40 Nm
- ❑ Final tightening torque: 80 Nm + 90° (1/4 turn) further

4 - Bolt for camshaft

- ❑ Renew
- ❑ Pre-tightening torque: 40 Nm
- ❑ Final tightening torque: 80 Nm + 90° (1/4 turn) further

5 - Camshaft adjuster for inlet camshaft

- ❑ Identification “Intake”
- ❑ Removing and installing ⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106

6 - Camshaft timing chain (left-side)

- ❑ Removing and installing ⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106

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7 - 9 Nm

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

- ❑ Removing and installing ⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106

9 - Oil strainer

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

10 - Gasket

- ❑ Renew
- ❑ Clipped onto chain tensioner

11 - Bearing bracket for drive sprocket

12 - 8 Nm + 45° (1/8 turn) further

- ❑ Renew
- ❑ Lubricate with oil before installing

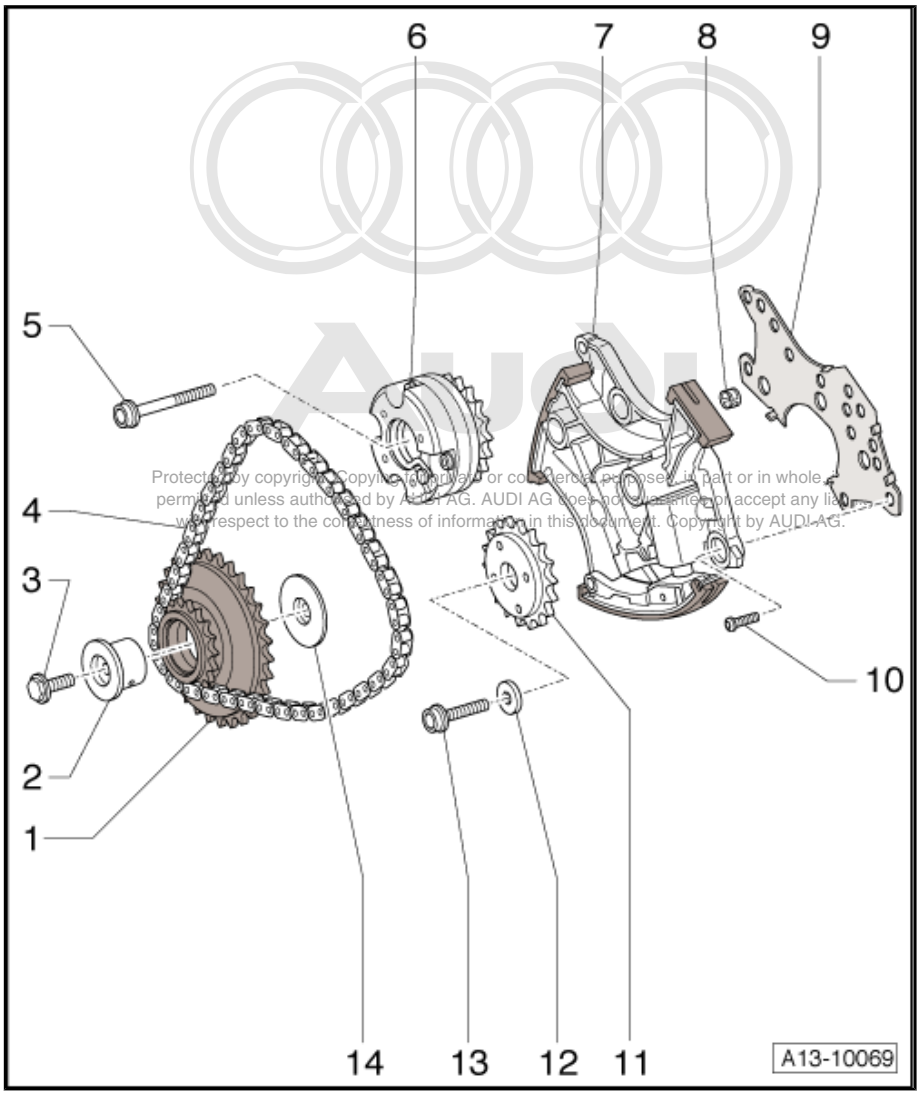
13 - Drive chain sprocket for camshaft timing chain (left-side)

14 - Thrust washer for drive sprocket

15 - 6 Nm + 60° ($^1/_6$ turn) further

- ❑ Renew

Camshaft timing chain (right-side)



1 - Drive chain sprocket

- ❑ For camshaft timing chain (right-side)

2 - Bearing mounting

- ❑ For drive chain sprocket

3 - 30 Nm + 90° ($^1/_4$ turn) further

4 - Camshaft timing chain (right-side)

- ❑ Removing and installing ⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106

5 - Bolt for camshaft

- ❑ Renew
- ❑ Pre-tightening torque: 40 Nm
- ❑ Final tightening torque: 80 Nm + 90° ($^1/_4$ turn) further

6 - Camshaft adjuster for inlet camshaft

- ❑ Identification “Intake”
- ❑ Removing and installing ⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106

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

- ❑ Removing and installing ⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106

8 - Oil strainer

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

9 - Gasket

- ❑ Renew
- ❑ Clipped onto chain tensioner

10 - 9 Nm

11 - Camshaft chain sprocket

- ❑ For exhaust camshaft

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12 - Washer

13 - Bolt for camshaft

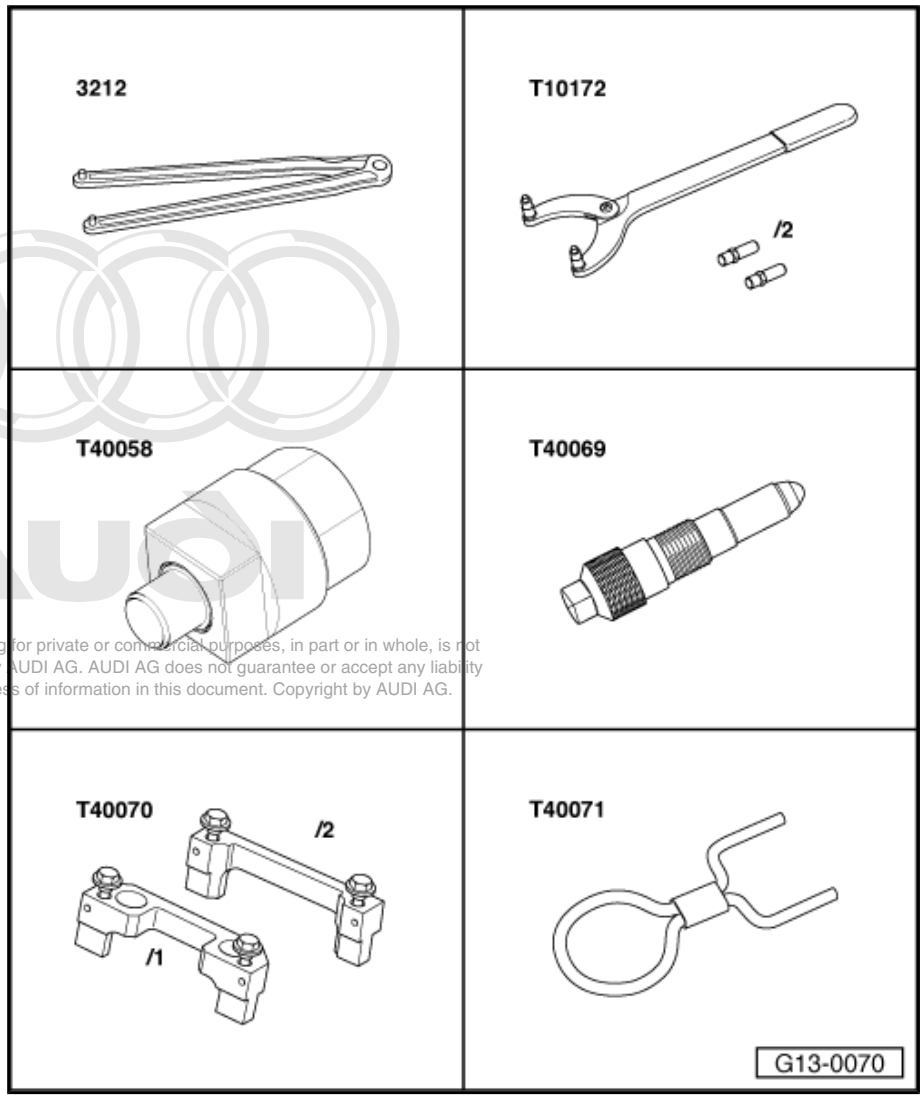
- ❑ Renew
- ❑ Pre-tightening torque: 40 Nm
- ❑ Final tightening torque: 80 Nm + 90° ($^1/_4$ turn) further

14 - Thrust washer for drive sprocket

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

Special tools and workshop equipment required

- ♦ Pin wrench - 3212-
- ♦ Counter-hold tool - T10172- with pin - T10172/2-
- ♦ Adapter - T40058-
- ♦ Locking pin - T40069-
- ♦ Camshaft clamp - T40070- (2x)
- ♦ Locking pin - T40071- (2x)



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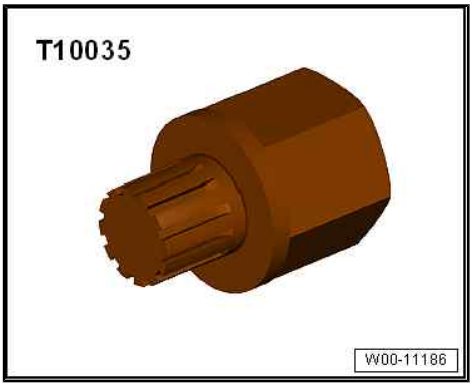
♦ Socket - T10035-



Removing

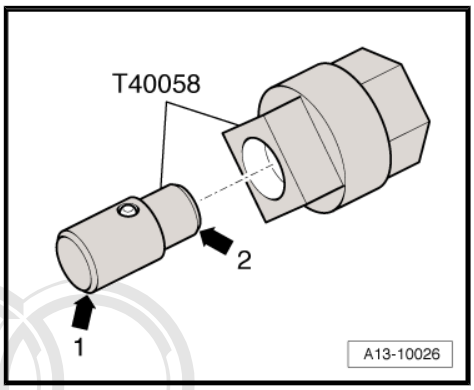
Note

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) *⇒ "3.3 Removing and installing timing chain cover (bottom)", page 94* .

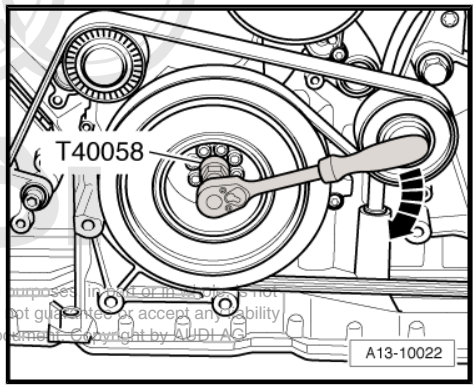
– Remove cylinder head cover: left-side ⇒ "1.2 Removing and installing cylinder head cover (left-side)", page 147 , right-side ⇒ "1.3 Removing and installing cylinder head cover (right-side)", page 149 .

– Remove timing chain covers (left and right) ⇒ "3.2 Removing and installing timing chain covers (left and right)", page 90 .

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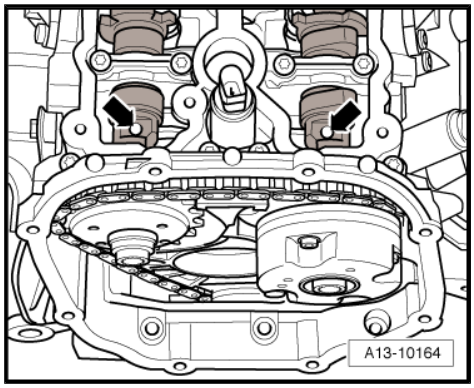
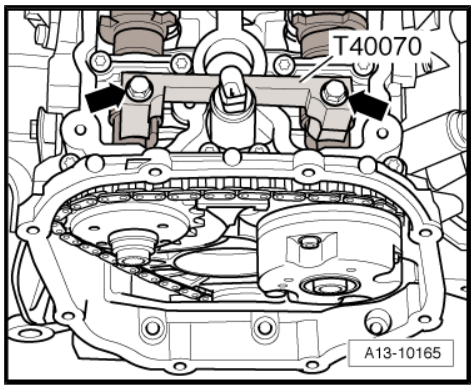
- The threaded holes -arrows- in the camshafts must face upwards.



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

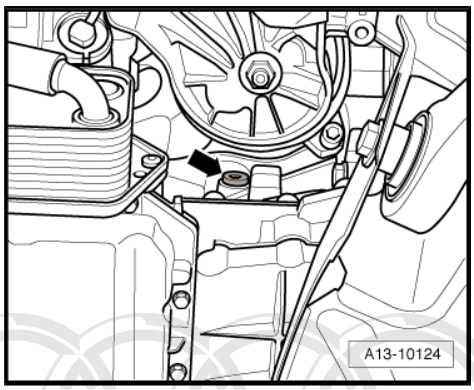
- The camshaft clamp - T40070- is positioned correctly if the holes for the cylinder head bolts remain free.



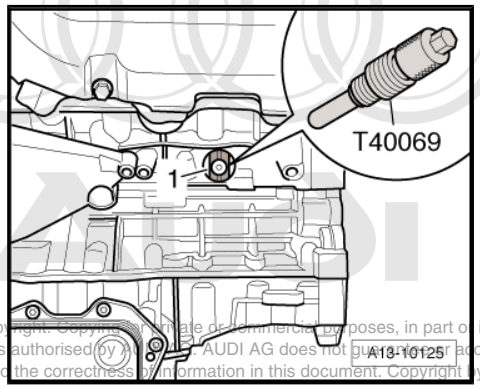
– Unscrew plug -arrow- from cylinder block.

WARNING

To avoid any risk of injury, do not rotate the crankshaft while feeling for the TDC hole with your finger.



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



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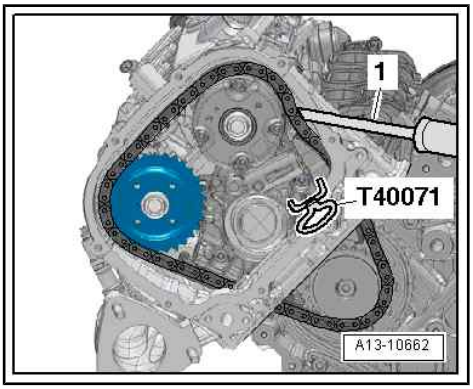
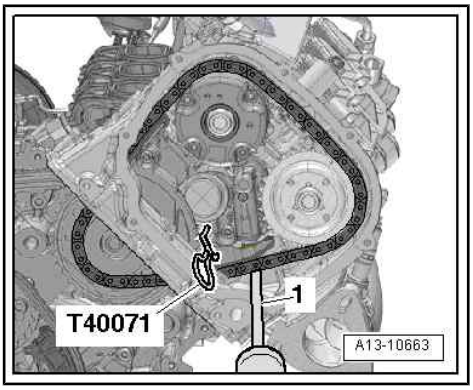
– Press guide rail of chain tensioner for camshaft timing chain (left-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .



Note

The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.

– Press guide rail of chain tensioner for camshaft timing chain (right-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .



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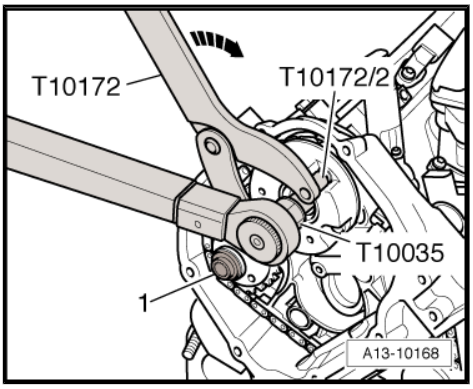
Note

The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.

Caution

Risk of damage to camshaft.

- ***Do NOT use camshaft clamp - T40133- to counterhold when loosening camshaft adjuster bolt.***



– Fit counterhold tool - T10172- with pin -T10172/2- to counterhold on corresponding camshaft adjuster and loosen bolt with special wrench - T10035- .

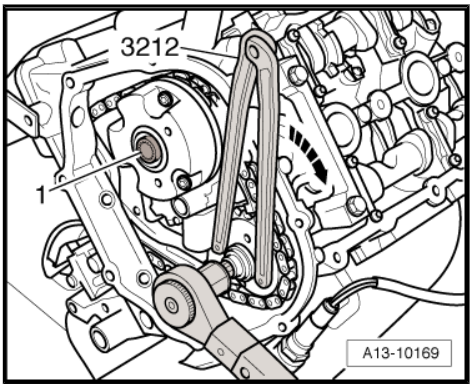
Note

Disregard -item 1- and -arrow-.

Caution

Risk of damage to camshaft.

- ***Do NOT use camshaft clamp - T40133- to counterhold when loosening camshaft sprocket bolt.***



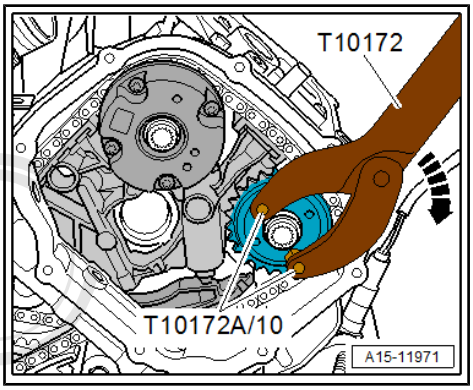
– Fit pin wrench - 3212- to counterhold on corresponding camshaft sprocket and loosen bolt with special wrench - T10035- .

Note

Disregard -item 1- and -arrow-.

Note

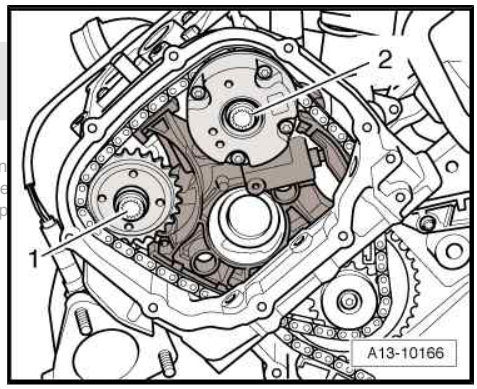
Bolt for camshaft sprocket can be unscrewed alternatively using counterhold tool - T10172A- with pin -T10172A/10- .



Note

Disregard -arrow-.

- Mark position of camshaft adjuster and camshaft sprocket with paint for re-installation.
- Unscrew bolts -1- and -2- for camshaft adjusters and camshaft chain sprocket using special wrench - T10035- .
- Remove camshaft adjusters and camshaft chain sprocket.



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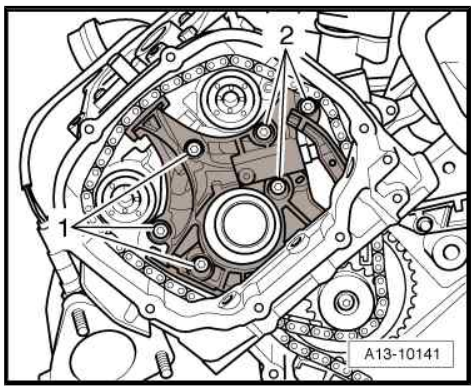
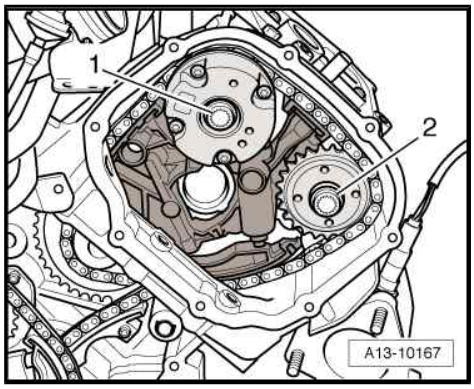
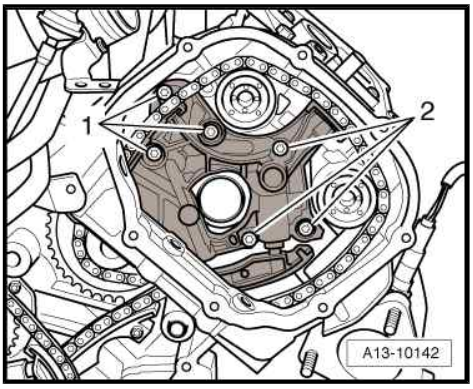
- Unscrew bolts -1- and -2- and remove chain tensioner.



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



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

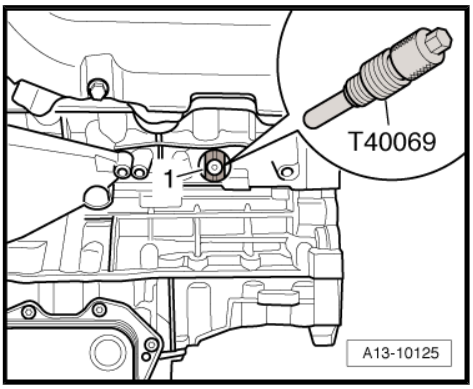


Installing

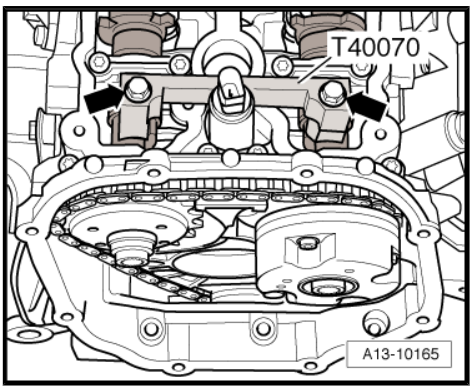
Note

- *Renew bolts which are tightened to a specified angle as well as oil 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.*

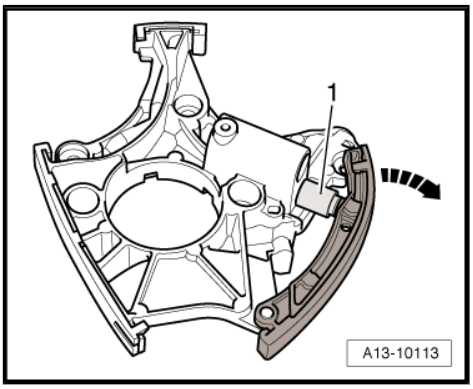
- Drive chain for valve gear installed
⇒ “4.4 Removing and installing drive chain for valve gear”, page 119
- Crankshaft locked in TDC position with locking pin - T40069- .



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



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



Note

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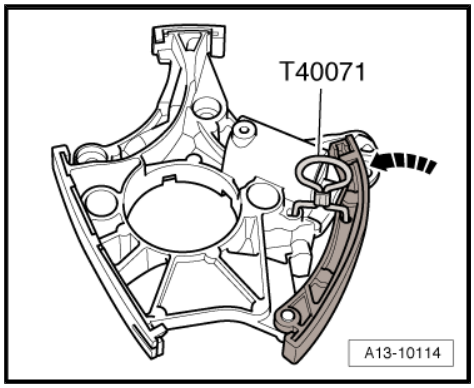
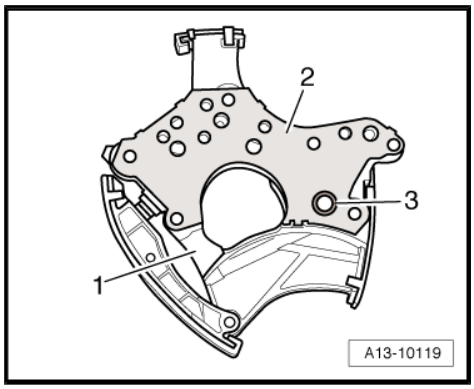
Note the correct installation position if the tensioning element has been removed from the chain tensioner: oil drilling in base of tensioning element housing faces chain tensioner and tensioning element piston faces tensioner rail.

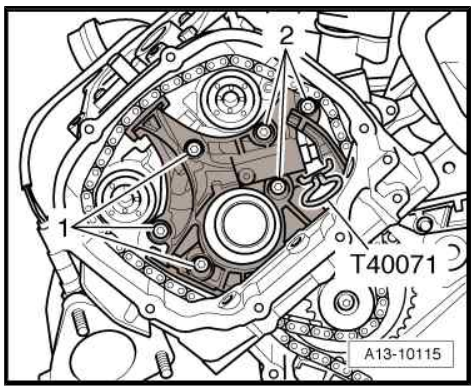
– Press guide rails of chain tensioners for camshaft timing chains (left and right) inwards in direction of -arrow- as far as the stop. Then lock chain tensioners by inserting locking pin - T40071- .



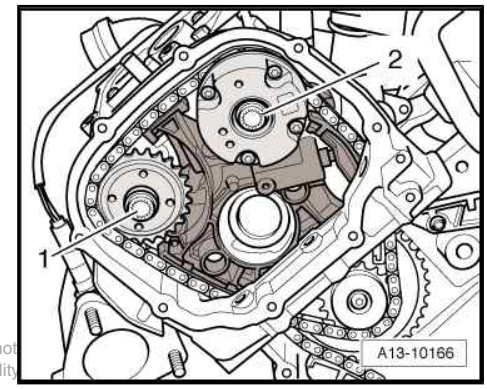
– If necessary, clean oil strainer -3- in both chain tensioners.
– Fit new gasket -2- to rear of chain tensioner -1-.



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



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



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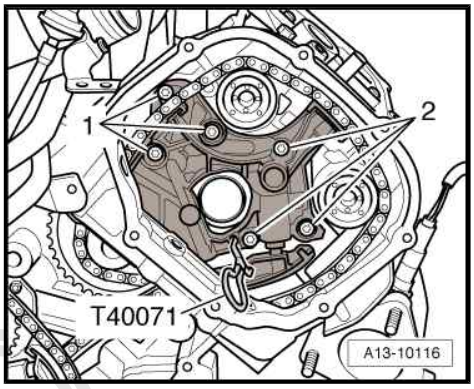
– Install chain tensioner on cylinder head (right-side) and position camshaft timing chain as shown in the illustration.

– Tighten bolts -1- and -2-.

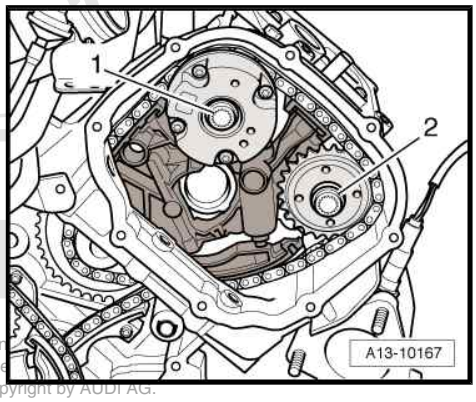


– Renew the camshaft bolts.

– Position camshaft timing chain on drive sprocket, camshaft chain sprocket and camshaft adjuster and loosely screw in bolts -1- and -2-.

• It should just be possible to turn the camshaft chain sprocket and camshaft adjuster on the camshaft without axial movement.

– Remove locking pin - T40071- .



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– Fit counterhold tool - T10172- with pin - T10172/2- onto camshaft adjuster of inlet camshaft (left-side).

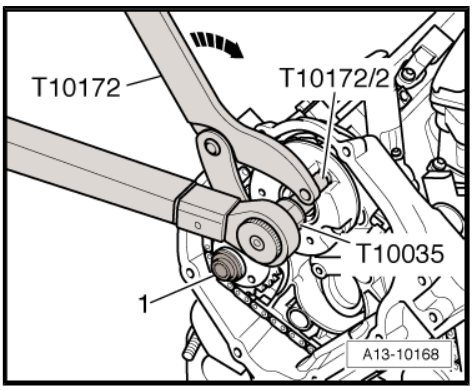
– Pretension camshaft timing chain by pressing counterhold tool in direction of -arrow-.

– At the same time pre-tighten camshaft bolt using special wrench - T10035- and torque wrench.

• Tightening torque: 40 Nm

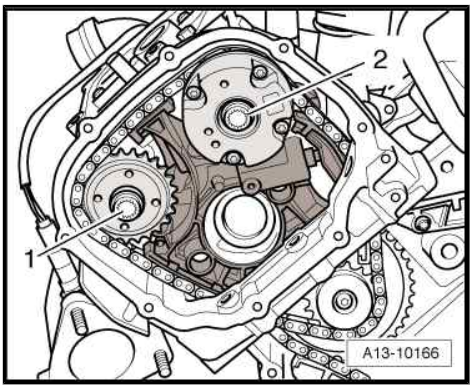
– Maintain tension on inlet camshaft and pre-tighten bolt -1- on exhaust camshaft.

• Tightening torque: 40 Nm

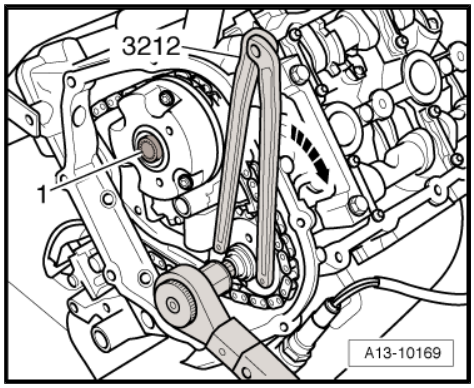


– Tighten camshaft bolts -1- and -2- at cylinder head (left-side) to final torque.

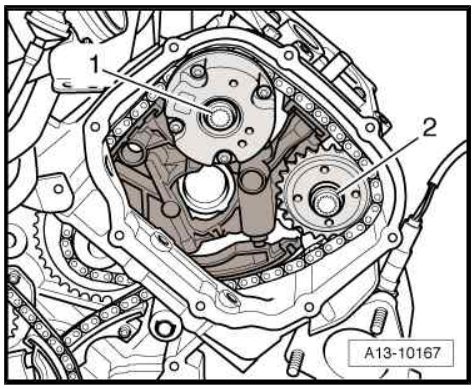
• Tightening torque: 80 Nm + 90° ($^1/_4$ turn further).



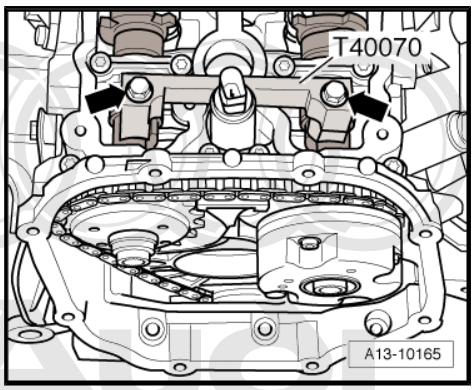
– Fit pin wrench - 3212- onto camshaft chain sprocket of exhaust camshaft (right-side).
– Pretension camshaft timing chain by pressing counterhold tool in direction of -arrow-.
– At the same time pre-tighten camshaft bolt using special wrench - T10035- and torque wrench.
• Tightening torque: 40 Nm
– Maintain tension on exhaust camshaft and pre-tighten bolt -1- on inlet camshaft.
• Tightening torque: 40 Nm



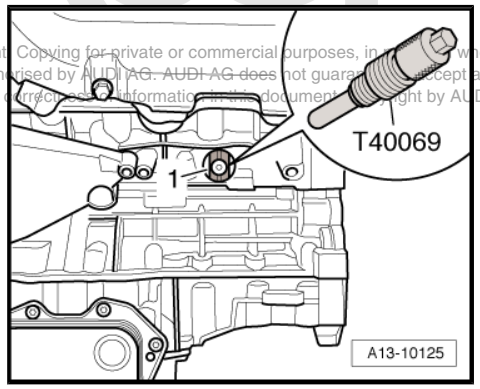
– Tighten camshaft bolts -1- and -2- at cylinder head (right-side) to final torque.
• Tightening torque: 80 Nm + 90° ($^1/_4$ turn further).



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



– Remove locking pin - T40069- .



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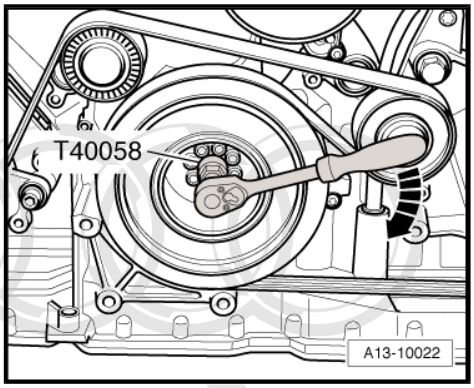
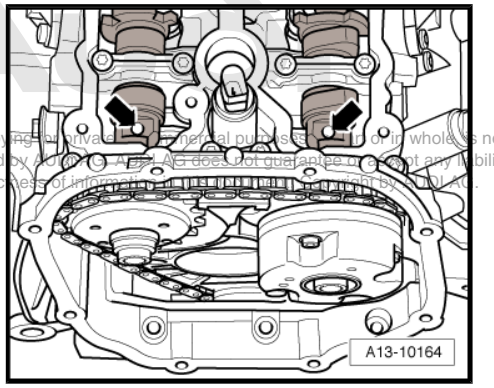
– Using adapter - T40058- , turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is at TDC again.



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.



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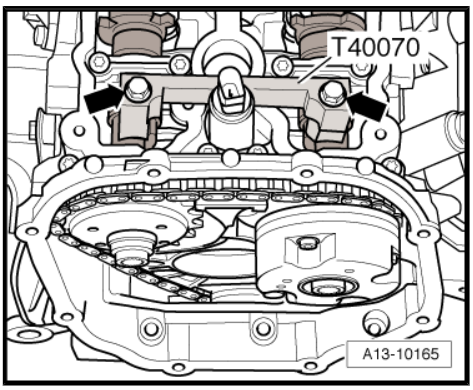
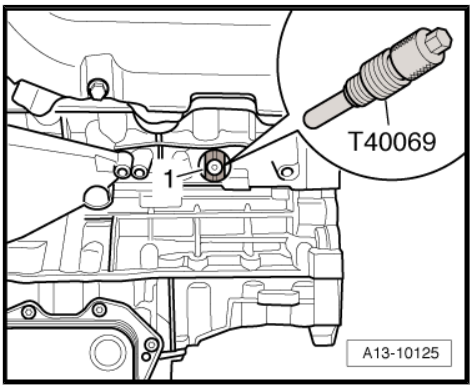
– Fit camshaft clamps - T40070- to both cylinder heads and tighten bolts -arrows- to 20 Nm.

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

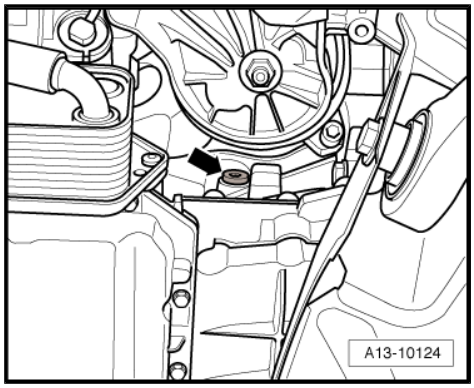


– Screw the locking pin - T40069- directly into the hole.

• The locking pin - T40069- must engage in the locating hole in crankshaft -1-. If it does not, reset valve timing.



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



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

– Install timing chain covers (left and right)
⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .
– Install cylinder head cover: left-side
⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147 , right-side
⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149 .

Tightening torques

Component	Nm
Chain tensioner to cylinder head	9
Camshaft bolts	80 + 90° 1)2)
Screw plug in cylinder block	14 3)

- 1) Renew bolts.
- 2) 90° = one quarter turn.
- 3) Install with new seal.

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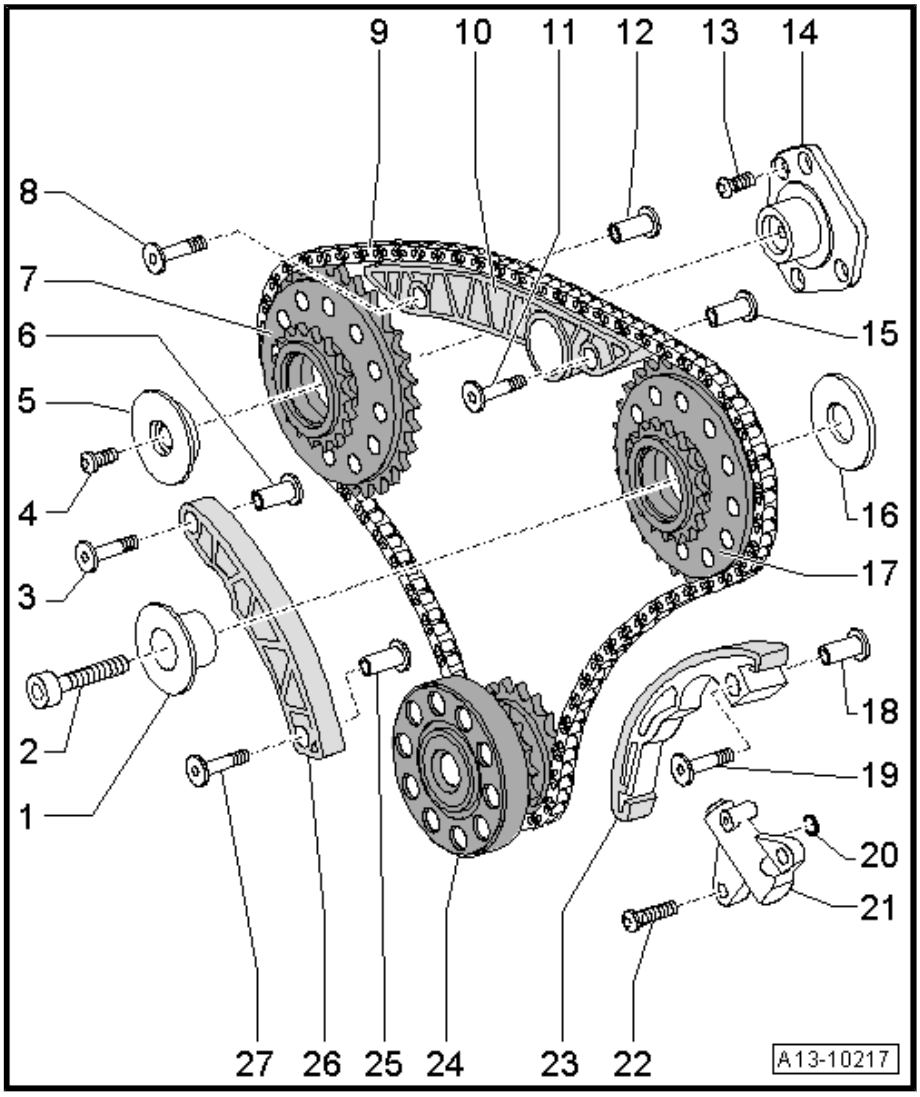
4.3 Drive chain for valve gear - exploded view



1 - Bearing mounting for drive sprocket

2 - 30 Nm + 90° (1/4 turn) further

- ❑ Renew

3 - Bolt

- ❑ Renew
- ❑ Types and tightening torque differ depending on version
  ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

4 - 6 Nm + 60° (1/6 turn) further

- ❑ Renew

5 - Thrust washer for drive sprocket

6 - Bush

- ❑ Depending on version
  ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

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

8 - Bolt

- ❑ Renew
- ❑ Types and tightening torque differ depending on version
  ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

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
  ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

12 - Bush

- ❑ Depending on version ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

13 - 8 Nm + 45° (1/8 turn) further

- ❑ Renew
- ❑ Lubricate with oil before installing

14 - Bearing bracket for drive sprocket

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15 - Bush

- ❑ Depending on version ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

16 - Thrust washer

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

18 - Bush

- ❑ Depending on version ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

19 - Bolt

- ❑ Renew
- ❑ Types and tightening torque differ depending on version
  ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

20 - O-ring

- ❑ Renew

21 - Chain tensioner

22 - 6 Nm + 45° ($^1/_8$ turn) further

- ❑ Renew

23 - Guide rail for chain tensioner

24 - Crankshaft

25 - Bush

- ❑ Depending on version ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

26 - Guide rail

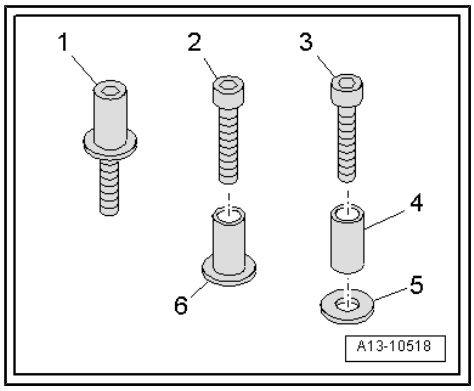
- ❑ Note installation position

27 - Bolt

- ❑ Renew
- ❑ Types and tightening torque differ depending on version
  ⇒ Fig. ""Different types of bolts securing guide rails"" , page 118

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° ($^1/_{12}$ turn) further

2 - Bolt with bush -6- with collar
- ♦ Renew
- ♦ 10 Nm + 90° ($^1/_4$ turn) further

3 - Bolt with bush -4- and washer -5-
- ♦ Renew
- ♦ 10 Nm + 90° ($^1/_4$ turn) further

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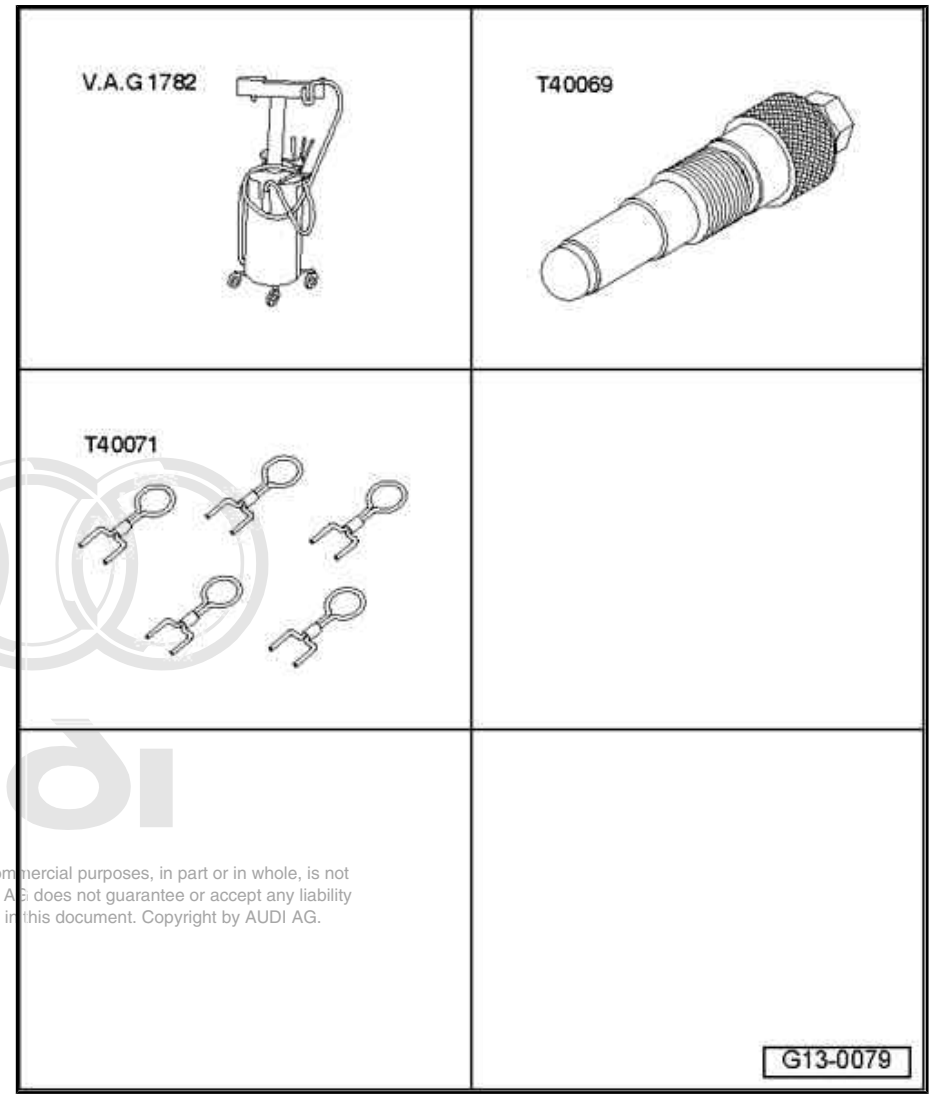
4.4 Removing and installing drive chain for valve gear

Special tools and workshop equipment required

- Used oil collection and extraction unit - V.A.G 1782-
- Locking pin - T40069-
- Locking pin - T40071-



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Removing

– Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

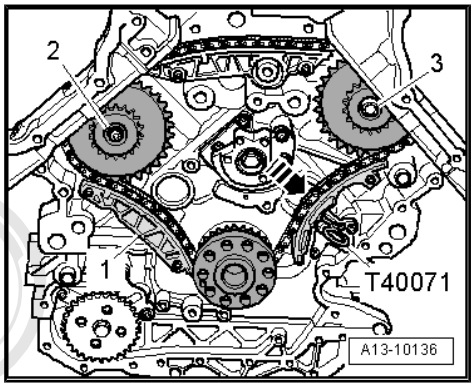
WARNING

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
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 .

– Vehicles with multitronic gearbox: Remove damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 and flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 .

– Place used oil collection and extraction unit - V.A.G 1782- under engine.
– Drain off engine oil.
– Remove timing chain covers (left and right)
⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .
– Remove timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .
– Detach timing chains from camshafts
⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106 .
– Remove drive chain for oil pump and balance shaft
⇒ “4.6 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006”, page 123 .
– 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 camshaft timing 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 locked in TDC position with locking pin - T40069- .

Note

Fit all cable ties in the original positions when installing.

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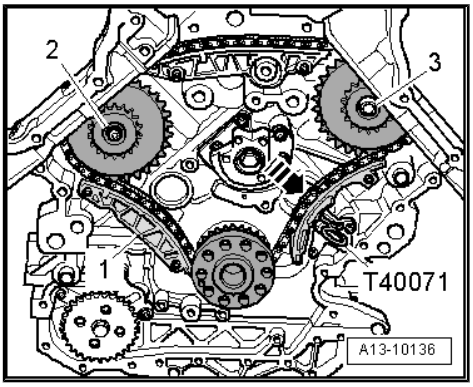

- First install sprocket for camshaft timing chain (left-side) -2-.
- Install guide rail -1- with drive chain fitted.
- Now install sprocket for camshaft timing chain (right-side) -3-.
- Press guide rail of chain tensioner for drive chain in direction of -arrow- and pull locking pin - T40071- out of chain tensioner.
- Install chain for oil pump and balance shaft ⇒ “4.6 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006”, page 123
- Install camshaft timing chains ⇒ page 111 .
- Install timing chain cover (bottom) ⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .
- Install timing chain covers (left and right) ⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .
- Vehicles with manual gearbox: Install dual-mass flywheel ⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 and pressure plate ⇒ Rep. gr. 30 .
- Vehicles with multitronic gearbox: Install flywheel ⇒ “2.6 Removing and installing flywheel - vehicles with multi-tronic gearbox”, page 85 and damper unit ⇒ “2.5 Removing and installing damper unit”, page 84 .
- Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Fill up with engine oil and check oil level ⇒ “1.13 Checking oil level”, page 202 .

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Tightening torques

Component	Nm
Drive chain sprocket (left-side) to bearing bracket	6 + 60° 1)2)
Drive chain sprocket (right-side) to cylinder block	30 + 90° 1)3)
Screw plug in cylinder block	14 4)

- 1) Renew bolts.
- 2) 60° = one sixth of a turn.
- 3) 90° = one quarter turn.
- 4) Install with new seal.

4.5 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 ⇒ “4.6 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006”, page 123

2 - Drive chain sprocket for oil pump

- ❑ Installation position: Side with lettering faces engine

3 - 30 Nm + 90° (1/4 turn) further

- ❑ Renew

4 - Compression spring

5 - Crankshaft

6 - 15 Nm + 90° (1/4 turn) further

- ❑ Renew

7 - Chain sprocket for balance shaft

- ❑ Installation position: Side with lettering faces gearbox

8 - 6 Nm + 45° (1/8 turn) further

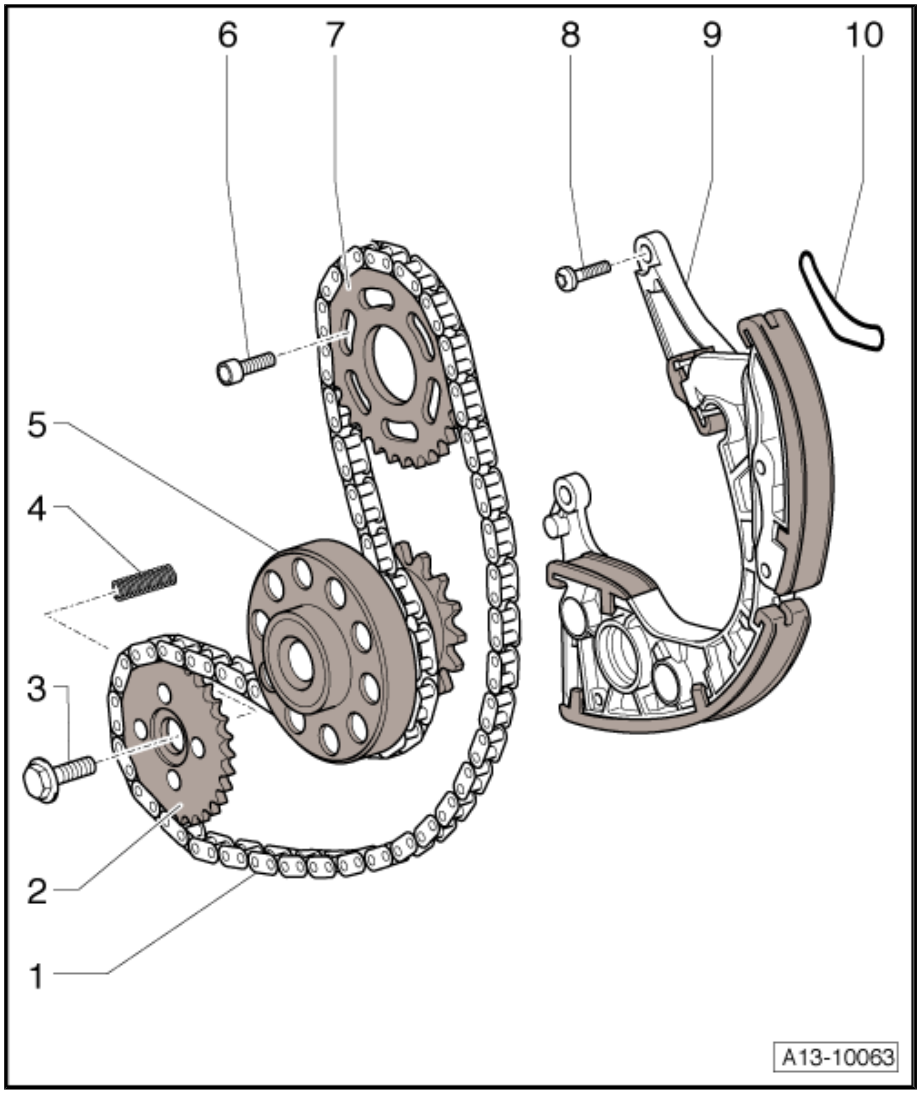
- ❑ Renew

9 - Chain tensioner

- ❑ With guide rail

10 - Gasket

- ❑ Depending on version
- ❑ Renew



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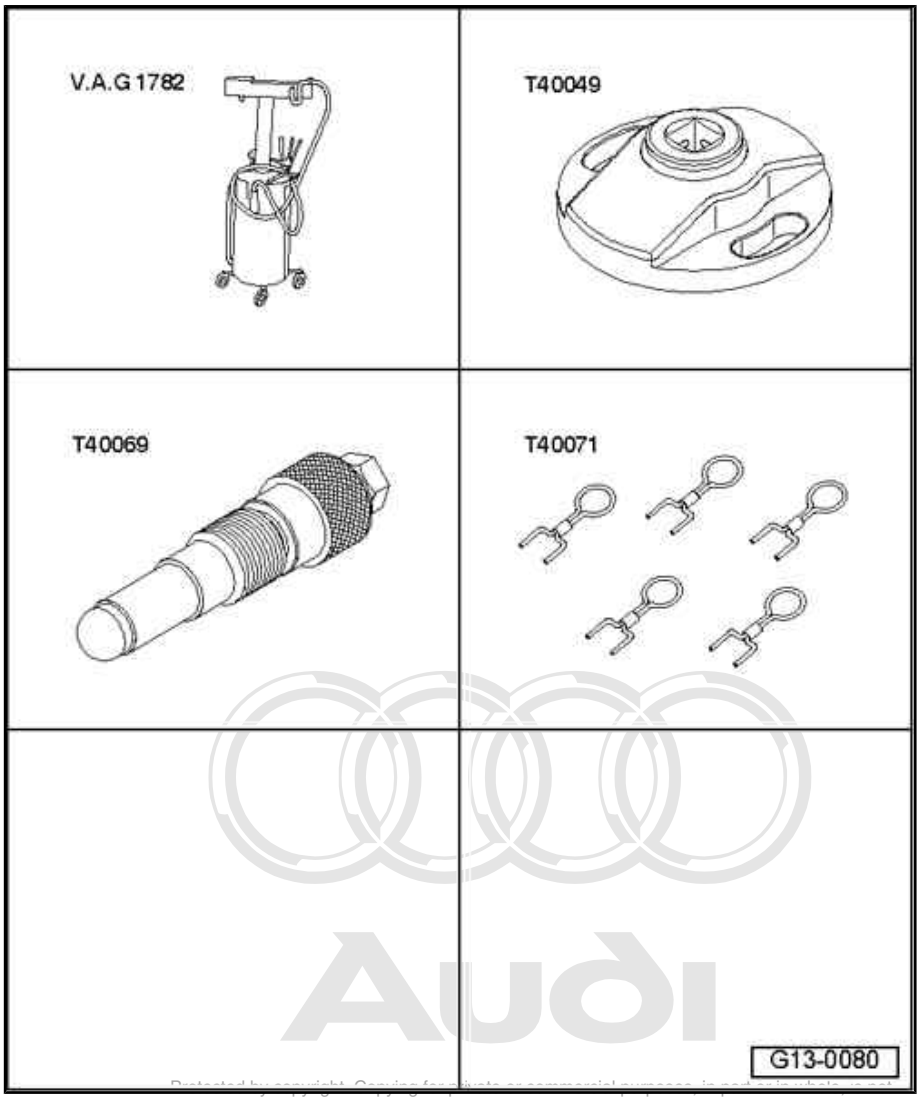
4.6 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006

Special tools and workshop equipment required

- Used oil collection and extraction unit - V.A.G 1782-
- Adapter - T40049-
- Locking pin - T40069-
- Locking pin - T40071-
- Drill bit, ∅ 8 mm



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Removing

– Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

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
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 .

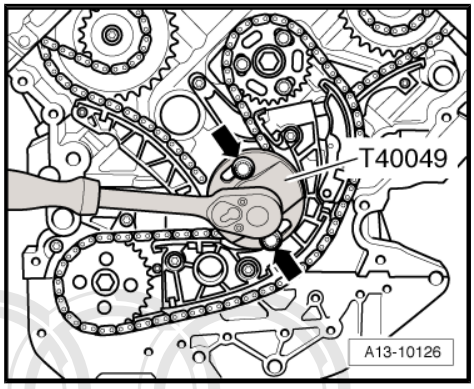
– Vehicles with multitronic gearbox: Remove damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 and flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 .

– Place used oil collection and extraction unit - V.A.G 1782- under engine.
– Drain off engine oil.
– Remove timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .

Caution

Place a washer under the bolt heads to make sure the chain does not get trapped by the bolts.

– Attach adapter - T40049- at rear end of crankshaft using two old securing bolts for dual-mass flywheel.

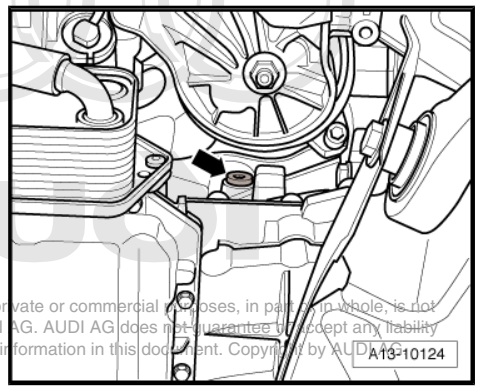


– Unscrew plug -arrow- from cylinder block.

WARNING

To avoid any risk of injury, do not rotate the crankshaft while feeling for the TDC hole with your finger.

– Turn crankshaft in normal direction of rotation to TDC position.



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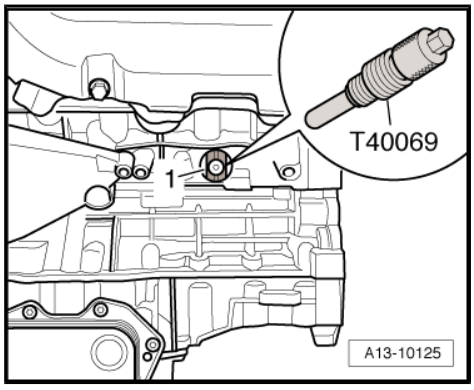
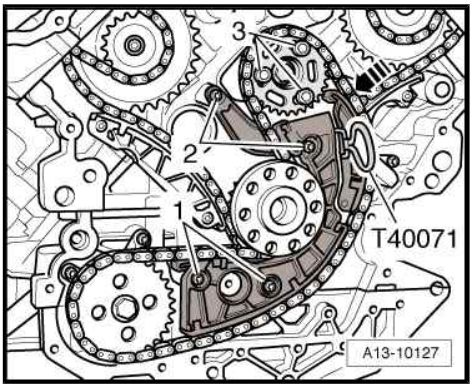
– Screw locking pin - T40069- into bore (tightening torque: 20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.
– Mark running direction of drive chain for auxiliary drives with paint.

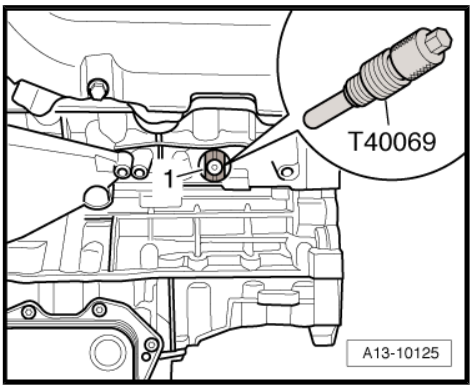


– Press guide rail of chain tensioner in direction of -arrow- and lock chain tensioner by inserting locking pin - T40071- .
– Remove bolts -1 ... 3- and take out chain tensioner, balance shaft sprocket and chain.



Installing

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



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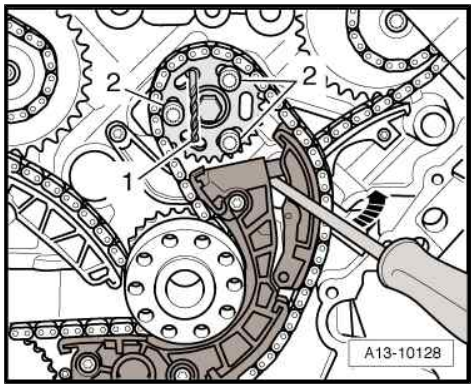

– Install chain tensioner with chain and balance shaft sprocket.
– Wrap insulating tape around tip and shaft of 8 mm ∅ drill bit to avoid cuts.
– Lock balance shaft in TDC position with ∅ 8 mm drill bit -item 1-.
• The elongated holes in the balance shaft sprocket must be aligned centrally over the threaded holes in the balance shaft. If necessary move chain one tooth further.
– Tighten bolts for chain tensioner.
– Screw in bolts -2- 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 -2- securing chain sprocket.
– Pull drill bit -item 1- out of balance shaft.

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

– Install timing chain cover (bottom)
⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .
– Install timing chain covers (left and right)
⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .
– Install crankshaft oil seal (timing chain end)
⇒ “2.7 Renewing crankshaft oil seal (timing chain end)”, page 86 .
– Vehicles with manual gearbox: Install dual-mass flywheel
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 and pressure plate ⇒ Rep. gr. 30 .
– Vehicles with multitronic gearbox: Install flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multi-tronic gearbox”, page 85 and damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 .
– Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
– Fill up with engine oil and check oil level
⇒ “1.13 Checking oil level”, page 202 .

Tightening torques

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Component	Nm
Chain tensioner to cylinder block	6 + 45° 1)2)
Chain sprocket for balance shaft to balance weight	15 + 90° 1)3)
Screw plug in cylinder block	14 4)

• 1) Renew bolts.
• 2) 45° = one eighth turn.
• 3) 90° = one quarter turn.
• 4) Install with new seal.

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

1 - Crankshaft

2 - Drive chain for auxiliary drives

- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ “4.8 Removing and installing drive chain for auxiliary drives on vehicles from 04.2006”, page 127

3 - Drive chain sprocket for oil pump

- ❑ Installation position: Side with lettering faces engine

4 - 30 Nm + 90° (1/4 turn) further

- ❑ Renew

5 - Compression spring

6 - 15 Nm + 90° (1/4 turn) further

- ❑ Renew

7 - Chain sprocket for balance shaft

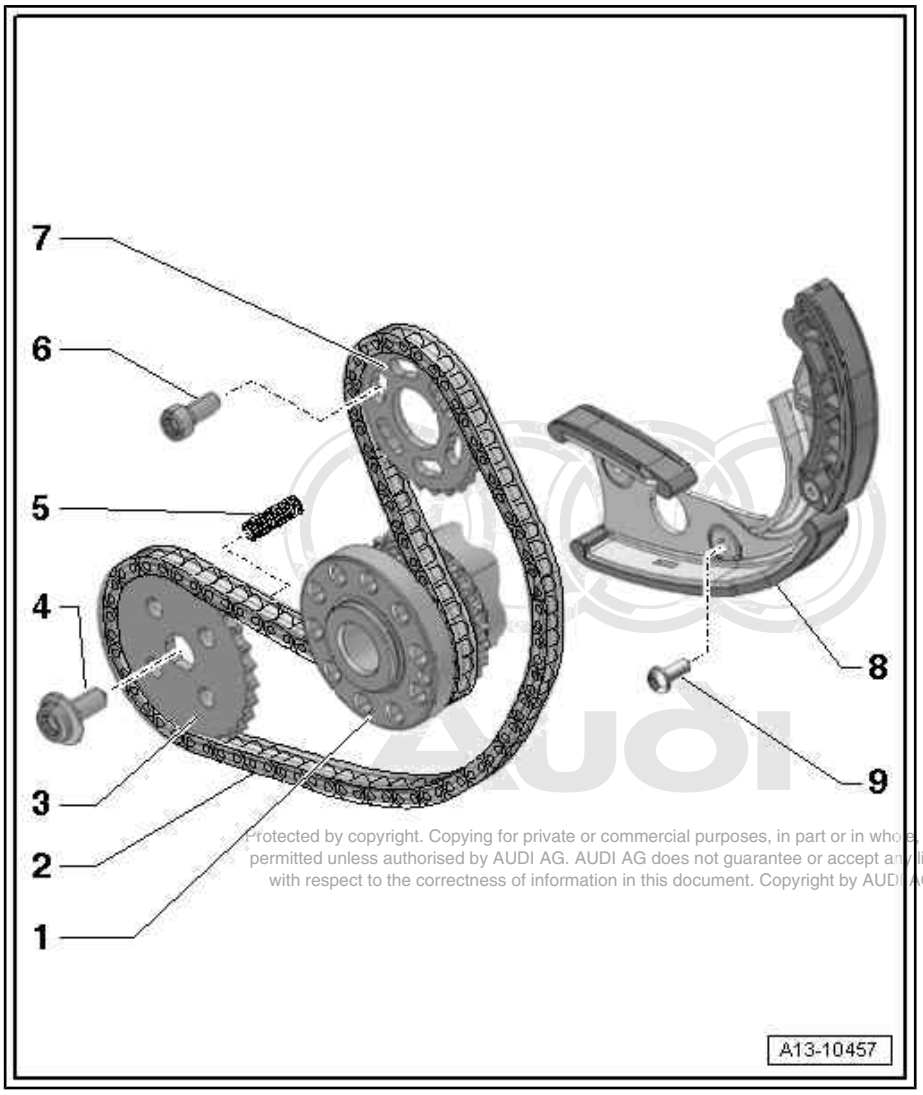
- ❑ Installation position: Side with lettering faces gearbox

8 - Chain tensioner

- ❑ With guide rail

9 - 10 Nm + 45° (1/8 turn) further

- ❑ Renew



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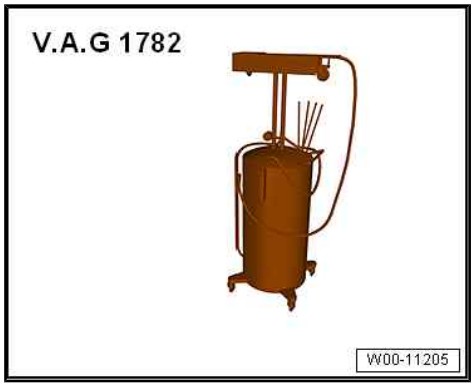
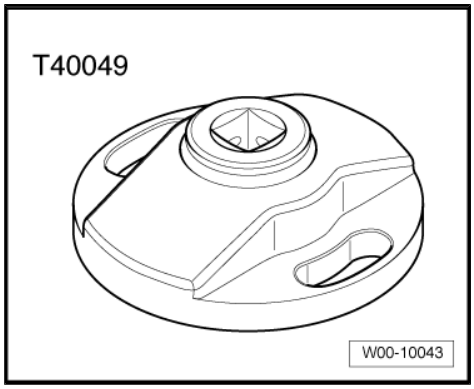
4.8 Removing and installing drive chain for auxiliary drives on vehicles from 04.2006

Special tools and workshop equipment required

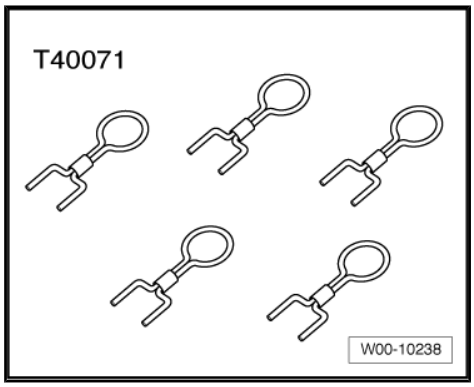
- Used oil collection and extraction unit - V.A.G 1782-



- Key - T40049-



- Locking pin - T40071-



- Drill bit, ∅ 8 mm

Removing

WARNING

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

– Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

– Vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. gr. 30 and dual-mass flywheel
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80

– Vehicles with multitronic gearbox: Remove damper unit ⇒ “2.5 Removing and installing damper unit”, page 84 and flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 .

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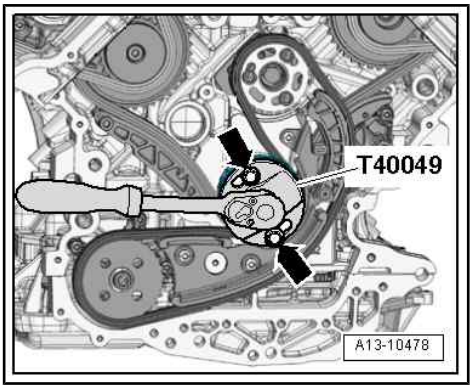
– Place used oil collection and extraction unit - V.A.G 1782- under engine and drain engine oil.
– Remove timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .

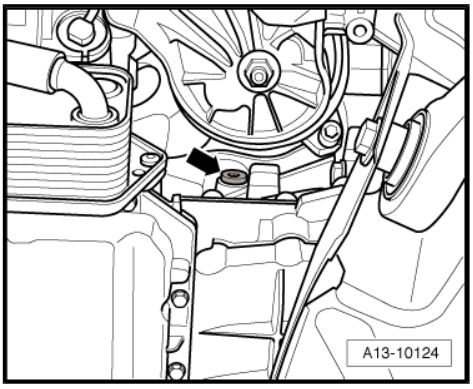
Caution

If necessary, place washers under the bolt heads to prevent the chain from being trapped by the bolts.

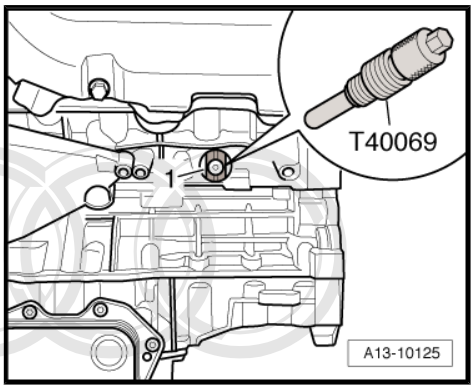
– Attach special wrench - T40049- at rear end of crankshaft using two old securing bolts for dual-mass flywheel.



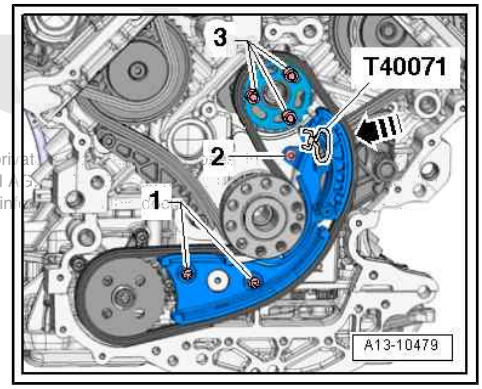
– Unscrew plug -arrow- for “TDC” marking from sump (top section).
– Turn crankshaft in normal direction of rotation to “TDC” position.



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



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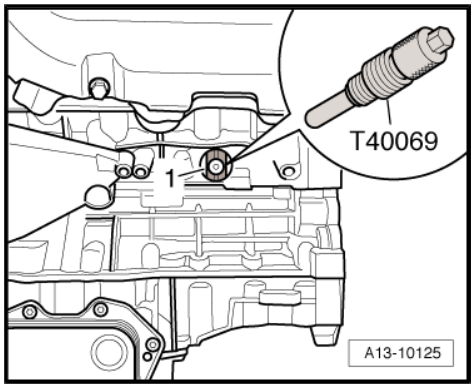
Installing

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



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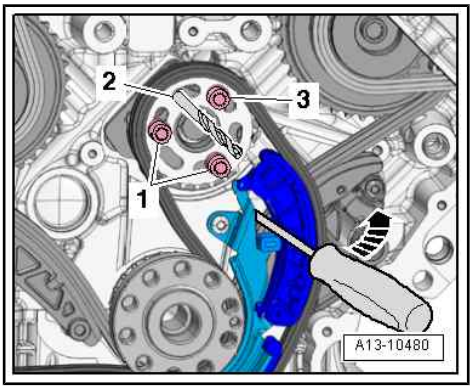

– Install chain tensioner with chain and balance shaft sprocket.
– Wrap insulating tape around tip and shaft of 8 mm ∅ drill bit to avoid cuts.
– Lock balance shaft in “TDC” position with 8 mm ∅ drill bit -item 2-.
• The elongated holes in the balance shaft sprocket must be aligned centrally over the threaded holes in the balance shaft. If necessary move chain one tooth further.
– Tighten bolts for chain tensioner.
– Fit bolts -1- and -3- for chain sprocket but do not tighten.
• It should just be possible to turn the sprocket on the balance shaft without axial movement.

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– Pull locking pin - T40071- out to release chain tensioner.
– Press against guide rail of chain tensioner -arrow- using a screwdriver, and at the same time tighten bolts -1- and -3- securing chain sprocket.
– Pull drill bit -2- out of balance shaft.

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

– Install timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .
– Install timing chain covers (left and right)
⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .
– Install crankshaft oil seal (gearbox end)
⇒ “2.7 Renewing crankshaft oil seal (timing chain end)”, page 86 .
– Vehicles with manual gearbox: Install dual-mass flywheel
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 and pressure plate ⇒ Rep. gr. 30 .
– Vehicles with multitronic gearbox: Install flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 and damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 .
– Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
– Fill up with engine oil and check oil level
⇒ “1.13 Checking oil level”, page 202 .

Tightening torques

Component	Nm
Chain tensioner to cylinder block	10 + 45° 1)2)
Chain sprocket for balance shaft to balance weight	15 + 90° 1)3)
Screw plug in cylinder block	14 4)

• 1) Renew bolts.
• 2) 45° = one eighth turn.
• 3) 90° = one quarter turn.
• 4) Install with new seal.

4.9 Balance shaft - exploded view

1 - Balance shaft

- ❑ Removing and installing ⇒ “4.10 Removing and installing balance shaft”, page 132

2 - 60 Nm

- ❑ Use ∅ 8 mm drill bit as counterhold when loosening and tightening

3 - Balance weight (timing chain end)

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

4 - Bearing plate

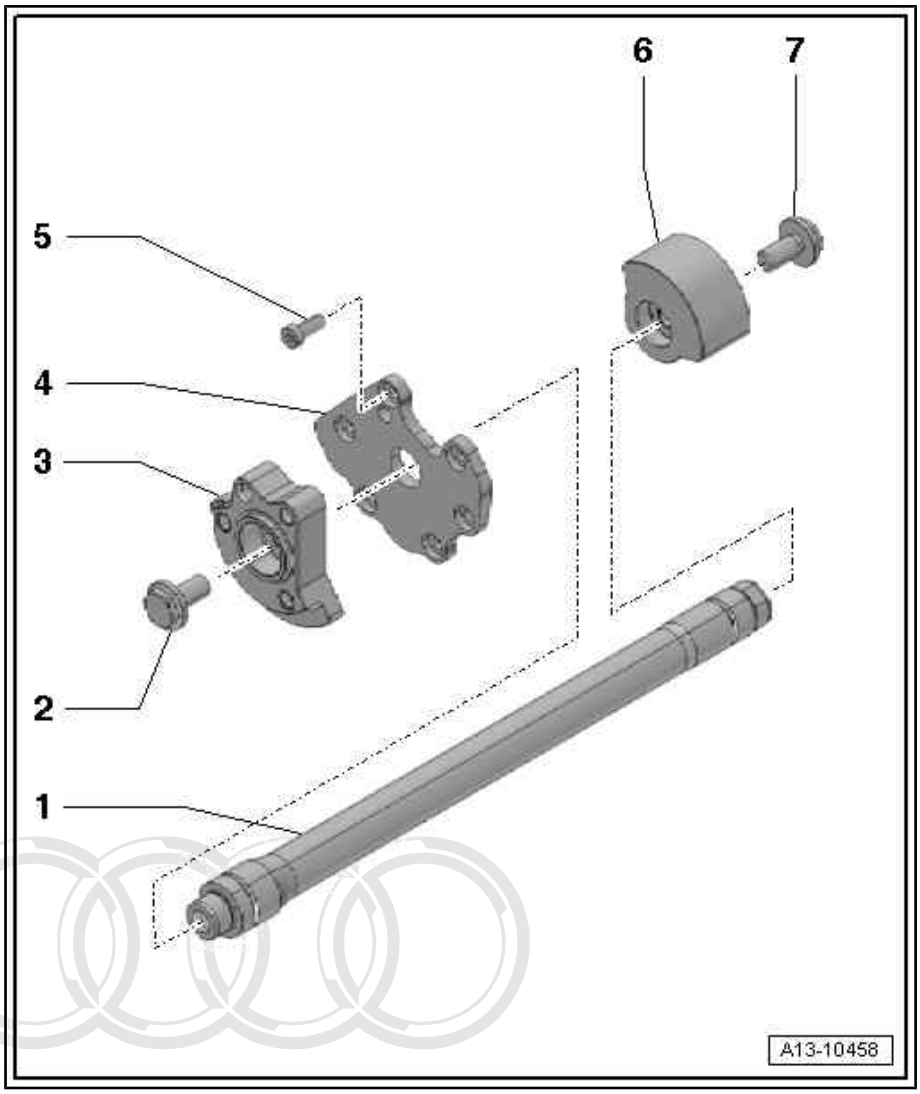
5 - 13 Nm

6 - Balance weight (pulley end)

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

7 - 60 Nm

- ❑ Use ∅ 8 mm drill bit as counterhold when loosening and tightening



4.10 Removing and installing balance shaft

Special tools and workshop equipment required

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

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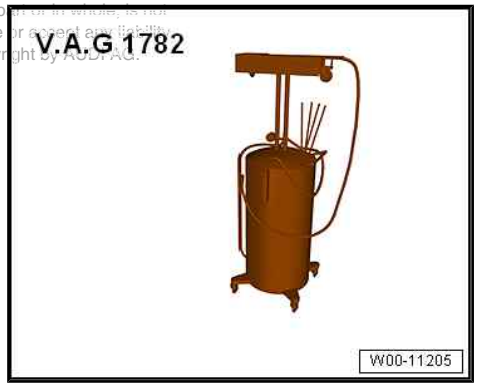
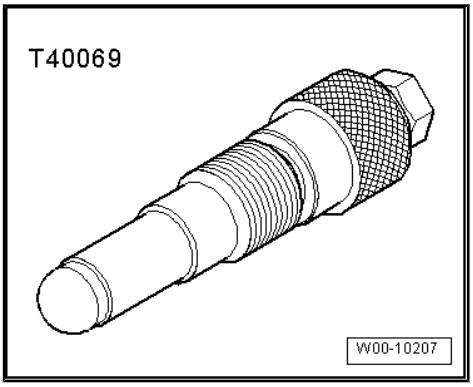


♦ Locking pin - T40069-



♦ Drill bit, ∅ 8 mm

Removing

– Remove gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

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
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 .

– Vehicles with multitronic gearbox: Remove damper unit ⇒ page 84 and flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 .

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– Place used oil collection and extraction unit - V.A.G 1782- under engine.

– Drain off engine oil.

– Remove sealing flange (pulley end)
⇒ “1.6 Renewing sealing flange (pulley end) with crankshaft oil seal”, page 75 .

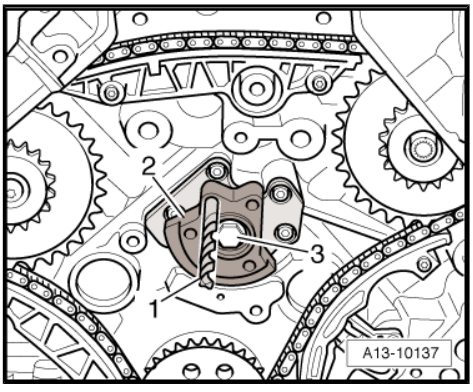
– Remove timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .

– Remove drive chain for oil pump and balance shaft
⇒ “4.6 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006”, page 123 .

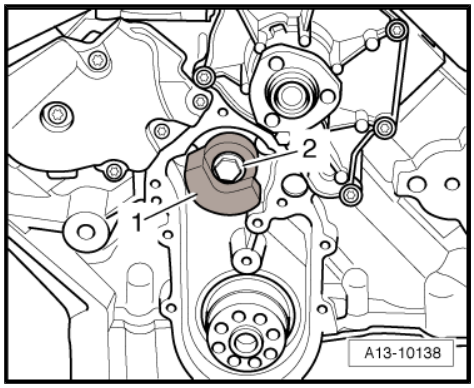
– Wrap insulating tape around tip and shaft of 8 mm ∅ drill bit to avoid cuts.

– Hold balance weight -2- in position at rear of engine using ∅ 8 mm drill bit -item 1-.

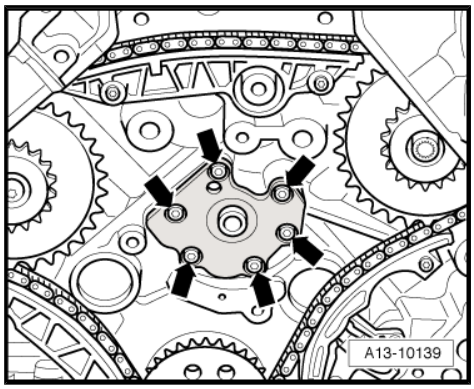
– Unscrew bolt -3- and detach balance weight from balance shaft.



– Unscrew bolt -2- (counterhold balance weight -1- with a suitable pin) and detach balance weight at front of engine from balance shaft.



– Unscrew bolts -arrows- and remove bearing plate for balance shaft at rear of engine.
– Pull balance shaft out of cylinder block towards rear.



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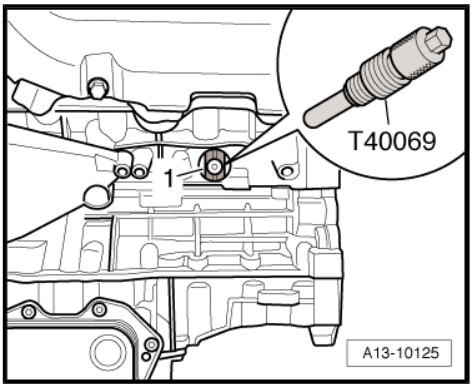
Installing

- 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 chain for oil pump and balance shaft
⇒ “4.6 Removing and installing drive chain for auxiliary drives on vehicles up to 04.2006”, page 123

– Install timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .

– Install sealing flange (pulley end)
⇒ “1.6 Renewing sealing flange (pulley end) with crankshaft oil seal”, page 75 .

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– Vehicles with manual gearbox: Install dual-mass flywheel
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 and pressure plate ⇒ Rep. gr. 30 .

– Vehicles with multitronic gearbox: Install flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 and damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 .

– Install gearbox ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

– Fill up with engine oil and check oil level
⇒ “1.13 Checking oil level”, page 202 .

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.	

5 Removing and installing crankshaft

⇒ “5.1 Crankshaft - exploded view”, page 136

⇒ “5.2 Crankshaft dimensions”, page 139

⇒ “5.3 Measuring axial clearance”, page 139

⇒ “5.4 Measuring radial clearance”, page 140

5.1 Crankshaft - exploded view

Note

When carrying out repairs, secure engine to engine and gearbox support - VAS 6095- : vehicles with manual gearbox ⇒ “1.3 Securing engine to engine and gearbox support”, page 31 , vehicles with multitronic gearbox ⇒ “2.3 Securing engine to engine and gearbox support”, page 61 .

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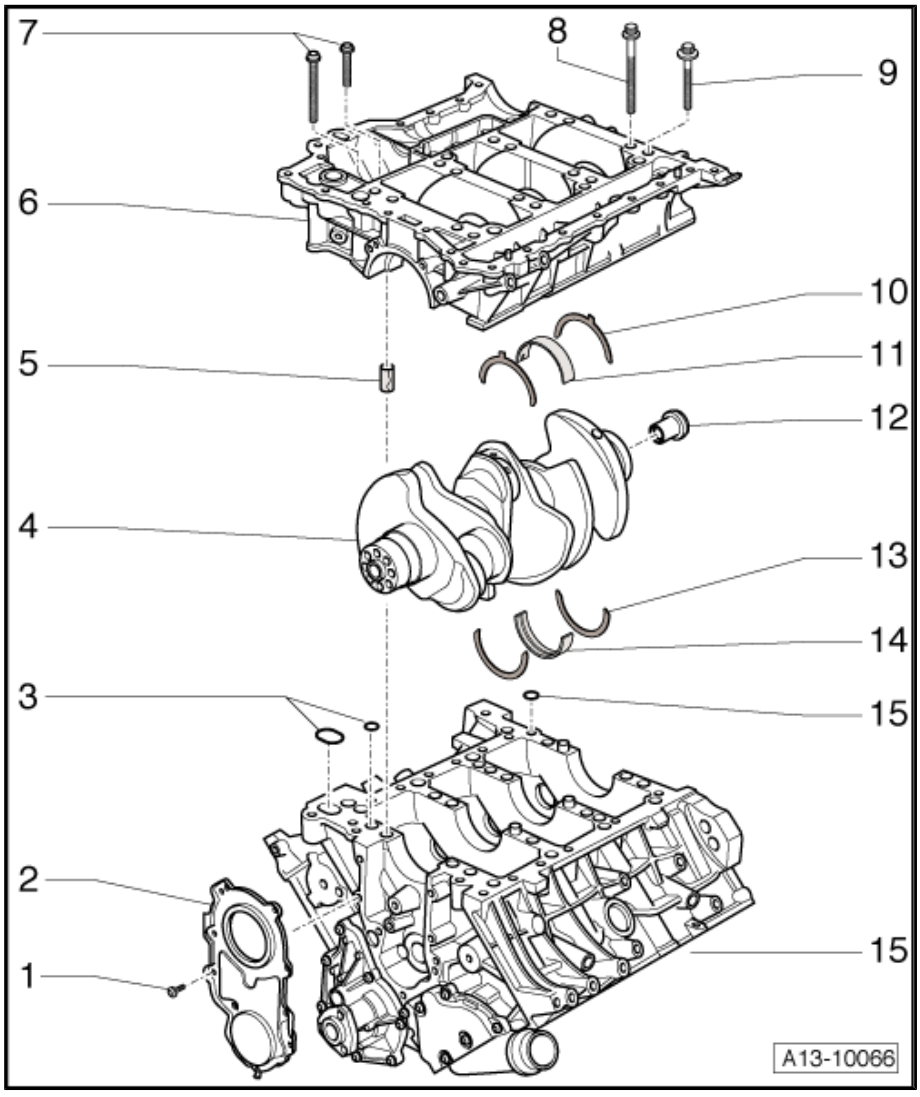

1 - 9 Nm

- ❑ Tighten in stages and in diagonal sequence

2 - Sealing flange (pulley end)

- ❑ Removing and installing ⇒ “1.6 Renewing sealing flange (pulley end) with crankshaft oil seal”, page 75

3 - Seals

- ❑ Different versions available ⇒ Electronic parts catalogue
- ❑ Renew

4 - Crankshaft

- ❑ Measuring axial clearance ⇒ “5.3 Measuring axial clearance”, page 139
- ❑ Measuring radial clearance ⇒ “5.4 Measuring radial clearance”, page 140
- ❑ Do not rotate the crankshaft when checking the radial clearance
- ❑ Crankshaft dimensions ⇒ “5.2 Crankshaft dimensions”, page 139

5 - Dowel sleeve

- ❑ 4x
- ❑ Inserting in retaining frame ⇒ Fig. ““Applying sealant to retaining frame, position of dowel sleeves”“ , page 138

6 - Retaining frame

- ❑ To remove, detach guide rail ⇒ Item 26 (page 118) for drive chain for valve gear
- ❑ Applying sealant ⇒ Fig. ““Applying sealant to retaining frame, position of dowel sleeves”“ , page 138
- ❑ Tightening sequence for securing bolts ⇒ Fig. ““Installing retaining frame”“ , page 138

7 - Bolt

- ❑ For sealing surfaces: cylinder block/retaining frame
- ❑ Differing bolt lengths and bolt heads
- ❑ Tightening sequence ⇒ Fig. ""Installing retaining frame"" , page 138

8 - Bolt (long, large collar)

- ❑ For retaining frame (inner row)
- ❑ Tightening sequence ⇒ Fig. ""Installing retaining frame"" , page 138

9 - Bolt (short, small collar)

- ❑ For retaining frame (outer row)
- ❑ Tightening sequence ⇒ Fig. ""Installing retaining frame"" , page 138

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 ⇒ "5.3 Measuring axial clearance", page 139

11 - Bearing shell

- ❑ For retaining frame (without oil groove)
- ❑ Do not interchange used bearing shells (mark positions)
- ❑ Note installation position
- ❑ Install new bearing shells for retaining frame with correct coloured markings
  ⇒ Fig. ""Matching crankshaft bearing shells to bearings in retaining frame"" , page 139

12 - Not fitted

13 - Thrust washer

- ❑ Only fitted on 3rd crankshaft bearing
- ❑ Oil grooves face outwards

14 - Bearing shell

- ❑ For cylinder block (with oil groove)
- ❑ Do not interchange used bearing shells (mark positions)
- ❑ Note installation position
- ❑ Install new bearing shells for the cylinder block with the correct coloured markings
  ⇒ Fig. ""Matching crankshaft bearing shells to bearings in cylinder block"" , page 138

15 - O-ring or seal

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

16 - Cylinder block

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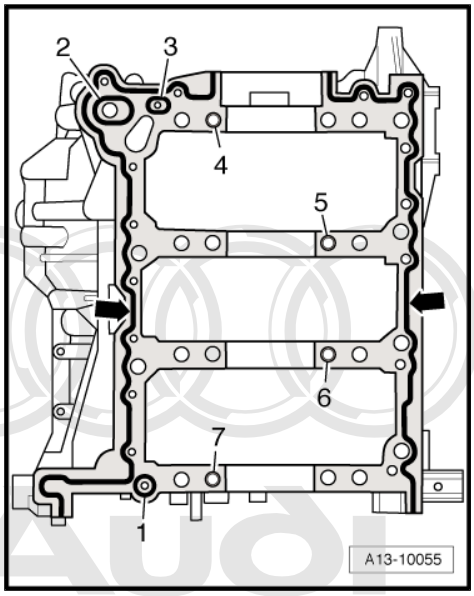
Applying sealant to retaining frame, position of dowel sleeves



– 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.

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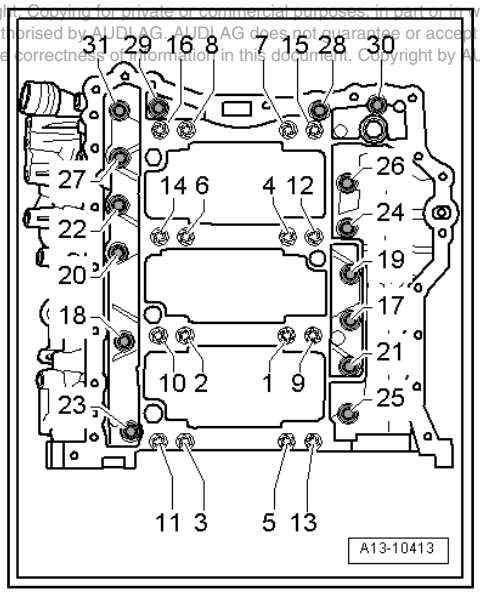
Installing retaining frame

– Renew bolts -1 … 16- for retaining frame.

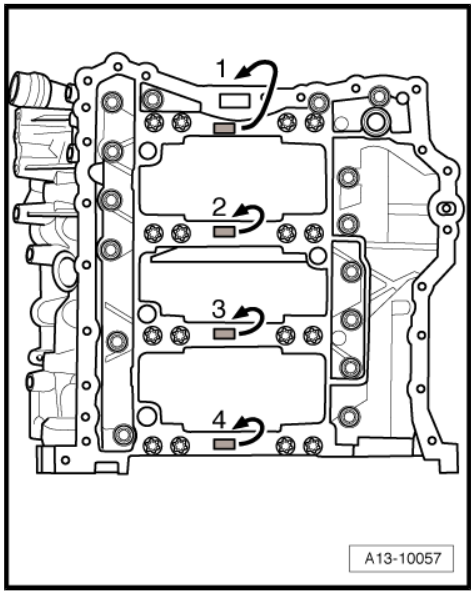
– Install long bolts in inner row on retaining frame.

– Tighten bolts -1 … 31- in 3 stages as follows:

1. Tighten bolts in the sequence -1 ... 16- to 50 Nm.
2. Turn bolts 90° further in the sequence -1 ... 16-.
3. Tighten bolts for sealing surfaces (retaining frame / cylinder block) in the sequence -17 ... 31- to 23 Nm.



Matching crankshaft bearing shells to bearings in cylinder block



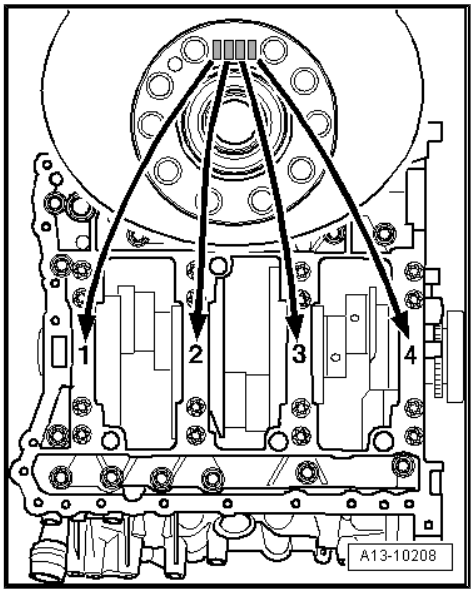
♦ Bearing shells of the correct thickness are matched to the bearings in the cylinder block at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.

♦ The allocation of the bearing shells to the bearing positions in the cylinder block is indicated by a code letter at the relevant bearing on the retaining frame.

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

Matching crankshaft bearing shells to bearings in retaining frame

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



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

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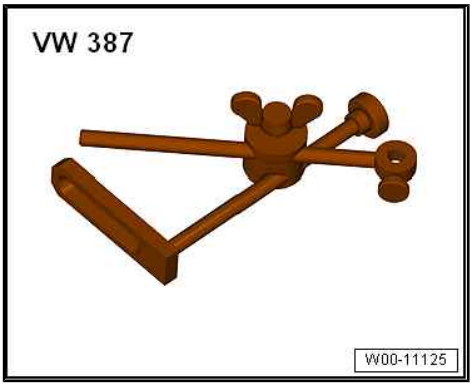
5.2 Crankshaft dimensions

Honing dimension (in mm)	Crankshaft main bearing journal ∅	Crankshaft conrod journal ∅
Basic dimension	65.00 – 0.022 – 0.042	56.00 – 0.022 – 0.042

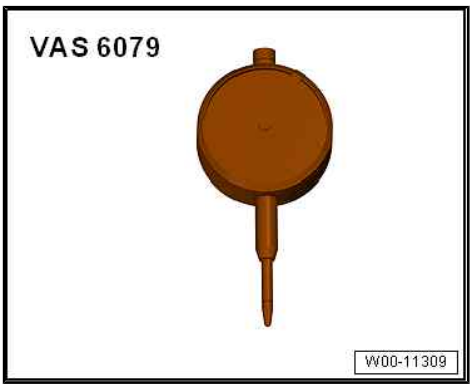
5.3 Measuring axial clearance

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-



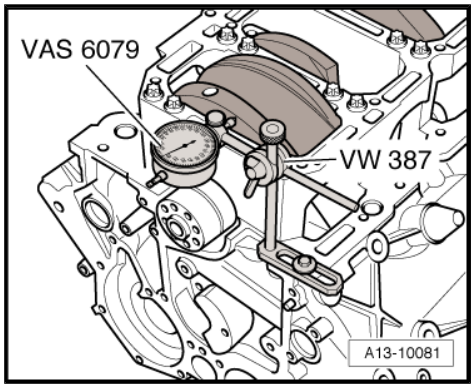
Procedure

– 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



5.4 Measuring radial clearance

Special tools and workshop equipment required

♦ Plastigauge

Procedure

Note

♦ *Do not interchange used bearings.*

♦ *Bearing shells worn down to nickel layer must be renewed.*

– Remove retaining frame and clean bearing journals.

– Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or bearing shell.

• The Plastigauge must be positioned in the centre of the bearing shell

– Fit retaining frame and secure with old bolts ⇒ Fig. ""Installing retaining frame"" , page 138 without rotating crankshaft.

– Remove retaining frame once more.

– Compare width of Plastigauge with measurement scale:

• Radial clearance (new): 0.015 ... 0.055 mm

• Radial clearance (wear limit): 0.08 mm

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6 Dismantling and assembling pistons and conrods

⇒ “6.1 Pistons and conrods - exploded view”, page 141

⇒ “6.2 Piston and cylinder dimensions”, page 144

⇒ “6.3 Checking radial clearance of conrod bearings”, page 144

6.1 Pistons and conrods - exploded view

Note

Oil spray jet for piston cooling ⇒ *Fig. ““Oil spray jet for piston cooling”“ , page 144* .

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

- ❑ Renew
- ❑ Lubricate threads and contact surface
- ❑ Use old bolts when measuring radial clearance

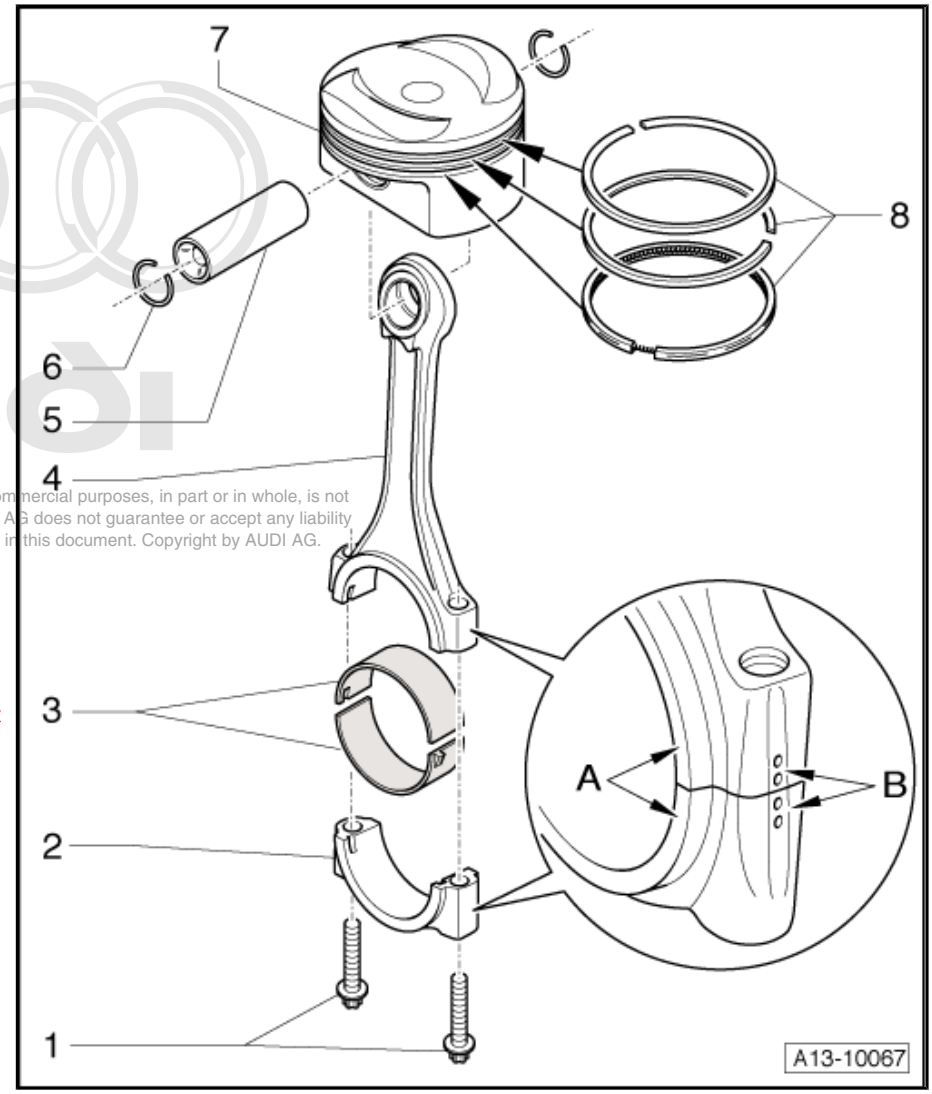
2 - Conrod bearing cap

- ❑ Do not interchange
- ❑ Mark cylinder allocation with a coloured pen -B- ⇒ Fig. ““Marking conrods”“ , page 143
- ❑ 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 ⇒ Fig. ““Conrod installation position”“ , page 144

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.



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or

- ❑ Bearing shells are the same: no special identification
- ❑ Ensure that retaining lugs are securely seated.
- ❑ Do not interchange used bearing shells (mark positions)
- ❑ Measuring radial clearance ⇒ “6.3 Checking radial clearance of conrod bearings”, page 144

- ❑ To measure radial clearance, tighten bolts ⇒ Item 1 (page 141) to 30 Nm but do not turn further

4 - Conrod

- ❑ Only renew as a complete set
- ❑ Mark cylinder allocation in colour -B- ⇒ Fig. ""Marking conrods"" , page 143
- ❑ 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 ⇒ Fig. ""Conrod installation position"" , page 144

5 - Piston pin

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

6 - Retaining ring

- ❑ Renew

7 - Piston

- ❑ Installation position and allocation of piston/cylinder ⇒ Fig. ""Piston installation position and piston/cylinder allocation"" , page 143
- ❑ Arrow on piston crown points to pulley end
- ❑ Checking ⇒ Fig. ""Checking piston"" , page 143
- ❑ Install using piston ring clamp
- ❑ Piston and cylinder dimensions ⇒ "6.2 Piston and cylinder dimensions", page 144
- ❑ Checking cylinder bore ⇒ Fig. ""Checking cylinder bore"" , page 143

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 ⇒ Fig. ""Checking piston ring gap"" , page 142
- ❑ Checking ring-to-groove clearance ⇒ Fig. ""Checking ring-to-groove clearance"" , page 142

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.

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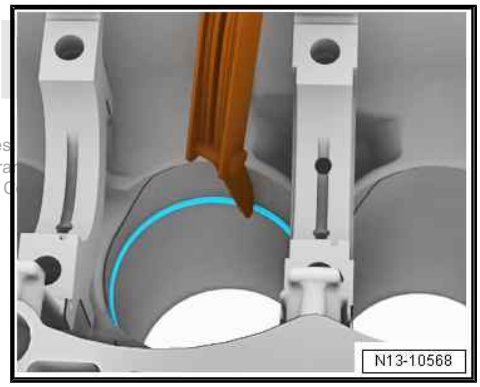
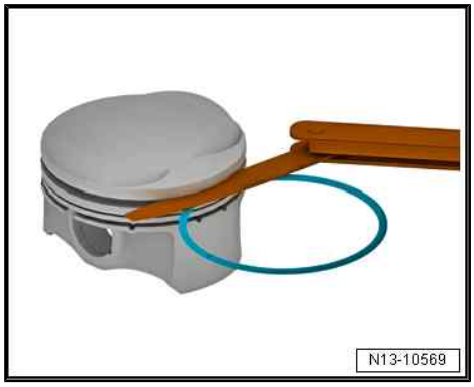
Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.20 … 0.35	0.8
2nd compression ring	0.50 … 0.70	1.0
Oil scraper ring	0.20 … 0.40	0.8



Checking ring-to-groove clearance

– Clean groove in piston before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
Compression rings	0.02 … 0.08	0.20
Oil scraper ring	0.02 … 0.08	0.15

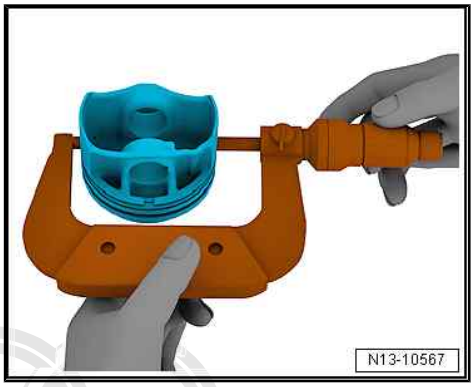


Checking piston

– Using a micrometer (75 ... 100 mm), measure approx. 10 mm from the lower edge, perpendicular to the piston pin axis.

• Maximum deviation from nominal dimension: 0.04 mm.

Nominal dimension
⇒ “6.2 Piston and cylinder dimensions”, page 144 .

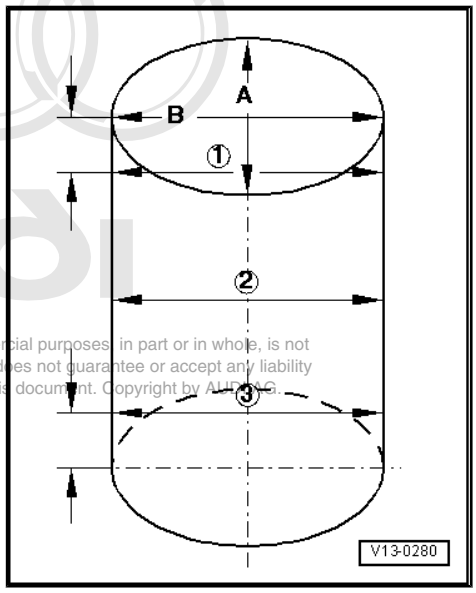


Checking cylinder bore

– 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
⇒ “6.2 Piston and cylinder dimensions”, page 144 .



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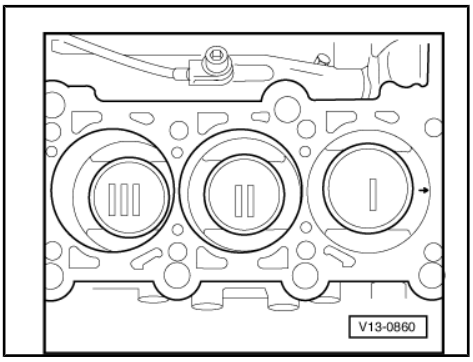
Piston installation position and piston/cylinder allocation

– 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 scriber, as this would damage the coating of the piston crown.

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



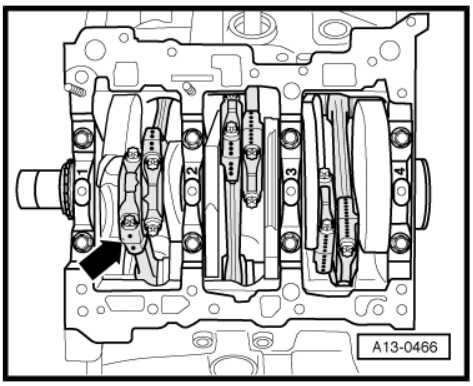
Marking conrods

Note

♦ *Only renew conrods as a complete set.*

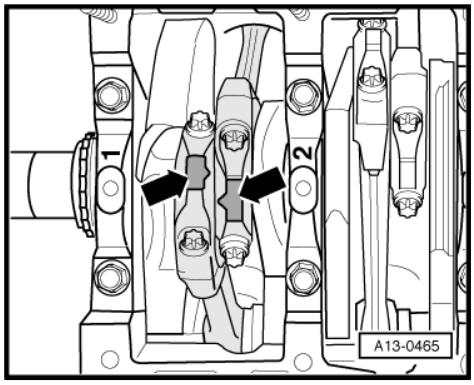
♦ *Do not interchange conrod bearings.*

– 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

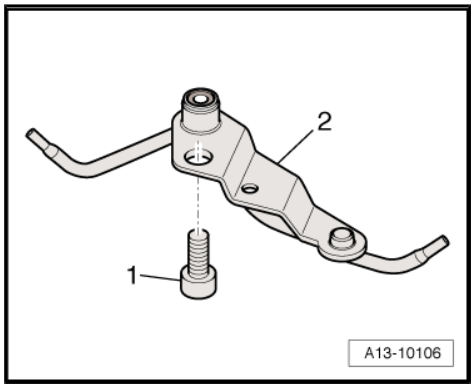
- The cast lugs -arrows- on the ground surfaces of the conrod pairs 1 and 2, 3 and 4, and 5 and 6 must face one another.



Oil spray jet for piston cooling

1 - Apply locking fluid when installing bolt (tightening torque 9 Nm); refer to ⇒ Electronic parts catalogue

2 - Oil spray jet with spray nozzle valve



6.2 Piston and cylinder dimensions

Honing dimension (in mm)	Piston ∅	Cylinder bore ∅
Basic dimension	80.99 1)	81.01
• 1) Dimensions including coating (thickness 0.02 mm). The coating will wear down in service.		

6.3 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

♦ Plastigauge

Procedure

– Remove conrod bearing cap. Clean bearing cap and bearing journal.

– Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or bearing shell.

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– Fit conrod bearing cap and secure with old bolts ⇒ Item 1 (page 141) without rotating crankshaft.

– Remove conrod bearing caps once more.

– Compare width of Plastigauge 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 Removing and installing cylinder head

⇒ “1.1 Cylinder head - exploded view”, page 145

⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147

⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149

⇒ “1.4 Removing and installing cylinder head”, page 151

⇒ “1.5 Removing and installing vacuum pump for brake servo”, page 157

⇒ “1.6 Checking compression”, page 157

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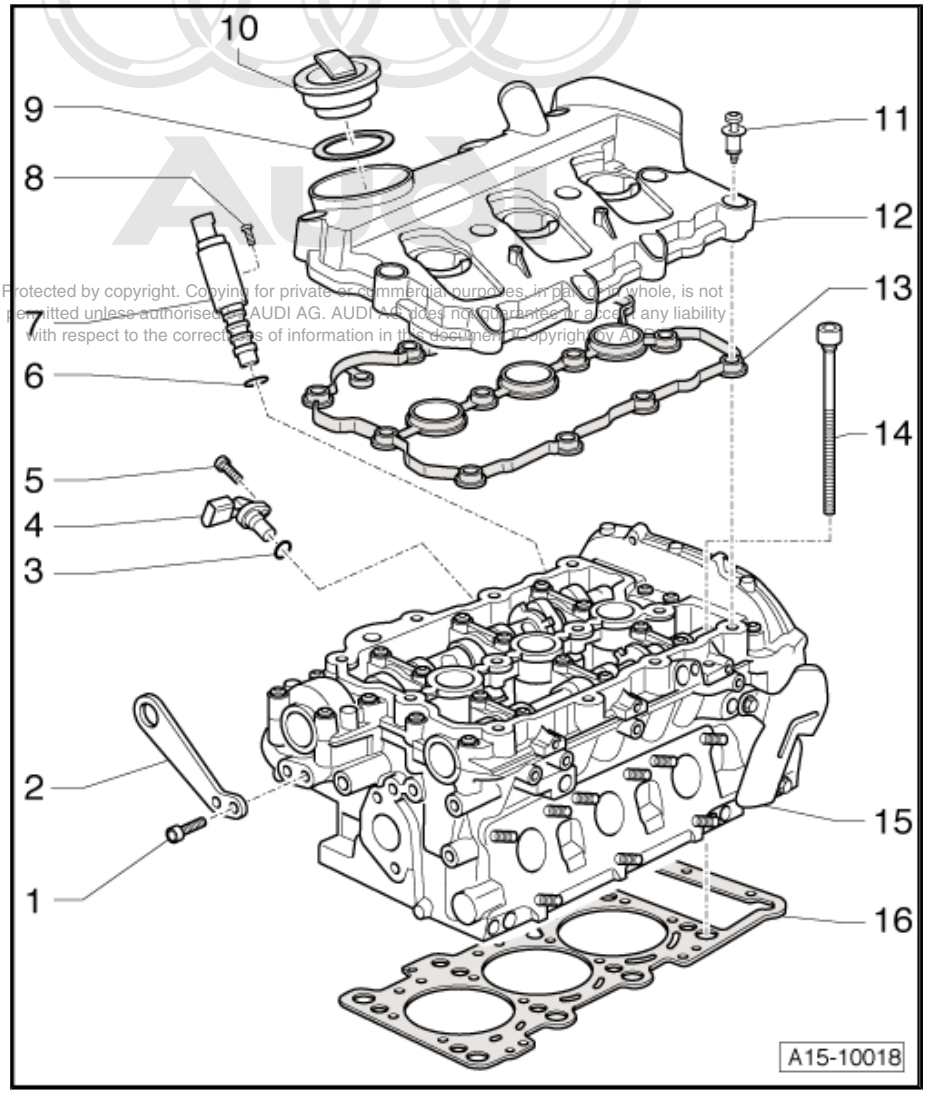
1.1 Cylinder head - exploded view

Note

Illustration shows left cylinder head.



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1 - 20 Nm

2 - Lifting eye

3 - O-ring

- ❑ Renew

4 - Hall sender

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

5 - 9 Nm

6 - O-ring

- ❑ Renew

7 - Camshaft control valve

- ❑ Cylinder bank 1 (right-side): camshaft control valve 1 - N205-
- ❑ Cylinder bank 2 (left-side): camshaft control valve 2 - N208-

8 - 2.5 Nm

9 - Seal

- ❑ Renew if damaged or leaking

10 - Filler cap

11 - Special bolt, 9 Nm

- ❑ Renew if damaged or leaking
- ❑ Note correct sequence when tightening ⇒ page 149

12 - Cylinder head cover

- ❑ Removing and installing cylinder head cover (left-side) ⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147
- ❑ Removing and installing cylinder head cover (right-side) ⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149

13 - Gasket for cylinder head cover

- ❑ Renew if damaged or leaking

14 - Cylinder head bolt

- ❑ Renew
- ❑ Note correct sequence when loosening ⇒ page 154
- ❑ Note correct sequence when tightening ⇒ page 155

15 - Cylinder head

- ❑ Removing ⇒ “1.4 Removing and installing cylinder head”, page 151
- ❑ Checking for distortion ⇒ Fig. ““Checking cylinder head for distortion”“ , page 147
- ❑ Machining limit ⇒ Fig. ““Cylinder head machining limit”“ , page 147
- ❑ Installing ⇒ page 154
- ❑ If renewed, change coolant and engine oil

16 - Cylinder head gasket

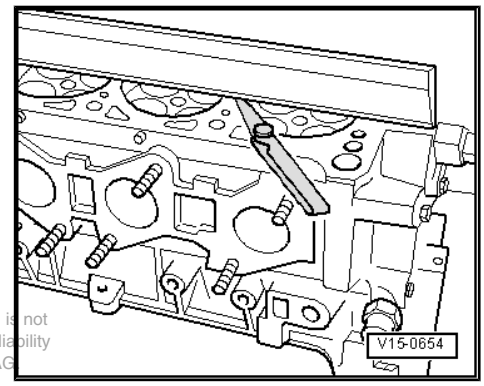
- ❑ Renewing ⇒ “1.4 Removing and installing cylinder head”, page 151

- ❑ 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



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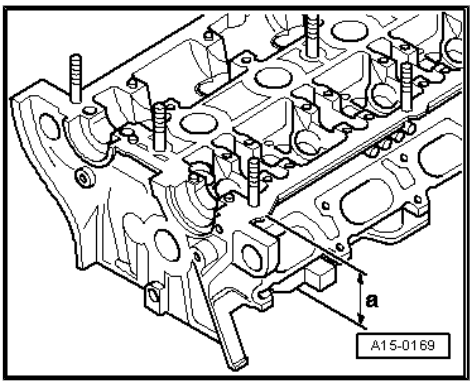
Cylinder head machining limit

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

• Minimum dimension: -a- = 139.20 mm



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

Special tools and workshop equipment required

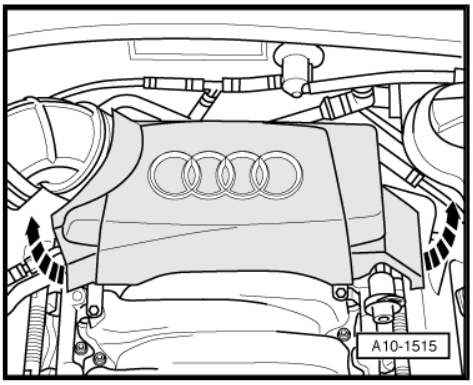
♦ Puller - T40039-

Removing

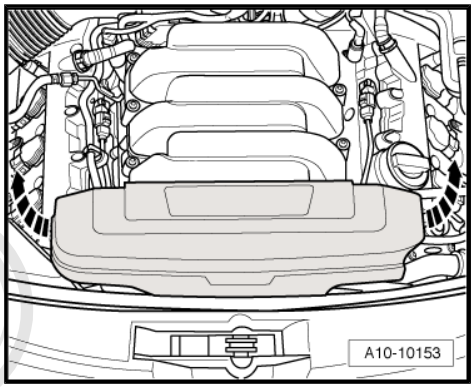
Note

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

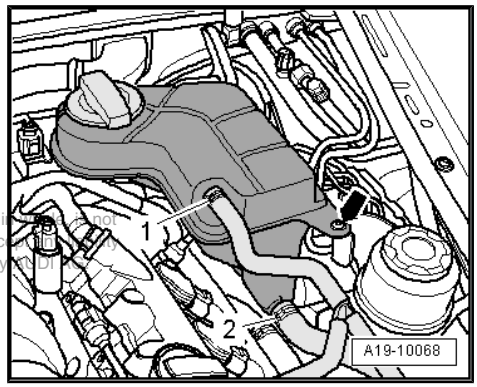
– Pull off engine cover panel (rear) -arrows-.



– Pull 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 coolant expansion tank to one side with coolant hoses -1- and -2- attached.



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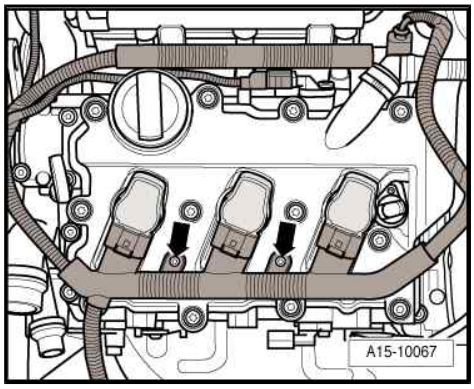
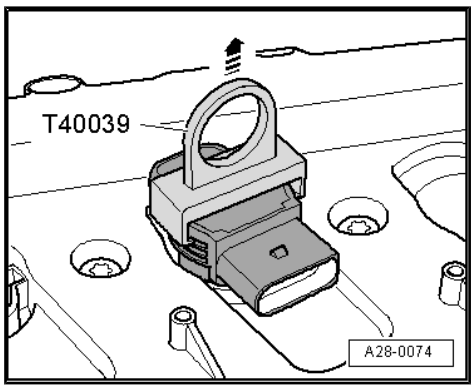
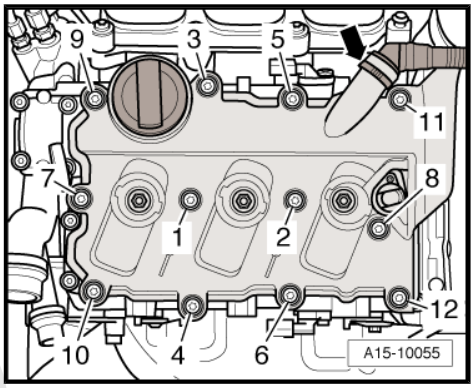
– Unscrew bolts -arrows- and unplug electrical connectors at ignition coils.



– Pull ignition coils out with puller - T40039- .



– 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

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

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

Special tools and workshop equipment required

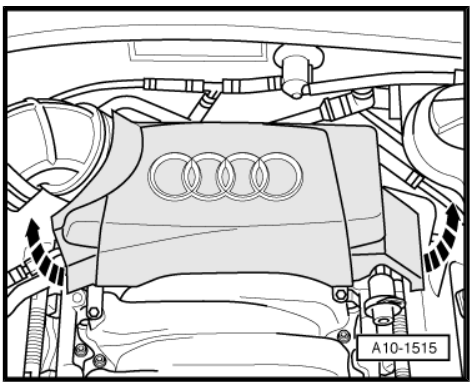
- Puller - T40039-

Removing

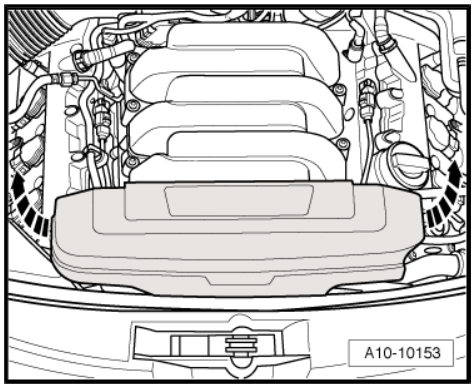
Note

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

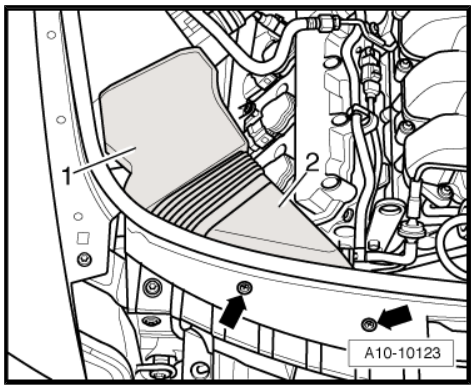
– Pull off engine cover panel (rear) -arrows-.



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



– Remove bolts -arrows-.
– Remove air duct -1- and -2-.



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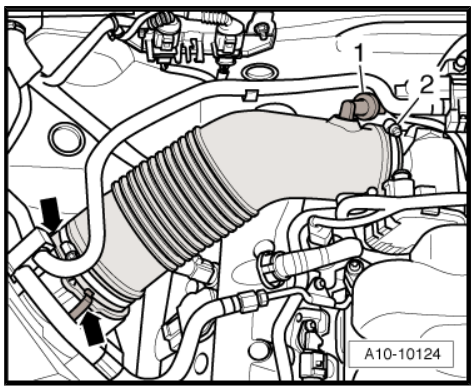
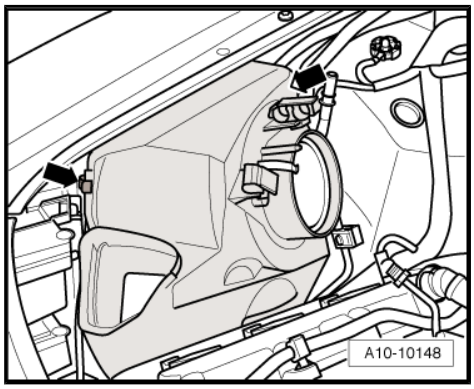
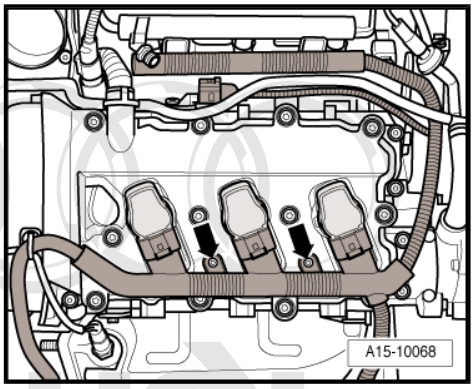
– Detach non-return valve -1- from air intake hose.
– Remove air hose. To do so, loosen hose clip -2- and release retaining clips -arrows-.



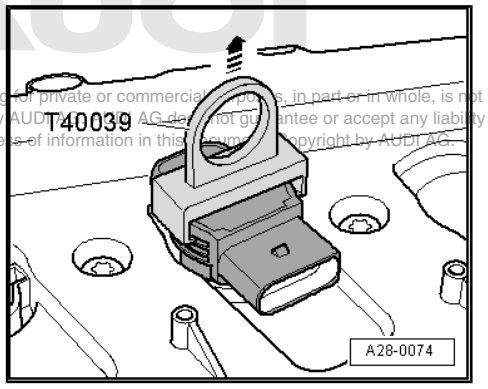
– Loosen clamps -arrows- and detach top section of air cleaner housing.



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



– Pull ignition coils out with puller - T40039- .



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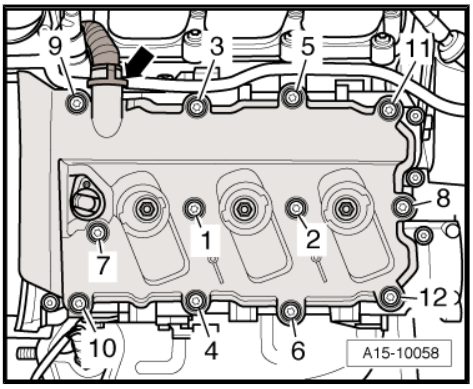
– Detach crankcase breather hose -arrow-.
– Move vacuum hose (leading to brake servo) on cylinder head cover clear to one side.
– Unscrew cylinder head cover bolts (right-side) in the sequence -12 ... 1-.
– Remove cylinder head cover.



Installing

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

Note

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

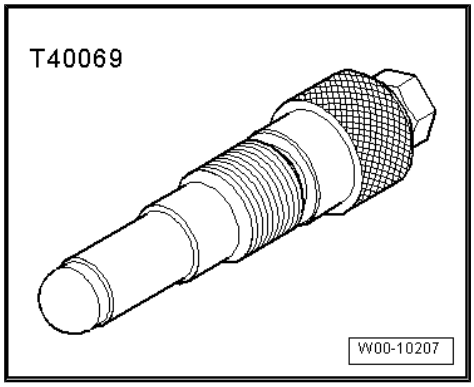
Tightening torques

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

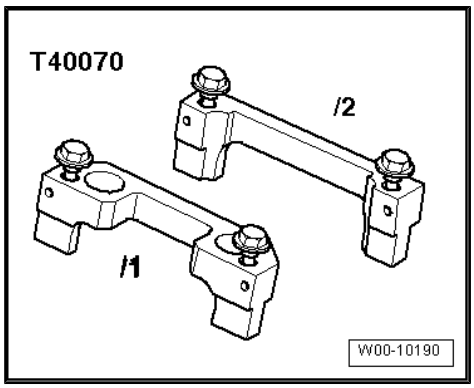
1.4 Removing and installing cylinder head

Special tools and workshop equipment required

♦ Locking pin - T40069-



♦ Camshaft clamp - T40070-



Removing

Note

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

– Drain off coolant
⇒ “1.2 Draining and filling cooling system”, page 206 .

– Remove front exhaust pipe: left-side
⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242 , right-side
⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246 .

– Remove poly V-belt
⇒ “1.4 Removing and installing poly V-belt”, page 73 .

– Remove coolant pipe (front)
⇒ “1.9 Removing and installing coolant pipe (front)”, page 217 .

– Remove power steering pump ⇒ Rep. gr. 48 .

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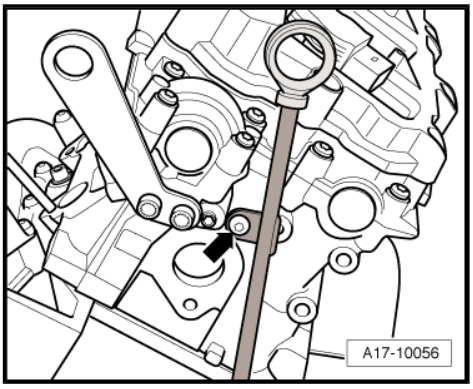
Note

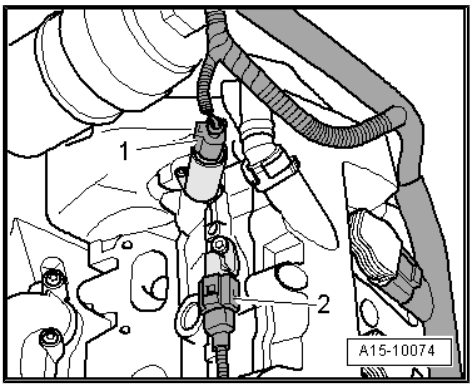
To remove the cylinder head (right-side) you must first remove the vacuum pump for brake servo
⇒ “1.5 Removing and installing vacuum pump for brake servo”, page 157 .

– Remove intake manifold ⇒ Rep. gr. 24 .

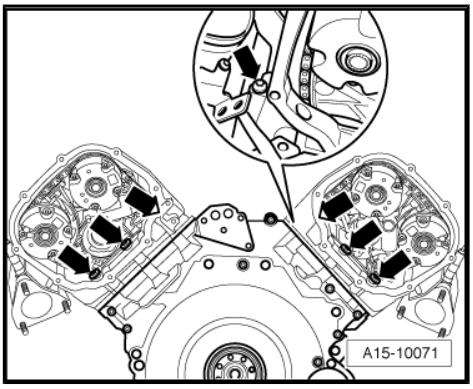
– Remove guide tube for oil dipstick -arrow-.



– Unplug electrical connectors -1- and -2-.
– Remove oil filter housing
⇒ “1.7 Removing and installing oil filter housing”, page 195 .
– Remove cylinder head cover: left-side
⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147 , right-side
⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149 .
– Detach timing chains from camshafts
⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106 .



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



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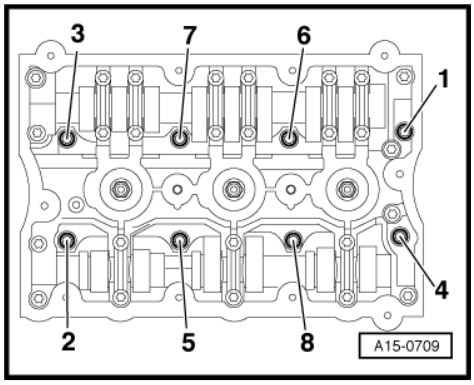
– Loosen cylinder head bolts in the sequence -1 ... 8-.

– Carefully remove 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 oil seals and gaskets.*
- *If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- *Carefully remove any remaining emery and abrasive material.*
- *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*
- *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 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.*

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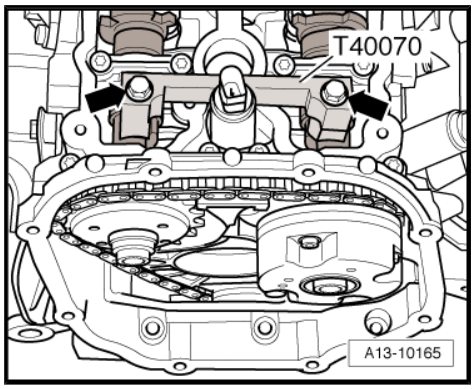
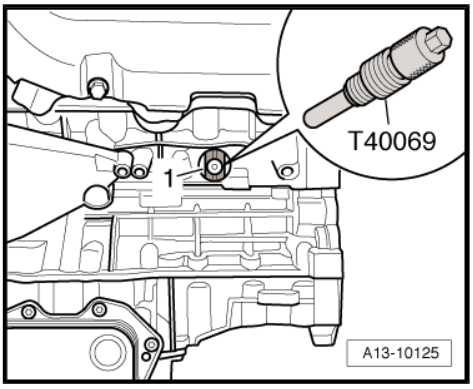
– Before fitting cylinder head, set crankshaft and camshafts to TDC. To do so, fit camshaft clamps - T40070- to both cylinder heads and tighten to 20 Nm.

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



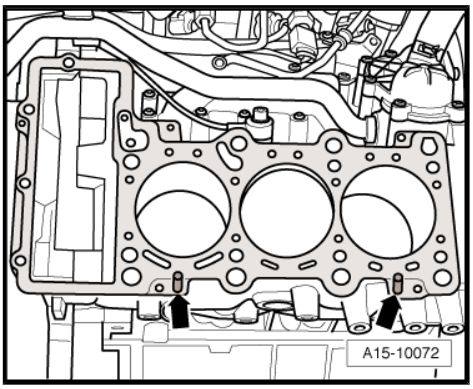
- The locking pin - T40069- must be screwed into the crankshaft.



– Fit cylinder head gasket.

- Note position of centring 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.

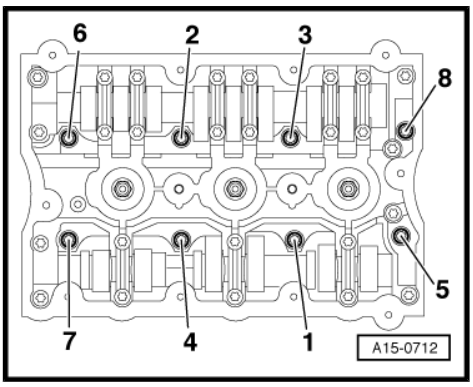
– Fit cylinder head.



– Insert new cylinder head bolts and tighten hand-tight.

– Tighten cylinder head in 3 stages in the following sequence:

1. Tighten with torque wrench to 40 Nm.
2. Turn 90° ($^1/_4$ turn) further using a rigid wrench.
3. Turn 90° ($^1/_4$ turn) further using a rigid wrench.



Note

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

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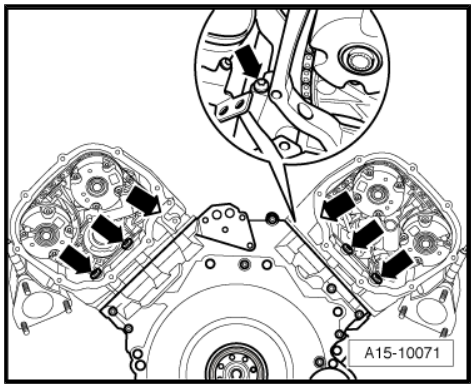
– Tighten bolts -arrows- to 9 Nm.

♦ 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 111 .

– Install timing chain covers (left and right) ⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .

– Install cylinder head cover: left-side ⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147 , right-side ⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149 .

– Install oil filter housing ⇒ “1.7 Removing and installing oil filter housing”, page 195 .

– Install intake manifold ⇒ Rep. gr. 24 .

– Install vacuum pump for brake servo ⇒ “1.5 Removing and installing vacuum pump for brake servo”, page 157 .

– Install power steering pump ⇒ Rep. gr. 48 .

– Install coolant pipe (front) ⇒ “1.9 Removing and installing coolant pipe (front)”, page 217 .

– Install poly V-belt ⇒ “1.4 Removing and installing poly V-belt”, page 73 .

– Install front exhaust pipe together with catalytic converter: left-side ⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242 , right-side ⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246 .

– Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .

– Change engine oil ⇒ Maintenance ; Booklet 405 .

– Fill cooling system with fresh coolant ⇒ “1.2 Draining and filling cooling system”, page 206 .

– Top up power steering fluid and bleed steering system ⇒ Rep. gr. 48 .

Tightening torque

Component	Nm
Guide tube for dipstick to cylinder head	9

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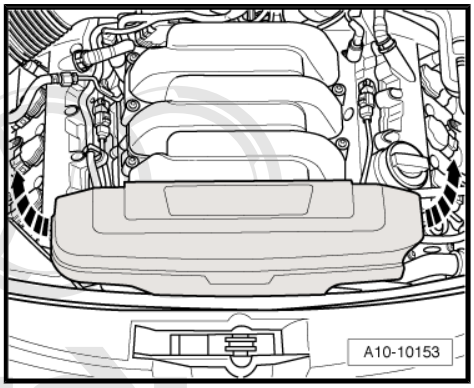
1.5 Removing and installing vacuum pump for brake servo

Removing

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



– Remove bolts -arrows-.

– Remove air duct -1- and -2-.

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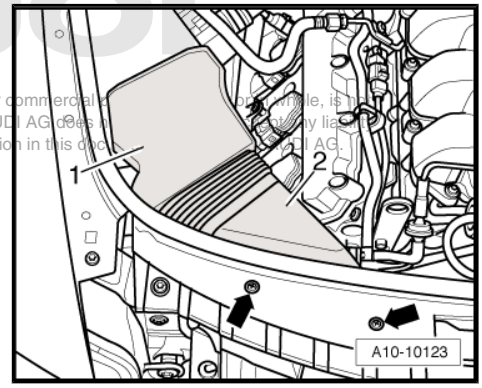
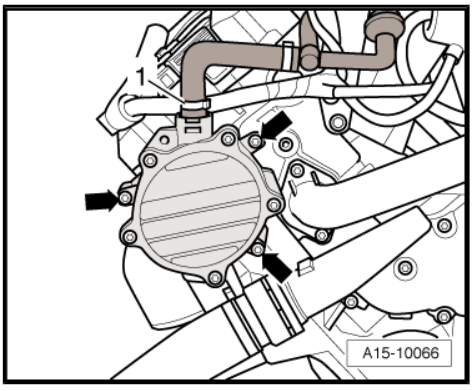


– Detach vacuum hose -1- from vacuum pump.

– Unscrew bolts -arrows- and remove vacuum pump.



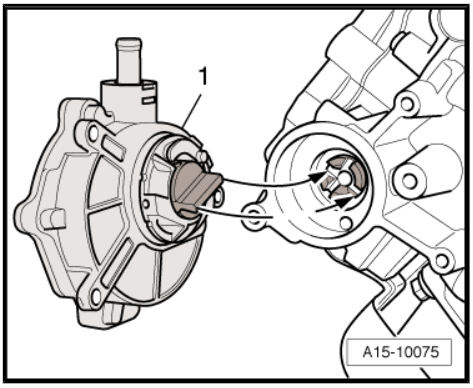
Installing

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 .*

– Set drive lug of vacuum pump -1- so it engages in slot on camshaft when pump is fitted -arrows-.



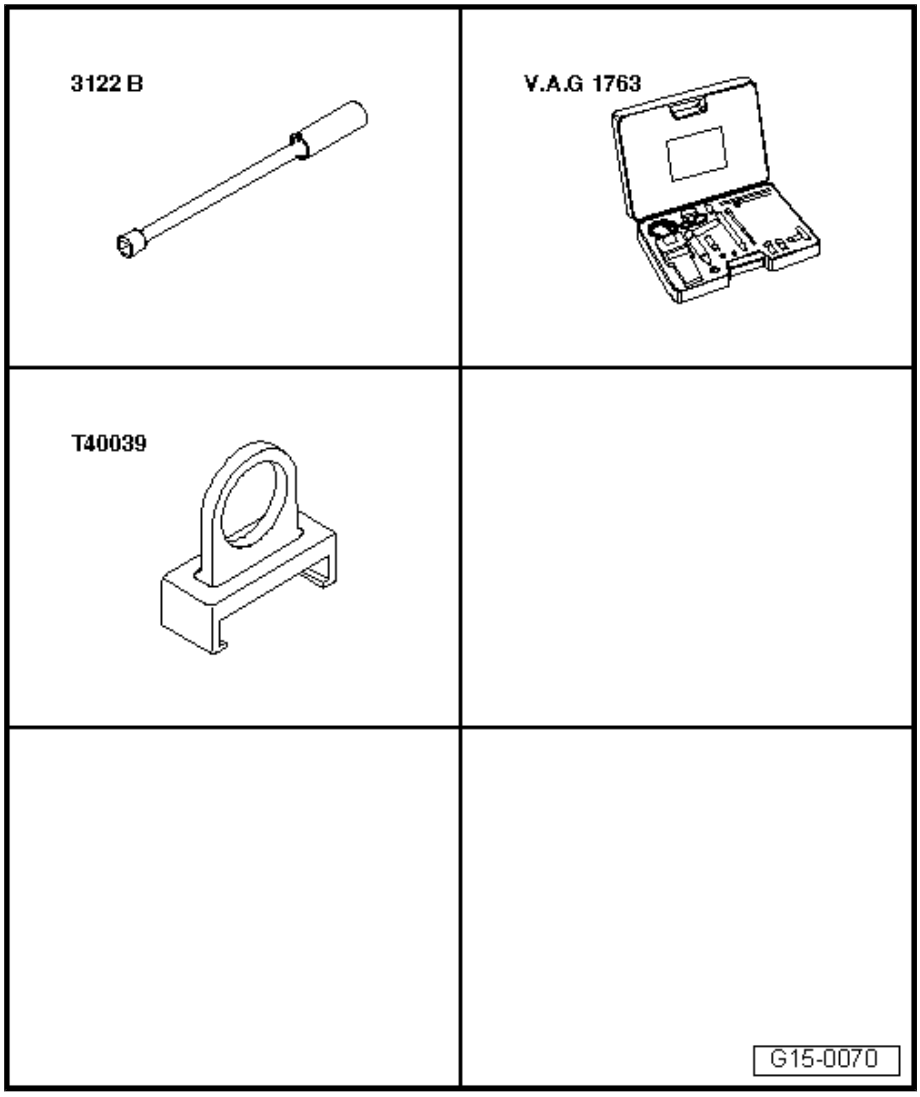
Tightening torque

Component	Nm
Vacuum pump to cylinder head	9

1.6 Checking compression

Special tools and workshop equipment required

- Spark plug spanner - 3122 B-
- Compression tester - V.A.G 1763-
- Puller - T40039-

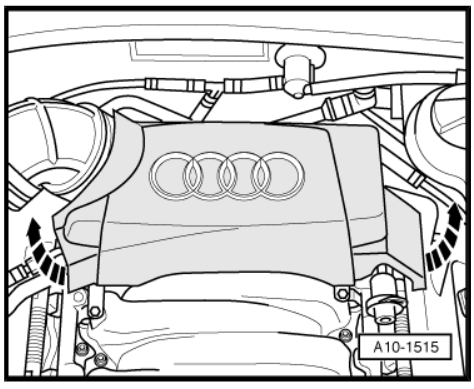


Procedure

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

– Switch off ignition.

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



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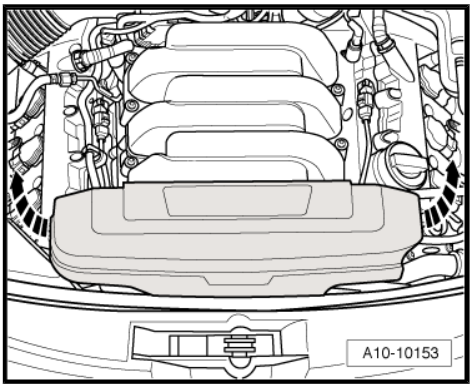
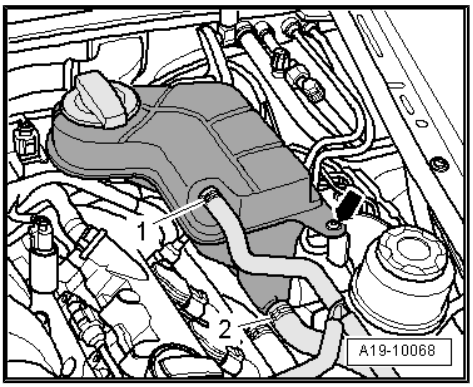
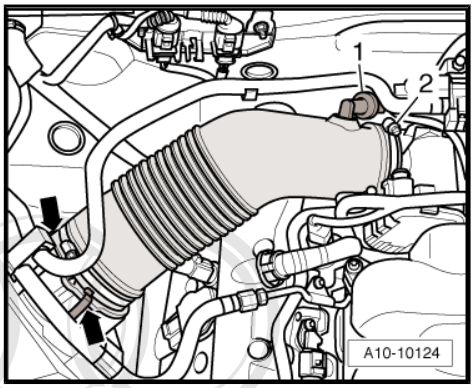
– Pull off engine cover panel (front) -arrows-.



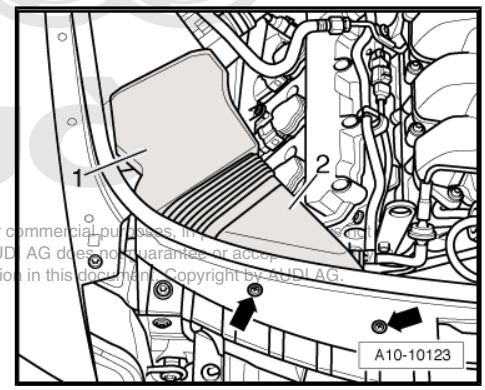
– Unbolt coolant expansion tank -arrow-.
– Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move coolant expansion tank to one side with coolant hoses -1- and -2- attached.



– Detach non-return valve -1- from air intake hose.
– Remove air hose. To do so, loosen hose clip -2- and release retaining clips -arrows-.



– Remove bolts -arrows-.
– Remove air duct -1- and -2-.



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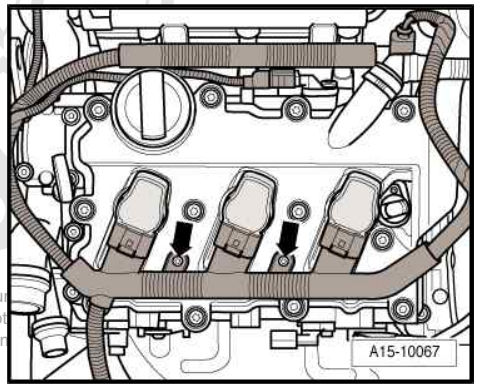
– Unscrew bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (left-side).



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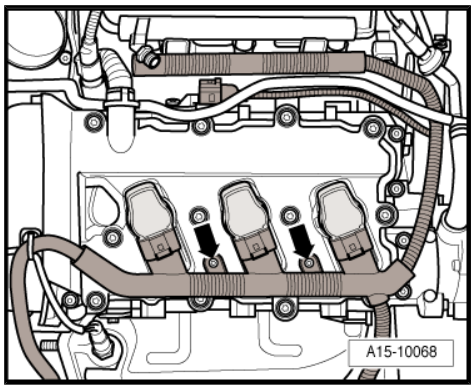
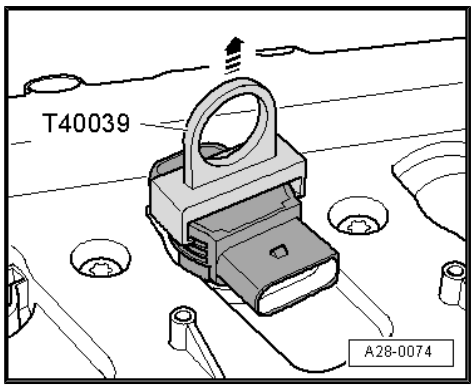
– Unscrew bolts -arrows- and unplug electrical connectors at ignition coils on cylinder head (right-side).



– Pull ignition coils out with puller - T40039- .
– Remove spark plugs using spark plug spanner - 3122 B- .
– Unplug electrical connectors at all injectors.
– Test the compression pressure with the compression tester - V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions .

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

Compression pressure	bar
When new	10.0 … 14.0
Wear limit	9.0
Difference between cylinders	3.0 (maximum)

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

– Install spark plugs ⇒ Maintenance ; Booklet 405 .
– After checking compression pressure, interrogate fault memory of engine control unit and erase it as necessary ⇒ Vehicle diagnostic tester.

Tightening torque

Component	Nm
Hose clips (9 mm wide)	3

2 Servicing 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.*

⇒ “2.1 Valve gear - exploded view”, page 161

⇒ “2.2 Checking axial clearance of camshafts”, page 163

⇒ “2.3 Removing and installing camshafts”, page 164

⇒ “2.4 Renewing valve stem oil seals (cylinder head installed)”, page 169

⇒ “2.5 Renewing valve stem oil seals (cylinder head removed)”, page 173

⇒ “2.6 Checking hydraulic valve compensation elements”, page 176

⇒ “2.7 Valve dimensions”, page 178

⇒ “2.8 Checking valve guides”, page 178

⇒ “2.9 Checking valves”, page 179

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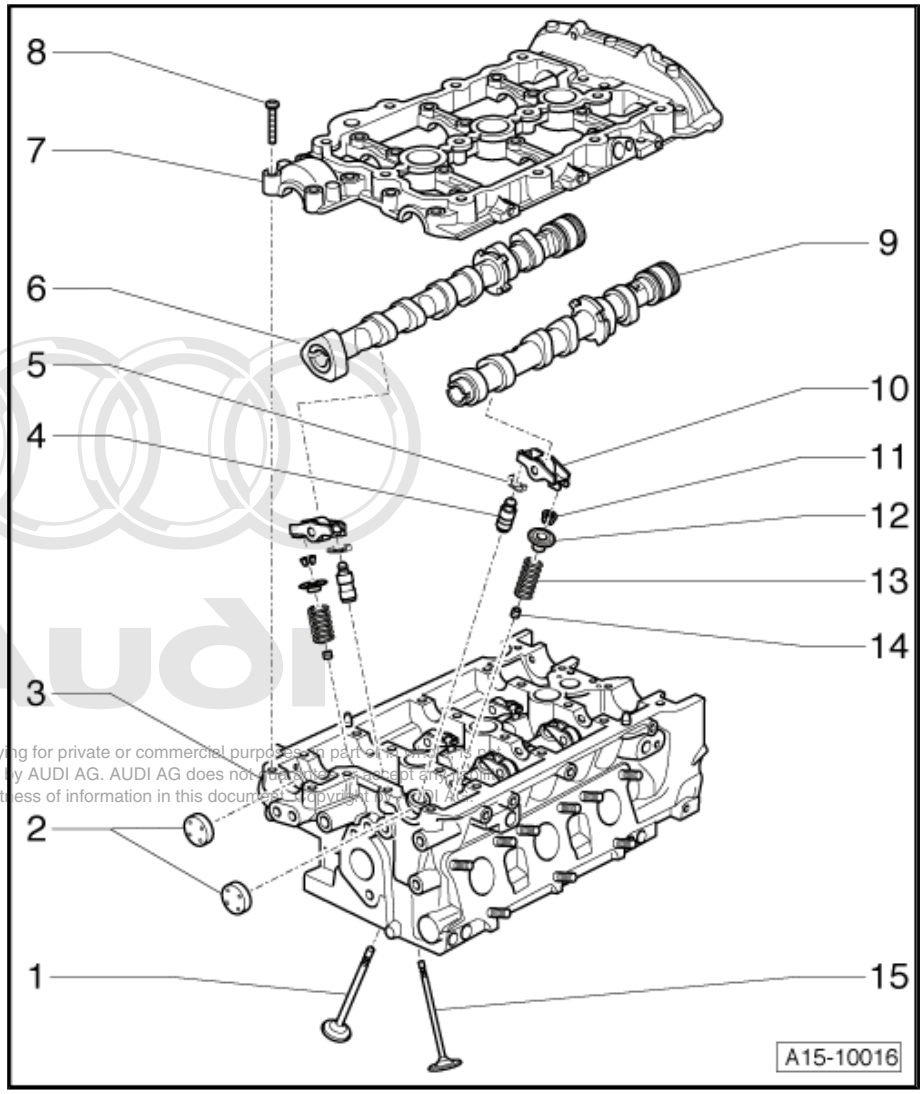
2.1 Valve gear - exploded view



1 - Exhaust valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Valve dimensions ⇒ “2.7 Valve dimensions”, page 178
- ❑ Checking valve guides ⇒ “2.8 Checking valve guides”, page 178

2 - Sealing plug

- ❑ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

3 - Cylinder head

- ❑ Checking valve guides ⇒ “2.8 Checking valve guides”, page 178

4 - Hydraulic valve compensation element

- ❑ Checking ⇒ “2.6 Checking hydraulic valve compensation elements”, page 176
- ❑ Do not interchange
- ❑ Lubricate contact surface

5 - Securing clip

- ❑ Check for firm attachment

6 - Inlet camshaft

- ❑ Checking axial clearance ⇒ “2.2 Checking axial clearance of camshafts”, page 163
- ❑ Removing and installing ⇒ “2.3 Removing and installing camshafts”, page 164
- ❑ Check radial clearance with Plastigauge (roller rocker fingers removed)
- ❑ Radial clearance when bearing ∅ is 24 mm: 0.024 ... 0.066 mm
- ❑ Radial clearance when bearing ∅ is 36 mm: 0.032 ... 0.078 mm
- ❑ Runout: max. 0.04 mm

7 - Retaining frame

- ❑ With integrated camshaft bearings
- ❑ Removing and installing ⇒ “2.3 Removing and installing camshafts”, page 164

8 - 8 Nm + 90° (1/4 turn) further

- ❑ Renew

9 - Exhaust camshaft

- ❑ Checking axial clearance ⇒ “2.2 Checking axial clearance of camshafts”, page 163
- ❑ Removing and installing ⇒ “2.3 Removing and installing camshafts”, page 164
- ❑ Check radial clearance with Plastigauge (roller rocker fingers removed)
- ❑ Radial clearance when bearing ∅ is 24 mm: 0.024 ... 0.066 mm
- ❑ Radial clearance when bearing ∅ is 36 mm: 0.032 ... 0.078 mm
- ❑ Runout: max. 0.04 mm

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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)
  ⇒ “2.4 Renewing valve stem oil seals (cylinder head installed)”, page 169
- ❑ Renewing (cylinder head removed)
  ⇒ “2.5 Renewing valve stem oil seals (cylinder head removed)”, page 173

15 - Inlet valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Valve dimensions ⇒ “2.7 Valve dimensions”, page 178
- ❑ Checking valve guides ⇒ “2.8 Checking valve guides”, page 178

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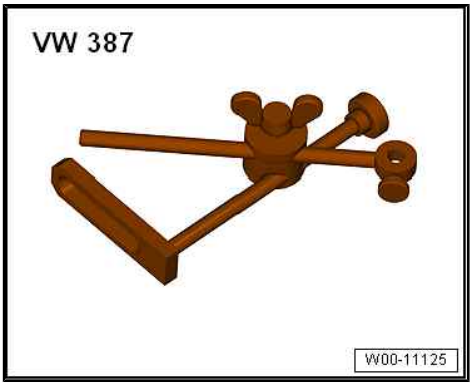
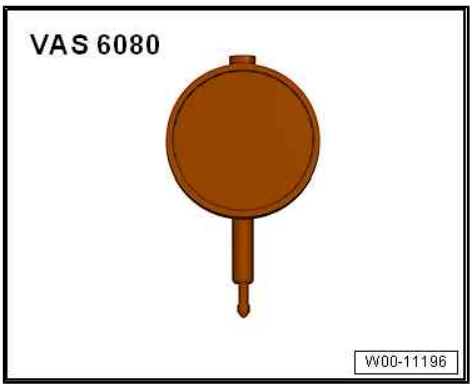
2.2 Checking axial clearance of camshafts

Special tools and workshop equipment required

- ♦ Universal dial gauge bracket - VW 387-



- ♦ Dial gauge - VAS 6080-



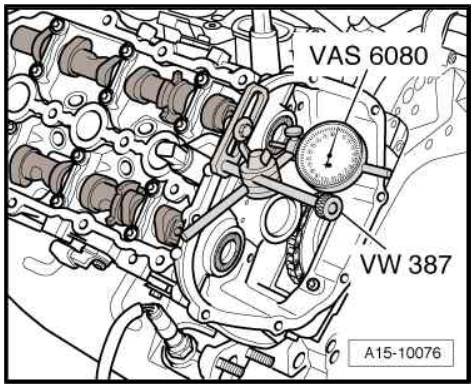
Procedure

– Perform measurement with roller rocker fingers and hydraulic compensation elements removed.

– Secure universal dial gauge bracket - VW 387- with dial gauge - VAS 6080- to cylinder head.

– Determine axial clearance.

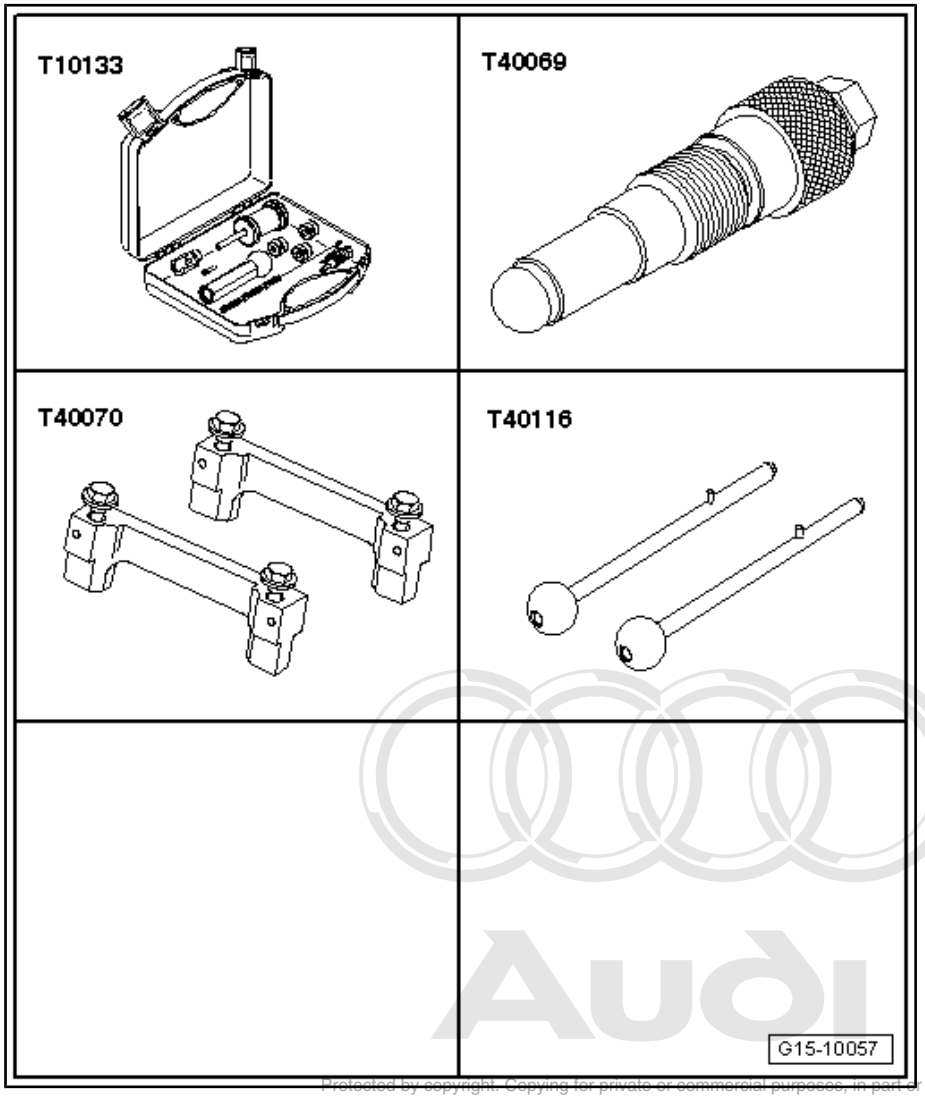
• Axial clearance: 0.100 ... 0.191 mm



2.3 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 1 set = 2x - T40116-
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue



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Removing

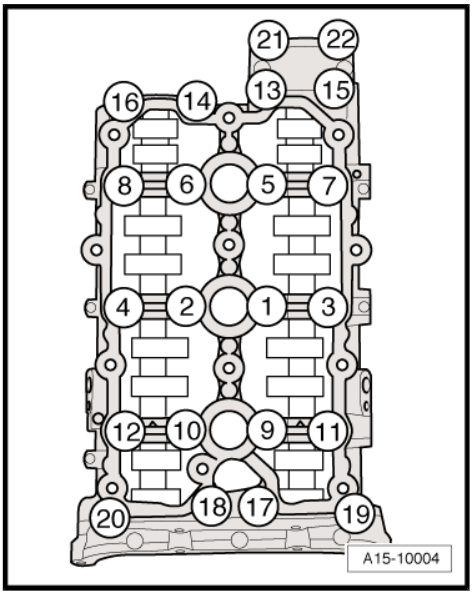
– Remove cylinder head cover: left-side ⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147 , right-side ⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149 .

– Remove timing chain covers (left and right)
⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .

– Detach timing chains from camshafts
⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106 .

– To remove the camshafts (right-side) you must first remove the vacuum pump for the brake servo
⇒ “1.5 Removing and installing vacuum pump for brake servo”, page 157 .

– Slacken retaining frame bolts in the sequence -22 ... 1-.



Note

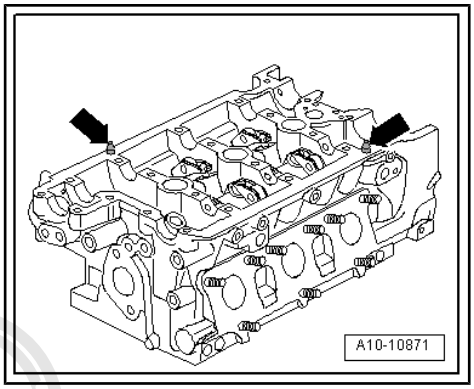
Illustration shows retaining frame of left-side cylinder head.

– Carefully remove retaining frame.

– 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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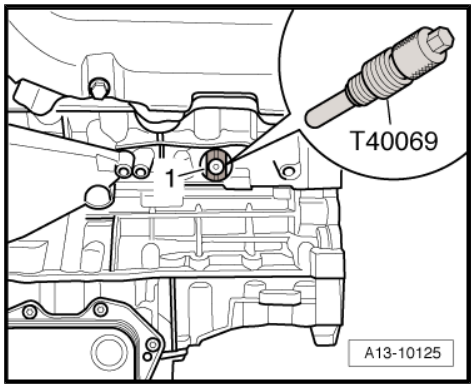
Installing



Note

Renew gaskets and seals.

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

WARNING

Put on 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.

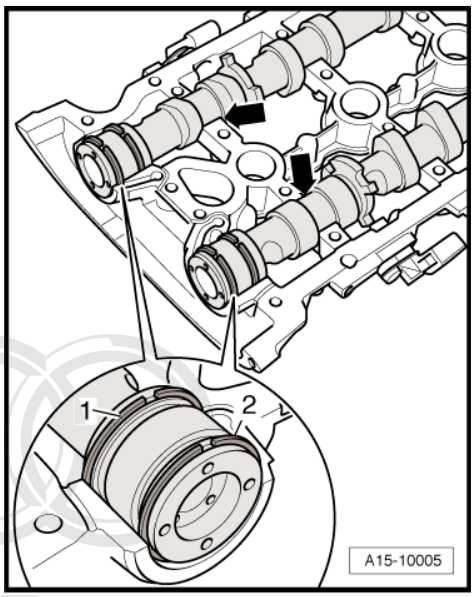
– Clean sealing surfaces; they must be free of oil and grease.

– 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.



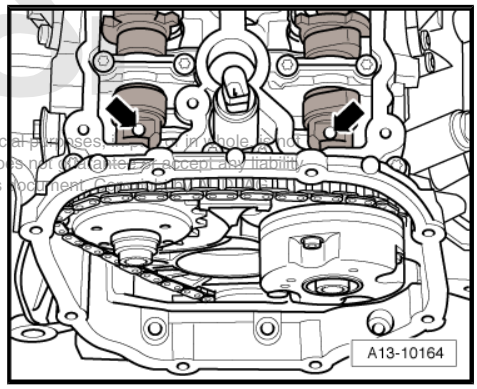
Note

The illustration shows the camshafts with two piston rings each; depending on the version, there may not be any piston rings fitted on the exhaust camshaft. For allocation, refer to ⇒ Electronic parts catalogue .

– 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.



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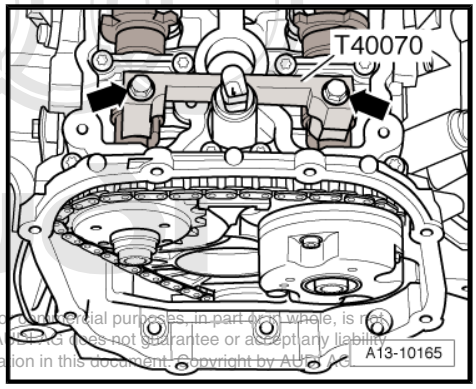
– Fit camshaft clamp - T40070- as shown in illustration and tighten bolts to 20 Nm.



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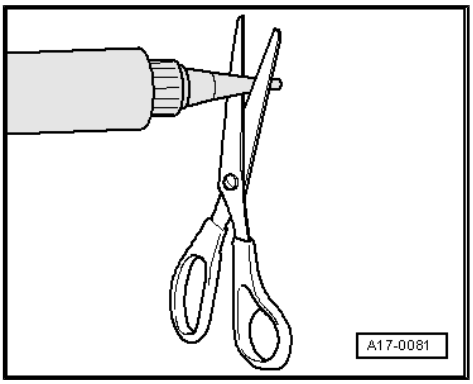
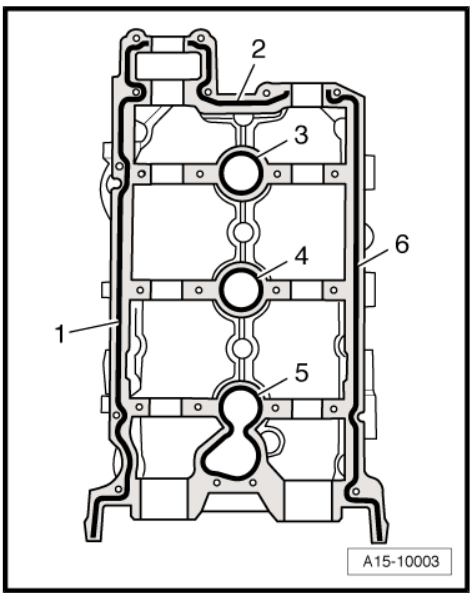
– Cut off nozzle of tube at front marking (∅ of nozzle approx. 1 mm).
– Turn retaining frame back up.



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 -arrows- 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.

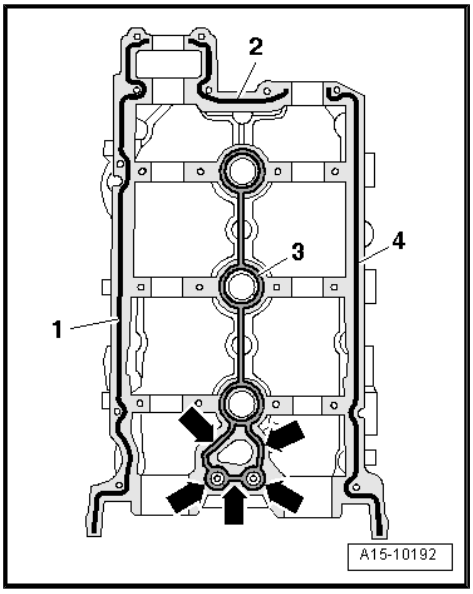
Vehicles from approx. 08.2004 onwards:

– 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

The beads of sealant must be applied exactly according to these instructions, otherwise excess sealant can get into the camshaft bearings.

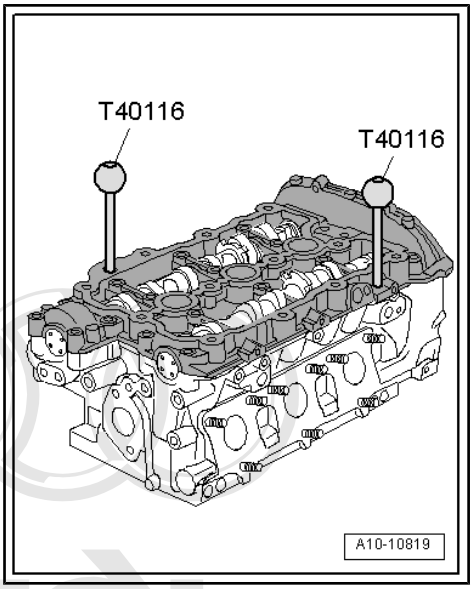
All vehicles:

Note

Fit and secure the retaining frame without delay, as the sealant starts hardening immediately.

– Fit retaining frame onto cylinder head.

– Insert locating pins -T40116- in retaining frame and cylinder head.

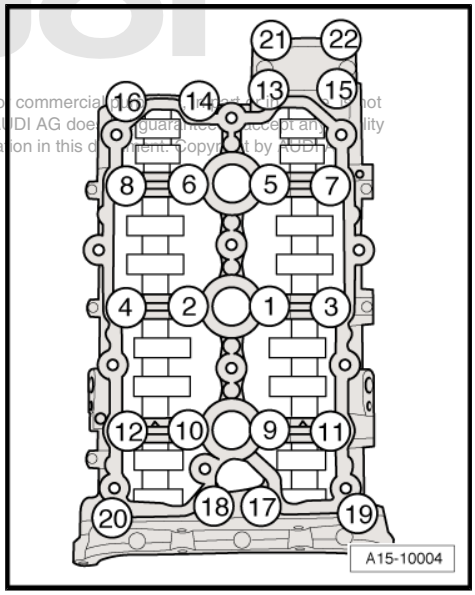


– Fit retaining frame onto cylinder head without delay.

– Tighten retaining frame bolts uniformly in the sequence -1 ... 22-, 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.*

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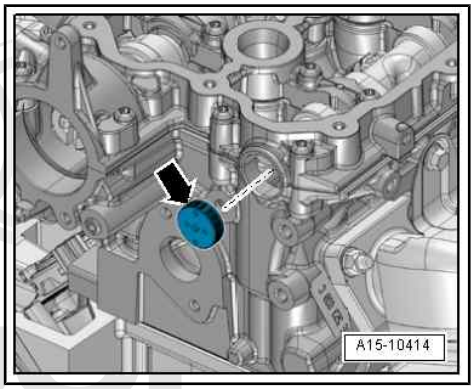
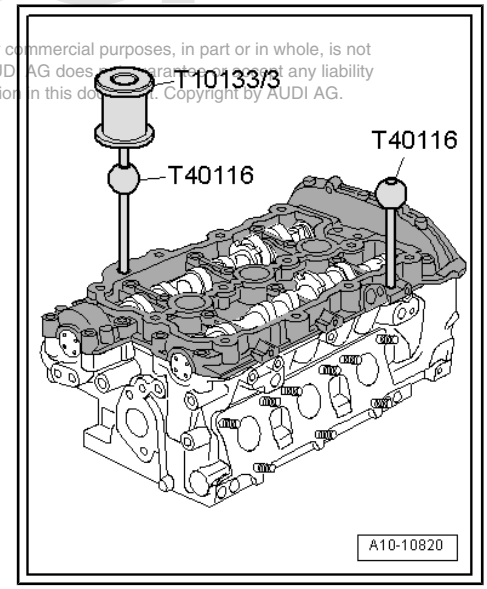
– Clean bore for sealing plug in cylinder head; it must be free of oil and grease.
– Coat outer circumference of sealing plug -arrow- with sealant; for sealant refer to ⇒ Electronic parts catalogue .
– Drive in sealing plug until flush.



– Use impact extractor attachment -T40116- to pull out locating pins -T10133/3- .



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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 ⇒ “1.5 Removing and installing vacuum pump for brake servo”, page 157 .
– Install camshaft timing chains ⇒ “4.2 Detaching timing chains from camshafts, removing and installing chain tensioners”, page 106 .
– Install timing chain covers (left and right) ⇒ “3.2 Removing and installing timing chain covers (left and right)”, page 90 .
– Install cylinder head cover: left-side ⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147 , right-side ⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149 .

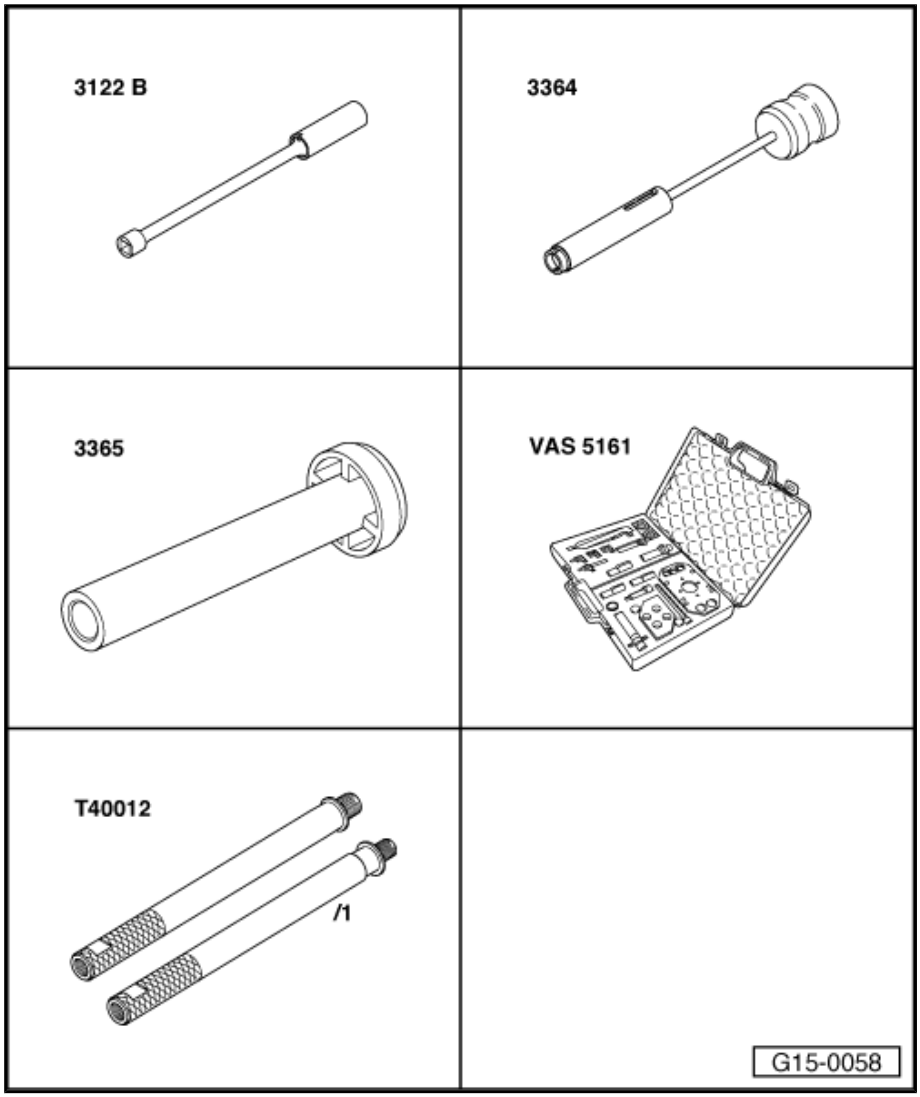
Tightening torque

Component	Nm
Retaining frame to cylinder head	8 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	

2.4 Renewing valve stem oil seals (cylinder head installed)

Special tools and workshop equipment required

- Spark plug spanner - 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-
- Adapters - T40012-



Procedure

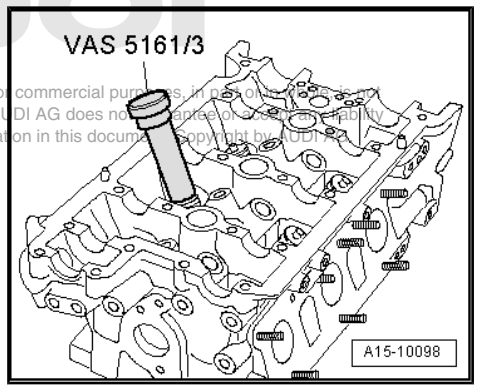
– Remove camshafts
⇒ “2.3 Removing and installing camshafts”, page 164 .

– 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 using spark plug spanner - 3122 B- .

– Apply drift - VAS 5161/3- to valve spring plate and knock valve cotters loose using a plastic hammer.



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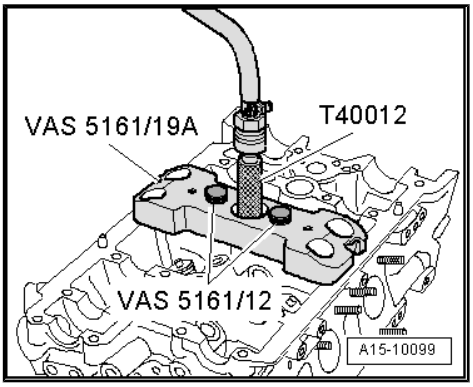
– Fit guide plate - VAS 5161/19 A- from removal and installation device for valve cotters - VAS 5161- on cylinder head.
– Secure guide plate using the knurled screws - VAS 5161/12- .
– Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread and apply a steady pressure.

• Minimum pressure: 6 bar



– Screw snap-in device - VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
– Insert assembly cartridge - VAS 5161/8- 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.

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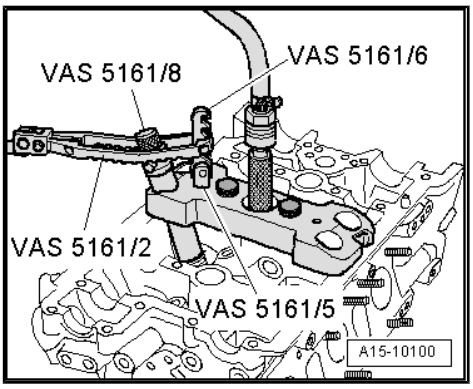
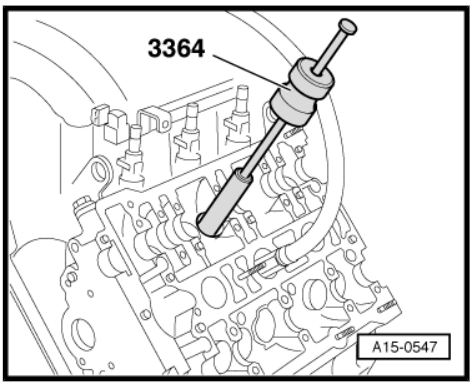


– Release pressure fork.
– Remove assembly cartridge.
– Detach guide plate and turn to one side.

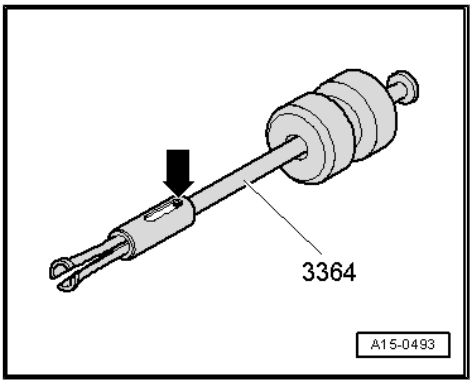
• The compressed air hose remains connected.

– Remove valve spring with valve spring plate.
– Remove valve stem oil seals using the valve stem seal puller - 3364- .

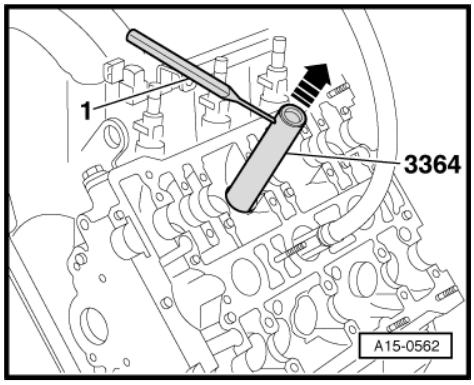


If the puller -3364- cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

– Knock out pin -arrow- of puller -3364- using a drift and remove the extractor attachment.



– Attach lower part of puller -3364- to valve stem oil seal.
– Secure puller -3364- with punch or roll-pin drift -1-, as shown in illustration.
– Apply an assembly lever to puller -3364- and pull out valve stem oil seal -arrow-.



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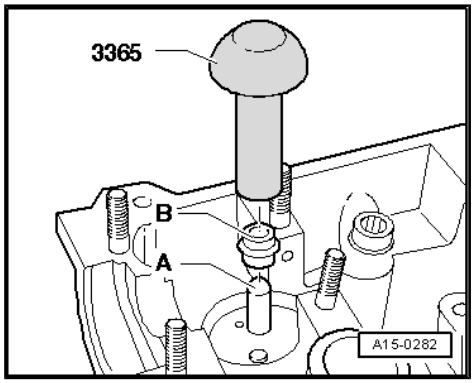
Note

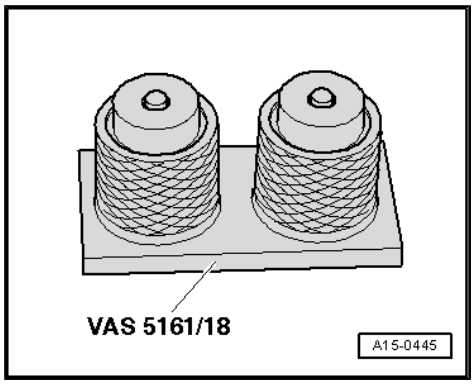
A plastic sleeve -A- is included with the new valve stem oil seals.

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



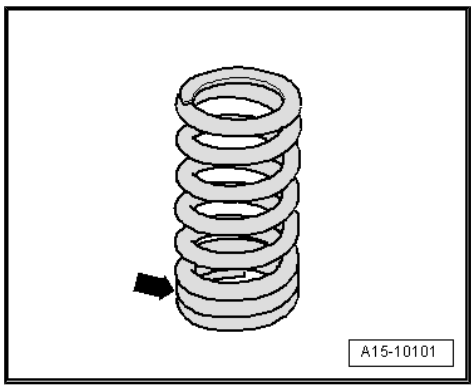
If valve cotters have been removed from assembly cartridge, they need to be put into insertion device for valve cotters - VAS 5161/18- first.

• Larger diameter of valve cotters faces upwards.

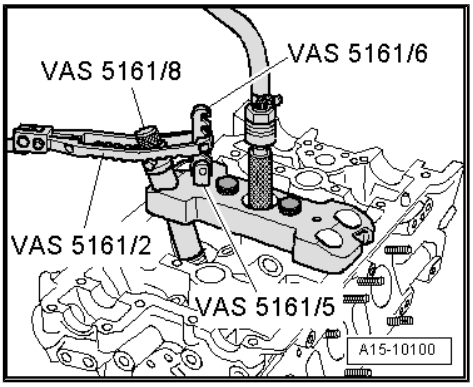


– Install valve spring and valve spring plate.

• 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 screw in both directions – this will insert the valve cotters.
– Release pressure fork with knurled screw still in pulled position.
– Ensure that all roller rocker fingers contact the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
– Install camshafts
⇒ “2.3 Removing and installing camshafts”, page 164 .
– 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.*

2.5 Renewing valve stem oil seals (cylinder head removed)

Special tools and workshop equipment required

- Valve stem seal puller - 3364-

- Valve stem seal fitting tool - 3365-

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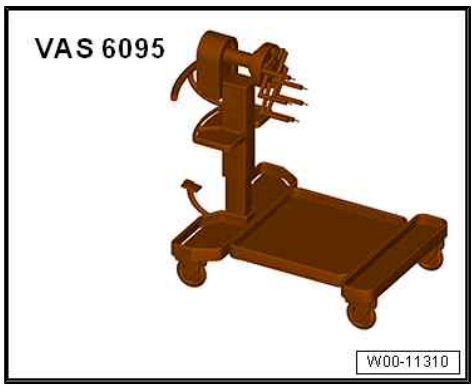
♦ Removal and installation device for valve cotters - VAS 5161 A-

♦ Engine and gearbox support - VAS 6095-



♦ Tensioning device -VAS 6419-

Procedure

– Remove camshafts
⇒ “2.3 Removing and installing camshafts”, page 164 .

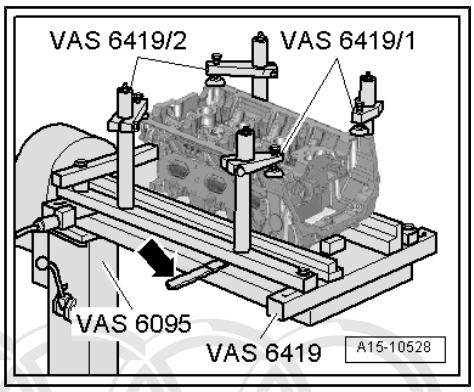
– Attach tensioning device -VAS 6419- to engine and gearbox support - VAS 6095- .

– Secure cylinder head in tensioning device -VAS 6419- as illustrated.

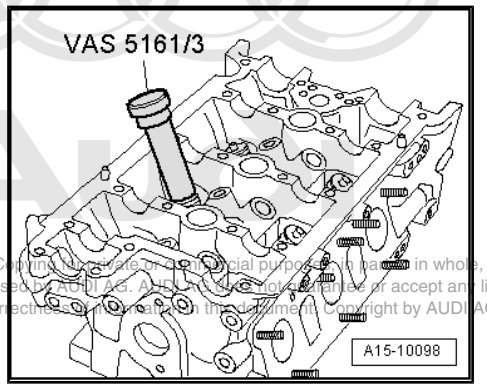
– Connect compressed air line to tensioning device -VAS 6419- .

– Using lever -arrow-, slide air pad under cylinder 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.



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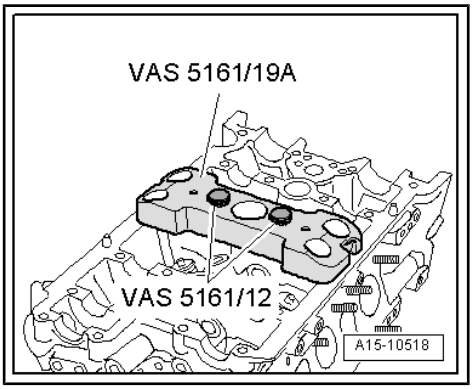
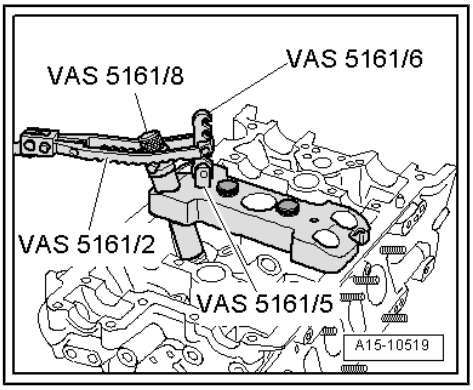
– Fit guide plate - VAS 5161/19 A- from removal and installation device for valve cotters - VAS 5161- on cylinder head.
– Secure guide plate using the knurled screws - VAS 5161/12- .



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



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

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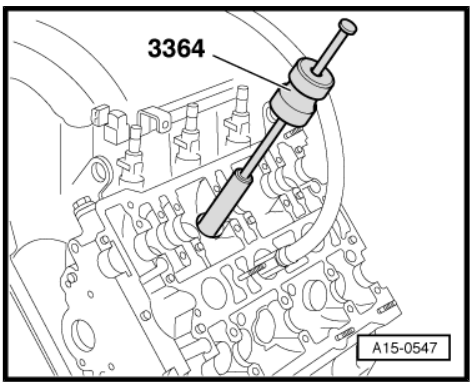
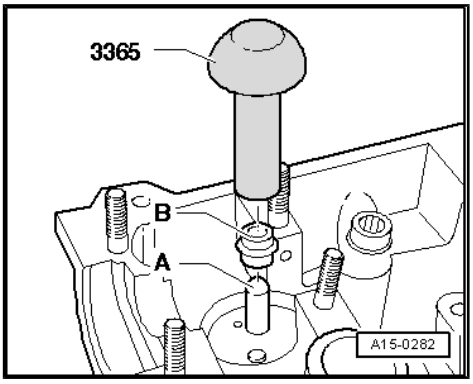


Note

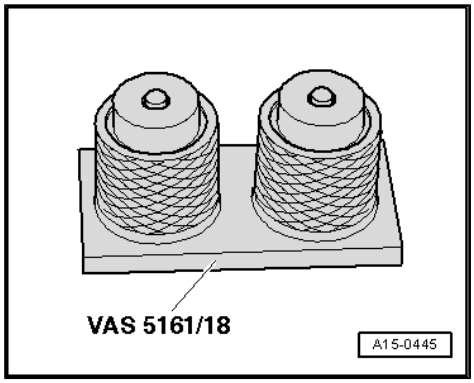
A plastic sleeve -A- is included with the new valve stem oil seals.

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



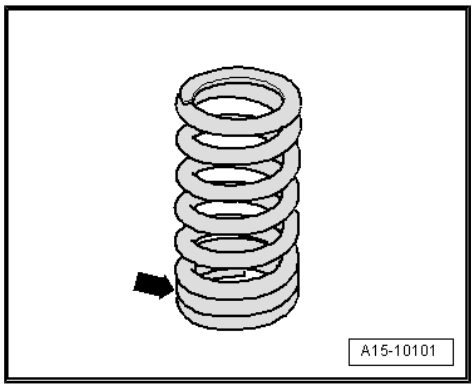
If valve cotters have been removed from assembly cartridge, they need to be put into insertion device - VAS 5161/18- first.

- Larger diameter of valve cotters faces upwards.



– Install valve spring and valve spring plate.

- The closely spaced spring coils -arrow- face the cylinder head.



– Screw guide plate back onto cylinder head.

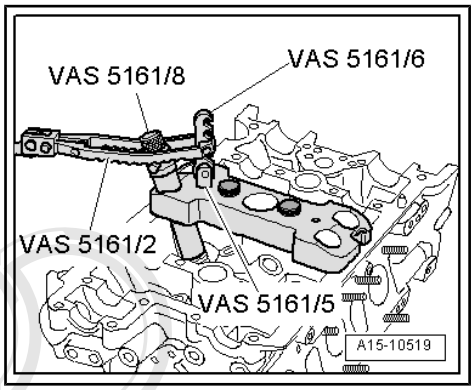
– Insert assembly cartridge into guide plate.

– Push pressure fork down and pull knurled screw upwards, while turning screw in both directions – this will insert the valve cotters.

– Release pressure fork with knurled screw still in pulled position.

– Ensure that all roller rocker fingers contact the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.

– Install camshafts
⇒ “2.3 Removing and installing camshafts”, page 164 .



2.6 Checking hydraulic valve compensation elements

Special tools and workshop equipment required

♦ Feeler gauge

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Note

♦ *The hydraulic compensation elements cannot be serviced.*

♦ *Irregular valve noises when starting engine are normal.*

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 193) , from 05.2005 ⇒ Item 7 (page 194) .

If the hydraulic compensation elements are still noisy, locate the defective element as follows:

– Remove cylinder head cover: left-side ⇒ “1.2 Removing and installing cylinder head cover (left-side)”, page 147 , right-side ⇒ “1.3 Removing and installing cylinder head cover (right-side)”, page 149 .

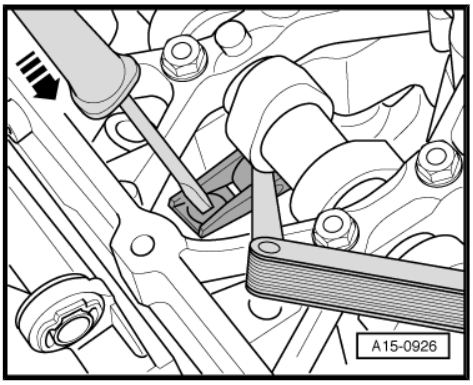
– Turn crankshaft until cams of compensation element to be tested are at top:

♦ Vehicles with manual gearbox: push vehicle forwards with 4th gear engaged and ignition switched off.

♦ Vehicles with multitronic gearbox: 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 ⇒ “2.3 Removing and installing camshafts”, page 164 .

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.*

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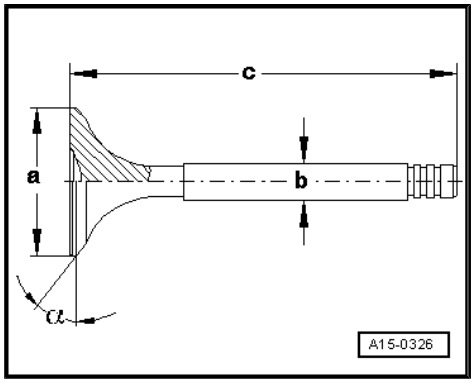
2.7 Valve dimensions



Note

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

Dimension		Inlet valve	Exhaust valve
∅ a	mm	32.35 + 0.10	28.0 + 0.1
∅ b	mm	5.98 + 0.01	5.96 + 0.01
c	mm	104.0 + 0.2	101.9 + 0.2
α	∠°	45	45

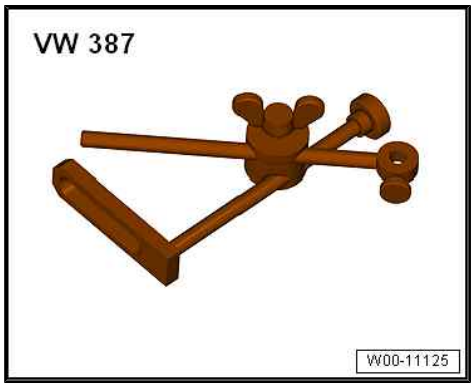
WARNING

- *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.*

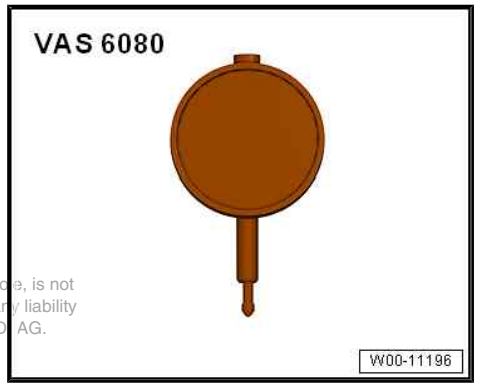
2.8 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6080-



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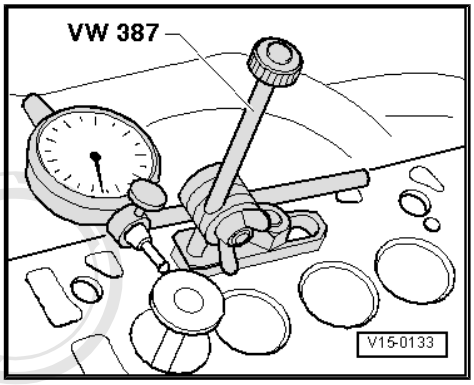
Procedure



– 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.*

2.9 Checking valves

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– Visually inspect for scoring on valve stem and on seating surface.

If scoring is clearly visible:

– Renew the relevant valve.

17 – Lubrication

1 Removing and installing parts of lubrication system

Note

- *If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler must be renewed in order to prevent further damage occurring later.*
- *The oil level must not be above max. mark on dipstick – danger of damage to catalytic converter.*
- *Refer to ⇒ Maintenance tables for viscosity grades, oil specifications and engine oil capacity.*

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⇒ “1.1 Sump (bottom section), sump (top section), oil pump, oil cooler - exploded view”, page 180

⇒ “1.2 Removing and installing oil cooler”, page 183

⇒ “1.3 Removing and installing sump (bottom section)”, page 184

⇒ “1.4 Removing and installing oil pump”, page 188

⇒ “1.5 Removing and installing sump (top section)”, page 188

⇒ “1.6 Oil filter housing - exploded view”, page 192

⇒ “1.7 Removing and installing oil filter housing”, page 195

⇒ “1.8 Oil retention valves, oil separator - exploded”, page 197

⇒ “1.9 Removing and installing crankcase breather hoses”, page 198

⇒ “1.10 Removing and installing oil pressure switch F1 ”, page 199

⇒ “1.11 Checking oil pressure”, page 200

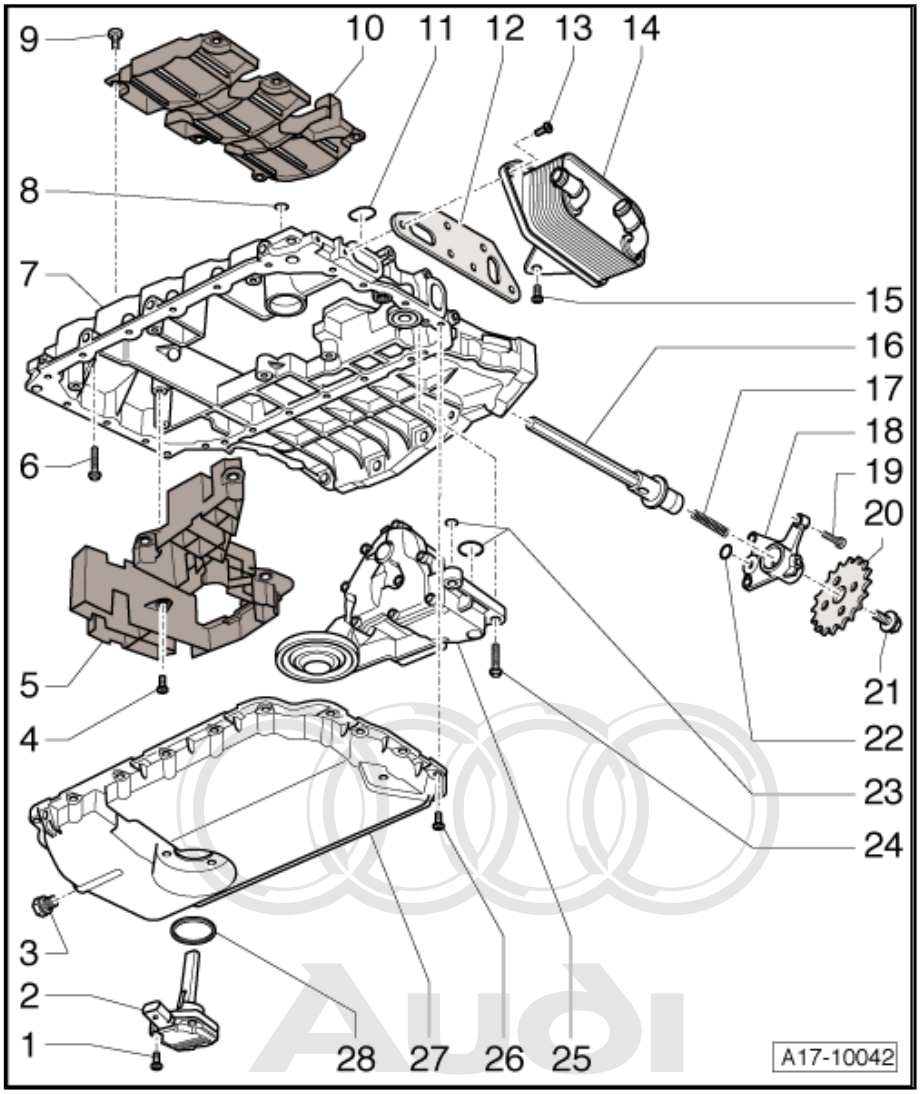
⇒ “1.12 Engine oil”, page 202

⇒ “1.13 Checking oil level”, page 202

1.1 Sump (bottom section), sump (top section), oil pump, oil cooler - exploded view

Note

Oil spray jet for piston cooling ⇒ Fig. ““Oil spray jet for piston cooling”“ , page 182 .



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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-

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 ⇒ “1.5 Removing and installing sump (top section)”, page 188

8 - O-ring

- ❑ Renew

9 - 9 Nm

- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue

10 - Baffle plate (top)

11 - Gasket

- ❑ Renew

12 - Gasket

- ❑ Renew

13 - 9 Nm

14 - Oil cooler

- ❑ See note ⇒ , page 180
- ❑ Removing and installing ⇒ “1.2 Removing and installing oil cooler”, page 183
- ❑ With oil cooler bypass valve

15 - 9 Nm

16 - Oil pump drive shaft

17 - Compression spring

18 - Bearing bracket

19 - 9 Nm

20 - Chain sprocket for oil pump

- ❑ Can only be fitted in one position on drive shaft

21 - 30 Nm + 90° (1/4 turn) 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° ($^1/_4$ turn) further
- ❑ Tighten in stages and in diagonal sequence

27 - Sump (bottom section)

- ❑ Different versions available ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ “1.3 Removing and installing sump (bottom section)”, page 184

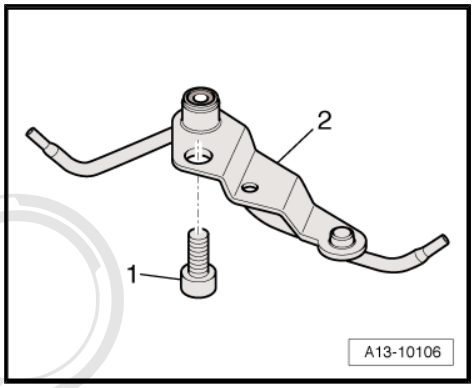
28 - Seal

- ❑ Renew

Oil spray jet for piston cooling

1 - Apply locking fluid when installing bolt (tightening torque 9 Nm); refer to ⇒ Electronic parts catalogue

2 - Oil spray jet with spray nozzle valve (opening pressure: 2 ... 2.4 bar)



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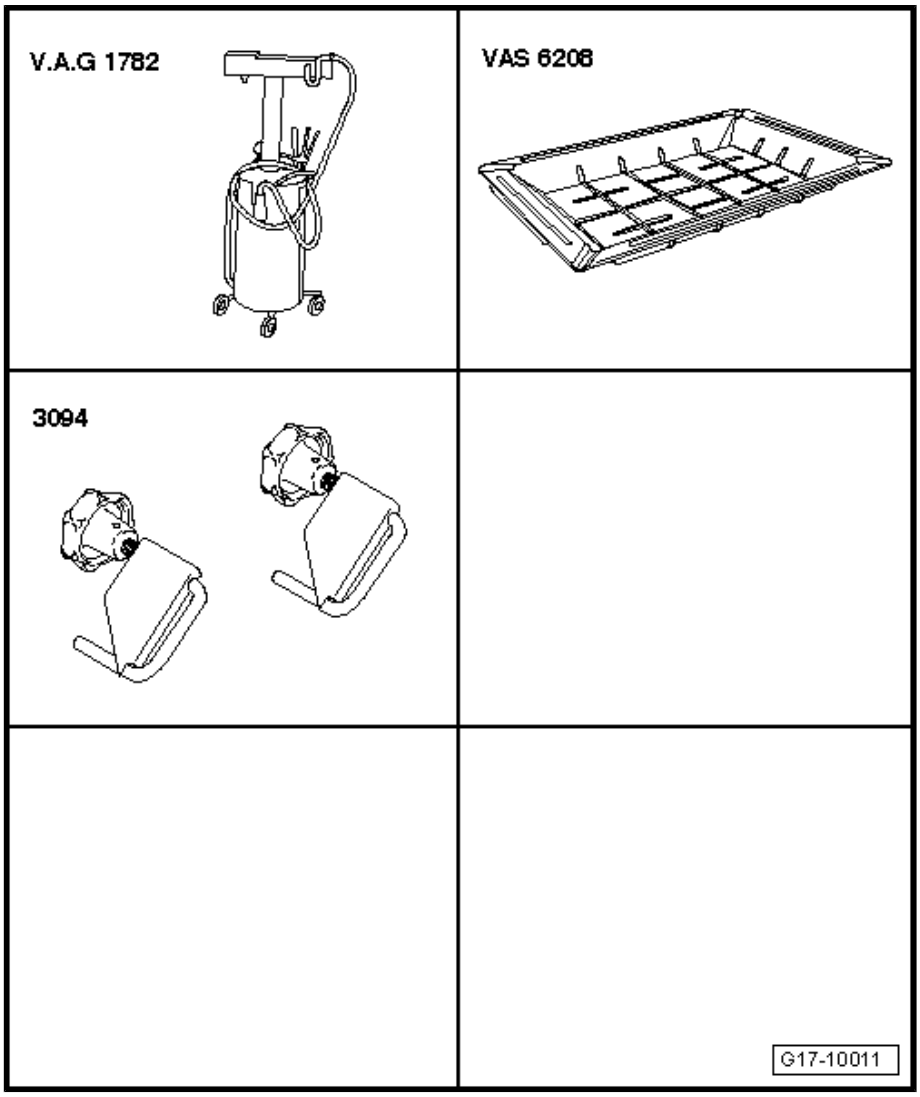
1.2 Removing and installing oil cooler

Special tools and workshop equipment required

- Used oil collection and extraction unit - V.A.G 1782-
- Drip tray for workshop hoist - VAS 6208-
- Hose clamps up to Ø 25 mm - 3094-



Removing

WARNING

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

Danger of scalding skin and other parts of the body.

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

– Open filler cap on coolant expansion tank.

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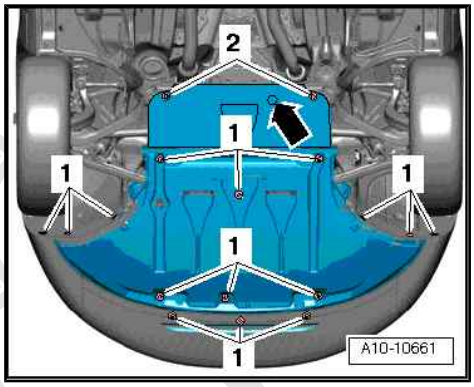
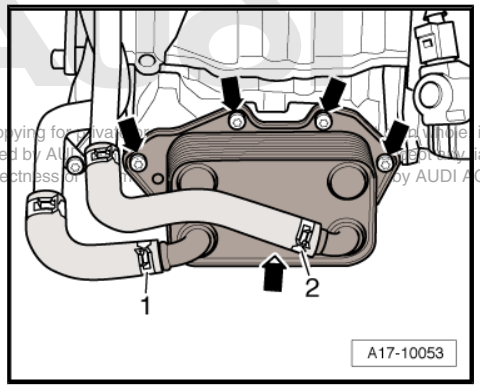
– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.
– Place used oil collection and extraction unit - V.A.G 1782- under engine.
– Drain off engine oil.



– 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 oil cooler and drain off coolant.
– Place used oil collection and extraction unit - V.A.G 1782- under engine.
– Unscrew the bolts -arrows- and remove oil cooler.



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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 up with engine oil and check oil level ⇒ “1.13 Checking oil level”, page 202 .
– Fill cooling system ⇒ page 207 .

Tightening torques

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

1.3 Removing and installing sump (bottom section)

Special tools and workshop equipment required

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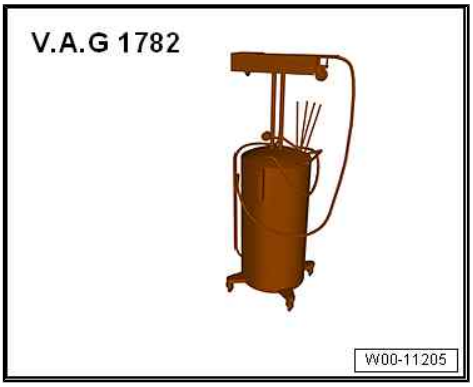
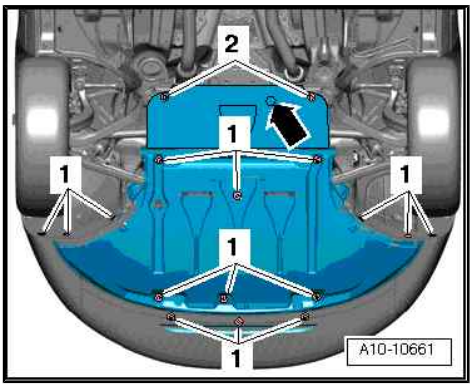
- Used oil collection and extraction unit - V.A.G 1782-



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

Removing

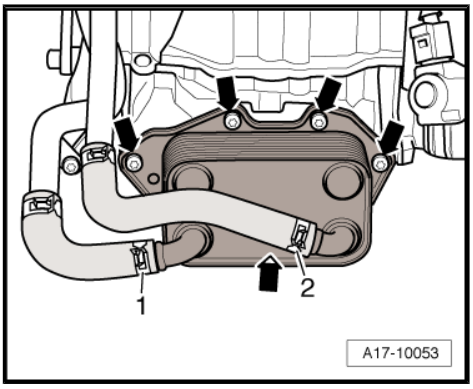
– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.



– Place used oil collection and extraction unit - V.A.G 1782- under engine.

– Drain off engine oil.

– Unscrew bolts -arrows- and detach oil cooler with coolant hoses -1- and -2- attached.



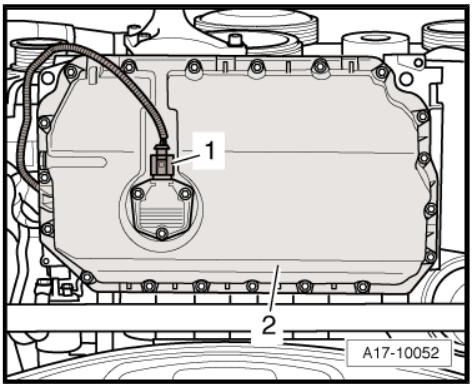
– Unplug electrical connector -1- at oil level and oil temperature sender - G266- -arrow- and move wiring clear.

– Release sump (bottom section) from bonded joint, taking care not to bend sump (sheet-metal version).

Installing

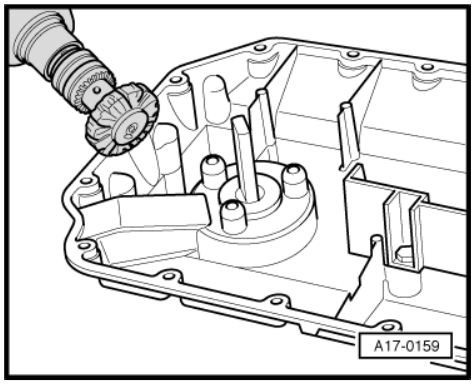
Note

- *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

Put on safety goggles.

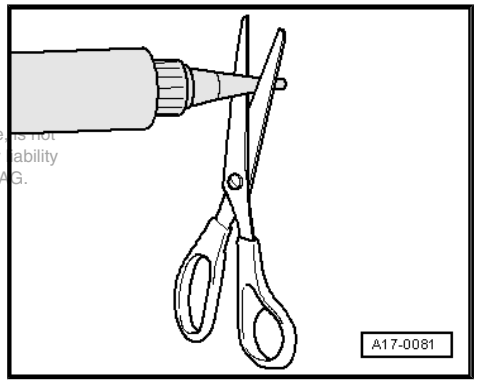


– Remove remaining sealant on bottom and top section of sump with a rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.

Note

On the sheet-metal version, take care not to damage the coating on the sump (bottom section).

– Cut off nozzle of tube at front marking (∅ of nozzle approx. 1 mm).



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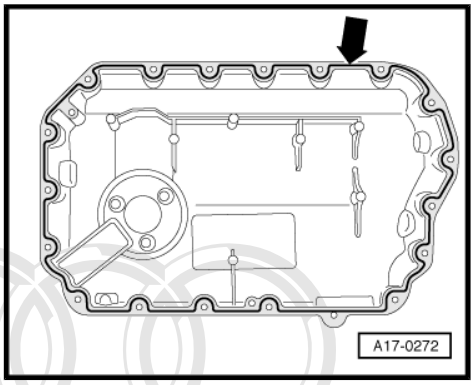
– Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as illustrated.

• 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 oil cooler
⇒ “1.2 Removing and installing oil cooler”, page 183 .

– Fill up with engine oil and check oil level
⇒ “1.13 Checking oil level”, page 202 .

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Tightening torques

Component	Nm
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)3)
Oil drain plug	30

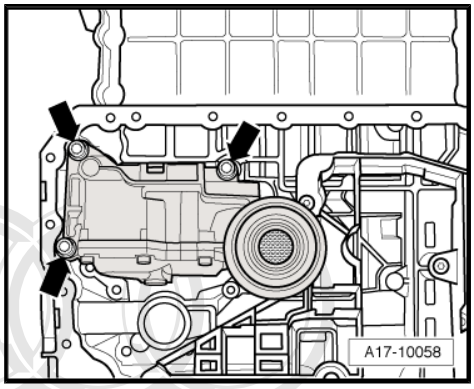
• 1) Tighten in diagonal sequence.

• 2) Renew bolts.

• 3) 90° = one quarter turn.

1.4 Removing and installing oil pump

Removing



– Remove sump (bottom section)
⇒ “1.3 Removing and installing sump (bottom section)”, page 184 .

– 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)
⇒ “1.3 Removing and installing sump (bottom section)”, page 184 .

– Fill up with engine oil and check oil level
⇒ “1.13 Checking oil level”, page 202 .

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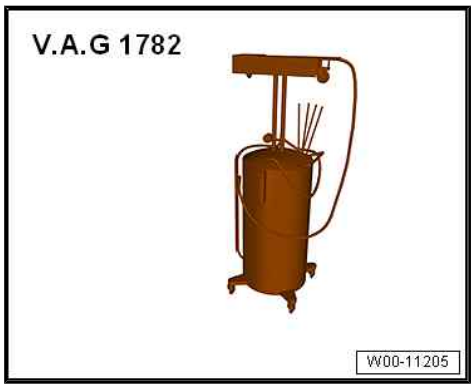
Tightening torque

Component	Nm
Oil pump to sump (top section)	20

1.5 Removing and installing sump (top section)

Special tools and workshop equipment required

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



♦ Safety goggles

♦ Electric drill with plastic brush attachment

♦ Sealant ⇒ Electronic parts catalogue

Removing

– Remove engine
⇒ “1 Removing and installing engine - vehicles with manual gearbox”, page 8 and
⇒ “2 Removing and installing engine - vehicles with multitronic gearbox”, page 39 .

– Separate engine from gearbox:
⇒ “1.2 Separating engine and manual gearbox”, page 27 or
⇒ “2.2 Detaching multitronic gearbox from engine”, page 57 .

– Secure engine to engine and gearbox support: vehicles with manual gearbox
⇒ “1.3 Securing engine to engine and gearbox support”, page 31 ; vehicles with multitronic gearbox
⇒ “2.3 Securing engine to engine and gearbox support”, page 61 .

– Vehicles with manual gearbox: remove clutch pressure plate
⇒ Rep. gr. 30 and dual-mass flywheel
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 .

– Vehicles with multitronic gearbox: Remove damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 and flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multitronic gearbox”, page 85 .

– Place used oil collection and extraction unit - V.A.G 1782- under engine.

– Drain off engine oil.

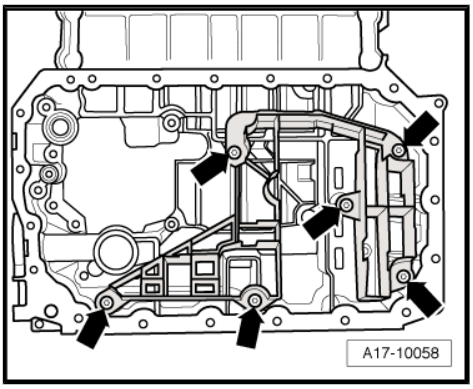
– Remove timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .

– Remove sealing flange (pulley end)
⇒ “1.6 Renewing sealing flange (pulley end) with crankshaft oil seal”, page 75 .

– Remove sump (bottom section)
⇒ “1.3 Removing and installing sump (bottom section)”, page 184 .

– Remove oil pump
⇒ “1.4 Removing and installing oil pump”, page 188 .

– Unscrew bolts -arrows- and remove baffle plate (bottom).



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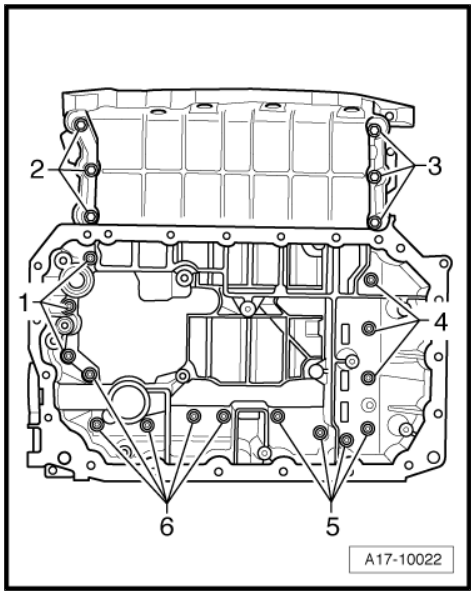
– Remove bolts -1 … 6- for sump (top section).
– Press sump (top section) off spring pins on cylinder block.



Installing

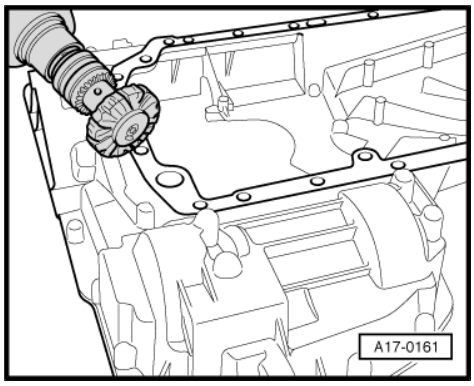
Note

Renew gaskets, seals and O-rings.

– Remove old sealant from grooves in sump (top section) and from sealing surfaces.

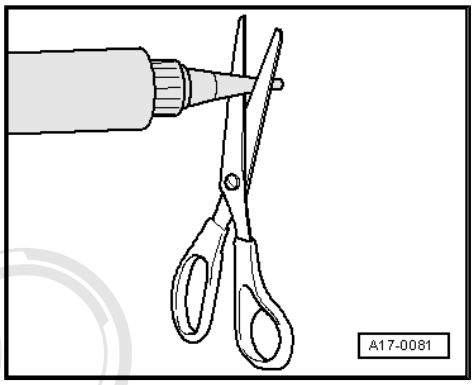
WARNING

Put on safety goggles.



– Remove remaining sealant on sump (top section) and cylinder block using rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.

– Cut off nozzle of tube at front marking (∅ of nozzle approx. 2 mm).



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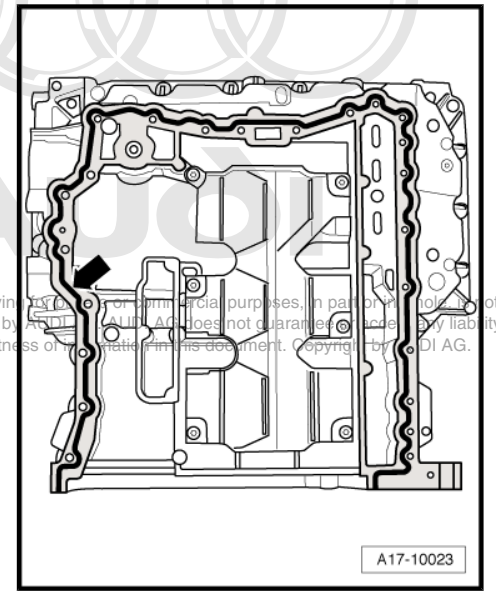
– Apply bead of sealant -arrows- onto clean sealing surface of sump (top section) as illustrated.

- 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.



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.*

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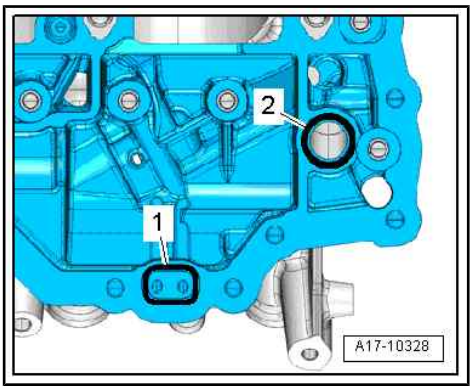
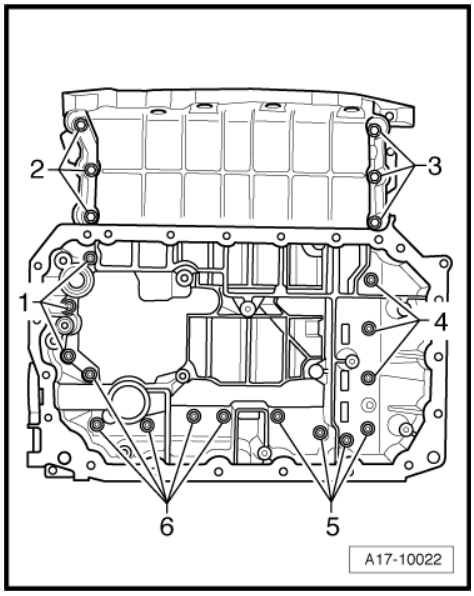
– Fit seal -1- and O-ring -2- in retaining frame.



– Fit sump (top section) and tighten bolts -1 … 6- in diagonal sequence to 5 Nm.
– Tighten bolts -1 ... 6- in diagonal sequence to final torque.

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

– Install oil pump
⇒ “1.4 Removing and installing oil pump”, page 188 .
– Install sump (bottom section)
⇒ “1.3 Removing and installing sump (bottom section)”, page 184 .
– Install sealing flange (pulley end)
⇒ “1.6 Renewing sealing flange (pulley end) with crankshaft oil seal”, page 75 .
– Install timing chain cover (bottom)
⇒ “3.3 Removing and installing timing chain cover (bottom)”, page 94 .
– Vehicles with manual gearbox: Install dual-mass flywheel
⇒ “2.2 Removing and installing dual-mass flywheel - vehicles with manual gearbox”, page 80 and pressure plate ⇒ Rep. gr. 30 .
– Vehicles with multitronic gearbox: Install flywheel
⇒ “2.6 Removing and installing flywheel - vehicles with multi-tronic gearbox”, page 85 and damper unit
⇒ “2.5 Removing and installing damper unit”, page 84 .
– Bolt gearbox to engine and install engine/gearbox assembly: vehicles with manual gearbox
⇒ “1.4 Installing engine”, page 33 , vehicles with multitronic gearbox ⇒ “2.4 Installing engine”, page 63 .
– Fill up with engine oil and check oil level
⇒ “1.13 Checking oil level”, page 202 .



Tightening torques

Component	Nm
Sump (top section) to cylinder block	16 1)
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.

1.6 Oil filter housing - exploded view

Vehicles up to 04.2005

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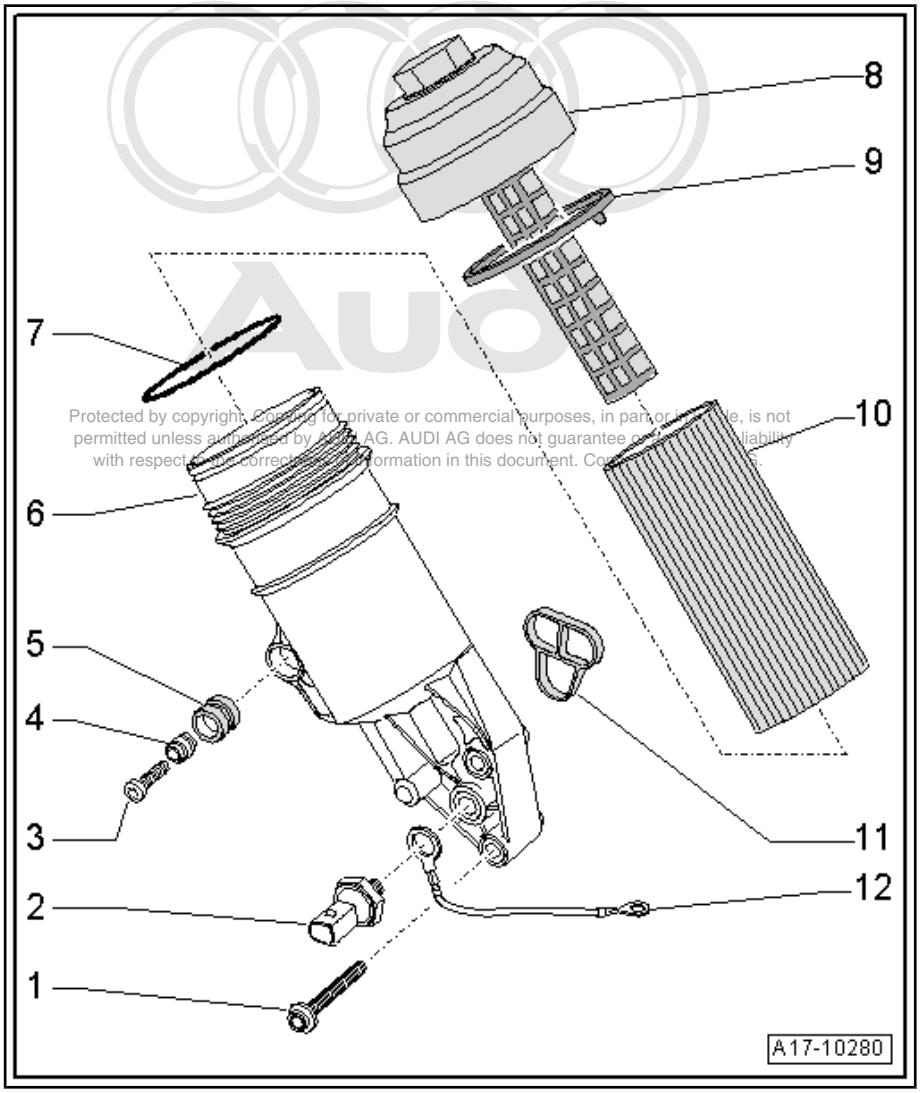


1 - 13 Nm

2 - Oil pressure switch - F1-

- ❑ Black insulation
- ❑ Checking ⇒ “1.11 Checking oil pressure”, page 200
- ❑ Removing and installing ⇒ “1.10 Removing and installing oil pressure switch F1 ”, page 199
- ❑ 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 ⇒ “1.7 Removing and installing oil filter housing”, page 195

7 - O-ring

- ❑ Renew
- ❑ Installing ⇒ Fig. ““Installing O-ring on oil filter housing”“ , page 195

8 - Sealing cap - 25 Nm

9 - Seal

- ❑ Renew
- ❑ Removing and installing ⇒ Fig. ““Renewing seal on sealing cap”“ , page 195

10 - Oil filter element

- ❑ Removing and installing ⇒ Maintenance ; Booklet 405

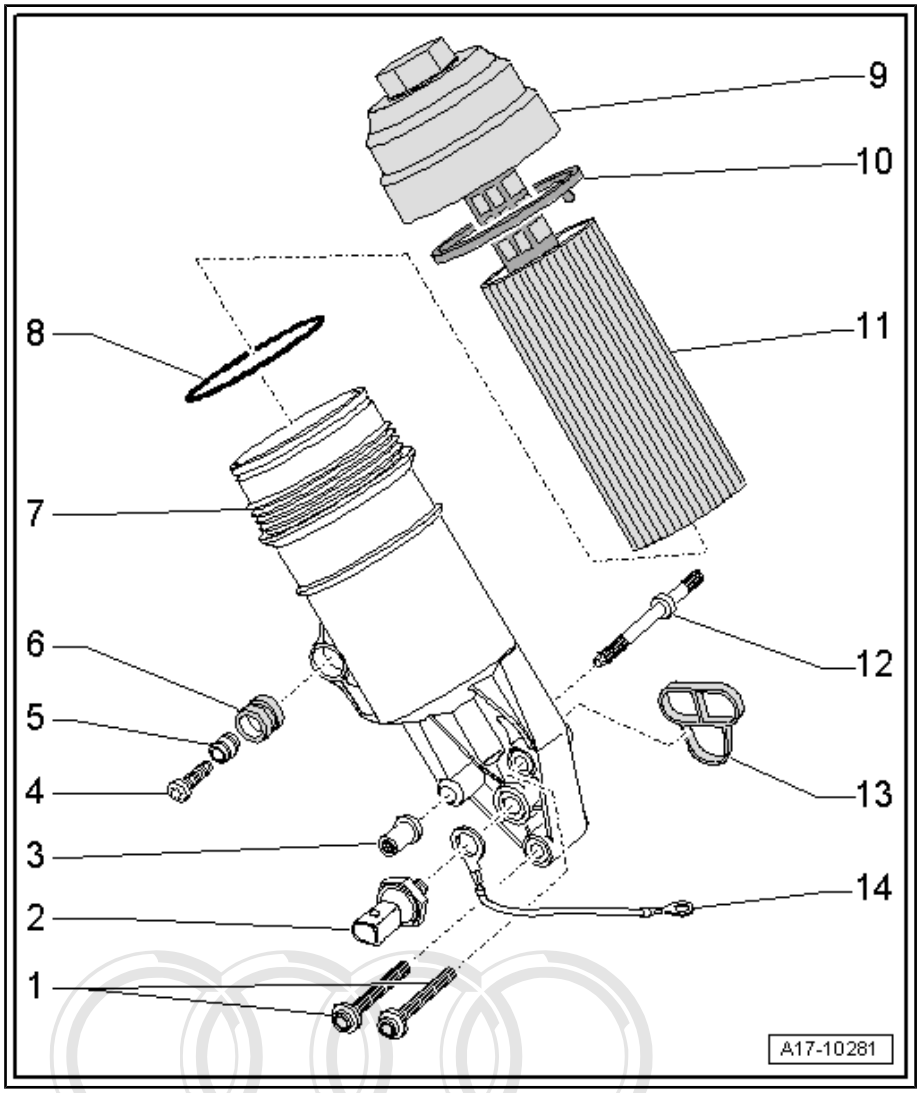
11 - Gasket

- ❑ Renew

12 - Seal with earth wire

- ❑ Renew

Vehicles from 05.2005 onwards



1 - 13 Nm

2 - Oil pressure switch - F1-

- ❑ Tighten to 20 Nm
- ❑ Black insulation
- ❑ Removing and installing ⇒ “1.10 Removing and installing oil pressure switch F1 ”, page 199
- ❑ Checking ⇒ “1.11 Checking oil pressure”, page 200

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 ⇒ Fig. ““Installing O-ring on oil filter housing”“ , page 195

9 - Sealing cap - 25 Nm

10 - Seal

- ❑ Renew
- ❑ Removing and installing ⇒ Fig. ““Renewing seal on sealing cap”“ , page 195

11 - Oil filter element

- ❑ Removing and installing ⇒ Maintenance ; Booklet 405

12 - Stud, 16 Nm

13 - Gasket

- ❑ Renew

14 - Seal with earth wire

- ❑ Renew

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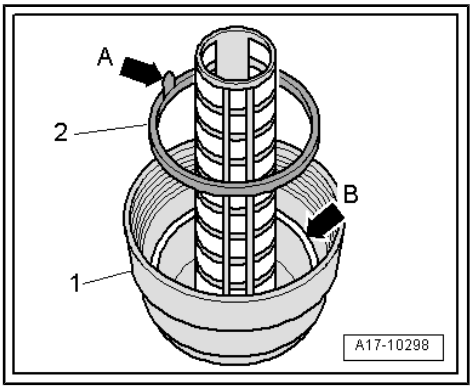
Renewing seal on sealing cap

– Take hold of tab -arrow A- and pull seal -2- out of sealing cap -1-.

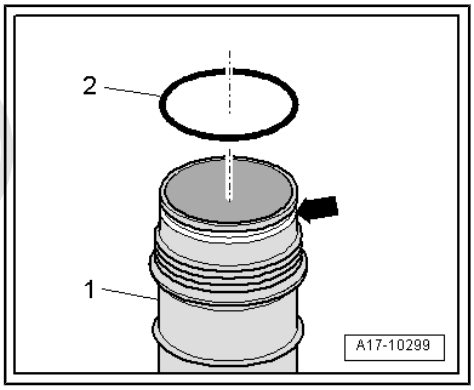
– Fit new seal with semi-circular profile in groove -arrow B- in sealing cap.

• Lug -arrow A- must point upwards.



Installing O-ring on oil filter housing

– Fit O-ring -2- in groove -arrow- on oil filter housing -1-.



1.7 Removing and installing oil filter housing

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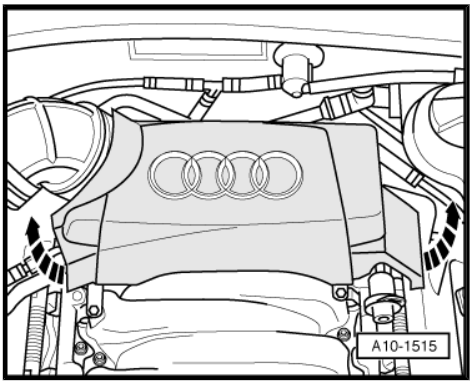
Special tools and workshop equipment required

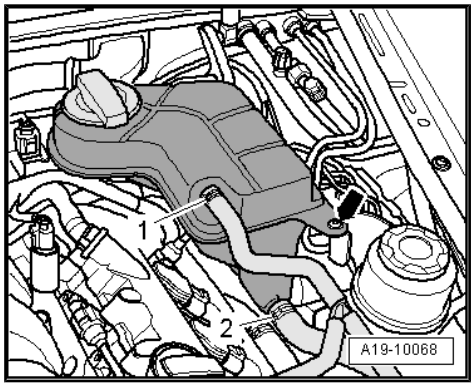
♦ Used oil collection and extraction unit - V.A.G 1782-

Removing

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



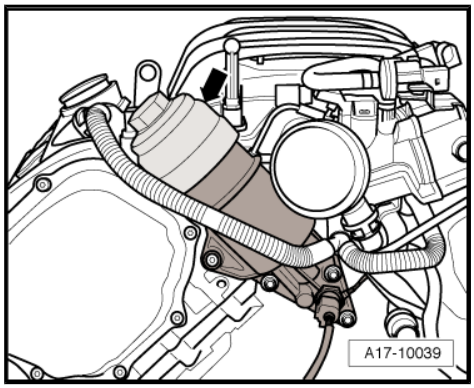
– Unbolt coolant expansion tank -arrow-.
– Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move coolant expansion tank to one side with coolant hoses -1- and -2- attached.



Note

In the following illustrations the steps to perform are shown from the rear and with the engine removed.

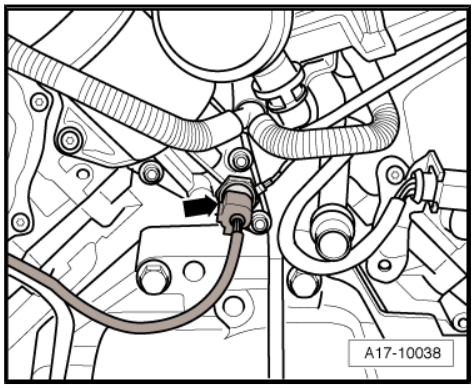
– Unscrew sealing cap -arrow- for oil filter housing.
– Remove oil filter element.
– Extract engine oil from oil filter housing using used oil collection and extraction unit - V.A.G 1782- .



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.



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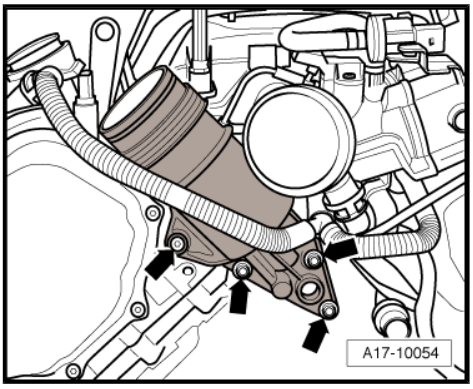

– Remove bolts -arrows-.
– On vehicles from 05.2005, also remove multi-point socket flange nut ⇒ Item 3 (page 194) .
– Remove oil filter housing.

Installing

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

Note

Renew gaskets, seals and O-rings.

– Fill up with engine oil and check oil level ⇒ “1.13 Checking oil level”, page 202 .

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

1.8 Oil retention valves, oil separator - exploded

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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 198) from below

5 - Gasket
- ❑ Renew

6 - Cover
- ❑ With connection for crankcase breather
- ❑ To remove, remove intake manifold ⇒ Rep. gr. 24

7 - O-ring
- ❑ Renew

8 - Gasket
- ❑ Renew

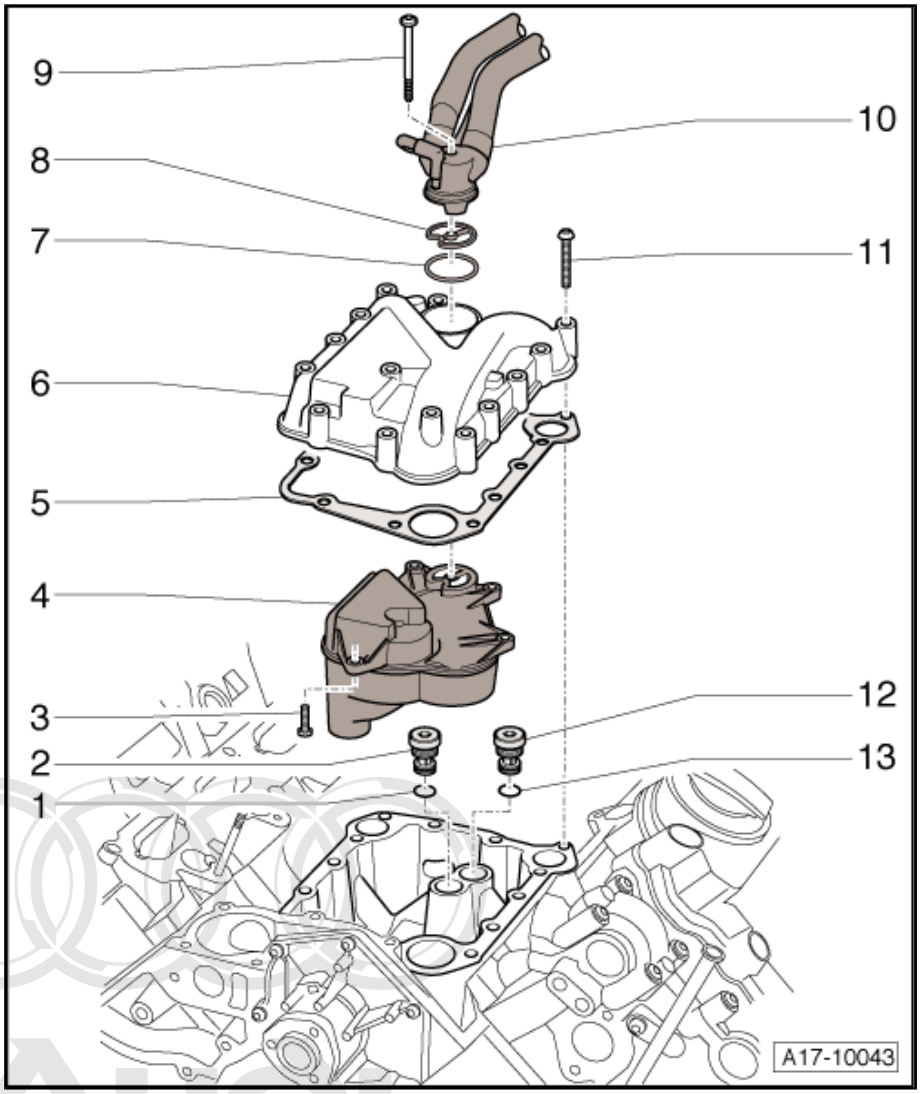
9 - 6 Nm

10 - Crankcase breather hoses
- ❑ Removing and installing ⇒ "1.9 Removing and installing crankcase breather hoses", page 198

11 - 9 Nm

12 - Oil retention valve, 20 Nm
- ❑ For oil supply to cylinder head (left-side)

13 - O-ring
- ❑ Renew



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1.9 Removing and installing crankcase breather hoses

Removing

Note

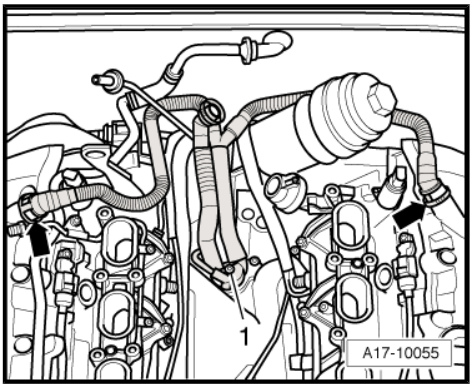
All cable ties which are released or cut open when removing must be refitted in the same position when installing.

– Remove intake manifold ⇒ Rep. gr. 24 .

– Disconnect crankcase breather hoses -arrows- from cylinder head covers.

– Move 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 ⇒ Rep. gr. 24 .

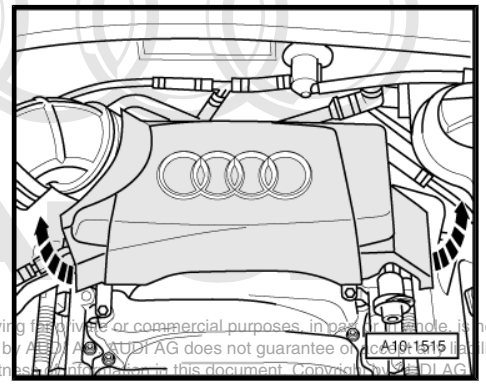
Tightening torque

Component	Nm
Hose connection for crankcase breather hoses to cover	6

1.10 Removing and installing oil pressure switch - F1-

Removing

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



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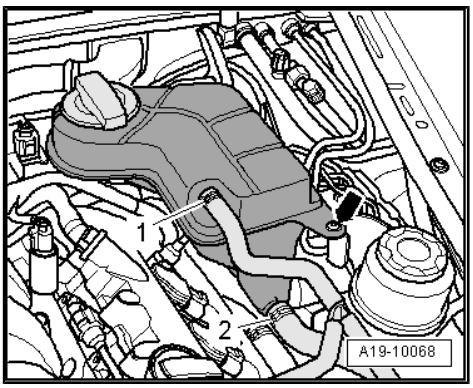
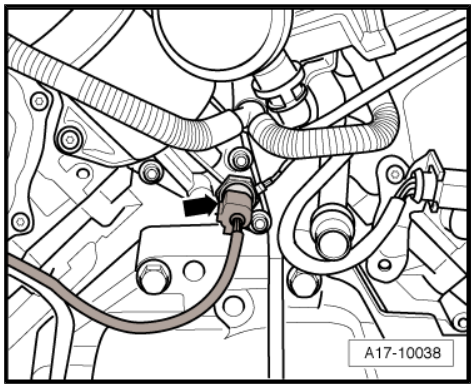
– Unbolt coolant expansion tank -arrow-.

– Unplug electrical connector for coolant shortage indicator switch - F66- at bottom of expansion tank and move coolant 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 ⇒ “1.13 Checking oil level”, page 202 .

Tightening torque

Component	Nm
Oil pressure switch to oil filter housing	20

1.11 Checking oil pressure

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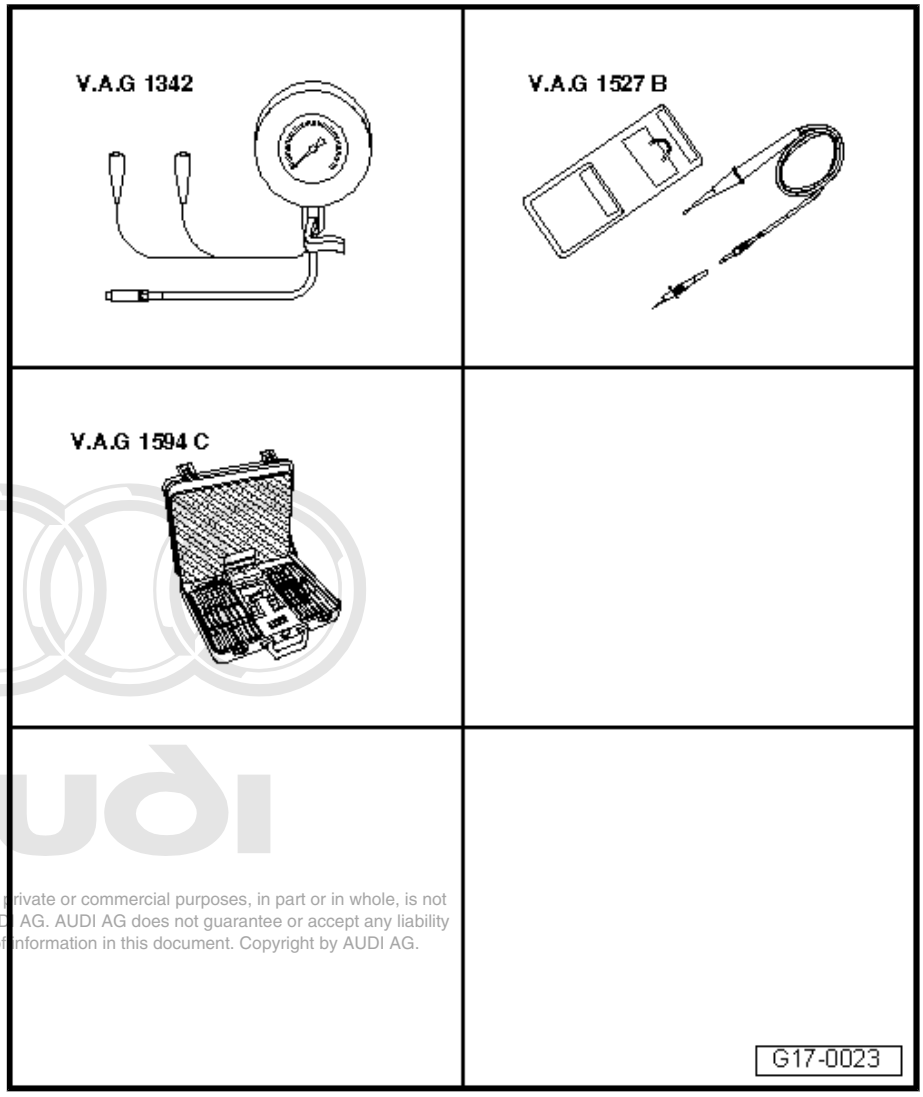
Special tools and workshop equipment required

- Oil pressure tester - V.A.G 1342-
- Voltage tester - V.A.G 1527 B-
- Auxiliary measuring set - V.A.G 1594 C-



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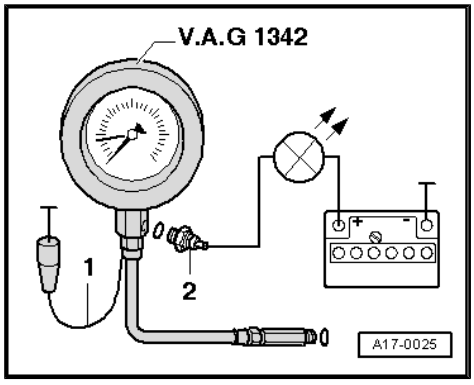
Procedure

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

– Remove oil pressure switch
⇒ “1.10 Removing and installing oil pressure switch F1 ”, page 199 .

– 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 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.

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• Minimum oil pressure at idling speed: 1.2 bar.

• Minimum oil pressure at 2000 rpm: 3.4 bar.

Assembling

– Install oil pressure switch
⇒ “1.10 Removing and installing oil pressure switch F1 ”, page 199 .

1.12 Engine oil

Refer to ⇒ Maintenance tables for viscosity grades, oil specifications and engine oil capacity.

1.13 Checking oil level

Procedure

• Engine oil temperature at least 60 °C

• Vehicle must be level (horizontal).

• Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.

– Pull out dipstick, wipe with a clean cloth and insert again as far as it will go.

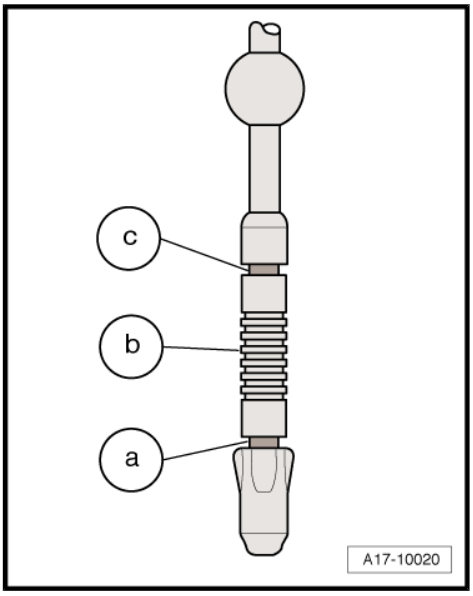
– Pull out dipstick again and read off oil level.

Markings on oil dipstick:

a - Oil must be topped up.

b - Oil can be topped up.

c - Oil must not be topped up.



Note

- *The oil level must not be above the “max” marking -c- and not below the “min” marking -a-.*
- *If the oil level is above the “max.” mark on the dipstick there is a risk of damage to the catalytic converter.*

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19 – Cooling

1 Removing and installing parts of cooling system

WARNING

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

- *The cooling system is under pressure when the engine is hot.*
- *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*

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 Connection diagram - coolant hoses”, page 204

⇒ “1.2 Draining and filling cooling system”, page 206

⇒ “1.3 Thermostat, coolant pump, hose connection - overview of components”, page 211

⇒ “1.4 Removing and installing coolant pump”, page 212

⇒ “1.5 Removing and installing thermostat”, page 214

⇒ “1.6 Checking thermostat”, page 215

⇒ “1.7 Coolant pipes - exploded view”, page 215

⇒ “1.8 Removing and installing coolant temperature sender G62 ”, page 216

⇒ “1.9 Removing and installing coolant pipe (front)”, page 217

⇒ “1.10 Removing and installing coolant pipes (left-side)”, page 219

⇒ “1.11 Removing and installing coolant pipe (top)”, page 222

⇒ “1.12 Removing and installing radiator”, page 223

⇒ “1.13 Removing and installing radiator cowl”, page 228

⇒ “1.14 Removing and installing radiator fan”, page 228

⇒ “1.15 Checking cooling system for leaks”, page 229

1.1 Connection diagram - coolant hoses

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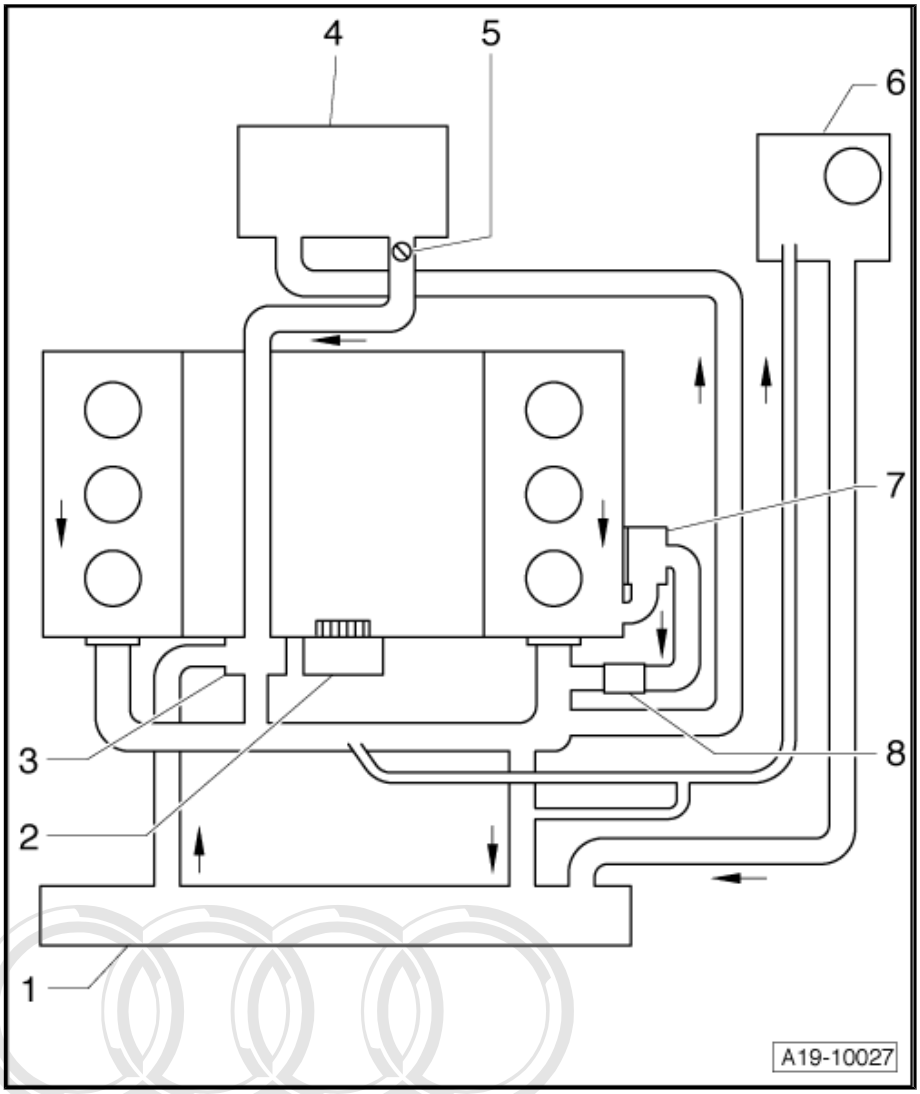

1 - Radiator

- ❑ Removing and installing ⇒ “1.2 Removing and installing oil cooler”, page 183
- ❑ If renewed, refill system with fresh coolant

2 - Coolant pump

- ❑ Removing and installing ⇒ “1.4 Removing and installing coolant pump”, page 212

3 - Thermostat

- ❑ Removing and installing ⇒ “1.5 Removing and installing thermostat”, page 214
- ❑ Checking ⇒ “1.6 Checking thermostat”, page 215

4 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

5 - Bleeder screw

6 - Expansion tank

- ❑ With filler cap
- ❑ Checking pressure relief valve in filler cap ⇒ , page 230

7 - Oil cooler

- ❑ If renewed, refill system with fresh coolant
- ❑ Removing and installing ⇒ “1.2 Removing and installing oil cooler”, page 183

8 - Continued coolant circulation pump - V51-

- ❑ Only on vehicles equipped for a hot climate

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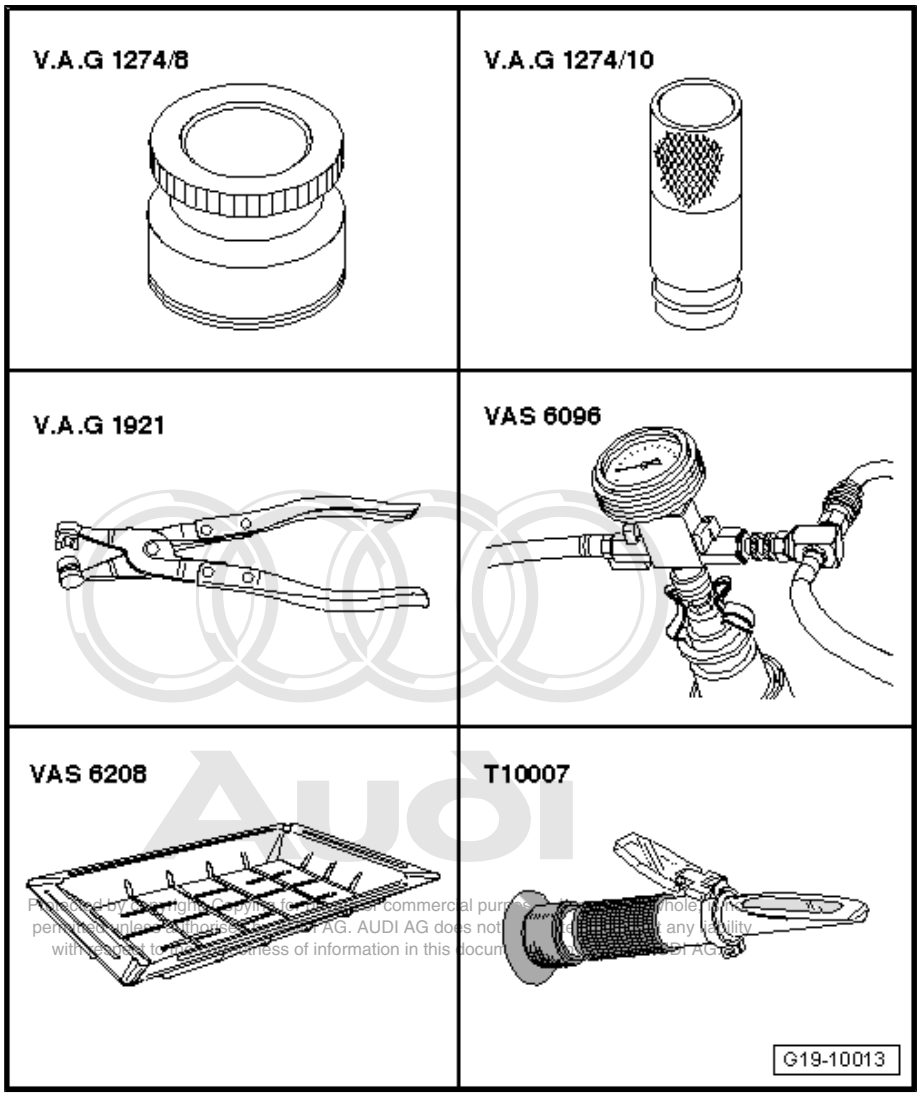
1.2 Draining and filling cooling system

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-
- Hose clip pliers - V.A.G 1921-
- Cooling system charge unit - VAS 6096-
- Drip tray for workshop hoist - VAS 6208-
- Refractometer - T10007-



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Draining

WARNING

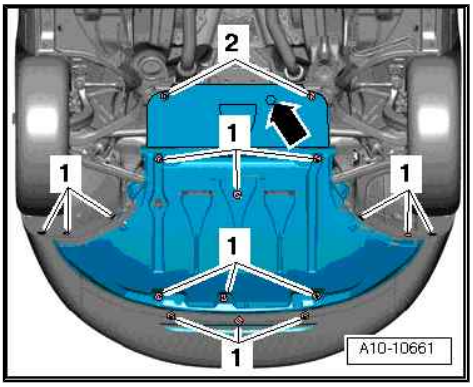
The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

Danger of scalding skin and other parts of the body.

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

– Open filler cap on coolant expansion tank.

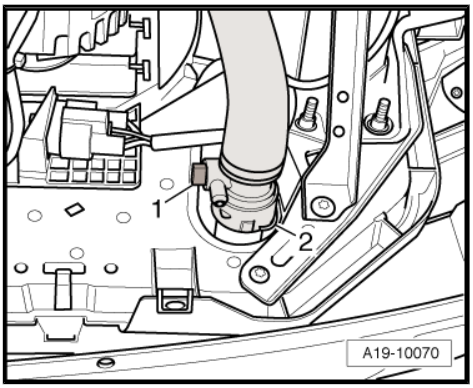
– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.



– Place drip tray for workshop hoist - VAS 6208- under engine.
– Open drain plug -1- and let coolant drain.

Note

Disregard -item 2-.



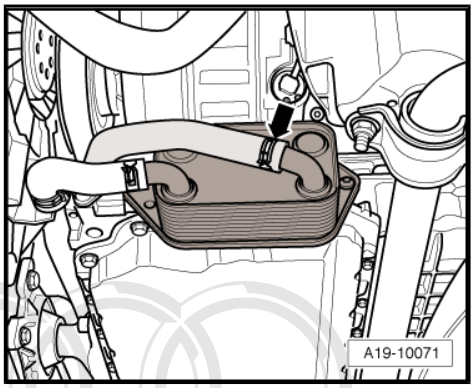
– Disconnect coolant hose -arrow- at oil cooler and drain off remaining coolant.

Filling

- Ignition switched off.

Caution

To ensure optimal corrosion protection, only distilled water may be mixed with coolant additives.



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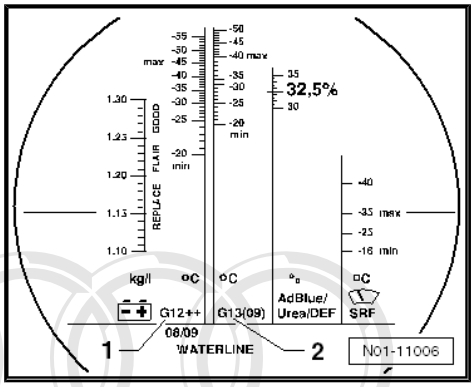

Note

- *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . If you use other coolant additives, this can significantly impair in particular the corrosion protection effect. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- *Coolant with the recommended mixture ratio prevents frost and corrosion damage and stops scaling. At the same time it raises the boiling point of the fluid in the system. For this reason the cooling system must be filled all year round with the correct coolant additive.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *The refractometer - T10007A- MUST be used to determine the current level of frost protection.*
- *The mixture must guarantee frost protection down to at least -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze should only be increased if greater frost protection is required in very cold climates. This must only be down to -48 °C, however, as otherwise the cooling efficiency of the coolant is impaired.*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be provided to at least -25 °C.*
- *Read off the level of frost protection on the scale for the relevant coolant additive.*
- *The temperature indicated on the refractometer - T10007A- corresponds to the temperature at which the first ice crystals can form in the coolant.*
- *Do not reuse coolant.*
- *Only use water/coolant additive as a lubricant for coolant hoses.*

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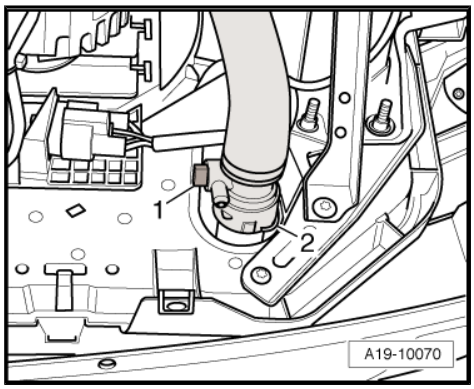
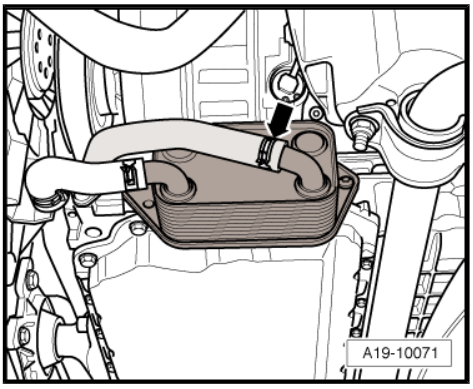
– Close drain plug -1-.



Note

Disregard -item 2-.

– Connect coolant hose to oil cooler -arrow-.



– Fill reservoir - VAS 6096/1- with at least 12 litres of premixed coolant (based on recommended ratio):

• Coolant (40 %) and distilled water (60 %) for frost protection to -25 °C

• Coolant (50 %) and distilled water (50 %) for frost protection to -36 °C

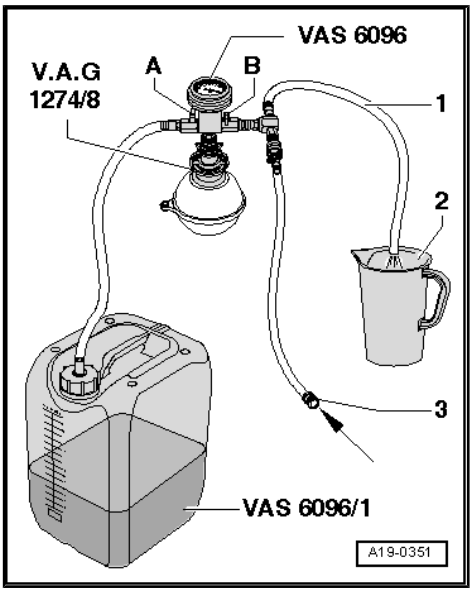
• Coolant ⇒ Electronic parts catalogue (ETKA)

– 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: 7 ... 10 bar.



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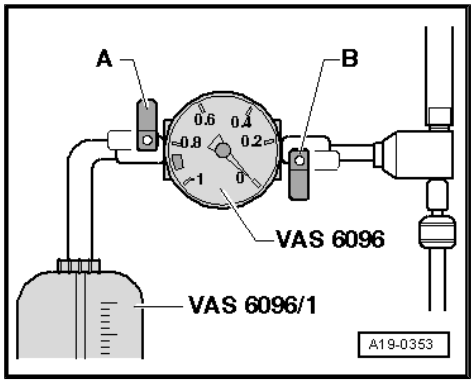
– Open valve -B- by setting lever in direction of flow.



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

- The needle on the gauge should move into the green zone.

– Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir - VAS 6096/1- can fill with coolant.

– Close valve -A- again.

– Leave valve -B- open for another 2 minutes.

- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge should remain in the green zone.

– Close valve -B-.

- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

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

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

– Detach compressed air hose.

– Open valve -A-.

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

– Detach cooling system charge unit - VAS 6096- from expansion tank.

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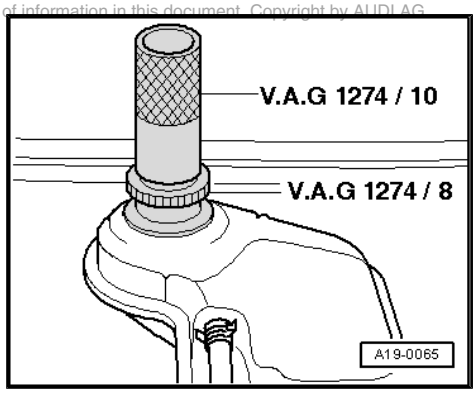
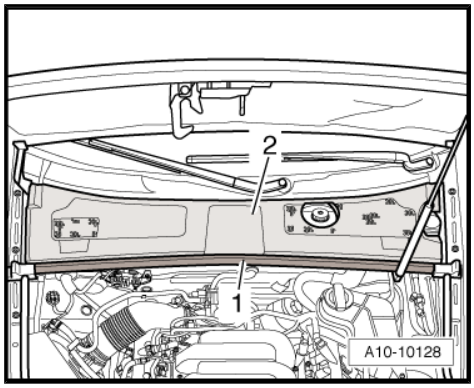
– Fit pipe - V.A.G 1274/10- onto adapter - V.A.G 1274/8- .

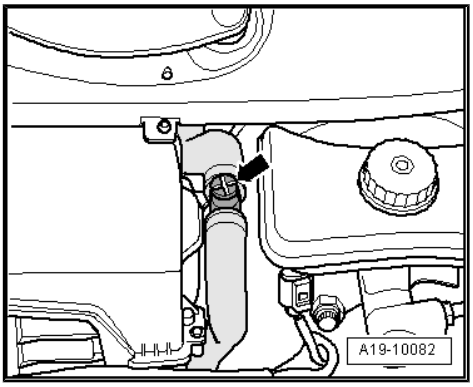


– Detach rubber seal -1- from plenum chamber cover.

– Detach plenum chamber cover -2-.

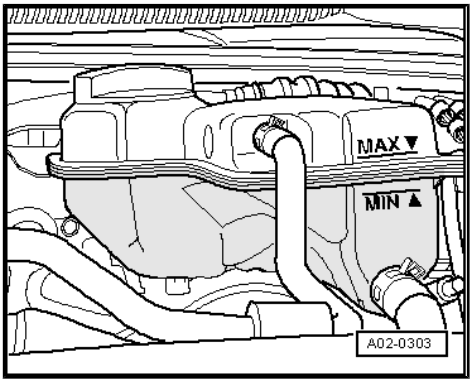


– Open bleeder screw -arrow-.
– Fill up with coolant until it flows out at bleeder hole in coolant hose.
– Close bleeder screw.
– On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
– Tighten filler cap on expansion tank.
– Start engine.
– Set heater/air conditioner on both sides to “HI”.
– Run the engine for 3 minutes at 2000 rpm.
– Allow the engine to run at idling speed until the two large coolant hoses at main radiator become warm.
– Run the engine for 1 minute at 2000 rpm.
– Switch off ignition and allow engine to cool down.



– Check coolant level.

- The coolant level must be at the MAX marking when the engine is cold.
- The coolant level can be above the MAX marking when the engine is warm.



1.3 Thermostat, coolant pump, hose connection - overview of components

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1 - 9 Nm

2 - 20 Nm

3 - Poly V-belt pulley for coolant pump

4 - Coolant pump

- ❑ With gasket
- ❑ Removing and installing ⇒ “1.4 Removing and installing coolant pump”, page 212

5 - 9 Nm

6 - Connection

- ❑ For coolant hose

7 - Gasket

- ❑ Renew

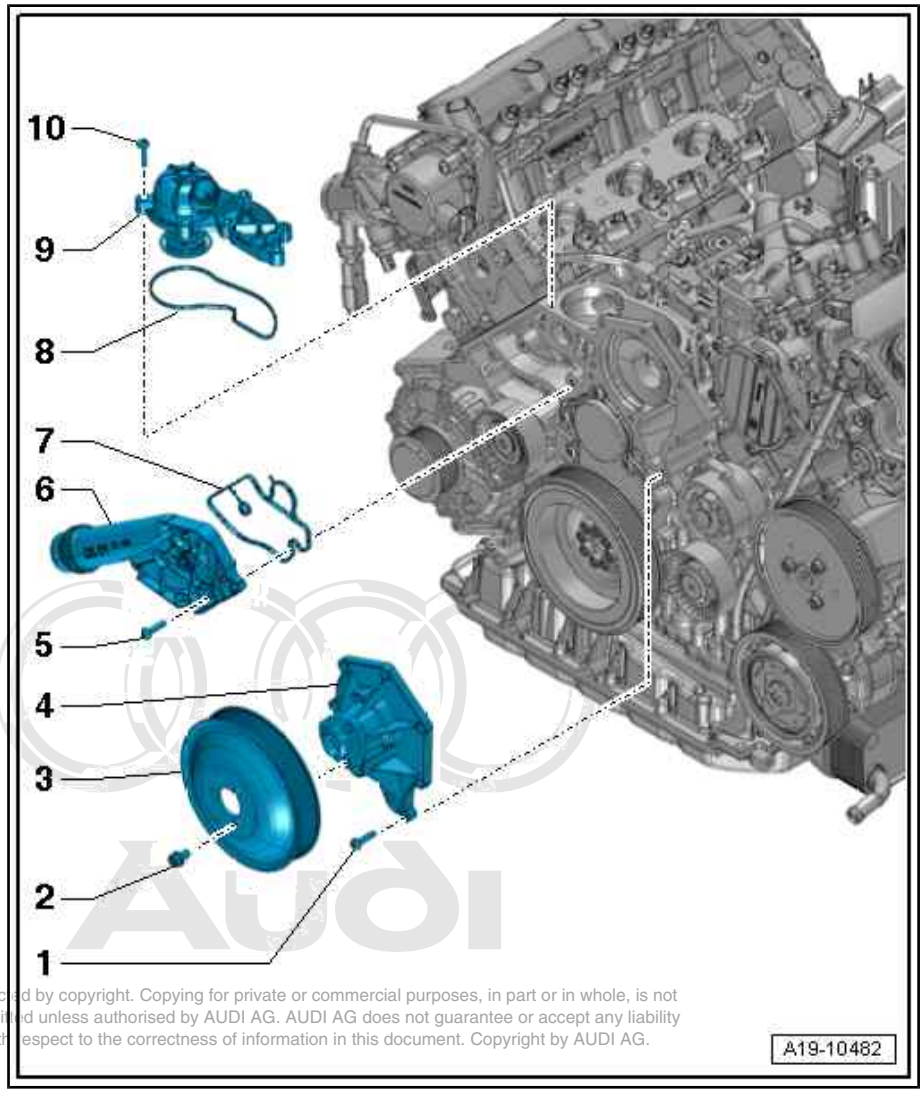
8 - Gasket

- ❑ Different versions available ⇒ Electronic parts catalogue
- ❑ Renew

9 - Thermostat

- ❑ Removing and installing ⇒ “1.5 Removing and installing thermostat”, page 214
- ❑ Checking ⇒ “1.6 Checking thermostat”, page 215

10 - 9 Nm



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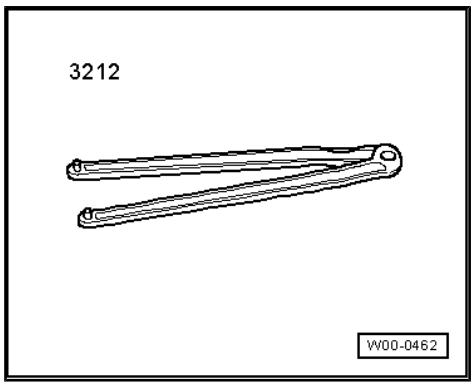
1.4 Removing and installing coolant pump

Special tools and workshop equipment required

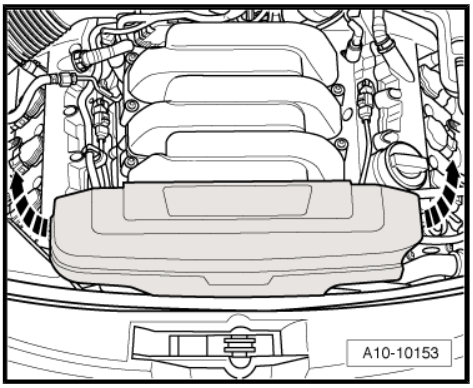
- ♦ Pin wrench - 3212-



Removing

– Drain off coolant
⇒ “1.2 Draining and filling cooling system”, page 206 .

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



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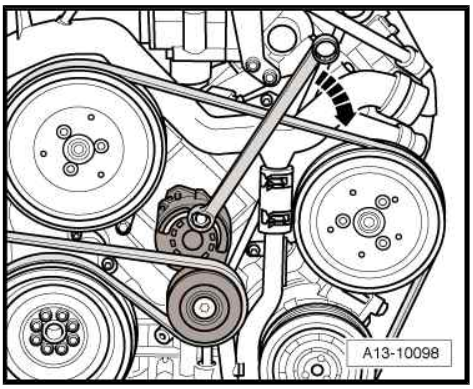
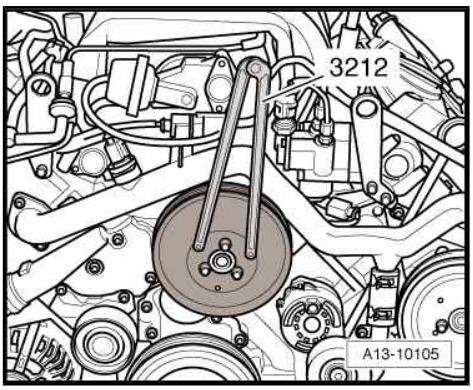
Note

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

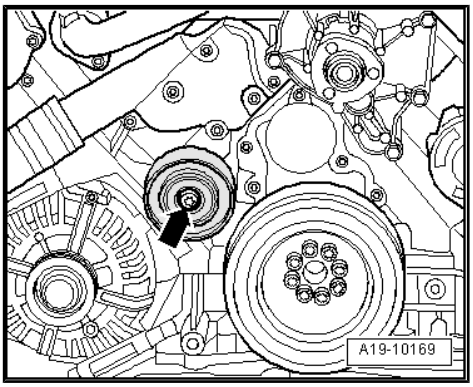
– To slacken poly V-belt turn tensioner in direction of -arrow-.
– Remove poly V-belt from coolant pump.
– Release pressure from the tensioner.



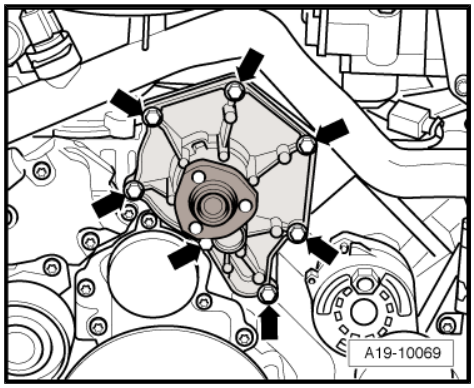
– Unbolt belt pulley from coolant pump.
– Use pin wrench - 3212- to counterhold pulley when loosening bolts.



– Prise off cap.
– Unscrew bolt -arrow- and detach idler roller.



– 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.

Note

If the old coolant pump is to be re-installed, clean the sealing surface and apply an approx. 1.5 mm thick bead of sealant in addition to the vulcanised seal.

– Install poly V-belt
⇒ “1.4 Removing and installing poly V-belt”, page 73 .

– Fill cooling system ⇒ page 207 .

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
⇒ “1.2 Draining and filling cooling system”, page 206 .

– Remove intake manifold ⇒ Rep. gr. 24 .

– Remove coolant pipe (front)
⇒ “1.9 Removing and installing coolant pipe (front)”, page 217 .

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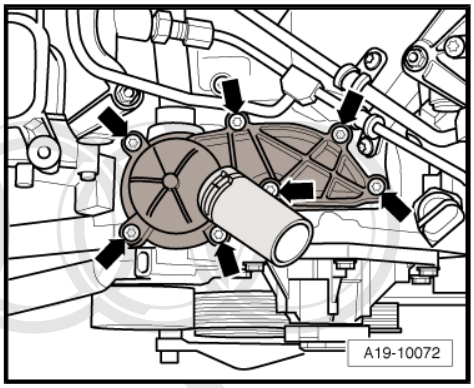
Note

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) ⇒ “1.9 Removing and installing coolant pipe (front)”, page 217 .
– Install intake manifold ⇒ Rep. gr. 24 .
– Fill cooling system ⇒ page 207 .

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Tightening torque

Component	Nm
Coolant thermostat with hose connection to cylinder block	9

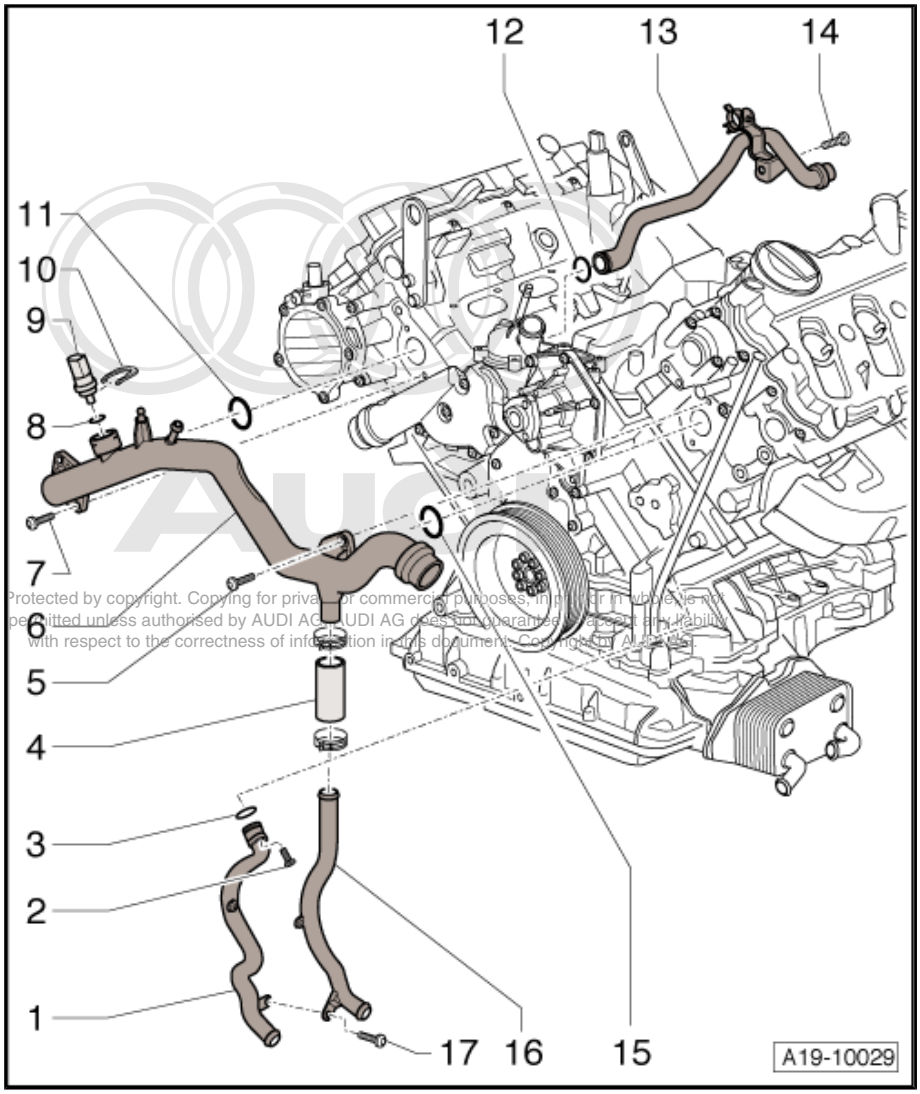
1.6 Checking thermostat

– Remove thermostat and heat it in a water bath.

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

• 1) Cannot be tested.

1.7 Coolant pipes - exploded view



1 - Coolant pipe (left-side)

- ❑ Remove and install together with
  ⇒ Item 16 (page 216)
  ⇒ “1.10 Removing and installing coolant pipes (left-side)”, page 219

2 - 9 Nm

3 - O-ring

- ❑ Renew

4 - Connecting hose

5 - 9 Nm

6 - Coolant pipe (front)

- ❑ Removing and installing
  ⇒ “1.9 Removing and installing coolant pipe (front)”, page 217

7 - 9 Nm

8 - O-ring

- ❑ Renew

9 - Coolant temperature sender - G62-

- ❑ Removing and installing
  ⇒ “1.8 Removing and installing coolant temperature sender G62 ”, page 216

10 - Retaining clip

11 - Seal

- ❑ Renew

12 - O-ring

- ❑ Renew

13 - Coolant pipe (top)

- ❑ Removing and installing ⇒ “1.11 Removing and installing coolant pipe (top)”, page 222

14 - 9 Nm

15 - Seal

- ❑ Renew

16 - Coolant pipe (left-side)

- ❑ Remove and install together with ⇒ Item 1 (page 216)
  ⇒ “1.10 Removing and installing coolant pipes (left-side)”, page 219

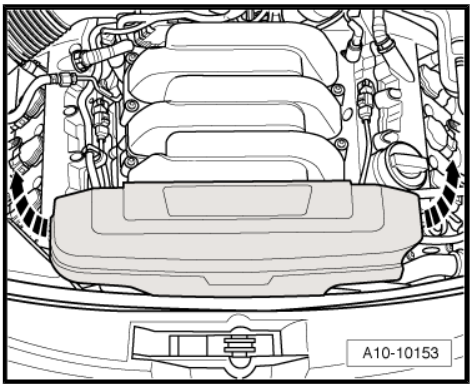
17 - 9 Nm

1.8 Removing and installing coolant temperature sender - G62-

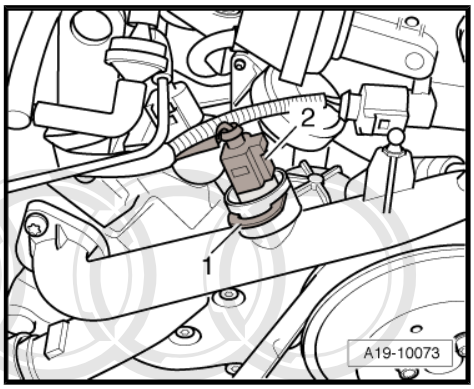
Removing

– Drain off coolant
  ⇒ “1.2 Draining and filling cooling system”, page 206 .

– 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 207 .

1.9 Removing and installing coolant pipe (front)

Special tools and workshop equipment required

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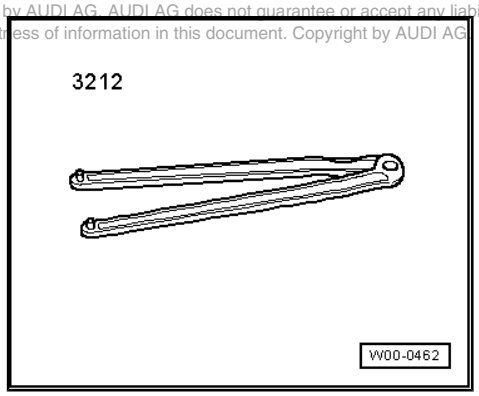
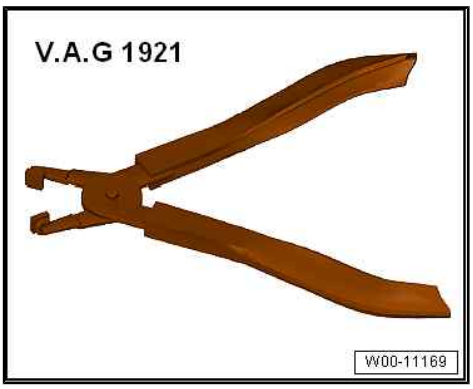
♦ Pin wrench - 3212-

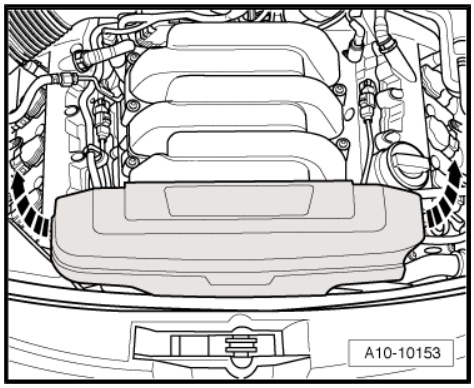


♦ Hose clip pliers - V.A.G 1921-

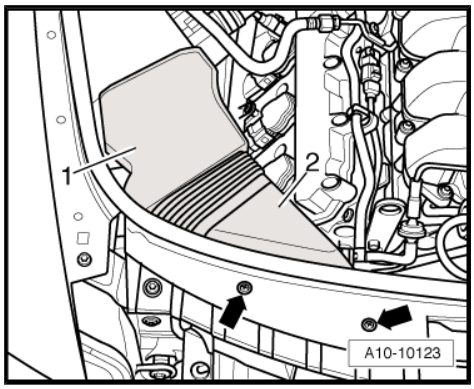


Removing

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



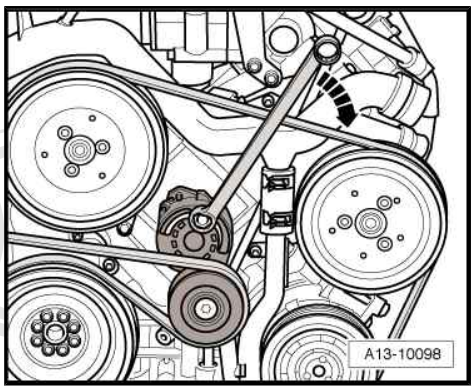
– Remove bolts -arrows-.
– Remove air duct -1- and -2-.



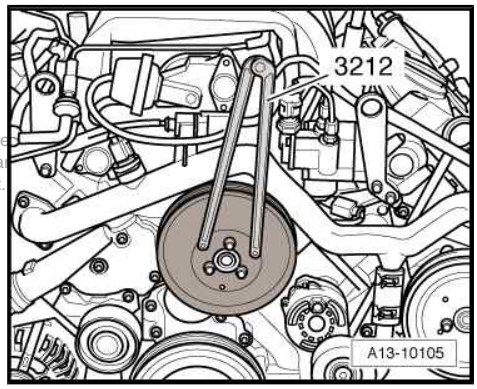
Note

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

– To slacken 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.



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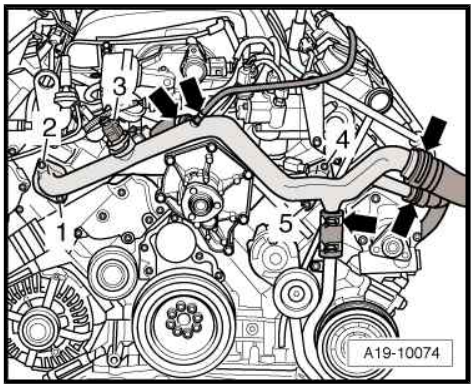

– Unplug electrical connector -3-.
– Detach coolant hoses -arrows- from coolant pipe (front).
– Unscrew bolts -1-, -2-, -4- and -5- and remove coolant pipe (front).

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
⇒ “1.4 Removing and installing poly V-belt”, page 73 .
– Fill cooling system ⇒ page 207 .

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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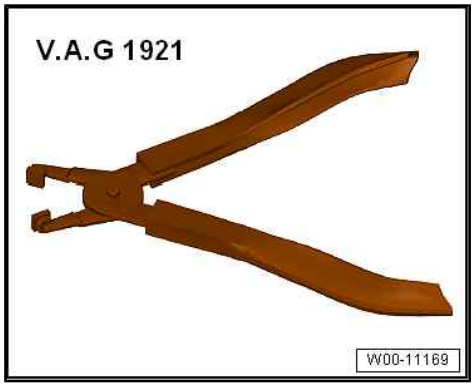
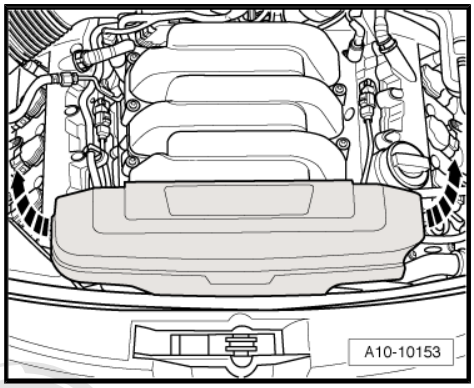
♦ Hose clip pliers - V.A.G 1921-



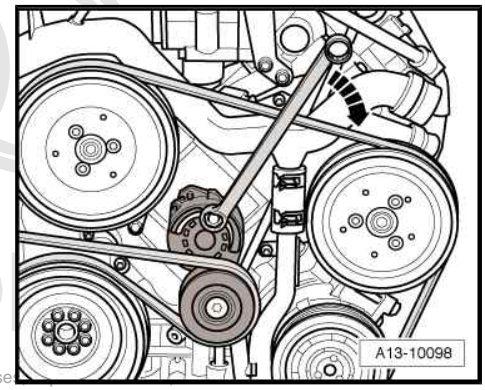
Removing

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



Note

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



– To slacken poly V-belt turn tensioner in direction of -arrow-.

– Remove poly V-belt and release pressure from the tensioner.

WARNING

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

Danger of scalding skin and other parts of the body.

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

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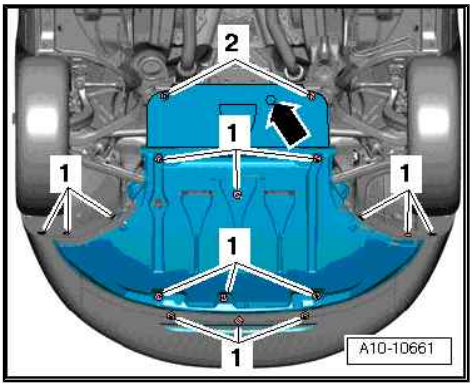
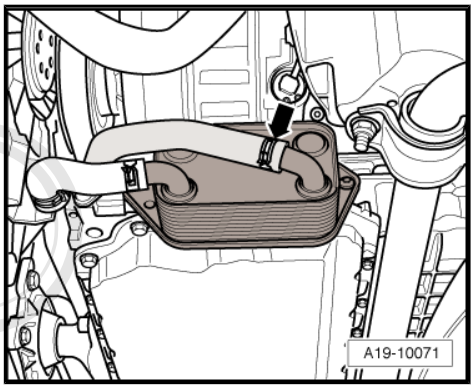
– Open filler cap on coolant expansion tank.

– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.



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

– Disconnect coolant hose -arrow- at 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.

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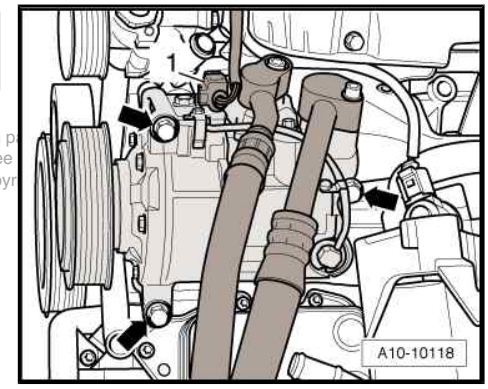


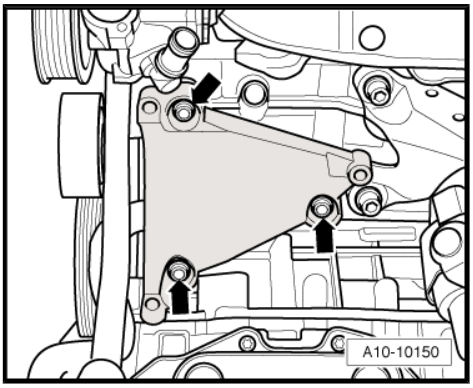
– Unscrew air conditioner compressor from bracket -arrows-.

Note

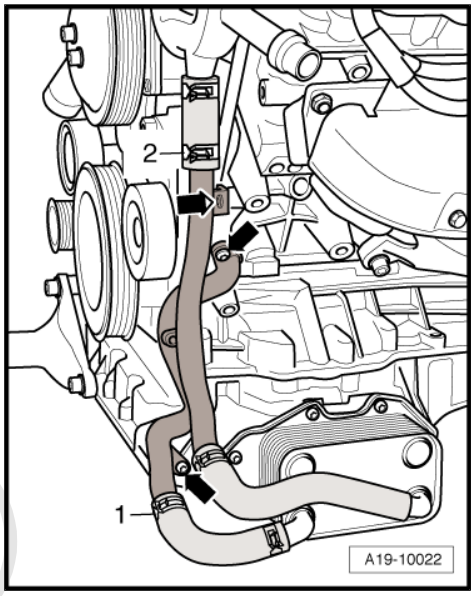
To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

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

– Remove bolts -arrows- and detach bracket for AC compressor.



– 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
⇒ “1.4 Removing and installing poly V-belt”, page 73 .
– Fill cooling system ⇒ page 207 .

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Tightening torque

Component	Nm
Coolant pipes to engine	9

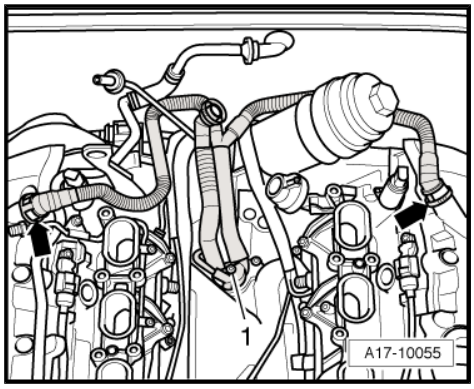
1.11 Removing and installing coolant pipe (top)

Removing

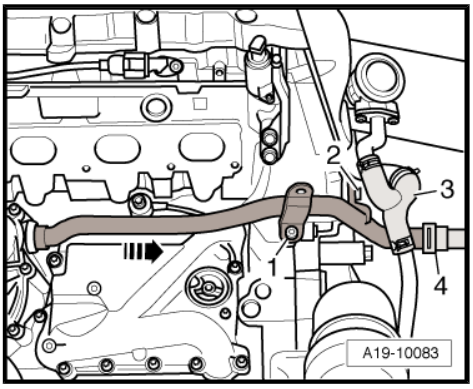
Note

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

– Drain off coolant
⇒ “1.2 Draining and filling cooling system”, page 206 .
– Remove intake manifold ⇒ Rep. gr. 24 .
– Disconnect crankcase breather hoses -arrows- from cylinder head covers.
– Move crankcase breather hoses clear.
– Unscrew bolt -1- and take out hose connection with crankcase breather hoses.



– Remove air intake hose -3- for secondary air system.



Note

Lay a cloth under coolant pipe to catch escaping coolant.

– Detach coolant hose -4- 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.
– Install intake manifold ⇒ Rep. gr. 24 .
– Fill cooling system ⇒ page 207 .

Tightening torques

Component	Nm
Coolant pipe to engine	9
Hose connection for crankcase breather hoses to cover	6

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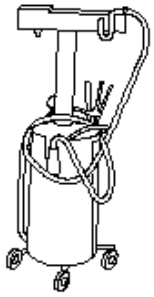
1.12 Removing and installing radiator

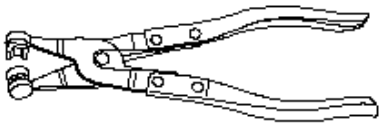
Special tools and workshop equipment required

- Used oil collection and extraction unit - V.A.G 1782-
- Hose clip pliers - V.A.G 1921-
- Drip tray for workshop hoist - VAS 6208-

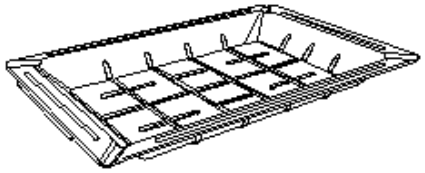
V.A.G 1782



V.A.G 1921



VAS 6208



G19-10003

Removing

Note

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.

WARNING

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

Danger of scalding skin and other parts of the body.

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

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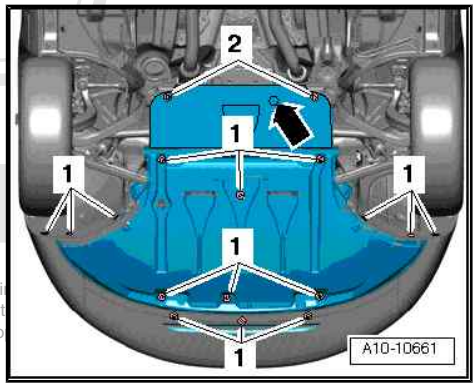
– Open filler cap on coolant expansion tank.
– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.
– Remove front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
– Remove bumper cover (front) ⇒ Rep. gr. 63 .



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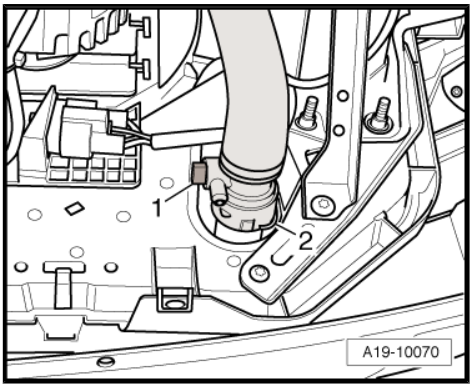
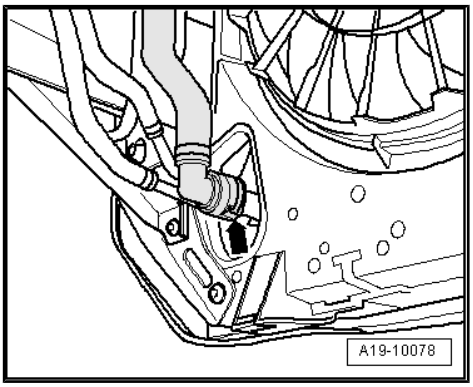
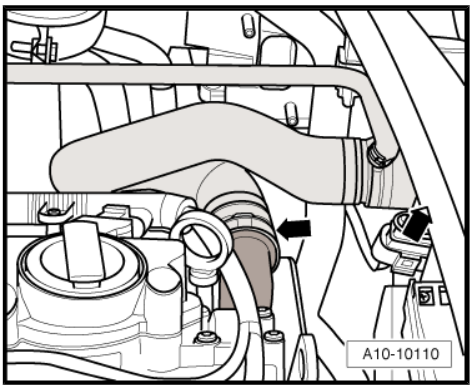
– Place drip tray for workshop hoist - VAS 6208- under engine.
– Open drain plug -1- and let coolant drain.
– Then disconnect coolant hose -2- from radiator.



– Detach coolant hose -arrow- at bottom left of radiator.



– Detach coolant hose (top) -arrow on right- from radiator.



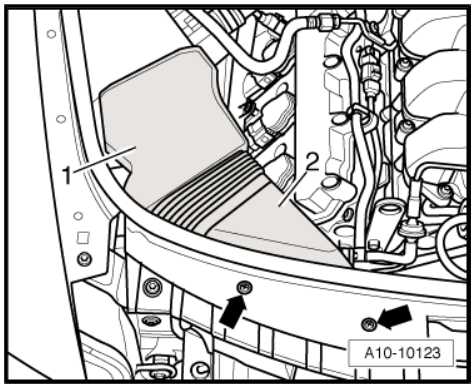
Note

Ignore -arrow on left side of illustration-.

Vehicles with multitronic gearbox:

– Remove bolts -arrows-.

– Remove air duct -1- and -2-.



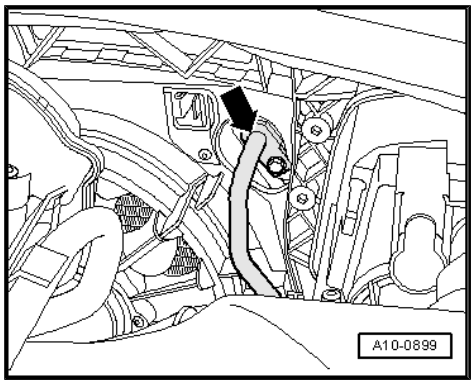
Note

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

– Place used oil collection and extraction unit - V.A.G 1782- under engine.

– Detach ATF lines (top -arrow- and bottom) from radiator: ⇒ Rep. gr. 37 .

– Tie ATF lines up onto longitudinal member to prevent fluid escaping.



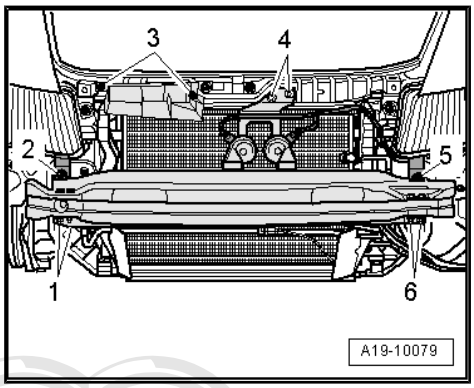
All vehicles:

– 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.

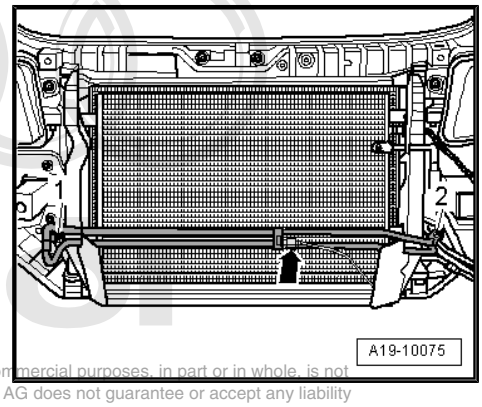
– Unscrew nuts -1- and -6- and remove bumper.



– 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.

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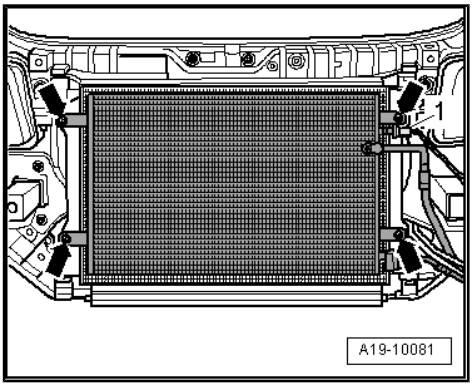
– Unplug electrical connector -1-.
– Remove bolts -arrows-.

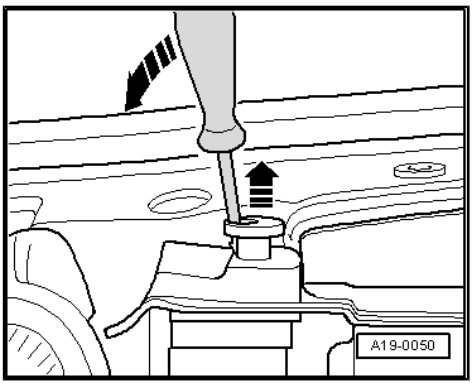


Note

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 lines ⇒ Rep. gr. 37 .
– Install bumper cover (front) ⇒ Rep. gr. 63 .
– Install front wheel housing liners (right and left) ⇒ Rep. gr. 66 .
– Fill cooling system ⇒ page 207 .

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

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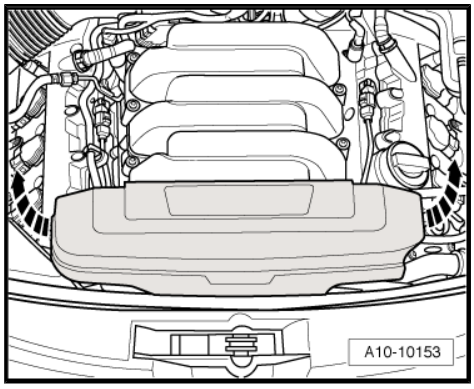
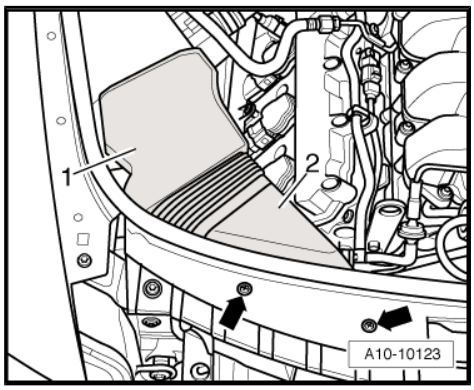
1.13 Removing and installing radiator cowl

Removing

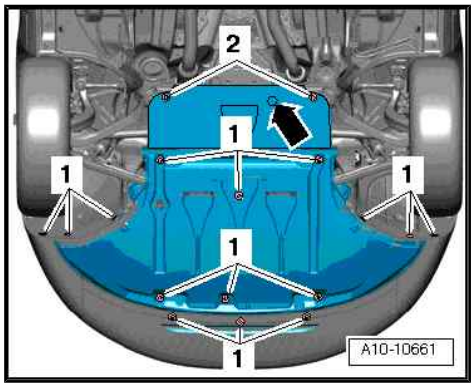
– Pull off engine cover panel (front) -arrows-.



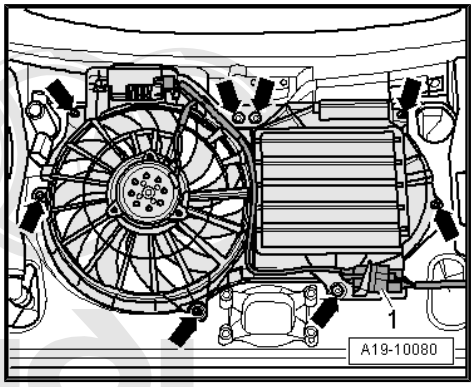
– Remove bolts -arrows-.
– Remove air duct -1- and -2-.



– Release fasteners -1- and remove front noise insulation panels.



– Unplug electrical connector -1- for radiator fan.
– Unscrew bolts -arrows- and lift out radiator cowl.



Installing

Install in reverse sequence.

Tightening torques

Component		Nm
Radiator cowl to	M6	11
Lock carrier	Panel bolt	2

1.14 Removing and installing radiator fan

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Removing

– Remove radiator cowl
⇒ “1.13 Removing and installing radiator cowl”, page 228 .
– Move wiring clear.

– Remove bolts -1 ... 5-.
– Remove radiator fan with control unit.

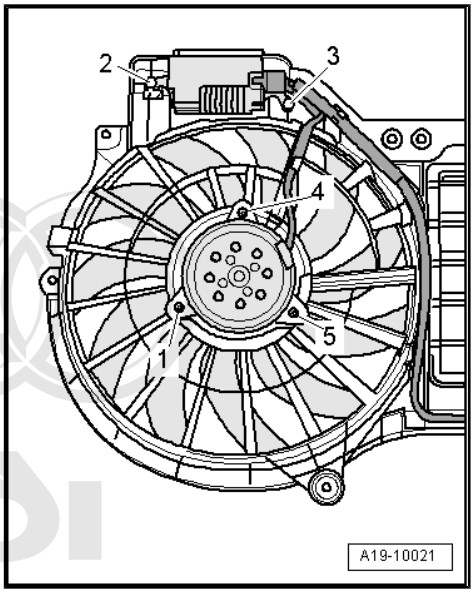
Installing

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

– Install radiator cowl
⇒ “1.13 Removing and installing radiator cowl”, page 228 .

Tightening torque

Component		Nm
Radiator fan	Single fan	3
to radiator cowl	Dual fan	4.5



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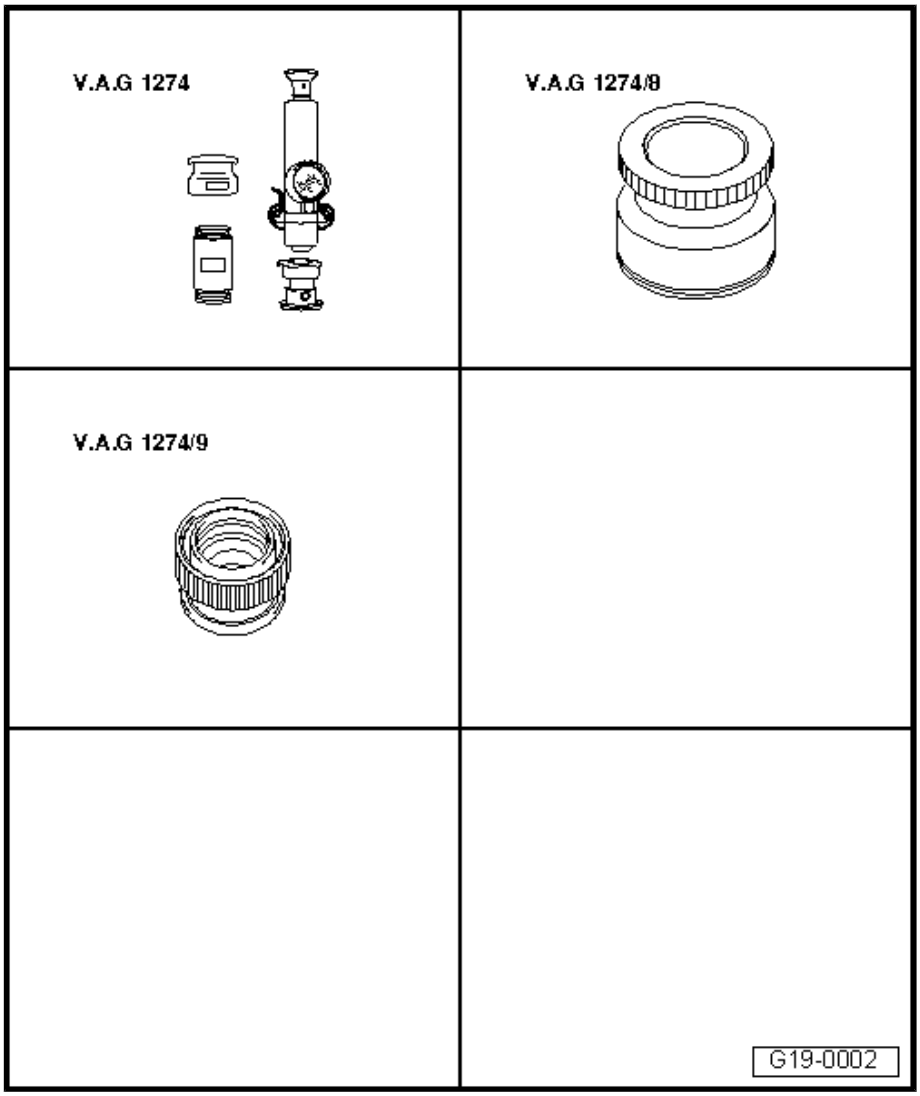
1.15 Checking cooling system for leaks

Special tools and workshop equipment required

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



Procedure

- Engine must be warm.

WARNING

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

Danger of scalding skin and other parts of the body.

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

– Open filler cap on coolant expansion tank.

– Attach cooling system tester - V.A.G 1274- with adapter - V.A.G 1274/8- to expansion tank.

– Use hand pump on cooling system tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

– Trace leak and repair.

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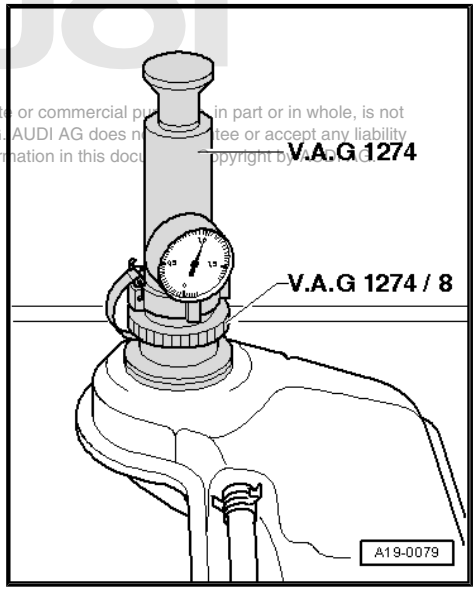


Checking pressure relief valve in filler cap

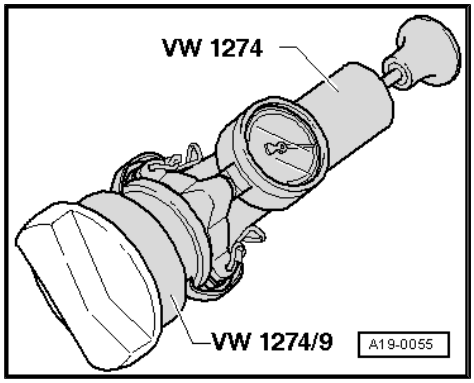
– Attach cooling system tester - V.A.G 1274- with adapter - V.A.G 1274/9- to filler cap.

– Use hand pump on cooling system tester to create pressure.

- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

If the pressure relief valve does not open as described:

– Renew filler cap.



26 – Exhaust system

1 Removing and installing parts of exhaust system

Note

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”, page 231

⇒ “1.2 Exhaust system on vehicles with four-wheel drive - exploded view”, page 236

⇒ “1.3 Separating centre and rear silencers”, page 239

⇒ “1.4 Renewing tailpipe”, page 241

⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242

⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246

⇒ “1.7 Exhaust manifold - exploded view”, page 251

⇒ “1.8 Removing and installing exhaust manifold (left-side)”, page 252

⇒ “1.9 Removing and installing exhaust manifold (right-side)”, page 254

⇒ “1.10 Stress-free alignment of exhaust system”, page 255

⇒ “1.11 Checking exhaust system for leaks”, page 257

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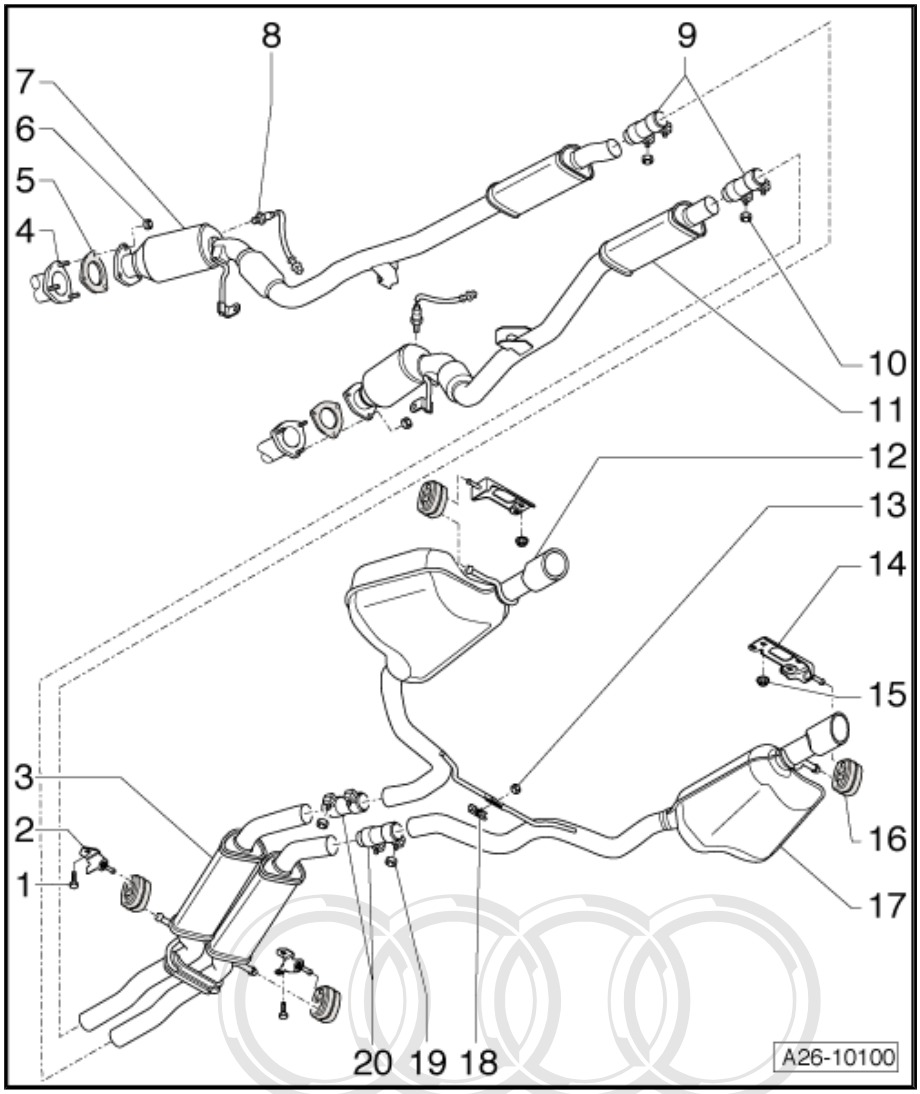
1.1 Exhaust system on vehicles with front-wheel drive - exploded view



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 240
- ❑ Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

4 - Exhaust manifold

- ❑ Removing and installing: left-side ⇒ “1.8 Removing and installing exhaust manifold (left-side)”, page 252 , right-side ⇒ “1.9 Removing and installing exhaust manifold (right-side)”, page 254

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 ⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242
- ❑ Components of exhaust pipe mountings: vehicles with manual gearbox ⇒ Fig. ““Components of exhaust pipe mountings (left-side) for vehicles with manual gearbox”“ page 234 ; vehicles with multitronic gearbox ⇒ Fig. ““Components of exhaust pipe mountings (left-side) for vehicles with multitronic gearbox”“ , page 235
- ❑ Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

8 - Lambda probe after catalytic converter

- ❑ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ❑ When re-using the old Lambda probe, grease thread with high-temperature paste; the paste must not get into the slots of the probe body; high-temperature paste⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ Rep. gr. 24
- ❑ Tighten to 55 Nm

9 - Clamps (front)

- ❑ Installation position ⇒ Fig. ““Installation position of front clamps”“ , page 234

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- ❑ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255
- ❑ Tighten bolted 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 ⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246
- ❑ Components of exhaust pipe mountings: vehicles with manual gearbox ⇒ Fig. ““Components of exhaust pipe mountings (right-side) for vehicles with manual gearbox”“ , page 235 ; vehicles with multitronic gearbox ⇒ Fig. ““Components of exhaust pipe mountings (right-side) for vehicles with multitronic gearbox”“ , page 235
- ❑ Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

12 - Rear silencer with tailpipe

- ❑ Left side of vehicle
- ❑ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 240
- ❑ Cutting point: rear silencer / tailpipe ⇒ “1.4 Renewing tailpipe”, page 241
- ❑ Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

13 - 23 Nm

- ❑ Renew

14 - Mounting

15 - 23 Nm

16 - Mounting

- ❑ Renew if damaged

17 - Rear silencer with tailpipe

- ❑ Right side of vehicle
- ❑ Centre silencer, rear silencer and tailpipe can be renewed separately as required
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 240
- ❑ Cutting point: rear silencer / tailpipe ⇒ “1.4 Renewing tailpipe”, page 241
- ❑ Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

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 ⇒ Fig. ““Installation position of rear clamps”“ , page 234
- ❑ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255
- ❑ Tighten bolted connections evenly

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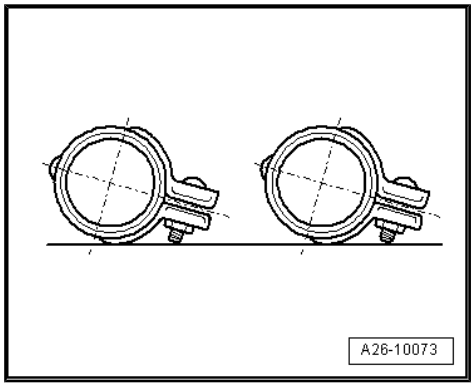
Installation position of front clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

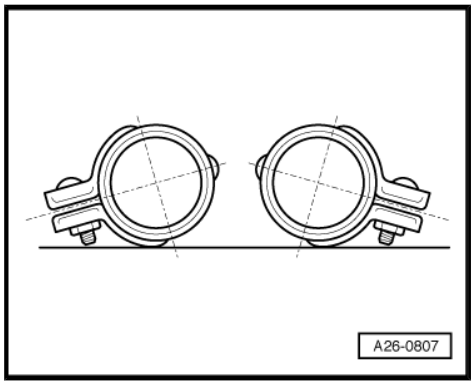
• Bolt connections face to right.



Installation position of rear clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Bolt connections face outwards.



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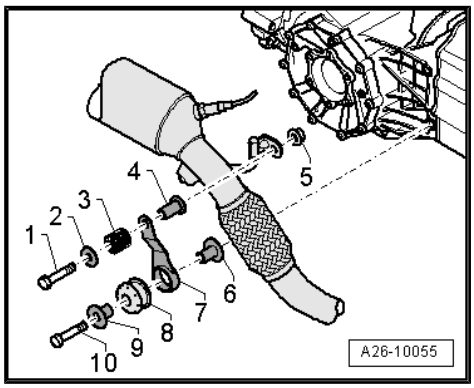
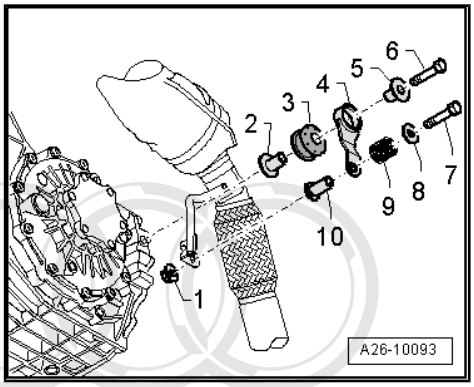
Components of exhaust pipe mountings (left-side) for vehicles with manual gearbox



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

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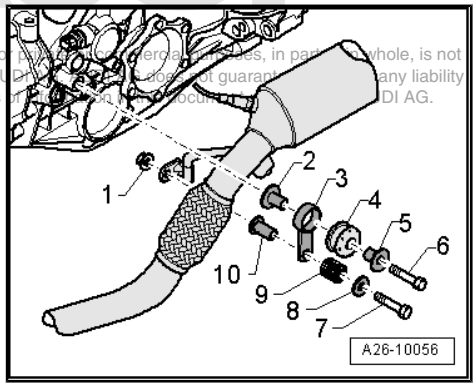
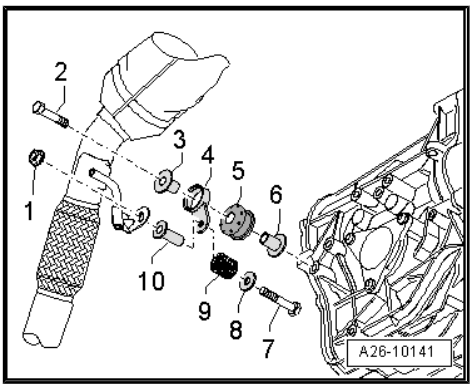


1 - Nut, 23 Nm
2 - Spacer sleeve
3 - Bracket
4 - Buffer
5 - Spacer sleeve
6 - Bolt, 23 Nm
7 - Bolt
8 - Washer
9 - Compression spring
10 - Spacer sleeve

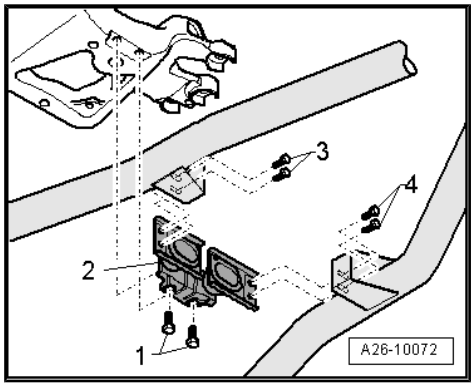
Components of exhaust pipe mountings (right-side) for vehicles with multitronic gearbox



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



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 location: vehicles with front-wheel drive ⇒ page 240 , vehicles with four-wheel drive ⇒ page 240 .
- ❑ Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

4 - Exhaust manifold

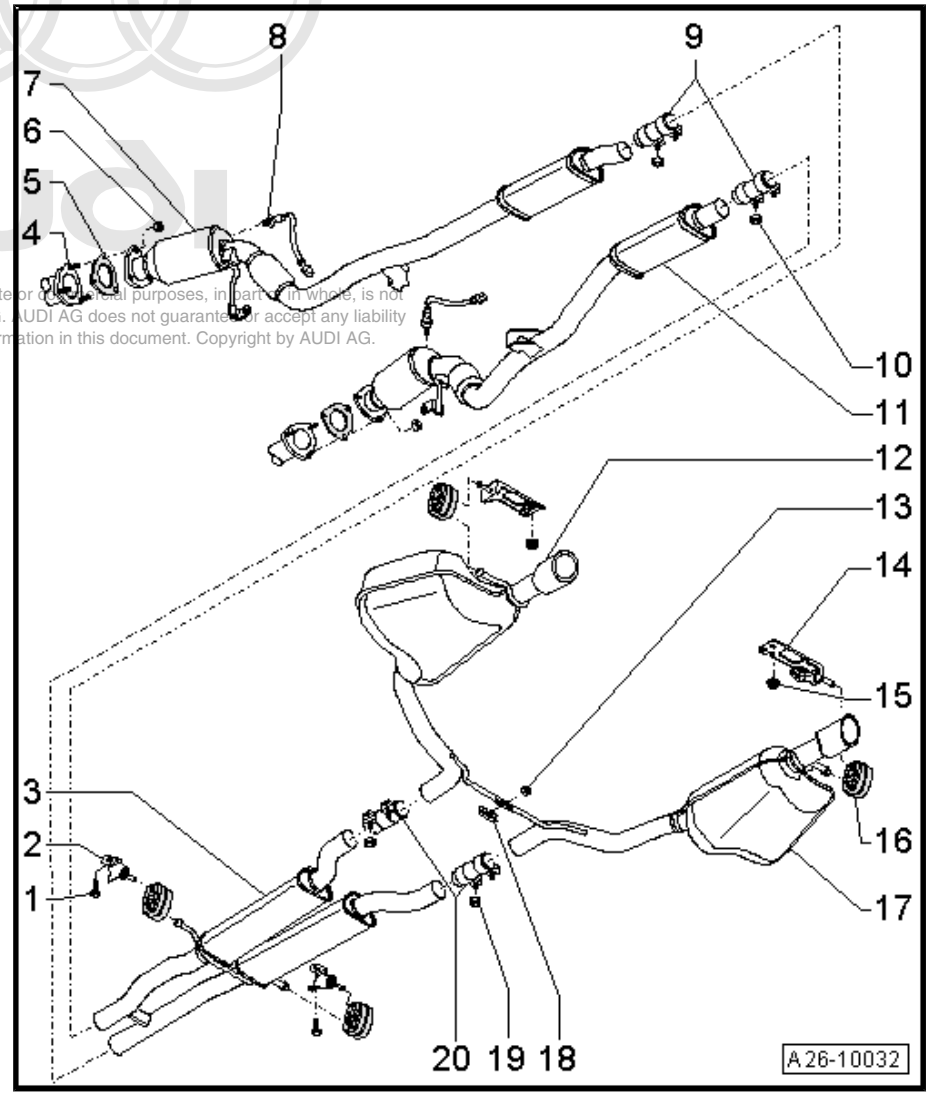
- ❑ Removing and installing: left-side ⇒ “1.8 Removing and installing exhaust manifold (left-side)”, page 252 , right-side ⇒ “1.9 Removing and installing exhaust manifold (right-side)”, page 254

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 ⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242
- ❑ Mounting components ⇒ Fig. ““Components of exhaust pipe mountings (left-side)”“ , page 238

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- ❑ Align exhaust system so it is free of stress
  ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

8 - Lambda probe after catalytic converter

- ❑ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ❑ When re-using the old Lambda probe, grease thread with high-temperature paste; the paste must not get into the slots of the probe body; high-temperature paste⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ Rep. gr. 24
- ❑ Tighten to 55 Nm

9 - Clamps (front)

- ❑ Installation position ⇒ Fig. ““Installation position of front clamps”“ , page 238
- ❑ Before tightening bolt connections, align exhaust system so it is free of stress
  ⇒ “1.10 Stress-free alignment of exhaust system”, page 255
- ❑ Tighten bolted 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
  ⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246
- ❑ Mounting components
  ⇒ Fig. ““Components of exhaust pipe mountings (right-side) for vehicles with manual gearbox”“ , page 239
- ❑ Align exhaust system so it is free of stress
  ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

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 240
- ❑ Cutting point: rear silencer / tailpipe ⇒ “1.4 Renewing tailpipe”, page 241
- ❑ Align exhaust system so it is free of stress
  ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

13 - 23 Nm

- ❑ Renew

14 - Mounting

15 - 23 Nm

16 - Mounting

- ❑ Renew if damaged

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17 - Rear silencer

- ❑ 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 240
- ❑ Cutting point: rear silencer / tailpipe ⇒ “1.4 Renewing tailpipe”, page 241
- ❑ Align exhaust system so it is free of stress
  ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

18 - Bracket

19 - 23 Nm

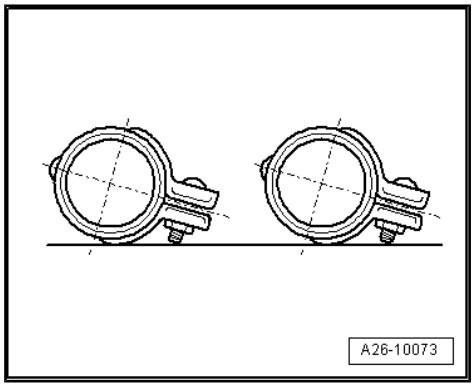
20 - Clamps (rear)

- ❑ For separate replacement of centre and rear silencers
- ❑ Position clamp so that it aligns with centre of cutting location
- ❑ Installation position ⇒ Fig. ""Installation position of rear clamps"" , page 238
- ❑ Before tightening bolt connections, align exhaust system so it is free of stress ⇒ "1.10 Stress-free alignment of exhaust system", page 255
- ❑ Tighten bolted connections evenly

Installation position of front clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

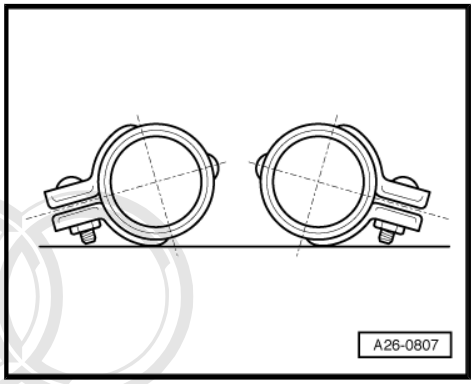
• Bolt connections face to right.



Installation position of rear clamps

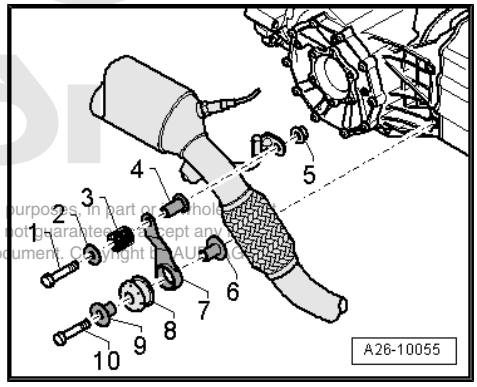
– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Bolt connections face outwards.



Components of exhaust pipe mountings (left-side)

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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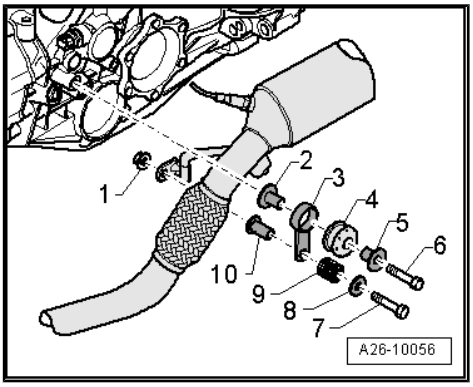
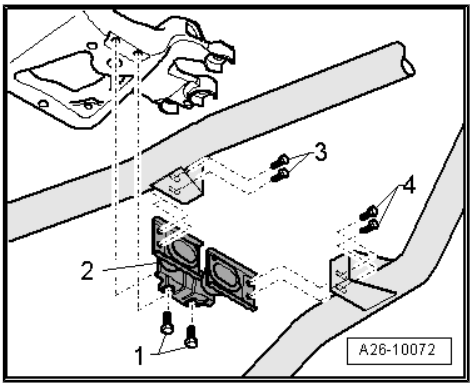
Components of exhaust pipe mountings (right-side) for vehicles with manual gearbox



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

Mounting components for centre bracket for front exhaust pipes



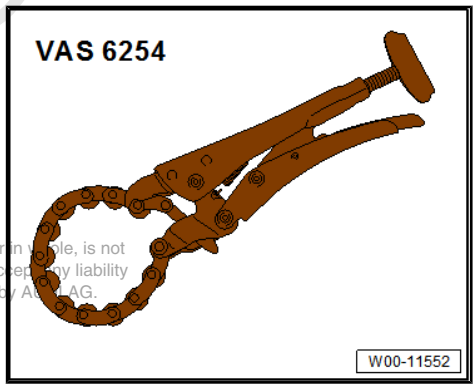
1 - 23 Nm
2 - Bracket
3 - 23 Nm
4 - 23 Nm

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 pipe cutter - VAS 6254-



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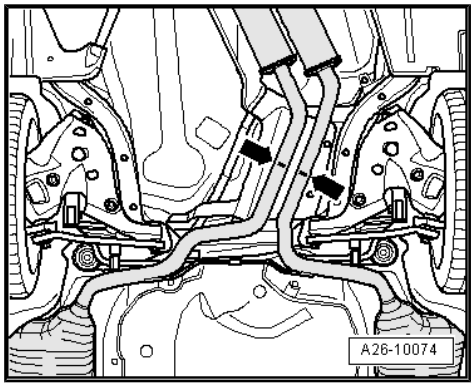
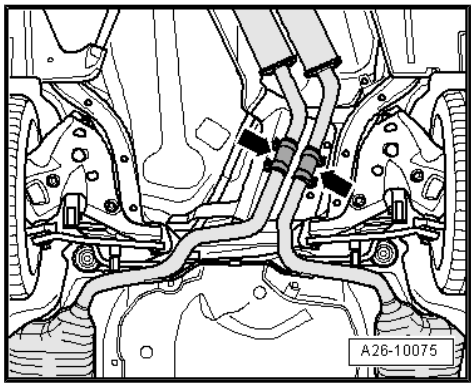
Procedure - vehicles with front-wheel drive:

– Cut through exhaust pipes at right angles at position marked -arrow- using chain pipe cutter - VAS 6254-



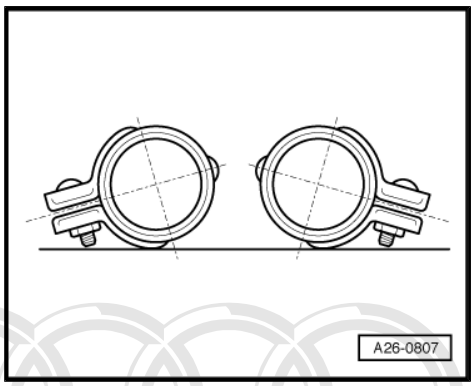
– When installing, position centre of clamps -arrows- over cutting location.



– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

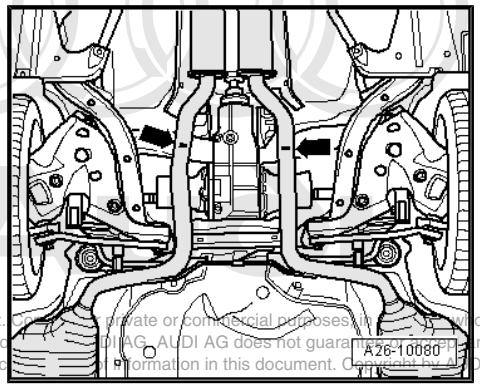
• Bolt connections face outwards.

– Align exhaust system so it is free of stress
⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .



Procedure - vehicles with four-wheel drive:

– Cut through exhaust pipes at right angles at position marked -arrow- using chain pipe cutter - VAS 6254-



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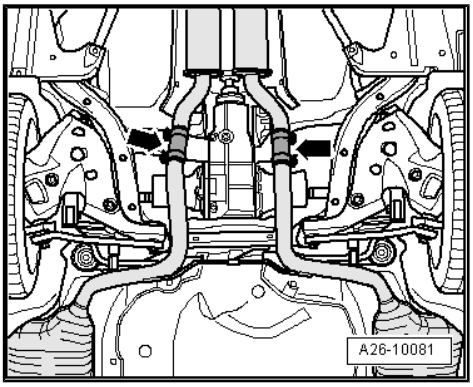
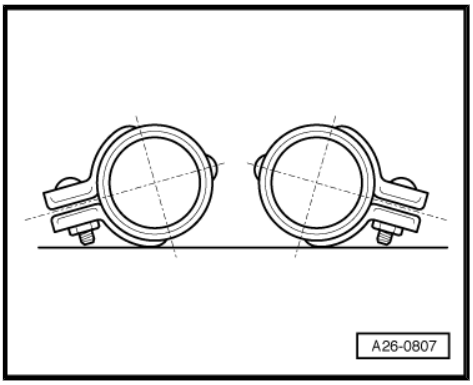
– When installing, position centre of clamps -arrows- over cutting location.



– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Bolt connections face outwards.

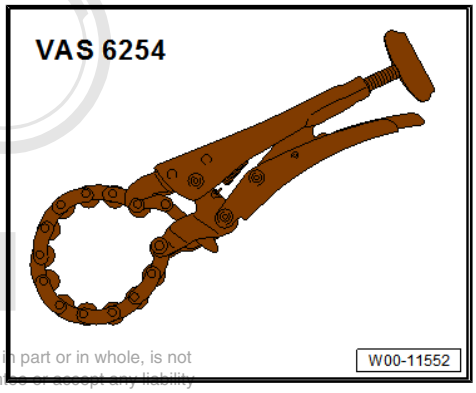
– Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .



1.4 Renewing tailpipe

Special tools and workshop equipment required

♦ Chain pipe cutter - VAS 6254-



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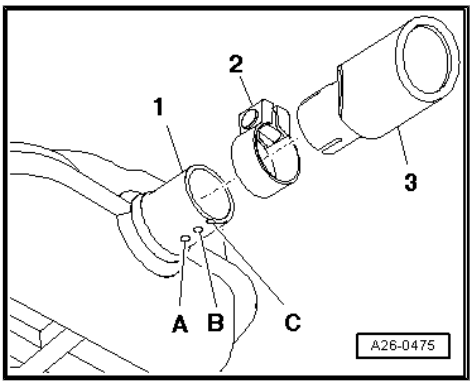
Procedure

– Cut through old tailpipe -1- at a right angle at cutting point -C- using chain pipe cutter - VAS 6254- .

– Push on new tailpipe -3- as far as marking -A-. Slot on tailpipe should align with marking -B-.

– Fit clamp -2-.



Tightening torque

Component	Nm
Clip	25

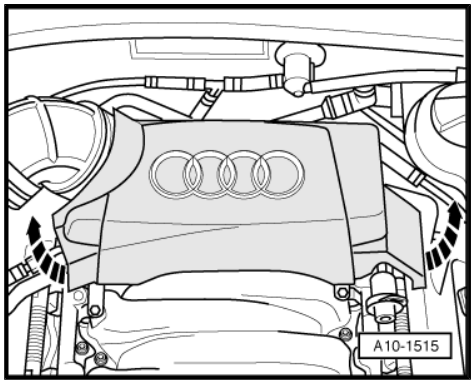
1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter

Removing

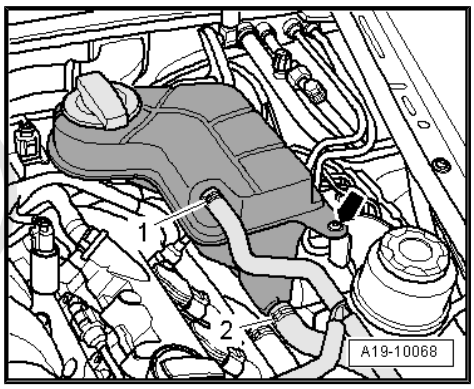
Note

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.



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

Note

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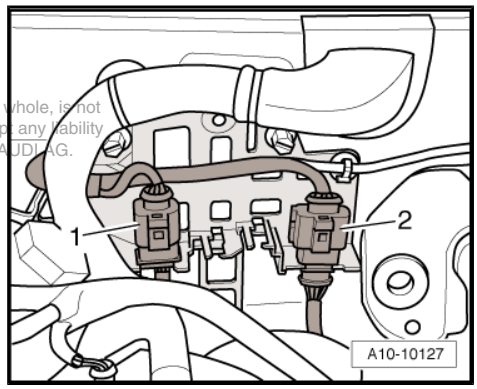
Disregard -item 1-.



– Unscrew nut -2- (accessible from above) connecting front exhaust pipe to exhaust manifold.

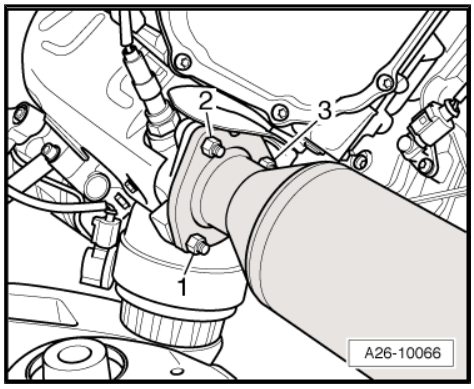
Note

Shown from rear with engine removed for illustration purposes.

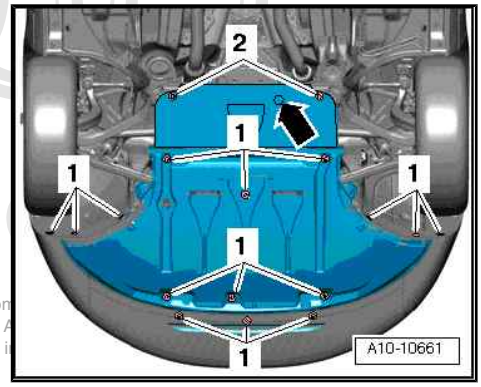
– Remove front left wheel.

Note

Secure brake disc with wheel bolts.



– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.



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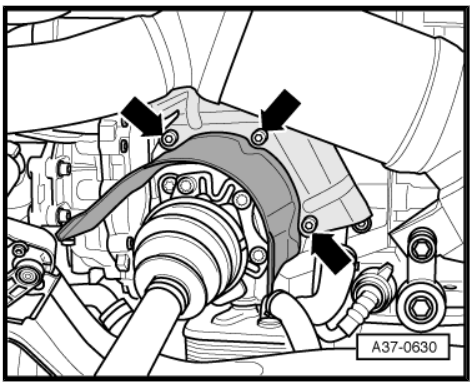
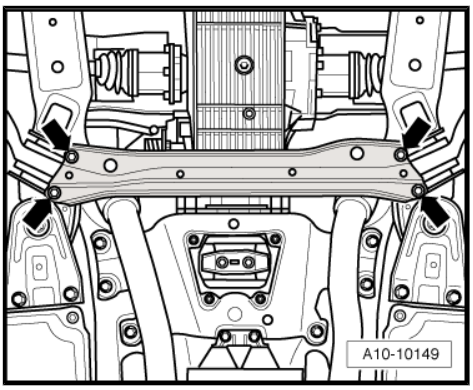
with respect to the correctness of information i

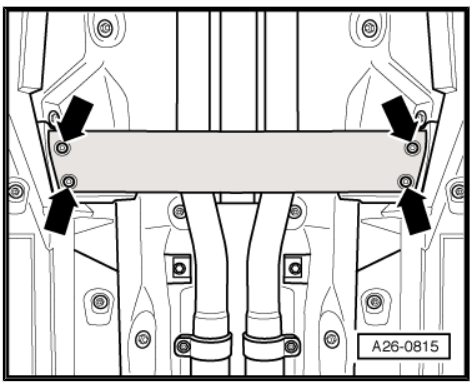
– Unbolt heat shield -arrows- for drive shaft (left-side).



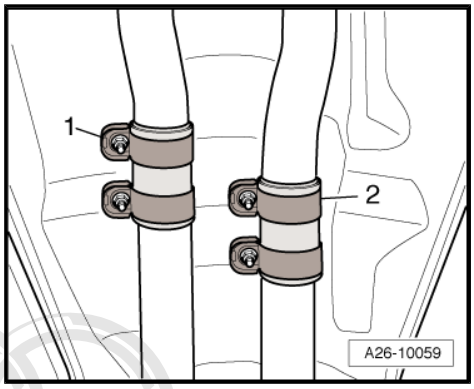
– Unbolt cross piece from subframe -arrows-.



– Remove front cross piece -arrows-.



Disconnect exhaust system at clamp (left-side) -2-.



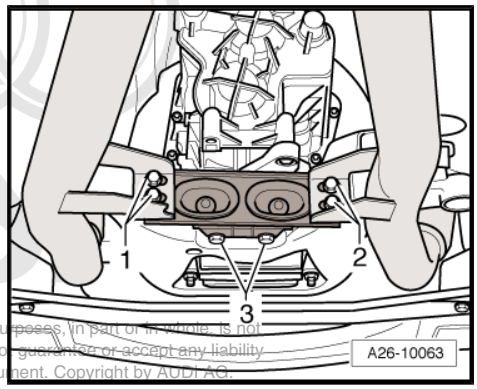
Note

Disregard -item 1-.

Note

The flexible pipe connection (de-coupling element) on the front exhaust pipe must not be bent more than 10° – otherwise it can be damaged.

– Remove bolts -1- on bracket (rear) for front exhaust pipe.



Note

Disregard items marked -2- and -3-.

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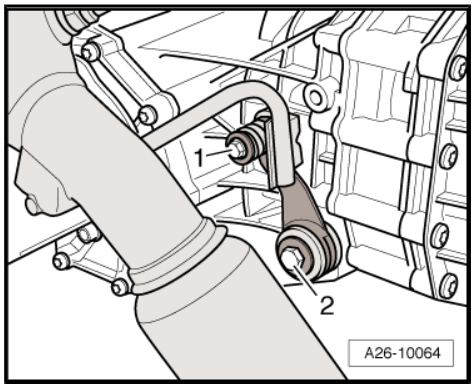
Vehicles with manual gearbox:

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

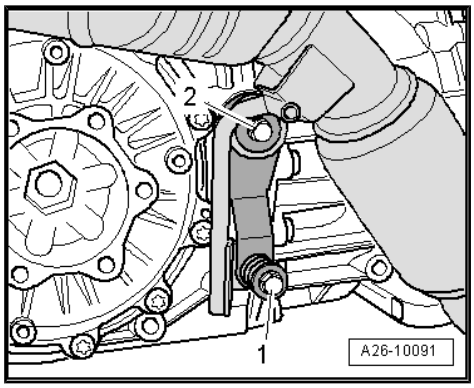


Note

Disregard -item 2-.

Vehicles with multitronic gearbox:

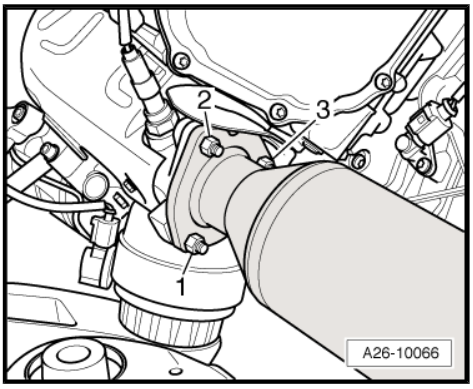
– Remove bolts -1- and -2-.
– Remove bracket (left-side) for front exhaust pipe.



All vehicles:

– Move Lambda probe wires clear.

– 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 ⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .

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Note

Components of exhaust pipe mountings: vehicles with manual gearbox
⇒ Fig. ““Components of exhaust pipe mountings (left-side)”“, page 238 , vehicles with multitronic gearbox
⇒ Fig. ““Components of exhaust pipe mountings (left-side) for vehicles with multitronic gearbox”“ , page 235

Tightening torque

		Nm
Front exhaust pipe with catalytic converter to exhaust manifold		23 1)2)
Mounting plate 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

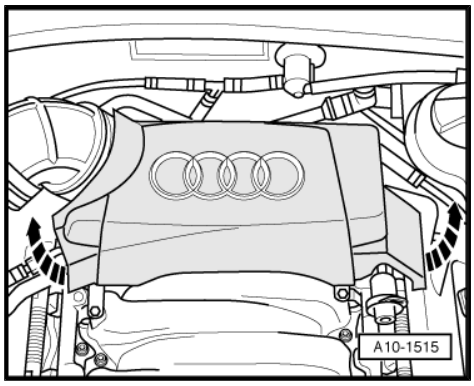
1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter

Removing

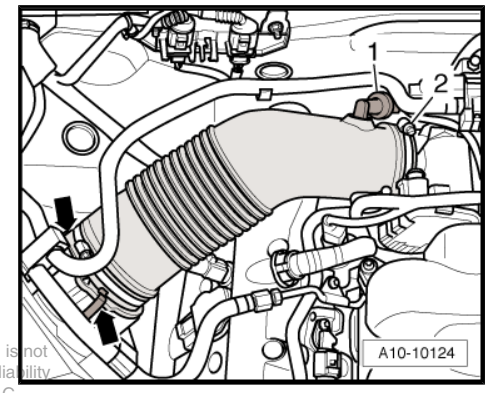
Note

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-.



– Detach non-return valve -1- from air intake hose.
– Remove air hose. To do so, loosen hose clip -2- and release retaining clips -arrows-.



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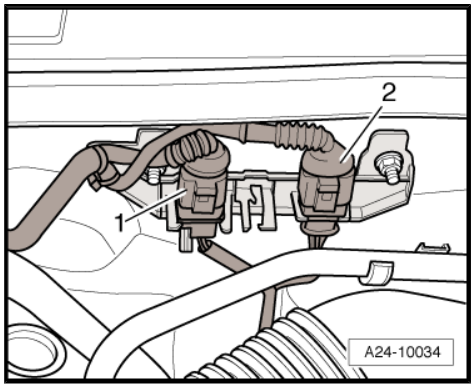
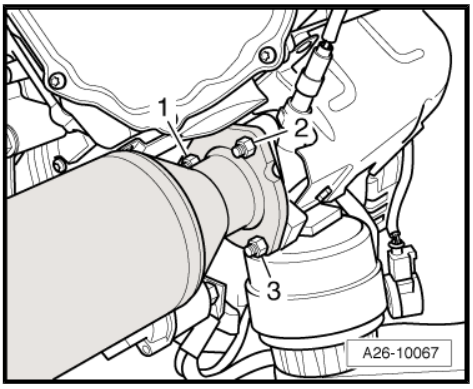
– Unplug electrical connector -2- for Lambda probe after catalytic converter - G130- and move wiring clear (downwards).



Note

Disregard -item 1-.

– Unscrew nut -2- (accessible from above) connecting front exhaust pipe to exhaust manifold.



Note

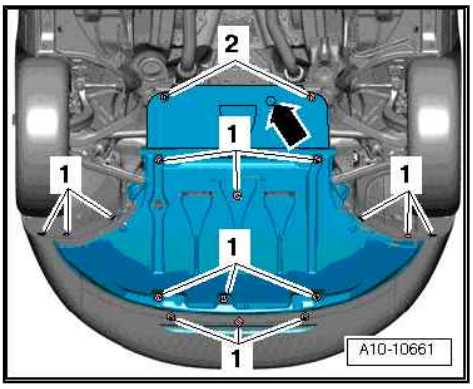
Shown from rear with engine removed for illustration purposes.

– Remove front right wheel.

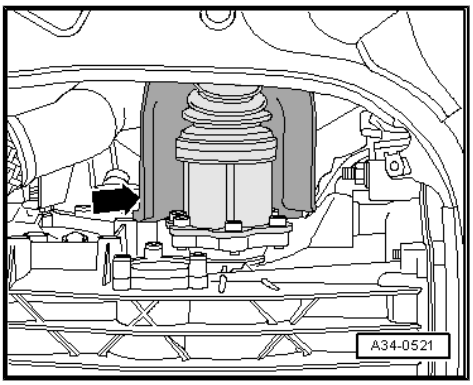
Note

Secure brake disc with wheel bolts.

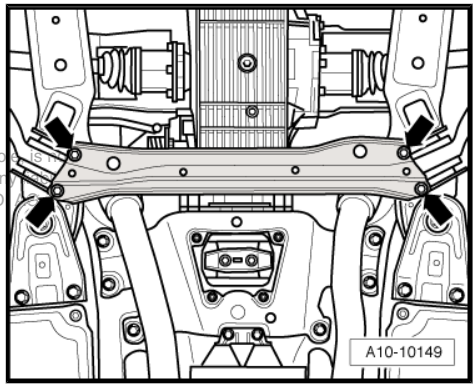
– Release fasteners -1, 2- and, if fitted -arrow-, and remove noise insulation panels.



– Unbolt heat shield -arrow- for drive shaft (right-side).



– Unbolt cross piece from subframe -arrows-.



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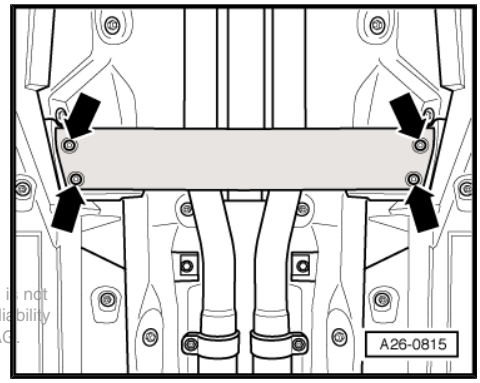
– Remove front cross piece -arrows-.



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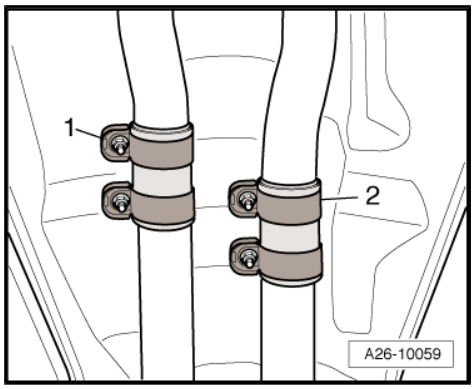
Disconnect exhaust system at clamp (right-side) -1-.



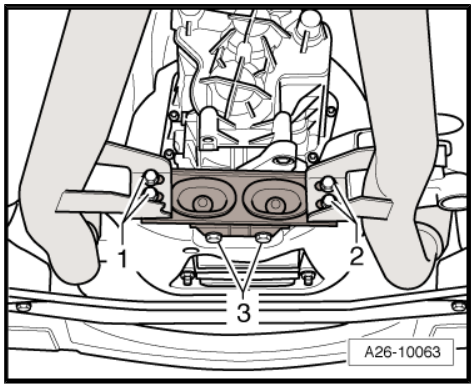
Note

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.

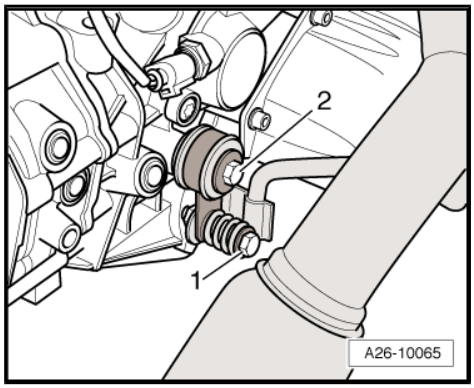


Note

Disregard items marked -1- and -3-.

Vehicles with manual gearbox:

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



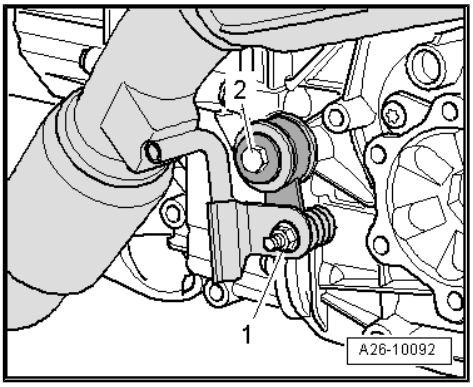
Note

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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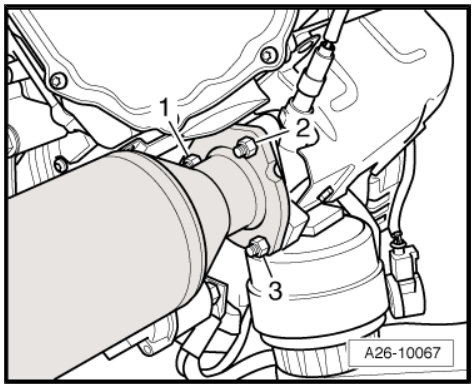
All vehicles:



– Move Lambda probe wires clear.

– 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.*
- *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.*

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– Install cross piece for subframe ⇒ Rep. gr. 40 .

– Install cross piece (front) ⇒ Rep. gr. 50 .

– Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .

Note

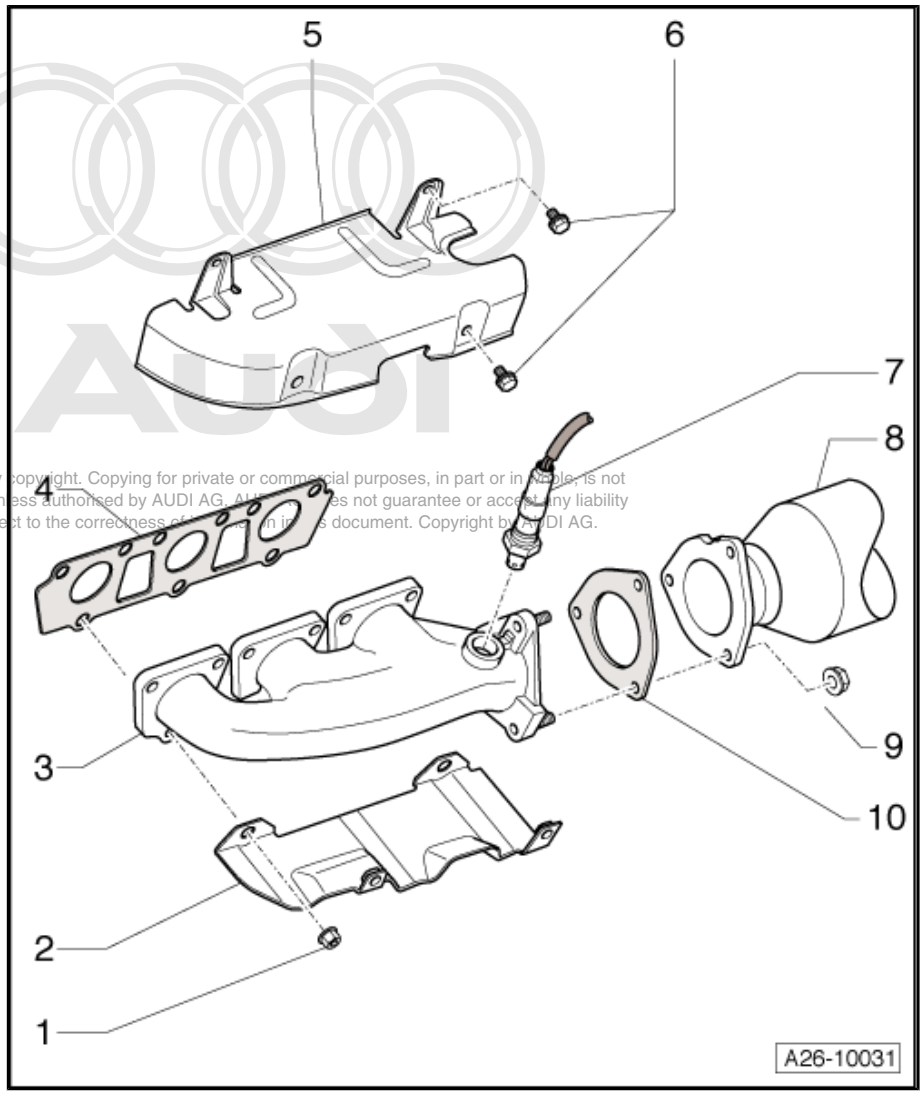
Components of exhaust pipe mountings: vehicles with manual gearbox
⇒ Fig. ““Components of exhaust pipe mountings (right-side) for vehicles with manual gearbox”“ , page 239 , *vehicles with multitronic gearbox*
⇒ Fig. ““Components of exhaust pipe mountings (right-side) for vehicles with multitronic gearbox”“ , page 235

Tightening torques

		Nm
Front exhaust pipe with catalytic converter to exhaust manifold		23 1)2)
Mounting plate 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 ⇒ Electronic parts catalogue for high-temperature paste

1.7 Exhaust manifold - exploded view



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1 - 25 Nm

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ Note tightening sequence ⇒ page 254 and ⇒ page 255

2 - Bracket for heat shield

3 - Exhaust manifold

- ❑ Removing and installing: left-side ⇒ “1.8 Removing and installing exhaust manifold (left-side)”, page 252 , right-side ⇒ “1.9 Removing and installing exhaust manifold (right-side)”, page 254

4 - Gasket

- ❑ Renew

5 - Heat shield

6 - 10 Nm

7 - Lambda probe, 55 Nm

- ❑ Before catalytic converter
- ❑ Threads of new Lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- ❑ When re-using the old Lambda probe, grease thread with high-temperature paste; the paste must not get into the slots of the probe body. High-temperature paste ⇒ Electronic parts catalogue

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 ⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242
- ❑ Mounting components ⇒ Fig. ““Components of exhaust pipe mountings (left-side)”“ , page 238
- ❑ Align exhaust system so it is free of stress ⇒ “1.10 Stress-free alignment of exhaust system”, page 255

9 - 23 Nm

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

10 - Gasket

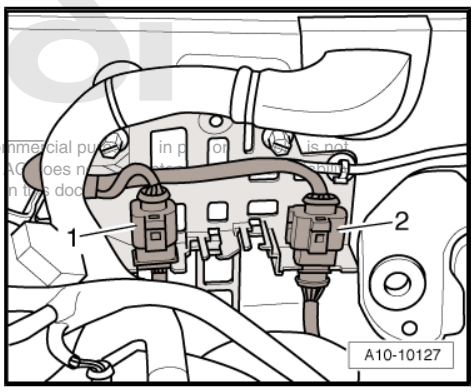
- ❑ Renew

1.8 Removing and installing exhaust manifold (left-side)

Removing

– Remove front exhaust pipe (left-side) together with catalytic converter
⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242 .

– Unplug electrical connector -1- for Lambda probe 2 - G108- and move wiring clear.



Note

Disregard -item 2-.

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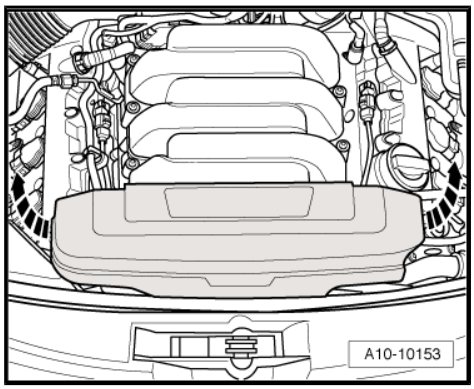
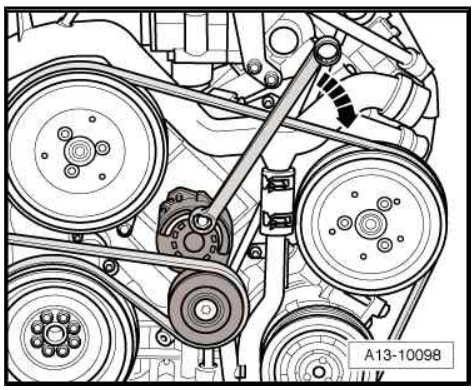
– Pull off engine cover panel (front) -arrows-.



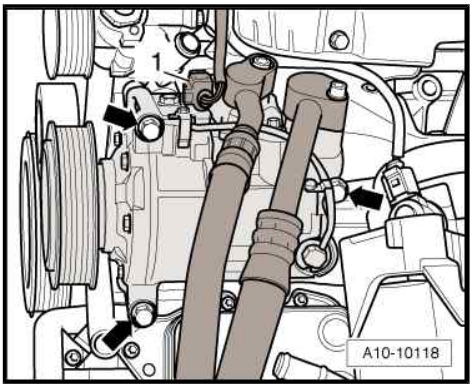
Note

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

– To slacken poly V-belt turn tensioner in direction of -arrow-.
– Remove poly V-belt 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

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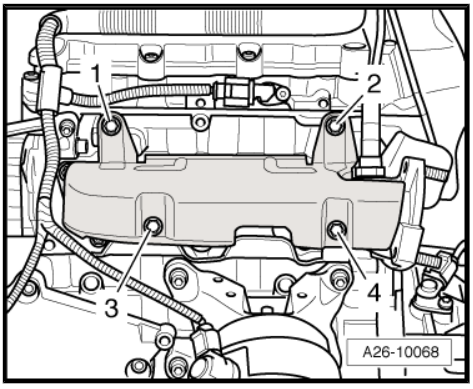
To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

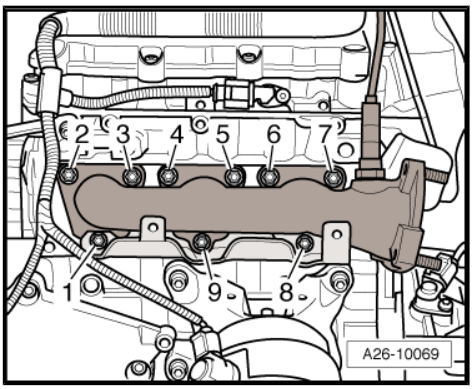
– Tie up air conditioner compressor with lines attached to left-side of vehicle.

– 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

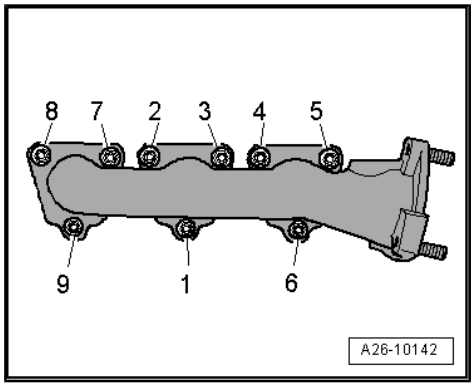
Installation is carried out in the reverse order; note the following:

Note

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
⇒ “1.5 Removing and installing front exhaust pipe (left-side) with catalytic converter”, page 242 .

– Align exhaust system so it is free of stress
⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .

– Install air conditioner compressor ⇒ Rep. gr. 87 .

– Install poly V-belt
⇒ “1.4 Removing and installing poly V-belt”, page 73 .

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
⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246 .

– Unplug electrical connector -1- for Lambda probe - G39- and move wiring clear.

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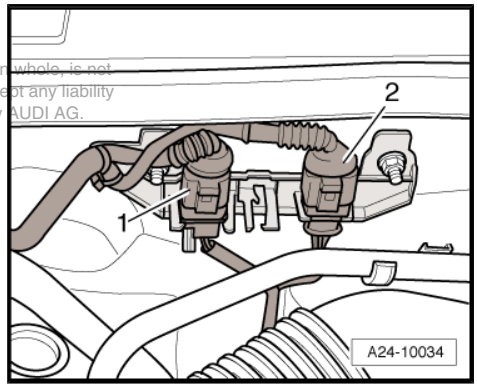
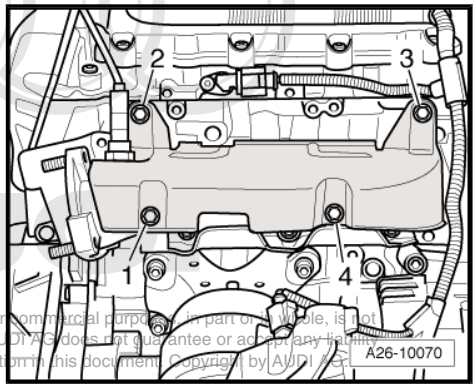


Note

Disregard -item 2-.

– Unscrew bolts -1 ... 4- and remove heat shield.



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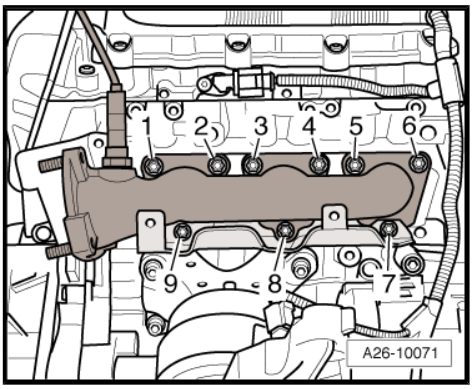
– Remove nuts -7- and -9- and detach bracket for heat shield.
– Unscrew nuts -1 ... 6- and -8- and remove exhaust manifold.



Installing

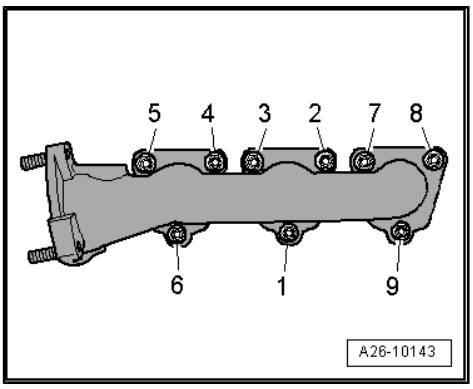
Installation is carried out in the reverse order; note the following:

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
⇒ “1.6 Removing and installing front exhaust pipe (right-side) with catalytic converter”, page 246 .
– Align exhaust system so it is free of stress
⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .

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

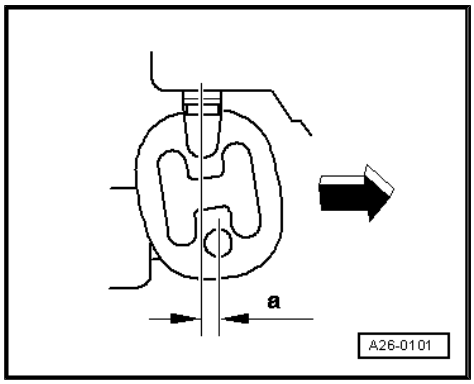
The exhaust system must be aligned when it is cool.

⇒ “1.10.1 Aligning tailpipes”, page 257

Vehicles without clamps between centre silencer and rear silencer

– Loosen bolt connections for clamps ⇒ Item 9 (page 232) .

– Push exhaust system towards front of vehicle -arrow-, so that mountings (right-side) for rear silencers are preloaded by -a- = 13 ... 17 mm.



– Tighten bolt connections of clamps evenly to 23 Nm.

– Align tailpipes ⇒ “1.10.1 Aligning tailpipes”, page 257 .

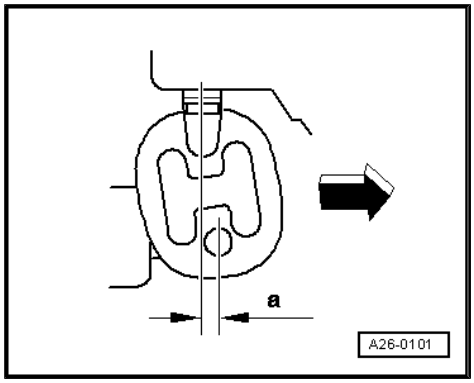
Vehicles with clamps between centre silencer and rear silencer

Note

On vehicles with clamps fitted between centre silencer and rear silencer, it is also necessary to align the centre silencer.

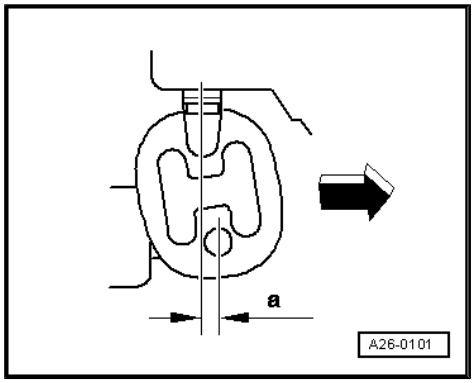
– Loosen bolts on clamps ⇒ Item 9 (page 232) and ⇒ Item 20 (page 238) .

– Push front section of exhaust system towards front of vehicle -arrow-, so that mountings for centre silencer are preloaded by -a- = 9 ... 13 mm.



– Tighten bolt connections for clamps (front) ⇒ Item 9 (page 232) 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- = 13 ... 17 mm.



– Align rear silencers so they are horizontal.

– Tighten bolt connections for clamps (rear) ⇒ Item 20 (page 238) evenly to 23 Nm.

– Align tailpipes ⇒ “1.10.1 Aligning tailpipes”, page 257 .

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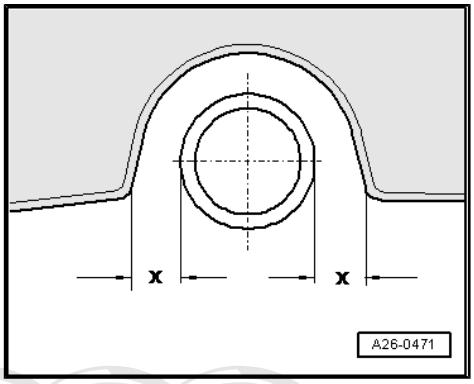
1.10.1 Aligning tailpipes

– Check clearance between tailpipes and bumper on both sides.

• Dimension -x- (left-side) = dimension -x- (right-side)

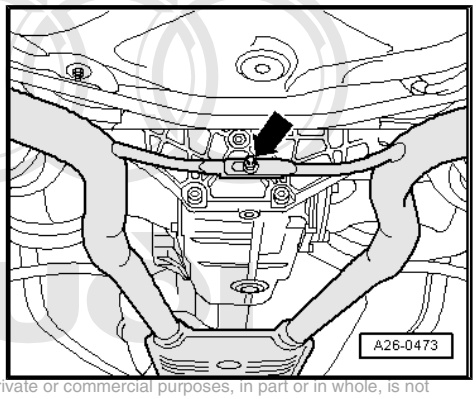


If necessary, correct dimension -x- as follows:

– Slacken bolt connections -arrows- on brace between exhaust pipes.

– Adjust the distance between the rear silencers.

– Tighten bolt connections to 25 Nm.



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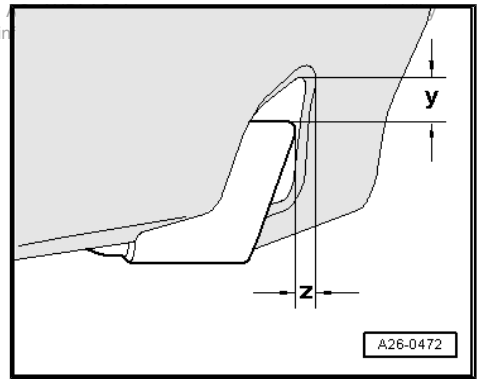
– Check distances -y- and -z- between tailpipes and bumper.

• Dimension -y- = 16 ... 21 mm.

• Dimension -z- = 8 ... 13 mm.

– If necessary, check whether the exhaust system is aligned free of stress
⇒ “1.10 Stress-free alignment of exhaust system”, page 255 .



1.11 Checking exhaust system for leaks

– Start engine and run at idling speed.

– Plug tailpipes during leak test (e.g. with cloth or plug).

– Listen for noise at connection points (cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe, etc.) to locate any leaks.

– Repair any leaks that are found.

2 Servicing secondary air system

⇒ “2.1 Principle and function”, page 258

⇒ “2.2 Checking combination valves for secondary air system for correct operation and leakage”, page 258

⇒ “2.3 Removing and installing combination valve for secondary air system (left-side)”, page 260

⇒ “2.4 Removing and installing combination valve for secondary air system (right-side)”, page 261

⇒ “2.5 Removing and installing secondary air pump”, page 262

2.1 Principle and function

Principle

Because of the over-enrichment of the mixture in the cold start phase, the proportion of unburned hydrocarbons in the exhaust gas is higher. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and thus reduces toxic emissions. The heat generated by oxidisation accelerates the "light off" of the catalytic converter and significantly improves exhaust gas quality during warm-up.

Function

- During the cold start phase (coolant temperature at +15 ... +35 °C) the secondary air system blows air behind the exhaust valves for approx. 65 seconds. This produces an oxygen-rich exhaust gas, causes afterburning and reduces the heating-up phase of the catalytic converter.
- In addition, 20 seconds after each following engine start (until coolant temperature reaches 85 °C), the secondary air system switches on for 5 seconds when at idling speed and is checked by the self-diagnosis.
- The secondary air pump motor - V101- is actuated via the Simos control unit - J361- and the secondary air pump relay - J299- .

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2.2 Checking combination valves for secondary air system for correct operation and leakage

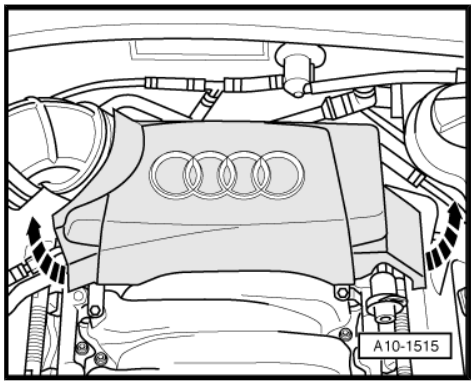
Special tools and workshop equipment required

- Test hose

Procedure

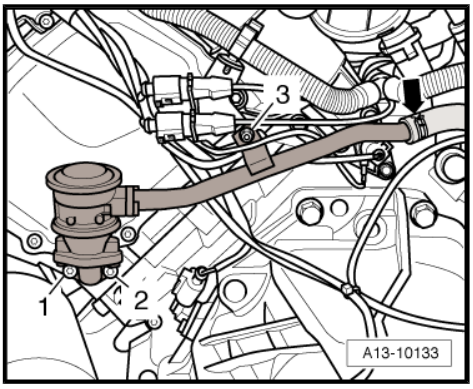
- Vacuum hoses and hose connections do not leak.
- Vacuum hoses are not clogged.

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



Combination valve (left-side):

– Detach air hose -arrow- from connecting pipe leading to combination valve.



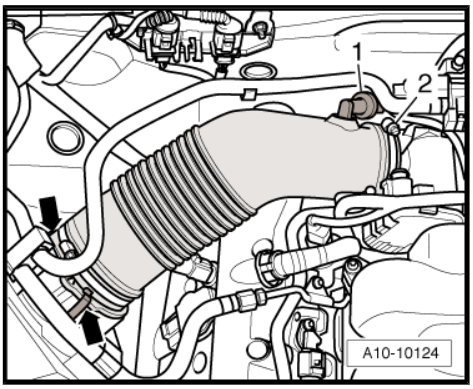
Note

Disregard -items 1 … 3-.

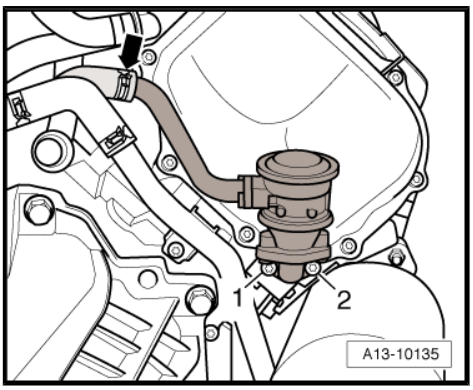
Combination valve (right-side):

– Detach non-return valve -1- from air intake hose.

– Remove air hose. To do so, loosen hose clip -2- and release retaining clips -arrows-.



– Disconnect air hose -arrow- from connecting pipe.



Note

Disregard items marked -1- and -2-.

Both sides (continued):

– Connect a suitable test hose to connecting pipe of relevant combination valve.

– Blow lightly into test hose with your mouth (do not use compressed air).

• The combination valve should be closed; it should not be possible to blow through the valve.

– Blow into test hose with your mouth using more force (do not use compressed air).

• The combination valve should open; it should now be possible to blow through the hose.

If you cannot determine the switching point:

– Renew combination valve: left-side ⇒ “2.3 Removing and installing combination valve for secondary air system (left-side)”, page 260, right-side ⇒ “2.4 Removing and installing combination valve for secondary air system (right-side)”, page 261 .

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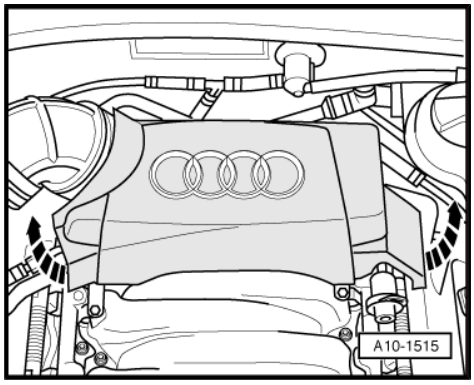
2.3 Removing and installing combination valve for secondary air system (left-side)

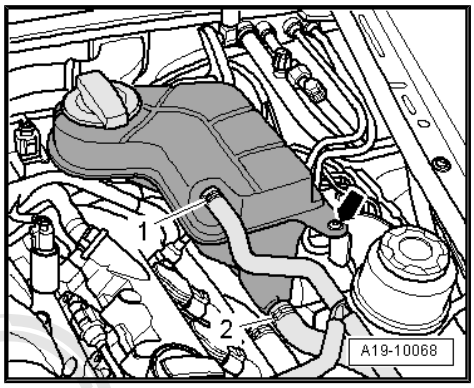
Removing

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

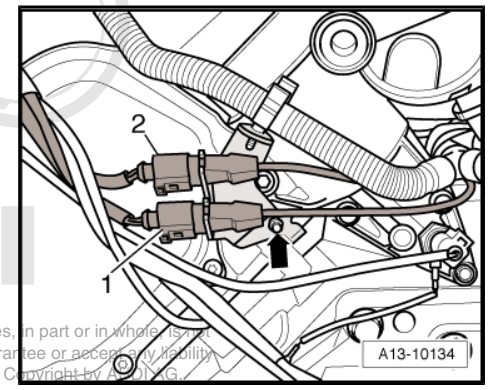


– Unbolt coolant expansion tank -arrow-.

– 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.



– Detach electrical connectors -1- and -2- from bracket and unplug connectors.



Note

- *Disregard -arrow-.*
- *Engine is shown from rear for illustration purposes.*

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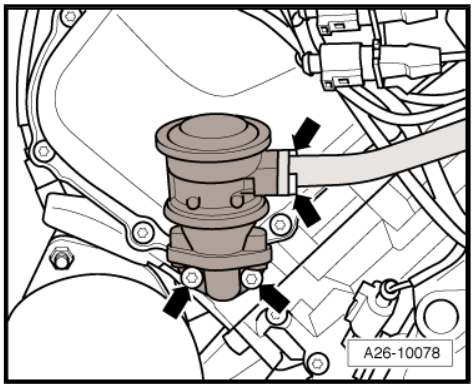
– Unscrew bolts -arrows- and take off combination valve for secondary air system.



Note

Engine is shown from rear for illustration purposes.

Installing

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

Note

Renew seals and gaskets.

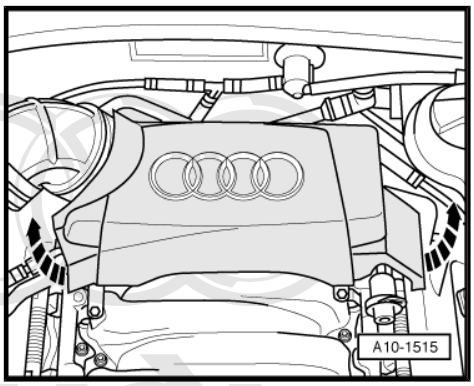
Tightening torques

Component	Nm
Connecting pipe to cylinder head	9
Connecting pipes to combination valve	9

2.4 Removing and installing combination valve for secondary air system (right-side)

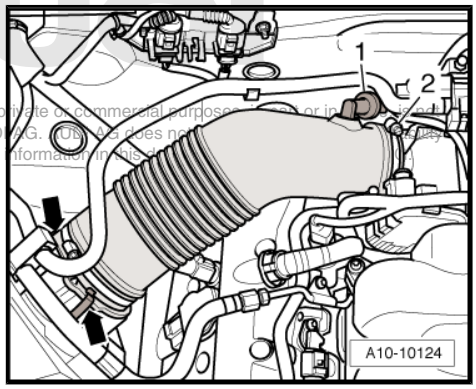
Removing

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



– Detach non-return valve -1- from air intake hose.

– Remove air hose. To do so, loosen hose clip -2- and release retaining clips -arrows-.



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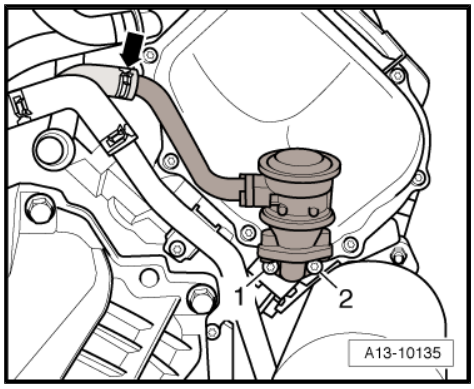
– Remove bolts -1- and -2-.
– Disconnect air hose -arrow- and remove the combination valve for secondary air.



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 .*

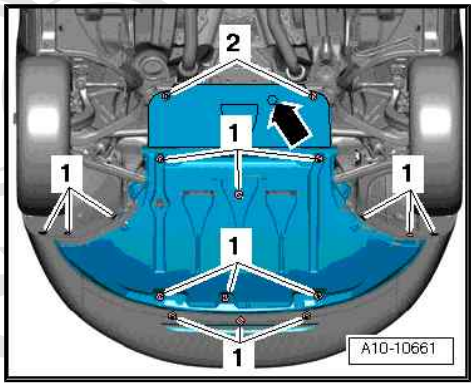
Tightening torques

Component	Nm
Connecting pipe to cylinder head	9
Connecting pipes to combination valve	9
Hose clips (9 mm wide)	3

2.5 Removing and installing secondary air pump

Removing

– Release fasteners -1- and remove front noise insulation panels.



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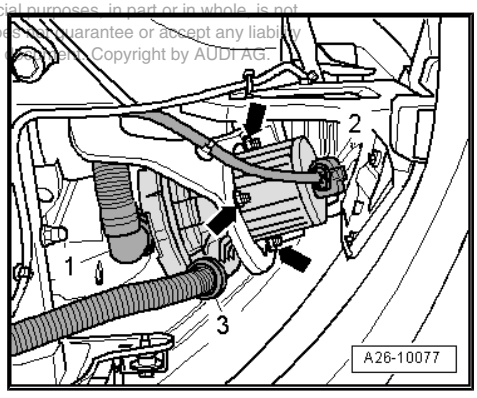
– Disconnect hoses -1- and -3- at secondary air pump.
– Unplug electrical connector -2-.
– Unscrew nuts -arrows- and remove secondary air pump from bracket.



Installing

Install in reverse sequence.

Tightening torque

Component	Nm
Secondary air pump to bracket	9