



Workshop Manual Audi A6 2005 ➤

10-cylinder direct petrol injection engine (5.0 ltr. 4-valve turbo RS 6), mechanics

Engine ID

BUH

Edition 12.2019



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- 19 - Cooling
- 21 - Turbocharging/supercharging
- 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

(ARL006689; Edition 12.2019)



Note

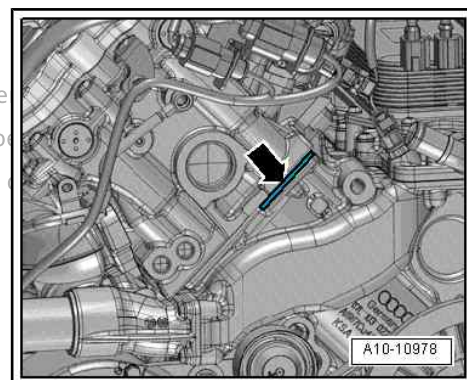
Pull off engine cover panel (front) to make the engine number visible.

The engine number (engine code and serial number) is located on the top of the cylinder block at the front -arrow-.



Note

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





2 Engine data

Code letters	BUH
Capacity	4.991
Power output	426/6250
Torque	650/1500 ... 6250
Bore	84.5
Stroke	89.0
Compression ratio	10.5
RON	95 ¹⁾
Injection system/ignition system	Bosch Motronic
Firing order	1-6-5-10-2-7-3-8-4-9
Exhaust gas recirculation	no
Turbocharging/supercharging	Turbocharger (2x)
Knock control	4 sensors
Charge air cooling	Yes
Lambda control	4 probes before catalytic converter 4 probes after catalytic converter
Variable valve timing	Inlet Exhaust
Intake manifold change-over	no
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	



3 Safety precautions

3.1 Working on the fuel system

When working on the fuel system note the following warnings:



WARNING

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

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*
- ◆ *Wrap a clean cloth around the connection and carefully loosen the connection to allow the residual pressure to dissipate.*

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

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

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



Caution

When disconnecting the battery there is a risk of irreparable damage to electronic components.

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

- Disconnect battery ⇒ Electrical system; Rep. gr. 27 .

3.2 Procedure before opening high-pressure section of injection system



WARNING

- ◆ *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 5 bar).*
- ◆ *The fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 5 bar prior to opening the system. For details of procedure, refer to ⇒ Rep. gr. 24 .*

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3.3 Working on the cooling system

When working on the cooling system note the following warnings:



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *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.*

3.4 Working on vehicles with start/stop system

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Please note the following when working on vehicles with start/stop system: not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



WARNING

Risk of injury due to automatic engine start on vehicles with start/stop system.

- ◆ *On vehicles with activated start/stop system (indicated by a message in the instrument cluster), the engine may start automatically if it needs to.*
- ◆ *Therefore it is important to ensure that the start/stop system is deactivated when performing repairs (switch off ignition, if required switch on ignition again).*

3.5 Using testers and measuring instruments during a road test

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



WARNING

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

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

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



3.6 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.*



4 General repair instructions

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

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:

- ◆ Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- ◆ Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- ◆ After removal, place parts on a clean surface and cover them. Only 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.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

4.2 Checking fuel system for leaks

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

4.3 Foreign particles in engine

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

4.4 Contact corrosion

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

For this reason, only fasteners with a special surface coating are 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 using Audi Genuine Accessories.
- ◆ Damage caused by contact corrosion is not covered by warranty.

4.5 Routing and attachment of pipes, hoses and wiring

Mark hydraulic lines, vacuum lines and electrical wiring before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.

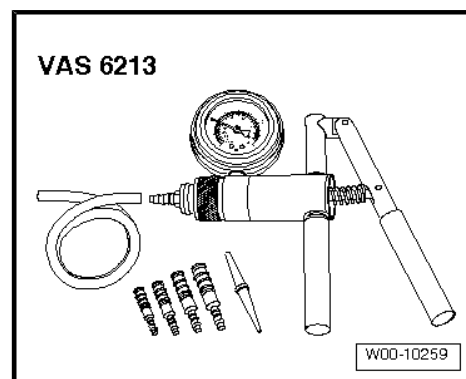
4.6 Installing radiators, condensers and charge air coolers

Even when the radiator, condenser and charge air cooler 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, charge air cooler or condenser.

4.7 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



Procedure

- Connection diagram for vacuum pipes and hoses
⇒ [page 265](#) .
- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Porous or leaking lines
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.



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

4.8 Nuts, bolts

- ◆ Loosen bolts in reverse sequence to specified tightening sequence.
- ◆ Bolts and nuts used to secure covers and housings must be tightened in steps according to the specified tightening sequence and method.
- ◆ Bolts and nuts which secure covers and housings should be loosened and tightened in diagonal sequence and in stages if no tightening sequence is specified.
- ◆ Always renew self-locking bolts and nuts.
- ◆ Unless otherwise specified, use a wire brush to clean the threads of bolts which are secured with locking fluid. Then install bolts with locking fluid; for locking fluid refer to ⇒ Electronic parts catalogue .
- ◆ Threaded holes which take self-locking bolts or bolts coated with locking fluid must be cleaned using a thread tap or similar. Otherwise there is a danger of the bolts shearing off the next time they are removed.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.

4.9 Identification plates

When renewing vehicle components, the identification plates on the old parts that have a replacement part number (see ⇒ Electronic parts catalogue) must be attached to the new parts due to approval regulations.



4.10 Use of impact wrenches

In general, it is permitted to use an impact wrench to unscrew bolts and nuts. An exception to this is when work is performed inside an open high-voltage battery. For this work, it is not permitted to use an impact wrench.

An impact wrench may be used to screw in bolts and nuts when performing repair work if the following requirements are observed. In general, electric and compressed-air impact wrenches should be used.

Requirements:

- Only screw in bolts with locking fluid or self-locking nuts at low speed.
- Use a suitable impact wrench with variable speed and adjustable torque range.
- Use suitable bits when working in the vicinity of sensitive surfaces, e.g. plastic-coated bits for aluminium rims.



- When working in the vicinity of natural gas systems, observe the information in the Workshop Manual "Natural gas engines - General information".

Use:

- Fit bolts/nuts by hand.
- Only use an impact wrench to screw in bolts/nuts until the head of the bolt/nut makes contact and then continue tightening with a torque wrench.
- Clean threaded pins before unscrewing the bolt/nut.



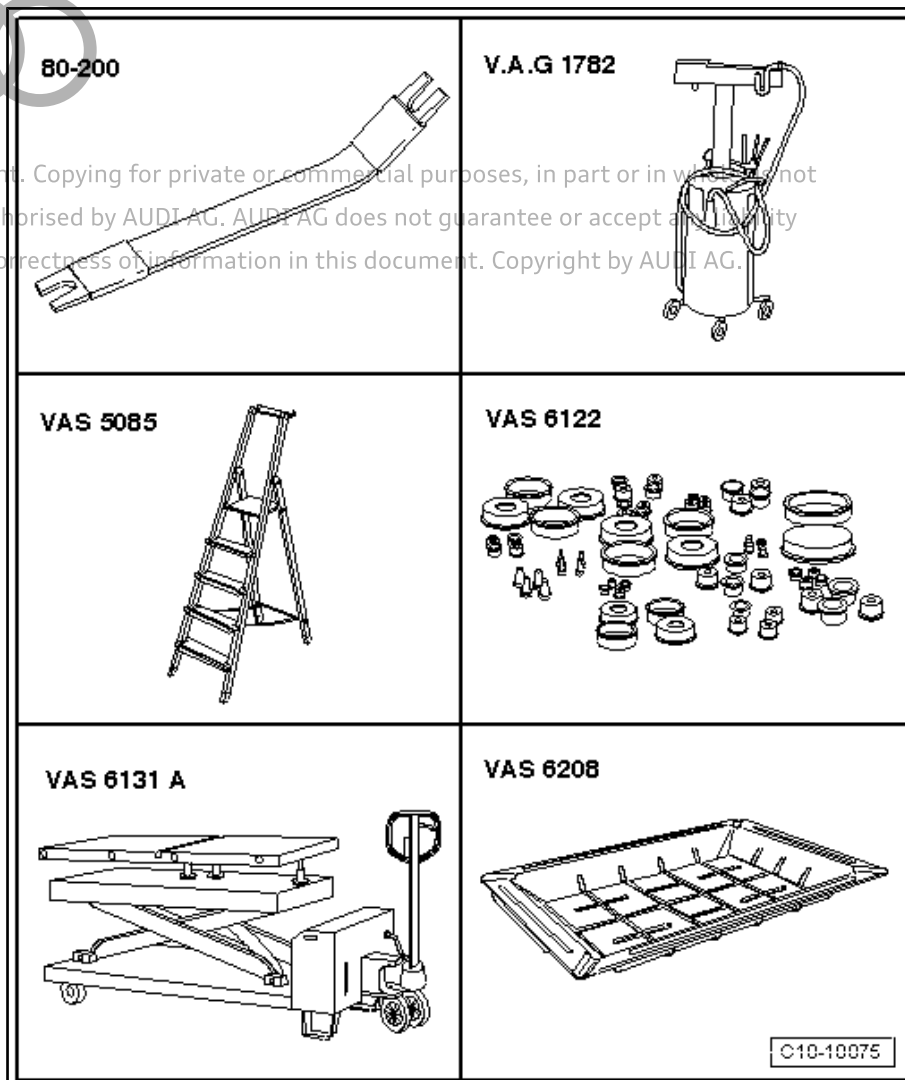
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10 – Removing and installing engine

1 Removing engine

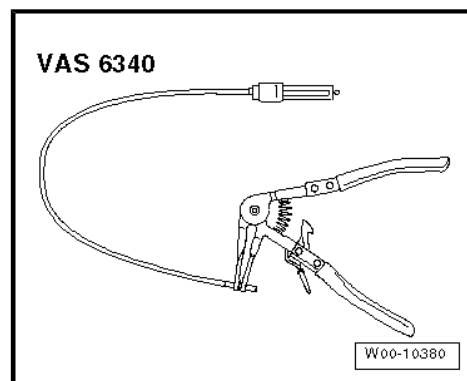
Special tools and workshop equipment required



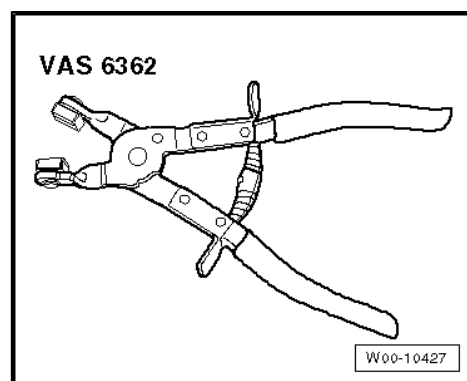
- ◆ Removal lever - 80 - 200-
- ◆ Used oil collection and extraction unit - V.A.G 1782-
- ◆ Stepladder - VAS 5085-
- ◆ Engine bung set - VAS 6122-
- ◆ Scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , adapter - VAS 6131/10-12- (2x) and support set -VAS 6131/11- and supplementary set -VAS 6131/13-
- ◆ Drip tray for workshop hoist - VAS 6208-



◆ Hose clip pliers - VAS 6340-

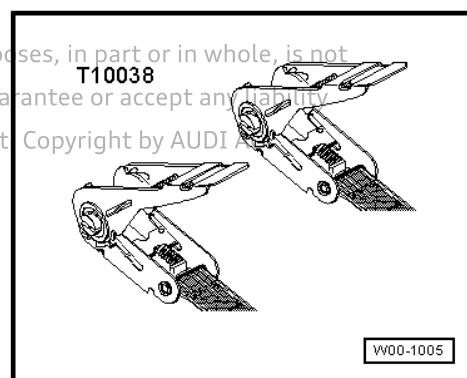


◆ Hose clip pliers - VAS 6362-

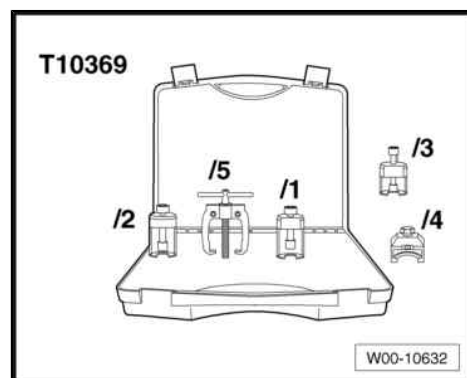


◆ Tensioning strap - T10038-

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◆ Puller - T10369-





Procedure



Note

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



WARNING

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

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

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

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

- Reduce fuel pressure in high-pressure section of injection system ⇒ Rep. gr. 24 .
- Switch off ignition.



Caution

Risk of irreparable damage to electronic components.

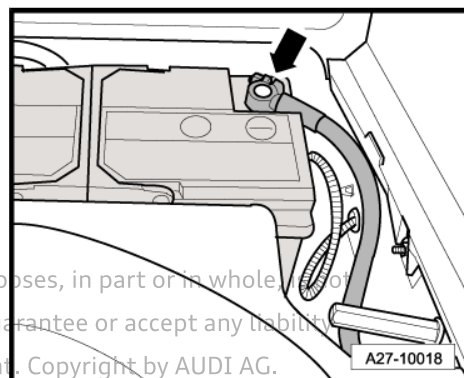
- ♦ ***Observe notes on procedure for disconnecting the battery.***



Note

The electromechanical parking brake must be released before disconnecting the battery, so that the propshaft can be turned during removal.

- With ignition switched off, disconnect earth cable -arrow- at battery ⇒ Electrical system; Rep. gr. 27 .
- Discharge refrigerant system ⇒ Air conditioner with refrigerant R134a .
- Extract hydraulic fluid for power steering from reservoir using used oil collection and extraction unit - V.A.G 1782- .
- Drain off engine oil ⇒ Maintenance ; Booklet 405 .
- Remove headlight (right-side) ⇒ Electrical system; Rep. gr. 94 .





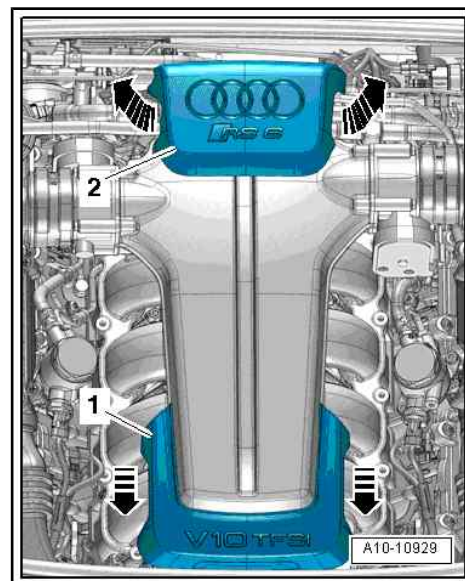
- Lift off engine cover panel (rear) -2- -arrows-.

**WARNING**

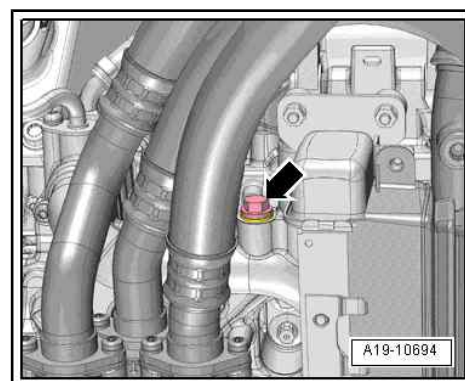
Risk of scalding due to hot steam and hot coolant.

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant filler tank with cloth and open carefully.*

- Open filler cap on coolant filler tank.
- Remove both front wheels ⇒ Rep. gr. 44 .



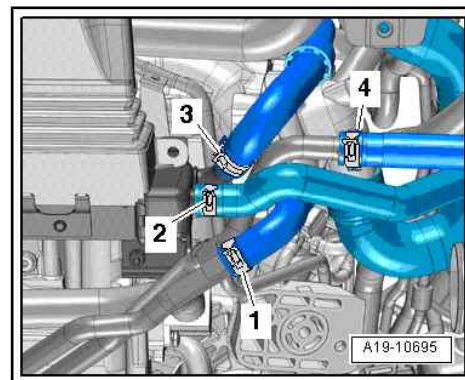
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Unscrew drain plug -arrow- at intake module and drain off coolant.



- Disconnect coolant hoses -2- and -4- and drain off remaining coolant.

**Note**

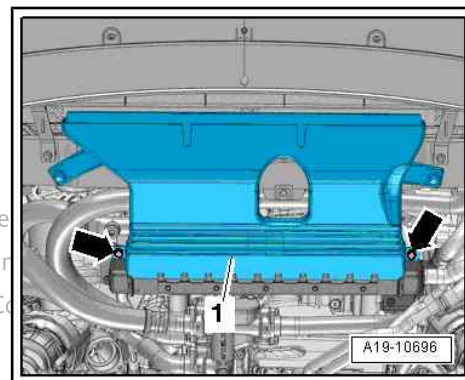
Disregard items -1 and 3-.



- Remove bolts -arrows- and detach air duct -1- towards front.



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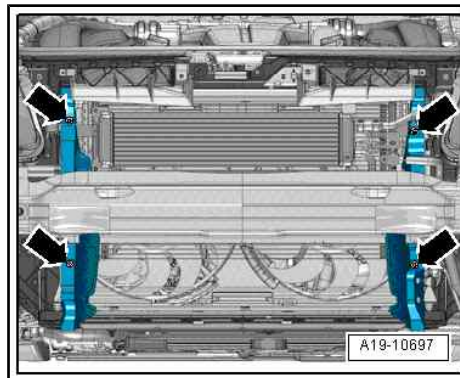


- Remove bolts -bottom arrows- for air ducts (left and right).



Note

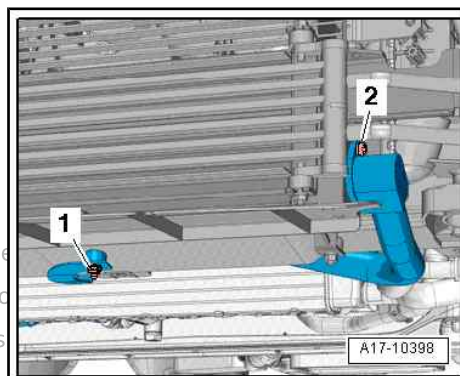
Disregard -top arrows-.



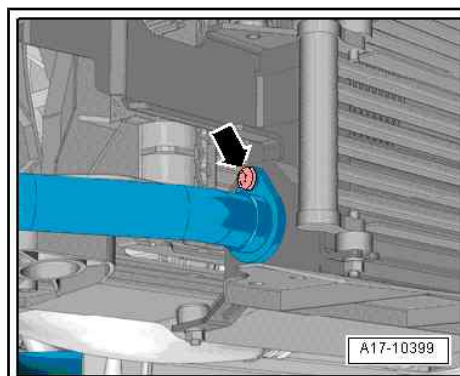
- Position used oil collection and extraction unit - V.A.G 1782- below connection point.
- Remove nut -1- and bolt -2-, detach oil line (left side) from engine oil cooler (front).



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- Remove bolt -arrow- and detach oil line (right-side) from engine oil cooler (front).
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

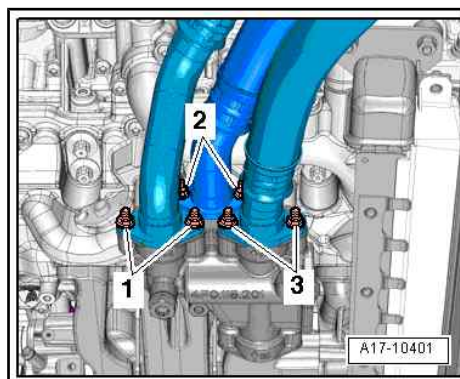


- Remove nuts -1-.
- Detach pipe/hose assembly from temperature regulator and tie up on one side.



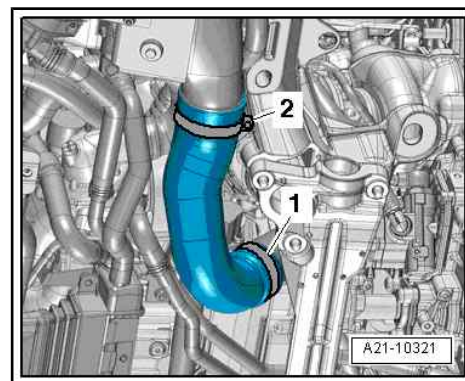
Note

Disregard items -2 and 3-.



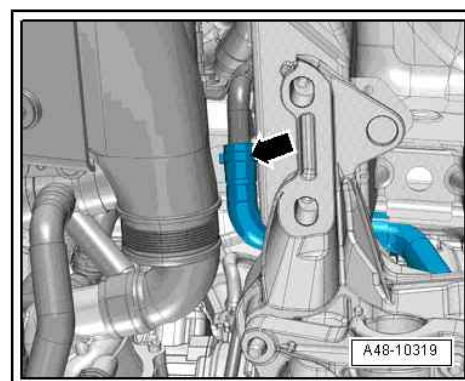


- Release hose clips -1- and -2- and remove air hose.

**Note**

Lay a cloth under the separating point to catch escaping hydraulic fluid.

- Detach hydraulic hose -arrow- from pipe at longitudinal member (left-side).
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

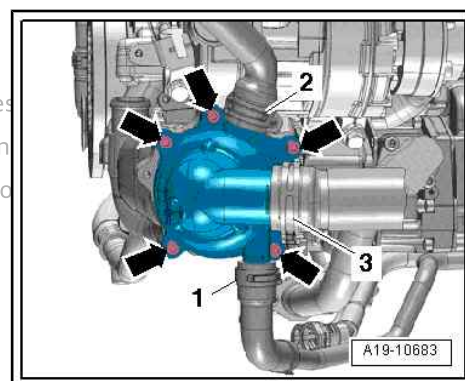


- Release hose clips -2- and -3- and disconnect coolant hoses from thermostat housing.



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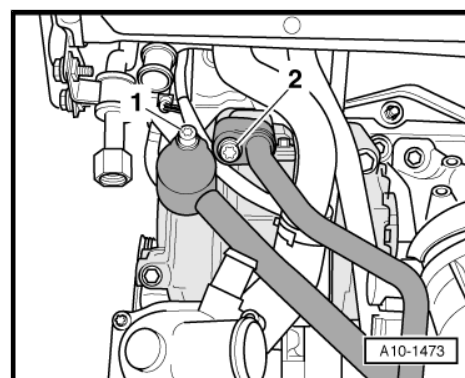
-Item 1- and -arrows- can be disregarded.

**Caution**

Risk of damage to refrigerant lines and hoses

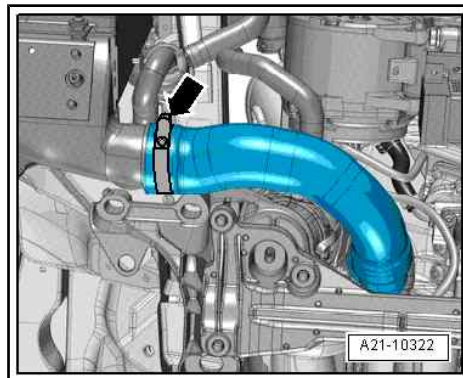
◆ ***Do NOT stretch, kink or bend refrigerant lines and hoses.***

- Remove bolts -1- and -2-.
- Disconnect refrigerant lines from A/C compressor.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .





- Release hose clip -arrow- and detach air hose from charge air cooler (right-side).

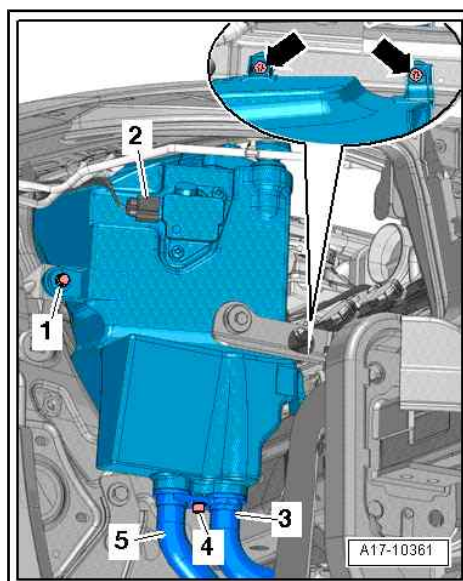


- Press coolant hoses to one side and remove bolt -4-.
- First detach pipe/hose assembly -5- and then pipe/hose assembly -3- from oil reservoir.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

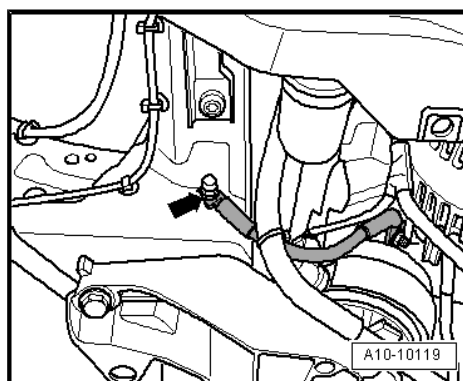


Note

Disregard items marked -1, 2- and -arrows-.



- Remove nut -arrow- for earth wire at longitudinal member (right-side).

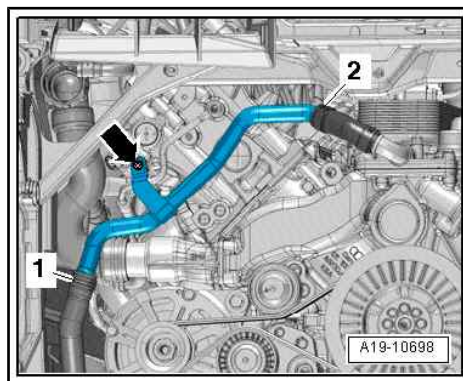


- Release hose clip -1- and detach coolant hose (bottom).



Note

Disregard -item 2- and -arrow-.



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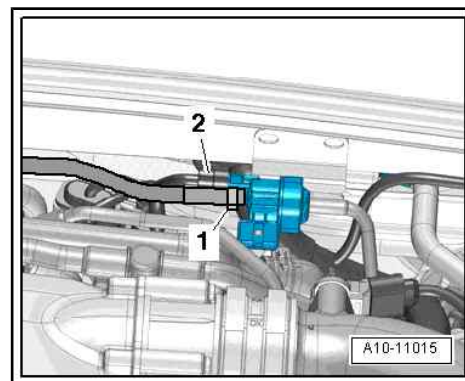
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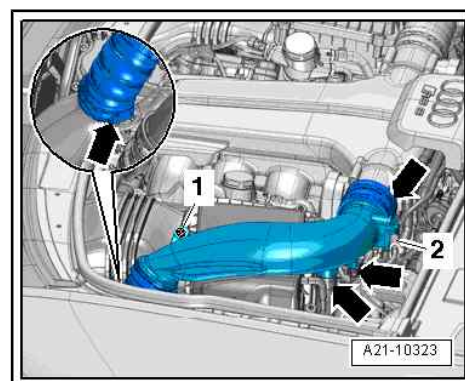
- Detach vacuum hose -1- from activated charcoal filter solenoid valve 1 - N80- .

**Note**

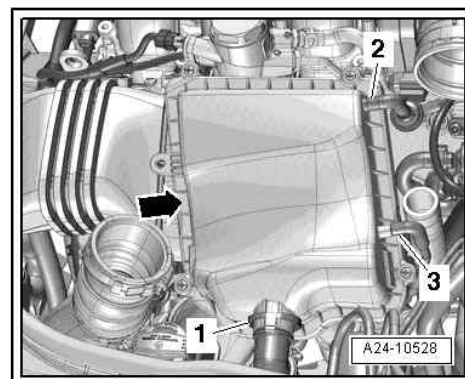
Disregard -item 2-.



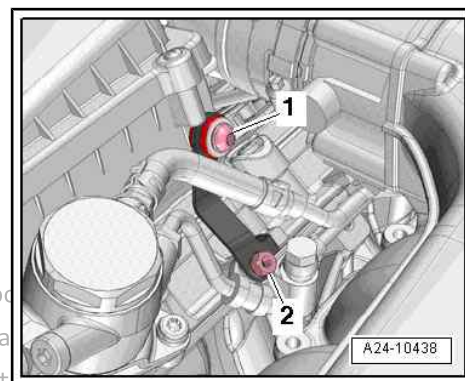
- Unscrew bolt -1- and unplug electrical connector -2- at charge pressure sender 2 - G447- .
- Loosen hose clips -arrows- and remove air pipe (left-side).



- Press release tabs and detach air hose -1-.
- Detach hoses -2- and -3- from air cleaner (top section) -arrow-.



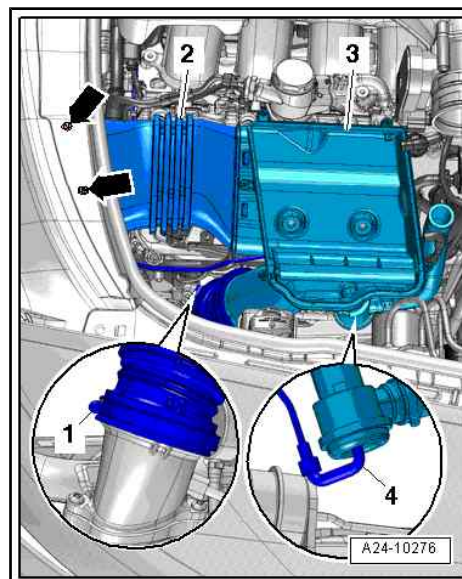
- Unscrew bolt -1- and nut -2- and remove bracket for air cleaner housing.



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- Unscrew bolts -arrows- and release hose clip -1-.
- Take out air cleaner housing -3- with air duct -2- and detach vacuum hose -4- from mechanical air recirculation valve.



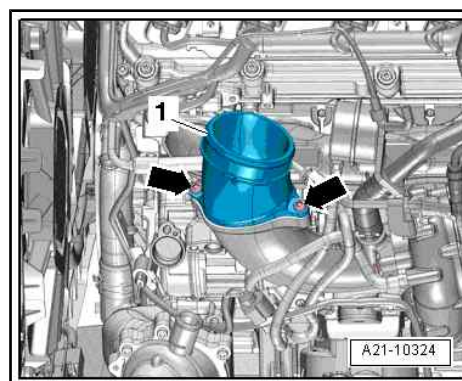
- Unscrew bolts -arrows- and remove intermediate flange -1-.



Caution

Risk of irreparable damage to turbocharger.

- ◆ Use adhesive tape to seal off connection for turbocharger to prevent small objects from dropping into the turbocharger.

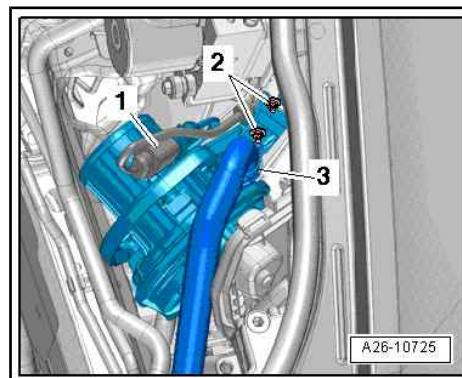


- Press release tabs and disconnect secondary air hose -3-.
- Unplug electrical connector -1- and move clear.



Note

Disregard -item 2-.



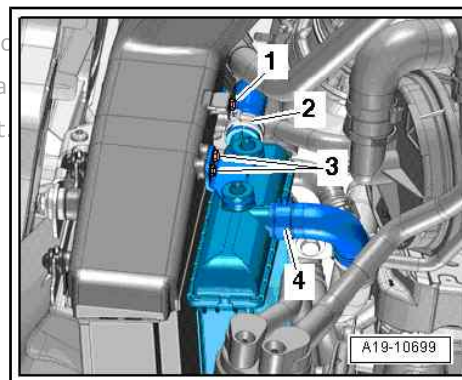
- Unscrew bolt -1- and detach bracket for hoses.
- Release hose clip -2- and detach coolant hose from radiator (left-side).

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Note

Disregard items -3 and 4-.



**Note**

Lay a cloth under the separating point to catch escaping hydraulic fluid.

- Disconnect hydraulic fluid line -arrow- for power steering at front left of engine.

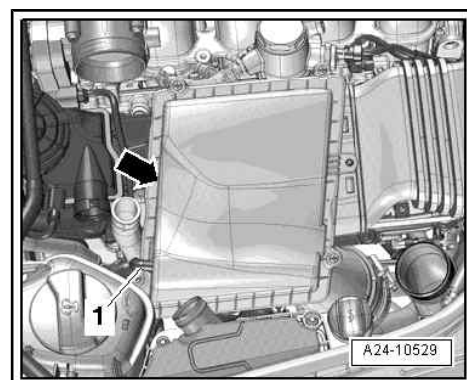
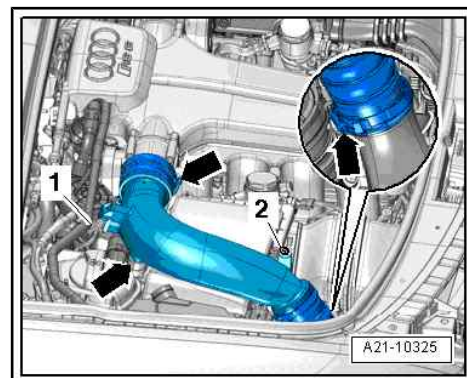
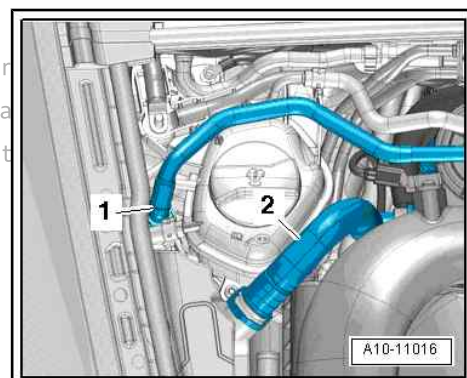
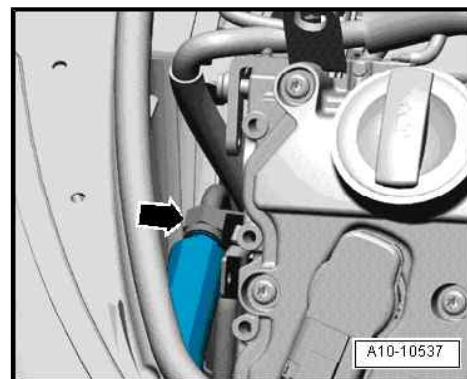


- Press release tabs and detach crankcase breather hose -1-.

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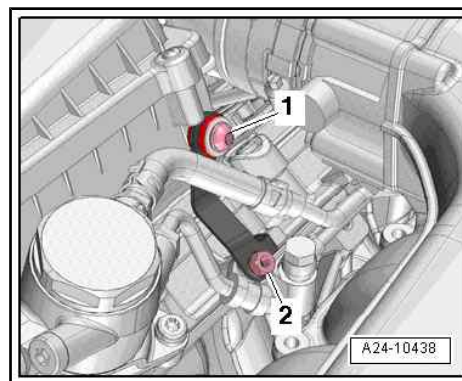
- Unscrew bolt -2- and unplug electrical connector -1- at charge pressure sender - G31- .
- Loosen hose clips -arrows- and detach air pipe (right-side).

- Detach breather hose -1- from air cleaner (top section) -arrow-.

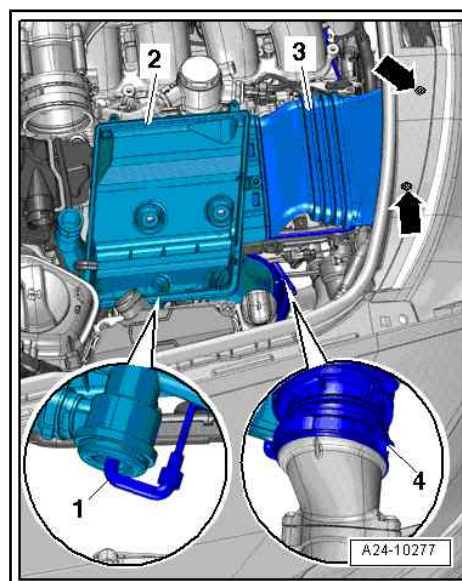




- Unscrew bolt -1- and nut -2- and remove bracket for air cleaner housing.



- Unscrew bolts -arrows- and release hose clip -4-.
- Detach air cleaner housing -2- from air duct -3- and disconnect vacuum hose -1- from mechanical air recirculation valve.
- Detach air duct.



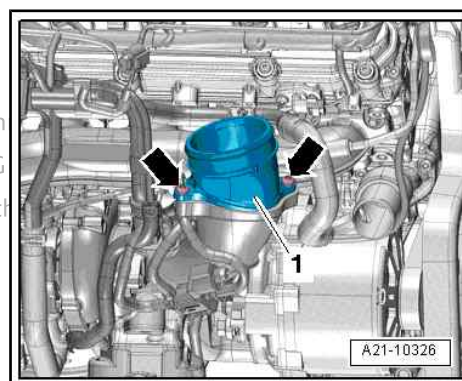
- Unscrew bolts -arrows- and remove intermediate flange -1-.



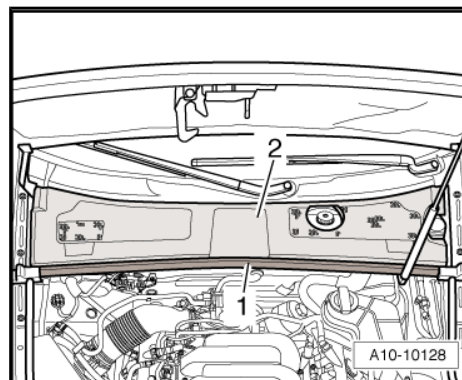
Caution

Risk of irreparable damage to turbocharger.

- ◆ Use adhesive tape to seal off connection for turbocharger to prevent small objects from dropping into the turbocharger.

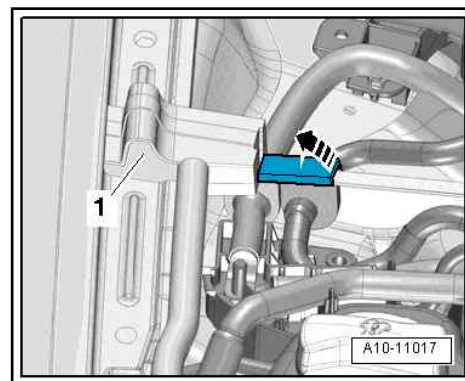


- Pull off seal -1- and remove plenum chamber cover -2-.





- Pull off sealing element -1-.
- Release and open lug for leadthrough -arrow-.

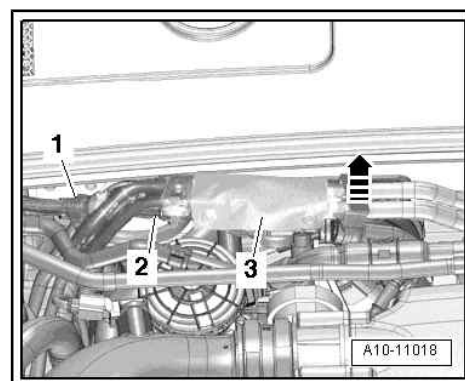


- Disconnect vacuum line -2- from brake servo and move clear -1-.
- Open retainer for hoses -arrow-.

**WARNING**

Risk of injury caused by fuel.

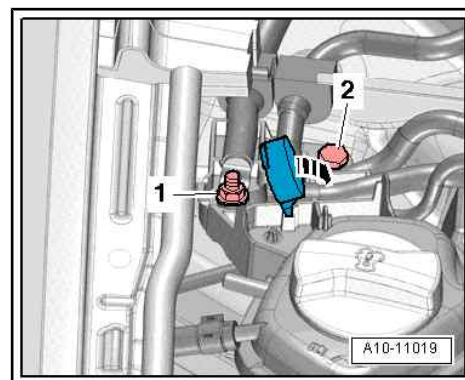
- ◆ *To allow the fuel pressure to dissipate, wrap a clean cloth around the connection and carefully loosen the connection before opening the fuel system.*

**Caution**

Take care to keep components clean.

- ◆ *Observe rules for cleanliness when working on the fuel supply system ➔ [page 6](#).*

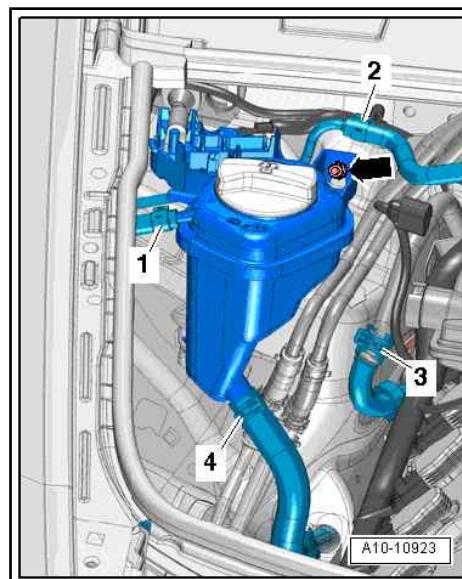
- Detach heat insulation sleeve -3- and disconnect fuel hose by pressing release ring.
- Open cover above positive terminal -arrow-.
- Unscrew nut -1- for positive terminal and move positive wiring clear.
- Unscrew earth stud -2- and move earth wiring clear.



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- Slacken hose clips -1 ... 4- and detach coolant hoses from coolant filler tank.
- Remove nut -arrow- and detach coolant filler tank.

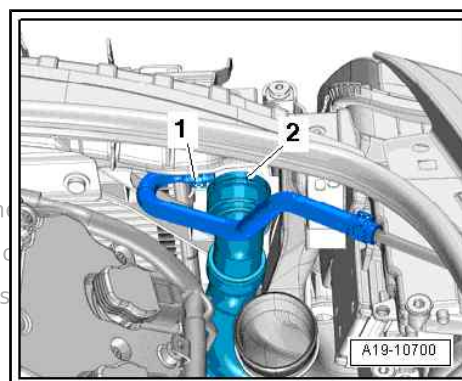


- Disconnect coolant hose -2- (top right) from radiator (pull out retaining clip).

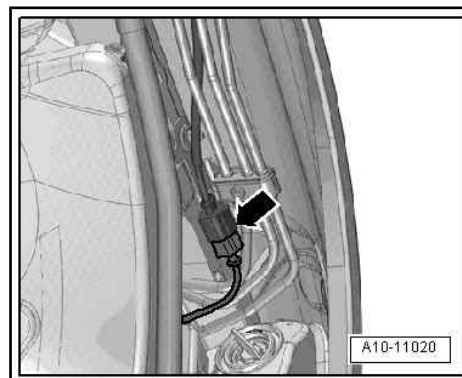


Note

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- Unplug electrical connector -arrow- at coolant shortage indicator switch - F66- .
- Move electrical wiring clear.

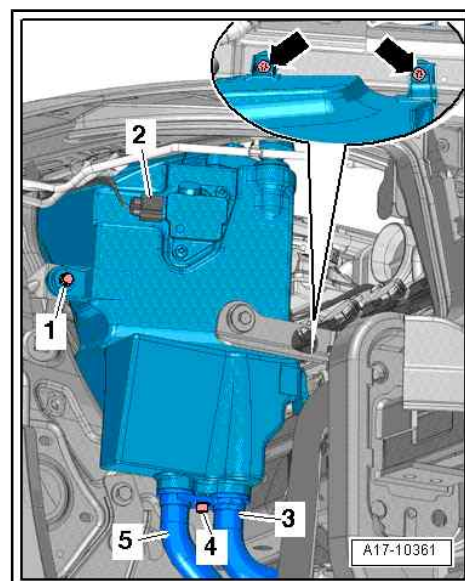




- Unscrew bolt -1- and pivot oil tank to the left.
- Unplug electrical connector -2- at oil level and oil temperature sender - G266- , move electrical wiring clear and lay on top of engine.

**Note**

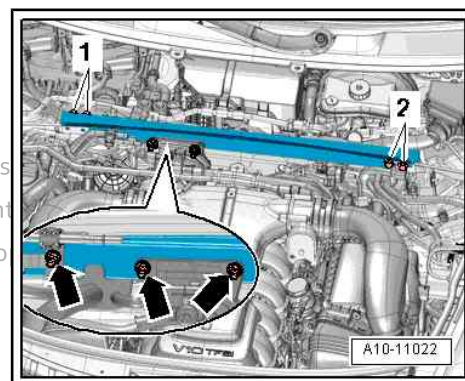
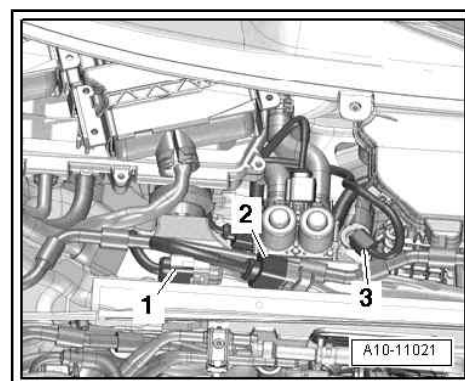
Disregard items -3, 4, 5- and -arrows-.

**WARNING**

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

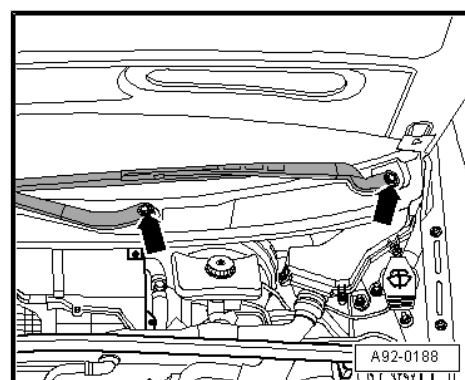
- ◆ *Wear protective gloves when working near the pump valve unit for the heating system.*

- Detach electrical connectors -1- and -2- from bracket and unplug connectors.
- Unplug electrical connector -3- from air quality sensor - G238- .
- Remove nuts -arrows- and detach wiring retainer from body brace.
- Remove bolts -1- and -2- and detach body brace.



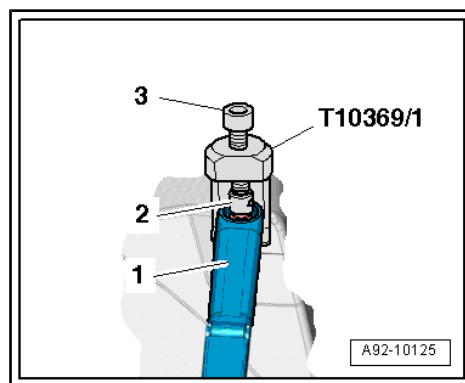
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- Pry off caps on windscreen wiper arms with a screwdriver.
- Loosen nuts -arrows- several turns.





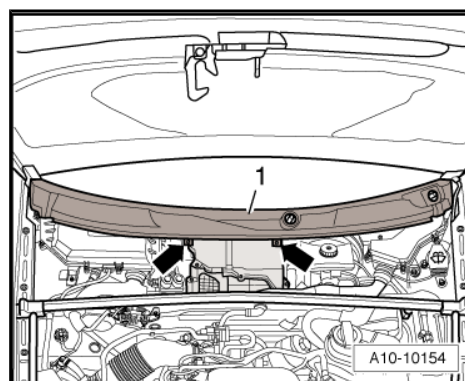
- Apply puller -T10369/1- to wiper arm -1- as shown in illustration.
- Apply thrust piece -2- at wiper shaft.
- Turn bolt -3- clockwise until wiper arm is clear of wiper shaft.
- Remove nuts and detach wiper arms.



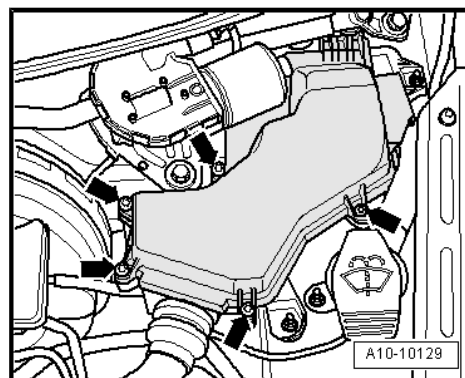
Caution

Risk of damage to cowl panel trim.

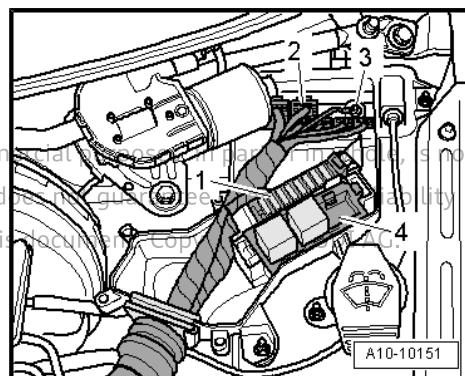
- ◆ **To avoid cracking the cowl panel trim -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel trim and pull the trim vertically up out of the windscreen surround, starting from the edge of the windscreen.**



- Unscrew bolts -arrows- and pull cowl panel trim off windscreen.
- Remove bolts -arrows- and detach cover for electronics box in engine compartment (left-side).



- Release fasteners, pull off fuse holder -1- and then 3-position relay carrier -4- upwards.
- Unscrew wiring -3-.
- Unplug three front electrical connectors -2- at rear of connector console.
- Disengage engine wiring harness at electronics box and move clear.





- Remove nut -arrow- for earth wire in plenum chamber (left-side).

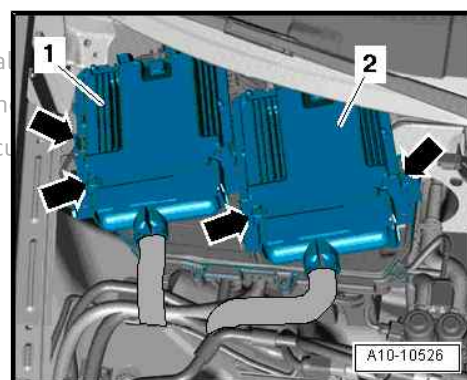
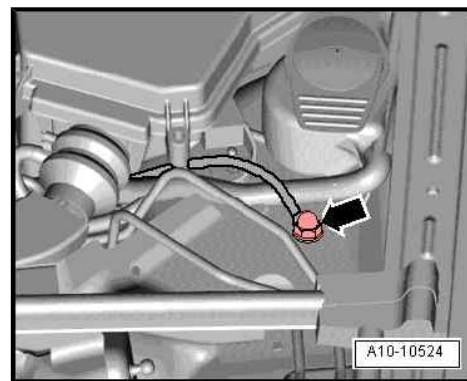


- Release retaining clips -arrows- and detach engine control units -1- and -2-.

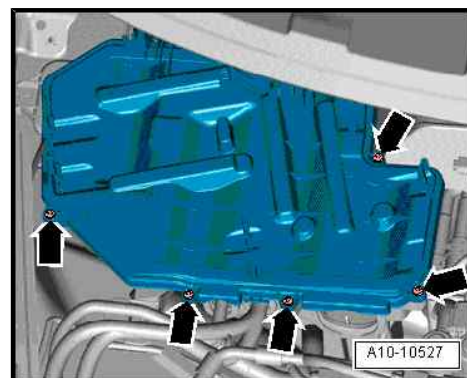
**Note**

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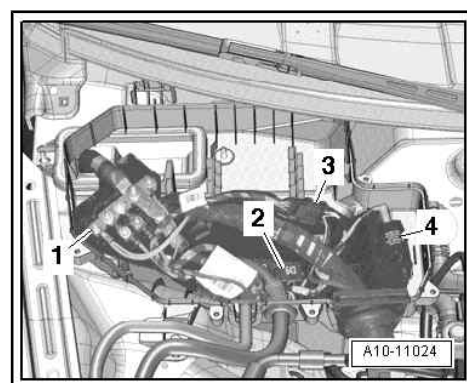
The engine control units remain connected to the wiring harness.



- Remove bolts -arrows- and detach cover for electronics box in engine compartment (right-side).

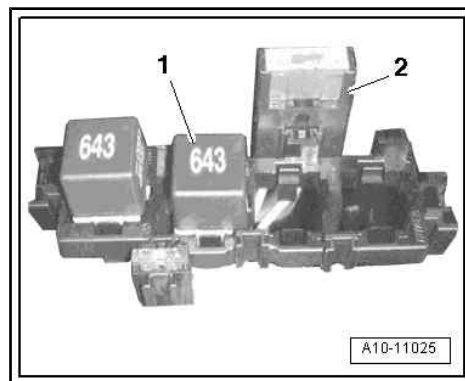


- Unclip suppressor capacitor -4- and take out of retainer in electronics box.
- Unplug electrical connector -3-.
- Unscrew wiring -1-.
- Unclip relay carrier -2- and take out of retainer in electronics box.





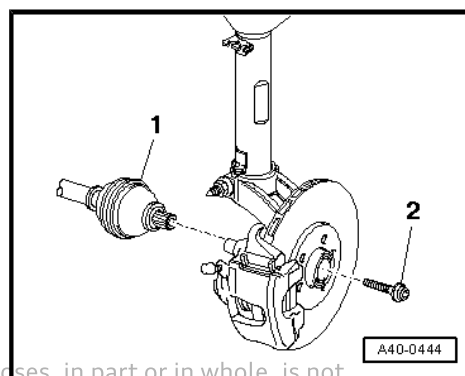
- Pull relay -1- out of relay carrier in electronics box in plenum chamber (right-side).
- Release fasteners and press fuse holder -2- and relay socket downwards out of relay carrier in electronics box in plenum chamber (right-side).
- Place wiring harnesses on engine and secure engine control units to prevent them from dropping.



Caution

Avoid damage to brake discs and wheel bearings.

- ◆ **When slackening the flange bolt securing the drive shaft, the vehicle must not be standing on its wheels.**
- ◆ **Secure brake discs by screwing in two wheel bolts.**

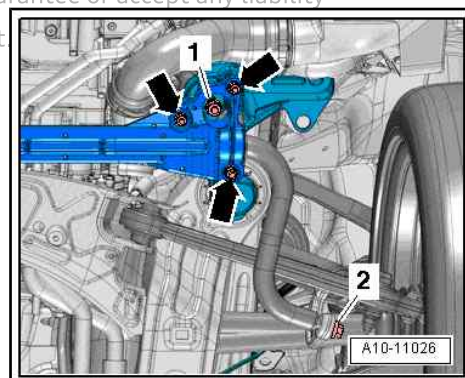


- Have a 2nd mechanic press the brake pedal.
- Unscrew flange bolt -2- from drive shafts -1- (left and right).
- Unscrew nuts -arrows- on both sides evenly.
- Unscrew bolts -2- on both sides and remove anti-roll bar.

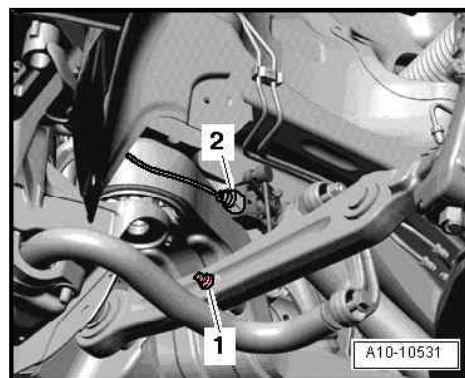


Note

Disregard -item 1-.



- Unplug electrical connector -2- at front left vehicle level sender - G78- .
- Remove nut -1- and detach coupling rod from track control link.

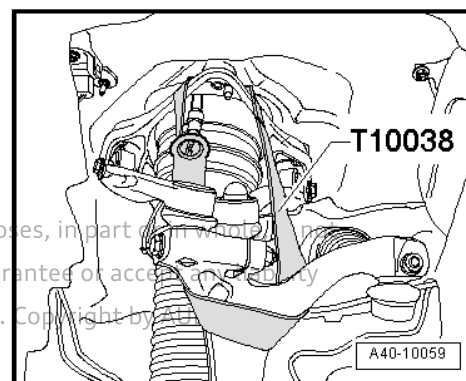


**Caution**

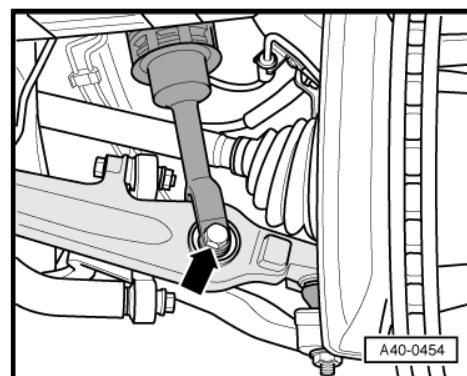
Danger of damage to the swivel joints of the upper links.

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

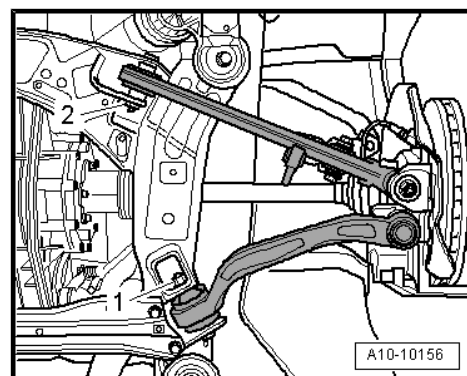
- Tie up wheel bearing housing with tensioning strap - T10038 - as shown on illustration.



- Remove bolt -arrow- and detach suspension strut from track control link.



- Remove nut -1- for guide link and nut -2- for track control link at subframe, remove bolts.





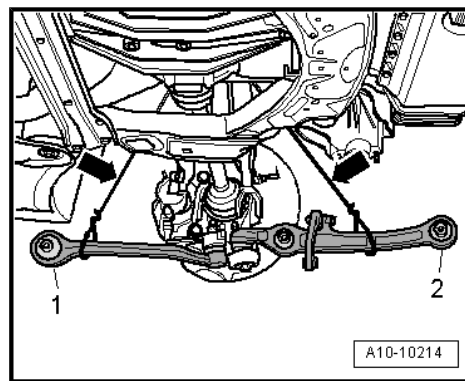
- Pivot guide link -1- and track control link -2- outwards.



Caution

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

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



- Detach drive shaft from flange shaft of gearbox.

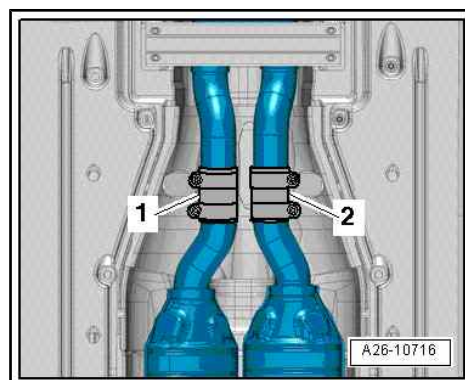


Caution

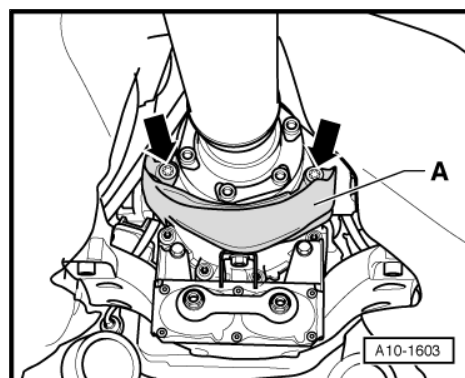
Risk of damage to brake hose

- ◆ **Take care when detaching drive shaft.**

- Pivot wheel bearing housing outwards and detach drive shaft.
- Repeat procedure on opposite side of vehicle.
- Loosen clamps -1- and -2- and move to rear.
- Move clear electrical wiring harness for Lambda probes.



- Remove bolts -arrows- and detach heat shield -A- for propshaft.
- Remove bolts securing propshaft to gearbox.
- Slide rear propshaft together towards rear final drive; the constant velocity joints can be moved axially.



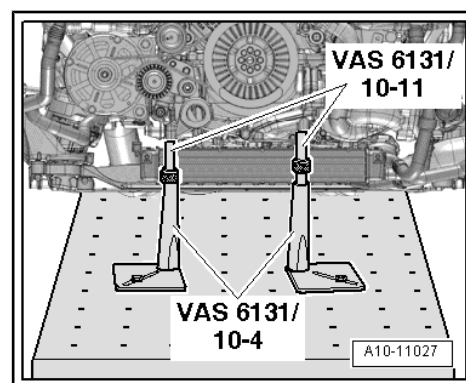
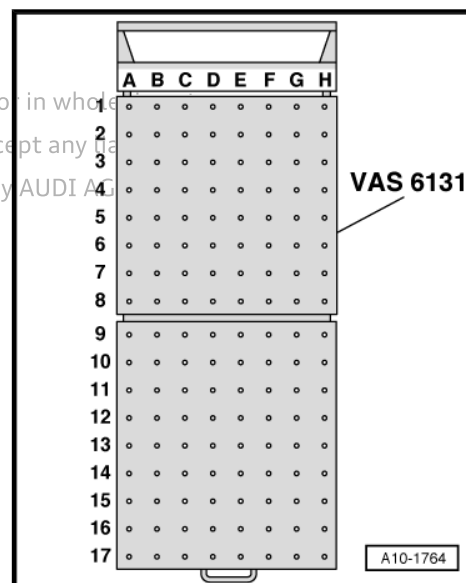


Setting up scissor-type assembly platform:

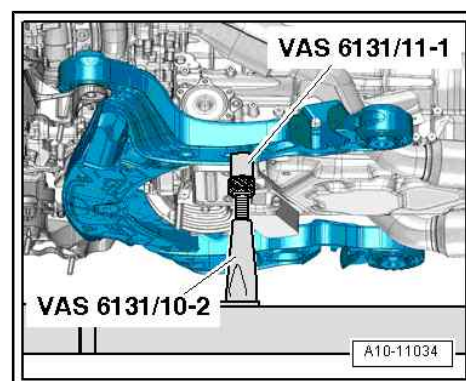
- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- and supplementary set - VAS 6131/11- and -VAS 6131/13- as follows:

Platform coordinates	Parts of support set for Audi - VAS 6131/10- , supplementary set -VAS 6131/11- and supplementary set -VAS 6131/13-			
B3	/10-1	/10-4	/10-5	/10-11
G3	/10-1	/10-4	/10-5	/10-11
A10	/10-1	/10-2	/10-5	/11-1
H10	/10-1	/10-2	/10-5	/11-1
B15	/10-1	/10-2	/10-5	/10-12
G15	/10-1	/10-2	/10-5	/10-12
C17	/10-1	/10-3	/10-5	/13-2
F17	/10-1	/10-3	/10-5	/13-2

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

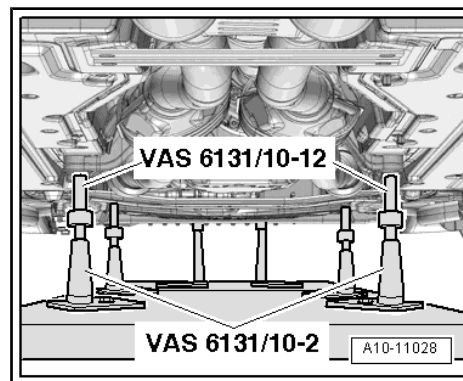


- Position support elements from -VAS 6131/10- and -VAS 6131/11- at front left and right of subframe as shown.

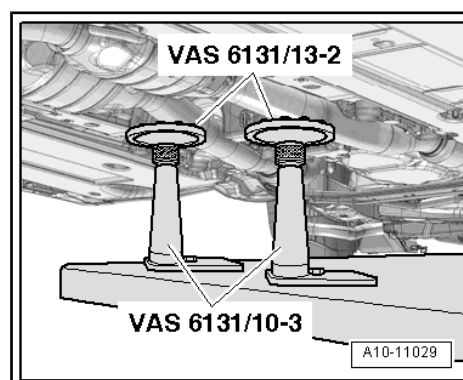




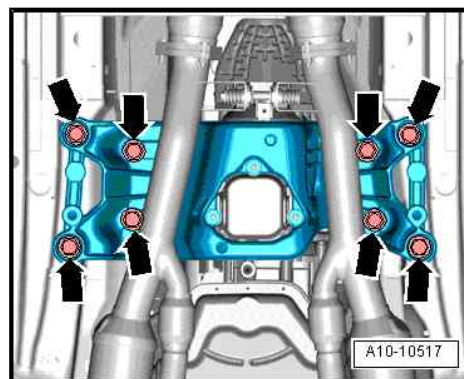
- Position the support elements from -VAS 6131/10- at rear of tunnel cross member, as shown in illustration.



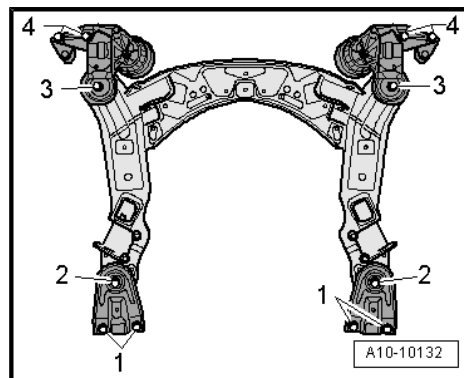
- Position support elements from -VAS 6131/10- and -VAS 6131/13- at left and right front exhaust pipes, as shown in the illustration.
- Turn all spindles for support elements upwards until all supports make contact with mounting points.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .



- Remove bolts -arrows- for tunnel cross member.



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



Caution

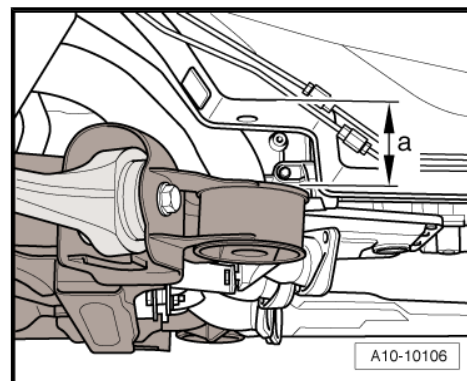
Danger of damage to hydraulic lines, vacuum lines or electrical wiring and to engine compartment.

- ◆ ***Check that all hydraulic lines, vacuum lines and electrical wiring between engine, gearbox, subframe and body have been detached.***
- ◆ ***Carefully guide engine/gearbox assembly with subframe out of engine compartment when lowering.***

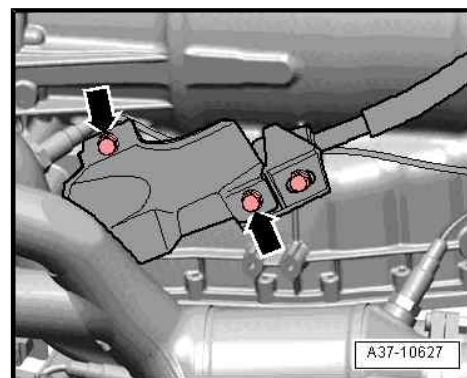
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- Lower engine/gearbox assembly using scissor-type assembly platform - VAS 6131 A- initially only as far as distance -a-.
- Distance -a- = max. 80 mm

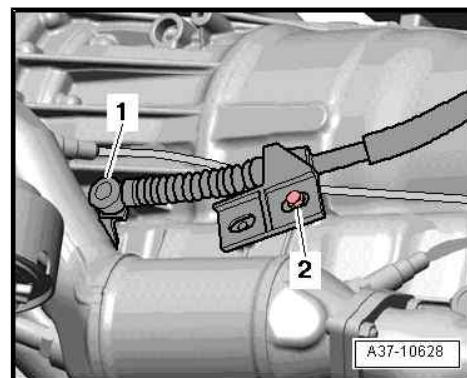


- Remove bolts -arrows- and detach heat shield for selector lever cable.

**Note**

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

- Pry ball socket -1- of selector lever cable off gearbox selector lever.
- Remove bolt -2- for cable support bracket.
- Move clear selector lever cable.
- Lower engine/gearbox assembly further using scissor-type assembly platform - VAS 6131 A- .
- Pull out scissor-type assembly platform - VAS 6131 A- with engine/gearbox assembly from underneath vehicle.



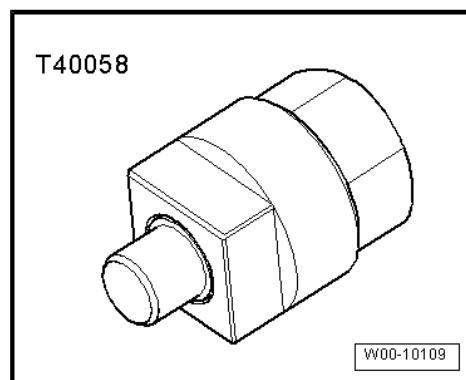
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2 Separating engine and gearbox

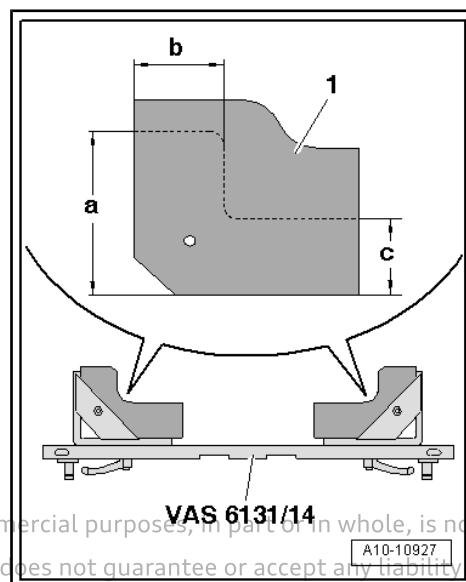
Special tools and workshop equipment required

- ◆ Adapter - VAS 6131/10-12-
- ◆ Supplementary set -VAS 6131/11-
- ◆ Gearbox support - VAS 6131/14-
- ◆ Adapter - T40058-



Setting up gearbox support - VAS 6131/14- :

- Cut foam plastic insert according to the dimensions given.
- Dimension -a- = 110 mm
- Dimension -b- = 55 mm
- Dimension -c- = 55 mm
- Order new foam plastic insert.



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Procedure

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A- ➔ [page 10](#) .
- Screw down spindles of support elements (left and right) at subframe as far as possible.
- Unscrew both base plates for support elements for subframe from scissor-type assembly platform - VAS 6131 A- .



Note

A second mechanic is required for removing the subframe.

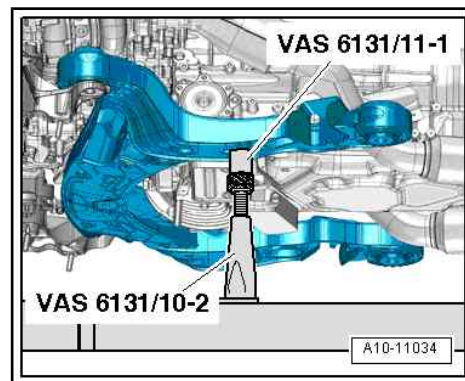
- Take out subframe to the side.



Note

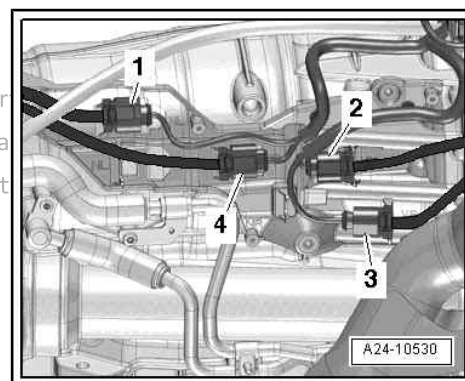
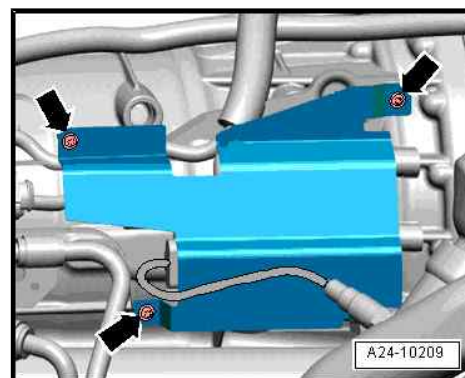
The mounting points for engine (front) and gearbox remain unchanged.

- Unscrew bolts -arrows- and detach heat shield for electrical connectors for Lambda probes (right-side) from gearbox.



- Remove electrical connectors -1 ... 4- for Lambda probes from bracket on gearbox.

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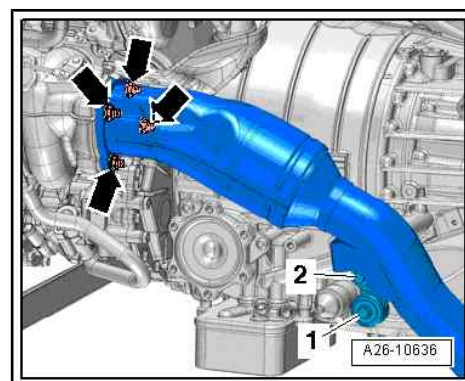


- Remove nuts -arrows- and bolt -1-.



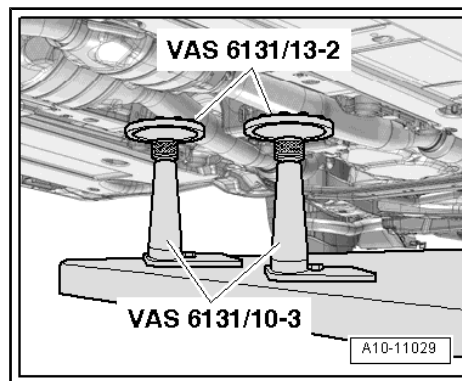
Note

Disregard -item 2-.





- Slacken bolt for support element (left-side) and pivot support element to side.
- Detach front exhaust pipe (left-side) with catalytic converters.

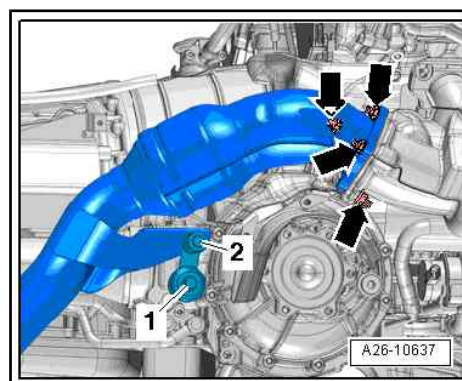


- Remove nuts -arrows- and bolt -1-.

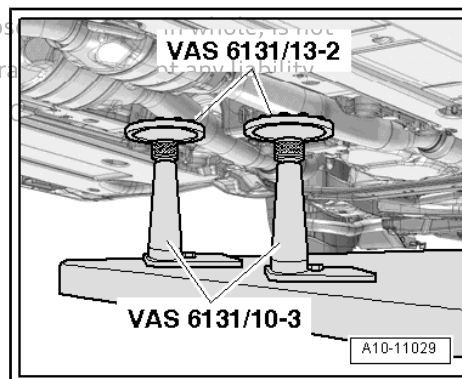


Note

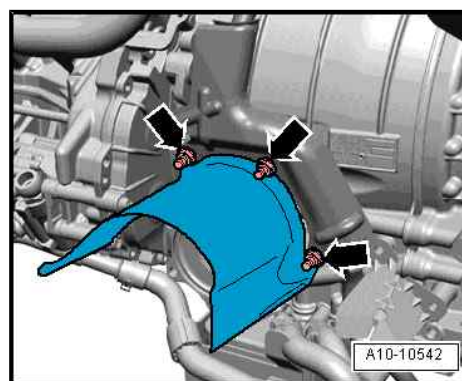
Disregard -item 2-.



- Slacken bolt for support element (right-side) and pivot support element to side.
- Detach front exhaust pipe (right-side) with catalytic converters.

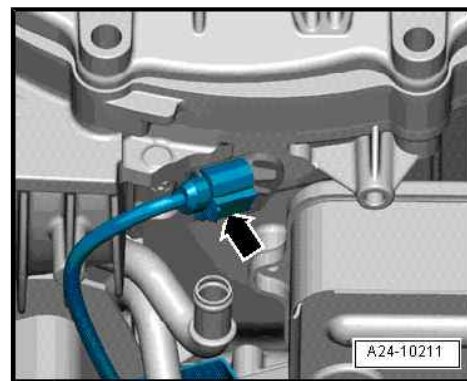


- Remove bolts -arrows- and detach heat shield for drive shaft (left-side) from gearbox.
- Detach heat shield for wiring harness and move wiring harness clear.





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

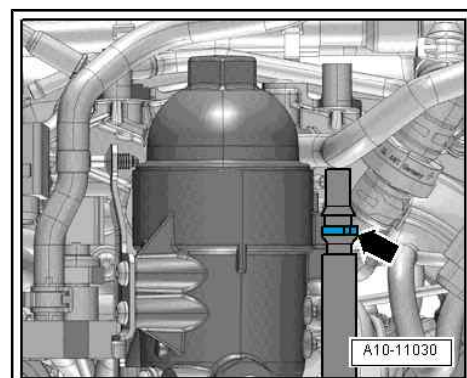
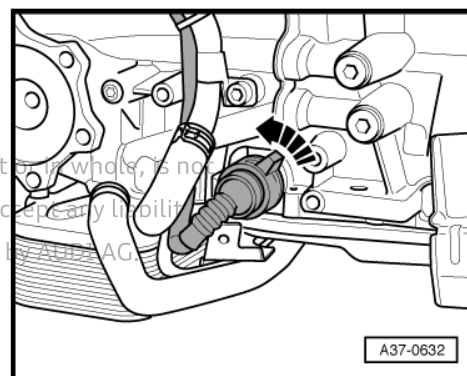
**Caution**

Risk of irreparable damage to gearbox control unit (mechanical unit) because of static discharge.

- ◆ ***Do NOT touch connector contacts in gearbox connector with your hands.***

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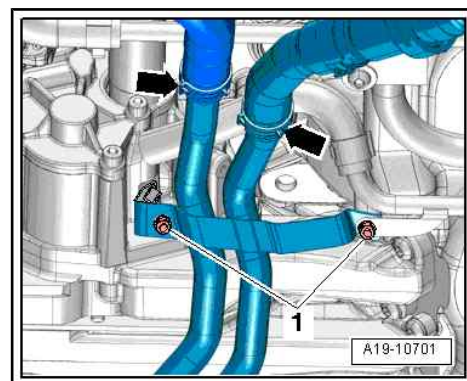
- Touch gearbox housing with your hand (without wearing gloves) to eliminate static charge.
- Turn retainer catch anti-clockwise -arrow- and unplug electrical connector on left of gearbox.
- Move electrical wiring harness clear at gearbox.
- Move breather pipe for gearbox housing clear -arrow-.



- Slacken hose clips -arrows- and detach coolant hoses from coolant pipe (bottom).

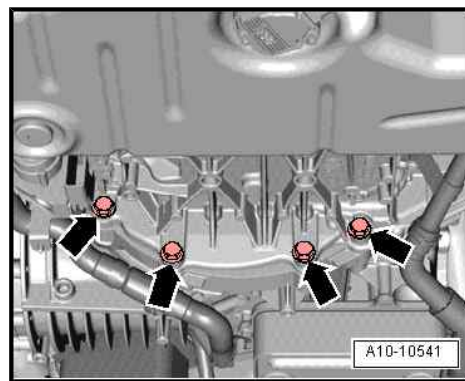
**Note**

Disregard -item 1-.

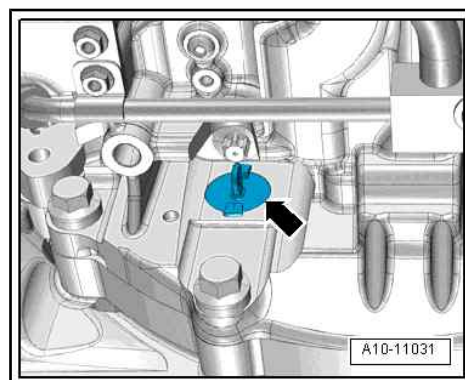




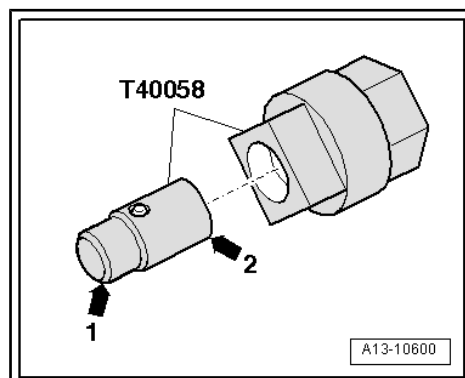
- Remove bottom bolts securing engine to gearbox -arrows-.



- Remove sealing plug -arrow-.



- Insert guide pin of adapter -T40058- as follows:
 - The smaller-diameter section -arrow 1- faces the engine.
 - The larger-diameter section -arrow 2- faces the adapter.



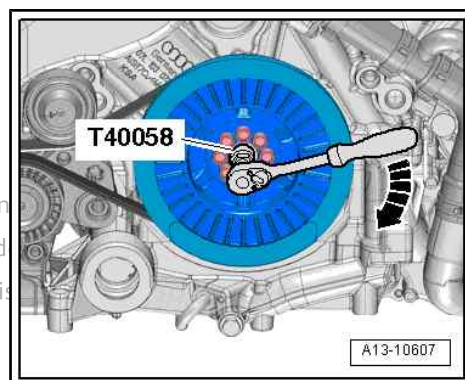
- Counterhold crankshaft using adapter - T40058- when slackening bolts for torque converter.



Note

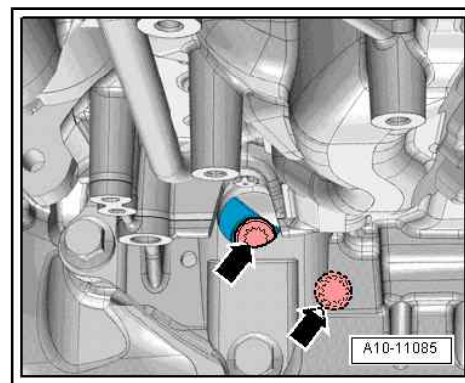
When performing the next step, turn the crankshaft only in the normal direction of rotation -arrow-.

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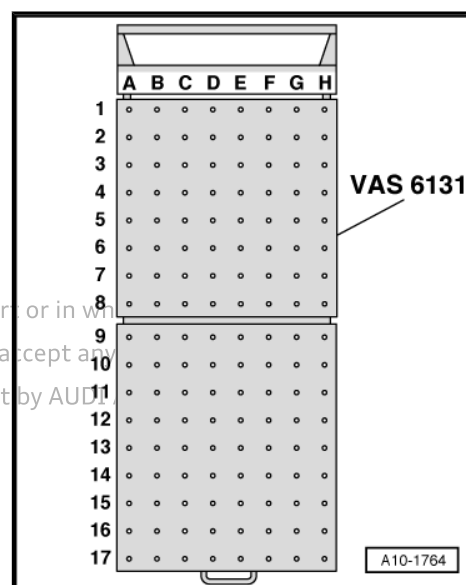


- Remove each pair of torque converter bolts -arrows- (2 bolts spaced closely together).
- Then turn crankshaft approx. 110° in direction of engine rotation once again and remove next pair of bolts.

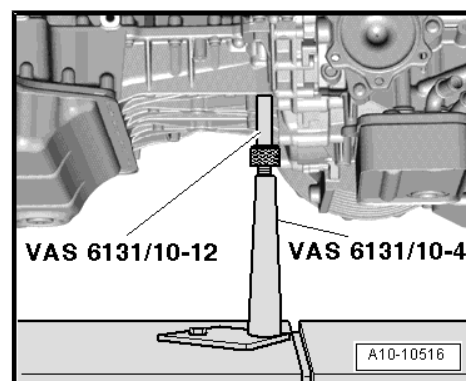


- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , supplementary set -VAS 6131/13- and gearbox support - VAS 6131/14- as follows:

Platform coordinates	Parts of support set for Audi - VAS 6131/10- , supplementary set -VAS 6131/13- and gearbox support - VAS 6131/14-			
B3 ¹⁾	/10-1	/10-4	/10-5	/10-11
G3 ¹⁾	/10-1	/10-4	/10-5	/10-11
C7	/10-1	/10-4	/10-5	/10-12
F7	/10-1	/10-4	/10-5	/11-2
G11	/10-1	/10-2	/10-5	/14
F11	/10-1	/10-2	/10-5	
B15 ¹⁾	/10-1	/10-2	/10-5	/10-12
G15 ¹⁾	/10-1	/10-2	/10-5	/10-12
C17 ¹⁾	/10-1	/10-3	/10-5	/13-2
F17 ¹⁾	/10-1	/10-3	/10-5	/13-2
• ¹⁾ Support elements remain unchanged.				



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

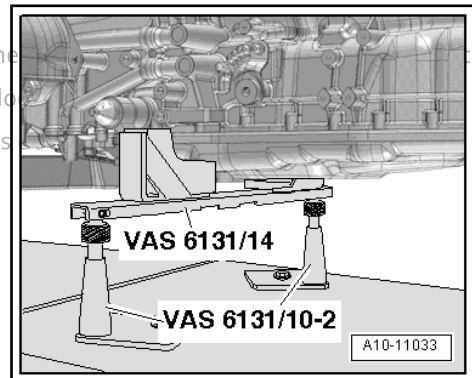
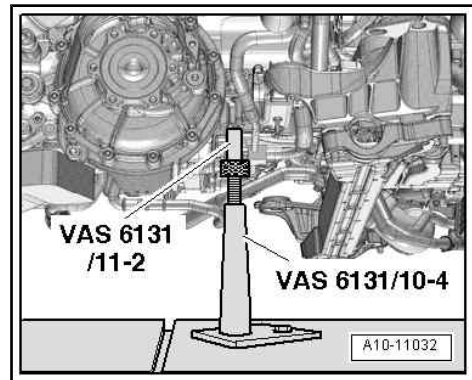




- Position support elements from -VAS 6131/10- and -VAS 6131/11- at rear right of engine as shown in illustration.
- Turn spindles for support elements upwards until all locating lugs make contact with mounting points.



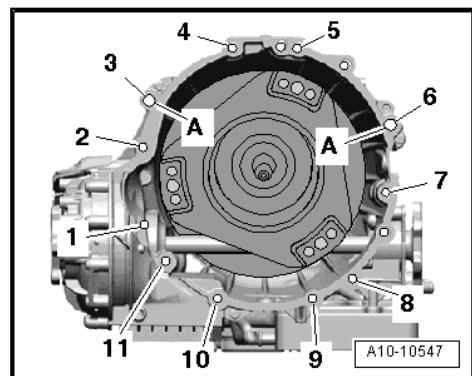
- Position support elements from -VAS 6131/10- and gearbox support - VAS 6131/14- at front of gearbox, as illustrated.
- Screw spindles on both sides upwards until gearbox support - VAS 6131/14- makes full contact with gearbox.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .



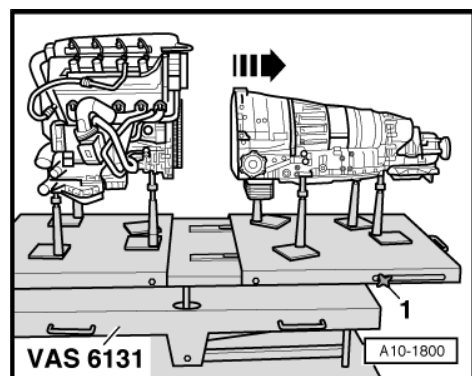
- Unscrew remaining bolts -2 ... 7- securing engine to gearbox.

**Note**

Disregard -items 1, A-.



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



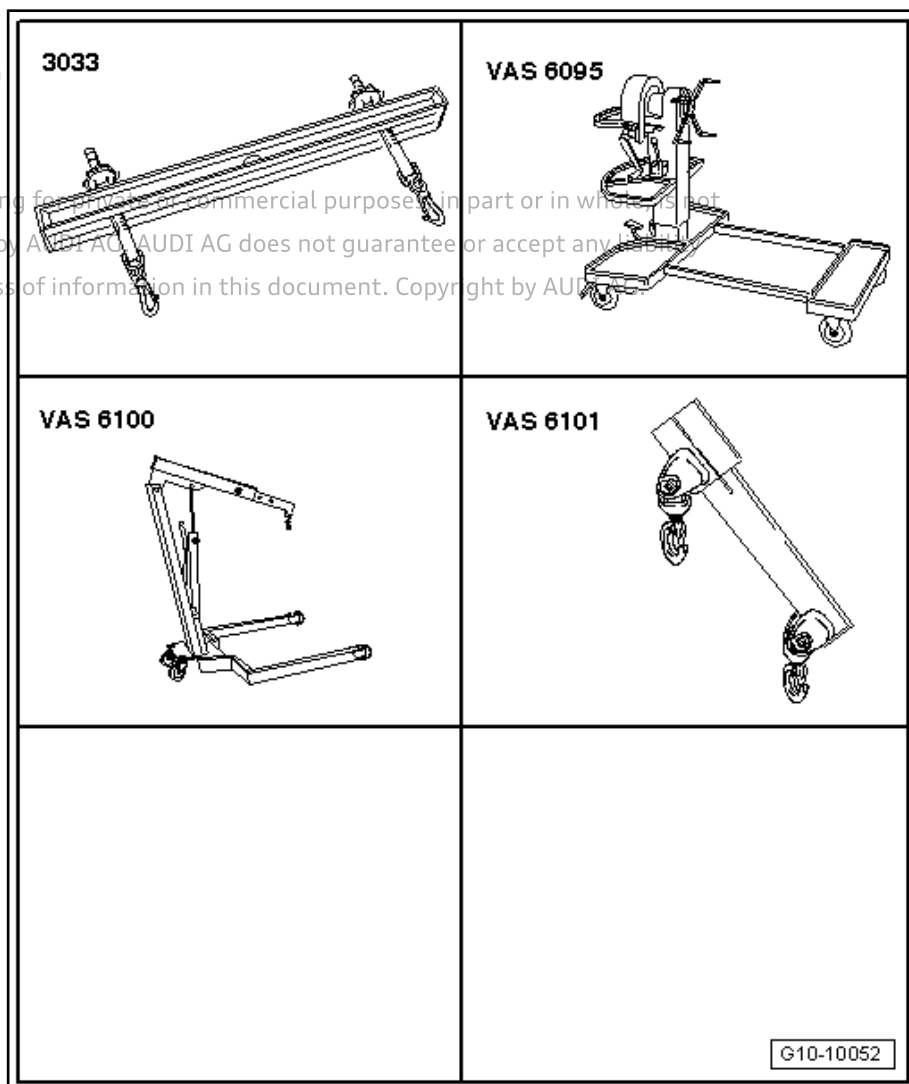


3 Securing engine to engine and gearbox support

Special tools and workshop equipment required



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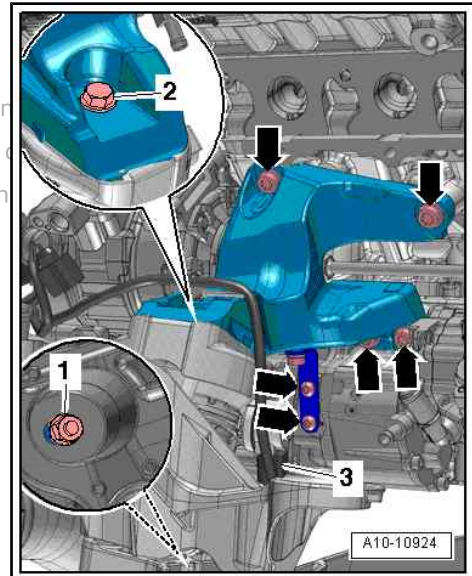
- ◆ Lifting tackle - 3033-
- ◆ Engine and gearbox support - VAS 6095- with bracket - VAS 6095/1-8-
- ◆ Workshop hoist - VAS 6100-
- ◆ Lift arm extension/workshop hoist - VAS 6101-

**Procedure**

- Remove turbocharger: left-side ➤ [page 234](#) ; right-side ➤ [page 238](#) .
- Unplug electrical connector -3- on left electrohydraulic engine mounting solenoid valve - N144- and move electrical wiring clear.
- Remove bolts -arrows- and detach engine support with engine mounting and console for engine mounting.

**Note**

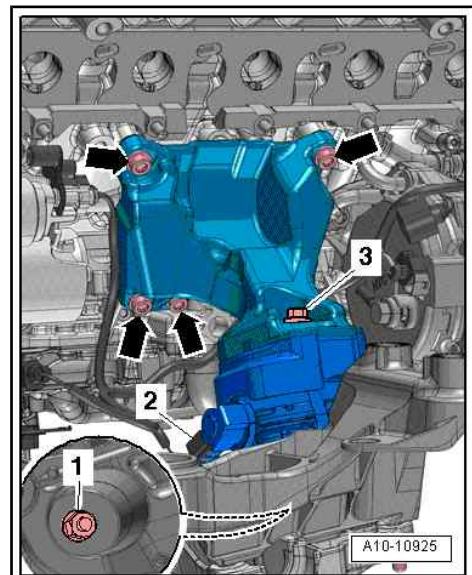
Disregard items -1 and 2-.



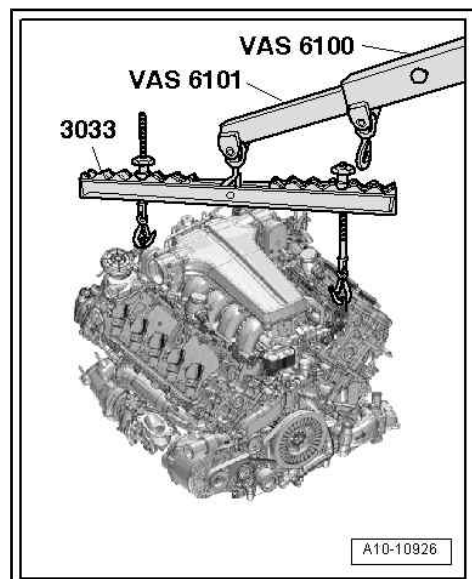
- Unplug electrical connector -2- on right electrohydraulic engine mounting solenoid valve - N145- .
- Remove bolts -arrows- and detach engine support with engine mounting and console for engine mounting.

**Note**

Disregard items -1 and 3-.



- Attach lifting tackle - 3033- to engine lifting eyes and workshop hoist - VAS 6100- with lift arm extension (workshop hoist) - VAS 6101- as shown in illustration.
- Lift engine off support elements on scissor-type assembly platform -VAS 6131 A- .

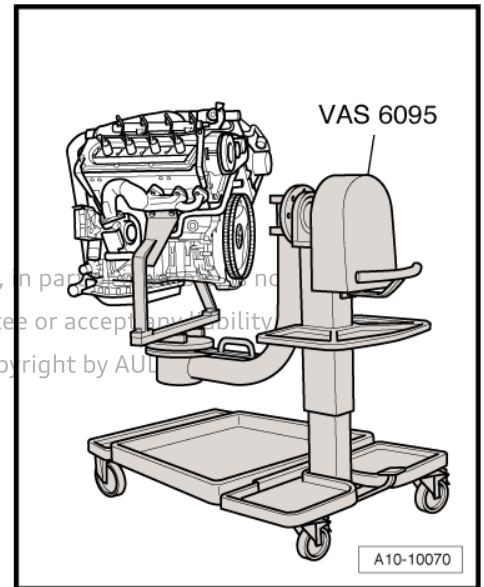




- Secure engine with bracket -VAS 6095/1-8- to engine and gearbox support - VAS 6095- as shown in illustration. Tightening torque: 42 Nm.



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4 Installing engine

Tightening torques



Note

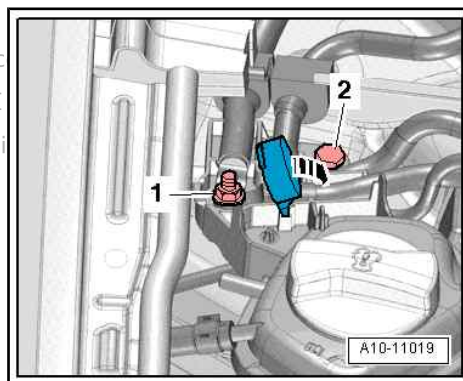
- ♦ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ♦ *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.*
- ♦ *Do not use de-greased parts.*
- ♦ *Tolerance for tightening torques: $\pm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

Tightening torques [⇒ page 50](#) , [⇒ page 219](#)

Component		Nm
Bolts/nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Except for the following:		
Drive plate to torque converter		⇒ Rep. gr. 37 ¹⁾
• ¹⁾ Renew bolts; use only genuine bolts (same as original equipment) ⇒ Electronic parts catalogue.		

Positive terminal and earth stud - tightening torques

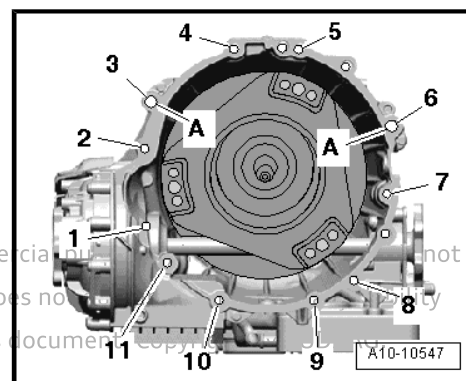
- Tighten nut -1- for positive terminal to 20 Nm.
- Tighten earth stud -2- to 9 Nm.





Securing automatic gearbox to engine

Item	Bolt	Nm
1	Securing starter ⇒ Electrical system; Rep. gr. 27	
2	M12x135	65
3	M12x105	65
4, 5	M12x100	65
6, 8	M12x75	65
7	M12x155	65
9, 10, 11	M12x67	65
A	Dowel sleeves for centralising	



Procedure

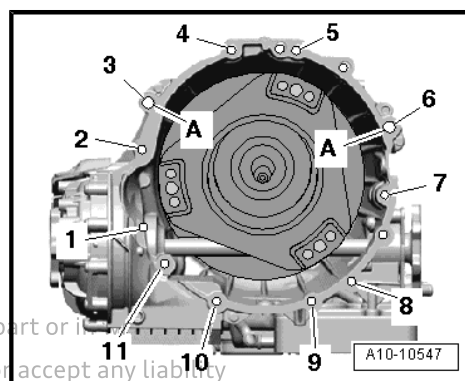
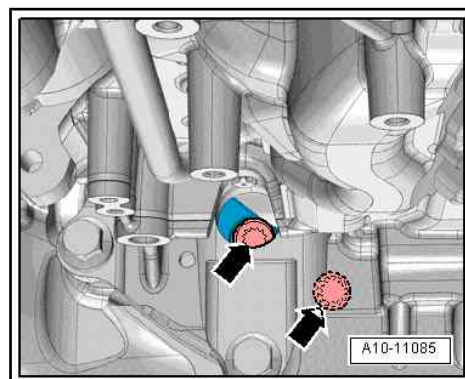
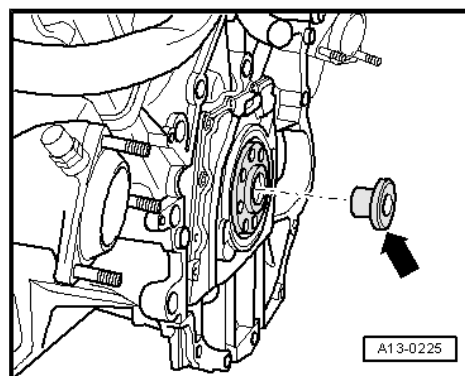
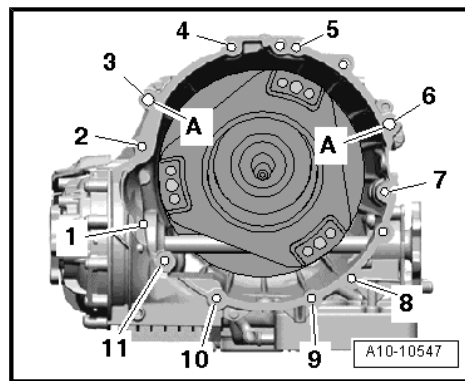


Note

- ◆ Renew the bolts tightened with specified tightening angle.
- ◆ Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.
- ◆ To secure torque converter on drive plate, use only new bolts of the correct type (same as original equipment) as specified in ⇒ *Electronic parts catalogue*.
- ◆ The threaded holes in the flange shaft for the propshaft on the gearbox must be cleaned of remaining locking fluid with a thread tap before assembling.
- ◆ Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
- ◆ The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.
- ◆ To ensure that there is enough clearance at the crash sensors, it is very important to observe the installation position of the hose clips at the air pipes ⇒ [page 243](#).
- ◆ Fit all heat shields and heat insulation sleeves in the original positions when installing.
- ◆ Fit all cable ties in the original positions when installing.
- Install engine supports with engine mountings and consoles for engine mountings (left and right).
- Install turbocharger: left-side ⇒ [page 234](#) ; right-side ⇒ [page 238](#).



- Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
- Check whether centring sleeve -arrow- for torque converter is fitted in rear of crankshaft; drive in centring sleeve if necessary.
- Before bringing engine and gearbox together, turn torque converter and drive plate on engine so that the holes for the securing bolts are in line with the opening for the intake module -arrows-.
- Bring gearbox into position on engine and tighten bolts -2 ... 11-.



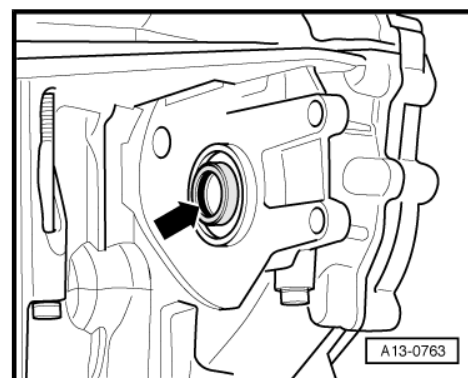
Note

Disregard -items 1, A-.

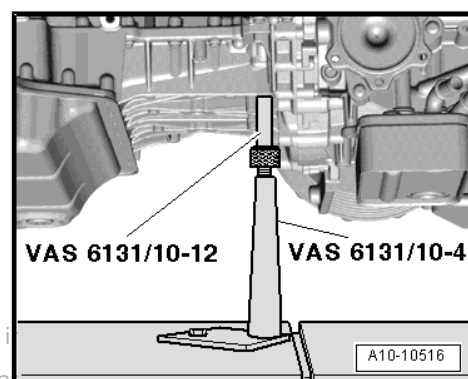
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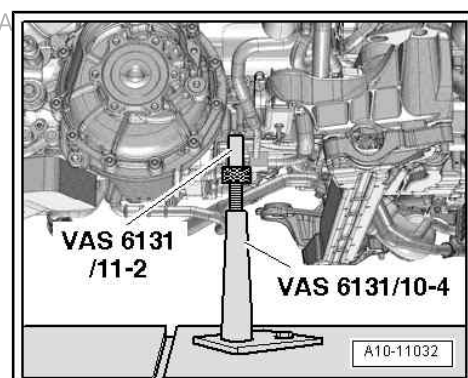
- Before installing an exchange engine, check whether the flat-section O-ring -arrow- is fitted in the drive shaft of the power steering pump located in the spur gear drive.
- Install front exhaust pipe with catalytic converters: left-side ➔ [page 259](#) , right-side ➔ [page 261](#) .



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



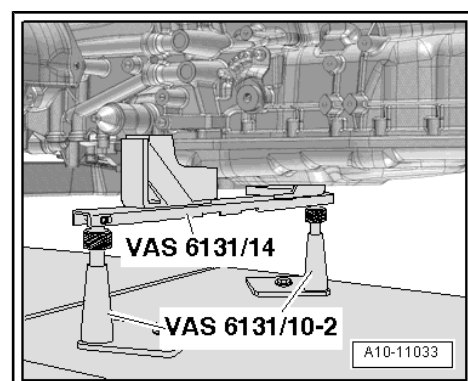
- Screw spindle for support element at right of engine downwards.
- Unscrew base plate for support element (right-side) from scissor-type assembly platform - VAS 6131 A- .



- Screw down spindles for gearbox support - VAS 6131/14- .
- Unscrew base plates for support elements from scissor-type assembly platform - VAS 6131 A- .

**Note**

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

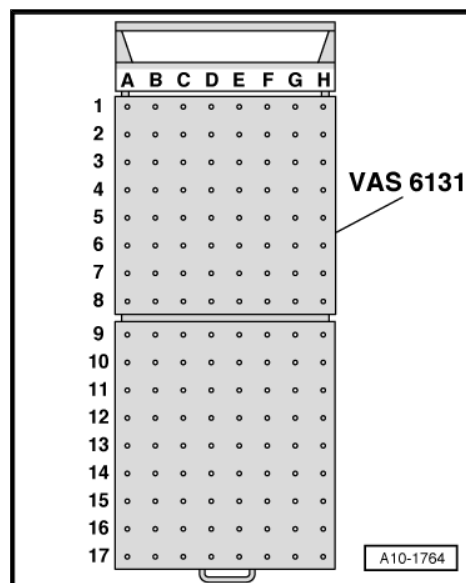




- Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- as follows:

Platform coordinates	Parts from support set for Audi - VAS 6131/10-			
B3 ¹⁾	/10-1	/10-4	/10-5	/10-11
G3 ¹⁾	/10-1	/10-4	/10-5	/10-11
A10	/10-1	/10-2 ²⁾	/10-5 ²⁾	/11-1
H10	/10-1	/10-2 ²⁾	/10-5 ²⁾	/11-1
B15 ¹⁾	/10-1	/10-2	/10-5	/10-12
G15 ¹⁾	/10-1	/10-2	/10-5	/10-12
C17 ¹⁾	/10-1	/10-3	/10-5	/13-2
F17 ¹⁾	/10-1	/10-3	/10-5	/13-2

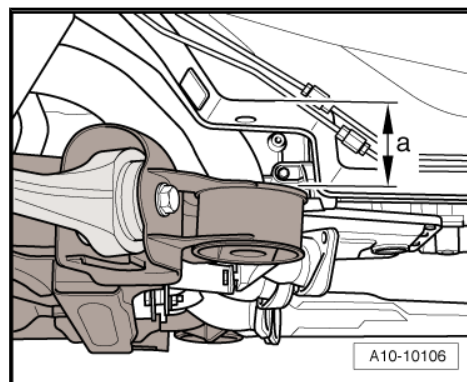
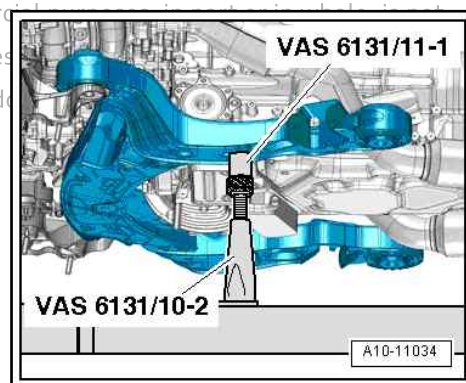
- ¹⁾ Support elements remain unchanged.
- ²⁾ Secure support elements only after installing the subframe.

**Note**

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

- Fit subframe on both support elements -VAS 6131/11-1- .
- Screw up spindles of support elements on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .
- Guide engine/gearbox assembly together with subframe into body from below using scissor-type assembly platform - VAS 6131 A- .
- Raise engine/gearbox assembly using scissor-type assembly platform - VAS 6131 A- until distance -a- has been reached.
- Distance -a- = max. 80 mm
- Install selector lever cable and check adjustment ⇒ Rep. gr. 37 .
- Raise engine/gearbox assembly together with subframe further using scissor-type assembly platform - VAS 6131 A- .





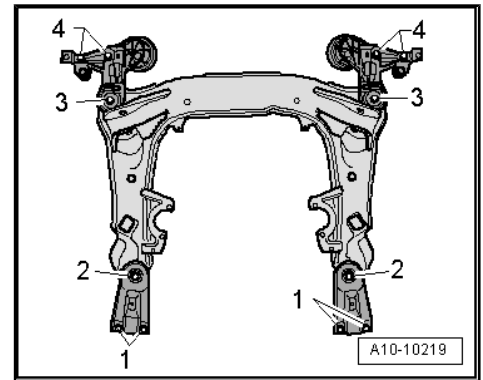
- Align subframe and consoles for engine mounting on longitudinal members according to markings made before removal.
- Tighten bolts for subframe and consoles for engine mountings only to specified torque (do not turn further); the bolts are only fully tightened after performing the wheel alignment check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



WARNING

Risk of accident if bolted connections are loose.

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



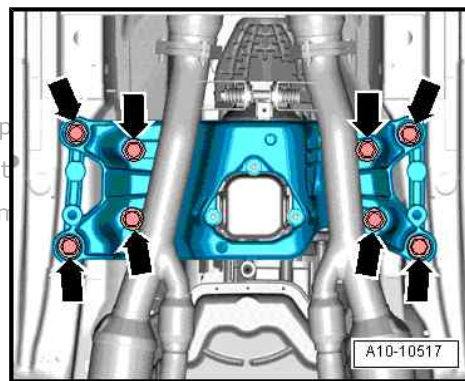
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- Tighten bolts -arrows- for tunnel cross member ⇒ Rep. gr. 37 .

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

- Install propshaft ⇒ Rear final drive 01R; Rep. gr. 39
- Align the exhaust system so it is free of stress ⇒ [page 262](#)
- Install drive shafts, guide links, track control links, anti-roll bar, coupling rod, front left vehicle level sender - G78- , suspension struts and cross piece for subframe ⇒ Rep. gr. 40 .
- Install hydraulic fluid line for power steering ⇒ Rep. gr. 48 .
- Install intermediate flange and air cleaner housing ⇒ Rep. gr. 24 .
- Install refrigerant lines ⇒ Rep. gr. 87 .
- Note installation position of air hoses and hose clips ⇒ [page 243](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations, tightening torques ⇒ Electrical system; Rep. gr. 97 .
- Install oil reservoir and pipe/hose assemblies ⇒ [page 180](#) .
- Install air ducts (left and right) ⇒ Rep. gr. 50 .
- Install headlight (right-side) ⇒ Electrical system; Rep. gr. 94 .
- Tighten nut for positive terminal and tighten earth stud ⇒ [page 42](#) .
- Observe notes on procedure for connecting the battery ⇒ Electrical system; Rep. gr. 27 .

**Caution**

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

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

- Install body brace ⇒ Rep. gr. 40 .
- Install and adjust wiper arms ⇒ Electrical system; Rep. gr. 92 .
- Before starting engine, top up hydraulic fluid in power steering reservoir ⇒ Rep. gr. 48 .

**Note**

The power steering pump must not be run when dry.

- Add engine oil ⇒ [page 192](#) .
- Fill up with coolant ⇒ [page 197](#) .



Note

- ◆ *Do not use drained coolant again if:*
 - ◆ *the cylinder head or cylinder block have been renewed.*
 - ◆ *the coolant is contaminated or dirty.*
- Charge refrigerant system ⇒ Air conditioner with refrigerant R134a .
- Check ATF level ⇒ Rep. gr. 37 .
- Align subframe and both consoles for engine mountings ⇒ Rep. gr. 40 .
- Fit front wheels and perform wheel alignment ⇒ Rep. gr. 44 .



WARNING

Risk of accident if bolted connections are loose.

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

- Install noise insulation panels ⇒ Rep. gr. 50 .



5 Assembly mountings

5.1 Exploded view - assembly mountings

1 - Nut

- ☐ Tightening torque ⇒
Rep. gr. 40

2 - Cross member

- ☐ Removing and installing
⇒ Rep. gr. 40

3 - Nut

- ☐ Self-locking
- ☐ Renew
- ☐ 40 Nm

4 - Bolt

- ☐ 75 Nm

5 - Console for engine mounting (right-side)

6 - Engine mounting (right-side)

- ☐ With right electrohydraulic engine mounting solenoid valve - N145-
⇒ [page 52](#)
- ☐ Removing and installing
⇒ [page 52](#)

7 - Bolt

- ☐ 40 Nm

8 - Bolt

- ☐ 42 Nm

9 - Engine support (right-side)

10 - Engine support (left-side)

11 - Bolt

- ☐ 42 Nm

12 - Bolt

- ☐ 40 Nm

13 - Engine mounting (left-side)

- ☐ With left electrohydraulic engine mounting solenoid valve - N144-
⇒ [page 51](#)
- ☐ Removing and installing ⇒ [page 51](#)

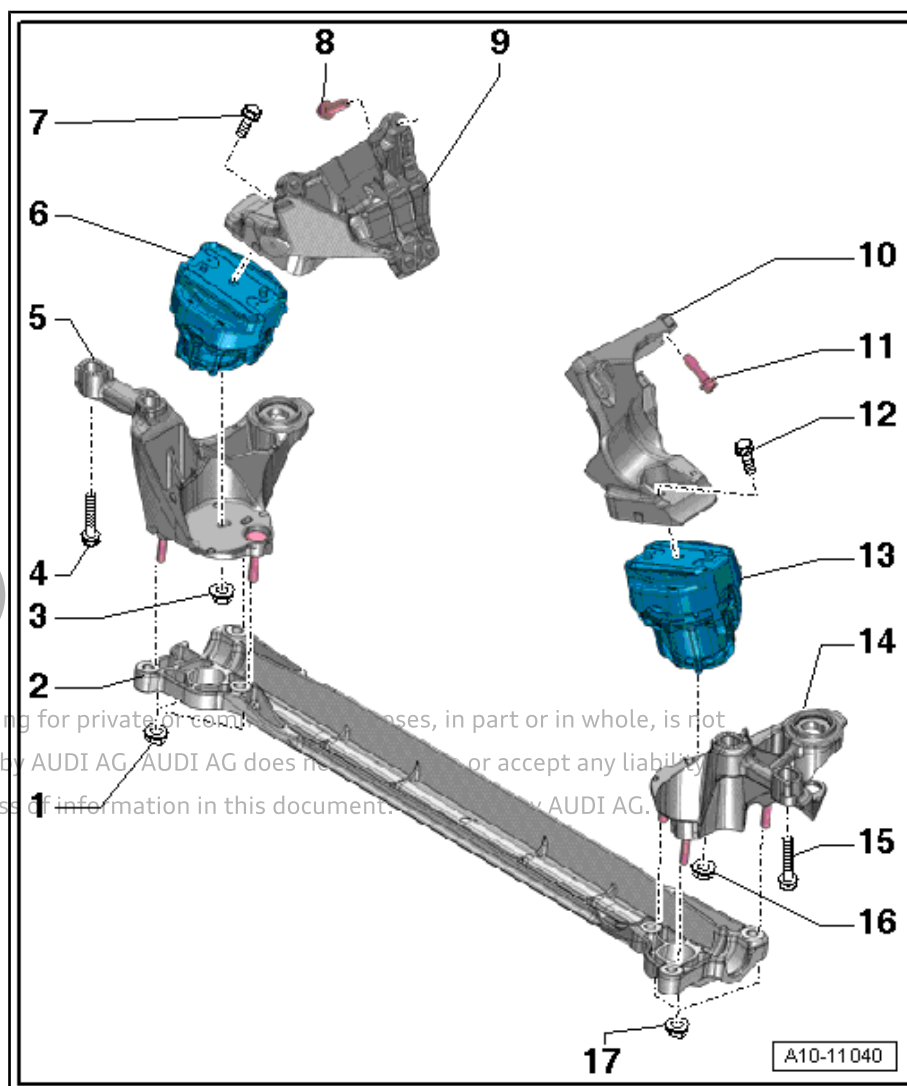
14 - Console for engine mounting (left-side)

15 - Bolt

- ☐ 75 Nm

16 - Nut

- ☐ Self-locking
- ☐ Renew
- ☐ 40 Nm





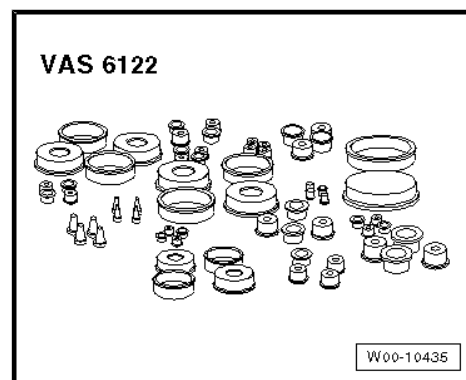
17 - Nut

- Tightening torque ⇒ Rep. gr. 40

5.2 Removing and installing engine mounting (left-side)

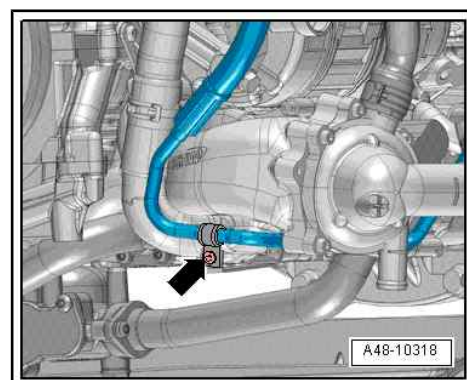
Special tools and workshop equipment required

- ◆ Engine bung set - VAS 6122-



Removing

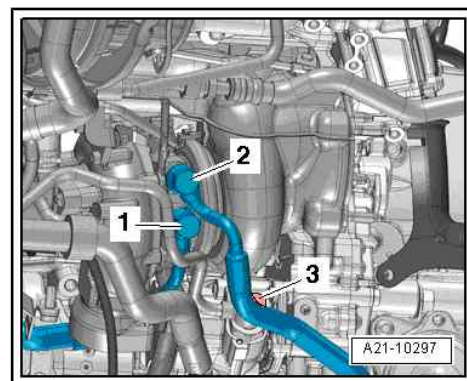
- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#).
- Remove bolt -arrow- at retaining clip for power steering hydraulic line.



Note

Lay a cloth under the separating point to catch escaping hydraulic fluid.

- Remove banjo bolt -3- and press power steering hydraulic line to side.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



Note

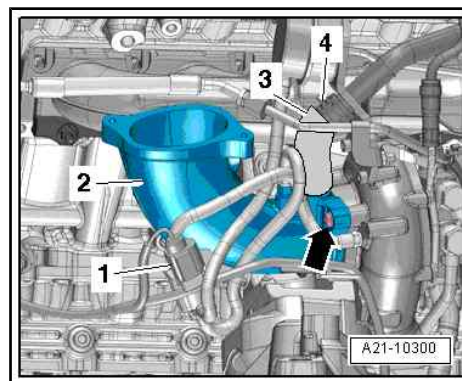
Disregard items -1 and 2-.



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- Unplug electrical connector -1- and detach heat insulation sleeve -3-.
- Remove bolt -arrow- and release hose clip -4-.
- Detach connection -2- from turbocharger and move clear to one side.



- Unplug electrical connector -3- on left electrohydraulic engine mounting solenoid valve - N144- .
- Remove nut -1- and detach console for engine mounting.
- Remove bolt -2- and remove engine mounting (left-side).



Note

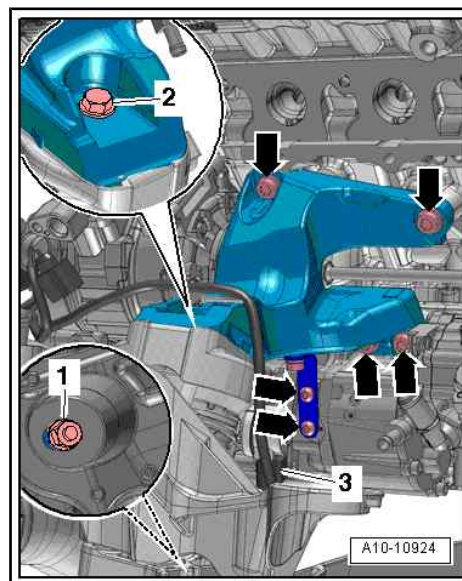
Disregard -arrows-.

Installing

- Tightening torques ⇒ [page 50](#)

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

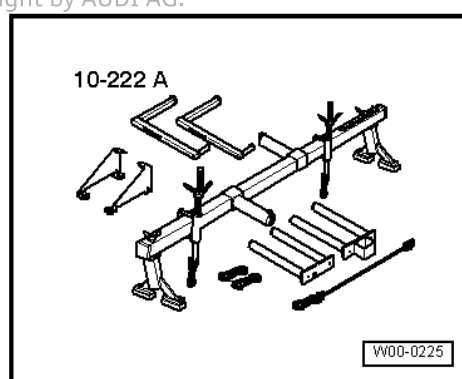
- Install connection for turbocharger ⇒ [page 232](#) .
- Install hydraulic fluid line for power steering ⇒ Rep. gr. 48 .



5.3 Removing and installing engine mounting (right-side)

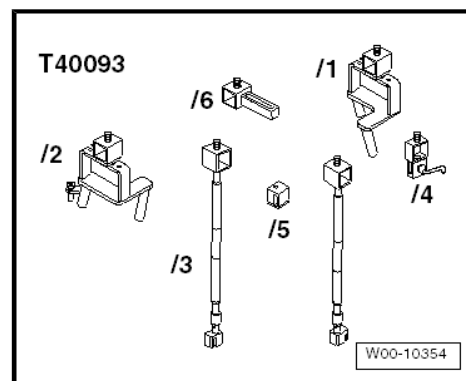
Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-





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



Removing



Caution

Risk of irreparable damage to electronic components.

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

- Disconnect battery ⇒ Electrical system; Rep. gr. 27 .
- Drain coolant ⇒ [page 195](#) .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove air cleaner housing (left and right) ⇒ Rep. gr. 24 .
- Remove bolts -arrows- and detach air duct -1-.



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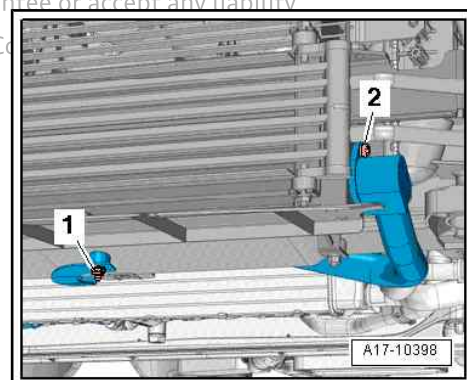
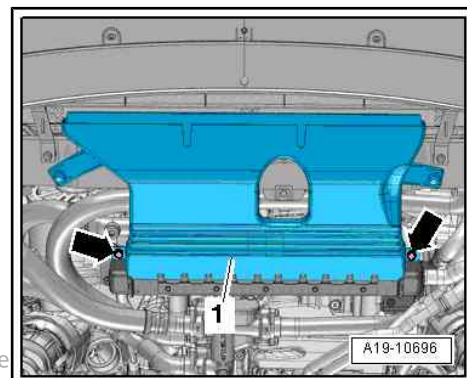
- Unscrew nut -1-.

with respect to the correctness of information in this document. Co



Note

Disregard -item 2-.



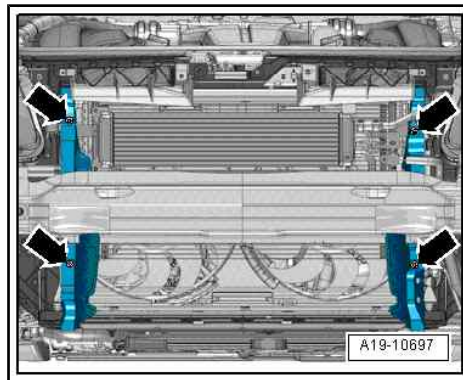


- Remove bolts -bottom arrows-.



Note

Disregard -top arrows-.

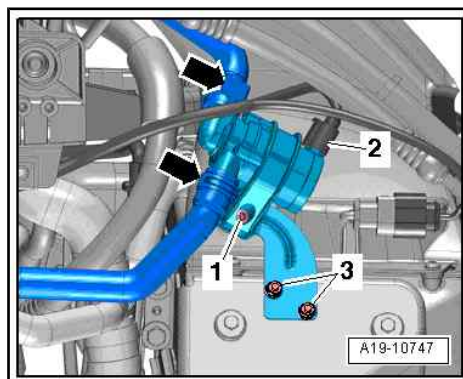


- Unplug electrical connector -2- at circulation pump 2 - V403- .



Note

Disregard items marked -1, 3- and -arrows-.



- Unplug electrical connector -1- and move clear.

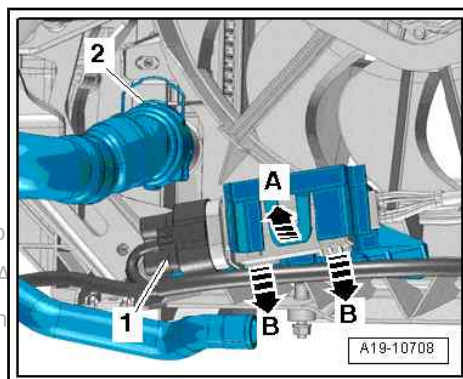


Note

-Item 2- and -arrows- can be disregarded.



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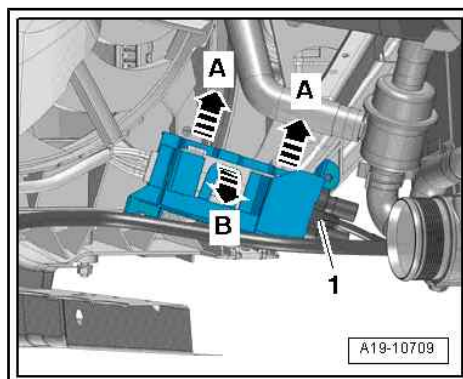


- Unplug electrical connector -1-.



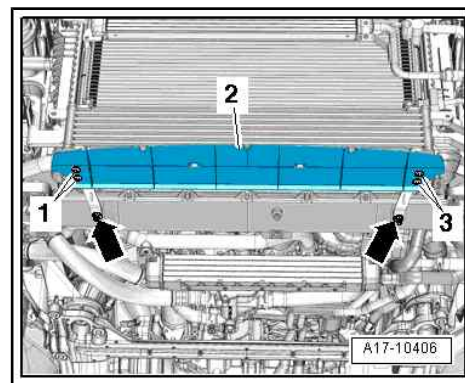
Note

Disregard -arrows-.





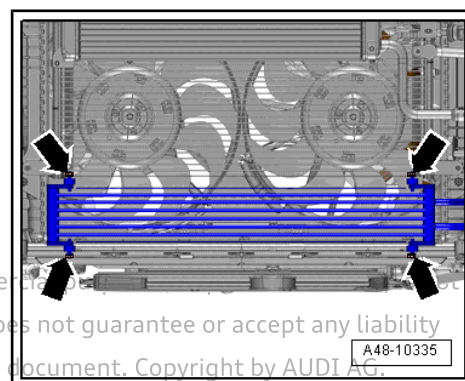
- Remove bolts -1- and -3-, detach air duct -2-.
- Slacken nuts -arrows-, do not remove.



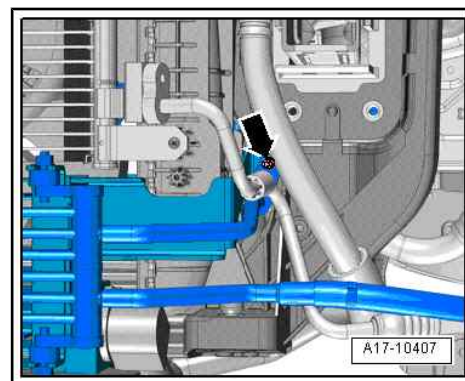
- Slacken nuts -arrows-, do not remove.



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- Remove nut -arrow- on both sides.
- Detach hydraulic fluid cooler for power steering from engine oil cooler.
- Engine oil cooler (front) remains suspended.
- Tie hydraulic fluid cooler onto bumper.

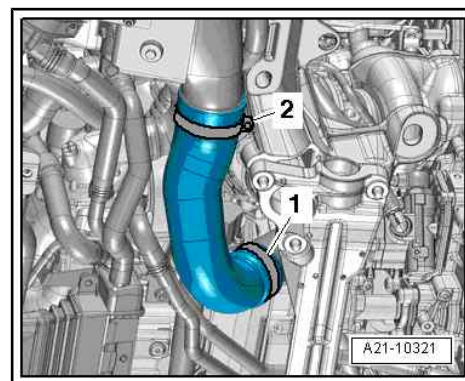


- Release hose clip -2- and detach air hose from charge air cooler (left-side).



Note

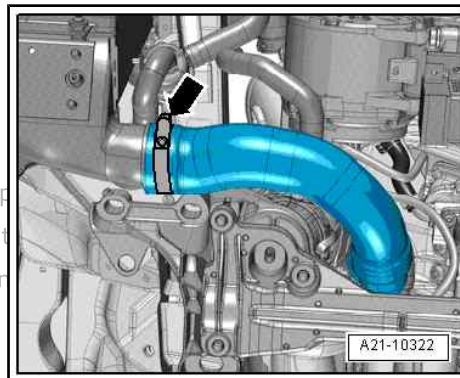
Disregard -item 1-.





- Release hose clip -arrow- and detach air hose from charge air cooler (right-side).

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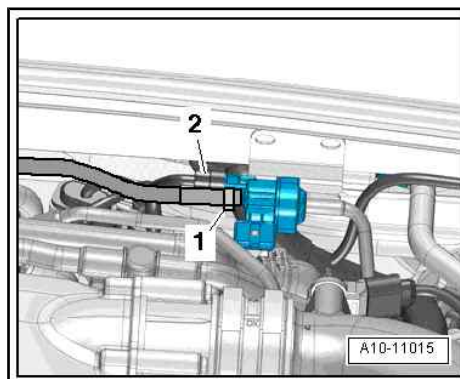


- Detach activated charcoal filter solenoid valve 1 - N80-item 2- from bracket and move it clear to the side.



Note

Disregard -item 1-.



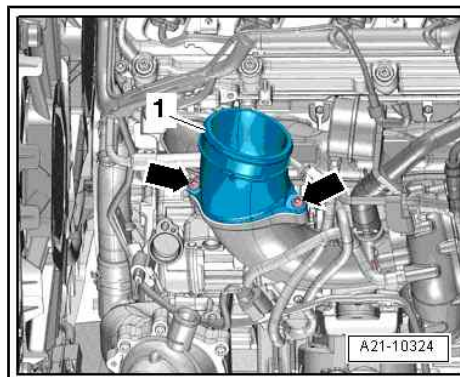
- Unscrew bolts -arrows- and remove intermediate flange -1-.



Caution

Risk of irreparable damage to turbocharger.

- ◆ ***Use adhesive tape to seal off connection for turbocharger to prevent small objects from dropping into the turbocharger.***

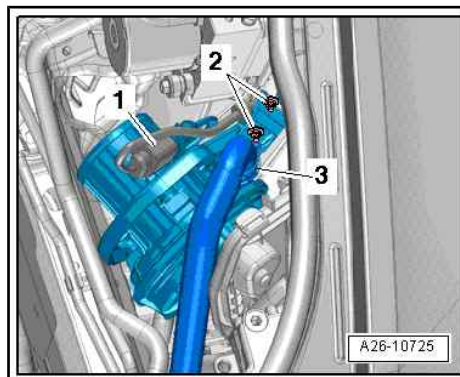


- Detach hose -3- for secondary air (press release tab).



Note

Disregard items -1 and 2-.

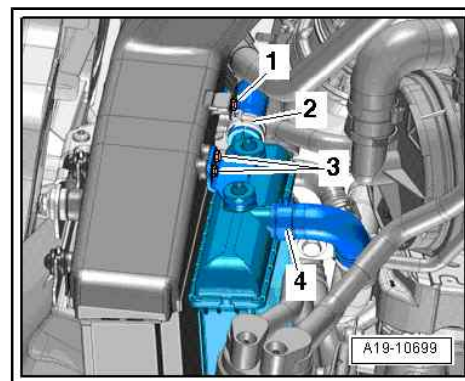




- Unscrew bolt -1- and detach bracket for hoses.
- Release hose clip -2- and detach coolant hose from radiator (left-side).

**Note**

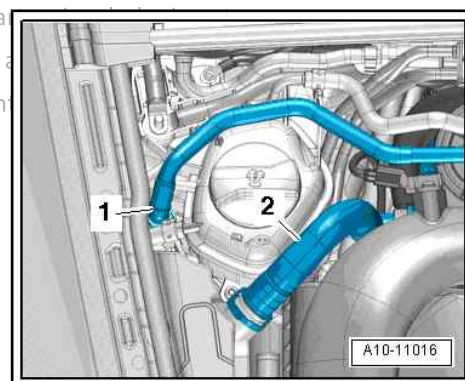
Disregard items -3 and 4-.



Press release tabs and detach crankcase breather hose -1-.

**Note**

Disregard -item 2-.

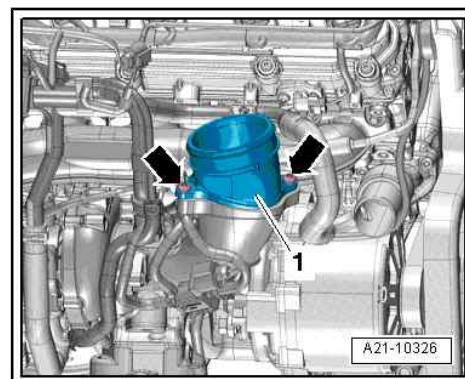


- Unscrew bolts -arrows- and remove intermediate flange -1-.

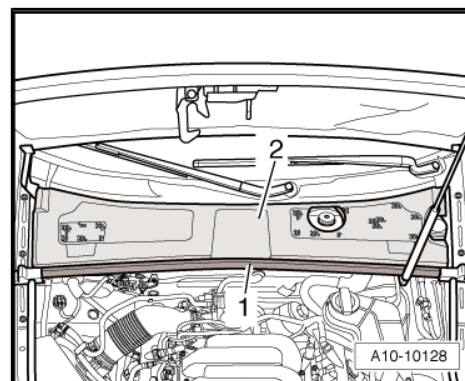
**Caution**

Risk of irreparable damage to turbocharger.

- ◆ ***Use adhesive tape to seal off connection for turbocharger to prevent small objects from dropping into the turbocharger.***

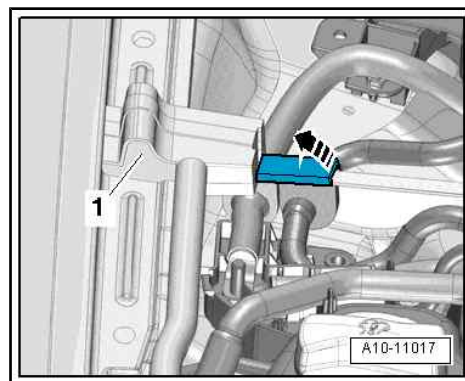


- Pull off seal -1- and remove plenum chamber cover -2-.

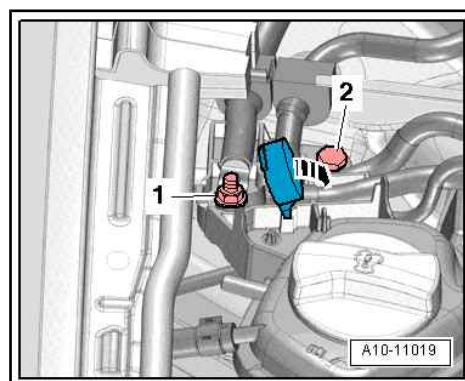




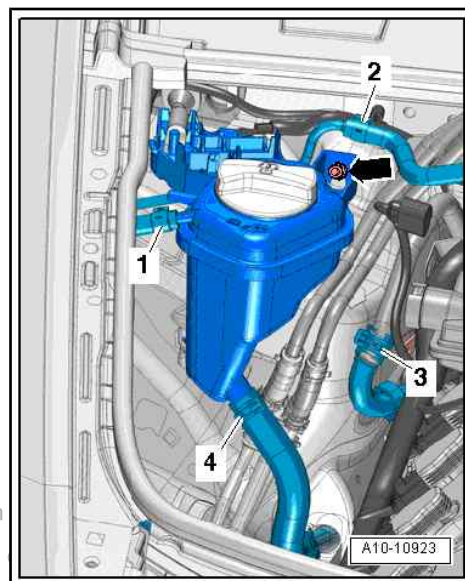
- Pull off sealing element -1-.
- Release and open lug for leadthrough -arrow-.



- Open cover above positive terminal -arrow-.
- Unscrew nut -1- for positive terminal and move positive wiring clear.
- Unscrew earth stud -2- and move earth wiring clear.



- Unscrew nut -arrow- and move coolant filler tank to one side (coolant hoses -1 ... 4- remain connected).



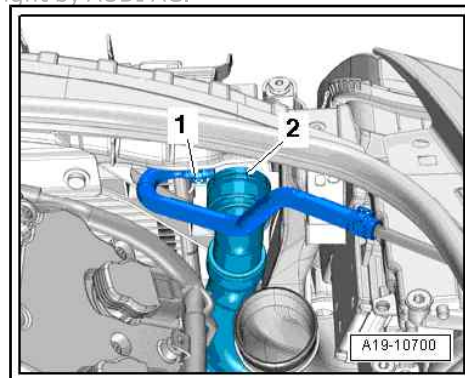
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- Disconnect coolant hose -2- (top right) from radiator (pull out retaining clip).



Note

Disregard -item 1-.





- Set up adapter - 10 - 222 A /4- with spindle - 10 - 222 A /11- (2x) and supports -T40093/1- and -T40093/2- on suspension turrets (left and right) as illustrated.

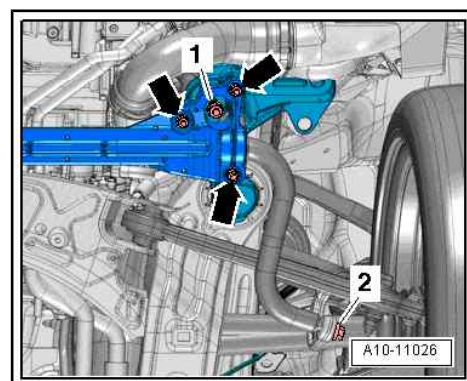
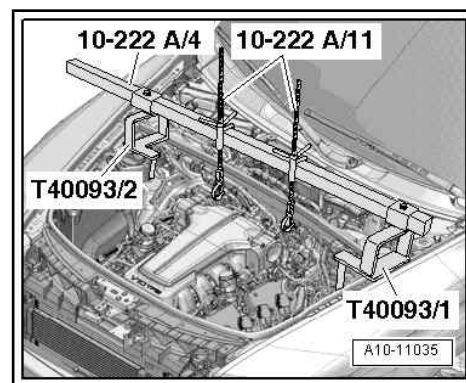
**Note**

The supports are marked for the left or right side of the vehicle.

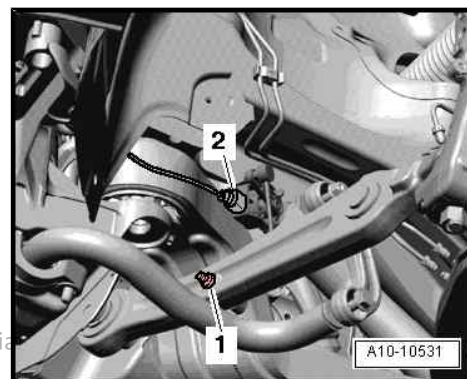
- Engage hooks - 10 - 222 A /10- at rear engine lifting eyes.
- Unscrew nuts -arrows- on both sides evenly and lower anti-roll bar.

**Note**

Disregard items -1 and 2-.



- Unplug electrical connector -2- at front left vehicle level sender - G78- .
- Remove nut -1- and detach coupling rod from track control link.



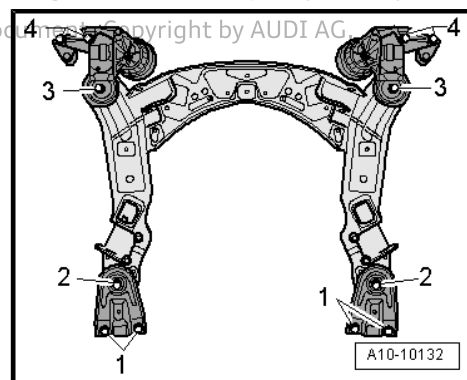
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**WARNING**

Accident risk if subframe mountings are detached.

◆ ***Subframe bolts -2- and -3- must not be loosened.***

- Remove bolts -3- and -4- and lower front part of subframe.

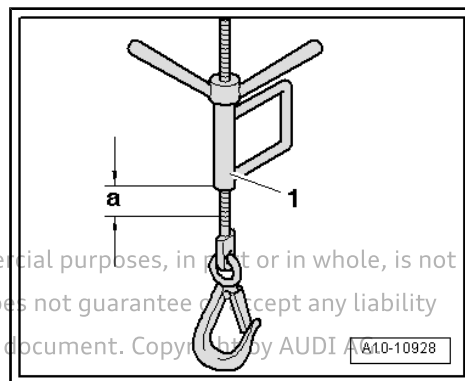




- Use spindles -10 - 222 A /11- to lower engine evenly on both sides through distance -a-.
- Dimension -a- = 30 mm



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- Remove nut -1- and detach console for engine mounting (right-side).
- Unplug electrical connector -2- for right electrohydraulic engine mounting solenoid valve - N145- .
- Remove bolt -3- and detach engine mounting (right-side).

**Note**

Disregard -arrows-.

Installing

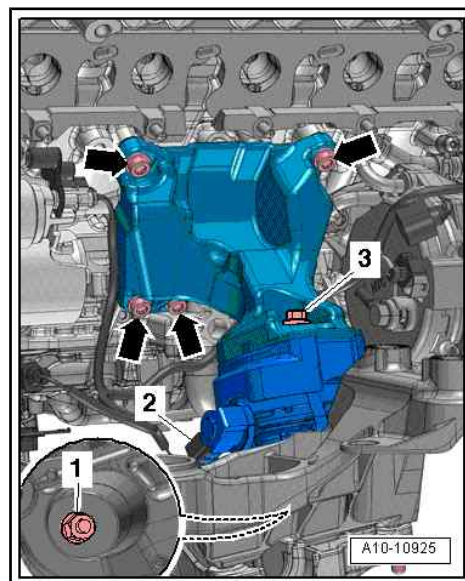
- Tightening torques ⇒ [page 50](#)

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

**Note**

- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
- ◆ *To ensure that there is enough clearance at the crash sensors, it is very important to observe the installation position of the hose clips at the air pipes ⇒ [page 243](#) .*

- Install subframe, front left vehicle level sender - G78- and anti-roll bar ⇒ Rep. gr. 40 .
- Tighten nut for positive terminal and tighten earth stud ⇒ [page 42](#) .
- Install intermediate flange and air cleaner housing ⇒ Rep. gr. 24 .
- Install engine oil cooler (front) ⇒ [page 180](#) .
- Observe notes on procedure for connecting the battery ⇒ Electrical system; Rep. gr. 27 .
- Fill up with coolant ⇒ [page 197](#) .





13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Exploded view - poly V-belt drive

1 - Bolt

- ☐ 55 Nm

2 - Bolt

- ☐ 28 Nm

3 - Poly V-belt tensioner

- ☐ Removing and installing
⇒ [page 65](#)

4 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Removing and installing
⇒ [page 62](#)
- ☐ Do not kink
- ☐ When installing, make sure it is properly seated on pulleys

5 - Cover for idler roller

6 - Bolt

- ☐ 22 Nm

7 - Bolt

- ☐ Tightening torque ⇒
Electrical system; Rep.
gr. 27

8 - Alternator

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

9 - Bolt

- ☐ 42 Nm

10 - Bracket for alternator

11 - Dowel sleeve

- ☐ For bracket for alternator
- ☐ 2x

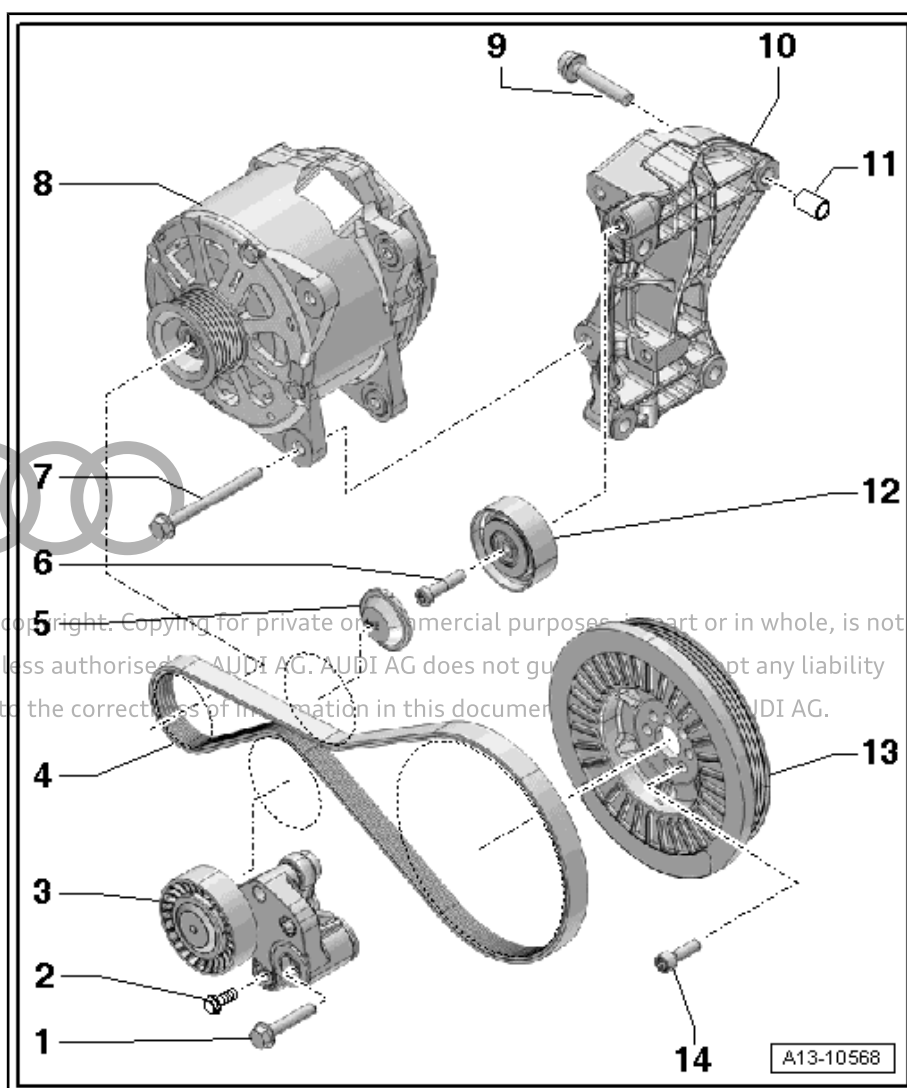
12 - Idler roller for poly V-belt

13 - Vibration damper

- ☐ Must always be renewed if bolts are loosened
- ☐ Removing and installing ⇒ [page 66](#)

14 - Bolt

- ☐ Renew



A13-10568



- ❑ Apply locking fluid when installing non-self-locking bolts; refer to ⇒ Electronic parts catalogue for locking fluid
- ❑ Tightening torque and sequence ⇒ [page 62](#)

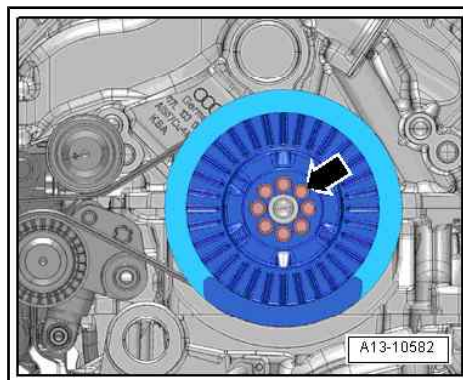
Vibration damper - tightening torque and sequence



Note

- ◆ Always renew the vibration damper if the bolts have been loosened.
- ◆ Replace the vibration damper bolts -arrow- with new bolts of the correct type (same as original equipment) ⇒ Electronic parts catalogue .
- Apply locking fluid when installing non-self-locking bolts; for locking fluid, refer to ⇒ Electronic parts catalogue .
- Tighten bolts in 3 stages as follows:

Stage	Bolts	Tightening torque/tightening angle
1.	-arrow-	15 Nm in diagonal sequence
2.	-arrow-	22 Nm in diagonal sequence
3.	-arrow-	Turn 90° further in diagonal sequence

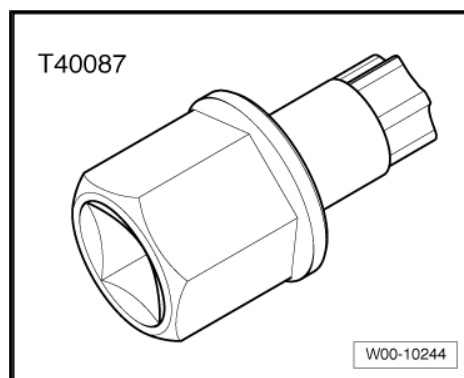


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1.2 Removing and installing poly V-belt

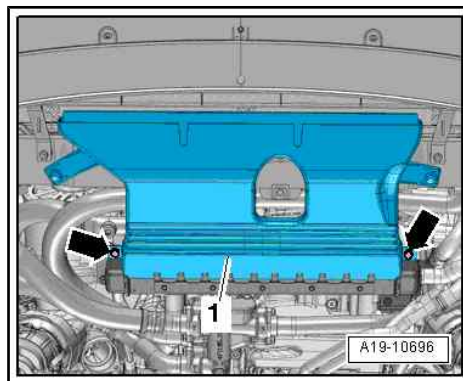
Special tools and workshop equipment required

- ◆ Socket Torx T60 - T40087-



Removing

- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove bolts -arrows- and detach air duct -1-.



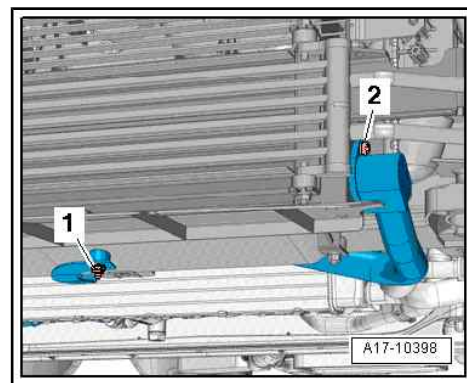


- Unscrew nut -1-.



Note

Disregard -item 2-.

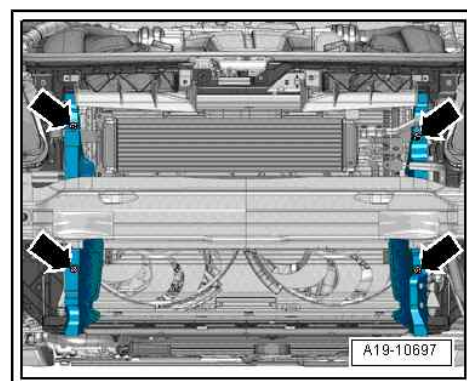


- Remove bolts -bottom arrows-.



Note

Disregard -top arrows-.

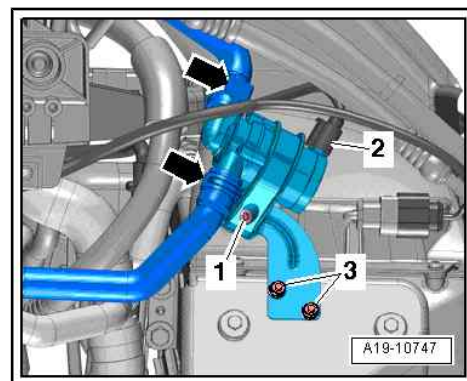


- Unplug electrical connector -2- at circulation pump 2 - V403- .



Note

Disregard items marked -1, 3- and -arrows-.

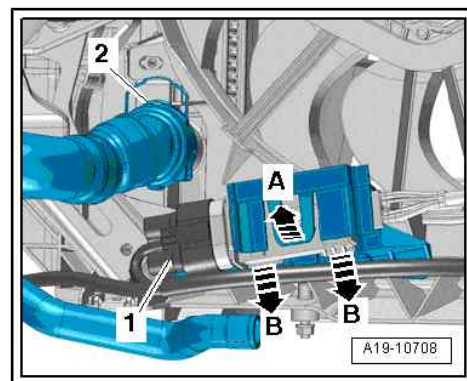


- Unplug electrical connector -1- and move clear.



Note

-Item 2- and -arrows- can be disregarded.



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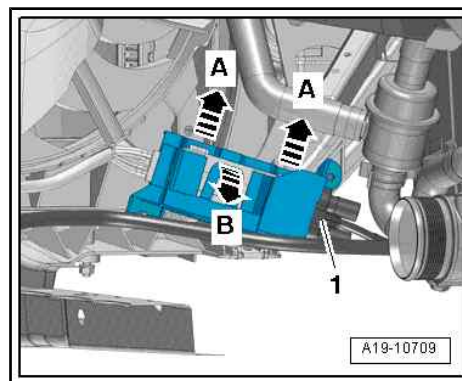


- Unplug electrical connector -1-.



Note

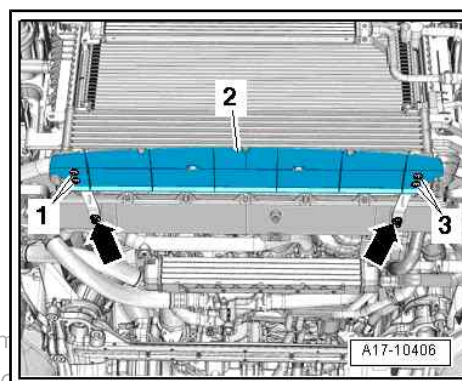
Disregard -arrows-.



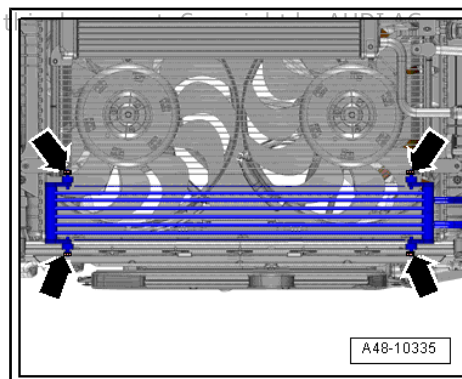
- Remove bolts -1- and -3-, detach air duct -2-.
- Slacken nuts -arrows-, do not remove.



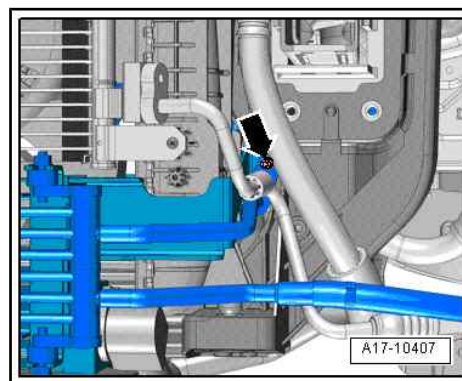
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- Slacken nuts -arrows-, do not remove.



- Remove nut -arrow- on both sides.
- Detach hydraulic fluid cooler for power steering from engine oil cooler.
- Engine oil cooler (front) remains suspended.
- Tie hydraulic fluid cooler onto bumper.



**Caution**

Running a used poly V-belt in the opposite direction could cause irreparable damage.

- ◆ *Before removing the poly V-belt, mark the direction of rotation with chalk or a felt-tip pen for re-installation.*

- To slacken poly V-belt turn tensioner in anti-clockwise direction -arrow-.
- Remove poly V-belt and release tensioner.

Installing

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

- Fit poly V-belt -2- onto pulleys in the following sequence:
- 1 - Alternator
- 3 - Idler roller
- 4 - Vibration damper
- 5 - Tensioner



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**Note**

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

- Install engine oil cooler (front) ⇒ [page 180](#) .
- Start engine and check that poly V-belt runs properly.

1.3 Removing and installing tensioner for poly V-belt

Removing

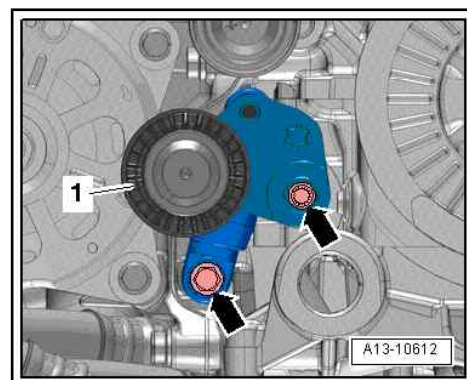
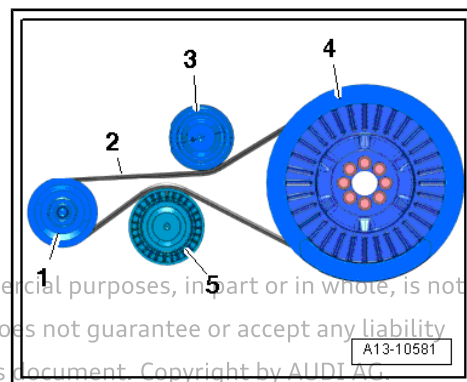
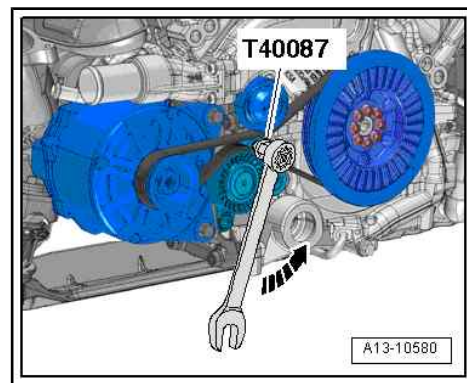
- Remove poly V-belt ⇒ [page 62](#) .
- Remove bolts -arrows- and take off tensioner -1-.

Installing

- Tightening torque ⇒ [page 61](#)

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

- Install poly V-belt ⇒ [page 62](#) .





1.4 Removing and installing vibration damper

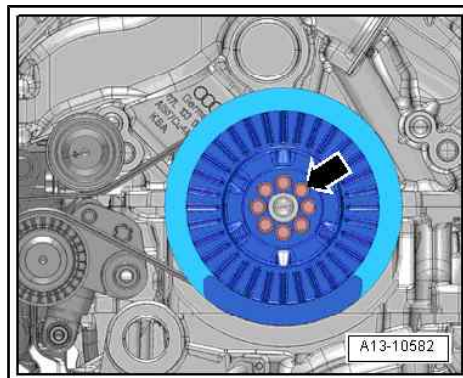
Removing

- Remove radiator (centre) ⇒ [page 221](#) .
- Slacken off bolts -arrow- on vibration damper several turns (counterhold with ring spanner on nut for poly V-belt pulley for alternator).
- Remove poly V-belt ⇒ [page 62](#) .
- Remove bolts completely and take off vibration damper.

Installing

- Tightening torque ⇒ [page 61](#)

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



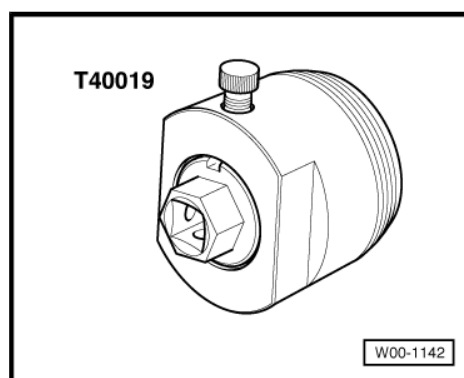
Note

- ◆ *Always renew the vibration damper if the bolts have been loosened.*
- ◆ *Replace vibration damper bolts with new bolts of the correct type (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- Apply locking fluid when installing non-self-locking bolts; for locking fluid, refer to ⇒ [Electronic parts catalogue](#) .
- The vibration damper can only be fitted in one position.
- Install poly V-belt ⇒ [page 62](#) .
- Install radiator (centre) ⇒ [page 221](#) .
- Fill up with coolant ⇒ [page 197](#) .

1.5 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

- ◆ Oil seal extractor - T40019-

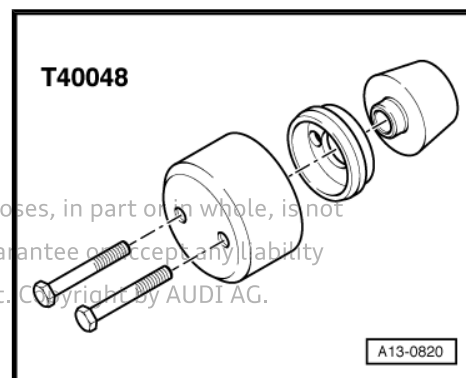




◆ Assembly tool - T40048-



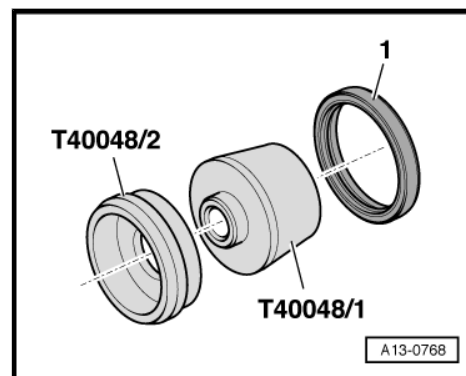
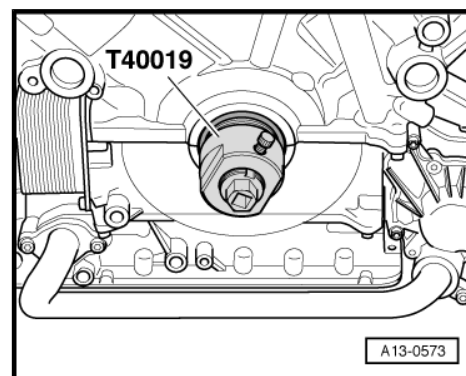
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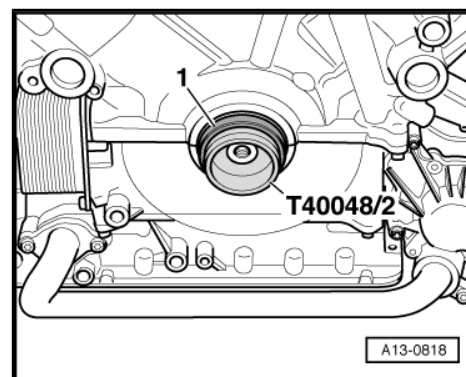
◆ 2x bolt M8x55

Procedure

- Remove vibration damper ➔ [page 66](#) .
- Adjust inner part of oil seal extractor -T40019- so it is flush with the outer part and lock in position with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface.
- Fit assembly aid -T40048/1- onto assembly sleeve -T40048/2- and slide oil seal -1- onto assembly sleeve.
- Detach assembly aid.

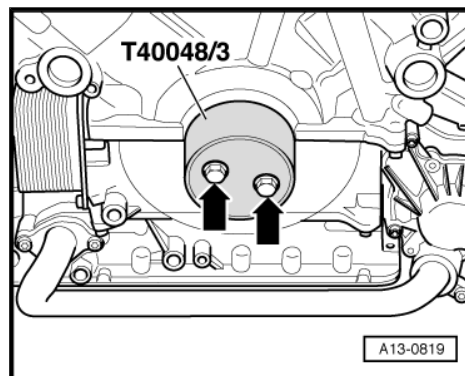


- Fit assembly sleeve -T40048/2- on crankshaft and slide oil seal -1- into sealing surface in cylinder block.
- Leave assembly sleeve in position on crankshaft for pressing in seal.





- Apply press sleeve -T40048/3- to crankshaft using two M8×55 mm bolts -arrows-.
- Initially screw in bolts by hand until they make contact.
- Tighten bolts alternately, 180° at a time, to press in oil seal onto stop.
- Install vibration damper ⇒ [page 66](#) .



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2 Cylinder block (gearbox end)



Note

When carrying out repairs, secure engine with bracket - VAS 6095/1-8- to engine and gearbox support - VAS 6095- ⇒ [page 39](#).

2.1 Exploded view - drive plate

1 - Washer

- ☐ 3.4 mm thick
- ☐ Mark installation position for re-installation

2 - Bolt

- ☐ Renew
- ☐ 60 Nm +90°

3 - Drive plate

- ☐ Removing and installing ⇒ [page 69](#)
- ☐ Can only be installed in one position (holes are off-set).

4 - Crankshaft

5 - Centring sleeve for torque converter

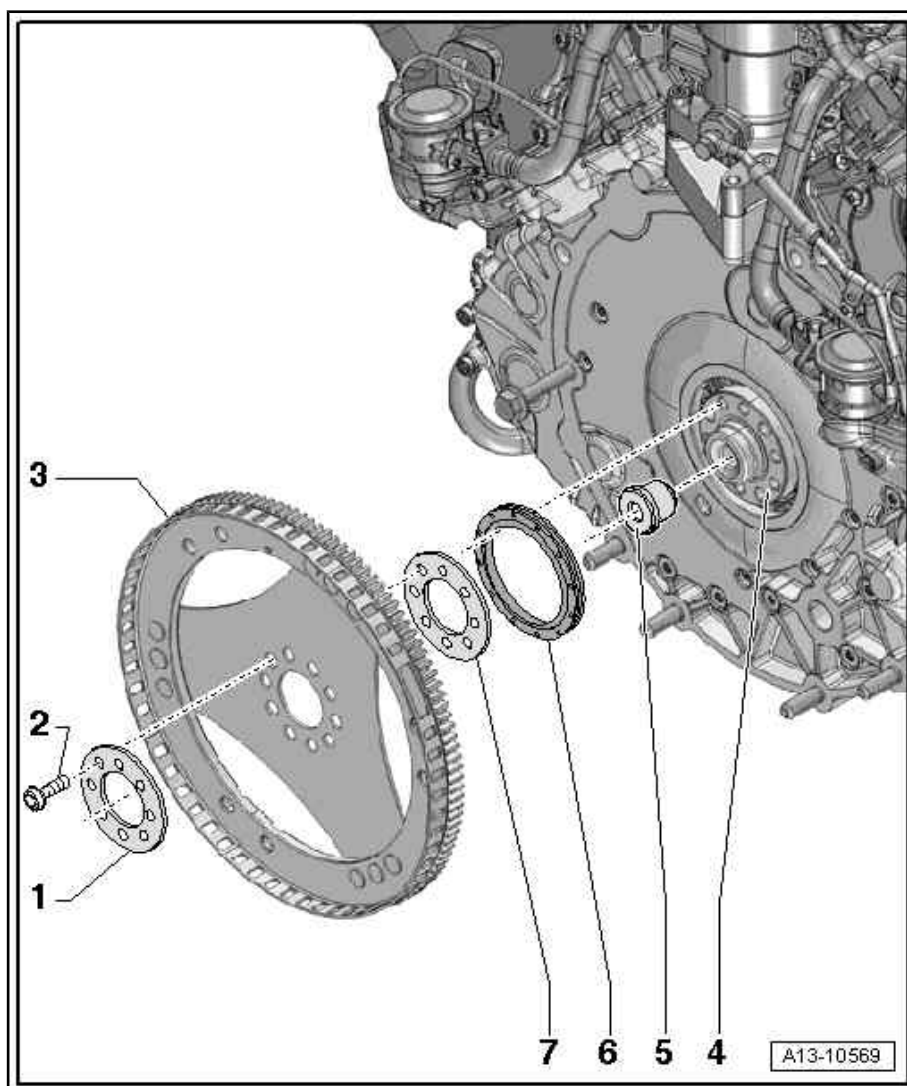
- ☐ Ensure proper fitting in crankshaft

6 - Crankshaft oil seal (gearbox end)

- ☐ Renewing ⇒ [page 70](#)

7 - Spacer

- ☐ 1.5 mm thick
- ☐ Mark installation position for re-installation



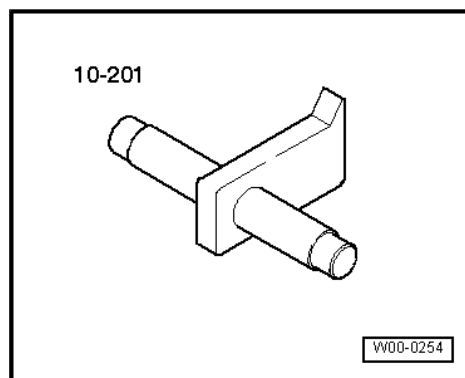
2.2 Removing and installing drive plate

Special tools and workshop equipment required

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◆ Counterhold tool - 10 - 201-

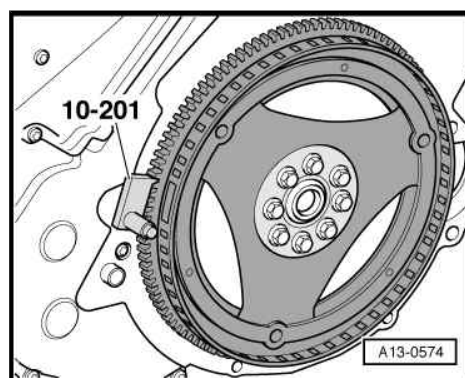
**Removing**

- Engine removed, engine separated from gearbox ⇒ [page 32](#).
- Insert counterhold tool - 10 - 201- to slacken bolts.

**Caution**

Take care not to damage outer surface of bearing flange on drive plate.

- ◆ *Use a multi-point socket bit with a length of at least 40 mm to slacken and tighten the drive plate bolts.*



- Remove bolts and take off drive plate.

Installing

- Tightening torque ⇒ [page 69](#)

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

**Note**

Renew bolts for drive plate.

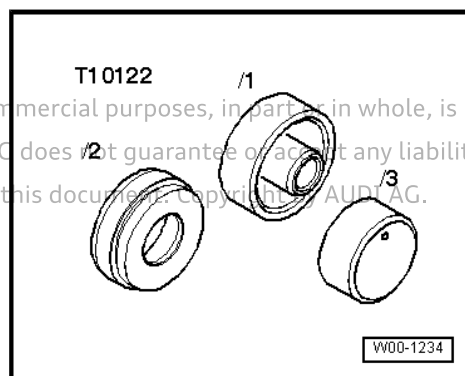
- Can only be installed in one position (holes are off-set)
- Fit counterhold tool - 10 - 201- the other way round to tighten bolts.

2.3 Renewing crankshaft oil seal (gearbox end)

Special tools and workshop equipment required

- ◆ Fitting tool - T10122-

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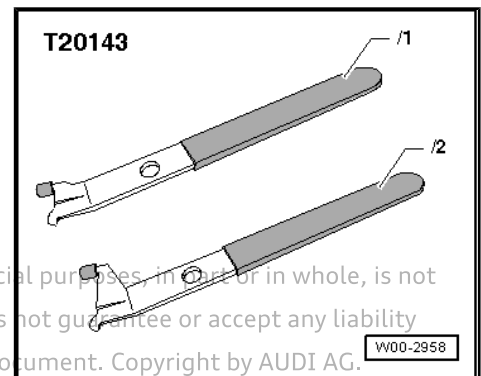




◆ Extractor hooks - T20143-

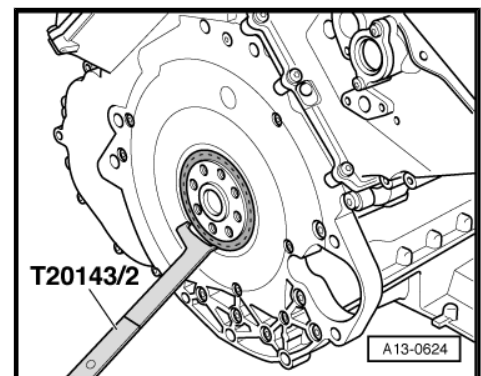


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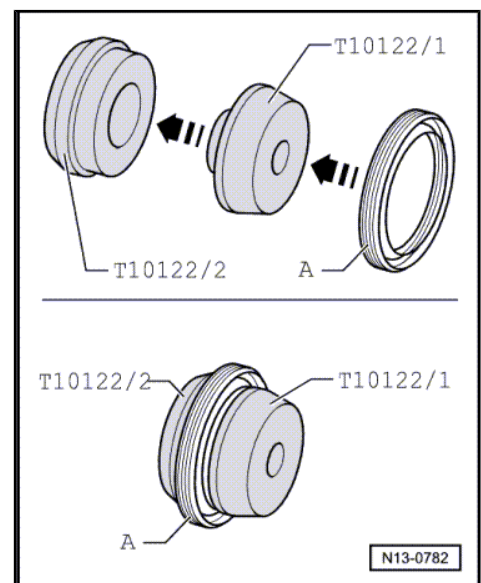


Procedure

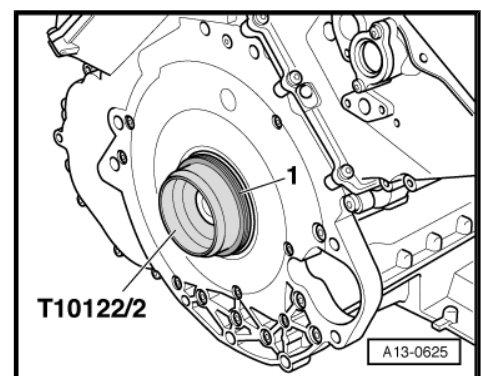
- Engine removed, engine separated from gearbox ⇒ [page 32](#) .
- Remove drive plate ⇒ [page 69](#) .
- Pry out oil seal using extractor hook -T20143/2- .
- Clean contact surface and sealing surface.



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



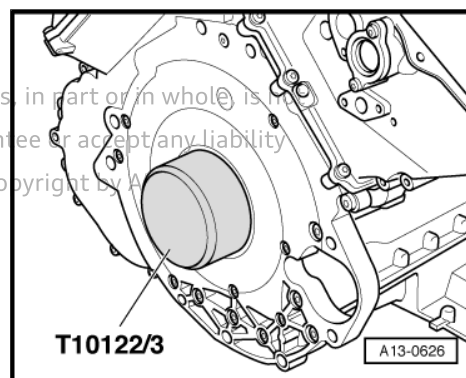
- Fit assembly sleeve -T10122/2- with oil seal -1- onto crankshaft.





- Press in oil seal uniformly until flush all round using thrust piece -T10122/3- .
- Install drive plate ➤ [page 69](#)

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3 Crankshaft



Note

When carrying out repairs, secure engine with bracket - VAS 6095/1-8- to engine and gearbox support - VAS 6095- ⇒ [page 39](#).

3.1 Exploded view - crankshaft

1 - Cylinder block

- ☐ Matched to -item 5-
- ☐ Applying sealant onto cylinder block - retaining frame side ⇒ [page 76](#)

2 - Dowel sleeve

- ☐ 3x
- ☐ Fit in retaining frame - cylinder block side
- ☐ Installation position ⇒ [page 75](#)

3 - Gasket

- ☐ Renew

4 - Oil seal for crankshaft (pulley end)

- ☐ Renewing ⇒ [page 66](#)

5 - Retaining frame

- ☐ Matched to -item 1-
- ☐ Applying sealant onto retaining frame - intake module side ⇒ [page 76](#)
- ☐ Tightening sequence ⇒ [page 77](#)

6 - Seal

- ☐ Renew

7 - O-ring

- ☐ Renew

8 - Dowel sleeve

- ☐ 2x
- ☐ Fit in retaining frame - intake module side
- ☐ Installation position ⇒ [page 75](#)

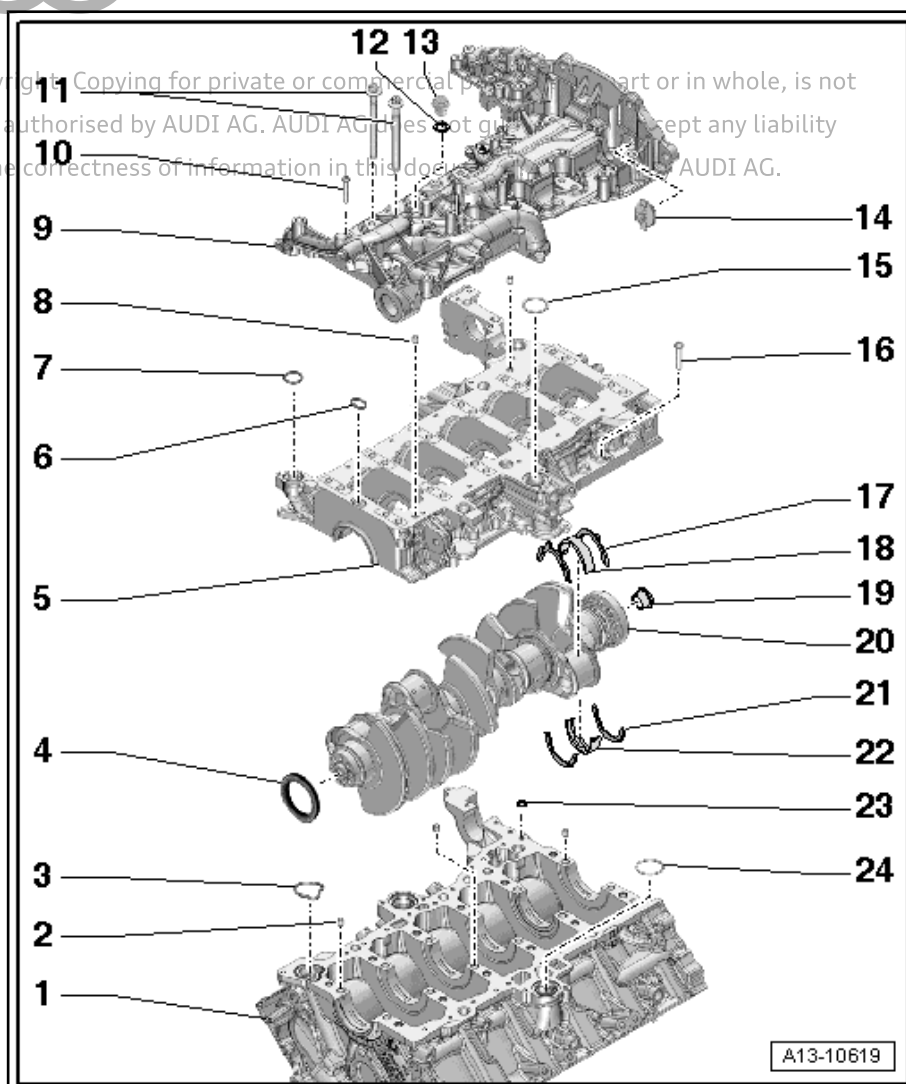
9 - Intake module

10 - Bolt

- ☐ For sealing surfaces between intake module and retaining frame
- ☐ Tightening torque and sequence ⇒ [page 77](#)

11 - Bolts

- ☐ Renew
- ☐ Different lengths





- ☐ Tightening torque and sequence ⇒ [page 77](#)

12 - Seal

- ☐ Renew

13 - Plug

- ☐ For "TDC" marking on crankshaft
- ☐ 45 Nm

14 - Sealing plug

15 - O-ring

- ☐ Renew

16 - Bolt

- ☐ For sealing surfaces: retaining frame to cylinder block
- ☐ Tightening torques and tightening sequence ⇒ [page 77](#)

17 - Thrust washer

- ☐ Only fitted on 5th crankshaft bearing
- ☐ Oil grooves face outwards
- ☐ Make sure it engages in retaining frame

18 - Bearing shell

- ☐ For retaining frame (without oil groove)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed
- ☐ Fit new bearing shells for retaining frame with the correct colour coding: new crankshaft ⇒ [page 77](#) , used and machined crankshaft ⇒ [page 79](#)

19 - Centring sleeve for torque converter

- ☐ Ensure proper fitting in crankshaft

20 - Crankshaft

- ☐ Measuring axial clearance ⇒ [page 79](#)
- ☐ Measuring radial clearance ⇒ [page 80](#)
- ☐ Crankshaft dimensions ⇒ [page 79](#)

21 - Thrust washer

- ☐ Only fitted on 5th crankshaft bearing
- ☐ Oil grooves face outwards

22 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed
- ☐ Fit new bearing shells for cylinder block with the correct colour coding: for new crankshafts ⇒ [page 77](#) , for used and machined crankshafts ⇒ [page 79](#)

23 - O-ring

- ☐ Renew

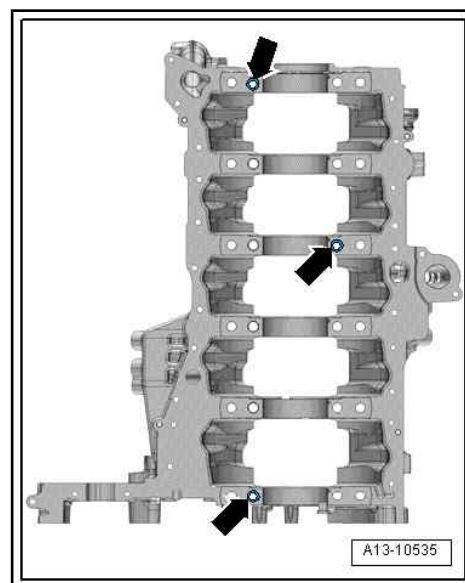
24 - Seal

- ☐ Renew



Installation position of dowel sleeves in retaining frame - cylinder block side

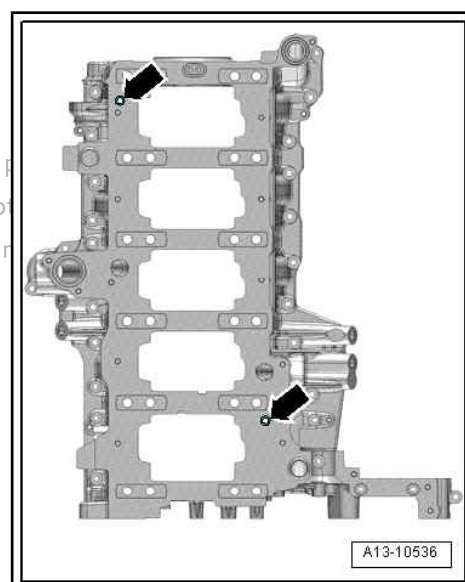
- Check that dowel sleeves -arrows- are inserted in retaining frame at positions shown in illustration.



Installation position of dowel sleeves in retaining frame - intake module side

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

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Applying sealant onto cylinder block - retaining frame side

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



Caution

Make sure lubrication system is not clogged by excess sealant.

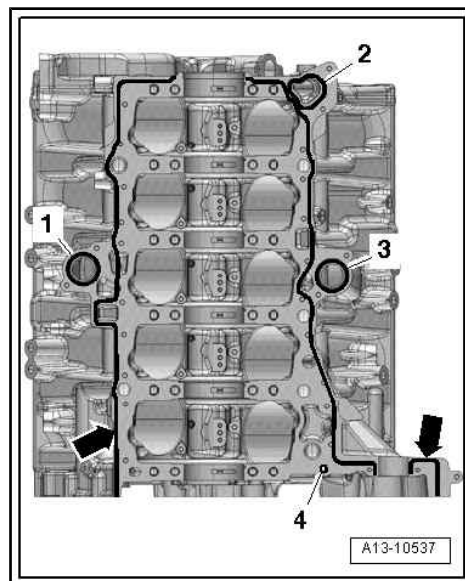
- ♦ ***The sealant bead must not be thicker than specified.***

- Apply sealant beads -arrows- onto clean sealing surfaces of cylinder block as shown in illustration.
- Width of sealant beads: 2.0 mm.
- Fit seals -1 ... 3-.



Note

When installing coolant flange ⇒ [Item 25 \(page 163\)](#) , fit O-ring -4-.



Applying sealant onto retaining frame - intake module side

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

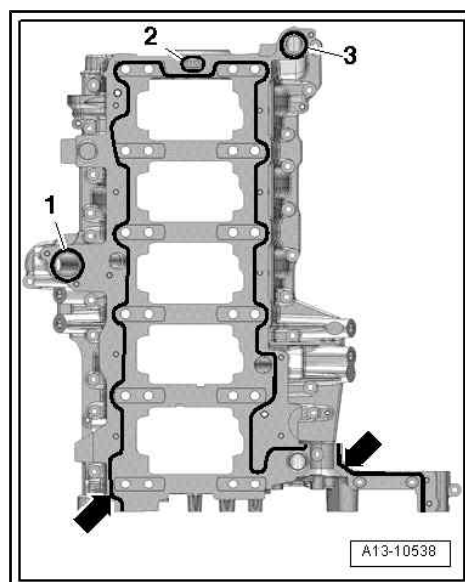


Caution

Make sure lubrication system is not clogged by excess sealant.

- ♦ ***The sealant beads must not be thicker than specified.***

- Apply sealant beads -arrows- onto clean sealing surfaces of retaining frame as shown in illustration.
- Width of sealant beads: 2.0 mm.
- Fit seals -1, 2, 3-.



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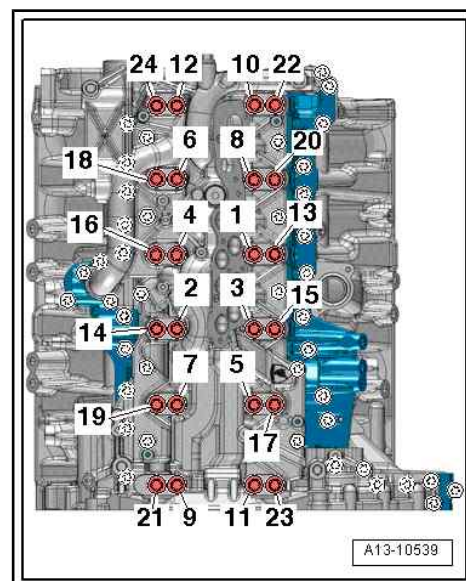


Installing retaining frame and intake module

- Renew bolts -1 ... 24- for retaining frame.
- Tighten bolts in 6 stages in the sequence shown:

Stage	Bolts	Tightening torque/tightening angle
1.	-1 ... 12-	30 Nm
2.	-13 ... 24-	20 Nm
3.	-1 ... 12-	50 Nm
4.	-13 ... 24-	40 Nm
5.	-1 ... 12-	Turn 180° further
6.	-13 ... 24-	Turn 135° further

- Tighten bolts for sealing surfaces between cylinder block and retaining frame -shaded white- to 9 Nm in diagonal sequence.



3.2 Allocation of main bearing shells for new crankshaft

Allocation of crankshaft bearing shells for 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 cylinder block is indicated by letters on the front left of the cylinder block (legible from outside), as shown in illustration.

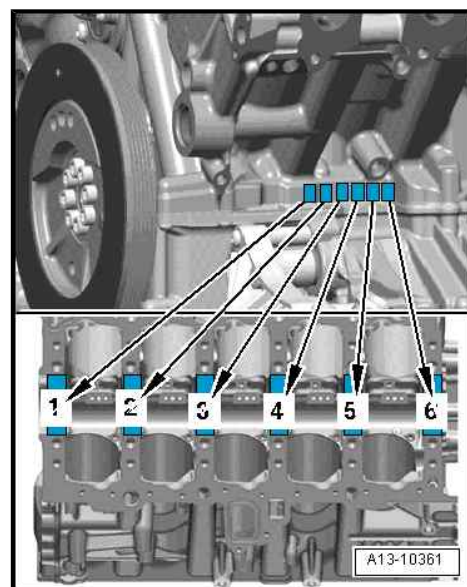
Letter on cylinder block	Colour coding of bearing
R =	Red
G =	Yellow
B =	Blue



Note

The code letters are also stamped on the retaining frame.

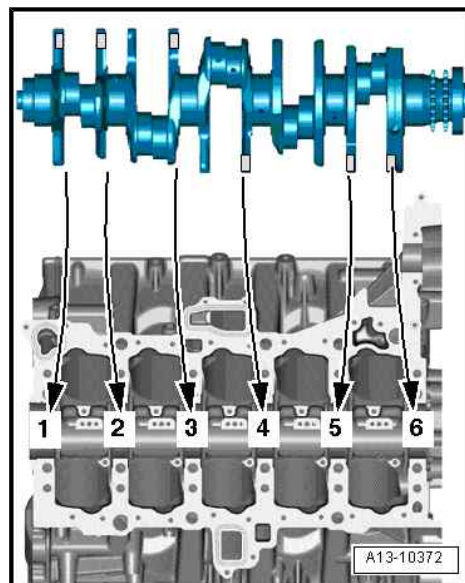
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**Allocation of crankshaft bearing shells for retaining frame - version 1**

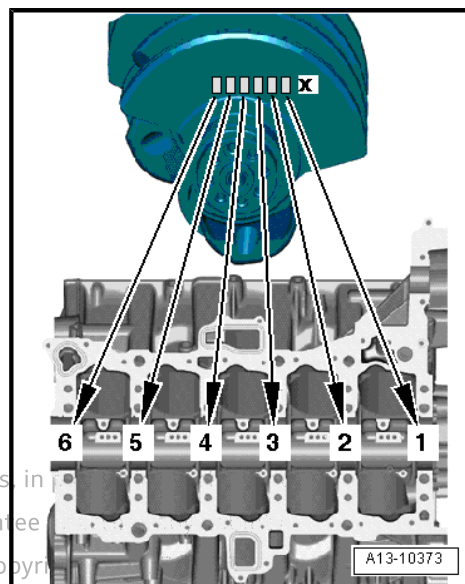
- ◆ Bearing shells of the correct thickness are matched to the bearings in the retaining frame at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- ◆ The allocation of the bearing shells to the retaining frame is indicated by colour codings on the crankshaft webs, as shown in the illustration.

Coloured marking on crankshaft	Colour coding of bearing
Red	Red
Yellow	Yellow
Blue	Blue

**Allocation of crankshaft bearing shells for retaining frame - version 2**

- ◆ 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 retaining frame is indicated by letters on the front crankshaft web, as shown in illustration. The "X" indicates the end of the row of letters and is next to the colour coding for bearing 1 (pulley end).

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



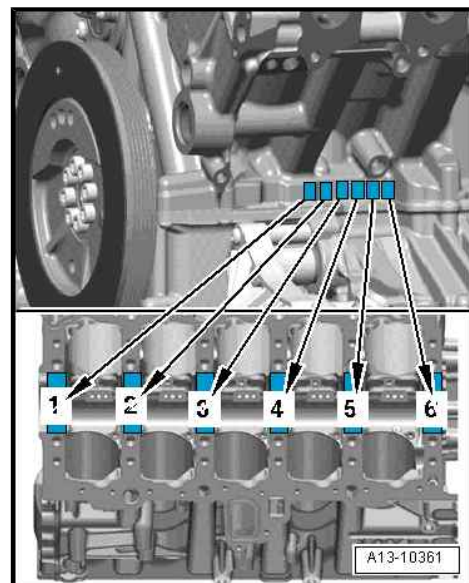


3.3 Allocation of main bearing shells on used and machined crankshafts

Matching crankshaft bearing shells to bearings in cylinder block

- ◆ Bearing shells are allocated to the cylinder block according to the colour codes stamped on the cylinder block.
- ◆ On a used or machined crankshaft, the main bearing journals must be measured in order to allocate the correct bearing shells.
- ◆ Basic dimension for main bearing journal = $\varnothing$ 65.00 mm
- ◆ Repair undersize for main bearing journal = $\varnothing$ 64.75 mm
- ◆ There are oversized (thicker) bearing shells available for machined crankshafts. These bearing shells have the same coloured marking as the original size bearing shells.

Letter on cylinder block	Colour coding of bearing
R =	Red
G =	Yellow
B =	Blue



Matching crankshaft bearing shells to bearings in retaining frame

- ◆ On a used and machined crankshaft, the main bearing journals must be measured in order to allocate the correct bearing shells.
- ◆ Any markings still visible on a machined crankshaft are invalid.
- ◆ Allocate the bearing shells according to the measured diameter of the crankshaft main bearing journals as follows:

Main bearing journal $\varnothing$	Colour code of bearing shells for retaining frame		
Dimensions in mm	Red	Yellow	Blue
Basic dimension 67.000	66.978 ... 66.972	66.972 ... 66.965	66.965 ... 66.958
Repair undersize 66.750 ¹⁾	66.728 ... 66.722	66.722 ... 66.715	66.715 ... 66.708

• ¹⁾ The colour codes for the oversized (thicker) bearing shells required for a machined crankshaft are the same as those on bearing shells for a new crankshaft, in spite of the greater bearing thickness.

3.4 Crankshaft dimensions

Honing dimension	Crankshaft bearing journal $\varnothing$ mm	Crankshaft conrod journal $\varnothing$ mm
Basic dimension	67.000 - 0.022 - 0.042	56.000 - 0.022 - 0.042
Repair oversize	66.750 - 0.022 - 0.042	55.750 - 0.022 - 0.042

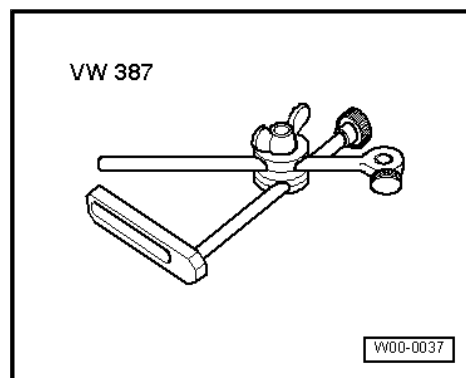
3.5 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

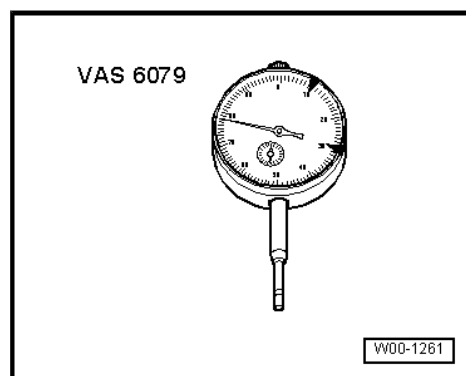
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- ◆ Universal dial gauge bracket - VW 387-

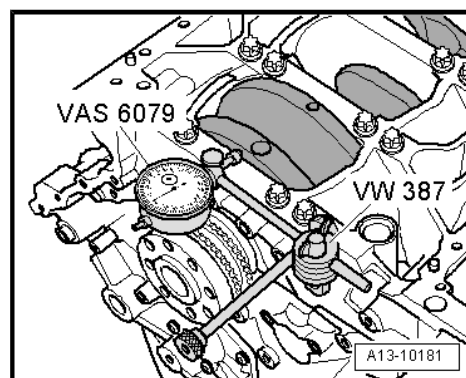


- ◆ Dial gauge - VAS 6079-



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.
- Set dial gauge to "0".
- Push crankshaft away from dial gauge and read off value.
- Axial clearance: 0.090 ... 0.158 mm



3.6 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Plastigauge

Procedure



Note



- ◆ *Mark used bearing shells for re-installation (but do not mark bearing surface).*

- ◆ *Bearing shells worn down to the base 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 in the bearing shell.
- The Plastigauge must be positioned in the centre of the bearing shell.



- Fit retaining frame and tighten to 30 Nm. Do not rotate crankshaft.
- Remove retaining frame again.
- Compare width of Plastigauge with measurement scale.

Radial clearance:

- New: 0.018 ... 0.046 mm.
- Wear limit: 0.08 mm.



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4 Pistons and conrods



Note

Oil spray jet for piston cooling ⇒ [page 85](#).

4.1 Exploded view - pistons and conrods

1 - Bolts

- ☐ Renew
- ☐ Lubricate threads and contact surface
- ☐ 50 Nm +90°

2 - Conrod bearing cap

- ☐ Mark installation position for re-installation
- ☐ Mark cylinder allocation in colour ⇒ [page 84](#)
- ☐ Installation position of conrod pairs ⇒ [page 85](#)

3 - Bearing shells

- ☐ Ensure that retaining lugs are securely seated.
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed
- ☐ There are oversized bearings available for machined crankshaft conrod journals ⇒ Electronic parts catalogue

4 - Conrod

- ☐ Only renew as a complete set
- ☐ Mark cylinder allocation in colour ⇒ [page 84](#)
- ☐ Installation position of conrod pairs ⇒ [page 85](#)
- ☐ Axial clearance for each conrod pair (when new): 0.20 ... 0.38 mm
- ☐ Measuring radial clearance ⇒ [page 85](#)

5 - Circlip

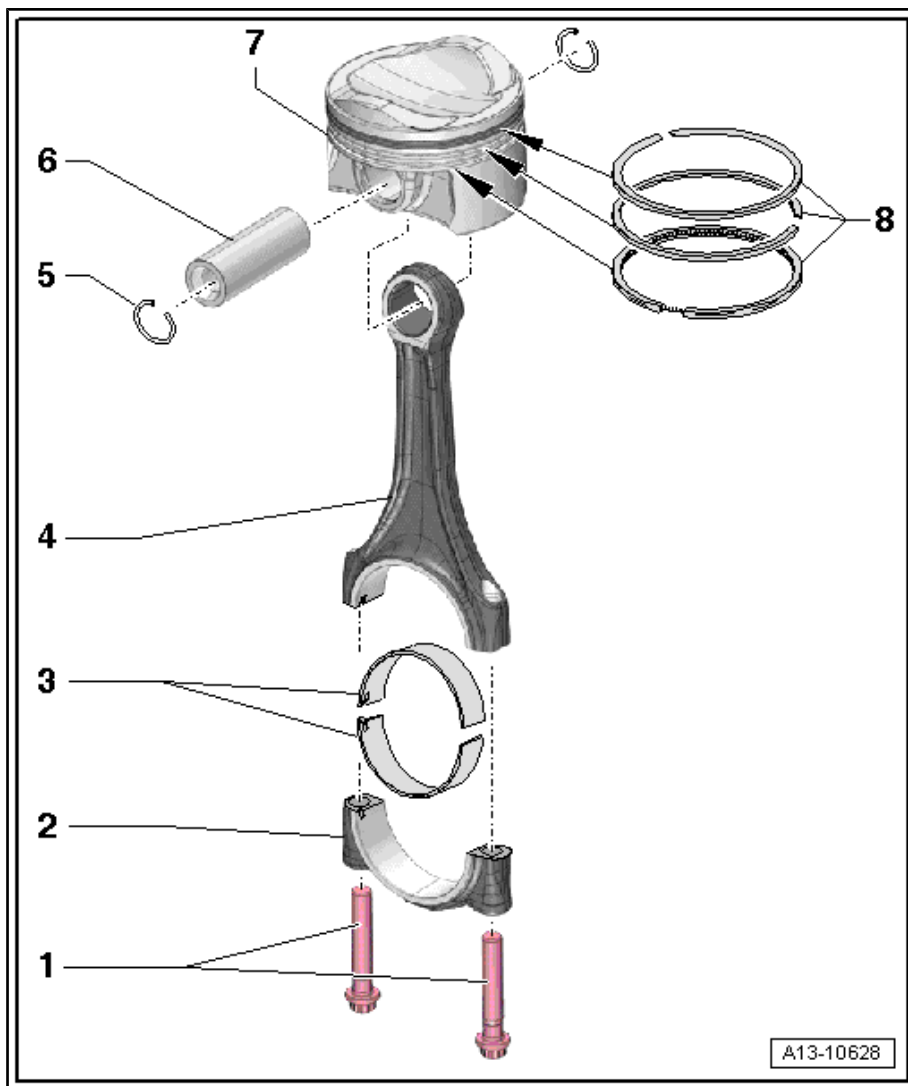
- ☐ Renew

6 - Piston pin

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

7 - Piston

- ☐ Mark installation position and cylinder number ⇒ [page 84](#)
- ☐ Checking ⇒ [page 83](#)





- ☐ Install using piston ring clamp
- ☐ Piston and cylinder dimensions ➔ [page 85](#)
- ☐ Measuring cylinder bore ➔ [page 84](#)

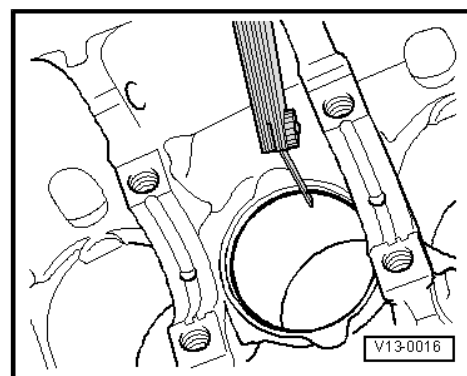
8 - Piston rings

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers to remove and install
- ☐ Installation position: marking "TOP" or side with lettering faces towards piston crown
- ☐ Measuring ring gap ➔ [page 83](#)
- ☐ Measuring ring-to-groove clearance ➔ [page 83](#)

Measuring piston ring gap

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

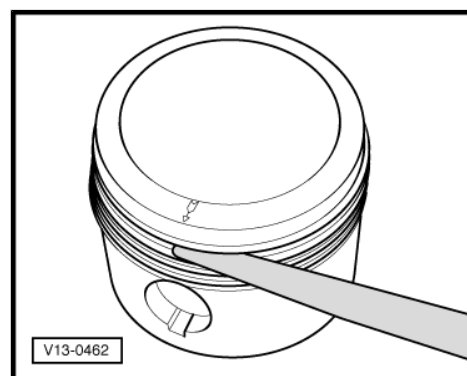
Piston ring	new mm	Wear limit mm
1. Compression ring	0.20 ... 0.30	0.80
2. Compression ring	0.50 ... 0.70	0.80
Oil scraper ring	0.25 ... 0.50	– ¹⁾
• ¹⁾ Specification not yet available.		



Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
1. Compression ring	0.04 ... 0.08	0.20
2. Compression ring	0.03 ... 0.07	0.20
Oil scraper ring	0.02 ... 0.06	0.15



Checking piston

- Using a micrometer (75 ... 100 mm), measure approx. 15 mm from the lower edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.03 mm.

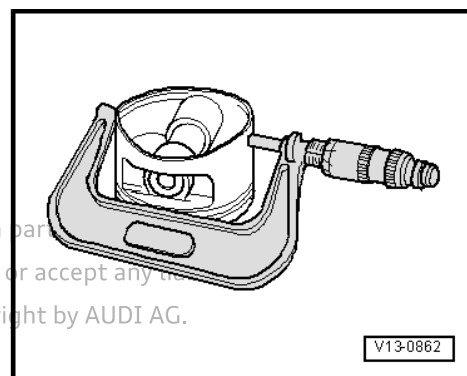
Nominal dimension

➔ ["4.2 Piston and cylinder dimensions", page 85](#)

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Measuring cylinder bore

- Use an internal dial gauge - VAS 6078- to take measurements at 3 points in transverse direction -A- and in longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.08 mm.

Nominal dimension

⇒ [“4.2 Piston and cylinder dimensions”, page 85](#) .



Installation position of pistons



Caution

Do not damage the coating of the piston crown.

- ◆ *If you intend to re-install used pistons, mark the cylinder number on the piston crown using paint. Do not attempt to mark the piston crown with a centre punch or by making a notch or similar.*

Installation position:

- Valve recesses -1- face centre of engine.
- Arrows on pistons point to pulley end.

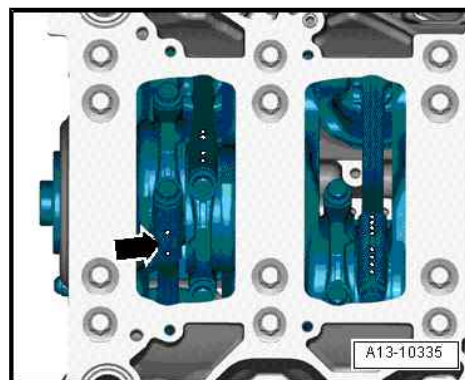
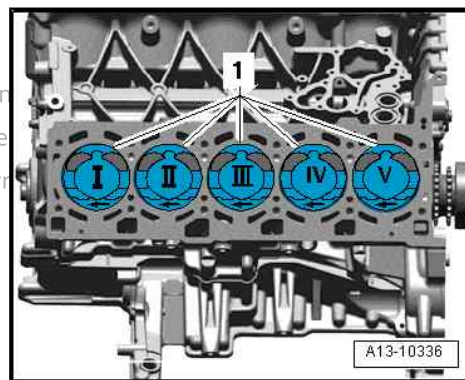
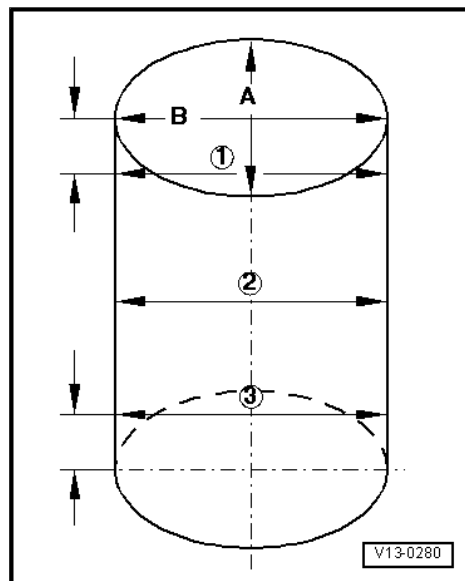
Marking conrods



Note

Only renew conrods as a complete set.

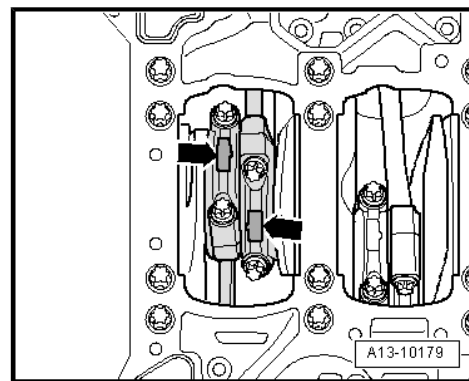
- Use a coloured pen to mark matching conrods and conrod bearing caps with cylinder numbers -arrow- for re-installation.





Installation position of conrods

- The cast lugs -arrows- on the ground surfaces of the conrod pairs "1 and 2", "3 and 4", "5 and 6", "7 and 8" and "9 and 10" must face each other.



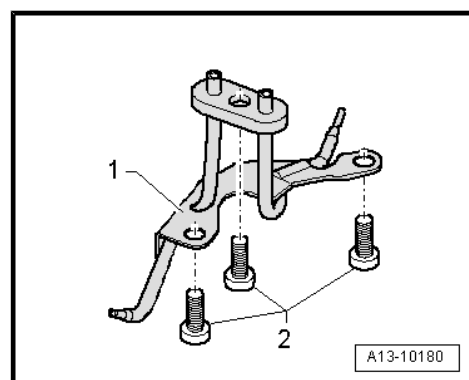
Oil spray jet for piston cooling

- Oil spray jet
- Apply locking fluid to bolts and tighten to 9 Nm; for locking fluid refer to ⇒ Electronic parts catalogue .



Note

- Take care not to bend oil spray jets.
- Always renew bent oil spray jets.



4.2 Piston and cylinder dimensions

There are different piston sizes specifically matched to the varying bore dimensions for the cylinder block.

Cylinder bore Ø mm	Piston Ø mm
84.510 ± 0.005	84.490 ¹⁾
84.610 ± 0.005	84.590 ¹⁾

• 1) Dimensions including coating (thickness 0.01 mm). The coating will wear down in service.

4.3 Measuring radial clearance of conrods

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 in the bearing shell.
- Fit conrod bearing cap and tighten to 50 Nm, but do not turn further. Do not rotate crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigauge with measurement scale.

Radial clearance:

- New: 0.020 ... 0.069 mm.
- Wear limit: 0.120 mm.
- Renew conrod bolts.



15 – Cylinder head, valve gear

1 Chain drive

1.1 Exploded view - timing chain covers

1 - Bolt

- ☐ Renew M6 bolts
- ☐ Tightening torque and sequence ⇒ [page 87](#)

2 - Crankshaft oil seal (gearbox end)

- ☐ Renewing ⇒ [page 70](#)

3 - Dowel sleeve

- ☐ 2x

4 - Timing chain cover (bottom)

- ☐ Removing and installing ⇒ [page 92](#)

5 - Cylinder head gasket (left-side)

6 - Timing chain cover (left-side)

- ☐ Removing and installing ⇒ [page 87](#)

7 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 87](#)

8 - Bracket for wiring harness

9 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 87](#)

10 - Bracket for electrical connectors

11 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 87](#)

12 - Bracket for electrical connector

13 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 87](#)

14 - Bracket for wiring harness

15 - Timing chain cover (right-side)

- ☐ Removing and installing ⇒ [page 90](#)

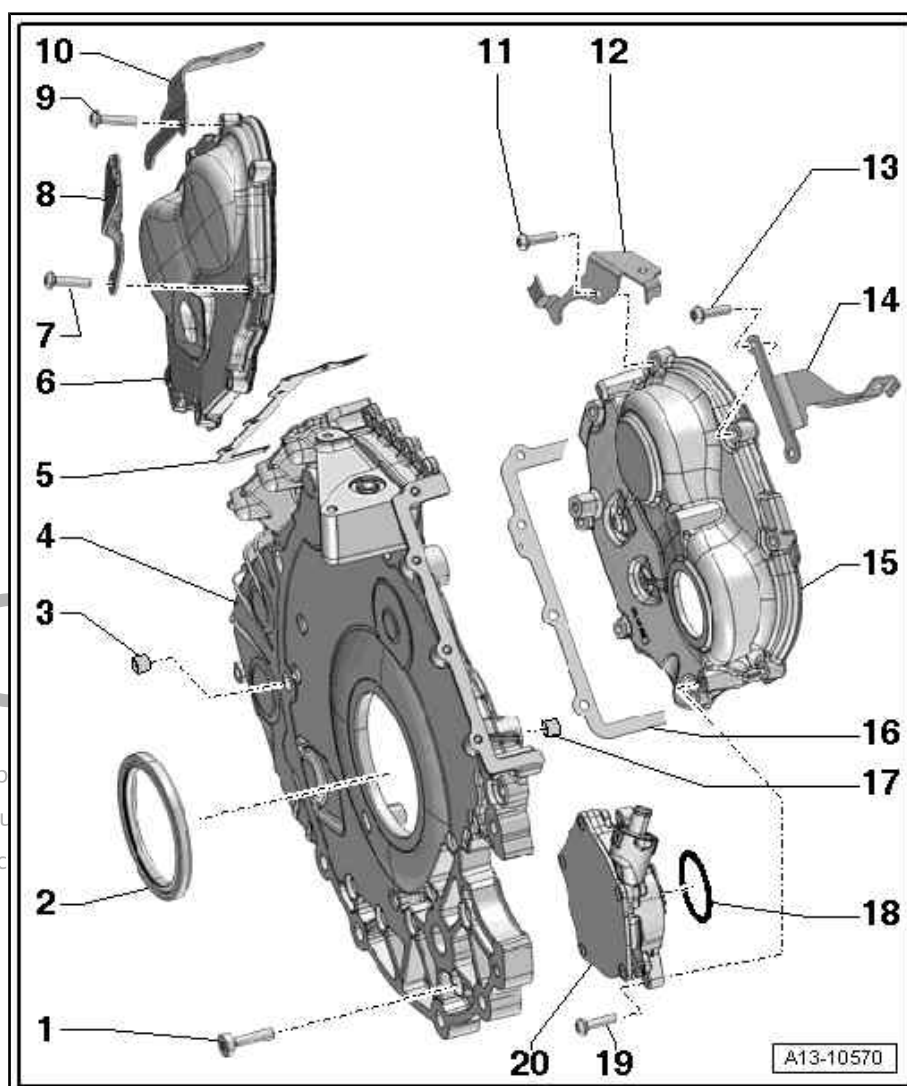
16 - Cylinder head gasket (right-side)

17 - Dowel sleeve

- ☐ 2x

18 - O-ring

- ☐ Renew





19 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 47

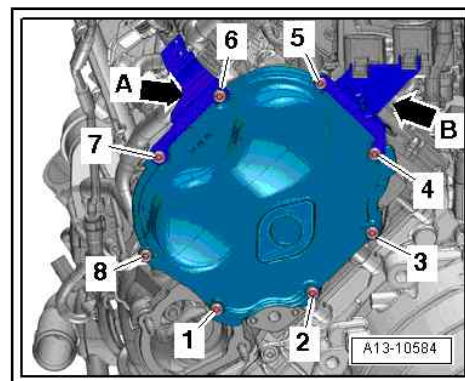
20 - Vacuum pump

- ❑ Removing and installing ⇒ Rep. gr. 47

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

- Tighten bolts in the sequence -1 ... 8- in 2 stages as follows:

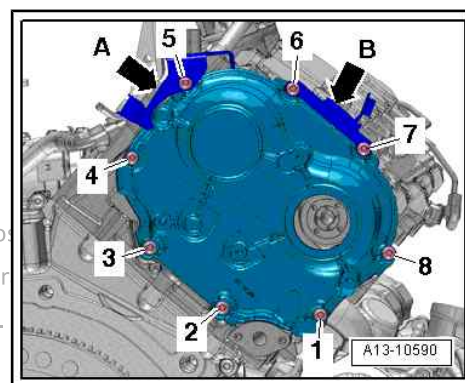
1. Initially tighten to 5 Nm.
2. Tighten to 9 Nm.



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

- Tighten bolts in the sequence -1 ... 8- in 2 stages as follows:

1. Initially tighten to 5 Nm.
2. Tighten to 9 Nm.

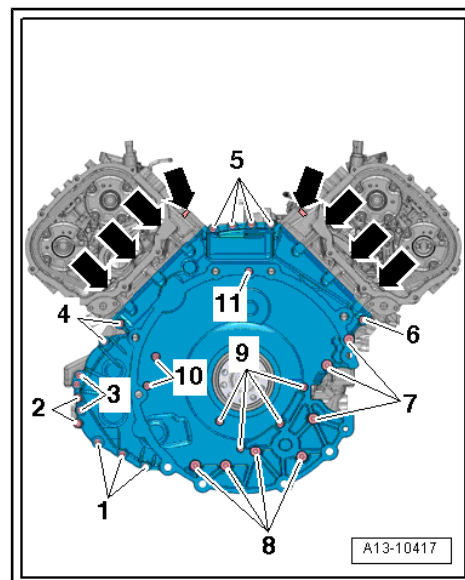


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Timing chain cover (bottom) - tightening torque and sequence

- Remove bolts -1, 3, 4, 5, 6, 9, 10, 11- and -arrows-.
- Tighten bolts for timing chain cover (bottom) in 6 stages as follows:

Stage	Bolts	Tightening torque/tightening angle
1.	-Arrows-	5 Nm
2.	-1 ... 11-	8 Nm in diagonal sequence
3.	-Arrows-	11 Nm
4.	-2, 7, 8-	22 Nm
5.	-1, 3, 4, 5, 6, 9, 10, 11-	Turn 90° further
6.	-Arrows-	Turn 90° further



1.2 Removing and installing timing chain cover (left-side)

Special tools and workshop equipment required

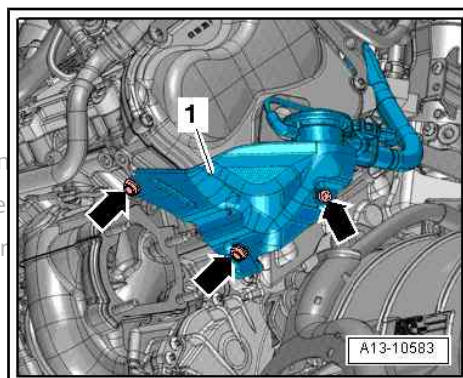
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles



- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .
- Remove front left exhaust pipe with catalytic converters ⇒ [page 259](#) .
- Remove bolts -arrows- and detach heat shield -1-.

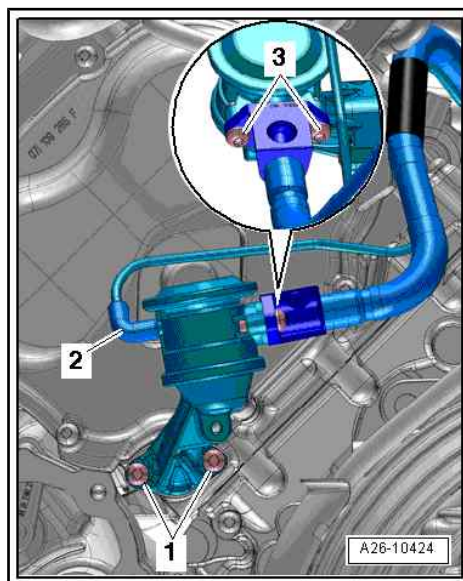


- Remove bolts -3- and move combination valve (left-side) for secondary air system to one side.



Note

Disregard items -1 and 2-.



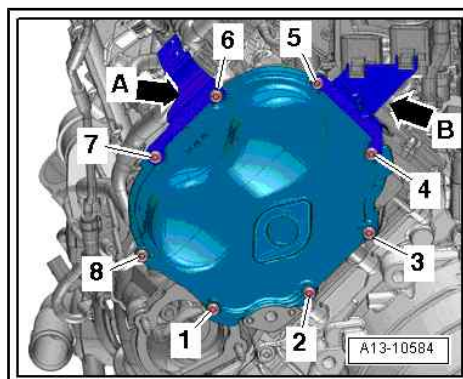
- Remove bolts -1 ... 8-.
- Move bracket -arrow A- and -arrow B- clear to one side.
- Release timing chain cover (left-side) from bonded joint.

Installing



Note

Fit all cable ties in the original positions when installing.



**Caution**

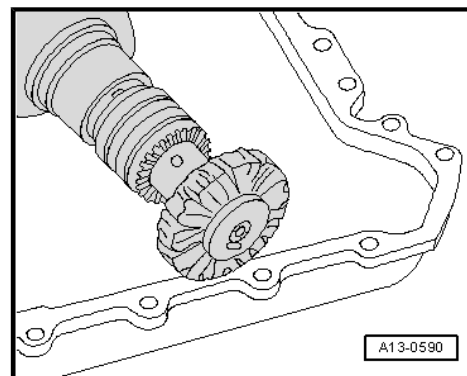
Protect lubrication system against contamination.

- ◆ **Cover exposed parts of the engine.**

**WARNING**

Risk of eye injury.

- ◆ **Put on safety goggles.**

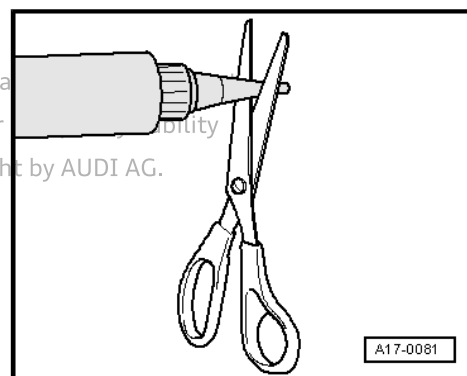


- Remove remaining sealant on timing chain cover and cylinder head using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

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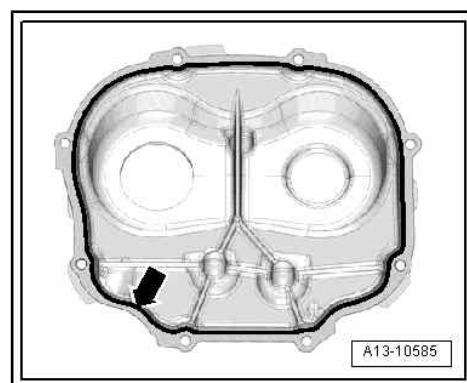
- **Note the use-by date of the sealant.**
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).

**Caution**

Make sure lubrication system is not clogged by excess sealant.

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

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

**Note**

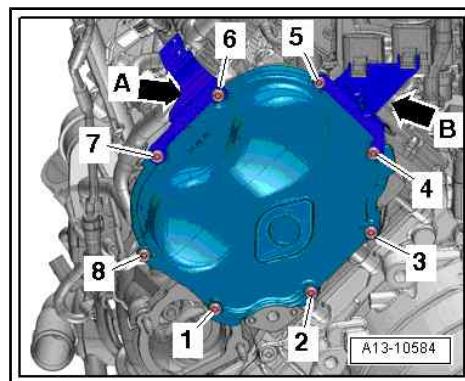
The timing chain cover must be installed within 5 minutes after applying the sealant.



- Fit timing chain cover (left-side), brackets -arrow A- and -arrow B- and tighten bolts ⇒ [page 87](#) .

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

- Install combination valve for secondary air (left-side) ⇒ [page 269](#) .
- Install front exhaust pipe with catalytic converters ⇒ [page 259](#) .



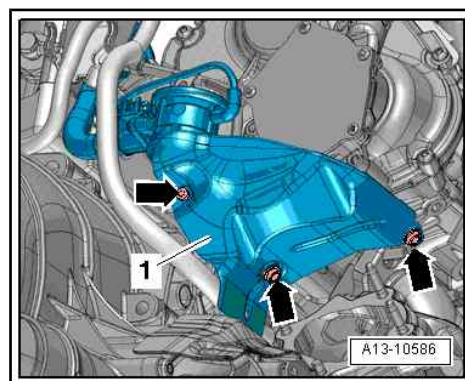
1.3 Removing and installing timing chain cover (right-side)

Special tools and workshop equipment required

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

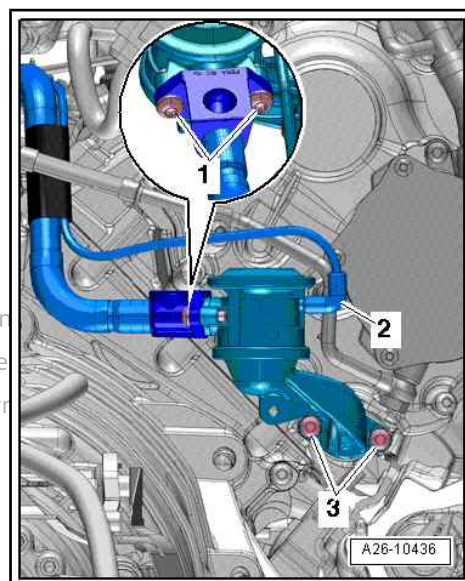
Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .
- Remove front exhaust pipe (right-side) with catalytic converters ⇒ [page 261](#) .
- Remove bolts -arrows- and detach heat shield -1-.
- Remove bolts -1- and move combination valve (right-side) for secondary air system to one side.



Note

Disregard items -2 and 3-.



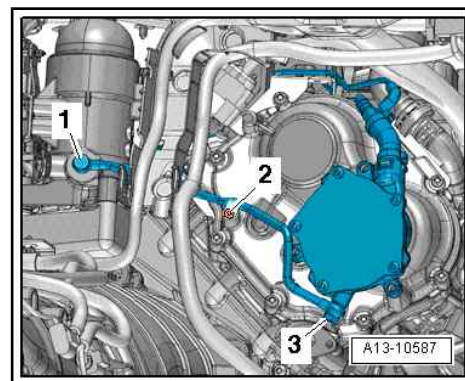
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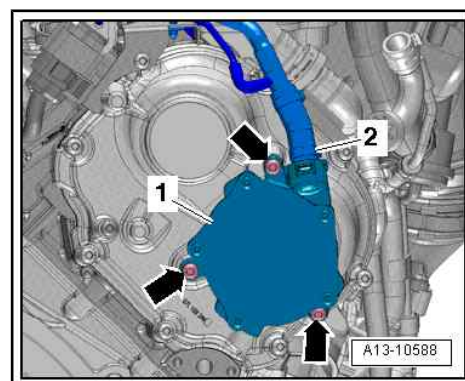
- Remove bolt -2- and banjo bolt -3-.
- Press oil supply line to the side.

**Note**

-Item 1- can be disregarded.



- Detach vacuum hose -2-.
- Remove bolts -arrows- and detach vacuum pump -1-.

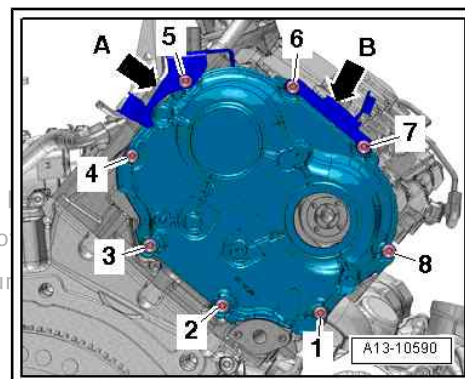


- Remove bolts -1 ... 8-.
- Move bracket -arrow A- and -arrow B- clear to one side.
- Release timing chain cover (right-side) from bonded joint.

Installing**Note**

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Fit all cable ties in the original positions when installing.

**Caution**

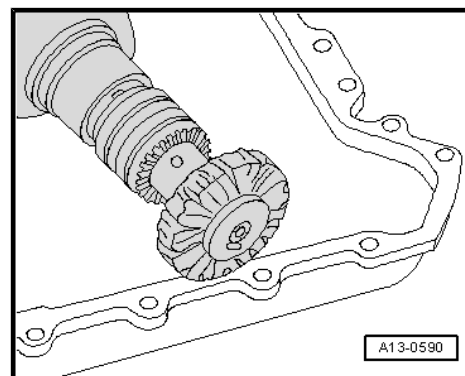
Protect lubrication system against contamination.

- ◆ **Cover exposed parts of the engine.**

**WARNING**

Risk of eye injury.

- ◆ **Put on safety goggles.**



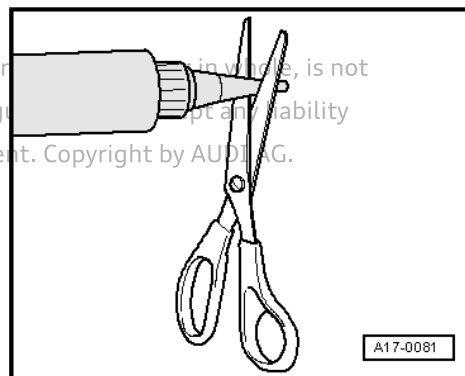
- Remove remaining sealant on timing chain cover and cylinder head using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

**Note**

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Note the use-by date of the sealant.

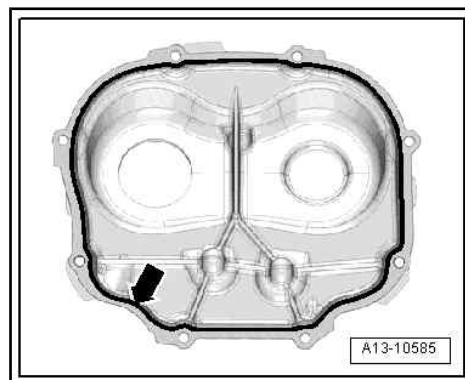
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).

**Caution**

Make sure lubrication system is not clogged by excess sealant.

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

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

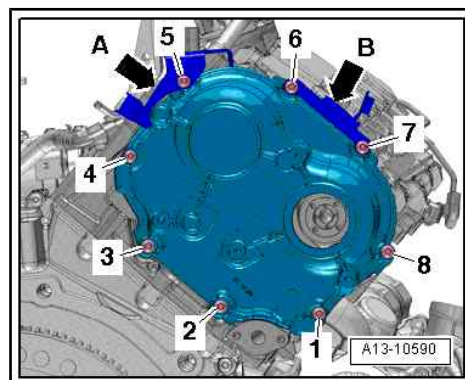
**Note**

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

- Fit timing chain cover (right-side), brackets -arrow A- and -arrow B- and tighten bolts ⇒ [page 87](#) .

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

- Install vacuum pump ⇒ Rep. gr. 47 .
- Install combination valve for secondary air (right-side) ⇒ [page 270](#) .
- Install front exhaust pipe (right-side) with catalytic converters ⇒ [page 261](#) .



1.4 Removing and installing timing chain cover (bottom)

Special tools and workshop equipment required

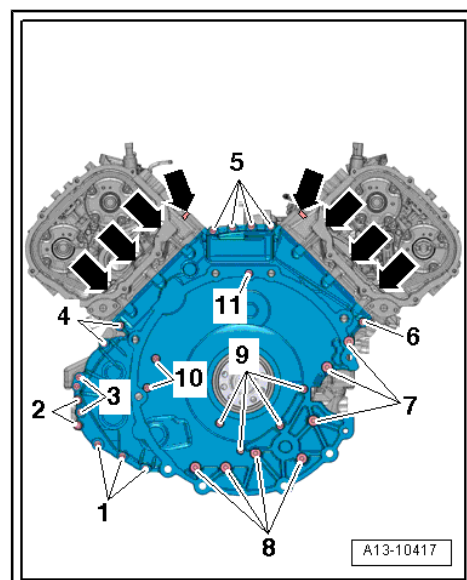
- ♦ Electric drill with plastic brush attachment
- ♦ Safety goggles
- ♦ Sealant ⇒ Electronic parts catalogue

Removing

- Engine removed, engine separated from gearbox ⇒ [page 32](#) .
- Engine in position on scissor-type assembly platform - VAS 6131 A- or secured to engine and gearbox support ⇒ [page 39](#) .
- Remove drive plate ⇒ [page 69](#) .



- Remove timing chain covers: left-side ⇒ [page 87](#) , right-side ⇒ [page 90](#) .
- Remove oil filter housing ⇒ [page 168](#) .
- Remove bolts -arrows-.
- Remove bolts -1 ... 11- and release timing chain cover (bottom) from bonded joint.
- Press crankshaft oil seal (gearbox end) out of timing chain cover (bottom).



Installing

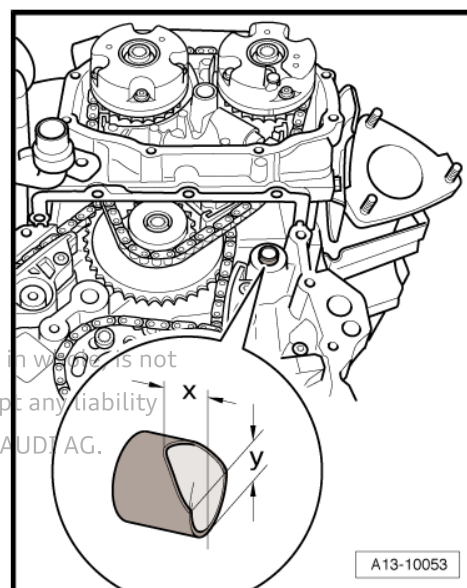
- Pull dowel sleeve at top right out of cylinder block.
- Bevel the dowel sleeve with a file, as illustrated.
- Dimension -x- = 6.5 mm
- Dimension -y- = 8 mm
- Fit dowel sleeve on cylinder block in such a way that the bevelled side points upwards.



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





Caution

Protect lubrication system against contamination.

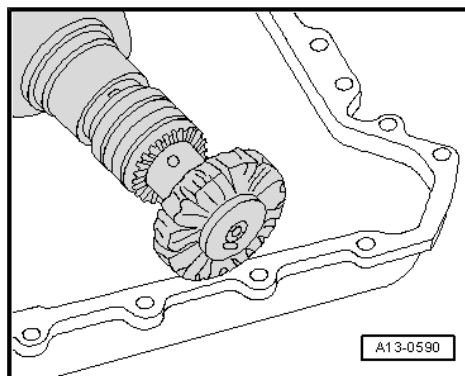
- ◆ *Cover exposed parts of the engine.*



WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*



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

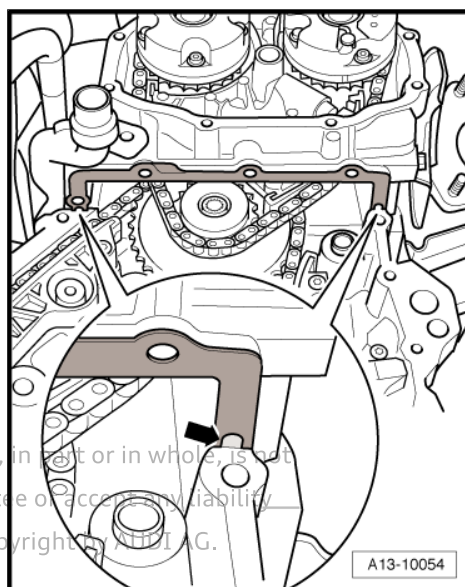


Note

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



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Caution

Avoid damage to cylinder head gasket.

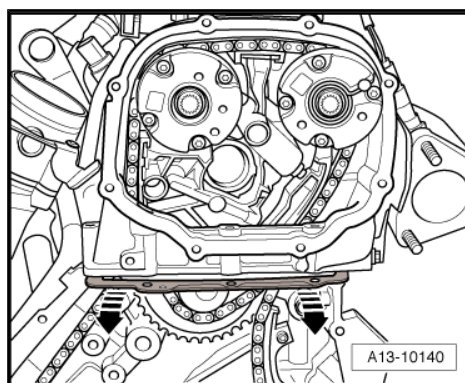
- ◆ *Only bend the ends of the cylinder head gaskets slightly and do not kink.*



Note

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

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





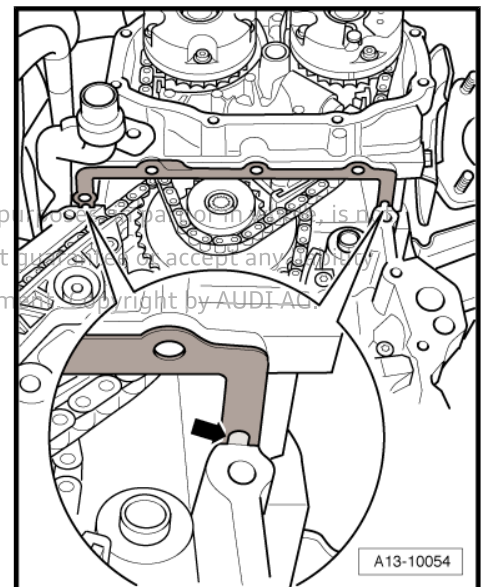
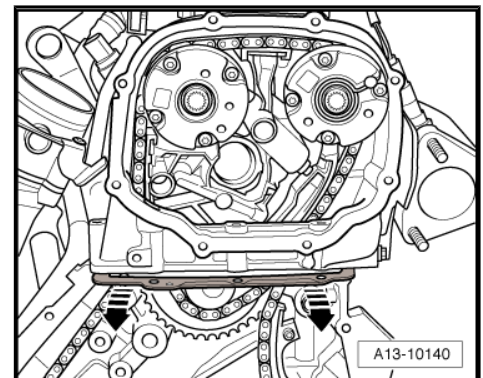
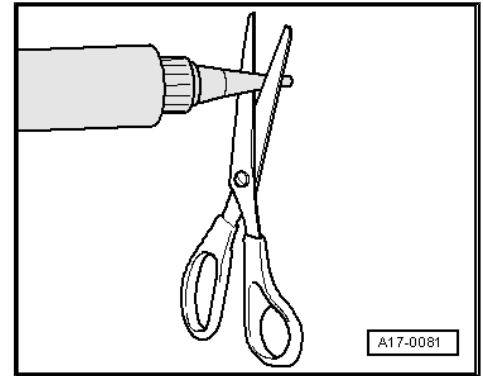
Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle $\varnothing$ approx. 2 mm).
- Apply a small amount of sealant to sealing surfaces of cylinder head gaskets (top and bottom). To do so, you again have to bend cylinder head gaskets down very slightly -arrows-.
- Use a flat object (e.g. a feeler gauge) to apply sealant to the area between cylinder head and gasket.
- Clean holes -arrow- in cylinder head gaskets and fill them with sealant.



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**Caution**

Make sure lubrication system is not clogged by excess sealant.

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

To avoid any risk of leakage, the sealant bead must be applied exactly as specified.

- ◆ *The sealant bead must be applied with a kink at the point indicated by the -arrow-.*
- ◆ *The sealant bead must NOT run straight at these points.*

- Apply sealant beads -1 ... 10- onto the clean sealing surfaces of the timing chain cover (bottom) as illustrated.
- Width of sealant beads: 2.5 mm.

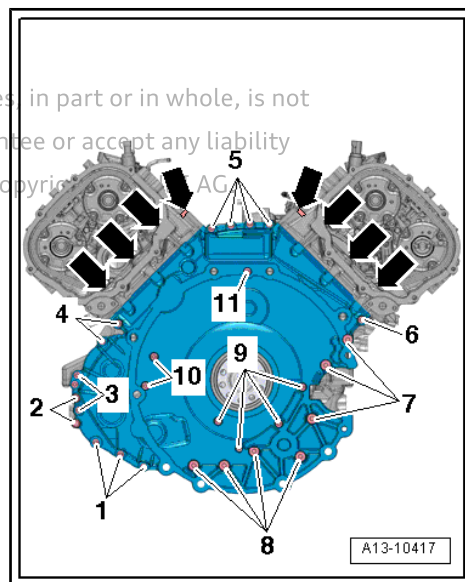
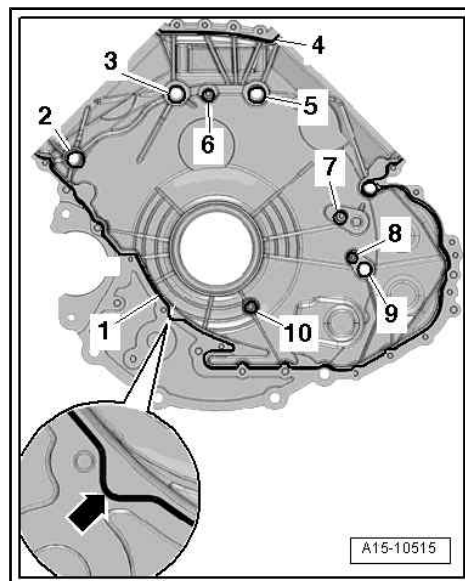
**Note**

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

- 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.
- Tighten bolts for timing chain cover (bottom) ⇒ [page 87](#) .

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

- Install crankshaft oil seal (gearbox end) ⇒ [page 70](#)
- Install oil filter housing ⇒ [page 168](#)
- Install timing chain covers: left-side ⇒ [page 87](#) , right-side ⇒ [page 90](#) .
- Install drive plate ⇒ [page 69](#) .



1.5 Exploded view - camshaft timing chains

Camshaft timing chain (left-side)



1 - Camshaft adjuster for exhaust camshaft

- ☐ Identification "Exhaust"
- ☐ Removing and installing
⇒ ["1.7 Removing and installing camshaft timing chains", page 108](#)

2 - Bolt

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

3 - Bolt

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

4 - Camshaft adjuster for inlet camshaft

- ☐ Identification "Intake"
- ☐ Removing and installing
⇒ ["1.7 Removing and installing camshaft timing chains", page 108](#)

5 - Camshaft timing chain (left-side)

- ☐ Before removing, mark running direction with paint
- ☐ Removing from camshafts ⇒ [page 100](#)
- ☐ Removing and installing ⇒ [page 108](#)

6 - Bolt

- ☐ Renew
- ☐ 5 Nm +90°

7 - Slide

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

- ☐ Removing and installing ⇒ ["1.7 Removing and installing camshaft timing chains", page 108](#)

9 - Oil strainer

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

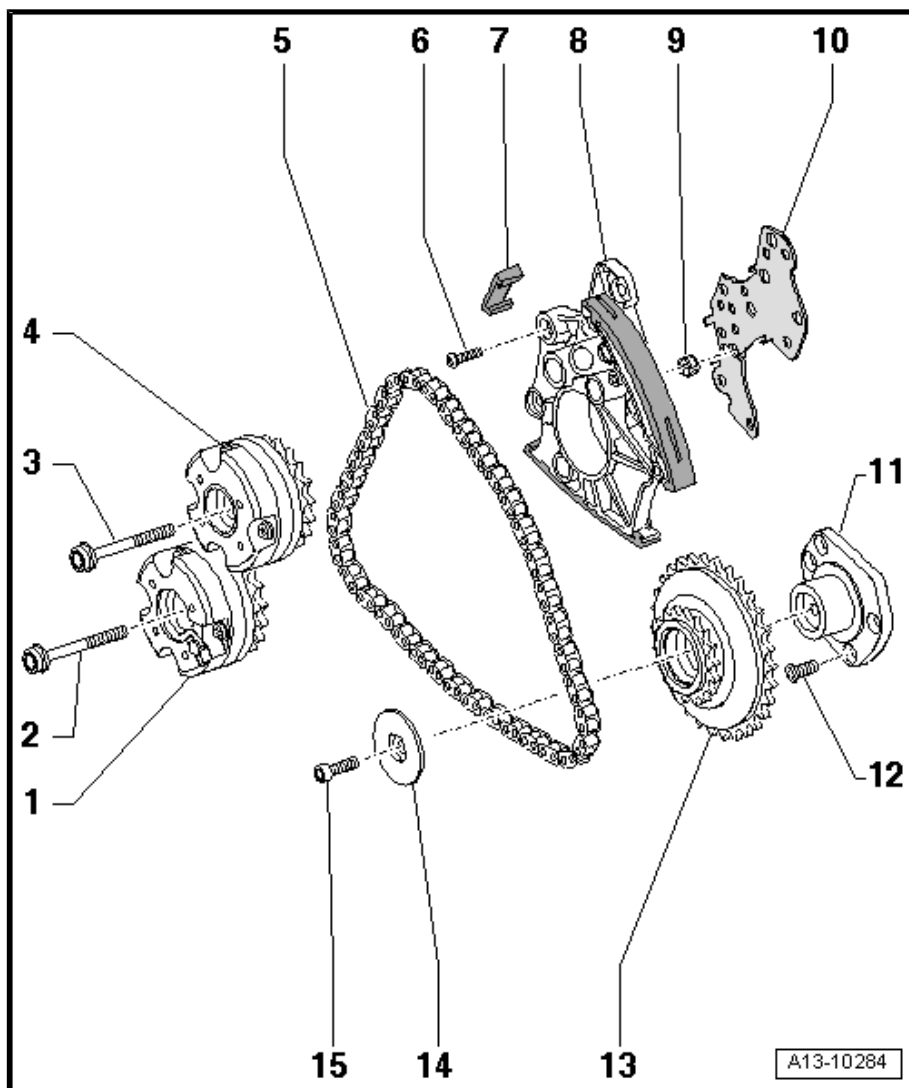
10 - Gasket

- ☐ Renew
- ☐ Clipped onto chain tensioner

11 - Bearing bracket for drive sprocket

12 - Bolt

- ☐ Renew
- ☐ 5 Nm +90°



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**13 - Drive sprocket for camshaft timing chain (left-side)****14 - Thrust washer for drive sprocket****15 - Bolt**

- ☐ 22 Nm

Camshaft timing chain (right-side)**1 - Bearing mounting for drive sprocket**

- ☐ For camshaft timing chain (right-side)
- ☐ Asymmetric version
- ☐ Installation position
⇒ [page 99](#)

2 - Bolt

- ☐ 42 Nm

3 - Camshaft adjuster for exhaust camshaft

- ☐ Identification "Exhaust"
- ☐ Removing and installing
⇒ ["1.7 Removing and installing camshaft timing chains"](#), [page 108](#)

4 - Bolt

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

5 - Bolt

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

6 - Camshaft adjuster for inlet camshaft

- ☐ Identification "Intake"
- ☐ Removing and installing
⇒ ["1.7 Removing and installing camshaft timing chains"](#), [page 108](#)

7 - Camshaft timing chain (right-side)

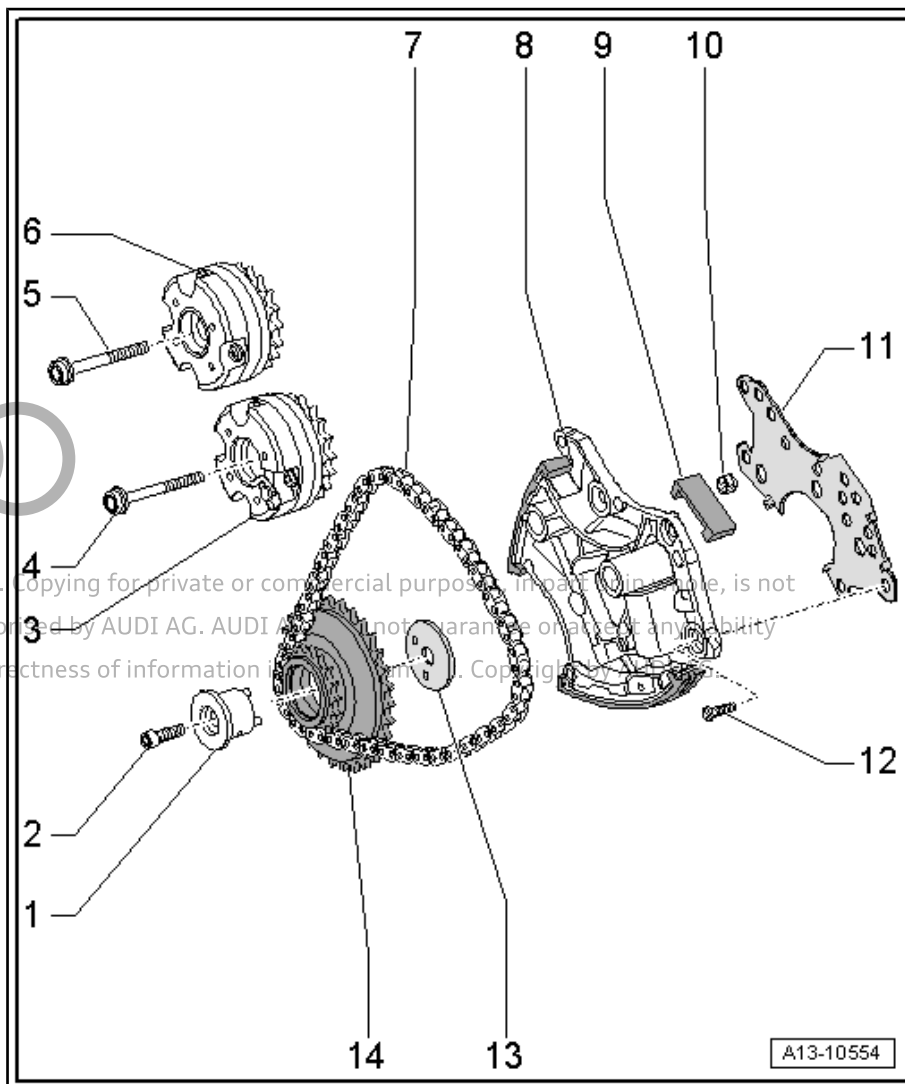
- ☐ Before removing, mark running direction with paint
- ☐ Removing from camshafts ⇒ [page 100](#)
- ☐ Removing and installing ⇒ [page 108](#)

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

- ☐ Removing and installing ⇒ ["1.7 Removing and installing camshaft timing chains"](#), [page 108](#)

9 - Slide**10 - Oil strainer**

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



**11 - Gasket**

- ☐ Renew
- ☐ Clipped onto chain tensioner

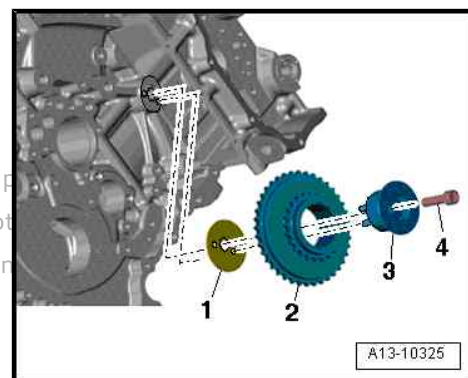
12 - Bolt

- ☐ Renew
- ☐ 5 Nm +90°

13 - Thrust washer for drive sprocket**14 - Drive sprocket for camshaft timing chain (right-side)**

Installation position: bearing mounting for drive sprocket for camshaft timing chain (right-side)

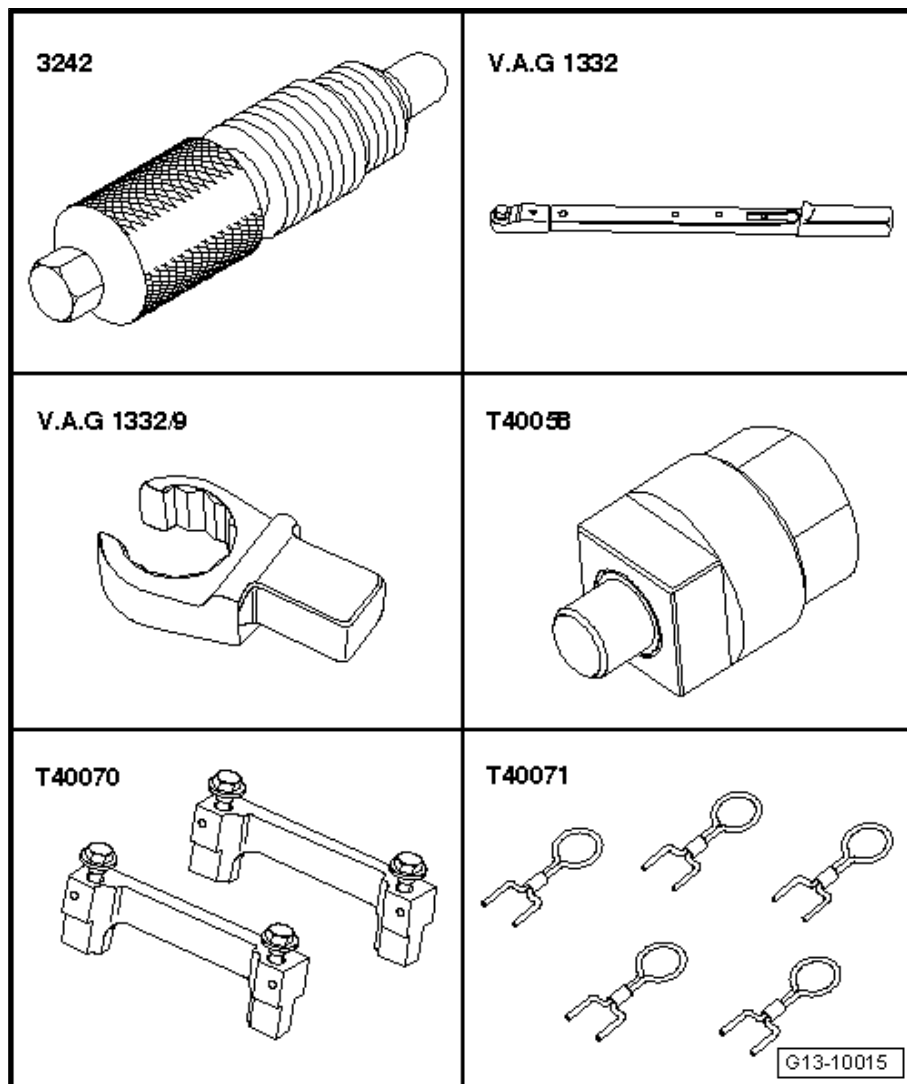
- Dowel pins in bearing mounting -3- for drive sprocket for camshaft timing chain (right-side) must engage in drillings in thrust washer -1- and in cylinder block drillings.

2 - Drive sprocket for camshaft timing chain (right-side)**4 - Bolt**



1.6 Removing timing chains from camshafts

Special tools and workshop equipment required



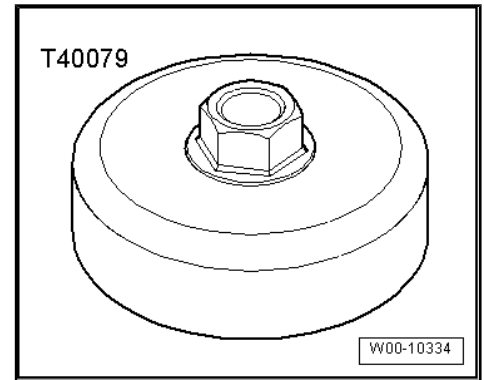
- ◆ Locking pin - 3242-
- ◆ Torque wrench - V.A.G 1332-
- ◆ Tool insert - V.A.G 1332/9-
- ◆ Adapter - T4005B-
- ◆ Camshaft clamp - T40070- (2x)
- ◆ Locking pin - T40071- (2x)



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◆ Adapter - T40079-



Removing

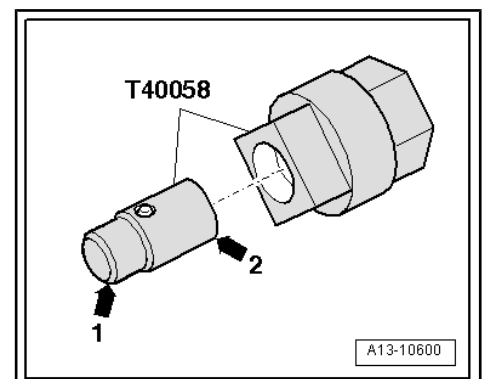
- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ➔ [page 10](#) .



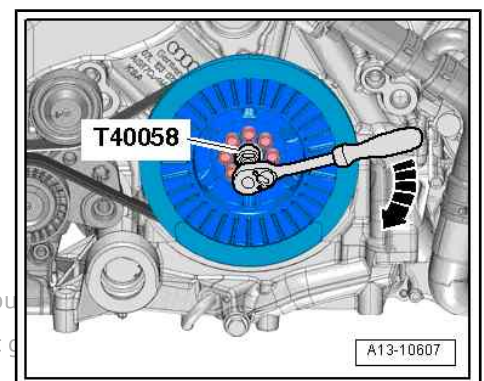
Note

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

- Remove cylinder head covers: left-side ➔ [page 128](#) ; right-side ➔ [page 129](#) .
- Remove timing chain covers: left-side ➔ [page 87](#) , right-side ➔ [page 90](#) .
- Insert guide pin of adapter -T40058- as follows:
 - The smaller-diameter section -arrow 1- faces the engine.
 - The larger-diameter section -arrow 2- faces the adapter.



- Turn crankshaft with adapter - T40058- in normal direction of rotation -arrow- to “TDC position”.



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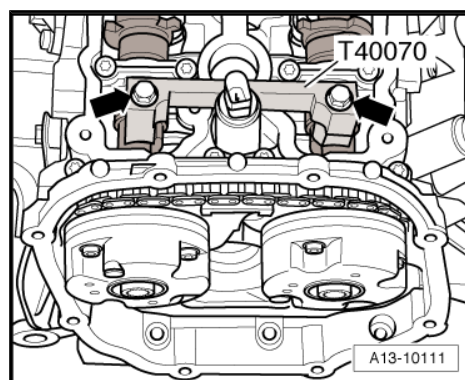
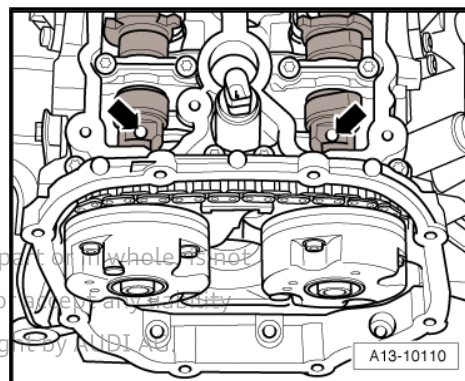


- The threaded holes -arrows- in the camshafts must face upwards.



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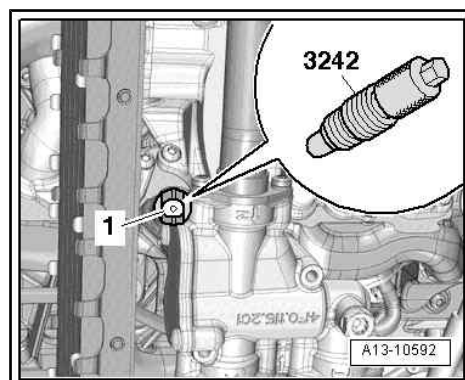
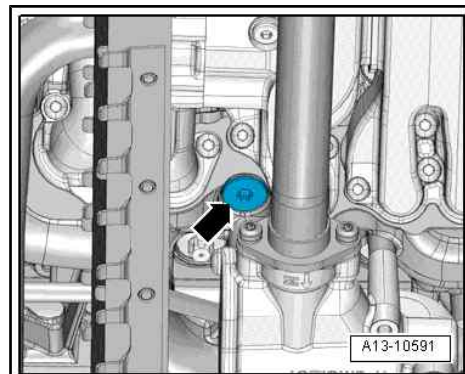
- Fit camshaft clamps - T40070- onto both cylinder heads and tighten bolts -arrows- to 25 Nm.
- The camshaft clamp - T40070- is positioned correctly if the holes for the cylinder head bolts remain free.



Note

Lay a cloth under the engine to catch escaping engine oil.

- Remove plug -arrow- for crankshaft “TDC” marking from intake module.
- Screw locking pin - 3242- into locating groove (20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



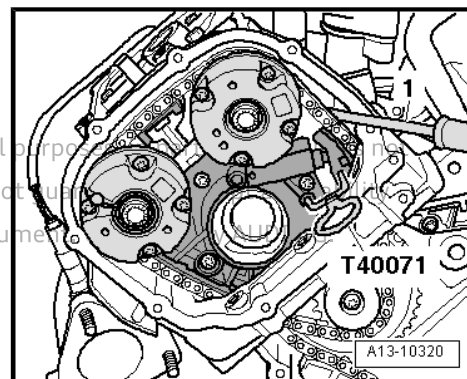


- Press guide rail of chain tensioner for camshaft timing chain (left-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .

**Note**

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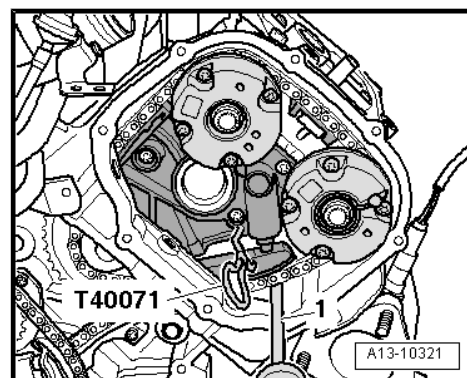
The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.



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

**Note**

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

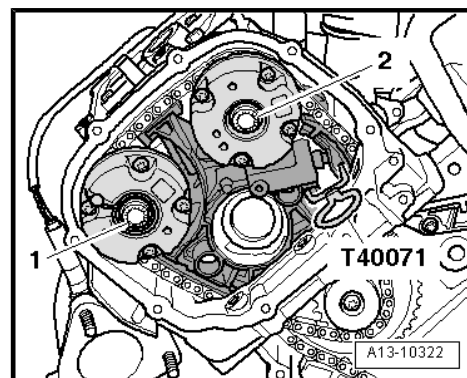


- Mark position of camshaft adjusters with paint for re-installation.

**Caution**

Risk of irreparable damage to engine.

- ◆ ***Block off the opening in the valve timing housing with a clean cloth to prevent small items from dropping into the engine.***



- Unscrew bolts -1- and -2- on cylinder head (left-side) and remove both camshaft adjusters.



- Mark position of camshaft adjusters with paint for re-installation.
- Unscrew bolts -1- and -2- on cylinder head (right-side) and remove both camshaft adjusters.

Installing

- Tightening torques ⇒ [page 96](#)



Note

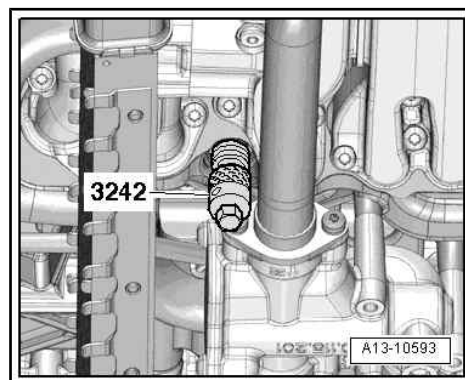
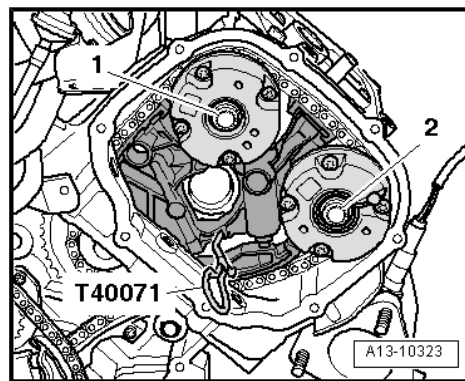
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew seal on screw plug for crankshaft "TDC" marking.*



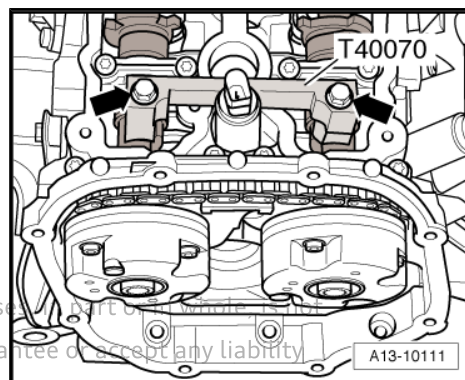
Caution

Risk of damage to valves and piston crowns.

- ◆ ***The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.***



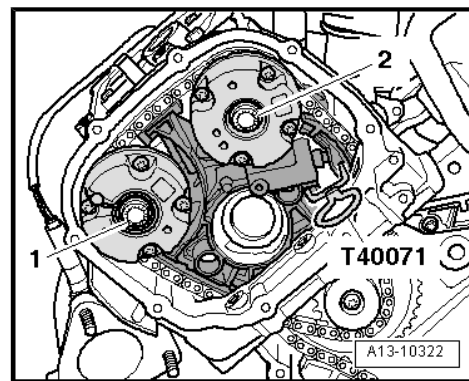
- Drive chain for valve gear installed ⇒ [page 112](#)
- Crankshaft locked in position with locking pin - 3242- .
- Camshaft clamps - T40070- installed on both cylinder heads and tightened to 25 Nm -arrows-.



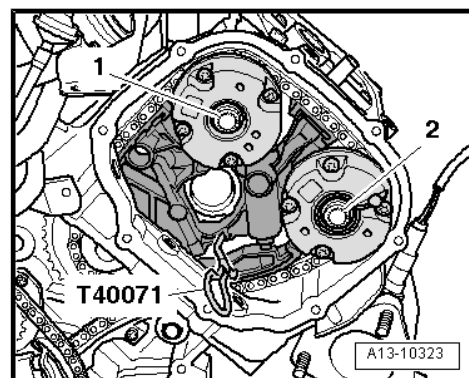
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- Re-install camshaft adjuster on cylinder head (left-side) in the same position as before (pay attention to marks applied when removing).
- Fit timing chain (left-side) onto drive chain sprocket and camshaft adjusters and fit bolts -1- and -2- without tightening.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
- Remove locking pin - T40071- .



- Re-install camshaft adjuster on cylinder head (right-side) in the same position as before (pay attention to marks applied when removing).
- Fit timing chain (right-side) onto drive chain sprocket and camshaft adjusters and fit bolts -1- and -2- without tightening.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
- Remove locking pin - T40071- .

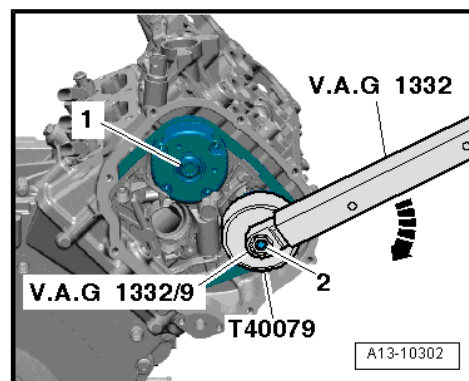
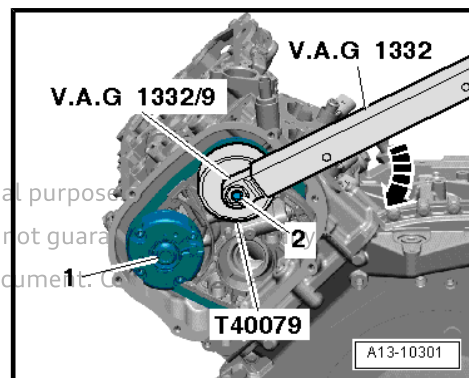


Note



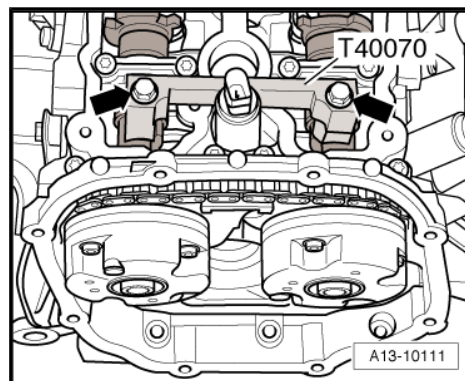
A second mechanic is required for the following work steps.

- Fit adapter - T40079- onto camshaft adjuster of inlet camshaft on cylinder head (left-side).
- Apply torque wrench - V.A.G 1332- with socket - V.A.G 1332/9- to adapter - T40079- .
- Have a 2nd mechanic apply a torque of 40 Nm to camshaft adjuster in clockwise direction -arrow-.
- Tighten bolts as follows while keeping camshaft adjuster under tension:
 1. Pre-tighten bolt -1- on exhaust camshaft to 60 Nm.
 2. Pre-tighten bolt -2- on inlet camshaft to 60 Nm.
- Fit adapter - T40079- onto camshaft adjuster of exhaust camshaft on cylinder head (right-side).
- Apply torque wrench - V.A.G 1332- with socket - V.A.G 1332/9- to adapter - T40079- .
- Have a 2nd mechanic apply a torque of 40 Nm to camshaft adjuster in clockwise direction -arrow-.
- Tighten bolts as follows while keeping camshaft adjuster under tension:
 1. Pre-tighten bolt -1- on inlet camshaft to 60 Nm.
 2. Pre-tighten bolt -2- on exhaust camshaft to 60 Nm.
- Remove adapter - T40079- .





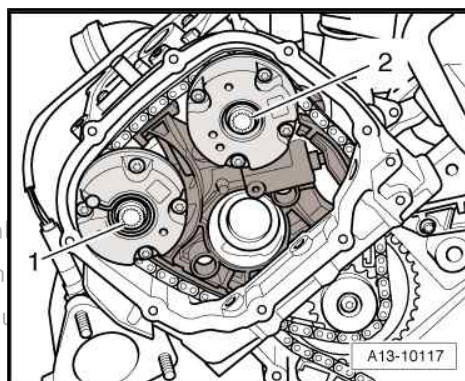
- Remove camshaft clamps - T40070- from both cylinder heads -arrows-.



- Tighten camshaft adjuster bolts on cylinder head (left-side) as follows:

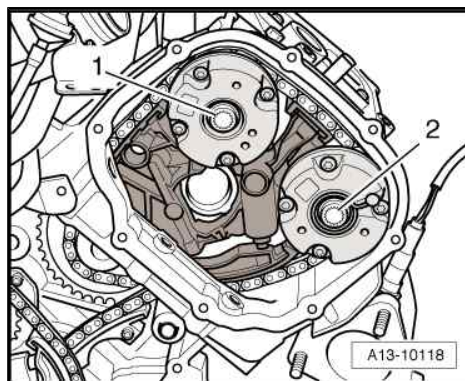
1. Tighten bolt -1- on exhaust camshaft to final tightening torque.
2. Tighten bolt -2- on inlet camshaft to final tightening torque.

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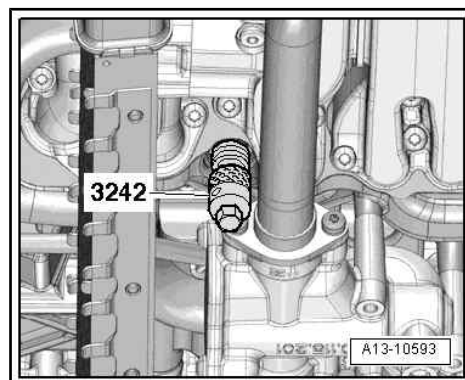


- Tighten camshaft adjuster bolts on cylinder head (right-side) as follows:

1. Tighten bolt -1- on inlet camshaft to final tightening torque.
2. Tighten bolt -2- on exhaust camshaft to final tightening torque.



- Remove locking pin - 3242- .

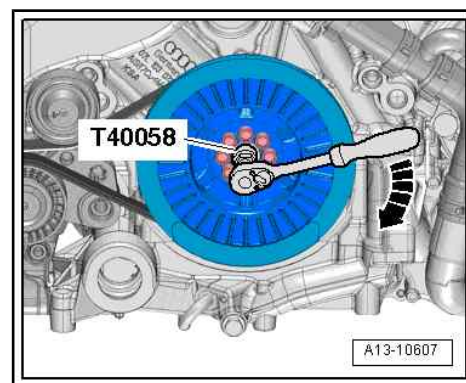




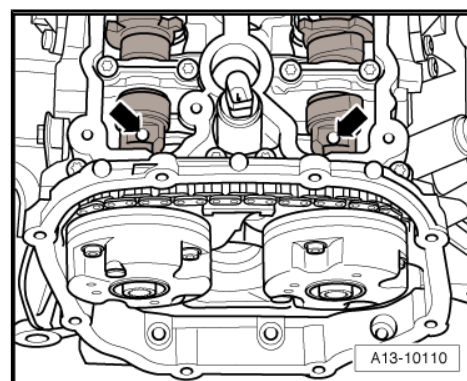
- Using adapter - T40058- , turn crankshaft 2 revolutions in normal direction of rotation -arrow- until crankshaft is at “TDC” again.

**Note**

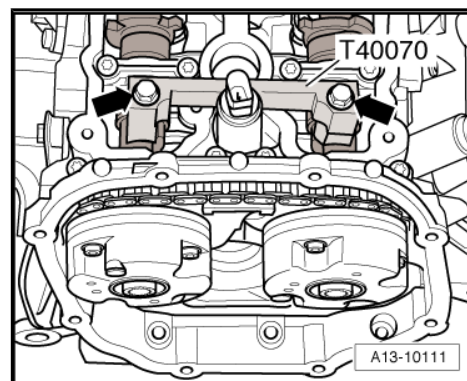
If you turn the crankshaft beyond “TDC” by mistake, turn it back approx. 30° and set to “TDC” again.



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

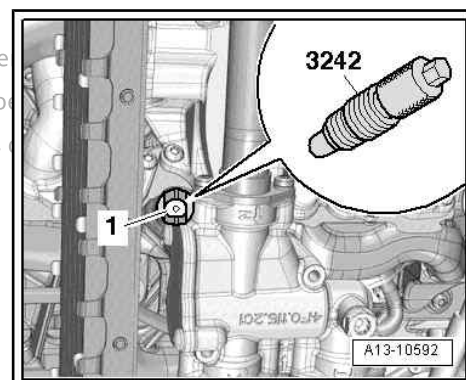


- Fit camshaft clamps - T40070- onto both cylinder heads and tighten bolts -arrows- to 25 Nm.
- The camshaft clamp - T40070- is positioned correctly if the holes for the cylinder head bolts remain free.



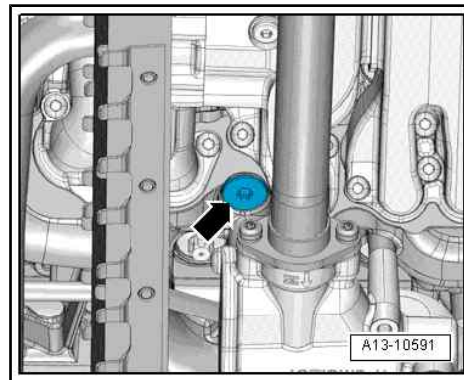
- Screw locking pin - 3242- into groove -1- and tighten to 20 Nm.
- The locking pin - 3242- must engage in the groove in the crankshaft. If it does not, reset valve timing.
- Remove camshaft clamps from both cylinder heads.
- Remove locking pin.

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





- Screw plug for crankshaft "TDC" marking into intake module and tighten ⇒ [Item 13 \(page 74\)](#) .
- Install timing chain covers: left-side ⇒ [page 87](#) , right-side ⇒ [page 90](#) .
- Install cylinder head covers: left-side ⇒ [page 128](#) ; right-side ⇒ [page 129](#) .



1.7 Removing and installing camshaft timing chains

Removing

- Engine removed, engine separated from gearbox ⇒ [page 32](#) .
- Engine in position on scissor-type assembly platform - VAS 6131 A- or secured to engine and gearbox support ⇒ [page 39](#) .
- Remove timing chain cover (bottom) ⇒ [page 92](#) .
- Remove timing chains from camshafts ⇒ [page 100](#) .

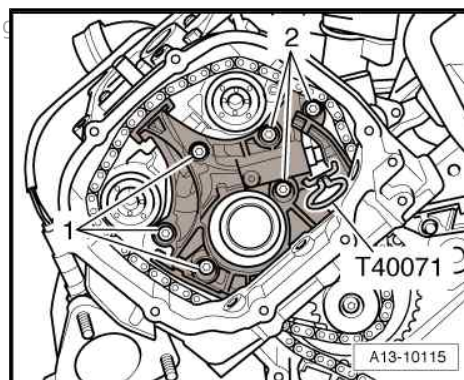


Caution

If a used timing chain rotates in the opposite direction when it is refitted, this can cause breakage.

- ◆ *Mark running direction of timing chain with coloured arrows for re-installation. Do not attempt to mark the timing chain with a centre punch or by making a notch or similar.*

- Remove bolts -1- and -2- and take off chain tensioner (left-side) and camshaft timing chain (left-side).





- Remove bolts -1- and -2- and take off chain tensioner (right-side) and timing chain (right-side).

Installing

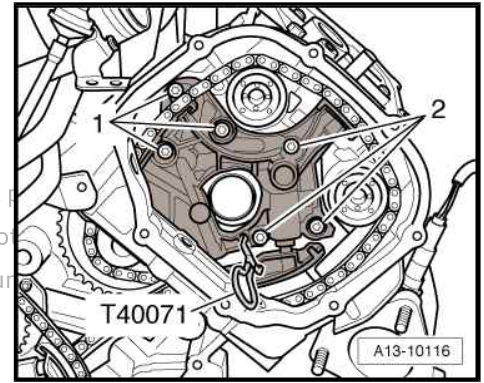
- Tightening torques ⇒ [page 96](#)



Note

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- ◆ *Note the correct installation position if the tensioning element has been removed from the chain tensioner: drilling in base of housing faces chain tensioner and piston faces tensioner rail.*
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew gaskets for chain tensioner.*

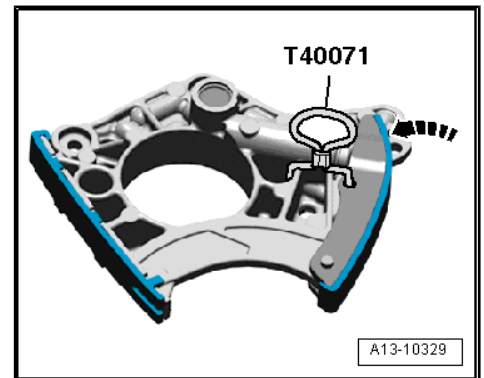


Caution

Risk of damage to valves and piston crowns.

- ◆ *The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.*

- Press guide rail of chain tensioner for camshaft timing chain (left and right) inwards -arrow- as far as the stop. Then lock chain tensioner by inserting locking pin - T40071- .



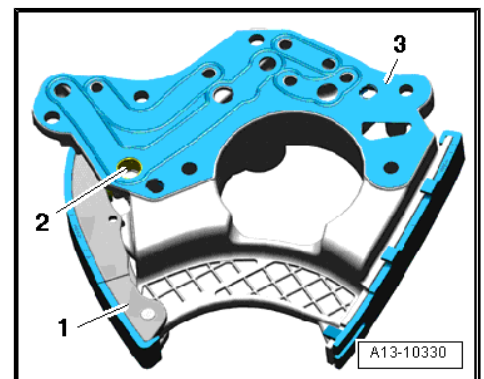
- If necessary, clean oil strainer -2- in both chain tensioners.



Note

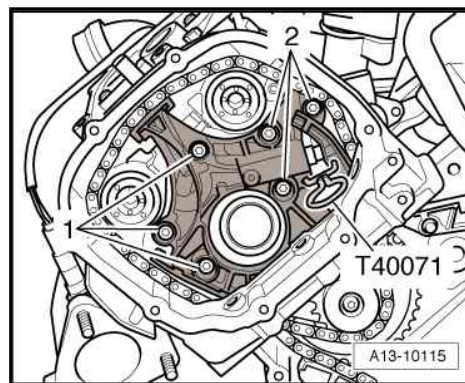
Pay attention to groove in chain tensioner when fitting oil strainer.

- Fit gasket -3- on rear of chain tensioner -1- and clip in.





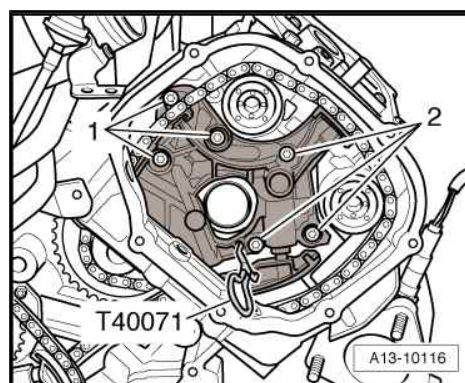
- Position timing chain (left-side) as shown in the illustration (according to marks applied during removal).
- Tighten bolts -1- and -2-.



- Fit chain tensioner on cylinder head (right-side) and position timing chain as shown in the illustration (according to marks applied when removing).
- Tighten bolts -1- and -2-.

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

- Fit timing chains on camshafts ⇒ [page 104](#) .
- Install timing chain cover (bottom) ⇒ [page 92](#) .



1.8 Exploded view - drive chain for valve gear

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**1 - Guide rail****2 - Bolt**

- ☐ Renew
- ☐ 17 Nm +90°

3 - Bolt

- ☐ Tightening torque
⇒ [Item 15 \(page 98\)](#)

4 - Thrust washer for drive sprocket**5 - Drive sprocket for camshaft timing chain (left-side)****6 - Bolt**

- ☐ Renew
- ☐ 17 Nm +90°

7 - Drive chain for valve gear

- ☐ Before removing, mark running direction with paint
- ☐ Removing and installing
⇒ [page 112](#)

8 - Guide rail**9 - Bolt**

- ☐ Renew
- ☐ 17 Nm +90°

10 - Bolt

- ☐ Tightening torque
⇒ [Item 12 \(page 97\)](#)

11 - Bearing bracket for drive sprocket

- ☐ For camshaft timing chain (right-side)
- ☐ Asymmetric version
- ☐ Installation position ⇒ [page 112](#)

12 - Thrust washer for drive sprocket**13 - Drive sprocket for camshaft timing chain (right-side)****14 - Bearing mounting for drive sprocket****15 - Bolt**

- ☐ Tightening torque ⇒ [Item 2 \(page 98\)](#)

16 - O-ring

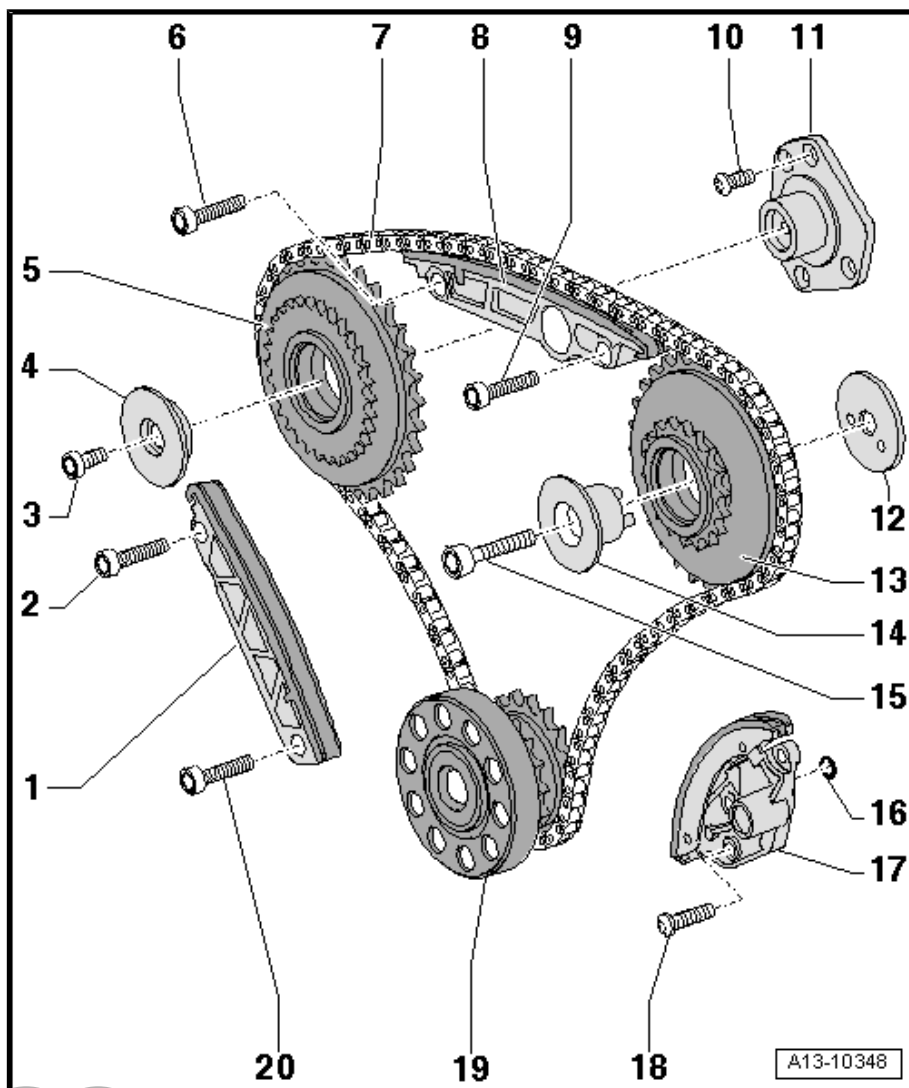
- ☐ Renew
- ☐ Version fitted in vehicle may differ from illustration

17 - Chain tensioner**18 - Bolt**

- ☐ Renew
- ☐ 5 Nm +90°

19 - Crankshaft**20 - Bolt**

- ☐ Renew



A13-10348

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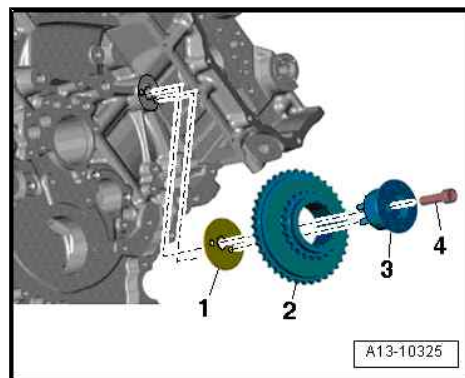
□ 17 Nm +90°

Installation position: bearing mounting for drive sprocket for camshaft timing chain (right-side)

- Dowel pins in bearing mounting -3- for drive sprocket for camshaft timing chain (right-side) must engage in drillings in thrust washer -1- and in cylinder block drillings.

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

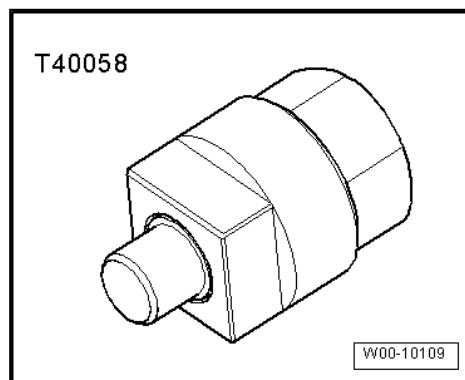
4 - Bolt



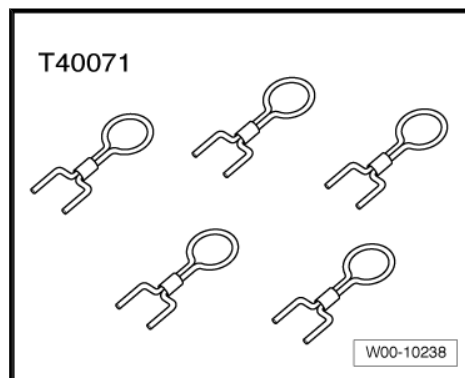
1.9 Removing and installing drive chain for valve gear

Special tools and workshop equipment required

- ◆ Adapter - T40058-



- ◆ Locking pin - T40071-



Removing

- Engine removed, engine separated from gearbox ⇒ [page 32](#).
- Engine in position on scissor-type assembly platform - VAS 6131 A- or secured to engine and gearbox support ⇒ [page 39](#).
- Remove timing chains ⇒ [page 108](#) .
- Remove drive chain for auxiliary drives ⇒ [page 114](#) .



- Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting locking pin - T40071- .



Caution

If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.

- ◆ *Mark running direction of drive chain with paint for re-installation. Do not attempt to mark the drive chain with a centre punch or by making a notch or similar.*

- Unscrew bolts -1- and remove guide rail.
- Remove bolts -2- and take off chain tensioner.
- Detach drive chain for valve gear.

Installing

- Tightening torque ➔ [page 110](#)

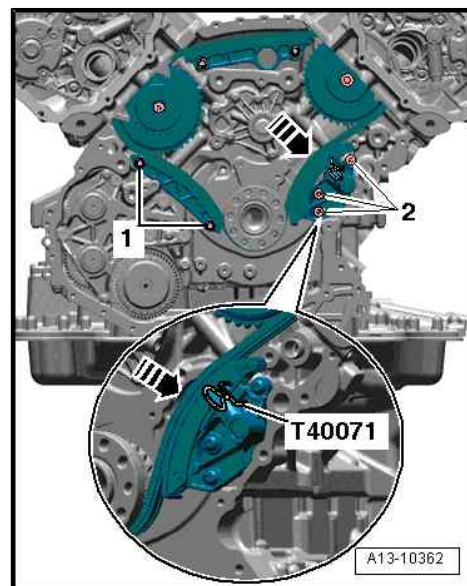
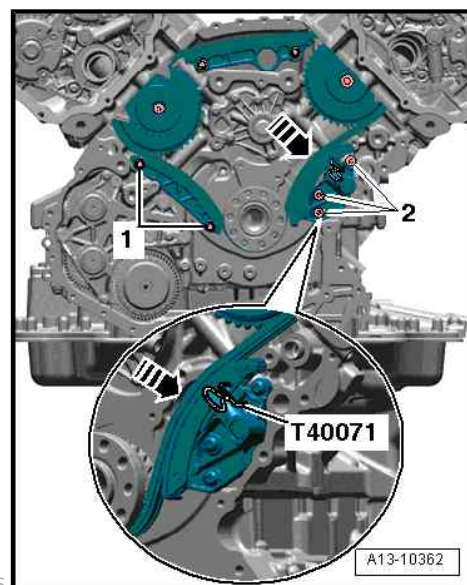
Installation is carried out in reverse order; note the following:



Note

Renew the bolts tightened with specified tightening angle.

- Position drive chain for valve gear onto drive chain sprockets (according to marks applied during removal).
- Install guide rail and tighten bolts -1-.
- Install chain tensioner and tighten bolts -2-.
- Press guide rail of chain tensioner for drive chain in direction of -arrow- and remove locking pin - T40071- .
- Install drive chain for auxiliary drives ➔ [page 114](#) .
- Install camshaft timing chains ➔ [page 108](#) .



1.10 Exploded view - drive chain for auxiliary drives

**1 - Bolt**

- ☐ Renew
- ☐ 5 Nm +90°

2 - Chain tensioner

- ☐ With guide rail

3 - Gasket

- ☐ Renew

4 - Bolt

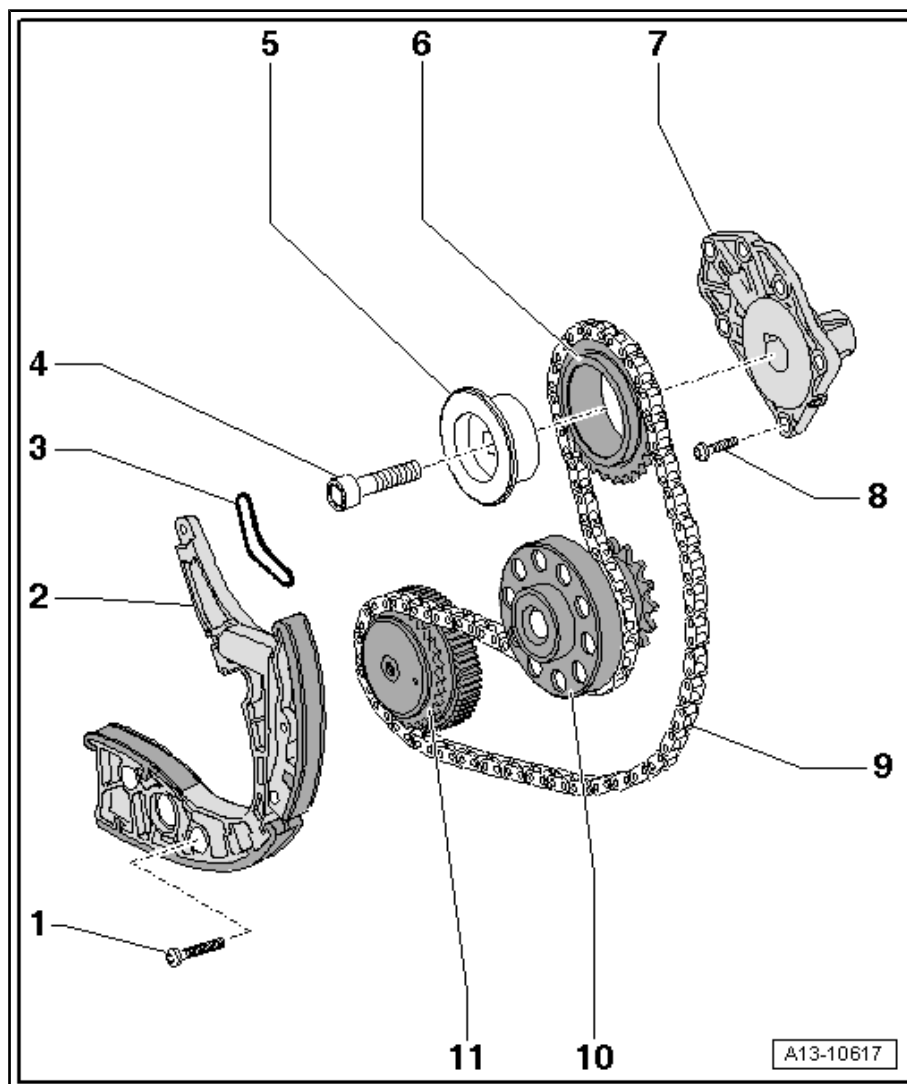
- ☐ 42 Nm

5 - Bearing mounting**6 - Idler sprocket****7 - Bearing bracket****8 - Bolt**

- ☐ Renew
- ☐ 5 Nm +90°

9 - Drive chain for auxiliary drives

- ☐ Before removing, mark running direction with paint
- ☐ Removing and installing
⇒ [page 114](#)

10 - Crankshaft**11 - Drive chain sprocket for auxiliary drives**

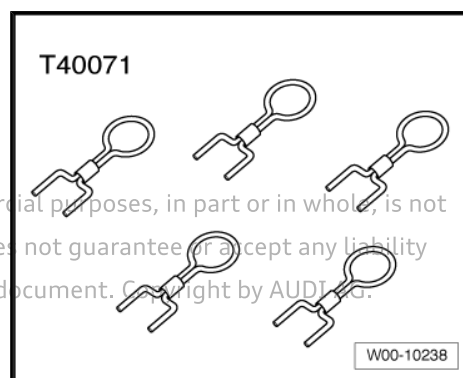
1.11 Removing and installing drive chain for auxiliary drives

Special tools and workshop equipment required

- ◆ Locking pin - T40071-



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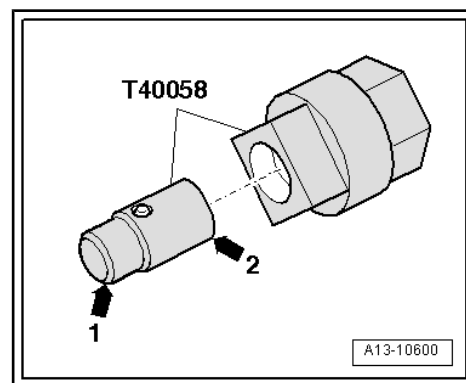


Removing

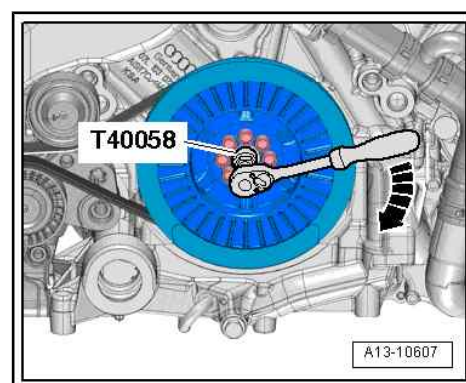
- Engine removed, engine separated from gearbox ⇒ [page 32](#) .
- Engine in position on scissor-type assembly platform - VAS 6131 A- or secured to engine and gearbox support
⇒ [page 39](#) .



- Insert guide pin of adapter -T40058- as follows:
 - The smaller-diameter section -arrow 1- faces the engine.
 - The larger-diameter section -arrow 2- faces the adapter.



- Turn crankshaft with adapter - T40058- in normal direction of rotation -arrow- to "TDC position".



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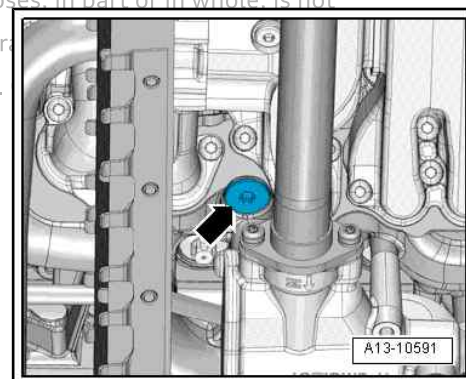


Note

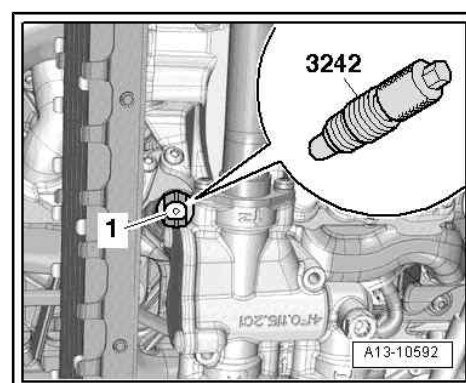
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Lay a cloth under the engine to catch escaping engine oil.

- Remove plug -arrow- for crankshaft "TDC" marking from intake module.



- Screw locking pin - 3242- into groove (20 Nm); if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.





- Remove timing chain cover (bottom) ⇒ [page 92](#) .



Caution

If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.

- ◆ *Mark running direction of drive chain with paint for re-installation. Do not attempt to mark the drive chain with a centre punch or by making a notch or similar.*

- Press tensioning rail in direction of -arrow- and lock chain tensioner in place using locking pin – T40071-
- Unscrew bolt -1- and remove idler sprocket.
- Remove bolts -2, 3, 4- and take off chain tensioner.
- Detach drive chain for auxiliary drives.

Installing

- Tightening torques ⇒ [page 113](#)

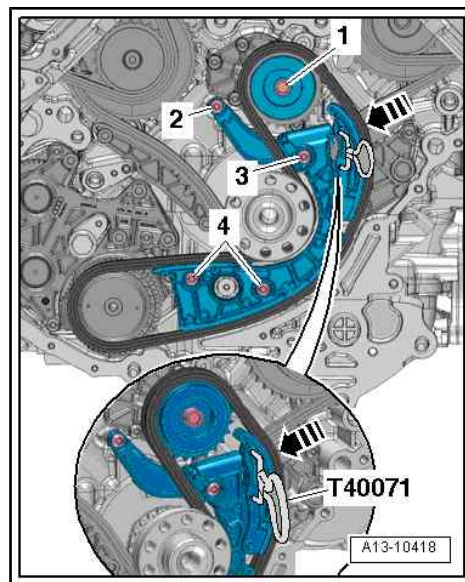
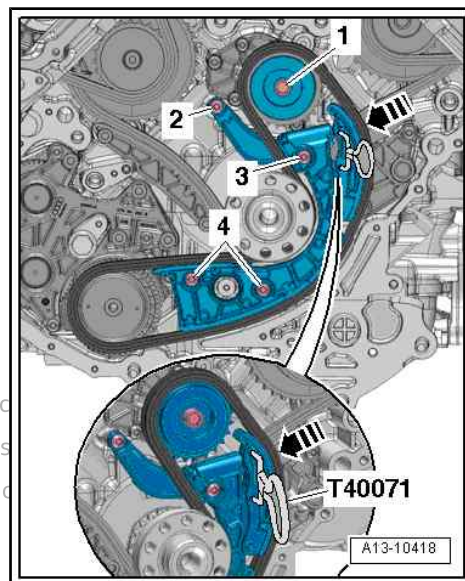
Installation is carried out in reverse order; note the following:



Note

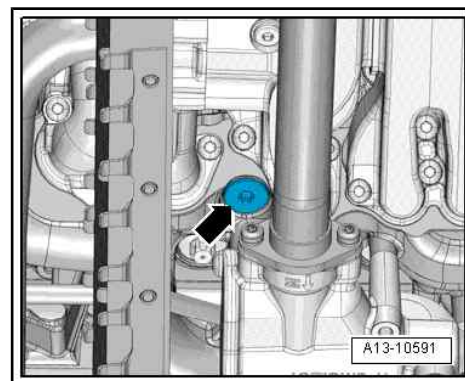
- ◆ *Renew seal/gasket.*
- ◆ *Renew seal on screw plug for crankshaft "TDC" marking.*
- Fit drive chain for auxiliary drives according to marks applied when removing.
- Install chain tensioner and tighten bolts -2, 3, 4-.
- Fit drive chain onto idler sprocket and tighten bolt -1-.

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





- Screw plug for crankshaft "TDC" marking into intake module and tighten ⇒ [Item 13 \(page 74\)](#) .
- Install timing chain cover (bottom) ⇒ [page 92](#) .



1.12 Exploded view - auxiliary drives

1 - Spur gear drive

- ☐ Do not dismantle
- ☐ Removing and installing ⇒ [page 121](#)

2 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 118](#)

3 - Oil seal for power steering pump drive

- ☐ Renewing ⇒ [page 120](#)

4 - Flat-section O-ring

- ☐ Renew if damaged
- ☐ Installation position in power steering pump drive ⇒ [page 118](#)

5 - Drive shaft for power steering pump

- ☐ With bonded rubber buffer

6 - Oil seal for air conditioner compressor drive

- ☐ Renewing ⇒ [page 118](#)

7 - Dust cap for air conditioner compressor drive

8 - Clamp

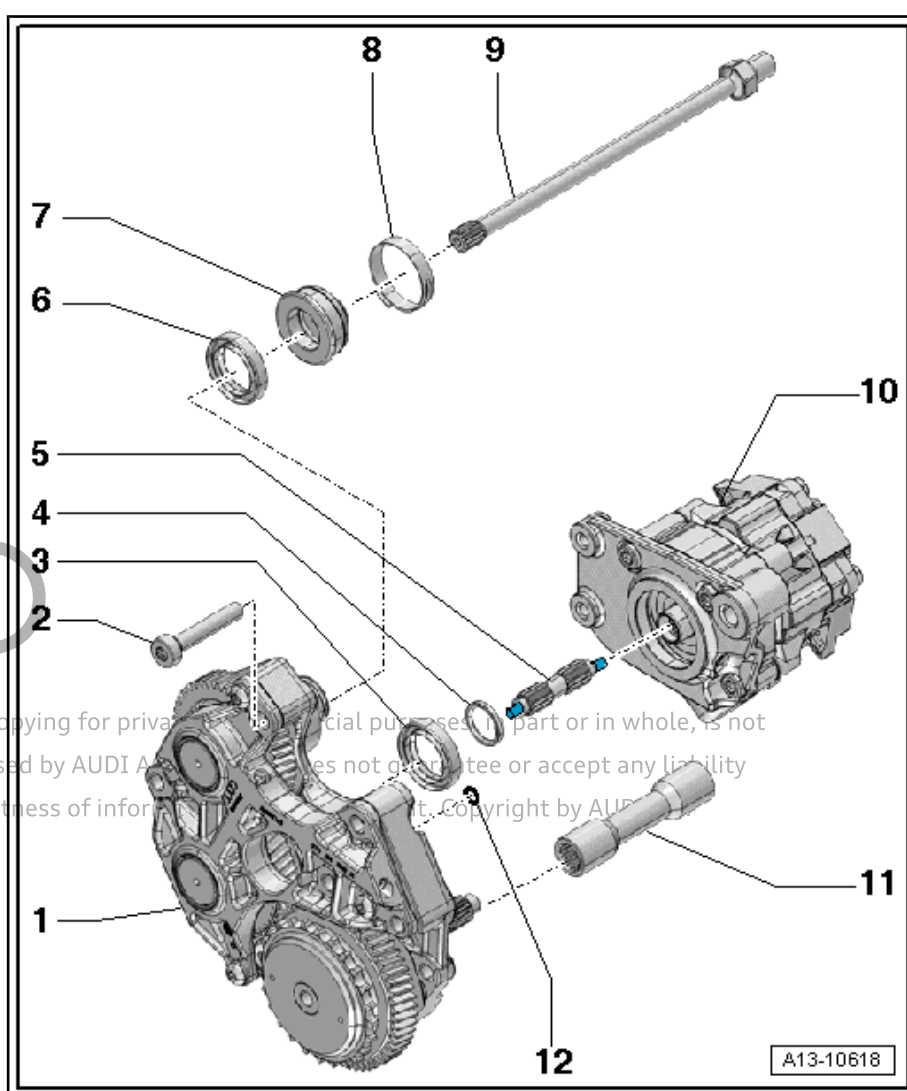
- ☐ Renew
- ☐ Use correct type (as original equipment) ⇒ Electronic parts catalogue

9 - Drive shaft for air conditioner compressor

- ☐ Tightening torque ⇒ Rep. gr. 87

10 - Power steering pump

- ☐ Removing and installing ⇒ Rep. gr. 48





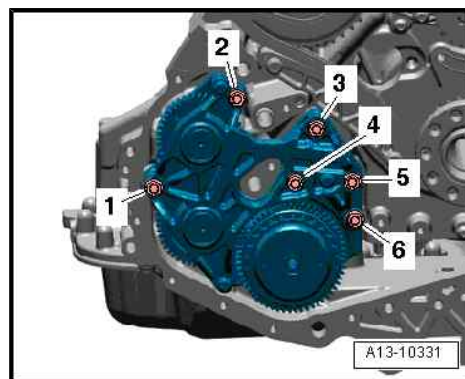
11 - Oil pump drive shaft

12 - O-ring

- Renew

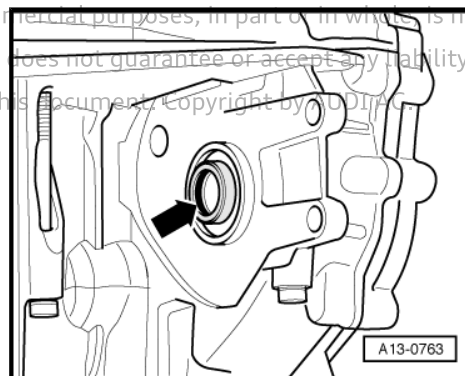
Spur gear drive - tightening torque and sequence

- Tighten bolts -1 ... 6- in diagonal sequence and in stages to 22 Nm.



Installation position of flat-section O-ring

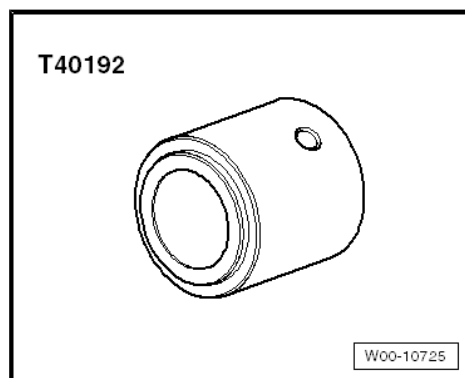
- ◆ In power steering pump drive -arrow-.



1.13 Renewing oil seal for air conditioner compressor drive

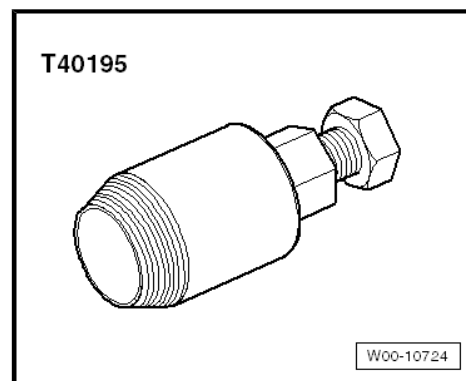
Special tools and workshop equipment required

- ◆ Thrust piece - T40192-



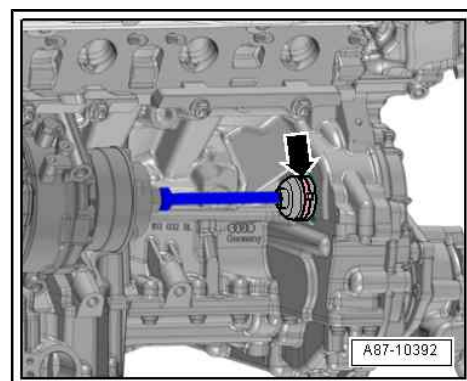


◆ Oil seal extractor -T40195-



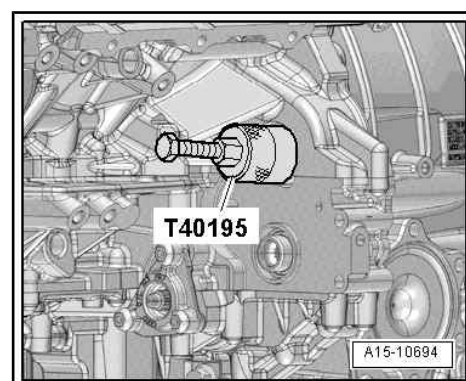
Procedure

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#).
- Remove air conditioner compressor ⇒ Rep. gr. 87.
- Detach hose clip on dust cap -arrow- for air conditioner compressor drive.
- Pull off dust cap together with drive shaft for air conditioner compressor from stub shaft of spur gear for air conditioner compressor drive.
- Screw spindle of oil seal extractor -T40195- all the way out.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Turn inner part of oil seal extractor against spur gear drive until the oil seal is pulled out.

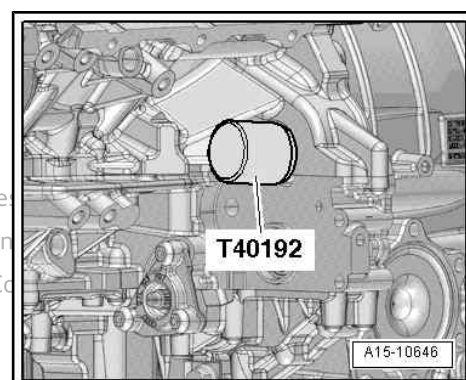


i Note

If the sections of the oil seal come apart, apply oil seal extractor again and pull out remaining part of oil seal.



- Clamp hexagon flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface.
- Drive oil seal for AC compressor drive in onto stop with thrust piece -T40192-.



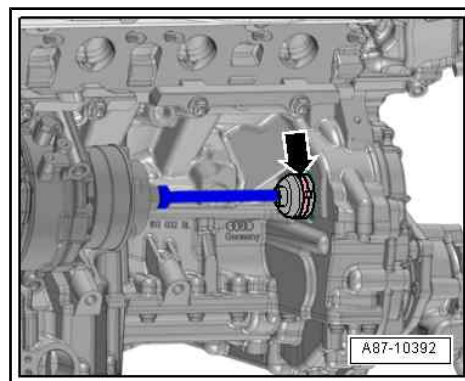
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Note

*Secure with correct type of hose clip (same as original equipment)
⇒ Electronic parts catalogue .*

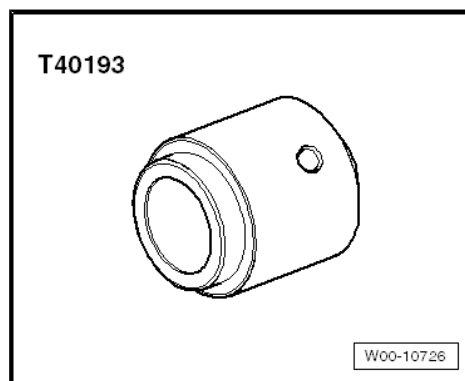
- Press dust cap -arrow- with hose clip fitted onto stub shaft of spur gear for air conditioner compressor drive and secure.
- Install air conditioner compressor ⇒ Rep. gr. 87 .



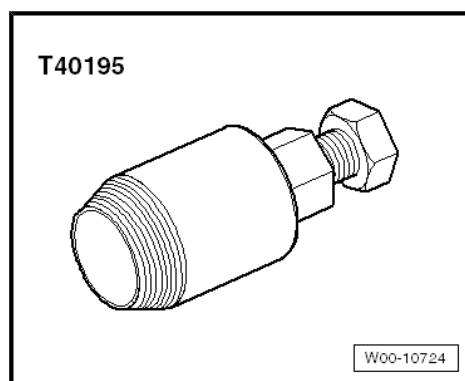
1.14 Renewing oil seal for power steering pump drive

Special tools and workshop equipment required

- ◆ Thrust piece - T40193-



- ◆ Oil seal extractor -T40195-

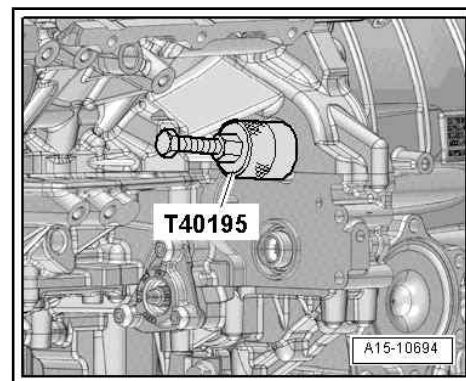


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Procedure

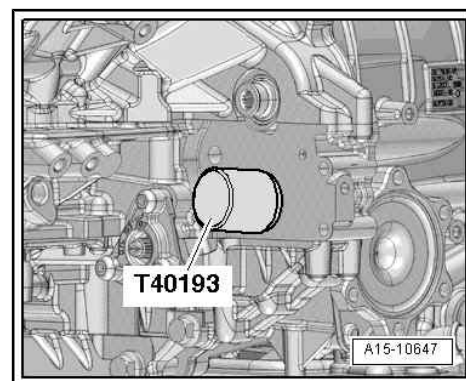
- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .
- Remove power steering pump ⇒ Rep. gr. 48 .
- Screw spindle of oil seal extractor -T40195- all the way out.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Turn inner part of oil seal extractor against spur gear drive until the oil seal is pulled out.



Note

If the sections of the oil seal come apart, apply oil seal extractor again and pull out remaining part of oil seal.

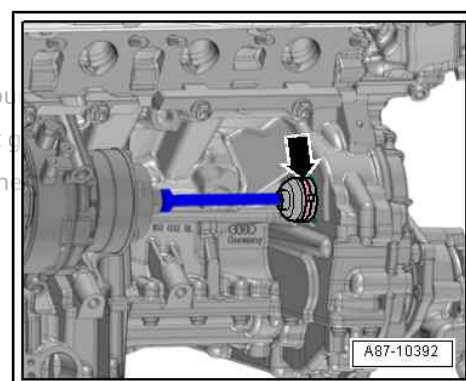
- Clamp hexagon flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface.
- Drive oil seal for power steering pump drive in onto stop with thrust piece -T40193- .
- Install power steering pump ⇒ Rep. gr. 48 .



1.15 Removing and installing spur gear drive

Removing

- Engine removed, engine separated from gearbox ⇒ [page 32](#) .
- Engine in position on scissor-type assembly platform - VAS 6131 A- or secured to engine and gearbox support ⇒ [page 39](#) .
- Remove timing chain cover (bottom) ⇒ [page 92](#) .
- Remove turbocharger (left-side) ⇒ [page 234](#) .
- Detach hose clip on dust cap -arrow- for air conditioner compressor drive.
- Remove drive chain for auxiliary drives ⇒ [page 114](#) .

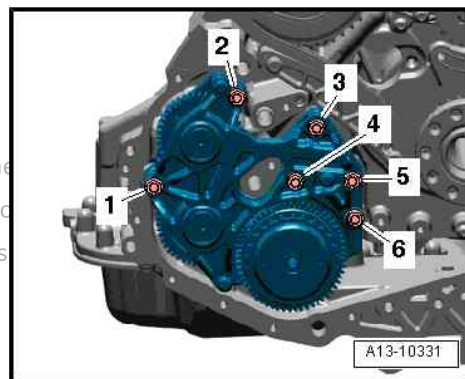




- Remove bolts -1- ... 6-.



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- Detach spur gear drive -1-, detach connection piece -2- from power steering pump and connection piece -3- from oil pump.

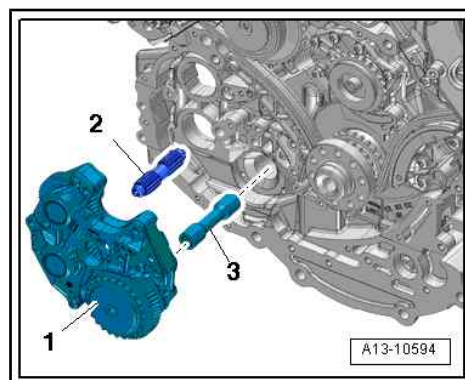
Installing



Note

Fit new O-ring.

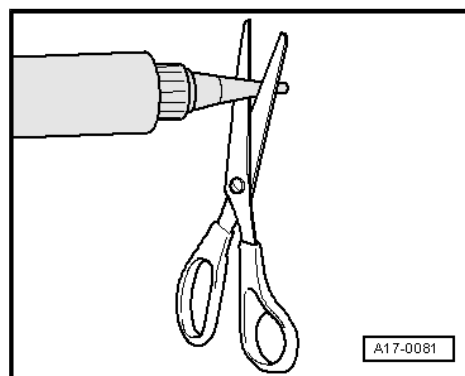
- Renew oil seals ⇒ [Item 3 \(page 117\)](#) , ⇒ [Item 6 \(page 117\)](#) and flat-section O-ring ⇒ [Item 4 \(page 117\)](#) in power steering pump drive if damaged.
- Remove sealant residues from spur gear drive and cylinder block.
- Clean sealing surfaces; they must be free of oil and grease.



Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 1.5 mm).

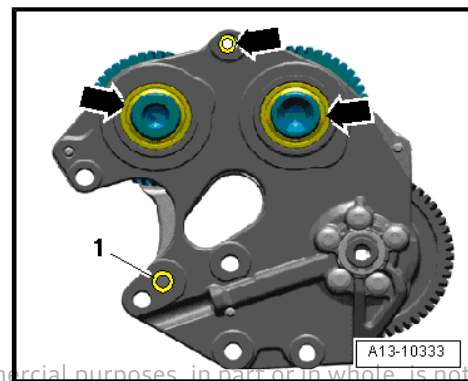


**Caution**

Make sure lubrication system is not clogged by excess sealant.

◆ ***The sealant beads must not be thicker than specified.***

- Apply beads of sealant -arrows- onto clean sealing surfaces of spur gear drive as shown in illustration.
- Width of sealant beads: 2.0 mm.
- Apply O-ring -1- and secure in position with a small amount of grease.

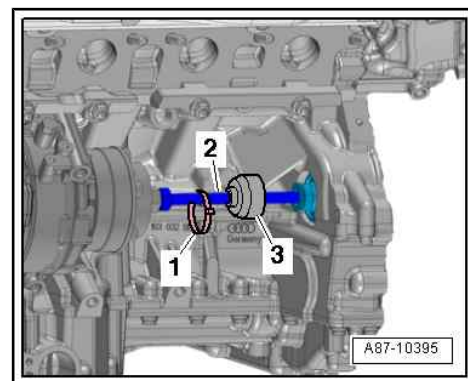
**Note**

The spur gear drive must be installed within 5 minutes after applying the sealant.

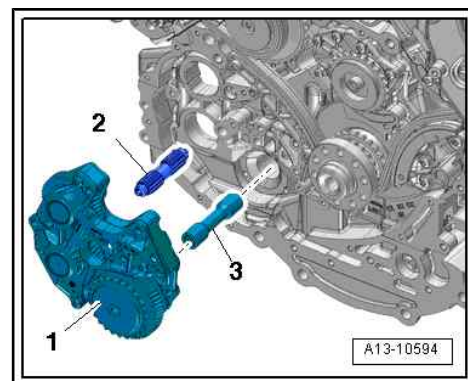
**Note**

*Secure with correct type of hose clip (same as original equipment)
⇒ Electronic parts catalogue .*

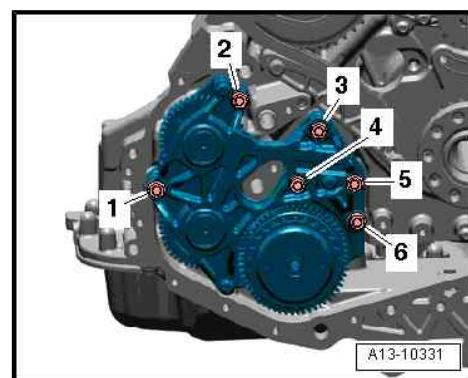
- The new hose clip -1- must be guided through the hole in the retaining frame and over the dust cap -3- onto the air conditioner compressor drive shaft -2- while the spur gear drive is still removed.



- Insert connection piece -2- into power steering pump and connection piece -3- into oil pump.
- Fit spur gear drive -1- onto connection pieces while holding power steering pump in installation position.
- Fit spur gear drive while turning gear wheels back and forth.



- Tighten bolts ⇒ [page 118](#) .

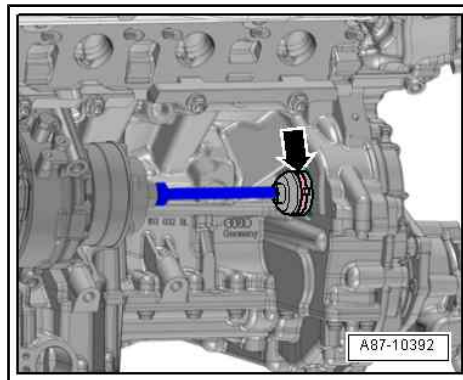




- Press dust cap -arrow- with hose clip fitted onto stub shaft of spur gear for air conditioner compressor drive and secure.

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

- Install drive chain for auxiliary drives ⇒ [page 114](#) .
- Install timing chain cover (bottom) ⇒ [page 92](#) .
- Install turbocharger (left-side) ⇒ [page 234](#) .



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2 Cylinder head

2.1 Exploded view - cylinder head and cylinder head cover



Note

The diagram shows the cylinder head on cylinder bank 2 (left-side).

1 - Bolt

- ☐ 9 Nm

2 - Oil supply line

- ☐ To turbocharger, cylinder bank 2 (left-side)

3 - Banjo bolt

- ☐ 17 Nm

4 - Seals

- ☐ Renew

5 - Cylinder head

- ☐ Removing and installing
⇒ [page 131](#)
- ☐ Checking for distortion
⇒ [page 127](#)
- ☐ Machining limit
⇒ [page 127](#)
- ☐ If renewed, change
coolant and engine oil

6 - Engine lifting eye

7 - Bolt

- ☐ 22 Nm

8 - Seal

- ☐ Renew

9 - Gasket for cylinder head cover

- ☐ Renew if damaged or leaking

10 - Cylinder head cover

- ☐ Removing and installing: left-side
⇒ [page 128](#) , right-side ⇒ [page 129](#)

11 - Plug

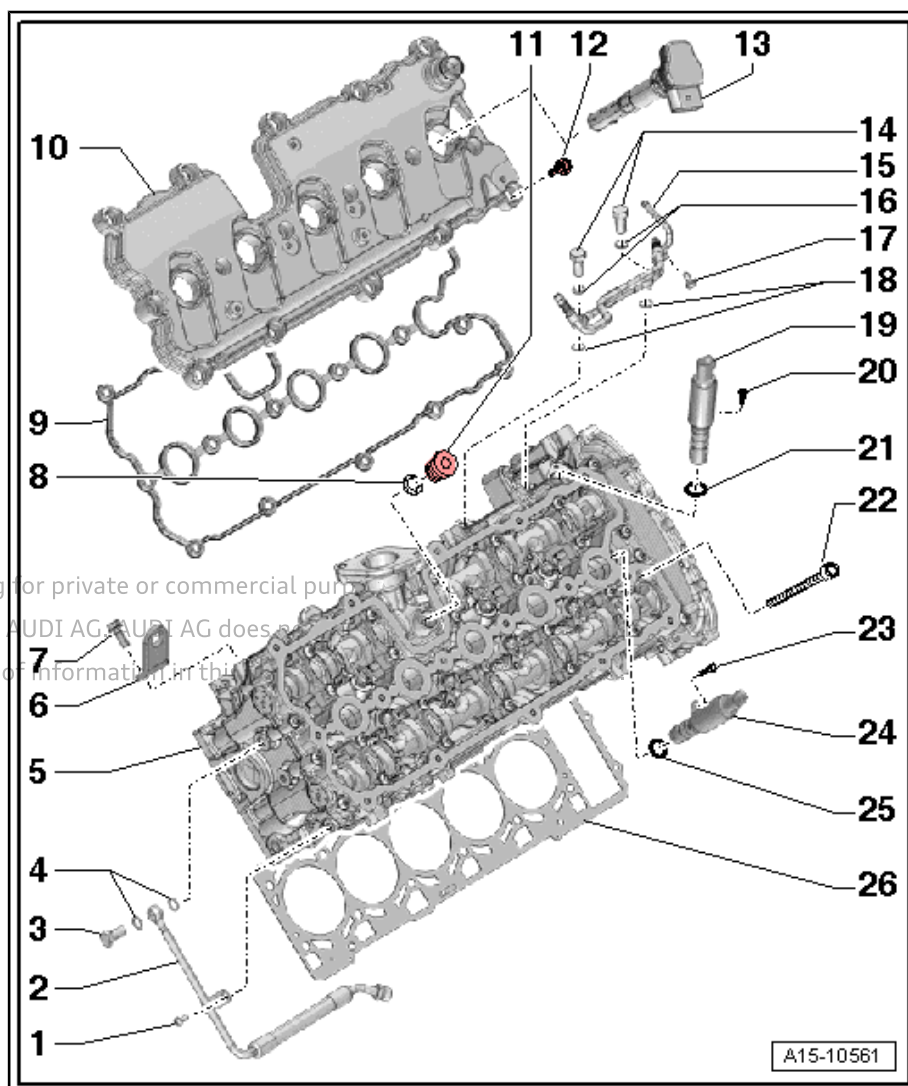
- ☐ 35 Nm

12 - Bolt

- ☐ Renew if gasket is damaged
- ☐ Tightening torque and tightening sequence: cylinder head cover (left-side) ⇒ [page 126](#) , cylinder head cover (right-side) ⇒ [page 127](#)

13 - Ignition coil

- ☐ Removing and installing ⇒ Rep. gr. 28





14 - Banjo bolt

- ☐ Renew
- ☐ 8 Nm +90°

15 - Coolant lines and fuel lines

16 - Seals

- ☐ Renew

17 - Bolt

- ☐ 9 Nm

18 - Seals

- ☐ Renew

19 - Camshaft control valve

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

20 - Bolt

- ☐ 2.4 Nm

21 - O-ring

- ☐ Renew

22 - Bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 134](#)
- ☐ Tightening torque and sequence ⇒ [page 127](#)

23 - Bolt

- ☐ 2.4 Nm

24 - Exhaust camshaft control valve

- ☐ Cylinder bank 1 (right-side): exhaust camshaft control valve 1 - N318-
- ☐ Cylinder bank 2 (left-side): exhaust camshaft control valve 2 - N319-

25 - O-ring

- ☐ Renew

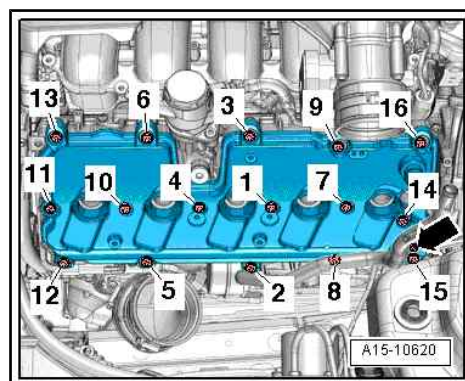
26 - Cylinder head gasket

- ☐ Renewing ⇒ [“2.4 Removing and installing cylinder head”, page 131](#)
- ☐ Installation position: part number must face cylinder head
- ☐ If renewed, change coolant and engine oil

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Cylinder head cover (left-side) - tightening torque and sequence

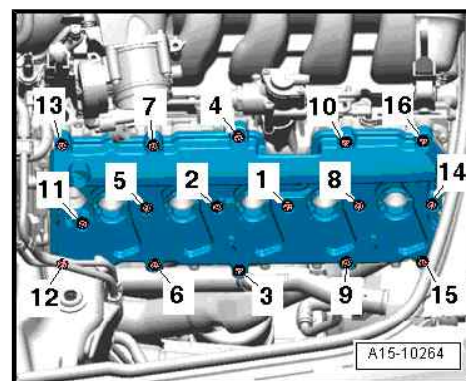
- Tighten bolts in the sequence -1 ... 16- to 9 Nm.





Cylinder head cover (right-side) - tightening torque and sequence

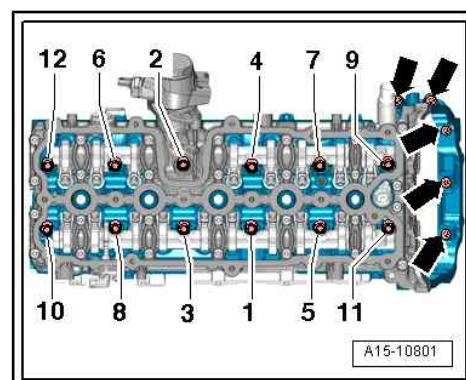
- Tighten bolts in the sequence -1 ... 16- to 9 Nm.



Cylinder head - tightening torque and sequence

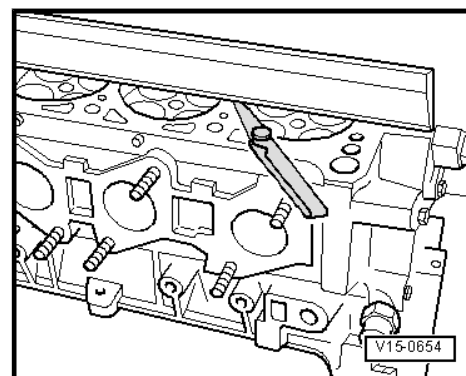
- Renew cylinder head bolts.
- Tighten bolts in 7 stages in the sequence shown:

Stage	Bolts	Tightening torque/tightening angle
1.	-1 ... 12-	Screw in by hand until bolts make contact with cylinder head
2.	-1 ... 12-	30 Nm
3.	-1 ... 12-	60 Nm
4.	-1 ... 12-	Turn 90° further
5.	-1 ... 12-	Turn 90° further
6.	-Arrows-	11 Nm
7.	-Arrows-	Turn 90° further



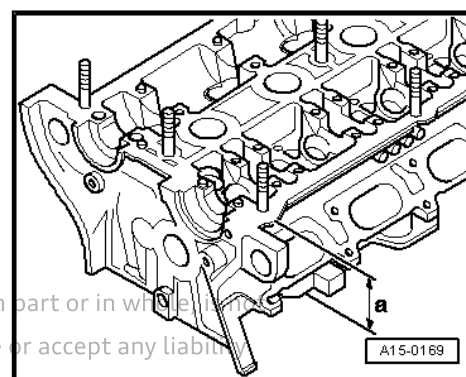
Checking cylinder head for distortion

- Use straight edge and feeler gauge to measure cylinder head for distortion at several points.
- Max. permissible distortion: 0.1 mm



Cylinder head machining limit

- Machining of the cylinder head (surface grinding) is only permissible down to the minimum dimension -a-.
- ♦ Minimum dimension: -a- = 139.5 mm



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

Removing

- Remove ignition coils for cylinders 6 ... 10 ⇒ Rep. gr. 28 .
- Unplug electrical connector -1- at throttle valve module 2 - J544- .

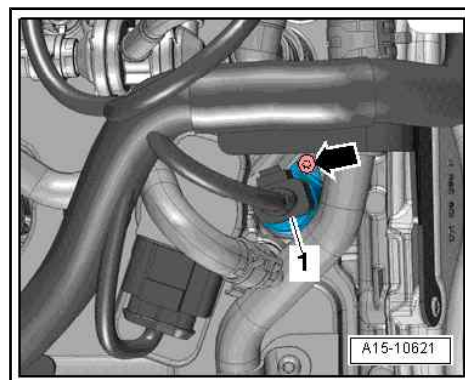
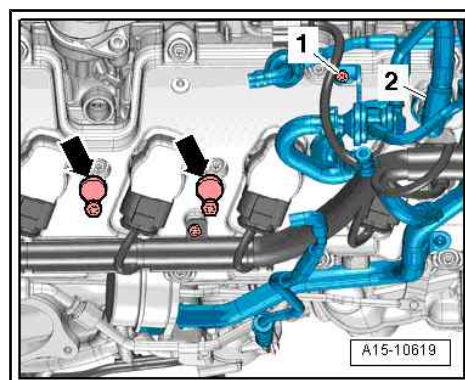
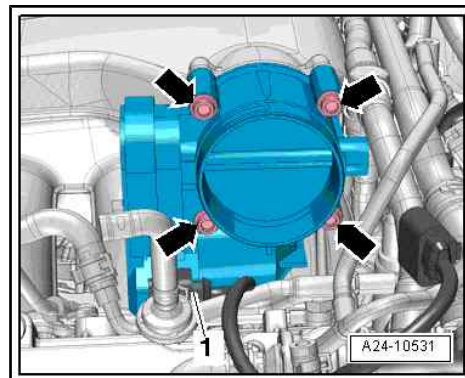


Note

Disregard -arrows-.

- Remove retaining studs -arrows- for air cleaner (bottom section) and bolt -1- securing bracket.
- Detach crankcase breather hose -2- (press release tabs).

- Unplug electrical connector -1-.
- Remove bolt -arrow- and remove exhaust camshaft control valve 2 - N319- .



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- Remove bolt -arrow- and push crankcase breather pipe slightly to the left.
- Slacken bolts for cylinder head cover (left-side) in the sequence -16 ... 1-.
- Remove bolts and take off cylinder head cover.

Installing

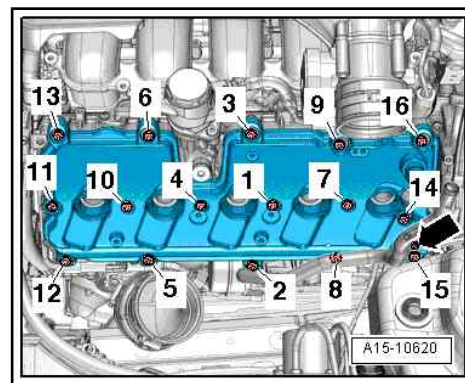
- Tightening torque ➔ [page 125](#)

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



Note

- ◆ *Renew gasket for cylinder head cover if damaged.*
- ◆ *Renew bolts for cylinder head cover if seals on bolts are damaged.*
- ◆ *Fit new O-ring.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Electronic parts catalogue .*
- Clean sealing surfaces; they must be free of oil and grease.
- Tighten bolts for cylinder head cover (left-side) ➔ [page 126](#) .
- Install ignition coils ➔ Rep. gr. 28 .



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

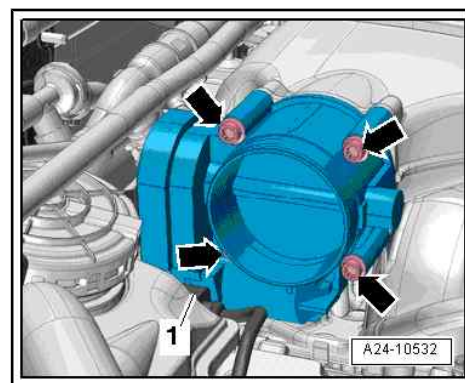
Removing

- Remove ignition coils for cylinders 1 ... 5 ➔ Rep. gr. 28 .
- Unplug electrical connector -1- at throttle valve module - J338- .

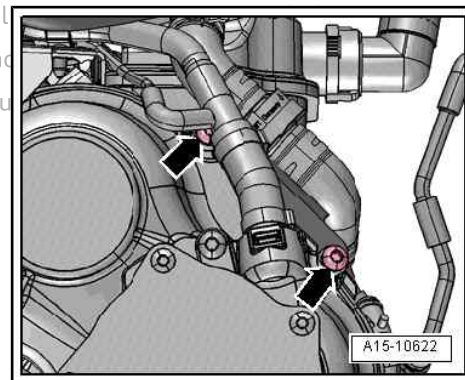


Note

Disregard -arrows-.

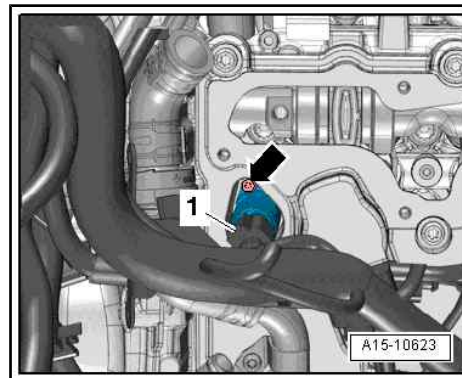


- Slacken bolts -arrows- a few turns.





- Unplug electrical connector -1-.
- Remove bolt -arrow- and remove exhaust camshaft control valve 1 - N318- .



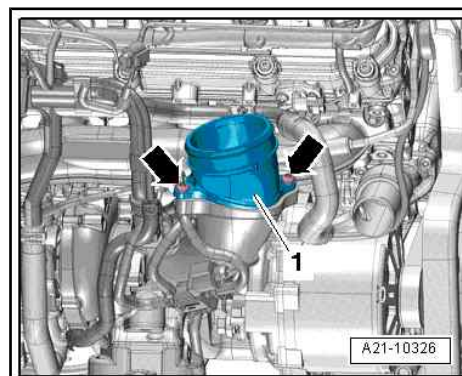
- Unscrew bolts -arrows- and remove intermediate flange -1-.



Caution

Risk of irreparable damage to turbocharger.

- ◆ *Use adhesive tape to seal off connection for turbocharger to prevent small objects from dropping into the turbocharger.*

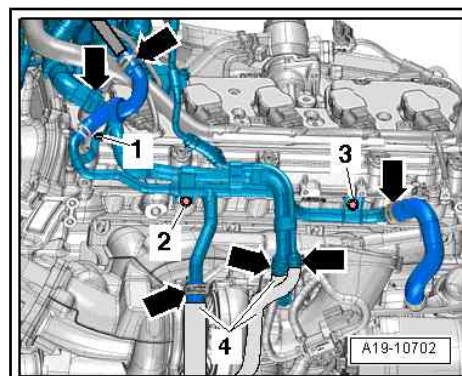


- Remove bolts -1, 2, 3-.
- Press coolant pipe (right-side) with pipes slightly to the right.



Note

-Item 4- and -arrows- can be disregarded.



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- Slacken bolts for cylinder head cover (right-side) in the sequence -16 ... 1-.
- Remove bolts and take off cylinder head cover.

Installing

- Tightening torque ⇒ [page 125](#)

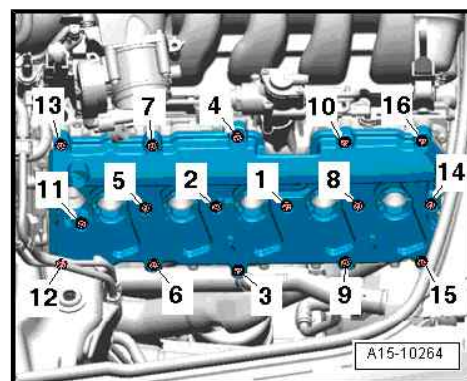
Installation is carried out in reverse order; note the following:



Note

- ◆ *Renew gasket for cylinder head cover if damaged.*
- ◆ *Renew bolts for cylinder head cover if seals on bolts are damaged.*
- ◆ *Fit new O-ring.*

- Clean sealing surfaces; they must be free of oil and grease.
- Tighten bolts for cylinder head cover (right-side) ⇒ [page 127](#) .
- Install coolant pipe (right-side) with coolant lines ⇒ [page 217](#) .
- Install intermediate flange (right-side) ⇒ Rep. gr. 24 .
- Install timing chain cover (right-side) ⇒ [page 90](#) .
- Install ignition coils ⇒ Rep. gr. 28 .



2.4 Removing and installing cylinder head

Special tools and workshop equipment required

- ◆ Socket XZN M12 (at least 140 mm), commercially available

Removing

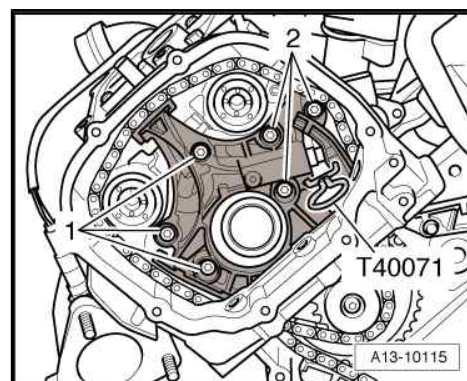
- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .



Note

The following description is for removing and installing on cylinder head (left-side).

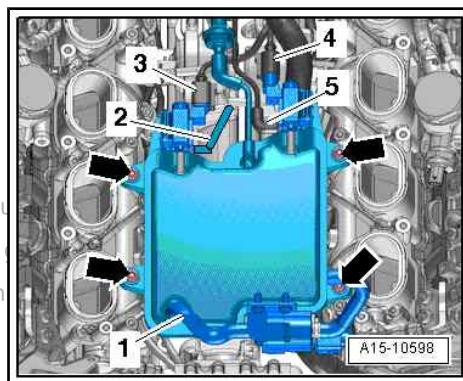
- Remove turbocharger (left-side) ⇒ [page 234](#) .
- Remove intake manifold (top section) ⇒ Rep. gr. 24 .
- Remove timing chains from camshafts ⇒ [page 100](#) .
- Remove bolts -1- and -2- and take off chain tensioner (left-side).





- Unplug electrical connectors -3- and -4-.
- Disconnect vacuum hoses -1, 2, 5- and take off vacuum reservoir.

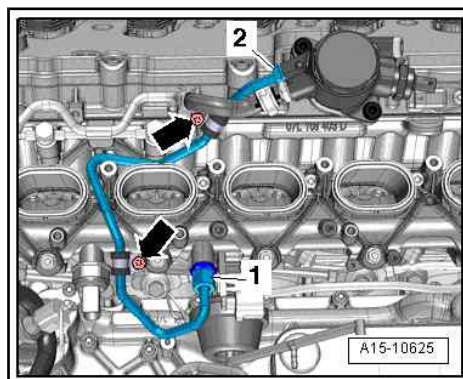
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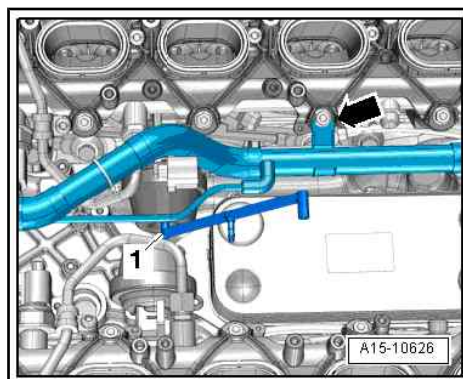
- Unscrew bolts -arrows- and connection -2-.
- Unscrew union nut -1-; to do so, counterhold at threaded connection and detach high-pressure pipe.

**Note**

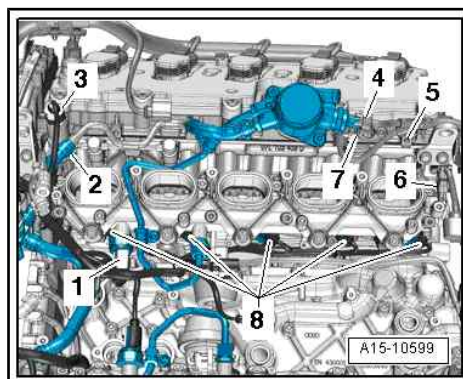
Do not attempt to bend high-pressure pipe to a different shape.



- Move clear secondary air hose -arrow- and detach vacuum hose -1- from vacuum unit.

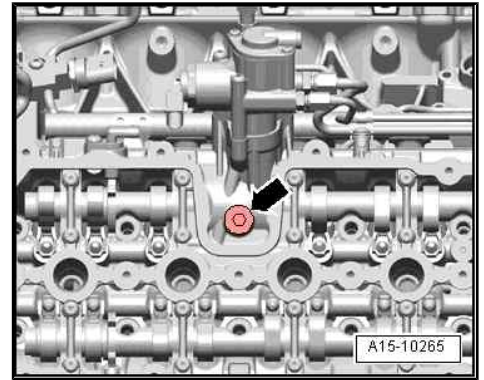


- Unplug electrical connectors and move clear:
 - 1 - For fuel pressure sender 2 - G624-
 - 3 - For camshaft control valve 2 - N208-
 - 4 - For fuel metering valve 2 - N402- on high-pressure pump
 - 6 - For intake manifold flap potentiometer 2 - G512-
 - 7 - For Hall sender 3 - G300-
 - 8 - For injectors
- Unscrew bolt -5- and move earth wiring clear.
- Detach fuel supply hose -2-.





- Remove screw plug -arrow-.



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- Remove bolts -arrows-.
- Slacken cylinder head bolts in the sequence -1 ... 12-.
- Unscrew bolts, detach cylinder head and set it down on a soft surface (foam plastic).

Installing

- Tightening torques ⇒ [page 125](#)



Caution

Risk of damage to sealing surfaces.

- ◆ *Carefully remove sealant residue from cylinder head and cylinder block.*
- ◆ *Ensure that no long scores or scratches are made on the surfaces.*

Risk of damage to cylinder block.

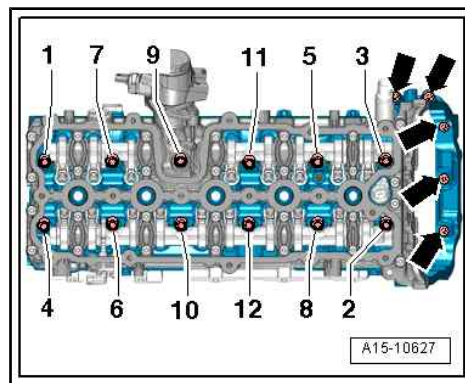
- ◆ *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*

Risk of leaks at cylinder head gasket.

- ◆ *Carefully remove any sealant residue 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.*
- ◆ *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- ◆ *Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.*

Risk of damage to open valves.

- ◆ *When installing an exchange cylinder head, the plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*

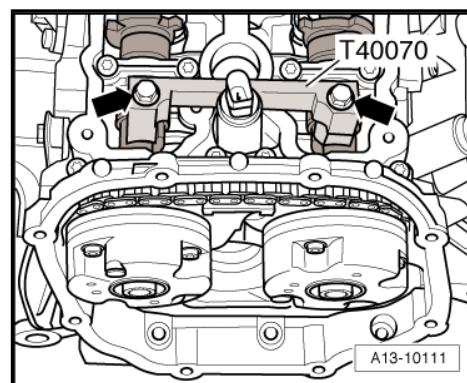


Note

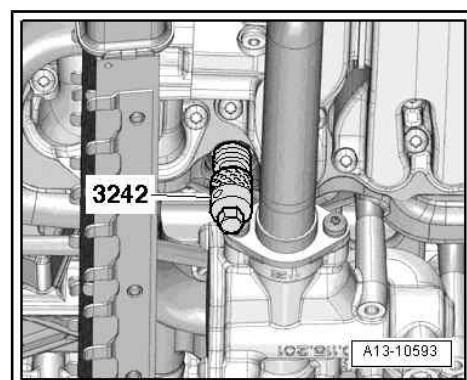
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew self-locking nuts as well as seals, gaskets and O-rings.*
- ◆ *When installing an exchange cylinder head with camshafts fitted, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
- ◆ *After fitting a new cylinder head or cylinder head gasket, change the engine oil and coolant.*



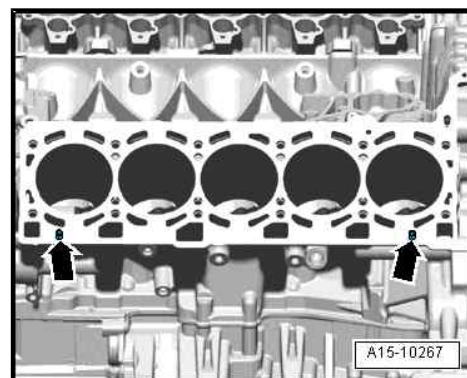
- Check that camshafts on both cylinder heads are positioned at “TDC”.
- Camshaft clamps - T40070- installed on both cylinder heads and tightened to 25 Nm -arrows-.



- Crankshaft locked in position with locking pin - 3242- .



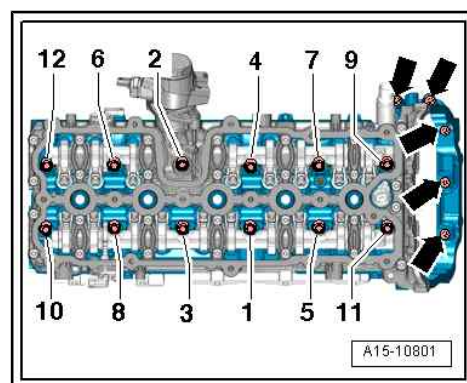
- Place cylinder head gasket in position.
- Installation position: the word “oben” (top) or the Part No. should be visible.
- Pay attention to dowel sleeves -arrows- in cylinder block.
- Fit cylinder head.



- Tighten cylinder head bolts ⇒ [page 127](#) .

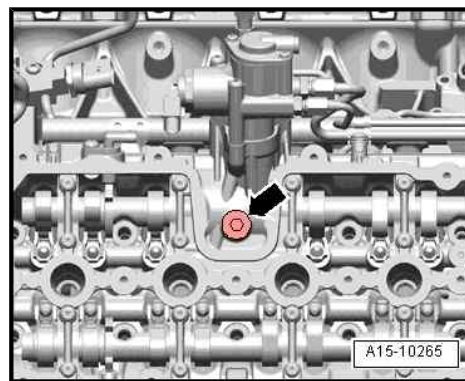
**Note**

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





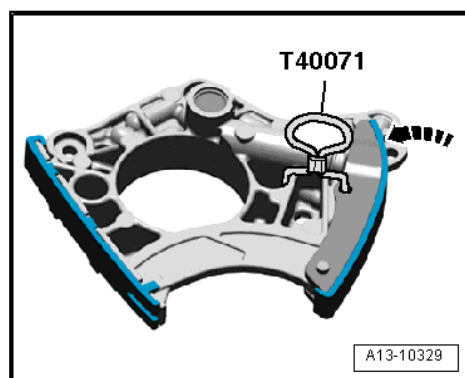
- Tighten screw plug -arrow-.



- Make sure that guide rail of chain tensioner for camshaft timing chain is locked with locking pin - T40071- .

**Note**

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

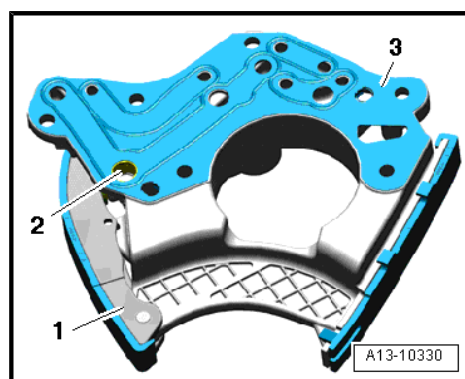


- If necessary, clean oil strainer -2- of chain tensioner.

**Note**

Pay attention to groove in chain tensioner when fitting oil strainer.

- Fit gasket -3- on rear of chain tensioner -1- and clip in.

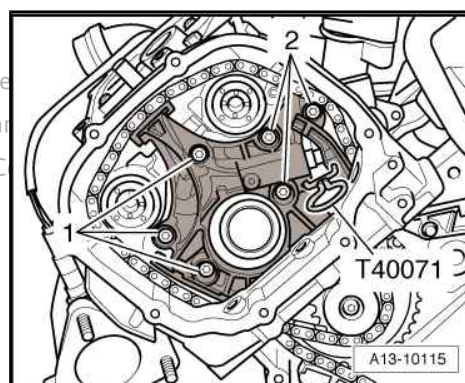


- Position timing chain (left-side) as shown in the illustration (according to marks applied during removal).

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

- Install high-pressure pipe ⇒ Rep. gr. 24 .
- Install camshaft timing chains ⇒ [page 104](#) .
- Install intake manifold (top section) ⇒ Rep. gr. 24 .
- Install turbocharger (left-side) ⇒ [page 234](#) .
- Change engine oil ⇒ Maintenance ; Booklet 405 .
- Fill cooling system with fresh coolant ⇒ [page 197](#) .

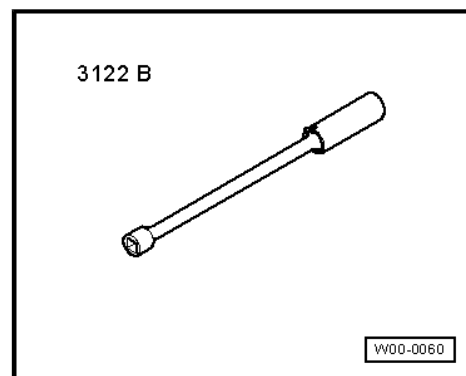


2.5 Checking compression

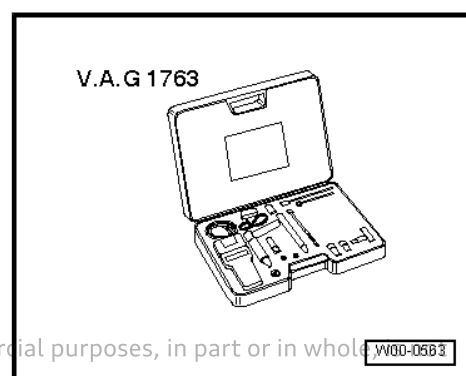
Special tools and workshop equipment required



◆ Spark plug spanner - 3122 B-

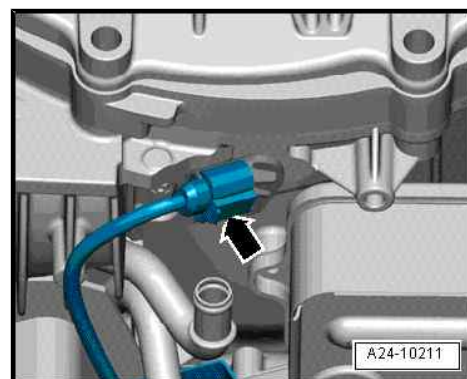


◆ Compression tester - V.A.G 1763-



Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Unplug electrical connector at engine speed sender - G28-
-arrow- at bottom of gearbox.
- Remove all ignition coils ⇒ Rep. gr. 28 .
- Unscrew spark plugs using spark plug socket - 3122 B- .
- Check compression pressure with compression tester -
V.A.G 1763- (see ⇒ operating instructions for details of how
to use tester).
- Have a second mechanic press down the accelerator pedal
completely and at the same time operate the starter until the
pressure on the tester display no longer increases.
- Repeat procedure on each cylinder.



Compression pressure	bar
When new	11.0 ... 15.0
Wear limit	10.0
Difference between cylinders	Max. 3.0

Assembling

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

- Install spark plugs ⇒ Maintenance ; Booklet 405 .
- Install ignition coils ⇒ Rep. gr. 28 .
- Faults are stored in engine control units because connectors
were unplugged: "Generate readiness code" in "Guided Func-
tions" ⇒ Vehicle diagnostic tester.



3 Valve gear



Caution

Risk of damage to valves and piston crowns after working on valve gear.

- ◆ **The hydraulic tappets have to settle; wait for approx. 30 minutes after installing camshafts before starting engine.**
- ◆ **Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.**



Note

Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.

3.1 Exploded view - valve gear



Note

The diagram shows the cylinder head on cylinder bank 2 (left-side).

**1 - Sealing plug**

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

2 - Valve stem oil seal

- ☐ Renewing with cylinder head installed
⇒ [page 148](#)
- ☐ Renewing with cylinder head removed
⇒ [page 151](#)

3 - Valve spring

- ☐ Installation position
⇒ [page 140](#)

4 - Hydraulic compensation element

- ☐ Clipped into roller rocker finger -item 8-
- ☐ Checking ⇒ [page 155](#)
- ☐ Mark installation position for re-installation
- ☐ Lubricate contact surface before installing

5 - Valve spring plate**6 - Valve cotters****7 - Securing clip**

- ☐ Not available as separate part
- ☐ Check for firm attachment

8 - Roller rocker finger

- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surface before installing
- ☐ Assembly: attach to hydraulic compensation element -item 4- using securing clip -item 7-

9 - Inlet camshaft

- ☐ Removing and installing ⇒ [page 142](#)
- ☐ Measuring axial clearance ⇒ [page 141](#)
- ☐ Measuring radial clearance ⇒ [page 142](#)
- ☐ Runout: max. 0.04 mm

10 - Gasket

- ☐ Renew

11 - Retaining frame

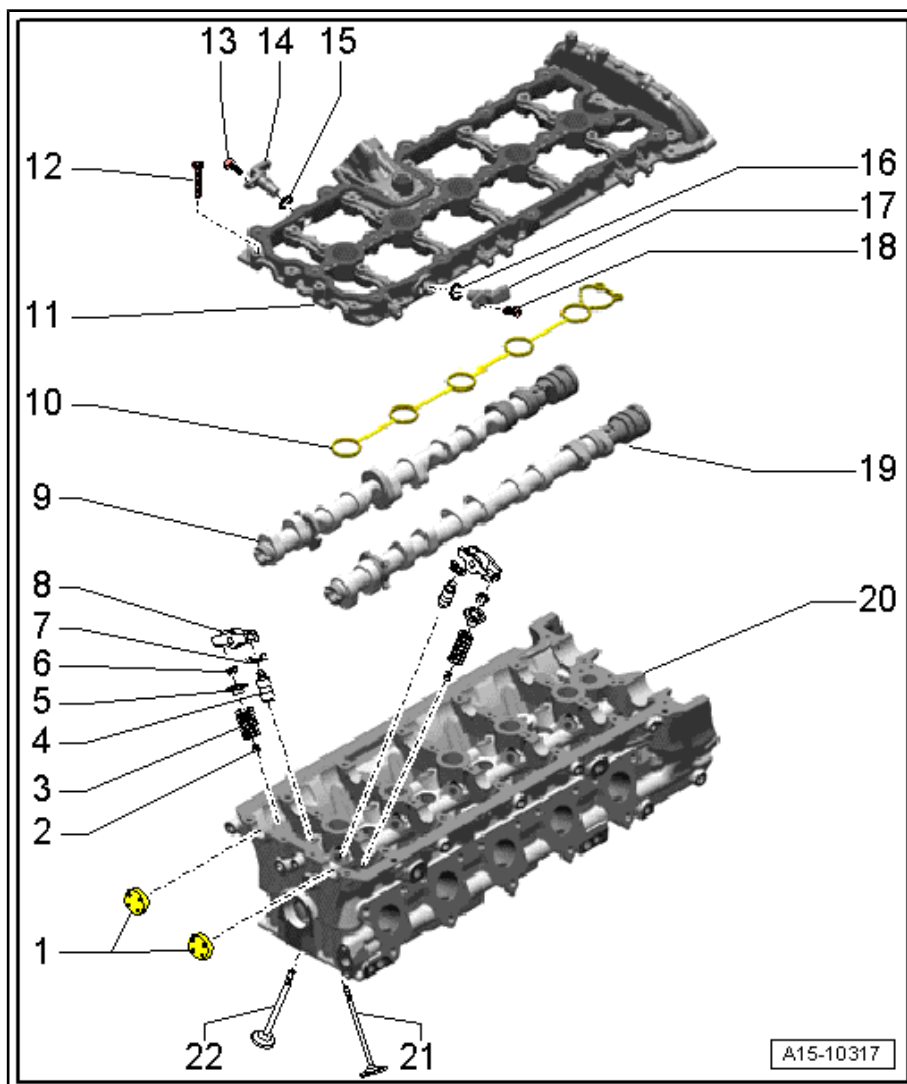
- ☐ With integrated camshaft bearings
- ☐ Removing and installing ⇒ ["3.4 Removing and installing camshafts", page 142](#)

12 - Bolt

- ☐ To avoid damage to retaining frame for camshafts, refer to tightening torque and sequence with respect to the correctness of information in this document. Copyright by AUDI AG.

13 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 28



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14 - Hall sender for inlet camshaft

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

15 - O-ring

- ☐ Renew

16 - O-ring

- ☐ Renew



17 - Hall sender for exhaust camshaft

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

18 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 28

19 - Exhaust camshaft

- ☐ Removing and installing ⇒ [page 142](#)
- ☐ Measuring axial clearance ⇒ [page 141](#)
- ☐ Measuring radial clearance ⇒ [page 142](#)
- ☐ Runout: max. 0.04 mm

20 - Cylinder head

- ☐ Checking valve guides ⇒ [page 159](#)

21 - Inlet valve

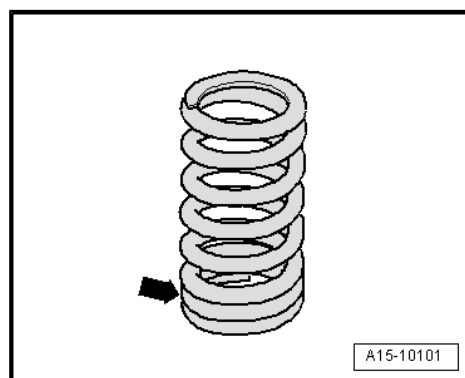
- ☐ Must not be machined; only grinding-in is permissible
- ☐ Mark installation position for re-installation
- ☐ Checking ⇒ [page 160](#)
- ☐ Valve dimensions ⇒ [page 159](#)
- ☐ Checking valve guides ⇒ [page 159](#)

22 - Exhaust valve

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Mark installation position for re-installation
- ☐ Checking ⇒ [page 160](#)
- ☐ Valve dimensions ⇒ [page 159](#)
- ☐ Checking valve guides ⇒ [page 159](#)

Position of valve spring

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





Retaining frame for camshafts - tightening torque and sequence



Note

The illustration shows the retaining frame for camshafts on cylinder head (left-side).



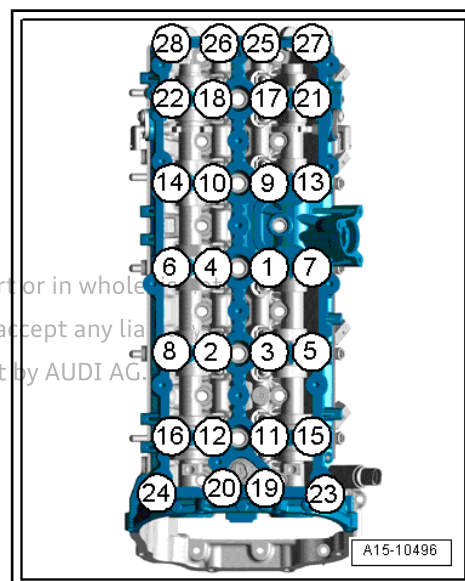
Caution

Risk of damage to retaining frame for camshafts.

- It is important to tighten the bolts securing the retaining frame as described below.

– Tighten bolts in 4 stages in the sequence shown:

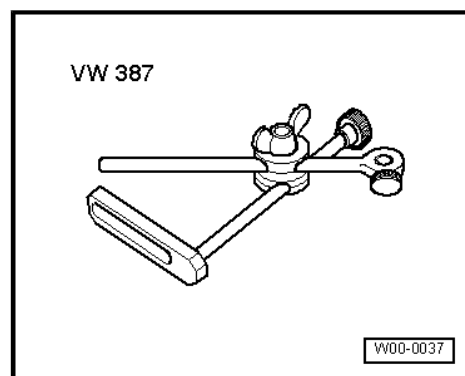
Stage	Bolts	Tightening torque/tightening angle
1.	-1 ... 28-	Screw in by hand until bolt heads make contact with retaining frame
2.	-1 ... 28-	Continue tightening 1 turn at a time in several stages until retaining frame makes full contact with cylinder head and a torque of 8 Nm is reached
3.	-1 ... 28-	8 Nm
4.	-1 ... 28-	Turn 90° further



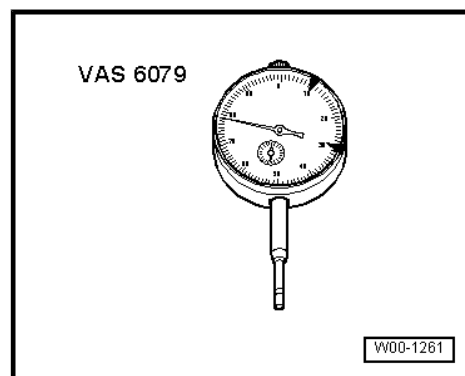
3.2 Measuring axial clearance of camshafts

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



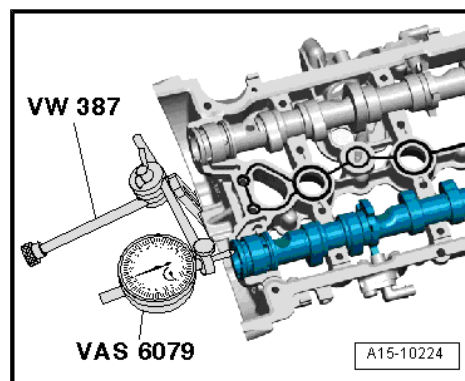
- Dial gauge - VAS 6079-





Procedure

- Remove retaining frame
⇒ [“3.4 Removing and installing camshafts”, page 142](#) .
- Fit camshaft to be tested in retaining frame.
- Attach dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to retaining frame.
- Press camshaft against dial gauge by hand.
- Set dial gauge to “0”.
- Press camshaft away from dial gauge and read off value:
- Axial clearance: 0.100 ... 0.191 mm



3.3 Measuring radial clearance of camshafts

Special tools and workshop equipment required

- ◆ Plastigauge

Procedure

- Remove roller rocker fingers
⇒ [“3.4 Removing and installing camshafts”, page 142](#) .
- Clean bearings and bearing journals.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.
- The Plastigauge must be positioned in the centre of the bearing.
- Fit retaining frame and tighten to torque (do not turn further) without rotating camshafts ⇒ [page 141](#) .
- Remove retaining frame again.
- Compare width of Plastigauge with measurement scale.

Radial clearance:

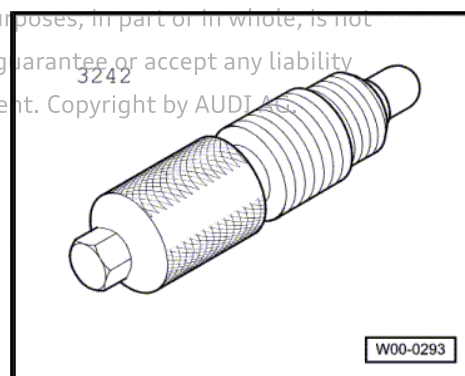
24 mm bearing diameter: 0.024 ... 0.066 mm.

36 mm bearing diameter: 0.100 ... 0.325 mm.

3.4 Removing and installing camshafts

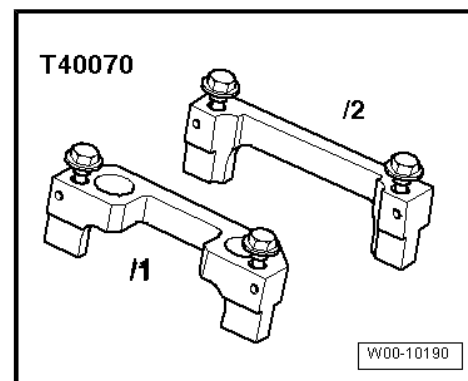
Special tools and workshop equipment required

- ◆ Locking pin - 3242-
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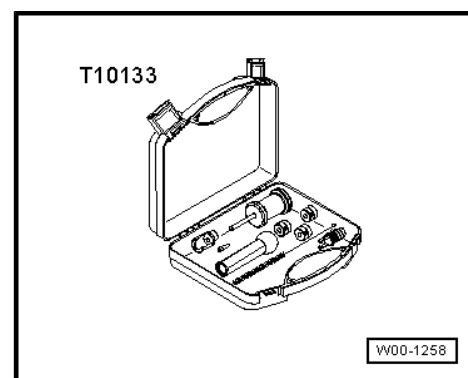




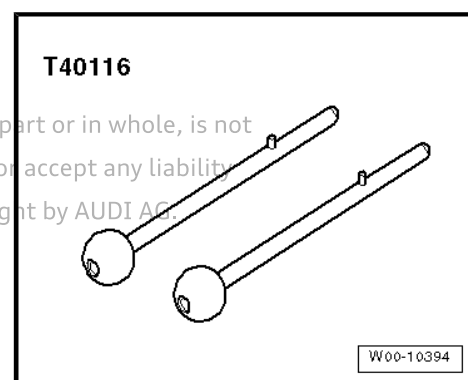
- ◆ 2x Camshaft clamp - T40070-



- ◆ Impact extractor attachment -T10133/3- from tool set for FSI engines - T10133-



- ◆ Locating pins 1 set = 2x - T40116-



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

Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .



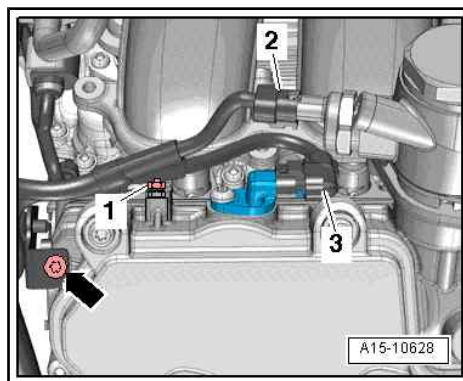
Note

The following description is for removing and installing on cylinder head (left-side).

- Remove timing chains from camshafts ⇒ [page 100](#) .



- Remove nut -1- for earth wire on retaining frame.
- Unplug electrical connector -2- for high-pressure pump and -3- for Hall sender 2 - G163- .
- Remove bolt -arrow- on bracket for wiring.
- Remove high-pressure pump ⇒ Rep. gr. 24 .



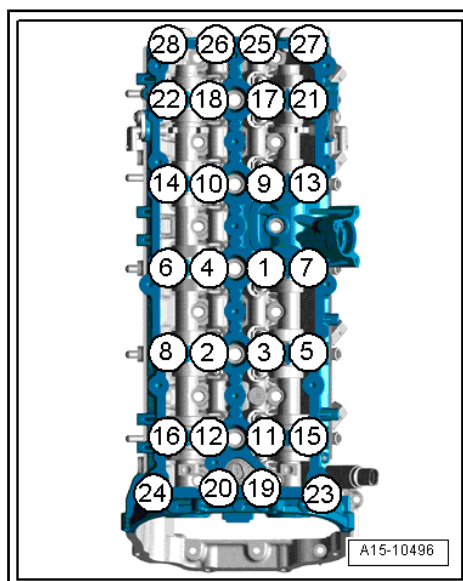
- Slacken retaining frame bolts in the sequence -28 ... 1-.



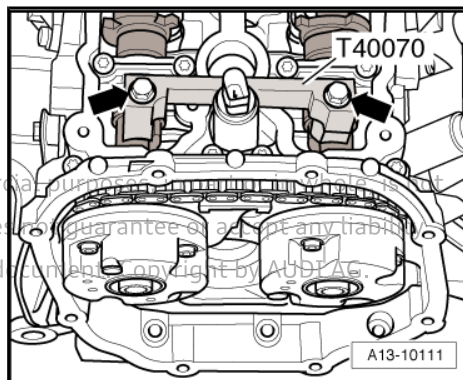
Note

Perform the same procedure (laterally reversed) on retaining frame (right-side).

- Remove bolts, carefully release retaining frame from bonded joint and set it down on a soft surface on workbench.



- Remove camshaft clamp - T40070- .
- Mark and remove camshafts.



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Installing

- Crankshaft locked in position with locking pin - 3242- .
- Hydraulic compensation elements and roller rocker fingers installed.



Note

Renew seals/gaskets and sealing plugs.



Caution

Protect lubrication system and bearings against contamination.

- ◆ *Cover exposed parts of the engine.*

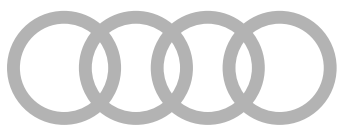
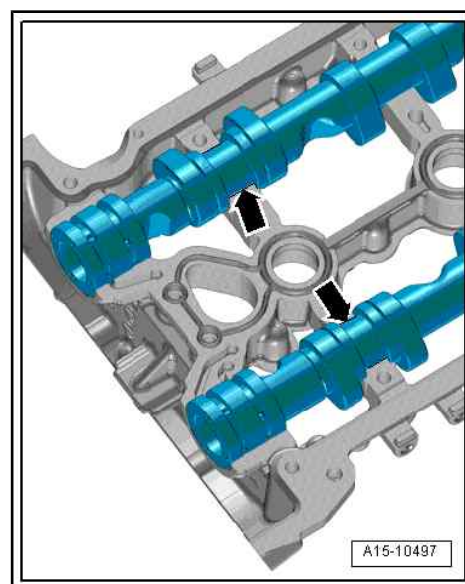
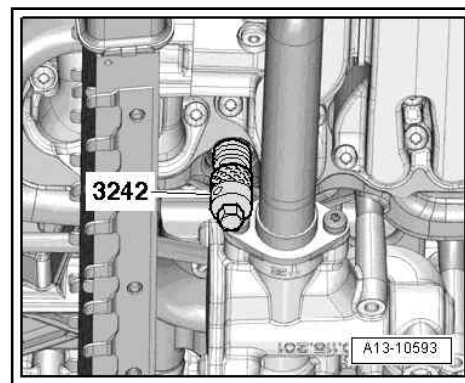


WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

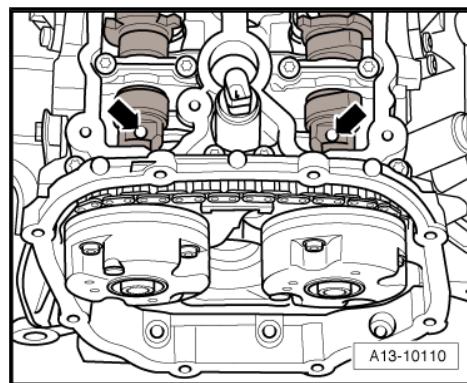
- Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Oil running surfaces of both camshafts.
- Fit camshafts in retaining frame.
- Camshafts must be in correct position in axial bearings -arrows- in retaining frame.
- Turn retaining frame over with camshafts fitted, holding camshafts firmly in position.



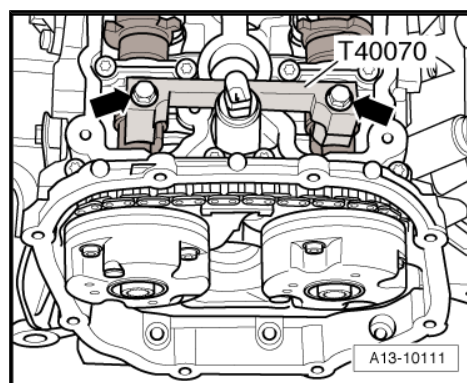
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- Turn camshafts until threaded holes -arrows- point upwards.
- Check that camshafts are still in correct position in axial bearings in retaining frame.

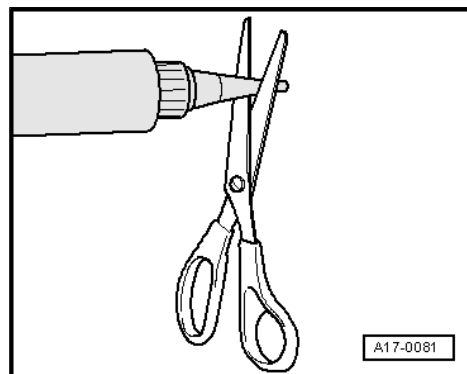


- Fit camshaft clamps - T40070- onto both cylinder heads and tighten bolts -arrows- to 25 Nm.

**Note**

Note the use-by date of the sealant.

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



- Turn retaining frame upside down again.
- Fit new gasket -2- in grooves on retaining frame.

**Caution**

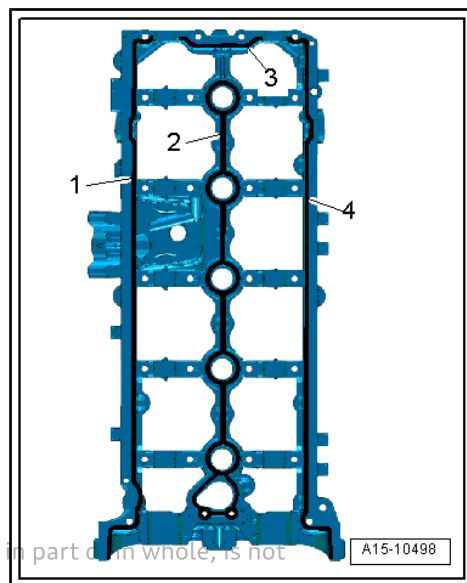
Make sure lubrication system is not clogged by excess sealant.

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

- Apply sealant beads -1, 3, 4- onto clean sealing surfaces of retaining frame as shown in illustration.
- Width of sealant beads: 2.5 mm.

**Note**

The retaining frame must be installed within 5 minutes after applying the sealant.



- Fit retaining frame onto cylinder head.

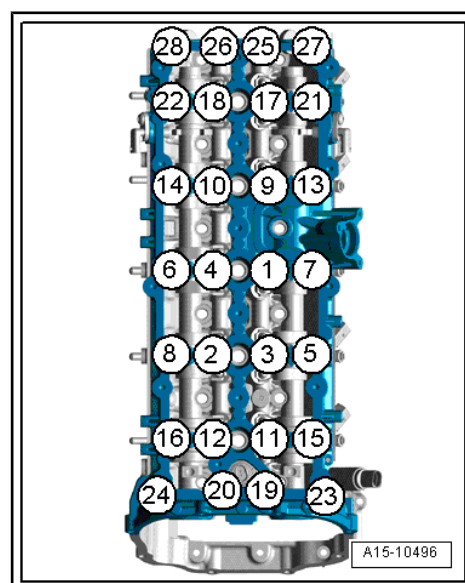
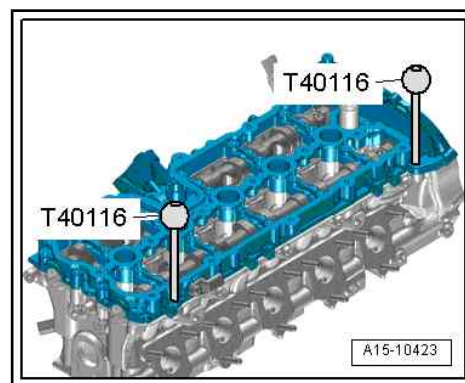


- Insert locating pins -T40116- in retaining frame and cylinder head.

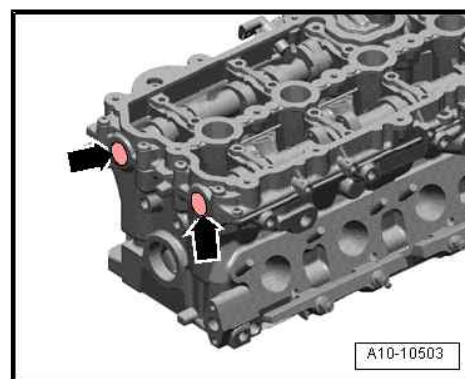
**Note**

After installing the retaining frame, wait about 30 minutes for the sealant to dry.

- Tighten bolts securing retaining frame for camshafts
⇒ [page 141](#) .



- Clean bores for sealing plugs in cylinder head; they must be free of oil and grease.
- Coat outer circumference of sealing plugs -arrows- with sealant; refer to ⇒ Electronic parts catalogue for sealant.
- Drive in sealing plug until flush.



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

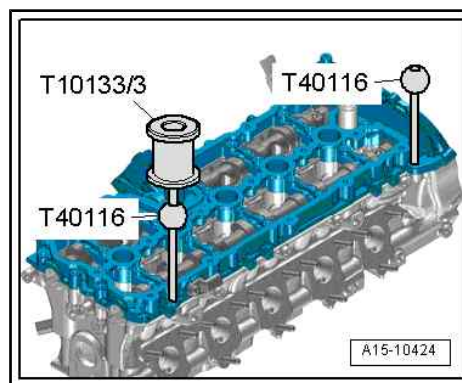
Remaining installation steps are carried out in reverse sequence; note the following:

- Install high-pressure pump ⇒ Rep. gr. 24 .
- Fit timing chains on camshafts ⇒ [page 104](#) .

**Caution**

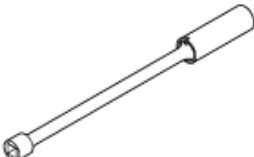
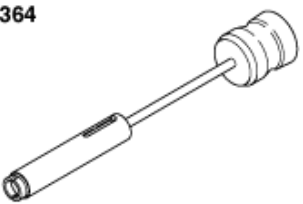
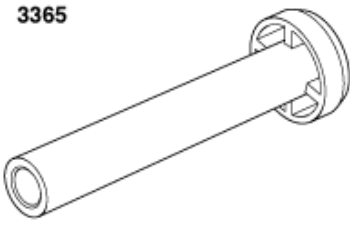
Risk of damage to valves and piston crowns after working on valve gear.

- ◆ **Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.**



3.5 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

3122 B 	3364 
3365 	VAS 5161 
T40012 	G15-0058

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- ◆ Spark plug spanner - 3122 B-
- ◆ Valve stem seal puller - 3364-



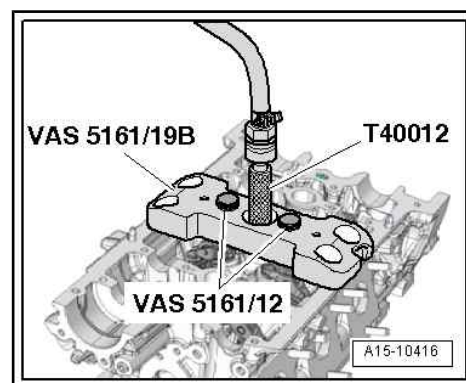
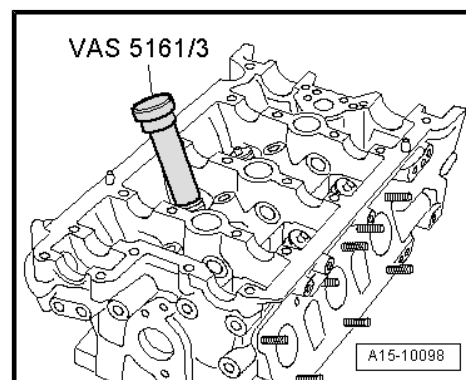
- ◆ Valve stem oil seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161- with guide plate -VAS 5161/19B-
- ◆ Adapters - T40012-

Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .
- Remove camshafts ⇒ [page 142](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Remove ignition coils ⇒ Rep. gr. 28 .
- Unscrew spark plugs using spark plug socket - 3122 B- .
- Set piston of appropriate cylinder to “bottom dead centre”.
- Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.

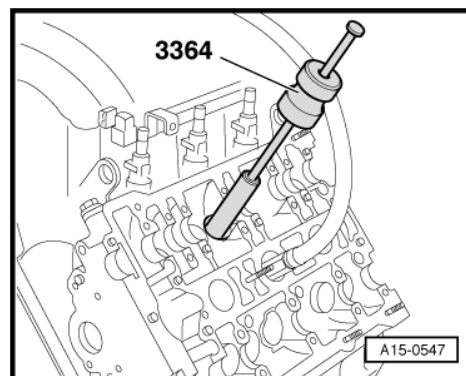
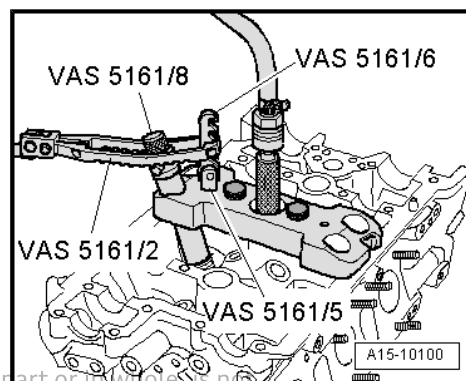
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- Fit guide plate -VAS 5161/19B- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- .
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.
- Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
- Minimum pressure: 6 bar





- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
 - The compressed air hose remains connected.
- Detach valve spring with valve spring plate.
- Pull off valve stem oil seal with valve stem seal puller - 3364- .

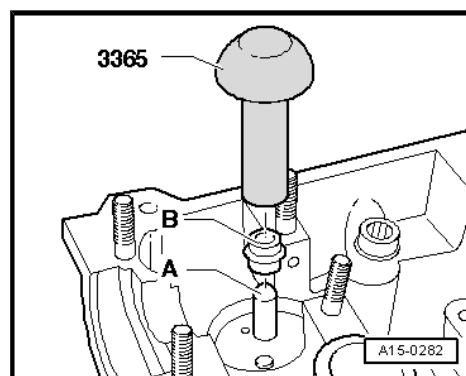


Caution

Make sure valve stem oil seals are not damaged when installing.

- ◆ ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***

- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Take off plastic sleeve.





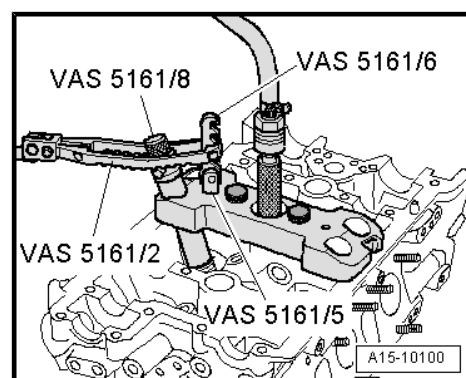
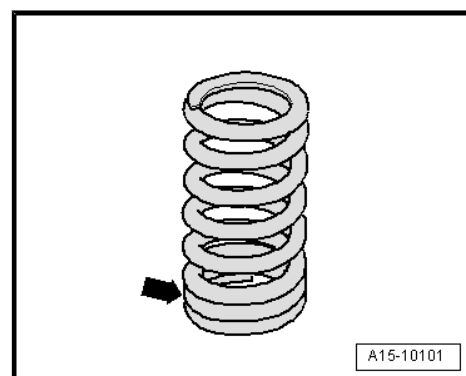
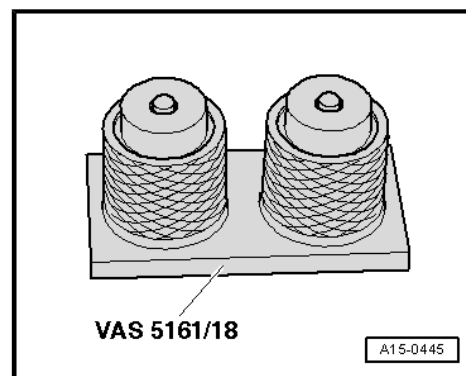
If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

- Larger diameter of valve cotters faces upwards.
 - Press assembly cartridge onto insertion device from above and take up valve cotters.
-
- Insert valve spring and valve spring plate.
 - Installation position: Closely spaced spring coils -arrow- face towards cylinder head.
-
- Secure guide plate back onto cylinder head.
 - Insert assembly cartridge in guide plate.
 - Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
 - Release pressure fork with knurled screw still in pulled position.
 - Repeat procedure for each valve.

Assembling

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

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 142](#) .
- Install spark plugs ⇒ Maintenance ; Booklet 405 .
- Install ignition coils ⇒ Rep. gr. 28 .

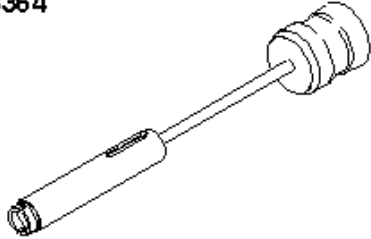
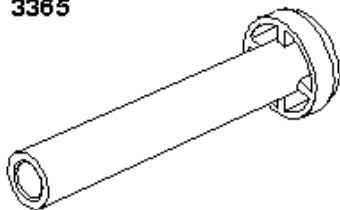
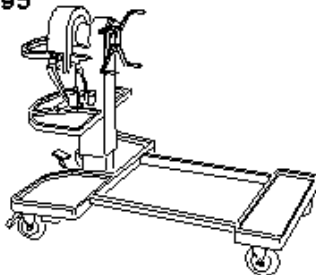
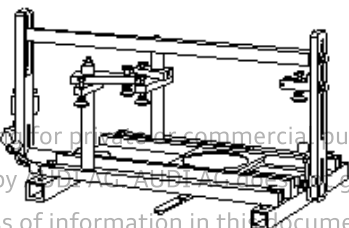


3.6 Renewing valve stem oil seals with cylinder head removed



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**Special tools and workshop equipment required**

3364 	3365 
VAS 5161 	VAS 6095 
VAS 6419 	

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G15-10068

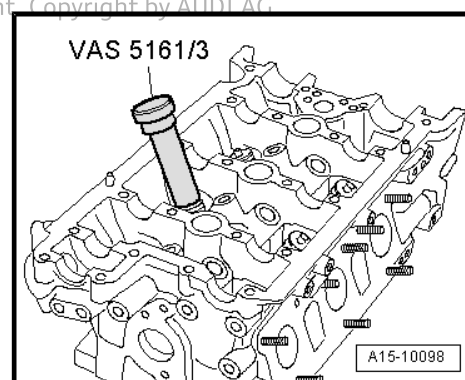
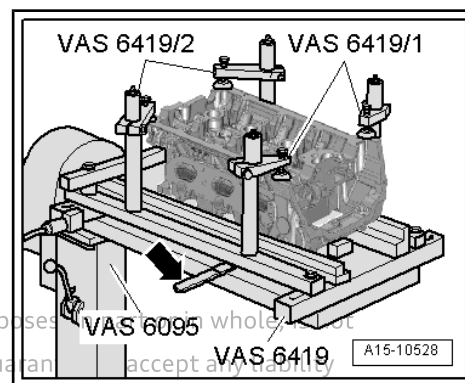
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem oil seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161-
with guide plate -VAS 5161/19B-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Cylinder head tensioning device - VAS 6419-

Procedure

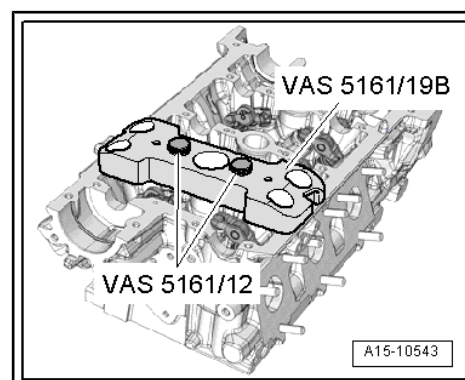
- Remove camshafts ➤ [page 142](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.



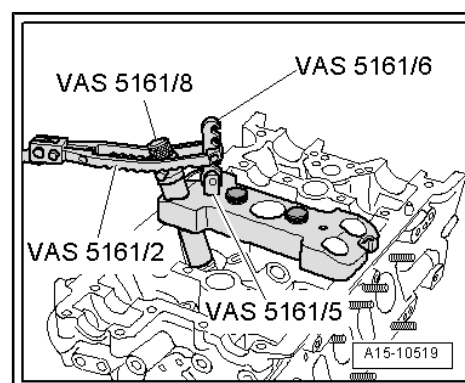
- Insert cylinder head tensoning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensoning device, as shown in illustration.
- Connect cylinder head tensoning device to compressed air supply.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.
- Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.



- Fit guide plate -VAS 5161/19B- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- .



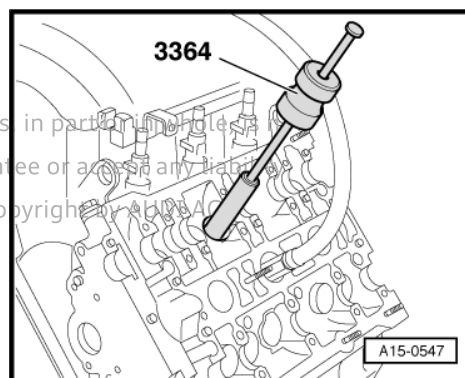
- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise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





- Pull off valve stem oil seal with valve stem seal puller - 3364- .

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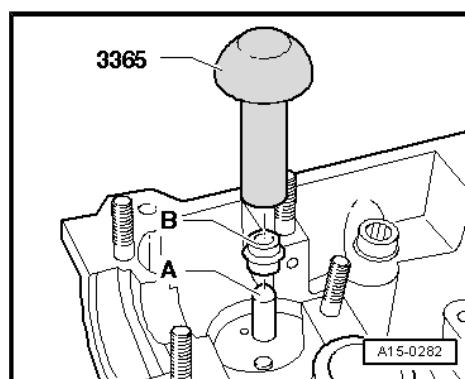


Caution

Make sure valve stem oil seals are not damaged when installing.

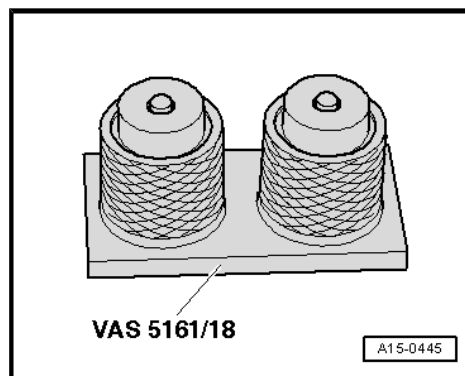
- ◆ ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***

- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Take off plastic sleeve.

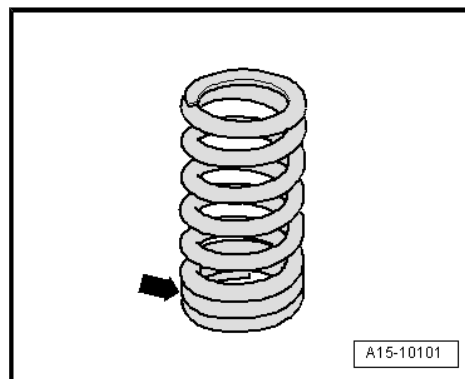


If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and take up valve cotters.



- Insert valve spring and valve spring plate.
- Installation position: Closely spaced spring coils -arrow- face towards cylinder head.



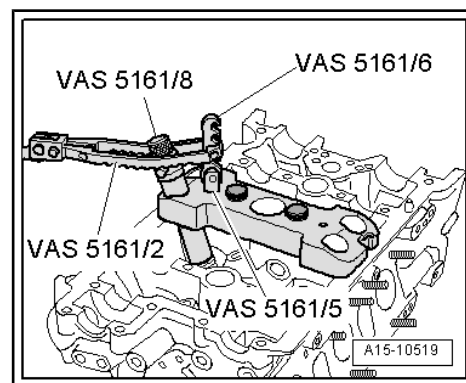


- Secure guide plate back onto cylinder head.
- Insert assembly cartridge in guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 142](#) .



3.7 Checking hydraulic compensation elements

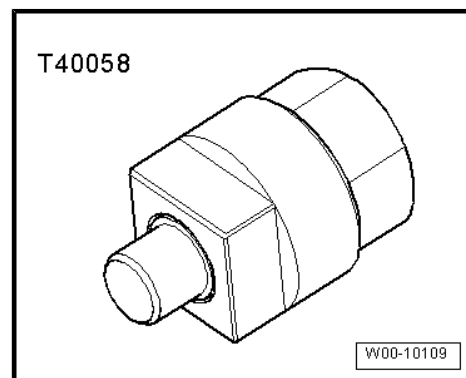


Note

- ◆ *The hydraulic compensation elements cannot be serviced.*
- ◆ *Irregular valve noises when starting engine are normal.*

Special tools and workshop equipment required

- ◆ Adapter - T40058-



- ◆ Feeler gauge

Procedure

- Start engine and run until radiator fan has started up once.
- Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).



Note

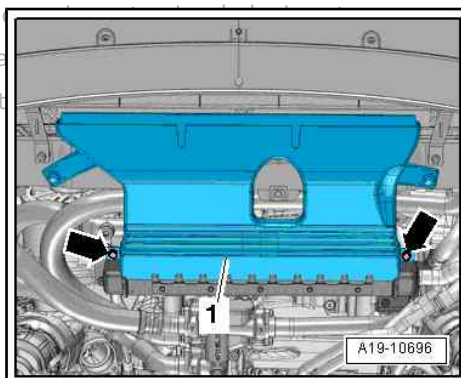
If irregular valve noise disappears but repeatedly re-occurs when travelling short distances, renew oil retention valve 1
⇒ [page 173](#) .

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



- Remove cylinder head cover: left-side ⇒ [page 128](#) ; right-side ⇒ [page 129](#) .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove bolts -arrows- and detach air duct -1-.

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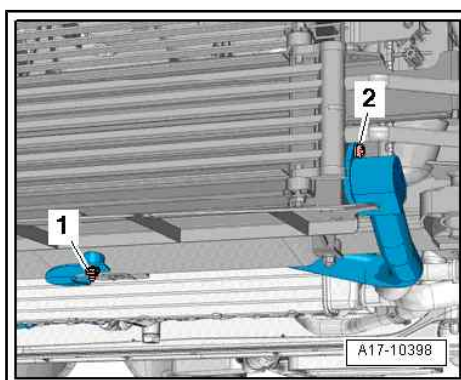


- Unscrew nut -1-.



Note

-Item 2- can be disregarded.

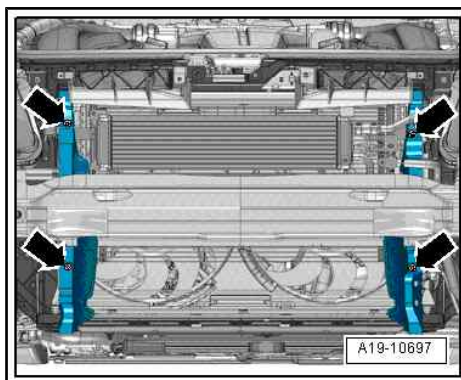


- Remove bolts -bottom arrows-.



Note

Disregard -top arrows-.

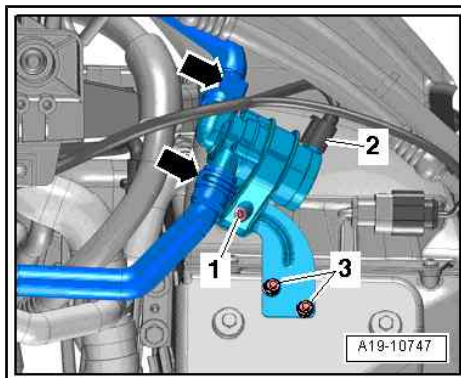


- Unplug electrical connector -2- at circulation pump 2 - V403- .



Note

Items -1, 3- and -arrows- can be disregarded.



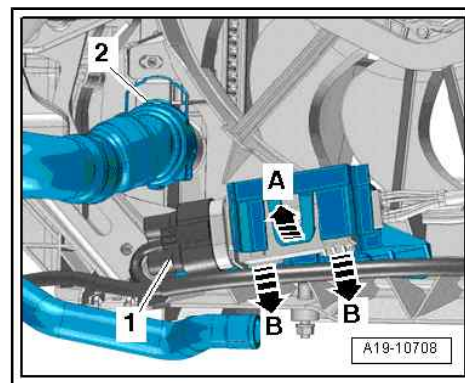


- Unplug electrical connector -1- and move clear.



Note

-Item 2- and -arrows- can be disregarded.

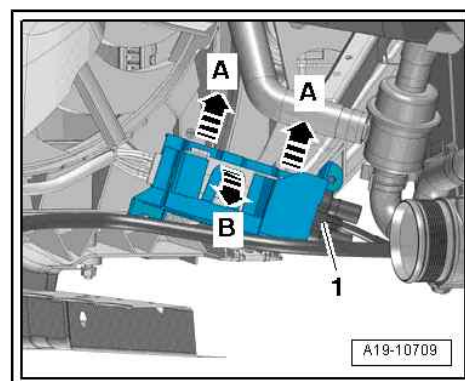


- Unplug electrical connector -1-.

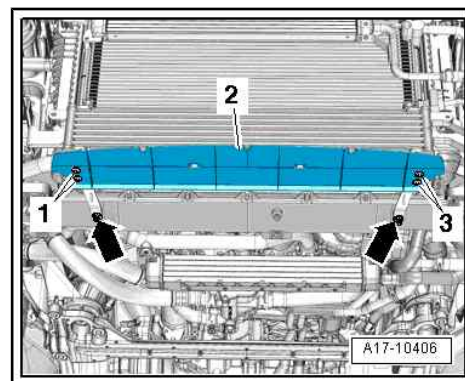


Note

Disregard -arrows-.

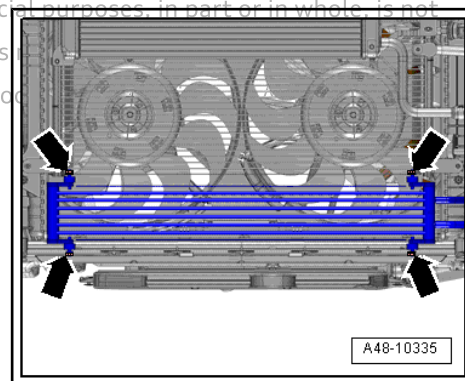


- Remove bolts -1- and -3-, detach air duct -2-.
- Slacken nuts -arrows-, do not remove.



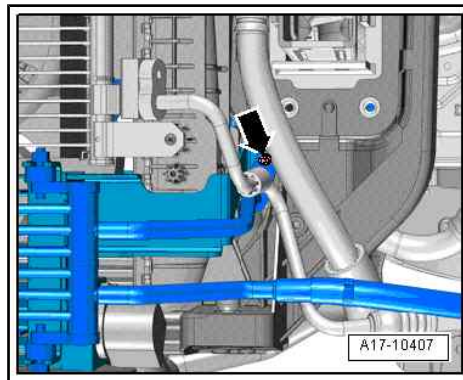
- Slacken nuts -arrows-, do not remove.

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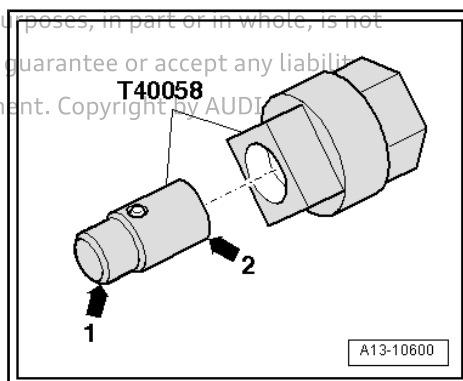




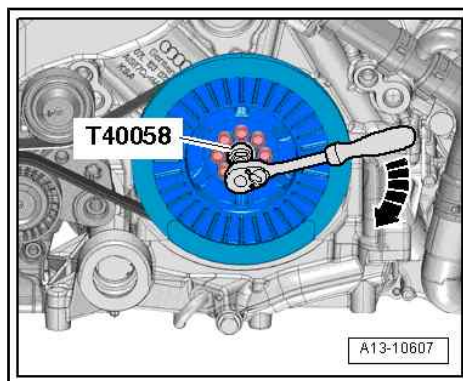
- Remove nut -arrow- on both sides.
- Detach hydraulic fluid cooler for power steering from engine oil cooler.
- Engine oil cooler (front) remains suspended.
- Tie hydraulic fluid cooler onto bumper.



- Insert guide pin of adapter T40058 as follows:
- The smaller-diameter section -arrow 1- faces the engine.
- The larger-diameter section -arrow 2- faces the adapter.



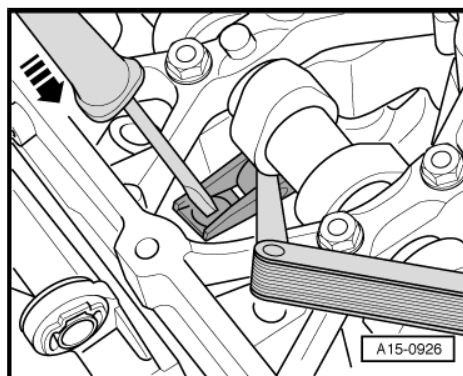
- Turn crankshaft with adapter - T40058- in direction of engine rotation -arrow- until cam of hydraulic compensation element to be tested faces upwards.



- Press roller rocker finger down -arrow- to determine clearance between cam and roller rocker finger.
- If it is possible to insert a feeler gauge of 0.20 mm between cam and roller rocker finger, renew compensation element ⇒ ["3.4 Removing and installing camshafts", page 142](#) .

Additional steps required

- Install engine oil cooler (front) ⇒ [page 180](#) .
- Install cylinder head cover: left-side ⇒ [page 128](#) ; right-side ⇒ [page 129](#) .





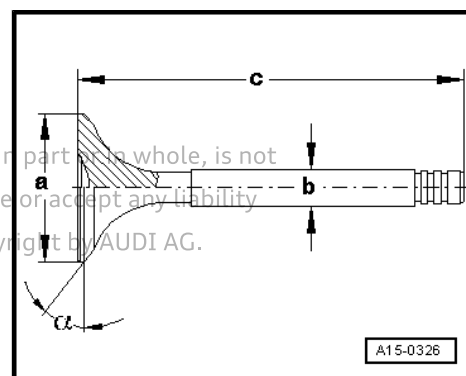
3.8 Valve dimensions



Note

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

Dimension		Inlet valve	Exhaust valve
Ø a	mm	33.85 ± 0.10	28.0 ± 0.1
Ø b	mm	5.980 ± 0.007	5.965 ± 0.007
c	mm	103.97 ± 0.20	101.87 ± 0.20
α	°	45	45



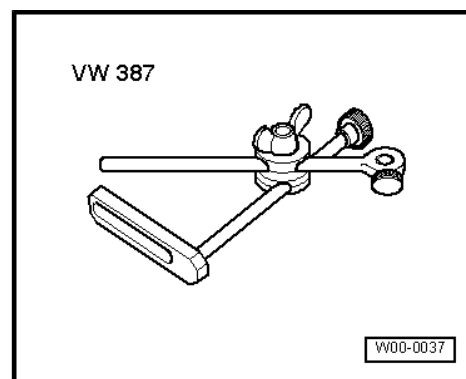
WARNING

- ◆ *Care must be taken when disposing of old sodium-cooled exhaust valves.*
- ◆ *The valves must be sawn in two with a metal saw between the centre of the stem and valve head. When doing so, the valves must not come into contact with water. After preparing the valves, throw a maximum of ten into a bucket of water. Then step away immediately, since a chemical reaction will occur in which the sodium filling burns.*
- ◆ *After performing these steps the valves can be disposed of in the normal way.*

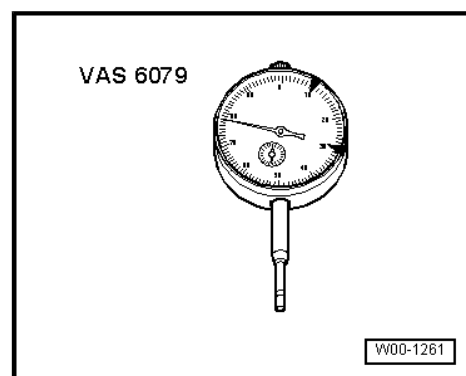
3.9 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-



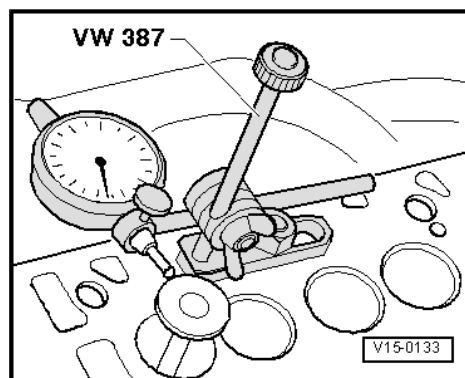


Procedure



Note

- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ◆ *Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.*
- Insert valve into guide.
- End of valve stem must be flush with valve guide.
- Measure the amount of sideways play.
- Wear limit: 0.8 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded.



Note

Valve guides cannot be renewed.

3.10 Checking valves

- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.



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17 – Lubrication

1 Oil pump and intake module



Caution

Risk of damage to catalytic converter.

- ◆ *The oil level must not be above the "MAX" mark on the dipstick.*



Note

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- ◆ *If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil passages carefully and renew the oil spray jets, engine oil cooler and oil filter.*
- ◆ *Oil capacities, oil specifications and viscosity grades ⇒ Maintenance tables .*

1.1 Exploded view - oil pump, intake module

**1 - Oil pump**

- ☐ With coolant pump
- ☐ Removing and installing
⇒ [page 164](#)

2 - Bolt

- ☐ Tightening torque
⇒ [Item 3 \(page 203\)](#)

3 - Seal

- ☐ Renew

4 - Dowel sleeve

- ☐ 2x

5 - Bolt

- ☐ Tightening torque
⇒ [Item 15 \(page 203\)](#)

6 - Bracket**7 - Connecting pipe**

- ☐ For coolant
- ☐ Renew after coolant pump has been removed

8 - Plug

- ☐ For "TDC" marking on crankshaft
- ☐ Tightening torque
⇒ [Item 13 \(page 74\)](#)

9 - Seal

- ☐ Renew

10 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 77](#)

11 - Oil drain plug

- ☐ 25 Nm

12 - Seal

- ☐ Renew

13 - Intake module

- ☐ Apply sealant prior to installing ⇒ [page 76](#)
- ☐ Tightening torque and sequence ⇒ [page 77](#)

14 - Seal

- ☐ Renew

15 - Coolant drain plug

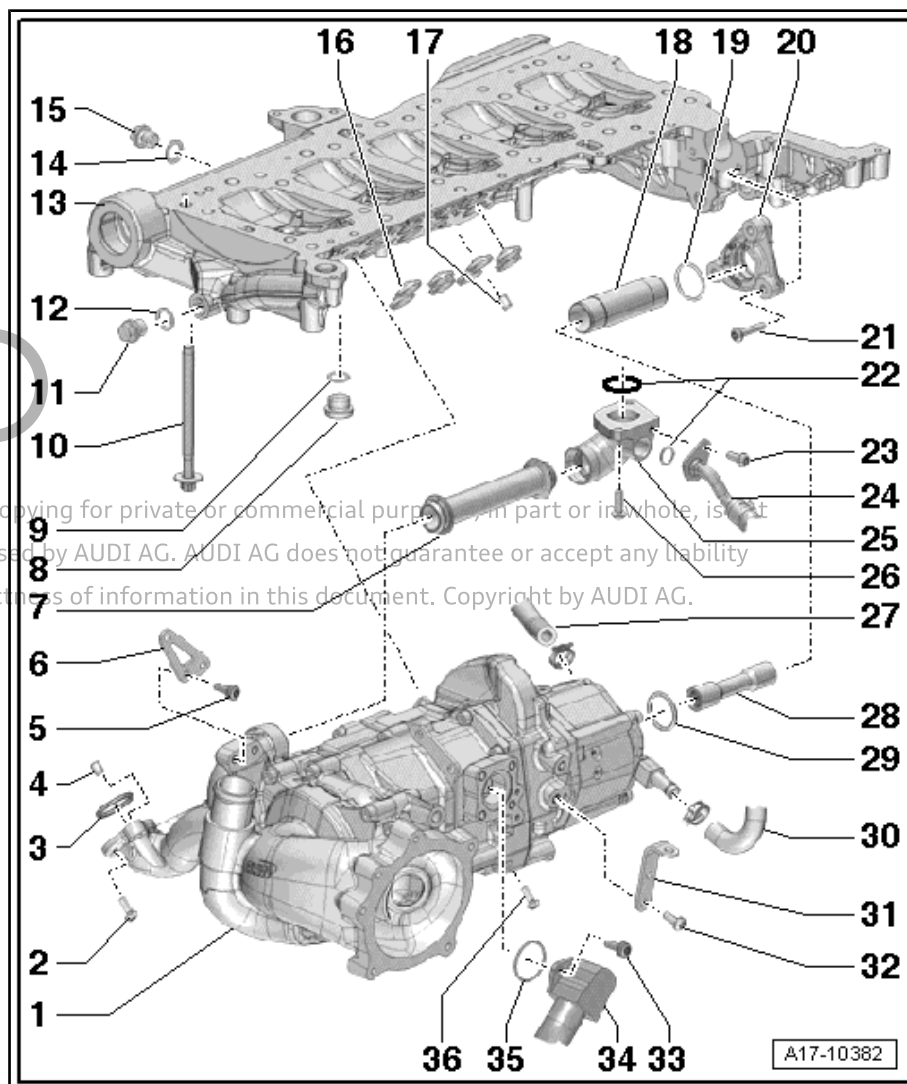
- ☐ 25 Nm

16 - Seal

- ☐ With strainer
- ☐ 8x

17 - Dowel sleeve**18 - Protective tube**

- ☐ For oil pump drive shaft



**19 - O-ring**

- ☐ Renew

20 - Flange

- ☐ For protective tube
- ☐ Applying sealant ⇒ [page 164](#)

21 - Bolt

- ☐ 9 Nm

22 - O-rings

- ☐ Renew

23 - Bolt

- ☐ 9 Nm

24 - Coolant pipe

- ☐ To turbocharger, cylinder bank 2 (left-side)

25 - Coolant flange**26 - Bolt**

- ☐ 9 Nm

27 - Oil return hose

- ☐ From turbocharger, cylinder bank 1 (right-side)

28 - Drive shaft

- ☐ For oil pump

29 - O-ring

- ☐ Renew

30 - Oil return hose

- ☐ From turbocharger, cylinder bank 2 (left-side)

31 - Bracket**32 - Bolt**

- ☐ Renew
- ☐ 6 Nm +45°

33 - Bolt

- ☐ 9 Nm

34 - Oil line

- ☐ From oil pump to temperature regulator ⇒ [Item 34 \(page 181\)](#)

35 - O-rings

- ☐ 2x
- ☐ Renew

36 - Bolt

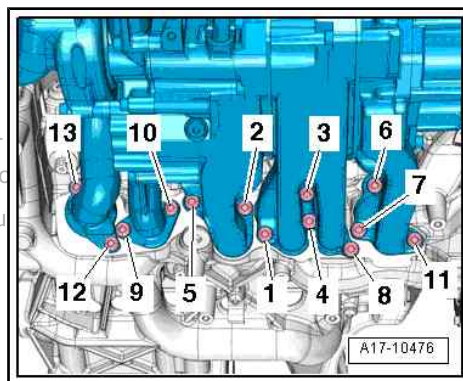
- ☐ Tightening torque and sequence ⇒ [page 164](#)



Oil pump - tightening torque and sequence

– Tighten bolts in 2 stages in the sequence -1 ... 13- as follows:

1. Initially tighten to 8 Nm.
2. Tighten to 10 Nm.



Applying sealant to flange for protective tube

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



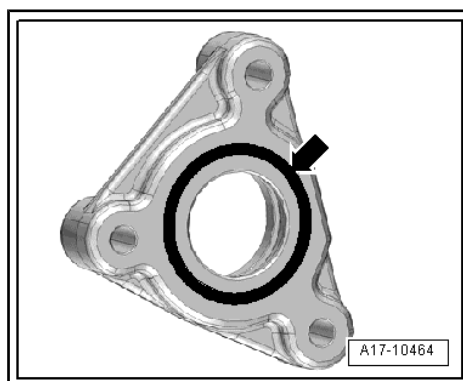
Caution

Make sure lubrication system is not clogged by excess sealant.

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

– Apply sealant bead -arrow- onto clean sealing surface of flange as shown in illustration.

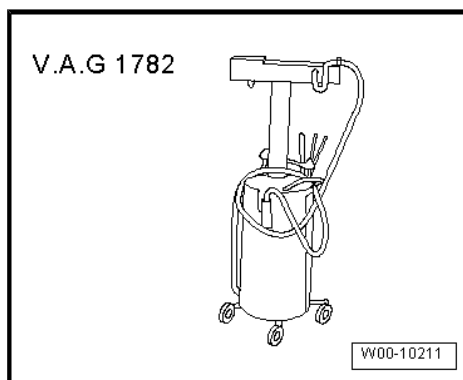
- Width of sealant bead: 2.0 mm.



1.2 Removing and installing oil pump

Special tools and workshop equipment required

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

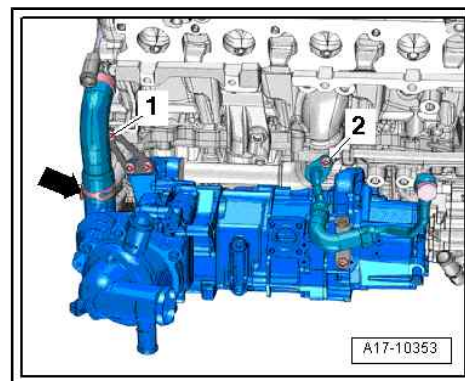


Removing

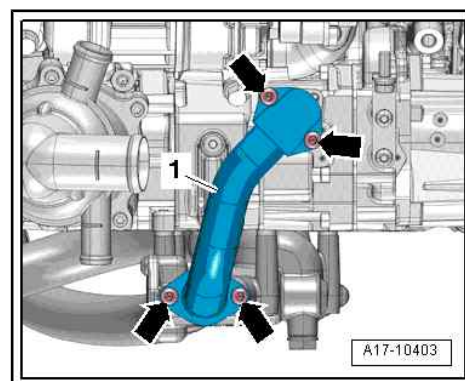
- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .
- Remove air conditioner compressor ⇒ Rep. gr. 87 .
- Remove radiator (bottom) ⇒ [page 227](#) .



- Release hose clip -arrow- and detach coolant hose.
- Remove bolts -1- and -2- and detach coolant pipe from cylinder block.



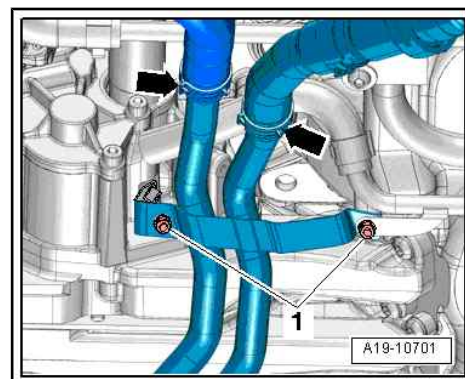
- Position used oil collection and extraction unit - V.A.G 1782- below connection point.
- Remove bolts -arrows- and take out oil pipe -1-.



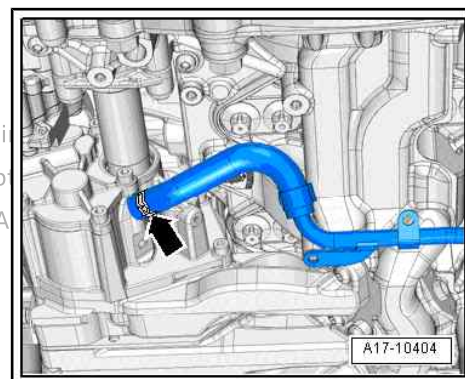
- Remove nuts -1-; coolant pipes (bottom) remain in installation position.

**Note**

Disregard -arrows-.



- Release hose clip -arrow- and detach oil return hose.



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- Remove bolts in the sequence -13 ... 1-.
- Detach oil pump towards front of vehicle (pay attention to connection piece).

Installing

- Tightening torques ⇒ [page 161](#) , ⇒ [page 180](#) .

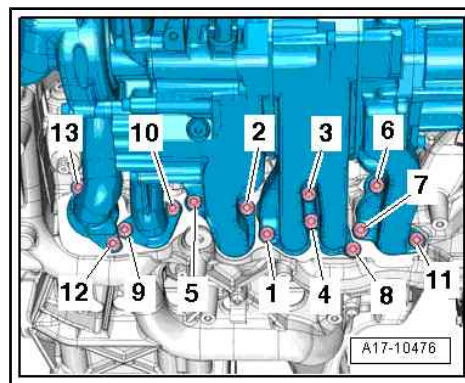


Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew seals and O-rings.*

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

- Tighten bolts for oil pump ⇒ [page 164](#) .
- Install coolant pipes (bottom) ⇒ [page 215](#) .
- Fit coolant pipe onto cylinder block (left-side) ⇒ [page 214](#) .
- Install radiator (bottom) ⇒ [page 227](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .



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2 Oil filter housing, engine oil cooler, oil retention valves, spray nozzle valve

2.1 Exploded view - oil filter housing

1 - Seal

- ☐ Renew

2 - Bolt

- ☐ 9 Nm

3 - Oil pressure switch - F1-

- ☐ Black insulation
- ☐ Removing and installing
⇒ [page 175](#)
- ☐ 20 Nm

4 - Seal

- ☐ Renew

5 - Oil filter housing

- ☐ With oil filter bypass valve
- ☐ Removing and installing
⇒ [page 168](#)

6 - O-ring

- ☐ Part of oil filter element

7 - Oil filter element

- ☐ Removing and installing
⇒ Maintenance ; Book-let 405

8 - O-ring

- ☐ Renew

9 - Sealing cap

- ☐ 25 Nm

10 - Oil line

- ☐ To vacuum pump

11 - Banjo bolt

- ☐ 17 Nm

12 - Seals

- ☐ Renew

13 - Plug

- ☐ 50 Nm

14 - Bolt

- ☐ 9 Nm

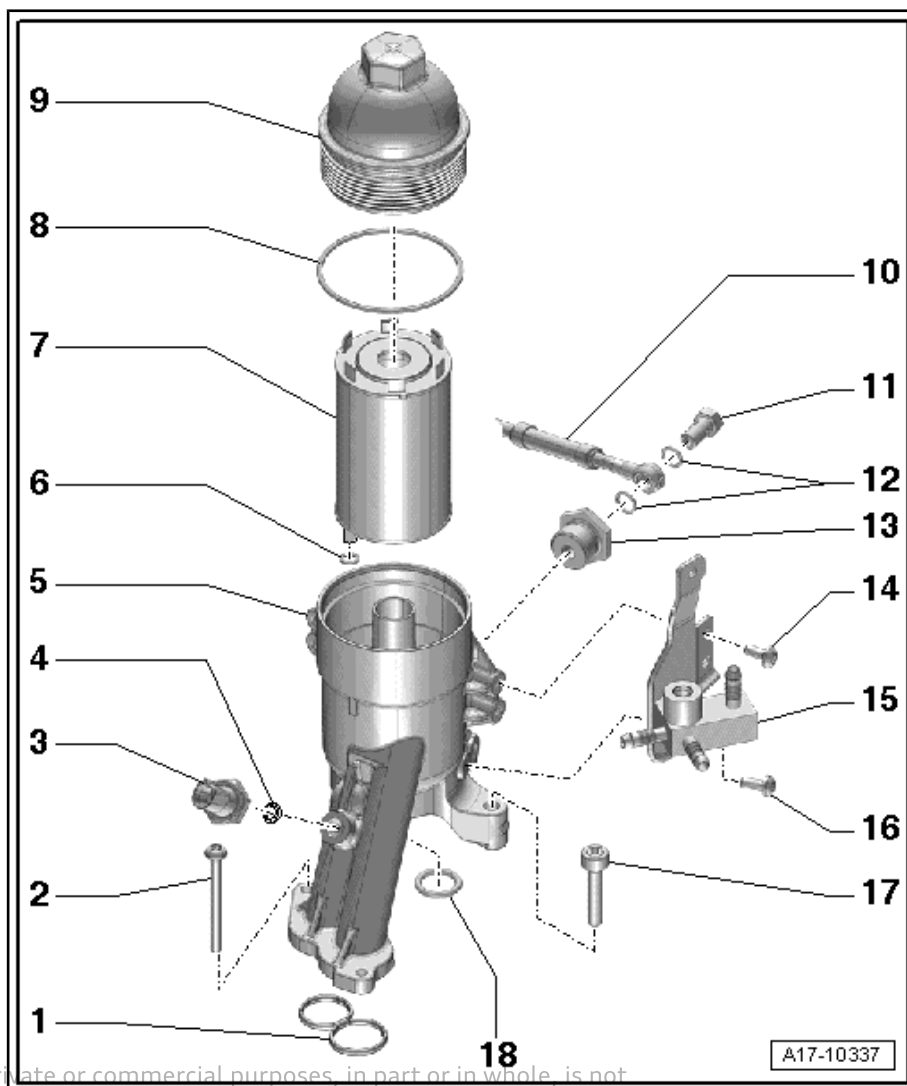
15 - Fuel rail

16 - Bolt

- ☐ 9 Nm

17 - Bolt

- ☐ 22 Nm



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18 - O-ring

- ☐ Renew

2.2 Removing and installing oil filter housing

Removing

- Remove oil pressure switch - F1- ⇒ [page 175](#) .
- Remove oil filter element ⇒ Maintenance ; Booklet 405 .



Note

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

- Remove bolts -arrows-.
- Move breather pipe for gearbox housing clear -arrow-.
- Remove banjo bolt -3-.
- Pivot oil filter housing slightly to right side and remove bolts -1- on bracket -2- for fuel rail.
- Detach oil filter housing.

Installing

- Tightening torque ⇒ [page 167](#)

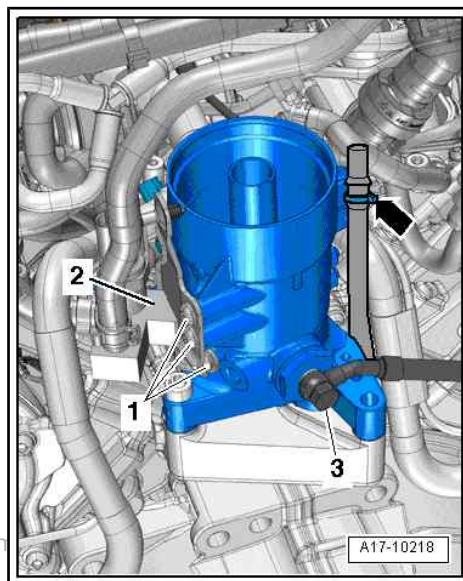
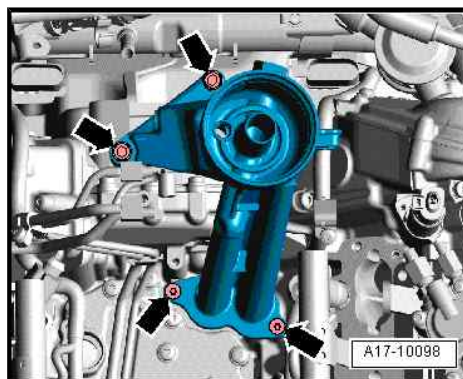
Installation is carried out in reverse order; note the following:



Note

Renew seals and O-rings.

- Install oil filter element ⇒ Maintenance ; Booklet 405 .
- Install oil pressure switch - F1- ⇒ [page 175](#) .
- Check oil level ⇒ Maintenance ; Booklet 405 .





2.3 Exploded view - engine oil cooler (top), oil retention valves, spray nozzle valve

1 - O-ring

- ☐ Renew

2 - Restrictor

- ☐ For oil return
- ☐ 5x
- ☐ 9 Nm

3 - Dowel sleeve

4 - Gasket

- ☐ Renew

5 - O-ring

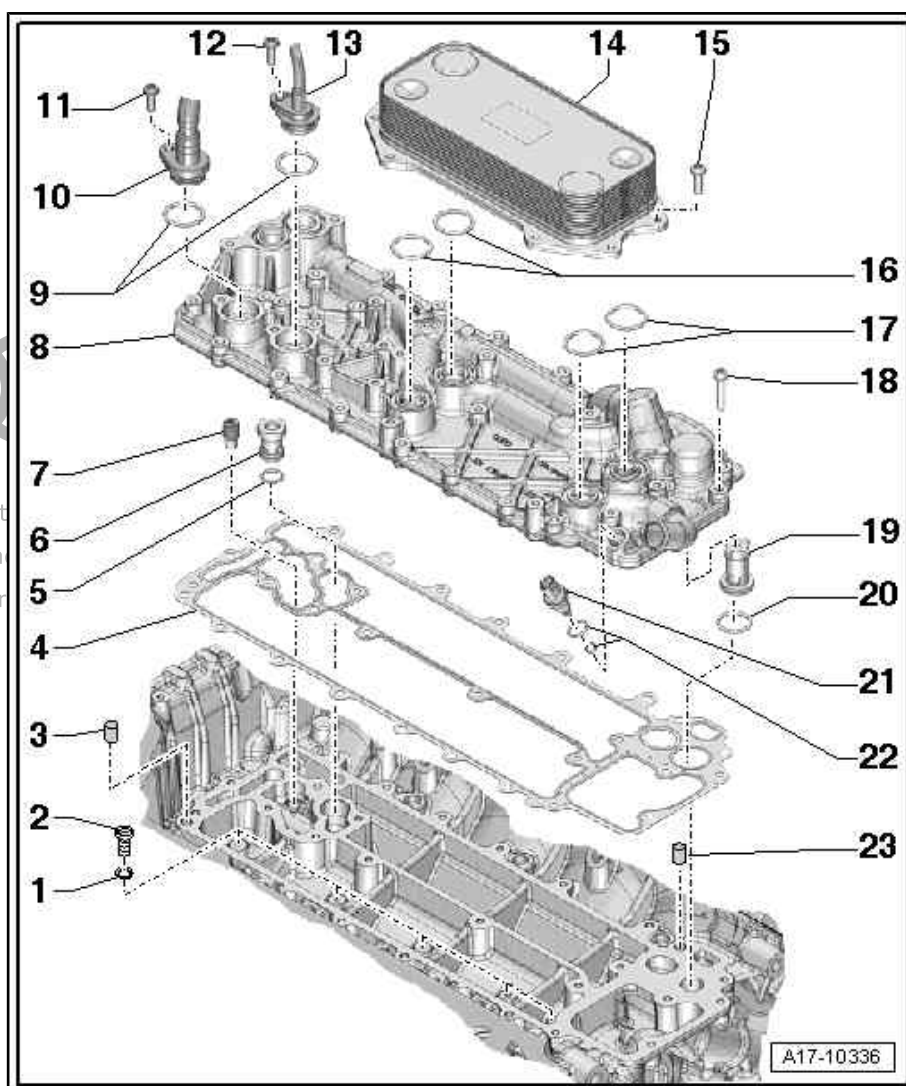
- ☐ Renew

6 - Oil retention valve 1

- ☐ Prevents oil from flowing back from oil passages in cylinder head and hydraulic compensation elements when engine stops
- ☐ Removing and installing ⇒ [page 173](#)
- ☐ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ☐ 6 Nm

7 - Spray nozzle valve

- ☐ Supplies oil spray jet for piston cooling with oil as soon as a specified oil pressure is attained
- ☐ Removing and installing ⇒ [page 173](#)



8 - Mounting plate

- ☐ For engine oil cooler (top) and oil filter housing
- ☐ Removing and installing ⇒ [page 171](#)

9 - O-rings

- ☐ Renew

10 - Crankcase breather hose

11 - Bolt

- ☐ 9 Nm

12 - Bolt

- ☐ 9 Nm

13 - Crankcase breather hose

14 - Engine oil cooler (top)

- ☐ Removing and installing ⇒ [page 171](#)

15 - Bolt

- ☐ 9 Nm



16 - O-rings

- ☐ Renew

17 - O-rings

- ☐ Renew

18 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 170](#)

19 - Oil retention valve 2

- ☐ Prevents oil from flowing back from engine oil cooler and oil filter when engine stops
- ☐ Removing and installing ⇒ [page 174](#)

20 - O-ring

- ☐ Renew

21 - Coolant temperature sender - G62-

- ☐ Removing and installing ⇒ [page 208](#)
- ☐ 2 Nm

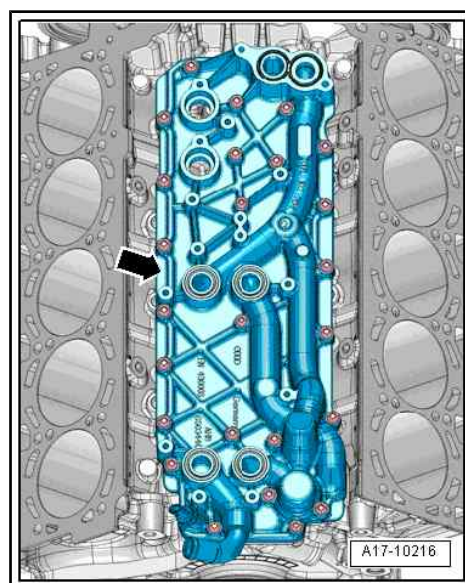
22 - O-rings

- ☐ 2x
- ☐ Renew

23 - Dowel sleeve

Mounting plate - tightening torque and sequence

- Tighten bolts for mounting plate in stages, working from inside to outside; final torque 9 Nm.



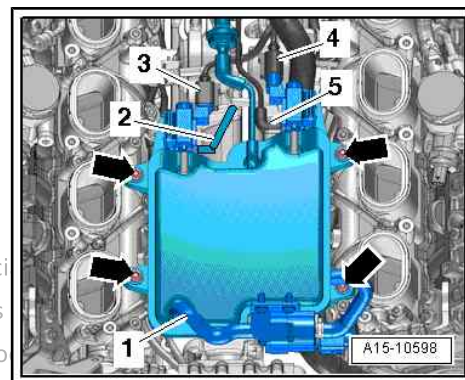


2.4 Removing and installing engine oil cooler (top)

Removing

- Drain coolant ➔ [page 195](#) .
- Remove intake manifold (top section) ➔ Rep. gr. 24 .
- Unplug electrical connectors -3- and -4-.
- Disconnect vacuum hoses -1, 2, 5-.
- Remove bolts -arrows- and detach vacuum reservoir.

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Note

Place a cloth underneath engine oil cooler to catch escaping engine oil.

- Remove bolts -arrows- and move bracket -1- for electrical connectors to one side.
- Detach engine oil cooler -2-.

Installing

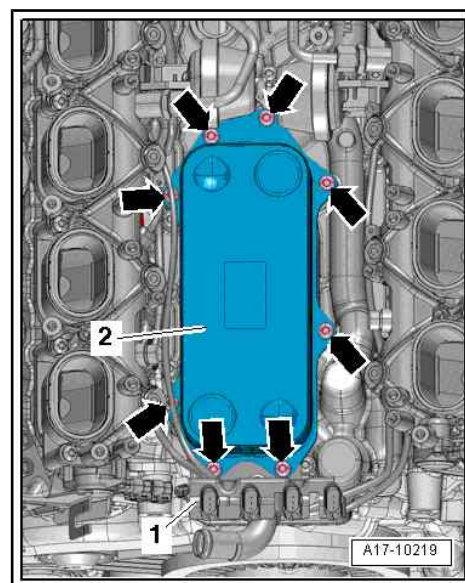
- Tightening torques ➔ [page 169](#)

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



Note

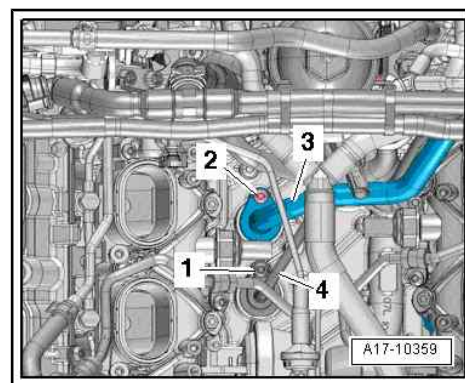
- ◆ Fit new O-rings.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ *Electronic parts catalogue* .
- Install intake manifold (top section) ➔ Rep. gr. 24 .
- Check oil level ➔ Maintenance ; Booklet 405 .
- Fill up with coolant ➔ [page 197](#) .



2.5 Removing and installing mounting plate

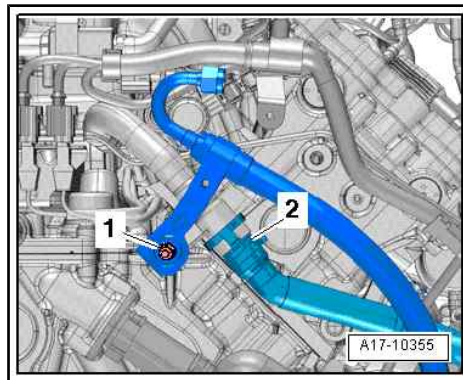
Removing

- Remove engine oil cooler (top) ➔ [page 171](#) .
- Remove oil filter housing ➔ [page 168](#) .
- Remove intake manifold bottom section (left and right) ➔ Rep. gr. 24 .
- Remove bolts -1- and -2-.
- Detach crankcase breather hoses -3- and -4- and move clear to one side.





- Unscrew nut -1-.
- Press release tabs and disconnect secondary air hose -2-.
- Move secondary air hose clear.

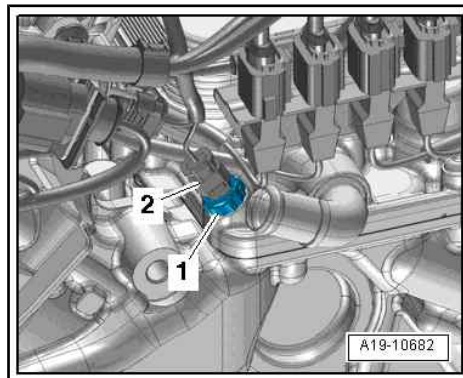


- Unplug electrical connector -2- at coolant temperature sender - G62- .

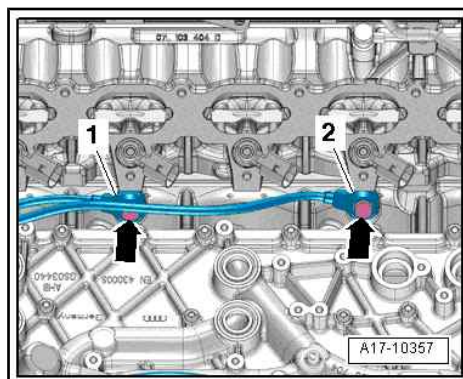


Note

-Item 1- can be disregarded.



- Remove bolts -arrows-.
- Detach knock sensor 2 - G66- -item 1- and knock sensor 1 - G61- -item 2- and move clear.

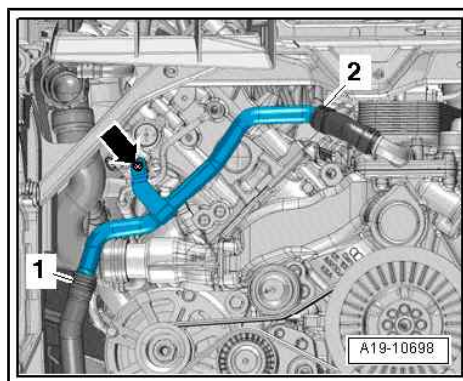


- Release hose clip -2-.



Note

Disregard items marked -1- and -arrow-.



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**Note**

Spread out rags around cover to catch escaping engine oil.

- Remove bolts and lift off cover -arrow- from cylinder block and coolant pipe.

Installing

- Tightening torque ⇒ [page 169](#)
- Connection diagram for vacuum pipes and hoses ⇒ [page 265](#) .

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

**Note**

Renew gasket and O-rings.

- Tighten bolts securing cover ⇒ [page 170](#) .

- Install knock sensors ⇒ Rep. gr. 28 .

- Install secondary air hose ⇒ [page 266](#) .

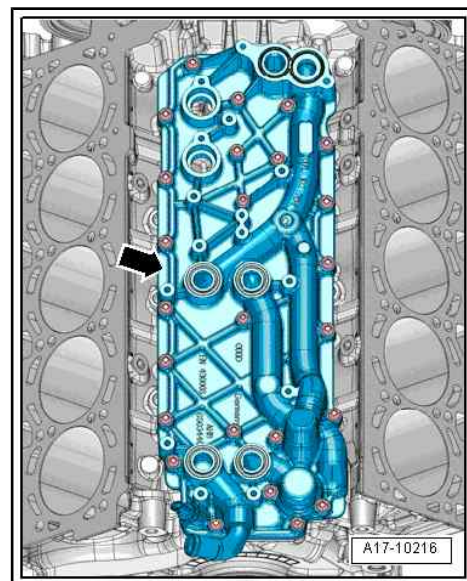
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- Install intake manifold bottom section (left and right) ⇒ Rep. gr. 24 .

- Install oil filter housing ⇒ [page 168](#) .

- Install engine oil cooler (top) ⇒ [page 171](#) .

- Check oil level ⇒ Maintenance ; Booklet 405 .



2.6 Removing and installing oil retention valve 1 and spray nozzle valve

**Note**

In the event of irregular valve noise which disappears after a lengthy drive but repeatedly re-occurs when travelling short distances, the oil retention valve 1 must be renewed.



Removing

- Remove mounting plate ⇒ [page 171](#) .
- Unscrew spray nozzle valve -1- and remove.
- Pull out oil retention valve 1 -item 2-.

Installing

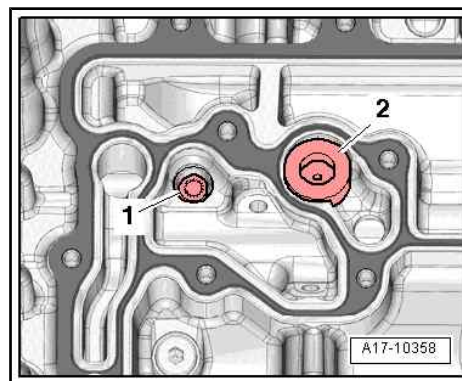
- Tightening torque ⇒ [page 169](#)

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



Note

- ◆ *Fit new O-rings.*
- ◆ *Apply locking fluid when installing spray nozzle valve -1-; for locking fluid refer to ⇒ [Electronic parts catalogue](#) .*
- Install mounting plate ⇒ [page 171](#) .
- Check oil level ⇒ Maintenance ; Booklet 405 .



2.7 Removing and installing oil retention valve 2

Removing

- Remove mounting plate ⇒ [page 171](#) .
- Pull out oil retention valve 2 -arrow-.

Installing

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

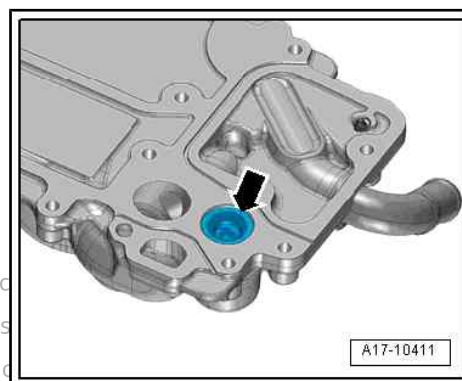


Note

Fit new O-ring.

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- Install mounting plate ⇒ [page 171](#) .
- Check oil level ⇒ Maintenance ; Booklet 405 .



2.8 Removing and installing crankcase breather hoses

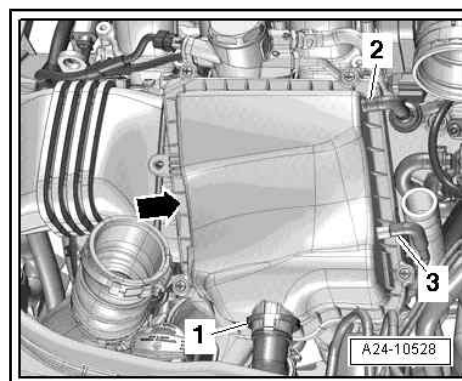
Removing

- Remove intake manifold (top section) ⇒ Rep. gr. 24 .
- Detach hose -2- from air cleaner (top section) -arrow-.



Note

Disregard items -1 and 3-.





- Remove bolts -1- and -2-.
- Detach crankcase breather hoses -3- and -4-.

Installing

- Tightening torque ⇒ [page 169](#)

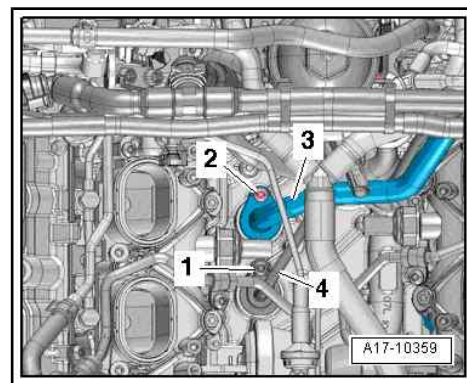
Installation is carried out in reverse order; note the following:



Note

Fit new O-rings.

- Install intake manifold (top section) ⇒ Rep. gr. 24 .



2.9 Removing and installing oil pressure switch - F1-

Removing

- Remove intake manifold (top section) ⇒ Rep. gr. 24 .
- Unplug electrical connector -1-.
- Remove oil pressure switch - F1- -item 2-

Installing

- Tightening torque ⇒ [page 169](#)

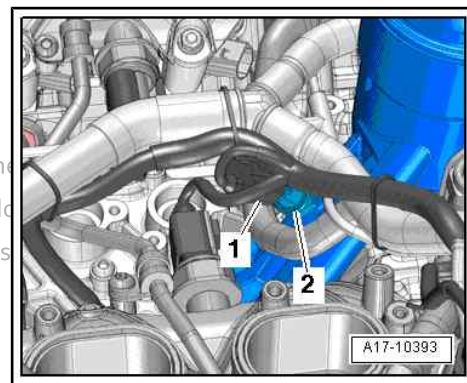
Installation is carried out in reverse order; note the following:



Note

Renew seal.

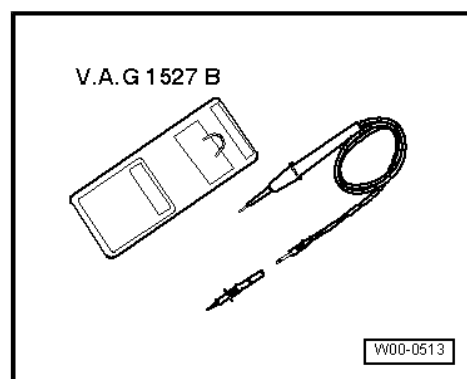
- Install intake manifold (top section) ⇒ Rep. gr. 24 .



2.10 Checking oil pressure switch - F1-

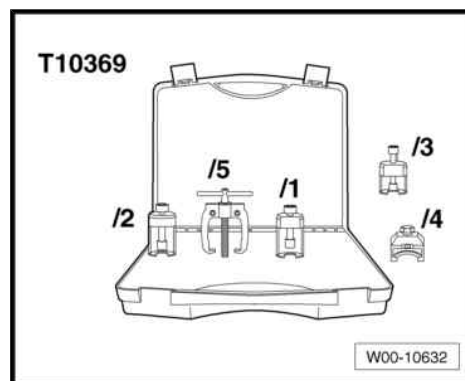
Special tools and workshop equipment required

- ◆ Voltage tester - V.A.G 1527B-



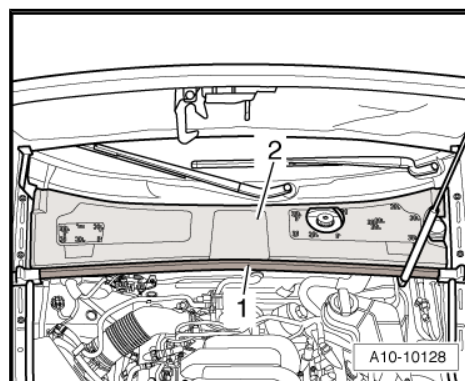


◆ Puller - T10369-

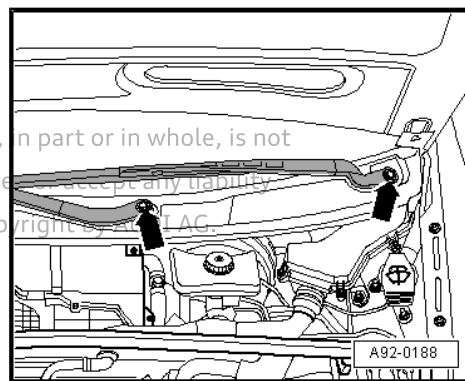


Procedure

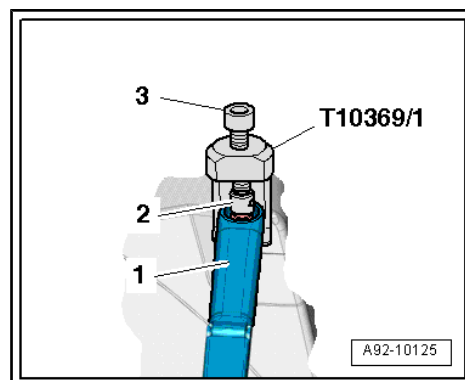
- Oil pressure tester - V.A.G 1342- set up for oil pressure test
⇒ [page 178](#) .
- Pull off seal -1- and remove plenum chamber cover -2-.



- Pry off caps on windscreen wiper arms with a screwdriver.
- Loosen nuts -arrows- several turns.



- Apply puller -T10369/1- to wiper arm -1- as shown in illustration.
- Apply thrust piece -2- at wiper shaft.
- Turn bolt -3- clockwise until wiper arm is clear of wiper shaft.
- Remove nuts and detach wiper arms.

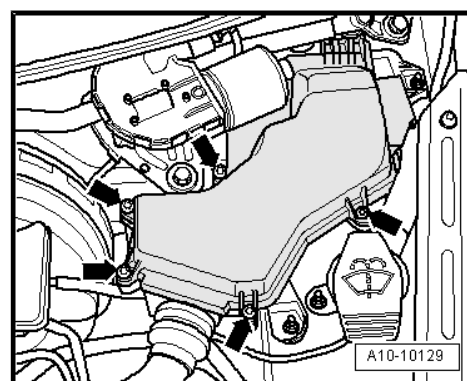
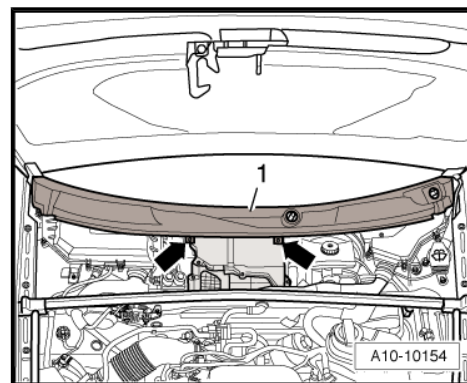


**Caution**

Risk of damage to cowl panel trim.

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

- Unscrew bolts -arrows- and pull cowl panel trim off windscreen.
- Remove bolts -arrows- and detach cover for electronics box in engine compartment (left-side).



- Apply probe of voltage tester -V.A.G 1527B- to 17-pin connector (red) -arrow- for oil pressure switch located on connector point in electronics box in plenum chamber (left-side); connector assignment ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Apply second probe of voltage tester -V.A.G 1527B- to connection on positive wire »+« on connector point in electronics box in plenum chamber (left-side).
- LED should not light up.
- Renew oil pressure switch if LED lights up when engine is not running ⇒ [page 175](#).
- Start engine.

**Note**

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

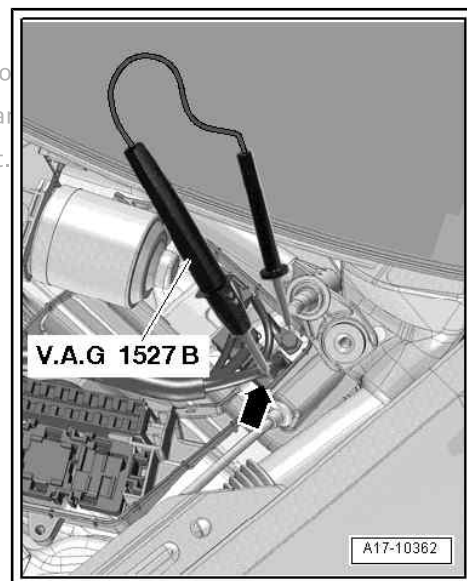
- LED should light up at 1.2 ... 1.6 bar.
- Renew oil pressure switch if LED does not light up ⇒ [page 175](#).

Assembling

- Tightening torque ⇒ Electrical system; Rep. gr. 97

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

- Install and adjust wiper arms ⇒ Electrical system; Rep. gr. 92.

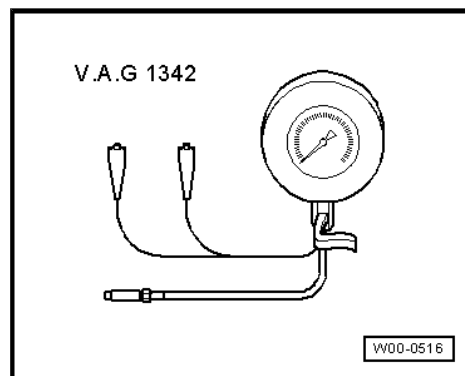




2.11 Checking oil pressure

Special tools and workshop equipment required

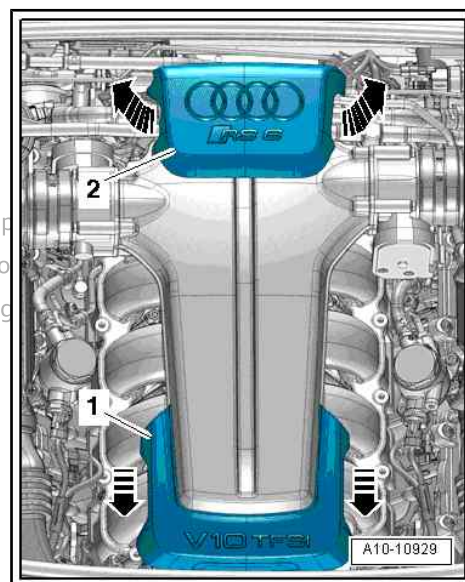
- ♦ Oil pressure tester - V.A.G 1342-



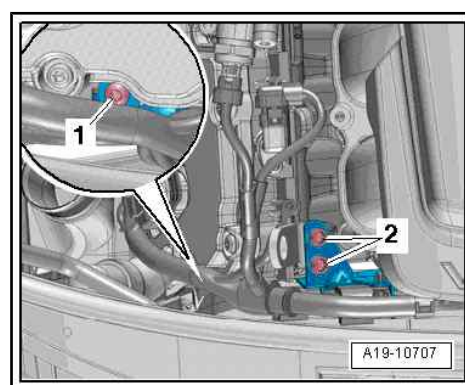
- ♦ Adapter set - V.A.G 1342/22-

Procedure

- Tightening torque ⇒ [page 232](#)
- Oil level OK
- Engine oil temperature approx. 100 °C (display of dash panel insert indicates temperature in oil reservoir).
- Pull off engine cover panel (front) -1- towards front -arrows-.
- Remove air cleaner housing (right-side) ⇒ Rep. gr. 24.



- Remove bolts -1- and -2-.
- Detach engine lifting eye and push wiring harness to one side.



**WARNING**

Risk of burns when touching oil supply line.

- ◆ *Wear protective gloves when working near components.*

**Note**

Lay a cloth under the oil supply line to catch escaping engine oil.

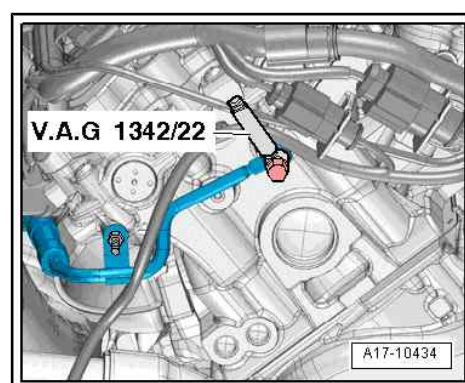
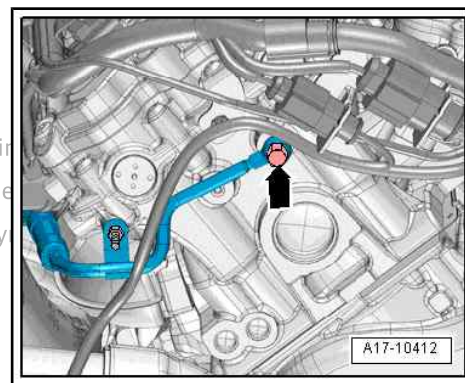
- Remove banjo bolt -arrow- for oil supply line going to turbo-charger (right-side).
- Reconnect oil supply line with adapter set - V.A.G 1342/22- and new seals as shown in illustration.
- Screw a used oil pressure switch into threaded hole on oil pressure tester - V.A.G 1342- to seal hole.
- Connect oil pressure tester to adapter.
- Start engine.
 - Oil pressure at idling speed: at least 1.7 bar.
 - Oil pressure at 2000 rpm: at least 3.5 bar.

Assembling

- Tightening torque ⇒ [page 125](#)

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

- Install air cleaner housing (right-side) ⇒ Rep. gr. 24 .





3 Engine oil cooler (front), oil reservoir

3.1 Exploded view - engine oil cooler (front), oil reservoir

1 - Hydraulic fluid cooler

- ☐ For power steering
- ☐ Removing and installing
⇒ Rep. gr. 48

2 - Bolt

- ☐ 9 Nm

3 - Engine oil cooler (front)

- ☐ Removing and installing
⇒ [page 183](#)

4 - O-ring

- ☐ Renew

5 - Oil drain plug

- ☐ 40 Nm

6 - Seal

- ☐ Renew

7 - Bolt

- ☐ 8 Nm

8 - Pipe/hose assembly

- ☐ From engine oil cooler
(front) to temperature
regulator

9 - Oil drain plug

- ☐ 40 Nm

10 - Seal

11 - O-rings

- ☐ Renew

12 - Nut

- ☐ 9 Nm

13 - Bolt

- ☐ 9 Nm

14 - Pipe/hose assembly

- ☐ From intake module to oil reservoir

15 - O-ring

- ☐ Renew

16 - Oil reservoir

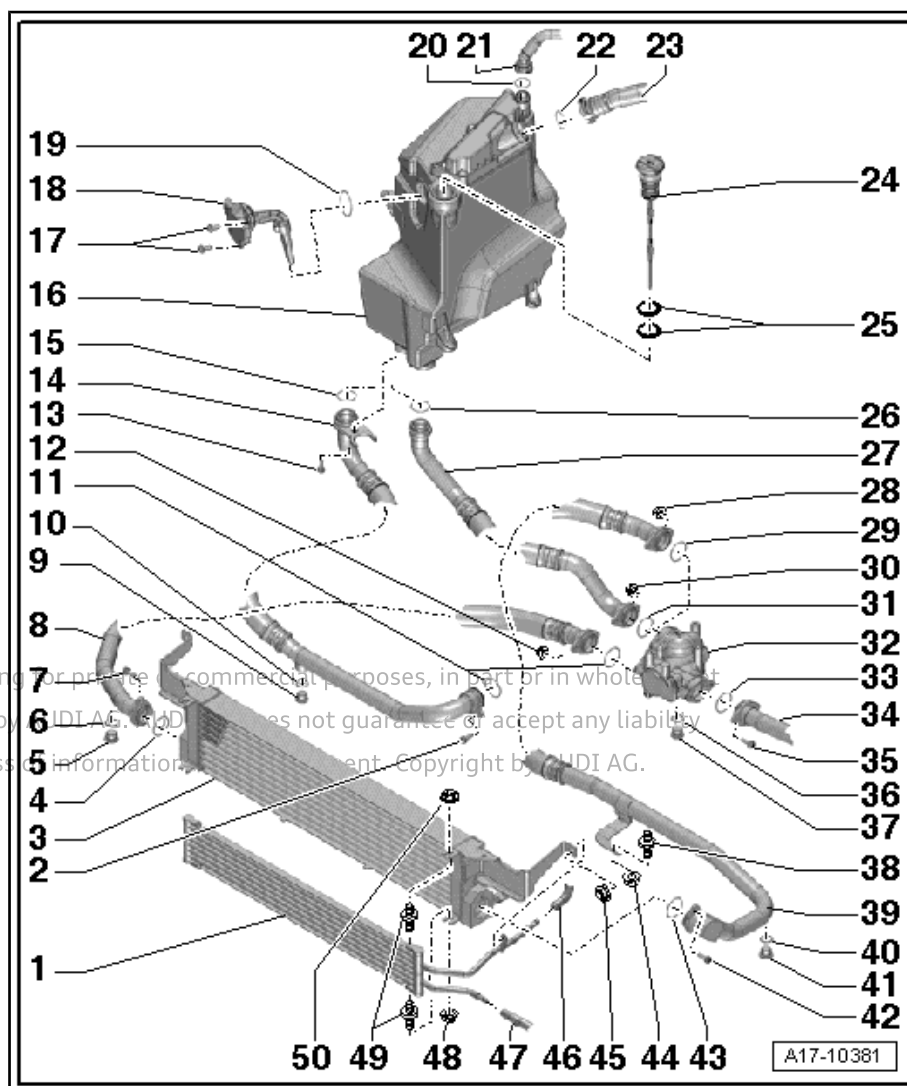
- ☐ Removing and installing ⇒ [page 186](#)
- ☐ Tightening torques ⇒ [page 182](#)

17 - Bolt

- ☐ 9 Nm

18 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing ⇒ [page 183](#)



**19 - O-ring**

- ☐ Renew

20 - O-ring

- ☐ Renew

21 - Crankcase breather hose**22 - O-ring**

- ☐ Renew

23 - Crankcase breather hose**24 - Oil dipstick****25 - O-rings**

- ☐ Renew

26 - O-ring

- ☐ Renew

27 - Pipe/hose assembly

- ☐ From oil reservoir to temperature regulator

28 - Nut

- ☐ 9 Nm

29 - O-ring

- ☐ Renew

**30 - Nut**

- ☐ 9 Nm

31 - O-ring

- ☐ Renew

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32 - Temperature regulator

- ☐ Removing and installing ⇒ [page 185](#)
- ☐ Tightening torques ⇒ [page 182](#)

33 - O-ring

- ☐ Renew

34 - Oil line

- ☐ From oil pump to temperature regulator ⇒ [Item 34 \(page 163\)](#)

35 - Bolt

- ☐ 9 Nm

36 - Seal

- ☐ Renew

37 - Oil drain plug

- ☐ 25 Nm

38 - Bonded rubber bush**39 - Pipe/hose assembly**

- ☐ From engine oil cooler (front) to temperature regulator

40 - Seal

- ☐ Renew

41 - Oil drain plug

- ☐ 40 Nm

42 - Bolt

- ☐ 8 Nm



43 - O-ring

- ☐ Renew

44 - Nut

- ☐ 6 Nm

45 - Nut

- ☐ 6 Nm

46 - Hose

- ☐ For power steering

47 - Hose

- ☐ For power steering

48 - Nut

- ☐ 6 Nm

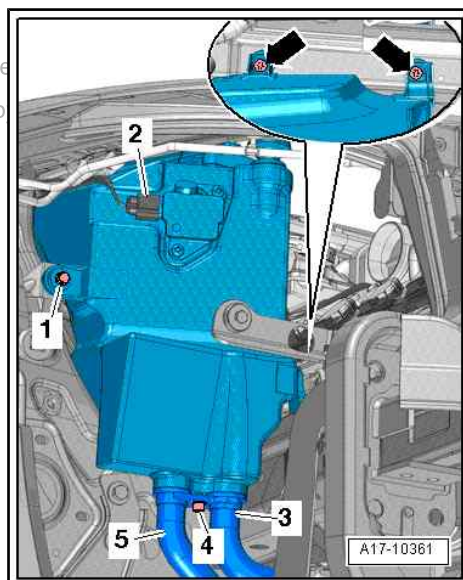
49 - Bonded rubber bush

50 - Nut

- ☐ 6 Nm

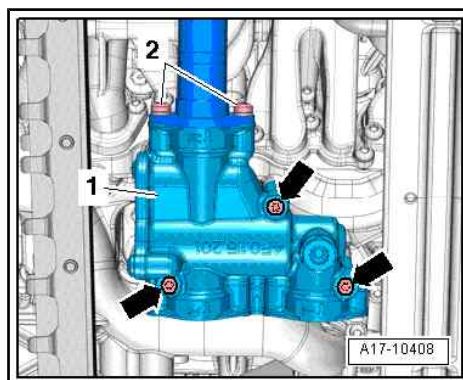
Oil reservoir - tightening torque

- Tighten bolts 1 and arrows for oil reservoir to 9 Nm.



Temperature regulator - tightening torque

- Tighten bolts -arrows- for temperature regulator to 9 Nm.





3.2 Removing and installing oil level and oil temperature sender - G266-

Removing

- Remove headlight (right-side) ⇒ Electrical system; Rep. gr. 94 .
- Unplug electrical connector -1-.
- Remove bolts -arrows- and detach oil level and oil temperature sender - G266- from oil reservoir.

Installing

- Tightening torque ⇒ [page 180](#)

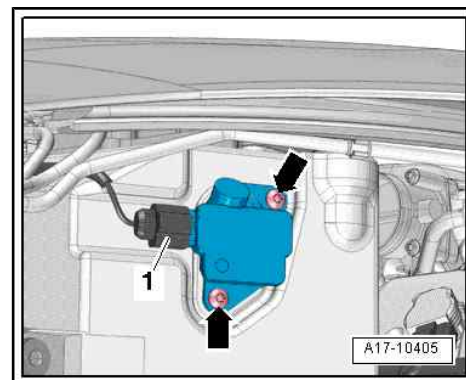
Installation is carried out in reverse order; note the following:



Note

Fit new O-ring.

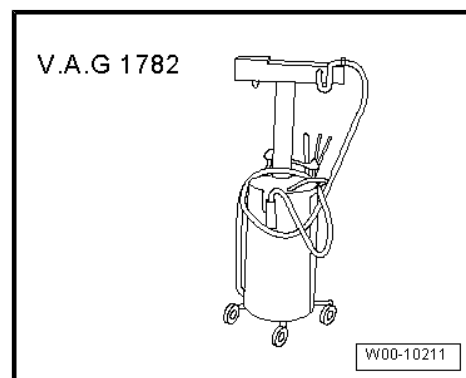
- Install headlight (right-side) ⇒ Electrical system; Rep. gr. 94 .



3.3 Removing and installing engine oil cooler (front)

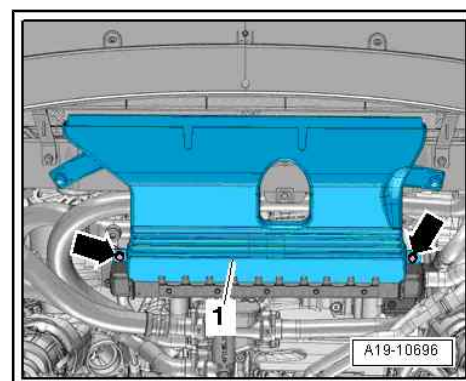
Special tools and workshop equipment required

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



Removing

- Drain off engine oil ⇒ Maintenance ; Booklet 405 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Remove bolts -arrows- and detach air duct -1-.



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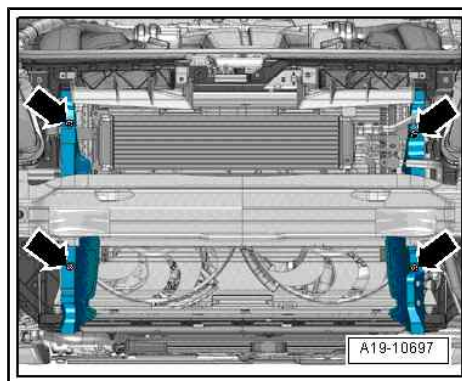


- Remove bolts -bottom arrows- for air ducts (left and right).

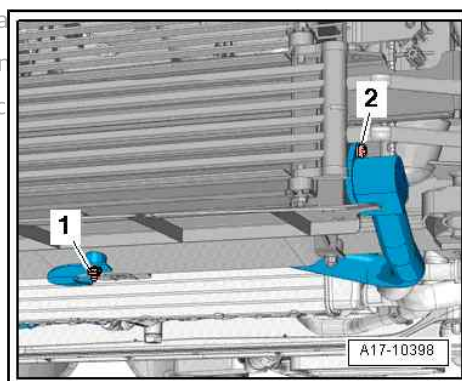


Note

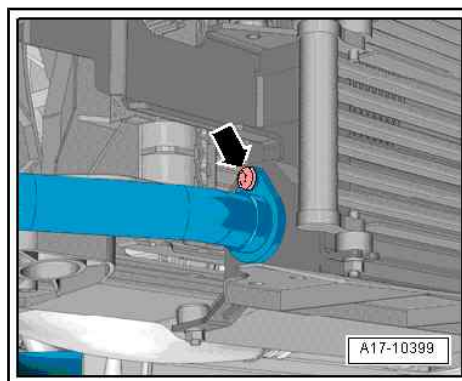
Disregard -top arrows-.



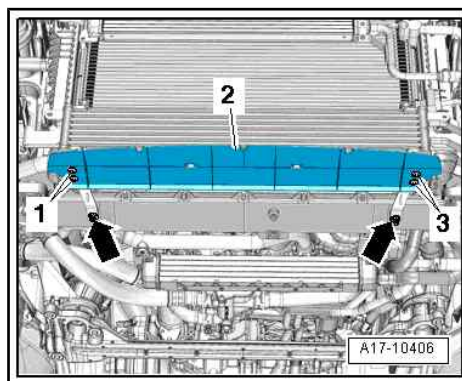
- Position used oil collection and extraction unit V.A.G 1782 underneath engine oil cooler (front).
- Remove nut -1- and bolt -2-, detach oil line (left side) from engine oil cooler (front).



- Remove bolt -arrow- and detach oil line (right-side) from engine oil cooler (front).

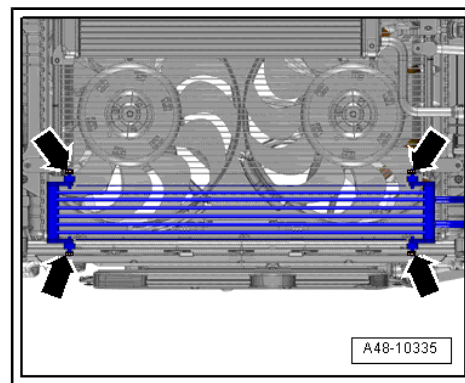


- Remove bolts -1- and -3-, detach air duct -2-.
- Slacken nuts -arrows-, do not remove.

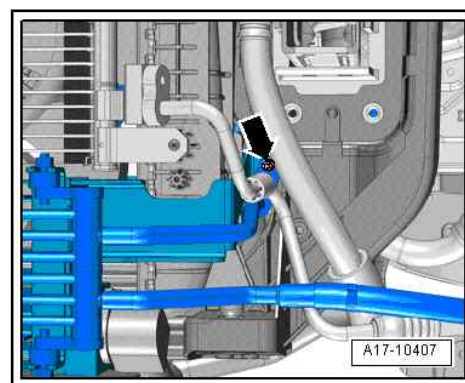




- Slacken nuts -arrows-, do not remove.



- Position used oil collection and extraction unit - V.A.G 1782- below engine.
- Remove nut -arrow- on both sides.
- Detach hydraulic fluid cooler for power steering from engine oil cooler (front).
- Detach engine oil cooler (front).
- Tie hydraulic fluid cooler onto bumper.



Installing

- Tightening torques ➔ [page 180](#) , ➔ [page 219](#) .

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



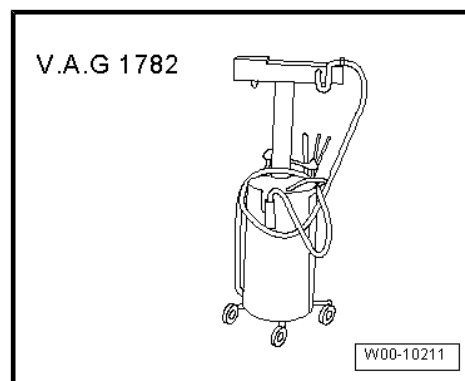
Note

- ◆ *Fit new O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Electronic parts catalogue .*
- Install hydraulic fluid cooler for power steering ➔ Rep. gr. 48 .
- Add engine oil ➔ [page 192](#) .
- Install air ducts (left and right) ➔ Rep. gr. 50 .
- Install bumper cover (front) ➔ Rep. gr. 63 .

3.4 Removing and installing temperature regulator

Special tools and workshop equipment required

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

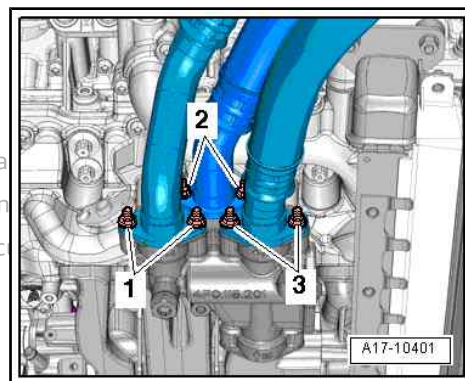




Removing

- Drain off engine oil ⇒ Maintenance ; Booklet 405 .
- Position used oil collection and extraction unit - V.A.G 1782- below connection point.
- Remove nuts -1, 2, 3- and detach pipe/hose assembly from temperature regulator.

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- Remove bolts -2- for oil line.
- Remove bolts -arrows- and detach temperature regulator -1- from oil line.

Installing

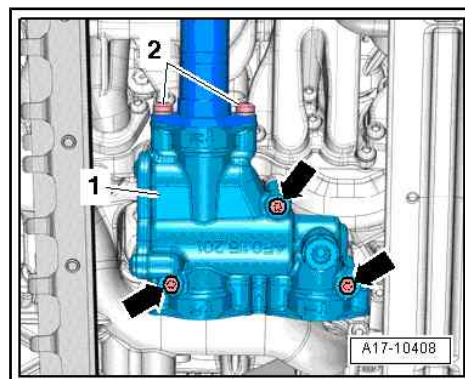
- Tightening torques ⇒ [page 180](#)

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



Note

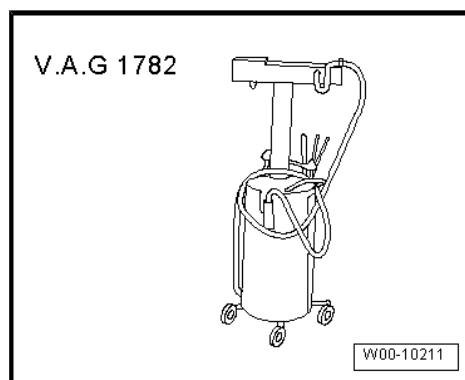
- ♦ *Fit new O-rings.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Tighten bolts for temperature regulator ⇒ [page 182](#) .
- Add engine oil ⇒ [page 192](#) .



3.5 Removing and installing oil reservoir

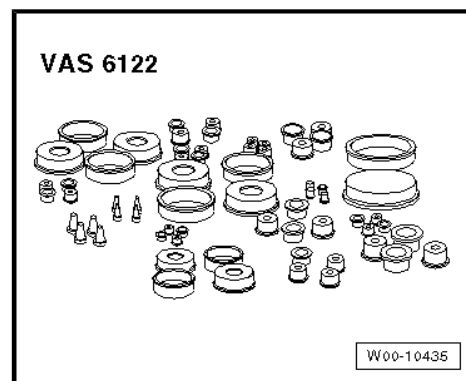
Special tools and workshop equipment required

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





◆ Engine bung set - VAS 6122-



Removing

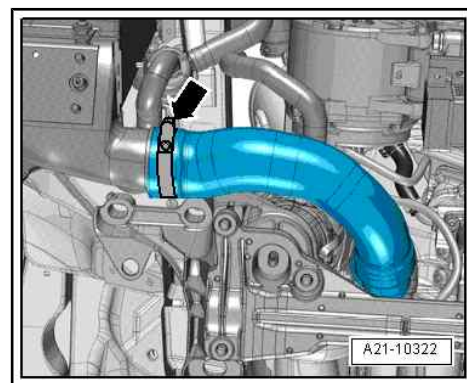


Caution

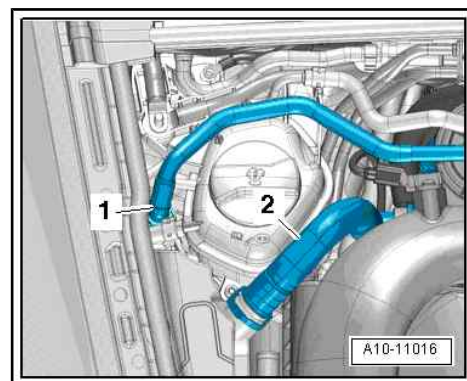
Risk of irreparable damage to electronic components.

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

- Disconnect battery ⇒ Electrical system; Rep. gr. 27 .
- Drain coolant ⇒ [page 195](#) .
- Place used oil collection and extraction unit - V.A.G 1782- underneath engine and drain engine oil from oil reservoir ⇒ Maintenance ; Booklet 405 .
- Remove headlight (right-side) ⇒ Electrical system; Rep. gr. 94 .
- Release hose clip -arrow- and detach air hose from charge air cooler (right-side), push air hose to one side.



- Press release tabs and detach crankcase breather hose -1-.
- Press release tabs and remove crankcase breather hose -2-.
- Remove air cleaner housing (right-side) ⇒ Rep. gr. 24 .



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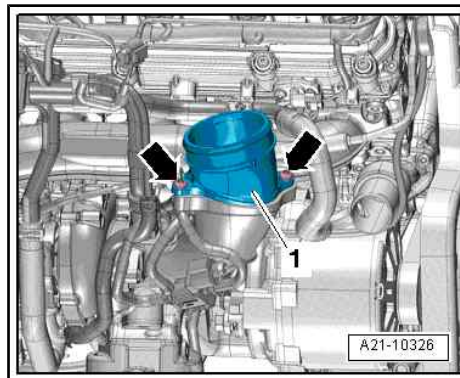
- Unscrew bolts -arrows- and remove intermediate flange -1-.



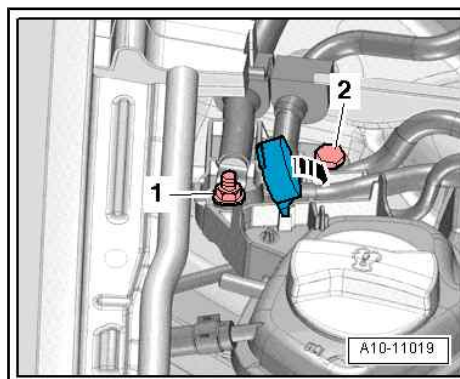
Caution

Risk of irreparable damage to turbocharger.

- ◆ ***Use adhesive tape to seal off connection for turbocharger to prevent small objects from dropping into the turbocharger.***



- Open cover above positive terminal -arrow-.
- Unscrew nut -1- for positive terminal and move positive wiring clear.
- Unscrew earth stud -2- and move earth wiring clear.



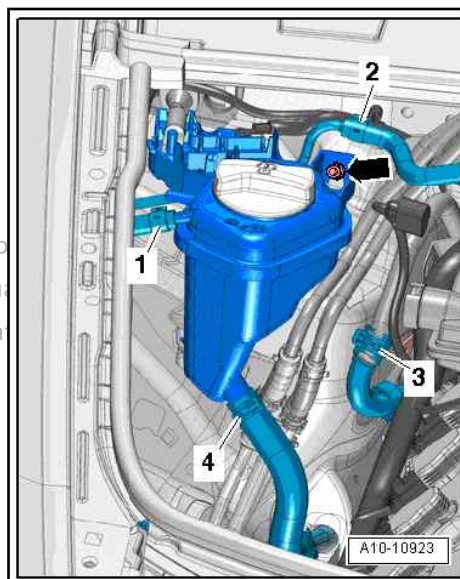
- Release hose clips -1- and -4- and disconnect coolant hoses from coolant filler tank.
- Remove nut -arrow- and detach coolant filler tank.



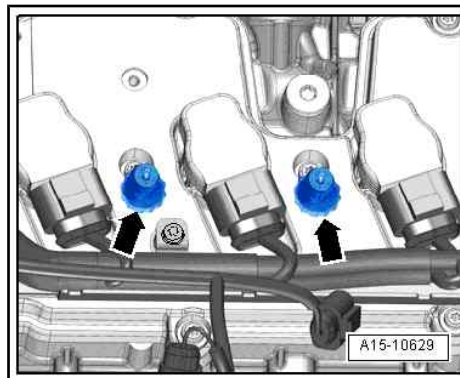
Note

Disregard items 2 and 3.

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- Remove retaining pins -arrows-.





- Press coolant hoses to one side and remove bolt -4-.
- First detach pipe/hose assembly -5- and then pipe/hose assembly -3- from oil reservoir.
- Unplug electrical connector -2- at oil level and oil temperature sender - G266- .
- Remove bolts -arrows- at longitudinal member.
- Remove bolt -1- on body panel and remove oil reservoir.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

Installing

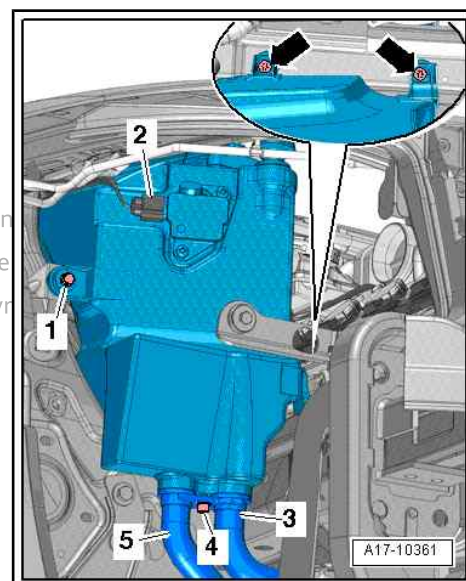
- Tightening torque ➔ [page 180](#)

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



Note

- ◆ *Fit new O-rings.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Electronic parts catalogue .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
- ◆ *To ensure that there is enough clearance at the crash sensors, it is very important to observe the installation position of the hose clips at the air pipes ➔ [page 243](#) .*
- Tighten nut for positive terminal and tighten earth stud ➔ [page 42](#) .
- Install intermediate flange and air cleaner housing ➔ Rep. gr. 24 .
- Install headlight (right-side) ➔ Electrical system; Rep. gr. 94 .
- Add engine oil ➔ [page 192](#) .
- Observe notes on procedure for connecting the battery ➔ Electrical system; Rep. gr. 27 .
- Fill up with coolant ➔ [page 197](#) .

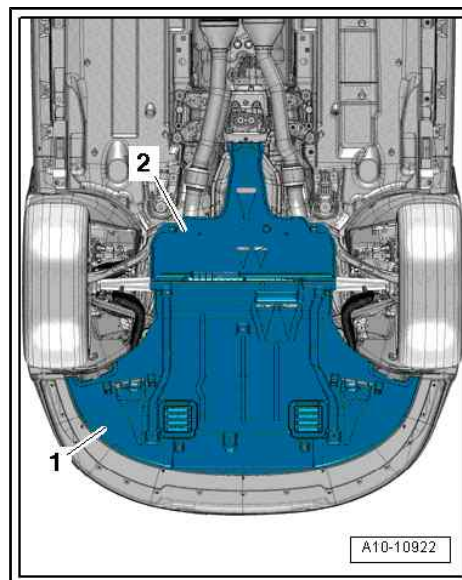




3.6 Installing oil return line with oil reservoir

Removing

- Remove noise insulation panels -1- and -2- ⇒ Rep. gr. 50 .

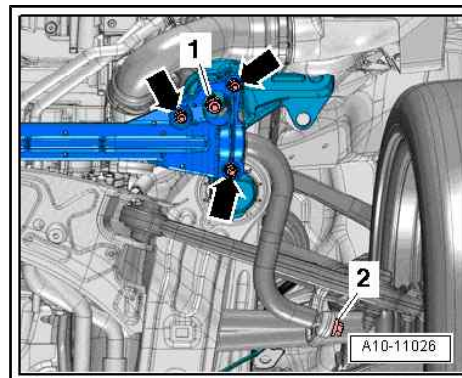


- Unscrew nuts -arrows- on both sides evenly and lower anti-roll bar.



Note

Disregard items -1 and 2-.



Note

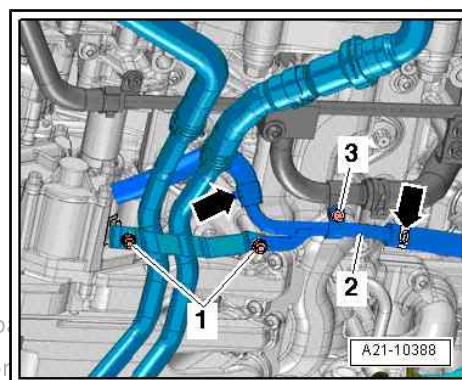
Lay a cloth under the separating point to catch escaping engine oil.

- Remove nuts -1- and bolt -3-.
- Detach oil return hoses -arrows- and oil return line -2-.



Note

Do not reuse the oil return line.

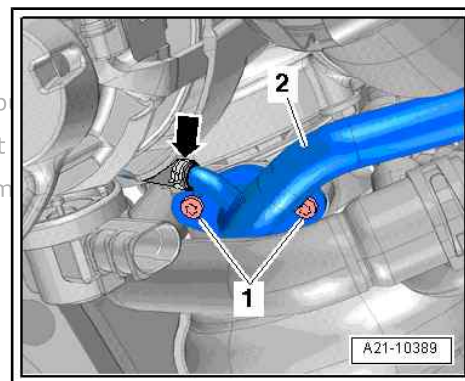




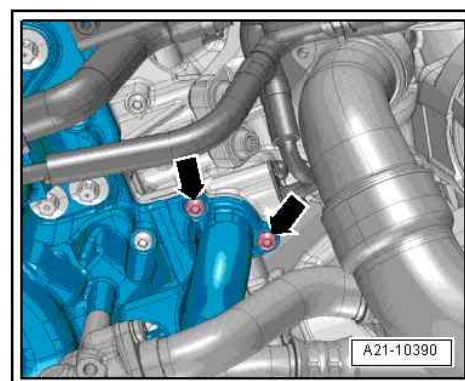
- Remove bolts -1-.
- Detach oil return line -2- and disconnect air hose -arrow-.



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with respect to the correctness of information in this document.
Do not reuse the oil return line.

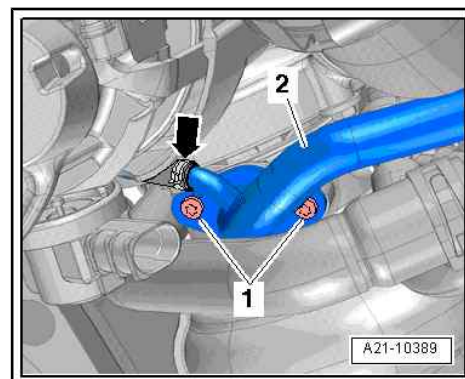


- Remove bolts -arrows-.

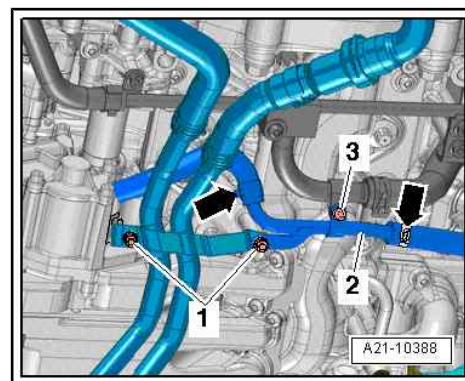


Installing

- Tightening torques ➔ [page 161](#) , ➔ [page 180](#) , ➔ [page 232](#) .
- Place new oil return line -2- with oil reservoir in installation position.
- Install air hose -arrow- (replace spring-type clip with hose clip).
- Bolt oil return line with new seal onto turbocharger.

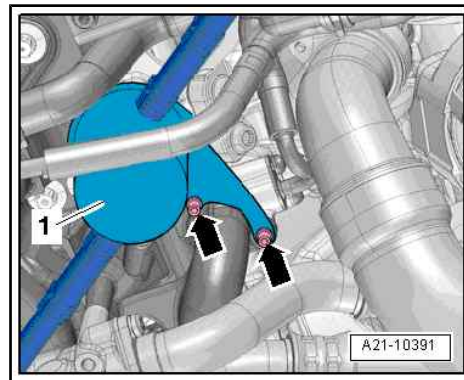


- Install new oil return line -2-.





- Secure oil reservoir with new bolts -arrows-.
- Install anti-roll bar ⇒ Rep. gr. 40 .
- Check oil level ⇒ Maintenance ; Booklet 405 .



3.7 Engine oil

Oil capacities, oil specifications and viscosity grades ⇒ Maintenance tables .

3.8 Checking oil level

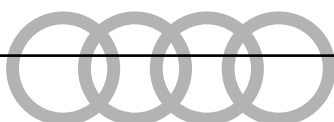
Check oil level ⇒ Maintenance ; Booklet 405 .

3.9 First filling of engine with oil after repairs

Procedure



Caution



Irreparable engine damage can be caused if it not filled with a sufficient amount of oil.

- ◆ ***New engines and exchange engines are filled with only a very little amount of oil at the factory.***
- ◆ ***The same applies if the oil circuit has been opened and oil has been drained for repairs.***

To prevent damaging the engine, perform the first filling with engine oil as follows:

- Fill oil reservoir with 6 ltr. of engine oil.
- Start engine and run at idling speed for 30 seconds.
- Switch off engine.
- Fill oil reservoir with an additional 2 ltr. of engine oil.
- Fill up oil level to “MAX” ⇒ Maintenance ; Booklet 405 .



19 – Cooling

1 Cooling system



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant filler tank with cloth and open carefully.*



Note

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*
- ◆ *Fit all heat shields and heat insulation sleeves in the original positions when installing.*

1.1 Connection diagram - coolant hoses



Note

- ◆ *Blue = Large coolant circuit*
- ◆ *Red = Small coolant circuit*
- ◆ *Brown = Heating circuit*



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**1 - Radiator (right-side)**

- ☐ If renewed, refill system with fresh coolant

2 - Additional thermostat**3 - Alternator****4 - Coolant expansion tank**

- ☐ With filler cap
- ☐ Checking pressure relief valve in filler cap
⇒ [page 231](#)

5 - Continued coolant circulation pump - V51-**6 - Coolant filler tank****7 - Turbocharger**

- ☐ For cylinder bank 1 (right-side)

8 - Pump/valve unit**9 - Heat exchanger for heater (right-side)**

- ☐ Removing and installing
⇒ Rep. gr. 87
- ☐ If renewed, refill system with fresh coolant

10 - Heat exchanger for heater (left-side)

- ☐ Removing and installing
⇒ Rep. gr. 87
- ☐ If renewed, refill system with fresh coolant

11 - Bleeder screw**12 - Engine oil cooler (top)****13 - Turbocharger**

- ☐ For cylinder bank 2 (left-side)

14 - Coolant pump

- ☐ Combined with oil pump

15 - Additional thermostat**16 - Engine oil cooler**

- ☐ For differential
- ☐ Removing and installing ⇒ Rep. gr. 39

17 - Thermostat**18 - ATF cooler**

- ☐ Removing and installing ⇒ Rep. gr. 37

19 - Circulation pump 2 - V403-

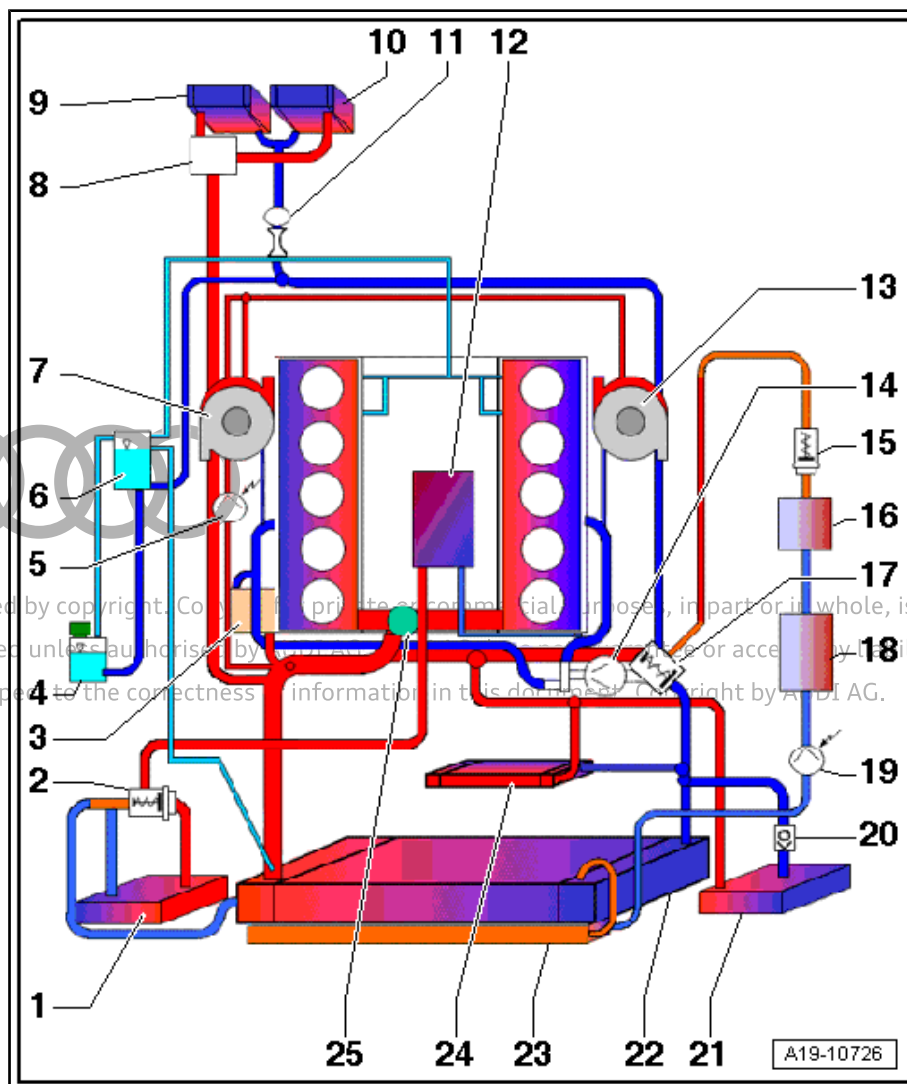
- ☐ For engine oil cooler and ATF cooler

20 - Non-return valve

- ☐ For coolant hose

21 - Radiator (left-side)

- ☐ If renewed, refill system with fresh coolant





22 - Radiator (centre)

- ❑ If renewed, refill system with fresh coolant

23 - Radiator (top)

- ❑ If renewed, refill system with fresh coolant

24 - Radiator (bottom)

- ❑ If renewed, refill system with fresh coolant

25 - Coolant temperature sender - G62-

1.2 Draining and filling cooling system

Special tools and workshop equipment required



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V.A.G 1274/8 	V.A.G 1274/10
VAS 6096 	VAS 6208
VAS 6362 	T10007 G19-10025

- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Pipe for cooling system tester - V.A.G 1274/10-
- ◆ Cooling system charge unit - VAS 6096-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Refractometer - T10007-



Draining



Note

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



WARNING

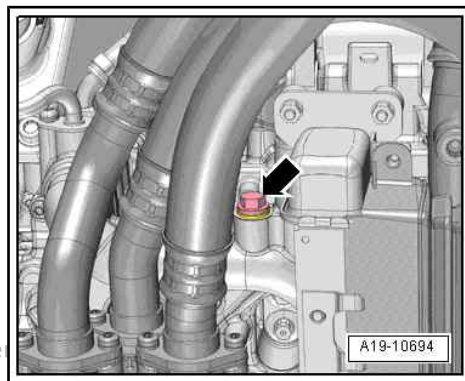
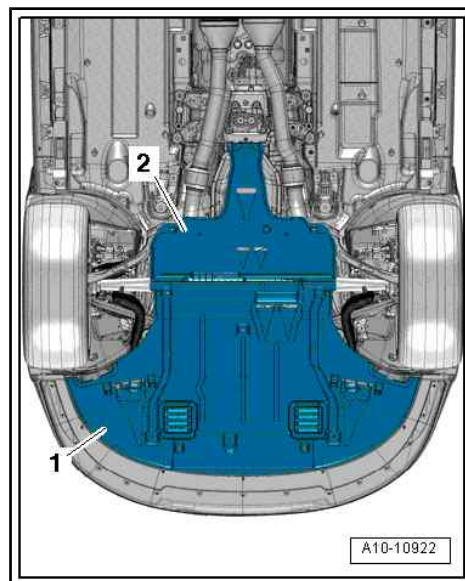
Risk of scalding due to hot steam and hot coolant.

- ◆ ***The cooling system is under pressure when the engine is hot.***
- ◆ ***To allow pressure to dissipate, cover filler cap on coolant filler tank with cloth and open carefully.***

- Open filler cap on coolant filler tank.
- Remove noise insulation -1- ⇒ Rep. gr. 50 .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Unscrew drain plug -arrow- at intake module and drain off coolant.



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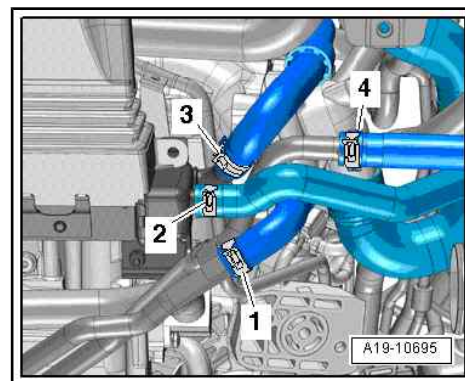
- Release hose clips -1- and -2-, disconnect coolant hoses and drain off remaining coolant.

**Note**

Disregard items -3 and 4-.

Filling

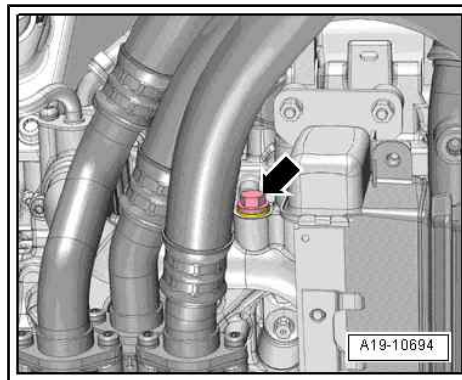
- Tightening torque ⇒ [page 161](#)
- Ignition switched off.

**Note**

- ◆ *Renew seal on drain plug.*
- ◆ *The cooling system is filled all year round with a mixture of water and radiator antifreeze/anti-corrosion agent.*
- ◆ *Use only the radiator antifreeze/anti-corrosion agent approved for this engine ⇒ Electronic parts catalogue . 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.*
- ◆ *The specified radiator antifreeze/anti-corrosion agent prevents frost and corrosion damage and stops scaling. Such additives also raise the boiling point of the coolant. It is therefore essential to use the correct radiator anti-freeze and corrosion protection additive in the cooling system all year round.*
- ◆ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *Frost protection is required down to about -25 °C (in countries with arctic climate: down to about -35 °C).*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant concentration must be at least 40 %.*
- ◆ *If greater frost protection is required in very cold climates, the concentration of radiator antifreeze/anti-corrosion agent can be increased, but only up to 60 % (this gives frost protection to about -40 °C). If the concentration exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.*
- ◆ *Use only clean tap water for mixing coolant.*
- ◆ *Do not use drained coolant again if:*
 - ◆ *radiator, heat exchanger for heater, cylinder head and cylinder head gasket or cylinder block have been renewed.*
 - ◆ *the coolant is contaminated or dirty.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *For checking anti-freeze protection in cooling system, use refractometer - T10007- .*



- Fit drain plug -arrow- with new seal into intake module.

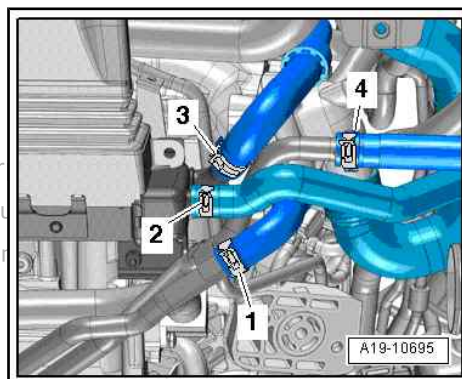


- Connect coolant hoses -1- and -2-.

**Note**

Disregard items -3- and -4-.

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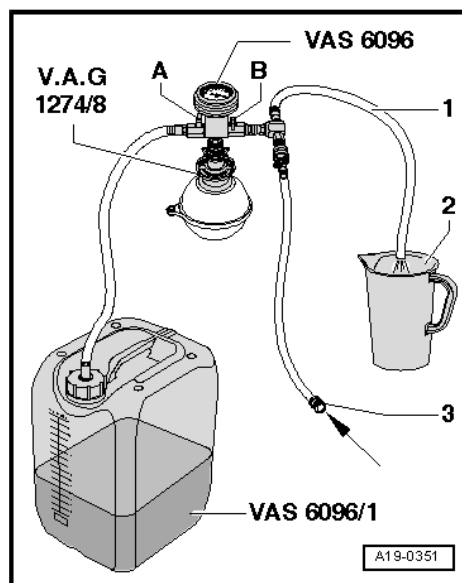


- Fill reservoir of -VAS 6096- with at least 14 litres of premixed coolant (according to recommended ratio).
- Radiator antifreeze/anti-corrosion agent (40 %) and water (60 %) for frost protection to -25 °C
- Radiator antifreeze/anti-corrosion agent (50 %) and water (50 %) for frost protection to -35 °C
- Radiator antifreeze/anti-corrosion agent (60 %) and water (40 %) for frost protection to -40 °C
- Radiator antifreeze/anti-corrosion agent ⇒ Electronic parts catalogue
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant filler tank.
- Attach cooling system charge unit - VAS 6096- to adapter.
- Run vent hose -1- into a small container -2-.

**Note**

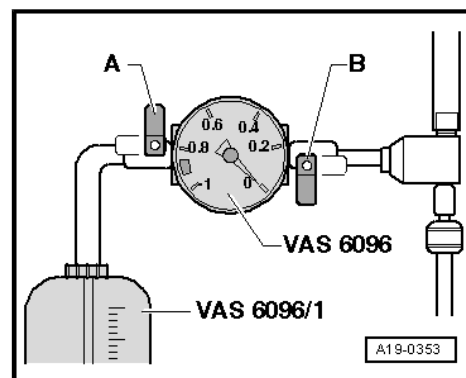
The vented air draws along a small amount of coolant, which should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -3- to compressed air supply.
- Pressure: 6 ... 10 bar.





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

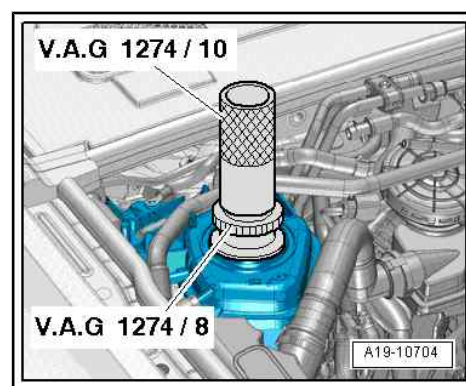
**Note**

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

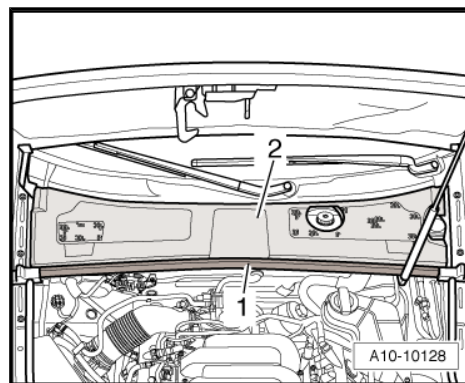
♦ *Check cooling system for leaks if the vacuum is not maintained.*

- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.
- Detach cooling system charge unit - VAS 6096- from adapter for cooling system tester - V.A.G 1274/8- on coolant filler tank.
- Fit pipe for cooling system tester - V.A.G 1274/10- onto adapter.

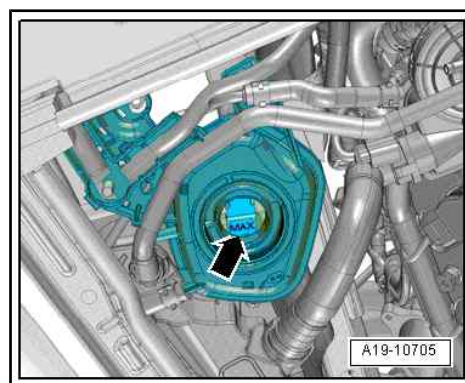
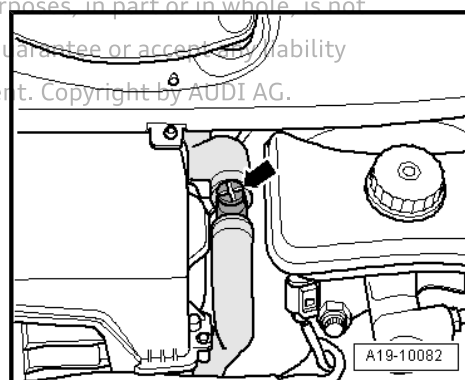




- Pull off seal -1- and remove plenum chamber cover -2-.



- Open bleeder screw -arrow-.
- Fill up with coolant until it flows out at bleeder hole in coolant hose.
- Close bleeder screw.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Close filler cap on coolant filler tank.
- Start engine.
- Set temperature to “HI” in all zones.
- Switch off air conditioner compressor (press **ECON** button).
- Run engine for 3 minutes at 2000 rpm.
- Allow engine to run at idling speed until both large coolant hoses at radiator become warm.
- Run engine for 1 minute at 2000 rpm.
- Switch off ignition and allow engine to cool down.
- Install front noise insulation ⇒ Rep. gr. 50 .
- Check coolant level.
 - The coolant level should be at the “MAX” marking when the engine is cold -arrow-.
 - The coolant level can be above the “MAX” marking when the engine is warm.





2 Thermostat, coolant pumps and coolant pipes

2.1 Exploded view - thermostat

1 - Bolts

- ☐ 4.5 Nm

2 - Seal

- ☐ Renew

3 - Thermostat

- ☐ Not available as separate part
- ☐ Checking ⇒ [page 202](#)

4 - Thermostat housing

- ☐ Combined with thermostat
- ☐ Removing and installing ⇒ [page 202](#)

5 - Drain plug

- ☐ 5 Nm

6 - Seal

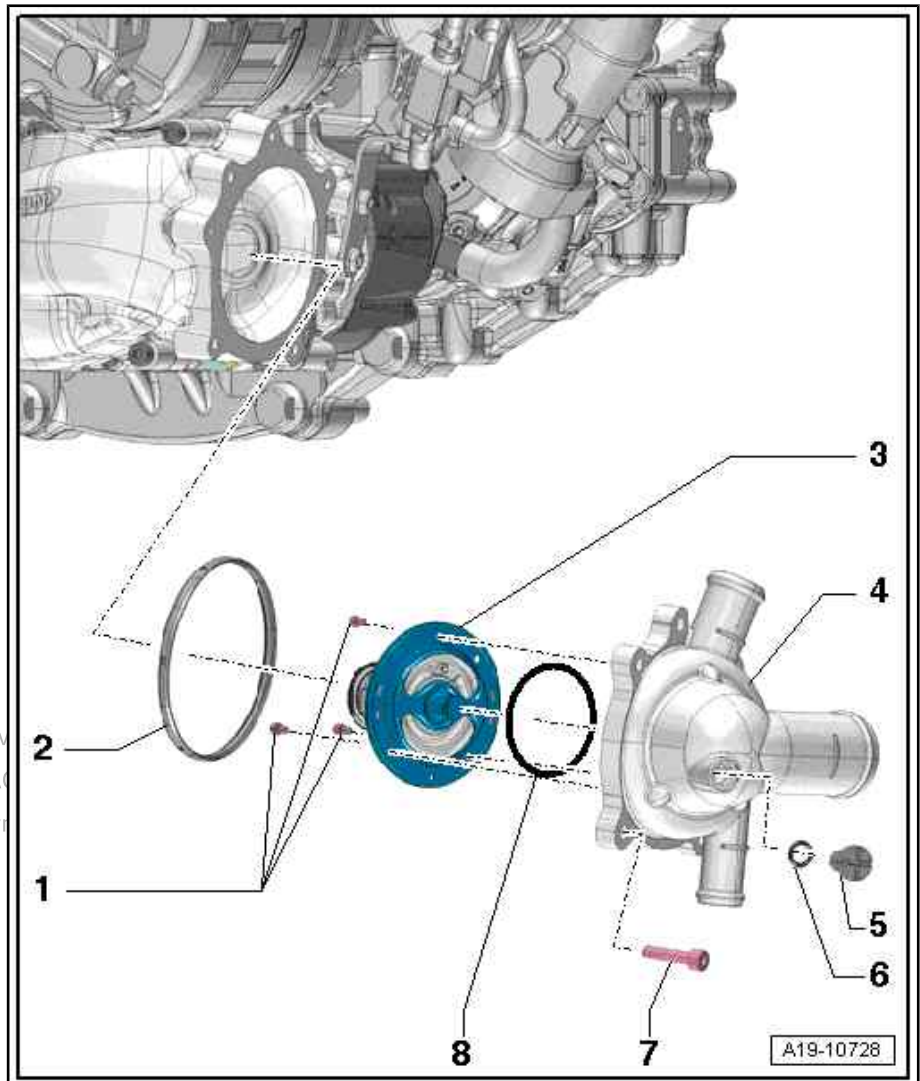
- ☐ Renew

7 - Bolt

- ☐ 9 Nm

8 - O-ring

- ☐ Renew



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2.2 Removing and installing thermostat housing

Removing

- Drain coolant ⇒ [page 195](#) .
- Release hose clips -1, 2, 3- and disconnect coolant hoses from thermostat housing.
- Remove bolts -arrows- and take out thermostat housing.

Installing

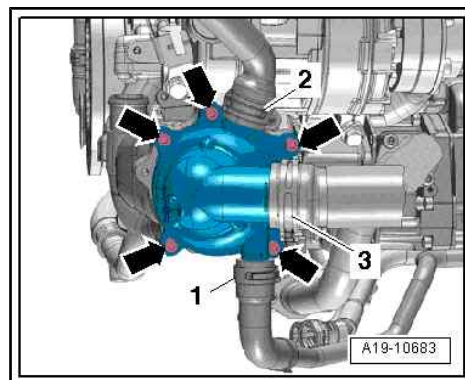
- Tightening torque ⇒ [page 201](#)

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



Note

- ◆ *Renew seal.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Fill up with coolant ⇒ [page 197](#) .



2.3 Checking thermostat

Procedure

- Tightening torque ⇒ [page 201](#)
- Remove thermostat housing ⇒ [page 202](#) , unscrew 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.		

2.4 Exploded view - coolant pump



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**1 - Bracket**

- ☐ For electrical connector

2 - Bolt

- ☐ 10 Nm

3 - Bolt

- ☐ 9 Nm

4 - Seal

- ☐ Renew

5 - Dowel sleeve**6 - Housing**

- ☐ For coolant pump
- ☐ Removing and installing
⇒ [page 203](#)

7 - O-ring

- ☐ Renew

8 - Coolant pump

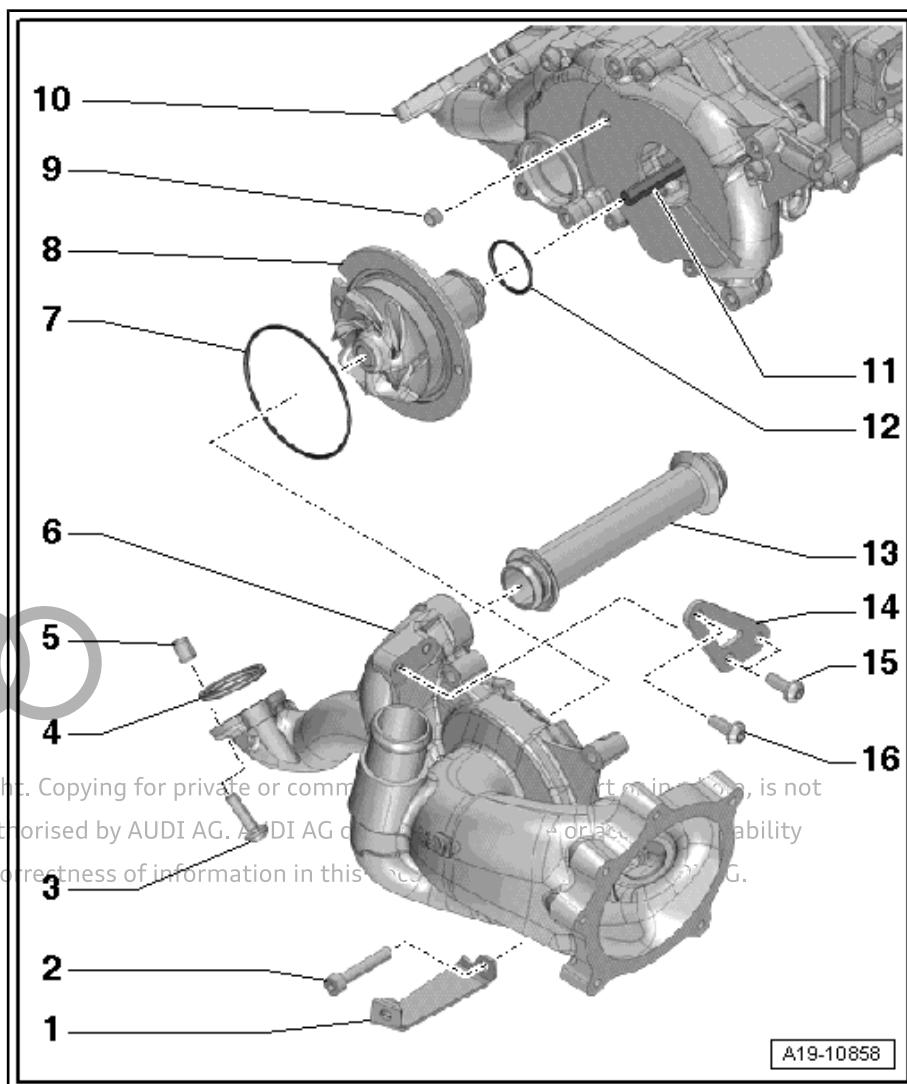
- ☐ Removing and installing
⇒ [page 203](#)

9 - Dowel sleeve**10 - Oil pump****11 - Drive shaft****12 - O-ring**

- ☐ Renew

13 - Connecting pipe

- ☐ For coolant
- ☐ Renew after coolant pump has been removed

**14 - Bracket****15 - Bolt**

- ☐ Do not unscrew when renewing coolant pump
- ☐ Renew
- ☐ 6 Nm +45°

16 - Bolt

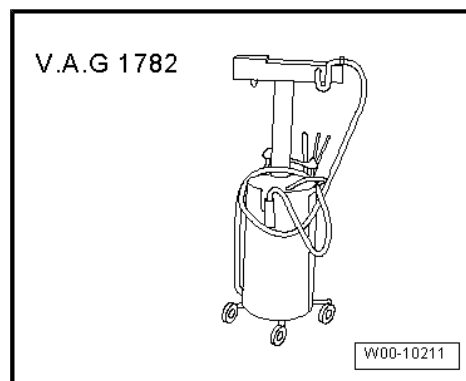
- ☐ Renew
- ☐ 6 Nm +45°

2.5 Removing and installing coolant pump

Special tools and workshop equipment required



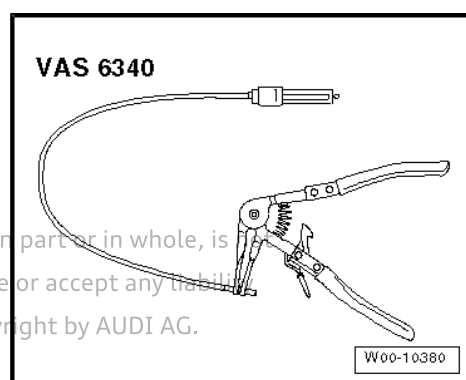
- ◆ Used oil collection and extraction unit - V.A.G 1782-



- ◆ Hose clip pliers - VAS 6340-



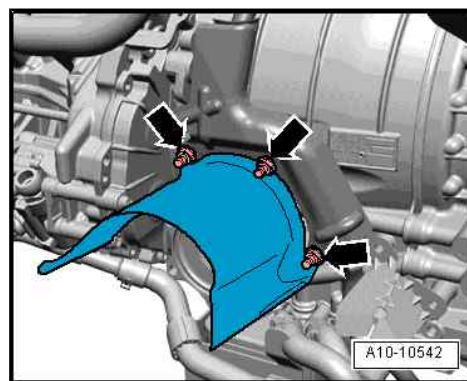
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- ◆ Silicone-free lubricant

Removing

- Remove thermostat housing ⇒ [page 202](#) .
- Remove radiator (bottom) ⇒ [page 227](#) .
- Remove front left wheel ⇒ Rep. gr. 44 .
- Extract hydraulic fluid for power steering from reservoir using used oil collection and extraction unit - V.A.G 1782- .
- Remove bolts -arrows- and detach heat shield for drive shaft (left-side) from gearbox.
- Detach drive shaft (left-side) from flange shaft of gearbox and move to rear.





Note

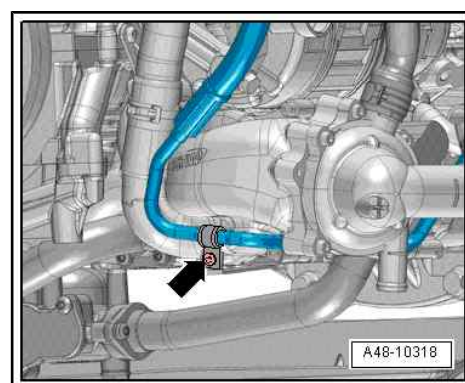
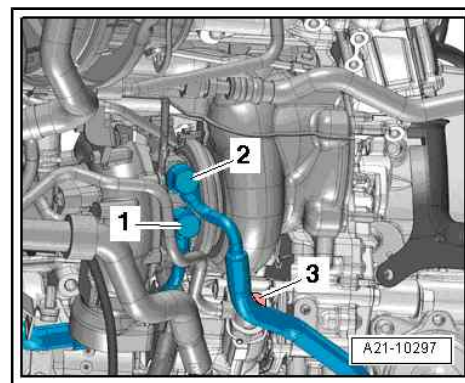
Lay a cloth under the connection to catch escaping hydraulic fluid and coolant.

- Remove banjo bolt -3-.

Note

- ◆ *Disregard items -1 and 2-.*
- ◆ *The illustration shows the installation position with the engine removed.*

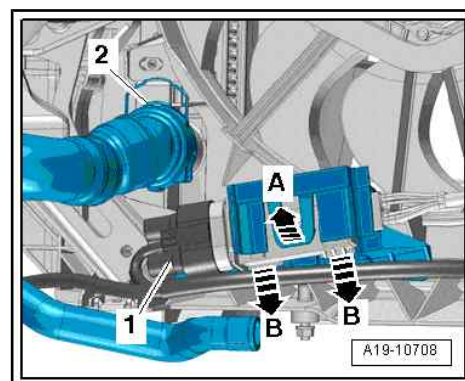
- Remove bolt -arrow- at retaining clip for power steering hydraulic line.



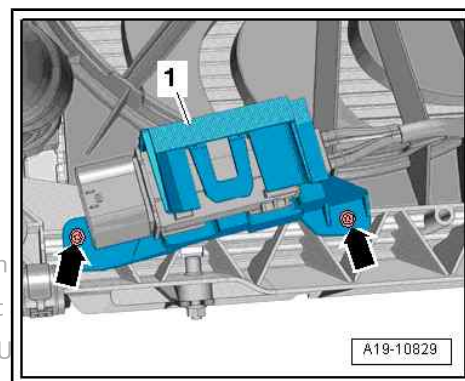
- Unplug electrical connector -1-.
- Release catch -arrow A- and remove electrical connector from bracket -arrows B-.

Note

Disregard -item 2-.



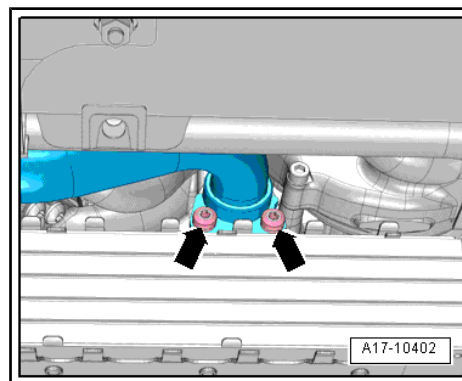
- Remove bolts -arrows- and detach bracket -1-.



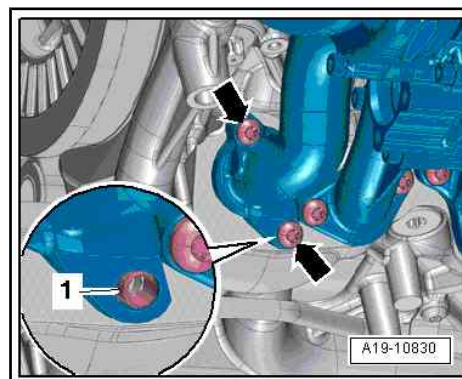
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- Position used oil collection and extraction unit - V.A.G 1782- below connection point.
- Remove bolts -arrows- and detach oil pipe from oil pump.



- Remove bolts -arrows-.
- Detach dowel sleeve -1-.

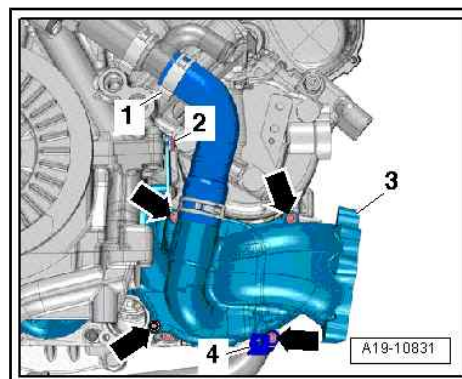


- Release hose clip -1- and detach coolant hose.
- Remove bolts -arrows- and detach bracket -4-.
- Unscrew bolts -2- and detach housing -3- for coolant pump.

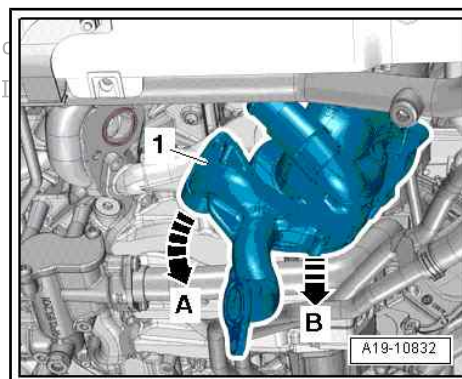


Note

Leave the bracket on the housing for the coolant pump.



- To do so, turn housing -1- for coolant pump in anti-clockwise direction -arrow A- and detach downwards -arrow B-.





- To detach coolant pump, screw two M6x15 bolts -arrows- into threaded holes on coolant pump.
- Alternately turn each bolt $1\frac{1}{2}$ turn further until coolant pump -1- can be detached.

Installing

- Tightening torque ⇒ [page 202](#)

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



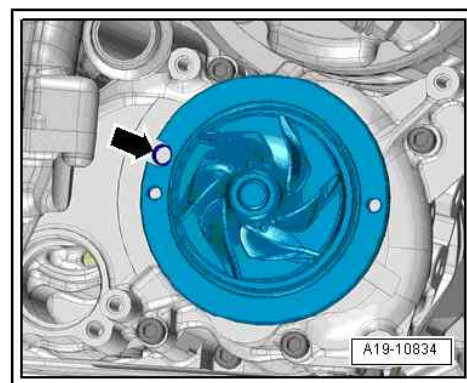
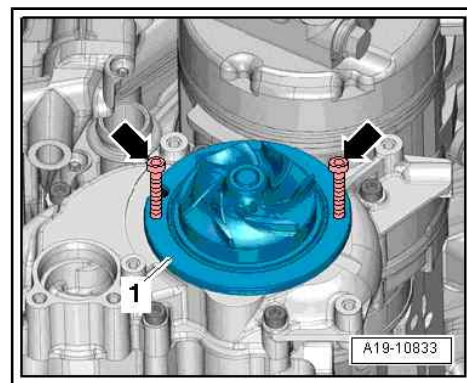
Note

- ◆ *Renew seal, O-rings and connecting pipe for coolant.*

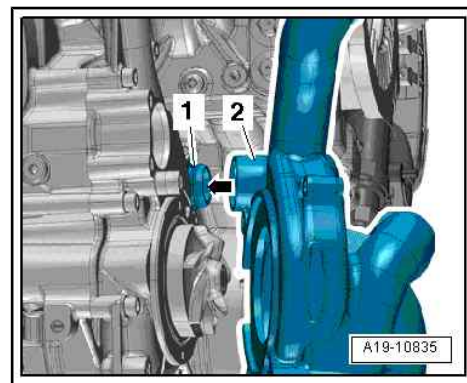
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#).*

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- Slide coolant pump onto drive shaft; at the same time dowel sleeve -arrow- must engage in opening in coolant pump.



- Coat connecting pipe -1- for coolant and O-rings with silicone-free lubricant.
- Position connecting pipe for coolant so that it can be inserted into hole in housing -2- for coolant pump when attaching it.
- Install oil pipe ⇒ [page 180](#).
- Install drive shaft (left-side) ⇒ Rep. gr. 40.
- Install hydraulic fluid line for power steering ⇒ Rep. gr. 48.
- Fit front wheel ⇒ Rep. gr. 44.
- Install radiator (bottom) ⇒ [page 227](#).
- Install thermostat housing ⇒ [page 202](#).
- Before starting engine, top up hydraulic fluid in power steering reservoir ⇒ Rep. gr. 48.



Note

The power steering pump must not be run when dry.

- Fill up with engine oil ⇒ Maintenance ; Booklet 405.



2.6 Removing and installing coolant temperature sender - G62-

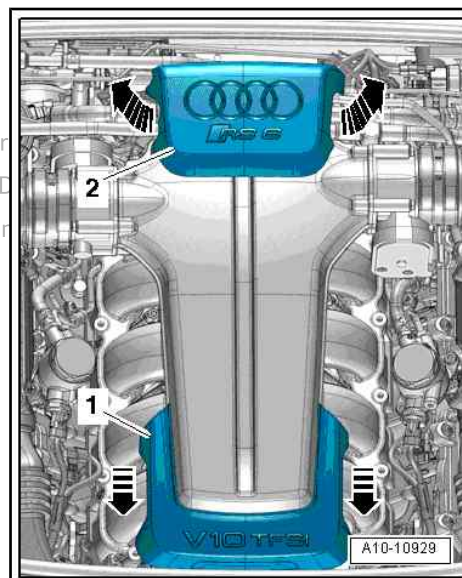


Note

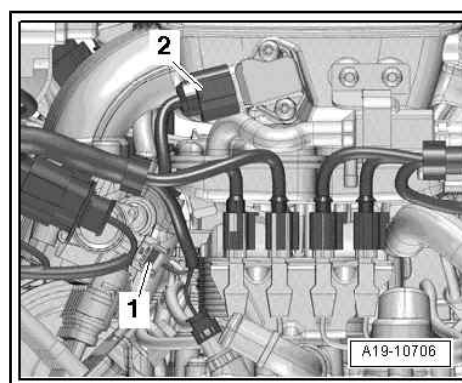
Fitting location of coolant temperature sender -G62-
⇒ [page 169](#).

Removing

- Engine cold.
- Open filler cap on coolant filler tank briefly and allow residual pressure in cooling system to dissipate.
- Pull off engine cover panel (front) -1- towards front -arrows-.



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





- Unplug electrical connector -2-.

**Note**

Place a cloth underneath to catch escaping coolant.

- Unscrew coolant temperature sender - G62- -item 1-.

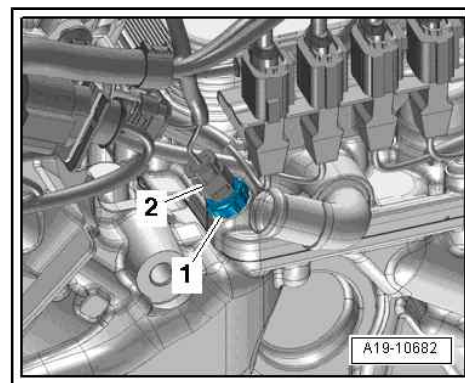
Installing

- Tightening torque ➔ [page 169](#)

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

**Note**

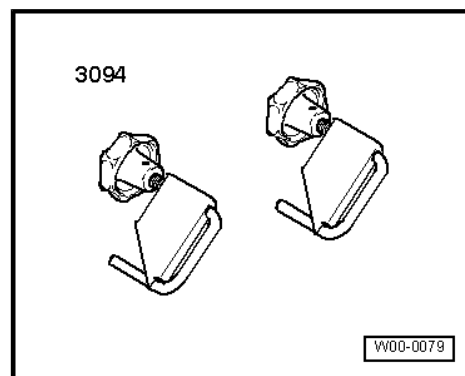
- ◆ *Fit new O-rings.*
- ◆ *Screw new coolant temperature sender - G62- immediately into bore to avoid loss of coolant.*
- Check coolant level ➔ [page 200](#) .



2.7 Removing and installing circulation pump 2 - V403-

Special tools and workshop equipment required

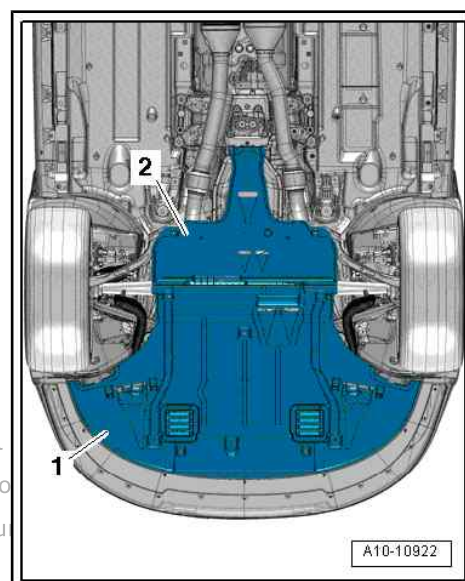
- ◆ Hose clamps up to 25 mm - 3094-

**Removing**

- Remove front noise insulation -1- ➔ Rep. gr. 50 .



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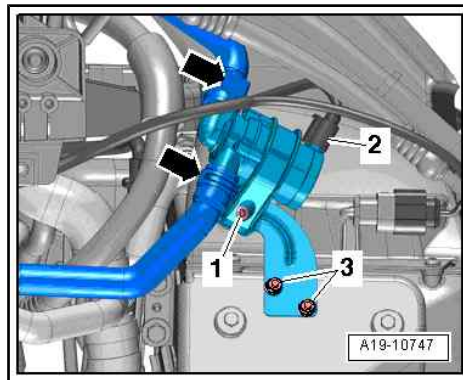


- Clamp off coolant hoses -arrows- with hose clamps -3094- and detach.
- Remove bolt -1-, detach circulation pump 2 - V403- and unplug electrical connector -2-.



Note

- ◆ For illustration purposes, the installation position is shown with the front bumper cover removed.
- ◆ -Item 3- can be disregarded.



Installing

- Tightening torque ⇒ [page 251](#)

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

- Install front noise insulation ⇒ Rep. gr. 50 .
- Check coolant level ⇒ [page 200](#) .

2.8 Exploded view - continued coolant circulation pump - V51-

1 - Bracket

- For continued coolant circulation pump - V51-

2 - Coolant hose

3 - Continued coolant circulation pump - V51-

- Removing and installing ⇒ [page 211](#)

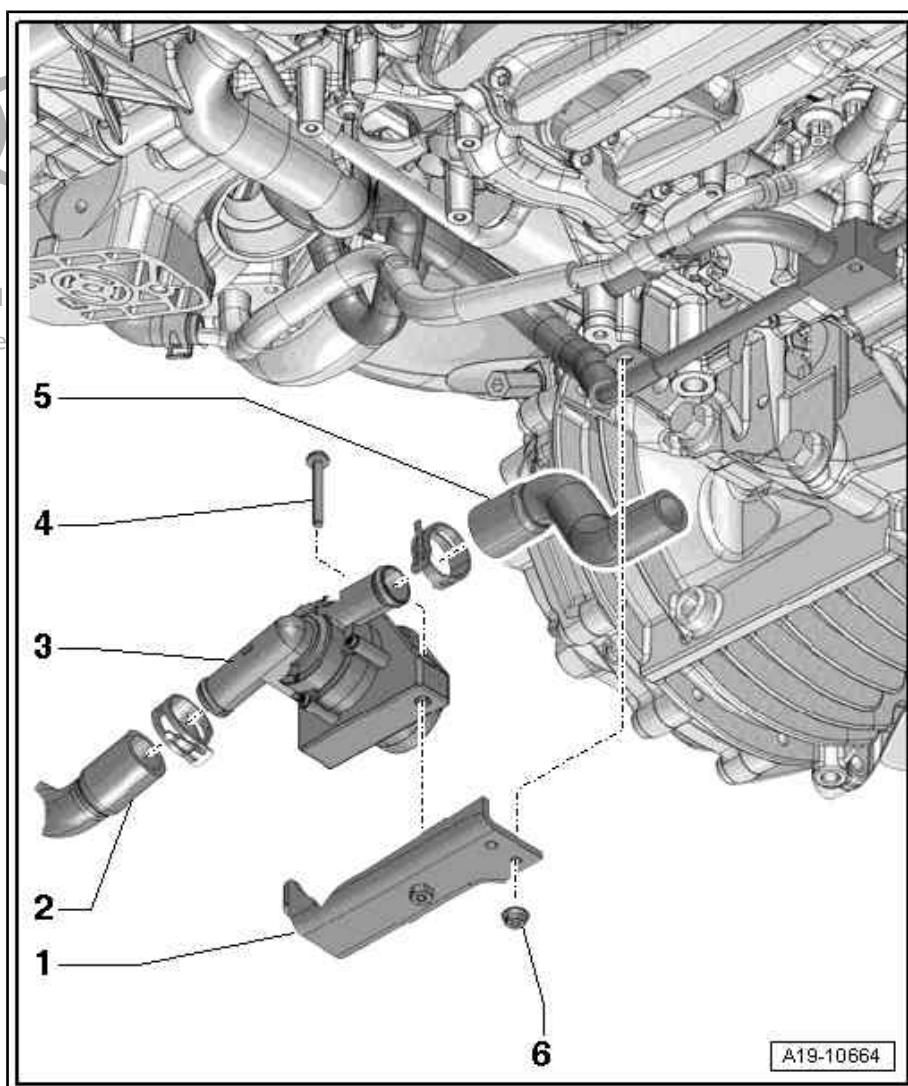
4 - Bolt

- 9 Nm

5 - Coolant hose

6 - Nut

- 9 Nm



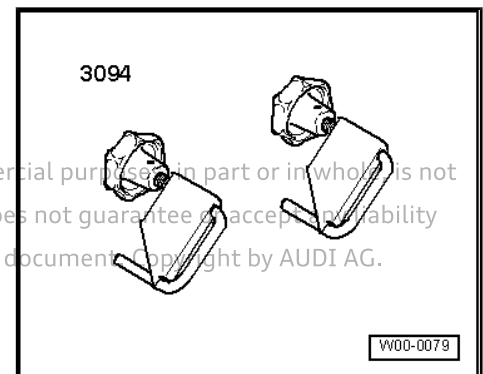


2.9 Removing and installing continued coolant circulation pump - V51-

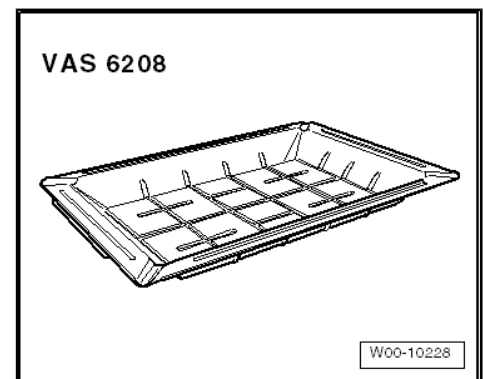
Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-

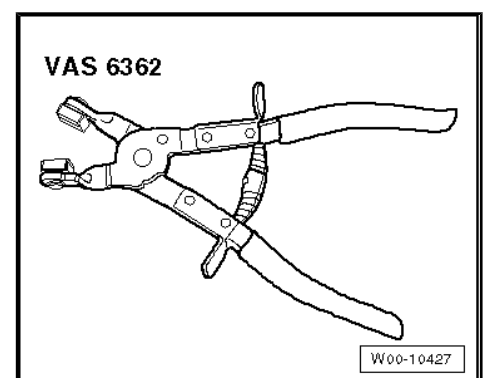
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- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - VAS 6362-



Removing



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant filler tank with cloth and open carefully.*

- Open filler cap on coolant filler tank.
- Remove anti-roll bar ⇒ Rep. gr. 40 .

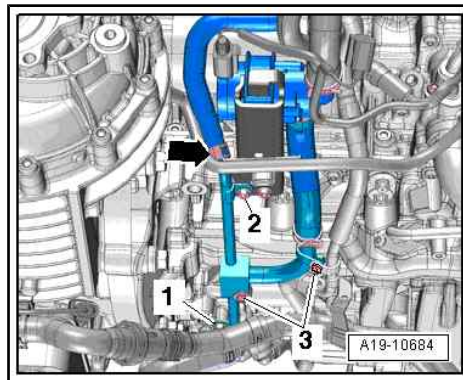


- Remove nuts -1- and -2- and bolts -3-.
- Push coolant line to one side.



Note

Disregard -arrow-.

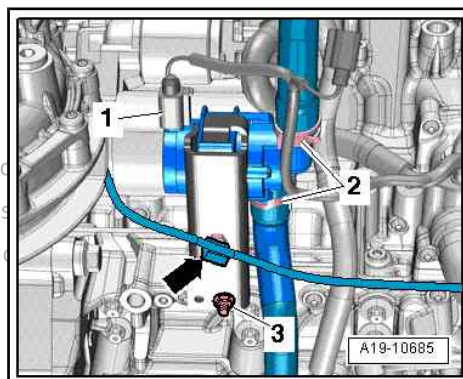


- Move earth wire at bracket clear -arrow-.
- Unplug electrical connector -1-.
- Clamp off coolant hoses -2- with hose clamps -3094- and detach.
- Remove nut -3- and detach continued coolant circulation pump - V51- with bracket.

Installing

- Tightening torque ⇒ [page 210](#)

Installation is carried out in 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 anti-roll bar ⇒ Rep. gr. 40 .
- Check coolant level ⇒ [page 200](#) .

2.10 Exploded view - coolant pipes

**1 - Coolant pipes (bottom)**

- ☐ Removing and installing
⇒ [page 215](#)

2 - Bolt

- ☐ 9 Nm

3 - Bracket**4 - Coolant pipe (front)**

- ☐ Removing and installing
⇒ [page 214](#)

5 - Nut

- ☐ 9 Nm

6 - Bolt

- ☐ 23 Nm

7 - Coolant pipe (right-side)

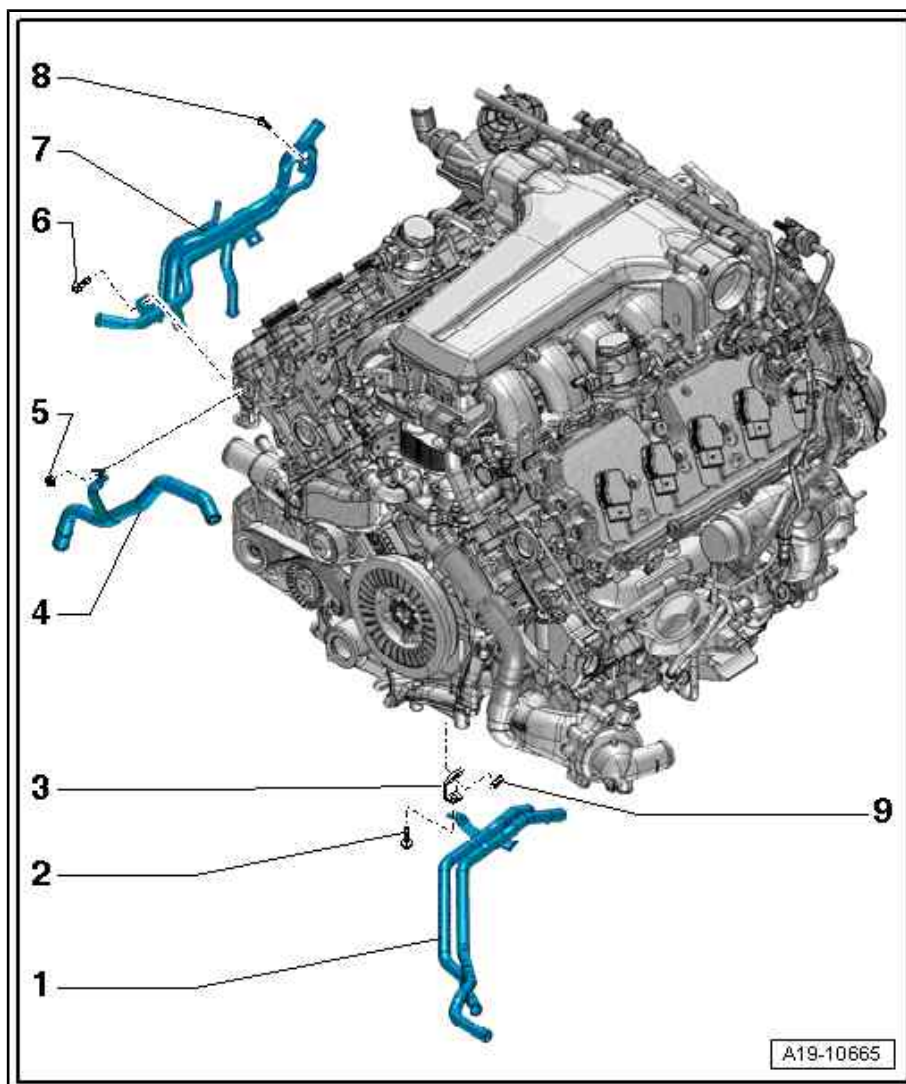
- ☐ With coolant lines
- ☐ Removing and installing
⇒ [page 217](#)

8 - Bolt

- ☐ 9 Nm

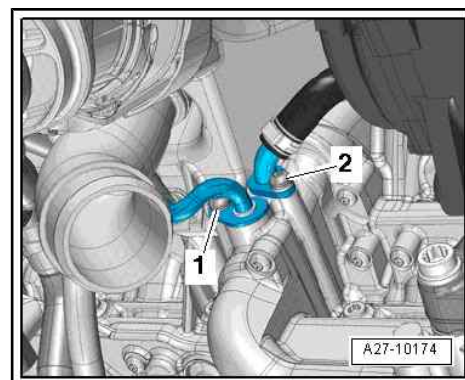
9 - Nut

- ☐ 9 Nm

**Coolant pipes (right-side) on cylinder block - tightening torques****Note**

Fit new O-rings.

- Tighten bolts -1- and -2- to 9 Nm.



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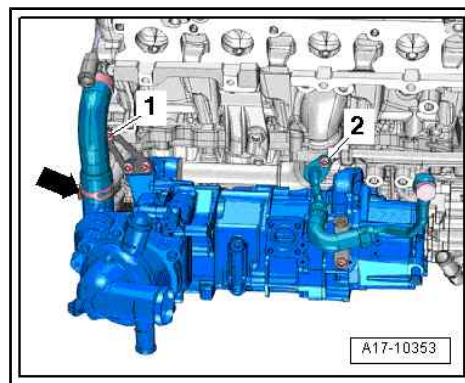
Coolant pipes (left-side) on cylinder block - tightening torques



Note

Fit new O-ring.

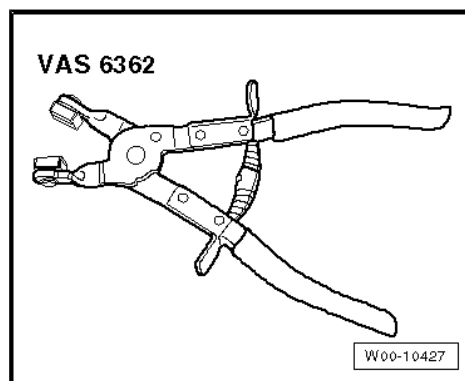
- Tighten bolt -2- to 9 Nm.



2.11 Removing and installing coolant pipe (front)

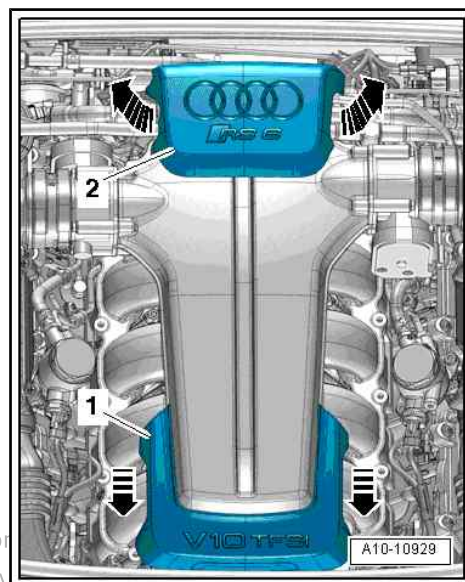
Special tools and workshop equipment required

- ♦ Hose clip pliers - VAS 6362-



Removing

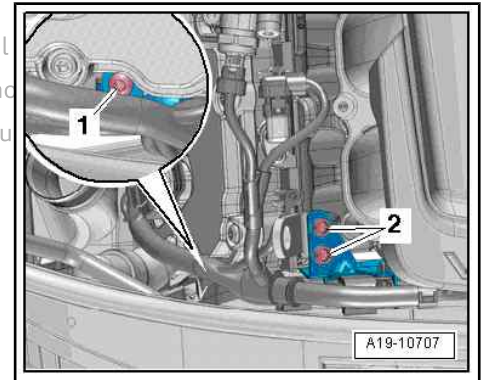
- Pull off engine cover panel (front) -1- towards front -arrows-.
- Drain coolant ⇒ [page 195](#) .
- Remove air cleaner housing (right-side) ⇒ Rep. gr. 24 .



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- Remove bolts -1- and -2-.
- Detach engine lifting eye and push wiring harness to one side.



- Remove nut -arrow-.
- Release hose clips -1- and -2- and disconnect coolant hoses from coolant pipe (front).
- Detach coolant pipe (front).

Installing

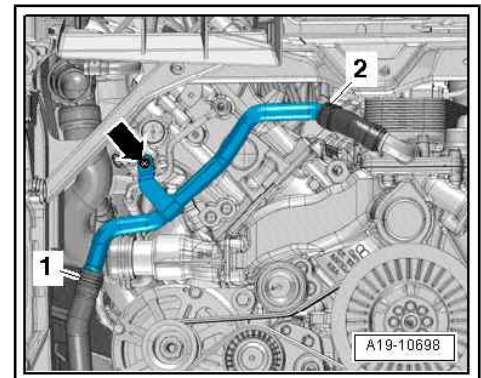
- Tightening torque ➔ [page 212](#)

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



Note

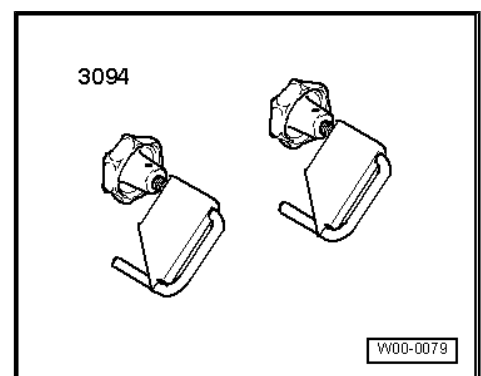
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Electronic parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install engine lifting eye ➔ [page 125](#) .
- Install air cleaner housing (right-side) ➔ Rep. gr. 24 .
- Fill up with coolant ➔ [page 197](#) .



2.12 Removing and installing coolant pipes (bottom)

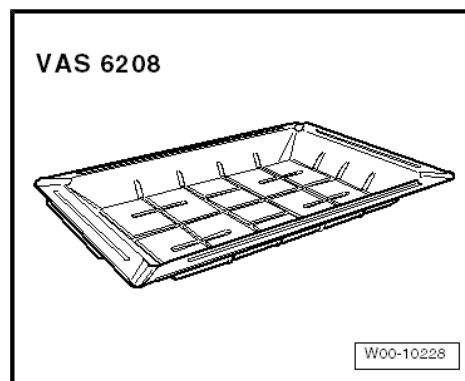
Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-





- ◆ Drip tray for workshop hoist - VAS 6208-

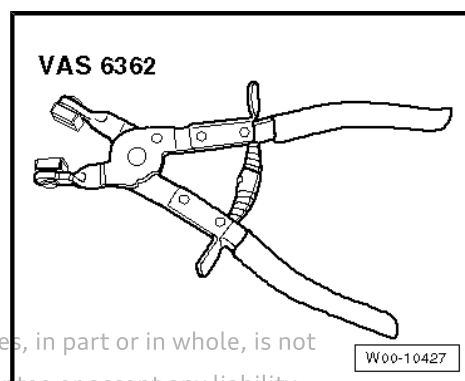


- ◆ Hose clip pliers - VAS 6362-



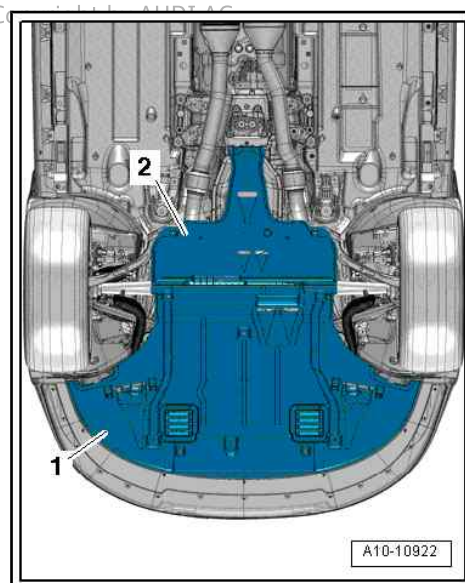
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Removing

- Remove noise insulation panels -1- and -2- ⇒ Rep. gr. 50 .

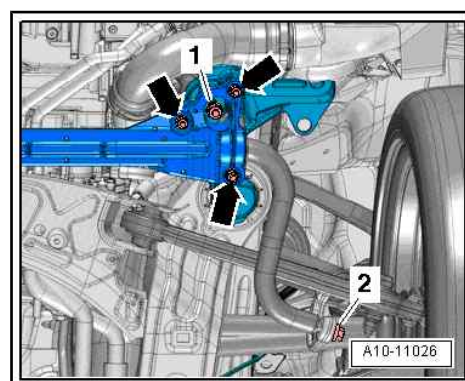


- Unscrew nuts -arrows- on both sides evenly and lower anti-roll bar.



Note

Disregard items -1 and 2-.





- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Clamp off coolant hoses using hose clamps -3094- and disconnect; to do so, release hose clips -arrows-.
- Unscrew bolts -1- and remove coolant pipes (bottom).

Installing

- Tightening torque ➔ [page 212](#)

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



Note

Renew seals and O-rings.

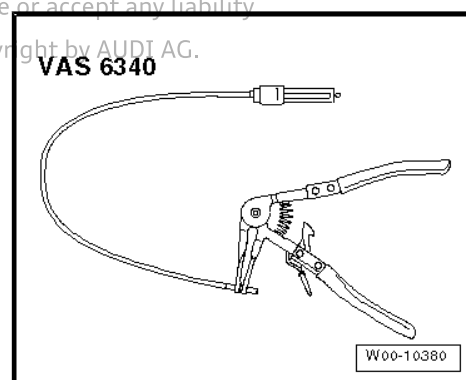
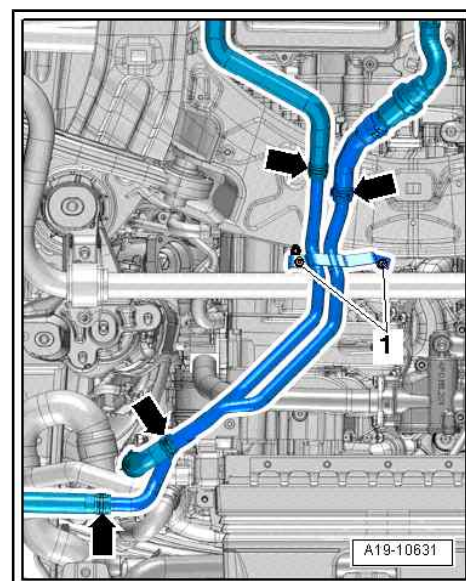
- Install anti-roll bar ➔ Rep. gr. 40 .
- Fill up with coolant ➔ [page 197](#) .

2.13 Removing and installing coolant pipe (right-side) with coolant lines

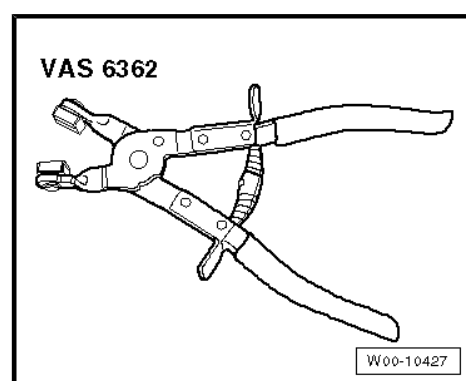
Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6340-

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- ◆ Hose clip pliers - VAS 6362-





Removing

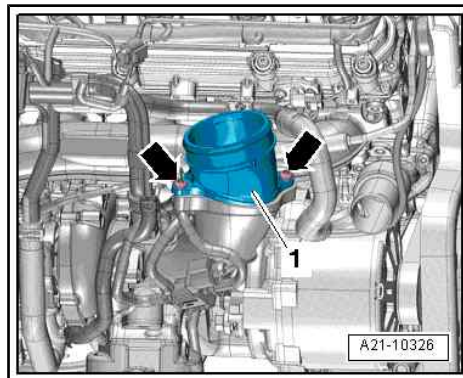
- Drain coolant ➔ [page 195](#) .
- Remove air cleaner housing (right-side) ➔ Rep. gr. 24 .
- Unscrew bolts -arrows- and remove intermediate flange -1-.



Caution

Risk of irreparable damage to turbocharger.

- ◆ **Use adhesive tape to seal off connection for turbocharger to prevent small objects from dropping into the turbo-charger.**

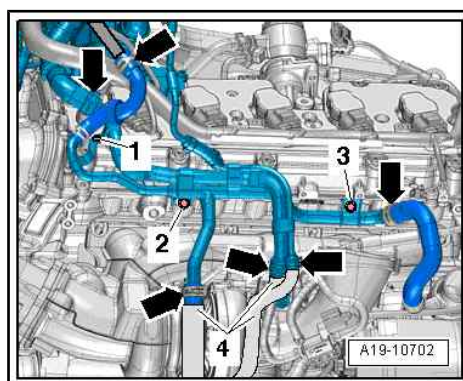


- Remove bolts -1, 2, 3-.
- Push heat insulation sleeves -4- downwards.
- Slacken hose clips -arrows- and detach coolant hoses from coolant pipe (right-side) with coolant lines.
- Remove coolant pipe (right-side) with coolant lines.



Note

For illustration purposes, the installation position is shown with the engine removed.



Installing

- Tightening torque ➔ [page 212](#)

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



Note

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- Install intermediate flange and air cleaner housing (right-side)
➔ Rep. gr. 24 .
- Fill up with coolant ➔ [page 197](#) .



3 Radiators and radiator fans

3.1 Exploded view - radiators

1 - Radiator (bottom)

- ☐ Removing and installing
⇒ [page 227](#)
- ☐ If renewed, refill system
with fresh coolant

2 - Nut

- ☐ 6 Nm

3 - Bonded rubber bush

- ☐ Renew if damaged

4 - Coolant hose

5 - Radiator (centre)

- ☐ Removing and installing
⇒ [page 221](#)
- ☐ If renewed, refill system
with fresh coolant

6 - Coolant hose

- ☐ Lift retaining clip to de-
tach
- ☐ Connecting to radiator
⇒ [page 220](#)

7 - O-ring

- ☐ Renew

8 - Coolant hose

- ☐ Lift retaining clip to de-
tach
- ☐ Connecting to radiator
⇒ [page 220](#)

9 - O-ring

- ☐ Renew

10 - Grommet

11 - Retaining pin

- ☐ Use screwdriver to release and pull off

12 - Coolant hose

13 - Coolant pipe

14 - Bolt

- ☐ 5 Nm

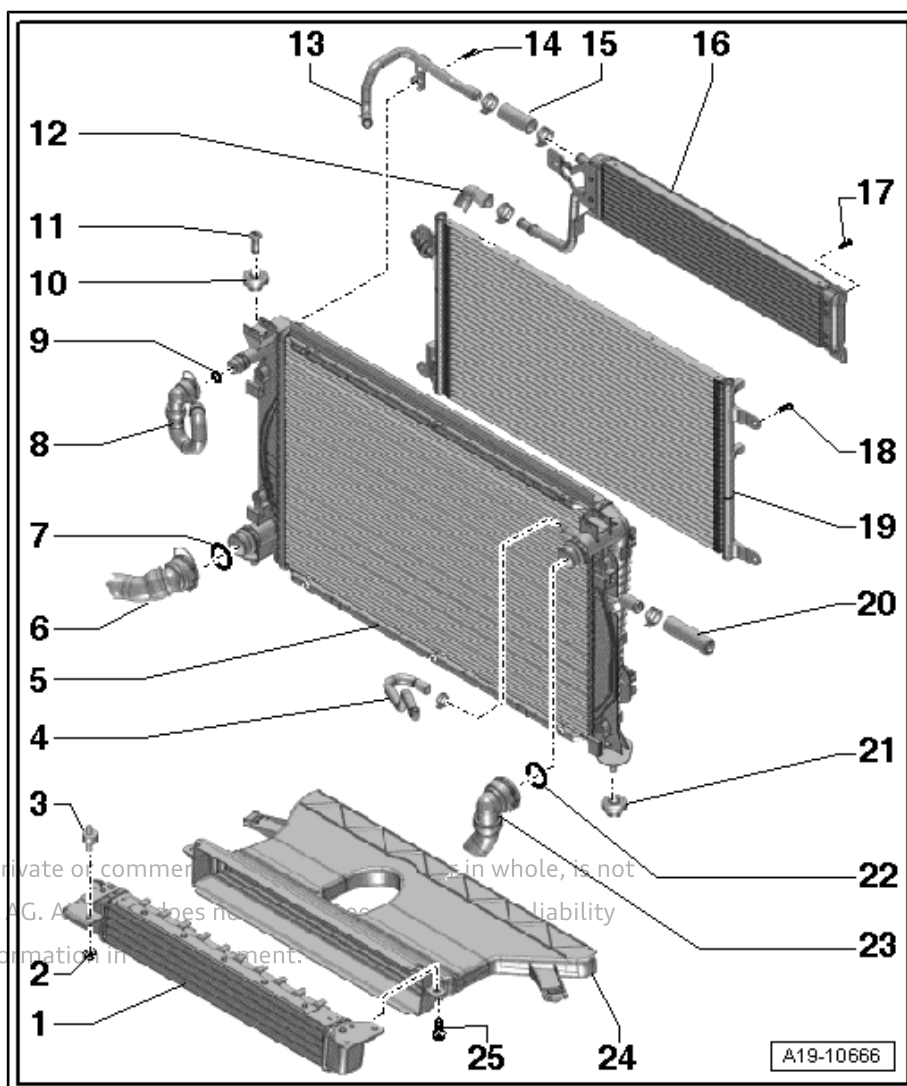
15 - Coolant hose

16 - Radiator (top)

- ☐ Removing and installing ⇒ [page 220](#)
- ☐ If renewed, refill system with fresh coolant

17 - Bolt

- ☐ 8 Nm





18 - Bolt

- ☐ 5 Nm

19 - Condenser

- ☐ Removing and installing ⇒ Rep. gr. 87

20 - Coolant hose

21 - Grommet

22 - O-ring

- ☐ Renew

23 - Coolant hose

- ☐ Lift retaining clip to detach
- ☐ Connecting to radiator ⇒ [page 220](#)

24 - Air guide

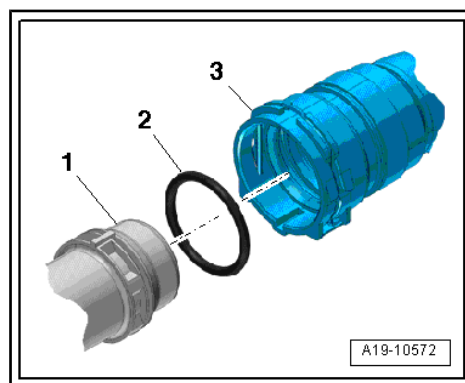
- ☐ For radiator (bottom)
- ☐ To remove, first remove front noise insulation ⇒ Rep. gr. 50

25 - Bolt

- ☐ 7 Nm

Connecting coolant hose with plug-in connector to radiator

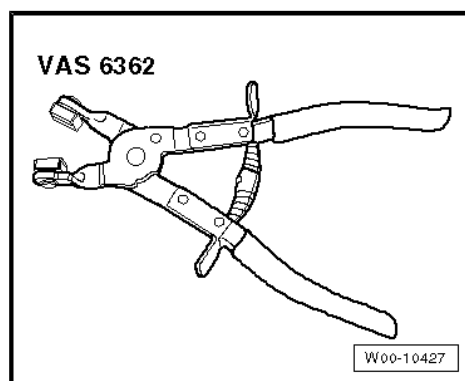
- Remove old O-ring -2- from coolant hose -3-.
- Lightly lubricate new O-ring with coolant and fit O-ring in coolant hose.
- Press coolant hose onto radiator -1- until it engages with a click.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.



3.2 Removing and installing radiator (top)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-





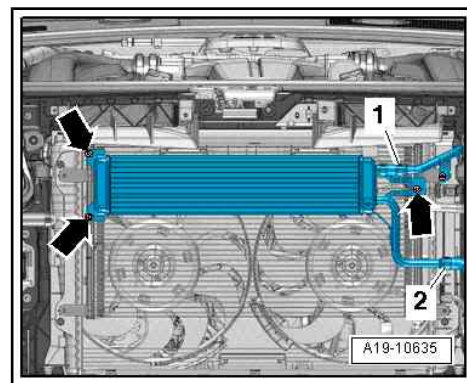
Removing



Note

If there are slight impressions on the fins, refer to [⇒ page 7](#).

- Drain coolant [⇒ page 195](#).
- Remove bumper cover (front) [⇒ Rep. gr. 63](#).
- Release hose clip -2- and detach coolant hose from radiator (top).
- Remove bolts -arrows-.
- Release hose clip -1- and remove radiator (top) from coolant hose.



Installing

- Tightening torque [⇒ page 219](#)

Installation is carried out in 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 bumper cover (front) [⇒ Rep. gr. 63](#).
- Fill up with coolant [⇒ page 197](#).



Note

The coolant in the entire system must be changed if the radiator is renewed.

3.3 Removing and installing radiator (centre)

Removing



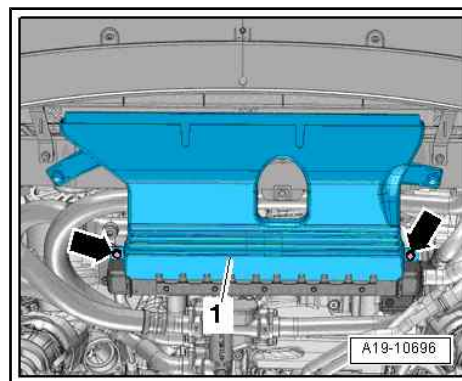
Note

If there are slight impressions on the fins, refer to [⇒ page 7](#).

- Drain coolant [⇒ page 195](#).
- Remove air cleaner housing (left and right) [⇒ Rep. gr. 24](#).
- Remove front bumper [⇒ Rep. gr. 63](#).



- Remove bolts -arrows- and detach air duct -1-.

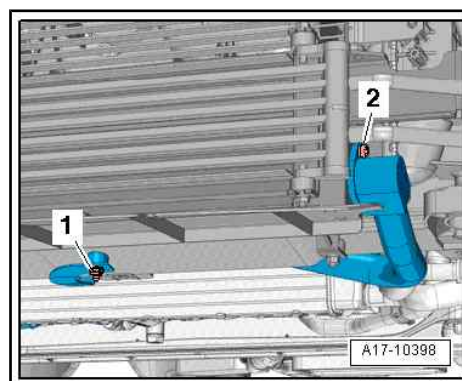


- Unscrew nut -1-.

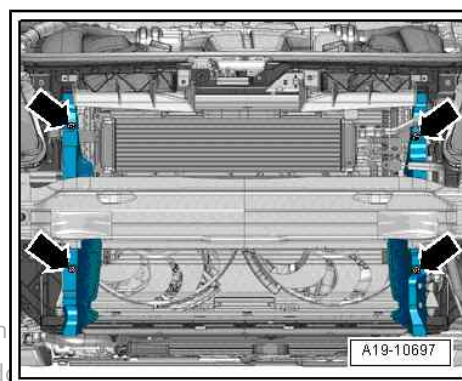


Note

-Item 2- can be disregarded.



- Unscrew bolts -arrows- and remove air ducts (left and right).
- Remove radiator (top) ➤ [page 220](#) .



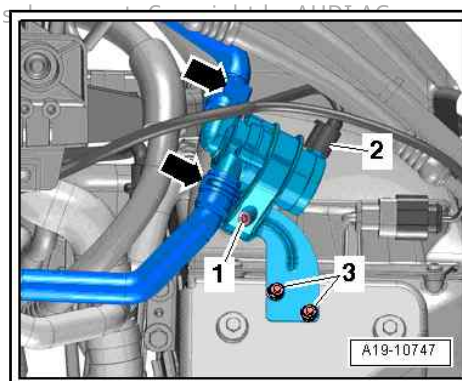
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- Unplug electrical connector -2- at circulation pump 2 - V403- and move wiring clear.



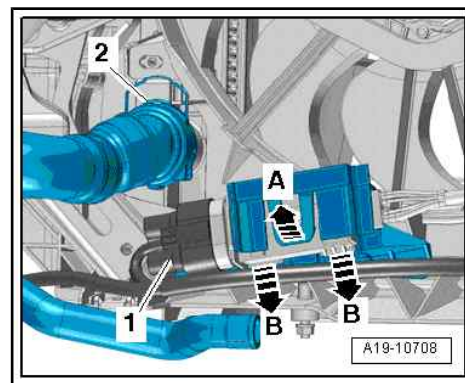
Note

Items -1, 3- and -arrows- can be disregarded.

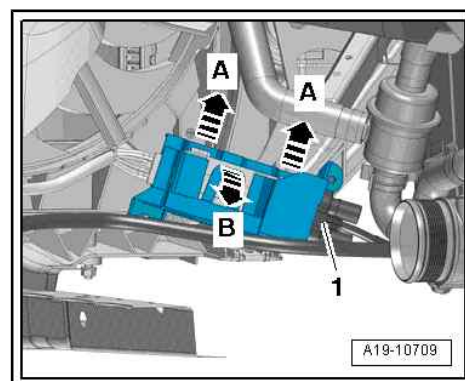




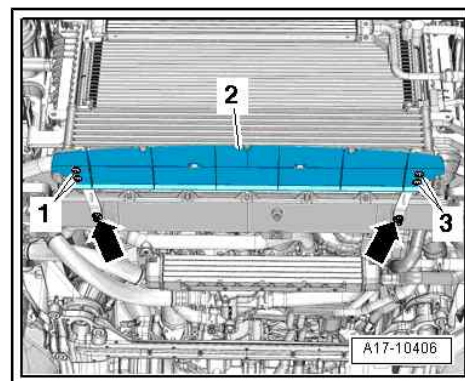
- Disconnect coolant hose -2- from radiator (pull out retaining clip).
- Unplug connector -1- and move clear.
- Release catch -arrow A- and remove electrical connector from bracket -arrows B-.



- Unplug connector -1- and move clear.
- Release catch -arrow B- and take connector out of bracket -arrows A-.



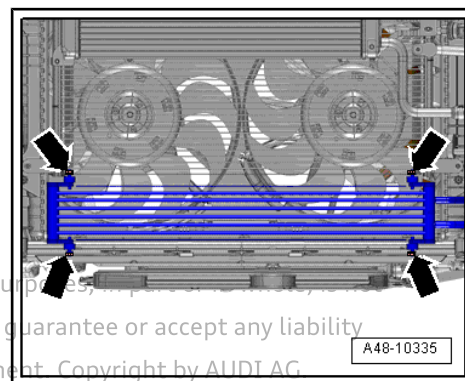
- Remove bolts -1- and -3- and detach air guide -2-.
- Slacken nuts -arrows-, do not remove.



- Slacken nuts -arrows-, do not remove.

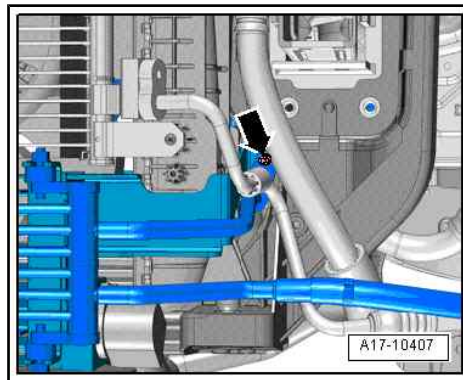


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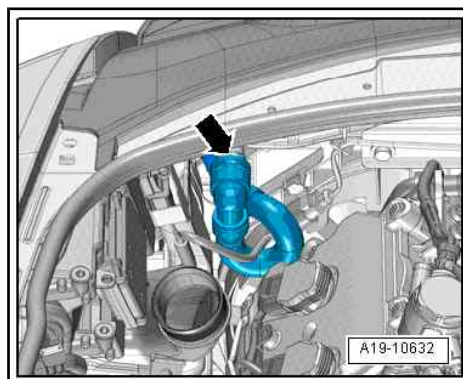




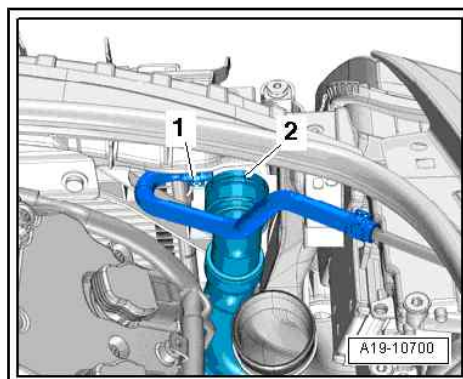
- Remove nut -arrow- on both sides.
- Detach hydraulic fluid cooler for power steering from engine oil cooler.
- Engine oil cooler (front) remains suspended.
- Tie hydraulic fluid cooler onto impact damper.



- Disconnect coolant hose -arrow- (top left) from radiator (pull out retaining clip).



- Disconnect coolant hose -2- (top right) from radiator (pull out retaining clip).
- Release hose clip -1- and detach coolant hose from radiator.



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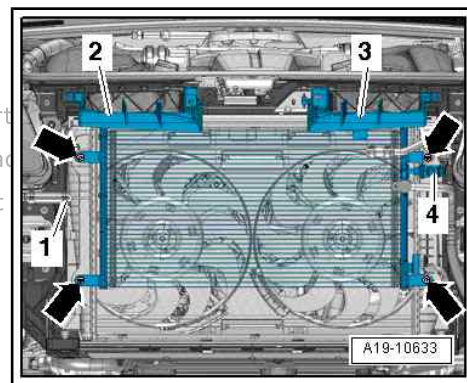
- Detach air ducts -2- and -3-.
- Release hose clip -1- and detach coolant hose.

**WARNING**

Risk of injury caused by refrigerant.

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

- Unplug electrical connector -4-.
- Remove bolts -arrows-.

**Caution**

Risk of damage to refrigerant lines and hoses

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

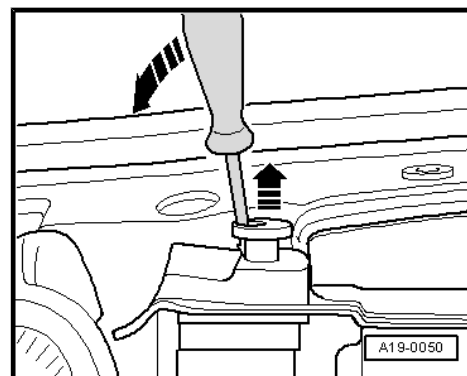
- Pivot hydraulic fluid cooler and condenser forwards with pipes/hoses attached.
- Release two retaining pins for radiator and pull out upwards -arrows-.
- Swivel radiator forwards and lift off.
- Tie hydraulic fluid cooler and condenser to lock carrier with pipes/hoses attached.

Installing

- Tightening torque ⇒ [page 219](#)

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

- Install condenser ⇒ Rep. gr. 87 .
- Install radiator (top) ⇒ [page 220](#) .
- Install engine oil cooler (front) ⇒ [page 183](#) .
- Install front bumper ⇒ Rep. gr. 63 .
- Install air cleaner housings (left and right) ⇒ Rep. gr. 24 .
- Fill up with coolant ⇒ [page 197](#) .

**Note**

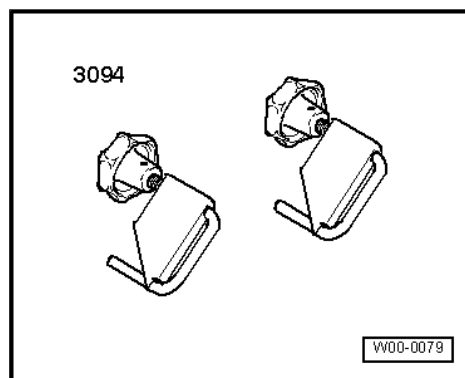
The coolant in the entire system must be changed if the radiator is renewed.

3.4 Removing and installing radiators (left and right)

Special tools and workshop equipment required



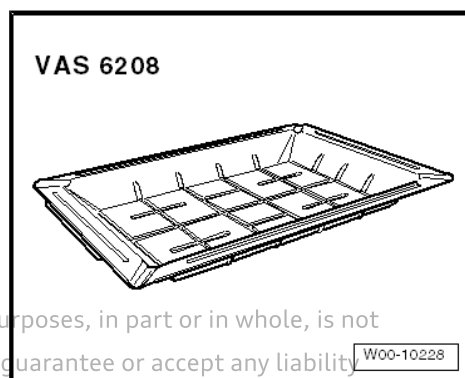
- ◆ Hose clamps up to 25 mm - 3094-



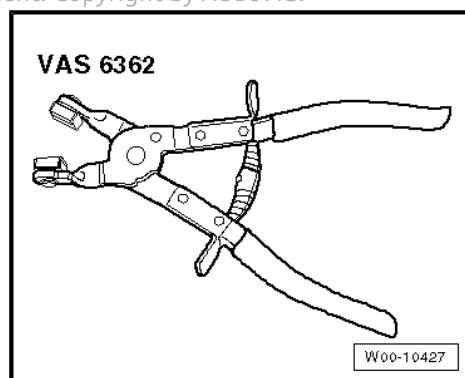
- ◆ Drip tray for workshop hoist - VAS 6208-



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- ◆ Hose clip pliers - VAS 6362-



Removing



Note

- ◆ *The following description is for removing and installing the radiator on the left side. The procedure on the right side is similar.*
- ◆ *If there are slight impressions on the fins, refer to [⇒ page 7](#).*
- Remove charge air cooler (left-side) [⇒ page 253](#).
- Place drip tray for workshop hoist - VAS 6208- beneath engine.



- Use hose clamps -3094- to clamp off coolant hoses -2- and -4- and detach coolant hoses.
- Detach radiator (left-side) and drain it.

**Note**

Disregard items -1 and 3-.

Installing

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

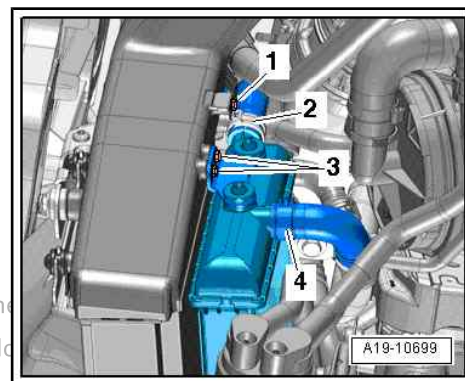
**Note**

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.

- Install charge air cooler (left-side) ⇒ [page 253](#).
- Fill up with coolant ⇒ [page 197](#).

**Note**

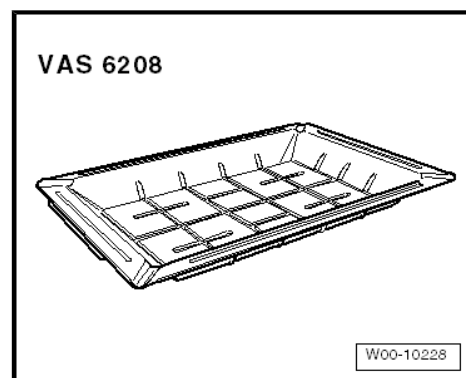
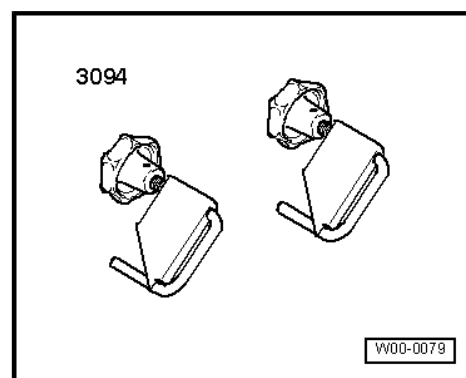
The coolant in the entire system must be changed if the radiator is renewed.



3.5 Removing and installing radiator (bottom)

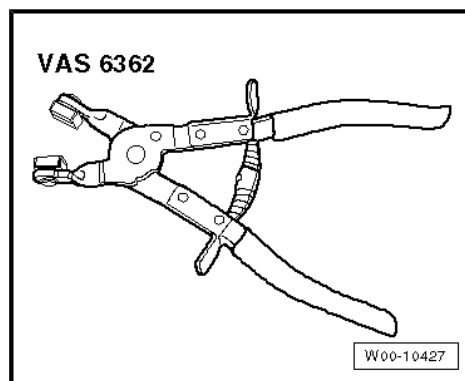
Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-
- ◆ Drip tray for workshop hoist - VAS 6208-





- ◆ Hose clip pliers - VAS 6362-



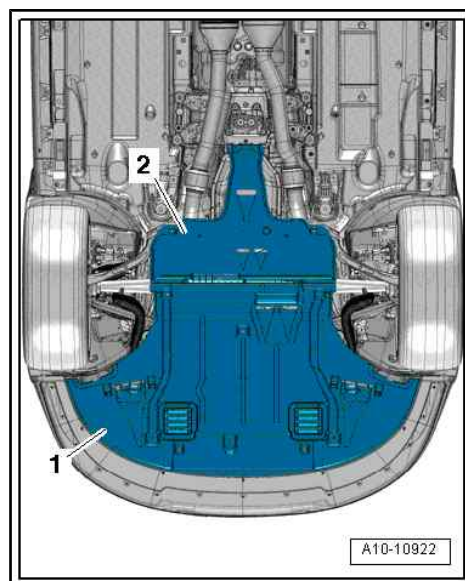
Removing



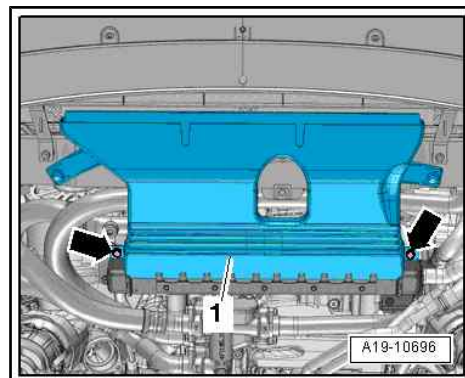
Note

If there are slight impressions on the fins, refer to ⇒ [page 7](#).

- Remove front noise insulation -1- ⇒ Rep. gr. 50.



- Remove bolts -arrows- and detach air duct -1- towards front.

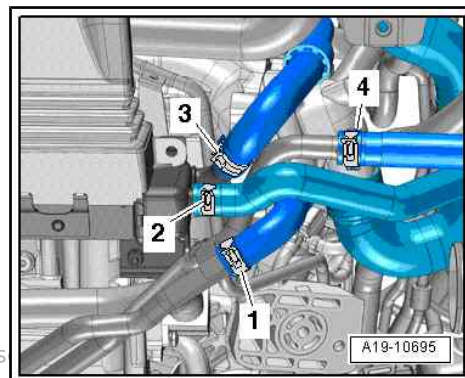


- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Use hose clamps -3094- to clamp off coolant hoses -2- and -3- and detach coolant hoses from radiator (bottom).



Note

Disregard items -1 and 4-



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- Unscrew nuts -arrows- and detach radiator -1-.

Installing

- Tightening torque ⇒ [page 219](#)

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



Note

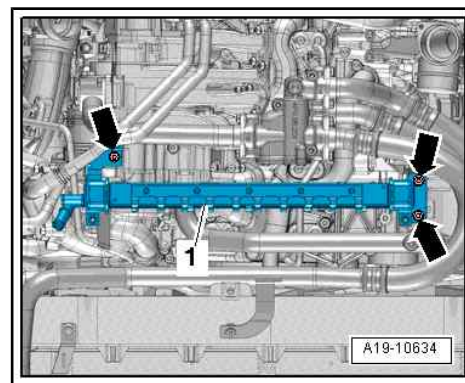
Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Install noise insulation ⇒ Rep. gr. 50 .
- Fill up with coolant ⇒ [page 197](#) .



Note

The coolant in the entire system must be changed if the radiator is renewed.



3.6 Exploded view - radiator fans

1 - Bolt

- 5 Nm

2 - Bolt

- 10 Nm

3 - Bolt

- 10 Nm

4 - Radiator cowl

- Removing and installing
⇒ [page 230](#)

5 - Bolt

- 2.5 Nm

6 - Retainer

- For electrical connector

7 - Radiator fan - V7-

- With radiator fan control unit - J293-
- Removing and installing
⇒ [page 230](#)

8 - Radiator fan 2 - V177-

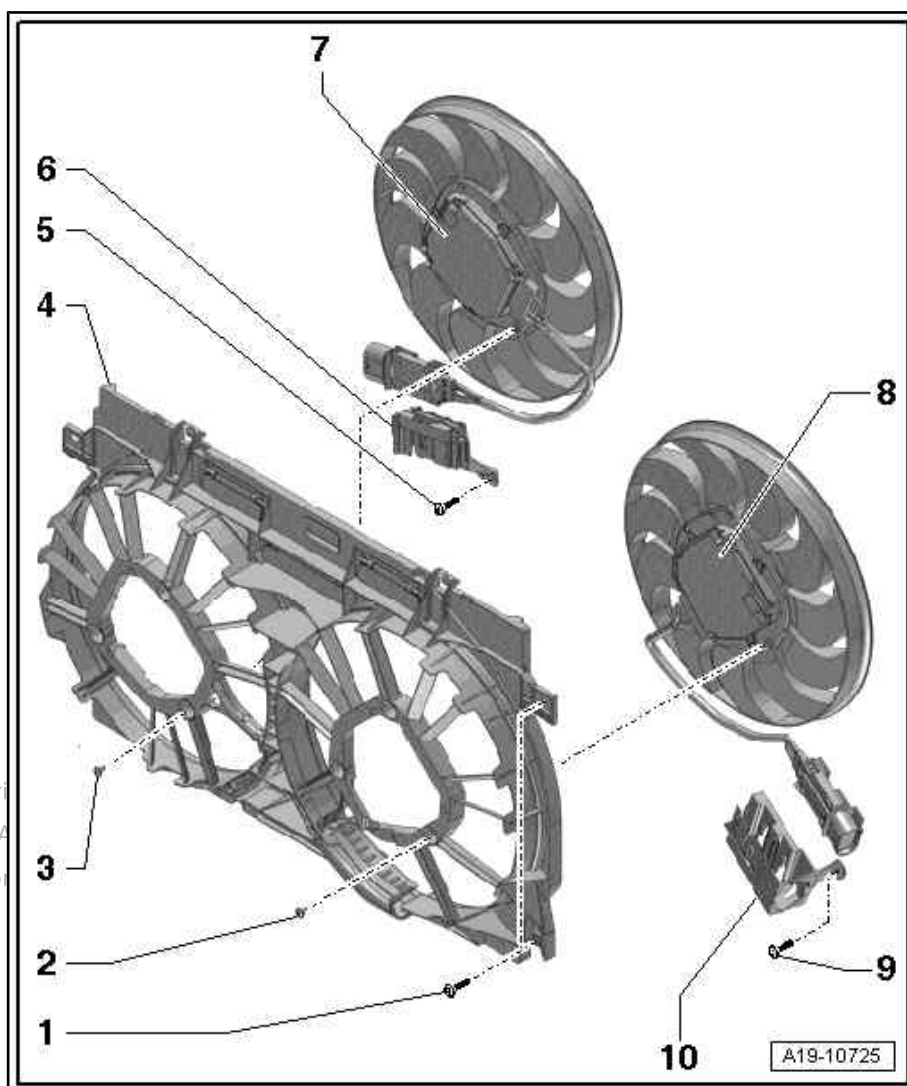
- With radiator fan control unit 2 - J671-
- Removing and installing
⇒ [page 230](#)

9 - Bolt

- 2.5 Nm

10 - Retainer

- For electrical connector





3.7 Removing and installing radiator cowl

Removing

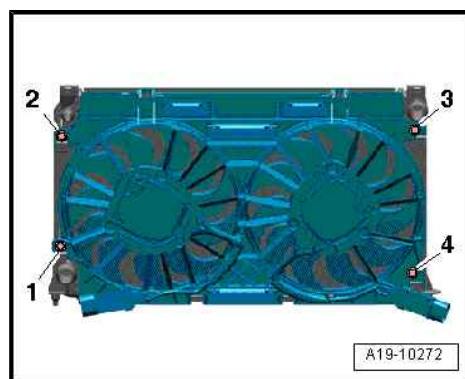
- Remove radiator (centre) ⇒ [page 221](#) .
- Remove bolts -1 ... 4- and detach radiator cowl.

Installing

- Tightening torque ⇒ [page 229](#)

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

- Install radiator (centre) ⇒ [page 221](#) .
- Fill up with coolant ⇒ [page 197](#) .



3.8 Removing and installing radiator fans - V7- / -V177-

Removing

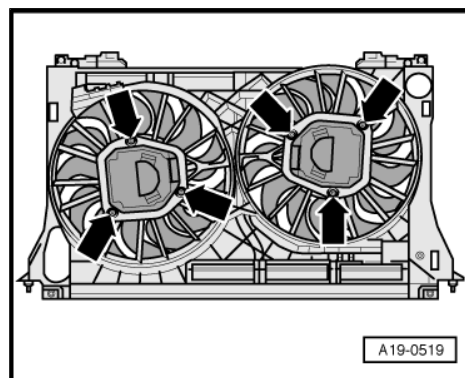
- Remove radiator cowl ⇒ [page 230](#) .
- Unscrew bolts -arrows- and remove radiator fans.

Installing

- Tightening torque ⇒ [page 229](#)

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

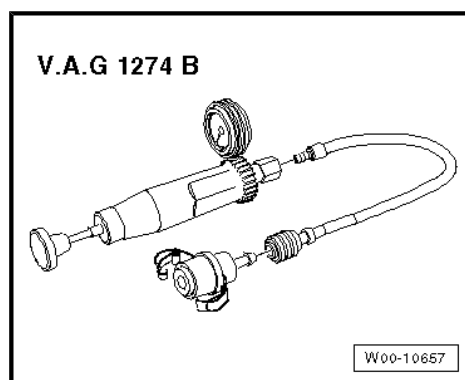
- Install radiator cowl ⇒ [page 230](#) .



3.9 Checking cooling system for leaks

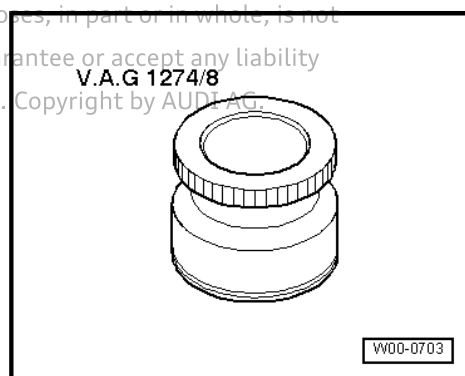
Special tools and workshop equipment required

- ◆ Cooling system tester - V.A.G 1274 B-



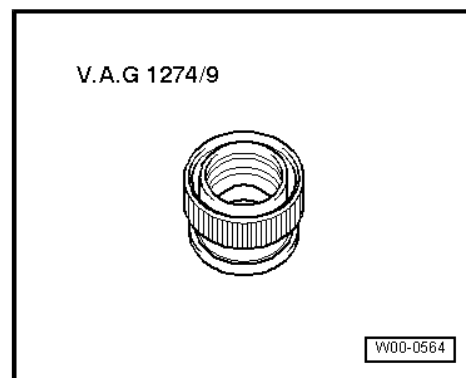
- ◆ Adapter for cooling system tester - V.A.G 1274/8-

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



Procedure

- Engine must be warm.

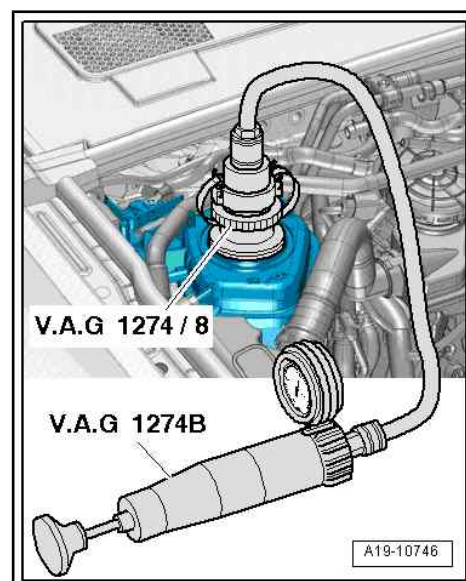


WARNING

Risk of scalding due to hot steam and hot coolant.

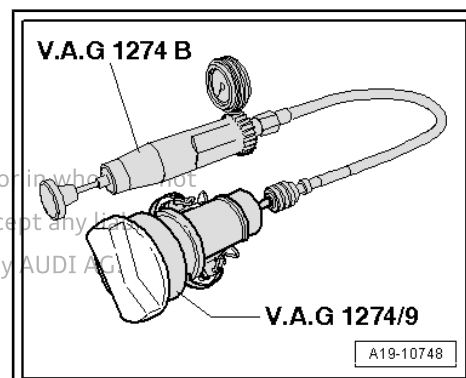
- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *Cover filler cap on coolant filler tank with a cloth and open carefully to dissipate pressure.*

- Open filler cap on coolant filler tank.
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant filler tank.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.
- If this pressure is not maintained, locate and rectify leaks.



Checking pressure relief valve in filler cap

- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
- Build up pressure with hand pump on cooling system tester.
- The pressure relief valve should open at a pressure of 1.7 - 1.9 bar.
- Renew filler cap if pressure relief valve does not open as described.





21 – Turbocharging/supercharging

1 Turbochargers



Note

- ♦ *Observe rules for cleanliness ⇒ [page 6](#).*
- ♦ *Check that all air pipes and hoses and vacuum lines are correctly fitted and that there are no leaks before carrying out tests or repairs.*

1.1 Exploded view - turbocharger



Note

The diagram shows the turbocharger on cylinder bank 2 (left-side).

1 - Charge pressure control solenoid valve

- ☐ Cylinder bank 1 (right-side): charge pressure control solenoid valve - N75-
- ☐ Cylinder bank 2 (left-side): charge pressure control solenoid valve 2 - N274-

2 - Retainer

- ☐ For charge pressure control solenoid valve

3 - Hose

4 - Bolt

- ☐ 4.7 Nm

5 - Connection

- ☐ For turbocharger

6 - O-ring

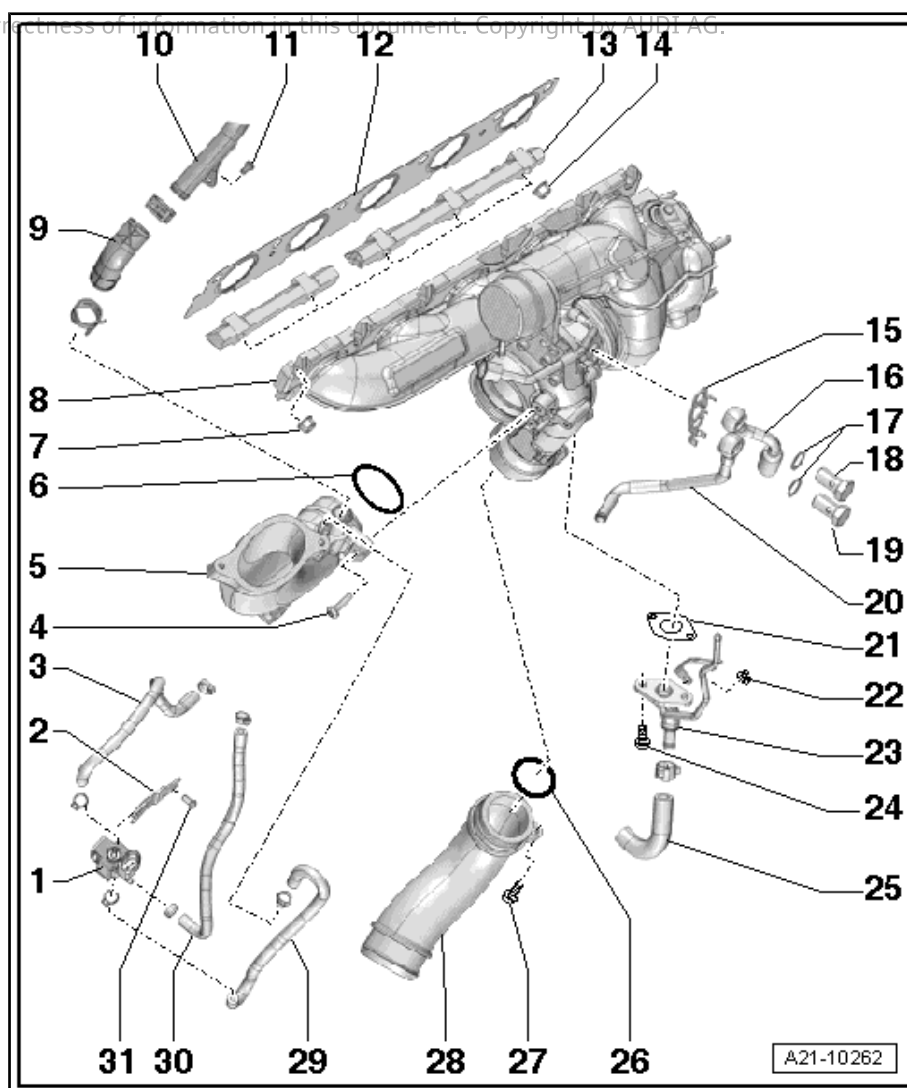
- ☐ Renew

7 - Nut

- ☐ Self-locking
- ☐ Renew
- ☐ Tightening torque and tightening sequence:
left-side ⇒ [page 234](#) ;
right-side ⇒ [page 234](#)

8 - Turbocharger

- ☐ With exhaust manifold
- ☐ Removing and installing: left-side
⇒ [page 234](#) ; right-side
⇒ [page 238](#)



**9 - Air hose****10 - Air pipe****11 - Bolt**

- ☐ 6 Nm

12 - Gasket

- ☐ Renew

13 - Mounting strip

- ☐ Remains installed when turbocharger is removed

14 - Nut

- ☐ Self-locking
- ☐ Renew
- ☐ 25 Nm

15 - Gasket

- ☐ Renew

16 - Coolant pipe**17 - Seals**

- ☐ Renew

18 - Banjo bolt

- ☐ 30 Nm

19 - Banjo bolt

- ☐ 30 Nm

20 - Coolant pipe**21 - Gasket**

- ☐ Renew

22 - Nut

- ☐ 6 Nm

23 - Connection

For oil return hose

24 - Bolt

- ☐ 4.7 Nm

25 - Oil return line

- ☐ For turbocharger (left-side), with oil reservoir depending on equipment version
- ☐ Installing oil reservoir for oil return line ⇒ [page 190](#)

26 - O-ring

- ☐ Renew

27 - Bolt

- ☐ 4.7 Nm

28 - Connection

- ☐ For air hose

29 - Hose**30 - Hose****31 - Bolt**

- ☐ 4.7 Nm

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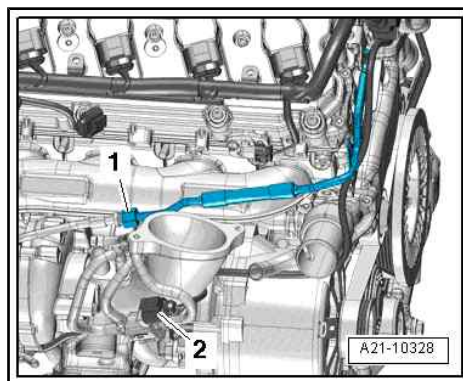
Oil supply line to turbocharger



Note

The illustration shows the oil supply line to cylinder bank 1; cylinder bank 2 is similar in principle.

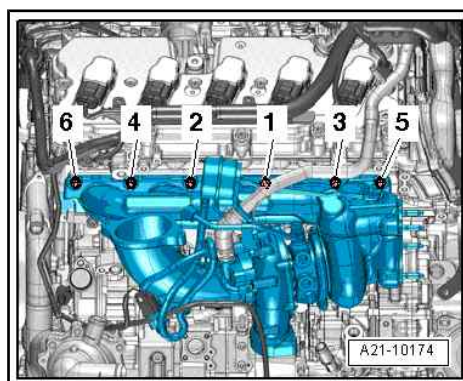
Tightening torque for union nut -item 1-: 35 Nm



Turbocharger with exhaust manifold (left-side) - tightening torque and sequence

– Tighten nuts in 4 stages in the sequence shown:

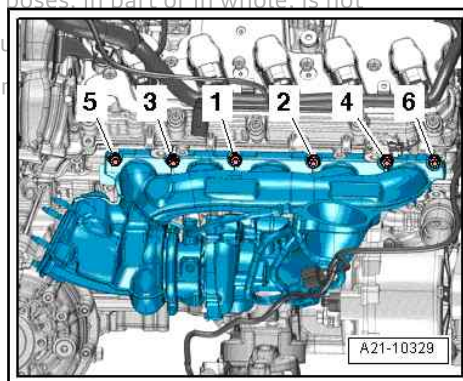
Stage	Nuts	Tightening torque
1.	-1 ... 6-	Screw in by hand until nuts make contact with exhaust manifold
2.	-1 ... 6-	10 Nm
3.	-1 ... 6-	17 Nm
4.	-1 ... 6-	26 Nm



Turbocharger with exhaust manifold (right-side) - tightening torque and sequence

– Tighten nuts in 4 stages in the sequence shown:

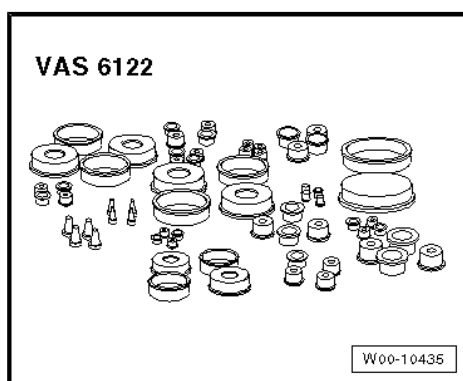
Stage	Nuts	Tightening torque
1.	-1 ... 6-	Screw in by hand until nuts make contact with exhaust manifold
2.	-1 ... 6-	10 Nm
3.	-1 ... 6-	17 Nm
4.	-1 ... 6-	26 Nm



1.2 Removing and installing turbocharger (left-side)

Special tools and workshop equipment required

- ♦ Engine bung set - VAS 6122-





Removing



Caution

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

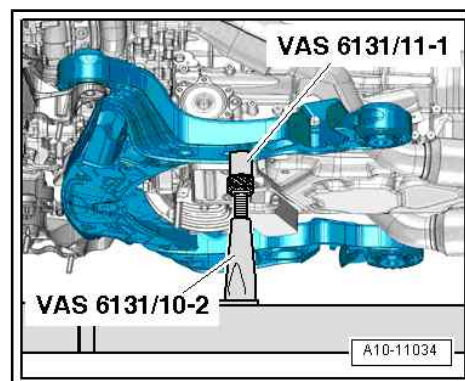
- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ➔ [page 10](#) .
- Remove front left exhaust pipe with catalytic converters ➔ [page 259](#) .
- Screw down spindles of support elements (left and right) at subframe as far as possible.
- Unscrew both base plates for support elements for subframe from scissor-type assembly platform - VAS 6131 A- .



Note

A second mechanic is required for removing the subframe.

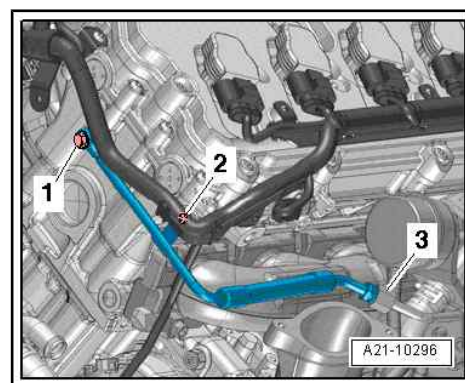
- Take out subframe to the side.



Note

Place a cloth underneath to catch escaping engine oil.

- Remove oil supply line from connection; to do so, counterhold at hexagon flats with an open-end spanner and loosen union nut -3-.



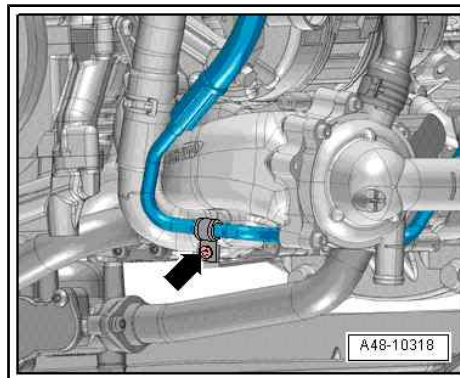
Note

Disregard items -1 and 2-.

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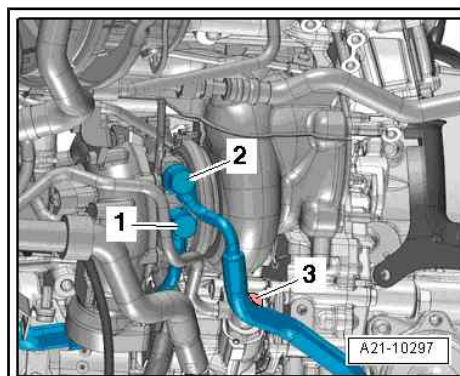
- Remove bolt -arrow- at retaining clip for power steering hydraulic line.



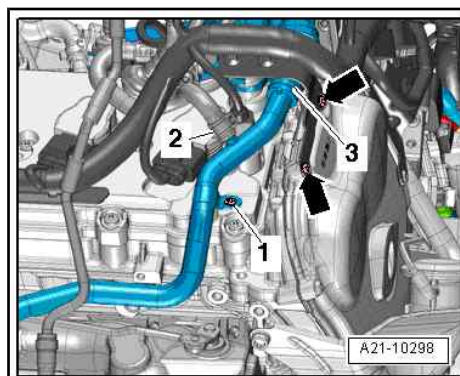
Note

Lay a cloth under the connection to catch escaping hydraulic fluid and coolant.

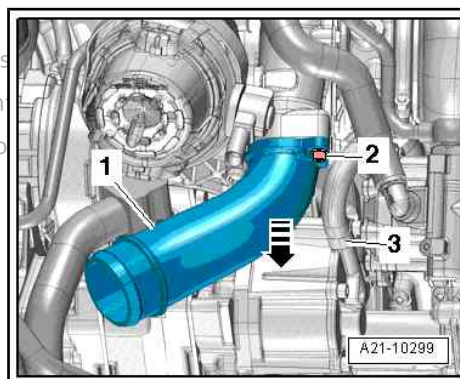
- Remove banjo bolts -1, 2, 3- and move lines clear to one side.



- Remove bolts -arrows- and move bracket with wiring harness to one side.
- Remove bolt -1-.
- Release hose clips -2- and -3- and disconnect hoses from crankcase breather pipe.



- Remove bolt -2-.
- Detach air pipe -1- from turbocharger in direction of -arrow-.
- Release hose clip -3- and detach oil return hose from oil pump.

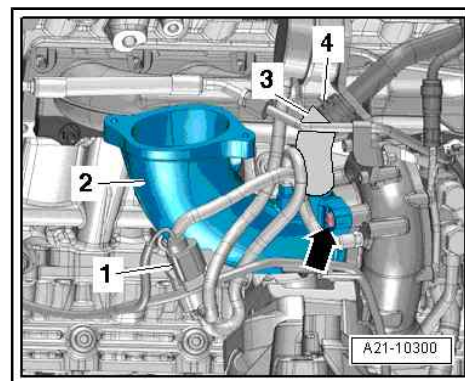




- Unplug electrical connector -1- at charge pressure control solenoid valve 2 - N274- .

**Note**

Disregard items -2, 3, 4- and -arrow-.

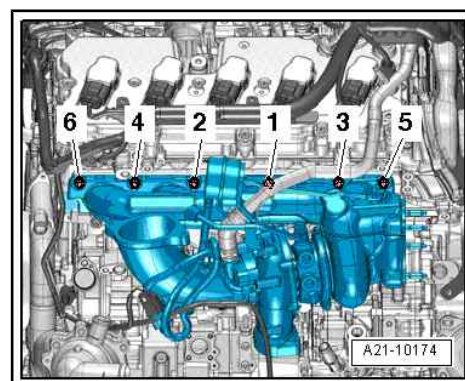


- Remove turbocharger nuts in the sequence: -6 ... 1-.
- Detach exhaust manifold with turbocharger.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

Installing

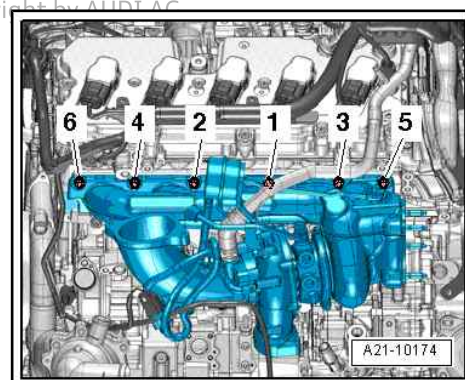
- Tightening torques ➔ [page 232](#)
- Tightening torque for oil supply line to turbocharger ➔ [page 234](#)

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

**Note**

- ◆ *Renew seals, gaskets, O-rings and self-locking nuts.*
 - ◆ *Do not remove plugs or protective caps until you are ready to fit the relevant line.*
 - ◆ *Fill turbocharger with engine oil at connection for oil supply line.*
 - ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
 - ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Electronic parts catalogue .*
 - ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
 - ◆ *After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.*
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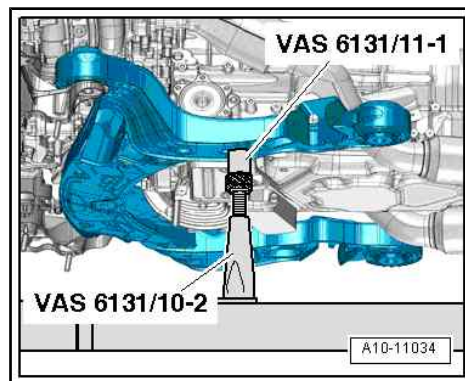
- Tighten turbocharger nuts ➔ [page 234](#) .



**Note**

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

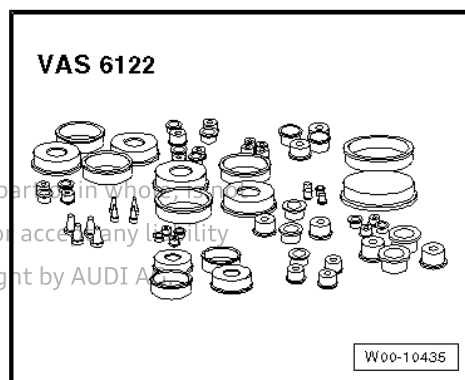
- Fit subframe on both support elements -VAS 6131/11-1- .
- Screw up spindles of support elements on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .
- Install front exhaust pipe (left-side) with catalytic converters ⇒ [page 259](#) .
- Install hydraulic line ⇒ Rep. gr. 48 .



1.3 Removing and installing turbocharger (right-side)

Special tools and workshop equipment required

- ◆ Engine bung set - VAS 6122-



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Removing

**Caution**

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .
- Remove front exhaust pipe (right-side) with catalytic converters ⇒ [page 261](#) .
- Remove coolant pipe (right-side) with coolant lines ⇒ [page 217](#) .



- Screw down spindles of support elements (left and right) at subframe as far as possible.
- Unscrew both base plates for support elements for subframe from scissor-type assembly platform - VAS 6131 A- .

**Note**

A second mechanic is required for removing the subframe.

- Take out subframe to the side.
- Remove bolts -2-.
- Disconnect oil return line from turbocharger and move clear to one side.

**Note**

-Item 1- can be disregarded.



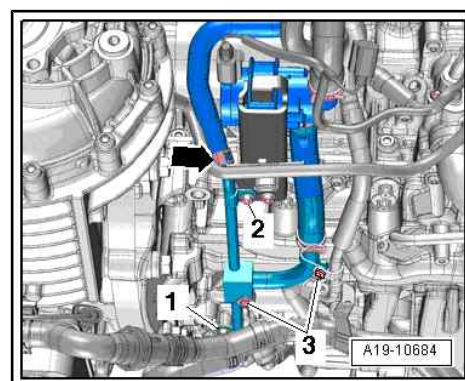
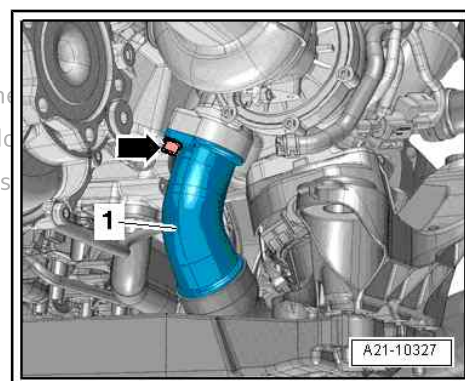
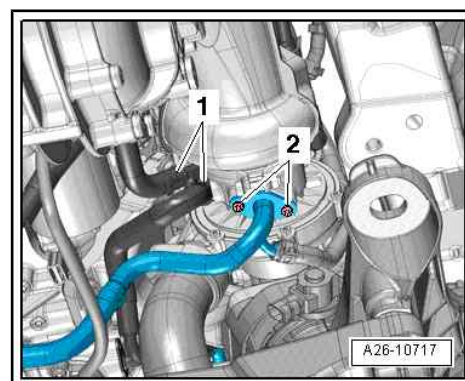
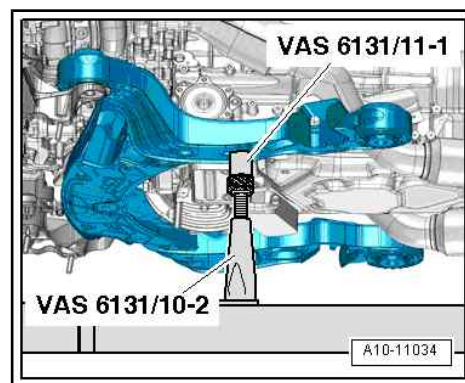
- Remove bolt -arrow-.
- Detach connection -1- from turbocharger (right-side).

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- Disconnect coolant pipe -arrow-.

**Note**

Disregard items -1, 2, 3-.

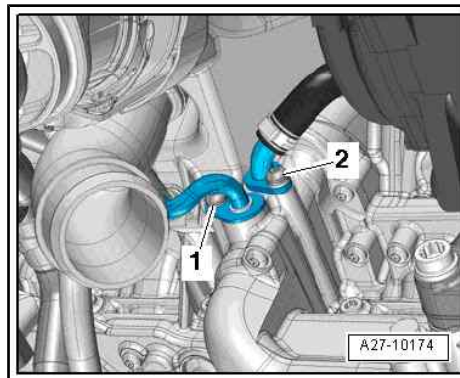




- Remove bolt -1- and detach coolant pipe from cylinder block.

**Note**

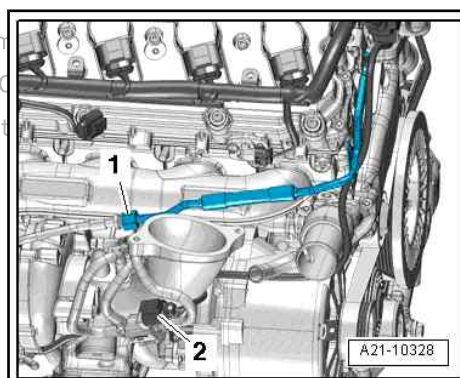
-Item 2- can be disregarded.

**Note**

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Lay a cloth under the separating point to catch escaping engine oil.

- Remove oil supply line from connection; to do so, counterhold at hexagon flats with an open-end spanner and loosen union nut -1-.
- Unplug electrical connector -2- at charge pressure control solenoid valve - N75- .

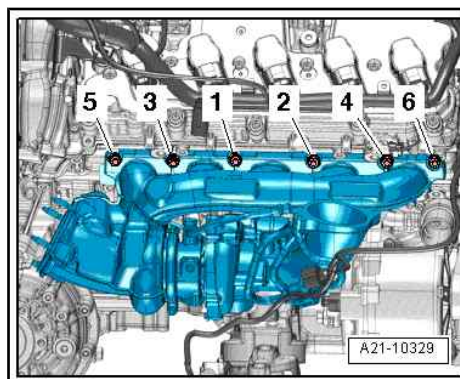


- Remove nuts in the sequence -6 ... 1-.
- Detach exhaust manifold with turbocharger.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

Installing

- Tightening torques ⇒ [page 232](#)
- Tightening torque for oil supply line to turbocharger ⇒ [page 234](#)

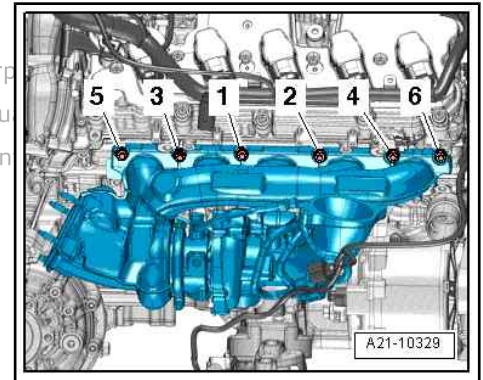
Installation is carried out in reverse order; note the following:

**Note**

- ◆ Renew seals, gaskets, O-rings and self-locking nuts.
- ◆ Do not remove plugs or protective caps until you are ready to fit the relevant line.
- ◆ Fill turbocharger with engine oil at connection for oil supply line.
- ◆ Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue* .
- ◆ The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.
- ◆ After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.



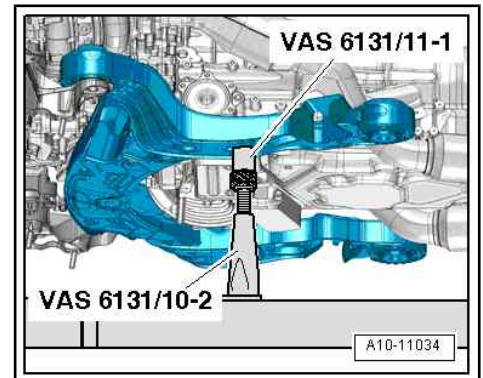
- Tighten turbocharger nuts ⇒ [page 234](#) .
- Fit coolant pipe onto cylinder block (right-side) ⇒ [page 213](#) .
- Install coolant pipe (right-side) with coolant lines ⇒ [page 217](#) .



Note

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

- Fit subframe on both support elements -VAS 6131/11-1- .
- Screw up spindles of support elements on both sides.
- Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .
- Install front exhaust pipe (right-side) with catalytic converters ⇒ [page 261](#) .





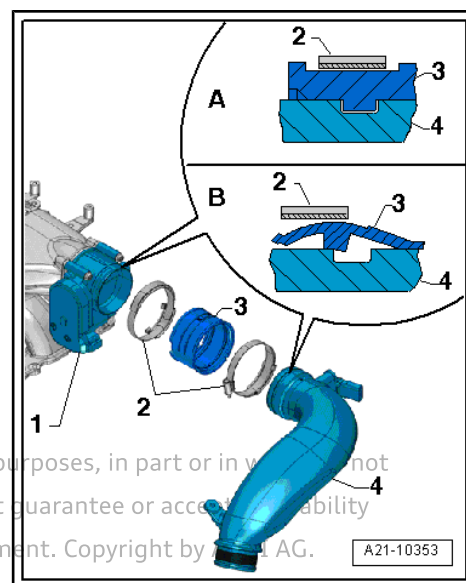
2.2 Checking air hoses for correct seating

Procedure

- Before installing the hose clips -2-, it is important to make sure that the beaded rings in the air hose -3- are correctly seated in the grooves of the throttle valve module -1- and in the air pipe -4-.
- Sectional view -A- shows correct assembly.
- Sectional view -B- shows wrong assembly.



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2.3 Installing air hoses and hose clips

To ensure that there is enough clearance at the crash sensors, it is very important to observe the installation position of the hose clips at the air pipes.



Installing air hose (left-side) between air cleaner housing and turbocharger

-1- Intermediate flange

- ◆ To turbocharger

-2- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting

- ◆ 5.5 Nm

-3- Air hose

- ◆ Installation markings -item 6- and -item 7- must align
- ◆ Do not use lubricant when installing

-4- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting

- ◆ 5.5 Nm

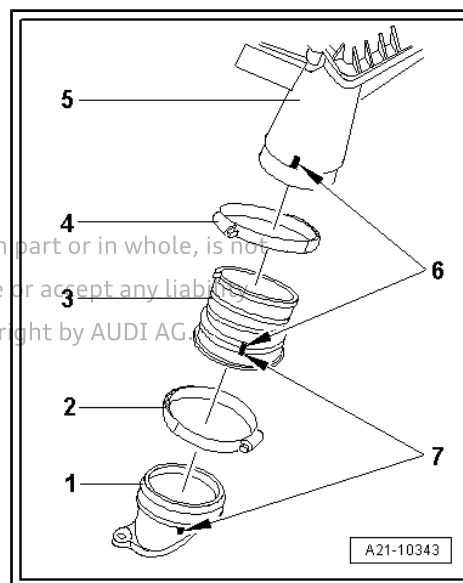
-5- Air cleaner housing

-6- Installation marking

- ◆ Installation markings on air cleaner housing and air hose must align

-7- Installation marking

- ◆ Installation markings on intermediate flange and air hose must align

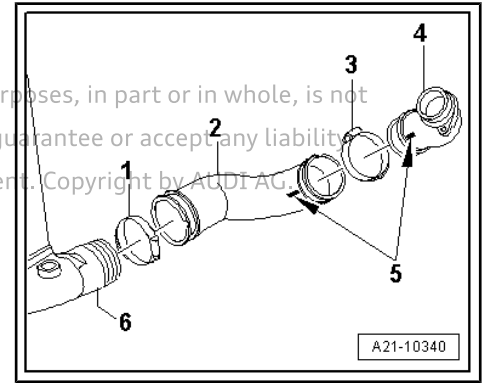




Installing air hose (left-side) between turbocharger and charge air cooler (left-side)

-1- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm



-2- Air hose

- ◆ Installation markings -items 5- must align
- ◆ Do not use lubricant when installing

-3- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm

-4- Connection for turbocharger

-5- Installation markings

- ◆ Installation markings on connection for turbocharger and air hose must align

-6- Charge air cooler



Installing air hose (left-side) between charge air cooler (left-side) and air pipe (left-side)

-1- Charge air cooler

-2- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm

-3- Air hose

- ◆ Installation markings -items 6- must align
- ◆ Do not use lubricant when installing

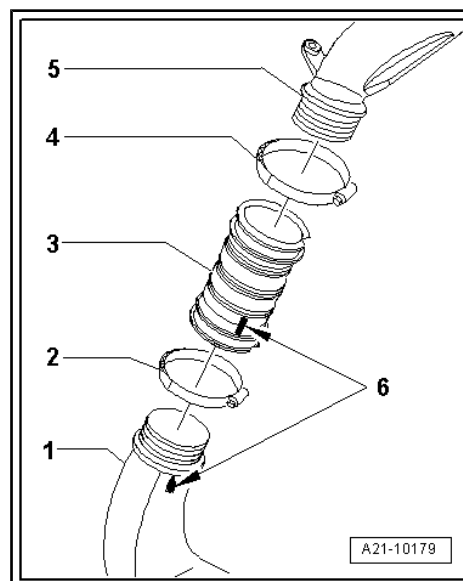
-4- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm

-5- Air pipe (left-side)

-6- Installation markings

- ◆ Installation markings on charge air cooler and air hose must align





Installing air hose (left-side) between air pipe and throttle valve module 2 - J544-

-1- Throttle valve module 2 - J544-

-2- Installation markings

- ◆ Installation markings on air hose and throttle valve module must align

-3- Air hose

- ◆ Observe installation marking -item 2-: thick white line on air hose must point to marking on throttle valve module 2 - J544-
- ◆ For installation on left side of vehicle, letter "L" -item 7- must be legible from the front
- ◆ Do not use lubricant when installing

-4- Hose clip

- ◆ Width: 9 mm
- ◆ Installation position as marked on air hose and shown in illustration
- ◆ Lock must be positioned on dotted line -6- on air hose. When hose clip is tightened, lock is pulled towards continuous line -8-

- ◆ Spray screw sections of used screw-type clips with rust remover before fitting

- ◆ Before tightening, slide hose clip as far as possible towards end of hose

- ◆ 3.5 Nm, after 5 minutes tighten again to 3.5 Nm

-5- Air pipe (left-side)

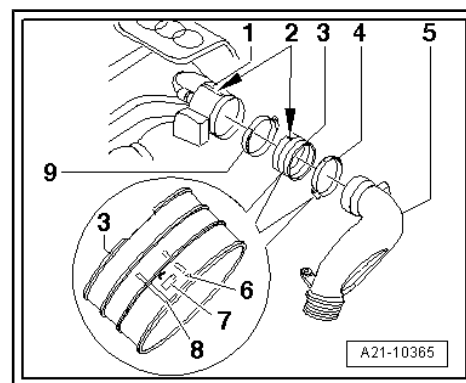
-9- Hose clip

- ◆ Width: 9 mm
- ◆ Installation position as marked on air hose and shown in illustration
- ◆ Lock must be positioned on dotted line on air hose. When hose clip is tightened, lock is pulled towards continuous line

- ◆ Spray screw sections of used screw-type clips with rust remover before fitting

- ◆ Before tightening, slide hose clip as far as possible towards end of hose

- ◆ 3.5 ... 4 Nm, after 5 minutes tighten again to 3.5 ... 4 Nm



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Installing air hose (right-side) between air cleaner housing and turbocharger

-1- Installation marking

- ◆ Installation markings on intermediate flange and air hose must align

-2- Installation marking

- ◆ Installation markings on air cleaner housing and air hose must align

-3- Air cleaner housing

-4- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting

- ◆ 5.5 Nm

-5- Air hose

- ◆ Installation markings -item 1- and -item 2- must align
- ◆ Do not use lubricant when installing

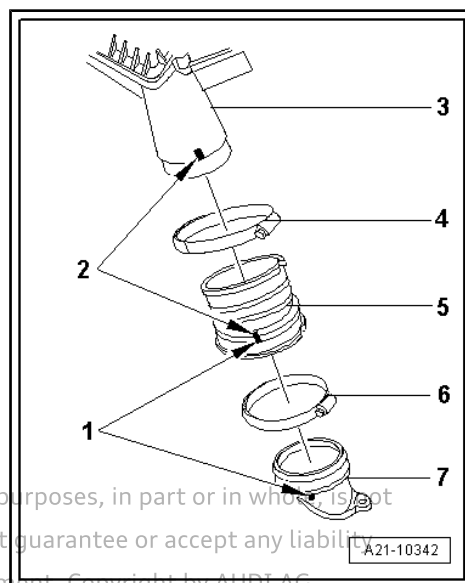
-6- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Intermediate flange
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting

- ◆ 5.5 Nm

-7- Intermediate flange

- ◆ To turbocharger





Installing air hose (right-side) between turbocharger and charge air cooler (right-side)

-1- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm

-2- Air hose

- ◆ Installation markings -items 5- must align
- ◆ Do not use lubricant when installing

-3- Hose clip

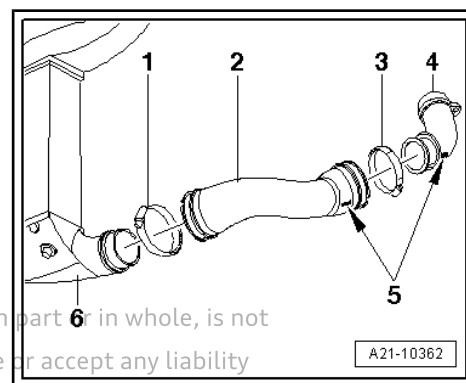
- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm

-4- Connection for turbocharger

-5- Installation markings

- ◆ Installation markings on connection for turbocharger and air hose must align

-6- Charge air cooler





Installing air hose (right-side) between charge air cooler (right-side) and air pipe (right-side)

-1- Charge air cooler

-2- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm

-3- Air hose

- ◆ Observe installation markings - items 6-
- ◆ Do not use lubricant when installing

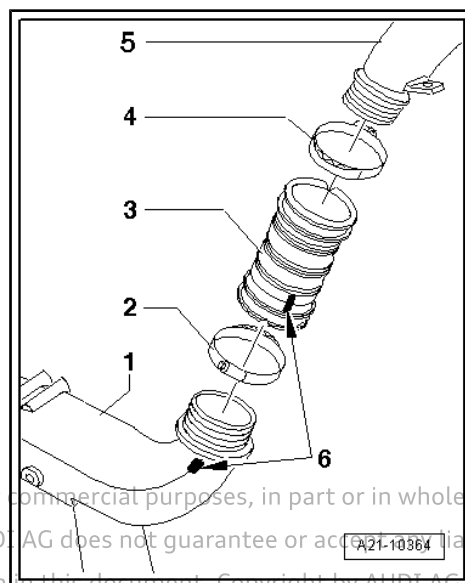
-4- Hose clip

- ◆ With locating device
- ◆ Do not detach from air hose
- ◆ Installation position as marked on air hose (triangular notch) and shown in illustration
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ 5.5 Nm

-5- Air pipe (right-side)

-6- Installation markings

- ◆ Installation markings on charge air cooler and air hose must align



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Installing air hose (right-side) between air pipe and throttle valve module - J338-

-1- Air pipe (right-side)

-2- Hose clip

- ◆ Width: 9 mm
- ◆ Installation position as marked on air hose and shown in illustration
- ◆ Lock must be positioned on dotted line -10- on air hose. When hose clip is tightened, lock is pulled towards continuous line -8-
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ Before tightening, slide hose clip as far as possible towards end of hose
- ◆ 3.5 Nm, after 5 minutes tighten again to 3.5 Nm

-3- Air hose

- ◆ Observe installation marking -item 4-: thick white line on air hose must point to marking on throttle valve module - J338-
- ◆ For installation on right side of vehicle, letter "R" -item 9- must be legible from the front
- ◆ Do not use lubricant when installing

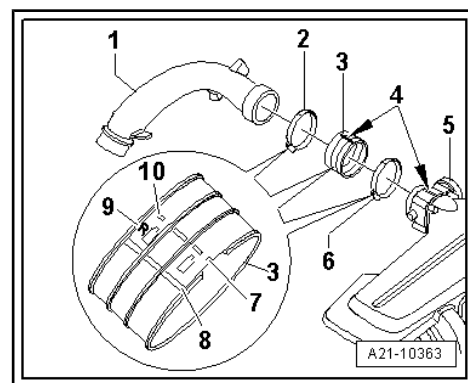
-4- Installation markings

- ◆ Installation markings on air hose and throttle valve module must align

-5- Throttle valve module - J338-

-6- Hose clip

- ◆ Width: 9 mm
- ◆ Installation position as marked on air hose and shown in illustration
- ◆ Lock must be positioned on dotted line -7- on air hose. When hose clip is tightened, lock is pulled towards continuous line -8-
- ◆ Spray screw sections of used screw-type clips with rust remover before fitting
- ◆ Before tightening, slide hose clip as far as possible towards end of hose
- ◆ 3.5 ... 4 Nm, after 5 minutes tighten again to 3.5 ... 4 Nm



2.4 Exploded view - charge air cooling



Note

- ◆ The illustration shows the left-side charge air cooler.
- ◆ Installing air hoses and hose clips ⇒ [page 243](#).

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**1 - Front air duct****2 - Ambient temperature sensor - G17-**

- ☐ Removing and installing
⇒ Rep. gr. 90

3 - Radiator fan

- ☐ Radiator fan (right-side)
- V35-, radiator fan (left-side)
- V402-

4 - Bracket

- ☐ For radiator fan

5 - Bolt

- ☐ 9 Nm

6 - Spacer sleeve**7 - Grommet****8 - Air hose****9 - Air pipe****10 - Bolt**

- ☐ 5 Nm

11 - Air hose**12 - O-ring**

- ☐ Renew

13 - Charge pressure sender

- ☐ Cylinder bank 1 (right-side): charge pressure sender - G31-
- ☐ Cylinder bank 2 (left-side): charge pressure sender 2 - G447-

- ☐ Removing and installing ⇒ [page 257](#)

14 - Bolt

- ☐ 2.5 Nm

15 - Bolt

- ☐ 9 Nm

16 - Grommet**17 - Bolt**

- ☐ 9 Nm

18 - Bracket (inside)

- ☐ For charge air cooler

19 - Bracket

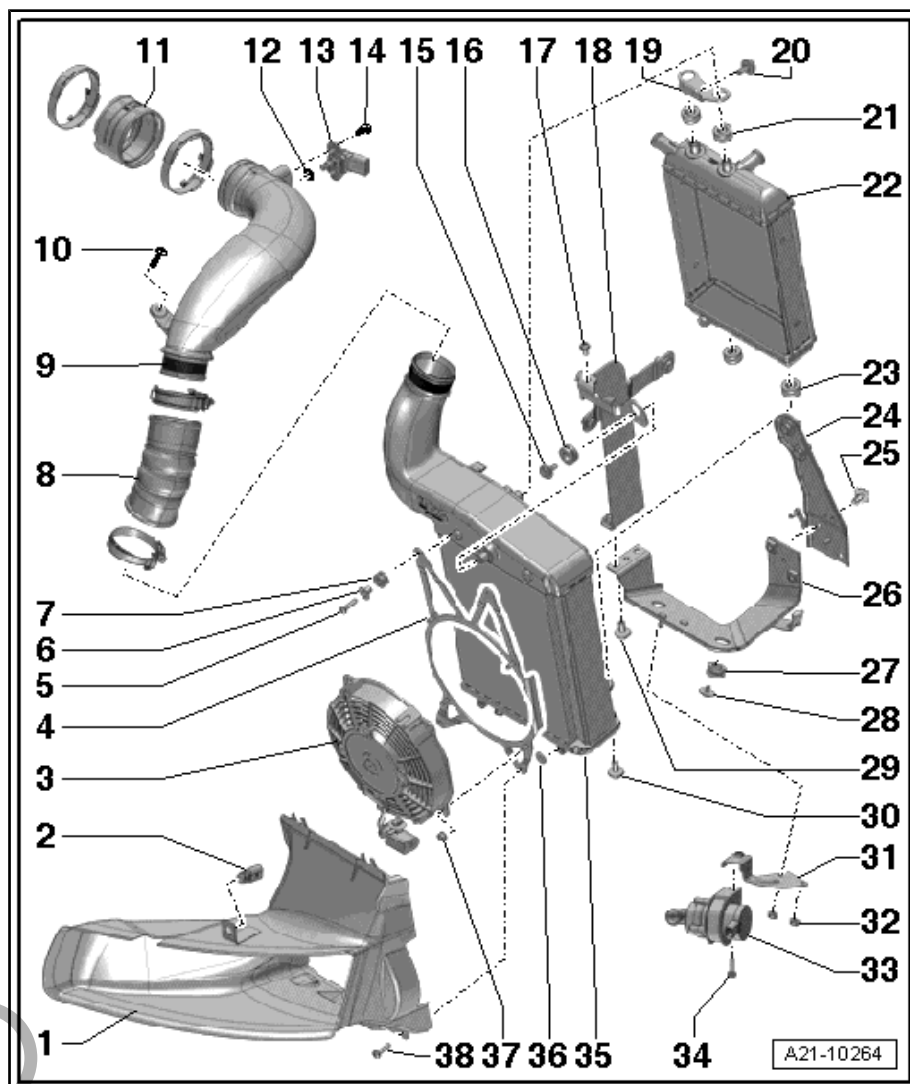
- ☐ For radiator (left-side)

20 - Bolt

- ☐ 9 Nm

21 - Grommet**22 - Radiator (left-side)**

- ☐ Removing and installing ⇒ [page 225](#)
- ☐ If renewed, refill system with fresh coolant



**23 - Grommet****24 - Bracket (outside)**

- ☐ For charge air cooler

25 - Bolt

- ☐ 23 Nm

26 - Bracket (bottom)

- ☐ For charge air cooler

27 - Grommet**28 - Bolt**

- ☐ 6 Nm

29 - Bolt

- ☐ 23 Nm

30 - Bolt

- ☐ 9 Nm

31 - Bracket

- ☐ For circulation pump 2 - V403-

32 - Nut

- ☐ 9 Nm

33 - Circulation pump 2 - V403-

- ☐ Removing and installing ⇒ [page 209](#)

34 - Bolt

- ☐ 9 Nm

35 - Charge air cooler (left-side)

- ☐ Removing and installing ⇒ [page 253](#)

36 - Grommet**37 - Nut**

- ☐ 9 Nm

38 - Bolt

- ☐ 7 Nm

2.5 Removing and installing charge air cooler

**Note**

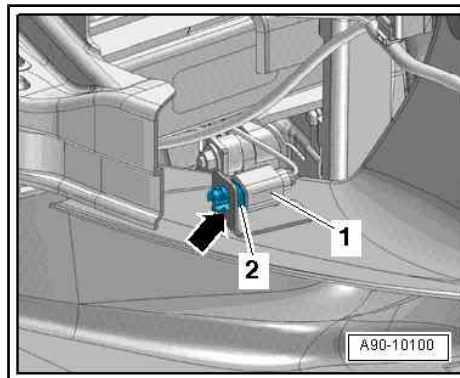
The following description is for removing and installing the charge air cooler on the left side of the vehicle. The procedure on the right side is similar.

**Removing**

- Remove headlight (left-side) ⇒ Electrical system; Rep. gr. 94 .
- Detach electrical connector -1- at ambient temperature sensor - G17- -item 2-.

**Note**

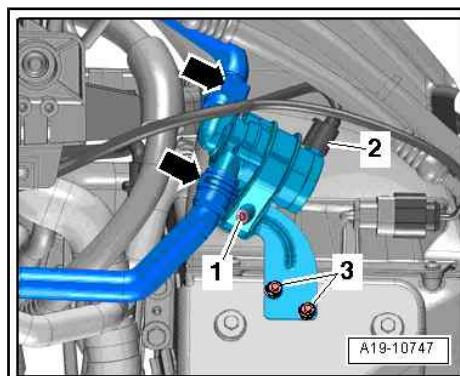
Disregard -arrow-.



- Remove nuts -3-.
- Move circulation pump 2 - V403- clear to one side; hoses -arrows- and electrical connector -2- remain attached.

**Note**

-Item 1- can be disregarded.

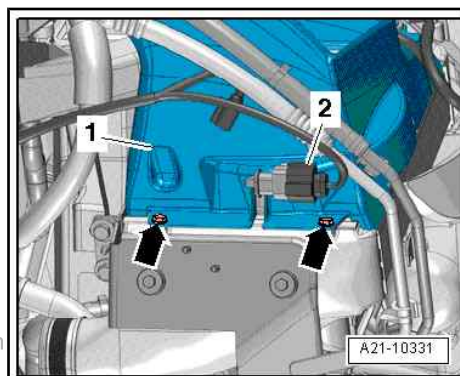


- Take electrical connector -2- for radiator fan (left-side) - V402- out of retainer.
- Remove bolts -arrows- and detach air duct -1-.

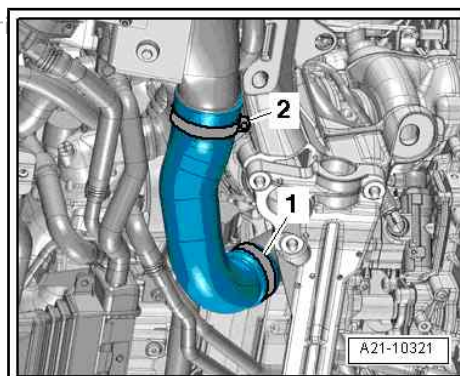


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- Release hose clip -2- and detach air hose from charge air cooler (left-side).

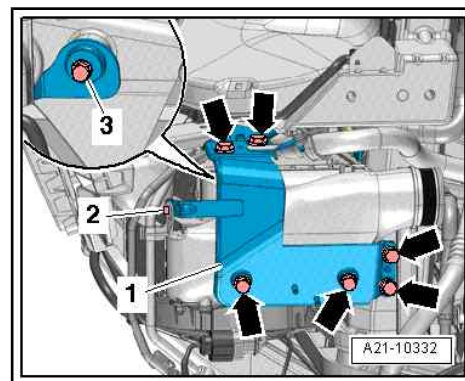
**Note**

-Item 1- can be disregarded.





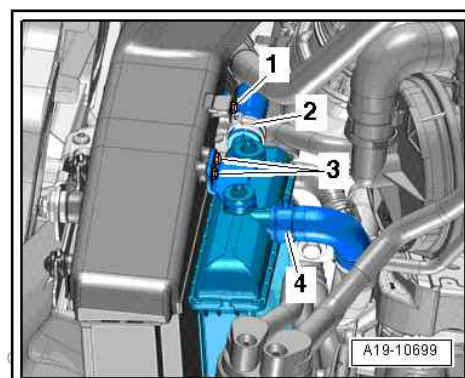
- Remove bolt -2- on bracket for hydraulic lines.
- Remove bolts -arrows- and detach bottom bracket -1- for charge air cooler.
- Remove bolt -3- for radiator.



- Remove bolts -1- and -3-, lift radiator off charge air cooler and secure to prevent it from dropping.

**Note**

Disregard items -2 and 4-.



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- Release hose clip -2- and detach air hose from charge air cooler.
- Remove bolt -arrow- and move bracket -1- to left.
- Remove charge air cooler (left-side).

Installing

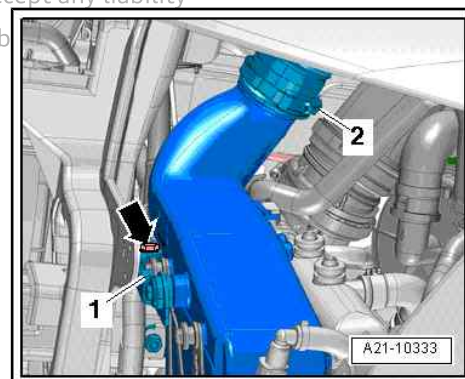
- Tightening torques ⇒ [page 251](#)

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

**Note**

- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
- ◆ *To ensure that there is enough clearance at the crash sensors, it is very important to observe the installation position of the hose clips at the air pipes ⇒ [page 243](#) .*

- Install headlight (left-side) ⇒ Electrical system; Rep. gr. 94 .





2.6 Removing and installing radiator fans - V35- / -V402-



Note

The following description is for removing and installing the radiator fan on the left side of the vehicle. The procedure on the right side is similar.

Removing

- Remove headlight (left-side) ⇒ Electrical system; Rep. gr. 94 .
- Detach electrical connector -1- at ambient temperature sensor - G17- -item 2-.



Note

Disregard -arrow-.

- Remove nuts -3-.
- Move circulation pump 2 - V403- clear to one side; hoses -arrows- and electrical connector -2- remain attached.

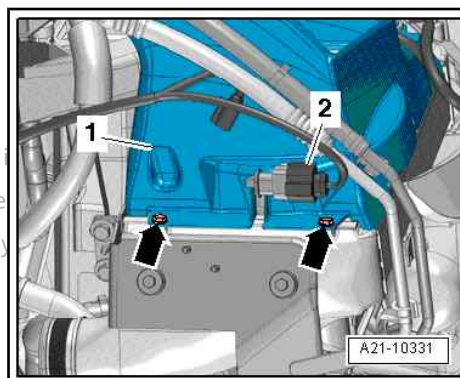
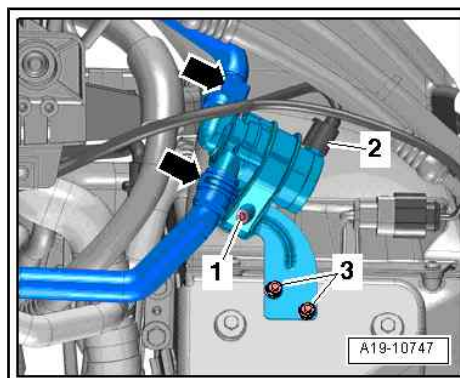
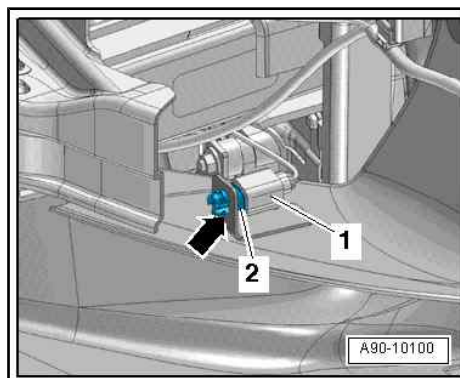


Note

-Item 1- can be disregarded.

- Take electrical connector -2- for radiator fan (left-side) - V402- out of retainer.
- Remove bolts -arrows- and detach air duct -1-.

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- Remove nuts -arrows- and detach radiator fan (left-side) - V402- -item 1-.

Installing

- Tightening torque ➔ [page 251](#)

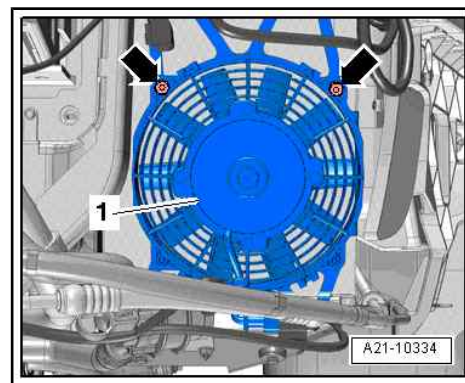
Installation is carried out in reverse order; note the following:



Note

Fit new O-ring.

- Install headlight (left-side) ➔ Electrical system; Rep. gr. 94 .



2.7 Removing and installing charge pressure sender -G31- / -G447-



Note

The following description is for removing and installing the charge pressure sender - G31- on the right side of the vehicle. The procedure on the left side is similar.

Removing

- Unplug electrical connector -1- on charge pressure sender.
- Remove bolts -arrows- and pull charge pressure sender out of air pipe.

Installing

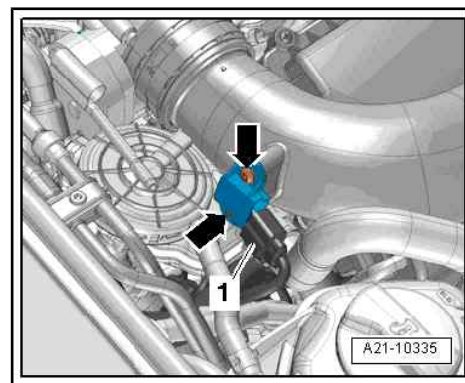
- Tightening torque ➔ [page 251](#)

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



Note

Fit new O-ring.



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26 – Exhaust system

1 Silencers



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 Exploded view - silencers

1 - Turbocharger

2 - Gasket

- ☐ Renew

3 - Nut

- ☐ 27 Nm

4 - Front exhaust pipe with catalytic converters

- ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Protect against knocks and impact
- ☐ Removing and installing: left-side
⇒ [page 259](#), right-side
⇒ [page 261](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 262](#)

5 - Bolt

- ☐ 23 Nm

6 - Retainer

7 - Rubber mounting

- ☐ Renew if damaged

8 - Centre silencer and rear silencer

- ☐ No cutting point provided

9 - Rubber mounting

- ☐ Renew if damaged

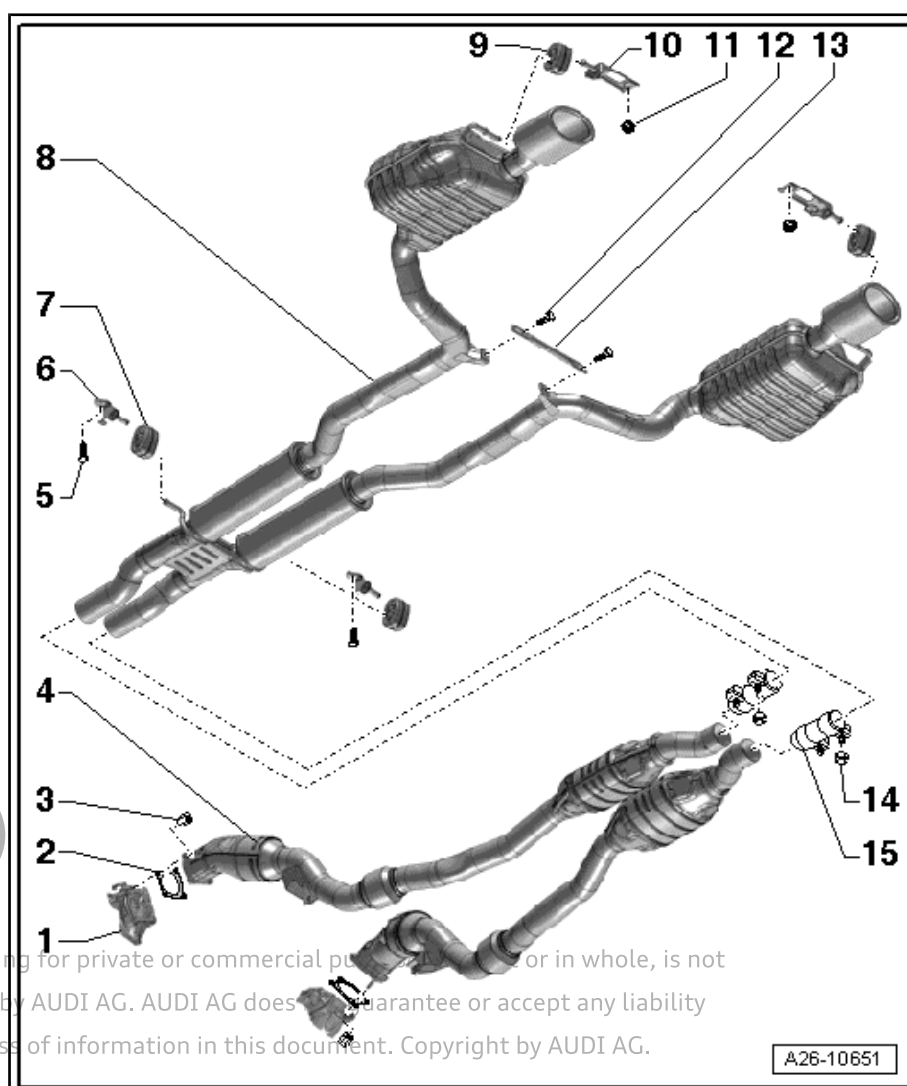
10 - Retainer

11 - Nut

- ☐ 23 Nm

12 - Bolt

- ☐ 23 Nm



A26-10651



13 - Support

14 - Nut

- ☐ 23 Nm

15 - Clamp

- ☐ Installation position ➔ [page 259](#)
- ☐ Before tightening, align exhaust system so it is free of stress ➔ [page 262](#)
- ☐ Tighten bolted connections evenly

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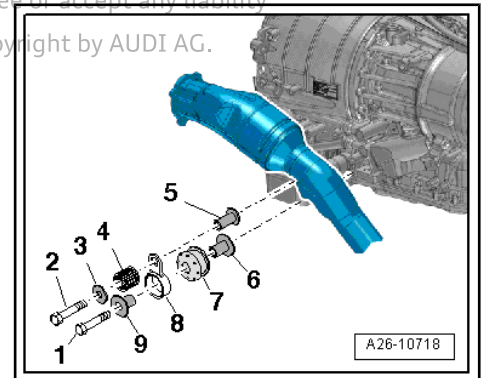
Mounting components



Note

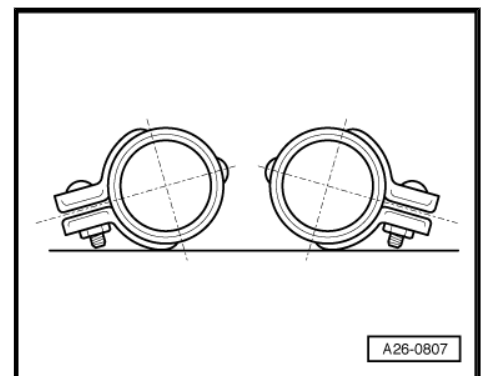
The illustration shows the left-side mounting.

- 1 - Bolt, 25 Nm
- 2 - Bolt, 25 Nm
- 3 - Washer
- 4 - Compression spring
- 5 - Spacer sleeve
- 6 - Spacer sleeve
- 7 - Buffer
- 8 - Bracket
- 9 - Spacer sleeve



Installation position of clamps

- Install clamps so that ends of bolts do not protrude beyond bottom of clamps.
- Bolt connections face outwards.



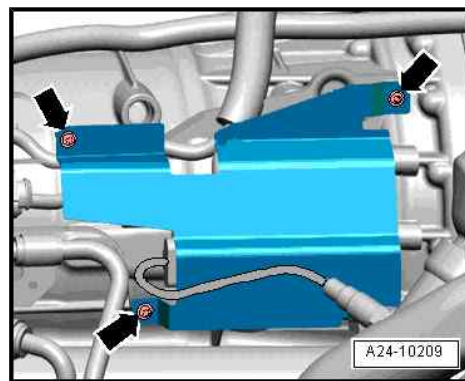
1.2 Removing and installing front exhaust pipe (left-side) with catalytic converters

Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ➔ [page 10](#).



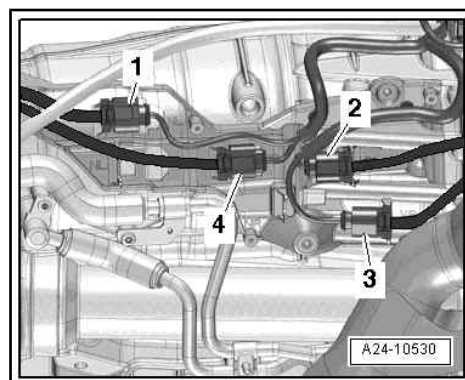
- Unscrew bolts -arrows- and detach heat shield for electrical connectors for Lambda probes (right-side) from gearbox.



- Remove electrical connectors -1- and -2- for Lambda probes from brackets on gearbox.
- Unplug electrical connectors and move wiring clear.

**Note**

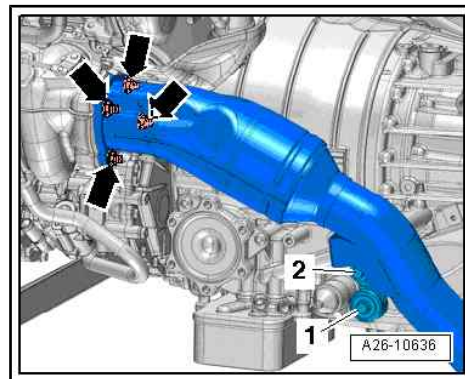
Disregard items -3 and 4-.



- Remove nuts -arrows- and bolt -1-.

**Note**

-Item 2- can be disregarded.



- Slacken bolt for support element (left-side) and pivot support element to side.
- Detach front exhaust pipe (left-side) with catalytic converters.

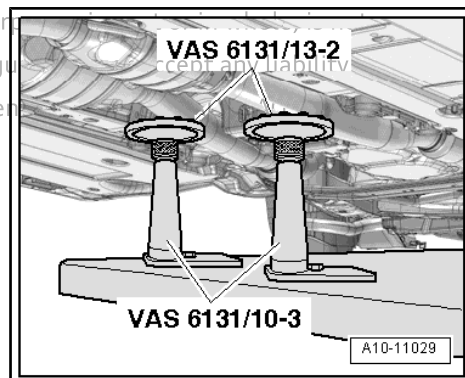
Installing

- Tightening torque ⇒ [page 258](#)

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

**Note**

- ◆ *Renew gasket and self-locking nuts.*
- ◆ *Fit all heat shields and heat insulation sleeves in the original positions when installing.*
- ◆ *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.*

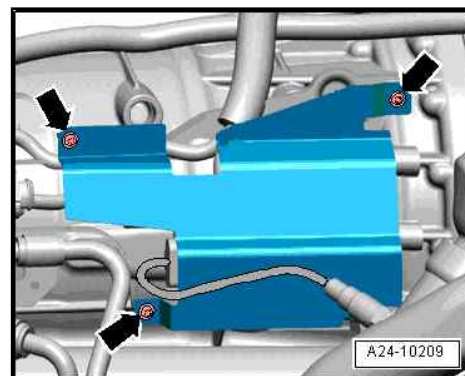




1.3 Removing and installing front exhaust pipe (right-side) with catalytic converters

Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ➔ [page 10](#) .
- Unscrew bolts -arrows- and detach heat shield for electrical connectors for Lambda probes (right-side) from gearbox.



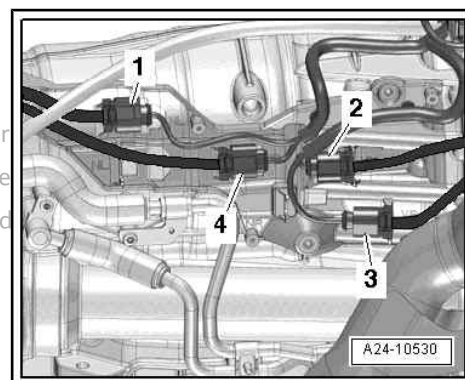
- Remove electrical connectors -3- and -4- for Lambda probes from brackets on gearbox.
- Unplug electrical connectors and move wiring clear.



Note

Disregard items -1 and 2-.

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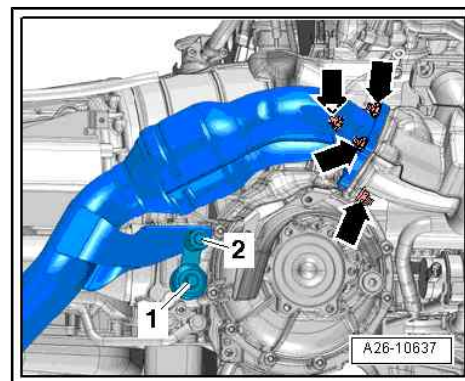


- Remove nuts -arrows- and bolt -1-.



Note

-Item 2- can be disregarded.





- Slacken bolt for support element (right-side) and pivot support element to side.
- Detach front exhaust pipe (right-side) with catalytic converters.

Installing

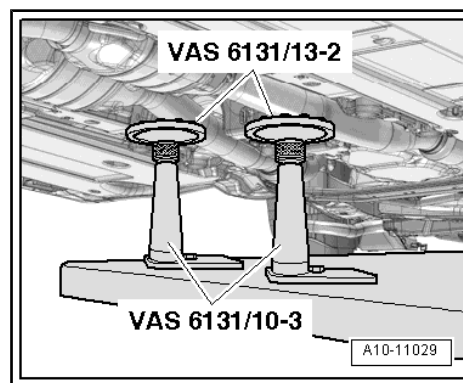
- Tightening torque ⇒ [page 258](#)

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

**Note**

- ◆ *Renew gasket and self-locking nuts.*
- ◆ *Fit all heat shields and heat insulation sleeves in the original positions when installing.*
- ◆ *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.*

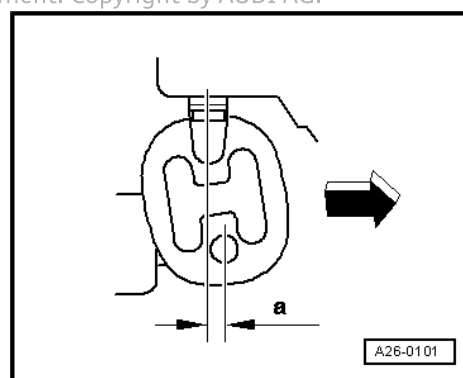
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1.4 Stress-free alignment of exhaust system

Procedure

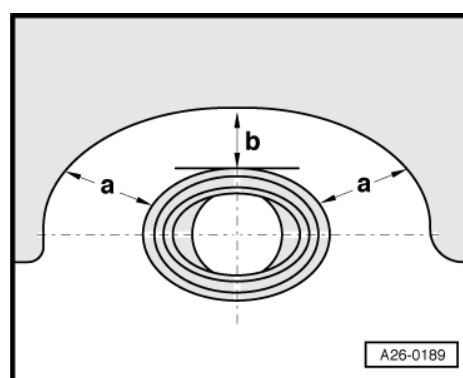
- The exhaust system must be aligned when it is cool.
- Tightening torque ⇒ [page 258](#)
- Loosen bolt connections for clamps.
- Push exhaust system towards front of vehicle -arrow- so that rear mountings for rear silencers are preloaded by -a- = 11 ± 2 mm.
- Tighten bolted connections on clamps evenly.
- Align tailpipes ⇒ [page 262](#).



1.5 Aligning tailpipes

Procedure

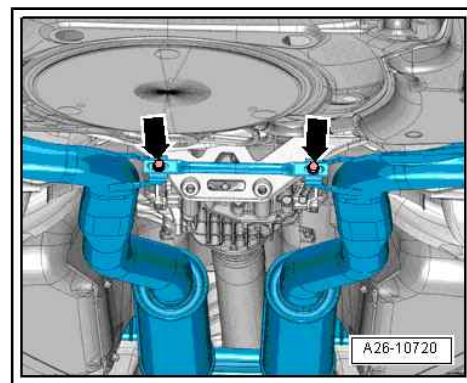
- Tightening torque ⇒ [page 258](#)
- Check clearance between tailpipes and bumper cover on both sides:
- Dimension -a- = approx. 20 mm
- Dimension -b- = approx. 20 mm





If necessary, correct dimension -a- as follows:

- Loosen bolts -arrows- on strut between exhaust pipes.
- Adjust the distance between the rear silencers.



1.6 Checking exhaust system for leaks

- Start the engine and run at idling speed.
- Plug tailpipes during leak test (e.g. with cloth or plugs).
- Listen for leaks at joints between cylinder head/turbocharger, turbocharger/front exhaust pipe etc.
- Rectify any leaks that are found.



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2 Exhaust manifold

The exhaust manifold and turbocharger are combined as one unit;
removing and installing: left-side ⇒ [page 234](#) ; right-side
⇒ [page 238](#) .



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3 Secondary air system

Principle

Because of the over-enrichment of the mixture in the cold start phase, the proportion of unburned hydrocarbons in the exhaust gas is higher. The secondary air system improves the afterburning (oxidation) process in the catalytic converter, and thus reduces toxic emissions. The heat generated by oxidation accelerates the light off of the catalytic converter and significantly improves exhaust gas quality during warm-up.

Operation

- ◆ In the warm-up phase, the engine control unit activates the secondary air pump via the secondary air pump relay. Air is routed to the secondary air combination valves.
- ◆ In parallel to this, the secondary air inlet valve is activated and allows vacuum to pass to the secondary air combination valves. In this way, the combination valve opens a passage for the secondary air system to supply air to the exhaust ports in the cylinder head.

3.1 Connection diagram for vacuum lines and hoses

1 - Vacuum line

- ☐ To mechanical air recirculation valve (right-side)

2 - Intake manifold flap valve - N316-

3 - Vacuum unit

- ☐ For intake manifold flaps on cylinder bank 1 (right-side)

4 - Non-return valve

- ☐ In vacuum supply line to vacuum reservoir
- ☐ Installation position: arrows on housing point to vacuum reservoir

5 - Vacuum supply line

- ☐ From vacuum pump to vacuum reservoir

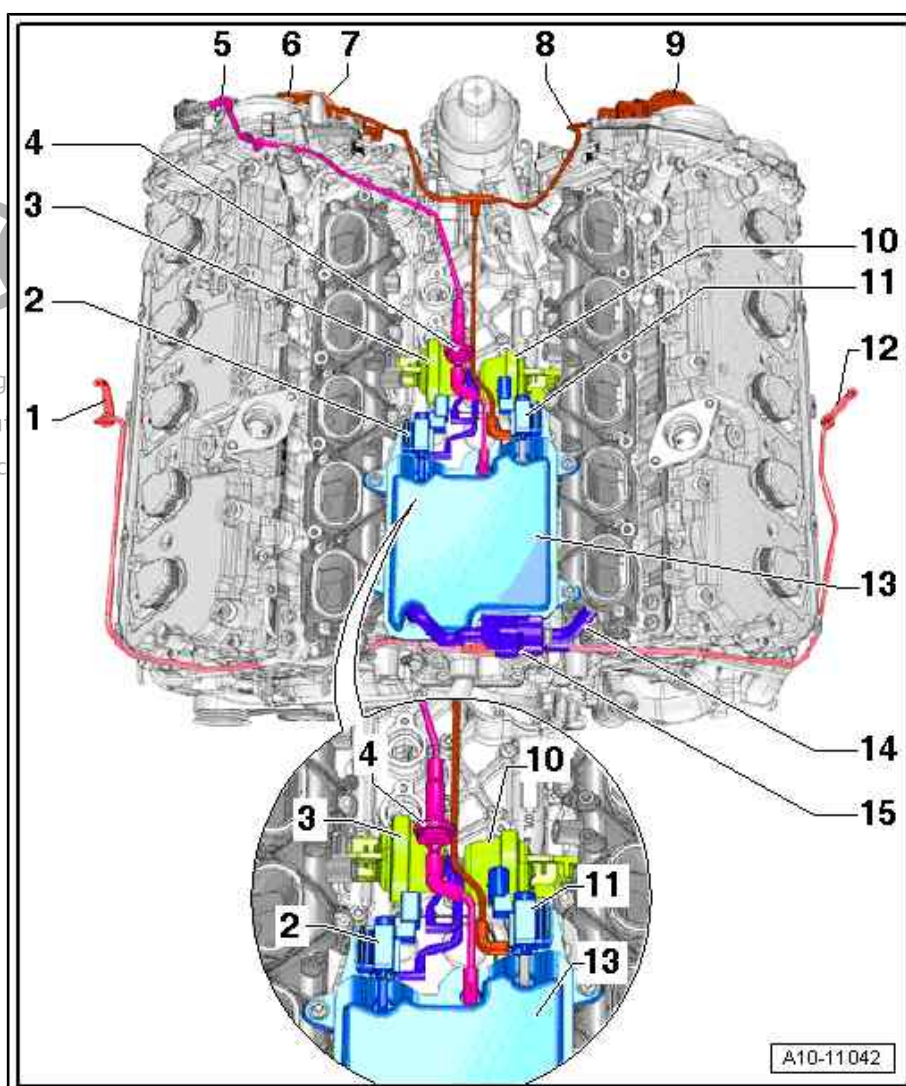
6 - Vacuum line

- ☐ From secondary air inlet valve - N112- to combination valve for secondary air system (right-side)

7 - Combination valve for secondary air system (right-side)

8 - Vacuum line

- ☐ From secondary air inlet valve - N112- to combination valve for secondary air system (left-side)



A10-11042

**9 - Combination valve for secondary air system (left-side)****10 - Vacuum unit**

- ☐ For intake manifold flaps on cylinder bank 2 (left-side)

11 - Secondary air inlet valve - N112-**12 - Vacuum line**

- ☐ To mechanical air recirculation valve (left-side)

13 - Vacuum reservoir**14 - Vent line**

- ☐ For turbocharger air recirculation valve - N249-
- ☐ To intake manifold

15 - Turbocharger air recirculation valve - N249-**3.2 Exploded view - secondary air system****1 - Secondary air hose****2 - O-ring**

- ☐ Renew

3 - Centre hex stud

- ☐ 15 Nm

4 - Nut

- ☐ 9 Nm

5 - Secondary air hose**6 - Nut**

- ☐ 9 Nm

7 - Gasket

- ☐ Renew

8 - Bolt

- ☐ 9 Nm

9 - Vacuum hose**10 - Combination valve for secondary air system (right-side)**

- ☐ Checking ⇒ [page 267](#)
- ☐ Removing and installing ⇒ [page 270](#)

11 - Bolt

- ☐ 9 Nm

12 - Bolt

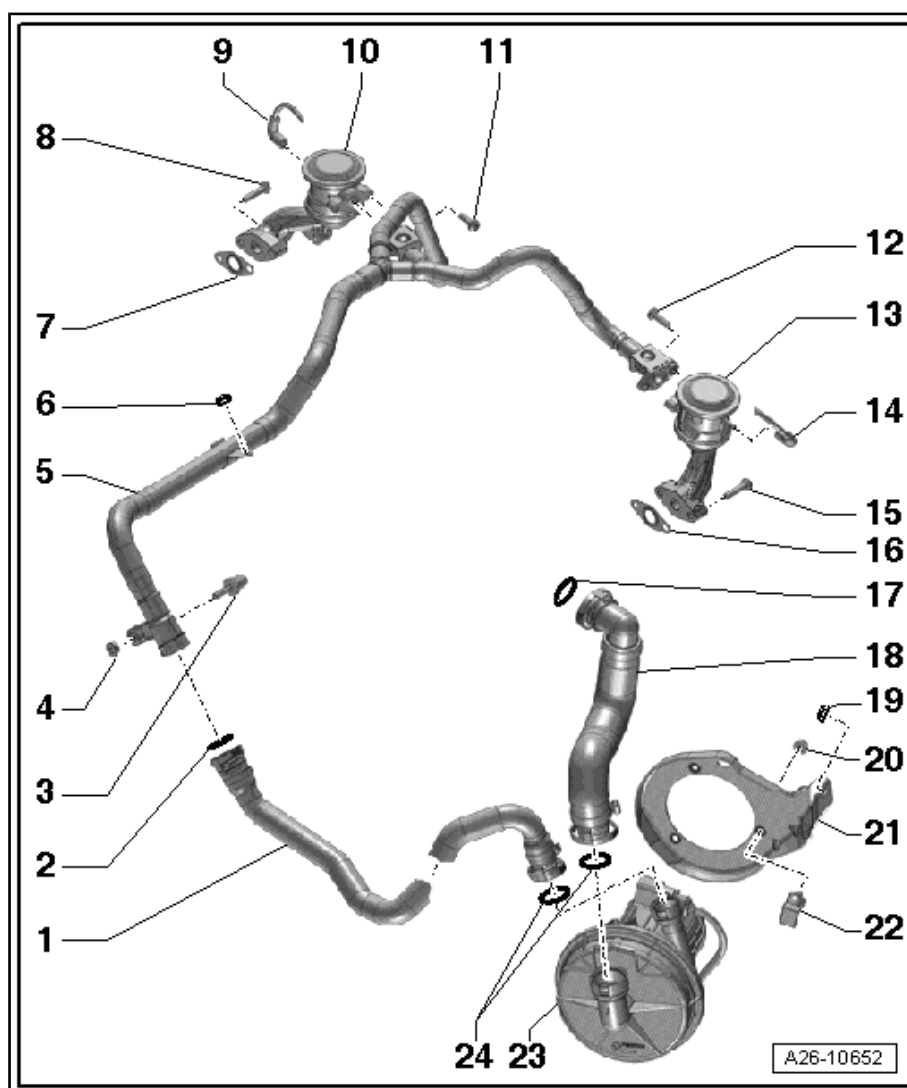
- ☐ 9 Nm

13 - Combination valve for secondary air system (left-side)

- ☐ Checking ⇒ [page 267](#)
- ☐ Removing and installing ⇒ [page 269](#)

14 - Vacuum hose**15 - Bolt**

- ☐ 9 Nm



**16 - Gasket**

- ☐ Renew

17 - O-ring

- ☐ Renew

18 - Secondary air hose**19 - Nut**

- ☐ 9 Nm

20 - Nut

- ☐ 8 Nm

21 - Bracket

- ☐ For secondary air pump motor - V101-

22 - Bonded rubber bush**23 - Secondary air pump motor - V101-**

- ☐ Removing and installing ⇒ [page 267](#)
- ☐ Clip electrical connector into bracket
- ☐ Check in "Guided Functions" ⇒ Vehicle diagnostic tester.

24 - O-rings

- ☐ Renew

3.3 Removing and installing secondary air pump -V101-

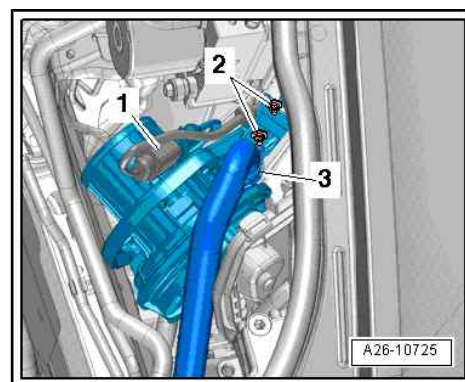
Removing

- Remove air cleaner housing (left-side) ⇒ Rep. gr. 24 .
- Unplug electrical connector -1-.
- Press release tabs and disconnect air hose -3- from secondary air pump -V101- .
- Unscrew nuts -2- and detach secondary air pump.

Installing

- Tightening torque ⇒ [page 266](#)

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

**Note**

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Fit all cable ties in the original positions when installing.

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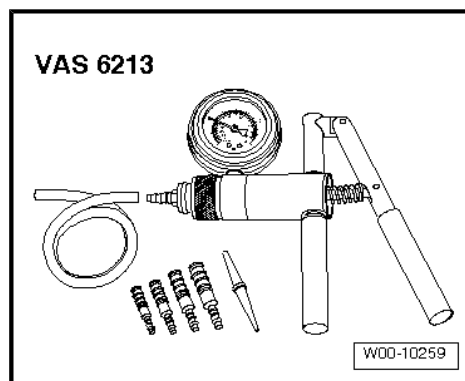
- Install air cleaner housing (left-side) ⇒ Rep. gr. 24 .

3.4 Checking combination valves for secondary air system for correct operation and leakage

Special tools and workshop equipment required



◆ Hand vacuum pump - VAS 6213-



Procedure

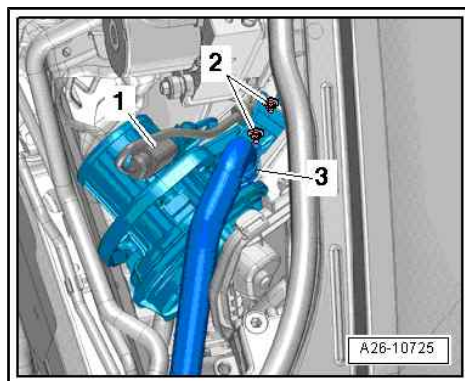
- Vacuum hoses and hose connections do not leak.
- Vacuum hoses are not clogged.
- Remove air cleaner housing (left-side) ⇒ Rep. gr. 24 .
- Press release tabs and disconnect secondary air hose -3- from secondary air pump.



Note



Disregard items -1 and 2-.



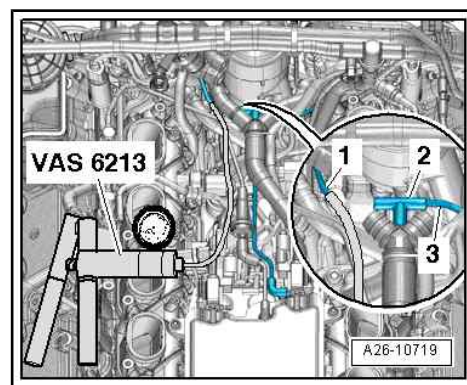
- Blow lightly into secondary air hose with your mouth (do not use compressed air).
- The combination valves for secondary air should be closed; it should not be possible to blow through the hose.
- If it is possible to blow through the hose, determine defective secondary air combination valve with engine removed and re-new: left-side ⇒ [page 269](#) , right-side ⇒ [page 270](#) .

If it is not possible to blow through the hose, proceed with check as follows:

- Remove intake manifold (top section) ⇒ Rep. gr. 24 .



- Detach vacuum hose -1- going to combination valve for secondary air (right-side) from T-piece -2-.
- Connect hand vacuum pump - VAS 6213- to vacuum connection -1- on combination valve (right-side) for secondary air system, as shown in illustration.
- Blow lightly into secondary air hose with your mouth (do not use compressed air).
- The combination valve for secondary air system should be closed; it should not be possible to blow through the hose.
- Operate hand vacuum pump to produce a vacuum.
- The combination valve for secondary air system should open; it should now be possible to blow through the hose.

**Note**

To check combination valve for secondary air (left-side), detach vacuum hose -2- from T-piece. Connect hand vacuum pump - VAS 6213- to vacuum hose and repeat check.

- If valve does not react as described, renew combination valve for secondary air system (left-side ⇒ [page 269](#) , right-side ⇒ [page 270](#)).

Assembling

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

**Note**

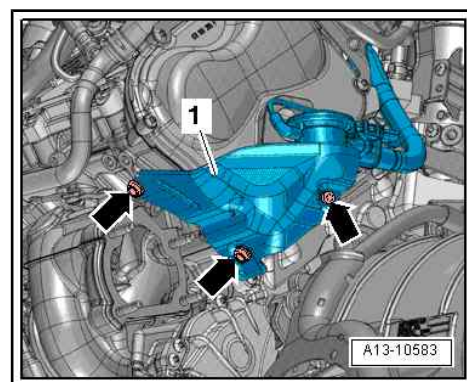
Fit new O-ring.

- Install intake manifold (top section) ⇒ Rep. gr. 24 .
- Install air cleaner housing (left-side) ⇒ Rep. gr. 24 .

3.5 Removing and installing combination valve for secondary air system (left-side)

Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#) .
- Remove front left exhaust pipe with catalytic converters ⇒ [page 259](#) .
- Remove bolts -arrows- and detach heat shield -1-.



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- Remove bolts -3- for secondary air system hose.
- Detach vacuum hose -2- from combination valve for secondary air system.
- Unscrew bolts -1- and detach combination valve for secondary air system.

Installing

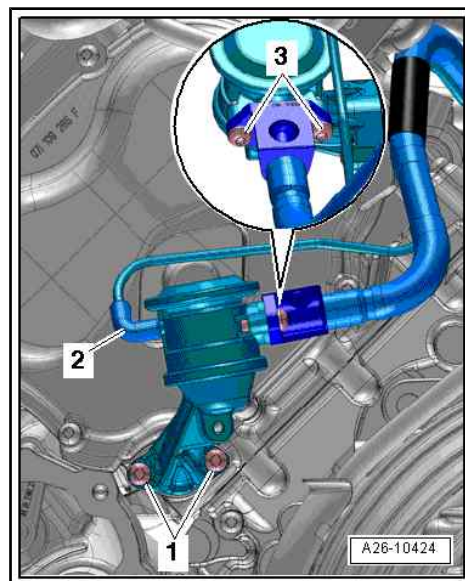
- Tightening torque ⇒ [page 266](#)
- Connection diagram for vacuum pipes and hoses ⇒ [page 265](#).

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

**Note**

Renew seal/gasket.

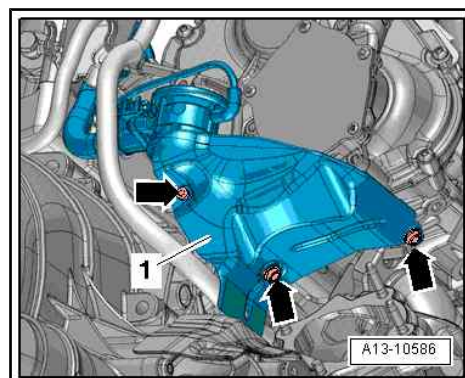
- Install front exhaust pipe (left-side) with catalytic converters ⇒ [page 259](#).



3.6 Removing and installing combination valve for secondary air system (right-side)

Removing

- Engine removed and in position on scissor-type assembly platform - VAS 6131 A- with gearbox attached ⇒ [page 10](#).
- Remove front exhaust pipe (right-side) with catalytic converters ⇒ [page 261](#).
- Remove bolts -arrows- and detach heat shield -1-.



- Remove bolts -1- for secondary air system hose.
- Detach vacuum hose -2- from combination valve for secondary air system.
- Unscrew bolts -3- and detach combination valve for secondary air system.

Installing

- Tightening torque ⇒ [page 266](#)
- Connection diagram for vacuum pipes and hoses ⇒ [page 265](#).

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

**Note**

Renew seal/gasket.

- Install front exhaust pipe (right-side) with catalytic converters ⇒ [page 261](#).

