

Workshop Manual Audi A3 2004 ➤

**4-cylinder direct injection engine (1.4 ltr. 4-valve TFSI),
mechanics**

Engine ID	CAX C	CMS A							
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Edition 04.2015



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List of Workshop Manual Repair Groups

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- 17 - Lubrication
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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

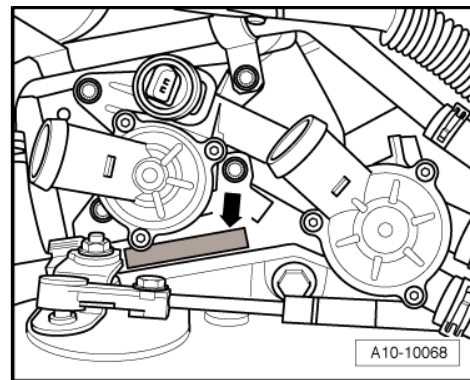
(ARL004234; Edition 04.2015)

- ◆ There is a sticker on the timing chain cover indicating the “Engine code” and “Serial number” -arrow-.
- ◆ Starting with the letter “C”, the engine codes consist of 4 letters.
- ◆ The first 3 characters of the engine code stand for the engine capacity and the mechanical construction and design. They are stamped on the cylinder block, together with the serial number.
- ◆ The 4th character indicates the power output and torque of the engine, and is determined by the engine control unit.



Note

- ◆ *The 4-character engine code can be found on the type plate (in versions for some countries only) and on the vehicle data sticker and the engine control unit.*
- ◆ *Fitting locations of the type plate (certain countries only) and the vehicle data sticker → Maintenance ; Booklet 808 .*
- ◆ *If the sticker is missing, use a mirror and a torch to read off the “Engine code” and the “Serial number”:*
- ◆ *Read off the engine code and serial number on the left-side of the cylinder block -arrow-.*



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2 Safety precautions

⇒ [“2.1 Working on the fuel system”, page 2](#)

⇒ [“2.2 Working on the cooling system”, page 2](#)

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⇒ [“2.5 Working on the exhaust system”, page 3](#)

2.1 Working on the fuel system

Risk of injury - fuel system operates under high pressure

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

Before opening the fuel system:

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



Risk of fire due to escaping fuel

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

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

2.2 Working on the cooling system

Risk of scalding as hot coolant can escape

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

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

2.3 Working on vehicles with start/stop system

Risk of injury - engine may start unexpectedly

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

- Deactivate start/stop system by switching off ignition.

2.4 Using testers and measuring instruments during a road test

Risk of injury if test equipment is not secured

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

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

Or

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

2.5 Working on the exhaust system



Caution

Risk of damage to flexible joint.

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

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3 General repair instructions

⇒ [“3.1 Rules for cleanliness when working on fuel supply system, injection system and turbocharger”, page 4](#)

⇒ [“3.2 Checking fuel system for leaks”, page 4](#)

⇒ [“3.3 Foreign particles in engine”, page 4](#)

⇒ [“3.4 Contact corrosion!”, page 5](#)

⇒ [“3.5 Routing and attachment of pipes, hoses and wiring”, page 5](#)

⇒ [“3.6 Installing radiators, condensers and charge air coolers”, page 5](#)

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

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

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

3.2 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.

3.3 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.

3.4 Contact corrosion!

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

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

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

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

Note the following:

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

3.5 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.

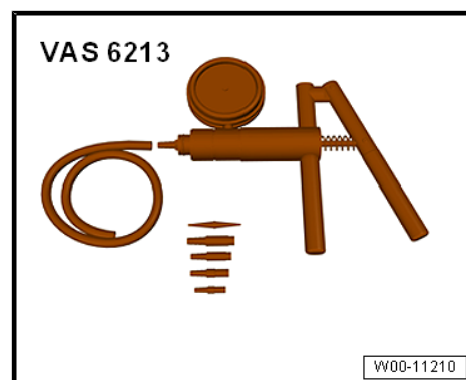
3.6 Installing radiators, condensers and charge air coolers

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, condenser or charge air cooler.

3.7 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking



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



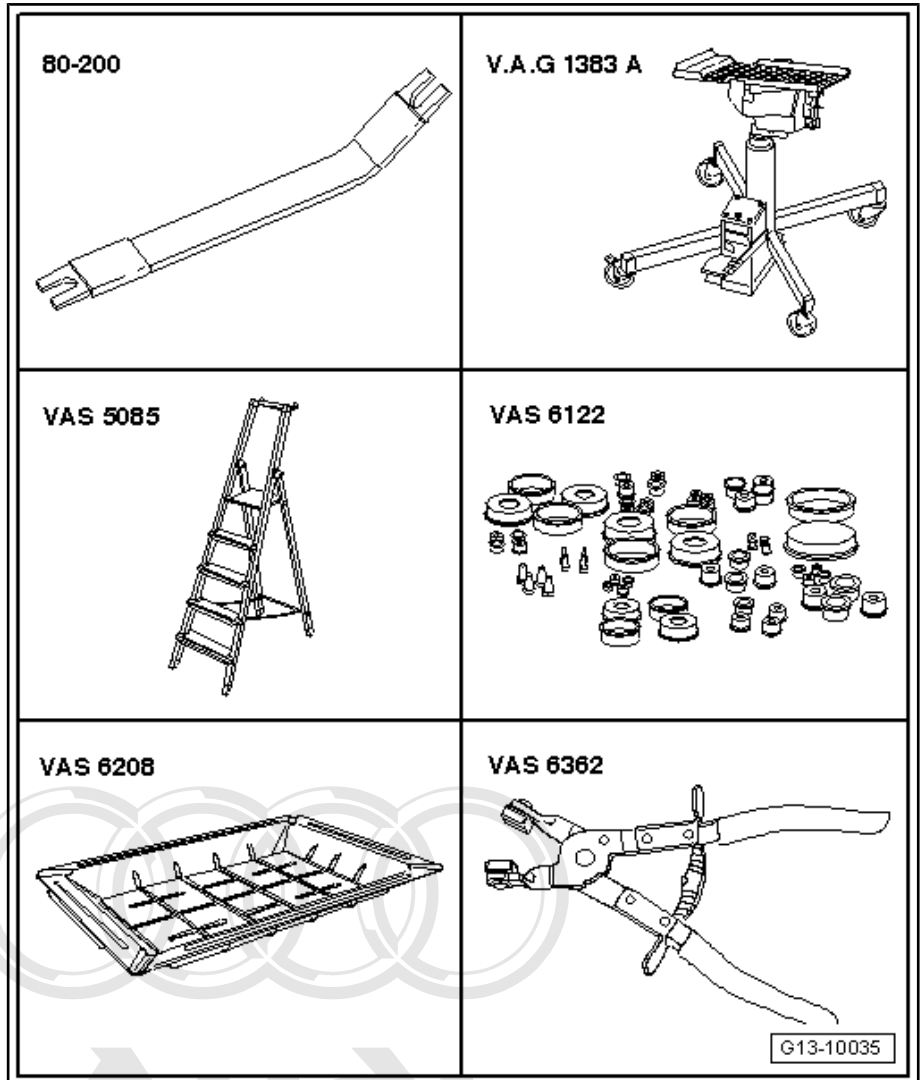
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10 – Removing and installing engine

1 Removing engine

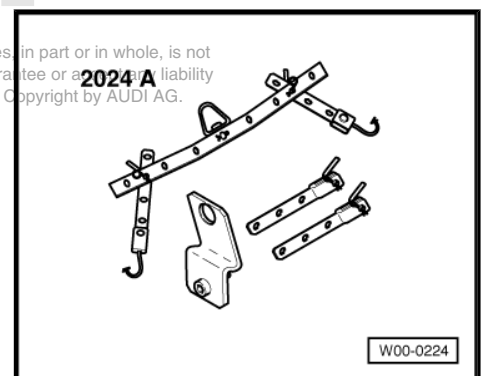
Special tools and workshop equipment required

- ◆ Removal lever - 80 - 200-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Stepladder - VAS 5085-
- ◆ Engine bung set - VAS 6122-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-



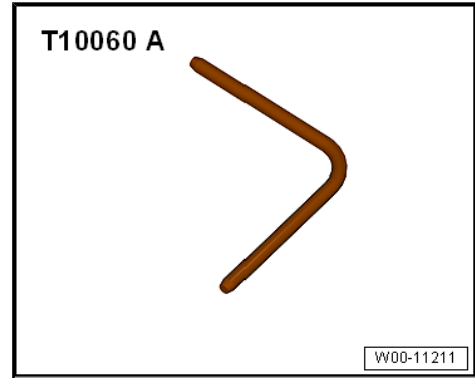
- ◆ Hook -2024 A /1- of lifting tackle - 2024 A-

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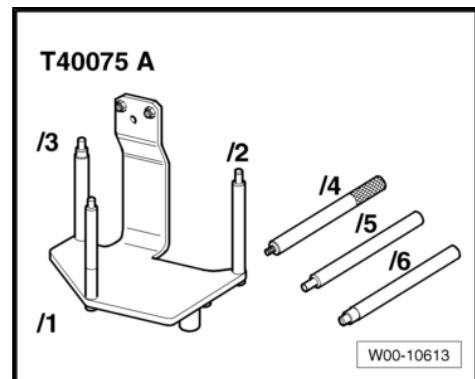




- ◆ Locking pin - T10060 A-



- ◆ Engine support - T40075 A-



- ◆ Bolt M8x40 with washer

- ◆ Nuts M10 (2x)

Procedure



Note

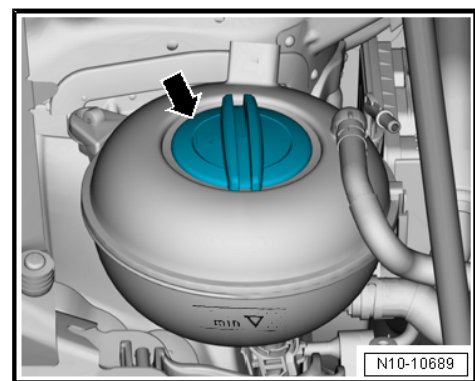
- ◆ *The engine is removed from underneath together with the gearbox.*
- ◆ *Fit cable ties in the original positions when installing.*



WARNING

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

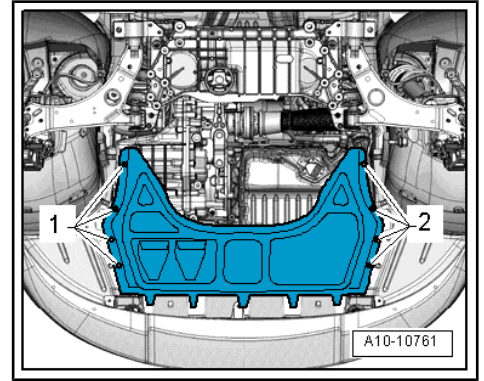
- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*



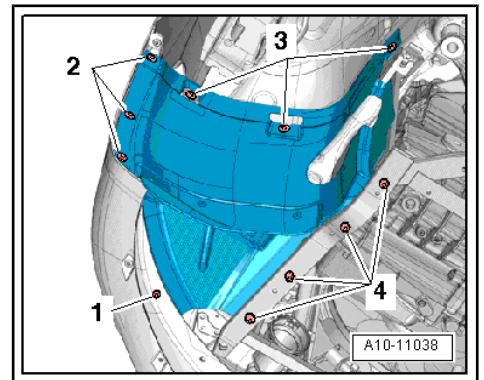
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– **Open filler cap -arrow- on coolant expansion tank**

- Remove both front wheels.
- Remove noise insulation ⇒ Rep. gr. 50 .



- Remove front left and front right wheel housing liners (front section) ⇒ Rep. gr. 66 .

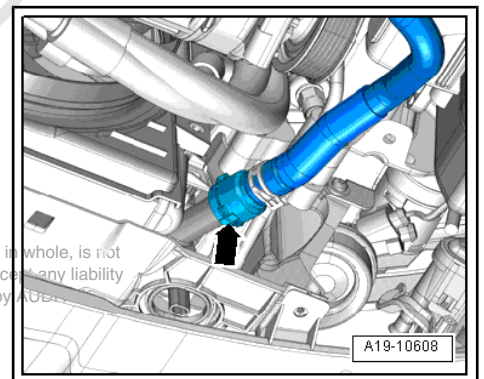
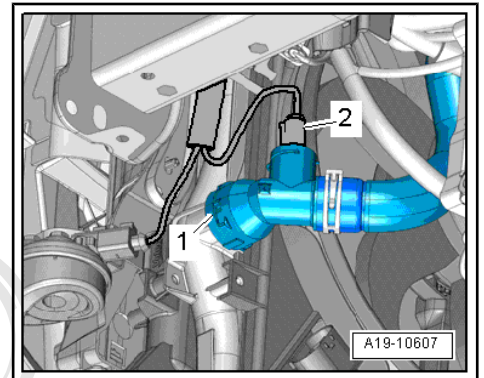


- Unplug electrical connector -2- at radiator outlet coolant temperature sender - G83- .

 **Note**

Collect drained coolant in a clean container for re-use or disposal.

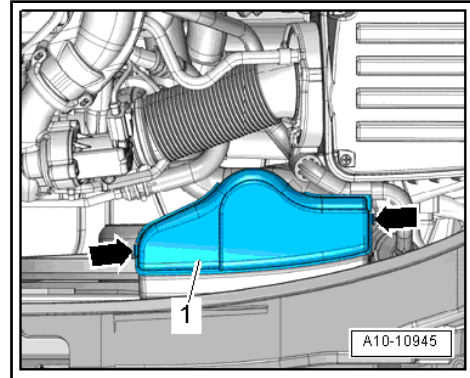
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Lift retaining clip, disconnect coolant hose -1- from radiator (bottom) and drain off coolant.
- Lift retaining clip, disconnect coolant hose -arrow- (bottom right) from water radiator for charge air cooling circuit and drain off remaining coolant.



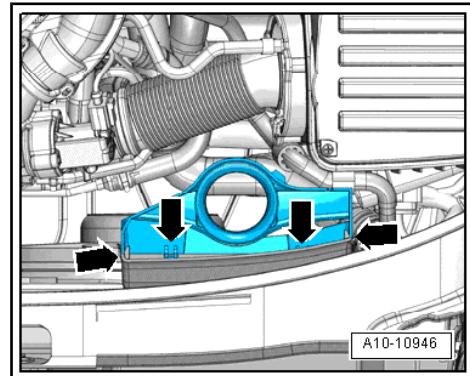
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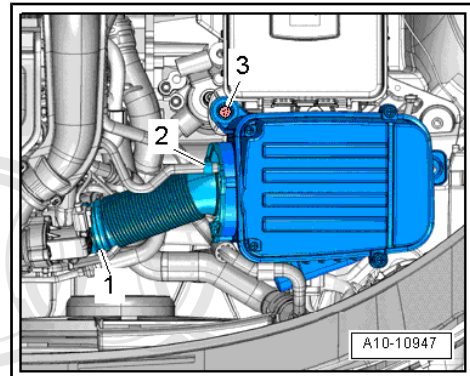
- Pull cover -1- off intake air duct (release clips on sides -arrows-).



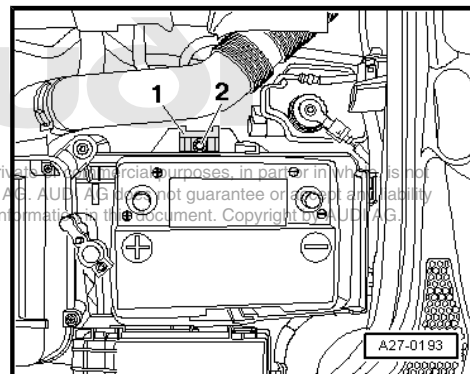
- Unclip air duct at the bottom by releasing clips -arrows-.
- Detach air duct at bottom together with air hose.



- Release hose clip and detach air hose -1- from turbocharger.
- Disconnect vacuum hose -2-.
- Unscrew bolt -3- and remove air cleaner housing.



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



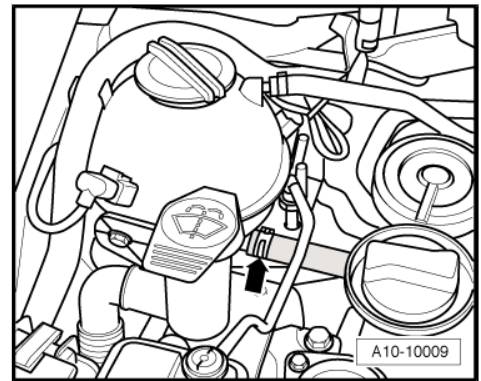
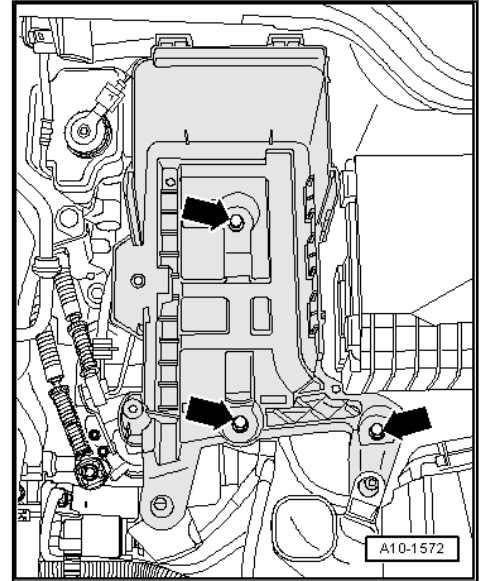
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- Unscrew bolts -arrows- and remove battery tray.

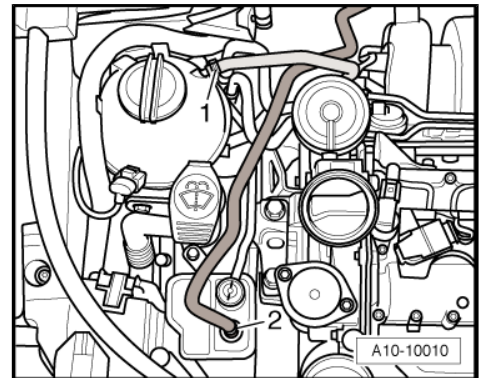


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- Detach coolant hose -arrow- from coolant expansion tank and guide downwards as far as possible to allow remaining coolant to drain off.
- Disconnect coolant hose -1- from coolant expansion tank.



- Disconnect vacuum hose -2- from activated charcoal filter and move hose clear.

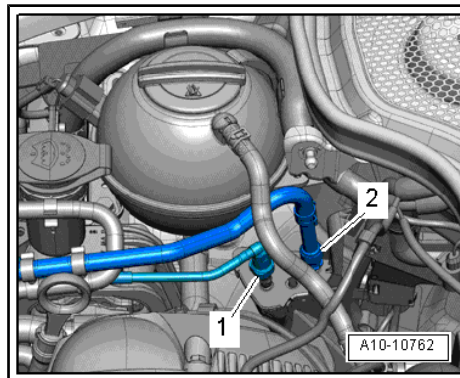


**WARNING**

The fuel system is pressurised.

Risk of injury as fuel may spray out.

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

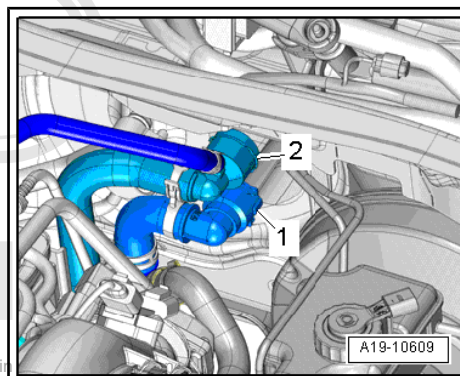


- Disconnect fuel supply line -2- (pull release ring).

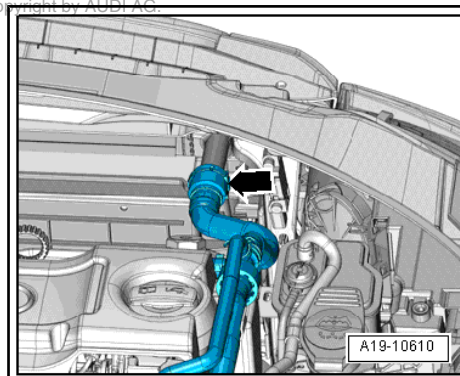
**Note**

Disregard -item 1-.

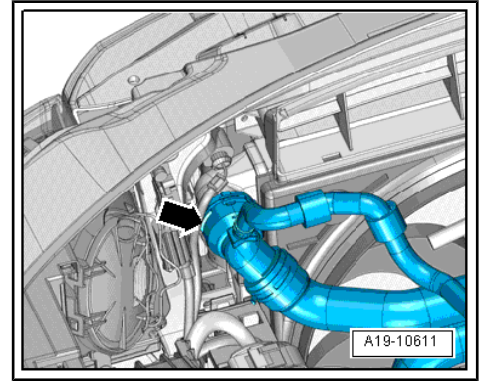
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Lift retaining clips and disconnect coolant hoses -1- and -2- from heat exchanger for heater.



- Lift retaining clip and disconnect coolant hose (top right) -arrow- from water radiator for charge air cooling circuit.



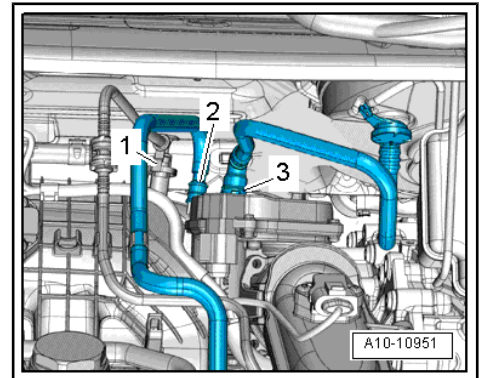
- Disconnect coolant hose -arrow- (top left) from radiator (pull out retaining clip).



- Press release tabs and disconnect vacuum line -3- from intake manifold.

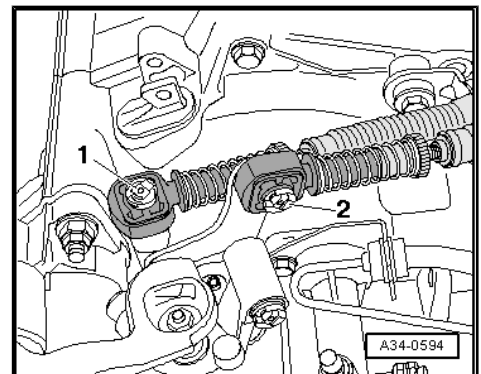
 Note

Disregard -items 1, 2-.

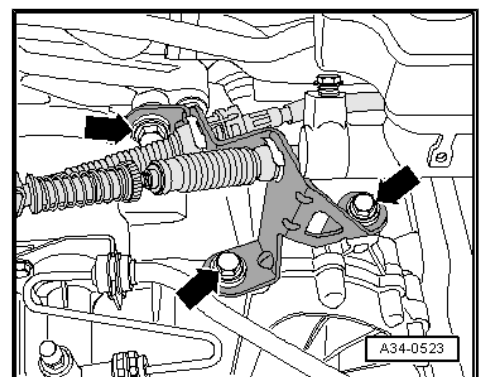


Vehicles with manual gearbox:

- Detach securing clips -1- and -2- on both selector cables.
- Detach cable end-pieces from gearbox selector lever and relay lever.



- Detach cable support bracket from gearbox -arrows- and place to one side.





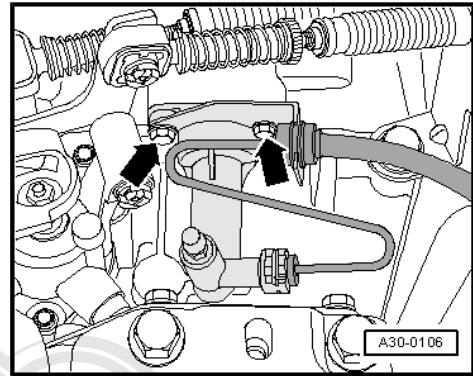
- Remove bolts -arrows- and place clutch slave cylinder to one side. Do not open pipes.



Caution

Avoid damage to clutch slave cylinder.

- ◆ *Do not operate clutch pedal with slave cylinder removed.*



Vehicles with dual clutch gearbox:

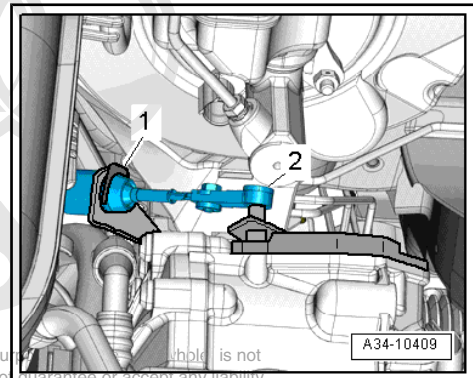
- Use removal lever - 80 - 200- to prise selector lever cable -2- off gearbox selector lever.
- Detach circlip -1- for selector lever cable.



Caution

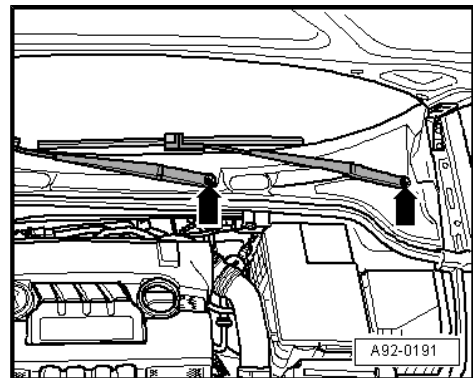
Risk of damage to selector lever cable.

- ◆ *Do not press the selector lever cable rearwards out of the cable support bracket. The selector lever cable is guided out of the cable support bracket at a later stage when lowering the engine/gearbox assembly.*

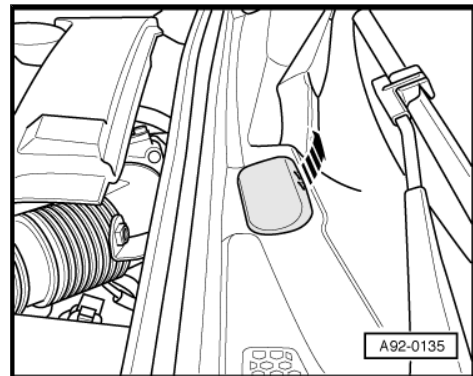


All vehicles (continued):

- Remove wiper arms → Electrical system; Rep. gr. 92 .



- Unclip washer jets -arrow-.
- Push washer jets through assembly opening back into plenum chamber, leaving hoses connected.

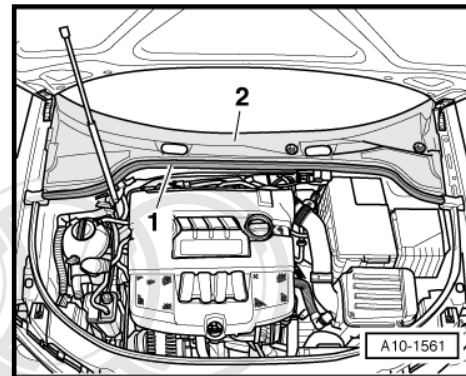


- Remove seal -1-.

Caution

Risk of damage to plenum chamber cover.

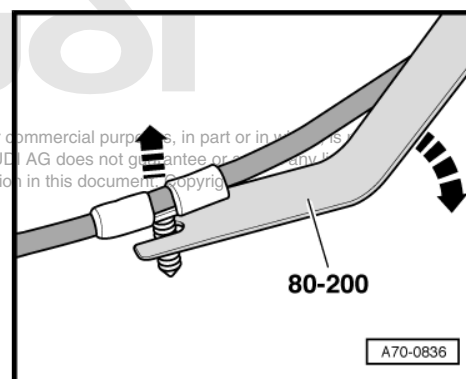
◆ *To avoid cracking the plenum chamber cover -2- during removal, apply a small amount of soap solution to the joint between the windscreen and the plenum chamber cover and pull the plenum chamber cover vertically up out of the windscreen surround, starting from the edge of the windscreen.*



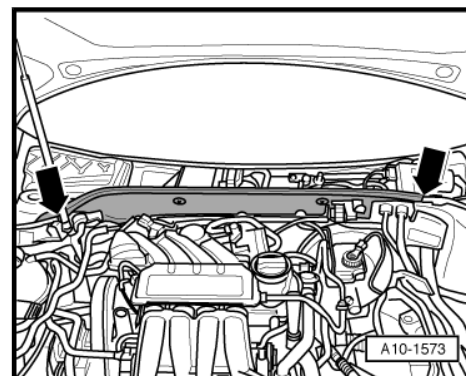
- Pull off plenum chamber cover -2-

Note

Use removal lever - 80 - 200- to lever out the wiring clips when performing the next work steps.



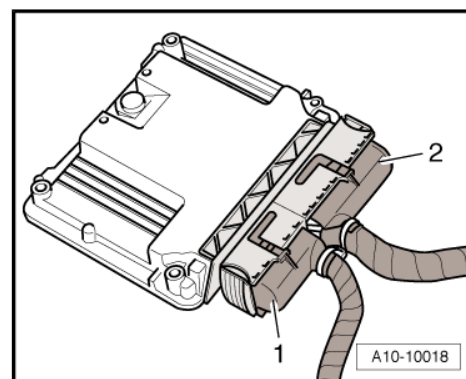
- Move clear engine wiring harness at rear of plenum chamber partition panel.
- Remove bolts -arrows- and detach plenum chamber partition panel.



- Remove engine control unit => Rep. gr. 24 .
- Unplug electrical connector -1- for engine wiring harness.

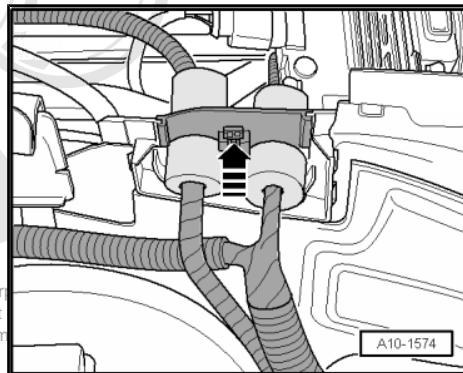
Note

Disregard -item 2-.



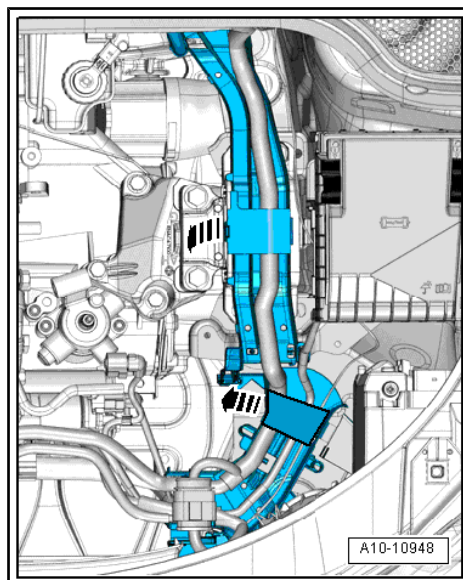


- Release wiring protector for engine wiring harness -arrow- and lift protector off.

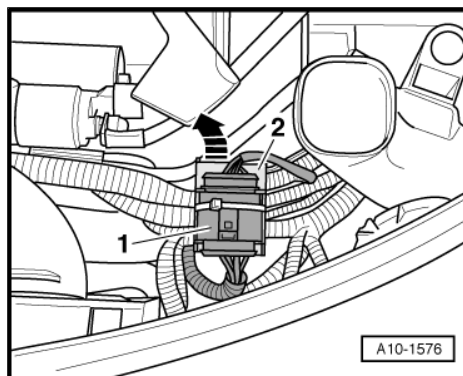


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- Open wiring duct brackets -arrows-.



- Move electrical connector -1- clear and disconnect.
- Open wiring duct bracket located below -2-.
- Remove wiring harness for engine control unit from wiring duct and place on engine.

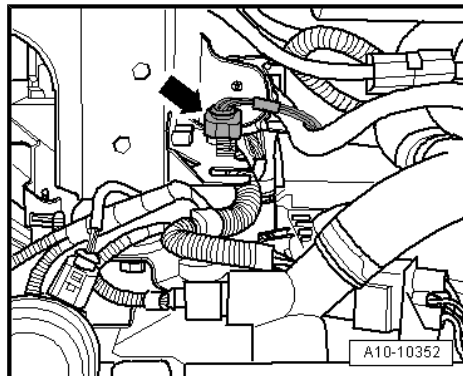


- Unplug electrical connector -arrow- at longitudinal member (bottom left).

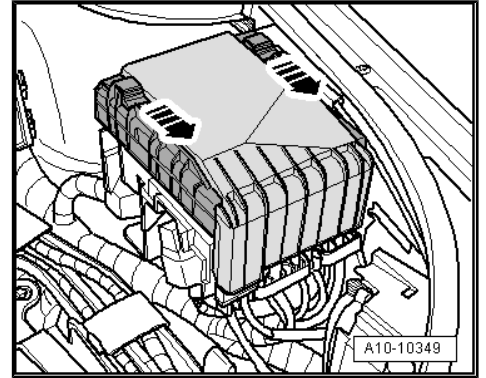


Note

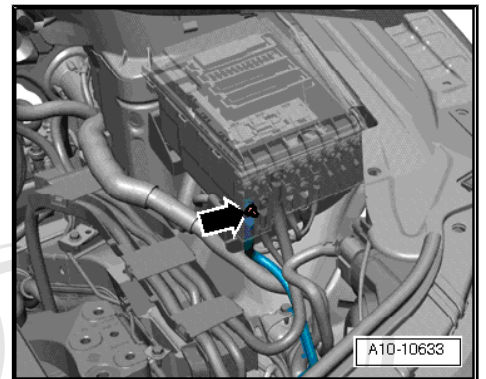
For illustration purposes, the installation position is shown from below.



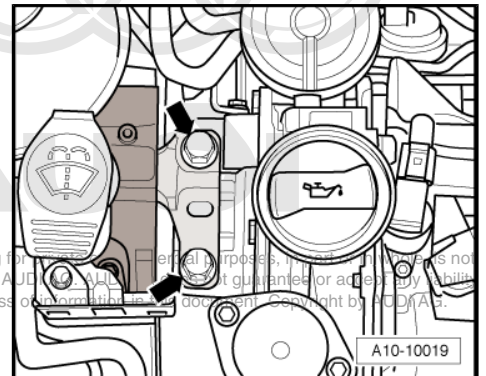
- Slide the two clips in the direction of the -arrows- and remove cover from electronics box in engine compartment.



- Remove nut -arrow-, detach terminal 30 wire from electronics box in engine compartment and move it clear.



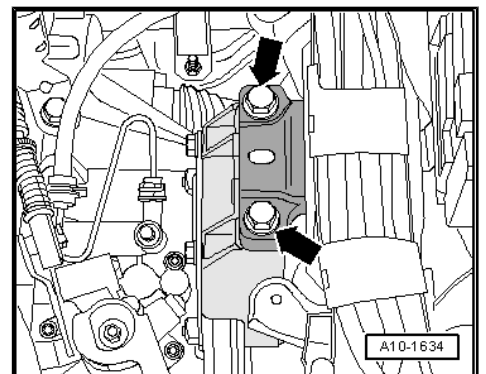
- Loosen bolts -arrows- of assembly mounting at engine approx. 2 turns.



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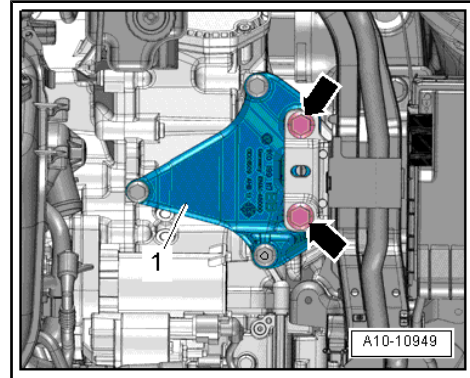
Vehicles with manual gearbox:

- Loosen bolts -arrows- securing gearbox mounting to gearbox support approx. 2 turns.



Vehicles with dual clutch gearbox:

- Loosen bolts -arrows- securing gearbox mounting to gearbox support -1- approx. 2 turns.



Vehicles with manual gearbox:

- Remove nut -1- and detach earth wire.

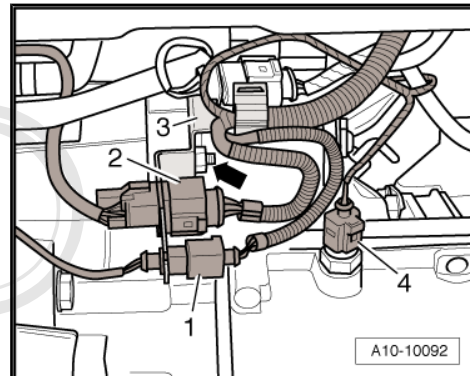
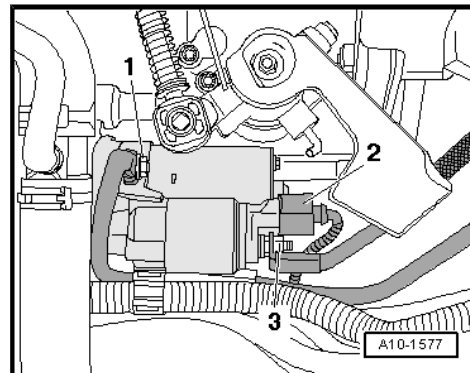


Note

On some versions the earth wire may be attached to the engine mounting.

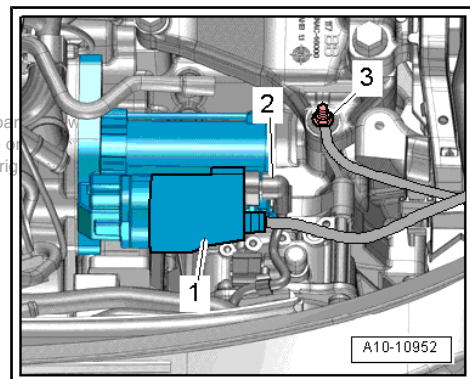
- Remove nut -3-, detach electrical wiring and move clear.
- Unplug electrical connector -2- and move clear.
- Unplug electrical connector -2- for Lambda probe - G39- .
- Unplug electrical connector -4- for reversing light switch - F4- .
- Move engine wiring harness clear at bracket -3-.
- Unscrew nut -arrow- and detach bracket with electrical wiring from stud.

1 - Electrical connector for Lambda probe after catalytic converter - G130-

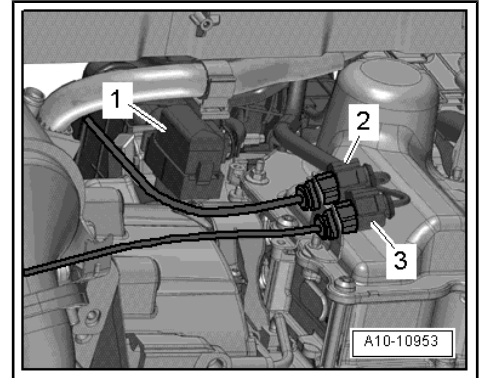


Vehicles with dual clutch gearbox:


- Unplug electrical connector -2-.
- Push back protective cover -1- and unscrew "B+" cable at starter solenoid switch.
- Remove nut -3- for earth wire.



- Remove electrical connector -3- for Lambda probe after catalytic converter - G130- from bracket and unplug connector.
- Unplug electrical connector -2- for Lambda probe - G39- and -1- for dual clutch gearbox and move connectors clear.
- Move electrical wiring clear at gearbox.

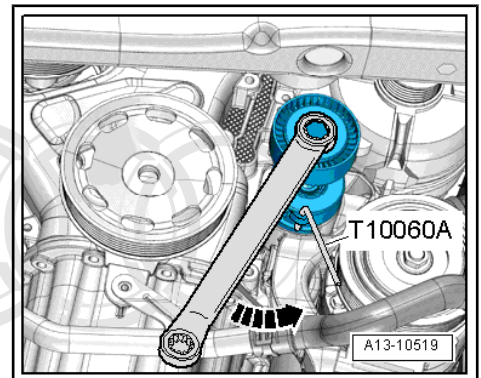


All vehicles (continued):


 **Caution**

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

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

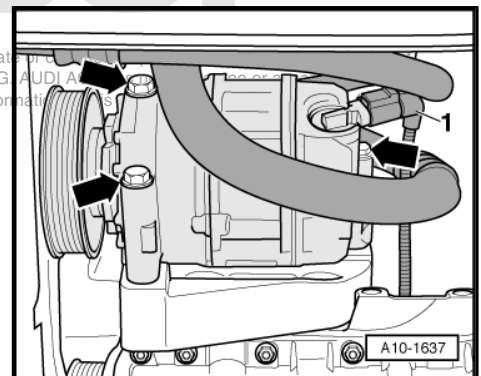


- To slacken poly V-belt, turn tensioner in anti-clockwise direction -arrow-.
- Use locking pin - T10060 A- to lock poly V-belt tensioner and detach poly V-belt.
- Unplug electrical connector -1- for air conditioner compressor regulating valve - N280- at air conditioner compressor.


 **WARNING**

Risk of injury caused by refrigerant.

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



- Remove bolts -arrows- for air conditioner compressor.

 **Caution**

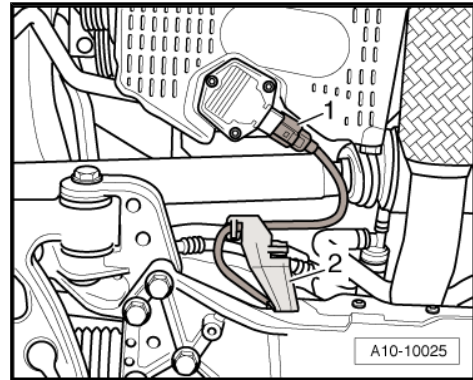
Danger of damage to refrigerant lines and hoses.

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

- Tie up air conditioner compressor together with refrigerant hoses to longitudinal member (refrigerant hoses remain connected).



- Unplug electrical connector -1- at oil level and oil temperature sender - G266- .
- Unclip bracket -2- for wire to oil level and oil temperature sender - G266- from subframe.

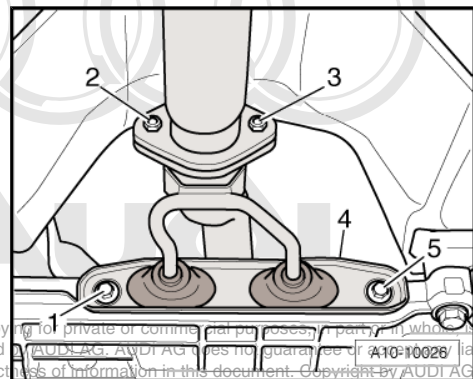
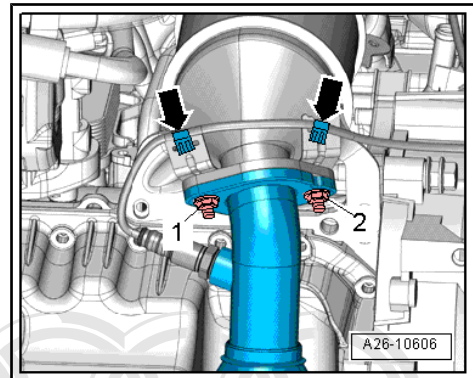


Caution

Risk of damage to flexible joint.

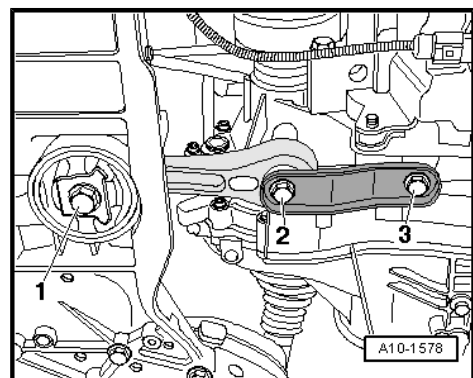
◆ **Do NOT bend flexible joint in front exhaust pipe more than 10°.**

- Remove nuts -1- and -2-.
- Move clear electrical wiring for Lambda probe - G39- -arrows-.
- Remove nuts -2- and -3- and disconnect exhaust system.
- Remove bolts -1- and -5-.
- Pull off bracket -4- for exhaust system from pins on front exhaust pipe.
- Detach front exhaust pipe.

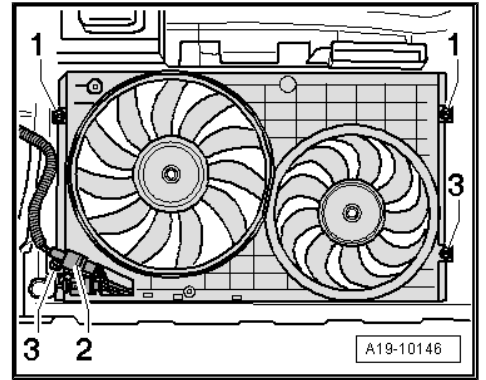


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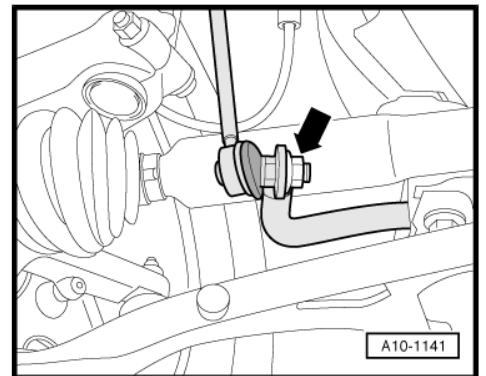
- Remove bolts -1, 2, 3- and remove pendulum support.



- Unplug electrical connector -2-.
- Remove bolts -1- and -3- and take off radiator cowl downwards.



- Remove nuts -arrow- on both sides and detach coupling rods from anti-roll bar.



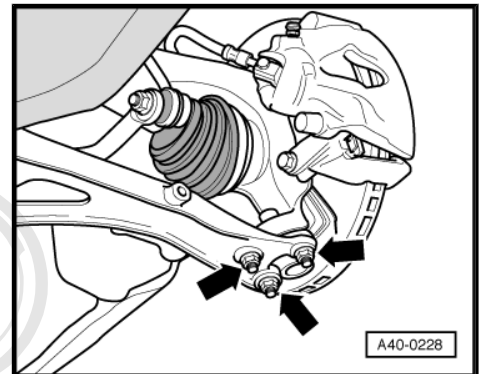
- Remove nuts -arrows- for swivel joint on both sides.
- If fitted, loosen nut on bracket for front left vehicle level sender -G78-.
- Detach swivel joints from wishbones.

Vehicles with manual gearbox:

- Unbolt drive shafts (left and right) from gearbox flange shafts.

Vehicles with dual clutch gearbox:

- Use assembly lever to press drive shafts (left and right) off gearbox flange shafts.



All vehicles (continued):

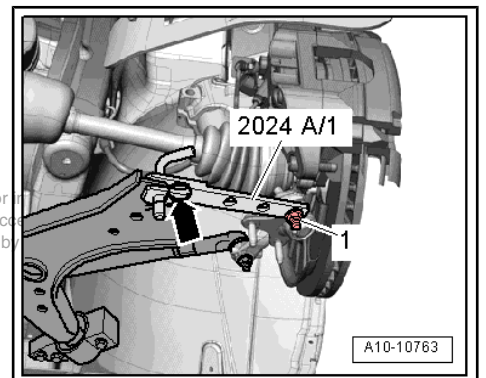
- Swing suspension strut (left-side) outwards and support with extension -2024 A /1- as shown in illustration.

 **WARNING**

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Accident risk from loose components of support bracket.

◆ **Secure retaining pin and swivel joint with locking pin -arrow- and nut -1-.**



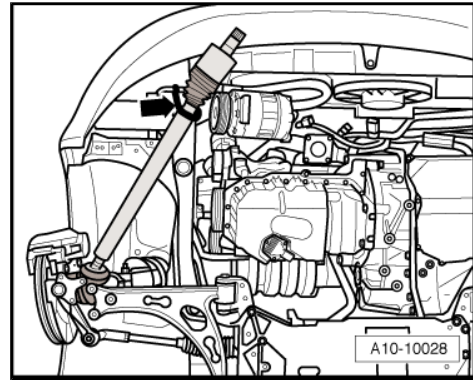


- Pivot drive shaft (right-side) forwards; to do so, push engine/ gearbox assembly slightly forwards.
- Tie up drive shaft to longitudinal member -arrow-.



Note

Take care not to damage the surface coating of the drive shaft.

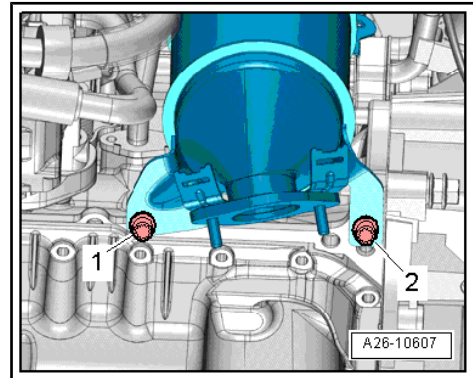


- Remove bolt -1-.



Note

Disregard -item 2-.

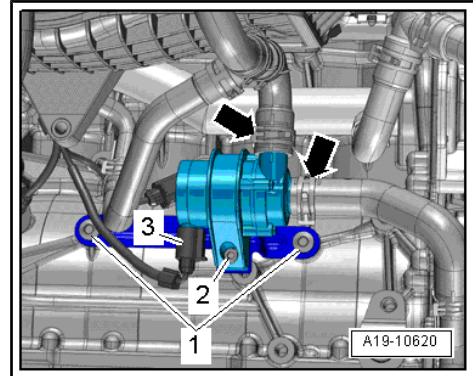


- Remove bolts -1- and move coolant circulation pump - V50- clear to one side.

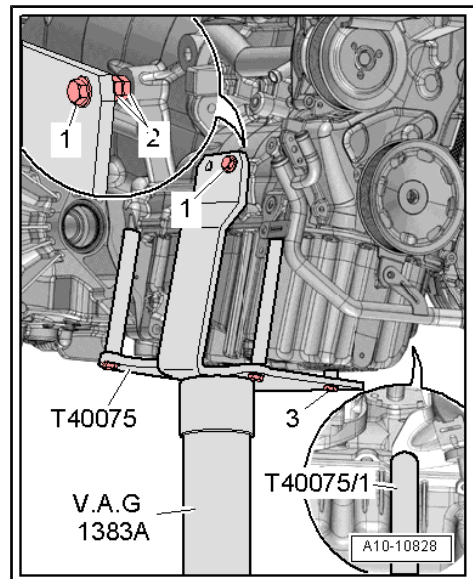


Note

Disregard items marked -2, 3- and -arrows-.



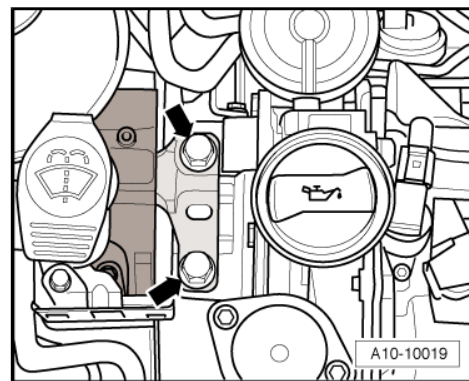
- Remove bolt -3- for support -T40075/1- on engine support - T40075-
- Fit support -T40075/1- into vacant threaded hole for catalytic converter.
- Attach engine support - T40075- to engine as shown in illustration and secure with bolt -3- to support -T40075/1- .
- Fit engine support - T40075- to rear of engine with a bolt M8x45 -item 1-, a washer and two nuts M10 -item 2- placed in between and secure to cylinder block (tightening torque 20 Nm).
- Fit engine support - T40075- onto engine and gearbox jack - V.A.G 1383 A- .



i Note

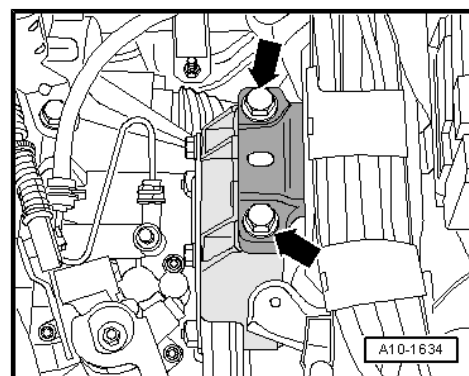
To unscrew bolts for assembly mounting use stepladder - VAS 5085- .

- Remove bolts -arrows- of assembly mounting at engine.



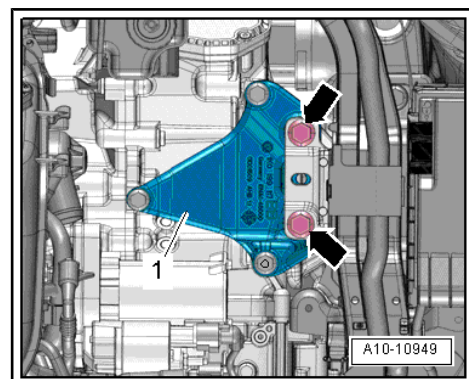
Vehicles with manual gearbox:

- Remove bolts -arrows- securing gearbox mounting to gearbox support.



Vehicles with dual clutch gearbox:

- Remove bolts -arrows- securing gearbox mounting to gearbox support -1-.



! Caution

Risk of damage to selector lever cable.

- ◆ *Guide the selector lever cable out of the cable support bracket when lowering the engine/gearbox assembly.*
- ◆ *Take care not to bend or kink selector lever cable.*

All vehicles (continued):

! 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 out engine/gearbox assembly with sub-frame from engine compartment when lowering.*



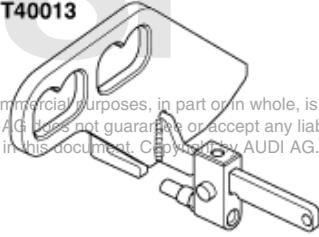
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- Pull engine/gearbox assembly as far forward as possible, and lower gradually.



2 Separating engine and manual gearbox

Special tools and workshop equipment required

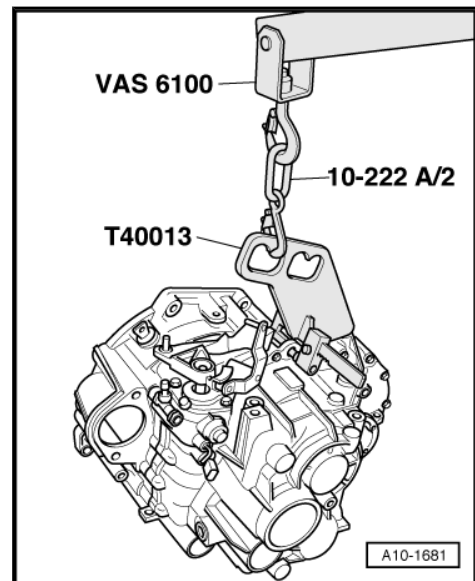
- ◆ Hooks - 10 - 222 A /2-
- ◆ Workshop hoist - VAS 6100-
- ◆ Lifting tackle - T40013-

<p style="text-align: center;">10-222 A/2</p> 	<p style="text-align: center;">VAS 6100</p> 
<p style="text-align: center;">T40013</p> 	
	<p>G34-0029</p>

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Procedure

- Engine/gearbox assembly removed and attached to engine support - T40075- .
- Attach lifting tackle - T40013- to gearbox and close lock.
- Attach workshop hoist - VAS 6100- with hooks - 10 - 222 A / 2- to the lifting tackle.

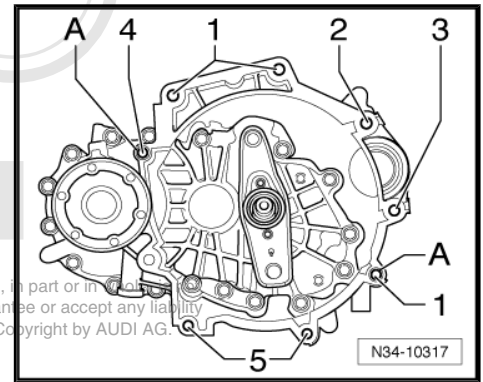


- Unscrew bolts -2- and -3- and remove starter.
- Remove bolts -1, 4, 5- securing gearbox to engine.

 **Note**

Disregard -item A-.

- Detach gearbox from engine.



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3 Separating engine and dual clutch gearbox

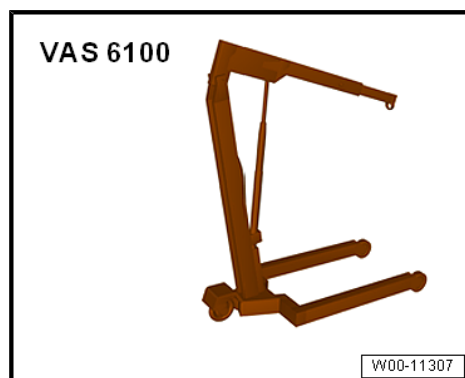
Special tools and workshop equipment required

- ◆ Shackle - 10 - 222 A /12-

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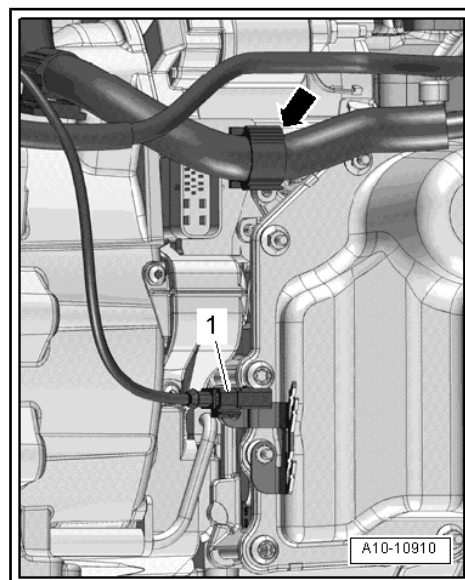


- ◆ Workshop hoist - VAS 6100-

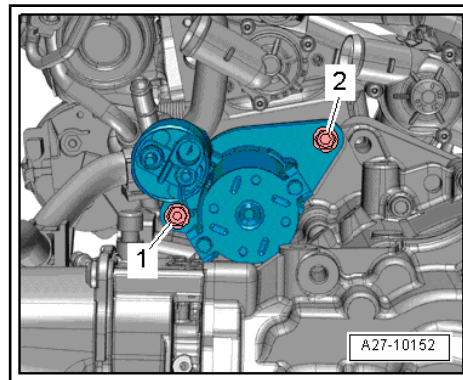


Procedure

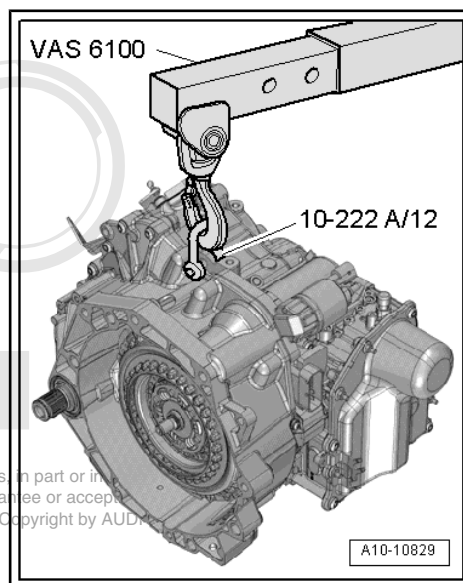
- Engine/gearbox assembly removed and attached to engine support - T40075- .
- Move electrical connector -1- for Lambda probe - G39- clear at bracket.
- Move electrical wiring harness clear -arrow-.



- Unscrew bolts -1- and -2- and remove starter from gearbox.



- Secure gearbox to workshop hoist - VAS 6100- using shackle - 10 - 222 A /12- .



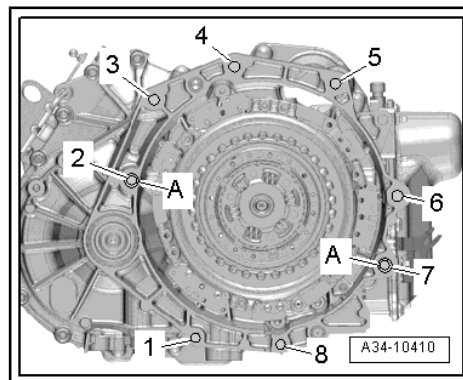
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- Remove bolts -1 ... 8- securing gearbox to engine.

i Note

Disregard -item A-.

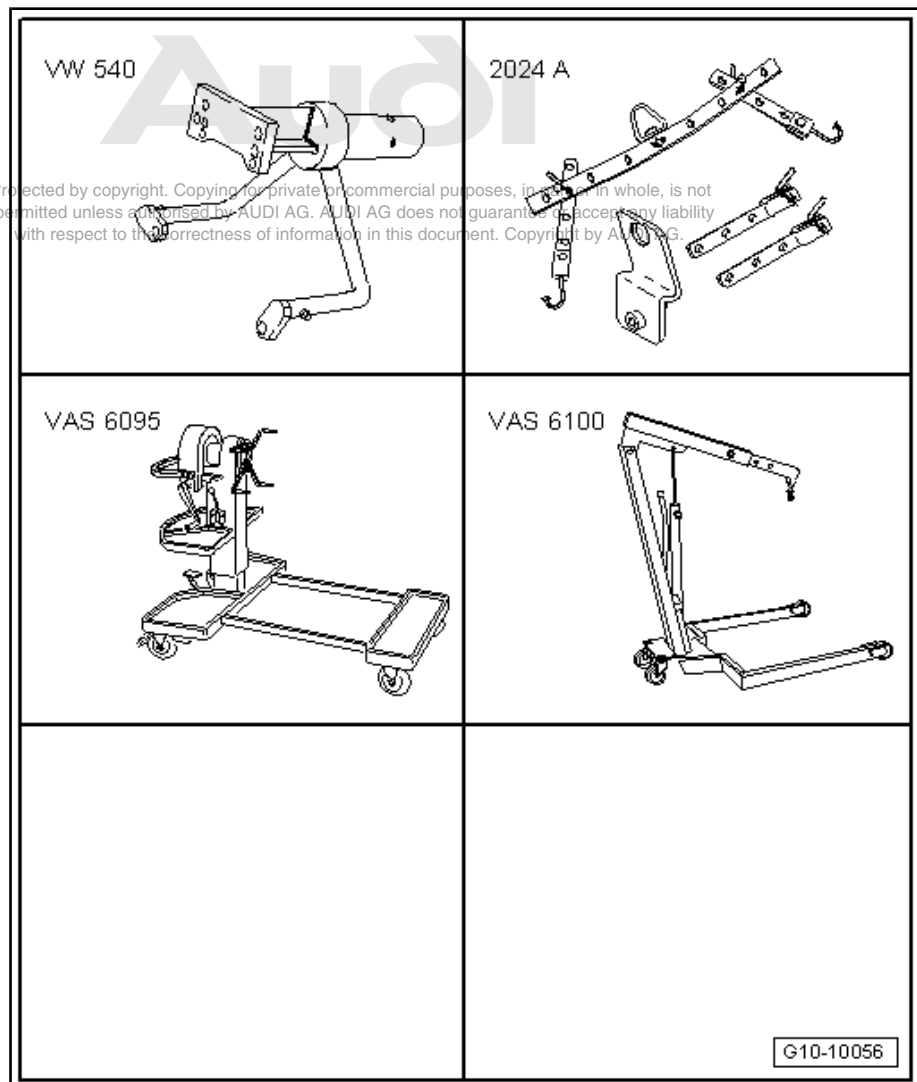
- Detach gearbox from engine.



4 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- ◆ Engine and gearbox support - VW 540-
- ◆ Lifting tackle - 2024 A-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Workshop hoist - VAS 6100-



Procedure

- Gearbox detached from engine
⇒ [“2 Separating engine and manual gearbox”, page 24](#) or
⇒ [“3 Separating engine and dual clutch gearbox”, page 26](#) .
- Remove flywheel ⇒ [page 53](#) .

- To transport engine, engage lifting tackle - 2024 A- on engine and workshop hoist - VAS 6100- .

 Note

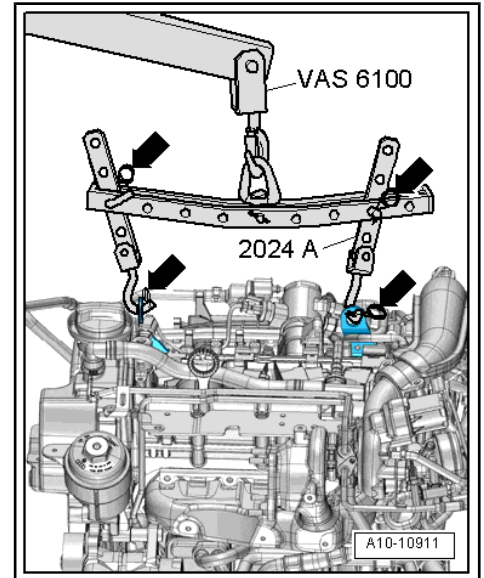
To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks must be positioned as shown.



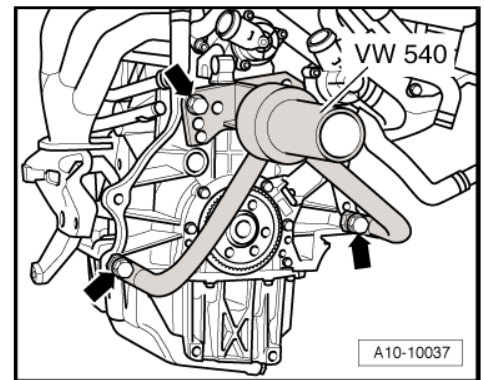
WARNING

Accident risk from loose components of support bracket.

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



- Secure engine with engine and gearbox support - VW 540- to engine and gearbox support - VAS 6095- -arrows-.



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5 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 degreased parts.*
- ◆ *Tolerance for tightening torques: $\pm 15\%$.*

Assembly mountings ⇒ page 35

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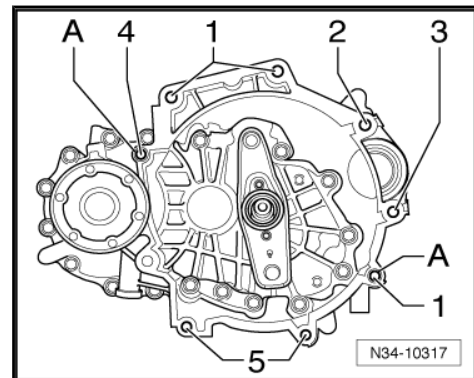
Further tightening torques

Component		Nm
Bolts/nuts	M6	9
	M7	15
	M8	22
	M10	40
	M12	65

Securing manual gearbox to engine

Item	Bolt	Nm
1	M12x65	80
2 ¹⁾	M12x135	80
3 ¹⁾	M12x150	80
4	M12x80	80
5	M10x50	40
A	Dowel sleeves for centralising	

- ¹⁾ Also for starter to gearbox



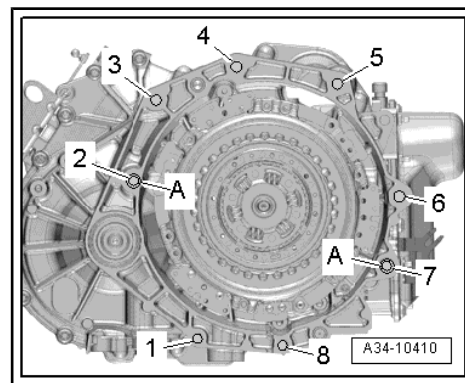
Securing dual-clutch gearbox to engine

Item	Bolt	Nm
1, 8	M10x50	40
2, 6, 7	M12x65	80
3, 4, 5	M12x55	80
A	Dowel sleeves for centralising	

Procedure

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

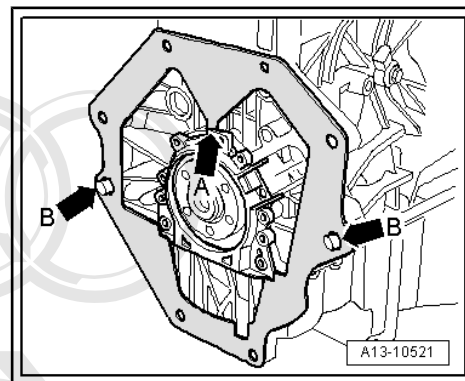
- Engine attached to engine support - T40075-



Note

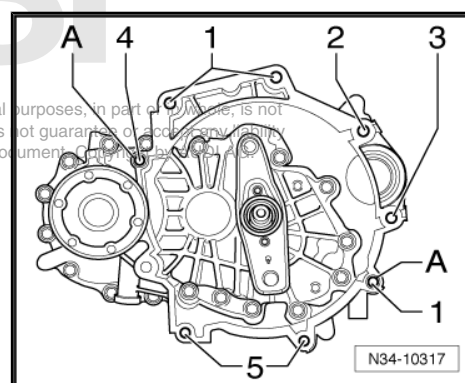
- ◆ Renew seals, gaskets and self-locking nuts and bolts.
- ◆ Renew the bolts tightened with specified tightening angle.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue* .
- ◆ Fit cable ties in the original positions when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

- Ensure that intermediate plate is engaged on sealing flange -arrow A- and pushed onto dowel sleeves -arrows B-.
- Install flywheel ⇒ [page 53](#) .



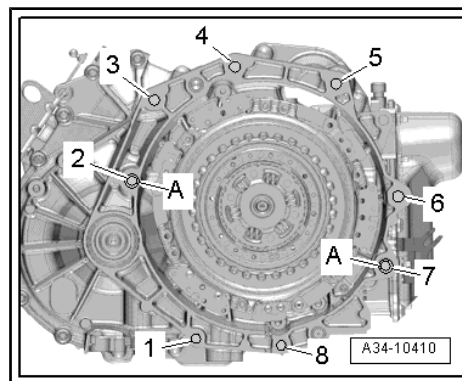
Vehicles with manual gearbox:

- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Remove needle bearing in crankshaft if fitted ⇒ [page 68](#) .
- Renew clutch release bearing if worn ⇒ Rep. gr. 30 .
- Install clutch plate ⇒ Rep. gr. 30 .
- Clean input shaft splines and hub splines. Remove corrosion and apply only a very thin coating of grease to splines. For grease, see ⇒ *Electronic parts catalogue* . Remove any excess grease.



Vehicles with dual clutch gearbox:

- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Install needle bearing if not fitted in crankshaft ⇒ [page 68](#) .

**All vehicles (continued):**

- Secure gearbox to engine.
- Install starter ⇒ Electrical system; Rep. gr. 27 .

Vehicles with dual clutch gearbox:

- Guide selector lever cable into cable support bracket when lifting engine/gearbox assembly.

**Note**

Take care not to bend or kink selector lever cable.

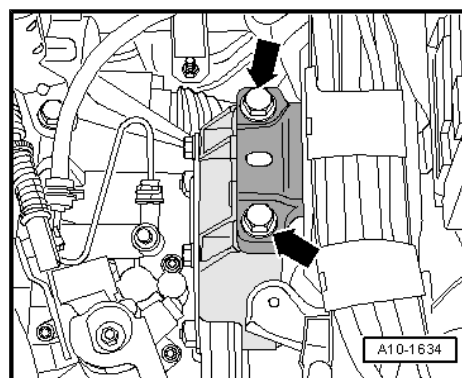
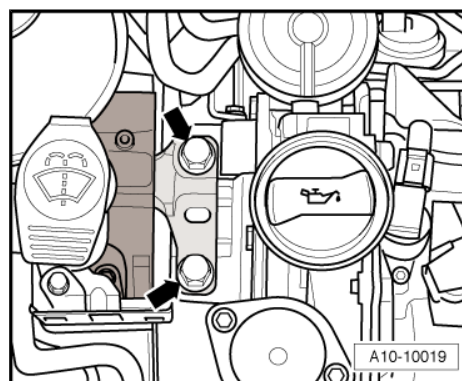
All vehicles (continued):

- Guide engine/gearbox assembly into body.
- Tighten bolts -arrows- securing engine mounting to engine support initially hand-tight.

Vehicles with manual gearbox:

- Tighten bolts -arrows- securing gearbox mounting to gearbox support initially hand-tight.

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Vehicles with dual clutch gearbox:

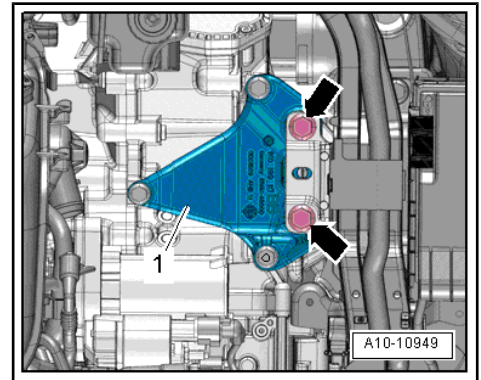
- Tighten bolts -arrows- securing gearbox mounting to gearbox support -1- initially hand-tight.

All vehicles (continued):

Note

The bolts are tightened to final torque only after adjusting the assembly mountings ⇒ [page 35](#) .

- Remove engine support - T40075- from engine.
- Install coolant circulation pump - V50- ⇒ [page 167](#) .
- Install drive shafts, swivel joints and anti-roll bar ⇒ Rep. gr. 40 .
- Install radiator cowl ⇒ [page 188](#) .



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- Install pendulum support ⇒ [page 35](#) .
- Install exhaust system and align free of stress ⇒ [page 226](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt ⇒ [page 42](#) .
- Adjust assembly mountings ⇒ [page 35](#) .
- Install engine control unit ⇒ Rep. gr. 24 .
- Install wiper arms ⇒ Electrical system; Rep. gr. 92 .

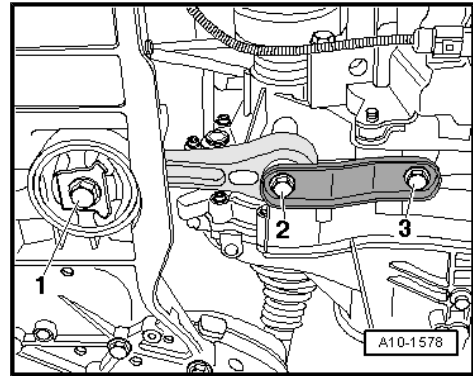
Vehicles with manual gearbox:



Caution

Avoid damage to clutch slave cylinder.

- ◆ *Do not operate clutch pedal with slave cylinder removed.*



- Install clutch slave cylinder ⇒ Rep. gr. 30 .
- Install and adjust gear selector cable and gate selector cable ⇒ Rep. gr. 34 .

Vehicles with dual clutch gearbox:

- Install selector lever cable ⇒ Rep. gr. 34 .

All vehicles (continued):

- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install battery tray and battery ⇒ Electrical system; Rep. gr. 27 .
- Install air cleaner housing ⇒ Rep. gr. 24 .
- Check oil level ⇒ Maintenance ; Booklet 808 .



Caution

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

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



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 160](#) .
- Install wheel housing liners ⇒ Rep. gr. 66 .
- Fit front wheels ⇒ Rep. gr. 44 .
- Install noise insulation panels ⇒ Rep. gr. 66 .
- After renewing engine, misfire adaption must be reset. To do so, select **01 - Reset adaptions misfires in Guided Functions** mode of ⇒ **Vehicle diagnostic tester**.

6 Assembly mountings

⇒ [“6.1 Exploded view - assembly mountings”, page 35](#)

⇒ [“6.2 Checking adjustment of assembly mountings \(engine/gearbox mountings\)”, page 36](#)

⇒ [“6.3 Adjusting assembly mountings”, page 37](#)

6.1 Exploded view - assembly mountings

1 - Gearbox support

2 - Bolt

- Gearbox support to gearbox
- Tightening torque ⇒ Rep. gr. 34

3 - Bolt

- Gearbox support to gearbox
- Tightening torque ⇒ Rep. gr. 34

4 - Engine mounting

5 - Bolt

- Engine mounting to body
- Renew
- 40 Nm + turn 90° further

6 - Bracket for activated charcoal filter

7 - Bolt

- 9 Nm

8 - Nut

- 9 Nm

9 - Bolt

- Connecting bracket to body
- Renew
- 20 Nm + turn 90° further

10 - Bolt

- Connecting bracket to engine mounting
- Renew
- 20 Nm + turn 90° further

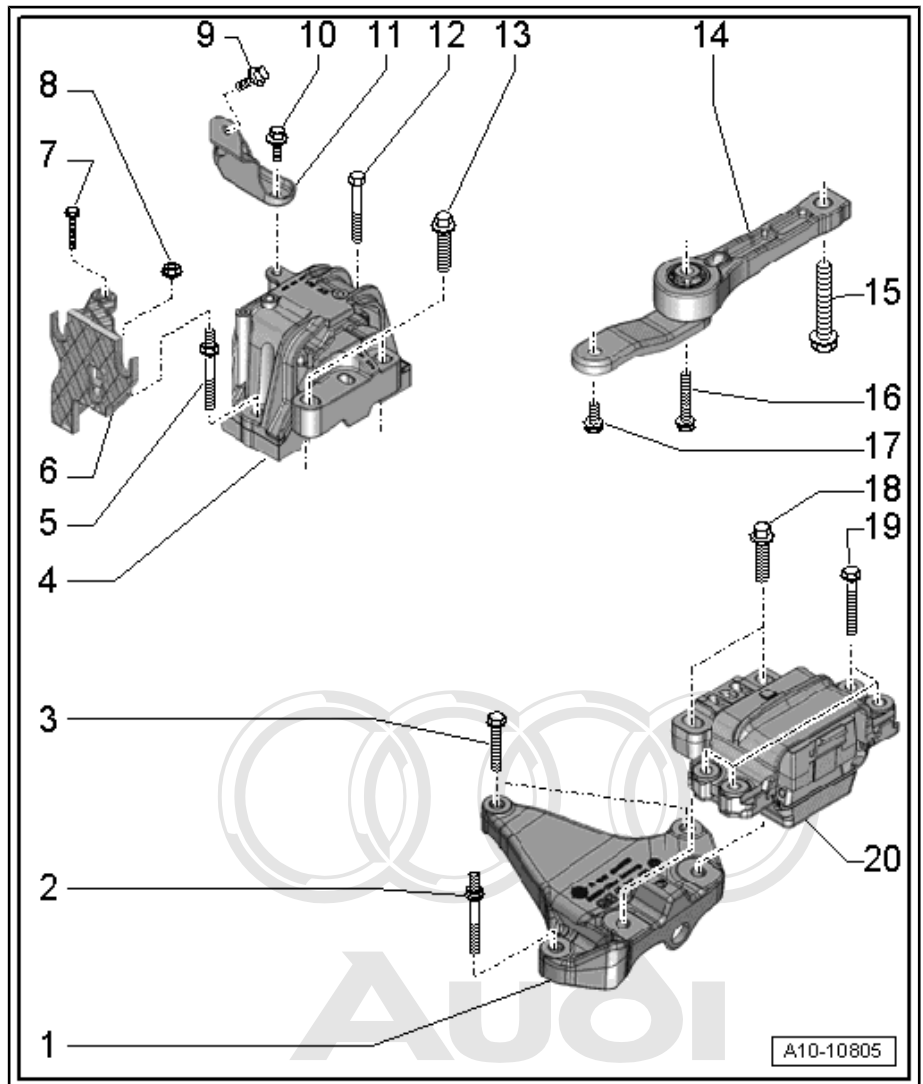
11 - Connecting bracket

12 - Bolt

- Engine mounting to body
- Renew
- 40 Nm + turn 90° further

13 - Bolt

- Engine mounting to timing chain cover



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- Renew
- 60 Nm + turn 90° further

14 - Pendulum support

15 - Bolt

- Pendulum support to subframe
- Renew
- 100 Nm + turn 90° further

16 - Bolt

- Pendulum support to gearbox
- Renew
- 40 Nm + turn 90° further

17 - Bolt

- Pendulum support to gearbox
- Renew
- 40 Nm + turn 90° further

18 - Bolt

- Gearbox mounting to gearbox support
- Tightening torque ⇒ Rep. gr. 34

19 - Bolt

- Gearbox mounting to body
- Tightening torque ⇒ Rep. gr. 34

20 - Gearbox mounting

- Illustration shows version for dual clutch gearbox



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6.2 Checking adjustment of assembly mountings (engine/gearbox mountings)

Procedure

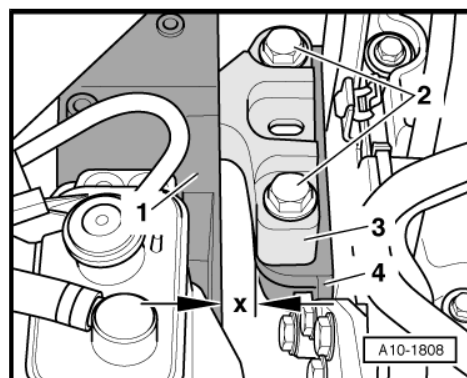
- Check distances at mounting (right-side) for engine and gearbox:
- The two bolt heads -2- must be parallel with edge of support arm -3- for engine mounting.
- There must be a distance of -x- = 12 mm between engine mounting -1- and timing chain cover -4-.



Note

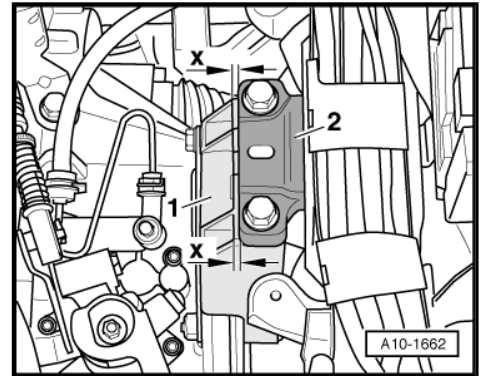
Distance -x- = 12 mm can also be checked with a metal rod of suitable size, or similar.

- If the distance measured is too large or small, the assembly mountings must be adjusted ⇒ [page 37](#).

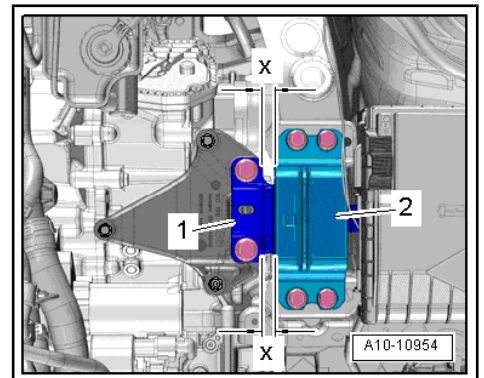


Vehicles with manual gearbox:

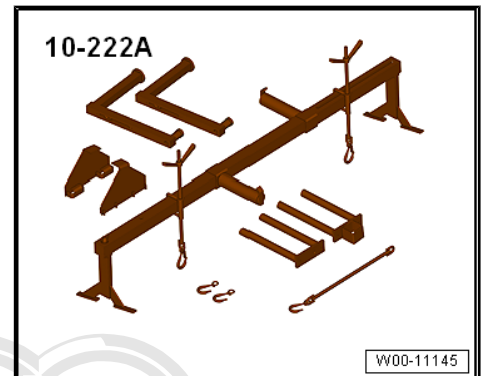
- Ensure that the edges of the support arm -2- (on the gearbox assembly mounting) and gearbox support -1- are parallel.
- Dimension -x- must be identical on both sides.

**Vehicles with dual clutch gearbox:**

- Ensure that the edges of the support arm -2- (on the gearbox assembly mounting) and gearbox support -1- are parallel.
- Dimension -x- must be identical on both sides.

**6.3 Adjusting assembly mountings****Special tools and workshop equipment required**

- ◆ Support bracket - 10 - 222 A-

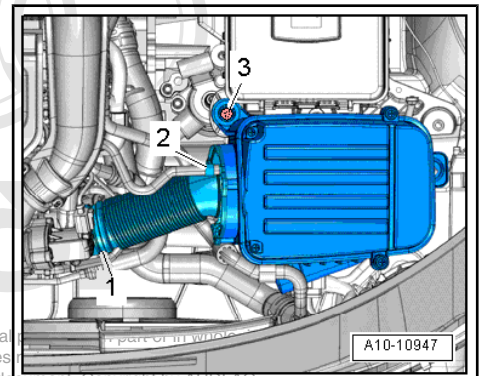
**Procedure**

- Tightening torques ⇒ [page 35](#)
- Remove air cleaner housing ⇒ Rep. gr. 24 .

**Caution**

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

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



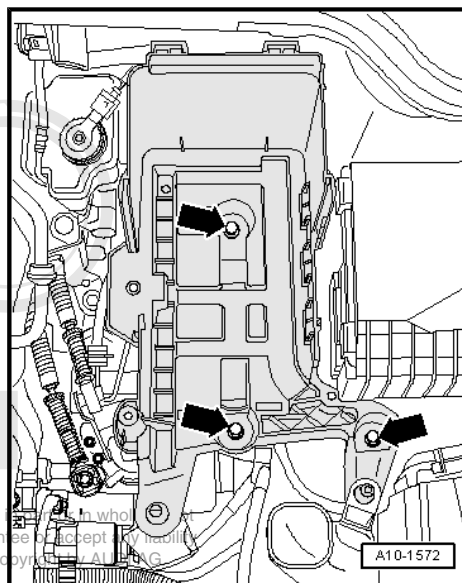
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- Remove battery ⇒ Electrical system; Rep. gr. 27 .
- Unscrew bolts -arrows- and remove battery tray.

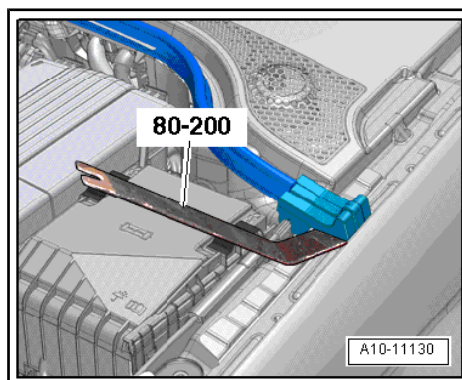


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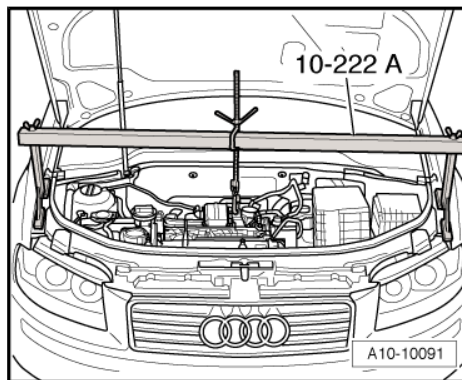
Vehicles from 06.2008 onwards:

- Lever off clip of sealing element with removal lever - 80 - 200- and fold open sealing element.

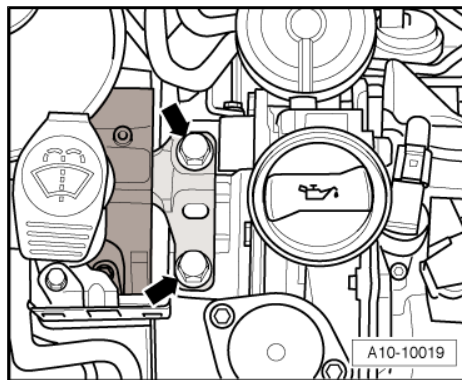


All vehicles (continued):

- Position support bracket - 10 - 222 A- on bolted flanges of wing panels (vehicles up to 05.2008) or body flanges (vehicles from 06.2008 onwards).
- Hook spindle of lifting tackle onto left-side engine lifting eye.
- Take up weight of engine with the spindle, but do not lift.

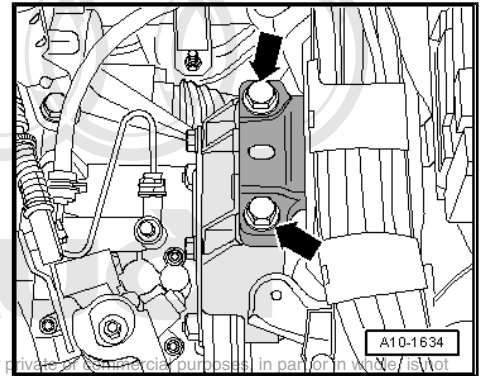


- Remove bolts -arrows- of assembly mounting at engine.



Vehicles with manual gearbox:

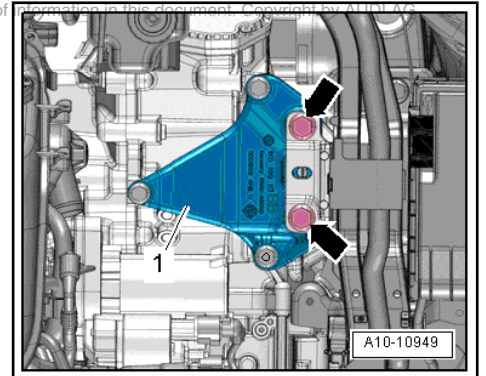
- Remove bolts -arrows- securing gearbox mounting to gearbox support.



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Vehicles with dual clutch gearbox:

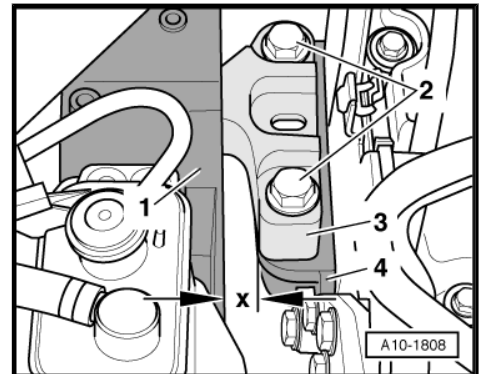
- Remove bolts -arrows- securing gearbox mounting to gearbox support -1-.



All vehicles (continued):

- Renew each of the 4 or 5 bolts in turn (if not already done when installing engine) and hand-tighten.
- Slacken bolts on left and right-hand support arms by about two turns each.

- Using an assembly lever, adjust engine/gearbox assembly between engine mounting -1- and support arm -3- for engine mounting until the specifications listed below are obtained:
 - The two bolt heads -2- must be parallel with edge of support arm -3- for engine mounting.
 - There must be a distance of -x- = 12 mm between engine mounting -1- and timing chain cover -4-.



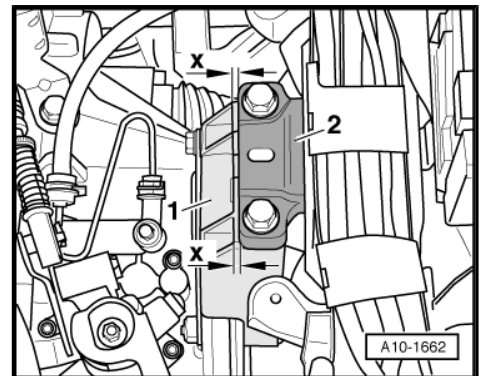
 **Note**

Distance -x- = 12 mm can also be checked with a metal rod of suitable size, or similar.

- Tighten bolts for assembly mounting at gearbox.

Vehicles with manual gearbox:

- Ensure that the edges of the support arm -2- (on the gearbox assembly mounting) and gearbox support -1- are parallel.
- Dimension -x- must be identical on both sides.





Vehicles with dual clutch gearbox:

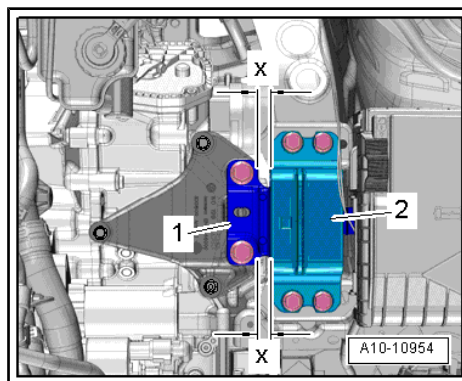
- Ensure that the edges of the support arm -2- (on the gearbox assembly mounting) and gearbox support -1- are parallel.
- Dimension -x- must be identical on both sides.

All vehicles (continued):

- Tighten bolts for assembly mounting.

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

- Install battery ⇒ Electrical system; Rep. gr. 27 .
- Install air cleaner housing ⇒ Rep. gr. 24 .



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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ [“1.1 Exploded view - poly V-belt drive”, page 41](#)

⇒ [“1.2 Removing and installing poly V-belt”, page 42](#)

⇒ [“1.3 Removing and installing idler roller for poly V-belt”, page 44](#)

⇒ [“1.4 Removing and installing poly V-belt pulley for crankshaft”, page 44](#)

⇒ [“1.5 Renewing crankshaft oil seal”, page 49](#)

1.1 Exploded view - poly V-belt drive

1 - Poly V-belt

- Check for wear
- Before removing, mark direction of rotation with chalk or felt-tip pen
- Removing and installing ⇒ [page 42](#)
- Do not kink
- When installing, make sure it is properly seated on pulleys

2 - Bolt

- With washer
- Renew
- Lubricate thread with oil before fitting
- Contact surface must be free of oil and grease
- 150 Nm + 180°

3 - Poly V-belt pulley for crankshaft

- Removing and installing ⇒ [page 44](#)
- Contact surfaces must be free of oil and grease
- When loosening and tightening, lock using counterhold tool - 3415-

4 - Bush

- Contact surfaces must be free of oil and grease

5 - O-ring

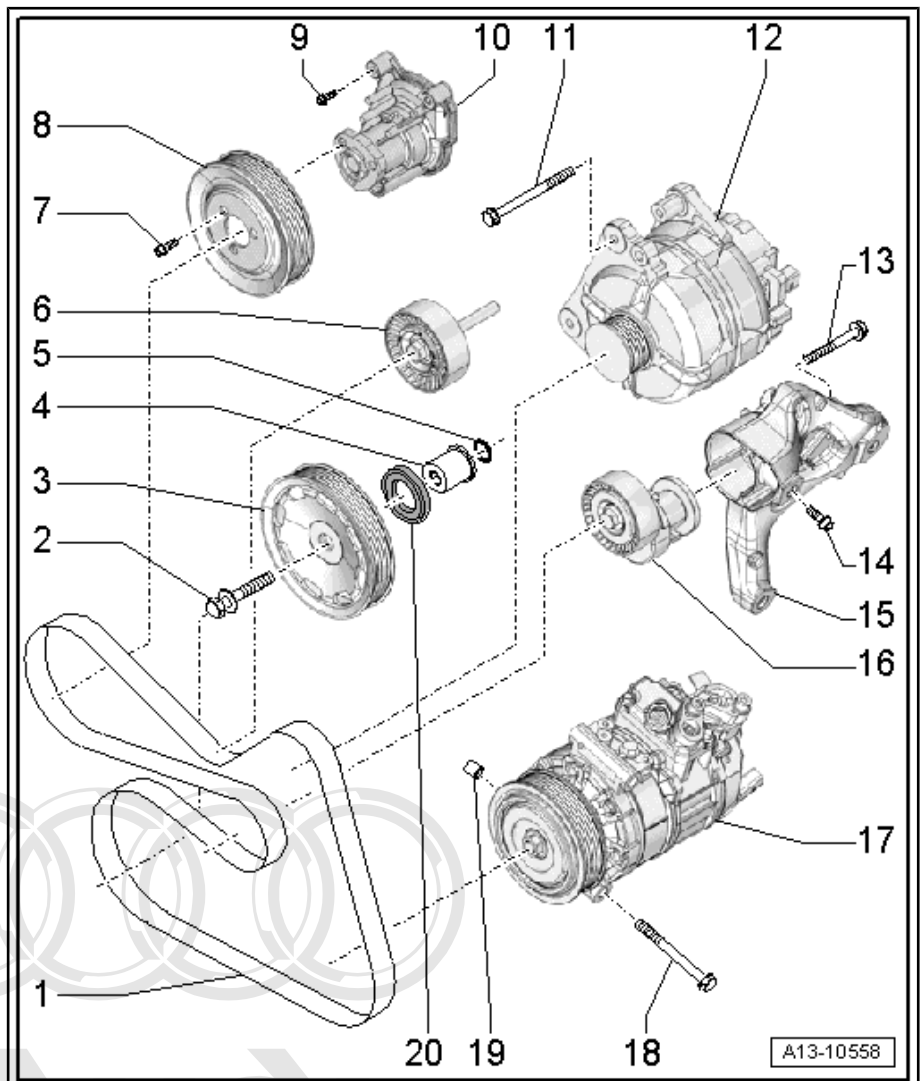
- Renew

6 - Idler roller for poly V-belt

- 40 Nm

7 - Bolt

- Tightening torque ⇒ [Item 8 \(page 165\)](#)



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8 - Poly V-belt pulley for coolant pump

- Removing and installing ⇒ [page 166](#)

9 - Bolt

- Tightening torque ⇒ [Item 7 \(page 165\)](#)

10 - Coolant pump

- Removing and installing ⇒ [page 167](#)

11 - Bolt

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

12 - Alternator

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

13 - Bolt

- Renew
- 20 Nm + turn 90° further

14 - Bolt

- 25 Nm

15 - Bracket for air conditioner compressor

- Removing and installing ⇒ Rep. gr. 87

16 - Poly V-belt tensioner

- Lock in position with locking pin - T10060 A- .

17 - Air conditioner compressor

- Removing and installing ⇒ Rep. gr. 87

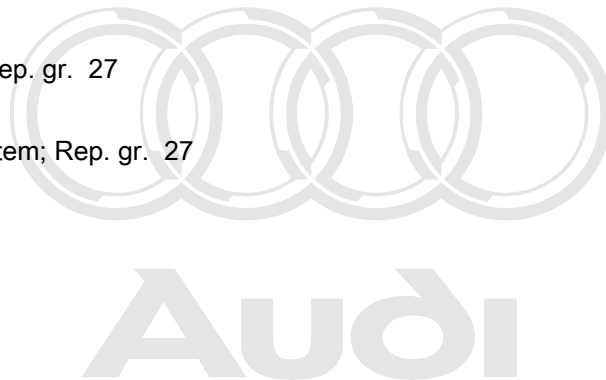
18 - Bolt

- Tightening torque ⇒ Rep. gr. 87

19 - Dowel sleeve

20 - Oil seal for crankshaft (pulley end)

- Renewing ⇒ [page 49](#)

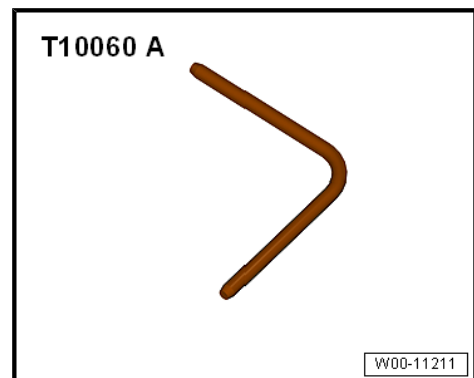


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1.2 Removing and installing poly V-belt

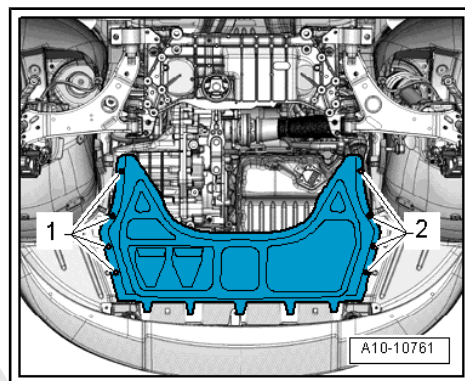
Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-

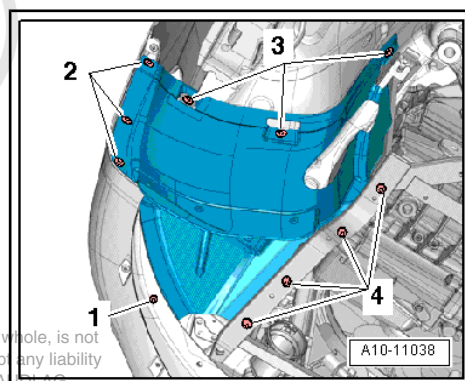


Removing

- Remove noise insulation ⇒ Rep. gr. 50 .



- Remove front wheel housing liner (front section, right-side) ⇒ Rep. gr. 66 .



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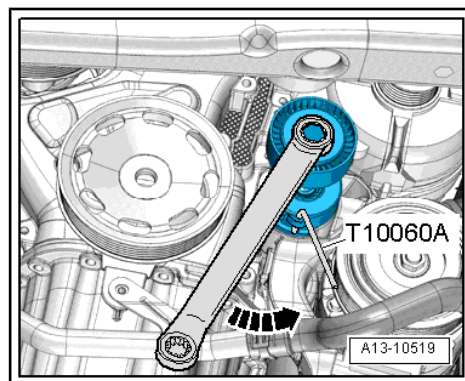


Caution

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

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

- To slacken poly V-belt turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.



Installing

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



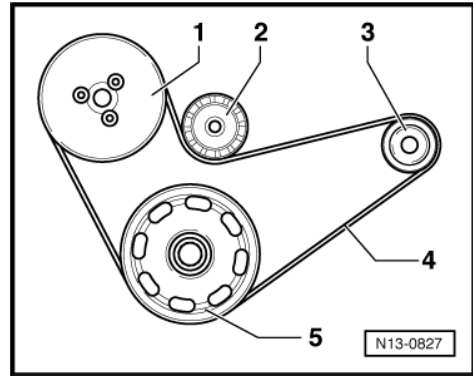
Note

Secure alternator and air conditioner compressor before fitting poly V-belt.

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

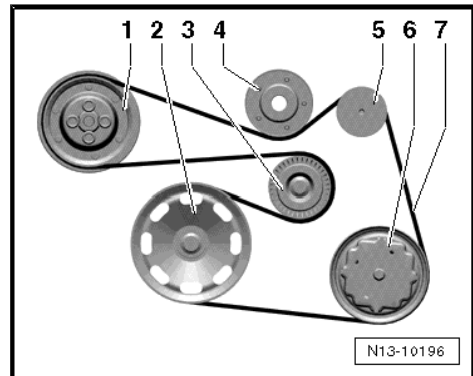
Vehicles not equipped with air conditioning:

- 1 - Coolant pump
- 2 - Tensioner
- 3 - Alternator
- 4 - Poly V-belt
- 5 - Crankshaft

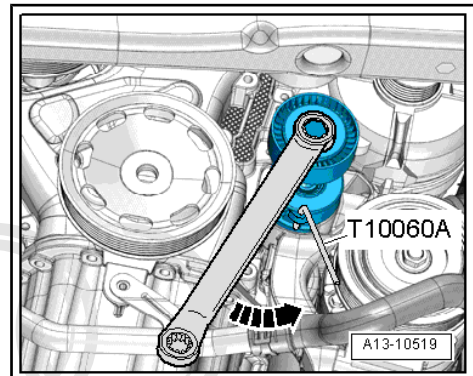


Vehicles with air conditioning:

- 1 - Coolant pump
- 2 - Crankshaft
- 3 - Tensioner
- 4 - Idler roller
- 5 - Alternator
- 6 - Air conditioner compressor
- 7 - Poly V-belt



- Hold tensioner with ring spanner and remove locking pin - T10060 A- .
- Release tensioner.
- Check that poly V-belt is properly seated.
- Start engine and check that poly V-belt runs properly.
- Install noise insulation panels ⇒ Rep. gr. 66 .



1.3 Removing and installing idler roller for poly V-belt

Removing

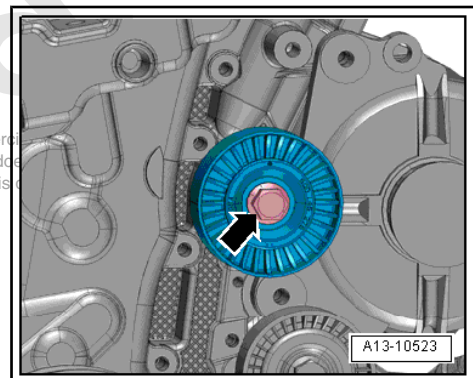
- Remove poly V-belt ⇒ [page 42](#) .
- Remove bolt -arrow- and take off idler roller for poly-V-belt.

Installing

- Tightening torque ⇒ [page 41](#)

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

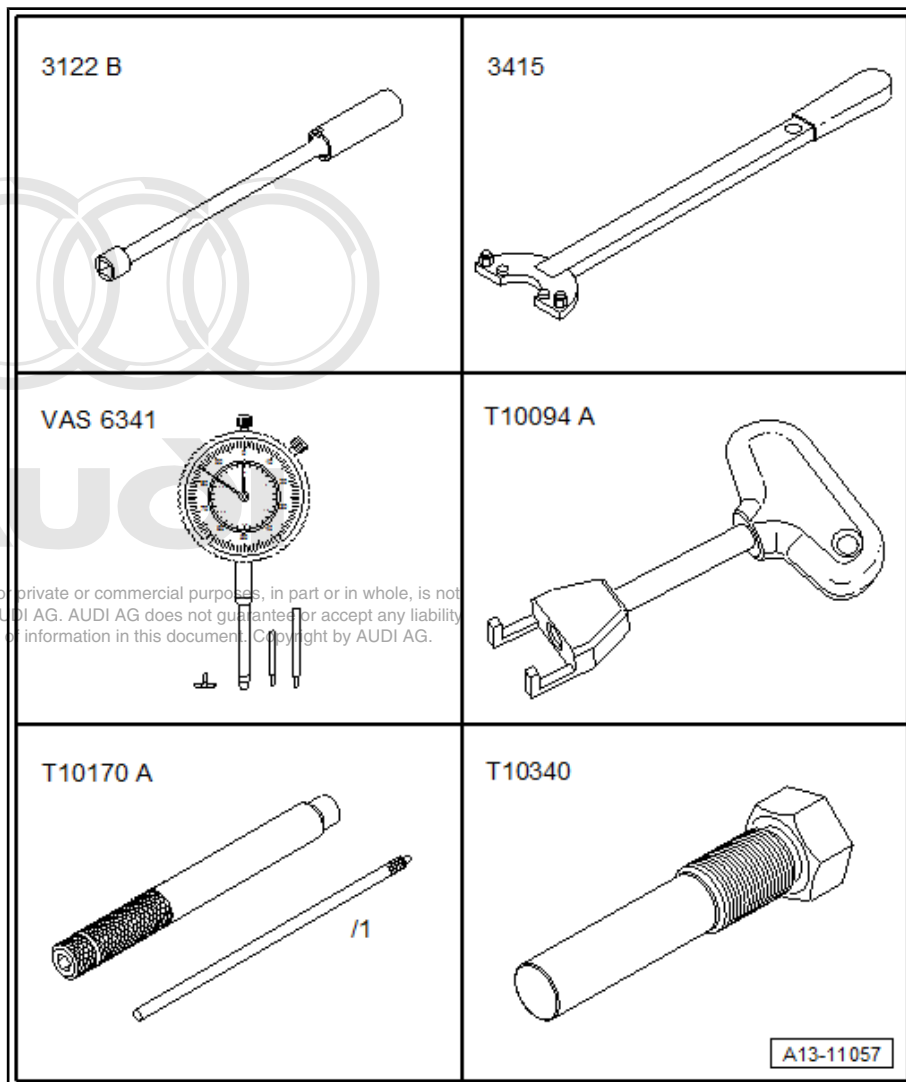
- Install poly V-belt ⇒ [page 42](#) .



1.4 Removing and installing poly V-belt pulley for crankshaft

Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-
- ◆ Counterhold tool - 3415- with pins -3415/1-
- ◆ Dial gauge set, 4-part - VAS 6341-
- ◆ Puller - T10094 A-
- ◆ Adapter for dial gauge - T10170 A-
- ◆ Locking pin - T10340-



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Removing



Note

- ◆ Use locking pin - 3415- in addition to counterhold tool - T10340- to prevent slipping and to make sure the tightening torque for the crankshaft pulley bolt is maintained.
- ◆ The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



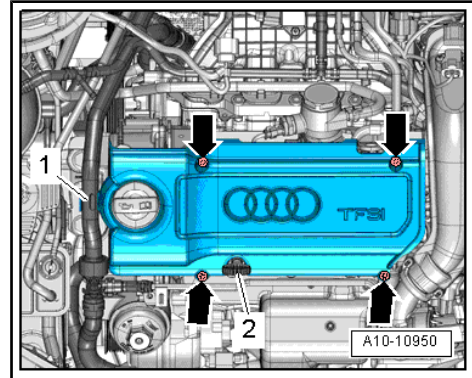
Caution

Risk of damage to engine.

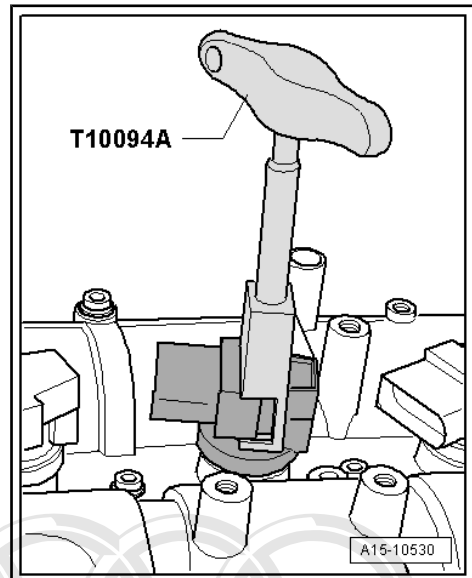
- ◆ Locking pin - T10340- must be screwed in with crankshaft at "TDC" position.

– Remove poly V-belt ⇒ [page 42](#) .

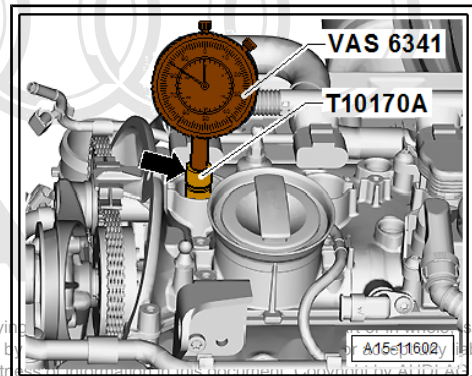
- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.



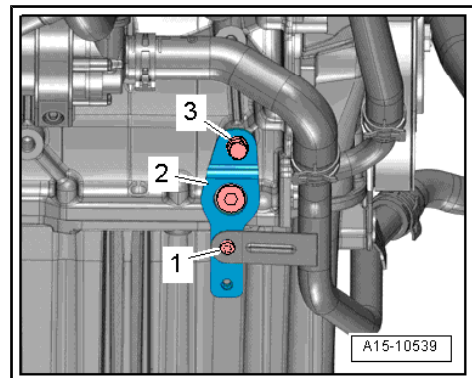
- Apply puller - T10094 A- to ignition coil for cylinder 1 -arrow-, pull out ignition coil and at the same time unplug electrical connector at ignition coil for cylinder 1.
- Remove spark plug for cylinder 1 with spark plug socket and extension - 3122 B- .



- Screw adapter for dial gauge - T10170 A- into spark plug hole as far as the stop.
- Insert dial gauge - VAS 6341- with extension -T10170 A/1- and secure using locking nut -arrow-.
- Rotate crankshaft in normal direction of rotation to "TDC".
- "TDC" = maximum measured value on dial gauge.

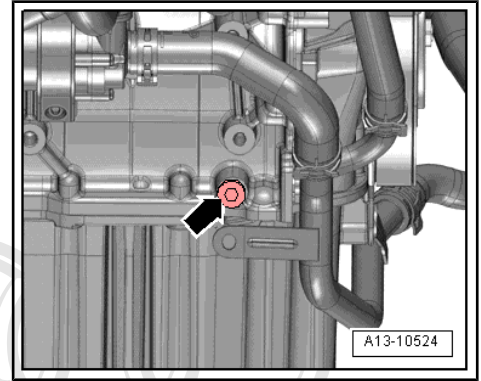


- Remove bolts -1- and -3- and take off bracket -2- for coolant pipe (right-side).



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- Unscrew plug -arrow- for "TDC" hole on cylinder block.

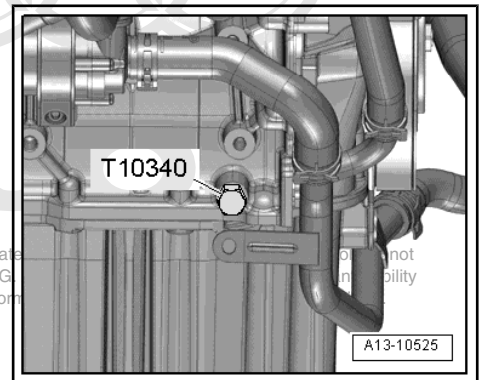


- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.

i Note

The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

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**Caution****Risk of damage to engine.**

- ◆ *To prevent the crankshaft chain sprocket from slipping off the drive lug, do not rotate the crankshaft after the poly V-belt pulley has been detached.*

- Loosen bolt for poly V-belt pulley using counterhold tool - 3415- with pin -3415/1- .
- Remove bolt and take off poly V-belt pulley.

Installing

- Tightening torques ⇒ [page 41](#)

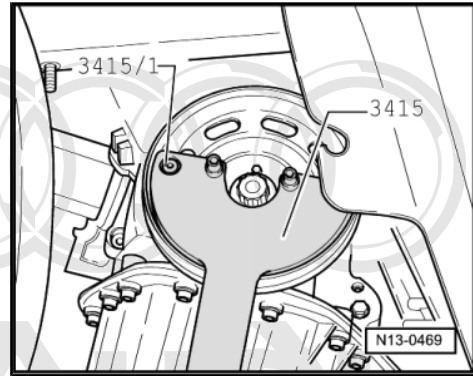
**Note**

- ◆ *Renew bolt for poly V-belt pulley.*
- ◆ *All contact surfaces between bolt, poly V-belt pulley, bush and chain sprocket must be free of oil and grease.*
- Fit poly V-belt pulley, lubricate threads of bolt for poly V-belt pulley with oil and screw in by hand until bolt makes contact.

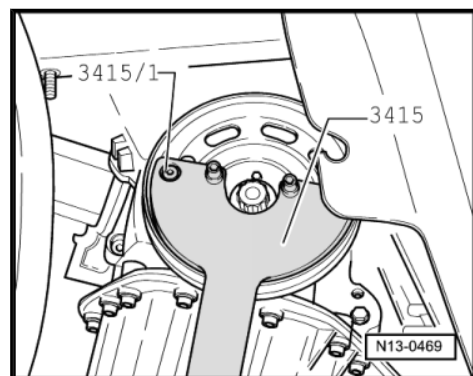
**Caution****Risk of damage to engine.**

- ◆ *Use dial gauge to check "TDC" position of crankshaft. Crankshaft must only be brought into contact with locking pin - T10340- from "TDC" position.*
- ◆ *Also use counterhold tool - 3415- and pin -3415/1- to counterhold poly V-belt pulley when tightening bolt.*

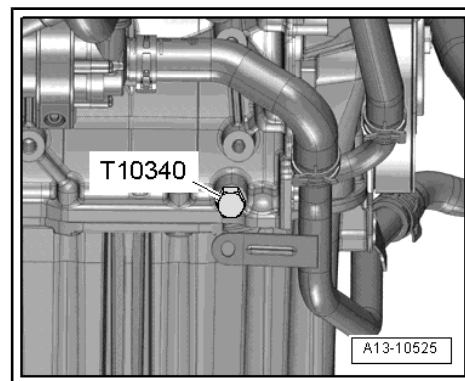
- Turn crankshaft in direction of engine rotation until it makes contact with locking pin - T10340- .
- Tighten bolt for poly V-belt pulley (counterhold with counterhold tool - 3415- and pin -3415/1-).



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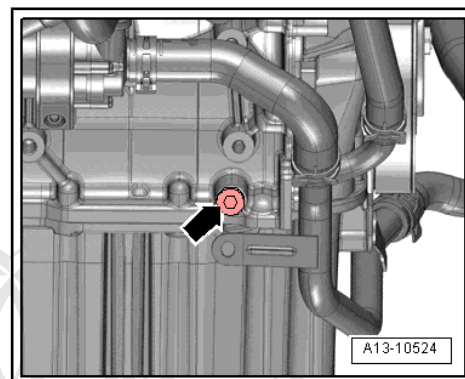
- Remove locking pin - T10340- .



- Tighten plug for “TDC” drilling ⇒ [page 66](#) .

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

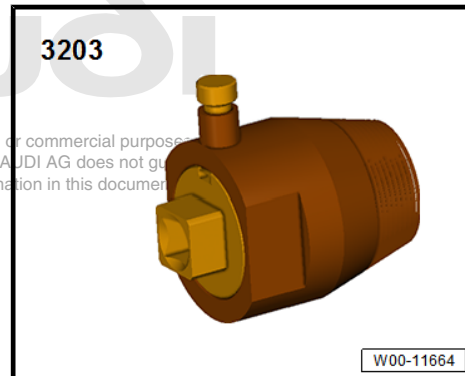
- Install engine cover panel ⇒ [page 121](#) .
- Install poly V-belt ⇒ [page 42](#) .



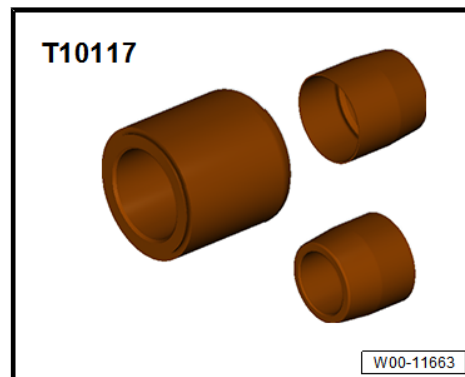
1.5 Renewing crankshaft oil seal

Special tools and workshop equipment required

- ◆ Oil seal extractor - 3203-

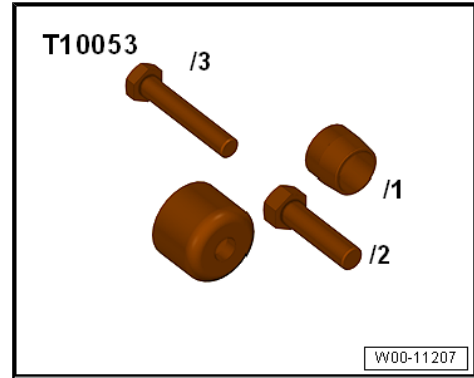


- ◆ Assembly tool - T10117-

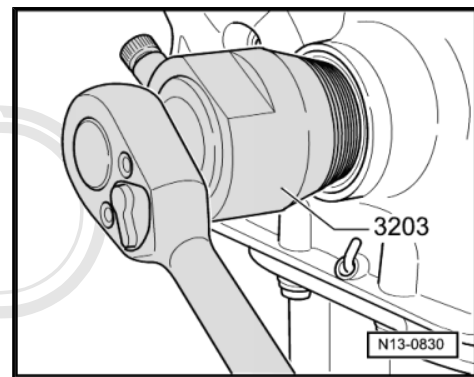


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◆ Assembly tool - T10053-

**Procedure**

- Remove poly V-belt pulley for crankshaft ⇒ [page 44](#) .
- Adjust inner part of oil seal extractor - 3203- so that it is level 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.
- Remove bush and O-ring from crankshaft journal.
- Clean contact surfaces for crankshaft chain sprocket and bush.
- Clean contact surface and sealing surface for oil seal.



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**Note**

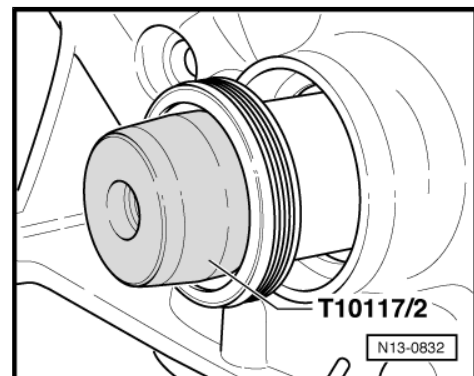
Fit new O-ring.

- Push bush with O-ring onto crankshaft journal.

**Note**

Do not lubricate sealing lip and outer rim of oil seal before pressing in.

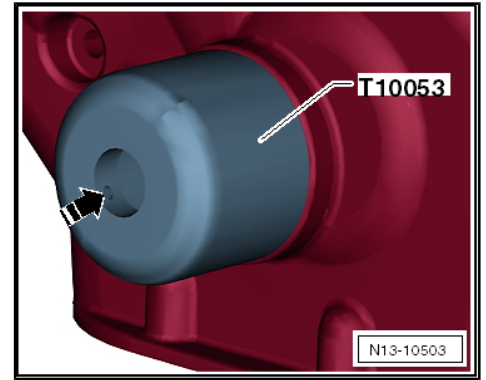
- Apply guide sleeve -T10117/2- to bush and slide oil seal over guide sleeve.
- Take off guide sleeve.



- Drive in oil seal carefully as far as stop using assembly tool - T10053- and a hammer -arrow-.

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

- Install poly V-belt pulley for crankshaft ⇒ [page 44](#) .



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2 Cylinder block (gearbox end)



Note

Servicing clutch ⇒ Rep. gr. 30

⇒ "2.1 Exploded view - flywheel and sealing flange", page 52

⇒ "2.2 Removing and installing flywheel", page 53

⇒ "2.3 Renewing sealing flange", page 54

2.1 Exploded view - flywheel and sealing flange

1 - Bolt

- Renew
- 60 Nm + turn 90° further

2 - Flywheel

- Different versions available ⇒ Electronic parts catalogue
- Can only be installed in one position (holes are off-set)
- Removing and installing ⇒ [page 53](#)

3 - Sender wheel

- For engine speed sender - G28-
- Removing and installing ⇒ "2.3 Renewing sealing flange", page 54

4 - Bolt

- Renew
- 12 Nm

5 - Intermediate plate

- Must be positioned on dowel sleeves
- Do not damage or bend when assembling
- Is fitted onto sealing flange ⇒ [page 53](#)

6 - Engine speed sender - G28-

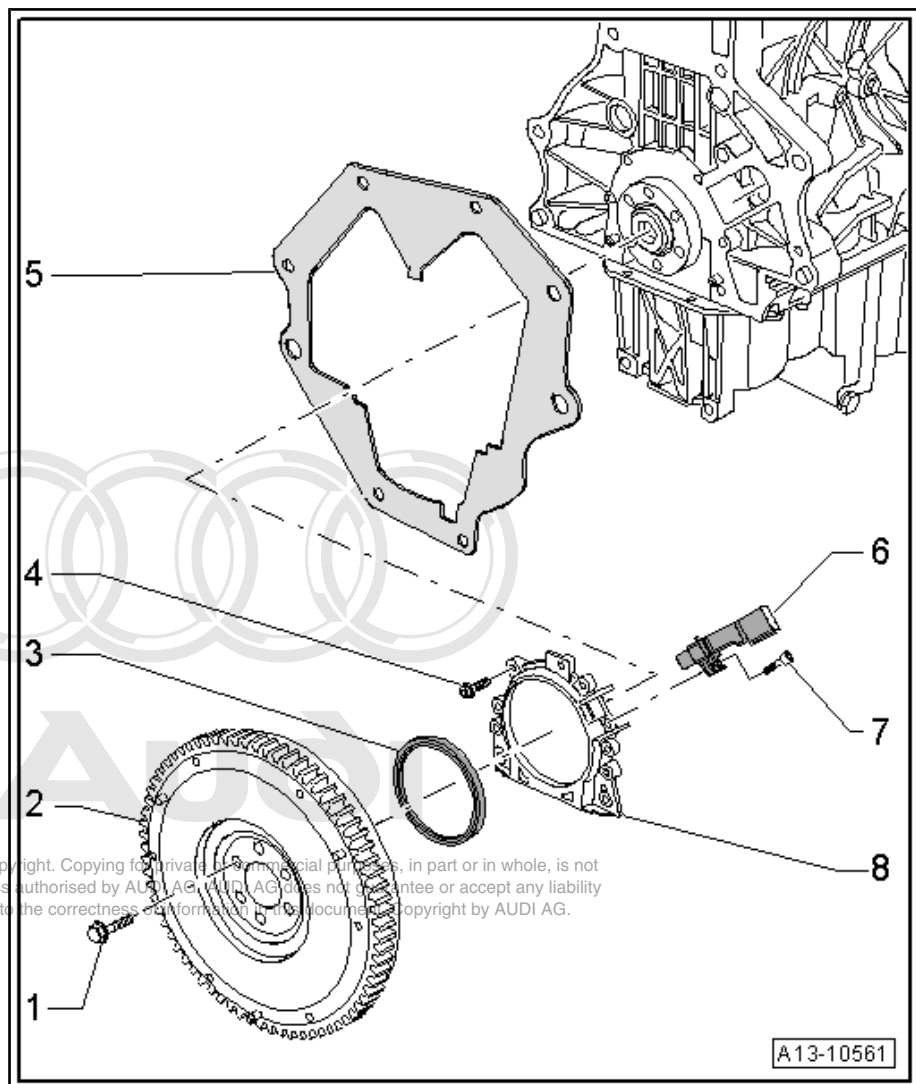
- Removing and installing ⇒ Rep. gr. 28

7 - Bolt

- Tightening torque ⇒ Rep. gr. 28

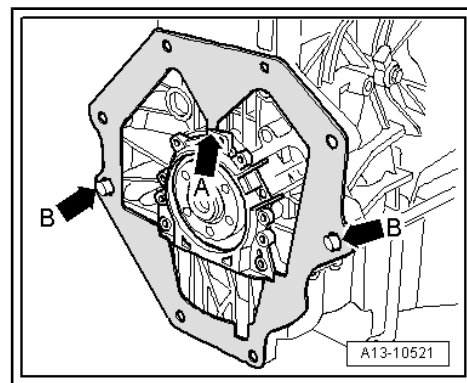
8 - Sealing flange

- With seal
- Renewing ⇒ [page 54](#)



Engaging intermediate plate on sealing flange

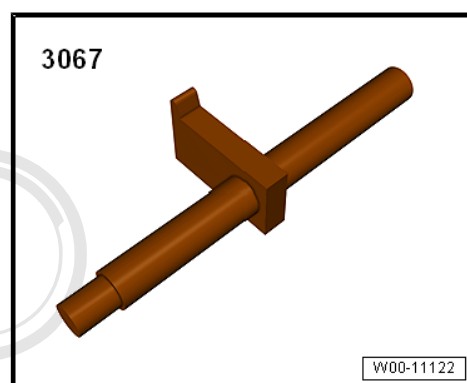
- Ensure that intermediate plate is engaged on sealing flange -arrow A- and pushed onto dowel sleeves -arrows B-.



2.2 Removing and installing flywheel

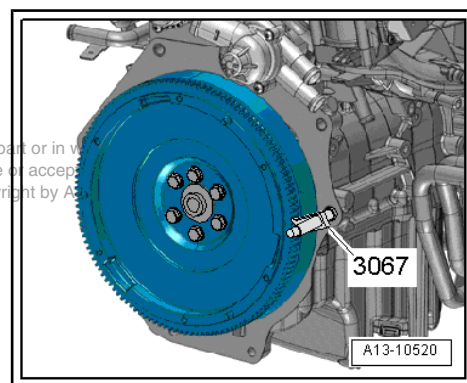
Special tools and workshop equipment required

- ◆ Counterhold tool - 3067-



Removing

- Gearbox removed
- On vehicles with manual gearbox: remove clutch pressure plate ⇒ Rep. gr. 30
- Insert counterhold tool - 3067- to slacken bolts



Vehicles with dual-mass flywheel:**Caution**

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

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

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

All vehicles (continued):

- Remove bolts and take off flywheel.

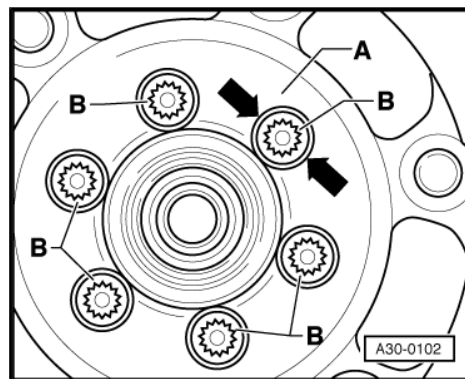
Installing

- Tightening torque ⇒ [page 52](#)

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

**Note**

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Can only be installed in one position (holes are off-set)*
- Fit counterhold tool - 3067- the other way round to tighten bolts.
- On vehicles with manual gearbox: install clutch pressure plate ⇒ Rep. gr. 30 .



2.3 Renewing sealing flange

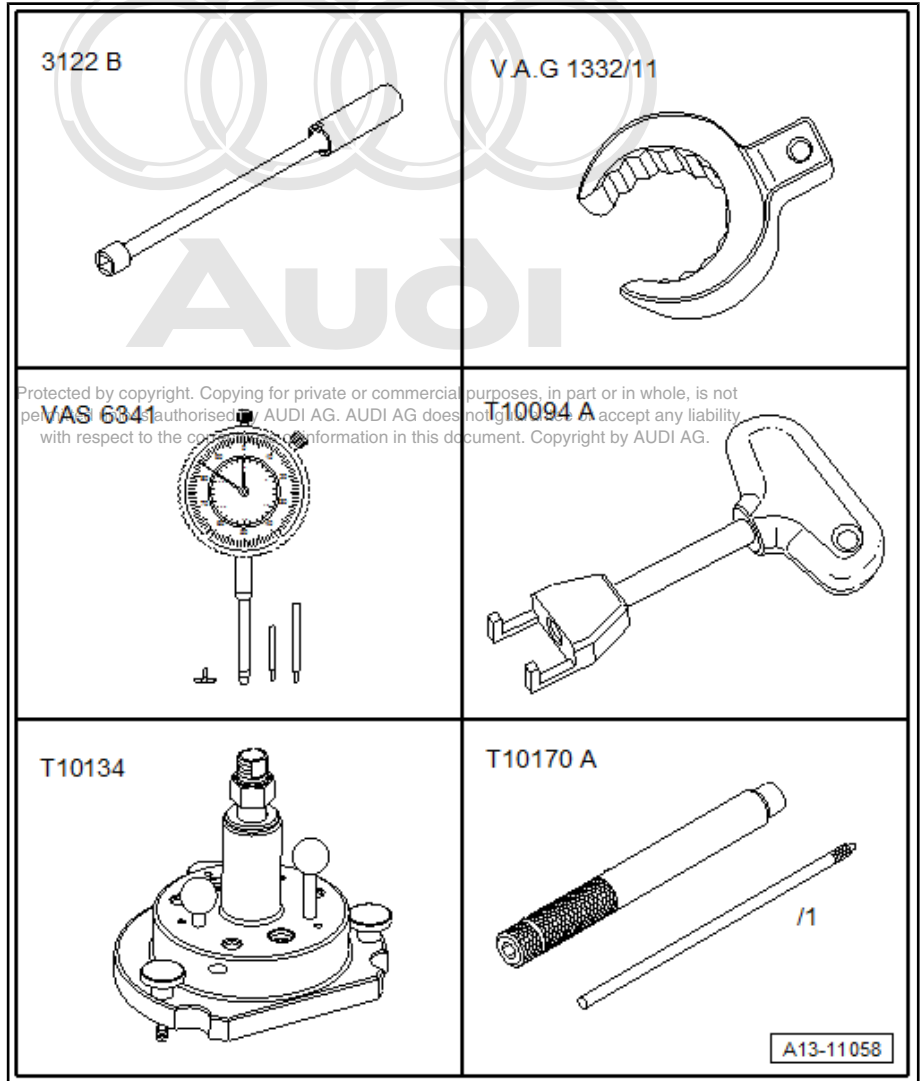


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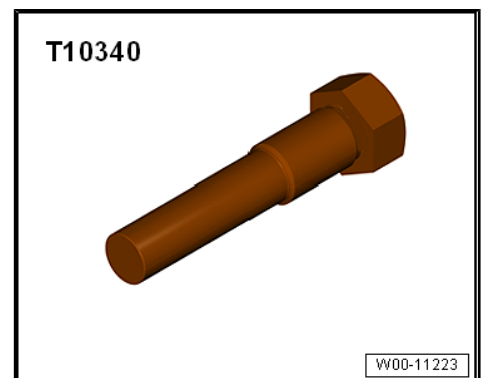
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Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-
- ◆ Open ring spanner - V.A.G 1332/11-
- ◆ Dial gauge set, 4-part - VAS 6341-
- ◆ Puller - T10094 A-
- ◆ Assembly tool - T10134-
- ◆ Adapter for dial gauge - T10170 A-

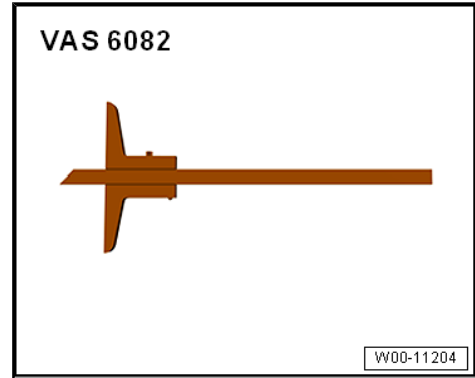


- ◆ Locking pin - T10340-





- ◆ Depth gauge - VAS 6082-



- ◆ Hexagon bolt M6×35 mm (3x)
- ◆ Feeler gauge
- ◆ Depth gauge

Pressing sealing flange with sender wheel off crankshaft

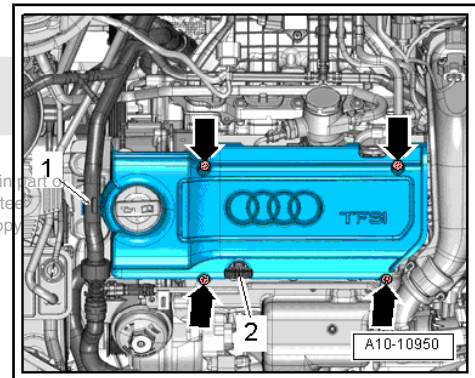
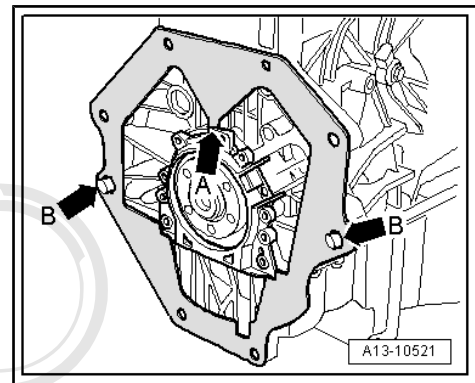
- Gearbox removed



Note

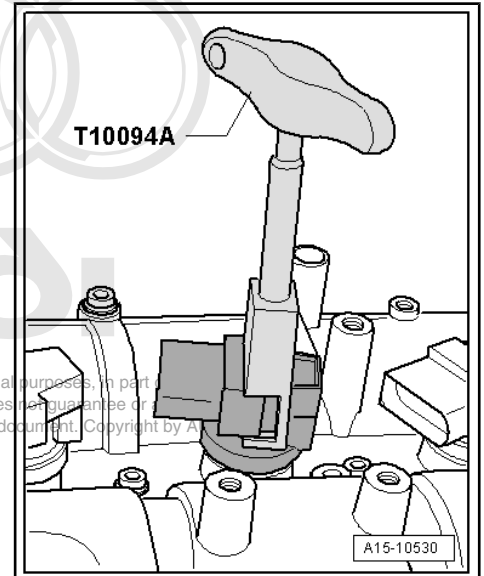
For illustration purposes, the procedure is shown with the engine removed.

- Remove flywheel ⇒ [page 53](#) .
- Press intermediate plate off dowel sleeves -arrows B- and detach from top of sealing flange -arrow A-
- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.

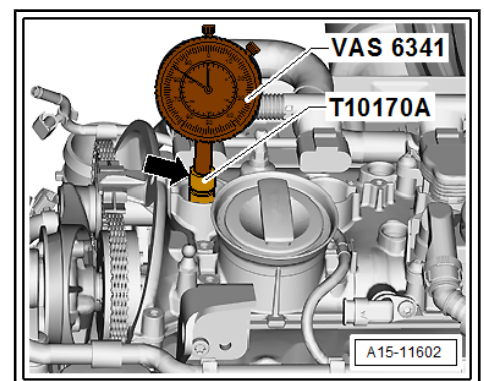


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- Apply puller - T10094 A- to ignition coil for cylinder 1 -arrow-, pull out ignition coil and at the same time unplug electrical connector at ignition coil for cylinder 1.
- Remove spark plug for cylinder 1 with spark plug socket and extension - 3122 B- .



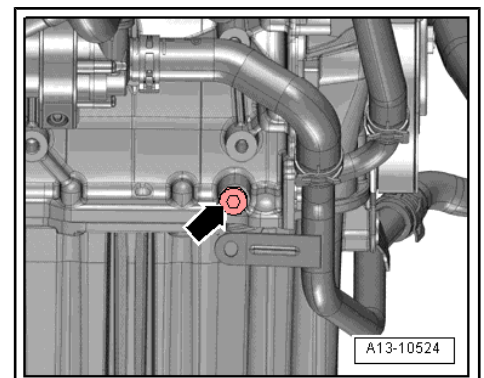
- Screw adapter for dial gauge - T10170 A- into spark plug hole as far as the stop.
- Insert dial gauge - VAS 6341- with extension -T10170 A/1- and secure using locking nut -arrow-.
- Rotate crankshaft in normal direction of rotation to "TDC".
- "TDC" = maximum measured value on dial gauge.

**Caution**

Risk of damage to engine.

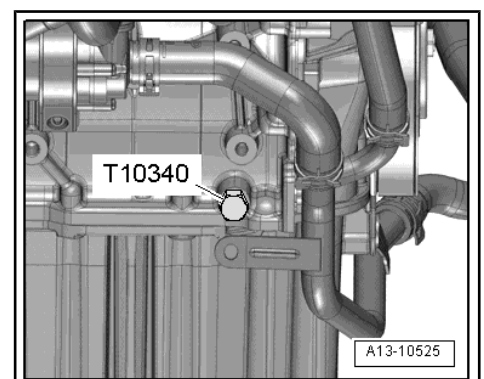
- ◆ *Locking pin - T10340- must be screwed in with crankshaft at "TDC" position.*

- Unscrew plug -arrow- for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.

**Note**

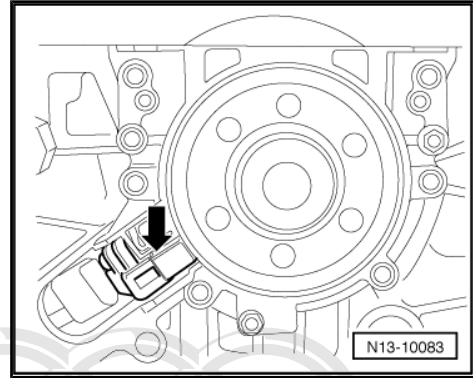
The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

- Remove sump => [page 143](#) .





- Remove bolt -arrow- and detach engine speed sender - G28- .

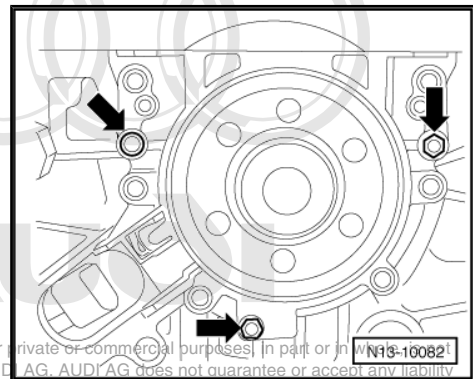


- Remove bolts for sealing flange.

**Note**

The sealing flange is pressed off the crankshaft together with the sender wheel.

- To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than 1/2 turn at a time.
- Take off sealing flange with sender wheel.

**Pressing in sealing flange with sender wheel**

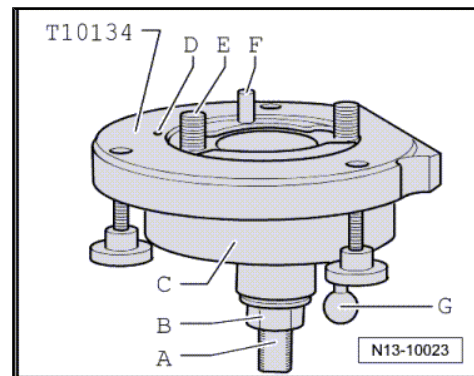
- Tightening torque ⇒ [page 52](#)

**Note**

- ◆ *The sealing flange with PTFE oil seal is fitted with a sealing lip support ring. This support ring acts as an assembly sleeve and must not be removed before installation.*
- ◆ *Sealing flange and sender wheel must not be separated or rotated out of position after removal from packaging.*
- ◆ *The sender wheel is held in its installation position by a locating pin on the assembly tool - T10134- .*
- ◆ *The sealing flange and oil seal are one unit and can only be replaced together with the sender wheel.*
- ◆ *The assembly tool - T10134- is held in the correct position relative to the crankshaft by a guide pin which is inserted into a hole in the crankshaft.*

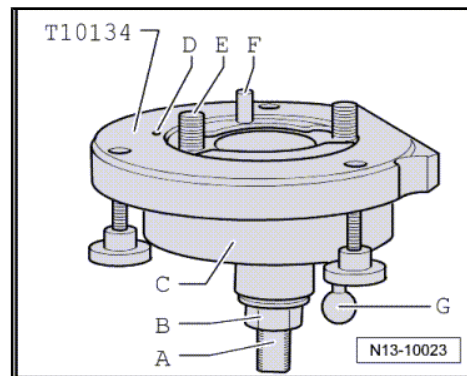
Construction of assembly tool - T10134- :

- A - Tightening flats
- B - Nut
- C - Assembly housing
- D - Locating pin
- E - Hexagon socket-head bolt
- F - Guide pin for diesel engines (black handle)
- G - Guide pin for petrol engines (red handle)

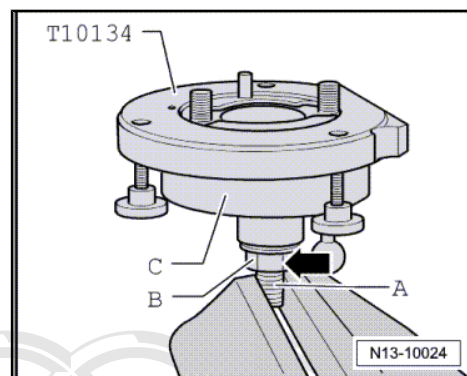


A - Fitting oil seal with sender wheel onto assembly tool - T10134- :

- Unscrew nut -B- until it is just in front of tightening flats -A- on threaded spindle.



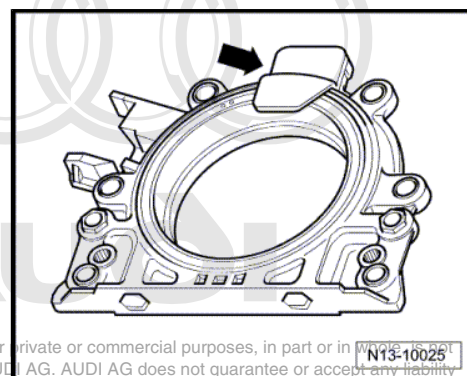
- Clamp assembly tool - T10134- in a vice on tightening flats -A- of threaded spindle.
- Press the assembly housing -C- downwards so that it lies on the nut -B- -arrow-.
- Inner part of assembly device and assembly housing must align (be level) with each other.



- Remove the securing clip -arrow- from new sealing flange.

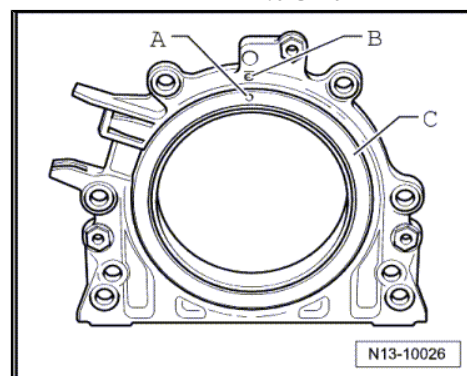
i Note

The sender wheel must not be taken out of the sealing flange or rotated out of position.



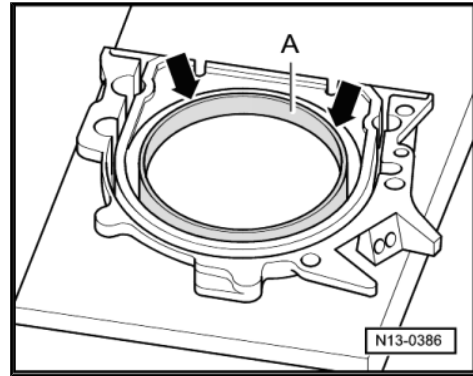
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- The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.

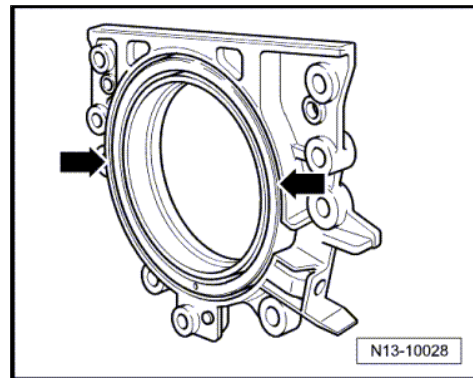




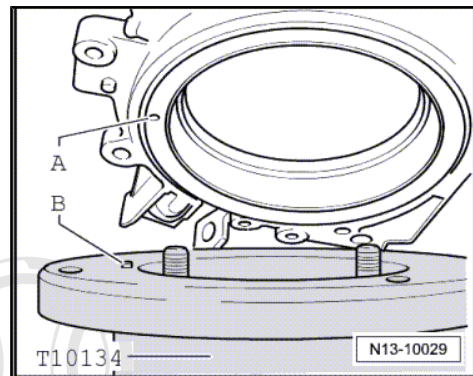
- Place sealing flange (with front side downwards) on a clean flat surface.
- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



- The upper edge of the sender wheel and the front edge of the sealing flange must align -arrows-.



- Place front side of sealing flange on assembly tool - T10134-, so that locating pin -B- can be inserted in hole -A- in sender wheel.
- Ensure that sealing flange lies flat on assembly tool.



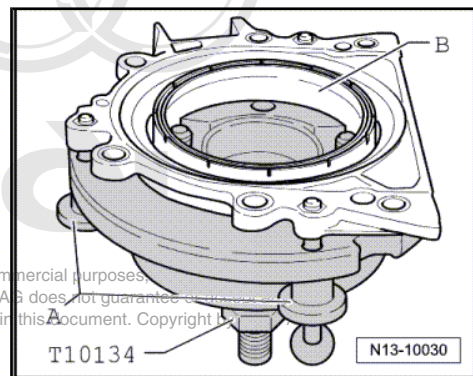
- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool - T10134- while tightening the 3 knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.



Note

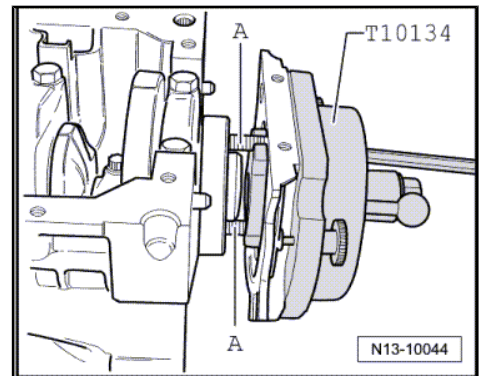
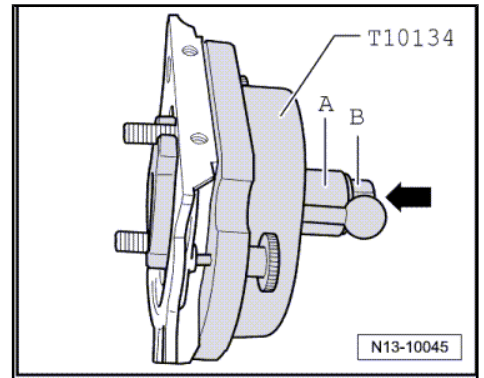
Ensure that the sender wheel remains fixed on the assembly tool when installing the sealing flange.

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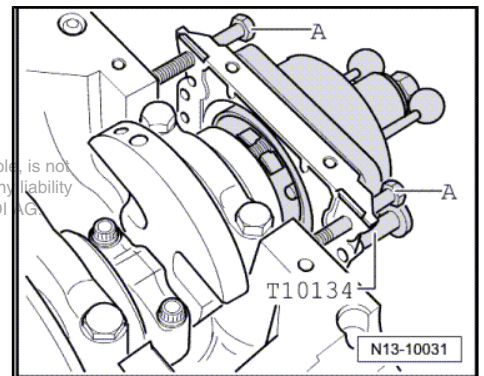
B - Installing assembly tool - T10134- with sealing flange on crankshaft flange:

- Crankshaft flange must be free of oil and grease.
- Engine is at "TDC" position.
- Screw nut -B- to end of threaded spindle.
- Press threaded spindle of assembly tool - T10134- in direction of -arrow- until nut -B- makes contact with assembly housing -A-.
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.
- Secure assembly tool - T10134- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.



- Screw two bolts M6×35 mm -item A- into cylinder block to guide sealing flange.

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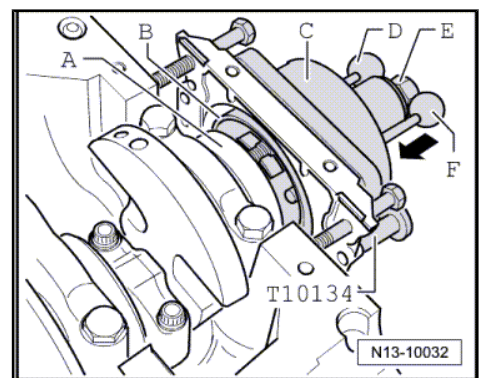


C - Securing assembly tool - T10134- onto crankshaft flange:

- Press the assembly housing -C- by hand in the direction of the -arrow- until the sealing lip support ring -B- lies on the surface of the crankshaft flange -A-.
- Press the guide pin for petrol engines (red handle) -F- into aperture in crankshaft. This ensures that sender wheel reaches its final installation position.

 **Note**

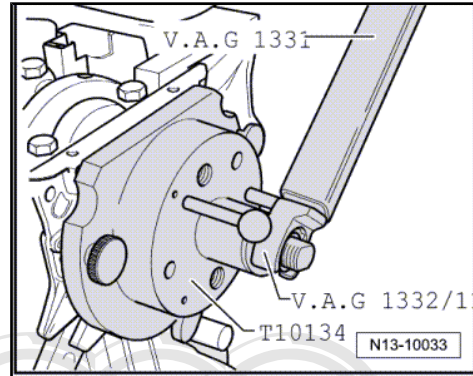
The guide pin for diesel engines (black handle) -D- must not be inserted into threaded hole in crankshaft.



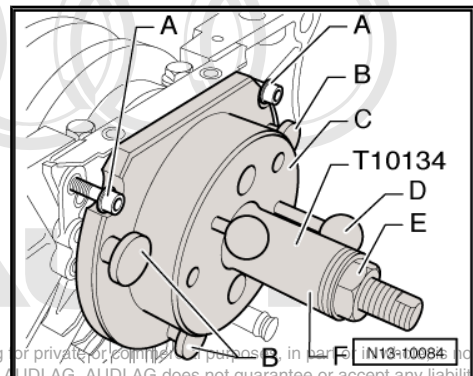
- Tighten the two hexagon socket head bolts on assembly tool hand-tight.
- Screw nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.

D - Pressing sender wheel onto crankshaft flange with assembly tool - T10134- :

- Tighten nut on assembly tool - T10134- to 35 Nm.
- A small air gap must be present between cylinder block and sealing flange after tightening nut to 35 Nm.

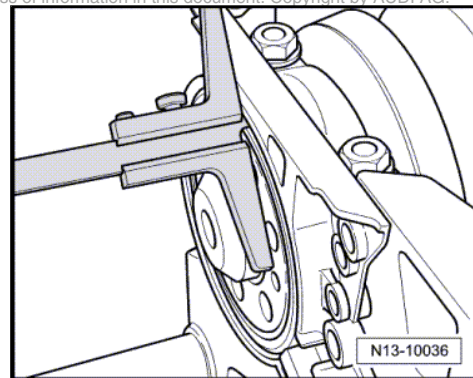
**E - Checking installation position of sender wheel on crankshaft:**

- Screw nut -E- to end of threaded spindle.
- Remove both bolts -A- from cylinder block.
- Unscrew the three knurled screws -B- from sealing flange.
- Detach assembly tool - T10134- .
- Detach sealing lip support ring.

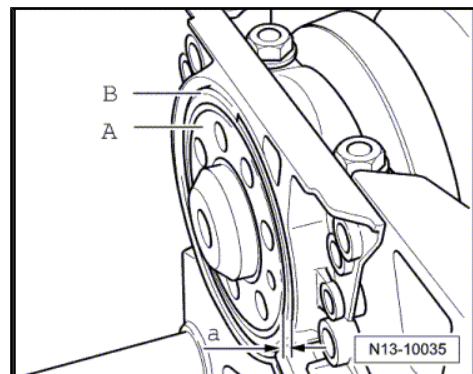


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- Apply depth gauge to crankshaft flange.

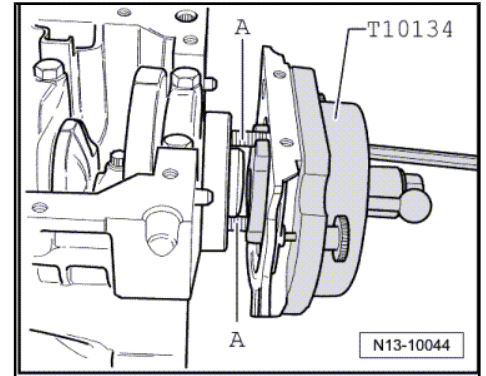


- Measure distance -a- between crankshaft flange -A- and sender wheel -B-.
- Specification: Distance -a- = 0.5 mm.
- Press sender wheel in further if distance is too small
⇒ [page 63](#) .
- If reading matches specification, continue with assembly
⇒ [page 63](#) .

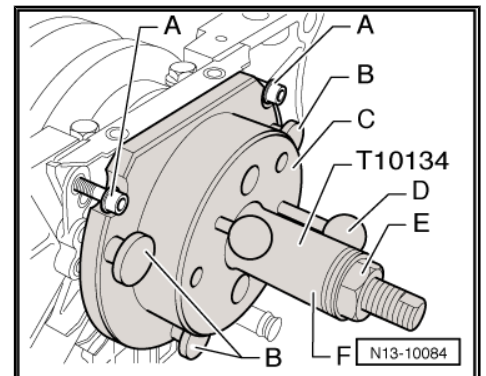


F - Pressing sender wheel in further:

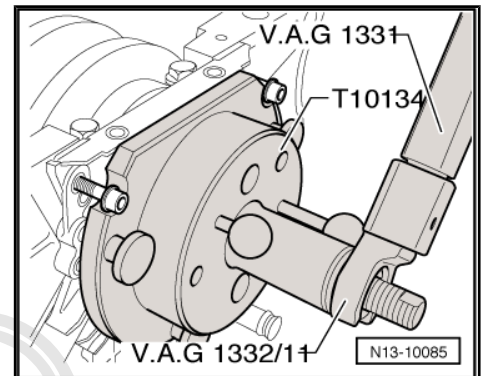
- Secure assembly tool - T10134- to crankshaft flange by tightening hexagon socket head bolts -A- hand-tight.
- Slide assembly tool - T10134- onto sealing flange by hand.



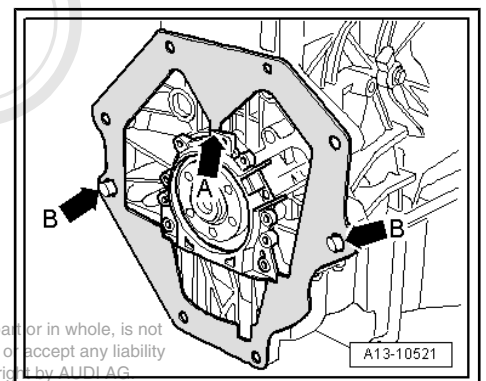
- Screw nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.



- Tighten nut on assembly tool - T10134- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 62](#) .
- Tighten nut on assembly tool - T10134- to 45 Nm if distance is too small.
- Check installation position of sender wheel on crankshaft again ⇒ [page 62](#) .

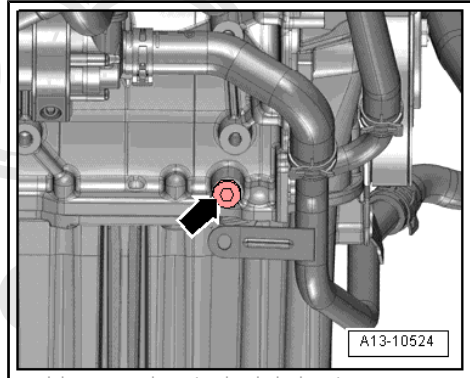
**Assembling:****Renew sealing flange bolts.**

- Tighten bolts for sealing flange in diagonal sequence.
- Install engine speed sender - G28- ⇒ Rep. gr. 28 .
- Install sump ⇒ [page 145](#) .
- Engage intermediate plate at top of sealing flange -arrow A- and push onto dowel sleeves -arrows B-.





- Tighten plug for "TDC" drilling ⇒ [page 66](#) .
- Install engine cover panel ⇒ [page 121](#) .
- Install flywheel ⇒ [page 53](#) .
- After renewing sender wheel, misfire adaption must be reset.
To do so, select 01 - Reset adaptions misfires in Guided Functions mode of ⇒ Vehicle diagnostic tester.



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3 Crankshaft

⇒ [“3.1 Exploded view - crankshaft”, page 65](#)

⇒ [“3.2 Crankshaft dimensions”, page 66](#)

⇒ [“3.3 Measuring axial clearance of crankshaft”, page 66](#)

⇒ [“3.4 Measuring radial clearance of crankshaft”, page 67](#)

⇒ [“3.5 Extracting and driving in needle bearing for crankshaft - vehicles with dual clutch gearbox”, page 68](#)

3.1 Exploded view - crankshaft

1 - Bearing shell

- For cylinder block (with oil groove)
- Renew used bearing shells
- Note location

2 - Chain sprocket

- For drive chain for oil pump and camshaft timing chain
- Push-fitted onto crankshaft
- To remove or install ⇒ [“1.4 Removing and installing camshaft timing chain”, page 81](#) and ⇒ [“1.5 Removing and installing oil pump”, page 148](#)
- Installation position ⇒ [page 66](#)

- Contact surfaces must be free of oil and grease**

3 - Bearing shell

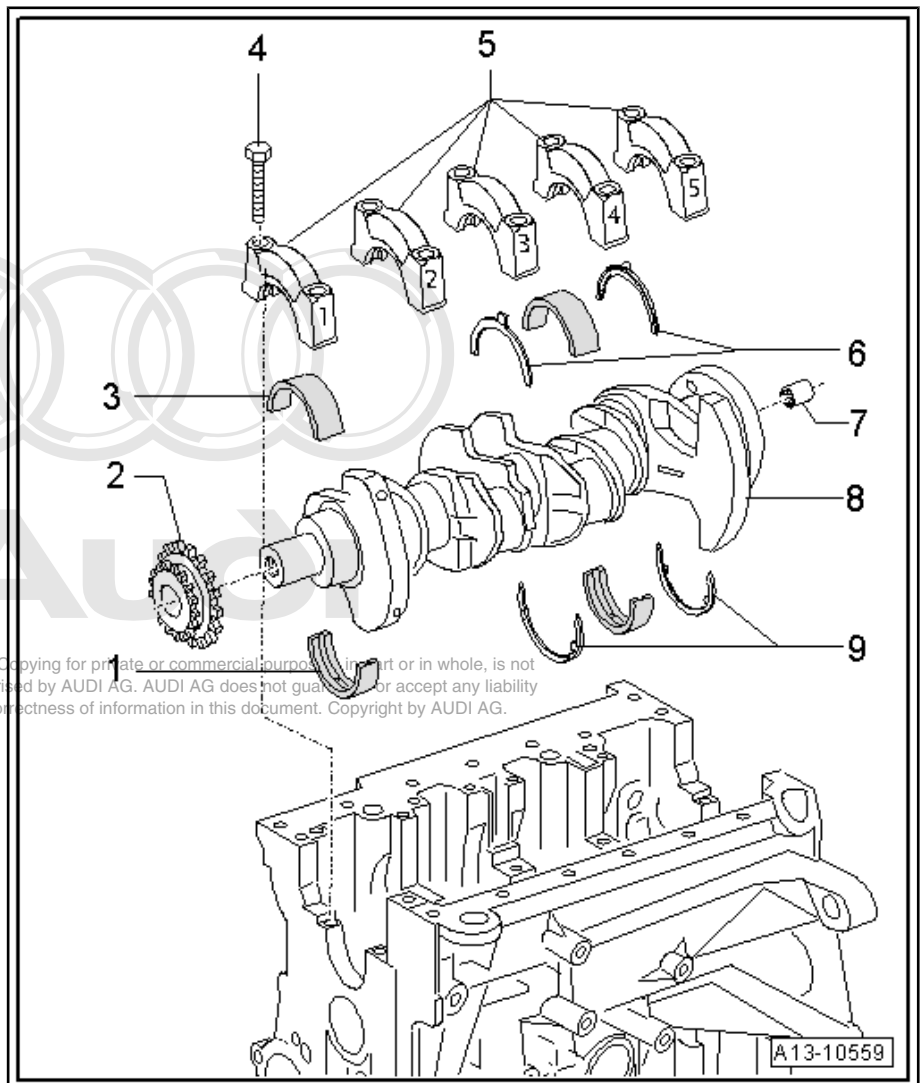
- For bearing cap (without oil groove)
- Renew used bearing shells
- Bearing shells in bearing caps are only supplied as spare parts with “yellow” colour-coding.
- Note location

4 - Bolt

- Renew
- 50 Nm + turn 90° further
- Use old bolts when measuring radial clearance

5 - Bearing cap

- Mark used bearing caps for re-installation
- Bearing cap 3 with recesses for thrust washers
- Installation position: retaining lugs on bearing shells in cylinder block and bearing caps must be on the same side



6 - Thrust washers

- For bearing cap 3
- Note location

7 - Needle bearing

- Only fitted on vehicles with dual clutch gearbox

8 - Crankshaft

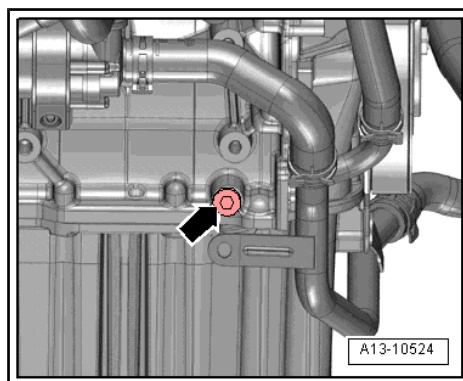
- Measuring axial clearance ⇒ [page 66](#)
- Measuring radial clearance ⇒ [page 67](#)
- Crankshaft dimensions ⇒ [page 66](#)

9 - Thrust washers

- Only fitted on 3rd crankshaft bearing
- Installation position: oil grooves face toward crank webs

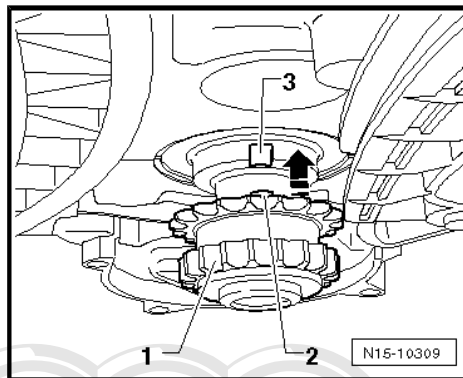
Plug for "TDC" drilling - tightening torque

- Renew seal on plug for "TDC" drilling.
- Tighten plug -arrow- in cylinder block to 30 Nm.



Installation position of chain sprocket

- Drive lug -2- on chain sprocket -1- must engage in groove -3- on crankshaft.



3.2 Crankshaft dimensions

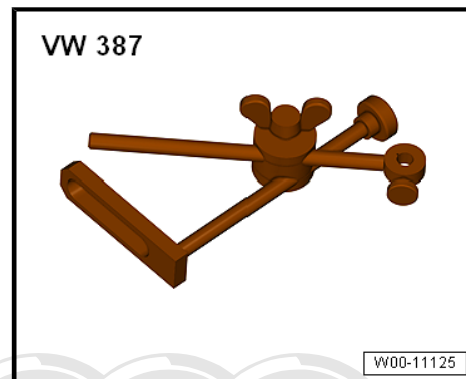
Honing dimension	Main bearing journal Ø mm	Conrod journal Ø mm
Basic dimension	54.000 - 0.022 - 0.037	47.800 - 0.022 - 0.037
Repair under-size I	53.750 - 0.022 - 0.037	47.550 - 0.022 - 0.037
Repair under-size II	-	47.300 - 0.022 - 0.037

3.3 Measuring axial clearance of crankshaft

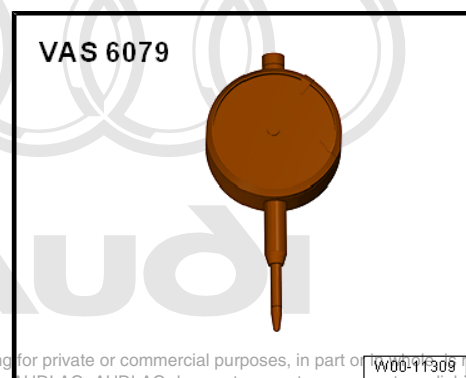
Special tools and workshop equipment required

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- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-



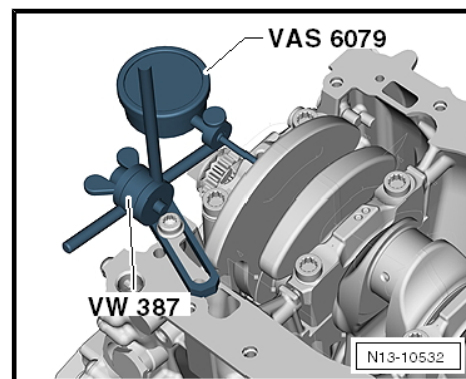
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Procedure

- Secure dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder block as shown in illustration.
- Apply dial gauge to crank web.
- Press crankshaft against dial gauge by hand and set gauge to “0”.
- Push crankshaft away from dial gauge and read off value.

Axial clearance

- New: 0.07 ... 0.24 mm
- Wear limit: 0.26 mm



3.4 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

- Remove bearing cap and clean bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- The Plastigage must be positioned in the centre of the bearing shell.
- Fit bearing cap and secure with old bolts ⇒ [Item 4 \(page 65\)](#) without rotating crankshaft.
- Remove bearing cap again.
- Compare width of Plastigage with measurement scale.



Radial clearance:

- New: 0.03 ... 0.05 mm.
- Wear limit: 0.13 mm.
- Renew bearing cap bolts.

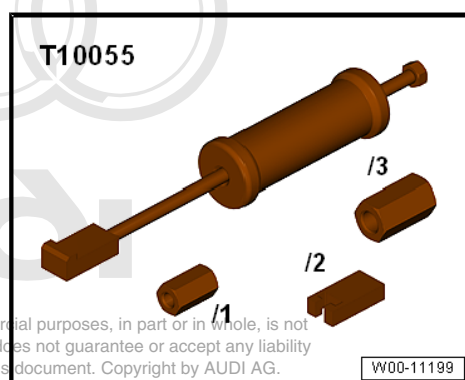
3.5 Extracting and driving in needle bearing for crankshaft - vehicles with dual clutch gearbox

Special tools and workshop equipment required

- ◆ Drift - VW 207 C-



- ◆ Puller - T10055- with adapter -T10055/3-



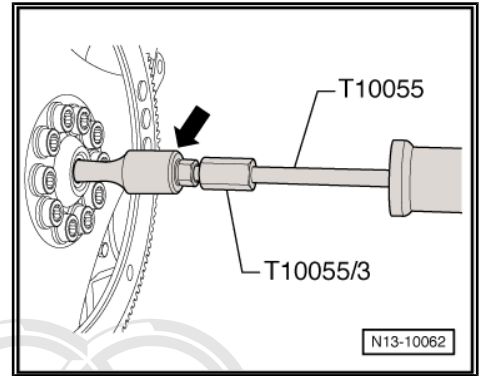
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- ◆ -1- Internal puller Kukko 21/2

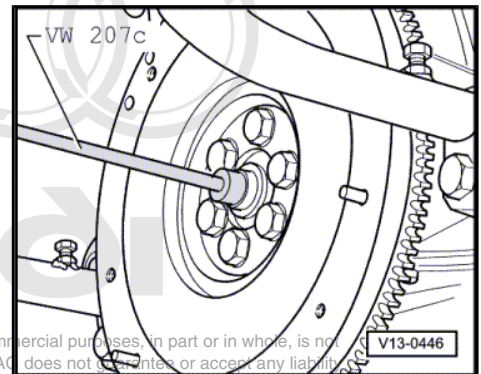


Procedure

- Gearbox removed
- Remove flywheel ⇒ [page 53](#) .
- Use internal puller Kukko 21/2, adapter -T10055/3- and puller - T10055- to pull out needle bearing.

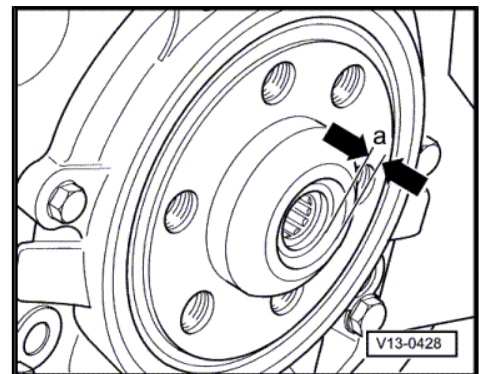


- Drive in needle bearing with drift - VW 207 C- .



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- Installation depth: dimension -a- = 2 mm.
- Install flywheel ⇒ [page 53](#) .



4 Pistons and conrods



Note

- ◆ All bearing and running surfaces must be oiled before assembling.
- ◆ Oil spray jet and pressure relief valve ⇒ [page 73](#)

⇒ [“4.1 Exploded view - pistons and conrods”, page 70](#)

⇒ [“4.2 Piston and cylinder dimensions”, page 73](#)

⇒ [“4.3 Measuring radial clearance of conrods”, page 73](#)

4.1 Exploded view - pistons and conrods

1 - Bolts

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

2 - Conrod bearing cap

- Mark cylinder allocation before removing -A-
- Installation position: marking -B- faces towards pulley end (apply marking before removal if no marking is visible)

3 - Bearing shells

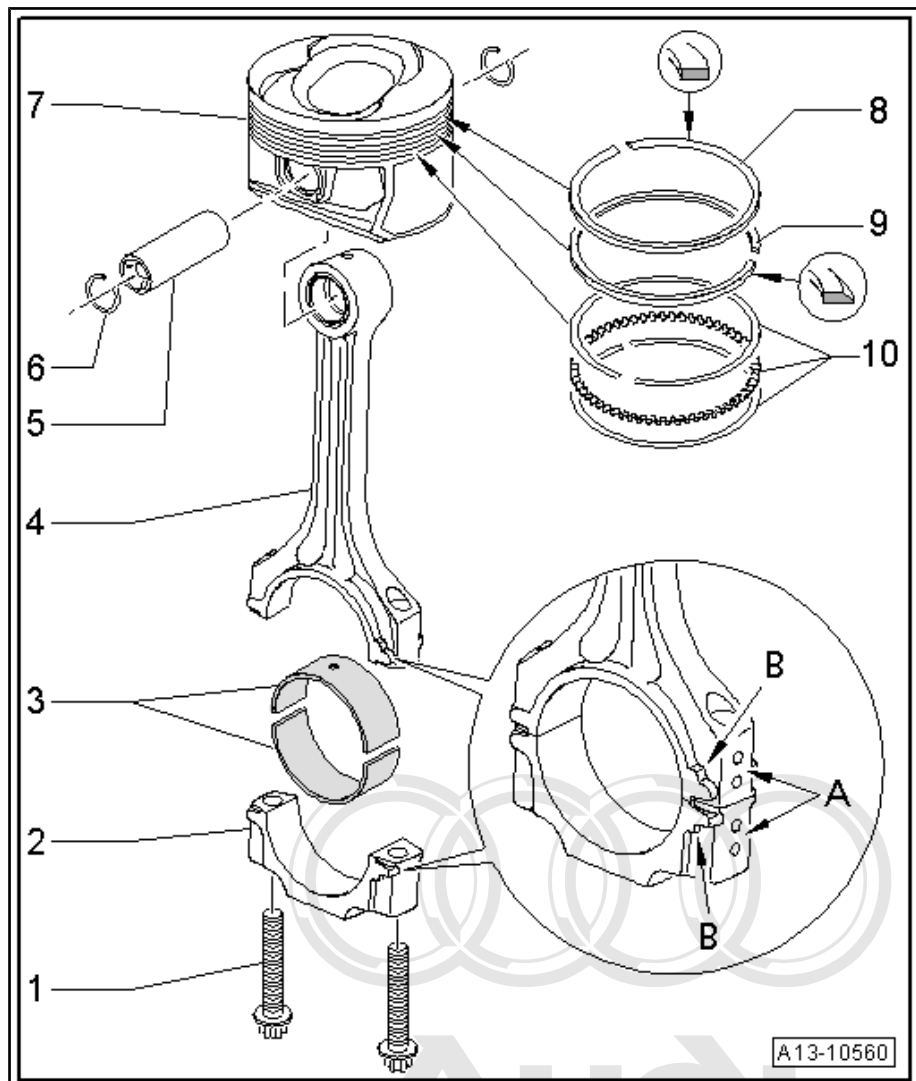
- Upper bearing shell with oil hole for piston pin lubrication
- Installation position ⇒ [page 72](#)
- Renew used bearing shells

4 - Conrod

- Only renew as a complete set
- Mark cylinder allocation before removing -A-
- Installation position: marking -B- faces towards pulley end (apply marking before removal if no marking is visible)
- Guided axially via piston
- Measuring radial clearance ⇒ [page 73](#)

5 - Piston pin

- If difficult to remove, heat piston to 60 °C
- Remove and install using drift - VW 222 A-



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6 - Circlip

- Renew

7 - Piston

- Checking ⇒ [page 72](#)
- Mark installation position and cylinder number
- Installation position: arrow on piston crown points to pulley end
- Install using piston ring clamp
- Measuring cylinder bore ⇒ [page 72](#)
- Piston and cylinder dimensions ⇒ [page 73](#)

8 - Compression ring

- Pay attention to cross section
- Offset gap by 120° to next compression ring
- Use piston ring pliers to remove and install
- Inscription "TOP" faces towards piston crown
- Measuring ring gap ⇒ [page 71](#)
- Measuring ring-to-groove clearance ⇒ [page 72](#)

9 - Compression ring

- Pay attention to cross section
- Offset gap 120° relative to adjacent oil scraper ring
- Use piston ring pliers to remove and install
- Inscription "TOP" faces towards piston crown
- Measuring ring gap ⇒ [page 71](#)
- Measuring ring-to-groove clearance ⇒ [page 72](#)

10 - Oil scraper ring

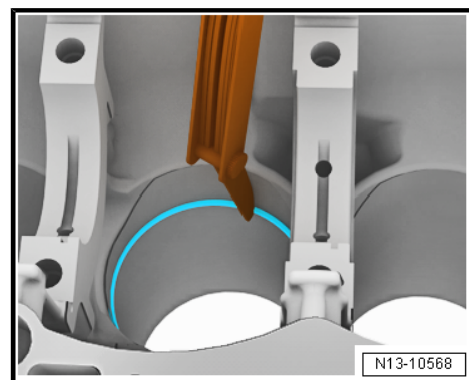
- 3 parts
- Offset gap of top steel element of piston ring by 120° to next compression ring
- Offset gaps of individual parts of oil scraper ring
- Measuring ring gap ⇒ [page 71](#)
- Ring-to-groove clearance cannot be checked

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Measuring piston ring gap

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

Piston ring	new mm	Wear limit mm
1st compression ring	0.20 ... 0.40	1.00
2nd compression ring	0.40 ... 0.60	1.00
Oil scraper ring	0.20 ... 0.80	No wear limit data available



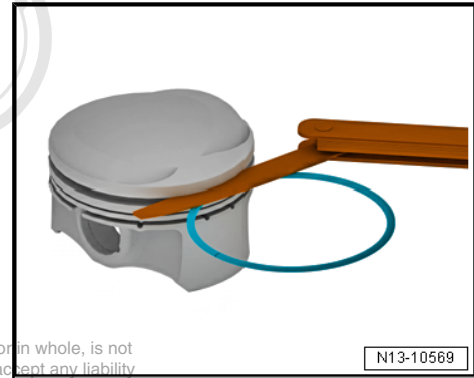


Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
1st compression ring	0.04 ... 0.08	0.15
2nd compression ring	0.02 ... 0.06	0.15
Oil scraper ring	Cannot be measured	

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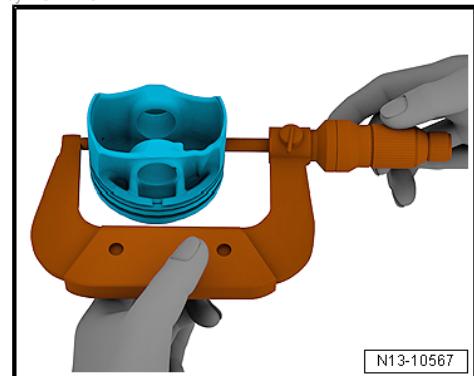


Checking piston

- Using a micrometer (75 ... 100 mm), measure approx. 12 mm from the lower edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.

Nominal dimension

⇒ "4.2 Piston and cylinder dimensions", page 73 .



Measuring cylinder bore

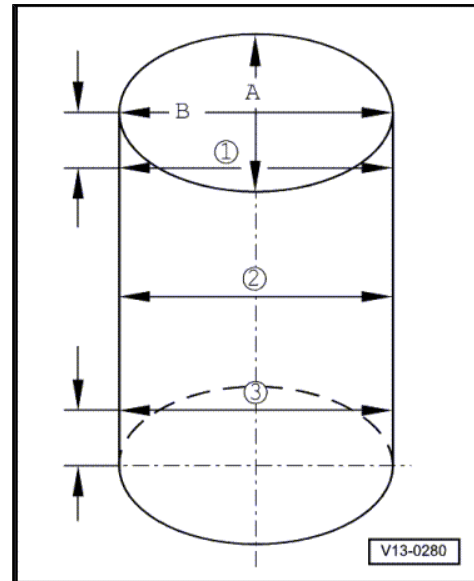
- Use a cylinder gauge - VAS 6078- to take measurements at 3 points in transverse direction -A- and in longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.08 mm.

Nominal dimension

⇒ "4.2 Piston and cylinder dimensions", page 73 .

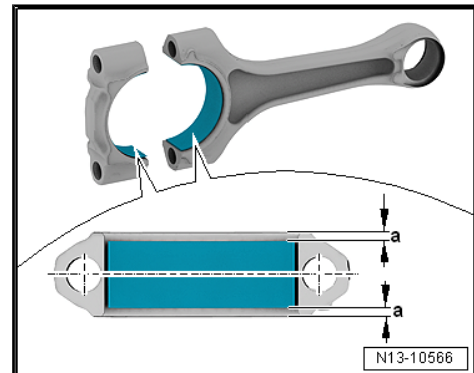
Note

Do not mount cylinder block on engine and gearbox support - VAS 6095- , as incorrect measurements may result.



Installation position of bearing shells in conrods

- Position bearing shells in centre of conrod and conrod bearing cap when fitting.
- Distance -a- = approx. 1.5 mm.



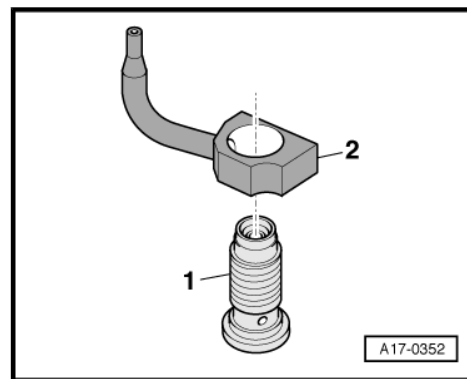
Oil spray jet and pressure relief valve

- 1 - Bolt with pressure relief valve, 27 Nm
 - 2 - Oil spray jet (for cooling of pistons)
- Installation position: align locating edge of oil spray jet with machined surface of cylinder block.



Caution

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



4.2 Piston and cylinder dimensions

Honing dimension	Piston \varnothing ¹⁾ mm	Cylinder bore \varnothing mm
Basic dimension	76.46 ²⁾	76.51
Repair oversize I	76.71 ²⁾	76.76
Repair oversize II	76.96 ²⁾	77.01

- ¹⁾ Measure approx. 12 mm from bottom edge of piston.
- ²⁾ 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

- ◆ Plastigage

Procedure

- Remove conrod bearing cap.
- Clean bearing cap and bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- Fit conrod bearing cap and secure with old bolts
 ⇒ [Item 1 \(page 70\)](#) without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

- New: 0.02 ... 0.06 mm.
- Wear limit: 0.09 mm.
- Renew conrod bolts.

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15 – Cylinder head, valve gear

1 Chain drive

⇒ [“1.1 Exploded view - timing chain cover”, page 74](#)

⇒ [“1.2 Removing and installing timing chain cover”, page 75](#)

⇒ [“1.3 Exploded view - camshaft timing chain”, page 79](#)

⇒ [“1.4 Removing and installing camshaft timing chain”, page 81](#)

⇒ [“1.5 Checking valve timing”, page 92](#)

⇒ [“1.6 Checking timing chain”, page 95](#)

1.1 Exploded view - timing chain cover

1 - Bolt

- Renew
- Tightening torque
⇒ [Item 2 \(page 41\)](#)

2 - Poly V-belt pulley

⚠ Caution
Risk of damage to engine.
To prevent the crankshaft chain sprocket from slipping off the drive lug, do not rotate the crankshaft after the poly V-belt pulley has been detached.

3 - Timing chain cover

- Removing and installing
⇒ [page 75](#)

4 - Idler roller for poly V-belt

- Tightening torque
⇒ [Item 6 \(page 41\)](#)

5 - Bolt

- 50 Nm

6 - Gasket

- Renew
- Apply sealant when installing; refer to ⇒ [Electronic parts catalogue](#)

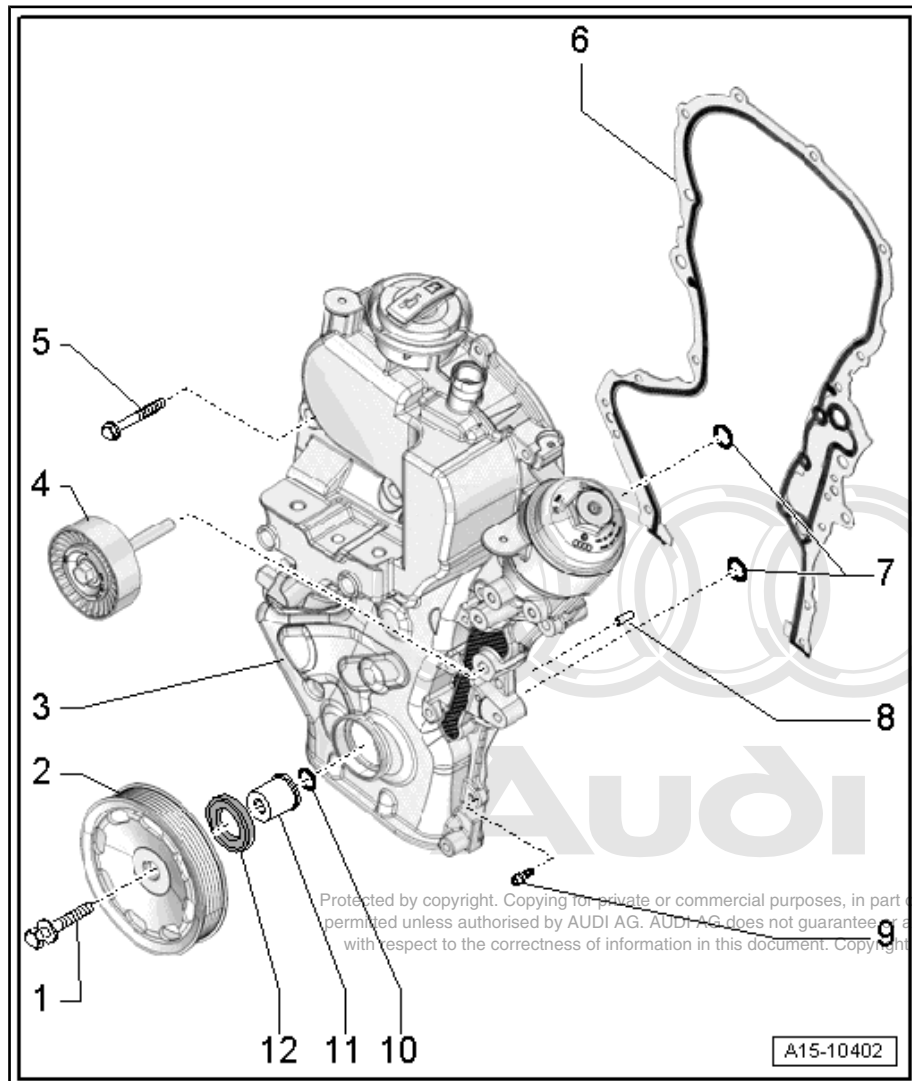
7 - Seals

- Inserted onto rear of timing chain cover
- Renew

8 - Dowel pin

9 - Bolt

- Tighten in diagonal sequence



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A15-10402

- 10 Nm

10 - O-ring

- Renew

11 - Bush

- Installation position: collar faces crankshaft

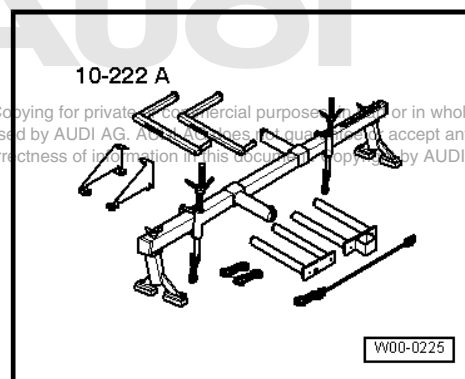
12 - Crankshaft oil seal

- Renewing ⇒ [page 49](#)

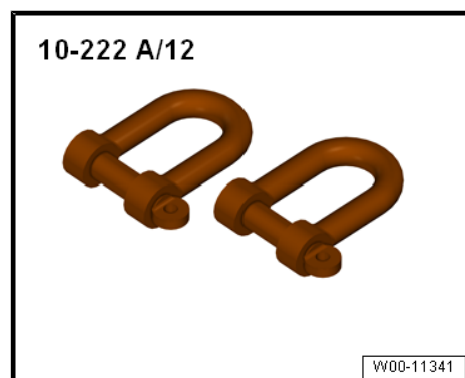
1.2 Removing and installing timing chain cover

Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-

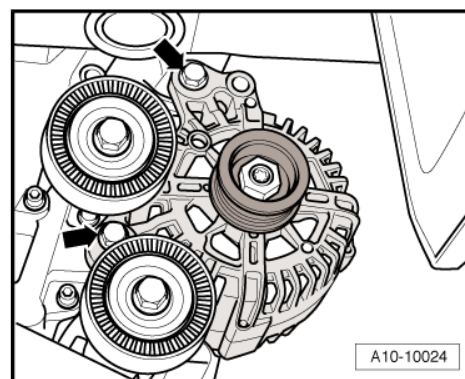


- ◆ Shackle - 10 - 222 A /12-



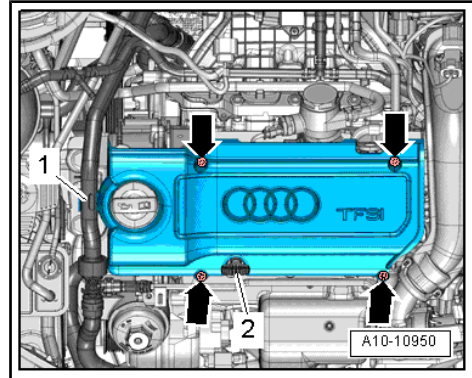
Removing

- Remove alternator ⇒ Electrical system; Rep. gr. 27 .
- Remove poly V-belt pulley for crankshaft ⇒ [page 44](#) .
- Remove poly V-belt pulley for coolant pump ⇒ [page 166](#) .
- Removing idler roller for poly V-belt ⇒ [page 44](#) .

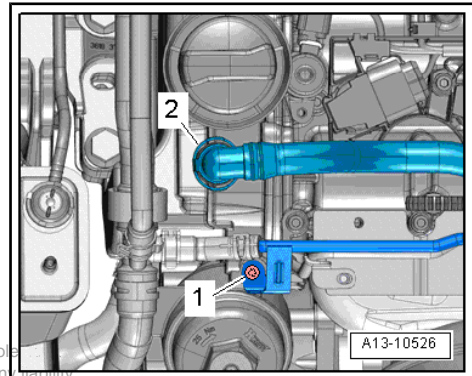




- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.



- Remove bolt -1- for coolant pipe.
- Disconnect crankcase breather hose -2- from timing chain cover (press release tabs).
- Remove sump => [page 143](#) .



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- Unplug electrical connector -1- for air conditioner compressor regulating valve - N280- at air conditioner compressor.

WARNING

Risk of injury caused by refrigerant.

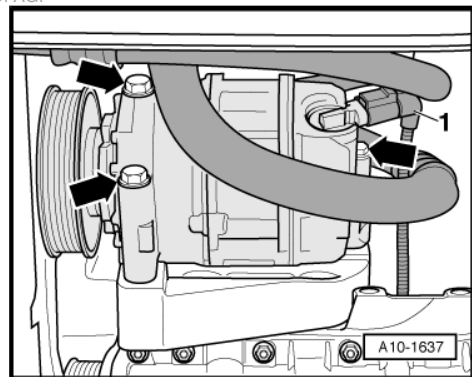
◆ *The air conditioner refrigerant circuit must not be opened.*

- Remove bolts -arrows- for air conditioner compressor.

Caution

Danger of damage to refrigerant lines and hoses.

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

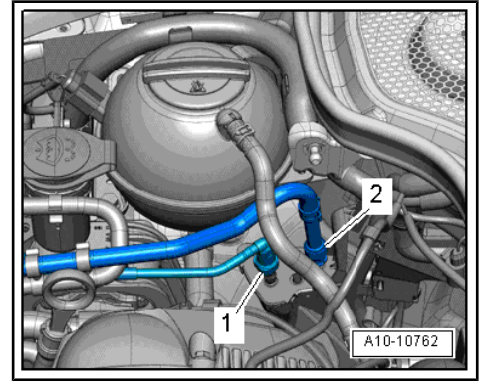


- Tie up air conditioner compressor together with refrigerant hoses to longitudinal member (refrigerant hoses remain connected).
- Remove bracket for air conditioner compressor => Rep. gr. 87 .

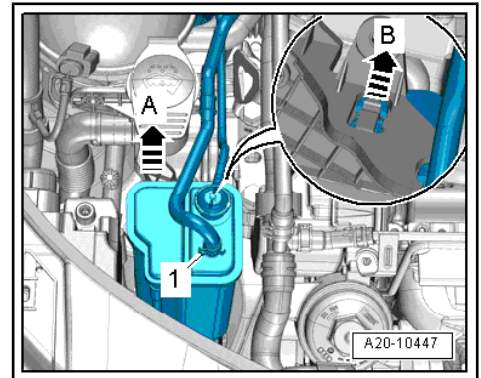
- Disconnect line -1- going to activated charcoal filter (press release tab).

 **Note**

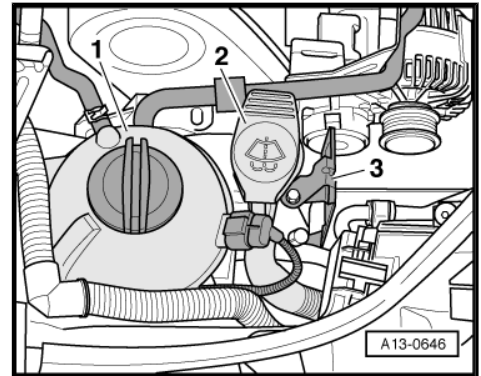
Disregard -item 2-.



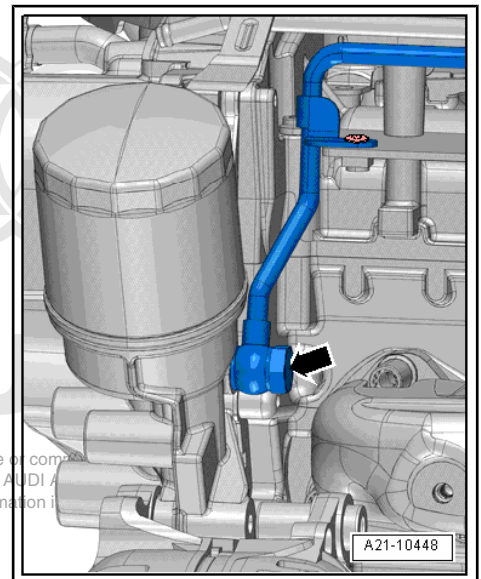
- Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side with line -1- connected.



- Remove bracket -3- for activated charcoal filter.
- Remove bolt on filler neck -2- for washer fluid reservoir.
- Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank and move wiring harness clear.
- Remove bolts for coolant expansion tank -1- and place coolant expansion tank on top of engine with the hoses attached (secure if necessary).



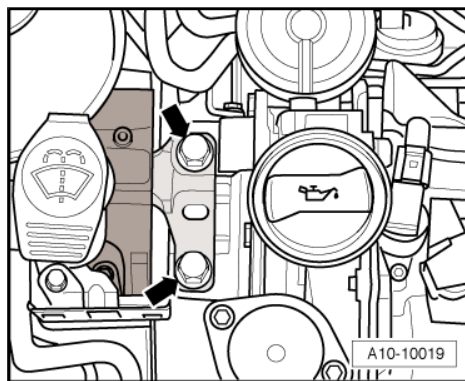
- Vehicles from approx. 04.2008 onwards: remove banjo bolt -arrow- for oil supply line at timing chain cover.



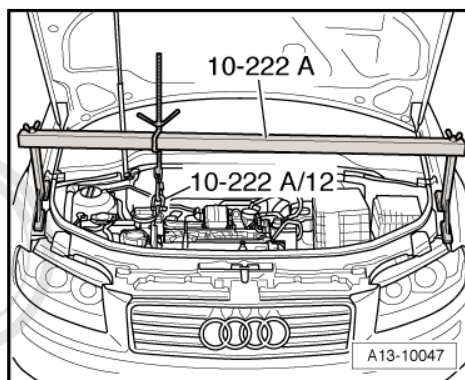
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- Loosen bolts -arrows- of assembly mounting at engine approx. 2 turns.

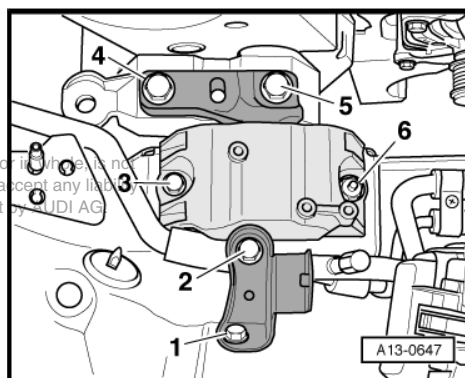


- Secure shackle - 10 - 222 A /12- to engine lifting eye (right-side).
- Position support bracket - 10 - 222 A- on bolted flanges of wing panels (vehicles up to 05.2008) or body flanges (vehicles from 06.2008 onwards).
- The spindle is located at rear.
- Engage hook on spindle in shackle.
- Apply light tension to spindle.

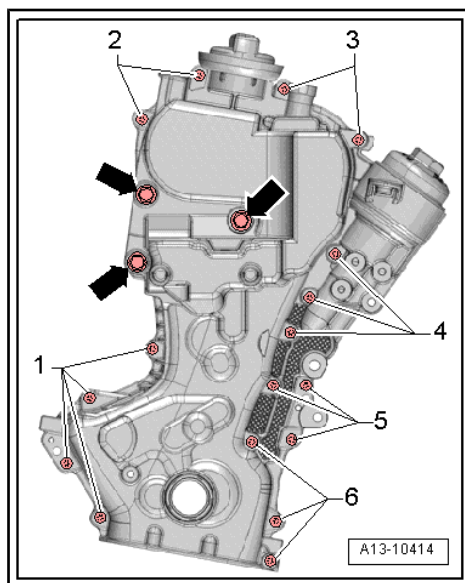


- Remove bolts -1- and -2- and detach connecting bracket.
- Remove bolts -3 ... 6- and detach engine mounting.

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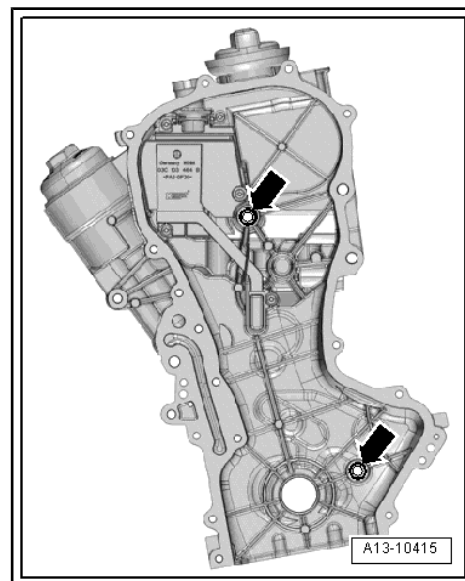
- Remove bolts -1 ... 6- and -arrows- for timing chain cover.
- Raise engine slightly and remove timing chain cover.
- Use drift to drive out crankshaft oil seal.



Installing

Note

- ◆ *Renew gasket and O-rings.*
- ◆ *Please note that the contact surfaces of the pulley, the securing bolt, the bearing bush and the crankshaft chain sprocket must be free of oil and grease.*
- Clean sealing surfaces; they must be free of oil and grease.
- Insert O-rings -arrows- on reverse side of timing chain cover.

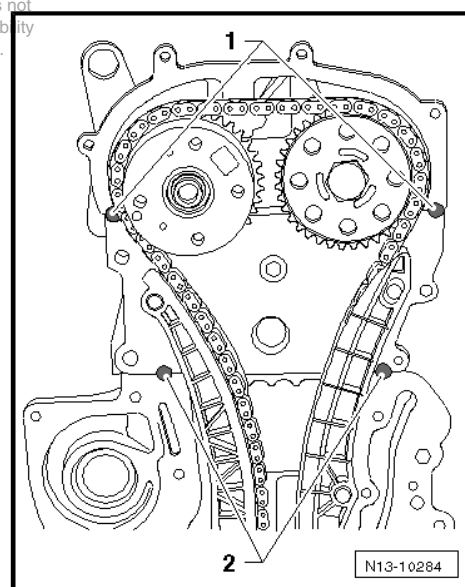


- Apply a bead of sealant to each joint, \varnothing 10 mm, approx. 1 mm thick.

- 1 - Joint between camshaft housing and cylinder head
 - 2 - Joint between cylinder head and cylinder block
- Fit gasket onto dowel pins in cylinder block.
 - Screw 2 threaded pins M6x80 into cylinder head and cylinder block to help guide cover.
 - Carefully fit timing chain cover onto threaded pins and dowel pins, then tighten bolts evenly in diagonal sequence.
 - Make sure that the timing chain cover remains straight.

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

- ◆ Tightening torques ⇒ [page 74](#) , ⇒ [page 152](#) .
- Install engine mounting and adjust assembly mountings ⇒ [page 35](#) .
- Renew crankshaft oil seal ⇒ [page 49](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install sump ⇒ [page 145](#) .
- Install engine cover panel ⇒ [page 121](#) .
- Install idler roller for poly V-belt ⇒ [page 44](#) .
- Install poly V-belt pulley for coolant pump ⇒ [page 166](#) .
- Install poly V-belt pulley for crankshaft ⇒ [page 44](#) .
- Install alternator ⇒ Electrical system; Rep. gr. 27 .



1.3 Exploded view - camshaft timing chain

**1 - Bolt**

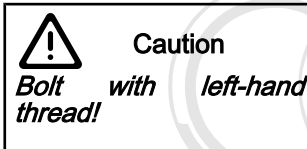
- 9 Nm

2 - Chain tensioner

- Exerts spring pressure
- Before removing, lock in place using locking pin - T40011-

3 - Tensioning rail**4 - Guide pin**

- 18 Nm

5 - Bolt

- Renew
- When loosening and tightening, lock camshaft chain sprocket using counterhold tool - T10172-
- 40 Nm + turn 90° further

6 - Camshaft adjuster for inlet camshaft

- Do not dismantle
- Use with -item 8-
- Removing and installing ⇒ [page 81](#)

7 - Camshaft timing chain

- Before removing, mark running direction with paint
- ⇒ ["1.4 Removing and installing camshaft timing chain", page 81](#)
- ⇒ ["1.5 Checking valve timing", page 92](#)
- ⇒ ["1.6 Checking timing chain", page 95](#)

8 - Bearing bush

- For camshaft adjuster

9 - Camshaft housing

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

10 - Camshaft chain sprocket for exhaust camshaft

- Removing and installing ⇒ [page 81](#)

11 - Bolt

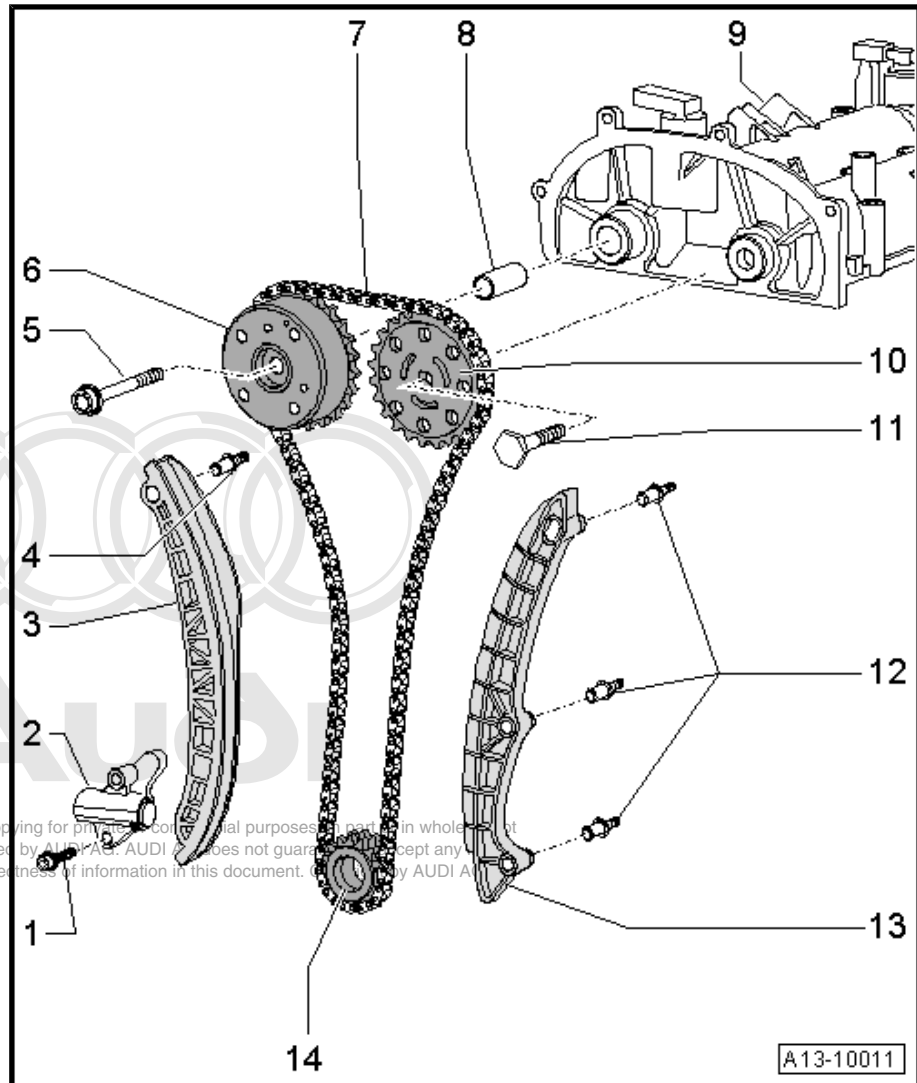
- Renew
- When loosening and tightening, lock camshaft chain sprocket using counterhold tool - T10172-
- 50 Nm + turn 90° further

12 - Guide pin

- 18 Nm

13 - Guide rail

- Removing and installing ⇒ [page 81](#)



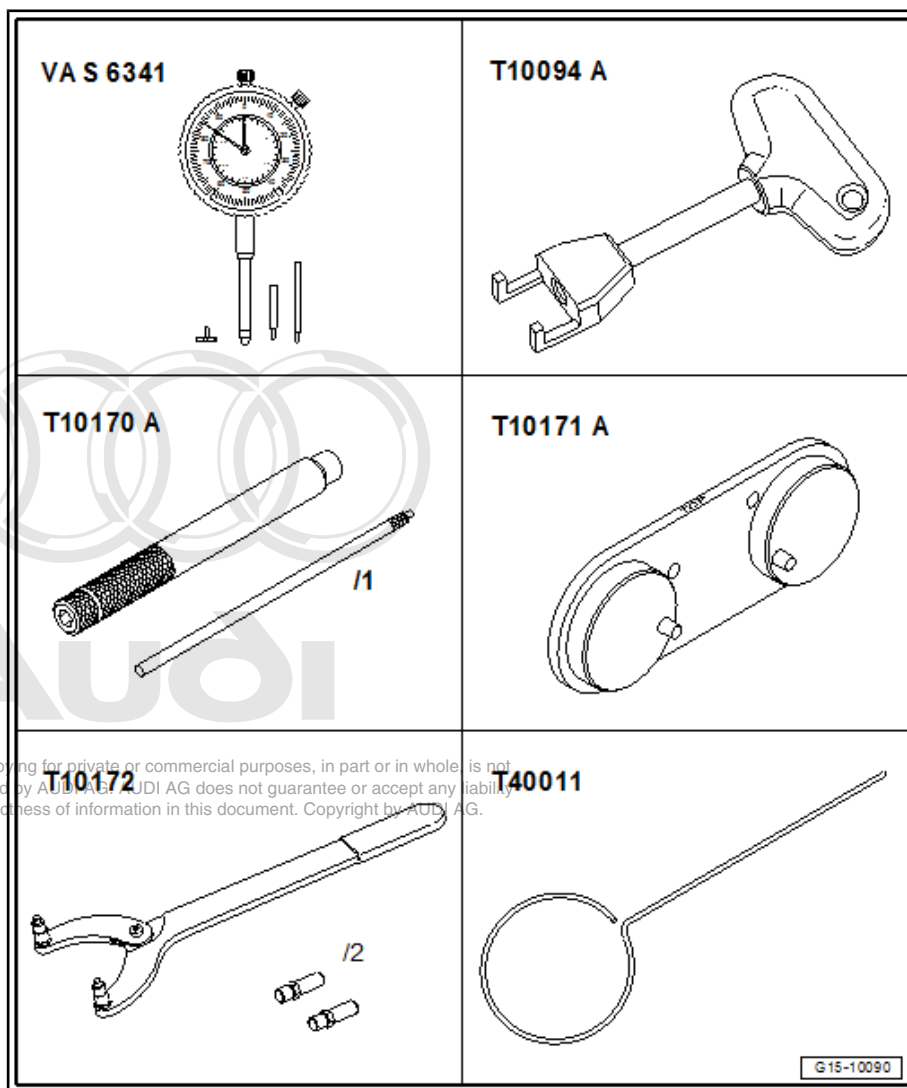
14 - Chain sprocket

- For drive chain for oil pump and camshaft timing chain
- Push-fitted onto crankshaft
- To remove or install ⇒ ["1.4 Removing and installing camshaft timing chain", page 81](#) and ⇒ ["1.5 Removing and installing oil pump", page 148](#)
- Installation position ⇒ [page 66](#)
- Contact surfaces must be free of oil and grease

1.4 Removing and installing camshaft timing chain

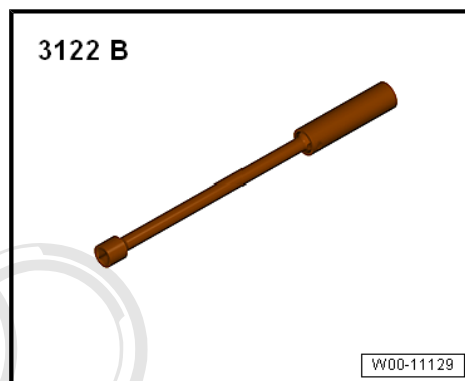
Special tools and workshop equipment required

- ◆ Dial gauge set, 4-part - VAS 6341-
- ◆ Puller - T10094 A-
- ◆ Adapter for dial gauge - T10170 A-
- ◆ Camshaft clamp - T10171 A-
- ◆ Counterhold tool - T10172-
- ◆ Locking pin - T40011-





- ◆ Spark plug socket and extension - 3122 B-



- ◆ Locking pin - T10340-

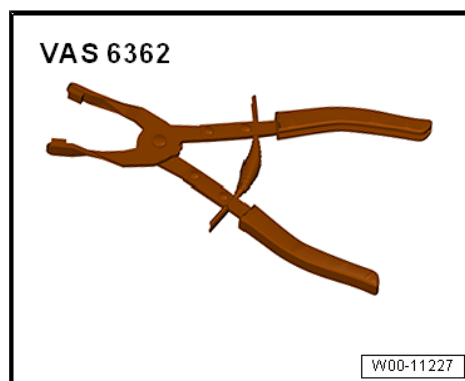


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- ◆ Counterhold tool - 3415- with pins -3415/1-

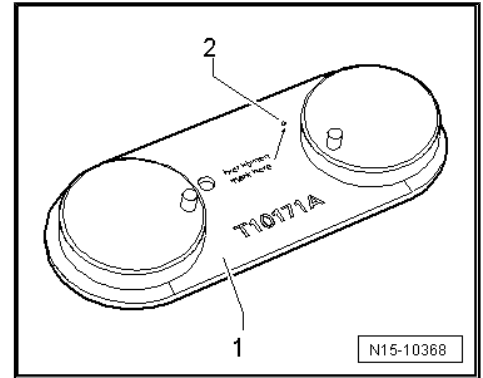


- ◆ Hose clip pliers - VAS 6362-



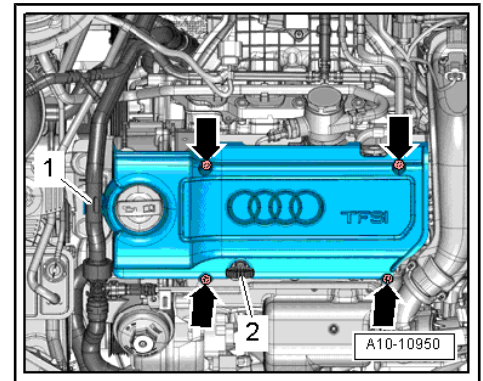
i Note

- ◆ *Camshaft clamp - T10171 A- can also be used instead of camshaft clamp - T10171- if an additional hole is drilled as described below.*
- ◆ *Place drilling template -1- onto camshaft clamp - T10171- as shown in illustration.*
- ◆ *Apply a centre punch mark at marking -2-.*
- ◆ *Use a \varnothing 7 mm drill bit to drill a hole at position marked and deburr hole.*
- ◆ *Apply identification marking "T10171 A" to tool*

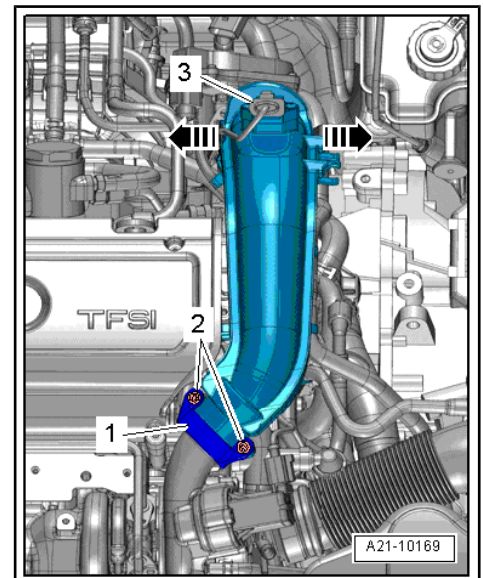


Removing

- Remove poly V-belt => [page 42](#) .
- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.



- Unscrew bolts -2- and detach retaining bracket -1-.
- Unplug electrical connector -3- at charge pressure sender - G31- .
- Release retainers -arrows- and detach air pipe first from throttle valve module - J338- and then from turbocharger.
- Move hoses on air pipe clear.

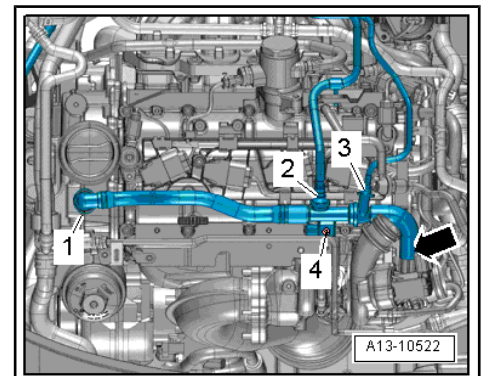


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- Detach vacuum lines -2- and -3-.

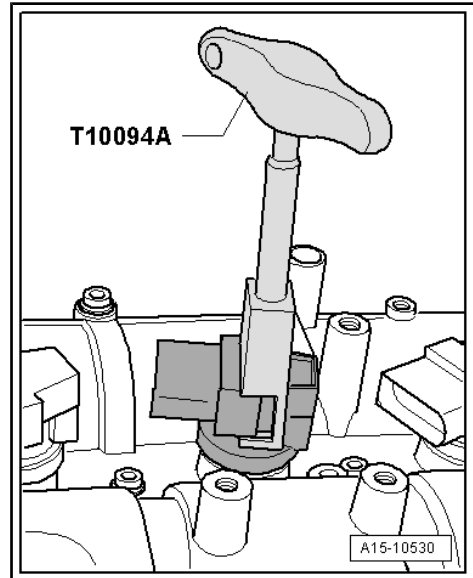
i Note

Disregard -items 1, 4- and -arrow-.

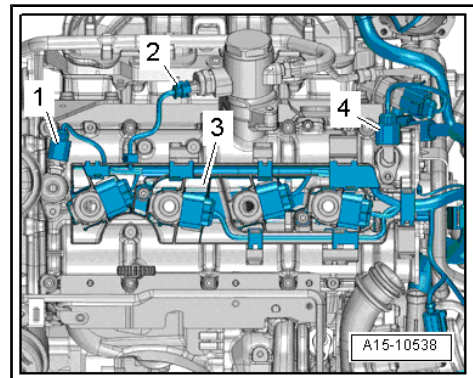




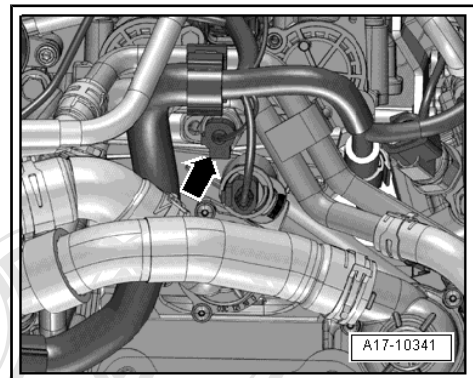
- Apply puller - T10094 A- to all ignition coils -arrow-, pull out ignition coils and at the same time unplug electrical connectors at ignition coils for cylinders 1 ... 4.
- Remove spark plug for cylinder 1 with spark plug socket and extension - 3122 B- .



- Unplug electrical connectors -1, 2, 4-, detach wiring duct -3- from camshaft housing and swivel to left side.



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

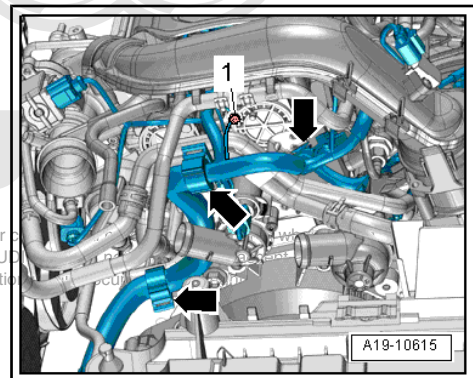


- Remove bolt -1- for earth connection.



Note

Disregard -arrows-.

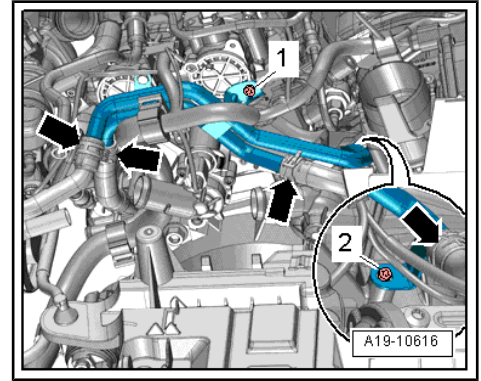


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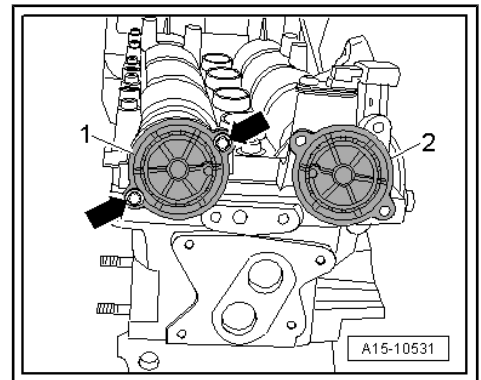
- Remove bolts -1- and -2- and press coolant pipes (left-side) to left side.

 **Note**

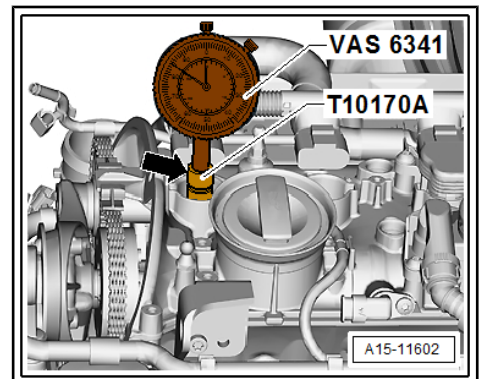
Disregard -arrows-.



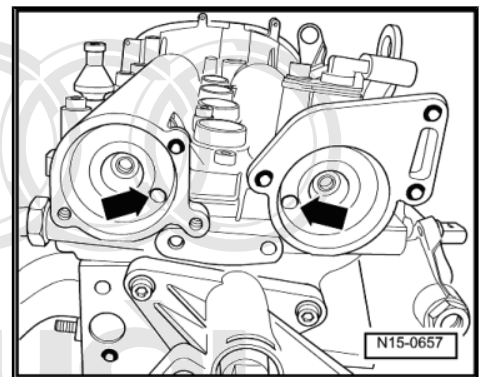
- Remove bolts -arrows- and detach sealing caps -1- and -2-.



- Screw adapter for dial gauge - T10170 A- into spark plug hole as far as the stop.
- Insert dial gauge - VAS 6341- with extension -T10170 A/1- and secure using locking nut -arrow-.
- Rotate crankshaft in normal direction of rotation to “TDC”.
- “TDC” = maximum measured value on dial gauge.

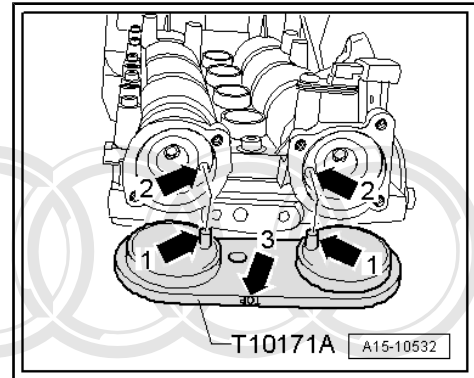


- The threaded holes -arrows- in the camshafts must be positioned as shown in illustration. Turn crankshaft one turn (360°) if necessary.



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- Insert camshaft clamp - T10171 A- into holes in camshafts as far as stop.
- The locking pins -arrows 1- must engage in the holes -arrows 2-.
- The inscription "TOP" -arrow 3- should be legible from above.



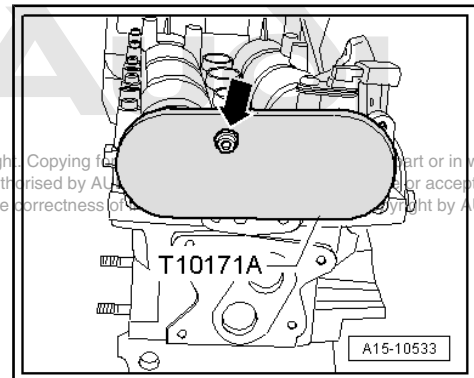
- To secure the camshaft clamp - T10171 A- , screw in an M6 bolt -arrow- hand-tight, but do not tighten.

**Caution**

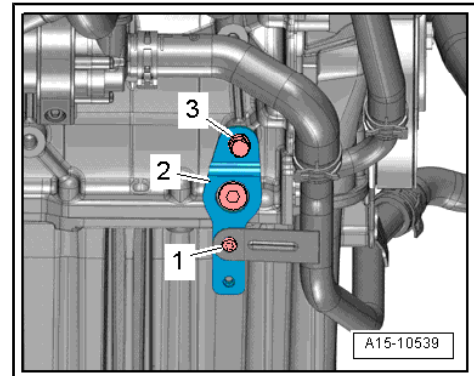
Risk of damage to camshafts.

- ◆ **The camshaft clamp - T10171 A- must not be used as a counterhold tool.**

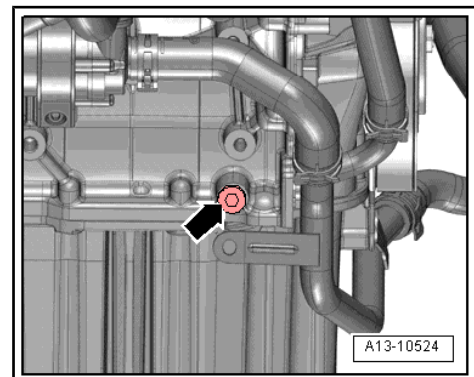
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- Remove bolts -1- and -3- and take off bracket -2- for coolant pipe (right-side).



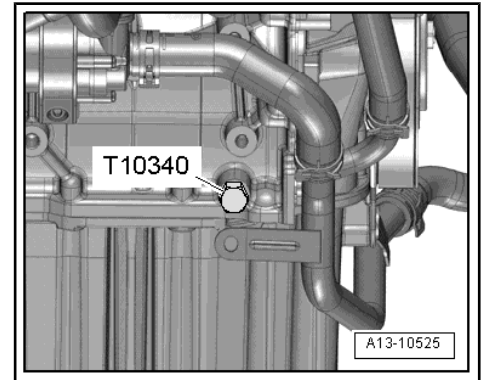
- Unscrew plug -arrow- for "TDC" hole on cylinder block.



- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.

 Note

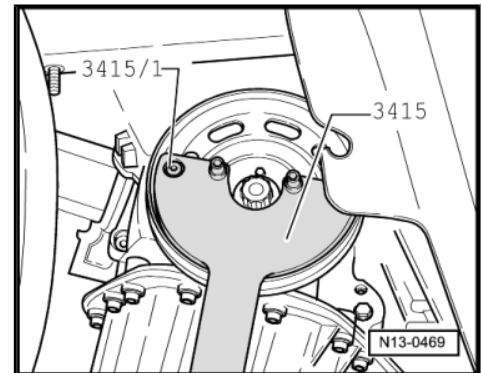
The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



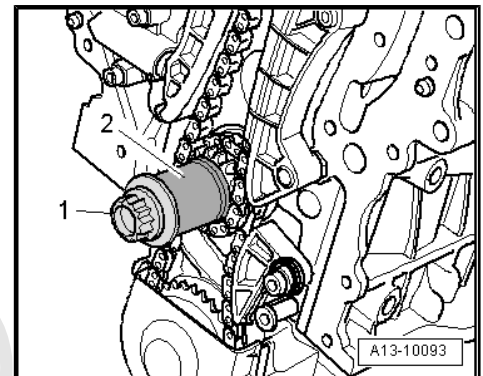
 Caution

Risk of damage to engine.

- ◆ *To prevent the crankshaft chain sprocket from slipping off the drive lug, do not rotate the crankshaft after the poly V-belt pulley has been detached.*



- Loosen bolt for poly V-belt pulley using counterhold tool - 3415- with pin -3415/1- .
- Remove bolt and take off poly V-belt pulley.
- Remove timing chain cover => [page 75](#) .
- Insert bush -2- and screw in crankshaft pulley bolt -1- hand-tight to secure chain sprocket on crankshaft.



- Press tensioning rail -2- in direction of -arrow- and use locking pin - T40011- to lock piston for chain tensioner -1-.

 Caution

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

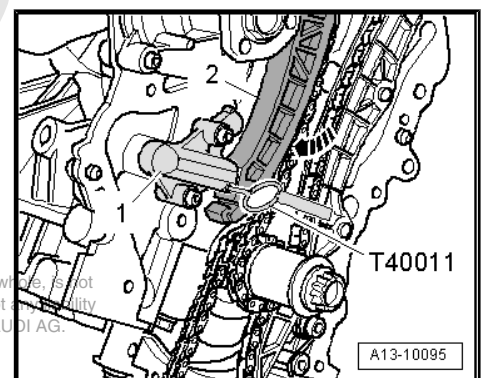
- ◆ **Mark running direction of timing chain with coloured arrows for re-installation. Do not mark timing chain by means of centre punch, notch or the like.**

Risk of damage to camshafts.

- ◆ **The camshaft clamp - T10171 A- must not be used as a counterhold tool.**

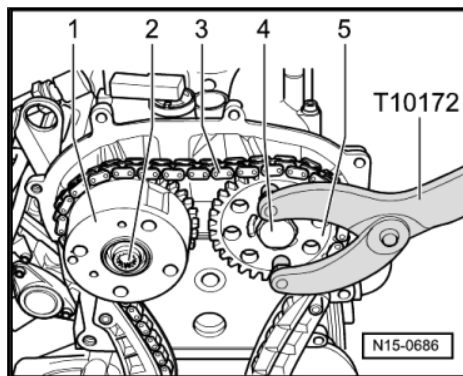
Risk of damage to thread.

- ◆ **The camshaft adjuster central bolt has a left-hand thread.**





- Loosen bolt -2- for camshaft adjuster -1- and bolt -4- for camshaft chain sprocket -5-, using counterhold tool - T10172- to counterhold on camshaft chain sprocket.
- Detach camshaft chain sprocket together with camshaft timing chain -3-.



Note

Leave camshaft adjuster on camshaft.

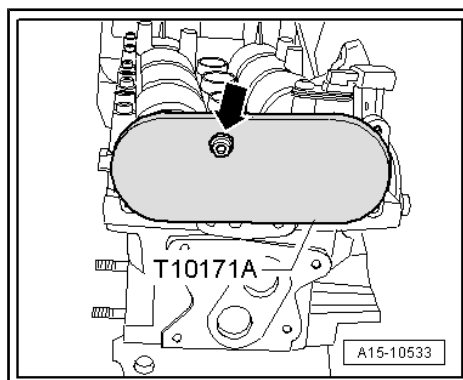
Installing

- Tightening torques => [page 79](#)



Note

- ◆ Renew bolts for camshaft chain sprocket and camshaft adjuster.
 - ◆ Renew gaskets and O-rings for camshaft sealing caps.
- Check "TDC" position of camshaft and crankshaft:
 - The camshaft clamp - T10171 A- must be fitted to camshaft housing.



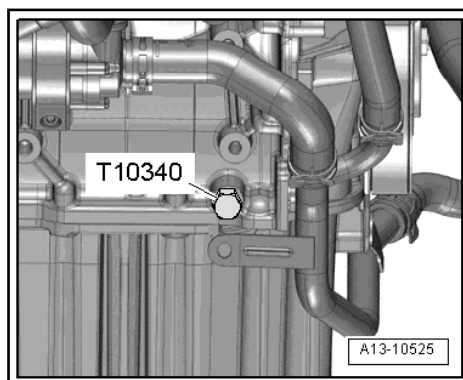
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Risk of damage to valve gear.

- ◆ *The camshafts must not be moved axially when turning.*

- Locking pin - T10340- screwed into cylinder block as far as stop and tightened to 30 Nm.
- Turn crankshaft in direction of engine rotation until it makes contact with locking pin - T10340- .



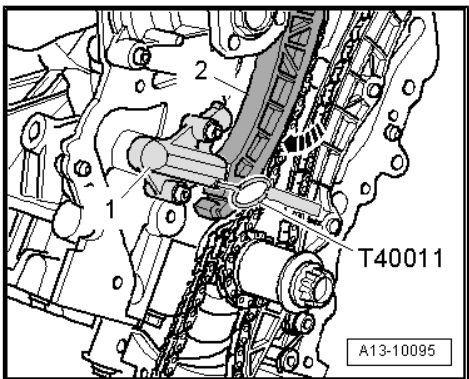
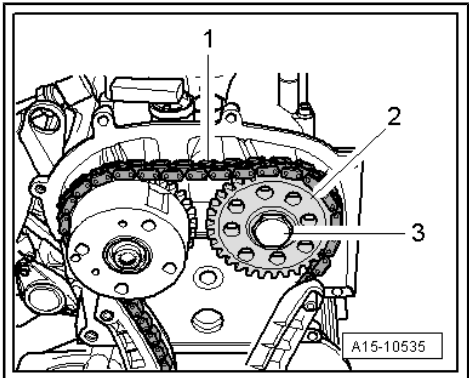
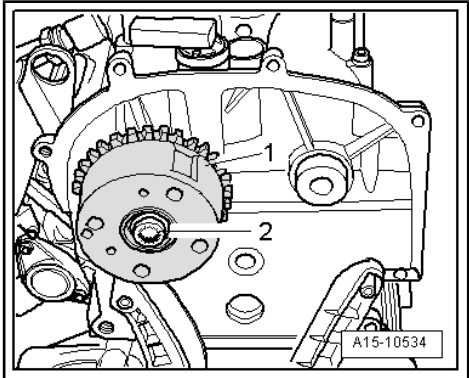
 **Caution**
Risk of damage to thread.
 ♦ **The camshaft adjuster central bolt has a left-hand thread.**

- Fit bolt -2- for camshaft adjuster -1- without tightening.
- It should just be possible to turn the adjuster on the camshaft without axial movement.

- Fit camshaft timing chain according to marks applied when removing.
- Fit camshaft timing chain -1- together with chain sprocket -2- for exhaust camshaft onto crankshaft sprocket and camshaft adjuster.
- Fit bolt -3- for camshaft chain sprocket without tightening.
- It should just be possible to turn the camshaft chain sprocket on the camshaft without axial movement.

- Remove locking pin - T40011- from chain tensioner -1- and tension camshaft timing chain.
- Check "TDC" position of camshaft and crankshaft again

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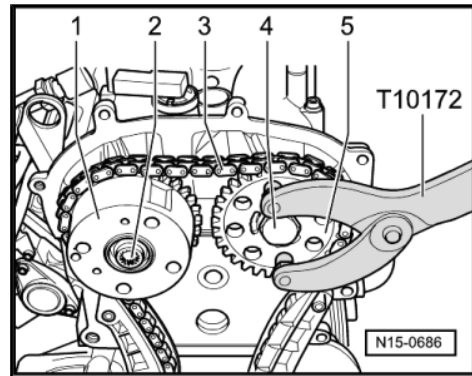


**Caution**

Risk of damage to thread.

- ◆ *The camshaft adjuster central bolt has a left-hand thread.*

- Tighten bolt -2- for camshaft adjuster -1- to 40 Nm and bolt -4- for camshaft chain sprocket -5- to 50 Nm, using counterhold tool - T10172- to counterhold on camshaft chain sprocket.

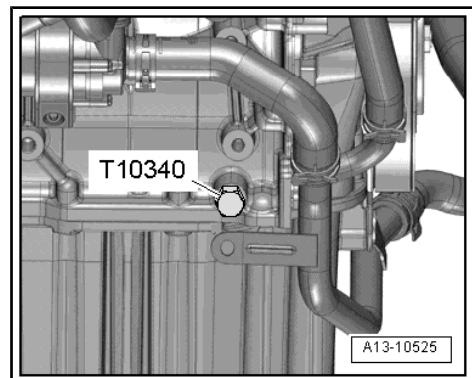
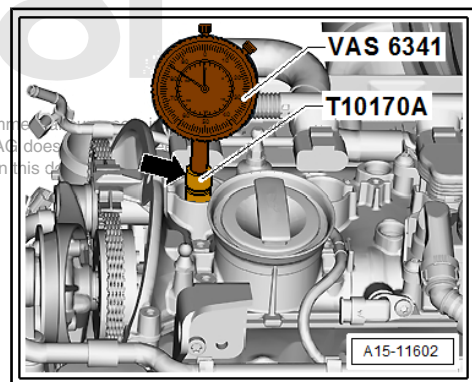
**Note**

- ◆ *Do not tighten bolts for camshaft adjuster and camshaft chain sprocket to final torque before checking timing again.*
 - ◆ *When tightening the bolts, the crankshaft must not turn and the camshaft timing chain -3- must remain tensioned on both sides.*
- Detach camshaft clamp - T10171 A- .
 - Remove locking pin - T10340- .
 - Turn crankshaft 2 revolutions in direction of engine rotation and set to “TDC”.
 - “TDC” = maximum measured value on dial gauge.

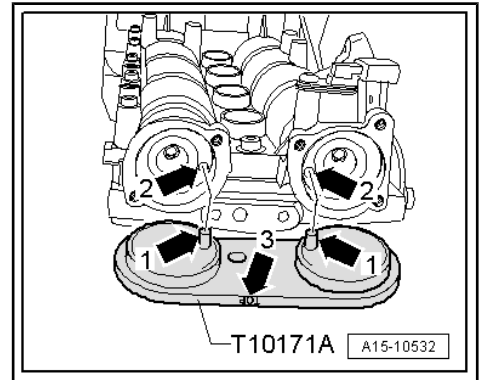
**Note**


- ◆ *If the crankshaft was turned more than 0.01 mm beyond “TDC”, turn back the crankshaft approx. 45° in the opposite direction of normal rotation. Then turn crankshaft in normal direction of rotation to “TDC”.*
 - ◆ *Permissible deviation from TDC: ± 0.01 mm.*
 - ◆ *Disregard -arrow-.*
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
 - Turn crankshaft in direction of engine rotation until it makes contact with locking pin.

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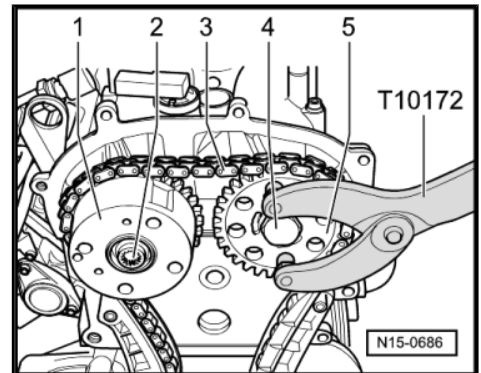


- Insert camshaft clamp - T10171 A- into holes in camshafts as far as stop.
- The locking pins -arrows 1- must engage in the holes -arrows 2-.
- The inscription "TOP" -arrow 3- should be legible from above.
- If camshaft clamp - T10171 A- cannot be fully inserted into holes in camshafts, repeat adjustment.
- If it is possible to insert camshaft clamp - T10171 A- completely, take off camshaft clamp again.
- Remove locking pin - T10340- .



 **Caution**
Risk of damage to thread.
 ♦ *The camshaft adjuster central bolt has a left-hand thread.*


- Tighten bolt -2- for camshaft adjuster -1- and bolt -4- for camshaft chain sprocket -5- and turn further through specified angle to final setting (counterhold at camshaft chain sprocket using counterhold tool - T10172-).



 **Note**

Disregard -item 3-.

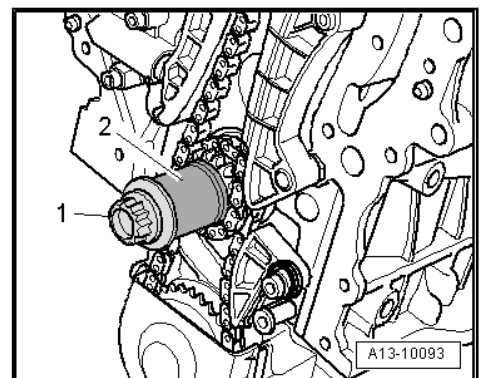
- Turn crankshaft 2 revolutions in direction of engine rotation and set to "TDC".
- Check adjustment ⇒ [page 90](#) , repeat adjustment if necessary.

 **Caution**
Risk of damage to engine.
 ♦ *To prevent the crankshaft chain sprocket from slipping off the drive lug, do not rotate the crankshaft after the poly V-belt pulley has been detached.*

- Remove bolt for poly V-belt pulley -1-.

 **Note**

Leave bush -2- in position on crankshaft.



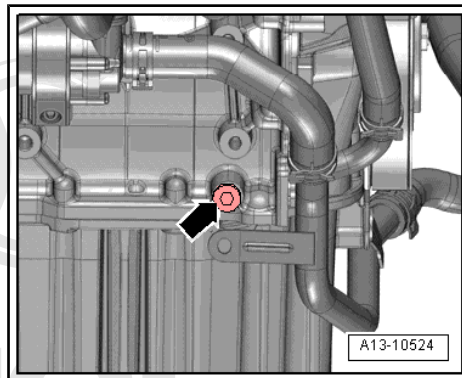
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Installation is carried out in the reverse order; note the following:

- Install timing chain cover ⇒ [page 75](#) .
- Lubricate O-rings for camshaft sealing caps with oil before installing.
- Install poly V-belt pulley for crankshaft ⇒ [page 44](#) .



- Tighten plug for "TDC" drilling ⇒ [page 66](#) .
- Install coolant pipes (left-side) ⇒ [page 177](#) .
- Install spark plug ⇒ Maintenance ; Booklet 808 .
- Install air pipe ⇒ [page 191](#) .
- Install engine cover panel ⇒ [page 121](#) .
- Install poly V-belt ⇒ [page 42](#) .

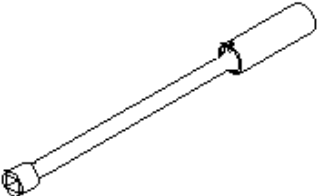
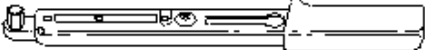

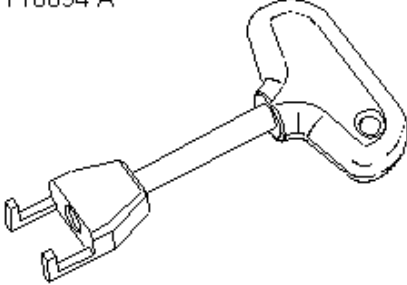
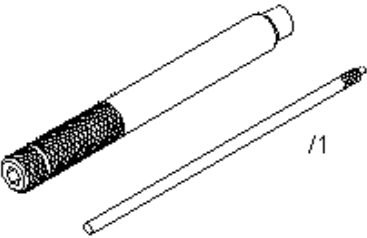
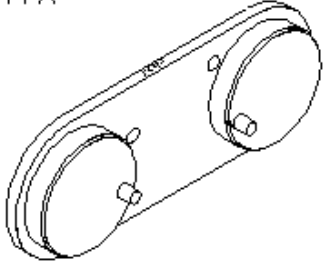


1.5 Checking valve timing

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Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-
- ◆ Torque wrench (5 ... 50 Nm) - V.A.G 1331-
- ◆ Dial gauge - VAS 6079-
- ◆ Puller - T10094 A-
- ◆ Dial gauge adapter - T10170- or dial gauge adapter - T10170 A-
- ◆ Camshaft clamp - T10171 A-

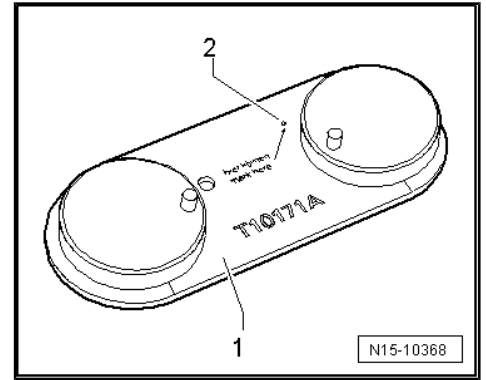
<p>3122 B</p> 	<p>V.A.G 1331</p> 
<p>VAS 6079</p> 	<p>T10094 A</p> 
<p>T10170</p> 	<p>T10171 A</p>  <p>W15-10067</p>



Note

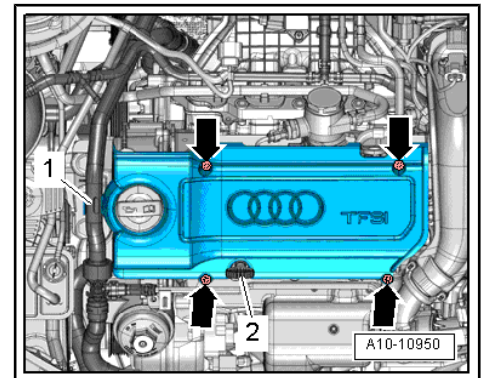
The attachment points for securing the camshaft clamps have changed. A new special tool (designated camshaft clamp - T10171 A-) has been introduced. The previous camshaft clamp - T10171- can still be used if it is adapted as described below.

- Place drilling template -1- onto camshaft clamp - T10171- .
- Apply a centre punch mark at marking -2- on camshaft clamp - T10171- .
- Drill a hole in the camshaft clamp - T10171- using a 7 mm drill.
- Deburr the hole on both sides.
- Add an »A« to the tool designation -T10171- .

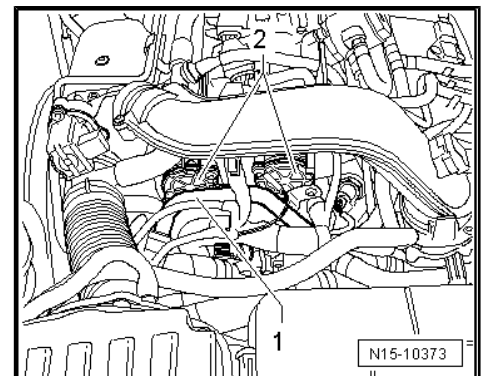


Test sequence

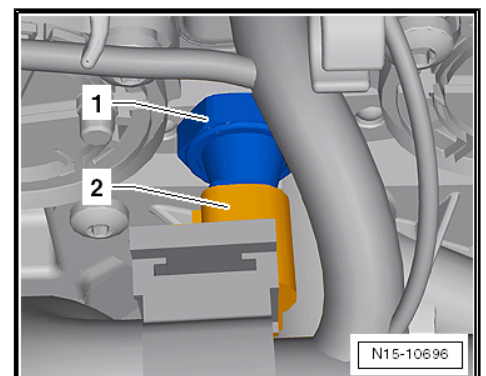
- Remove lower section of front wheel housing liner (right-side)
⇒ General body repairs; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Drain off coolant ⇒ [page 159](#) .
- Unscrew securing bolts -arrows- for engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Disengage coolant hoses -1- at engine cover panel and pull engine cover panel upwards.



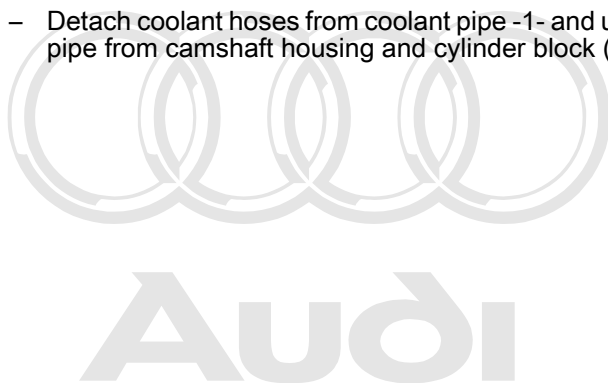
- Detach coolant hoses from coolant pipe -1- and unbolt coolant pipe from camshaft housing and cylinder block (from below).



- Release connector -2- and unplug.
- Remove oil pressure switch -F1-.

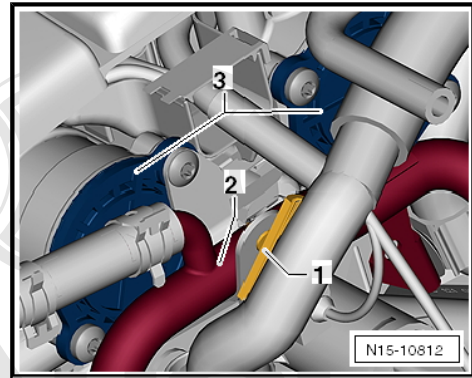


- Unscrew bolts for both camshaft covers -3-.

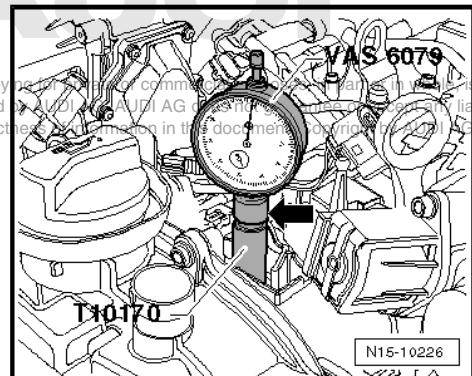


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- Unclip engine prewiring -1-.
- Pull coolant pipe -2- and engine prewiring -1- away from cylinder head.
- Prise both camshaft covers -3- out of cylinder head.
- Remove spark plug from cylinder 1. To do so, use puller -T10094 A- and spark plug spanner 3122 B.



- Screw dial gauge adapter -T10170- into spark plug thread as far as stop.
- Insert dial gauge -VAS 6079- with extension -T10170/1- as far as stop and secure using locking nut -arrow-.
- Turn crankshaft in normal direction of rotation to TDC for cylinder 1 and note position of small indicator on dial gauge.

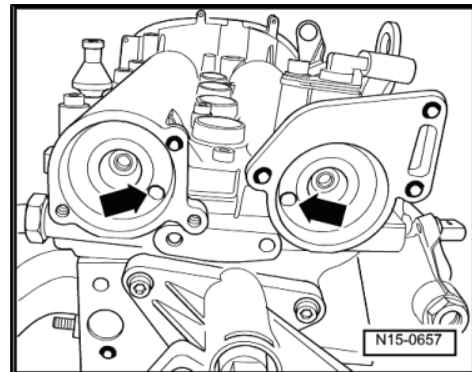


The holes -arrows- in the camshafts must be positioned as shown in illustration; turn crankshaft another full rotation (360°) if necessary.



Note

- ◆ *If the crankshaft has been turned more than 0.01 mm beyond the TDC position, it must be turned two rotations further in normal direction of engine rotation so that it is at the TDC position for cylinder 1.*
- ◆ *Permissible deviation from TDC for cylinder 1: ± 0.01 mm.*



Caution

Before inserting camshaft clamp - T10171 A- , check if the pins on the tool protrude by at least 7 mm.

If this is not the case, the camshaft clamp is defective and must be renewed.

Do not knock camshaft clamp into place with any kind of tool.

- Insert camshaft clamp -T10171 A- into camshaft openings as far as stop.

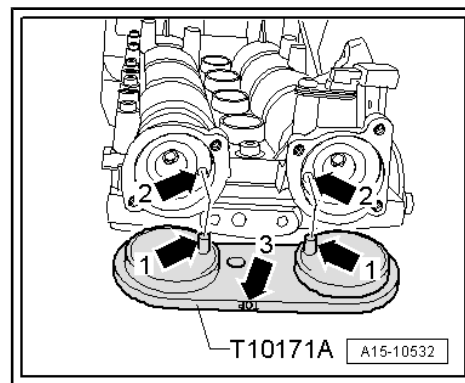
The locking pins -arrows 1- must engage in the holes -arrows 2-. The inscription "TOP" -arrow 3- should be legible from above.

If the camshaft clamp -T10171 A- cannot be inserted into the camshaft openings as far as the stop, the valve timing is not correct and must be adjusted ⇒ [page 81](#) .

The valve timing is OK if the camshaft clamp -T10171 A- can be inserted into the camshaft openings as far as the stop.

Further assembly is basically carried out in reverse order of dismantling. Note the following:

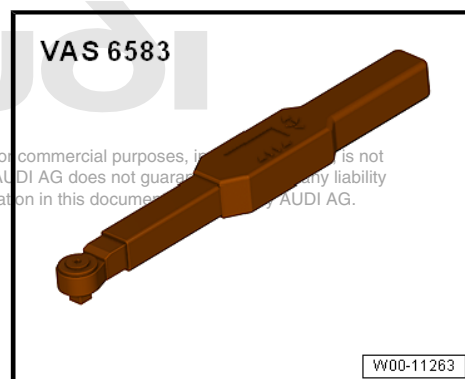
- ◆ Renew seals for camshaft sealing caps and lubricate with oil before installing.
- ◆ Because the seal cannot be renewed individually, the oil pressure switch must be renewed after removal.
- ◆ Tightening torque for oil pressure switch - F1- : 20 Nm
- Fill system with coolant ⇒ [page 159](#) .



1.6 Checking timing chain

Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-



- ◆ Testing tools - T10550-

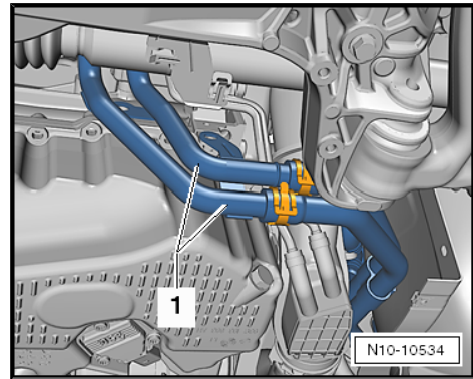


- ◆ Camshaft clamp - T10550/1-
- ◆ Pointer - T10550/2-
- ◆ Scaling sleeve - T10550/3-
- Engine oil temperature must be at least 40 °C ⇒ Vehicle diagnostic tester.
- Engine must not be at »TDC« position.

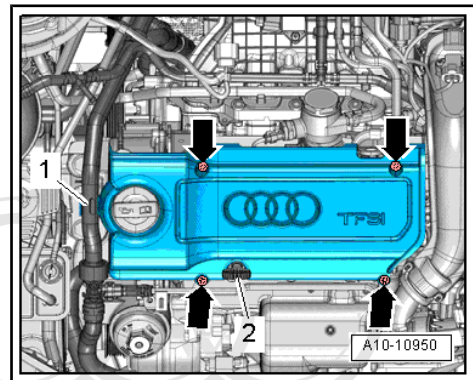
- Remove front wheel (right-side) ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres .
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Exploded view - noise insulation .
- Remove front wheel housing liner (right-side) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner .
- Remove poly V-belt ⇒ [page 42](#) .

Vehicles with auxiliary/supplementary heater:

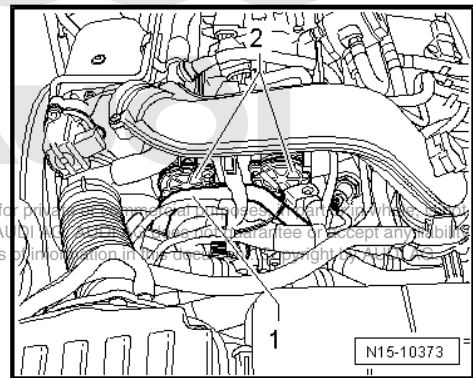
- Clamp off coolant hoses with hose clamps up to 25 mm - 3094- .
- Open clamps and disconnect coolant hoses from coolant pipes -1-.
- Remove auxiliary/supplementary heater with exhaust pipe and coolant hoses connected ⇒ Auxiliary/supplementary heater; Rep. gr. 82 ; Auxiliary/supplementary heater; Removing and installing auxiliary/supplementary heater .

**All vehicles (continued):**

- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.

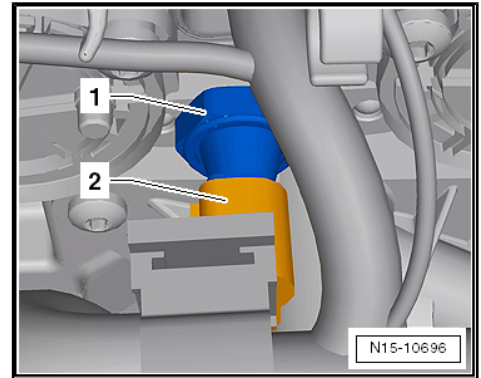


- Detach coolant hoses from coolant pipe -1- and unbolt coolant pipe from camshaft housing and cylinder block (from below).
- Release connector -2- and unplug.

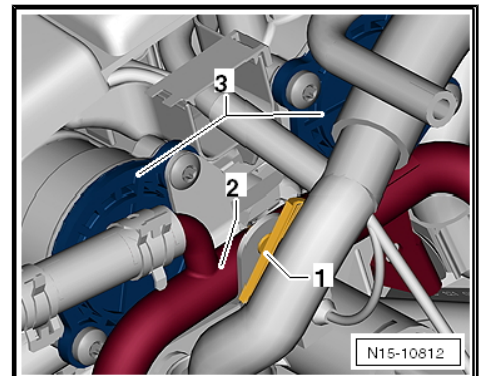


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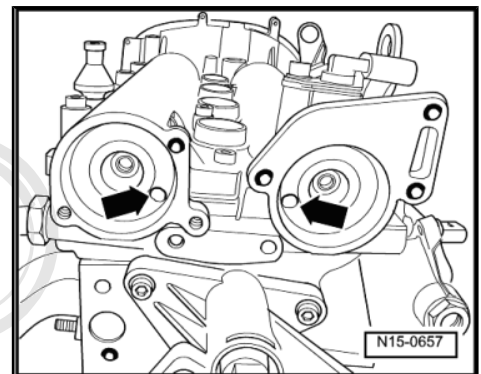
Disregard item -1-.



- Remove bolts from both camshaft covers -3-.
- Unclip electrical wiring harness -1-.
- Pull coolant pipe -2- and electrical wiring harness -1- away from cylinder head.
- Prise both camshaft covers -3- out of cylinder head.

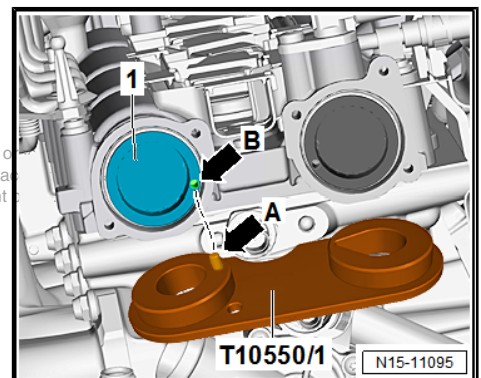


- Hole -left arrow- in exhaust camshaft (left-side) must be in position shown.
- If necessary, turn crankshaft in direction of engine rotation.



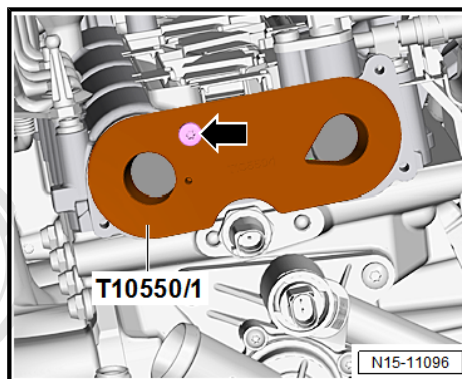
- Insert camshaft clamp - T10550/1- all the way into camshaft openings.
- Locking pin -arrow A- must engage in hole -arrow B- in exhaust camshaft.
- Marking "TOP" should be legible from above.

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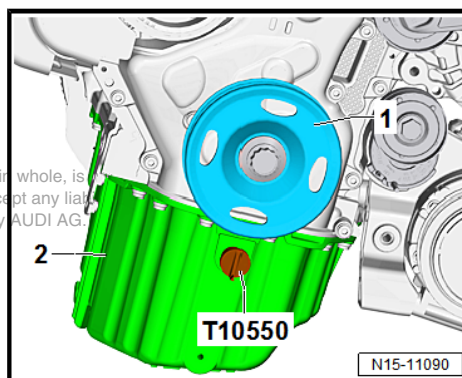


- Secure camshaft clamp - T10550/1- with bolt so it is hand-tight.
- Use one of the camshaft cover bolts -arrow-.




- Screw pointer - T10550/2- into hole in sump.
- Align pointer vertically, ensuring that tip faces upwards.
- Tighten pointer with knurled nut.

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- Position scaling sleeve - T10550/3- on pulley.

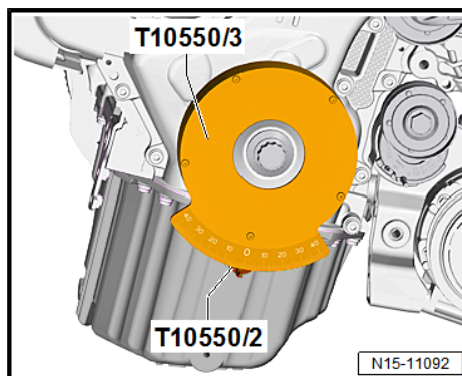
 **Caution**

Risk of injury: fingers could become jammed between the parts.

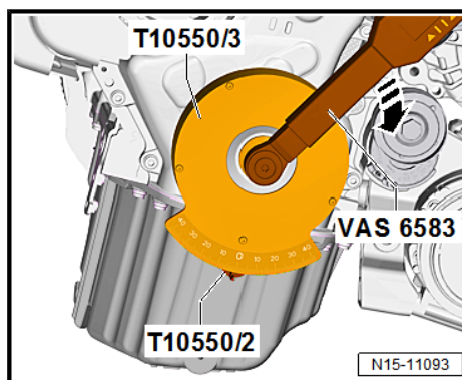
The scaling sleeve - T10550/3- is fitted with magnets.

Carefully bring the parts together.

When doing so, note that the parts pull towards each other very quickly.



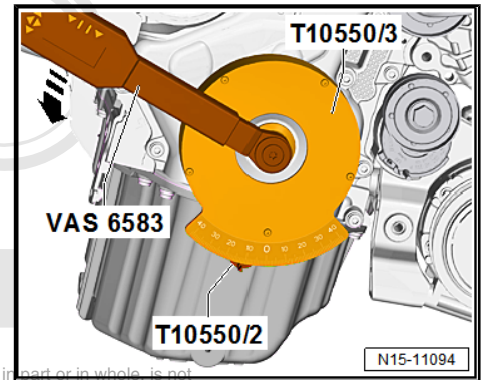
- Align scaling sleeve - T10550/3- with pointer - T10550/2- as shown.
- Fit torque wrench - VAS 6583- onto crankshaft bolt using a suitable socket.
- Push torque wrench - VAS 6583- clockwise and hold at 40 Nm.
- Turn scaling sleeve - T10550/3- so that pointer - T10550/2- is at position »0«.



- Switch torque wrench - VAS 6583- direction setting and slowly push it anti-clockwise.
- Hold torque wrench - VAS 6583- at 40 Nm.
- Read off value indicated on scaling sleeve.
- If timing chain skips during test, it must be renewed
⇒ [page 81](#) .
- Timing chain skipping can be easily heard and felt.

Test evaluation

- If timing chain is elongated by up to 28°, it is OK.
- If timing chain is elongated by 29° or more, it is not OK and must be renewed ⇒ [page 81](#) .



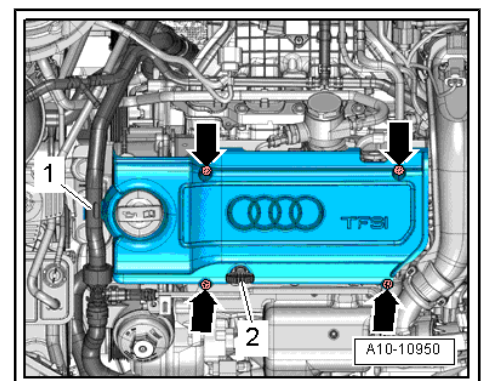
Assemble in reverse order. Note the following:

Note

- ◆ *The scaling sleeve - T10550/3- is fitted with magnets.*
- ◆ *Do not use any tools to prise the scaling sleeve - T10550/3- off the pulley.*
- Turn scaling sleeve - T10550/3- approx. 45° to the right so that the scaling area is no longer above the pointer - T10550/2- .
- Reach behind scaling sleeve - T10550/3- with both hands.
- Press against pulley bolt with your thumbs and pull off scaling sleeve - T10550/3- .
- Renew seals for camshaft sealing caps and lubricate with oil before installing.
- Fill up with coolant ⇒ [page 159](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - camshaft housing”, page 119](#)
- ◆ ⇒ [“1.2 Removing and installing poly V-belt”, page 42](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Exploded view - noise insulation
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres
- Fit engine cover panel onto camshaft housing and engage coolant hose -1- in retainer.
- Tighten securing bolts -arrows- to 10 Nm.



2 Cylinder head

⇒ "2.1 Exploded view - cylinder head", page 100

⇒ "2.2 Removing and installing cylinder head", page 102

⇒ "2.3 Checking compression", page 116

2.1 Exploded view - cylinder head

1 - Cylinder head

- Removing and installing
⇒ [page 102](#)
- Checking for distortion
⇒ [page 101](#)
- Sealing surface for camshaft housing must be free of oil and grease
- If renewed, change coolant and engine oil

2 - Guide pin

- Tightening torque
⇒ [Item 4 \(page 80\)](#)

3 - Bolt

- 20 Nm

4 - Engine lifting eye

5 - Hydraulic valve compensation element

- Do not interchange
- Lubricate running surfaces with oil

6 - Securing clip

- Check for firm attachment
- Not supplied separately

7 - Roller rocker finger

- Check roller bearings for ease of movement
- Lubricate contact surfaces before installing
- Attach to hydraulic compensation element -item 5- using securing clip -item 6-

8 - Oil strainer

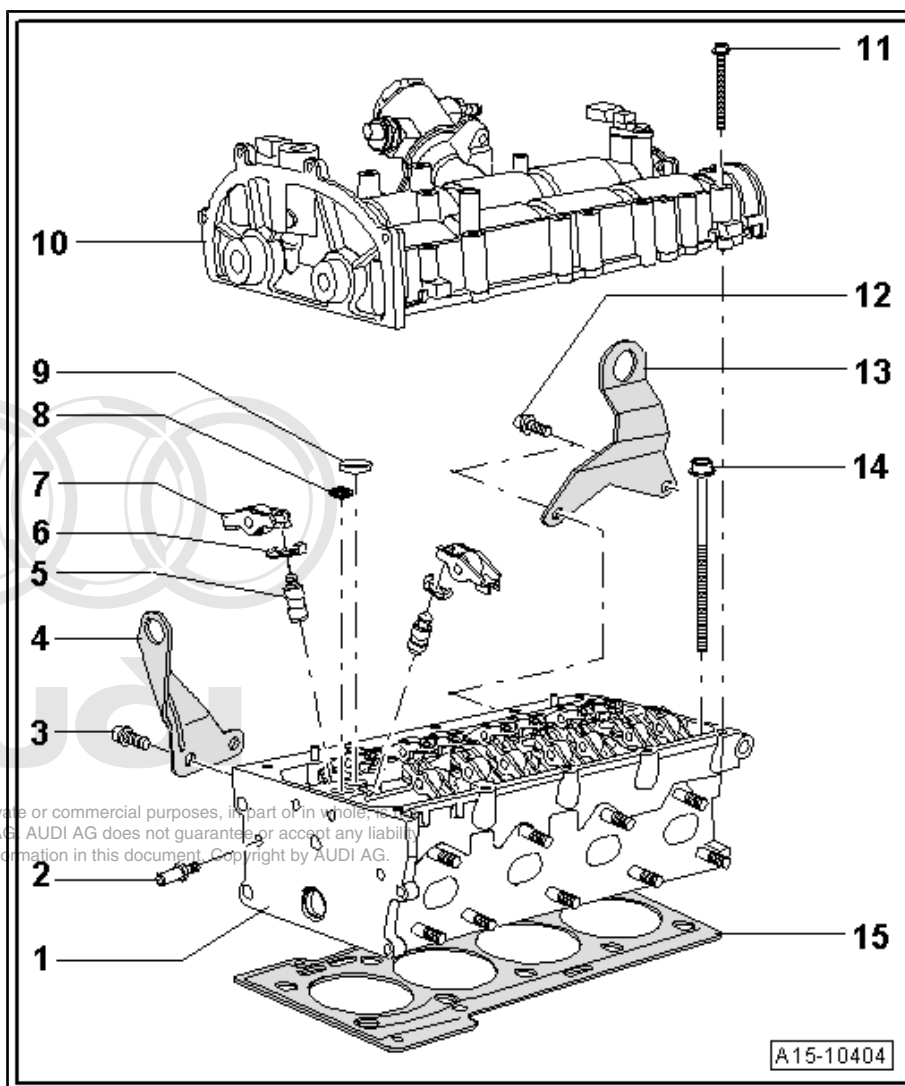
- Inserted into cylinder head
- Renew

9 - Seal

- Inserted into cylinder head
- 4x
- Renew

10 - Camshaft housing

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



11 - Bolt

- Renew
- Note correct sequence when loosening ⇒ [page 124](#)
- Tightening torque and sequence ⇒ [page 120](#)

12 - Bolt

- 20 Nm

13 - Engine lifting eye

14 - Bolt

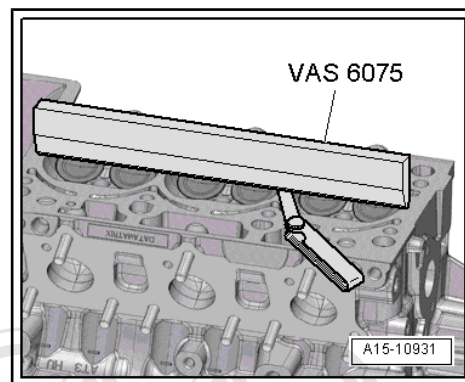
- Renew
- Note correct sequence when loosening ⇒ [page 113](#)
- Tightening torque and sequence ⇒ [page 102](#)

15 - Cylinder head gasket

- Renewing ⇒ [“2.2 Removing and installing cylinder head”, page 102](#)
- Installation position: Part number points towards cylinder head, and must be legible from the inlet side
- If renewed, change coolant and engine oil

Checking cylinder head for distortion

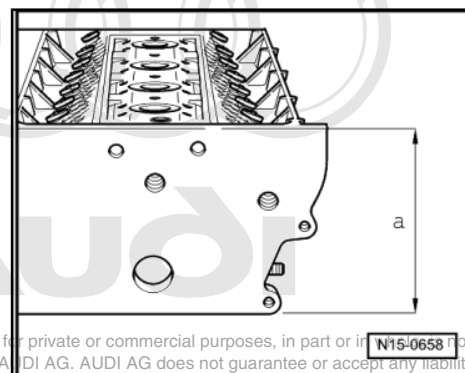
- Use straight edge 500 mm - VAS 6075- and feeler gauge to measure cylinder head for distortion at several points.
- Max. permissible distortion: 0.05 mm.



Reworking cylinder head sealing surface

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

- Minimum dimension: -a- = 108.25 mm



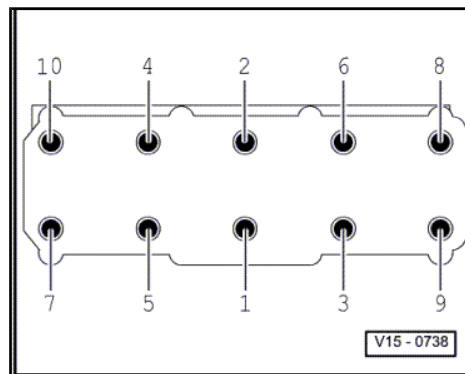
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**Cylinder head - tightening torque and sequence****Note**

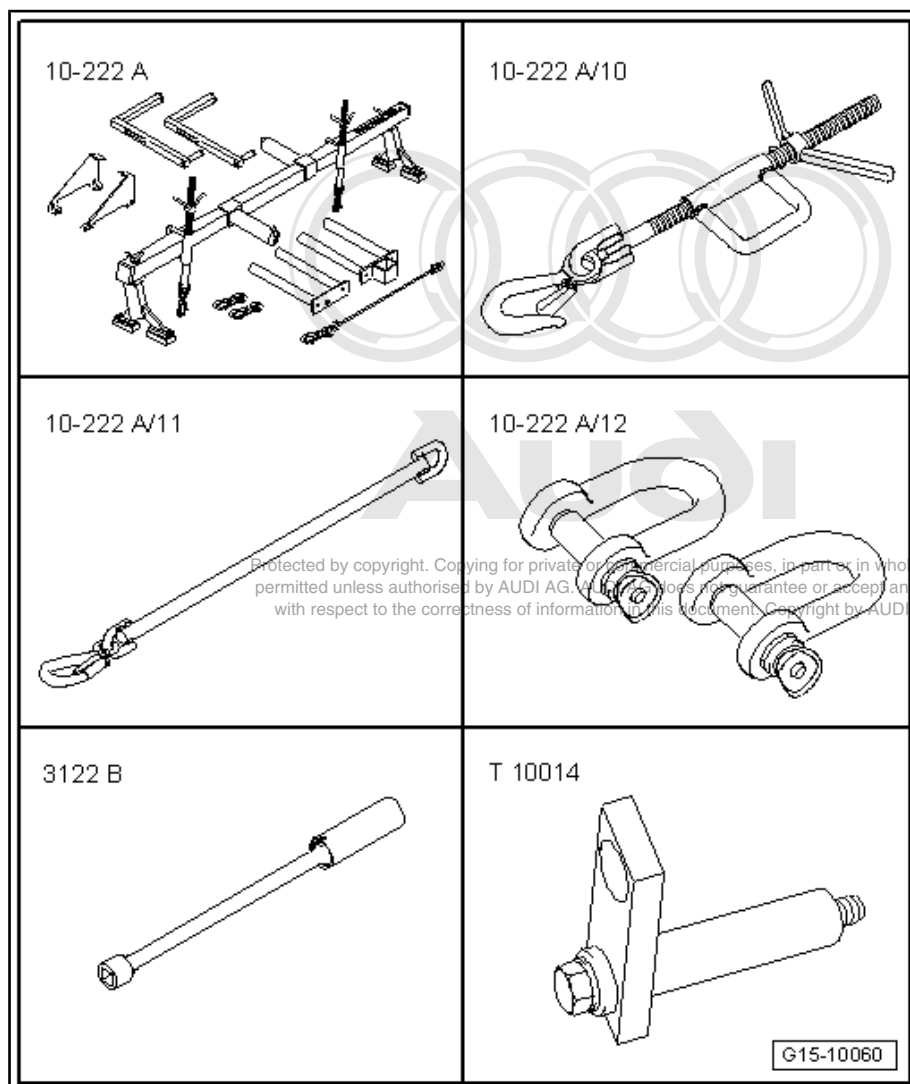
Renew the bolts tightened with specified tightening angle.

– Tighten bolts in 4 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 10-	Screw in by hand until contact is made
2.	-1 ... 10-	40 Nm
3.	-1 ... 10-	Turn 90° further
4.	-1 ... 10-	Turn 90° further

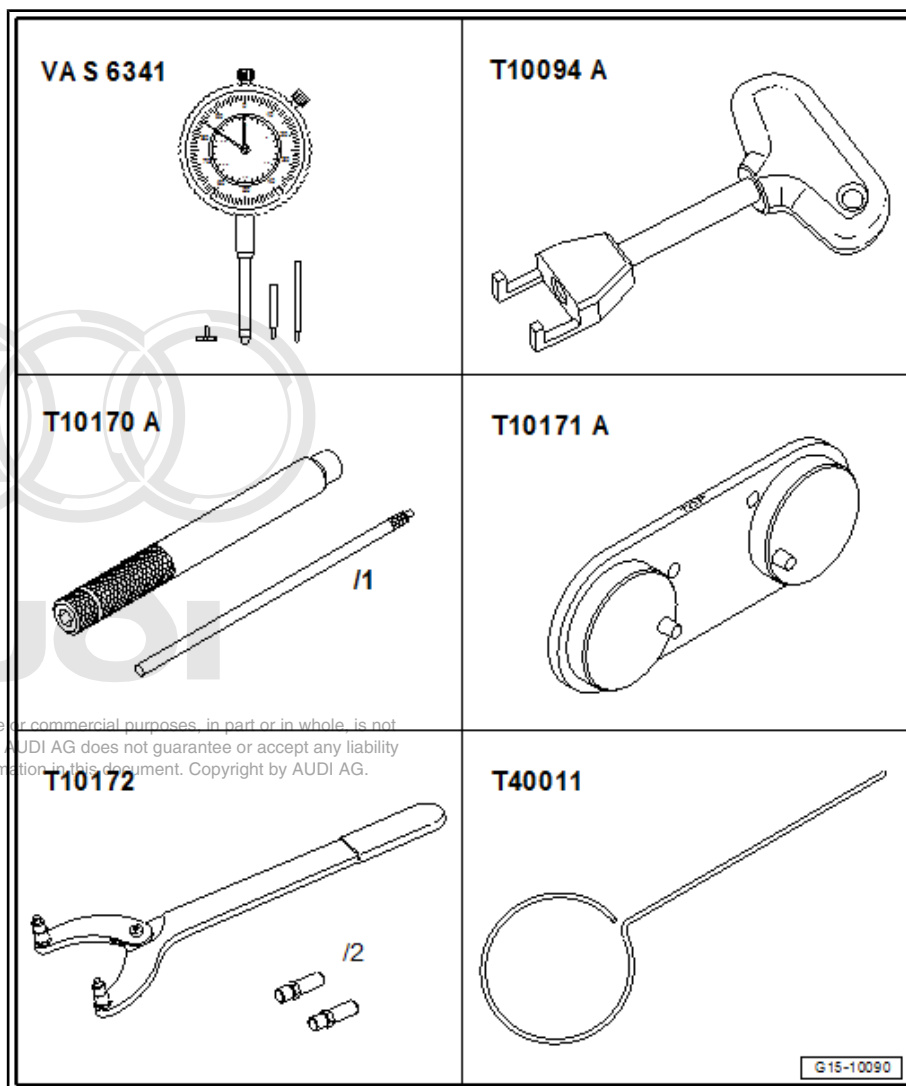
**2.2 Removing and installing cylinder head****Special tools and workshop equipment required**

- ◆ Support bracket - 10 - 222 A-
- ◆ Hook - 10 - 222 A /10-
- ◆ Spindle - 10 - 222 A /11-
- ◆ Shackle - 10 - 222 A /12-
- ◆ Spark plug socket and extension - 3122 B-
- ◆ Retainer - T10014-

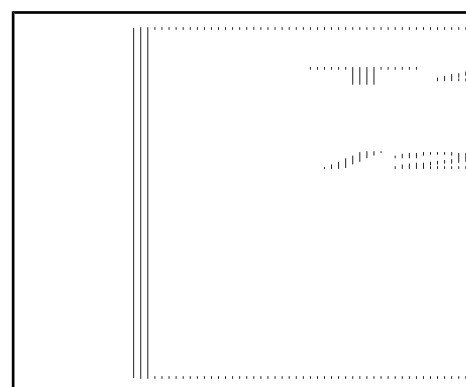


Special tools and workshop equipment required

- ◆ Dial gauge set, 4-part - VAS 6341-
- ◆ Puller - T10094 A-
- ◆ Adapter for dial gauge - T10170 A-
- ◆ Camshaft clamp - T10171 A-
- ◆ Counterhold tool - T10172-
- ◆ Locking pin - T40011-



- ◆ Adapter -T40093/6- from engine support bracket (supplementary set) - T40093-



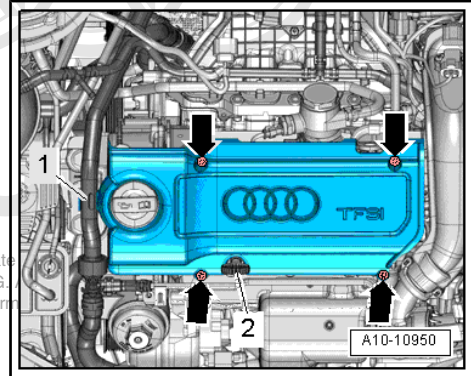
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Drain coolant ⇒ [page 159](#) .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 .
- Remove poly V-belt pulley for coolant pump ⇒ [page 166](#) .
- Removing idler roller for poly V-belt ⇒ [page 44](#) .

- Remove intake manifold ⇒ Rep. gr. 24 .
- Remove catalytic converter ⇒ [page 223](#) .
- Remove sump ⇒ [page 143](#) .
- Remove thermostat housing ⇒ [page 171](#) .
- Remove bracket for air conditioner compressor ⇒ Rep. gr. 87 .
- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.

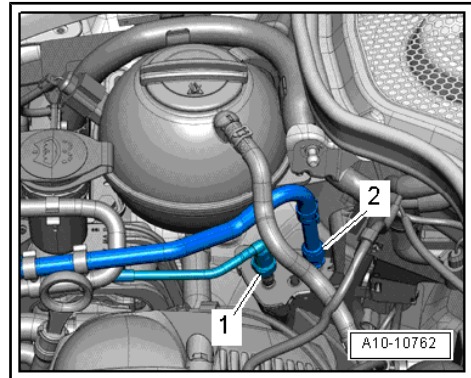
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**WARNING**

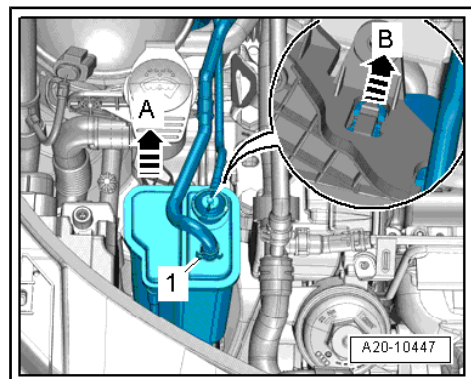
The fuel system is pressurised.

Risk of injury as fuel may spray out.

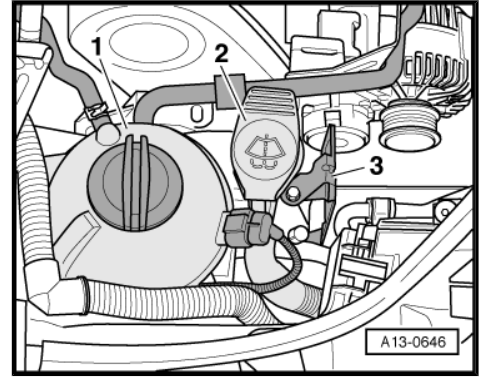
- *Wear safety goggles.*
- *Wear protective gloves.*
- *Release pressure (wrap clean cloth around connection and open connection carefully).*



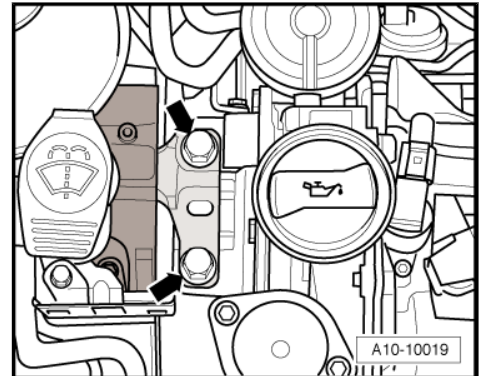
- Disconnect fuel supply line -2- (pull release ring).
- Disconnect line -1- going to activated charcoal filter (press release tab).
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side with line -1- connected.



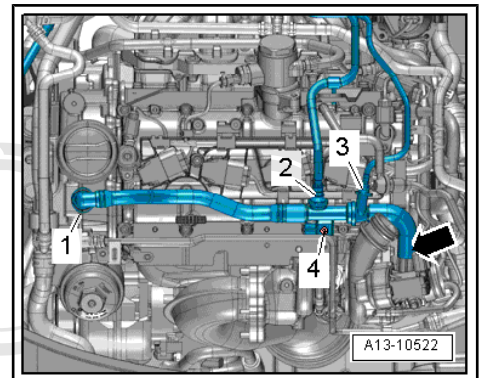
- Remove bracket -3- for activated charcoal filter.
- Remove bolt on filler neck -2- for washer fluid reservoir.
- Detach electrical connector at coolant shortage indicator switch - F66- on coolant expansion tank and move wiring harness clear.
- Remove bolts for coolant expansion tank -1- and place coolant expansion tank on top of engine with the hoses attached (secure if necessary).



- Loosen bolts -arrows- of assembly mounting at engine approx. 2 turns.



- Remove bolt -4- and detach crankcase breather hose from turbocharger -arrow-.
- Detach crankcase breather hose -1- from timing chain cover (press release tabs and take off with lines -2- and -3- still connected).

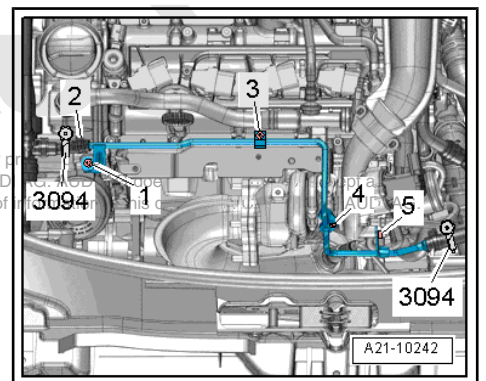


- Remove bolts -1, 3, 4, 5-.
- Disconnect coolant lines from turbocharger and move clear to one side.



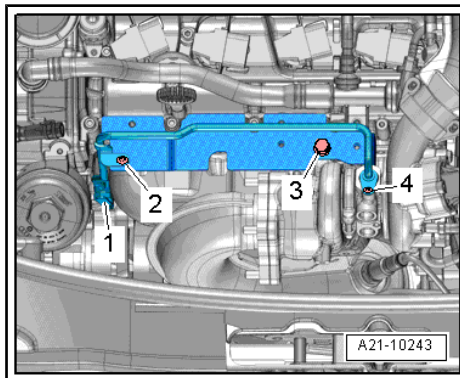
Disregard -item 2- and -3094- .

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- Remove banjo bolt -1- and bolts -2, 3, 4-, detach oil supply line and retaining plate from turbocharger.

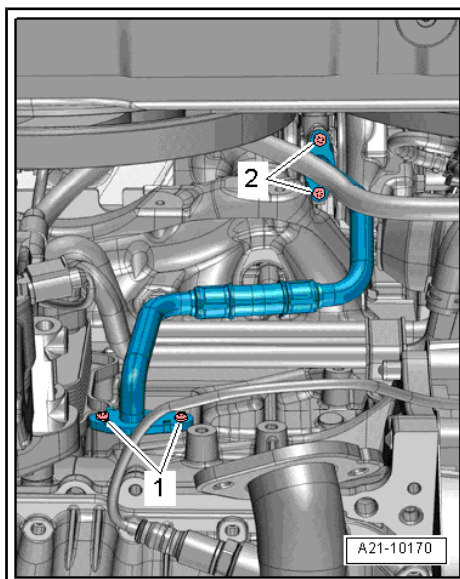


- Remove bolts -2- for oil return pipe (top).

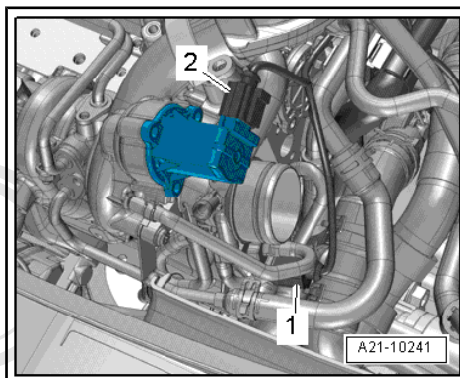


Note

Disregard -item 1-.



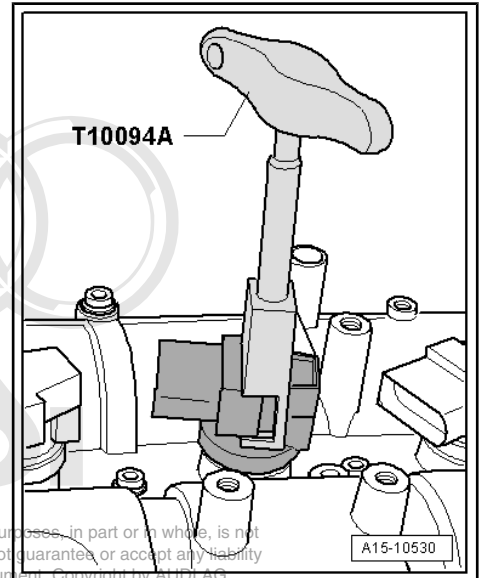
- Unplug electrical connector -1- on charge pressure control solenoid valve - N75- and -2- on turbocharger air recirculation valve - N249- .



Audi

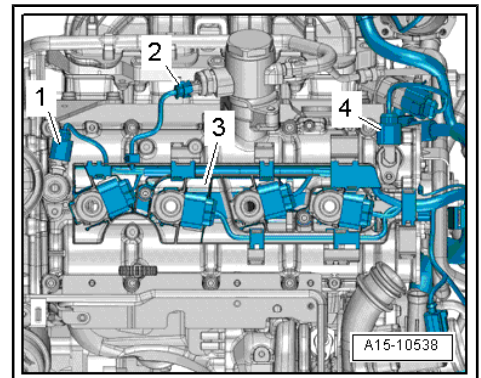
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- Apply puller - T10094 A- to all ignition coils -arrow-, pull out ignition coils and at the same time unplug electrical connectors at ignition coils for cylinders 1 ... 4.
- Remove spark plug for cylinder 1 with spark plug socket and extension - 3122 B- .



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- Unplug electrical connectors -1, 2, 4-, detach wiring duct -3- from camshaft housing and swivel to left side.

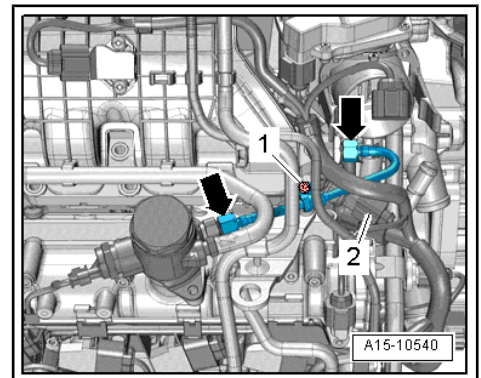


 **WARNING**

The fuel system is pressurised.

Risk of injury as fuel may spray out.

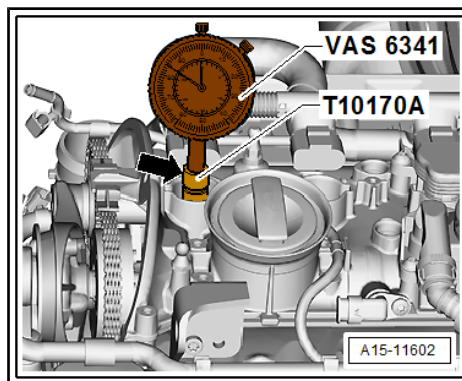
- *Wear safety goggles.*
- *Wear protective gloves.*
- *Release pressure (wrap clean cloth around connection and open connection carefully).*



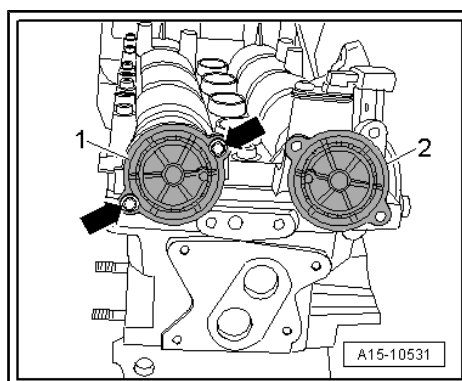
- Remove union nuts -arrows- and bolt -1- and detach high-pressure pipe.
- Unplug electrical connector -2- on fuel pressure regulating valve - N276- .
- Unplug electrical connectors at injectors and move clear.



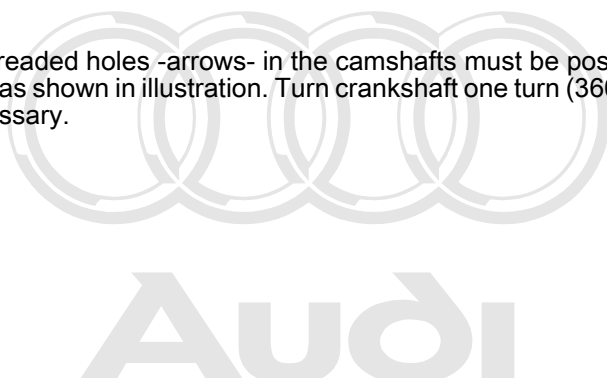
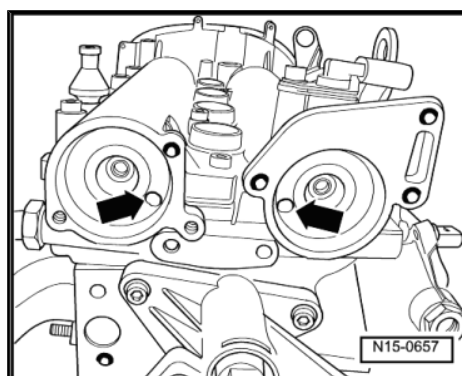
- Screw adapter for dial gauge - T10170 A- into spark plug hole as far as the stop.
- Insert dial gauge - VAS 6341- with extension -T10170 A/1- and secure using locking nut -arrow-.
- Rotate crankshaft in normal direction of rotation to "TDC".
- "TDC" = maximum measured value on dial gauge.



- Remove bolts -arrows- and detach sealing caps -1- and -2-.

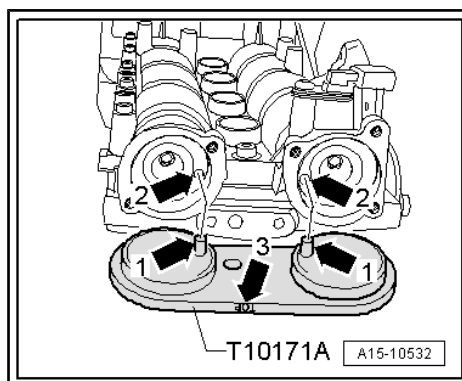


- The threaded holes -arrows- in the camshafts must be positioned as shown in illustration. Turn crankshaft one turn (360°) if necessary.




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- Insert camshaft clamp - T10171 A- into holes in camshafts as far as stop.
- The locking pins -arrows 1- must engage in the holes -arrows 2-.
- The inscription "TOP" -arrow 3- should be legible from above.

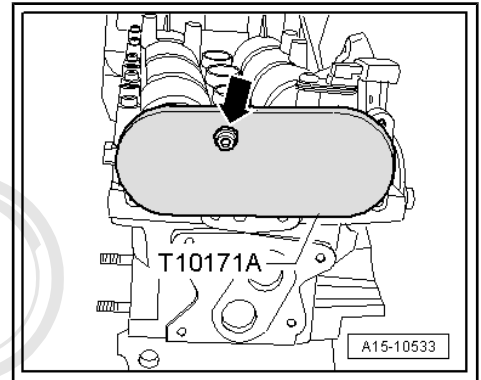


- To secure the camshaft clamp - T10171 A- , screw in an M6 bolt -arrow- hand-tight, but do not tighten.

 **Caution**

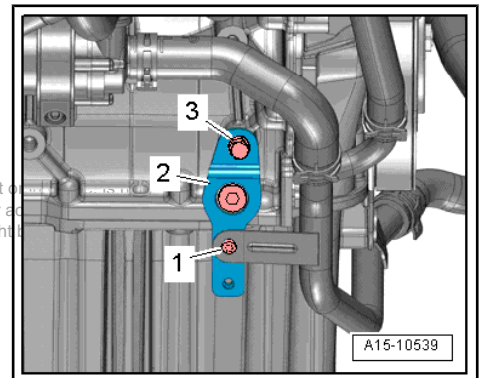
Risk of damage to camshafts.

◆ *The camshaft clamp - T10171 A- must not be used as a counterhold tool.*

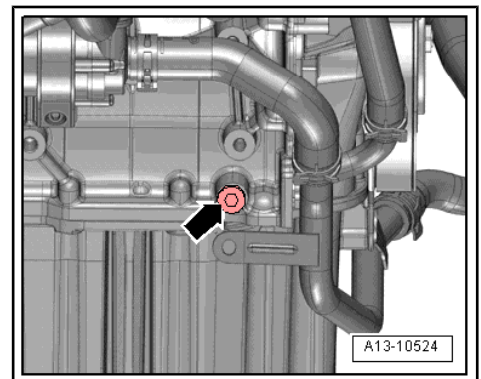


- Remove bolts -1- and -3- and take off bracket -2- for coolant pipe (right-side).

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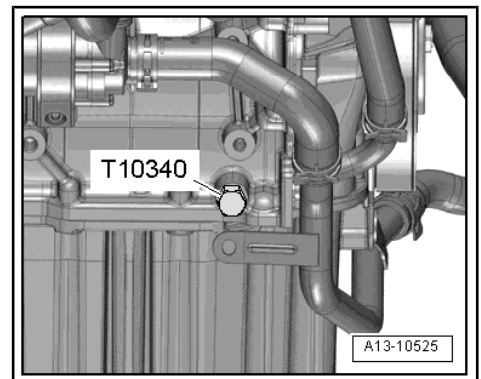
- Unscrew plug -arrow- for "TDC" hole on cylinder block.



- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.

 **Note**

The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



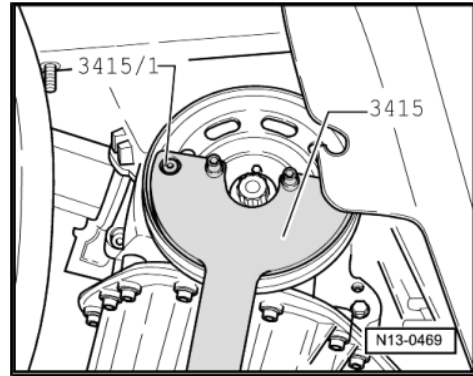


Caution

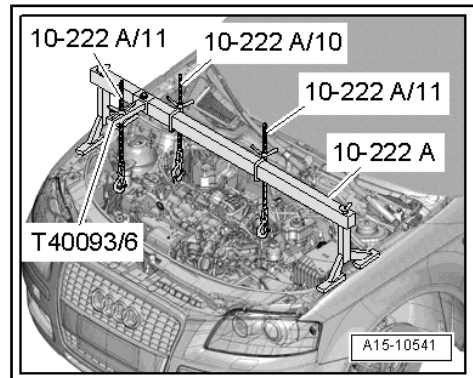
Risk of damage to engine.

◆ **To prevent the crankshaft chain sprocket from slipping off the drive lug, do not rotate the crankshaft after the poly V-belt pulley has been detached.**

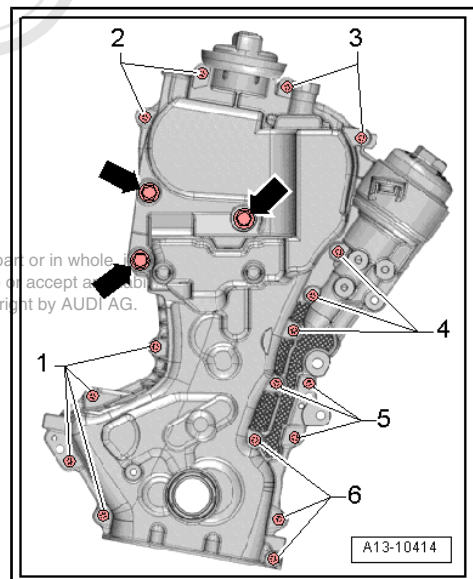
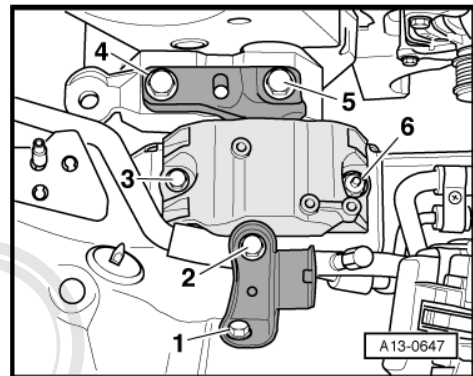
- Loosen bolt for poly V-belt pulley using counterhold tool - 3415- with pin -3415/1- .
- Remove bolt and take off poly V-belt pulley.
- Set up support bracket - 10 - 222 A- with hook - 10 - 222 A / 10- , spindle - 10 - 222 A /11- (2x) and adapter -T40093/6- on top edges of body flanges (left and right), as shown in illustration.
- Attach hook - 10 - 222 A /10- in right engine lifting eye and tighten spindle slightly to take up weight of engine/gearbox assembly.



- Remove bolts -1- and -2- and detach connecting bracket.
- Remove bolts -3 ... 6- and detach engine mounting.

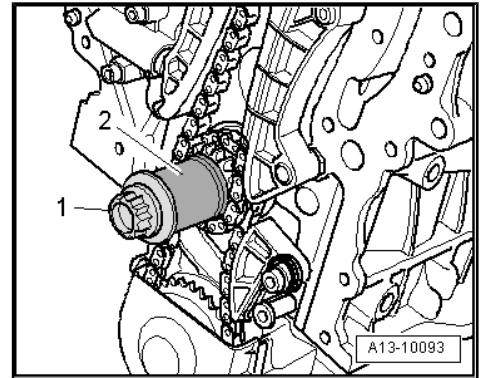


- Remove bolts -1 ... 6- and -arrows- for timing chain cover.
- Raise engine slightly and remove timing chain cover.
- Use drift to drive out oil seal.

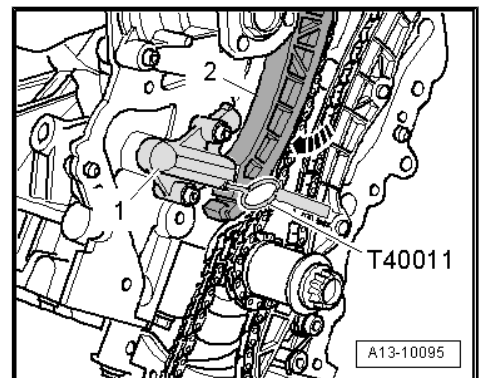


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- Insert bush -2- and screw in crankshaft pulley bolt -1- hand-tight to secure chain sprocket on crankshaft.



- Press tensioning rail -2- in direction of -arrow- and use locking pin - T40011- to lock piston for chain tensioner -1-.



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 mark timing chain by means of centre punch, notch or the like.*

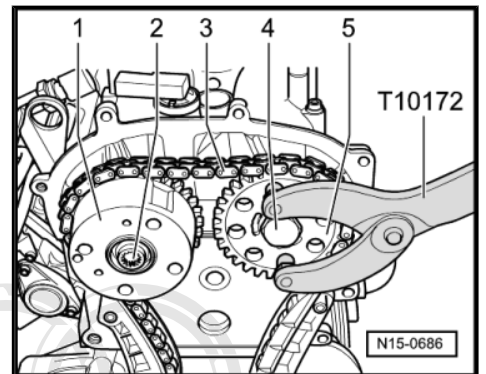
Risk of damage to camshafts.

- ◆ *The camshaft clamp - T10171 A- must not be used as a counterhold tool.*

Risk of damage to thread.

- ◆ *The camshaft adjuster central bolt has a left-hand thread.*

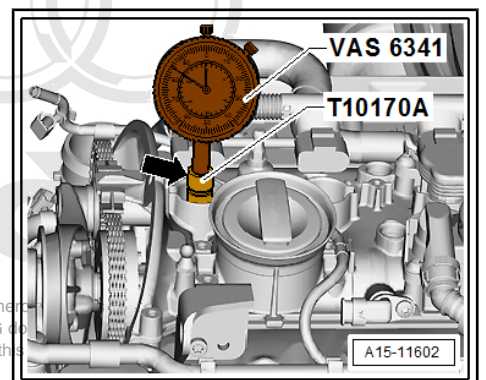
- Loosen bolt -2- for camshaft adjuster -1- and bolt -4- for camshaft chain sprocket -5-, using counterhold tool - T10172- to counterhold on camshaft chain sprocket.
- Detach camshaft chain sprocket together with camshaft timing chain -3-.



Note

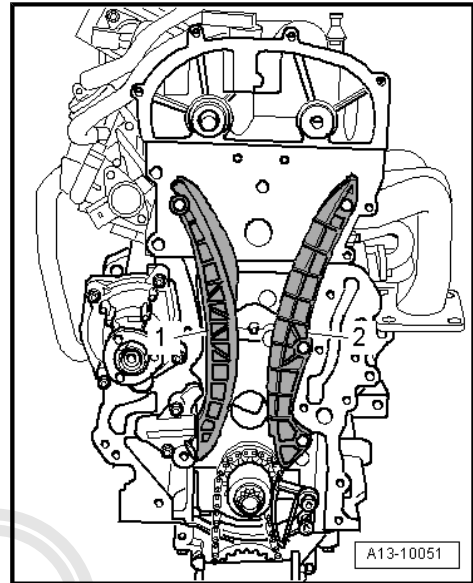
Leave camshaft adjuster on camshaft.

- Loosen locking nut -arrow- and detach adapter for dial gauge - T10170 A- with dial gauge - VAS 6341- .



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- Pull tensioning rail -1- and guide rail -2- off mounting pins.



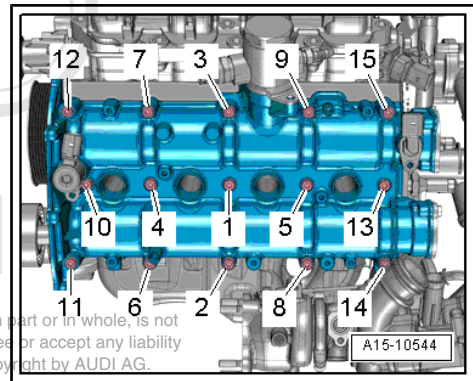
- Slacken camshaft housing bolts in the sequence -15 ... 1-.



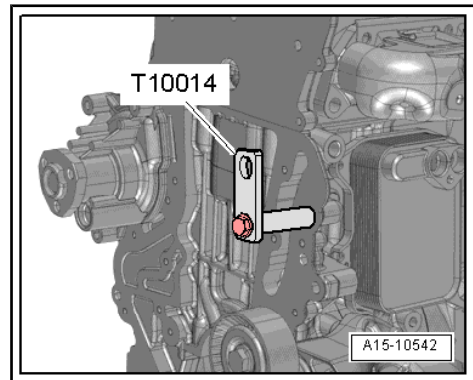
Note

Bolt -14- below turbocharger remains in camshaft housing.

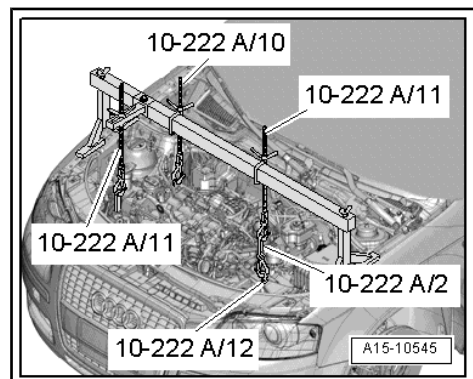
- Carefully detach camshaft housing to the right.
- Mark original positions of roller rocker fingers and compensation elements for re-installation.
- Remove roller rocker fingers together with compensation elements and put down on a clean surface.



- Secure retainer - T10014- in threaded hole in cylinder block as shown in illustration and tighten to 40 Nm.



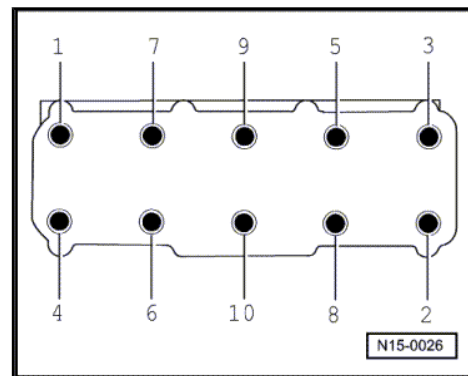
- Attach spindle - 10 - 222 A /11- (right-side) to retainer - T10014- .
- Attach spindle - 10 - 222 A /11- (left-side) with hook - 10 - 222 A /2- and shackle - 10 - 222 A /12- to gearbox.
- Take up weight at both spindles, detach hook - 10 - 222 A /10- and move to side.



- Slacken cylinder head bolts in the sequence -1 ... 10-
- Remove bolts and carefully take off cylinder head.
- Place cylinder head onto soft surface (foam plastic).

Installing

- Tightening torques ⇒ [page 100](#)



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.
- ◆ Renew oil strainer in cylinder head.
- ◆ When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the cylinder head cover.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
- ◆ After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.

**Caution**

Protect lubrication system and bearings against contamination.

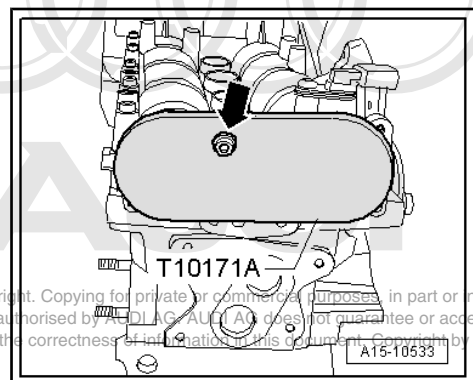
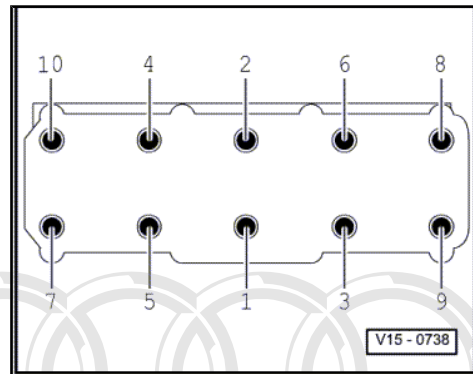
- ◆ **Cover exposed parts of the engine.**

- Remove sealant residue on cylinder head and camshaft housing using commercially available sealant remover.
- Clean sealing surfaces; they must be free of oil and grease.
- Check that crankshaft is still positioned at “TDC” and then turn back in the opposite direction of engine rotation by approx. 45°.
- Place cylinder head gasket in position.
- Installation position: Part No. must be visible.
- Note position of dowel sleeves in cylinder block.
- Fit cylinder head.
- Tighten cylinder head bolts ⇒ [page 102](#) .

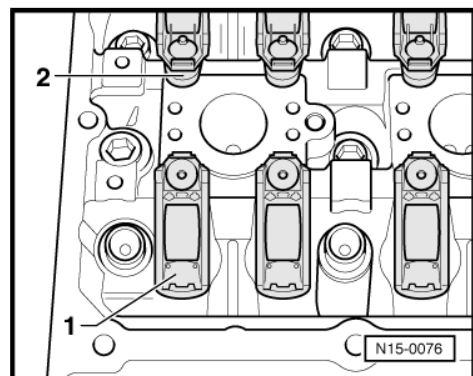
**Note**

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

- Camshaft clamp - T10171 A- must be fitted and secured with a bolt -arrow- before installing camshaft housing.
- Ensure all roller rocker fingers contact the valve ends -1- correctly and are clipped into their respective support elements -2-.



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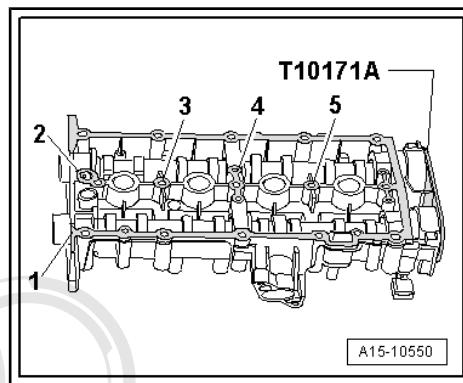
Caution
Make sure lubrication system is not clogged by excess sealant.
 ♦ **The sealant bead must not be thicker than specified.**

- Apply a thin and even layer of sealant to the clean sealing surface of the camshaft housing at grey-shaded areas -1 ... 5- shown in illustration.

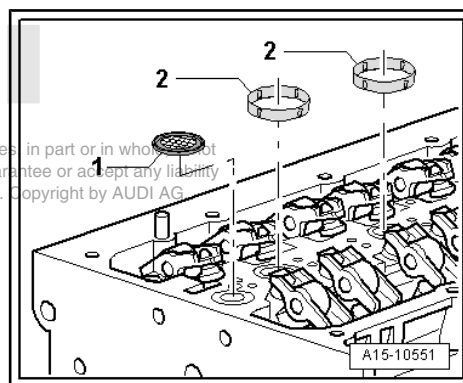
Note

The camshaft housing must be installed within 5 minutes after applying the sealant.

- Fit new oil strainer -1- in cylinder head.
- Fit 4 seals -2- into cylinder head.



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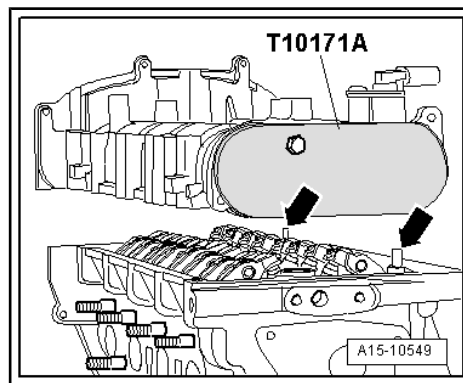


Caution
Make sure remnants of oil are removed before fitting, otherwise leakage can occur.
 ♦ **Make sure sealing surfaces are free of oil when fitting camshaft housing.**

- Carefully fit the camshaft housing vertically onto the dowel pins -arrows- on cylinder head from above.

Note

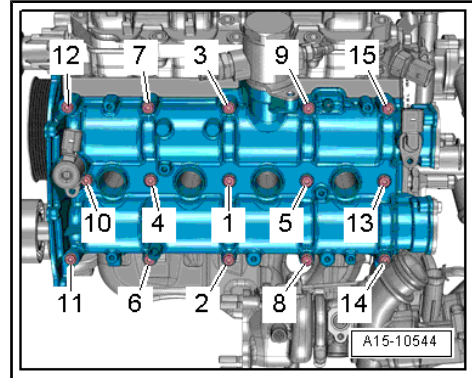
Make sure that camshaft housing is kept straight.



- Tighten camshaft housing bolts ⇒ [page 120](#) .

**Note**

After fitting camshaft housing, allow sealant to dry for approx. 30 minutes.



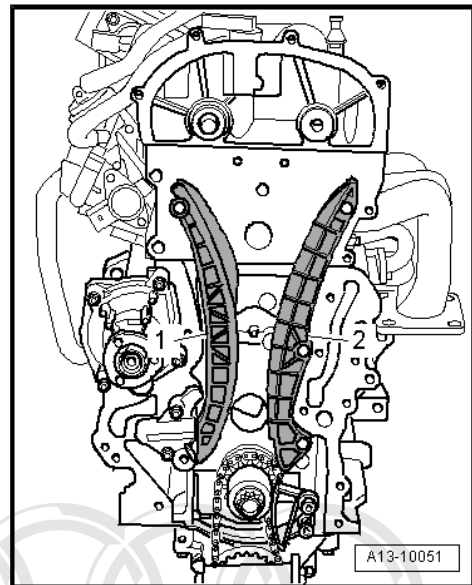
- Fit tensioning rail -1- and guide rail -2- onto mounting pins.
- Install camshaft timing chain ⇒ [page 88](#) .

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

**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.



- Install sump ⇒ [page 145](#) .
- Install intake manifold ⇒ Rep. gr. 24 .
- Install thermostat housing ⇒ [page 171](#) .
- Install catalytic converter ⇒ [page 223](#) .

2.3 Checking compression

Special tools and workshop equipment required

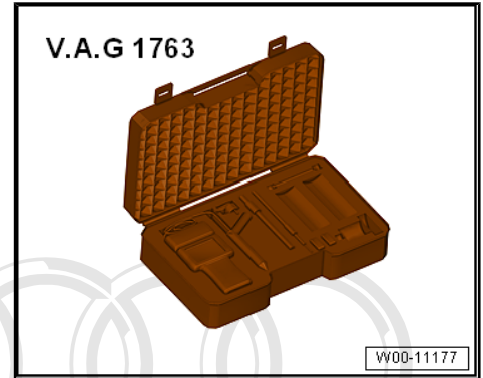
- ◆ Spark plug socket and extension - 3122 B-

3122 B

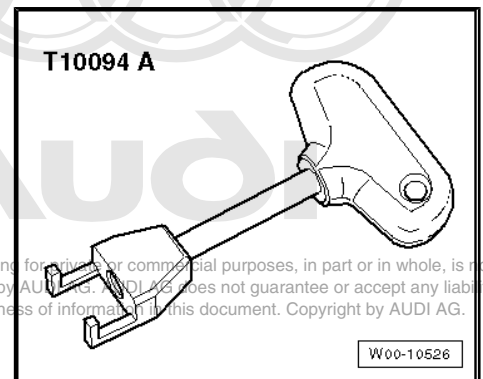
W00-11129

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◆ Compression tester - V.A.G 1763-



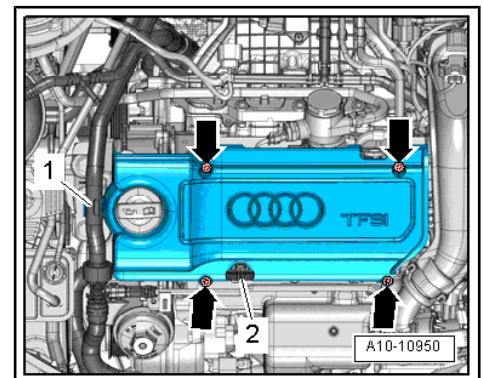
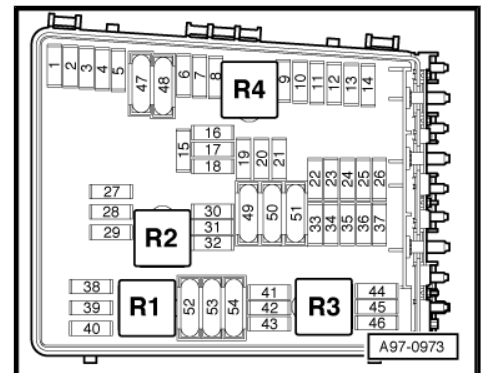
◆ Puller - T10094 A-



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Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Switch off ignition.
- Open lid of electronics box in engine compartment and remove fuse for Motronic current supply relay - J271- ; for fuse assignment see ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.



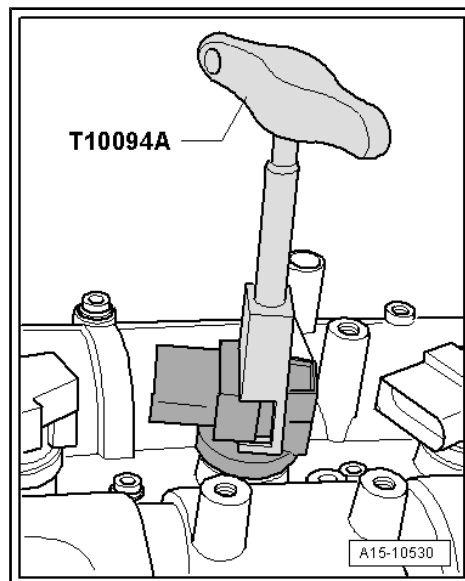


- Apply puller - T10094 A- to all ignition coils -arrow-, pull out ignition coils and at the same time unplug electrical connectors at ignition coils for cylinders 1 ... 4.
- Remove spark plugs with spark plug socket and extension - 3122 B- .
- Check compression pressure with compression tester - V.A.G 1763- (see ⇒ operating instructions for details of how to use tester).
- Have a 2nd 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	10.0 ... 15.0
Wear limit	9.0
Maximum difference between cylinders	3.0

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

- Install spark plugs ⇒ Maintenance ; Booklet 808 .
- Faults are stored in engine control unit because electrical connectors were unplugged and engine was started: Generate readiness code in Guided Functions ⇒ Vehicle diagnostic tester .



3 Valve gear

⇒ [“3.1 Exploded view - camshaft housing”, page 119](#)

⇒ [“3.2 Checking axial clearance of camshafts”, page 121](#)

⇒ [“3.3 Removing and installing camshaft housing”, page 121](#)

⇒ [“3.4 Removing and installing camshafts”, page 126](#)

⇒ [“3.5 Exploded view - valves”, page 127](#)

⇒ [“3.6 Renewing valve stem oil seals with cylinder head installed”, page 128](#)

⇒ [“3.7 Renewing valve stem oil seals with cylinder head removed”, page 131](#)

⇒ [“3.8 Valve dimensions”, page 135](#)

⇒ [“3.9 Checking valve guides”, page 135](#)

⇒ [“3.10 Checking valves”, page 136](#)

⇒ [“3.11 Machining valve seats”, page 137](#)

3.1 Exploded view - camshaft housing

1 - Guide sleeve

2 - Seal

- Inserted into cylinder head
- 4x
- Renew

3 - Oil strainer

- Inserted in cylinder head
- Renew

4 - Camshaft housing

- With integrated camshaft bearings
- Removing and installing ⇒ [page 121](#)
- Remove old sealant residues
- Carefully clean sealing surfaces; they must be free of oil and grease
- Coat with sealant before installing; for sealant refer to ⇒ Electronic parts catalogue
- Installing: fit vertically from above onto stud and dowel pins

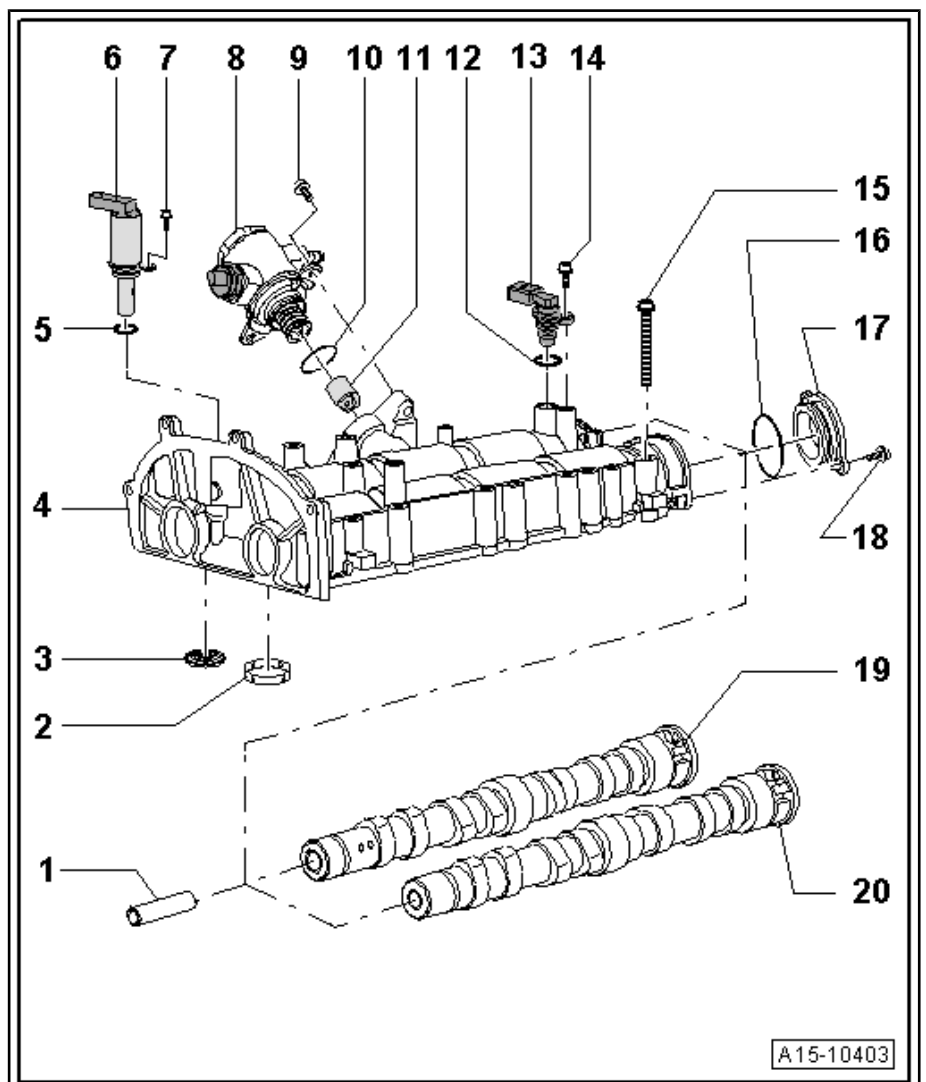
5 - O-ring

- Renew

6 - Camshaft control valve 1 - N205-

7 - Bolt

- 10 Nm



8 - High-pressure pump with fuel pressure regulating valve - N276-

- Removing and installing ⇒ Rep. gr. 24

9 - Bolt

- Tightening torque ⇒ Rep. gr. 24

10 - O-ring

- Renew

11 - Roller tappet for high-pressure pump

- Installation position: can only be inserted in one position.

12 - O-ring

- Renew

13 - Hall sender - G40-

14 - Bolt

- 10 Nm

15 - Bolt

- Renew
- Note correct sequence when loosening ⇒ [page 124](#)
- Tightening torque and sequence ⇒ [page 120](#)

16 - O-ring

- Renew

17 - Sealing cap

18 - Bolt

- 10 Nm

19 - Inlet camshaft

- With cam for high-pressure pump
- Before removing, detach roller tappet for high-pressure pump
- Checking axial clearance ⇒ [page 121](#)
- Removing and installing ⇒ [page 126](#)
- Lubricate with oil before installing (also lubricate collar of axial bearing)

20 - Exhaust camshaft

- Checking axial clearance ⇒ [page 121](#)
- Removing and installing ⇒ [page 126](#)
- Lubricate with oil before installing (also lubricate collar of axial bearing)

Camshaft housing - tightening torque and sequence

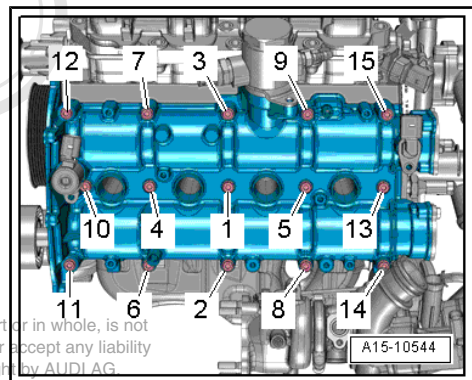


Note

Renew the bolts tightened with specified tightening angle.

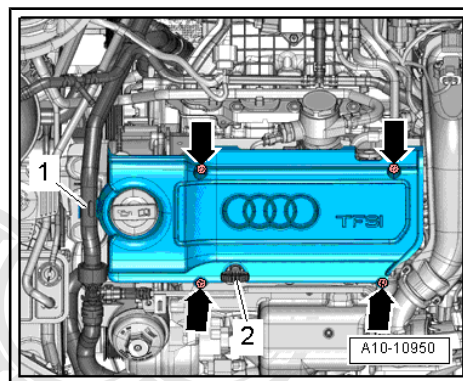
– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 15	10 Nm
2.	-1 ... 15-	Turn 90° further



Tightening torque for engine cover panel

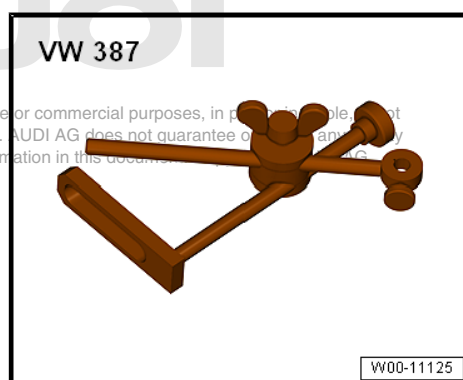
- Tighten bolts -arrows- to 10 Nm.



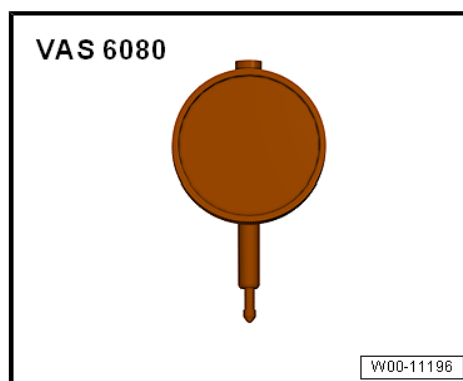
3.2 Checking axial clearance of camshafts

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

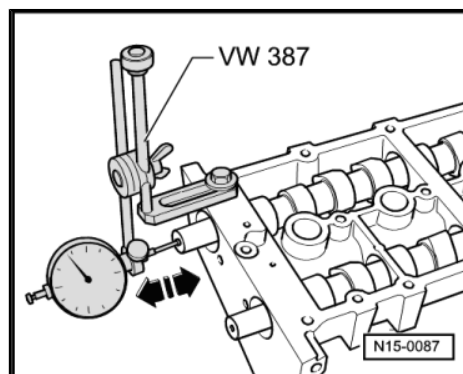


- ◆ Dial gauge - VAS 6080-



Procedure

- Perform measurements with camshaft housing removed and sealing caps fitted.
- Secure universal dial gauge bracket - VW 387- with dial gauge - VAS 6080- to camshaft housing, as shown in illustration.
- Measure axial clearance.
- Wear limit: 0.40 mm.



3.3 Removing and installing camshaft housing

Special tools and workshop equipment required



- ◆ Hose clamps, up to 25 mm - 3094-




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- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove camshaft timing chain ⇒ [page 81](#) .

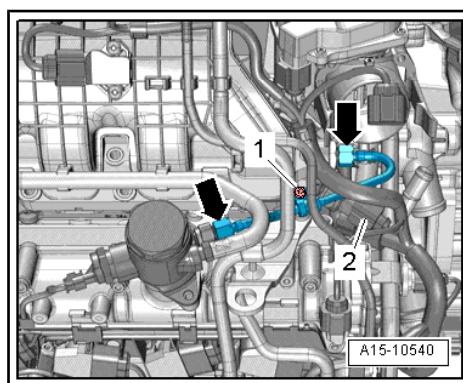


WARNING

The fuel system is pressurised.

Risk of injury as fuel may spray out.

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



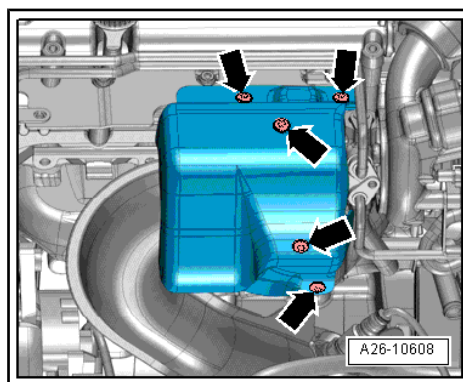
- Remove union nuts -arrows- and bolt -1- and detach high-pressure pipe.



Note

Disregard -item 2-.

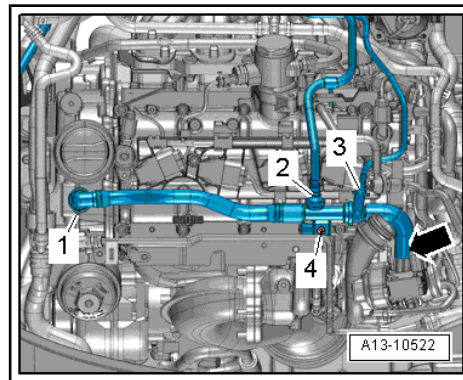
- Remove bolts -arrows- and detach heat shield for turbocharger.



- Remove bolt -4- and detach crankcase breather hose from turbocharger -arrow-.

i Note

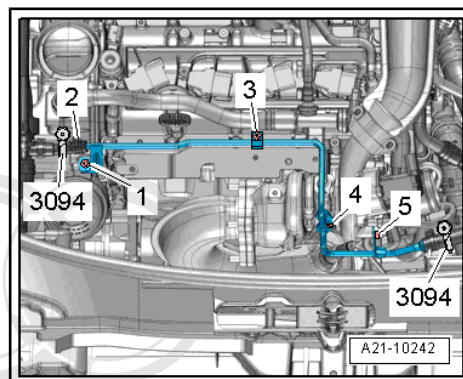
Disregard -items 1, 2, 3-.



- Clamp off coolant hoses with hose clamps -3094- as shown in illustration.
- Remove bolts -1, 3, 4, 5-.
- Disconnect coolant lines from turbocharger and move clear to one side.

i Note

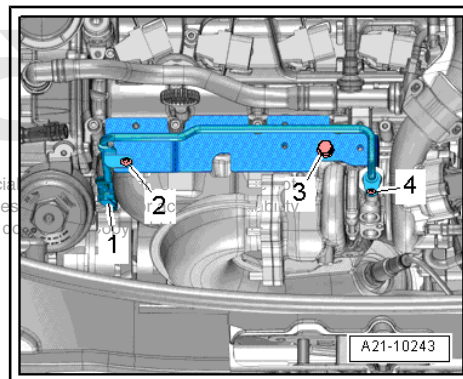
Disregard -item 2-.



- Remove bolts -2- and -3- and take off retaining plate.

i Note

Disregard -items 1, 4-.



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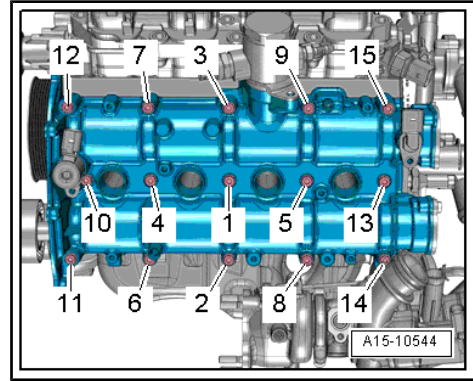
- Slacken camshaft housing bolts in the sequence -15 ... 1-.



Note

Bolt -14- below turbocharger remains in camshaft housing.

- Carefully release camshaft housing from bonded joint and detach.
- Mark original positions of roller rocker fingers and compensation elements for re-installation.
- Remove roller rocker fingers together with compensation elements and put down on a clean surface.



Installing

- Tightening torques ⇒ [page 120](#) , ⇒ [page 191](#) .
- No piston at "TDC".



Note

Renew oil strainer and seals in cylinder head.



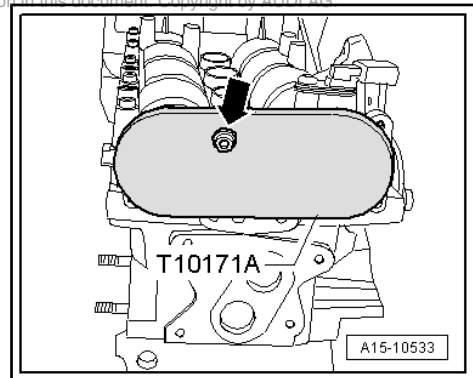
Caution

Protect lubrication system and bearings against contamination.

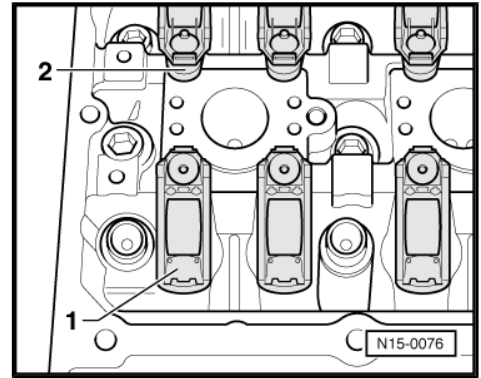
- ◆ *Cover exposed parts of the engine.*

- Carefully remove sealant residue on cylinder head and camshaft housing.
- Clean sealing surfaces; they must be free of oil and grease.
- Camshaft clamp - T10171 A- must be fitted and secured with a bolt -arrow- before installing camshaft housing.

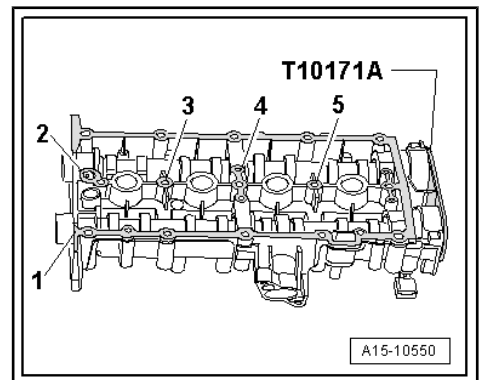
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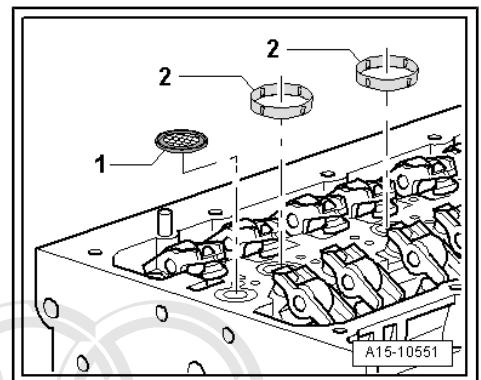
- Ensure all roller rocker fingers contact the valve ends -1- correctly and are clipped into their respective support elements -2-.




- Apply a thin and even layer of sealant to the clean sealing surface of the camshaft housing at grey-shaded areas -1 ... 5- shown in illustration.



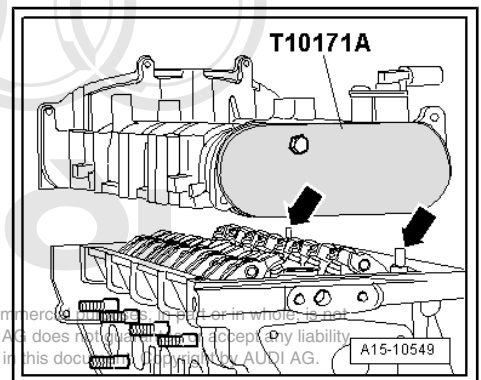
- Fit new oil strainer -1- in cylinder head.
- Fit 4 seals -2- into cylinder head.



 **Caution**

Make sure remnants of oil are removed before fitting, otherwise leakage can occur.

◆ *Make sure sealing surfaces are free of oil when fitting camshaft housing.*



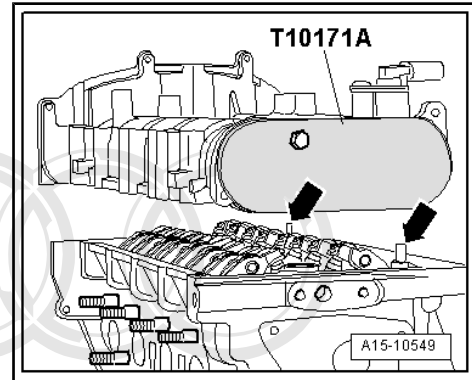
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- Carefully fit the camshaft housing vertically onto the dowel pins -arrows- on cylinder head from above.



Note

Make sure that camshaft housing is kept straight.

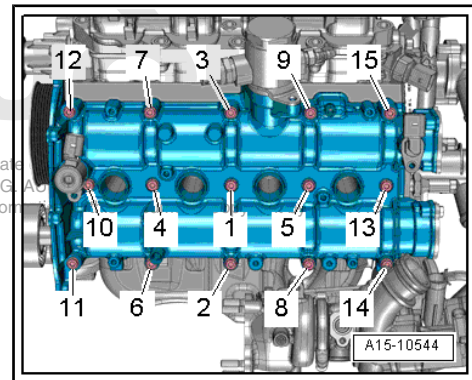


- Tighten camshaft housing bolts ⇒ [page 120](#) .



Note

After fitting camshaft housing, allow sealant to dry for approx 30 minutes.



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

- Install high-pressure pipe ⇒ Rep. gr. 24 .
- Install camshaft timing chain ⇒ [page 88](#) .

3.4 Removing and installing camshafts

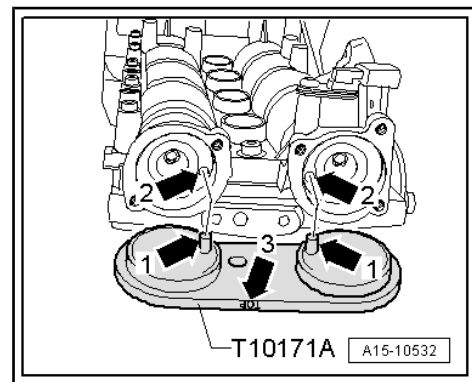
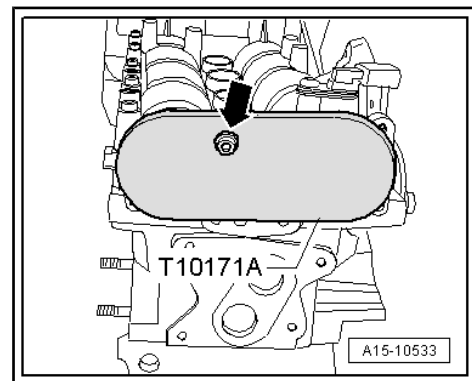
Removing

- Remove camshaft housing ⇒ [page 121](#) .
- Remove camshaft clamp - T10171 A- -arrow-.
- Pull camshafts out of camshaft housing.

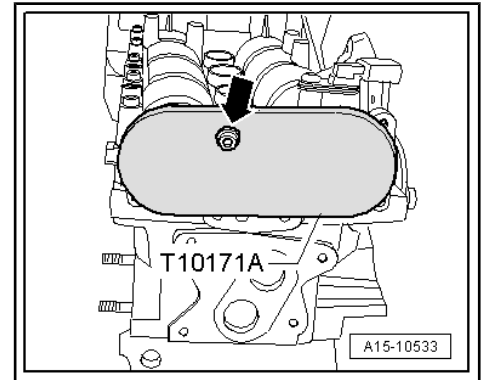
Installing

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

- Insert camshafts into camshaft housing (lubricate running surfaces with oil before inserting).
- Turn the inlet and exhaust camshafts in the removed camshaft housing by hand until the camshaft clamp - T10171 A- can be inserted all the way into the holes in the camshafts.
- The locking pins -arrows 1- must engage in the holes -arrows 2-.
- The inscription “TOP” -arrow 3- should be legible from above.



- To secure the camshaft clamp - T10171 A- , screw in an M6 bolt -arrow- hand-tight, but do not tighten.
- Install high-pressure pump ⇒ Rep. gr. 24 .
- Install camshaft housing ⇒ [page 121](#) .



3.5 Exploded view - valves

1 - Inlet valve

- Must not be machined; only grinding-in is permissible
- Valve dimensions ⇒ [page 135](#)
- Checking valve guides ⇒ [page 135](#)
- Machining valve seats ⇒ [page 137](#)

2 - Exhaust valve

- Must not be machined; only grinding-in is permissible
- Valve dimensions ⇒ [page 135](#)
- Checking valve guides ⇒ [page 135](#)
- Machining valve seats ⇒ [page 137](#)

3 - Cylinder head

4 - Valve stem oil seal

- Renewing: cylinder head installed ⇒ [page 128](#) , cylinder head removed ⇒ [page 131](#)

5 - Valve spring

6 - Valve spring plate

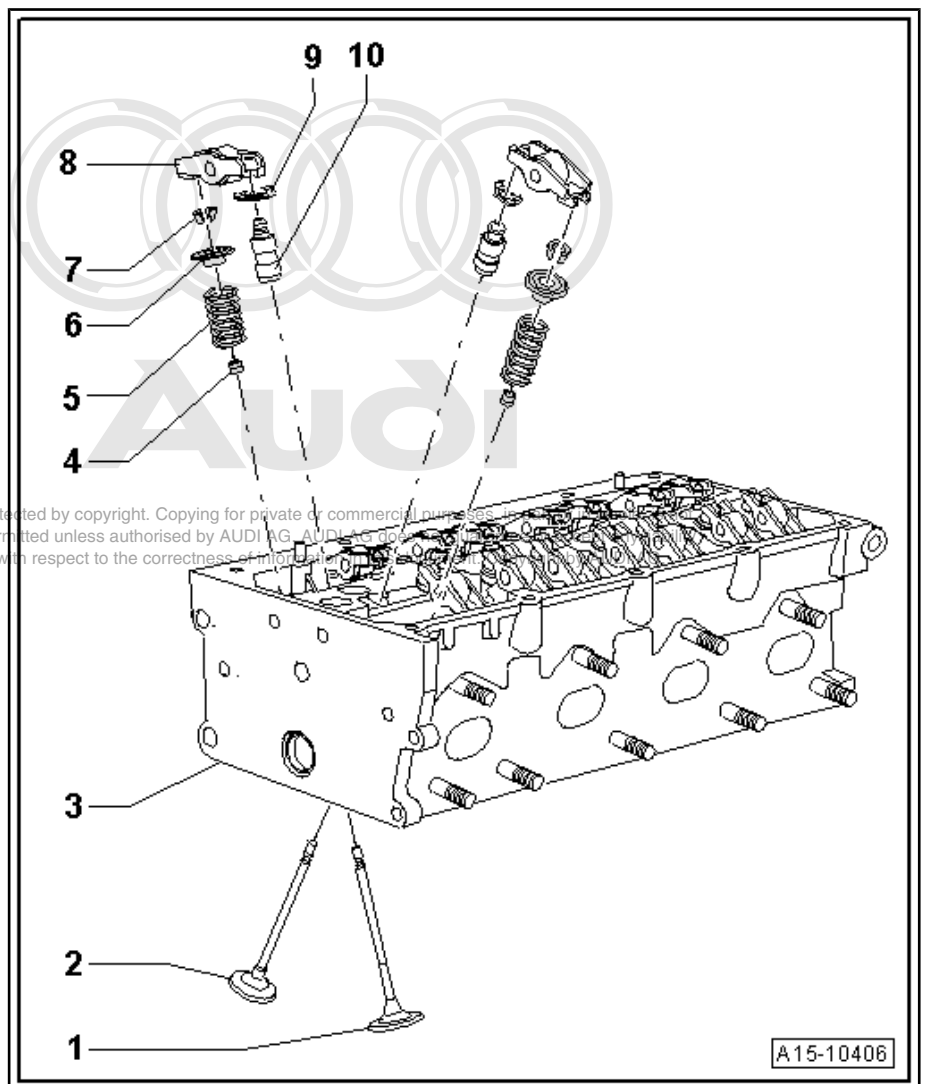
7 - Valve cotters

8 - Roller rocker finger

- Do not interchange
- Check roller bearings for ease of movement
- Lubricate contact surfaces before installing
- Attach to hydraulic compensation element -item 10- using securing clip -item 9-

9 - Securing clip

- Check for firm attachment
- Not supplied separately





10 - Hydraulic valve compensation element

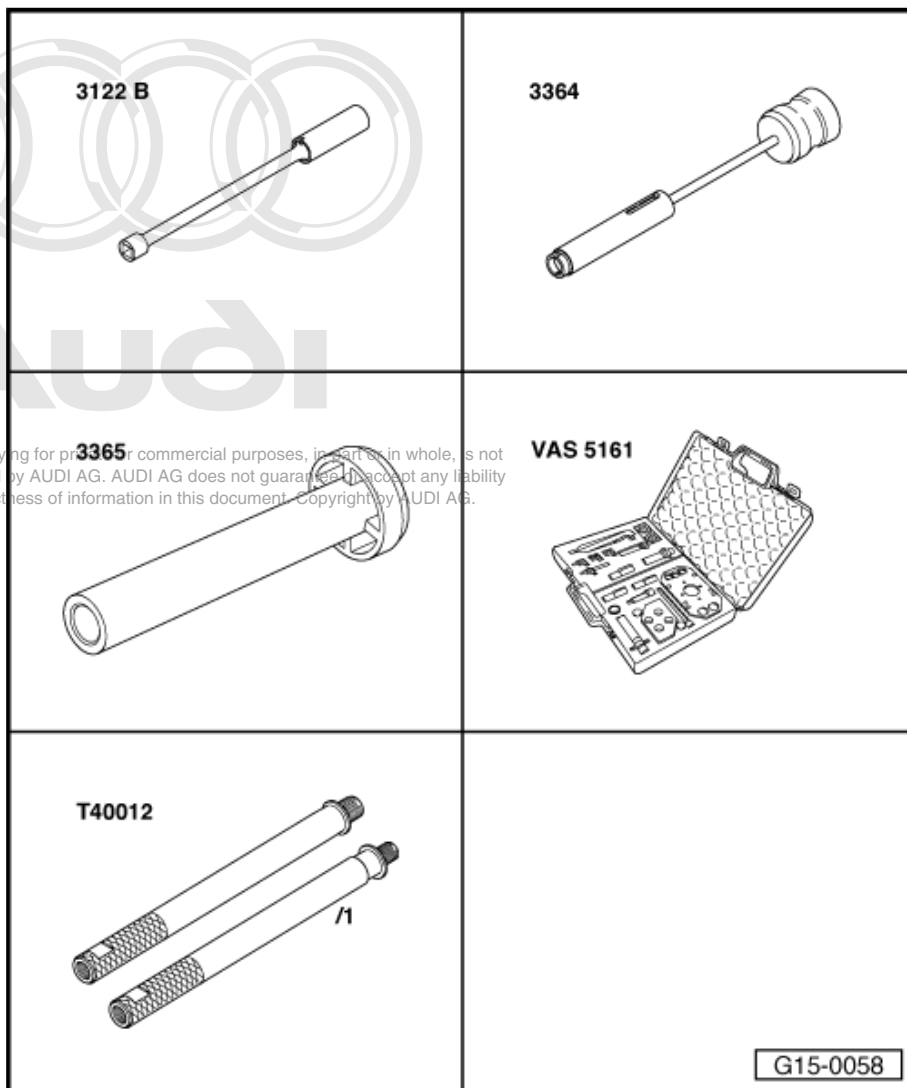
- Mark installation position for re-installation with a coloured pen
- Lubricate contact surfaces before installing

3.6 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate for 1.6 ltr. FSI engine - VAS 5161/22-
- ◆ Adapters - T40012-

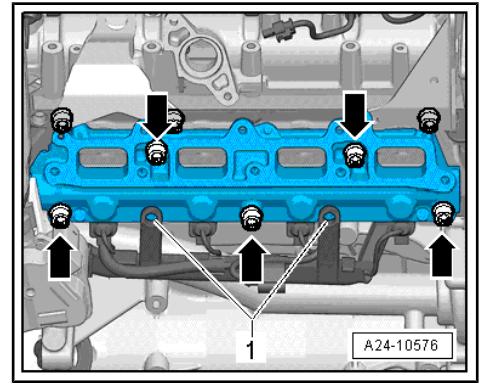
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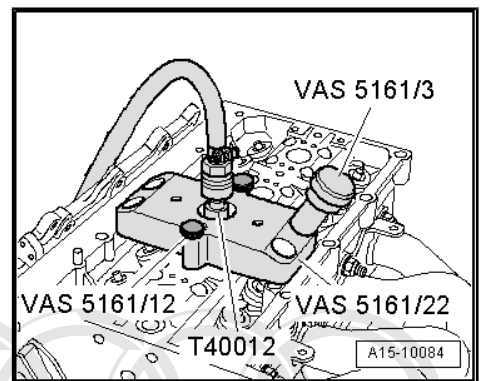
Procedure

- Remove intake manifold ⇒ Rep. gr. 24 .
- Remove camshaft housing ⇒ [page 121](#) .

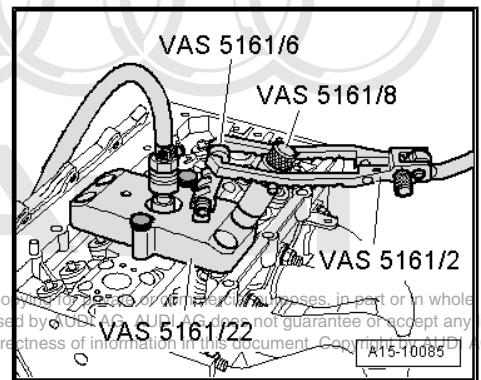
- Detach intake manifold (bottom section) with fuel rail from cylinder head ⇒ Rep. gr. 24 .
- Detach engine lifting eyes from cylinder head.
- Remove turbocharger ⇒ [page 208](#) .
- Remove spark plugs with spark plug socket and extension - 3122 B- .
- Set piston of appropriate cylinder to “bottom dead centre”.



- 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
- Fit guide plate for 1.6 ltr. FSI engine - VAS 5161/22- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- onto cylinder head.
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.



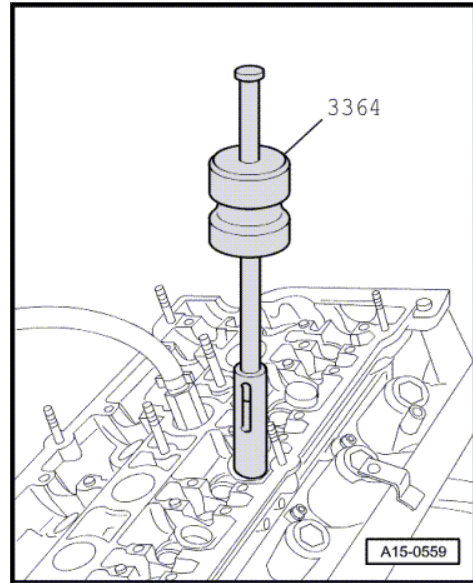
- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise 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.

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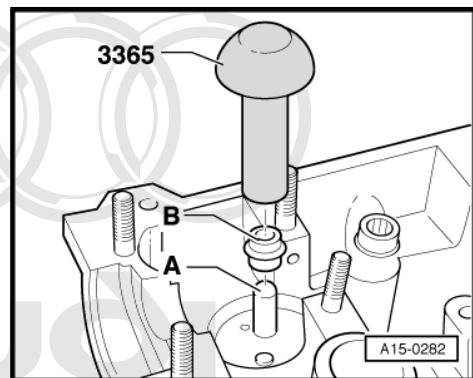
- Pull off valve stem oil seal with valve stem seal puller - 3364- .

**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.**

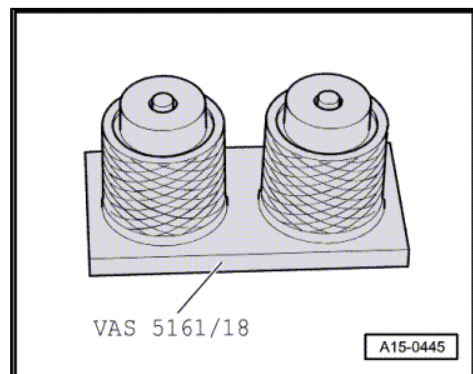
- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.



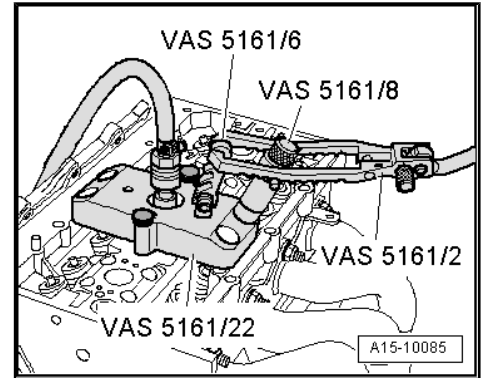
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If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

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



- Insert valve spring and valve spring plate.
- Secure guide plate -VAS 5161/22- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/8- 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:

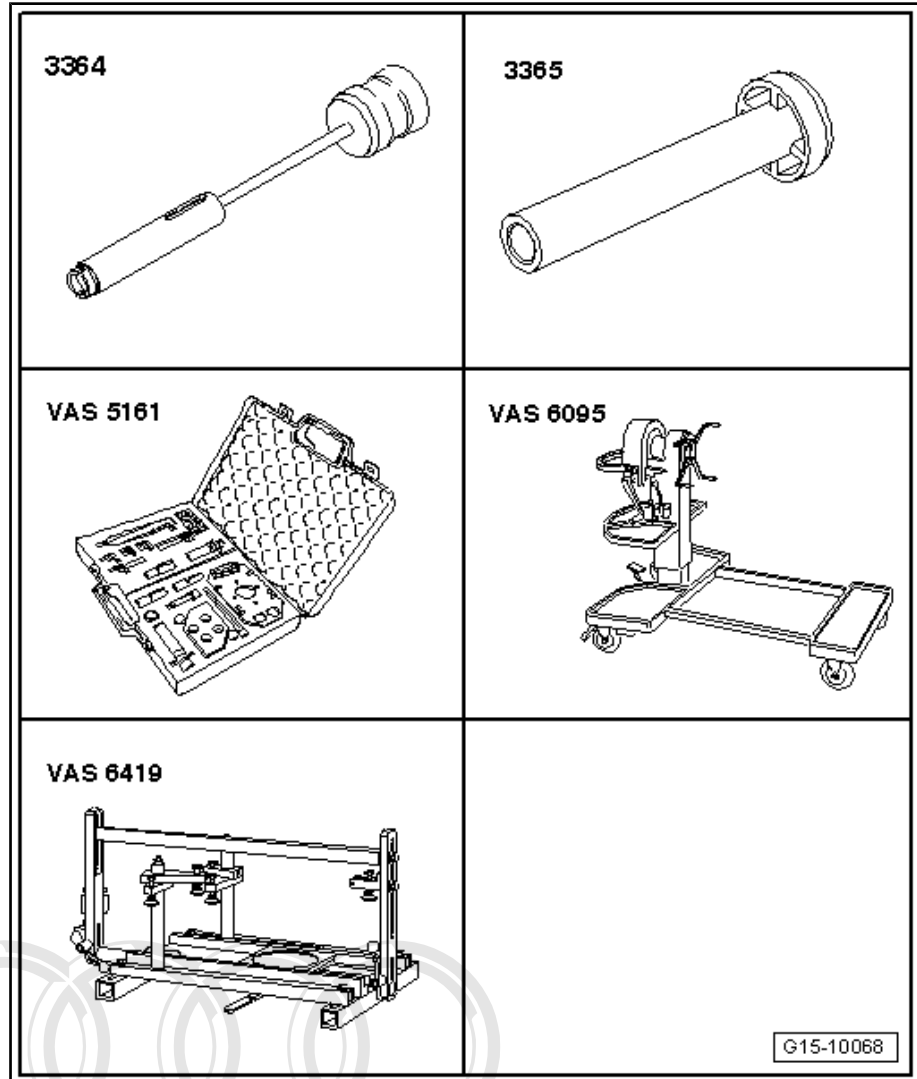
- Install spark plugs ⇒ Maintenance ; Booklet 808 .
- Install turbocharger ⇒ [page 208](#) .
- Install engine lifting eyes ⇒ [page 100](#) .
- Install intake manifold (bottom section) with fuel rail ⇒ Rep. gr. 24 .
- Install camshaft housing ⇒ [page 121](#) .
- Install intake manifold ⇒ Rep. gr. 24 .

3.7 Renewing valve stem oil seals with cylinder head removed

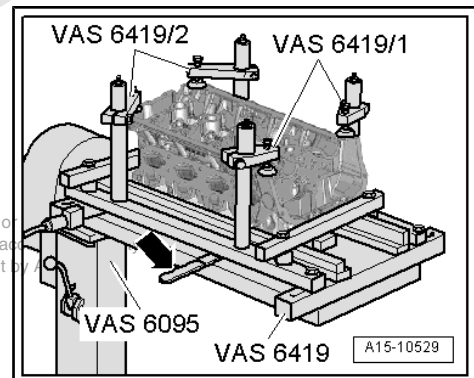
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**Special tools and workshop equipment required**

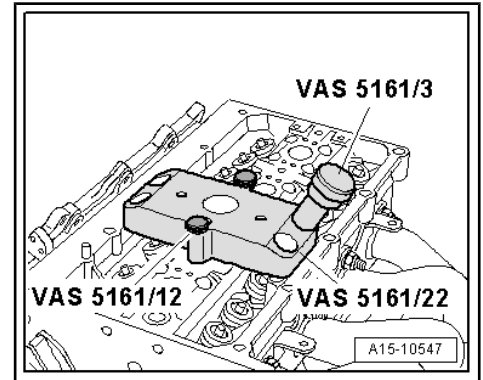
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161- with guide plate for 1.6 ltr. FSI engine - VAS 5161/22-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Cylinder head tensing device - VAS 6419-

**Procedure**

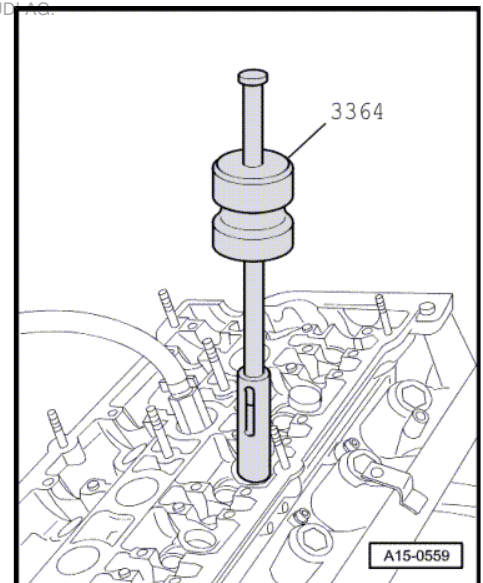
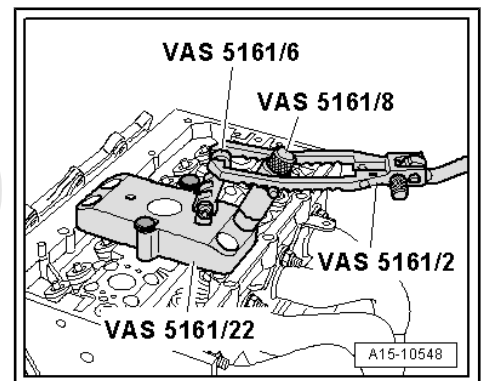
- Insert cylinder head tensing device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensing device, as illustrated.
- Connect cylinder head tensing device to compressed air.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.



- Fit guide plate for 1.6 ltr. FSI engine - VAS 5161/22- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- onto cylinder head.
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.



- 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.**

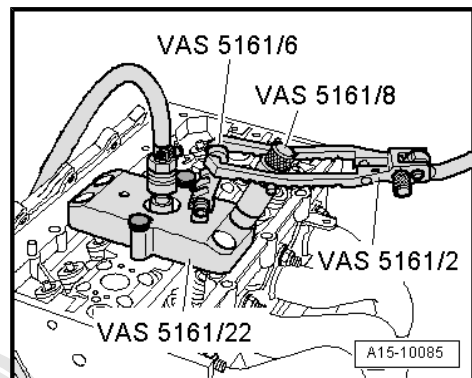
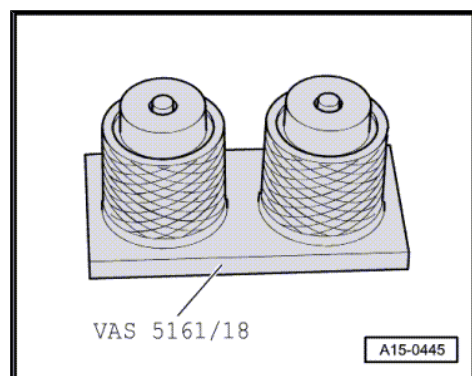
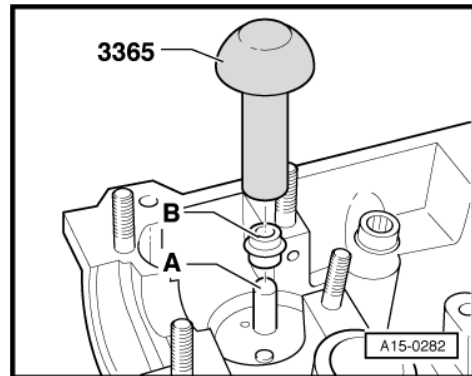
- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.

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

**Note**

Larger diameter of valve cotters faces upwards.

- Press assembly cartridge onto insertion device from above and pick up valve cotters.
- Insert valve spring and valve spring plate.
- Secure guide plate -VAS 5161/22- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/8- 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.

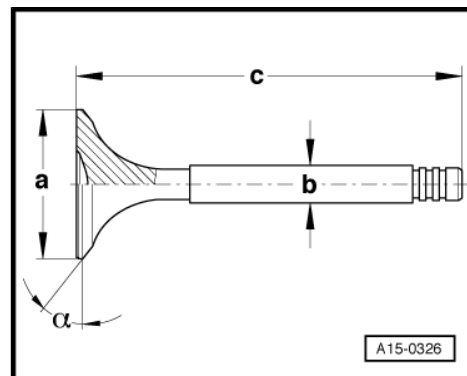


3.8 Valve dimensions

i Note

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

Dimension		Inlet valve	Exhaust valve
∅ a	mm	29.5	26.0
∅ b	mm	5.973	5.953
c	mm	100.9	100.5
α	∠°	45	45



WARNING

Care must be taken when disposing of old sodium-cooled exhaust valves - risk of injury.

- ◆ *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.*
- ◆ *Then throw a maximum of ten valves into a bucket of water and step away immediately.*
- ◆ *A sudden chemical reaction will occur upon contact with water in which the sodium filling burns.*
- ◆ *After performing these steps the valves can be disposed of in the normal way.*

3.9 Checking valve guides

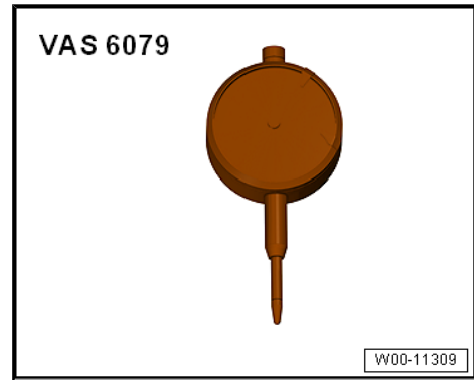
Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

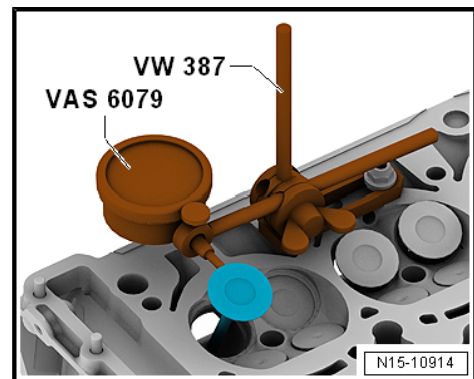


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◆ Dial gauge - VAS 6079-

**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 valve guide and exhaust valve into exhaust valve 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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3.11 Machining valve seats

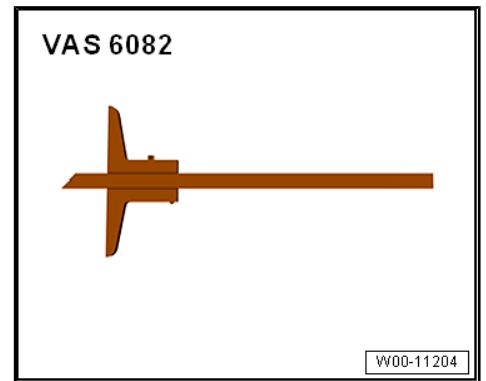


Note

- ◆ *If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (machined).*
- ◆ *When servicing engines with leaking valves, it is not sufficient to machine (reface) the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high-mileage engines ⇒ [page 135](#).*
- ◆ *Valve seats should only be machined to the extent required to give a proper seating pattern.*
- ◆ *The maximum permissible machining dimension must be calculated before starting work.*
- ◆ *If the machining dimension is exceeded, the function of the hydraulic valve play compensation can no longer be guaranteed and the cylinder head must be renewed.*

Special tools and workshop equipment required

- ◆ Depth gauge - VAS 6082-



- ◆ Valve seat machining tool



A - Calculating maximum permissible machining dimension

- Insert valve and press firmly against valve seat.



Note

If the valve has to be renewed as part of a repair, use a new valve for the measurement.

- Measure distance between end of valve stem (upper edge) and top surface of cylinder head.
- Calculate maximum permissible machining dimension from measured distance and minimum dimension.
- Minimum dimension for inlet valve and exhaust valve: 7.6 mm.
Measured distance minus minimum dimension = max. permissible machining dimension.

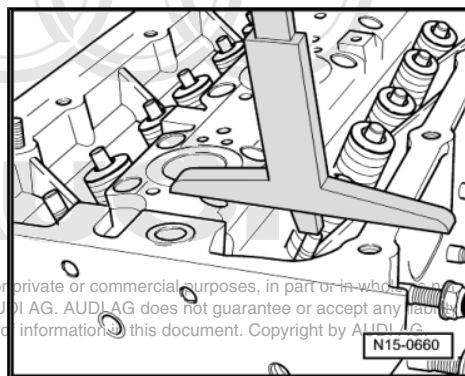
Example:

Measured distance	8.0 mm
Minimum dimension	– 7.6 mm
Maximum permissible machining dimension	= 0.4 mm



Note

- ◆ *If the calculated maximum permissible machining dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve.*
- ◆ *If the result is again 0 mm or less than 0 mm, renew the cylinder head.*



B - Machining valve seats

Inlet valve seat

a - \varnothing 28.7 mm

b - Maximum permissible machining dimension

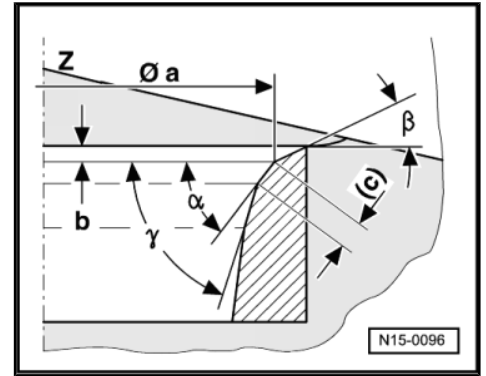
c - 1.5 ... 1.8 mm

Z - Bottom surface of cylinder head

α - 45° valve seat angle

β - 30° upper correction angle

γ - 60° lower correction angle



Exhaust valve seat

a - \varnothing 25.0 mm

b - Maximum permissible machining dimension

c - approx. 1.8 mm

Z - Lower edge of cylinder head

α - 45° valve seat angle

β - 30° upper correction angle

γ - 60° lower correction angle



Note

Calculating maximum permissible machining dimension
 ⇒ [page 138](#).



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17 – Lubrication

1 Sump and oil pump



Caution

Risk of damage to catalytic converter.

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



Note

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

⇒ ["1.1 Exploded view - sump, oil pump", page 140](#)

⇒ ["1.2 Removing and installing oil level and oil temperature sender G266", page 142](#)

⇒ ["1.3 Removing and installing sump", page 143](#)

⇒ ["1.4 Removing and installing drive chain for oil pump", page 147](#)

⇒ ["1.5 Removing and installing oil pump", page 148](#)

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1.1 Exploded view - sump, oil pump

1 - Oil level and oil temperature sender - G266-

- Removing and installing ⇒ [page 142](#)

2 - Seal

- Renew

3 - Sump

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

4 - Bolt

- Renew
- Tightening torque and sequence ⇒ [page 142](#)
- When loosening and tightening the bolts on the gearbox end, use Allen key, long reach - T10058-

5 - Bolt

- Renew
- 14 Nm + 90°

6 - Chain sprocket for oil pump

- Sprocket can only be fitted on oil pump shaft in one position.
- Lock using counterhold tool - T10172-

7 - Bolt

- Renew
- 20 Nm + turn 90° further

8 - Chain sprocket cover

- Clipped onto oil pump

9 - Drive chain for oil pump

- Before removing, mark running direction with paint
- Check for wear
- Removing and installing ⇒ [page 147](#)

10 - Stop bolt for chain tensioner

- 8 Nm

11 - Bearing mounting for chain tensioner

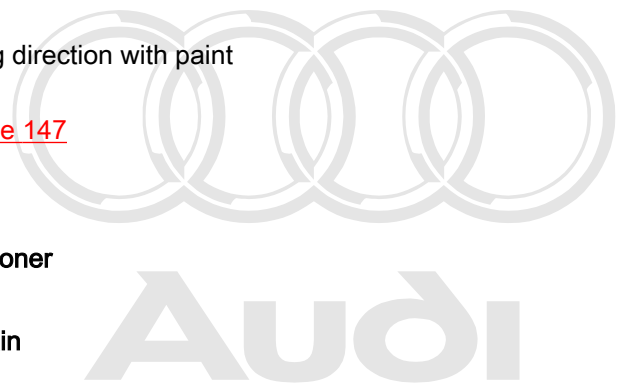
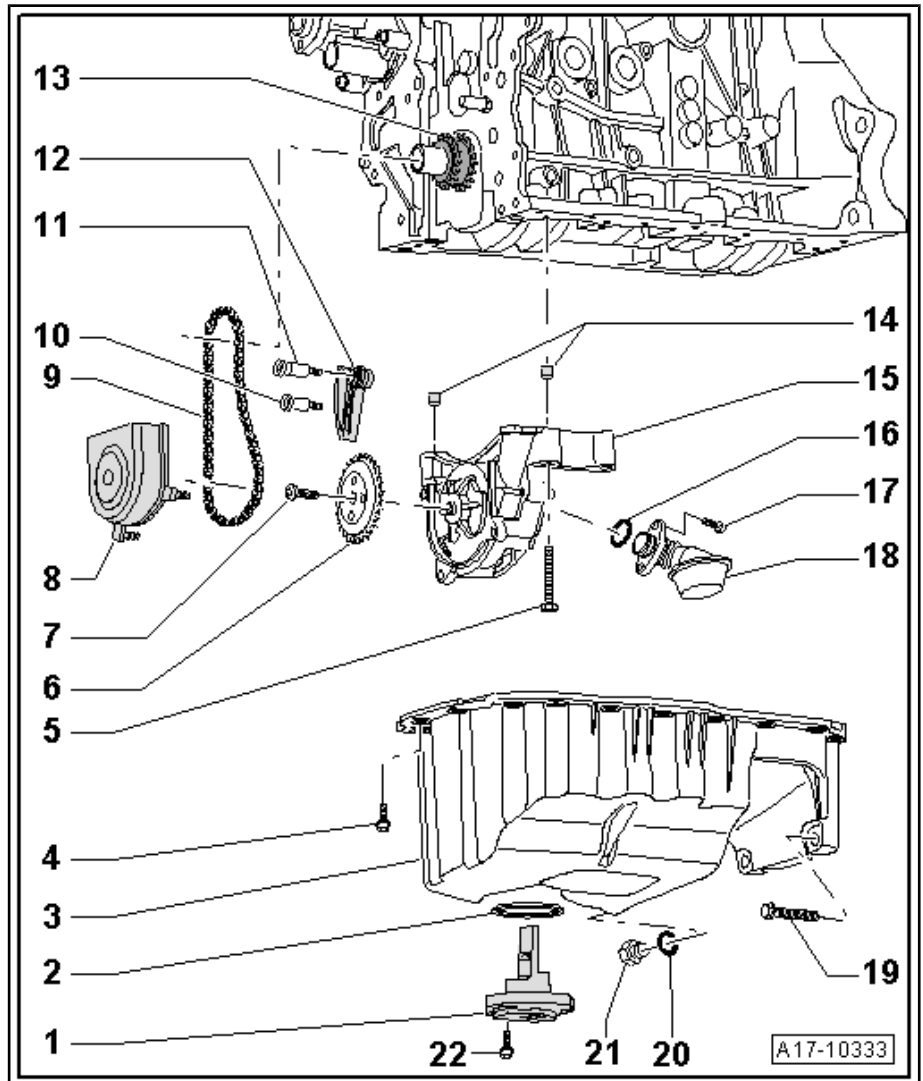
- 8 Nm

12 - Chain tensioner for oil pump chain

- With tensioning spring
- Do not dismantle
- When installing, pre-tension spring and engage

13 - Chain sprocket

- For drive chain for oil pump and camshaft timing chain
- Push-fitted onto crankshaft
- To remove or install ⇒ [“1.4 Removing and installing camshaft timing chain”, page 81](#) and ⇒ [“1.5 Removing and installing oil pump”, page 148](#)
- Installation position ⇒ [page 66](#)
- Contact surfaces must be free of oil and grease



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14 - Dowel sleeves

15 - Oil pump

- With pressure relief valve
- Removing and installing ⇒ [page 148](#)
- Before installing, check that the two dowel sleeves for centring oil pump/cylinder block are fitted

16 - O-ring

- Renew

17 - Bolt

- 10 Nm

18 - Suction pipe

- Clean strainer if dirty

19 - Bolt

- Tightening torque and sequence ⇒ [page 142](#)

20 - Seal

- Renew

21 - Oil drain plug

- 30 Nm

22 - Bolt

- 10 Nm

Sump - tightening torque and sequence

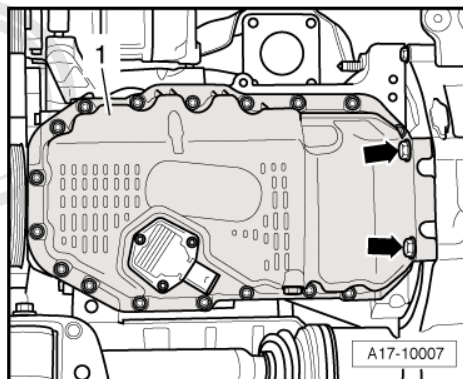


Note

Renew the bolts tightened with specified tightening angle.

– Tighten bolts in 3 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	Sump to cylinder block	5 Nm
2.	-arrows- T10058	40 Nm, using Allen key, long reach -
3.	Sump to cylinder block	13 Nm

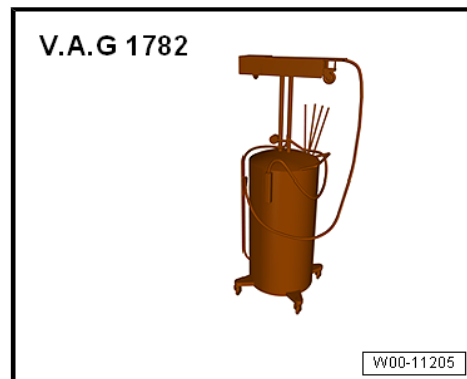


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1.2 Removing and installing oil level and oil temperature sender - G266-

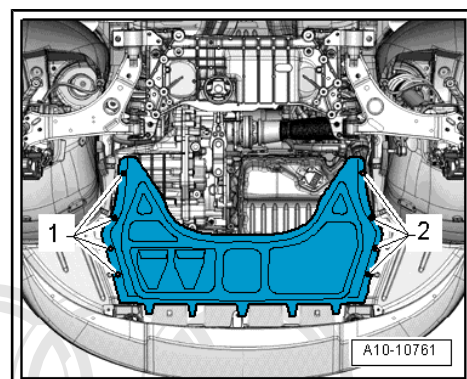
Special tools and workshop equipment required

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



Removing

- Remove noise insulation ⇒ Rep. gr. 50 .
- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.



- Unplug electrical connector -3-.
- Remove bolt -1- and detach oil level and oil temperature sender - G266- -item 4-.

Installing

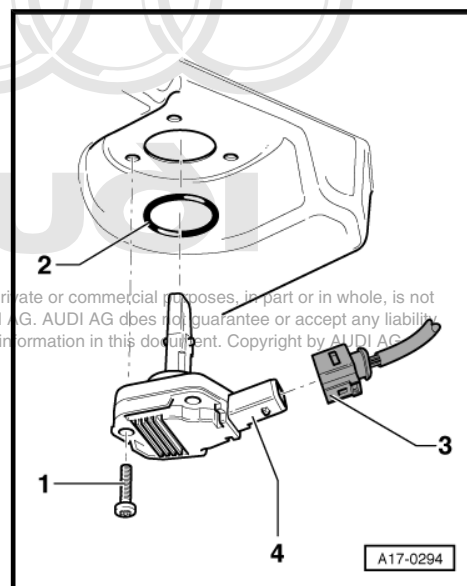
- Tightening torque ⇒ [page 140](#)

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

Note

Renew seal -2-.

- Fill with engine oil and check oil level ⇒ [page 156](#) .
- Install noise insulation ⇒ Rep. gr. 66 .



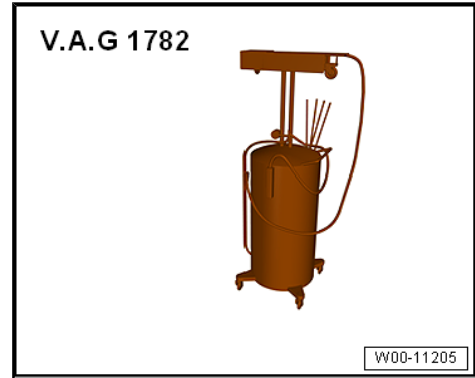
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1.3 Removing and installing sump

Special tools and workshop equipment required



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



- ◆ Allen key, long reach - T10058-



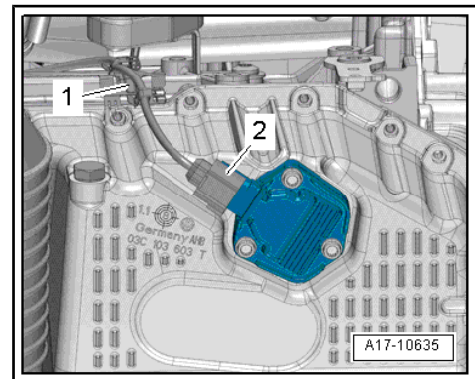
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove front exhaust pipe ⇒ [page 222](#) .
- Unplug electrical connector -2- at oil level and oil temperature sender - G266- .



Disregard -item 1-.

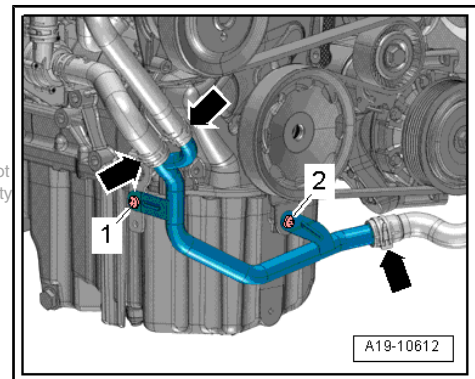


- Remove bolts -1- and -2- and press coolant pipe (right-side) to the side.

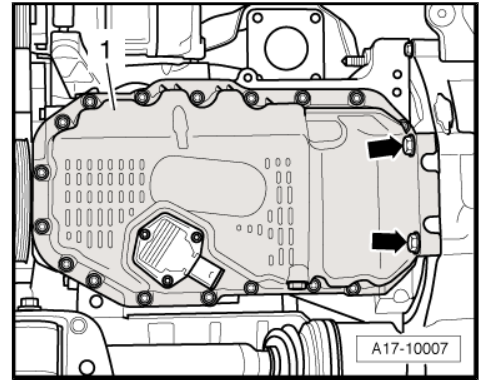


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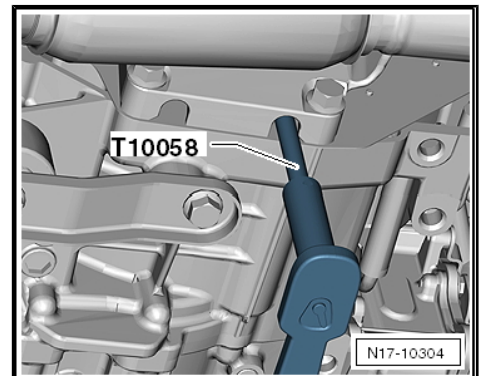
Disregard -arrows-



- Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.
- Remove bolts securing sump to gearbox -arrows-.
- Unscrew bolts for sump -1- in diagonal sequence and remove.



- Two bolts may not be immediately accessible on the gearbox side. If bolt heads cannot be reached with Allen key, long reach - T10058- , turn crankshaft in normal direction of engine rotation until bolts are accessible. There are recesses on the flywheel.
- Carefully release sump from bonded joint.



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Installing

- Tightening torque ⇒ [page 142](#)



Caution

Take care to keep cylinder block clean.

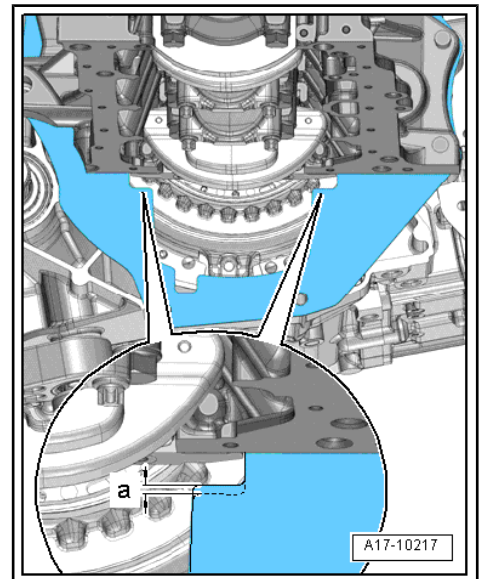
- ◆ *Cover exposed parts of the engine.*

- Machine intermediate plate between engine and gearbox to dimension -a- as shown in illustration.
- Dimension -a- = 5 mm



Note

It is not possible for fit sump with sealant bead onto cylinder block without machining the intermediate plate.



**Caution**

Protect lubrication system against contamination.

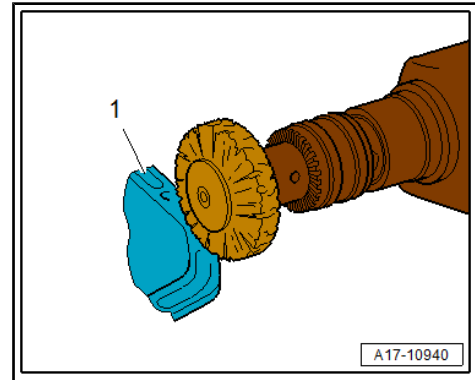
- ◆ *Cover exposed parts of the engine.*

**WARNING**

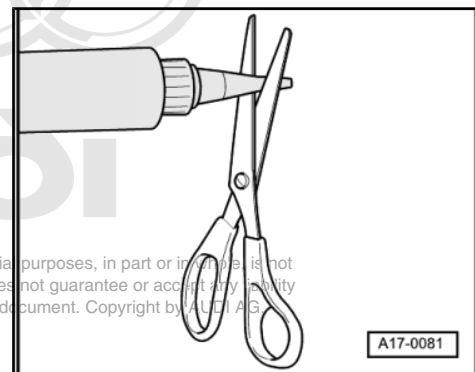
Risk of eye injury.

- ◆ *Wear safety goggles.*

- Remove sealant residue from sump and cylinder block using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Cut off nozzle of tube at front marking (nozzle \varnothing approx. 2 mm).



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**Caution**

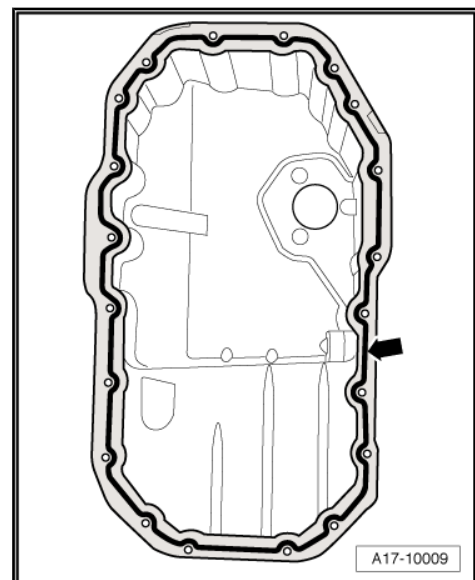
Make sure lubrication system is not clogged by excess sealant.

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

- Apply bead of sealant -arrow- onto clean sealing surface of sump as illustrated.
- Thickness of sealant bead: 2 ... 3 mm

**Note**

- ◆ *Take particular care when applying sealant bead in area of sealing flange.*
- ◆ *The sump must be installed within 5 minutes after applying the sealant.*



- Fit sump and tighten bolts ⇒ [page 142](#) .

i Note

- ◆ *If sump is fitted with engine removed, make sure sump is flush with cylinder block at gearbox end.*
- ◆ *After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.*

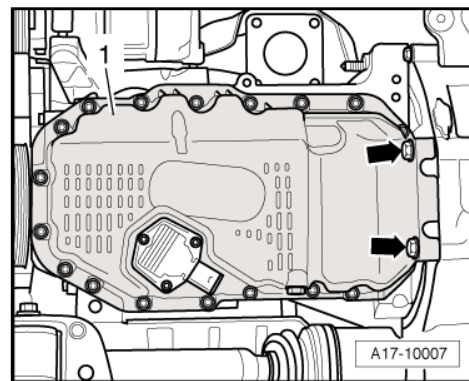
Remaining installation steps are carried out in reverse sequence; note the following:

- Install coolant pipe (right-side) ⇒ [page 178](#) .
- Install front exhaust pipe ⇒ [page 222](#) .
- Fill with engine oil and check oil level ⇒ [page 156](#) .

1.4 Removing and installing drive chain for oil pump

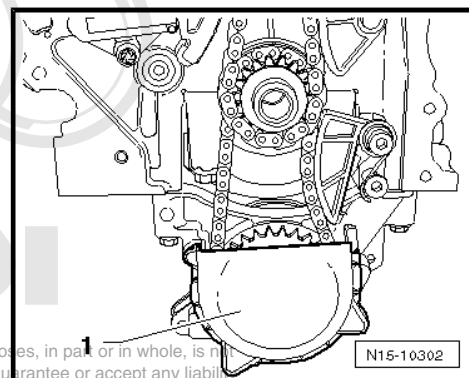
Special tools and workshop equipment required

- ◆ Counterhold tool - T10172 A-



Removing

- Remove camshaft timing chain ⇒ [page 81](#) .
- Unclip cover -1- for chain sprocket for oil pump



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**Caution**

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

- ◆ *Mark running direction of drive chain with paint for re-installation. Do not mark drive chain by means of centre punch, notch or the like.*

- Using a screwdriver, pry off tensioning spring -1- at bolt -2- and detach
- Slacken off bolt -1- for chain sprocket for oil pump; use counterhold tool - T10172- to counterhold at chain sprocket.
- Remove bolt for chain sprocket for oil pump and detach chain sprocket for oil pump with drive chain -2-.

Installing

- Tightening torque ⇒ [page 140](#)

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

**Note**

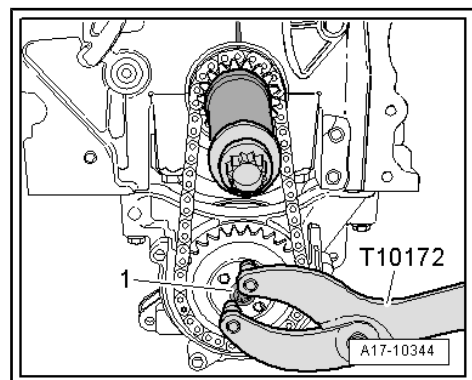
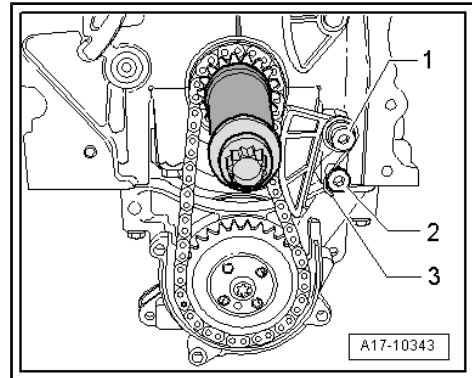
Renew bolt for chain sprocket for oil pump.

- Install drive chain for oil pump together with chain sprocket for oil pump according to marks applied when removing.
- The chain sprocket for oil pump can only be installed correctly in one position.
- Install camshaft timing chain ⇒ [page 81](#) .

1.5 Removing and installing oil pump

Special tools and workshop equipment required

- ◆ Counterhold tool - T10172 A-

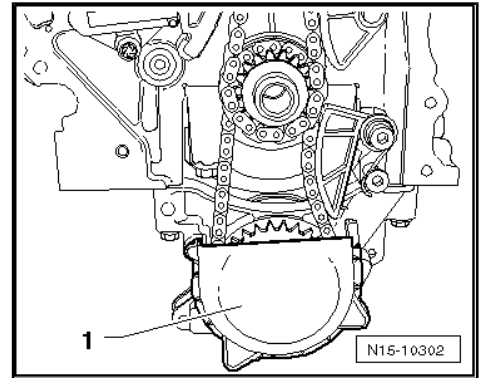


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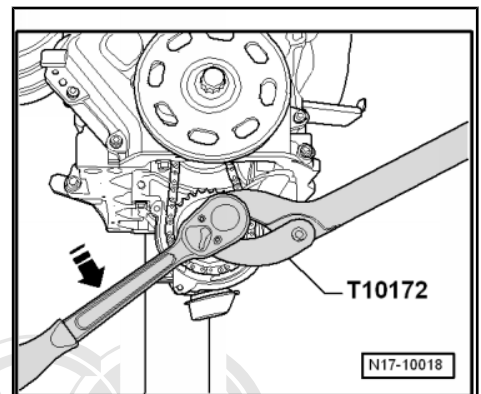


Removing

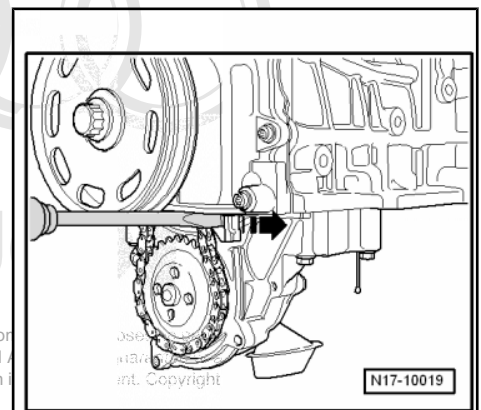
- Remove sump ⇒ [page 143](#) .
- Unclip cover -1- for chain sprocket for oil pump



- Slacken off bolt for chain sprocket for oil pump several turns -arrow-; use counterhold tool - T10172- to counterhold at chain sprocket.



- Use screwdriver to press chain tensioner in direction of -arrow-.
- Remove bolt for chain sprocket for oil pump.
- Detach chain sprocket from oil pump and take out of chain.



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- Remove bolts -arrows- and remove oil pump.

Installing

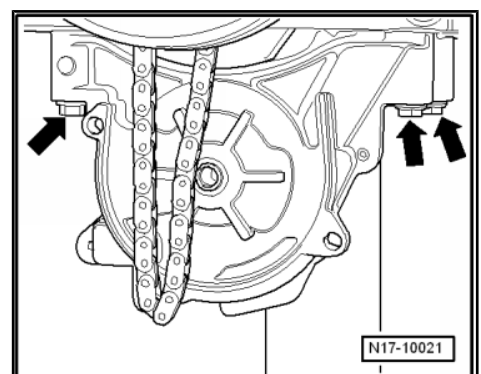
- Tightening torques ⇒ [page 140](#)



Note

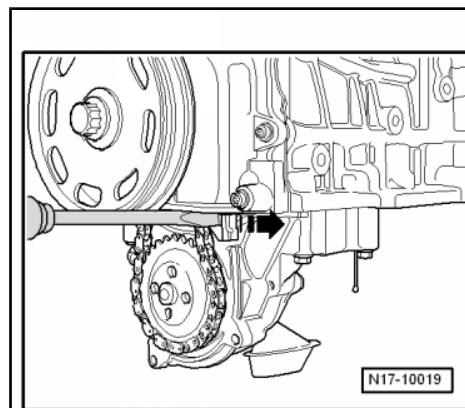
Renew the bolts tightened with specified tightening angle.

- Check whether dowel sleeves for centring oil pump and cylinder block are fitted; install missing dowel sleeves.
- Fit oil pump and tighten bolts.





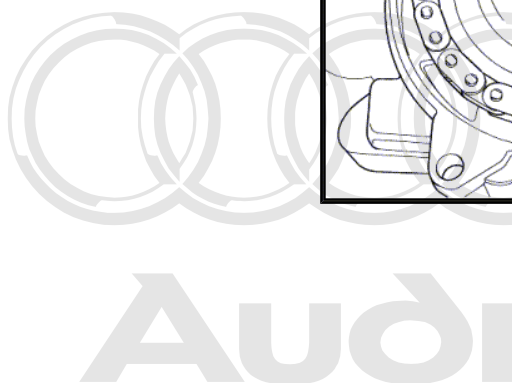
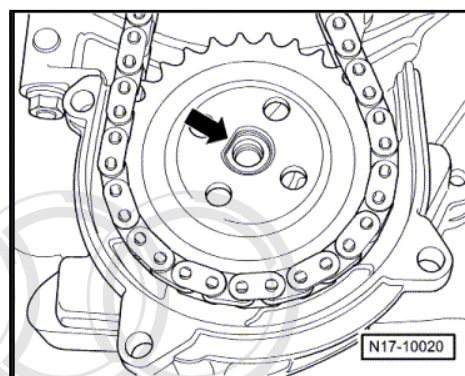
- Use screwdriver to press chain tensioner in direction of -arrow-.



- Fit chain sprocket for oil pump
- Installation position: Sprocket can only be fitted on oil pump shaft in one position -arrow-.

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

- Install sump ⇒ [page 143](#) .



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2 Oil filter housing and engine oil cooler

- ⇒ ["2.1 Exploded view - oil filter housing", page 151](#)
- ⇒ ["2.2 Exploded view - engine oil cooler", page 153](#)
- ⇒ ["2.3 Removing and installing engine oil cooler", page 153](#)
- ⇒ ["2.4 Removing and installing oil pressure switch F1", page 155](#)
- ⇒ ["2.5 Checking oil pressure switch F1 and oil pressure", page 155](#)
- ⇒ ["2.6 Engine oil", page 156](#)
- ⇒ ["2.7 Checking oil level", page 156](#)

2.1 Exploded view - oil filter housing

1 - Timing chain cover with oil filter housing

2 - Cap

3 - Seal

- Renew if leaking

4 - Filler cap

5 - O-ring

- Renew

6 - Crankcase breather hose

- Press release tabs to detach

7 - Seal

- Renew if leaking

8 - Bolt

- 5 Nm

9 - Oil separator

10 - Sealing cap on oil filter housing

- Depending on version
- 25 Nm

11 - O-ring

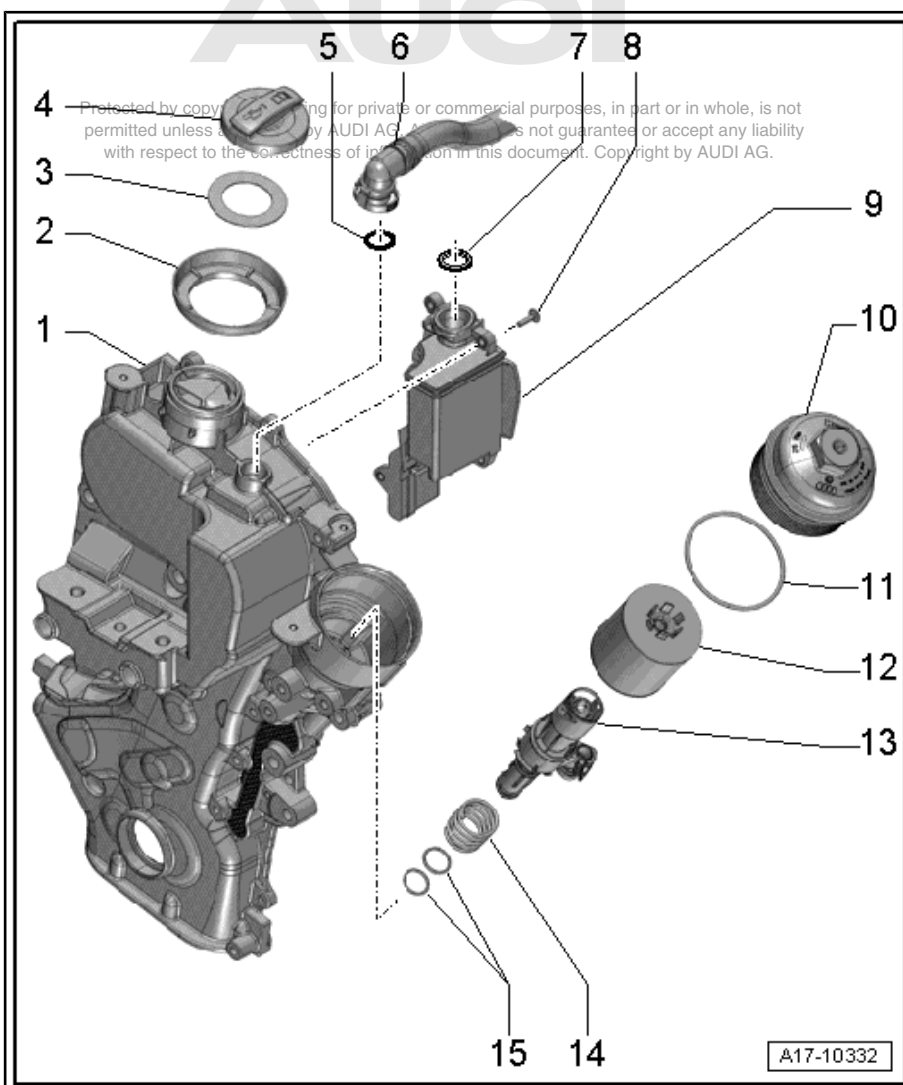
- Depending on version
- Renew

12 - Oil filter element

- Oil filter cartridge on some versions
⇒ [page 152](#)
- Removing and installing
⇒ Maintenance ; Book-let 808

13 - Valve unit

- With filter bypass valve, 1.8 bar
- With non-return valve
- To remove, press release tab and turn anti-clockwise
- Cannot be renewed separately





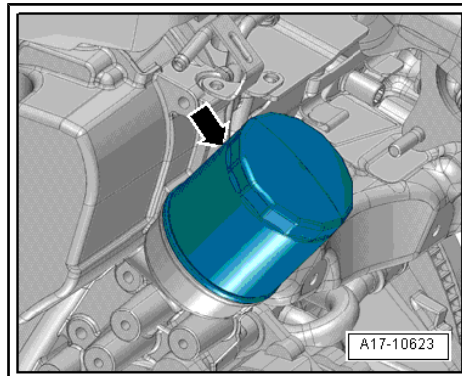
14 - Compression spring

15 - O-rings

- Renew

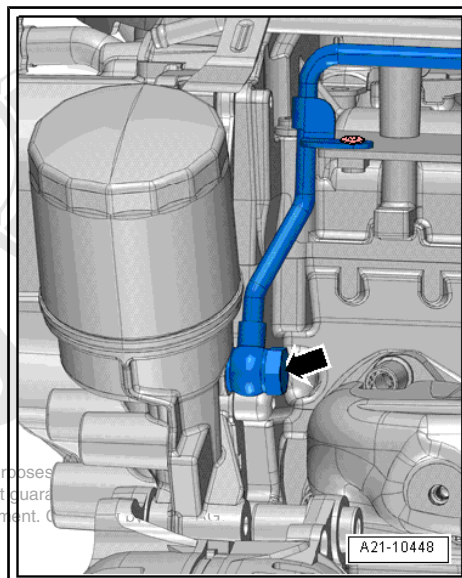
Oil filter

A complete oil filter cartridge -arrow- is installed instead of an oil filter element in some engine versions.



Bolted connection: oil supply line to timing chain cover (from approx 04.2008 onwards)

- Tighten banjo bolt -arrow- to 20 Nm.



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2.2 Exploded view - engine oil cooler

1 - Engine oil cooler

- See note ⇒ [page 140](#)
- Removing and installing ⇒ [page 153](#)

2 - Gasket

- Renew

3 - O-rings

- Renew

4 - Coolant pipes

5 - Bolt

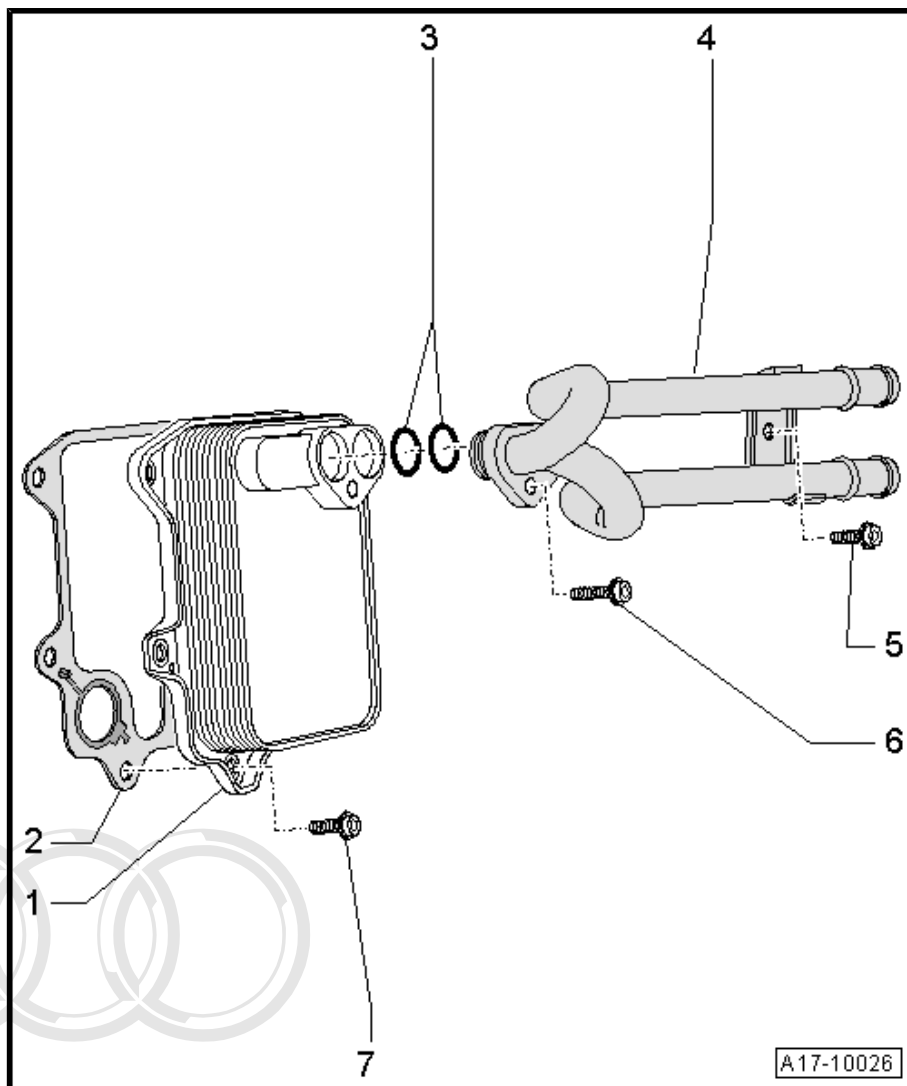
- Tightening torque ⇒ [Item 10 \(page 176\)](#)

6 - Bolt

- Tightening torque ⇒ [Item 8 \(page 176\)](#)

7 - Bolt

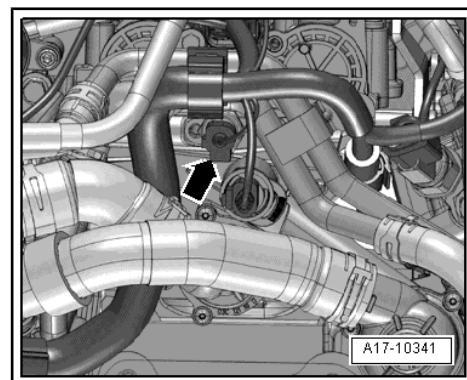
- 8 Nm



Oil pressure switch - F1- - tightening torque

- Tighten oil pressure switch - F1- -arrow- to 20 Nm.

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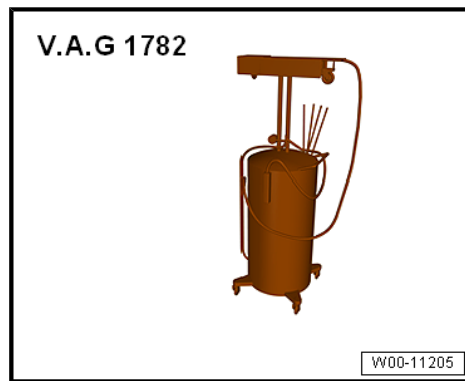


2.3 Removing and installing engine oil cooler

Special tools and workshop equipment required



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



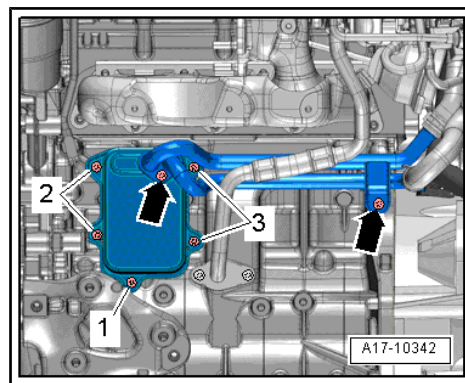
Removing

- Drain coolant ⇒ [page 159](#) .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 .
- Remove bolts -arrows- for coolant pipes at cylinder block and engine oil cooler.
- Position used oil collection and extraction unit - V.A.G 1782- below engine.
- Pull coolant pipes forwards out of engine oil cooler.
- Unscrew bolts -1, 2, 3- and remove engine oil cooler from cylinder block.



Note

For illustration purposes, the installation position is shown with the catalytic converter removed.



Installing

- Tightening torques ⇒ [page 153](#)
- Installation is carried out in the reverse order; note the following:



Note

- ◆ *Fit new O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Install alternator ⇒ Electrical system; Rep. gr. 27 .
- Fill up with coolant ⇒ [page 160](#) .



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The coolant in the entire system must be changed if the engine oil cooler is renewed.

2.4 Removing and installing oil pressure switch - F1-

Removing

- Unplug electrical wiring on oil pressure switch - F1- -arrow-.
- Unscrew oil pressure switch - F1- .

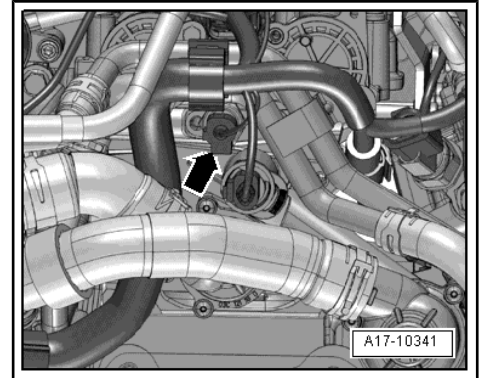
Installing

- Tightening torque => [page 153](#)

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

Note


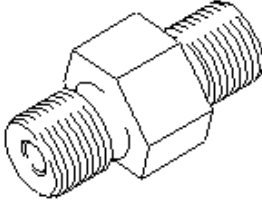
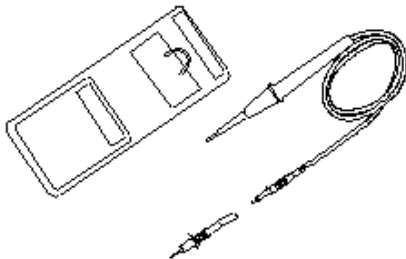

- ◆ *Renew seal.*
- ◆ *Fit the new oil pressure switch - F1- into the connection immediately to avoid loss of oil.*
- Check oil level => [page 156](#) .



2.5 Checking oil pressure switch - F1- and oil pressure

Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-
- ◆ Adapter - V.A.G 1342/14-
- ◆ Voltage tester - V.A.G 1527B-
- ◆ Auxiliary measuring set - V.A.G 1594C-

<p>V.A.G 1342</p> 	<p>V.A.G 1342/14</p> 
<p>V.A.G 1527 B</p> 	<p>V.A.G 1594 C</p> 
<p style="text-align: right;">G17-10005</p>	

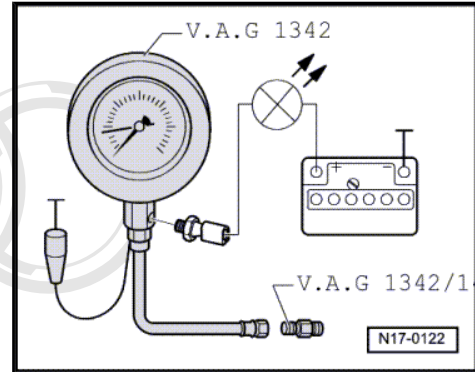


Procedure

- Oil level OK
- Engine oil temperature approx. 80 °C
- Remove oil pressure switch - F1- ⇒ [page 155](#) .
- Connect oil pressure tester - V.A.G 1342- with adapter - V.A.G 1342/14- to bore for oil pressure switch.
- Screw oil pressure switch - F1- into oil pressure tester - V.A.G 1342- .
- Connect brown wire of oil pressure tester to earth “-”.

Checking oil pressure switch

- Connect voltage tester - V.A.G 1527B- with adapter leads from auxiliary measuring set - V.A.G 1594C- to oil pressure switch and battery positive (“+”).
- LED should not light up.



Note

Renew oil pressure switch if LED lights up at this stage.

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- 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 0.3 ... 0.6 bar.
- Renew oil pressure switch if LED does not light up.

Checking oil pressure

- Start engine.
- Oil pressure at 2000 rpm: at least 2.0 bar.

Assembling

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

- Install oil pressure switch - F1- ⇒ [page 155](#) .

2.6 Engine oil

Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.

2.7 Checking oil level

Check oil level ⇒ Maintenance ; Booklet 808 .

19 – Cooling

1 Removing and installing parts of cooling system



WARNING

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

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



Note

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*

⇒ [“1.1 Connection diagram - coolant hoses”, page 157](#)

⇒ [“1.2 Draining and filling cooling system”, page 159](#)

1.1 Connection diagram - coolant hoses

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1 - Water radiator for charge air cooling circuit

- Removing and installing ⇒ [page 186](#)
- If renewed, refill system with fresh coolant

2 - Turbocharger**3 - Cylinder head and cylinder block**

- If renewed, refill system with fresh coolant

4 - Auxiliary heater**5 - Restrictor****6 - Non-return valve**

- Arrow points in direction of through-flow

7 - Coolant expansion tank**8 - Filler cap for expansion tank**

- Checking pressure relief valve ⇒ [page 190](#)

9 - Coolant circulation pump - V50-

- Removing and installing ⇒ [page 167](#)

10 - Coolant pump

- Removing and installing ⇒ [page 167](#)

11 - Non-return valve

- Arrow points in direction of through-flow

12 - Charge air cooler

- Water-cooled
- If renewed, refill system with fresh coolant

13 - Heat exchanger for heater

- Removing and installing ⇒ Rep. gr. 87
- If renewed, refill system with fresh coolant

14 - Thermostat housing

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

15 - Coolant temperature sender - G62-

- Removing and installing ⇒ [page 169](#)

16 - Restrictor**17 - Engine oil cooler**

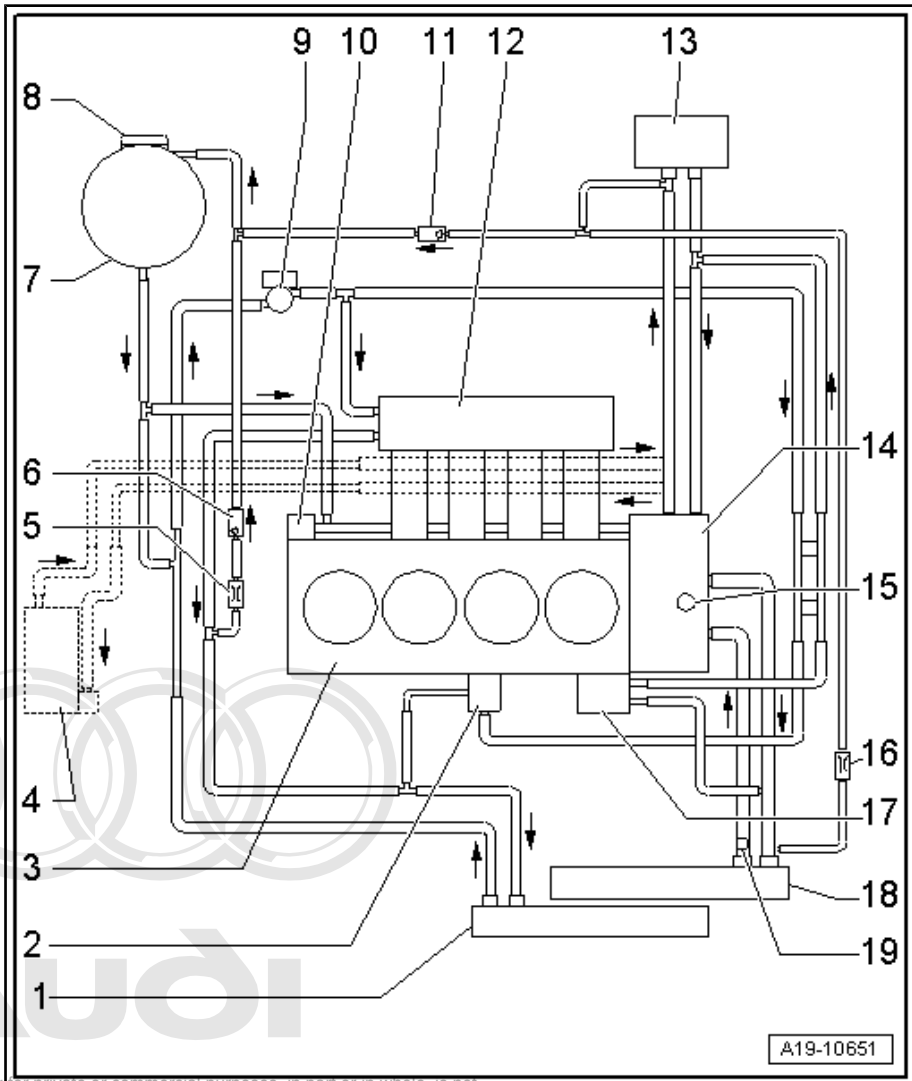
- Removing and installing ⇒ [page 153](#)

18 - Radiator

- Removing and installing ⇒ [page 184](#)
- If renewed, refill system with fresh coolant

19 - Radiator outlet coolant temperature sender - G83-

- Removing and installing ⇒ [page 183](#)

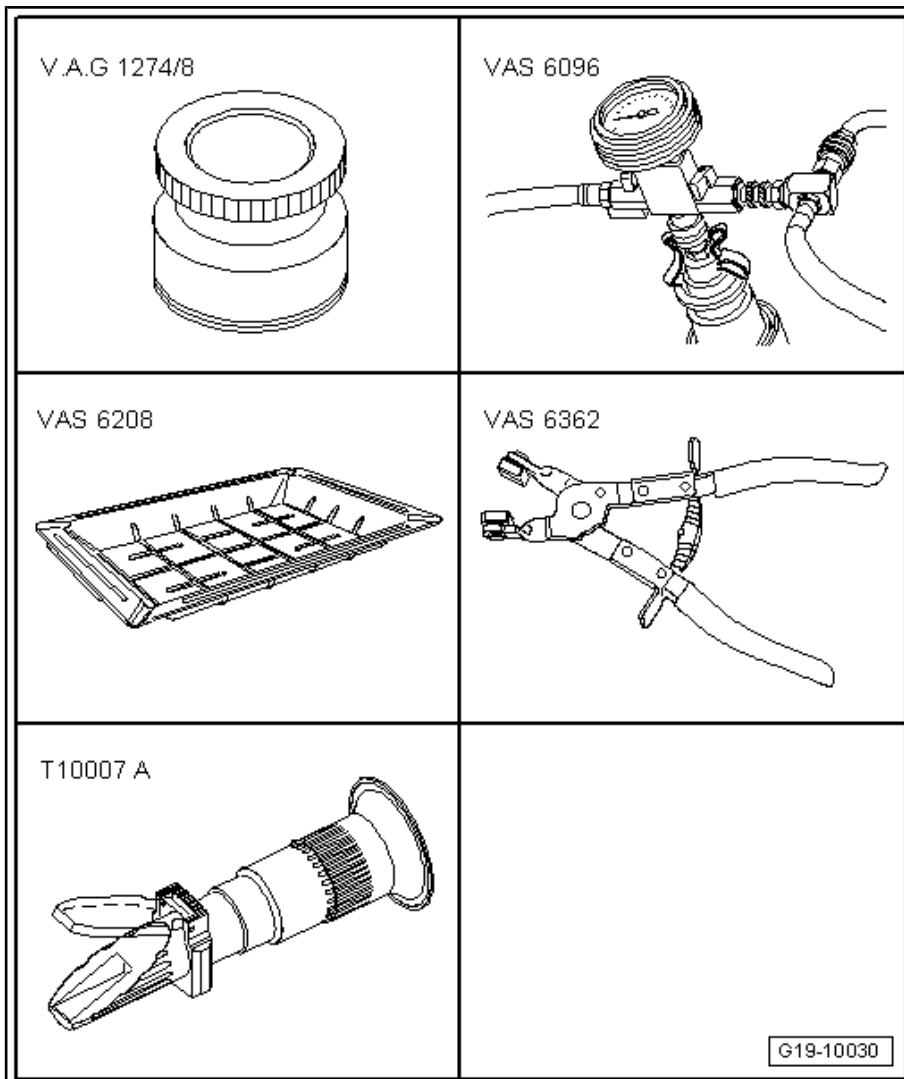


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1.2 Draining and filling cooling system

Special tools and workshop equipment required

- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Cooling system charge unit - VAS 6096- with - VAS 6096/1-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Refractometer - T10007 A-



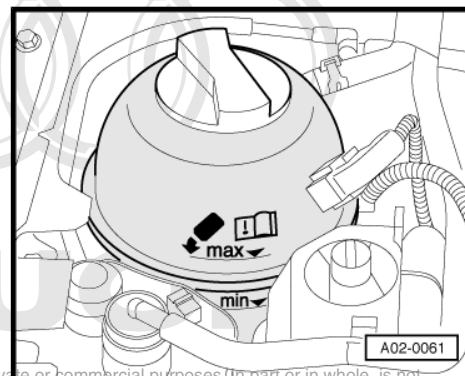
Draining



WARNING

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

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

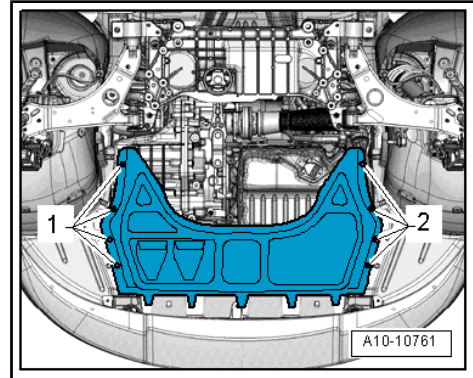


- Open filler cap on coolant expansion tank.

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- Remove noise insulation ⇒ Rep. gr. 50 .

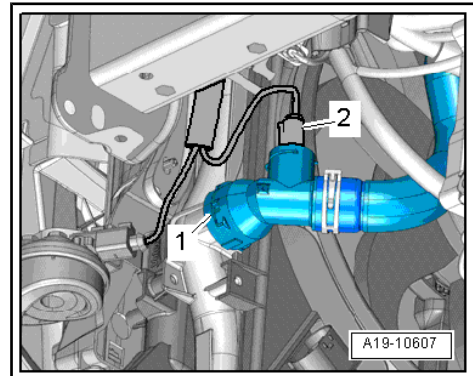


- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Disconnect coolant hose -1- (bottom) from radiator (pull out retaining clip).

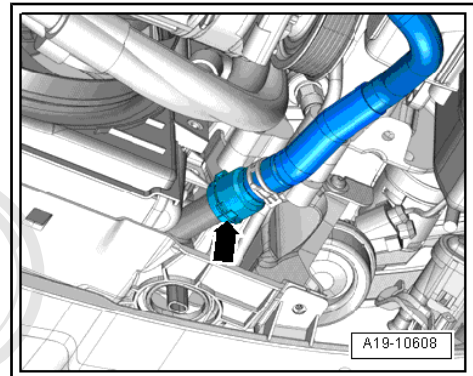


Note

Disregard -item 2-.



- Lift retaining clip and disconnect coolant hose (bottom right) -arrow- from water radiator for charge air cooling circuit.



- Disconnect coolant hose -arrow- from coolant expansion tank, guide downwards all the way and drain off remaining coolant.

Filling

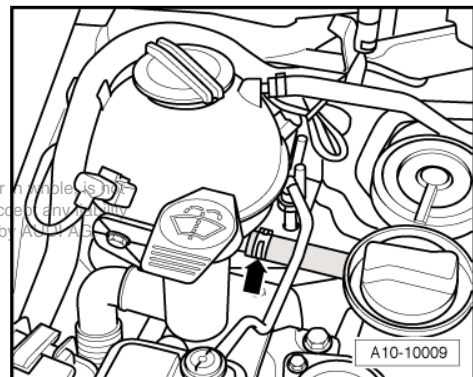
- Ignition off.



Caution

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Always use distilled water for mixing coolant additives as this ensures optimum corrosion protection.

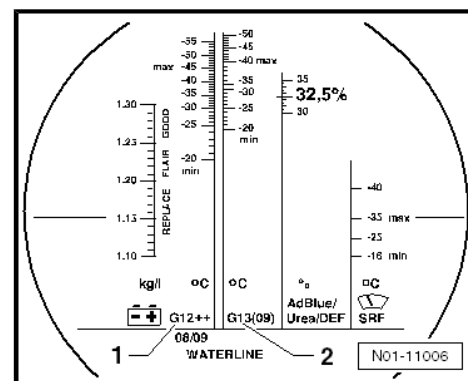


 Note

- ◆ *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- ◆ *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- ◆ *Coolant with the recommended mixture ratio prevents frost and corrosion damage and stops scaling. At the same time it raises the boiling point of the fluid in the system. For this reason the cooling system must be filled all year round with the correct coolant additive.*
- ◆ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *The refractometer - T10007A- MUST be used to determine the current level of frost protection.*
- ◆ *The mixture must guarantee frost protection down to at least -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze should only be increased if greater frost protection is required in very cold climates. This must only be down to -48 °C, however, as otherwise the cooling efficiency of the coolant is impaired.*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be provided to at least -25 °C.*
- ◆ *Read off the level of frost protection on the scale for the relevant coolant additive.*
- ◆ *The temperature indicated on the refractometer - T10007A- corresponds to the temperature at which the first ice crystals can form in the coolant.*
- ◆ *Do not reuse coolant.*
- ◆ *Only use water/coolant additive as a lubricant for coolant hoses.*

Recommended mixture ratio for coolant

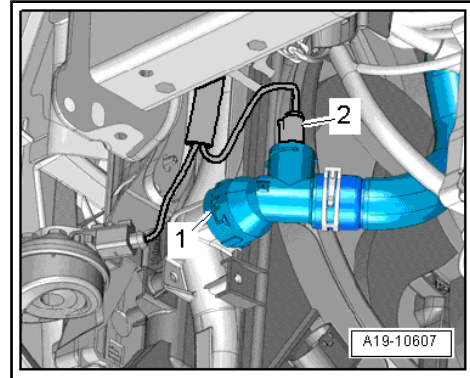
- Coolant (40 %) and water (60 %) for frost protection to -25 °C
- Coolant (50 %) and water (50 %) for frost protection to -36 °C
- Coolant ⇒ Electronic parts catalogue



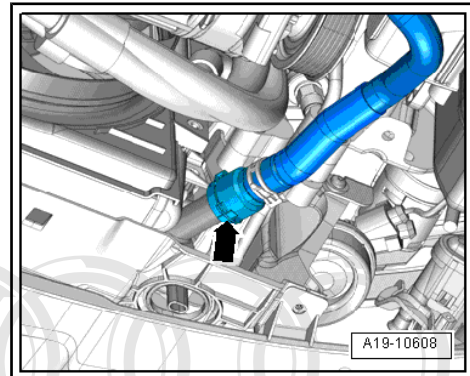
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**Procedure**

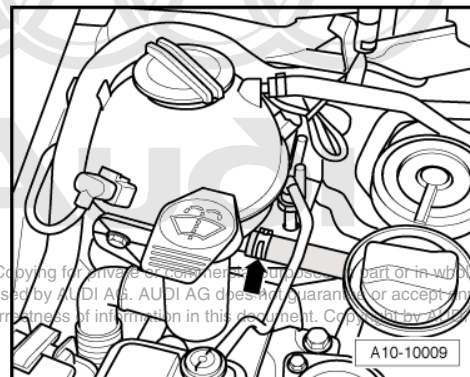
- Connect coolant hose -1- with plug-in connector to radiator
⇒ [page 183](#) .



- Connect coolant hose -arrow- to water radiator for charge air cooling circuit (bottom right).



- Connect coolant hose -arrow- to coolant expansion tank.

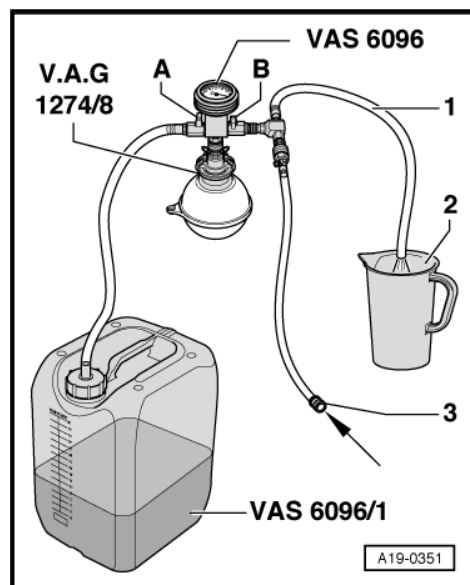


- Fill reservoir of -VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio):
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-.

**Note**

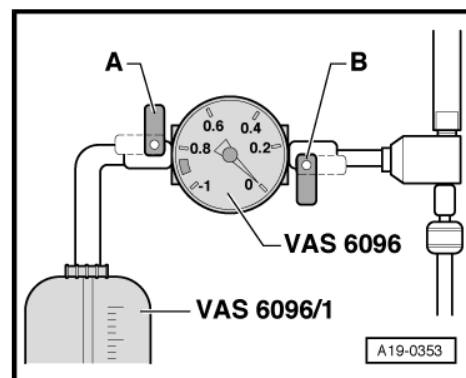
The vented air draws along a small amount of coolant, which should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



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- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir 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.

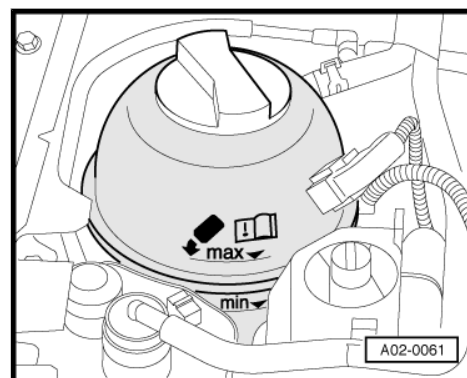


 **Note**

- ◆ *If the needle does not reach the green zone, repeat the process.*
- ◆ *Check cooling system for leaks if the vacuum is not maintained.*

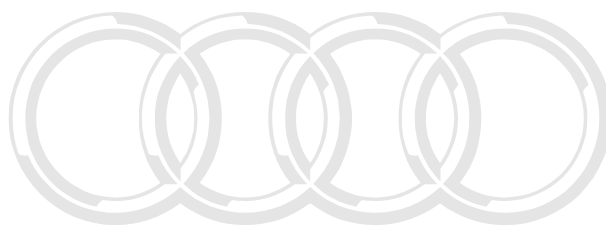
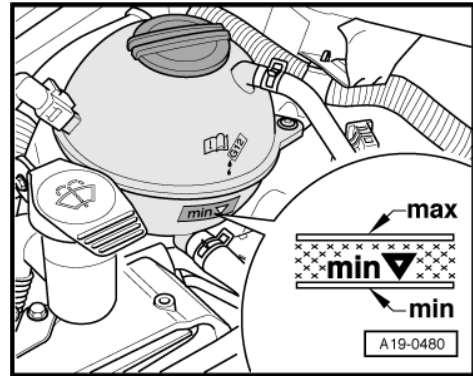
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- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the coolant expansion tank of -VAS 6096- ; the cooling system is then filled.
- Top up coolant to "max" mark.
- Start engine and run for 2 minutes (maximum) at approx. 1500 rpm.
- Top up coolant to overflow hole on expansion tank with engine running.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Close filler cap on expansion tank.
- Start engine and run for 2 minutes (maximum) at approx. 1500 rpm.
- Top up coolant to overflow hole on expansion tank with engine running.
- Close filler cap on coolant expansion tank.
- Allow engine to run at idling speed until both large coolant hoses at radiator become warm.
- Switch off ignition and allow engine to cool down.
- Install noise insulation ⇒ Rep. gr. 66 .





- Check coolant level.
- The coolant level must be between the “min” and “max” markings when the engine is cold.
- The coolant level can be at the “max” marking when the engine is warm.
- Top up with coolant again if necessary.



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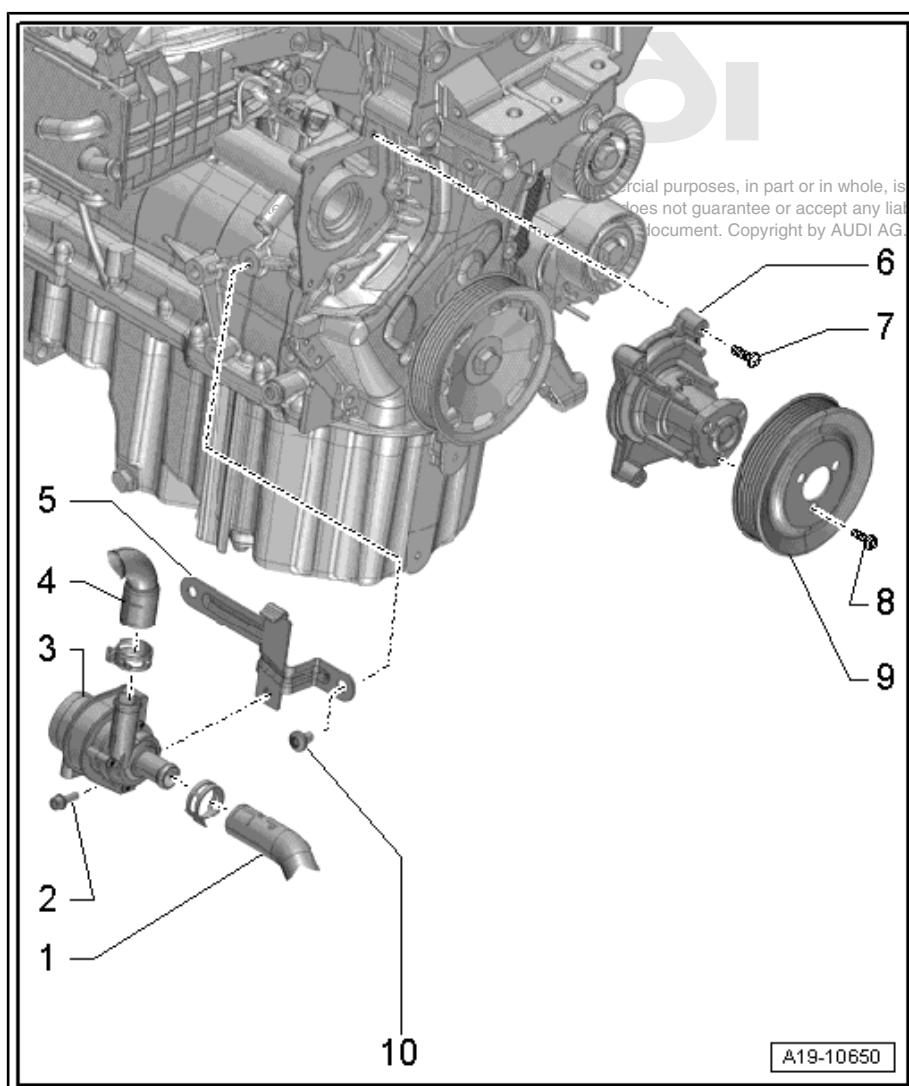
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2 Coolant pump and thermostat

- ⇒ [“2.1 Exploded view - coolant pump”, page 165](#)
- ⇒ [“2.2 Removing and installing coolant pump pulley”, page 166](#)
- ⇒ [“2.3 Removing and installing coolant pump”, page 167](#)
- ⇒ [“2.4 Removing and installing coolant circulation pump V50”, page 167](#)
- ⇒ [“2.5 Exploded view - thermostat housing”, page 168](#)
- ⇒ [“2.6 Removing and installing coolant temperature sender G62”, page 169](#)
- ⇒ [“2.7 Removing and installing thermostat”, page 170](#)
- ⇒ [“2.8 Removing and installing thermostat housing and coolant pipe \(rear\)”, page 171](#)

2.1 Exploded view - coolant pump

- 1 - Coolant hose
- 2 - Bolt
 - 10 Nm
- 3 - Coolant circulation pump - V50-
 - Removing and installing ⇒ [page 167](#)
- 4 - Coolant hose
- 5 - Bracket
- 6 - Coolant pump
 - Removing and installing ⇒ [page 167](#)
 - With integral seal
- 7 - Bolt
 - 9 Nm
- 8 - Bolt
 - 20 Nm
- 9 - Poly V-belt pulley for coolant pump
 - Removing and installing ⇒ [page 166](#)
- 10 - Bolt
 - 20 Nm



2.2 Removing and installing coolant pump pulley

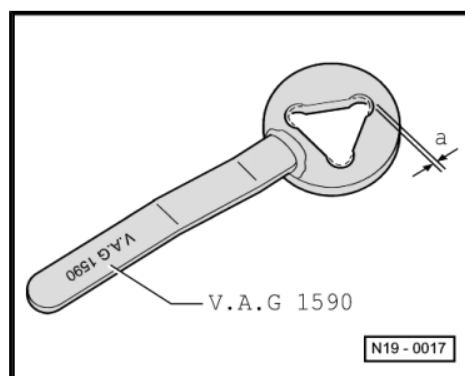
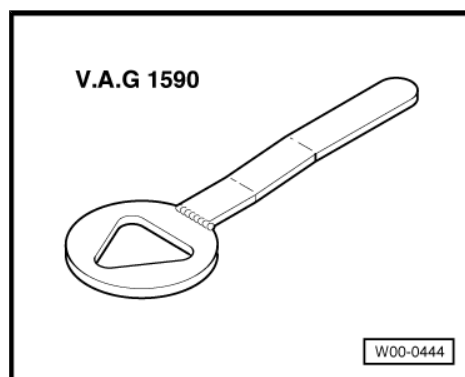
Special tools and workshop equipment required

- ◆ Water pump wrench - V.A.G 1590-



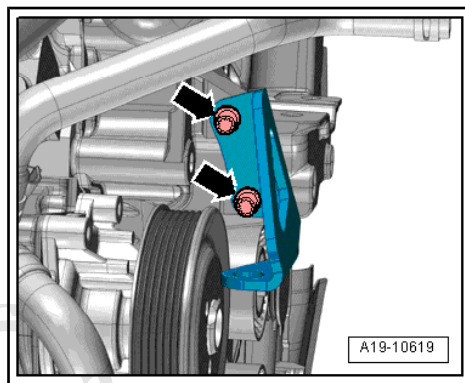
Note

Check whether the 3 round corners on the water pump wrench - V.A.G 1590- have been filed down to dimension -a- = 1 mm. If this is not the case, file the corners down.



Removing

- Remove poly V-belt ⇒ [page 42](#) .
- Unscrew bolts -arrows- and remove bracket from timing chain cover.



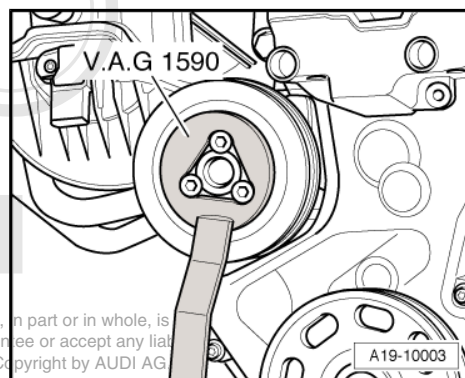
- Remove bolts for coolant pump pulley (counterhold with water pump wrench - V.A.G 1590-).

Installing

- Tightening torque ⇒ [page 165](#)

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

- Install poly V-belt ⇒ [page 42](#) .



2.3 Removing and installing coolant pump

Removing

- Drain coolant ⇒ [page 159](#) .
- Remove poly V-belt pulley for coolant pump ⇒ [page 166](#) .
- Remove bolts -arrows- and detach coolant pump.

Installing

- Tightening torque ⇒ [page 165](#)

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

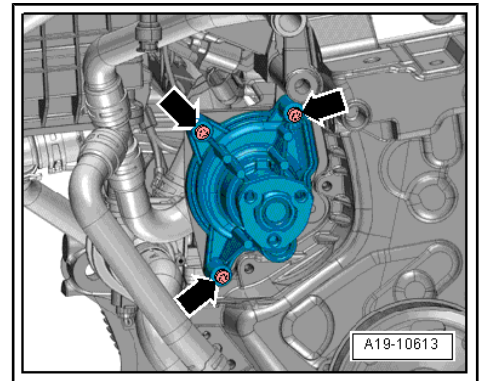


Note

Fit new O-ring.

- Clean and smoothen sealing surface for O-ring.
- Lubricate O ring with coolant additive.
- Install poly V-belt pulley for coolant pump ⇒ [page 166](#) .
- Fill up with coolant ⇒ [page 160](#) .

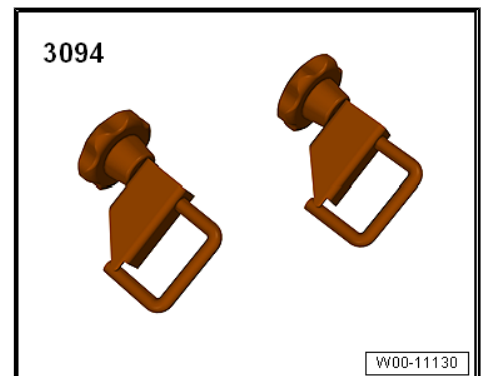
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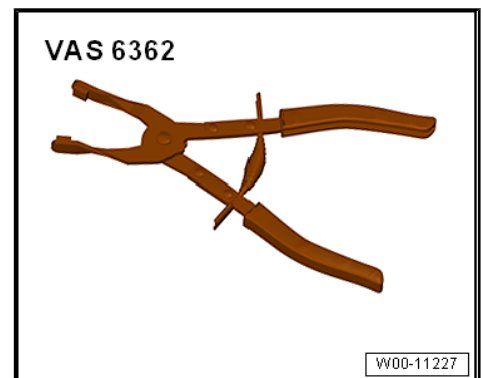
2.4 Removing and installing coolant circulation pump - V50-

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6362-





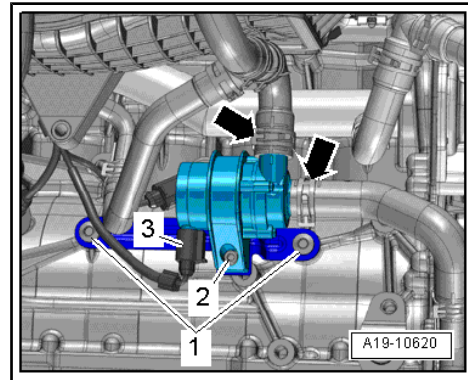
Removing

- Unplug electrical connector -3-.
- Remove bolt -2- and detach coolant circulation pump - V50- from retainer.
- Clamp off coolant hoses with hose clamps -3094- and disconnect hoses from coolant circulation pump - V50- .



Note

Ignore items marked -1- and -arrows-.



Installing

- Tightening torques => [page 165](#)

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

- Check coolant level => [page 164](#) .

2.5 Exploded view - thermostat housing

1 - Bolt

- 5 Nm

2 - Connection

3 - Bolt

- 5 Nm

4 - Connection

5 - O-ring

- Renew

6 - Compression spring

7 - Thermostat plunger

- Removing and installing => [page 171](#)

8 - Temperature element for thermostat 95 °C

- Removing and installing => [page 171](#)

9 - Retaining clip

- Check for firm attachment

10 - Coolant temperature sender - G62-

- Removing and installing => [page 169](#)

11 - O-ring

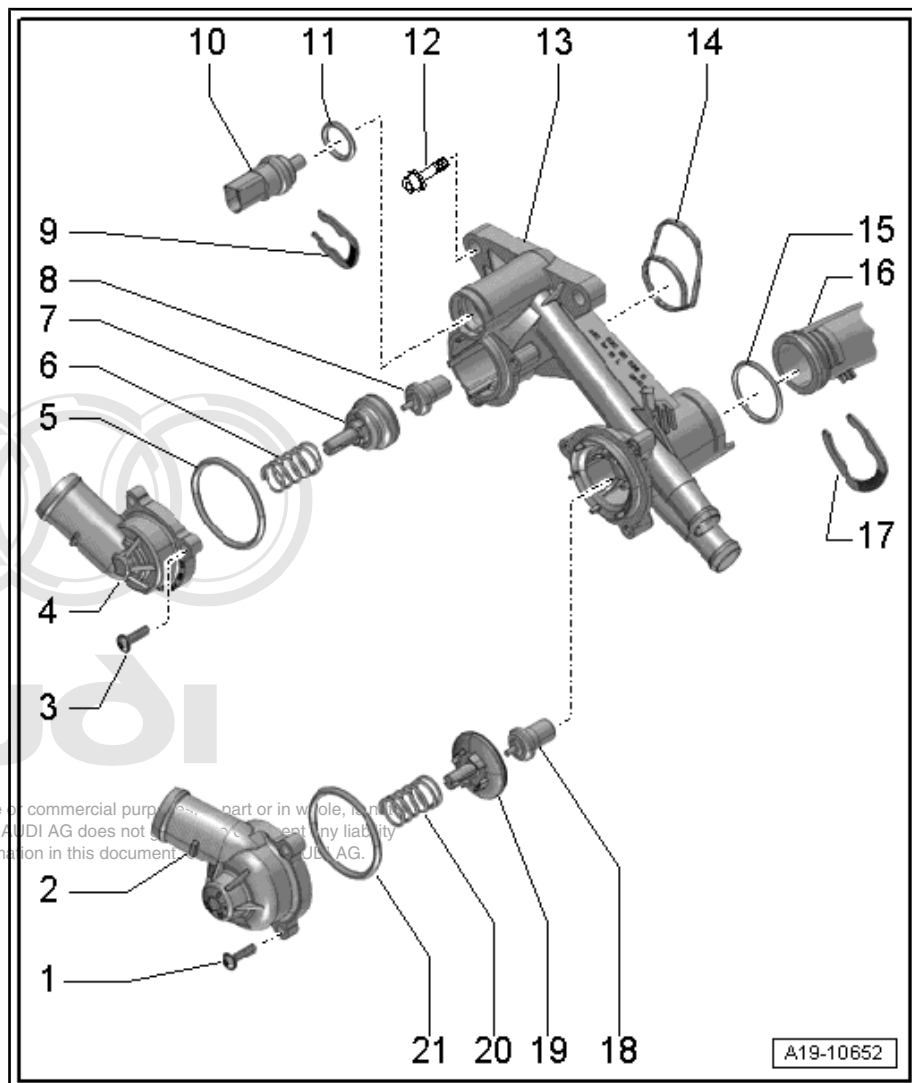
- Renew

12 - Bolt

- 10 Nm

13 - Thermostat housing

- Removing and installing => [page 171](#)



14 - Seal

- Renew

15 - O-ring

- Renew

16 - Coolant pipe

- Removing and installing ⇒ [page 170](#)

17 - Retaining clip for coolant pipe

18 - Temperature element for thermostat 83 °C

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

19 - Thermostat plunger

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

20 - Compression spring

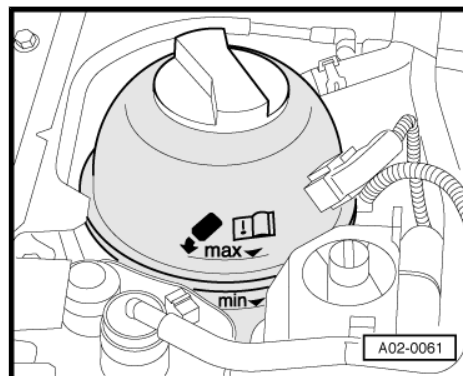
21 - O-ring

- Renew

2.6 Removing and installing coolant temperature sender - G62-

Removing

- Engine cold.
- Open filler cap on coolant expansion tank briefly to dissipate residual pressure in cooling system.

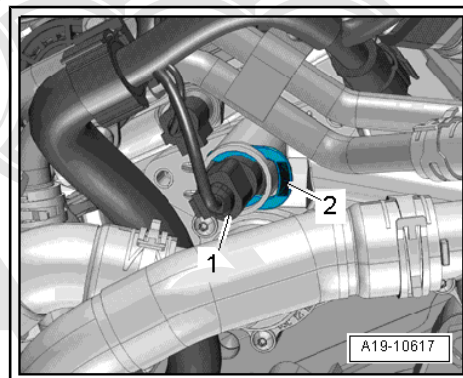


- Unplug electrical connector -1- at coolant temperature sender - G62- .

 **Note**

Place a cloth underneath to catch escaping coolant.

- Pull off retaining clip -2- and detach coolant temperature sender - G62- .



Installing

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

 **Note**

- ◆ *Fit new O-ring.*
- ◆ *Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.*

- Check coolant level ⇒ [page 164](#) .

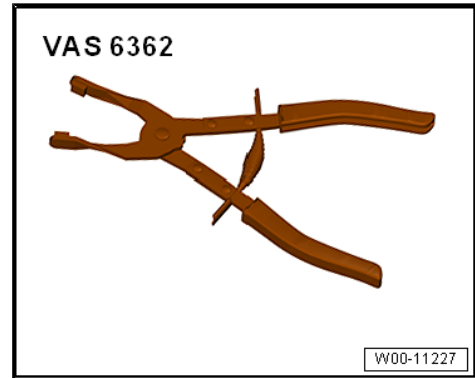
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2.7 Removing and installing thermostat

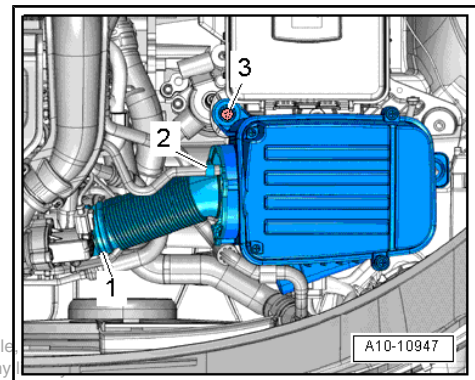
Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



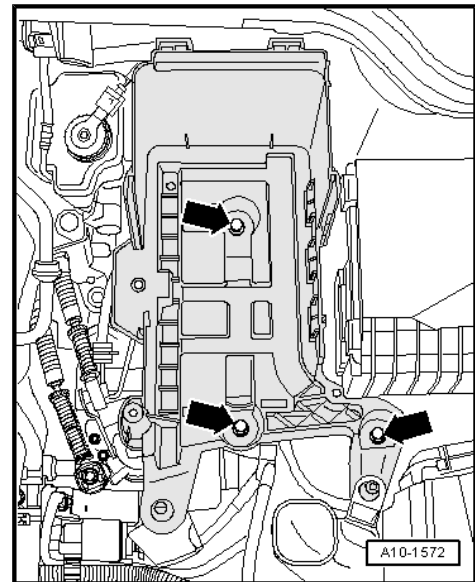
Removing

- Drain coolant ⇒ [page 159](#) .
- Remove air cleaner housing ⇒ Rep. gr. 24 .

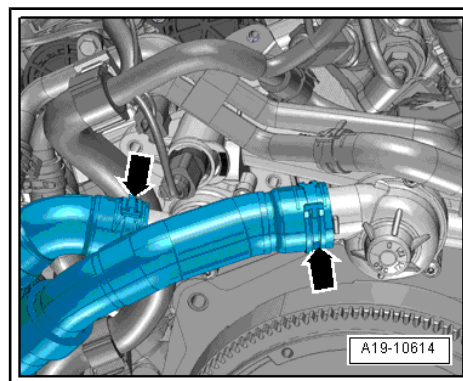


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- Remove battery ⇒ Electrical system; Rep. gr. 27 .
- Unscrew bolts -arrows- and remove battery tray.



- Remove coolant hoses -arrows- from thermostat housing.



- Unscrew bolts -arrows- and remove corresponding connection.
- Detach spring, plunger and thermostat.

Installing

- Tightening torques => [page 168](#)

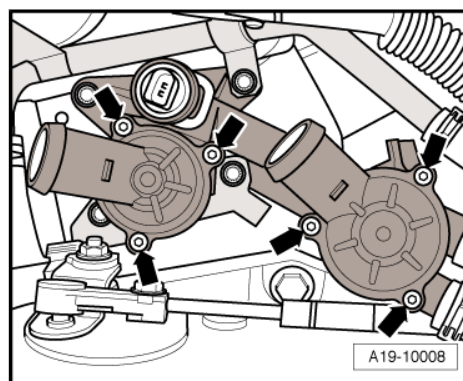
Installation is carried out in the reverse order; note the following:



Note

Fit new O-rings.

- Clean and smoothen sealing surfaces for O-rings.
- Lubricate O rings with coolant additive.
- Insert thermostat.
- Installation position: the hole in the thermostat plunger must face upwards.
- Install battery => [Electrical system; Rep. gr. 27](#).
- Install air cleaner housing => [Rep. gr. 24](#).
- Fill up with coolant => [page 160](#).



2.8 Removing and installing thermostat housing and coolant pipe (rear)

Special tools and workshop equipment required

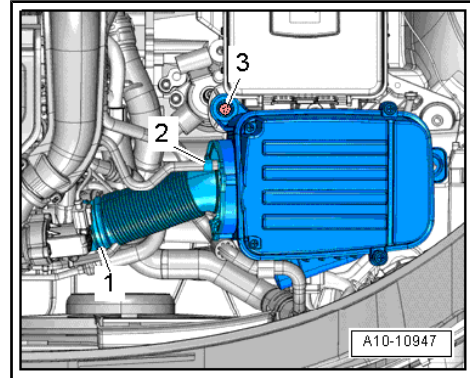
- ◆ Hose clip pliers - VAS 6362-



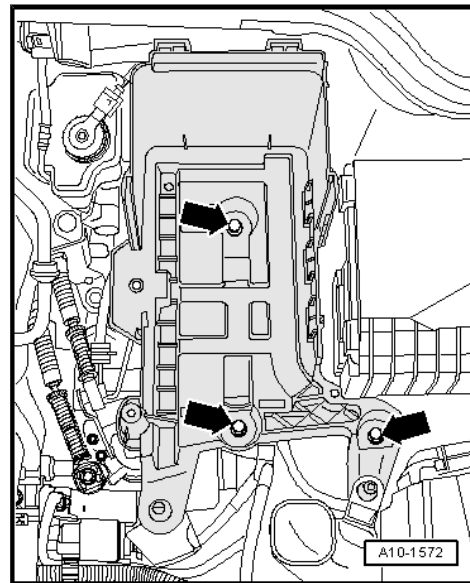


Removing

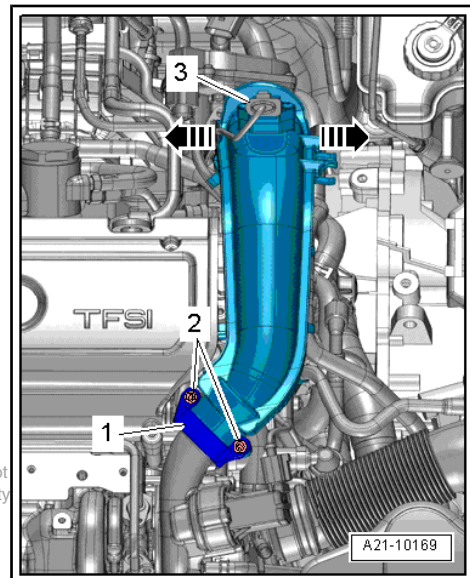
- Drain coolant ⇒ [page 159](#) .
- Remove air cleaner housing ⇒ Rep. gr. 24 .



- Remove battery ⇒ Electrical system; Rep. gr. 27 .
- Unscrew bolts -arrows- and remove battery tray.

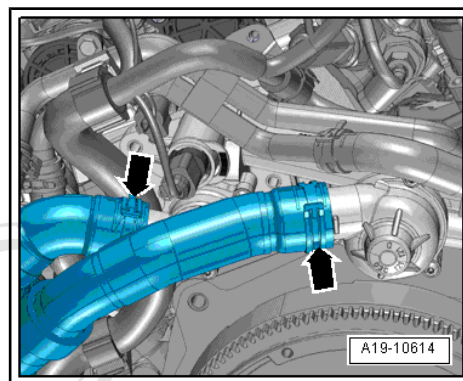


- Unscrew bolts -2- and detach retaining bracket -1-.
- Unplug electrical connector -3- at charge pressure sender -G31- .
- Release retainers -arrows- and detach air pipe first from throttle valve module - J338- and then from turbocharger.
- Move hoses on air pipe clear and detach air pipe.

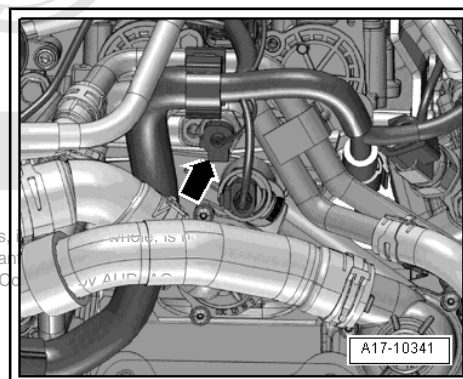


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- Remove coolant hoses -arrows- from thermostat housing.



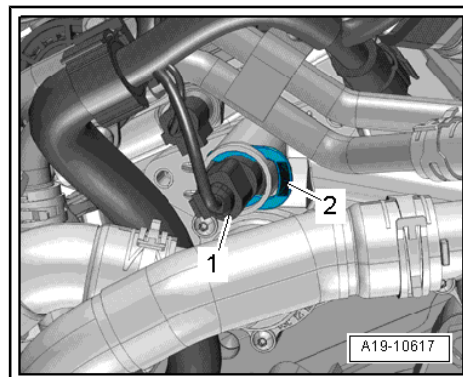
- Unplug electrical connector -arrow- on oil pressure switch - F1- .



- Unplug electrical connector -1- at coolant temperature sender - G62- .

i Note

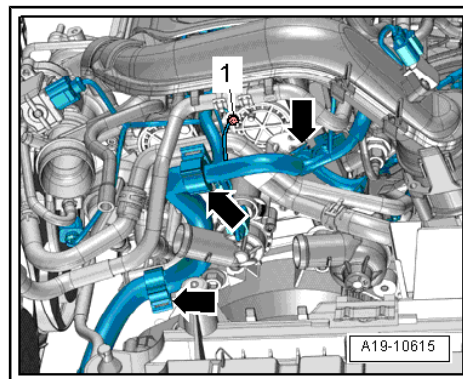
Disregard -item 2-.



- Move electrical wiring clear at brackets -arrows-.

i Note

Disregard -item 1-.



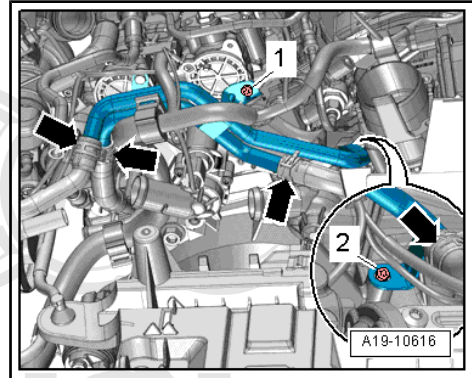


- Remove bolts -1- and -2- and disconnect coolant hoses -left arrows-.
- Swivel coolant pipes (left-side) slightly to rear.



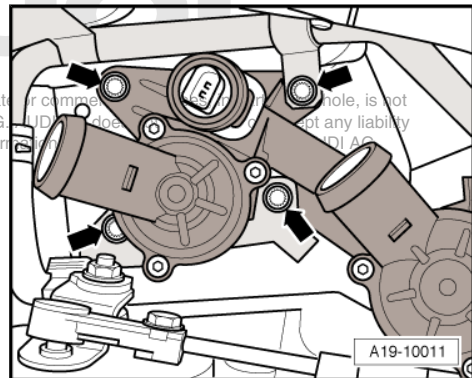
Note

Disregard -arrows- on right-side of illustration.



- Remove bolts -arrows- for thermostat housing.

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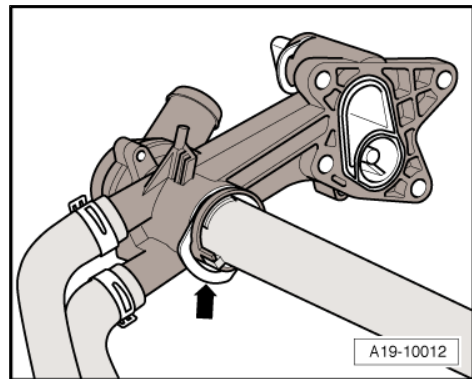
- Pull out retaining clip -arrow- for coolant pipe.



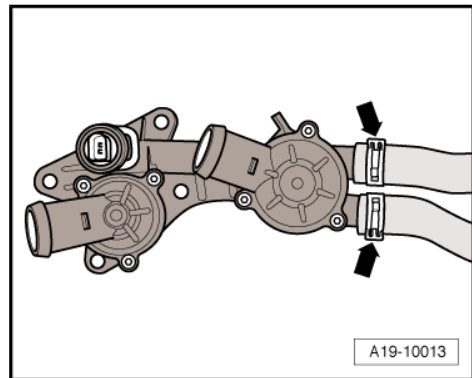
Note

For illustration purposes, the installation position is shown with the thermostat housing removed.

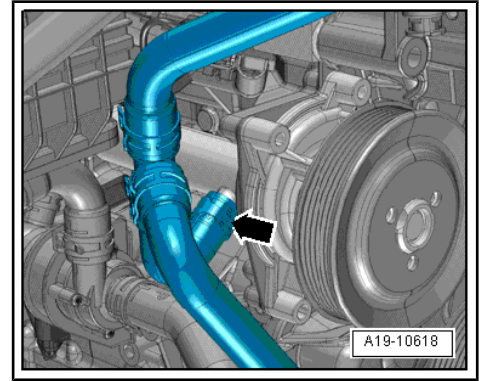
- Detach thermostat housing from coolant pipe.



- Pull thermostat housing slightly to front.
- Mark position of coolant hoses -arrows- on thermostat housing for re-installation and detach coolant hoses.



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



– Detach coolant pipe -1- (rear) from cylinder block -3-.

Installing

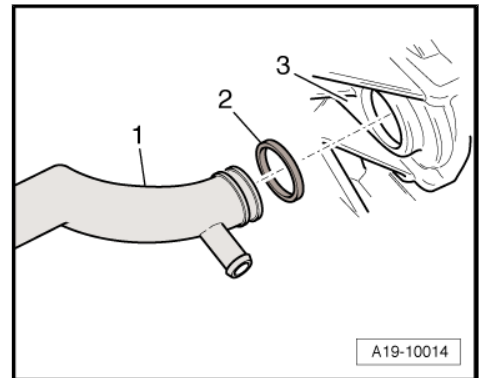
• Tightening torques ⇒ [page 168](#)

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

i Note

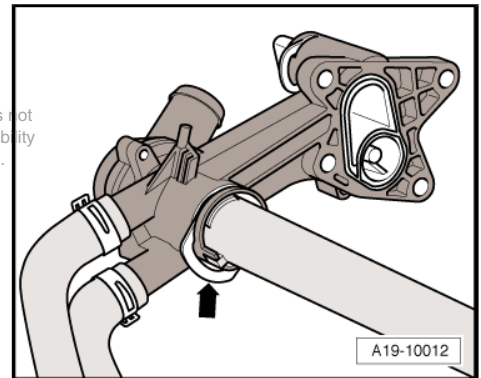
Renew seals and O-ring -2-.

- Clean and smoothen sealing surface for O-ring.
- Lubricate O ring with coolant additive.
- Attach coolant hoses to thermostat housing according to markings made when removing.
- After securing thermostat housing, move coolant pipe up against housing as far as stop and only then insert retaining clip -arrow-.
- Check that coolant pipe is firmly secured in thermostat housing.



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

- Install coolant pipes (left-side) ⇒ [page 177](#) .
- Install air pipe ⇒ [page 191](#) .
- Install battery ⇒ Electrical system; Rep. gr. 27 .
- Install air cleaner housing ⇒ Rep. gr. 24 .
- Fill up with coolant ⇒ [page 160](#) .



3 Coolant pipes

⇒ ["3.1 Exploded view - coolant pipes", page 176](#)

⇒ ["3.2 Removing and installing coolant pipes \(left-side\)", page 177](#)

⇒ ["3.3 Removing and installing coolant pipe \(right-side\)", page 178](#)

⇒ ["3.4 Removing and installing coolant pipes \(front\)", page 180](#)

3.1 Exploded view - coolant pipes

1 - Bolt

- 9 Nm

2 - Coolant pipe (right-side)

- Removing and installing
⇒ [page 178](#)

3 - Bolt

- 20 Nm

4 - Coolant pipes (left-side)

- Removing and installing
⇒ [page 177](#)

5 - Bolt

- 9 Nm

6 - O-ring

- Renew

7 - Coolant pipe (front)

- Removing and installing
⇒ [page 180](#)

8 - Bolt

- 8 Nm

9 - O-rings

- Renew

10 - Bolt

- 8 Nm

11 - Seal

- Renew

12 - Coolant pipe (rear)

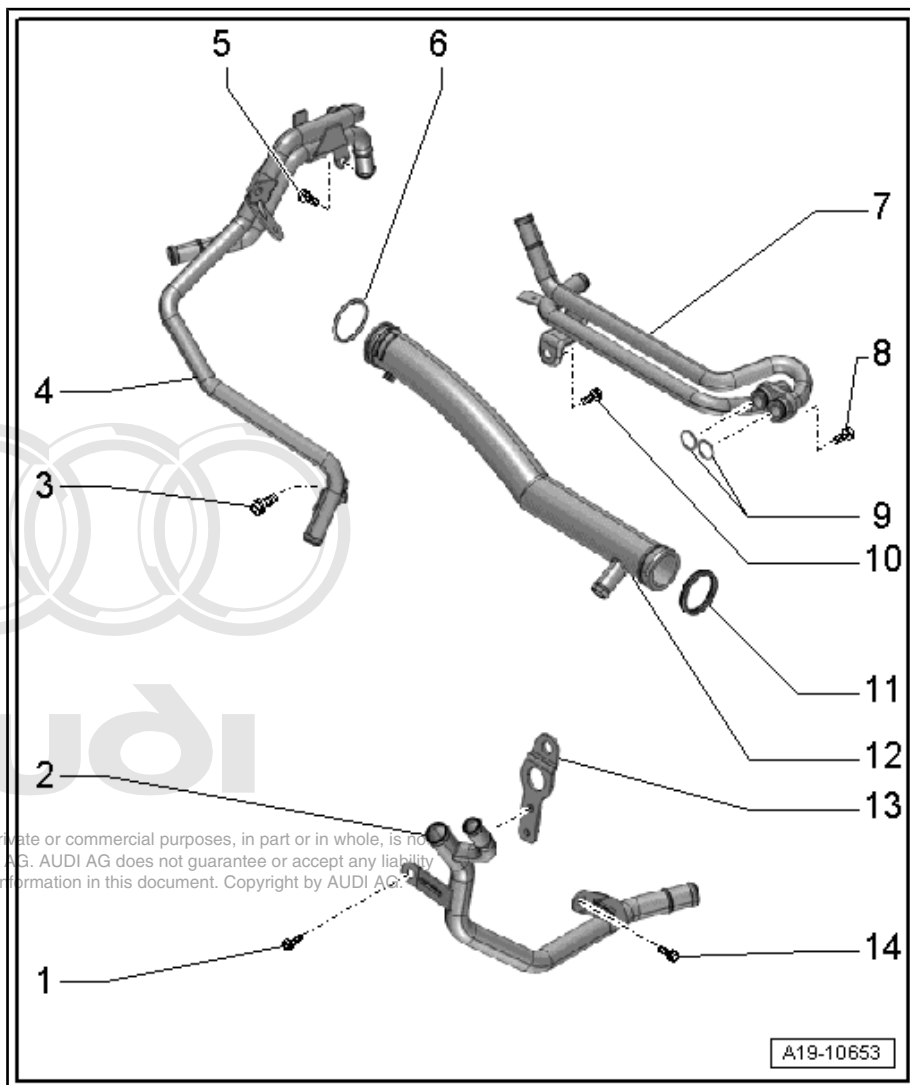
- Removing and installing
⇒ ["2.8 Removing and installing thermostat housing and coolant pipe \(rear\)", page 171](#)

13 - Bracket

- For coolant pipe (right-side)

14 - Bolt

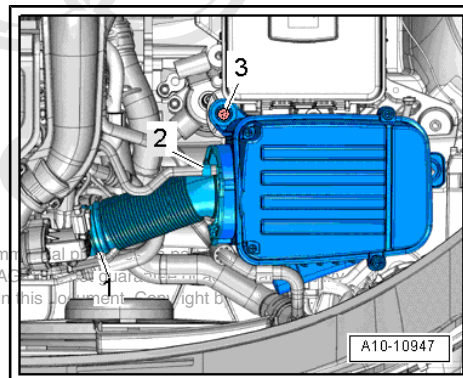
- 20 Nm



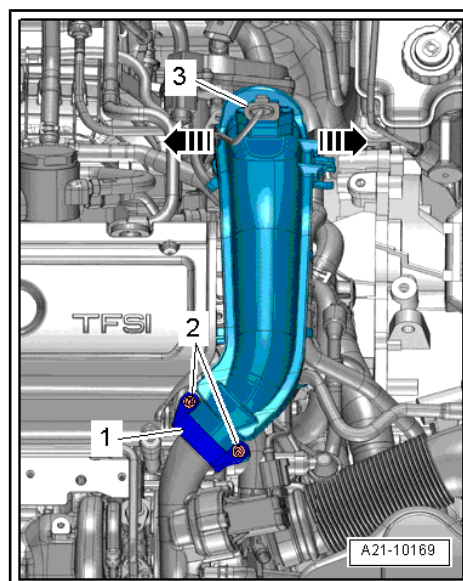
3.2 Removing and installing coolant pipes (left-side)

Removing

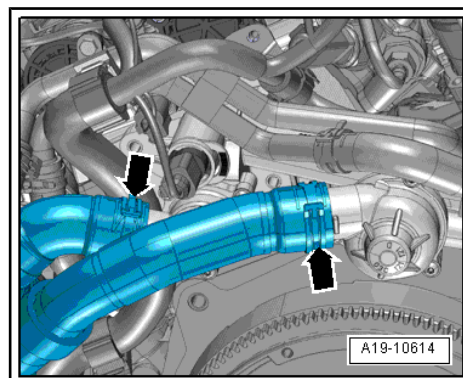
- Drain coolant ⇒ [page 159](#) .
- Remove air cleaner housing ⇒ Rep. gr. 24 .



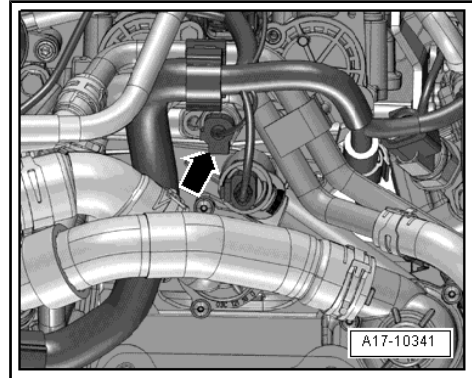
- Unscrew bolts -2- and detach retaining bracket -1-.
- Unplug electrical connector -3- at charge pressure sender - G31- .
- Release retainers -arrows- and detach air pipe first from throttle valve module - J338- and then from turbocharger.
- Move hoses on air pipe clear and detach air pipe.



- Remove coolant hoses -arrows- from thermostat housing.



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

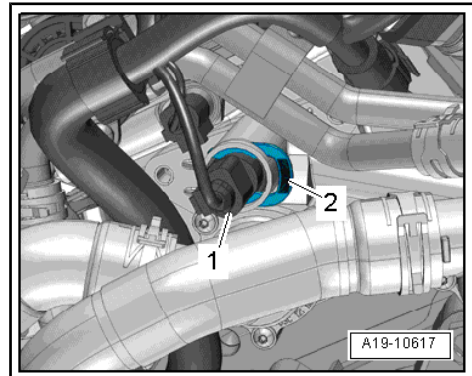


- Unplug electrical connector -1- at coolant temperature sender - G62- .



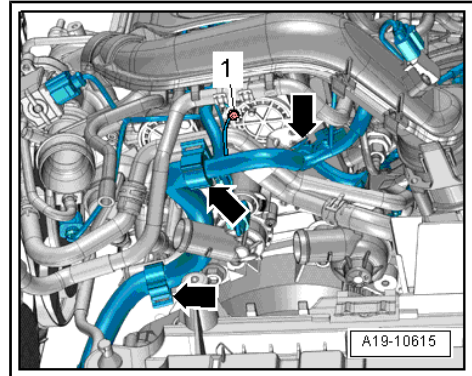
Note

Disregard -item 2-.



- Move electrical wiring clear at brackets -arrows-.
- Remove bolt -1- and move earth wiring clear.

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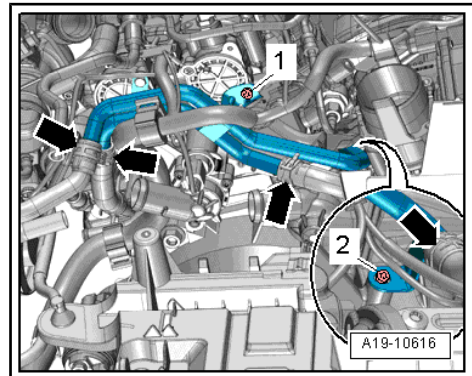
- Remove bolts -1- and -2- and disconnect coolant hoses -arrows-.
- Move coolant pipes (left-side) to rear and detach.

Installing

- Tightening torques ⇒ [page 176](#)

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

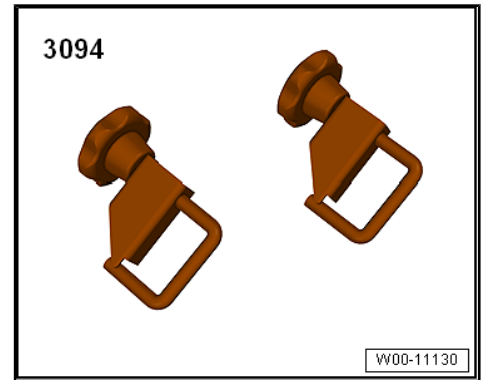
- Install air pipe ⇒ [page 191](#) .
- Install air cleaner housing ⇒ Rep. gr. 24 .
- Fill up with coolant ⇒ [page 160](#) .



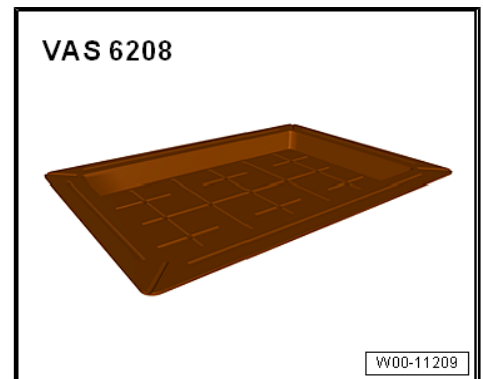
3.3 Removing and installing coolant pipe (right-side)

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-

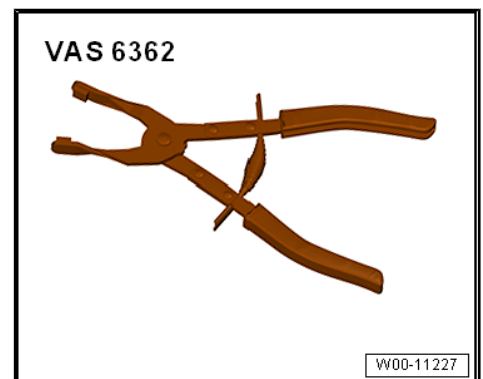


- ◆ Drip tray for workshop hoist - VAS 6208-



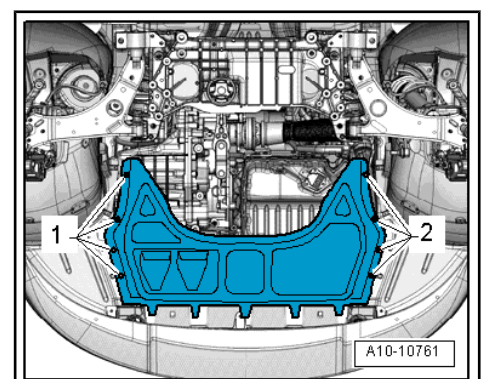
- ◆ Hose clip pliers - VAS 6362-

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Removing

- Remove noise insulation ⇒ Rep. gr. 50 .





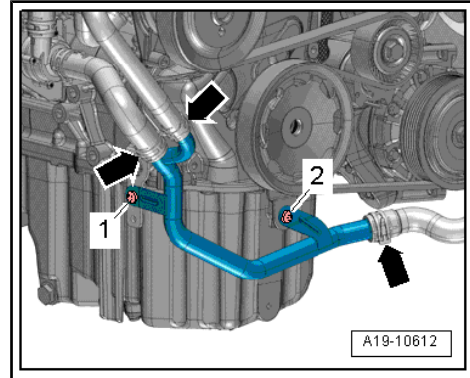
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Clamp off coolant hoses -arrows- with hose clamps -3094- and detach.
- Remove bolts -1- and -2- and take off coolant pipe (right-side).

Installing

- Tightening torques ⇒ [page 176](#)

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

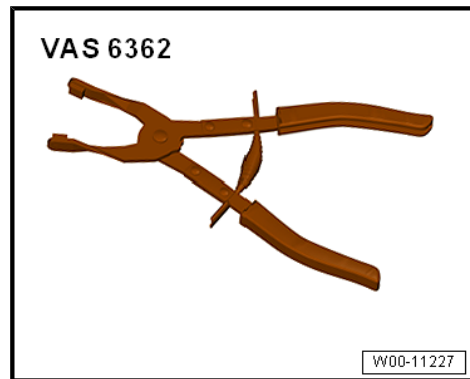
- Install noise insulation ⇒ Rep. gr. 66 .
- Check coolant level ⇒ [page 164](#) .



3.4 Removing and installing coolant pipes (front)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing

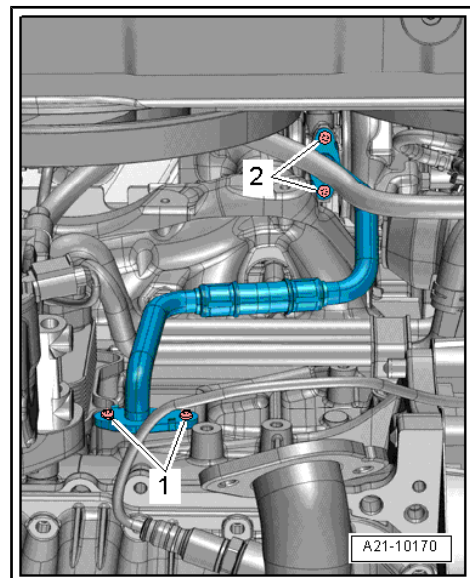
- Drain coolant ⇒ [page 159](#) .
- Remove catalytic converter ⇒ [page 223](#) .



Note

Place a cloth underneath to catch escaping engine oil.

- Unscrew bolts -1- and -2- and remove oil return pipe for turbocharger.



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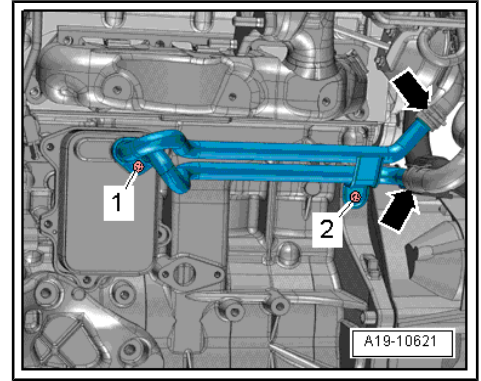
- Remove bolts -1- and -2- and detach coolant pipes (front) from engine oil cooler.
- Detach coolant hoses -arrows-.

Installing

- Tightening torques ⇒ [page 176](#)

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

- Install oil return pipe for turbocharger ⇒ [page 191](#) .
- Install catalytic converter ⇒ [page 223](#) .
- Fill up with coolant ⇒ [page 160](#) .



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4 Radiators and radiator fans

⇒ [“4.1 Exploded view - radiators and radiator fans”, page 182](#)

⇒ [“4.2 Removing and installing radiator outlet coolant temperature sender G83”, page 183](#)

⇒ [“4.3 Removing and installing radiator”, page 184](#)

⇒ [“4.4 Removing and installing water radiator for charge air cooling circuit”, page 186](#)

⇒ [“4.5 Removing and installing radiator cowl”, page 188](#)

⇒ [“4.6 Removing and installing radiator fan V7 and radiator fan 2 V177”, page 189](#)

⇒ [“4.7 Checking cooling system for leaks”, page 189](#)

4.1 Exploded view - radiators and radiator fans

1 - Radiator fan 2 - V177-

- Removing and installing ⇒ [page 189](#)

2 - Radiator fan - V7-

- With radiator fan control unit - J293-
- Removing and installing ⇒ [page 189](#)

3 - Nut

- 5 Nm

4 - Radiator cowl

- Removing and installing ⇒ [page 188](#)

5 - Coolant hose (bottom)

- To connection for thermostat
- Connecting ⇒ [page 183](#)

6 - Retaining clip

7 - Radiator outlet coolant temperature sender - G83-

- Removing and installing ⇒ [page 183](#)

8 - O-ring

- Renew

9 - Coolant hose (top)

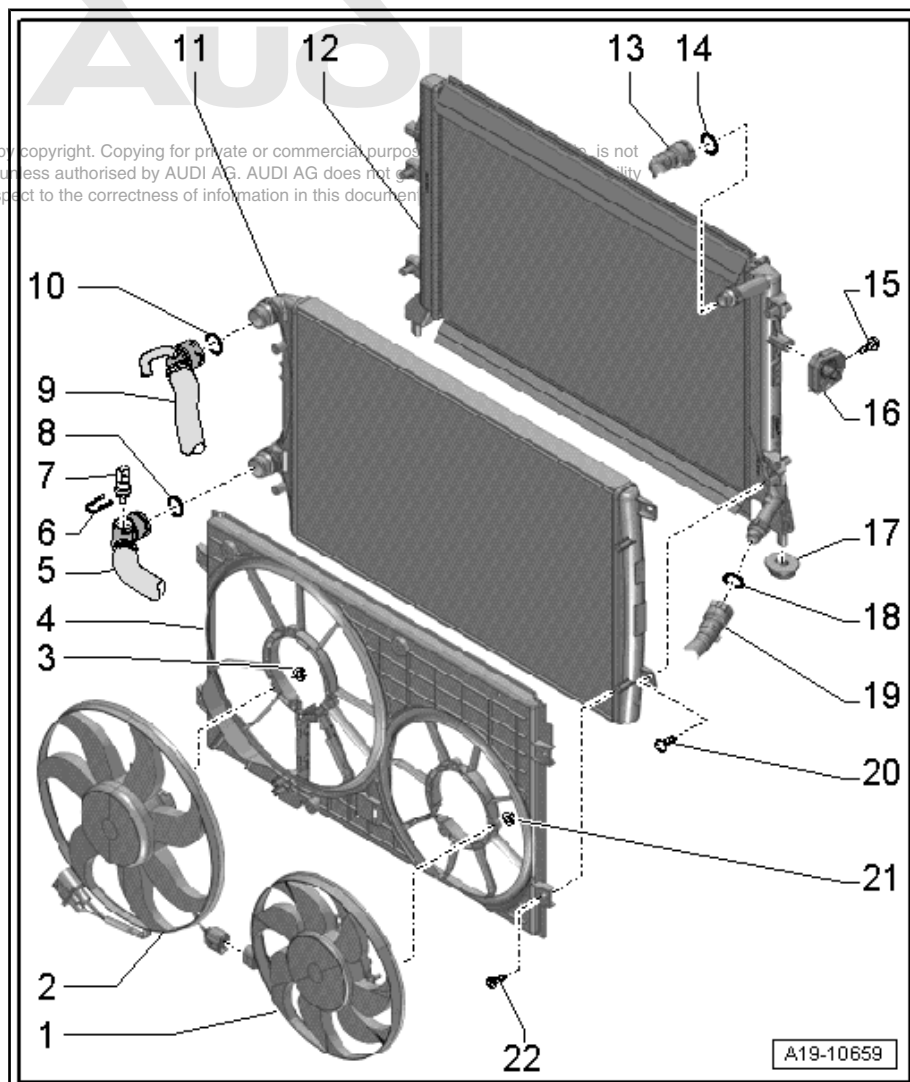
- To connection at cylinder head
- Connecting ⇒ [page 183](#)

10 - O-ring

- Renew

11 - Radiator

- Removing and installing ⇒ [page 184](#)
- If renewed, change coolant in entire system



12 - Water radiator for charge air cooling circuit

- Removing and installing ⇒ [page 186](#)

13 - Coolant hose (top)

- Connecting ⇒ [page 183](#)

14 - O-ring

- Renew

15 - Bolt

- 5 Nm

16 - Bracket

- For water radiator for charge air cooling circuit

17 - Mounting**18 - O-ring**

- Renew

19 - Coolant hose (top)

- Connecting ⇒ [page 183](#)

20 - Bolt

- 5 Nm

21 - Nut

- 5 Nm

22 - Bolt

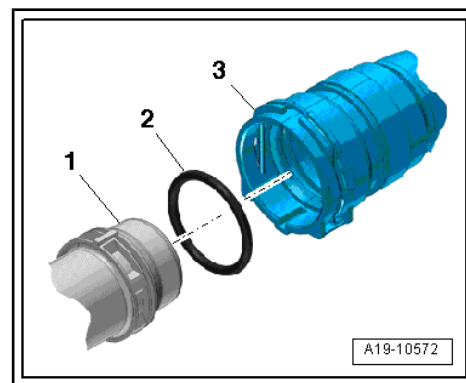
- 5 Nm



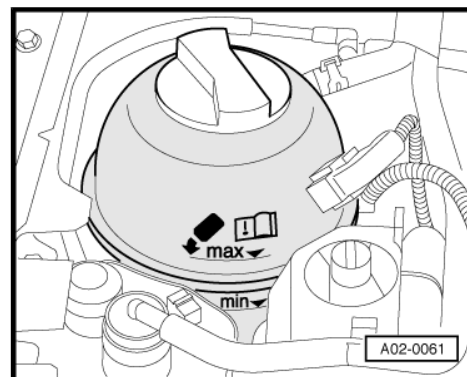
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Connecting coolant hose with plug-in connector to radiator

- Remove old O-ring -2- from coolant hose -3-.
- Lubricate new O-ring with coolant additive and fit O-ring in coolant hose.
- Press coolant hose onto radiator -1- until it engages with a click.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.

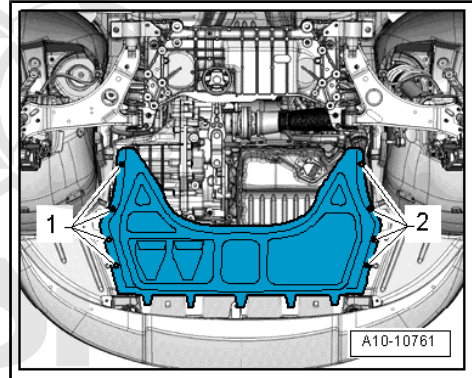
**4.2 Removing and installing radiator outlet coolant temperature sender - G83-****Removing**

- Engine cold.
- Open filler cap on coolant expansion tank briefly to dissipate residual pressure in cooling system.





- Remove noise insulation ⇒ Rep. gr. 50 .



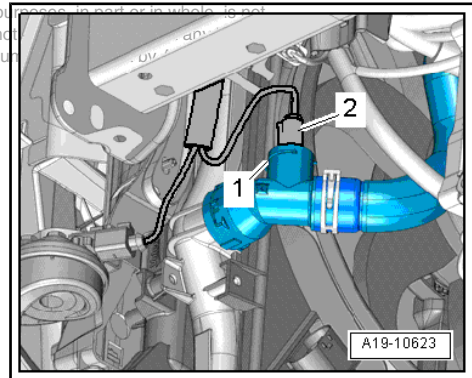
- Unplug electrical connector **2** at radiator outlet coolant temperature sender - G83- .



Note

Place a cloth underneath to catch escaping coolant.

- Pull out retaining clip -1- and detach radiator outlet coolant temperature sender - G83- .



Installing

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



Note

- ◆ *Fit new O-ring.*
- ◆ *Insert new radiator outlet coolant temperature sender - G83- immediately into connection to avoid loss of coolant.*
- Install noise insulation ⇒ Rep. gr. 66 .
- Check coolant level ⇒ [page 164](#) .

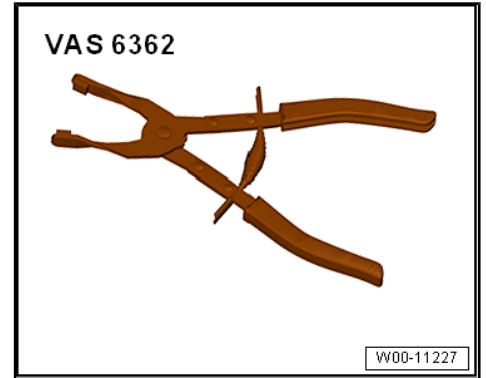
4.3 Removing and installing radiator

Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - VAS 6362-



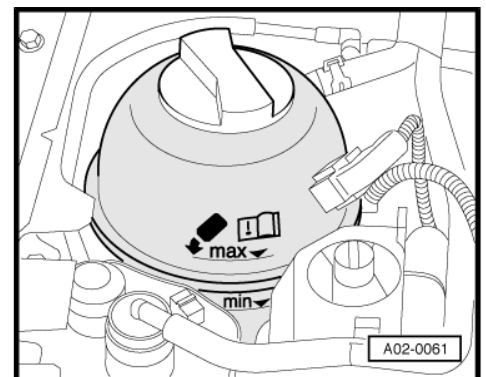
Removing



Note

If there are slight impressions on the fins, refer to ⇒ [page 5](#).

- Remove radiator cowl ⇒ [page 188](#).



WARNING

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

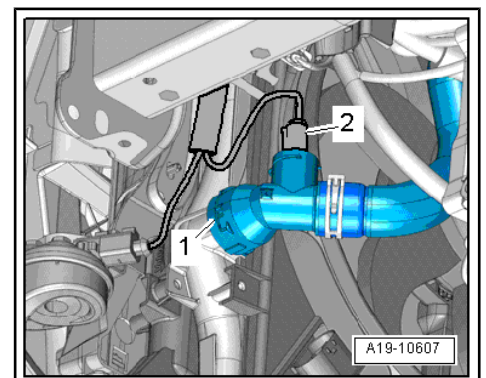
- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*

- Open filler cap on coolant expansion tank.
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Disconnect coolant hose -1- (bottom) from radiator (pull out retaining clip)

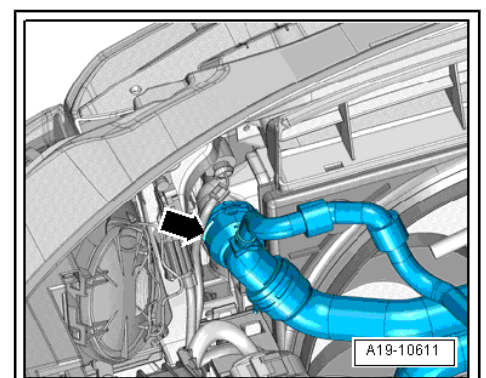


Note

Disregard -item 2-.



- Disconnect coolant hose -arrow- (top left) from radiator (pull out retaining clip).





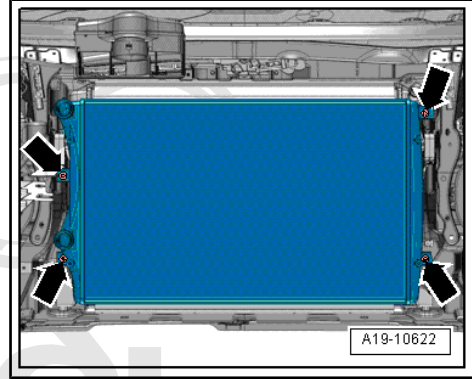
- Remove bolts -arrows- and take out radiator downwards.

Installing

- Tightening torques ⇒ [page 182](#)

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

- Install radiator cowl ⇒ [page 188](#) .
- Fill up with coolant ⇒ [page 160](#) .

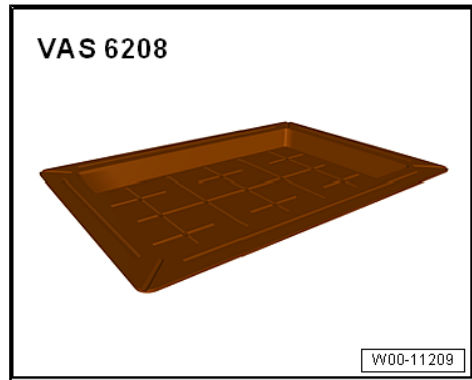


4.4 Removing and installing water radiator for charge air cooling circuit

Special tools and workshop equipment required

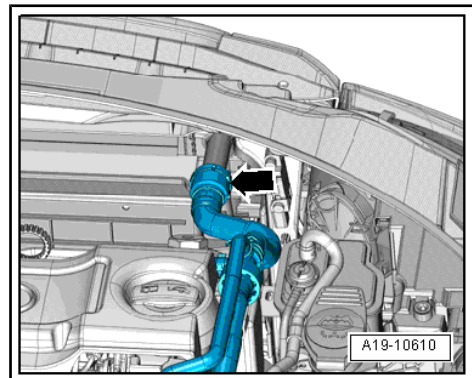
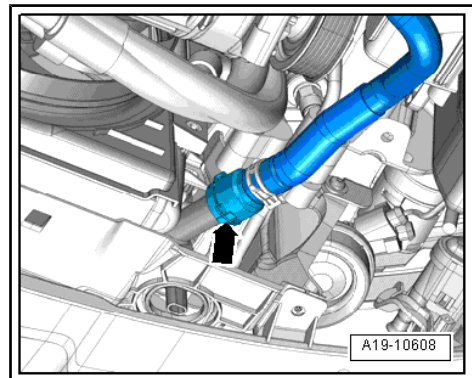
- ◆ Drip tray for workshop hoist - VAS 6208-

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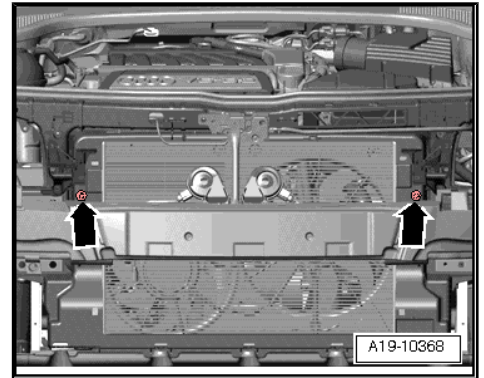


Removing

- Remove radiator ⇒ [page 184](#) .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Lift retaining clip and disconnect coolant hose (bottom right) -arrow- from water radiator for charge air cooling circuit.
- Lift retaining clip and disconnect coolant hose (top right) -arrow- from water radiator for charge air cooling circuit.



- Release air ducts (left and right) and push to one side in order to remove bolts -arrows-.
- Swivel top edge of water radiator for charge air cooling circuit slightly to rear.
- Lift water radiator for charge air cooling circuit and detach from bottom mounting points.
- Push water radiator for charge air cooling circuit towards engine.
- Support water radiator for charge air cooling circuit from below to prevent it from dropping.

**WARNING**

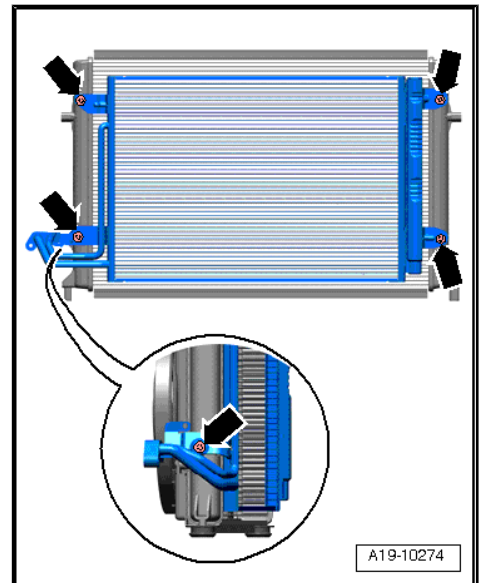
Risk of injury caused by refrigerant.

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

**Caution**

Risk of damage to condenser and refrigerant pipes/hoses.

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



- Remove bolts -arrows-.
- Disconnect condenser from radiator.
- Move condenser to front and place in lock carrier, then secure with cable ties to prevent from dropping.
- Take out water radiator for charge air cooling circuit downwards.

Installing

- Tightening torques ⇒ [page 182](#)

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

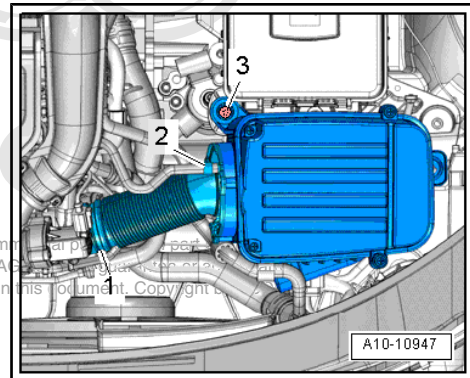
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- Install condenser ⇒ [Rep. gr. 87](#)
- Install radiator ⇒ [page 184](#) .
- Install bumper cover (front) ⇒ [Rep. gr. 63](#) .
- Fill up with coolant ⇒ [page 160](#) .

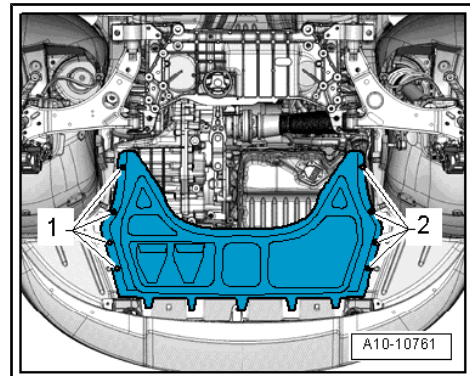
4.5 Removing and installing radiator cowl

Removing

- Remove air cleaner housing ⇒ Rep. gr. 24 .



- Remove noise insulation ⇒ Rep. gr. 50 .

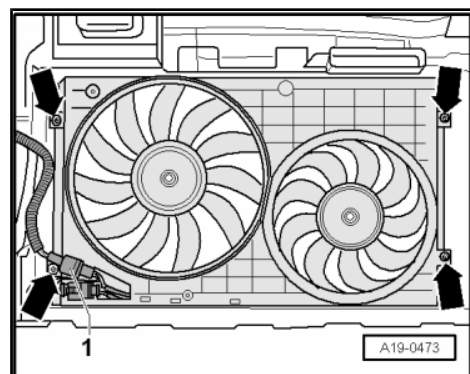


WARNING

Risk of injury as the radiator fans may start up automatically.

- ◆ *Unplug electrical connectors before performing work on radiator cowl.*

- Detach electrical connectors -1- for radiator fans at bottom of radiator cowl.
- Unscrew bolts -arrows- and remove radiator cowl with radiator fans from below.



Installing

- Tightening torque ⇒ [page 182](#)

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

- Install noise insulation ⇒ Rep. gr. 66 .
- Install air cleaner housing ⇒ Rep. gr. 24 .

4.6 Removing and installing radiator fan - V7- and radiator fan 2 - V177-

Removing

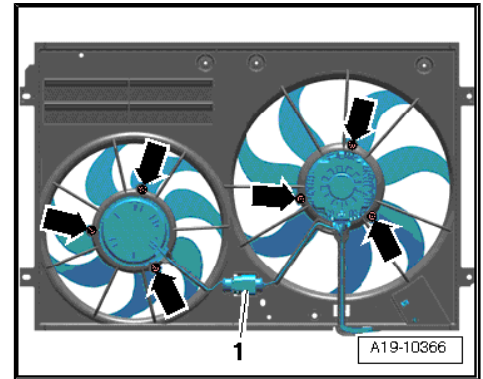
- Remove radiator cowl ⇒ [page 188](#) .
- Unplug electrical connector -1-.
- Move electrical wiring clear.
- Unscrew nuts -arrows- and remove radiator fans.

Installing

- Tightening torque ⇒ [page 182](#)

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

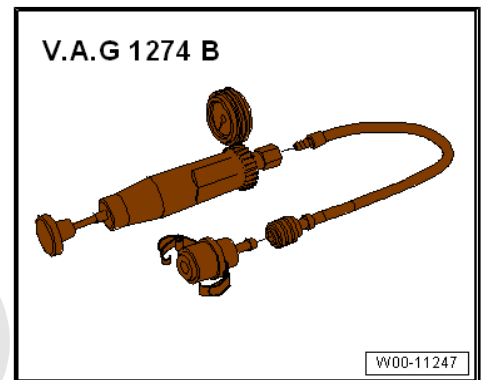
- Install radiator cowl ⇒ [page 188](#) .



4.7 Checking cooling system for leaks

Special tools and workshop equipment required

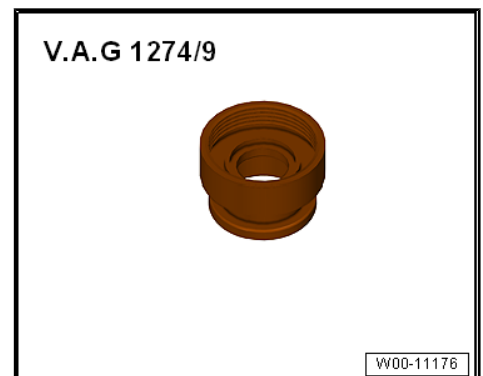
- ◆ Cooling system tester - V.A.G 1274 B-



- ◆ Adapter for cooling system tester - V.A.G 1274/8-



- ◆ Adapter for cooling system tester - V.A.G 1274/9-



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Procedure

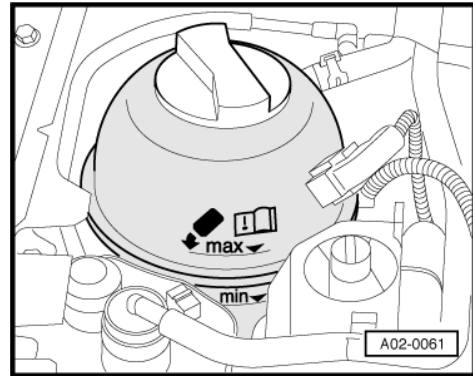
- Engine must be warm.



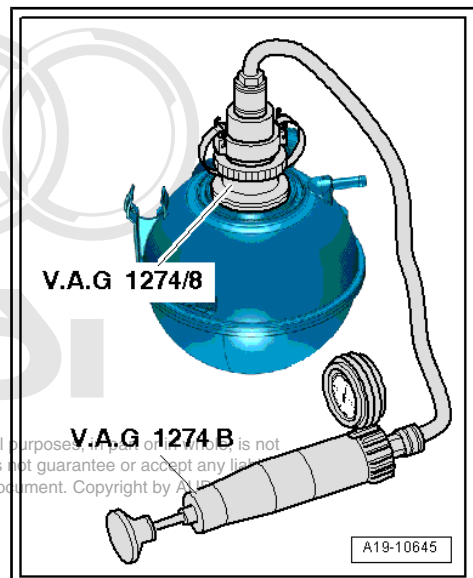
WARNING

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

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



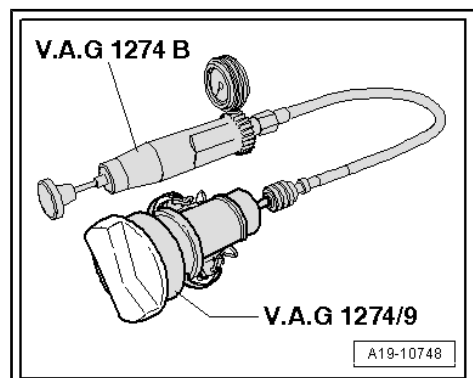
- Open filler cap on coolant expansion tank.
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.
- If this pressure is not maintained, locate and rectify leaks.



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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 1.4 ... 1.6 bar.
- Renew filler cap if pressure relief valve does not open as described.



21 – Turbocharging/supercharging

1 Turbocharger

- Observe rules for cleanliness
 ⇒ [“3.1 Rules for cleanliness when working on fuel supply system, injection system and turbocharger”, page 4](#).

⇒ [“1.1 Exploded view - turbocharger”, page 191](#)

⇒ [“1.2 Checking vacuum unit for turbocharger”, page 193](#)

⇒ [“1.3 Removing and installing vacuum unit for turbocharger”, page 195](#)

⇒ [“1.4 Adjusting vacuum unit for turbocharger”, page 197](#)

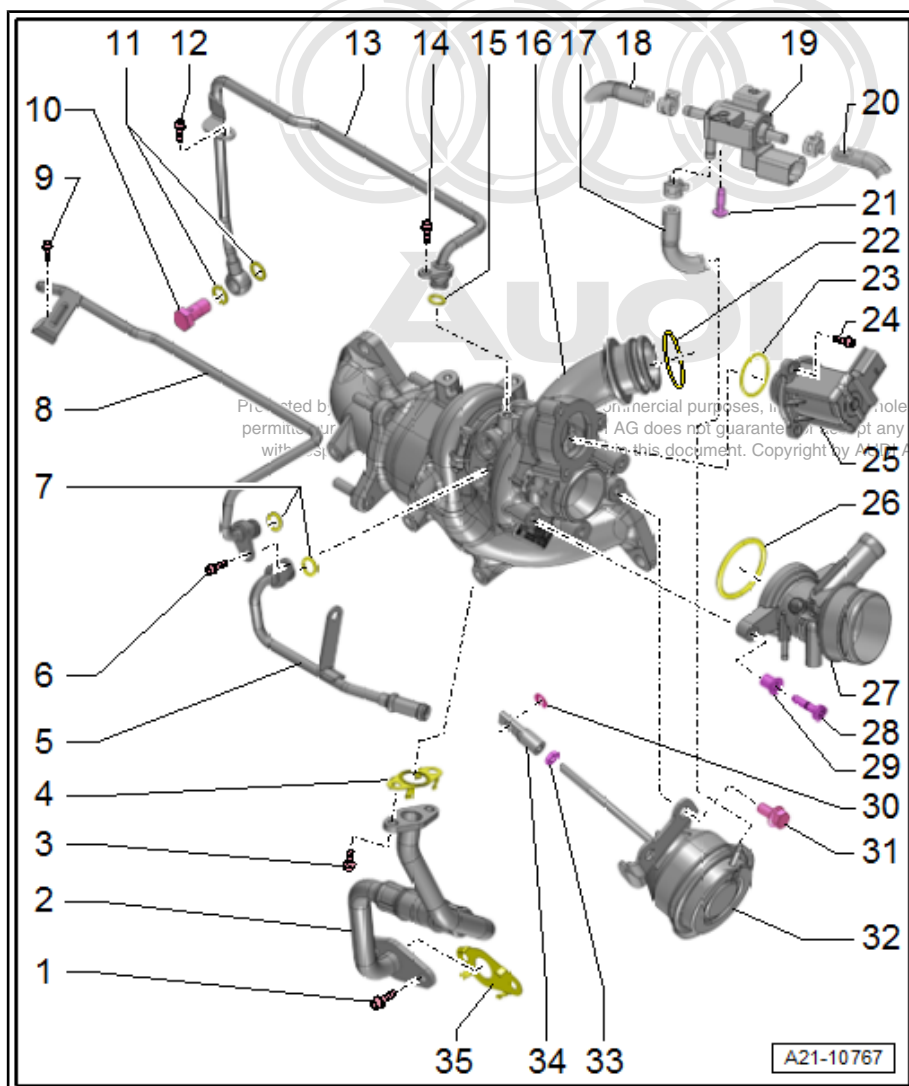
⇒ [“1.5 Removing and installing compressor housing and turbine housing”, page 204](#)

⇒ [“1.6 Removing and installing turbocharger”, page 208](#)

1.1 Exploded view - turbocharger

Part 1

- 1 - Bolt
 - 8 Nm
- 2 - Oil return line
- 3 - Bolt
 - 8 Nm
- 4 - Gasket
 - Renew
- 5 - Coolant supply line
- 6 - Bolt
 - 11 Nm
- 7 - O-rings
 - Renew
- 8 - Coolant return hose/pipe
- 9 - Bolt
 - 8 Nm
- 10 - Banjo bolt
 - For attaching oil supply line to cylinder block: 30 Nm
 - For attaching oil supply line to timing chain cover ⇒ [page 152](#)
- 11 - Seals
 - Renew
- 12 - Bolt
 - 8 Nm
- 13 - Oil supply line
 - Up to approx. 04.2008: bolted to cylinder block





- From approx 04.2008 onwards: bolted to timing chain cover ⇒ [page 152](#)

14 - Bolt

- 8 Nm

15 - O-ring

- Renew

16 - Turbocharger

- Combined with exhaust manifold
- Removing and installing ⇒ [page 208](#)

17 - Connecting hose

18 - Connecting hose

19 - Charge pressure control solenoid valve - N75-

20 - Connecting hose

21 - Bolt

- 10 Nm

22 - O-ring

- Renew

23 - O-ring

- Renew

24 - Bolt

- 11 Nm

25 - Turbocharger air recirculation valve - N249-

26 - O-ring

- Renew

27 - Intake connecting pipe

28 - Bolt

- 10 Nm

29 - Sleeve

30 - Retaining clip

- Renew

31 - Bolt

- 20 Nm

32 - Vacuum unit for turbocharger

- Checking ⇒ [page 193](#)
- Removing and installing ⇒ [page 195](#)
- Adjusting ⇒ [page 197](#)

33 - Lock nut

- 10 Nm

34 - Operating lever

35 - Gasket

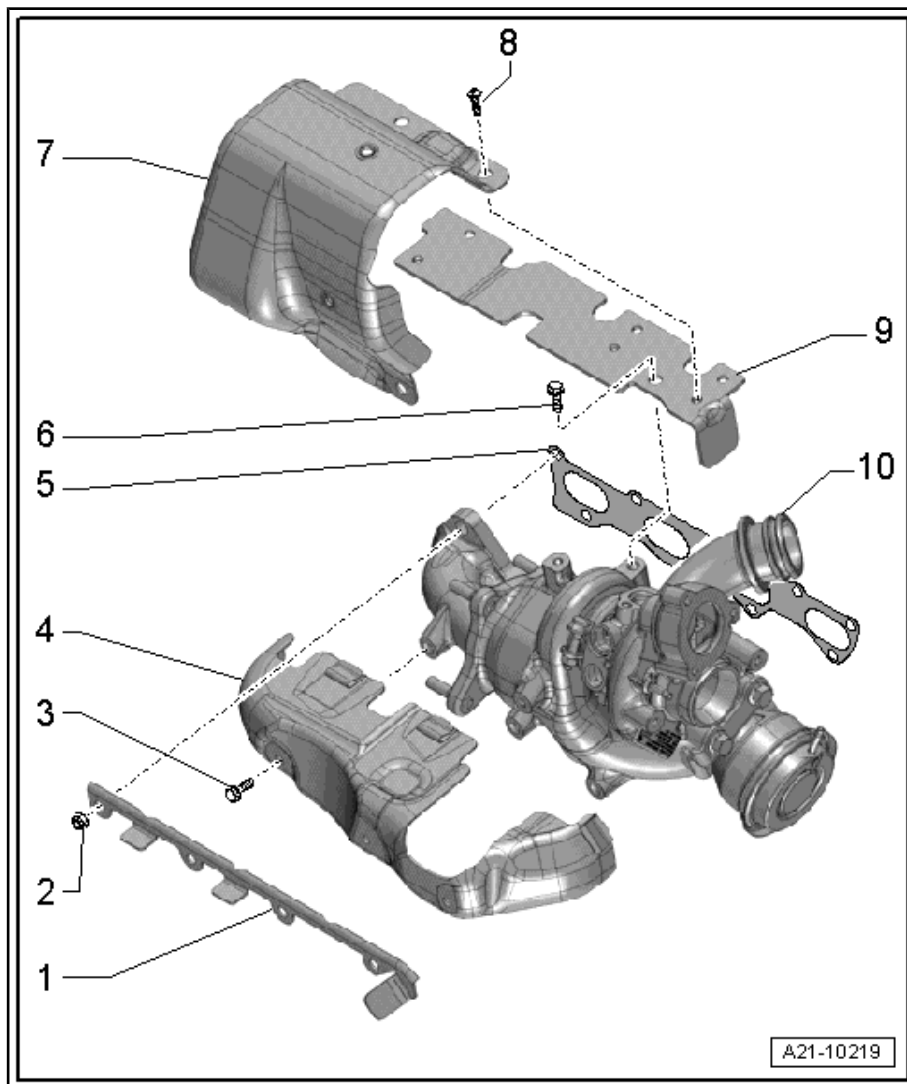
- Renew



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Part 2

- 1 - Bracket
- 2 - Nut
 - Tightening torque and sequence ⇒ [page 193](#)
- 3 - Bolt
 - 10 Nm
- 4 - Heat shield
- 5 - Exhaust manifold gasket
 - Renew
- 6 - Bolt
 - 23 Nm
- 7 - Heat shield
- 8 - Bolt
 - 10 Nm
- 9 - Bracket
- 10 - Turbocharger
 - Combined with exhaust manifold
 - Removing and installing ⇒ [page 208](#)



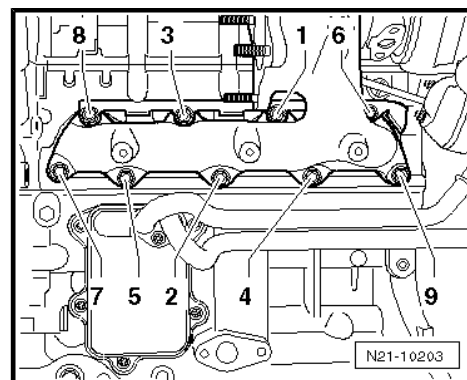
Turbocharger - tightening torque and sequence

Note

Renew nuts.

– Tighten nuts in 2 stages in the sequence shown:

Stage	Nuts	Tightening torque
1.	-1 ... 9-	Screw in by hand until contact is made
2.	-1 ... 9-	16 Nm

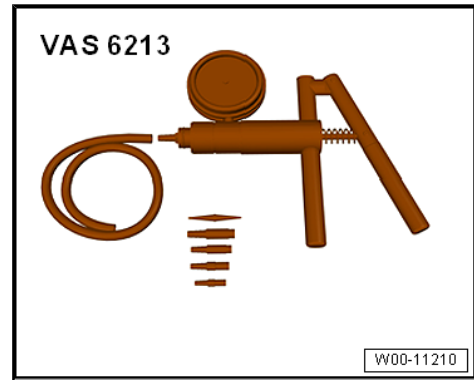


1.2 Checking vacuum unit for turbocharger

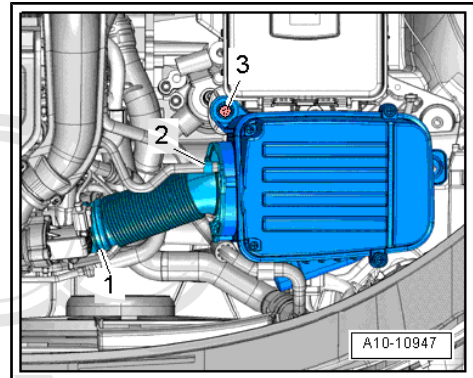
Special tools and workshop equipment required

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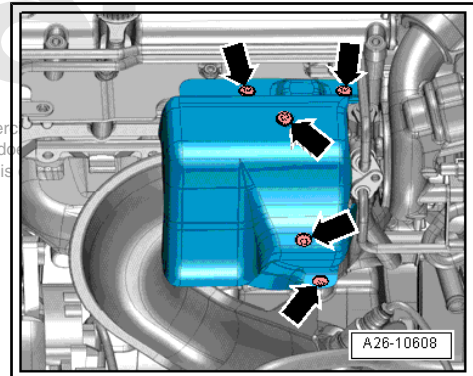
◆ Hand vacuum pump - VAS 6213-

**Procedure**

- Hose from turbocharger via charge pressure solenoid valve - N75- to vacuum unit must be airtight and unobstructed.
- Charge pressure control solenoid valve - N75- OK.
- Remove air cleaner housing ⇒ Rep. gr. 24 .

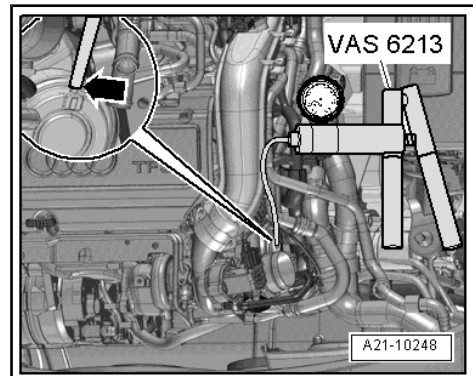


- Remove bolts -arrows- and detach heat shield for turbocharger.



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- Disconnect vacuum hose -arrow- at vacuum unit on turbocharger and attach hand vacuum pump - VAS 6213- instead.

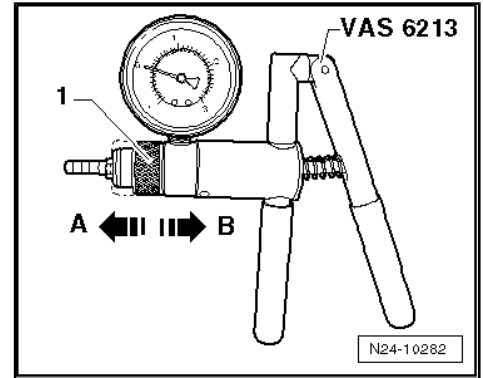


- Move adjuster ring -1- on hand vacuum pump - VAS 6213- to position -B- to select "pressure".
- Operate hand vacuum pump - VAS 6213- several times.

Caution

Risk of damage to vacuum unit on account of excessive pressure.

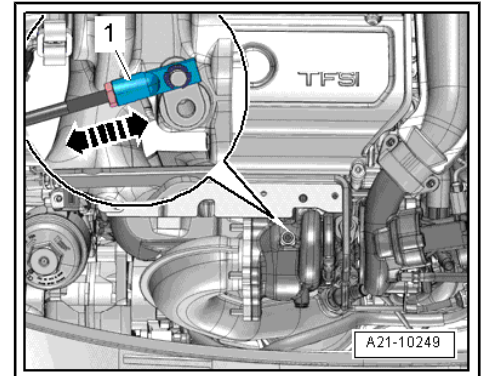
◆ *The pressure must not exceed 800 mbar.*



Note

Illustration shows installation position with turbocharger removed.

- Observe operating rod -1- of vacuum unit for turbocharger.
- The operating rod should move at a pressure of approx. 300 mbar and above.
- The operating rod should be at its end position at a pressure of approx. 800 mbar.



- Vent hand vacuum pump - VAS 6213- -arrow A-.
- The operating rod should move in the opposite direction.

Note

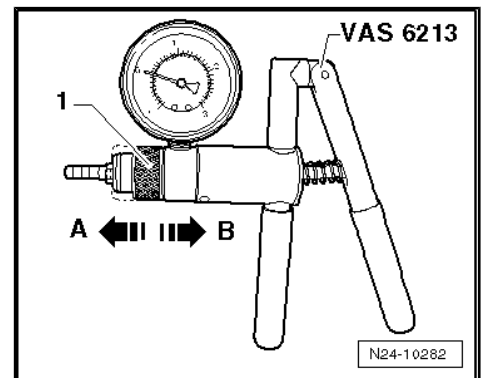
Observe the movement of the operating rod over the complete range of travel. It should move steadily and smoothly.

Assembling

- Tightening torques ⇒ [page 191](#) , ⇒ [page 214](#) , ⇒ [page 193](#) .

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

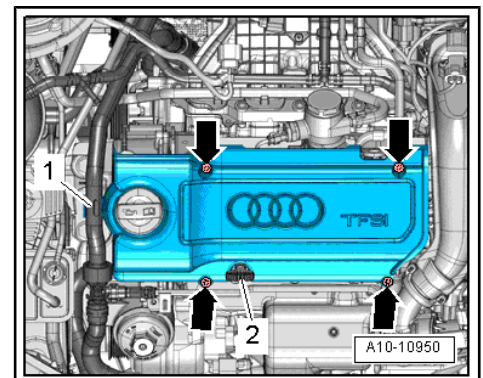
- Install air cleaner housing ⇒ Rep. gr. 24 .



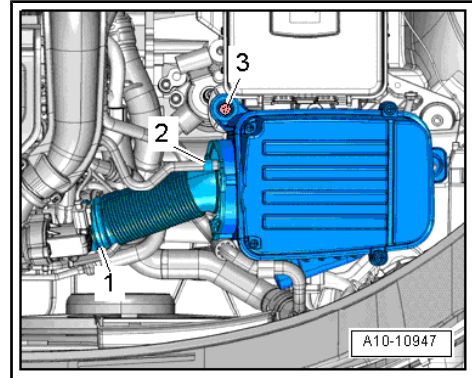
1.3 Removing and installing vacuum unit for turbocharger

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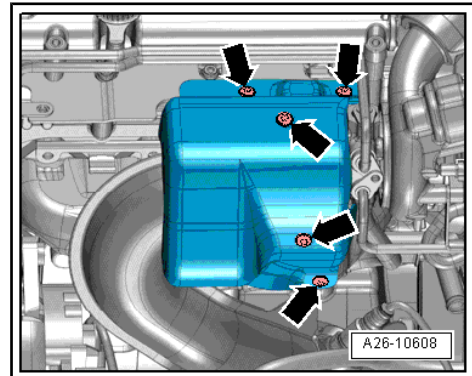
- Removing**
- Disengage coolant hose -1- at engine cover panel.
 - Pull oil dipstick -2- out of guide tube.
 - Unscrew bolts -arrows- and remove engine cover panel.



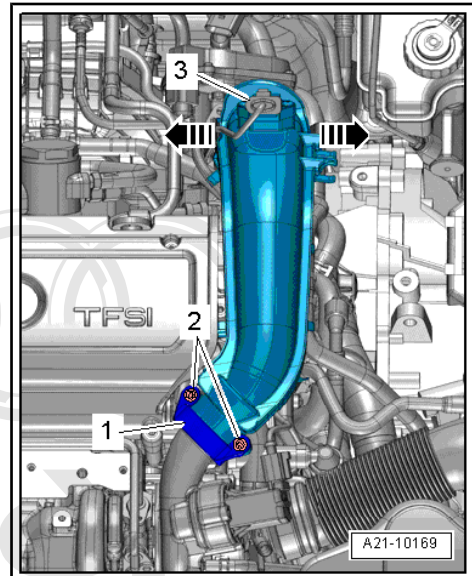
- Remove air cleaner housing ⇒ Rep. gr. 24 .



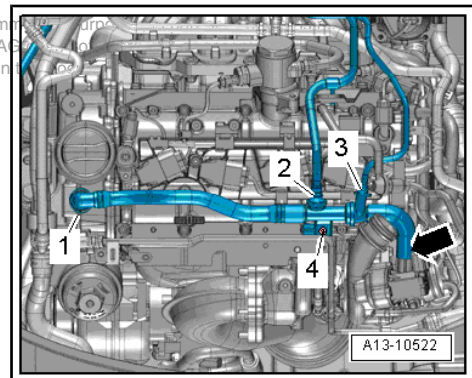
- Remove bolts -arrows- and detach heat shield for turbocharger.



- Unscrew bolts -2- and detach retaining bracket -1-.
- Unplug electrical connector -3- at charge pressure sender - G31- .
- Release retainers -arrows- and detach air pipe first from throttle valve module - J338- and then from turbocharger.
- Move hoses on air pipe clear.



- Remove bolt -4-, detach crankcase breather hose from turbocharger -arrow- and move clear to one side.

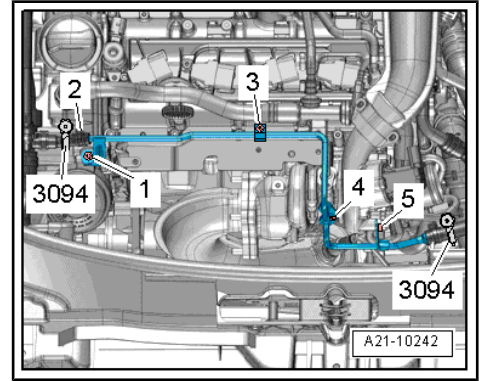
**Note**

Disregard -items 1, 2, 3-.

- Clamp off coolant hoses with hose clamps -3094- as shown in illustration.
- Remove bolts -1, 3, 4, 5-.
- Disconnect coolant lines from turbocharger and move clear to one side.

 **Note**

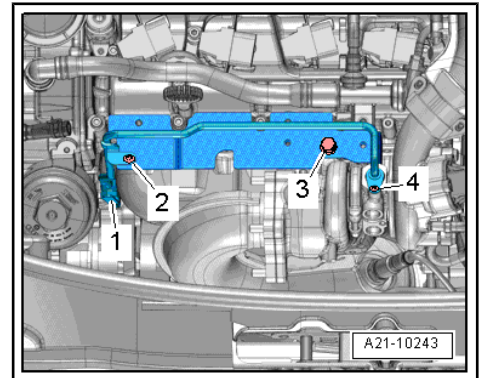
Disregard -item 2-.



- Remove bolts -2- and -3- and take off retaining plate.

 **Note**

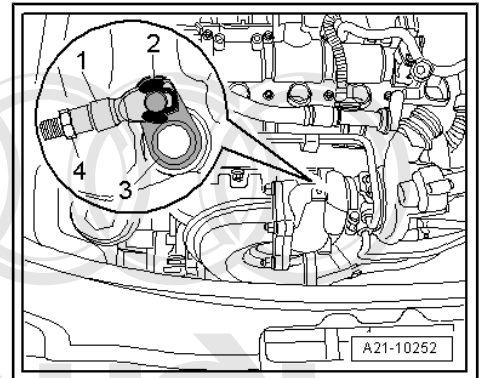
Disregard -items 1, 4-.



- Lever off retaining clip -2- and detach threaded collar -1- on operating rod from pin of operating lever -3-.

 **Note**

Disregard -item 4-.



- Disconnect hose -2- at vacuum unit for turbocharger.
- Remove bolts -1- and detach vacuum unit -3- for turbocharger.

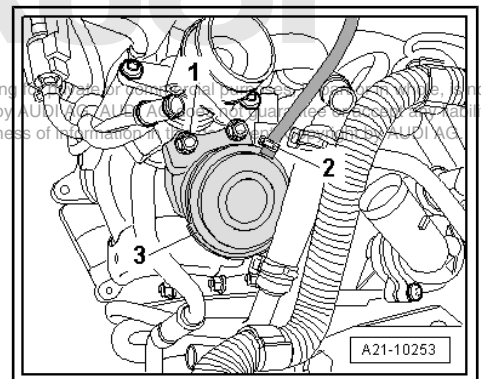
Installing

- Tightening torques ⇒ [page 191](#)

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

 **Note**

- ◆ *Check correct installation of the vacuum unit and its operating rod.*
- ◆ *Renew retaining clip for operating rod.*
- Adjust vacuum unit for turbocharger ⇒ [page 197](#) .

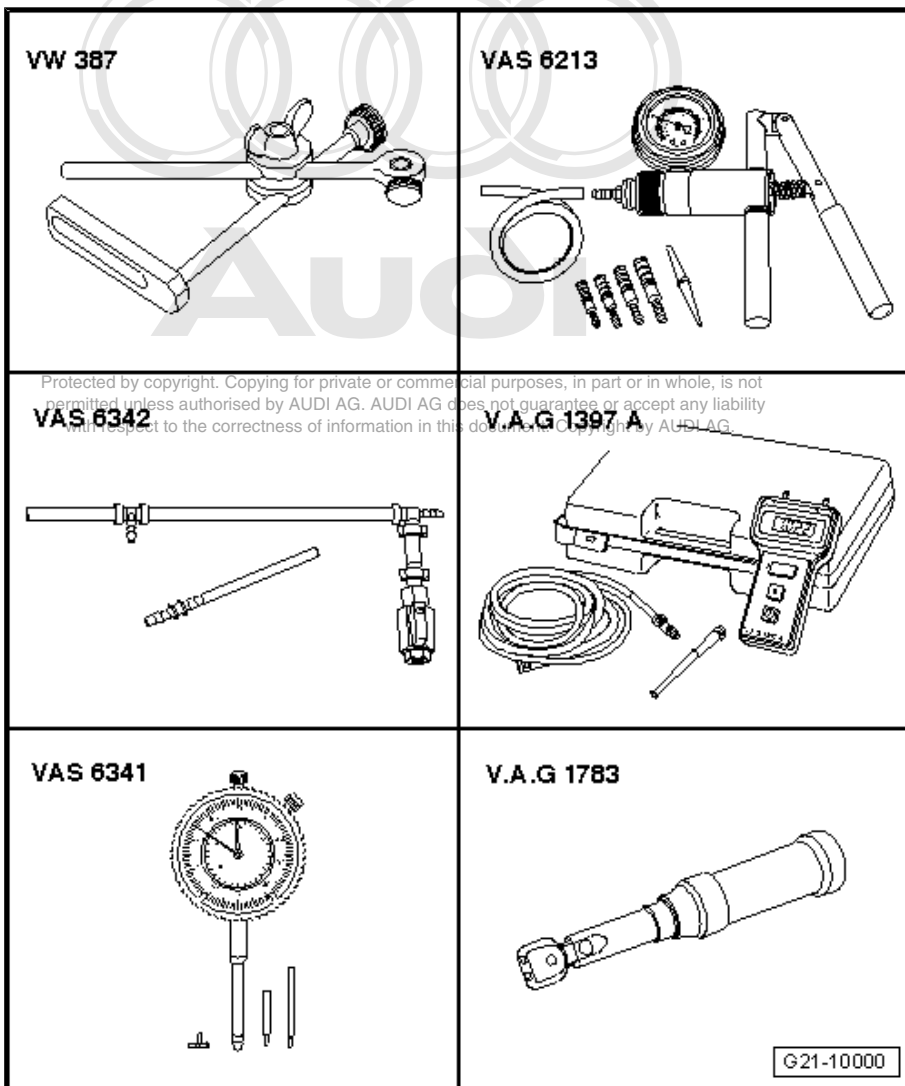


1.4 Adjusting vacuum unit for turbocharger

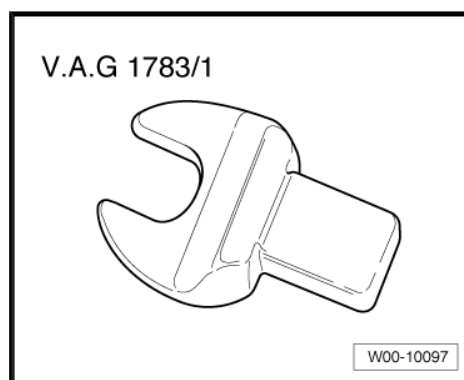


Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-
- ◆ Hand vacuum pump - VAS 6213-
- ◆ Pressure control valve - VAS 6342-
- ◆ Turbocharger tester - V.A.G 1397A-
- ◆ Dial gauge set, 4-part - VAS 6341-
- ◆ Torque wrench - V.A.G 1783-

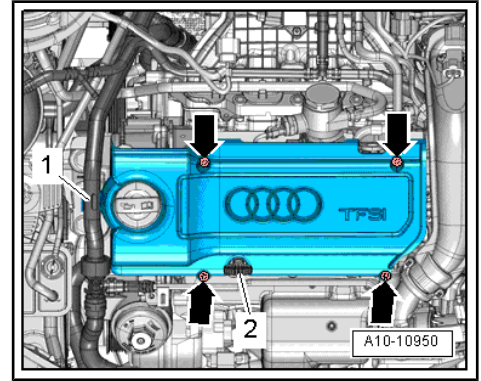


- ◆ Open-end spanner insert AF 10 - V.A.G 1783/1-

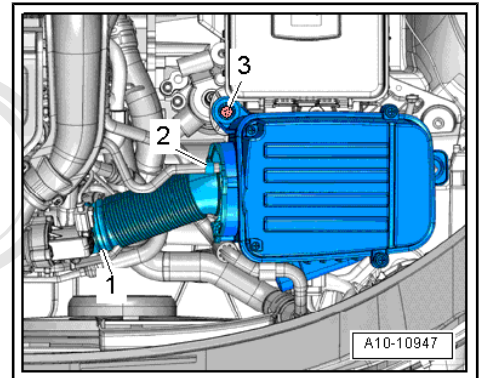


Procedure

- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.

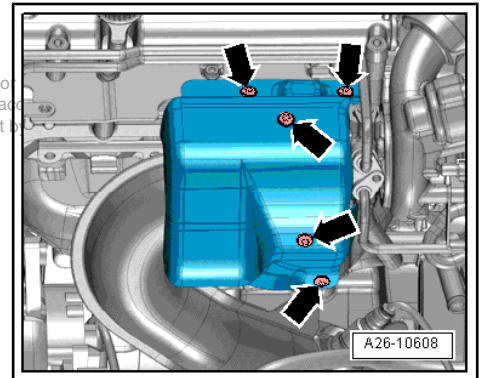


- Remove air cleaner housing ⇒ Rep. gr. 24 .

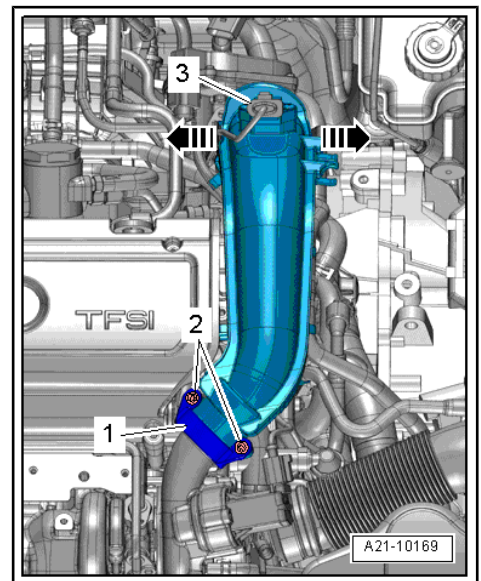


- Remove bolts -arrows- and detach heat shield for turbocharger.

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- Unscrew bolts -2- and detach retaining bracket -1-.
- Unplug electrical connector -3- at charge pressure sender - G31- .
- Release retainers -arrows- and detach air pipe first from throttle valve module - J338- and then from turbocharger.
- Move hoses on air pipe clear.



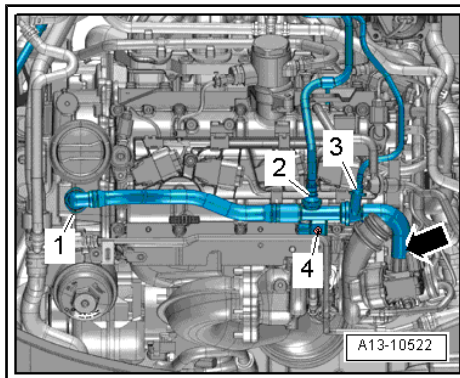


- Remove bolt -4-, detach crankcase breather hose from turbocharger -arrow- and move clear to one side.



Note

Disregard -items 1, 2, 3-.

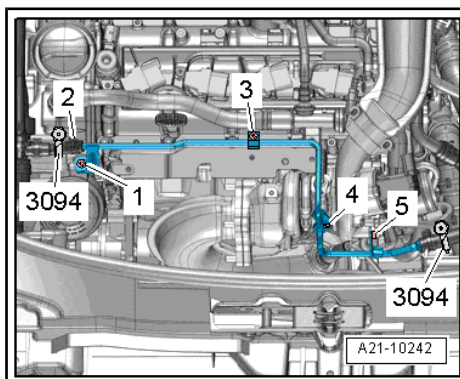


- Clamp off coolant hoses with hose clamps -3094- as shown in illustration.
- Remove bolts -1, 3, 4, 5-.
- Disconnect coolant lines from turbocharger and move clear to one side.



Note

Disregard -item 2-.



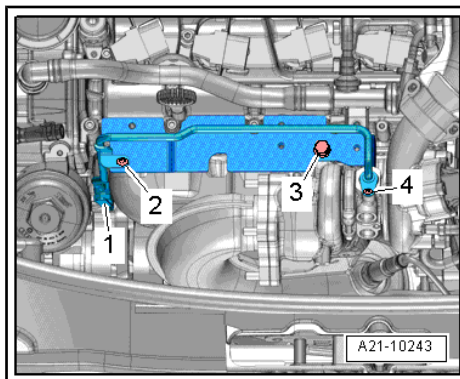
- Remove bolts -2- and -3- and take off retaining plate.



Note

Disregard -items 1, 4-.

- Remove catalytic converter => [page 223](#) .

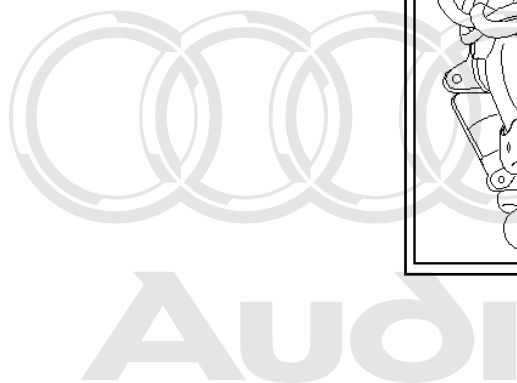
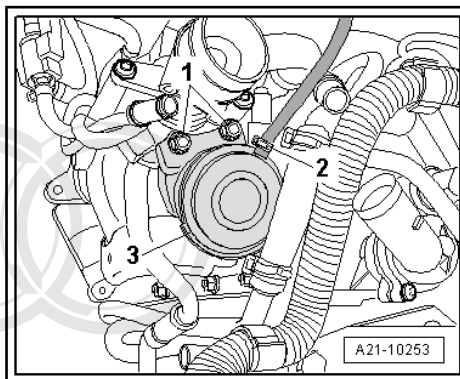


- Disconnect hose -2- at vacuum unit for turbocharger.



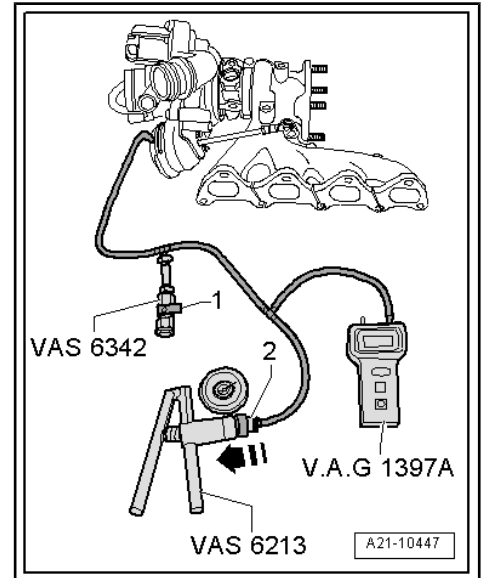
Note

Disregard -item 1-.

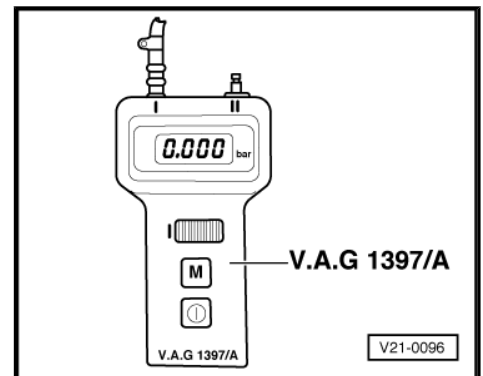


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- Close lever -1- on pressure control valve - VAS 6342- .
- Set up measuring equipment and testers as shown in illustration and connect to connection "II" of turbocharger tester - V.A.G 1397A- and to vacuum unit for turbocharger.
- Move adjuster ring -2- on hand vacuum pump - VAS 6213- to select "pressure" -arrow-.



- Switch on turbocharger tester - V.A.G 1397A- and set sliding switch to position "II".

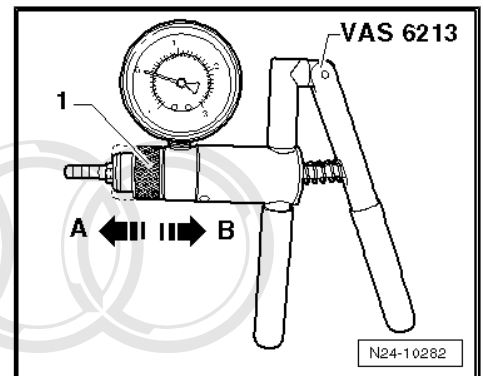


- Operate hand vacuum pump - VAS 6213- several times until the pressure is approx. 800 mbar.

 **Caution**

Risk of damage to vacuum unit on account of excessive pressure.

◆ *The pressure must not exceed 800 mbar.*



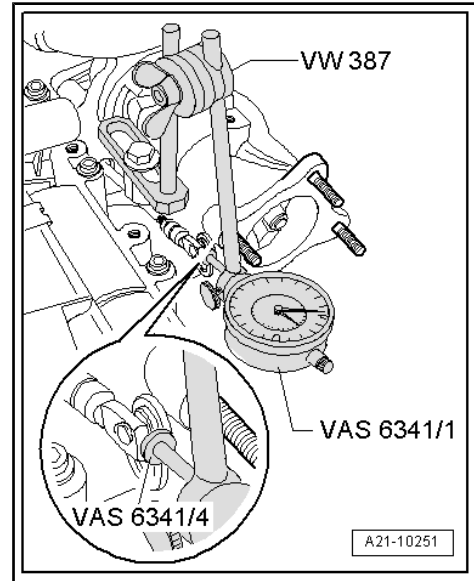
- Vent hand vacuum pump - VAS 6213- -arrow A- to make sure the linkage of the charge pressure control in the turbocharger is free to move.
- Repeat procedure 5 times.

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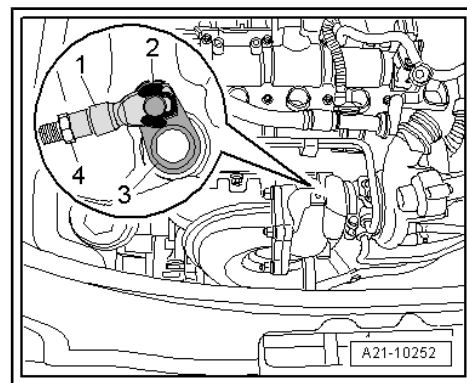
- Attach dial gauge -VAS 6341/1- with flat probe -VAS 6341/4- to universal dial gauge bracket - VW 387- .
- Secure universal dial gauge bracket - VW 387- to turbocharger as shown in illustration.
- With pressure at 0 bar, set dial gauge -VAS 6341/1- to 1 mm preload.
- Set scale of dial gauge -VAS 6341/1- to "0".
- Operate hand vacuum pump - VAS 6213- several times until the pressure displayed on turbocharger tester - V.A.G 1397A- is approx. 385 mbar.
- Specification on dial gauge -VAS 6341/1- : 1 mm travel



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 Note

- ◆ If reading does not match specification, loosen lock nut -4-.
- ◆ Lever off retaining clip -2- and detach threaded collar -1- from pin of operating lever -3-.
- ◆ Turn threaded collar on operating rod until specification is met. Fit threaded collar onto pin of operating lever each time adjustment is checked.
- ◆ Secure threaded collar with retaining clip -2- onto pin of operating lever and tighten lock nut -4-.

**Checking adjustment of vacuum unit**

- With pressure at 0 bar, set dial gauge -VAS 6341/1- to 1 mm preload.

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Measurement 1:

- Operate hand vacuum pump - VAS 6213- several times until the pressure displayed on turbocharger tester - V.A.G 1397A- is approx. 750 ... 800 mbar.
- Vent system via pressure control valve - VAS 6342- so that pressure reading drops to 375 mbar.
- Read off and note travel indicated on dial gauge - VAS 6341/1- .
- Vent system via pressure control valve - VAS 6342- so that pressure reading drops to 0 mbar.
- Operate hand vacuum pump - VAS 6213- several times until the pressure displayed on turbocharger tester - V.A.G 1397A- is approx. 375 mbar.
- Read off and note travel indicated on dial gauge - VAS 6341/1- .
- Determine average value: add values "1" and "2" together and divide by 2.
- Specification: 1 mm

Measurement 2:

- Operate hand vacuum pump - VAS 6213- several times until the pressure displayed on turbocharger tester - V.A.G 1397A- is approx. 750 ... 800 mbar.
- Vent system via pressure control valve - VAS 6342- so that pressure reading drops to 475 mbar.
- Read off and note travel indicated on dial gauge - VAS 6341/1- .
- Vent system via pressure control valve - VAS 6342- so that pressure reading drops to 0 mbar.
- Set scale of dial gauge -VAS 6341/1- to "0".
- Operate hand vacuum pump - VAS 6213- several times until the pressure displayed on turbocharger tester - V.A.G 1397A- is approx. 475 mbar.
- Read off and note travel indicated on dial gauge - VAS 6341/1- .
- Determine average value: add values "1" and "2" together and divide by 2.
- Specification: 5 mm



- Repeat adjustment procedure if readings do not match specifications ⇒ [page 203](#) .

Assembling

- Tightening torques ⇒ [page 191](#) , ⇒ [page 214](#) .

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

- Install air cleaner housing ⇒ Rep. gr. 24 .
- Install catalytic converter ⇒ [page 223](#) .

1.5 Removing and installing compressor housing and turbine housing

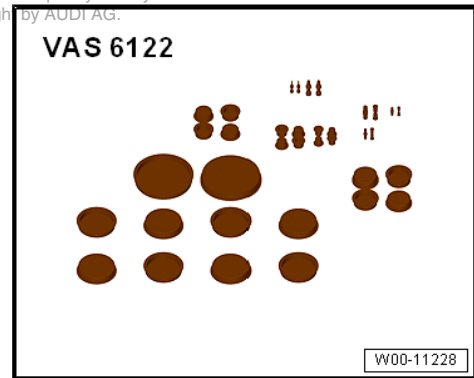


Note

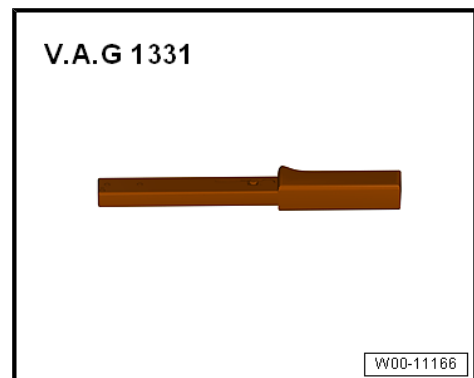
A repair kit is required for this repair procedure ⇒ *Electronic parts catalogue (ETKA)* .

Special tools and workshop equipment required

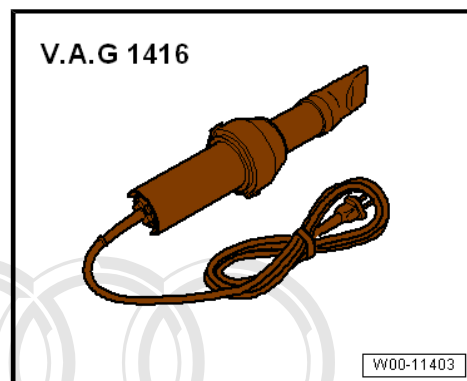
- ◆ Engine bung set - VAS 6122-



- ◆ Torque wrench - V.A.G 1331-



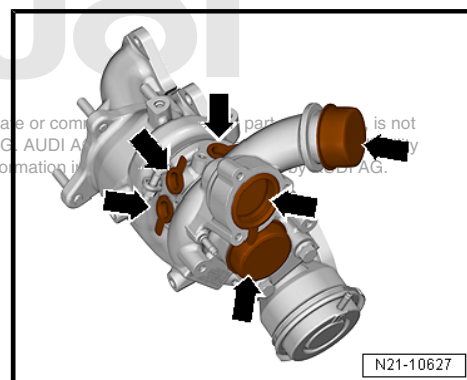
- ◆ Hot air blower - V.A.G 1416-



Removing

- Remove turbocharger ⇒ [page 208](#) .
- Check vacuum unit for turbocharger ⇒ [page 193](#) .
- Seal all openings on turbocharger -arrows- using corresponding plugs from engine bung set - VAS 6122- .

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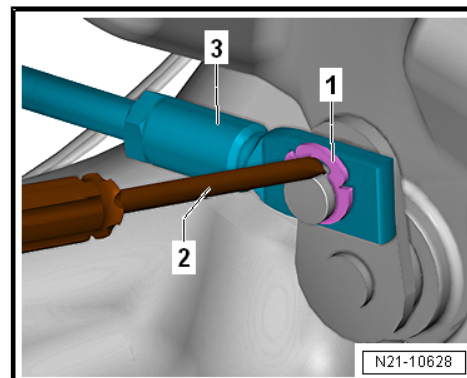


- Use screwdriver -2- to remove circlip -1-.
- Pull threaded rod -3- off pin.

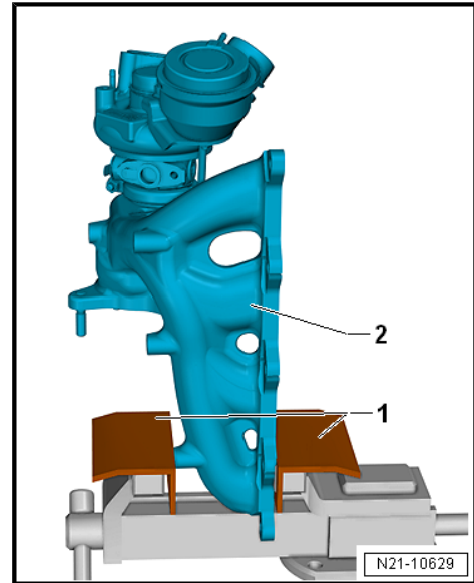


Caution

The vice must be fitted with aluminium jaw covers -1- in order to prevent damage to the exhaust manifold.



- Clamp exhaust manifold -2- in vice, as shown.

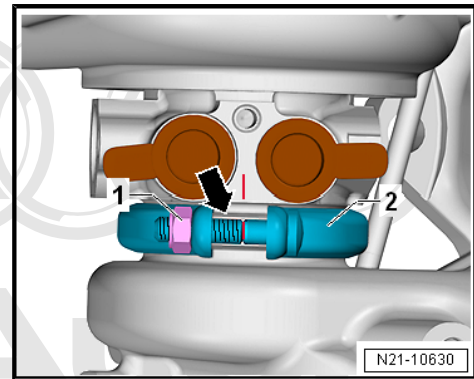


- Use a waterproof pen to mark the position of the bolt -arrow- in relation to the compressor housing.
- Unscrew securing nut -1- for clamp -2- and detach clamp.

**Caution**

If the turbine housing is still secured to the compressor housing -2- after detaching the clamp:

- *Do not use a lever tool!*
- *Hot air blower - V.A.G 1416- must be used in order to loosen the connection without damaging the centring pin on the turbine housing.*



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If deposits are preventing compressor housing from being readily separated from turbine housing:

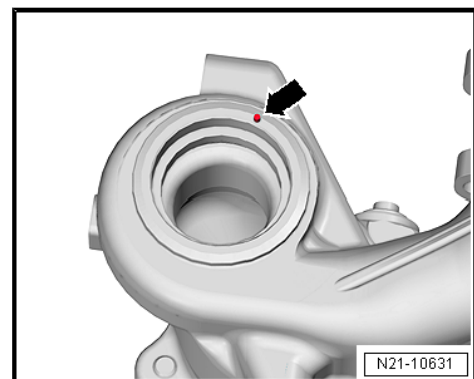
- Heat full circumference of joint between compressor housing and turbine housing evenly for approx. 2 minutes using hot air blower - V.A.G 1416- .
- Carefully lift off compressor housing.

If centring pin -arrow- is sheared off or damaged, turbocharger must be renewed together with exhaust manifold.

**Caution**

Place the compressor housing down on the workbench as shown in illustration to prevent damage to the turbine.

Do not use compressed air to clean the compressor housing.



- Clean all round compressor housing -arrows-, e.g. with brake cleaner and sandpaper (220 ... 1000 grain size).
- Take exhaust manifold out of vice.

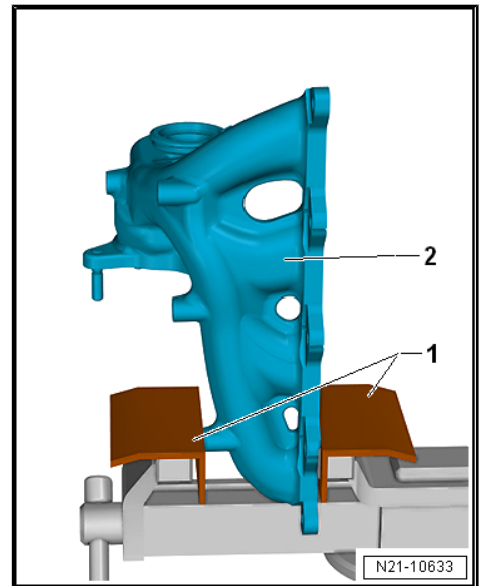
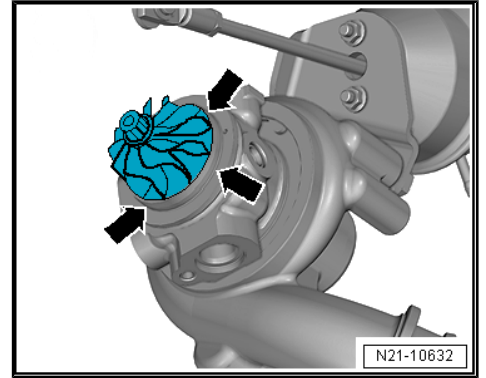
Installing



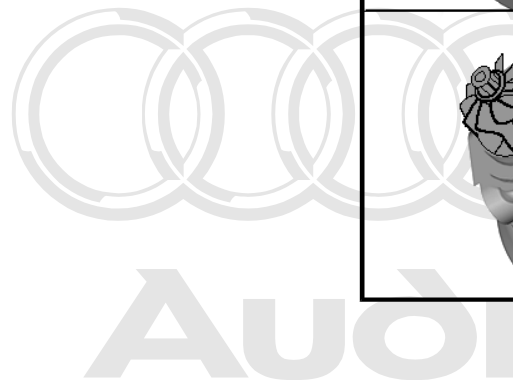
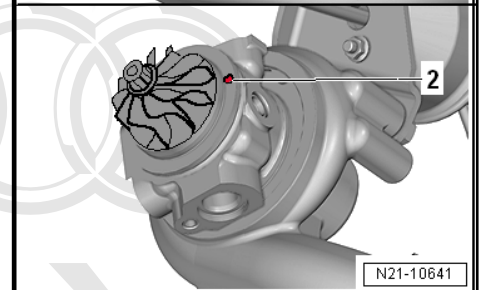
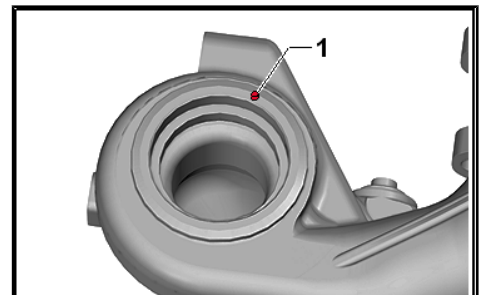
Caution

The vice must be fitted with aluminium jaw covers -1- in order to prevent damage to the exhaust manifold.

- Clamp new exhaust manifold -2- in vice, as shown.
- Fit compressor housing onto turbine housing.



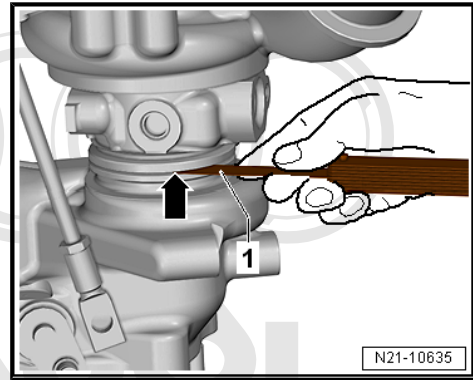
Centring pin -1- on turbine housing must engage in hole -2- on compressor housing.



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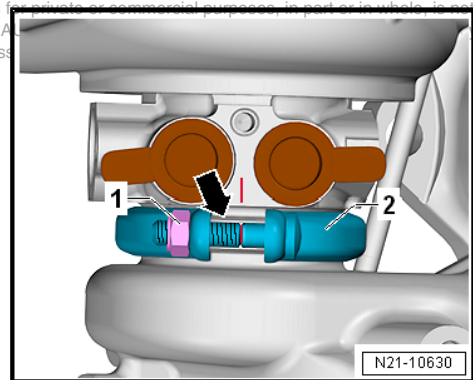
- Use a gauge -1- to measure gap -arrow- between compressor housing and turbine housing.
- Dimension should be ≤ 1.2 mm around complete circumference.
- Fit new clamp around both flanges.



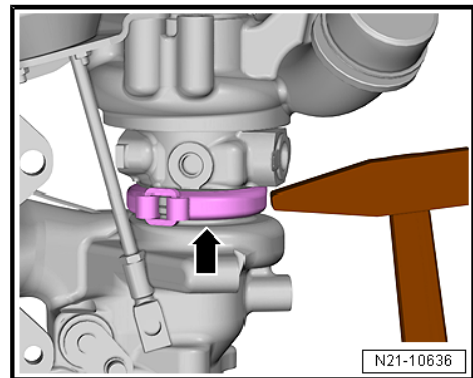
i Note

- ◆ *The stud may become slightly distorted when the securing nut is tightened to 9 Nm. This is normal and non-critical.*
- ◆ *For this reason, a new clamp with a new stud must always be used during installation.*

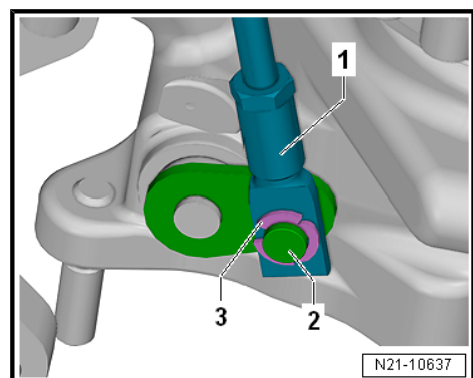
- Adjust clamp so that centre of stud is aligned with marking -arrow- on compressor housing.
- Tighten securing nut -1- of clamp -2- to 9 Nm.



- Using a hammer, knock lightly on alternate sides of clamp -arrow-.
- This will ensure that the clamp is correctly seated.
- Then tighten securing nut to 9 Nm again.



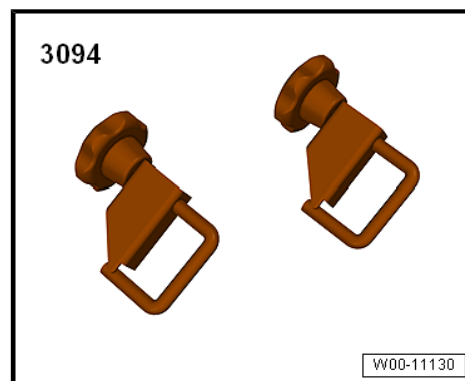
- Slide threaded rod -1- of vacuum unit onto pin -2-.
- Slide new circlip -3- into groove on pin.
- Adjust vacuum unit for turbocharger => [page 197](#) .
- Install turbocharger => [page 208](#) .



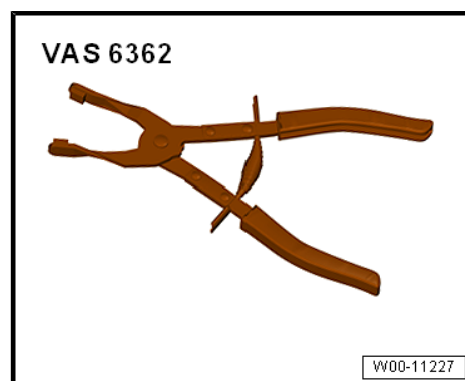
1.6 Removing and installing turbocharger

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6362-



- ◆ Bit XZN 10 - T10501-



Removing



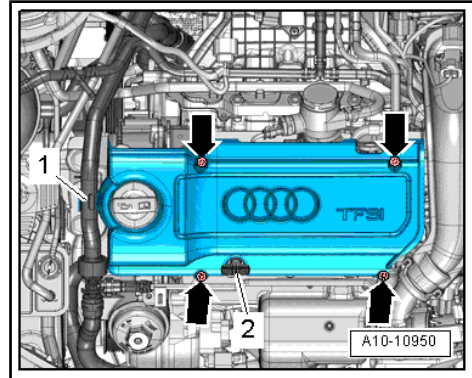
Caution

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:

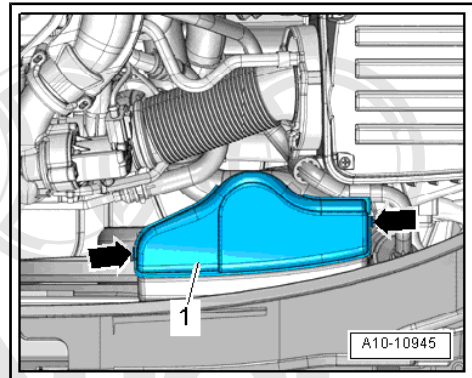
- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*



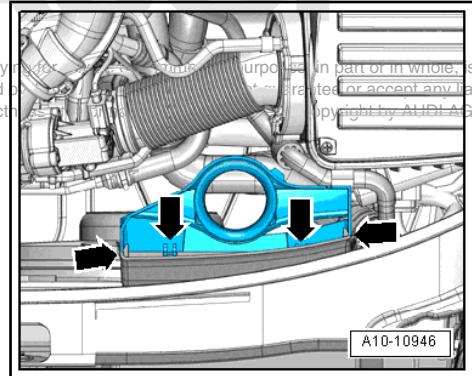
- Disengage coolant hose -1- at engine cover panel.
- Pull oil dipstick -2- out of guide tube.
- Unscrew bolts -arrows- and remove engine cover panel.
- Remove catalytic converter => [page 223](#) .



- Pull cover -1- off air duct (release clips on sides -arrows-).



- Unclip air duct at the bottom by releasing clips -arrows-.
- Detach air duct at bottom together with air hose.

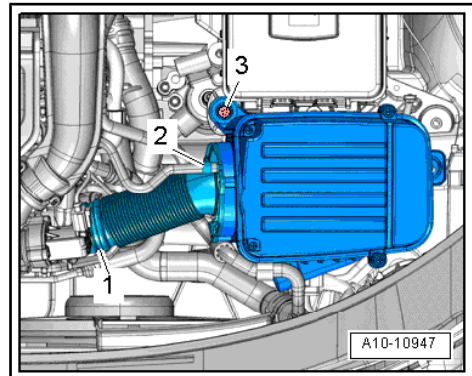


- Release hose clip and detach air hose -1- from turbocharger.

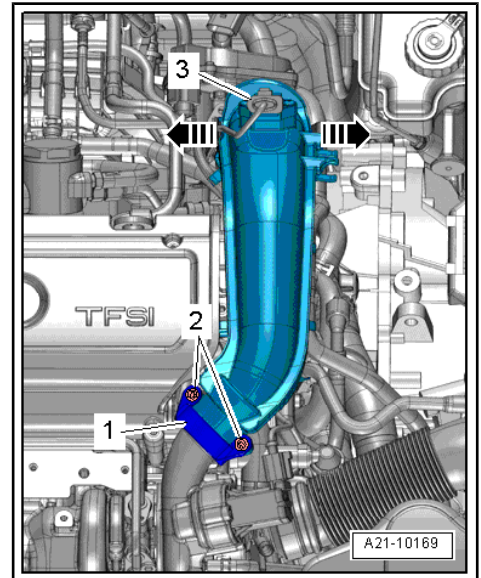


Note

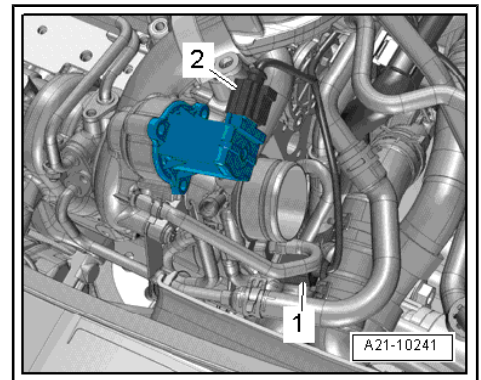
Disregard -items 2, 3-.



- Unscrew bolts -2- and detach retaining bracket -1-.
- Unplug electrical connector -3- at charge pressure sender - G31- .
- Release retainers -arrows- and detach air pipe first from throttle valve module - J338- and then from turbocharger.
- Move hoses on air pipe clear.



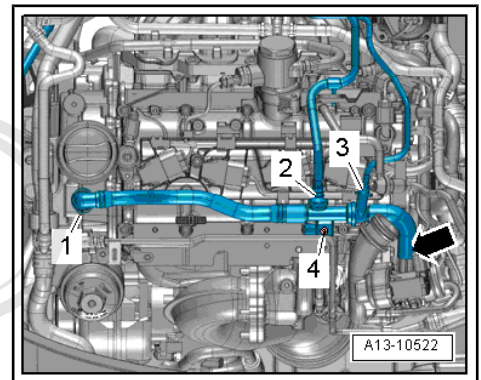
- Unplug electrical connector -1- on charge pressure control solenoid valve - N75- and -2- on turbocharger air recirculation valve - N249- .



- Remove bolt -4- and detach crankcase breather hose from turbocharger -arrow-.

 **Note**

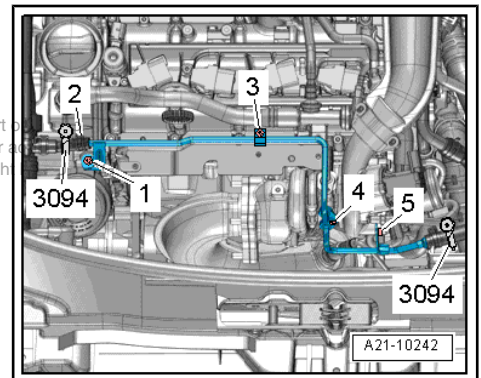
Disregard -items 1, 2, 3-.



- Clamp off coolant hoses with hose clamps -3094- as shown in illustration.
- Remove bolts -1, 3, 4, 5-.
- Disconnect coolant lines from turbocharger and move clear to one side.

 **Note**

Disregard -item 2-.



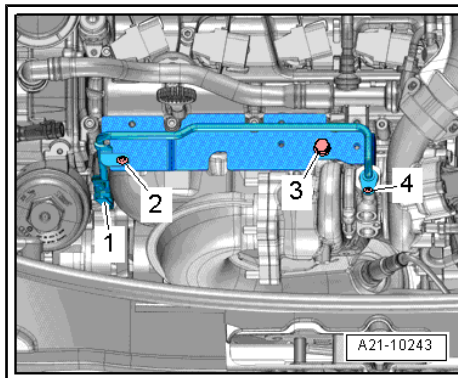


- Remove banjo bolt -1- and bolts -2, 3, 4-, detach oil supply line and retaining plate from turbocharger.



Note

Do not bend the oil supply line out of shape.

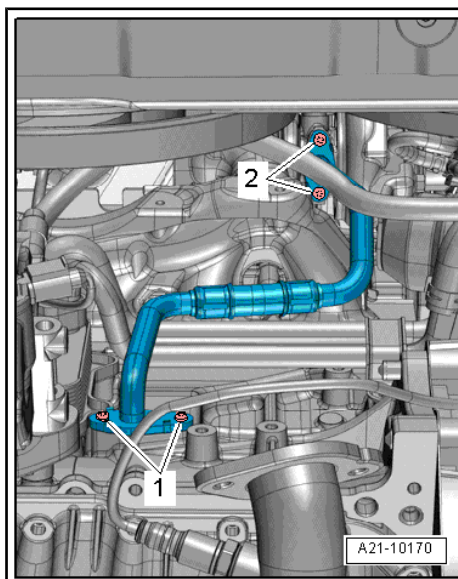


- Remove bolts -2- for oil return pipe (top).

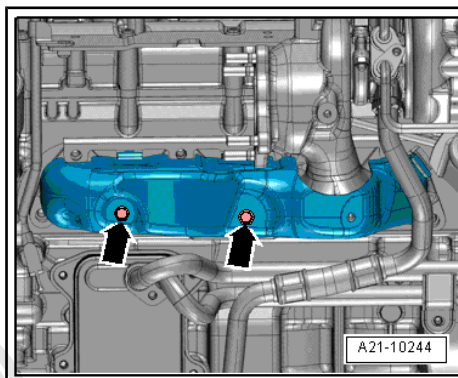


Note

Disregard -item 1-.



- Remove bolts -arrows- and detach heat shield.



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- Remove nuts -arrows- and detach bracket -1- and turbocharger with exhaust manifold.

 **Note**

Seal off open pipes/lines and connections on turbocharger with clean plugs or protective caps to prevent dirt from entering.

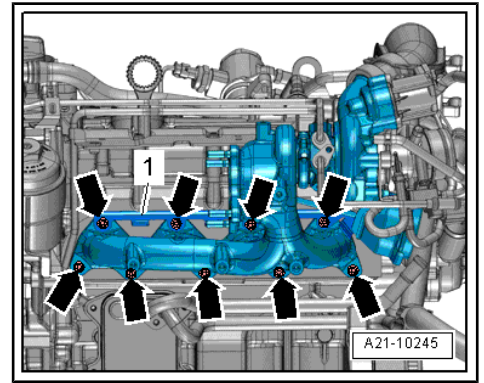
Installing

- Tightening torques
 - ⇒ [“1.1 Exploded view - turbocharger”, page 191](#) ,
 - ⇒ [“2.1 Exploded view - charge air cooler”, page 214](#) ,
 - ⇒ [Fig. ““Turbocharger - tightening torque and sequence””, page 193](#) .

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

 **Note**

- ◆ *Renew seals, gaskets, O-rings and self-locking nuts.*
 - ◆ *Fill turbocharger with engine oil at connection for oil supply line.*
 - ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
 - ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
 - ◆ *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.*
- Install air pipe ⇒ [page 191](#) .
 - Install catalytic converter ⇒ [page 223](#) .
 - Install engine cover panel ⇒ [page 121](#) .
 - Check oil level ⇒ [page 156](#) .
 - Check coolant level ⇒ [page 164](#) .



2 Charge air cooler

⇒ "2.1 Exploded view - charge air cooler", page 214

⇒ "2.2 Removing and installing charge pressure sender G31 / intake air temperature sender 2 G299", page 215

⇒ "2.3 Removing and installing charge air cooler", page 215

⇒ "2.4 Checking charge air system for leaks", page 216

2.1 Exploded view - charge air cooler

1 - Intake manifold

- Removing and installing
⇒ Rep. gr. 24

2 - Seal

- Renew

3 - Throttle valve module - J338-

- Removing and installing
⇒ Rep. gr. 24

4 - Securing clip

5 - Bolt

- 7 Nm

6 - O-ring

- Renew

7 - Air pipe

8 - Retaining clip

9 - Bolt

- 7 Nm

10 - O-ring

- Renew

11 - Charge pressure sender - G31- / intake air temperature sender 2 - G299-

- Removing and installing
⇒ [page 215](#)

12 - Bolt

- 5 Nm

13 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

14 - Bolt

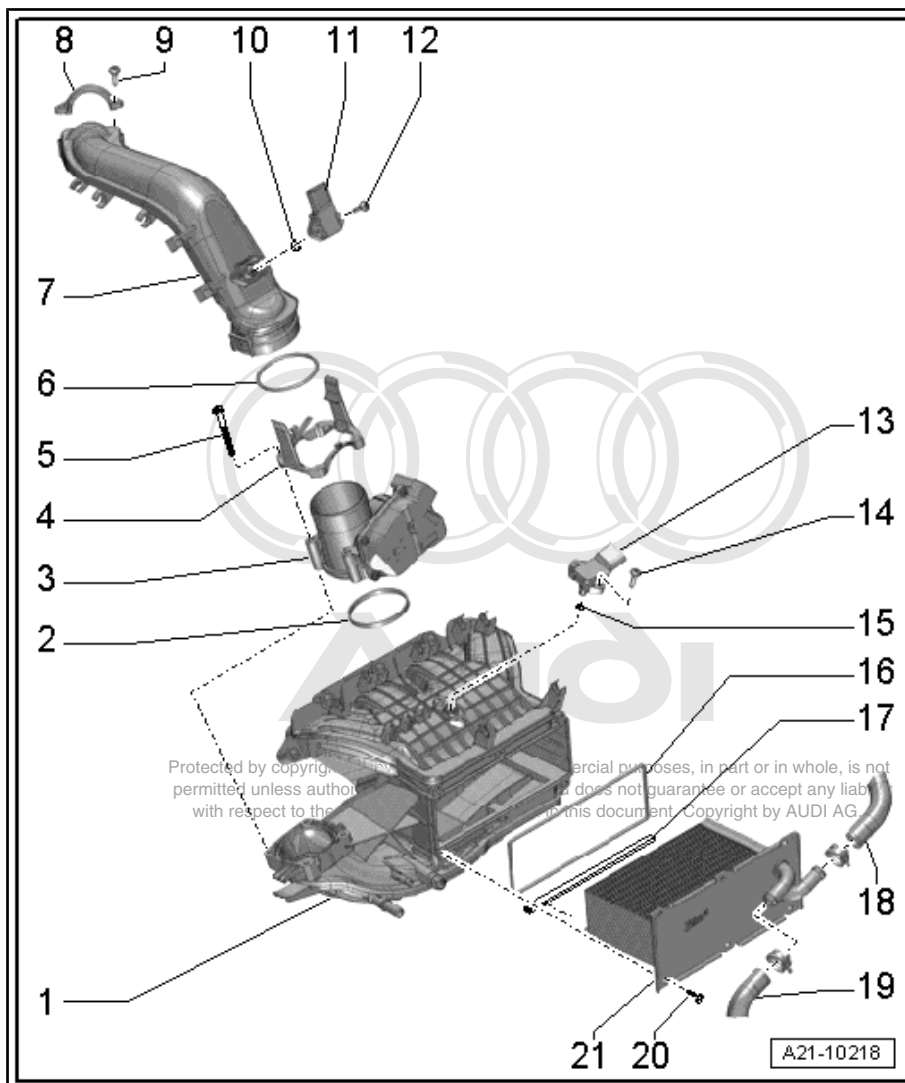
- 5 Nm

15 - O-ring

- Renew

16 - Seal

- Renew



- 17 - Sealing lip
- 18 - Coolant return hose
- 19 - Coolant supply hose
- 20 - Bolt

□ Tightening torque and sequence ⇒ [page 215](#)

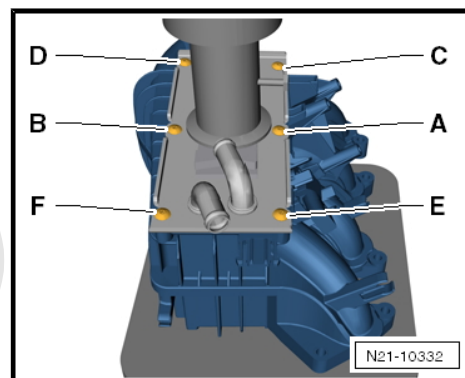
21 - Charge air cooler

□ Removing and installing ⇒ [page 215](#)

Charge air cooler - tightening torque and sequence

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-A ... F-	Screw in by hand until contact is made
2.	-A ... F-	7 Nm



2.2 Removing and installing charge pressure sender - G31- / intake air temperature sender 2 - G299-

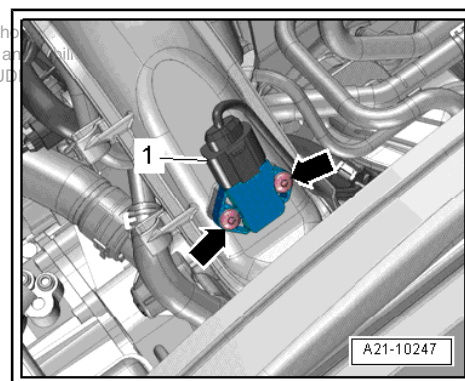
Removing

- Unplug electrical connector - 1 -
- Unscrew bolts -arrows- and remove charge pressure sender - G31- / intake air temperature sender 2 - G299- .

Installing

- Tightening torque ⇒ [page 191](#)

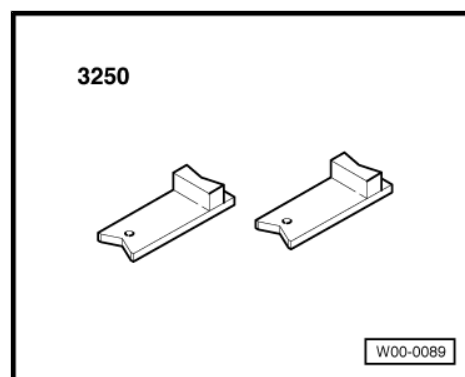
Install in reverse order.



2.3 Removing and installing charge air cooler

Special tools and workshop equipment required

- ◆ Support - 3250-





Removing

- Remove intake manifold => Rep. gr. 24 .
- Slacken and remove bolts in the sequence: -A ... F- and pull charge air cooler out of intake manifold.

Installing

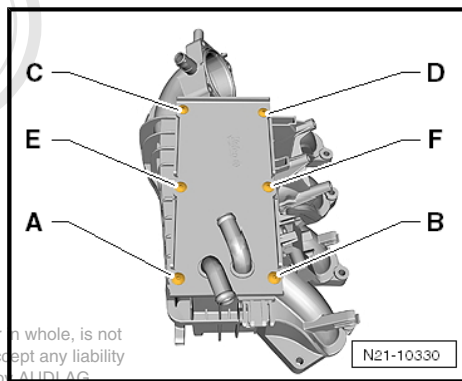
- Tightening torques => [page 215](#)



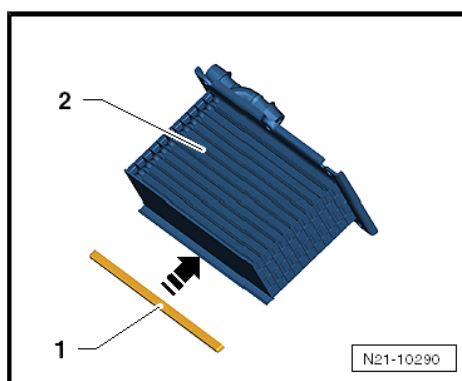
Note

- ◆ *Renew seal.*
- ◆ *The workshop press is used to install the charge air cooler to ensure a perfect seal.*

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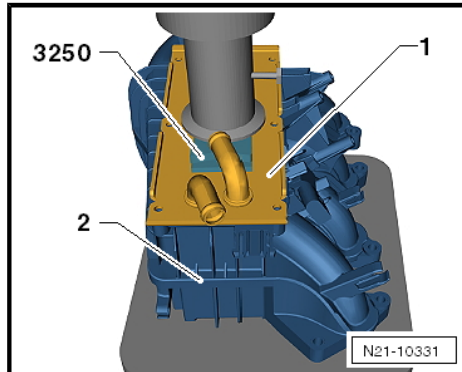


- Press sealing strip -1- onto edge of charge air cooler -arrow-.
- Check that seal is correctly seated on intake manifold.
- Insert charge air cooler into intake manifold as far as stop (take care not to tilt it).

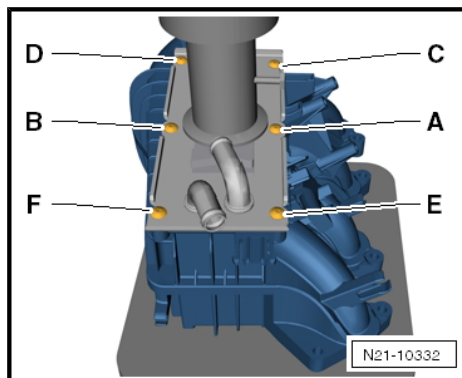


- Position intake manifold on table of workshop press with a piece of wood underneath.
- Housing of charge air cooler -1- must be horizontal.
- Apply support - 3250- to centre of charge air cooler.
- Carefully lower workshop press until housing of charge air cooler makes contact with intake manifold -2-.

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



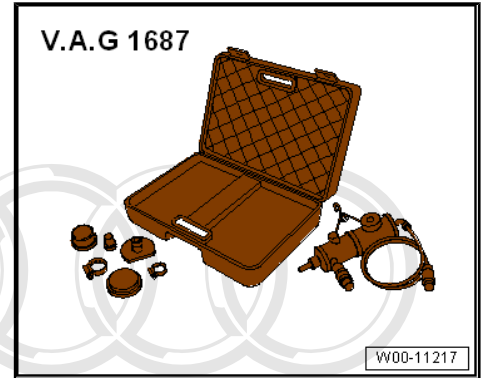
- Tighten bolts for charge air cooler => [page 215](#) .
- Install intake manifold => Rep. gr. 24 .



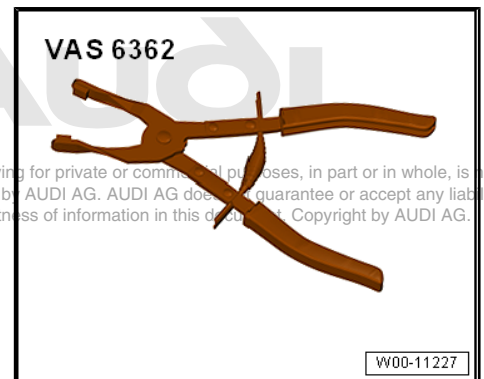
2.4 Checking charge air system for leaks

Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687- with adapter - V.A.G 1687/11- and -V.A.G 1687/15-



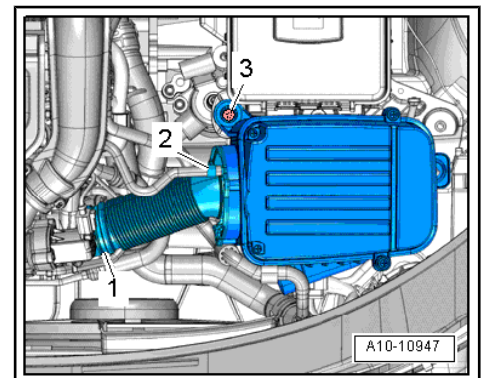
- ◆ Hose clip pliers - VAS 6362-



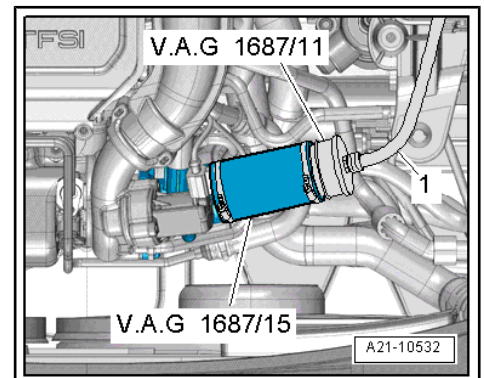
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Procedure

- Remove air cleaner housing ⇒ Rep. gr. 24 .

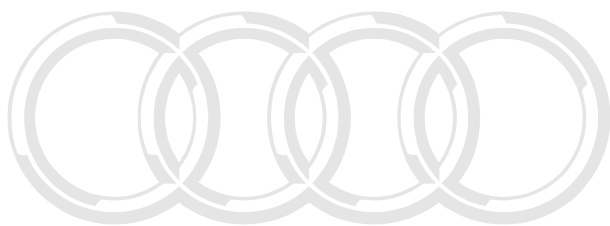
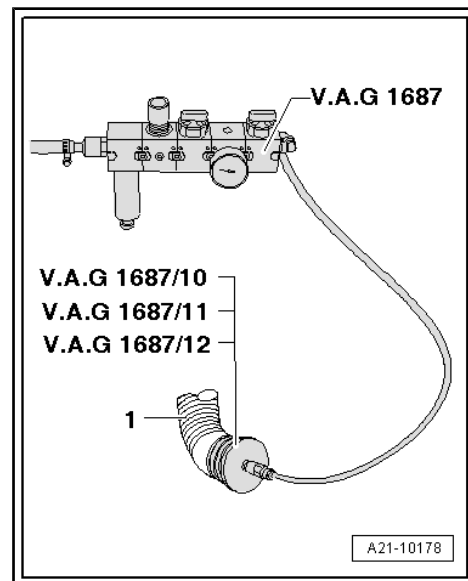


- Connect adapter - V.A.G 1687/11- with -V.A.G 1687/15- to turbocharger.
- Connect pressure hose -1- to adapter.





- Connect charge air system tester - V.A.G 1687- to adapter.



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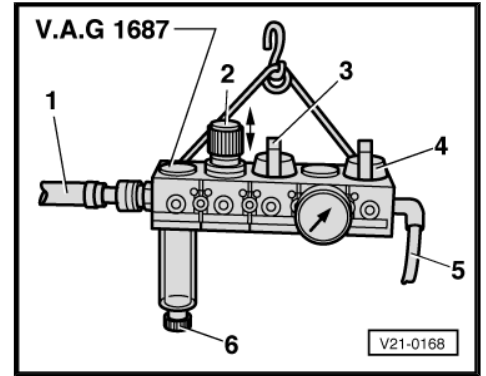
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Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Make sure knob is pulled out before turning pressure control valve.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.

 **Note**

If there is water in sight glass, remove drain plug -6- and drain water.



- Open valve -3-.



Caution

Risk of damage if pressure is set too high.

- ◆ ***The pressure must not exceed 0.5 bar.***

- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
- Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detecting spray or use ultrasonic tester - V.A.G 1842-.

 **Note**

- ◆ *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- ◆ *For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .*
- ◆ *Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

26 – Exhaust system

1 Silencers



Note

The exhaust manifold and the turbocharger are combined as one unit; removing and installing ⇒ [page 191](#).

⇒ [“1.1 Exploded view - silencers”, page 220](#)

⇒ [“1.2 Removing and installing front exhaust pipe”, page 222](#)

⇒ [“1.3 Removing and installing catalytic converter”, page 223](#)

⇒ [“1.4 Separating centre and rear silencers”, page 225](#)

⇒ [“1.5 Stress-free alignment of exhaust system”, page 226](#)

⇒ [“1.6 Checking exhaust system for leaks”, page 227](#)

1.1 Exploded view - silencers

1 - Centre silencer

- Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- Cutting point ⇒ [page 225](#)
- Align exhaust system so it is free of stress ⇒ [page 226](#)

2 - Nut

- 25 Nm

3 - Clamp (front)

- Before tightening, align exhaust system so it is free of stress ⇒ [page 226](#)
- Installation position ⇒ [page 222](#)
- Tighten bolted connections evenly

4 - Rubber mounting

- Renew if damaged

5 - Nut

- 25 Nm

6 - Bracket

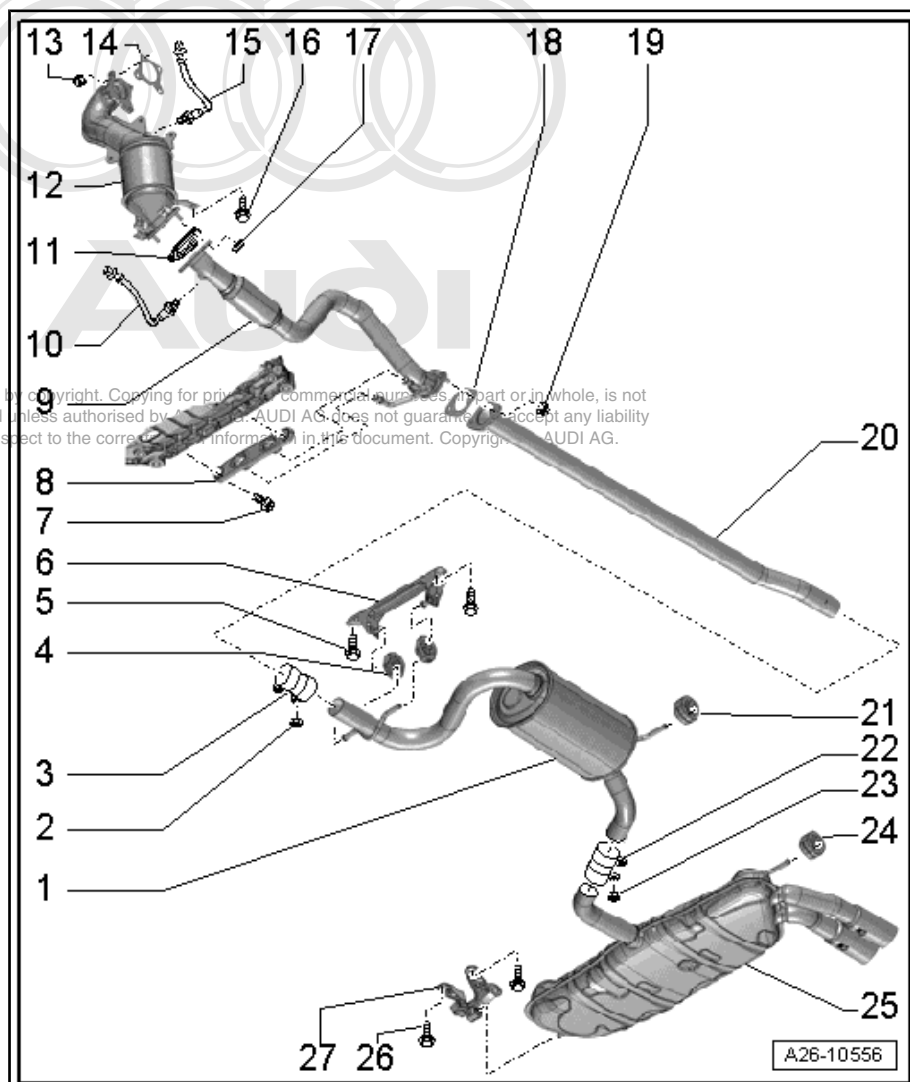
- Note installation position

7 - Bolt

- 25 Nm

8 - Bracket

- Note installation position



9 - Front exhaust pipe

- With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- Removing and installing ⇒ [page 222](#)
- Align exhaust system so it is free of stress ⇒ [page 226](#)

10 - Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-

- The threads on the new Lambda probes are coated with a special assembly paste.
- If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste
- The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
- Removing and installing ⇒ Rep. gr. 24

11 - Gasket

- Renew

12 - Catalytic converter

- Protect against knocks and impact
- Removing and installing ⇒ [page 223](#)

13 - Nut

- Renew
- 25 Nm

14 - Gasket

- Renew

15 - Lambda probe - G39- and Lambda probe heater - Z19-

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- The threads on the new Lambda probes are coated with a special assembly paste.
 - If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste
 - The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
 - Removing and installing ⇒ Rep. gr. 24

16 - Bolt

- 25 Nm

17 - Nut

- Renew
- 25 Nm

18 - Gasket

- Renew

19 - Nut

- 25 Nm

20 - Intermediate pipe

- Align exhaust system so it is free of stress ⇒ [page 226](#)

21 - Rubber mounting

- Renew if damaged

22 - Clamp (rear)

- For separate replacement of centre and rear silencers
- Installation position ⇒ [page 222](#)
- Before tightening, align exhaust system so it is free of stress ⇒ [page 226](#)
- Tighten bolted connections evenly

23 - Nut

- 23 Nm



24 - Rubber mounting

- ❑ Renew if damaged

25 - Rear silencer

- ❑ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point ⇒ [page 225](#)
- ❑ Align exhaust system so it is free of stress ⇒ [page 226](#)

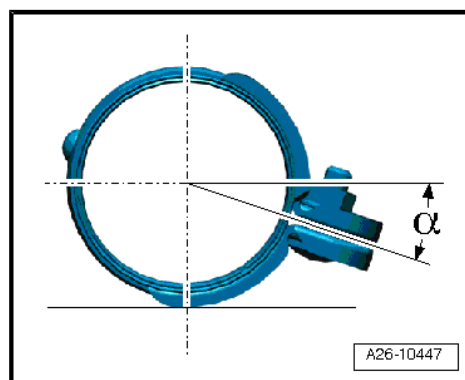
26 - Bolt

- ❑ 25 Nm

27 - Bracket

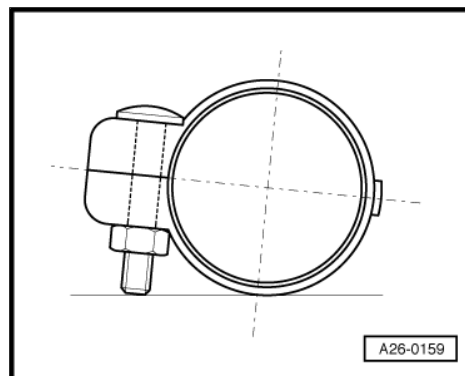
Installation position of front clamp

- Fit the clamp at the angle shown.
- Bolted connections face to right.
- Nuts face upwards.
- $\alpha = \text{approx. } 20^\circ$



Installation position of rear clamp

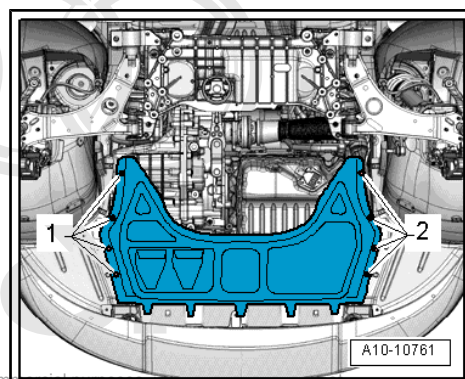
- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolted connections face to rear.



1.2 Removing and installing front exhaust pipe

Removing

- Remove noise insulation ⇒ Rep. gr. 50 .

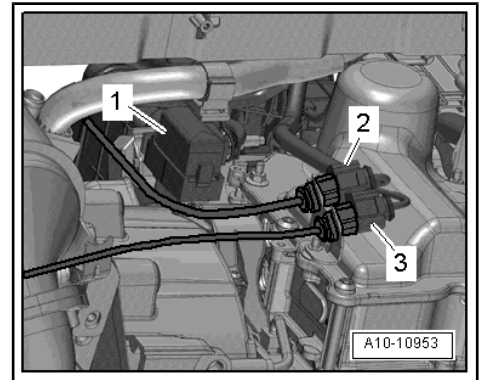


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- Remove electrical connector -3- for Lambda probe after catalytic converter - G130- from bracket and unplug connector.

 **Note**

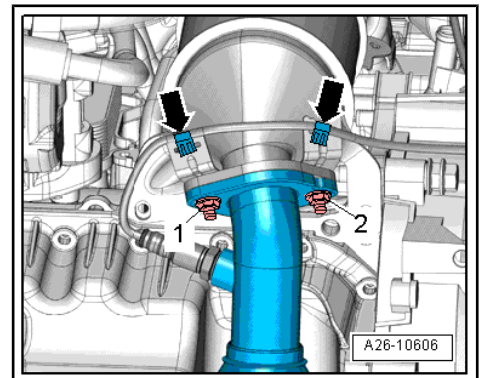
Disregard -items 1, 2-.



Caution

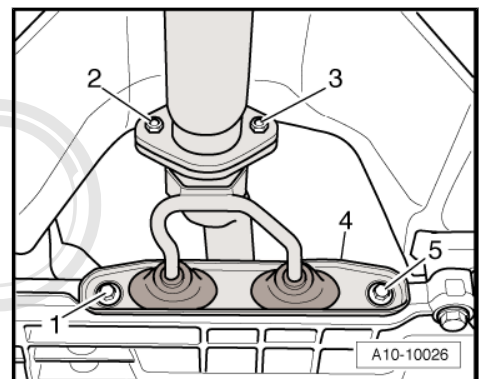
Risk of damage to flexible joint.

- ◆ **Do NOT bend flexible joint in front exhaust pipe more than 10°.**



- Remove nuts -1- and -2-.
- Move clear electrical wiring for Lambda probe after catalytic converter - G130- -arrows-.

- Remove nuts -2- and -3- and disconnect exhaust system.
- Remove bolts -1- and -5-.
- Pull off bracket -4- for exhaust system from pins on front exhaust pipe.
- Detach front exhaust pipe.



Installing

- Tightening torques ⇒ [page 220](#)

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

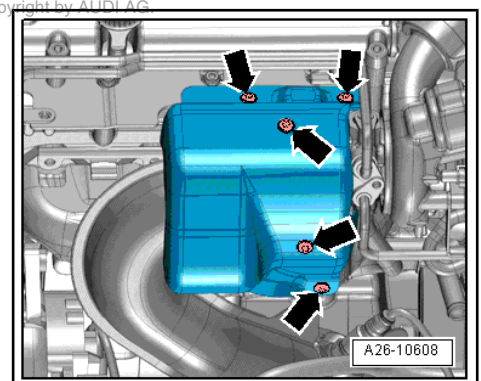
- Align the exhaust system so it is free of stress ⇒ [page 226](#).
- Install noise insulation ⇒ Rep. gr. 66.

1.3 Removing and installing catalytic converter

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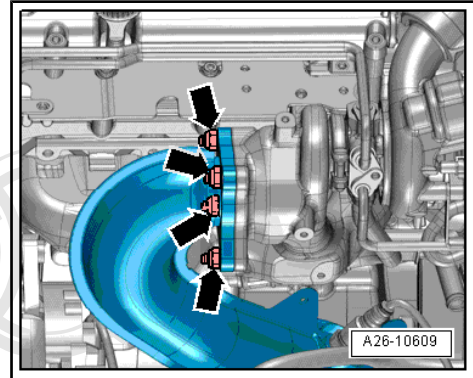
Removing

- Remove bolts -arrows- and detach heat shield for turbocharger.





- Remove nuts -arrows- for catalytic converter.
- Move electrical wiring harness leading to alternator clear at catalytic converter.
- Remove poly V-belt => [page 42](#) .

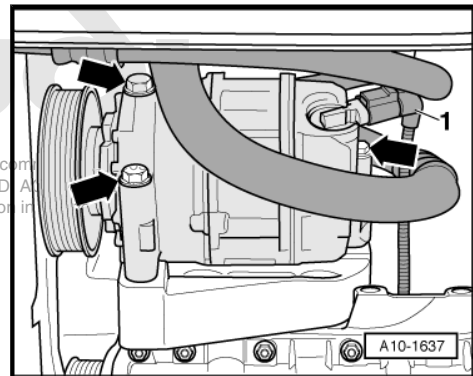


- Unplug electrical connector -1- for air conditioner compressor regulating valve - N280- at air conditioner compressor.

! WARNING

Risk of injury caused by refrigerant.

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



- Remove bolts -arrows- for air conditioner compressor.

! Caution

Danger of damage to refrigerant lines and hoses.

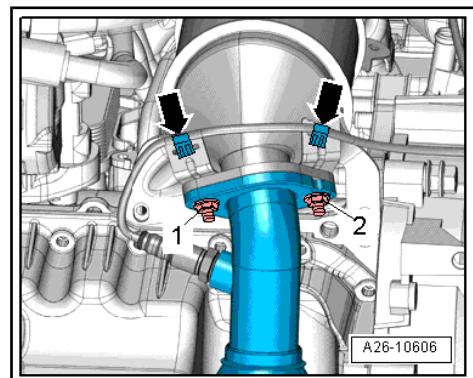
◆ **Do NOT stretch, kink or bend refrigerant lines and hoses.**

- Tie up air conditioner compressor together with refrigerant hoses to longitudinal member (refrigerant hoses remain connected).

! Caution

Risk of damage to flexible joint.

◆ **Do NOT bend flexible joint in front exhaust pipe more than 10°.**

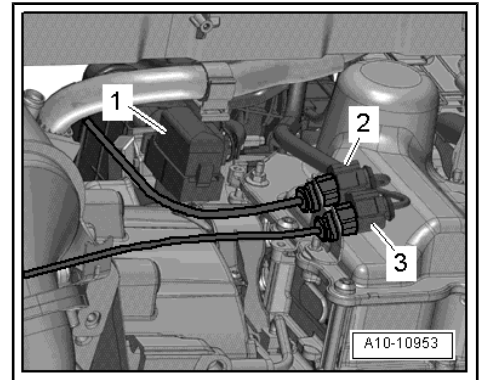


- Remove nuts -1- and -2-.
- Move clear electrical wiring for Lambda probe after catalytic converter - G130- -arrows-.
- Detach front exhaust pipe from catalytic converter.

- Remove electrical connector -2- for Lambda probe - G39- from bracket and unplug connector.
- Move clear electrical wiring for Lambda probe - G39- .

**Note**

Disregard -items 1, 3-.



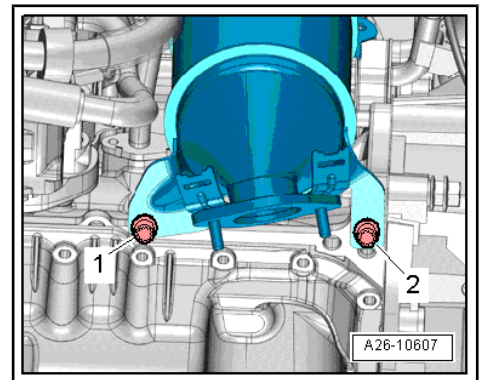
- Remove bolts -1- and -2- and detach catalytic converter.

Installing

- Tightening torques ⇒ [page 220](#)

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

- Install front exhaust pipe ⇒ [page 222](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt ⇒ [page 42](#) .
- Install heat shield for turbocharger ⇒ [page 191](#) .

**1.4 Separating centre and rear silencers**

- ◆ The connecting pipe can be cut through at the cutting point in order to renew the centre or rear silencer separately.
- ◆ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

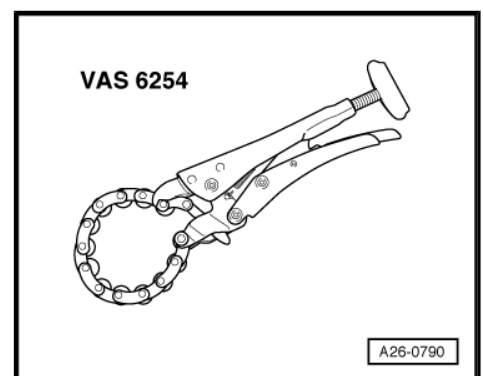
Special tools and workshop equipment required

- ◆ Chain pipe cutter - VAS 6254-

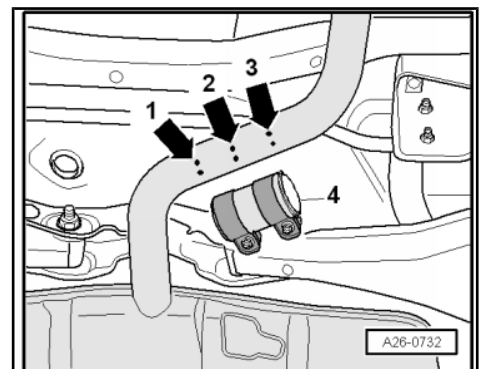


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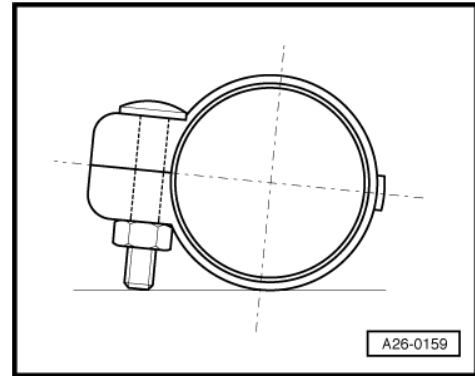
**Procedure**

- Tightening torque ⇒ [page 220](#)
- Cut through exhaust pipe at right angles at the position marked -arrow 2- using chain-type pipe cutter - VAS 6254- .
- Position clamp -4- at side marks when installing -arrow 1- and -arrow 3-.





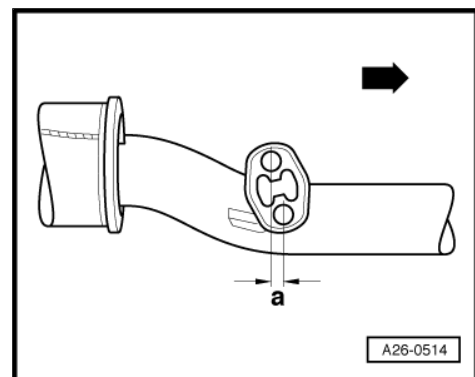
- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolted connections face to rear.
- Align the exhaust system so it is free of stress ⇒ [page 226](#) .



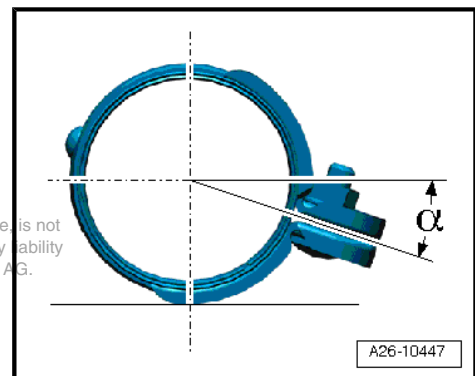
1.5 Stress-free alignment of exhaust system

Procedure

- Tightening torques ⇒ [page 220](#)
- The exhaust system must be aligned when it is cool.
- Loosen bolted connections on front clamp.
- Push rear section of exhaust system towards front of vehicle -arrow-, so that rear mounting for centre silencer is preloaded by -a- = 13 ... 17 mm.

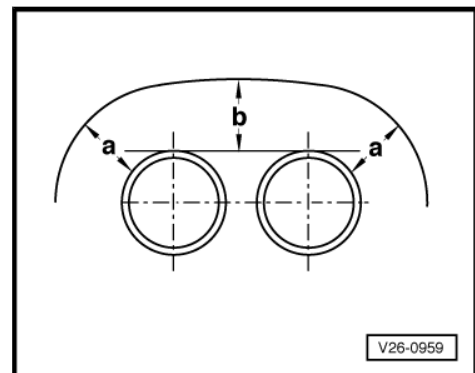


- Fit the clamp at the angle shown.
- Bolted connections face to right.
- Nuts face upwards.
- $\alpha = \text{approx. } 20^\circ$



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- Position rear silencer to align tailpipes as follows:
- Distance between tailpipes and bumper cut-out must be equal on both sides.
- Distance -a- is the same on both sides.
- At the same time, specified clearance must be maintained between bumper cut-out and top of tailpipes.
- Distance -b- = 21 mm.
- If necessary, unfasten rear silencer mounting to align tailpipes.



1.6 Checking exhaust system for leaks

- Start the engine and run at idling speed.
- Plug tailpipe during leak test (e.g. with cloth or plugs).
- Listen for leaks at joints between cylinder head and exhaust manifold with turbocharger, exhaust manifold/turbocharger and front exhaust pipe, etc.
- Rectify any leaks that are found.



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2 Exhaust manifold

The exhaust manifold and the turbocharger are combined as one unit; removing and installing ⇒ [“1 Turbocharger”, page 191](#) .



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