

Workshop Manual Audi A1 2011 ➤

4-cylinder direct petrol injection engine (2.0 ltr. 4-valve turbo EA113)

Engine ID	CDL H								
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Edition 02.2014



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List of Workshop Manual Repair Groups

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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

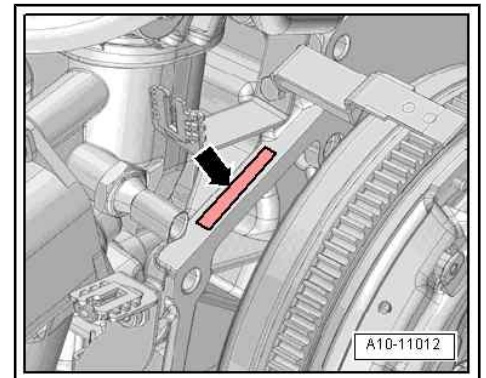
1 Identification

(ARL003745; Edition 02.2014)

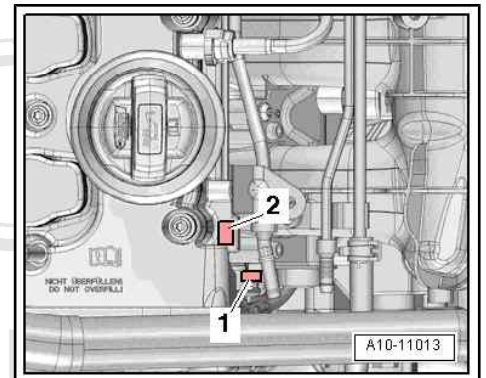
⇒ [“1.1 Engine identification number/engine data”, page 1](#)

1.1 Engine identification number/engine data

Engine number



- ◆ The engine number (“Engine code” and “Serial number”) can be found on the left of the joint between engine and gearbox -arrow-.
- ◆ The engine code letters are also stamped on the right of the cylinder head -2- and on the cylinder block -1-.
- ◆ Additionally there is a sticker on the toothed belt cover with “engine code” and “serial number”.
- ◆ 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 819 .*

Engine data

Code letters		CDLH
Capacity	ltr.	1.984
Power output	kW at rpm	188/6000
Torque	Nm at rpm	350/2500 - 4500
Bore	Ø in mm	82.5



Code letters		CDLH
Stroke	mm	92.8
Compression ratio		9.8
RON	at least	98 ¹⁾
Firing order		1-3-4-2
Emission standards		EU5
Exhaust gas recirculation		no
Turbocharging/supercharging		Turbocharger
Knock control		yes
Charge air cooling		yes
Lambda control		2 Lambda probes
Variable valve timing		Inlet
Intake manifold change-over		no
Secondary air system		no
Valves per cylinder		4
• ¹⁾ Unleaded premium RON 95 can also be used, but results in reduced power		

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2 Safety precautions

⇒ [“2.1 Safety precautions when working on the fuel supply system”, page 3](#)

⇒ [“2.2 Safety precautions when working on vehicles with start/stop system”, page 4](#)

⇒ [“2.3 Safety precautions when using testers and measuring instruments during a road test”, page 4](#)

⇒ [“2.4 Safety precautions when working on the ignition system”, page 5](#)

⇒ [“2.5 Safety precautions when working on the cooling system”, page 5](#)

2.1 Safety precautions when working on the fuel supply system

Please note the following warnings when working on the fuel supply system:



WARNING

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

- ◆ *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (4 ... 7 bar).*
- ◆ *The fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 6 bar prior to opening the system. Procedure ⇒ [page 192](#)*

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

- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ Always switch off ignition before washing engine.
- ◆ Entries are stored in event memory of engine control unit if electrical connectors were unplugged and engine was started: [Generate readiness code](#) in [Guided Functions](#) ⇒ Vehicle diagnostic tester.



Caution

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

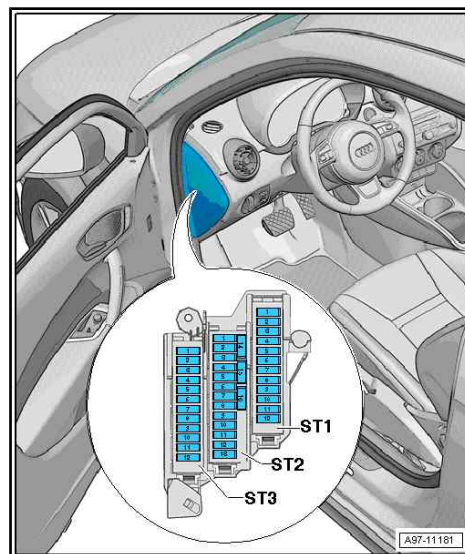
- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery ⇒ [Electrical system](#); [Rep. gr. 27](#); [Battery](#); [Disconnecting and connecting battery](#).*



WARNING

Escaping fuel can cause a risk.

- ◆ *The power supply for the fuel system pressurisation pump - G6- must be disconnected before opening the fuel system, since -G6- will be activated briefly when the driver's door is opened with the battery still connected.*
- ◆ *Remove fuse for fuel pump control unit - J538- in fuse holder C - SC- under dash panel cover (driver's side); for identification of fuses refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*



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

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When performing repairs on vehicles with start/stop system, note the following:



WARNING

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

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

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

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



WARNING

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

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

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

2.4 Safety precautions when working on the ignition system

To prevent injuries to persons and/or irreparable damage to the fuel injection and ignition system, the following must be noted:

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ Erase any entries in event memory resulting from testing or installation ⇒ Vehicle diagnostic tester, Guided Functions, Interrogate event memory, then Generate readiness code.
- ◆ Always switch off the ignition before cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ If you want to turn over the engine at cranking speed without actually starting it (e.g. compression test), first unplug the connectors from the ignition coils ⇒ [page 245](#) . Also remove fuse for fuel pump control unit - J538- ⇒ [page 4](#) .



Caution

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

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .*

2.5 Safety precautions when working on the cooling system

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When working on the cooling system note the following warnings:



WARNING

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

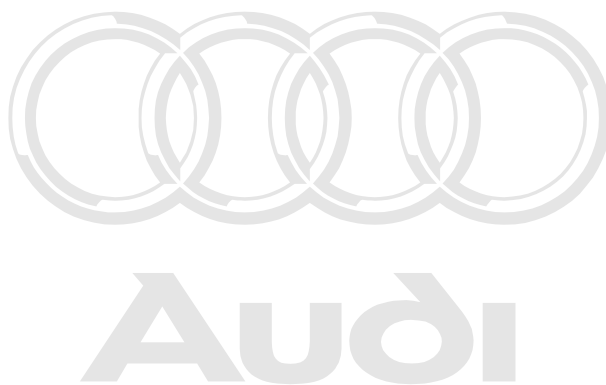
- ◆ *The cooling system is under pressure when the engine is hot.*
- ◆ *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*



Caution

Overheating can occur if the filler cap is not fitted properly.

- ◆ *The filler cap must engage positively and audibly when it is closed.*



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3 Repair instructions

⇒ [“3.1 Rules for cleanliness”, page 7](#)

⇒ [“3.2 Foreign particles in engine”, page 7](#)

⇒ [“3.3 Contact corrosion”, page 7](#)

⇒ [“3.4 Routing and attachment of pipes, hoses and wiring”, page 8](#)

⇒ [“3.5 Installing radiators and condensers”, page 8](#)

3.1 Rules for cleanliness

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.
- ◆ Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- ◆ Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open, do not work with compressed air and do not move the vehicle.
- ◆ Make sure that no fuel runs onto the fuel hoses. Should this occur, the fuel hoses must be cleaned again immediately.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

3.2 Foreign particles in engine

When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122-) to prevent foreign particles from entering the engine.



Note

*If the turbocharger has suffered mechanical damage
⇒ [page 164](#)*

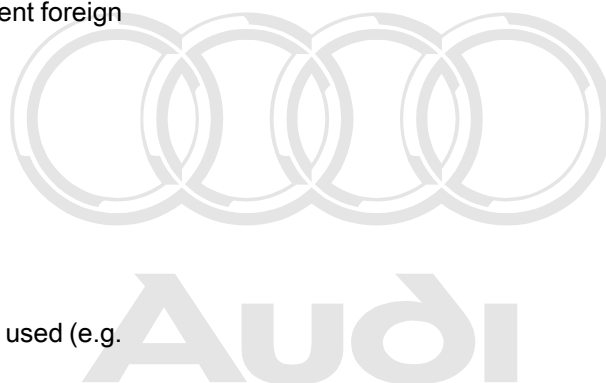
3.3 Contact corrosion

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

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



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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.

3.4 Routing and attachment of pipes, hoses and wiring

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

3.5 Installing radiators and condensers

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.



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10 – Removing and installing engine

1 Removing and installing engine

⇒ [“1.1 Removing engine”, page 9](#)

⇒ [“1.2 Separating engine and gearbox”, page 19](#)

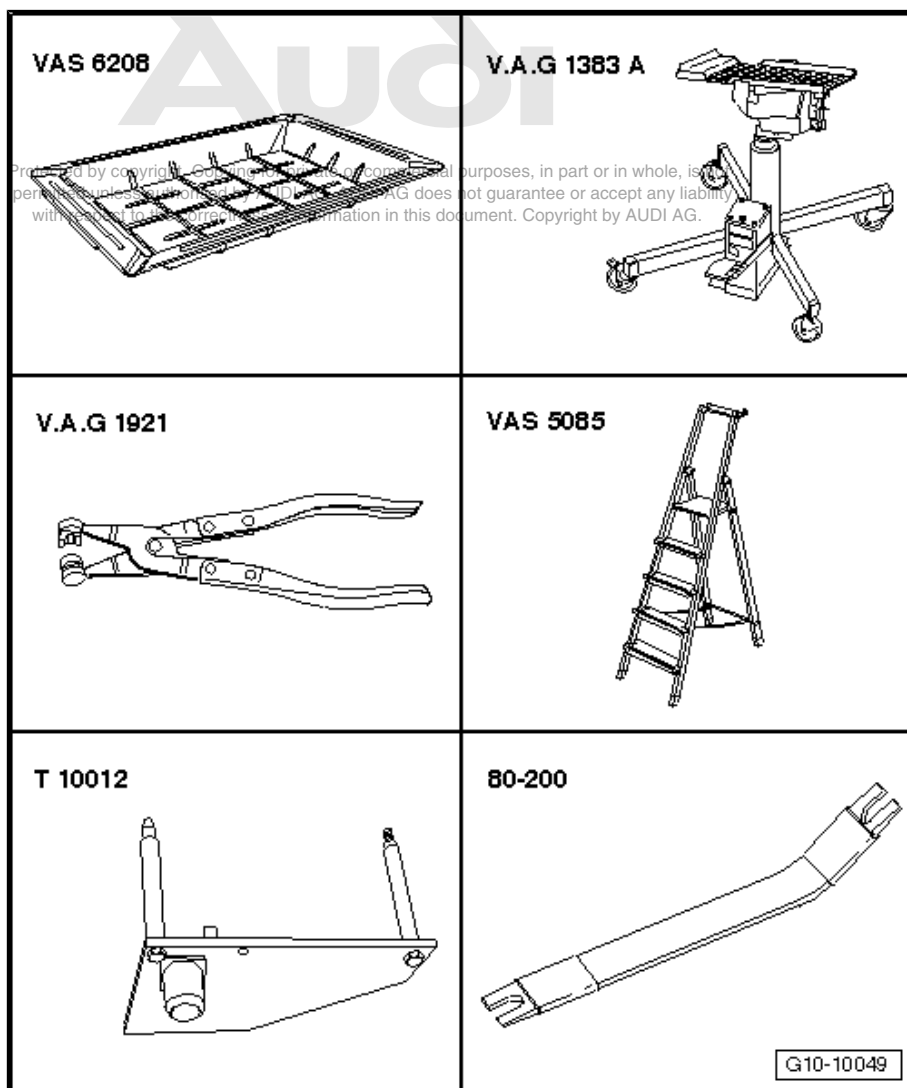
⇒ [“1.3 Securing engine to engine and gearbox support”, page 21](#)

⇒ [“1.4 Installing engine”, page 23](#)

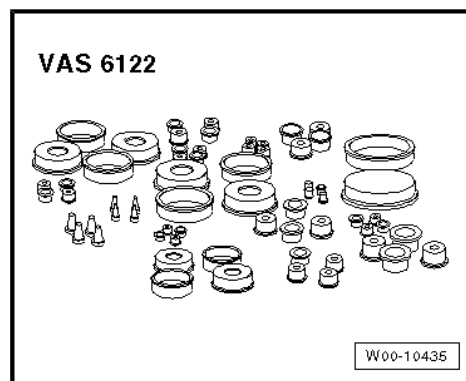
1.1 Removing engine

Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Stepladder - VAS 5085-
- ◆ Engine bracket - T10012-
- ◆ Removal lever - 80 - 200-



◆ Engine bung set - VAS 6122-



Procedure



Note

- ◆ *The engine is removed from underneath together with the gearbox.*
- ◆ *Fit cable ties in the same locations when installing.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*



WARNING

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

- ◆ *Do not open the high-pressure section of the injection system when removing the engine.*
- ◆ *However, if the engine has to be removed for repair procedures which necessitate opening the high-pressure section, the fuel pressure in the high-pressure section must be reduced in a controlled manner to a residual pressure prior to opening.*

- Reduce fuel pressure in high-pressure section of injection system ⇒ [page 192](#) .
- Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

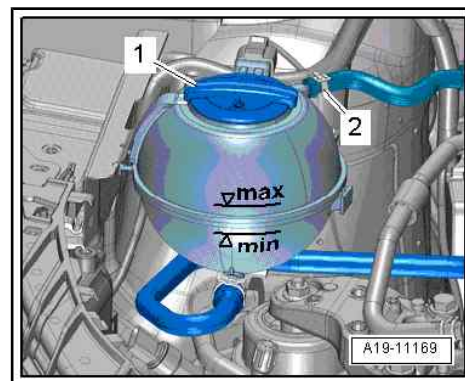


WARNING

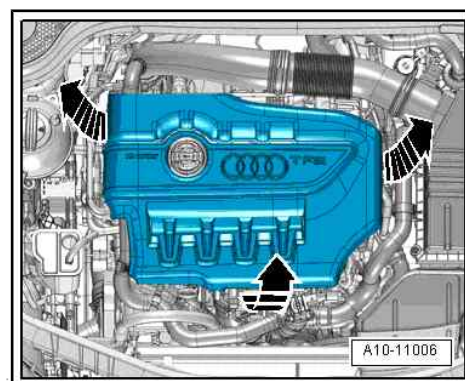
Hot steam/hot coolant can escape - risk of scalding.

- ◆ *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.*

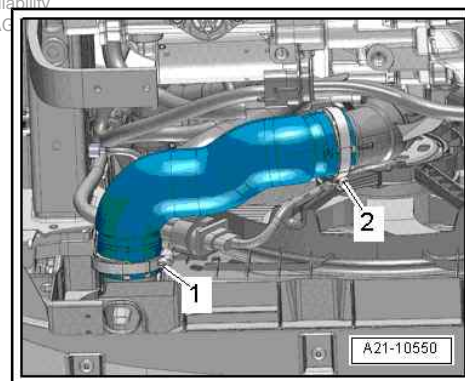
- Open filler cap -1- on coolant expansion tank.
- Release hose clip -2- and detach coolant hose.



- Remove engine cover panel -arrows-.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove front wheel housing liner (left and right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .



- Release hose clips -1- and -2- and remove air hose (bottom left).

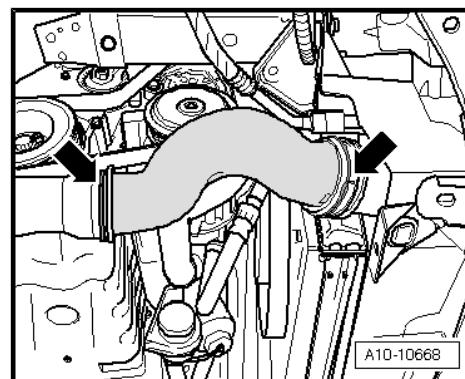


- Remove charge air hose (right-side) -arrows-.
- Extract refrigerant ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87 ; Refrigerant circuit .

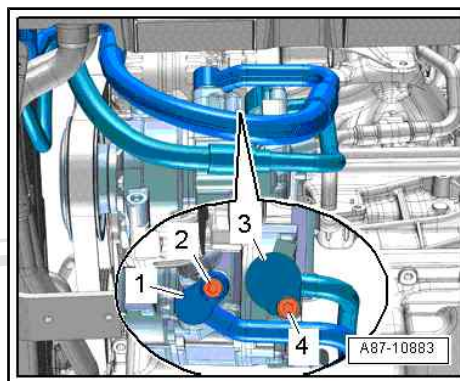
**Caution**

Danger of damage to refrigerant lines and hoses.

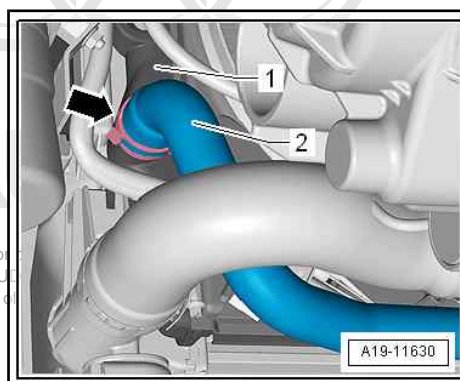
◆ ***Do NOT stretch, kink or bend refrigerant lines and hoses.***



- Unscrew bolts -2- and -4- and detach refrigerant lines -1- and -3-.
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Drain coolant ⇒ [page 135](#) .
- Unclip coolant hose -2- (bottom) from bracket for radiator cowl.



- Release hose clips -arrow-, disconnect coolant hose -2- (bottom) from radiator -1- and drain off remaining coolant.

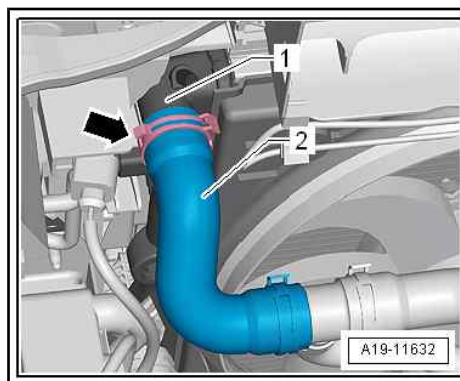


- Release hose clip -arrow-, disconnect coolant hose -2- (top) from radiator -1- and drain off remaining coolant.

Note

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

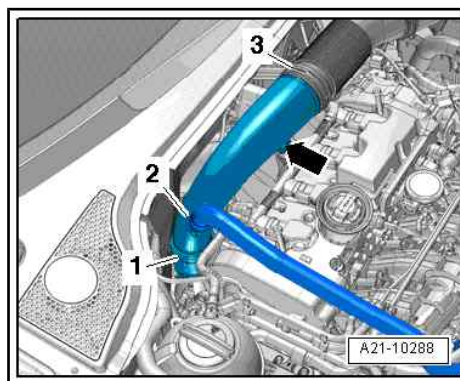
- Remove air cleaner housing ⇒ [page 195](#) .



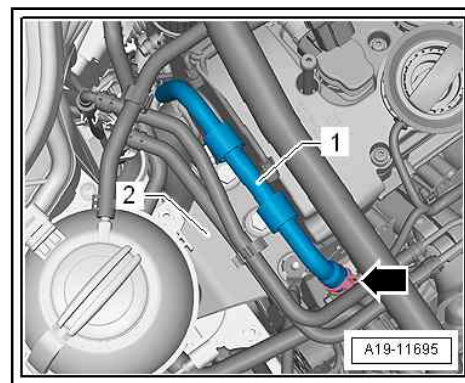
- Remove bolt -arrow-.
- Release hose clip -1- and lay air pipe on engine (hose -2- remains attached).

Note

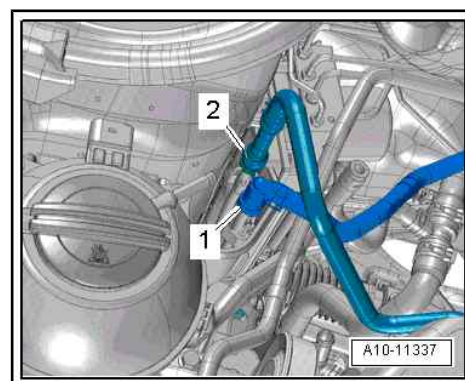
- ◆ Disregard item -3-.
- ◆ In the following steps, the coolant hose above the engine bracket must be removed to avoid damage.



- Release spring-type clip -arrow- and disconnect coolant hose -1- from front coolant pipe.
- Place coolant hose -1- on top of engine.

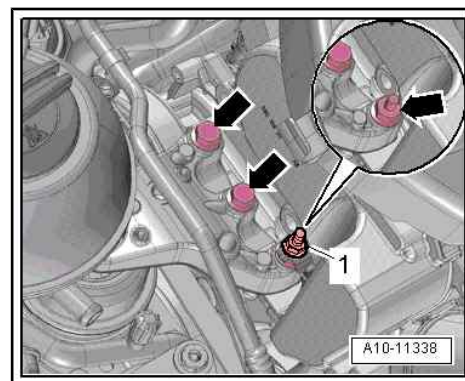


- Press release tabs and disconnect vacuum hose -1- from activated charcoal filter.
- Disconnect fuel supply line -2- (pull release ring).
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122-.

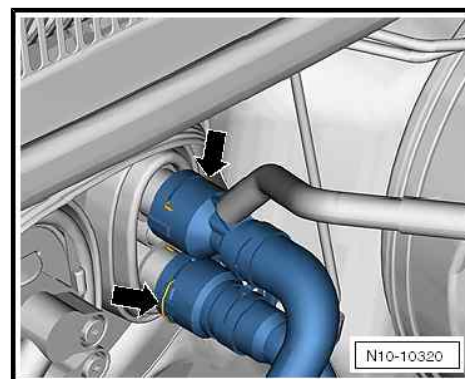


- Remove nut -1- and move earth wire clear.
- Loosen bolts -arrows- for support arm of engine mounting approx. 2 turns.

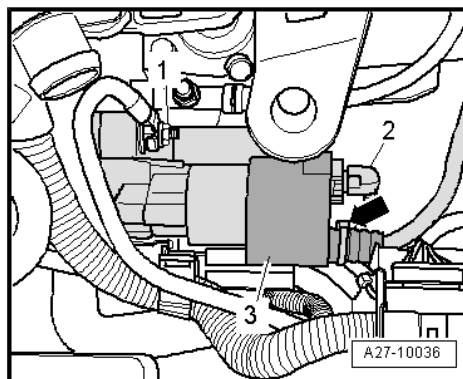
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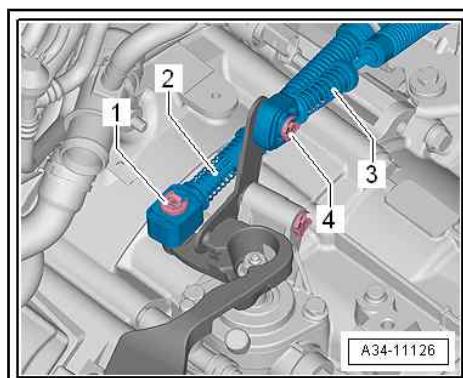
- Release coolant hoses at heat exchanger -arrows- and detach coolant hoses.



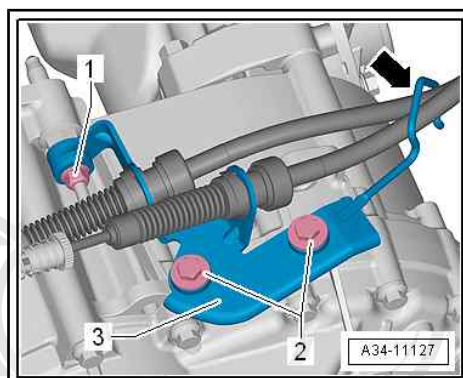
- Open covers -3-.
- Cut open cable tie -arrow- for protective cover -3-.
- Unplug electrical connector -2-.
- Push back protective cover and unscrew B+ cable at starter solenoid switch
- Remove nut -1- for earth wire.
- Remove top starter bolt.



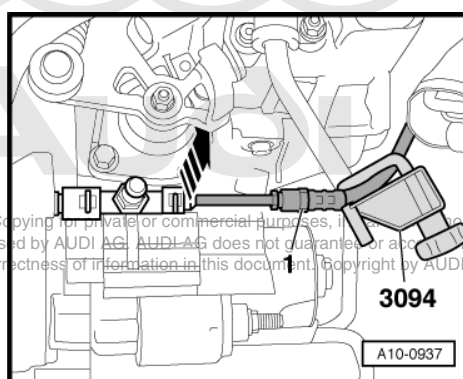
- Remove securing clip -1- and detach gear selector cable -2- from gearbox selector lever.
- Remove securing clip -4- and detach gate selector cable -3- from gear selector relay lever.



- Remove nut -1- and bolts -2- for cable support bracket -3-.
- Pull selector cable end-pieces with selector cables off selector shaft lever and relay lever.
- Tie selector cables with cable support bracket to one side.



- Clamp off pressure hose to clutch slave cylinder using a hose clamp -3094-.
- Pull securing clip upwards -arrow- and detach pipe/hose assembly -1- from bleeder connection on clutch slave cylinder.



Caution

Risk of contamination by escaping brake fluid.

- ◆ ***Do not operate clutch pedal after detaching pipe/hose assembly from bleeder connection on clutch slave cylinder.***

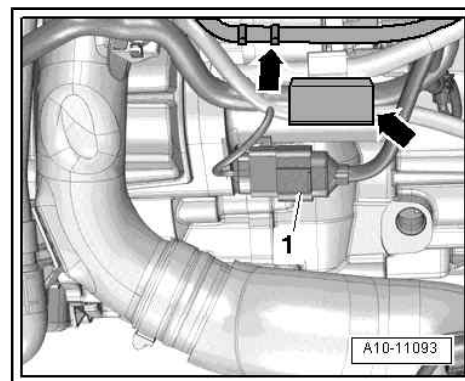
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- Unplug electrical connector -1-.

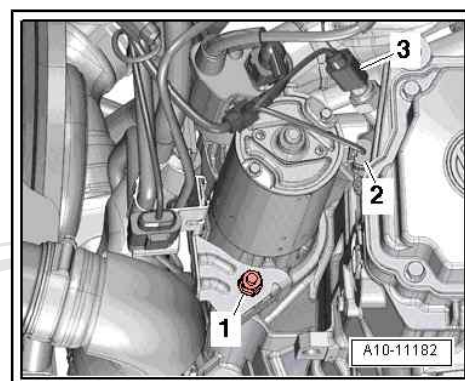


Note

Disregard -arrows-.

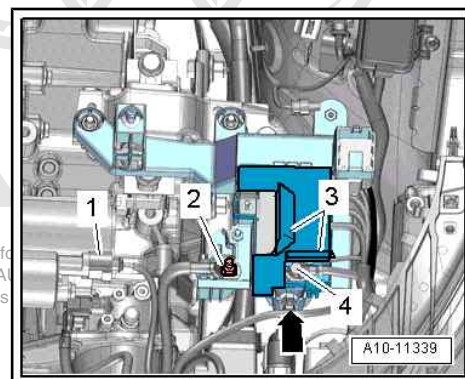


- Unplug electrical connector -2- at reversing light switch - F4- .
- Unscrew nut -1- and detach bracket for electrical wiring.

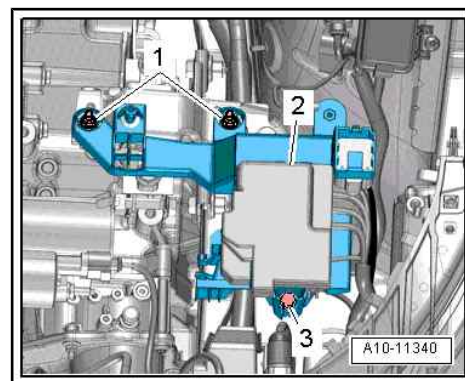


- Unplug electrical connector -1- at starter.
- Open covers -3-.
- Unscrew nut -2- and move clear electrical wiring going to starter.
- Release catches and detach retaining clip for electrical wiring.
- Unscrew nut -4- and move electrical wiring clear -arrow-.

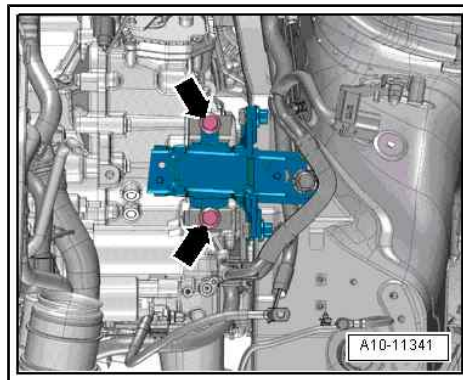
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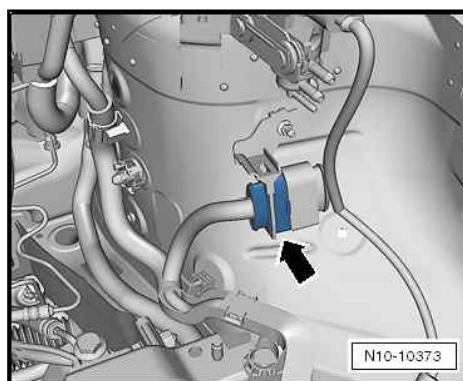
- Unscrew nut -1- and bolt -3-, and push electronics box -2- to the side.



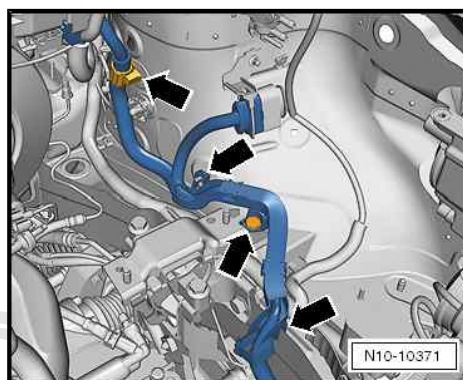
- Loosen bolts -arrows- for gearbox mounting approx. 2 turns.
- Remove engine control unit ⇒ [page 232](#) .
- Unplug electrical connector for Lambda probe at plenum chamber partition panel.



- Unplug electrical connector -arrow-.



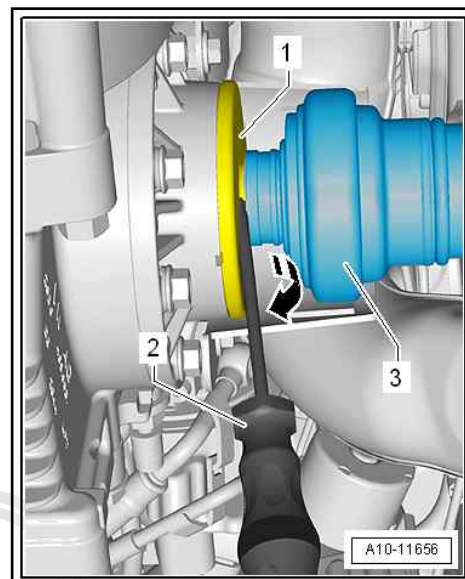
- Move engine wiring harness clear -arrows- and lay on top of engine.
- If fitted, loosen nut on bracket for front left vehicle level sender -G78- .
- Remove subframe with steering rack ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
- Unbolt drive shaft (left-side) from gearbox flange shaft and tie it up ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .
- Remove drive shaft (right-side) ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .
- Loosen but do not remove bolts with washers from support bracket for centre propshaft bearing and push propshaft towards rear as far as possible.



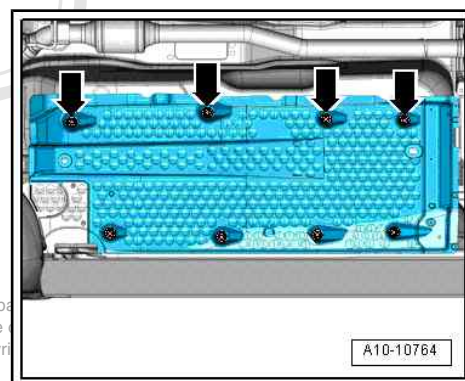
- Position a suitable flat-bladed screwdriver -2- between cover on gearbox flange -1- and propshaft -3- and press propshaft off gearbox flange by turning screwdriver 90°.

**Note**

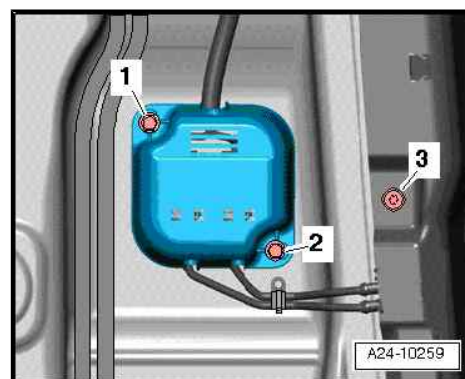
Use a screwdriver with a hexagonal shaft for greater leverage when turning using a wrench.



- Unscrew nuts -arrows- for underbody trim (right-side) and pull underbody trim downwards slightly.



- Unscrew bolts -1- and -2- at bracket for electrical connector for Lambda probe (on underbody) and remove cover.



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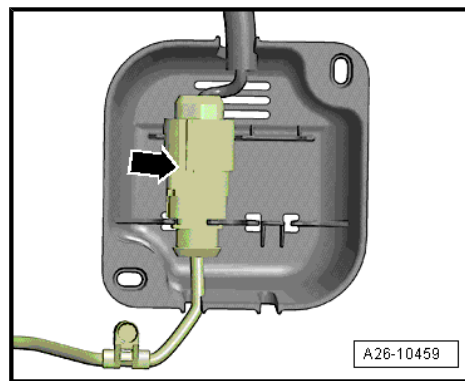
- Take plug-in connector -arrow- out of bracket.
- Unplug electrical connector for Lambda probe after catalytic converter - G130- and move clear.



Caution

Avoid 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.
- ◆ Prevent flexible joint from bending by using transportation lock for flexible joint - T10404- .

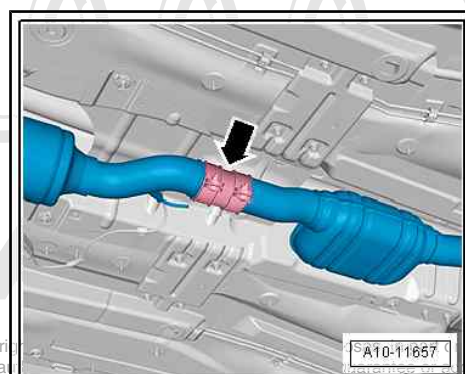


- Loosen nuts for clamp -arrow-.
- Disconnect exhaust system at clamp.



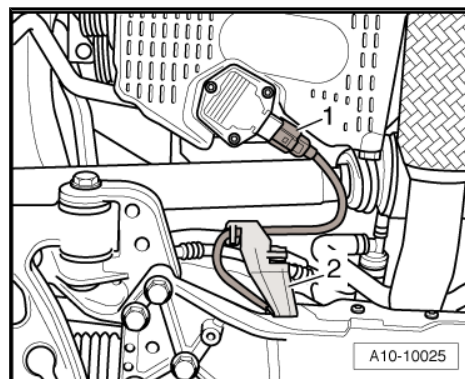
Note

Use suitable workshop equipment (transport lock) to protect flexible joint of exhaust system (front) from being stretched.



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- Unplug electrical connector -1- at oil level and oil temperature sender - G266- .

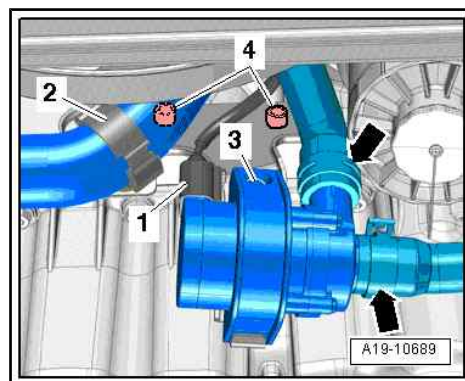


- Move coolant hose clear -2-.
- Unscrew bolts -4- and move continued coolant circulation pump - V51- to one side (coolant hoses -arrows- remain connected).



Note

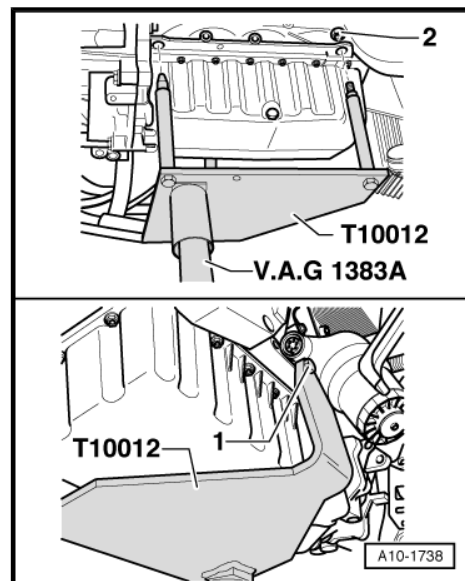
Disregard items -1- and -3-.



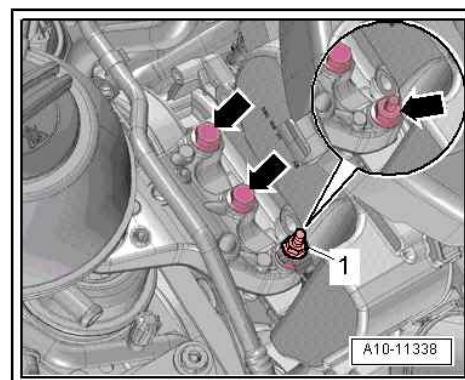
- Secure engine bracket - T10012- to cylinder block with bolt -1- and nut -2- (tightening torque: approx. 20 Nm).
- Tighten all bolts on engine support to 20 Nm.
- Insert engine and gearbox jack - V.A.G 1383 A- in engine support - T10012- and raise engine/gearbox assembly slightly.

**Note**

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



- Remove bolts -arrows- for support arm of engine mounting.

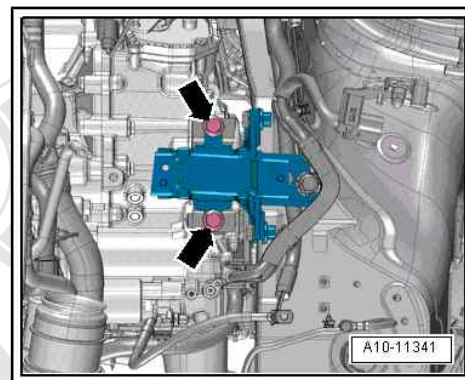


- Remove bolts -arrows- securing gearbox mounting.

**Caution**

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

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



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

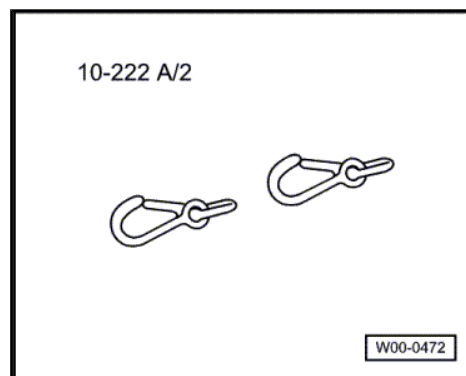
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1.2 Separating engine and gearbox

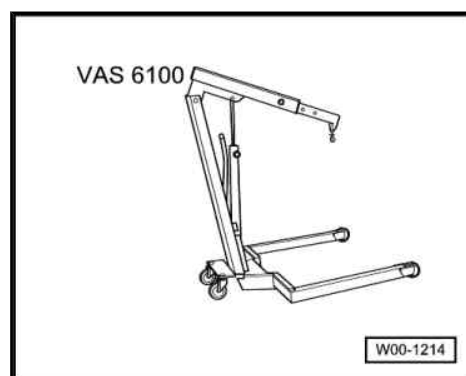
Special tools and workshop equipment required



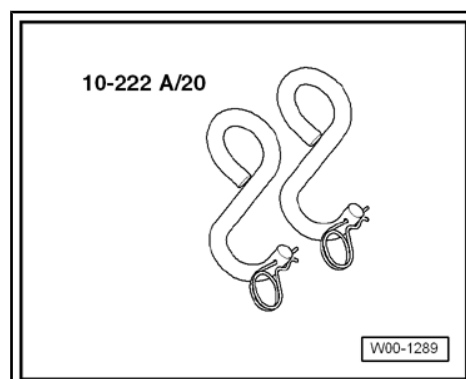
◆ Hooks - 10 - 222 A /2-



◆ Workshop hoist - VAS 6100-



◆ Hook - 10 - 222 A /22-



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Procedure

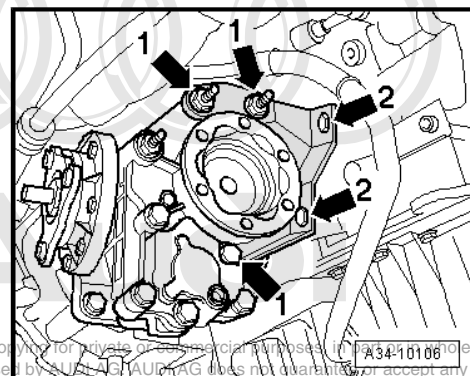
- Engine/gearbox assembly removed and attached to engine bracket - T10012- .



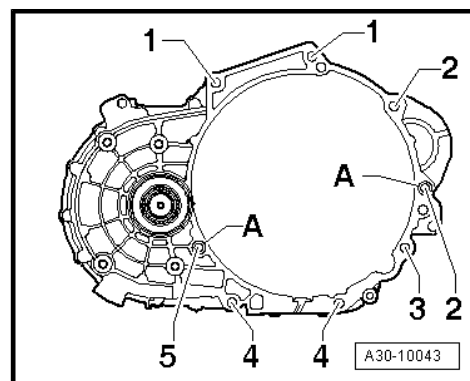
Caution

Avoid 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.**
- ◆ **Prevent flexible joint from bending by using transportation lock for flexible joint - T10404- .**



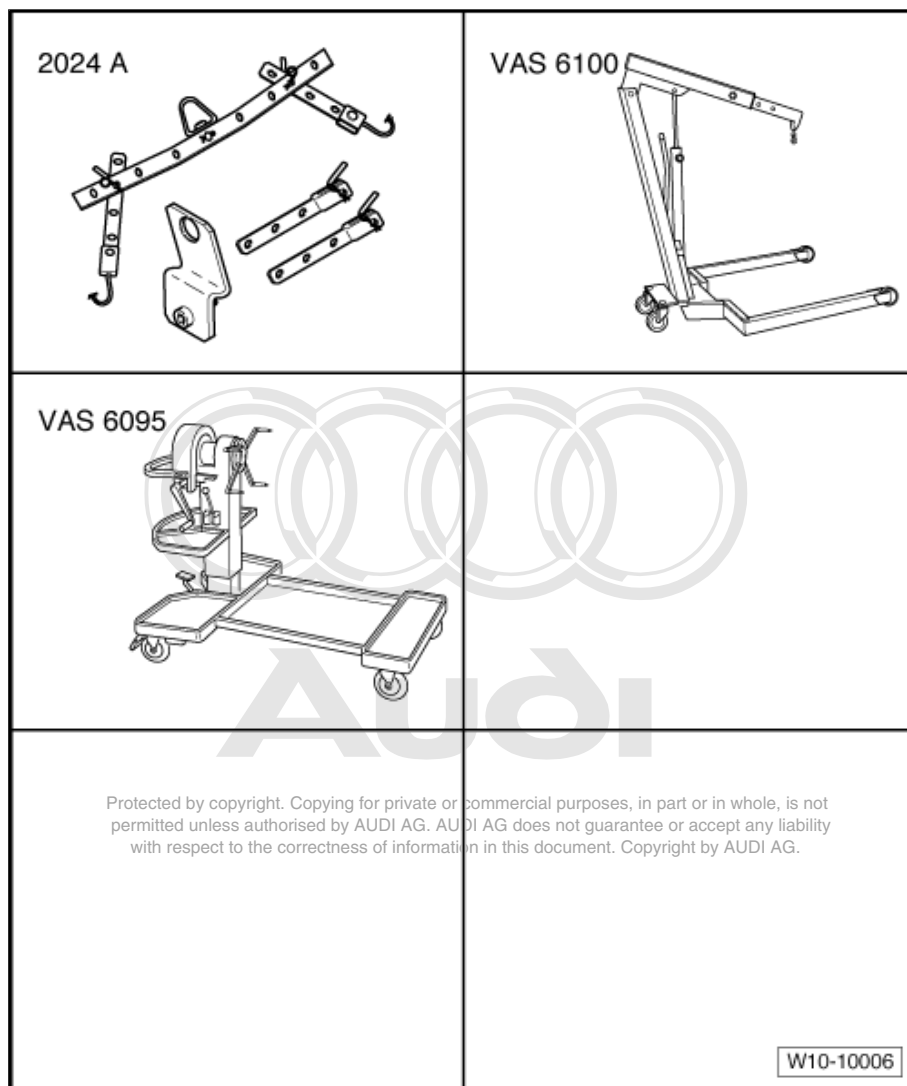
- Detach front exhaust pipe from engine ⇒ [page 241](#) .
- Unscrew bolts -1- and -2- and detach bracket for bevel box.
- Attach hook - 10 - 222 A /22- to gearbox and secure with split pin.
- Attach workshop hoist - VAS 6100- with hooks - 10 - 222 A / 2- to hook - 10 - 222 A /20- .
- Remove bolts -1 ... 5- securing gearbox to engine.
- Detach gearbox from engine.



1.3 Securing engine to engine and gearbox support

Special tools and workshop equipment required

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



Procedure

- Gearbox detached from engine.
- Attach lifting tackle - 2024 A- to engine and workshop hoist - VAS 6100- as shown in illustration.



Note

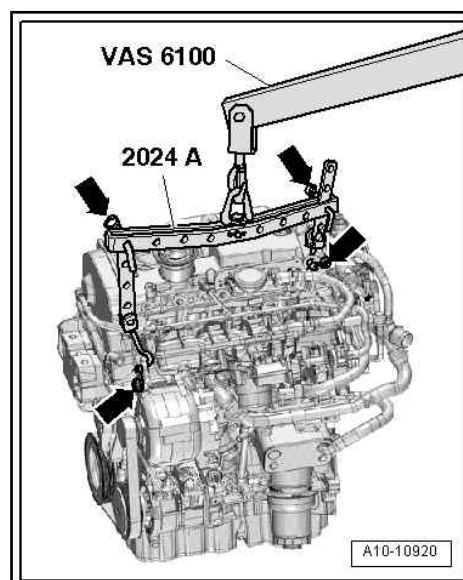
To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks must be positioned as shown.



WARNING

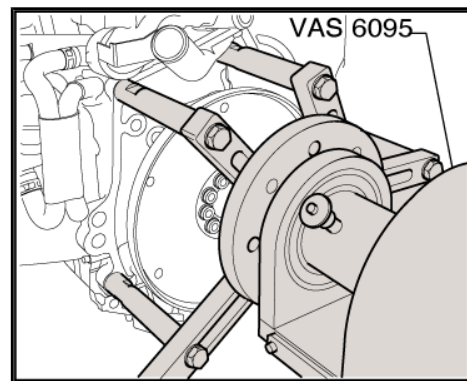
Accident risk from loose components of lifting tackle.

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



- Lift engine off engine bracket - T10012- using workshop hoist - VAS 6100- .

- Secure engine to engine and gearbox support - VAS 6095- (gearbox end) as shown in illustration.



1.4 Installing engine

Tightening torques



Note

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

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	22
	M10	40
	M12	65
Except for the following:		
Earth cable		22

- ◆ Assembly mountings
⇒ ["2.1 Exploded view - assembly mountings", page 26](#)
- ◆ Securing gearbox to engine ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox

Procedure

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

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Note

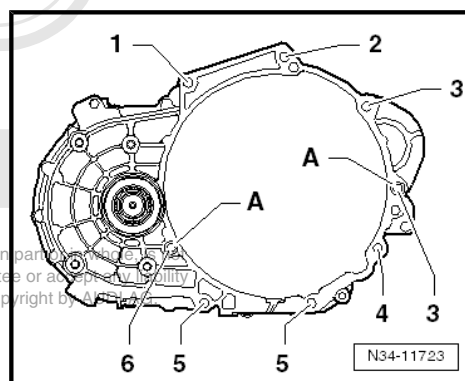
- ◆ *Renew self-locking nuts and bolts.*
- ◆ *Renew bolts which are tightened to a specified angle as well as seals and gaskets.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- ◆ *Fit cable ties in the same locations when installing.*
- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease for clutch plate splines - G 000 100- to the splines. Then move clutch plate back and forth on input shaft until the hub moves smoothly on the shaft. Remove any excess grease ⇒ Electronic parts catalogue .
- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.



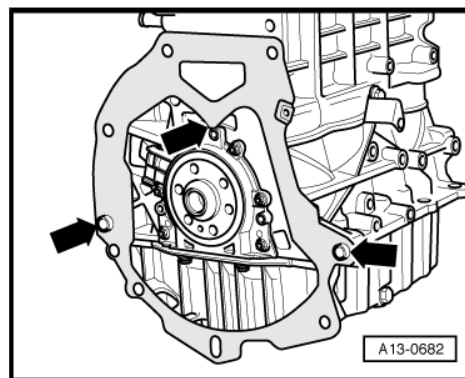
Note

If dowel sleeves are not fitted, this will lead to difficulty shifting gears, clutch problems and noises from the gearbox (rattling of loose gears).

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- Ensure that intermediate plate is engaged on sealing flange -top arrow- and pushed onto dowel sleeves -bottom arrows-.
- Renew clutch release bearing if worn ⇒ Rep. gr. 30 ; Clutch mechanism; Servicing clutch mechanism .
- Make sure that clutch plate is properly centred.
- Secure gearbox to engine.

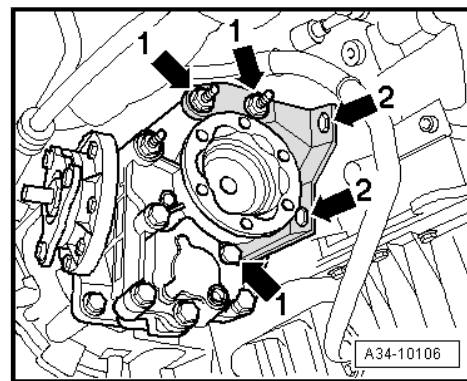


- Secure bracket for bevel box ⇒ Rep. gr. 34 ; Bevel box .
- Install front exhaust pipe ⇒ [page 241](#) .

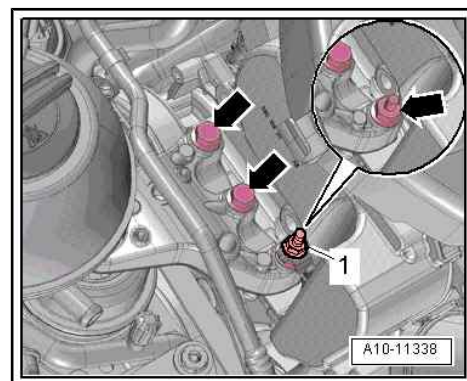
**Caution**

Avoid 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.*
- ◆ *Prevent flexible joint from bending by using transportation lock for flexible joint - T10404- .*

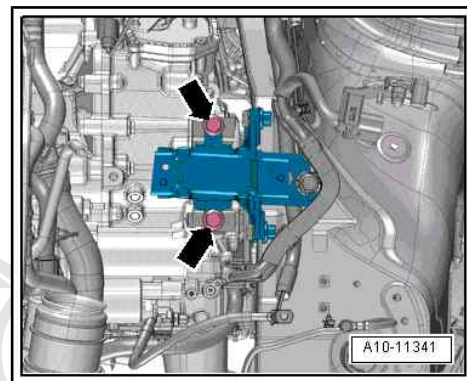


- Use suitable workshop equipment (transport lock) to protect flexible joint of exhaust system (front) from being stretched.
- Guide engine/gearbox assembly into body.
- Initially hand-tighten bolts -arrows- for support arm of engine mounting as far as stop.



- Initially screw in bolts -arrows- for gearbox mounting by hand until they make contact.

Further installation steps are carried out in the reverse sequence of removal.



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2 Assembly mountings

⇒ "2.1 Exploded view - assembly mountings", page 26

⇒ "2.2 Removing and installing engine mountings", page 27

⇒ "2.3 Removing and installing gearbox mounting", page 30

⇒ "2.4 Removing and installing pendulum support", page 32

2.1 Exploded view - assembly mountings

1 - Console for engine mounting

- ☐ to engine

2 - Bolt

- ☐ Support bracket for engine mounting to engine
- ☐ 40 Nm

3 - Engine mounting

- ☐ Removing and installing
⇒ page 27

4 - Bolt

- ☐ Engine mounting to body
- ☐ Renew
- ☐ 20 Nm + 90°

5 - Support arm

- ☐ Engine mounting to console for engine mounting

6 - Nut

- ☐ Do not loosen unless renewing engine mounting - item 3-
- ☐ Renew
- ☐ 40 Nm + 90°

7 - Threaded pin

- ☐ Renew
- ☐ 30 Nm + 90°

8 - Bolt

- ☐ Renew
- ☐ 30 Nm + 90°

9 - Pendulum support

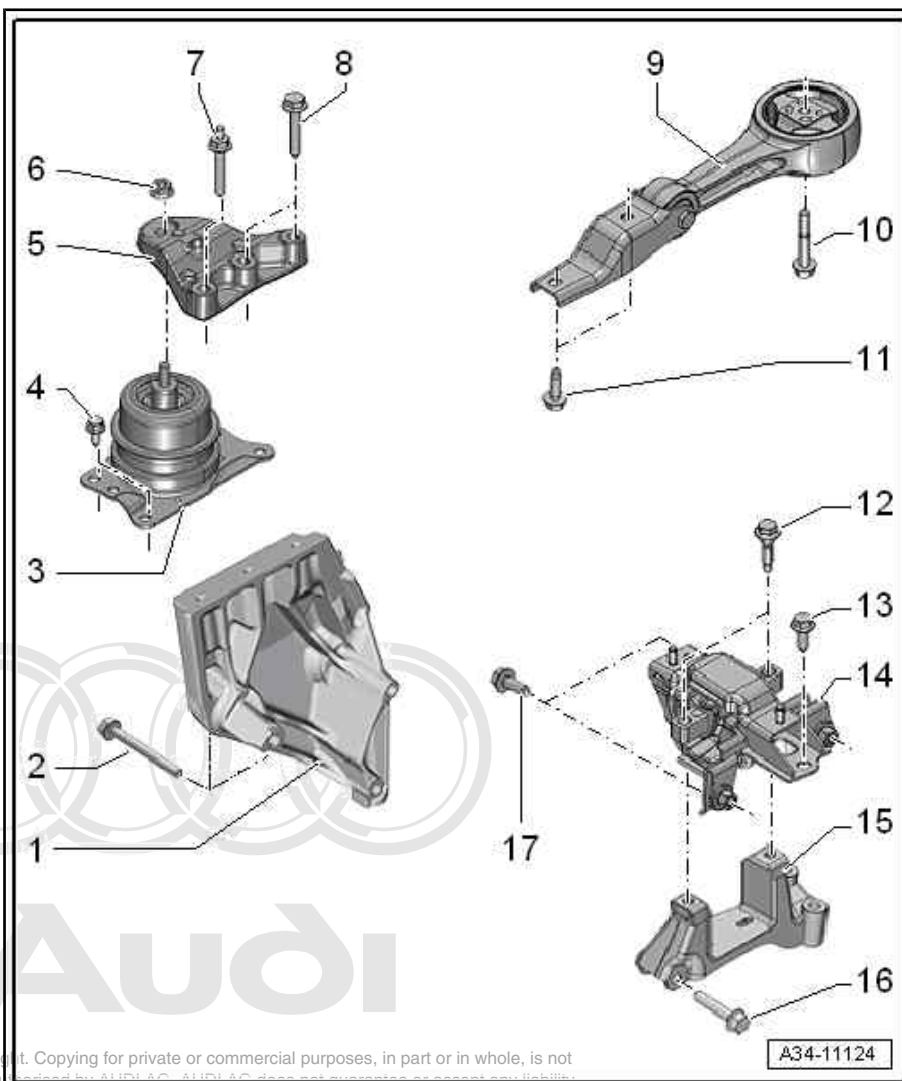
- ☐ Removing and installing ⇒ page 32

10 - Bolt

- ☐ Pendulum support to subframe
- ☐ Renew
- ☐ 40 Nm + 90°

11 - Bolt

- ☐ Pendulum support to gearbox
- ☐ Renew



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- ☐ 30 Nm + 90°

12 - Bolt

- ☐ Gearbox mounting to gearbox support
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

13 - Bolt

- ☐ Gearbox mounting to body
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

14 - Gearbox mounting

- ☐ Removing and installing ⇒ [page 30](#)

15 - Gearbox support

- ☐ Removing and installing ⇒ [“2.3 Removing and installing gearbox mounting”, page 30](#)

16 - Bolt

- ☐ Gearbox support to gearbox
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

17 - Bolt

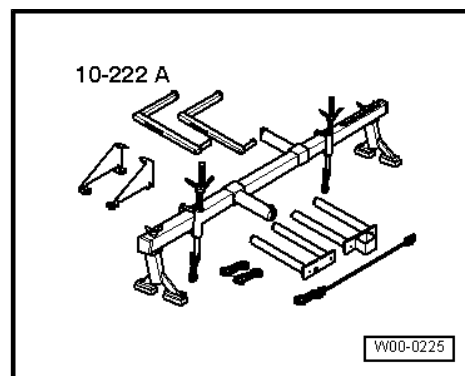
- ☐ Gearbox mounting to body
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

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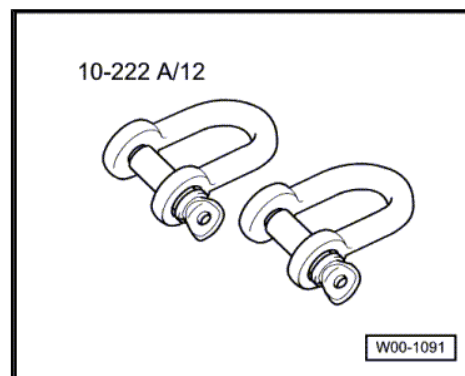
2.2 Removing and installing engine mountings

Special tools and workshop equipment required

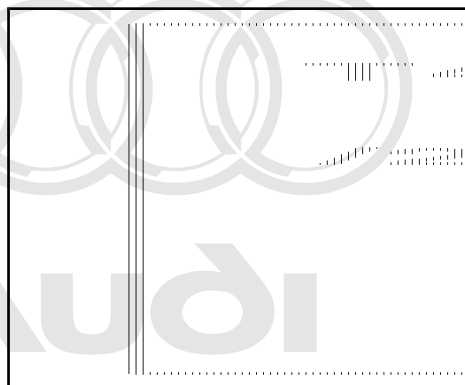
- ◆ Support bracket - 10 - 222 A-



- ◆ Shackle - 10 - 222 A /12-



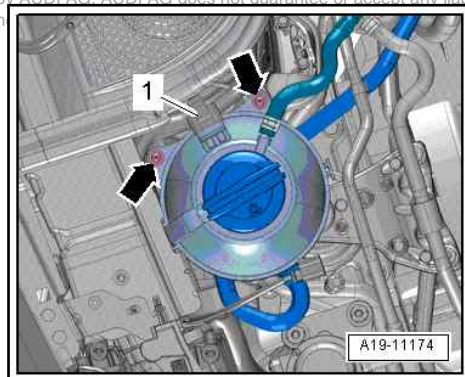
◆ Adapter -T40093/6- (2x)



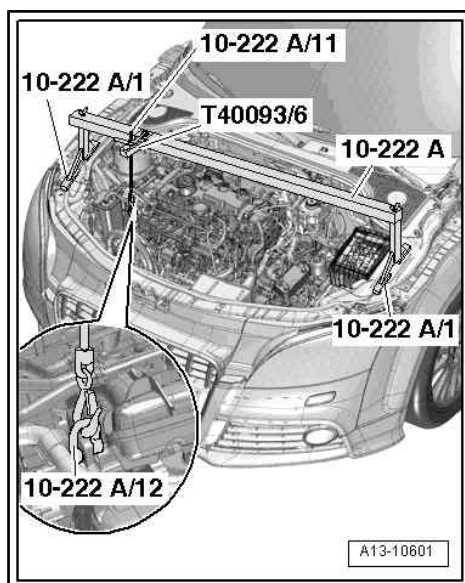
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Removing

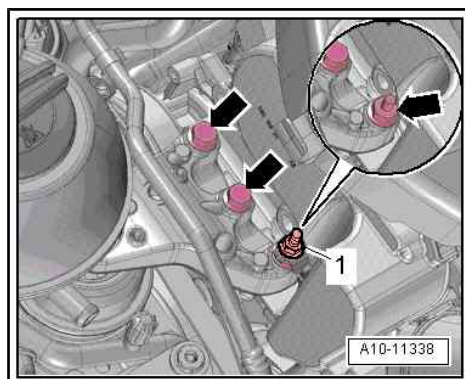
- Remove engine cover panel ⇒ [page 33](#) .
- Remove bolts -arrows-.
- Detach electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.



- Position support bracket - 10 - 222 A- on top of body flanges using the following tools:
 - ◆ Rack - 10 - 222 A /1- (2x)
 - ◆ Spindle - 10 - 222 A /11-
 - ◆ Shackle - 10 - 222 A /12-
 - ◆ Adapter -T40093/6- (2x)
- Hook spindle - 10 - 222 A /11- with shackle - 10 - 222 A /12- onto engine lifting eye.
- Take up weight of engine/gearbox assembly by tightening spindle.
- Attach hook of spindle - 10 - 222 A /11- to engine lifting eye.
- Apply light tension to spindle.



- Remove nut -1- and move earth wire clear.



- Remove bolts -arrows- for support arm of engine mounting.

**WARNING**

Risk of accident.

- ◆ *Do not loosen nut -1- unless renewing engine mounting.*

- Remove bolts -arrows- and detach engine mounting.

Installing

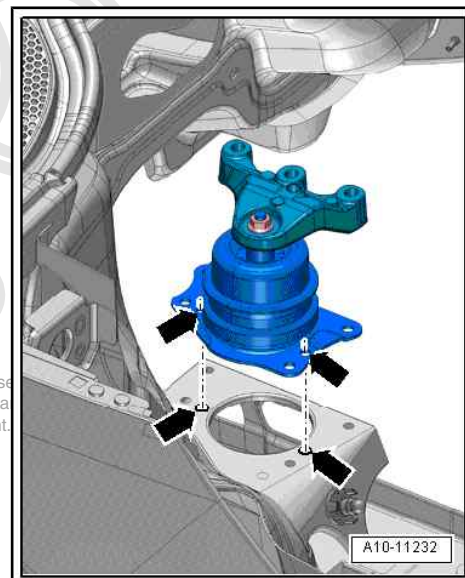
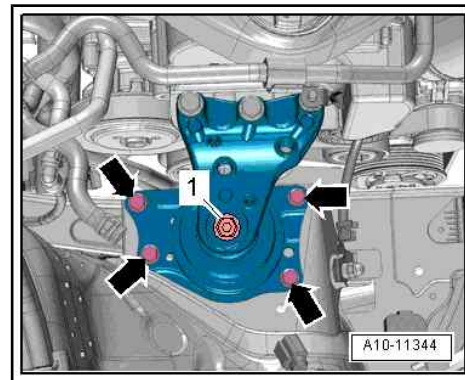
Installation is carried out in the reverse order; note the following:

**Note**

Renew bolts tightened with specified tightening angle.

- Fit engine mounting on longitudinal member.
- The positioning holes -arrows- must align. If necessary, check with suitable drill bit.

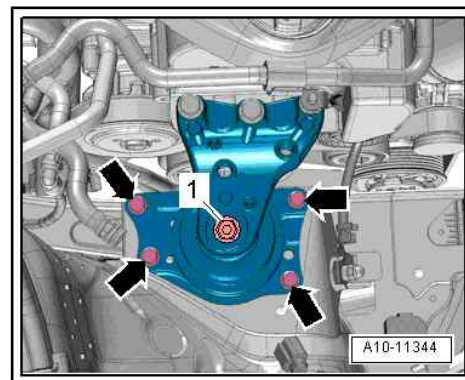
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- Initially screw in bolts -arrows- by hand until they make contact.
- Tighten bolts.

**Note**

Disregard -item 1-.



- Initially hand-tighten bolts -arrows- for support arm of engine mounting as far as stop.
- The support arm must not turn when you tighten the bolts.
- Tighten bolts.



Note

Disregard -item 1-.

- Install engine cover panel ⇒ [page 33](#) .

Tightening torques

- ♦ ⇒ ["2.1 Exploded view - assembly mountings", page 26](#)

2.3 Removing and installing gearbox mounting

Special tools and workshop equipment required

- ♦ Shackle - 10 - 222 A /12-



10-222 A/12



W00-11341

- ♦ Workshop hoist - VAS 6100-

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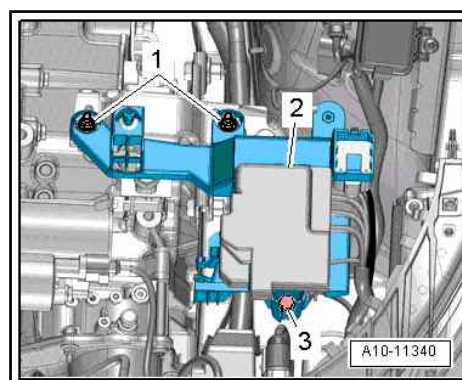
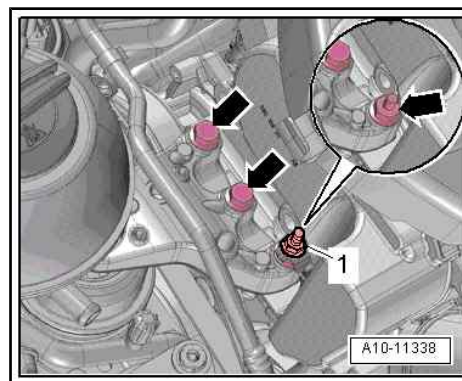
VAS 6100



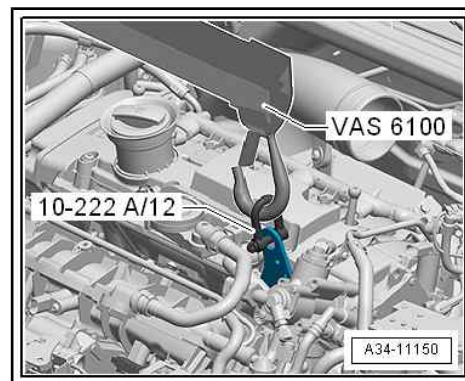
W00-11307

Removing

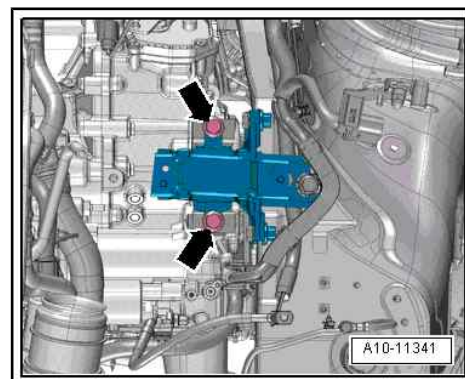
- Remove air cleaner housing ⇒ [page 195](#) .
- Unscrew nuts -1- and bolt -3-, and push electronics box -2- to the side.



- Fit shackle - 10 - 222 A /12- into engine lifting eye (left-side).
- Attach hook of workshop hoist - VAS 6100- to shackle and take up weight of engine/gearbox assembly slightly (do not lift).



- Remove bolts -arrows- securing gearbox mounting.



- Remove bolts -arrows A, B, C- and detach gearbox mounting.

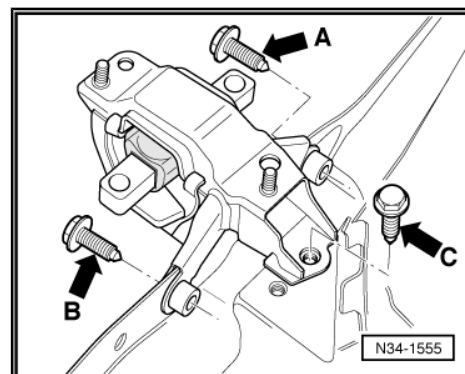
Installing

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



Note

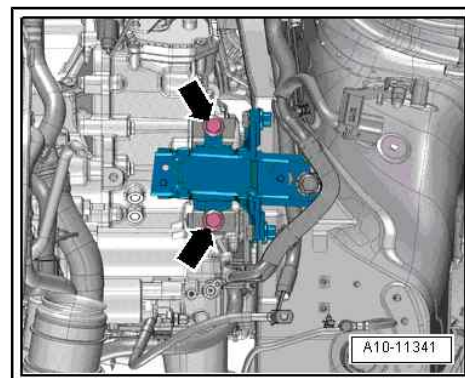
Renew the bolts tightened with specified tightening angle.



Caution

Bolts must be fitted straight to avoid damage to threads in gearbox bracket.

- ◆ **Gearbox bracket and gearbox mounting must be perfectly parallel to each other before screwing in bolts -arrows-. If necessary, lift gearbox at rear using trolley jack.**
- ◆ **Only remove workshop hoist - VAS 6100- when bolts -arrows- on assembly mounting have been tightened to specified torque.**



- Install air cleaner housing ⇒ [page 195](#) .

Tightening torques

- ◆ Gearbox mounting: tightening torque and sequence ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

2.4 Removing and installing pendulum support

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



WARNING

Risk of accident.

- ◆ **Do NOT loosen bolted connection -1-.**

- Remove bolts -arrows-.
- Pull pendulum support out of subframe.

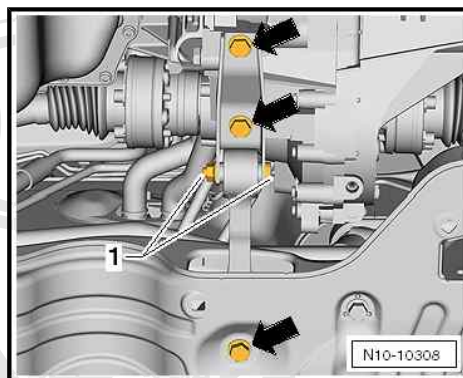
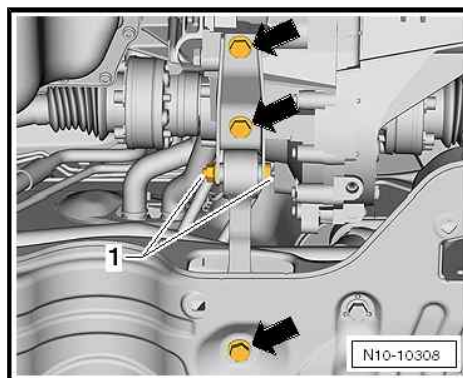
Installing

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

- Secure pendulum support first to gearbox and then to subframe.

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 26](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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3 Engine cover panel

⇒ **"3.1 Removing and installing engine cover panel", page 33**

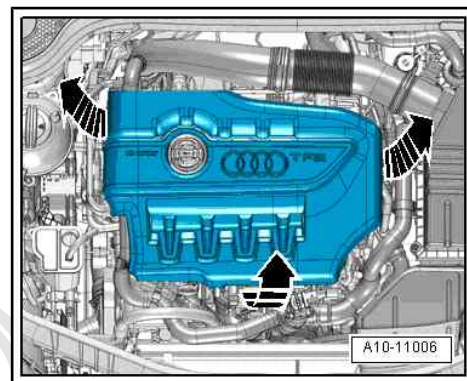
3.1 Removing and installing engine cover panel

Removing

- Carefully lift engine cover panel off mountings -arrows-.

Installing

- Press engine cover panel carefully back into its mountings.
- To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.



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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ [“1.1 Exploded view - cylinder block \(pulley end\)”, page 34](#)

⇒ [“1.2 Exploded view - sealing flange \(pulley end\)”, page 36](#)

⇒ [“1.3 Removing and installing poly V-belt”, page 37](#)

⇒ [“1.4 Removing and installing tensioner for poly V-belt”, page 39](#)

⇒ [“1.5 Removing and installing vibration damper”, page 40](#)

⇒ [“1.6 Removing and installing bracket for ancillaries”, page 40](#)

⇒ [“1.7 Renewing crankshaft oil seal \(pulley end\)”, page 41](#)

⇒ [“1.8 Removing and installing sealing flange \(pulley end\)”, page 43](#)

1.1 Exploded view - cylinder block (pulley end)

1 - Vibration damper

- ☐ With poly V-belt pulley
- ☐ Removing and installing
⇒ [page 40](#)
- ☐ Can only be installed in one position

2 - Bolt

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

3 - Bolt

- ☐ 23 Nm

4 - Poly V-belt tensioner

- ☐ Lock with locking pin - T10060 A-
- ☐ Removing and installing
⇒ [page 39](#)

5 - Bracket for ancillaries

- ☐ Removing and installing
⇒ [page 40](#)

6 - Bolt

- ☐ Exploded view ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator

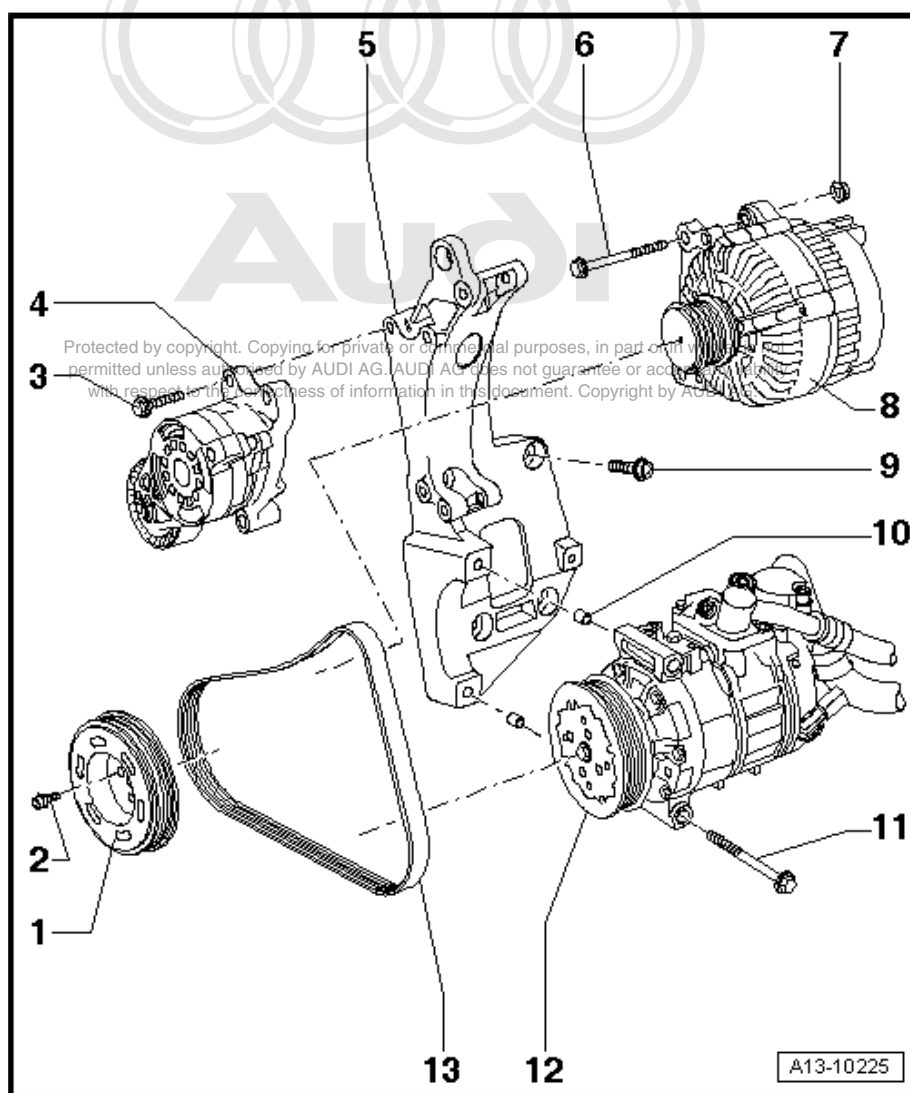
7 - Sliding bush

8 - Alternator

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

9 - Bolt

- ☐ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue



- ☐ Tightening torque and sequence ⇒ [page 35](#)

10 - Bush

- ☐ 2x

11 - Bolt

- ☐ Exploded view ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

12 - Air conditioner compressor

- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

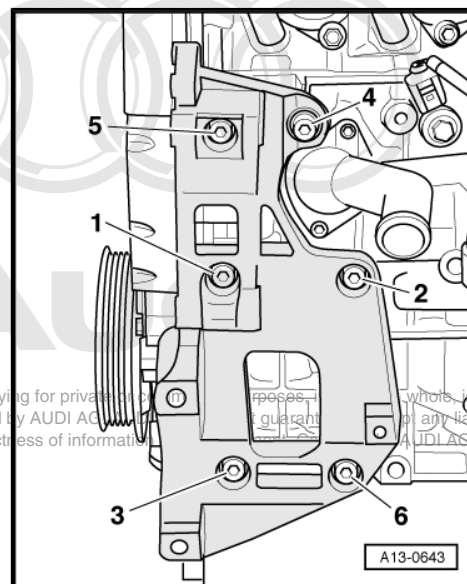
13 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Removing and installing ⇒ [page 37](#)
- ☐ Do not kink
- ☐ When installing, make sure it is properly seated on pulleys

Bracket for ancillaries - tightening torque and tightening sequence

- Tighten bolts in the sequence -1 ... 6- in 2 stages as follows:

1. Screw in bolts by hand until they make contact.
2. Tighten to 40 Nm.



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1.2 Exploded view - sealing flange (pulley end)

1 - Bolt

- ❑ Tightening torque
⇒ [Item 20 \(page 66\)](#)

2 - Crankshaft sprocket

- ❑ Contact surface to crankshaft must be free of oil
- ❑ Can only be installed in one position

3 - Diamond-coated washer

- ❑ Between toothed belt sprocket and crankshaft
- ❑ Renew washer if toothed belt sprocket is removed

4 - Oil seal

- ❑ For crankshaft (pulley end)
- ❑ Renewing ⇒ [page 41](#)
- ❑ Do not lubricate with oil prior to installation. This is not permitted unless authorised by AUDI.

5 - Sealing flange (pulley end)

- ❑ Should be positioned on dowel pins
- ❑ Removing and installing
⇒ [page 43](#)

6 - Bolt

- ❑ Tightening torque
⇒ [Item 12 \(page 65\)](#)

7 - Damper wheel

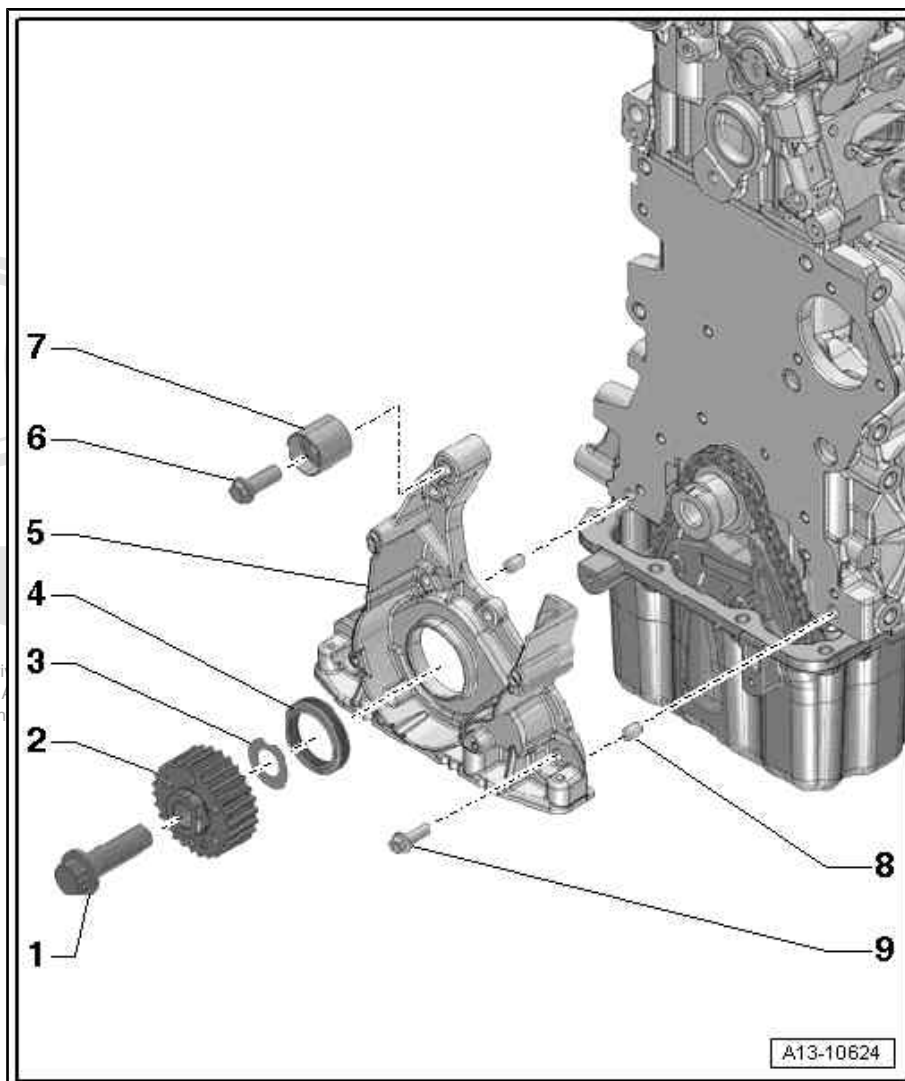
- ❑ For toothed belt

8 - Dowel pin

- ❑ 2x

9 - Bolt

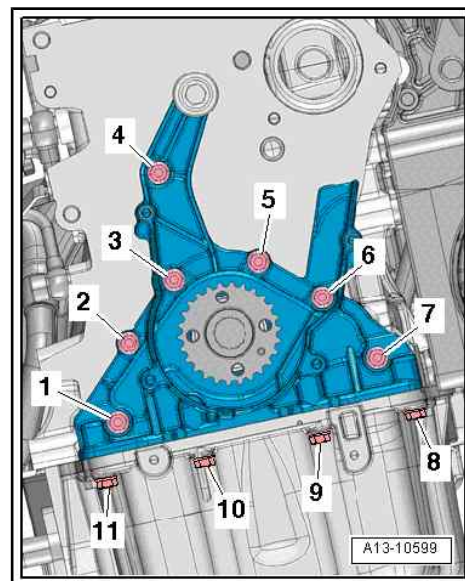
- ❑ Tightening torque and sequence ⇒ [page 37](#)



Sealing flange (pulley end) - tightening torque and sequence

– Tighten bolts -1 ... 11- in 3 stages as follows:

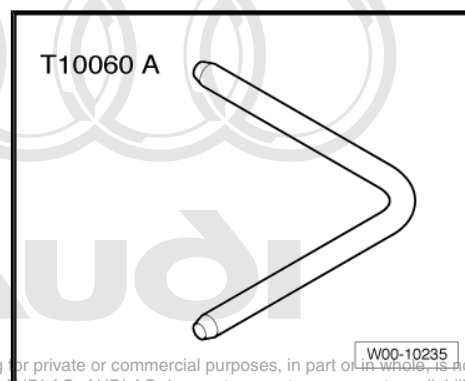
1. Hand-tighten bolts -1 ... 11- until they make contact.
2. Tighten bolts -1 ... 7- in diagonal sequence and in stages to 15 Nm.
3. Tighten bolts -8 ... 11- to 15 Nm.



1.3 Removing and installing poly V-belt

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-



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Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

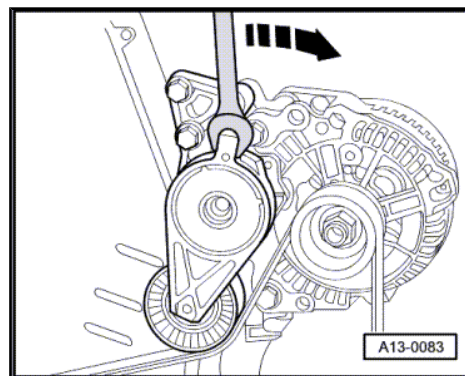


Caution

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 clockwise direction -arrow-.

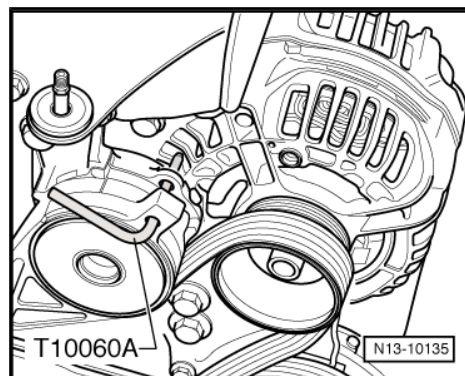


- Secure tensioner with locking pin - T10060 A-
- Take off poly V-belt.

Installing

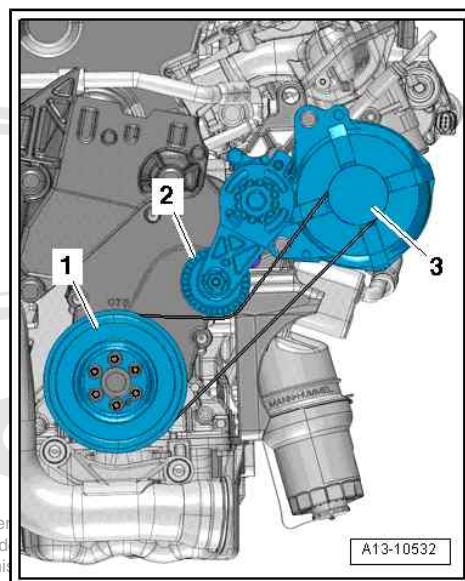
Installation is carried out in the reverse order; note the following:

- Fit poly V-belt on poly V-belt pulleys (on alternator pulley last).



Vehicles not equipped with air conditioning:

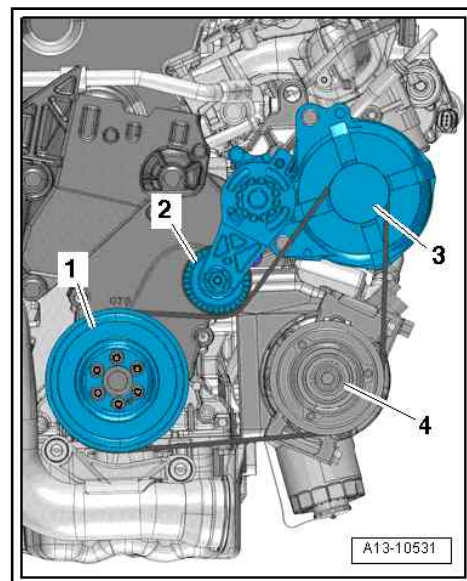
- 1 - Crankshaft
- 2 - Tensioner
- 3 - Alternator



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Vehicles with air conditioning:

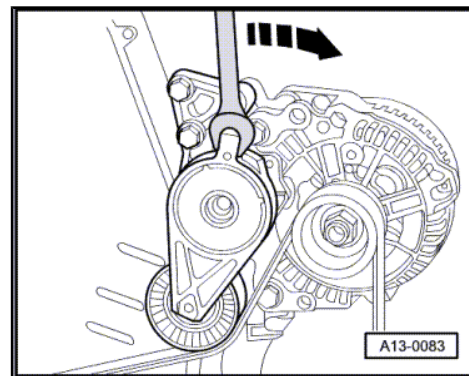
- 1 - Crankshaft
- 2 - Tensioner
- 3 - Alternator
- 4 - Air conditioner compressor

**All vehicles (continued):**

- Swivel tensioner fractionally clockwise -arrow-, remove locking pin - T10060 A- and release tensioner.
- Check that poly V-belt is properly seated.
- Start engine and check that belt runs properly.

Tightening torques

- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



1.4 Removing and installing tensioner for poly V-belt

Removing

- Remove poly V-belt ⇒ [page 37](#) .

**Note**

The tensioner is not locked.

- Remove bolts -arrows- and take off tensioner for poly V-belt.

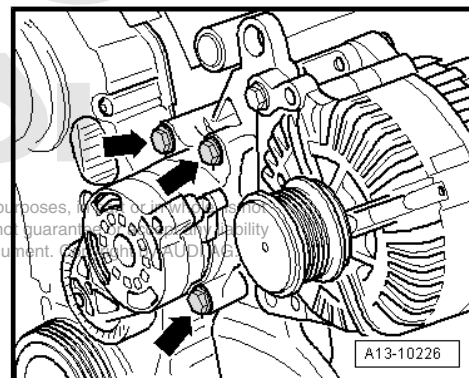
Installing

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

- Install poly V-belt ⇒ [page 37](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - cylinder block \(pulley end\)"](#), [page 34](#)



1.5 Removing and installing vibration damper

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing 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 (front) .
- Remove poly V-belt ⇒ [page 37](#) .
- Slacken bolts for vibration damper and remove (counterhold with ring spanner).

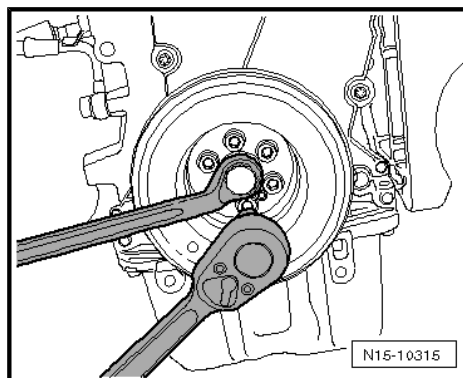
Installing

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



Note

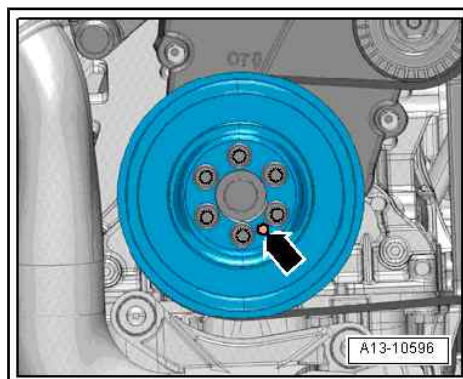
Renew bolts for vibration damper.



- The vibration damper can only be installed in one position. The hole -arrow- in the vibration damper must be located over the projection on the toothed belt sprocket.
- Install poly V-belt ⇒ [page 40](#) .

Tightening torques

- ♦ ⇒ ["1.1 Exploded view - cylinder block \(pulley end\)", page 34](#)
- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)
- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



1.6 Removing and installing bracket for ancillaries

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove poly V-belt tensioner ⇒ [page 39](#) .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove front wheel housing liner (right-side) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front)

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Vehicles with air conditioning:

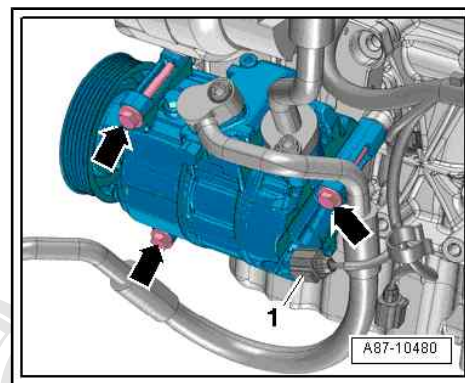
- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**Caution**

Danger of damage to refrigerant lines and hoses.

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

- Remove bolts -arrows-.
- Detach air conditioner compressor from bracket and tie up to lock carrier.

**All vehicles (continued):**

- Remove bolts -1 ... 6- and detach bracket for ancillaries.

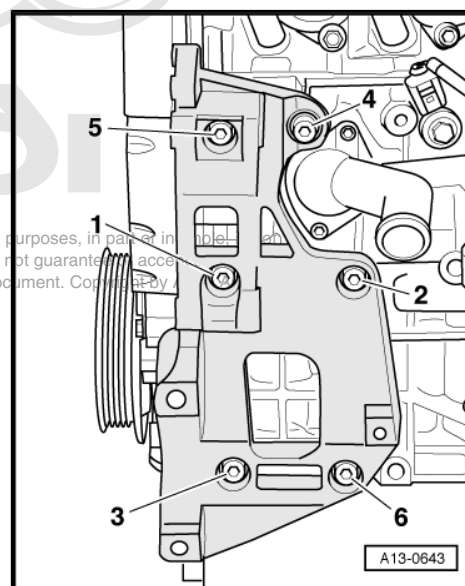
Installing

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

- Install poly V-belt tensioner ⇒ [page 39](#) .

Tightening torques

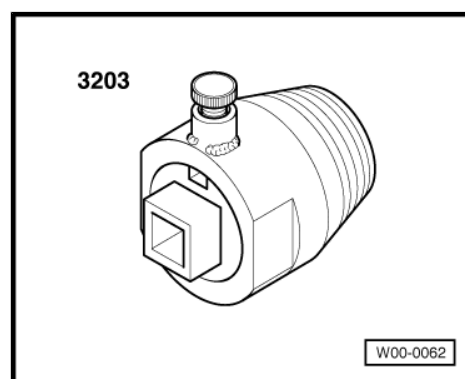
- ◆ ⇒ Fig. “Bracket for ancillaries - tightening torque and tightening sequence”, [page 35](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



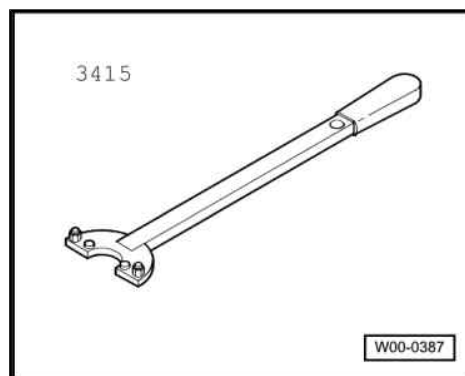
1.7 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

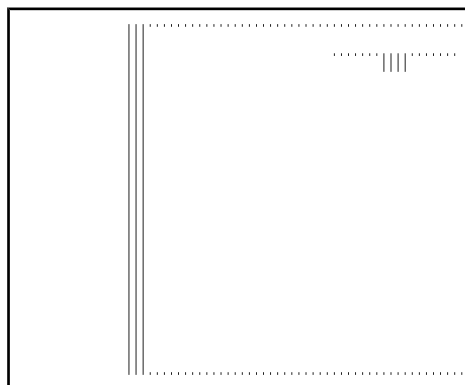
- ◆ Oil seal extractor - 3203-



◆ Counterhold tool - 3415-

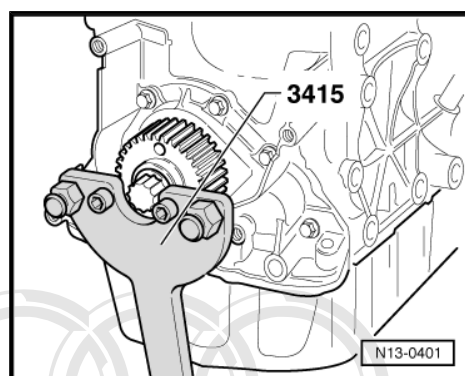


◆ Assembly tool - T10053-

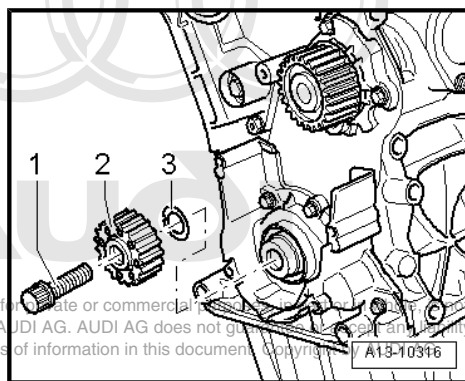


Procedure

- Remove toothed belt → [page 66](#) .
- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .

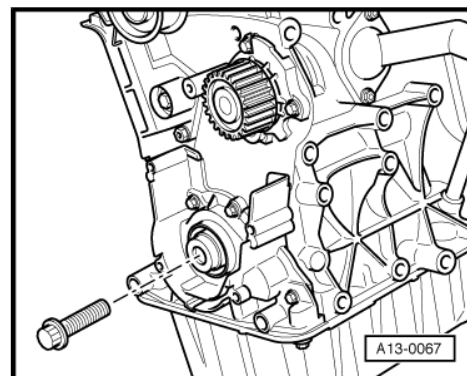


- Unscrew bolt -1- and detach crankshaft sprocket -2- and diamond-coated washer -3-



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- To guide oil seal extractor, screw bolt for toothed belt sprocket into crankshaft onto stop by hand.



- Screw inner section of oil seal extractor -3203- nine turns (approx. 20 mm) out of outer section and lock 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.

- **Remove bolt for crankshaft sprocket**

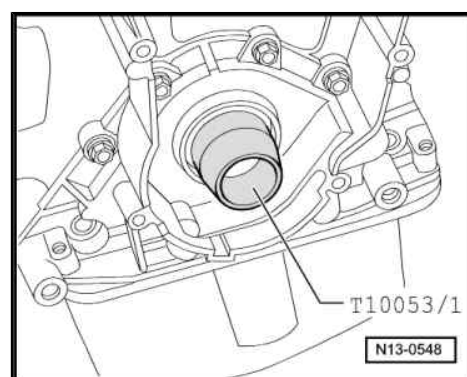
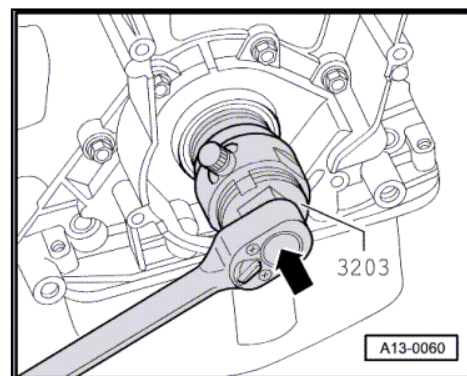
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.

- Clean contact surface and sealing surface for oil seal.

- Remove oil residue from crankshaft journal with a clean cloth.

- Fit guide sleeve -T10053/1- onto crankshaft journal.

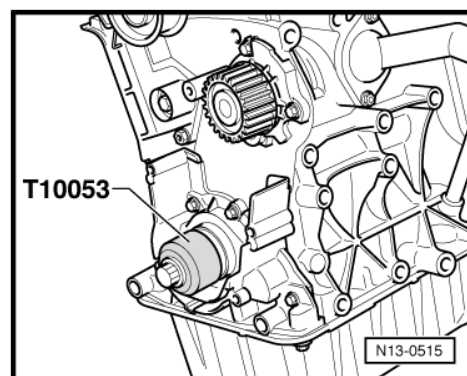
- Push oil seal over guide sleeve onto crankshaft journal.



- Press in oil seal using bolt for crankshaft sprocket and thrust sleeve of assembly tool - T10053- until flush.

- Install crankshaft sprocket ⇒ [page 66](#) .

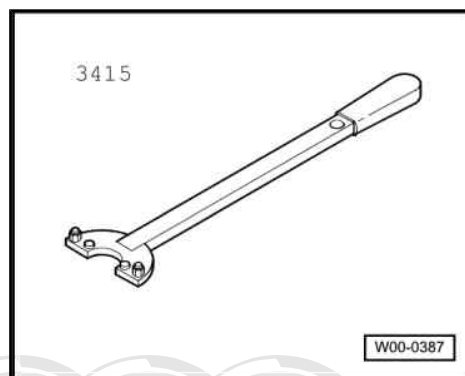
- Install toothed belt (adjust valve timing) ⇒ [page 71](#) .



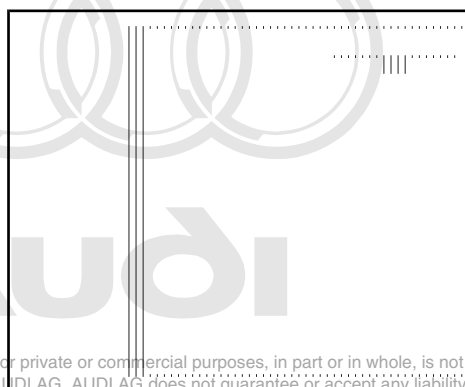
1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

- ◆ Counterhold tool - 3415-



- ◆ Assembly tool - T10053-

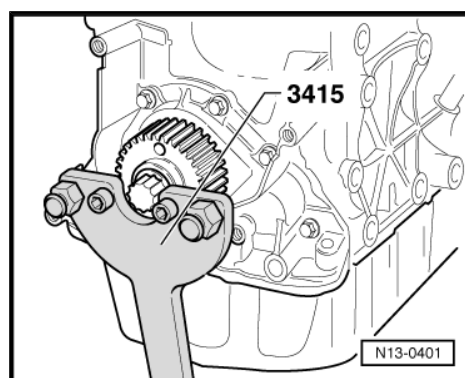


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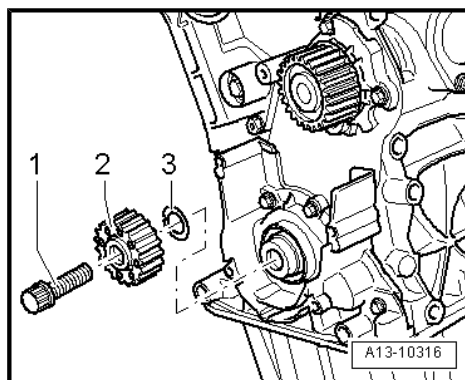
- ◆ Electric drill with plastic brush
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove toothed belt ⇒ [page 66](#) .
- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .



- Unscrew bolt -1- and detach crankshaft sprocket -2- and diamond-coated washer -3-



- Remove bolts -1 ... 11-.
- Carefully lever off sealing flange.
- If necessary, unscrew damper wheel from sealing flange
⇒ [page 65](#) .

Installing

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

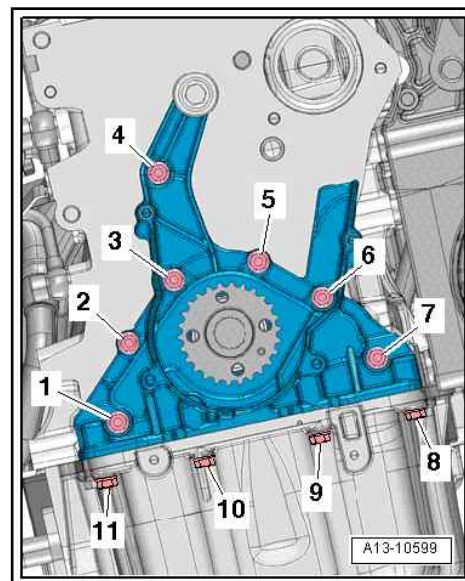


Caution

Make sure sealant residue does not enter lubrication system.

- ◆ ***Place a clean cloth over the exposed section of the sump.***

- Carefully remove sealant residue on cylinder block and sump.

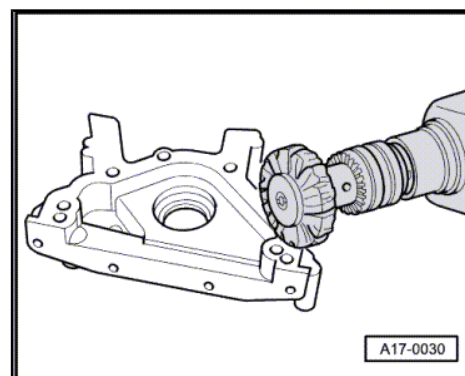


WARNING

Risk of eye injury.

- ◆ ***Wear safety goggles.***

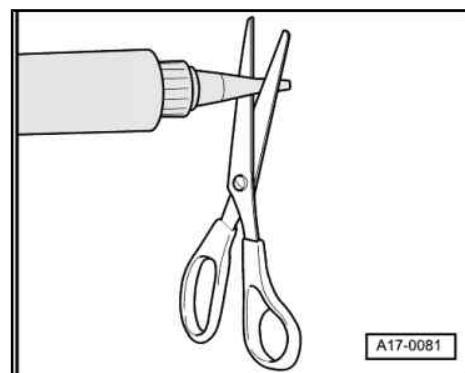
- Use e.g. rotating plastic brush to remove sealant residue on sealing flange.
- Clean sealing surfaces; they must be free of oil and grease.



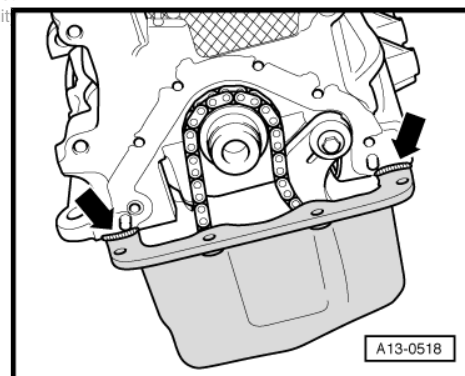
Note

Note the use-by date of the sealant.

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



- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.





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 sealing flange as illustrated.
- Thickness of sealant bead: 2 ... 3 mm
- Apply a thin coat of sealant to bottom sealing surface -shaded- on sealing flange.



Note

The sealing flange must be installed within 5 minutes after applying the sealant.

- Carefully fit sealing flange onto dowel pins in cylinder block.



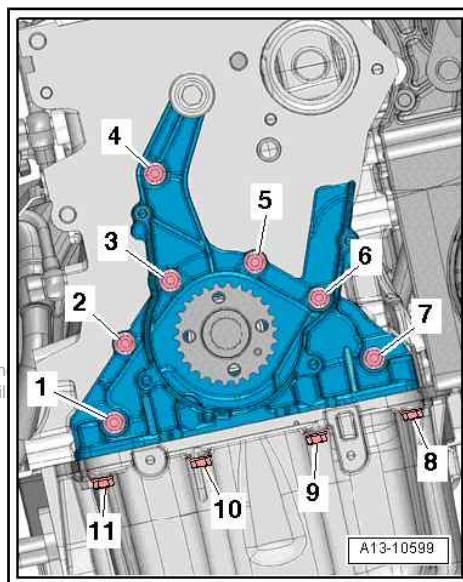
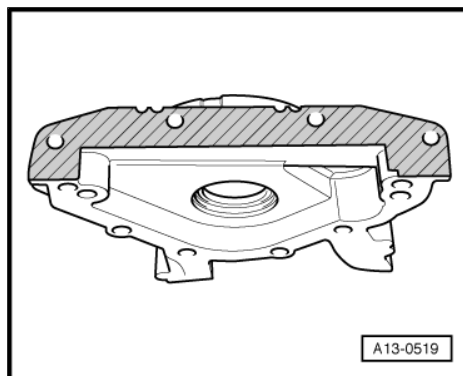
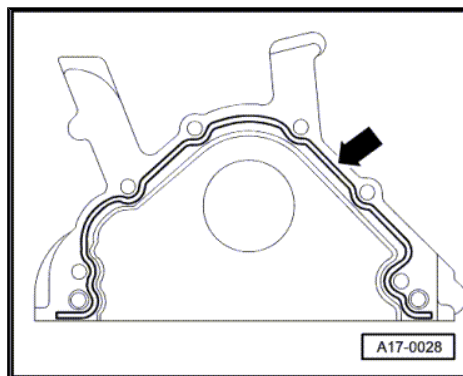
Note

Use guide sleeve -T10053/1- to attach sealing flange with oil seal fitted.

- Tighten sealing flange ⇒ [page 37](#) .
- Install crankshaft sprocket ⇒ [page 66](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 71](#) .

Tightening torques

- ◆ ⇒ [Fig. "Sealing flange \(pulley end\) - tightening torque and sequence"](#) , [page 37](#)



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2 Cylinder block (gearbox end)

⇒ "2.1 Exploded view - cylinder block (gearbox end)", page 47

⇒ "2.2 Removing and installing flywheel", page 48

⇒ "2.3 Removing and installing sealing flange (gearbox end)", page 49

2.1 Exploded view - cylinder block (gearbox end)



Note

- ◆ When performing assembly work, secure engine to engine and gearbox support ⇒ [page 21](#).
- ◆ Servicing clutch ⇒ Rep. gr. 30; Clutch; Exploded view - clutch

1 - Bolt

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

2 - Dual-mass flywheel

- ☐ Removing and installing ⇒ [page 48](#)
- ☐ Can only be installed in one position (holes are off-set)

3 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 48](#)

4 - Intermediate plate

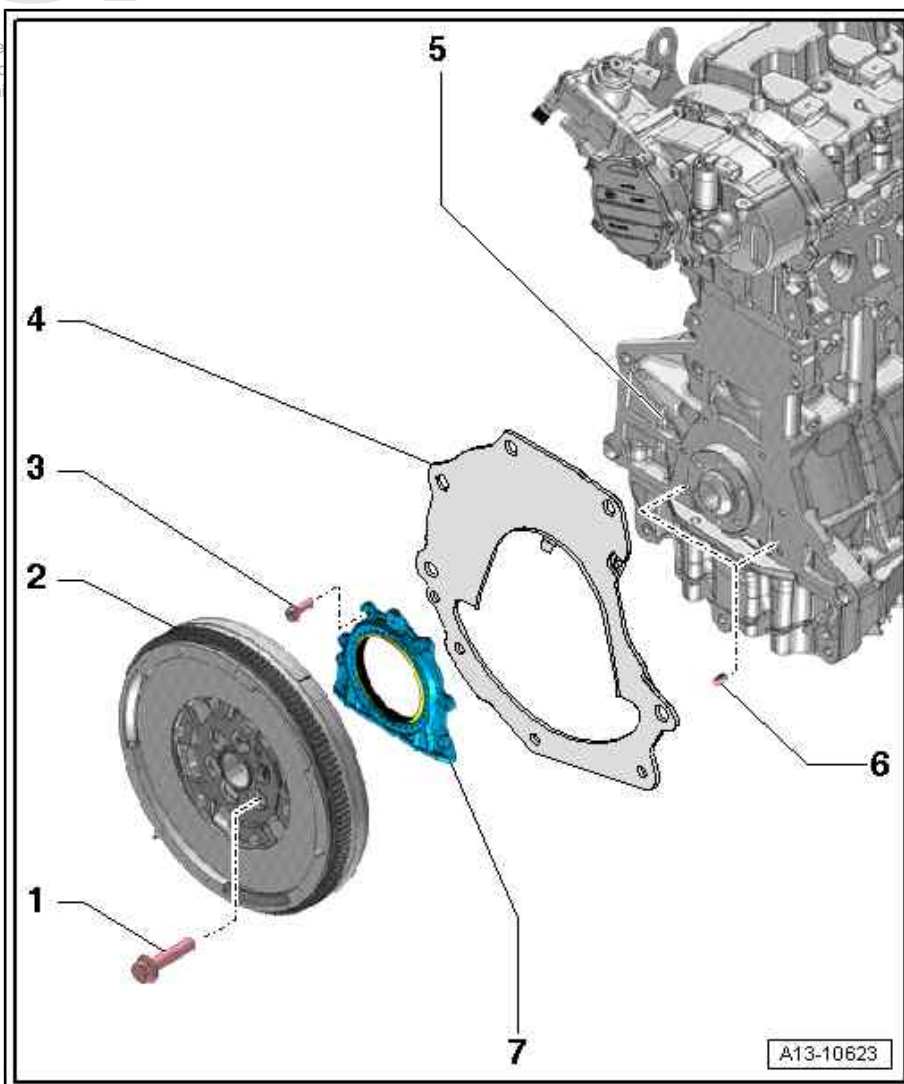
- ☐ Should be positioned on dowel pins
- ☐ Do not damage or bend
- ☐ Is fitted onto sealing flange ⇒ [page 48](#)

5 - Cylinder block

6 - Dowel pin

7 - Sealing flange (gearbox end)

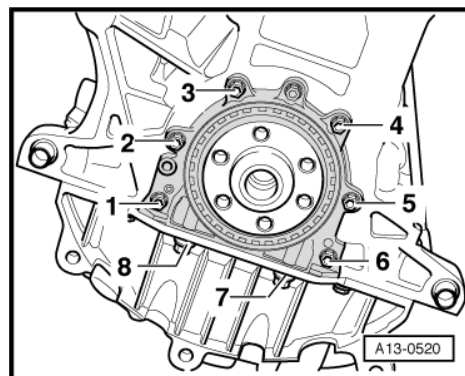
- ☐ With oil seal
- ☐ Renew only as complete unit ⇒ [page 49](#)
- ☐ Do not lubricate/grease sealing lip of oil seal
- ☐ Use guide sleeve supplied when fitting
- ☐ Do not remove guide sleeve until sealing flange has been slipped onto crankshaft journal



Sealing flange (gearbox end) - tightening torque and sequence

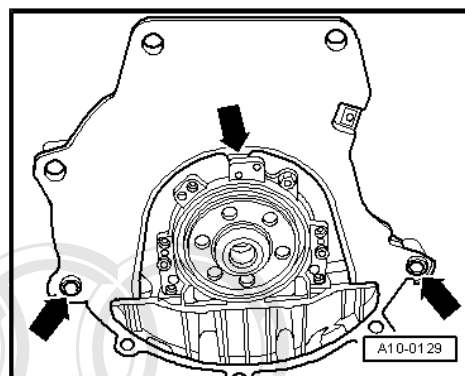
– Tighten sealing flange bolts (gearbox end) in three stages as follows:

1. Hand-tighten bolts -1 ... 8- until they make contact.
2. Tighten bolts -1 ... 6- in diagonal sequence and in stages to 15 Nm.
3. Tighten bolts -7- and -8- to 15 Nm.



Installing intermediate plate

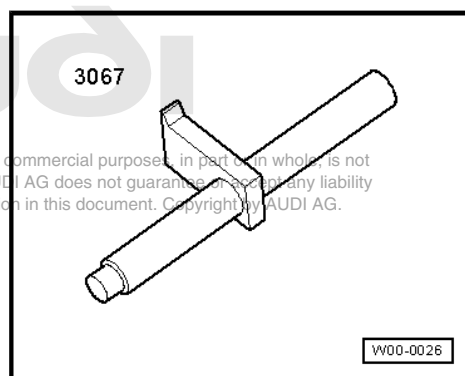
– Engage intermediate plate in sealing flange and slide onto dowel pins -arrows-.



2.2 Removing and installing flywheel

Special tools and workshop equipment required

- ◆ Counterhold tool - 3067-



Removing

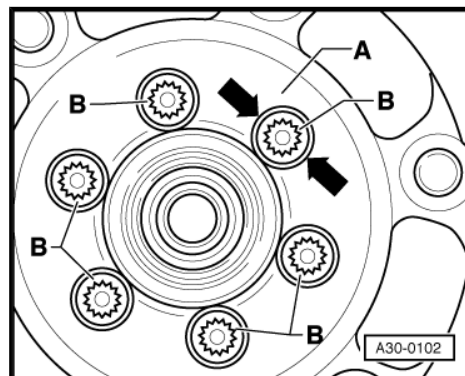
- Gearbox removed.



Caution

Risk of irreparable damage to dual-mass flywheel.

- ◆ Remove bolts -B- using normal hand tools (do not use pneumatic wrench or impact driver, etc.).
- ◆ When removing the bolts, make sure that the bolt heads do not come into contact with the dual-mass flywheel.
- ◆ Rotate the dual-mass flywheel -A- so that the bolts -B- align centrally with the holes -arrows-.



- Insert counterhold tool - 3067- in hole on cylinder block -item B-, slacken and remove bolts for dual-mass flywheel.

Installing

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



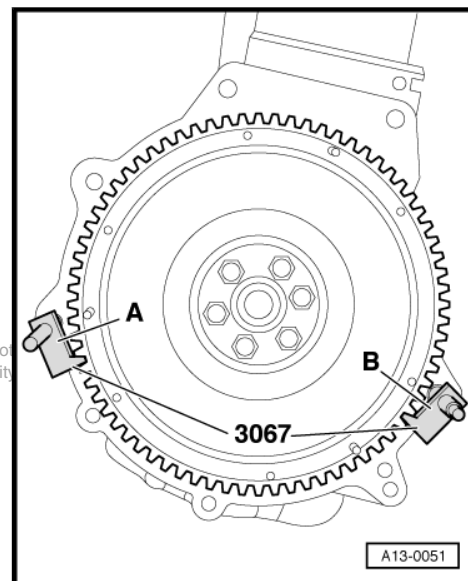
Note

Renew bolts for dual-mass flywheel.

- Insert counterhold tool - 3067- in hole on cylinder block -item A-.

Tightening torques

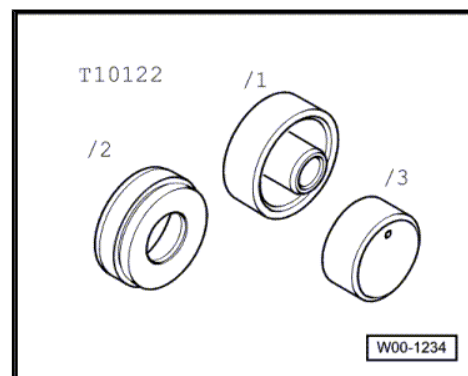
- ◆ ⇒ ["2.1 Exploded view - cylinder block \(gearbox end\)", page 47](#)



2.3 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

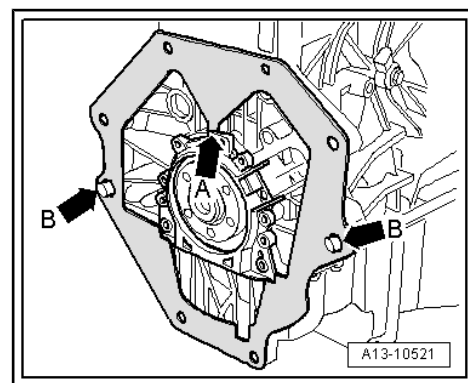
- ◆ Fitting tool - T10122-



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

Removing

- Gearbox removed.
- Remove flywheel ⇒ [page 48](#) .
- Disengage intermediate plate on sealing flange -arrow A- and pull intermediate plate off dowel sleeves -arrows B-.



- Remove bolts -1 ... 8-.
- Lever off sealing flange (gearbox end) and remove.

Installing

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



Note

Place a cloth over the exposed section of the sump.

- Carefully remove sealant residues from sump and bottom of sealing flange.
- Clean sealing surfaces; they must be free of oil and grease.



Note

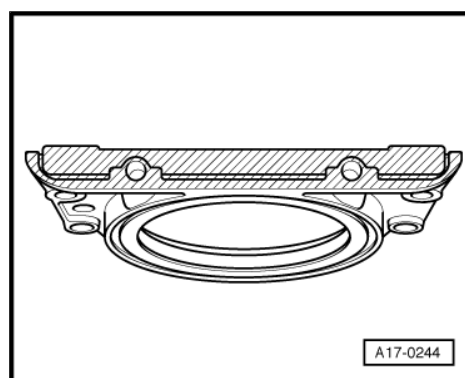
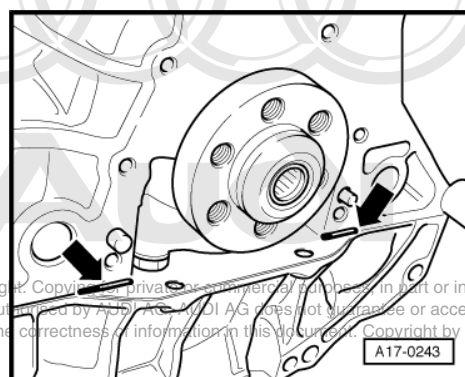
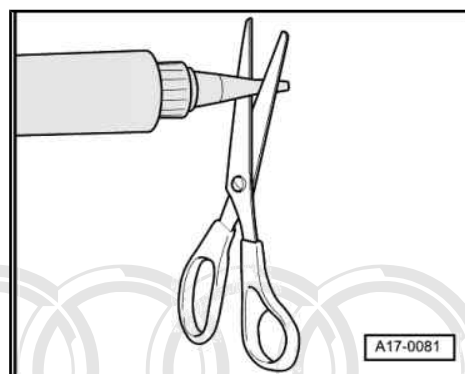
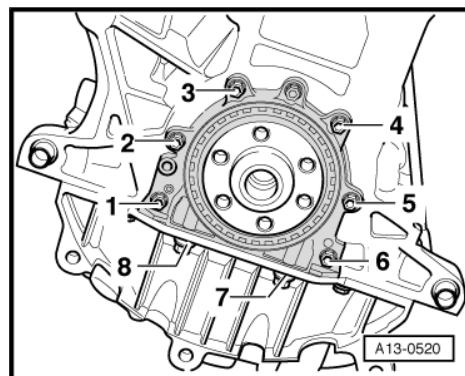
Note the use-by date of the sealant.

- Cut off tube nozzle at front marking (diameter of nozzle approx. 3 mm).
- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.
- Coat the lower sealing surface on the sealing flange lightly with sealant -hatched area-.



Note

The sealing flange must be installed within 5 minutes after applying sealant.



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- Attach fitting sleeve -T10122/1- to guide sleeve -T10122/2- .
- Slide sealing flange -A- over fitting sleeve and onto guide sleeve.



- Detach fitting sleeve -T10122/1- , position guide sleeve -T10122/2- on crankshaft journal and push sealing flange onto cylinder block.

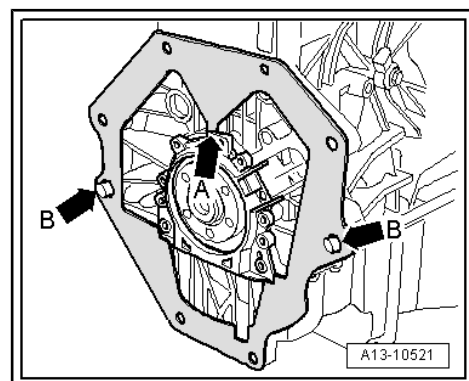
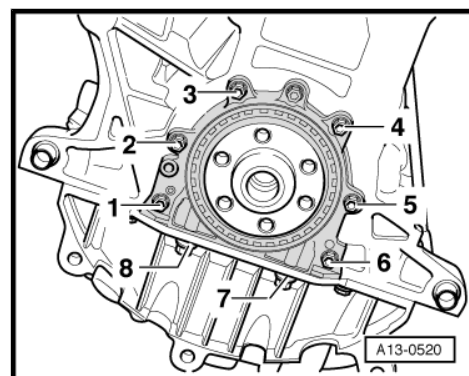
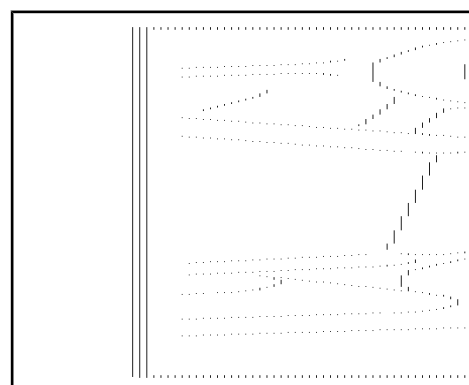
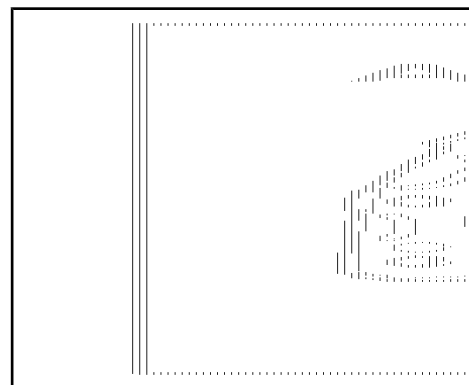
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- Tighten bolts in the specified sequence:
- First tighten bolts -1 ... 6-.
- Then tighten bolts -7- and -8-.

- Engage intermediate plate on sealing flange -arrow A- and push onto dowel sleeves -arrows B-.
- Install flywheel ⇒ [page 48](#) .

Tightening torques

- ◆ ⇒ Fig. [“Sealing flange \(gearbox end\) - tightening torque and sequence”](#) , [page 48](#)



3 Crankshaft

⇒ "3.1 Exploded view - crankshaft", page 52

⇒ "3.2 Crankshaft dimensions", page 54

⇒ "3.3 Measuring axial clearance of crankshaft", page 54

⇒ "3.4 Measuring radial clearance of crankshaft", page 55

⇒ "3.5 Removing and installing drive chain sprocket", page 56

3.1 Exploded view - crankshaft



Note

- ◆ When performing assembly work, secure engine to engine and gearbox support ⇒ [page 21](#) .
- ◆ 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.

1 - Bolt

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

2 - Bearing cap

- ☐ Bearing cap 1: Pulley end
- ☐ Installation position: retaining lugs on bearing shells in cylinder block and bearing caps must be on the same side

3 - Bolt

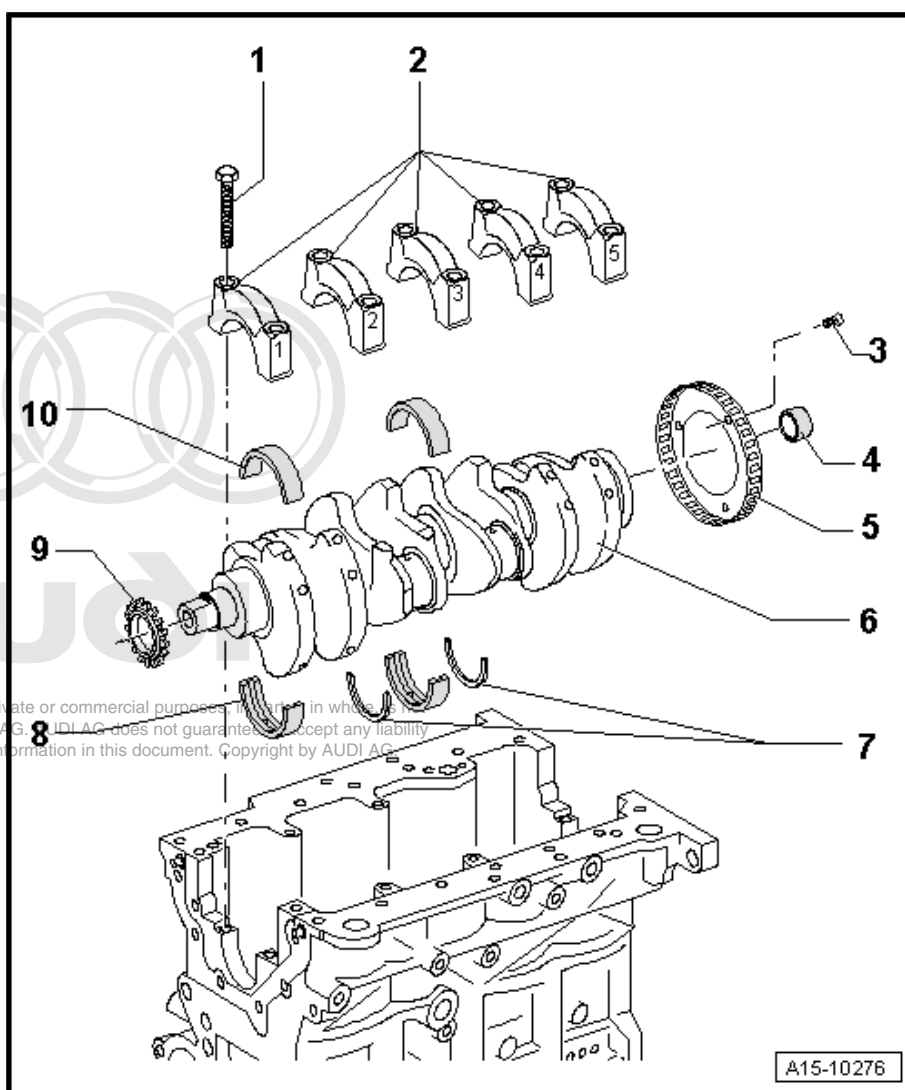
- ☐ Renew
- ☐ Sender wheel must be renewed if bolts are loosened ⇒ [page 53](#)
- ☐ 10 Nm + turn 90° further

4 - Needle bearing

- ☐ Not fitted
- ☐ Only fitted on vehicles with dual clutch gearbox

5 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Sender wheel must be renewed if bolts are loosened
- ☐ Removing and installing ⇒ [page 53](#)
- ☐ Can only be installed in one position (holes are off-set)



6 - Crankshaft

- ☐ Do not place on sender wheel -item 5- after removing
- ☐ Measuring axial clearance ⇒ [page 54](#)
- ☐ Measuring radial clearance ⇒ [page 55](#)
- ☐ Crankshaft dimensions ⇒ [page 54](#)

7 - Thrust washers

- ☐ For bearing No. 3

8 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to nickel layer must be renewed
- ☐ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ [page 54](#)

9 - Drive chain sprocket

- ☐ For drive chain for oil pump
- ☐ Removing and installing ⇒ [page 56](#)

10 - Bearing shell

- ☐ For bearing cap (without oil groove)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to nickel layer must be renewed
- ☐ Installing new bearing shells for bearing cap with correct colour-coding ⇒ [page 54](#)

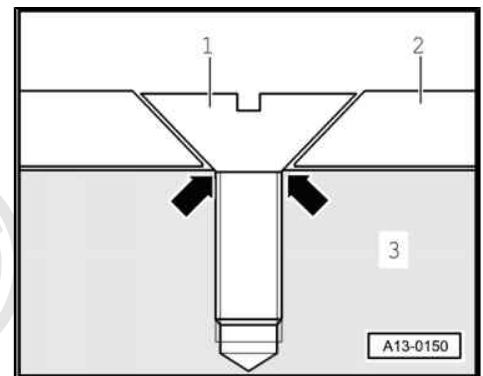
Removing and installing sender wheel



Caution

Safety risk from loose sender wheel.

- ◆ **Sender wheel -2- must always be renewed after slackening off bolts -1-.**
- ◆ **If the countersunk bolts are tightened a second time, the seats for the bolt heads in the sender wheel will be deformed to such an extent that the bolt heads make contact with the crankshaft -3- -arrows- and the sender wheel beneath the bolts will be loose.**



Note

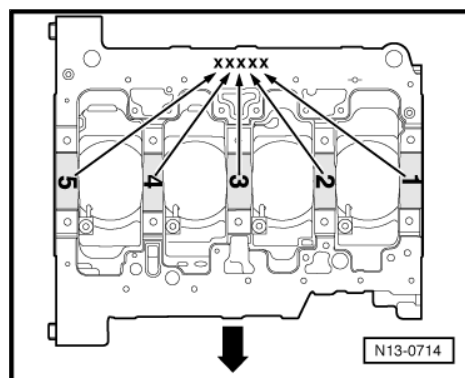
Sender wheel can only be installed in one position (holes are off-set).

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Allocation of crankshaft bearing shells (top) for cylinder block

- ◆ Bearing shells of the correct thickness are matched to the bearings (top) in the cylinder block at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- ◆ Letter codes on the lower sealing surface of the cylinder block indicate the thickness of the bearing shell to be fitted at each location.

Letter on cylinder block	Colour coding of bearing
S =	Black
R =	Red
G =	Yellow



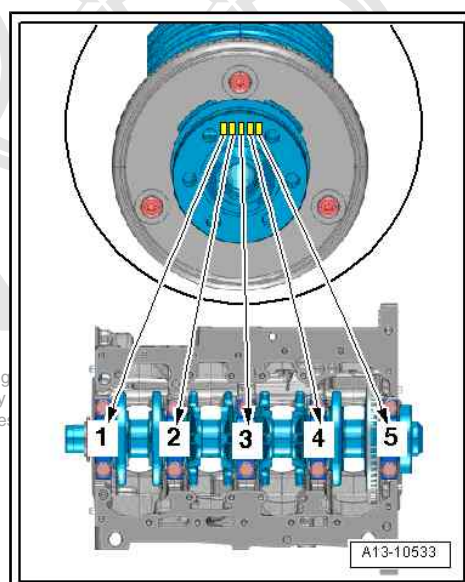
Note

The -arrow- points in direction of travel.

Matching crankshaft bearing shells to bearing caps

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

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



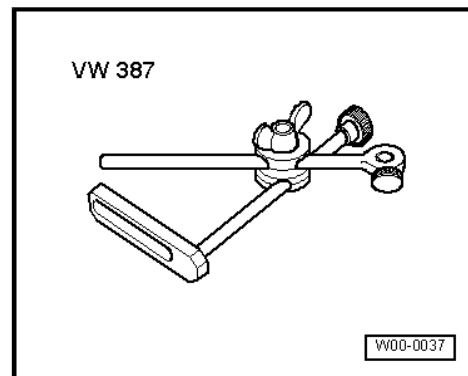
3.2 Crankshaft dimensions

Honing dimension (in mm)	Main bearing journal Ø	Conrod journal Ø
Basic dimension	54.000 – 0.017 – 0.037	47.800 – 0.022 – 0.042

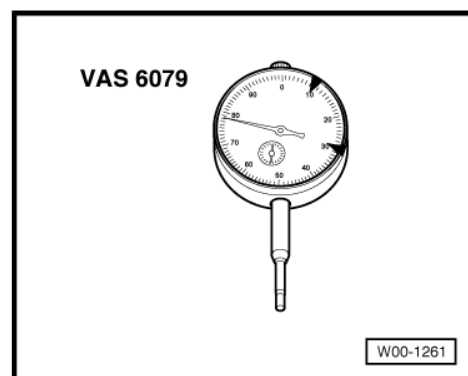
3.3 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

◆ Universal dial gauge bracket - VW 387-



◆ Dial gauge - VAS 6079-

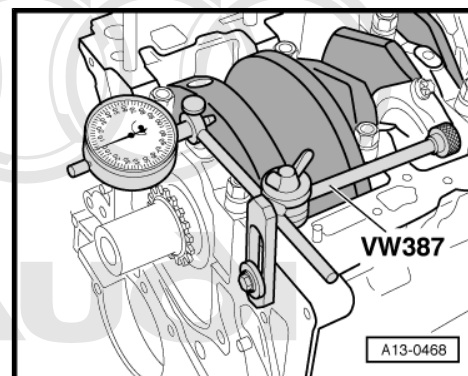


Procedure

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

Axial clearance:

- New: 0.07 ... 0.23 mm.
- Wear limit: 0.30 mm.



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3.4 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Plastigage

Procedure



Note

- ◆ *Do not interchange used bearings.*
- ◆ *Bearing shells worn down to the nickel layer must be renewed.*
- Remove 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.

- The Plastigage must be positioned in the centre of the bearing shell.
- Fit bearing cap and secure with old bolts ⇒ [Item 1 \(page 52\)](#) without rotating crankshaft.
- Remove bearing cap again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

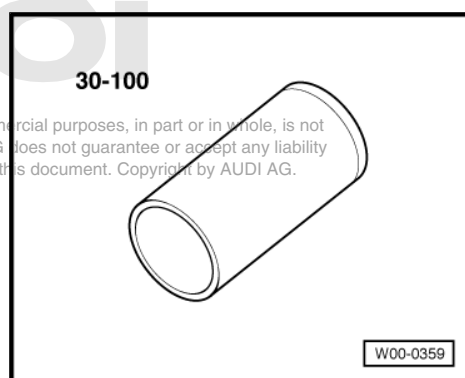
- New: 0.017 ... 0.037 mm.
- Wear limit: 0.10 mm.

3.5 Removing and installing drive chain sprocket

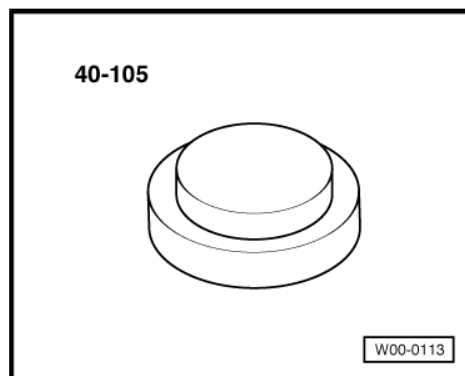
Special tools and workshop equipment required

- ◆ Drift sleeve - 30 - 100-

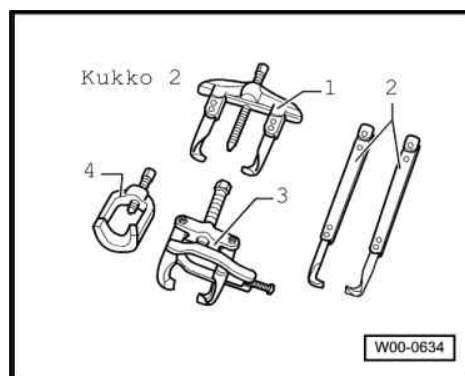
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- ◆ Thrust plate - 40 - 105-



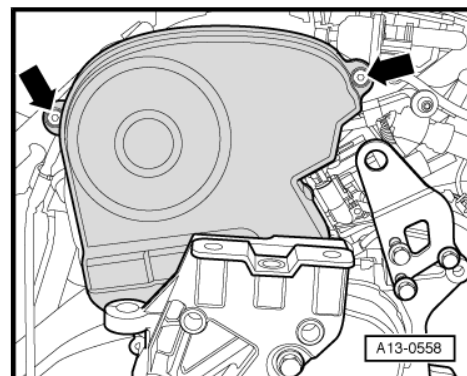
- ◆ -1- Two-arm puller Kukko 44/1



- ◆ Protective gloves

Removing

- Remove sump ⇒ [page 112](#) .



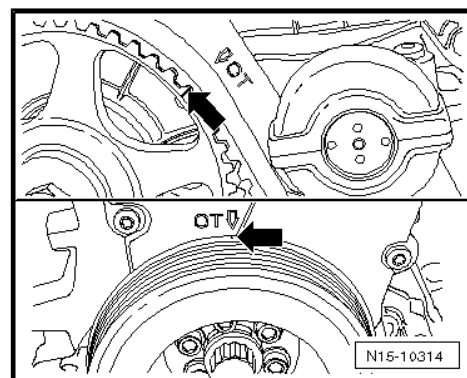
- Unscrew bolts -arrows- and remove toothed belt cover (top section).



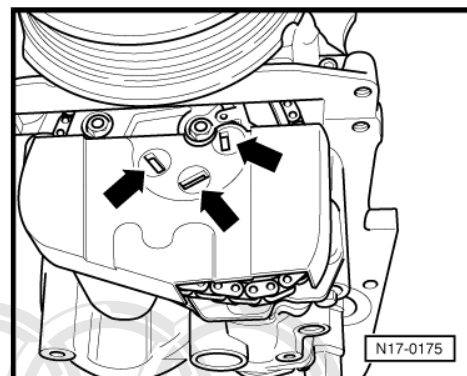
Caution

Irreparable damage can be caused if the toothed belt slips.

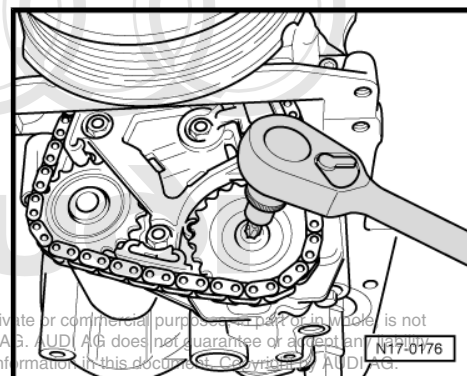
◆ *Turn crankshaft only in direction of engine rotation.*



- Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at "TDC".
- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.
- Pull off chain guard; if necessary, retaining tabs can be released with a small screwdriver (insert in openings -arrows-).

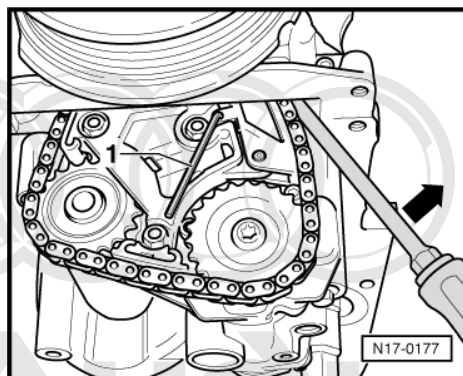


- Counterhold crankshaft at bolt for toothed belt sprocket and slacken bolt for chain sprocket for oil pump.



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- Use screwdriver to slacken chain rail -arrow- and lock it in position with hexagon key (3 mm) -1-.
- Remove sealing flange (pulley end) ⇒ [page 43](#) .

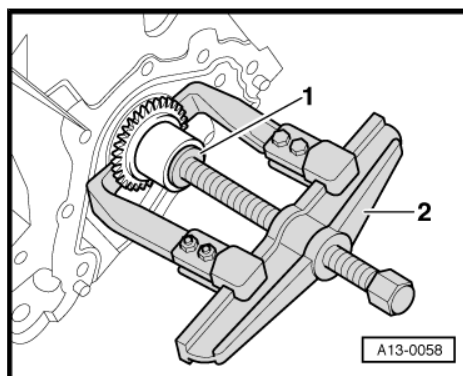
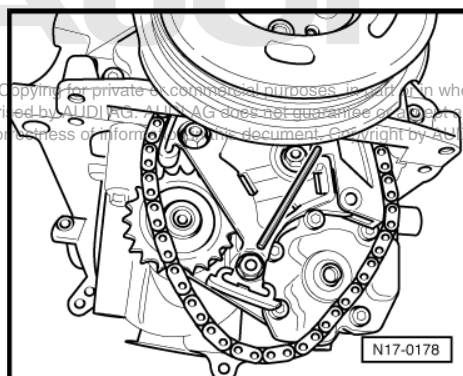


Caution

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

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

- Detach chain sprocket with drive chain for oil pump.
- Pull off drive chain sprocket using two-arm puller Kukko 44/1 -item 2- (protect end of crankshaft with thrust plate - 40 - 105- -item 1-).



Installing

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

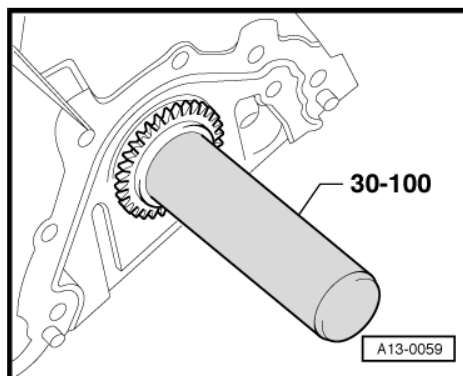


WARNING

Risk of burn injuries.

- ◆ ***Wear protective gloves.***

- Heat drive chain sprocket in oven for approx. 15 minutes to 220°C.
- Installation position: wide collar on drive chain sprocket faces engine.
- Fit drive chain sprocket on end of crankshaft using pliers, and press onto crankshaft as far as the stop using drift sleeve - 30 - 100- .
- Fit drive chain according to marking for direction of rotation (made during removal).
- Install sealing flange (pulley end) ⇒ [page 43](#) .
- Install balance shaft assembly with oil pump ⇒ [page 127](#) .



4 Pistons and conrods

⇒ [“4.1 Exploded view - pistons and conrods”, page 59](#)

⇒ [“4.2 Removing and installing pistons”, page 60](#)

⇒ [“4.3 Checking pistons and cylinder bores”, page 62](#)

⇒ [“4.4 Measuring axial clearance of conrods”, page 63](#)

⇒ [“4.5 Checking radial clearance of conrod bearings”, page 63](#)

4.1 Exploded view - pistons and conrods



Note

- ◆ All bearing and running surfaces must be oiled before assembling.
- ◆ Oil spray jet and pressure relief valve ⇒ [page 60](#)

1 - Bolts

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

2 - Conrod bearing cap

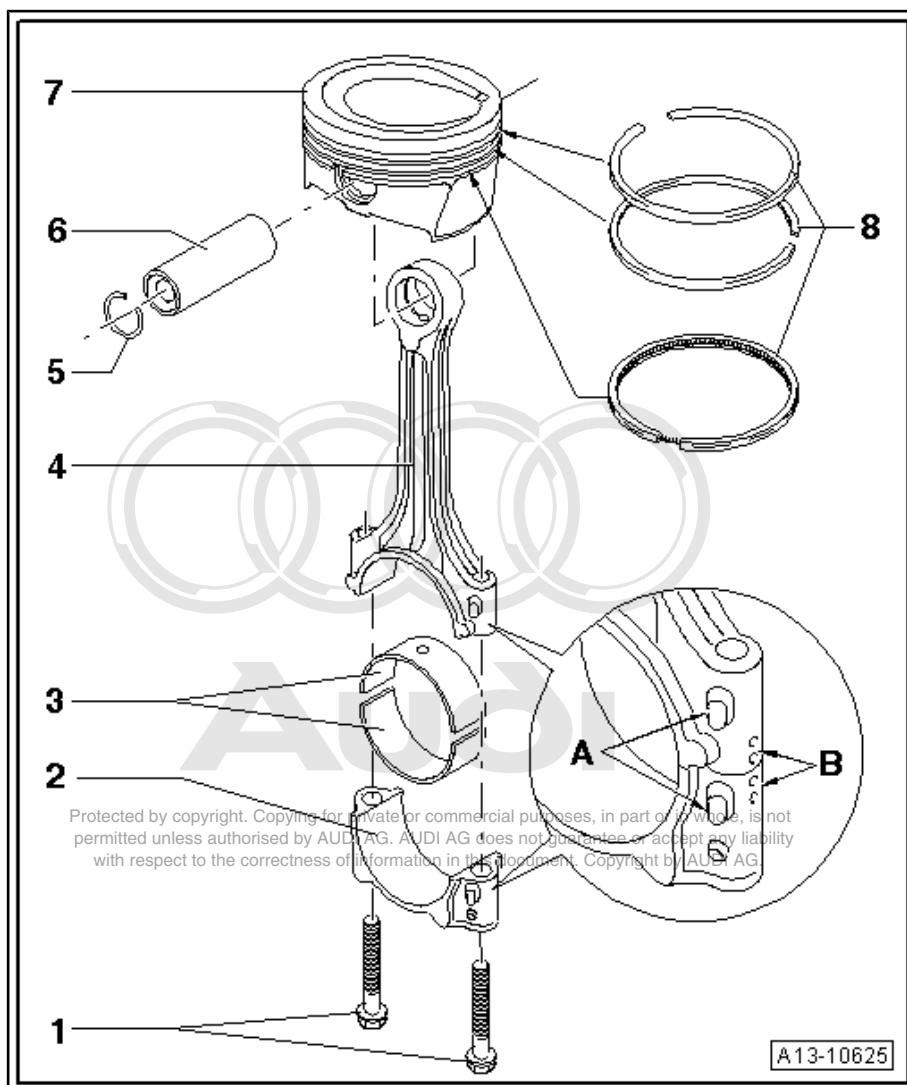
- ☐ Mark cylinder allocation in colour -B-
- ☐ Installation position: Markings -A- face towards pulley end

3 - Bearing shells

- ☐ Upper bearing shell with oil hole for piston pin lubrication
- ☐ Installation position ⇒ [page 60](#)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to nickel layer must be renewed

4 - Conrod

- ☐ With oil drilling for piston pin lubrication
- ☐ Only renew as a complete set
- ☐ Mark cylinder allocation in colour -B-
- ☐ Installation position: Markings -A- face towards pulley end
- ☐ Measuring axial clearance ⇒ [page 63](#)
- ☐ Measuring radial clearance ⇒ [page 63](#)



5 - Circlip

- ☐ Renew

6 - Piston pin

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

7 - Piston

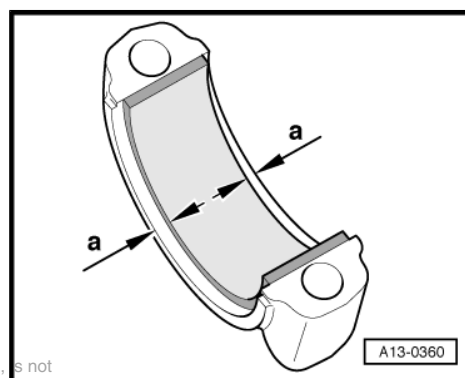
- ☐ Checking ⇒ [page 62](#)
- ☐ Mark installation position to conrod and cylinder allocation
- ☐ Installation position: arrow on piston crown points to pulley end
- ☐ Install using piston ring clamp
- ☐ Checking cylinder bore ⇒ [page 63](#)

8 - Piston rings

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers to remove and install
- ☐ Inscription "TOP" faces towards piston crown
- ☐ Checking ring gap ⇒ [page 62](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 62](#)

Installation position of bearing shells in conrods

- Insert bearing shells centrally in conrod/conrod bearing cap.
- Distance -a- = approx. 1.5 mm.



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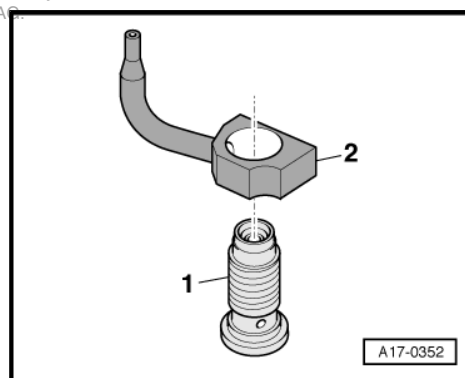
Oil spray jet and pressure relief valve

- 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.



Note

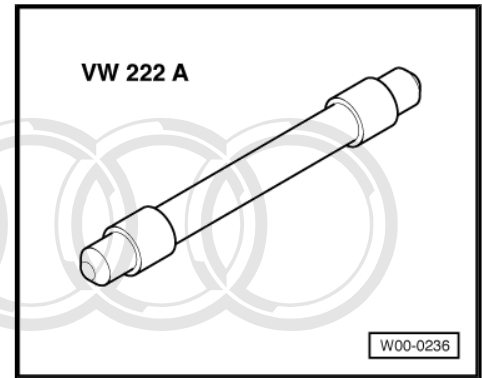
- ◆ Take care not to bend oil spray jets.
- ◆ Always renew bent oil spray jets.



4.2 Removing and installing pistons

Special tools and workshop equipment required

◆ Drift - VW 222 A-



◆ Piston ring clamp, commercially available

Removing

- Remove cylinder head ⇒ [page 76](#) .
- Remove balance shaft assembly with oil pump ⇒ [page 127](#) .
- Mark installation position and cylinder number of piston.
- Mark installation position and cylinder number of conrod
⇒ [Item 4 \(page 59\)](#) .
- Remove conrod bearing cap and pull out piston and conrod upwards.

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Note

If piston pin is difficult to remove, heat piston to approx. 60 °C.

- Take circlip out of piston pin boss.
- Use drift - VW 222 A- to drive out piston pin.

Installing

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



Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Arrow on piston crown points to pulley end.*
- ◆ *Piston ring gaps should be spaced at 120°.*
- Oil running surfaces of bearing shells.
- Install piston using commercially available piston ring clamp; note installation position ⇒ [Item 7 \(page 60\)](#) .
- Install conrod bearing cap; note installation position
⇒ [Item 2 \(page 59\)](#) .
- Install cylinder head ⇒ [page 76](#) .
- Install balance shaft assembly with oil pump ⇒ [page 127](#) .

Tightening torques

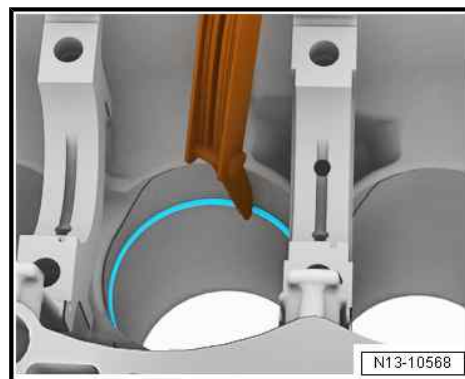
- ◆ ⇒ [“4.1 Exploded view - pistons and conrods”, page 59](#)

4.3 Checking pistons and cylinder bores

Checking piston ring gap

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

Piston ring Dimensions in mm	New	Wear limit
Compression ring	0.20 ... 0.40	0.8
Oil scraper ring	0.25 ... 0.55	0.8



Checking ring-to-groove clearance

- Clean annular groove of piston.
- Check gap using feeler gauge.

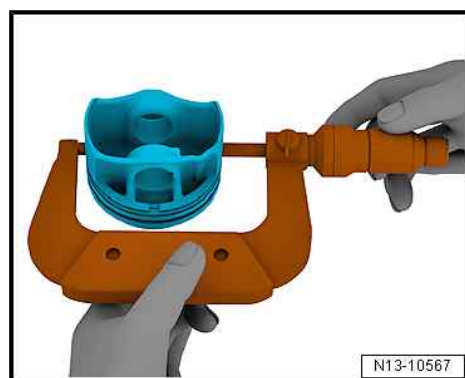
Piston ring Dimensions in mm	New	Wear limit
Compression ring	0.035 ... 0.075	0.15
Oil scraper ring	0.03 ... 0.06	0.15



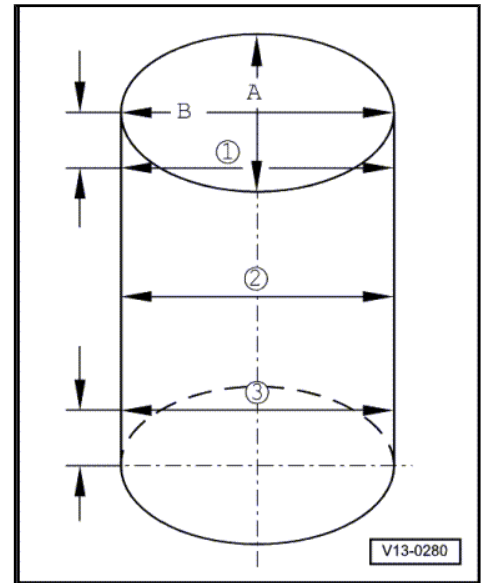
Checking piston

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

	Piston Ø
Basic dimension mm	82.465 ¹⁾
• ¹⁾ Dimension not including graphite coating (thickness 0.02 mm). The graphite coating wears down in service.	



Checking cylinder bore



Special tools and workshop equipment required

- ◆ Cylinder gauge - VAS 6078-



Note

- ◆ *Dark or shiny patches on the cylinder wall do not indicate damage to the cylinder bore so long as the cross-hatching is visible.*
- ◆ *The cylinder bore should always be measured at three points in the transverse direction and in the longitudinal direction using cylinder gauge - VAS 6078-.*
- 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.

		Cylinder bore Ø
Basic dimension	mm	82.51

4.4 Measuring axial clearance of conrods

Special tools and workshop equipment required

- ◆ Feeler gauge

Procedure

- Check gap using feeler gauge.

Axial clearance:

- New: 0.10 ... 0.30 mm.
- Wear limit: 0.40 mm.

4.5 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

- ◆ Plastigage

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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.
- The Plastigage must be positioned in the centre of the bearing shell.
- Fit conrod bearing cap and secure with old bolts
⇒ [Item 1 \(page 59\)](#) 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 Toothed belt drive

⇒ [“1.1 Exploded view - toothed belt”, page 65](#)

⇒ [“1.2 Removing and installing toothed belt”, page 66](#)

1.1 Exploded view - toothed belt

1 - Bolt

- ☐ 9 Nm

2 - Toothed belt cover (top)

3 - Bolt

- ☐ Renew
- ☐ Slacken and tighten with counterhold tool - 3036-
- ☐ 50Nm + turn 180° further

4 - Camshaft sprocket

- ☐ Located in position by Woodruff key - item 7-

5 - Bolt

- ☐ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ☐ 9 Nm

6 - Toothed belt cover (rear)

7 - Woodruff key

- ☐ Check for firm attachment

8 - Nut

- ☐ 23 Nm

9 - Tensioning roller

10 - Coolant pump

- ☐ Removing and installing ⇒ [page 144](#)

11 - O-ring

- ☐ Renew

12 - Bolt

- ☐ 23 Nm

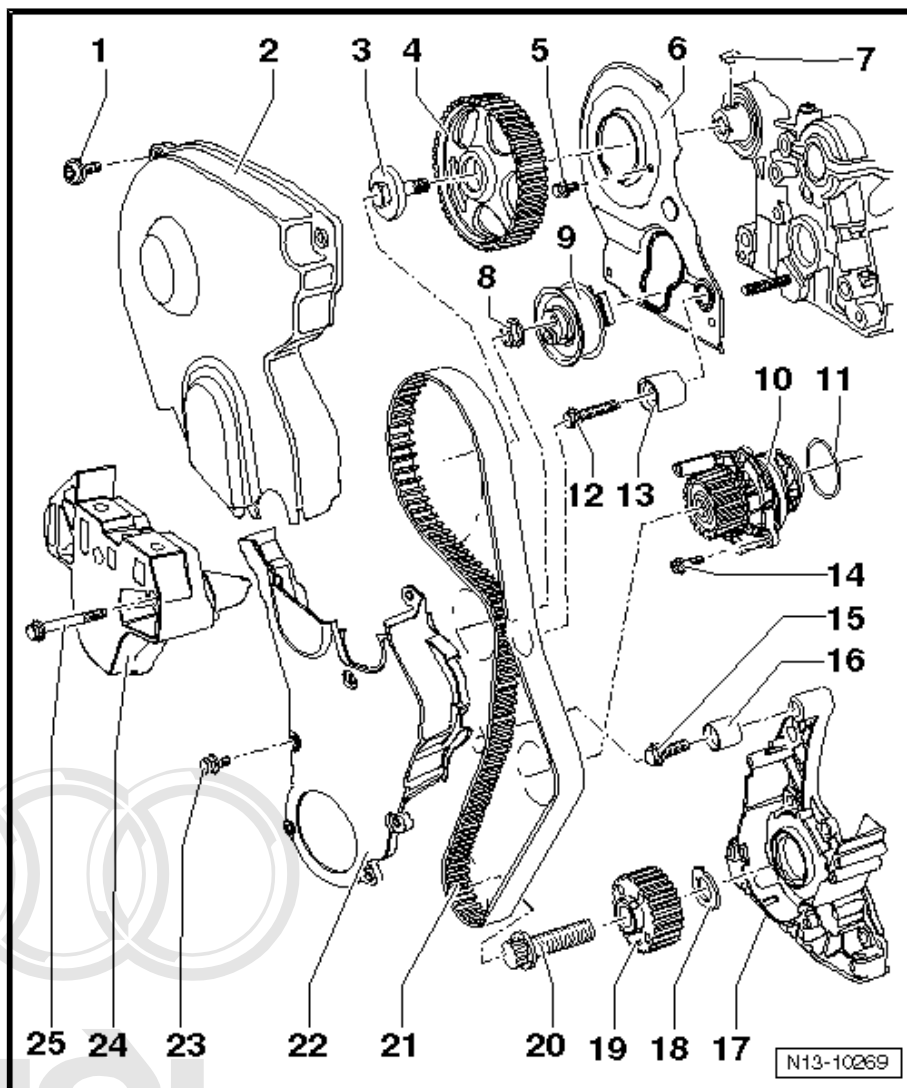
13 - Damper wheel

14 - Bolt

- ☐ Tightening torque ⇒ [Item 17 \(page 143\)](#)

15 - Bolt

- ☐ 33 Nm



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16 - Damper wheel**17 - Sealing flange**

- ☐ Removing and installing ⇒ [page 43](#)

18 - Diamond-coated washer

- ☐ Between toothed belt sprocket and crankshaft
- ☐ Renew

19 - Crankshaft sprocket

- ☐ Removing and installing ⇒ [page 66](#)
- ☐ Contact surfaces between toothed belt sprocket, diamond-coated washer and crankshaft must be free of oil
- ☐ Can only be installed in one position

20 - Bolt

- ☐ Renew
- ☐ Do not lubricate with oil
- ☐ 90 Nm + turn 90° further

21 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Check for wear
- ☐ Removing ⇒ [page 66](#)
- ☐ Installing (adjusting valve timing) ⇒ [page 71](#)

22 - Toothed belt cover (bottom)**23 - Bolts**

- ☐ 7x
- ☐ 9 Nm

24 - Engine support**25 - Bolt**

- ☐ Tightening torque ⇒ [Item 1 \(page 26\)](#)

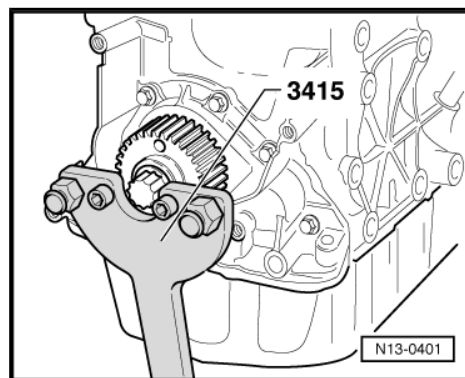
Removing and installing crankshaft sprocket

- Use counterhold tool - 3415- to slacken and tighten bolt for crankshaft sprocket.

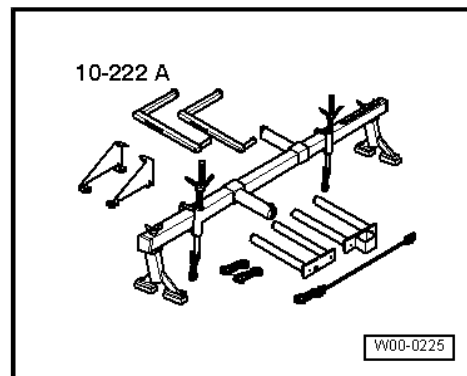
**Note**

Contact surfaces between toothed belt sprocket, diamond-coated washer and crankshaft must be free of oil.

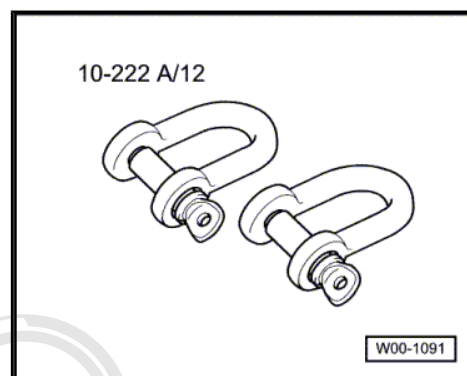
- When installing, fit new diamond-coated washer between toothed belt sprocket and crankshaft.

**1.2 Removing and installing toothed belt****Special tools and workshop equipment required**

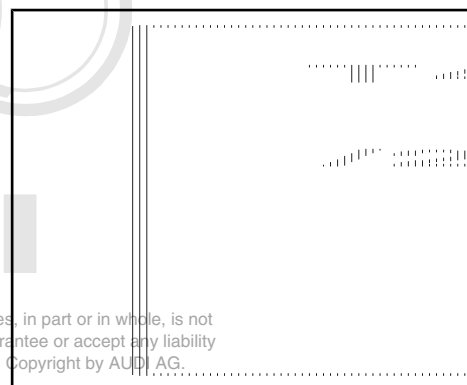
◆ Support bracket - 10 - 222 A-



◆ Shackle - 10 - 222 A /12-



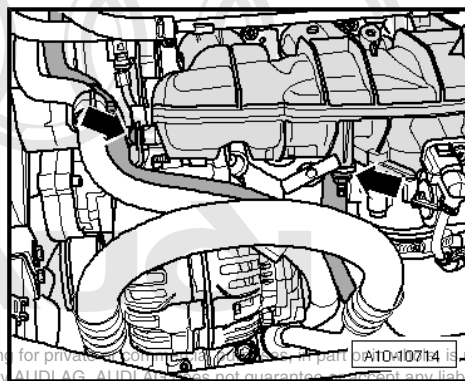
◆ Adapter -T40093/6- (2x)



Removing

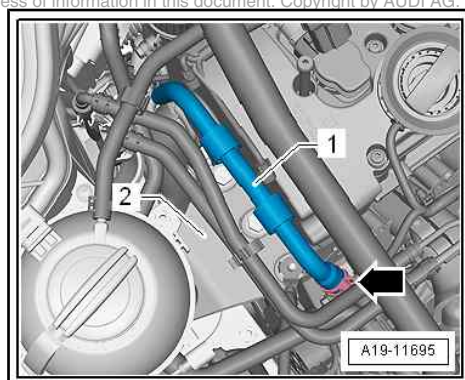
- Remove engine cover panel ⇒ [page 33](#) .
- Remove pendulum support ⇒ [page 32](#) .
- Remove air cleaner housing ⇒ [page 195](#) .
- Drain coolant ⇒ [page 135](#) .
- Remove front wheel housing liner (right-side) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Remove front right wheel.
- Remove poly V-belt tensioner ⇒ [page 39](#) .

- Unscrew bolt and nut -arrows- and press coolant pipe (front right) to one side.

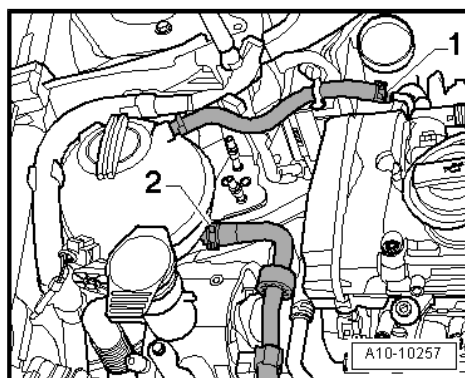


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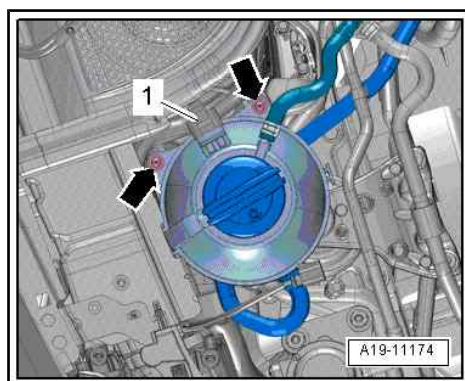
- Release spring-type clip -arrow- and disconnect coolant hose -1- from front coolant pipe.
- Place coolant hose -1- on top of engine.



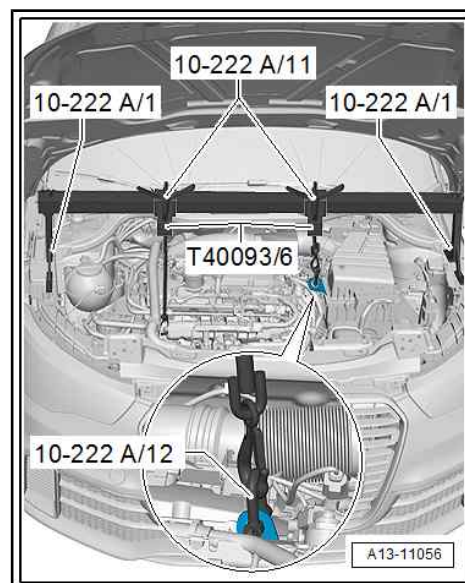
- Detach coolant hoses -1- and -2-.



- Remove bolts -arrows-.
- Detach electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.
- Remove bolts -arrows- and remove coolant expansion tank.
- Remove Hall sender - G40- ⇒ [page 249](#) .



- Position support bracket - 10 - 222 A- on top of body flanges using the following tools:
 - ◆ Rack - 10 - 222 A /1- (2x)
 - ◆ Spindle - 10 - 222 A /11- (2x)
 - ◆ - 10 - 222 A /12-
 - ◆ Adapter -T40093/6- (2x)
- Hook the two spindles - 10 - 222 A /11- with shackles - 10 - 222 A /12- onto the two engine lifting eyes.
- Take up weight of engine/gearbox assembly by tightening spindle.



Engine mounting

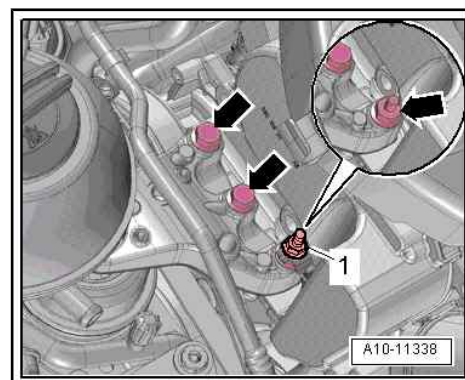
- Remove nut -1- and move earth wire clear.
- Remove bolts -arrows- for support arm of engine mounting.



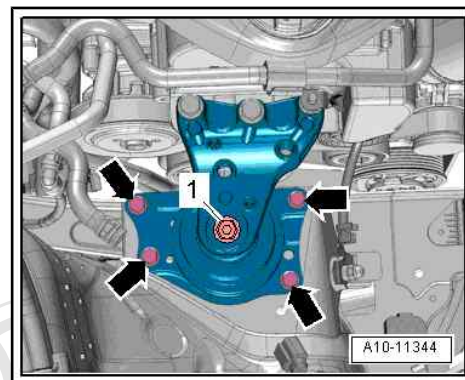
WARNING

Risk of accident.

- ◆ *Do not loosen nut -1- unless renewing engine mounting.*

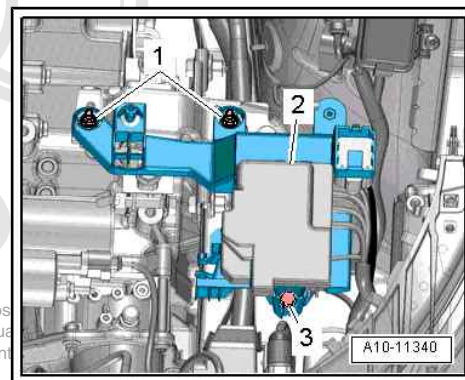


- Remove bolts -arrows- and detach engine mounting.



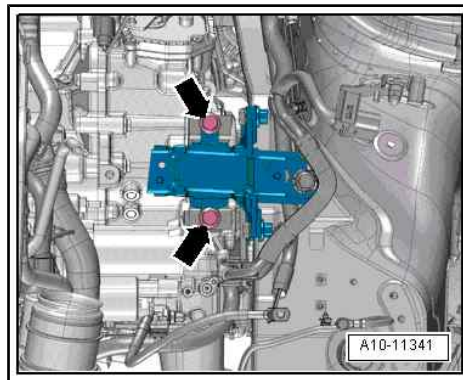
Gearbox mounting

- Unscrew nuts -1- and bolt -3-, and push electronics box -2- to the side.



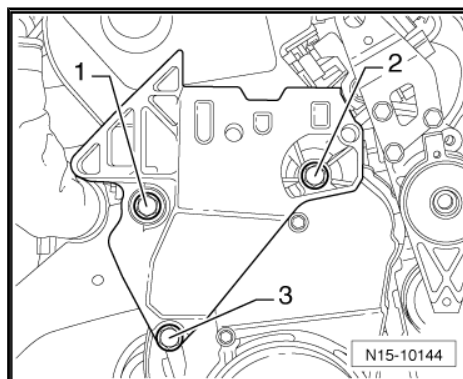
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- Remove bolts -arrows- securing gearbox mounting.

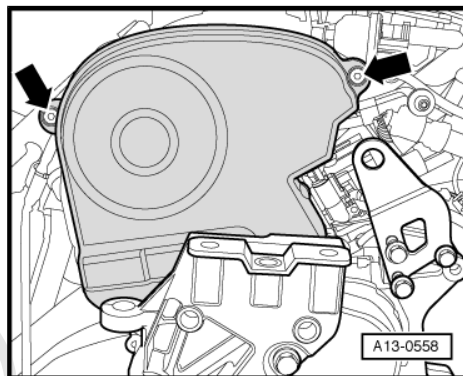


Console for engine mounting

- Remove bolts -1, 2 and 3-.
- Lower engine end via spindle - 10 - 222 A /11- approx. 30 mm.
- Lower gearbox end via spindle - 10 - 222 A /11- approx. 40 mm.



- Remove bolts -arrows-.
- Rotate engine/gearbox assembly and lift out toothed belt cover with console for engine mounting.

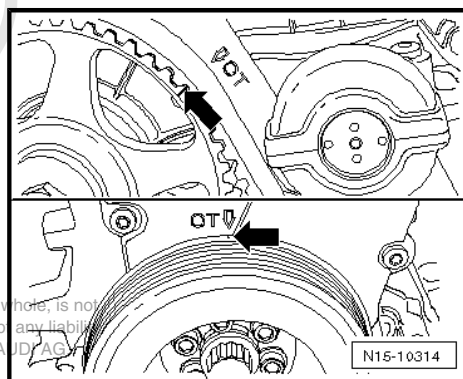


Caution

Irreparable damage can be caused if the toothed belt slips.

- ◆ Turn crankshaft only in direction of engine rotation.

- Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at "TDC".
- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.
- Remove vibration damper ⇒ [page 40](#).

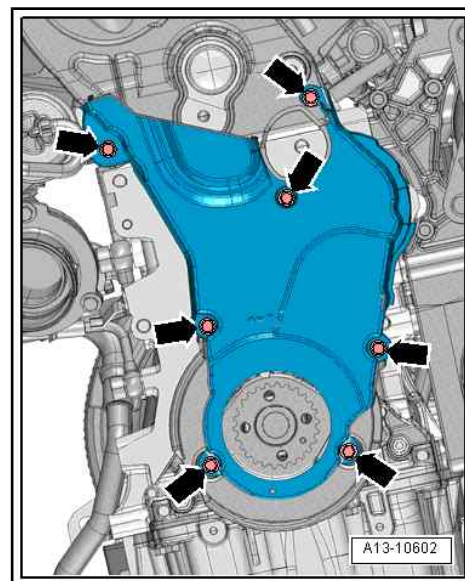


Caution

Risk of damage to engine.

- ◆ The "TDC" markings must align before the vibration damper is detached.
- ◆ Do not rotate the crankshaft unless the "TDC" position is marked by an additional marking.

- Unscrew bolts -arrows- and remove toothed belt cover (bottom section).



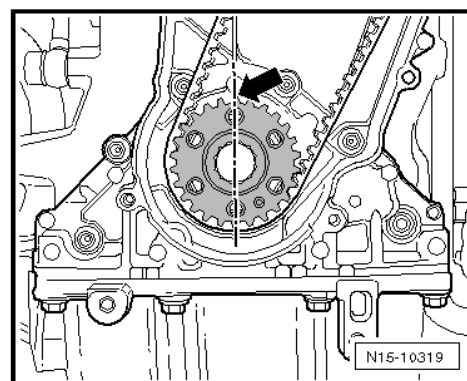
- Mark "TDC" position -arrow-.



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 toothed belt with chalk or felt-tip pen for re-installation.*



- Loosen tensioning roller and detach toothed belt.

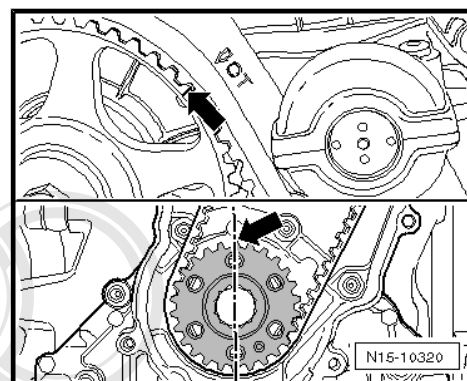
Installing (adjusting valve timing)



Caution

Avoid damage to valves and piston crowns.

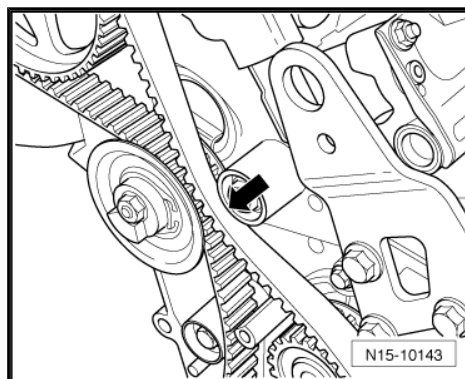
- ◆ *The crankshaft must not be at "TDC" at any cylinder when the camshaft is turned.*
- ◆ *The engine must be no more than warm to touch.*



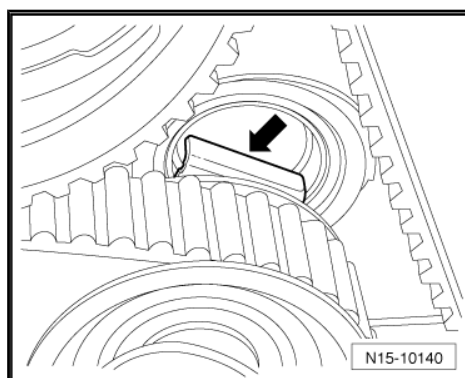
- Check whether the camshaft and the crankshaft are positioned at "TDC":
 - The markings on the camshaft -top arrow- and the crankshaft -bottom arrow- must be aligned.

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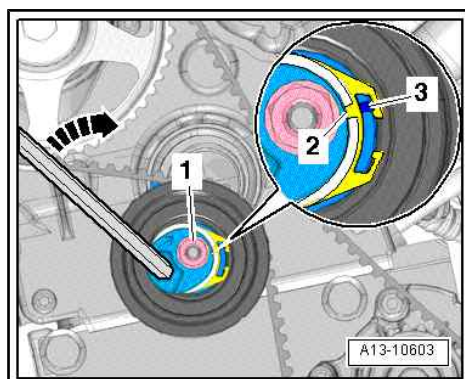
- Fit toothed belt according to marking for direction of rotation (made during removal) as follows:
- Crankshaft, tensioning roller, camshaft, coolant pump and idler roller -arrow-.



- Make sure tensioning roller is positioned correctly in cylinder head.
- Retaining bracket -arrow- must engage in slot on cylinder head.



- Tension toothed belt as follows:
- 1. Using hexagon key, turn eccentric adjuster clockwise -arrow- until notch -2- is above indicator -3- (toothed belt over-tensioned).
- 2. Let eccentric adjuster return to initial position (release toothed belt).
- 3. Using hexagon key, turn eccentric adjuster clockwise -arrow- until notch -2- is aligned with indicator -3-.
- Tighten nut -1- for tensioning roller.



Caution

Irreparable damage can be caused if the toothed belt slips.

- ◆ Turn crankshaft only in direction of engine rotation.

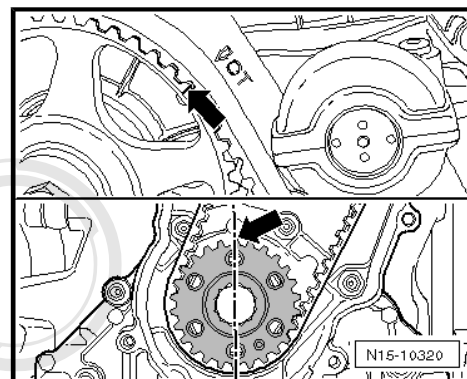
- Turn crankshaft two rotations in direction of engine rotation by turning bolt for toothed belt sprocket until crankshaft is at “TDC” again.
- It is important that the engine is rotated without stopping during the final 45° ($\frac{1}{8}$ turn).
- Check toothed belt tension:
- Notch -2- and indicator -3- must be aligned.
- If necessary, tighten toothed belt further.

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- Check valve timing:
- The markings on the camshaft -top arrow- and the crankshaft -bottom arrow- must be aligned.
- Repeat adjustment of valve timing if markings are not aligned.

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

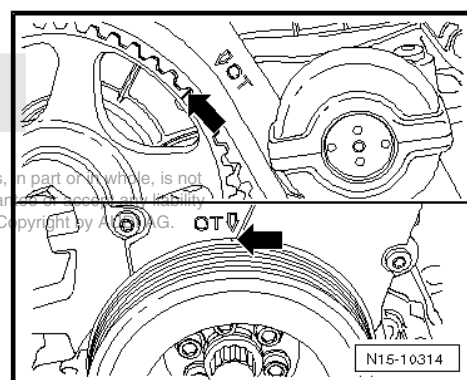
- Install toothed belt cover (bottom section) ⇒ [page 65](#) .
- Install vibration damper ⇒ [page 40](#) .



- Check valve timing again:
- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.

- Install engine support and engine mounting ⇒ [page 26](#) .

- Install gearbox mounting ⇒ [page 30](#) .
- Install pendulum support ⇒ [page 32](#) .
- Install coolant pipe (front right) ⇒ [page 152](#) .
- Install poly V-belt tensioner ⇒ [page 39](#) .
- Fill up with coolant ⇒ [page 137](#) .



Tightening torques

- ◆ ⇒ [“1.1 Exploded view - toothed belt”, page 65](#)

2 Cylinder head

⇒ "2.1 Exploded view - cylinder head", page 74

⇒ "2.2 Removing and installing cylinder head", page 76

⇒ "2.3 Removing and installing cylinder head cover", page 82

⇒ "2.4 Checking compression", page 84

2.1 Exploded view - cylinder head

1 - Bolt

- ☐ Renew if seal is damaged

- ☐ Tightening sequence
⇒ page 75

2 - Cylinder head cover

3 - Seal

- ☐ Renew if damaged or leaking

4 - Pressure control valve

- ☐ For crankcase breather

5 - Filler cap

6 - Seal

- ☐ Renew if damaged or leaking

7 - Bolt

- ☐ 4 Nm

8 - Gasket for cylinder head cover

- ☐ Renew if damaged or leaking

9 - Vacuum pump

10 - Bolt

- ☐ 4 Nm

11 - Camshaft control valve 1 - N205-

- ☐ Removing and installing
⇒ page 100

12 - Seal

- ☐ Renew

13 - Bolt

- ☐ 9 Nm

14 - Retainer

15 - Seal

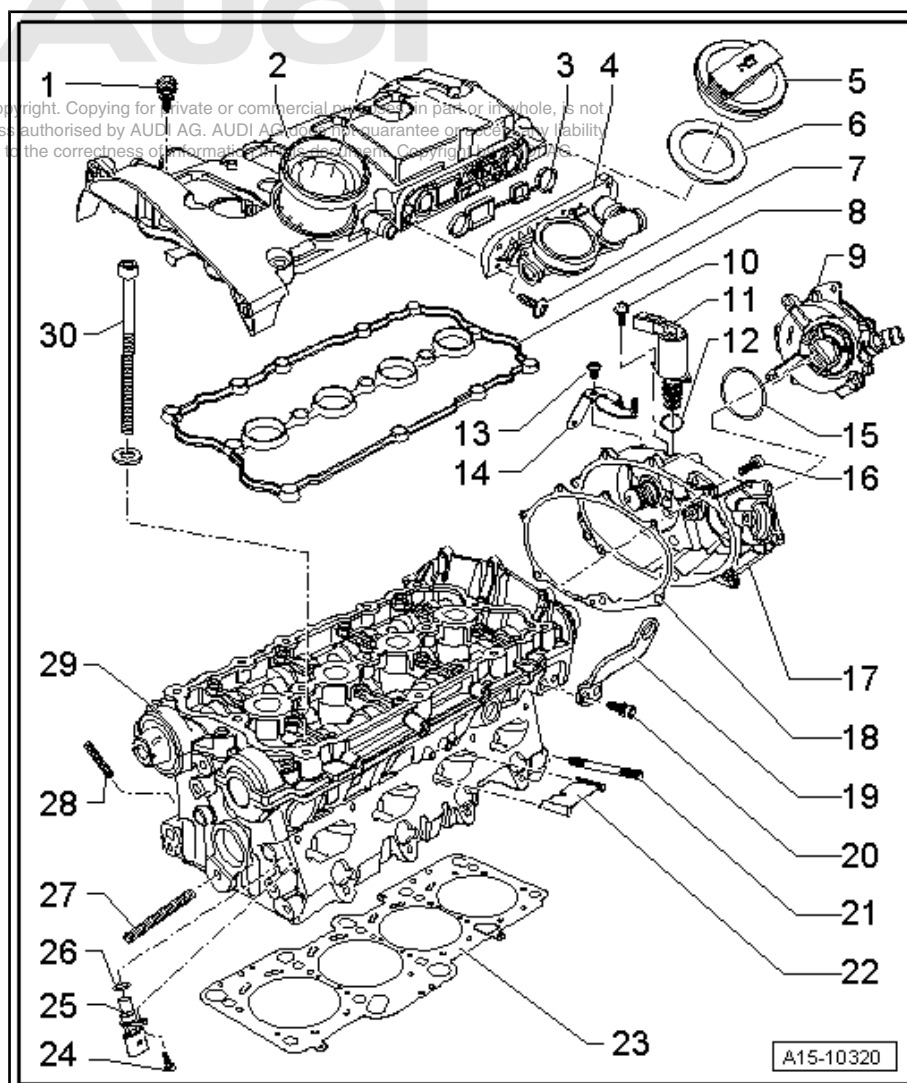
- ☐ Renew if damaged or leaking

16 - Bolt

- ☐ 9 Nm

17 - Housing

- ☐ For drive chain



18 - Gasket

- ☐ Renew

19 - Engine lifting eye**20 - Bolt**

- ☐ 23 Nm

21 - Threaded pin

- ☐ For intake manifold
- ☐ 9 Nm

22 - Separating plate**23 - Cylinder head gasket**

- ☐ Renew
- ☐ Note installation position: part number must face cylinder head

24 - Bolt

- ☐ Tightening torque [⇒ Item 12 \(page 245\)](#)

25 - Hall sender - G40

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

26 - Seal**27 - Threaded pin**

- ☐ For tensioning roller
- ☐ 15 Nm

28 - Threaded pin

- ☐ For exhaust manifold
- ☐ 17 Nm

29 - Cylinder head

- ☐ Removing and installing [⇒ page 76](#)
- ☐ [⇒ Fig. "“Checking cylinder head for distortion”", page 76](#)
- ☐ [⇒ Fig. "“Cylinder head machining limit”", page 76](#)
- ☐ If renewed, change coolant and engine oil

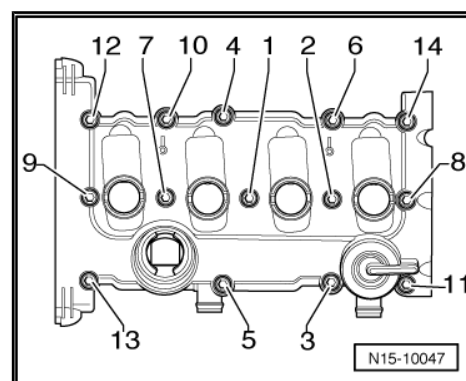
30 - Bolt

- ☐ Renew
- ☐ Note correct sequence when loosening [⇒ page 80](#)
- ☐ Tightening torque and sequence [⇒ page 76](#)

Cylinder head cover - tightening torque and sequence

- Tighten bolts in the sequence -1 ... 14- in 2 stages as follows:

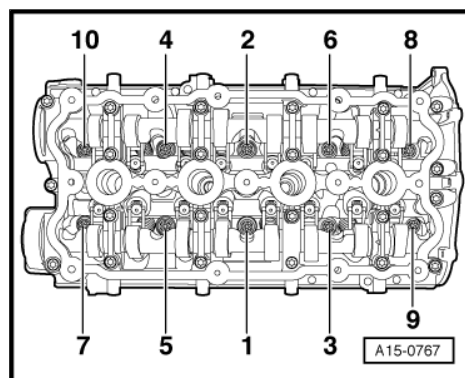
1. Screw in bolts by hand until they make contact.
2. Tighten to 10 Nm.



Cylinder head - tightening torque and sequence

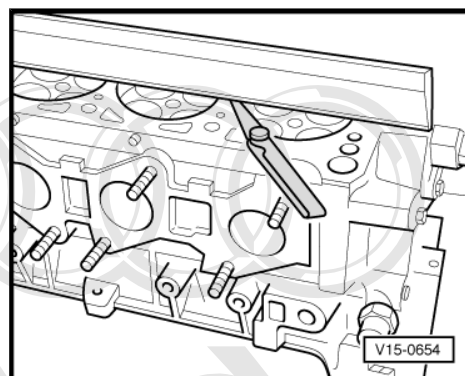
– Tighten bolts in the sequence -1 ... 10- in 3 stages as follows:

1. Tighten to 40 Nm.
2. Turn 90° further.
3. Turn 90° further.



Checking cylinder head for distortion

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

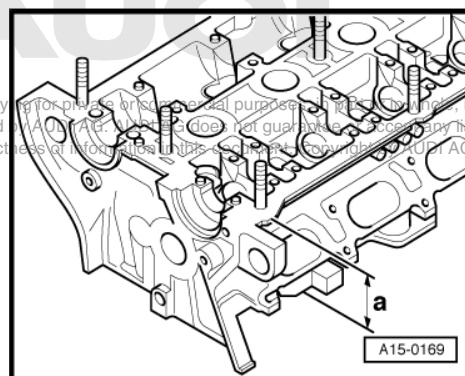


Cylinder head machining limit

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

- Minimum dimension: -a- = 139.20 mm

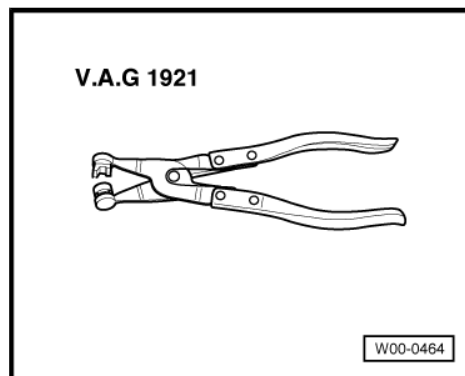
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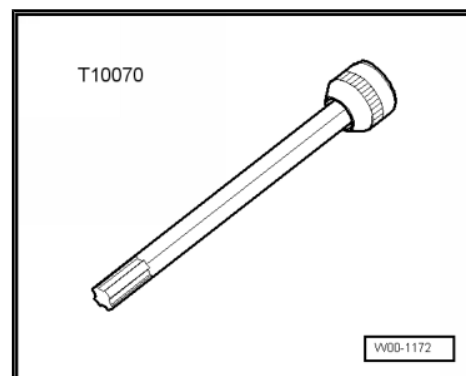
2.2 Removing and installing cylinder head

Special tools and workshop equipment required

- ◆ Hose clip pliers - V.A.G 1921-

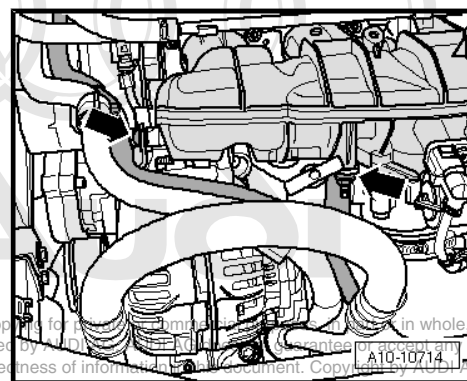


- ◆ Special wrench, long reach - T10070-



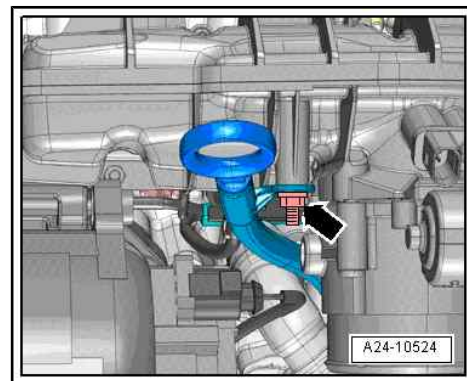
Removing

- Engine removed ⇒ [page 9](#)
- Remove turbocharger ⇒ [page 163](#).
- Unscrew bolt and nut -arrows- and press coolant pipe (front right) to one side (coolant hoses remain attached).



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- Remove centre hex stud -arrow- for dipstick guide tube.

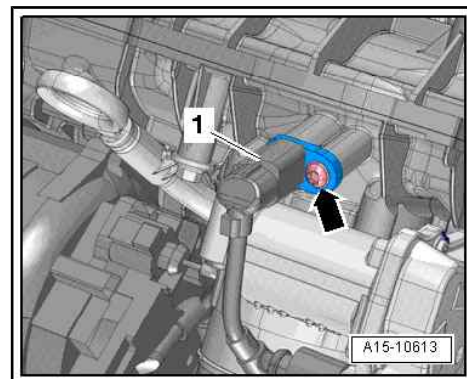


- Unplug electrical connector -1- at intake air temperature sender 2 - G299-.

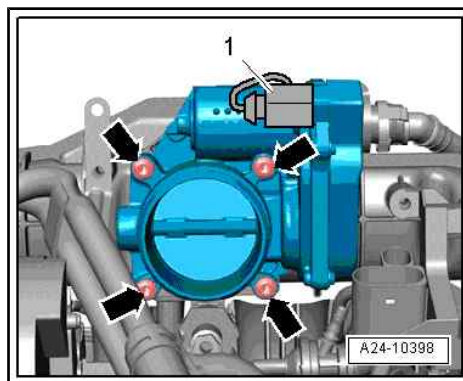


Note

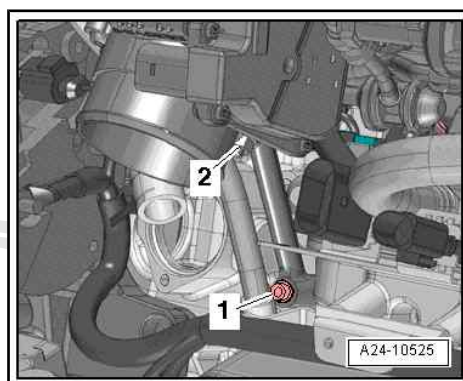
Disregard -arrow-.



- Unplug electrical connector -1-.
- Remove bolts -arrows- and detach throttle valve module - J338- .



- Unscrew nut -2- and bolt -1- and remove support for intake manifold.



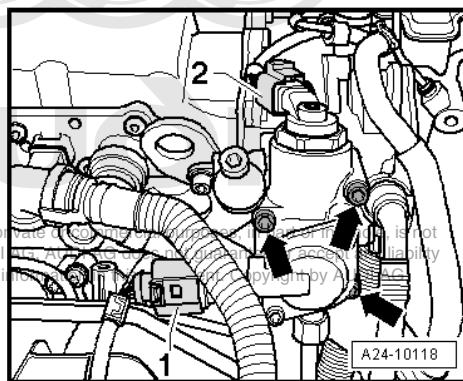
- Unplug electrical connectors at fuel pressure sender for low pressure - G410- -1- and fuel pressure regulating valve - N276- -2-.
- Move electrical wiring clear.



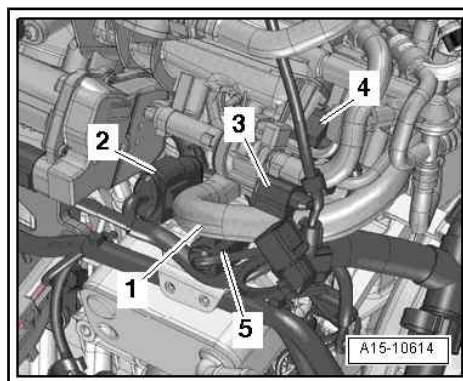
Note

Disregard -arrows-.

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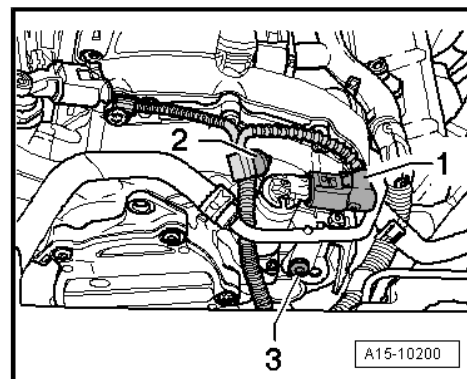
- Press release tabs and disconnect crankcase breather hose -1- from oil separator.
- Unplug electrical connectors:
 - 2 - For injectors (remove electrical connectors from bracket)
 - 3 - For activated charcoal filter solenoid valve 1 - N80-
 - 4 - Intake manifold flap motor - V157-
 - 5 - For fuel pressure sender - G247- and Hall sender - G40- (remove electrical connectors from bracket)



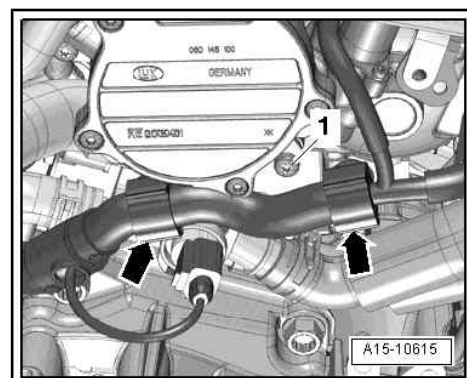
- Unplug electrical connector -1-.
- Release electrical wiring -2- from bracket.

**Note**

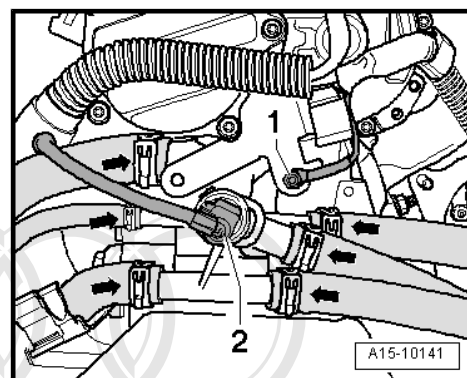
Disregard item -3-.



- Move electrical wiring harness clear -arrows- and remove bolt -1- for bracket.



- Unscrew earth wire -1-.
- Unplug electrical connector -2-.
- Disconnect coolant hoses and vacuum hoses -arrows-.
- Remove toothed belt ⇒ [page 66](#) .
- Remove cylinder head cover ⇒ [page 82](#) .



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- Slacken cylinder head bolts in the sequence -1 ... 10-.
- Remove bolts and detach cylinder head.

Installing



Caution

Avoid 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.**

Avoid damage to cylinder block.

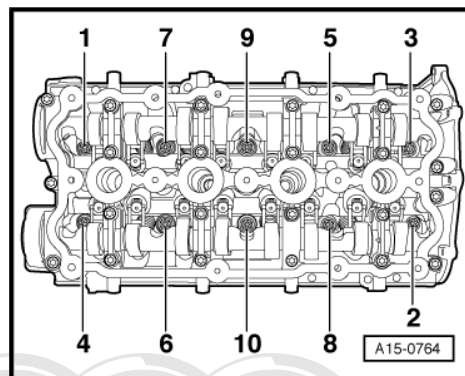
- ◆ **No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.**

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.**

Avoid damage to open valves.

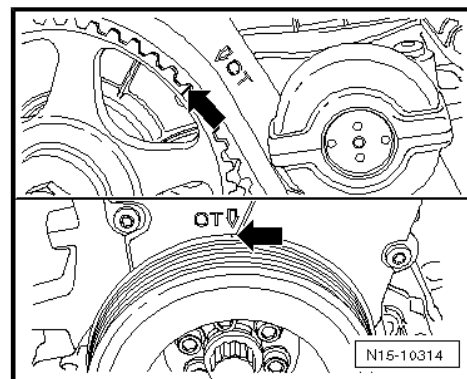
- ◆ **When installing an exchange cylinder head, the plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.**



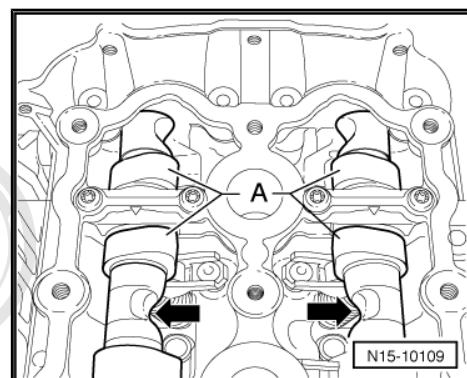
Note

- ◆ **Renew the bolts tightened with specified tightening angle.**
- ◆ **Renew self-locking nuts as well as seals, gaskets and O-rings.**
- ◆ **When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the camshaft housing.**
- ◆ **Hose connections and air pipes and hoses must be free of oil and grease before assembly.**
- ◆ **Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .**
- ◆ **To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.**
- ◆ **After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.**

- Align mark on camshaft sprocket with mark on toothed belt cover -top arrow-.



- Cams -A- on both camshafts should be symmetrically aligned.
- Recesses -arrows- on both camshafts must face each other.
- 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°.



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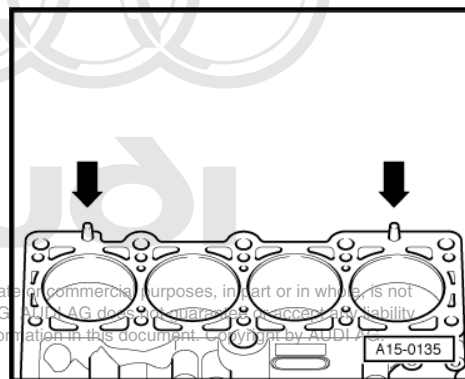
- Place cylinder head gasket in position.
- Installation position: Part No. must be visible.
- Note position of dowel sleeves in cylinder block.
- Fit cylinder head.
- Tighten cylinder head bolts ⇒ [page 76](#) .



Note

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

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- Install cylinder head cover ⇒ [page 82](#) .
- Rotate crankshaft in normal direction of rotation back to “TDC”.
- Install toothed belt (adjust valve timing) ⇒ [page 71](#) .
- Install support for intake manifold and throttle valve module - J338- ⇒ [page 197](#) .
- Secure dipstick guide tube ⇒ [page 112](#) .
- Install coolant pipe (front right) ⇒ [page 152](#) .
- Install turbocharger ⇒ [page 163](#) .
- Install engine ⇒ [page 9](#) .
- Install radiator cowl ⇒ [page 157](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Change engine oil ⇒ Maintenance ; Booklet 819 .
- Fill cooling system with fresh coolant ⇒ [page 135](#) .

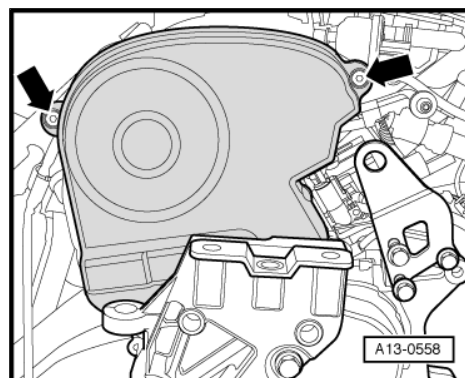
Tightening torques

- ♦ ⇒ [Fig. “Cylinder head - tightening torque and sequence”](#), [page 76](#)
- ♦ ⇒ [“2.1 Exploded view - cylinder head”](#), [page 74](#)

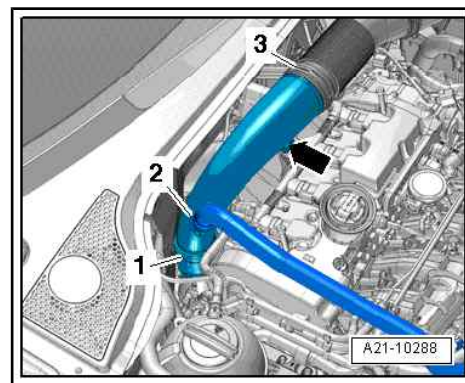
2.3 Removing and installing cylinder head cover

Removing

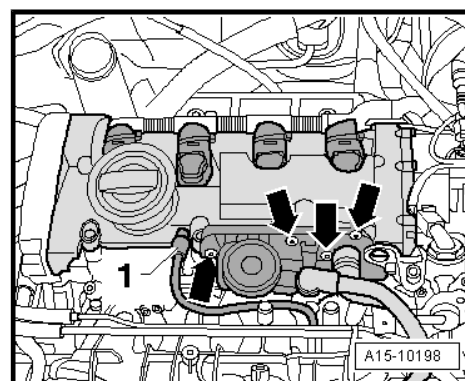
- Remove engine cover panel ⇒ [page 33](#) .
- Unscrew bolts -arrows- and press toothed belt cover (top) slightly to one side.
- Remove ignition coils ⇒ [page 245](#) .



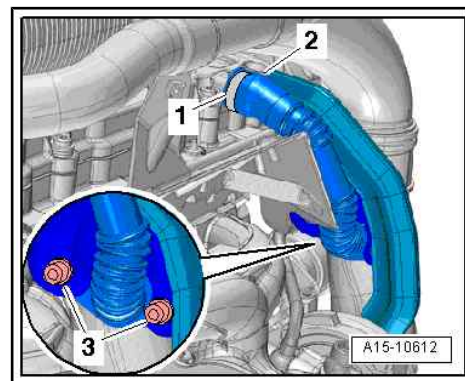
- Remove bolt -arrow-.
- Loosen hose clips -1- and -3- and move air pipe clear to one side (hose -2- remains connected).



- Disconnect vacuum hose -1- from cylinder head cover.
- Remove bolts -arrows- and detach pressure control valve for crankcase breather system.



- Disconnect pipe -2- coming from activated charcoal filter from cylinder head cover.
- Remove bolts -3-, release hose clip -1- and disconnect crankcase breather pipe with heat shield from cylinder head cover.



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- Slacken cylinder head cover bolts in the sequence -14 ... 1-.
- Remove bolts and take off cylinder head cover.

Installing

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

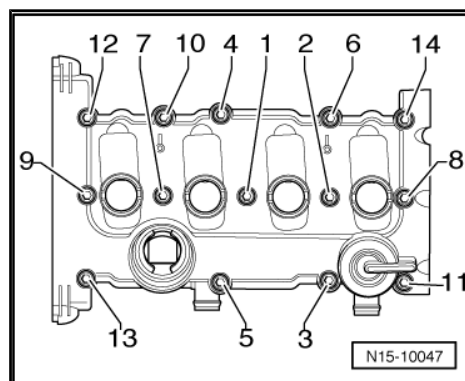


Note

- ◆ *Renew gasket for cylinder head cover if damaged.*
- ◆ *Renew bolts for cylinder head cover if seals on bolts are damaged.*
- ◆ *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 .*
- Tighten cylinder head cover bolts ⇒ [page 75](#) .
- Install crankcase breather pipe ⇒ [page 160](#) .
- Secure toothed belt cover (top section) ⇒ [page 65](#) .
- Install ignition coils ⇒ [page 245](#) .

Tightening torques

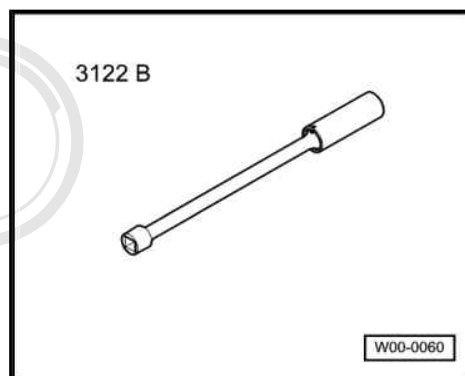
- ◆ ⇒ [Fig. “Cylinder head cover - tightening torque and sequence”](#), [page 75](#)
- ◆ ⇒ [“2.1 Exploded view - cylinder head”](#), [page 74](#)



2.4 Checking compression

Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-



- ◆ Compression tester - V.A.G 1763-

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Procedure

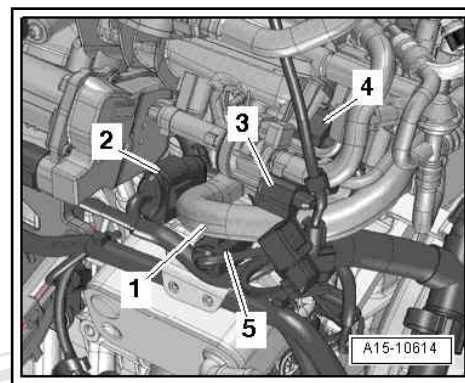
- Engine oil temperature at least 30 °C.
- Battery voltage at least 12.5 V.
- Unplug electrical connector -2- for injectors.



Note

Disregard items -1, 3, 4, 5-.

- Remove ignition coils ⇒ [page 245](#) .
- 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 - 14.0
Wear limit	7.0
Maximum difference between cylinders	3.0

Assembling

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

- Install spark plugs ⇒ Maintenance ; Booklet 819 .
- Install ignition coils ⇒ [page 245](#) .

Faults are stored in engine control unit because electrical connectors have been unplugged.

- Connect vehicle diagnostic, testing and information system - VAS 5051B- .
- Start “Guided Functions” mode.
- Generate readiness code in engine control unit.

3 Valve gear

- ⇒ ["3.1 Exploded view - valve gear", page 86](#)
- ⇒ ["3.2 Measuring axial clearance of camshaft", page 88](#)
- ⇒ ["3.3 Measuring radial clearance of camshaft", page 89](#)
- ⇒ ["3.4 Removing and installing camshaft oil seal", page 89](#)
- ⇒ ["3.5 Removing and installing camshaft", page 91](#)
- ⇒ ["3.6 Removing and installing camshaft adjuster", page 95](#)
- ⇒ ["3.7 Removing and installing camshaft control valve 1 N205", page 100](#)
- ⇒ ["3.8 Removing and installing valve stem oil seals", page 101](#)

3.1 Exploded view - valve gear

1 - Bolt

- ☐ Renew
- ☐ Slacken and tighten with counterhold tool - 3036-
- ☐ Tightening torque
⇒ [Item 3 \(page 65\)](#)

2 - Camshaft sprocket

3 - Oil seal

- ☐ For exhaust camshaft
- ☐ Renewing ⇒ [page 89](#)

4 - Cylinder head

5 - Valve guide

- ☐ Checking ⇒ [page 109](#)

6 - Valve stem oil seal

- ☐ Renewing: with cylinder head installed
⇒ [page 101](#), with cylinder head removed
⇒ [page 105](#)

7 - Valve spring

8 - Valve spring plate

9 - Valve cotters

10 - Hydraulic valve compensation element

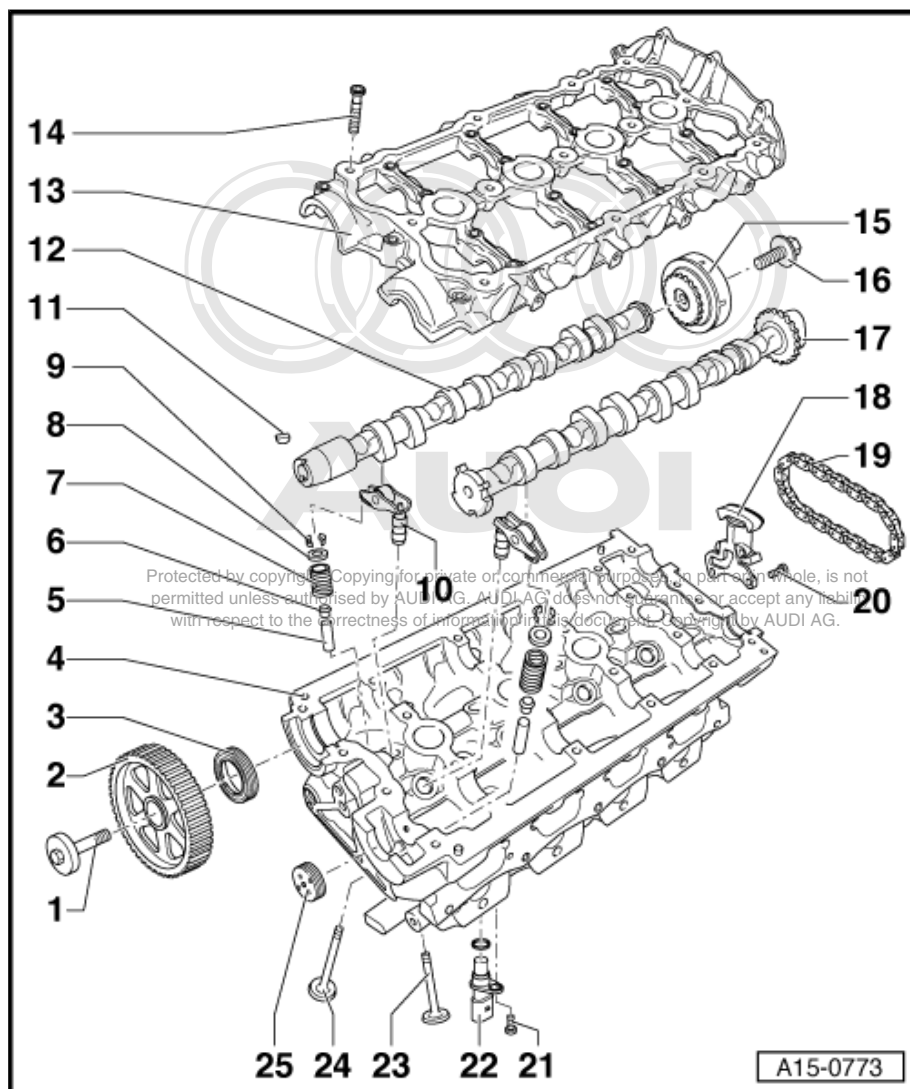
- ☐ With roller rocker finger and securing clip
- ☐ Mark installation position for re-installation
- ☐ Lubricate running surfaces with oil

11 - Parallel key

- ☐ Check for firm attachment

12 - Exhaust camshaft

- ☐ Removing and installing ⇒ [page 91](#)
- ☐ Measuring axial clearance ⇒ [page 88](#)



- ☐ Measuring radial clearance ⇒ [page 89](#)

- ☐ Runout: max. 0.04 mm

13 - Retaining frame

- ☐ With integrated camshaft bearings
- ☐ Only clean sealing surface (do not machine)
- ☐ Only renew together with cylinder head

14 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 88](#)

15 - Camshaft adjuster

- ☐ Removing and installing ⇒ [page 95](#)

16 - Bolt

- ☐ Renew
- ☐ 20 Nm + turn 45° further

17 - Inlet camshaft

- ☐ Removing and installing ⇒ [“3.5 Removing and installing camshaft”, page 91](#)
- ☐ Measuring axial clearance ⇒ [page 88](#)
- ☐ Measuring radial clearance ⇒ [page 89](#)
- ☐ Runout: max. 0.04 mm

18 - Chain tensioner

- ☐ Removing ⇒ [“3.6 Removing and installing camshaft adjuster”, page 95](#)
- ☐ Before removing, lock in place using locking pin - T10115-

19 - Drive chain

20 - Bolt

- ☐ Self-locking
- ☐ Renew
- ☐ 9 Nm

21 - Bolt

- ☐ Tightening torque ⇒ [Item 12 \(page 245\)](#)

22 - Hall sender - G40-

- ☐ Version fitted in vehicle may differ from illustration

23 - Exhaust valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Valve dimensions ⇒ [page 110](#)
- ☐ Checking valve guides ⇒ [page 109](#)

24 - Inlet valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Valve dimensions ⇒ [page 110](#)
- ☐ Checking valve guides ⇒ [page 109](#)

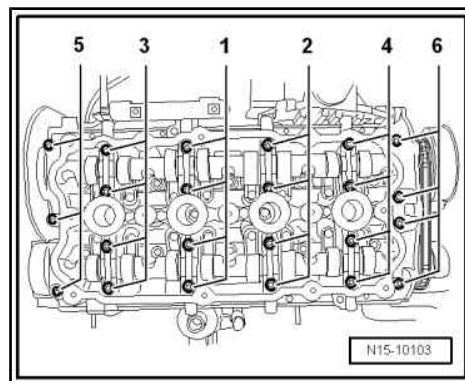
25 - Sealing cap

- ☐ Renew
- ☐ Removing sealing cap with retaining frame installed: pierce on one side with an awl and pry out
- ☐ Installing: press in 1 ... 2 mm deep without sealant using thrust piece - 3334-

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Retaining frame - tightening torque and sequence

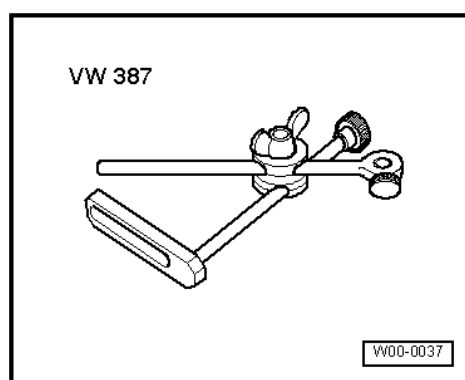
- Renew bolts for retaining frame.
- Tighten bolts in the sequence -1 ... 6- in 3 stages as follows:
 1. Screw in by hand until contact is made.
 - The retaining frame should make contact with the cylinder head over the full surface.
 2. Tighten to 8 Nm.
 3. Turn 90° further.



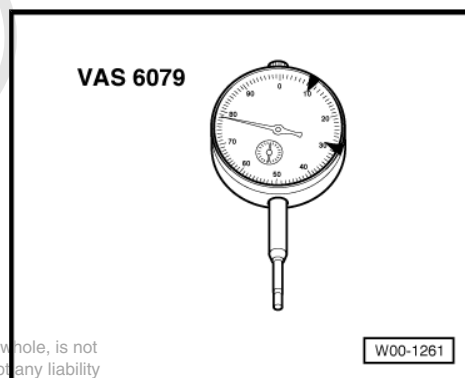
3.2 Measuring axial clearance of camshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



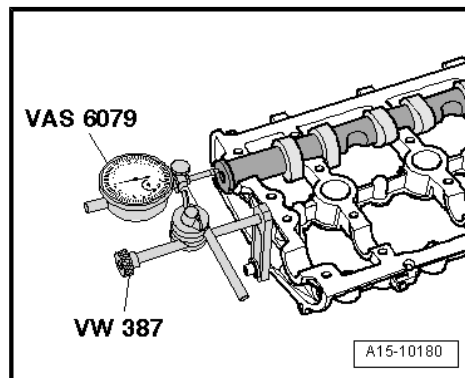
- ◆ Dial gauge - VAS 6079-



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Procedure

- Remove retaining frame
⇒ [“3.5 Removing and installing camshaft”, page 91](#) .
- Fit camshaft to be tested in retaining frame.
- Attach dial gauge - VAS 6079- with dial gauge bracket - VW 387- to cylinder head.
- Press camshaft against dial gauge by hand.
- Set dial gauge to “0”.
- Press camshaft away from dial gauge and read off value:
 - Axial clearance: 0.05 ... 0.17 mm



3.3 Measuring radial clearance of camshaft

Procedure

- Remove roller rocker fingers
⇒ ["3.5 Removing and installing camshaft", page 91](#).
- Clean bearings and bearing journals.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.
- The Plastigage must be positioned in the centre of the bearing.
- Fit retaining frame and tighten to 8 Nm without rotating camshafts ⇒ [page 88](#).
- Remove retaining frame again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

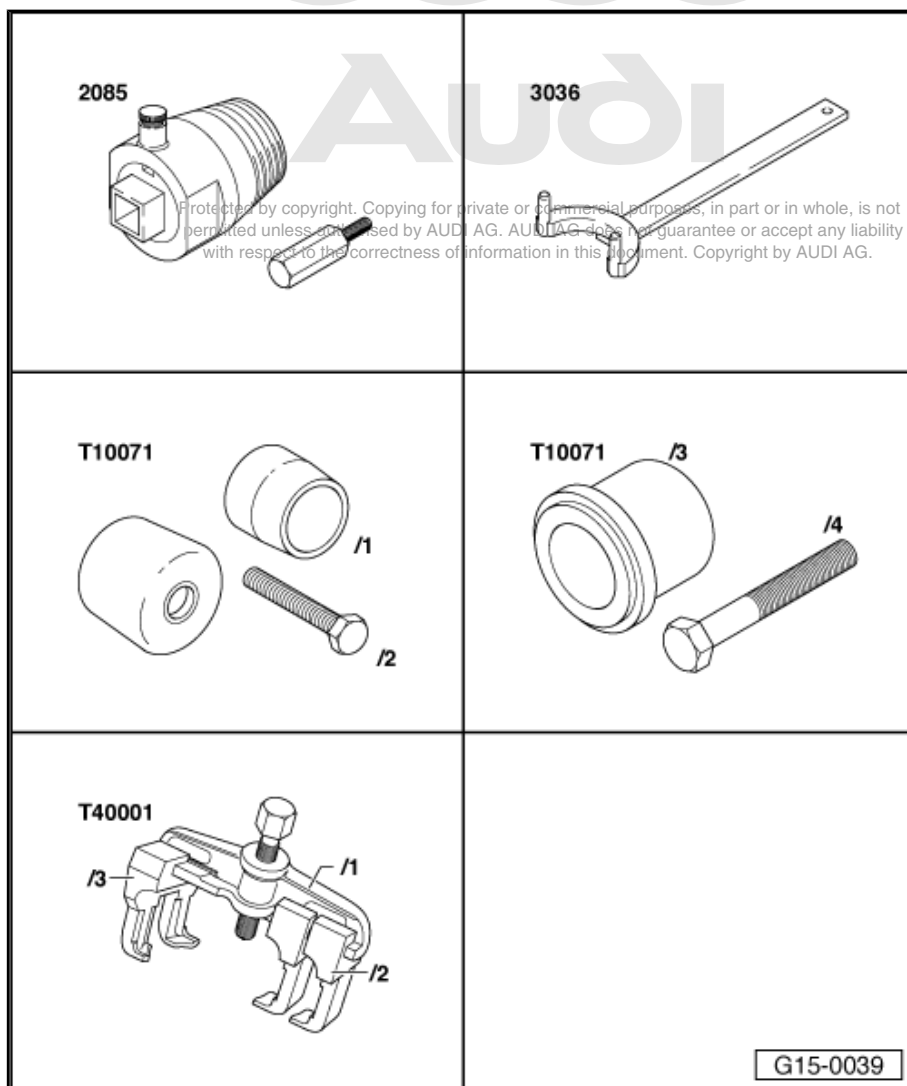
24 mm bearing diameter: 0.024 ... 0.066 mm.

32 mm bearing diameter: 0.030 ... 0.051 mm.

3.4 Removing and installing camshaft oil seal

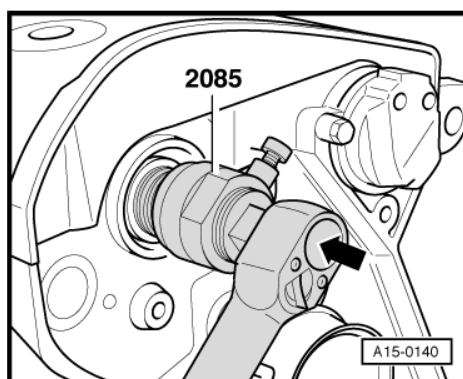
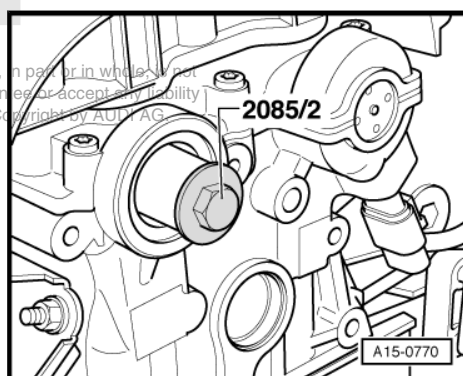
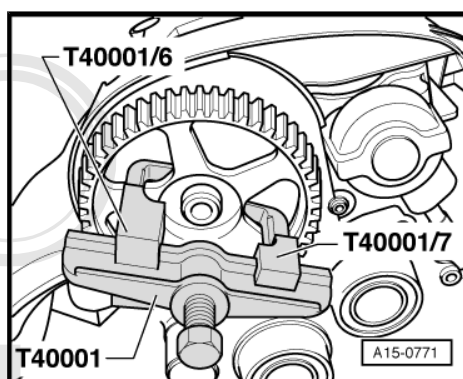
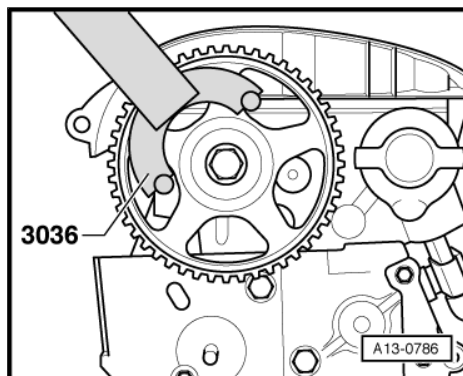
Special tools and workshop equipment required

- ◆ Oil seal extractor - 2085-
- ◆ Counterhold tool - 3036-
- ◆ Assembly tool - T10071-
- ◆ Puller - T40001-
- ◆ Nuts M12 (2x)



Procedure

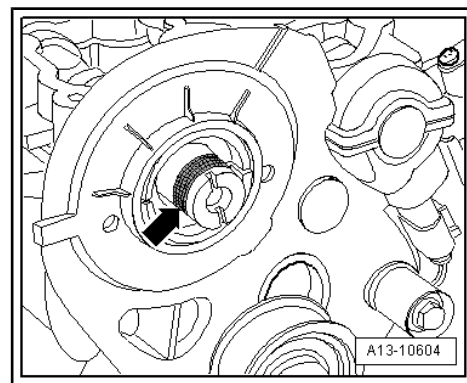
- Remove toothed belt ⇒ [page 66](#) .
- Loosen bolt for camshaft sprocket using counterhold tool - 3036- .
- Detach camshaft sprocket using two-arm puller - T40001- and claws -T40001/6- and -T40001/7-
- To guide oil seal extractor, screw adapter - 2085/2- into camshaft by hand as far as it will go.
- Screw inner section of oil seal extractor - 2085- two turns (approx. 3 mm) out of outer section and lock 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 section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface for oil seal.



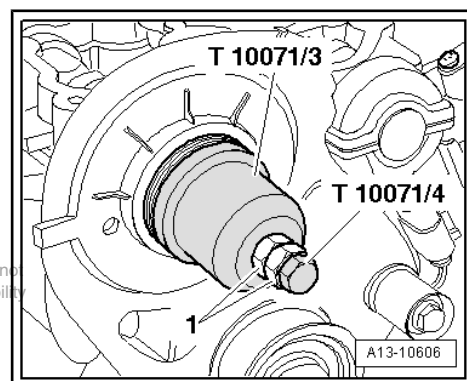
Note

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

- Mask groove at taper of camshaft with adhesive tape -arrow-.



- Place two M12 nuts -item 1- underneath head of bolt -T10071/4- .
- Press oil seal in onto stop using guide sleeve -T10071/3- and bolt -T10071/4- .



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Note

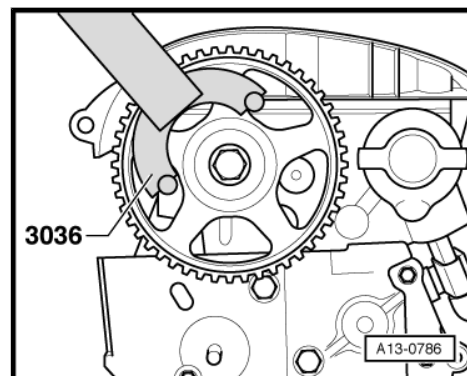
Make sure parallel key for camshaft sprocket is correctly seated.



Caution

Avoid damage to valves and piston crowns.

- ◆ ***The crankshaft must not be at "TDC" at any cylinder when the camshaft is turned.***
- ◆ ***The engine must be no more than warm to touch.***



- Tighten bolt for camshaft sprocket using counterhold tool -3036- .
- Install toothed belt (adjust valve timing) ⇒ [page 71](#) .

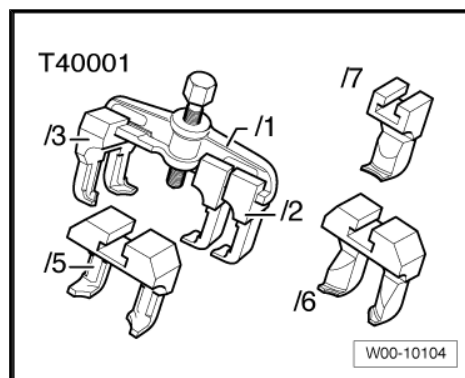
Tightening torques

- ◆ ⇒ ["3.1 Exploded view - valve gear", page 86](#)

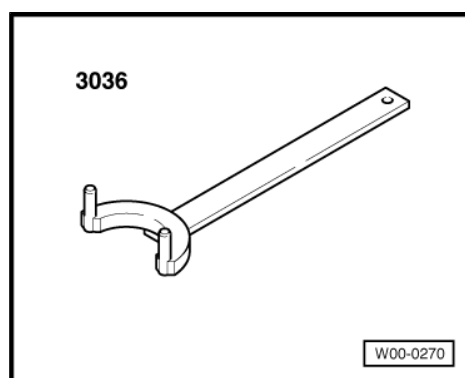
3.5 Removing and installing camshaft

Special tools and workshop equipment required

◆ Two-arm puller - T40001-



◆ Counterhold tool - 3036-



◆ Sealant remover, commercially available

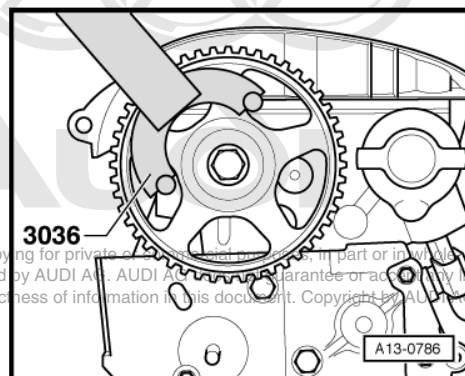
◆ Sealant ⇒ Electronic parts catalogue

Removing



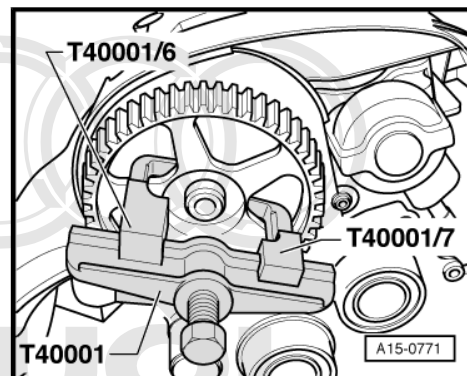
Note

- ◆ *Sealing surfaces at bottom of retaining frame and top of cylinder head may not be machined.*
- ◆ *The camshaft bearings are integrated into the cylinder head and retaining frame. Toothed belt must be slackened before removing retaining frame.*
- ◆ *If the retaining frame has been unfastened, oil seal for camshaft and sealing cap must be renewed.*
- Remove camshaft adjuster ⇒ [page 95](#) .
- Remove toothed belt ⇒ [page 66](#) .
- Loosen bolt for camshaft sprocket using counterhold tool - 3036- .

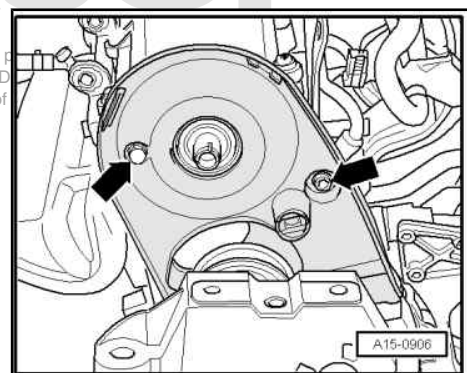


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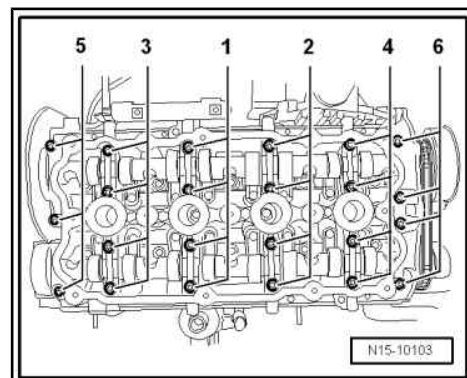
- Detach camshaft sprocket using two-arm puller - T40001- and claws -T40001/6- and -T40001/7-



- Remove bolts -arrows- for toothed belt cover (rear).
- Swivel toothed belt cover (rear) slightly away from cylinder head.



- Slacken retaining frame bolts in the sequence -6 ... 1-.
- Unscrew bolts, carefully detach retaining frame and set it down on a soft surface on workbench.
- Remove camshafts from cylinder head and place on a clean surface.



Installing



Note

Renew bolts for retaining frame.



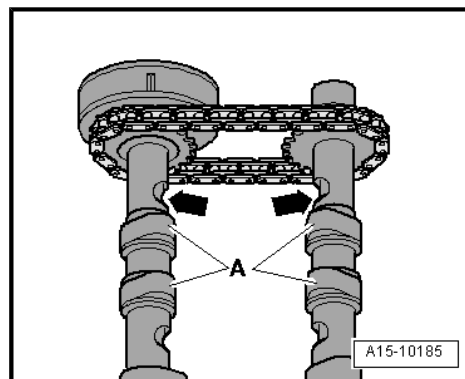
Caution

Protect lubrication system and bearings against contamination.

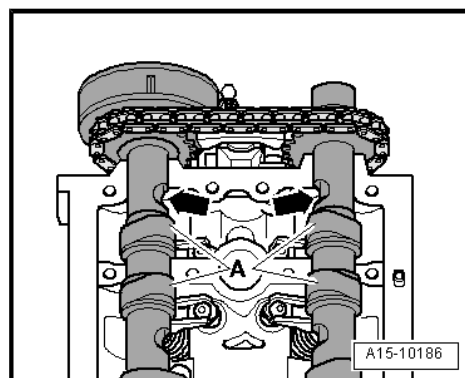
- ◆ ***Cover exposed parts of the engine.***

- Remove sealant residue on cylinder head and retaining frame using commercially available sealant remover.
- Clean sealing surfaces; they must be free of oil and grease.
- Check whether all roller rocker fingers contact the valve ends correctly.
- Oil running surfaces of both camshafts.

- Position drive chain as follows on chain sprockets of camshaft (removed):
- Cams -A- of cylinder 4 must face each other.
- Recesses -arrows- on both camshafts must face each other.
- The side surfaces of the recesses should be positioned exactly vertical.
- Insert camshafts together with drive chain into cylinder head and chain tensioner.



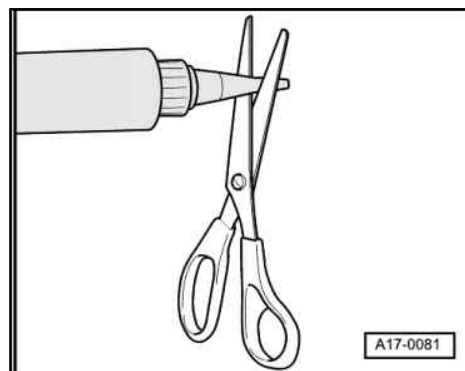
- Check "TDC" position of camshafts again:
- Cams -A- of cylinder 4 must face each other.
- Recesses -arrows- on both camshafts must face each other.
- The side surfaces of the recesses should be positioned in exactly vertical line to the cylinder head.



Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 1.0 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

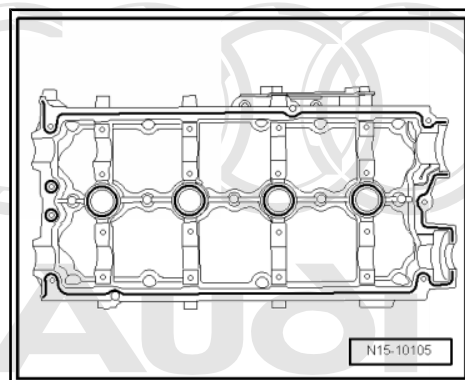
- ◆ ***The sealant beads must not be thicker than specified.***

- Apply an even, slightly projecting sealant bead into the clean groove of the retaining frame.



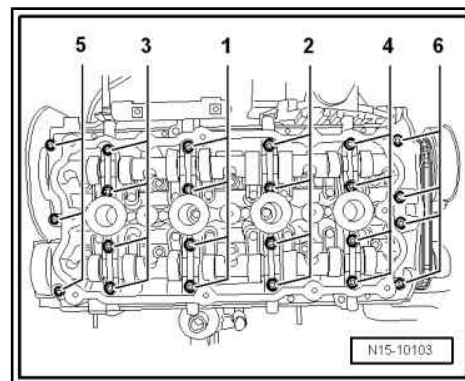
Note

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



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- Tighten bolts for retaining frame ⇒ [page 88](#) .

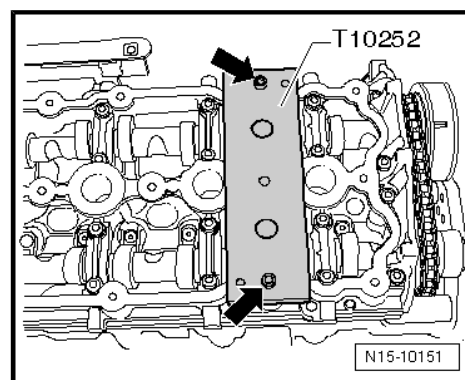


- Check “TDC” position of camshafts:
- It should be possible to insert camshaft clamp - T10252- as far as stop.

**Note**

- ◆ *If necessary, turn camshafts slightly backwards or forwards when inserting camshaft clamp - T10252- .*
- ◆ *Disregard -arrows-.*

- Remove camshaft clamp - T10252- .
- Drive sealing cap ⇒ [Item 25 \(page 87\)](#) in approx. 1 ... 2 mm using thrust piece - 3334- .



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

**Caution**

Avoid damage to valves and piston crowns.

- ◆ *The crankshaft must not be at “TDC” at any cylinder when the camshaft is turned.*
- ◆ *The engine must be no more than warm to touch.*

- Install camshaft oil seal ⇒ [page 89](#) .
- Secure toothed belt cover (rear) ⇒ [page 65](#) .
- Insert parallel key into camshaft, ensuring it is correctly seated.
- Install camshaft adjuster ⇒ [page 95](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 71](#) .

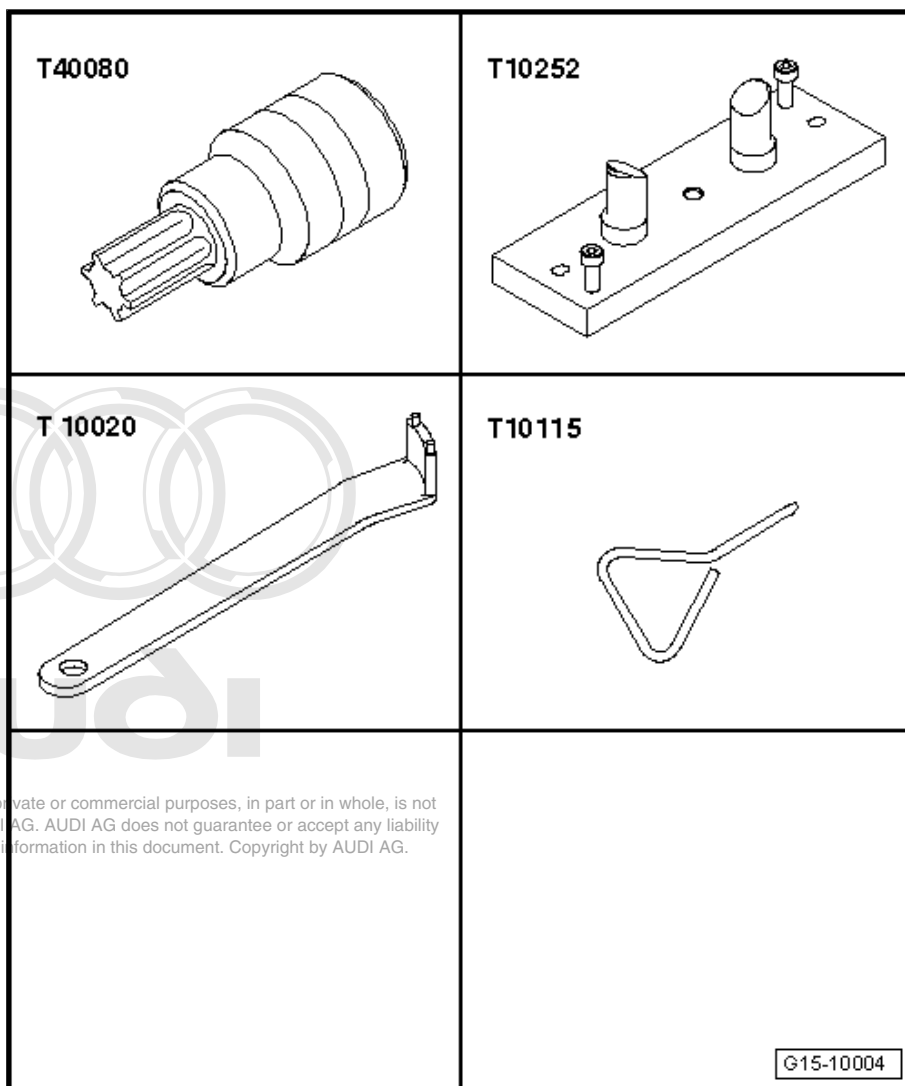
Tightening torques

- ◆ ⇒ [Fig. “Retaining frame - tightening torque and sequence”](#), [page 88](#)

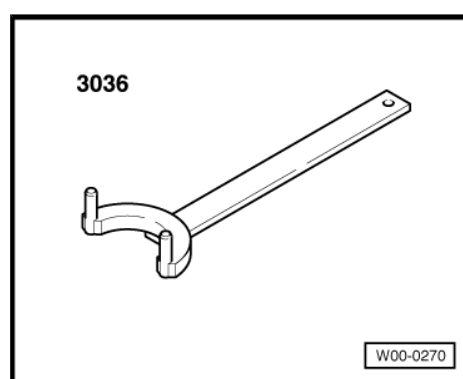
3.6 Removing and installing camshaft adjuster

Special tools and workshop equipment required

- ◆ Special wrench, long reach - T40080-
- ◆ Camshaft clamp - T10252-
- ◆ Pin wrench - T10020-
- ◆ Locking pin - T10115-



- ◆ Counterhold tool - 3036-



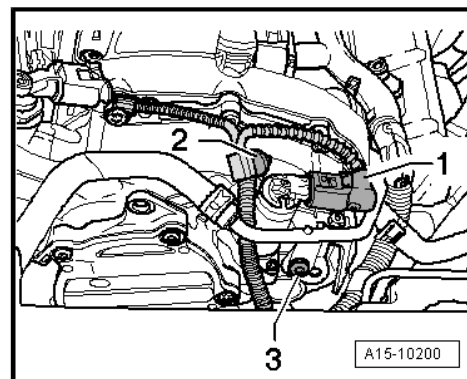
Removing

- Remove high-pressure pump ⇒ [page 224](#) .
- Remove cylinder head cover ⇒ [page 82](#) .
- Remove vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .

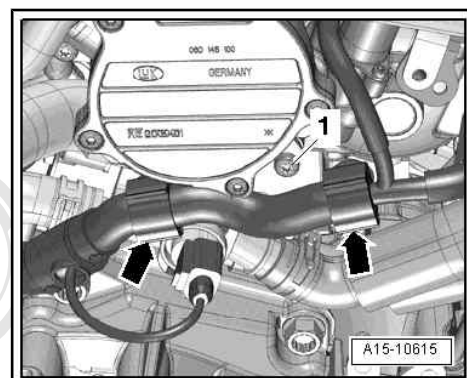
- If fitted, unplug electrical connector -1-.
- If fitted, release electrical wiring harness -2- from bracket.

**Note**

Disregard item -3-.



- Move electrical wiring harness clear -arrows- and remove bolt -1- for bracket.
- Remove brake fluid reservoir ⇒ Brake system; Rep. gr. 47 ; Brake servo/brake master cylinder; Removing and installing brake fluid reservoir .

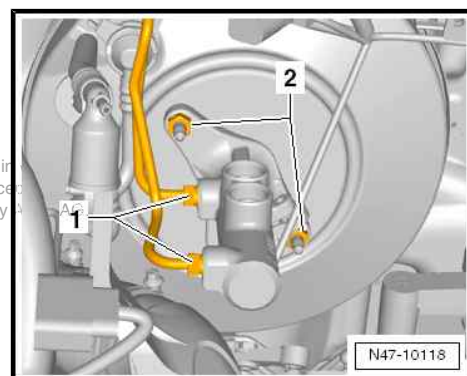


- Only disconnect front brake line -1- from brake master cylinder; seal brake lines with plugs from repair kit.

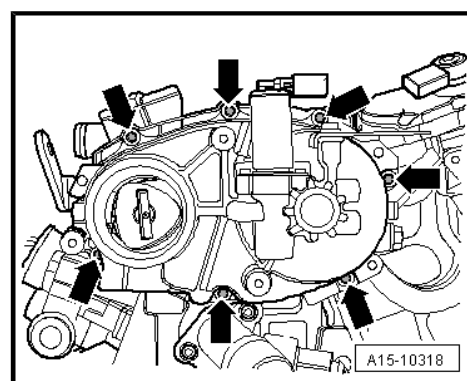
**Note**

Item -2- can be disregarded.

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- Remove bolts -arrows- and detach housing for camshaft adjuster.



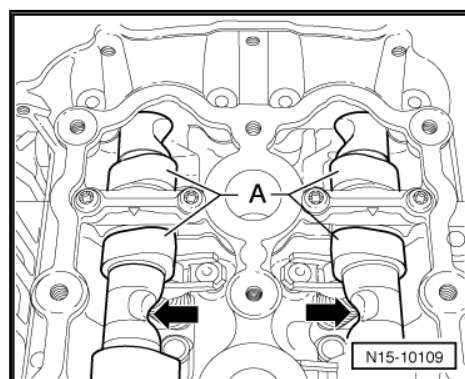
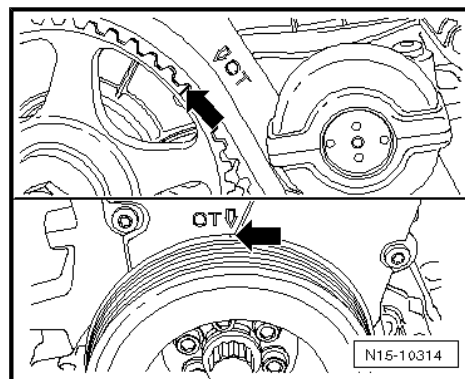


Caution

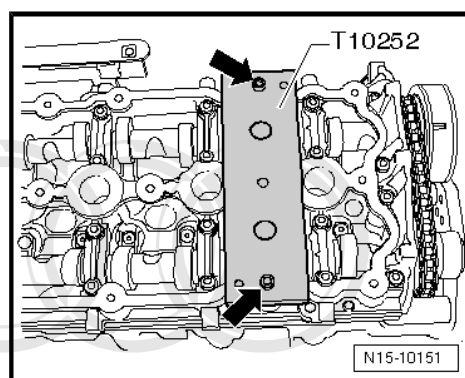
Irreparable damage can be caused if the toothed belt slips.

◆ Turn crankshaft only in direction of engine rotation.

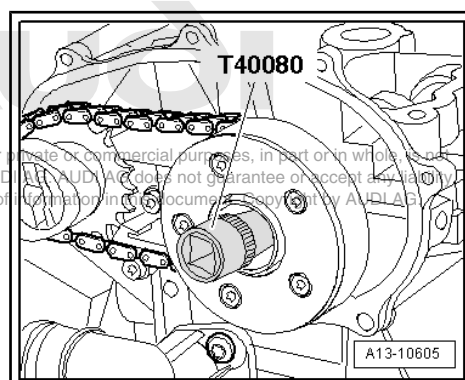
- Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at “TDC”.
- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.
- Cams -A- on both camshafts should be symmetrically aligned.
- Recesses -arrows- on both camshafts must face each other.



- Fit camshaft clamp - T10252- and tighten -arrows-, as shown in illustration.
- Additionally, counterhold camshaft sprocket with counterhold tool - 3036- .

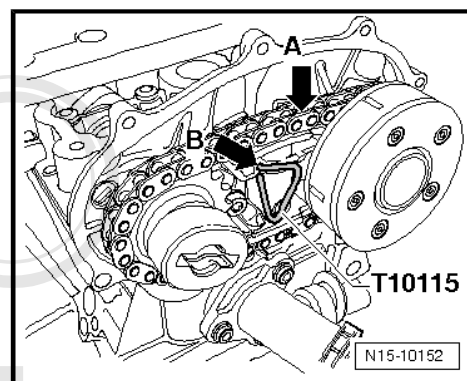


- Use special wrench, long reach - T40080- to slacken camshaft adjuster bolt approx. 1/2 a turn.



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- Press chain tensioner down -arrow A- and lock with locking pin - T10115- -arrow B-.
- Unscrew camshaft adjuster bolt and remove camshaft adjuster together with drive chain.



Installing

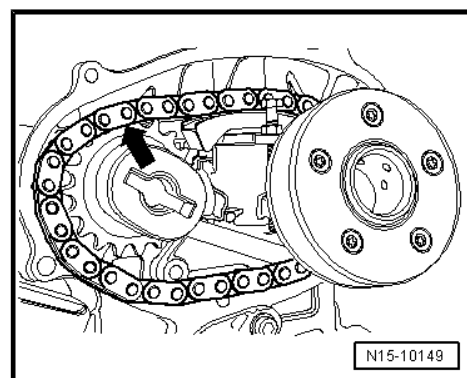
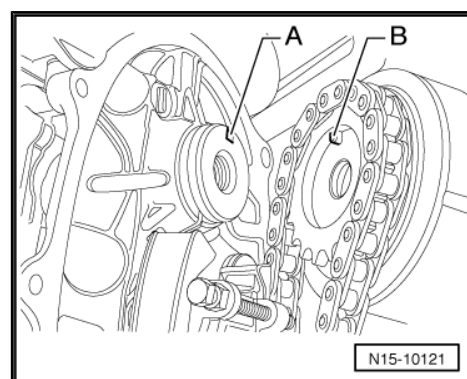
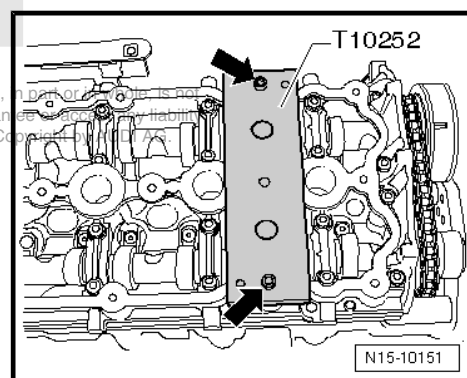
- Camshafts locked in position with camshaft clamp - T10252- .



Note

Renew camshaft adjuster bolt.

- Fit drive chain on camshaft adjuster.
- Position camshaft adjuster in front of exhaust camshaft as follows:
- Groove -A- and pin -B- must be aligned.
- Lay chain over inlet camshaft sprocket starting at top -arrow- without changing its position.



- Slowly turn inlet camshaft in clockwise direction -arrow A- using pin wrench - T10020- until camshaft adjuster fits onto camshaft.



Note

If it is not possible to fit the pin into the notch: remove chain and fit chain again.

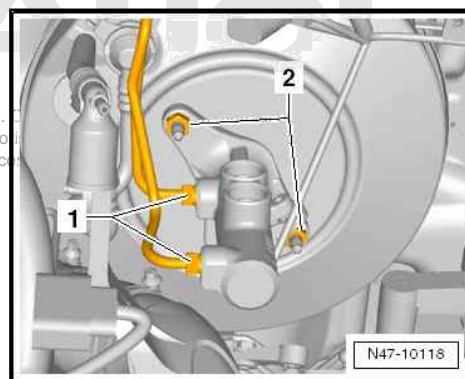
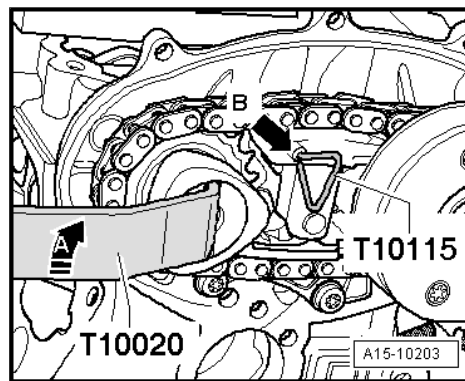
- Tighten camshaft adjuster bolt using special wrench, long reach - T40080- .

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

- Install coolant bleeder line ⇒ [page 149](#) .
- Install vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .
- Install cylinder head cover ⇒ [page 82](#) .
- Install high-pressure pump ⇒ [page 224](#) .
- Install brake fluid reservoir ⇒ Brake system; Rep. gr. 47 ; Brake servo/brake master cylinder; Removing and installing brake fluid reservoir .
- Connect front brake line -1- to brake master cylinder ⇒ Brake system; Rep. gr. 47 ; Brake servo/brake master cylinder; Removing and installing brake master cylinder .

Tightening torques

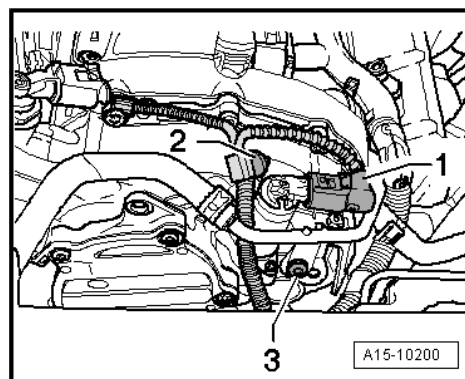
- ♦ ⇒ [“3.1 Exploded view - valve gear”, page 86](#)



3.7 Removing and installing camshaft control valve 1 - N205-

Removing

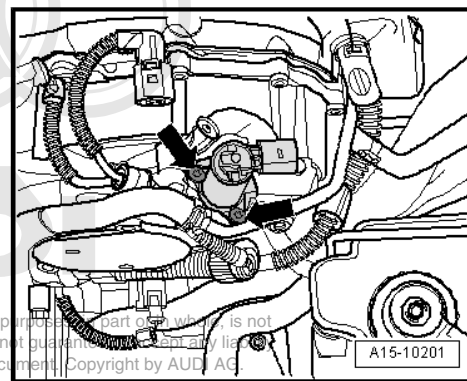
- Remove engine cover panel ⇒ [page 33](#) .
- Unplug electrical connector -1-.
- Release electrical wiring -2- from bracket.
- Remove bolt -3-.



**Caution**

Risk of damage to electrical wiring.

- ◆ *Do not pull on electrical connector when removing camshaft control valve 1 - N205-.*



- Remove bolts -arrows- and pull inlet camshaft control valve 1 - N205- out of drive chain housing.

Installing**Note**

- ◆ *Renew seal.*
- ◆ *Remove any kind of dirt from inlet camshaft control valve 1 - N205-.*

**Caution**

- ◆ *Protect inlet camshaft control valve 1 - N205- against damage by knocks and impact.*
- ◆ *Do not remove a new inlet camshaft control valve 1 - N205- from packaging until you are ready to install it.*

- Lubricate seal lightly with engine oil.
- Carefully fit inlet camshaft control valve 1 - N205- into drive chain housing and press in by hand as far as the stop (exert pressure in line with axis of valve).

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

- Install coolant bleeder line ⇒ [page 149](#).

Tightening torques

- ◆ ⇒ ["2.1 Exploded view - cylinder head", page 74](#)

3.8 Removing and installing valve stem oil seals

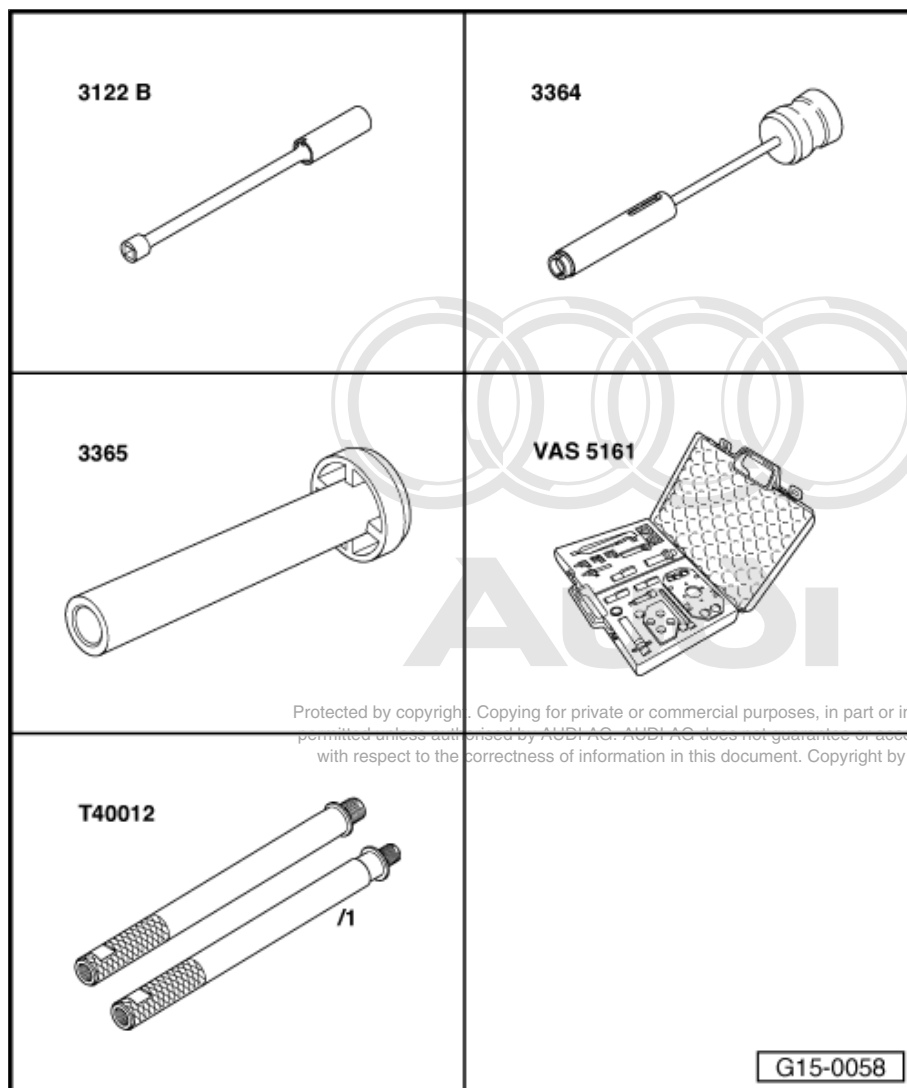
⇒ ["3.8.1 Removing and installing valve stem oil seals \(cylinder head installed\)", page 101](#)

⇒ ["3.8.2 Removing and installing valve stem oil seals \(cylinder head removed\)", page 105](#)

3.8.1 Removing and installing valve stem oil seals (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 2.0 ltr. and 3.0 ltr. FSI engine - VAS 5161/19B-
- ◆ Adapters - T40012-

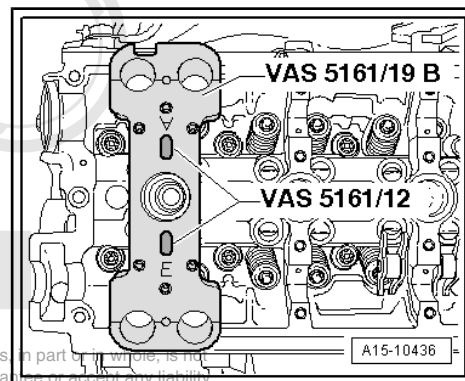


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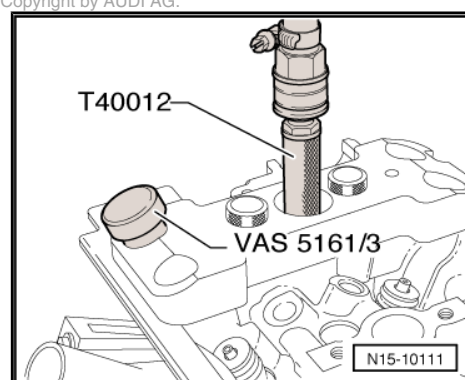
Procedure

- Remove camshafts ⇒ [page 91](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for reinstallation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Remove spark plugs with spark plug socket and extension - 3122 B- .
- Set piston of appropriate cylinder to “bottom dead centre”.

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



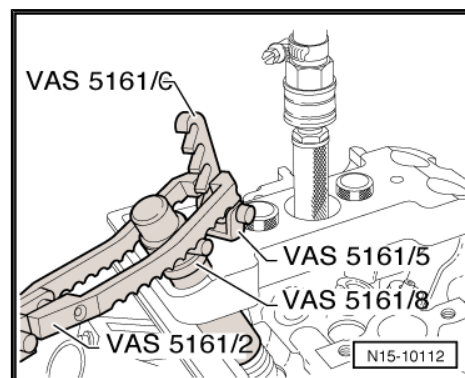
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.
- Connect adapter to compressed air line using a commercially available connection piece, and apply constant air pressure.
- Minimum pressure: 6 bar



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

Inlet side:

- Engage pressure fork -VAS 5161/2- at snap-in device, as shown in illustration.

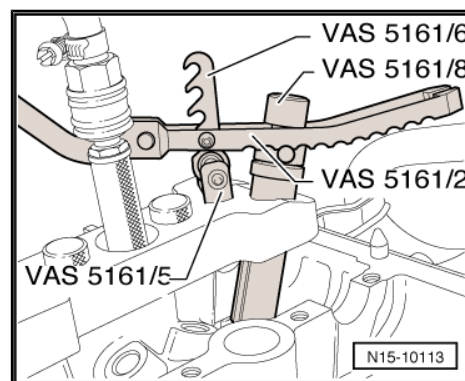


Exhaust side:

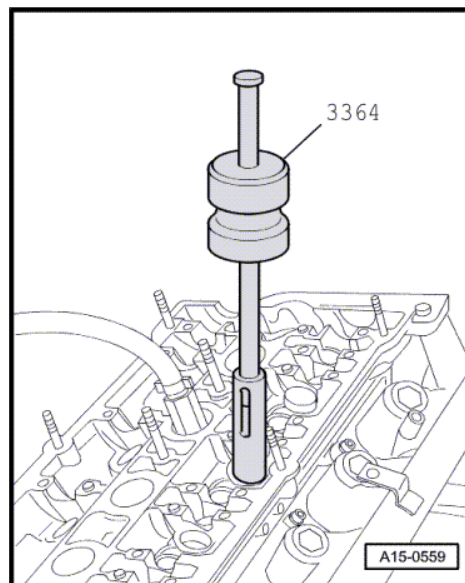
- Engage pressure fork -VAS 5161/2- at snap-in device, as shown in illustration.

Continuation for both sides:

- Press down with pressure fork for assembly cartridge.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Turn knurled screw in both directions.
- The valve cotters are forced apart and are taken up by the cartridge.
- Release pressure fork.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
- The compressed air hose remains connected.
- Detach valve spring with valve spring plate.

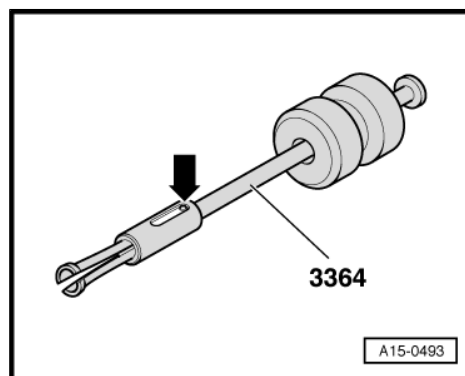


- Pull off valve stem oil seal with valve stem seal puller - 3364- .

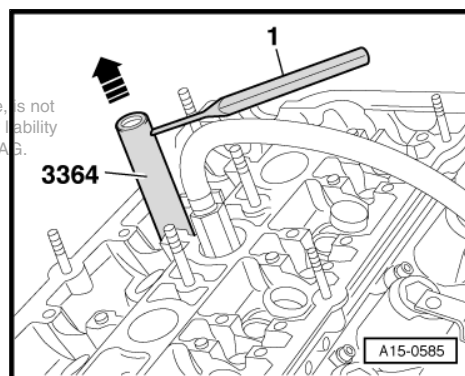


If the puller -3364- cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

- Knock out pin -arrow- of puller using a drift and remove impact extractor attachment.



- Apply bottom section of puller -3364- to valve stem oil seal.
- Secure puller with a punch or roll-pin drift -1-, as shown in illustration.
- Apply assembly lever to puller and pull out valve stem oil seal -arrow-.



**Caution**

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

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

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

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

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and take up valve cotters.
- Insert valve spring and valve spring plate.
- Secure guide plate back onto cylinder head.
- Insert assembly cartridge with knurled spacer ring 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 the pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

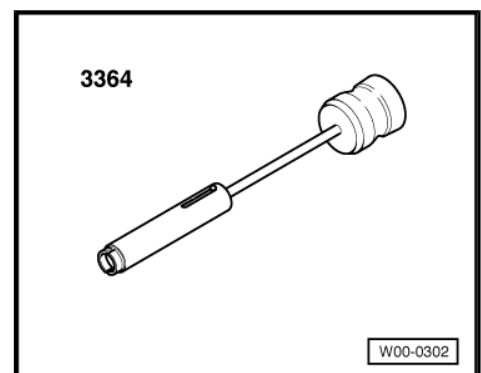
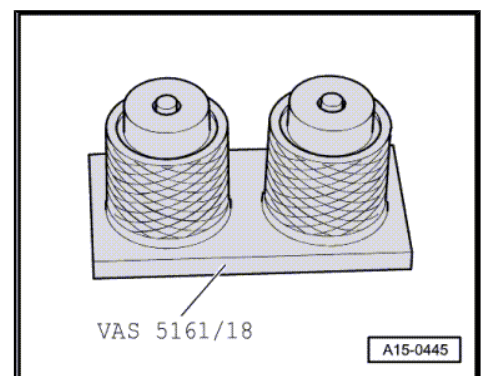
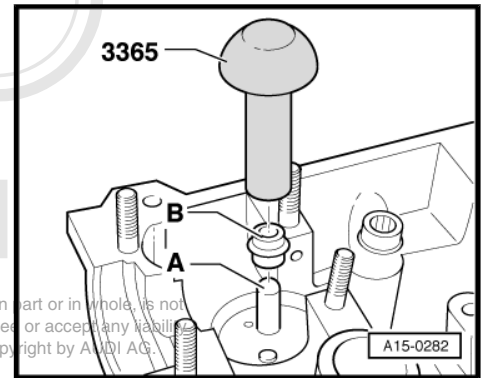
Installation is carried out in the reverse order; note the following:

- Install camshafts ⇒ [page 91](#) .
- Install spark plugs ⇒ Maintenance ; Booklet 819 .

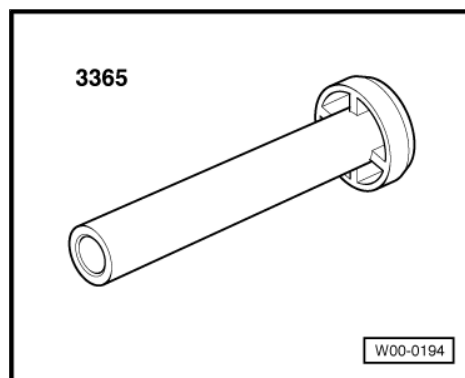
3.8.2 Removing and installing valve stem oil seals (cylinder head removed)

Special tools and workshop equipment required

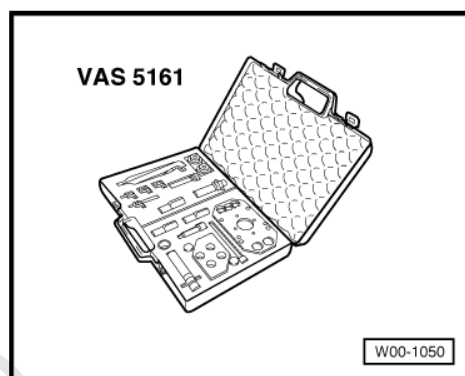
- ◆ Valve stem seal puller - 3364-



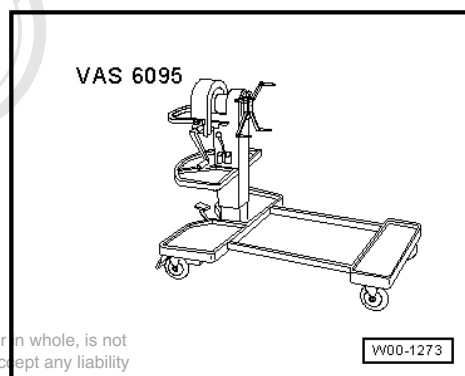
◆ Valve stem seal fitting tool - 3365-



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



◆ Engine and gearbox support - VAS 6095-

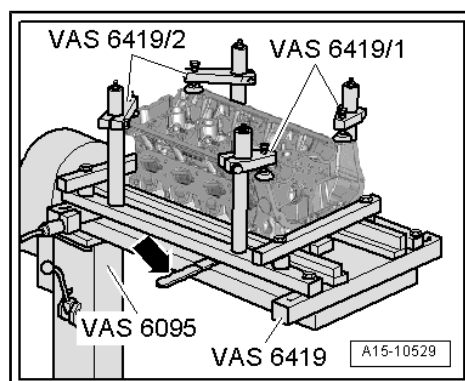


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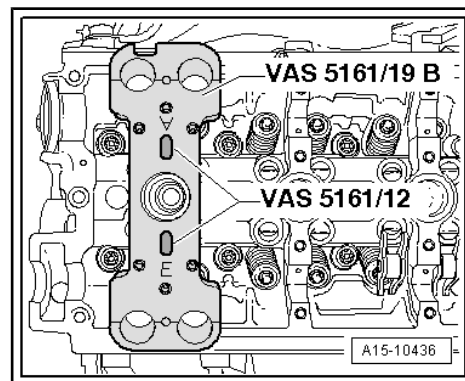
◆ Tensioning device -VAS 6419-

Procedure

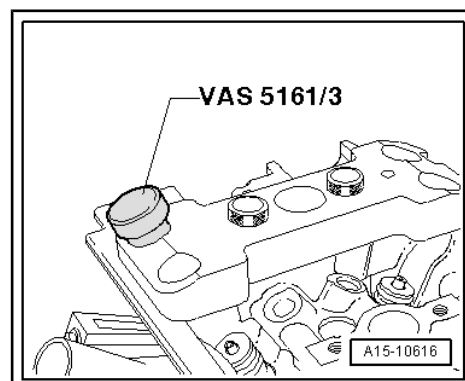
- Remove camshafts ➔ [page 91](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for reinstallation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Attach tensioning device -VAS 6419- to engine and gearbox support - VAS 6095- .
- Secure cylinder head in tensioning device -VAS 6419- as illustrated.
- Connect compressed air line to tensioning device -VAS 6419- .
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.



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



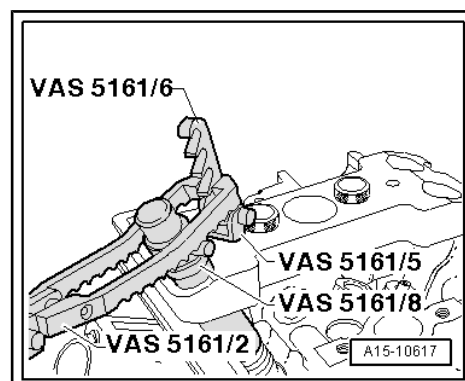
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.



- 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.

Inlet side:

- Engage pressure fork -VAS 5161/2- at snap-in device, as shown in illustration.

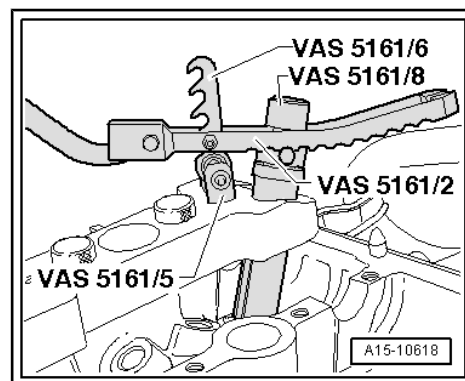


Exhaust side:

- Engage pressure fork -VAS 5161/2- at snap-in device, as shown in illustration.

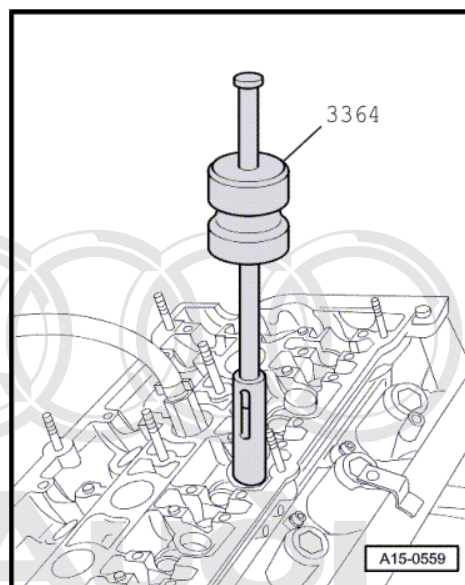
Continuation for both sides:

- Press down with pressure fork for assembly cartridge.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Turn knurled screw in both directions.
- The valve cotters are forced apart and are taken up by the cartridge.
- Release pressure fork.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
- Detach valve spring with valve spring plate.



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

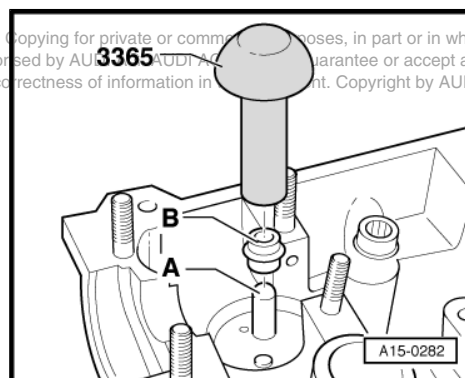


Caution

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

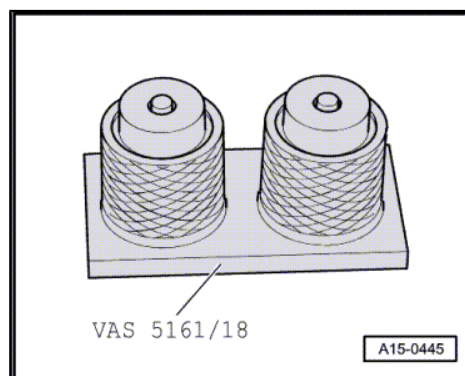
- ◆ **New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.**

- 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.



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

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and take up valve cotters.
- Insert valve spring and valve spring plate.
- Secure guide plate back onto cylinder head.
- Insert assembly cartridge with knurled spacer ring 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 the pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.



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

- Install camshafts ⇒ [page 91](#) .

4 Inlet and exhaust valves

⇒ ["4.1 Checking valve guides", page 109](#)

⇒ ["4.2 Checking valves", page 110](#)

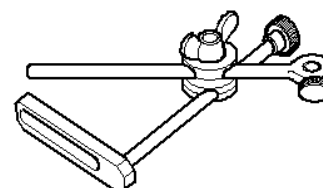
⇒ ["4.3 Valve dimensions", page 110](#)

4.1 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

VW 387



W00-0037

- ◆ Dial gauge - VAS 6079-

VAS 6079



W00-1261

Procedure



Note

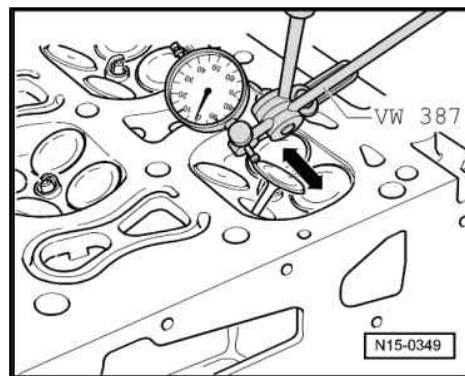
- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ◆ *Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.*
- Insert valve into guide.
- End of valve stem must be flush with valve guide.

- Determine 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.



4.2 Checking valves

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

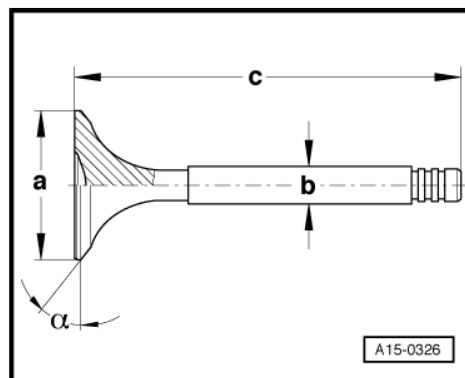
4.3 Valve dimensions



Note

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

Dimension		Inlet valve	Exhaust valve
Ø a	mm	33.85 ± 0.10	28.0 ± 0.1
Ø b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	104.0 ± 0.2	101.9 ± 0.2
α	°	45	45



WARNING

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



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17 – Lubrication

1 Sump/oil pump

⇒ [“1.1 Exploded view - sump/oil pump”, page 111](#)

⇒ [“1.2 Engine oil”, page 112](#)

⇒ [“1.3 Removing and installing sump”, page 112](#)

⇒ [“1.4 Removing and installing oil level and oil temperature sender G266”, page 116](#)

1.1 Exploded view - sump/oil pump



Note

- ◆ If large quantities of metal shavings or abrasion are found when performing engine repairs, this is 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 - Bolt

- ☐ 9 Nm

2 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing
⇒ [page 116](#)

3 - Seal

- ☐ Renew

4 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 37](#)

5 - Sump

- ☐ Clean sealing surface before installing
- ☐ Removing and installing
⇒ [page 112](#)

6 - Baffle plate

7 - Bolt

- ☐ 9 Nm

8 - Oil return line

9 - Bolt

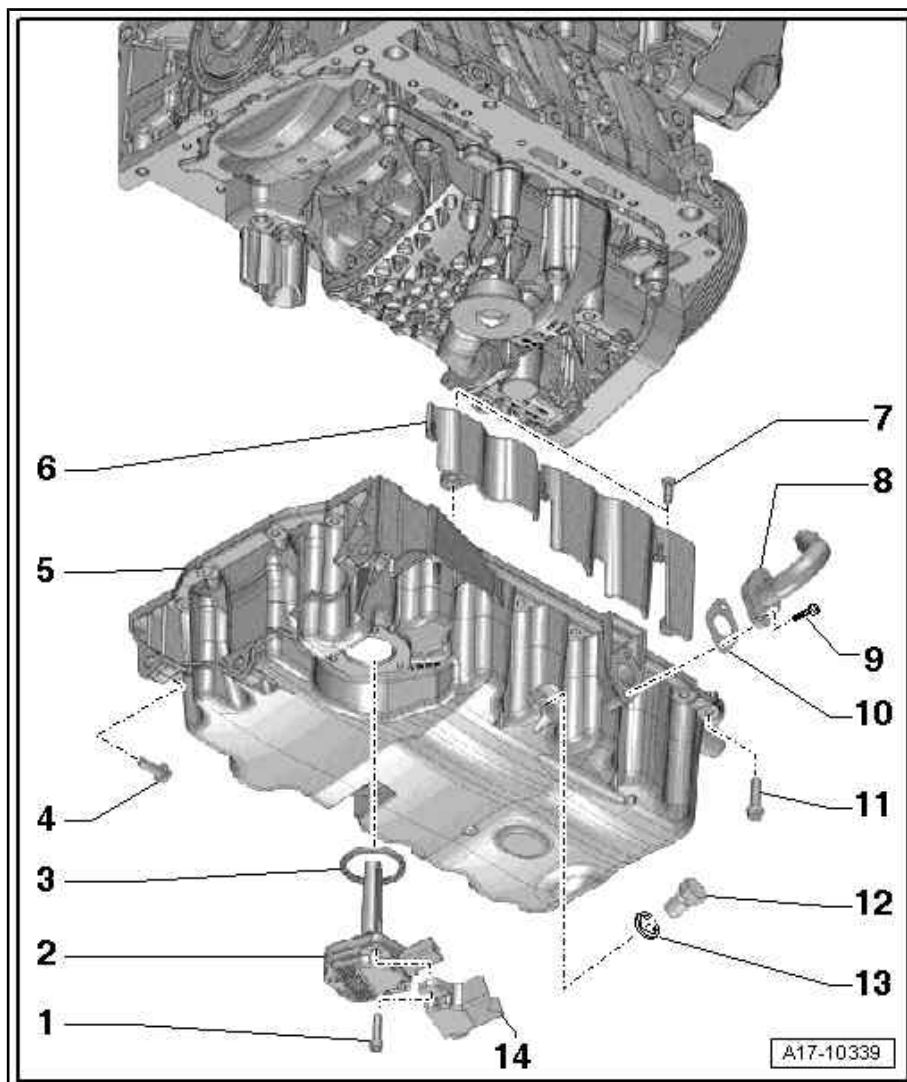
- ☐ Tightening torque
⇒ [Item 13 \(page 161\)](#)

10 - Gasket

- ☐ Renew

11 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 112](#)



12 - Oil drain plug

- 30 Nm

13 - Seal

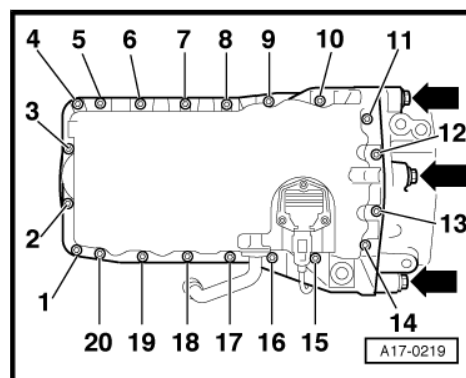
- Renew

14 - Cover

Sump - tightening torque and sequence

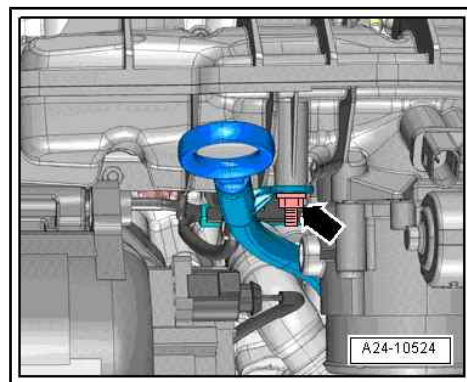
- Tighten bolts securing sump in three stages as follows:

1. Tighten bolts -1 ... 20- securing sump to cylinder block in diagonal sequence initially to 5 Nm.
2. Tighten bolts securing sump to gearbox -arrows- to 40 Nm.
3. Tighten bolts -1 ... 20- securing sump to cylinder block in diagonal sequence to 15 Nm.



Guide tube for oil dipstick - tightening torque

- Tighten centre hex stud -arrow- to 6 Nm.



1.2 Engine oil

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



Caution

Risk of damage to catalytic converter.

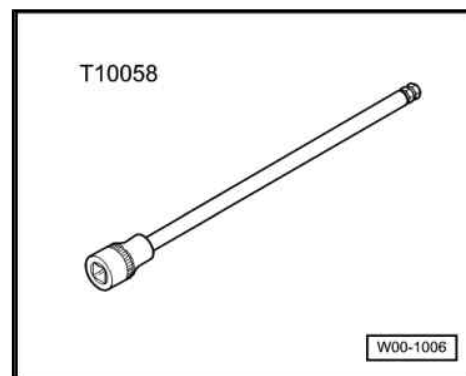
- ◆ *The oil level must not be above the "max" mark on the dipstick.*

1.3 Removing and installing sump

Special tools and workshop equipment required

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- ◆ Allen key, long reach - T10058-

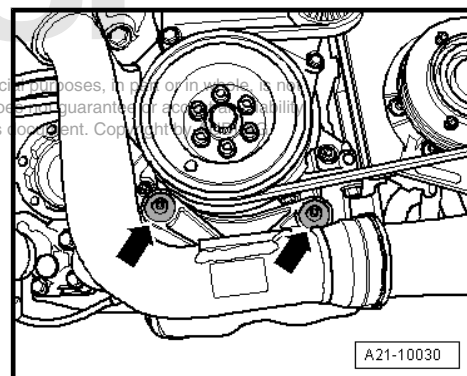


- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing 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 (front) .
- Drain off engine oil ⇒ Maintenance ; Booklet 819 .
- Unscrew bolts -arrows- and remove air pipe.

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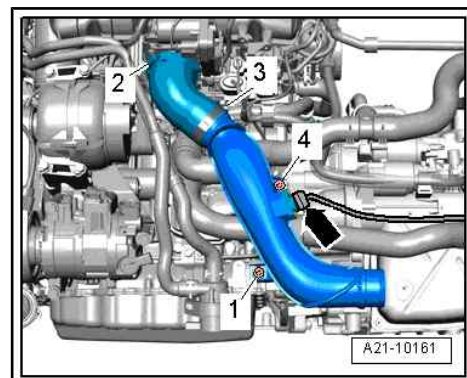


- Remove bolt -1-.

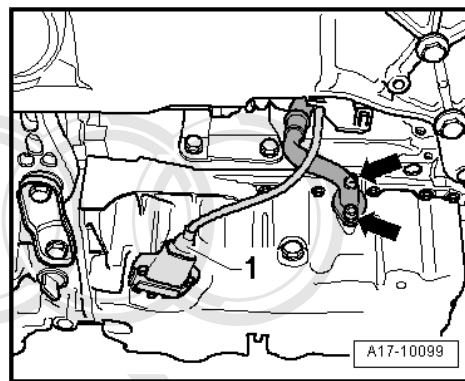


Note

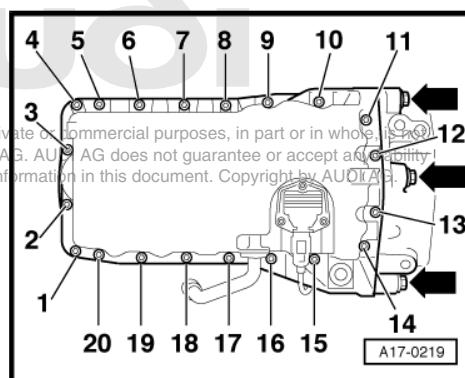
Disregard items marked -2, 3, 4- and -arrow-.



- Unplug electrical connector -1- at oil level and oil temperature sender - G266- .
- Remove bolts -arrows- for oil return line for turbocharger.



- Remove bolts -arrows- securing sump to gearbox.
- Unscrew bolts -1 ... 20- securing sump to cylinder block in diagonal sequence.
- Carefully release sump from bonded joint, taking care not to bend sump.



Installing



Caution

Protect lubrication system and bearings against contamination.

- ◆ *Cover exposed parts of the engine.*

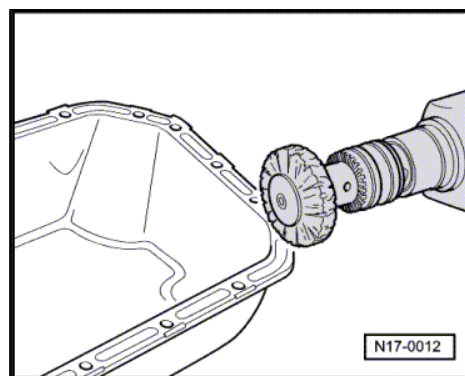


WARNING

Risk of eye injury.

- ◆ *Wear safety goggles.*

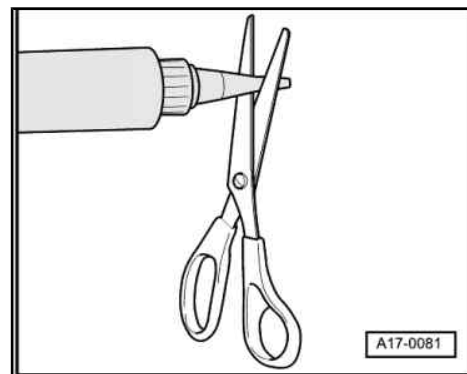
- Remove sealant residue from sump and cylinder block using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.



Note

Note the use-by date of the sealant.

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



Caution

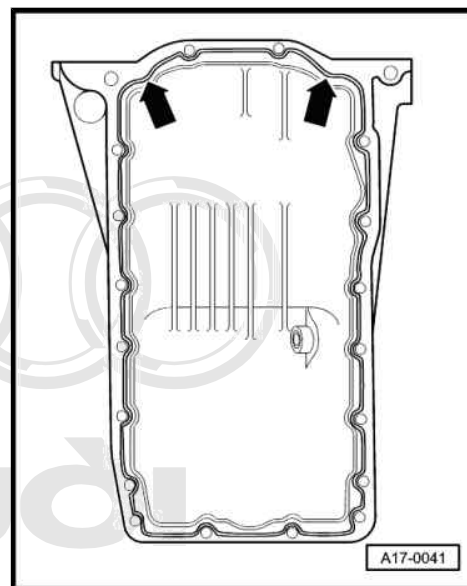
Make sure lubrication system is not clogged by excess sealant.

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

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

Note

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



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- Fit sump and tighten bolts ⇒ [page 112](#) .

Note

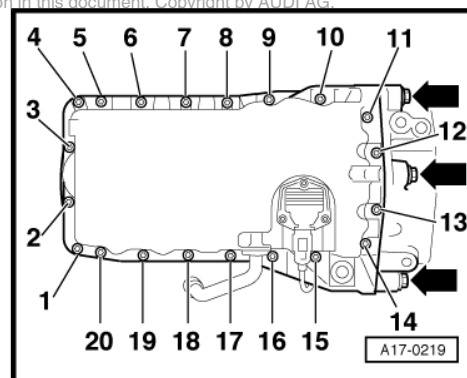
- ◆ *If sump is fitted with engine removed, make sure sump is flush with cylinder block at gearbox end.*
- ◆ *After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.*

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

- Install air pipe ⇒ [page 174](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .

Tightening torques

- ◆ ⇒ [Fig. ““Sump - tightening torque and sequence””, page 112](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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

Removing

- Drain off engine oil ⇒ Maintenance ; Booklet 819 .
- Unplug electrical connector -5-.
- Unscrew three bolts -1- and remove cover -2-.
- Pull oil level and oil temperature sender - G266- -item 3- off sump and remove together with seal -4-.

Installing

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



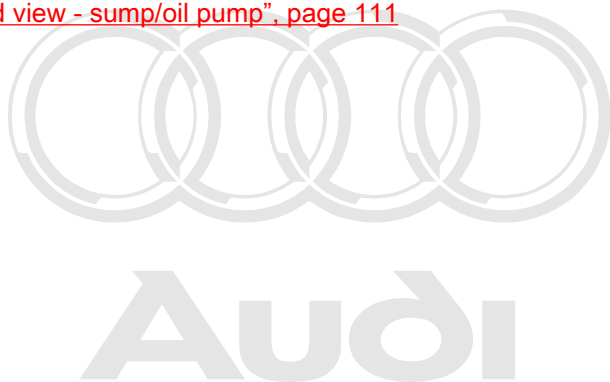
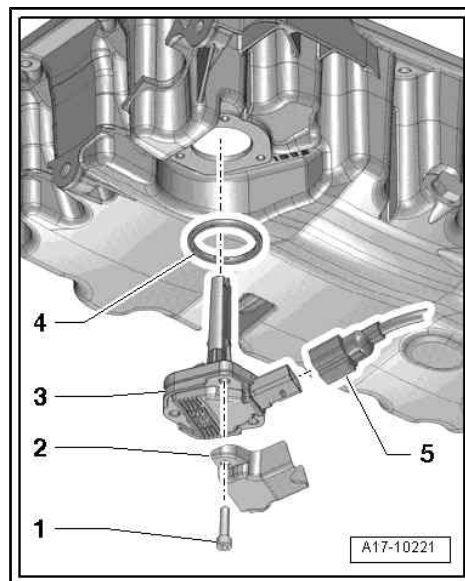
Note

Renew seal.

- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .

Tightening torques

- ♦ ⇒ [“1.1 Exploded view - sump/oil pump”, page 111](#)



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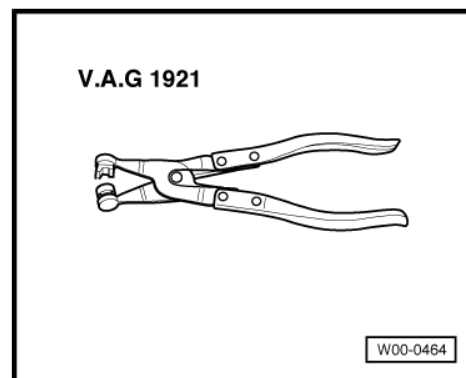
2 Engine oil cooler

⇒ [“2.1 Removing and installing engine oil cooler”, page 117](#)

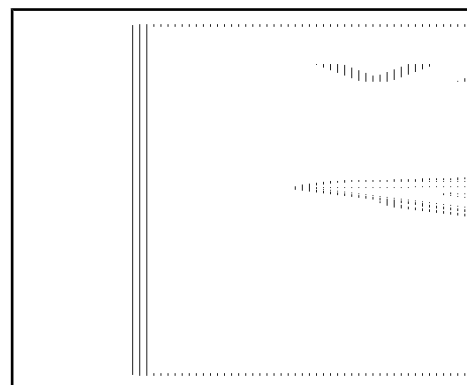
2.1 Removing and installing engine oil cooler

Special tools and workshop equipment required

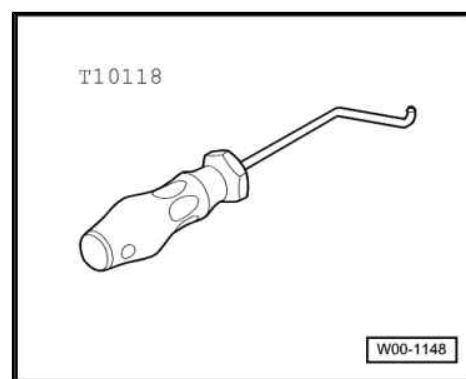
- ◆ Hose clip pliers - V.A.G 1921-



- ◆ Drip tray for workshop hoist - VAS 6208-



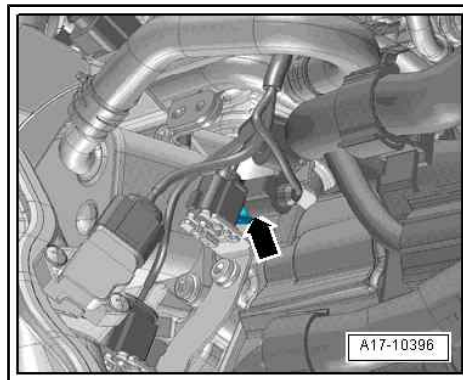
- ◆ Assembly tool - T10118-



Removing

- Remove radiator cowl ⇒ [page 157](#) .
- Drain coolant ⇒ [page 135](#) .

- Use assembly tool - T10118- to release electrical connector -arrow- at oil pressure switch - F1- and unplug.



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Detach coolant hose -1-.
- Unscrew bolts -arrows- and detach engine oil cooler.

Installing

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



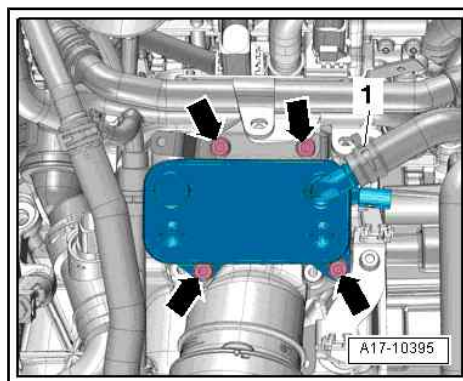
Note

- ◆ *Renew seals and gaskets.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Install radiator cowl ⇒ [page 157](#) .
- Fill up with coolant ⇒ [page 137](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - oil filter housing/oil pressure switch”, page 119](#)



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3 Oil filter/oil pressure switch

⇒ ["3.1 Exploded view - oil filter housing/oil pressure switch", page 119](#)

⇒ ["3.2 Removing and installing oil pressure switch F1", page 120](#)

⇒ ["3.3 Checking oil pressure and oil pressure switch", page 122](#)

⇒ ["3.4 Removing and installing oil filter housing", page 123](#)

3.1 Exploded view - oil filter housing/oil pressure switch

1 - Pipe

- ☐ For crankcase breather

2 - Oil pressure switch - F1-

- ☐ Version fitted in vehicle may differ from illustration
- ☐ Black insulation
- ☐ Opening/closing pressure 1.2 ... 1.6 bar
- ☐ Checking ⇒ [page 122](#)
- ☐ Removing and installing ⇒ [page 120](#)
- ☐ 21 Nm

3 - Not fitted

4 - Bracket

5 - Bolt

- ☐ 15 Nm

6 - Engine oil cooler

- ☐ See note ⇒ [page 111](#)
- ☐ Ensure clearance from surrounding components
- ☐ Connection diagram - coolant hoses ⇒ [page 133](#)
- ☐ Removing and installing ⇒ [page 117](#)

7 - Seal

- ☐ Renew

8 - Cover for oil filter housing

- ☐ Removing and installing ⇒ Maintenance ; Booklet 819

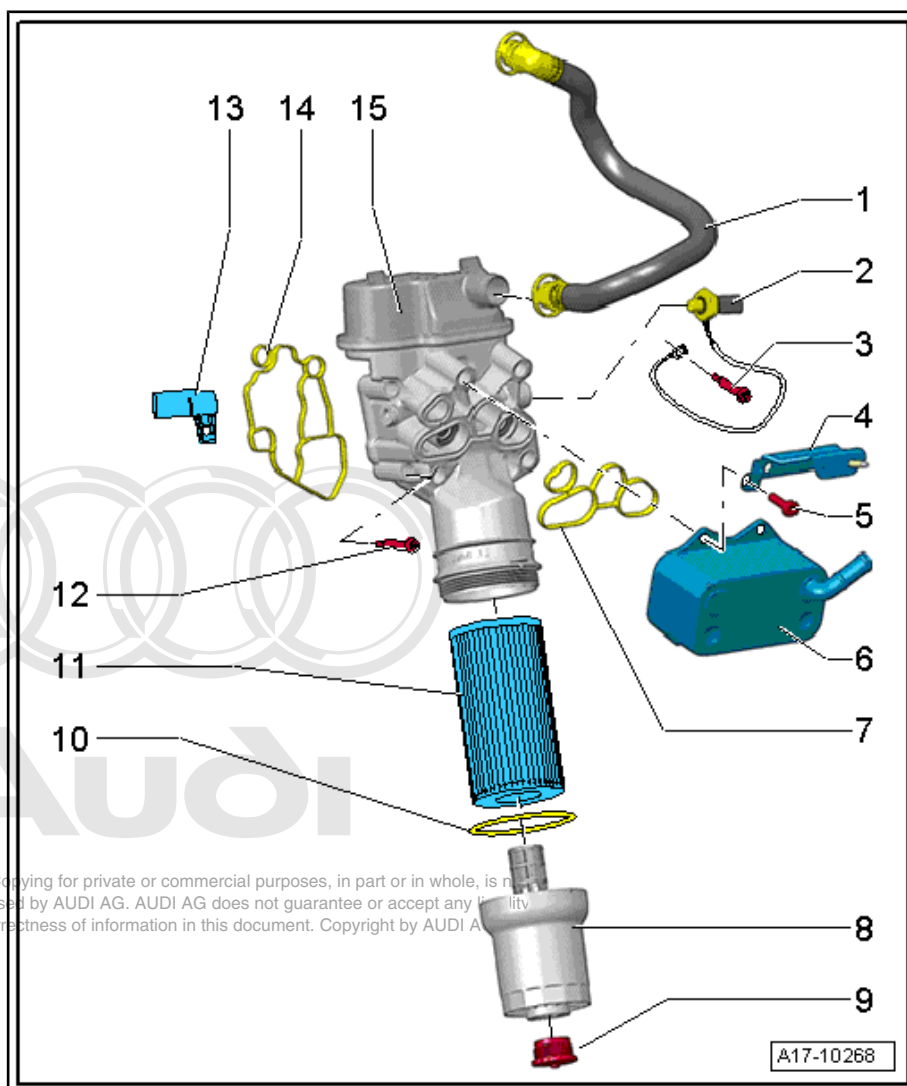
9 - Screw plug

10 - Seal

- ☐ Renew
- ☐ Lubricate lightly with oil
- ☐ Installation position ⇒ [page 120](#)

11 - Oil filter element

- ☐ Removing and installing ⇒ Maintenance ; Booklet 819



12 - Bolt

- 15 Nm

13 - Baffle plate

- Installation position ⇒ [page 120](#)

14 - Seal

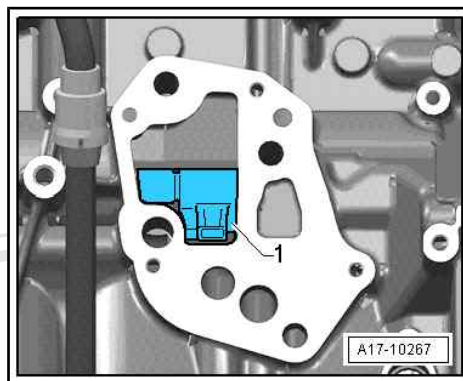
- Renew

15 - Oil filter bracket

- Removing and installing ⇒ [page 125](#)

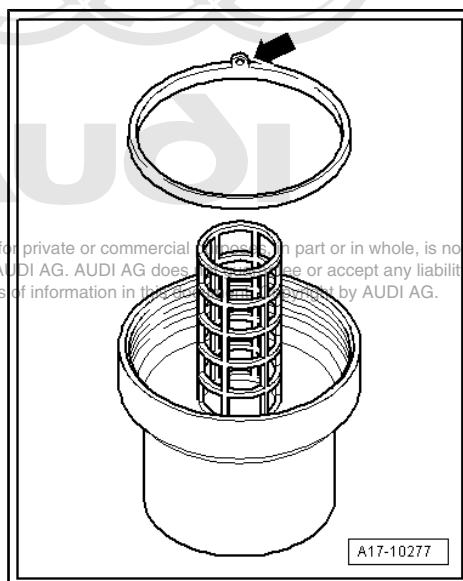
Installation position of baffle plate

- Insert baffle plate -1- into cylinder block, as shown in illustration.



Installation position of seal

- Note position of tab on seal -arrow-.
- Flat side of seal must face outwards.

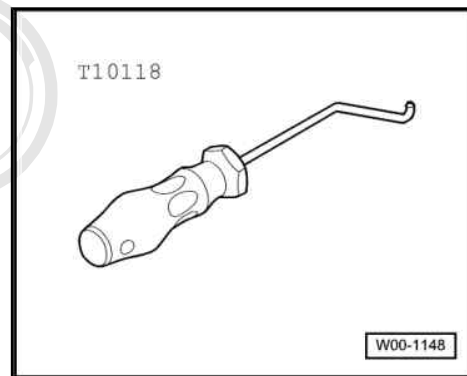


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3.2 Removing and installing oil pressure switch - F1-

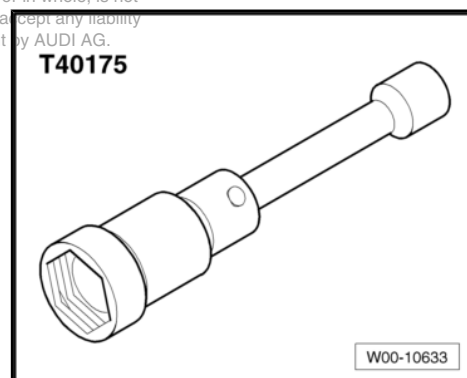
Special tools and workshop equipment required

◆ Assembly tool - T10118-



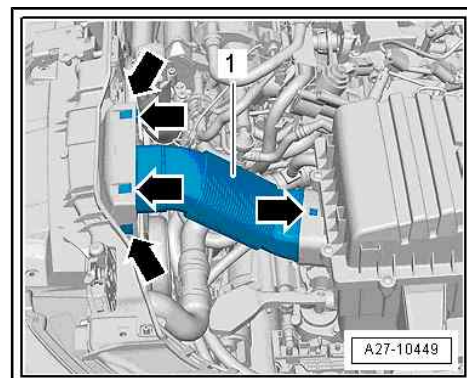
◆ U/J extension and socket for oil pressure switch -T40175-

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Removing

- Remove engine cover panel ⇒ [page 33](#) .
- Release fasteners -arrows- and detach air duct -1-.



- Use assembly tool - T10118- to release electrical connector -arrow- at oil pressure switch - F1- and unplug.
- Unscrew oil pressure switch - F1- using U/J extension and socket for oil pressure switch -T40175- .

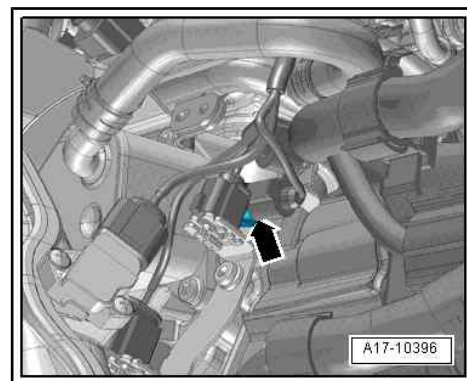
Installing

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



Note

- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*



Tightening torques

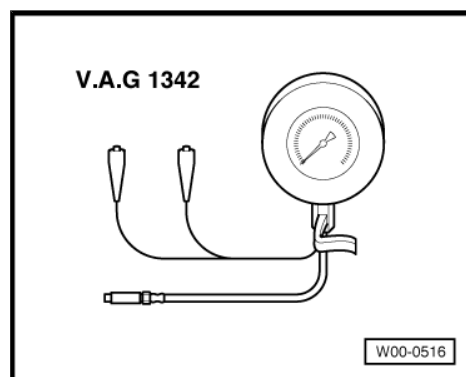
- ◆ ⇒ ["3.1 Exploded view - oil filter housing/oil pressure switch", page 119](#)

3.3 Checking oil pressure and oil pressure switch

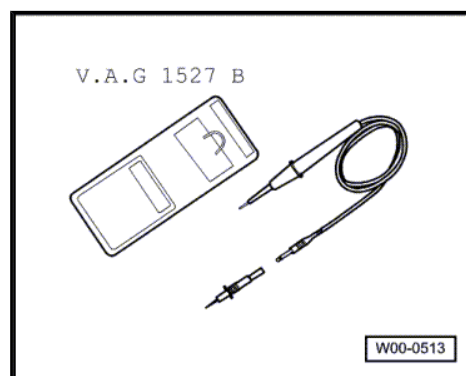
Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-

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- ◆ Voltage tester - V.A.G 1527B-



- ◆ Auxiliary measuring set - V.A.G 1594C-



Procedure

- Oil level OK
- Engine oil temperature approx. 80 °C
- Remove oil pressure switch ⇒ [page 120](#) .
- Screw oil pressure switch into oil pressure tester - V.A.G 1342- .

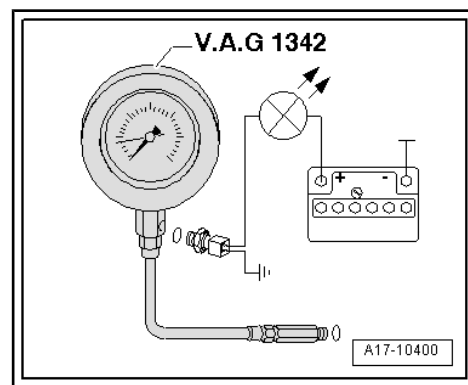
- Screw oil pressure tester - V.A.G 1342- into bore for oil pressure switch in oil filter bracket.

Checking oil pressure

- Start engine.
- Oil pressure at idling speed: at least 1.2 bar.
- Oil pressure at 2000 rpm: at least 2.7 bar.

Checking oil pressure switch

- Connect voltage tester - V.A.G 1527B- with adapter leads from auxiliary measuring set - V.A.G 1594C- to positive battery terminal ("+") and connect one connection of oil pressure switch.
- Connect second connection of oil pressure switch to earth ("–").
- LED should not light up.
- Renew oil pressure switch if LED lights up when engine is not running.
- Start engine.



Note

Observe oil pressure tester and LED while starting engine, as switching point of oil pressure switch may already be exceeded when starting.

- LED should light up at 1.2 ... 1.6 bar.
- Renew oil pressure switch if LED does not light up.

Assembling

- Install oil pressure switch → [page 120](#).

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3.4 Removing and installing oil filter housing

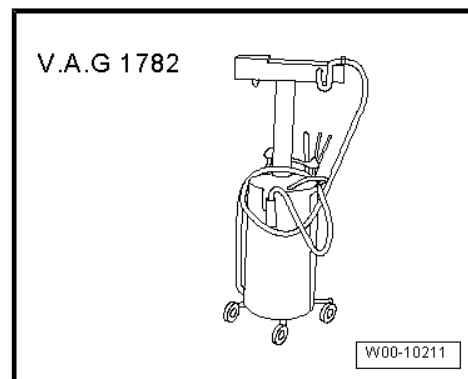
⇒ ["3.4.1 Draining oil filter housing", page 123](#)

⇒ ["3.4.2 Removing and installing oil filter housing", page 125](#)

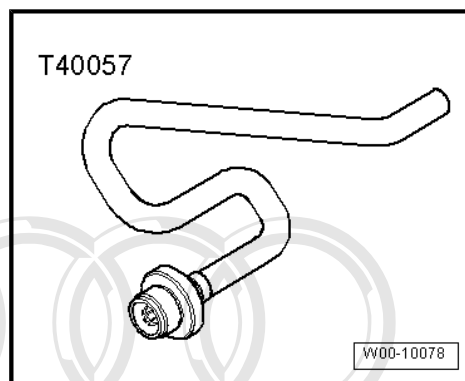
3.4.1 Draining oil filter housing

Special tools and workshop equipment required

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

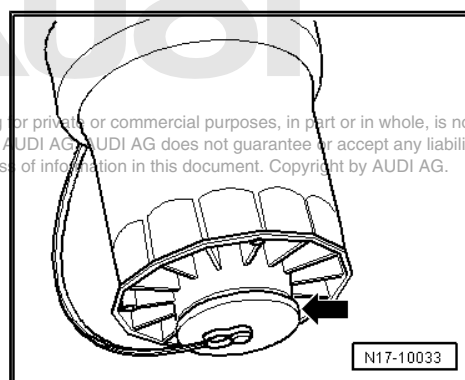


◆ Oil drain adapter - T40057-

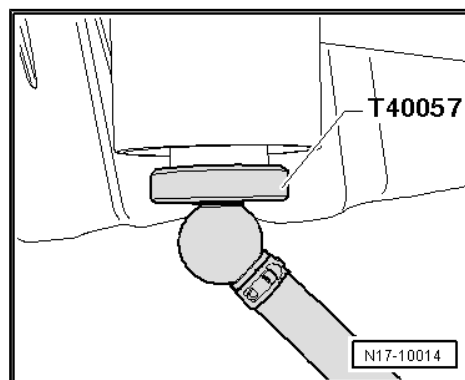


- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove dust cap -arrow- on oil filter housing.
- Hold hose of oil drain adapter -T40057- in used oil collection and extraction unit - V.A.G 1782- .

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- Screw oil drain adapter into oil filter housing.
- A valve in the oil filter housing will be opened when the oil drain adapter is screwed in.
- Allow engine oil to drain out.



3.4.2 Removing and installing oil filter housing

Removing

- Remove engine oil cooler ⇒ [page 117](#) .
- Drain oil filter housing ⇒ [page 123](#) .
- Press release tabs and disconnect crankcase breather pipe -1-.
- Unscrew bolts -arrows- and remove oil filter bracket.



Note

Disregard item -2-.

Installing

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



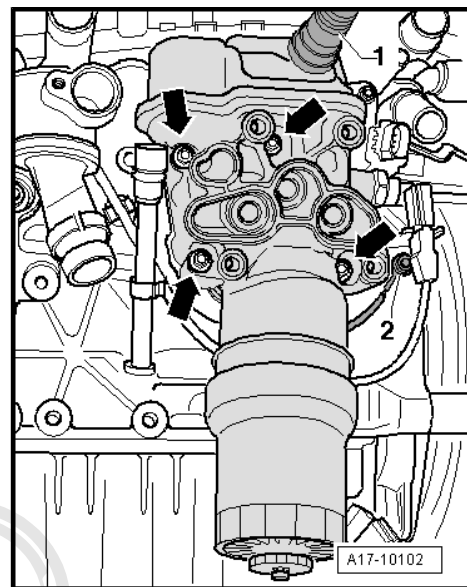
Note

- ◆ *Renew seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- Install baffle plate ⇒ [page 120](#) .
- Install engine oil cooler ⇒ [page 117](#) .

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - oil filter housing/oil pressure switch", page 119](#)

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4 Balance shaft assembly

⇒ "4.1 Exploded view - balance shaft assembly", page 126

⇒ "4.2 Removing and installing balance shaft assembly", page 127

4.1 Exploded view - balance shaft assembly

1 - Chain guard

2 - Chain

- ☐ Before removing, mark running direction with paint

3 - Dowel sleeves

4 - Spacer plate

5 - Balance shaft assembly with oil pump

- ☐ Before installing, check that the two dowel sleeves for centralising oil pump and cylinder block are fitted
- ☐ Do not dismantle
- ☐ Do not unscrew chain sprocket for balance shaft assembly
- ☐ Removing and installing ⇒ page 127

6 - Bolt

- ☐ 9 Nm

7 - Baffle plate

8 - Bolt

- ☐ 20 Nm

9 - Bolt

- ☐ 8 Nm

10 - Oil intake pipe

- ☐ Clean strainer if dirty

11 - O-ring

- ☐ Renew

12 - Bolt

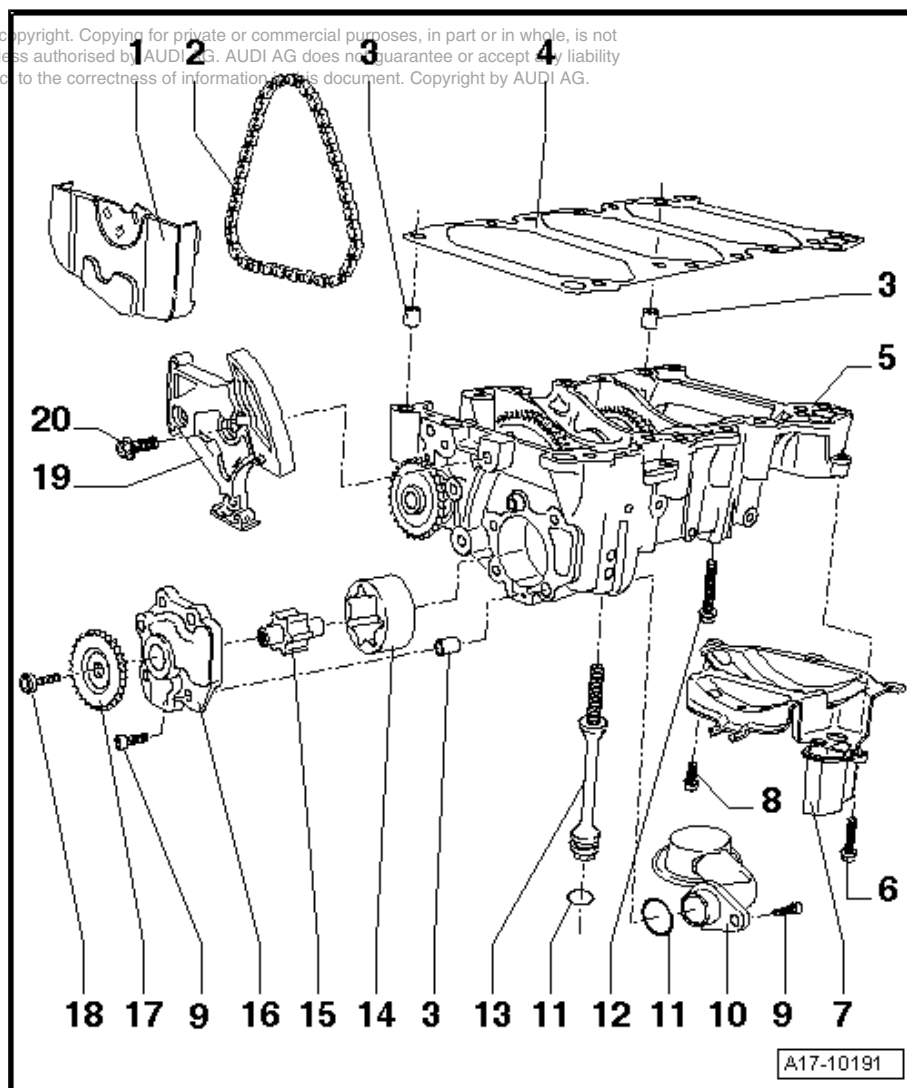
- ☐ Renew
- ☐ Different bolt lengths ⇒ page 127
- ☐ Tightening torque and sequence ⇒ page 127

13 - Bolt

- ☐ Renew
- ☐ Different bolt lengths ⇒ page 127
- ☐ Tightening torque and sequence ⇒ page 127

14 - Outer rotor

- ☐ Check contact surfaces for scores
- ☐ Marking must be visible



15 - Inner rotor

- ☐ Check contact surfaces for scores

16 - Oil pump cover

- ☐ To remove, detach chain tensioner -item 19-

17 - Chain sprocket

- ☐ Can only be installed in one position

18 - Bolt

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

19 - Chain tensioner with tensioning rail

- ☐ To detach, remove balance shaft assembly ⇒ [page 127](#)
- ☐ Pre-tension before installing ⇒ [page 130](#)

20 - Bolt

- ☐ 15 Nm

Bolts securing balance shaft assembly

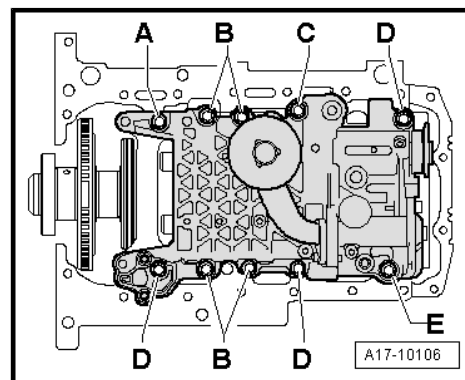
A - Flange bolt M7x40

B - Flange bolt M7x70

C - Flange bolt M7x90

D - Flange bolt M7x55

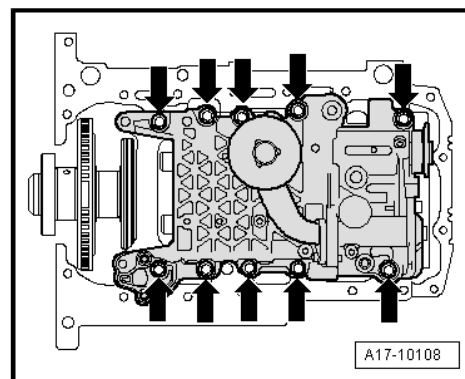
E - Screw plug with O-ring

**Balance shaft assembly - tightening torque and sequence**

- Renew bolts -arrows- securing balance shaft assembly.

- Tighten bolts in 3 stages as follows:

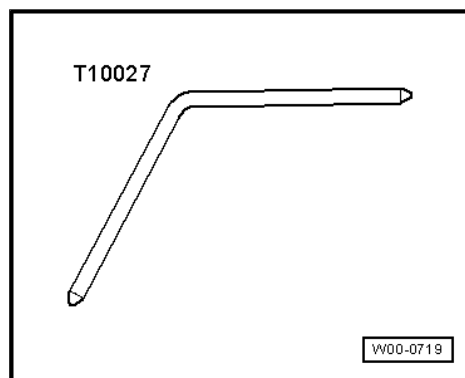
1. **Screw in bolts by hand until they make contact.**
2. Tighten bolts to 15 Nm in diagonal sequence starting from inside and working outwards.
3. Turn bolts 90° further in diagonal sequence starting from inside and working outwards.



4.2 Removing and installing balance shaft assembly

Special tools and workshop equipment required

◆ Locking pin - T10027-



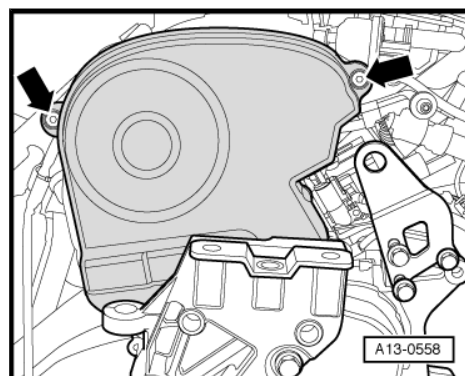
Removing

- Remove sump ⇒ [page 112](#) .
- Remove bolts -arrows-.



Note

A second mechanic is required for the next operation.



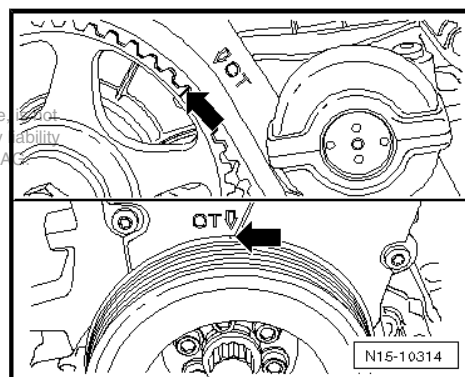
- Press toothed belt cover (top) to one side and use a mirror to check TDC marking (as described below).



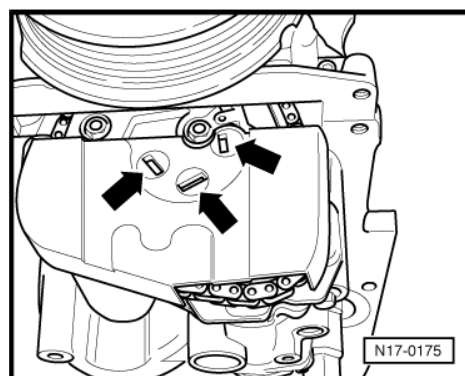
Caution

Irreparable damage can be caused if the toothed belt slips.

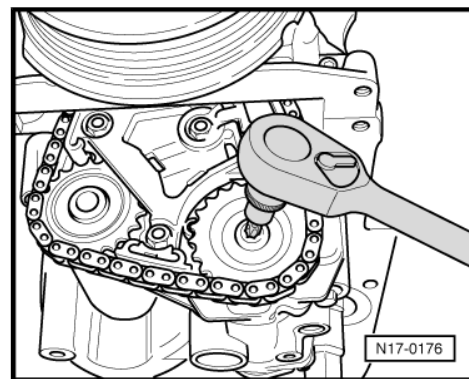
- ◆ Turn crankshaft only in direction of engine rotation.



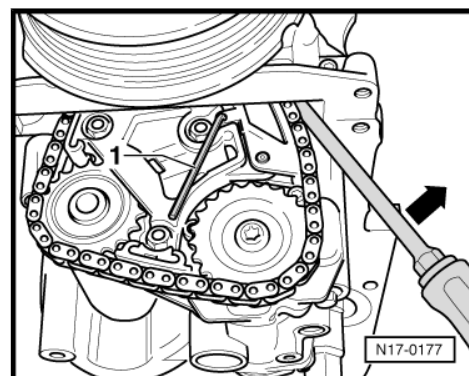
- Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at “TDC”.
- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.
- Pull off chain guard; if necessary, retaining tabs can be released with a small screwdriver (insert in openings -arrows-).



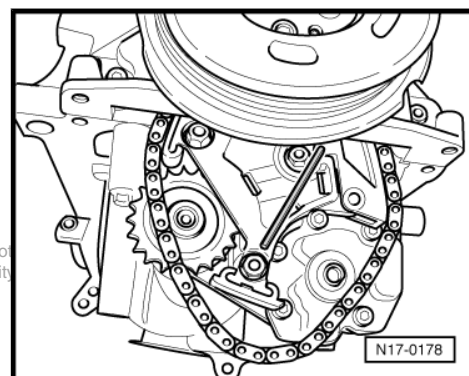
- Counterhold crankshaft at bolt for toothed belt sprocket and slacken bolt for chain sprocket for oil pump.



- Use screwdriver to slacken chain rail -arrow- and lock it in position with hexagon key (3 mm) -1-.



- Detach chain sprocket for oil pump and disengage drive chain at balance shaft drive.

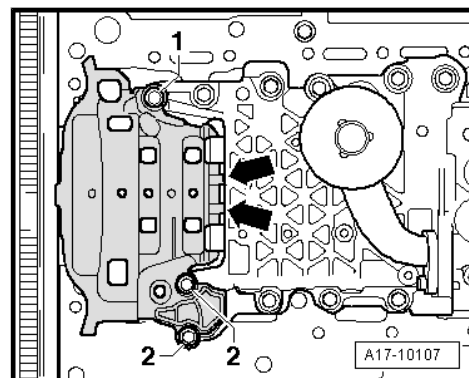


- Remove bolts -1- and -2- and detach baffle plate.



Note

Disregard -arrows-.



- Slacken bolts -arrows-, working from outside inwards.
- Remove bolts and detach balance shaft assembly.

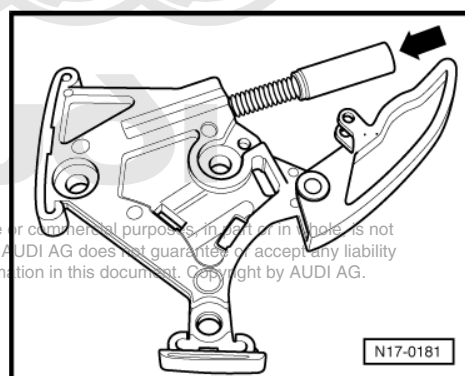
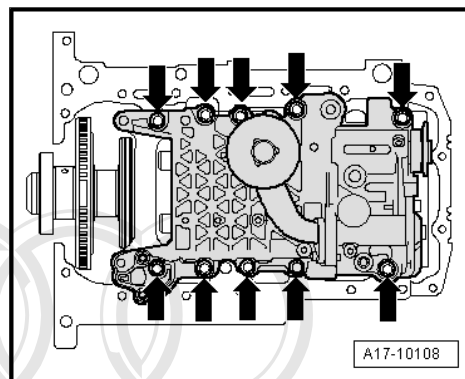
Installing



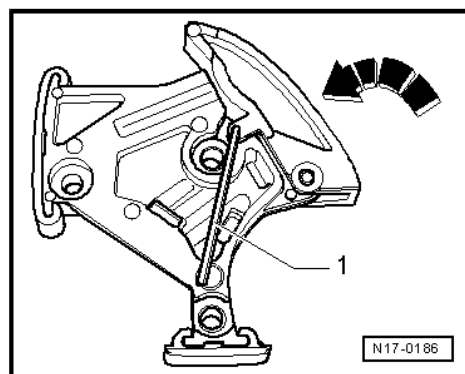
Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew seal on bolt for balance shaft assembly*
⇒ [Item 13 \(page 126\)](#).

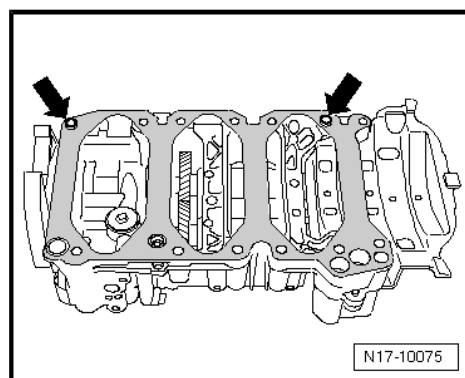
- If necessary, pre-tension chain tensioner:
- Pre-tension piston by hand -arrow-.



- Press chain rail in direction of -arrow- and lock in place using hexagon key (3 mm) -item 1-.

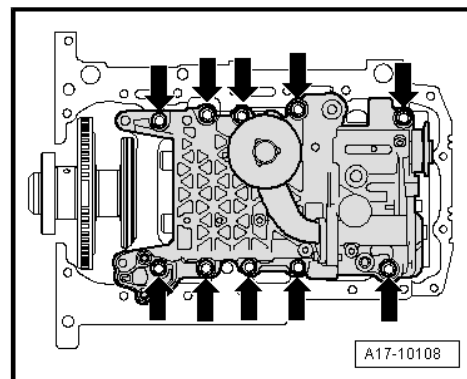


- Fit spacer plate onto dowel sleeves on balance shaft assembly as shown -arrows-.

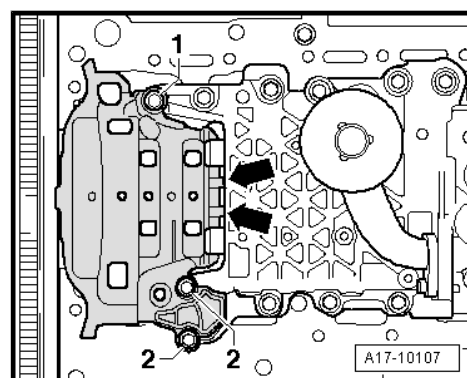


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- Fit balance shaft assembly with oil pump and spacer plate.
- Fit bolts -arrows- with correct length ⇒ [page 127](#) and tighten ⇒ [page 127](#).

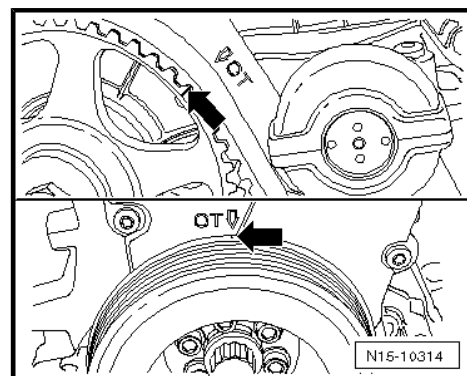


- To install baffle plate, insert lugs -arrows- into balance shaft assembly.

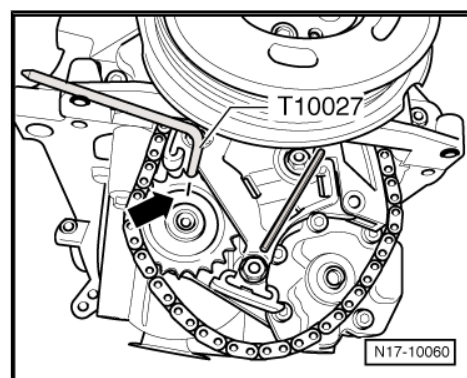


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- Check whether the camshaft and the crankshaft are positioned at “TDC”:
- The markings on the camshaft -top arrow- and the crankshaft -bottom arrow- must be aligned.



- Align mark -arrow- on balance shaft sprocket with locating hole.
- Use locking pin - T10027- to lock balance shaft sprocket in this position.
- Fit drive chain onto balance shaft sprocket.
- Install chain sprocket for oil pump (hand-tighten bolts until they make contact).
- Chain sprocket for oil pump can only be installed correctly in one position.
- When installing, you may turn ONLY the oil pump.



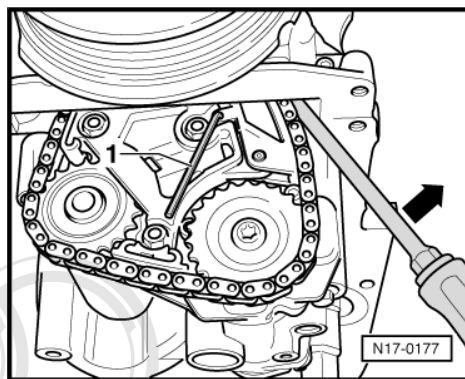
- Remove hexagon key (3 mm) -item 1-.
- Counterhold crankshaft at bolt for toothed belt sprocket and tighten bolt for chain sprocket for oil pump.

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

- Install toothed belt cover (top section) ⇒ [page 65](#) .
- Install sump ⇒ [page 112](#) .

Tightening torques

- ◆ ⇒ [Fig. “Balance shaft assembly - tightening torque and sequence”](#), [page 127](#)
- ◆ ⇒ [“4.1 Exploded view - balance shaft assembly”](#), [page 126](#)



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19 – Cooling

1 Cooling system/coolant

⇒ [“1.1 Connection diagram - coolant hoses”, page 133](#)

⇒ [“1.2 Checking cooling system for leaks”, page 133](#)

⇒ [“1.3 Draining and filling cooling system”, page 135](#)

1.1 Connection diagram - coolant hoses

1 - Radiator

- ☐ If renewed, refill system with fresh coolant

2 - Continued coolant circulation pump - V51-

3 - Thermostat with housing

4 - Coolant pump

5 - Cylinder head and cylinder block

- ☐ If renewed, refill system with fresh coolant

6 - Turbocharger

7 - Coolant expansion tank

- ☐ With filler cap and pressure relief valve
- ☐ Checking pressure relief valve ⇒ [page 135](#)

8 - Heat exchanger for heater

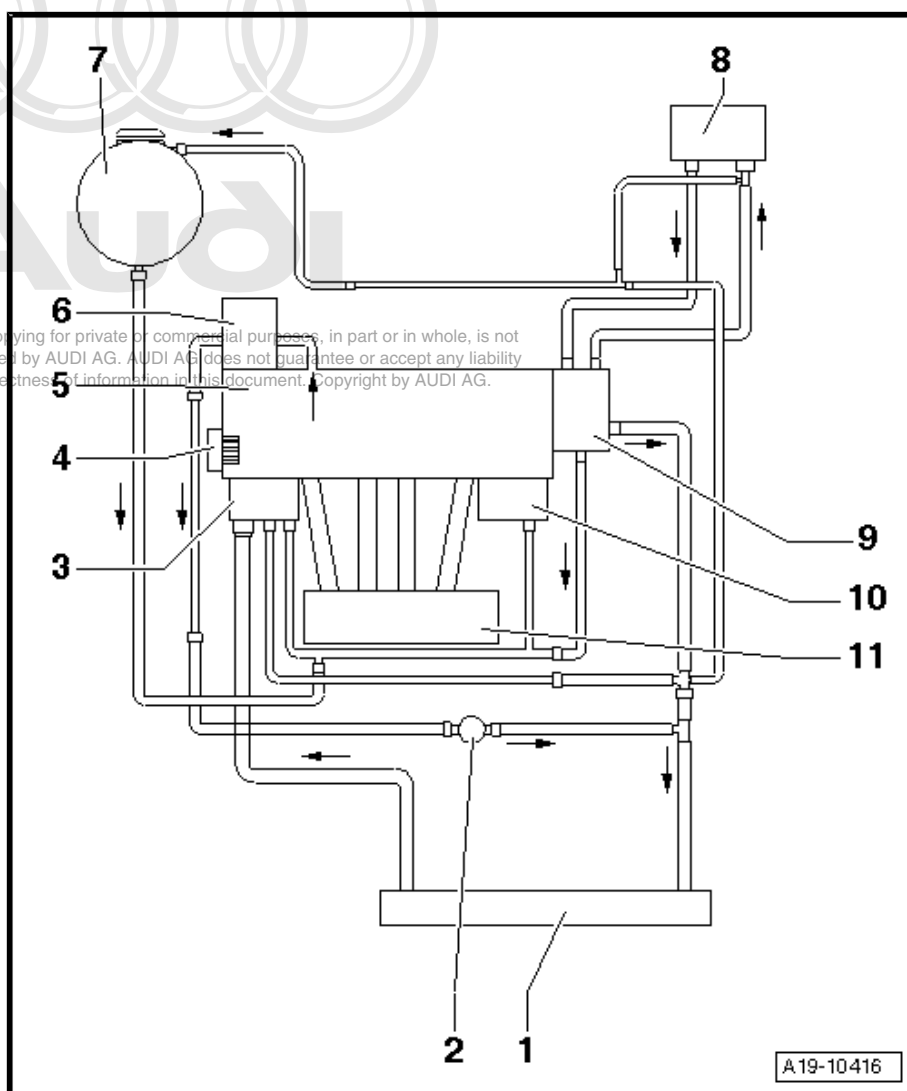
- ☐ If renewed, refill system with fresh coolant

9 - Coolant hose/pipe connection

10 - Engine oil cooler

- ☐ If renewed, refill system with fresh coolant

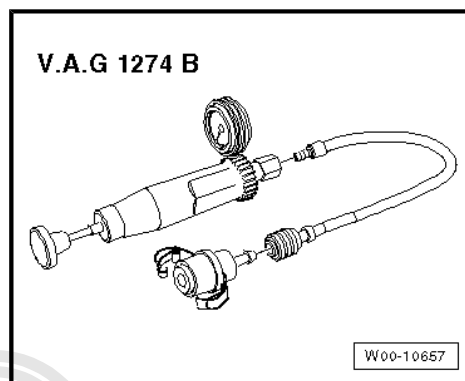
11 - Intake manifold



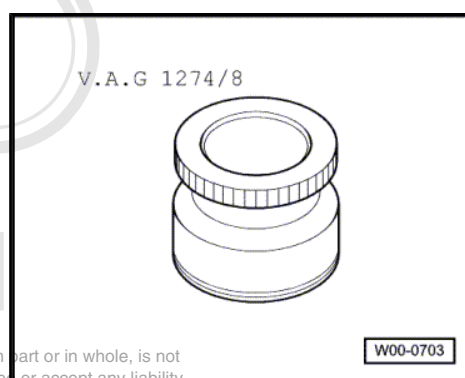
1.2 Checking cooling system for leaks

Special tools and workshop equipment required

◆ Cooling system tester - V.A.G 1274 B-



◆ Adapter for cooling system tester - V.A.G 1274/8-



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◆ Adapter for cooling system tester - V.A.G 1274/9-



Procedure

- Engine must be warm.



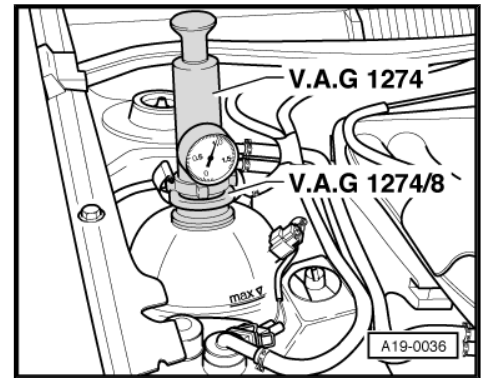
WARNING

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.*

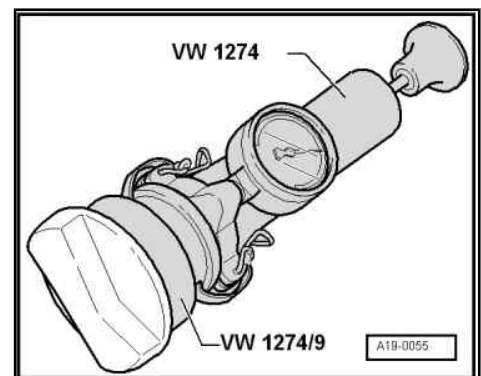
- Open filler cap on coolant expansion tank.

- 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.



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.



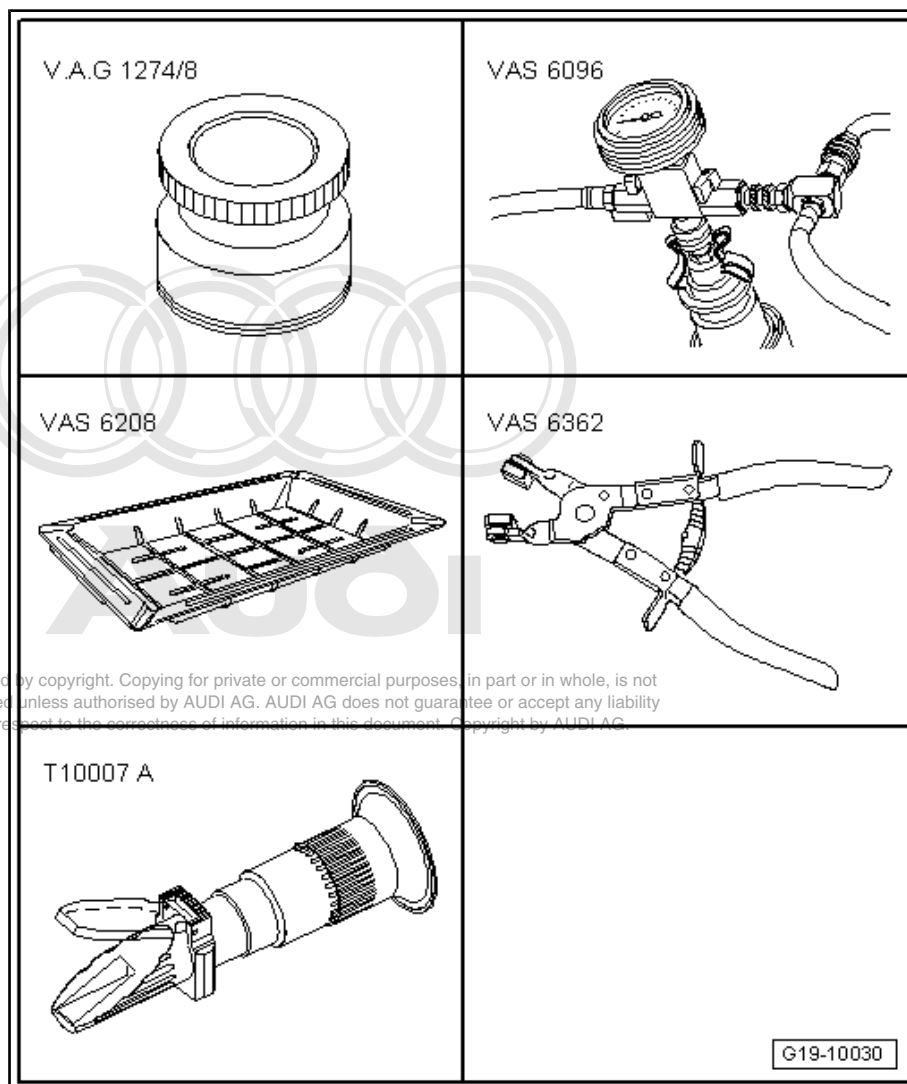
1.3 Draining and filling cooling system



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Special tools and workshop equipment required

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



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Draining



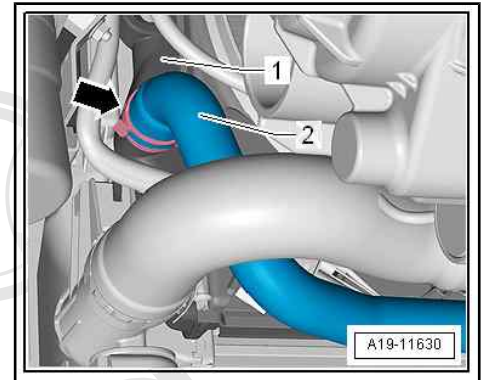
WARNING

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.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.

- Disconnect coolant hose -2- from radiator -1- (bottom) and drain off coolant.



- Disconnect bottom coolant hose leading to continued coolant circulation pump - V51- -arrow- and drain off coolant.

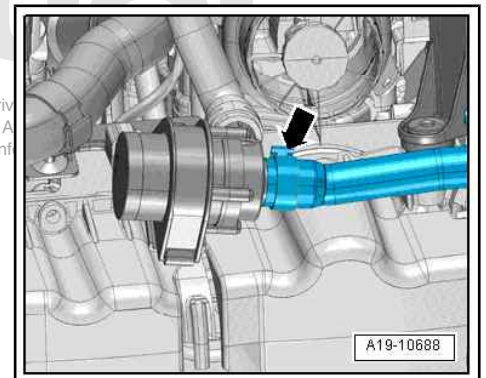
Filling



Caution

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

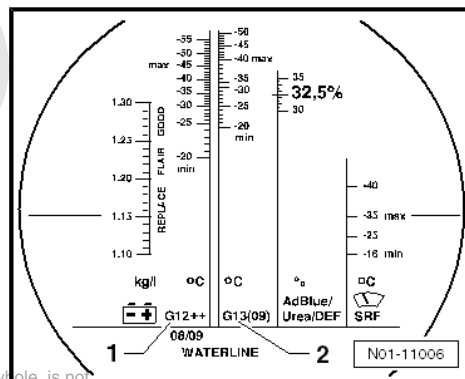
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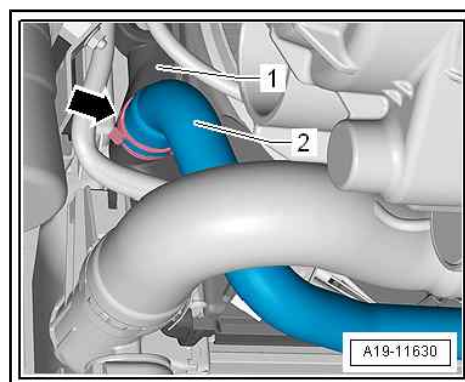


Note

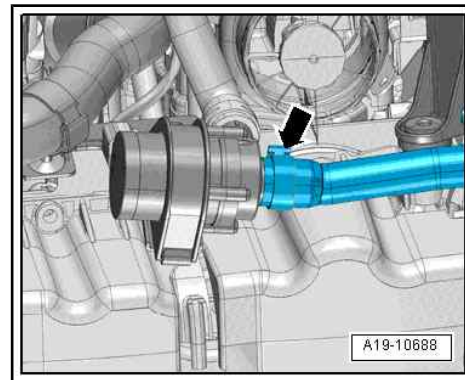
- ◆ *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- ◆ *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . 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 -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze can only be increased if greater frost protection is required in very cold climates. This must only be up 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.*



- Connect coolant hose to radiator.



- Connect the coolant hose to the continued circulation coolant pump - V51- -arrow-.



- Fill coolant expansion tank of -VAS 6096- with at least 10 litres of premixed coolant (according to recommended ratio [⇒ page 139](#)).

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 -35°C
- ◆ Coolant ⇒ Electronic parts catalogue
- 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-.

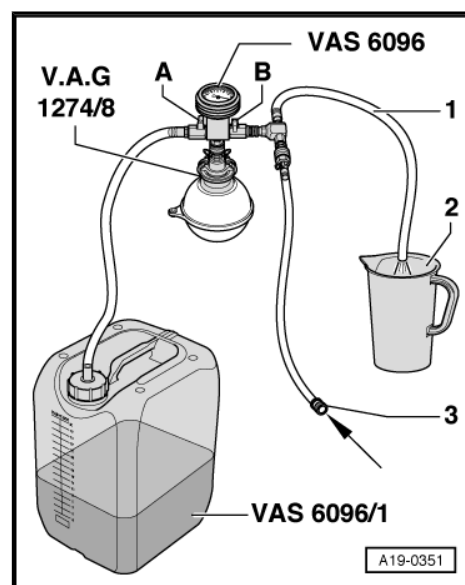


Note

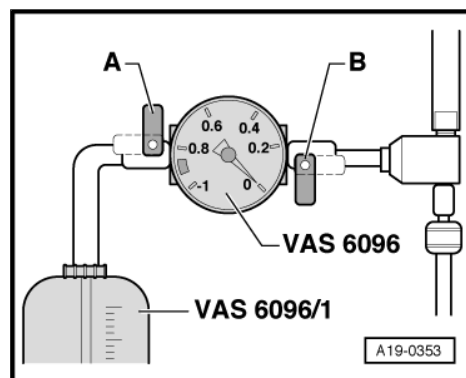
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The vented air draws along a small amount of coolant, which should be collected.

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

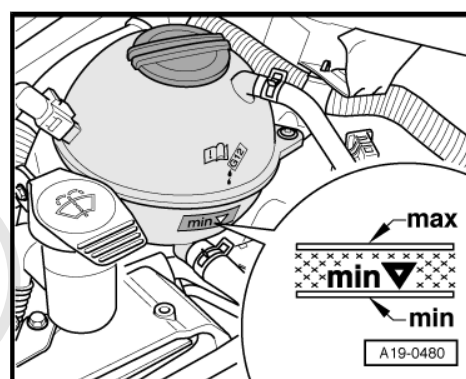


- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump continues to generate a 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.



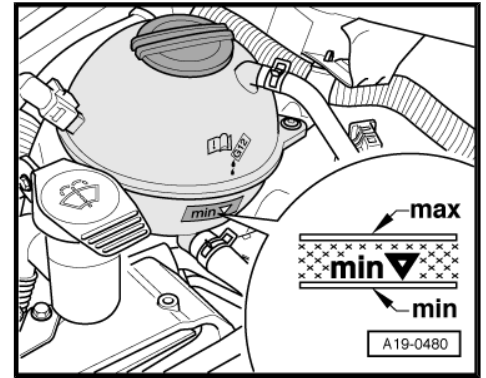
Note

- ◆ If the needle does not reach the green zone, repeat the process.
- ◆ Check cooling system for leaks if the vacuum is not maintained.
- 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.
- Detach cooling system charge unit - VAS 6096- from coolant expansion tank.
- Top up coolant to “max” mark.
- Set temperature to “HI”.
- Switch off air conditioner compressor (press **ECON** button).
- 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 ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



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- 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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2 Coolant pump/thermostat assembly

⇒ ["2.1 Exploded view - coolant pump and thermostat", page 142](#)

⇒ ["2.2 Exploded view - electric coolant pump", page 143](#)

⇒ ["2.3 Removing and installing electrical coolant pump", page 143](#)

⇒ ["2.4 Removing and installing coolant pump", page 144](#)

⇒ ["2.5 Removing and installing thermostat", page 145](#)

⇒ ["2.6 Removing and installing coolant temperature sender G62", page 146](#)

⇒ ["2.7 Removing and installing radiator outlet coolant temperature sender G83", page 147](#)

2.1 Exploded view - coolant pump and thermostat

1 - O-ring

- ☐ Renew

2 - Thermostat with housing

- ☐ Removing and installing
⇒ [page 145](#)

3 - Bolt

- ☐ 9 Nm

4 - Spring-type clip

- ☐ On housing

5 - Coolant pipe

6 - Spring-type clip

- ☐ On coolant pipe

7 - O-ring

- ☐ Renew

8 - Coolant pipe 1 (front)

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

9 - Bolt

- ☐ Tightening torque
⇒ [Item 17 \(page 149\)](#)

10 - Spring clip

- ☐ Check for correct seating
⇒ [page 155](#)

11 - Retaining clip

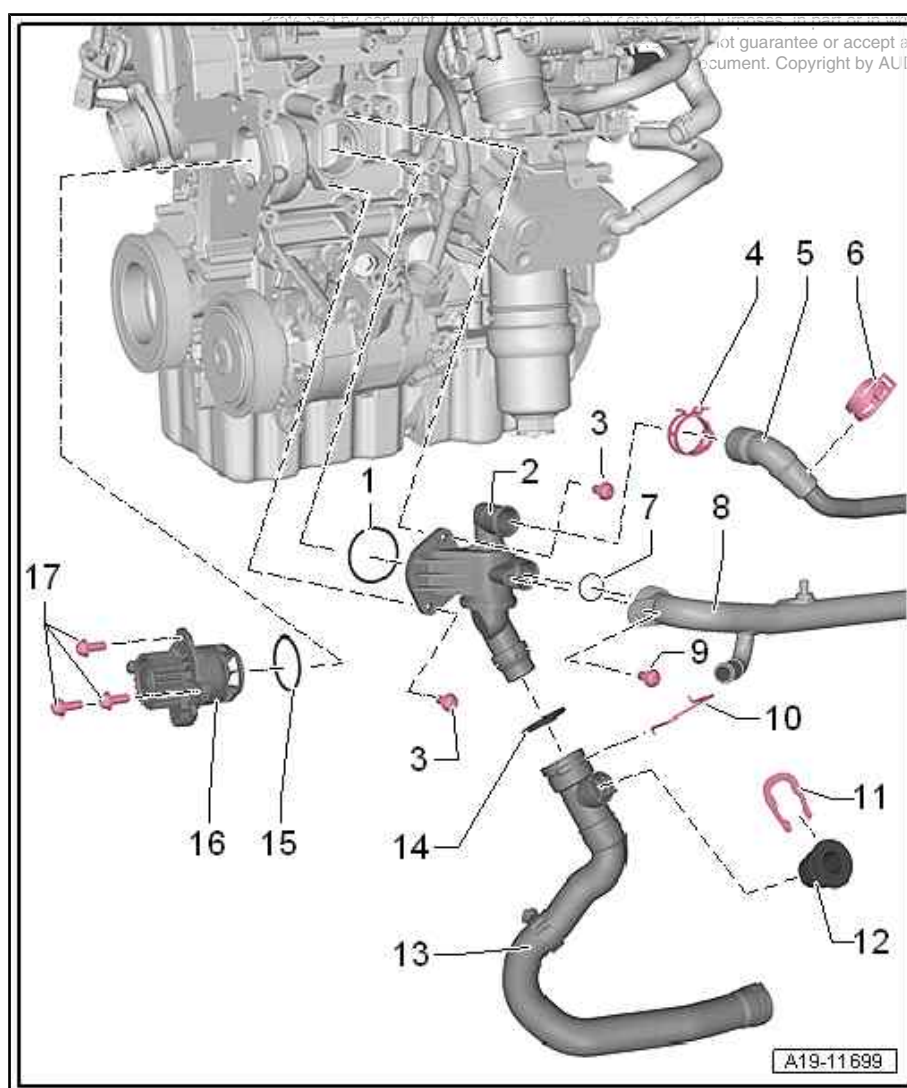
- ☐ Check for correct seating

12 - Sealing cap

13 - Coolant hose

14 - O-ring

- ☐ Renew
- ☐ Check for correct seating ⇒ [page 155](#)



15 - O-ring

- ☐ ⇒ ["2.4 Removing and installing coolant pump", page 144](#)
- ☐ Renew

16 - Coolant pump

- ☐ ⇒ ["2.4 Removing and installing coolant pump", page 144](#)

17 - Bolt

- ☐ ⇒ ["2.4 Removing and installing coolant pump", page 144](#)
- ☐ 15 Nm

2.2 Exploded view - electric coolant pump

1 - Bracket

- ☐ Bracket is secured to base engine with two bolts

2 - Bolt

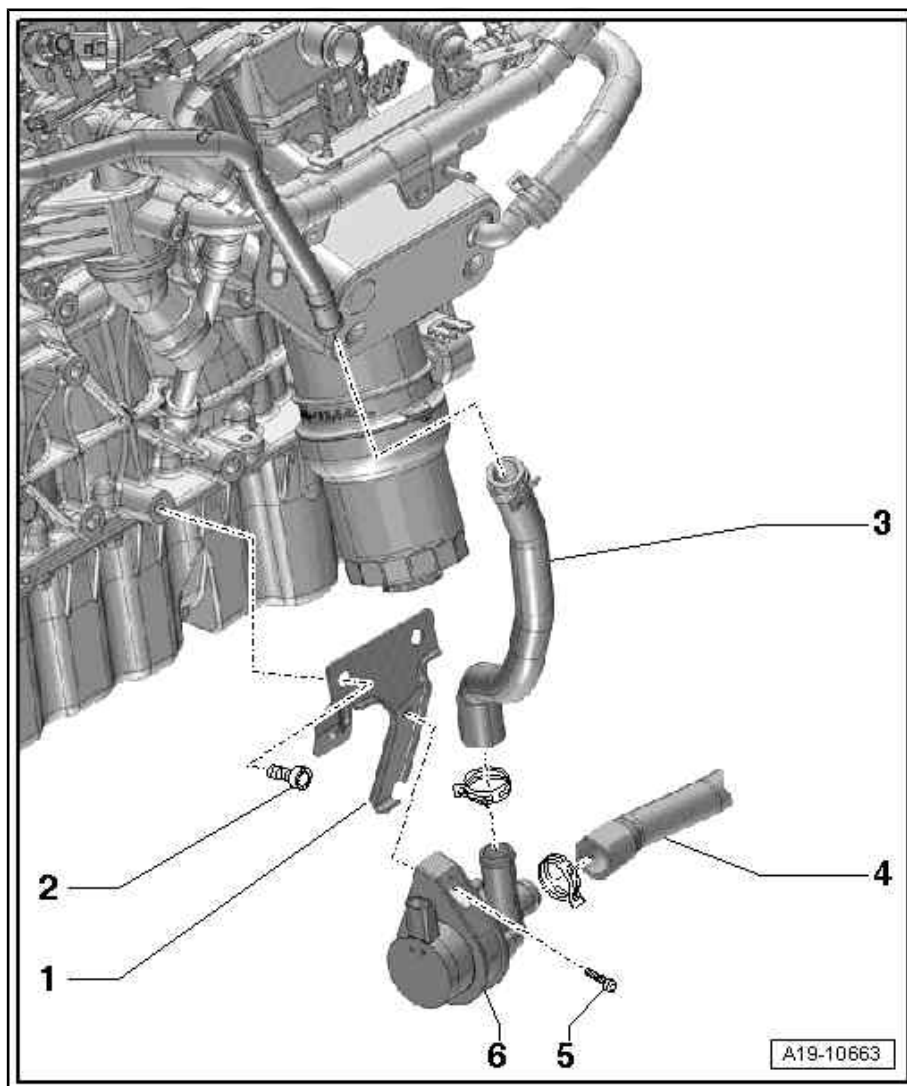
- ☐ 2x
- ☐ 9 Nm

3 - Coolant hose**4 - Coolant hose****5 - Bolt**

- ☐ 4 Nm

6 - Continued coolant circulation pump - V51-

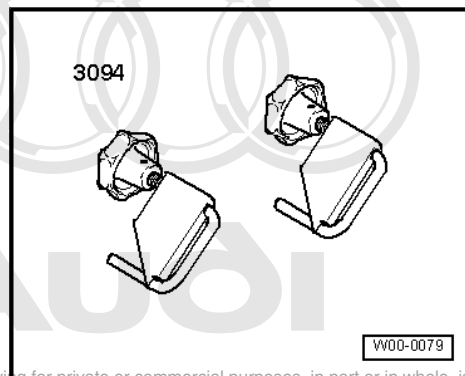
- ☐ Removing and installing
⇒ [page 143](#)



2.3 Removing and installing electrical coolant pump

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-



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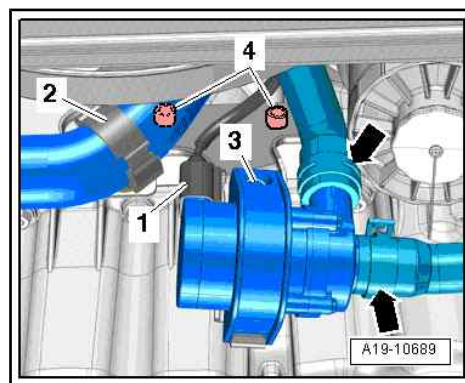
Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -1-.
- Remove bolt -3- and detach continued coolant circulation pump - V51- .



Note

- ◆ *Disregard -items 2 and 4-.*
- ◆ *Place a cloth underneath to catch escaping coolant.*
- Clamp off coolant hoses -arrows- with hose clamps -3094- and detach.



Installing

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

- Check coolant level ⇒ [page 141](#) .

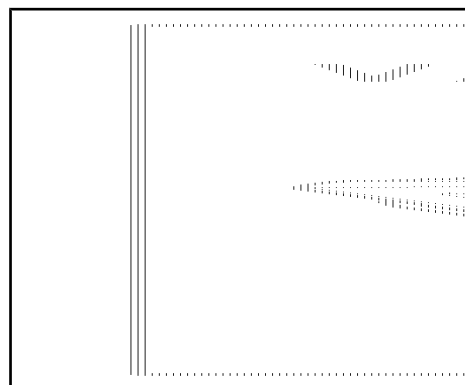
Tightening torques

- ◆ ⇒ [“2.2 Exploded view - electric coolant pump”, page 143](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

2.4 Removing and installing coolant pump

Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-



Removing

- Remove toothed belt ⇒ [page 66](#) .

- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Unscrew bolts -1- and remove coolant pump -2- with O-ring -3-.

Installing

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



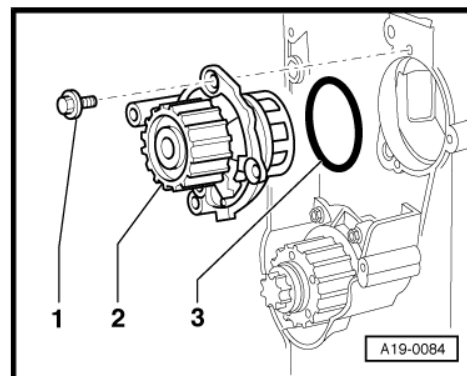
Note

Fit new O-ring.

- Clean and smoothen sealing surface for O-ring.
- Lubricate O ring -3- with coolant additive.
- Fit coolant pump -2-.
- Installation position: Sealing plug in housing faces downwards.
- Install toothed belt (adjust valve timing) ⇒ [page 71](#) .
- Fill up with coolant ⇒ [page 137](#) .

Tightening torques

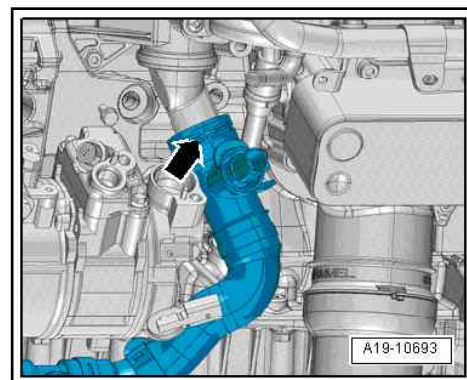
- ◆ ⇒ [“2.1 Exploded view - coolant pump and thermostat”, page 142](#)



2.5 Removing and installing thermostat

Removing

- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove coolant pipes ⇒ [page 150](#) .
- Lift retaining clip and detach coolant hose -arrow- from thermostat with housing.



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- Unscrew bolts -arrows- and remove thermostat with housing.

Installing

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

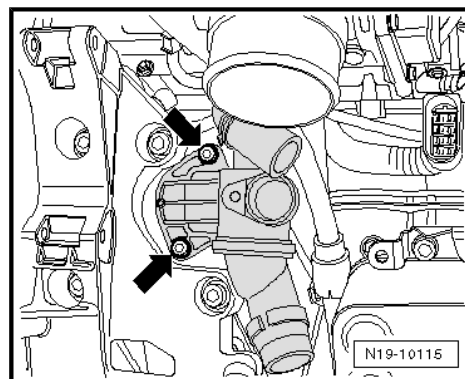
Note

- ◆ *Renew seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*

- Clean and smoothen sealing surface for O-ring.
- Lubricate O ring with coolant additive.
- Install coolant pipes ⇒ [page 150](#) .
- Fill up with coolant ⇒ [page 137](#) .

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - coolant pump and thermostat”, page 142](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator



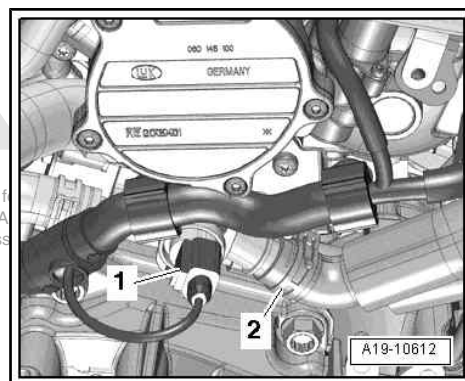
2.6 Removing and installing coolant temperature sender - G62-

Removing

- Engine cold
- Remove engine cover panel ⇒ [page 33](#) .
- Open filler cap on coolant expansion tank briefly and allow residual pressure in cooling system to dissipate.
- Remove air cleaner housing ⇒ [page 195](#) .
- Unplug electrical connector -1- at coolant temperature sender - G62- .

Note

- ◆ *Place a cloth underneath to catch escaping coolant.*
- ◆ *Disregard item -2-.*
- Pull off retaining clip and detach coolant temperature sender - G62- .



Installing

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

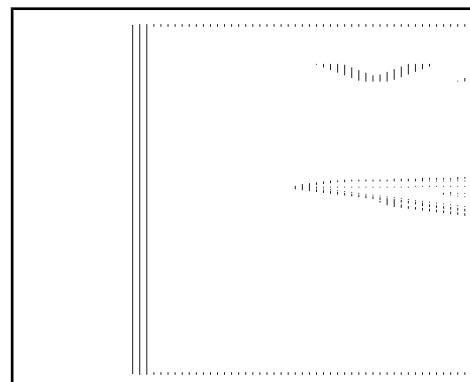
Note

- ◆ *Fit new O-ring.*
- ◆ *Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.*
- Check coolant level ⇒ [page 141](#) .

2.7 Removing and installing radiator outlet coolant temperature sender - G83-

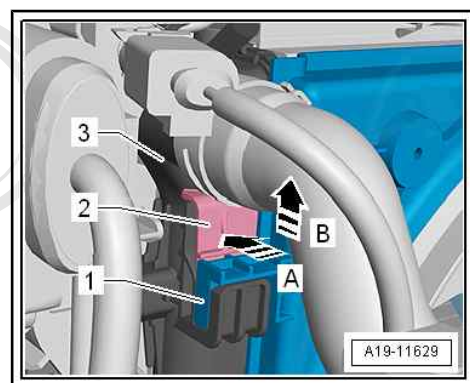
Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-



Removing

- Engine cold.
- Open filler cap on coolant expansion tank briefly to dissipate residual pressure in cooling system.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Place drip tray for workshop hoist - VAS 6208- underneath.
- Release retainer -2- on both sides in direction of -arrow A-.
- Lift radiator cowl -1- upwards out of radiator mounting in direction of -arrow B- and push slightly to right.

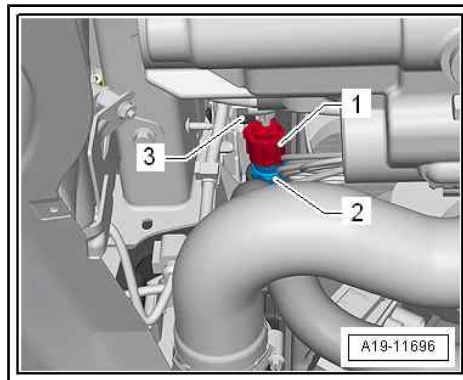


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- Unplug electrical connector -1- at coolant temperature sender - G83- -2-.
- Remove coolant temperature sender - G83- .

**Note**

- ◆ *Place a cloth underneath to catch escaping coolant.*
- ◆ *Screw new coolant temperature sender - G83- immediately into connection to avoid loss of coolant.*
- Remove radiator outlet coolant temperature sender - G83- -2- from radiator -3-.

**Installing**

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

- Install noise insulation.
- Check coolant level ⇒ [page 141](#) .

Tightening torques

- ◆ Radiator outlet coolant temperature sender - G83-
⇒ [Item 10 \(page 154\)](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

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3 Coolant pipes

⇒ ["3.1 Exploded view - coolant pipes", page 149](#)

⇒ ["3.2 Removing and installing coolant pipes", page 150](#)

3.1 Exploded view - coolant pipes

1 - Coolant pipe (front right)

- ☐ Removing and installing
⇒ [page 152](#)

2 - Bolt

- ☐ 6 Nm

3 - Bolt

- ☐ 40 Nm

4 - Bolt

- ☐ 23 Nm

5 - Coolant bleeder pipe

6 - Bolt

- ☐ 9 Nm

7 - O-ring

- ☐ Renew

8 - Bolt

- ☐ 9 Nm

9 - Retaining clip

10 - Coolant temperature sender - G62-

- ☐ Removing and installing
⇒ [page 146](#)

11 - O-ring

- ☐ Renew

12 - Coolant hose/pipe connection

13 - Coolant pipe 1 (front)

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

14 - Bolt

- ☐ 9 Nm

15 - Coolant pipe 2 (front)

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

16 - Bolt

- ☐ 9 Nm

17 - Bolt

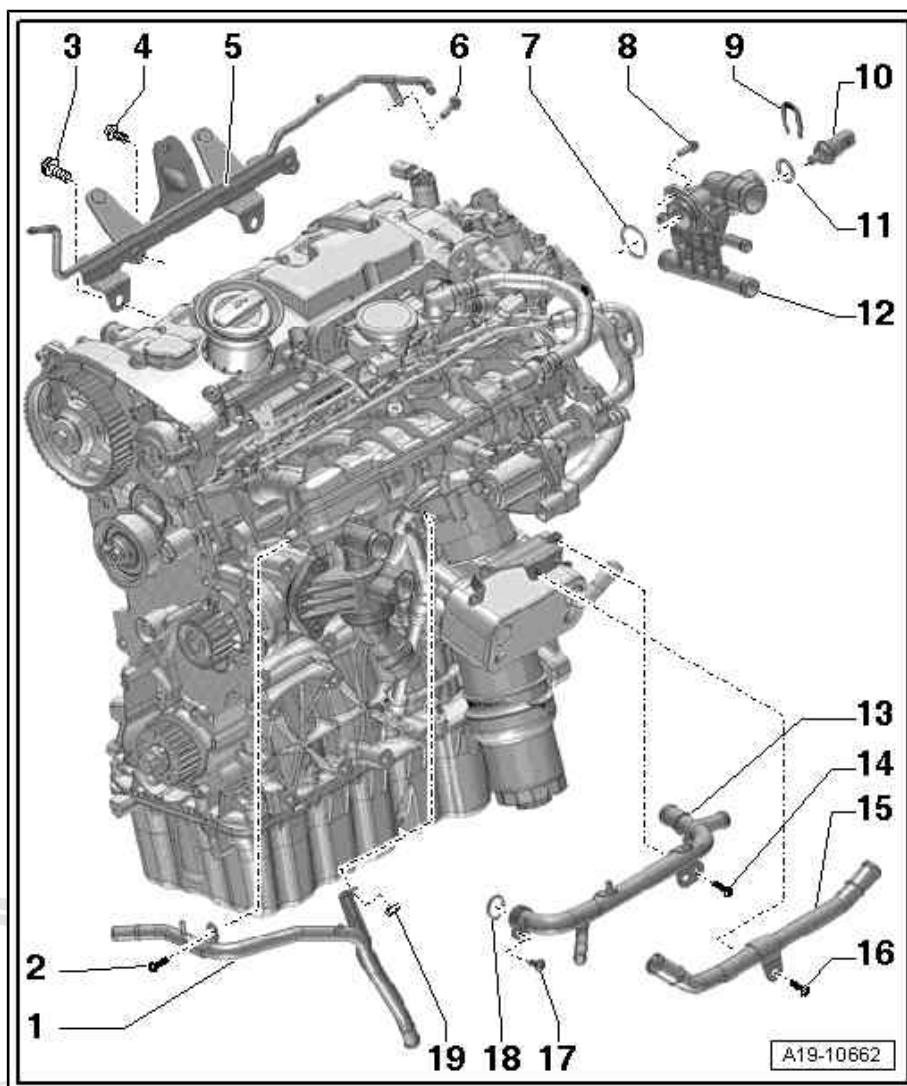
- ☐ 9 Nm

18 - O-ring

- ☐ Renew

19 - Nut

- ☐ 9 Nm



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3.2 Removing and installing coolant pipes

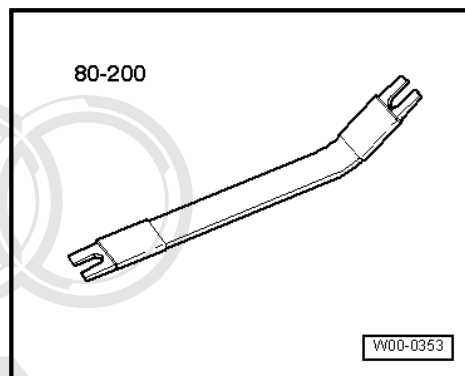
⇒ ["3.2.1 Removing and installing coolant pipes 1 and 2 \(front\)", page 150](#)

⇒ ["3.2.2 Removing and installing coolant pipe \(front right\)", page 152](#)

3.2.1 Removing and installing coolant pipes 1 and 2 (front)

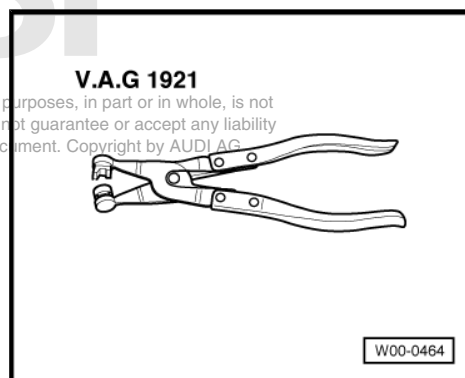
Special tools and workshop equipment required

◆ Removal lever - 80 - 200-

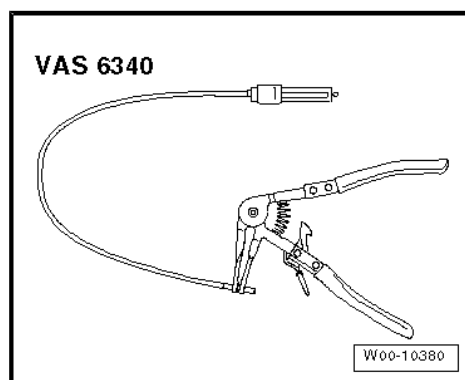


◆ Hose clip pliers - V.A.G 1921-

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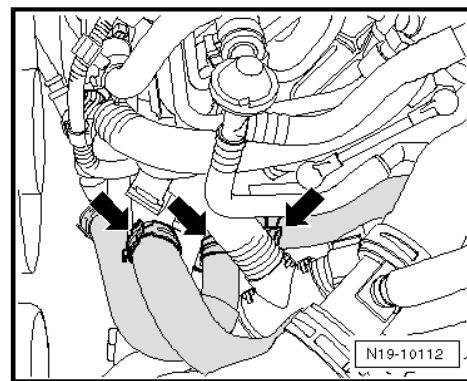
◆ Hose clip pliers - VAS 6340-



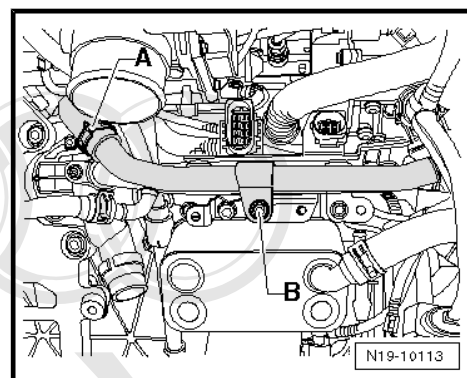
Removing

- Drain coolant ⇒ [page 135](#) .
- Remove radiator cowl ⇒ [page 157](#) .

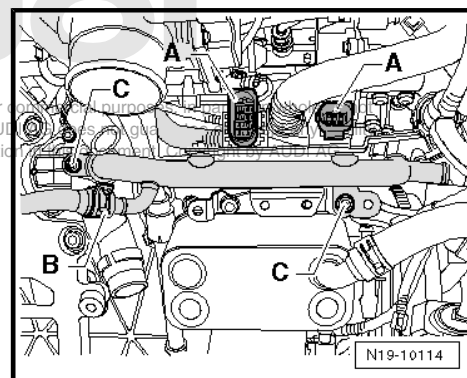
- Detach coolant hoses -arrows- from coolant pipes.



- Detach coolant hose -A-.
- Unscrew bolt -B- and remove coolant pipe 2 (front).



- Using removal lever - 80 - 200- , press bracket with electrical connectors -A- off coolant pipe.
- Detach coolant hose -B-.
- Unscrew bolts -C- and remove coolant pipe 1 (front).



Installing

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



Note

- ◆ *Renew seals and gaskets.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- Install air pipe ⇒ [page 174](#) .
- Install air cleaner housing ⇒ [page 195](#) .
- Install radiator cowl ⇒ [page 157](#) .
- Fill up with coolant ⇒ [page 137](#) .

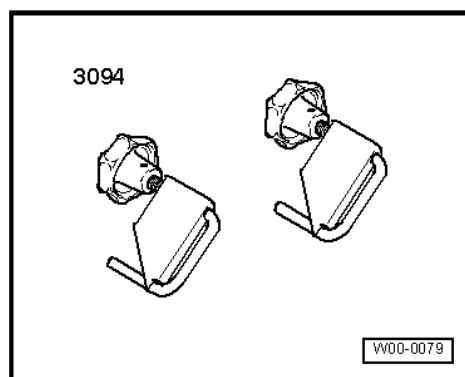
Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 149](#)

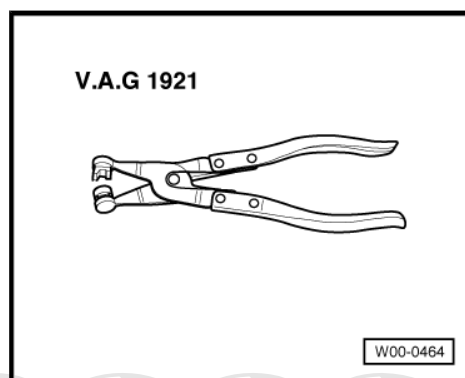
3.2.2 Removing and installing coolant pipe (front right)

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-

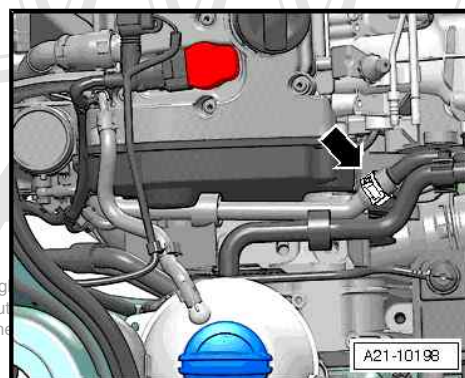


- ◆ Hose clip pliers - V.A.G 1921-

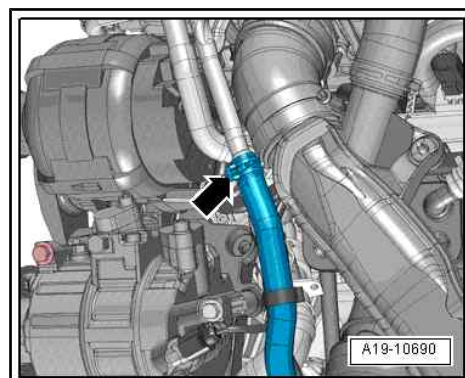


Removing

- Remove engine cover panel ⇒ [page 33](#) .
- Clamp off coolant hose -arrow- with hose clamp -3094- and detach.



- Clamp off coolant hose -arrow- with hose clamp -3094- and detach.





Note

Place a cloth underneath to catch escaping coolant.

- Unscrew bolt and nut -arrows- and detach coolant pipe (front right).

Installing

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



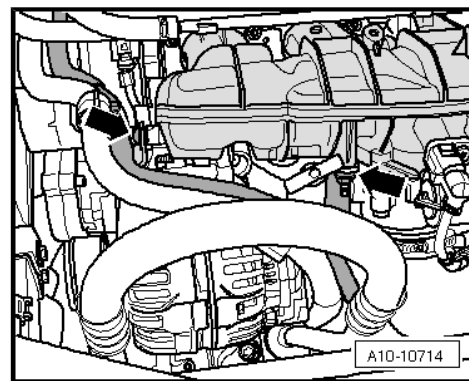
Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Check coolant level ⇒ [page 141](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 149](#)



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4 Radiator/radiator fans

⇒ "4.1 Exploded view - radiator/radiator fans", page 154

⇒ "4.2 Removing and installing radiator", page 155

⇒ "4.3 Removing and installing radiator cowl", page 157

⇒ "4.4 Removing and installing radiator fans", page 159

4.1 Exploded view - radiator/radiator fans

1 - Radiator fan - V7-

- ☐ Removing and installing
⇒ [page 159](#)

2 - Nut

- ☐ Radiator fan - V7- to radiator cowl
- ☐ 10 Nm

3 - Radiator cowl

- ☐ Removing and installing
⇒ [page 157](#)

4 - Coolant hose (top)

- ☐ Connecting to radiator
⇒ [page 155](#)

5 - Spring-type clip

- ☐ Coolant hose (top)

6 - Cap

- ☐ For additional radiator outlet

7 - Radiator

- ☐ Removing and installing
⇒ [page 155](#)
- ☐ If renewed, change coolant in entire system

8 - Coolant hose (bottom)

- ☐ Connecting to radiator
⇒ [page 155](#)

9 - Spring-type clip

- ☐ Coolant hose (bottom)

10 - Radiator outlet coolant temperature sender - G83-

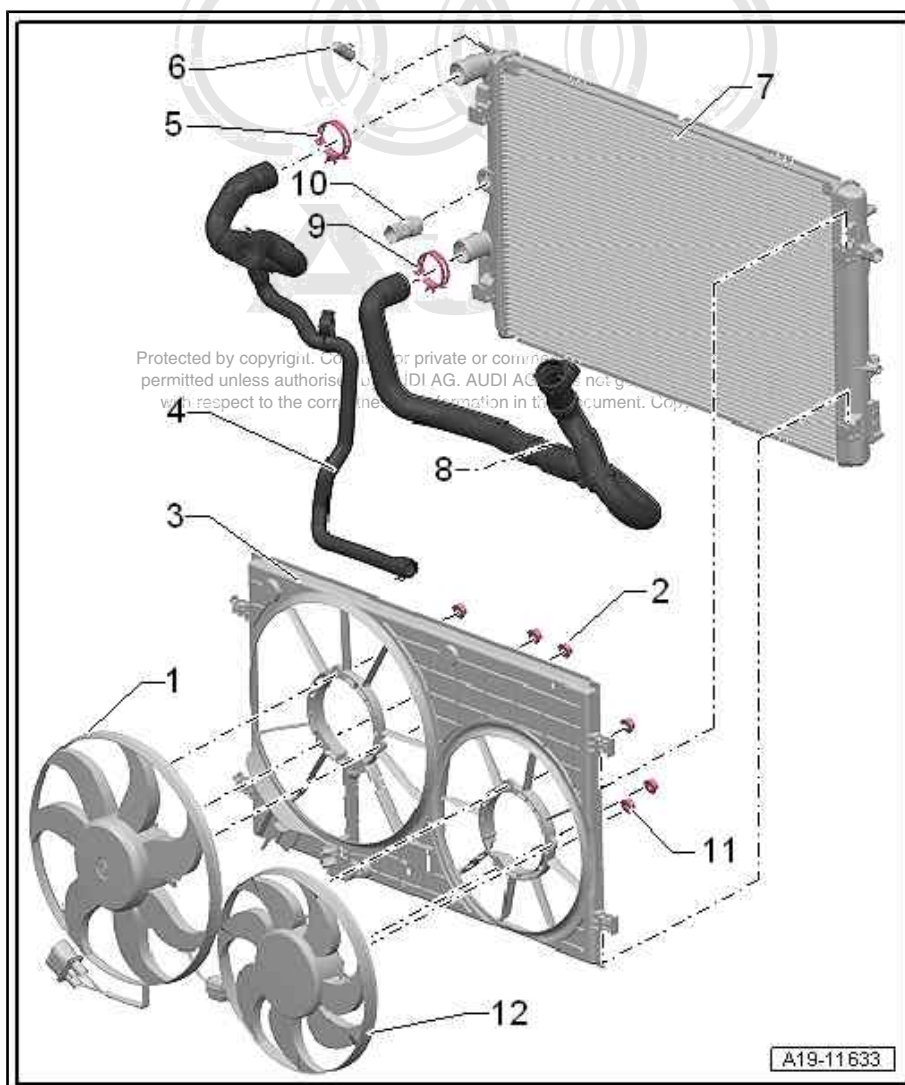
- ☐ Removing and installing ⇒ [page 147](#)
- ☐ Tightening torque: 35 Nm

11 - Radiator fan 2 - V177-

- ☐ Removing and installing ⇒ [page 159](#)

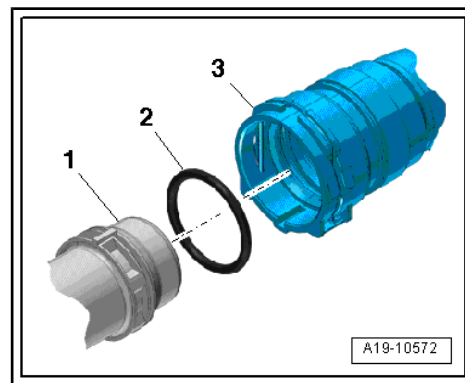
12 - Nut

- ☐ Radiator fan 2 - V177- to radiator cowl
- ☐ 10 Nm



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

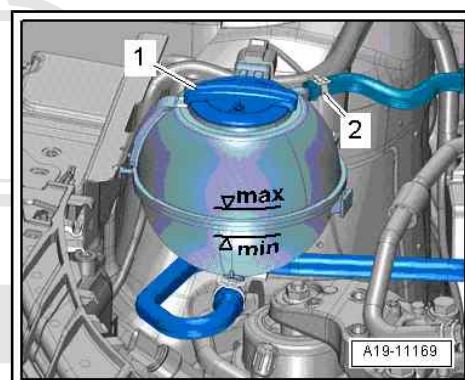
Removing



Note

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

- Open filler cap -1- on coolant expansion tank.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

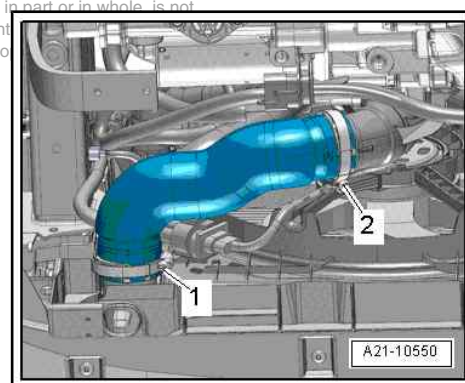


- Release hose clip -1- for air hose (bottom left) and disconnect hose from charge air cooler.

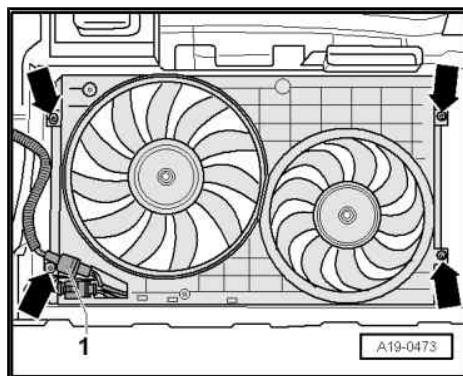


Note

Item -2- can be disregarded.



- Unplug connector -1-.



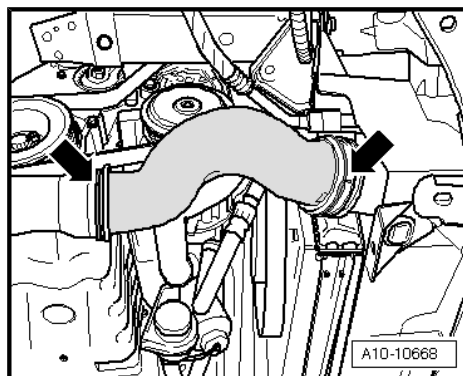
- Remove charge air hose (right-side) -arrows-.



Caution

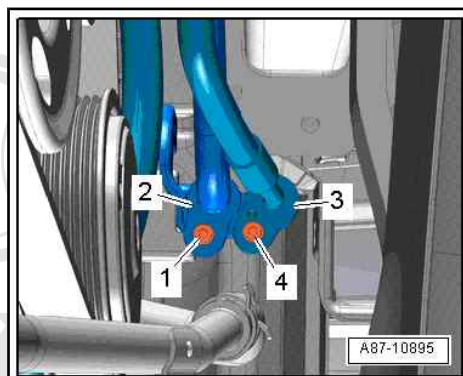
Danger of damage to refrigerant lines and hoses.

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

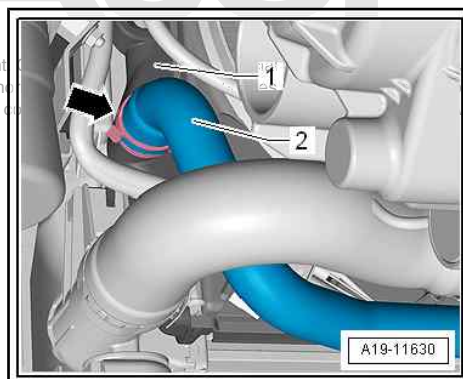


- Discharge refrigerant system ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87 ; Refrigerant circuit .

- Unscrew bolts -1 and 4- and disconnect refrigerant lines -2, 3-.
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Drain coolant ⇒ [page 135](#) .



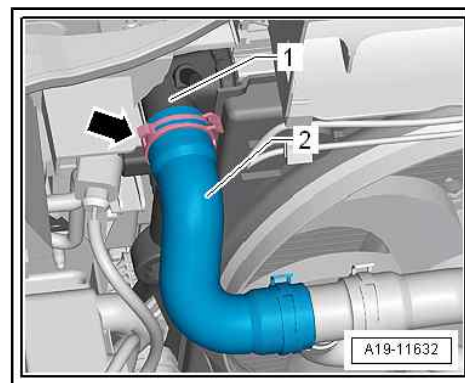
- Unclip coolant hose -2- (bottom) from bracket for radiator cowl.
- Release hose clips -arrow-, disconnect coolant hose -2- (bottom) from radiator -1- and drain off remaining coolant.



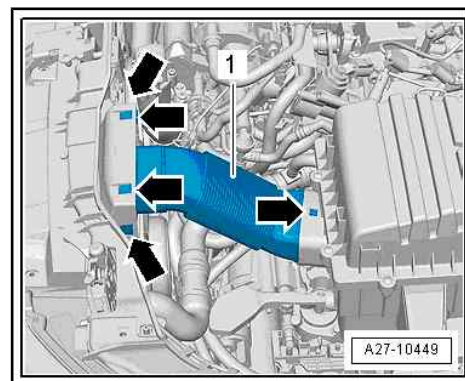
- Release hose clip -arrow-, disconnect coolant hose -2- (top) from radiator -1- and drain off remaining coolant.

**Note**

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



- Release fasteners -arrows- and detach air duct -1-.
- Remove lock carrier ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Removing and installing lock carrier .

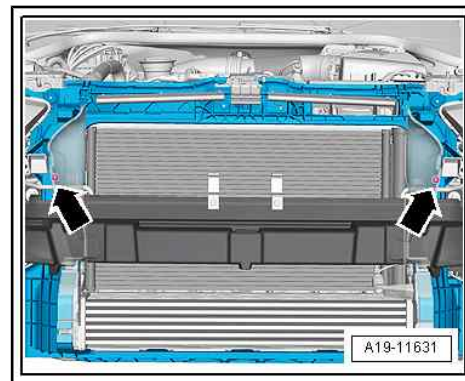


- Loosen bolts -arrows- and take radiator module out of lock carrier (lift out of bottom mountings).
- Disassemble radiator module and renew radiator.

Installing

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

- Install lock carrier ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Exploded view - lock carrier .
- Fill up with coolant ⇒ [page 137](#) .

**Tightening torques**

- ♦ ⇒ [“4.1 Exploded view - radiator/radiator fans”, page 154](#)

4.3 Removing and installing radiator cowl**WARNING**

Risk of injury as the radiator fans may start up automatically.

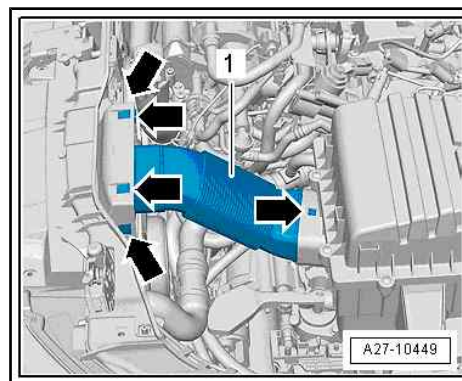
- ♦ *Unplug electrical connectors before performing work on radiator cowl.*

Removing

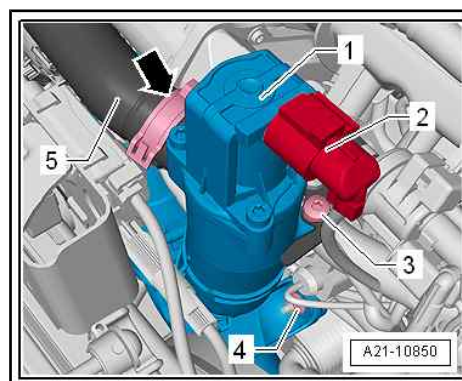
- Remove engine cover panel ⇒ [page 33](#) .

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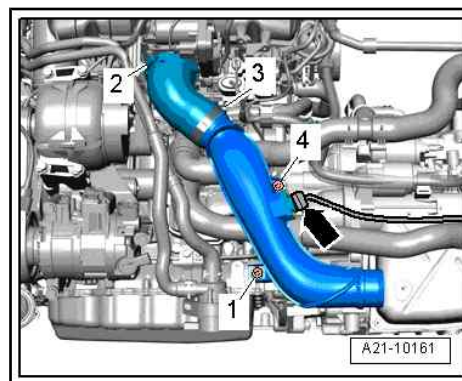
- Release fasteners -arrows- and detach air duct -1-.



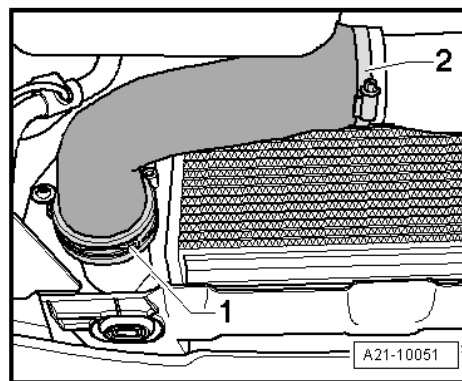
- Unplug electrical connector -2-.
- Release hose clip -arrow- and detach hose -5- from turbo-charger air recirculation valve - N249- .
- Remove nut -4-.



- Loosen hose clip -2-.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



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

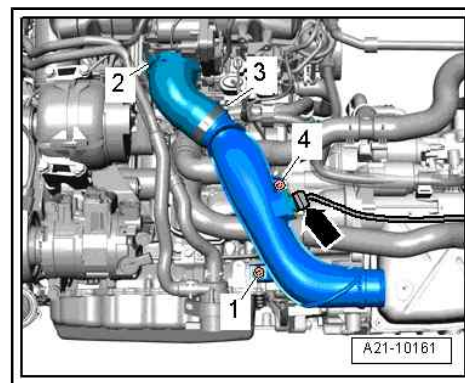


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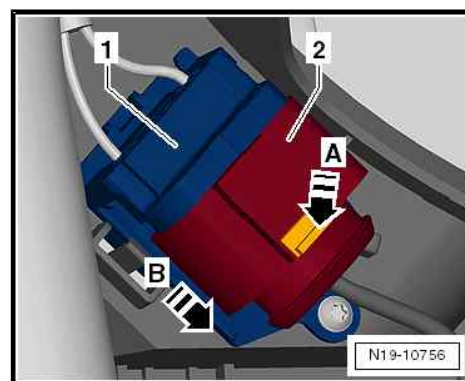
- Unplug electrical connector -arrow- at charge pressure sender - G31- .
- Unscrew bolt -1- and remove charge air pipe with turbocharger air recirculation valve - N249- downwards.

**Note**

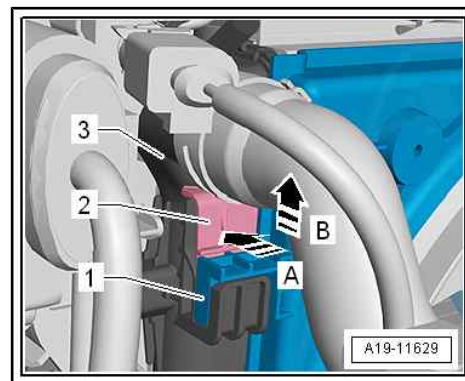
Disregard item -3-.



- Unplug connector -2- on electrical wiring harness -1- of radiator fan -2-.
- To do so, release retaining tab -arrow A-.
- Unplug connector -2- in direction of -arrow B-.



- Release retainer -2- on both sides in direction of -arrow A-.
- Lift radiator cowl -1- upwards out of radiator mounting in direction of -arrow B-.
- Remove radiator cowl downwards.

**Installing**

Install in reverse order.

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiator/radiator fans”, page 154](#)
- ◆ ⇒ [“2.2 Exploded view - charge air system”, page 174](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

4.4 Removing and installing radiator fans

Removing

- Remove radiator cowl ⇒ [page 157](#) .
- Unplug electrical connector -1-.
- Move electrical wiring clear.

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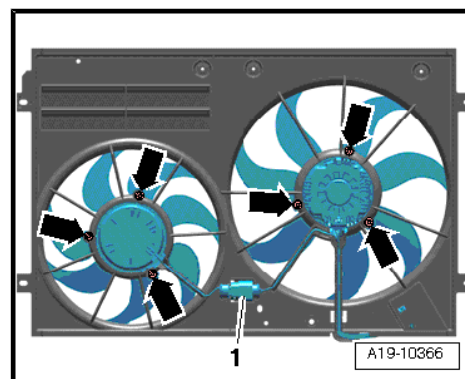
Installing

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

- Install radiator cowl ⇒ [page 157](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiator/radiator fans”, page 154](#)



21 – Turbocharging/supercharging

1 Turbocharger

⇒ [“1.1 Exploded view - turbocharger”, page 160](#)

⇒ [“1.2 Removing and installing turbocharger”, page 163](#)

⇒ [“1.3 Checking vacuum unit for turbocharger”, page 167](#)

⇒ [“1.4 Adjusting vacuum unit for turbocharger”, page 168](#)

⇒ [“1.5 Renewing vacuum unit for turbocharger”, page 172](#)

1.1 Exploded view - turbocharger

Part 1

1 - Turbocharger

- ☐ Combined with exhaust manifold
- ☐ Removing and installing
⇒ [page 163](#)

2 - Gasket

- ☐ Renew

3 - Bolt

- ☐ 9 Nm

4 - Heat shield

5 - Crankcase breather pipe

6 - Hose leading to activated charcoal filter

7 - Vacuum unit for turbocharger

- ☐ Checking ⇒ [page 167](#)
- ☐ Removing and installing
⇒ [page 172](#)
- ☐ Adjusting ⇒ [page 168](#)

8 - Ring connector

9 - Hose

10 - Charge pressure control solenoid valve - N75-

11 - Hose

12 - Bolt

- ☐ 3 Nm

13 - Banjo bolt

- ☐ 8 Nm

14 - Hose

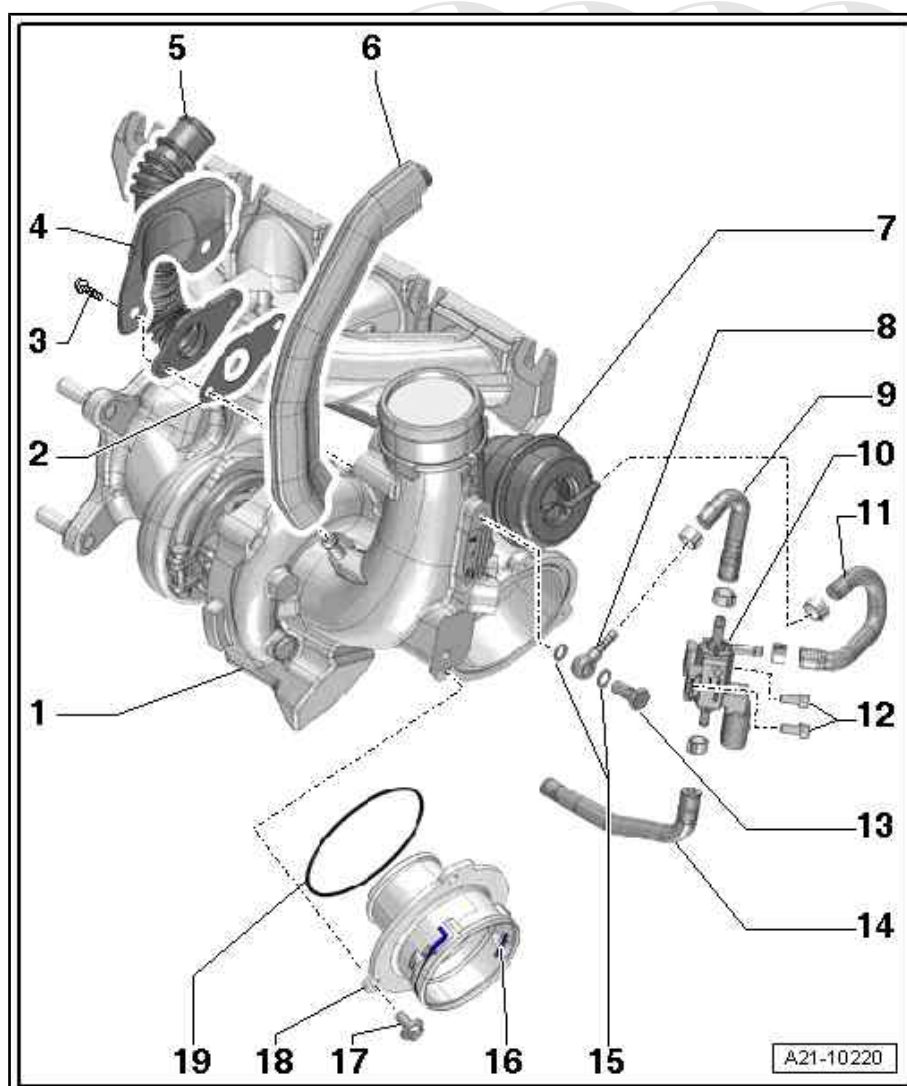
15 - Seals

- ☐ Renew

16 - Securing clip

17 - Bolt

- ☐ 7 Nm



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18 - Connection

19 - Seal

- ☐ Renew

Part 2

1 - Seal

- ☐ Renew

2 - Banjo bolt

- ☐ 30 Nm

3 - Oil supply line

4 - Turbocharger

- ☐ Combined with exhaust manifold
- ☐ Removing and installing
⇒ [page 163](#)

5 - Bolt

- ☐ 9 Nm

6 - Banjo bolt

- ☐ 30 Nm

7 - Seal

- ☐ Renew

8 - Banjo bolt

- ☐ 35 Nm

9 - Seal

- ☐ Renew

10 - Coolant supply line

11 - Bolt

- ☐ 23 Nm

12 - Banjo bolt

- ☐ 35 Nm

13 - Bolt

- ☐ 9 Nm

14 - Seal

- ☐ Renew

15 - Gasket

- ☐ Renew

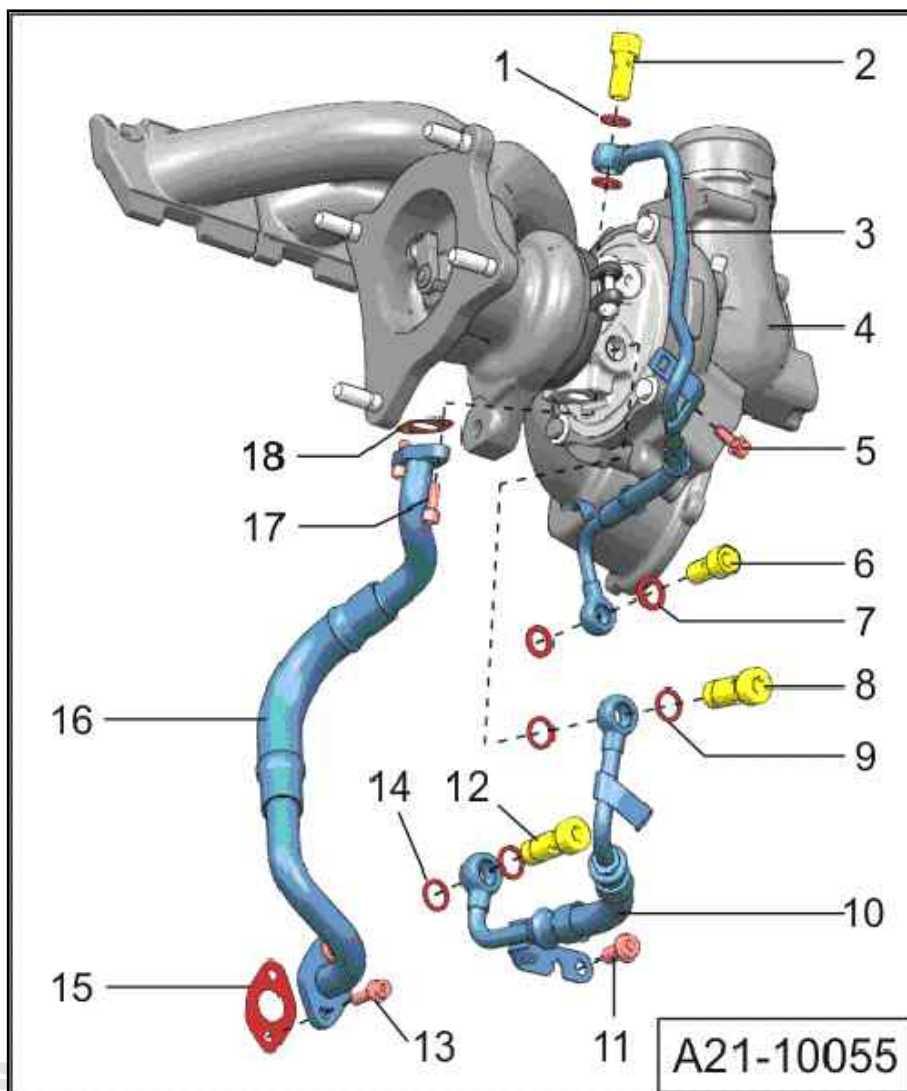
16 - Oil return line

17 - Bolt

- ☐ 9 Nm

18 - Gasket

- ☐ Renew



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Part 3

1 - Gasket

- ☐ Renew

2 - Nut

- ☐ Renew
- ☐ Lubricate threaded pins on exhaust manifold with high-temperature paste. For high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 21 Nm

3 - Banjo bolt

- ☐ 35 Nm

4 - Seal

- ☐ Renew

5 - Bolt

- ☐ 9 Nm

6 - Coolant return hose/pipe
7 - Turbocharger

- ☐ Combined with exhaust manifold
- ☐ Removing and installing ⇒ [page 163](#)

8 - Bracket
9 - Bolt

- ☐ Coat with high-temperature paste when installing; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 30 Nm

10 - Bolt

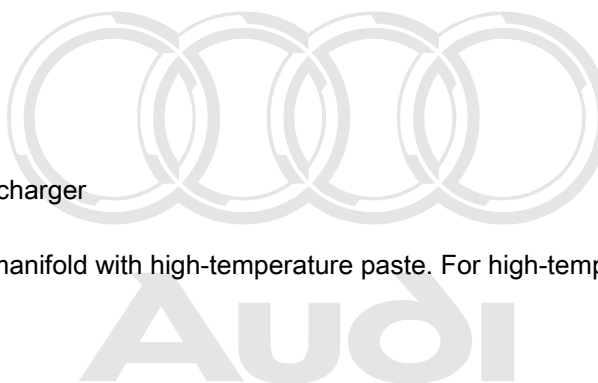
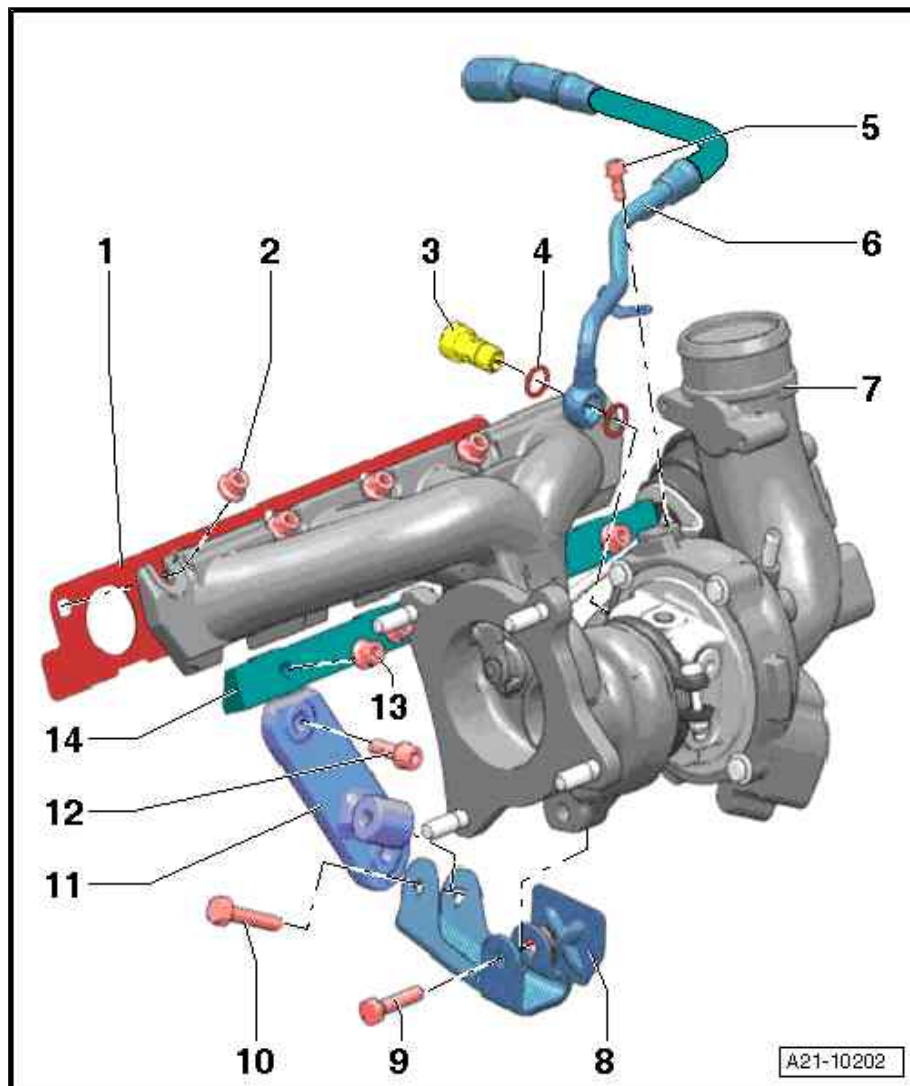
- ☐ Coat with high-temperature paste when installing; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 30 Nm

11 - Bracket
12 - Bolt

- ☐ 23 Nm

13 - Nut

- ☐ Do not slacken when removing turbocharger
- ☐ Renew
- ☐ Lubricate threaded pins on exhaust manifold with high-temperature paste. For high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 30 Nm

14 - Fastening strip


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Part 4

1 - Vacuum unit for turbocharger

- ☐ Checking ⇒ [page 167](#)
- ☐ Removing and installing ⇒ [page 172](#)
- ☐ Adjusting ⇒ [page 168](#)

2 - Pressure hose**3 - Bolts**

- ☐ Self-locking

- ☐ Renew

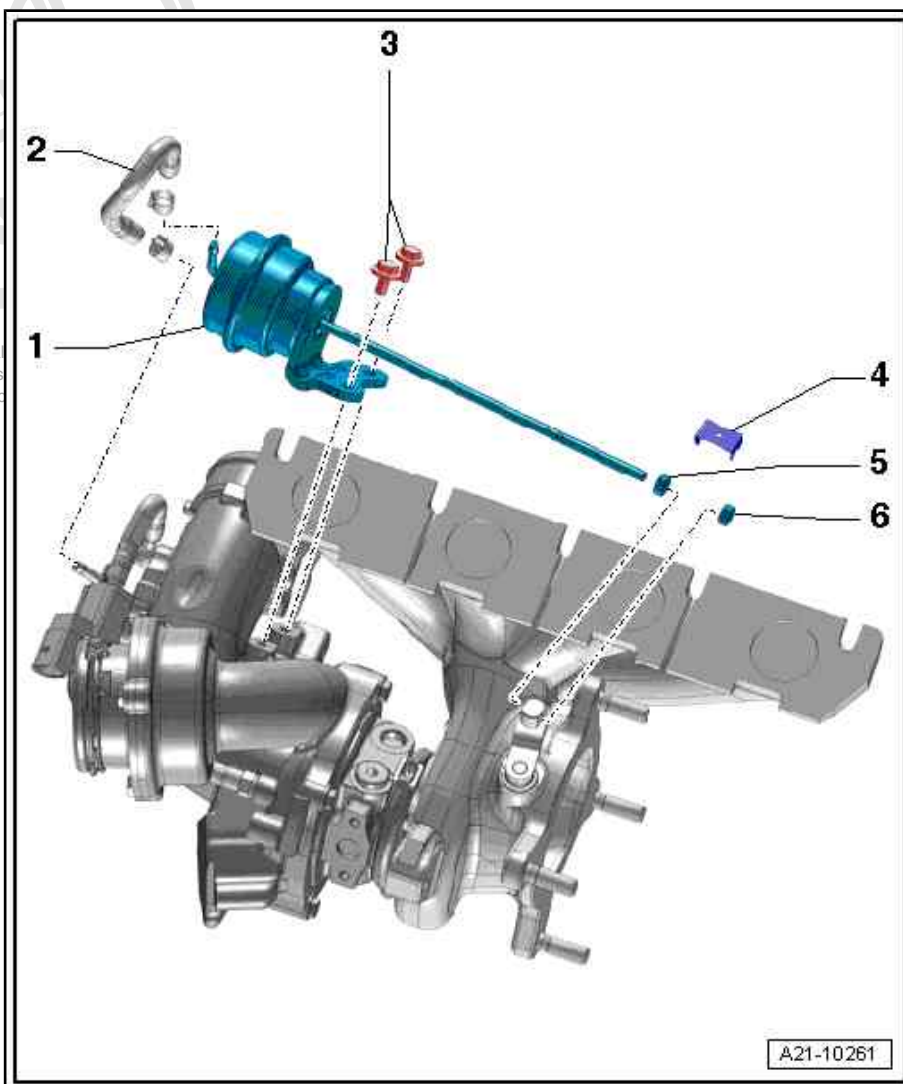
- ☐ 9 Nm

4 - Locking plate**5 - Lock nut**

- ☐ 9 Nm
- ☐ After tightening, secure with sealant paint; for sealing paint refer to ⇒ Electronic parts catalogue

6 - Adjusting nut

- ☐ After tightening, secure with sealant paint; for sealing paint refer to ⇒ Electronic parts catalogue

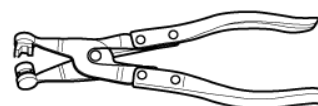


A21-10261

1.2 Removing and installing turbocharger**Special tools and workshop equipment required**

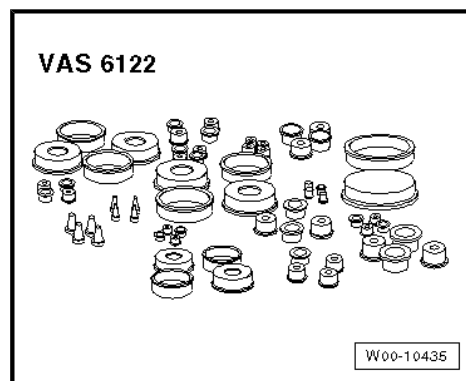
- ◆ Hose clip pliers - V.A.G 1921-

V.A.G 1921

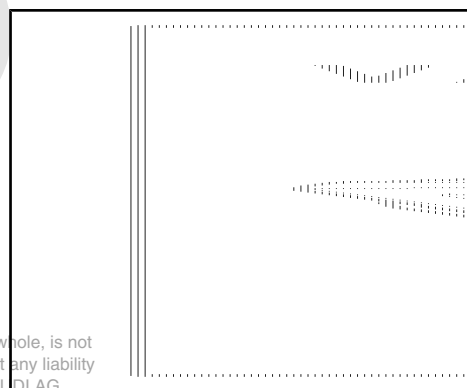


W00-0464

◆ Engine bung set - VAS 6122-



◆ Drip tray for workshop hoist - VAS 6208-



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Removing



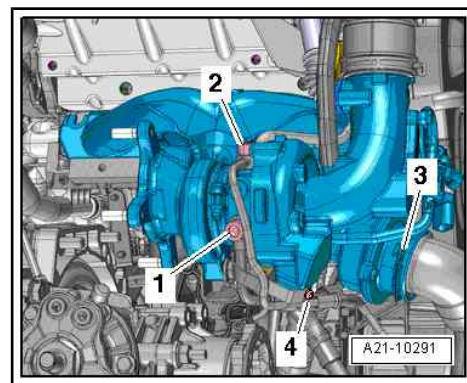
Caution

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

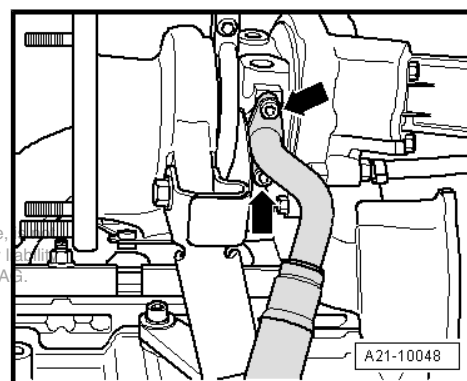
- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

- Remove engine ⇒ [page 9](#) .
- Remove front exhaust pipe ⇒ [page 241](#) .
- Unbolt heat shield for drive shaft (right-side) from bevel box.

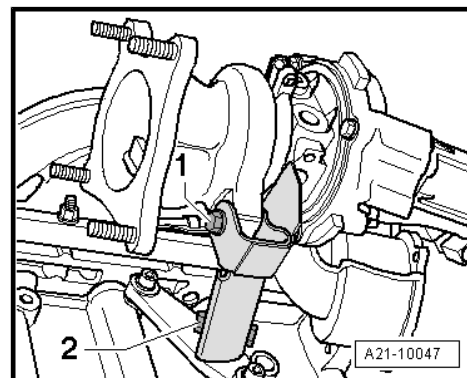
- Lift retaining clip -3- and remove bolt -4-.
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Remove banjo bolt -1- for coolant supply line and -2- for oil supply line and press pipes to the side.



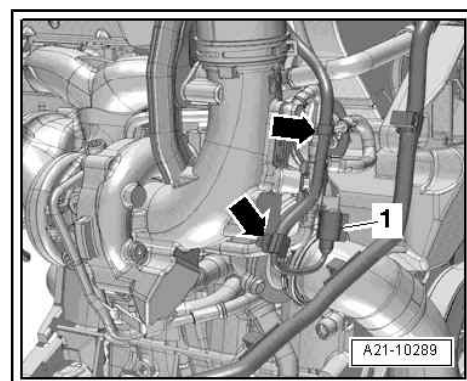
- Remove bolts -arrows- and detach oil return line from turbocharger.



- Unscrew bolts -1- and -2- and remove support for turbocharger.

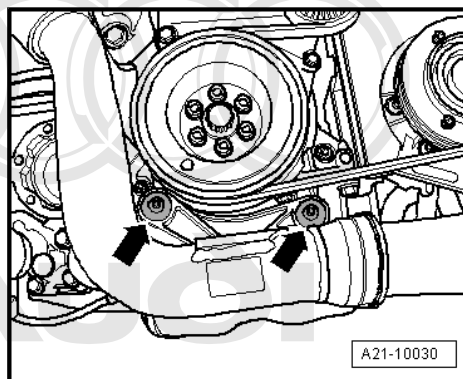


- Unplug electrical connector -1- and move electrical wiring harness -arrows- clear.

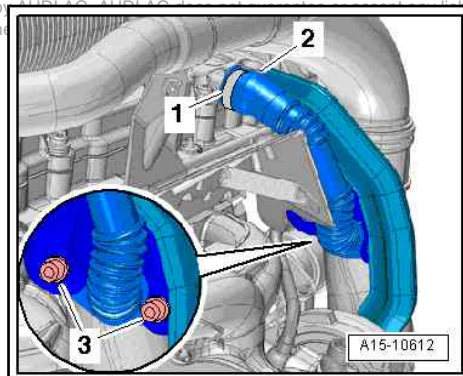


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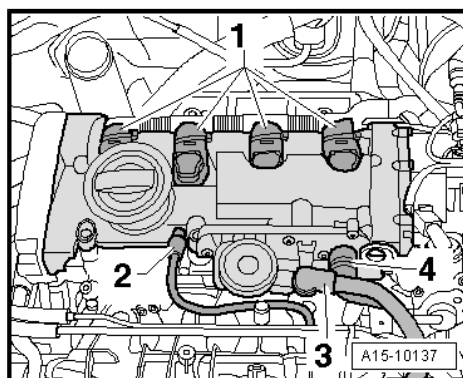
- Remove bolts -arrows- and pull air pipe off turbocharger (leave in installation position).



- Disconnect hose -2- coming from activated charcoal filter from cylinder head cover.
- Remove bolts -3-, release hose clip -1- and disconnect crank-case breather pipe with heat shield from cylinder head cover.



- Unplug electrical connectors -1- at ignition coils and place to one side.



- Unscrew nuts -arrows- and lift off 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

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 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*.
- ◆ 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 coolant bleeder line ⇒ [page 149](#).
- Observe the instructions for installing air pipes and hoses with plug-in connectors ⇒ [page 175](#).
- Install front exhaust pipe ⇒ [page 241](#).
- Install engine ⇒ [page 23](#).
- Check oil level ⇒ Maintenance ; Booklet 819.
- Fill up with coolant ⇒ [page 137](#).

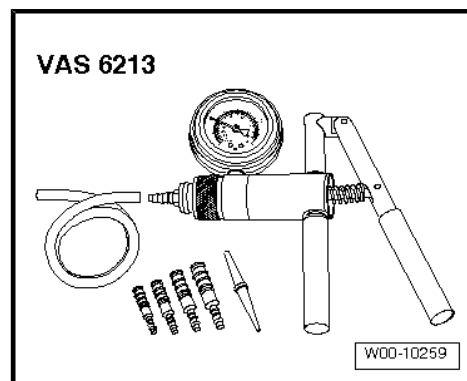
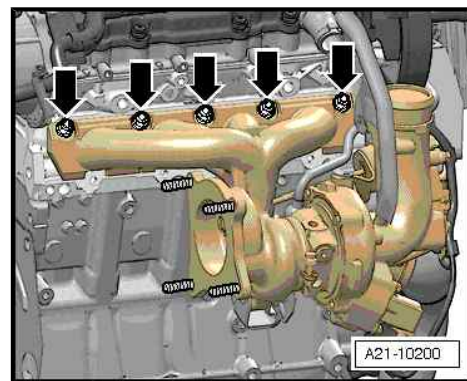
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Tightening torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 160](#)
- ◆ ⇒ [“2.2 Exploded view - charge air system”, page 174](#)

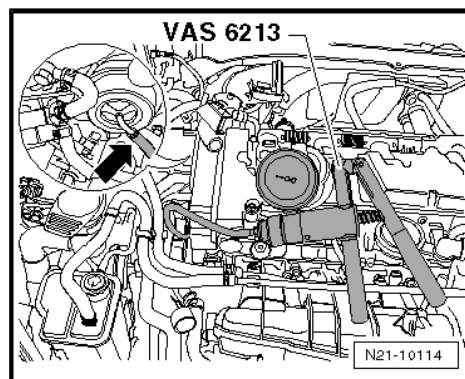
1.3 Checking vacuum unit for turbocharger**Special tools and workshop equipment required**

- ◆ Hand vacuum pump - VAS 6213-

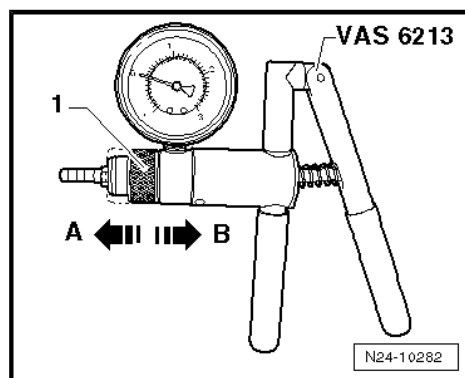


Procedure

- ◆ Hose from turbocharger via charge pressure solenoid valve - N75- to vacuum unit must not be blocked.
- ◆ Charge pressure control solenoid valve - N75- OK.
- Remove engine cover panel ⇒ [page 33](#) .
- Connect hand vacuum pump - VAS 6213- to vacuum unit -arrow-.



- Move adjuster ring -1- on hand vacuum pump to position “pressure” -arrow B-.

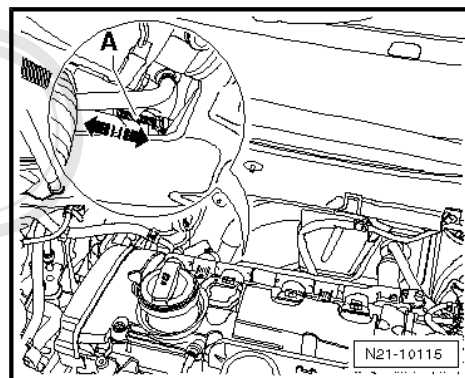


Caution

Risk of damage to vacuum unit.

- ◆ *The pressure must not exceed 850 mbar.*

- Operate hand vacuum pump repeatedly and observe linkage -A-.
- The linkage should move at a pressure of approx. 300 mbar and above.
- At approx. 800 mbar the linkage should be at its limit stop.
- The linkage should travel approx. 13 mm.



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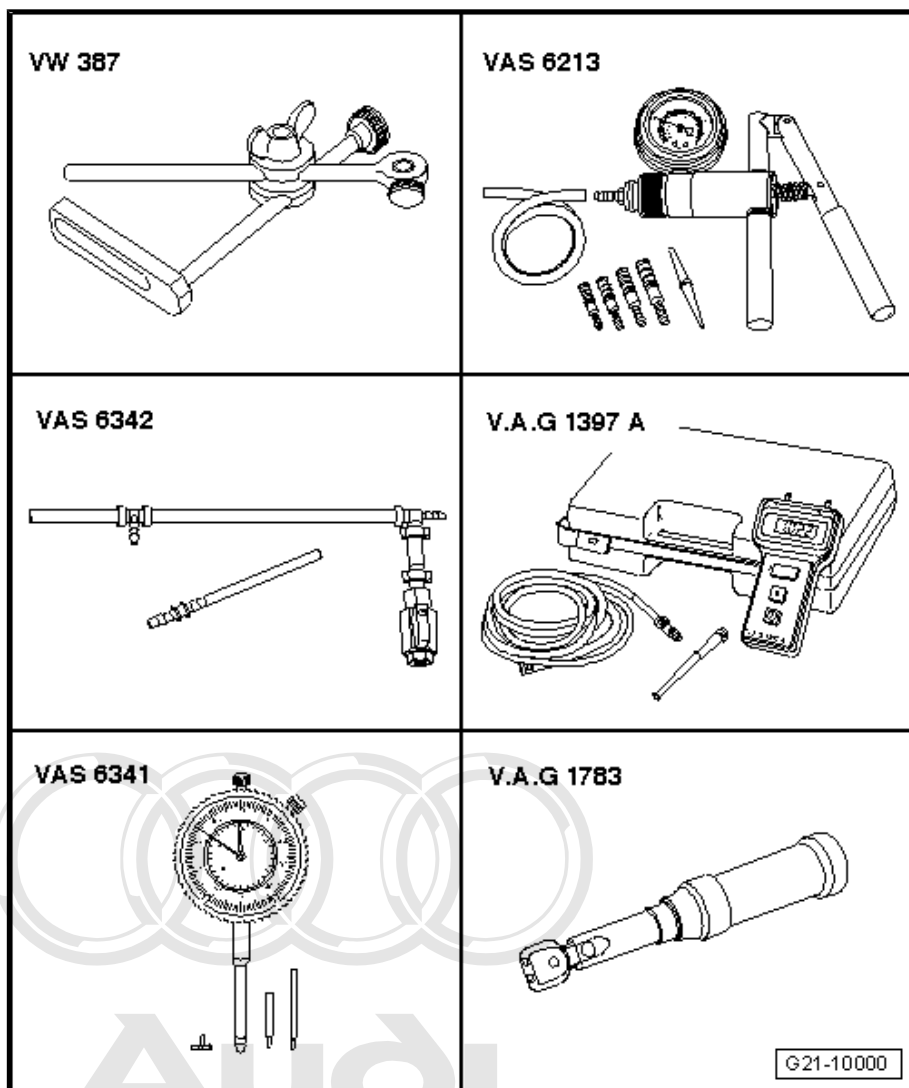
Note

- ◆ *If it is not possible to build up pressure with hand vacuum pump or if the pressure drops again immediately, check hand vacuum pump and connecting hoses for leaks.*
- ◆ *If no fault is found: renew vacuum unit ⇒ [page 172](#) .*

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

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Procedure

- Turbocharger removed ⇒ [page 163](#)
- Disconnect pressure hose -arrow-.
- Detach locking plate -2- for turbocharger linkage.

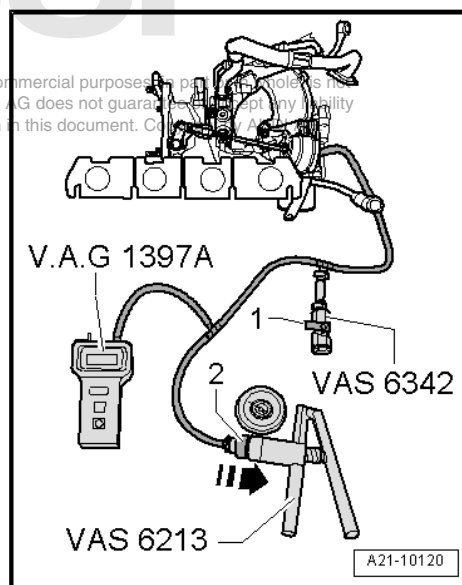
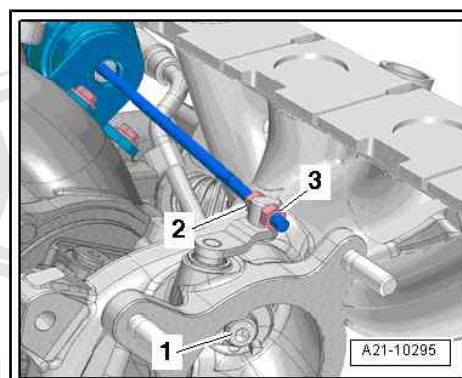
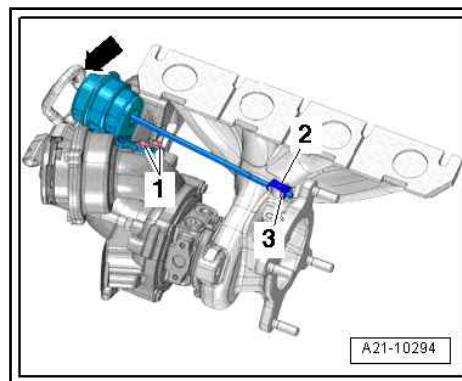


Note

Disregard -items 1 and 3-.

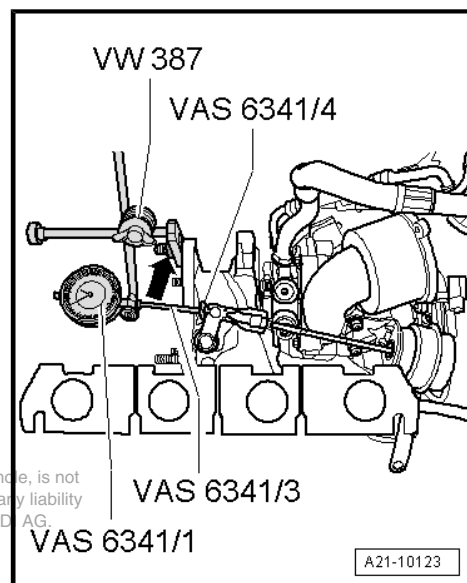
- Loosen nut -2-.
- Adjust bypass flap via nut -3-.
- It must be possible to still just turn the bypass flap by hand.
- Hand-tighten nut -2-.

- Connect hand vacuum pump - VAS 6213- and pressure control valve - VAS 6342- to vacuum unit and connection "II" of turbocharger tester -V.A.G 1397A- as shown in illustration.
- Close pressure control valve - VAS 6342-.
- Lever -1- should be horizontal.
- Move adjuster ring -1- on hand vacuum pump to position "pressure" -arrow-.
- Switch on turbocharger tester - V.A.G 1397A- and set sliding switch to position "II".

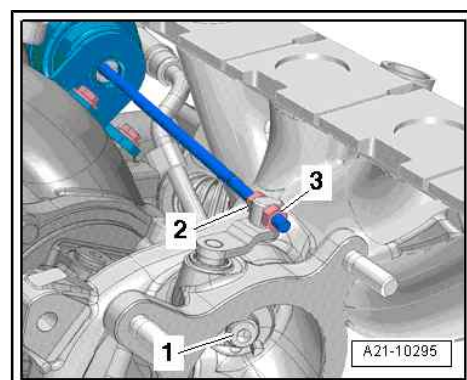


- Secure universal dial gauge bracket - VW 387- to turbocharger -arrow-.
- Attach dial gauge - VAS 6341/1- with extension, 30 mm - VAS 6341/3- and flat pickup - VAS 6341/4- to universal dial gauge bracket, as shown in illustration.
- With pressure at 0 bar, set dial gauge to 1 mm preload.
- Set scale of dial gauge to "0".
- Make sure that dial gauge can move freely.
- Operate hand vacuum pump until turbocharger tester indicates the following value:
 - 500 ± 5 mbar.
- Read off value indicated on dial gauge.
- Specification: $3.75 - 4.25$ mm.

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- If specification is not attained or is exceeded, turn nut -3- accordingly.
- Lock nut -2- by hand and repeat measurement.



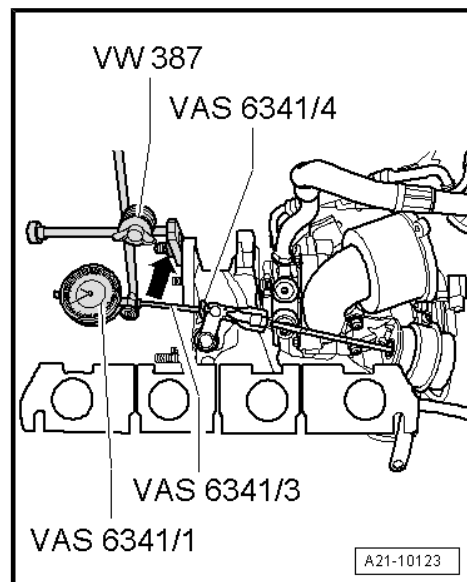
- Vent system via pressure control valve - VAS 6342- so that pressure reading drops to 0 mbar.
- Set dial gauge - VAS 6341/1- to "0".



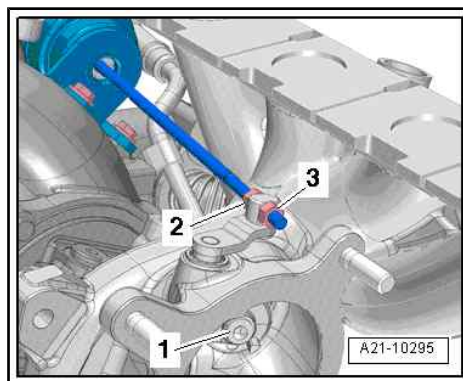
Note

The following measurements must be performed in the specified sequence. Do not allow the pressure to drop to 0 mbar between measurements.

- Operate hand vacuum pump - VAS 6213- until turbocharger tester - V.A.G 1397A- indicates the following value:
 - 500 ± 5 mbar.
- Read off and note value indicated on dial gauge - VAS 6341/1- .
- Operate hand vacuum pump until turbocharger tester indicates the following value:
 - 650 ... 700 mbar
- Vent system via pressure control valve - VAS 6342- so that pressure reading drops to 500 ± 5 mbar.
- Read off and note value indicated on dial gauge.
- Add values "1" and "2" together and divide by 2.
- Specification (mean value): 4 ± 0.25 mm



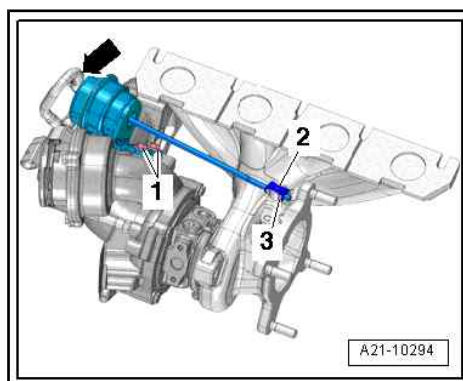
- If specification is not attained or is exceeded, turn nut -3- accordingly.
- Lock nut -2- by hand and repeat measurement.
- If the specification is attained, lock nuts and secure with sealing paint; for sealing paint refer to ⇒ Electronic parts catalogue .



- Secure locking plate -2- at linkage for vacuum unit and connect pressure hose -arrow-.

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 160](#)



1.5 Renewing vacuum unit for turbocharger

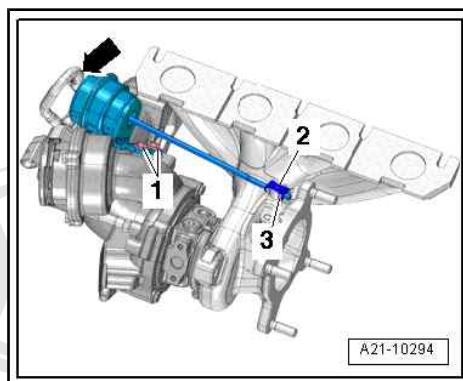
Removing

- Remove turbocharger ⇒ [page 163](#) .
- Detach locking plate -2- for linkage.
- Remove nut -3- and bolts -1-.
- Disconnect pressure hose -arrow- and vacuum unit.

Installing

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

- Adjust vacuum unit for turbocharger ⇒ [page 168](#) .
- Install turbocharger ⇒ [page 163](#) .



Tightening torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 160](#)

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2 Charge air system

⇒ [“2.1 Overview - charge air system”, page 173](#)

⇒ [“2.2 Exploded view - charge air system”, page 174](#)

⇒ [“2.3 Exploded view - hose connections for charge air system”, page 175](#)

⇒ [“2.4 Fitting hose connections for charge air system”, page 176](#)

⇒ [“2.5 Removing and installing charge air cooler”, page 177](#)

⇒ [“2.6 Removing and installing charge pressure sender G31”, page 180](#)

⇒ [“2.7 Removing and installing turbocharger air recirculation valve N249”, page 181](#)

⇒ [“2.8 Checking charge air system for leaks”, page 181](#)

2.1 Overview - charge air system

1 - Turbocharger air recirculation valve - N249-

2 - Throttle valve module - J338-

3 - Pressure control valve for crankcase breather system

4 - To activated charcoal filter

5 - Vacuum unit

6 - Charge pressure control solenoid valve - N75-

7 - Turbocharger

8 - Brake servo

9 - Non-return valve

10 - Air mass meter - G70-

11 - Air cleaner

12 - Coolant hose/pipe connection

13 - Vacuum pump

14 - Non-return valve

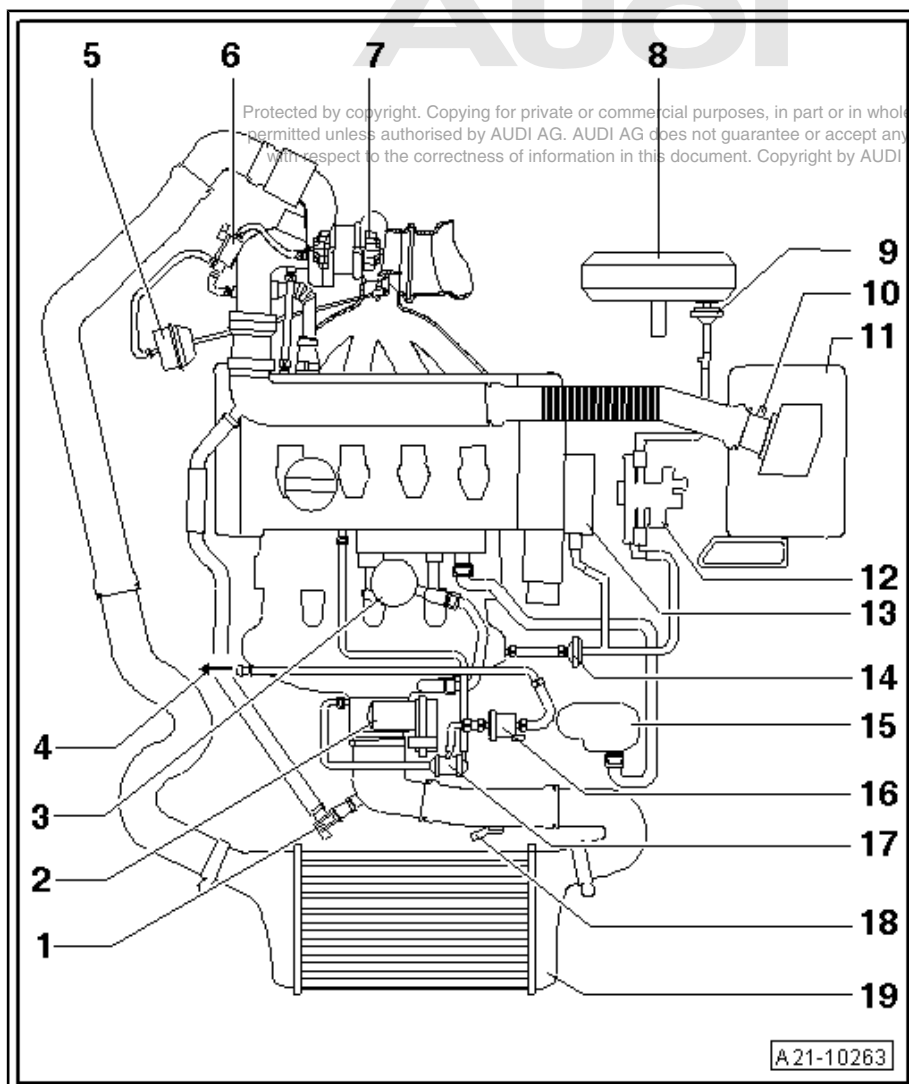
15 - Oil filter bracket

16 - Activated charcoal filter solenoid valve 1 - N80-

17 - Dual non-return valve

18 - Charge pressure sender - G31-

19 - Charge air cooler



2.2 Exploded view - charge air system



Note

- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

1 - Bolt

- 5 Nm

2 - Mounting

- For charge air cooler

3 - Charge air cooler

- Removing and installing
⇒ [page 177](#)

4 - Hose clip

- Tightening torque
⇒ [page 177](#)

5 - Bolt

- 10 Nm

6 - Air pipe

- Removing and installing
⇒ [Item 6 \(page 175\)](#)

7 - Air hose

8 - Hose clip

9 - Leading to air hose

10 - Air hose

- To throttle valve module
- J338-

11 - Hose clip

12 - Air pipe

13 - Bolt

- 10 Nm

14 - Hose clip

15 - Air hose

16 - Hose clip

17 - O-ring

- Renew

18 - Charge pressure sender - G31-

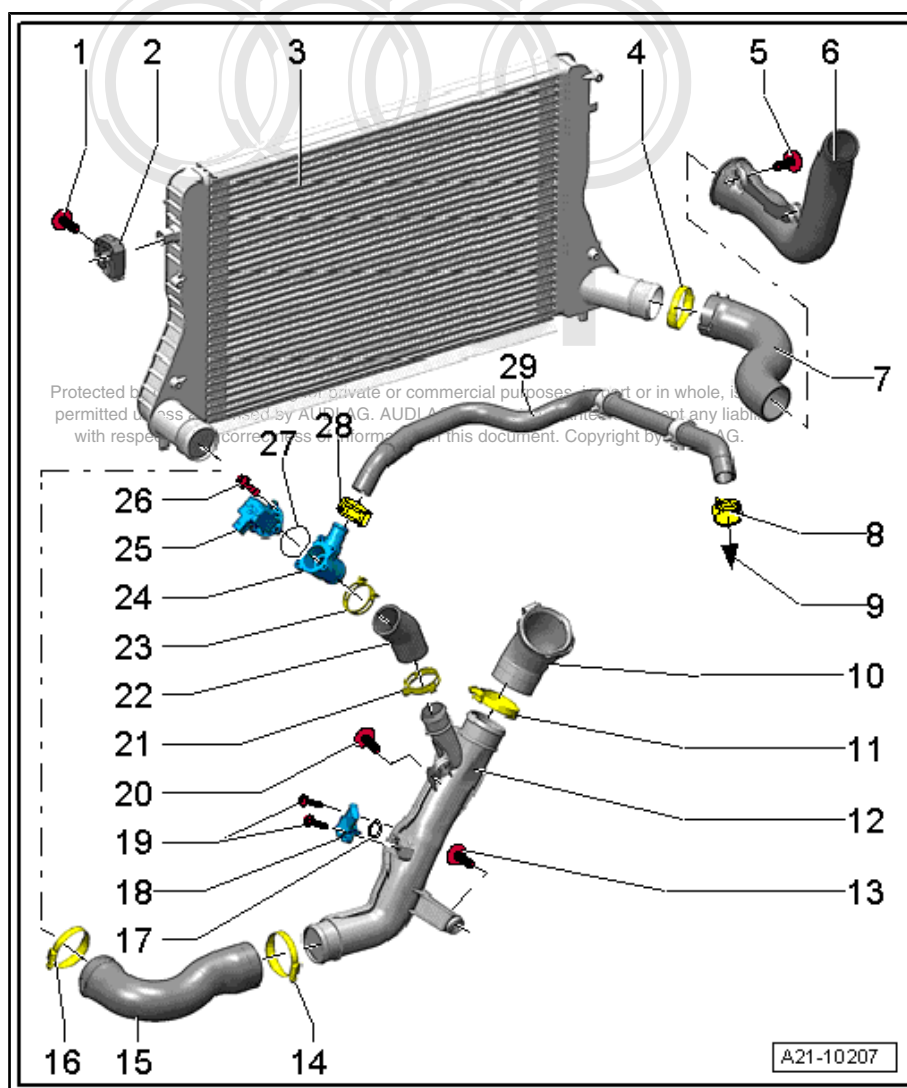
- Removing and installing ⇒ [page 180](#)

19 - Bolts

- 5 Nm

20 - Nut

- 10 Nm



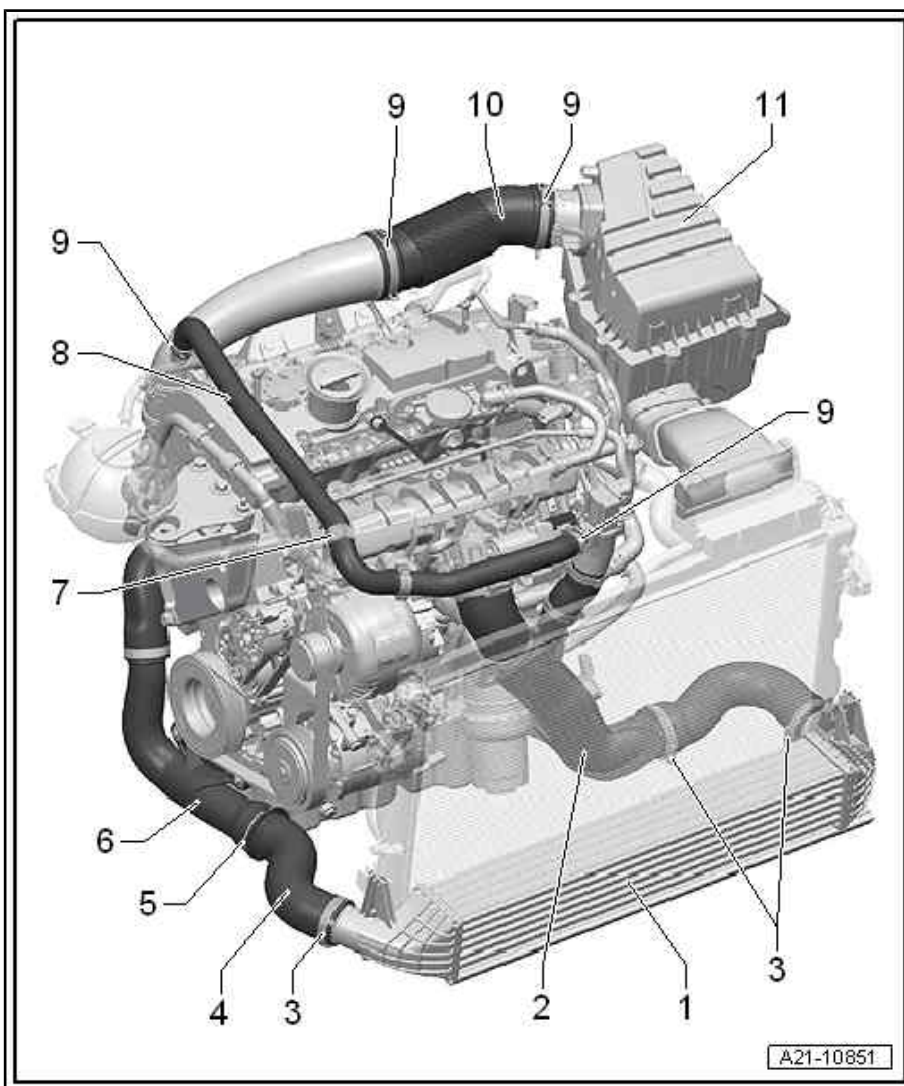
- 21 - Hose clip
- 22 - Hose
- 23 - Hose clip
- 24 - Housing
- 25 - Turbocharger air recirculation valve - N249-
 - ☐ Removing and installing ⇒ [page 181](#)
- 26 - Bolt
 - ☐ 3x
 - ☐ 7 Nm
- 27 - O-ring
 - ☐ Renew
- 28 - Hose clip
- 29 - Hose



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2.3 Exploded view - hose connections for charge air system

- 1 - Charge air cooler
 - ☐ Removing and installing ⇒ [page 177](#)
- 2 - Charge air pipe with charge pressure sender - G31-
 - ☐ Removing and installing ⇒ [page 157](#)
- 3 - Hose clips
 - ☐ ⇒ [page 177](#)
- 4 - Charge air hose
- 5 - Quick release coupling for charge air hose
 - ☐ ⇒ [page 176](#)
- 6 - Side charge air pipe
 - ☐ Turbocharger to charge air cooler
- 7 - Securing clip for hose
- 8 - Air recirculation hose
- 9 - Spring-type clip
- 10 - Connecting pipe
- 11 - Damper filter
 - ☐ Air cleaner with snow screen (opening for enhanced performance)
 - ☐ Attached to air cleaner with 4 plugs
 - ☐ Check for dirt and damage every time maintenance is performed
 - ☐ Renew if dirty or damaged



2.4 Fitting hose connections for charge air system

⇒ [“2.4.1 Fitting hose connections for charge air system, plug-in connectors”, page 176](#)

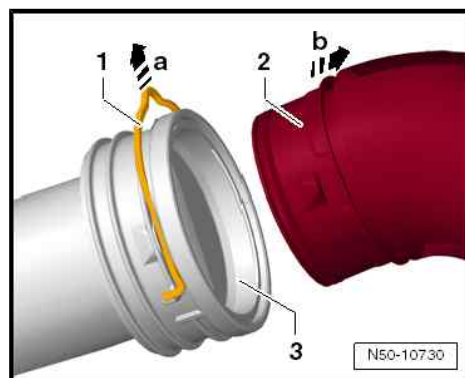
⇒ [“2.4.2 Fitting hose connections for charge air system, corrugated connection and hose clip”, page 177](#)

2.4.1 Fitting hose connections for charge air system, plug-in connectors

Releasing pressure hose

Perform the following steps:

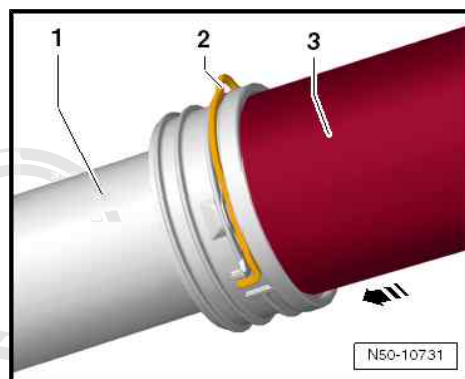
- Release retaining clip -1- in direction of -arrow a-.
- Pull pressure hose -2- out of connector -3- in direction of -arrow b-.



Engaging pressure hose

Perform the following steps:

- Ensure that retaining clip -2- is in upper position.
- Insert pressure hose -3- into connector -1- in direction of -arrow-.
- Press retaining clip -2- down completely.



Note

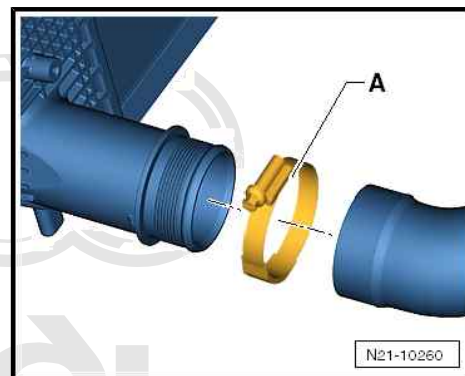
- ◆ *Renew seal if damaged.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Make sure that the seal is correctly seated in the groove on the complete circumference of the air pipe/hose.*
- ◆ *Apply a thin coating of **silicon-free lubricant to the sealing area and the seal.***
- ◆ *If it is not possible to press the retaining clip down completely, the pressure hose has not been inserted far enough into the connector.*
- ◆ *Press the pressure hose in again and lock retaining clip.*
- Check plug-in connector by pulling at it.

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2.4.2 Fitting hose connections for charge air system, corrugated connection and hose clip

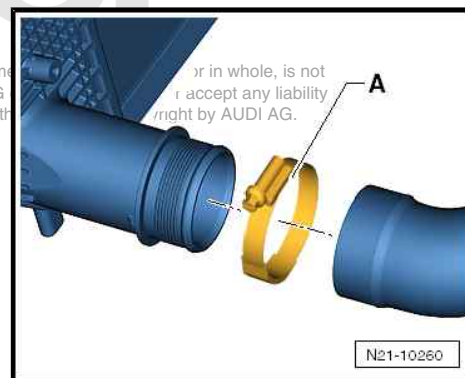
Removing pressure hose

- Loosen screw on hose clip -A-.
- Disconnect pressure hose with hose clip -A- from corrugated connection.



Installing pressure hose

- Push pressure hose with hose clip -A- onto corrugated connection as far as stop.
- Tighten screw on hose clip -A-.

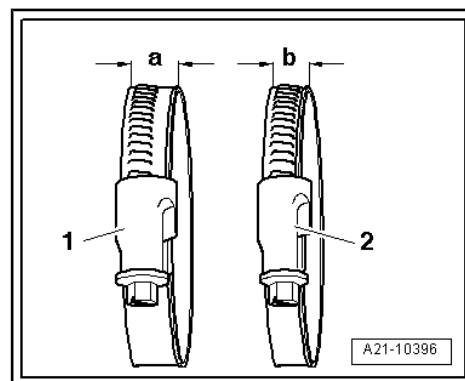


Caution

It is very important to tighten the screw on the hose clip -A- according to specifications ⇒ [page 177](#). Tightening to insufficient or excessive torque can cause the pressure hose to slip off the corrugated connection when driving.

Tightening torque for hose clips

- 1 - Hose clip -a- = 13 mm wide: 5.5 Nm
- 2 - Hose clip -b- = 9 mm wide: 3 Nm



2.5 Removing and installing charge air cooler

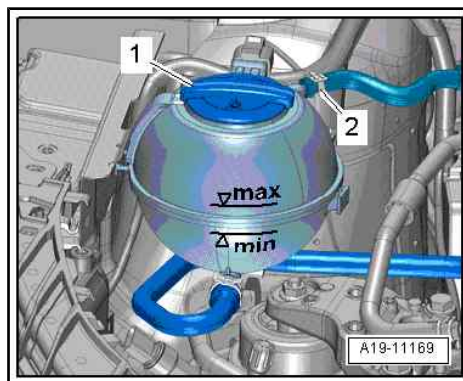
Removing



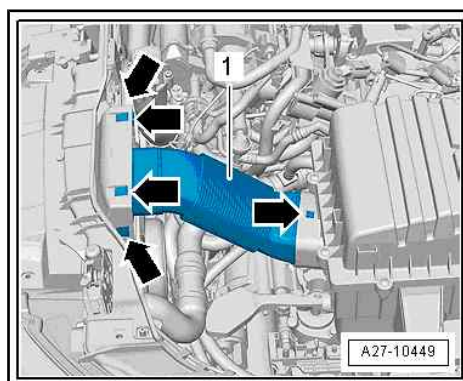
Note

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

- Open filler cap -1- on coolant expansion tank.



- Release fasteners -arrows- and detach air duct -1-.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

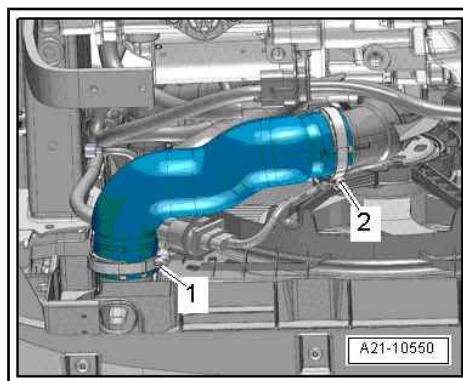


- Release hose clip -1- for air hose (bottom left) and disconnect hose from charge air cooler.

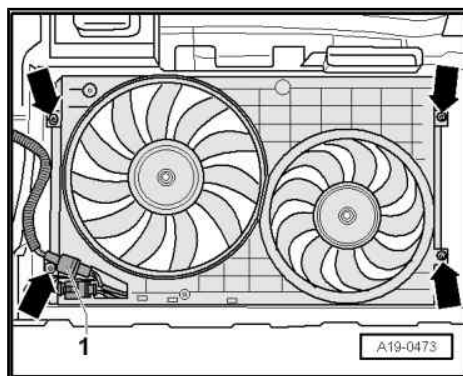


Note

Item -2- can be disregarded.



- Unplug connector -1-.



- Remove charge air hose (right-side) -arrows-.

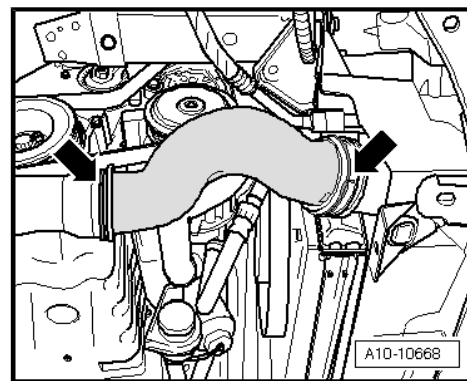
**Note**

Item -1- can be disregarded.

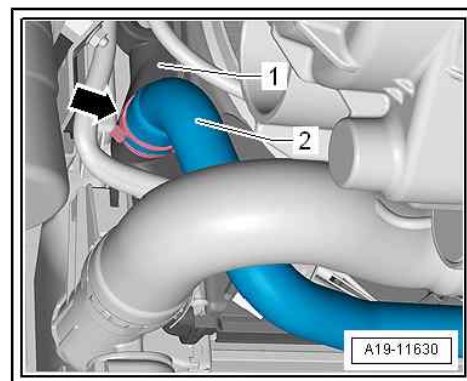
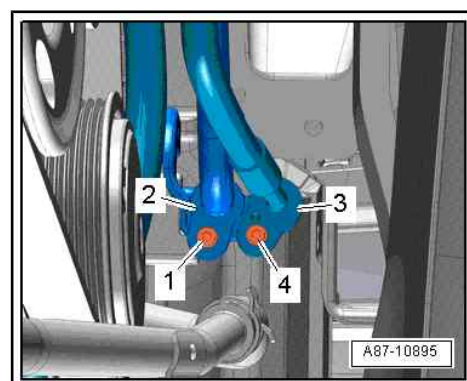
**Caution**

Danger of damage to refrigerant lines and hoses.

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



- Extract refrigerant ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87 ; Refrigerant circuit .
- Unscrew bolts -1 and 4- and disconnect refrigerant lines -2, 3-.
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Drain coolant ⇒ [page 135](#) .
- Unclip coolant hose -2- (bottom) from bracket for radiator cowl.
- Release hose clips -arrow-, disconnect coolant hose -2- (bottom) from radiator -1- and drain off remaining coolant.

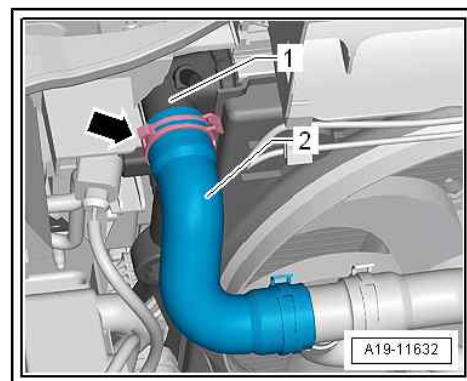


- Release hose clip -arrow-, disconnect coolant hose -2- (top) from radiator -1- and drain off remaining coolant.

**Note**

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

- Remove lock carrier ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Removing and installing lock carrier .



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- Loosen bolts -arrows- and take radiator module out of lock carrier (lift out of bottom mountings).
- Disassemble radiator module and renew radiator.

Installing

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



Note

- ◆ *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 .*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Install lock carrier ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Exploded view - lock carrier .

- Check coolant level ⇒ [page 141](#) .

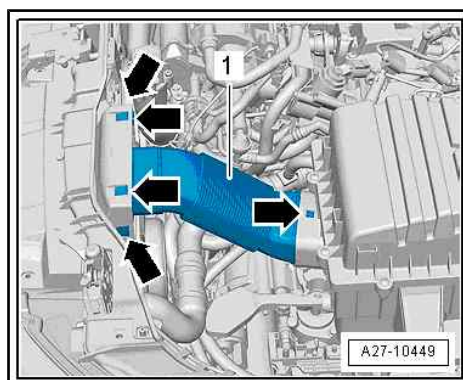
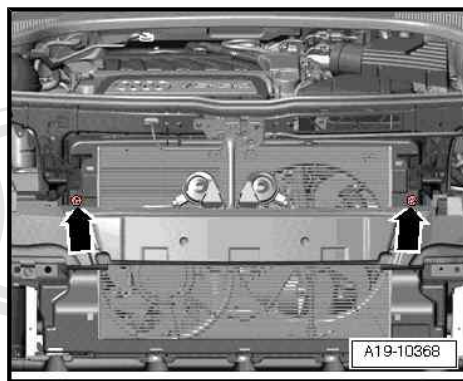
Tightening torques

- ◆ ⇒ [“2.2 Exploded view - charge air system”, page 174](#)

2.6 Removing and installing charge pressure sender - G31-

Removing

- Release fasteners -arrows- and detach air duct -1-.



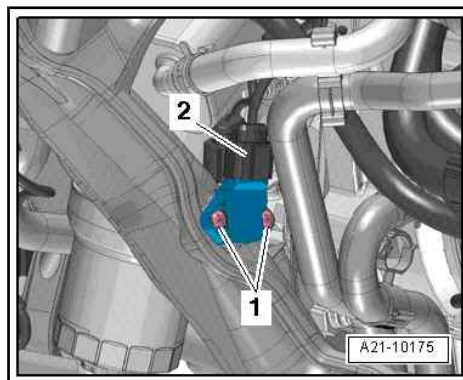
- Unplug electrical connector -2-.
- Unscrew bolts -1- and remove charge pressure sender - G31- .

Installing

Install in reverse order.

Tightening torques

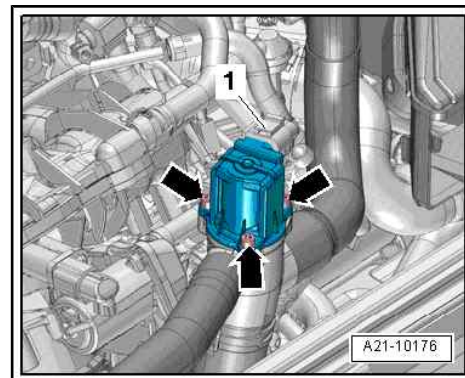
- ◆ ⇒ [“2.2 Exploded view - charge air system”, page 174](#)



2.7 Removing and installing turbocharger air recirculation valve - N249-

Removing

- Unplug electrical connector -1-.
- Unscrew bolts -arrows- and remove turbocharger air recirculation valve - N249- .



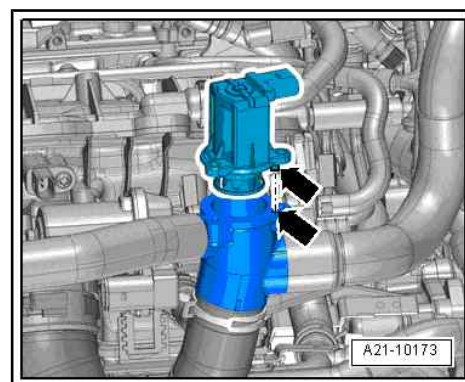
Installing

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

- Installation position: Markings must be on same side -arrows-.

Tightening torques

- ◆ ⇒ ["2.2 Exploded view - charge air system", page 174](#)

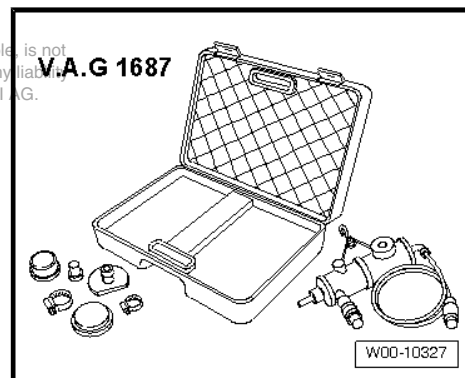


2.8 Checking charge air system for leaks

Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687-

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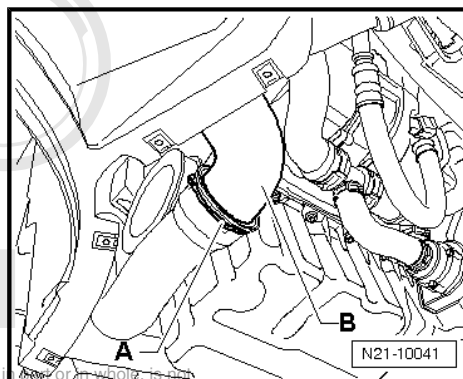


- ◆ Adapter - V.A.G 1687/5-

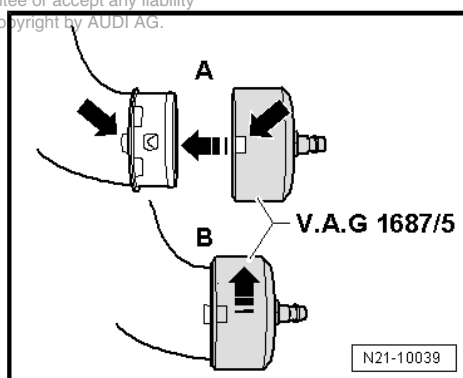
Procedure

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

- Lift retaining clip -A- and detach air hose -B-.



- Fit adapter - V.A.G 1687/5- onto air hose -A- and turn by approx. 90° -B-.



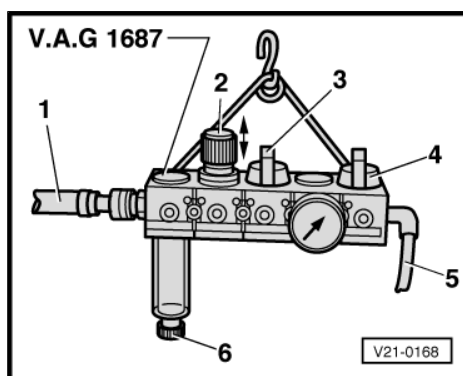
Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.

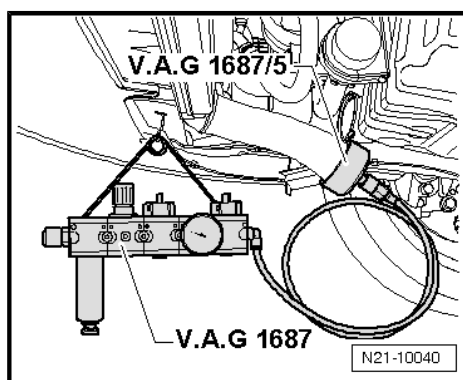


Note

Make sure knob is pulled out before turning pressure control valve -2-.



- Connect charge air system tester - V.A.G 1687- as shown on illustration.



- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.

**Note**

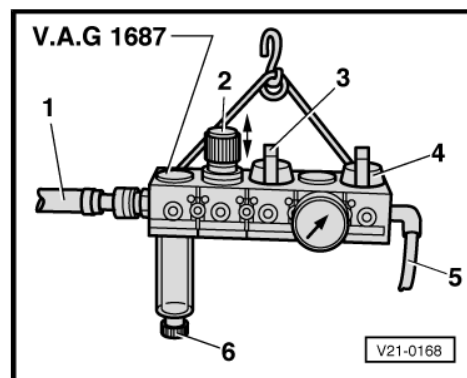
If there is water in sight glass, remove drain plug -6- and drain water.

- 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 by detaching coupling from adapter - V.A.G 1687/5- before removing adapter.*
- ♦ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*

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- Observe the instructions for installing air pipes and hoses with plug-in connectors ⇒ [page 175](#) .

Tightening torques

- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

24 – Mixture preparation - injection

1 Injection system

⇒ [“1.1 Overview of fitting locations - injection system”, page 184](#)

⇒ [“1.2 Filling and bleeding fuel system”, page 192](#)

1.1 Overview of fitting locations - injection system

Components A to L are not shown in the overview.

1 - Hall sender - G40- (cam-shaft position sensor)

- ☐ Fitting location
⇒ [page 188](#)
- ☐ Electrical connectors for Hall sender - G40-
⇒ [page 189](#)

2 - Connector

- ☐ For Lambda probe - G39- and Lambda probe heater - Z19- (black) ⇒ [page 190](#)

3 - Charge pressure control solenoid valve - N75-

- ☐ Located directly on turbocharger ⇒ [page 191](#)

4 - Turbocharger

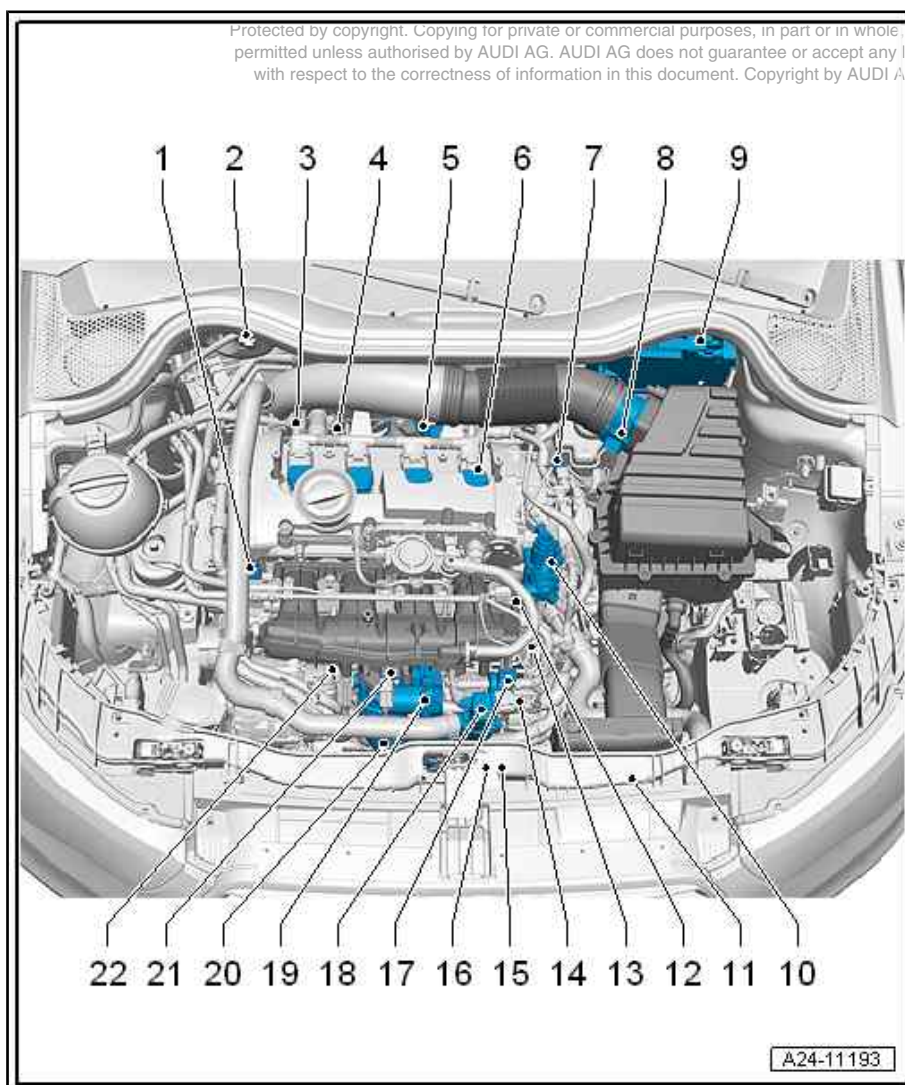
- ☐ Removing and installing
⇒ [page 163](#)

5 - Lambda probe - G39- and Lambda probe heater - Z19-

- ☐ Fitting location
⇒ [page 190](#)
- ☐ Removing and installing
⇒ [page 226](#)

6 - Ignition coils with output stages

- ☐ Removing and installing
⇒ [page 245](#)
- ☐ Ignition coil 1 with output stage - N70-
- ☐ Ignition coil 2 with output



- stage - N127-
- ☐ Ignition coil 3 with output stage - N291-
 - ☐ Ignition coil 4 with output stage - N292-
 - ☐ Puller - T40039- is required for removing ignition coils from cylinder head.
- 7 - Camshaft control valve 1 - N205-**
- ☐ Removing and installing ⇒ [page 100](#)
- 8 - Air mass meter - G70-**
- ☐ Removing and installing ⇒ [page 222](#)
- 9 - Engine control unit - J623-**
- ☐ Removing and installing ⇒ [page 232](#)
- 10 - High-pressure pump**
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- ☐ With fuel pressure regulating valve - N276-
 - ☐ Removing and installing ⇒ [page 224](#)
- 11 - Radiator outlet coolant temperature sender - G83-**
- ☐ Fitting location ⇒ [page 187](#)
- 12 - Fuel pressure sender for low pressure - G410-**
- ☐ 15 Nm
- 13 - Coolant temperature sender - G62-**
- ☐ Fitting location ⇒ [page 187](#)
- 14 - Intake manifold flap motor - V157- with intake manifold flap potentiometer - G336-**
- ☐ After fuel rail has been removed or renewed, intake manifold flap potentiometer - G336- must be re-adapted to engine control unit - J623- ; see "Guided Functions" using vehicle diagnostic tester
 - ☐ Removing and installing ⇒ [page 204](#)
- 15 - Engine speed sender - G28-**
- ☐ Electrical connectors for knock sensor 1 - G61- and for knock sensor 2 - G66-
 - ☐ Fitting location ⇒ [page 189](#)
- 16 - Charge pressure sender - G31-**
- ☐ Fitting location ⇒ [page 189](#)
- 17 - Activated charcoal filter solenoid valve 1 - N80-**
- ☐ Fitting location ⇒ [page 191](#)
- 18 - Turbocharger air recirculation valve - N249-**
- ☐ Fitting location ⇒ [page 191](#)
 - ☐ Removing and installing ⇒ [page 181](#)
- 19 - Throttle valve module - J338-**
- ☐ Including throttle valve drive for electric throttle - G186- , throttle valve drive angle sender 1 for electric throttle - G187- and throttle valve drive angle sender 2 for electric throttle - G188-
 - ☐ After throttle valve module - J338- has been renewed, it must be re-adapted to engine control unit - J623- ; see "Guided Functions" using a vehicle diagnostic tester
- 20 - Continued coolant circulation pump - V51-**
- ☐ Fitting location ⇒ [page 190](#)
- 21 - Intake air temperature sender - G42-**
- 22 - Fuel pressure sender - G247-**
- ☐ 22 Nm
 - ☐ Fitting location ⇒ [page 187](#)
 - ☐ Removing and installing ⇒ [page 218](#)
 - ☐ Electrical connectors for fuel pressure sender - G247- ⇒ [page 189](#)

A - Fuel pump control unit - J538-

- ☐ Fitting location ⇒ [page 188](#)
- ☐ Adaption of fuel pump must be performed after renewing fuel pump control unit - J538- ; see “Guided Functions” using a vehicle diagnostic tester

B - Brake light switch - F-

- ☐ Fitting location ⇒ [page 189](#)
- ☐ Removing and installing ⇒ Brake system; Rep. gr. 45 ; Sensors; Removing and installing brake light switch

C - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ☐ Fitting location ⇒ [page 187](#)
- ☐ On accelerator pedal (both senders are accommodated in one housing)
- ☐ If accelerator pedal module or engine control unit is renewed, kick-down function must be adapted on vehicles with automatic gearbox
- ☐ Removing and installing ⇒ Fuel supply system, petrol engines; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-

D - Clutch position sender - G476-

- ☐ Fitting location ⇒ [page 188](#)
- ☐ Removing and installing ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch position sender - G476-

E - Relay and fuse holder in electronics box

- ☐ Removing relay and fuses ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

F - Radiator fan control unit - J293-

- ☐ Fitting location ⇒ [page 190](#)

G - Injectors

- ☐ In fuel rail
- ☐ Removing and installing ⇒ [page 211](#)
- ☐ Injector, cylinder 1 - N30-
- ☐ Injector, cylinder 2 - N31-
- ☐ Injector, cylinder 3 - N32-
- ☐ Injector, cylinder 4 - N33-

The fuel injectors are high-pressure injectors. They inject fuel at high pressure (maximum approx. 110 bar) directly into the cylinder.

H - Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-

- ☐ Fitting location ⇒ [page 191](#)
- ☐ Removing and installing ⇒ [page 227](#)

I - Knock sensor 1 - G61-

- ☐ For cylinders 1 and 2
- ☐ 20 Nm
- ☐ Fitting location ⇒ [page 189](#)
- ☐ Removing and installing ⇒ [page 246](#)

J - Knock sensor 2 - G66-

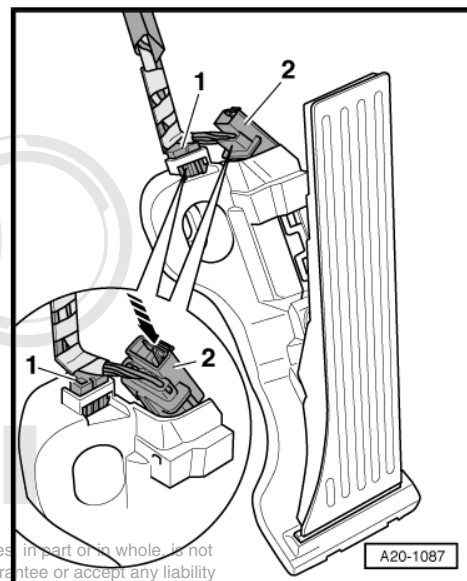
- ☐ For cylinders 3 and 4
- ☐ 20 Nm
- ☐ Fitting location ⇒ [page 189](#)
- ☐ Removing and installing ⇒ [page 247](#)

K - Oil pressure switch - F1-

- ☐ Fitting location ⇒ [page 189](#)
- ☐ Removing and installing ⇒ [page 120](#)

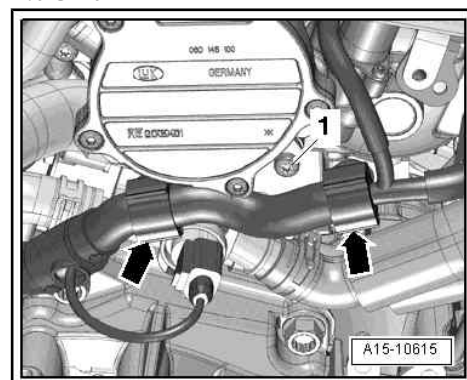
Accelerator position sender - G79- and accelerator position sender 2 - G185-

2 - Electrical connector for accelerator pedal module

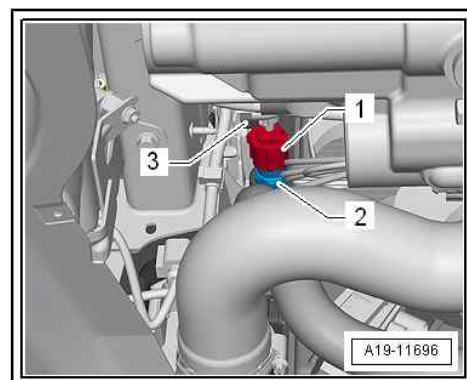


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Coolant temperature sender - G62- -1-

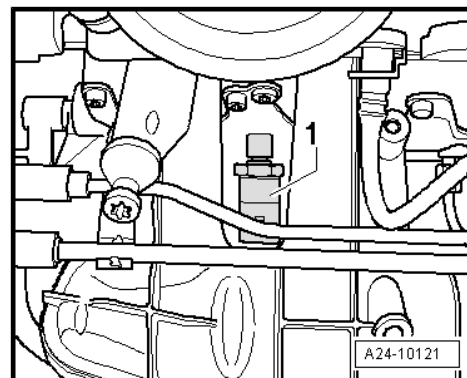


Radiator outlet coolant temperature sender - G83- -2-

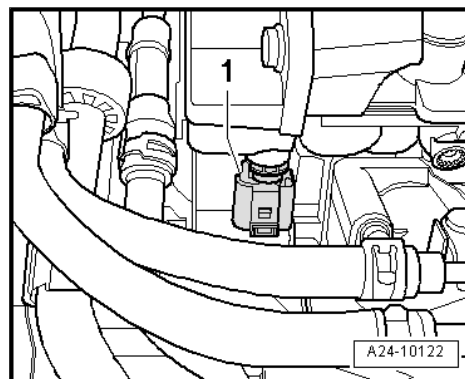


Fuel pressure sender - G247- -1-

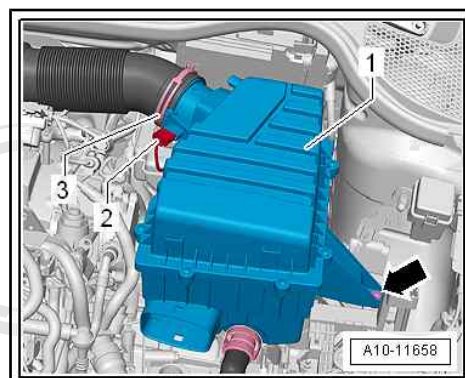
Removing and installing ⇒ [page 218](#)



Hall sender - G40- -1-

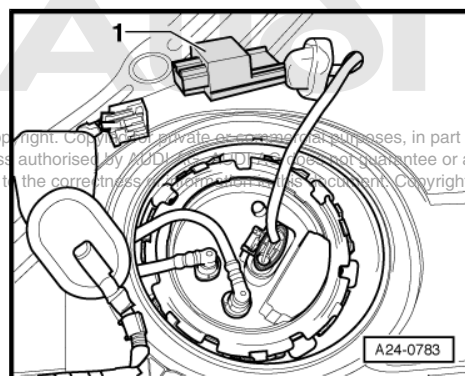


Air mass meter - G70- -2-

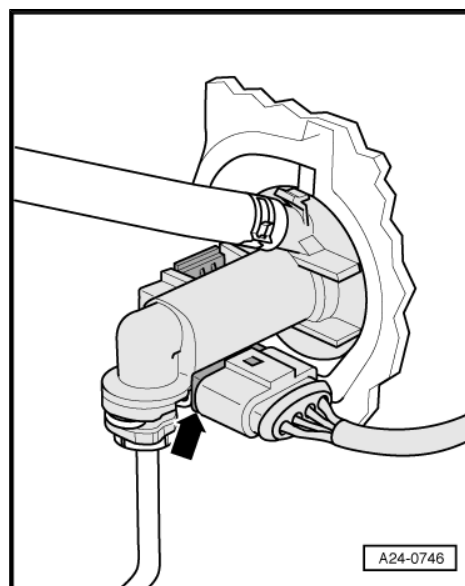


Fuel pump control unit - J538- -1-

Adaption of fuel pump must be performed after renewing fuel pump control unit - J538- . Refer to: Basic setting, measured value block 103.

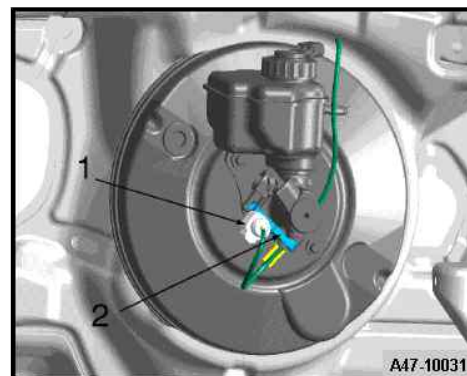


Clutch position sender - G476-



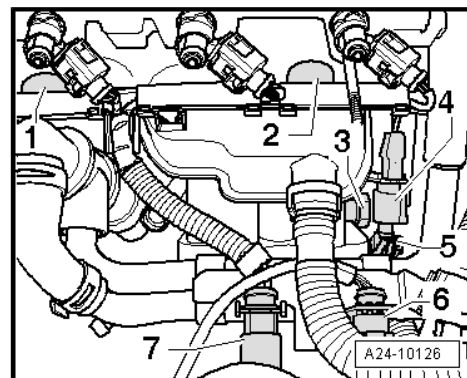
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Brake light switch - F- and brake pedal switch - F63-



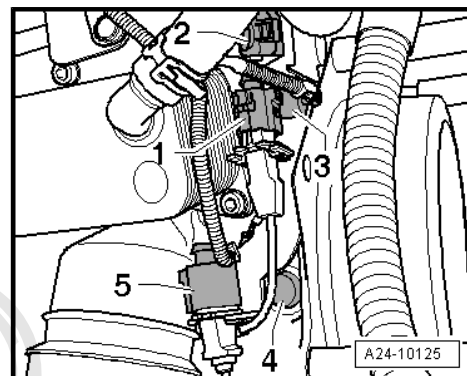
Fitting locations of components below intake manifold

- 1 - Knock sensor 1 - G61-
- 2 - Knock sensor 2 - G66-
- 3 - Oil pressure switch - F1-
- 4 - 3-pin connector (brown) for knock sensor 2 - G66-
- 5 - 3-pin electrical connector (grey) for engine speed sender - G28-
- 6 - Electrical connector for Hall sender - G40- and fuel pressure sender - G247-
- 7 - 8-pin connector for injectors

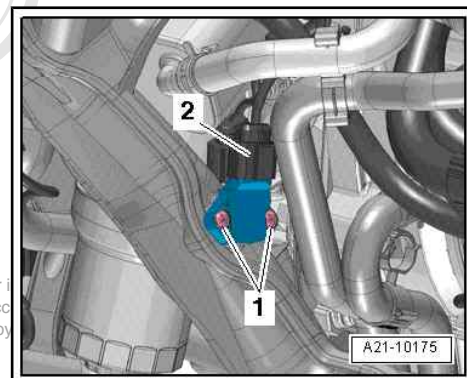


Electrical connectors

- 1 - 3-pin connector (green) for knock sensor 1 - G61-
- 2 - 3-pin connector (brown) for knock sensor 2 - G66-
- 3 - Oil pressure switch - F1-
- 4 - Engine speed sender - G28-
- 5 - 3-pin electrical connector (grey) for engine speed sender - G28-



Charge pressure sender - G31- -2-



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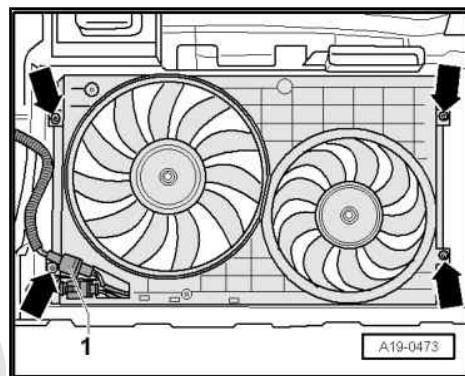
Radiator fan control unit - J293-

1 - Connector for radiator fan control unit - J293-

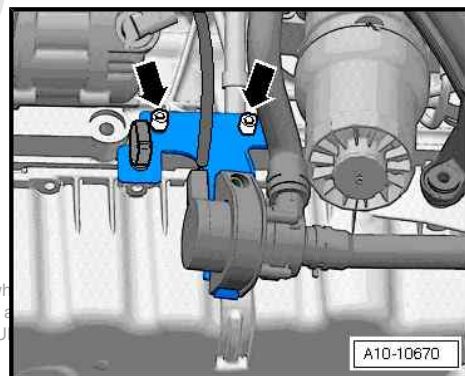


Note

The radiator fan control unit - J293- is integrated into the radiator fan - V7- .



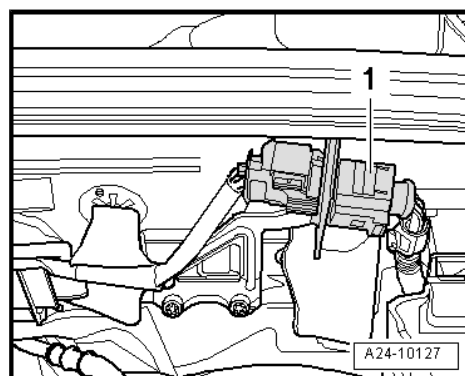
Continued coolant circulation pump - V51-



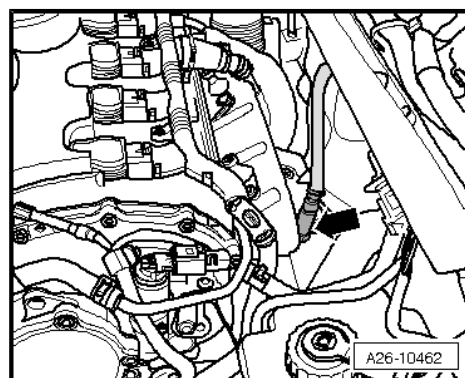
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Electrical connector -arrow-

- Lambda probe - G39- and Lambda probe heater - Z19-

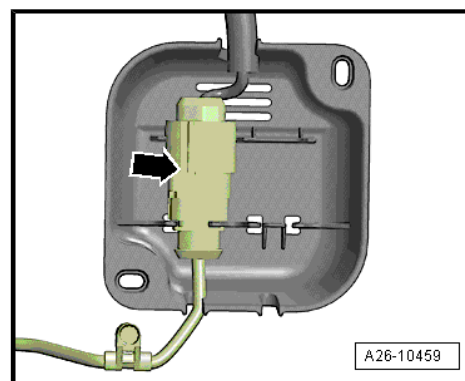


Lambda probe - G39- -arrow-

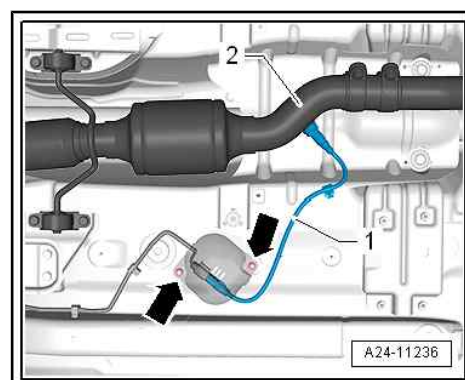


Electrical connector -arrow-

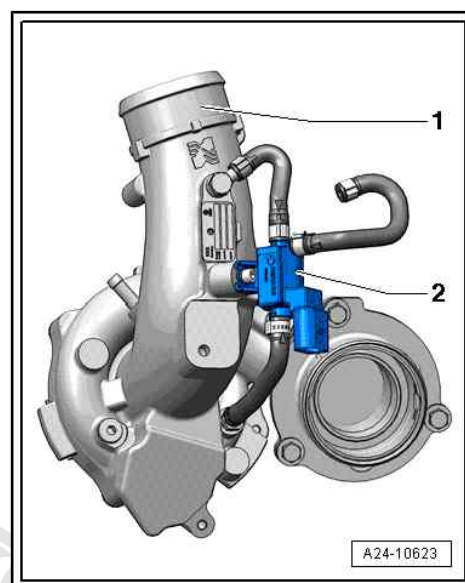
- Lambda probe, after catalytic converter - G130- and Lambda probe heater 1, after catalytic converter - Z29- on underbody (right-side)

**Lambda probe after catalytic converter -arrow-**

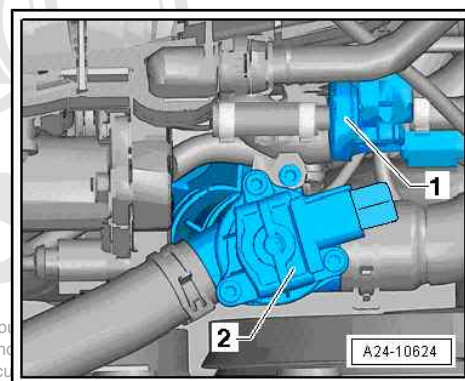
- Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-

**Components on turbocharger:**

- 1 - Turbocharger
- 2 - Tighten charge pressure control solenoid valve - N75- to 3 Nm

**Turbocharger air recirculation valve - N249- -2-**

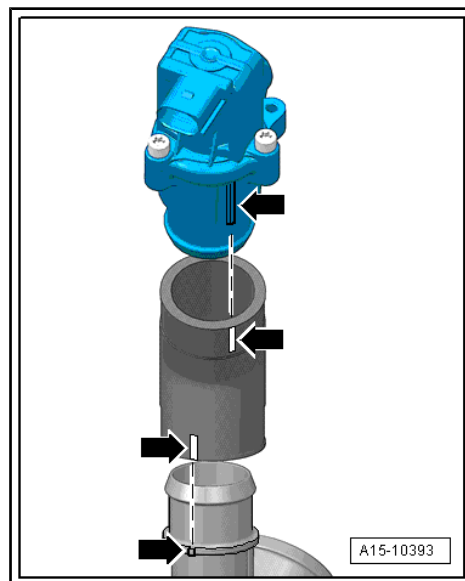
- 1 - Activated charcoal filter solenoid valve 1 - N80-
- 2 - Turbocharger air recirculation valve - N249-



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Pay attention to installation position of turbocharger air recirculation valve - N249-

The marks -arrows- must align.



1.2 Filling and bleeding fuel system



WARNING

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

- ◆ *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 7 bar).*
- ◆ *Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes or fuel pressure sender - G247-), the fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 7 bar. The procedure is described below.*

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

Reducing fuel pressure in high-pressure section:

- Connect vehicle diagnostic tester and perform function “Reduce fuel pressure” in “Guided Functions”.
- Fuel pressure will drop to a specified value.
- Switch off ignition.

The fuel rail is still filled with fuel, however it is no longer under high pressure.



WARNING

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There is a risk of injury: avoid skin contact with fuel.

- ◆ *Wear safety goggles and protective clothing when opening the fuel system.*
- ◆ *Before opening the high-pressure section of the fuel system, place a clean cloth around the connection to catch escaping fuel.*

- The high-pressure system must be opened »immediately« after reducing the fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.

**Note**

- ◆ *The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.*
- ◆ *The ignition must not be switched on again from this point on as this would increase the pressure again.*

Additional steps required

- Erase event memory and generate readiness code in engine control unit in "Guided Functions" mode.



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2 Air cleaner

⇒ "2.1 Exploded view - air cleaner housing", page 194

⇒ "2.2 Removing and installing air cleaner housing", page 195

2.1 Exploded view - air cleaner housing

1 - Air cleaner (top section)

- ☐ Clean any salt residue, leaves and dirt out of air cleaner (top section)

2 - Bolt

- ☐ 5 Nm

3 - Plug

4 - Air hose

- ☐ Connection of air mass meter - G70- to engine

5 - Bolt

- ☐ 3 Nm

6 - Spring-type clip

7 - Connecting pipe with mounting for air mass meter - G70-

8 - Air mass meter - G70-

- ☐ Removing and installing
⇒ page 222

9 - Bolt

- ☐ 3 Nm

10 - Nut

- ☐ Secures bracket to body
- ☐ 10 Nm

11 - Bracket

- ☐ Air cleaner housing (rear)

12 - Rubber bush

- ☐ Mounting for bracket (rear)

13 - Rubber bush

- ☐ Mounting for bracket (centre)

14 - Pins

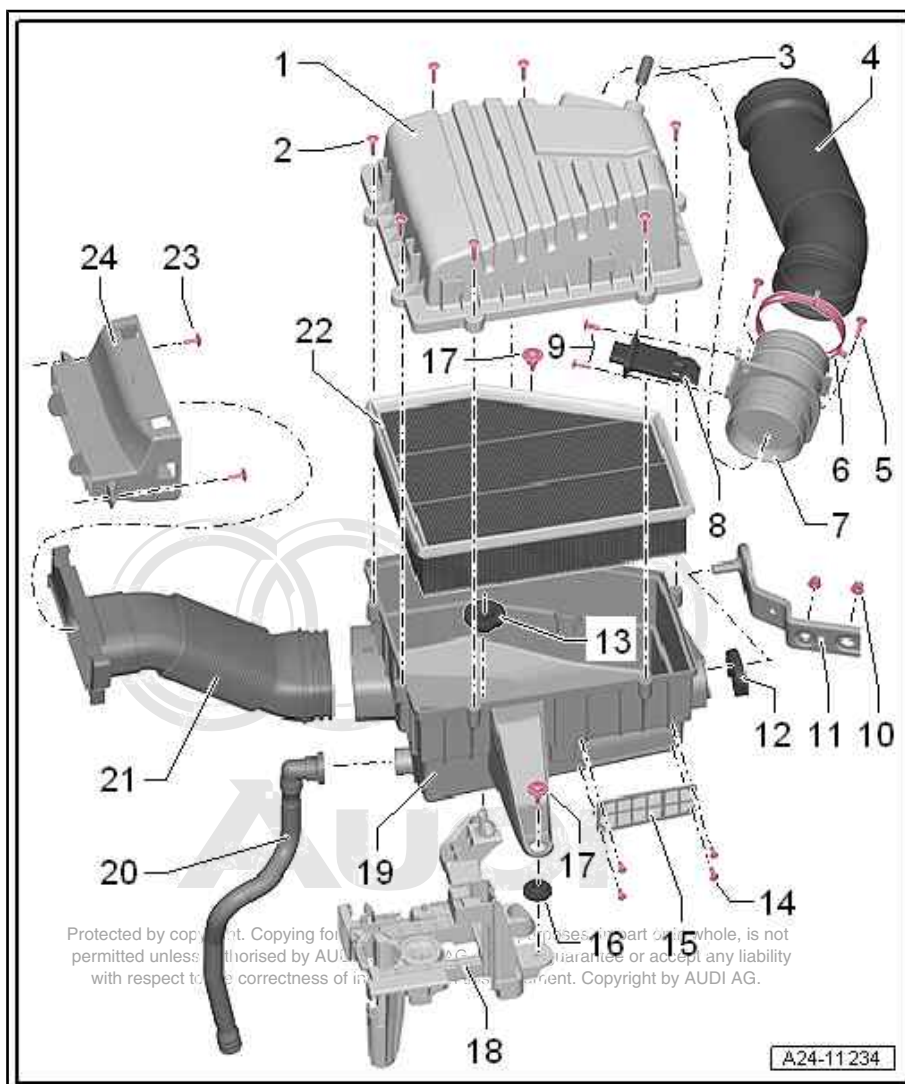
- ☐ Secure snow screen (additional opening for increased performance)
- ☐ Pins are removed from inside to outside

15 - Snow screen

- ☐ Secure snow screen (additional opening for increased performance)
- ☐ Check for dirt and damage every time maintenance is performed
- ☐ Renew if damaged
- ☐ Clean if dirty

16 - Rubber bush

- ☐ Mounting for bracket (left-side)



17 - Bolt

- ☐ 10 Nm

18 - Bracket with mountings for air cleaner housing**19 - Air cleaner (bottom section)**

- ☐ Clean any salt residue, leaves and dirt out of air cleaner (bottom section)
- ☐ Removing and installing ⇒ [page 195](#)
- ☐ Clean out dirt, leaves and salt deposits

20 - Water drain hose

- ☐ Clean out dirt and leaves etc. from opening
- ☐ Check operation

21 - Front air duct

- ☐ Clean out dirt, leaves and salt deposits

22 - Air filter element

- ☐ Always use genuine part for air filter element
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing ⇒ Maintenance ; Booklet 819

23 - Bolt

- ☐ 5 Nm

24 - Mounting for air duct

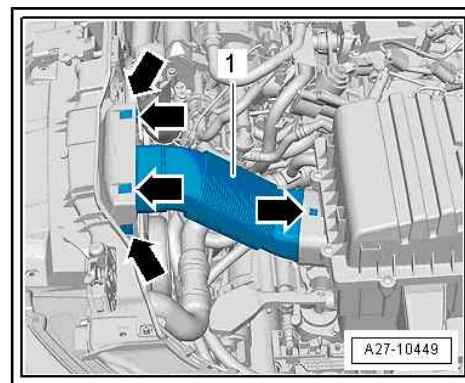
- ☐ Bolted to lock carrier
- ☐ Clean out dirt, leaves and salt deposits

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2.2 Removing and installing air cleaner housing

Removing

- Release fasteners -arrows- and detach air duct -1-.



- Unplug electrical connector -2- for air mass meter - G70- .
- Release hose clip -3- and detach air hose from intake connecting pipe.
- Disconnect water drain hose from air cleaner housing.
- Unscrew bolt -arrow- for air cleaner housing and lift air cleaner housing out of both rubber mountings.

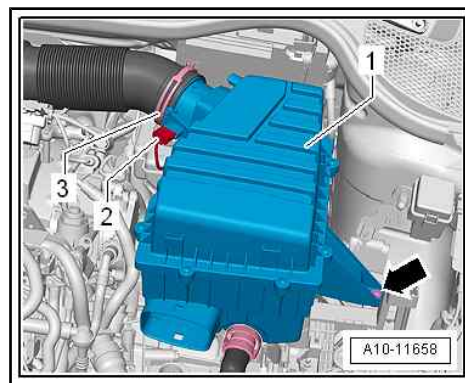
Installing

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



Note

- ◆ *The air cleaner housing MUST be clean.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To prevent malfunctions, cover all critical parts of the engine air intake tract (air mass meter, snow screen covering opening for increased performance ⇒ [Item 15 \(page 194\)](#) , intake pipes etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*



Tightening torques

- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 194](#)



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3 Intake manifold

⇒ [“3.1 Exploded view - intake manifold”, page 197](#)

⇒ [“3.2 Removing and installing intake manifold with fuel rail”, page 198](#)

⇒ [“3.3 Removing and installing throttle valve module J338”, page 202](#)

⇒ [“3.4 Cleaning throttle valve module”, page 203](#)

⇒ [“3.5 Removing and installing intake manifold flap motor V157”, page 204](#)

⇒ [“3.6 Checking intake manifold change-over function”, page 205](#)

3.1 Exploded view - intake manifold

1 - Screw for intake air temperature sender - G42-

- ☐ 5 Nm

2 - Intake air temperature sender - G42-

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3 - Intake manifold

- ☐ Removing and installing
⇒ [page 198](#)

4 - Activated charcoal filter solenoid valve 1 - N80-

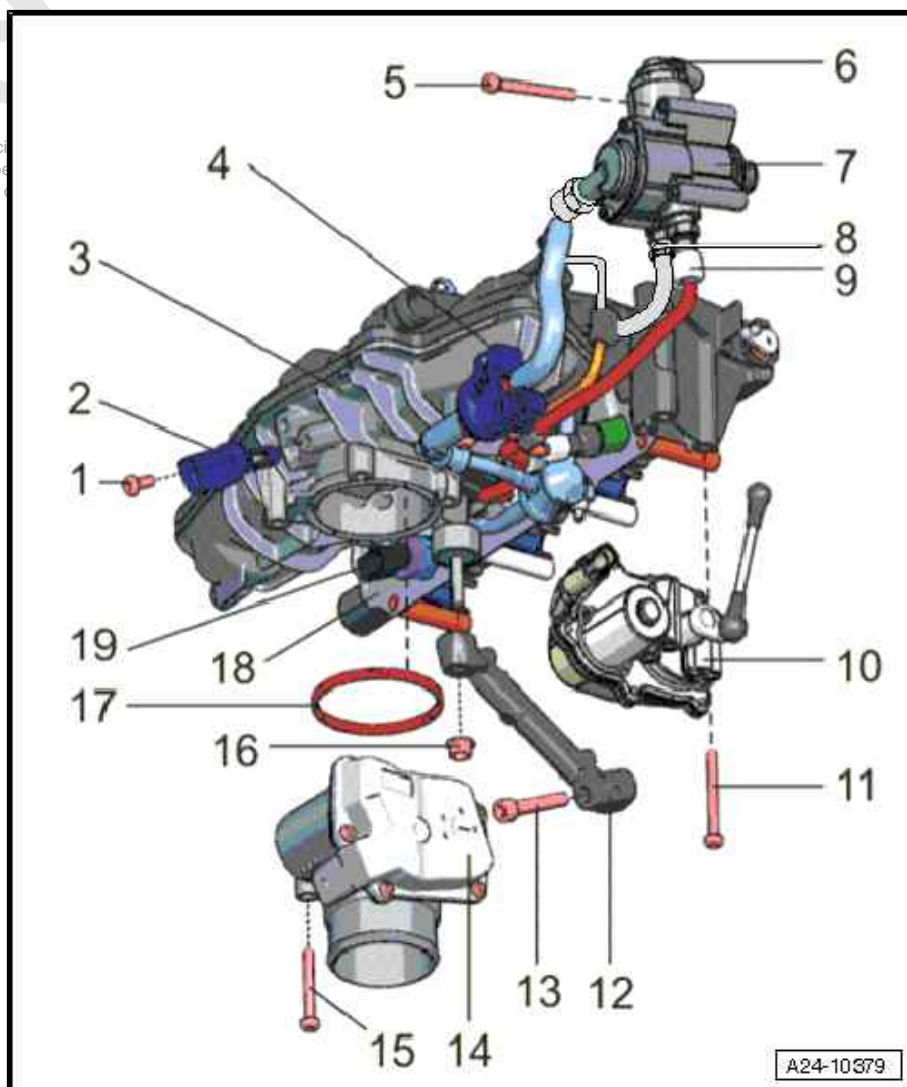
5 - Bolt for high-pressure pump

- ☐ 3x
- ☐ 10 Nm

6 - Fuel pressure regulating valve - N276-

7 - High-pressure pump

- ☐ With fuel pressure regulating valve - N276- and fuel pressure sender, low pressure - G410-
- ☐ An electric fuel pump (fitted in fuel tank) supplies fuel to the mechanical high-pressure pump at a pressure of approx. 6 bar
- ☐ When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.
- ☐ The fuel system must not be under pressure;



procedure for reducing
fuel pressure ⇒ [page 192](#)

- ☐ Fuel lines must be free of tension when installed.
- ☐ Removing and installing ⇒ [page 224](#)

8 - Connection for fuel return line to fuel tank

- ☐ Fuel pipe must be free of tension when installed (make sure all parts are clean)

9 - Fuel supply line to fuel rail

- ☐ Renew connecting piece
- ☐ Tighten connecting piece to 30 Nm
- ☐ Fuel line must be free of tension when installed (make sure all parts are clean); tightening torque: 27 Nm

10 - Intake manifold flap motor - V157- with intake manifold flap potentiometer - G336-

- ☐ After fuel rail has been renewed, intake manifold flap potentiometer - G336- must be re-adapted to engine control unit; see "Guided Functions" using vehicle diagnostic tester .
- ☐ Removing and installing ⇒ [page 204](#)

11 - Bolt for intake manifold flap motor - V157- with intake manifold flap potentiometer - G336-

- ☐ 7 Nm

12 - Intake manifold support

13 - Bolt for intake manifold support

- ☐ 23 Nm

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14 - Throttle valve module - J338- , throttle valve drive for electric throttle - G186-

- ☐ Throttle valve drive angle sender 1 for electric throttle - G187- and throttle valve drive angle sender 2 for electric throttle - G188-
- ☐ After throttle valve module - J338- has been renewed, it must be re-adapted to engine control unit - J623- ; see "Guided Functions" using a vehicle diagnostic tester

15 - Bolt for throttle valve module - J338-

- ☐ 4x
- ☐ 7 Nm

16 - Securing nut for intake manifold support

- ☐ 10 Nm

17 - Schraube

- ☐ Renew

18 - Fuel rail

- ☐ Removing and installing ⇒ [page 198](#)

19 - Fuel pressure sender - G247-

- ☐ 20 Nm

3.2 Removing and installing intake manifold with fuel rail

After fuel rail has been renewed, intake manifold flap potentiometer - G336- must be re-adapted to engine control unit - J623- ; see "Guided Functions" using vehicle diagnostic tester



Note

- ◆ *The injectors can only be accessed after the intake manifold and the fuel rail with the air flow control flaps have been removed. (Additional or fewer steps may be required depending on the model.)*
- ◆ *The combustion chamber ring seal (teflon) and the O-ring must always be renewed.*
- ◆ *Exploded view - intake manifold ⇒ [page 197](#) .*
- ◆ *Exploded view - fuel rail ⇒ [page 209](#)*

Removing

- Remove radiator cowl ⇒ [page 157](#) .



WARNING

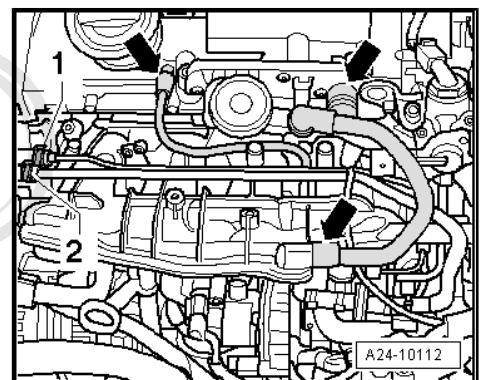
The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ [page 192](#) .

- Unplug all electrical connectors required.
- Disconnect vacuum hose between intake manifold and vacuum pump from intake manifold.



Note

- ◆ *This vacuum hose and the vacuum pump (located at rear of cylinder head) are only fitted on vehicles with automatic gear-box.*
- ◆ *Ignore items marked 1 and 2 in illustration.*
- Disconnect hose connections -arrows- at cylinder head cover.
- Disconnect vacuum line -2- leading to activated charcoal filter.

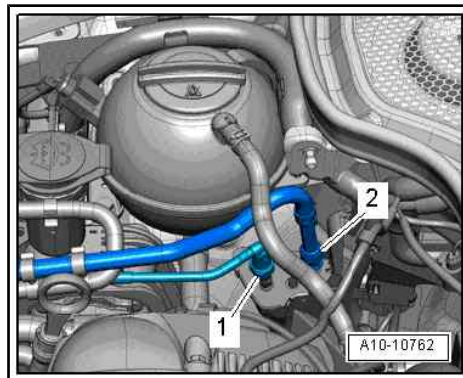


- Disconnect fuel supply hose -2- by pressing release ring.

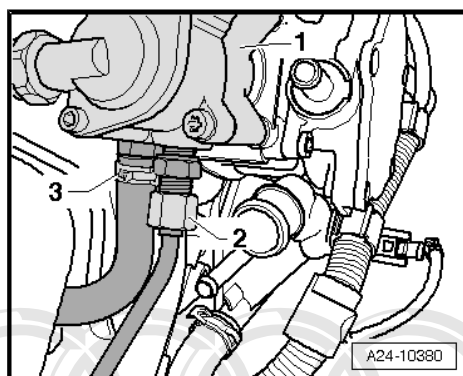


Note

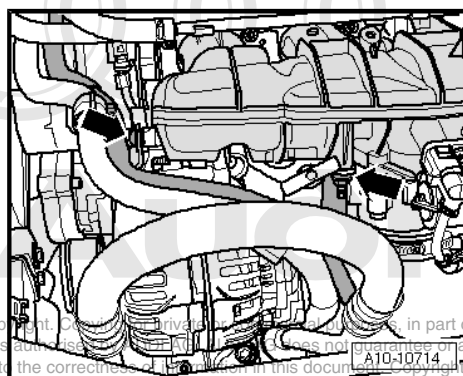
- ◆ *The fuel system must not be under pressure.*
- ◆ *Use a clean cloth to catch escaping fuel.*



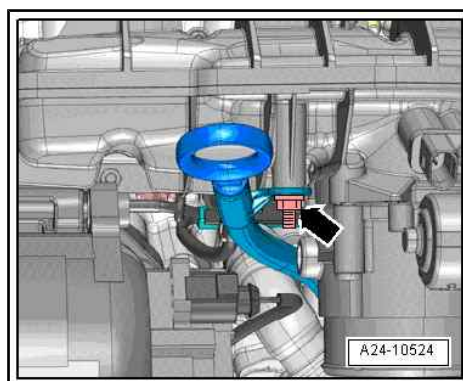
- Open both fuel pipe connections -2 and 3- at high-pressure pump.



- Unscrew bolt and nut -arrows- and press coolant pipe (front right) to one side (coolant hoses remain attached).

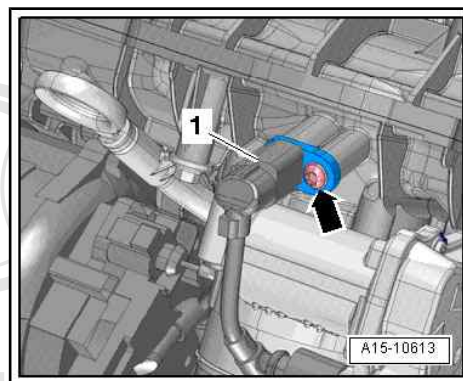


- Remove bolt -arrow- for dipstick guide tube.



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- Unplug electrical connector -1- at intake air temperature sender - G42- .



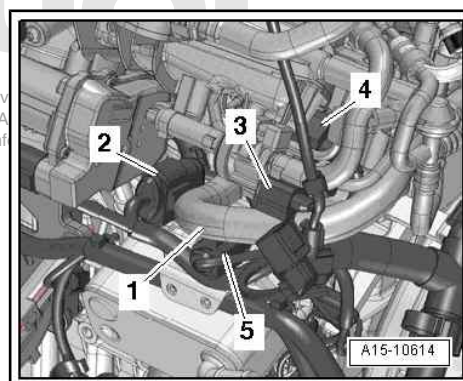
- Unplug electrical connectors:

2 - For injectors (remove electrical connectors from bracket)

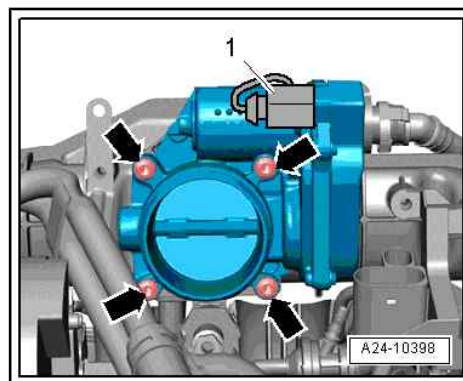
3 - For activated charcoal filter solenoid valve - N80-

4 - Intake manifold flap motor - V157-

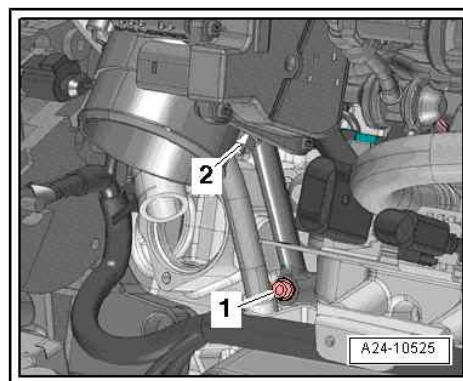
5 - For fuel pressure sender - G247- and Hall sender - G40- (remove electrical connectors from bracket)



- Unplug electrical connector -1-.
- Remove bolts -arrows- and detach throttle valve module - J338- .



- Unscrew nut -2- and bolt -1- and remove support for intake manifold.



- Unplug electrical connector -1- at fuel pressure sender - G247- .
- Unscrew all bolts from intake manifold.
- Carefully pull intake manifold and fuel rail off cylinder head.

**Note**

The injectors can remain in the fuel rail.

- Removing and installing fuel rail ⇒ [page 210](#)

Installing

- Install in reverse order.
- Install radiator cowl ⇒ [page 157](#) .

Tightening torques

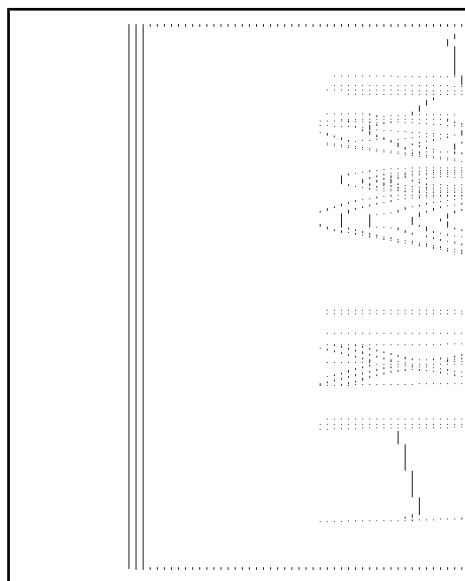
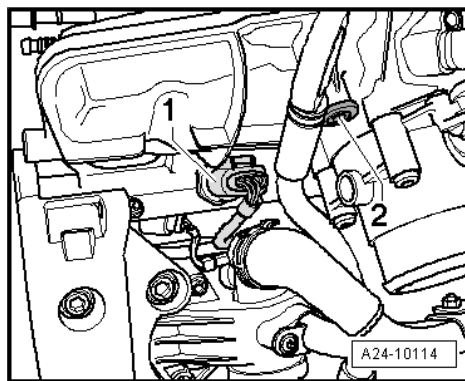
- ♦ ⇒ [“3.1 Exploded view - intake manifold”, page 197](#)
- ♦ ⇒ [“5.1 Exploded view - fuel rail with injectors”, page 209](#)

3.3 Removing and installing throttle valve module - J338-

Removing

- Remove engine cover panel ⇒ [page 33](#) .
- Remove noise insulation.
- Release screw-type clips -top arrows-, unscrew bolts -bottom arrows- and remove charge air pipe and hose from below.
- Unplug electrical connector -1- from throttle valve module - J338- .

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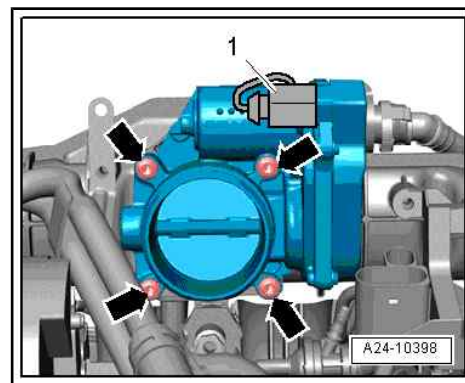
- Remove the four bolts -arrows- from throttle valve module - J338- and detach throttle valve module - J338- .

Installing

- Install in reverse order.
- Clean sealing surface for seal.
- Renew seal.
- After throttle valve module - J338- has been renewed, it must be re-adapted to engine control unit - J623- ; see “Guided Functions” using a vehicle diagnostic tester .

Tightening torques

- ◆ ⇒ “3.1 Exploded view - intake manifold”, page 197



3.4 Cleaning throttle valve module



Note

- ◆ *The throttle valve module must be adapted if a new engine control unit - J623- is installed.*
- ◆ *Take care not to scratch the throttle valve housing when cleaning it.*

Special tools and workshop equipment required

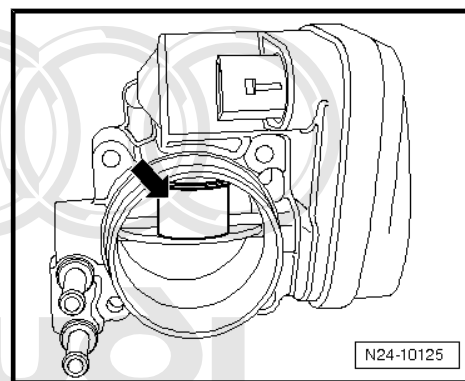
- ◆ Acetone (commercially available)
- ◆ Brush
- Remove throttle valve module - J338- ⇒ [page 202](#) .
- Open throttle valve by hand and lock it in open position with a wedge (plastic or wood) -arrow-.



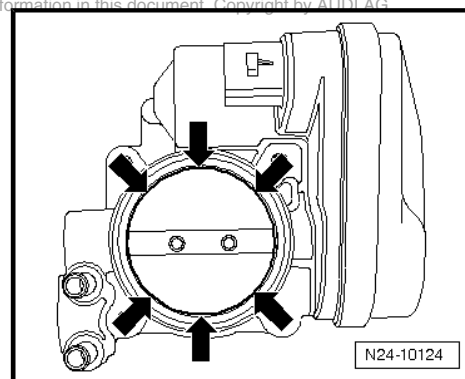
WARNING

Acetone is highly flammable.

- ◆ **Observe all accident prevention regulations and safety precautions when handling flammable liquids.**
- ◆ **Do not use compressed air when cleaning the throttle valve.**
- ◆ **Wear safety goggles and protective clothing to avoid any contact with skin and risk of injury.**



- Clean throttle valve housing thoroughly, especially around the points -arrows- where the throttle valve closes, using commercially available acetone and a small brush.
- Wipe out throttle valve housing with a lint-free cloth.
- Allow acetone to flash off completely.
- Install throttle valve module - J338- ⇒ [page 202](#) .
- Erase learnt values and adapt engine control unit - J623- to throttle valve module - J338- . Use vehicle diagnostic tester .



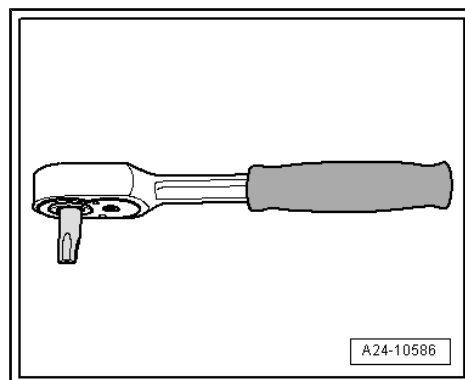
3.5 Removing and installing intake manifold flap motor - V157-

Removing and installing intake manifold flap motor - V157- with intake manifold flap potentiometer - G336-

For fitting location of intake manifold flap motor - V157- , refer to [⇒ "3.1 Exploded view - intake manifold", page 197](#) .

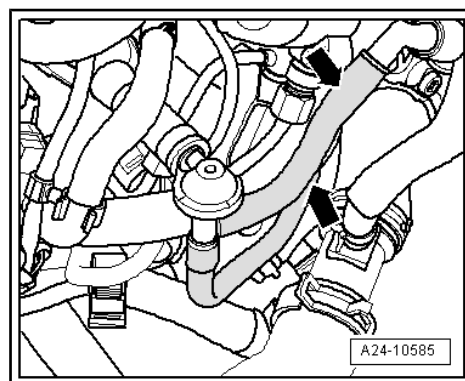
Special tools and workshop equipment required

- ◆ Standard 1/4 inch ratchet
- ◆ Torx insert 30

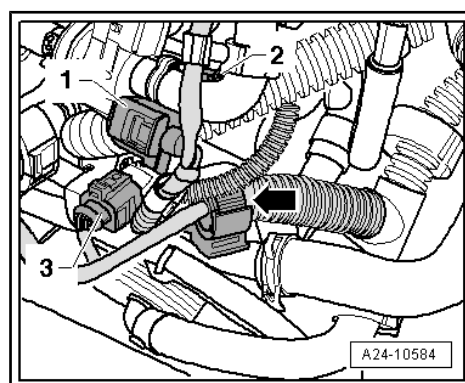


Removing

- Remove radiator cowl [⇒ page 157](#) .
- Detach vacuum lines -arrows-.



- Remove bracket -arrow- for electrical wiring harness.
- Unplug electrical connectors connected to electrical wiring harness and move wiring harness as far as necessary to one side.
- Pull bracket for connectors off coolant pipe.
- Carefully pry off linkage from intake manifold flap motor - V157- -4-.



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- Unbolt intake manifold flap motor - V157- -5-.



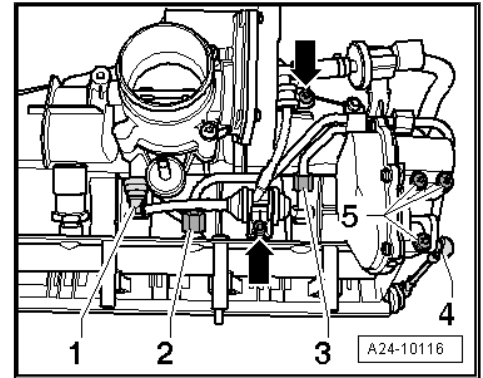
The illustration shows the intake manifold flap motor - V157- with the intake manifold removed.

Installing

- Install in reverse order.
- Install radiator cowl ⇒ [page 157](#) .

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - intake manifold"](#), [page 197](#)

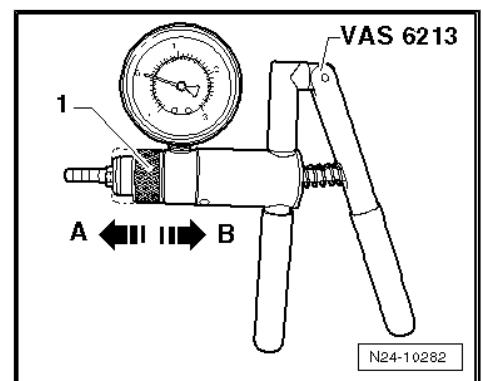


3.6 Checking intake manifold change-over function

Only perform this test if there is a loss of engine torque (poor flexibility or lack of pulling power).

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



Test condition

- ◆ Intake manifold flap valve - N316- has been checked with vehicle diagnostic tester.

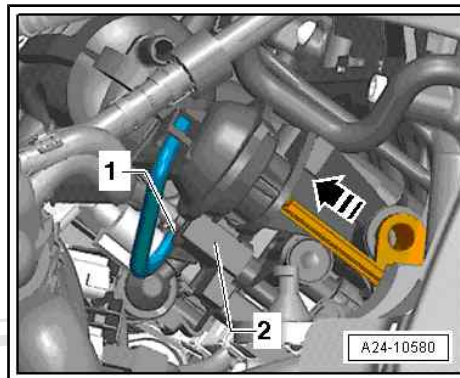
Perform the following steps if the intake manifold flap valve - N316- is OK.

- Remove engine cover panel ⇒ [page 33](#) .
- Start engine and run at idling speed.
- Have a second mechanic rev up engine quickly (short burst of throttle) and observe vacuum unit for intake manifold change-over.

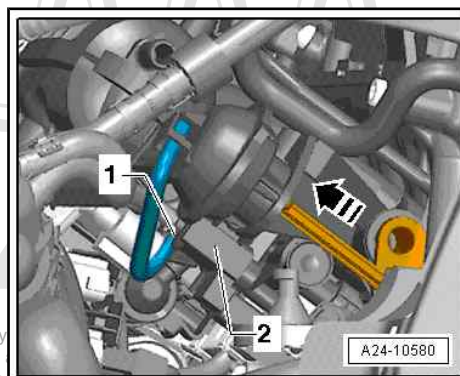
- The vacuum unit should pick up -arrow-.

If the change-over does not operate as described:

- Check vacuum system for leaks.
- Check that change-over mechanism moves freely by operating linkage manually.
- Check proper connection of vacuum lines.
- Check vacuum hoses for porosity.



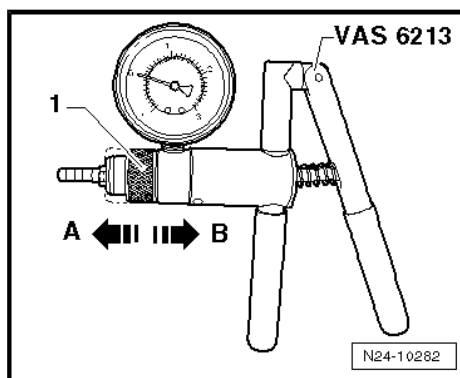
- Disconnect vacuum hose -1- leading to vacuum unit for intake manifold flap valve - N316- at intake manifold flap valve - N316- -2-.



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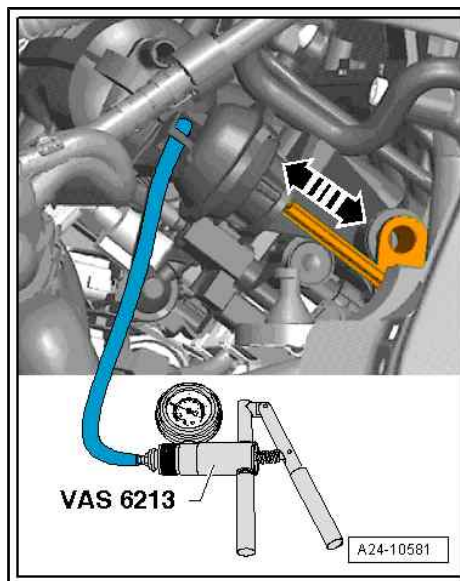
- Move adjuster ring -1- on hand vacuum pump - VAS 6213- to position -A- to select "vacuum".



- Connect hand vacuum pump - VAS 6213- to vacuum unit for intake manifold flap valve - N316- .
- Operate the hand vacuum pump - VAS 6213- several times.

The vacuum unit should move -arrows-.

- If vacuum unit does not move, it must be renewed.



4 Vacuum system

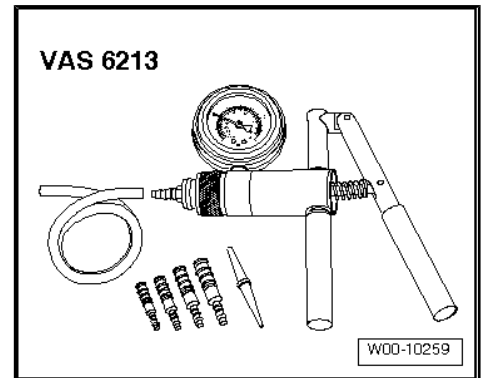
⇒ ["4.1 Checking vacuum system", page 207](#)

⇒ ["4.2 Checking dual non-return valve", page 207](#)

4.1 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



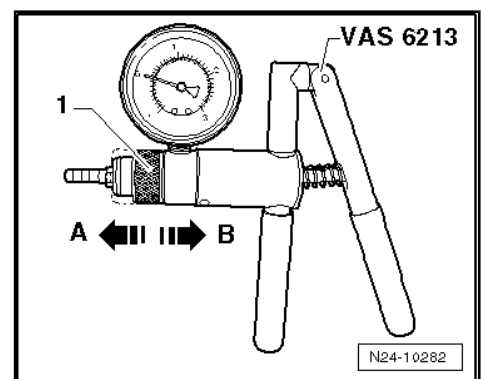
Procedure

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

4.2 Checking dual non-return valve

Special tools and workshop equipment required

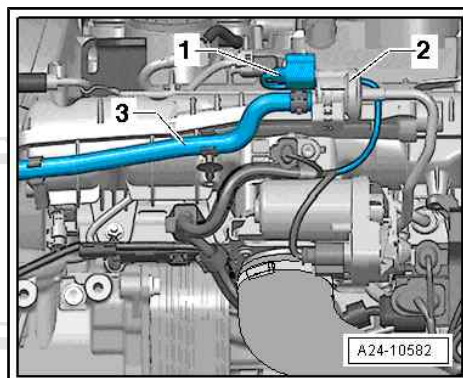
- ◆ Hand vacuum pump - VAS 6213-



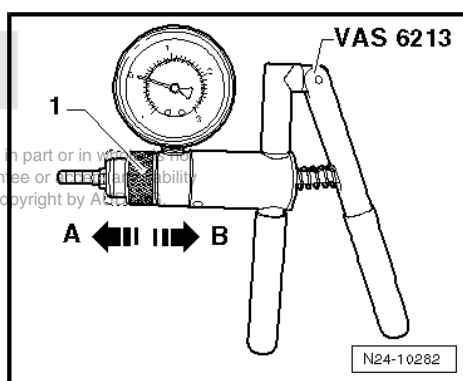
- ◆ Auxiliary measuring set - V.A.G 1594C-

Test condition

- Activated charcoal filter solenoid valve 1 - N80- has been checked with vehicle diagnostic tester and is OK.
- Remove engine cover panel ⇒ [page 33](#) .
- Unplug connector -1- and detach breather line -3- from activated charcoal filter solenoid valve 1 - N80- -2-.



- Move adjuster ring -1- on hand vacuum pump - VAS 6213- to position -A- to select "vacuum".



- Connect hand vacuum pump - VAS 6213- to activated charcoal filter solenoid valve 1 - N80- .
- Connect contacts of activated charcoal filter solenoid valve 1 - N80- -1- to battery using test leads. This will open activated charcoal filter solenoid valve 1 - N80- .

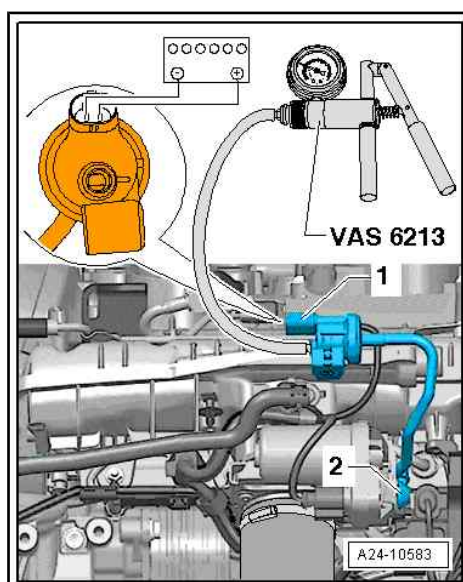
Then immediately operate hand vacuum pump - VAS 6213- several times.

- Vacuum should build up.
- Again disconnect battery to cut off current supply.

If vacuum does not build up:

- Renew dual non-return valve -1-.

Dual non-return valve, activated charcoal filter solenoid valve 1 - N80- and plastic hoses are combined as one unit and can only be renewed together.



5 Injectors

⇒ ["5.1 Exploded view - fuel rail with injectors", page 209](#)

⇒ ["5.2 Removing and installing fuel rail", page 210](#)

⇒ ["5.3 Removing and installing injectors", page 211](#)

⇒ ["5.4 Cleaning injectors", page 216](#)

5.1 Exploded view - fuel rail with injectors

1 - Radial compensation element

- ☐ Renew if damaged

2 - Injector

- ☐ With combustion chamber ring seal (teflon ring seal): always renew
- ☐ Renew O-rings
- ☐ Ensure correct installation position.
- ☐ Removing and installing
⇒ [page 211](#)

3 - Support ring

4 - Fuel rail

- ☐ Removing and installing
⇒ [page 198](#)

5 - Fuel pressure sender - G247-

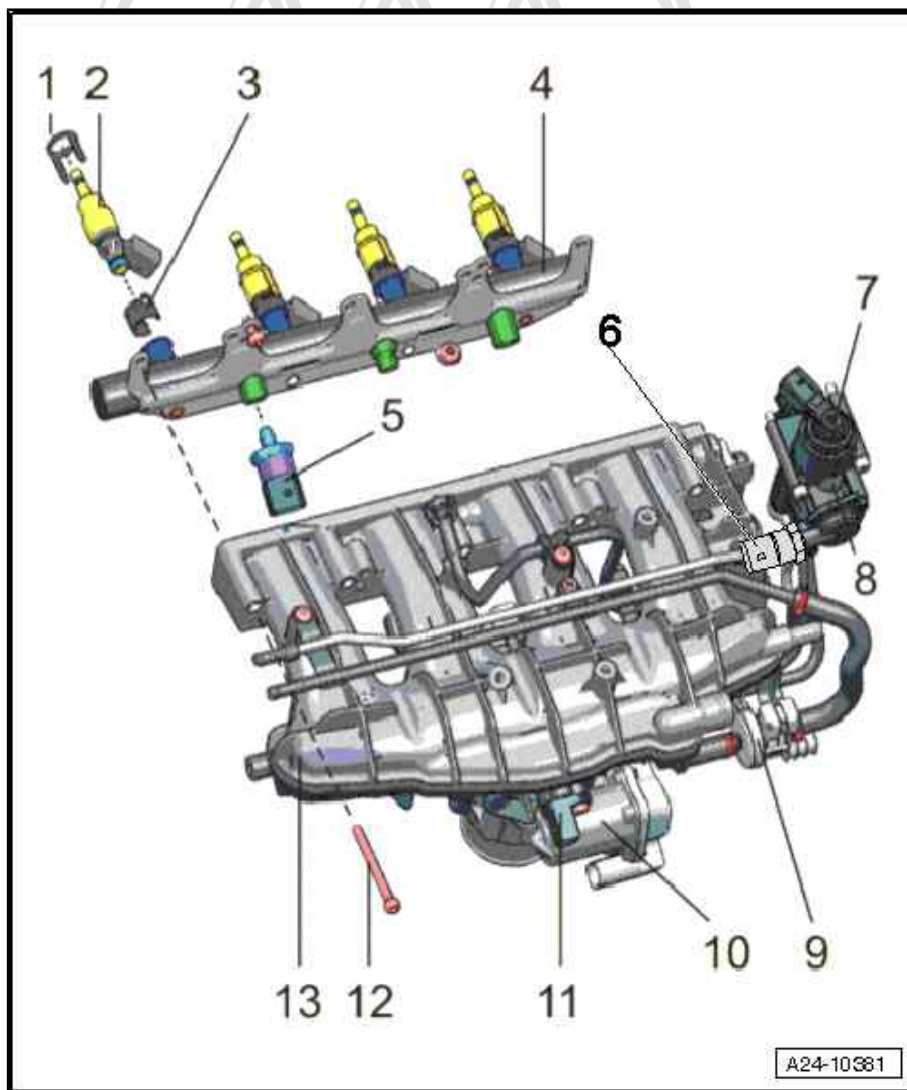
- ☐ 22 Nm
- ☐ Tighten connecting piece to 30 Nm

6 - Fuel pressure sender for low pressure - G410-

7 - Fuel pressure regulating valve - N276-

8 - High-pressure pump

- ☐ With fuel pressure regulating valve - N276- and fuel pressure sender, low pressure - G410-
- ☐ An electric fuel pump (fitted in fuel tank) sup-



plies fuel to the mechanical high-pressure pump at a pressure of approx. 6 bar

- ☐ When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.
- ☐ The fuel system must not be under pressure when installing the high-pressure pump; procedure for reducing fuel pressure ⇒ [page 192](#)
- ☐ Fuel lines must be free of tension when installed.
- ☐ Removing and installing ⇒ [page 224](#)

9 - Activated charcoal filter solenoid valve 1 - N80-

10 - Throttle valve module - J338- , throttle valve drive for electric throttle - G186-

- ☐ Throttle valve drive angle sender 1 for electric throttle - G187- and throttle valve drive angle sender 2 for electric throttle - G188-
- ☐ After throttle valve module - J338- has been renewed, it must be re-adapted to engine control unit - J623- ; see "Guided Functions" using a vehicle diagnostic tester

11 - Intake air temperature sender 2 - G299-

- ☐ 5 Nm

12 - Bolts for intake manifold

- ☐ 9 Nm

13 - Intake manifold

- ☐ Removing and installing ⇒ [page 198](#)

5.2 Removing and installing fuel rail

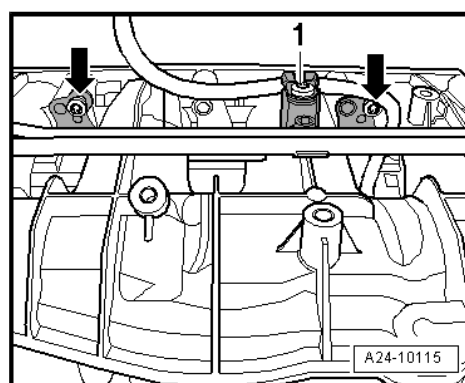
If fuel rail is renewed, intake manifold flap potentiometer - G336- must be adapted to engine control unit - J623- ; see "Guided Functions" using vehicle diagnostic tester .



Note

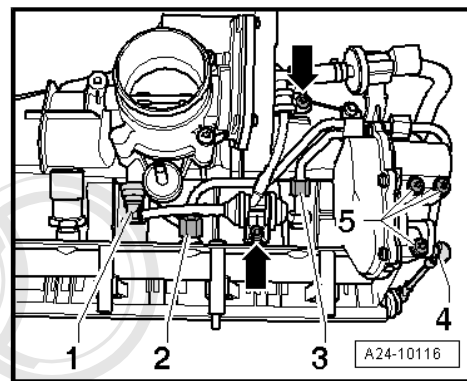
Intake manifold must be removed; removing intake manifold ⇒ [page 198](#) .

- Remove hoses from activated charcoal filter.
- To do so, release hose clip -1-.
- Loosen both bolts -arrows- on fuel rail.
- Detach hose connection -1- from intake manifold and unscrew two bolts -arrows-.

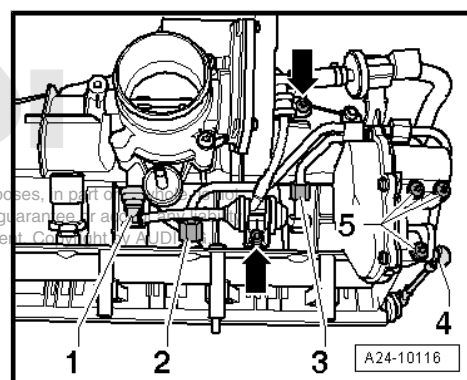


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- Disconnect both fuel lines -2- and -3-.
- Carefully press linkage off intake manifold flap motor - V157- -4-.



- Unbolt intake manifold flap motor - V157- -5-.

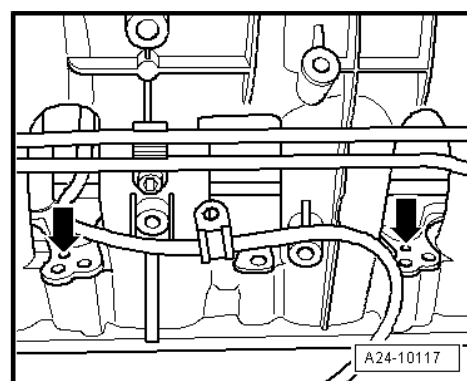


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- Press fuel rail over retaining lugs -arrows- on intake manifold.
- Detach fuel rail from intake manifold.

Installing

- Install in reverse order.
- Install intake manifold ⇒ [page 198](#) .



5.3 Removing and installing injectors

Special tools and workshop equipment required

- ◆ Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-





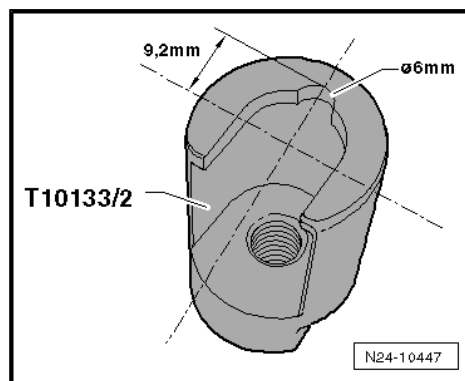
Note

Special tool T10133/2 (puller) has been modified and now has the designation puller T10133/2 A . If you have not yet received the new tool you can make the modification yourself.

Modifying special tool T10133/2 (puller) to make it equivalent to puller T10133/2 A

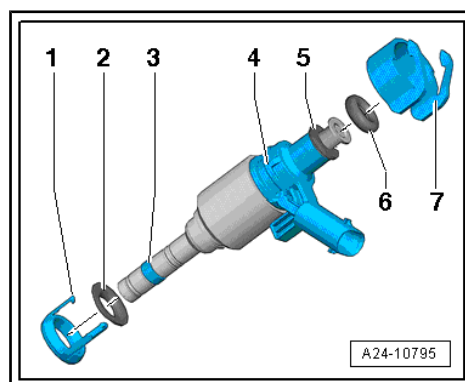
Special tools and workshop equipment required

- ◆ Round file, approx. 6 mm
- File out a semi-circular recess as shown in the illustration. The recess allows the tool to be pushed further onto the injector so the contact surface is increased.
- For identification purposes, mark the modified tool with the letter “A” after the tool number.



Injector

- 1 - Intermediate ring (renew)
- 2 - Retainer
- 3 - Combustion chamber ring seal (teflon ring seal) - renew; when fitting, do not grease ring or use any other lubricant
- 4 - Injector
- 5 - Spacer ring (renew if damaged)
- 6 - O-ring (renew; apply thin coating of clean engine oil prior to installation)
- 7 - Support ring (via this support ring, fuel rail exerts force which secures injector in cylinder head)



Removing

- Remove engine cover panel ⇒ [page 33](#) .
- Remove intake manifold and fuel rail ⇒ [page 198](#) .

Removing injectors (from fuel rail)

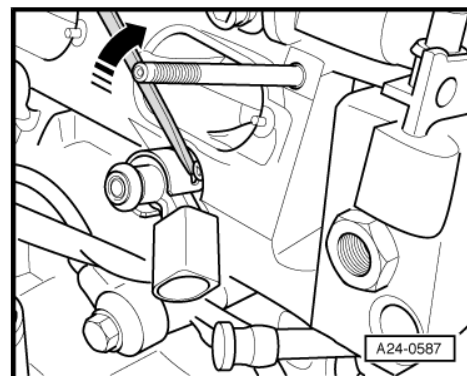
Carefully pull injectors out of fuel rail.

Removing injectors (from cylinder head)

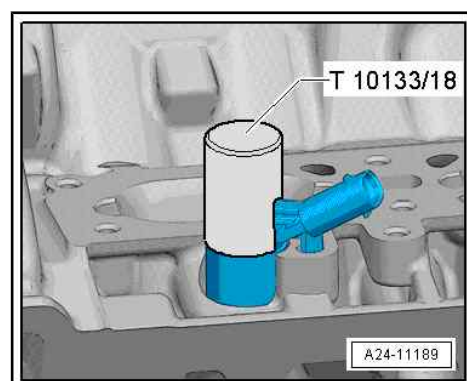
- Cover open inlet ports with a clean cloth.
- Unplug electrical connector at injector that is to be removed.

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- Use a screwdriver to bend retainer tabs of radial compensation element to side, and pull support ring off injector.



- Slide stop sleeve -T10133/18- over injector.

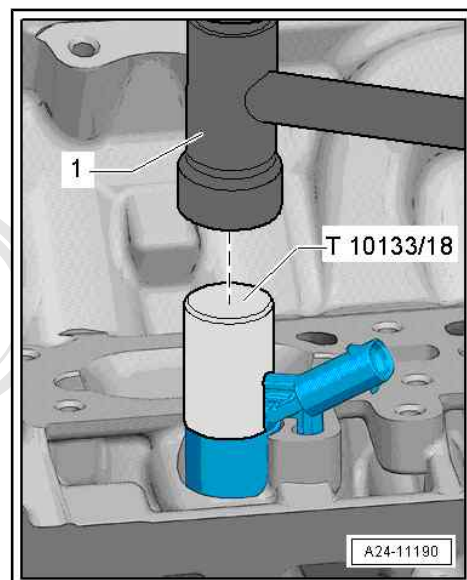


- Carefully knock against stop sleeve several times to loosen injector.



Note

- ◆ Use a torque wrench to pull out injector.
- ◆ Adjust torque wrench to 5 Nm.



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- Apply puller -T10133/19- to groove on injector.
- Attach removal tool -T10133/16- to puller.
- Pull out injector by screwing in bolt -1-.
- If injector does not come loose after limit torque of 5 Nm is reached, remove puller and repeat procedure using stop sleeve to loosen injector.
- Repeat procedure for each injector.


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- ♦ *Observe correct torque to avoid irreparable damage to injector.*
- ♦ *The combustion chamber ring seal must always be renewed before the injector is re-installed.*


Note

The combustion chamber ring seal must always be renewed prior to reinstalling the injector.

Renewing combustion chamber ring seal (teflon ring seal)

- Carefully remove old combustion chamber ring seal using suitable tools (e.g. cut open ring using razor blade, or prise open ring with small screwdriver and then pull off forwards). It is important to ensure that the groove and the continuous ridge in the bottom of the groove are not damaged.


Note

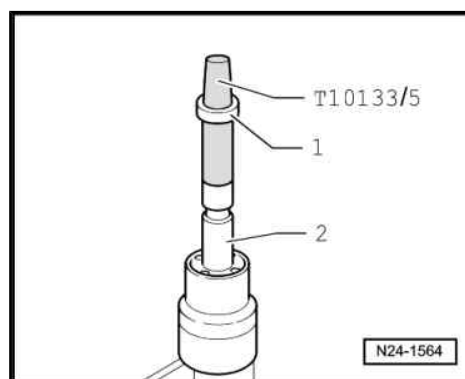
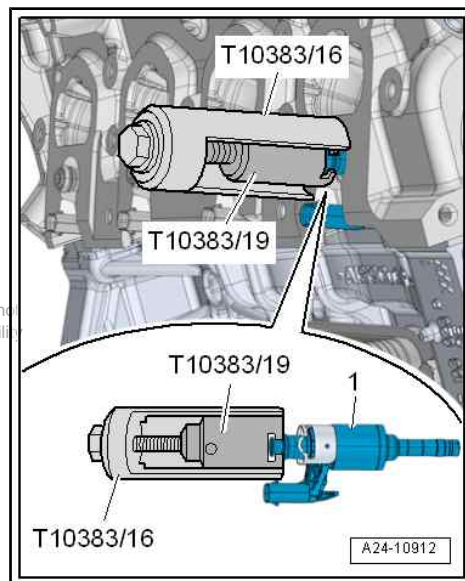
The injector must be renewed if the groove is damaged.

- Before new combustion chamber ring seal is fitted, any combustion residue must be removed from ring groove and injector stem using a clean cloth.


Note

The illustration shows an injector with "offset connector". This can be ignored since it is not relevant when renewing the combustion chamber ring seal.

- Fit assembly cone -T10133/5- with new teflon ring -1- onto injector -2-.



- Use assembly sleeve -T10133/6- to press teflon ring further onto assembly cone -T10133/5- until it seats in groove. Do not use any lubricants during this procedure.



Note

The combustion chamber ring seal is widened when it is pushed onto the injector. The combustion chamber ring seal must therefore be compressed again after it has been fitted. This is done in two steps. The procedure is described below.

Step 1 of the calibration of the combustion chamber ring seal is performed with the calibration sleeve -T10133/7- .

- Slide calibration sleeve -T10133/7- onto injector as far as stop by pressing lightly and turning approx. 180°. Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.

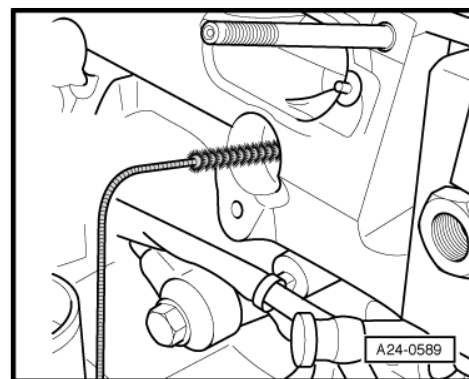
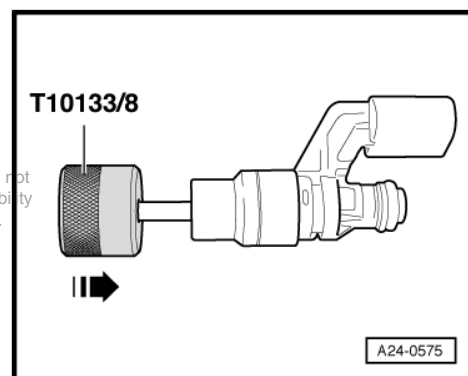
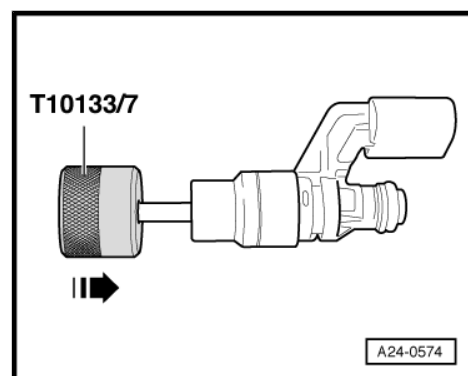
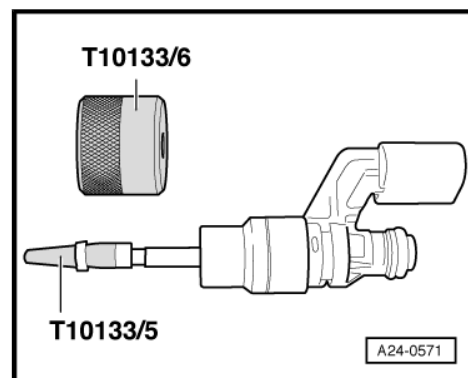
Step 2 of the calibration of the combustion chamber ring seal is performed with the calibration sleeve -T10133/8- .

- Slide calibration sleeve -T10133/8- onto injector as far as stop by pressing lightly and turning approx. 180°. Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.

- Fit new O-ring on injector. Lubricate O-ring lightly with clean engine oil before installing.

- The combustion chamber ring seal must not be lubricated.

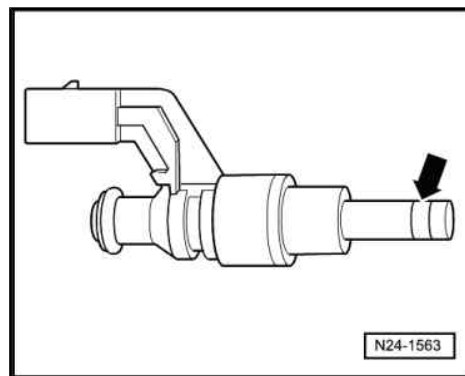
- Before installing injectors, thoroughly clean apertures for injectors in cylinder head using supplied nylon brush -T10133/4- .





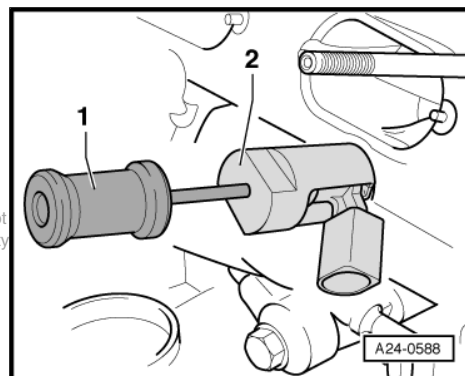
Note

- ◆ *The combustion chamber ring seal on the injector must not be oiled or greased.*
- ◆ *Make sure that there is no cleaning fluid or oil in the holes in the cylinder head when installing the injectors.*
- Push injector by hand as far as it will go into aperture in cylinder head (do not use oil or grease). Ensure that the injector is properly seated in the cylinder head.



Note

- ◆ *It should be possible to insert the injector easily. If necessary, wait until the seal has contracted sufficiently.*
- ◆ *Note correct installation position and ensure that injectors are properly seated in cylinder head.*
- ◆ *If the injector cannot be pushed in by hand, use puller T10133/2A- -2- with striker - T10133/3- to insert the injector.*
- The remaining installation steps are carried out in the reverse sequence.



Important: the following points must always be observed:

- The combustion chamber ring seal on the injector must not be oiled or greased.
- Make sure there is no cleaning fluid or oil in the cylinder head bores when installing the injectors.
- Coat O-rings of injectors with clean engine oil to facilitate insertion into fuel rail.
- Renew all seals.
- Fuel rail must be positioned on injectors and pressed in evenly.
- Install intake manifold with fuel rail ⇒ [page 198](#) .

5.4 Cleaning injectors

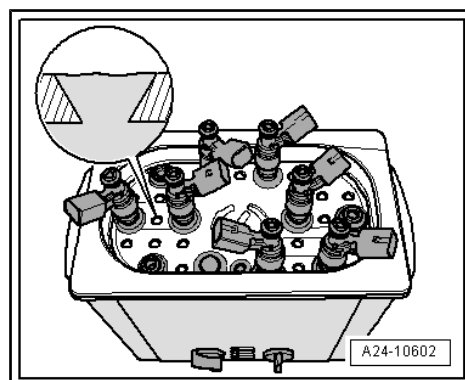
Special tools and workshop equipment required

- ◆ Ultrasonic cleaning unit - VAS 6418-
- ◆ Mounting plate for injection modules - VAS 6418/1-
- ◆ Cleaning fluid - VAS 6418/2-



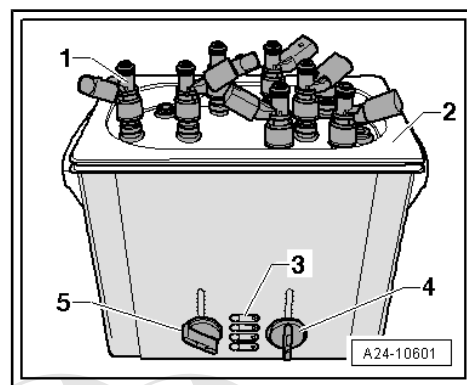
Note

- ◆ *Ultrasonic unit must be filled with cleaning fluid up to top edge of apertures (see detail in illustration).*
- ◆ *Observe safety precautions and operating instructions for ultrasonic unit.*



Cleaning

- Remove injectors ⇒ [page 211](#) .
- Insert injectors -1- all the way into mounting plate for injection modules - VAS 6418/1- -2-.
- Immerse injectors together with mounting plate for injection modules - VAS 6418/1- into cleaning fluid.
- Set rotary knob -4- to a temperature of 50°C.
- Select a cleaning time of 30 minutes with rotary knob -5-.
- Switch on ultrasonic unit with button -3-.



Note

The time set starts to elapse as soon as a cleaning temperature of 50°C has been reached.

- After cleaning, always renew combustion chamber ring seal (teflon ring seal) for each injector ⇒ [page 214](#) .
- Then re-install injectors ⇒ [page 211](#) .

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6 Senders and sensors

⇒ ["6.1 Removing and installing fuel pressure sender G247", page 218](#)

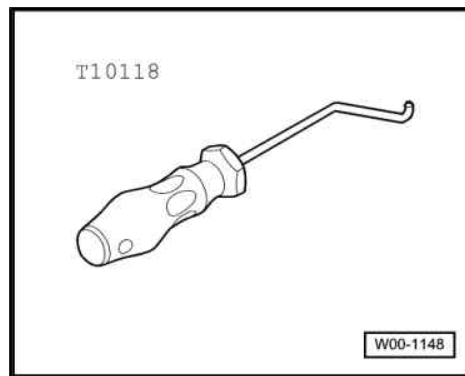
⇒ ["6.2 Checking fuel pressure sender G247", page 219](#)

⇒ ["6.3 Removing and installing air mass meter", page 222](#)

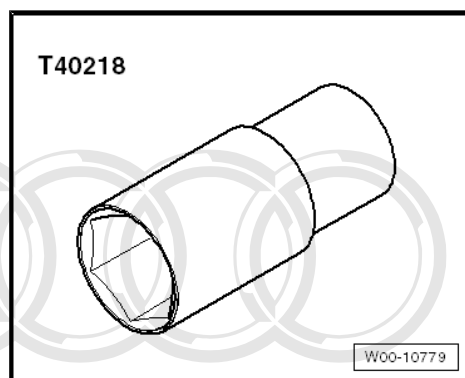
6.1 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

◆ Assembly tool - T10118-



◆ Bit (27 mm) - T40218- or commercially available socket (27 mm)



Removing

– Remove engine cover panel ⇒ [page 33](#) .

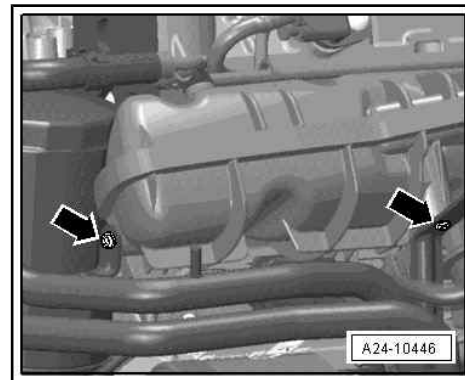


WARNING

The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ [page 192](#) .

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- Detach coolant pipe from intake manifold -arrows-.



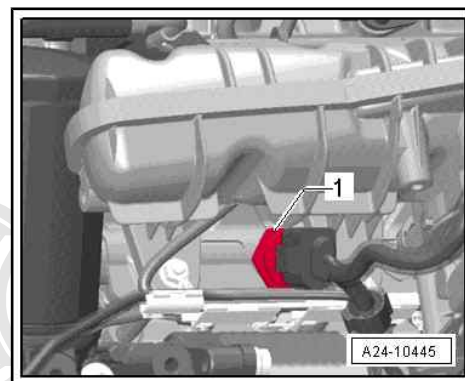
- Release connector on fuel pressure sender - G247- using assembly tool - T10118- .
- Unscrew fuel pressure sender - G247- using bit, 27mm - T40218- .

Installing

- Install in reverse order.
- Make sure that connecting piece is tightened to specified torque before installing fuel pressure sender - G247- .

Tightening torques

- ◆ Connection
⇒ [“5.1 Exploded view - fuel rail with injectors”, page 209](#)
- ◆ Fuel pressure sender - G247-
⇒ [“5.1 Exploded view - fuel rail with injectors”, page 209](#)

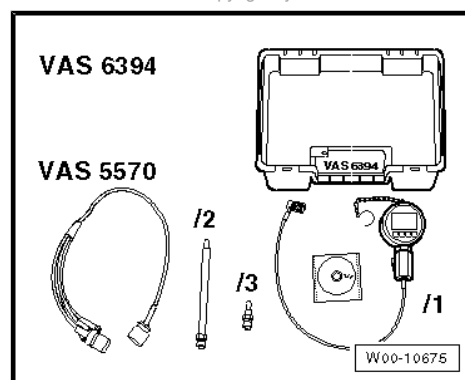


6.2 Checking fuel pressure sender - G247-

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester
- ◆ Test instrument adapter/DSO (3-pin) - VAS 5570-

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- ◆ Pressure sensor tester - VAS 6394-
- ◆ Socket, 27 mm (commercially available)

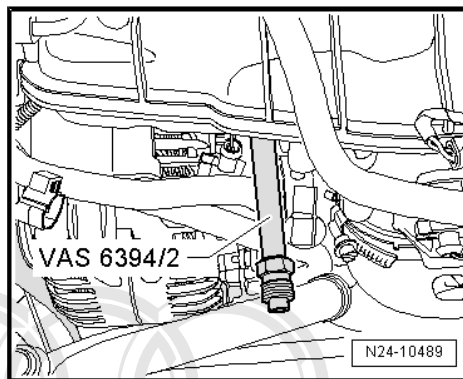
Procedure:

- Remove engine cover panel ⇒ [page 33](#) .

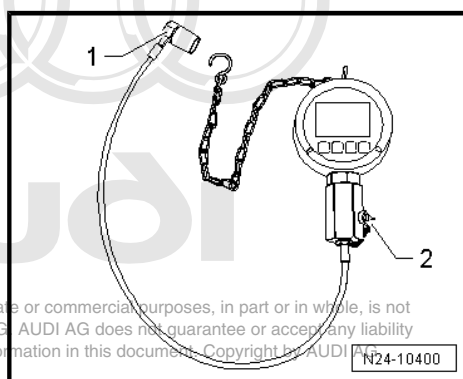

WARNING

The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ [page 192](#).

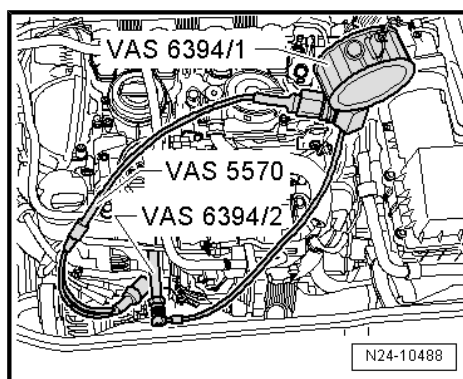
- Remove fuel pressure sender - G247- ⇒ [page 218](#) .
- Screw in adapter - VAS 6294/2- in place of fuel pressure sender - G247- and tighten adapter with the same torque as that specified for fuel pressure sender - G247- .
- ◆ Tightening torque ⇒ [page 209](#)



- Unscrew plug -2- and screw fuel pressure sender - G247- into pressure sensor tester - VAS 6394- .



- Connect vehicle and fuel pressure sender - G247- electrically using test instrument adapter/DSO (3-pin) - VAS 5570- .



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- Switch on tester -VAS 6394/1- by pressing button -A- once briefly.

**Note**

- ◆ You can press and hold button -A- for 2 seconds to switch on the illumination for 20 seconds.
- ◆ If pressure gauge - VAS 6394/1- does not indicate 0 bar, zero the tester ⇒ Operating instructions .

Pressure gauge - VAS 6394/1- should indicate 0 bar. If this is not the case, press button -C- once briefly to zero the tester.

- Connect pressure line of pressure gauge - VAS 6394/1- to adapter - VAS 6394/2- .
- Connect a vehicle diagnostic tester .
- Start engine and run at idling speed.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select “Measured values”.
- Select measured value block 140.

Display zone 3 shows the actual pressure value being transmitted to the engine control unit by the fuel pressure sender - G247- .

- Compare the pressure indicated by pressure gauge - VAS 6394/1- with the actual pressure value on the vehicle diagnostic tester .
- The pressure readings must not deviate by more than 5 bar.
- If the deviation is more than 5 bar, test a new fuel pressure sender - G247- .

**WARNING**

The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening, for procedure see ⇒ page 192 .

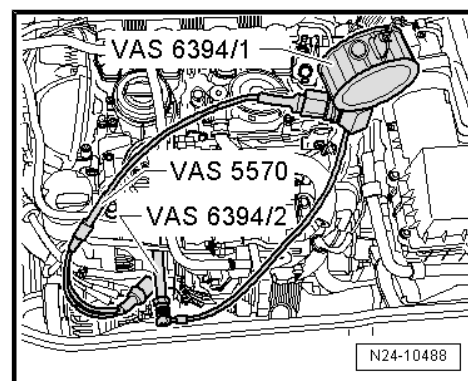
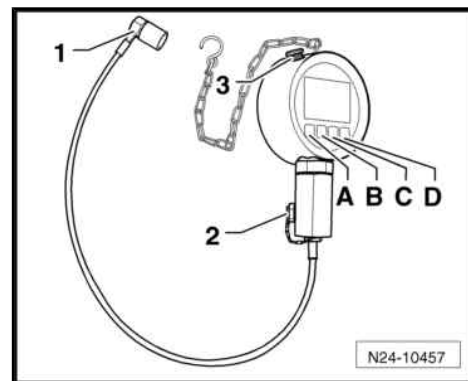
- Screw a new fuel pressure sender - G247- into the pressure gauge - VAS 6394/1- .
- Repeat the test with the new fuel pressure sender - G247- and compare the two pressure values.

If the two values still do not agree:

- Check the electrical connection between the fuel pressure sender - G247- and the engine control unit; refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If the values agree:

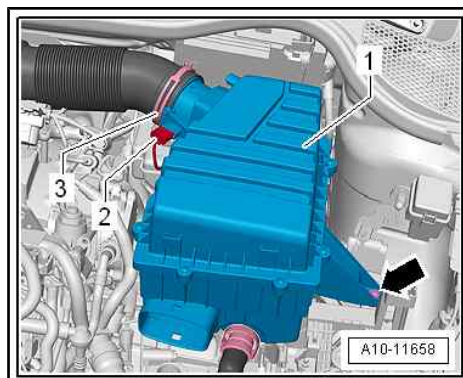
- Install the new fuel pressure sender - G247- ⇒ page 218 .



6.3 Removing and installing air mass meter

Removing

- Detach electrical connector -2- for air mass meter - G70- .
- Loosen hose clip -3- and detach air intake hose.



- Remove bolts -arrows-.
- Carefully pull air mass meter - G70- out of guide on air cleaner (top section).

Installing

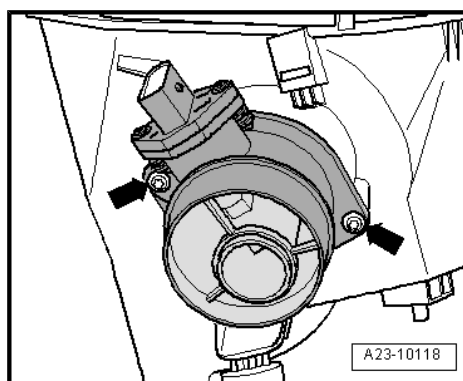
Installation is carried out in the reverse order; note the following.

To ensure the proper function of the air mass meter it is important to observe the following notes and instructions.



Note

- ◆ *Renew O-ring.*
- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *Use silicone-free lubricant when fitting air hose.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*



Tightening torques

- ◆ ⇒ ["2.1 Exploded view - air cleaner housing", page 194](#)



7 High-pressure pump

⇒ "7.1 Exploded view - high-pressure pump", page 223

⇒ "7.2 Removing and installing high-pressure pump", page 224

7.1 Exploded view - high-pressure pump

1 - High-pressure pump

- ☐ With fuel pressure regulating valve - N276-
- ☐ An electric fuel pump (fitted in fuel tank) supplies fuel to the mechanical high-pressure pump at a pressure of approx. 6 bar
- ☐ When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.
- ☐ The fuel system must not be under pressure; procedure for reducing fuel pressure
⇒ [page 192](#)
- ☐ Fuel lines must be free of tension when installed.
- ☐ Removing and installing
⇒ [page 224](#)

2 - O-ring

- ☐ Renew

3 - Connecting piece for fuel return line to fuel tank

- ☐ It is important to leave the old seal in the pump when replacing the threaded connection. When it is first installed at the supplier it becomes crushed and cannot be removed. For this reason, the threaded connection has a deformable sealing lip

4 - Connecting piece for fuel supply line to fuel rail

- ☐ Renew connecting piece
- ☐ Tighten connecting piece to 27 Nm
- ☐ Union nut for fuel supply line must be free of tension when installed

5 - High-pressure pipe

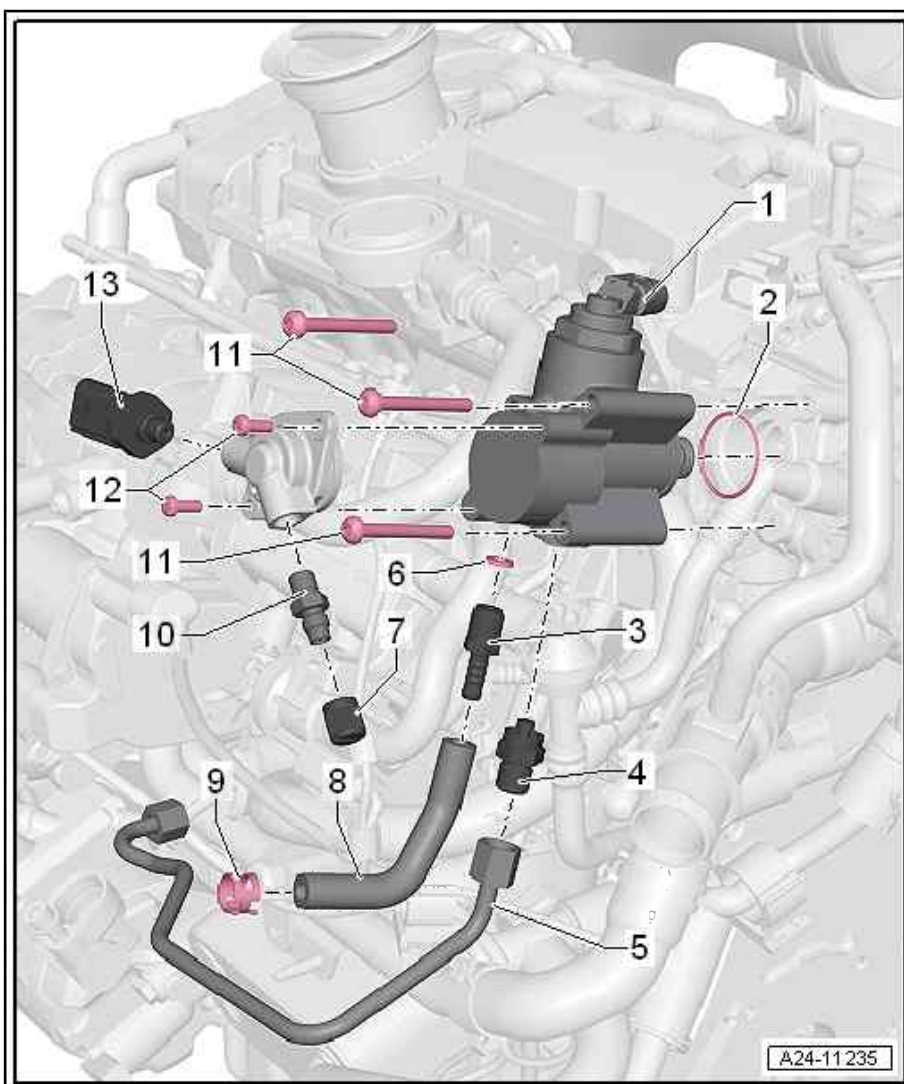
- ☐ Install so that parts are free of tension
- ☐ Check for damage and cracking

6 - Seal

- ☐ Renew

7 - Sealing cap

- ☐ Fuel discharge valve



8 - Fuel return line

- ☐ Connection for high-pressure pump has a deformable sealing lip
- ☐ Renew after removing

9 - Spring-type clip**10 - Fuel discharge valve**

- ☐ 15 Nm

11 - Securing bolts for high-pressure pump

- ☐ Tighten to 8 Nm in diagonal sequence, then turn 90° further
- ☐ Renew

12 - Bolts

- ☐ Cover with mountings for test adapter and fuel pressure sender for low pressure - G410-
- ☐ Hand-tighten to 8 Nm, then tighten 90° further
- ☐ Renew

13 - Fuel pressure sender for low pressure - G410-

- ☐ 15 Nm

7.2 Removing and installing high-pressure pump

**WARNING**

Fuel system operates under high pressure. Always dissipate fuel pressure prior to opening fuel system. For procedure, refer to ⇒ [page 192](#)

**Note**

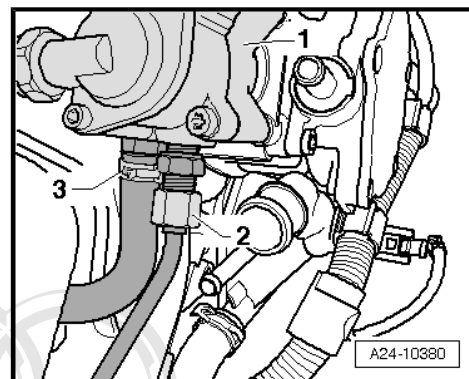
- ◆ *The high-pressure pump must only be removed when the engine is cold.*
- ◆ *When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.*
- ◆ *Use a cloth to catch escaping fuel.*
- ◆ *The O-ring must always be renewed.*
- ◆ *Banjo bolt for fuel return line must always be renewed.*
- ◆ *Lubricate high-pressure fuel pipes lightly with engine oil and always ensure that pipes are free of tension when tightening the connections.*

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Removing

- Remove engine cover panel ⇒ [page 33](#) .

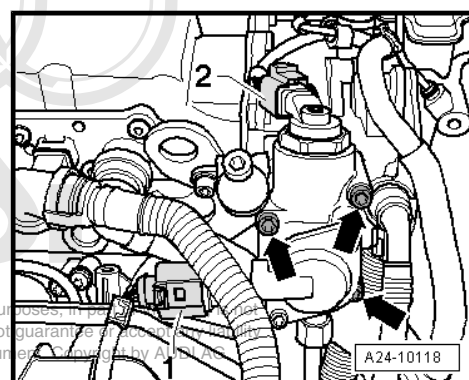
- Disconnect both fuel lines -2- and -3-.
- Unplug electrical connectors from fuel pressure sender for low pressure - G410- -1- and fuel pressure regulating valve - N276- -2-.



- Remove bolts -arrows-.
- Carefully pull out high-pressure pump.

Installing

- Renew O-ring for high-pressure pump.
- Turn crankshaft until roller tappet is positioned at lowest point.
- Carefully fit high-pressure pump in cylinder head opening.
- Tighten bolts hand-tight.
- Now tighten bolts in diagonal sequence to specified torque.
- Make sure that connecting pieces on high-pressure pump are tightened to specified torque before installing fuel lines
⇒ ["7.1 Exploded view - high-pressure pump", page 223](#) .
- Tighten union nut on fuel supply line hand-tight. Align so it is free of tension and tighten to specified torque ⇒ [page 223](#) .
- Fit hose for fuel return line firmly onto connection (use hose clip) and align so that it is free of stress.
- Tighten union nut on fuel supply line hand-tight and align line so that it is free of stress.
- Reattach electrical connectors for fuel pressure sender low pressure - G410- and fuel pressure regulating valve - N276- .
- Put back fuse if it has been removed.

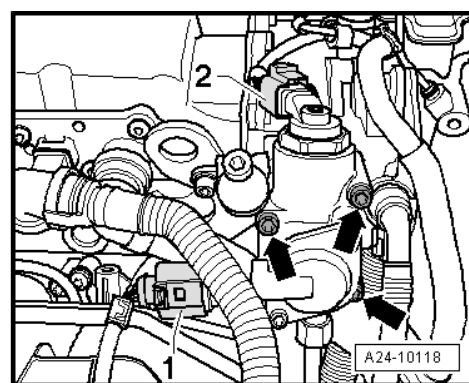


Note

Check fuel system for leaks.

Tightening torques

- ◆ ⇒ ["7.1 Exploded view - high-pressure pump", page 223](#)



8 Lambda probe

⇒ ["8.1 Exploded view - Lambda probe", page 226](#)

⇒ ["8.2 Removing and installing Lambda probe", page 226](#)

8.1 Exploded view - Lambda probe

1 - Front exhaust pipe with catalytic converter and front silencer



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.

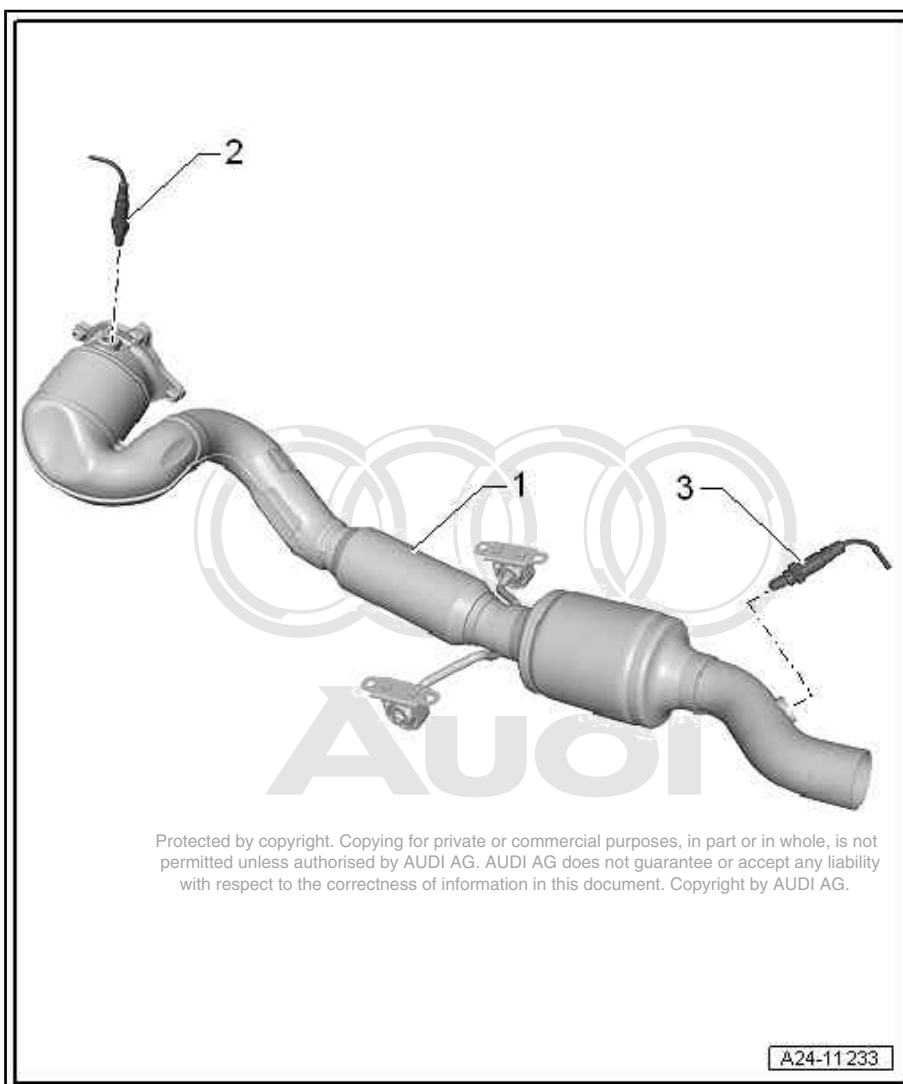
- ☐ Protect catalytic converter from damage by knocks and impact
- ☐ Removing and installing
⇒ [page 241](#)
- ☐ Do not remove protective packaging from replacement part until you are ready to fit the flexible joint

2 - Lambda probe - G39- before catalytic converter

- ☐ Removing and installing
⇒ [page 226](#)
- ☐ 55 Nm

3 - Lambda probe - G130- after catalytic converter

- ☐ Removing and installing
⇒ [page 227](#)
- ☐ 55 Nm



8.2 Removing and installing Lambda probe

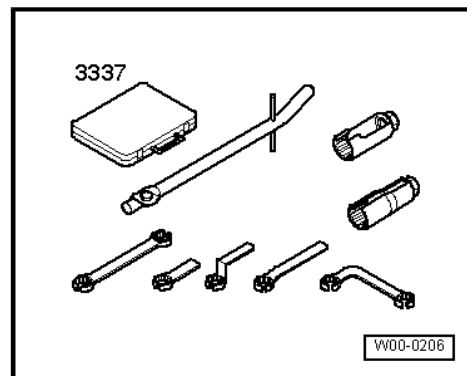
⇒ ["8.2.1 Removing and installing Lambda probe G39", page 226](#)

⇒ ["8.2.2 Removing and installing Lambda probe after catalytic converter G130", page 227](#)

8.2.1 Removing and installing Lambda probe - G39-

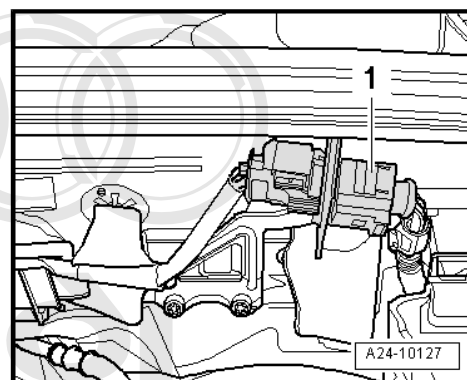
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set - 3337-



Removing

- Remove engine cover panel ⇒ [page 33](#) .
- Unplug electrical connector -1- for Lambda probe - G39- .



- Unscrew Lambda probe - G39- -arrow- using a tool from Lambda probe open ring spanner set - 3337- .

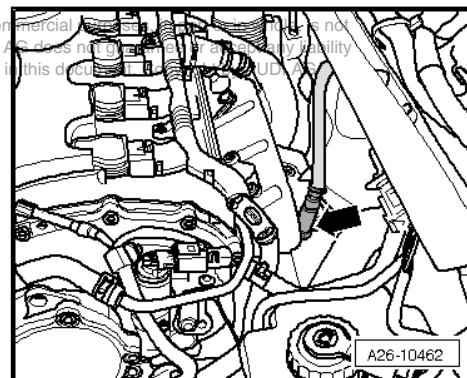
Installing

When installing, note the following:



Note

- ◆ *New Lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic parts catalogue*
- ◆ *The electrical wiring of the lambda probe must be secured at the original locations when installing. The wiring must NOT come into contact with the exhaust pipe.*



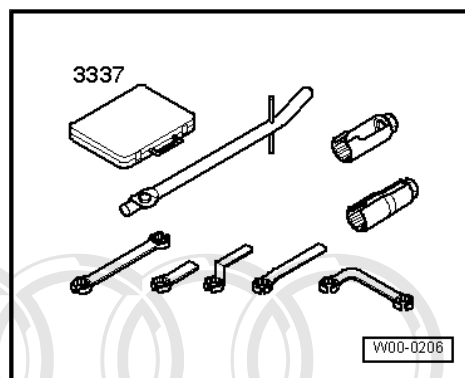
Tightening torques

- ◆ ⇒ ["8.1 Exploded view - Lambda probe", page 226](#)

8.2.2 Removing and installing Lambda probe after catalytic converter - G130-

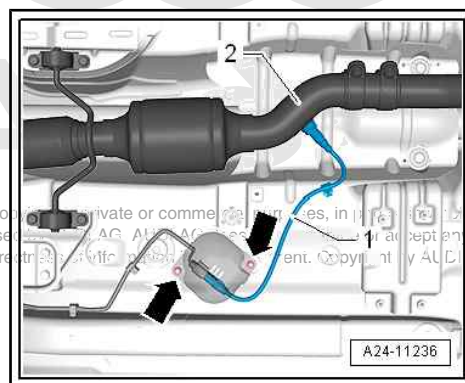
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set - 3337-

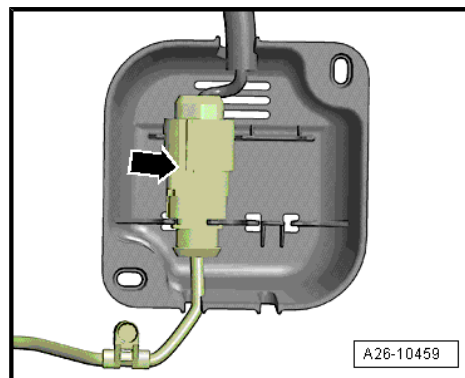


Removing

- Remove nuts -arrows- for cover.



- Detach cover and unplug electrical connector -arrow- for Lambda probe after catalytic converter - G130- and Lambda probe heater after catalytic converter - Z29- .



- Unscrew Lambda probe after catalytic converter - G130- -1- using a tool from Lambda probe open ring spanner set - 3337- .

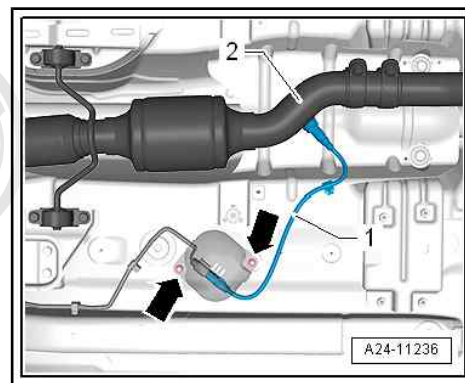
Installing

When installing, note the following:



Note

- ◆ *New Lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ [Electronic parts catalogue](#)*
- ◆ *The electrical wiring of the lambda probe must be secured at the original locations when installing. The wiring must NOT come into contact with the exhaust pipe.*



Tightening torques

- ◆ ⇒ [“8.1 Exploded view - Lambda probe”, page 226](#)

9 Engine control unit

⇒ ["9.1 Wiring and component check with test box", page 230](#)

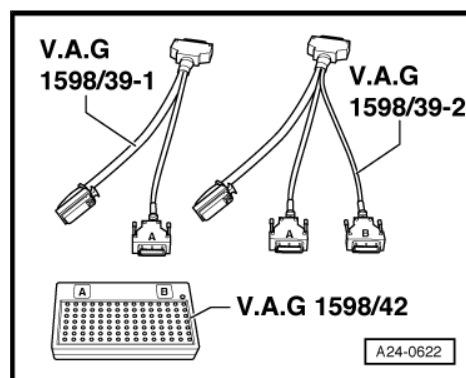
⇒ ["9.2 Removing and installing engine control unit J623 ", page 232](#)

9.1 Wiring and component check with test box

Special tools and workshop equipment required

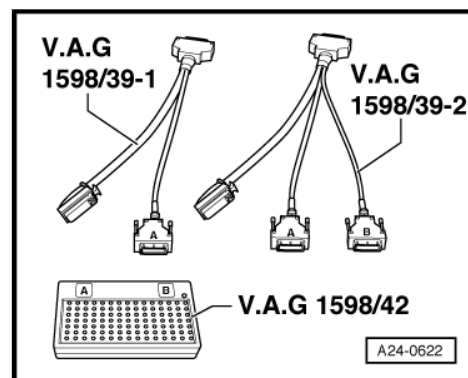
- ◆ Adapter cable - V.A.G 1598/39-1-
- ◆ Adapter cable - V.A.G 1598/39-2-
- ◆ Test box - V.A.G 1598/42-

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**Note**

- ◆ The test box has 105 sockets. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.
- ◆ The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.
- ◆ To carry out tests on the 60-pin electrical wiring harness connector, the adapter cable - V.A.G 1598/39-1- is connected to connector -A- on the test box. For components connected to 60-pin electrical wiring harness connector see → Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ To carry out tests on the 94-pin electrical wiring harness connector, the adapter cable - V.A.G 1598/39-2- must be connected to connectors -A- and -B- on the test box. For components connected to 94-pin electrical wiring harness connector see → Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ The test box - V.A.G 1598/42- is designed so it can be connected both to the electrical wiring harness for the engine control unit and to the engine control unit itself at the same time.
- ◆ The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.
- ◆ Always use auxiliary measuring set - V.A.G 1527 B- to connect test equipment (e.g. voltage tester - V.A.G 1526 C-, hand-held multimeter - V.A.G 1594 C- etc.).

**WARNING**

To prevent irreparable damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

The engine control unit has to be removed before multi-pin connectors can be unplugged from engine control unit → [page 232](#)

- Connect test box - V.A.G 1598/42- to electrical wiring harness connector. The earth clip on the test box must be connected to the negative battery terminal. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.

Installing engine control unit:

Installation is performed in the reverse sequence.

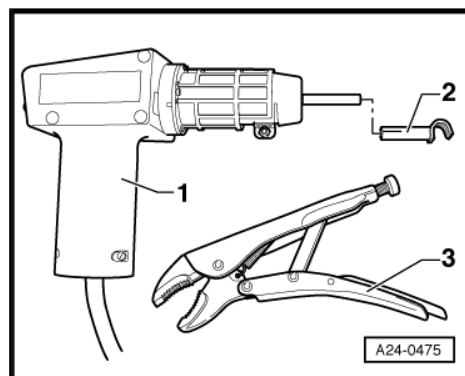
- After installation, the locking plate must be re-fitted on the control unit.
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.

- Interrogate event memory and erase if necessary.

9.2 Removing and installing engine control unit - J623-

Special tools and workshop equipment required

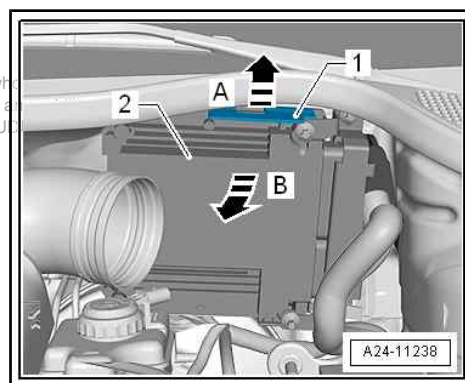
- ◆ Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-



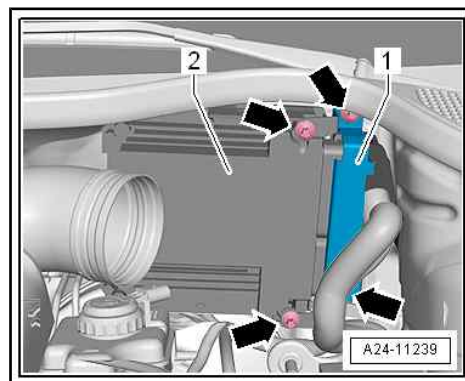
- ◆ Commercially available mole grips -3-
- ◆ Vehicle diagnostic tester

Removing

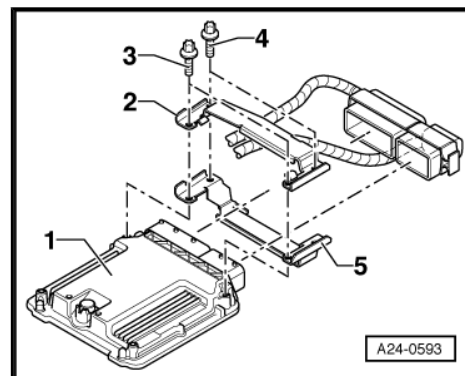
- To do so, activate engine control unit by selecting diagnosis object "Replace engine control unit" in "Guided Functions" mode of vehicle diagnostic tester .
- Switch off ignition and take out ignition key.
- Remove air cleaner housing ⇒ [page 195](#) .
- Push locking plate -1- upwards in direction of -arrow A-.
- Detach engine control unit -2- forwards in direction of -arrow B-.



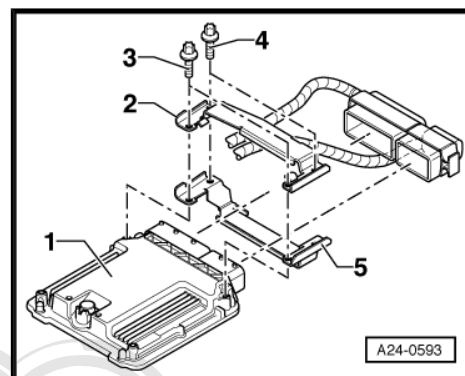
To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate or a metal casing.



The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.

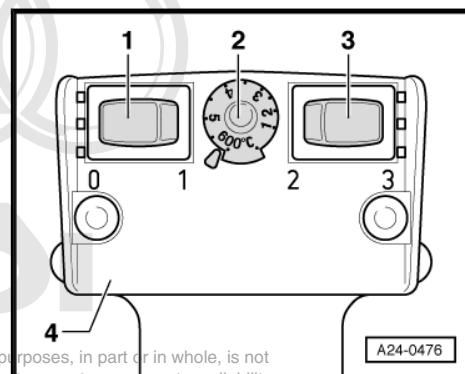


Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



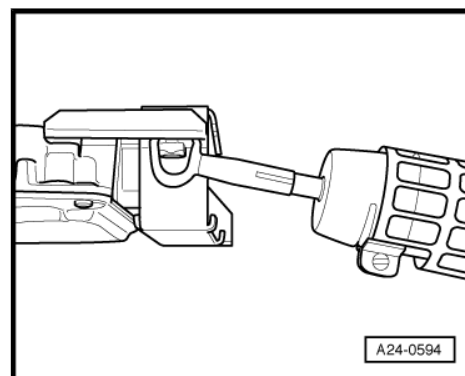
WARNING

Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

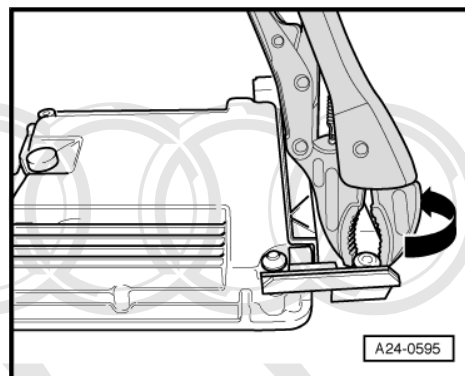


Apply heat to the threads of the shear bolts on the connector side as shown in the illustration.

To do so, switch on the hot air blower and heat the bolts for approximately 20 ... 30 seconds.



- Unscrew shear bolts (in direction of arrow) using suitable mole grips.
- The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.
- Detach metal locking plate from connectors.
- Remove both bolts from bracket for engine control unit - J623- .



- Release and unplug connectors from engine control unit - J623- .
- Take out the old engine control unit - J623- and connect the new one.

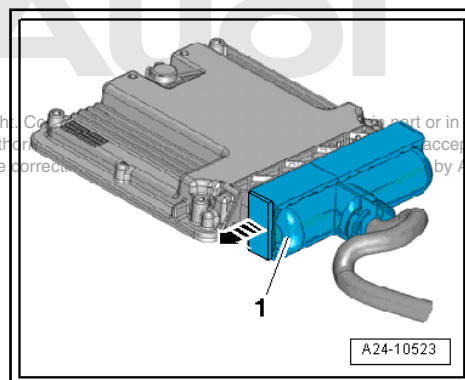
Installing engine control unit:

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

- After installation, the protective housing must be re-fitted on the engine control unit - J623- .
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.

After installing a new engine control unit, the following operation must be performed:

- Activate engine control unit via a vehicle diagnostic tester in “Guided Functions” mode, “Replace engine control unit”.



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26 – Exhaust system

1 Exhaust pipes/silencers

⇒ [“1.1 Exploded view - silencers”, page 235](#)

⇒ [“1.2 Separating exhaust pipes/silencers”, page 236](#)

⇒ [“1.3 Stress-free alignment of exhaust system”, page 238](#)

⇒ [“1.4 Checking exhaust system for leaks”, page 239](#)

1.1 Exploded view - silencers

1 - Bolt

☐ Bolted connection for exhaust system and fuel tank

☐ Renew ⇒ Electronic parts catalogue (ETKA)

☐ 23 Nm

2 - Bolt

☐ Only for bolted connection for exhaust system

☐ Renew ⇒ Electronic parts catalogue (ETKA)

☐ 23 Nm

3 - Cutting point

☐ Front ⇒ [page 236](#)

4 - Exhaust system (rear)

☐ To remove, first remove tunnel cross member ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim

☐ With cutting point ⇒ [page 236](#)

☐ Align exhaust system so it is free of stress ⇒ [page 238](#)

5 - Mounting

☐ To body

☐ Front

☐ Renew if damaged

6 - Cutting point

☐ Rear ⇒ [page 237](#)

7 - Mounting

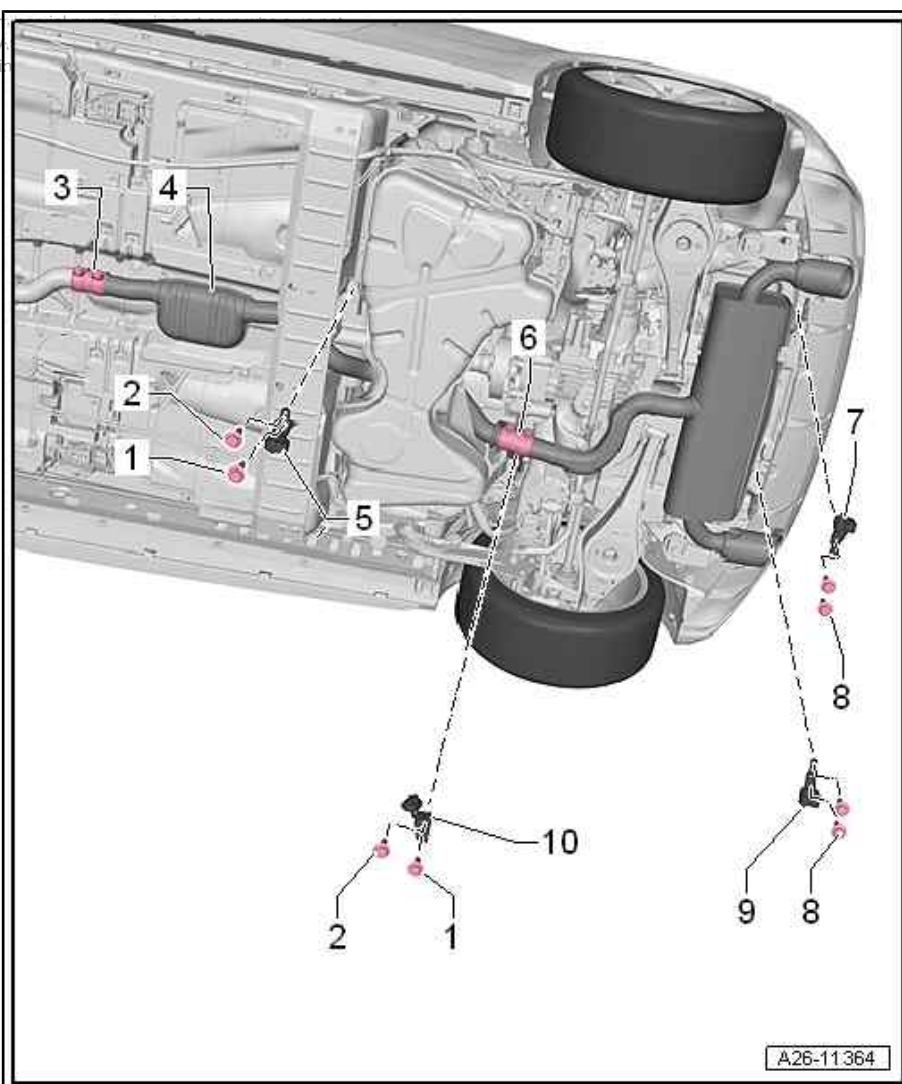
☐ To body

☐ Rear right

☐ Renew if damaged

8 - Bolt

☐ Renew ⇒ Electronic parts catalogue (ETKA)



- ☐ 23 Nm

9 - Mounting

- ☐ To body
- ☐ Rear left
- ☐ Renew if damaged

10 - Mounting

- ☐ To body
- ☐ Centre
- ☐ Renew if damaged

1.2 Separating exhaust pipes/silencers

⇒ "1.2.1 Separating exhaust pipes/silencers (front cutting point)", page 236

⇒ "1.2.2 Separating exhaust pipes/silencers (rear connection point)", page 237

1.2.1 Separating exhaust pipes/silencers (front cutting point)



Note

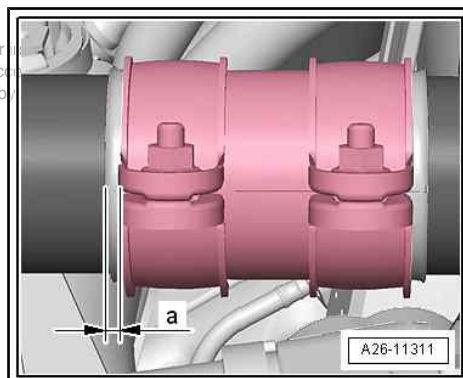
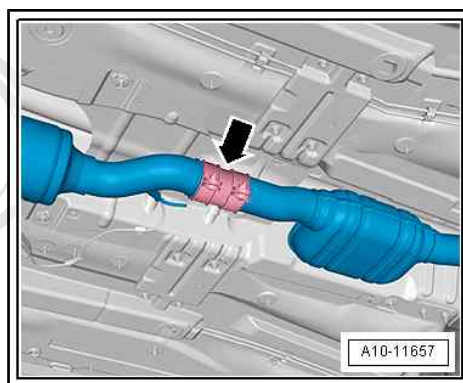
The exhaust system (rear) must be disconnected/cut in two places in order to remove it with the fuel tank installed
⇒ [page 237](#).

Removing

- Remove tunnel cross member ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .
- Loosen nuts for clamp -arrow-.
- Disconnect exhaust system at clamp (front and rear).
- Take out exhaust system towards front.

Installing

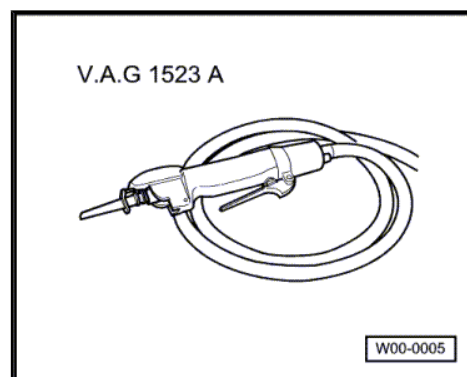
- Position clamp at both outer markings and tighten by hand.
- Distance -a = 5 mm-
- Then align the exhaust system so it is free of stress
⇒ [page 238](#) .
- Install tunnel cross member ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .



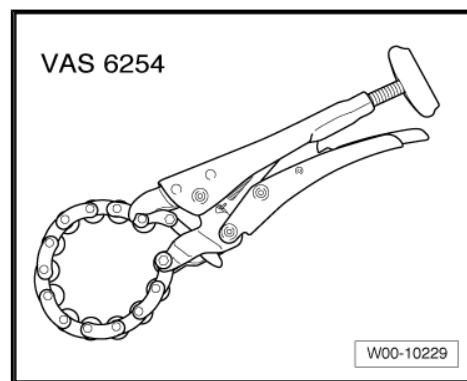
1.2.2 Separating exhaust pipes/silencers (rear connection point)

Special tools and workshop equipment required

- ◆ Body repair saw - V.A.G 1523 A- or



- ◆ Chain pipe cutter - VAS 6254-



- ◆ Torque wrench - V.A.G 1331- (not illustrated)

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- ◆ Safety goggles

- ◆ Protective clothing



Note

- ◆ The connecting pipe can be cut through at the cutting point provided in order to remove and install the front and rear silencers separately.
- ◆ The position of the cutting point must be measured.
- ◆ Measurement is taken from centre of mounting to cutting point.

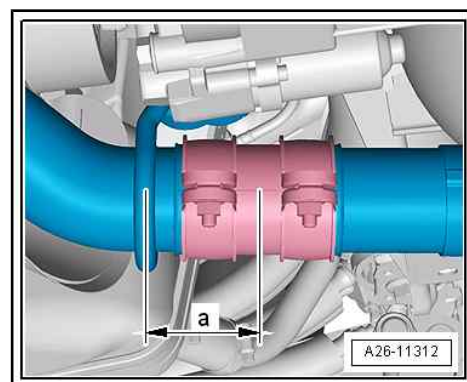
Distance -a- must be 64 mm.

Cutting



WARNING

Wear safety goggles and protective clothing to avoid any risk of injury from sharp metal parts.



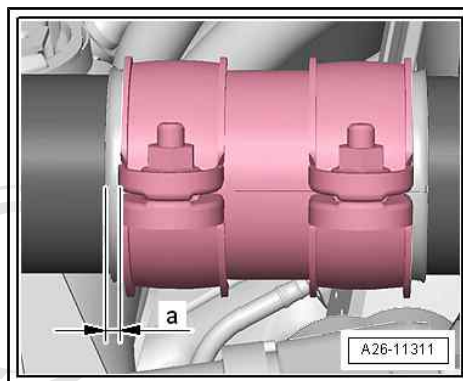
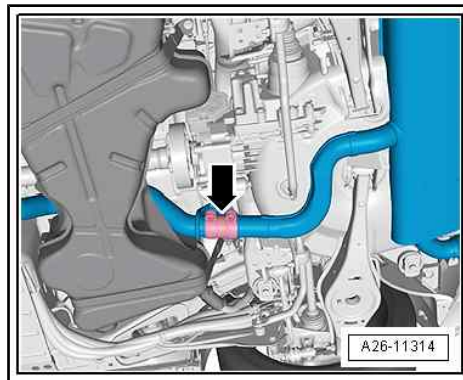
- Cut through exhaust pipe at right angles at position marked -arrow- e.g. using body repair saw - V.A.G 1523 A- or chain pipe cutter - VAS 6254- .

Connecting



Note

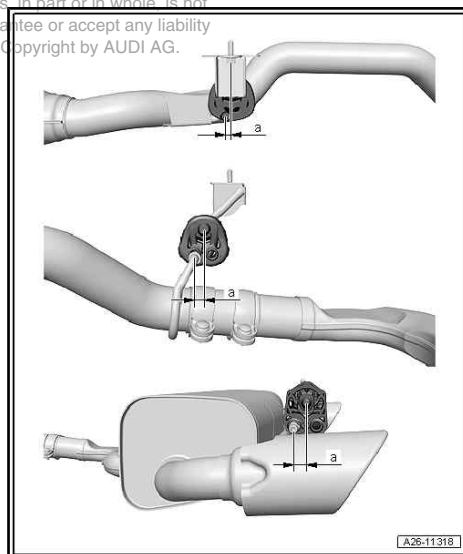
- ◆ A second mechanic is required to secure the rear clamp (repair - clamp).
- ◆ There must be a gap of approx. 10 mm between both exhaust pipes.
- Secure front silencer in mountings. Front clamp remains in place on pipes but is not tightened.
- Align rear silencer horizontally and hold in this position.
- Hand-tighten clamp in correct position.
- Distance -a = 5 mm-
- Then align the exhaust system so it is free of stress
⇒ [page 238](#) .



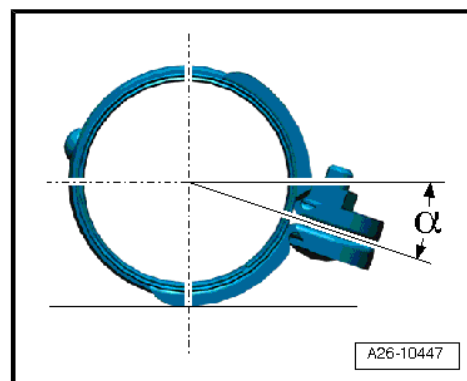
1.3 Stress-free alignment of exhaust system

Procedure

- The exhaust system must be aligned when it is cool.
- Loosen bolt connections for clamp.
- Push rear silencer towards front of vehicle until preloading at mountings -a- = 9 mm (front) ... 16 mm (rear).
- Distance top -a = 9 mm-
- Distance centre -a = 12 mm-
- Distance bottom -a = 16 mm-
- Fit the clamp at the angle shown.

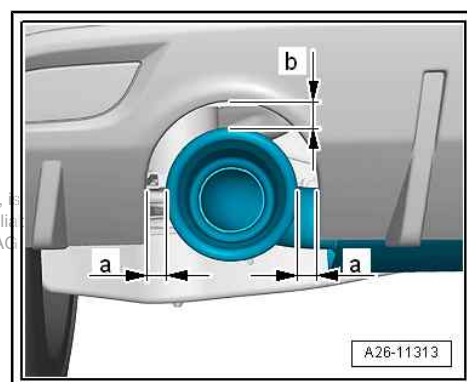


- Tightening torque for clamp is 23 Nm.
- α = approx. 45°
- Nuts facing upwards



Aligning tailpipe

- Adjust rear silencer so that there is an even distance between bumper cut-out and tailpipe.
- Distance -a- is the same on both sides.
- Distance -b- = 19 mm
- Unfasten rear silencer mounting to align tailpipes.
- Bolts must be renewed after they are loosened ⇒ [page 235](#)



Tightening torques

- ◆ ⇒ ["1.1 Exploded view - silencers", page 235](#)

1.4 Checking exhaust system for leaks

Procedure

- Start the engine and run at idling speed.
- Plug tailpipes during leak test (e.g. with cloth or plugs).
- Listen for leaks at joints between cylinder head and exhaust manifold with turbocharger, exhaust manifold/turbocharger and front exhaust pipe, etc.
- Rectify any leaks that are found.

2 Emission control system

⇒ "2.1 Exploded view - emission control system", page 240

⇒ "2.2 Removing and installing catalytic converter", page 241

2.1 Exploded view - emission control system

1 - Front exhaust pipe with catalytic converter and front silencer



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.

- ☐ Protect catalytic converter from damage by knocks and impact
- ☐ Removing and installing ⇒ page 241
- ☐ Do not remove protective packaging from replacement part until you are ready to fit the flexible joint
- ☐ Align exhaust system so it is free of stress ⇒ page 238

2 - Nut

- ☐ Renew ⇒ Electronic parts catalogue (ETKA)
- ☐ Coat threaded pins with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

- ☐ 40 Nm

3 - Lambda probe G39

- ☐ Removing and installing ⇒ page 226

4 - Gasket

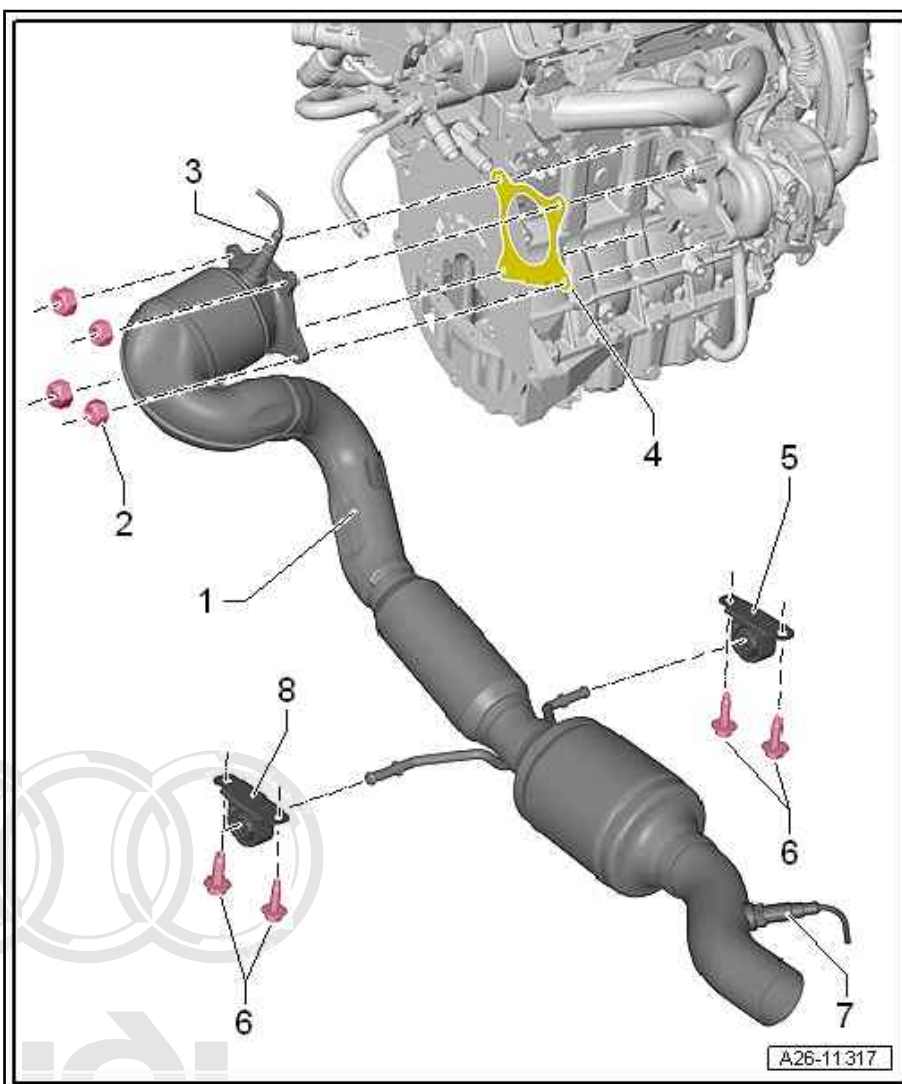
- ☐ Renew

5 - Mounting

- ☐ Right-side
- ☐ Renew if damaged

6 - Bolt

- ☐ Renew ⇒ Electronic parts catalogue (ETKA)
- ☐ 23 Nm



7 - Lambda probe 2 - G108-

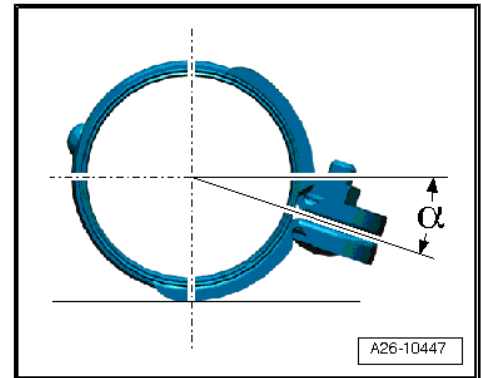
- ☐ Removing and installing ⇒ [page 227](#)

8 - Mounting

- ☐ Left-side
- ☐ Renew if damaged

Installation position of clamp

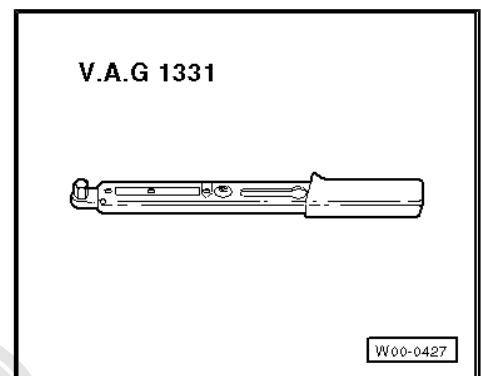
- Fit the clamp at the angle shown.
- α = approx. 45°
- Nuts facing upwards



2.2 Removing and installing catalytic converter

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-



- ◆ High-temperature paste ⇒ Electronic parts catalogue (ETKA)
- Engine removed ⇒ [page 9](#)

Removing



Caution

Avoid 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.*
- ◆ *Prevent flexible joint from bending by using transportation lock for flexible joint - T10404-.*

- Remove nuts -2- securing front exhaust pipe to turbocharger.
- Detach front exhaust pipe -1- with catalytic converter and front silencer.

Installing

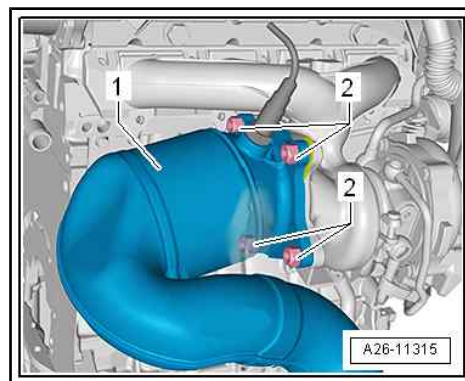
Installation is carried out in the reverse order; note the following.



Caution

Avoid 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.*
- ◆ *Prevent flexible joint from bending by using transportation lock for flexible joint - T10404- .*



- Install engine ⇒ [page 9](#) .
- Align the exhaust system so it is free of stress ⇒ [page 238](#) .

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - emission control system”, page 240](#)



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3 Exhaust manifold

The exhaust manifold and the turbocharger are combined as one unit; removing and installing ⇒ [page 164](#) .



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28 – Ignition system

1 Ignition system

⇒ "1.1 Exploded view - ignition system", page 244

⇒ "1.2 Test data, spark plugs", page 245

⇒ “1.3 Removing and installing ignition coils with output stages”, page 245

⇒ "1.4 Removing and installing knock sensor", page 246

⇒ "1.5 Removing and installing Hall sender", page 249

⇒ "1.6 Removing and installing engine speed sender G28 ", page 250

1.1 Exploded view - ignition system

1 - Ignition coil with output stage - N70-

- ☐ Removing and installing
⇒ [page 245](#)
- ☐ Cylinder 1
- ☐ Use puller - T40039- for
removal

2 - Ignition coil with output stage - N127-

- ❑ Removing and installing
⇒ [page 245](#)
- ❑ Cylinder 2
- ❑ Use puller - T40039- for removal

3 - Ignition coil with output stage - N291-

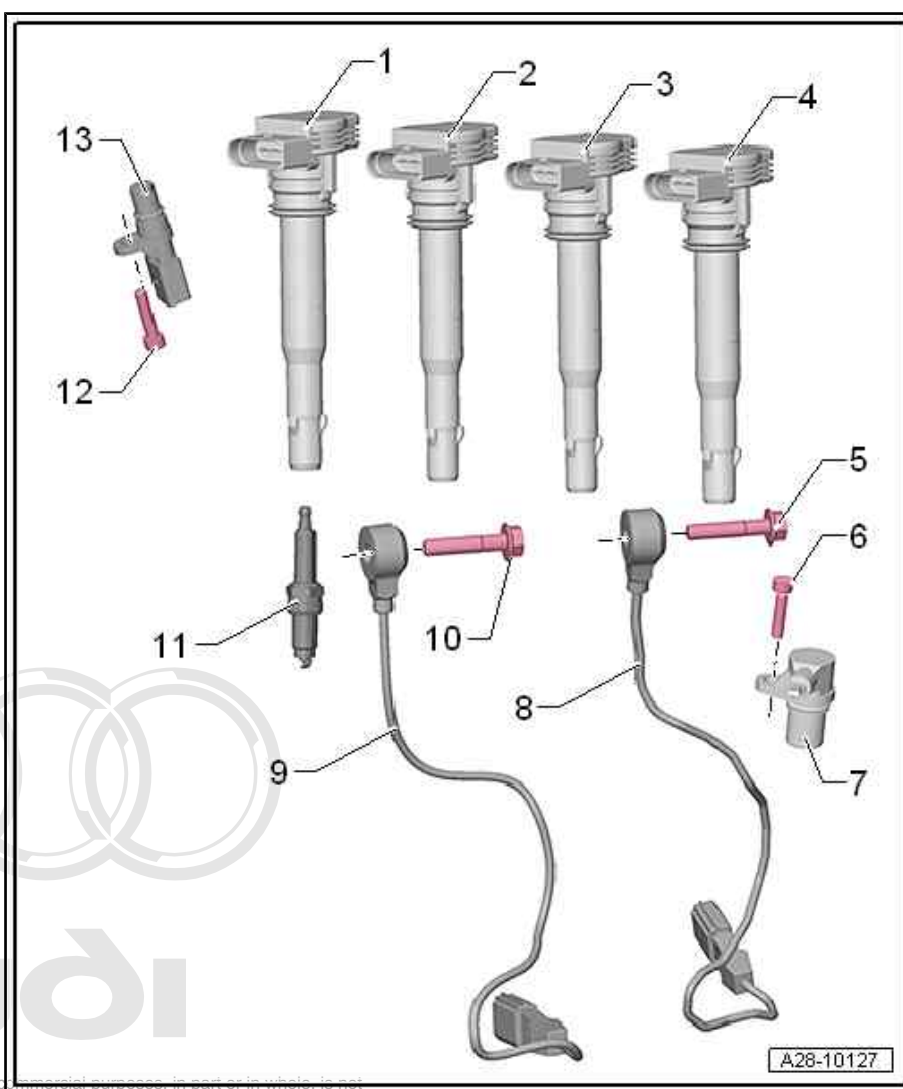
- ☐ Removing and installing
⇒ [page 245](#)
- ☐ Cylinder 3
- ☐ Use puller - T40039- for
removal

4 - Ignition coil with output stage - N292-

- ☐ Removing and installing
⇒ [page 245](#)
- ☐ Cylinder 4
- ☐ Use puller - T40039- for
removal

5 - Bolt

- Renew
- 20 Nm



A28-10125

⚠ Tightening torque influences the function of the knock sensor

6 - Bolt

- ☐ Engine speed sender - G28-
- ☐ 4 Nm + turn 45° further
- ☐ Renew bolt

7 - Engine speed sender - G28-

- ☐ Removing and installing ⇒ [page 250](#)
- ☐ Lubricate seal with oil

8 - Knock sensor 1 - G61-

- ☐ Removing and installing ⇒ [page 246](#)
- ☐ Contacts gold-plated
- ☐ Before removing, remove coolant distributor housing

9 - Knock sensor 2 - G66-

- ☐ Removing and installing ⇒ [page 247](#)
- ☐ Not installed in all vehicles
- ☐ Contacts gold-plated

10 - Bolt

- ☐ Renew
- ☐ 20 Nm
- ☐ Tightening torque influences the function of the knock sensor

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11 - Spark plug

- ☐ Removing and installing ⇒ Maintenance ; Booklet 819
- ☐ Use spark plug socket and extension - 3122 B- for removal

12 - Bolt

- ☐ 9 Nm

13 - Hall sender - G40-

- ☐ Removing and installing ⇒ [page 249](#)
- ☐ Renew O-ring if damaged
- ☐ Contacts gold-plated

1.2 Test data, spark plugs

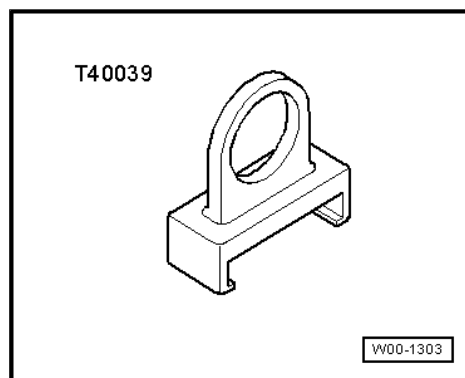
Engine data		2.0 ltr. TFSI engine
Idling speed is not adjustable; controlled by the idling speed stabilisation		760 ±100 rpm
Engine speed limiter (deactivates injectors/closes throttle valve)		6800 ±100 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.		
Ignition system		Multi-coil system with 4 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Electronic parts catalogue
	Tightening torque	⇒ Maintenance ; Booklet 819
Firing order		1-3-4-2

1.3 Removing and installing ignition coils with output stages

Special tools and workshop equipment required

◆ Puller - T40039-

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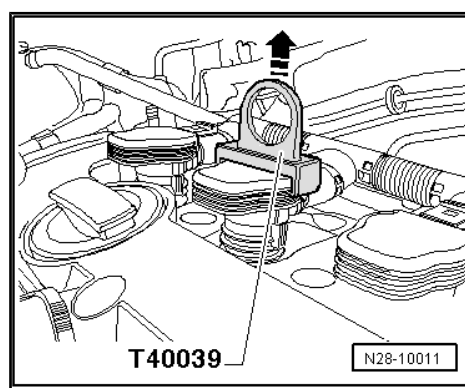


Removing:

- Release electrical connectors at all ignition coils and unplug all connectors from ignition coils simultaneously.
- Using puller - T40039- , pull all ignition coils out of spark plug holes.

Installing

- Fit all ignition coils loosely into spark plug holes.
- Align the ignition coils with the connectors and attach all connectors onto ignition coils simultaneously.
- Press ignition coils onto spark plugs by hand with uniform pressure (do not use any tools).



1.4 Removing and installing knock sensor

⇒ ["1.4.1 Removing and installing knock sensor 1 G61", page 246](#)

⇒ ["1.4.2 Removing and installing knock sensor 2 G66", page 247](#)

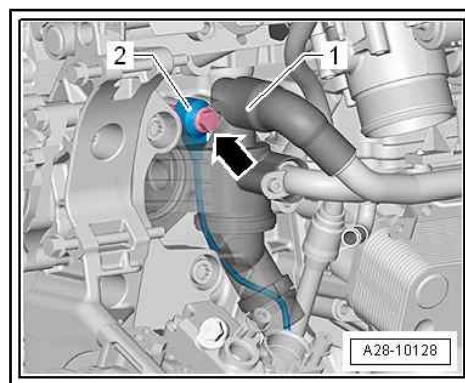
1.4.1 Removing and installing knock sensor 1 - G61-



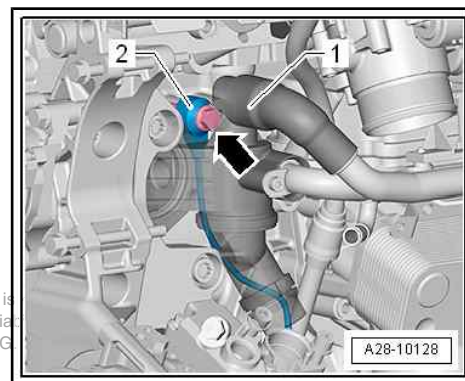
Knock sensor 1 - G61- -2- is located below the intake manifold and behind the thermostat -1-.

Removing

- Remove radiator cowl ⇒ [page 157](#) .
- Remove thermostat with housing ⇒ [page 145](#) .
- Unplug electrical connector for knock sensor 1 - G61- at coupling point.



- Unclip electrical wiring from retainers.
- Remove bolt -arrow- and detach knock sensor 1 - G61- -2-.



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Installing

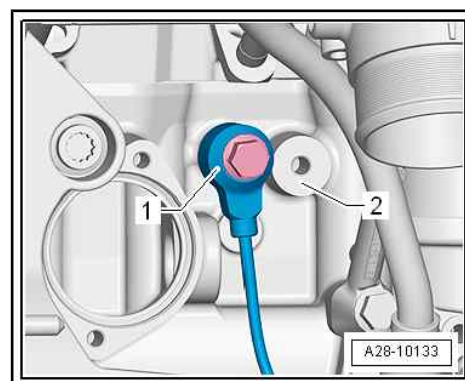
Installation is carried out in the reverse order; note the following:



Caution

Two threaded holes are provided. Knock sensor 1 - G61- is screwed into left threaded hole -1-.

Right threaded hole -2- is not used.



- Install radiator cowl ⇒ [page 157](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - ignition system", page 244](#)
- ◆ ⇒ ["2.1 Exploded view - coolant pump and thermostat", page 142](#)

1.4.2 Removing and installing knock sensor 2 - G66-

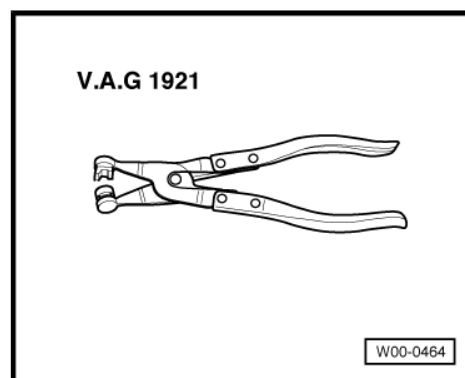


Note

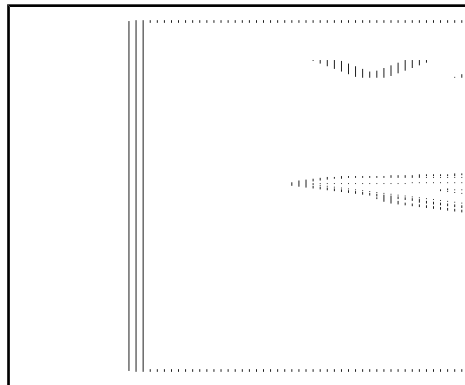
Knock sensor 2 - G66- is located below the intake manifold and behind the oil filter housing.

Special tools and workshop equipment required

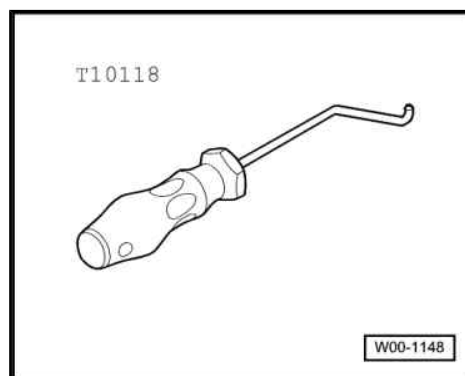
- ◆ Hose clip pliers - V.A.G 1921-



- ◆ Drip tray for workshop hoist - VAS 6208-

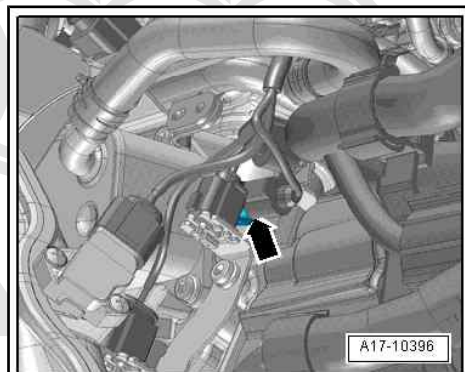


- ◆ Assembly tool - T10118-

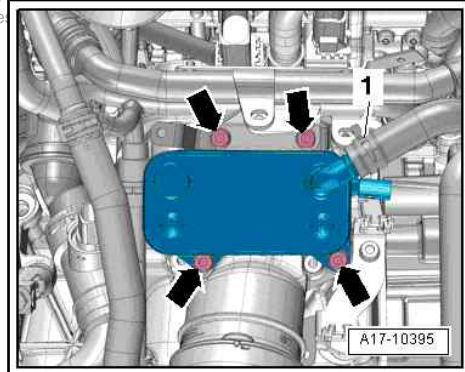


Removing

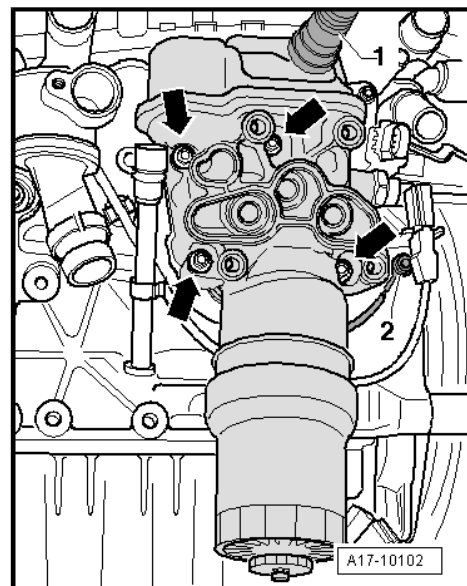
- Remove radiator cowl ⇒ [page 157](#) .
- Drain coolant ⇒ [page 135](#) .
- Drain oil filter housing ⇒ [page 123](#) .
- Use assembly tool - T10118- to release electrical connector -arrow- at oil pressure switch - F1- and knock sensor 2 - G66- and unplug.



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Detach coolant hose -1-.
- Unscrew bolts -arrows- and detach engine oil cooler.



- Press release tabs and disconnect crankcase breather pipe -1-.
- Unscrew bolts -arrows- and remove oil filter bracket.



- Knock sensor 2 - G66- is located behind oil filter bracket -1-.
- Unscrew bolt -arrow- and remove knock sensor 2 - G66- -2-.

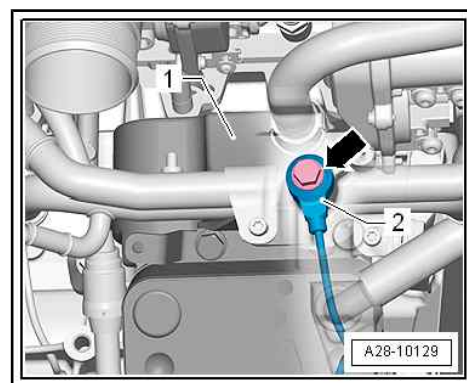
Installing

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



Note

- ◆ *Renew gaskets and seals.*
- ◆ *Secure all hose connections with clips (as original equipment)*
⇒ *Parts catalogue*.



Installation position of baffle plate ⇒ [page 120](#)

- Install radiator cowl ⇒ [page 157](#).

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”, page 244](#)
- ◆ ⇒ [“3.1 Exploded view - oil filter housing/oil pressure switch”, page 119](#)

1.5 Removing and installing Hall sender

Removing

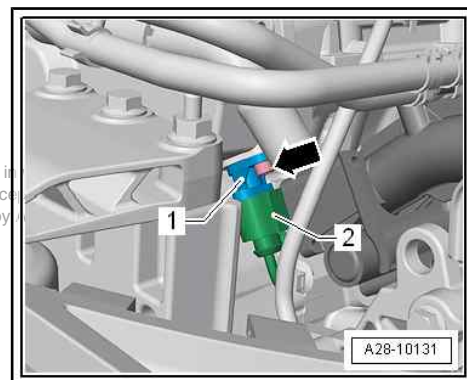
- Remove engine cover panel ⇒ [page 33](#).
- Unplug electrical connector -2-.
- Unscrew bolt -arrow- and remove Hall sender -1-.

Installing

- Renew O-ring.

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”, page 244](#)



1.6 Removing and installing engine speed sender - G28-

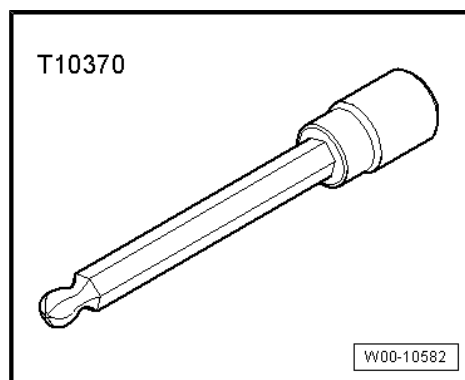


Note

Engine speed sender - G28- is located at the front (right-side, beside oil filter housing) between engine and gearbox.

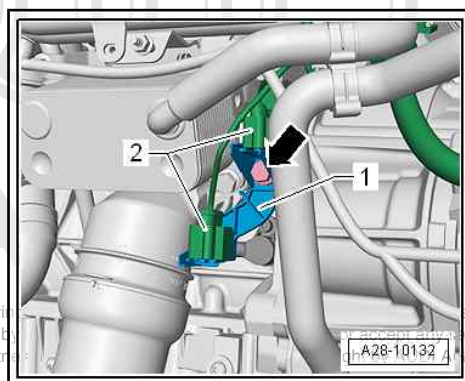
Special tools and workshop equipment required

- ◆ Socket, AF 4 mm - T10370-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unclip both connectors -2- from bracket -1-.
- Remove bolt -arrow- for bracket for coupling point -1- and detach bracket.



- Remove bolt -arrow- and detach engine speed sender - G28- -1-.

Installing

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

- Lubricate O-ring with clean engine oil.
- Carefully insert engine speed sender - G28- -1- into guide (do not knock in).

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - ignition system", page 244](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

