

Workshop Manual Audi A3 2004 ➤

4-cylinder TDI unit injector engine (1.9 ltr.; 2.0 ltr. 2-valve), mechanics

Engine ID	BMM	BLS							
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Edition 04.2013

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List of Workshop Manual Repair Groups

Repair Group

00 - Technical data

10 - Removing and installing engine

13 - Crankshaft group

15 - Cylinder head, valve gear

17 - Lubrication

19 - Cooling

21 - Turbocharging/supercharging

26 - Exhaust system

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

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Audi A3 2004 ►

4-cylinder TDI unit injector engine (1.9 ltr.; 2.0 ltr. 2-valve), mechanics - Edition 04.2013



Audi

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00 – Technical data

1 Engine number

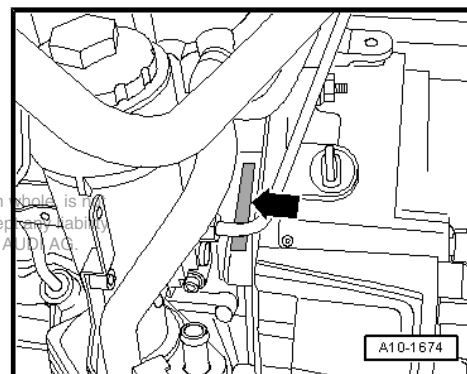
(ARL003323; Edition 04.2013)

The engine number ("Engine code" and "Serial number") can be found at the front of the joint between engine and gearbox.

Additionally there is a sticker on the toothed belt cover showing the "engine code" and "serial number".

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

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2 Engine data

Code letters		BLS	BMM
Capacity	ltr.	1.896	1.968
Power output	kW at rpm	77/4000	103/4000
Torque	Nm at rpm	250/1900	320/1750
Bore	Ø mm	79.5	81.0
Stroke	mm	95.5	95.5
Compression ratio		18.5	18.5
CN	at least	51	51
Firing order		1-3-4-2	1-3-4-2
Exhaust gas recirculation		yes	yes
Turbocharging/supercharging		Turbocharger	Turbocharger
Charge air cooling		yes	yes
Particulate filter		yes	yes
Valves per cylinder		2	2



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3 General repair instructions

3.1 Safety precautions when working on TDI engines

When working on the fuel system note the following warnings:



WARNING

Risk of injury - fuel system operates under pressure.

- ◆ *Wrap a clean cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*

The fuel can become extremely hot. This can cause injuries.

- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*

Observe the following points to prevent personal injuries and damage to the injection and glow plug system:

- ◆ Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- ◆ Always switch off ignition before washing engine.
- ◆ Faults are stored in the engine control unit if electrical connectors were unplugged and the engine was started: "Interrogate event memory" in "Vehicle self-diagnosis" ⇒ Vehicle diagnostic tester.

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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.*

– Disconnect battery ⇒ Rep. gr. 27 .

When working on the cooling system note the following warnings:

**WARNING**

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

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

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.*

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3.2 Handling ceramic glow plugs

Metal glow plugs are installed on Audi A3 with 4-cyl. 1.9 ltr. 2V TDI engine.

Metal or ceramic glow plugs are installed on Audi A3 with 4-cyl. 2.0 ltr. 2V TDI engine.

Removing and installing ⇒ Rep. gr. 28

Visible features of ceramic glow plugs

Vehicles with 2-valve cylinder head

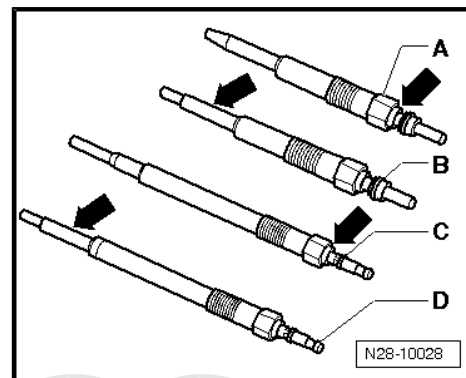
-A- = metal glow plug with colour coding -arrow-

-B- = ceramic glow plug with supporting tube -arrow- (no colour coding)



Note

Glow plugs -C and D- can be disregarded.



Important: Note the following points regarding ceramic glow plugs:



Caution

- ◆ *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28.*
- ◆ *Use only the approved type of ceramic glow plugs ⇒ Electronic parts catalogue.*
- ◆ *Transport and store only in original packaging or packed separately in bubble wrap.*
- ◆ *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- ◆ *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- ◆ *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- ◆ *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- ◆ *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- ◆ *To check compression, select function "Self-diagnosis compatible systems" in "Guided Fault Finding" ⇒ Vehicle diagnostic tester.*
- ◆ *The ceramic glow plugs must not be removed when checking cylinder compression.*

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

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

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

3.4 Checking for leaks in the fuel system

- Start the engine and let it run at medium speed for a few minutes.
- Switch off ignition.
- Check the entire fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Then carry out a road test with at least one full-power acceleration.
- Then check high-pressure part of fuel system again for leakage.

3.5 Foreign particles in engine

When working on the engine, all open inlet and exhaust ports must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122-) to prevent foreign particles from entering the engine.

3.6 Contact corrosion!

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

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

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

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

Note the following:

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

3.7 Routing and attachment of pipes, hoses and wiring

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

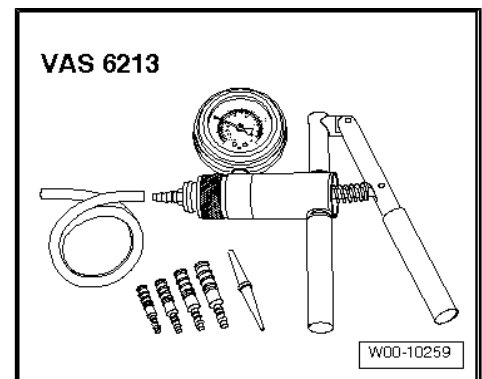
3.8 Installing radiators, condensers and charge air coolers

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

3.9 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-

**Procedure**

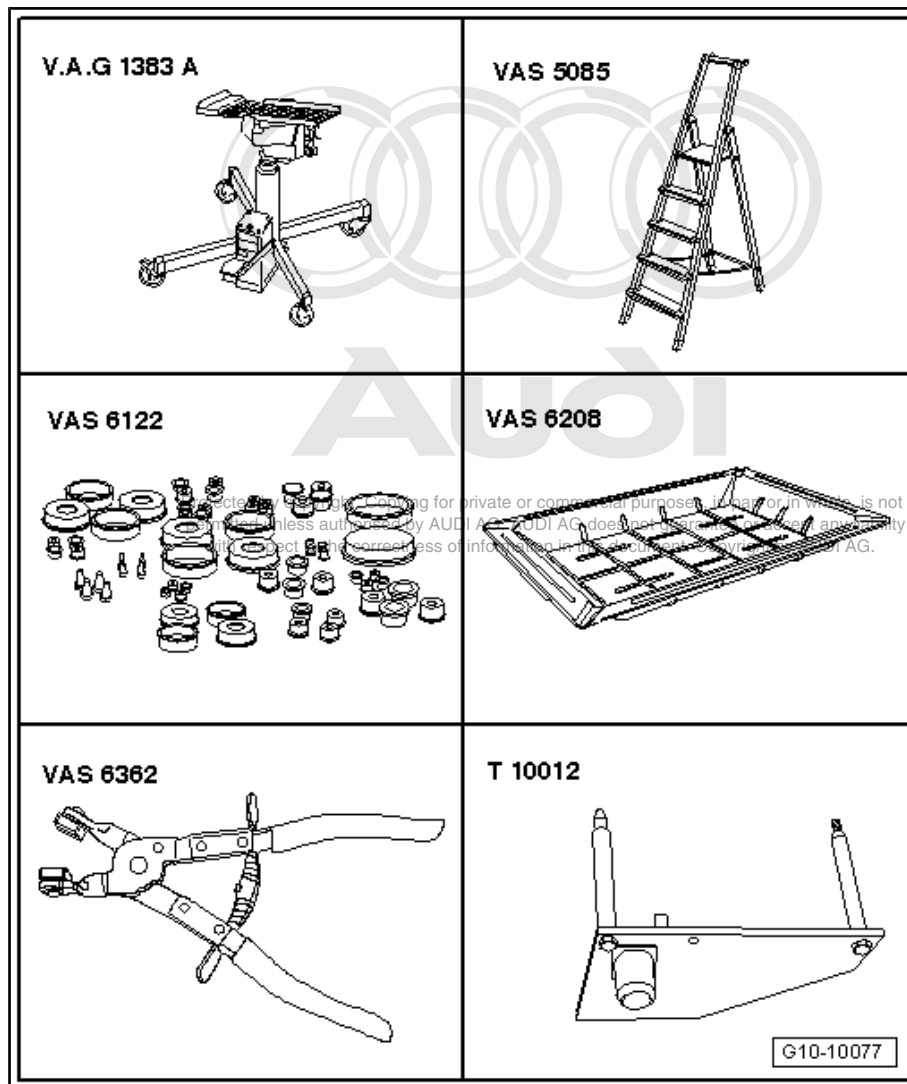
- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If an entry is stored in the event memory, check the 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.

10 – Removing and installing engine

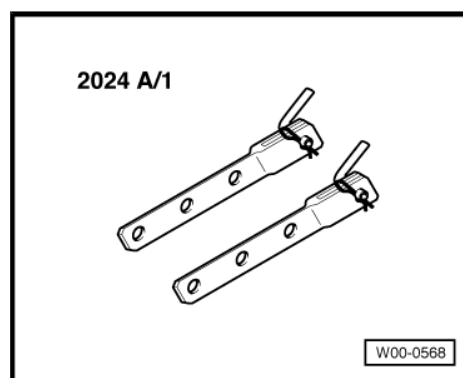
1 Removing engine

Special tools and workshop equipment required

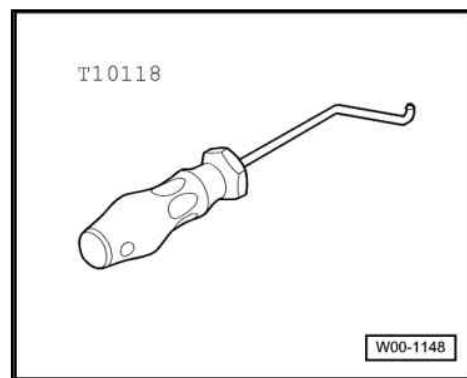
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Stepladder - VAS 5085-
- ◆ Engine bung set - VAS 6122-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Engine bracket - T10012-



- ◆ Extension -2024 A /1-



- ◆ Assembly tool - T10118-

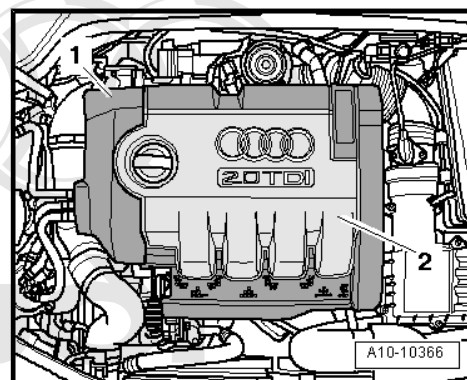


Procedure

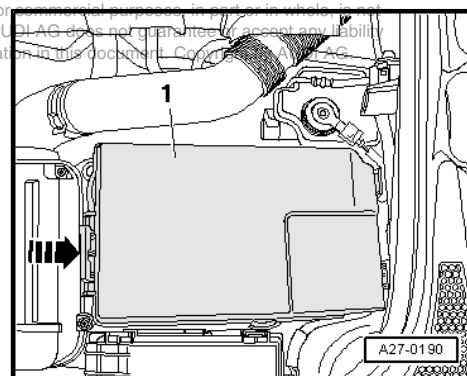


Note

- ◆ *The engine is removed from underneath together with the gearbox.*
- ◆ *Collect drained coolant in a clean container for re-use or disposal.*
- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



- Remove cover -1- over battery; to do so, press release tab -arrow-.




Caution

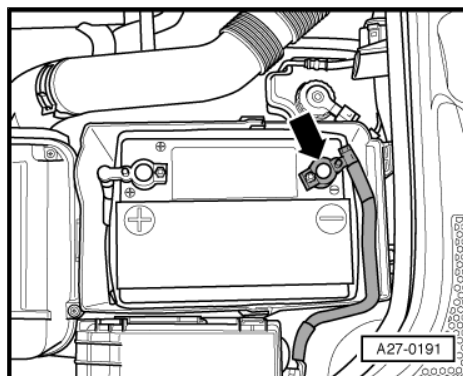
Observe notes on procedure for disconnecting the battery ⇒ Rep. gr. 27.

- With ignition switched off, disconnect battery earth cable -arrow-.

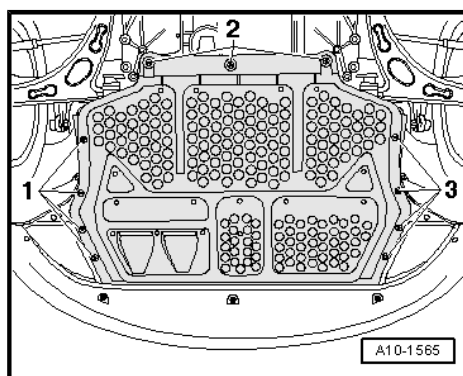

WARNING

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

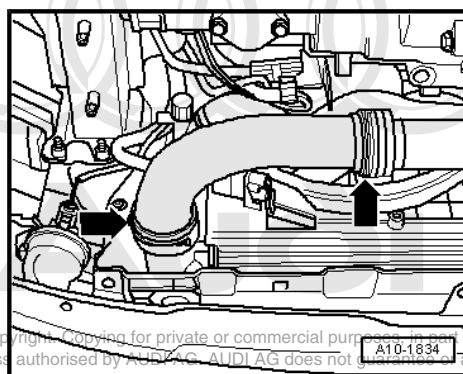
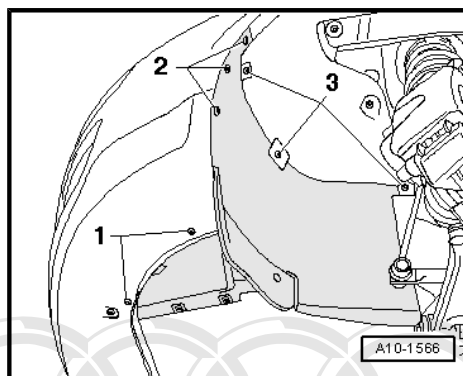
- Open filler cap on coolant expansion tank.
- Remove both front wheels.
- Remove centre noise insulation -fasteners 1 ... 3-.



- Remove noise insulation (left and right) -fasteners 1 ... 3-.



- Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.



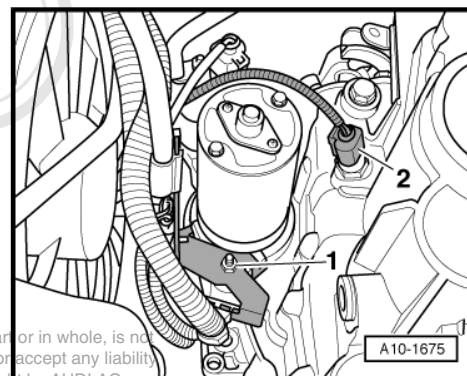
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Vehicles with manual gearbox:

- Unplug electrical connector -2- for reversing light switch - F4- .

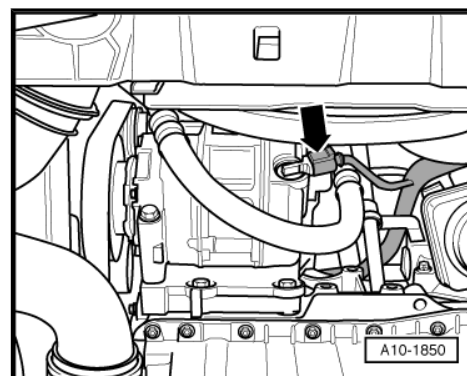
All vehicles (continued):

- Unscrew nut -1- and remove bracket with wiring from stud.
- Unclip bracket from wiring harness.

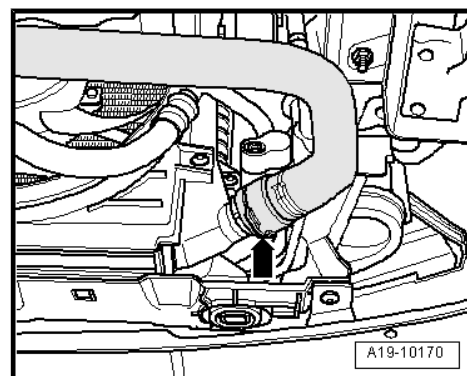


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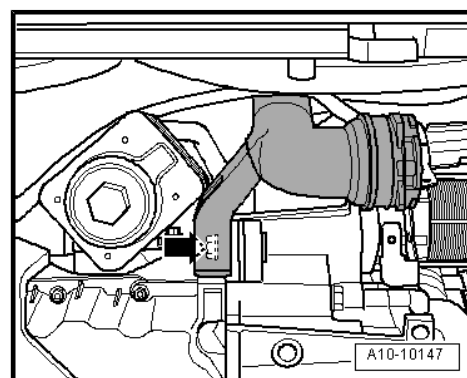
- Unplug electrical connector -arrow- for magnetic clutch of air conditioner compressor.



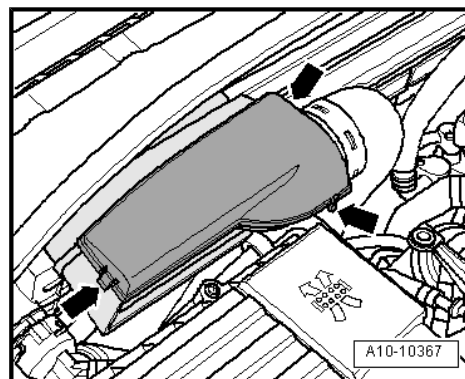
- Place drip tray for workshop hoist - VAS 6208- under engine.
- Lift retaining clip -arrow- and disconnect coolant hose from radiator.



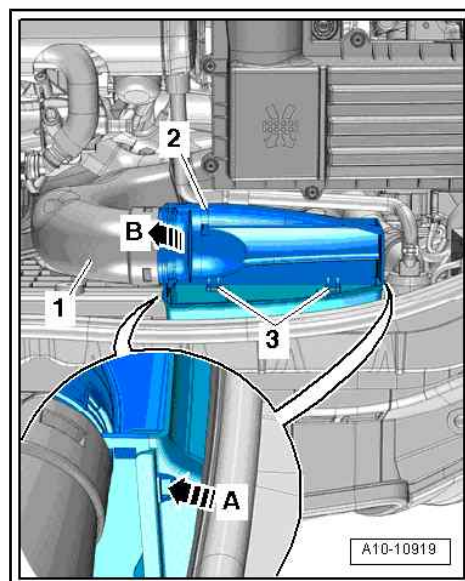
- Remove bolt -arrow- for air intake pipe (left-side).



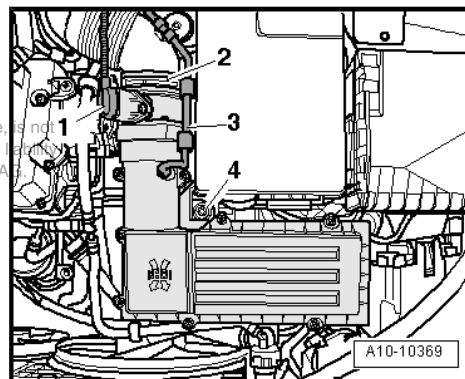
- Pull cover off air duct (release clips on sides) -arrows-.



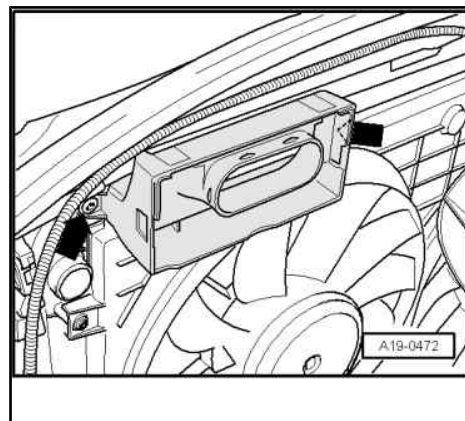
- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.



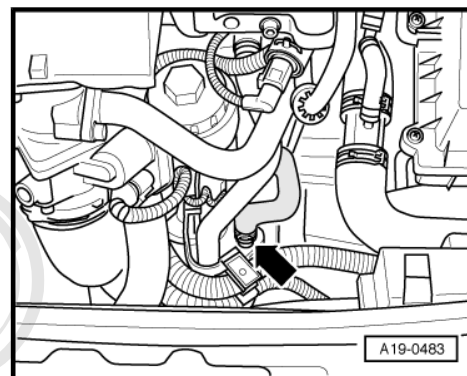
- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.



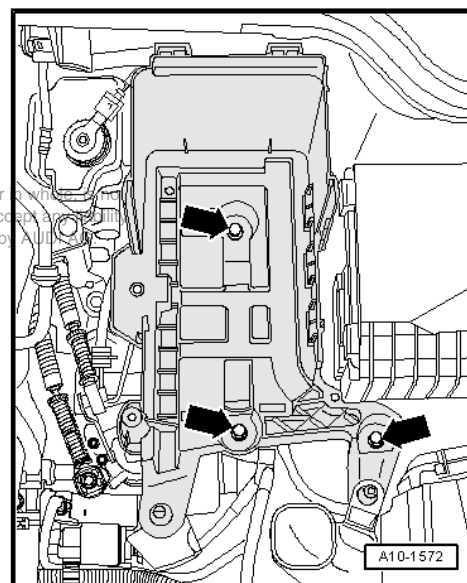
- Unscrew air duct at lock carrier -arrows-.



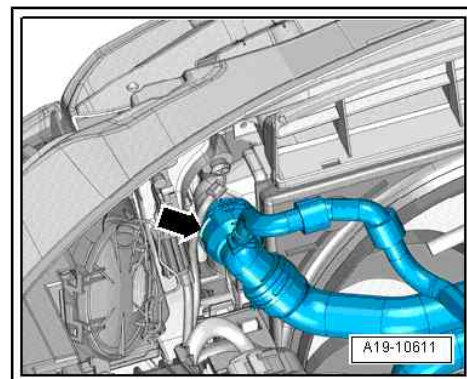
- Disconnect coolant hose at bottom of engine oil cooler -arrow- and drain off remaining coolant.



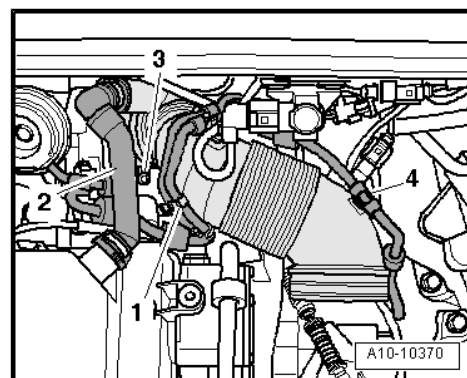
- Remove battery ⇒ Rep. gr. 27 .
- Remove battery tray -arrows-.



- Lift retaining clip -arrow- and disconnect coolant hose (top left) from radiator.



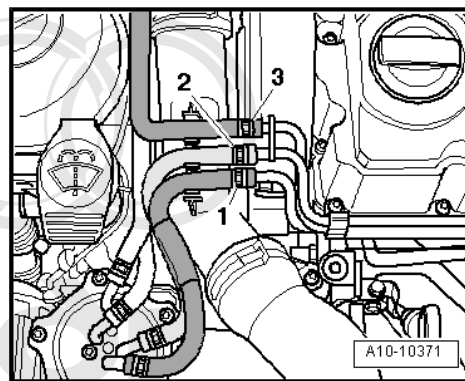
- Detach crankcase breather hose -2-.
- Move vent hose -4- and vacuum hoses -1- clear at air intake hose.
- Remove bolt -3-.
- Swing air hose to rear and detach from turbocharger.





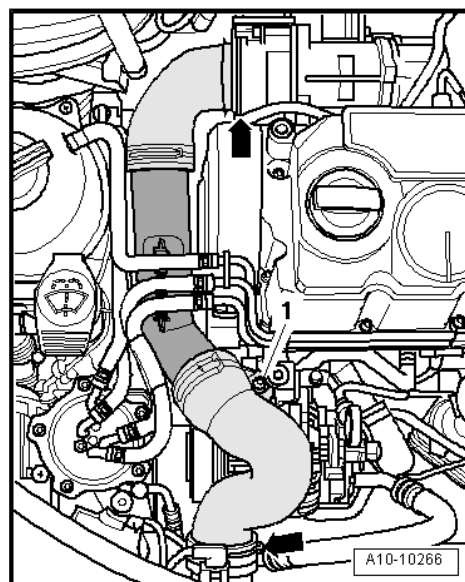
WARNING

- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*



- Disconnect fuel supply hose -2- and fuel return hose -1- from fuel lines.
- Detach coolant hose -3-.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.

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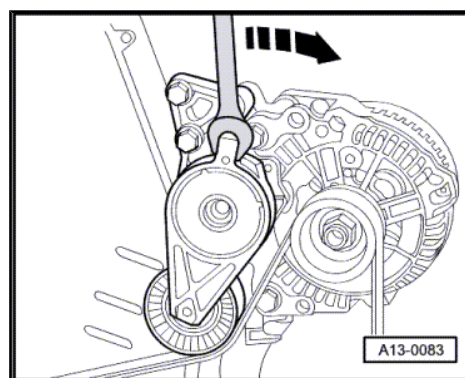
Vehicles with air conditioning:



Note

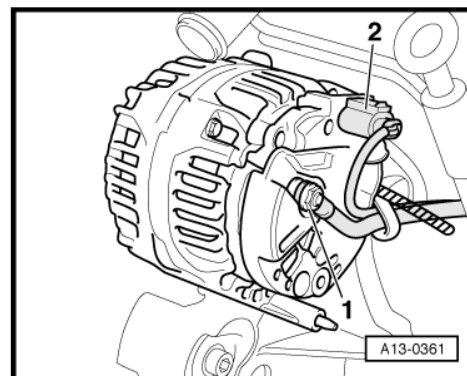
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- To slacken poly V-belt turn tensioner in clockwise direction -arrow-.
- Remove poly V-belt.
- Release tensioner.

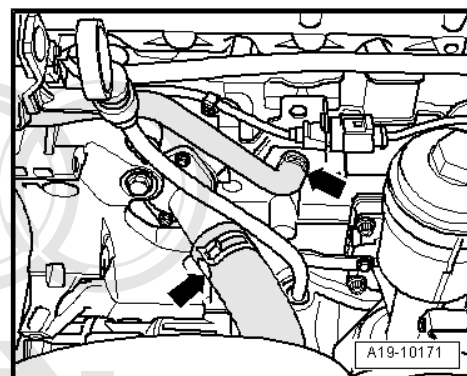


All vehicles (continued):

- Unplug electrical connector -2-.
- Unscrew wire -1- at alternator.
- Unscrew wire clamp on alternator.



- Disconnect coolant hoses -arrows-.
- Move coolant hoses clear.

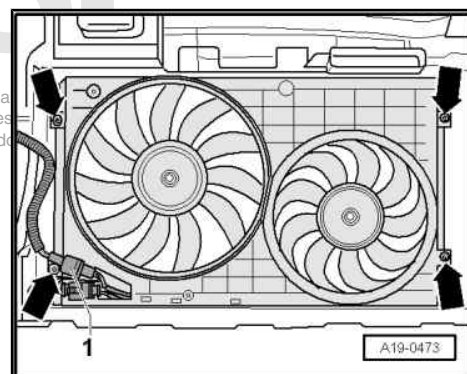


- Unscrew top bolts -upper arrows- for radiator cowl.

**Note**

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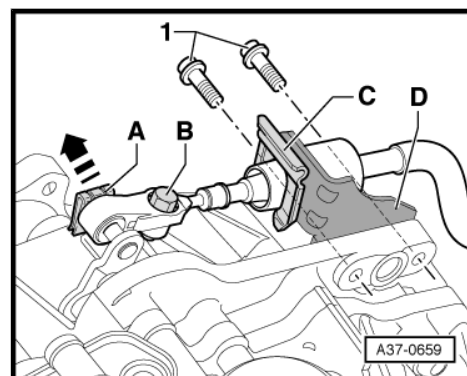
The bolts -bottom arrows- are removed at a later stage.

**Vehicles with dual clutch gearbox:**

- Unscrew bolts -1- for cable support bracket -D-.
- Pull off the retaining clip -A- upwards -arrow- and detach selector lever cable from gearbox.

**Note**

Disregard items -B- and -C-.

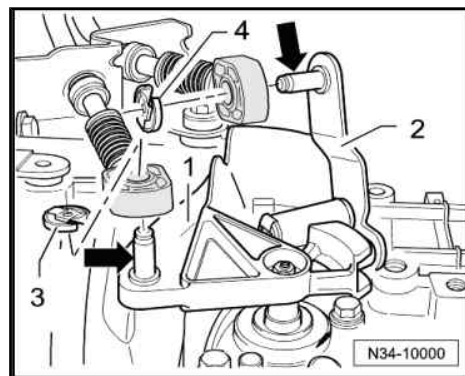


Vehicles with manual gearbox:

- Detach securing clip -3- for gear selector cable from gearbox selector lever -1- and pull cable off pin -arrow-.

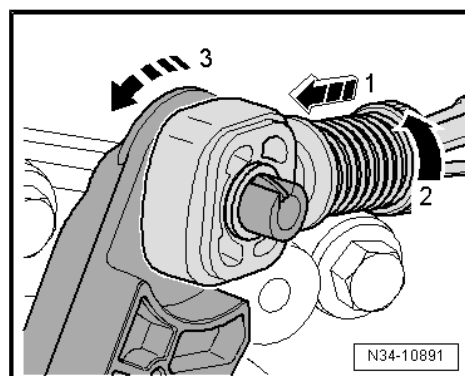
Metal relay lever:

- Detach securing clip -4- for gate selector cable from relay lever -2- and pull cable off pin -arrow-.



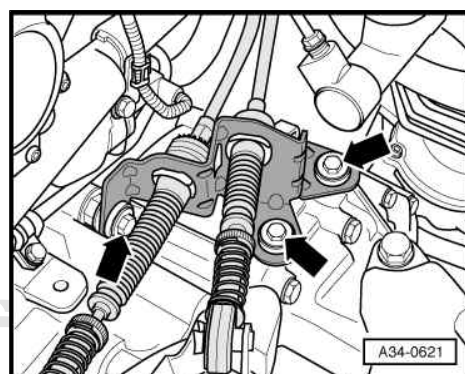
Plastic relay lever:

- To prevent damage to gate selector cable, cable end-piece must be detached from gate selector cable before removing.
- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press gate relay lever towards front -arrow 3-.

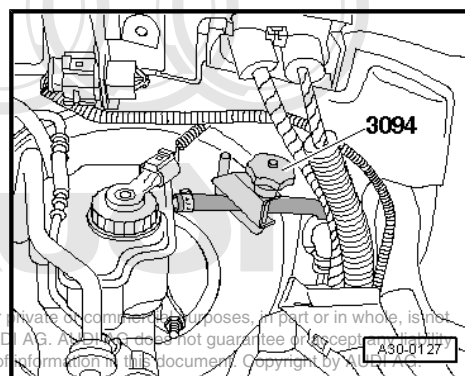


Vehicles with manual gearbox (continued):

- Remove cable support bracket -arrows- from manual gearbox and place to one side (selector cables remain fitted).



- Vehicles with plastic pipe between clutch master cylinder and slave cylinder: clamp off supply hose at brake fluid reservoir using hose clamp -3094- .

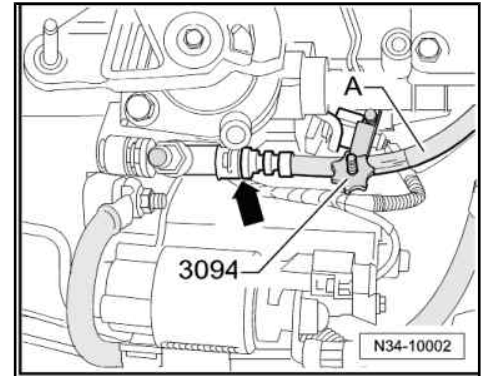


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- Vehicles with pipe/hose assembly between clutch master cylinder and slave cylinder: clamp off hose -A- at pipe/hose assembly using hose clamp - 3094- .

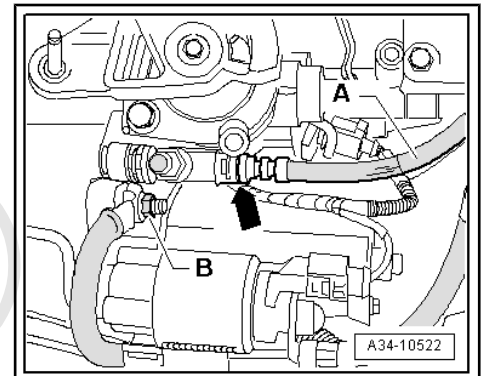
**Note**

Disregard -arrow-.

**Note**

Make sure brake fluid does not come into contact with starter or gearbox when performing the following operations. If it does, clean affected area thoroughly.

- Pull out clip -arrow- as far as stop.
- Pull plastic pipe or pipe/hose assembly -A- out of bleeder connection for clutch slave cylinder.

**Note**

Disregard -item B-.

- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

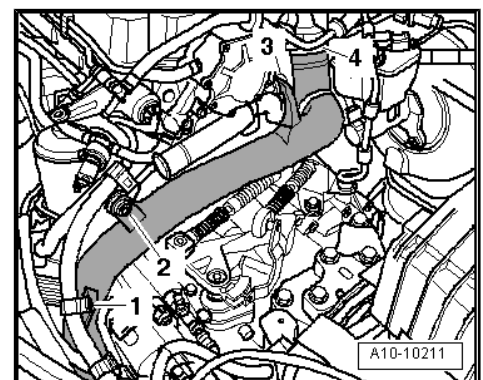
**Caution**

Do not press clutch pedal after removing slave cylinder.

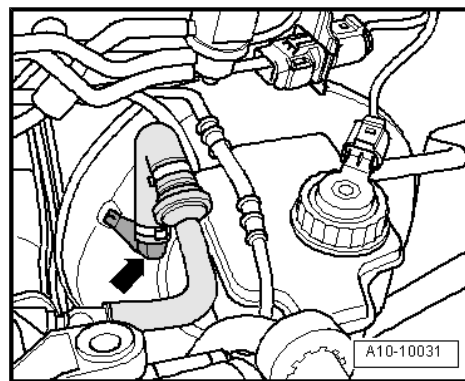
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All vehicles (continued):

- Unclip wiring clip -1-.
- Remove bolts -2- and -3-.
- Detach air pipe (left-side) from turbocharger by lifting retaining clip -4- slightly.
- Remove air pipe from engine compartment downwards.



- Disconnect vacuum hose -arrow- at brake servo.



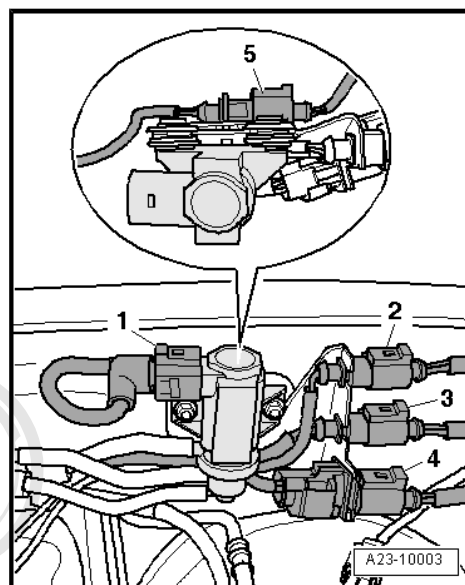
- Unplug electrical connectors:
- 1 - Charge pressure control solenoid valve - N75-
- 2 - Exhaust gas temperature sender 1 - G235- (black)
- 4 - Lambda probe - G39-



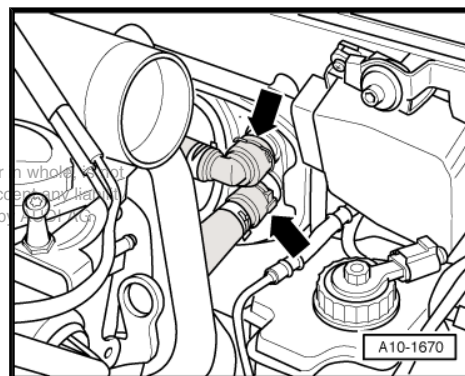
Note

Disregard -item 3-.

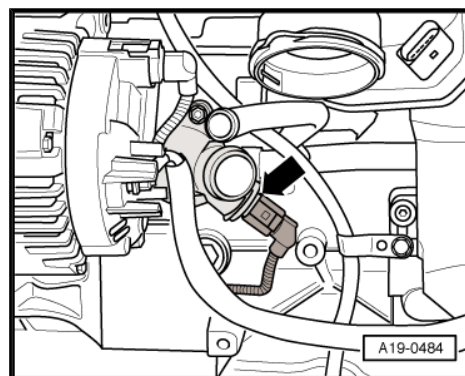
- Unscrew bolts and place charge pressure control solenoid valve - N75- on engine (hoses remain connected).



- Detach coolant hoses leading to heat exchanger for heater at plenum chamber partition panel -arrows-.

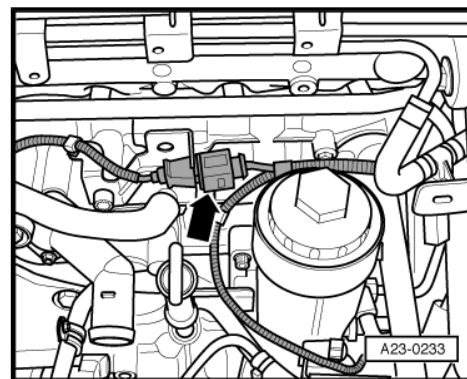


- Unplug electrical connector -arrow- at radiator outlet coolant temperature sender - G83- .

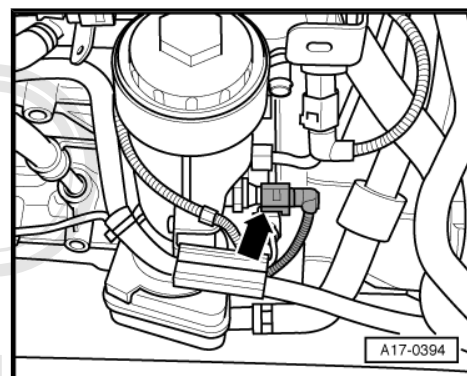


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- Remove electrical connector -arrow- for Hall sender - G40- from bracket and unplug.

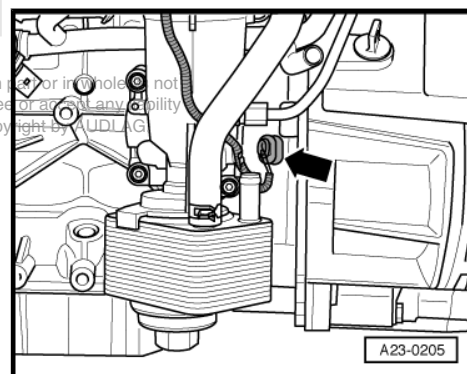


- Unplug electrical connector -arrow- at oil pressure switch - F1- .
- Unscrew oil pressure switch.

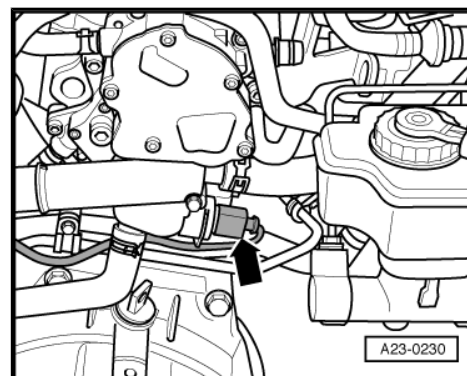


- Unplug electrical connector -arrow- at engine speed sender - G28- using assembly tool - T10118- .
- Move wiring harness clear.

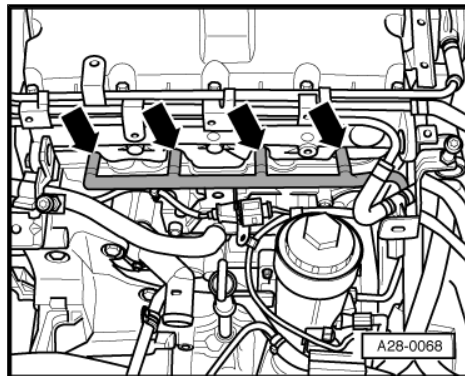
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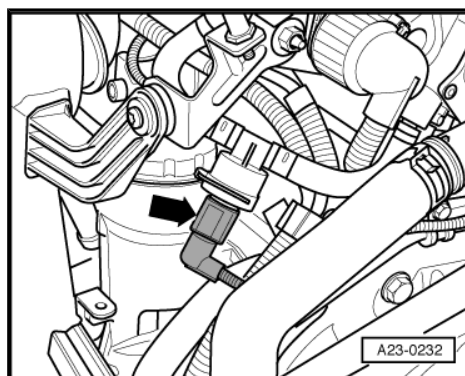
- Unplug electrical connector -arrow- at coolant temperature sender - G62- .



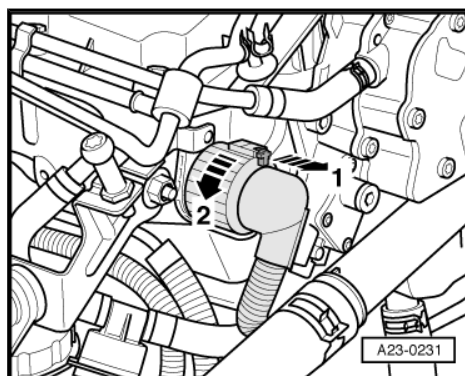
- Detach connector rail from glow plugs -arrows-.



- Unplug electrical connector -arrow- at fuel temperature sender - G81- and move wiring clear.

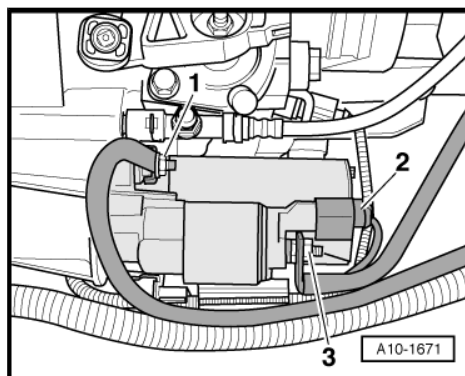


- Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
- Disconnect main connector for unit injectors and move wiring harness clear.



Vehicles with manual gearbox:

- Disconnect earth cable -1-.
- Detach electrical wires -2- and -3- at starter.

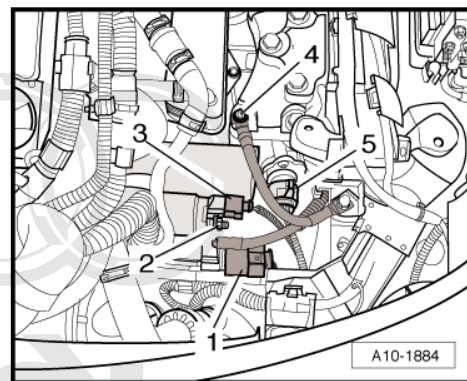


Vehicles with dual clutch gearbox:

- Remove cable tie for protective cover.
- Unplug electrical connector -3-.
- Push back protective cover and unscrew B+ cable -2- at solenoid switch.
- Unplug electrical connector -5-.
- Disconnect earth cable -4-.

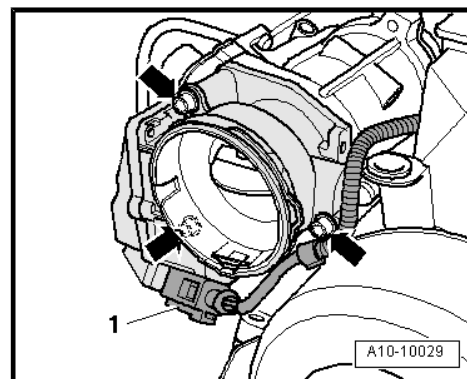
**Note**

Disregard -item 1-.

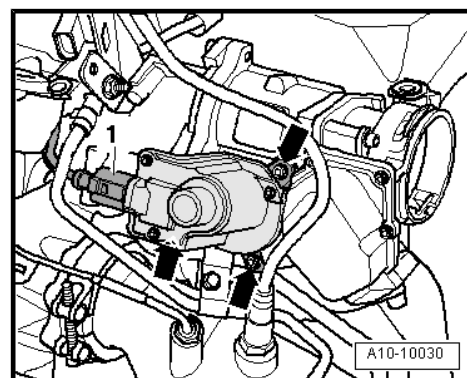
**All vehicles (continued):**

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- Set aside wiring harness leading to body.
- Detach electrical connector -1- at intake manifold flap motor - V157- .
- Remove bolts -arrows- and detach intake manifold flap motor - V157- .



- Unplug electrical connector -1- at exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212- .
- Remove bolts -arrows-.
- Detach exhaust gas recirculation valve - N18- at intake manifold.

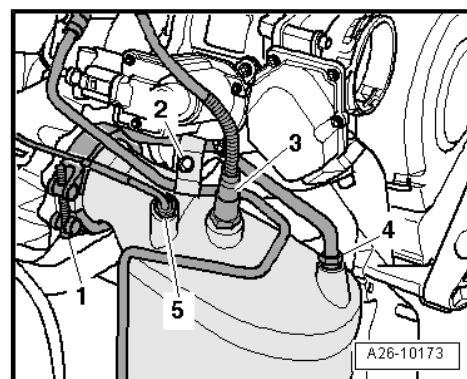
**Note**

Shown from rear with engine removed for illustration purposes.

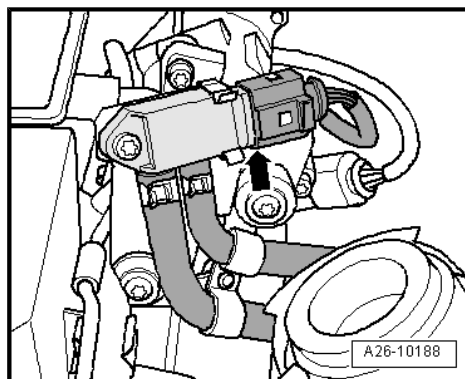
- Slacken retaining clamp -1- for particulate filter.
- Detach retaining clamp.

**Note**

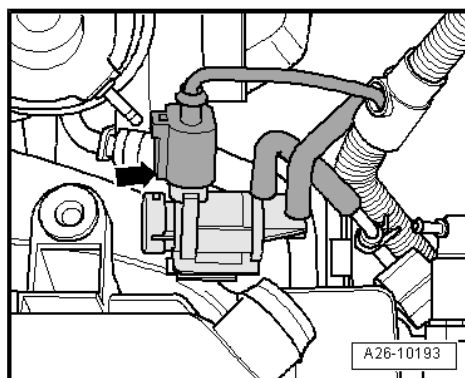
Disregard items marked -2 ... 5-.



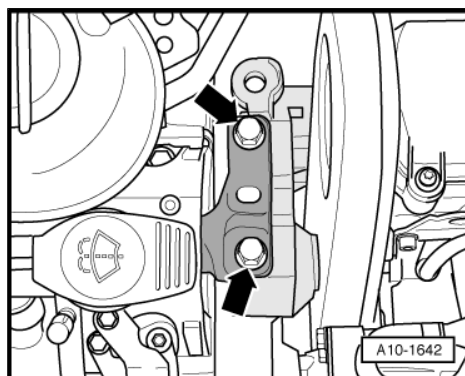
- Unplug electrical connector -arrow- at exhaust gas pressure sensor 1 - G450- .
- Remove exhaust gas pressure sensor 1 - G450- with bracket and move clear.



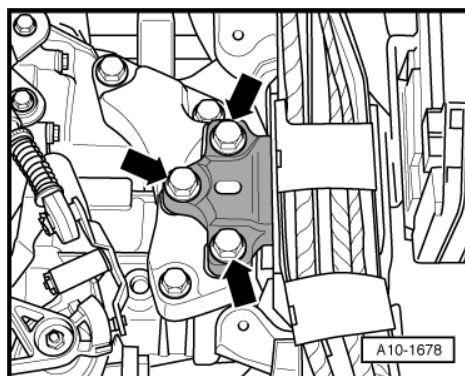
- Unplug electrical connector at exhaust gas recirculation cooler change-over valve - N345- -arrow-.
- Set aside wiring harness leading to body.



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

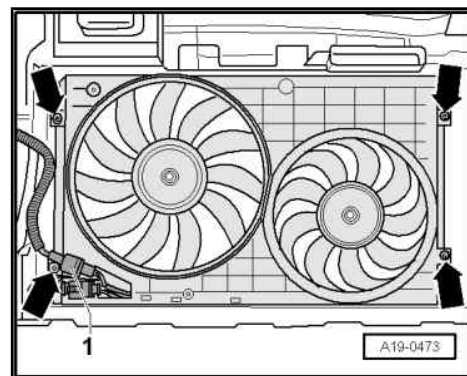


- Loosen bolts -arrows- of assembly mounting for gearbox approx. 2 turns.



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- Unplug electrical connector -1-.
- Unscrew bottom bolts for radiator cowl -bottom arrows- and remove radiator cowl downwards.



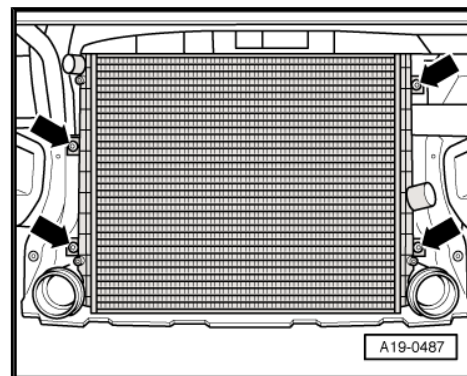
- Remove bolts -arrows- at rear and lift out radiator.

**WARNING**

The air conditioner refrigerant circuit must not be opened.

**Note**

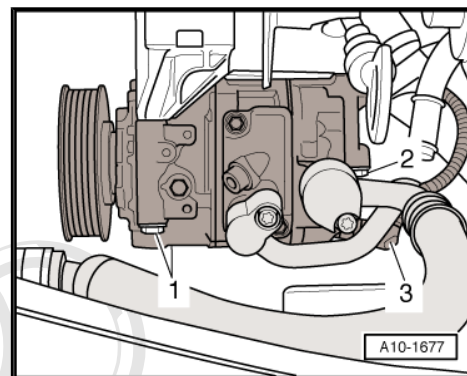
To prevent damage to the air conditioner compressor and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.



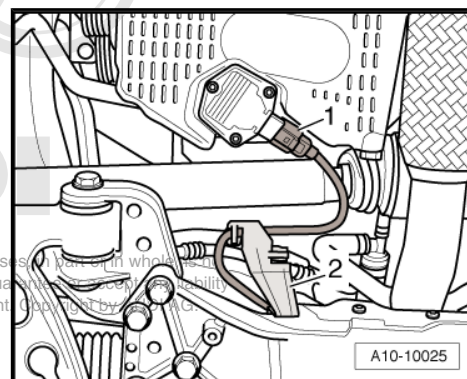
- Unscrew bolts -1- and -2- for air conditioner compressor.
- Tie air conditioner compressor up to lock carrier.

**Note**

Disregard -item 3-.



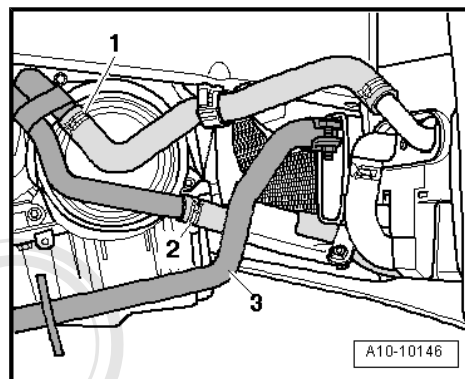
- Unplug electrical connector -1- at oil level and oil temperature sender - G266- .
- Unclip bracket -2- at subframe.



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Vehicles with auxiliary heater:

- Remove exhaust pipe -3- for auxiliary heater ⇒ Rep. gr. 82 .
- Detach coolant hoses -1- and -2- for auxiliary heater and move hoses clear.



Vehicles with front-wheel drive:

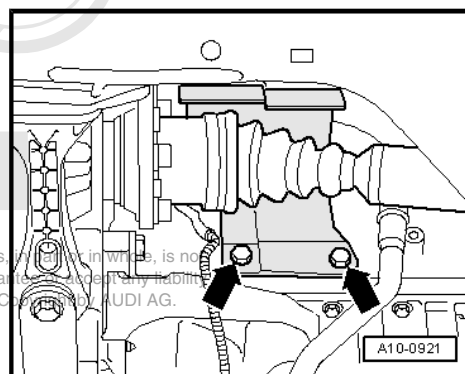
- Unbolt heat shield -arrows- for drive shaft (right-side).
- Unbolt drive shafts (left and right) from gearbox flange shaft.
- Tie up drive shaft (left-side).



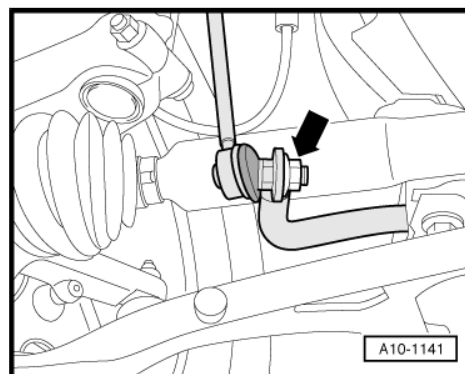
Note

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



- Remove nuts -arrow- for coupling rod on anti-roll bar on both sides.



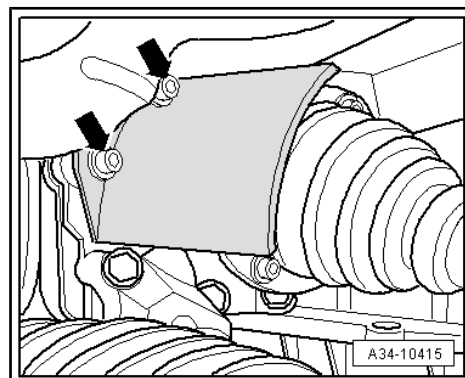
Vehicles with four-wheel drive:

- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Detach drive shaft (left-side) from flange shaft of gearbox and tie up.
- Detach drive shaft (right-side) from flange shaft of bevel box.



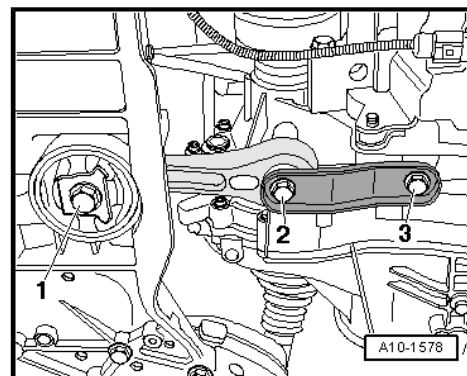
Note

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

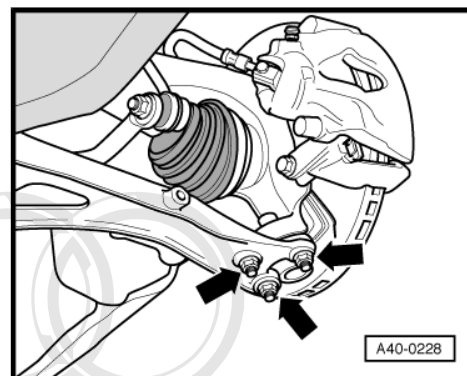


All vehicles (continued):

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



- Mark position of nuts -arrows- securing swivel joint.
- Remove nuts for swivel joint (right-side).
- If fitted, remove nut on bracket for front right vehicle level sender - G289- .
- Detach swivel joint from wishbone.



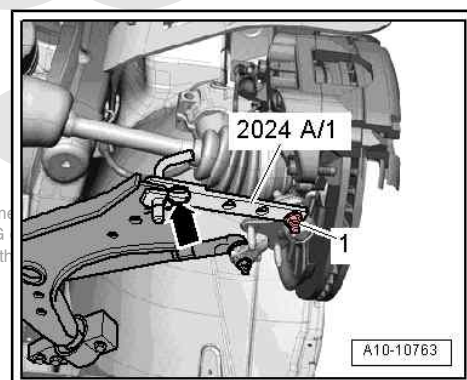
- Swing suspension strut (right-side) outwards and support with extension -2024 A /1- as shown in illustration.

**WARNING**

Accident risk from loose components of support bracket.

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

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**Note**

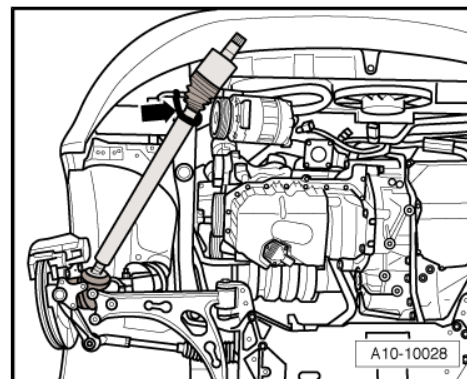
The illustration shows the installation position on front suspension (left-side).

Vehicles with front-wheel drive:

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

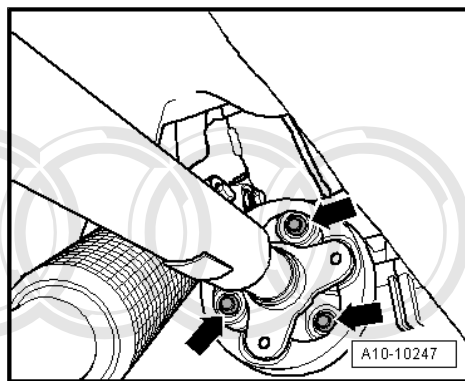
**Note**

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



Vehicles with four-wheel drive:

- Mark position of flexible coupling and flange for bevel box in relation to each other.
- Unbolt flexible coupling for propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).



- Push engine/gearbox assembly forward slightly (towards front end) and pull propshaft off bevel box.

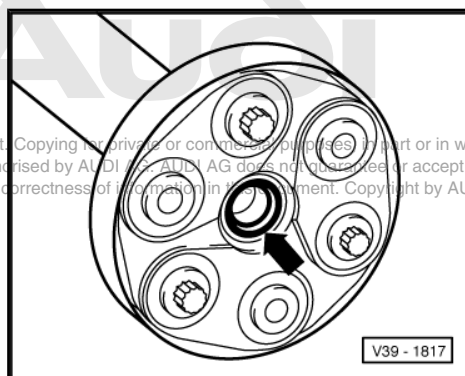


Caution

Make sure not to damage the seal -arrow- in the propshaft flange.

- ◆ **Push the propshaft horizontally to the rear and towards the right side of vehicle as far as possible.**

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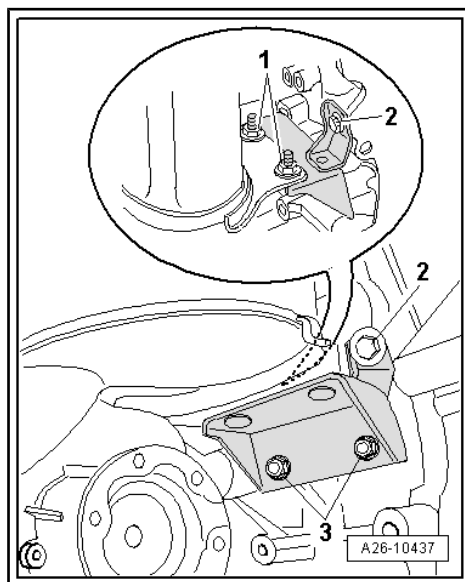


Note

The propshaft must be renewed if oil seal is damaged.

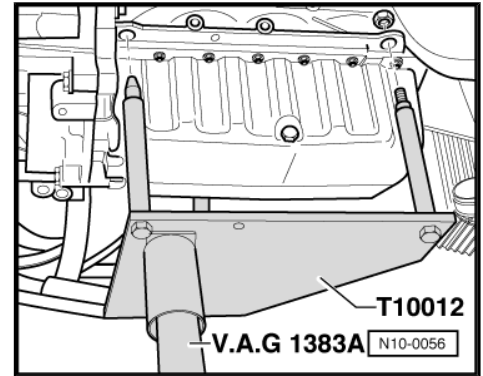
All vehicles (continued):

- Remove nuts -1, 3- and bolt -2- and detach bracket for particulate filter.
- Tie up particulate filter to rear.



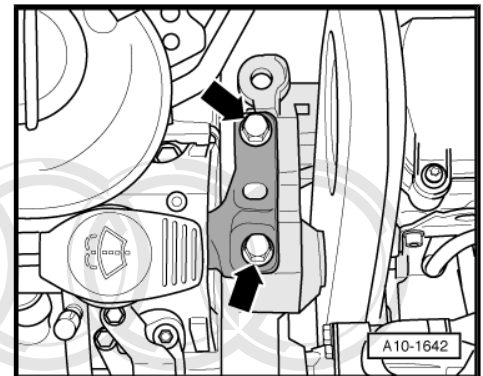
**Note**

- ◆ *On vehicles with auxiliary heater the coolant pipes leading to the auxiliary heater must be disconnected from the cylinder block in order to attach engine bracket - T10012- .*
- ◆ *Remove coolant hose bracket to gain access to drilling at front of cylinder block.*
- Attach engine bracket - T10012- with securing nut and bolt to cylinder block: approx. 20 Nm.
- Apply engine and gearbox jack - V.A.G 1383 A- to engine bracket - T10012- and raise engine/gearbox assembly slightly.

**Note**

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

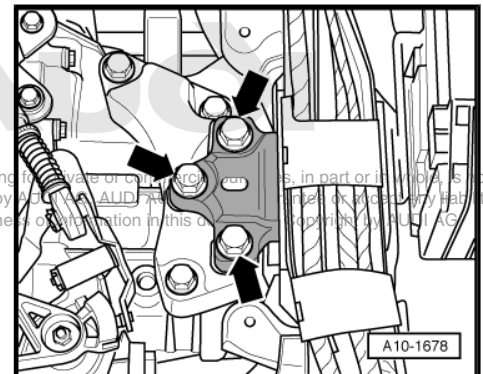
- Loosen and remove bolts -arrows- of assembly mounting on engine.



- Loosen and remove bolts -arrows- of assembly mounting on gearbox.

**Note**

- ◆ *Check that all hoses, pipes and wiring connections between engine, gearbox and body have been detached.*
- ◆ *Carefully guide engine/gearbox assembly when lowering to avoid damage.*
- ◆ *Make sure there is sufficient clearance from air conditioner compressor.*

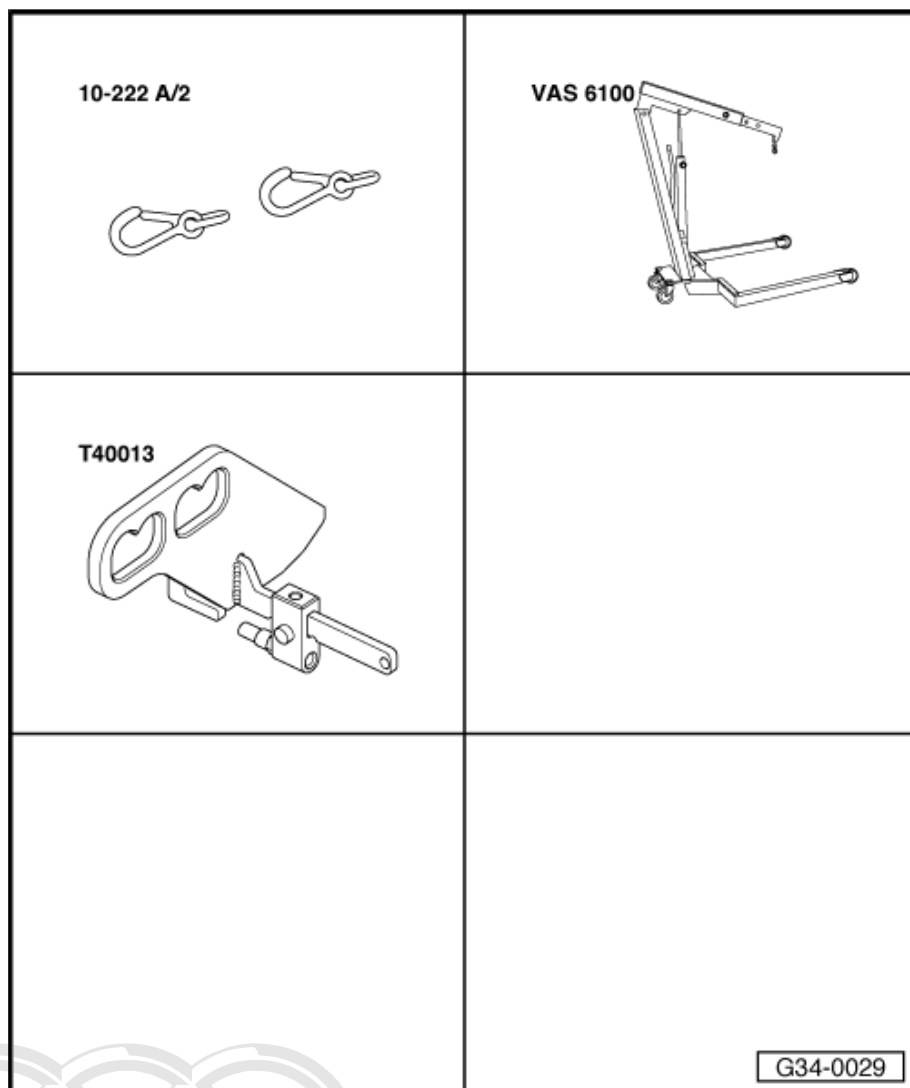


- First lower engine/gearbox assembly only slightly.
- Then swing gearbox end of engine/gearbox assembly forwards and only then lower further.

2 Separating engine from manual gearbox

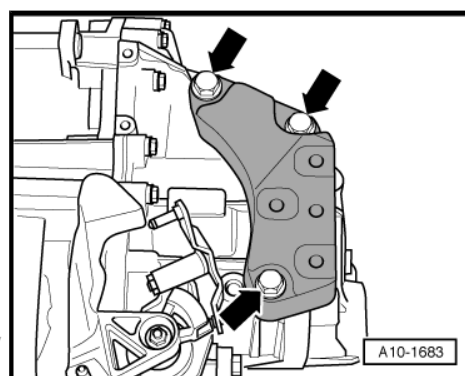
Special tools and workshop equipment required

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



Procedure

- Engine/gearbox assembly removed and attached to engine bracket - T10012- .
- Unscrew bolts -arrows- and detach gearbox support.



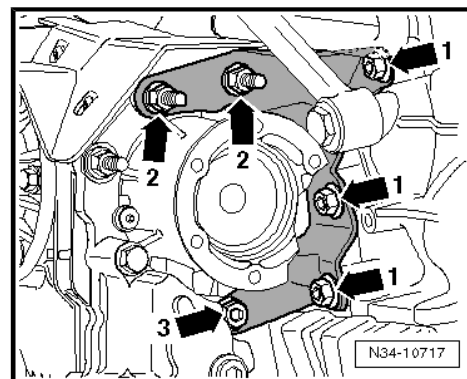
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Vehicles with four-wheel drive:

- Remove bolts -arrows 2, 3- securing bracket for bevel box.

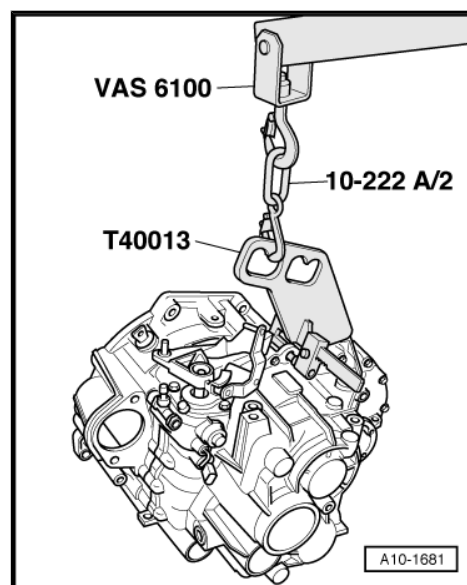


Disregard -arrows 1-.

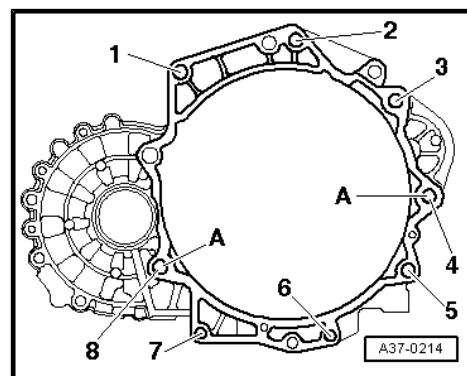
**All vehicles (continued):**

- Attach lifting tackle - T40013- to gearbox and close lock.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the written permission of Audi AG. All rights reserved. Copyright by Audi AG. **Attach workshop hoist - VAS 6100- with hooks - 10-222 A/2- to the lifting tackle.**



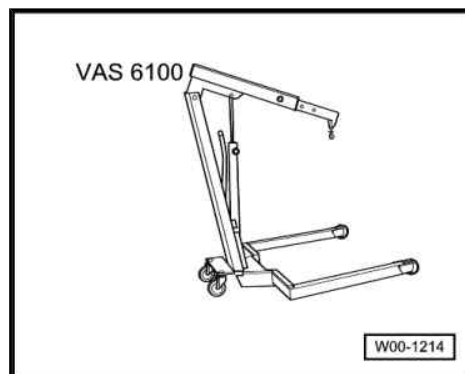
- Remove bolts -1 ... 8- on engine/gearbox flange.
- Detach starter.
- Separate gearbox from engine.



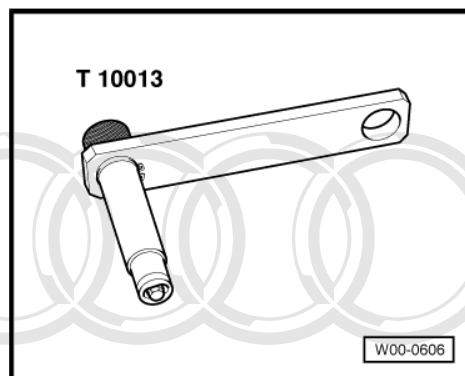
3 Separating engine and dual clutch gearbox

Special tools and workshop equipment required

- ◆ Workshop hoist - VAS 6100-



- ◆ Retainer - T10013-

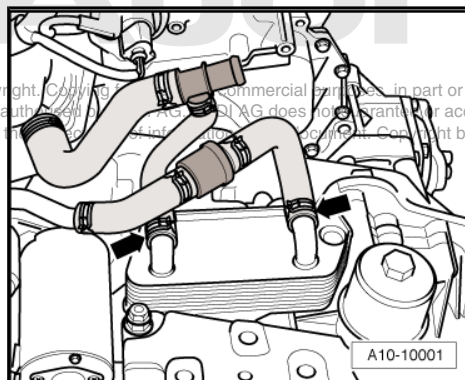


- ◆ Bolt M8x40 with nut and washer (30 mm outer diameter)

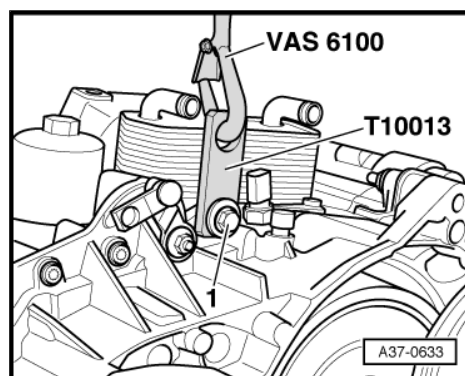
Procedure

- Disconnect coolant hoses -arrows- at gear oil cooler.

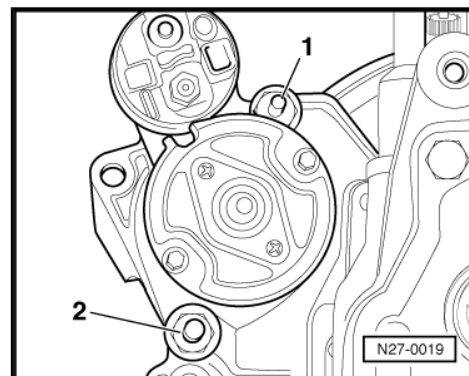
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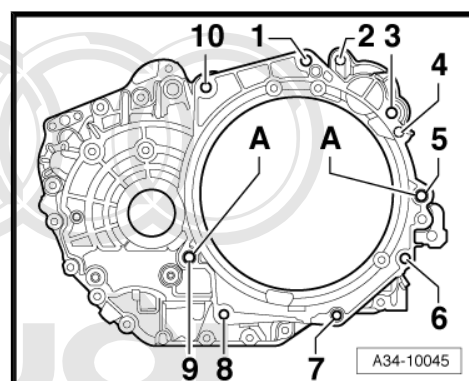
- Remove the pin from retainer - T10013- ; to do so, remove circlip.
- Secure retainer - T10013- with a bolt M8x40 and washer (outer dia. 30 mm) to the gearbox lifting eye.
- Attach workshop hoist - VAS 6100- to retainer - T10013- .



- Remove bolts -1- and -2-.
- Remove starter from gearbox.



- Remove bolts -1- and -3 ... 10- on engine/gearbox flange.
- Separate gearbox from engine.

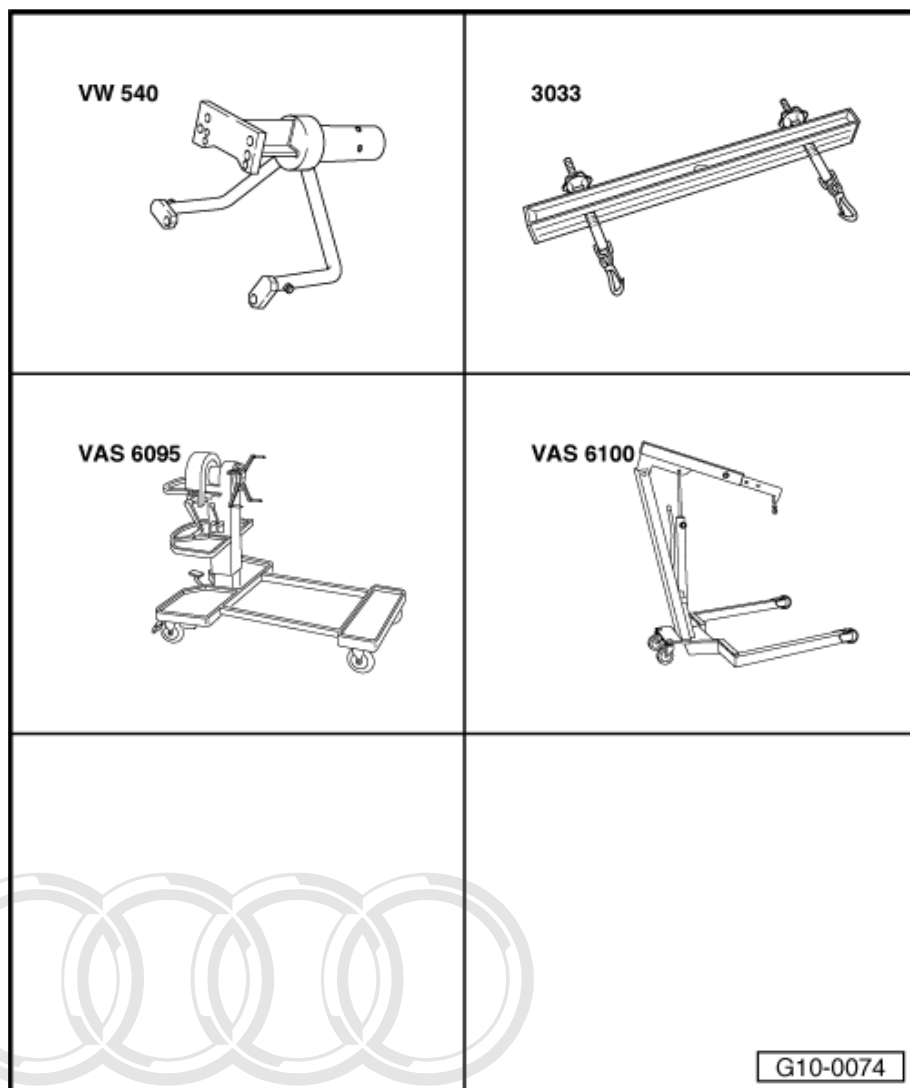


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4 Securing engine to engine and gearbox support

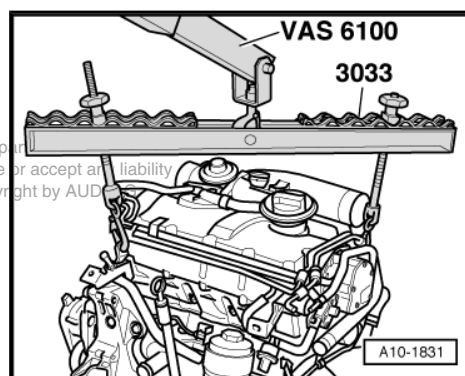
Special tools and workshop equipment required

- ◆ Engine and gearbox support - VW 540- with engine and gearbox support supplement - VW 540/1 B-
- ◆ Lifting tackle - 3033-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Workshop hoist - VAS 6100-

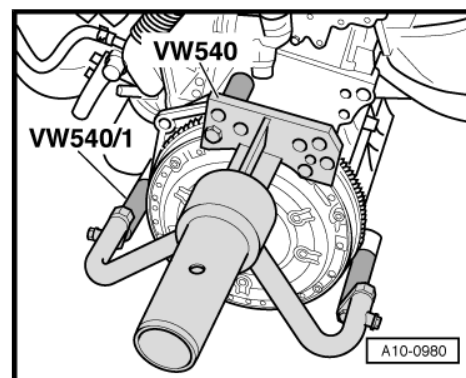


Procedure

- Gearbox detached from engine.
- Attach lifting tackle - 3033- to engine and workshop hoist - VAS 6100- as shown in the illustration.
- Lift engine off engine bracket - VAS 6100- using workshop hoist - T10012- .



- Secure engine to engine and gearbox support - VAS 6095- using -VW 540- and -VW 540/1 B- prior to performing assembly work.



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5 Installing engine

- Engine/gearbox unit attached to engine bracket - T10012- .

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

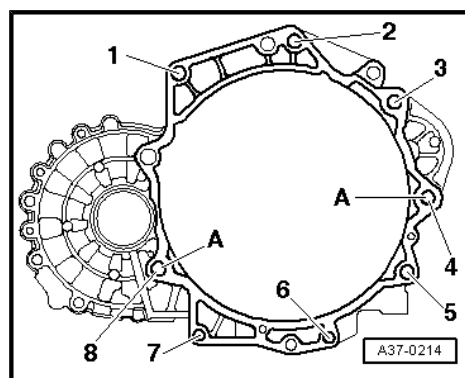


Note

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

Vehicles with manual gearbox:

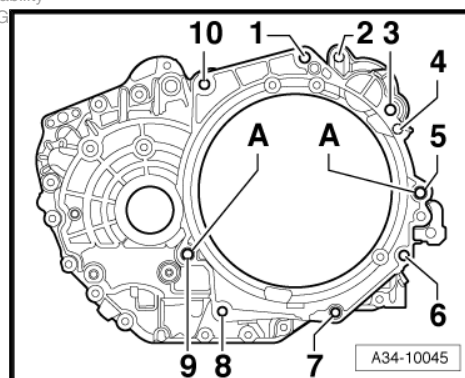
- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Check that clutch plate is correctly centred ⇒ Rep. gr. 30 .
- Check clutch release bearing for wear; renew clutch slave cylinder with release bearing if necessary.
- Clean input shaft splines and (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.



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Vehicles with dual clutch gearbox:

- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Clean input shaft splines on gearbox and splines of damper unit on flywheel; remove corrosion and apply only a very thin coating of grease for clutch plate splines - G 000 100- to the splines. Remove any excess grease.
- A needle bearing must be fitted in the crankshaft on vehicles with dual clutch gearbox; install needle bearing if not already fitted ⇒ [page 83](#) .



All vehicles (continued):

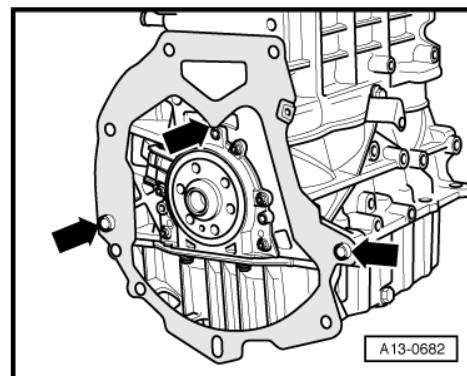
- Ensure that the intermediate plate is engaged on the sealing flange and pushed onto the dowel sleeves -arrows-.
- Bolt gearbox to engine.

Vehicles with four-wheel drive:

- Install bracket for bevel box ⇒ Rep. gr. 34 .

All vehicles (continued):

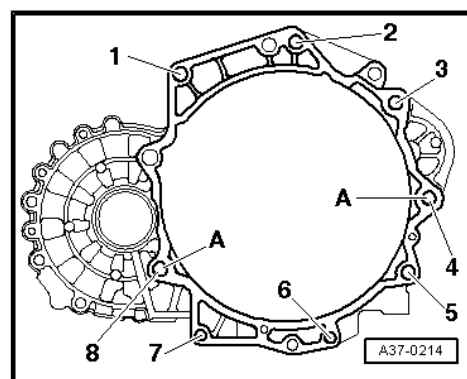
- Install gearbox support ⇒ Rep. gr. 34 .

**Note**

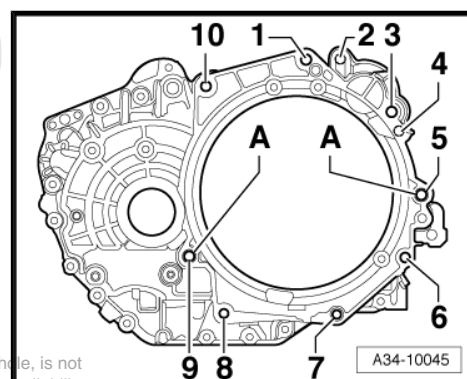
- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricants such as engine or gear oil may be used, but do not use lubricants containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ *Tolerance for tightening torques: $\pm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

Securing engine to manual gearbox

Item	Bolt	Nm
1, 2	M12x55 ¹⁾²⁾	80
3, 4	M12x165 ¹⁾	80
5	M12x105 ²⁾	80
6, 7	M10x50 ²⁾	40
8	M10x70 ²⁾	40
A	Dowel sleeves for centralising	
• ¹⁾ Bolt with M8 threaded pin • ²⁾ Renew bolt.		

**Securing engine to dual clutch gearbox**

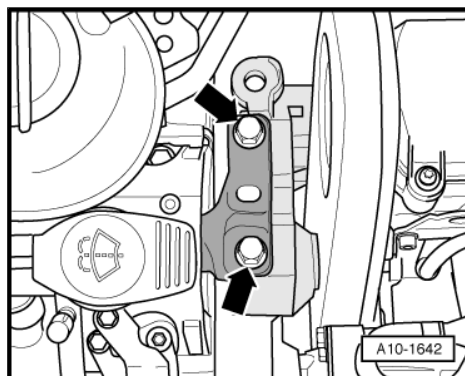
Item	Bolt	Nm
1, 3, 10	M12x55	80
5, 9	M12x70	80
6, 7, 8	M10x50	40
A	Dowel sleeves for centralising	
• Bolts -2 and 4- secure starter to gearbox ⇒ Rep. gr. 27 .		



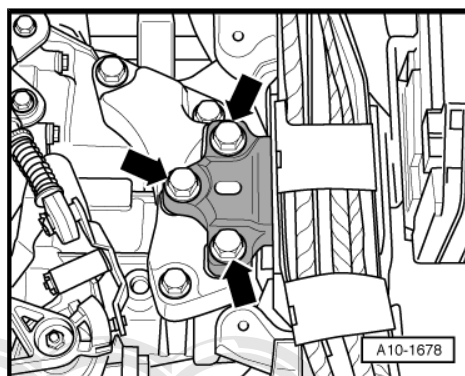
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All vehicles (continued):

- Guide engine/gearbox assembly into the body.
- Tighten bolts -arrows- of assembly mounting for engine initially hand-tight.



- Tighten bolts of assembly mounting for gearbox -arrows- initially hand-tight.
- Use new securing bolts.



Note

The bolts are tightened to final torque only after adjusting the engine mountings ⇒ [page 39](#) .

- Remove engine bracket - T10012- from engine.
- Install drive shafts ⇒ Rep. gr. 40 .
- Install wishbone (right-side) ⇒ Rep. gr. 40 .

Vehicles with four-wheel drive:

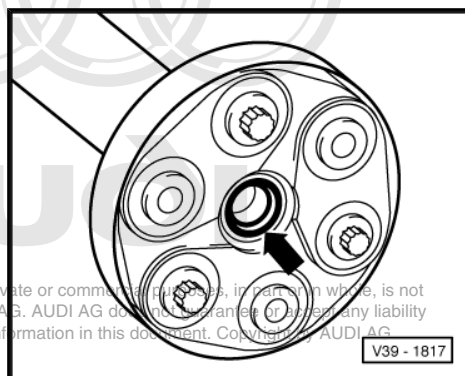


Caution

Make sure not to damage the seal -arrow- in the propshaft flange.

- ◆ Push propshaft with flexible coupling horizontally onto centring pin and secure to bevel box flange ⇒ *Rear final drive 02D, 0AV and 0BR; Rep. gr. 39*

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All vehicles (continued):

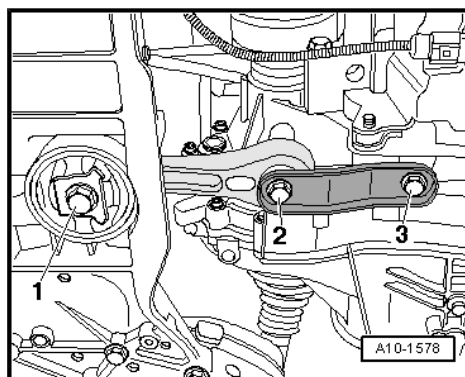
- Secure pendulum support ⇒ Rep. gr. 34 .
- Install particulate filter ⇒ [page 229](#) .
- Align exhaust system so it is free of stress ⇒ [page 235](#) .

Vehicles with auxiliary heater:

- Install exhaust pipe for auxiliary heater ⇒ Rep. gr. 82 .

All vehicles (continued):

- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install radiator cowl ⇒ [page 202](#) .
- To facilitate positioning of alternator, drive back bushes for securing bolts slightly.
- Install alternator ⇒ Rep. gr. 27 .
- Install poly V-belt: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .

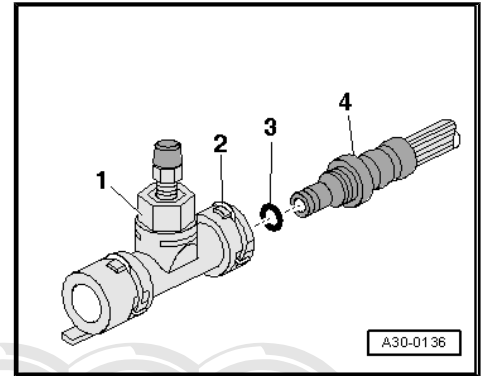


Vehicles with manual gearbox:

- Insert pipe/hose assembly -4- for clutch mechanism with a new O-ring -3- into bleeder connection -1- until securing clip -2- audibly locks into place.
- Pull on pipe/hose assembly as a check.

**Caution**

The clutch pedal must not be operated before the clutch system has been bled.



- Detach hose clamp - 3094- .
- Bleed clutch hydraulics ⇒ Rep. gr. 30 .
- Attach and adjust selector mechanism at gearbox ⇒ Rep. gr. 34 .

Vehicles with dual clutch gearbox:

- Fit selector lever cable and adjust ⇒ Rep. gr. 34 .

All vehicles (continued):

- Connect coolant hose to radiator ⇒ [page 197](#) .
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Adjust assembly mountings ⇒ [page 39](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install battery ⇒ Rep. gr. 27 .
- Check oil level ⇒ Maintenance ; Booklet 808 .

**Caution**

Never use battery charging equipment for boost starting. There is danger of damaging the vehicle's control units.

- Fill cooling system ⇒ [page 183](#) .

**Note**

Coolant must not be used again.

**Tightening torques**

Component	Nm
Bolts/nuts	M6 10
	M7 15
	M8 20
	M10 40
	M12 65
Except for the following:	
Starter to dual clutch gearbox	40
Underbody cross member to body	23
Charge pressure control solenoid valve - N75- to bracket	8
Terminal B+ to starter	16
Earth cable	22
Oil pressure switch to oil filter bracket	20
Air pipe (left-side) to bracket	8
Air cleaner housing to bracket	10
Air pipe (right-side) to bracket	8
Heat shield to cylinder block	35

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6 Assembly mountings

6.1 Assembly mountings - exploded view

1 - Bolt

- ☐ Gearbox support to gearbox
- ☐ 40 Nm +90°

2 - Bolts

- ☐ Pendulum support to gearbox
- ☐ 40 Nm +90°

3 - Engine support

- ☐ Version fitted in vehicle may differ from illustration

4 - Bolt

- ☐ Engine support to engine
- ☐ Renew
- ☐ Tightening torque and sequence for small engine support

⇒ page 40

- ☐ Tightening torque and sequence for large engine support

⇒ page 40

5 - Engine mounting

- ☐ With support arm

6 - Bolt

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

7 - Connecting bracket

8 - Bolt

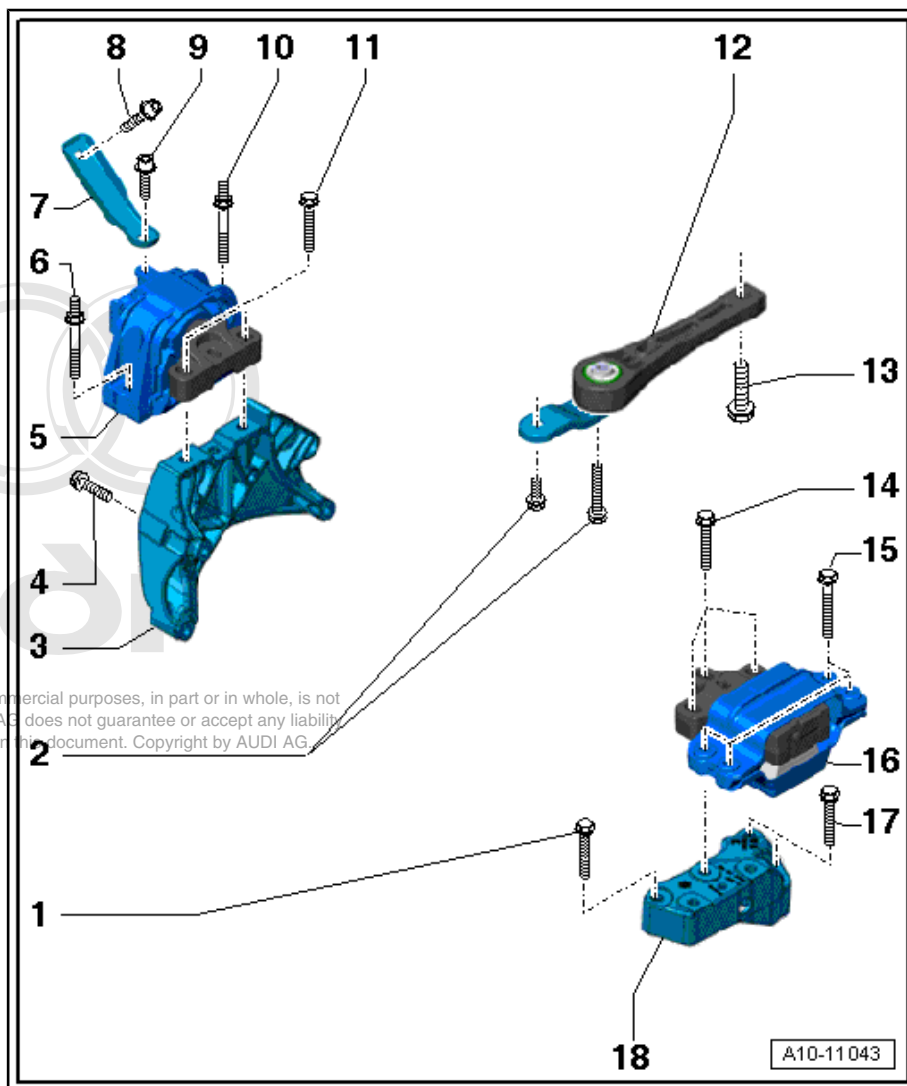
- ☐ Connecting bracket to engine mounting
- ☐ Renew
- ☐ 20 Nm +90°

9 - Bolt

- ☐ Connecting bracket to body
- ☐ Renew
- ☐ 20 Nm +90°

10 - Bolt

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



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11 - Bolt

- ☐ Engine mounting to engine support
- ☐ Renew
- ☐ 60 Nm +90°

12 - Pendulum support

13 - Bolt

- ☐ Pendulum support to subframe
- ☐ 100 Nm +90°

14 - Bolt

- ☐ Gearbox mounting to gearbox support
- ☐ 60 Nm +90°

15 - Bolt

- ☐ Gearbox mounting to body
- ☐ 40 Nm +90°

16 - Gearbox mounting

- ☐ With support arm

17 - Bolt

- ☐ Gearbox support to gearbox
- ☐ 40 Nm +90°

18 - Gearbox support

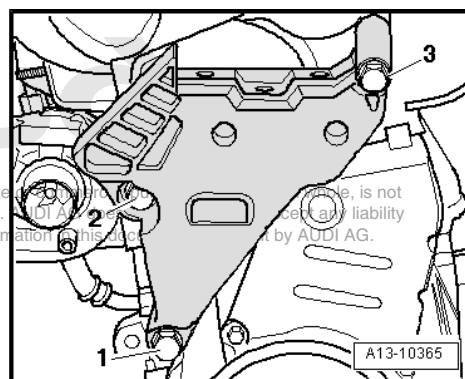
Large engine support - tightening torque and sequence

Note

Renew bolts securing engine support.

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

1. Tighten to 7 Nm.
2. Tighten to 40 Nm.
3. Turn 180° further.



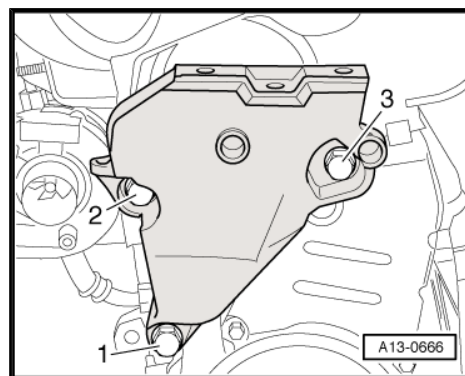
Small engine support - tightening torque and sequence

Note

Renew bolts securing engine support.

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

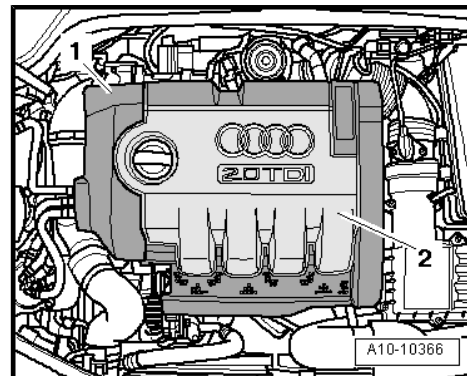
1. Tighten to 7 Nm.
2. Tighten to 40 Nm.
3. Turn 180° further.



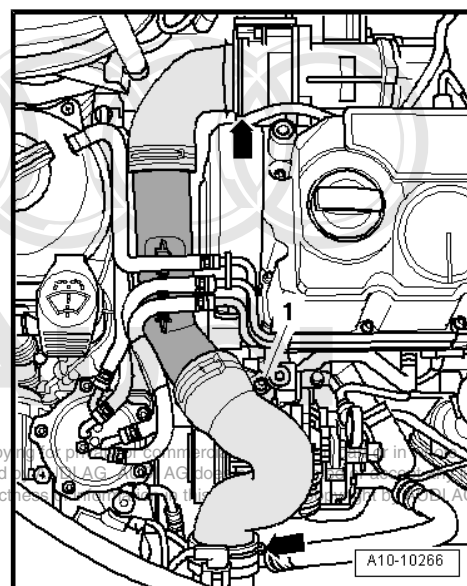
6.2 Checking adjustment of assembly mountings (engine/gearbox mountings)

Procedure

- Lift off outer engine cover panel -1- by pulling up evenly.



- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



The following specifications must be obtained:

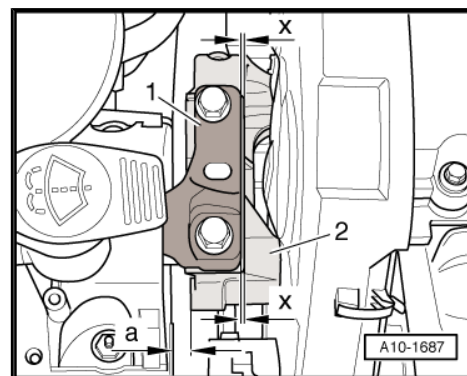
- There must be a distance of -a- = approx. 18 mm between engine support and longitudinal member (right-side).
- The side of the engine support casting -2- must be aligned parallel to the support arm -1- (distance -x- = distance -x-).



Note

Distance -a- = approx. 18 mm can also be checked with a metal rod of suitable size, or similar.

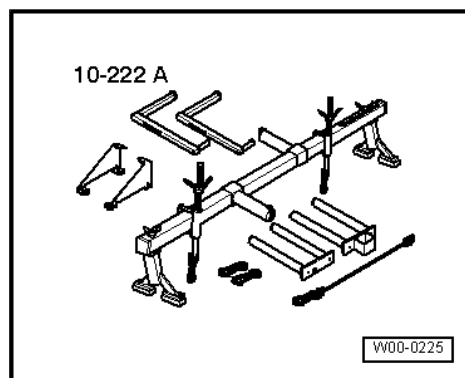
If the distance measured is too large or small, the assembly mountings must be adjusted [⇒ page 41](#).



6.3 Adjusting assembly mountings

Special tools and workshop equipment required

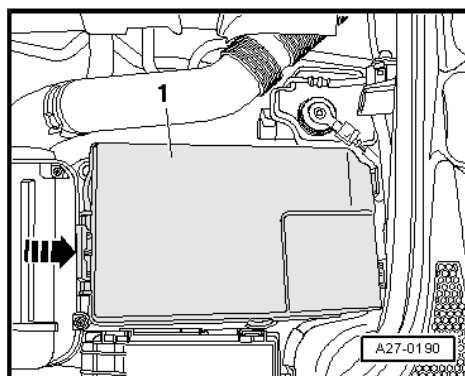
◆ Support bracket - 10-222 A-



Procedure

If the distance measured is too large or small, proceed as follows:

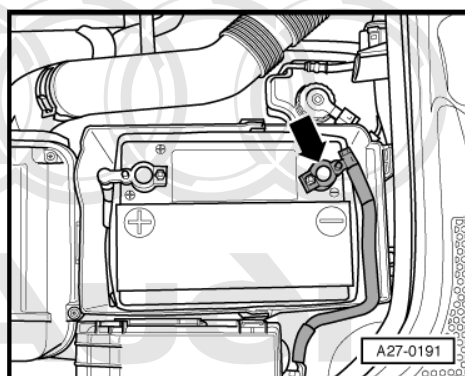
- Remove cover -1- over battery; to do so, press release tab -arrow-.



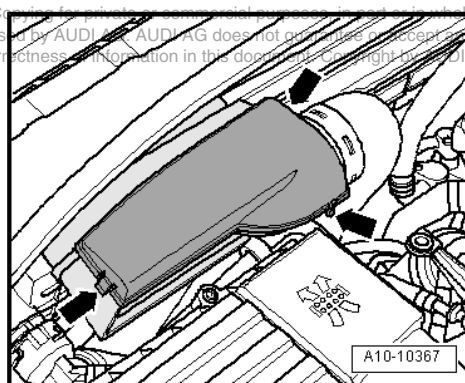
Caution

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

- With ignition switched off, disconnect battery earth cable -arrow-.

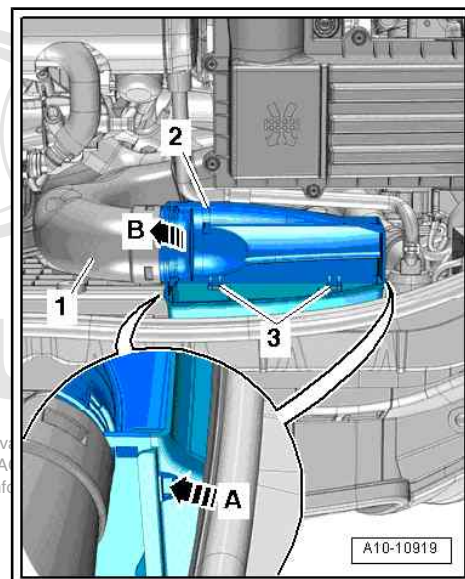


- Pull cover off air duct (release clips on sides) -arrows-.

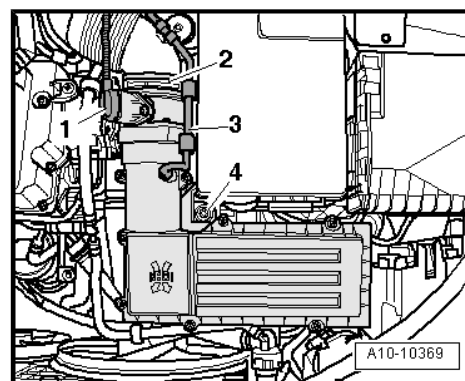


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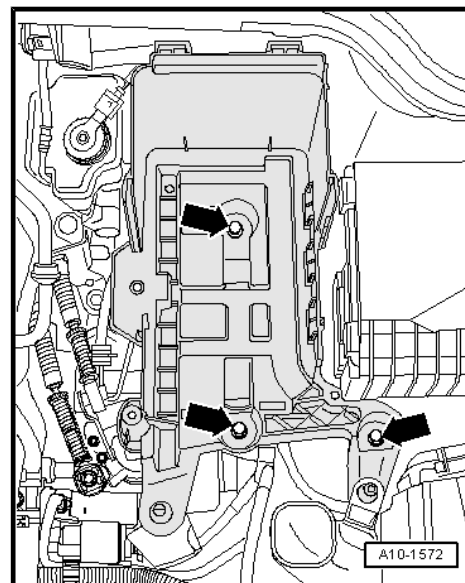
- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.



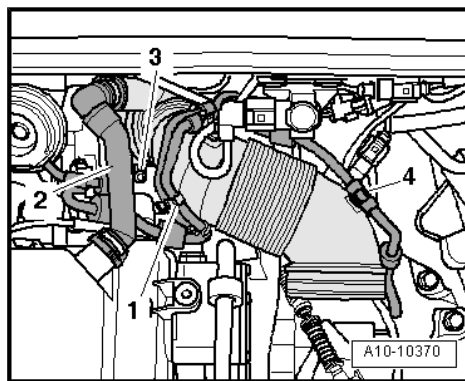
- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.



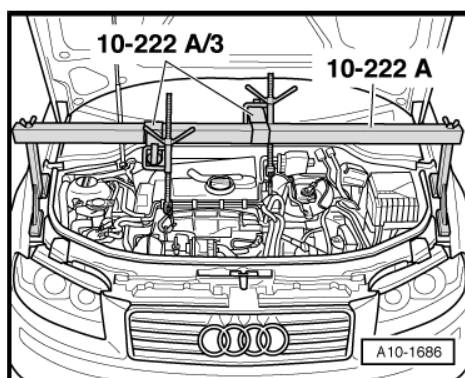
- Remove battery ⇒ Rep. gr. 27 .
- Remove battery tray -arrows-.



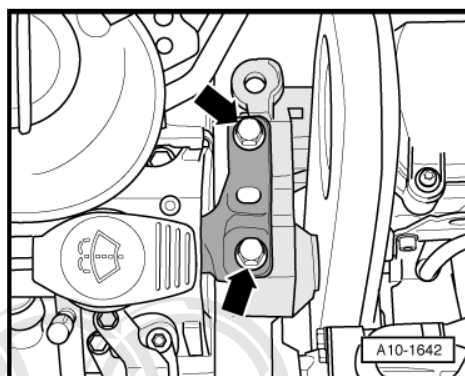
- Detach crankcase breather hose -2-.
- Move vent hose -4- and vacuum hoses -1- clear at air intake hose.
- Remove bolt -3-.
- Swing air hose to rear and detach from turbocharger.



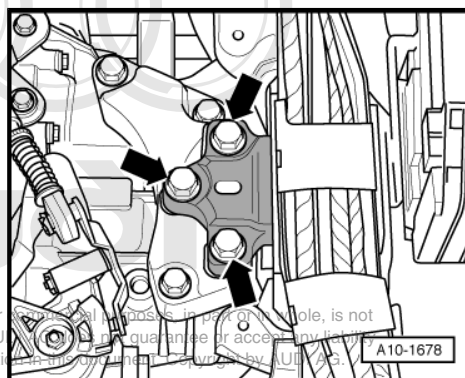
- Set up support bracket - 10-222 A- with adapters - 10-222 A/ 3- on wing panel flanges.
- Attach hooks of spindles to lifting eyes.
- Take up weight of engine evenly with both spindles (but do not raise engine).



- Renew the bolts for assembly mounting at engine -arrows- one by one (if not already renewed when engine was installed).
- Screw in new bolts initially finger-tight.



- Renew the bolts for assembly mounting at gearbox -arrows- one by one (if not already renewed when engine was installed).
- Screw in new bolts initially finger-tight.

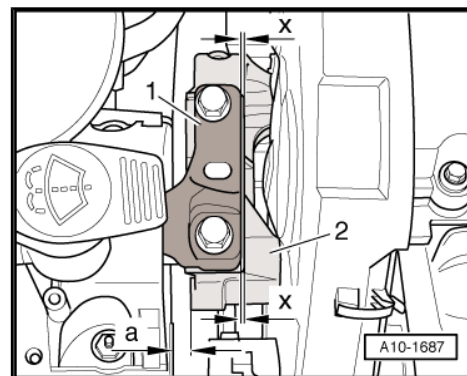


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- Using a tyre iron between engine support and support arm -1-, adjust position of engine until the specifications listed below are obtained:
- There must be a distance of -a- = approx. 18 mm between engine support -2- and longitudinal member (right-side).
- The side of the engine support casting -2- must be aligned parallel to the support arm -1- (distance -x- = distance -x-).

**Note**

Distance -a- = approx. 18 mm can also be checked with a metal rod of suitable size, or similar.



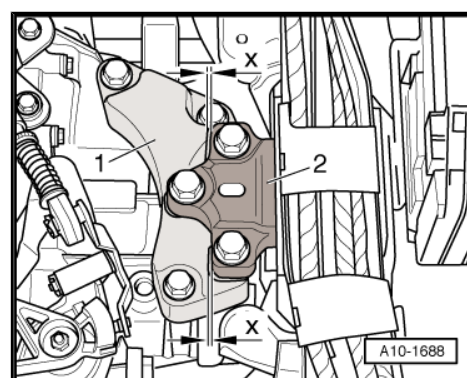
- Tighten the bolts for engine assembly mounting.
- On the gearbox side, check that the edges of the support arm -2- and gearbox support -1- are parallel (distance -x- = distance -x-).
- Tighten the bolts for gearbox assembly mounting ⇒ Rep. gr. 34 .

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

- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Install battery ⇒ Rep. gr. 27 .

Tightening torques

Component	Nm
Engine mounting to engine support	60 +90° ¹⁾
Air cleaner housing to bracket	10
Air pipe (right-side) to bracket	8
• ¹⁾ Renew bolts.	



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13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Poly V-belt drive - exploded view

1 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Removing and installing: vehicles with tensioner ⇒ [page 47](#), vehicles without tensioner ⇒ [page 50](#).
- ☐ When installing, make sure it is properly seated on pulleys.

2 - Vibration damper

- ☐ With pulley for poly V-belt
- ☐ Removing and installing ⇒ [page 50](#)

3 - Special bolt

- ☐ Renew
- ☐ Use only genuine bolts ⇒ Electronic parts catalogue
- ☐ 10 Nm +90°

4 - Poly V-belt tensioner

- ☐ Pivot with open-end spanner to slacken poly V-belt
- ☐ Lock tensioner with locking pin - T10060 A- or -T10060-
- ☐ Not installed on vehicles without air conditioner (equipment version)

5 - Bolt

- ☐ 23 Nm

6 - Bracket for ancillaries

- ☐ Removing and installing ⇒ [page 52](#)

7 - Dowel sleeve

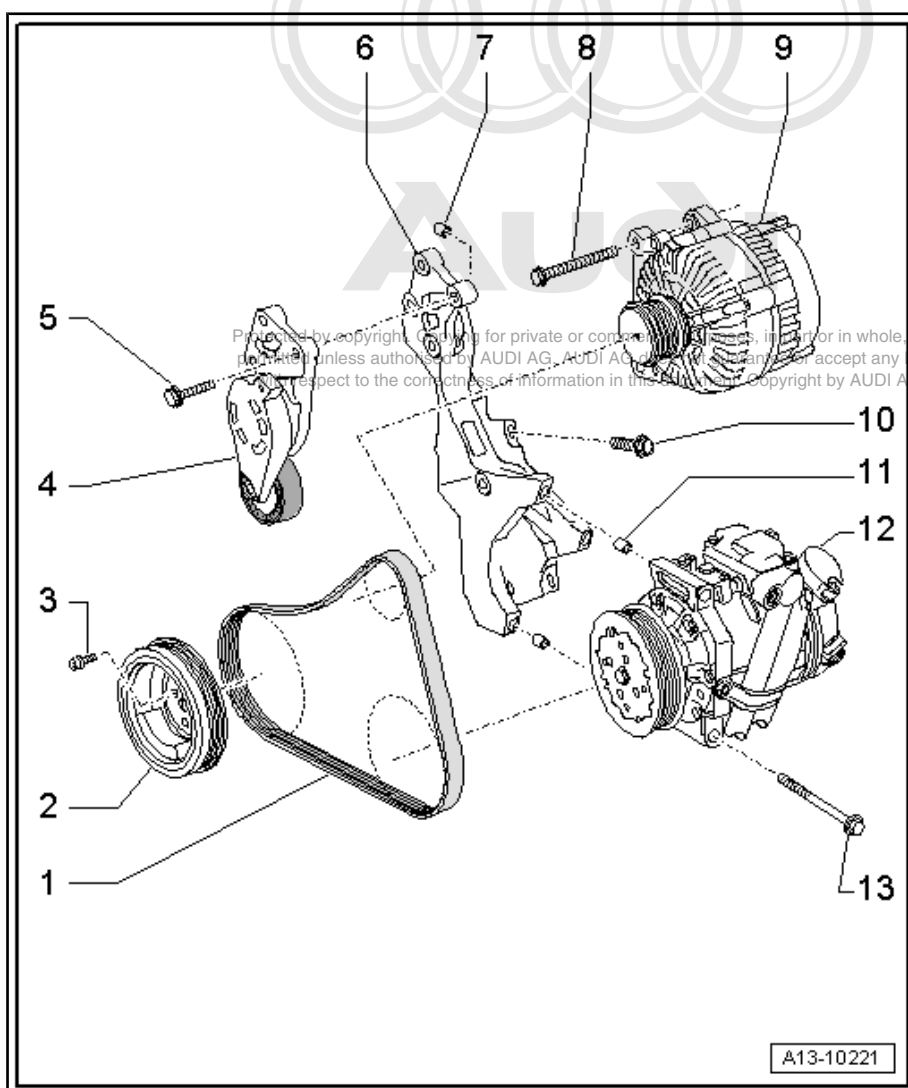
- ☐ Ensure correct seating in bracket

8 - Bolt

- ☐ 23 Nm

9 - Alternator

- ☐ Removing and installing ⇒ Rep. gr. 27



- ☐ To facilitate attachment of alternator, knock back threaded bushes for alternator securing bolts slightly

10 - Bolt

- ☐ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ☐ Observe correct tightening sequence ⇒ [page 47](#)
- ☐ 45 Nm

11 - Dowel sleeve

- ☐ 2x
- ☐ Ensure correct seating in bracket

12 - Air conditioner compressor

- ☐ Removing and installing ⇒ Rep. gr. 87

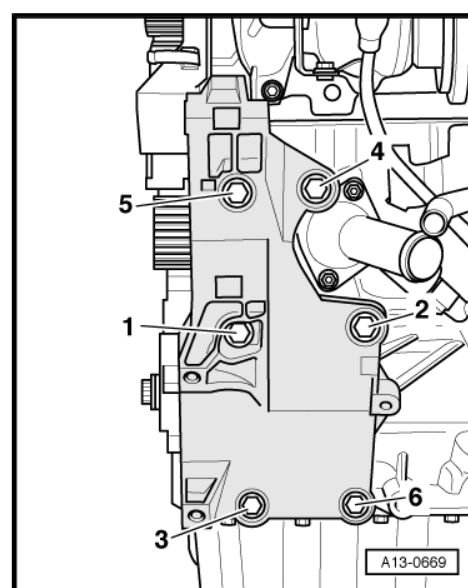
13 - Bolt

- ☐ 25 Nm

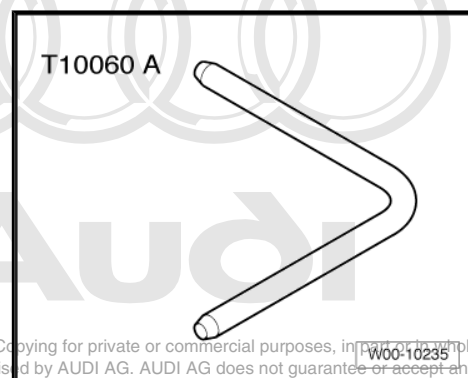
Bracket for ancillaries - tightening torque and tightening sequence

- Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 6-	Screw in bolts by hand until they make contact
2.	-1 ... 6-	45 Nm

**1.2 Removing and installing poly V-belt - vehicles with tensioner****Special tools and workshop equipment required**

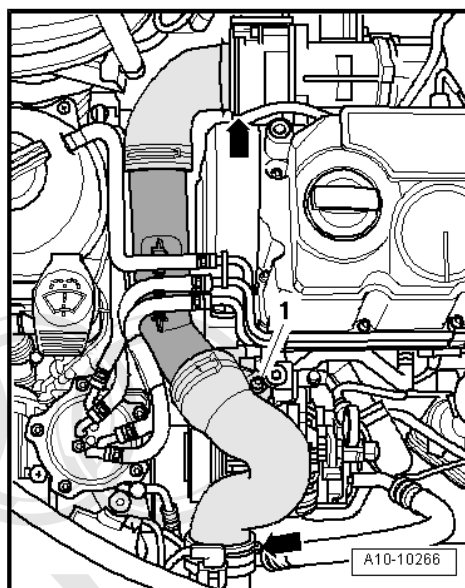
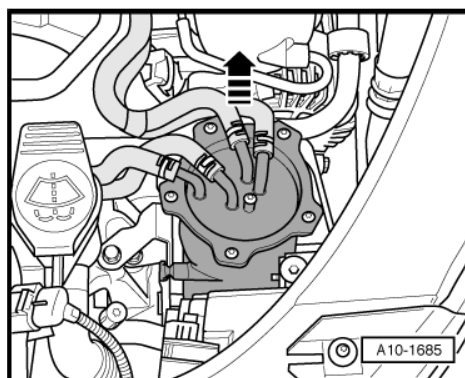
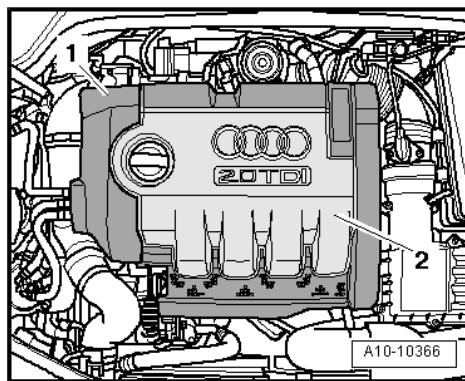
- ◆ Locking pin - T10060 A-



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Removing

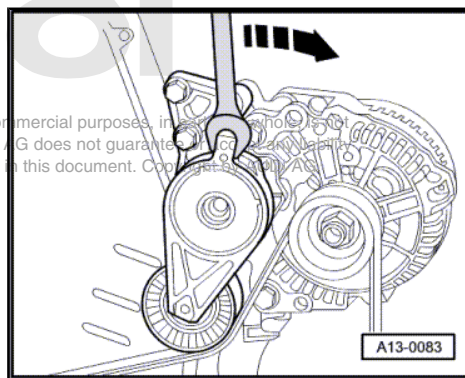
- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.
- Pull fuel filter with hoses attached upwards out of the bracket -arrow- and place to side.
- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



Note

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

- To slacken poly V-belt turn tensioner in clockwise direction -arrow-.



- Lock poly V-belt tensioner with locking pin - T10060 A- .
- Remove poly V-belt.

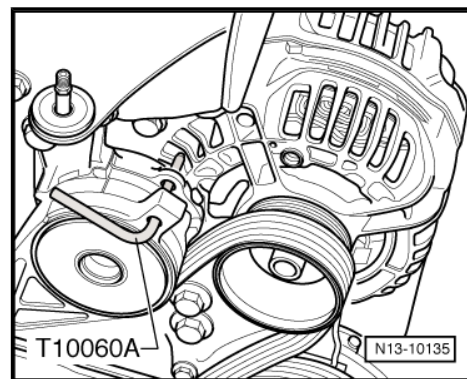
Installing

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



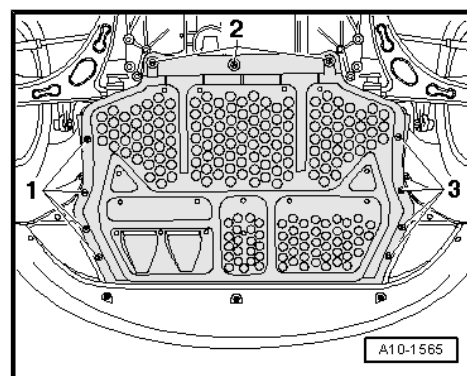
Note

Before fitting poly V-belt, make sure all mechanical units (alternator and air conditioner compressor) are firmly in position.



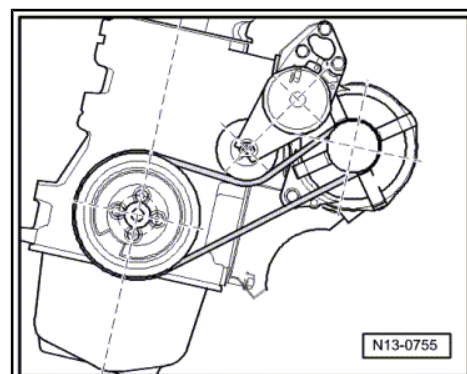
Vehicles with auxiliary heater:

- Remove centre noise insulation -fasteners 1 ... 3-.



Vehicles with tensioner and without air conditioning:

- Fit poly V-belt onto crankshaft pulley and alternator pulley.



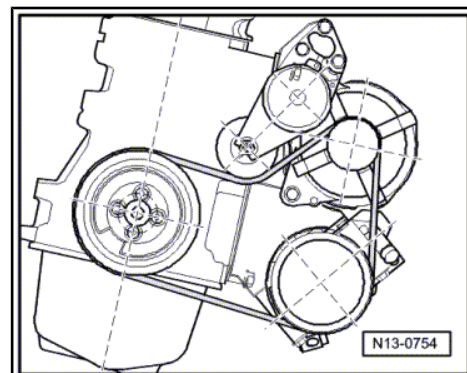
Vehicles with air conditioning:

- Fit poly V-belt onto crankshaft pulley, A/C compressor pulley and then onto alternator pulley.

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All vehicles (continued):

- Release tensioner.
- Check poly V-belt for proper seating.
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Start engine and check that belt runs properly.



Tightening torque

Component	Nm
Air pipe (right-side) to bracket	8

1.3 Removing and installing poly V-belt - vehicles without tensioner



Note

The poly V-belt tensioner is not installed on vehicles without air conditioner (equipment version).

Special tools and workshop equipment required

- ◆ Poly V-belt repair set with assembly tool ⇒ Electronic parts catalogue

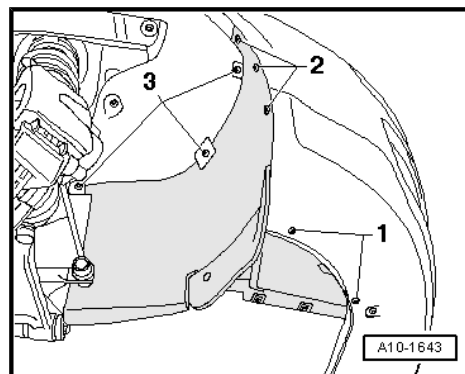
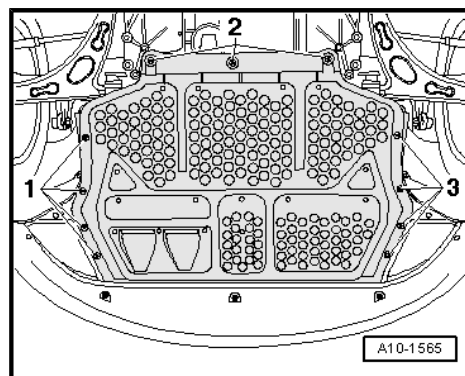
Procedure



Note

The poly V-belt repair set with assembly tool contains the assembly tool -T10367- and illustrated instructions.

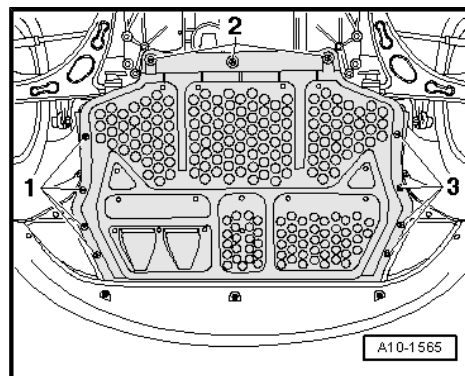
- Remove front right wheel.
- Remove centre noise insulation -fasteners 1 ... 3-.
- Remove noise insulation (right-side) -fasteners 1 ... 3-.
- Follow procedure specified in illustrated instructions.



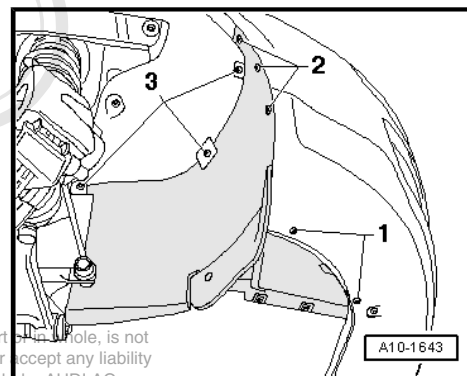
1.4 Removing and installing vibration damper

Removing

- Remove poly V-belt: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .
- Remove front right wheel.
- Remove centre noise insulation -fasteners 1 ... 3-.

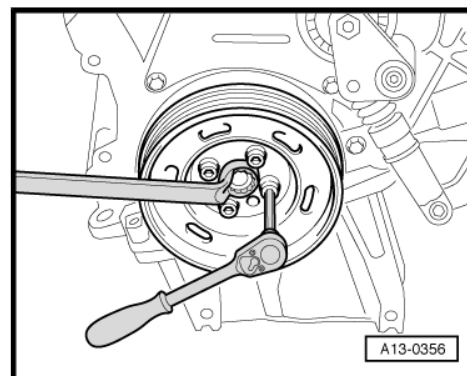


- Remove noise insulation (right-side) -fasteners 1 ... 3-.



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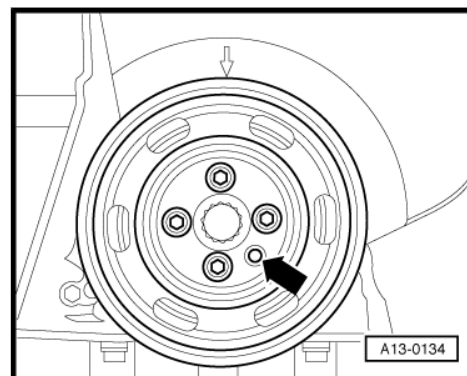
- Remove cover cap for vibration damper.
- Unbolt vibration damper; counterhold on centre bolt with ring spanner.



Installing

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

- Use new securing bolts.
- Install vibration damper, using only genuine bolts (same as original equipment) ⇒ Electronic parts catalogue .
- 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: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .



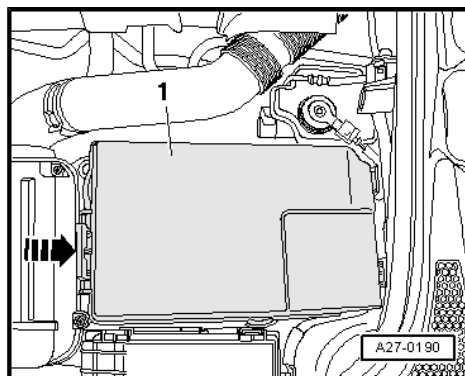
Tightening torque

Component	Nm
Vibration damper to crankshaft sprocket	10 +90° 1)
• 1) Renew bolts.	

1.5 Removing and installing bracket for ancillaries

Removing

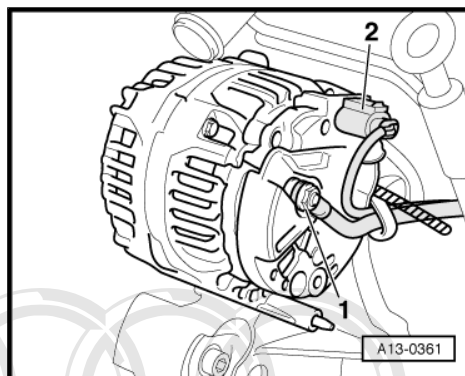
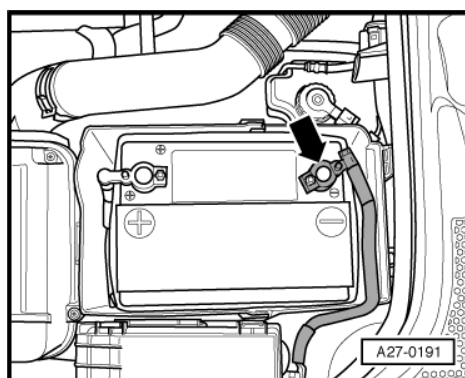
- Remove poly V-belt: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .
- Remove cover -1- over battery; to do so, press release tab -arrow-.



Caution

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

- With ignition switched off, disconnect battery earth cable -arrow-.
- Unplug electrical connector -2-.
- Unscrew wire -1- and wire clamp.

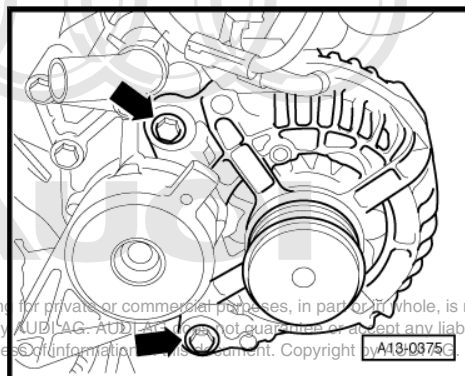


- Unscrew bolts -arrows- and remove alternator.



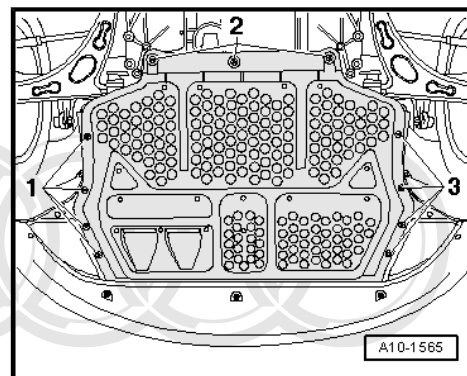
Note

- ◆ *If alternator sticks in its bracket, screw bolt back in again down to the last 2 turns.*
- ◆ *Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.*



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- Remove centre noise insulation -fasteners 1 ... 3-.

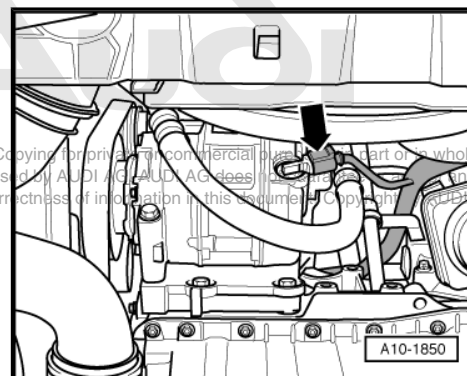


- Unplug electrical connector -arrow- for magnetic clutch of air conditioner compressor.
- Move wiring clear.

**WARNING**

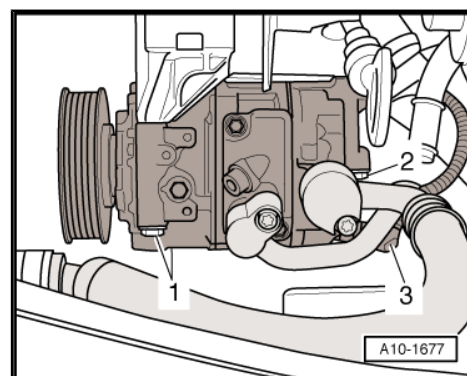
The air conditioner refrigerant circuit must not be opened.

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**Note**

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

- Unscrew bolts -1- and -2- for air conditioner compressor.
- Tie air conditioner compressor up to lock carrier.

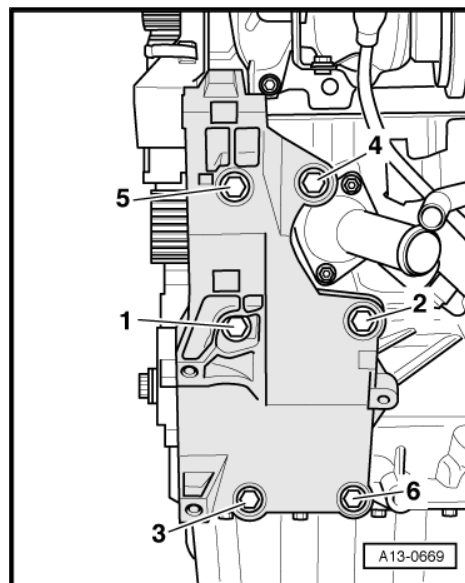


- Detach engine support from bracket for ancillaries.
- Remove bolts -1 ... 6-.
- Remove bracket for ancillaries together with poly V-belt tensioner.

Installing

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

- Check that dowel sleeve for centring the bracket for ancillary units on cylinder block is fitted; insert if necessary.
- First tighten bolts in the sequence -1 ... 6- hand-tight, then tighten to specified torque.
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install alternator ⇒ Rep. gr. 27 .
- Install poly V-belt: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .
- Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .



Tightening torque

Component	Nm
Bracket for ancillaries to cylinder block	45

1.6 Toothed belt drive - exploded view

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1 - Bolt

- ☐ Renew
- ☐ 10 Nm +90°

2 - Vibration damper

- ☐ With pulley for poly V-belt
- ☐ Removing and installing
⇒ [page 50](#)

3 - Toothed belt cover (bottom)**4 - Bolt**

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

5 - Toothed belt cover (centre)

- ☐ To remove, take out toothed belt cover (top) and unbolt poly V-belt tensioner

6 - Toothed belt cover (top)

- ☐ To remove, take out air pipe (right-side)
- ☐ Engage carefully in centre toothed belt cover when installing

7 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage
- ☐ Check for wear
- ☐ Removing ⇒ [page 57](#)
- ☐ Installing (adjusting valve timing) ⇒ [page 63](#)

8 - Nut

- ☐ 20 Nm +45°

9 - Tensioning roller**10 - Bolt**

- ☐ 25 Nm

11 - Camshaft sprocket

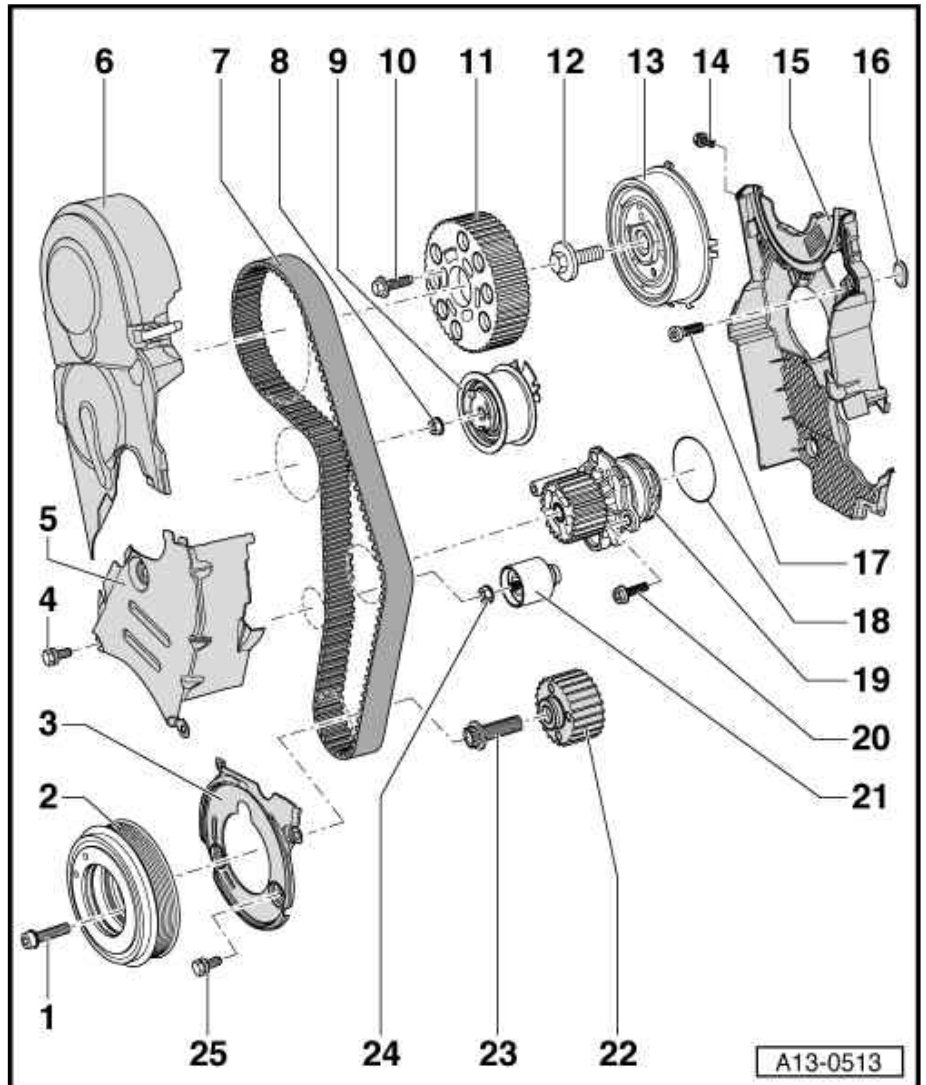
- ☐ Mark installation position

12 - Bolt

- ☐ Use counterhold tool - T10051- when loosening and tightening
⇒ ["3.5 Removing and installing camshaft", page 148](#)
- ☐ 100 Nm

13 - Hub

- ☐ With sender wheel for Hall sender - G40-
- ☐ Use counterhold tool - T10051- when loosening and tightening
- ☐ To remove, use puller - T10052-



- ☐ Removing ⇒ [page 117](#)

14 - Bolt

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

15 - Toothed belt cover (rear)

- ☐ To remove, take out coolant pump ⇒ [page 187](#)
- ☐ When installing, engage carefully in sealing flange at pulley end.

16 - Rubber grommet

- ☐ Renew if damaged

17 - Bolt

- ☐ 25 Nm

18 - O-ring

- ☐ Renew

19 - Coolant pump

- ☐ Removing and installing ⇒ [page 187](#)

20 - Bolt

- ☐ 13 Nm

21 - Idler roller**22 - Crankshaft sprocket**

- ☐ Contact surface between sprocket and crankshaft must be free of oil
- ☐ Can only be installed in one position
- ☐ Removing and installing ⇒ [page 56](#)

23 - Bolt

- ☐ Renew
- ☐ Do not lubricate with oil
- ☐ Use counterhold tool - 3415- when loosening and tightening ⇒ [page 56](#)
- ☐ 120 Nm +90°

24 - Nut

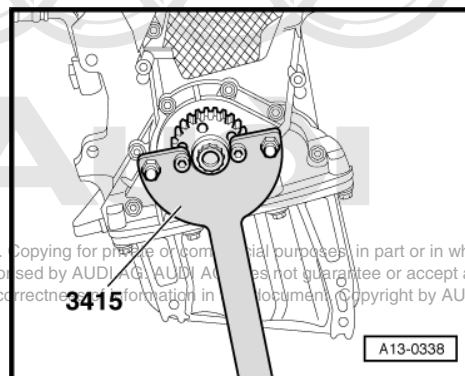
- ☐ 22 Nm

25 - Bolt

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

Removing and installing crankshaft sprocket

- Use counterhold tool - 3415- when loosening and tightening.



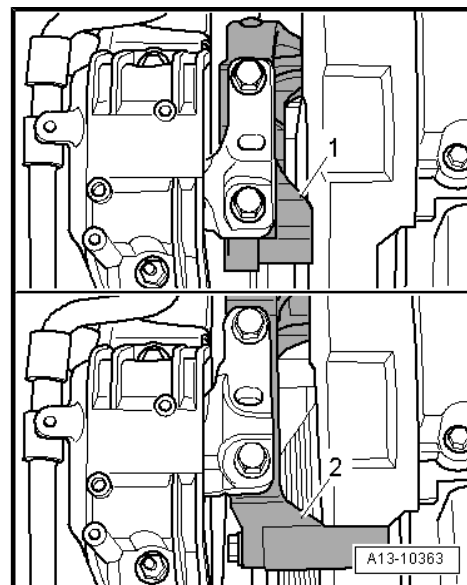
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1.7 Removing and installing toothed belt



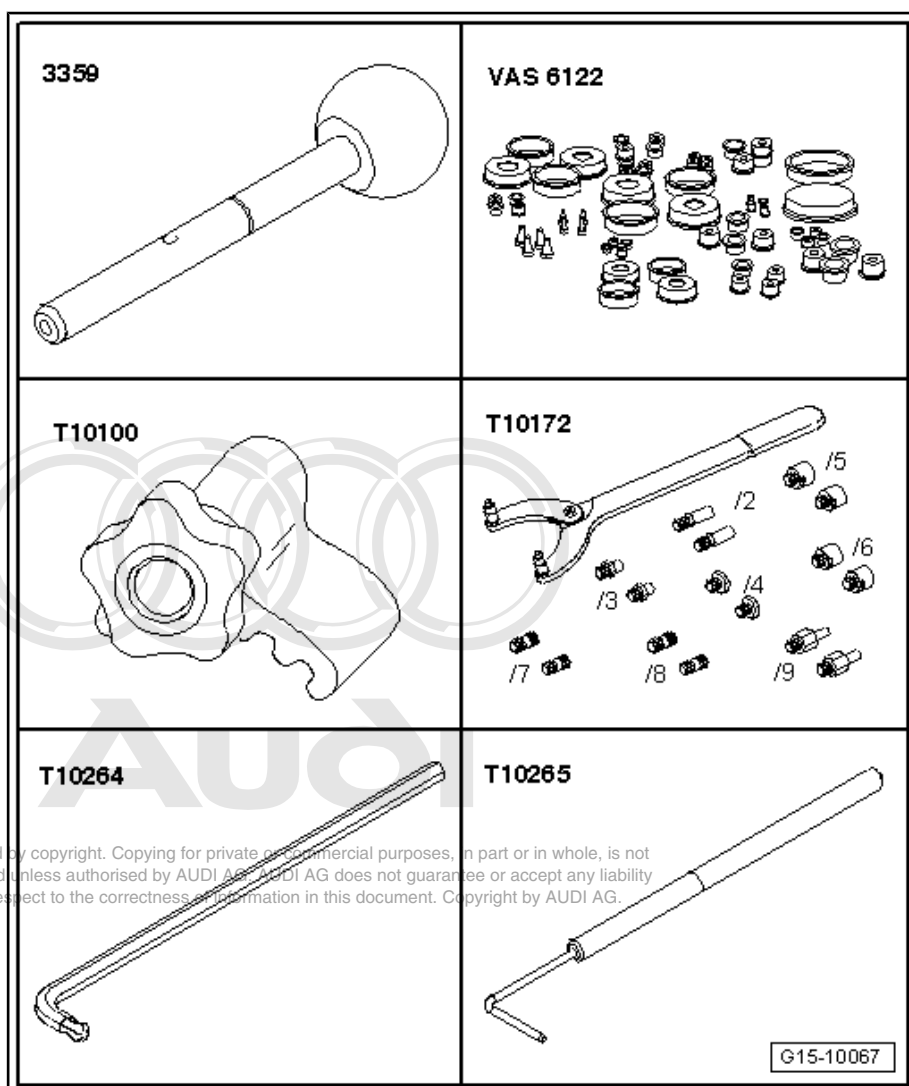
Note

- ◆ The engine support has to be removed and the engine supported from above in order to remove the toothed belt on vehicles with small engine support -version 1-.
- ◆ The engine support remains installed on vehicles with large engine support -version 2-.



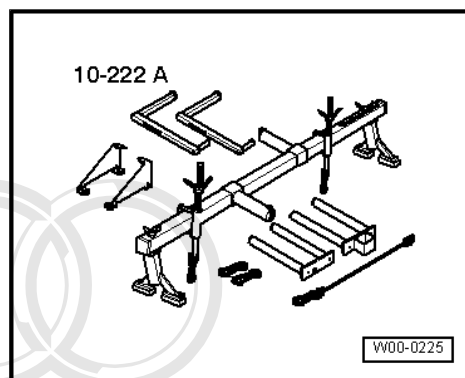
Special tools and workshop equipment required

- ◆ Locking pin - 3359-
- ◆ Engine bung set - VAS 6122-
- ◆ Crankshaft stop - T10100-
- ◆ Counter-hold tool - T10172- with pin - T10172/4-
- ◆ Special wrench, long reach - T10264-
- ◆ Locking tool - T10265-



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- ◆ Support bracket - 10 - 222 A- for vehicles with small engine support

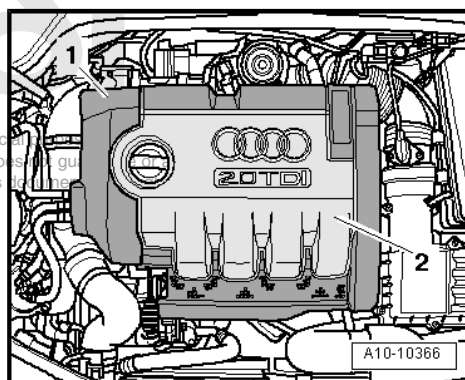


- ◆ Locking fluid ⇒ Electronic parts catalogue

Removing

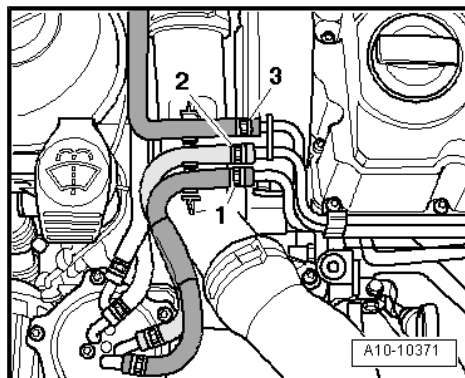
- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.

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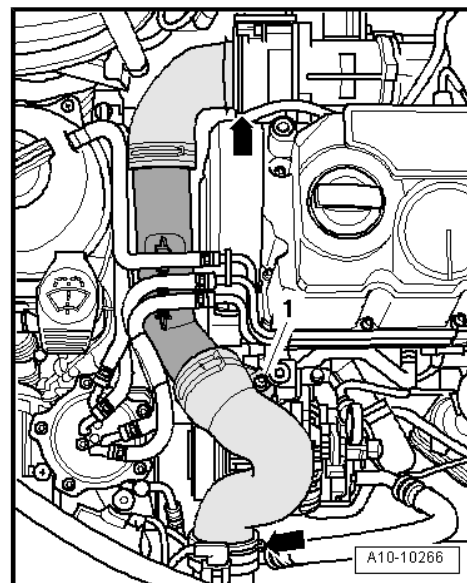
WARNING

- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*



- Disconnect fuel supply hose -2- and fuel return hose -1- from fuel lines.
- Detach coolant hose -3-.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.

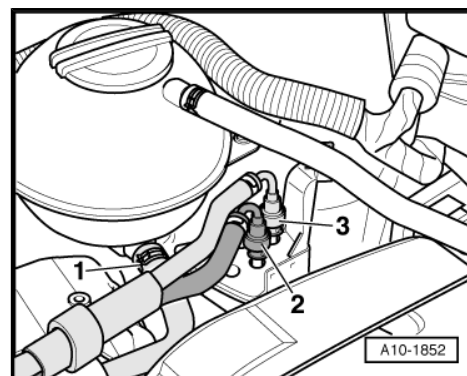


- Pull release tabs and disconnect fuel supply line -3- and fuel return line -2-.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

- Detach coolant hose -1- at coolant expansion tank.

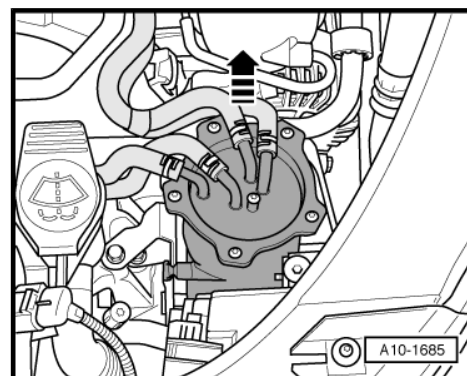
Vehicles with auxiliary heater:

- Disconnect fuel pipe (press release tab).
- Move fuel pipe clear.

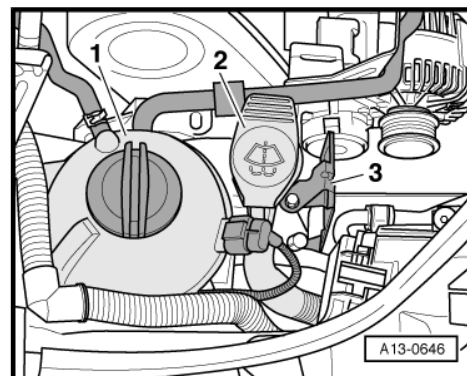


All vehicles (continued):

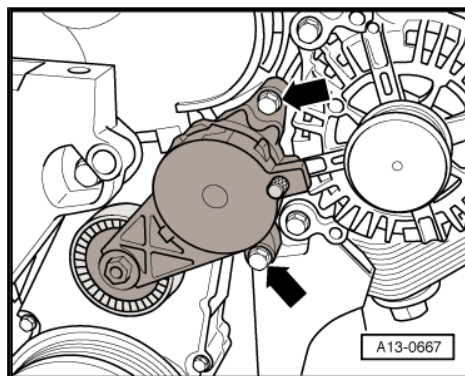
- Pull fuel filter with hoses attached upwards out of the bracket -arrow- and place to side.



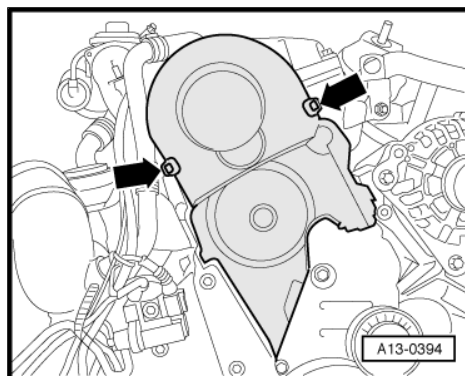
- Unscrew bracket -3- for fuel filter.
- Unscrew bolt at filler neck -2- for washer fluid reservoir.
- Unplug electrical connector at coolant expansion tank -1-.
- Unbolt coolant expansion tank and lay it aside with hoses connected.
- Remove poly V-belt: vehicles with tensioner ➤ [page 47](#) , vehicles without tensioner ➤ [page 50](#) .



- Vehicles with tensioner: remove bolts -arrows- and take off tensioner for poly-V-belt.

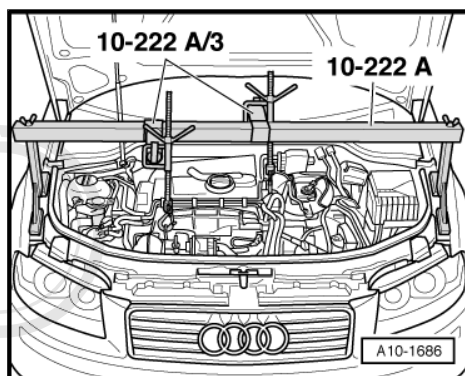


- Remove top toothed belt cover by releasing retaining clips -arrows-.

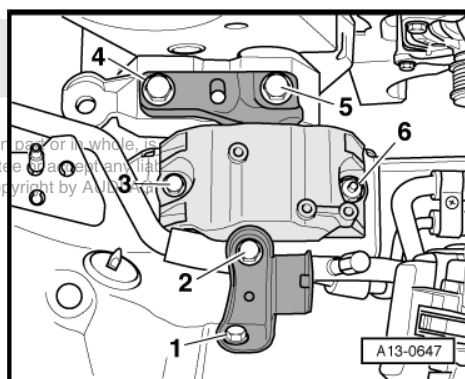


Vehicles with small engine support

- Set up support bracket - 10-222 A- with adapters - 10-222 A/3- on wing panel flanges.
- Attach hooks of spindles to lifting eyes.
- Take up weight of engine evenly with both spindles (but do not raise engine).



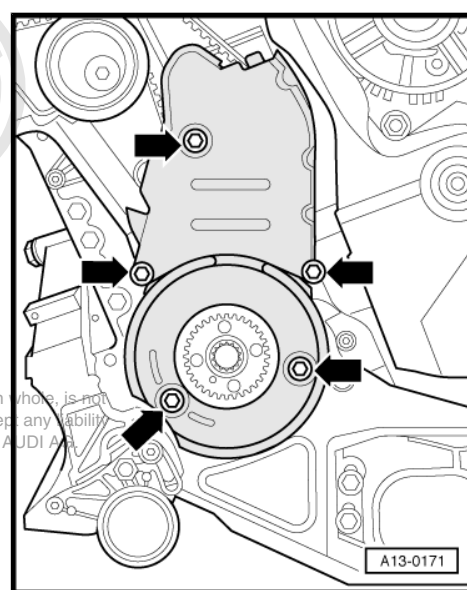
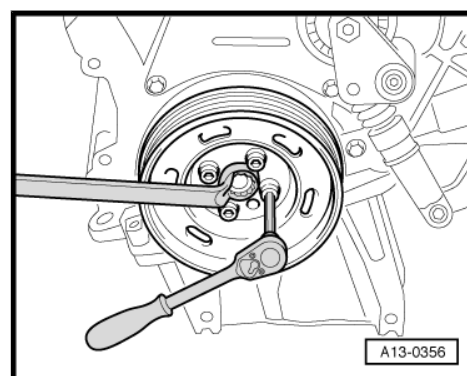
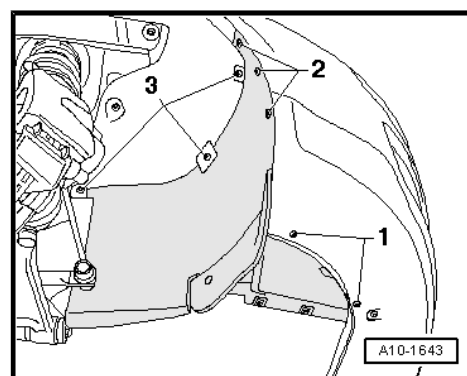
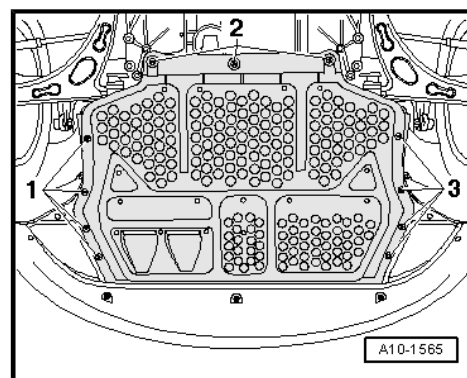
- Remove bolts -1- and -2- and detach connecting bracket.
- Remove bolts -3 ... 6- and remove engine mounting.



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All vehicles (continued):

- Remove front right wheel.
- Remove centre noise insulation -fasteners 1 ... 3-.
- Remove noise insulation (right-side) -fasteners 1 ... 3-.
- Remove cover cap for vibration damper.
- Unbolt vibration damper; counterhold on centre bolt with ring spanner.
- Unbolt toothed belt cover (centre and bottom) -arrows-.



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Vehicles with small engine support

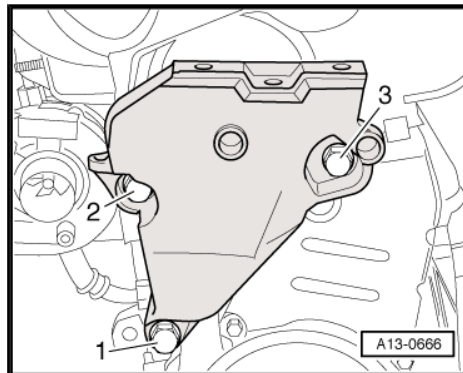
- Remove bolts -1 ... 3- for engine support.



Note

To remove the bolts for the engine support, raise or lower the engine slightly as necessary via the spindles on support bracket - 10-222 A-.

- Raise engine/gearbox assembly slightly via the two spindles and remove engine support.



All vehicles (continued):



Caution

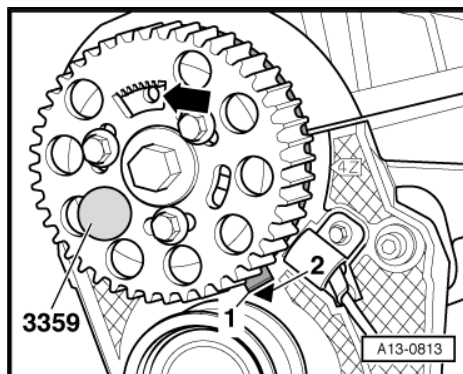
The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).



Note

Turn over the engine at the central bolt on the crankshaft.

- Turn the crankshaft to TDC.
- The toothed segment -arrow- at camshaft sprocket must face upwards.
- Lug -1- on sender wheel for camshaft must align with marking -2- on rear toothed belt cover (not fitted on all versions).



Note

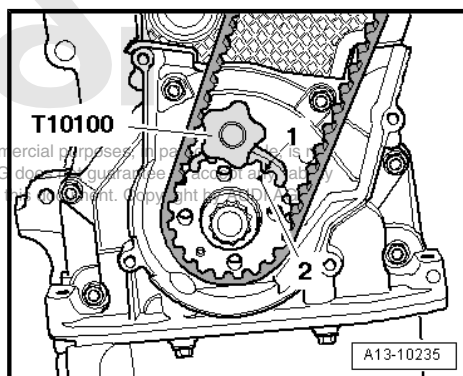
The camshaft sprocket is shown with the toothed belt removed for illustrative purposes.

- Lock hub with locking pin - 3359-.
- Lock crankshaft sprocket with crankshaft stop - T10100-.
- The markings on the sprocket -2- and the crankshaft stop -1- must align. The lug of the crankshaft stop must engage in the bore in the sealing flange.



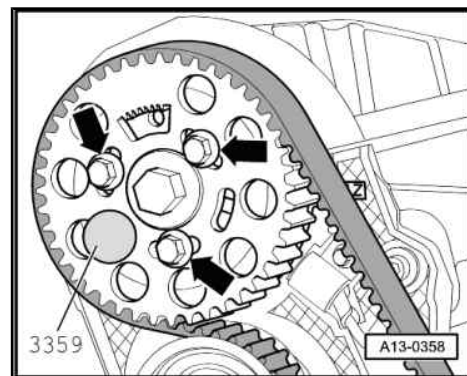
Note

The crankshaft stop can only be pushed onto the sprocket from the front face of the teeth.

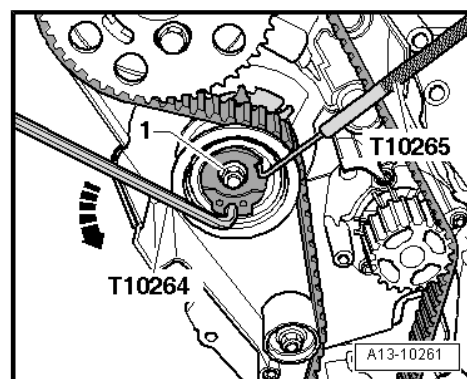


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- Mark direction of rotation of toothed belt with chalk or felt-tip pen.
- Loosen securing bolts for camshaft sprocket -arrows-.



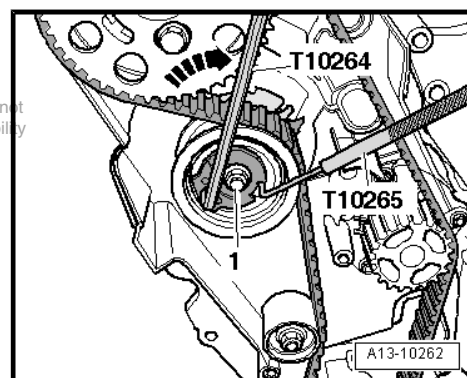
- Loosen securing nut -1- for tensioning roller.
- Turn the eccentric adjuster with the angle driver - T10264- anti-clockwise -arrow- until the tensioning roller can be secured with the locking tool - T10265- .



- Now turn eccentric adjuster of tensioning roller clockwise -arrow- until stop and tighten securing nut -1- finger-tight.
- Take off toothed belt first from coolant pump and then from the remaining sprockets.

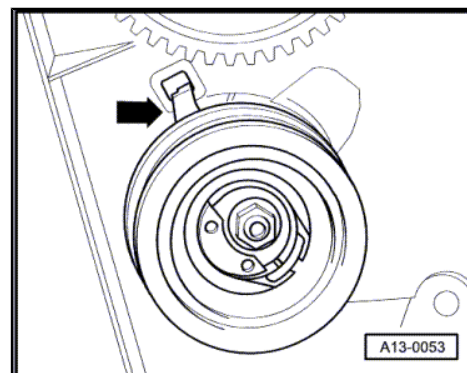
Installing (adjusting valve timing)

- Camshaft locked with locking pin - 3359- .
- Crankshaft locked with crankshaft stop - T10100- .
- Tensioning roller locked with locking tool - T10265- and secured at right stop with securing nut.

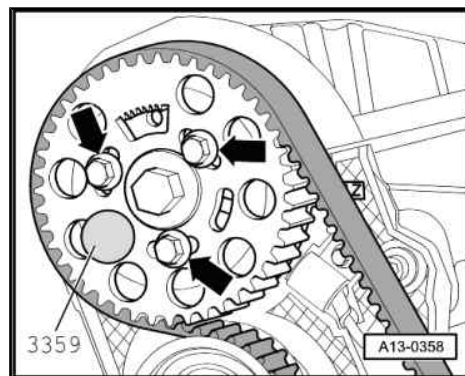


Note

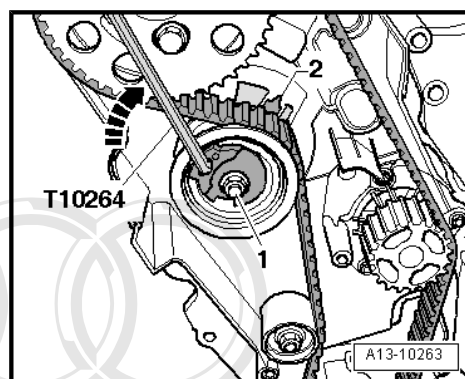
- ◆ *Toothed belt adjustment must always be performed when the engine is cold.*
- ◆ *The crankshaft must not be at TDC at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.*
- Ensure that tensioning roller is seated properly in rear toothed belt cover -arrow-.



- Screw in bolts -arrows-, but do not tighten.
- It should just be possible to turn the camshaft sprocket on the hub without axial movement.
- Turn the camshaft sprocket in its elongated hole clockwise until the stop.
- Guide toothed belt in from above between engine support and engine.
- Fit toothed belt first onto camshaft sprocket, tensioning roller, crankshaft sprocket and then onto coolant pump sprocket.



- Adjust toothed belt tension as follows:
- Remove locking tool - T10265- from tensioning roller.
- Loosen securing nut -1- for tensioning roller.
- Turn eccentric adjuster of tensioning roller clockwise -arrow- using special wrench, long reach - T10264- until pointer -2- aligns with the centre of the slot on the base plate.



Note

- ♦ *Make sure that the securing nut does not also turn.*
- ♦ *Shown in illustration without engine support.*

- Hold tensioning roller in this position and tighten tensioning roller nut to 20 Nm + 45 .



Note

When tightening the securing nut, the pointer may move up to 5 mm (maximum) to the right of the slot in the base plate. This position must not be corrected, because the toothed belt stretches slightly when running in.

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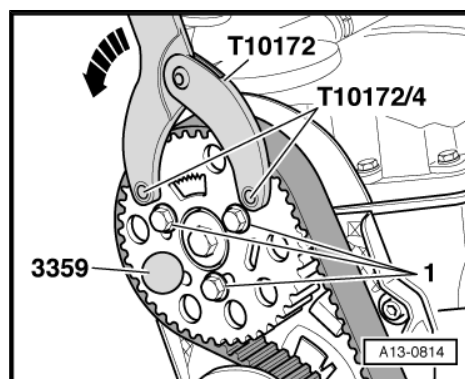
- Insert counterhold tool - T10172- with pins - T10172/4- as shown in illustration and pretension driving section of toothed belt by pressing in direction of -arrow-.
- Tighten bolts -1- on camshaft sprocket to 25 Nm.
- Remove locking pin - 3359- and crankshaft stop - T10100- .

Checking valve timing:



Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).



- Turn crankshaft two rotations in normal direction of rotation until the crankshaft is just before TDC again.

- Lock the camshaft hub into place with the locking pin - 3359- while turning.
- Check whether:
 - The crankshaft can be locked with the crankshaft stop - T10100- .
 - The tensioner pointer is centred or a maximum of 5 mm to the right of the slot in the base plate.

If the crankshaft cannot be locked:

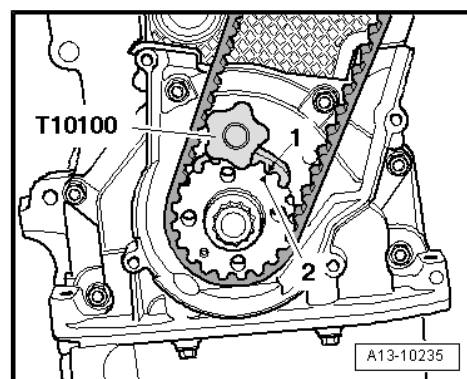
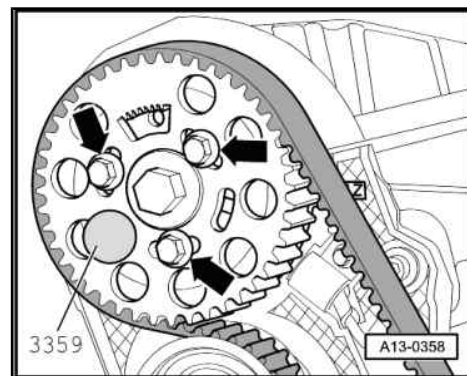
- Loosen securing bolts for camshaft sprocket -arrows-.
- Turn the crankshaft slightly further in the normal direction of rotation until it can be locked with crankshaft stop - T10100- .



Note

If the crankshaft has been rotated beyond TDC, turn it back slightly so you can then reset it to TDC by turning in the normal direction of rotation.

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- Tighten securing bolts for camshaft sprocket -arrows- to 25 Nm.
- Remove locking pin - 3359- and crankshaft stop - T10100- .



Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

- Turn crankshaft two rotations in normal direction of rotation until crankshaft is at TDC again.
- Check valve timing once again ⇒ [page 64](#) .

Assembling:

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

- Install centre and bottom sections of toothed belt cover.



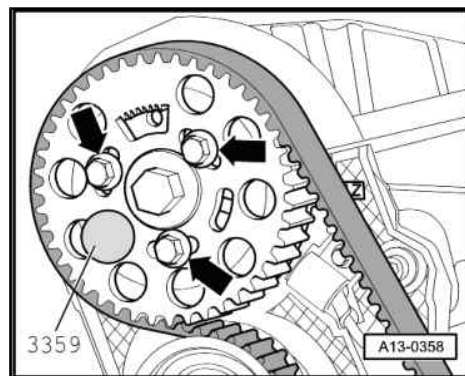
Note

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- ◆ *Renew seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Secure engine support ⇒ [page 39](#) .
- Install vibration damper ⇒ [page 50](#) .
- Adjust assembly mountings ⇒ [page 41](#) .
- Install poly V-belt: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .

Tightening torques

Component	Nm
Tensioning roller for toothed belt to cylinder head	20 +45°
Camshaft sprocket to hub	25
Toothed belt cover (bottom) to cylinder block	10 ¹⁾
Toothed belt cover (centre) to cylinder block	10 ¹⁾
Tensioner for poly V-belt to bracket for ancillaries	23
Air pipe (right-side) to bracket	8
• ¹⁾ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue for locking fluid.	



2 Sealing flanges and dual-mass flywheel

2.1 Sealing flanges and dual-mass flywheel - exploded view



Note

Servicing clutch ⇒ Rep. gr. 30

1 - 15 Nm

2 - Crankshaft oil seal

- ☐ Renewing ⇒ [page 68](#)
- ☐ Do not lubricate with oil

3 - Sealing flange (pulley end)

- ☐ Removing and installing ⇒ [page 70](#)
- ☐ Must be positioned on dowel sleeves

4 - Cylinder block

5 - Dual-mass flywheel

- ☐ Removing and installing ⇒ [page 80](#)
- ☐ Can only be installed in one position (holes are off-set)

6 - 60 Nm +90°

- ☐ Renew

7 - Intermediate plate

- ☐ Do not damage/bend when assembling
- ☐ Must be positioned on dowel sleeves

8 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Removing and installing ⇒ ["2.4 Renewing sealing flange \(flywheel end\)", page 72](#)

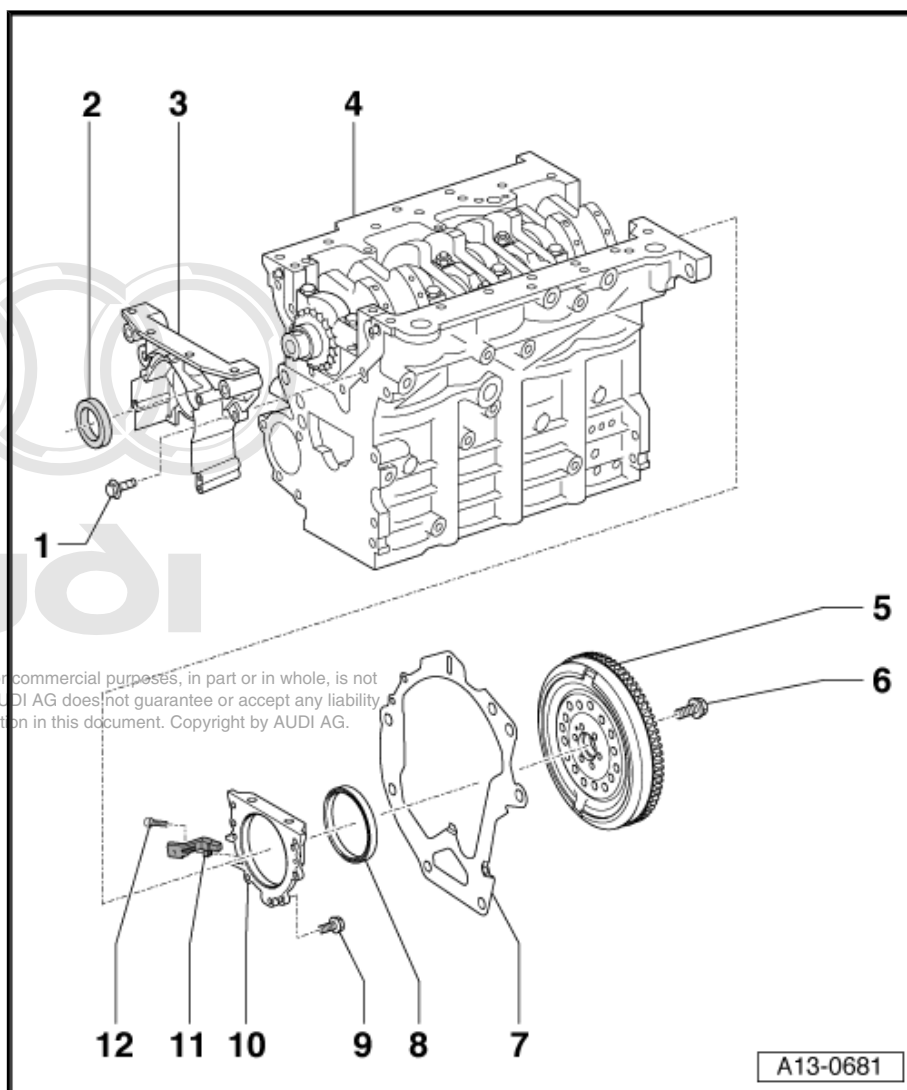
9 - 15 Nm

10 - Sealing flange (flywheel end)

- ☐ With oil seal
- ☐ Renewing ⇒ [page 72](#)

11 - Engine speed sender - G28-

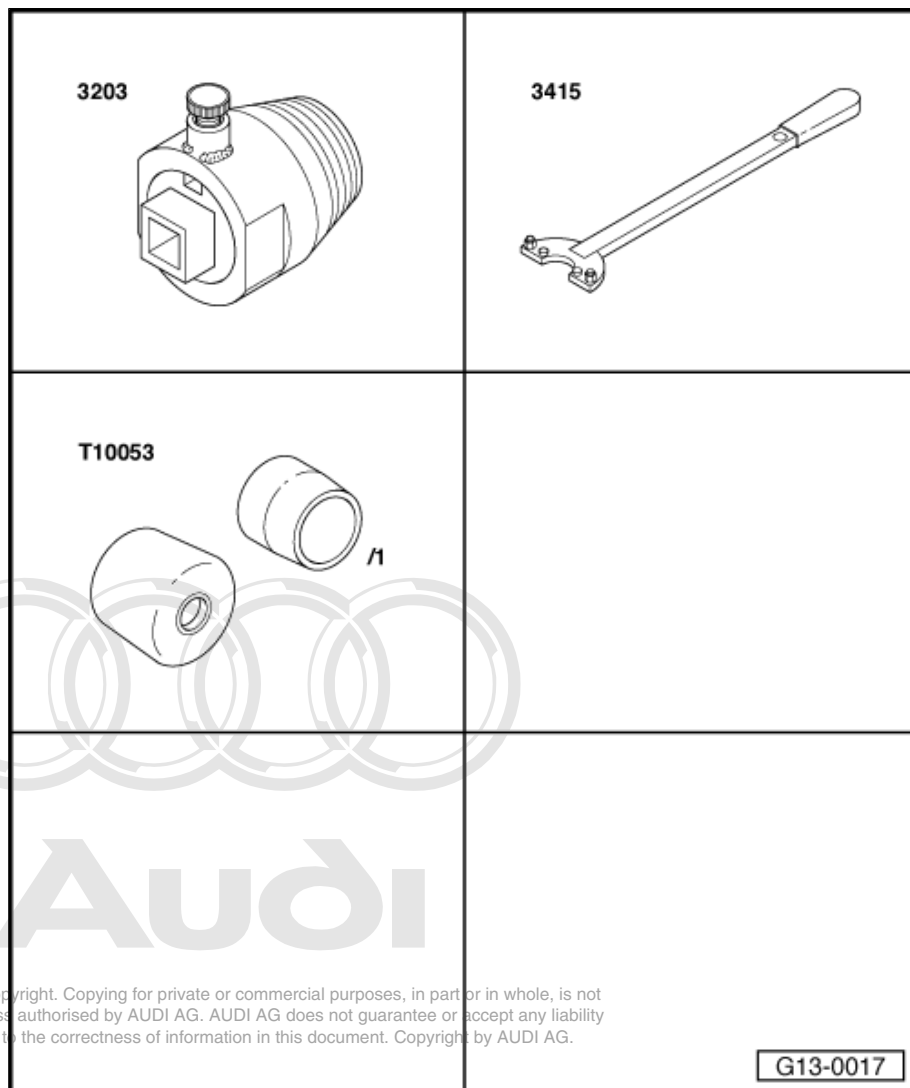
12 - 4.5 Nm



2.2 Renewing crankshaft oil seal

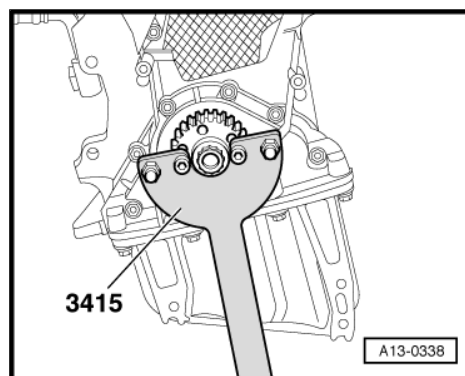
Special tools and workshop equipment required

- ◆ Oil seal extractor - 3203-
- ◆ Counterhold tool - 3415-
- ◆ Assembly tool - T10053-

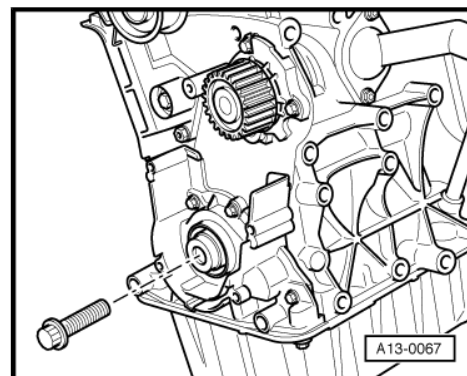


Procedure

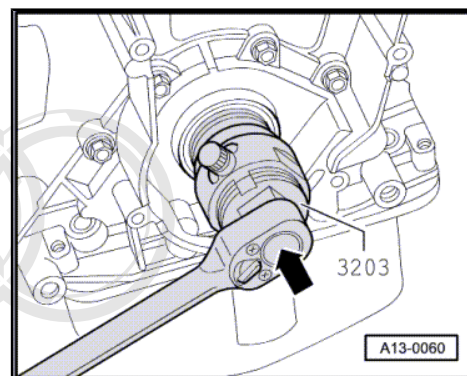
- Engine in vehicle.
- Remove toothed belt ⇒ [page 57](#) .
- Remove crankshaft sprocket; use counterhold tool - 3415- to lock crankshaft sprocket in place.



- Before fitting oil seal extractor, fully screw in centre bolt for sprocket into crankshaft.

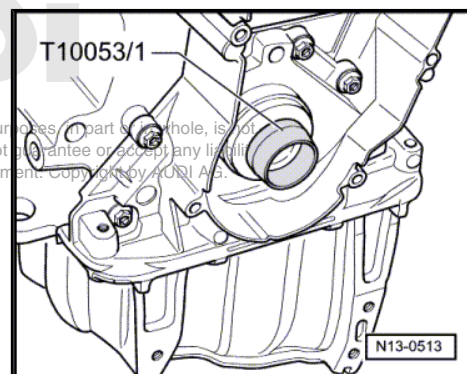


- Unscrew inner section of oil seal extractor - 3203- 8 turns out of outer section and lock with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice.
- Remove oil seal with pliers.
- Clean running surface and sealing surface.

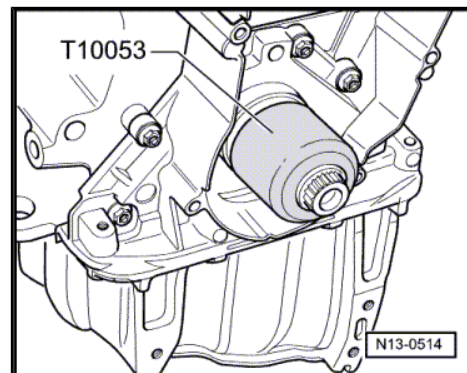
**Note**

Do not apply oil to sealing lip or outer circumference of oil seal.

- Place guide sleeve - T10053/1- onto crankshaft journal.
- Slide oil seal over guide sleeve.



- Press in oil seal flush using the centre bolt of toothed belt sprocket and press sleeve from -T10053- .

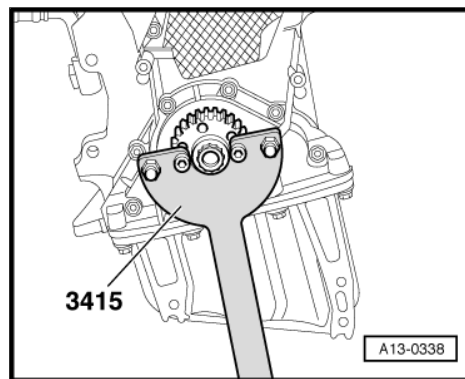


- Renew centre bolt for toothed belt sprocket.



Note

- ◆ *Contact surface between toothed belt sprocket and crankshaft must be free of oil.*
- ◆ *Do not lubricate bolt for crankshaft sprocket.*
- Install crankshaft sprocket; use counterhold tool - 3415- to lock sprocket in place.
- Install toothed belt (adjust valve timing) ⇒ [page 63](#) .
- Install poly V-belt: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .



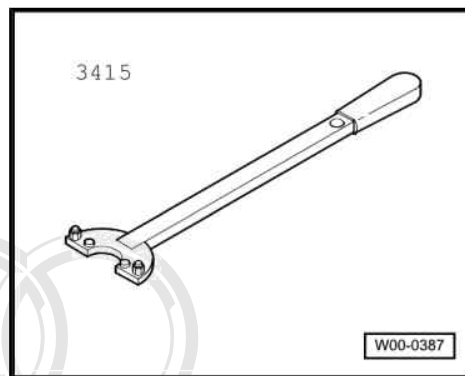
Tightening torque

Component	Nm
Toothed belt sprocket to crankshaft	120 +90° 1)
• 1) Renew bolt.	

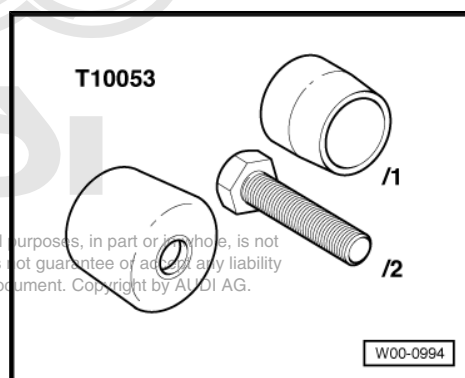
2.3 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

- ◆ Counterhold tool - 3415-



- ◆ Assembly tool - T10053-

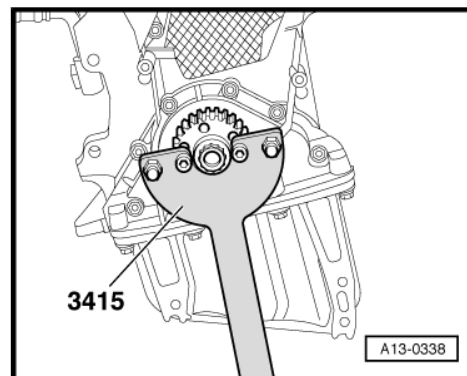


- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

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Removing

- Engine in vehicle.
- Remove toothed belt ⇒ [page 57](#) .
- Remove crankshaft sprocket; use counterhold tool - 3415- to lock crankshaft sprocket in place.



- Remove bolts -1 ... 10-.
- Release sealing flange (pulley end) from bonded joint.
- Drive out oil seal with sealing flange removed.

Installing

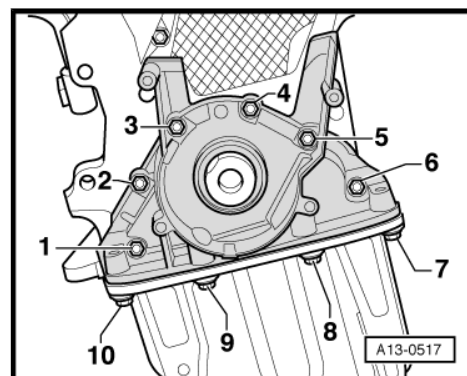
Installation is carried out in the reverse order; note the following:



Note

Place a cloth over the exposed section of the sump.

- Carefully remove any sealant residue on the cylinder block and sump.

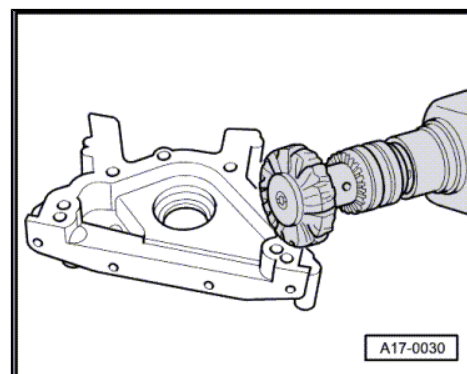


WARNING

Wear safety goggles.

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



Note

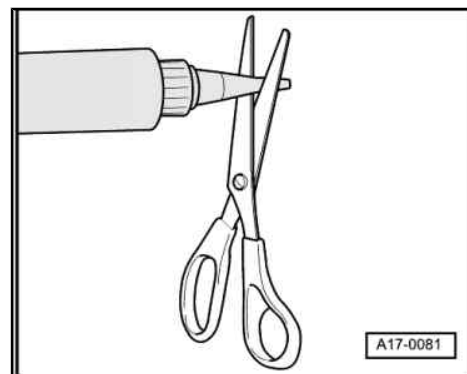
Note the use-by date of the sealant.

- Cut off tube nozzle at front marking (diameter of nozzle approx. 3 mm).

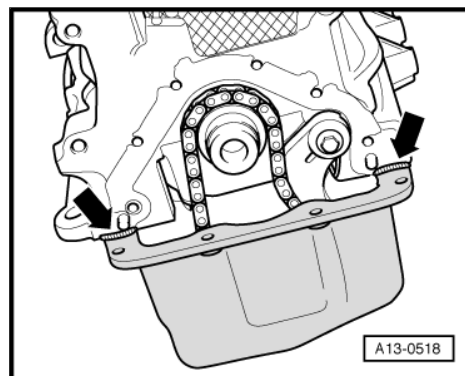


Note

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



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

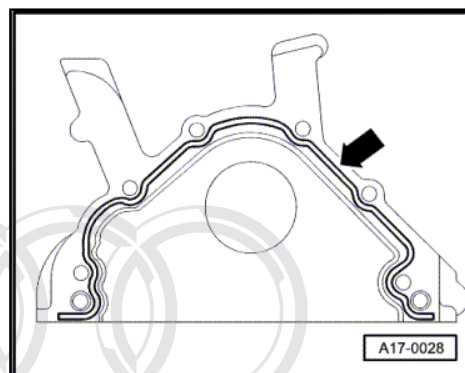


- Apply the bead of sealant onto the clean sealing surface of the sealing flange as illustrated -arrow-.
- Width of sealant bead -arrow-: 2 ... 3 mm.

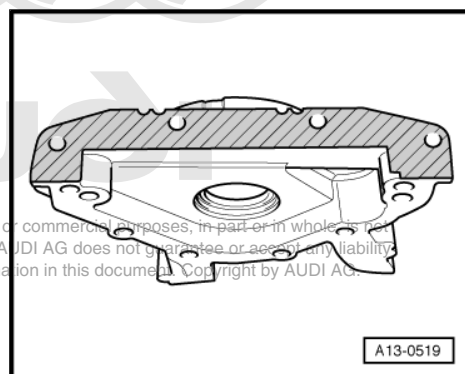


Note

Sealant bead must not be wider than 3 mm, otherwise excess sealant could ingress into sump and clog strainer in oil intake pipe.



- Coat the lower sealing surface on the sealing flange lightly with sealant -hatched area-.
- Push the sealing flange carefully onto the dowel pins on the cylinder block.

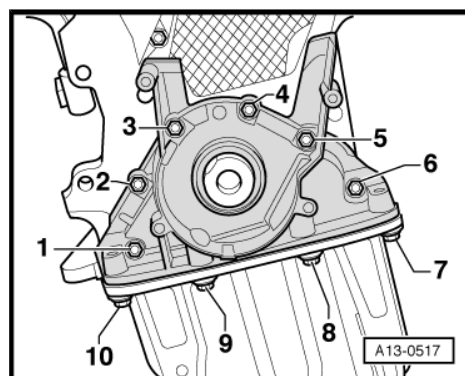


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- Tighten bolts in the specified sequence:
 1. Tighten bolts -1 ... 6-.
 2. Tighten bolts -7 ... 10-.
- Install crankshaft oil seal (pulley end) ⇒ [page 69](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 63](#) .

Tightening torque

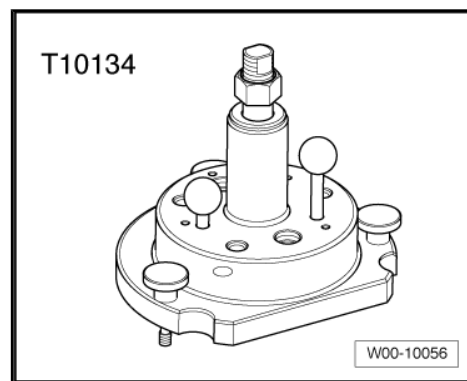
Component	Nm
Sealing flange to cylinder block	15



2.4 Renewing sealing flange (flywheel end)

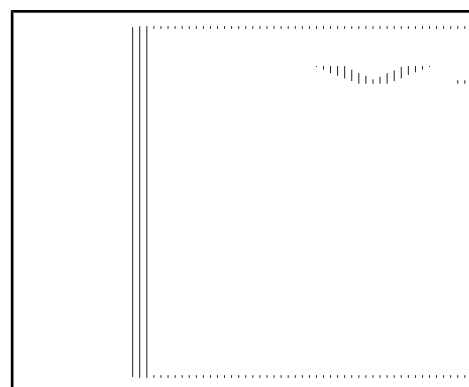
Special tools and workshop equipment required

◆ Assembly tool - T10134-

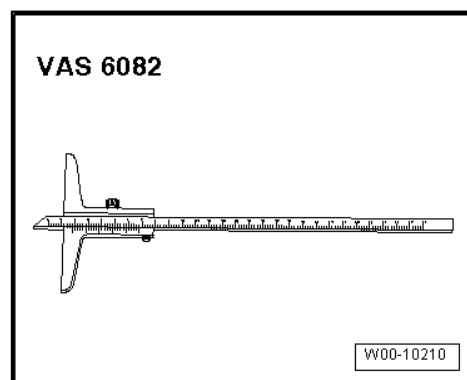


◆ Tool insert, AF 22 - V.A.G 1332/12-

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◆ Depth gauge - VAS 6082-

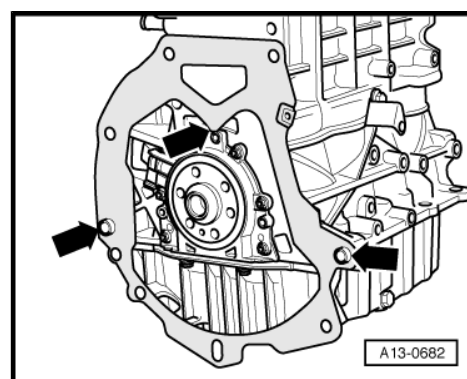


◆ Bolt M6x35 (3x)

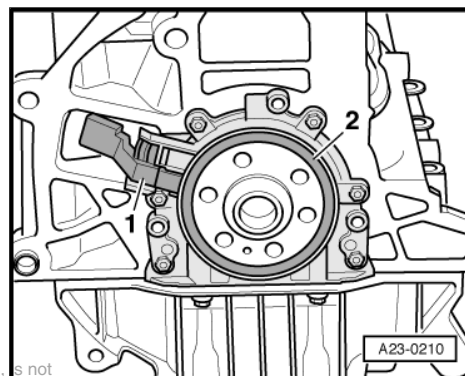
◆ Bolt M7x35 (2x)

Pressing out sealing flange with sender wheel

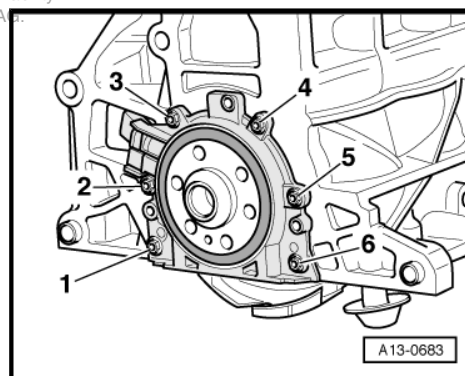
- Gearbox removed.
- Remove dual-mass flywheel ⇒ [page 80](#) .
- Detach intermediate plate at sealing flange and dowel sleeves -arrows-.
- Turn the crankshaft to TDC ⇒ [page 57](#) .



- Remove engine speed sender - G28- -item 1- using a standard ball head hexagon key.
- Remove sump ⇒ [page 168](#) .



- Unscrew bolts -1 ... 6- for sealing flange.

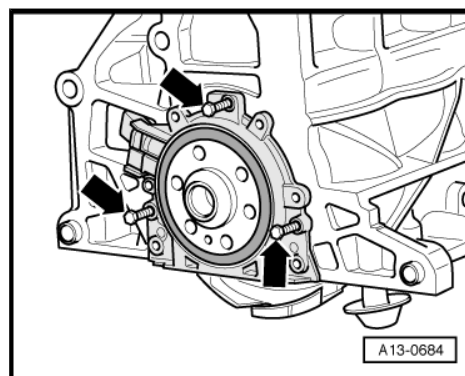


Note

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

- To press out, screw in 3 bolts M6x35 -arrows- alternately into sealing flange not more than $\frac{1}{2}$ turn at a time.
- Remove sealing flange together with sender wheel.

Pressing in sealing flange with sender wheel

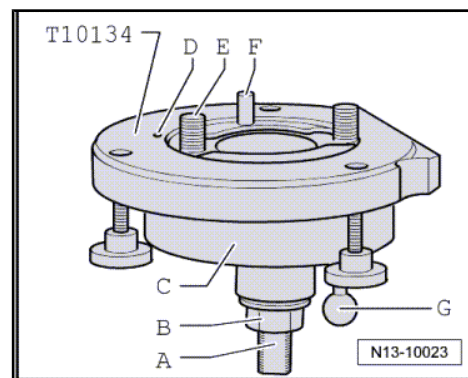


Note

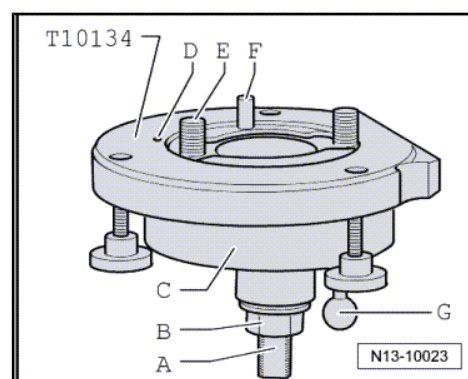
- ◆ The sealing flange with PTFE oil seal is fitted with a sealing lip support ring. This support ring acts as an assembly sleeve and must not be removed before installation.
- ◆ Sealing flange and sender wheel must not be separated or rotated out of position after removal from packaging.
- ◆ The sender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

Construction of assembly tool - T10134-

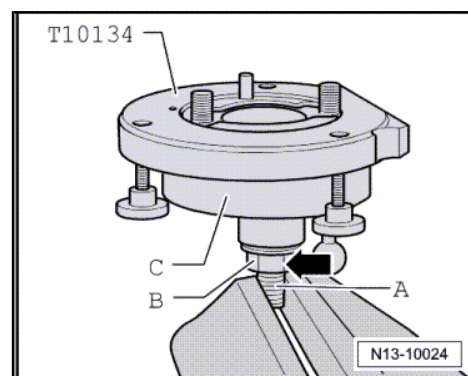
- A - Tightening flats
- B - Hexagon nut
- C - Assembly housing
- D - Locating pin
- E - Hexagon socket-head bolt
- F - Guide pin for diesel engines (black handle)
- G - Guide pin for petrol engines (red handle)

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

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



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

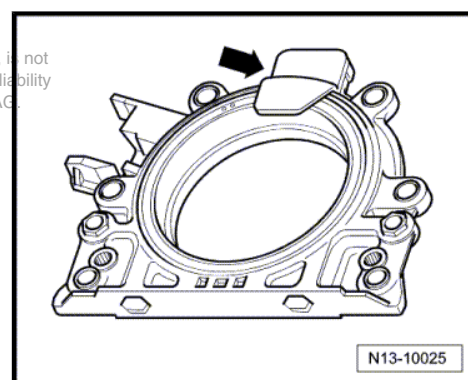


- Remove the securing clip -arrow- from new sealing flange.

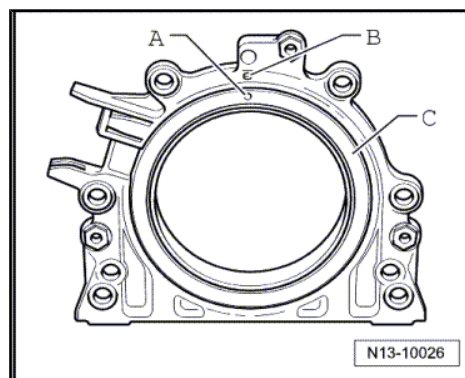
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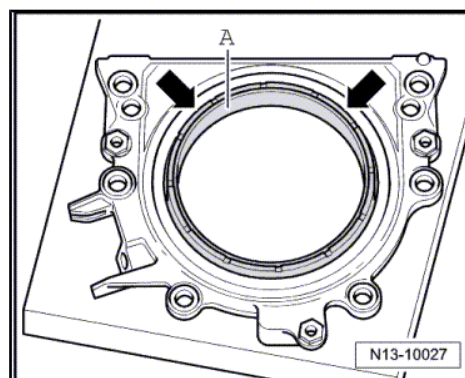
The sender wheel must not be removed from the sealing flange or rotated out of position.



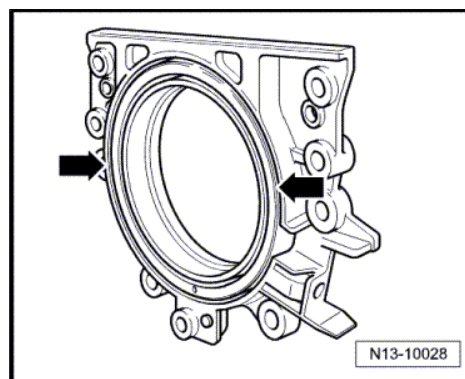
- The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.
- Place the sealing flange (with the front side downwards) on a clean flat surface.



- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



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

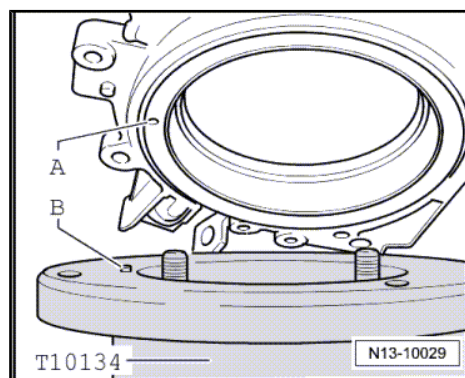


- Place front side of sealing flange on assembly tool - T10134-, so that locating pin -B- can be inserted in hole -A- in sender wheel.



Note

Ensure the sealing flange lies flat on the assembly tool.



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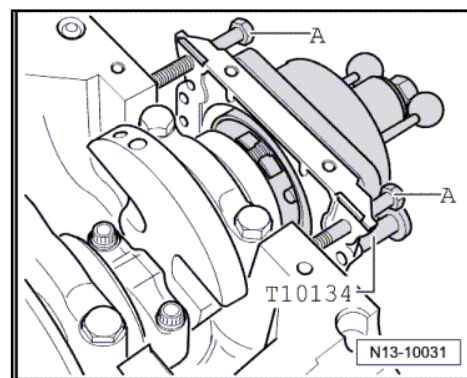
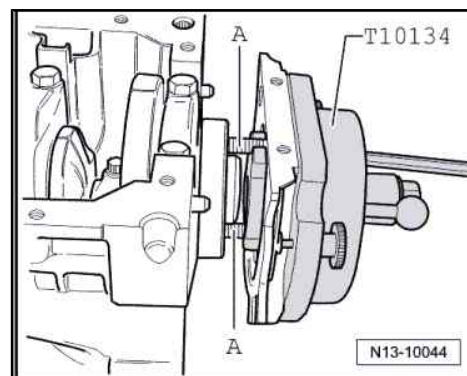
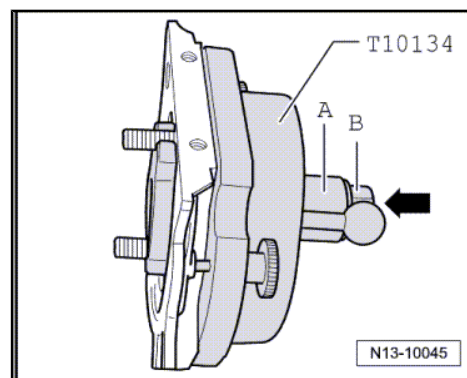
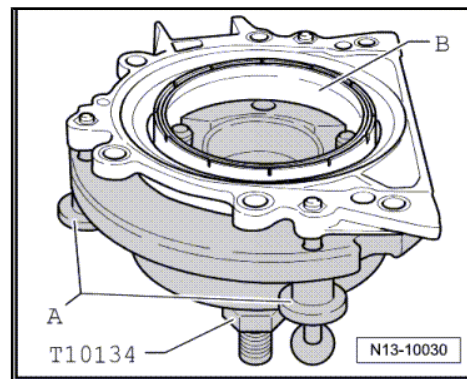
- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool - T10134- while tightening the three knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.

**Note**

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

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

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



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- Screw two bolts M7×35 mm -A- into cylinder block to guide sealing flange.

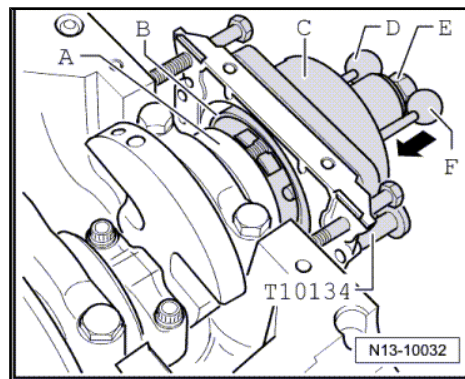
C - Securing assembly tool - T10134- onto crankshaft flange:

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



Note

The guide pin for PETROL engines (red handle) -F- MUST NOT be inserted into the threaded hole in the crankshaft.



- Tighten the 2 hexagon socket head bolts on assembly tool finger-tight.
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.

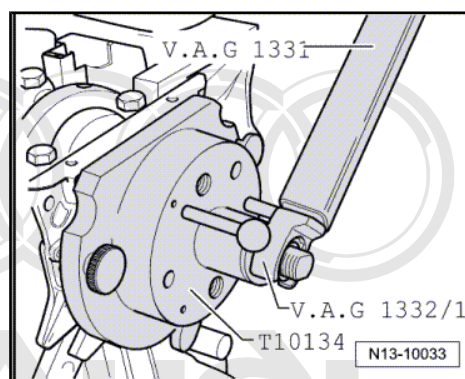
D - Pressing sender wheel onto crankshaft flange with assembly tool - T10134- :

- Tighten hexagon nut of assembly tool - T10134- to 35 Nm.



Note

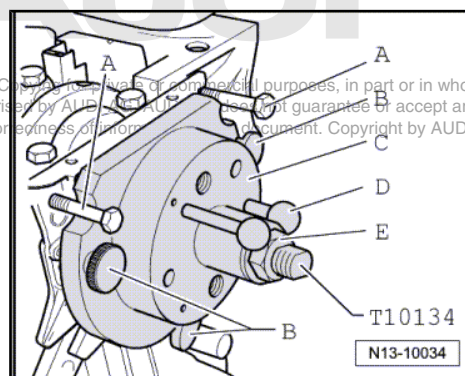
A small air gap must be present between cylinder block and sealing flange after tightening hexagon nut to 35 Nm.



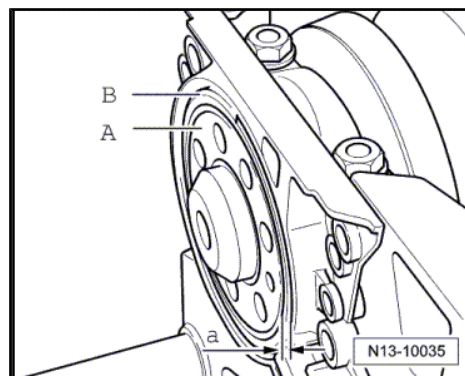
E - Checking installation position of sender wheel on crankshaft:

- Screw hexagon nut -E- to end of threaded spindle.
- Unscrew the 2 bolts -A- out of cylinder block.
- Unscrew the 3 knurled screws -B- from sealing flange.
- Remove assembly tool - T10134- .
- Remove sealing lip support ring.

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- The sender wheel is positioned correctly on the crankshaft if the distance -a- between the crankshaft flange -A- and the sender wheel -B- is 0.5 mm.



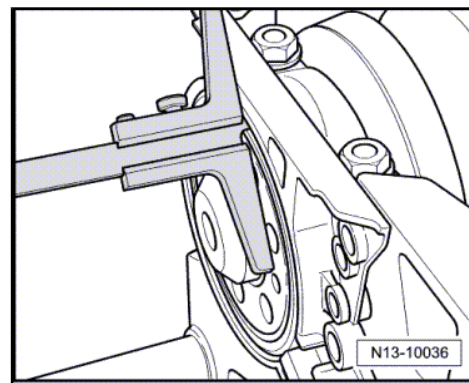
- Apply a depth gauge - VAS 6082- on the crankshaft flange.
- Measure distance -a- between crankshaft flange and sender wheel.

If dimension -a- is too small:

- Press in the sender wheel further ⇒ [page 79](#) .

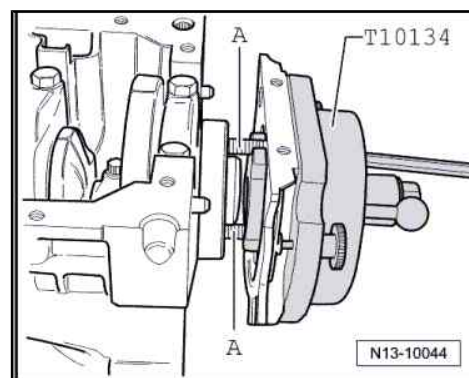
When dimension -a- is achieved:

- Continue with assembly ⇒ [page 80](#) .

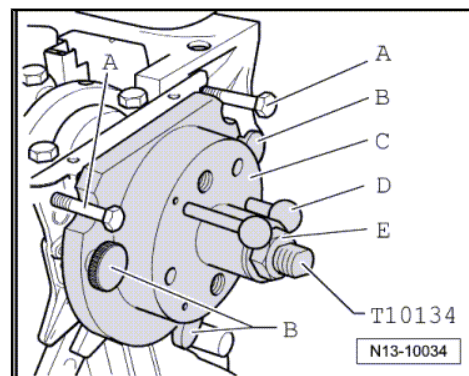


F - Pressing sender wheel in further:

- Secure assembly tool - T10134- to crankshaft flange by tightening hexagon socket head bolts finger-tight -items A-.
- Press the assembly tool - T10134- towards the sealing flange by hand.



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

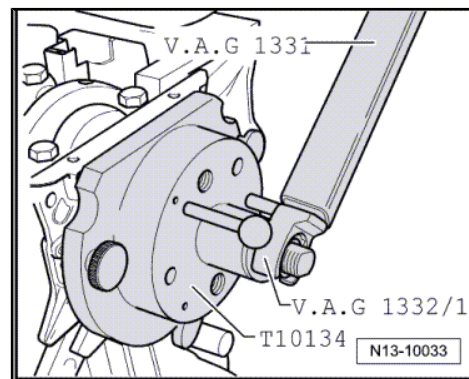


- Tighten hexagon nut of assembly tool - T10134- to 40 Nm.

- Check installation position of sender wheel on crankshaft again ⇒ [page 78](#) .

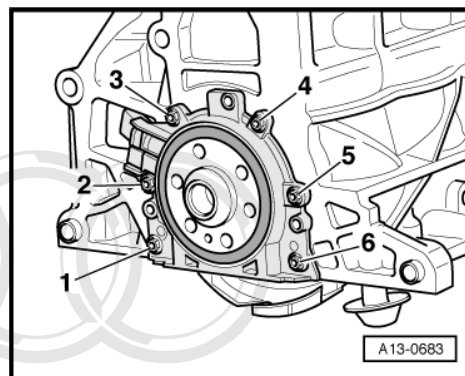
If dimension “a” is too small again:

- Tighten hexagon nut of assembly tool - T10134- to 45 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 78](#) .

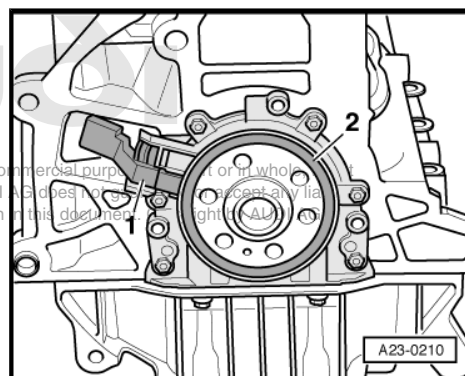


Assembling:

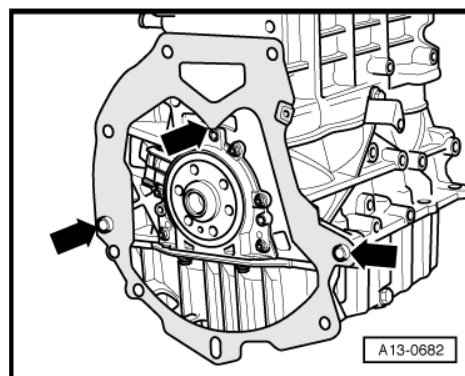
- Tighten new securing bolts for sealing flange -1 ... 6- in diagonal sequence.



- Secure engine speed sender - G28- -item 1-.
- Install sump ⇒ [page 168](#) .



- Fit intermediate plate on sealing flange and push onto dowel sleeves -arrows-.
- Install dual-mass flywheel ⇒ [page 80](#) .



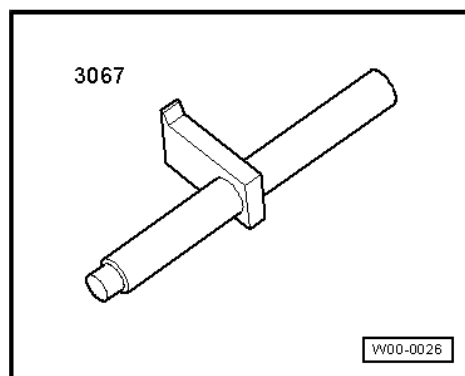
Tightening torques

Component	Nm
Sealing flange to cylinder block	15 ¹⁾
Engine speed sender - G28- to cylinder block	5
• ¹⁾ Tighten bolts in diagonal sequence	

2.5 Removing and installing dual-mass fly-wheel

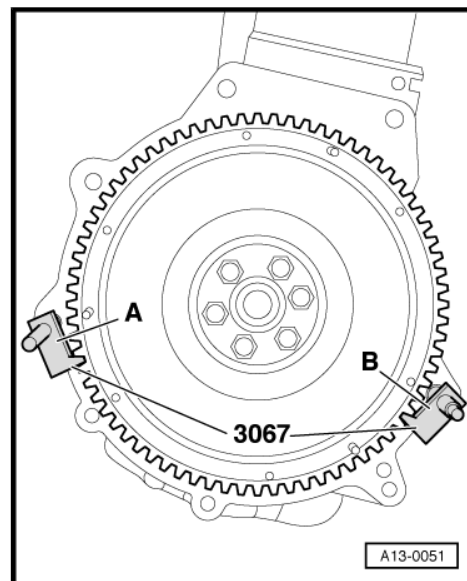
Special tools and workshop equipment required

- ◆ Counterhold tool - 3067-



Removing

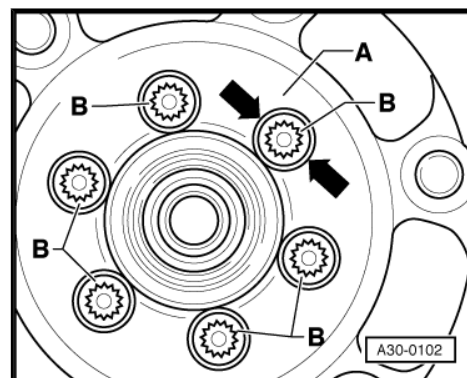
- Attach counterhold tool - 3067- at -position B- in order to loosen bolts.
- Unbolt dual-mass flywheel.
- Insert counter-hold tool - 3067- in hole on cylinder block, and secure on dual-mass flywheel.



Note

To prevent damage to the dual-mass flywheel when removing, the bolts -B- must not be removed with an impact wrench or similar. The bolts may only be removed by hand using conventional tools.

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



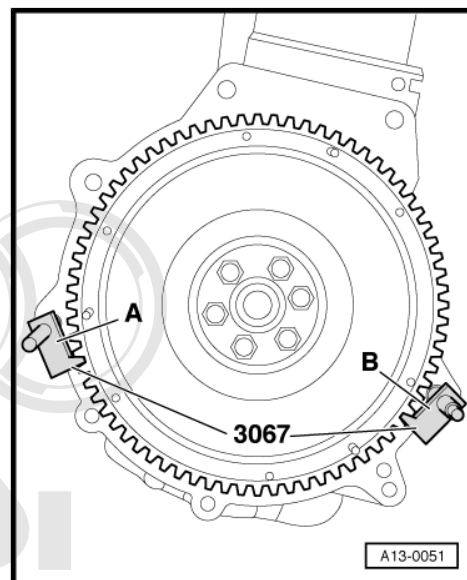
Installing

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

- Use new securing bolts.
- Fit counterhold tool - 3067- at -position A- to tighten bolts.

Tightening torque

Component	Nm
Dual-mass flywheel to crankshaft	60 +90° 1)
• 1) Renew bolts.	



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3 Crankshaft



Note

When performing assembly work, secure engine to engine and gearbox support ⇒ [page 32](#).

3.1 Crankshaft - exploded view

1 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed

2 - Chain sprocket

- ☐ For oil pump chain
- ☐ Renewing ⇒ [page 86](#)

3 - 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 the base layer must be renewed

4 - Thrust washers

- ☐ For bearing No. 3
- ☐ Different types for cylinder block and bearing cap
- ☐ Note location

5 - Bolts

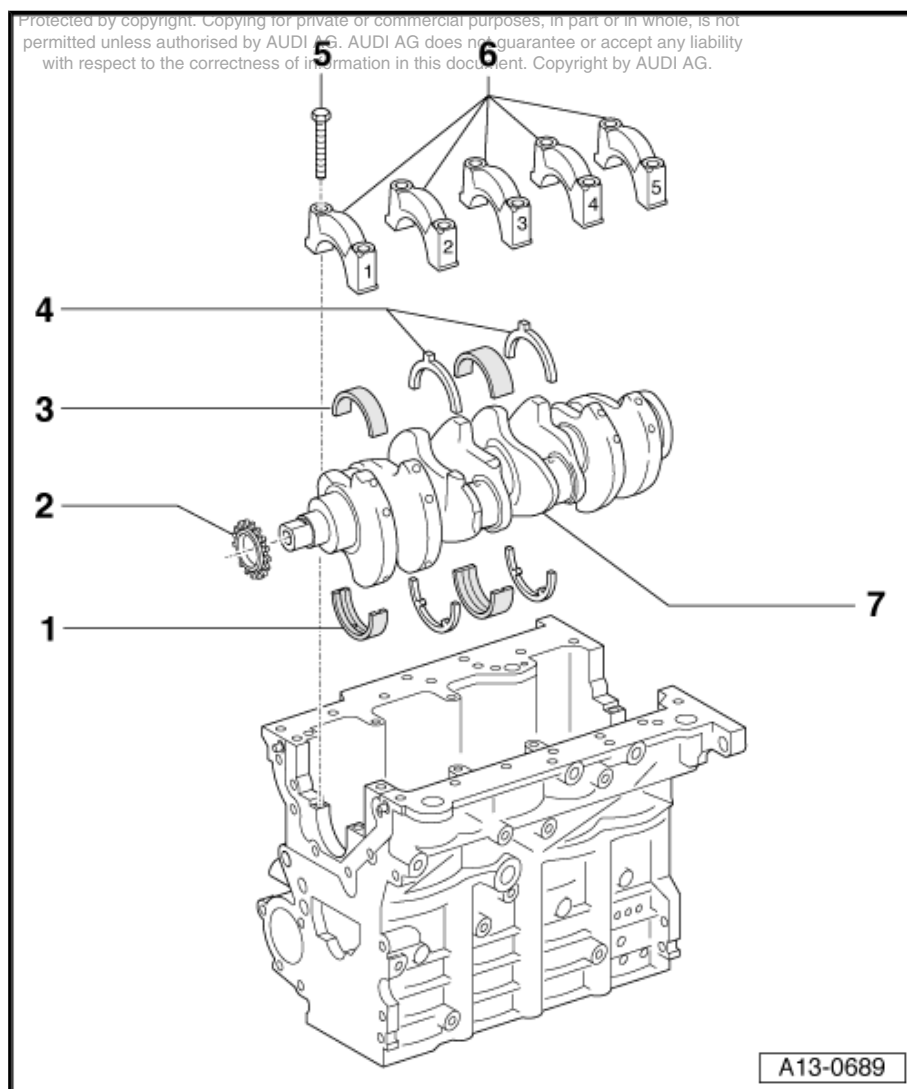
- ☐ Renew
- ☐ 65 Nm +90°
- ☐ When measuring radial clearance, tighten used bolt to 65 Nm and turn 90° further

6 - Bearing cap

- ☐ Bearing cap 1: Pulley end
- ☐ Bearing cap 3 with recesses for thrust washers
- ☐ Retaining lugs of cylinder block bearing shells / bearing caps must be on the same side of the bearing

7 - Crankshaft

- ☐ Measuring axial clearance ⇒ [page 84](#)
- ☐ Measuring radial clearance ⇒ [page 85](#)
- ☐ Crankshaft dimensions ⇒ [page 84](#)

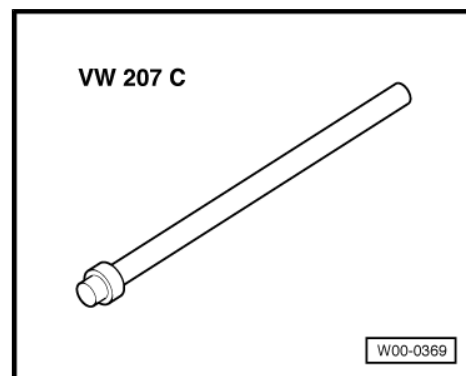


- ❑ A needle bearing must be fitted in the crankshaft on vehicles with dual clutch gearbox; install needle bearing if not already fitted ⇒ [page 83](#)

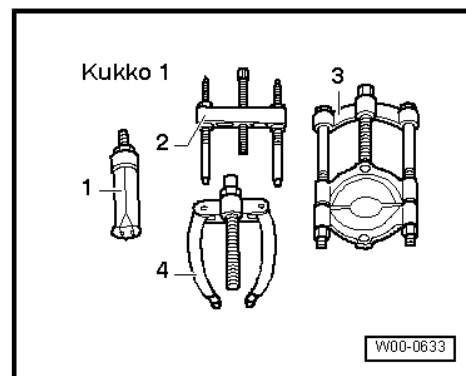
3.2 Extracting and driving in needle bearing for crankshaft

Special tools and workshop equipment required

- ◆ Drift - VW 207 C- or centring mandrel - 3176-

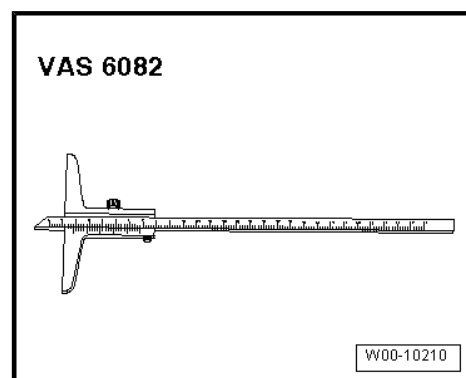


- ◆ 1 - Internal puller - Kukko 21/1-



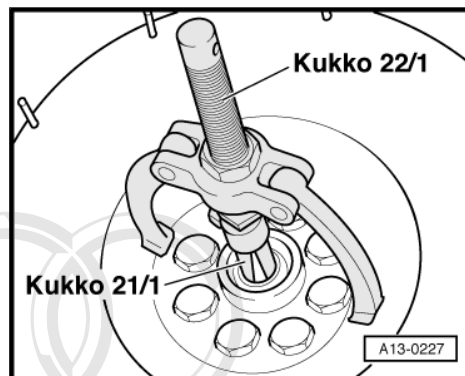
- ◆ 4 - Counter-support - Kukko 22/1-

- ◆ Depth gauge - VAS 6082-



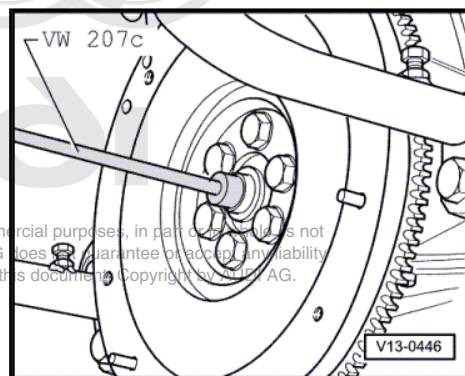
Removing

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



Installing

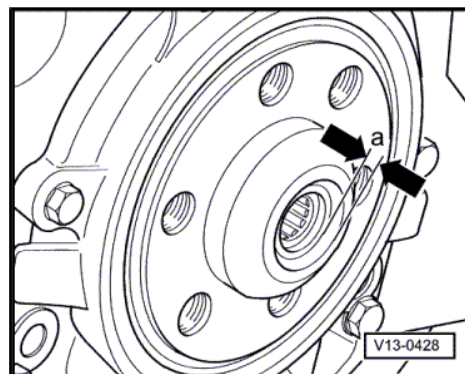
- Drive in needle bearing using drift - VW 207 C- or centring mandrel - 3176- .
- The inscription on needle bearing must be visible when installed.



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Installation position for needle bearing:

- Distance -a- = 2.0 mm



3.3 Crankshaft dimensions

1.9 ltr. engine

Honing dimension (in mm)	Crankshaft main bearing journal Ø	Conrod bearing journal Ø
Basic dimension	54.00 -0.022 -0.042	47.80 -0.022 -0.042

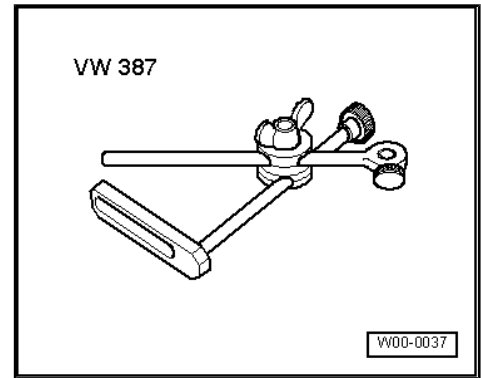
2.0 ltr. engine

Honing dimension (in mm)	Crankshaft main bearing journal Ø	Conrod bearing journal Ø
Basic dimension	54.00 -0.022 -0.042	50.90 -0.022 -0.042

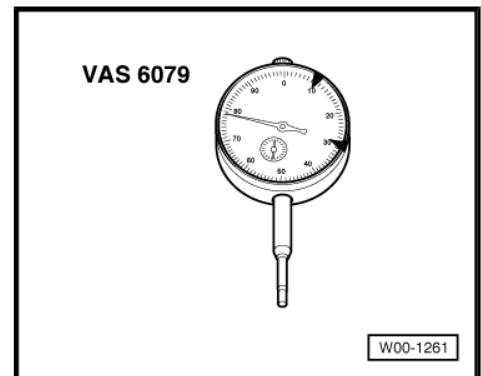
3.4 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

◆ Universal dial gauge bracket - VW 387-



◆ Dial gauge - VAS 6079-

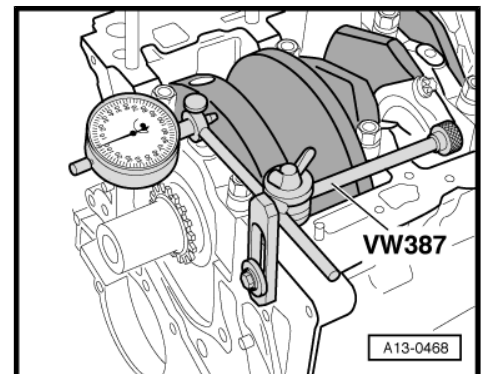


Procedure

- Bolt dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- onto cylinder block (as shown in illustration) 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 ... 0.17 mm.
- Wear limit: 0.37 mm.



3.5 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Plastigage

Procedure



Note

- ◆ *Mark used bearing shells for re-installation (but do not mark bearing surface).*
- ◆ *Bearing shells worn down to the base layer must be renewed.*
- Remove bearing cap and clean bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shell.

- The Plastigage must be positioned in the centre of the bearing shell.
- Fit bearing cap and secure with old bolts ⇒ [Item 5 \(page 82\)](#) without rotating crankshaft.
- Remove bearing cap again.
- Compare width of Plastigage with measurement scale.

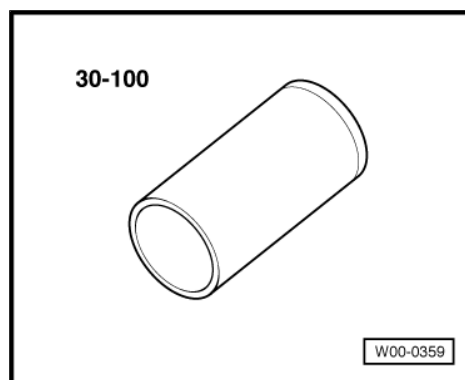
Radial clearance:

- New: 0.03 ... 0.08 mm.
- Wear limit: 0.17 mm.

3.6 Removing and installing chain sprocket

Special tools and workshop equipment required

- ◆ Drift sleeve - 30-100-



- ◆ Two-arm puller, commercially available
- ◆ Protective gloves

Removing

- Remove sump ⇒ [page 168](#) .
- Remove sealing flange (pulley end) ⇒ [page 70](#) .
- Remove the following components:
 - ◆ Chain sprocket for oil pump ⇒ [Item 2 \(page 166\)](#) .
 - ◆ Chain tensioner ⇒ [Item 7 \(page 167\)](#) .
 - ◆ Chain ⇒ [Item 4 \(page 166\)](#) .
- Detach chain sprocket from crankshaft with puller -2-; use a suitable washer -1- to protect end of crankshaft.

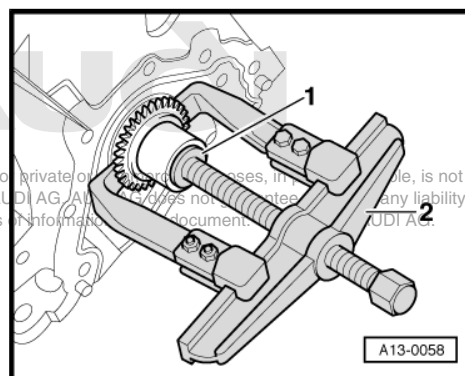
Installing

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



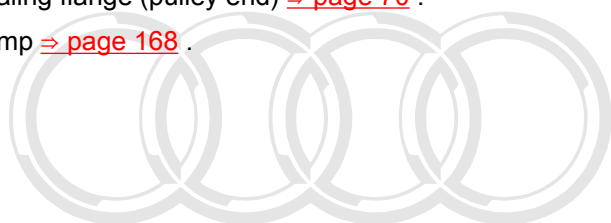
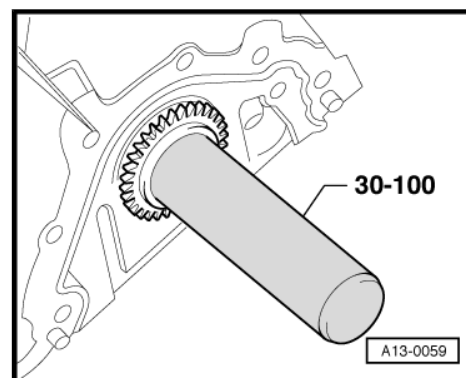
WARNING

Wear protective gloves.



- Heat chain sprocket in oven for approx. 15 minutes to 220°C.

- Fit chain sprocket on end of crankshaft using pliers, and press onto crankshaft as far as the stop using drift sleeve - 30-100- .
- Installation position: wide collar on sprocket faces engine.
- Install sealing flange (pulley end) ⇒ [page 70](#) .
- Install sump ⇒ [page 168](#) .



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4 Pistons and conrods

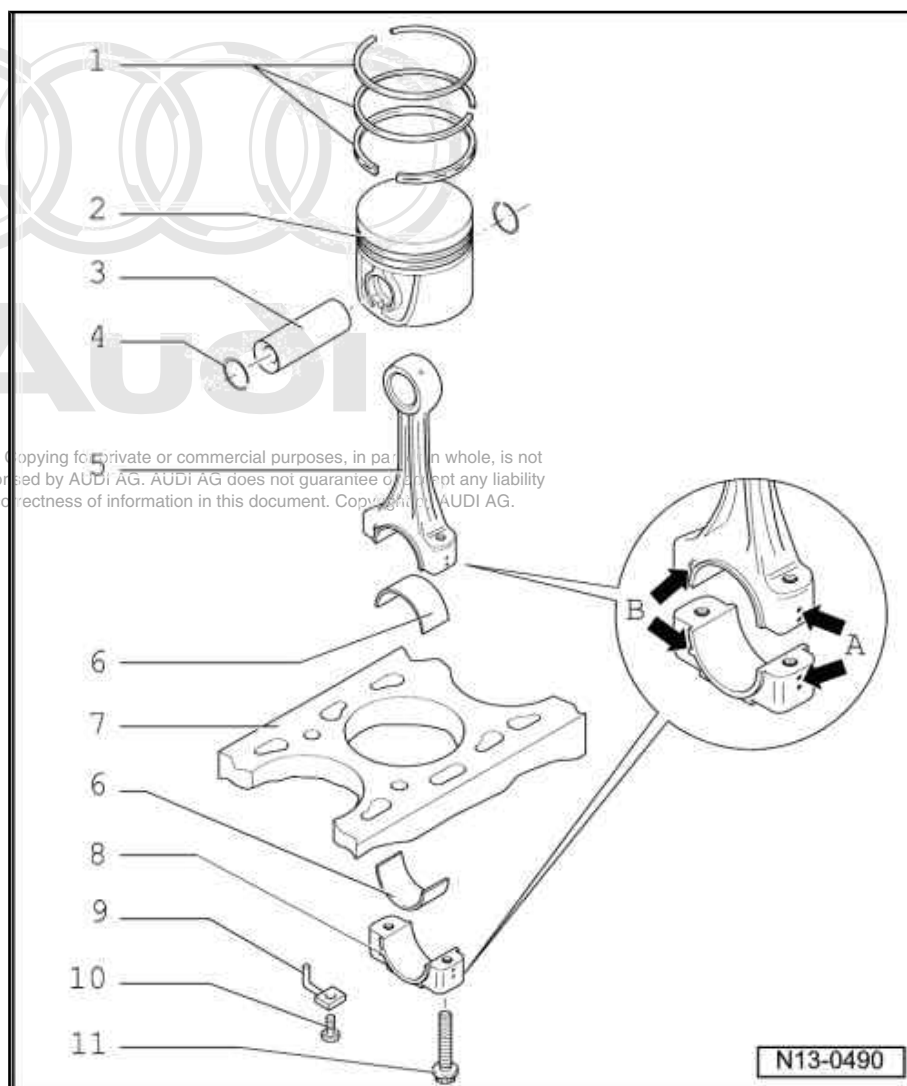
4.1 Pistons and conrods - exploded view

1 - Piston rings

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers to remove and install
- ☐ Marking "TOP" or inscription must face piston crown.
- ☐ Checking ring gap
⇒ [page 89](#)
- ☐ Checking ring-to-groove clearance ⇒ [page 90](#)

2 - Piston

- ☐ With combustion chamber
- ☐ Mark installation position and cylinder number
- ☐ Installation position and allocation of piston/cylinder ⇒ [page 90](#)
- ☐ Arrow on piston crown points to pulley end
- ☐ If cracking is visible on piston skirt, renew piston
- ☐ Checking piston
⇒ [page 90](#)
- ☐ Piston and cylinder dimensions ⇒ [page 93](#)
- ☐ Checking cylinder bore
⇒ [page 91](#)
- ☐ Install using piston ring clamp
- ☐ Measuring piston projection at TDC
⇒ [page 92](#)



3 - Piston pin

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

4 - Circlip

- ☐ Renew

5 - Conrod

- ☐ Mark cylinder allocation -A-
- ☐ Installation position: Marking -B- faces towards pulley end
- ☐ With industrially cracked conrod bearing cap
- ☐ Separating parts of new conrod ⇒ [page 91](#)
- ☐ Axial clearance: wear limit: 0.37 mm
- ☐ Measuring radial clearance ⇒ [page 93](#)

6 - Bearing shell

- ☐ Installation position ⇒ [page 91](#)
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed
- ☐ Note type: upper bearing shell (closest to piston) is made of more wear-resistant material. Distinguishing feature on new bearing shells: black marking on bearing surface near joint
- ☐ Check that it is securely seated

7 - Cylinder block

- ☐ Checking cylinder bore ⇒ [page 91](#)
- ☐ Piston and cylinder dimensions ⇒ [page 93](#)

8 - Conrod bearing cap

- ☐ Note installation position
- ☐ Since industrially cracked conrods are used (the conrod is cast as one unit and the cap is then cracked off), the conrod bearing cap can only be fitted in one position on the corresponding conrod

9 - Oil spray jet

- ☐ For piston cooling ⇒ [page 92](#)

10 - Bolt

- ☐ Insert without sealant
- ☐ 27 Nm

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11 - Conrod bolt

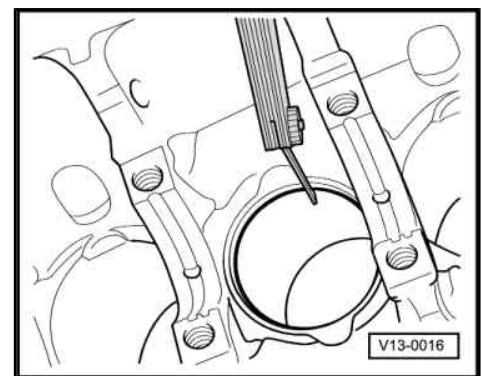
- ☐ Renew
- ☐ When measuring radial clearance, tighten used bolt to 30 Nm and turn 90° further
- ☐ Lubricate threads and contact surface
- ☐ 30 Nm +90°

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.

1.9 ltr. engine	new mm	Wear limit mm
1st compression ring	0.30 ... 0.40	1.00
2nd compression ring	0.20 ... 0.45	1.00
Oil scraper ring	0.25 ... 0.55	1.00

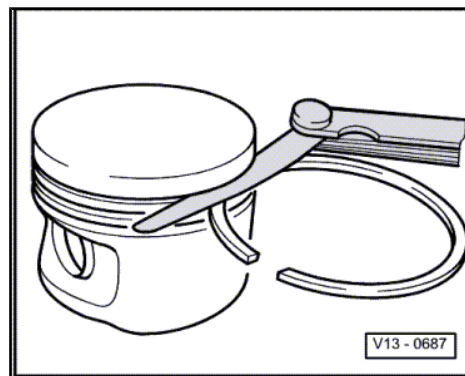
2.0 ltr. engine	new mm	Wear limit mm
1st compression ring	0.30 ... 0.40	1.00
2nd compression ring	0.30 ... 0.50	1.00
Oil scraper ring	0.25 ... 0.50	1.00



Checking ring-to-groove clearance

- Clean groove in piston before checking clearance.

1.9 ltr./2.0 ltr. engine	new mm	Wear limit mm
1st compression ring	0.06 ... 0.09	0.25
2nd compression ring	0.05 ... 0.08	0.25
Oil scraper ring	0.03 ... 0.06	0.15

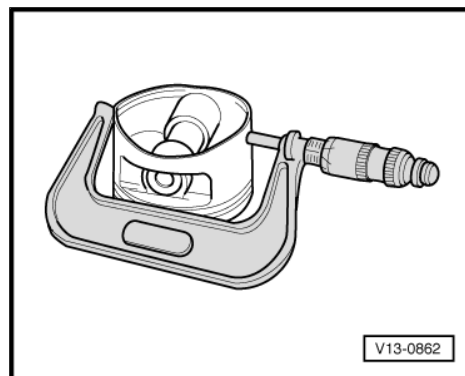


Checking piston

- Measure approx. 10 mm from the bottom edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.

Nominal dimension

⇒ [“4.3 Piston and cylinder dimensions”, page 93](#) .



Piston installation position and piston/cylinder allocation

Pistons in cylinders 1 and 2:

- Large cut-out for inlet valve faces flywheel end -arrows-.

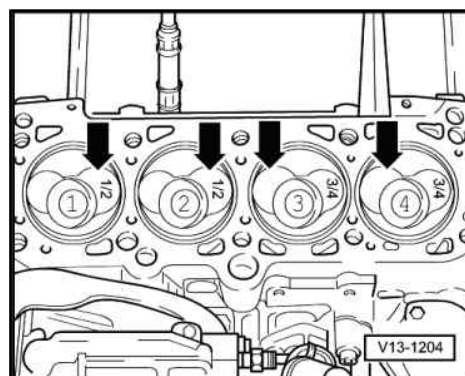
Pistons in cylinders 3 and 4:

- Large cut-out for inlet valve faces pulley end -arrows-.



Note

- ◆ With new pistons, cylinder allocation is indicated by a coloured marking on piston crown.
- ◆ Piston for cylinder 1 and 2: marked 1/2.
- ◆ Piston for cylinder 3 and 4: marked 3/4.



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Checking cylinder bore

- Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.10 mm.

Nominal dimension

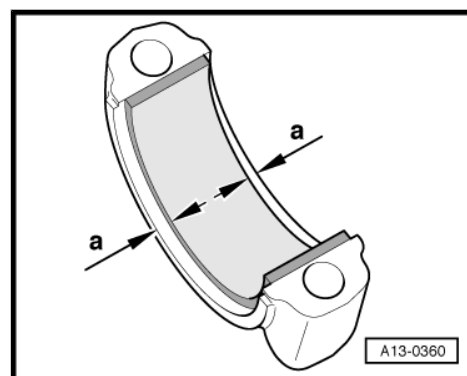
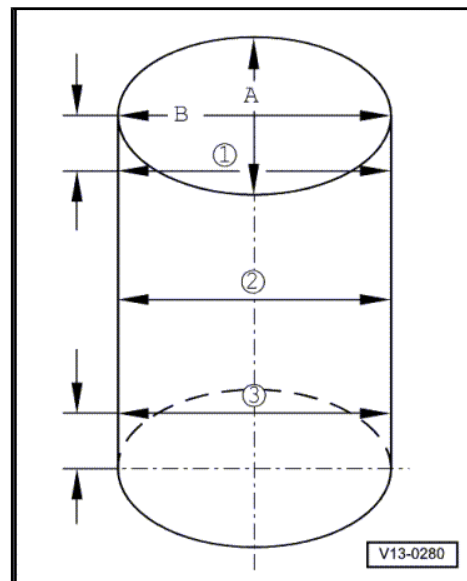
⇒ [“4.3 Piston and cylinder dimensions”, page 93](#).



Installation position of bearing shell

- Insert bearing shells centrally in conrod/conrod bearing cap.
- Distance -a- = 2.5 mm

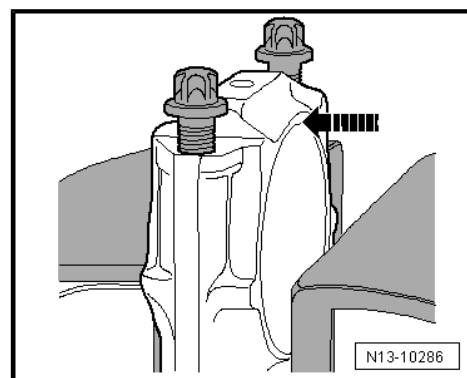
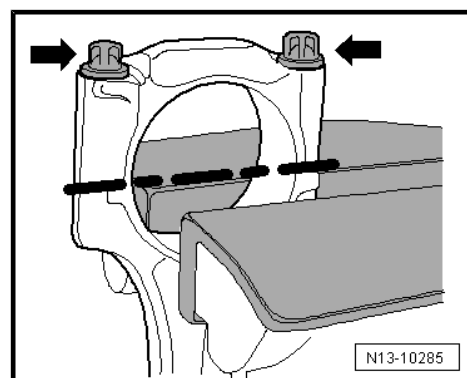
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Separating parts of new conrod

It is possible that the two parts of a new conrod are not completely separated as intended. If it is not possible to take off the conrod bearing cap by hand, proceed as follows:

- To avoid any risk of damage, the conrod should only be clamped lightly in a vice using jaw covers as shown in illustration.
- The conrod is clamped in position below the dotted line.
- Unscrew bolts -arrows- approx. 5 turns.
- Using a plastic hammer, carefully knock conrod bearing cap loose -arrow-.



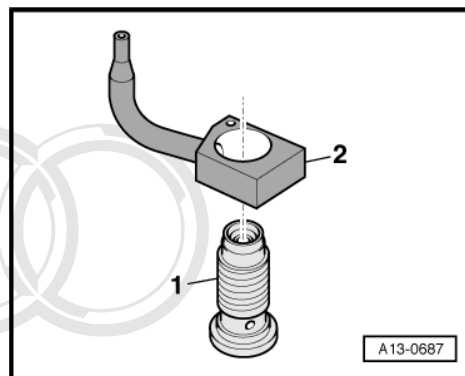
Oil spray jet and pressure relief valve

- 1 - Bolt with pressure relief valve, 27 Nm
- 2 - Oil spray jet (for cooling of pistons)



Note

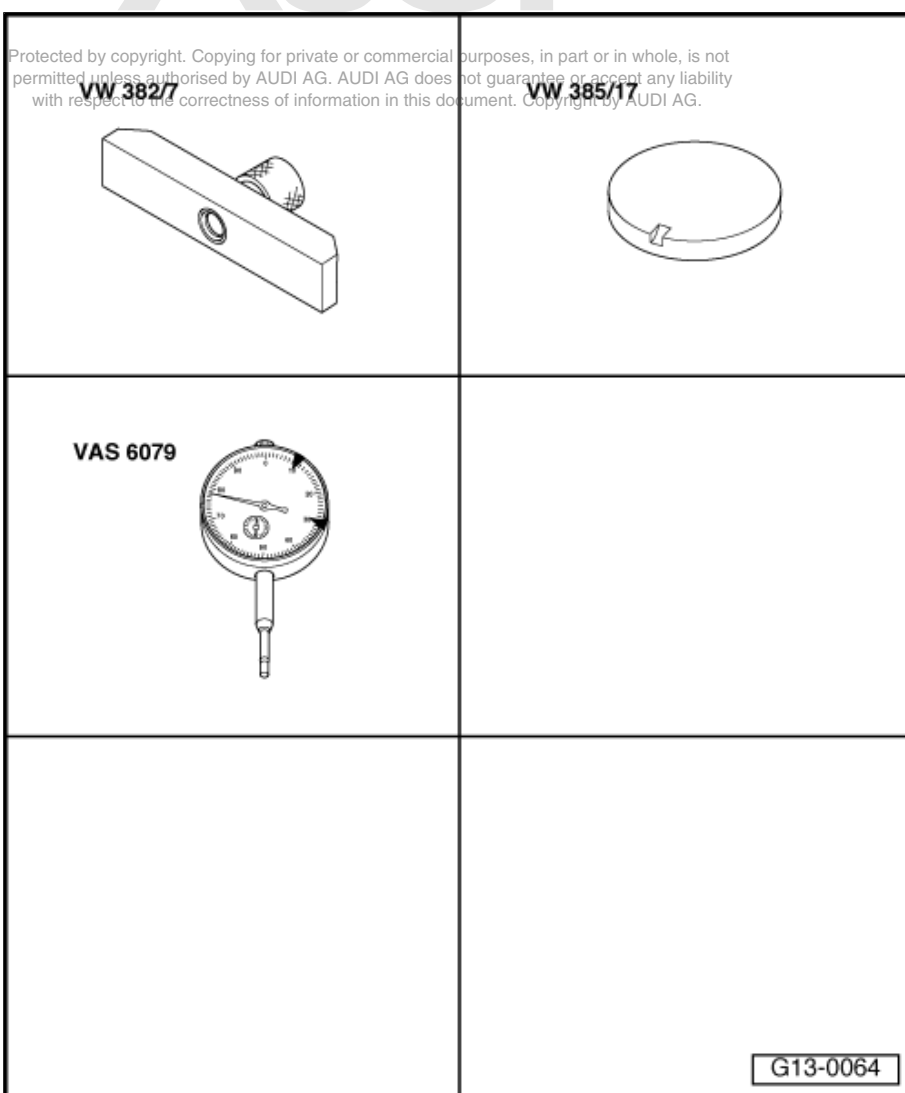
- ◆ Take care not to bend oil spray jets.
- ◆ Always renew bent oil spray jets.



4.2 Measuring piston projection at TDC

Special tools and workshop equipment required

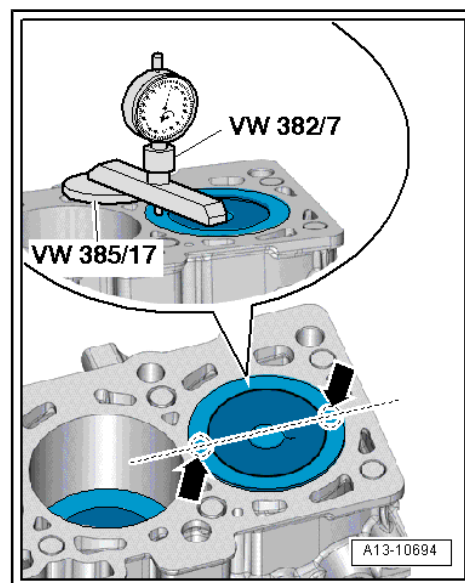
- ◆ Measuring bridge - VW 382/7- from measuring tool - VW 382-
- ◆ Measuring plate - VW 385/17- from universal measuring tool - VW 385-
- ◆ Dial gauge - VAS 6079-



Procedure

- Secure dial gauge - VAS 6079- with measuring bridge - VW 382/7- and measuring plate -VW 385/17- to cylinder block as shown in illustration.
- Measure projection at each piston at both locations marked with -arrows- (seen in longitudinal direction of engine: at front and rear of piston).
- Install cylinder head gasket corresponding to piston projection according to table below:

Piston projection above top surface of cylinder block in mm	Identification (No. of holes)
0.91 ... 1.00	1
1.01 ... 1.10	2
1.11 ... 1.20	3

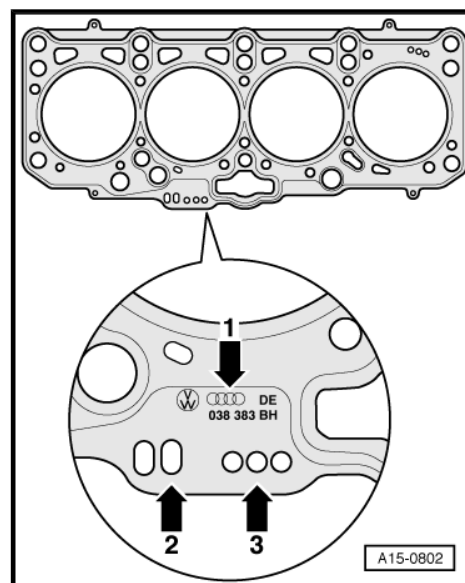
**Identification of cylinder head gasket**

- 1 - Part number
- 2 - Production code (can be disregarded)
- 3 - Holes

**Note**

If the measured values for piston projection are not the same for all pistons, use the highest value to determine the correct gasket size.

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**4.3 Piston and cylinder dimensions****1.9 ltr. engine**

Honing dimension	Piston Ø	Cylinder bore Ø
Basic dimension mm	79.47	79.51

2.0 ltr. engine

Honing dimension	Piston Ø	Cylinder bore Ø
Basic dimension mm	80.96	81.01

4.4 Measuring radial clearance of conrods**Special tools and workshop equipment required**

- ◆ Plastigage

Procedure

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



- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- Fit conrod bearing cap and secure with old bolts
⇒ [Item 11 \(page 89\)](#) without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

- Wear limit: 0.08 mm.
- Renew conrod bolts.

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15 – Cylinder head, valve gear

1 Glow plugs



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1.1 Handling ceramic glow plugs

Metal glow plugs are installed on Audi A3 with 4-cyl. 1.9 ltr. 2V TDI engine.

Metal or ceramic glow plugs are installed on Audi A3 with 4-cyl. 2.0 ltr. 2V TDI engine.

Removing and installing ⇒ Rep. gr. 28

Visible features of ceramic glow plugs

Vehicles with 2-valve cylinder head

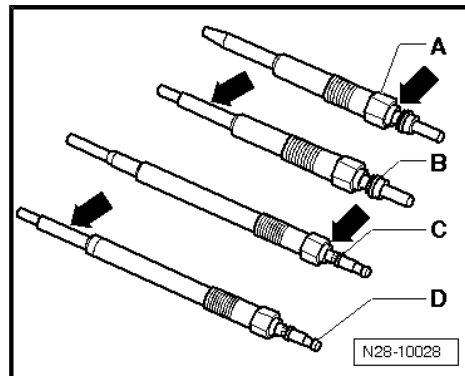
-A- = metal glow plug with colour coding -arrow-

-B- = ceramic glow plug with supporting tube -arrow- (no colour coding)



Note

Glow plugs -C and D- can be disregarded.



Important: Note the following points regarding ceramic glow plugs:



Caution

- ◆ Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .
- ◆ Use only the approved type of ceramic glow plugs ⇒ Electronic parts catalogue .
- ◆ Transport and store only in original packaging or packed separately in bubble wrap.
- ◆ Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.
- ◆ Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).
- ◆ Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.
- ◆ Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.
- ◆ If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).
- ◆ To check compression, select function "Self-diagnosis compatible systems" in "Guided Fault Finding" ⇒ Vehicle diagnostic tester.
- ◆ The ceramic glow plugs must not be removed when checking cylinder compression.

2 Cylinder head

2.1 Cylinder head - exploded view

1 - 10 Nm

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

2 - 15 Nm

3 - 100 Nm

- ☐ Use counterhold tool - T10051- when loosening and tightening
⇒ ["3.5 Removing and installing camshaft"](#), page 148

4 - Hub

- ☐ With sender wheel for Hall sender - G40-
- ☐ To remove, use puller - T10052-
⇒ ["3.5 Removing and installing camshaft"](#), page 148

5 - Cylinder head

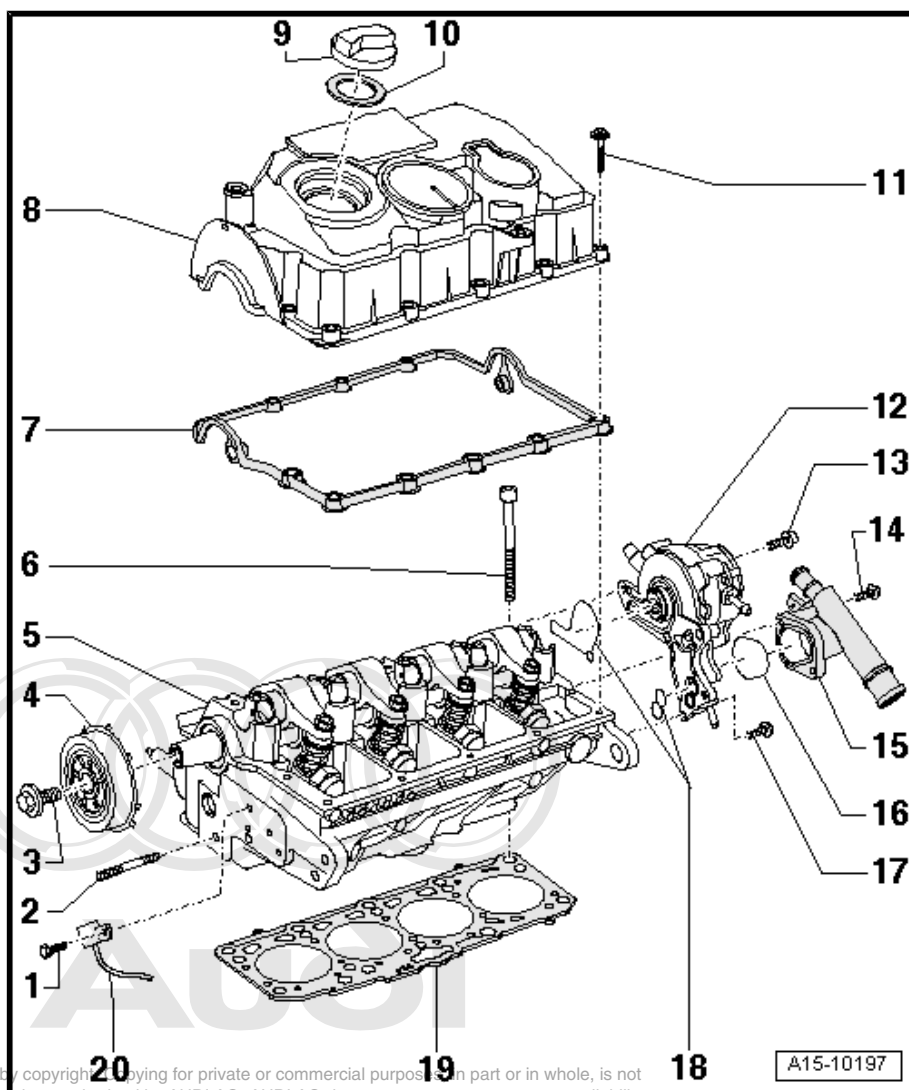
- ☐ Removing: vehicles with large engine support ⇒ [page 102](#) ; vehicles with small engine support ⇒ [page 119](#)
- ☐ Installing ⇒ [page 136](#)



Caution

The ceramic glow plugs are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed.

Handling ceramic glow plugs ⇒ [page 5](#).



- ☐ Checking for distortion ⇒ [page 98](#)
- ☐ If renewed, change engine oil and coolant

6 - Cylinder head bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 118](#) and ⇒ [page 136](#)
- ☐ Note correct sequence when tightening ⇒ [page 139](#)
- ☐ Ensure that washers ⇒ [Item 9 \(page 143\)](#) are fitted in cylinder head

7 - Gasket for cylinder head cover

- ☐ Renew if damaged or leaking
- ☐ Before fitting, apply sealant at sealing points ⇒ [page 99](#)
- ☐ Insert lugs into holes on cylinder head

8 - Cylinder head cover

- ☐ With vacuum reservoir
- ☐ Removing and installing ⇒ [page 100](#)

9 - Filler cap

10 - Gasket

- ☐ Renew if damaged or leaking

11 - Special bolt, 10 Nm

- ☐ Renew if damaged or leaking
- ☐ Note correct sequence for loosening and tightening
⇒ [“2.2 Removing and installing cylinder head cover”, page 100](#)

12 - Tandem pump

- ☐ Removing and installing ⇒ Rep. gr. 20

13 - 20 Nm

14 - 10 Nm

15 - Coolant flange

16 - O-ring

- ☐ Renew

17 - 10 Nm

18 - Seals

- ☐ Renew

19 - Cylinder head gasket

- ☐ Renewing ⇒ [“2.3 Removing cylinder head - vehicles with large engine support”, page 102](#) ,
⇒ [“2.4 Removing cylinder head - vehicles with small engine support”, page 119](#) and
⇒ [“2.5 Installing cylinder head”, page 136](#)
- ☐ Note marking ⇒ [page 99](#)
- ☐ If renewed, change engine oil and coolant

20 - Hall sender - G40-

- ☐ For camshaft position

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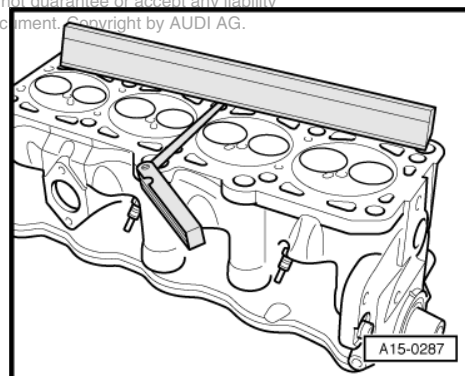
Checking cylinder head for distortion

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



Note

The cylinder heads of diesel engines must not be machined.



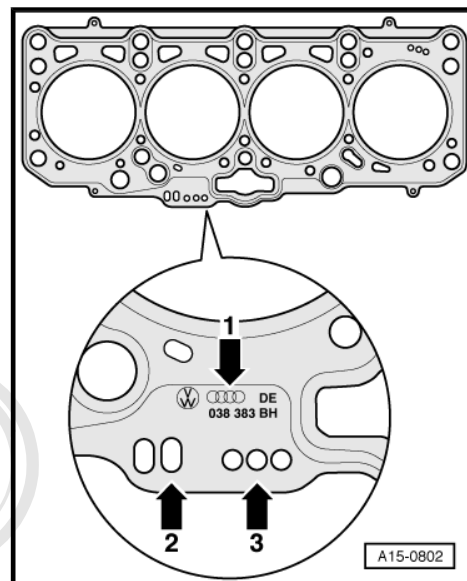
Identification of cylinder head gasket

- 1 - Part number
- 2 - Production code (can be disregarded)
- 3 - Holes



Note

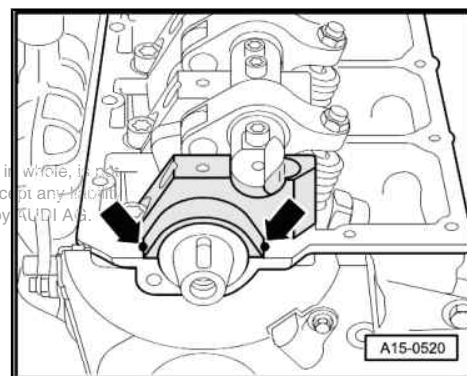
Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection ⇒ [page 92](#). When renewing just the cylinder head gasket, the new gasket should have the same identification as the old one.



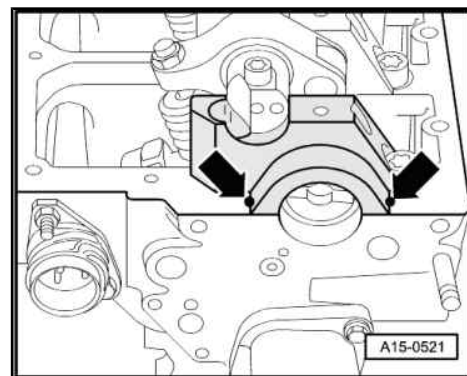
Sealing points between bearing cap and cylinder head

- Apply one drop of sealant (Ø approx. 5 mm) to each sealing point at front bearing cap/cylinder head -arrows-; for sealant refer to ⇒ Electronic parts catalogue .

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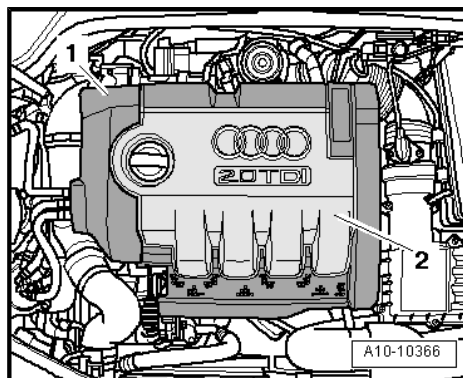
- Apply one drop of sealant (Ø approx. 5 mm) to each sealing point at rear bearing cap/cylinder head -arrows-; for sealant refer to ⇒ Electronic parts catalogue .



2.2 Removing and installing cylinder head cover

Removing

- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



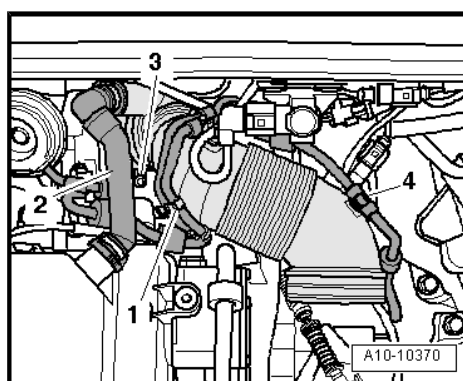
- Remove crankcase breather hose -2-.



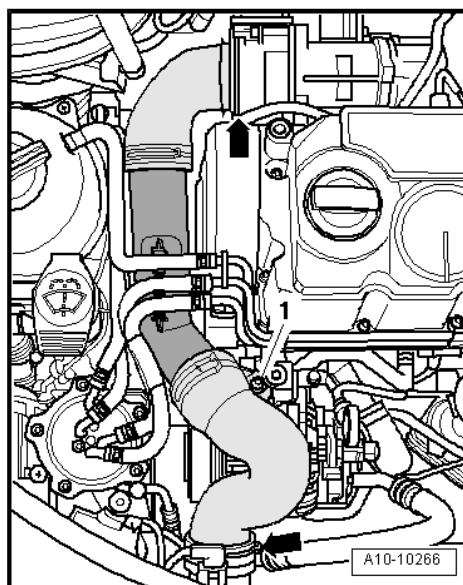
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Ignore items marked -1-, -3- and -4-.

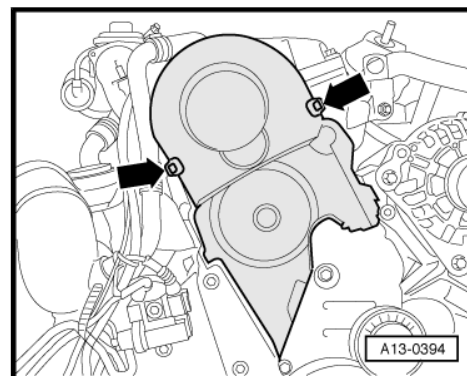
- Disconnect vacuum hose from vacuum reservoir at cylinder head.



- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



- Remove top toothed belt cover by releasing retaining clips -arrows-.



- Remove cylinder head cover bolts in the sequence -13 ... 1-.
- Remove cylinder head cover.

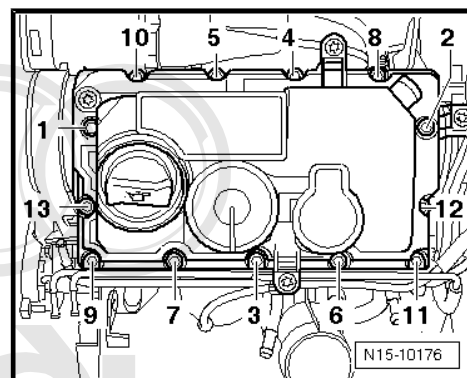
Installing

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



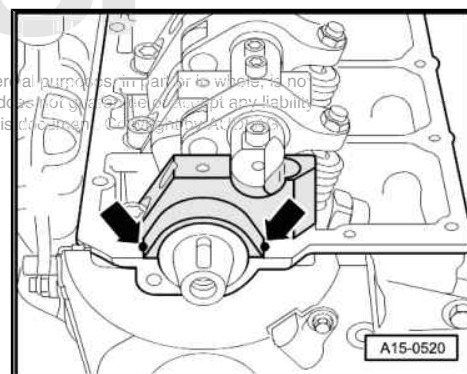
Note

If seal for bolt is damaged, renew bolt.

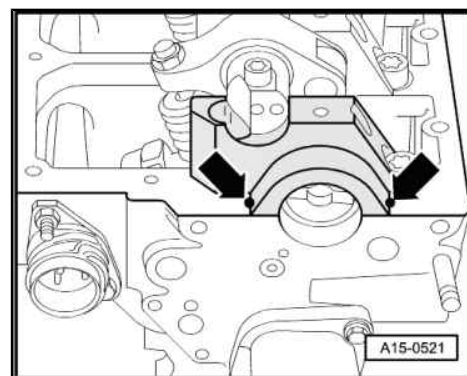


- Apply one drop of sealant ($\varnothing$ approx. 5 mm) to each sealing point at front bearing cap/cylinder head -arrows-; for sealant refer to ⇒ **Electronic parts catalogue**

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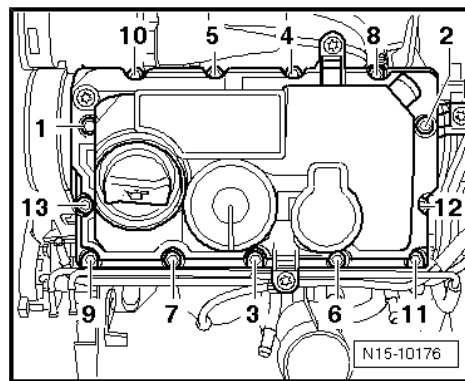
- Apply one drop of sealant ($\varnothing$ approx. 5 mm) to each sealing point at rear bearing cap/cylinder head -arrows-; for sealant refer to ⇒ **Electronic parts catalogue**.



- Initially hand-tighten bolts for cylinder head cover in the sequence -1 ... 13-.
- Tighten bolts for cylinder head cover to final setting in the sequence -1 ... 13-.
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Air pipe (right-side) to bracket	8

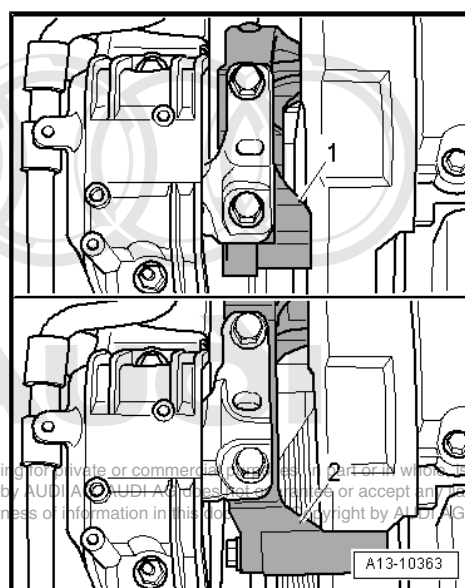


2.3 Removing cylinder head - vehicles with large engine support



Note

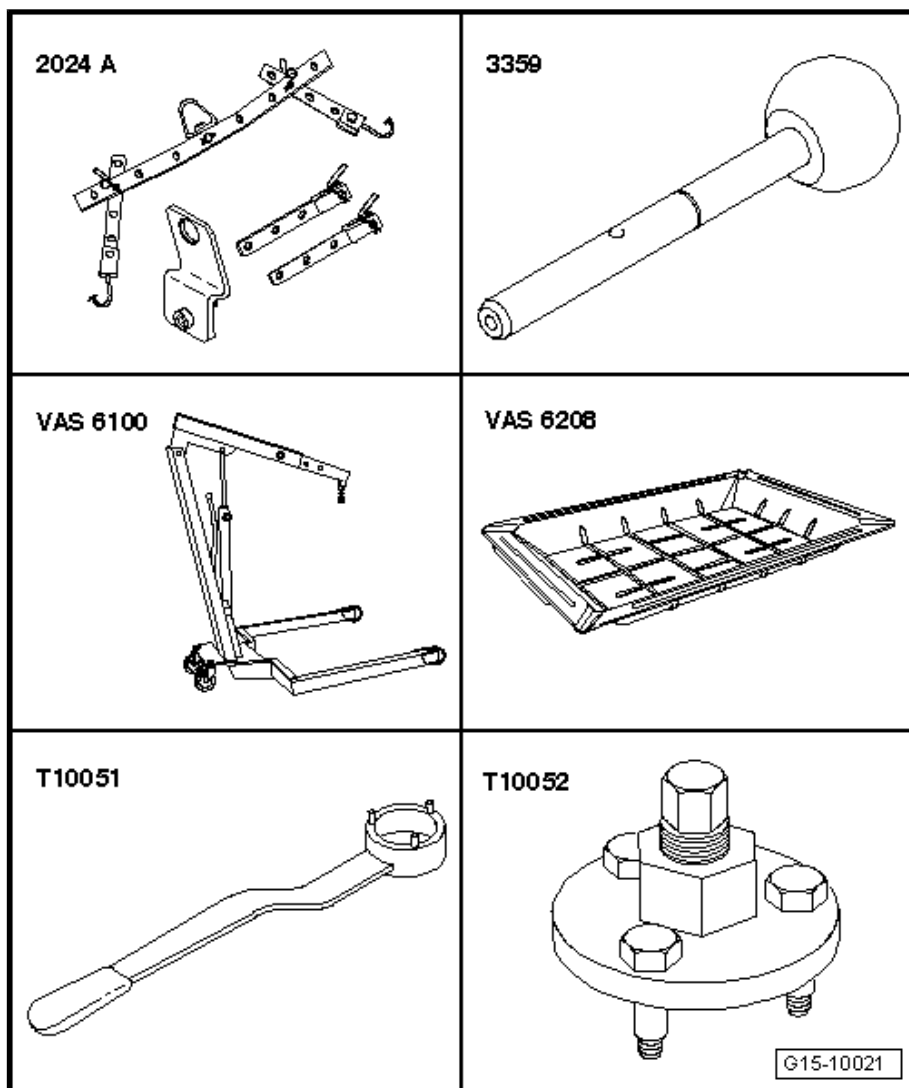
The engine support does not have to be removed in order to remove the cylinder head on vehicles with large engine support -version 2-.



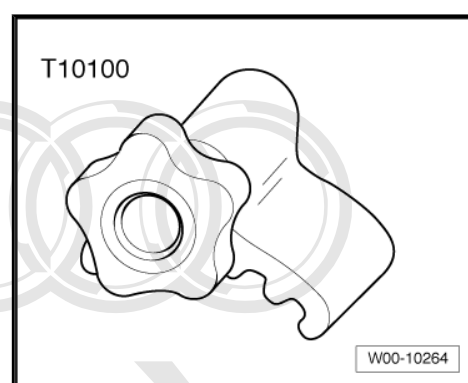
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Special tools and workshop equipment required

- ◆ Lifting tackle - 2024 A-
- ◆ Diesel injection pump locking pin - 3359-
- ◆ Workshop hoist - VAS 6100-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-

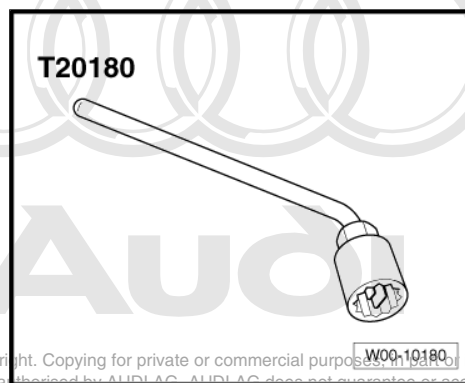


- ◆ Crankshaft stop - T10100-



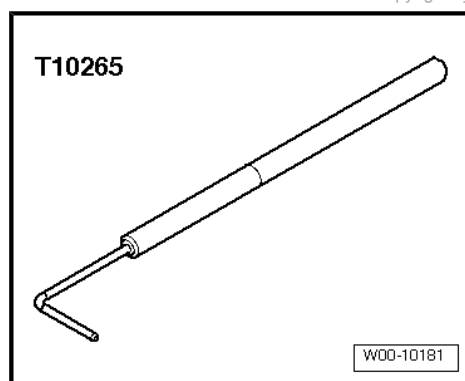
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- ◆ Special wrench, long reach - T10264-

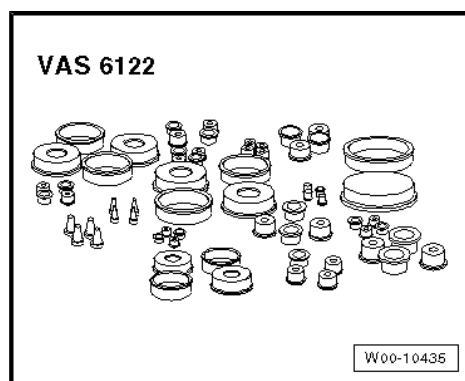


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- ◆ Locking tool - T10265-

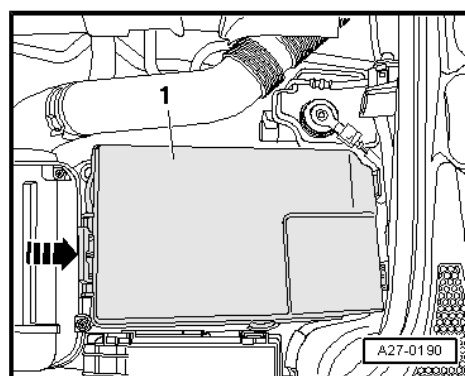


- ◆ Engine bung set - VAS 6122-



Removing

- Remove particulate filter ⇒ [page 229](#) .
- Remove cover -1- over battery; to do so, press release tab -arrow-.



**Caution**

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

- With ignition switched off, disconnect battery earth cable -arrow-.

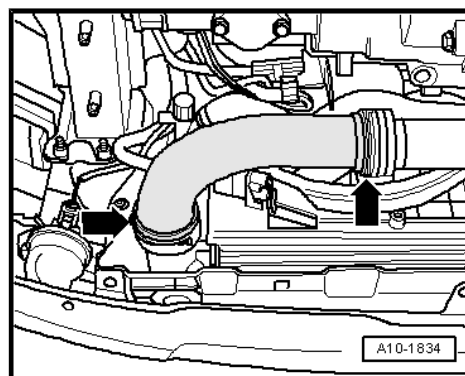
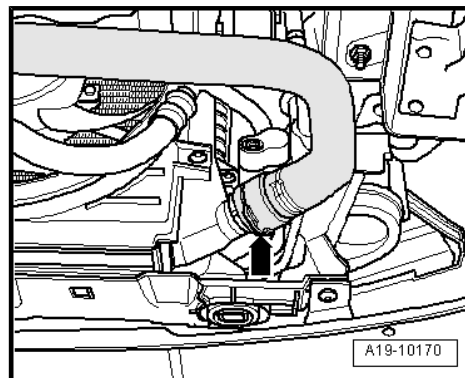
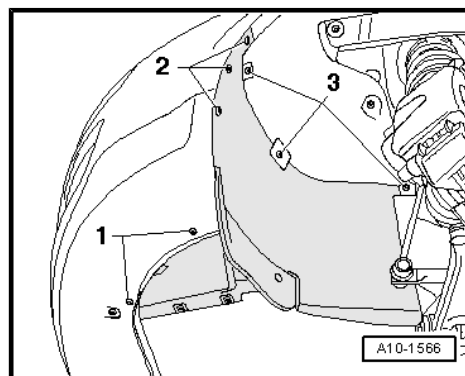
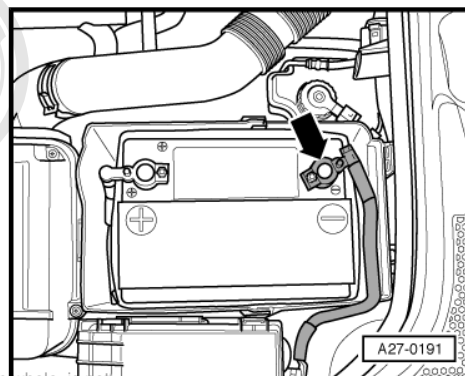
**WARNING**

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

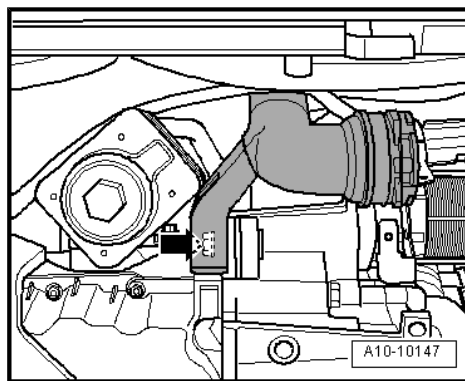
- Open filler cap on coolant expansion tank.
- Remove front left wheel.
- Remove noise insulation (left-side) -fasteners 1 ... 3-.

- Place drip tray for workshop hoist - VAS 6208- under engine.
- Lift retaining clip -arrow- and disconnect coolant hose from radiator.

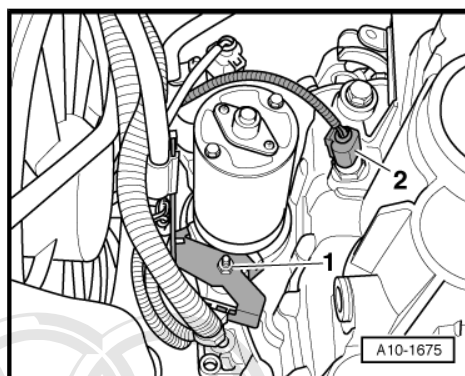
- Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.



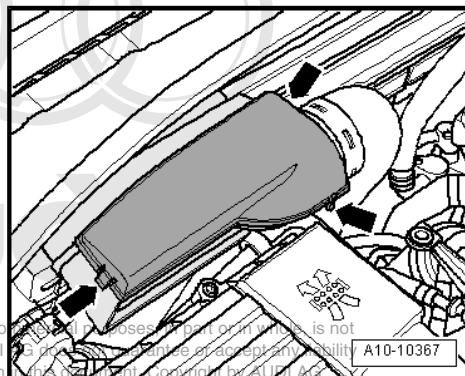
- Remove bolt -arrow- for air intake pipe (left-side).



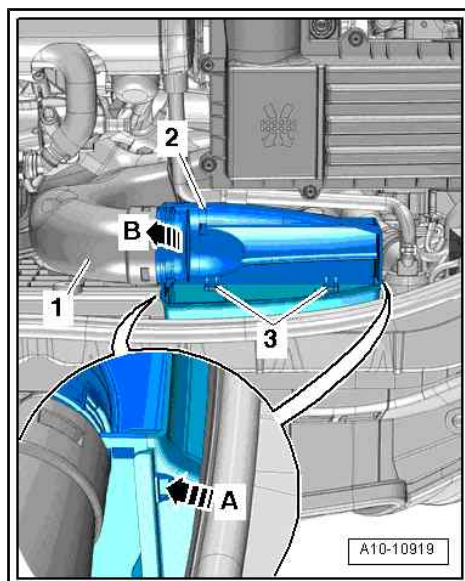
- Unscrew nut -1- and remove bracket with wiring from stud.
- Unclip bracket from wiring harness.



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

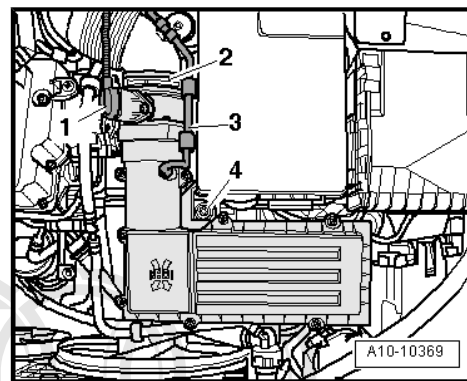


- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.

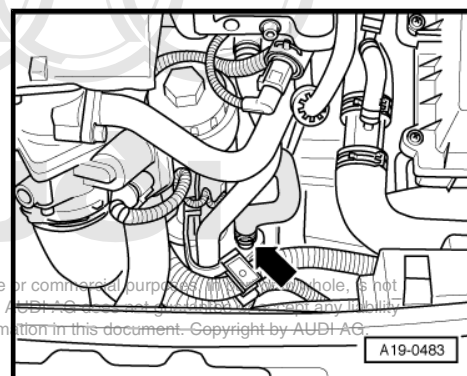


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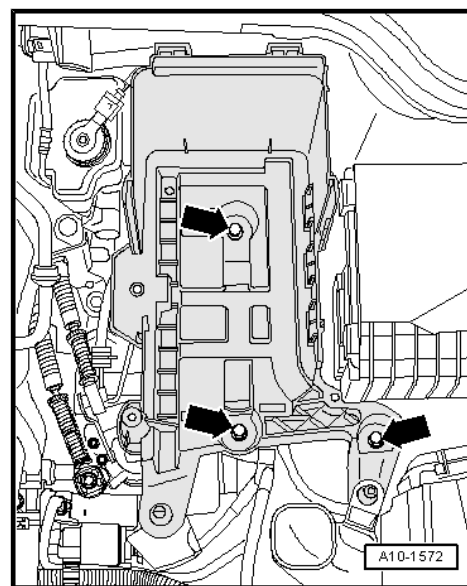
- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.



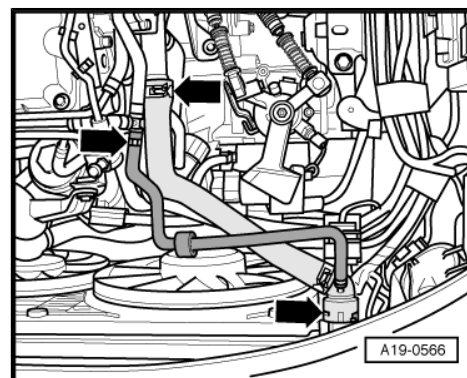
- Disconnect coolant hose at bottom of engine oil cooler -arrow- and drain off remaining coolant.



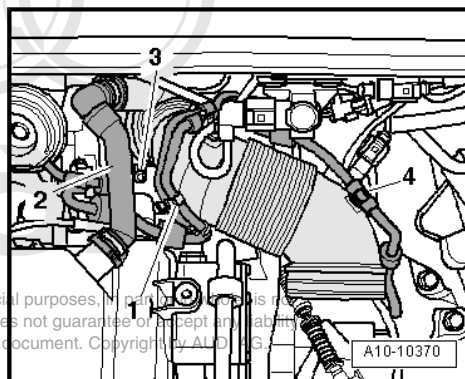
- Remove battery ⇒ Rep. gr. 27 .
- Remove battery tray -arrows-.



- Remove coolant hose between engine and radiator -arrows-.



- Detach crankcase breather hose -2-.
- Move vent hose -4- and vacuum hoses -1- clear at air intake hose.
- Remove bolt -3-.
- Swing air hose to rear and detach from turbocharger.



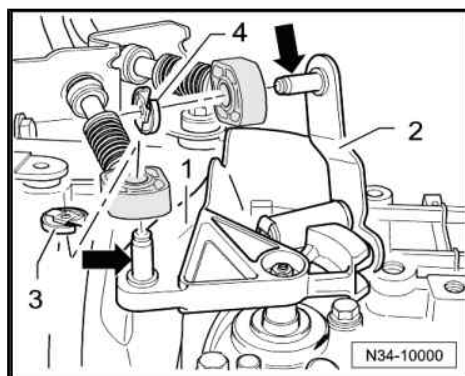
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Vehicles with manual gearbox:

- Detach securing clip -3- for gear selector cable from gearbox selector lever -1- and pull cable off pin -arrow-.

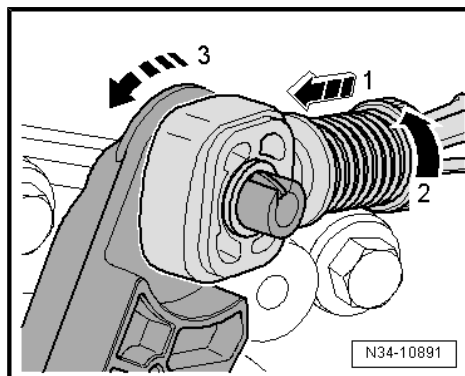
Metal relay lever:

- Detach securing clip -4- for gate selector cable from relay lever -2- and pull cable off pin -arrow-.



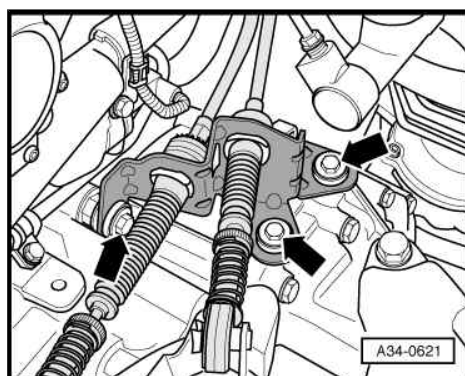
Plastic relay lever:

- To prevent damage to gate selector cable, cable end-piece must be detached from gate selector cable before removing.
- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press gate relay lever towards front -arrow 3-.



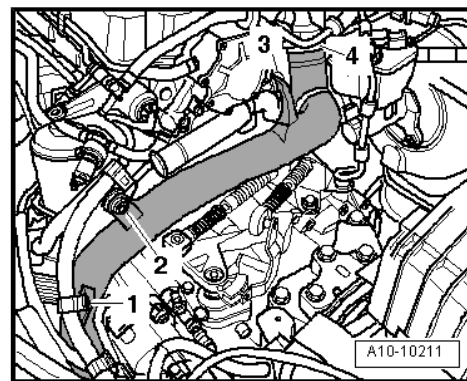
Vehicles with manual gearbox (continued):

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

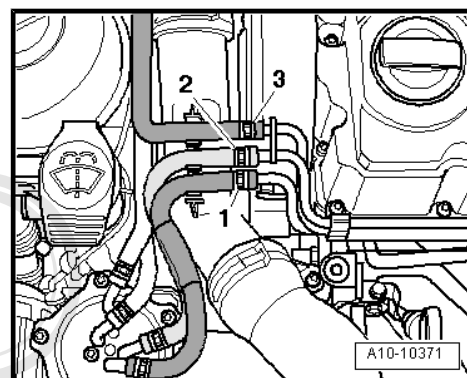


All vehicles (continued):

- Unclip wiring clip -1-.
- Remove bolts -2- and -3-.
- Detach air pipe (left-side) from turbocharger by lifting retaining clip -4- slightly.
- Remove air pipe from engine compartment downwards.

**WARNING**

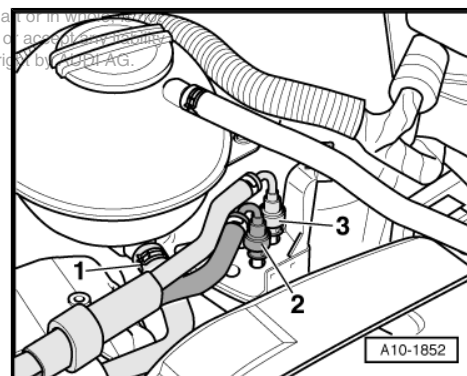
- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*



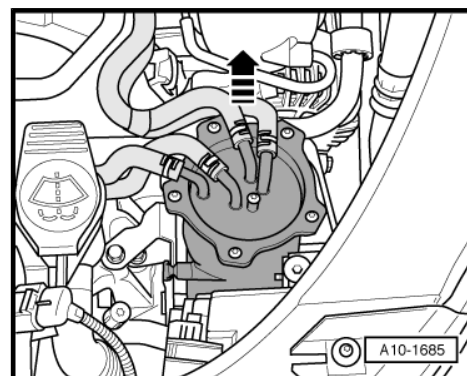
- Disconnect fuel supply hose -2- and fuel return hose -1- from fuel lines.
- Detach coolant hose -3-.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Pull release tabs and disconnect fuel supply line -3- and fuel return line -2-.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Detach coolant hose -1- at coolant expansion tank.

Vehicles with auxiliary heater:

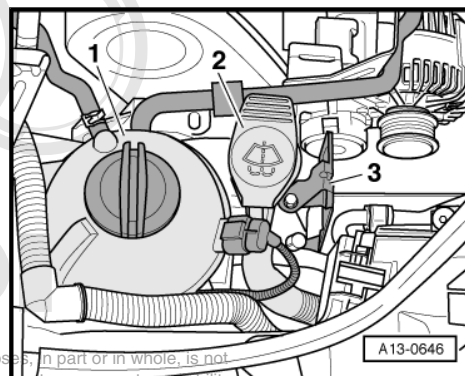
- Disconnect fuel pipe (press release tab).
- Move fuel pipe clear.

**All vehicles (continued):**

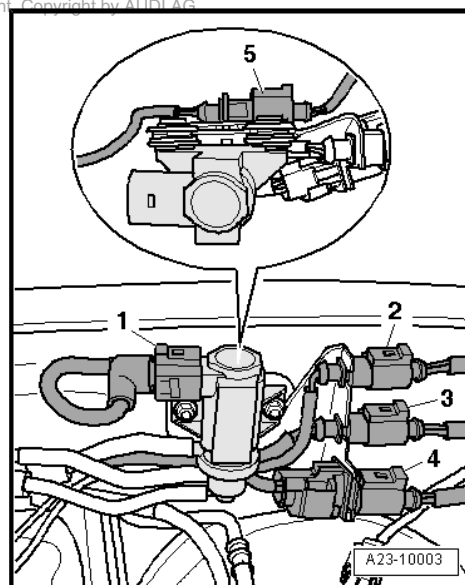
- Pull fuel filter upwards out of bracket -arrow- (hoses remain attached).



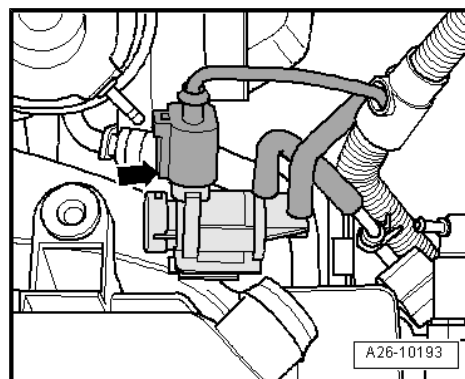
- Unscrew bracket -3- for fuel filter.
- Unscrew bolt at filler neck -2- for washer fluid reservoir.
- Unplug electrical connector at coolant expansion tank.
- Unscrew coolant expansion tank -1- and move clear to one side (hoses remain attached).



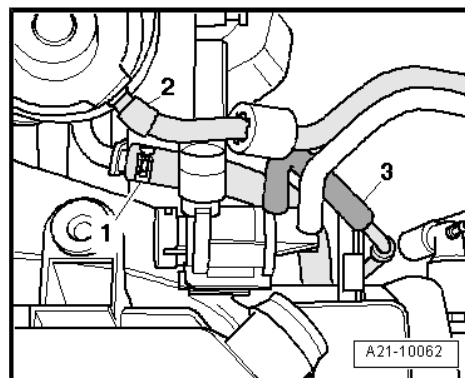
- Unplug electrical connector -2- for exhaust gas temperature sender 1 - G235- .



- Unplug electrical connector at exhaust gas recirculation cooler change-over valve - N345- -arrow-.
- Set aside wiring harness leading to body.



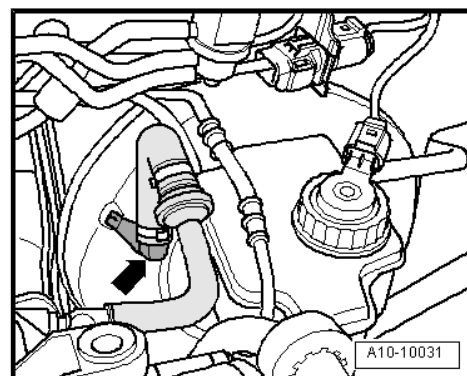
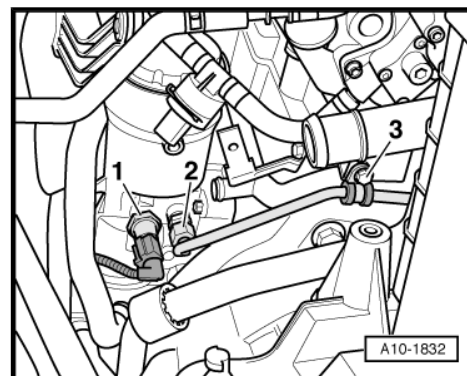
- Detach vacuum hose -2- from vacuum unit for charge pressure control.
- Detach vacuum hose -3- from line going to vacuum unit for change-over flap for exhaust gas recirculation.
- Disconnect vacuum line from tandem pump.
- Unclip exhaust gas recirculation cooler change-over valve - N345- from bracket.
- Move exhaust gas recirculation cooler change-over valve - N345- clear to one side (vacuum hoses remain attached).
- Detach oil supply hose -1- from turbocharger.
- Detach oil supply line going to oil filter bracket.



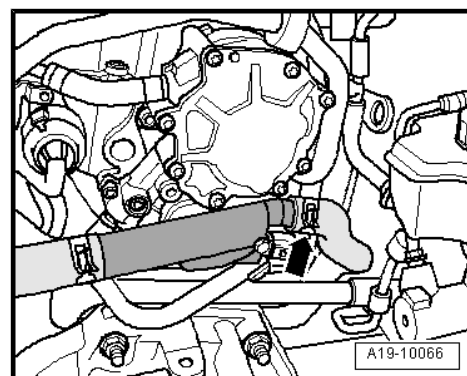
- Unplug electrical connector at oil pressure switch - F1- .
- Unscrew oil pressure switch -1-.
- Detach oil supply line going to turbocharger at retaining clip -3- and at oil filter bracket -2-.
- Disconnect oil supply line at rear engine lifting eye.
- Detach oil supply line.

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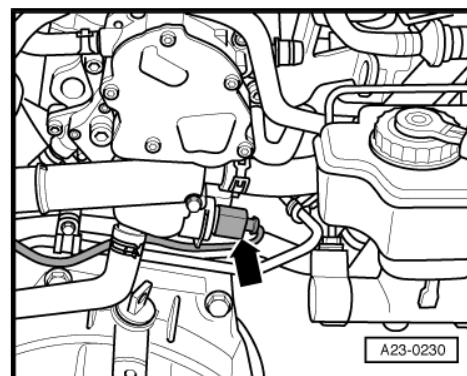
- Disconnect vacuum hose -arrow- at brake servo.



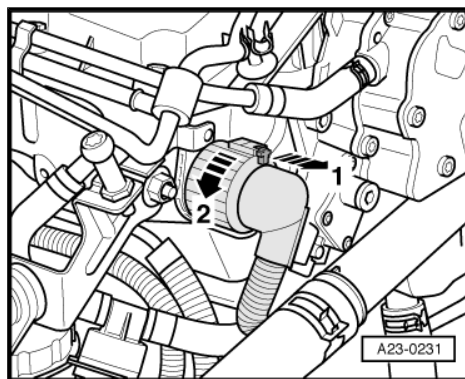
- Detach coolant hose -arrow- at coolant hose/pipe connection.



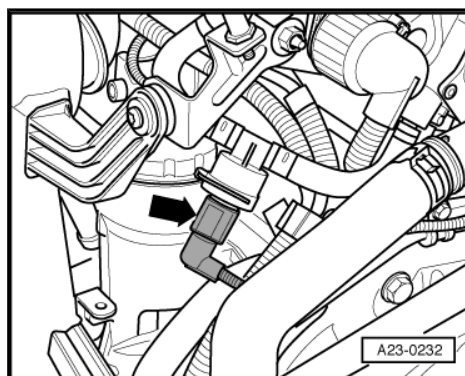
- Unplug electrical connector -arrow- at coolant temperature sender - G62- and move wiring clear.



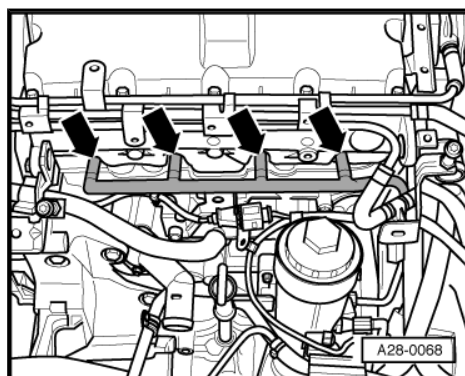
- Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
- Disconnect main connector for unit injectors and move wiring harness clear.



- Unplug electrical connector -arrow- at fuel temperature sender - G81- .

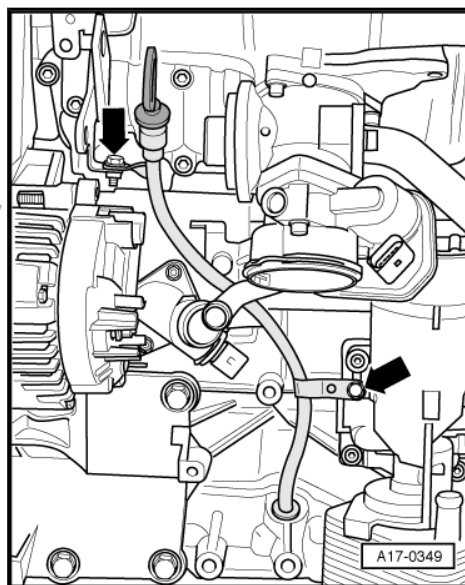


- Detach connector rail from glow plugs -arrows-.

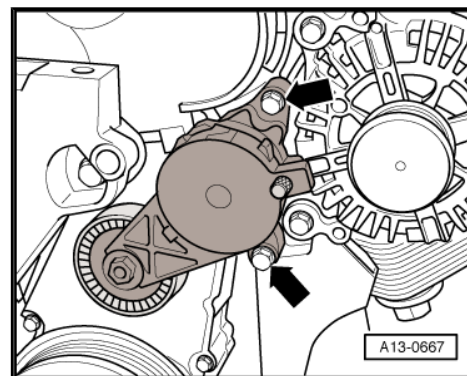


- Remove bolts -arrows-.
- Pull the guide tube for oil dipstick upwards out of cylinder block.
- Remove poly V-belt: vehicles with tensioner ⇒ [page 47](#) , vehicles without tensioner ⇒ [page 50](#) .

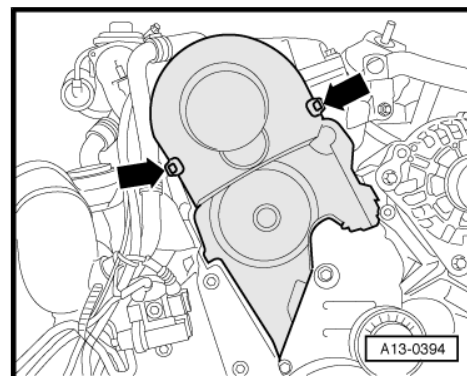
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- Vehicles with tensioner: remove bolts -arrows- and take off tensioner for poly-V-belt.



- Remove top toothed belt cover by releasing retaining clips -arrows-.



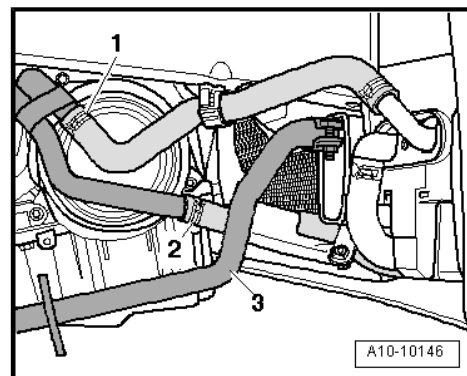
Vehicles with auxiliary heater:

- Remove exhaust pipe -3- for auxiliary heater ⇒ Rep. gr. 82 .



Note

Disregard items -1- and -2-.

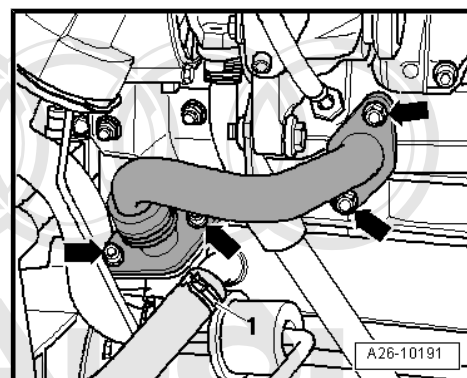


All vehicles (continued):

- Place drip tray for workshop hoist - VAS 6208- under engine.
- Detach coolant hose -1- at exhaust gas recirculation cooler.
- Unbolt connecting pipe going to exhaust gas recirculation cooler -arrows-.

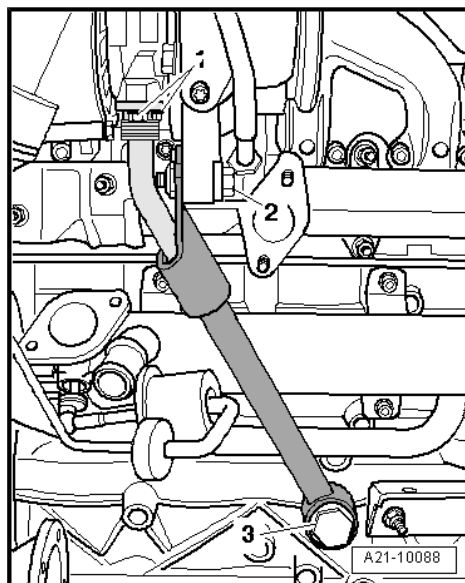
Vehicles with auxiliary heater:

- Remove coolant pipes going to auxiliary heater from cylinder block (coolant hoses remain connected).



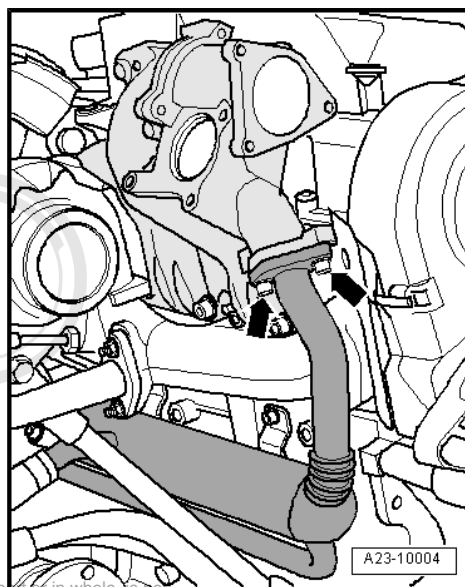
Vehicles with front-wheel drive:

- Remove nuts -1-, bolt -2- and banjo bolt -3-.
- Remove support for turbocharger together with oil return line.

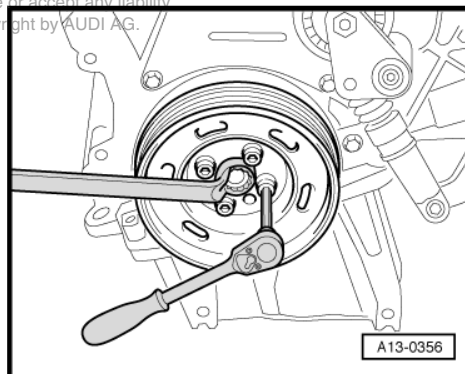


All vehicles (continued):

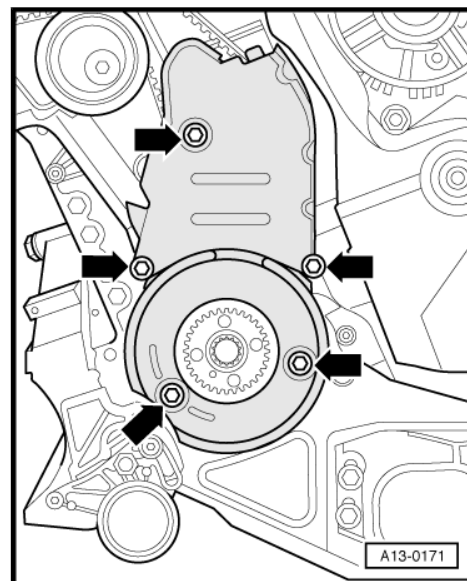
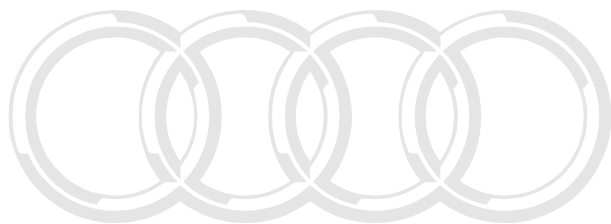
- Unscrew bolts on flange between exhaust gas recirculation cooler and intake manifold.



- Remove cover cap for vibration damper.
- Unbolt vibration damper; counterhold on centre bolt with ring spanner.



- Unbolt toothed belt covers (bottom and centre) -arrows-.

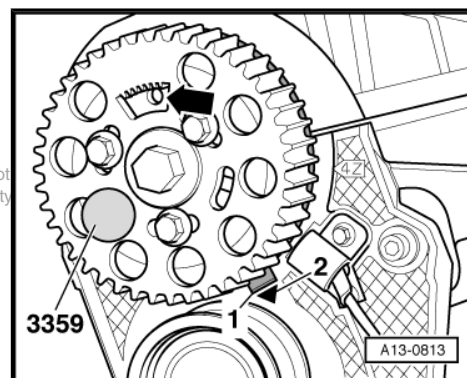


Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

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- Turn the crankshaft to TDC.
- The toothed segment -arrow- at camshaft sprocket must face upwards.
- Lug -1- on sender wheel for camshaft must align with marking -2- on rear toothed belt cover (not fitted on all versions).



Note

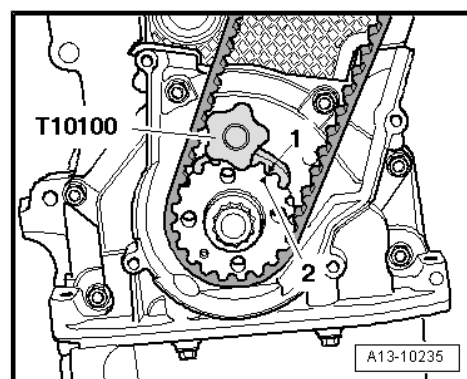
The camshaft sprocket is shown with the toothed belt removed for illustrative purposes.

- Lock hub with locking pin - 3359- .
- Lock crankshaft sprocket with crankshaft stop - T10100- .
- The markings on the sprocket -2- and the crankshaft stop -1- must align. The lug of the crankshaft stop must engage in the bore in the sealing flange.

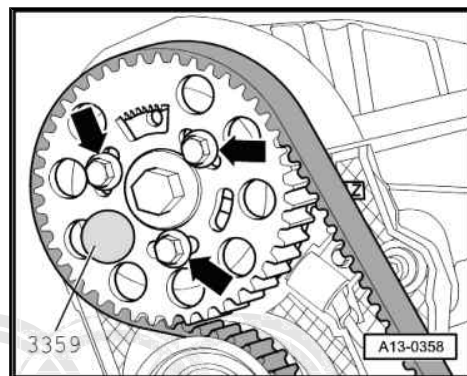


Note

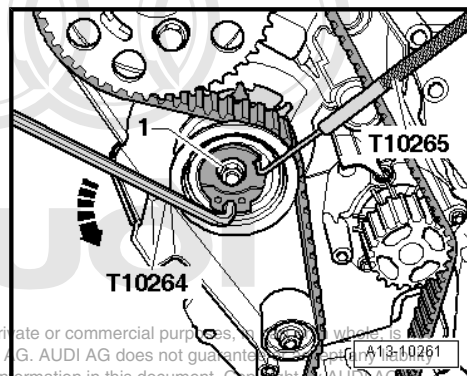
The crankshaft stop can only be pushed onto the sprocket from the front face of the teeth.



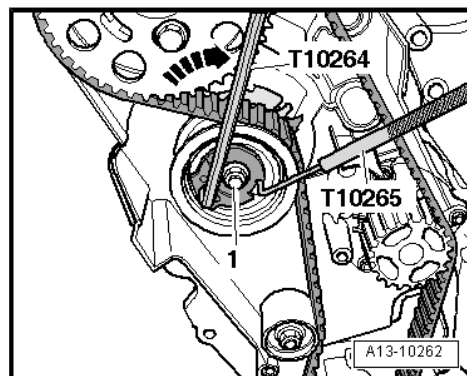
- Mark direction of rotation of toothed belt with chalk or felt-tip pen.
- Loosen securing bolts for camshaft sprocket -arrows-.



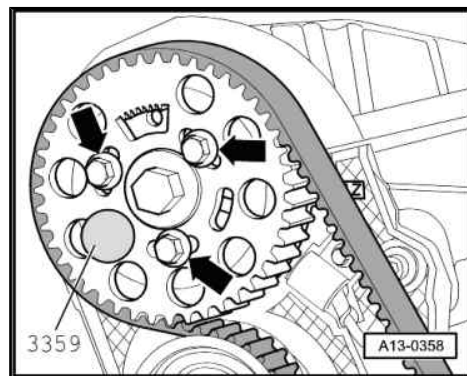
- Loosen securing nut -1- for tensioning roller.
- Turn the eccentric adjuster with the angle driver - T10264- anti-clockwise -arrow- until the tensioning roller can be secured with the locking tool - T10265- .



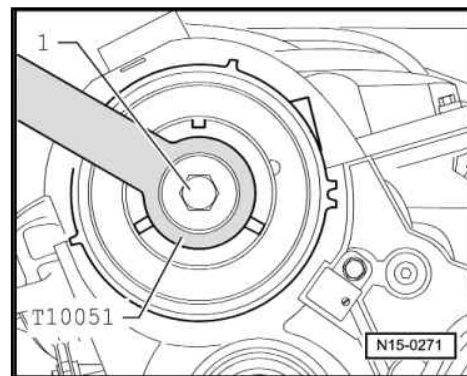
- Now turn eccentric adjuster of tensioning roller clockwise -arrow- until stop and tighten securing nut -1- finger-tight.
- Take off toothed belt first from coolant pump and then from the remaining sprockets.



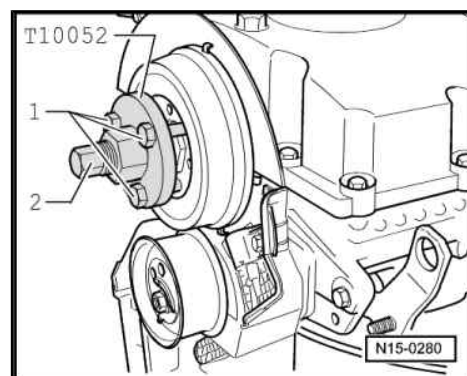
- Remove locking pin - 3359- .
- Unscrew bolts -arrows- for camshaft sprocket and remove camshaft sprocket from hub.



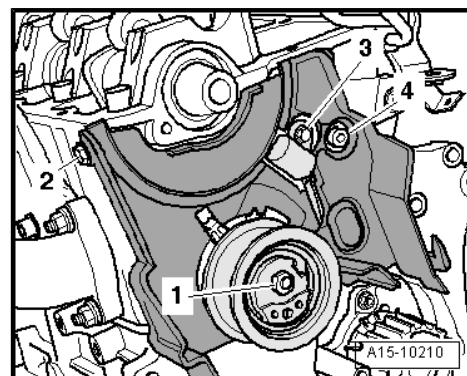
- Loosen securing bolt for hub; use counterhold tool - T10051- .
- Then unscrew bolt approx. 2 turns.



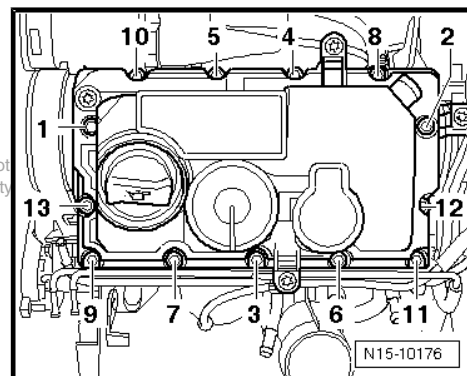
- Apply puller - T10052- and screw bolts -1- into hub.
- Remove hub by screwing in bolt -2- while counterholding at hexagon flats (30 mm) of puller.



- Unscrew nut -1- for tensioning roller.
- Remove locking tool - T10265- from tensioning roller.
- Remove bolts -2- and -4-.
- Unscrew bolt -3- and remove Hall sender - G40- from cylinder head.

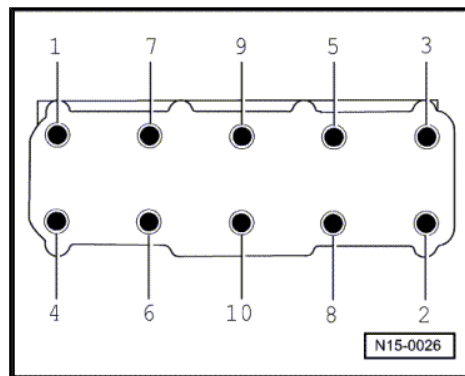


- Unscrew cylinder head cover bolts in the sequence -13 ... 1-.
- Remove bolts and take off cylinder head cover.



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- Follow the sequence for loosening the cylinder head bolts.



- Attach lifting tackle - 2024 A- at cylinder head.



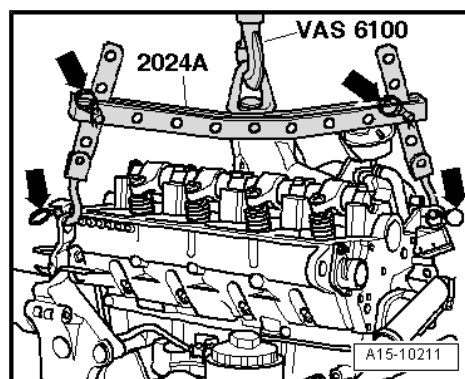
WARNING

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



Note

Also tie up intake manifold to eye of lifting tackle to maintain the centre of gravity in one position.



- Slightly lift cylinder head using workshop hoist - VAS 6100- .
- Swivel cylinder head to left out of toothed belt cover (rear) and remove tensioning roller at the same time.
- Lay cylinder head aside on a clean surface with the combustion chamber side facing upwards.



Caution

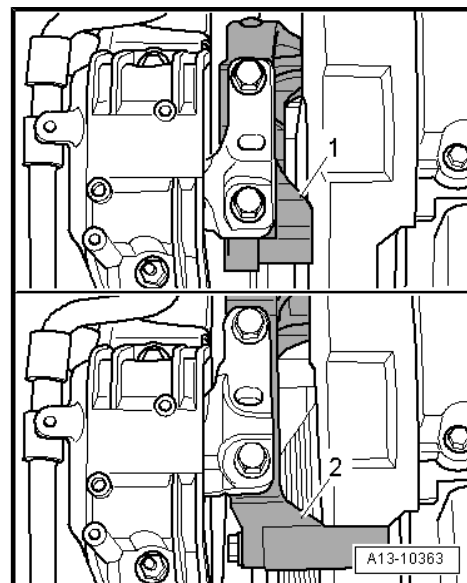
- ◆ *Vehicles with ceramic glow plugs: The ceramic glow plugs fitted in this engine are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed.*
- ◆ *Handling ceramic glow plugs ⇒ [page 96](#) .*

2.4 Removing cylinder head - vehicles with small engine support



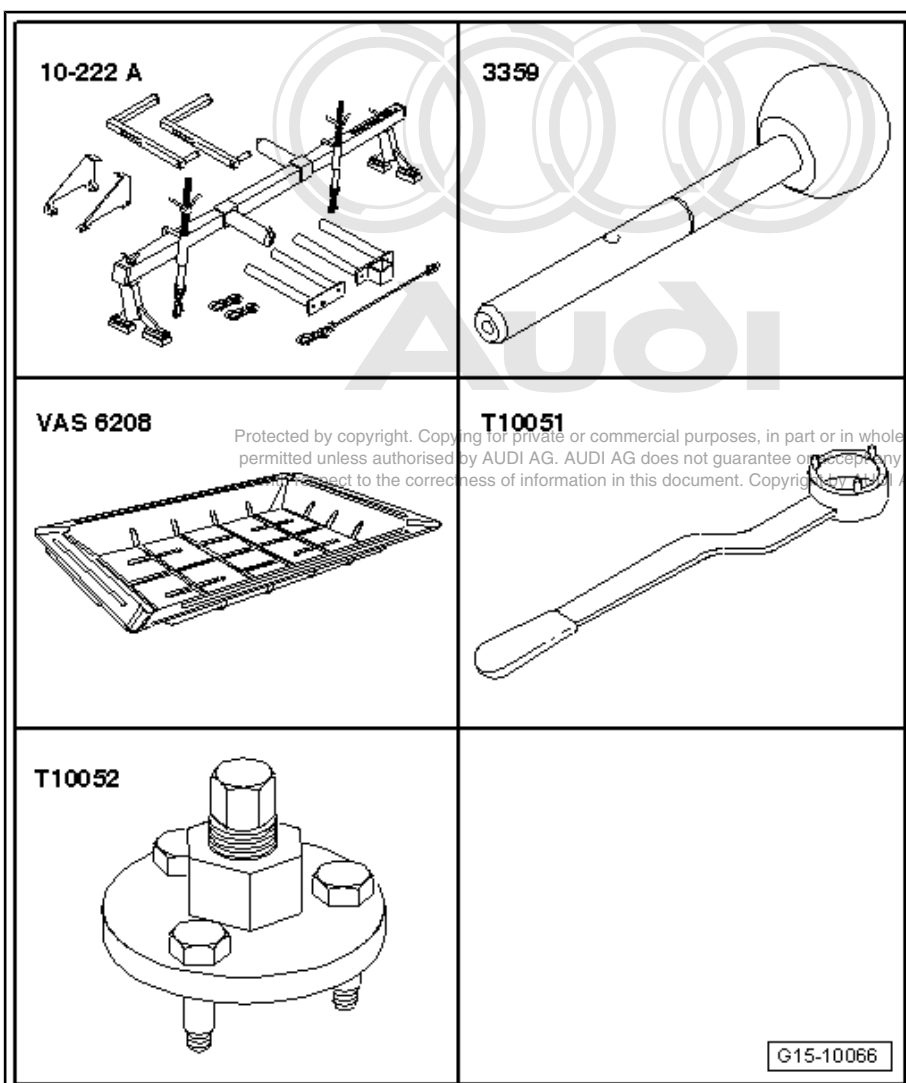
Note

The engine support has to be removed and the engine supported from above in order to remove the cylinder head on vehicles with small engine support -version 1-.



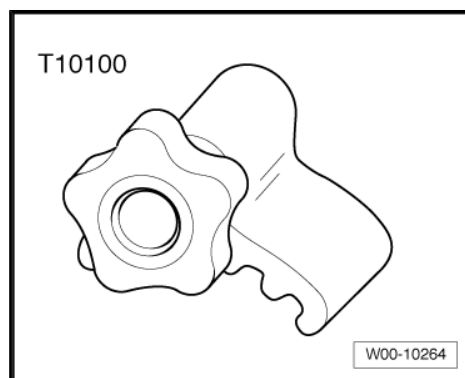
Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-
- ◆ Diesel injection pump locking pin - 3359-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-

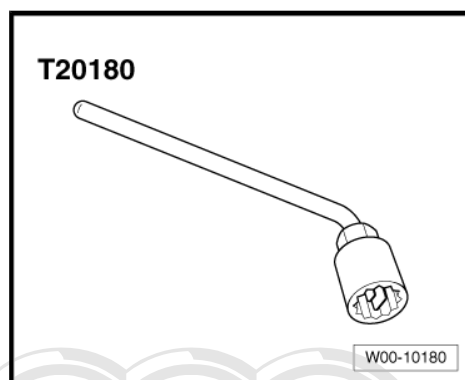


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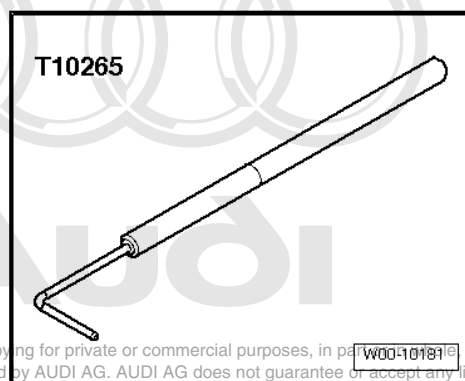
◆ Crankshaft stop - T10100-



◆ Special wrench, long reach - T10264-

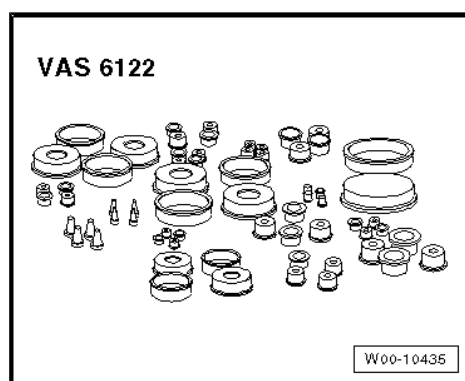


◆ Locking tool - T10265-



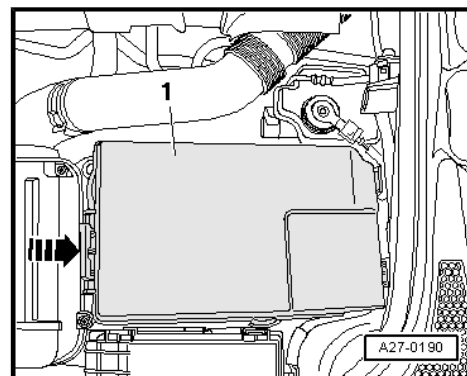
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◆ Engine bung set - VAS 6122-



Removing

- Remove particulate filter ⇒ [page 229](#) .
- Remove cover -1- over battery; to do so, press release tab -arrow-.



Caution

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

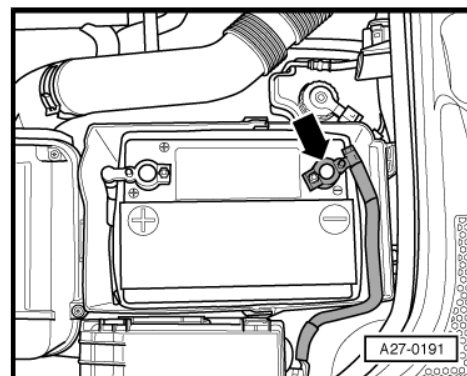
- With ignition switched off, disconnect battery earth cable -arrow-.

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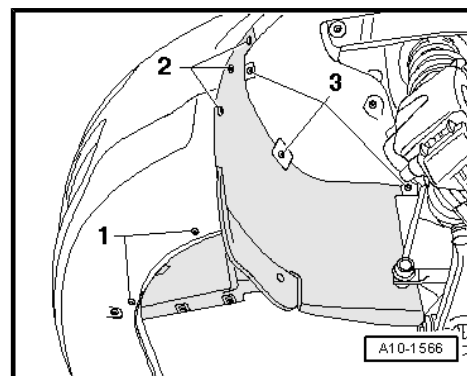


WARNING

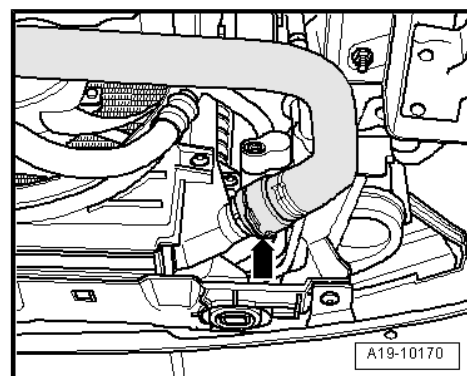
Hot steam or hot coolant can escape when coolant expansion tank is opened; cover filler cap with cloth and open carefully.



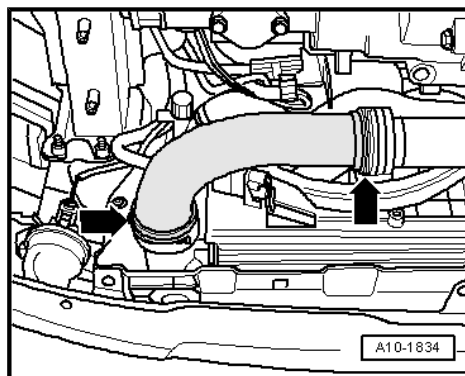
- Open filler cap on coolant expansion tank.
- Remove front left wheel.
- Remove noise insulation (left-side) -fasteners 1 ... 3-.



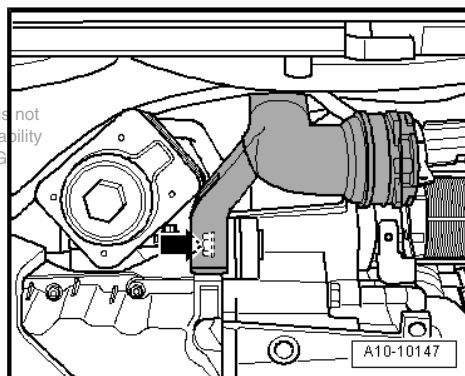
- Place drip tray for workshop hoist - VAS 6208- under engine.
- Lift retaining clip -arrow- and disconnect coolant hose from radiator.



- Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.

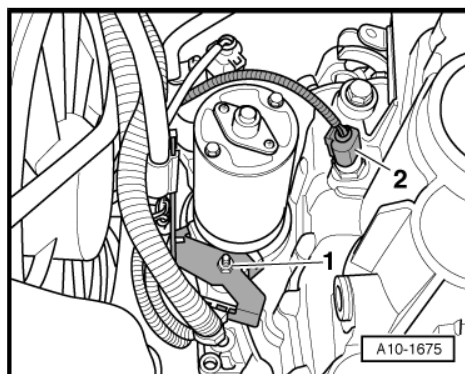


- Remove bolt -arrow- for air intake pipe (left-side).

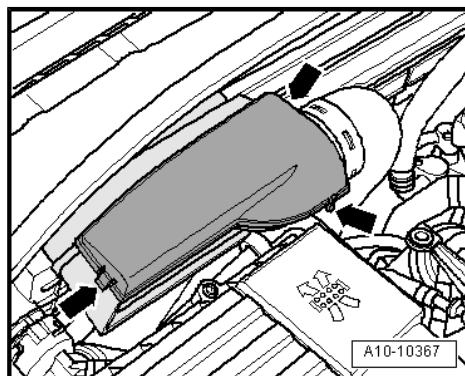


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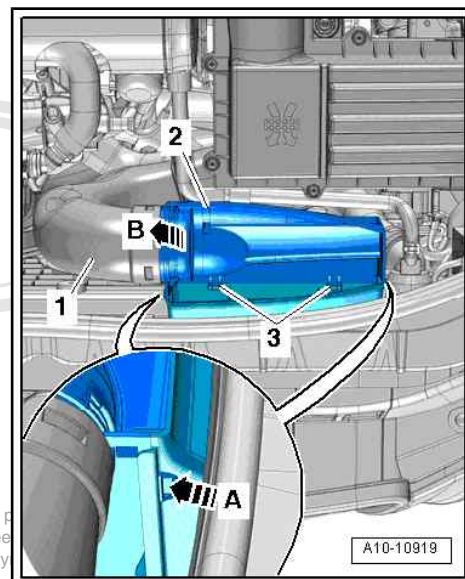
- Unscrew nut -1- and remove bracket with wiring from stud.
- Unclip bracket from wiring harness.



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

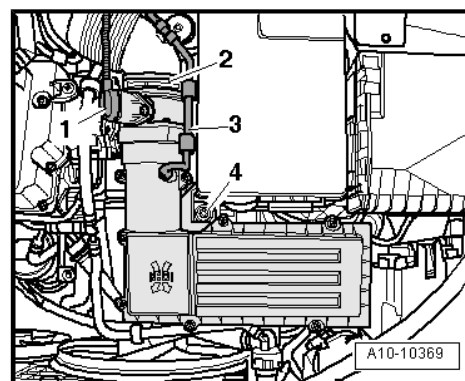


- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.

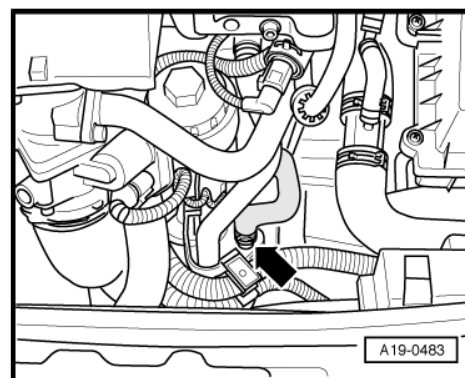


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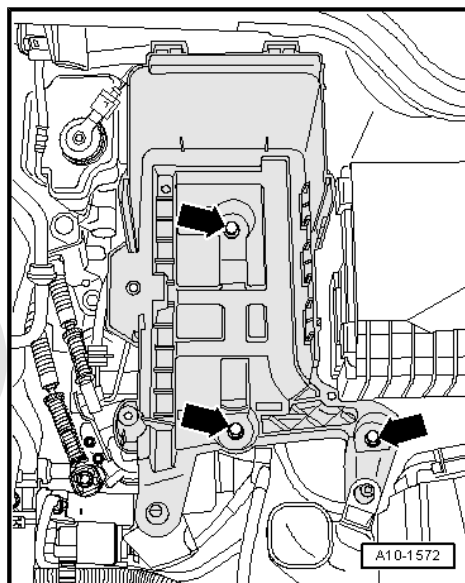
- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.



- Disconnect coolant hose at bottom of engine oil cooler -arrow- and drain off remaining coolant.

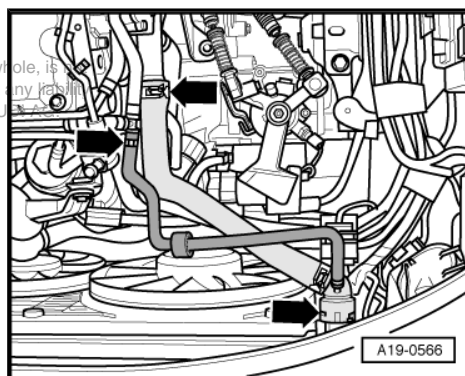


- Remove battery ⇒ Rep. gr. 27 .
- Remove battery tray -arrows-.

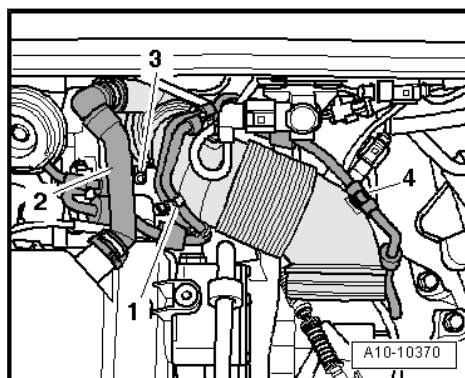


- Remove coolant hose between engine and radiator -arrows-.

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- Detach crankcase breather hose -2-.
- Move vent hose -4- and vacuum hoses -1- clear at air intake hose.
- Remove bolt -3-.
- Swing air hose to rear and detach from turbocharger.

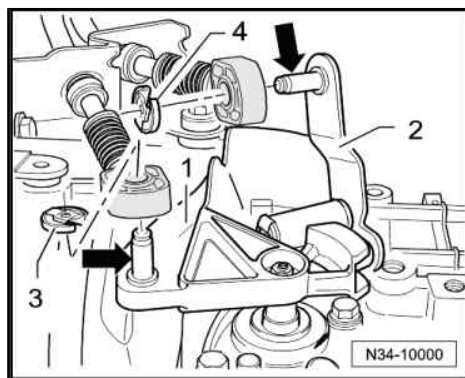


Vehicles with manual gearbox:

- Detach securing clip -3- for gear selector cable from gearbox selector lever -1- and pull cable off pin -arrow-.

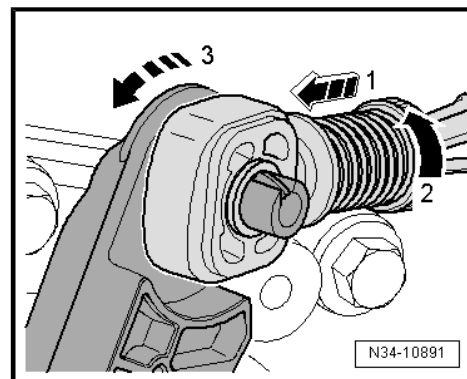
Metal relay lever:

- Detach securing clip -4- for gate selector cable from relay lever -2- and pull cable off pin -arrow-.



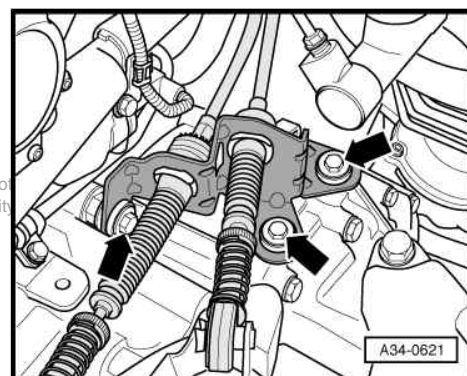
Plastic relay lever:

- To prevent damage to gate selector cable, cable end-piece must be detached from gate selector cable before removing.
- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press gate relay lever towards front -arrow 3-.

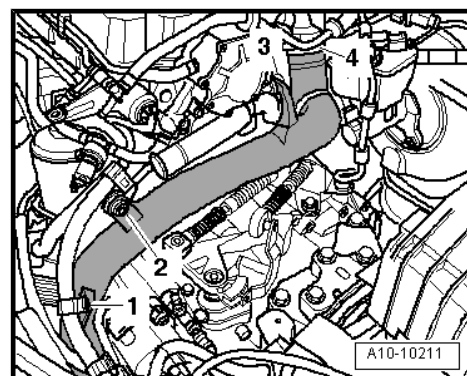
**All vehicles with manual gearbox (continued):**

- Remove cable support bracket -arrows- from gearbox and place to one side (selector cables remain fitted).

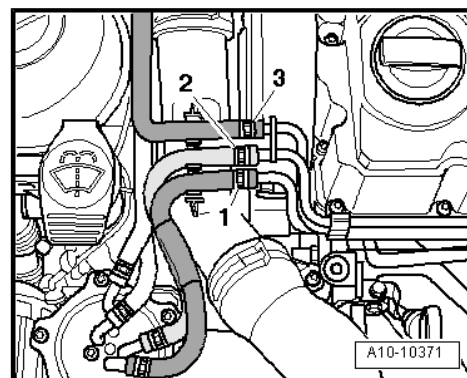
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**All vehicles (continued):**

- Unclip wiring clip -1-.
- Remove bolts -2- and -3-.
- Detach air pipe (left-side) from turbocharger by lifting retaining clip -4- slightly.
- Remove air pipe from engine compartment downwards.

**WARNING**

- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*

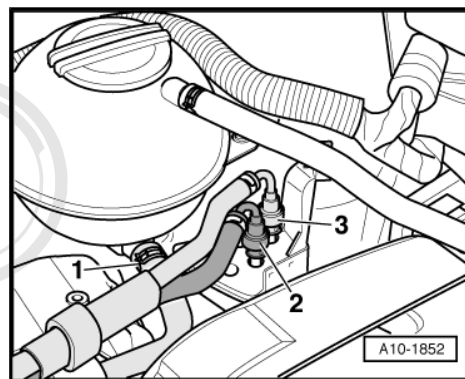


- Disconnect fuel supply hose -2- and fuel return hose -1- from fuel lines.
- Detach coolant hose -3-.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

- Pull release tabs and disconnect fuel supply line -3- and fuel return line -2-.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Detach coolant hose -1- at coolant expansion tank.

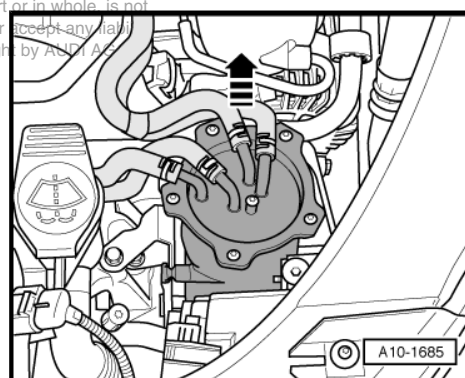
Vehicles with auxiliary heater:

- Disconnect fuel pipe (press release tab).
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Move fuel pipe clear.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

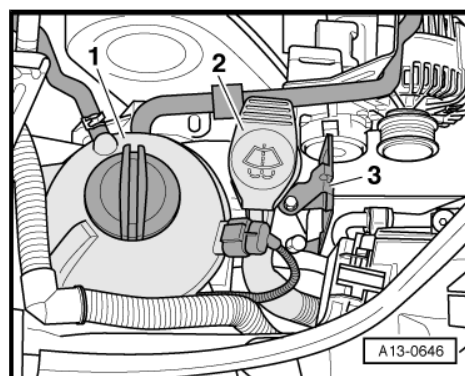


All vehicles (continued):

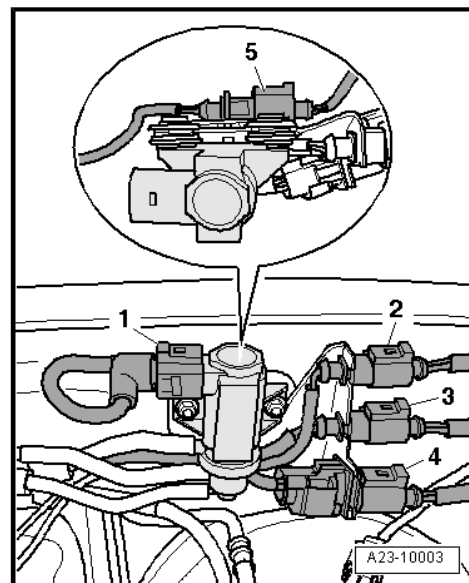
- Pull fuel filter upwards out of bracket -arrow- (hoses remain attached).



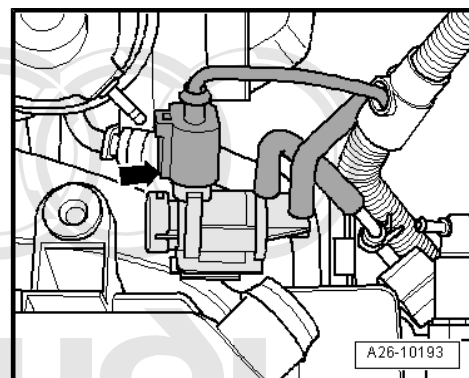
- Unscrew bracket -3- for fuel filter.
- Unscrew bolt at filler neck -2- for washer fluid reservoir.
- Unplug electrical connector at coolant expansion tank.
- Unscrew coolant expansion tank -1- and move clear to one side (hoses remain attached).



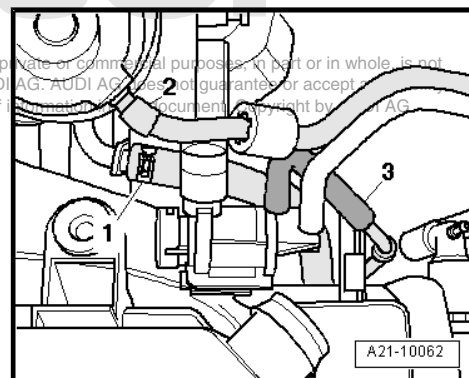
- Unplug electrical connector -2- for exhaust gas temperature sender 1 - G235- .



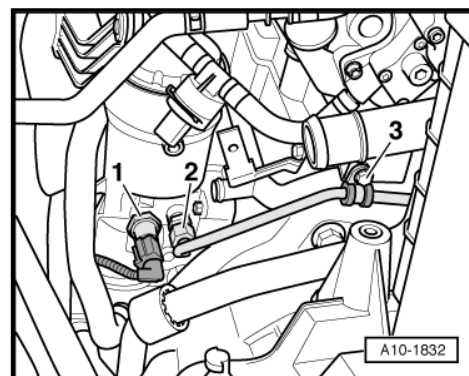
- Unplug electrical connector at exhaust gas recirculation cooler change-over valve - N345- -arrow-.
- Set aside wiring harness leading to body.



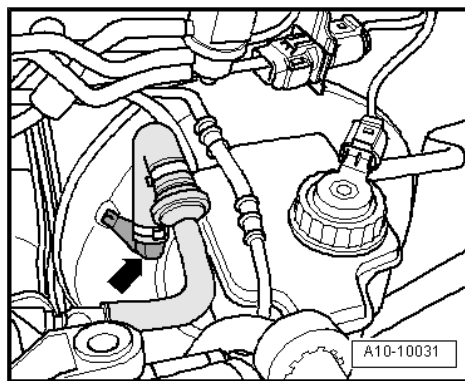
- Detach vacuum hose -2- from vacuum unit for charge pressure control.
- Detach vacuum hose -3- from line going to vacuum unit for change-over flap for exhaust gas recirculation.
- Disconnect vacuum line from tandem pump.
- Unclip exhaust gas recirculation cooler change-over valve - N345- from bracket.
- Move exhaust gas recirculation cooler change-over valve - N345- clear to one side (vacuum hoses remain attached).
- Detach oil supply hose -1- from turbocharger.
- Detach oil supply line going to oil filter bracket.



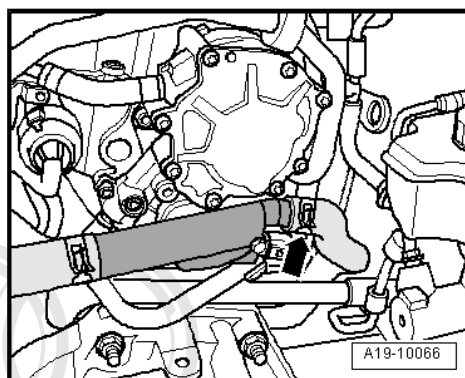
- Unplug electrical connector at oil pressure switch - F1- .
- Unscrew oil pressure switch -1-.
- Detach oil supply line going to turbocharger at retaining clip -3- and at oil filter bracket -2-.
- Disconnect oil supply line at rear engine lifting eye.
- Detach oil supply line.



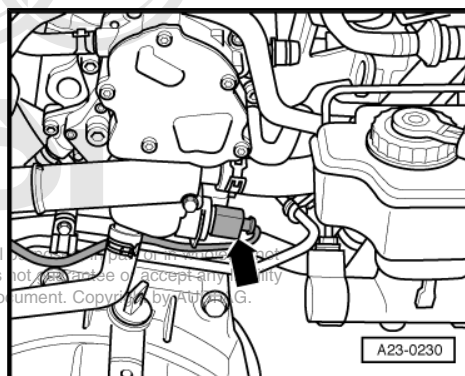
- Disconnect vacuum hose -arrow- at brake servo.



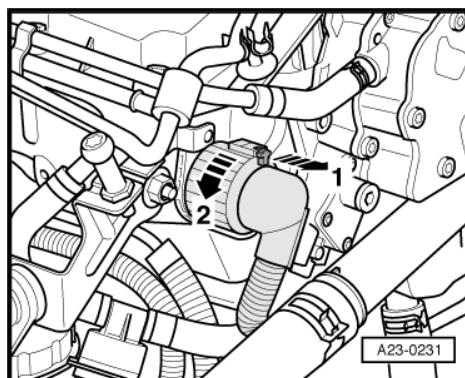
- Detach coolant hose -arrow- at coolant hose/pipe connection.



- Unplug electrical connector -arrow- at coolant temperature sender - G62- and move wiring clear.

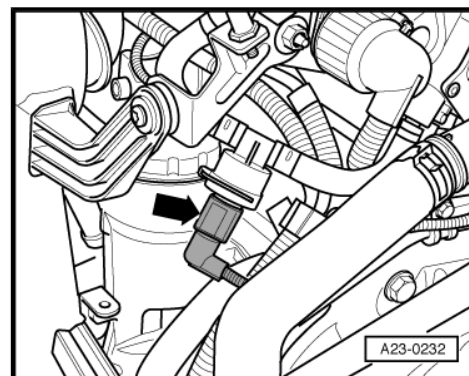


- Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
- Disconnect main connector for unit injectors and move wiring harness clear.

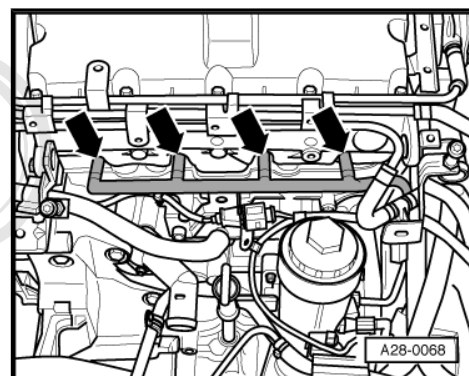


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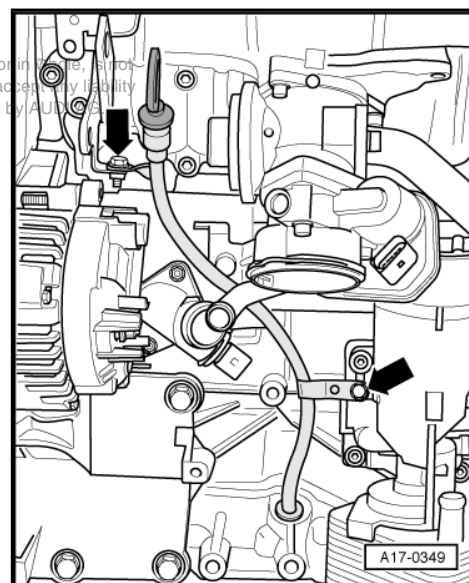
- Unplug electrical connector -arrow- at fuel temperature sender - G81- .



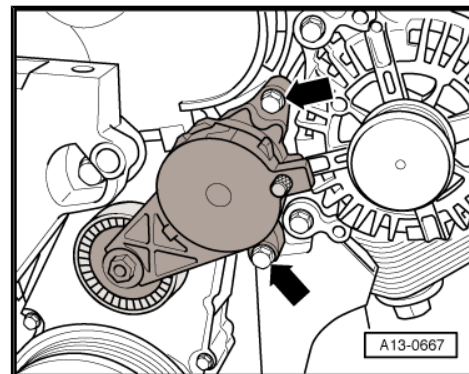
- Detach connector rail from glow plugs -arrows-.



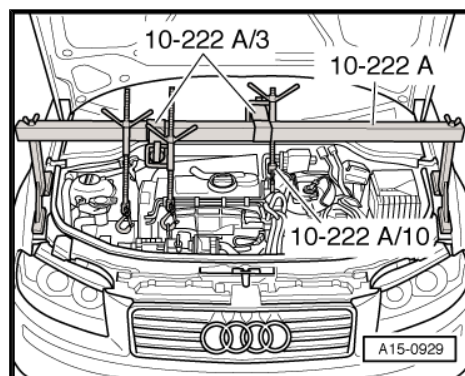
- Remove bolts -arrows-.
- Pull the guide tube for oil dipstick upwards out of cylinder block.
- Remove poly V-belt: vehicles with tensioner [⇒ page 47](#) , vehicles without tensioner [⇒ page 50](#) .



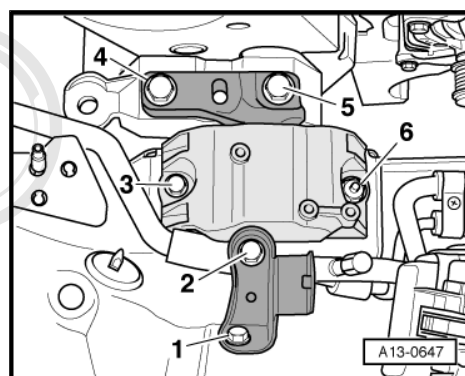
- Vehicles with tensioner: remove bolts -arrows- and take off tensioner for poly-V-belt.



- Set up support bracket - 10-222 A- with adapters - 10-222 A/3- and a total of 3 spindles on wing panel flanges as illustrated.
- Attach hooks of spindles to lifting eyes; the remaining spindle on the right side should not yet be attached.
- Take up weight of engine evenly with both spindles (but do not raise engine).

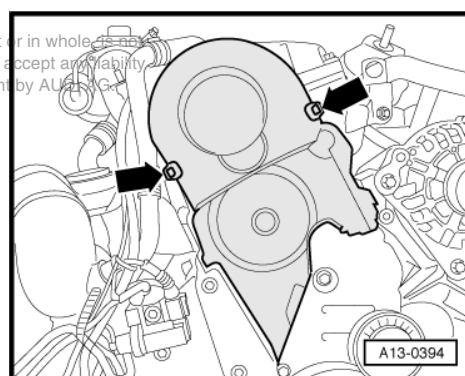


- Remove bolts -1- and -2- and detach connecting bracket.
- Remove bolts -3 ... 6- and remove engine mounting.



- Remove top toothed belt cover by releasing retaining clips -arrows-.

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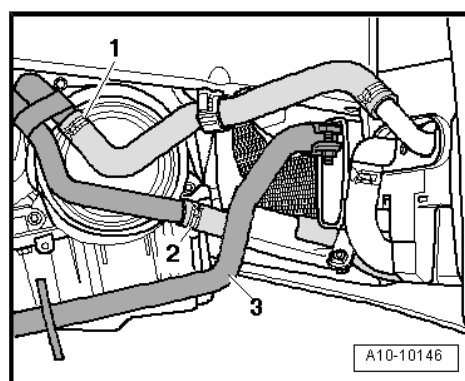
Vehicles with auxiliary heater:

- Remove exhaust pipe -3- for auxiliary heater ⇒ Rep. gr. 82 .



Note

Disregard items -1- and -2-.

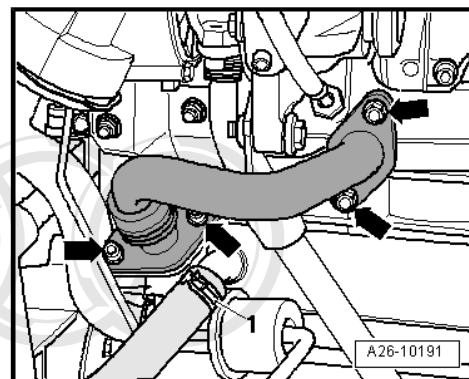


All vehicles (continued):

- Place drip tray for workshop hoist - VAS 6208- under engine.
- Detach coolant hose -1- at exhaust gas recirculation cooler.
- Unbolt connecting pipe going to exhaust gas recirculation cooler -arrows-.

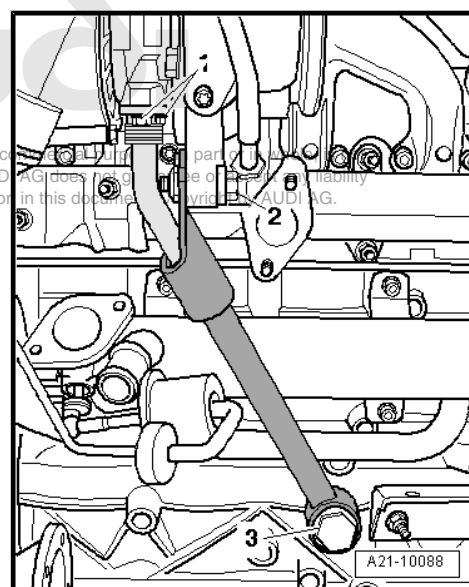
Vehicles with auxiliary heater:

- Remove coolant pipes going to auxiliary heater from cylinder block (coolant hoses remain connected).

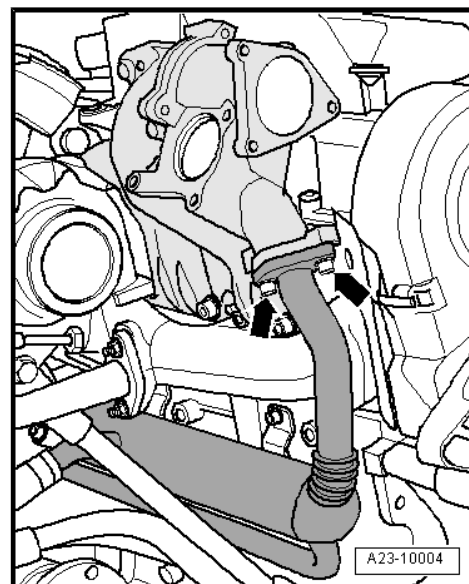
**Vehicles with front-wheel drive:**

- Remove nuts -1-, bolt -2- and banjo bolt -3-.
- Remove support for turbocharger together with oil return line.

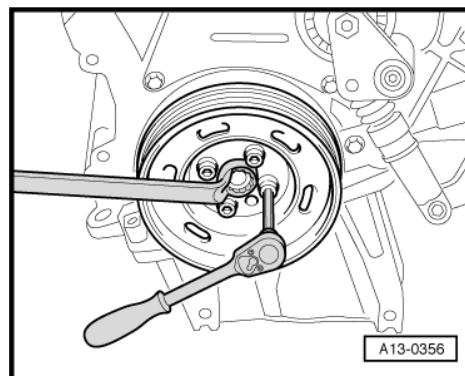
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**All vehicles (continued):**

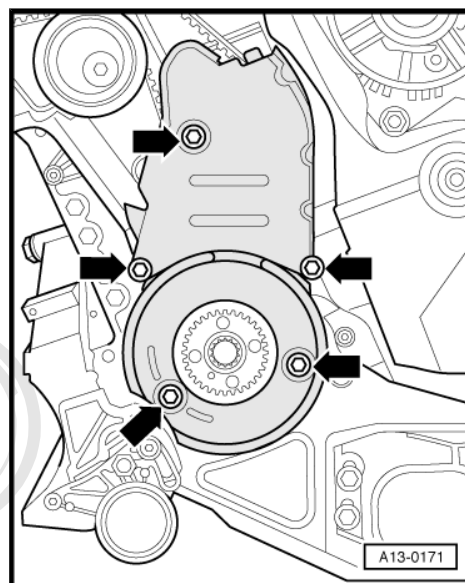
- Unscrew bolts on flange between exhaust gas recirculation cooler and intake manifold.



- Remove cover cap for vibration damper.
- Unbolt vibration damper; counterhold on centre bolt with ring spanner.



- Unbolt toothed belt covers (bottom and centre) -arrows-.



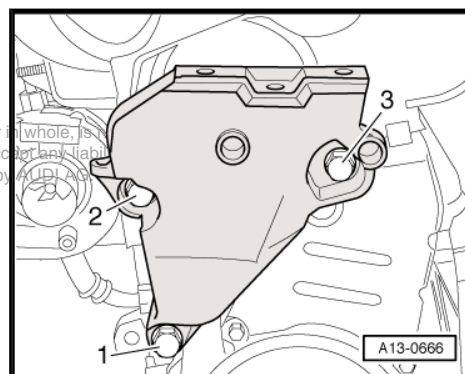
- Remove bolts -1 ... 3- for engine support.



Note

To remove the bolts for the engine support, raise or lower the engine slightly as necessary via the spindles on support bracket - 10 - 222 A-.

- Raise engine/gearbox assembly slightly via the two spindles and remove engine support.
- Lower the engine/gearbox assembly again.



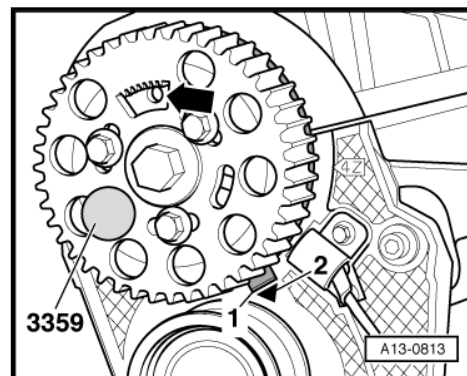
Caution

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

- Turn the crankshaft to TDC.
- The toothed segment -arrow- at camshaft sprocket must face upwards.
- Lug -1- on sender wheel for camshaft must align with marking -2- on rear toothed belt cover (not fitted on all versions).

**Note**

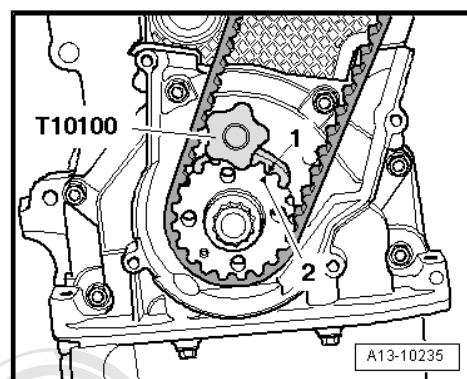
The camshaft sprocket is shown with the toothed belt removed for illustrative purposes.



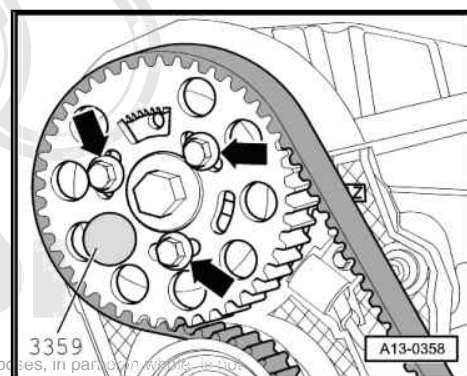
- Lock hub with locking pin - 3359- .
- Lock crankshaft sprocket with crankshaft stop - T10100- .
- The markings on the sprocket -2- and the crankshaft stop -1- must align. The lug of the crankshaft stop must engage in the bore in the sealing flange.

**Note**

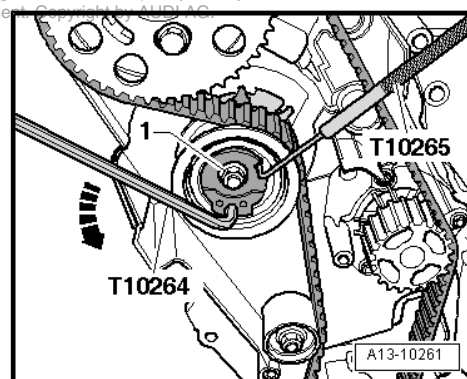
The crankshaft stop can only be pushed onto the sprocket from the front face of the teeth.



- Mark direction of rotation of toothed belt with chalk or felt-tip pen.
- Loosen securing bolts for camshaft sprocket -arrows-.

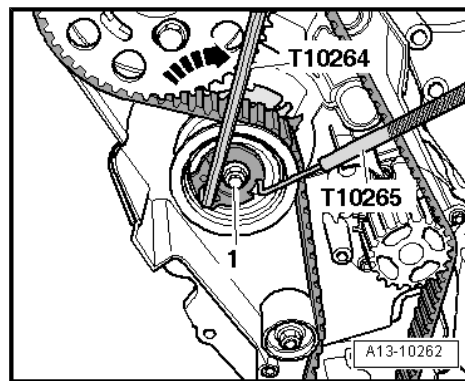


- Loosen securing nut -1- for tensioning roller.
- Turn the eccentric adjuster with the angle driver - T10264- anti-clockwise -arrow- until the tensioning roller can be secured with the locking tool - T10265- .

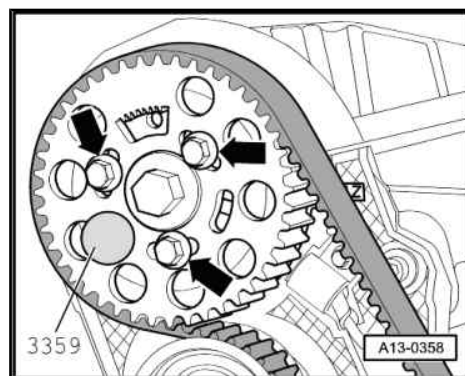


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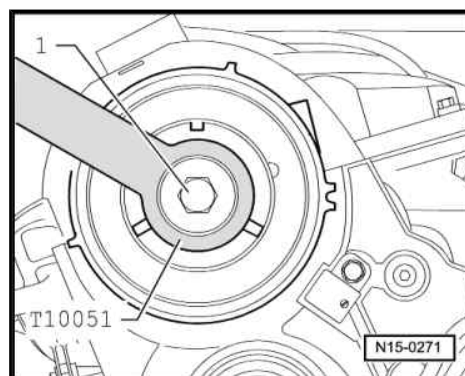
- Now turn eccentric adjuster of tensioning roller clockwise -arrow- until stop and tighten securing nut -1- finger-tight.
- Take off toothed belt first from coolant pump and then from the remaining sprockets.



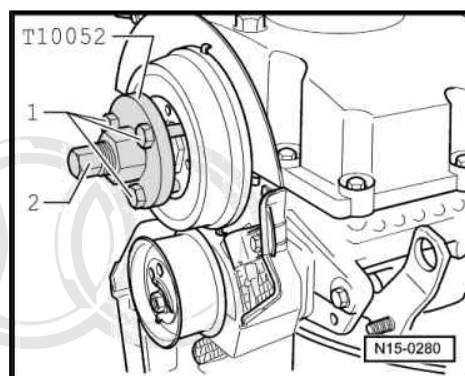
- Remove locking pin - 3359- .
- Unscrew bolts -arrows- for camshaft sprocket and remove camshaft sprocket from hub.



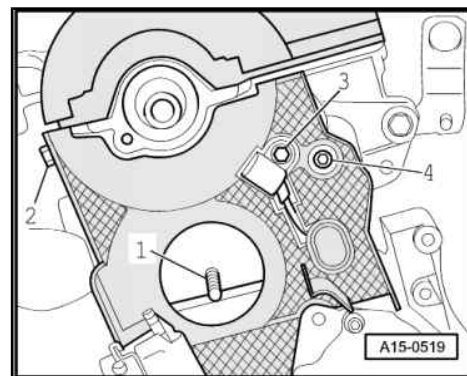
- Loosen securing bolt for hub; use counterhold tool - T10051- .
- Then unscrew bolt approx. 2 turns.



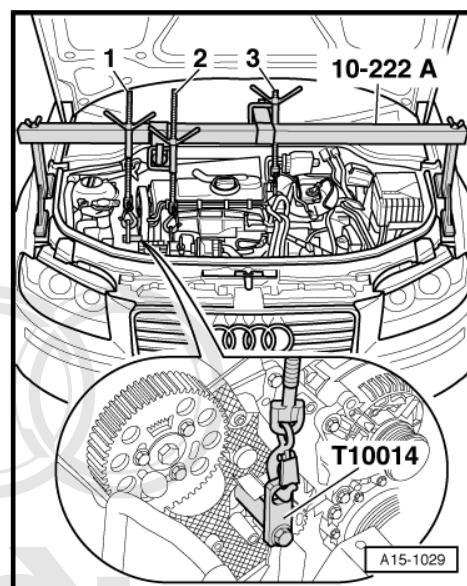
- Apply puller - T10052- and screw bolts -1- into hub.
- Remove hub by screwing in bolt -2- while counterholding at hexagon flats (30 mm) of puller.



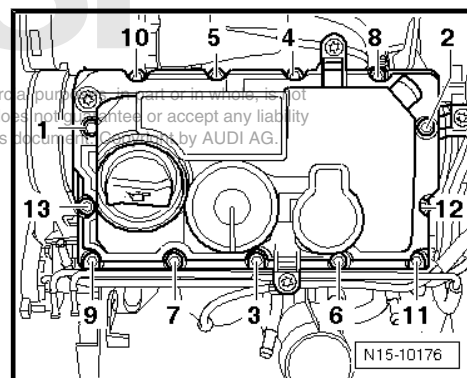
- Remove toothed belt tensioning roller.
- Remove bolts -2- and -4-.
- Unscrew bolt -3- and remove Hall sender - G40- from cylinder head.
- Unscrew stud -1- using two M8 lock nuts.



- Screw in bracket - T10014- into threaded hole above coolant pump.
- Attach spindle -1- of support bar - 10-222 A- to bracket - T10014-.
- Lift engine using spindle -1- until spindles -2- and -3- are no longer carrying a load.
- Unhook spindles -2- and -3- and move to side.



- Unscrew cylinder head cover bolts in the sequence -13 ... 1-.
- Remove bolts and take off cylinder head cover.



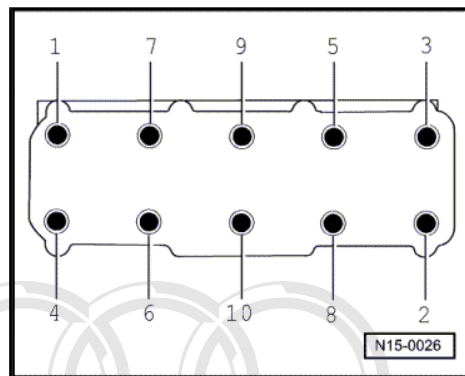
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- Follow the sequence for loosening the cylinder head bolts.
- Remove the cylinder head with the assistance of a 2nd mechanic.
- Lay cylinder head aside on a clean surface with the combustion chamber side facing upwards.



Caution

- ◆ **Vehicles with ceramic glow plugs:** The ceramic glow plugs fitted in this engine are very easily damaged and project slightly beyond the cylinder head gasket surface, so do **NOT** lay the cylinder head down on the gasket side while the glow plugs are still installed.
- ◆ **Handling ceramic glow plugs** ⇒ **page 96**.



2.5 Installing cylinder head

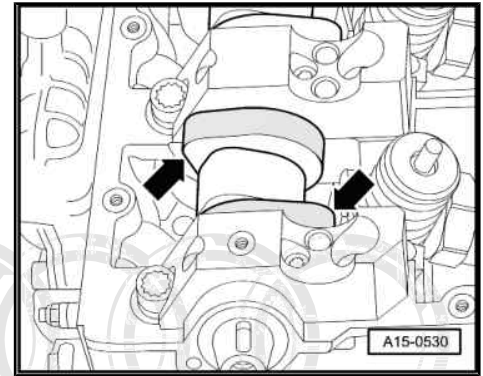


Note

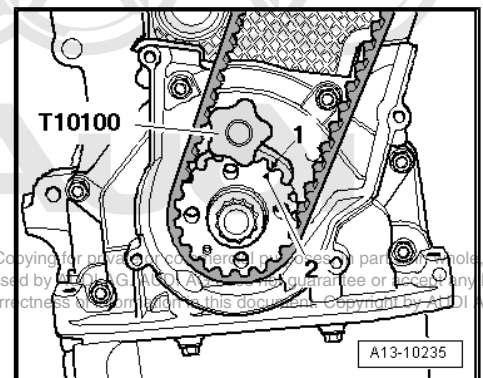
- ◆ **Renew the cylinder head bolts.**
- ◆ **Renew self-locking nuts and bolts when performing assembly work.**
- ◆ **Renew bolts which are tightened to a specified angle as well as seals and gaskets.**
- ◆ **If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.**
- ◆ **Carefully remove any remaining emery and abrasive material.**
- ◆ **No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.**
- ◆ **Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.**
- ◆ **The cylinder heads of diesel engines must not be machined.**
- ◆ **When installing a replacement cylinder head with fitted camshaft, the contact surfaces between hydraulic tappets and cam running surfaces must be oiled after installing the cylinder head.**
- ◆ **The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.**
- ◆ **Do not remove new cylinder head gasket from packaging until it is ready to be fitted.**
- ◆ **Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.**
- ◆ **Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.**
- ◆ **After fitting a new cylinder head or cylinder head gasket, change the coolant and engine oil.**
- ◆ **After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.**

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- Check whether the camshaft and the crankshaft are positioned at TDC:
- The cams for cylinder 1 must point upwards evenly on camshaft -arrows-.



- The crankshaft sprocket must be locked with the crankshaft stop - T10100- .
- The markings on the sprocket -2- and the crankshaft stop -1- must align. The lug of the crankshaft stop must engage in the bore in the sealing flange.



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- Check whether there is a slit dowel sleeve inserted between cylinders 1 and 2 -arrow A-; insert if necessary.
- Check which type of dowel sleeve is inserted between cylinders 3 and 4 -arrow B-:

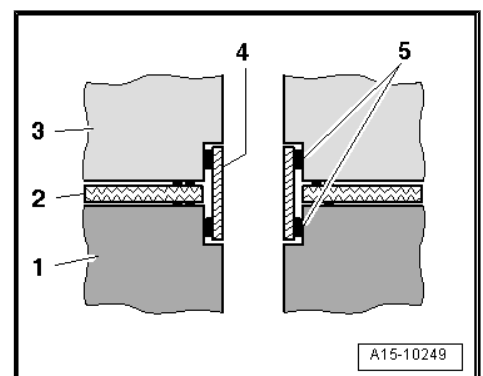
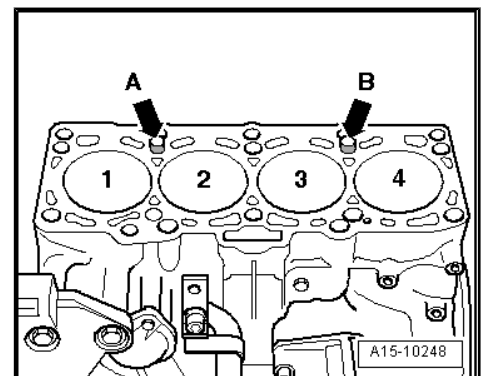
Vehicles with slit dowel sleeve -arrow B-:

- A slit dowel sleeve remains installed.

Vehicles with closed dowel sleeve -arrow B-:

- A closed dowel sleeve must be coated with new sealant as described in the following.
- Pull closed dowel sleeve -arrow B- out of cylinder block and remove any remaining sealant.
- Blow out drilled holes for dowel sleeve in cylinder block -1- and in cylinder head -3- with compressed air.
- Clean and degrease each drilled hole down to a depth of 10 mm.
- Allow holes to dry for 3 minutes and then coat drilled holes in cylinder block and cylinder head all around with sealant - D 154 103 A1- .
- Insert closed dowel sleeve -4-.

2 - Cylinder head gasket



All vehicles (continued):

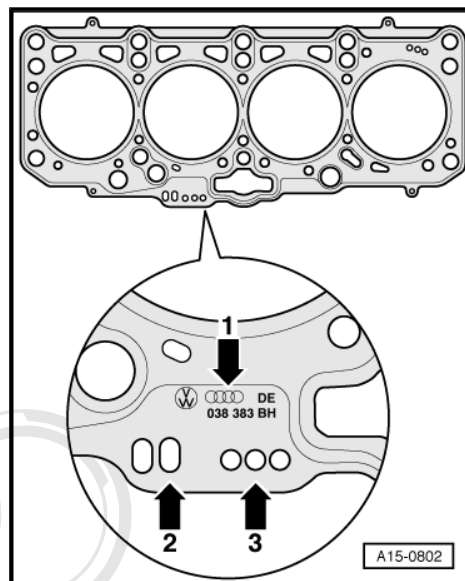
- Note identification markings on cylinder head gasket.

- 1 - Part number
- 2 - Production code (can be disregarded)
- 3 - Holes



Note

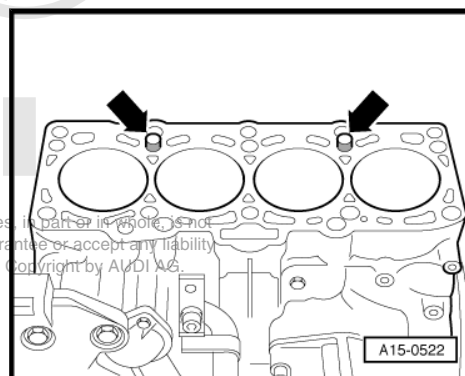
- ◆ If the cylinder head gasket or cylinder head is renewed, be sure to install a gasket with the same identification.
- ◆ If parts of the crankshaft drive have been renewed, the new cylinder head gasket must be selected by measuring the piston projection at TDC ⇒ [page 92](#).



- Fit cylinder head gasket.
- Note centring sleeves -arrows- in cylinder block.
- Note installation position of cylinder head gasket: the word "oben" (top) or the part number should face towards the cylinder head.

Vehicles with small engine support:

- Fit cylinder head.



Vehicles with large engine support:

- Attach lifting tackle - 2024 A- at cylinder head.



WARNING

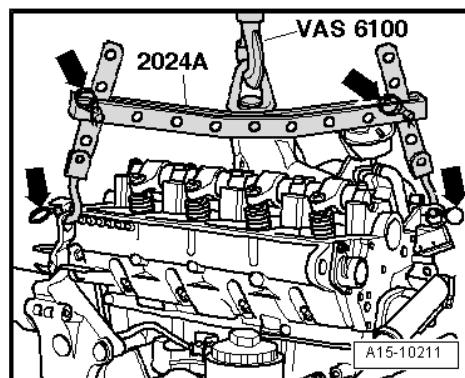
The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.



Note

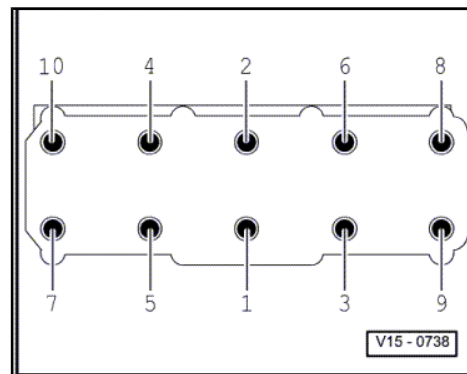
Also tie up intake manifold to eye of lifting tackle to maintain the centre of gravity in one position.

- Slightly lift cylinder head using workshop hoist - VAS 6100- .
- Swivel cylinder head so that stud for toothed belt tensioner is inserted into aperture in toothed belt cover (rear) and attach tensioning roller at the same time.
- Fit cylinder head onto cylinder block.



All vehicles (continued):

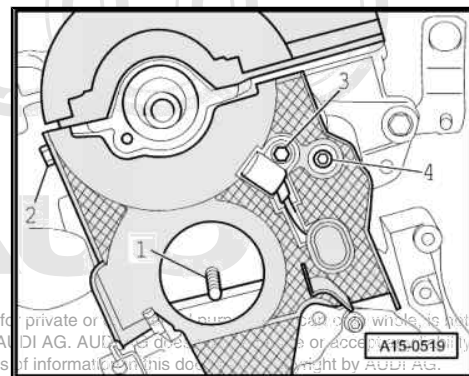
- Insert new cylinder head bolts and tighten hand-tight.
- Tighten cylinder head bolts in the sequence -1 ... 10- in 4 stages as follows:
 1. Tighten to 40 Nm.
 2. Tighten to 60 Nm.
 3. Turn 90° further.
 4. Turn 90° further.

**Note**

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

Vehicles with small engine support:

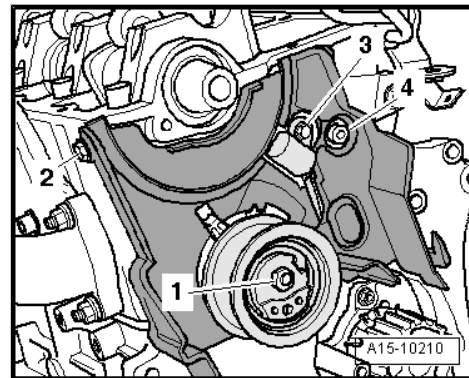
- Secure the engine lifting eye at front on cylinder head.
- Apply locking fluid to bolts -2 ... 4- and tighten; for locking fluid refer to ⇒ Parts catalogue .
- Screw in stud -1-.



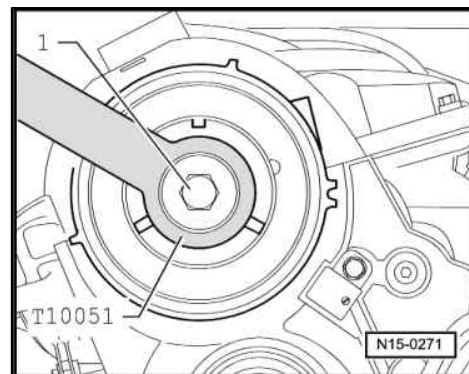
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Vehicles with large engine support:

- Apply locking fluid to bolts -2 ... 4- and tighten; for locking fluid refer to ⇒ Parts catalogue .
- Screw nut -1- for toothed belt tensioner onto stud for toothed belt tensioner.

**All vehicles (continued):**

- Attach hub to camshaft.
- Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



- Push camshaft sprocket onto hub.
- Toothed segment -arrow- in camshaft sprocket must face upwards.
- Screw in bolts -1- finger-tight.
- Lock hub on camshaft with locking pin - 3359- .
- Install toothed belt (adjust valve timing) ⇒ [page 63](#) .
- Install cylinder head cover ⇒ [page 101](#) .

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

- Install vibration damper ⇒ [page 50](#) .

Vehicles with manual gearbox

- Attach and adjust selector mechanism at gearbox ⇒ Rep. gr. 34 .

All vehicles (continued):

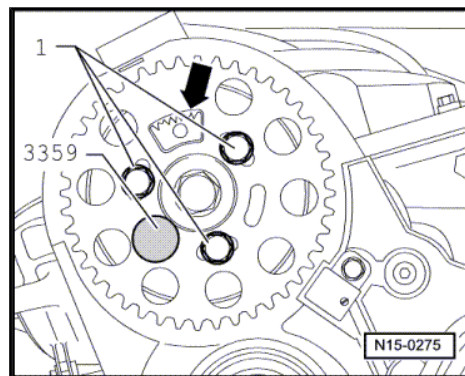
- Install particulate filter ⇒ [page 229](#) .
- Align exhaust system so it is free of stress ⇒ [page 235](#) .

Vehicles with auxiliary heater:

- Install exhaust pipe for auxiliary heater ⇒ Rep. gr. 82 .

All vehicles (continued):

- Install battery ⇒ Rep. gr. 27 .
- Change engine oil ⇒ Maintenance ; Booklet 808 .
- Connect coolant hose to radiator ⇒ [page 197](#) .
- Fill cooling system with fresh coolant ⇒ [page 183](#) .



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Tightening torques

Component		Nm
Hall sender - G40- to cylinder head		10 ¹⁾
Stud to cylinder head		15
Rear toothed belt cover to cylinder head	M6	10 ¹⁾
	M8	25 ¹⁾
Hub to camshaft		100
Toothed belt cover (centre) to cylinder block		10 ¹⁾
Toothed belt cover (bottom) to cylinder block		10 ¹⁾
Exhaust gas recirculation cooler to intake manifold		22
Support for turbocharger to:	Turbocharger	25
	Cylinder block	60
Oil return line to turbocharger		15
EGR connecting pipe to:	Exhaust gas recirculation cooler	22
	Exhaust manifold	25
Tensioner for poly V-belt to bracket for ancillaries		23
Guide tube for oil dipstick		10
Oil filter bracket to:	Oil filter bracket	10
	Lifting eye	10
Bracket for oil supply line		10
Oil supply line to oil filter bracket		22
Oil pressure switch to oil filter bracket		20
¹⁾ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue for locking fluid.		

2.6 Checking compression

The compression test is carried out using the "Guided Fault Finding" function of the vehicle diagnostic, testing and information system - VAS 5051B- under "Repair group 15; Cylinder head, valve gear; Subsystem, background conditions; Diagnosis object: compression pressure poor".

3 Valve gear



Note

- ◆ After installing the camshaft, the engine must NOT be started for about 30 minutes. The hydraulic tappets have to settle (otherwise valves will strike pistons).
- ◆ After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- ◆ Renew seals and gaskets.
- ◆ Removing and installing tandem pump ⇒ Rep. gr. 20.

3.1 Valve gear - exploded view

1 - Cylinder head

2 - Bearing shell

- ☐ Note installation position
- ☐ Mark used bearing shells for re-installation but not on bearing surface
- ☐ Bearing shells worn down to the base layer must be renewed
- ☐ Make sure that the retaining lugs are correctly seated in the bearing caps and the cylinder head
- ☐ Fit new bearing shells if camshaft is being renewed.

3 - Camshaft

- ☐ Removing and installing ⇒ [page 148](#)
- ☐ Measuring axial clearance ⇒ [page 144](#)
- ☐ Measuring radial clearance ⇒ [page 145](#)
- ☐ Runout: max. 0.04 mm

4 - Bearing shell

- ☐ Note installation position
- ☐ Mark used bearing shells for re-installation but not on bearing surface

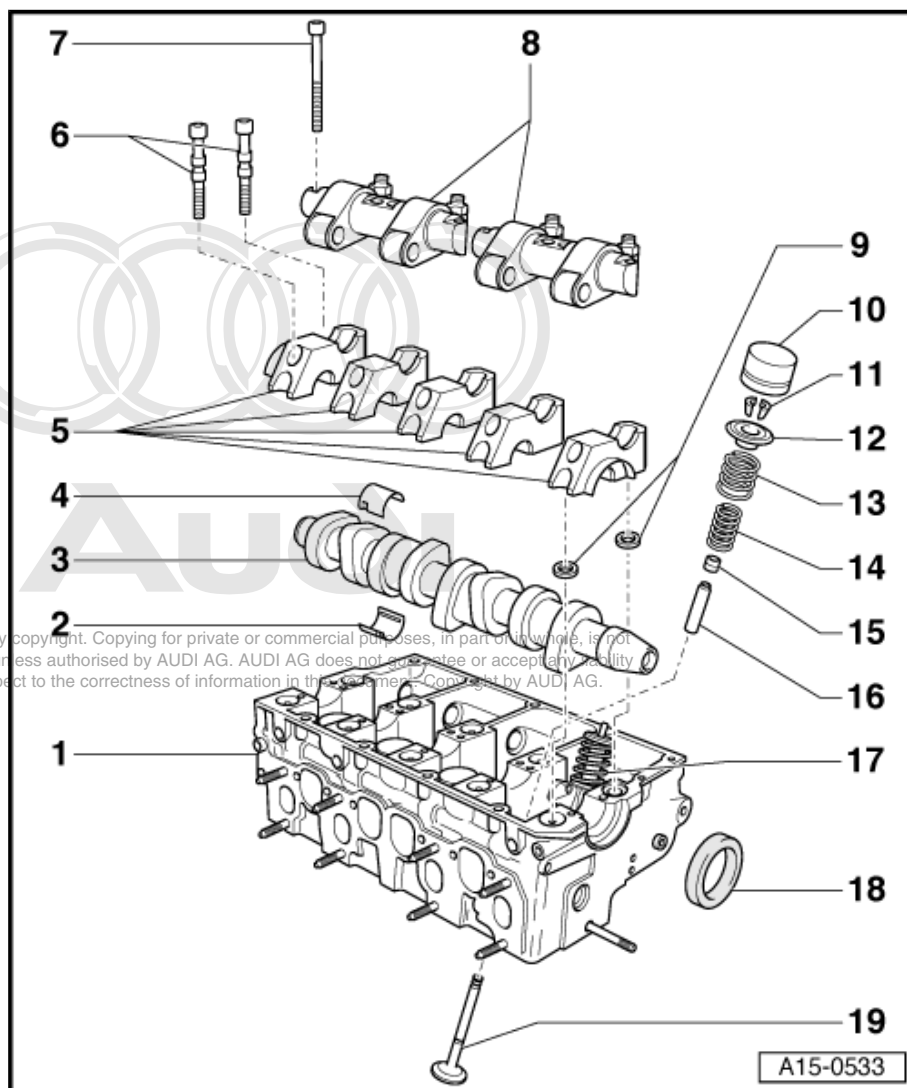
- ☐ Bearing shells worn down to the base layer must be renewed

- ☐ Make sure that the retaining lugs are correctly seated in the bearing caps and the cylinder head

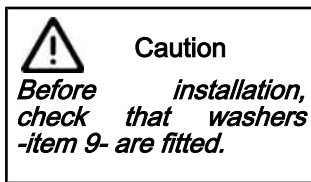
- ☐ Fit new bearing shells if camshaft is being renewed.

5 - Bearing cap

- ☐ Installation sequence ⇒ ["3.5 Removing and installing camshaft", page 148](#)



- ☐ Apply sealant to bearing caps 1 and 5 ⇒ [page 144](#)



6 - 8 Nm +90°

- ☐ Renew

7 - 20 Nm +90°

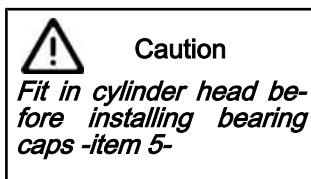
- ☐ Renew
- ☐ Note correct sequence for loosening and tightening
⇒ [“3.5 Removing and installing camshaft”, page 148](#)

8 - Rocker arm shaft

- ☐ Mark allocation of rocker arms
- ☐ Do not interchange
- ☐ Removing and installing ⇒ [“3.5 Removing and installing camshaft”, page 148](#)
- ☐ Before installing, check that all ball studs and O-rings are inserted in the unit injectors ⇒ [page 144](#)

9 - Washers

- ☐ For cylinder head bolts



10 - Hydraulic bucket tappet

- ☐ Checking ⇒ [page 163](#)
- ☐ Removing and installing ⇒ [“3.6 Renewing valve stem oil seals with cylinder head installed”, page 153](#)
- ☐ Do not interchange (mark allocation)
- ☐ Place down with contact surface facing downwards
- ☐ Check axial clearance of camshaft before installing ⇒ [page 144](#)
- ☐ Lubricate contact surface

11 - Valve cotters

12 - Valve spring plate

13 - Valve spring (outer)

- ☐ Removing and installing with cylinder head installed
⇒ [“3.6 Renewing valve stem oil seals with cylinder head installed”, page 153](#)
- ☐ Remove and install with cylinder head removed using valve spring compressor - 2037-

14 - Valve spring (inner)

- ☐ Removing and installing with cylinder head installed
⇒ [“3.6 Renewing valve stem oil seals with cylinder head installed”, page 153](#)
- ☐ Remove and install with cylinder head removed using valve spring compressor - 2037-

15 - Valve stem oil seal

- ☐ Renewing with cylinder head installed ⇒ [page 153](#)
- ☐ Renewing with cylinder head removed ⇒ [page 158](#)

16 - Valve guide

- ☐ Checking ⇒ [page 164](#)

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17 - Unit injector

- ❑ Removing and installing ⇒ Rep. gr. 23

18 - Seal

- ❑ Renewing ⇒ [page 145](#)

19 - Valves

- ❑ Checking ⇒ [page 165](#)
- ❑ Valve dimensions ⇒ [page 164](#)
- ❑ Must not be machined; only grinding-in is permissible

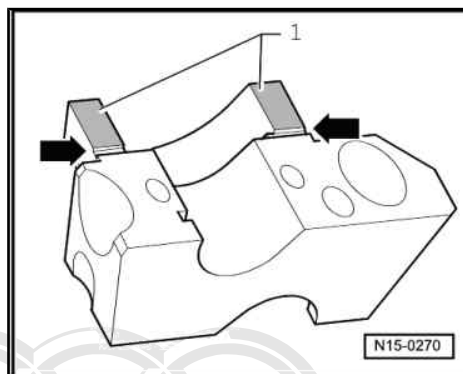
Applying sealant to bearing caps 1 and 5

- Apply a thin and even coat of sealant to surfaces -1-; for sealant refer to ⇒ Electronic parts catalogue .



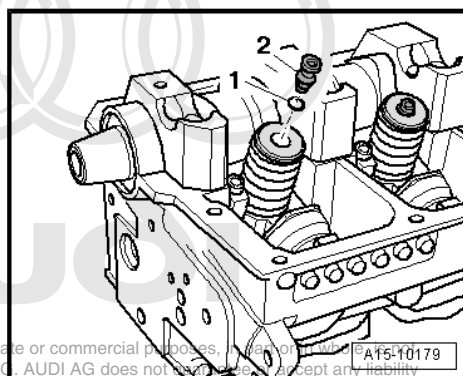
Note

Make sure no sealant gets into the grooves -arrows- or onto the other surfaces.



Ball stud for rocker arm shaft

- Before inserting rocker arm shaft, check that all ball studs -2- and O-rings -1- have been installed in unit injectors.

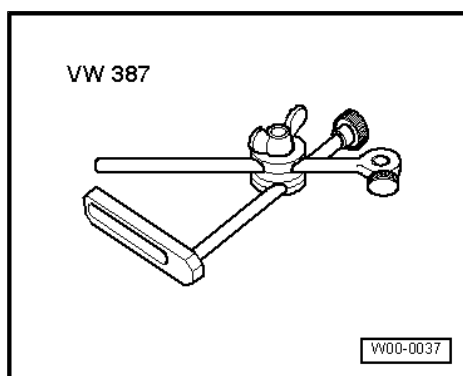


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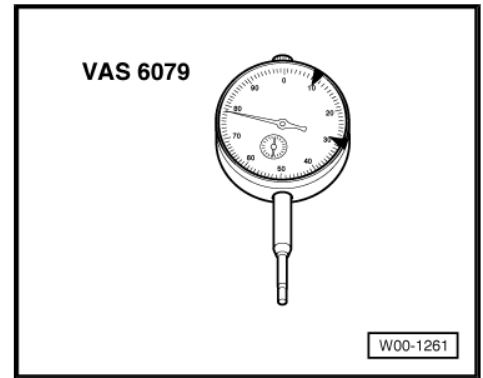
3.2 Measuring axial clearance of camshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

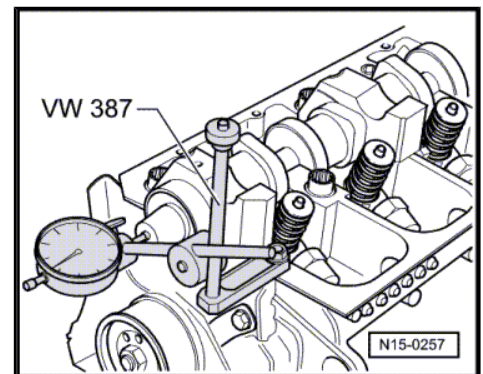


◆ Dial gauge - VAS 6079-



Procedure

- Remove bucket tappets
⇒ ["3.5 Removing and installing camshaft", page 148](#).
- Install camshaft again and fit first and last bearing cap.
- Secure dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder head as shown in illustration.
- Press camshaft against dial gauge by hand.
- Set dial gauge to "0".
- Press camshaft away from dial gauge and read off value:



Axial clearance on inlet camshaft and exhaust camshaft:

- Wear limit: 0.15 mm.

3.3 Measuring radial clearance of camshaft

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

- Remove bucket tappets
⇒ ["3.5 Removing and installing camshaft", page 148](#).
- Clean bearing and bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.
- The Plastigage must be positioned in the centre of the bearing.
- Fit bearing cap and tighten to 8 Nm (do not turn further) without rotating camshaft
⇒ ["3.5 Removing and installing camshaft", page 148](#).
- Remove bearing cap again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

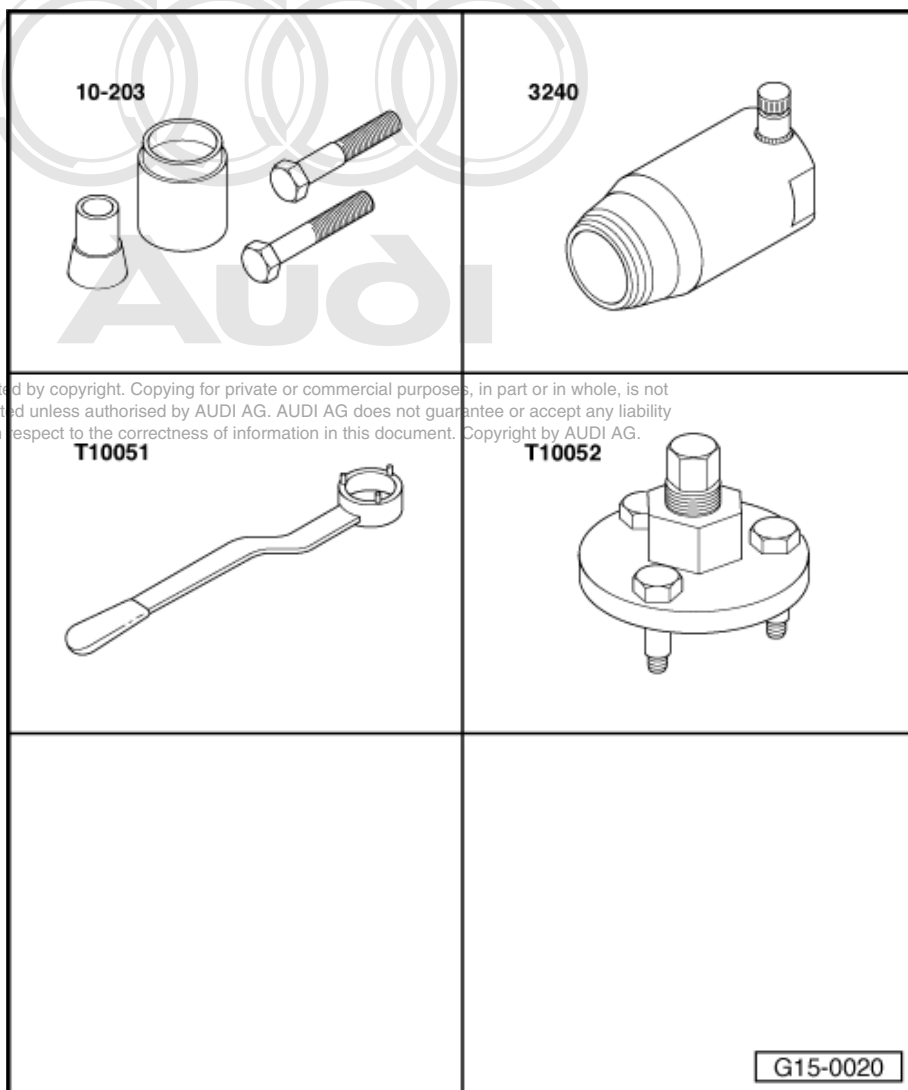
- Wear limit: 0.11 mm.

3.4 Renewing camshaft oil seal

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Special tools and workshop equipment required

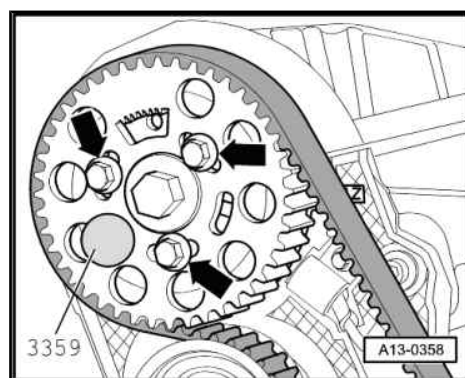
- ◆ Fitting tool - 10-203-
- ◆ Oil seal extractor - 3240-
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Bolt M12x65



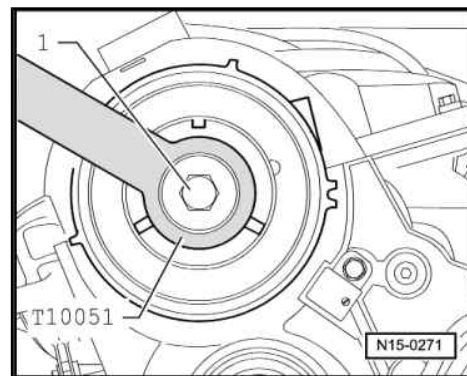
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Removing

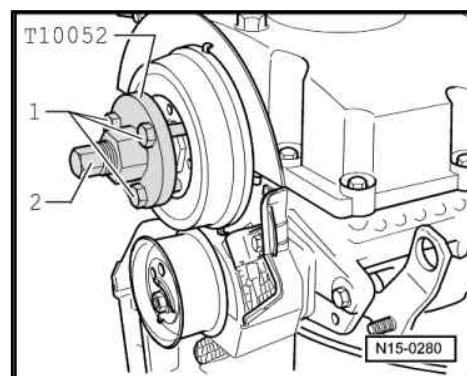
- Cylinder head installed.
- Remove toothed belt ⇒ [page 57](#) .
- Remove locking pin - 3359- .
- Unscrew bolts -arrows- for camshaft sprocket.
- Detach camshaft sprocket from hub.



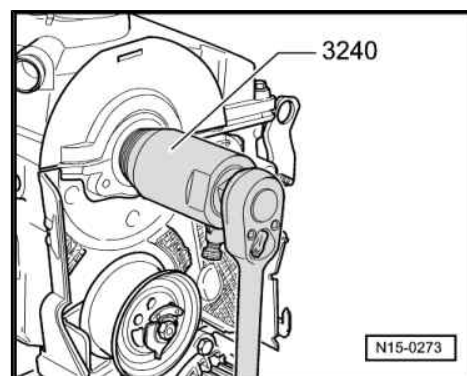
- Loosen securing bolt -1- for hub; use counterhold tool - T10051- .
- Then unscrew bolt approx. 2 turns.



- Fit puller - T10052- on hub and screw bolts -1- into hub.
- Remove hub by screwing in bolt -2- while counterholding at hexagon flats (30 mm) of puller.



- Adjust inner part of oil seal extractor - 3240- so that it is level with the outer part and lock in position with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into camshaft 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.
- Remove oil seal with pliers.
- Clean running surface and sealing surface.



Installing

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

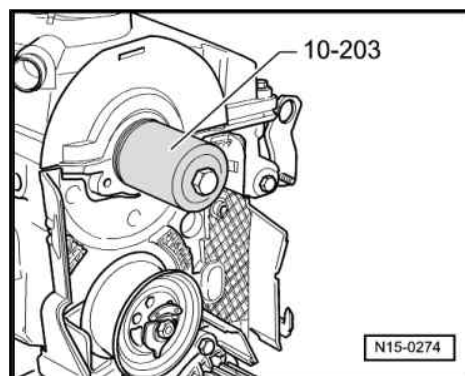


Note

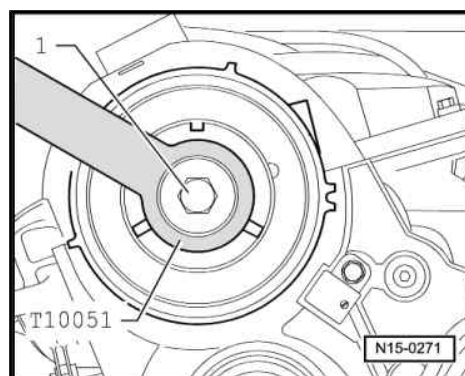
The sealing lip of the oil seal must not be additionally oiled or greased.

- Remove oil residue on camshaft journal with a clean cloth.
- Tape off groove on taper of camshaft with adhesive tape.

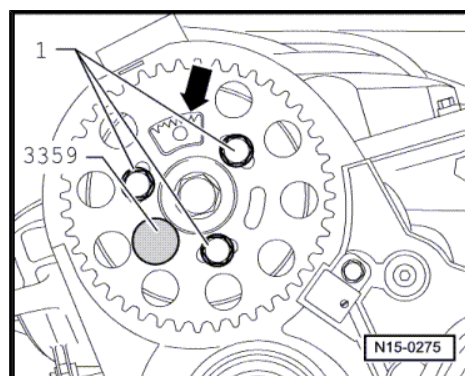
- Carefully position oil seal on camshaft.
- Press in oil seal with press piece of fitting tool - 10-203- and bolt M12×65 as far as the stop.



- Attach hub to camshaft.
- Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



- Push camshaft sprocket onto hub.
 - Toothed segment -arrow- of camshaft sprocket must be at top.
- Screw in bolts -1- finger-tight.
- Lock hub with locking pin - 3359- .
- Install toothed belt (adjust valve timing) ⇒ [page 63](#) .



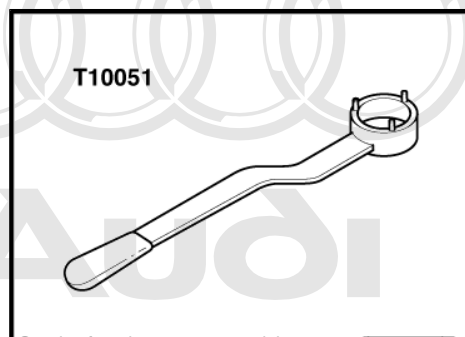
Tightening torque

Component	Nm
Hub to camshaft	100

3.5 Removing and installing camshaft

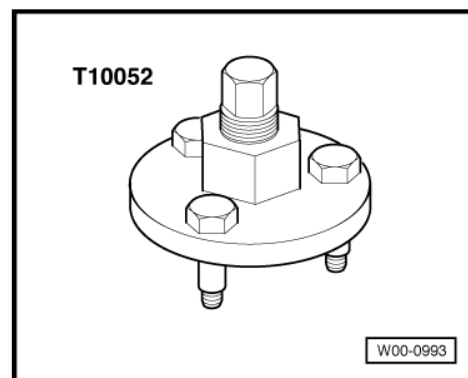
Special tools and workshop equipment required

- ◆ Counterhold tool - T10051-



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♦ Puller - T10052-



♦ Sealant ⇒ Electronic parts catalogue

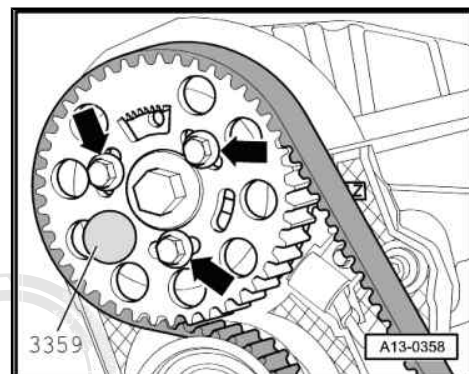
Removing

- Cylinder head installed.
- Remove toothed belt ⇒ [page 57](#) .
- Remove tandem pump ⇒ Rep. gr. 20 .

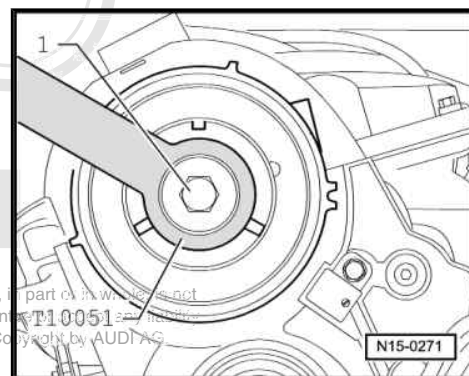
**Note**

The hoses can remain attached to the tandem pump.

- Remove locking pin - 3359- .
- Unscrew bolts -arrows- for camshaft sprocket.
- Detach camshaft sprocket from hub.

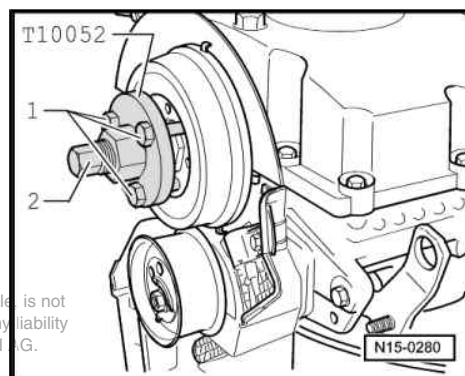


- Loosen securing bolt for hub; use counterhold tool - T10051- .
- Then unscrew bolt approx. 2 turns.



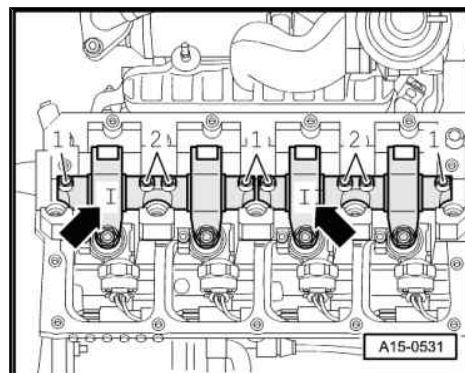
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- Fit puller - T10052- on hub and screw bolts -1- into hub.
- Remove hub by screwing in bolt -2- while counterholding at hexagon flats (30 mm) of puller.
- Remove cylinder head cover ➤ [page 100](#) .



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- Mark rocker arm shafts with waterproof felt-tip pen to make sure that they are reinstalled in the previous position and to avoid performing a basic setting of the unit injectors -arrows-.
- First loosen the two outer bolts -1- on the rocker arm shafts, then the inner bolts -2-.
- Remove the rocker arm shafts.

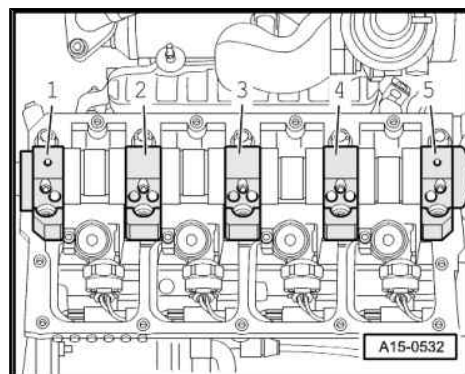


- First remove the bearing caps -1-, -3- and -5-.
- Then loosen bearing caps -2- and -4- alternately in diagonal sequence.

Note

- ♦ *Make sure that the camshaft bearing shells are not interchanged.*
- ♦ *Mark allocation of camshaft bearing shells on rear with a waterproof felt-tip pen.*

- Remove camshaft.



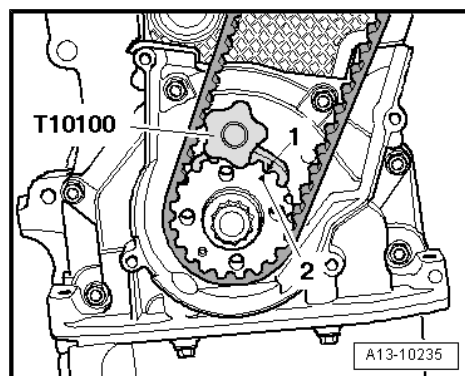
Installing

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

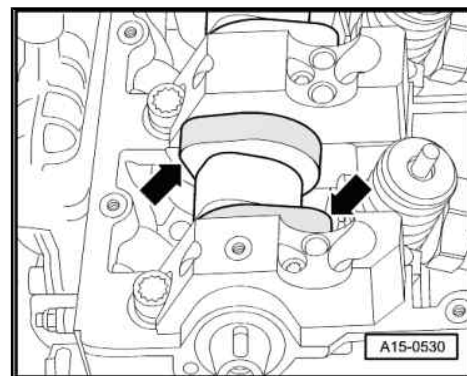
- Check whether the crankshaft is positioned at TDC.
- Crankshaft sprocket is locked at cylinder 1 TDC with crankshaft stop - T10100- .

Note

- ♦ *Make sure that the used camshaft bearing shells are not interchanged (note marking).*
- ♦ *When installing the camshaft, make sure that the retaining lugs on the bearing shells are correctly seated in the bearing caps and the cylinder head.*



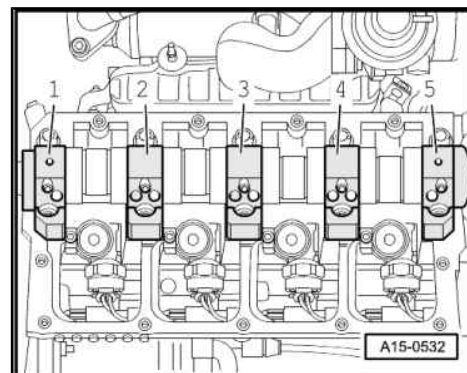
- Lubricate contact surfaces of camshaft.
- Install camshaft in TDC position for cylinder 1:
- The cams for cylinder 1 must point upwards on camshaft -arrows-.



i Note

If the bearing caps are fitted with the cylinder head removed, the washers for the cylinder head bolts ⇒ [Item 9 \(page 143\)](#) must first be fitted.

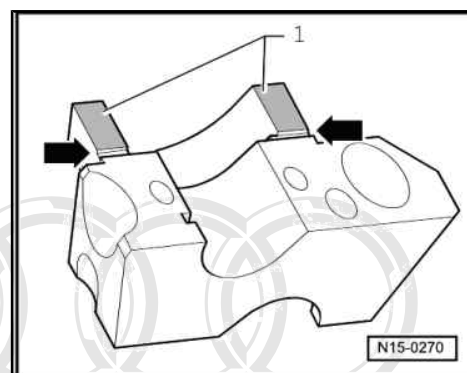
- Tighten bearing caps -2- and -4- alternately in diagonal sequence.



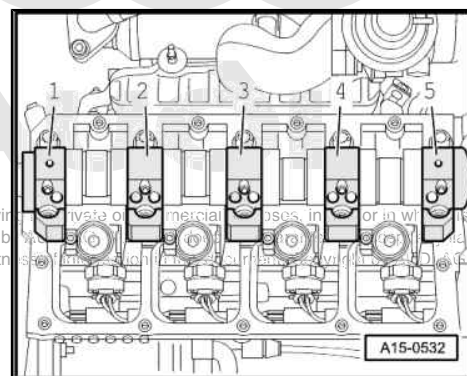
- Apply a thin and even coat of sealant to surfaces -1- of bearing caps 1 and 5; for sealant refer to ⇒ Electronic parts catalogue .

i Note

Make sure no sealant gets into the grooves -arrows- or onto the other surfaces.

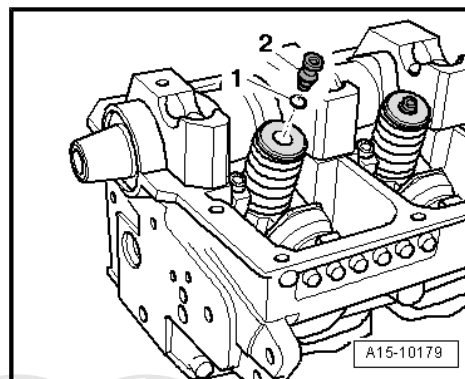


- Install bearing caps -1-, -3- and -5- and tighten.
- Bearing cap -5- must be flush with the outer edge of the cylinder head, otherwise the tandem pump may leak.
- Install camshaft oil seal ⇒ [page 147](#) .

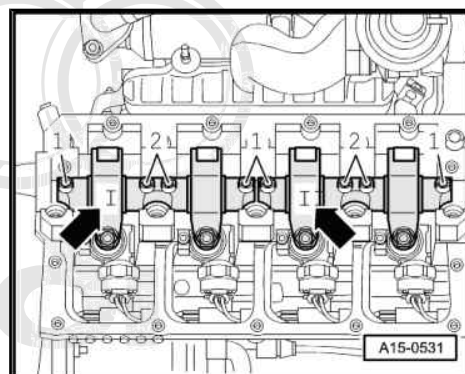


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- Before inserting rocker arm shaft, check that all ball studs -2- and O-rings -1- have been installed in unit injectors.

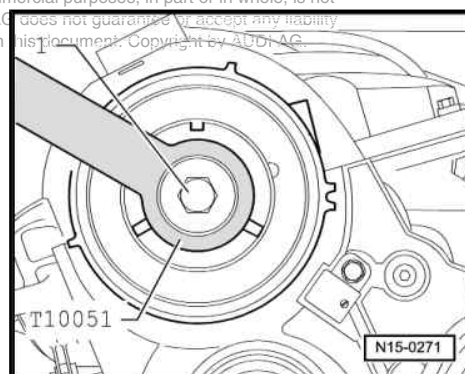


- Install rocker arm shafts. When doing so, note the markings made on removal -arrows-.
- First tighten inner bolts -2- and then outer bolts -1- in several stages.

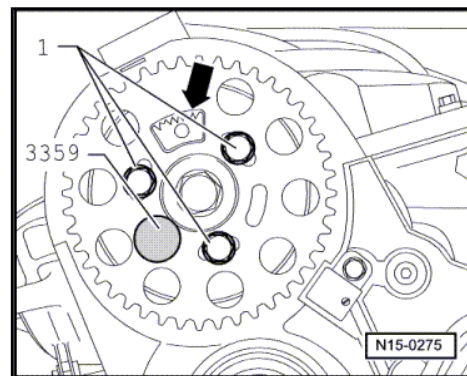


- Attach hub to camshaft.
- Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).

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- Push camshaft sprocket onto hub.
- Toothed segment -arrow- of camshaft sprocket must be at top.
- Screw in bolts -1- finger-tight.
- Lock hub with locking pin - 3359- .
- Install toothed belt (adjust valve timing) ⇒ [page 63](#) .
- Install tandem pump ⇒ Rep. gr. 20 .
- If the rocker arm shafts or ball studs and adjuster screws were renewed, the unit injectors must be adjusted ⇒ Rep. gr. 23 .
- Install cylinder head cover ⇒ [page 101](#) .



Note

- ◆ *After installing the camshaft, the engine must NOT be started for about 30 minutes. The hydraulic tappets have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

Tightening torques

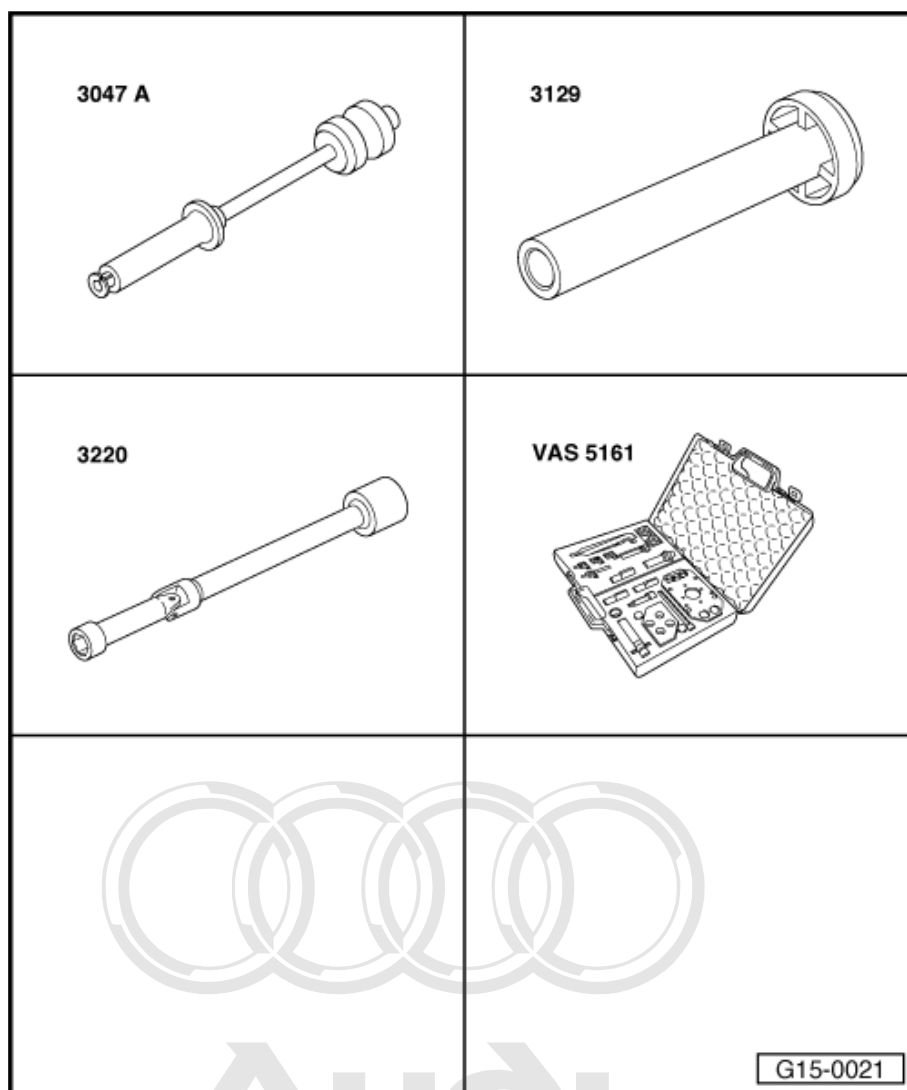
Component	Nm
Bearing cap to cylinder head	8 +90° 1)
Rocker arm shaft to cylinder head	20 +90° 1)
Hub to camshaft	100
• 1) Renew bolts.	

3.6 Renewing valve stem oil seals with cylinder head installed

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Special tools and workshop equipment required

- ◆ Puller - 3047 A-
- ◆ Fitting tool - 3129-
- ◆ U/J extension and socket, 10 mm - 3220-
- ◆ Removal and installation device - VAS 5161-



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Procedure

Metal glow plugs are installed on Audi A3 with 4-cyl. 1.9 ltr. 2V TDI engine.

Metal or ceramic glow plugs are installed on Audi A3 with 4-cyl. 2.0 ltr. 2V TDI engine.

Visible features of ceramic glow plugs

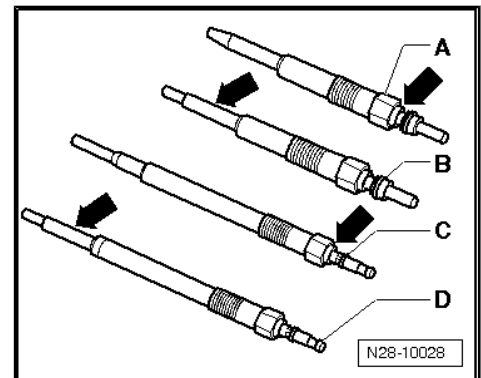
Vehicles with 2-valve cylinder head

- A- = metal glow plug with colour coding -arrow-
- B- = ceramic glow plug with supporting tube -arrow- (no colour coding)



Note

Glow plugs -C and D- can be disregarded.



Caution

Important: Always observe the special instructions for handling ceramic glow plugs.

Handling ceramic glow plugs:



Caution

- ◆ Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28.
- ◆ Use only the approved type of ceramic glow plugs ⇒ Electronic parts catalogue.
- ◆ Transport and store only in original packaging or packed separately in bubble wrap.
- ◆ Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.
- ◆ Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).
- ◆ Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.
- ◆ Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.
- ◆ If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).

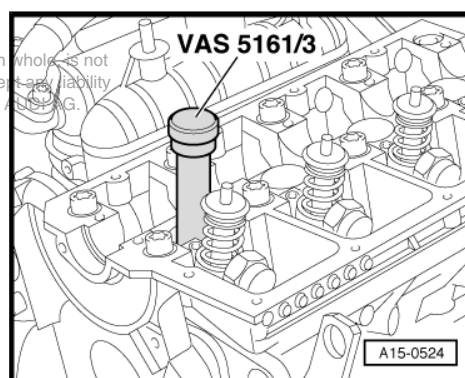
- Remove the camshaft ⇒ [page 148](#).
- Remove camshaft bearing shells from cylinder head.



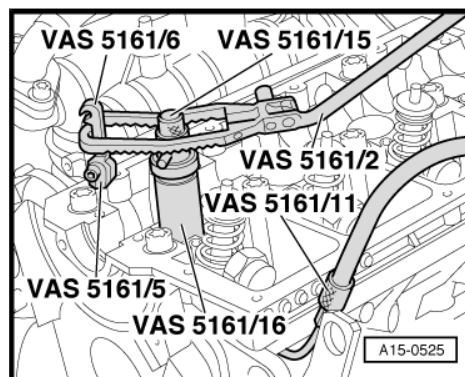
Note

- ◆ *Make sure that the used camshaft bearing shells are not interchanged (note marking).*
- ◆ *When installing the camshaft, make sure that the retaining lugs on the bearing shells are correctly seated in the bearing caps and the cylinder head.*
- ◆ *Make sure that the hydraulic bucket tappets are not interchanged; mark allocation on rear with a waterproof felt-tip pen.*

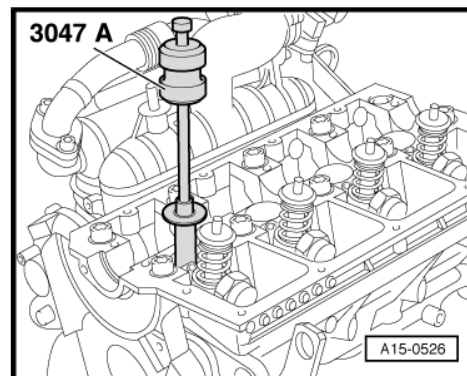
- Remove bucket tappets out of guides.
- Place bucket tappets down on a clean surface with contact surface facing downwards in the order in which they were removed.
- Insert punch - VAS 5161/3- into bucket tappet guide.
- Knock valve cotters loose on all valves using a plastic hammer.
- Remove all glow plugs ⇒ Rep. gr. 28 .
- Set piston of the respective cylinder to “bottom dead centre”.



- Screw adapter - VAS 5161/11- hand-tight into corresponding glow plug thread.
- Screw snap-in device - VAS 5161/6- with interlocking fork (M6) - VAS 5161/5- into threaded hole on cylinder head.
- Push guide bush - VAS 5161/16- as far as it will go into bucket tappet guide for valve to be removed.
- Installation position of guide bush: hatched areas are perpendicular to driving direction.
- Insert assembly cartridge - VAS 5161/15- into guide bush.
- Connect adapter - VAS 5161/11- to compressed air supply using a commercially available connection piece.
- Minimum pressure: 6 bar
- Attach pressure fork - VAS 5161/2- to snap-in device - VAS 5161/6- and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the cartridge.
- Release pressure fork.
- Remove assembly cartridge and guide bush.
- Remove valve spring plate and valve springs.

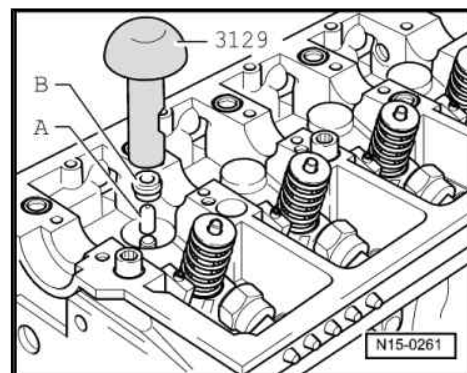


- Detach valve stem oil seals using puller - 3047 A- .

**Note**

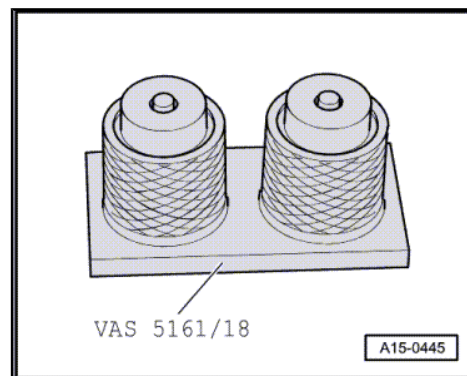
A plastic sleeve -A- is included with the new valve stem oil seals.

- Insert plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press valve stem oil seal down onto valve guide using fitting tool - 3129- .
- Remove plastic sleeve.
- If valve cotters have been removed from assembly cartridge, they need to be put into insertion device - VAS 5161/18- first.

**Note**

Larger diameter of valve cotters faces upwards.

- Press assembly cartridge - VAS 5161/15- onto insertion device from above and pick up valve cotters.
- Insert valve springs and valve spring plate.



Audi

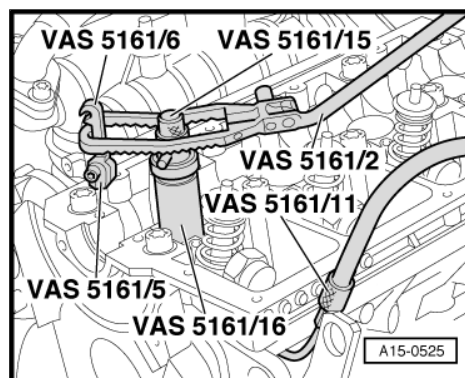
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- Reinstall the assembly cartridge - VAS 5161/15- into guide bush - VAS 5161/16- .
- Push pressure fork down and pull knurled screw upwards while turning to left and right - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Insert bucket tappets.
- Install camshaft ⇒ [page 148](#) .
- Install glow plugs ⇒ Rep. gr. 28 .



Note

- ◆ *After installing the camshaft, the engine must NOT be started for about 30 minutes. The hydraulic tappets have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

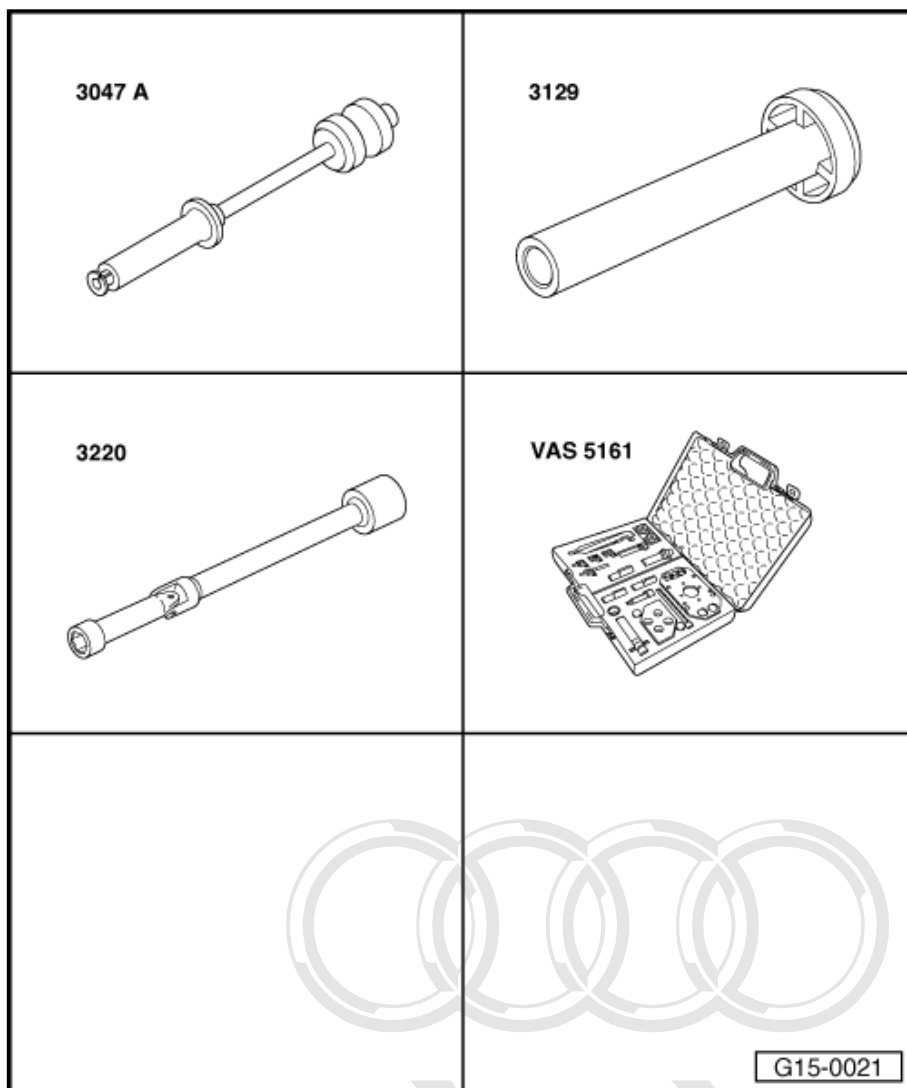
3.7 Renewing valve stem oil seals with cylinder head removed



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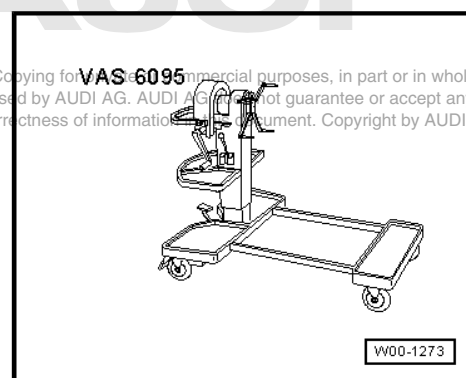
Special tools and workshop equipment required

- ◆ Puller - 3047 A-
- ◆ Fitting tool - 3129-
- ◆ U/J extension and socket, 10 mm - 3220-
- ◆ Removal and installation device for valve cotters - VAS 5161-



- ◆ Engine and gearbox support - VAS 6095-

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- ◆ Cylinder head tensioning device - VAS 6419-

Procedure

Metal glow plugs are installed on Audi A3 with 4-cyl. 1.9 ltr. 2V TDI engine.

Metal or ceramic glow plugs are installed on Audi A3 with 4-cyl. 2.0 ltr. 2V TDI engine.

Visible features of ceramic glow plugs

Vehicles with 2-valve cylinder head

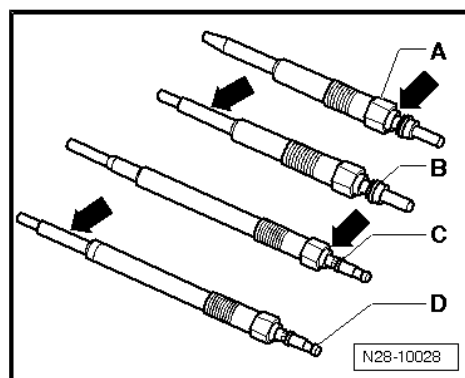
-A- = metal glow plug with colour coding -arrow-

-B- = ceramic glow plug with supporting tube -arrow- (no colour coding)



Note

Glow plugs -C and D- can be disregarded.



Caution

Important: Always observe the special instructions for handling ceramic glow plugs.

Handling ceramic glow plugs:



Caution

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- ◆ Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .
- ◆ Use only the approved type of ceramic glow plugs ⇒ Electronic parts catalogue .
- ◆ Transport and store only in original packaging or packed separately in bubble wrap.
- ◆ Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.
- ◆ Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).
- ◆ Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.
- ◆ Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.
- ◆ If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).

- Remove the camshaft ⇒ [page 148](#) .
- Remove camshaft bearing shells from cylinder head.

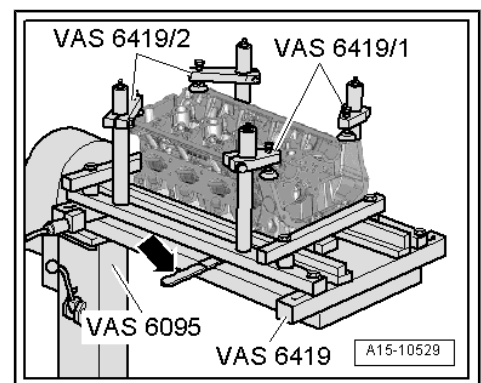
**Note**

- ◆ *Make sure that the used camshaft bearing shells are not interchanged (note marking).*
- ◆ *Make sure that the hydraulic bucket tappets are not interchanged; mark allocation on rear with a waterproof felt-tip pen.*

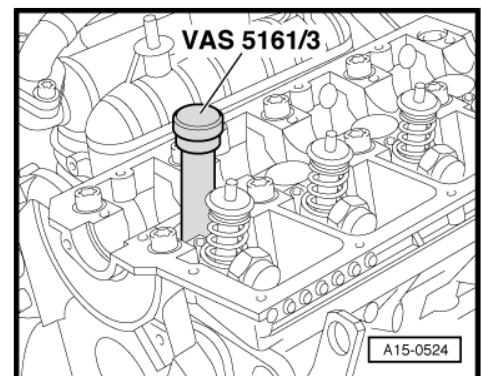
- Unscrew all glow plugs using U/J extension and socket, 10 mm - 3220- .
- Remove bucket tappets out of guides.
- Place bucket tappets down on a clean surface with contact surface facing downwards in the order in which they were removed.

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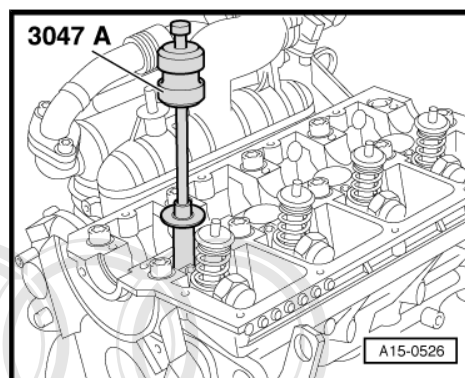
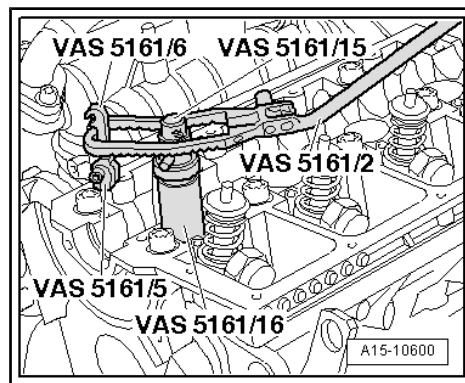
- Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensioning device, as illustrated.
- Connect cylinder head tensioning device to compressed air.
- Using lever -arrow-, slide air pad under combustion chamber where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



- Insert punch -VAS 5161/3- in bucket tappet guide.
- Knock valve cotters loose on all valves using a plastic hammer.



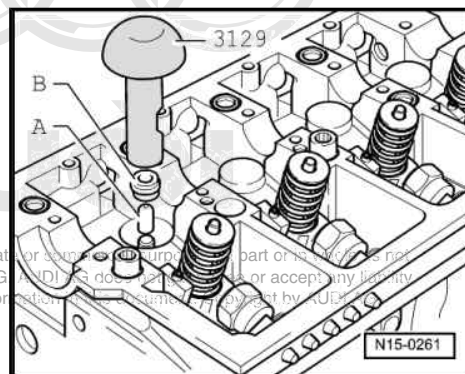
- Screw snap-in device -VAS 5161/6- with interlocking fork (M6) -VAS 5161/5- into threaded hole on cylinder head.
- Push guide bush -VAS 5161/16- as far as it will go into bucket tappet guide on valve to be removed.
- Installation position of guide bush: hatched areas are perpendicular to driving direction.
- Insert assembly cartridge -VAS 5161/15- into guide bush.
- Attach pressure fork -VAS 5161/2- to snap-in device -VAS 5161/6- and push assembly cartridge downwards.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the cartridge.
- Release pressure fork.
- Remove assembly cartridge and guide bush.
- Remove valve spring plate and valve springs.
- Detach valve stem oil seals using puller - 3047 A- .



Note

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

- Insert plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press valve stem oil seal down onto valve guide using fitting tool - 3129- .
- Remove plastic sleeve.



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

Note

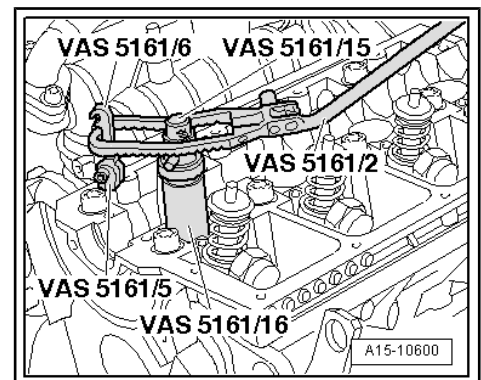
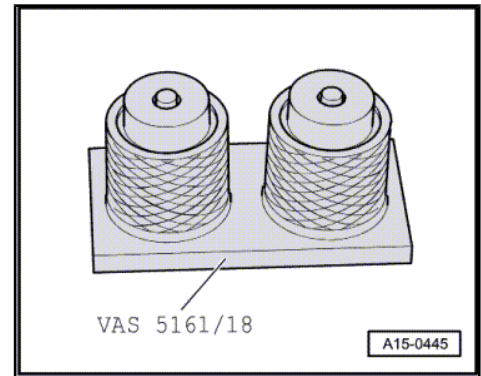
Larger diameter of valve cotters faces upwards.

- Press assembly cartridge -VAS 5161/15- onto insertion device from above and take up valve cotters.
- Insert valve springs and valve spring plate.
- Re-insert assembly cartridge in guide bush -VAS 5161/16-.
- Push pressure fork down and pull knurled screw upwards, while turning screw in both directions – this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Insert bucket tappets.
- Install camshaft ➔ [page 148](#).
- Install glow plugs ➔ Rep. gr. 28.



3.8 Checking hydraulic bucket tappets

Note

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

Special tools and workshop equipment required

- ◆ Feeler gauge
- ◆ Wooden/plastic wedge

Procedure

- Start engine and let it run until the radiator fan has switched on once.
- Increase engine speed to about 2500 rpm for approx. 2 minutes; perform test drive if necessary.

Note

If the irregular valve noise stops but repeatedly re-occurs when driving short distances, then the oil retention valve is defective. Fitting location: in oil filter bracket ➔ [Item 7 \(page 172\)](#). The oil retention valve cannot be renewed separately.

If the hydraulic tappets are still noisy, locate defective tappet as follows:

- Remove cylinder head cover ➔ [page 100](#).

- Turn crankshaft until cam of bucket tappet to be tested is at top:
- ◆ Vehicles with manual gearbox: push vehicle forwards with 4th gear engaged and ignition switched off.
- ◆ Vehicles with dual clutch gearbox: remove centre noise insulation and rotate crankshaft in clockwise direction via crankshaft sprocket central bolt.
- Determine clearance between cam and bucket tappet:
- Use wooden or plastic wedge to press down bucket tappet.

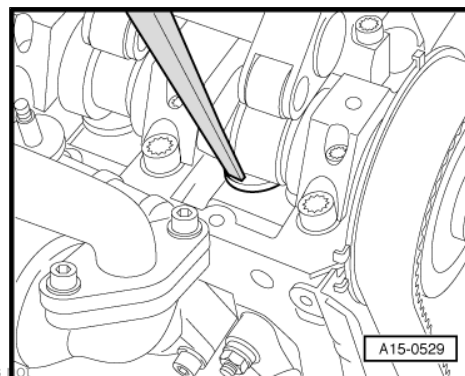
If it is possible to insert a feeler gauge of 0.20 mm between camshaft and bucket tappet:

- Renew hydraulic bucket tappet
⇒ ["3.5 Removing and installing camshaft", page 148](#).



Note

- ◆ *After installing the camshaft, the engine must NOT be started for about 30 minutes. The hydraulic tappets have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*



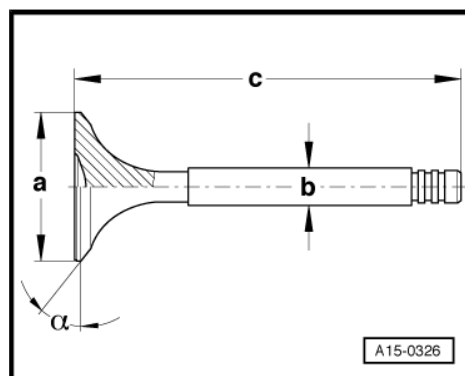
3.9 Valve dimensions

Dimension		Inlet valve	Exhaust valve
$\varnothing a$	mm	35.95	31.45
$\varnothing b$	mm	6.980	6.956
c	mm	89.95	89.95
α	°	45	45



Note

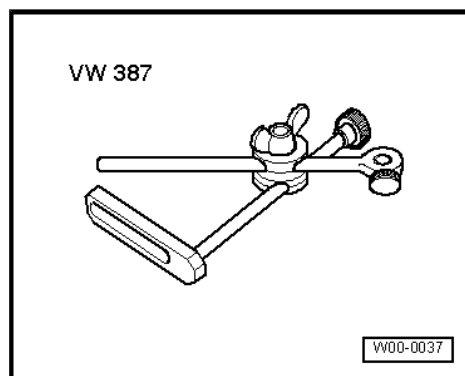
Valves must not be machined. Only grinding is permitted.



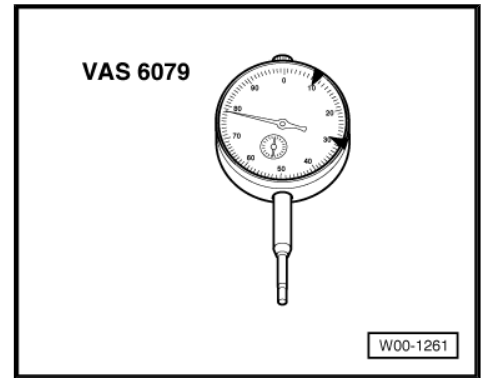
3.10 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



◆ Dial gauge - VAS 6079-

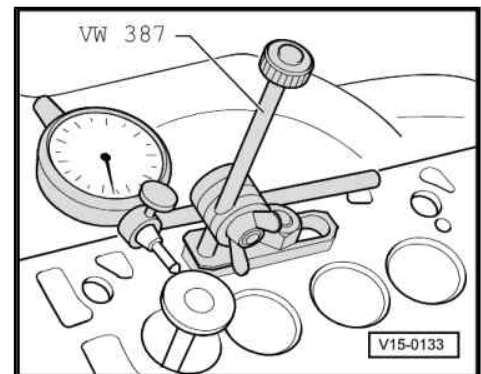


Procedure



Note

- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ◆ *Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.*
- Attach dial gauge - VAS 6079- with dial gauge bracket - VW 387- to cylinder head.
- Insert valve into valve guide.
 - End of valve stem must be flush with guide.
- Determine amount of sideways play.
 - Wear limit (sideways play): 1.3 mm.



Note

- ◆ *If the wear limit is exceeded, repeat the measurement with new valves. Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.*
- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*

3.11 Checking valves

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

If scoring is clearly visible:

- Renew the relevant valve.

17 – Lubrication

1 Lubrication system



Note

- ◆ If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the engine oil cooler must be renewed in order to prevent further damage occurring later.
- ◆ The oil level must not be above Max. mark on dipstick – danger of damage to catalytic converter.
- ◆ Oil spray jet and pressure relief valve ⇒ [page 92](#)
- ◆ Refer to ⇒ Maintenance tables for engine oil capacity, viscosity grades and oil specifications.

1.1 Sump, oil pump - exploded view

1 - Oil pump

- ☐ With pressure relief valve (12 bar)
- ☐ Removing and installing ⇒ [page 171](#)
- ☐ Before installing, check that the two dowel sleeves ⇒ [Item 9 \(page 167\)](#) for centring oil pump/cylinder block are fitted.
- ☐ Renew if running surfaces and gears are scored
- ☐ Tightening torque for oil pump cover to oil pump housing: 10 Nm

2 - Chain sprocket for oil pump

- ☐ Sprocket can only be fitted on oil pump shaft in one position.

3 - 20 Nm +90°

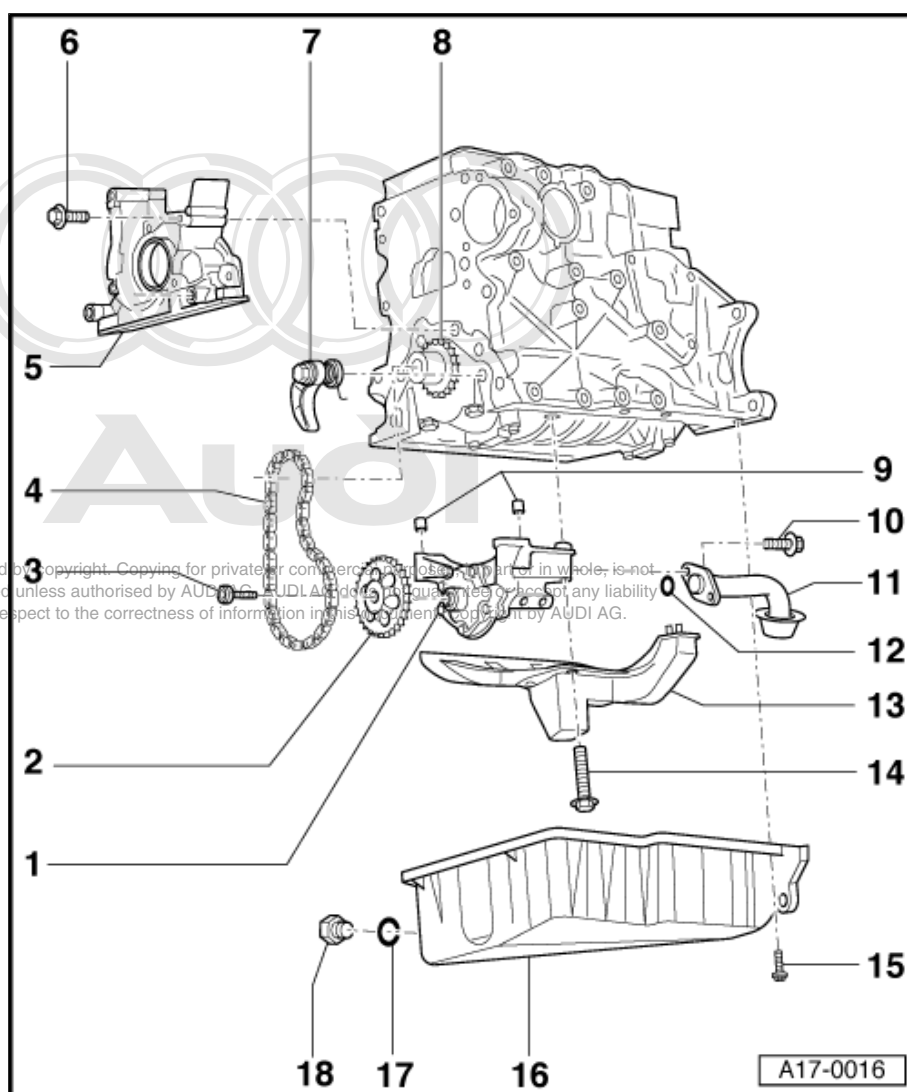
- ☐ Renew

4 - Drive chain for oil pump

- ☐ Mark direction of rotation before removing
- ☐ Check for wear

5 - Sealing flange (pulley end)

- ☐ Apply sealant prior to installing ⇒ [page 70](#)
- ☐ Renewing crankshaft oil seal ⇒ [page 68](#)



6 - 15 Nm**7 - Chain tensioner**

- ☐ Tighten to 16 Nm
- ☐ Do not dismantle
- ☐ Note installation position
- ☐ When installing, pre-tension spring and engage
- ☐ If the spring is broken, renew chain tensioner as complete unit

8 - Chain sprocket for oil pump

- ☐ Removing and installing ⇒ [page 86](#)

9 - Dowel sleeves

- ☐ 2x

10 - 15 Nm**11 - Suction pipe**

- ☐ Clean strainer if dirty

12 - O-ring

- ☐ Renew

13 - Baffle plate**14 - 16 Nm****15 - 15 Nm****16 - Sump**

- ☐ With oil level and oil temperature sender - G266-
- ☐ Removing and installing oil level and oil temperature sender - G266- ⇒ [page 168](#)
- ☐ Removing and installing sump ⇒ [page 168](#)

17 - Seal

- ☐ Renew

18 - Oil drain plug, 30 Nm

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

Removing

- Drain off engine oil ⇒ Maintenance ; Booklet 808 .
- Unplug electrical connector -3-.
- Remove bolts -1- and detach oil level and oil temperature sender - G266- -item 4-.

Installing

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



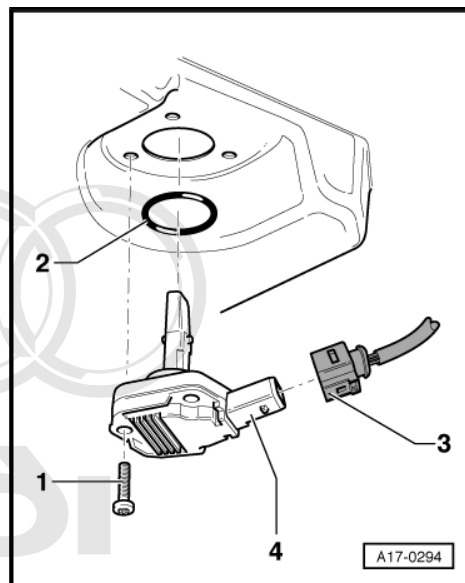
Note

Renew seal -2- and self-locking bolts -1-.

- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 808 .

Tightening torque

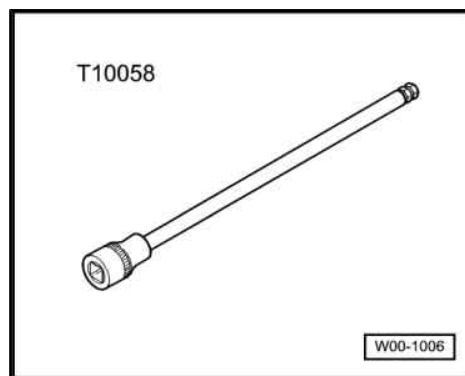
Component	Nm
Oil level and oil temperature sender - G266- to sump	10 ¹⁾
• ¹⁾ Renew bolts.	



1.3 Removing and installing sump

Special tools and workshop equipment required

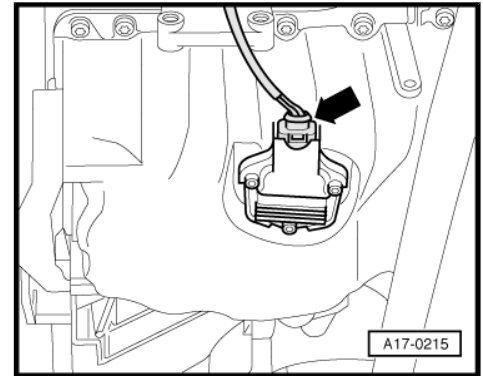
- ◆ Allen key, long reach - T10058-



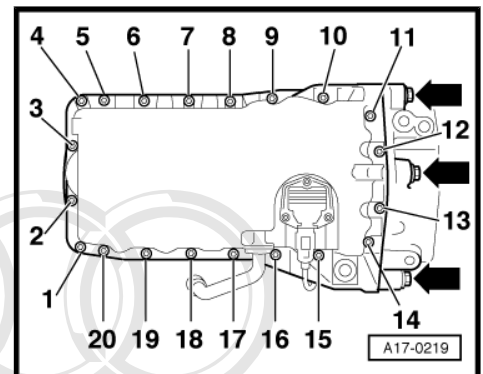
- ◆ Electric drill with plastic brush attachment
- ◆ Sealant ⇒ Electronic parts catalogue
- ◆ Safety goggles

Removing

- Drain off engine oil ⇒ Maintenance ; Booklet 808 .
- Unplug electrical connector at oil level and oil temperature sender - G266- -arrow-.



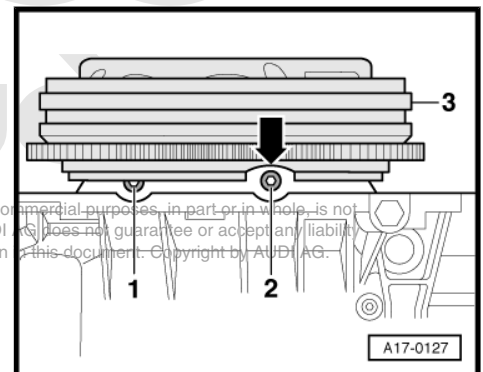
- Unscrew sump/gearbox bolts -arrows-.
- Slacken bolts -1 ... 20- in diagonal sequence.



Note

- ♦ *The two rear sump bolts -1- and -2- are accessible via the recess -arrow- on the dual-mass flywheel -3- (turn the flywheel as required).*
- ♦ *The bolts can be unscrewed using Allen key (long reach) -T10058- .*

- Carefully release sump from bonded joint.



Installing

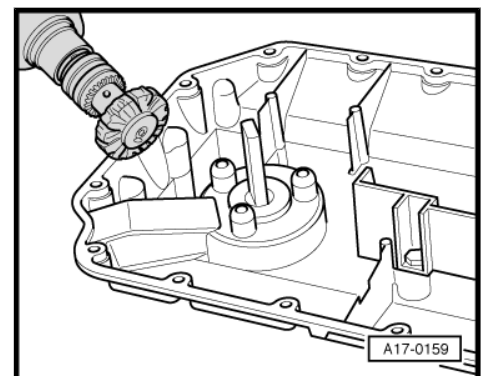
Installation is carried out in the reverse order; note the following:



WARNING

Wear safety goggles.

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

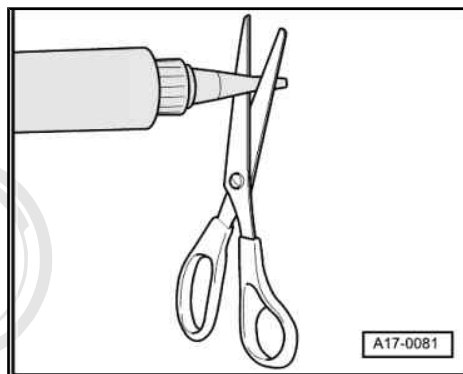




Note

Note the use-by date of the sealant.

- Cut off tube nozzle at front marking (diameter of nozzle approx. 3 mm).



- Apply bead of sealant onto clean sealing surface of sump as shown in illustration.

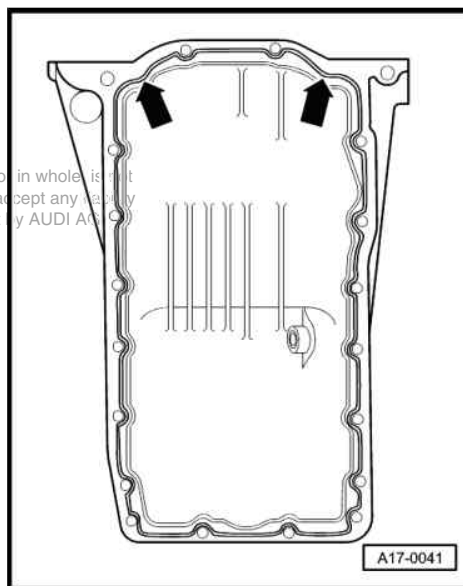
- Thickness of sealant bead: 2 ... 3 mm



Note

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- ♦ *Sealant bead must not be wider than 3 mm, otherwise excess sealant could ingress into sump and clog strainer in oil intake pipe.*
- ♦ *Take particular care when applying sealant bead in area of rear sealing flange -arrows-.*
- ♦ *The sump must be installed within 5 minutes after applying sealant.*



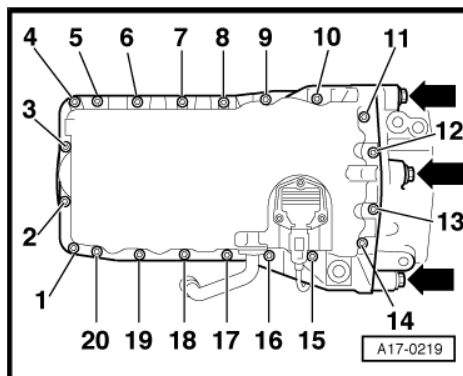
- Immediately install sump and tighten bolts in the following sequence:

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-.
3. Tighten bolts -1 ... 20- in diagonal sequence.



Note

- ♦ *When installing sump with engine removed from vehicle, ensure that sump is positioned flush with cylinder block at fly-wheel end.*
- ♦ *After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.*



- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 808 .

Tightening torques

Component		Nm
Sump to:	Cylinder block	15
	Gearbox	40
Oil drain plug		30

1.4 Removing and installing oil pump

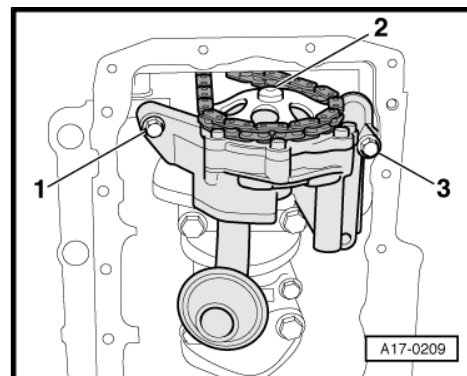
Removing

- Remove sump and baffle plate ⇒ [page 168](#) .
- Remove bolt -2-.
- Pull chain sprocket off oil pump shaft.
- Unscrew bolts -1- and -3- and remove oil pump.

Installing

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

- Insert dowel sleeves ⇒ [Item 9 \(page 167\)](#) at top of oil pump.
- Chain sprocket can only be fitted in one position on oil pump shaft.
- Install sump ⇒ [page 169](#) .



Tightening torques

Component	Nm
Chain sprocket to oil pump shaft	20 +90° 1)
Oil pump to cylinder block	16
• 1) Renew bolt.	

1.5 Oil filter bracket and engine oil cooler - exploded view

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1 - Screw plug, 25 Nm

2 - Seal

- ☐
- Renew

3 - Engine oil cooler

- ❑ Illustration shows version for 2.0 ltr. engine
- ❑ See note ⇒ [page 166](#)
- ❑ Diagram of coolant hose connections
⇒ [page 180](#)

4 - Seal

- ❑ Renew
- ❑ Installation position
⇒ **page 173**

5 - 14 Nm +90°

- ☐ Renew
- ☐ Tighten in diagonal sequence

6 - Gasket

-

7 - Oil filter bracket

- ☐ With oil retention valve
- ☐ The oil retention valve cannot be renewed separately

8 - Seal

-

9 - Oil pressure switch - F1-

- ☐ 0.7 bar - brown
- ☐ Checking ⇒ page 177
- ☐ Tighten to 20 Nm

10 - Sealing cap, 25 Nm

11 - O-ring

- ☐
- Renew

12 - Oil filter element

- 📄 Removing and installing ⇒ Maintenance ; Booklet 808

13 - O-ring

-

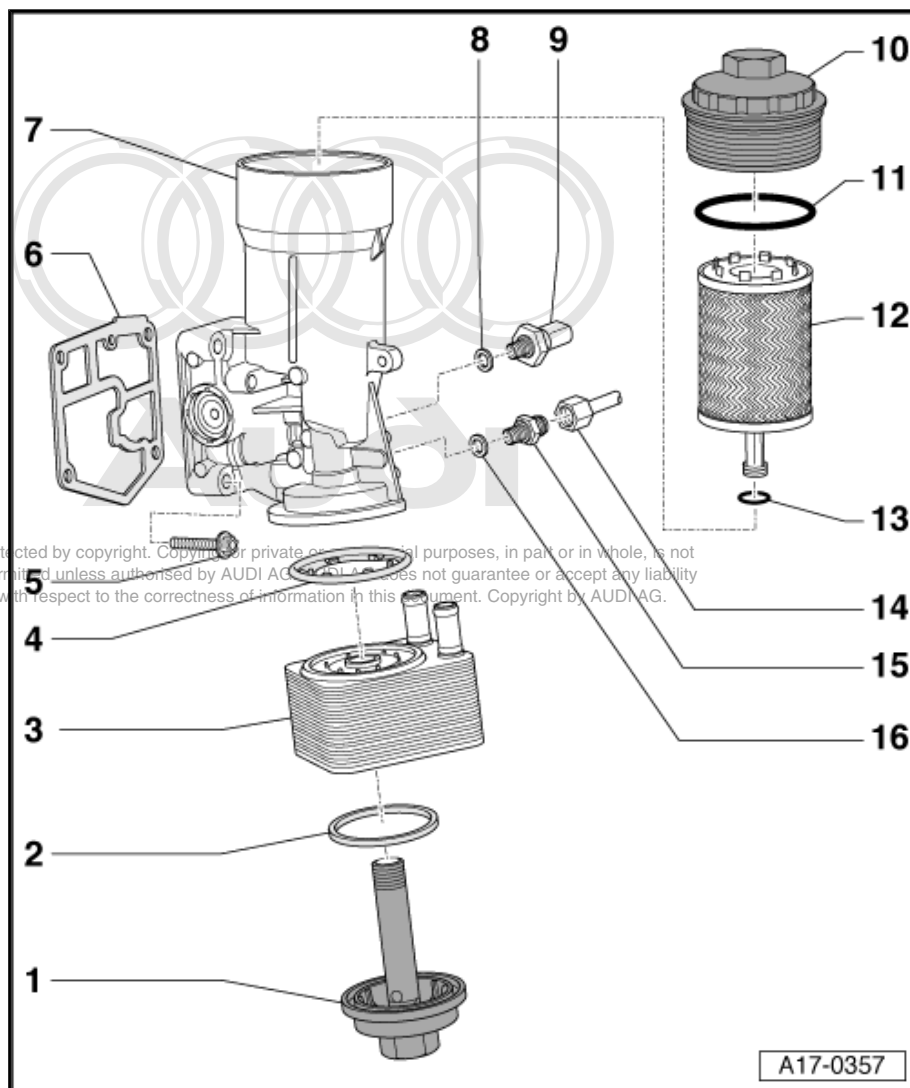
14 - Oil supply line

- ☐ To turbocharger
- ☐ Tighten to 22 Nm

15 - Connection

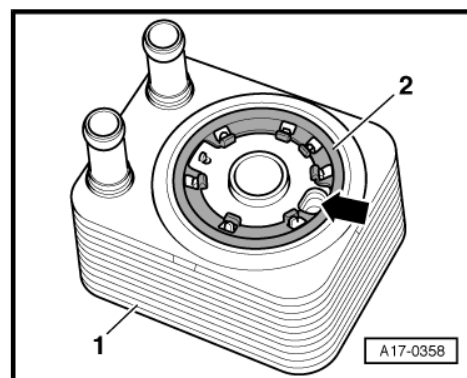
16 - Seal

-



Installation position of seal for engine oil cooler

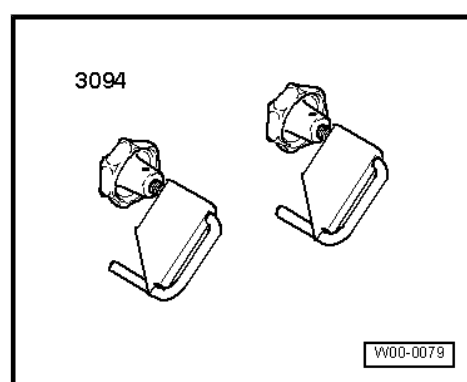
- Insert the seal -2- so that it can be attached to all tabs on the engine oil cooler -1-.
- The oil drilling -arrow- must not be covered by the seal.



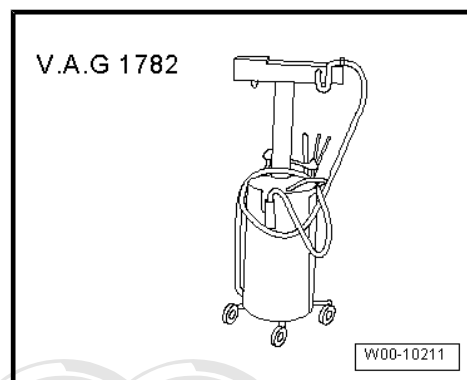
1.6 Removing and installing oil filter bracket with engine oil cooler

Special tools and workshop equipment required

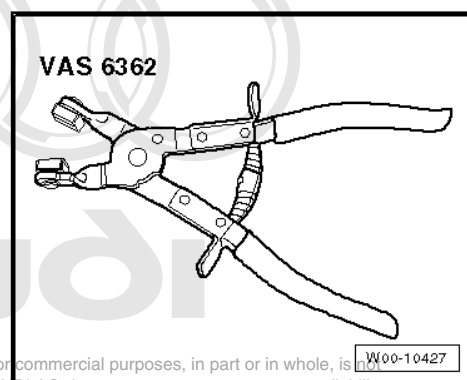
- ◆ Hose clamps for hoses up to 25 mm - 3094-



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

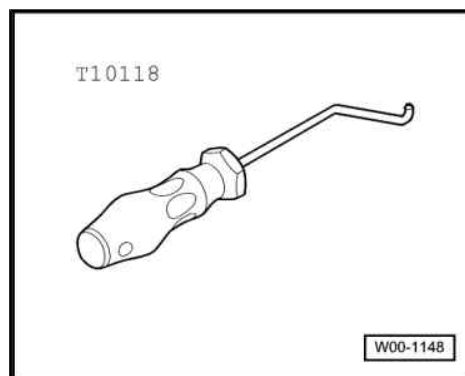


- ◆ Hose clip pliers - VAS 6362-



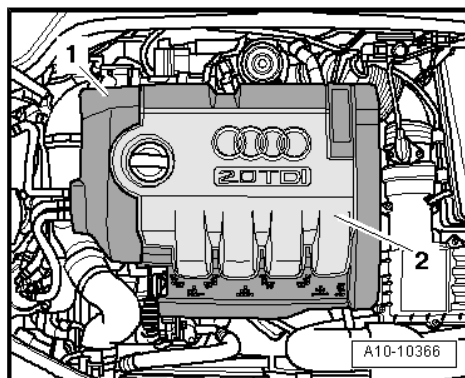
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- ◆ Assembly tool - T10118-

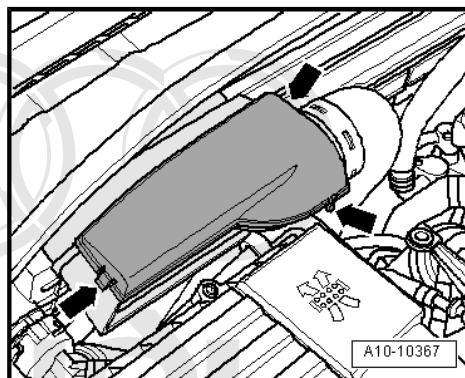


Removing

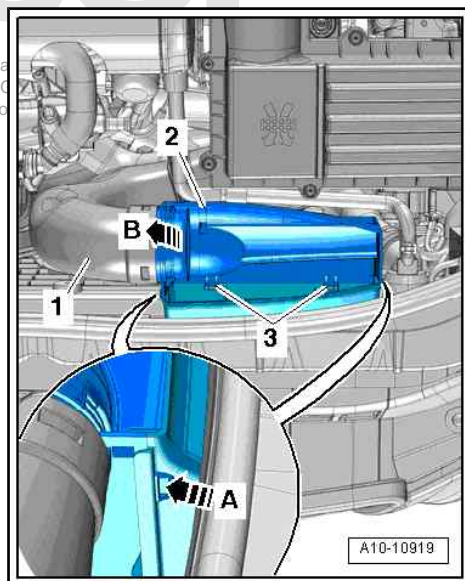
- Drain off coolant ⇒ [page 182](#) .
- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



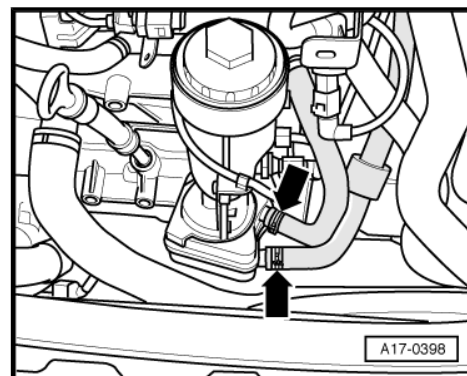
- Pull cover off air duct (release clips on sides) -arrows-.



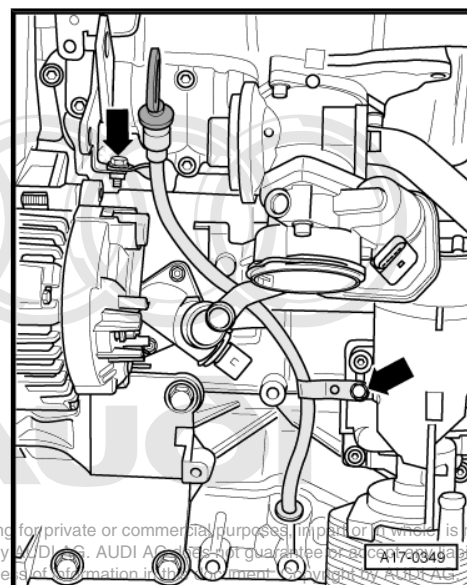
- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.



- Clamp off coolant hoses at engine oil cooler with hose clamps - 3094- and detach -arrows-.



- Remove bolts -arrows-.
- Pull the guide tube for oil dipstick upwards out of cylinder block.



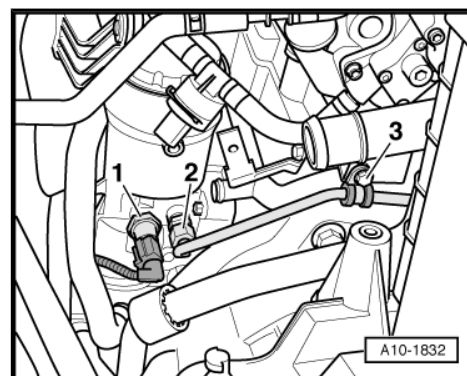
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- Unplug electrical connector at oil pressure switch - F1- .
- Place used oil collection and extraction unit - V.A.G 1782- under engine.
- Unscrew oil pressure switch -1-.
- Detach oil supply line going to turbocharger at oil filter bracket -2-.

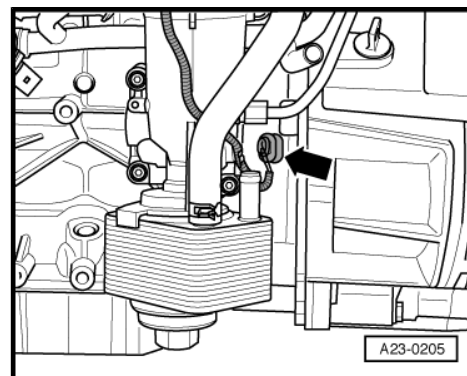


Note

Disregard -item 3-.



- Unplug electrical connector -arrow- at engine speed sender - G28- .
- Move wiring at wiring bracket clear.



- Remove bolts -arrows-.
- Remove oil filter bracket.

Installing

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

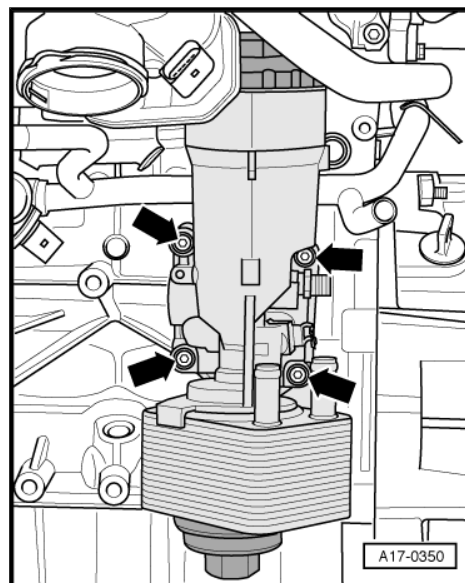


Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Fill up cooling system (or change coolant if the engine oil cooler has been renewed) ⇒ [page 183](#) .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 808 .

Tightening torques

Component	Nm
Oil filter bracket to cylinder block	14 +90° ¹⁾
Guide tube for oil dipstick to:	
Oil filter bracket	10
Lifting eye	10
Oil supply line to oil filter bracket	22
Retaining clip for oil supply line	10
Oil pressure switch to oil filter bracket	20
• ¹⁾ Renew bolts.	

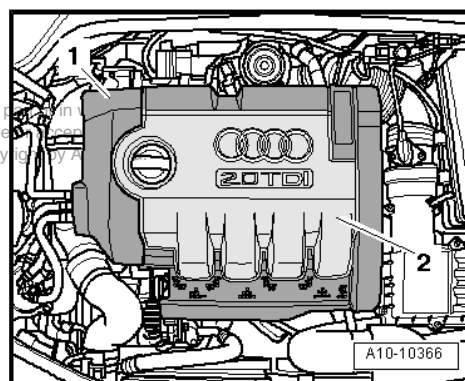


1.7 Removing and installing oil pressure switch - F1-

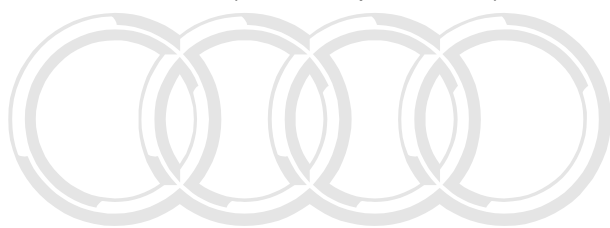
Removing

- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.

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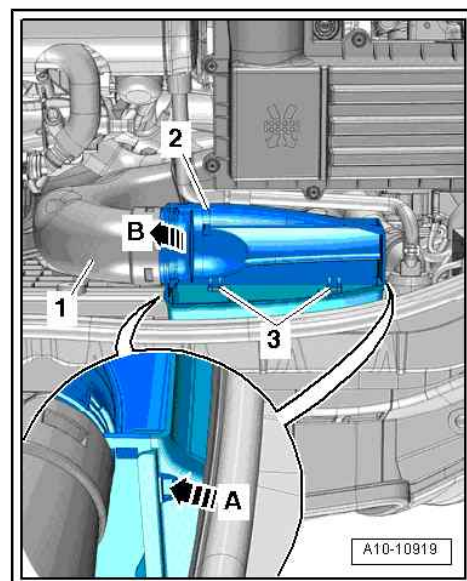
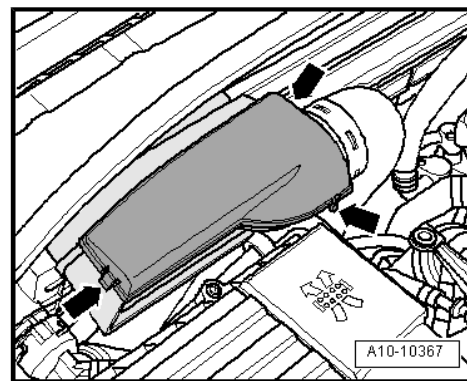


- Pull cover off air duct (release clips on sides) -arrows-.



- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.

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Note

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

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

Installing

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



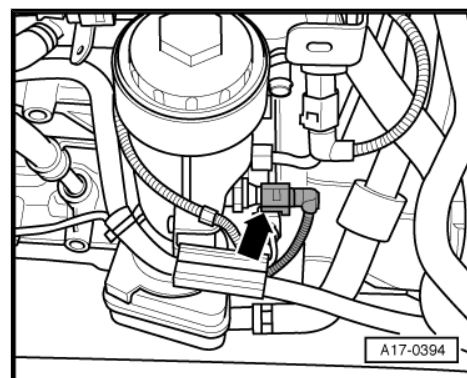
Note

Renew seal.

- Check oil level ⇒ Maintenance ; Booklet 808 .

Tightening torque

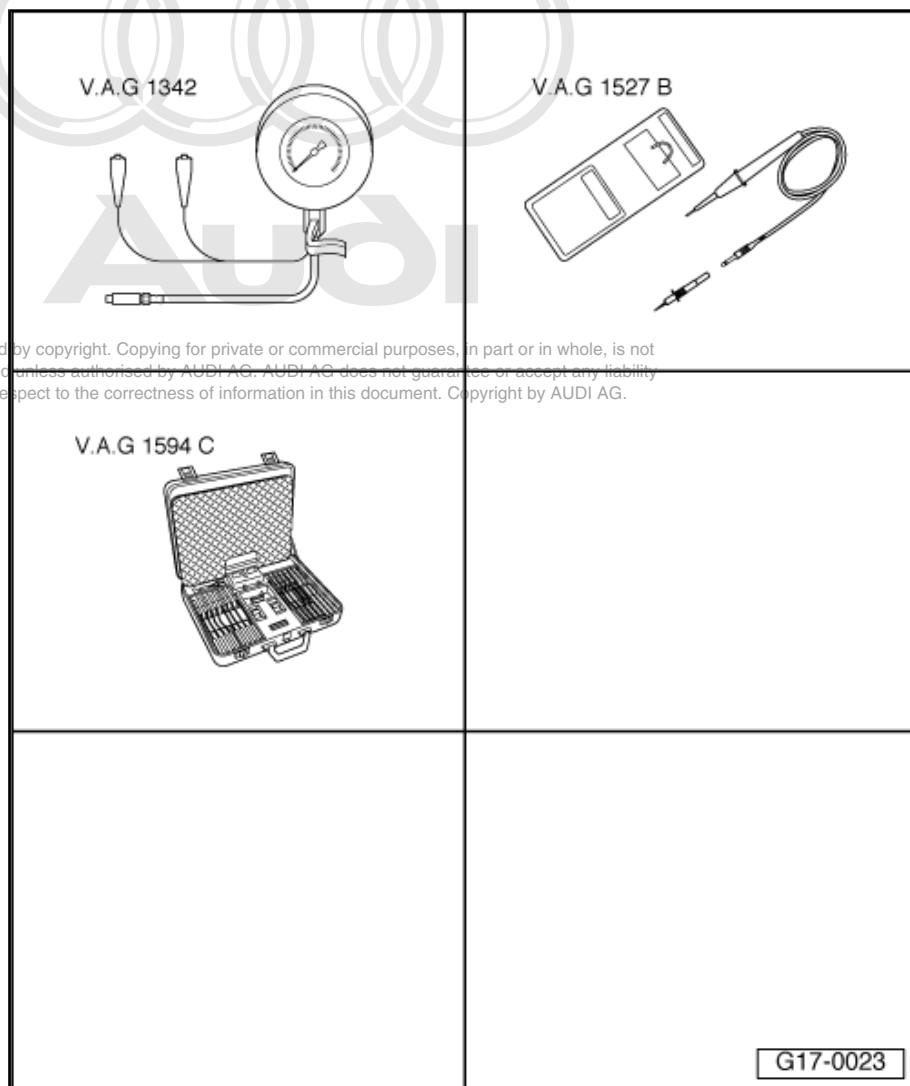
Component	Nm
Oil pressure switch to oil filter bracket	20



1.8 Checking oil pressure and oil pressure switch

Special tools and workshop equipment required

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



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Test conditions

- Oil level OK
- Engine oil temperature approx. 80 °C

Preparation for test

- Remove oil pressure switch ⇒ [page 176](#) .

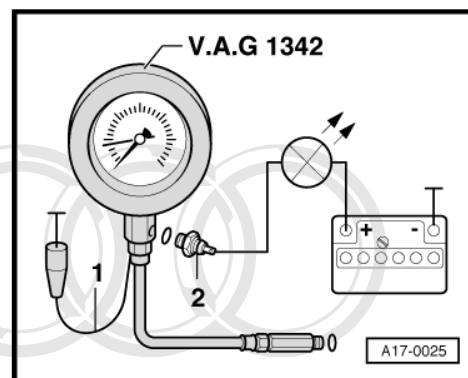
- Connect oil pressure tester - V.A.G 1342- to threaded hole for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester - V.A.G 1342- .

Checking oil pressure switch

- Connect brown wire -1- of oil pressure tester - V.A.G 1342- to earth (-).
- Connect voltage tester - V.A.G 1527 B- with test lead from auxiliary measuring set - V.A.G 1594 C- to oil pressure switch and battery positive (+).
- LED should not light up.

If LED lights up now:

- Renew oil pressure switch.
- Start engine.



Note

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

- LED should light up at 0.55 ... 0.85 bar.

If LED does not light up:

- Renew oil pressure switch.

Checking oil pressure

- Start engine.
- Minimum oil pressure at idling speed: 0.8 bar
- Minimum oil pressure at 2000 rpm: 2.0 bar

Assembling

- Install oil pressure switch ⇒ [page 176](#) .

1.9 Engine oil

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

1.10 Checking oil level

Check oil level ⇒ Maintenance ; Booklet 808 .

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19 – Cooling

1 Cooling system



WARNING

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



Note

- ◆ *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) → Electronic parts catalogue .*
- ◆ *Renew gaskets and seals.*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*

1.1 Diagram of coolant hose connections

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1 - Radiator

- ☐ Removing and installing
⇒ [page 197](#)
- ☐ If renewed, refill system
with fresh coolant

2 - Engine oil cooler

- ☐ Removing and installing
⇒ ["1.6 Removing and installing oil filter bracket with engine oil cooler"](#),
[page 173](#)
- ☐ If renewed, refill system
with fresh coolant

3 - Thermostat

- ☐ Removing and installing
⇒ [page 187](#)
- ☐ Checking ⇒ [page 189](#)

4 - Coolant pump

- ☐ Removing and installing
⇒ [page 187](#)

5 - Cylinder head/cylinder block

- ☐ If renewed, refill system
with fresh coolant

6 - Coolant expansion tank

- ☐ With filler cap
- ☐ Checking pressure relief valve in filler cap
⇒ [page 207](#)

7 - Exhaust gas recirculation cooler

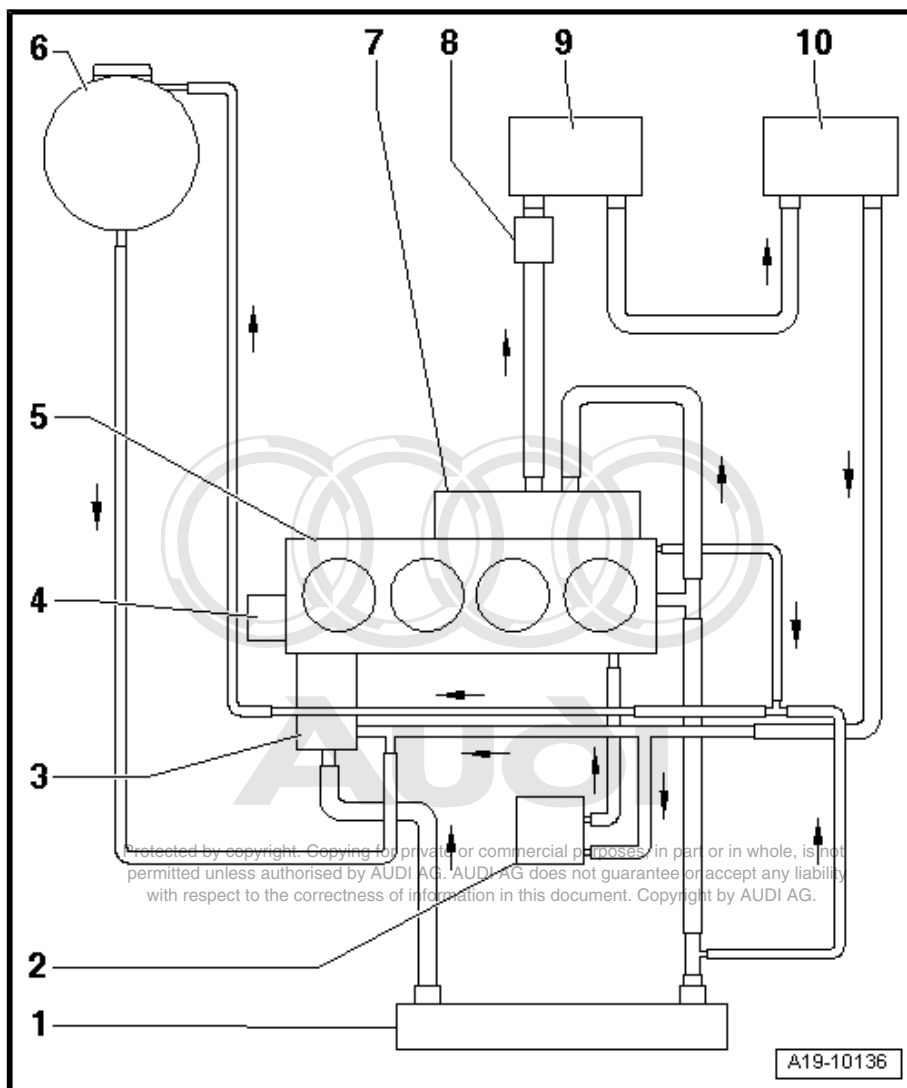
- ☐ Removing and installing
⇒ [page 248](#)
- ☐ If renewed, refill system with fresh coolant

8 - Circulation pump - V55-

- ☐ For auxiliary heater

9 - Auxiliary heater**10 - Heat exchanger for heater**

- ☐ If renewed, refill system with fresh coolant

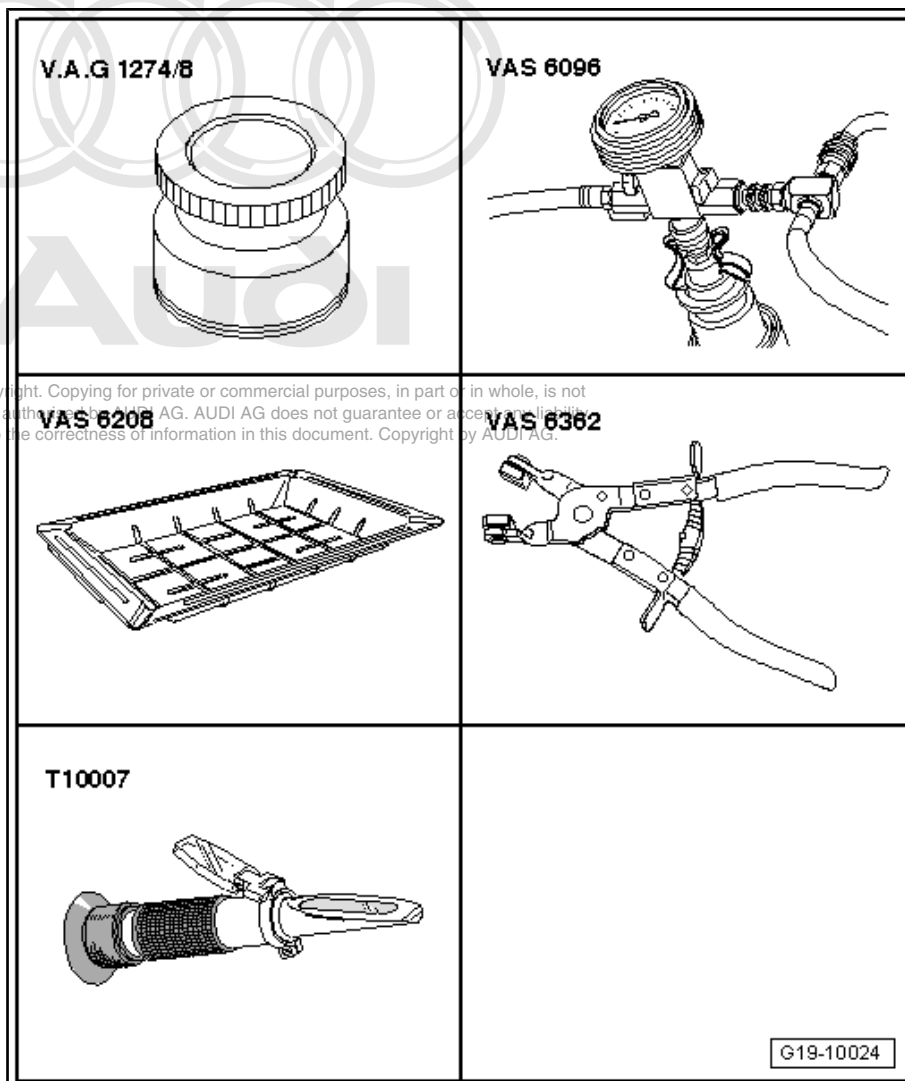


1.2 Draining and filling cooling system

Special tools and workshop equipment required

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

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Draining

- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



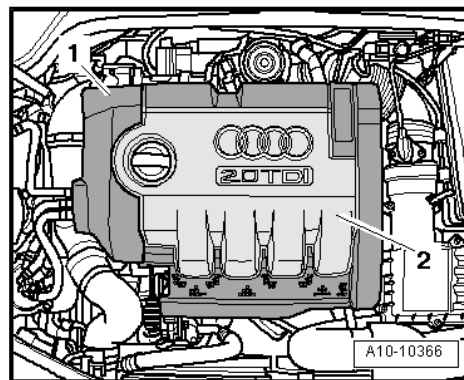
Note

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



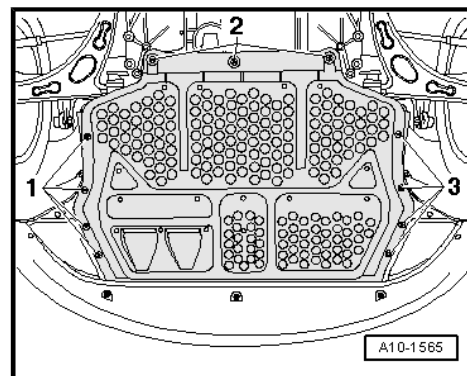
WARNING

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

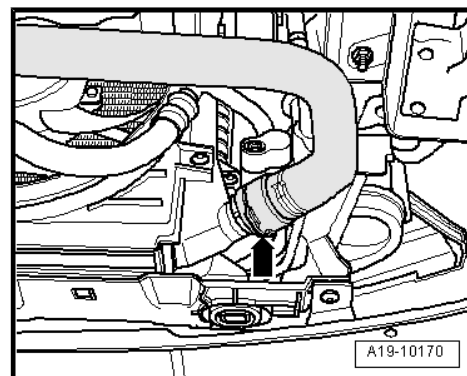


- Open filler cap on coolant expansion tank.

- Remove centre noise insulation -fasteners 1 ... 3-.

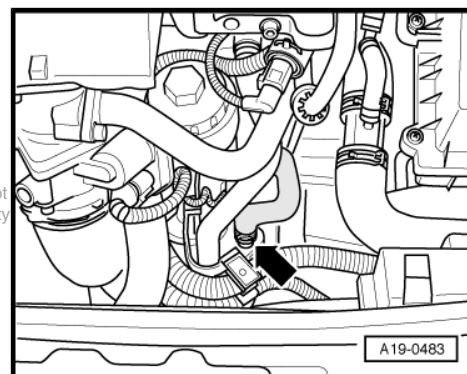


- Place drip tray for workshop hoist - VAS 6208- under engine.
- Lift retaining clip -arrow- and disconnect coolant hose from radiator.



- Disconnect coolant hose at bottom of engine oil cooler -arrow- and drain off remaining coolant.

Filling



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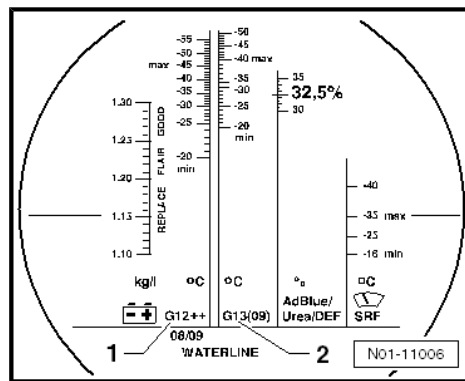
Note

- ◆ 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, Audi has decided to specify the water quality for cooling systems. Distilled water meets all the requirements. It is therefore recommended to use distilled water when topping up or filling up with coolant (also applies to all older models).
- ◆ Use only coolant additives listed in the ⇒ *Electronic parts catalogue*. 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 ⇒ [page 184](#) 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.
- ◆ Frost protection is required down to about -25 °C (in countries with arctic climate: down to about -36 °C).
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze concentration must be at least 40 %.
- ◆ If greater frost protection is required in very cold climates, the amount of antifreeze can be increased, but only up to 60 %, as otherwise frost protection decreases again, and the cooling efficiency is also impaired.
- ◆ For checking anti-freeze protection in cooling system with coolant generation G13, refractometer - T10007 A- MUST be used.
- ◆ Read off the level of frost protection on the scale for the relevant coolant additive.
- ◆ Do not reuse coolant.
- ◆ Secure all hose connections with correct type of hose clips (as *original equipment*) ⇒ *Electronic parts catalogue*

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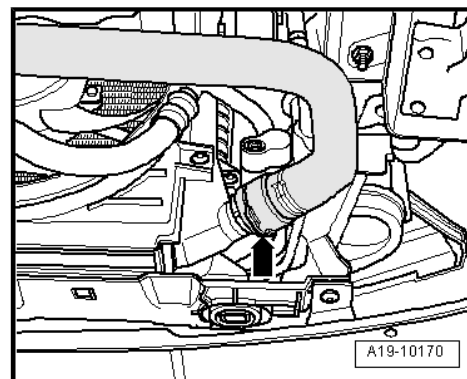
Recommended mixture ratio for coolant

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

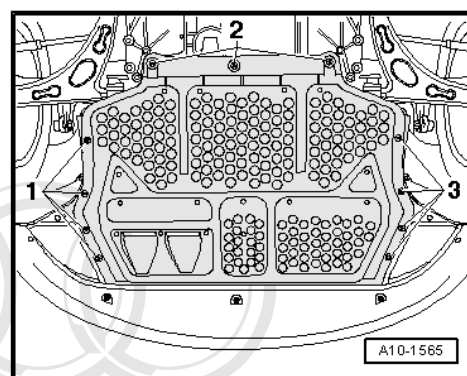


Procedure:

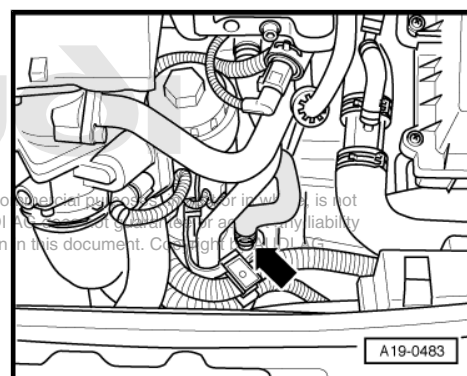
- Connect coolant hose -arrow- to radiator ⇒ [page 197](#) .



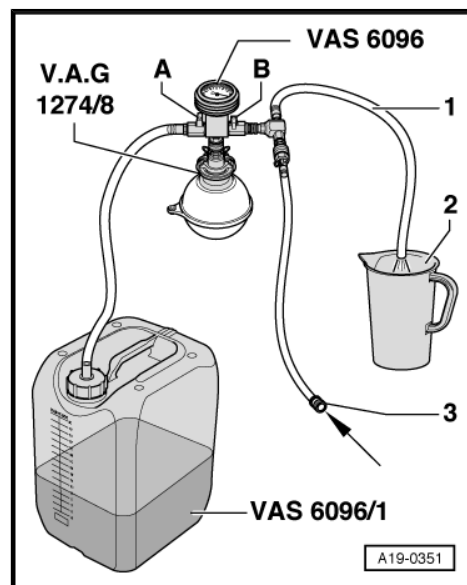
- Install centre noise insulation -fasteners 1 ... 3-.



- Attach coolant hose (bottom) at engine oil cooler -arrow-.



- Fill replacement reservoir for cooling system charge unit - VAS 6096/1- with at least 8 litres of premixed coolant (according to recommended ratio):
- Screw adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- onto adapter - V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
- Close the two valves -A- and -B- by setting lever at right angle to direction of flow.
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



- Open valve -B- by setting lever in direction of flow.

The suction jet pump generates a partial vacuum in the cooling system.

- The needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir - VAS 6096/1- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

If the needle does not reach the green zone, repeat the process.

If the vacuum level drops, there is a leak in the cooling system.

- Detach compressed air hose.
- Open valve -A-.

The partial vacuum in the cooling system causes the coolant to be drawn up out of the reservoir - VAS 6096/1- ; the cooling system is then filled.

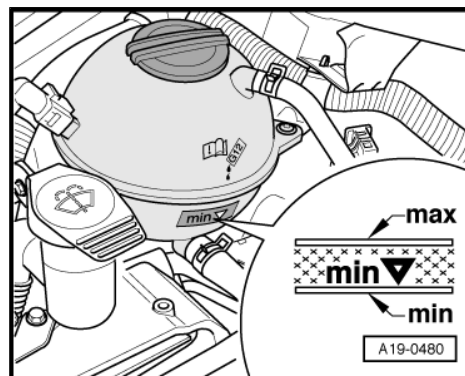
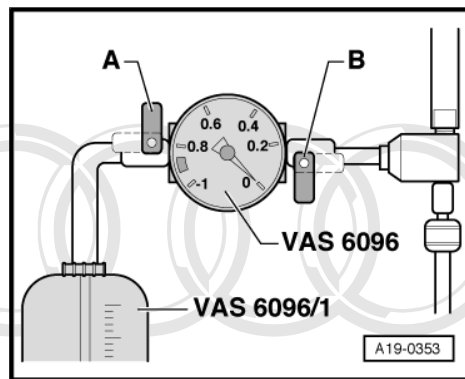
- Detach cooling system charge unit - VAS 6096- from expansion tank.
- Check the coolant level and top up coolant as far as the MAX mark.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) ⇒ Owner's Manual .
- Start engine, run for 2 minutes (maximum) at approx. 2000 rpm and top up coolant to overflow hole on expansion tank with engine running.
- Tighten filler cap on expansion tank.
- Run engine until radiator fan cuts in.



WARNING

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

- Check coolant level and top up if necessary.
- When the engine is at normal operating temperature, coolant level must be at MAX mark, when engine is cold it must be between MIN and MAX marks.
- Switch engine off.



1.3 Removing and installing coolant pump

Removing

- Drain off coolant ⇒ [page 182](#) .
- Remove toothed belt ⇒ [page 57](#) .
- Unscrew bolts -1- for coolant pump and remove coolant pump -2-.
- Remove O-ring -3-.

Installing

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



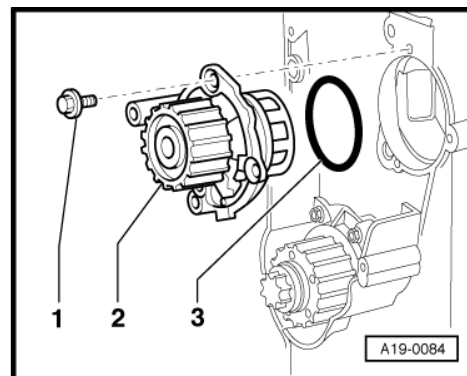
Note

Renew O-ring.

- Clean and smoothen sealing surface for O-ring as required.
- Lubricate new O-ring -3- with coolant.
- Fit coolant pump -2-.
- Installation position: Sealing plug in housing faces downwards.
- Tighten bolts -1- for coolant pump.
- Install toothed belt (adjust valve timing) ⇒ [page 63](#) .
- Fill cooling system ⇒ [page 183](#) .

Tightening torque

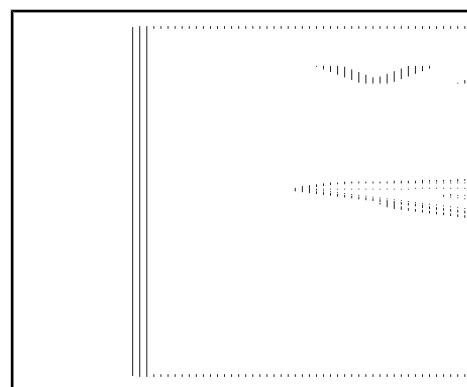
Component	Nm
Coolant pump to cylinder block	15



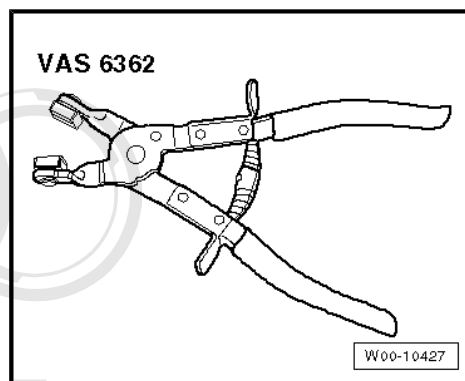
1.4 Removing and installing thermostat

Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-

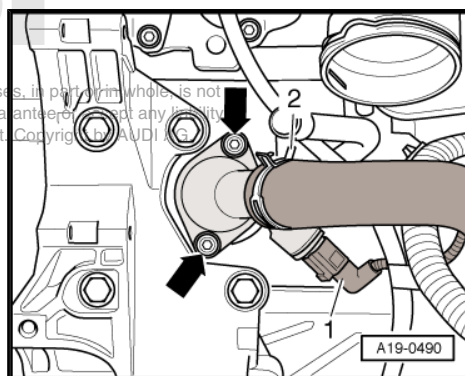


- ◆ Hose clip pliers - VAS 6362-



Removing

- Drain off coolant ⇒ [page 182](#).
- Detach coolant hose -2- from hose connection.
- Unplug electrical connector -1- at radiator outlet coolant temperature sender - G83-.
- Unscrew bolts -arrows- and remove hose connection.
- Turn thermostat clockwise through approx. 90°.
- Take thermostat out of hose connection.
- Remove O-ring.



Installing

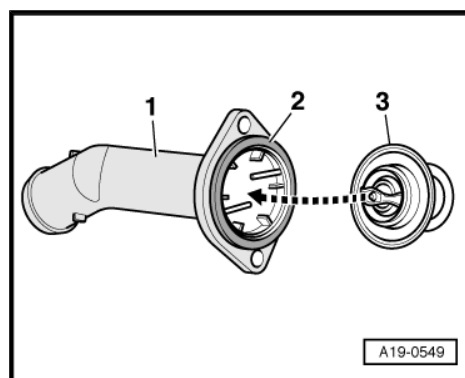
Installation is carried out in the reverse order; note the following:



Note

Renew O-ring.

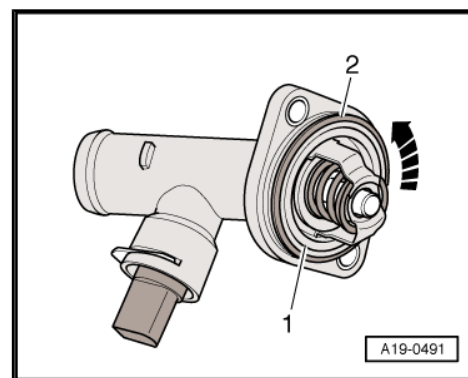
- Clean and smoothen sealing surface for O-ring as required.
- Insert thermostat -3- with new O-ring -2- into hose connection -1-.
- When inserting, the cross-piece on the thermostat should be horizontal as shown in the illustration.



- Lubricate O-ring -2- with coolant.
- Turn thermostat anti-clockwise -arrow- through approx. 90°.
- Fill cooling system ⇒ [page 183](#) .

Tightening torque

Component	Nm
Connection to cylinder block	15

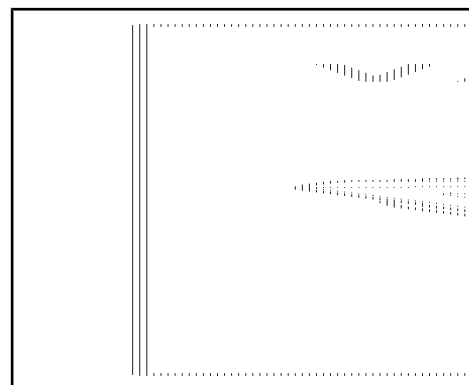
**1.5 Checking thermostat**

- Heat removed thermostat in water bath.

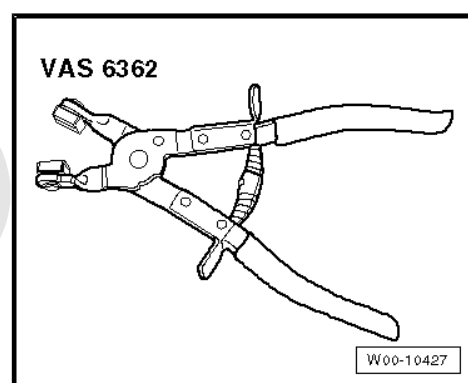
Starts to open	Fully open	Opening travel
approx. 87 °C	approx. 102 °C ¹⁾	at least 8 mm
• ¹⁾ Cannot be tested.		

1.6 Removing and installing coolant pipe**Special tools and workshop equipment required**

- ◆ Drip tray for workshop hoist - VAS 6208-



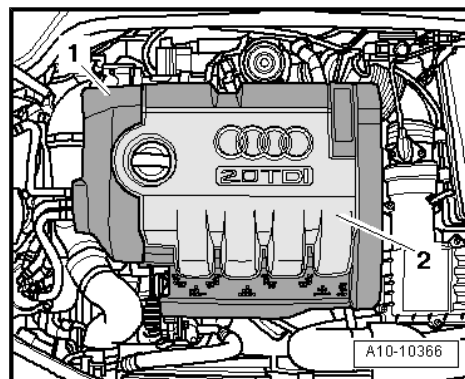
- ◆ Hose clip pliers - VAS 6362-



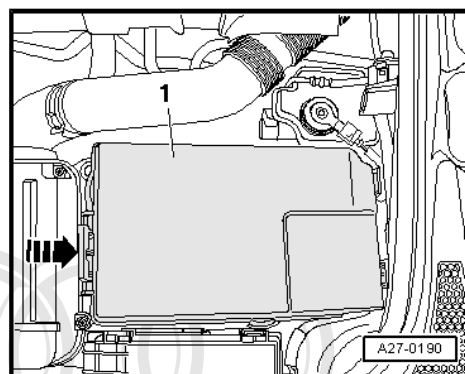
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Removing

- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



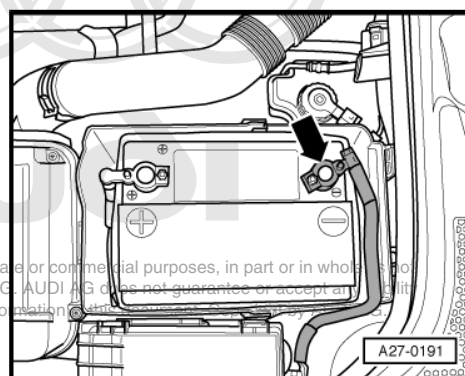
- Remove cover -1- over battery; to do so, press release tab -arrow-.



Caution

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

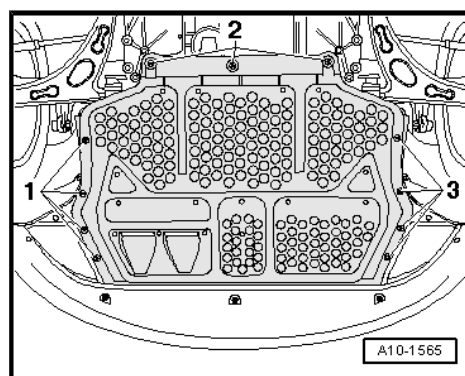
- With ignition switched off, disconnect battery earth cable -arrow-.



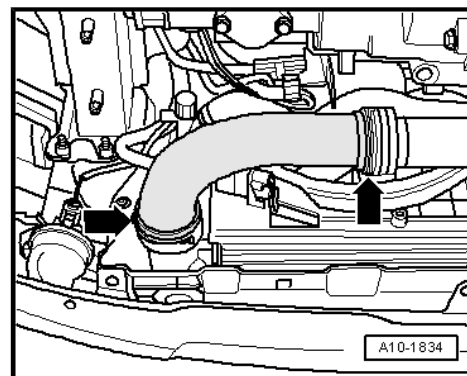
WARNING

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

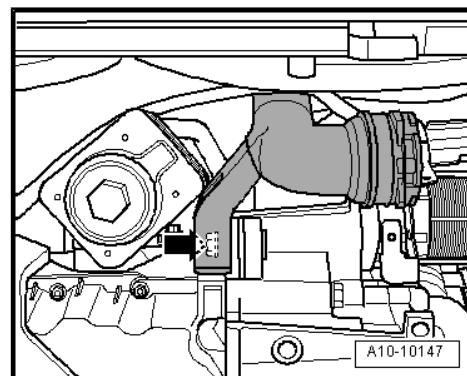
- Open filler cap on coolant expansion tank.
- Remove front right wheel.
- Remove centre noise insulation -fasteners 1 ... 3-.



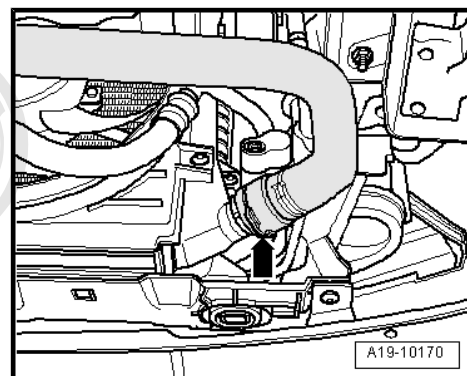
- Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.



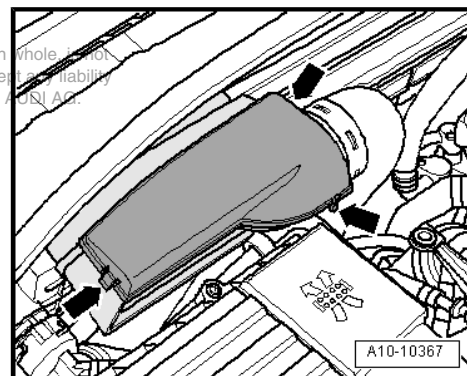
- Remove bolt -arrow- for air intake pipe (left-side).



- Place drip tray for workshop hoist - VAS 6208- under engine.
- Lift retaining clip -arrow- and disconnect coolant hose from radiator.

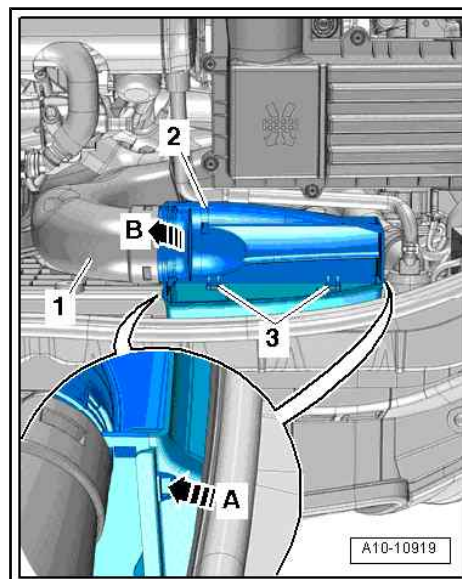


- Pull cover off air duct (release clips on sides) -arrows-.

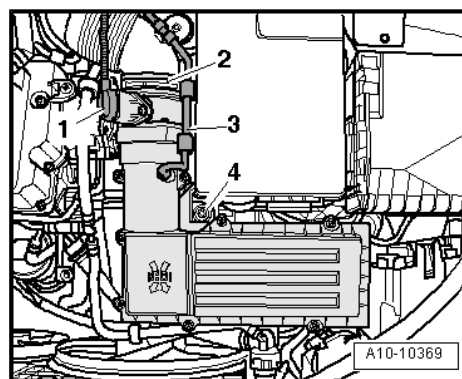


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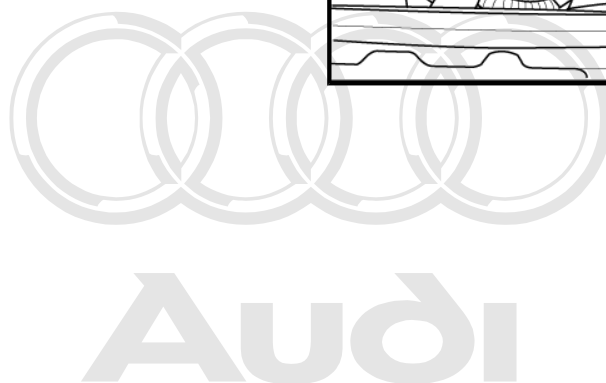
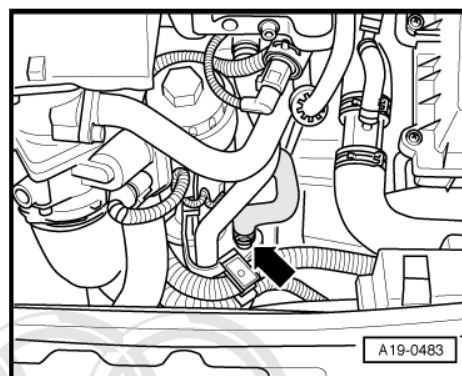
- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.



- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.

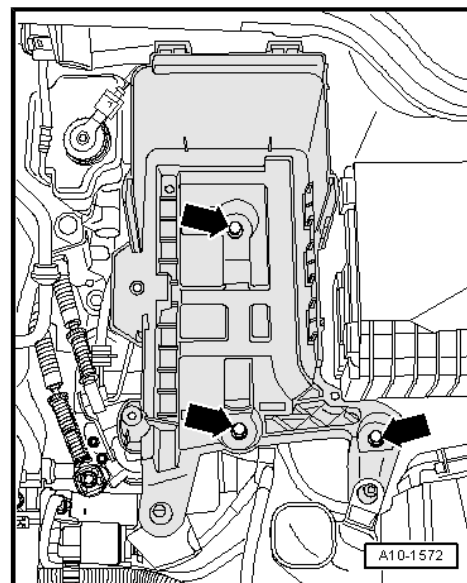


- Place drip tray for workshop hoist - VAS 6208- under engine.
- Disconnect coolant hose at bottom of engine oil cooler -arrow- and drain off coolant.

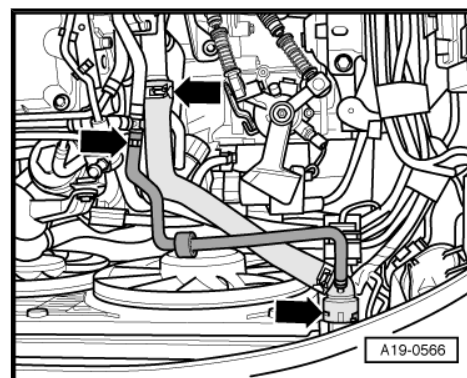


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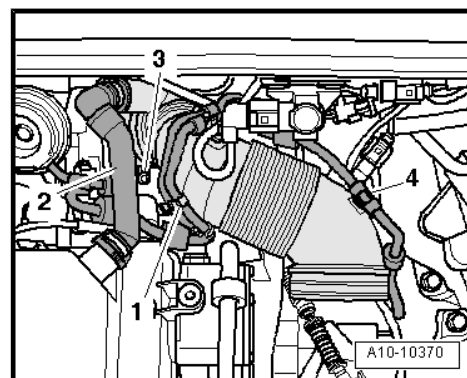
- Remove battery ⇒ Rep. gr. 27 .
- Remove battery tray -arrows-.



- Remove coolant hose between engine and radiator -arrows-.



- Detach crankcase breather hose -2-.
- Move vent hose -4- and vacuum hoses -1- clear at air intake hose.
- Remove bolt -3-.
- Swing air hose to rear and detach from turbocharger.

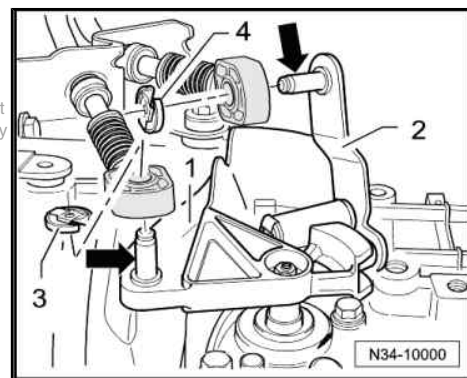


Vehicles with manual gearbox:

- Detach securing clip -3- for gear selector cable from gearbox selector lever -1- and pull cable off pin -arrow-.

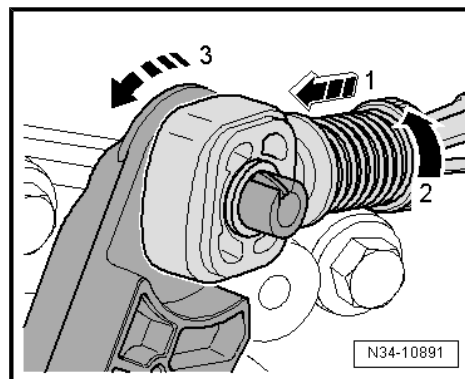
Metal relay lever.

- Detach securing clip -4- for gate selector cable from relay lever -2- and pull cable off pin -arrow-.



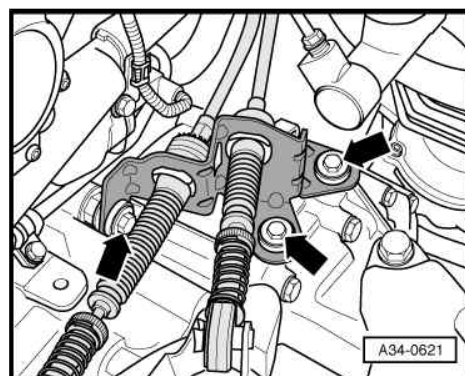
Plastic relay lever:

- To prevent damage to gate selector cable, cable end-piece must be detached from gate selector cable before removing.
- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press gate relay lever towards front -arrow 3-.



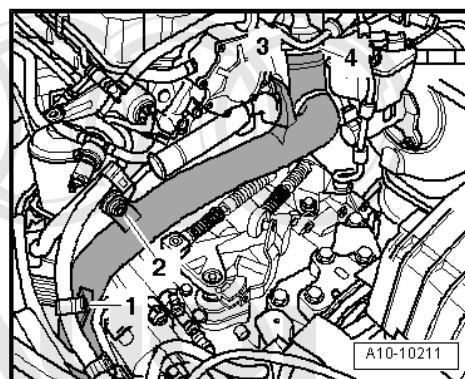
Vehicles with manual gearbox (continued):

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



All vehicles (continued):

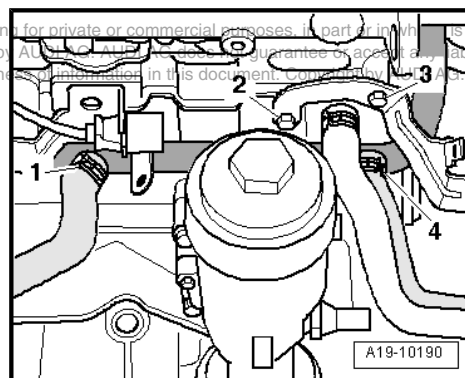
- Remove bolts -arrows-.
- Detach air pipe (left-side) from turbocharger by lifting retaining clips -arrows- slightly.
- Remove air pipe from engine compartment downwards.



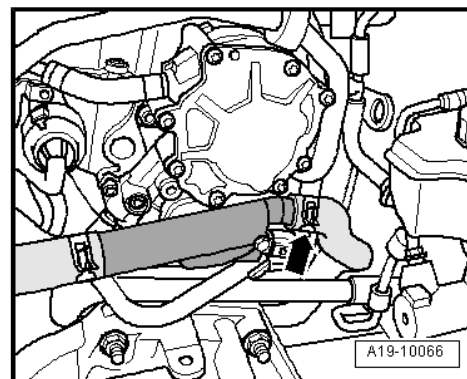
- Set aside wiring harness in vicinity of coolant pipe.

- Remove bolts -2- and -3-.

- Detach coolant hoses -1- and -4-.



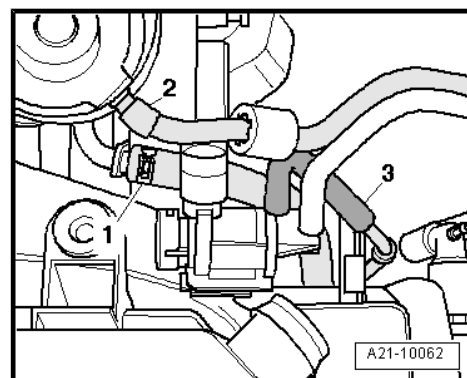
- Detach coolant hose -arrow- at coolant hose/pipe connection.



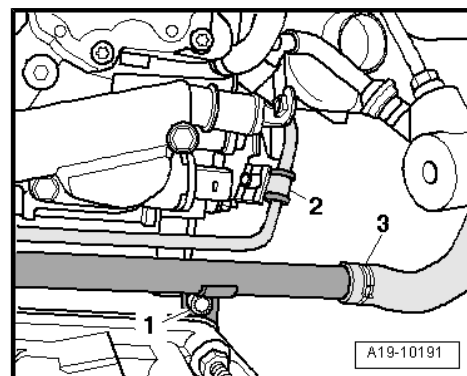
- Detach oil supply hose -1- from turbocharger.

**Note**

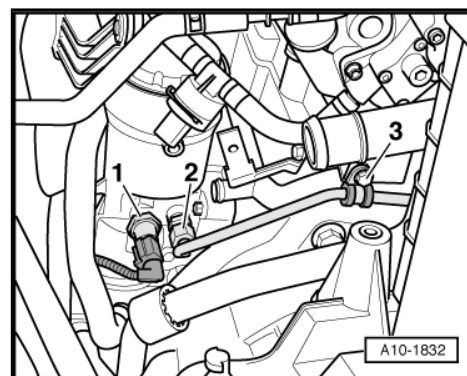
Disregard items -2- and -3-.



- Remove bolt -1- for coolant pipe.
- Disconnect coolant hose -3-.
- Detach oil supply line at bracket -2-.



- Unplug electrical connector at oil pressure switch - F1- .
- Unscrew oil pressure switch -1-.
- Detach oil supply line going to turbocharger at retaining clip -3- and at oil filter bracket -2-.
- Detach oil supply line.
- Detach coolant pipe.

**Installing**

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

**Note**

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Clean and smoothen contact surface for seal.

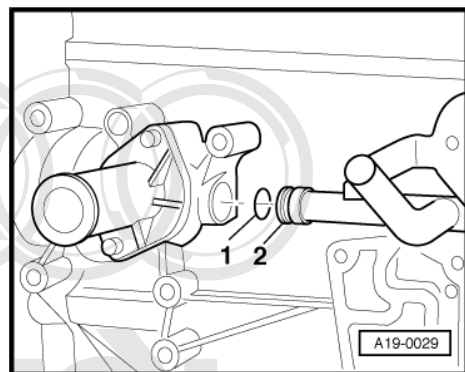
- Lubricate new seal -1- with coolant additive and push onto coolant pipe -2-.
- Push coolant pipe into bore on cylinder block.

Vehicles with manual gearbox

- Attach and adjust selector mechanism at gearbox ⇒ Rep. gr. 34 .

All vehicles (continued):

- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Install battery ⇒ Rep. gr. 27 .
- Connect coolant hose to radiator ⇒ [page 197](#) .
- Fill cooling system ⇒ [page 183](#) .



Tightening torques

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Component		Nm
Coolant pipe to cylinder block	M7	15
	M10	40
Oil supply line to oil filter flange		22
Retaining clip for oil supply line to:	Coolant pipe	10
	Bracket	10
Bracket for wiring harness		15
Air duct (left-side) to bracket		8
Air cleaner housing to bracket		10

1.7 Radiator and radiator fans - exploded view

1 - Radiator fan - V7-

- ☐ With radiator fan control unit - J293-
- ☐ Removing and installing ⇒ [page 202](#)

2 - 10 Nm**3 - Radiator cowl****4 - Coolant hose (top)**

- ☐ To connection at cylinder head
- ☐ Lift retaining clip to detach
- ☐ Connecting to radiator ⇒ [page 197](#)

5 - O-ring

- ☐ Renew if damaged

6 - Radiator

- ☐ Removing and installing ⇒ [page 197](#)
- ☐ If renewed, change coolant in entire system

7 - 5 Nm**8 - O-ring**

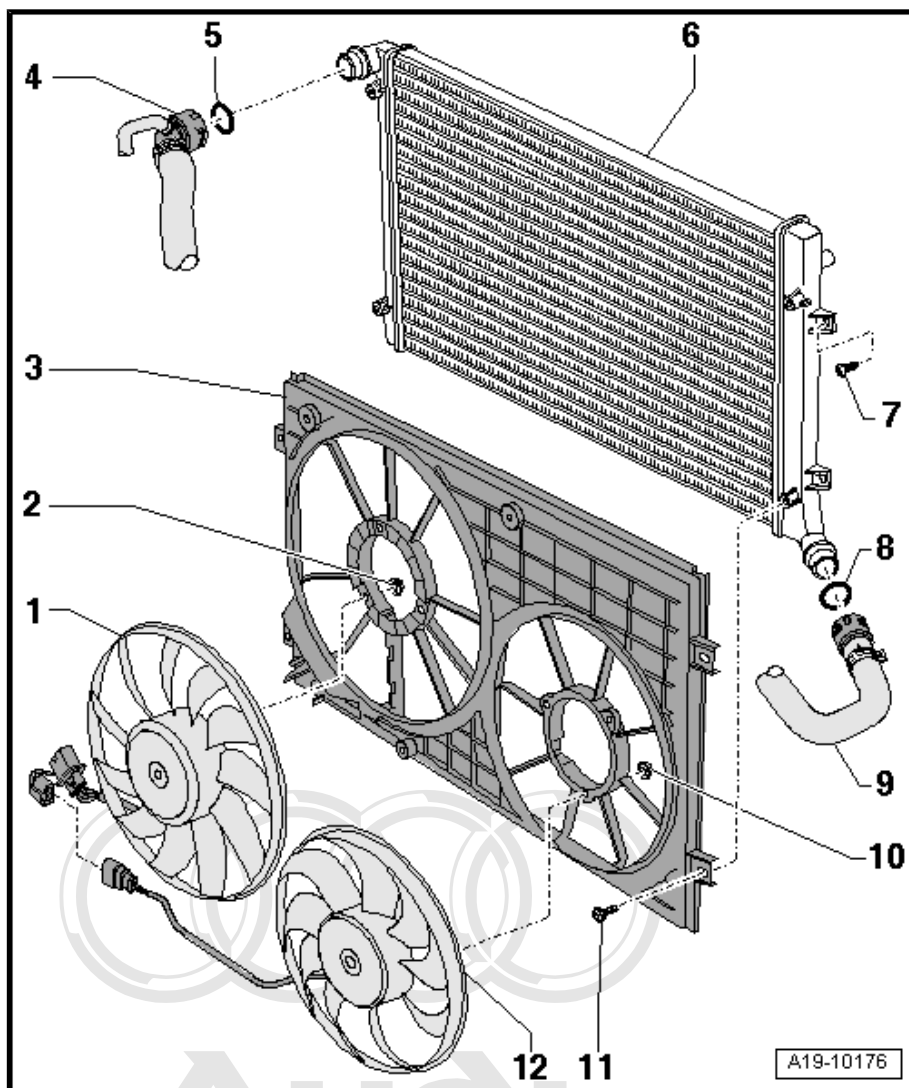
- ☐ Renew if damaged

9 - Coolant hose (bottom)

- ☐ To hose connection on thermostat
- ☐ Lift retaining clip to detach
- ☐ Connecting to radiator ⇒ [page 197](#)

10 - 5 Nm**11 - 5 Nm****12 - Radiator fan 2 - V177-**

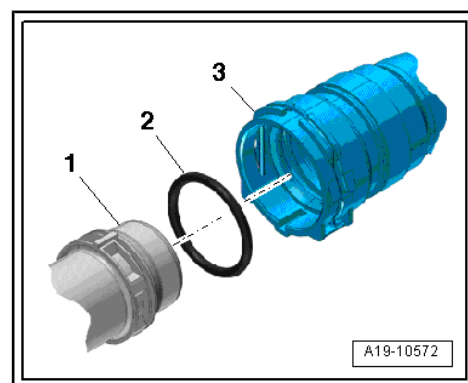
- ☐ Removing and installing ⇒ [page 202](#)



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Connecting coolant hose with plug-in connector

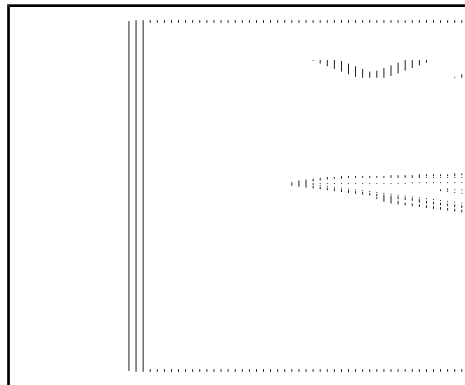
- Remove old O-ring -2- from coolant hose -3-.
- Lubricate new O-ring with coolant additive and fit O-ring in coolant hose.
- Press coolant hose onto connection -1- until it engages audibly.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.

**1.8 Removing and installing radiator**

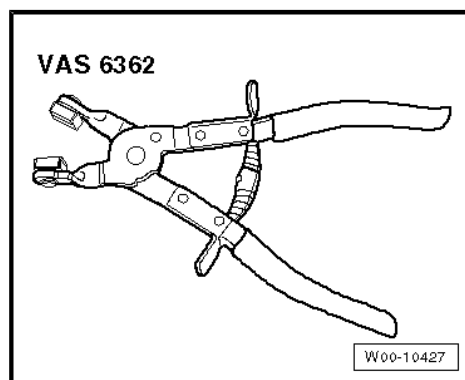
Special tools and workshop equipment required



- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - VAS 6362-



Removing



Note

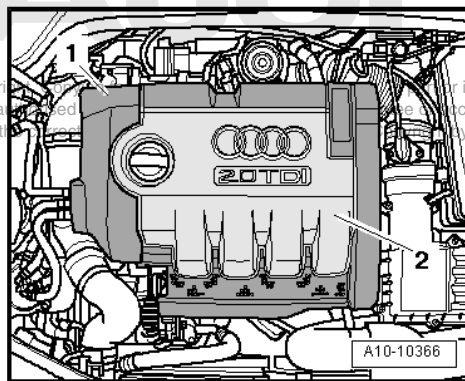
- ◆ If there are slight impressions on the fins, refer to [⇒ page 7](#).
- ◆ Collect drained coolant in a clean container for re-use or disposal.



WARNING

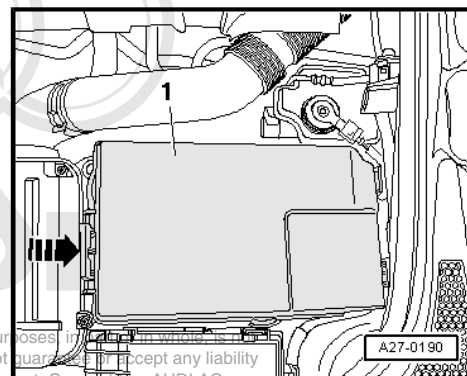
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



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- Remove cover -1- over battery; to do so, press release tab -arrow-.



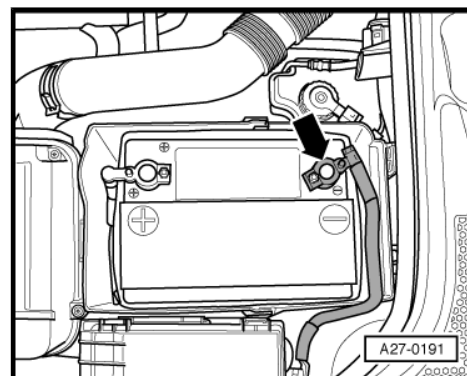
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Caution

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

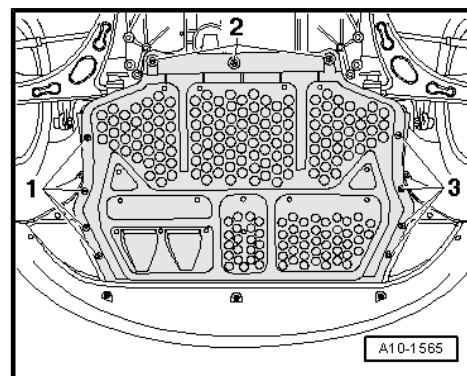
- With ignition switched off, disconnect battery earth cable -arrow-.



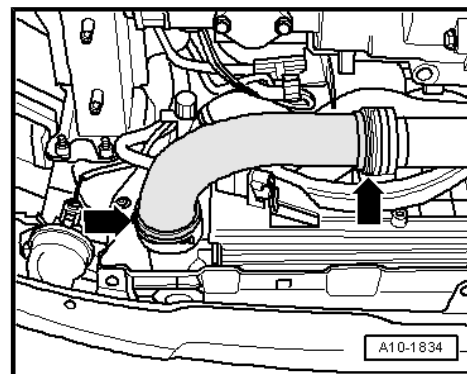
WARNING

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

- Open filler cap on coolant expansion tank.
- Remove centre noise insulation -fasteners 1 ... 3-.



- Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.

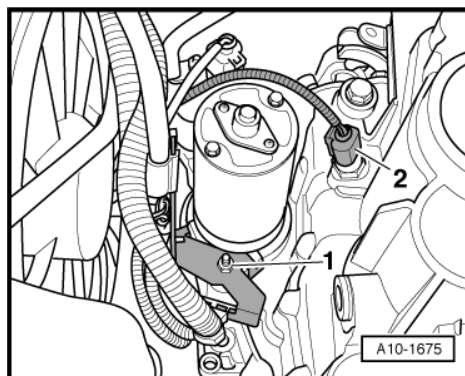


Vehicles with manual gearbox:

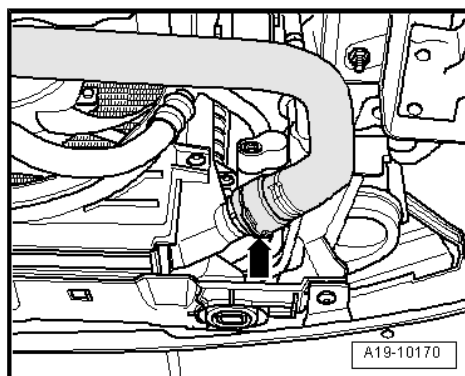
- Unplug electrical connector -2- for reversing light switch - F4- .

All vehicles (continued):

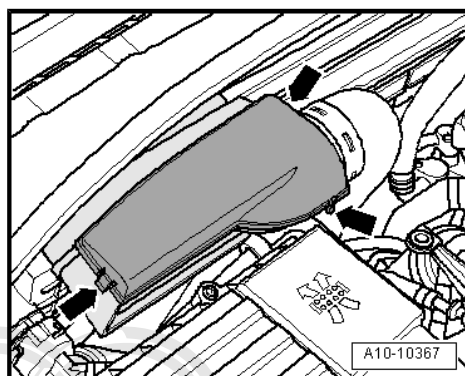
- Unscrew nut -1- and remove bracket with wiring from stud.
- Unclip bracket from wiring harness.



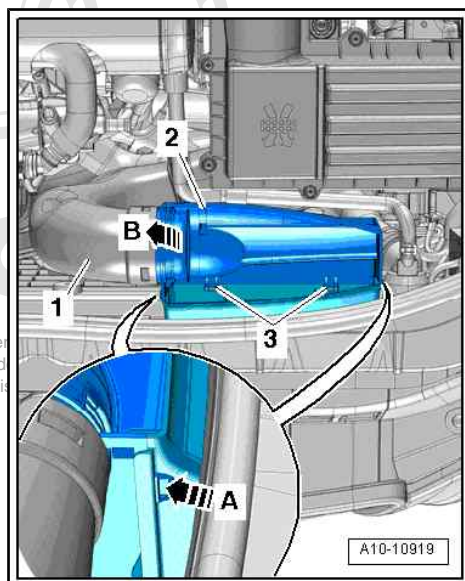
- Place drip tray for workshop hoist - VAS 6208- under engine.
- Lift retaining clip -arrow- and disconnect coolant hose from radiator.



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

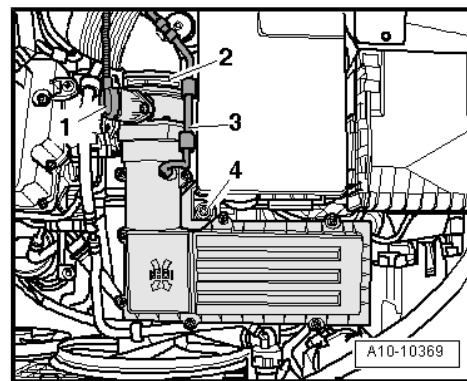


- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.

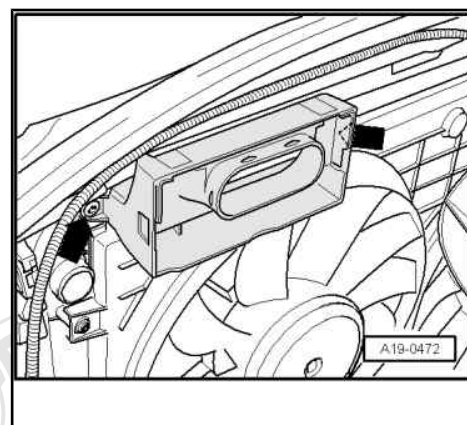


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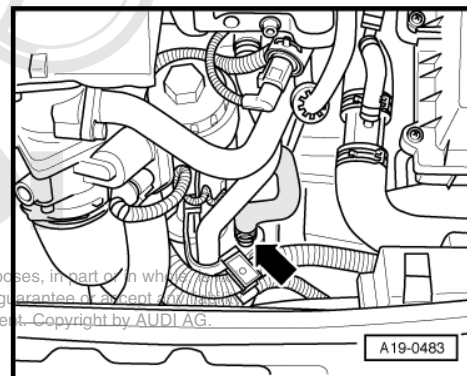
- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.



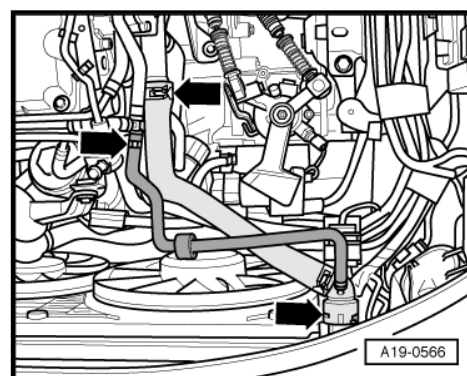
- Unscrew air duct at lock carrier -arrows-.



- Disconnect coolant hose at bottom of engine oil cooler -arrow- and drain off remaining coolant.

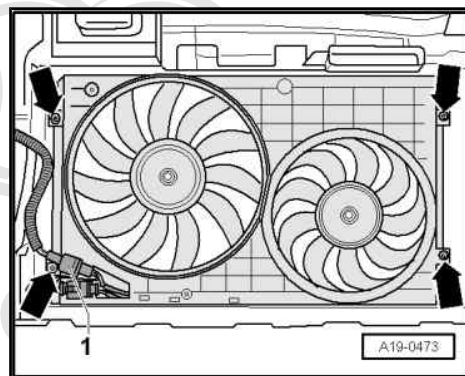


- Remove coolant hose between engine and radiator -arrows-.

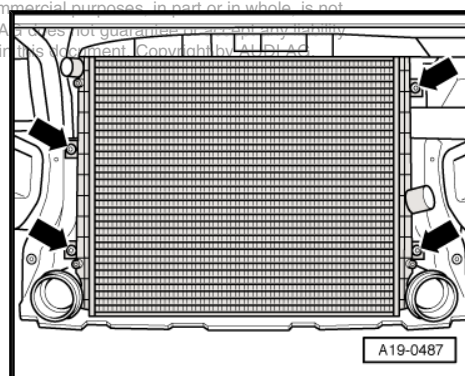


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- Unscrew top bolts -upper arrows- for radiator cowl.
- Unplug electrical connector -1-.
- Unscrew bottom bolts for radiator cowl -bottom arrows- and remove radiator cowl downwards.



- Unscrew bolts -arrows- on backside of radiator.
- Lift up radiator slightly and remove from below.



Installing

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

Note

- ◆ *Renew seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .
- Connect coolant hose to radiator ⇒ [page 197](#) .
- Fill cooling system ⇒ [page 183](#) .

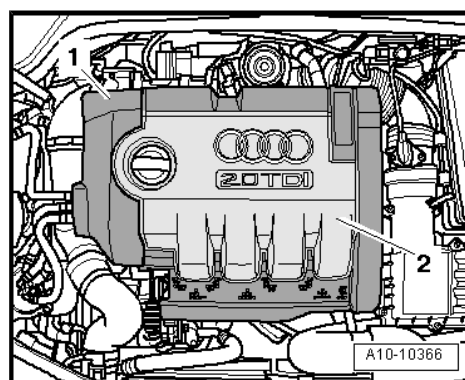
Tightening torques

Component	Nm
Radiator to charge air cooler	5
Radiator cowl to radiator	5
Air cleaner housing to bracket	10

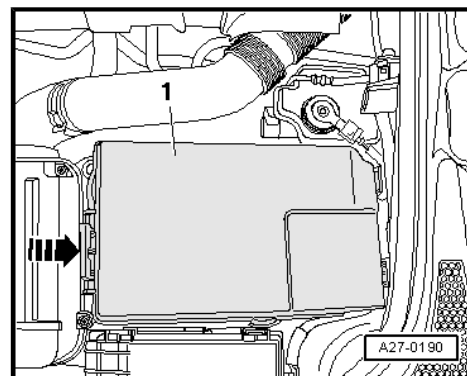
1.9 Removing and installing radiator fan - V7- and radiator fan 2 - V177-

Removing

- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.

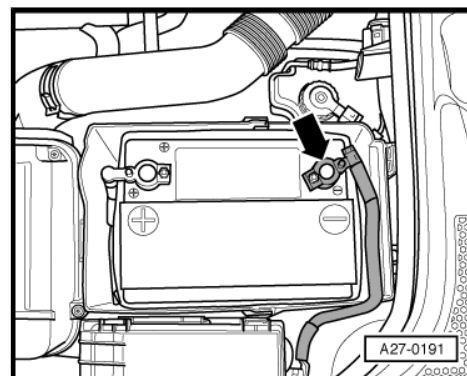


- Remove cover -1- over battery; to do so, press release tab -arrow-.

**Caution**

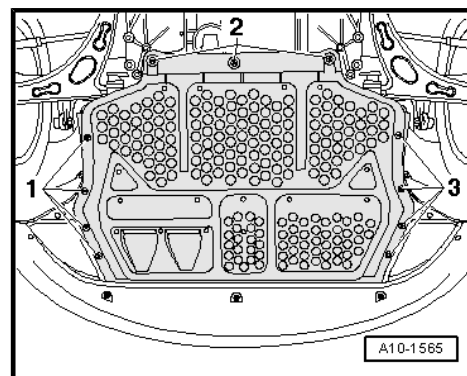
Observe notes on procedure for disconnecting the battery → Rep. gr. 27.

- With ignition switched off, disconnect battery earth cable -arrow-.

**WARNING**

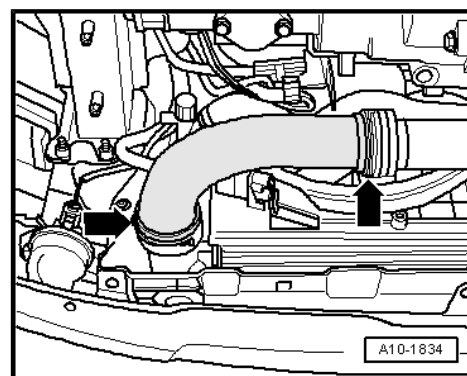
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Remove centre noise insulation -fasteners 1 ... 3-.



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- Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.

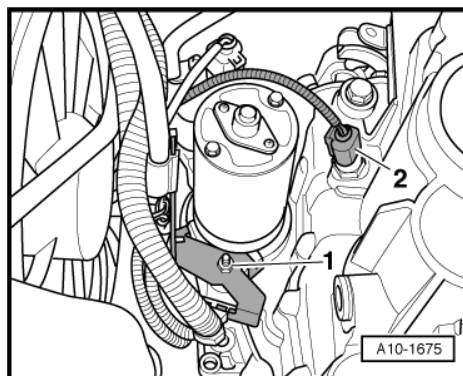


Vehicles with manual gearbox:

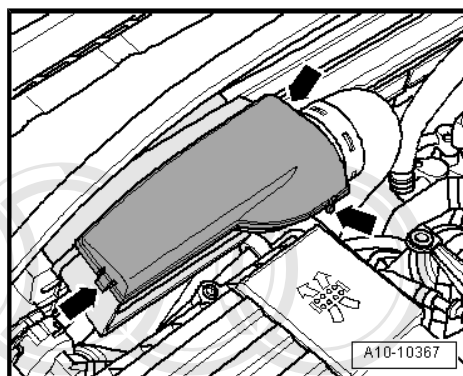
- Unplug electrical connector -2- for reversing light switch - F4- .

All vehicles (continued):

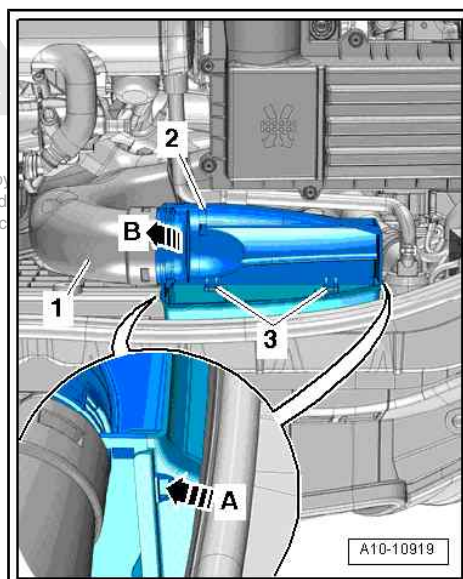
- Unscrew nut -1- and remove bracket with wiring from stud.
- Unclip bracket from wiring harness.



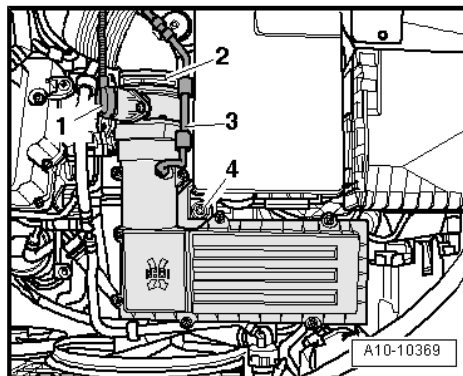
- Pull cover off air duct (release clips on sides) -arrows-.



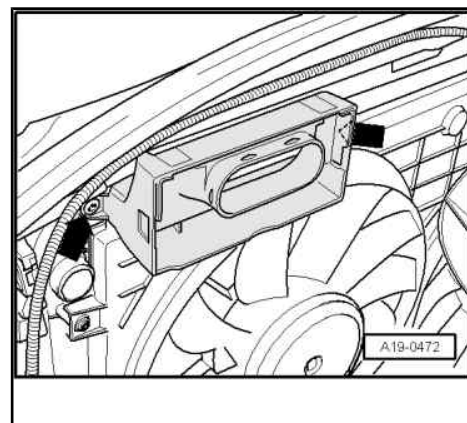
- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.



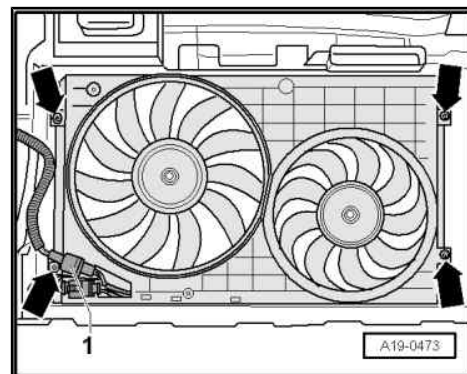
- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.



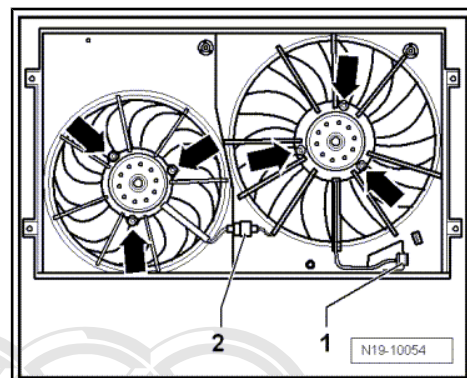
- Unscrew air duct at lock carrier -arrows-.



- Unscrew top bolts -upper arrows- for radiator cowl.
- Unplug electrical connector -1-.
- Unscrew lower securing bolts -lower arrows- for radiator cowl and remove it from below.



- Unplug electrical connector -2-.
- Move wiring clear.
- Detach connector -1- from radiator cowl and move wiring clear.
- Unscrew nuts -arrows- and remove radiator fan.



Installing

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



Note

Renew seal.

- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#).
- Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27.

Tightening torques

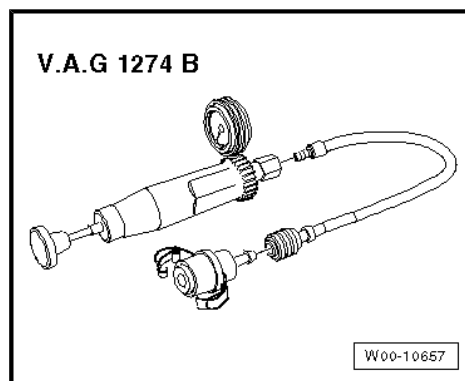
Component	Nm
Radiator fan to radiator cowl	5
Radiator cowl to radiator	5
Air cleaner housing to bracket	10

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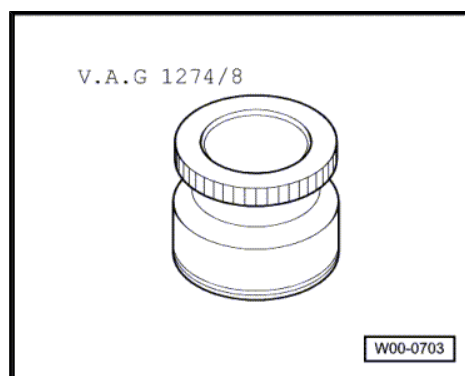
1.10 Checking cooling system for leaks

Special tools and workshop equipment required

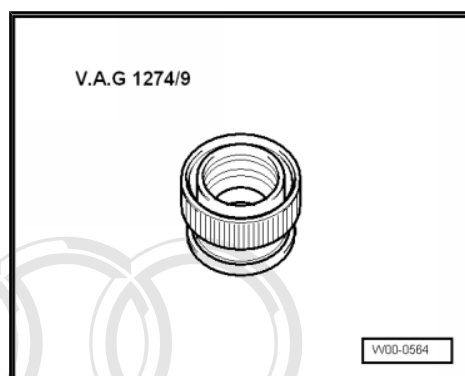
◆ Cooling system tester - V.A.G 1274 B-



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



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



Procedure

- Engine must be warm.



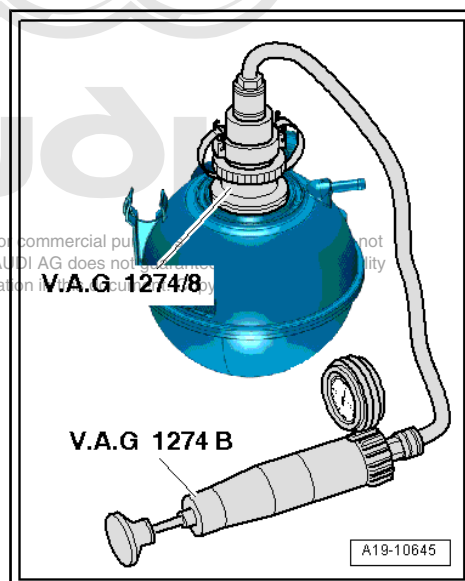
WARNING

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

- Open filler cap on coolant expansion tank.
- Attach cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- to expansion tank.
- Use hand pump on tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

- Trace leak and repair.

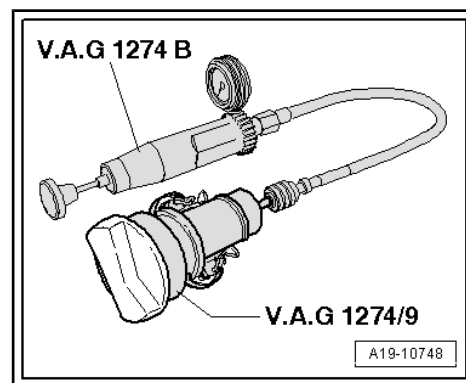


Checking pressure relief valve in filler cap

- Attach cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- to filler cap.
- Operate hand pump.
- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

If the pressure relief valve does not open as described:

- Renew filler cap.



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21 – Turbocharging/supercharging

1 Turbocharger and charge air cooler

– Observe rules for cleanliness ⇒ [page 6](#) .

1.1 Turbocharger - exploded view

1 - Bolt

- ☐ 10 Nm

2 - Bracket

3 - Heat shield

4 - Oil supply hose

- ☐ To connection for oil supply line at turbo-charger

5 - Turbocharger

- ☐ Can only be renewed together with exhaust manifold and vacuum unit as one unit
- ☐ Removing and installing ⇒ [page 209](#)
- ☐ Before installing, fill turbo-charger with engine oil at connection for oil supply line

6 - Vacuum hose

7 - Gasket

- ☐ Renew
- ☐ Note installation position

8 - To particulate filter

9 - Clamp

- ☐ For turbocharger/particulate filter
- ☐ Renew
- ☐ 7 Nm

10 - Exhaust manifold

- ☐ Can only be renewed together with turbocharger and vacuum unit as one unit

11 - Nut

- ☐ Renew
- ☐ 25 Nm

12 - Bolt

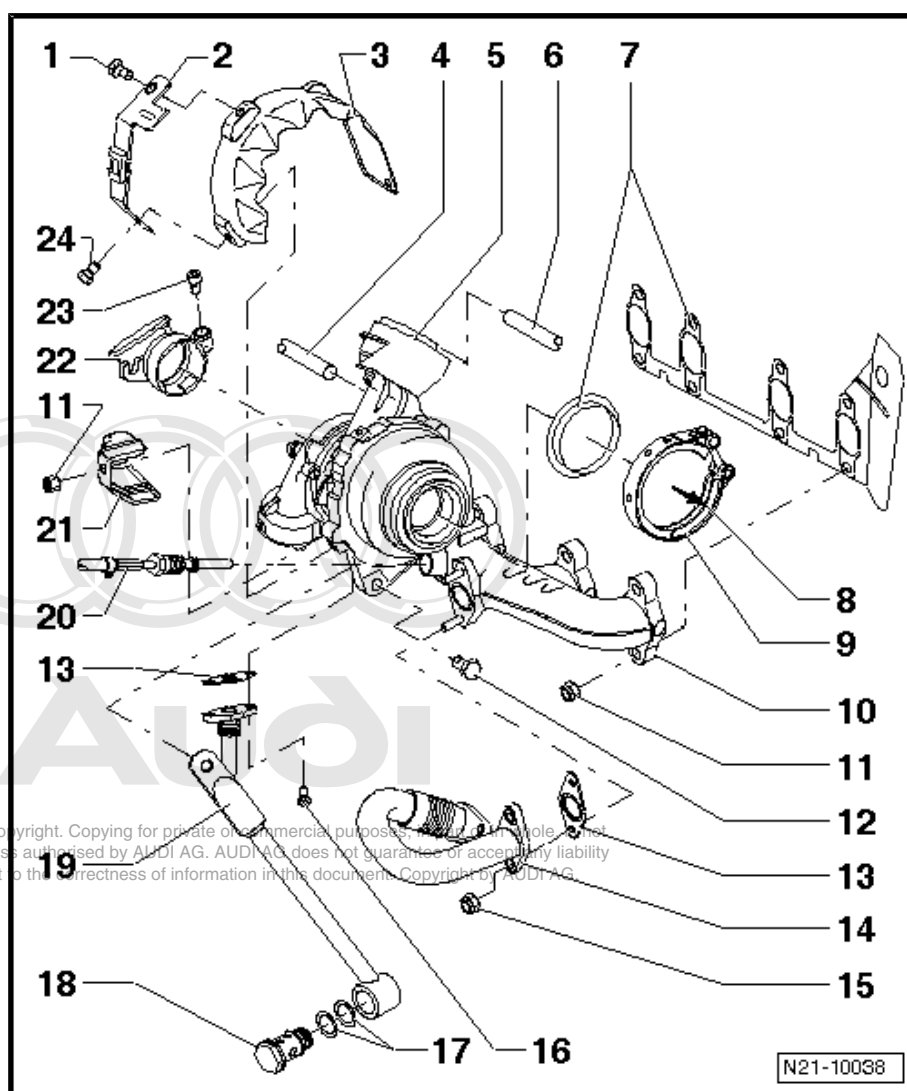
- ☐ 25 Nm

13 - Gasket

- ☐ Renew

14 - Connecting pipe

- ☐ For exhaust gas recirculation
- ☐ When installing, first tighten mountings finger-tight and then tighten to specified torque



15 - Nut

- ☐ Renew
- ☐ 25 Nm

16 - Bolt

- ☐ 15 Nm

17 - O-ring

- ☐ Renew

18 - Banjo bolt

- ☐ 60 Nm

19 - Support

- ☐ For turbocharger
- ☐ With oil return line

20 - Exhaust gas temperature sender 1 - G235-

- ☐ Coat thread of sender with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

21 - Heat shield**22 - Connection**

- ☐ For air cleaner/turbocharger intake hose

23 - Bolt

- ☐ 9 Nm

24 - Bolt

- ☐ 10 Nm

1.2 Removing and installing turbocharger

Removing

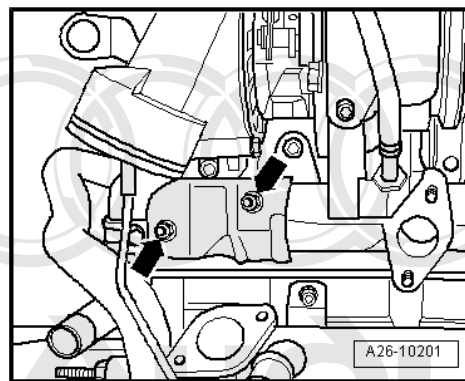
**Caution**

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:

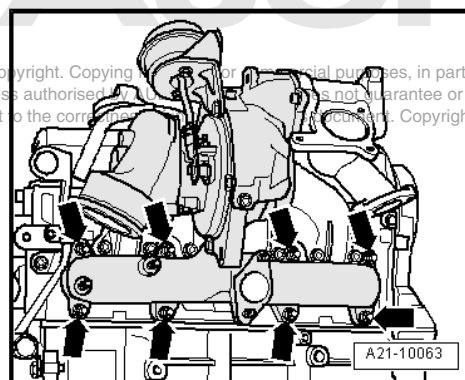
- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

- Remove exhaust gas recirculation cooler ⇒ [page 248](#) .

- Unbolt heat shield on exhaust manifold (left-side) -arrows-.



- Remove bolts -arrows-.
- Guide out turbocharger with exhaust manifold through wheel housing (right-side) and at the same time swivel engine/gear-box assembly slightly forwards.



Installing

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

Note

- ◆ *Renew gaskets, seals and self-locking nuts.*
- ◆ *Fill turbocharger with engine oil at connection for oil supply line.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

- Remove exhaust gas recirculation cooler ⇒ [page 248](#) .
- Install exhaust system and align it free of stress ⇒ [page 235](#) .
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Check oil level ⇒ Maintenance ; Booklet 808 .

Note

After installing turbocharger, allow engine to idle for approx. 1 minute and do not rev up immediately to ensure turbocharger is supplied with oil.

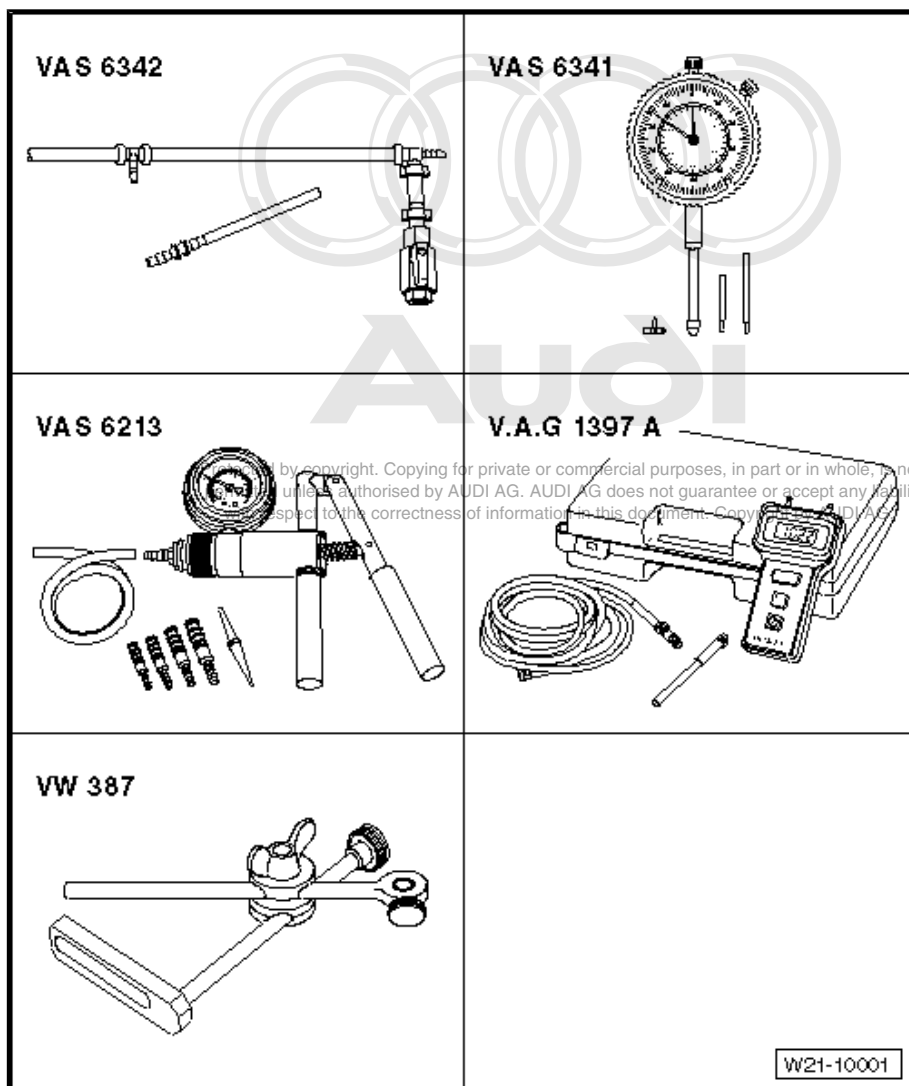
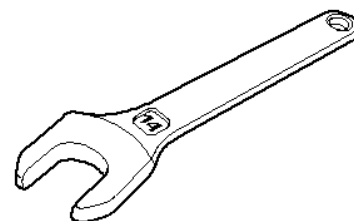
Tightening torques

Component	Nm
Exhaust manifold/turbocharger to cylinder head	25 ¹⁾
Heat shield to exhaust manifold/turbocharger	20 ¹⁾
• ¹⁾ Renew nuts.	

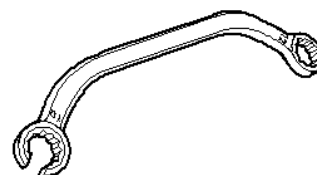
1.3 Renewing and adjusting vacuum unit for turbocharger - vehicles with engine code BLS from model year 2008 onwards only

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-
- ◆ Turbocharger tester - V.A.G 1397A-
- ◆ Pressure control valve - VAS 6342-
- ◆ Socket - T10454- (no illustration)
- ◆ Open-end spanner 14 mm - T10461-
- ◆ Ring spanner - T10423-

**T10461**

W00-10962

T10423

W00-10838



Caution

The tools listed, in particular the socket - T10454- , are only intended for use according to the procedure described in the following; do NOT use the tools for other bolted connections. There is danger of deformation if the specified torques are exceeded.

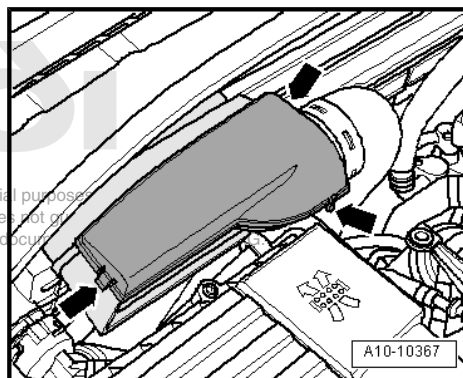


Note

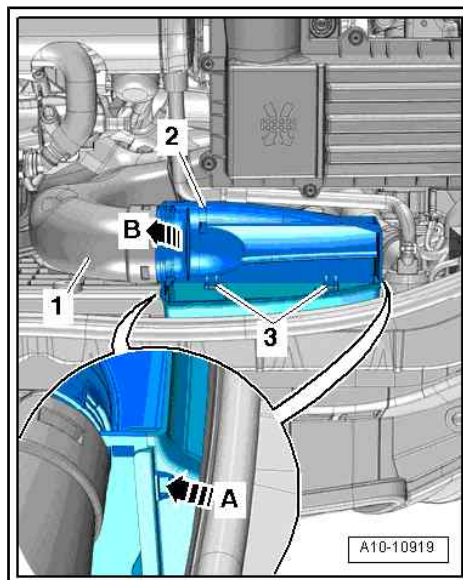
A replacement part kit is available for renewing the vacuum unit
⇒ Electronic parts catalogue .

Removing

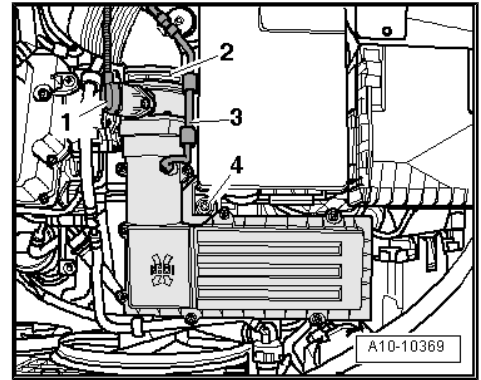
- Remove engine cover panel.
- Release clips on sides -arrows- and pull cover off air duct.



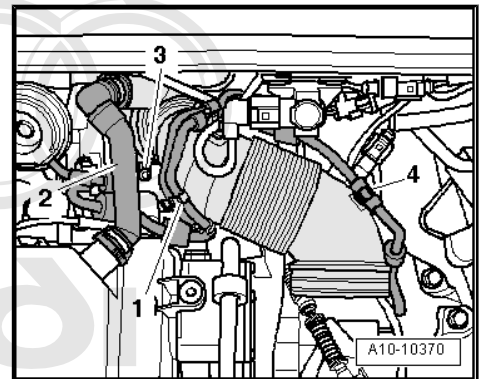
- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.



- Unplug electrical connector -1- from air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and detach air cleaner housing.



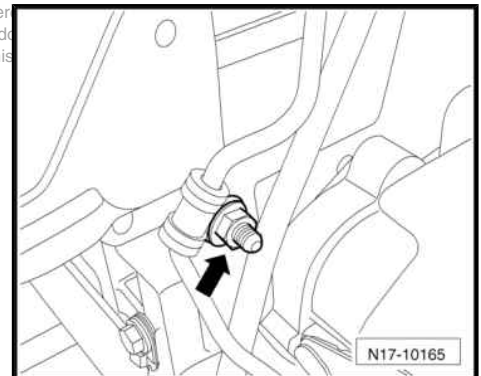
- Detach crankcase breather hose -2-.
- Move vent hose -4- and vacuum hoses -1- clear at air hose.
- Remove bolt -3-.
- Swing air hose to rear and detach from turbocharger.
- Seal opening in turbocharger with plug from replacement part kit.
- Disconnect vacuum hose from turbocharger.



- Depending on version, remove nut -arrow- securing oil supply line/vacuum line to cylinder head.

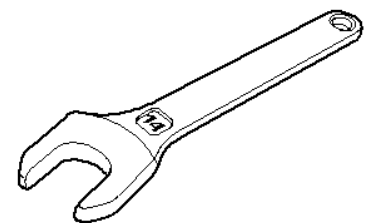
**Caution**

It is important that you counterhold connection when loosening oil supply line. Risk of further damage occurring later.



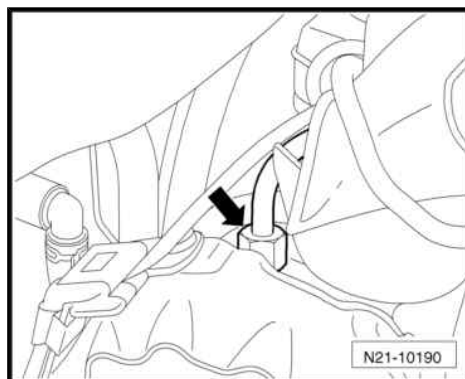
Improvised tool (14 mm) to counterhold connection for oil supply line

T10461

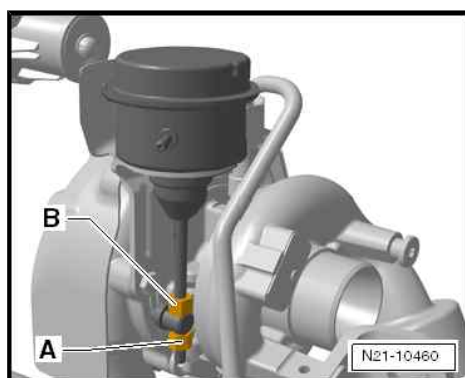


W00-10962

- Counterhold connection and remove oil supply line -arrow- from turbocharger.
- Seal opening for oil supply line in turbocharger with plug from replacement part kit.

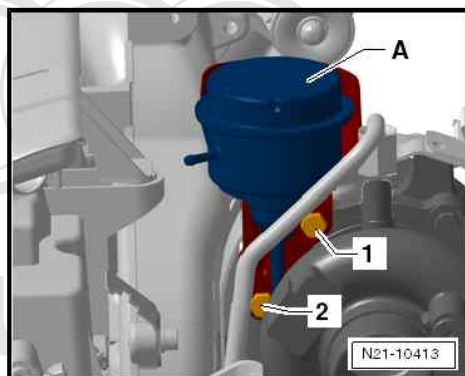


- Counterhold lock nut -B- with ring spanner - T10423- and remove securing nut -A- from control rod using socket - T10454- .



- Remove securing bolts -1- and then -2- and detach vacuum unit -A-.

Installing



- Mark vacuum unit and control rod as shown

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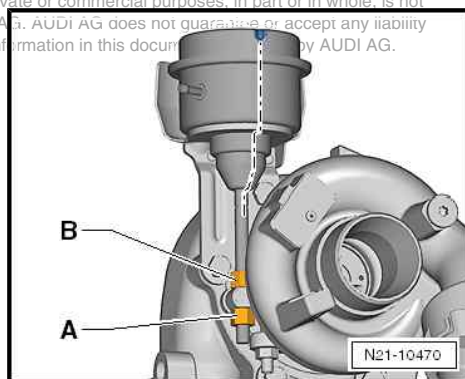
Note

The marking can be used to determine whether the control rod has turned out of position during tightening; the position can then be corrected.



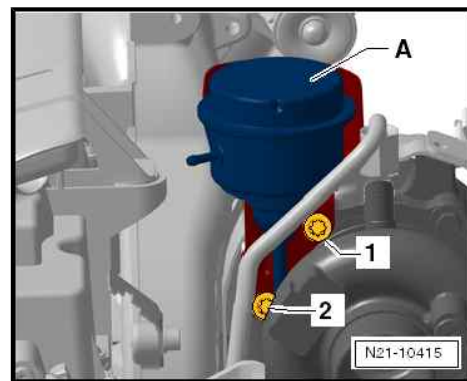
Caution

Only use new bolts and nuts from replacement part kit.

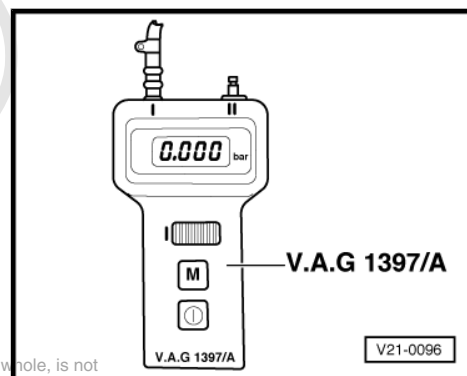


- If necessary, remove bottom nut securing control rod from new vacuum unit (from replacement part kit).
- Screw lock nut onto control rod by hand towards vacuum unit as far as stop.
- Guide control rod through adjusting lever on turbocharger, fit vacuum unit -A- and screw in bolts until they make contact.

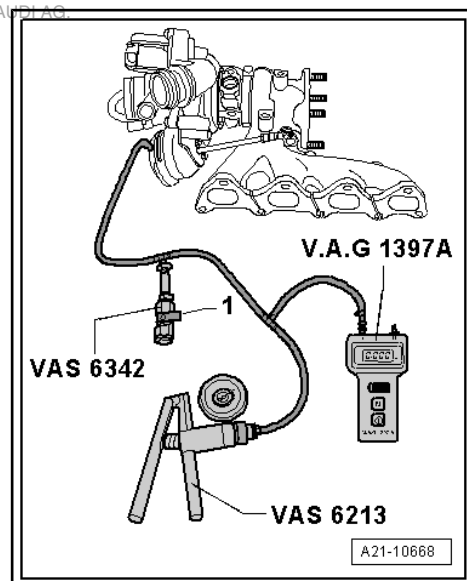
- Fit bolts -1- and -2- from replacement part kit.
- Tighten bolts -1- and -2- to 8 Nm.



- Switch on turbocharger tester - V.A.G 1397A- and set sliding switch to position "I".
- Subtract 600 mbar from atmospheric pressure displayed and make note of value (value 1).
- Subtract 650 mbar from atmospheric pressure displayed and make note of value (value 2).



- Set up measuring equipment and testers as shown in illustration and connect to connection "I" -arrow- of turbocharger tester - V.A.G 1397A- and to vacuum unit for turbocharger.
- Close lever -1- on pressure control valve - VAS 6342- .



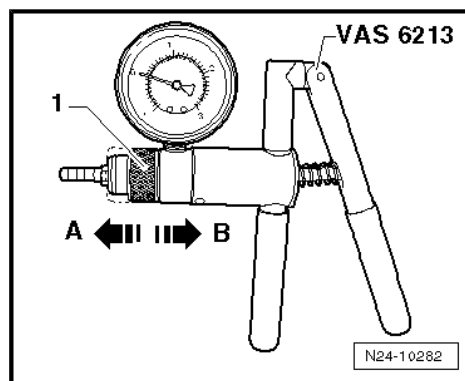
- Move adjuster ring -1- on hand vacuum pump - VAS 6213- to position -A- to select “vacuum”.



Caution

Risk of damage to vacuum unit on account of excessive pressure.

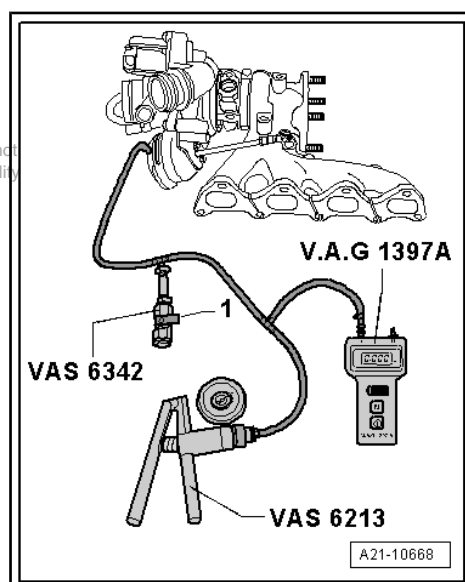
Pressure must not be below atmospheric pressure displayed minus 800 mbar.



Note

- ◆ When setting value 2, an accuracy of ± 20 mbar is sufficient.
- ◆ Please ensure that adjusting lever on turbocharger can be moved easily on control rod.
- Operate hand vacuum pump - VAS 6213- several times until pressure displayed on turbocharger tester - V.A.G 1397A- equals value 2 noted down previously.
- Set value 1 noted previously exactly by opening pressure control valve -1-.

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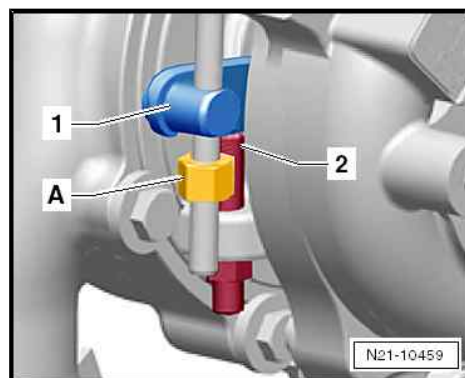


- Screw securing nut -A- several turns onto control rod.

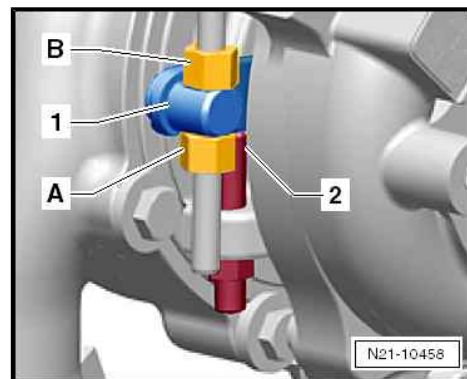


Note

- ◆ During next work step, make sure that adjusting lever -1- makes contact with adjuster screw -2- and does not rest on securing nut -A-.
- ◆ If this is the case, screw securing nut -A- back.
- Hold adjusting lever -1- so that it makes contact with adjusting nut -2-.

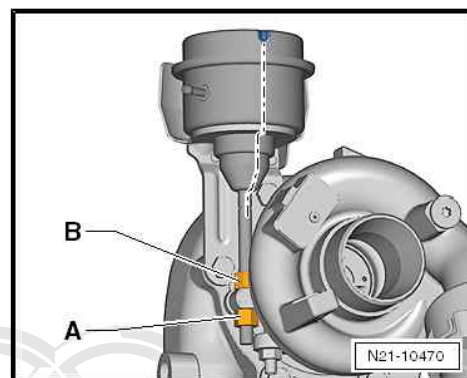


- Slowly screw lock nut -B- for control rod downwards by hand until it makes contact with adjusting lever -1-; do not screw any further.
- Screw securing nut -A- on control rod against adjusting lever.

**Note**

When tightening securing nut -A-, make sure that control rod does not turn out of position.

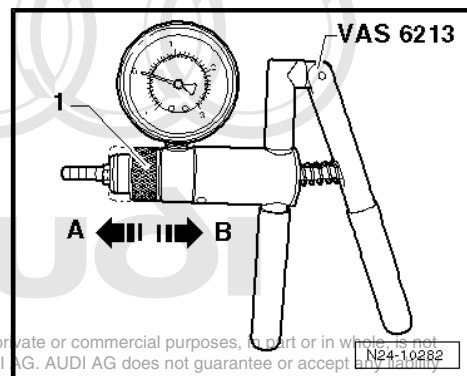
- Counterhold lock nut -B- with ring spanner - T10423- and tighten securing nut -A- using socket - T10454- .
- Checked markings on control rod; markings must be in line as shown.



- Relieve pressure; to do so move adjuster ring -1- on hand vacuum pump to position -B- and then back to position -A-.

**Note**

There is little room between the cylinder head and the turbo-charger. Make sure that you are positioning the feeler gauge (0.05 mm) correctly.



- Position feeler gauge (0.05 mm) between adjusting lever and adjuster screw.

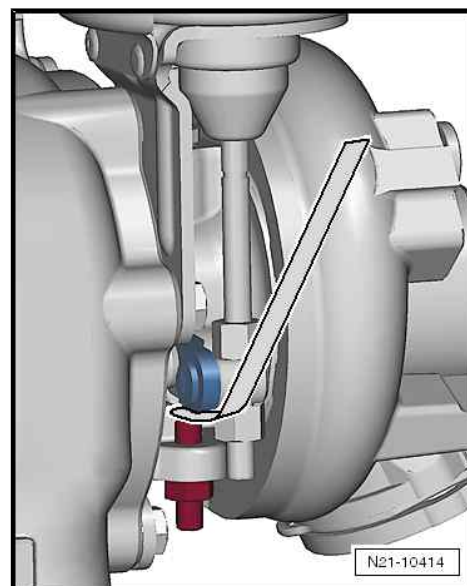
**Note**

The feeler gauge (0.05 mm) has a part number and must be ordered via the ⇒ Electronic parts catalogue .

- Now operate hand vacuum pump - VAS 6213- until feeler gauge (0.05 mm) is clamped between adjusting lever and adjuster screw.

The turbocharger tester - V.A.G 1397A- should now indicate value 1 ± 20 mbar.

Value OK

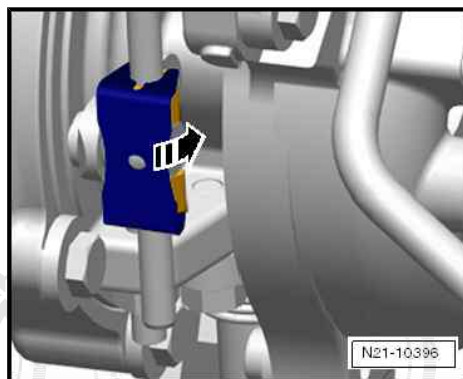


- Seal connection between control rod and securing nut with sealing paint from replacement part kit.
- Press locking plate onto control rod by hand and turn by 90° in direction of -arrow-.

Value not OK

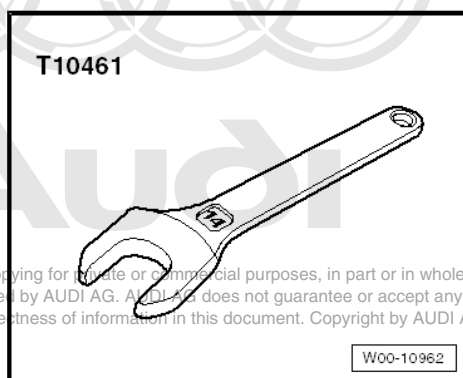
Repeat adjustment procedure.

Continued



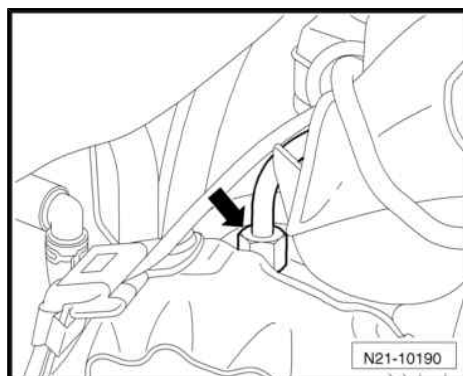
Improvised tool (14 mm) to counterhold connection for oil supply line

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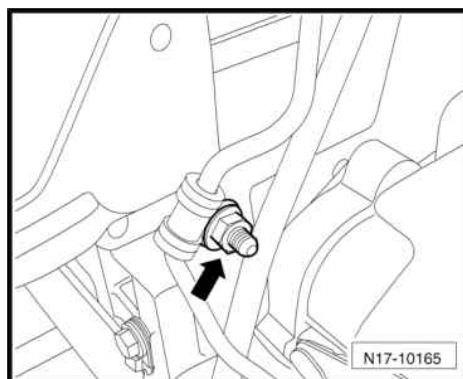


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- Counterhold connection and tighten oil supply line -arrow- on turbocharger.



- Depending on version, fit nut -arrow- securing oil supply line/ vacuum line to cylinder head and tighten connection.
- Fully assemble engine components.
- Start engine and erase event memory ⇒ Vehicle diagnostic tester.



1.4 Diagram of vacuum hose connections

1 - Turbocharger**2 - Air cleaner/turbocharger connecting pipe****3 - Non-return valve**

- ☐ Note installation position

4 - To brake servo**5 - Charge pressure control solenoid valve - N75-****6 - Air cleaner****7 - Cylinder head/cylinder block****8 - Intake manifold****9 - Bypass flap**

- ☐ For exhaust gas recirculation cooler

10 - Cooler

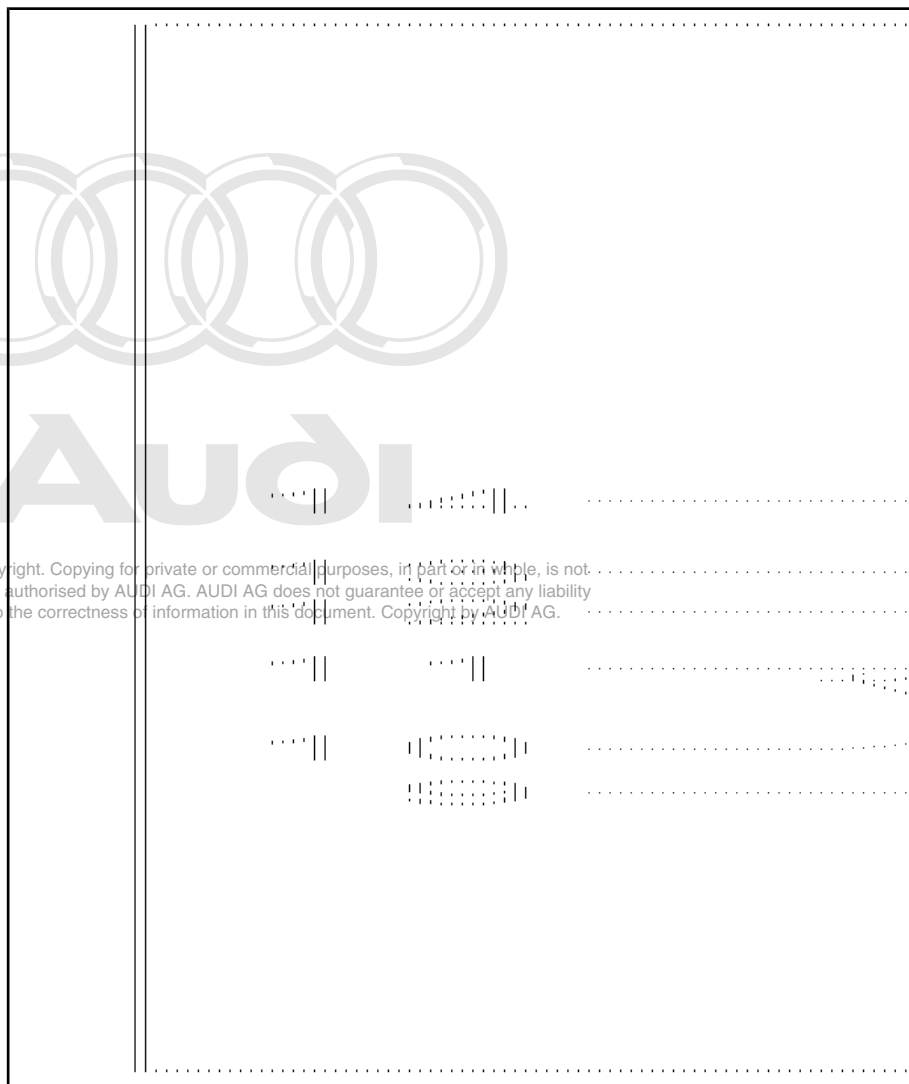
- ☐ For exhaust gas recirculation

11 - Exhaust gas recirculation valve - N18-**12 - Exhaust gas recirculation cooler change-over valve - N345-****13 - Non-return valve**

- ☐ Note installation position

14 - Vacuum unit

- ☐ Turbocharger



1.5 Charge air cooling - exploded view

1 - 8 Nm

2 - Bracket

- ☐ Note installation position

3 - Charge air cooler

- ☐ Removing and installing
⇒ [page 222](#)

4 - Sealing panel

- ☐ Attached to top and bottom of charge air cooler

5 - 3 Nm

6 - Charge pressure sender - G31- / intake air temperature sender - G42-

7 - O-ring

- ☐ Renew if damaged

8 - Bracket

9 - 5 Nm

10 - Air hose

11 - Air pipe

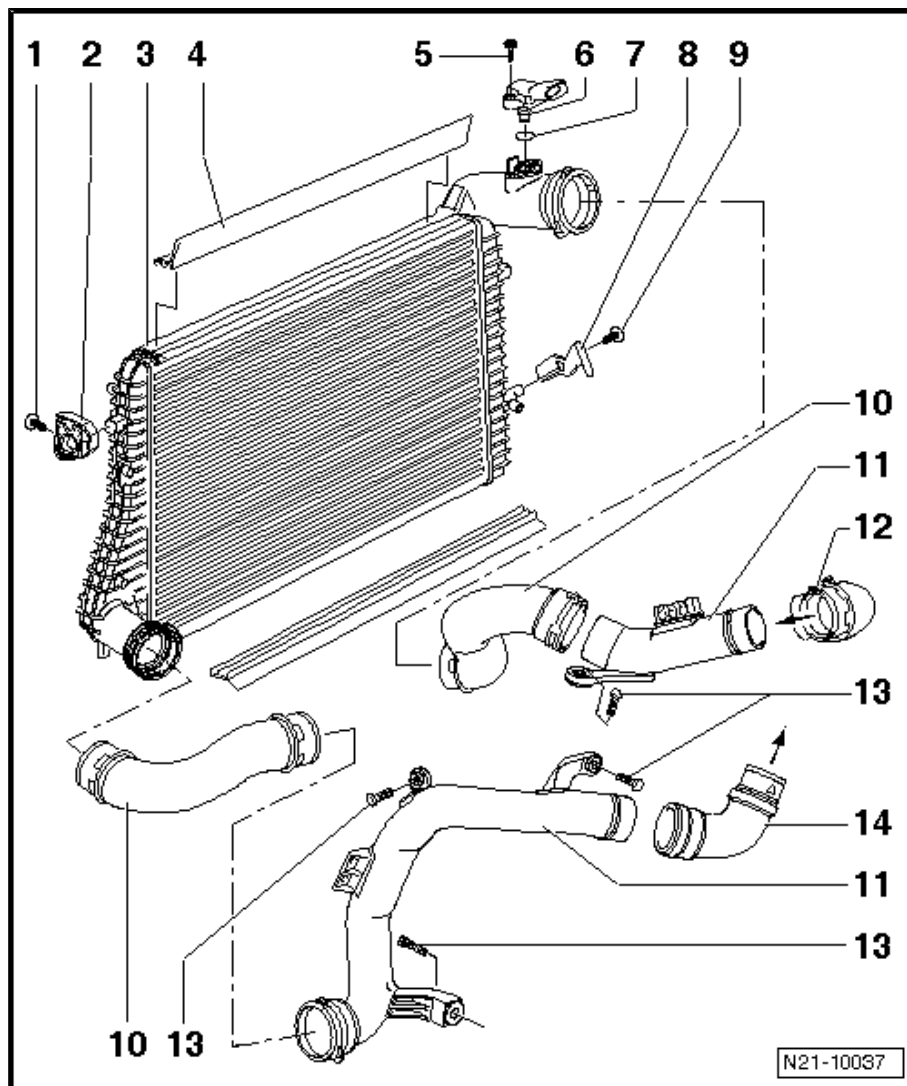
12 - Air hose

- ☐ To intake manifold flap motor - V157-

13 - 8 Nm

14 - Air hose

- ☐ To turbocharger



1.6 Removing and installing air pipes and hoses with plug-in connectors



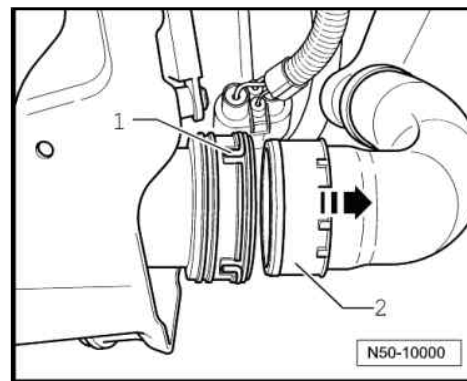
Note

- ◆ Check all air pipes and hoses and vacuum lines for correct fitting and leakage before carrying out tests or repairs.
- ◆ Hose connections and air pipes and hoses must be free of oil and grease before assembly.

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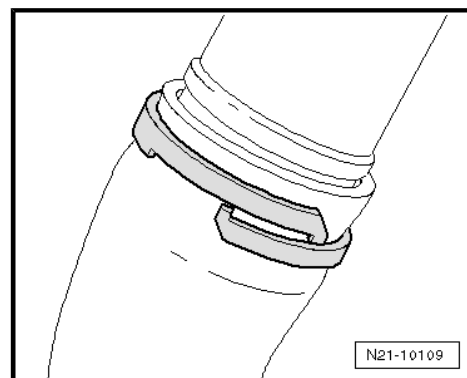
Removing

- Release plug-in connector by pulling out retaining clip -1-.
- Disconnect air pipe/hose -2- -arrow- by hand (do not use a tool).



Caution

- ◆ *Charge air pipes and hoses may only be disconnected at the connection points provided (with retaining clip). The spring-type ring shown in the illustration must NOT be opened.*
- ◆ *However, if this spring-type ring should have to be opened for any reason, it must be destroyed and replaced with a suitable spring-type hose clip ⇒ Electronic parts catalogue .*

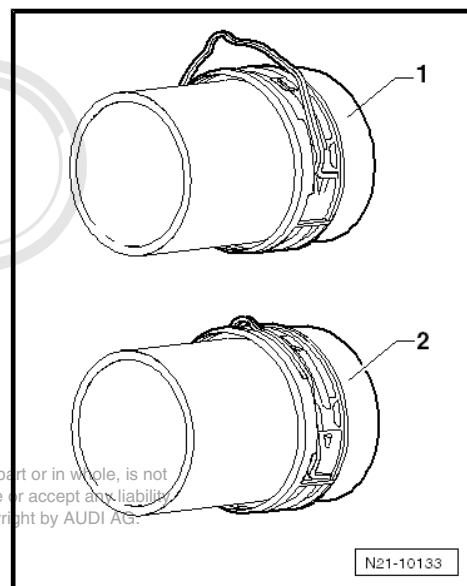


Installing



Note

- ◆ *Renew seal if damaged.*
- ◆ *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.*
- Pull retaining clip into release position -1-.
- Push air pipe/hose in as far as stop and press retaining clip to lock -2-.
- Press air pipe/hose again and pull again to check that plug-in connector is correctly engaged.



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1.7 Removing and installing charge air cooler

Removing



Note

If there are slight impressions on the fins, refer to ⇒ [page 7](#).

- Remove radiator ⇒ [page 197](#).
- Remove bumper cover (front) ⇒ Rep. gr. 63.
- Detach electrical connector -1- at ambient temperature sensor - G17-.
- Unscrew bolts -2- at air ducts (left and right) on charge air cooler.
- Disengage air ducts -3- (push them slightly upwards to do so).
- Swivel air ducts to left side of vehicle and guide out air ducts at rear of bumper.
- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



WARNING

The air conditioner refrigerant circuit must not be opened.

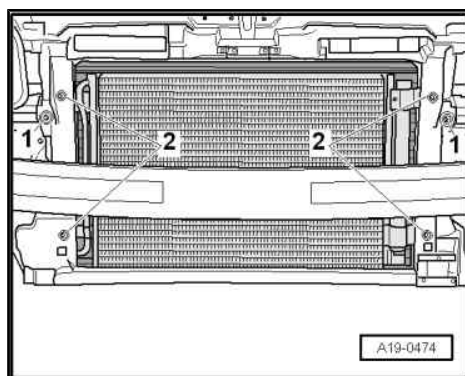
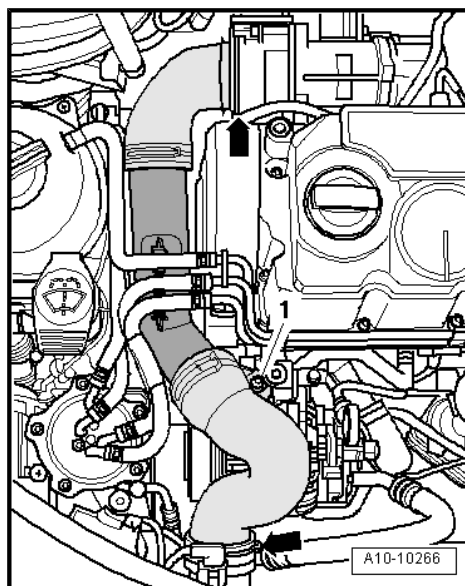
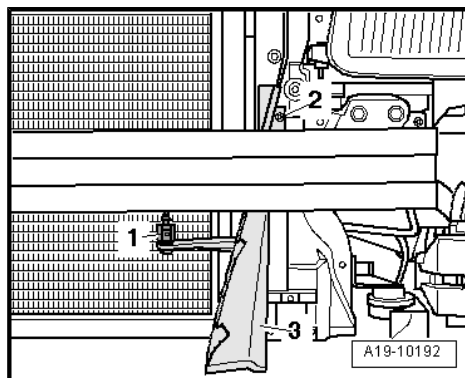


Note

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

- Remove bolt on retaining clip for refrigerant pipe in vicinity of longitudinal member.
- Unscrew bolts -2- for condenser.
- Unscrew bolts -1- at charge air cooler.
- Swing charge air cooler slightly to rear.

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- Unscrew bolt at bracket for refrigerant pipe (bottom right) at charge air cooler.
- Swivel condenser forward into opening on lock carrier.
- Detach charge air cooler upwards from lock carrier and remove by guiding it out diagonally from below.

Installing

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



Note

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

- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#).
- Install radiator ⇒ [page 197](#) .
- Install bumper cover (front) ⇒ Rep. gr. 63 .

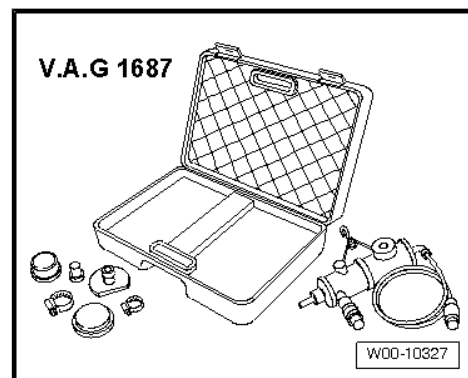
Tightening torques

Component	Nm
Charge air cooler to lock carrier	8
Condenser to charge air cooler	5
Bracket for refrigerant pipe to charge air cooler	5

1.8 Checking charge air system for leaks

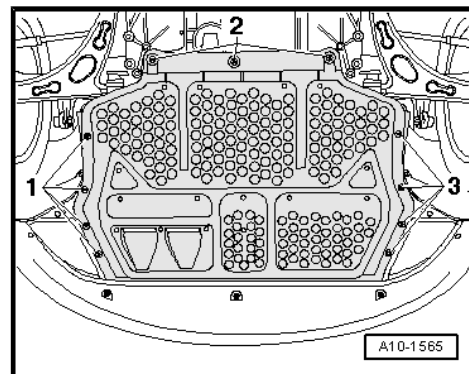
Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687- with adapter - V.A.G 1687/12-

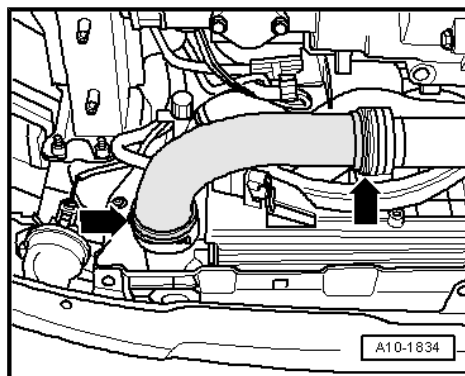


Procedure

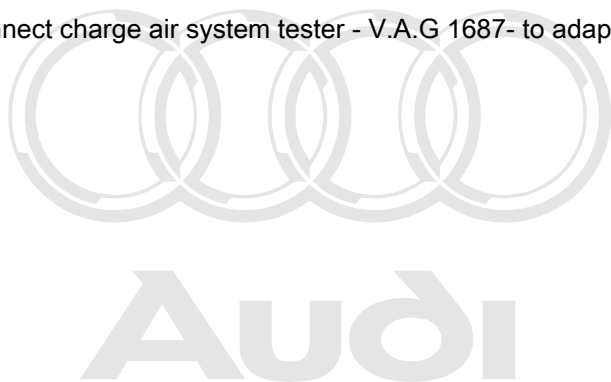
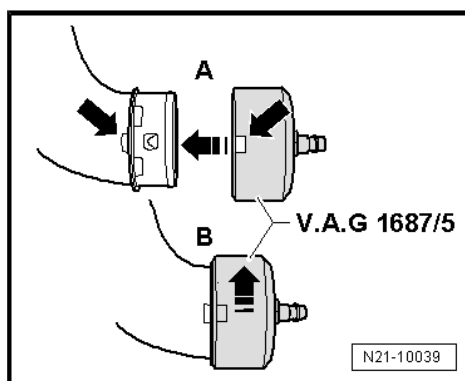
- Remove centre noise insulation -fasteners 1 ... 3-.



- Detach air intake hose (left-side) from air pipe (lift retaining clip -right arrow- slightly).



- Fit adapter - V.A.G 1687/5- onto charge air hose -A- and turn by approx. 90° -B-.
- Connect charge air system tester - V.A.G 1687- to adapter.



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Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Make sure knob is pulled out before turning pressure control valve -2-.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

- Open valve -3-.



Caution

Risk of damage if pressure is set too high.

◆ ***The pressure must not exceed 0.5 bar.***

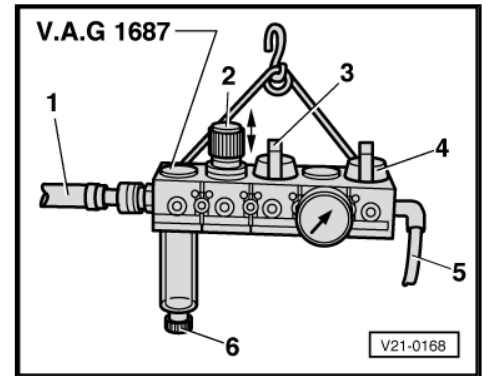
- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
- Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detecting spray or use ultrasonic tester - V.A.G 1842- .



Note

- ◆ *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- ◆ *For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .*
- ◆ *Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

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26 – Exhaust system

1 Exhaust system



Note

- ◆ After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamp and align silencers and exhaust pipe so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.
- ◆ Use screwdriver to unfasten and tighten lock washers for heat shields. Tightening torque: 2 Nm

1.1 Exhaust system - exploded view

1 - Rear cross member for underbody

2 - Centre silencer

- ☐ Depending on version
- ☐ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point
⇒ [page 229](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 235](#)

3 - Rubber mounting

- ☐ Renew if damaged

4 - Mounting

- ☐ Renew if damaged

5 - 23 Nm

6 - Mounting

- ☐ Renew if damaged

7 - 23 Nm

8 - 23 Nm

9 - Bracket

- ☐ For particulate filter

10 - 23 Nm

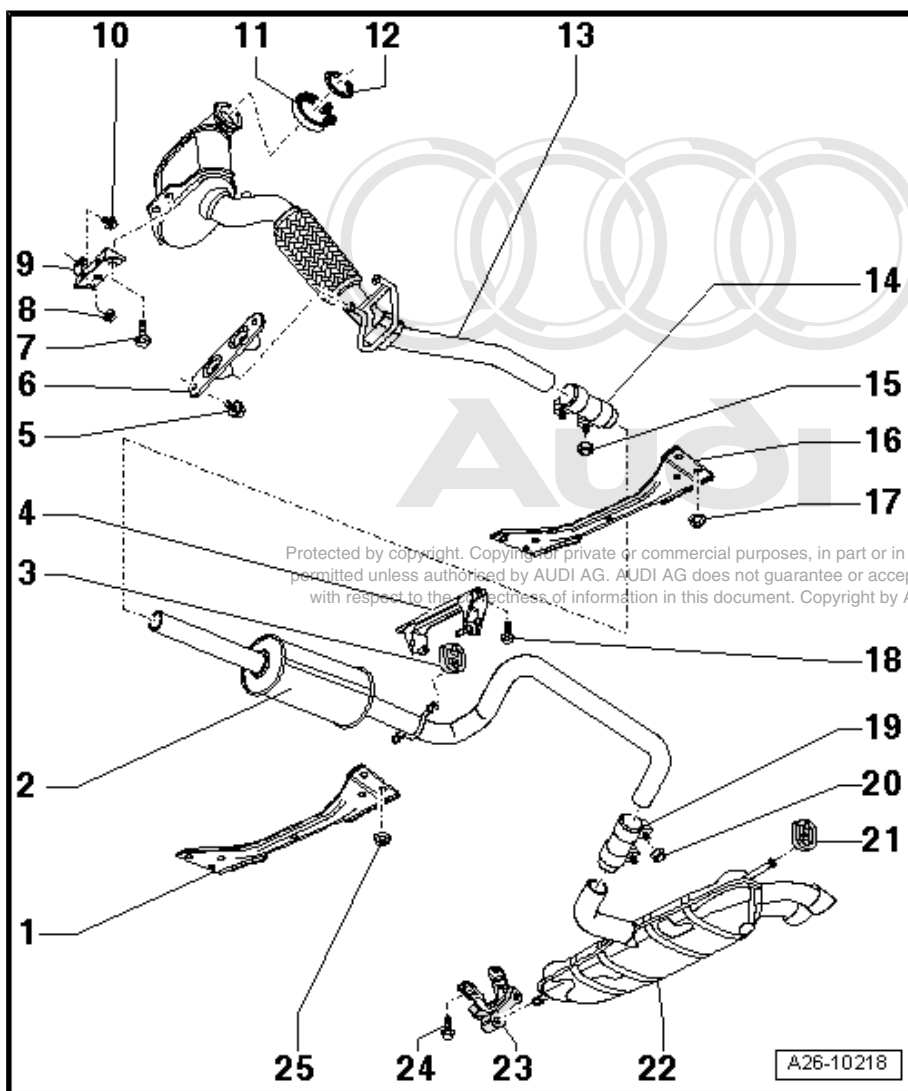
11 - Securing clamp, 7 Nm

- ☐ Renew

12 - Seal

13 - Diesel particulate filter with catalytic converter

- ☐ With flexible joint
- ☐ Do not bend flexible joint more than 10° – otherwise it can be damaged.
- ☐ Fitting locations of components on top of particulate filter ⇒ [page 227](#)



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- ☐ Fitting locations of components on underside of particulate filter ⇒ [page 228](#)
- ☐ Removing and installing ⇒ [page 229](#)
- ☐ After renewing particulate filter, perform adaption in "Guided Functions" ⇒ Vehicle diagnostic tester.

14 - Clamp (front)

- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 235](#)
- ☐ Installation position ⇒ [page 228](#)
- ☐ Tighten bolt connections evenly

15 - 25 Nm**16 - Front cross member for underbody****17 - 23 Nm****18 - 23 Nm****19 - Clamp (rear)**

- ☐ For separate replacement of centre and rear silencers
- ☐ Installation position ⇒ [page 228](#)
- ☐ Tighten bolt connections evenly

20 - 25 Nm**21 - Rubber mounting**

- ☐ Renew if damaged

22 - Rear silencer

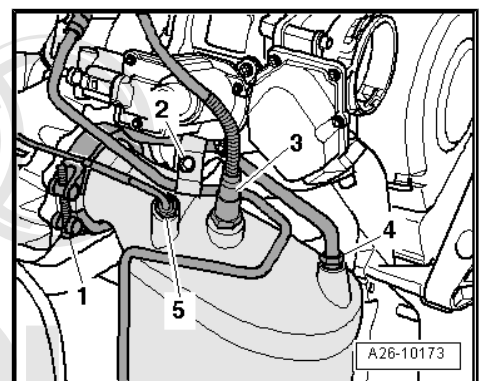
- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ [page 229](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 235](#)

23 - Mounting

- ☐ Renew if damaged

24 - 23 Nm**25 - 23 Nm****Fitting locations of components on top of particulate filter**

- 3 - Lambda probe - G39-
 - ◆ Removing and installing ⇒ Rep. gr. 23
- 4 - Pressure pipe going to exhaust gas pressure sensor 1 - G450-
 - ◆ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
 - ◆ Tighten union nut to 40 Nm.
- 5 - Temperature sender before particulate filter - G506-
 - ◆ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
 - ◆ Tighten to 45 Nm.



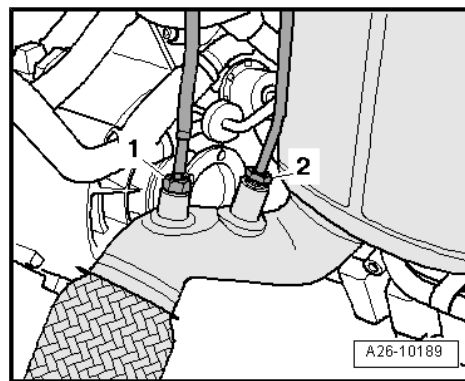
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**Note**

Disregard items -1- and -2-.

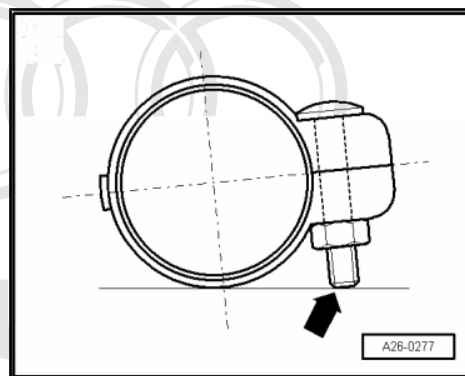
Fitting locations of components on underside of particulate filter

- 1 - Temperature sender after particulate filter - G527-
 - ◆ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
 - ◆ Tighten to 45 Nm.
- 2 - Pressure pipe going to exhaust gas pressure sensor 1 - G450-
 - ◆ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
 - ◆ Tighten union nut to 40 Nm.



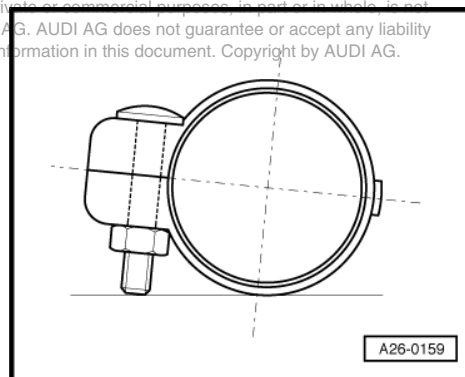
Installation position of front clamp

- Fit clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to right.



Installation position of rear clamp

- Fit clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to rear



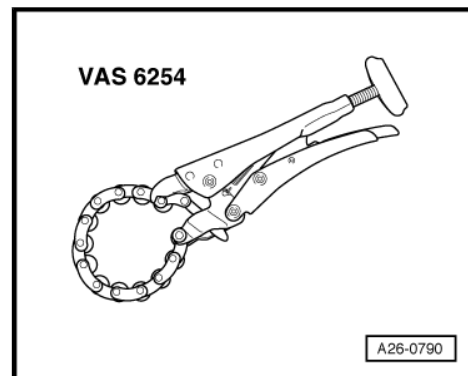
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1.2 Separating centre and rear silencers

- ◆ The connecting pipe can be cut through at the cutting point provided in order to renew the centre and rear silencers separately.
- ◆ The cutting point is marked by an indentation on the outside of the exhaust pipe.

Special tools and workshop equipment required

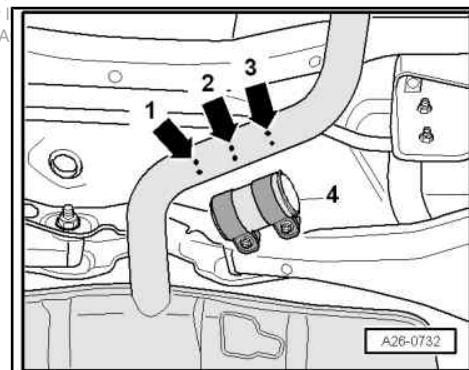
◆ Chain pipe cutter - VAS 6254-



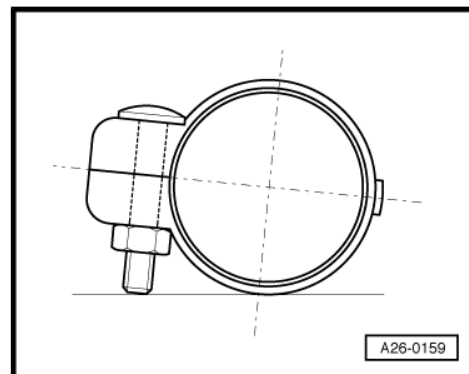
Procedure

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- Cut through exhaust pipe at a right angle at cutting point -arrow 2- using chain-type pipe cutter - VAS 6254- .
- When installing, position clamp -4- at marks -arrow 1- and -arrow 3- on side of exhaust pipe.



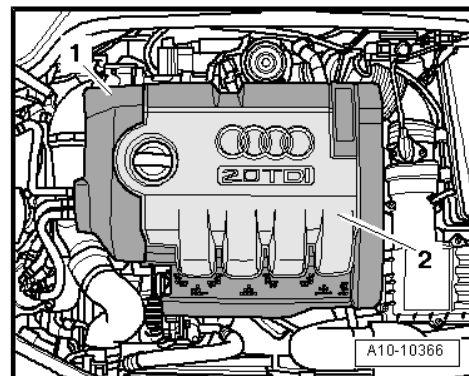
- Fit clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to rear
- Align exhaust system so it is free of stress ⇒ [page 235](#) .



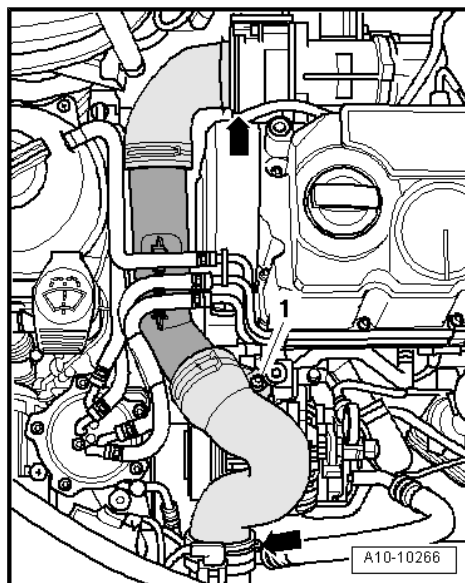
1.3 Removing and installing particulate filter

Removing

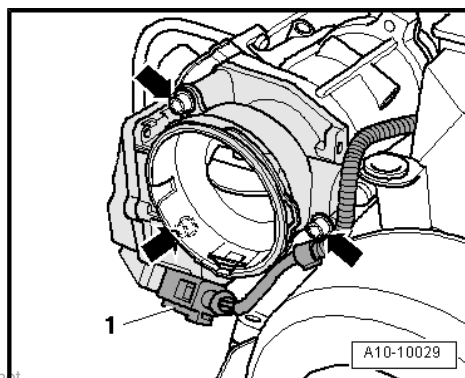
- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



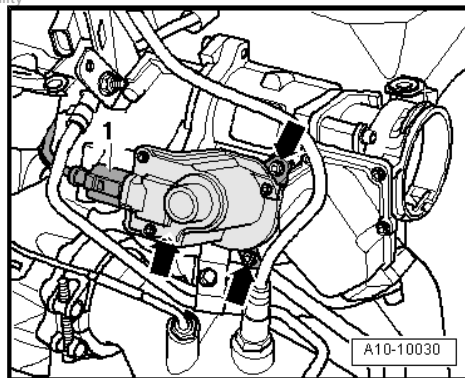
- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



- Detach electrical connector -1- at intake manifold flap motor - V157- .
- Remove bolts -arrows- and detach intake manifold flap motor - V157- .



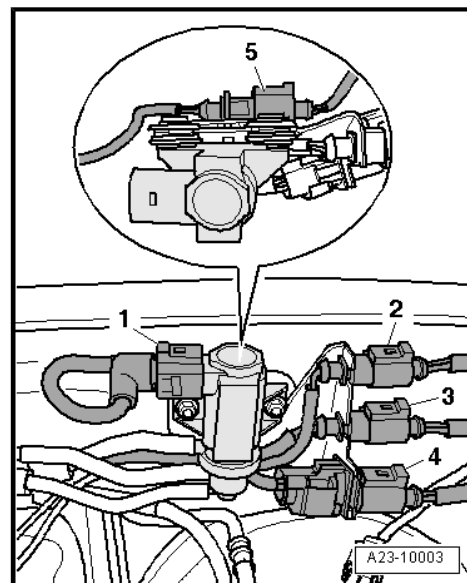
- Unplug electrical connector -1- at exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212- .
- Move electrical wiring harness clear.
- Remove bolts -arrows-.
- Detach exhaust gas recirculation valve - N18- at intake manifold.



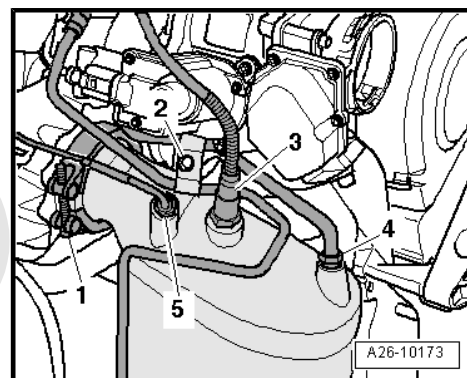
Note

Shown from rear with engine removed for illustration purposes.

- Unplug electrical connector -4- for Lambda probe - G39- .

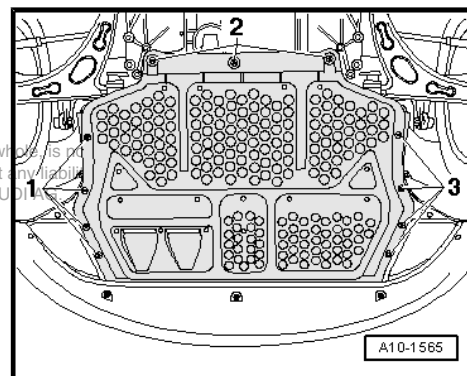


- Unscrew Lambda probe -3-.
- Remove temperature sender before particulate filter - G506- -item 5-.
- Unbolt bracket -2- for pressure pipes.
- Detach pressure pipe -4- at particulate filter.
- Slacken retaining clamp -1- for particulate filter.
- Detach retaining clamp.

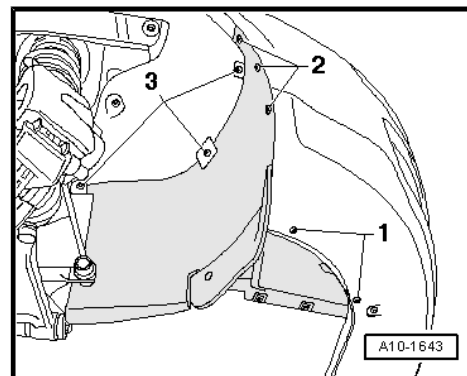


- Remove front right wheel.
- Remove centre noise insulation -fasteners 1 ... 3-.

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- Remove noise insulation (right-side) -fasteners 1 ... 3-.

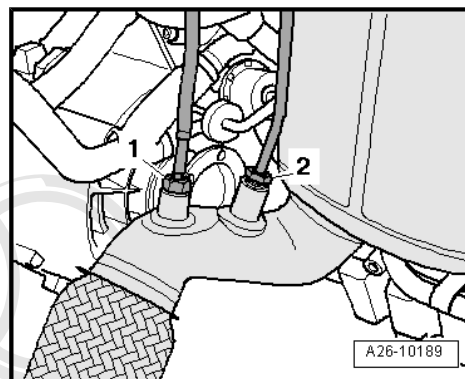


- Unscrew temperature sender after particulate filter - G527- -item 1- from exhaust pipe behind particulate filter.
- Unscrew pressure pipe -2- going to exhaust gas pressure sensor 1 - G450- .



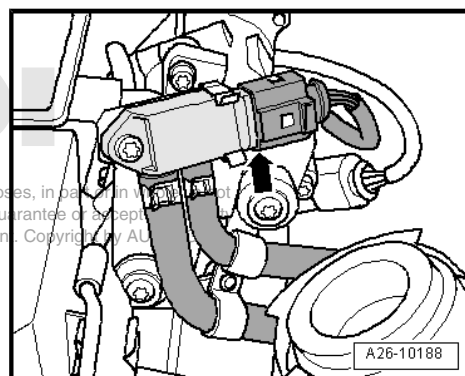
Note

The threaded connections are accessible through the wheel housing (right-side).



- Unplug electrical connector -arrow- at exhaust gas pressure sensor 1 - G450- .
- Unscrew exhaust gas pressure sensor 1 - G450- and detach together with pressure pipes.

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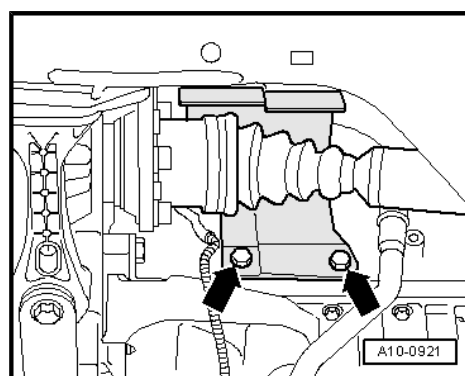
Vehicles with front-wheel drive:

- Unbolt heat shield -arrows- for drive shaft (right-side).
- Unbolt drive shaft (right-side) from gearbox flange.
- Push drive shaft (right-side) towards front of vehicle.



Note

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

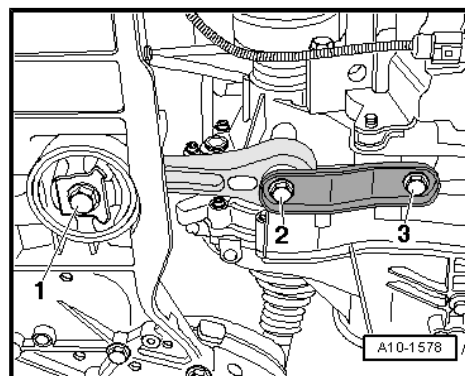


Vehicles with four-wheel drive:

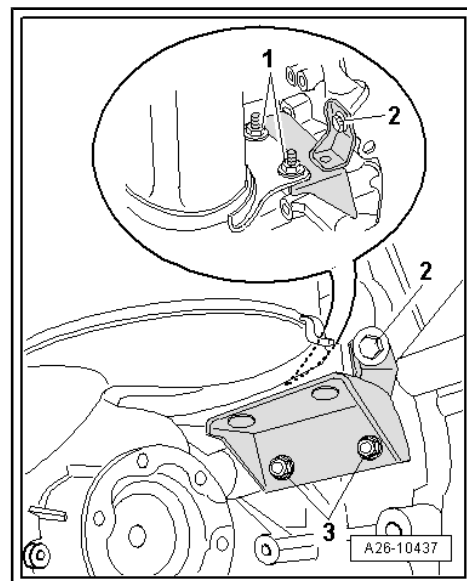
- Remove propshaft ⇒ Rear final drive 02D, 0AV and 0BR; Rep. gr. 39 .
- Remove bevel box ⇒ Rep. gr. 34 .

All vehicles (continued):

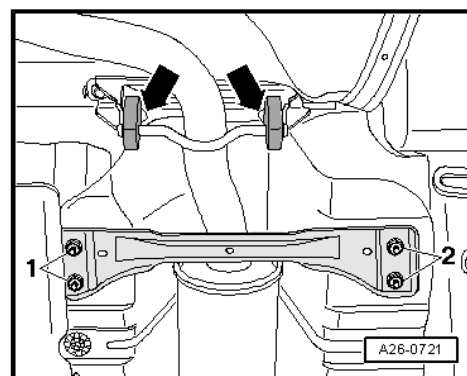
- Unscrew bolts -1 ... 3- and remove pendulum support.



- Remove nuts -1, 3- and bolt -2- and detach bracket for particulate filter.

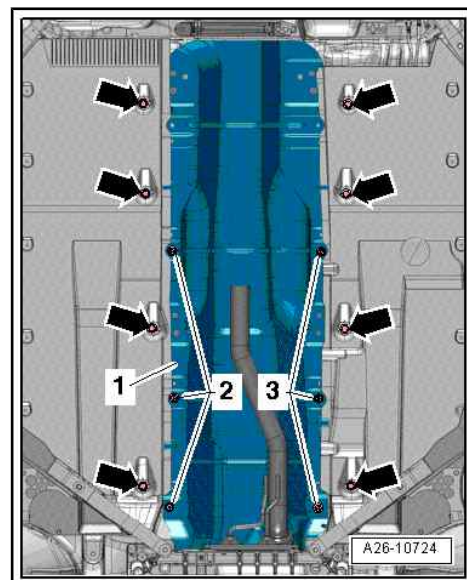


- Remove nuts -1- and -2- and detach rear cross member on vehicle underside.
- Disengage rear silencer and centre silencer at rubber mountings -arrows- and lower.



- Remove nuts -arrows- and lock washers -2- and -3-.

- Pull inner side of cover on vehicle underside down slightly until heat shield -1- for centre tunnel can be detached.



- Unbolt bracket for exhaust system -arrows-.
- Take out particulate filter: turn it 180° clockwise and at the same time push engine/gearbox assembly slightly forwards.

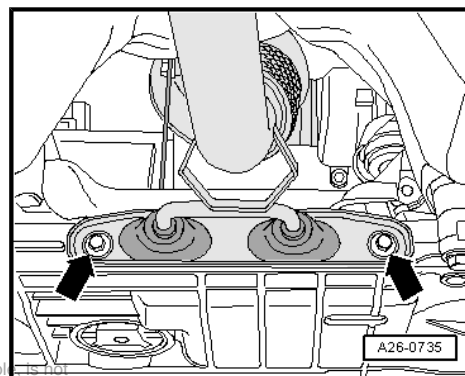
Installing

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



Note

- ◆ *Renew gaskets and self-locking nuts.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#).*
- ◆ *Fit all cable ties in the original positions when installing.*



- Install temperature sender after particulate filter - G527- ⇒ [page 241](#) .
- Install Lambda probe - G39- ⇒ Rep. gr. 23 .
- Install temperature sender before particulate filter - G506- ⇒ [page 239](#) .
- Install exhaust gas recirculation valve - N18- ⇒ [page 245](#) .
- Install intake manifold flap motor - V157- ⇒ Rep. gr. 23 .
- Install exhaust gas pressure sensor 1 - G450- ⇒ Rep. gr. 23 .
- Install pendulum support ⇒ Rep. gr. 34 .

Vehicles with four-wheel drive:

- Install bevel box ⇒ Rep. gr. 34 .
- Install propshaft ⇒ Rear final drive 02D, 0AV and 0BR; Rep. gr. 39 .

Vehicles with front-wheel drive:

- Install drive shaft ⇒ Rep. gr. 40 .

All vehicles (continued):

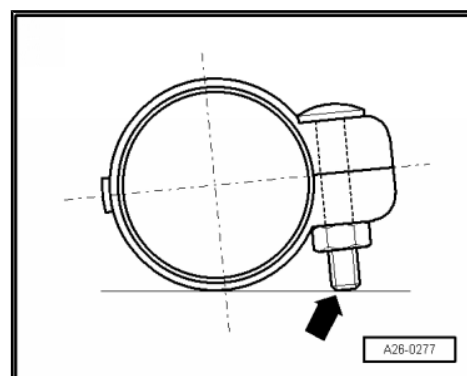
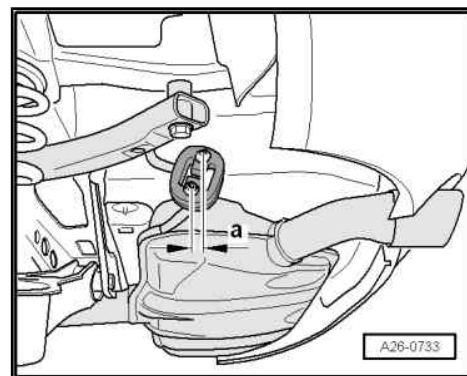
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Align exhaust system so it is free of stress ⇒ [page 235](#) .
- After renewing particulate filter, perform adaption in “Guided Functions” ⇒ Vehicle diagnostic tester

Tightening torques

Component	Nm
Bracket for exhaust system to subframe	23
Front exhaust pipe to turbocharger	7
Bracket for particulate filter to particulate filter	23
Heat shield to cylinder block	35
Underbody cross member (front) to body	23
Pressure pipe to particulate filter	40
Air pipe (right-side) to bracket	8

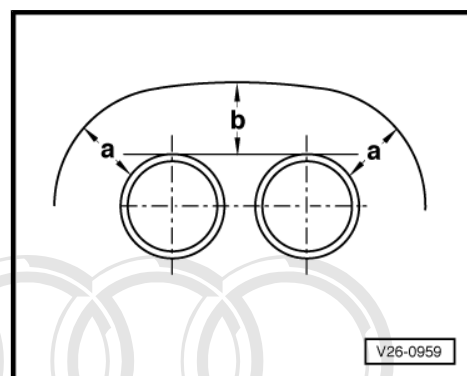
1.4 Stress-free alignment of exhaust system

- The exhaust system must be aligned when it is cool.
- Loosen bolt connections of front clamp
⇒ [Item 14 \(page 227\)](#).
- Push exhaust system towards front of vehicle so that rubber mounting for rear silencer is preloaded by dimension -a- = 15 ... 17 mm.
- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolt connection faces to right.
- Tighten bolt connections on clamp evenly to 25 Nm.



Aligning tailpipe

- Align rear silencer so that there is an equal distance -a- and -b- between bumper cut-out and tailpipes.
- If necessary, loosen mounting for rear silencer to adjust the tailpipes.



1.5 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Seal off tailpipes for duration of leak test with cloths or plugs, etc.
- Listen at joints between cylinder head/exhaust manifold, turbocharger/front exhaust pipe etc. to check for leaks.
- Repair any leaks that are found.

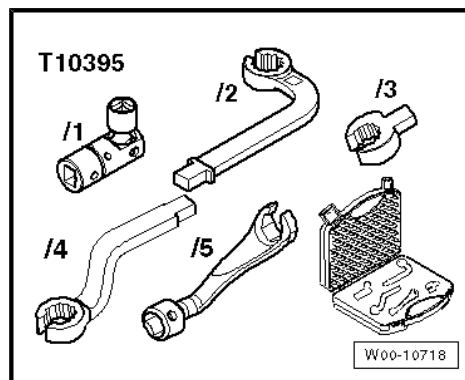
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2 Exhaust gas temperature control

2.1 Removing and installing exhaust gas temperature sender 1 - G235-

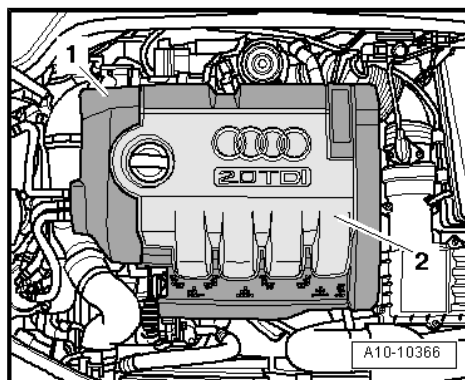
Special tools and workshop equipment required

- ◆ Tool set - T10395 A-

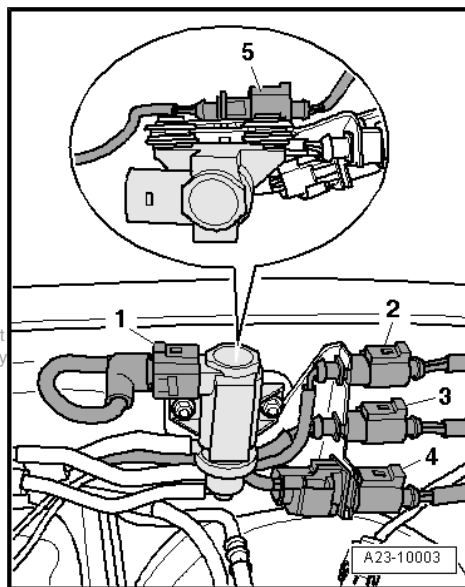


Removing

- Lift off outer engine cover panel -1- by pulling up evenly.

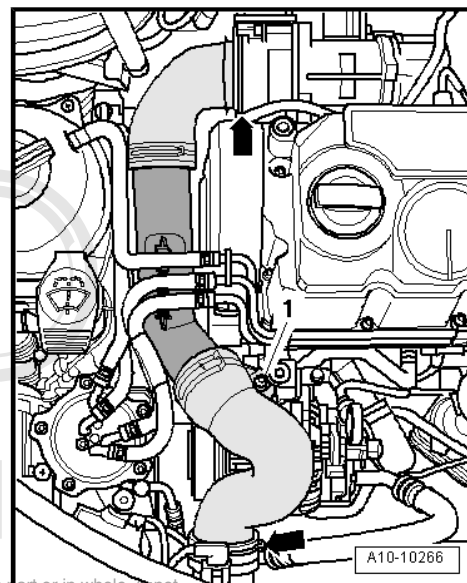


- Unplug electrical connector -3- at temperature sender before particulate filter - G506- and move wiring clear.

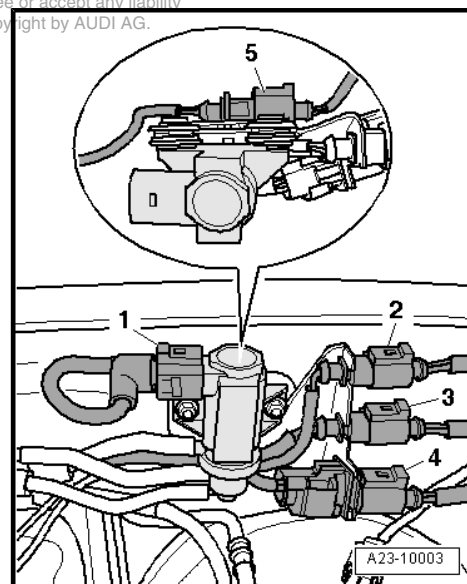


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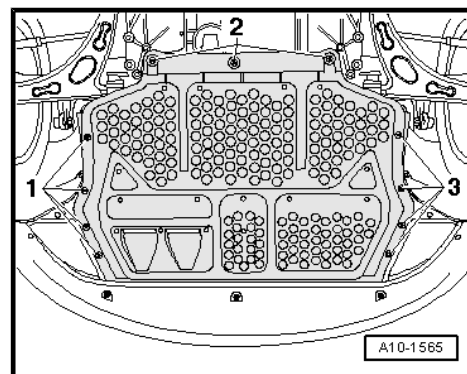
- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



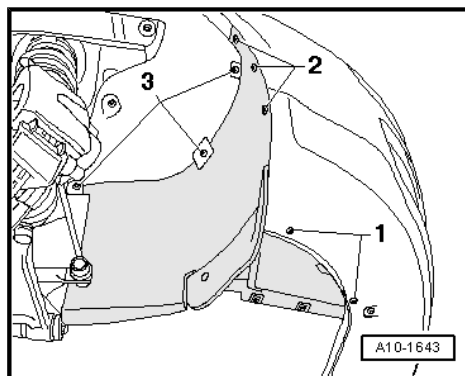
- Unplug electrical connector -2- for exhaust gas temperature sender 1 - G235- and move wiring clear.



- Remove front right wheel.
- Remove centre noise insulation -fasteners 1 ... 3-.



- Remove noise insulation (right-side) -fasteners 1 ... 3-.

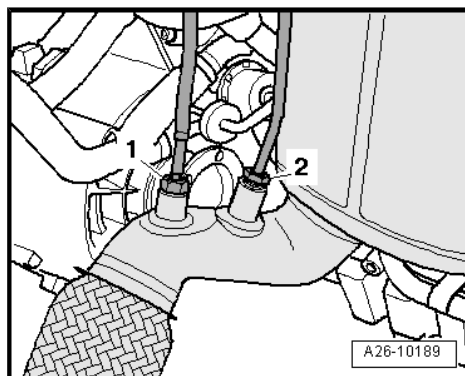


- Unscrew temperature sender after particulate filter - G527-
-item 1- from exhaust pipe behind particulate filter.

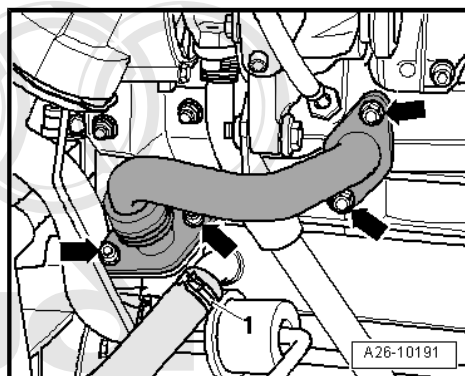


Note

- ◆ Disregard -item 2-.
- ◆ The threaded connections are accessible through the wheel housing (right-side).



- Unbolt connecting pipe going to exhaust gas recirculation cooler -arrows-.



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- Unscrew exhaust gas temperature sender 1 - G235- -arrow- from exhaust manifold.

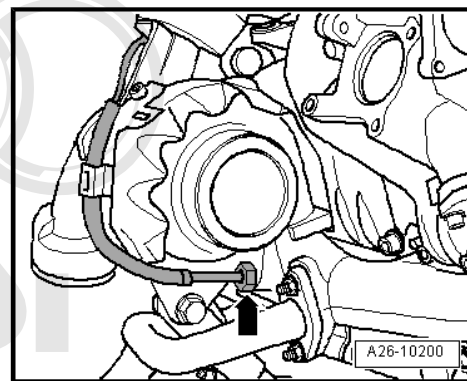
Installing

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



Note

- ◆ Coat threads of exhaust gas temperature sender 1 - G235- with high-temperature paste ⇒ *Electronic parts catalogue*.
- ◆ Fit all cable ties in the original positions when installing.



- Install temperature sender ~~after particulate filter~~ **G527** ⇒ [page 241](#) .
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .

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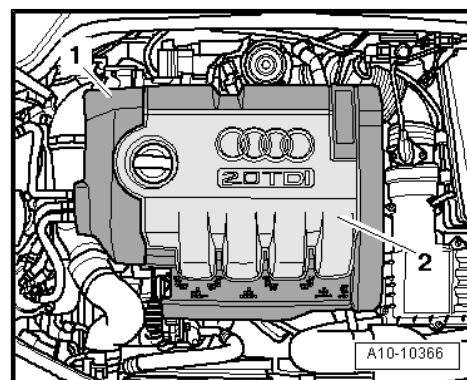
Tightening torques

Component	Nm
Exhaust gas temperature sender 1 - G235- to turbocharger	45
Pressure pipe to particulate filter	40
Air pipe (right-side) to bracket	8

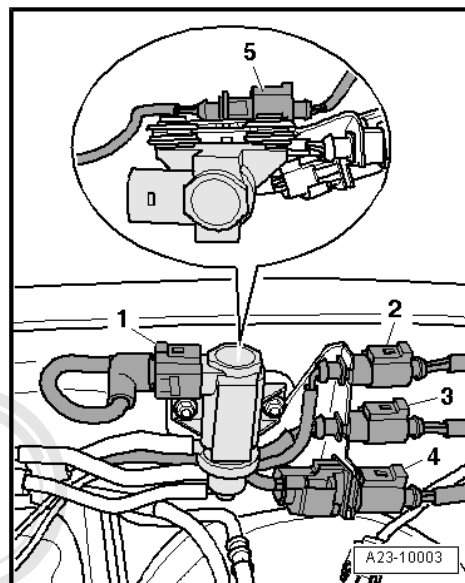
2.2 Removing and installing temperature sender before particulate filter - G506-

Removing

- Lift off outer engine cover panel -1- by pulling up evenly.

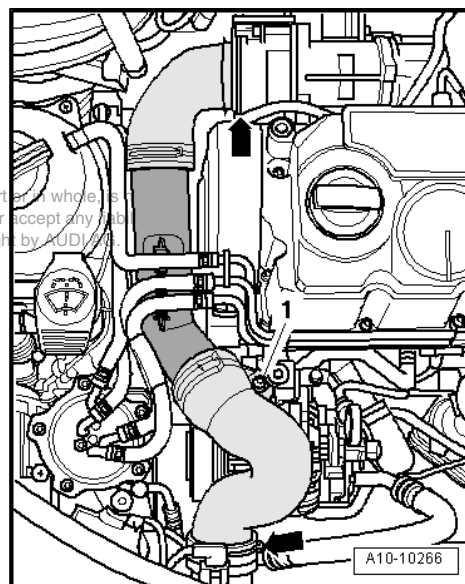


- Unplug electrical connector -3- at temperature sender before particulate filter - G506- and move wiring clear.



- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.

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- Remove temperature sender before particulate filter - G506- -item 5-.

**Note**

Disregard items marked -1 ... 4-.

Installing

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

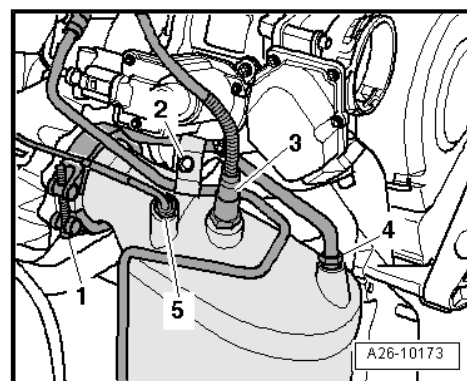
**Note**

- ◆ Coat threads of temperature sender before particulate filter - G506- with high-temperature paste ⇒ *Electronic parts catalogue*.
- ◆ Fit all cable ties in the original positions when installing.
- When installing, make sure that the angled end of temperature sender for particulate filter - G506- -item 5- points to left side of vehicle, as shown in illustration.
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#).

Tightening torques

Component	Nm
Temperature sender before particulate filter - G506- to particulate filter	45
Air pipe (right-side) to bracket	8

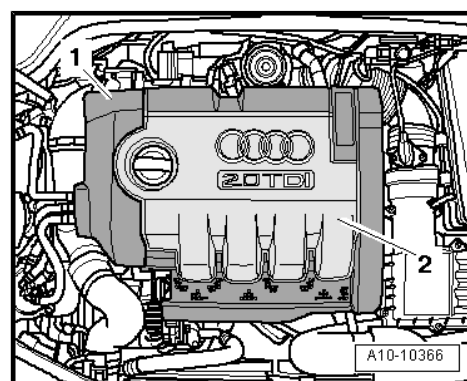
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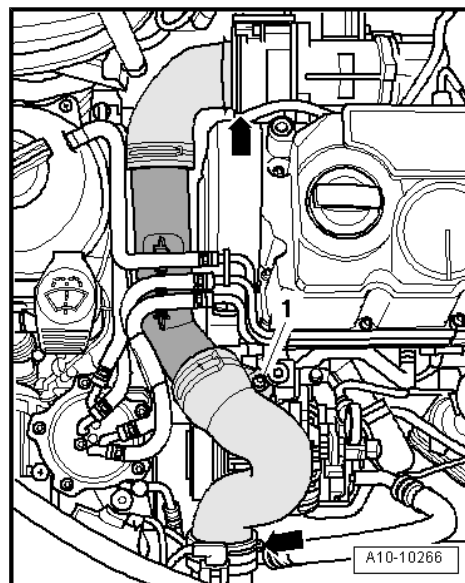
2.3 Removing and installing temperature sender after particulate filter - G527-

Removing

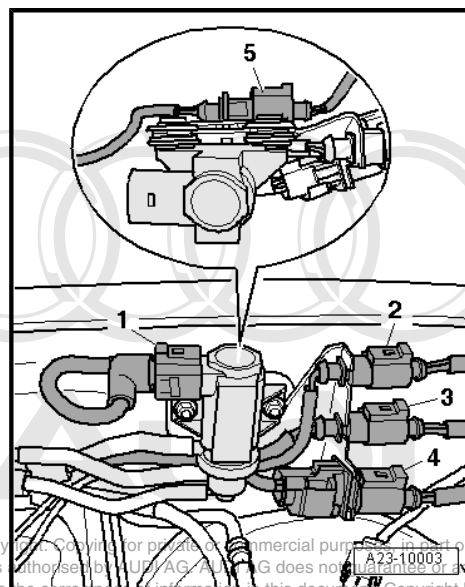
- Lift off outer engine cover panel -1- by pulling up evenly.



- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.

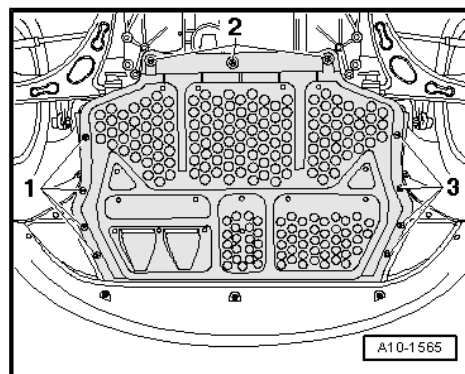


- Unplug electrical connector -2- for exhaust gas temperature sender 1 - G235- and move wiring clear.

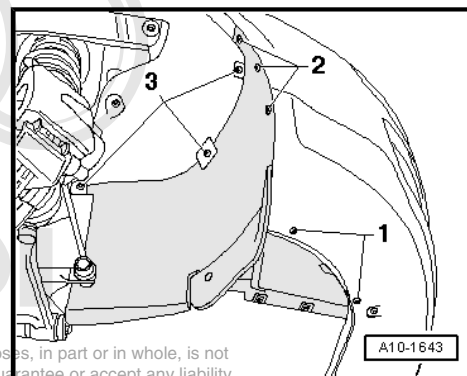


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- Remove front right wheel.
- Remove centre noise insulation -fasteners 1 ... 3-.



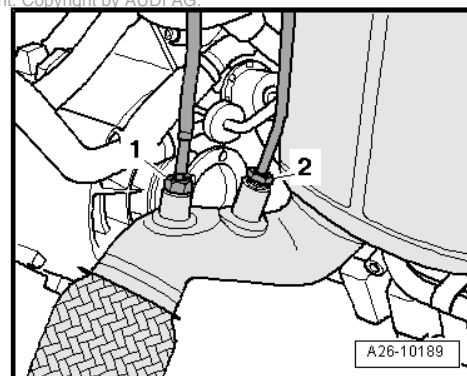
- Remove noise insulation (right-side) -fasteners 1 ... 3-



- Unscrew temperature sender after particulate filter - G527-
-item 1- from exhaust pipe behind particulate filter.

**Note**

- ◆ Disregard -item 2-.
- ◆ The threaded connections are accessible through the wheel housing (right-side).

**Installing**

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

**Note**

- ◆ Coat threads of temperature sender after particulate filter - G527- with high-temperature paste → *Electronic parts catalogue*.
- ◆ Fit all cable ties in the original positions when installing.
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#).

Tightening torques

Component	Nm
Temperature sender after particulate filter - G527- to particulate filter	45
Air pipe (right-side) to bracket	8

3 Exhaust gas recirculation system

To improve exhaust emission values, exhaust gas is recirculated to the combustion chambers, thus reducing the combustion chamber temperature. The cycle timing and the amount of recirculated exhaust gas is controlled by the exhaust gas recirculation valve - N18- , which is activated by the engine control unit. The position of the exhaust gas recirculation valve - N18- is transmitted back to the engine control unit by the exhaust gas recirculation potentiometer - G212- .

3.1 Exhaust gas recirculation system - exploded view

1 - 10 Nm

2 - Exhaust gas recirculation cooler

- ☐ Removing and installing
⇒ [page 248](#)

3 - O-ring

- ☐ Renew

4 - 10 Nm

5 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

- ☐ Removing and installing
⇒ [page 245](#)

6 - 22 Nm

7 - 10 Nm

8 - Intake manifold

- ☐ Removing and installing
⇒ Rep. gr. 23

9 - O-ring

- ☐ Renew

10 - Gasket

- ☐ Renew

11 - Connecting flange

12 - O-ring

- ☐ Renew

13 - Intake manifold connection with intake manifold flap motor - V157-

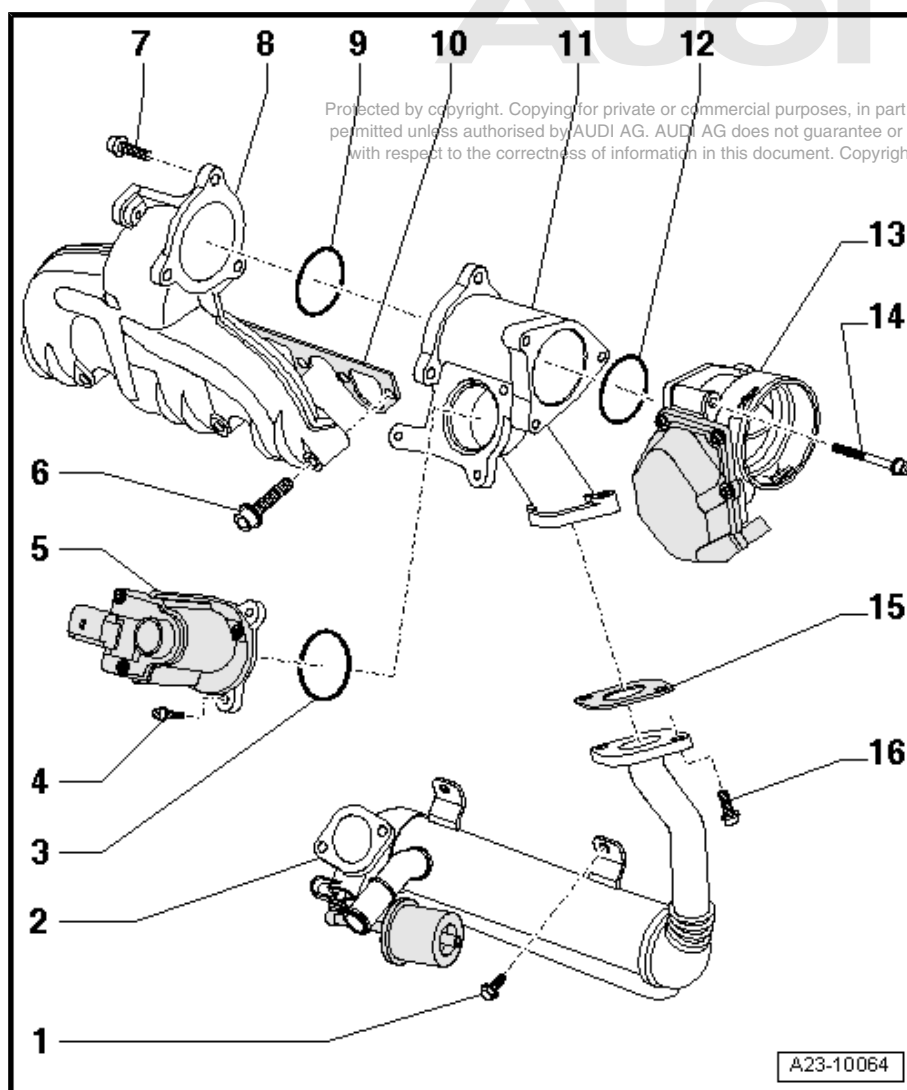
- ☐ Removing and installing
⇒ Rep. gr. 23

14 - 10 Nm

15 - Gasket

- ☐ Renew

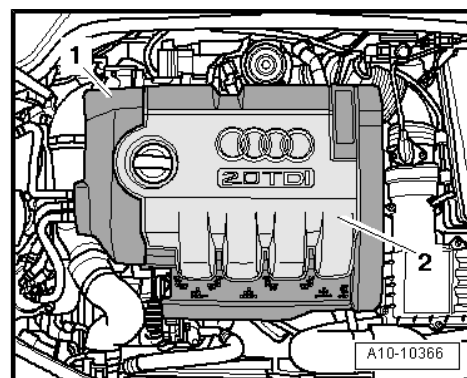
16 - 22 Nm



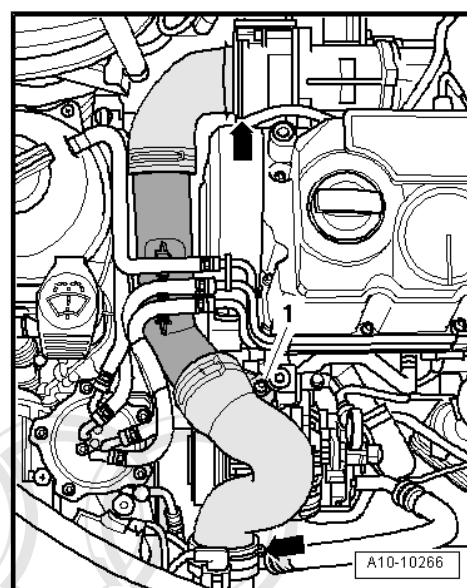
3.2 Removing and installing exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

Removing

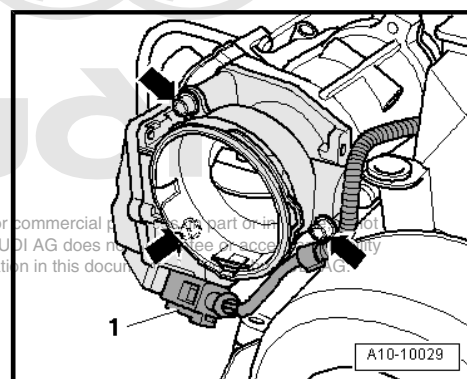
- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



- Unclip fuel and coolant hoses from air intake pipe (right-side).
- Remove bolt -1-.
- Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



- Detach electrical connector -1- at intake manifold flap motor - V157- .
- Remove bolts -arrows- and detach intake manifold flap motor - V157- .



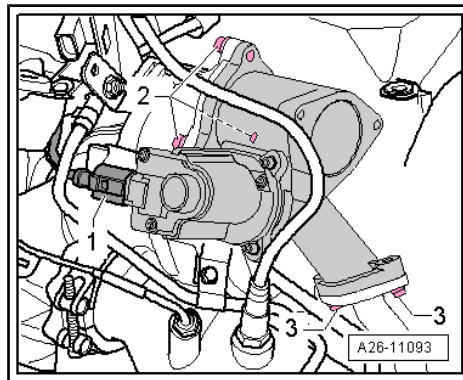
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- Unplug electrical connector -1- and move electrical wire clear.
- Remove bolts -3-.
- Remove bolts -2-.
- Take out exhaust gas recirculation valve - N18- with connecting flange.



Note

Shown from rear with engine removed for illustration purposes.



Installing

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



Note

Fit all cable ties in the original positions when installing.

- Install intake manifold flap motor - V157- ⇒ Rep. gr. 23 .
- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .

Tightening torques

⇒ [“3.1 Exhaust gas recirculation system - exploded view”, page 244](#)

3.3 Exhaust gas recirculation cooler

- ◆ To further improve the exhaust emission values, the exhaust gas recirculation system is equipped with a cooler that is connected into the engine cooling system.
- ◆ Under certain operating conditions, the flow of exhaust gas that is recirculated to the combustion chamber is routed via this cooler. The exhaust gas temperature is thereby reduced, further lowering the combustion temperature and improving the exhaust emission values.
- ◆ The engine control unit determines when the recirculated exhaust gas is routed via the cooler. The control unit actuates a vacuum unit via the exhaust gas cooler change-over valve - N345- which in turn operates the exhaust gas recirculation change-over flap.

Exploded view



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1 - Coolant hose

- ☐ To hose connection
- ☐ Diagram of coolant hose connections
⇒ [page 180](#)

2 - Gasket

- ☐ Renew

3 - 22 Nm**4 - Connecting pipe**

- ☐ For exhaust gas recirculation
- ☐ When installing, first tighten mountings finger-tight and then tighten to specified torque

5 - From exhaust manifold**6 - 25 Nm**

- ☐ Renew

7 - To connecting flange for intake manifold**8 - Exhaust gas recirculation cooler**

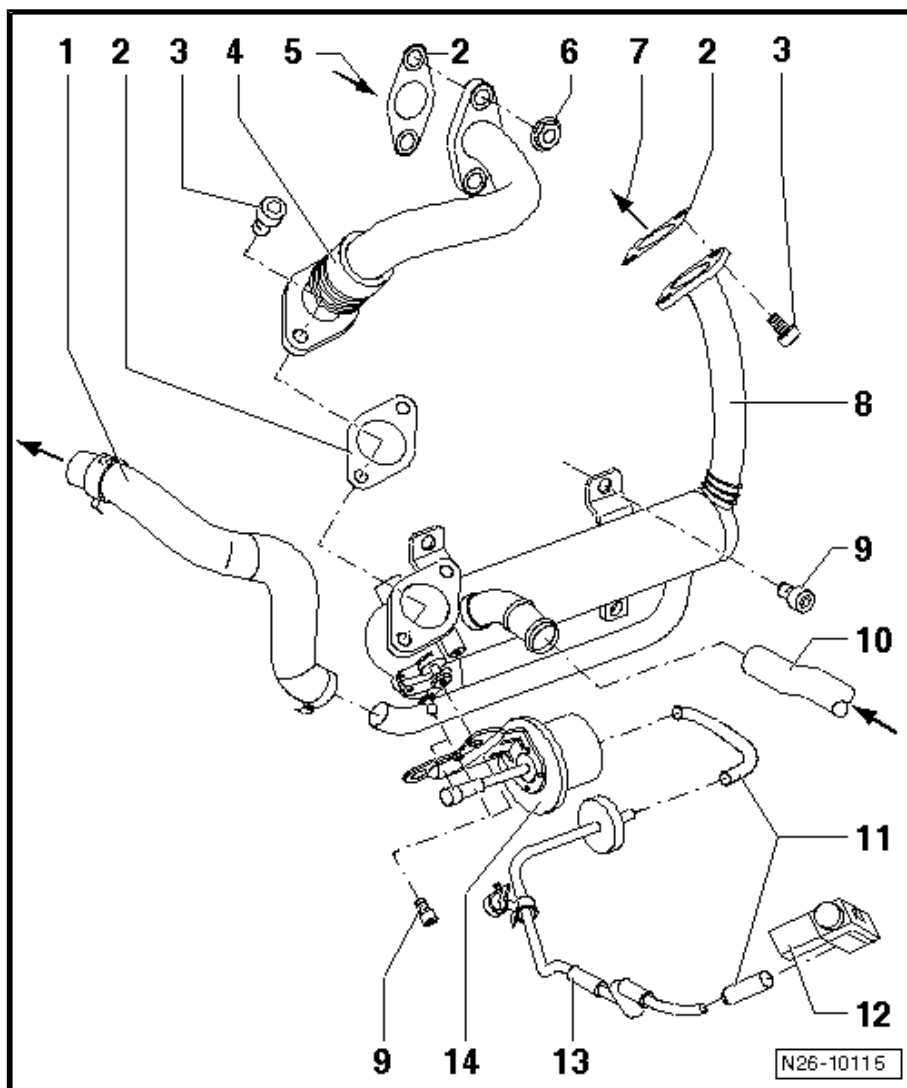
- ☐ With change-over flap
- ☐ Checking exhaust gas recirculation cooler change-over
⇒ [page 247](#)
- ☐ Removing and installing
⇒ [page 248](#)
- ☐ If renewed, change coolant in entire system

9 - 10 Nm**10 - Coolant hose**

- ☐ From coolant pipe (rear)
- ☐ Diagram of coolant hose connections ⇒ [page 180](#)

11 - Vacuum hose**12 - Change-over valve for exhaust gas recirculation cooler - N345-****13 - Vacuum pipe****14 - Vacuum unit**

- ☐ For bypass flap
- ☐ Only renew together with exhaust gas recirculation cooler

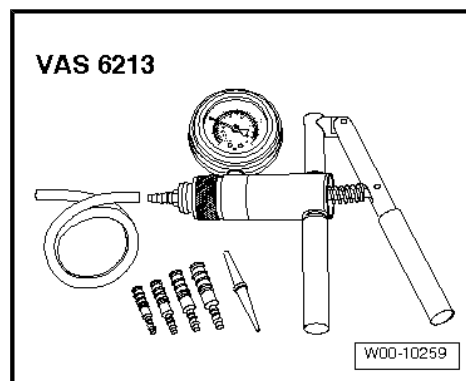


3.4 Checking exhaust gas recirculation cooler change-over

Special tools and workshop equipment required

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- ◆ Hand vacuum pump - VAS 6213-



Procedure



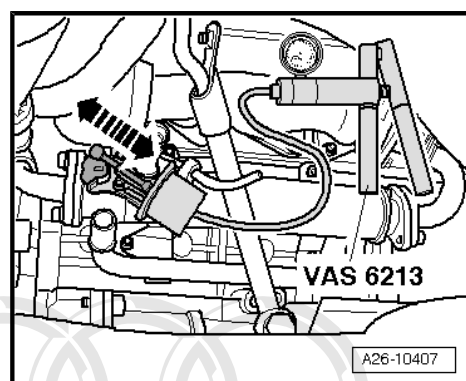
Note

The vacuum unit for the change-over flap is accessible from below.

- Detach vacuum hose at vacuum unit.
- Connect hand vacuum pump to vacuum unit.
- Operate hand vacuum pump.
- The linkage of the exhaust gas recirculation cooler change-over should move -arrows-.

If the linkage does not move or only moves jerkily:

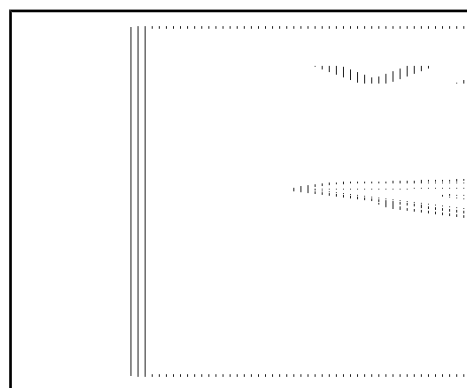
- ◆ The vacuum unit is defective.
- ◆ The change-over flap for the exhaust gas recirculation cooler is sticking.



3.5 Removing and installing exhaust gas recirculation cooler

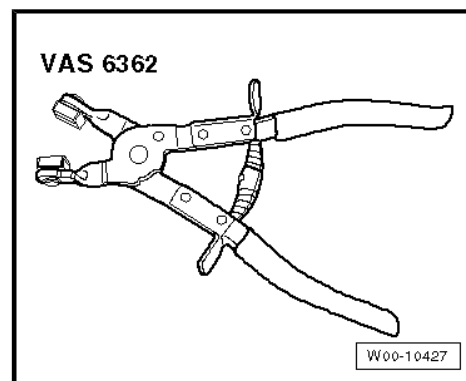
Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-



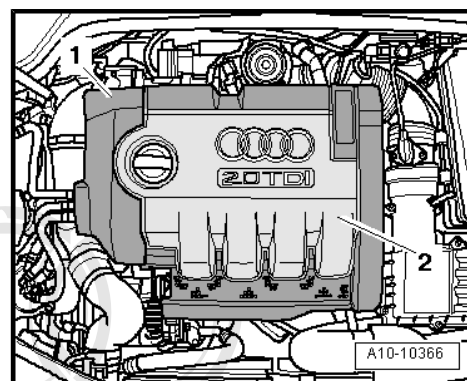
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- ◆ Hose clip pliers - VAS 6362-

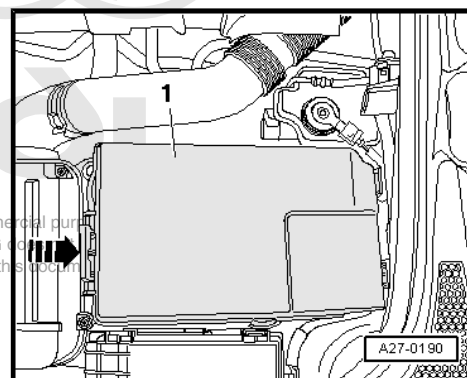


Removing

- Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



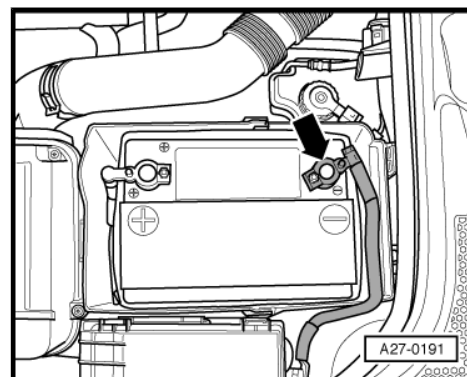
- Remove cover -1- over battery; to do so, press release tab -arrow-.



Caution

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

- With ignition switched off, disconnect battery earth cable -arrow-.

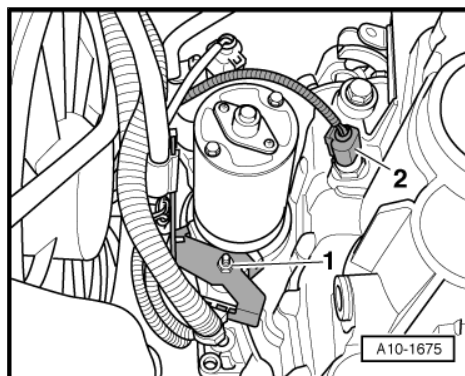


WARNING

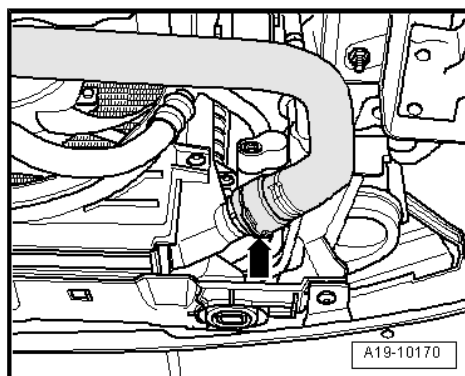
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Remove particulate filter ⇒ [page 229](#).

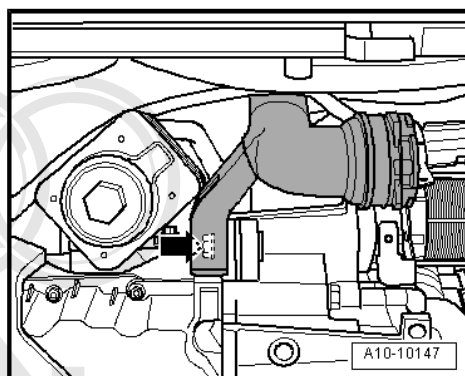
- Unscrew nut -1- and remove bracket with wiring from stud.
- Unclip bracket from wiring harness.



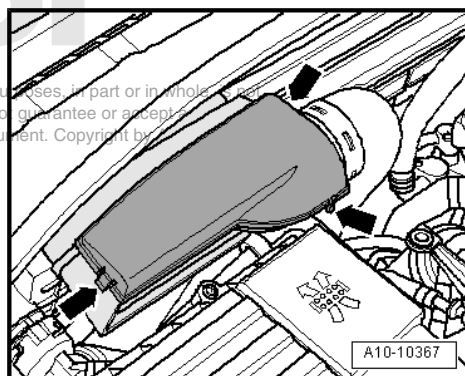
- Place drip tray for workshop hoist - VAS 6208- under engine.
- Lift retaining clip -arrow- and disconnect coolant hose from radiator.



- Remove bolt -arrow- for air intake pipe (front).

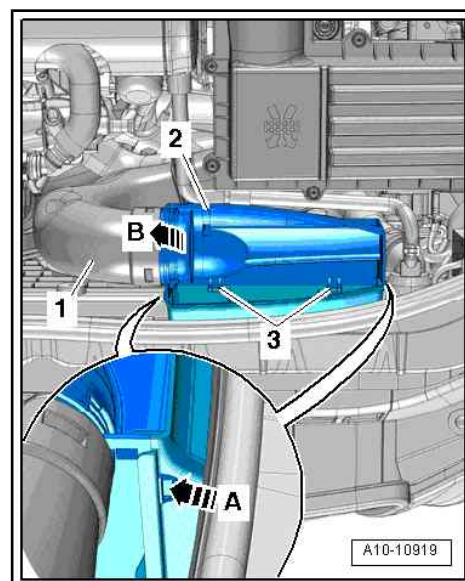


- Pull cover off air duct (release clips on sides) -arrows-.

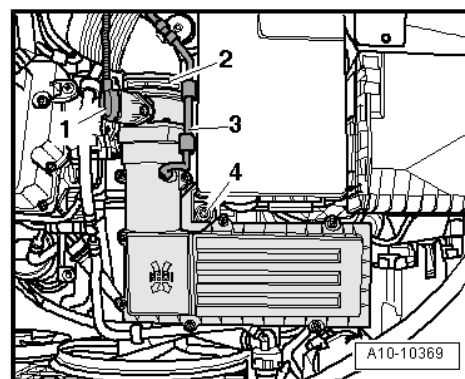


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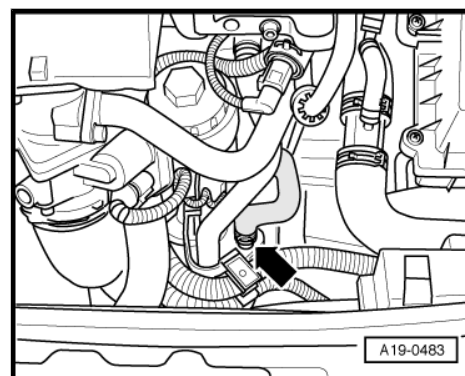
- Release clips on left and right -arrow A- and unclip air duct at bottom -2-.
- Swivel air duct (bottom) slightly to the rear and detach air duct (bottom) from retainers -3-.
- Detach air pipe -1- from air duct (bottom) -arrow B-.



- Unplug electrical connector -1- at air mass meter - G70- .
- Detach vent hose -3- and air hose -2-.
- Unscrew bolt -4- and remove air cleaner housing.

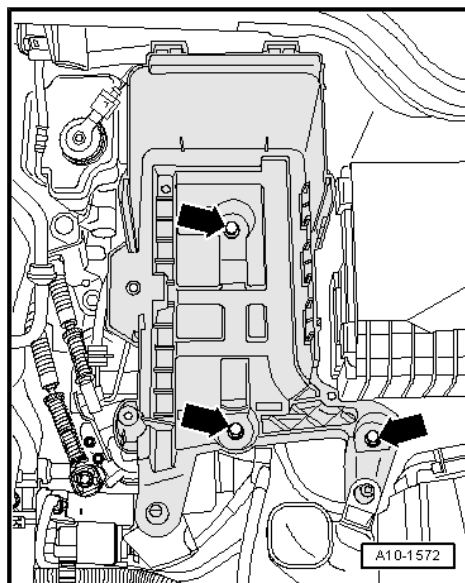


- Disconnect coolant hose at bottom of engine oil cooler -arrow- and drain off remaining coolant.

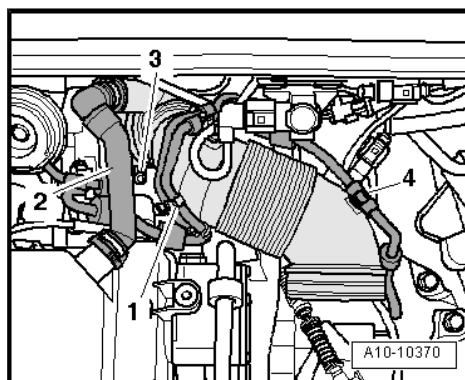


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- Remove battery ⇒ Rep. gr. 27 .
- Remove battery tray -arrows-.



- Detach crankcase breather hose -2-.
- Move vent hose -4- and vacuum hoses -1- clear at air intake hose.
- Remove bolt -3-.
- Swing air hose to rear and detach from turbocharger.

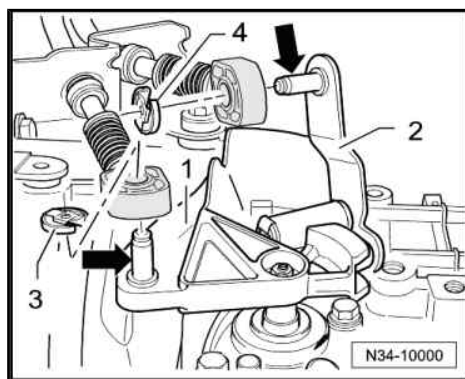


Vehicles with manual gearbox:

- Detach securing clip -3- for gear selector cable from gearbox selector lever -1- and pull cable off pin -arrow-.

Metal relay lever:

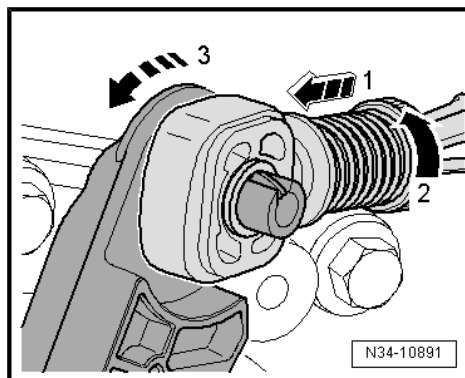
- Detach securing clip -4- for gate selector cable from relay lever -2- and pull cable off pin -arrow-.



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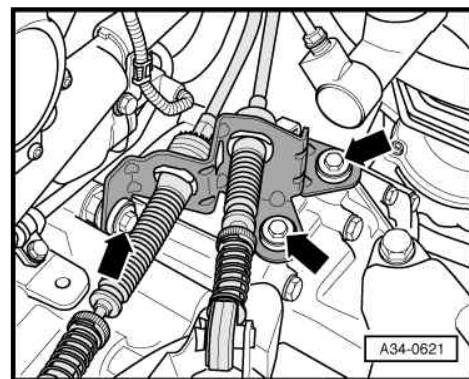
Plastic relay lever:

- To prevent damage to gate selector cable, cable end-piece must be detached from gate selector cable before removing.
- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press gate relay lever towards front -arrow 3-.

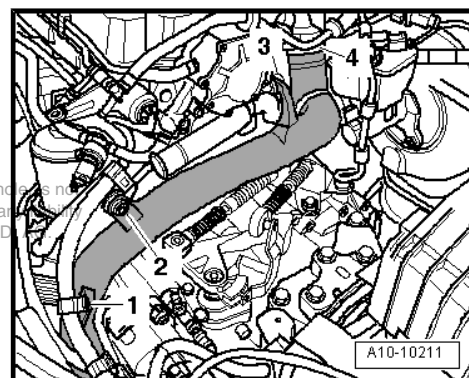


Vehicles with manual gearbox (continued):

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

**All vehicles (continued):**

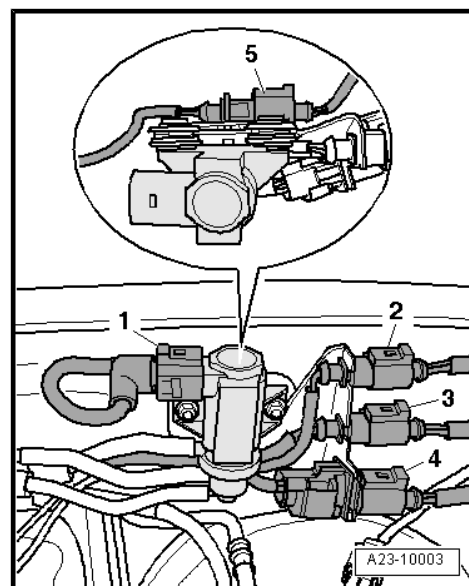
- Remove bolts -arrows-.
- Detach air pipe (left-side) from turbocharger by lifting retaining clips -arrows- slightly.
- Remove air pipe from engine compartment downwards.



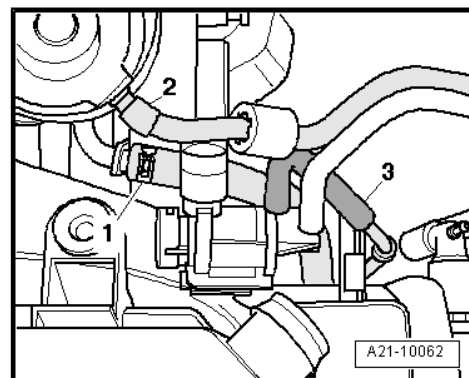
- Unplug electrical connector -2- for exhaust gas temperature sender 1 - G235-.

**Note**

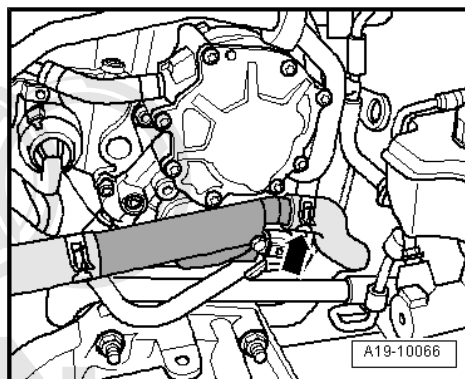
Disregard -items 1, 2, 4-.



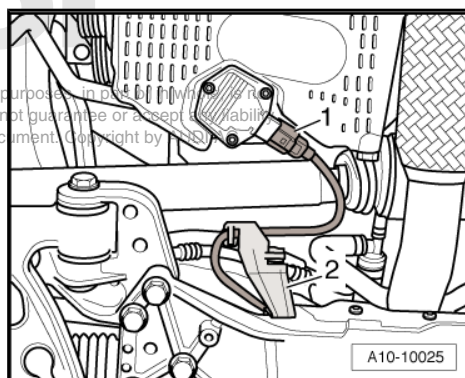
- Detach vacuum hose -2- from vacuum unit for charge pressure control.
- Detach vacuum hose -3- from line going to vacuum unit for change-over flap for exhaust gas recirculation.
- Detach oil supply hose -1- from turbocharger.



- Detach coolant hose -arrow- at coolant hose/pipe connection.

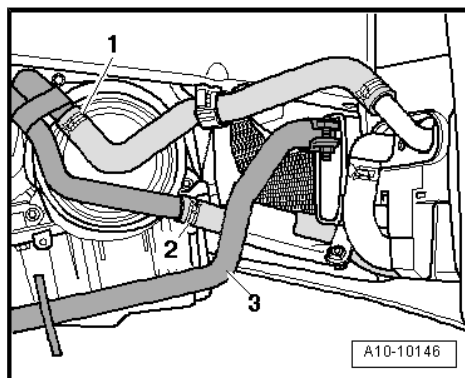


- Unplug electrical connector -1- at oil level and oil temperature sender - G266- .
- Unclip bracket -2- at subframe.



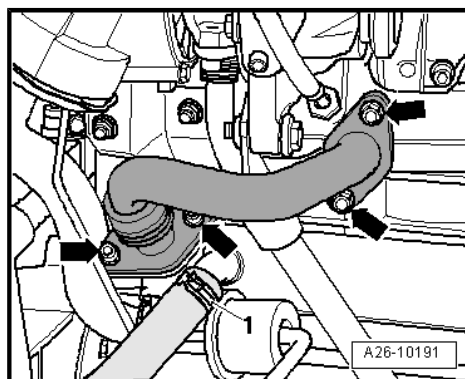
Vehicles with auxiliary heater:

- Remove exhaust pipe -3- for auxiliary heater ⇒ Rep. gr. 82 .
- Disconnect coolant pipes going to auxiliary heater from cylinder block together with coolant hoses -1- and -2-.



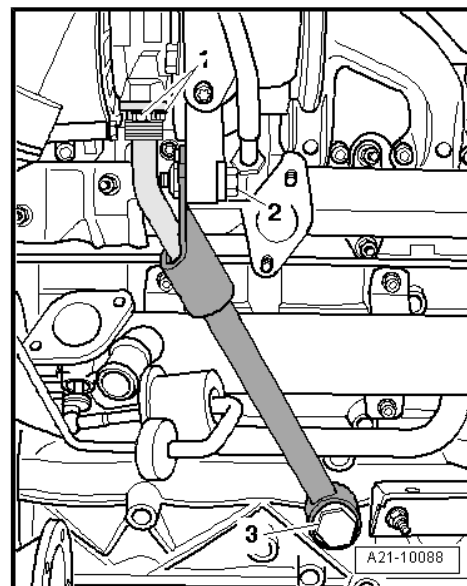
All vehicles (continued):

- Place drip tray for workshop hoist - VAS 6208- under engine.
- Detach coolant hose -1- at exhaust gas recirculation cooler.
- Unbolt connecting pipe going to exhaust gas recirculation cooler -arrows-.



Vehicles with front-wheel drive:

- Remove nuts -1-, bolt -2- and banjo bolt -3-.
- Remove support for turbocharger together with oil return line.



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All vehicles (continued):

- Unbolt bracket -2- for particulate filter.
- Detach vacuum line -1- from vacuum unit for change-over flap for exhaust gas recirculation.
- Remove vacuum pipe.
- Remove bolts -arrows- and take off exhaust gas recirculation cooler.

Installing

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



Note

- ◆ *Renew gaskets, seals and self-locking nuts.*
- ◆ *Fill turbocharger with engine oil at connection for oil supply line.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

Vehicles with manual gearbox

- Attach and adjust selector mechanism at gearbox ⇒ Rep. gr. 34 .

All vehicles (continued):

- Install particulate filter ⇒ [page 229](#) .

Vehicles with auxiliary heater:

- Install exhaust pipe for auxiliary heater ⇒ Rep. gr. 82 .

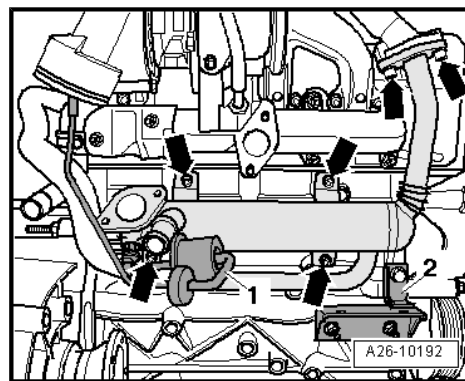
All vehicles (continued):

- Install air pipes/hoses with plug-in connectors ⇒ [page 220](#) .
- Install battery ⇒ Rep. gr. 27 .
- Check oil level ⇒ Maintenance ; Booklet 808 .
- Connect coolant hose to radiator ⇒ [page 197](#) .
- Fill up with coolant ⇒ [page 183](#) .



Note

After installing turbocharger, allow engine to idle for approx. 1 minute and do not rev up immediately to ensure turbocharger is supplied with oil.



Tightening torques

Component		Nm
Oil return line to turbocharger		15
Exhaust gas recirculation cooler to:	Intake manifold	22
	Cylinder block	10
Support for turbocharger to:	Turbocharger	25
	Cylinder block	60
EGR connecting pipe to:	Exhaust gas recirculation cooler	22
	Exhaust manifold	25
Underbody cross member (front) to body		23
Air pipe (left-side) to bracket		8

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