Workshop Manual
Audi A3 2004 ➤

4-cylinder TDI unit injector engine (2.0 ltr. 4-valve), mechanics									
Engine ID	BKD	AZV	BMN	BUY					

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

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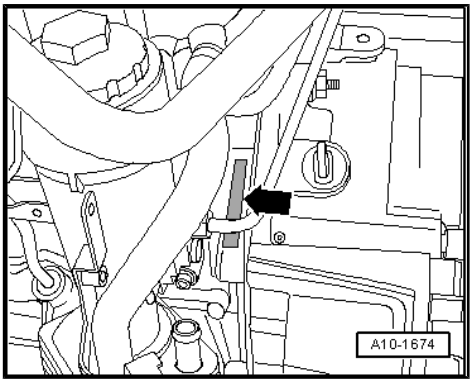
00 – Technical data

1 Engine number

The engine number (“Engine code” and “Serial number”) -arrow- 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		AZV	BKD
Capacity	ltr.	1.968	1.968
Power output	kW at rpm	100/4000	103/4000
Torque	Nm at rpm	320/1750 … 2500	320/1750 … 2500
Bore	∅ in mm	81.0	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
Emissions standard		EU4	EU4
Exhaust gas recirculation		yes	yes
Turbocharging/supercharging		Turbocharger	Turbocharger
Charge air cooling		yes	yes
Lambda control		no	no
Particulate filter		no	no
Valves per cylinder		4	4

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Code letters		BMN	BUY
Capacity	ltr.	1.968	1.968
Power output	kW at rpm	125/4200	120/4200
Torque	Nm at rpm	350/1800	350/1800
Bore	∅ in mm	81.0	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
Emissions standard		EU4	EU4
Exhaust gas recirculation		yes	yes
Turbocharging/supercharging		Turbocharger	Turbocharger
Charge air cooling		yes	yes
Lambda control		yes	yes
Particulate filter		yes	yes
Valves per cylinder		4	4
Emissions standard		EU4	EU4

3 Safety precautions

3.1 Working on the fuel system

When working on the fuel system note the following warnings:

WARNING

Risk of injury - fuel system operates under pressure.

-
- *Wrap a cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*

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

-
- *In extreme cases the temperature of the fuel lines and the fuel can be up to 100 °C after the engine is switched off. 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 engine control unit if electrical connectors were unplugged and the engine was started: “Interrogate fault memory” in “Vehicle self-diagnosis” ⇒ Vehicle diagnostic tester .

Caution

To prevent 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 .

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3.2 Working on the cooling system

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 expansion tank with cloth and open carefully.*

Caution

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

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

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3.3 Using testers and measuring instruments during a road test

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

WARNING

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

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

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

3.4 Working on the exhaust system

When working on the exhaust system please note the following:

Caution

Avoid damage to flexible joint.

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

4 General repair instructions

4.1 Different types of glow plugs

Two different types of glow plugs are installed in the 4-cylinder 2.0 ltr. 4-valve TDI engine in Audi A3 vehicles:

Engine codes AZV, BKD:

- These engines are fitted exclusively with metal glow plugs.

Engine codes BMN, BUY:

- These engines are fitted exclusively with NGK ceramic glow plugs.

Note

NGK ceramic glow plugs are colour-coded with a white, or possibly "silver-coloured" seal.

4.2 Handling ceramic glow plugs

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 diagnosis, testing and information system VAS 5051.*
- *The ceramic glow plugs must not be removed when checking cylinder compression.*

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

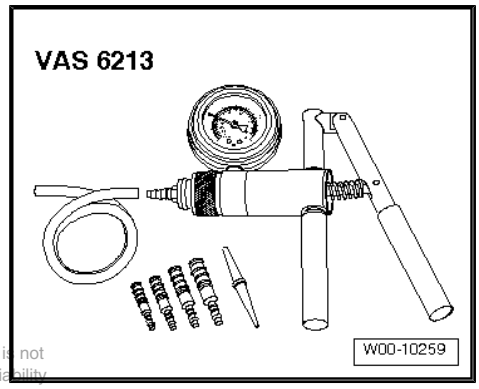
Even small amounts of dirt can cause malfunctions. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

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

4.4 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



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Procedure

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

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

– If a fault is stored in the fault memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines in the system.

– If it is not possible to build up pressure with the hand vacuum pump -VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

4.5 Routing and attachment of pipes, hoses and wiring

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

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4.6 Checking fuel system for leaks

– Allow engine to run for several minutes at moderate rpm.

– Switch off ignition.

– Check complete fuel system for leaks.

– If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.

– Road-test vehicle and accelerate with full throttle at least once.

– Then inspect high-pressure section of fuel system again for leaks.

4.7 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.

4.8 Installing radiators, condensers and charge air coolers

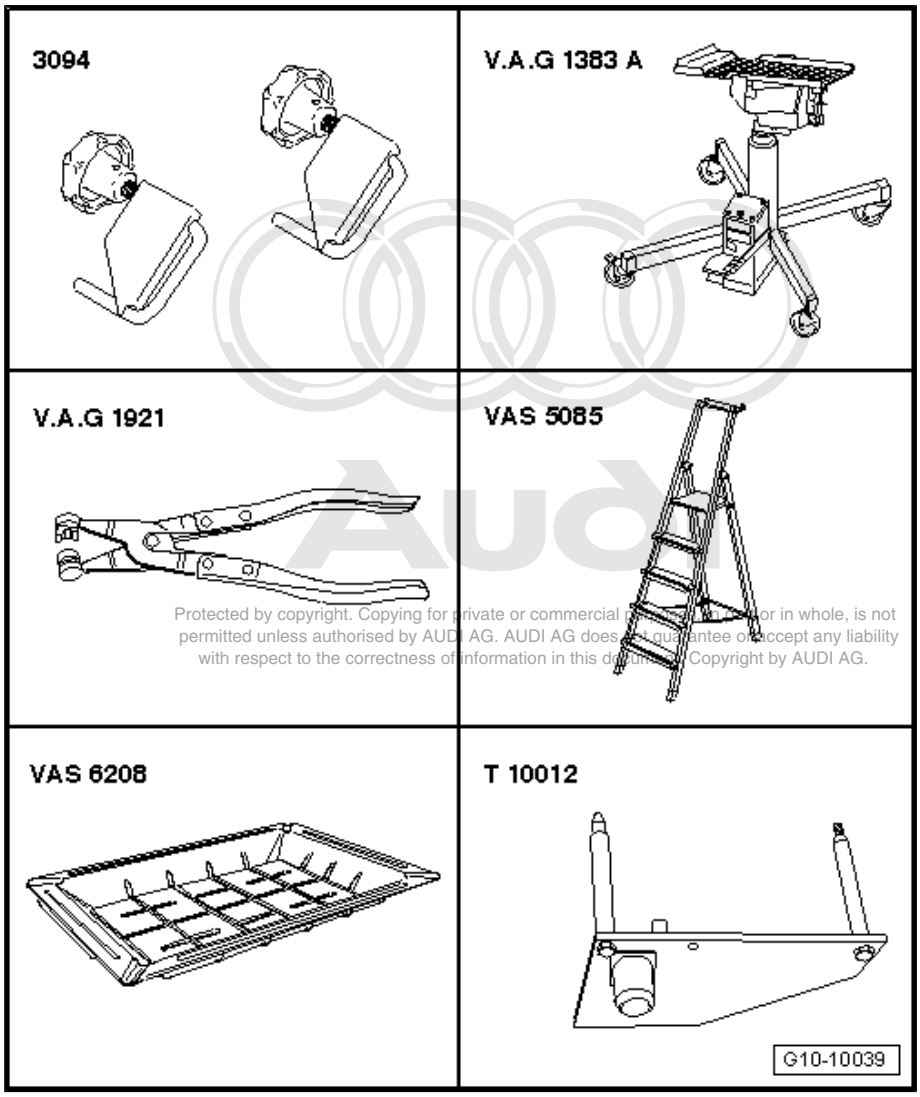
Even when the radiator, condenser and charge air cooler are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator, condenser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

10 – Removing and installing engine

1 Removing engine - vehicles with engine codes AZV, BKD

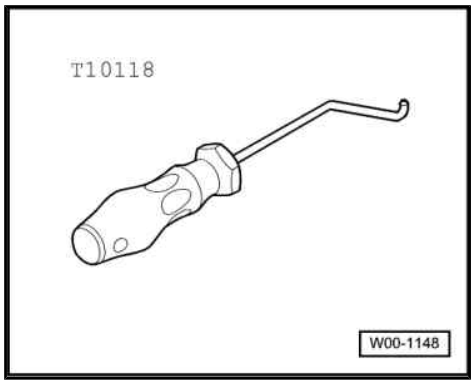
Special tools and workshop equipment required

- Hose clamps, up to 25 mm -3094- (only for vehicles with manual gearbox)
- Engine and gearbox jack -V.A.G 1383 A-
- Hose clip pliers -V.A.G 1921-
- Stepladder -VAS 5085-
- Drip tray for workshop hoist -VAS 6208-
- Engine bracket -T10012-



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- Assembly tool -T10118-



- Safety goggles
- Protective gloves

Procedure

Note

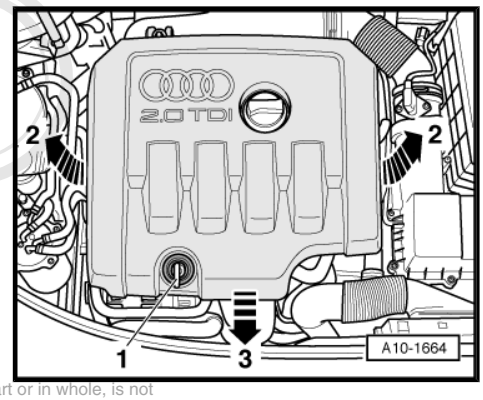
- *The engine is removed from underneath together with the gearbox.*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *Collect drained coolant in a clean container for re-use or disposal.*

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

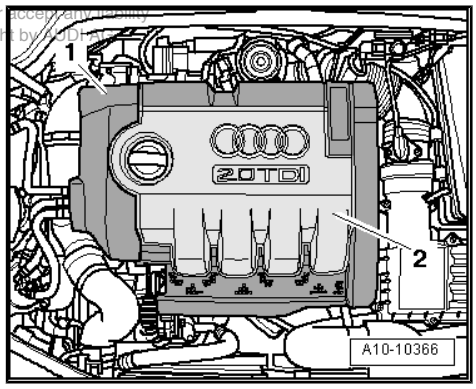
– Re-insert dipstick in guide tube.



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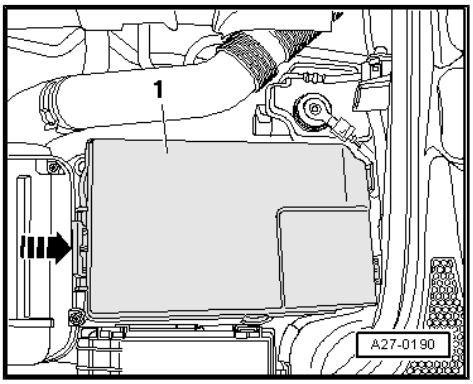
Engine cover panel (version 2):

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



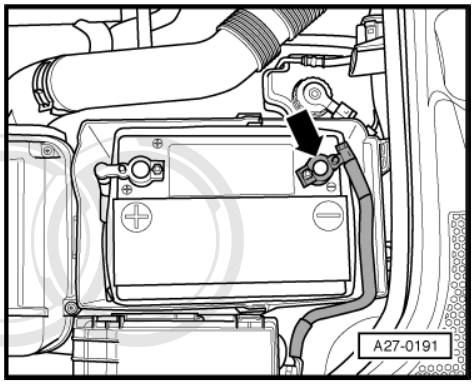
All vehicles (continued):

– 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-.

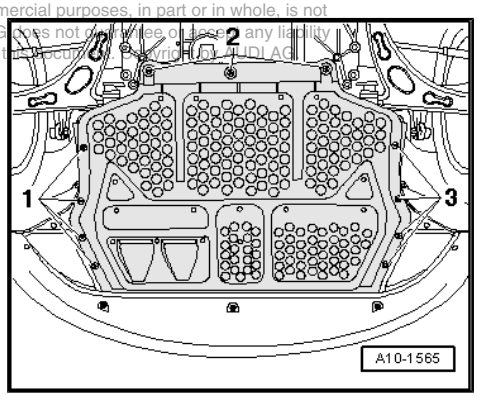
WARNING

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

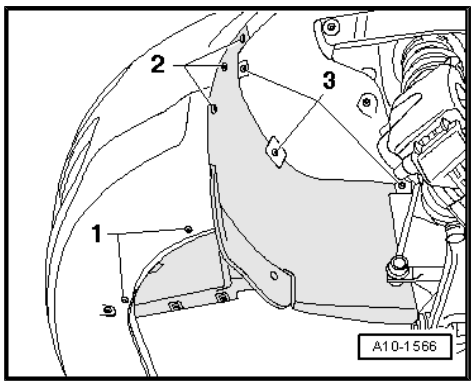
– Open filler cap on coolant expansion tank.

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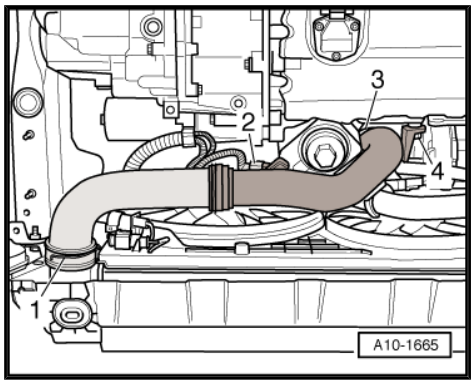
– Remove both front wheels.
– Remove centre noise insulation -fasteners 1 ... 3-.



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



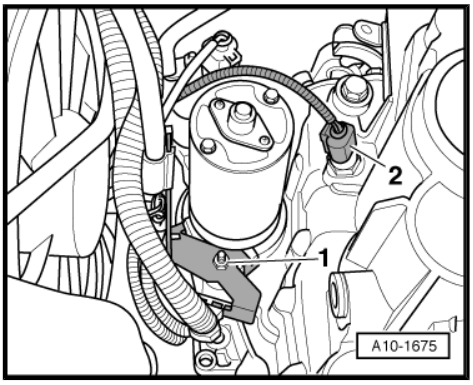
– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolt -4-.
– Remove front air pipe with air hose by lifting retaining clips slightly -1- and -3-.



Vehicles with manual gearbox:

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

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

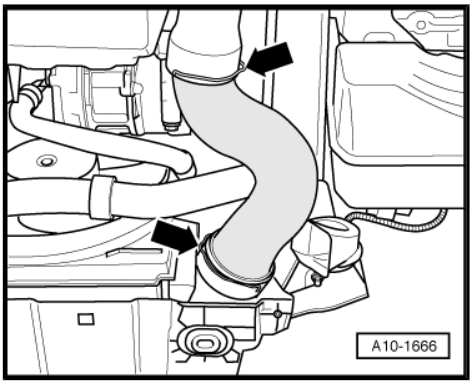


All vehicles (continued):

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

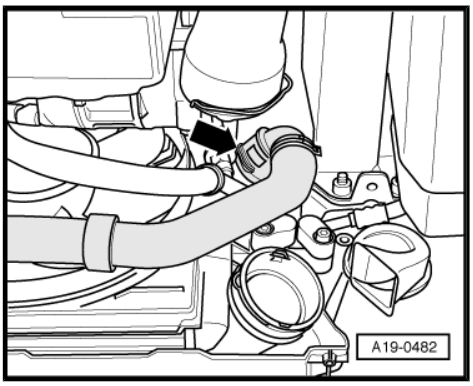
Caution

Seal opening of charge air cooler with a piece of clean foam or similar to prevent coolant from entering.



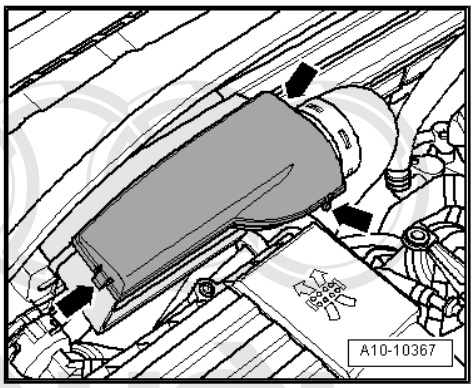
– Place drip tray for workshop hoist -VAS 6208- under engine.

– Pull out retaining clip at the bottom -arrow-, disconnect coolant hose from radiator and drain off coolant.



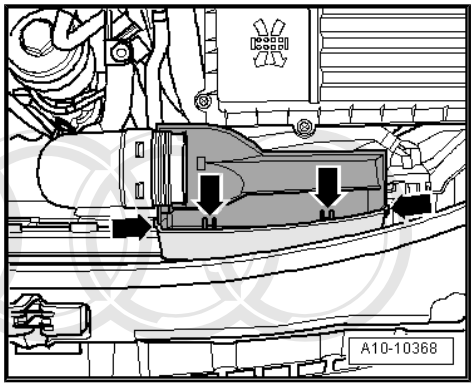
– Remove engine compartment seal from lock carrier and wing panel flanges.

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

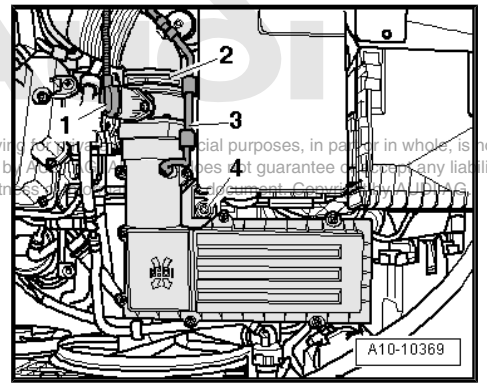


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– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.

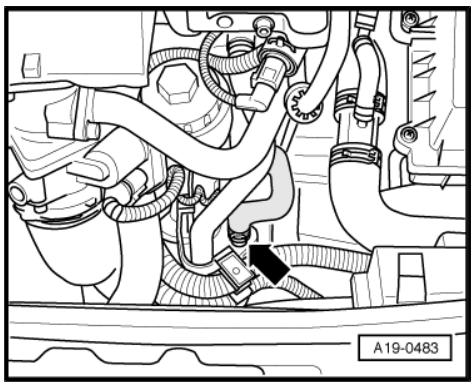


– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.

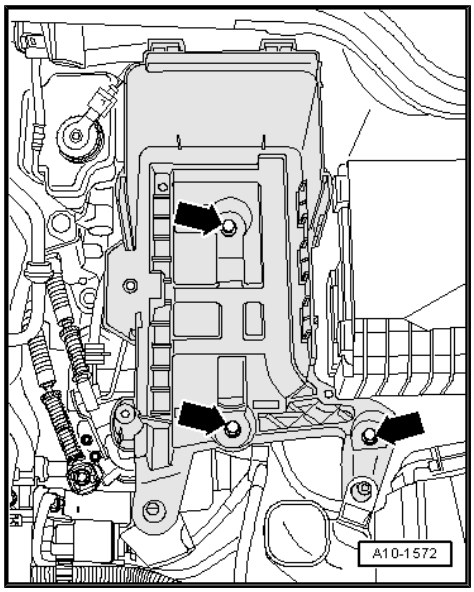


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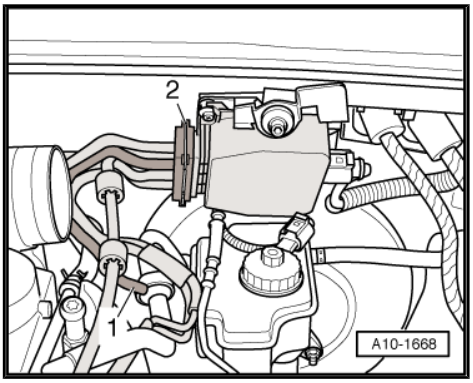
– Also detach upper coolant hose on oil cooler -arrow-, and drain off remaining coolant.



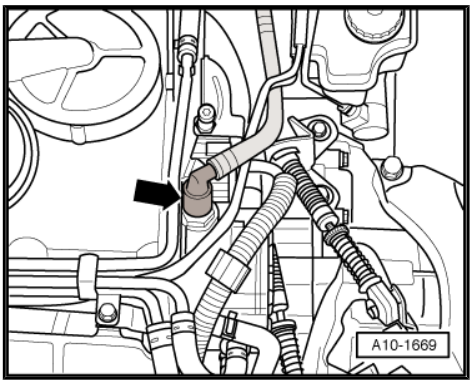
– Remove battery ⇒ Rep. Gr. 27 .
– Remove battery tray -arrows-.



– Detach hose connection carrier -2- at solenoid valve block by releasing retaining tab.
– Detach vacuum hose -1- at non-return valve for brake servo.

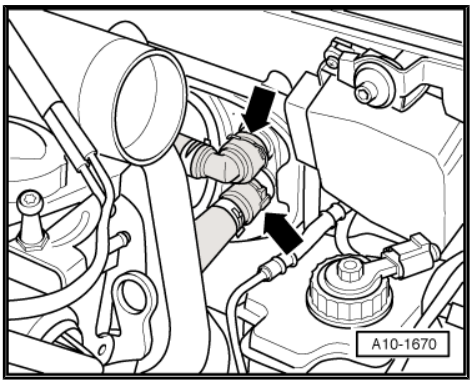


– Detach vacuum hose -arrow- going to brake servo at tandem pump.



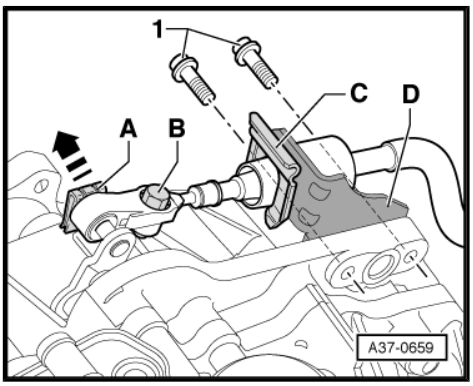
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– Detach coolant hoses going to heat exchanger at bulkhead -arrows-.



Vehicles with direct shift gearbox:

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



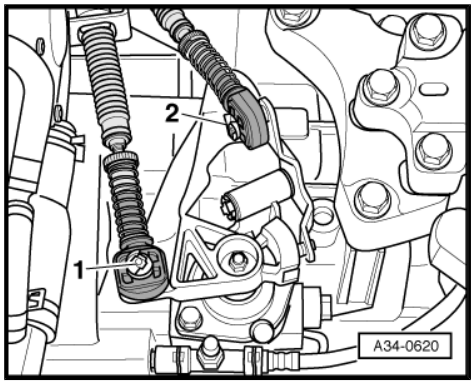
Note

Disregard items -B- and -C-.

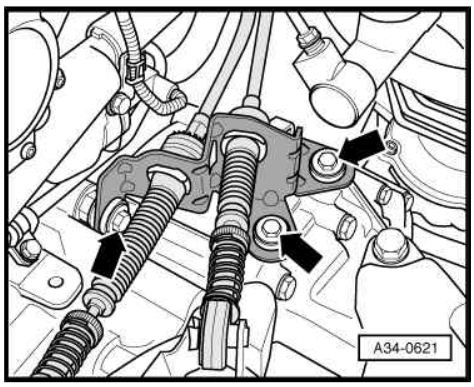
Vehicles with manual gearbox:

– Unclip securing clips -1- and -2- on both selector cables.

– Pull selector cable end-pieces off selector shaft lever and relay lever.



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

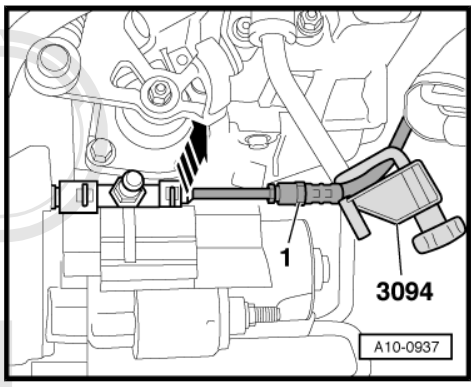


– Clamp off pressure hose to clutch slave cylinder using a hose clamp -3094- .

– Detach pressure hose -1- from hose connector by pulling securing clip -arrow- upwards.

Caution

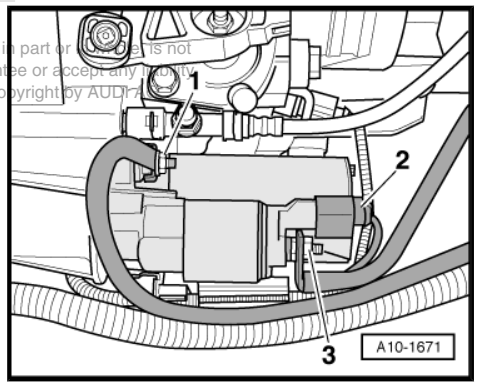
Do not operate clutch pedal with slave cylinder removed.



– Disconnect earth cable -1-.

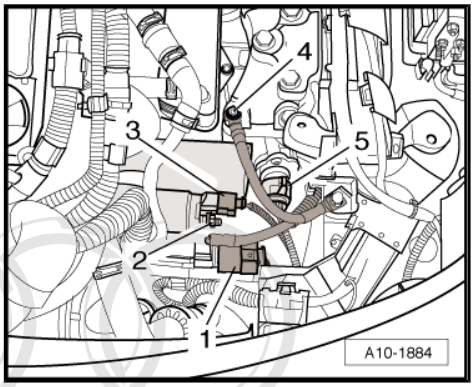
– Unplug electrical connector -2-.

– Push back protective cover and unscrew B+ wire -3- from starter solenoid switch.



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Vehicles with direct shift gearbox:

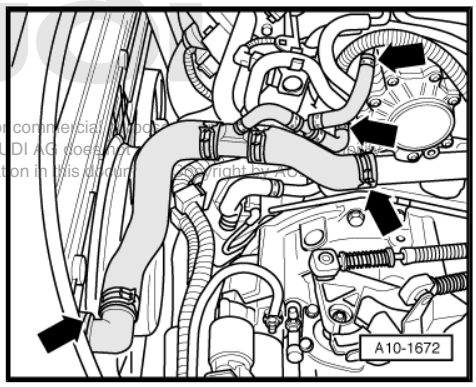


– Remove cable tie for protective cover.
– Unplug electrical connector -3-.
– Push back protective cover and unscrew B+ wire -2- from starter solenoid switch.
– Turn retainer catch anti-clockwise and unplug electrical connector -5- at gearbox.
– Disconnect earth cable -4-.

Note

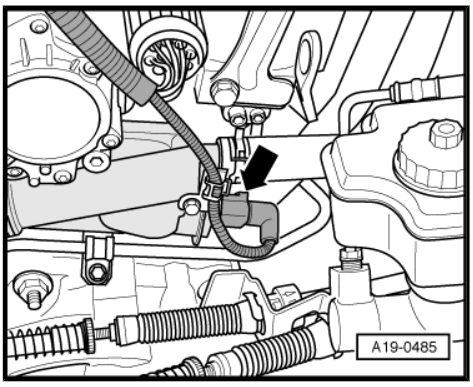
Disregard -item 1-.

All vehicles (continued):

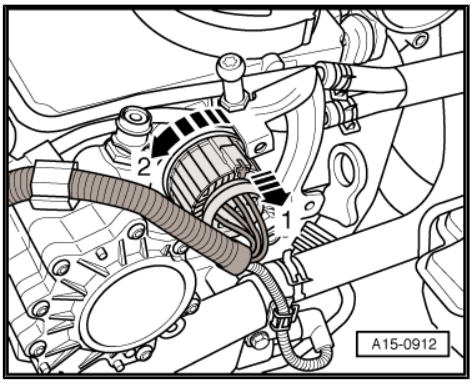


– Detach coolant hoses at the connections indicated -arrows-.

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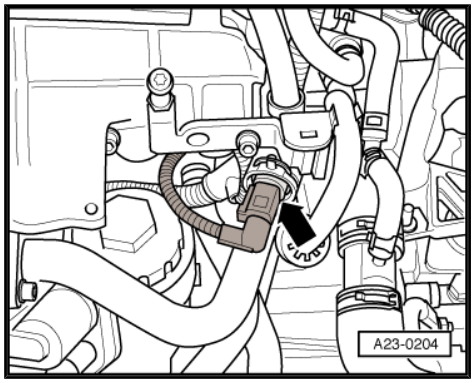


– Unplug electrical connector -arrow- at coolant temperature sender -G62- .

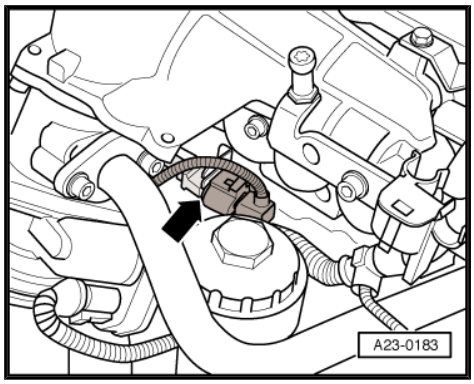


– Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
– Detach main connector for unit injectors and glow plugs.
– Detach fuel supply pipe at tandem pump and set wiring harness aside.

– Unplug electrical connector -arrow- at fuel temperature sender -G81- .
– Move fuel return pipe clear.

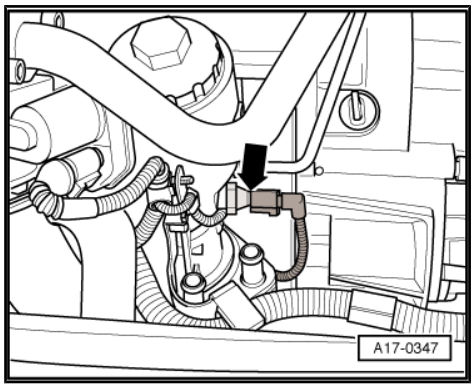


– Remove electrical connector from bracket -arrow-.
– Unplug connector for Hall sender -G40- .



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

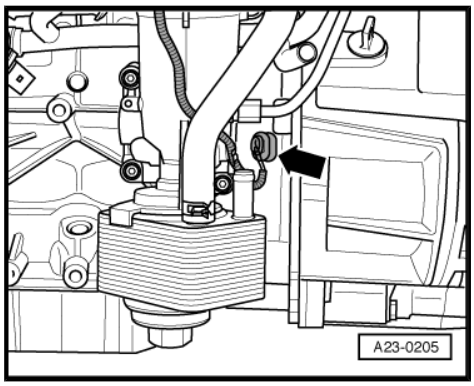


– Unplug electrical connector at engine speed sender -G28- -arrow- using assembly tool -T10118- .

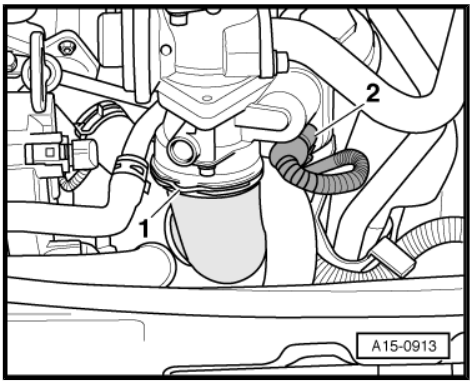
Note

To release electrical connector without assembly tool -T10118- , press connector on engine speed sender in with a screwdriver and at the same time lift release tab with a thin wire hook.

– Move wiring clear.

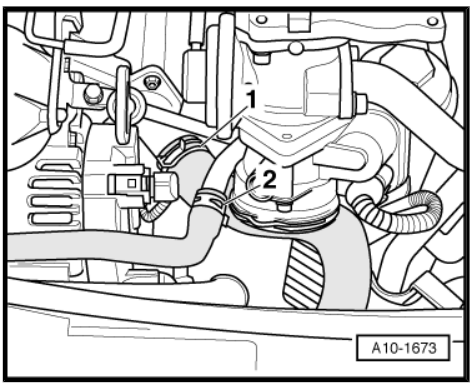


– Remove air intake hose at intake manifold flap by lifting retaining clip -1- slightly.
– Detach electrical connector -2- at intake manifold flap motor -V157- .

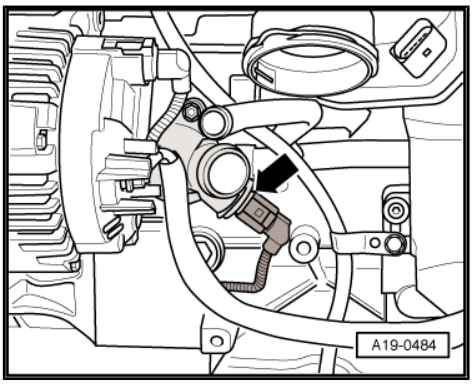


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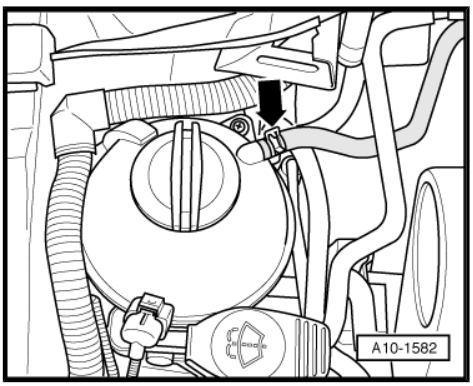
– Detach coolant hoses -1- and -2- at front of engine.



– Unplug electrical connector -arrow- at radiator outlet coolant temperature sender -G83- .
– Move wiring harness clear.



– Detach coolant hose -arrow- at expansion tank.

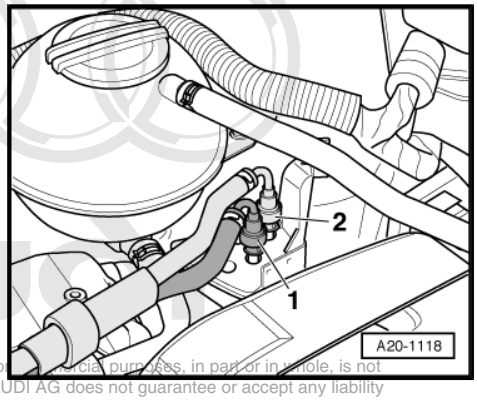


Caution

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

WARNING

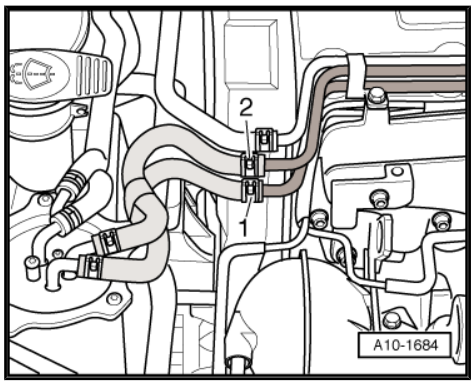
- *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- *Wear protective gloves.*
- *Wear safety goggles.*



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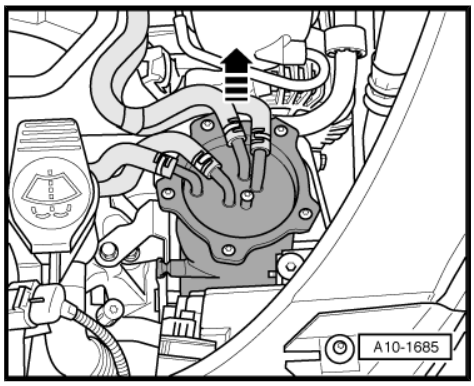
– Disconnect fuel supply pipe -2- and fuel return pipe -1- by pulling release tabs.

– Detach fuel supply hose -2- and fuel return hose -1- from fuel pipes.



Fuel filter - version 1:

– Pull fuel filter with hoses attached upwards out of the bracket -arrow-.

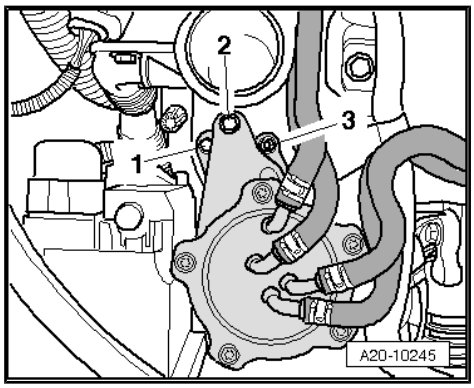


Fuel filter - version 2:

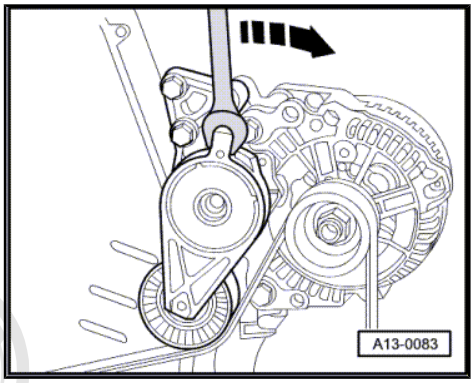
– Slacken bolt -1- one turn.

– Remove bolt -2- and nut -3-.

– Remove fuel filter with hoses attached.



All vehicles (continued):

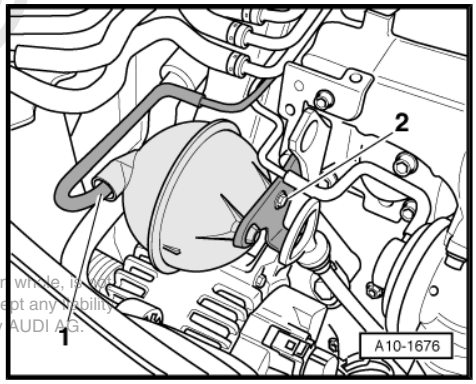


Note

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

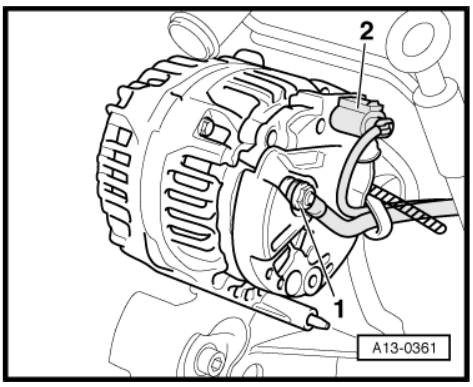
– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
– Remove poly V-belt.

– Detach vacuum hose -1-.
– Unscrew bolt -2- and detach vacuum reservoir from bracket.

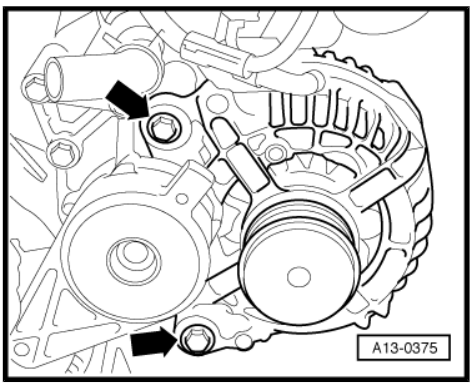


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– Unplug electrical connector -2-.
– Unscrew wire -1- and wire clamp.



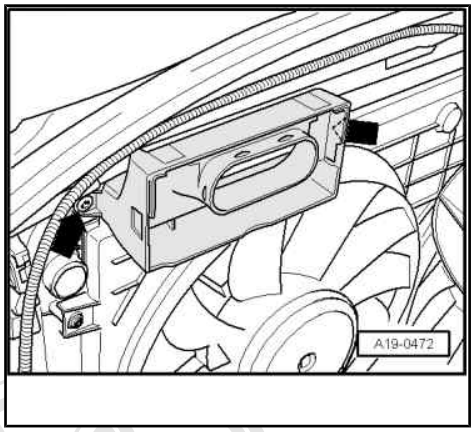
– Unscrew bolts -arrows- and remove alternator.



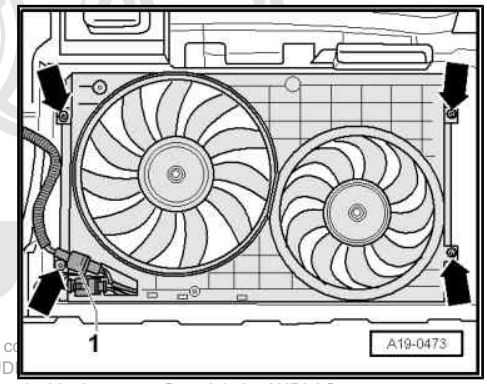
Note

- *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.*

– Unscrew air duct at lock carrier -arrows-.

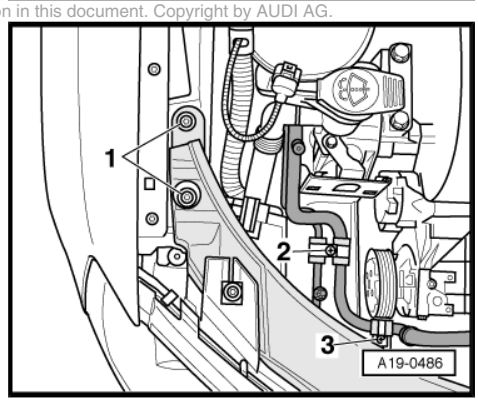


– Unplug electrical connector -1-.
– Unscrew the bolts -arrows- and remove radiator cowl from below.



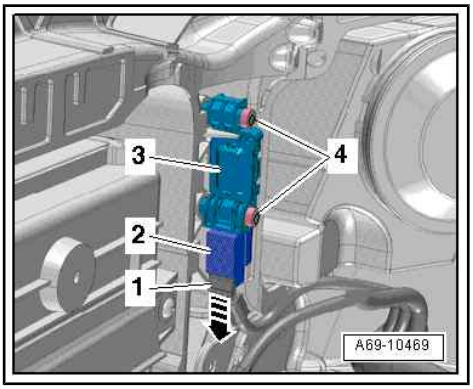
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– Unscrew bolts -1- for lock carrier (right-side).



WARNING

The air conditioner refrigerant circuit must not be opened.



Note

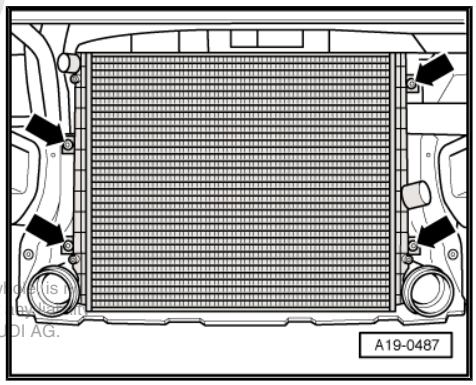
To prevent damage to the air conditioner compressor and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

– Unscrew bolts -2- and -3- at brackets for refrigerant pipes.
– Remove bolts -4- and move crash sensor (right-side) with wiring to one side.

Note

Disregard items marked -1, 2, 3- and -arrows-.

– Unscrew bolts -arrows- on backside of radiator.
– Lift out radiator from above.



WARNING

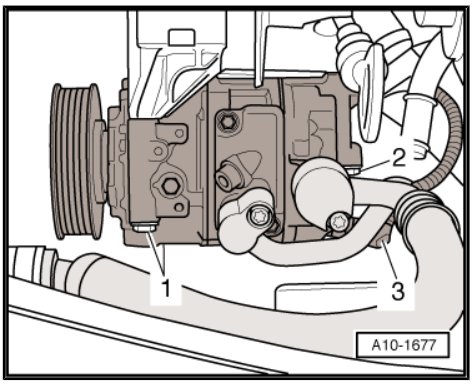
The air conditioner refrigerant circuit must not be opened.

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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.

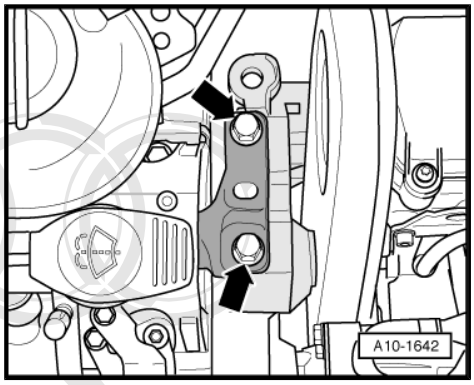


Note

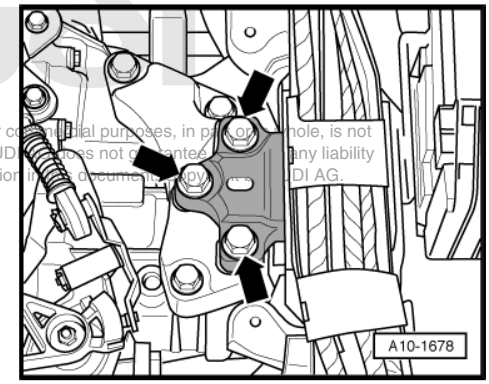
Disregard -item 3-.

– Set aside wiring harness leading to body.

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

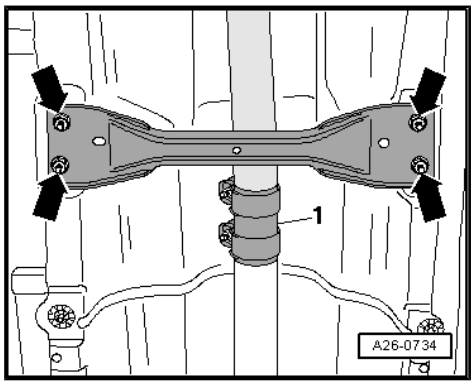


– Loosen bolts -arrows- of assembly mounting for gearbox approx. 2 turns.



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– Remove front cross-piece for underbody -arrows-.



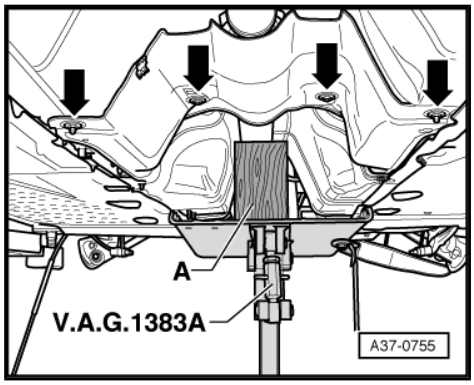
Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

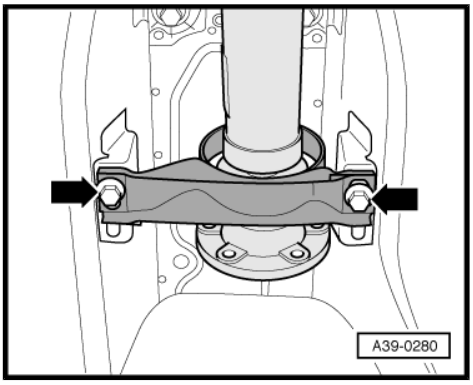
– Loosen nuts on clamp -1-.
– Push clamp back and tie up front exhaust pipe to underbody.

Vehicles with four-wheel drive:

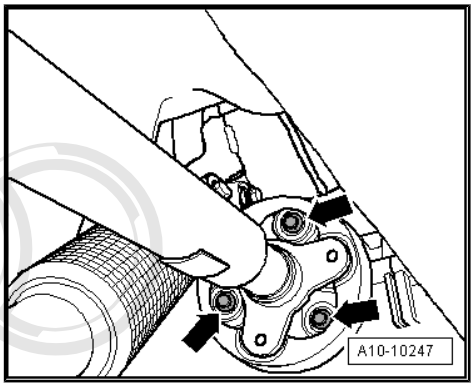
– To support propshaft, position engine and gearbox jack -V.A.G 1383 A- underneath with a piece of wood -A- placed in between.
– Remove bolts -arrows- securing heat shield and propshaft centre bearing and detach heat shield.



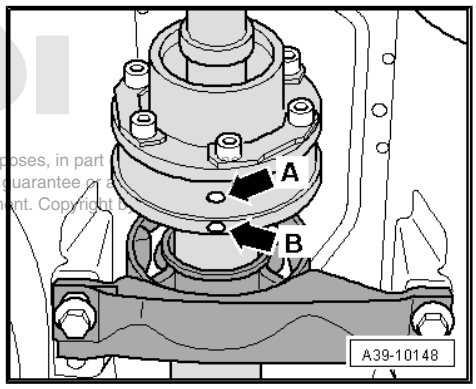
– Fit bolts -arrows- for propshaft centre bearing again.



– Unbolt flexible coupling for propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).



– Check whether markings -arrow A- and -arrow B- are visible on constant velocity joint and propshaft. Apply markings if necessary.



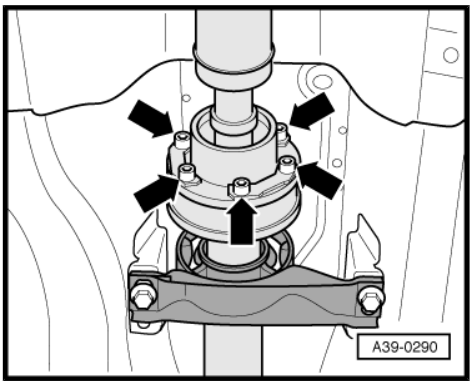
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– Remove bolts -arrows-.

Caution

Take care to bend the front section of the propshaft tube downwards as little as possible when detaching.

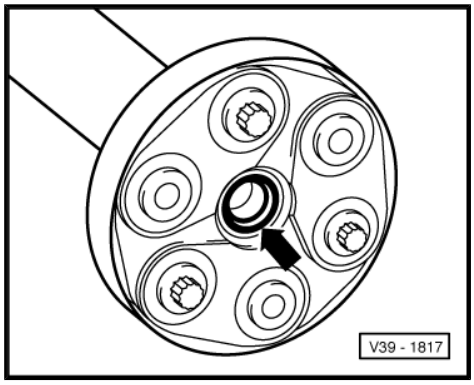
– Push front section of propshaft tube towards the front and swivel it out of rear section of propshaft tube.



Note

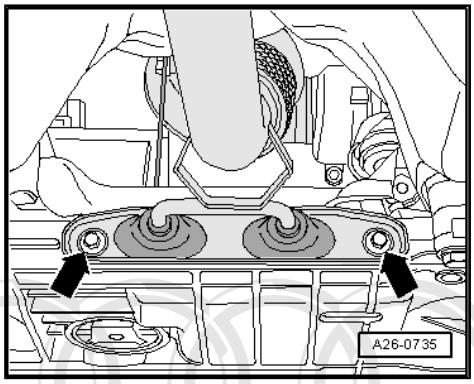
Avoid damaging the seal -arrow- in the propshaft flange when removing and installing.

– Pull front section of propshaft tube off centring pin on bevel box horizontally, swivel downwards and detach.

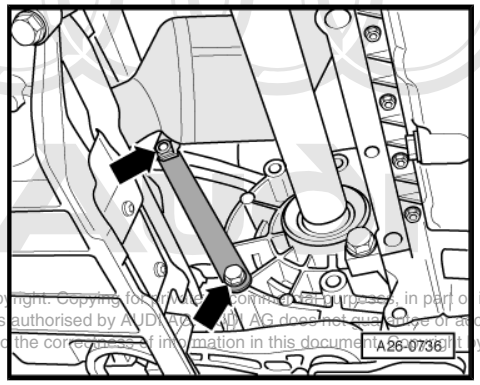


All vehicles (continued):

– Unbolt bracket for exhaust system -arrows-.

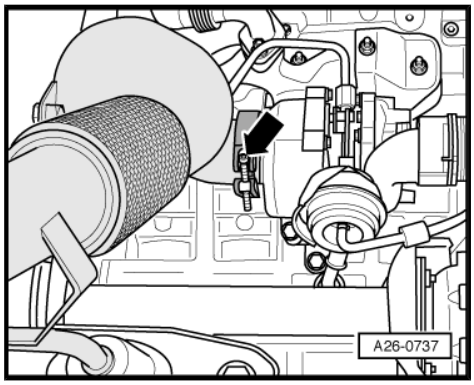


– Unbolt support for front exhaust pipe -arrows-.

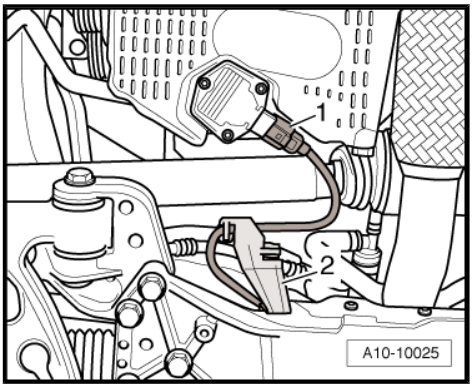


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– Open clamp -arrow- and detach front exhaust pipe from turbocharger.

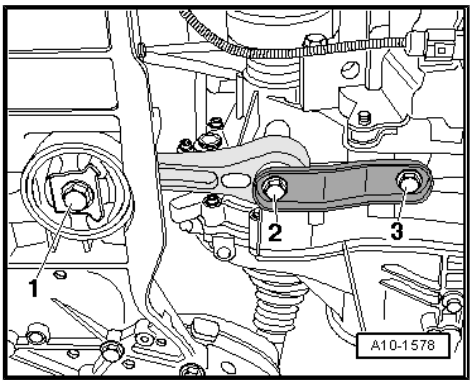


– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Unclip bracket -2- for wire to oil level and oil temperature sender -G266- at subframe.

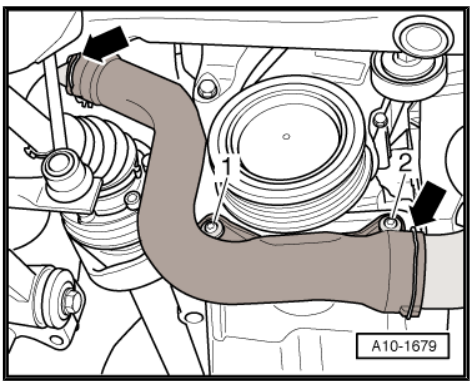


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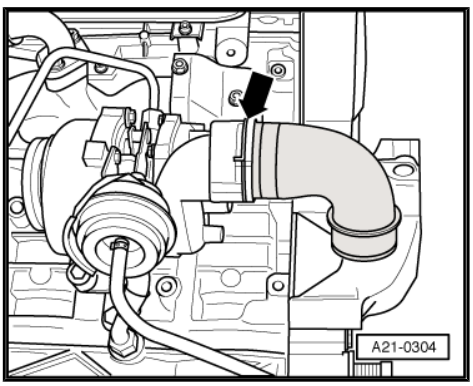
– Unscrew bolts -1 ... 3- and remove pendulum support.



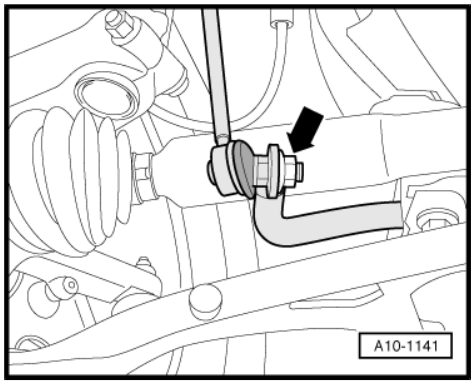
– Remove bolts -1- and -2-.
– Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



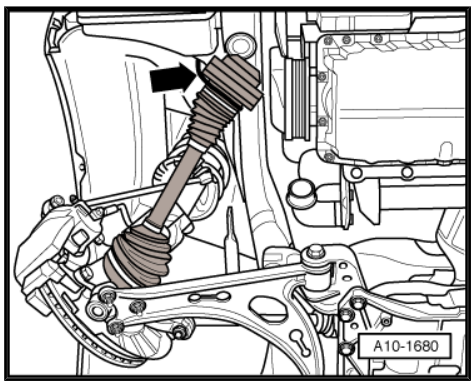
– Detach air intake hose from turbocharger by lifting retaining clip -arrow- slightly.



– Unbolt coupling rod (right-side) from anti-roll bar -arrows-.



Vehicles with front-wheel drive and manual gearbox:



– Unbolt drive shafts (left and right) from gearbox flange and centre bearing.
– Tie up the left drive shaft.
– Turn front wheels to the right.
– Swing right-side drive shaft forwards and tie up to longitudinal member as shown in illustration -arrow-.

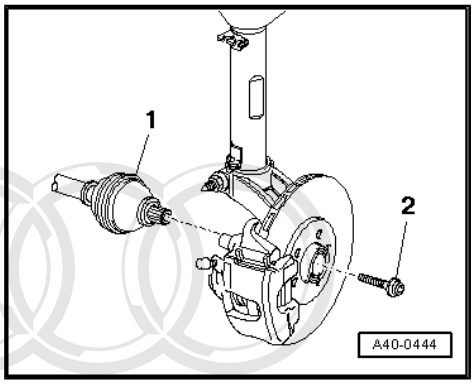
Vehicles with direct shift gearbox:

– Unbolt left-side drive shaft from gearbox flange.
– Tie up left-side drive shaft with wire.
– Have a 2nd mechanic press the brake pedal.

Caution

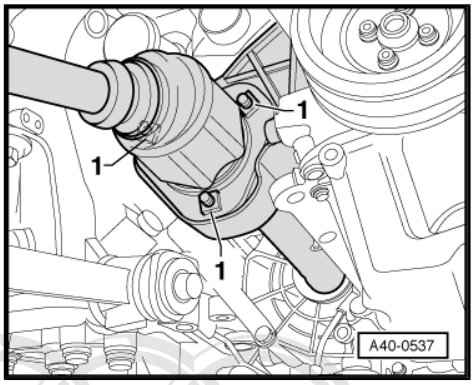
When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

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



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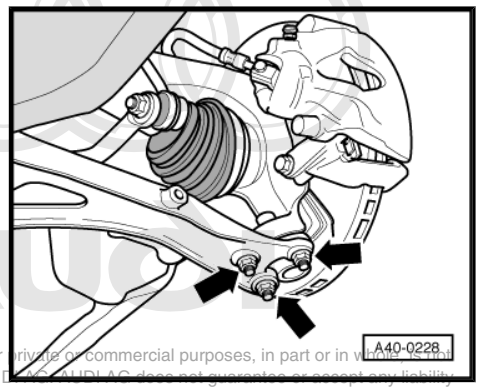
– Slacken off hexagon bolts -1- on intermediate flange.



– Unscrew hexagon nuts -arrows- at swivel joint (right-side).
– Detach wishbone at swivel joint (right-side).
– Pull drive shaft out of wheel bearing housing.
– Take off drive shaft together with intermediate shaft.

Vehicles with four-wheel drive:

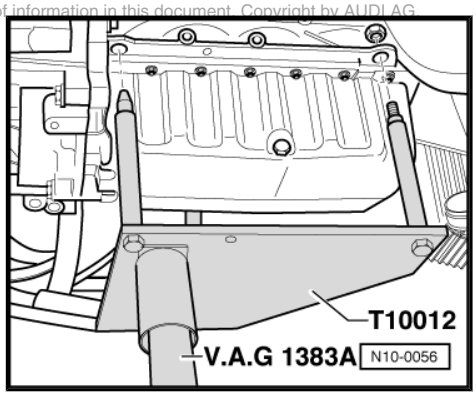
– Unbolt drive shaft (left-side) from gearbox flange and drive shaft (right-side) from bevel box flange.
– Tie up drive shaft (left-side), push back drive shaft (right-side).



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All vehicles (continued):

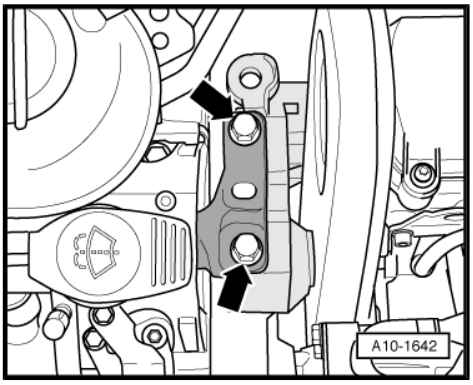
– Attach engine bracket -T10012- with securing nut and bolt to cylinder block: approx. 20 Nm.
– Apply engine and gearbox jack -V.A.G 1383 A- to engine bracket -T10012- and raise engine/gearbox assembly slightly.



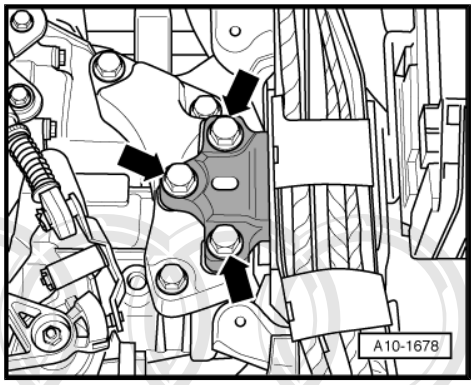
Note

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 at air conditioner compressor and at left-side drive shaft.*

– First lower engine/gearbox assembly only slightly.

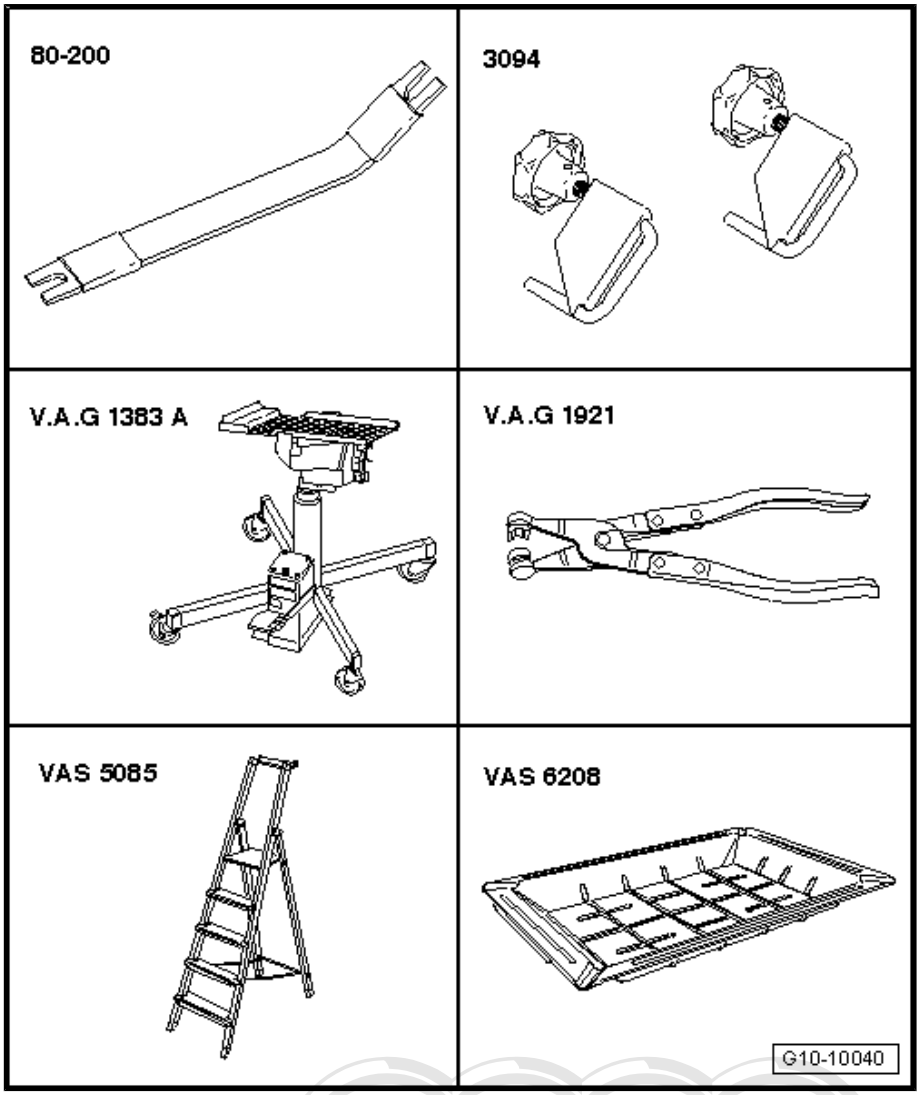
– Then swing gearbox end of engine/gearbox assembly forwards and only then lower further.

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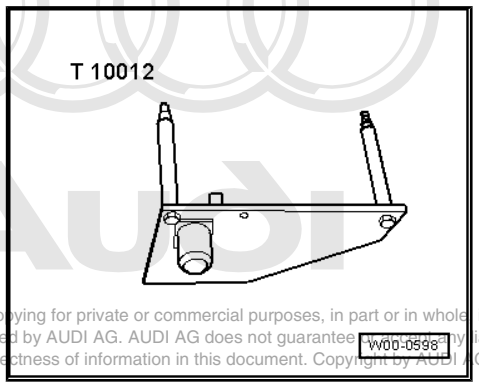
2 Removing engine - vehicles with front-wheel drive with engine codes BMN, BUY

Special tools and workshop equipment required

- Removal lever -80 - 200-
- Hose clamps, up to 25 mm -3094- (only for vehicles with manual gearbox)
- Engine and gearbox jack - V.A.G 1383 A-
- Hose clip pliers - V.A.G 1921-
- Stepladder -VAS 5085-
- Drip tray for workshop hoist -VAS 6208-

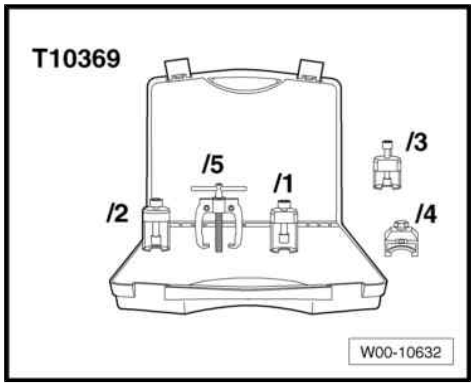


- Engine bracket -T10012-



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- Tool set for wiper arms -T10369-

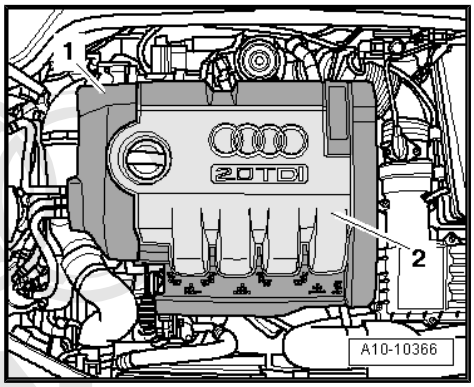


Procedure

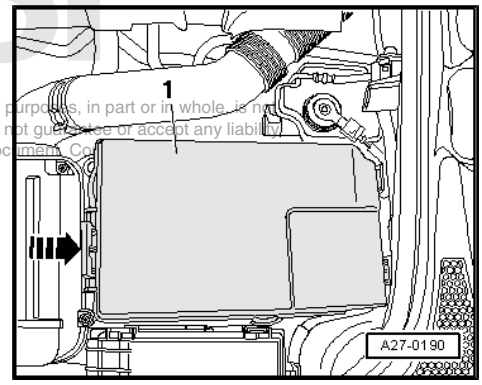
Note

- *The engine is removed from underneath together with the gearbox.*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *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-.

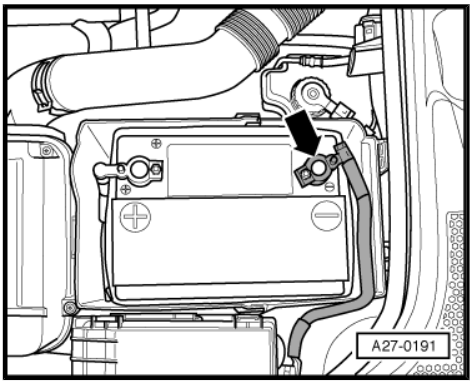


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Caution

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

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



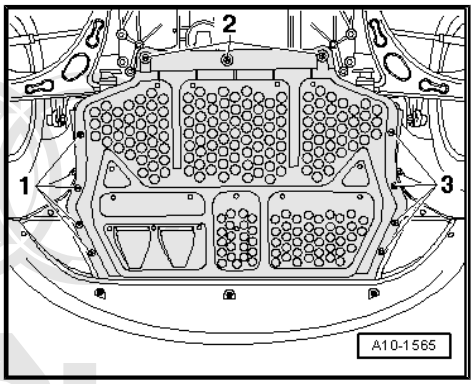
WARNING

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

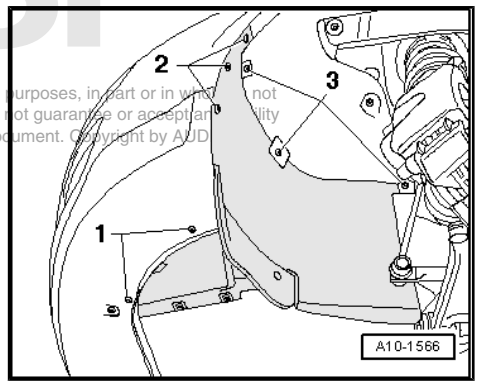
– Open filler cap on coolant expansion tank.

– Remove both front wheels.

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

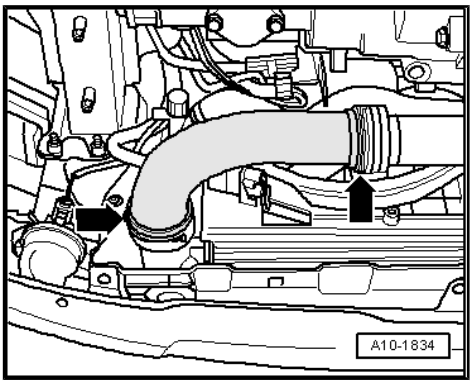


– Remove noise insulation (left and right) -fasteners 1 ... 3-.

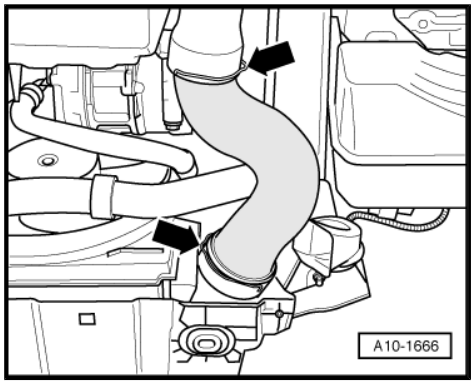


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– Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.



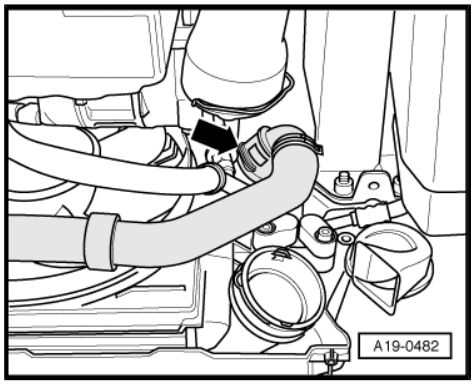
– Remove air intake hose (right-side) by lifting retaining clips -arrows- slightly.



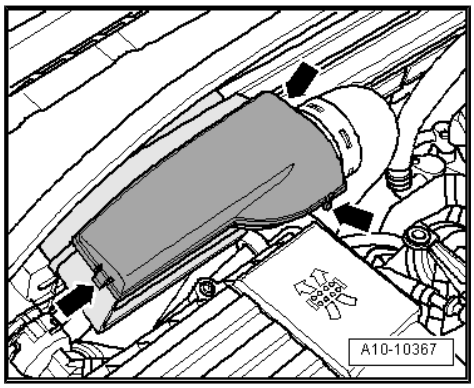
Caution

Seal opening of charge air cooler with a piece of clean foam or similar to prevent coolant from entering.

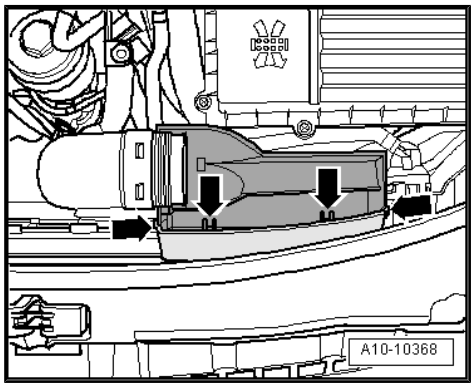
– Place drip tray for workshop hoist -VAS 6208- under engine.
– Pull out retaining clip at the bottom -arrow-, disconnect coolant hose from radiator and drain off coolant.
– Move coolant hose clear at air pipe.



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

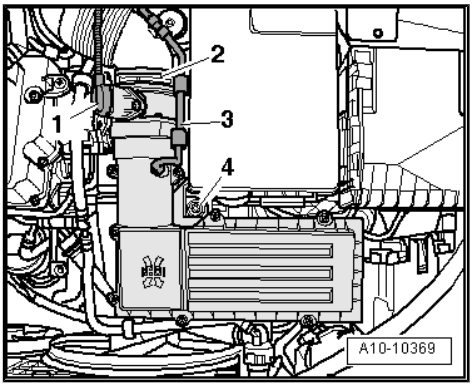


– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.

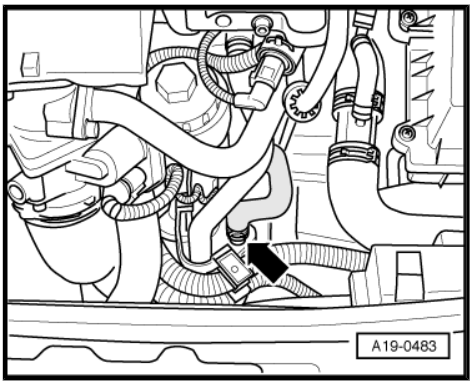


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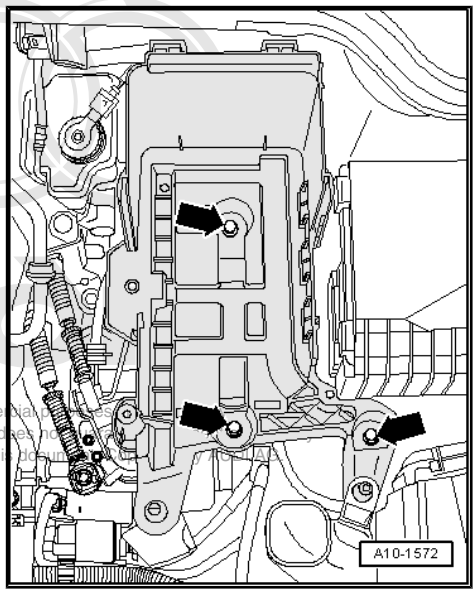
– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.



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



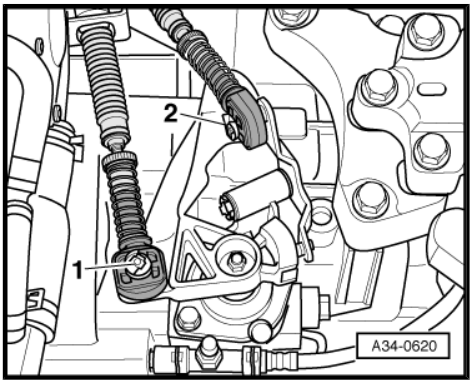
– Remove battery ⇒ Rep. Gr. 27 .
– Remove battery tray -arrows-.



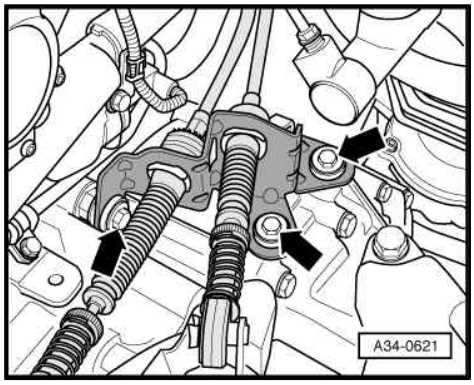
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Vehicles with manual gearbox:

– Unclip securing clips -1- and -2- on both selector cables.
– Pull selector cable end-pieces off selector shaft lever and relay lever.



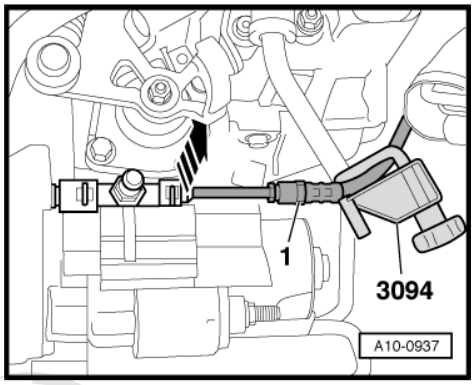
– Remove selector cable support bracket -arrows- from gearbox and place to one side.



– Clamp off pressure hose to clutch slave cylinder using a hose clamp -3094- .
– Detach pressure hose -1- from hose connector by pulling securing clip -arrow- upwards.

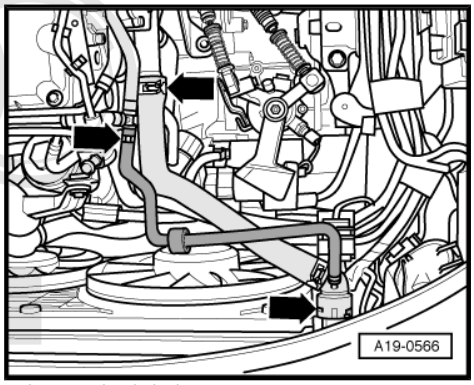
Caution

Do not operate clutch pedal with slave cylinder removed.



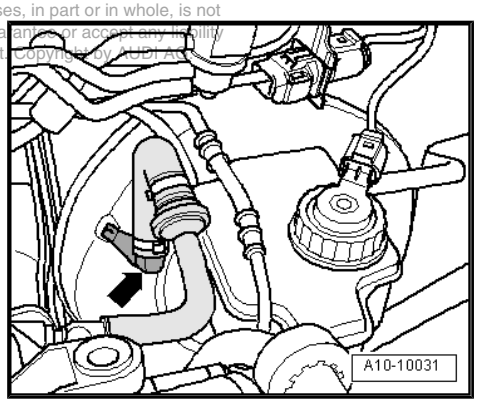
All vehicles (continued):

– Detach coolant hoses at the connections indicated -arrows-.

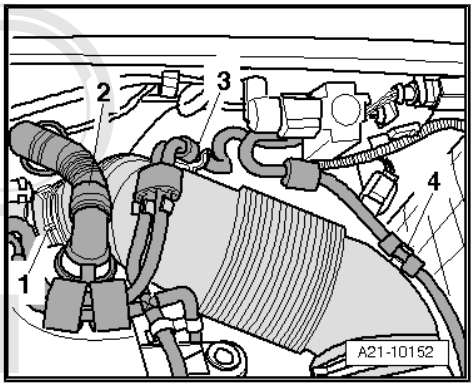


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– Disconnect vacuum hose -arrow- from brake servo.



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

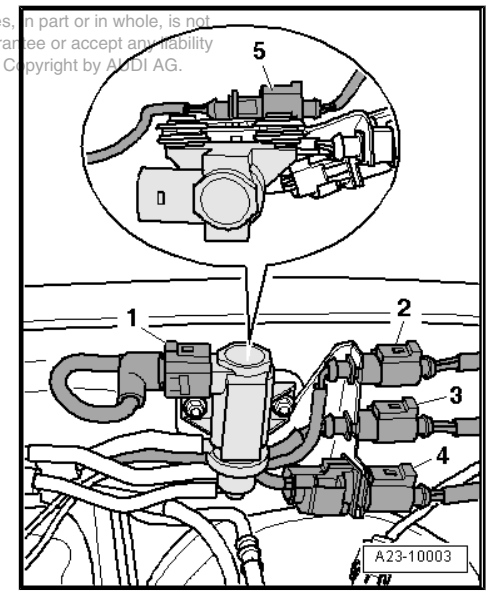


– Disconnect electrical connector -1- at charge pressure control solenoid valve -N75- .
– Unscrew nuts and place charge pressure control solenoid valve -N75- on engine (hoses remain connected).

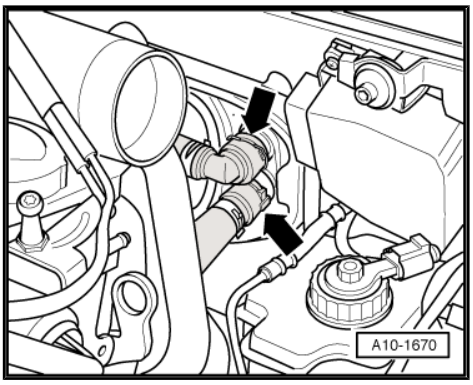
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Note

Disregard -items 2, 3, 4 and 5-.



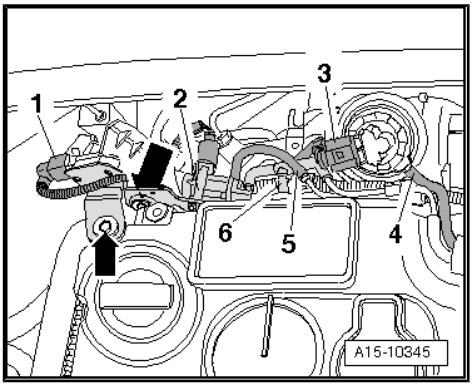
– Detach coolant hoses going to to heat exchanger at bulkhead -arrows-.



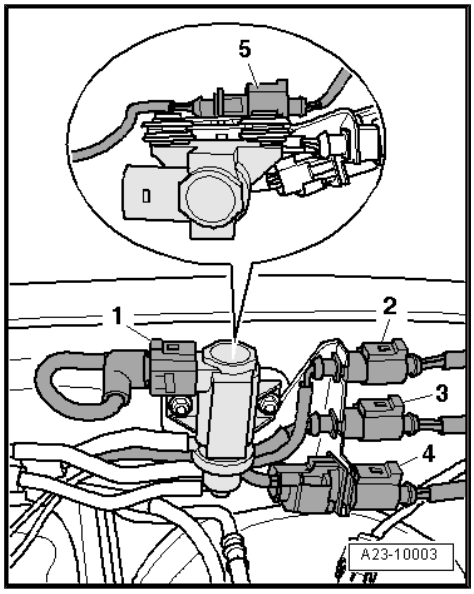
– Unclip change-over valve for exhaust gas recirculation cooler -N345- -item 2- from bracket.
– Unplug electrical connector -1- and move wiring clear.
– Remove bolts -arrows-.

Note

Disregard -items 3, 4, 5 and 6-.



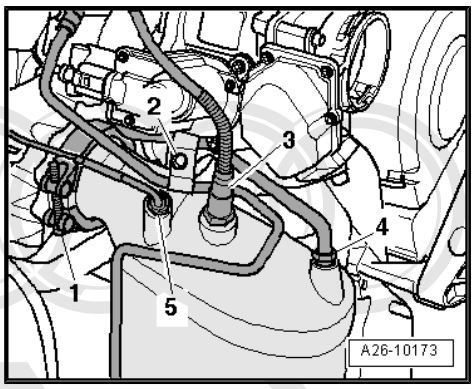
– Unplug electrical connector -3- for exhaust gas temperature sender 1 -G235- and electrical connector -4- for Lambda probe -G39- .
– Move wiring clear.



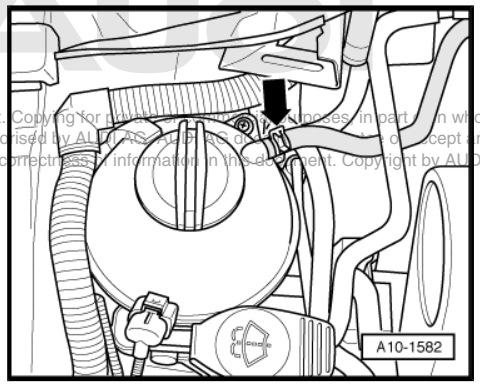
Note

Disregard -items 1, 2 and 5-.

– Unscrew Lambda probe -3- ⇒ Rep. Gr. 23 .
– Remove temperature sender before particulate filter -G506- -item 5- and move wiring clear.
– Unbolt bracket -2- for pressure pipes.
– Detach pressure pipe -4- from particulate filter.
– Remove exhaust gas pressure sensor 1 -G450- together with pressure pipes.
– Slacken and remove retaining clamp -1- for particulate filter.



– Detach coolant hose -arrow- at coolant expansion tank.



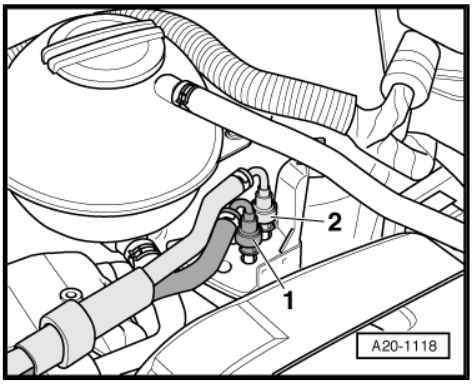
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Caution

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

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.*

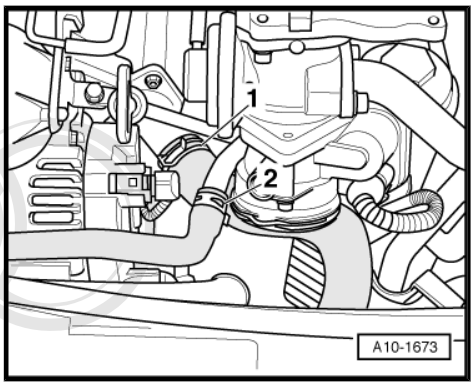


– Disconnect fuel supply pipe -2- and fuel return pipe -1- by pulling release tabs.

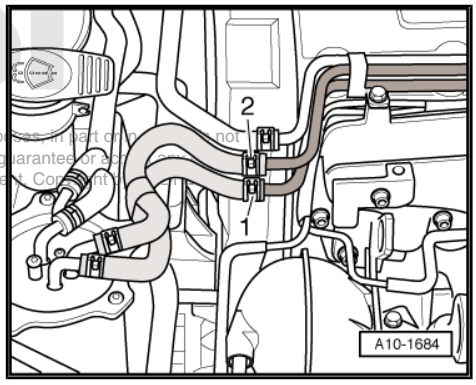
– Detach coolant hose -2- at front of engine.

Note

Disregard -item 1-.

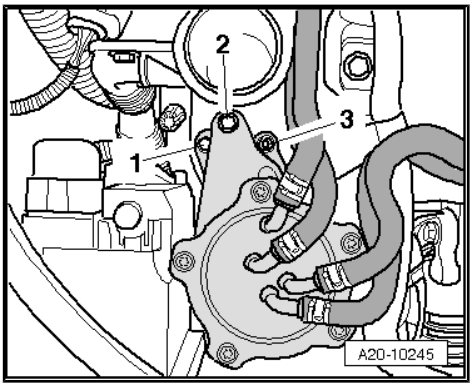


– Detach fuel supply hose -2- and fuel return hose -1- from fuel pipes.



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– Slacken bolt -1- one turn.
– Remove bolt -2- and nut -3-.
– Remove fuel filter with hoses attached.

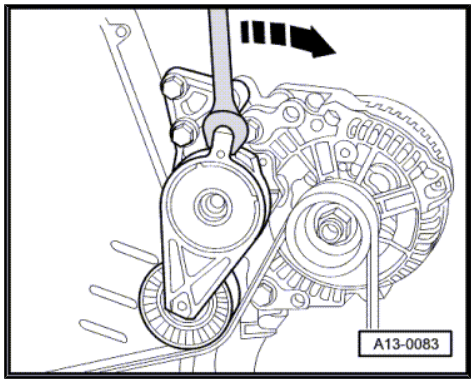


Note

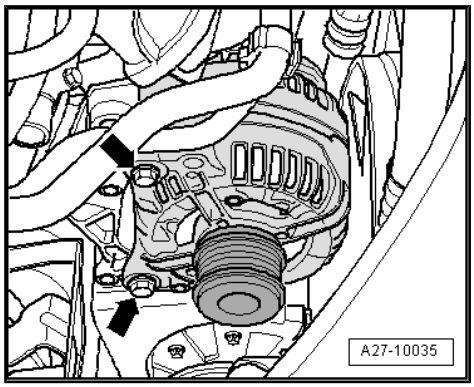
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.

– Remove poly V-belt.



– Unscrew bolts -arrows- and remove alternator.



Note

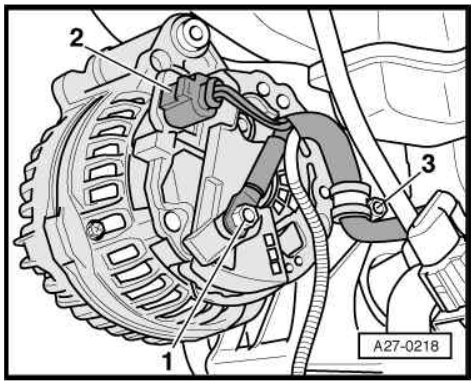
- *If alternator sticks in its bracket, screw bolt back in again down to the last 2 turns.*
- *Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.*

– Swivel alternator towards right side of vehicle with wiring connected.

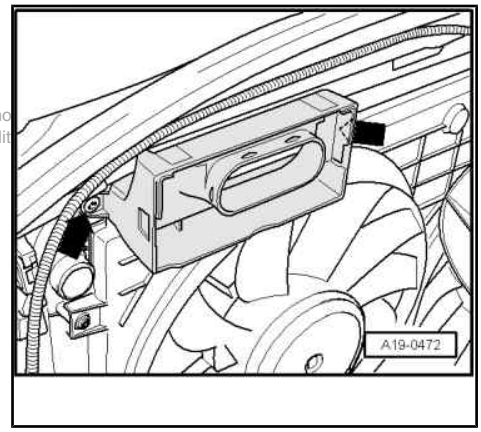
– Unplug electrical connector -2-.

– Unscrew wire -1- and wire clamp -3- at alternator.

– Lift out alternator.

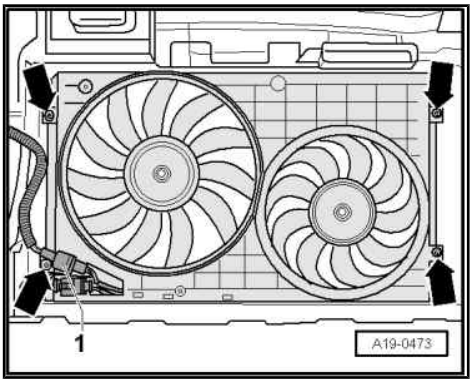


– Unscrew air duct at lock carrier -arrows-.

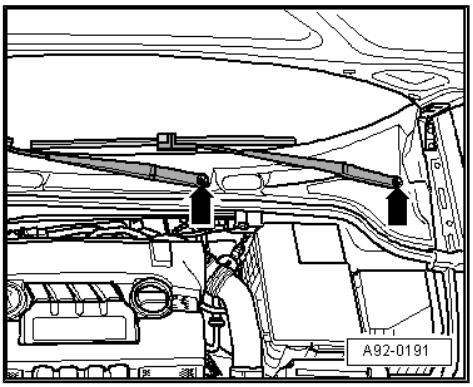


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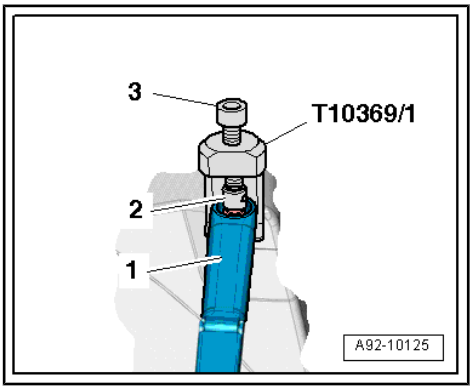
– Unscrew top bolts -upper arrows- for radiator cowl.



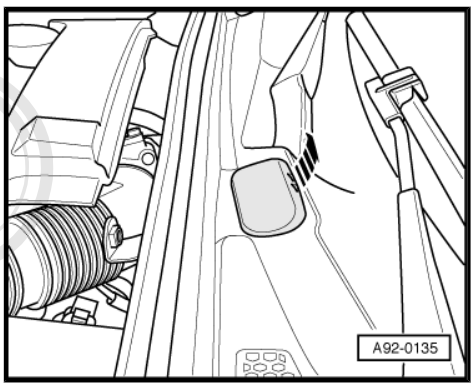
– Lever off caps on windscreen wiper arms with a screwdriver.
– Loosen nuts -arrows- several turns.



– Apply puller -T10369/1- onto wiper arm -1- as shown illustration.
– Apply thrust piece -2- onto wiper shaft.
– Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
– Remove nuts completely and take off wiper arms.

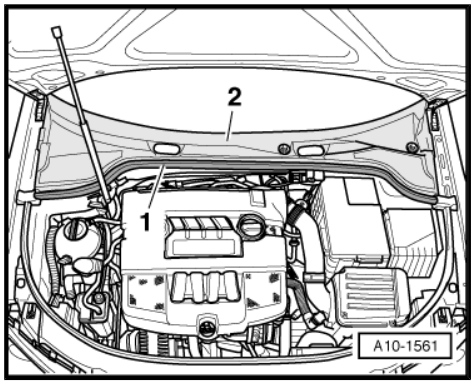


– Unclip washer jets -arrow-.
– Push washer jet through assembly opening back into plenum chamber, leaving hoses connected.

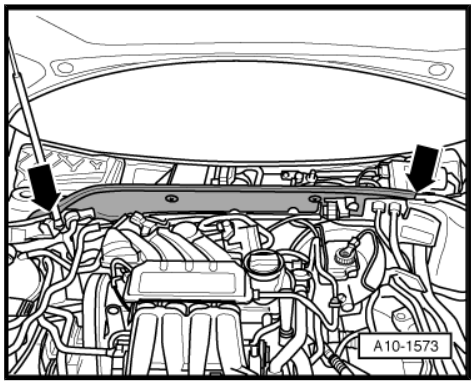


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– Pull off rubber seal -1- on plenum chamber cover.
– Detach plenum chamber cover -2-.



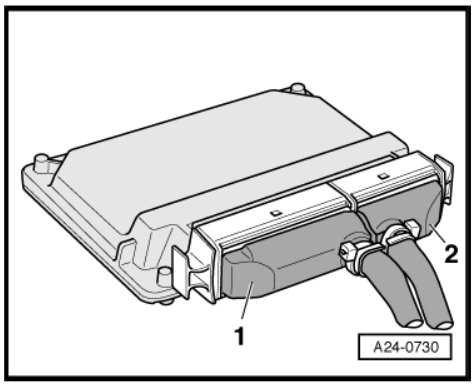
– Detach engine wiring harness at rear plenum chamber panel.
– Remove plenum chamber intermediate plate -arrows-.



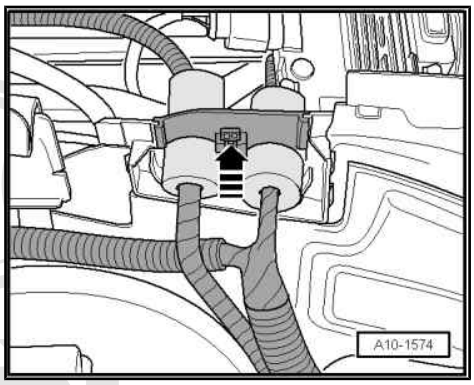
– Remove engine control unit ⇒ Rep. Gr. 23 .
– Unplug electrical connector -2- for engine wiring harness and move connector clear.

Note

The electrical connector -1- remains connected.

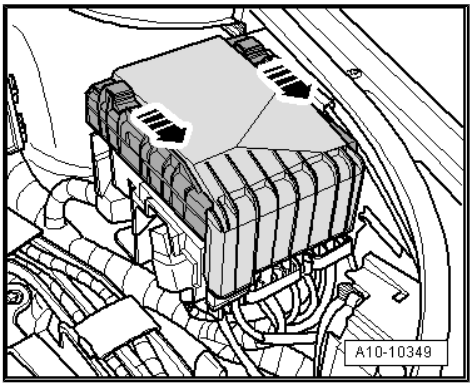


– Release wiring protector for engine wiring harness -arrow- and lift off.

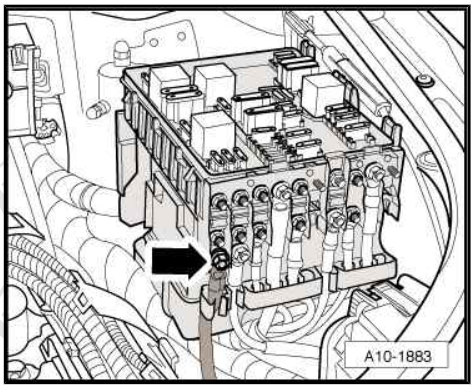


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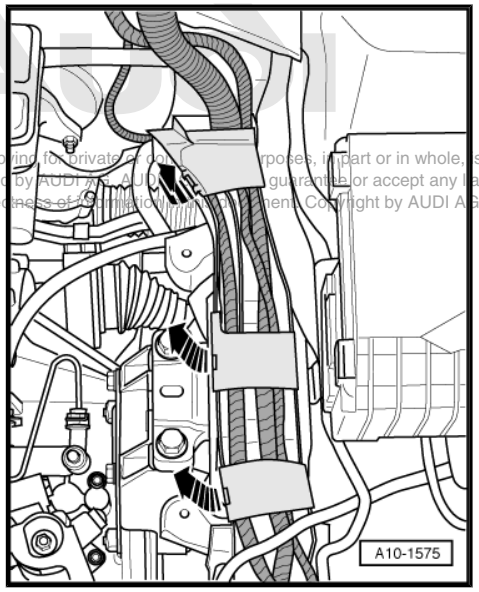
– Press the two clips in direction of the -arrows- and remove cover from electronics box in engine compartment.



– Unscrew terminal 30 wire -arrow- from electronics box in engine compartment and move it clear.



– Open wiring duct brackets -arrows-.

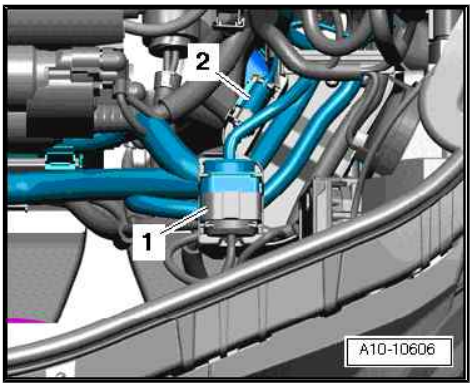


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– Unclip electrical connector -1- from bracket and unplug it.
– Open wiring duct bracket located below.
– Unclip engine control unit wiring harness from wiring duct.

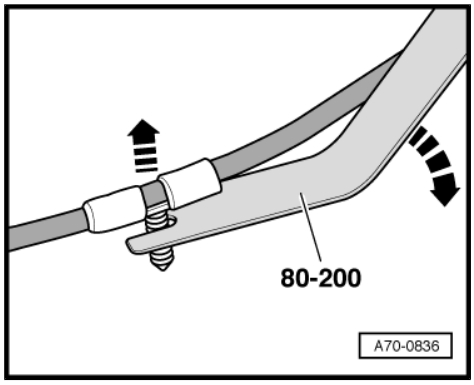
Note

Disregard -item 2-.



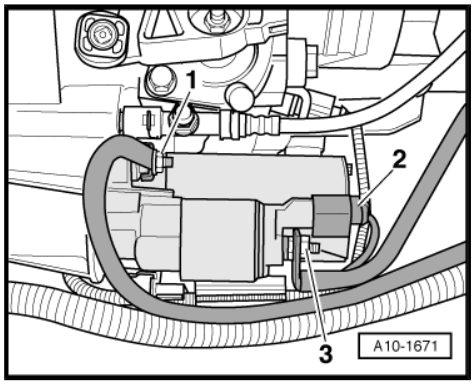
Note

Use removal lever -80 - 200- to lever out the wiring clips.

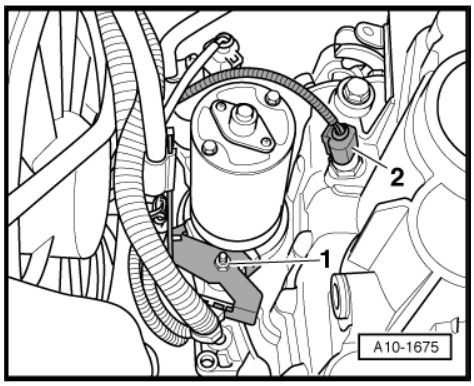


Vehicles with manual gearbox:

- Disconnect earth cable -1-.
- Unplug electrical connector -2-.
- Push back protective cover and unscrew B+ wire -3- from starter solenoid switch.

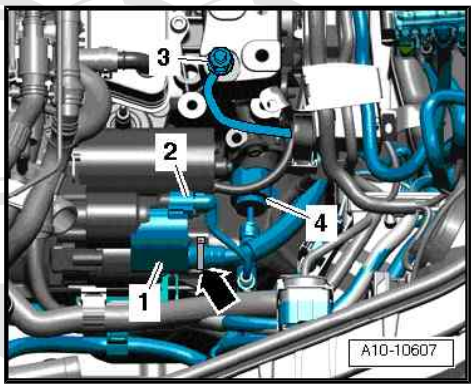


- Unplug electrical connector -2- for reversing light switch.
- Unscrew nut -1- and remove bracket with wiring from stud.



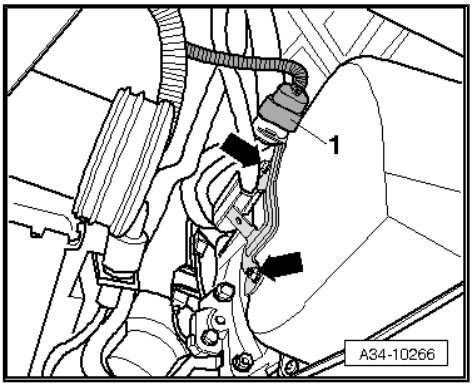
Vehicles with direct shift gearbox:

- Remove cable tie -arrow- for protective cover -1-.
- Unplug electrical connector -2-.
- Push back protective cover and unscrew B+ wire from starter solenoid switch.
- Disconnect earth cable -3-.
- Turn retainer catch anti-clockwise and unplug electrical connector -4- at gearbox.



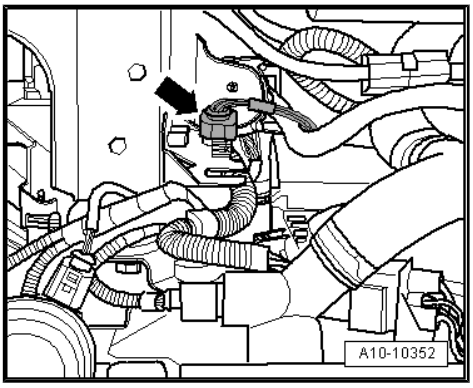
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– Unplug electrical connector -1-.



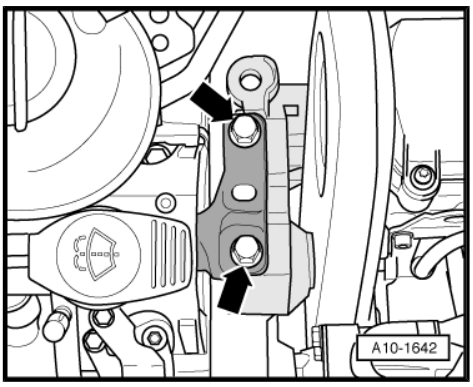
All vehicles (continued):

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

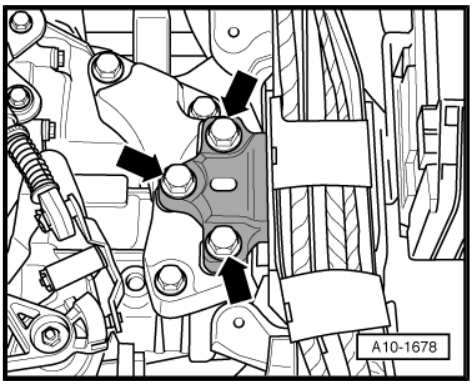


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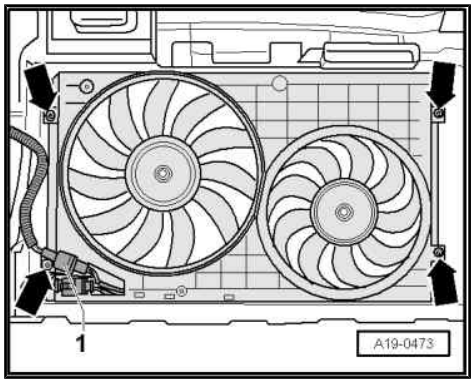
– Loosen bolts -arrows- of assembly mounting for engine approx. 2 turns.



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



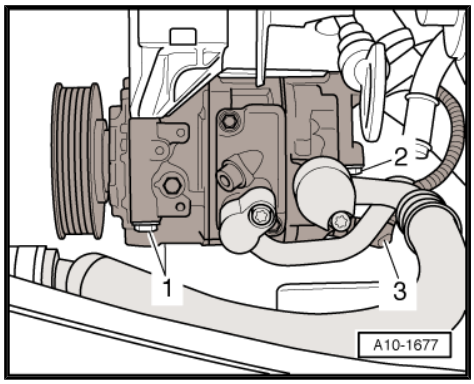
– Unplug electrical connector -1-.
– Unscrew the bottom bolts -bottom arrows- and remove radiator cowl from below.



– Unplug electrical connector -3- at air conditioner compressor.

Note

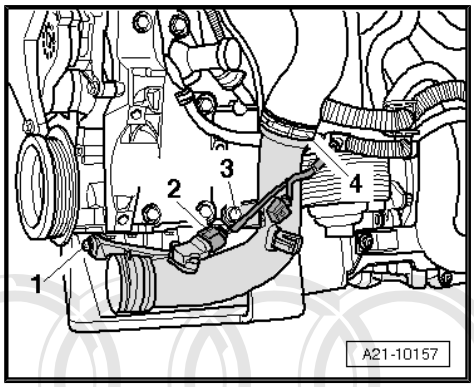
Disregard items marked -1- and -2-.



– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolts -1- and -3-.
– Disconnect air pipe from air hose -4- and remove pipe downwards.

WARNING

The air conditioner refrigerant circuit must not be opened.



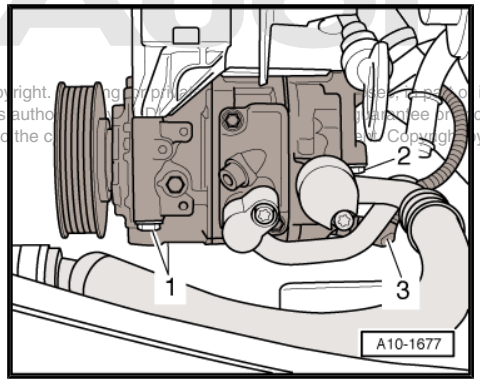
Note

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- and tie air conditioner compressor up to lock carrier.

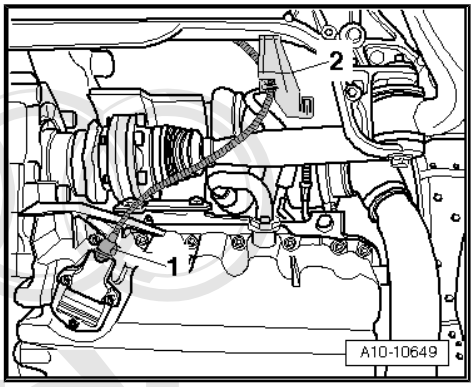
Note

Disregard -item 3-.

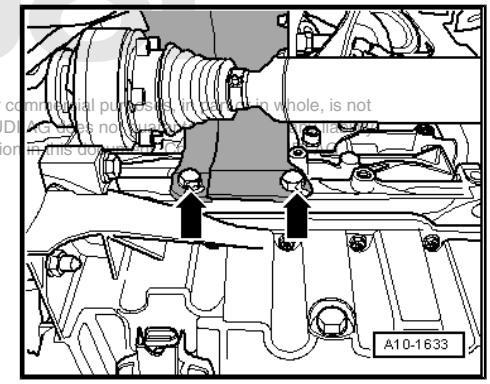


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– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Unclip bracket -2- for wire to oil level and oil temperature sender -G266- from subframe.

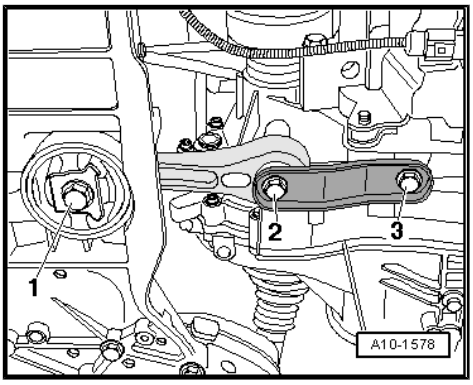


– Unbolt heat shield for drive shaft (right-side) -arrows-.
– Unbolt drive shafts (left and right) from gearbox flanges.
– Tie up drive shaft (left-side), push back drive shaft (right-side).

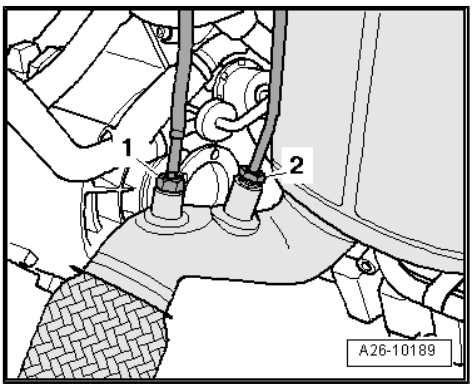


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– Unscrew bolts -1 ... 3- and remove pendulum support.



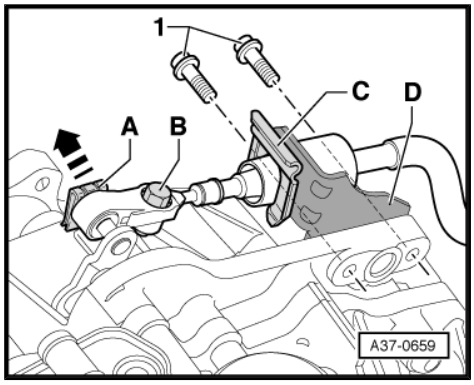
– Unscrew temperature sender after particulate filter -G527- -item 1- from exhaust pipe behind particulate filter and move wiring clear.
– Unscrew pressure pipe -2- going to exhaust gas pressure sensor 1 -G450- .



Vehicles with direct shift gearbox:

– Unscrew bolts -1- for support bracket -D-.

– Pull off the retaining clip -A- upwards -arrow- and detach selector lever cable from gearbox.

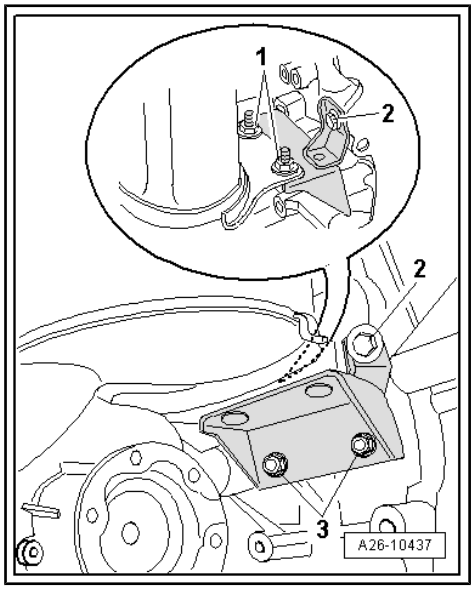


Note

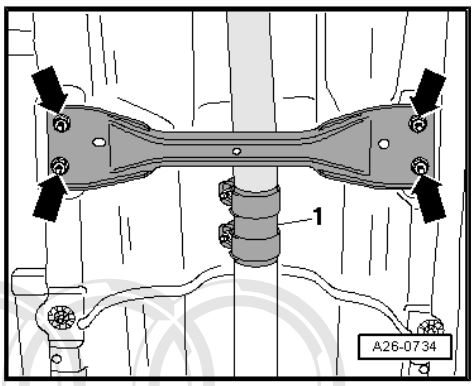
Disregard items -B- and -C-.

All vehicles (continued):

– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.



– Remove front cross-piece for underbody -arrows-.



Note

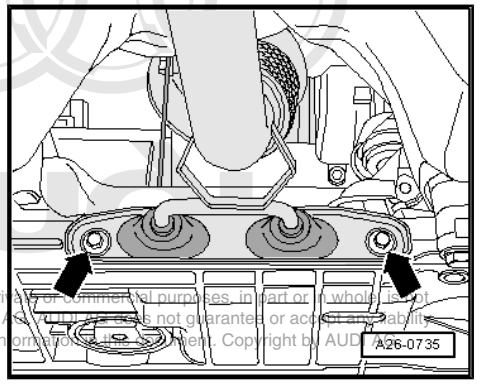
To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

– Loosen nuts on clamp -1-.

– 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.

– Tie up drive shaft (right-side) towards rear.

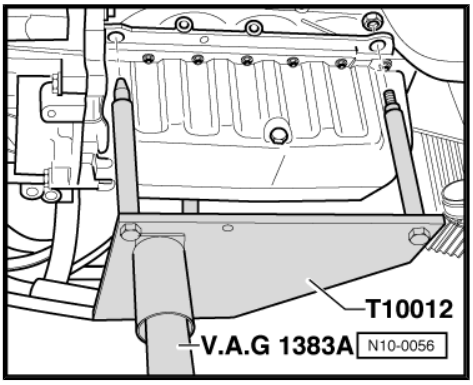


Note

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

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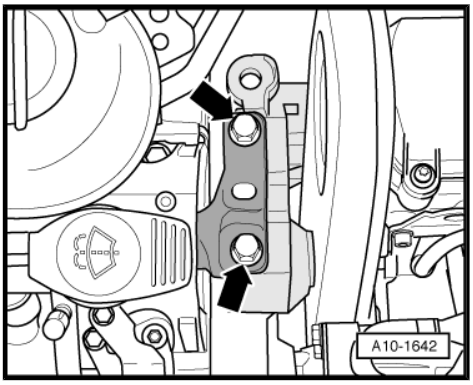
– Attach engine bracket -T10012- with securing nut and bolt to cylinder block: approx. 20 Nm.
– Apply engine and gearbox jack -V.A.G 1383 A- to engine bracket -T10012- and raise engine/gearbox assembly slightly.



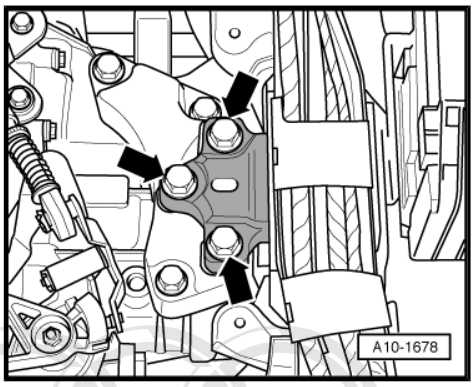
Note

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.*

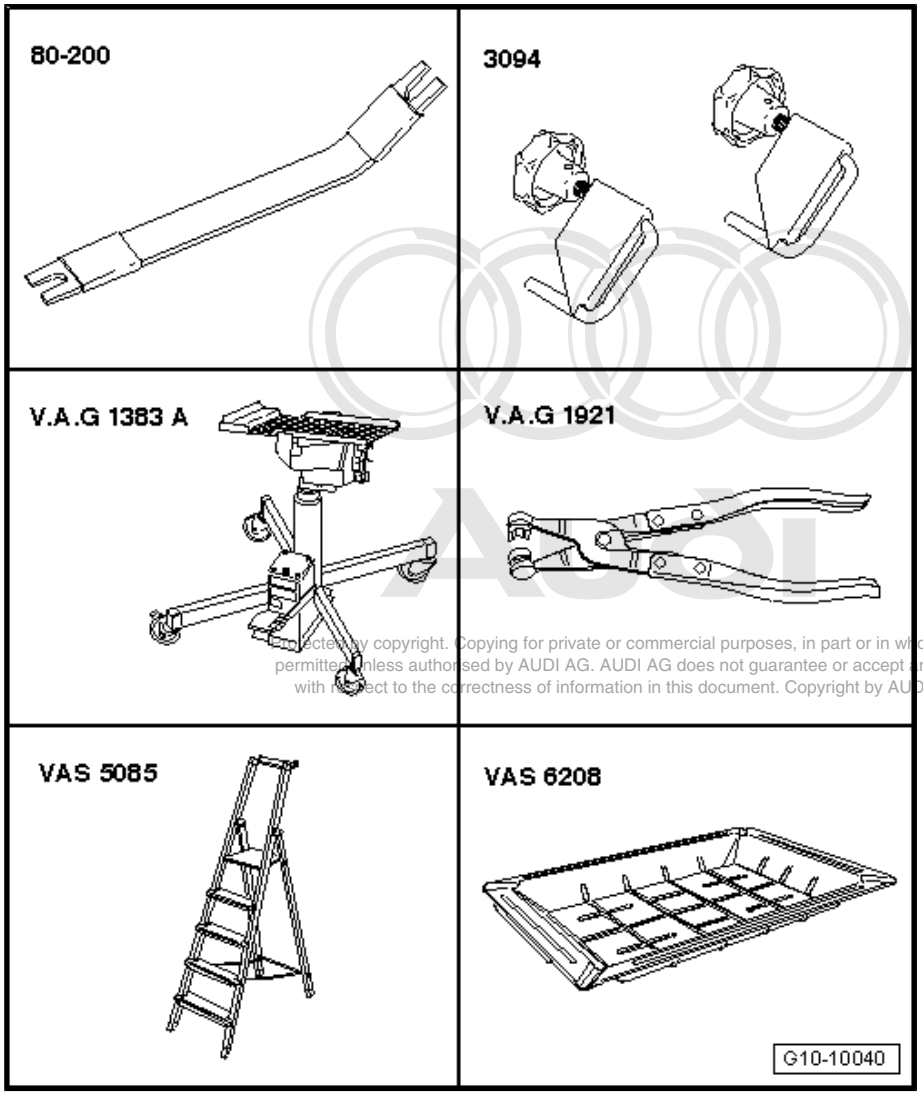
– First lower engine/gearbox assembly only slightly.
– Then swing gearbox end of engine/gearbox assembly forwards and only then lower further.

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3 Removing engine - vehicles with four-wheel drive with engine codes BMN, BUY

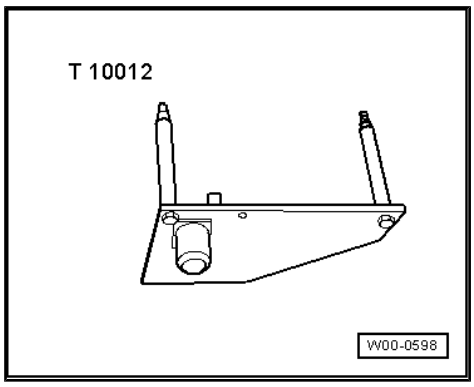
Special tools and workshop equipment required

- Removal lever -80 - 200-
- Hose clamps, up to 25 mm -3094- (only for vehicles with manual gearbox)
- Engine and gearbox jack - V.A.G 1383 A-
- Hose clip pliers - V.A.G 1921-
- Stepladder -VAS 5085-
- Drip tray for workshop hoist -VAS 6208-

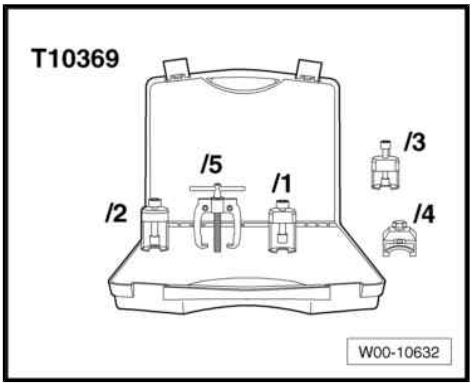


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- Engine bracket -T10012-



- Tool set for wiper arms -T10369-

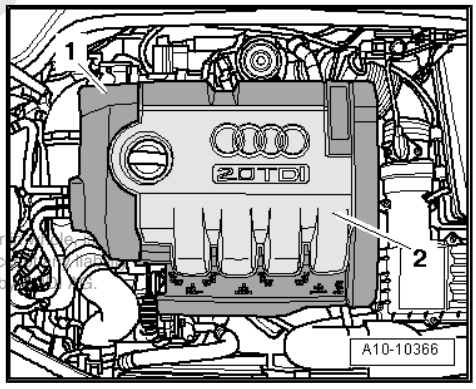


Procedure

Note

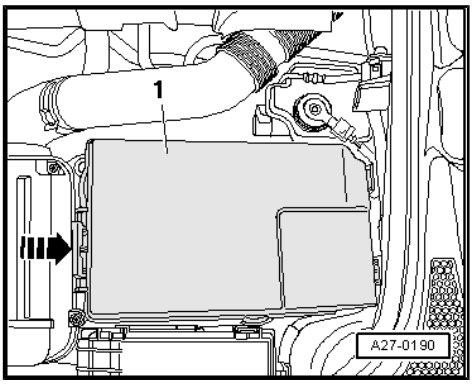
- *The engine is removed from underneath together with the gearbox.*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *Collect drained coolant in a clean container for re-use or disposal.*

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



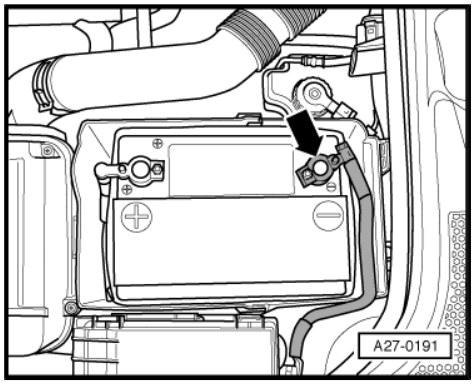
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– Remove cover -1- over battery; to do so, press release tab -arrow-.



Caution

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



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

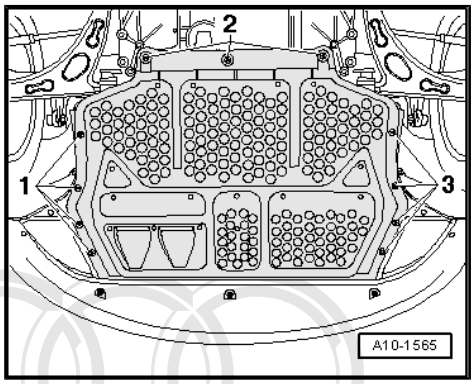
WARNING

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

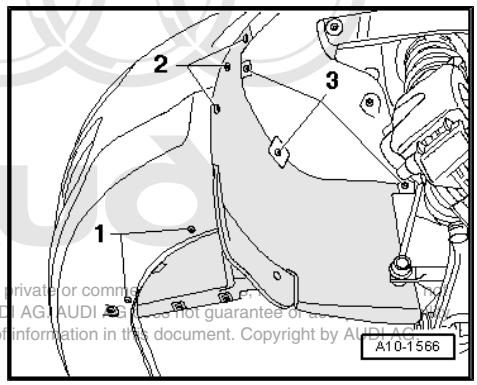
– Open filler cap on coolant expansion tank.

– Remove both front wheels.

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

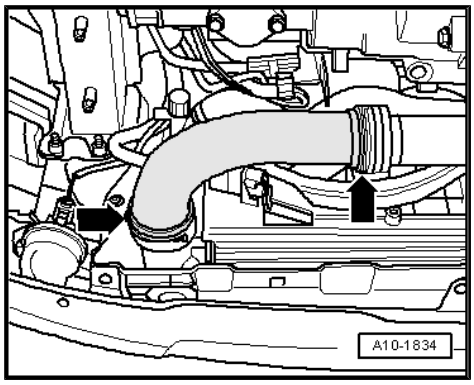


– Remove noise insulation (left and right) -fasteners 1 ... 3-.

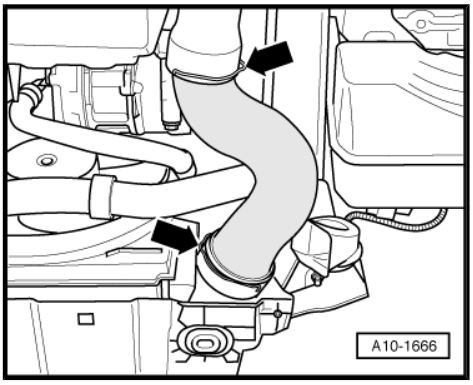


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– Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.



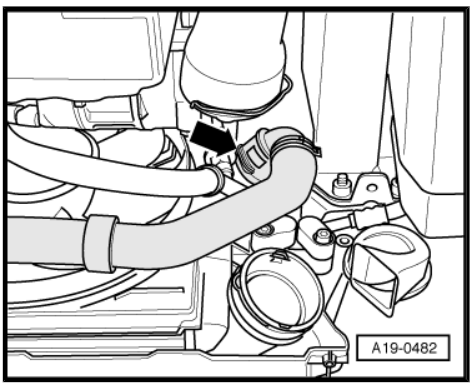
– Remove air intake hose (right-side) by lifting retaining clips -arrows- slightly.



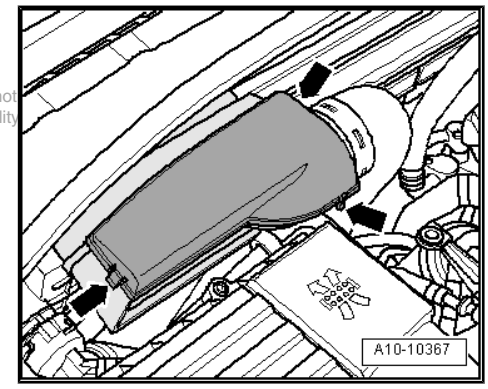
Caution

Seal opening of charge air cooler with a piece of clean foam or similar to prevent coolant from entering.

– Place drip tray for workshop hoist -VAS 6208- under engine.
– Pull out retaining clip at the bottom -arrow-, disconnect coolant hose from radiator and drain off coolant.
– Move coolant hose clear at air pipe.

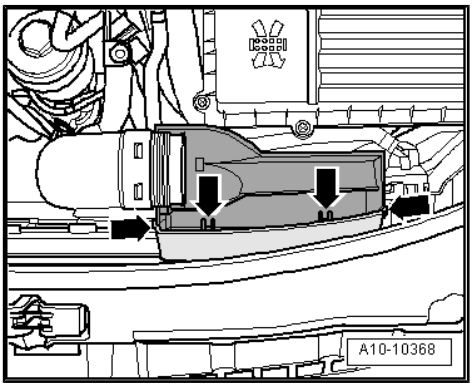


– Pull cover off air duct (release clips on sides) -arrows-.

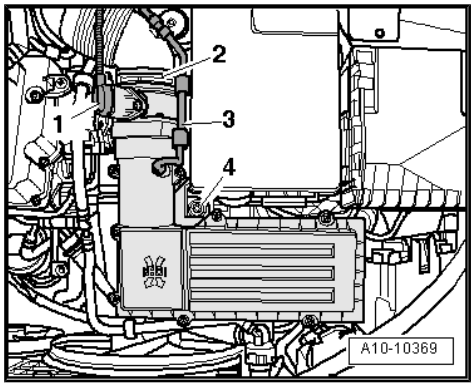


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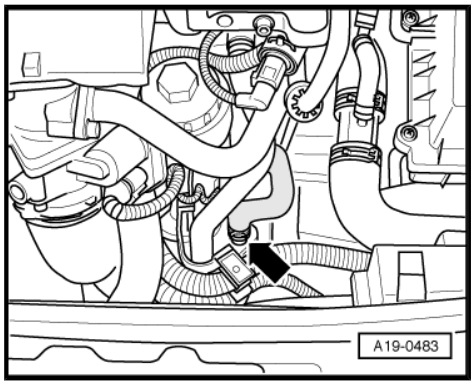
– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



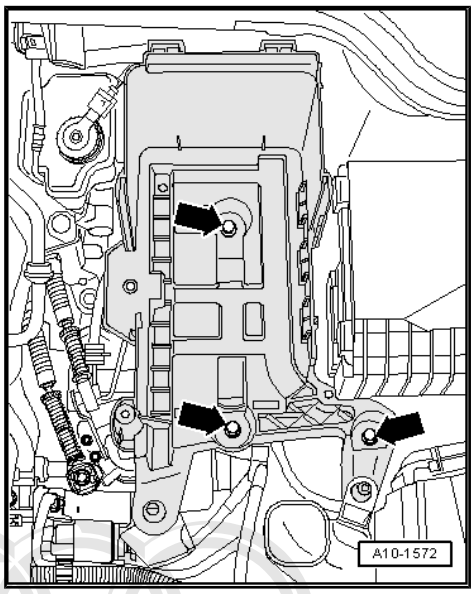
– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.



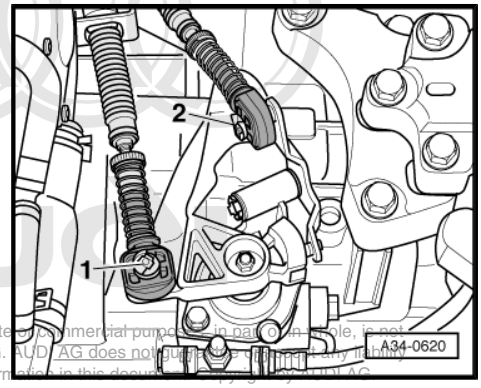
– Disconnect coolant hose at bottom of oil cooler -arrow- and drain off remaining coolant.



– Remove battery ⇒ Rep. Gr. 27 .
– Remove battery tray -arrows-.

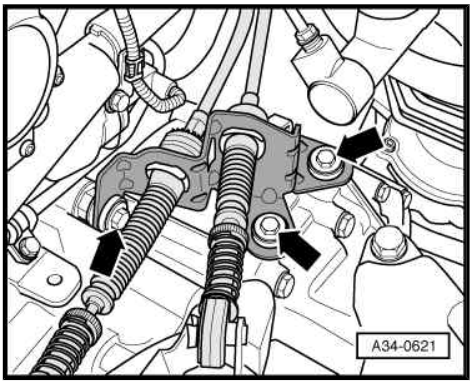


– Unclip securing clips -1- and -2- on both selector cables.
– Pull selector cable end-pieces off selector shaft lever and relay lever.



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

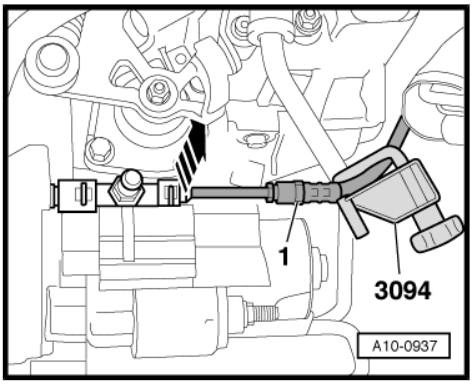


– Clamp off pressure hose to clutch slave cylinder using a hose clamp -3094- .

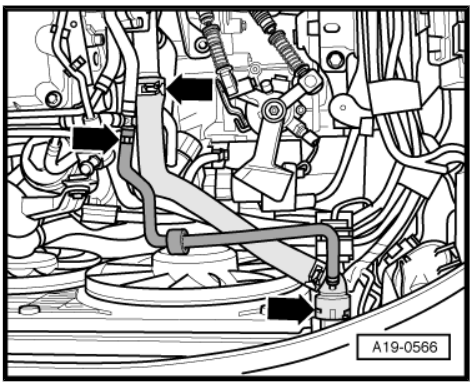
– Detach pressure hose -1- from hose connector by pulling securing clip -arrow- upwards.

Caution

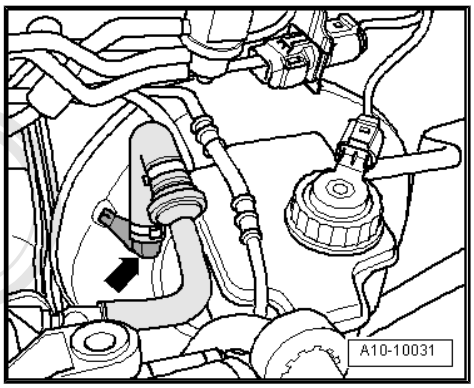
Do not operate clutch pedal with slave cylinder removed.



– Detach coolant hoses at the connections indicated -arrows-.

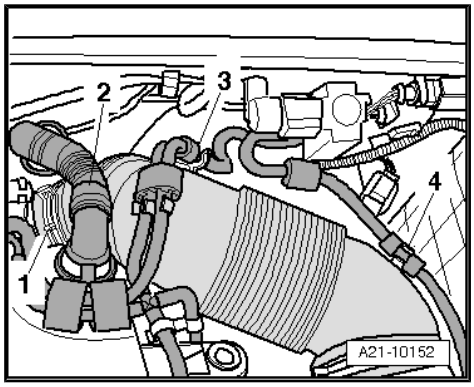


– Disconnect vacuum hose -arrow- from brake servo.



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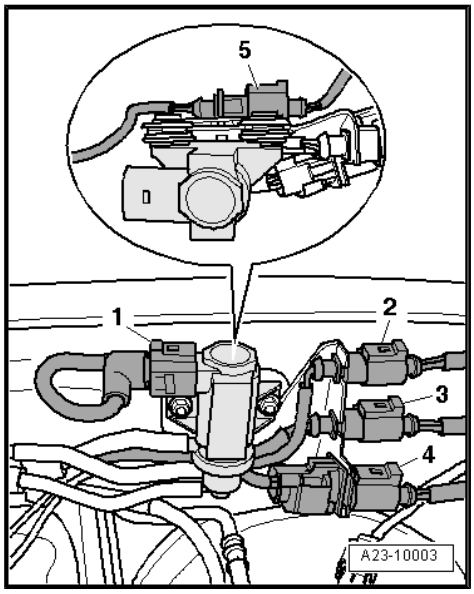
– Remove crankcase breather hose -2-.
– Move vent hose -4- and vacuum hoses -3- clear at air intake hose.
– Slacken hose clip -1-.
– Swing air hose to rear and detach from turbocharger.



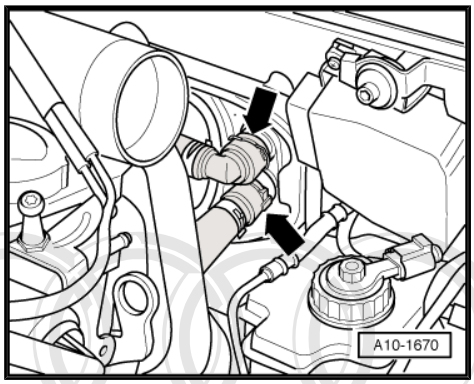
– Disconnect electrical connector -1- at charge pressure control solenoid valve -N75- .
– Unscrew nuts and place charge pressure control solenoid valve -N75- on engine (hoses remain connected).

Note

Disregard -items 2, 3, 4 and 5-.



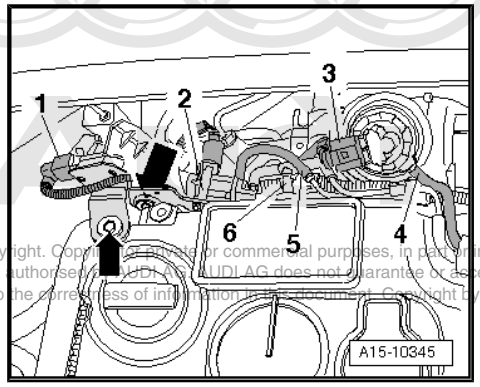
– Detach coolant hoses going to to heat exchanger at bulkhead -arrows-.



– Unclip change-over valve for exhaust gas recirculation cooler -N345- -item 2- from bracket.
– Unplug electrical connector -1- and move wiring clear.
– Remove bolts -arrows-.

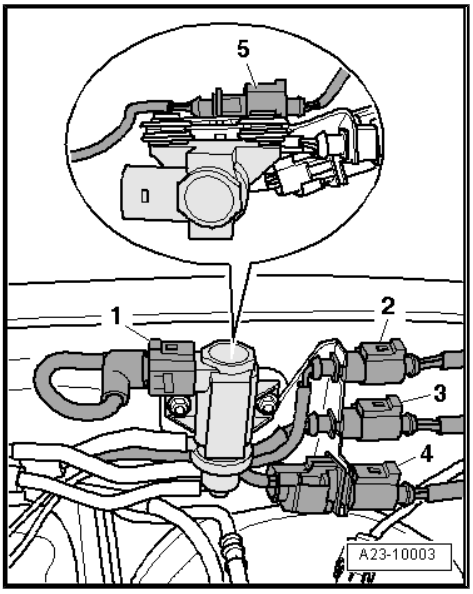
Note

Disregard -items 3, 4, 5 and 6-.



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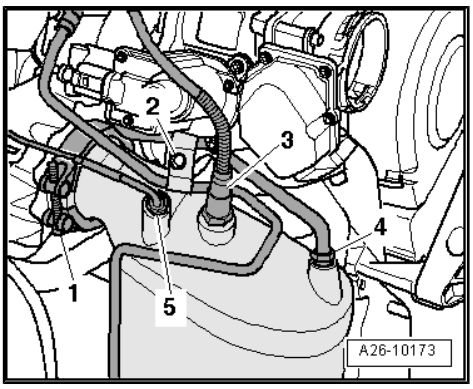
– Unplug electrical connector -3- for exhaust gas temperature sender 1 -G235- and electrical connector -4- for Lambda probe -G39- .
– Move wiring clear.



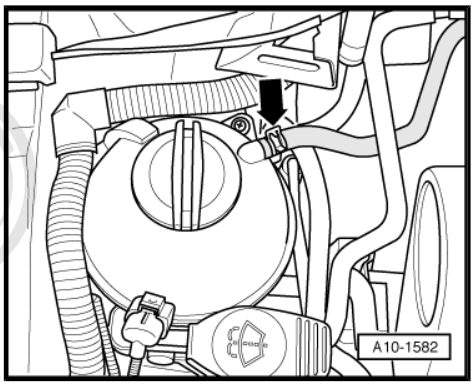
Note

Disregard -items 1, 2 and 5-.

– Unscrew Lambda probe -3- ⇒ Rep. Gr. 23 .
– Remove temperature sender before particulate filter -G506- -item 5- and move wiring clear.
– Unbolt bracket -2- for pressure pipes.
– Detach pressure pipe -4- from particulate filter.
– Remove exhaust gas pressure sensor 1 -G450- together with pressure pipes.
– Slacken and remove retaining clamp -1- for particulate filter.



– Detach coolant hose -arrow- at coolant expansion tank.



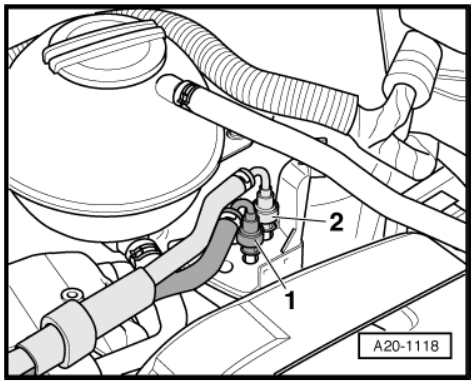
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Caution

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

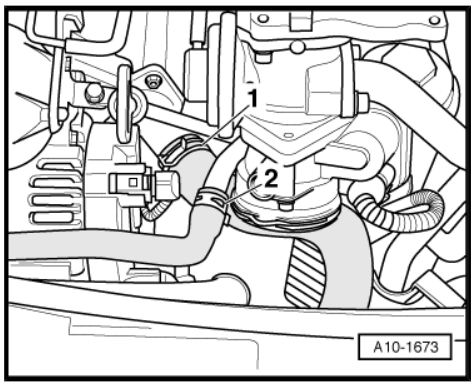
WARNING

- *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 pipe -2- and fuel return pipe -1- by pulling release tabs.

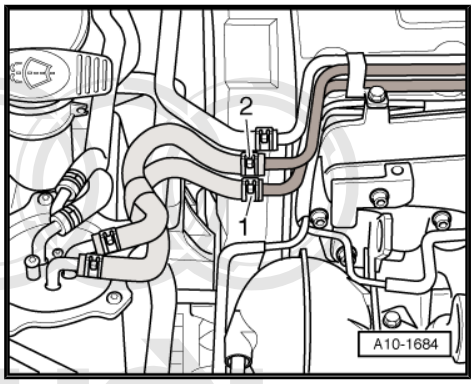
– Detach coolant hose -2- at front of engine.



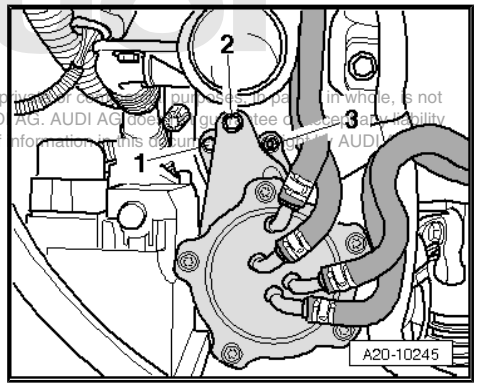
Note

Disregard -item 1-.

– Detach fuel supply hose -2- and fuel return hose -1- from fuel pipes.

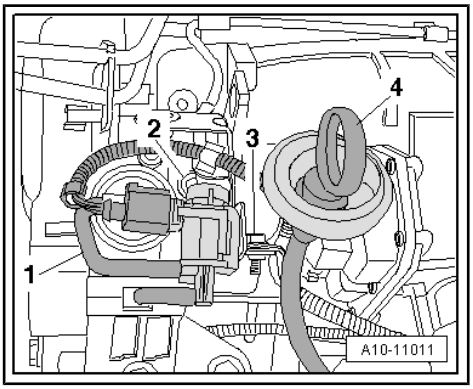


– Slacken bolt -1- one turn.
– Remove bolt -2- and nut -3-.
– Remove fuel filter with hoses attached.



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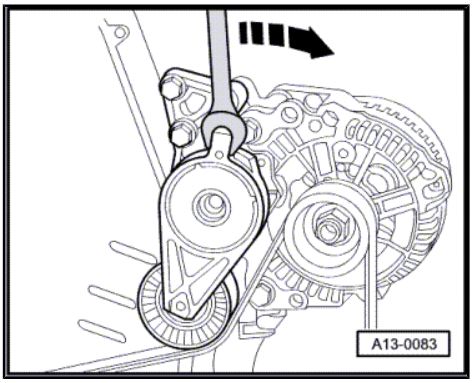
– Pull out oil dipstick -4-.
– Disconnect vacuum hose -1-.
– Remove bolts -2- and -3- and place engine lifting eye with intake manifold flap valve -N316- on engine.



Note

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

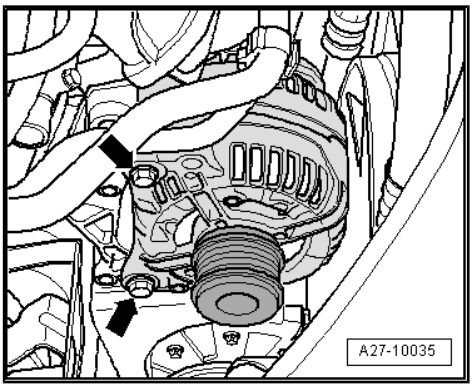
– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.
– Remove poly V-belt.



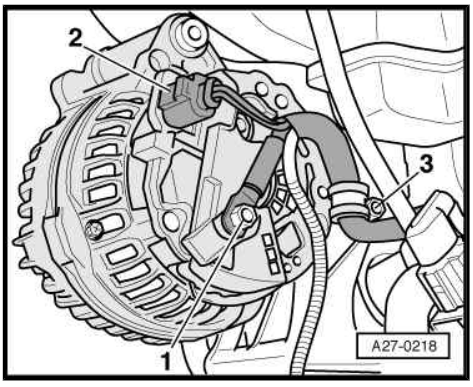
– Unscrew bolts -arrows- and remove alternator.

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.*

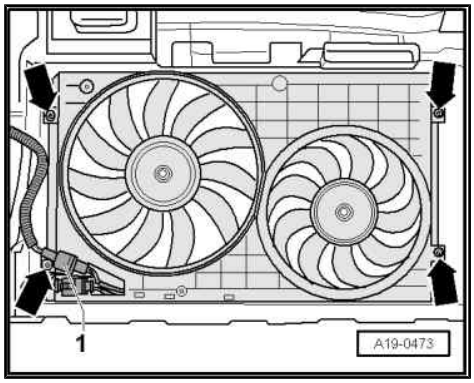


– Swivel alternator towards right side of vehicle with wiring connected.
– Unplug electrical connector -2-.
– Unscrew wire -1- and wire clamp -3- at alternator.
– Lift out alternator.

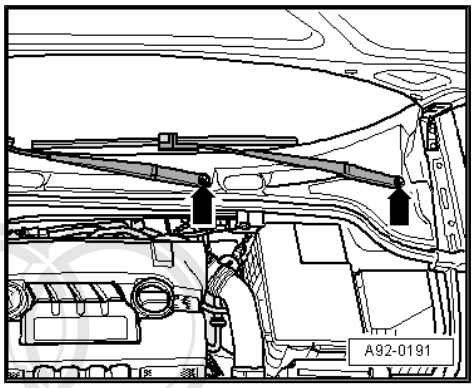


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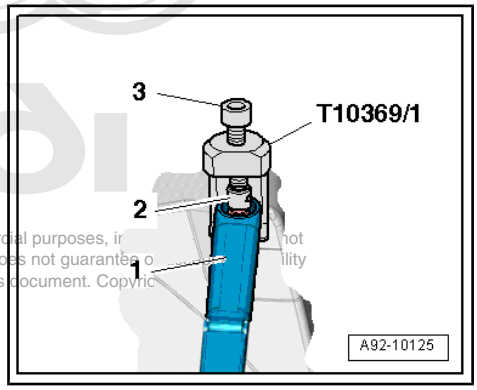
– Unscrew top bolts -upper arrows- for radiator cowl.



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

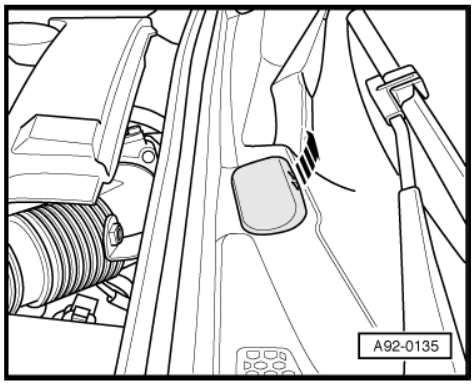


– Apply puller -T10369/1- onto wiper arm -1- as shown illustration.
– Apply thrust piece -2- onto wiper shaft.
– Turn bolt -3- in clockwise direction until wiper arm is pulled off wiper shaft.
– Remove nuts completely and take off wiper arms.

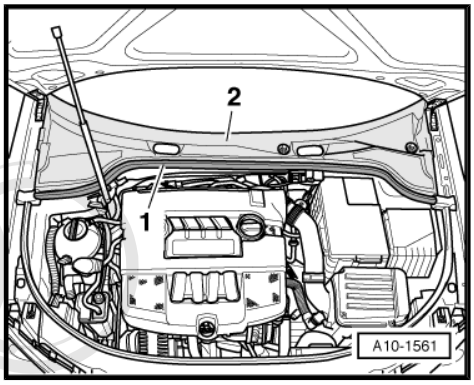


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– Unclip washer jets -arrow-.
– Push washer jet through assembly opening back into plenum chamber, leaving hoses connected.

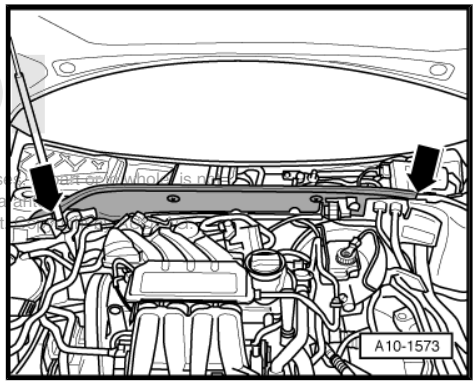


– Pull off rubber seal -1- on plenum chamber cover.
– Detach plenum chamber cover -2-.



– Detach engine wiring harness at rear plenum chamber panel.
– Remove plenum chamber intermediate plate -arrows-.

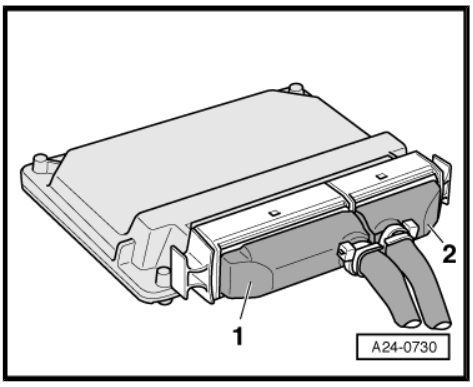
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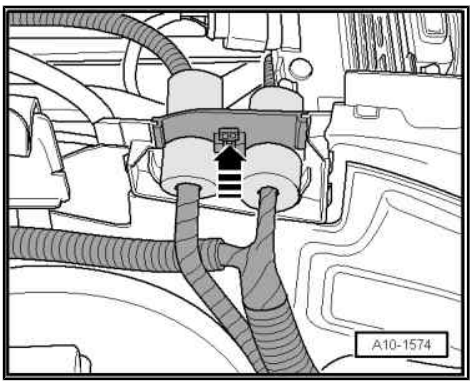
– Remove engine control unit ⇒ Rep. Gr. 23 .
– Unplug electrical connector -2- for engine wiring harness and move connector clear.

Note

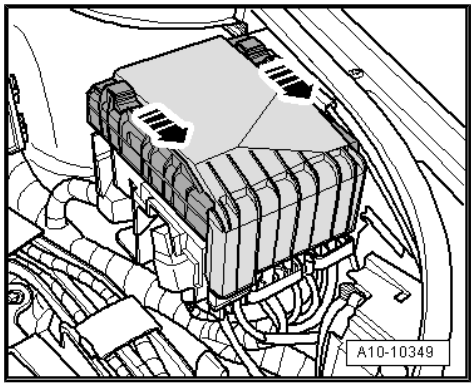
The electrical connector -1- remains connected.



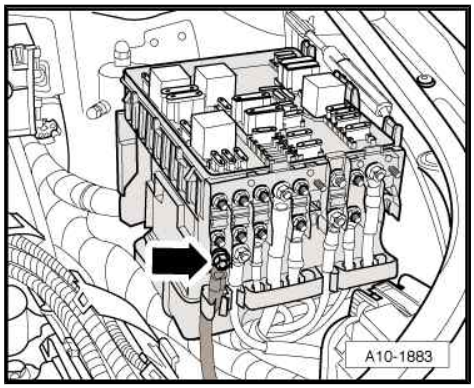
– Release wiring protector for engine wiring harness -arrow- and lift off.



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

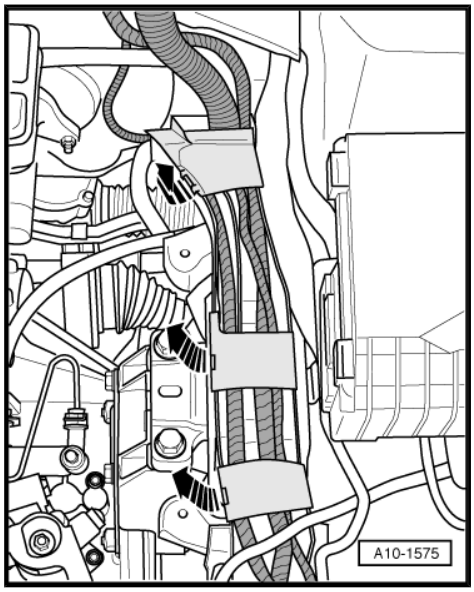


– Unscrew terminal 30 wire -arrow- from electronics box in engine compartment and move it clear.

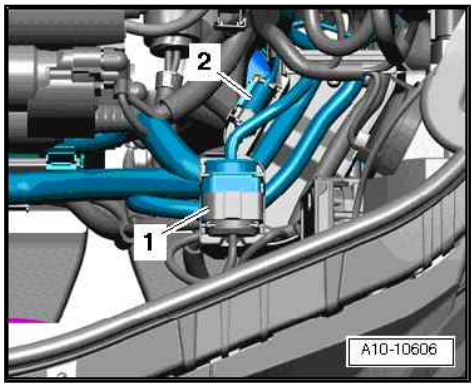


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– Open wiring duct brackets -arrows-.



– Unclip electrical connector -1- from bracket and unplug it.
– Open wiring duct bracket located below.
– Unclip engine control unit wiring harness from wiring duct.

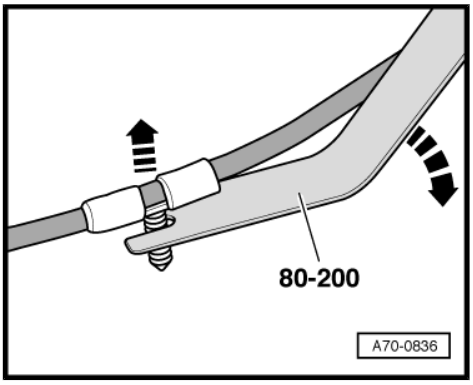


Note

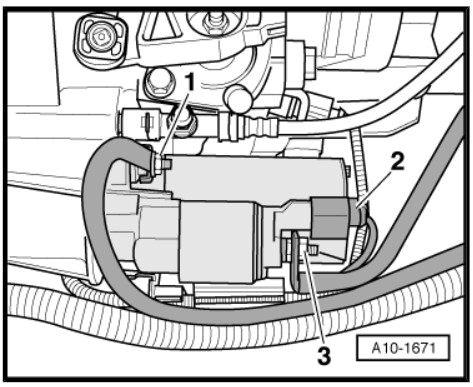
Disregard -item 2-.

Note

Use removal lever -80 - 200- to lever out the wiring clips.

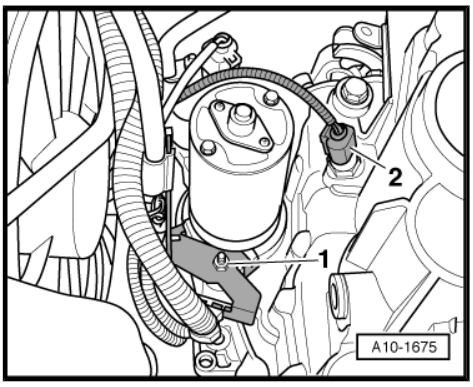


– Disconnect earth cable -1-.
– Unplug electrical connector -2-.
– Push back protective cover and unscrew B+ wire -3- from starter solenoid switch.

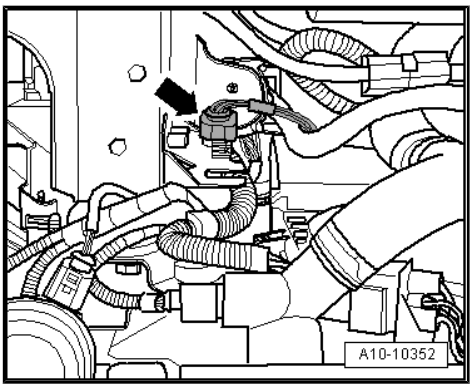


– Unplug electrical connector -2- for reversing light switch.
– Unscrew nut -1- and remove bracket with wiring from stud.

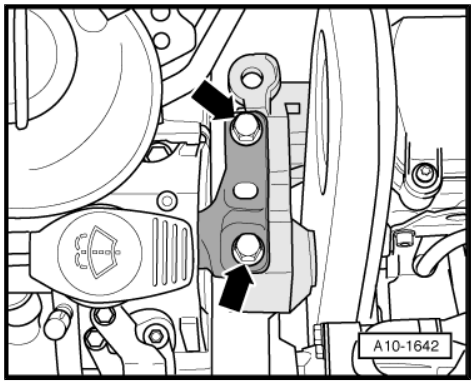
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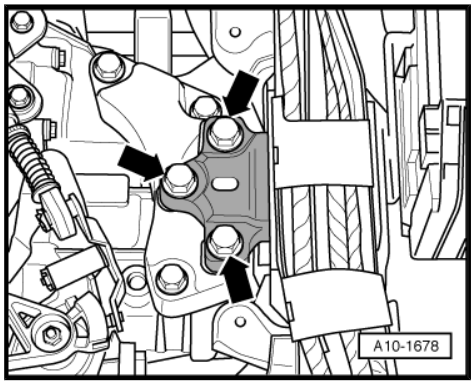
– Unplug electrical connector -arrow- at longitudinal member (bottom left).



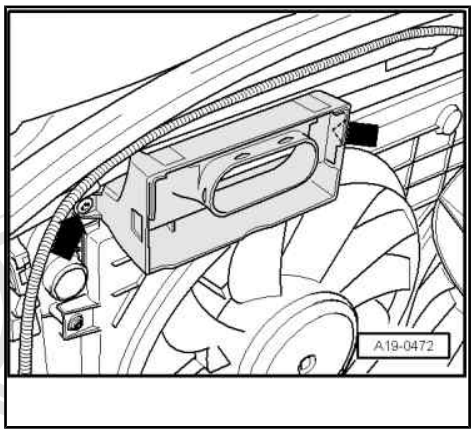
– Loosen bolts -arrows- of assembly mounting for engine approx. 2 turns.



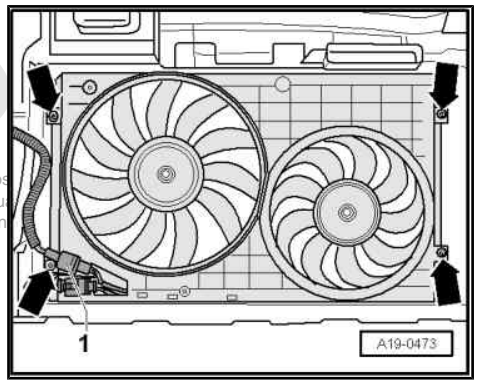
– Loosen bolts -arrows- of assembly mounting for gearbox approx. 2 turns.



– Unscrew air duct at lock carrier -arrows-.

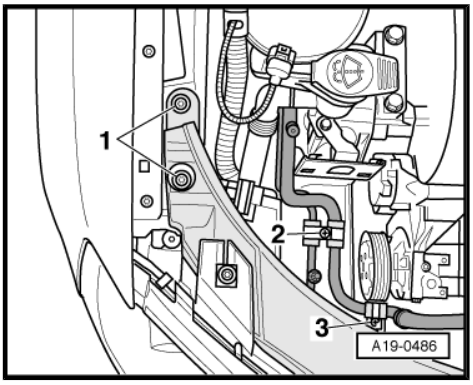


– Unplug electrical connector -1-.
– Unscrew the bottom bolts -bottom arrows- and remove radiator cowl from below.



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– Unscrew bolts -1- for lock carrier (right-side).



WARNING

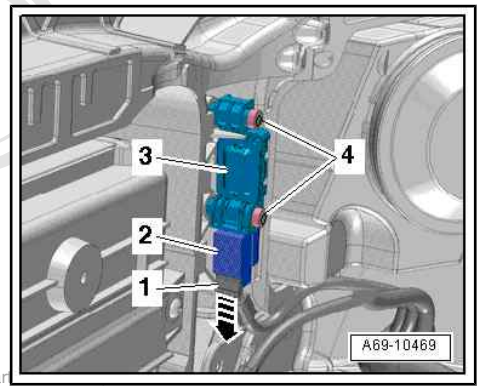
The air conditioner refrigerant circuit must not be opened.

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 -2- and -3- at brackets for refrigerant pipes.

– Remove bolts -4- and move crash sensor (right-side) with wiring to one side.



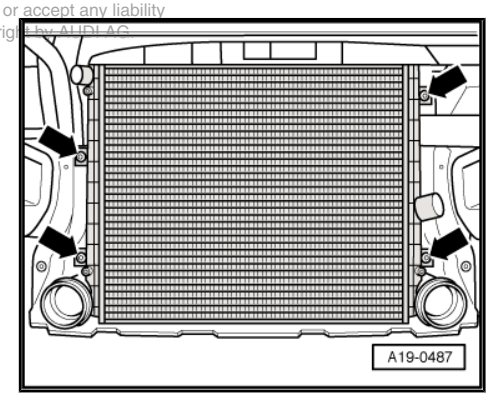
Note

Disregard items marked -1, 2, 3- and -arrows-.

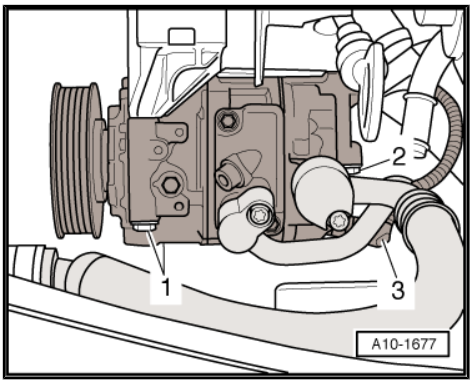
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– Unscrew bolts -arrows- on backside of radiator.

– Lift out radiator from above.



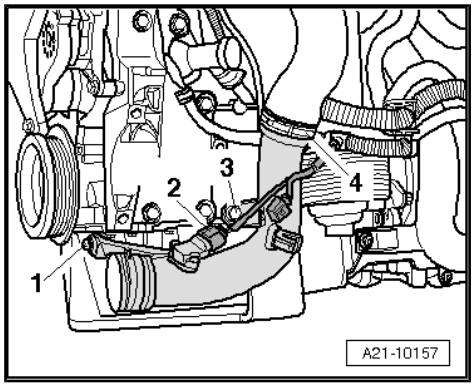
– Unplug electrical connector -3- at air conditioner compressor.



Note

Disregard items marked -1- and -2-.

– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolts -1- and -3-.
– Disconnect air pipe from air hose -4- and remove pipe downwards.



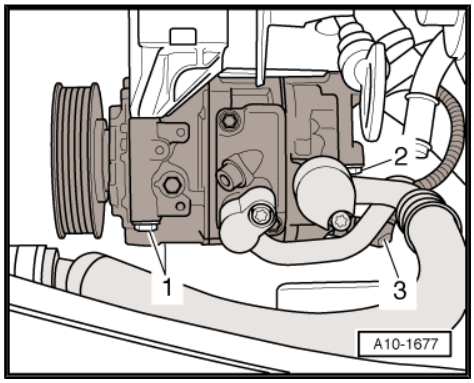
WARNING

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- and tie air conditioner compressor up to lock carrier.

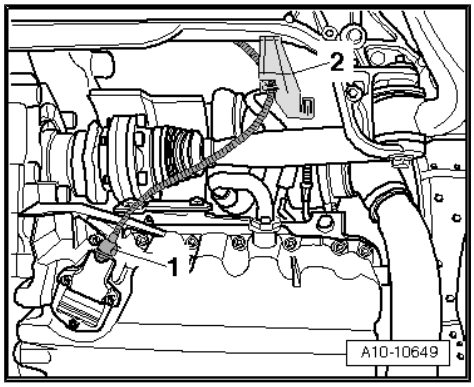


Note

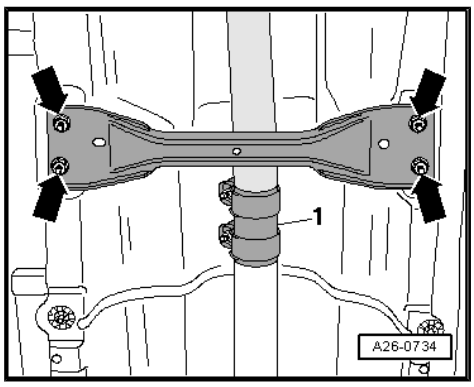
Disregard -item 3-.

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



– Remove front cross-piece for underbody -arrows-.

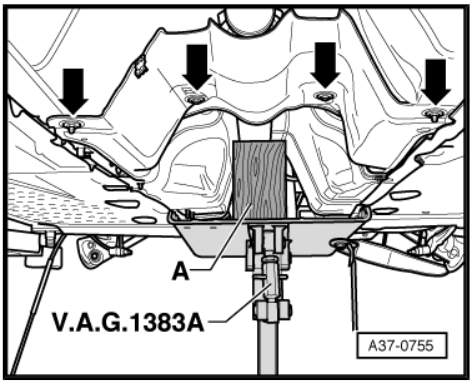


Note

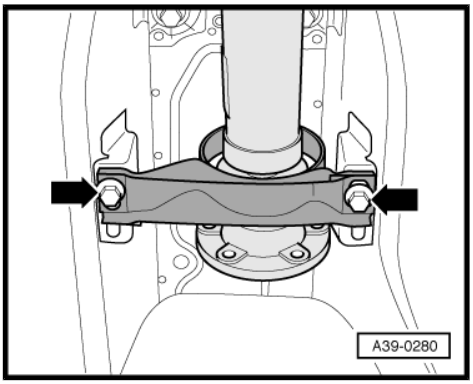
To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

– Loosen nuts on clamp -1-.
– Push clamp back and tie up front exhaust pipe to underbody.

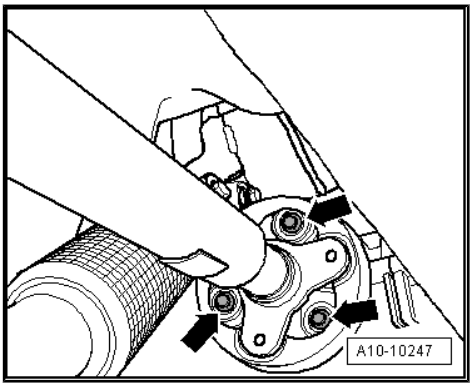
– To support propshaft, position engine and gearbox jack -V.A.G 1383 A- underneath with a piece of wood -A- placed in between.
– Remove bolts -arrows- securing heat shield and propshaft centre bearing and detach heat shield.



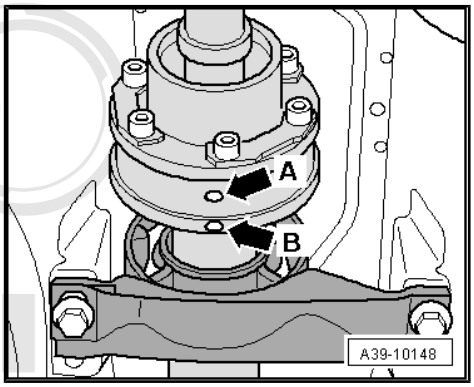
– Fit bolts -arrows- for propshaft centre bearing again.



– Unbolt flexible coupling for propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).

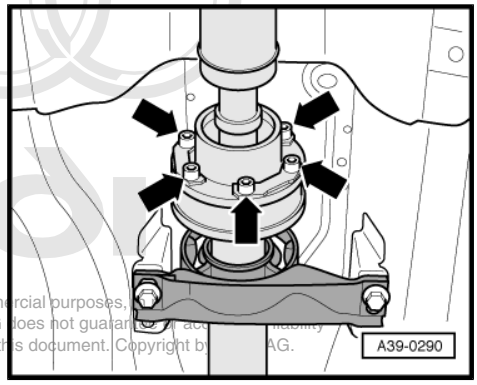


– Check whether markings -arrow A- and -arrow B- are visible on constant velocity joint and propshaft. Apply markings if necessary.



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– Remove bolts -arrows-.



Caution

Take care to bend the front section of the propshaft tube downwards as little as possible when detaching.

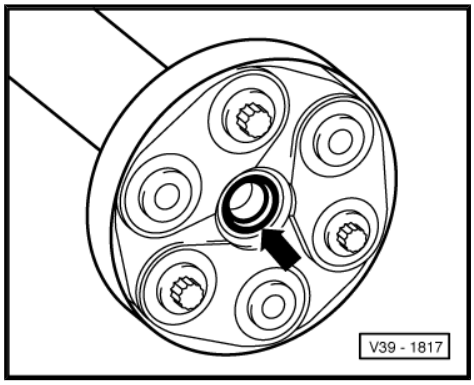
– Push front section of propshaft tube towards the front and swivel it out of rear section of propshaft tube.

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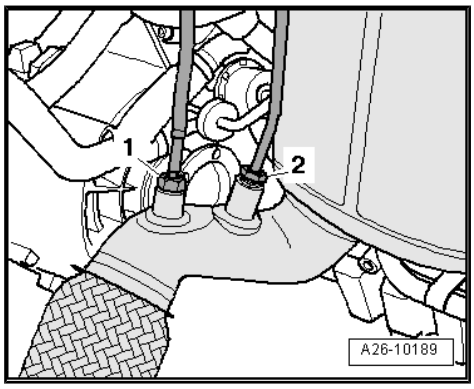
Note

Avoid damaging the seal -arrow- in the propshaft flange when removing and installing.

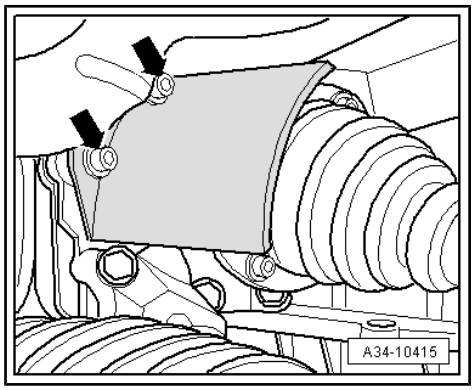
– Pull front section of propshaft tube off centring pin on bevel box horizontally, swivel downwards and detach.



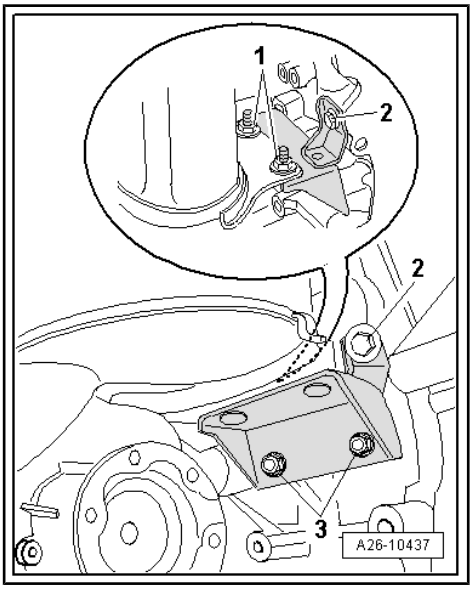
– Unscrew temperature sender after particulate filter -G527- -item 1- from exhaust pipe behind particulate filter.
– Unscrew pressure pipe -2- going to exhaust gas pressure sensor 1 -G450- .
– Remove exhaust gas pressure sensor 1 -G450- together with pressure pipes.



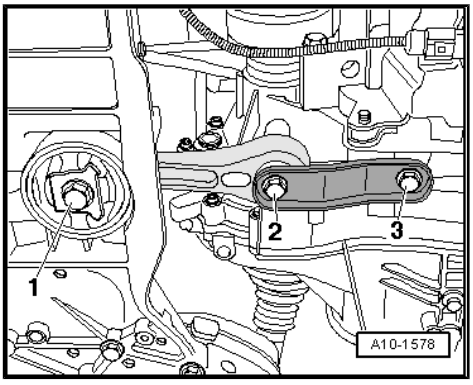
– Unbolt drive shaft (left-side) from gearbox flange and drive shaft (right-side) from bevel box flange.
– Unbolt heat shield for drive shaft (right-side) -arrows-.
– Tie up drive shaft (left-side), push back drive shaft (right-side).



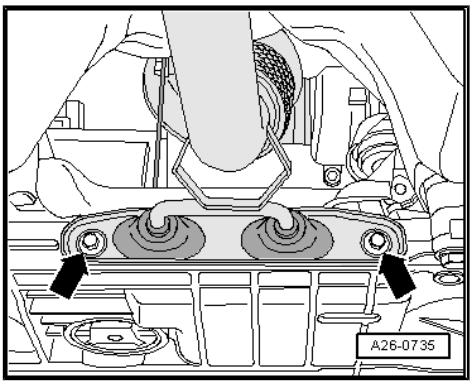
– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.



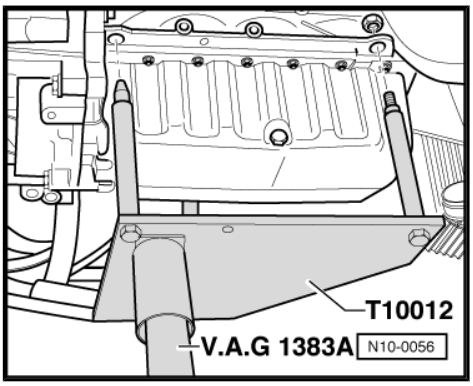
– Unscrew bolts -1 ... 3- and remove pendulum support.



– Unbolt bracket for exhaust system -arrows-.
– Place particulate filter to rear in engine compartment.



– 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.

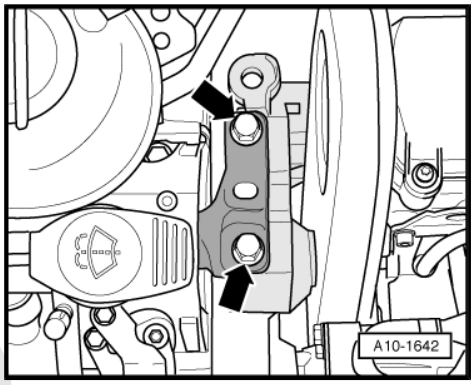


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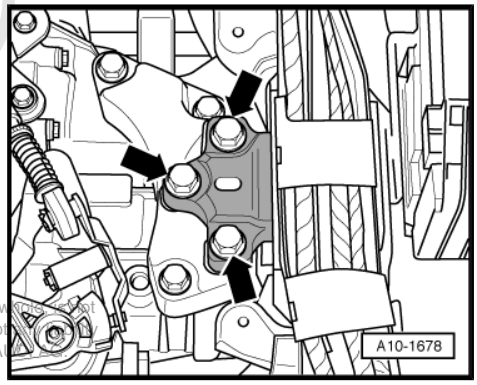
Note

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.*

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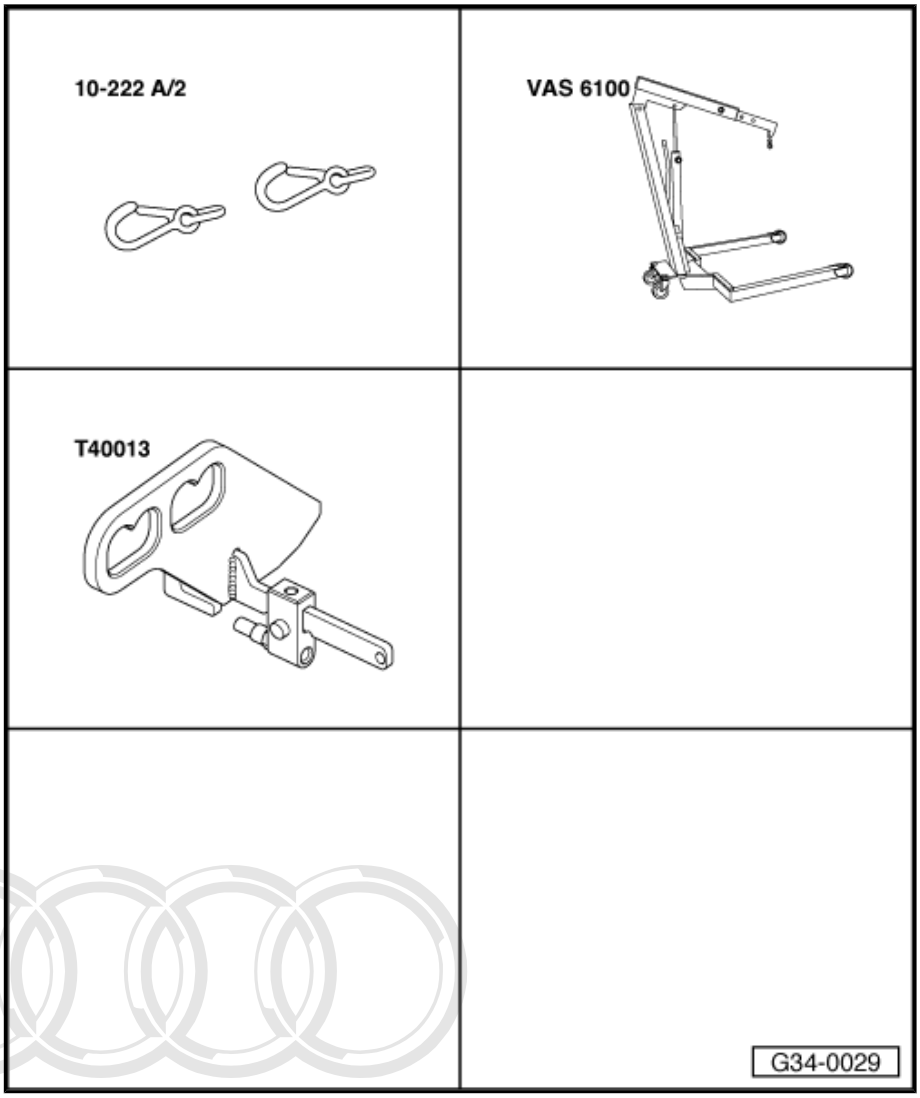
– First lower engine/gearbox assembly only slightly.

– Then swing gearbox end of engine/gearbox assembly forwards and only then lower further.

4 Separating engine from manual gearbox

Special tools and workshop equipment required

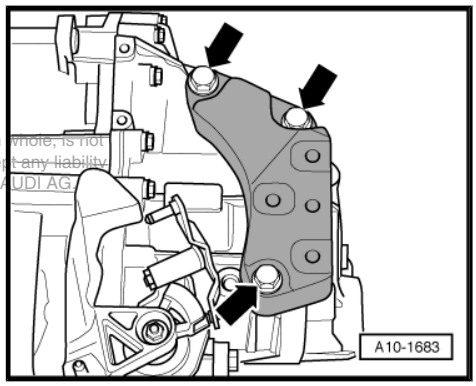
- Hooks -10-222 A/2-
- Workshop hoist - VAS 6100-
- Lifting tackle -T40013-



Procedure

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

– Unbolt gearbox support -arrows-.

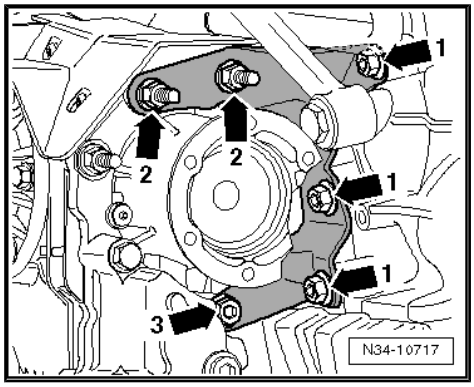


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Vehicles with four-wheel drive:

– Remove flange shaft (right-side) ⇒ Rep. Gr. 39 .

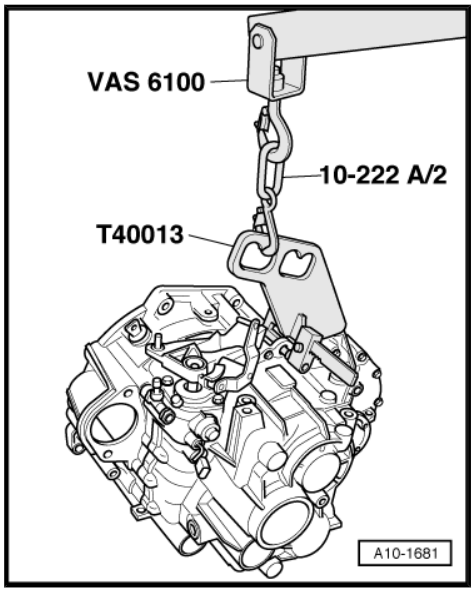
– Remove bolts -1 ... 3- and detach bracket for bevel box.



All vehicles (continued):

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

– Attach workshop hoist -VAS 6100- with hooks -10-222 A/2- to the lifting tackle.

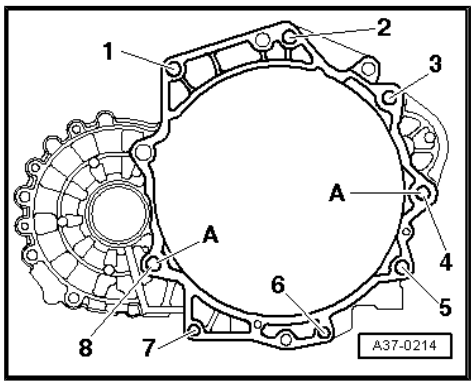


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– Remove bolts -1 ... 8- on engine/gearbox flange.

– Detach starter.

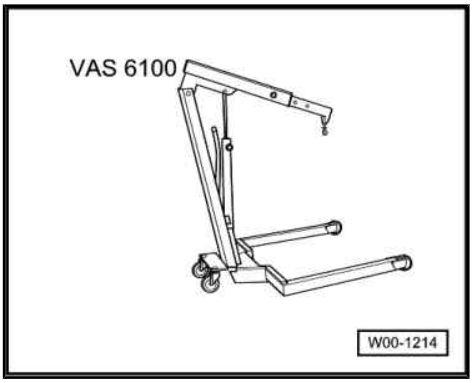
– Separate gearbox from engine.



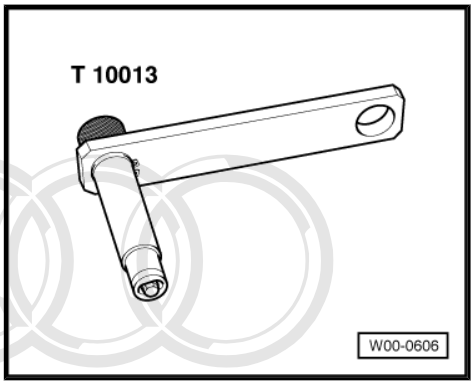
5 Separating engine from direct shift gearbox

Special tools and workshop equipment required

- Workshop hoist -VAS 6100-



- Retainer -T10013-

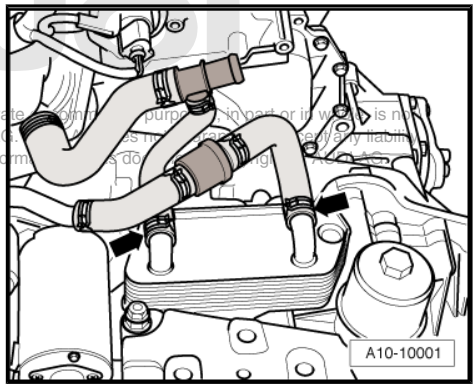


- Bolt M8x40 with nut and washer with ∅ 30 mm

Procedure

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

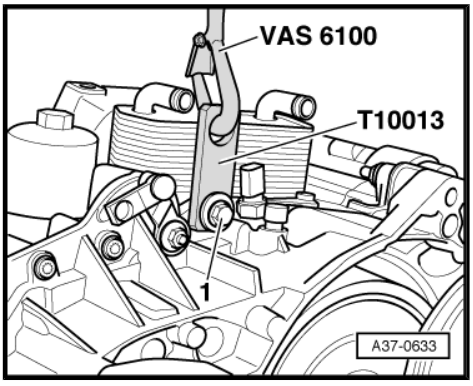
– Disconnect coolant hoses -arrows- at ATF cooler.



– Remove the pin from retainer -T10013- ; to do so, remove circlip.

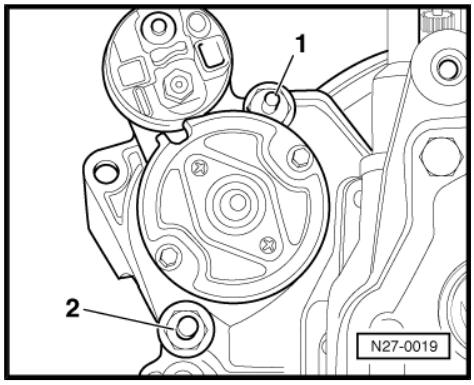
– Secure retainer -T10013- to gearbox lifting eye with a bolt M8x40 -item 1- and washer ∅ 30 mm.

– Attach workshop hoist -VAS 6100- to retainer -T10013- .

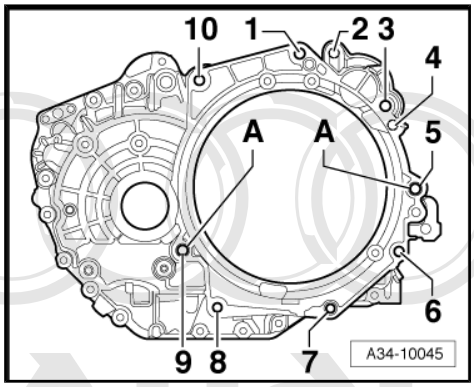


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– Remove bolts -1- and -2-.
– Remove starter from gearbox.



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

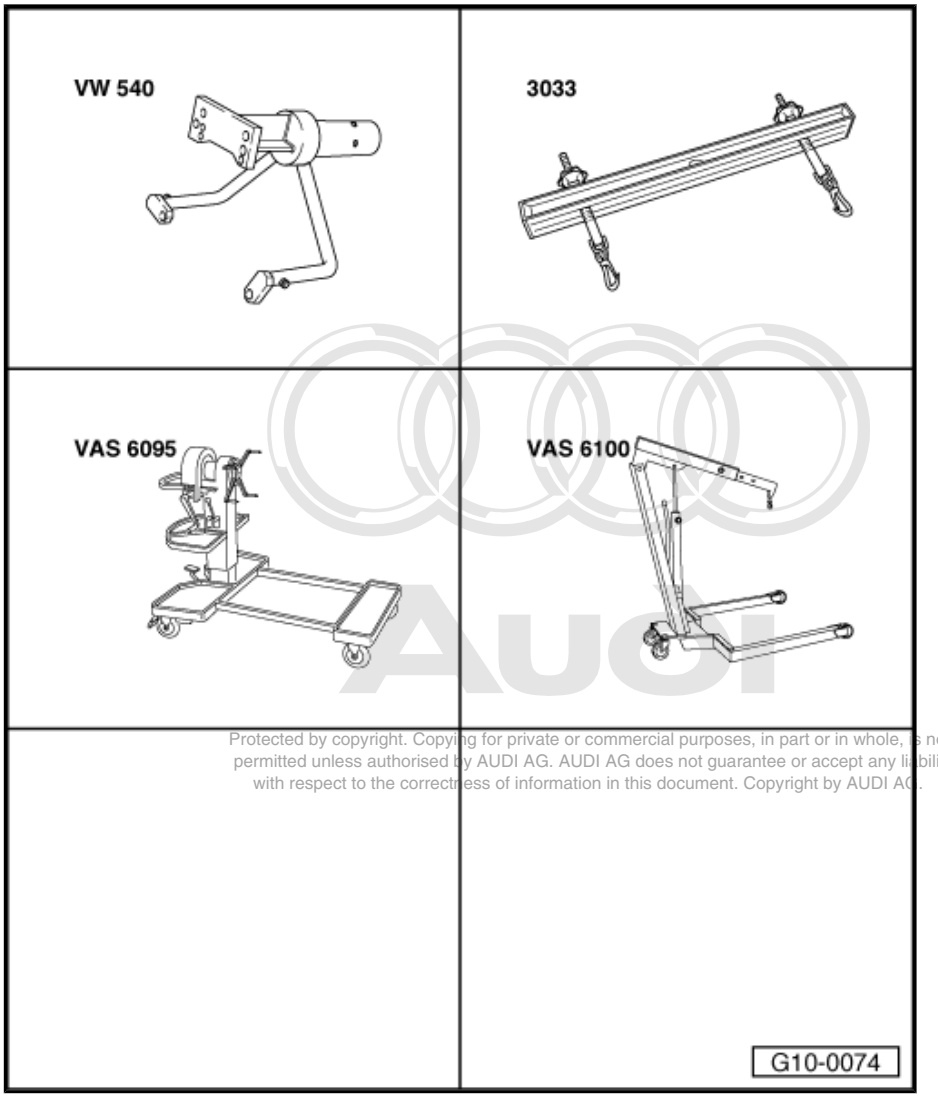


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6 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- Engine and gearbox support -VW 540-
- Lifting tackle -3033-
- Engine and gearbox support -VAS 6095-
- Workshop hoist - VAS 6100-



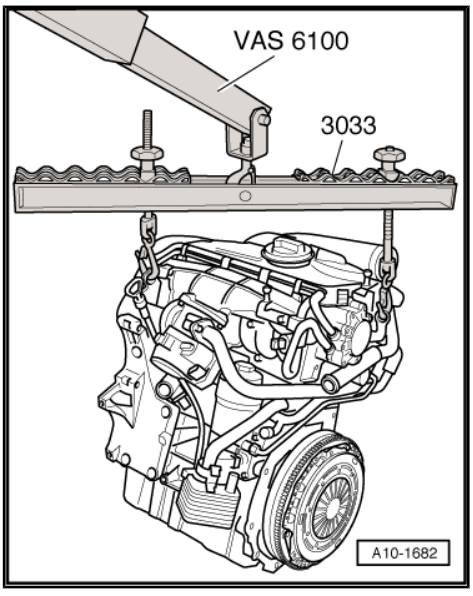
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Procedure

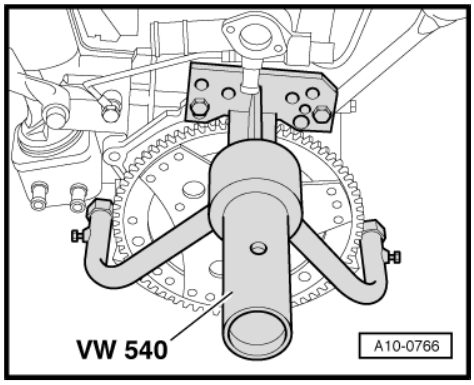
- Gearbox detached from engine.

– Attach lifting tackle -3033- to engine and workshop hoist -VAS 6100- as shown in the illustration.

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



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



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7 Installing engine

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

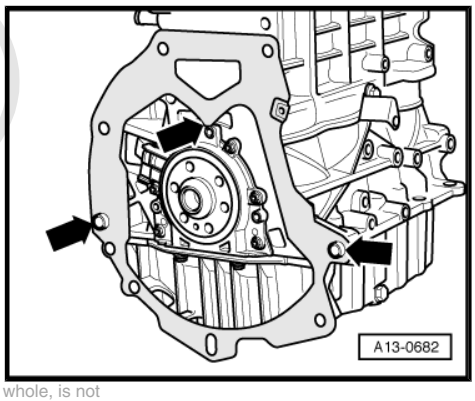
Installation is carried out in the reverse order; note the following:

Note

- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil 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.*

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

– Ensure that the intermediate plate is engaged on the sealing flange and pushed onto the dowel sleeves -arrows-.



Vehicles with manual gearbox:

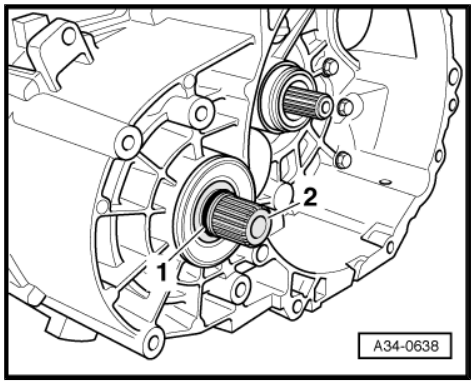
– Check that clutch plate is correctly centred ⇒ Rep. Gr. 30 .

– Check clutch release bearing for wear; renew 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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– Renew O-ring -1- on stub shaft of gearbox (right-side) and lubricate splines -2- with universal grease ⇒ Electronic parts catalogue .



Vehicles with direct shift gearbox:

– Clean input shaft splines on gearbox and splines 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 direct shift gearbox; install needle bearing if not yet fitted ⇒ page 145 .

All vehicles (continued):

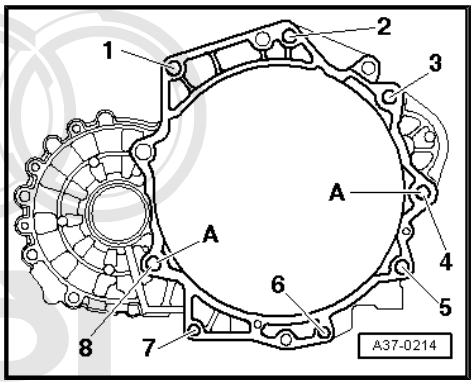
– Bolt gearbox to engine.

Note

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

Securing engine to manual gearbox

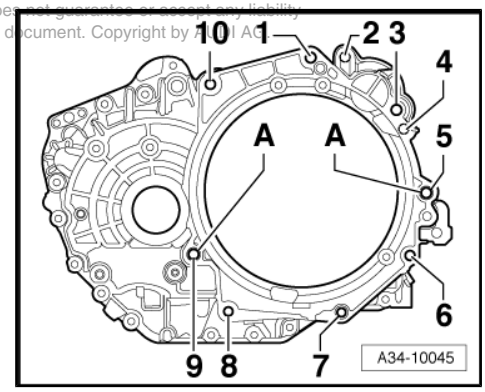
Item	Bolt	Nm
1 [1], 2 [1]	M12x55	80
3 , 4	M12x165	80
5 [1]	M12x105	80
6 [1], 7 [1]	M10x50	40
8 [1]	M10x70	40
A	Dowel sleeves for centralising	
• [1] Renew bolts.		



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Securing engine to direct shift gearbox

Item	Bolt	Nm
1 [1], 3 [1], 10 [1]	M12x55	80
5 [1], 9 [1]	M12x70	80
6 … 8 [1]	M10x50	40
A	Dowel sleeves for centralising	
• [1] Renew bolts.		



– Secure starter using bolts -2- and -4-.

Vehicles with four-wheel drive:

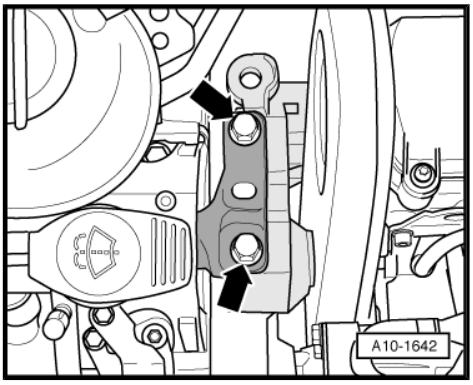
– Install bracket for bevel box ⇒ Rep. Gr. 34 .

– Install flange shaft (right-side) ⇒ Rep. Gr. 39 .

All vehicles (continued):

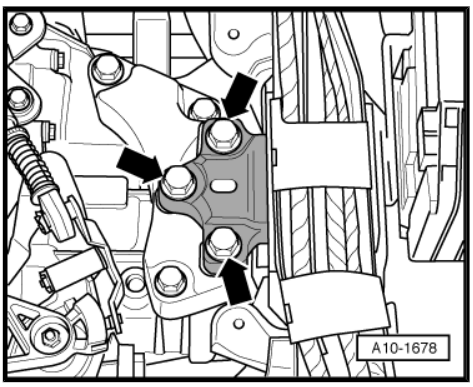
– Guide engine/gearbox assembly into the body.

– 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 assembly mountings ⇒ *page 80* .

– Remove engine bracket -T10012- from engine.

– Install drive shafts ⇒ Rep. Gr. 40 .

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Vehicles with engine codes AZV, BKD and direct shift gearbox:

– Install wishbone (right-side) ⇒ Rep. Gr. 40 .

– Install coupling rod (right-side) ⇒ Rep. Gr. 40 .

– Install radiator ⇒ page 264 .

– Install oil pressure switch ⇒ page 235 .

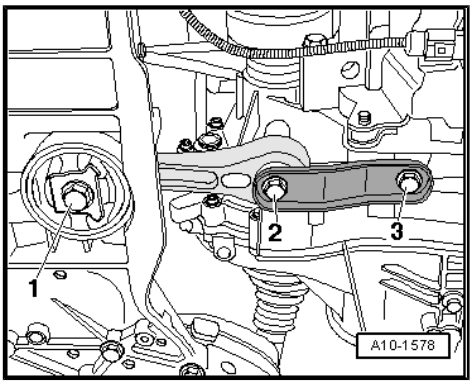
Vehicles with four-wheel drive:

– Install propshaft ⇒ Rep. Gr. 39 .

All vehicles (continued):

– Secure pendulum support with bolts -1 ... 3- to gearbox and subframe.

– Use new securing bolts.



Vehicles with engine codes AZV, BKD:

– Install front exhaust pipe ⇒ page 304 .

Vehicles with engine codes BMN, BUY:

– Install particulate filter ⇒ page 313 .

– Install exhaust system and align it free of stress ⇒ page 308 .

– Install air conditioner compressor ⇒ Rep. Gr. 87 .

– To facilitate positioning of alternator, drive back bushes for securing bolts slightly.

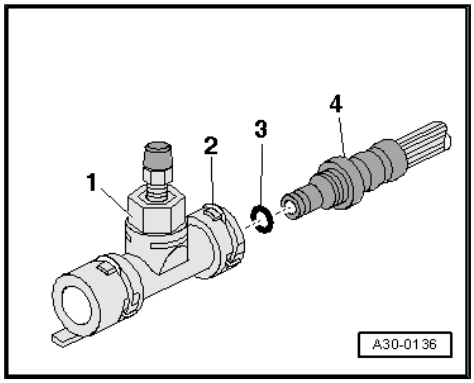
– Install alternator ⇒ Rep. Gr. 27 .

– Install poly V-belt ⇒ page 86 .

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.



WARNING

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 direct shift gearbox:

– Fit selector lever cable and adjust ⇒ Rep. Gr. 34 .

All vehicles (continued):

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

– Install air pipes: vehicles with engine codes AZV, BKD ⇒ page 279 , vehicles with engine codes BMN, BUY ⇒ page 299 .

Vehicles with four-wheel drive:

– Install crash sensor ⇒ Rep. Gr. 69 .

All vehicles (continued):

– Adjust assembly mountings ⇒ page 80 .

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install battery ⇒ Rep. Gr. 27 .

– Check oil level ⇒ page 244 .

– Fill cooling system ⇒ page 251 .

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Note

- *Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.*
- *Contaminated or dirty coolant must not be used again.*

WARNING

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

– Check headlight adjustment ⇒ Maintenance ; Booklet 808 .

Tightening torques

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	20
	M10	40
	M12	65
Except for the following:		
Direct shift gearbox: Starter to gearbox		40
Manual gearbox: Gearbox support to gearbox		60 + 90° 1)2)
Pendulum support to:	Gearbox / sub-frame	Manual gearbox ⇒ Rep. Gr. 34 , automatic gearbox ⇒ Rep. Gr. 37
Lock carrier to body		10
Terminal B+ to starter		16
Earth wire to gearbox		22
Air cleaner housing to bracket		10
Drive shaft heat shield to cylinder block		35
Underbody cross member (front) to body		23

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

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8 Adjusting assembly mountings

8.1 Checking adjustment

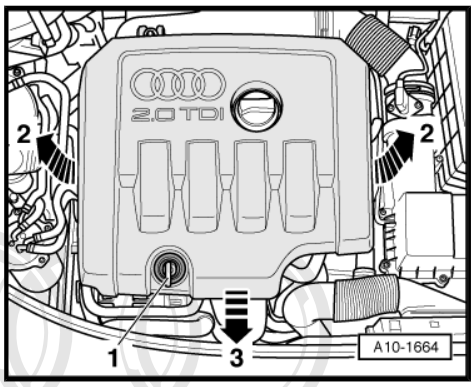
Procedure

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

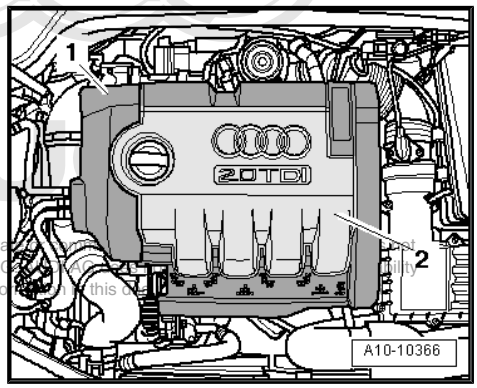
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

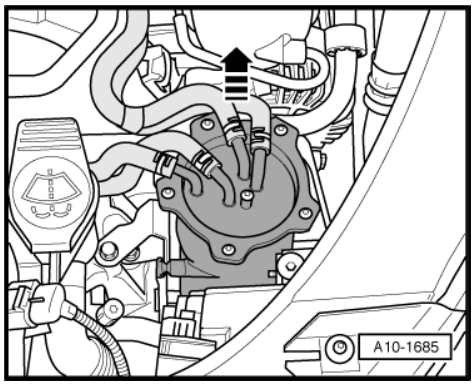
– Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



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Fuel filter - version 1:

– Lift fuel filter out of bracket -arrow- with hoses connected and move it aside (leaving hoses attached).

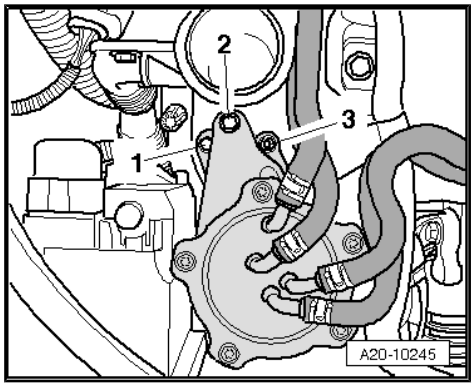


Fuel filter - version 2:

– Slacken bolt -1- one turn.

– Remove bolt -2- and nut -3-.

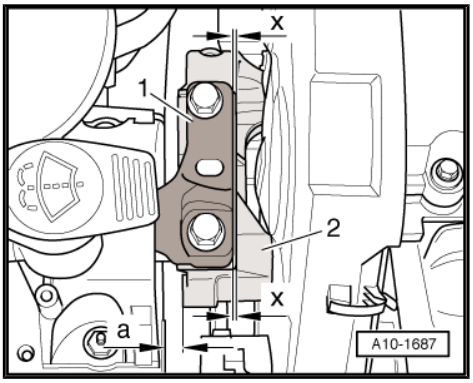
– Move fuel filter aside with hoses attached.



All vehicles (continued):

The following specifications must be obtained:

- There must be a distance of -a- = 13.5 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

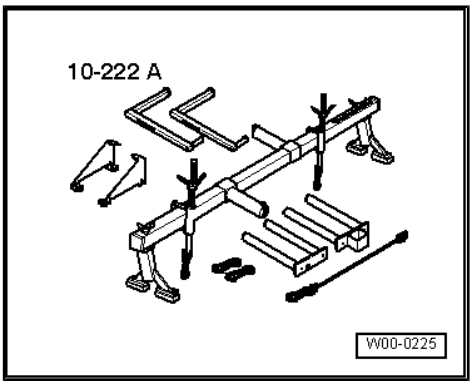
Distance -a- = 13.5 mm can also be checked with a metal rod of suitable size, or similar.

If the distance measured is too large or small, the assembly mountings must be adjusted ⇒ page 81 .

8.2 Adjusting assembly mountings

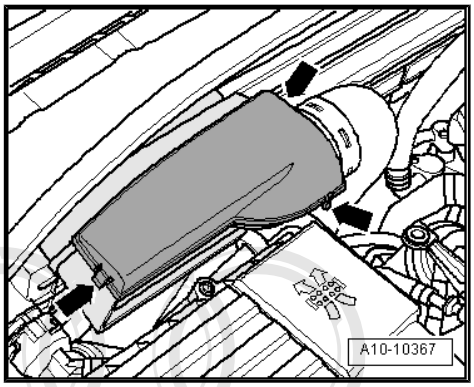
Special tools and workshop equipment required

- Support bracket -10 - 222 A-

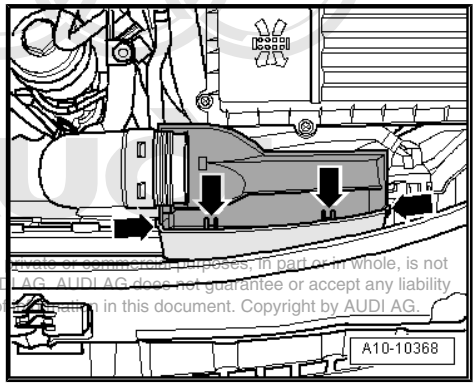


Procedure

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

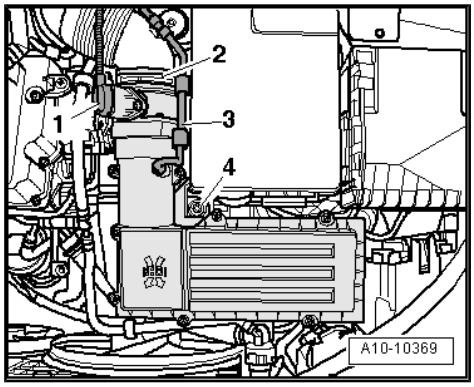


– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



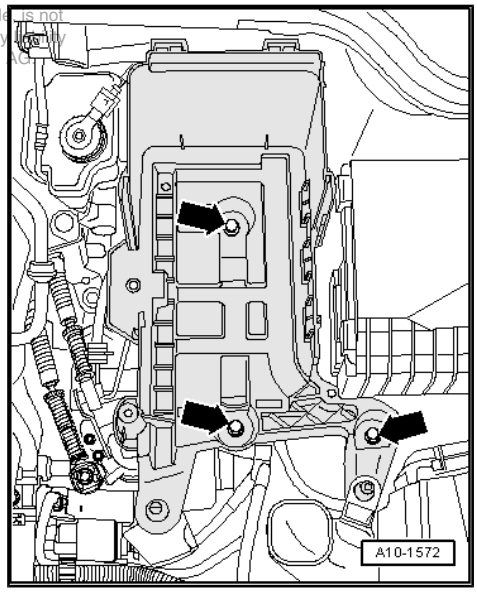
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– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.

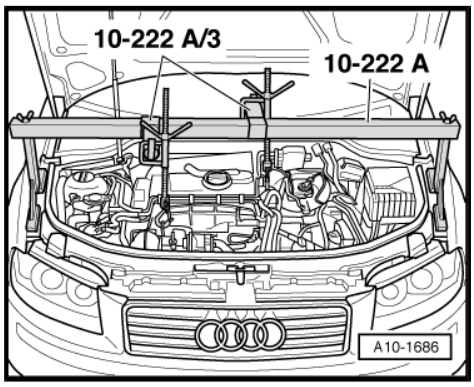


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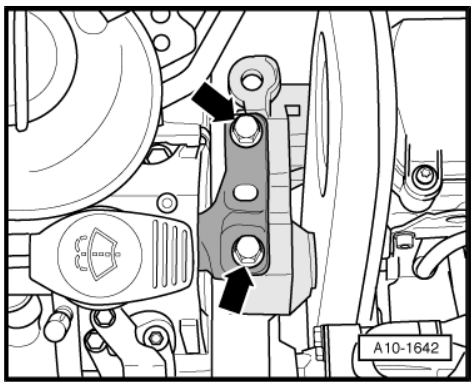
– Remove battery ⇒ Rep. Gr. 27.
– Remove battery tray -arrows-.



– 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).

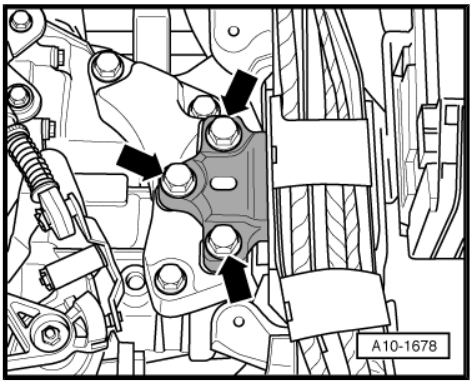


– Renew the bolts for assembly mounting at engine -arrows- one by one (if not already renewed when engine was installed).
– Screw in new bolts initially finger-tight.



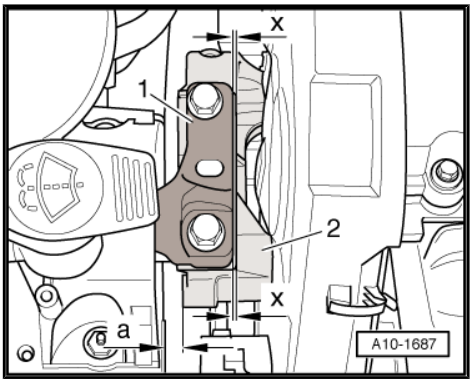
– Renew the bolts for assembly mounting at gearbox -arrows- one by one (if not already renewed when engine was installed).

– Screw in new bolts initially finger-tight.



– Using a tyre iron between engine mounting and support arm -1-, adjust position of engine until the specifications listed below are obtained:

- There must be a distance of -a- = 13.5 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-).



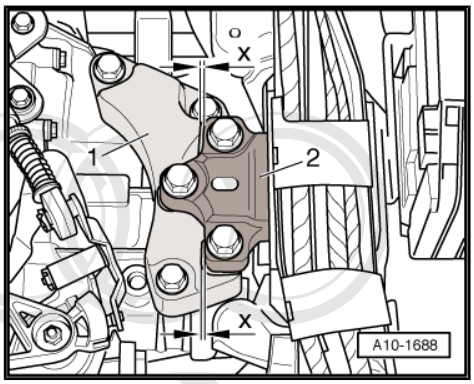
Note

Distance -a- = 13.5 mm can also be checked with a metal rod of suitable size, or similar.

– Tighten bolts for assembly mounting (for engine) to 60 Nm + 90°.

– On the gearbox side, check that the edges of the support arm -2- and gearbox support -1- are parallel (distance -x- = distance -x-).

– Tighten bolts for assembly mounting (for gearbox) to 60 Nm + 90°.



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

– Install battery ⇒ Rep. Gr. 27 .

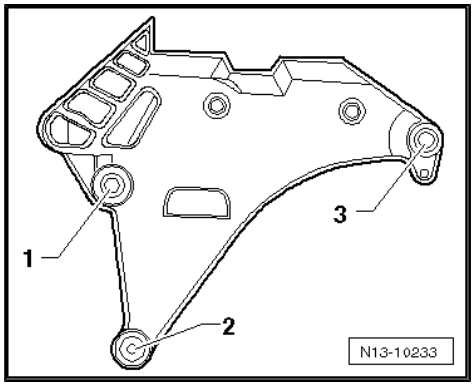
Tightening torques

Component	Nm
Support arm to engine support	60 + 90° 1)2)
Support arm to gearbox support	60 + 90° 1)2)

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

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8.3 Tightening torques for engine support



Note

- *Different bolts (tensile strength of bolts) and different types of engine support are installed, depending on the engine version.*
- *The tightening torque specifications always apply to new bolts. Allocation ⇒ Electronic parts catalogue*

Tightening torque and sequence for small and large engine support

1 - Screw in bolts in the sequence -1, 2, 3- hand-tight.

2 - Tighten bolts in the sequence -1, 2, 3- to 40 Nm.

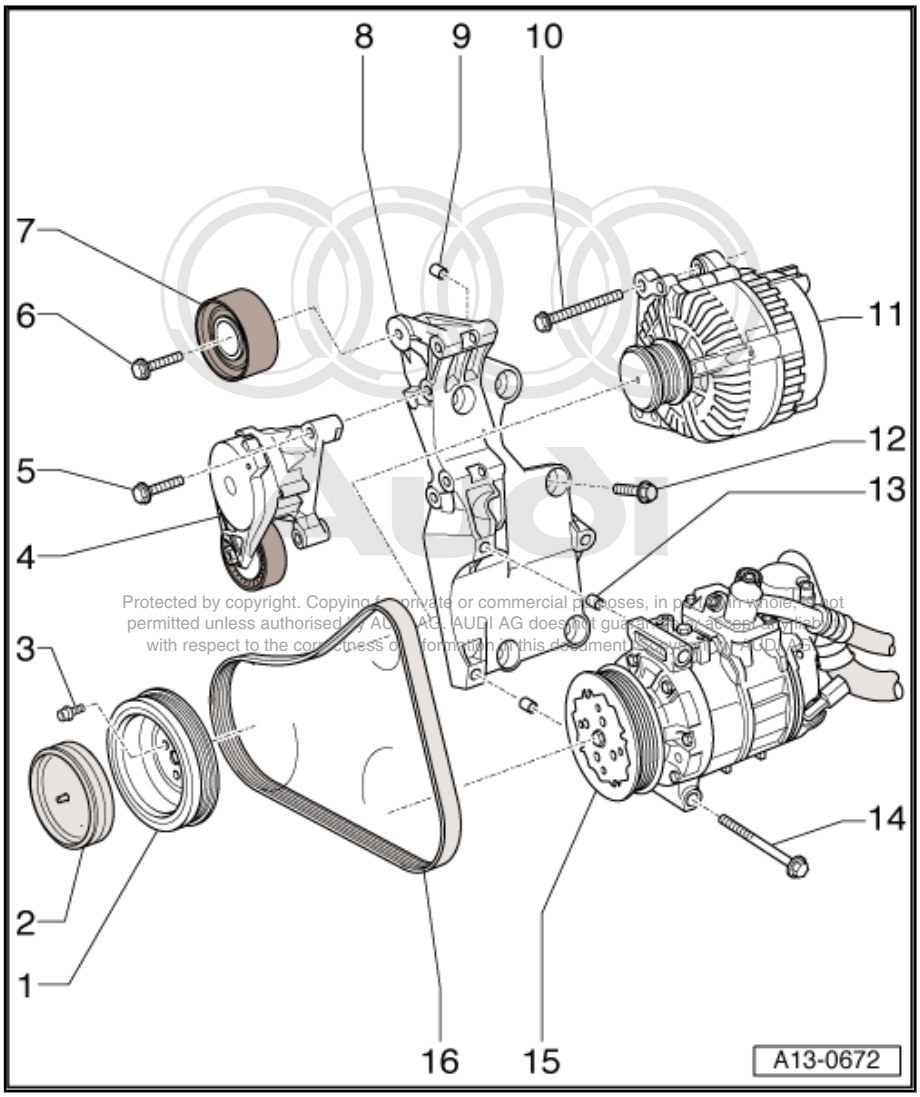
3 - Turn bolts in the sequence -1, 2, 3- 180° further.

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13 – Crankshaft group

1 Servicing work on pulley end

1.1 Poly V-belt drive - exploded view



1 - Vibration damper

- ❑ With pulley for poly V-belt
- ❑ Can only be installed in one position
- ❑ Removing and installing ⇒ page 89

2 - Cap

- ❑ For vibration damper

3 - 10 Nm + 90° (1/4 turn) further

- ❑ Renew
- ❑ Use only genuine bolts ⇒ Electronic parts catalogue

4 - Tensioner for poly V-belt

- ❑ Pivot with open-end spanner to slacken poly V-belt
- ❑ Lock tensioner with locking pin -T10060 A-

5 - 23 Nm

6 - Bolt for idler roller

- ❑ Renew
- ❑ Different bolts for vehicles with small or large engine support
- ❑ Tightening torque: vehicles with small engine support ⇒ page 86 ; vehicles with large engine support ⇒ page 86

7 - Idler roller

- ❑ For toothed belt

8 - Bracket for ancillaries

- ❑ Removing and installing: vehicles with small engine support ⇒ page 90 ; vehicles with large engine support ⇒ page 93

9 - Dowel sleeve

- ❑ Ensure correct seating in bracket

10 - 23 Nm

11 - Alternator

- ❑ Removing and installing ⇒ Rep. Gr. 27

12 - 45 Nm

- ❑ Observe correct tightening sequence ⇒ page 93

13 - Dowel sleeve

- ❑ 2x
- ❑ Ensure correct seating in bracket

14 - 25 Nm

15 - Air conditioner compressor

- ❑ Removing and installing ⇒ Rep. Gr. 87

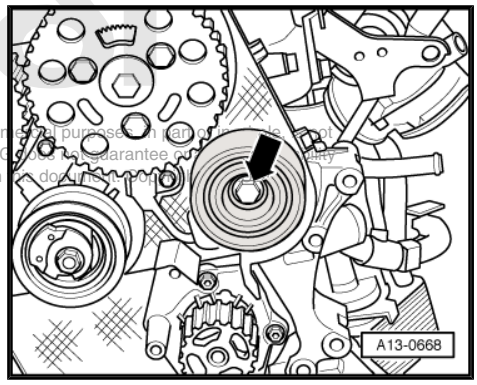
16 - Poly V-belt

- ❑ Check for wear
- ❑ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ❑ Removing and installing ⇒ page 86
- ❑ When installing, make sure it is properly seated on pulleys.

Tightening torque for idler roller - vehicles with small engine support

Bolt -arrow- without internal thread.

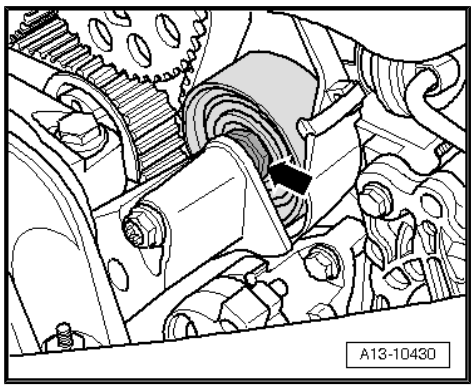
- Tightening torque: 40 Nm + 90° (1/4 turn further).



Tightening torque for idler roller - vehicles with large engine support

Bolt -arrow- with internal thread for securing to engine support.

- Tightening torque: 90 Nm + 90° (1/4 turn further).

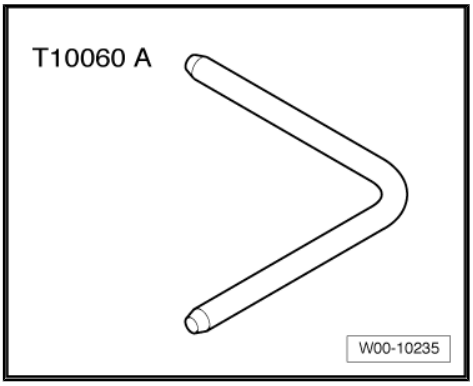


1.2 Removing and installing poly V-belt

Special tools and workshop equipment required

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♦ Locking pin -T10060 A-



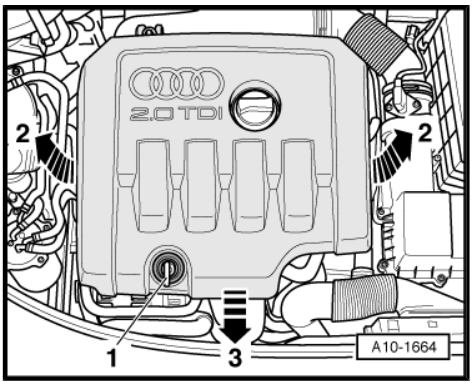
Removing

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

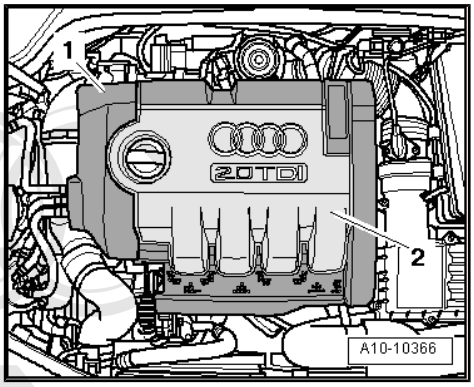
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



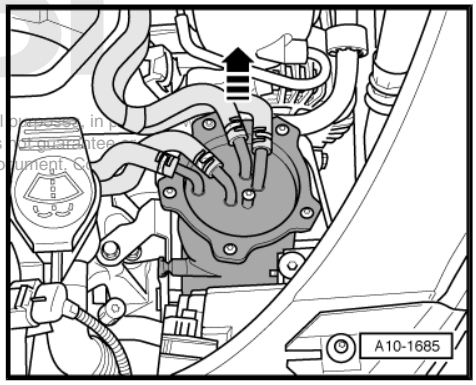
Engine cover panel (version 2):

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



Fuel filter - version 1:

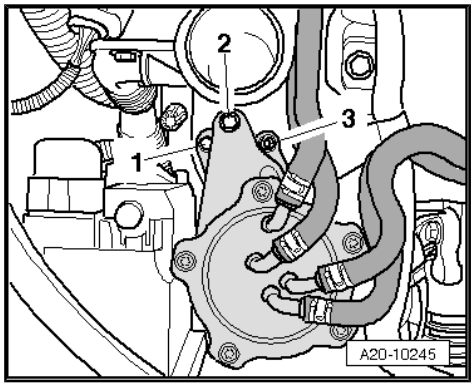
– Lift fuel filter out of bracket -arrow- with hoses connected and move it aside (leaving hoses attached).



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Fuel filter - version 2:

– Slacken bolt -1- one turn.
– Remove bolt -2- and nut -3-.
– Move fuel filter aside with hoses attached.

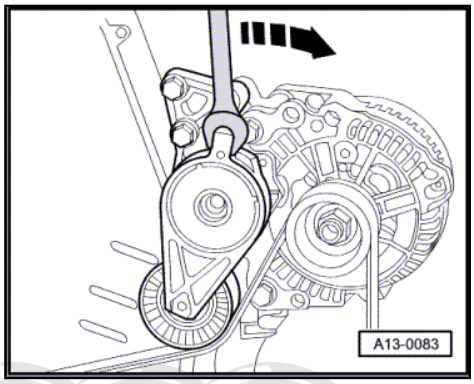


All vehicles (continued):

Note

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

– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.



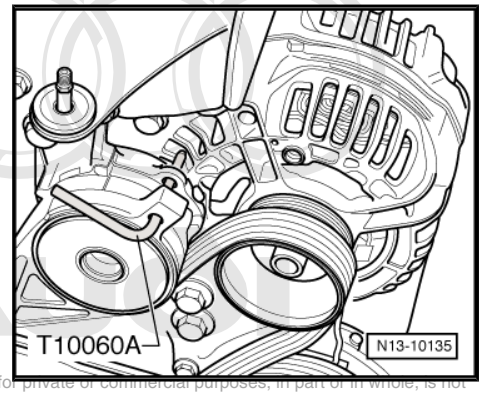
– Lock poly V-belt tensioner using locking pin -T10060 A- .
– Remove poly V-belt.

Installing

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

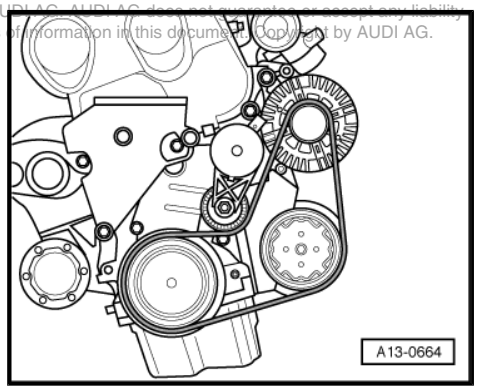
Note

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



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– Fit poly V-belt onto crankshaft pulley and air conditioner compressor pulley.
– Then position poly V-belt on alternator pulley and release tensioner.
– Check poly V-belt for proper seating.
– Start engine and check that belt runs properly.

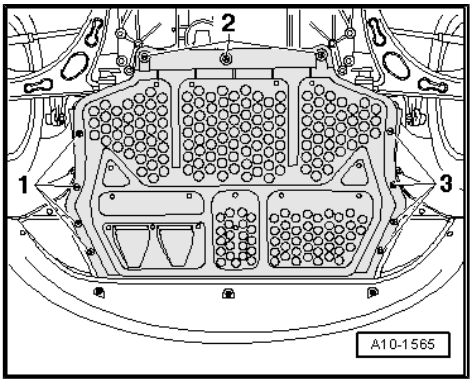


1.3 Removing and installing vibration damper

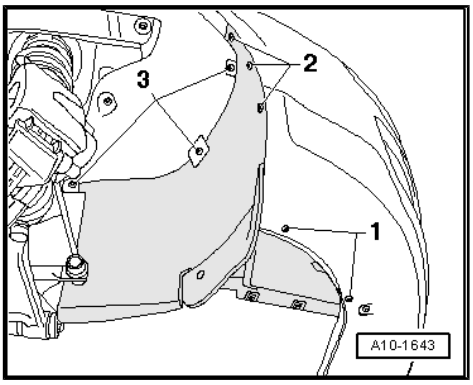
Removing

– Remove poly V-belt ⇒ page 86 .

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

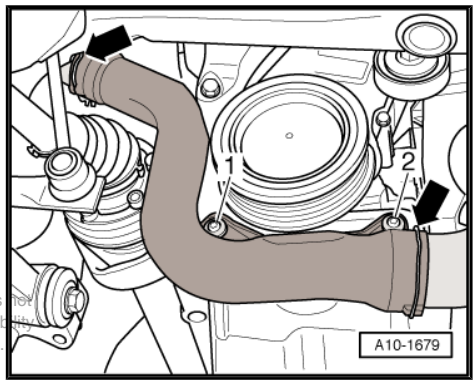


– Remove noise insulation (right-side) -fasteners 1 ... 3-.



– Remove bolts -1- and -2-.

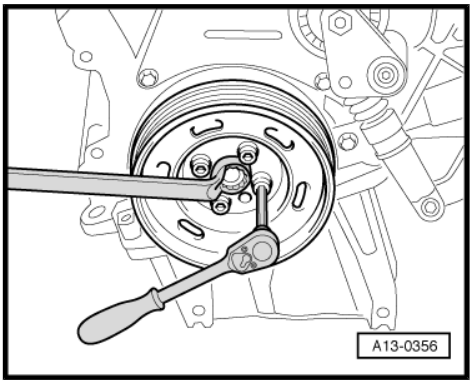
– Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



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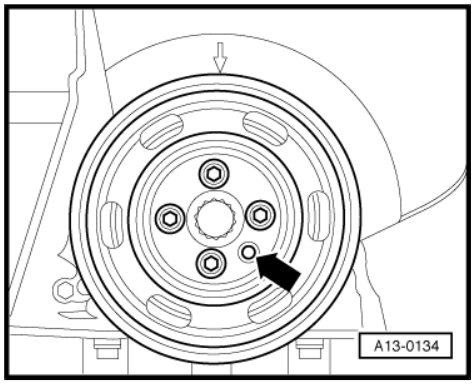
– Remove cover cap for vibration damper.

– Unbolt vibration damper; counterhold on centre bolt with ring spanner.



Installing

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



Note

Renew seals if damaged or leaking.

– 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.

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

– Install poly V-belt ⇒ page 86 .

Tightening torques

Component	Nm
Vibration damper to crankshaft sprocket	10 + 90° 1)2)
Air intake pipe (right-side) to sump	10

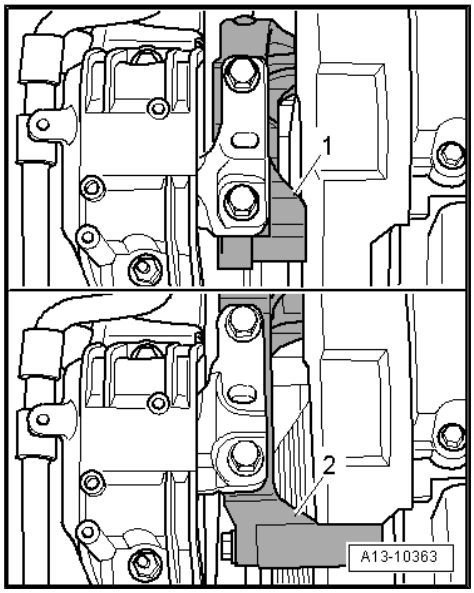
• 1) Renew bolts.

• 2) 90° = one quarter turn.

1.4 Removing and installing bracket for ancillaries - vehicles with small engine support

Note

The engine support does not have to be removed in order to remove the bracket for ancillaries on vehicles with small engine support -1-.



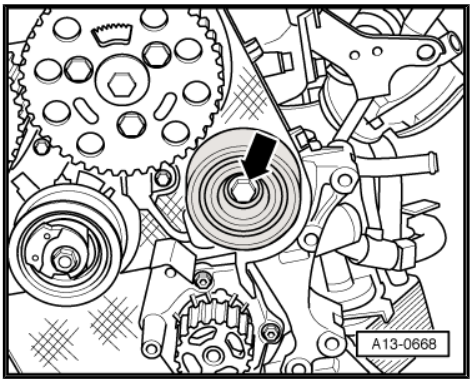
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Removing

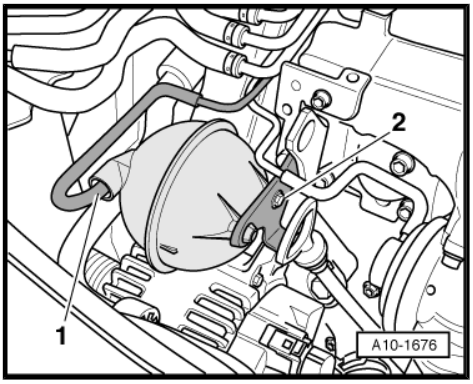
Caution

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

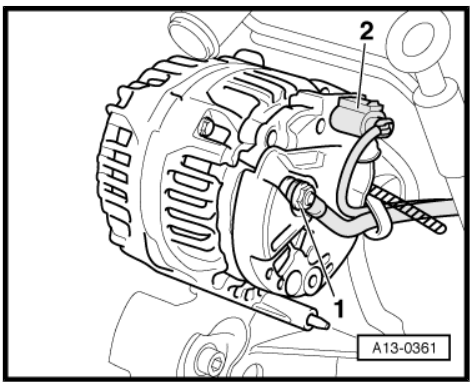
– Disconnect earth wire at battery with ignition switched off.
– Remove toothed belt ⇒ page 102 .
– Remove the idler roller -arrow-.



– Detach vacuum hose -1-.
– Unscrew bolt -2- and detach vacuum reservoir from bracket.

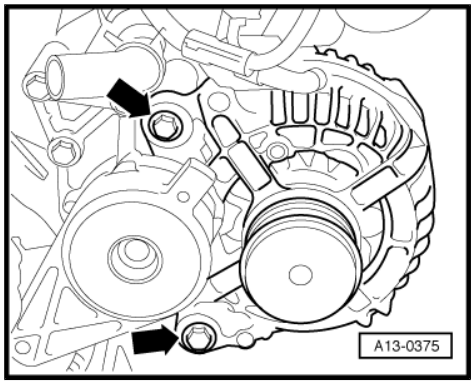


– Unplug electrical connector -2-.
– Unscrew wire -1- and wire clamp.



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– 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.*

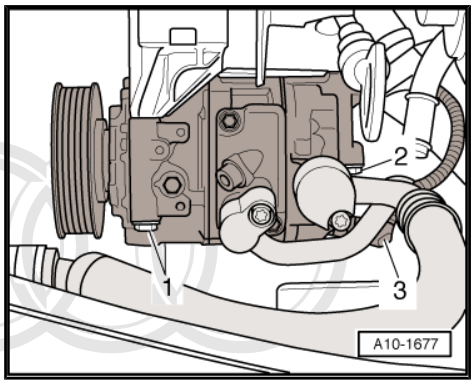
WARNING

The air conditioner refrigerant circuit must not be opened.

Note

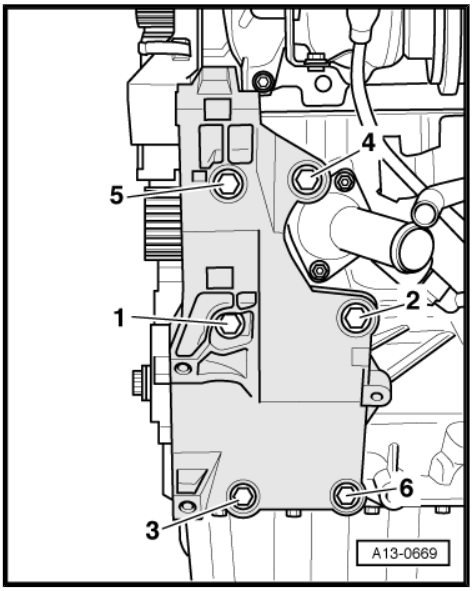
To prevent damage to the air conditioner compressor and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

– Unplug electrical connector -3- for magnetic clutch of air conditioner compressor.
– Unscrew bolts -1- and -2- for air conditioner compressor.
– Tie air conditioner compressor up to lock carrier.



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– Remove bracket for ancillaries -bolts 1 ... 6-.



Installing

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

Note

Renew the bolts tightened with specified tightening angle.

– Check that dowel sleeve at top right between bracket for ancillaries and cylinder block is fitted; insert if necessary.
– First tighten bolts in the sequence -1 ... 6- finger-tight, then tighten to torque.
– Install toothed belt (adjust valve timing) ⇒ page 111 .
– Install vibration damper ⇒ page 89 .
– Install air conditioner compressor ⇒ Rep. Gr. 87 .
– Install alternator ⇒ Rep. Gr. 27 .
– Install poly V-belt ⇒ page 86 .
– Connect battery. Procedures required ⇒ Rep. Gr. 27 .

Tightening torques

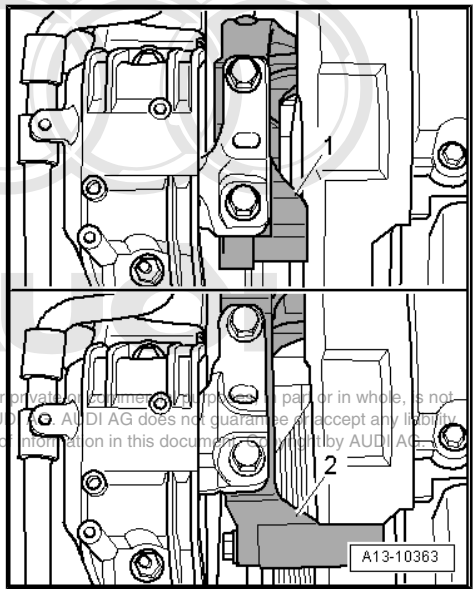
Component	Nm
Bracket for ancillaries to cylinder block	45
Idler roller to bracket for ancillaries	40 + 90° 1)2)

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

1.5 Removing and installing bracket for ancillaries - vehicles with large engine support

Note

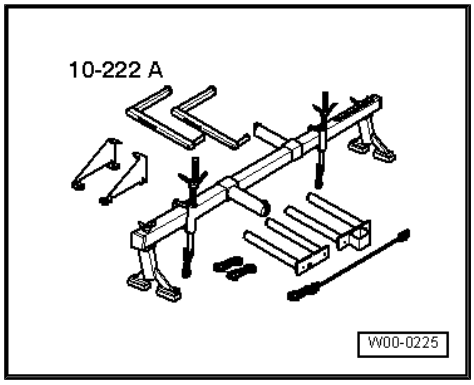
The engine support has to be removed and the engine supported from above in order to remove the bracket for ancillaries on vehicles with large engine support -2-.



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Special tools and workshop equipment required

♦ Support bracket -10 - 222 A-

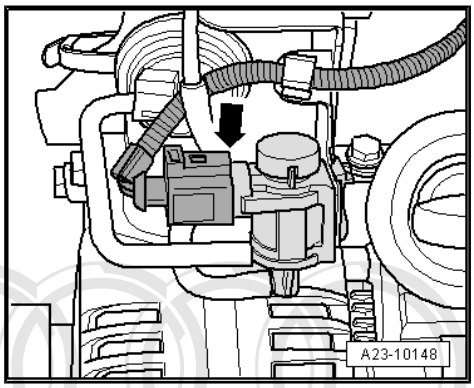


Removing

Caution

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

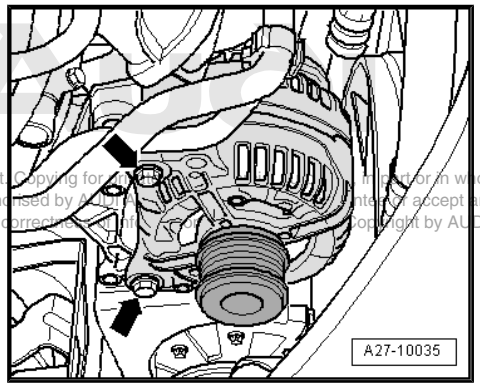
– Disconnect earth wire at battery with ignition switched off.
– Remove toothed belt ⇒ page 116 .
– Unplug electrical connector -arrow- at intake manifold flap valve -N316- .
– Unclip intake manifold flap valve -N316- from bracket and move it aside.



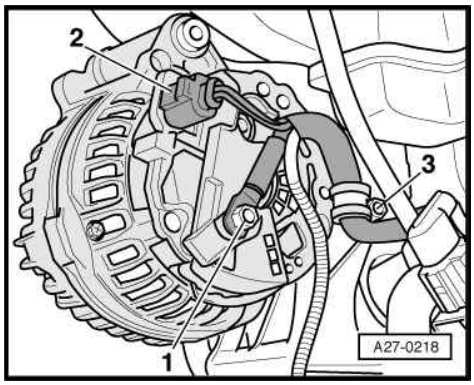
– Unscrew bolts -arrows- and remove alternator.

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.*

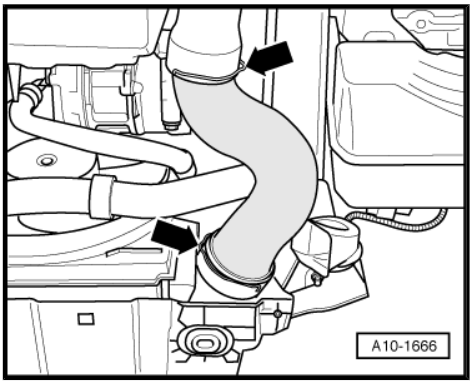


– Swivel alternator towards right side of vehicle with wiring connected.
– Unplug electrical connector -2-.
– Unscrew wire -1- and wire clamp -3- at alternator.
– Lift out alternator.



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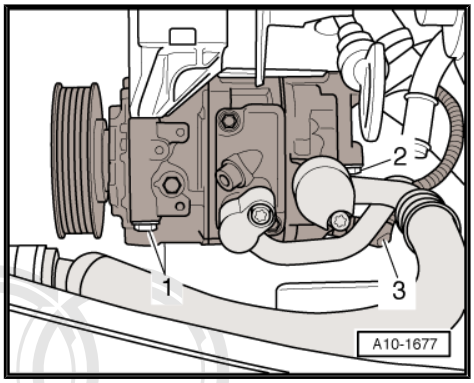
– Remove air intake hose (right-side) by lifting retaining clips -arrows- slightly.



– Unplug electrical connector -3- at air conditioner compressor.

Note

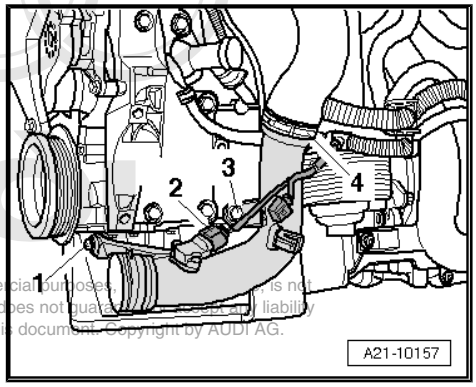
Disregard items marked -1- and -2-.



– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolts -1- and -3-.
– Disconnect air pipe from air hose -4- and remove pipe downwards.

WARNING

The air conditioner refrigerant circuit must not be opened.



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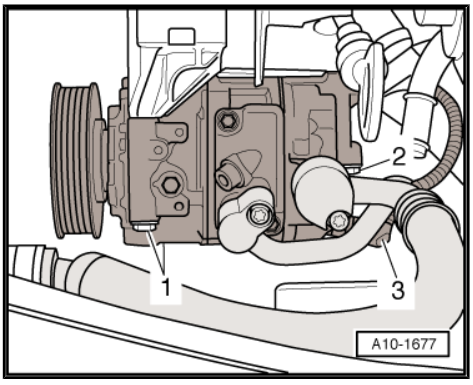
Note

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

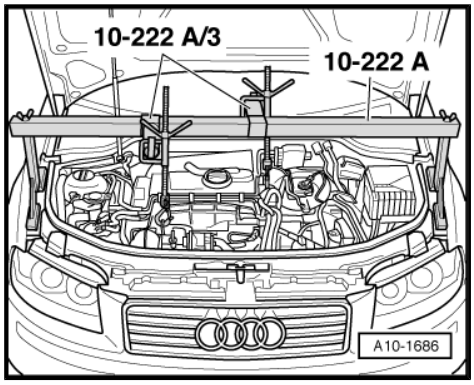
– Unscrew bolts -1- and -2- and tie air conditioner compressor up to lock carrier.

Note

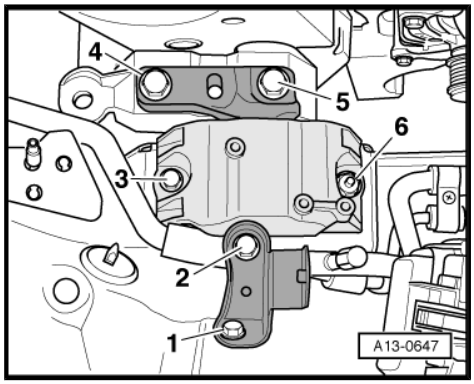
Disregard -item 3-.



– 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.

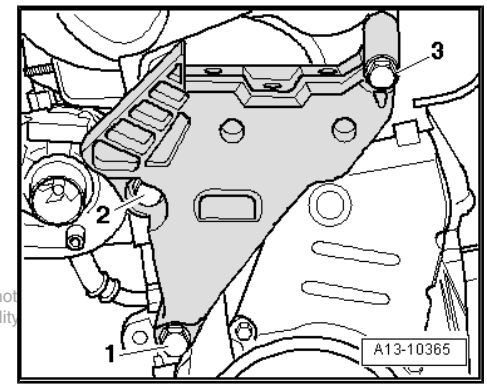


– Remove bolts -1 ... 3- for engine support.

Note

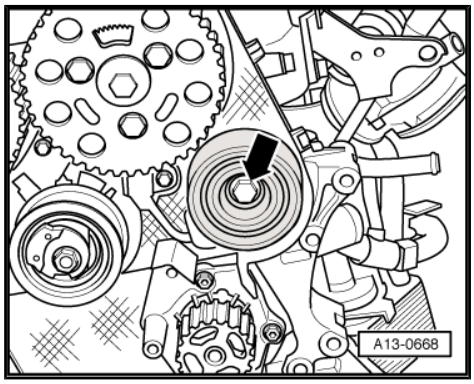
To remove the bolts for the engine support, raise or lower the engine slightly as necessary via the spindles on support bracket -10 - 222 A- .

– Raise engine/gearbox assembly slightly with spindles and remove engine support.

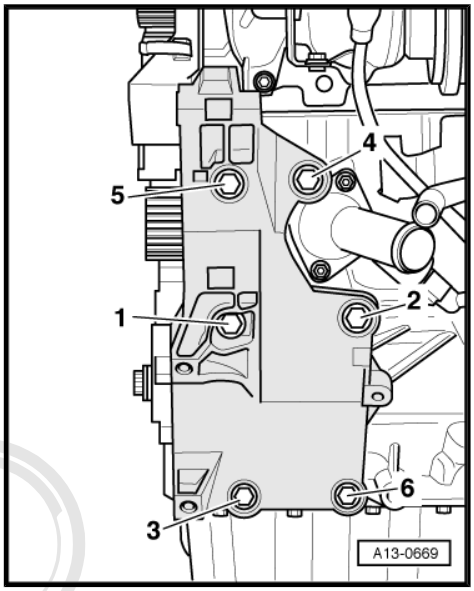


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– Remove the idler roller -arrow-.



– Remove bracket for ancillaries -bolts 1 ... 6-.



Installing

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

Note

Renew the bolts tightened with specified tightening angle.

– Check that dowel sleeve at top right between bracket for ancillaries and cylinder block is fitted; insert if necessary.
– First tighten bolts in the sequence -1 ... 6- hand-tight, then tighten to specified torque.
– Install toothed belt (adjust valve timing) ⇒ page 123 .
– Install engine support ⇒ page 84 .
– Install assembly mountings ⇒ page 81 .
– Install vibration damper ⇒ page 89 .
– Install air conditioner compressor ⇒ Rep. Gr. 87 .
– Install alternator ⇒ Rep. Gr. 27 .
– Install poly V-belt ⇒ page 86 .
– Install air pipe ⇒ page 299 .
– Connect battery. Procedures required ⇒ Rep. Gr. 27 .

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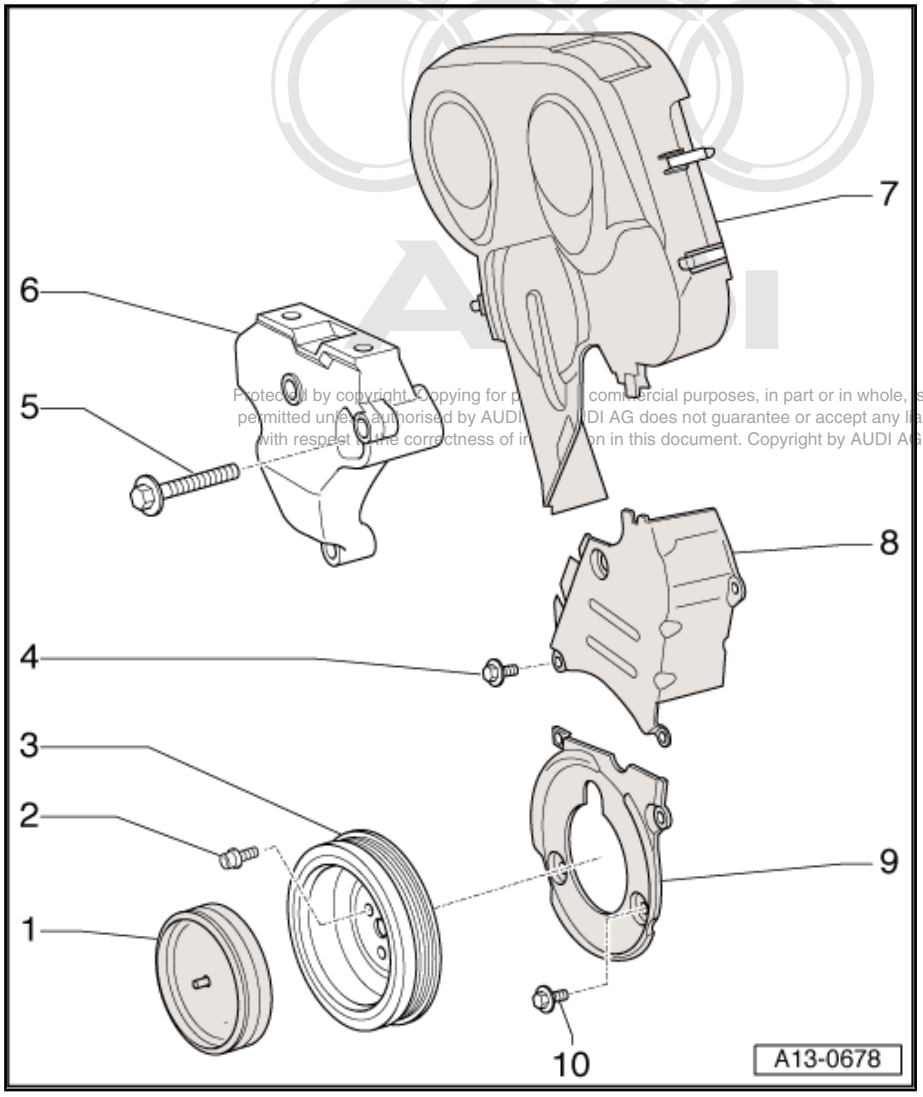
Tightening torques

Component	Nm
Bracket for ancillaries to cylinder block	45
Idler roller to bracket for ancillaries	90 + 90° 1)2)
Engine mounting to body	50
Connecting bracket to engine mounting/body	20 + 90° 3)4)

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

1.6 Toothed belt drive - exploded view

Part 1



1 - Cap

- ❑ For vibration damper

2 - 10 Nm + 90° (1/4 turn) further

- ❑ Renew
- ❑ Use only genuine bolts ⇒ Electronic parts catalogue

3 - Vibration damper

- ❑ With pulley for poly V-belt
- ❑ Can only be installed in one position
- ❑ Removing and installing ⇒ page 89

4 - 10 Nm

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

5 - Bolt for engine support

- ❑ Renew
- ❑ Tightening torque and sequence for engine support ⇒ page 84

6 - Engine support

- ❑ Small engine support ⇒ page 99
- ❑ Large engine support ⇒ page 99

7 - Toothed belt cover (top)

- ❑ Engage carefully in centre toothed belt cover when installing

8 - Toothed belt cover (centre)

- ❑ To remove, take out top toothed belt cover and unbolt poly V-belt tensioner

9 - Toothed belt cover (bottom)

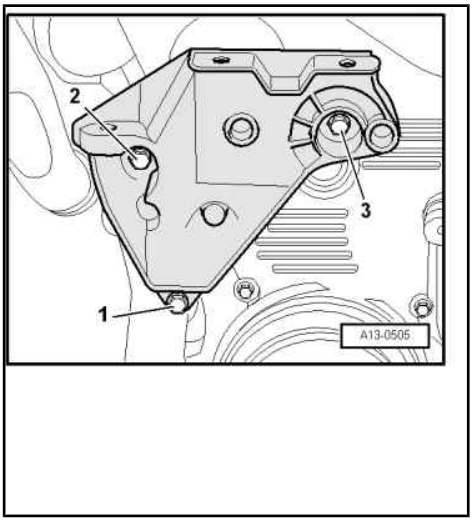
10 - 10 Nm

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

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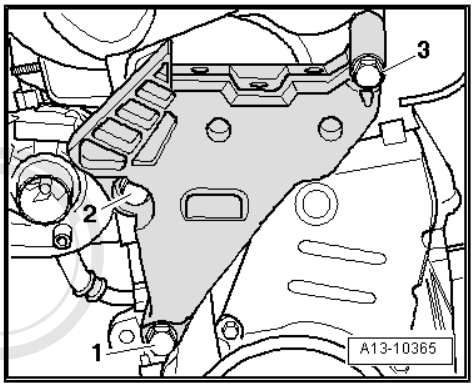
Small engine support

Tightening torque and sequence for engine support ⇒ page 84



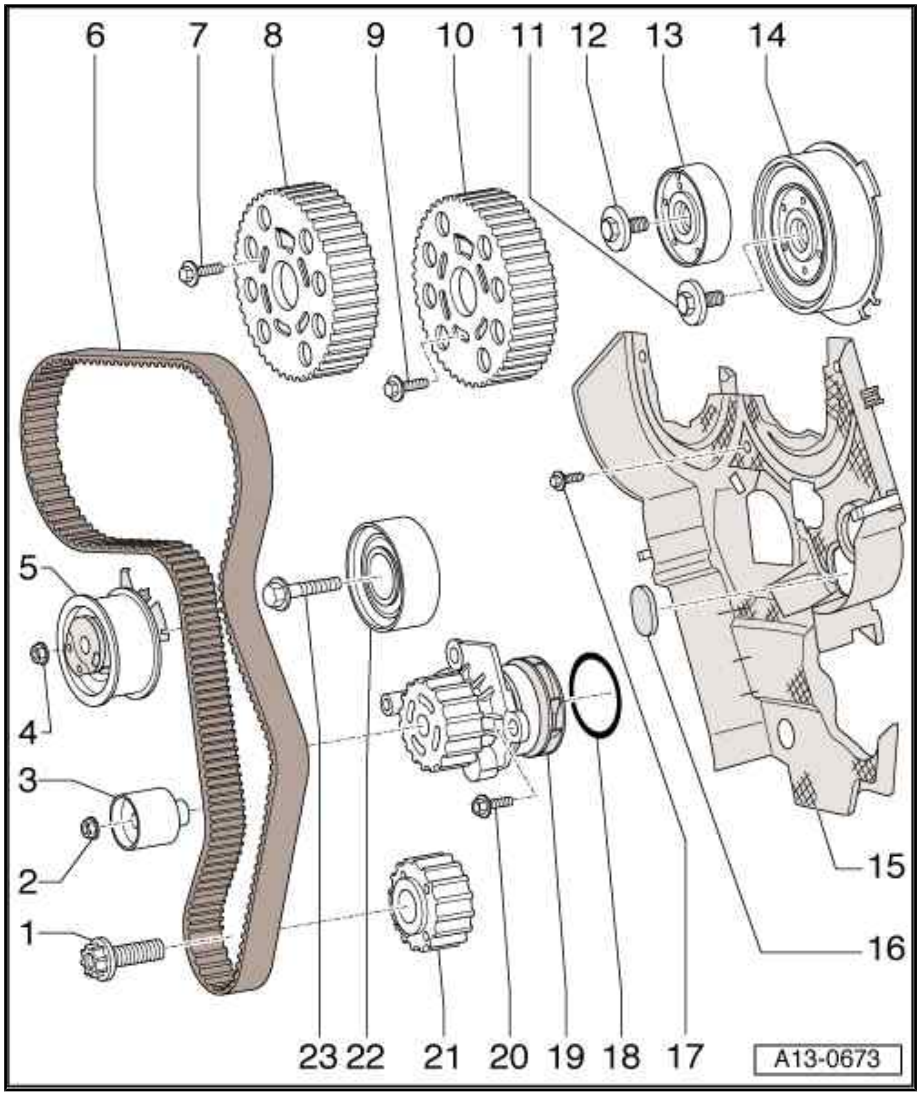
Large engine support

Tightening torque and sequence for engine support ⇒ page 84



Part 2

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1 - 120 Nm + 90° (1/4 turn) further

- ❑ Renew
- ❑ Do not lubricate with oil
- ❑ Use counterhold tool -3415- when loosening and tightening ⇒ “2.3 Removing and installing sealing flange (pulley end)”, page 130

2 - 20 Nm

3 - Idler roller

4 - 20 Nm + 45° (1/8 turn) further

5 - Tensioning roller

6 - Toothed belt

- ❑ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage
- ❑ Check for wear
- ❑ Removing: vehicles with small engine support ⇒ page 102 ; vehicles with large engine support ⇒ page 116
- ❑ Installing (adjusting valve timing): vehicles with small engine support ⇒ page 111 , vehicles with large engine support ⇒ page 123

7 - 25 Nm

8 - Camshaft sprocket

- ❑ For exhaust camshaft

9 - 25 Nm

10 - Camshaft sprocket

- ❑ For inlet camshaft

11 - 100 Nm

- ❑ Use counterhold tool -T10051- when loosening and tightening ⇒ “3.4 Removing and installing camshafts”, page 210

12 - 100 Nm

- ❑ Use counterhold tool -T10051- when loosening and tightening ⇒ “3.4 Removing and installing camshafts”, page 210

13 - Hub

- ❑ For exhaust camshaft
- ❑ To remove, use puller -T10052- ⇒ “3.4 Removing and installing camshafts”, page 210

14 - Hub

- ❑ For inlet camshaft
- ❑ With sender wheel for Hall sender -G40-

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- ❑ To remove, use puller -T10052- ⇒ “3.4 Removing and installing camshafts”, page 210

15 - Toothed belt cover (rear)

16 - Rubber grommet

- ❑ Renew if damaged

17 - 10 Nm

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

18 - O-ring

- ❑ Renew

19 - Coolant pump

- ❑ Removing and installing ⇒ page 254

20 - 15 Nm

21 - Crankshaft sprocket

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

22 - Idler roller

23 - Bolt for idler roller

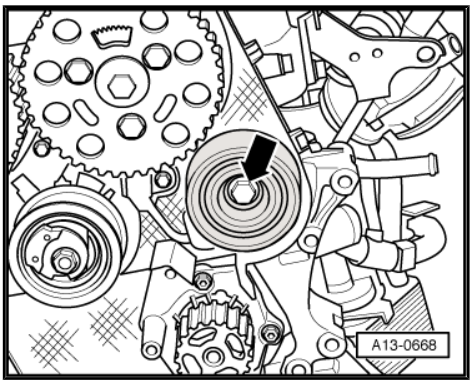
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- ❑ Renew
- ❑ Different bolts for vehicles with small or large engine support
- ❑ Tightening torque: vehicles with small engine support ⇒ page 101 ; vehicles with large engine support ⇒ page 101

Tightening torque for idler roller - vehicles with small engine support

Bolt -arrow- without internal thread.

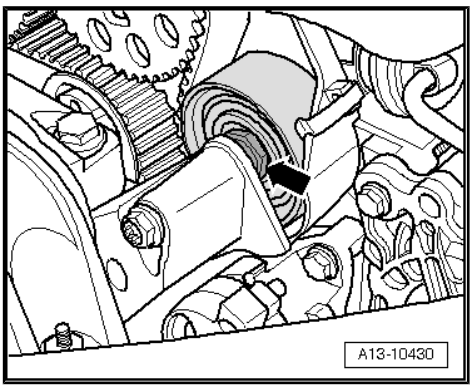
- Tightening torque: 40 Nm + 90° ($^1/_4$ turn further).



Tightening torque for idler roller - vehicles with large engine support

Bolt -arrow- with internal thread for securing to engine support.

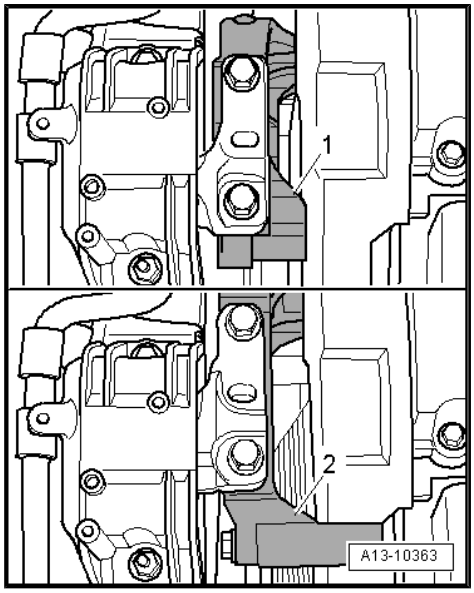
- Tightening torque: 90 Nm + 90° ($^1/_4$ turn further).



1.7 Removing and installing toothed belt - vehicles with small engine support

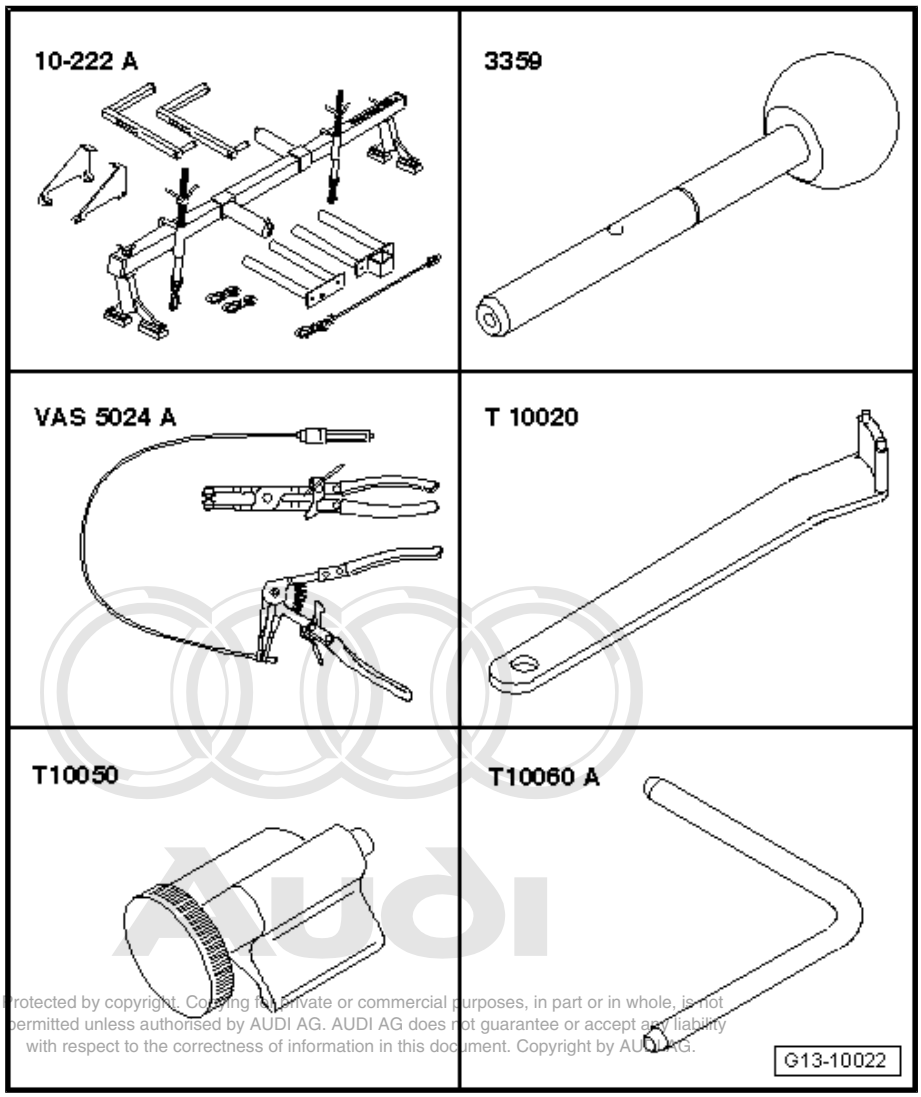
Note

The engine support has to be removed in order to remove the toothed belt on vehicles with small engine support -1-.



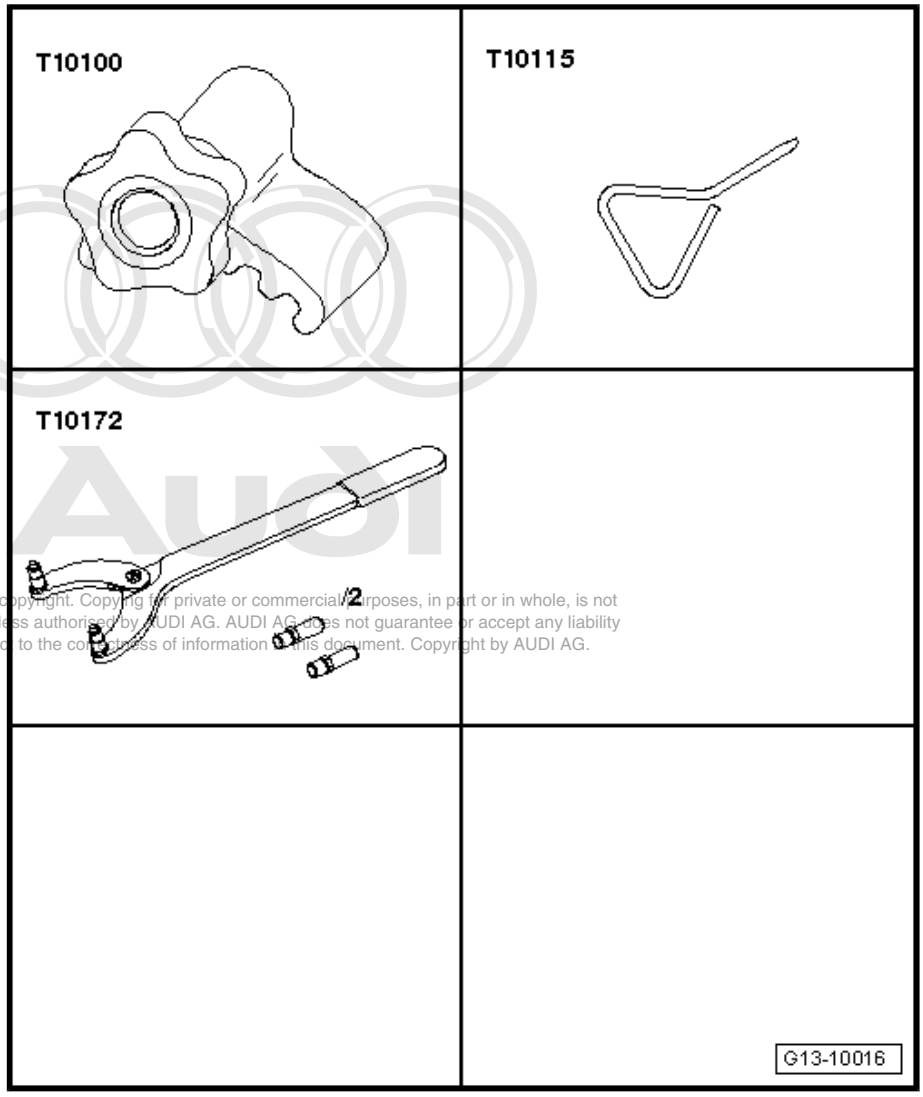
Special tools and workshop equipment required

- Support bracket -10 - 222 A-
- Diesel injection pump locking pin -3359- (2x)
- Spring type clip pliers - VAS 5024 A-
- Pin wrench -T10020-
- Crankshaft stop -T10050- for engines with circular crankshaft sprocket
- Locking pin -T10060 A-



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- Crankshaft stop -T10100- for engines with oval crankshaft sprocket
- Locking pin -T10115-
- Counterhold tool -T10172-
- Locking fluid ⇒ Electronic parts catalogue
- Safety goggles
- Protective gloves



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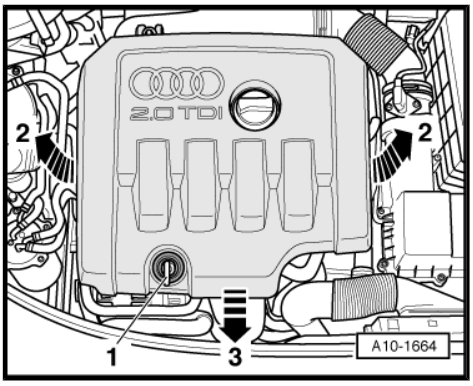
Removing

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

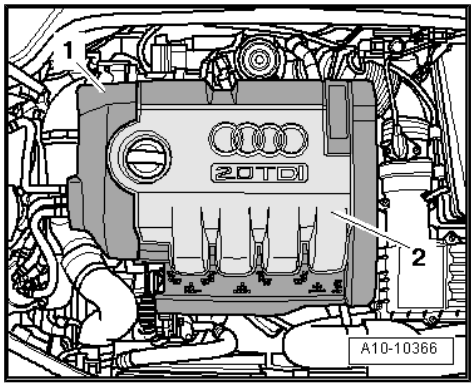
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

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



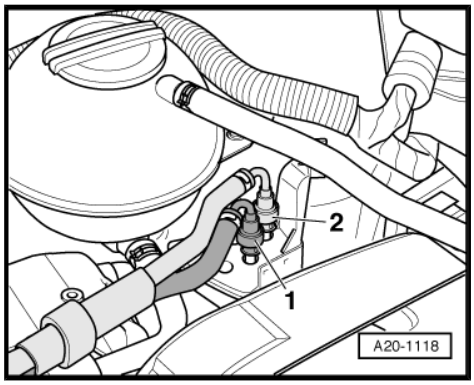
All vehicles (continued):

Caution

Rules for cleanliness when working on the injection system ⇒ page 6 .

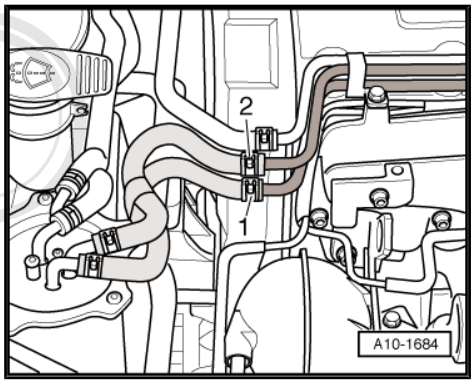
WARNING

- *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.*



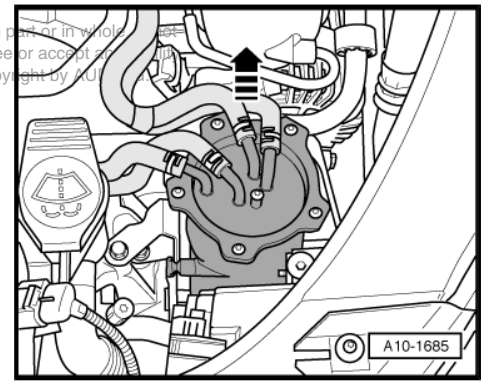
– Disconnect fuel supply pipe -2- and fuel return pipe -1- by pulling release tabs.

– Disconnect fuel supply pipe -2- and fuel return pipe -1- from fuel lines.



Fuel filter - version 1:

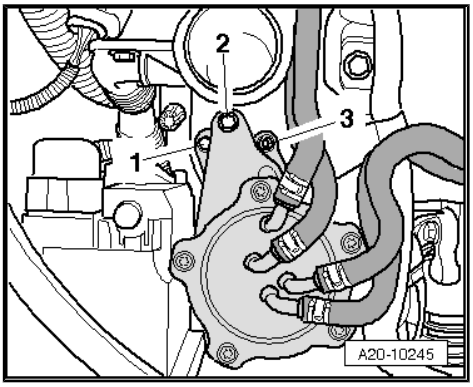
– Pull fuel filter with hoses attached upwards out of the bracket -arrow-.



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Fuel filter - version 2:

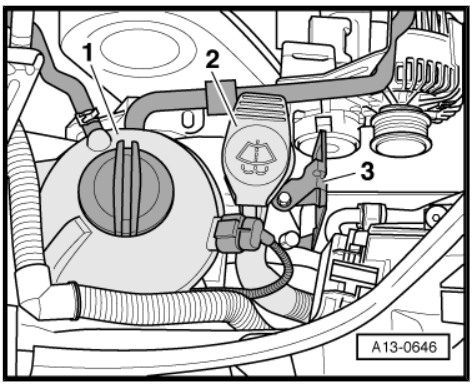
– Slacken bolt -1- one turn.
– Remove bolt -2- and nut -3-.
– Remove fuel filter with hoses attached.



All vehicles (continued):

– Unscrew bracket -3- for fuel filter.
– Unscrew bolt at filler neck -2- for washer fluid reservoir.
– Unscrew coolant expansion tank -1- and move clear to one side with the lines attached.

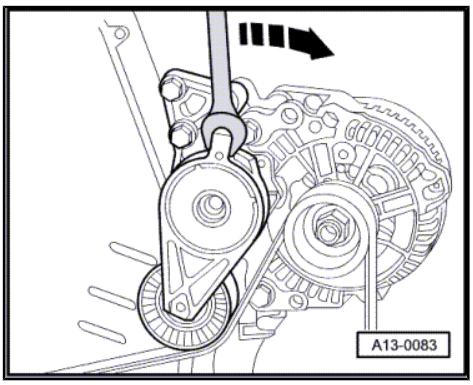
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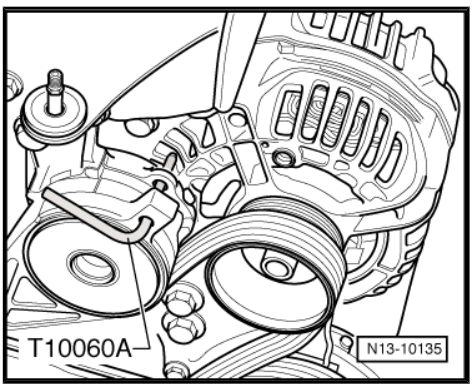
Note

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

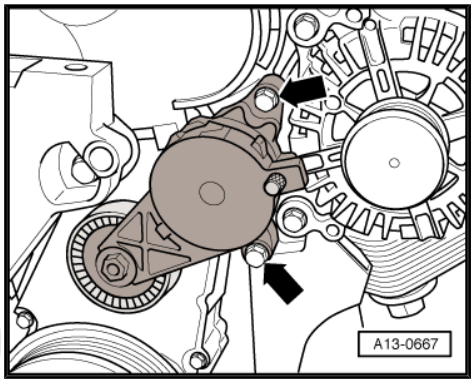
– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.



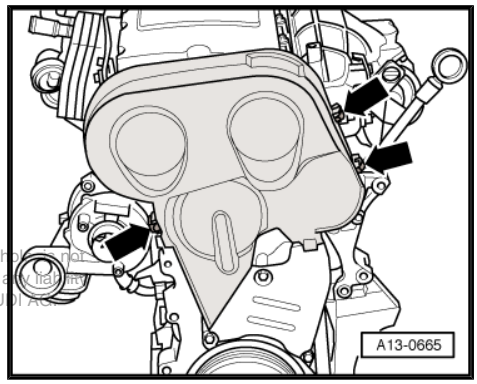
– Lock poly V-belt tensioner using locking pin -T10060 A- .
– Remove poly V-belt.



– Remove tensioner for poly V-belt -arrows-.

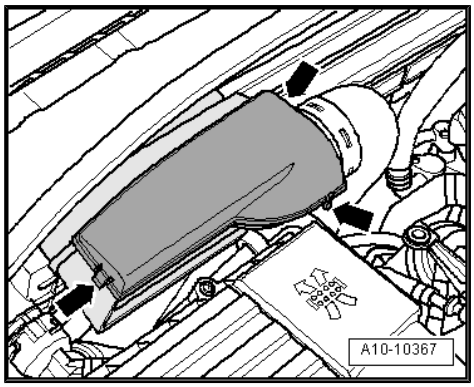


– Remove top toothed belt cover by releasing retaining clips -arrows-.

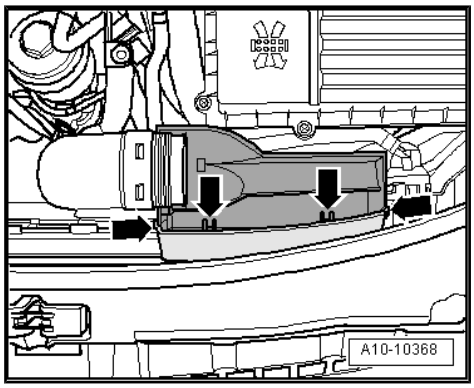


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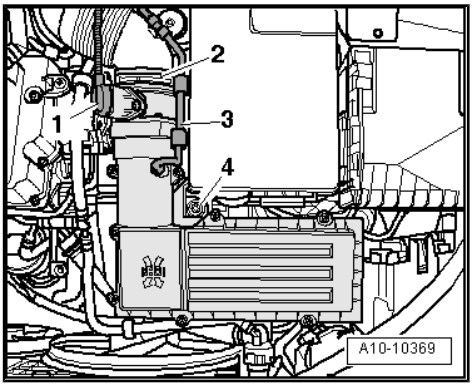
– Pull cover off air duct (release clips on sides) -arrows-.



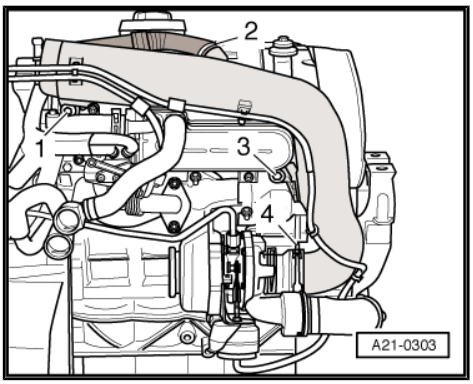
– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



– 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.



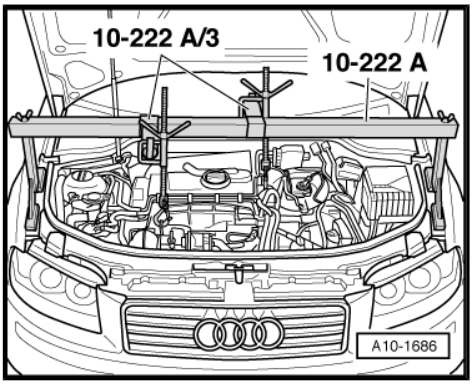
– Remove bolts -1- and -3-.
– Move vacuum hoses at rear intake pipe clear to one side.
– Disconnect hose -2- for crankcase breather system at air pipe.
– Release spring clip -4- with spring clip pliers -VAS 5024 A- and detach air pipe at connection for turbocharger.



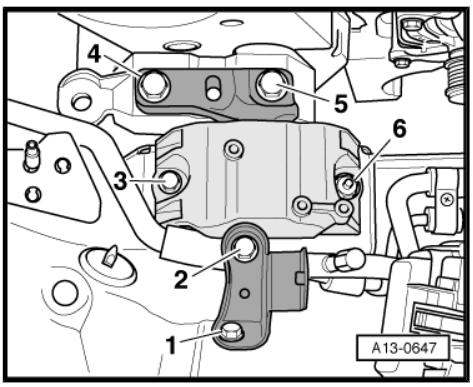
Note

Shown from rear with engine removed for illustration purposes.

– 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).

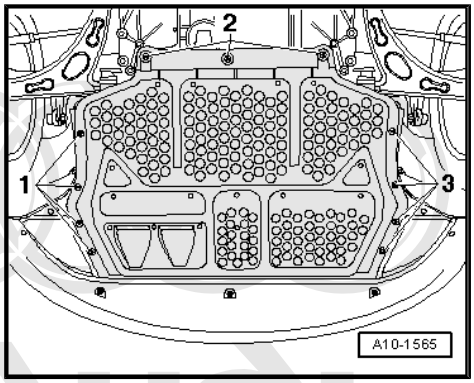


– Remove bolts -1- and -2- and detach connecting bracket.
– Remove bolts -3 ... 6- and remove engine mounting.

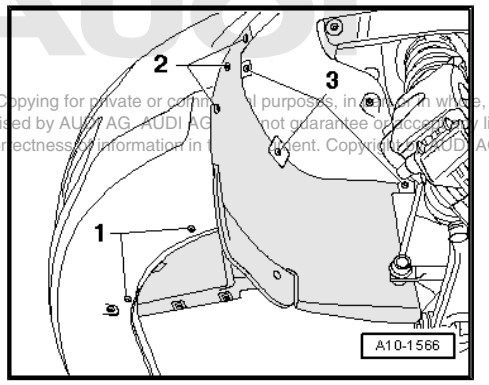


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– Remove centre noise insulation -fasteners 1 ... 3-.

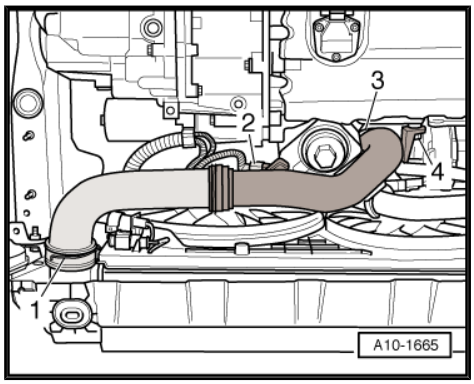


– Remove noise insulation (left and right) -fasteners 1 ... 3-.
– Unbolt drive shafts (left and right) from gearbox flange and centre bearing.
– Detach drive shaft (left-side) from gearbox flange and tie up.
– Remove front exhaust pipe ⇒ page 304 .

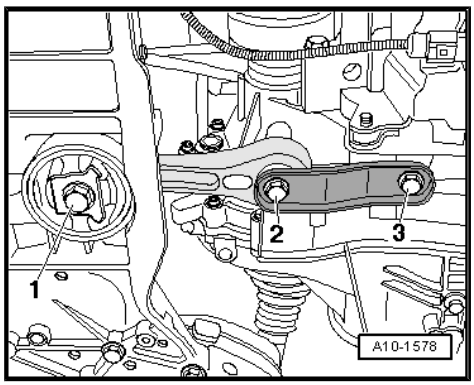


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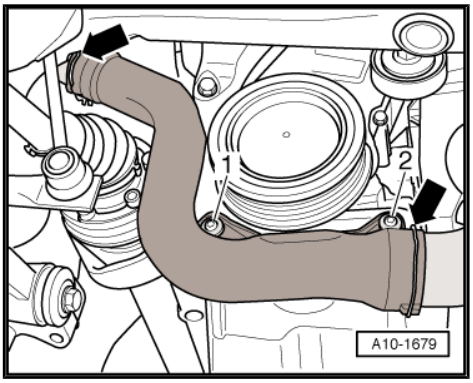
– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolt -4-.
– Remove front air pipe with air hose by lifting retaining clips slightly -1- and -3-.



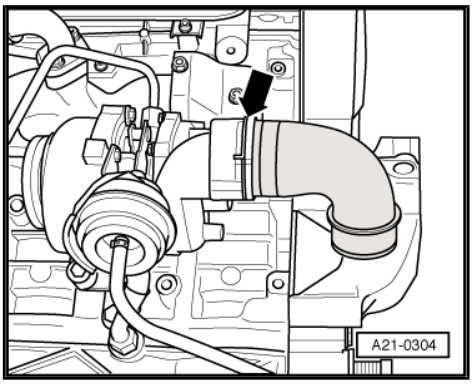
– Unscrew bolts -1 ... 3- and remove pendulum support.



– Remove bolts -1- and -2-.
– Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.

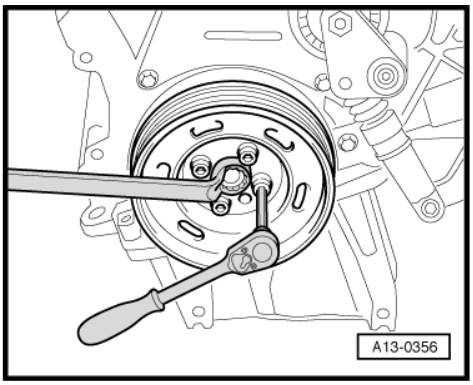


– Detach air intake hose from turbocharger by lifting retaining clip -arrow- slightly.

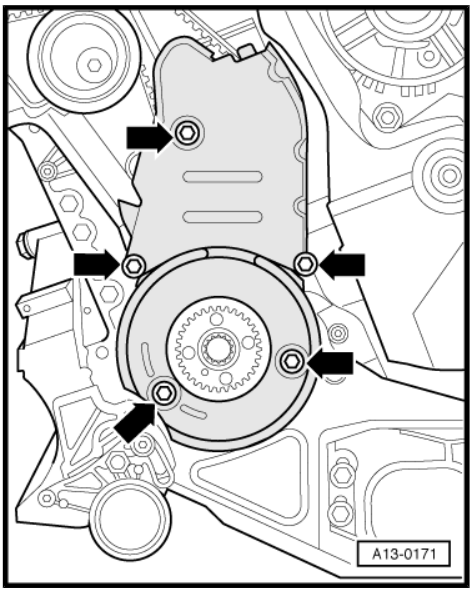


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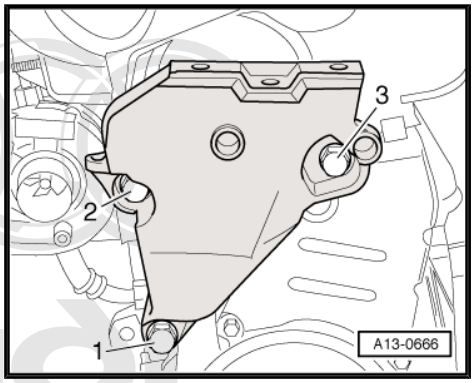
– Remove cover cap for vibration damper.
– Unbolt vibration damper; counterhold on centre bolt with ring spanner.



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



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



Note

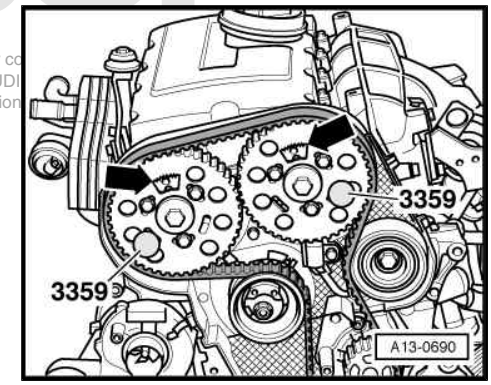
To remove the bolts for the engine support, raise or lower the engine slightly as necessary via the spindles on support bracket -10 - 222 A- .

– Raise engine/gearbox assembly slightly with spindles and remove engine support.

Caution

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with respect to the correctness of information

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



– Turn the crankshaft to TDC for cylinder No. 1.

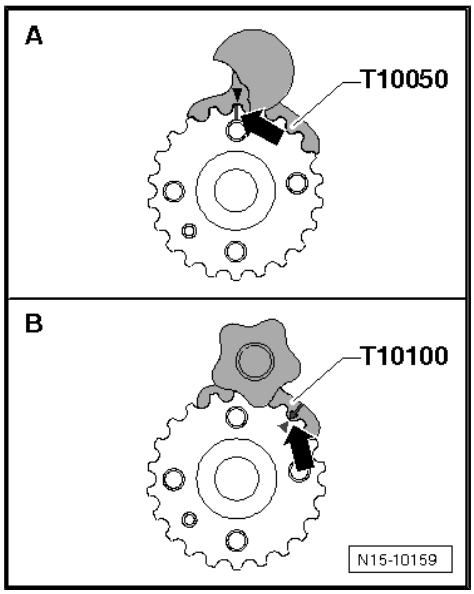
Note

At TDC position the toothed segments -arrows- face upwards.

– Lock hubs with locking pins -3359- .

– Lock crankshaft sprocket using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.

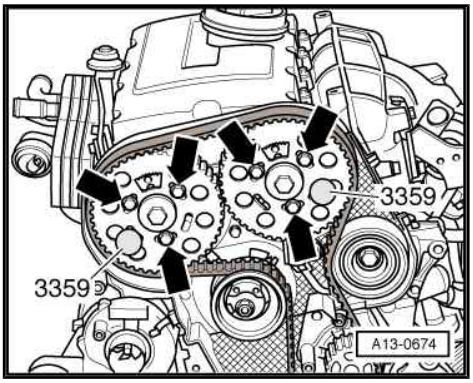
- The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-. The pin of the crankshaft stop must engage in the aperture in the sealing flange.



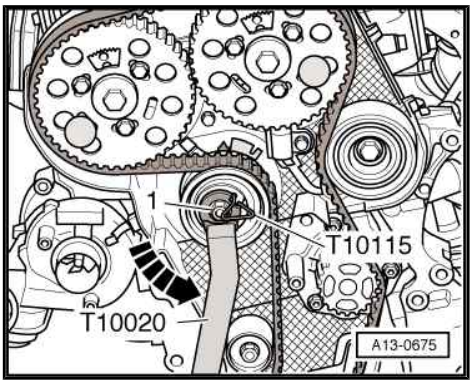
Note

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 pen.
– Loosen the bolts -arrows- for camshaft sprockets approx. 2 turns.



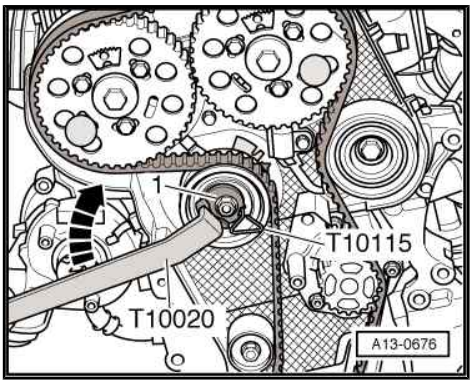
– Loosen securing nut -1- for tensioning roller.
– Turn eccentric adjuster of tensioning roller anti-clockwise using pin wrench -T10020- until tensioning roller can be secured with locking pin -T10115- .



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

Installing (adjusting valve timing)

- Camshafts locked with locking pin -3359- (2x).
- Crankshaft is locked using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.
- Tensioning roller locked with locking pin -T10115- and secured at right stop with securing nut.

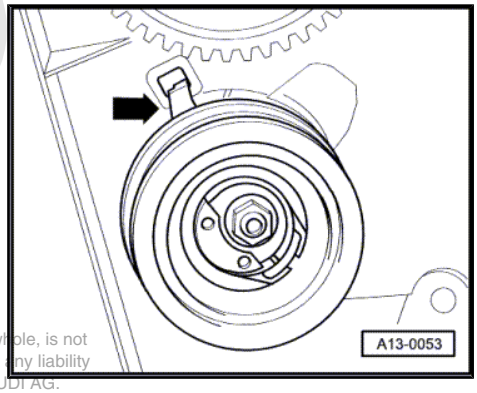


Note

- *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.*

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– Ensure that tensioning roller is seated properly in rear toothed belt cover -arrow-.



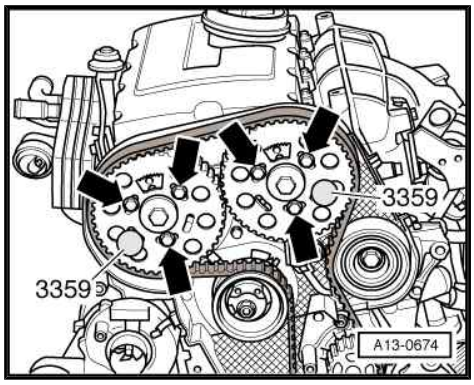
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– Screw in bolts -arrows-, but do not tighten.

• It should just be possible to turn the camshaft sprockets on the hubs without axial movement.

– Turn the camshaft sprockets in their elongated holes clockwise until the stop.

– Fit the toothed belt to crankshaft, tensioning roller, camshaft sprockets, idler roller and finally to sprocket for coolant pump.

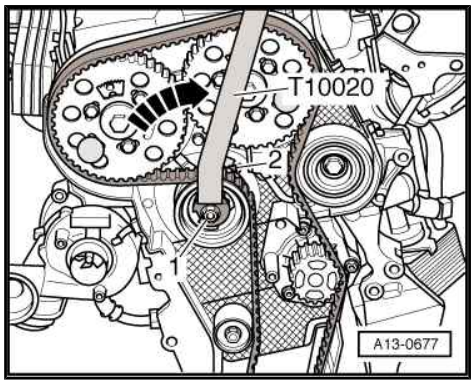


– Adjust toothed belt tension as follows:

– Remove locking pin -T10115- .

– Loosen securing nut -1- for tensioning roller.

– Turn eccentric adjuster of tensioning roller clockwise using pin wrench -T10020- until lug -2- aligns with the centre of the slot on the base plate.



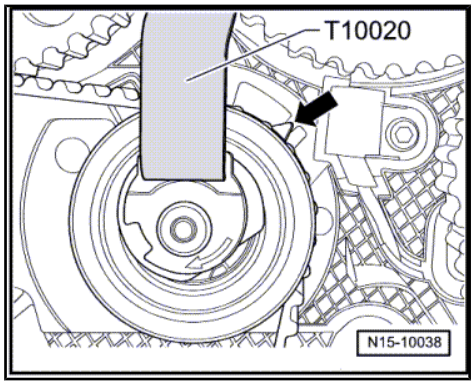
Note

Make sure that the securing nut -1- on the tensioning roller does not turn at the same time.

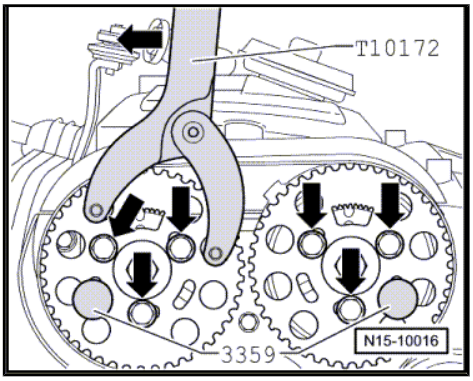
– Hold tensioning roller in this position and tighten securing nut -1- on tensioning roller to 20 Nm + 45° ($^1/_8$ turn).

Note

When tightening the securing nut, the pointer -arrow- 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.

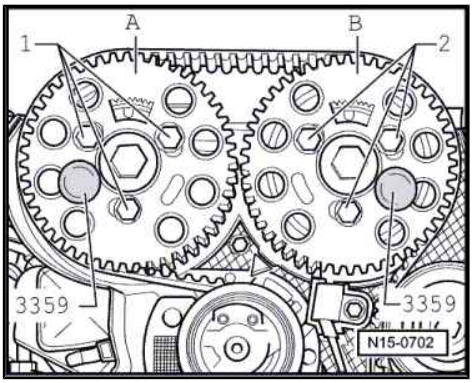


– Attach counter-hold tool -T10172- as shown in illustration and apply tension to driving section of toothed belt by pressing in direction of -arrow-.
– Tighten camshaft sprocket securing bolts -arrows- to 25 Nm.
– Remove locking pins and crankshaft stop.



Checking valve timing:

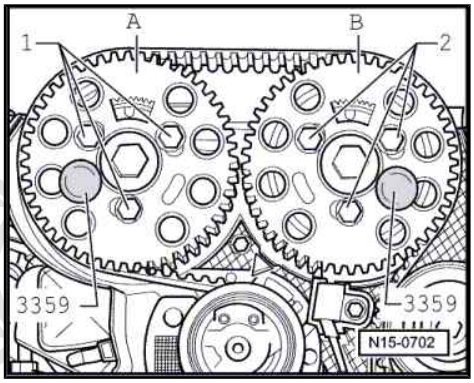
> **Caution**
>
> ***The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).***



– Turn crankshaft two rotations in normal direction of rotation until the crankshaft is just before TDC again.
– Lock the hub -A- into place with the locking pin -3359- when turning.
– Check whether:
♦ The hub -B- can be locked with the locking pin -3359- ;
♦ The crankshaft can be locked with the crankshaft stop.
♦ The tensioner pointer is centred or a maximum of 5 mm to the right of the slot in the base plate.

Adjusting the valve timing:

If hub -B- cannot be locked:



– Loosen securing bolts -2- for inlet camshaft sprocket.
– Place a ring spanner on the centre bolt for inlet camshaft.
– Turn hub until locking pin -3359- can be inserted.
– Tighten bolts -2- for inlet camshaft sprocket to 25 Nm.
– Remove locking pins and crankshaft stop.

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

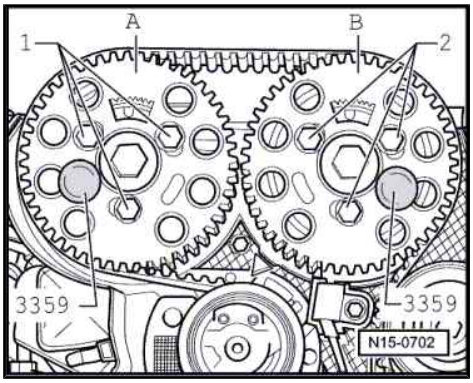
– Turn crankshaft two rotations in normal direction of rotation until crankshaft is at TDC again.
– Check valve timing once again ⇒ page 125.

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If the crankshaft cannot be locked:

– Loosen bolts -1- and -2- for the camshaft sprockets -A- and -B-.

– Continue to turn the crankshaft in the normal direction of rotation until it can be locked with crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.



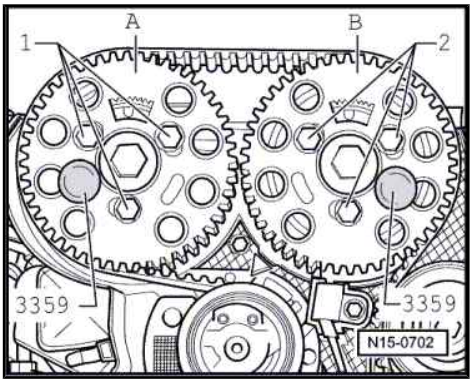
Note

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 bolts -1- and -2- for camshaft sprockets -A- and -B- to 25 Nm.

– Remove locking pins and crankshaft stop.



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 113 .

Assembling:

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

– Install centre and bottom sections of toothed belt cover.

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Note

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

– Install engine support ⇒ page 84 .

– Install vibration damper ⇒ page 89 .

– Adjust assembly mountings ⇒ page 80 .

– Install poly V-belt ⇒ page 86 .

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

– Install air pipes ⇒ page 279 .

Tightening torques

Component	Nm
Tensioning roller for toothed belt to cylinder head	20 + 45° 1)
Camshaft sprocket to hub	25
Toothed belt cover (bottom) to cylinder block	10 2)
Toothed belt cover (centre) to cylinder block	10 2)
Engine mounting to body	50
Connecting bracket to engine mounting/body	20 + 90° 3)4)
Pendulum support to subframe	Manual gearbox ⇒ Rep. Gr. 34 , automatic gearbox ⇒ Rep. Gr. 37
Tensioner for poly V-belt to bracket for ancillaries	23

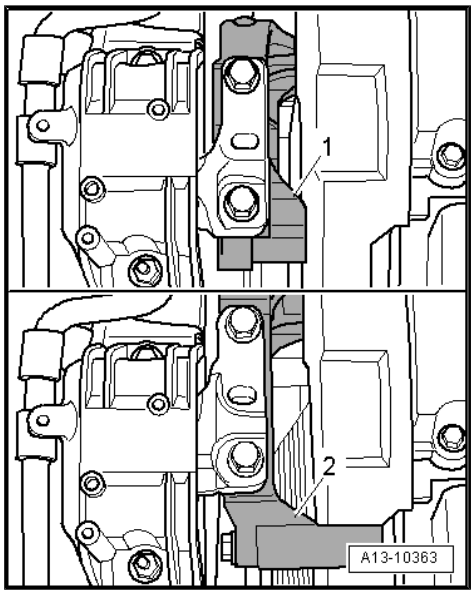
- 1) 45° = one eighth turn.
- 2) Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue for locking fluid.
- 3) Renew bolts.
- 4) 90° = one quarter turn.

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1.8 Removing and installing toothed belt - vehicles with large engine support

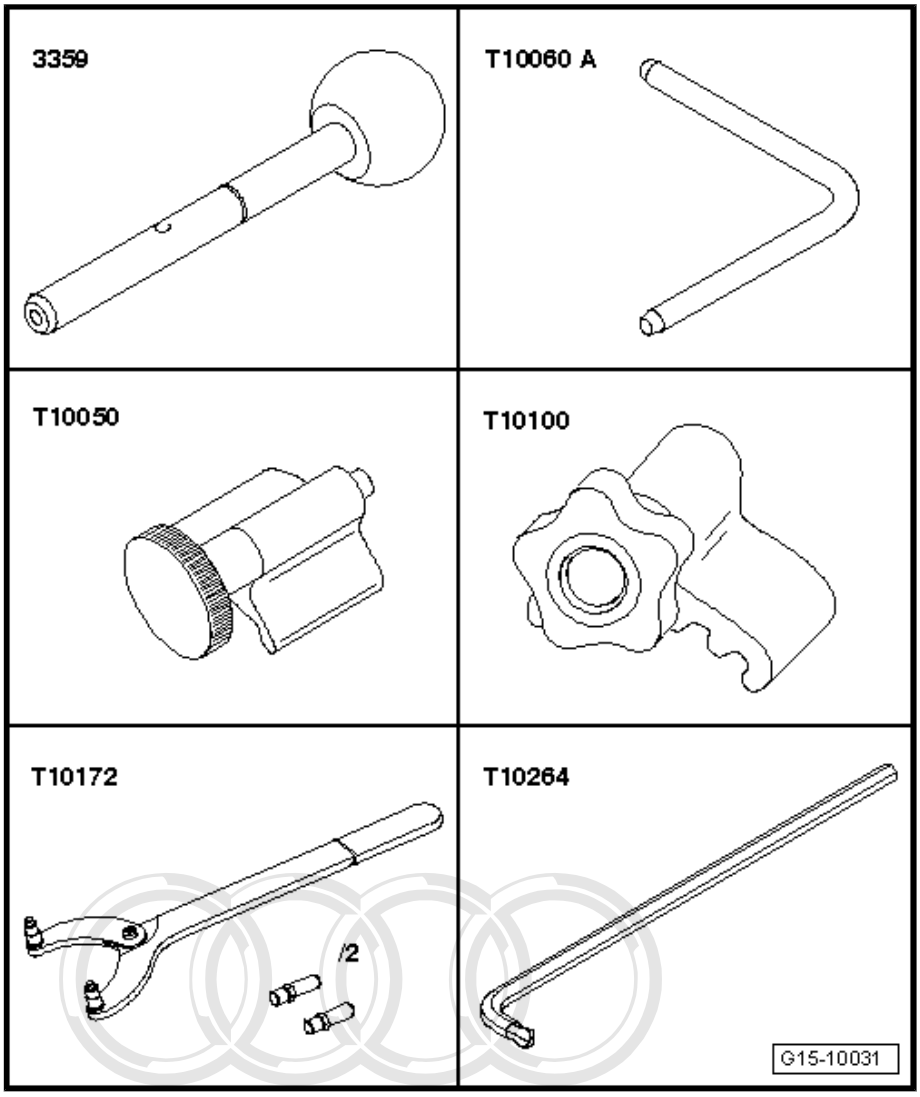
Note

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

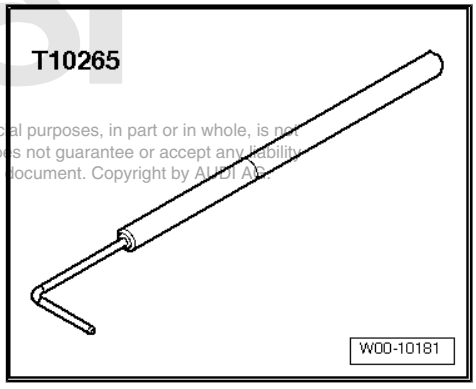


Special tools and workshop equipment required

- Diesel injection pump locking pin -3359- (2x)
- Locking pin -T10060 A-
- Crankshaft stop -T10050- for engines with circular crankshaft sprocket
- Crankshaft stop -T10100- for engines with oval crankshaft sprocket
- Counter-hold tool -T10172- with pin -T10172/4-
- Special wrench, long reach -T10264-



- Locking tool -T10265-

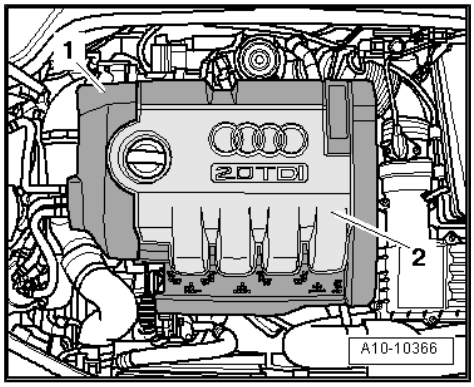


- Locking fluid ⇒ Electronic parts catalogue

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Removing

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

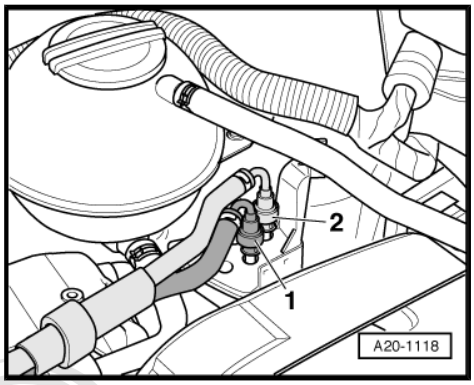


Caution

Rules for cleanliness when working on the injection system ⇒ page 6 .

WARNING

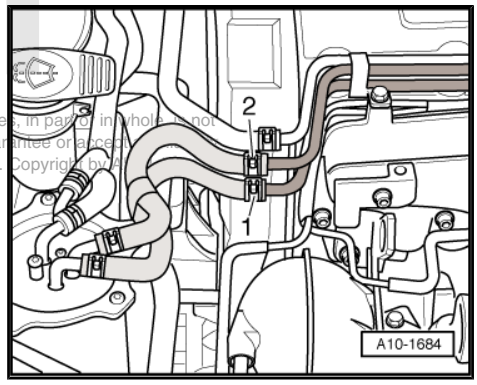
- *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- *Wear protective gloves.*
- *Wear safety goggles.*



– Disconnect fuel supply pipe -2- and fuel return pipe -1- by pulling release tabs.

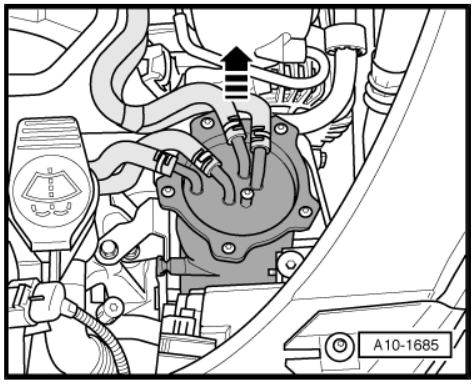
– Disconnect fuel supply pipe -2- and fuel return pipe -1- from fuel lines.

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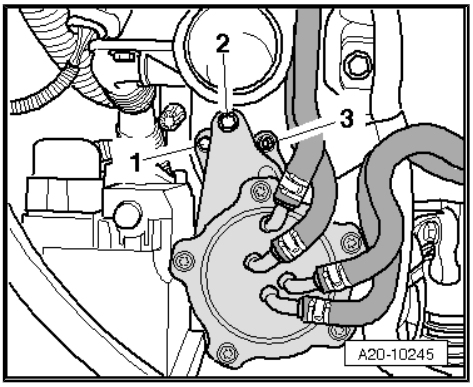
Fuel filter - version 1:

– Pull fuel filter with hoses attached upwards out of the bracket -arrow-.



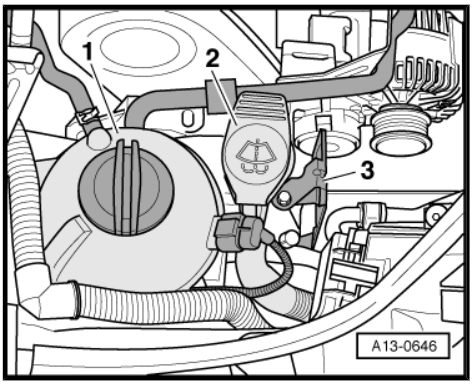
Fuel filter - version 2:

– Slacken bolt -1- one turn.
– Remove bolt -2- and nut -3-.
– Remove fuel filter with hoses attached.



All vehicles (continued):

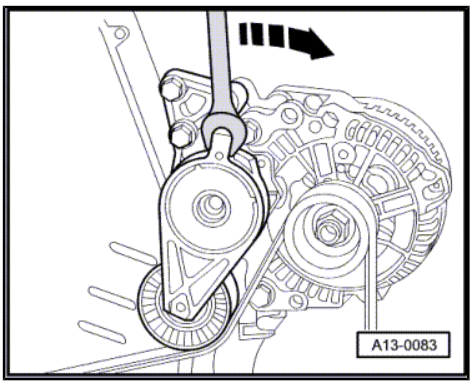
– Unscrew bracket -3- for fuel filter.
– Unscrew bolt at filler neck -2- for washer fluid reservoir.
– Unscrew coolant expansion tank -1- and move clear to one side with the lines attached.



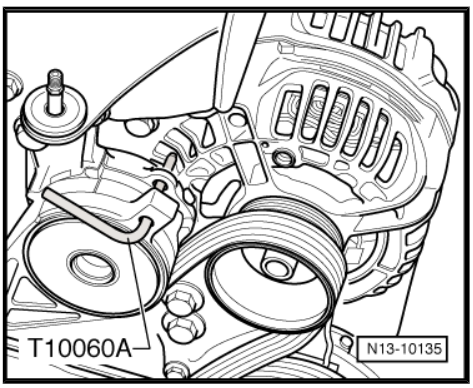
Note

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

– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.

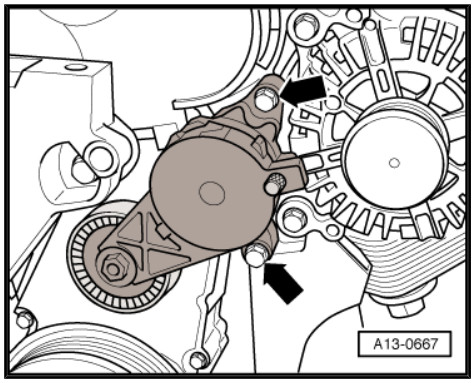


– Lock poly V-belt tensioner using locking pin -T10060 A- .
– Remove poly V-belt.

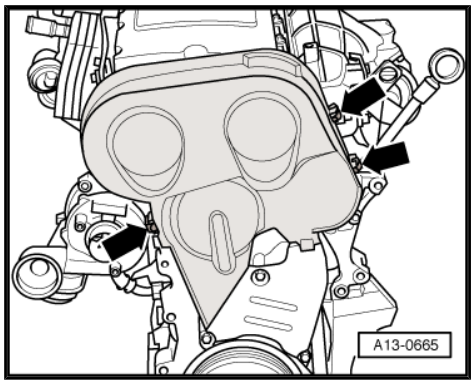


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– Remove tensioner for poly V-belt -arrows-.

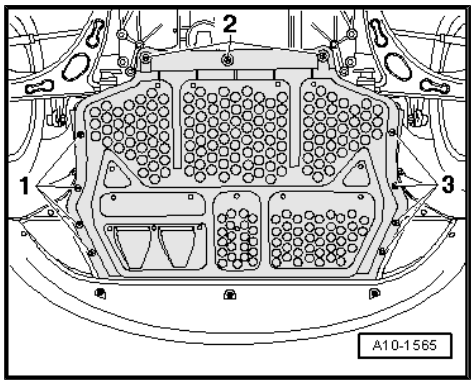


– Remove top toothed belt cover by releasing retaining clips -arrows-.

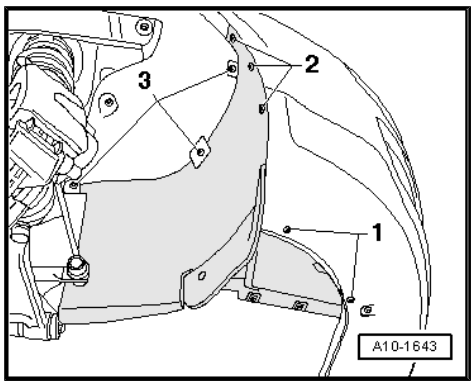


– Remove centre noise insulation -fasteners 1 ... 3-.

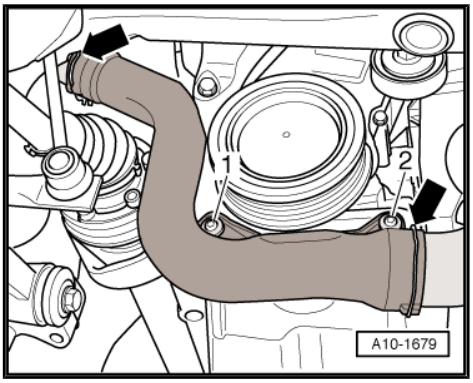
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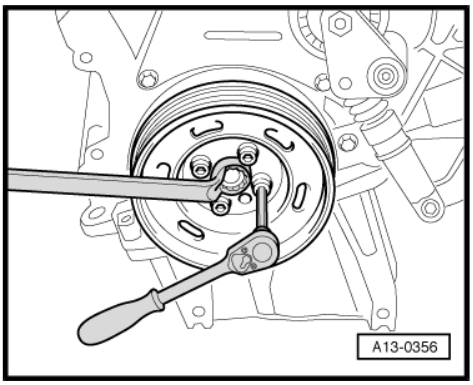
– Remove noise insulation (right-side) -fasteners 1 ... 3-.



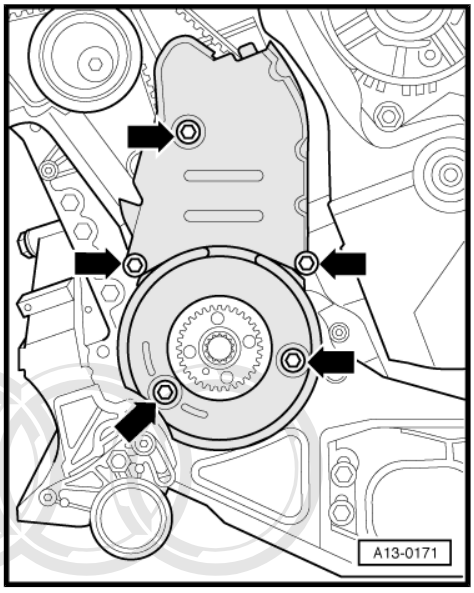
– If fitted, remove bolts -1- and -2-.
– Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



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



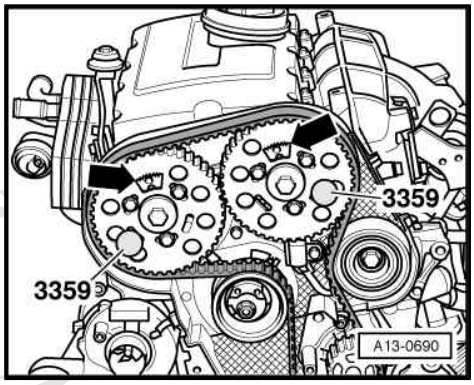
– Unbolt toothed belt covers (bottom and centre) -arrows-.



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Caution

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



– Turn the crankshaft to TDC for cylinder No. 1.

Note

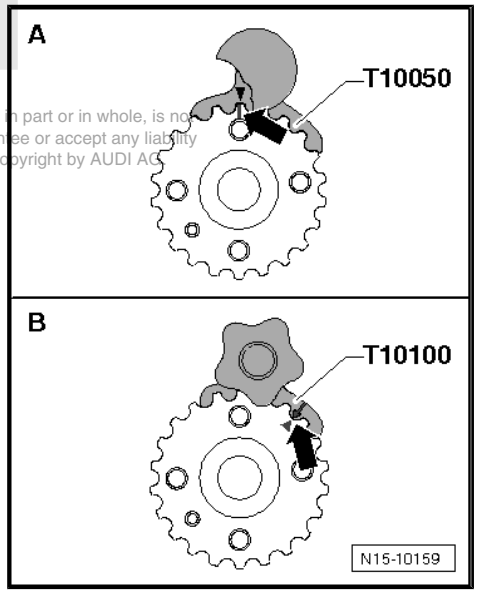
At TDC position the toothed segments -arrows- face upwards.

– Lock hubs with locking pins -3359- .

– Lock crankshaft sprocket using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.

• The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-. The pin of the crankshaft stop must engage in the aperture in the sealing flange.

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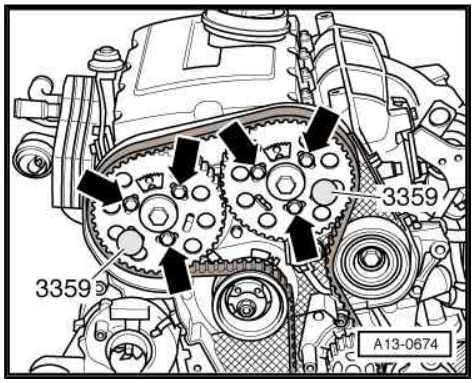


Note

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

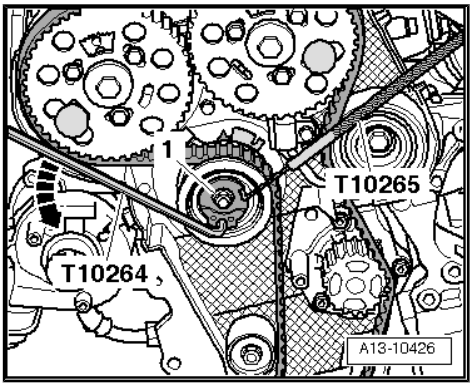
– Mark direction of rotation of toothed belt with chalk or felt pen.

– Loosen the bolts -arrows- for camshaft sprockets approx. 2 turns.



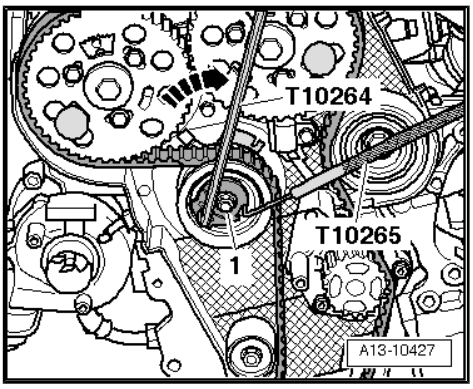
– Loosen securing nut -1- for tensioning roller.

– Turn eccentric adjuster of tensioning roller anti-clockwise -arrow- using special wrench, long reach -T10264- until tensioning roller can be secured with 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.



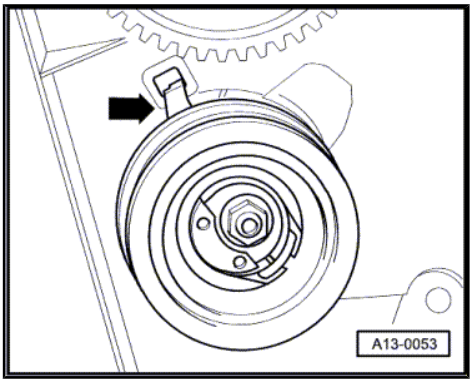
Installing (adjusting valve timing)

- Camshafts locked with locking pin -3359- (2x).
- Crankshaft is locked using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.
- 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-.



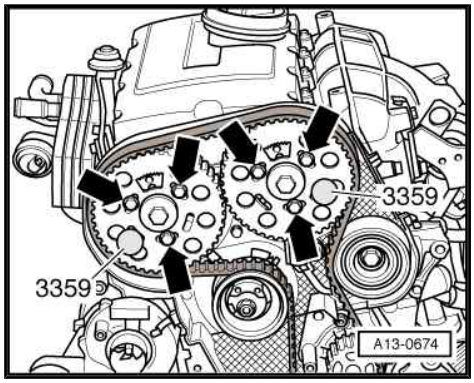
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– Screw in bolts -arrows-, but do not tighten.

• It should just be possible to turn the camshaft sprockets on the hubs without axial movement.

– Turn the camshaft sprockets in their elongated holes clockwise until the stop.

– Fit the toothed belt to crankshaft, tensioning roller, camshaft sprockets, idler roller and finally to sprocket for coolant pump.

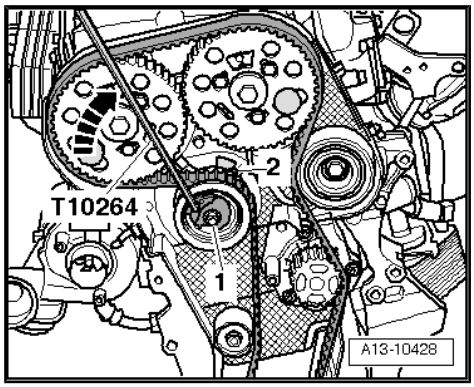


– Adjust toothed belt tension as follows:

– 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 -1- on the tensioning roller does not turn at the same time.

– Hold tensioning roller in this position and tighten securing nut -1- on tensioning roller to 20 Nm + 45° ($^1/_8$ turn).

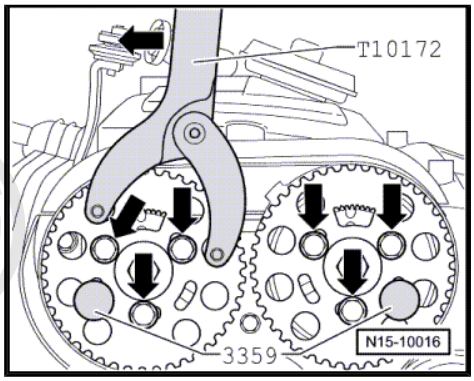
Note

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.

– Attach counter-hold tool -T10172- as shown in illustration and apply tension to driving section of toothed belt by pressing in direction of -arrow-.

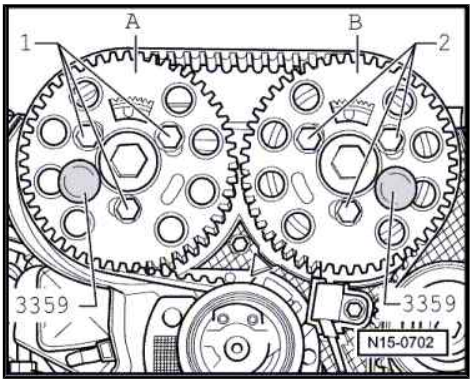
– Tighten camshaft sprocket securing bolts -arrows- to 25 Nm.

– Remove locking pins and crankshaft stop.



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Checking valve timing:

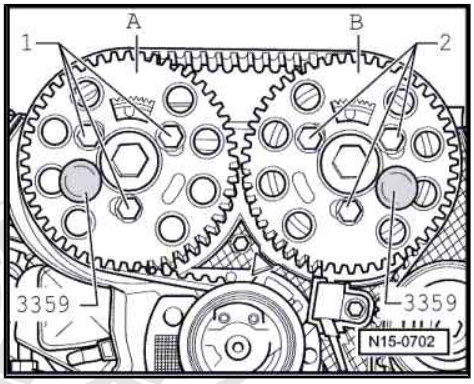


Caution

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 hub -A- into place with the locking pin -3359- when turning.
– Check whether:
♦ The hub -B- can be locked with the locking pin -3359- ;
♦ The crankshaft can be locked with the crankshaft stop.
♦ The tensioner pointer is centred or a maximum of 5 mm to the right of the slot in the base plate.

Adjusting the valve timing:



If hub -B- cannot be locked:

– Loosen securing bolts -2- for inlet camshaft sprocket.
– Place a ring spanner on the centre bolt for inlet camshaft.
– Turn hub until locking pin -3359- can be inserted.
– Tighten bolts -2- for inlet camshaft sprocket to 25 Nm.
– Remove locking pins and crankshaft stop.

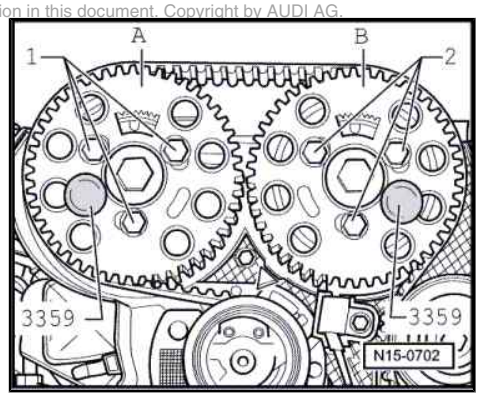
Caution

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 125.

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If the crankshaft cannot be locked:



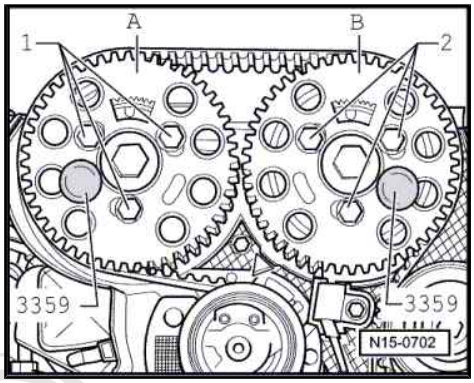
– Loosen bolts -1- and -2- for the camshaft sprockets -A- and -B-.
– Continue to turn the crankshaft in the normal direction of rotation until it can be locked with crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.

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.

– Tighten bolts -1- and -2- for camshaft sprockets -A- and -B- to 25 Nm.

– Remove locking pins and crankshaft stop.



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 125 .

Assembling:

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

Note

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

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– Install vibration damper ⇒ page 89 .

– Install poly V-belt ⇒ page 86 .

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

Tightening torques

Component	Nm
Tensioning roller for toothed belt to cylinder head	20 + 45° 1)
Camshaft sprocket to hub	25
Toothed belt cover (bottom) to cylinder block	10 2)
Toothed belt cover (centre) to cylinder block	10 2)
Tensioner for poly V-belt to bracket for ancillaries	23

- 1) 45° = one eighth turn.
- 2) Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue for locking fluid.

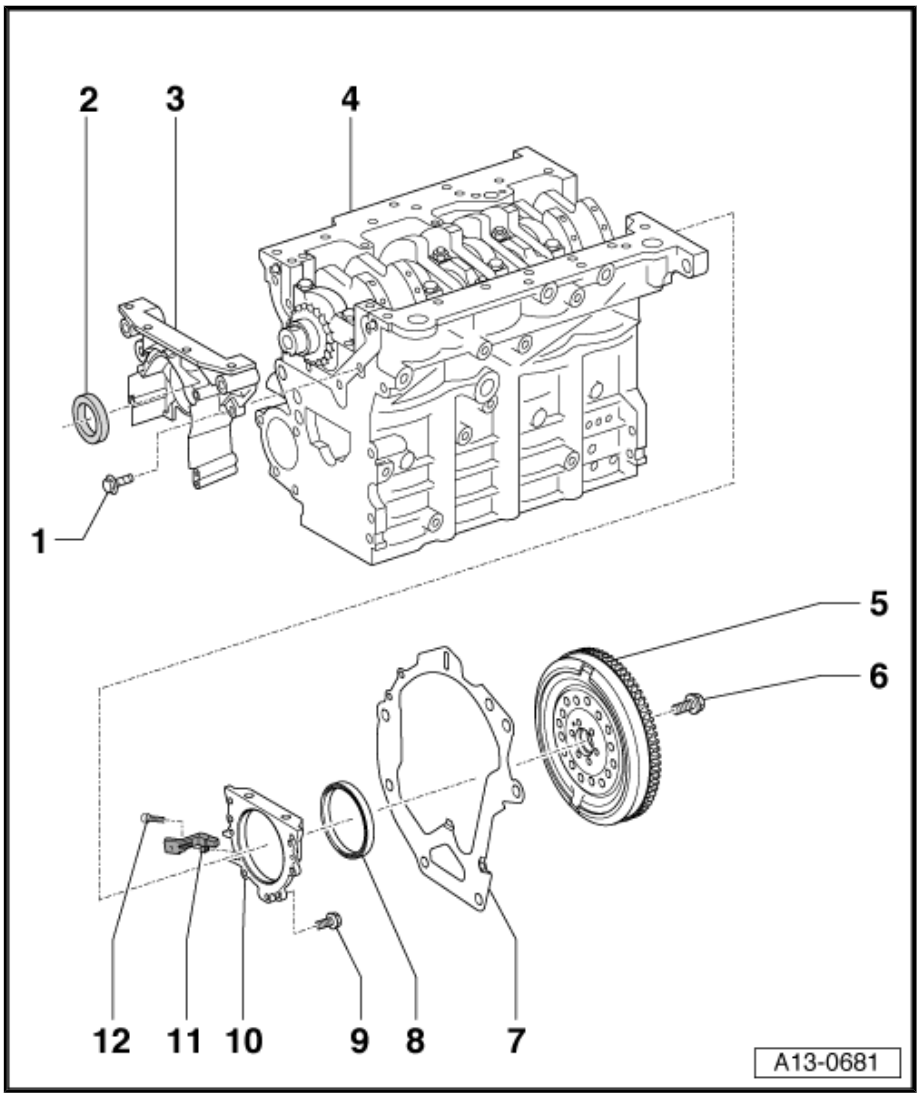
2 Removing and installing sealing flanges and dual-mass flywheel

Note

Servicing clutch ⇒ Rep. Gr. 30

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2.1 Sealing flanges and dual-mass flywheel - exploded view



1 - 15 Nm

2 - Oil seal

- ❑ Renewing ⇒ page 128
- ❑ Do not lubricate with oil

3 - Sealing flange (pulley end)

- ❑ Must be positioned on dowel sleeves
- ❑ Removing and installing ⇒ page 130

4 - Cylinder block

- ❑ Removing and installing crankshaft ⇒ page 143
- ❑ Dismantling and assembling pistons and conrods ⇒ page 147

5 - Dual-mass flywheel

- ❑ Removing and installing ⇒ page 133
- ❑ Can only be installed in one position (holes are off-set)

6 - 60 Nm + 90° (1/4 turn) further

- ❑ Renew

7 - Intermediate plate

- ❑ Must be positioned on dowel sleeves
- ❑ Do not damage/bend when assembling
- ❑ Is fitted onto sealing flange ⇒ page 128

8 - Sender wheel

- ❑ For engine speed sender -G28-
- ❑ Removing and installing ⇒ “2.5 Renewing sealing flange (gearbox end)”, page 134

9 - 15 Nm

10 - Sealing flange (gearbox end)

- ❑ With oil seal
- ❑ Renewing ⇒ page 134

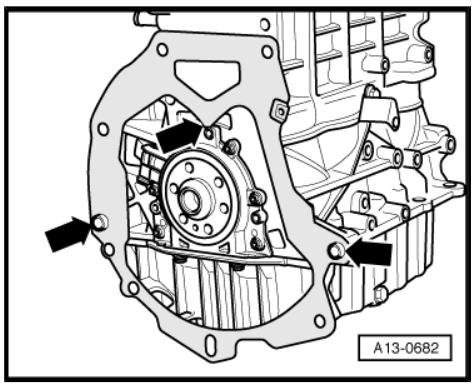
11 - Engine speed sender -G28-

- ❑ Removing and installing ⇒ “2.5 Renewing sealing flange (gearbox end)”, page 134

12 - 4.5 Nm

Installing intermediate plate

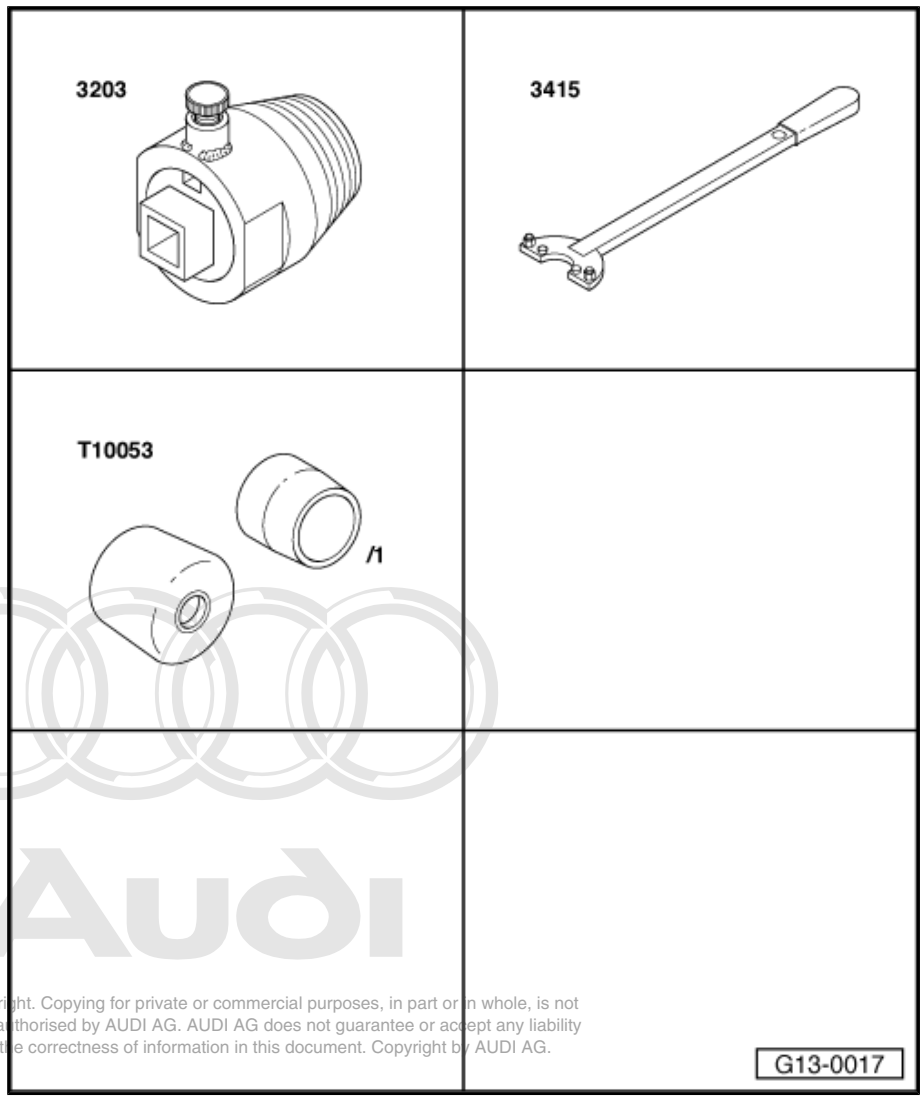
– Fit intermediate plate on sealing flange and push onto dowel sleeves -arrows-.



2.2 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

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



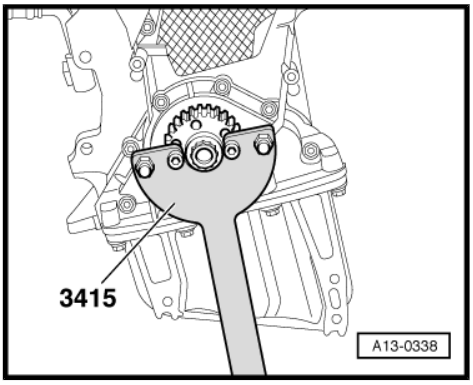
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Procedure

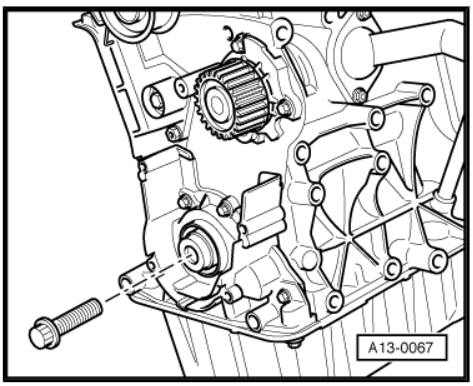
- Engine in vehicle.

– Remove toothed belt: vehicles with small engine support ⇒ page 102 , vehicles with large engine support ⇒ page 116

– Remove crankshaft sprocket; use counterhold tool -3415- to lock sprocket in place.



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



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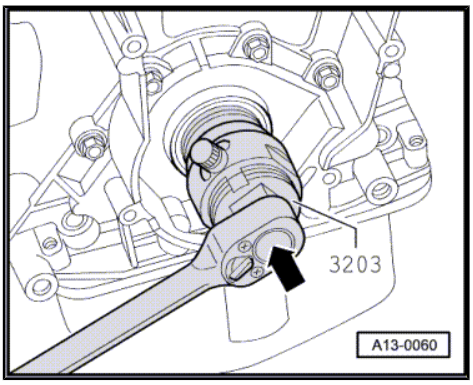
– Unscrew inner section of oil seal extractor -3203- 8 turns out of outer section and lock with knurled screw.

– Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure screw it into oil seal as far as possible.

– 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.

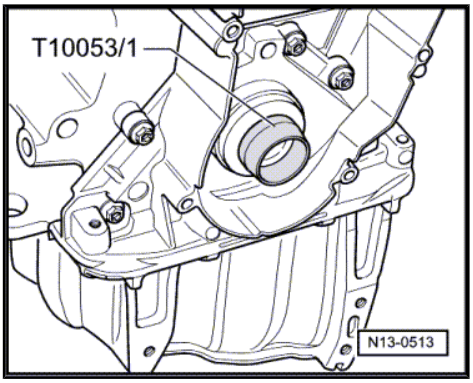


Note

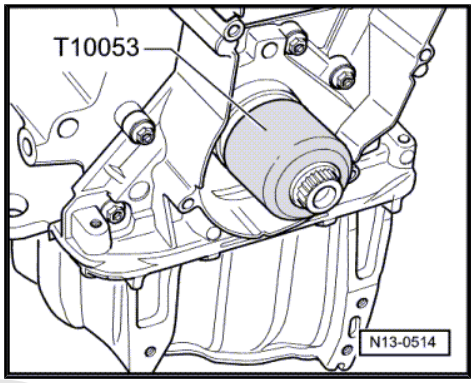
- *Renew the bolts tightened with specified tightening angle.*
- *Do not lubricate sealing lip and outer rim of oil seal before pressing in.*

– Place guide sleeve -T10053/1- onto crankshaft journal.

– Slide oil seal over guide sleeve.



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

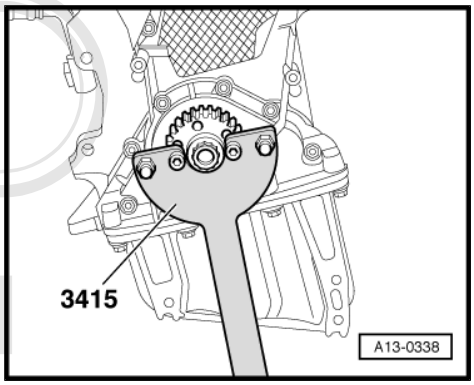


– Renew centre bolt for toothed belt sprocket.

• 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.



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

– Install toothed belt (adjust valve timing): vehicles with small engine support ⇒ page 111 , vehicles with large engine support ⇒ page 123

– Install vibration damper ⇒ page 89 .

– Install poly V-belt ⇒ page 86 .

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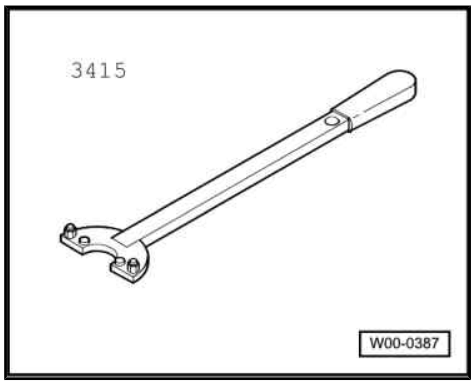
Tightening torque

Component	Nm
Toothed belt sprocket to crankshaft	120 + 90° 1)2)
• 1) Renew bolt. • 2) 90° = one quarter turn.	

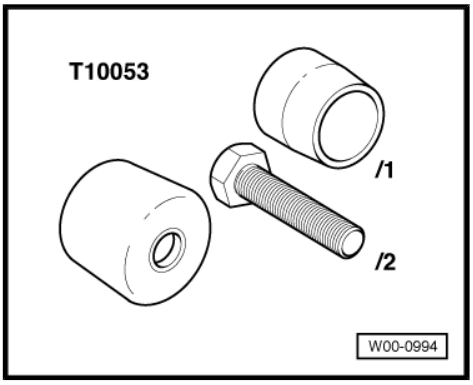
2.3 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

♦ Counterhold tool -3415-



♦ Assembly tool -T10053-



♦ Electric drill with plastic brush attachment

♦ Safety goggles

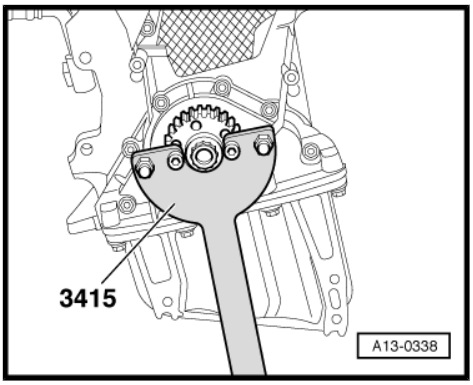
♦ Sealant ⇒ Electronic parts catalogue

Removing

• Engine in vehicle.

– Remove toothed belt: vehicles with small engine support ⇒ page 102 , vehicles with large engine support ⇒ page 116

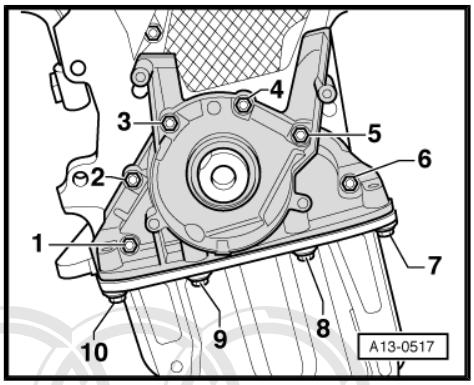
– Remove crankshaft sprocket; use counterhold tool -3415- to lock sprocket in place.



– Remove bolts -1 ... 10-.

– Pry off sealing flange (pulley end) and remove.

– Drive out oil seal with sealing flange removed.



Installing

Note

Place a cloth over the exposed section of the sump.

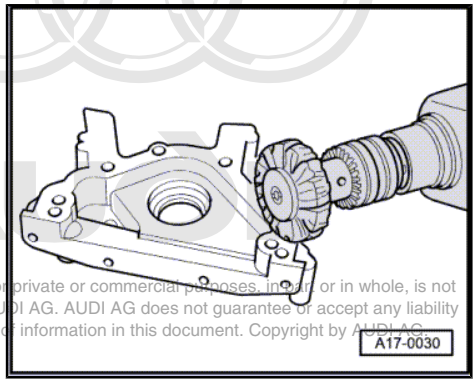
– Carefully remove any sealant residue on the cylinder block and sump.

WARNING

Wear safety goggles.

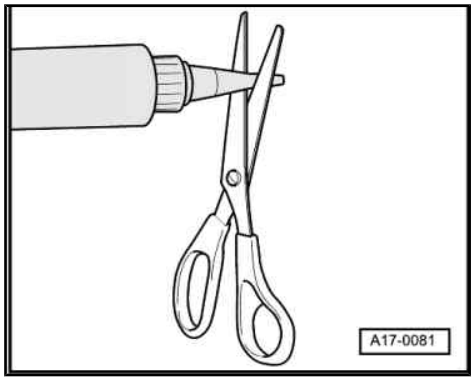
– Remove sealant residue from sealing flange with rotating plastic brush or similar.

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

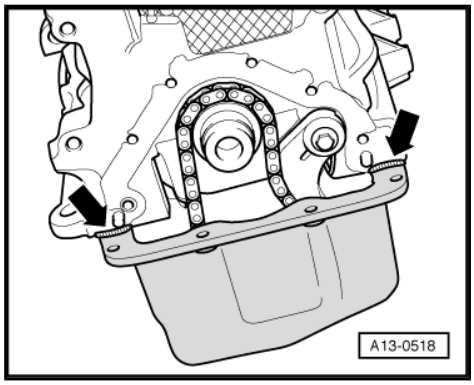


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– Cut off tube nozzle at front marking (nozzle approx. 2 mm ∅).



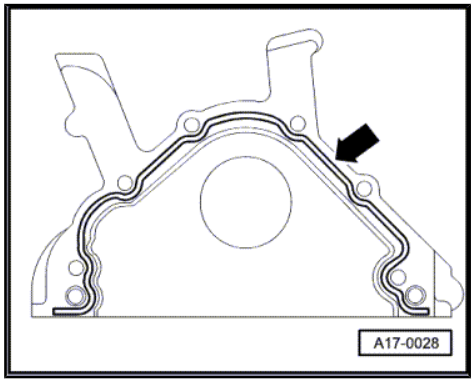
– Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



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– Apply the bead of sealant onto the clean sealing surface of the sealing flange as illustrated -arrow-.

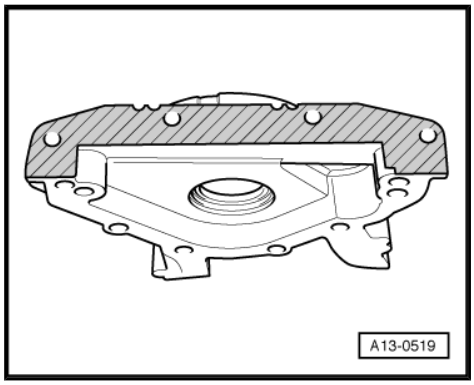
- Thickness of sealant bead: 2 ... 3 mm



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-.

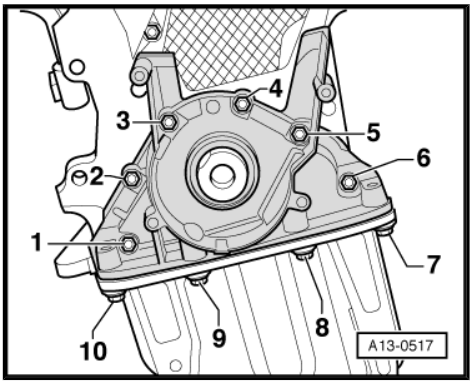


Note

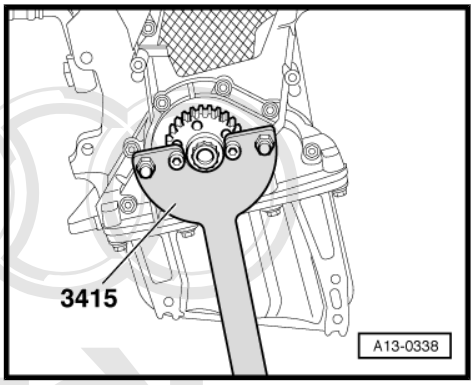
The sealing flange must be installed within 5 minutes after applying sealant.

– Push the sealing flange carefully onto the dowel pins on the cylinder block.

– Tighten bolts in the specified sequence:
– Tighten bolts -1 ... 6-.
– Tighten bolts -7 ... 10-.
– Install crankshaft oil seal (pulley end) ⇒ page 129 .



– Renew centre bolt for toothed belt sprocket.
• 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.



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

– Install toothed belt (adjust valve timing): vehicles with small engine support ⇒ page 111 , vehicles with large engine support ⇒ page 123
– Install vibration damper ⇒ page 89 .
– Install poly V-belt ⇒ page 86 .

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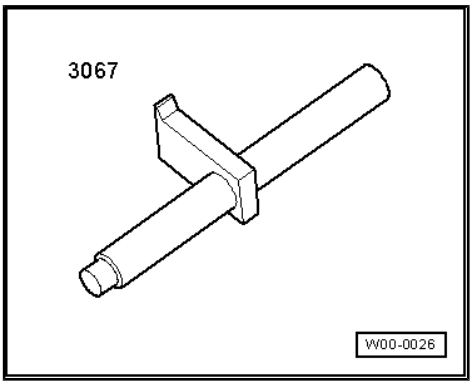
Tightening torques

Component	Nm
Sealing flange to cylinder block	15
Toothed belt sprocket to crankshaft	120 + 90° 1)2)
• 1) Renew bolt. • 2) 90° = one quarter turn.	

2.4 Removing and installing dual-mass flywheel

Special tools and workshop equipment required

♦ Counterhold tool -3067-



Removing

- Gearbox removed.

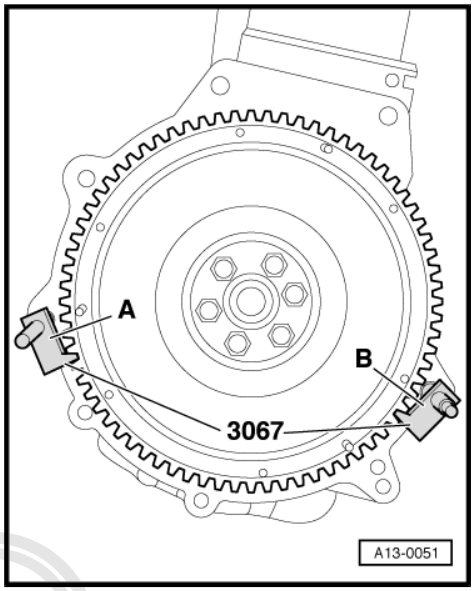
– Insert counter-hold tool -3067- in hole on cylinder block, and secure on dual-mass flywheel.

- Installation position for counterhold:

A - To tighten

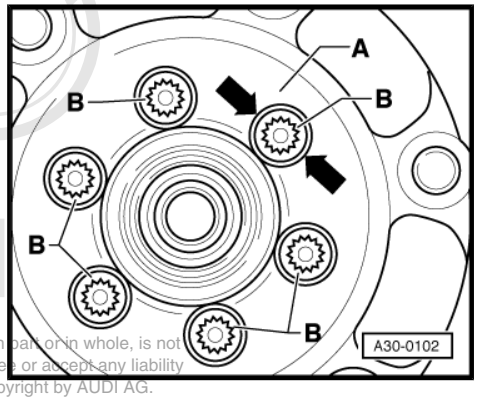
B - To loosen

– Mark installation position of dual-mass flywheel on crankshaft.



Caution

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.

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Installing

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

– Use new securing bolts.

– Reverse position of counterhold tool -3067- in order to tighten bolts.

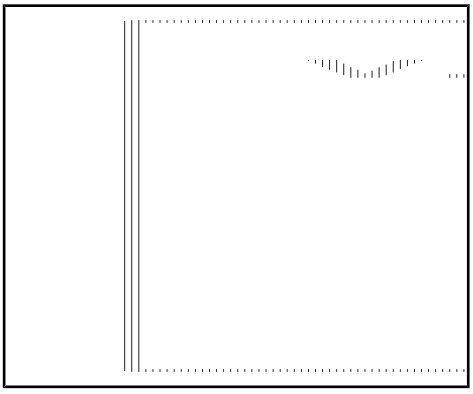
Tightening torque

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

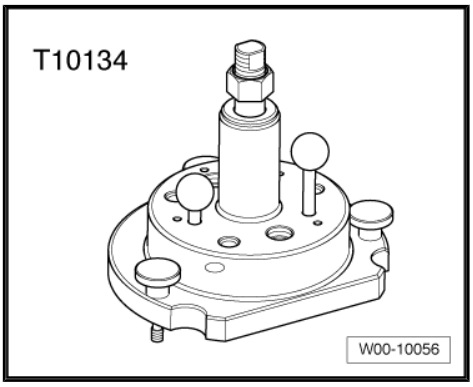
2.5 Renewing sealing flange (gearbox end)

Special tools and workshop equipment required

♦ Tool insert, AF 24 -V.A.G 1332/11-



♦ Assembly tool -T10134-



♦ Depth gauge

♦ Bolt M6x35 (3x)

♦ Bolt M7x35 (2x)

Pressing out sealing flange with sender wheel

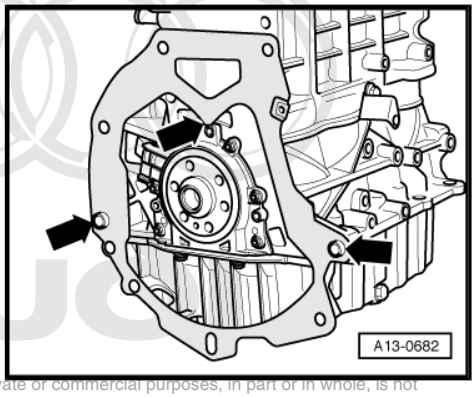
• Gearbox removed.

– Remove dual-mass flywheel ⇒ page 133 .

– Detach intermediate plate at sealing flange and dowel sleeves -arrows-.

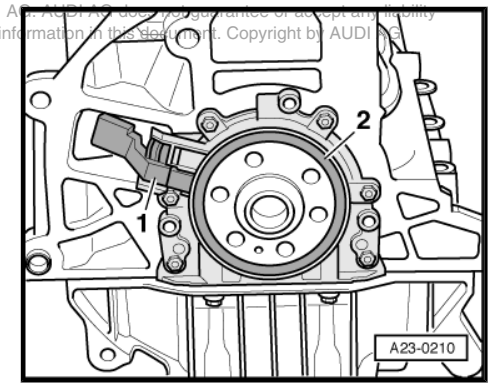
– Remove sump ⇒ page 231 .

– Turn the crankshaft to TDC ⇒ page 102 .



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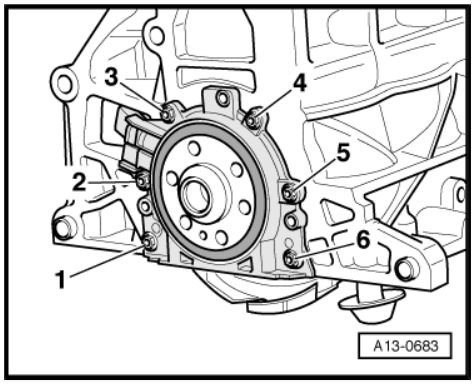
– Remove engine speed sender -G28- -item 1- using a standard ball head hexagon key.



Note

Disregard -item 2-.

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

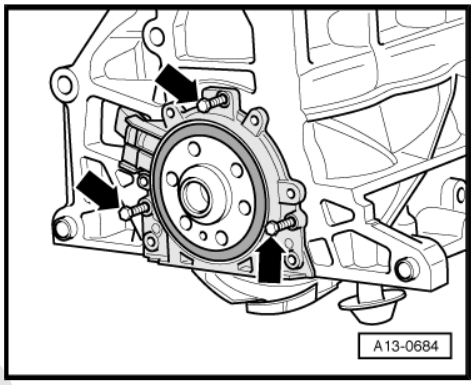


Note

Disregard items marked -7- and -8-.

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 $^1/_2$ 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 can only 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.*

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Construction of assembly tool -T10134-

A - Tightening flats

B - Hexagon nut

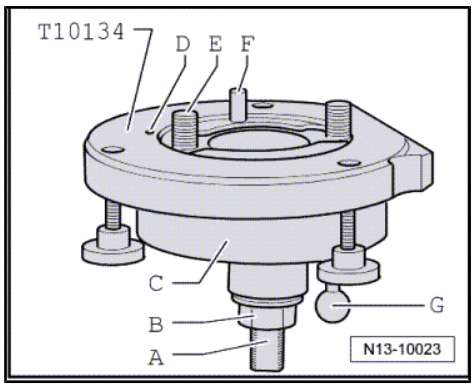
C - Assembly housing

D - Locating pin

E - Hexagon socket-head bolt

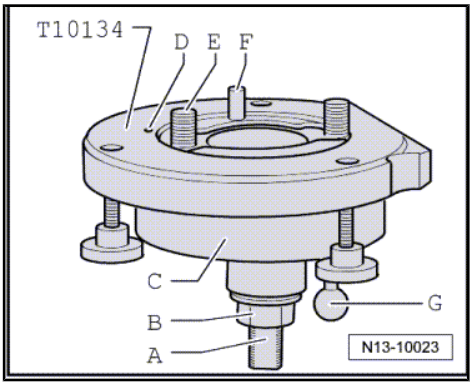
F - Guide pin for diesel engines (black handle)

G - Guide pin for petrol engines (red handle)



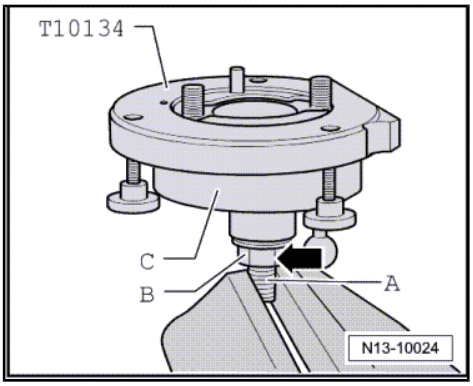
A - Fitting sealing flange with sender wheel onto assembly tool - T10134- :

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



– Clamp assembly tool -T10134- in a vice on tightening flats -A- of threaded spindle.

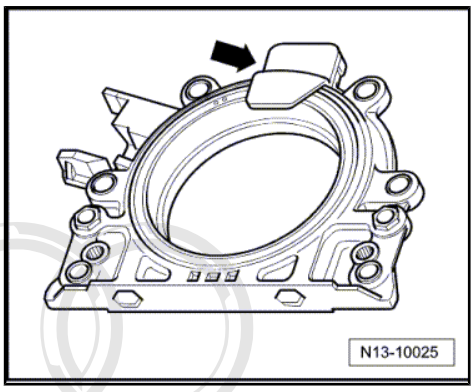
– Press the assembly housing -C- downwards so that it lies on the hexagon nut -B- -arrow-.



Note

Inner part of assembly device and assembly housing must align (be level) with each other.

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

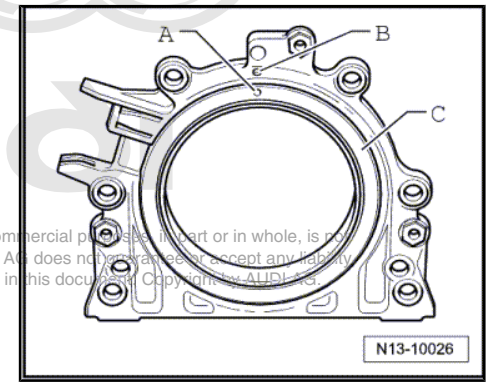


Note

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

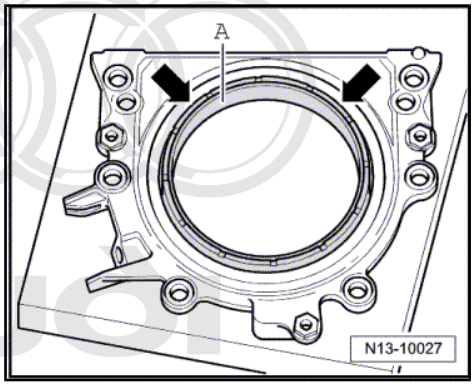
• The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.

– Place the sealing flange (with the front side downwards) on a clean flat surface.



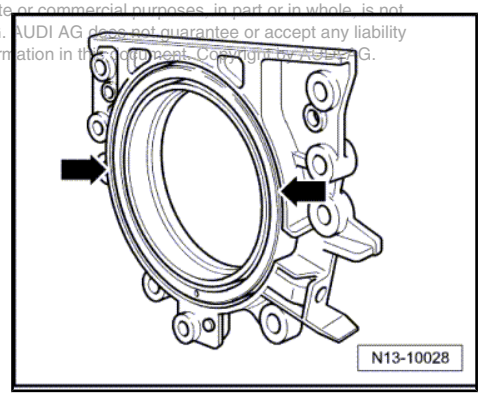
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– Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.

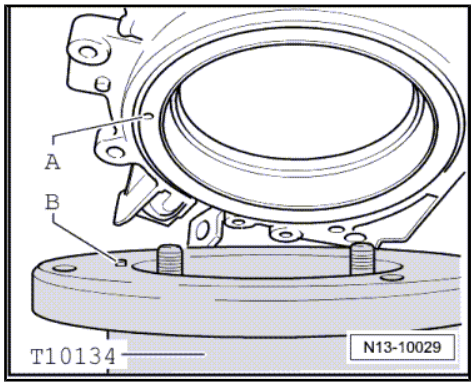


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- The upper edge of the sender wheel and the front edge of the sealing flange must align -arrows-.



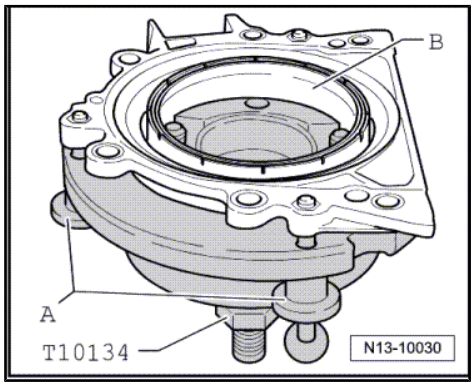
– Place the sealing flange with the front side on the assembly tool -T10134- , so that the locating pin -B- can be inserted in the sender wheel hole -A-.



Note

Ensure the sealing flange lies flat on the assembly tool.

– 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

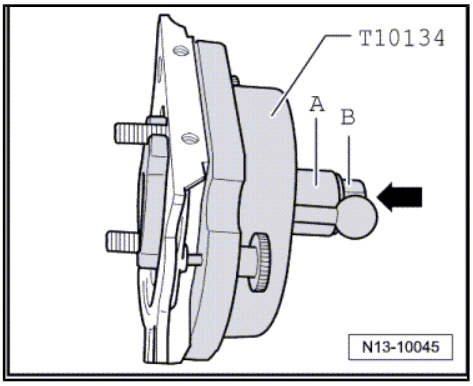
Ensure that the sender wheel remains fixed on the assembly tool when installing the sealing flange.

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

- Crankshaft flange free of oil and grease.
- Engine positioned at TDC (No. 1 cylinder).

– Screw hexagon nut -B- to end of threaded spindle.

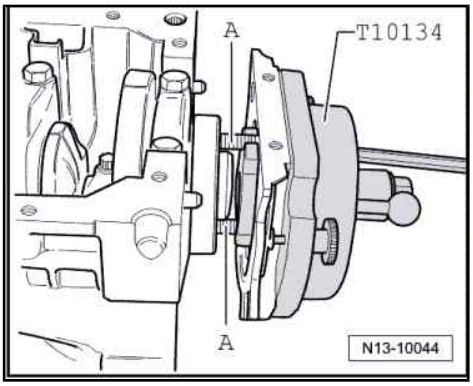
– Press the threaded spindle of assembly tool -T10134- in direction of -arrow- until the hexagon nut -B- lies on the assembly housing -A-.



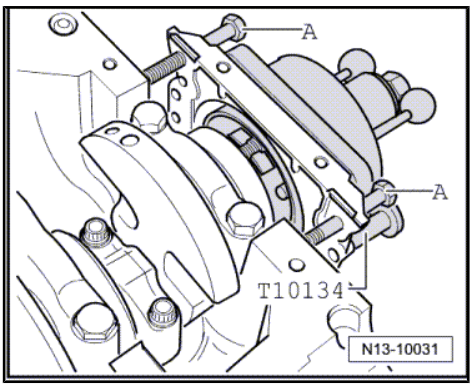
– Position flat edge of assembly housing towards sealing surface for sump on cylinder block.

– Secure assembly tool -T10134- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.

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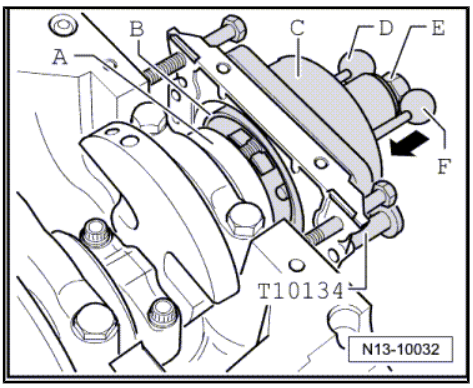
– Screw two bolts M7×35 mm -A- into cylinder block to guide sealing flange.



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 of crankshaft. This ensures that the sender wheel reaches its final installation position.



Note

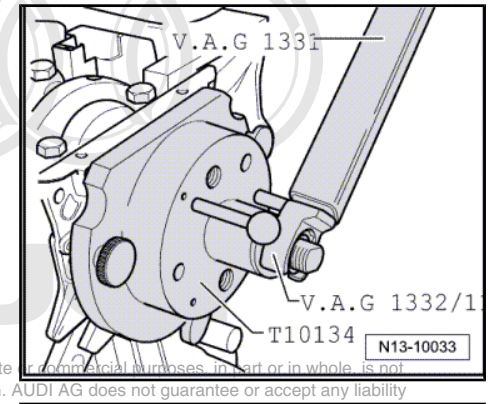
The guide pin for PETROL engines (red handle) -F- MUST NOT be inserted into the threaded hole in the crankshaft.

– Tighten both 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.

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E - Checking installation position of sender wheel on crankshaft:

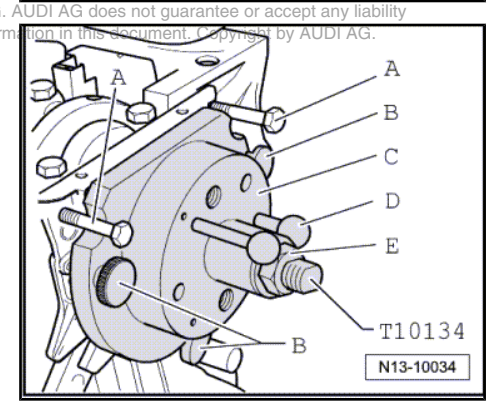
– Screw hexagon nut -E- to end of threaded spindle.

– Unscrew the 2 bolts -A- out of cylinder block.

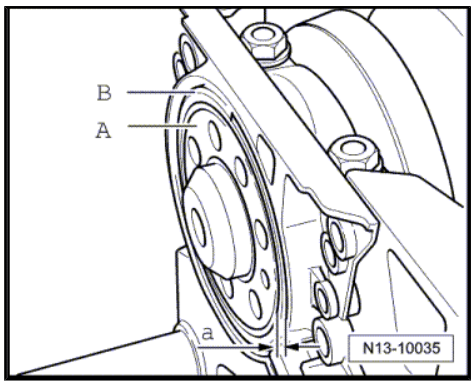
– Unscrew the three knurled screws -B- from sealing flange.

– Remove assembly tool -T10134- .

– Remove sealing lip support ring.



• 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 on the crankshaft flange.

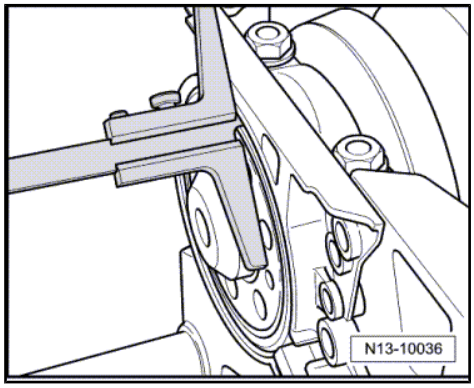
– Measure distance -a- between crankshaft flange and sender wheel.

If dimension -a- is too small:

– Press in the sender wheel further ⇒ page 141 .

When dimension -a- is achieved:

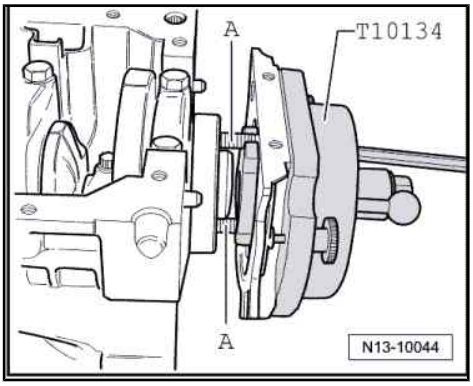
– Continue with assembly ⇒ page 141 .



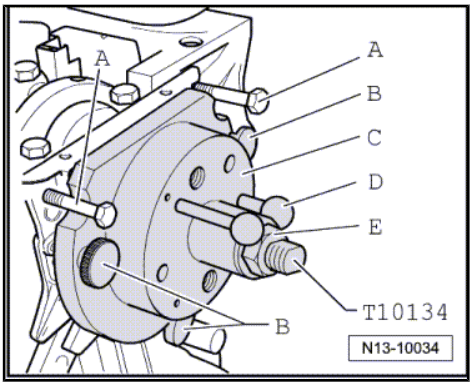
F - Pressing sender wheel in further:

– Secure the assembly tool -T10134- -A- to crankshaft flange by tightening hexagon socket head bolts finger-tight.

– 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-.



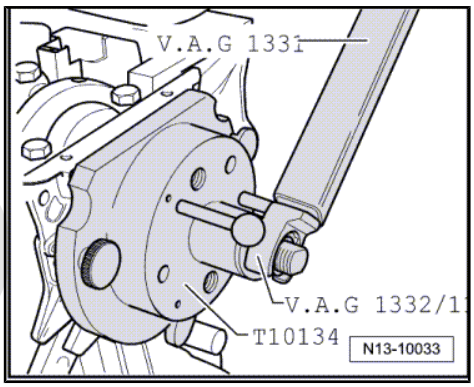
– Tighten hexagon nut of assembly tool -T10134- to 40 Nm.

– Check installation position of sender wheel on crankshaft again ⇒ page 140 .

If dimension “a” is too small again:

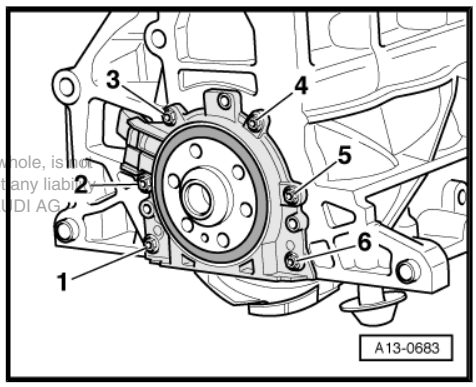
– Tighten hexagon nut of assembly tool -T10134- to 45 Nm.

– Check installation position of sender wheel on crankshaft again ⇒ page 140 .



Assembling:

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

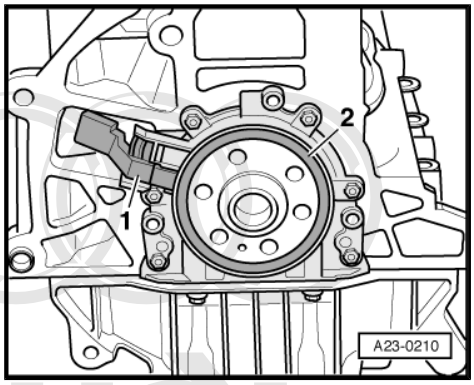


Note

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Disregard items marked -7- and -8-.

– Secure engine speed sender -G28- -item 1-.

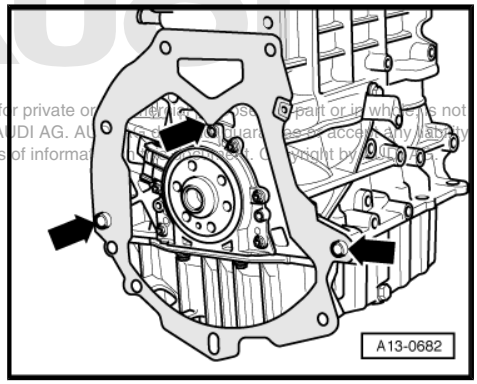


Note

Disregard -item 2-.

– Install sump ⇒ page 231 .

– Fit intermediate plate on sealing flange and push onto dowel sleeves -arrows-.



– Install dual-mass flywheel ⇒ page 133 .

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Tightening torque

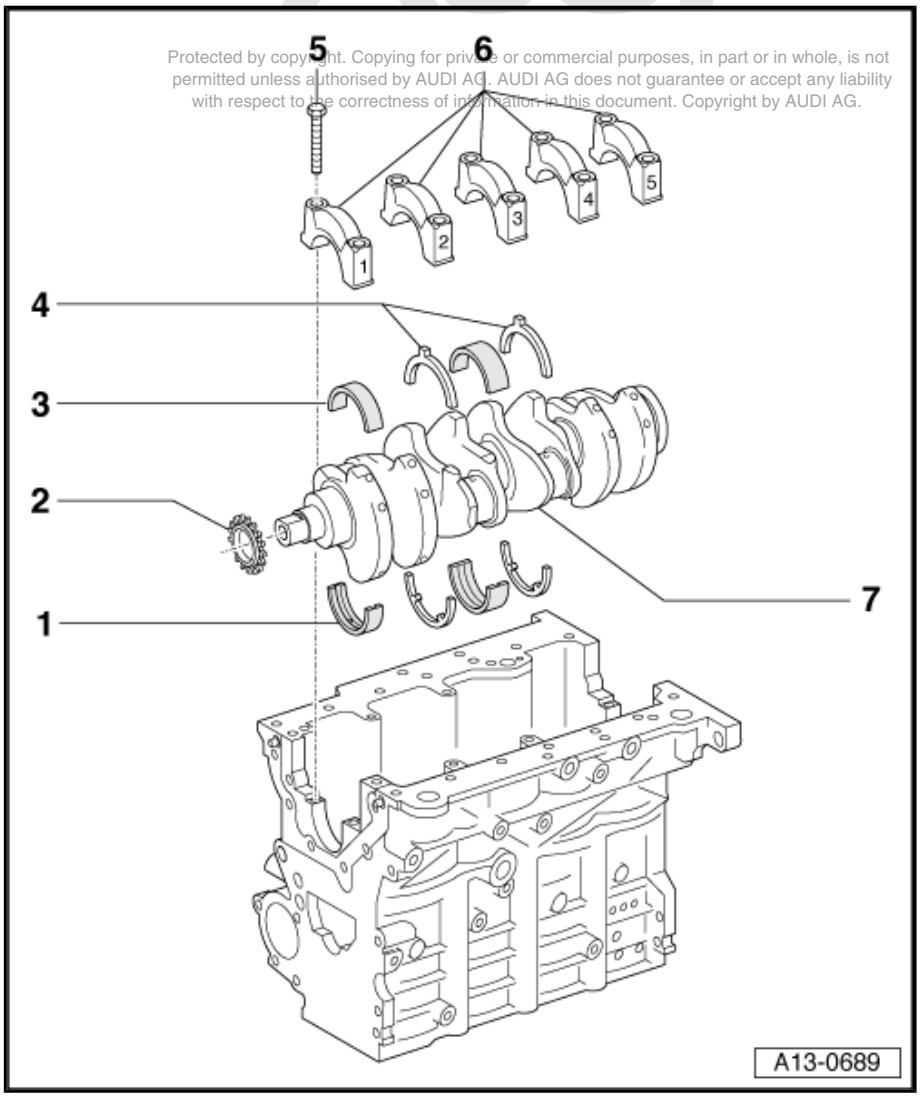
Component	Nm
Sealing flange to cylinder block	15 1)
Engine speed sender -G28- to cylinder block	5
• 1) Tighten bolts in diagonal sequence	

3 Removing and installing crankshaft

Note

When carrying out repairs, secure engine to assembly stand with engine and gearbox support -VW 540- ⇒ page 73 .

3.1 Crankshaft - exploded view



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1 - Bearing shell

- For cylinder block (with oil groove)
- Do not interchange used bearing shells (mark positions)

2 - Drive chain sprocket

- For oil pump
- Removing and installing ⇒ page 144

3 - Bearing shell

- For bearing cap (without oil groove)
- Do not interchange used bearing shells (mark positions)

4 - Thrust washers

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

5 - 65 Nm + 90° (1/4 turn) further

- Renew
- For measuring radial clearance of crankshaft, tighten to 65 Nm but not 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

- A needle bearing must be fitted in the crankshaft on vehicles with direct shift gearbox; install needle bearing if not yet fitted ⇒ page 145 .
- Axial clearance when new: 0.07 ... 0.17 mm; wear limit: 0.37 mm
- Check radial clearance with Plastigage
- Radial clearance when new: 0.03 ... 0.08 mm; wear limit 0.17 mm
- Do not rotate the crankshaft when checking the radial clearance
- Crankshaft dimensions ⇒ page 144

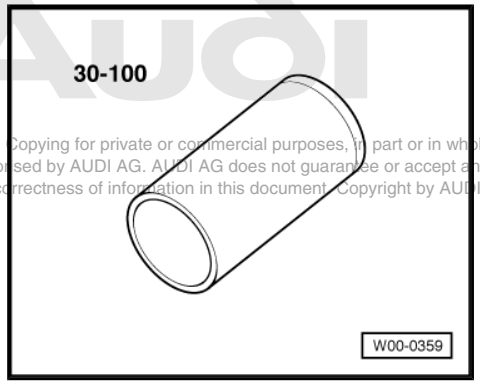
3.2 Crankshaft dimensions

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

3.3 Removing and installing drive chain sprocket

Special tools and workshop equipment required

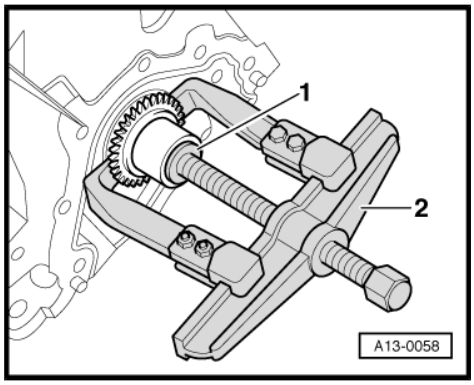
- Drift sleeve -30 - 100-



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- Two-arm puller, commercially available
- Protective gloves

Removing



– Remove sump ⇒ page 231 .
– Remove sealing flange (pulley end) ⇒ page 130 .
– Remove oil pump drive chain sprocket ⇒ Item 2 (page 230) , chain tensioner ⇒ Item 7 (page 230) and chain ⇒ Item 4 (page 230) .
– Pull drive chain sprocket off 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:

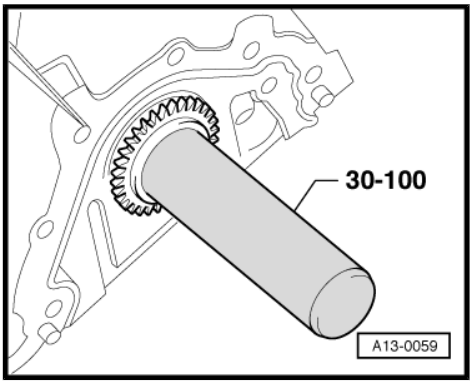
WARNING

Wear protective gloves.

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

– Fit drive chain sprocket on end of crankshaft using pliers, and press onto crankshaft as far as the stop using drift sleeve -30 - 100- .

• Installation position: wider collar on drive chain sprocket faces engine.



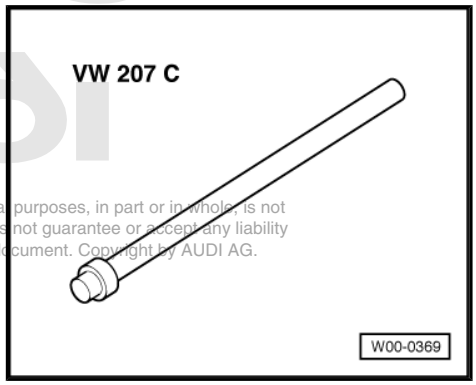
3.4 Extracting and driving in needle bearing for crankshaft

Note

A needle bearing must be fitted in the crankshaft on vehicles with direct shift gearbox; install needle bearing if not yet fitted.

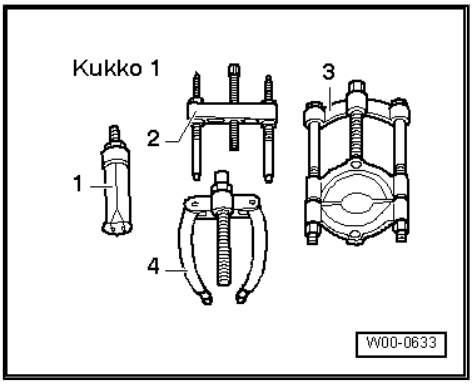
Special tools and workshop equipment required

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



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♦ -1- Internal puller Kukko 21/1



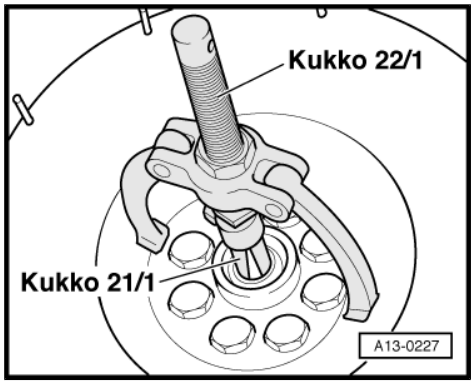
♦ -4- Counter-support Kukko 22/1

♦ Depth gauge

Pulling out

- Gearbox removed.

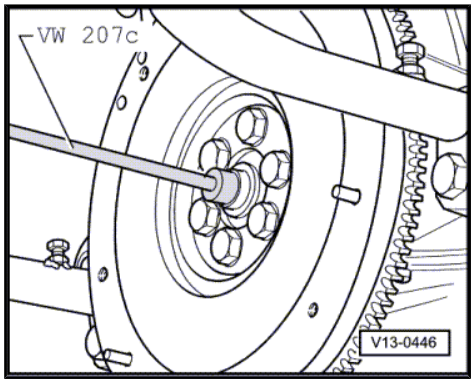
– Remove needle bearing using internal puller Kukko 21/1 and counter-support Kukko 22/1.



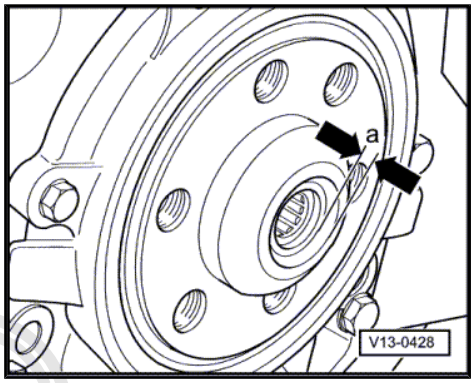
Driving in

– Drive in needle bearing using drift -VW 207 C- or centring mandrel -3176- .

- The lettering on the needle bearing must be visible when installed.



- Needle bearing must be inserted to a depth of -a- = approx. 3 mm



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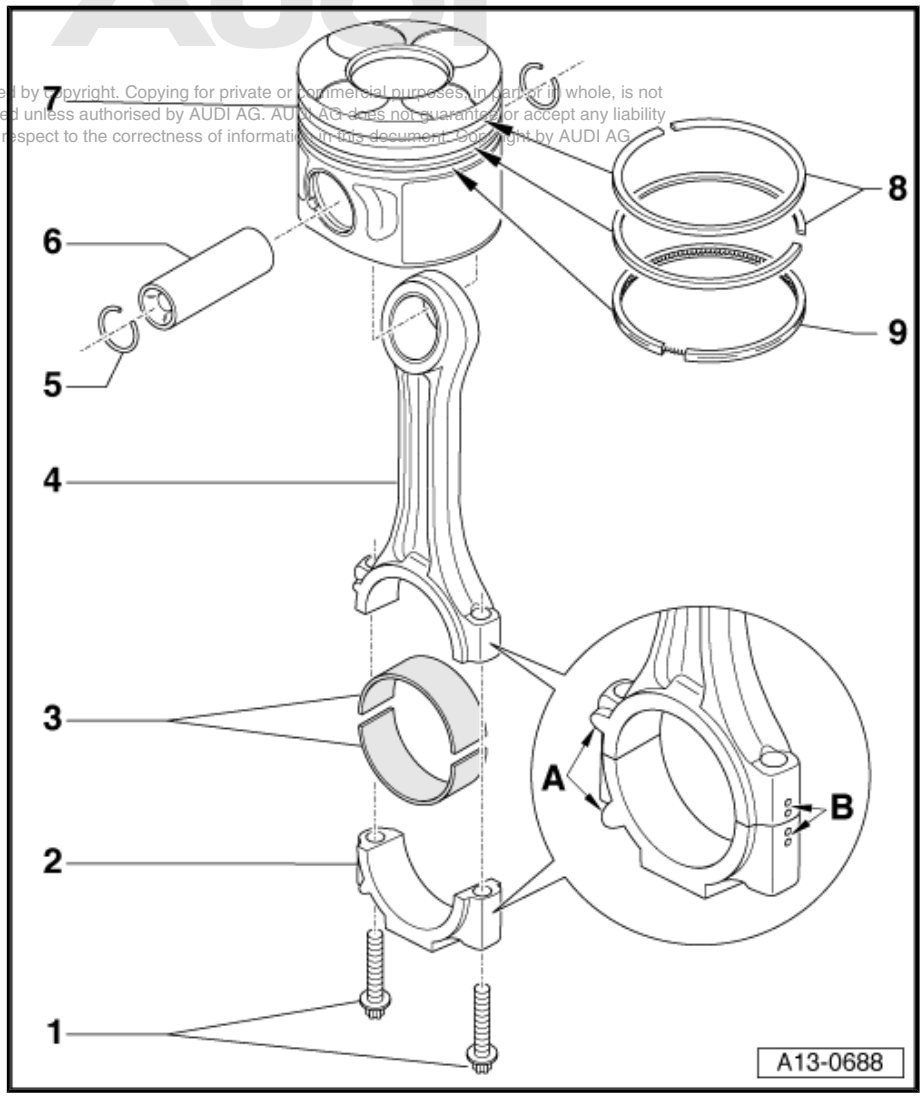
4 Dismantling and assembling pistons and conrods

Note

Oil spray jet and pressure relief valve ⇒ page 150 .

4.1 Pistons and conrods - exploded view

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

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

2 - Conrod bearing cap

- ❑ Mark cylinder number -B-
- ❑ Installation position: Markings -A- face towards pulley end

3 - Bearing shell

- ❑ Installation position ⇒ page 149
- ❑ Do not interchange used bearing shells (mark positions)
- ❑ 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
- ❑ Axial clearance: wear limit: 0.37 mm
- ❑ Measuring radial clearance ⇒ page 151

4 - Conrod

- ❑ Only renew as a complete set
- ❑ Mark cylinder number -B-
- ❑ Installation position: Markings -A- face towards pulley end

5 - Circlip

6 - Piston pin

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

7 - Piston

- ❑ With combustion chamber

- ❑ Mark installation position and cylinder number
- ❑ Installation position and allocation of piston/cylinder ⇒ page 149
- ❑ Arrow on piston crown points to pulley end
- ❑ If cracking is visible on piston skirt, renew piston
- ❑ Checking piston ⇒ page 149
- ❑ Piston and cylinder dimensions ⇒ page 151
- ❑ Checking cylinder bore ⇒ page 149
- ❑ Install using piston ring clamp
- ❑ Checking piston projection at TDC ⇒ page 150

8 - Piston rings

- ❑ Compression 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 148
- ❑ Checking ring-to-groove clearance ⇒ page 148

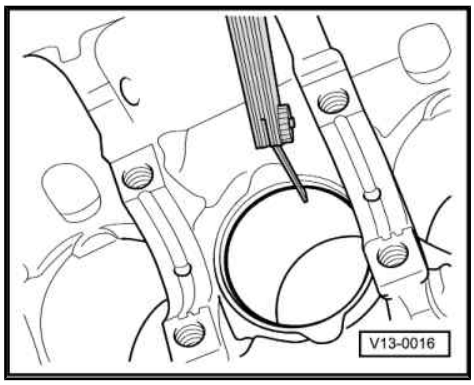
9 - Piston ring

- ❑ Oil scraper ring
- ❑ Offset gap 120° from bottom compression ring
- ❑ Use piston ring pliers to remove and install
- ❑ Checking ring gap ⇒ page 148
- ❑ Checking ring-to-groove clearance ⇒ page 148

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Checking piston ring gap

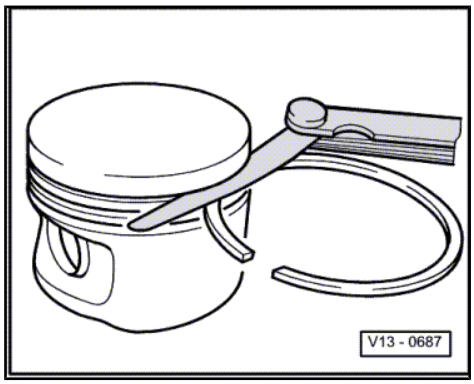
– Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. Use a piston without rings to push ring into bore.



Piston ring (in mm)	New	Wear limit
1st compression ring	0.25 … 0.40	1.00
2nd compression ring	0.25 … 0.40	1.00
Oil scraper ring	0.25 … 0.50	1.00

Checking ring-to-groove clearance

– Clean groove in piston before checking clearance.

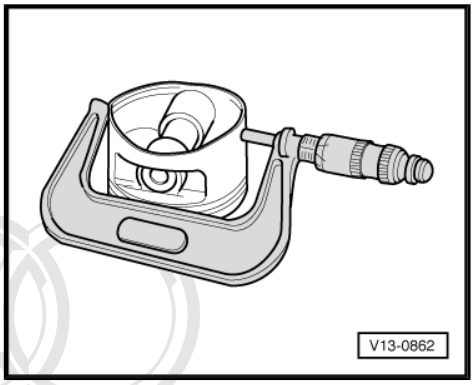


Piston ring (in mm)	New	Wear limit
1st compression ring	0.06 … 0.09	0.25
2nd compression ring	0.05 … 0.08	0.25
Oil scraper ring	0.03 … 0.06	0.15

Checking piston

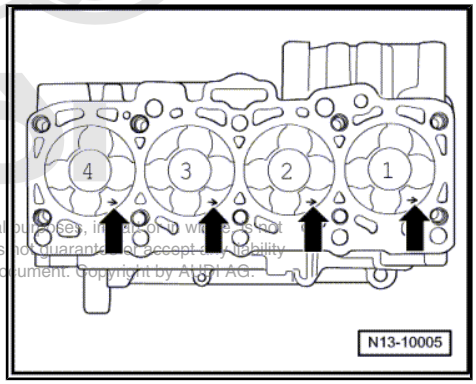
– Measure approx. 10 mm from the bottom edge, perpendicular to the piston pin axis.

• Maximum deviation from nominal dimension: 0.04 mm.



Piston installation position and piston/cylinder allocation

• Arrow on piston crown points to pulley end -arrows-.

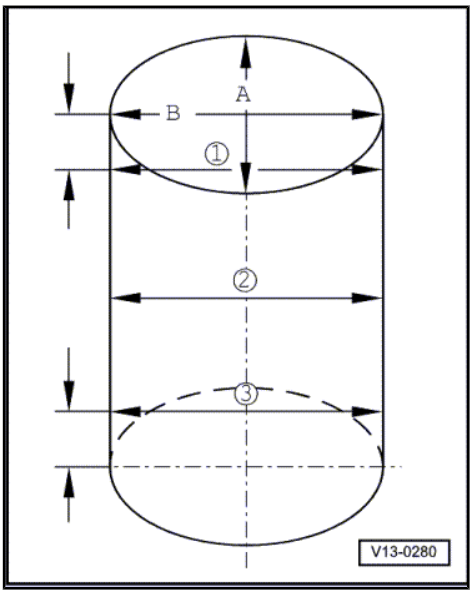


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Checking cylinder bore

– Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.

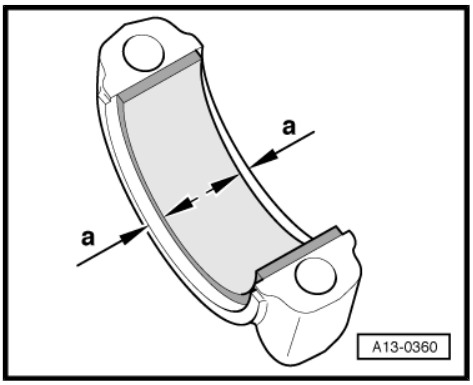
• Maximum deviation from nominal dimension: 0.10 mm.



Installation position of bearing shells in conrods

– Insert bearing shells centrally in conrod/conrod bearing cap.

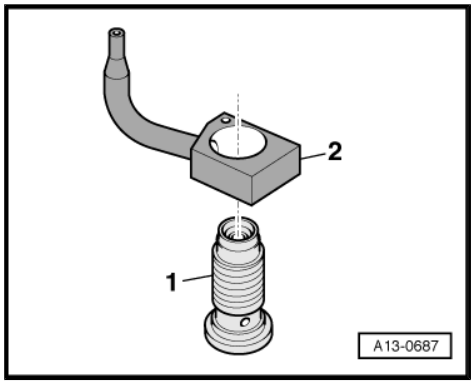
• Dimension -a- = 2.5 mm.



Oil spray jet and pressure relief valve

1 - Bolt with pressure relief valve, 27 Nm

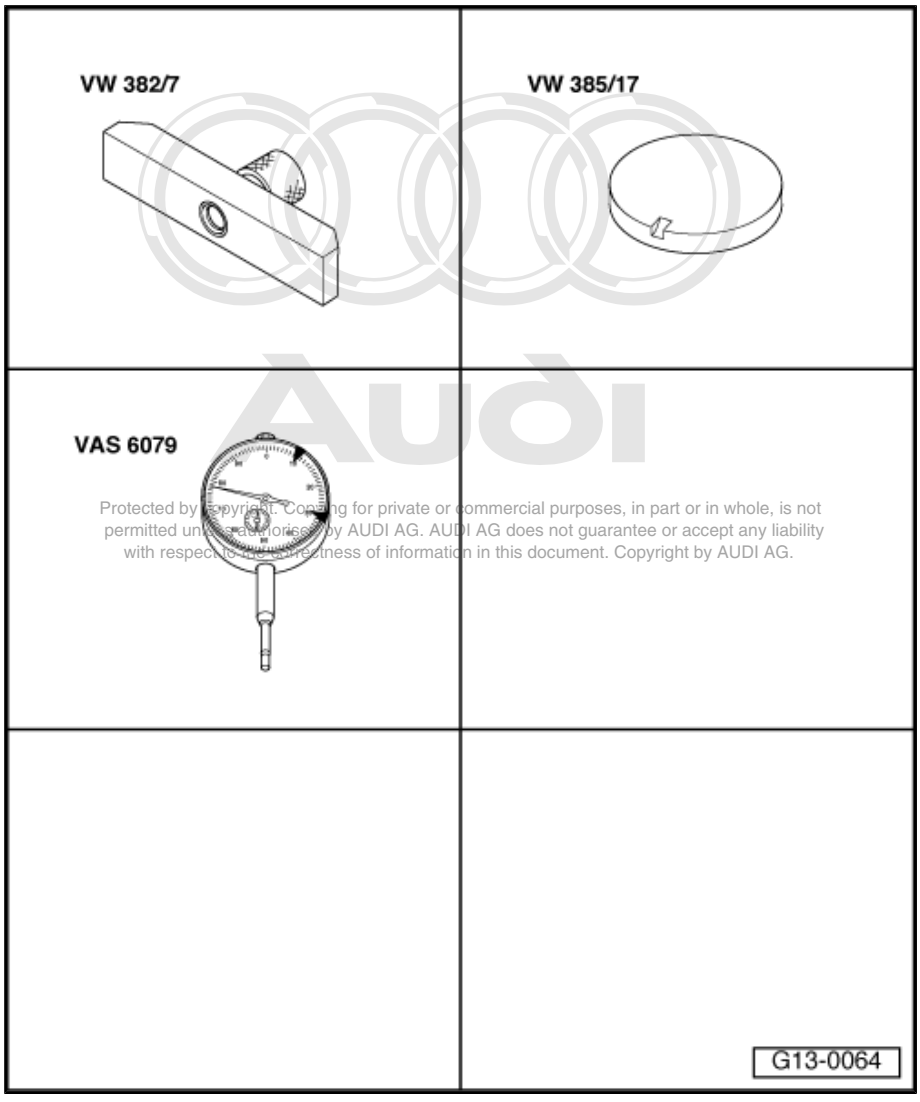
2 - Oil spray jet (for cooling of pistons)



4.2 Checking piston projection at TDC

Special tools and workshop equipment required

- -VW 382/7- from measuring tool -VW 382-
- -VW 385/17- from universal measuring tool -VW 385-
- Dial gauge -VAS 6079-



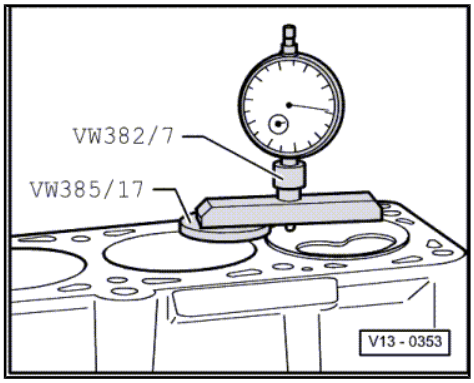
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Test sequence

– Check piston projection at TDC when installing new pistons or short engine.

– Install cylinder head gasket corresponding to piston projection according to table below:

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

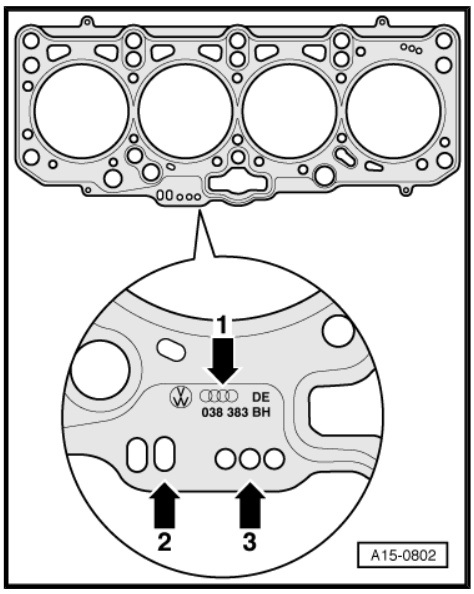


Identification of cylinder head gasket

1 - Part No.

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.

4.3 Piston and cylinder dimensions

Honing dimension	Piston ∅	Cylinder bore ∅
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 caps.

– Clean bearing caps and bearing journals.

– Place Plastigage onto bearing journal or into bearing shells corresponding to width of bearing.

– Fit conrod bearing caps and tighten to 30 Nm without rotating crankshaft.

– Remove conrod bearing caps once more.

– Compare width of Plastigage with measurement scale.

Radial clearance:

• Wear limit: 0.08 mm.

– Renew conrod bolts.

Audi
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15 – Cylinder head, valve gear

1 Handling glow plugs

1.1 Ceramic glow plugs

Two different types of glow plugs are installed in the 4-cylinder 2.0 ltr. 4-valve TDI engine in Audi A3 vehicles:

Engine codes AZV, BKD:

- These engines are fitted exclusively with metal glow plugs.

Engine codes BMN, BUY:

- These engines are fitted exclusively with NGK ceramic glow plugs.

Note

NGK ceramic glow plugs are colour-coded with a white, or possibly "silver-coloured" seal.

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1.2 Handling ceramic glow plugs

Important: Note the following points regarding ceramic glow plugs:

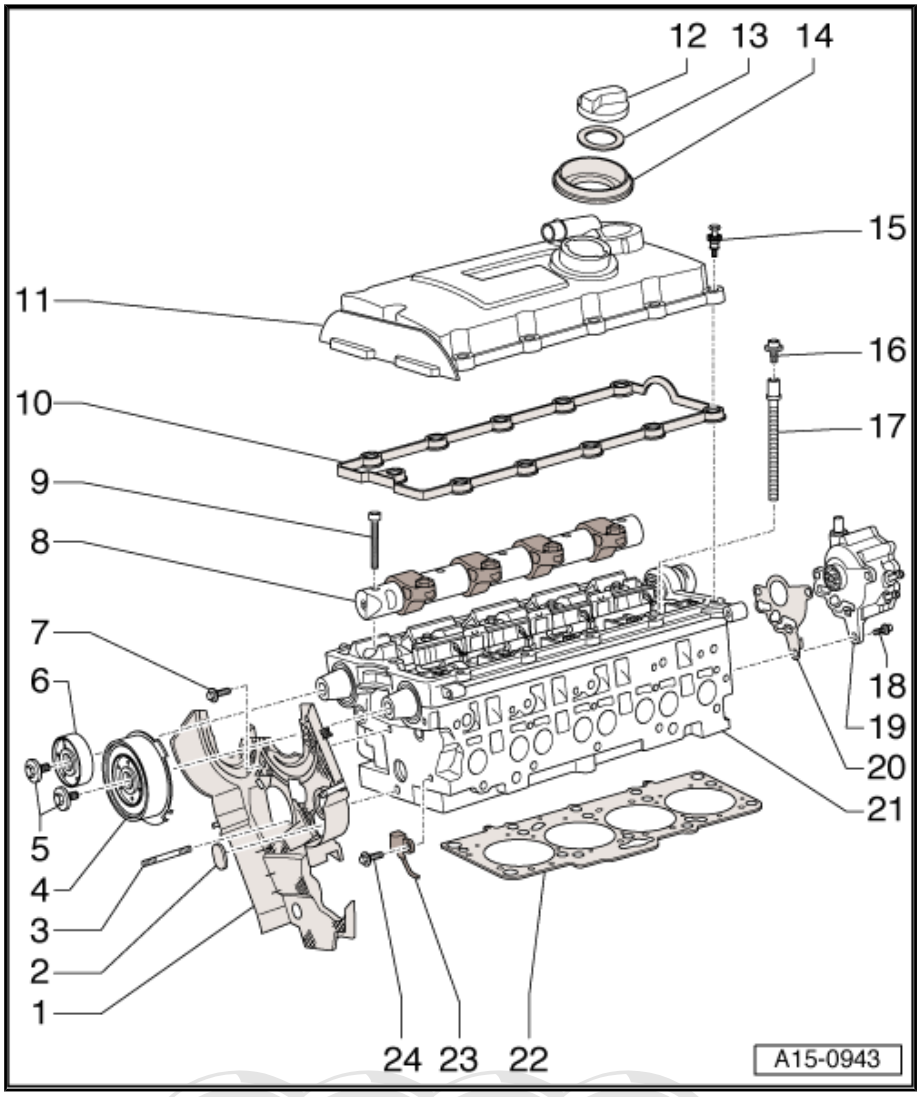
Caution

- *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 diagnosis, testing and information system VAS 5051.*
- *The ceramic glow plugs must not be removed when checking cylinder compression.*

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2 Removing and installing cylinder head

2.1 Cylinder head - exploded view



1 - Toothed belt cover (rear)

2 - Rubber grommet

- ❑ Renew if damaged

3 - Stud, 15 Nm

4 - Hub

- ❑ For inlet camshaft
- ❑ With sender wheel for Hall sender -G40-
- ❑ To remove, use puller - T10052- ⇒ page 156

5 - 100 Nm

- ❑ Use counterhold tool - T10051- when loosening and tightening ⇒ “3.4 Removing and installing camshafts”, page 210

6 - Hub

- ❑ For exhaust camshaft
- ❑ Removing ⇒ page 156

7 - 10 Nm

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

8 - Rocker arm shaft

- ❑ Mark allocation of rocker arms
- ❑ Do not interchange
- ❑ Removing and installing: vehicles with small engine support ⇒ page 162 ; vehicles with large engine support ⇒ page 180
- ❑ Before installing, check that all ball studs and O-rings are inserted in the unit injectors ⇒ page 156

9 - Bolt

- ❑ For rocker arm shaft
- ❑ Renew
- ❑ Note correct sequence when slackening: vehicles with small engine support ⇒ page 162 ; vehicles with large engine support ⇒ page 180
- ❑ Note correct sequence when tightening ⇒ page 200

10 - Gasket for cylinder head cover

- ❑ Renew if damaged or leaking
- ❑ Engage in spacer sleeves of -item 15-

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11 - Cylinder head cover

- ❑ Removing and installing: vehicles with engine codes AZV, BKD ⇒ page 157 , vehicles with engine codes BMN, BUY ⇒ page 160

12 - Filler cap

13 - Seal

- ❑ Renew if damaged or leaking

14 - Cap

15 - Special bolt, 10 Nm

- ❑ Renew if damaged or leaking
- ❑ Note sequence when loosening and tightening: vehicles with engine codes AZV, BKD ⇒ page 157 , vehicles with engine codes BMN, BUY ⇒ page 160

16 - 20 Nm

17 - Cylinder head bolt

- ❑ Renew
- ❑ Note correct sequence when slackening: vehicles with small engine support ⇒ page 180 ; vehicles with large engine support ⇒ page 195
- ❑ Note correct sequence when tightening ⇒ page 200

18 - 20 Nm

19 - Tandem pump

- ❑ Removing and installing ⇒ Rep. Gr. 20

20 - Gasket

- ❑ Renew

21 - Cylinder head

- ❑ Removing: vehicles with small engine support ⇒ page 162 ; vehicles with large engine support ⇒ page 180

Caution

Vehicles with ceramic glow plugs: 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 156
- ❑ Installing ⇒ page 197
- ❑ If renewed, change coolant and engine oil

22 - Cylinder head gasket

- ❑ Renewing ⇒ “2.4 Removing cylinder head - vehicles with small engine support”, page 162 and ⇒ “2.5 Removing cylinder head - vehicles with large engine support”, page 180
- ❑ Note marking ⇒ page 157
- ❑ If renewed, change coolant and engine oil

23 - Hall sender -G40-

- ❑ For camshaft position

Audi
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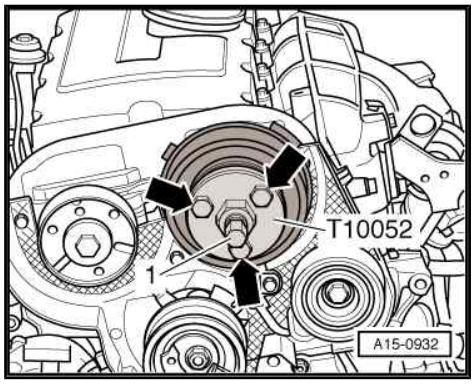
24 - 10 Nm

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

Removing hub on inlet camshaft

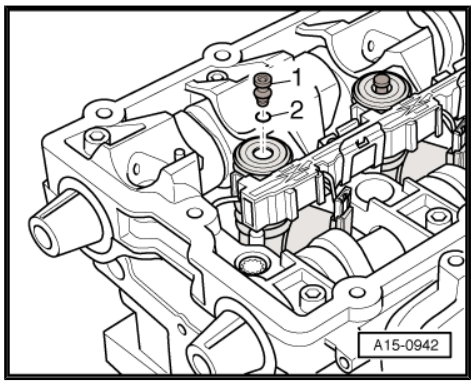
– Fit puller -T10052- on hub of inlet camshaft and screw bolts -arrows- into hub.

– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



Ball stud for rocker arm shaft

– Before installing rocker arm shaft, check that all ball studs -1- and O-rings -2- are fitted in unit injectors.

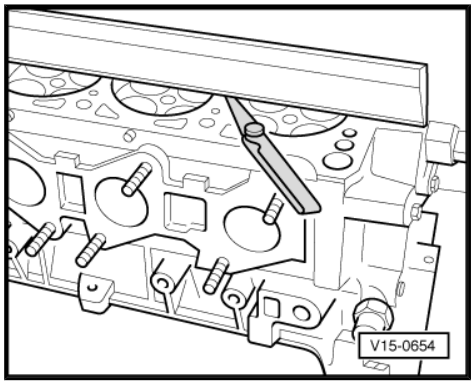


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Checking cylinder head for distortion

– 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.

Cylinder head gasket identification

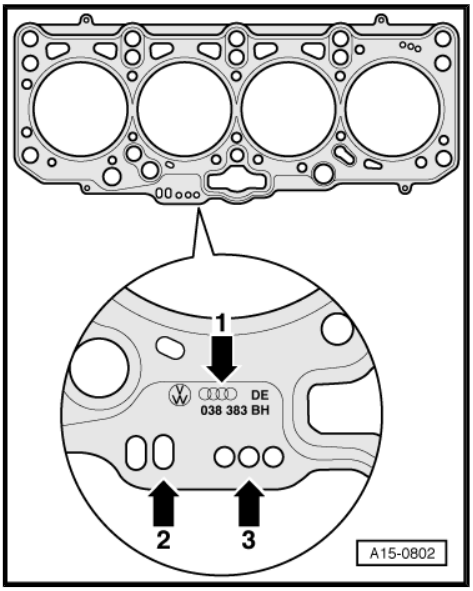
1 - Part No.

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 150 . When renewing just the cylinder head gasket, the new gasket should have the same identification as the old one.



2.2 Removing and installing cylinder head cover - vehicles with engine codes AZV, BKD

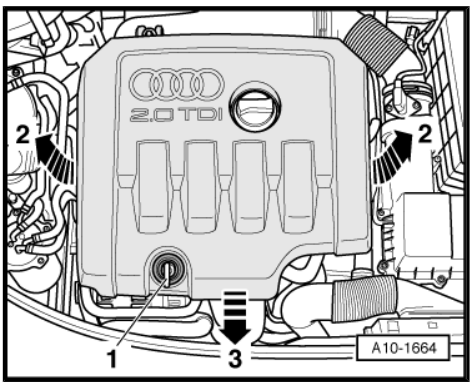
Removing

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

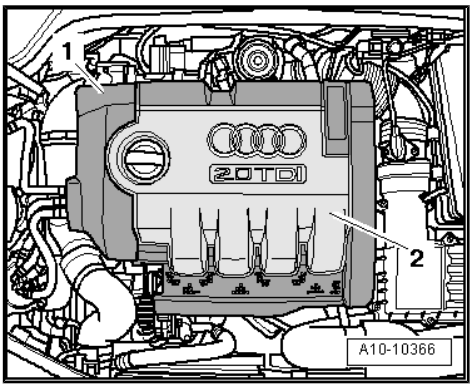
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

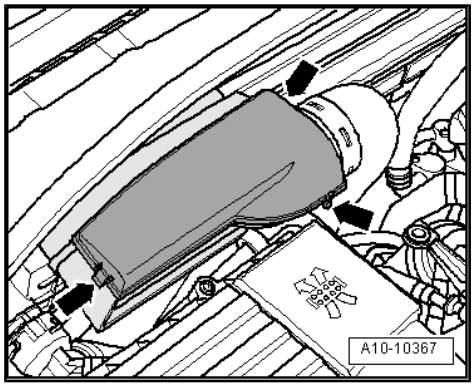
– Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



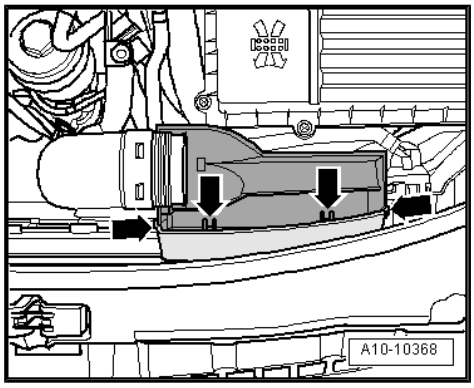
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All vehicles (continued):

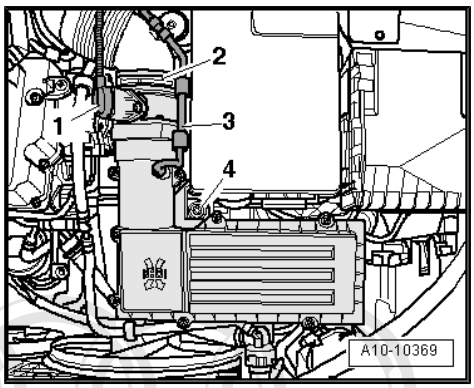
– Pull cover off air duct (release clips on sides) -arrows-.



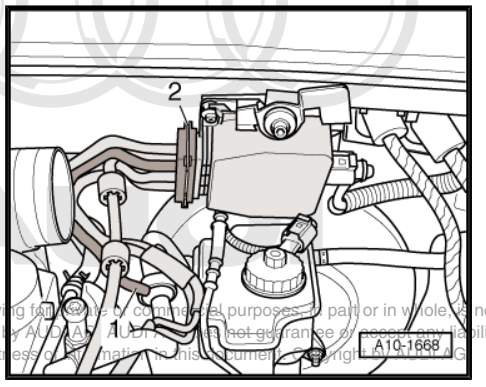
– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



– 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.

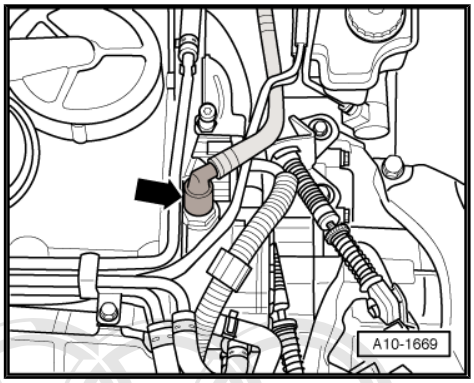


– Detach hose connection carrier -2- at solenoid valve block by releasing retaining tab.
– Detach vacuum hose -1- at non-return valve for brake servo.

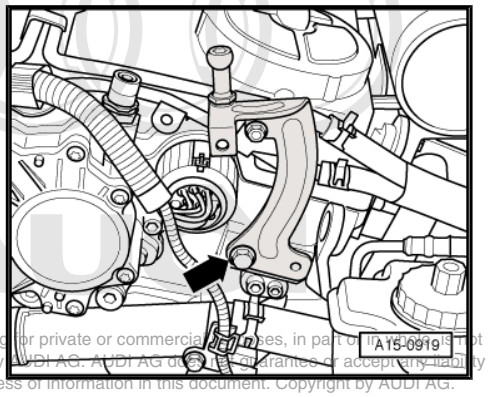


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– Detach vacuum hose -arrow- at tandem pump.



– Detach bracket for engine cover panel from cylinder head -arrow-.

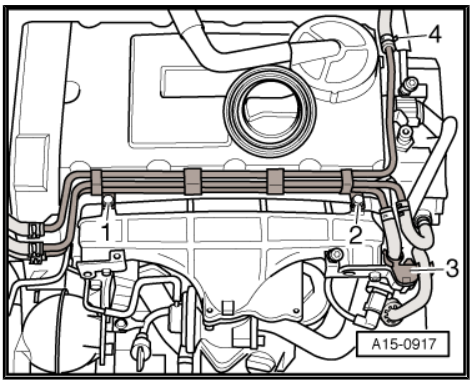


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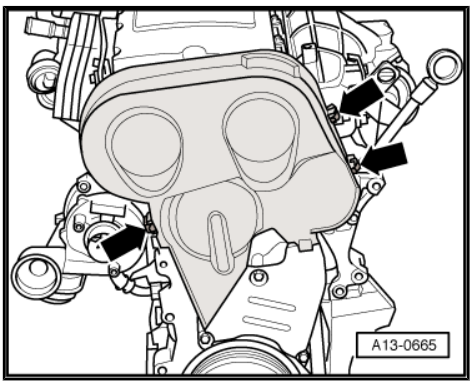
– Unclip bracket -3- for fuel hoses on left engine lifting eye.
– Remove bolts -1- and -2-.

Note

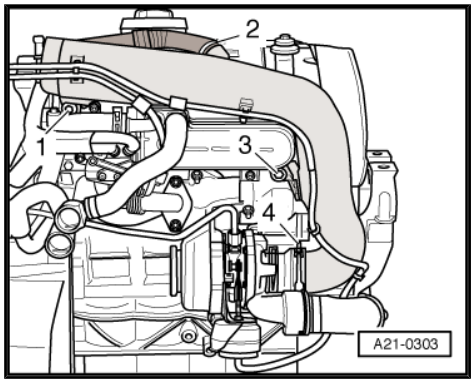
Disregard -item 4-.



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



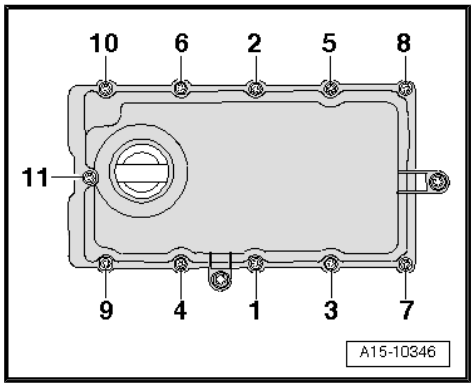
– Remove bolts -1- and -3-.
– Disconnect hose -2- for crankcase breather system at air pipe.
– Press the air intake pipe to the rear.



Note

- *The air intake pipe -Item 4- remains attached to the turbocharger.*
- *Shown from rear with engine removed for illustration purposes.*

– Remove cylinder head cover bolts in the sequence -11 ... 1-.
– Remove cylinder head cover.



Installing

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

Note

Renew gasket for cylinder head cover and bolts if damaged.

– Tighten bolts for cylinder head cover to final setting in the sequence -1 ... 11-.

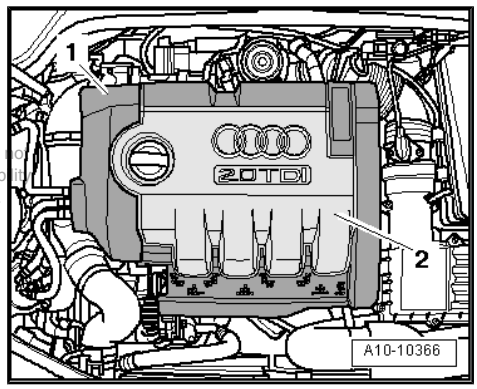
Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Air pipe (rear) to bracket	10
Pipes to intake manifold	10
Bracket for engine cover to cylinder head	22

2.3 Removing and installing cylinder head cover - vehicles with engine codes BMN, BUY

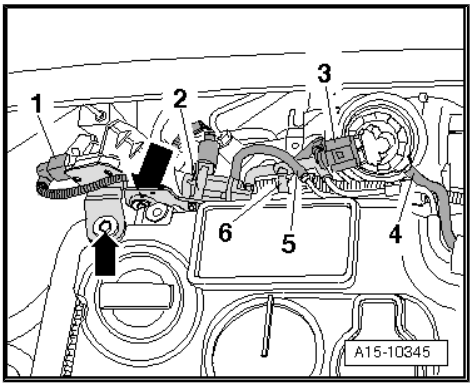
Removing

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



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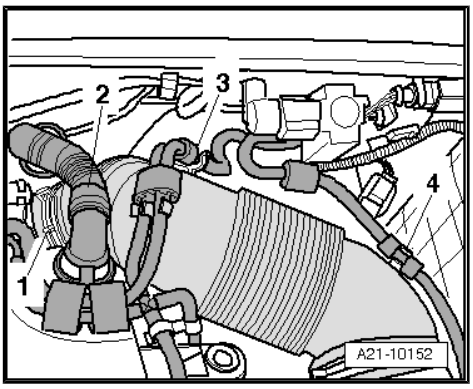
– Unclip change-over valve for exhaust gas recirculation cooler -N345- -item 2- from bracket.
– Unplug electrical connectors -1- and -3- and move wiring clear.
– Disconnect vacuum lines -4, 5, 6- and move them clear.
– Remove bolts -arrows-.



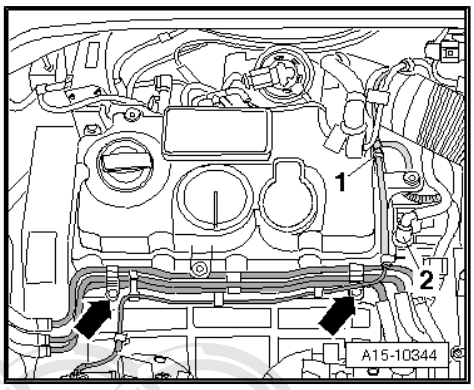
– Disconnect crankcase breather hose -2- at cylinder head cover.

Note

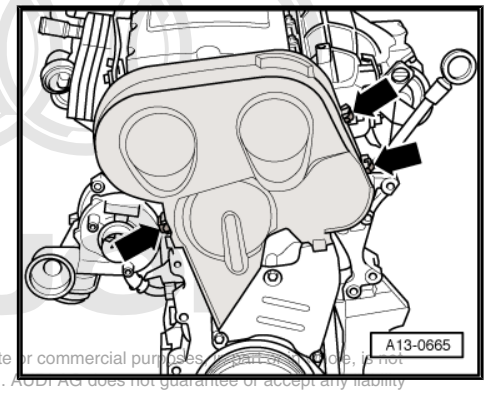
Items marked -1, 3 and 4- can be disregarded.



– Detach vacuum hose -1- at cylinder head cover.
– Remove bolts -arrows-.

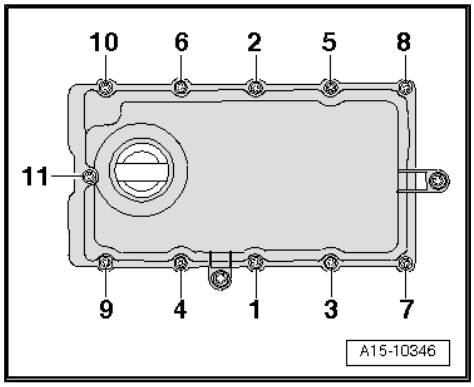


– Remove top toothed belt cover by releasing retaining clips -arrows-.



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– Remove cylinder head cover bolts in the sequence -11 ... 1-.
– Remove cylinder head cover.



Installing

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

Note

Renew gasket for cylinder head cover and bolts if damaged.

– Tighten bolts for cylinder head cover to final setting in the sequence -1 ... 11-.

Tightening torques

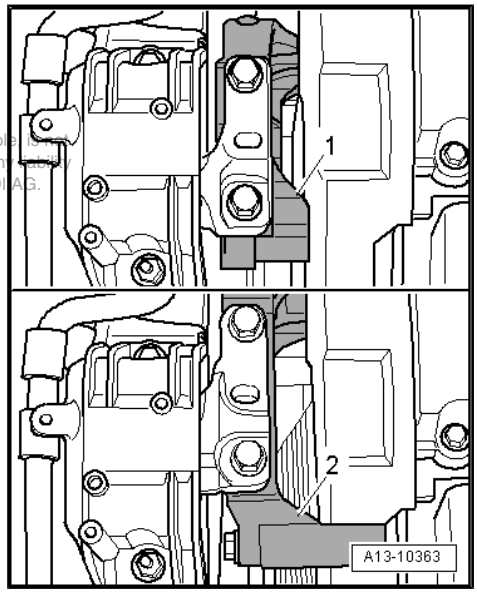
Component	Nm
Cylinder head cover to cylinder head	10
Pipes to intake manifold	10
Bracket for solenoid valves to cylinder head	10

2.4 Removing cylinder head - vehicles with small engine support

Note

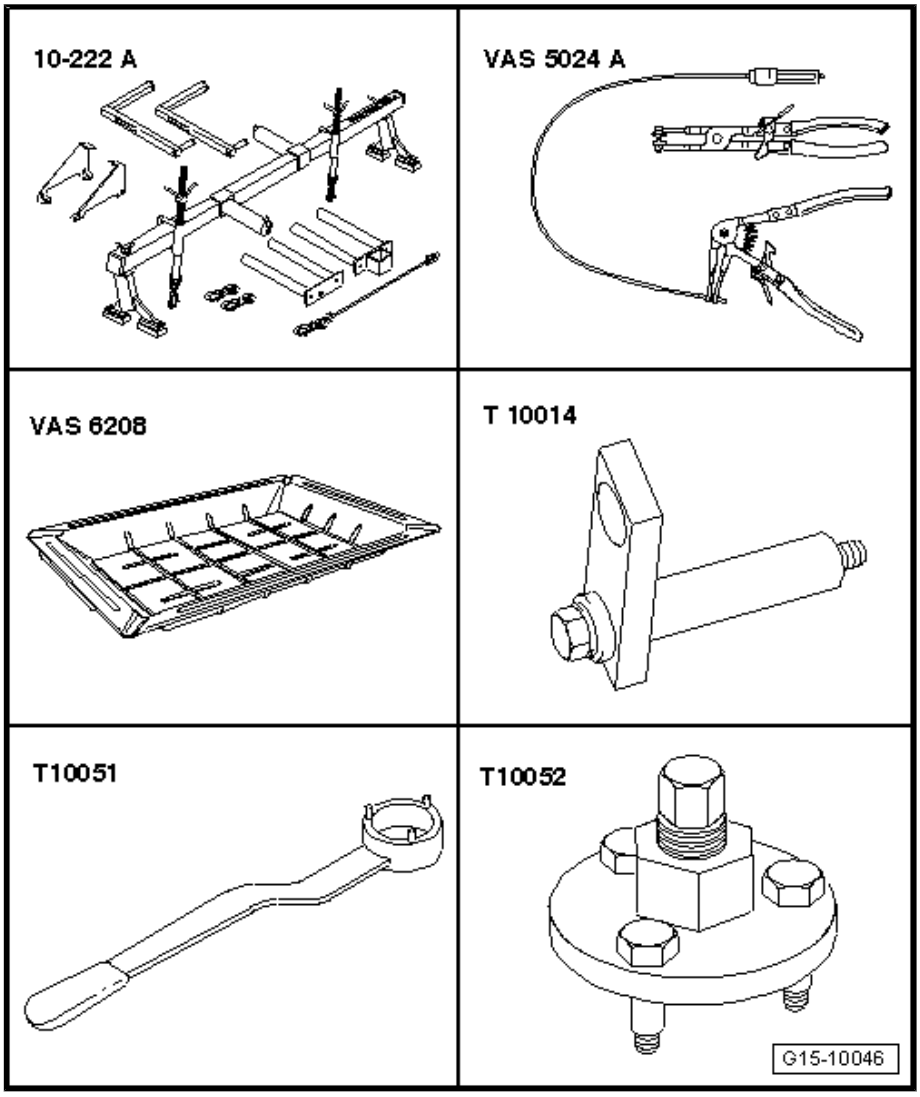
The engine support has to be removed and the engine supported from above in order to remove the cylinder head on vehicles with small engine support -1-.

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Special tools and workshop equipment required

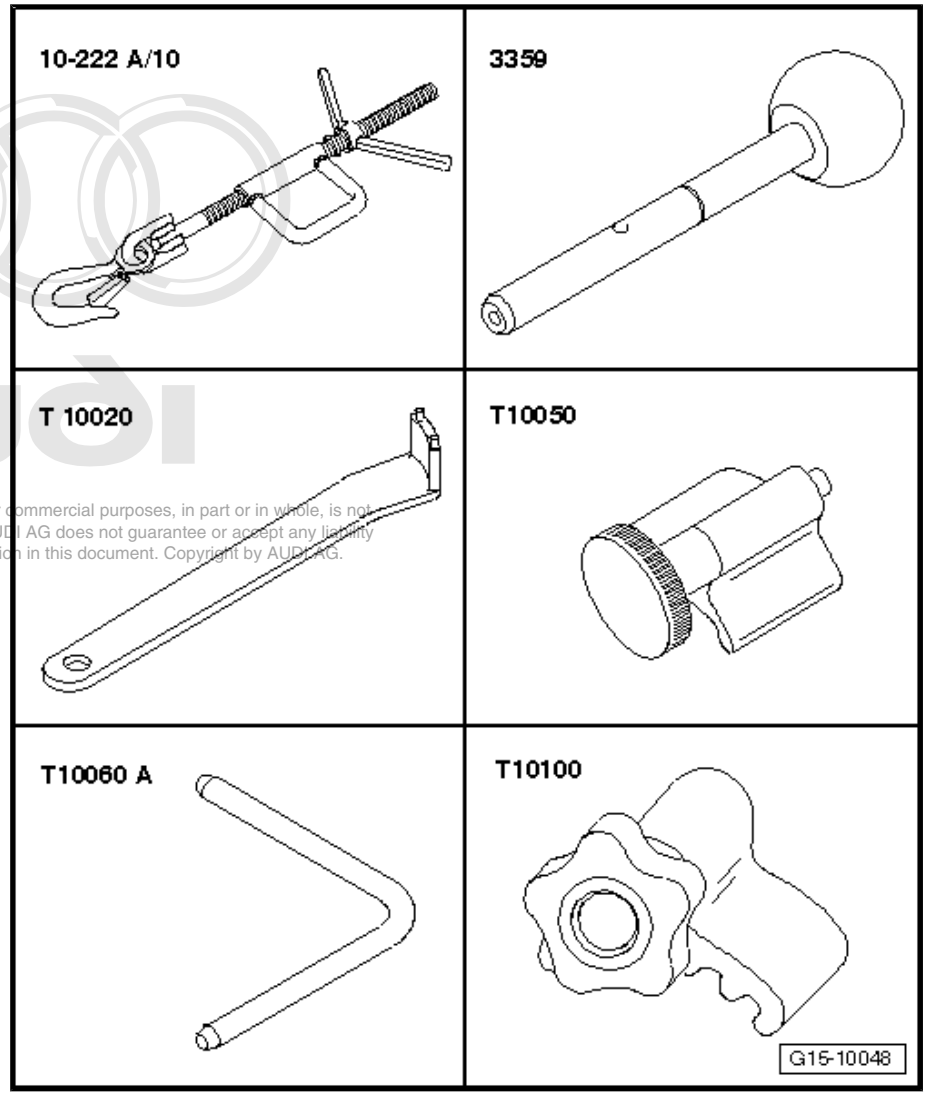
- Support bracket -10 - 222 A-
- Spring type clip pliers - VAS 5024 A-
- Drip tray for workshop hoist -VAS 6208-
- Retainer -T10014-
- Counterhold tool -T10051-
- Puller -T10052-



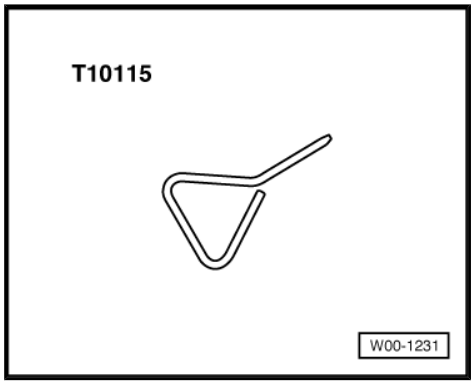
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- Hooks -10 - 222 A /10- (with spindle)
- Diesel injection pump locking pin -3359- (2x)
- Pin wrench -T10020-
- Crankshaft stop -T10050- for engines with circular crankshaft sprocket
- Locking pin -T10060 A-
- Crankshaft stop -T10100- for engines with oval crankshaft sprocket

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- Locking pin -T10115-



- Safety goggles
- Protective gloves

Procedure

> **Caution**
>
> *Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .*

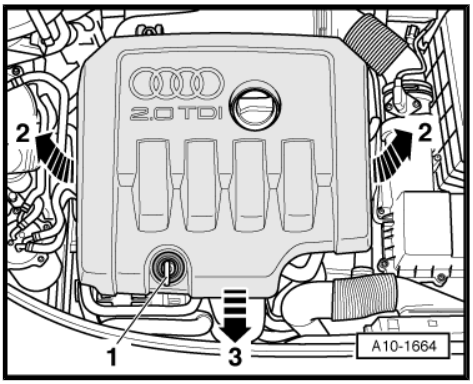
– Disconnect earth wire at battery with ignition switched off.

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

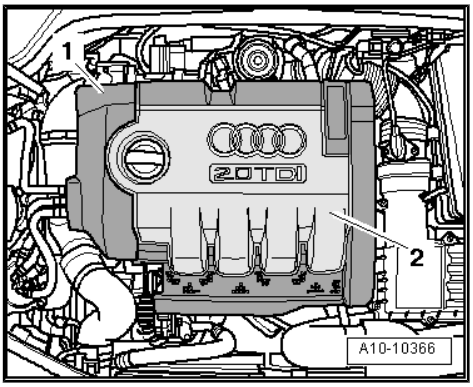
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

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

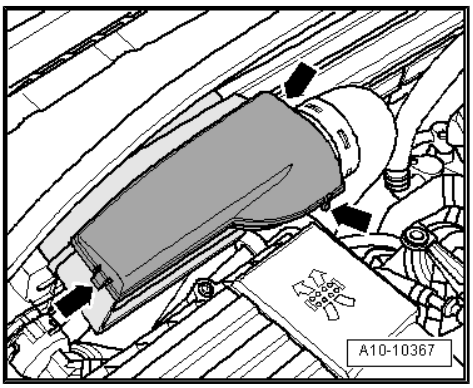


All vehicles (continued):

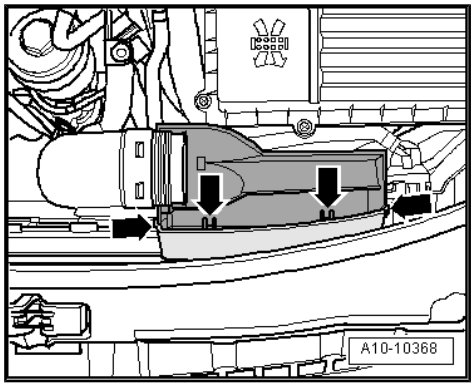
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– Remove engine compartment seal from lock carrier and wing panel flanges.

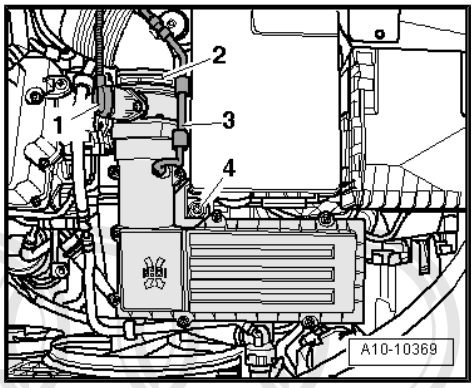
– Pull cover off air duct (release clips on sides) -arrows-.



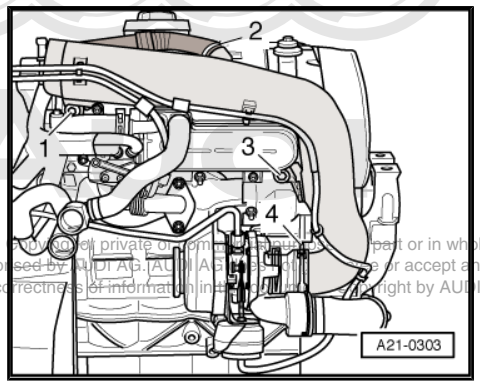
– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



– 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 bolts -1- and -3-.
– Move vacuum hoses at rear intake pipe clear to one side.
– Disconnect hose -2- for crankcase breather system at air pipe.
– Release spring clip -4- with spring clip pliers -VAS 5024 A- and detach air pipe at connection for turbocharger.



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Note

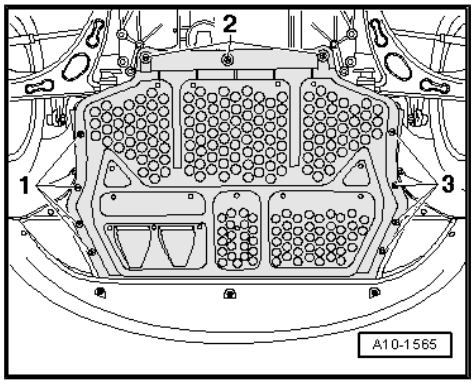
Shown from rear with engine removed for illustration purposes.

WARNING

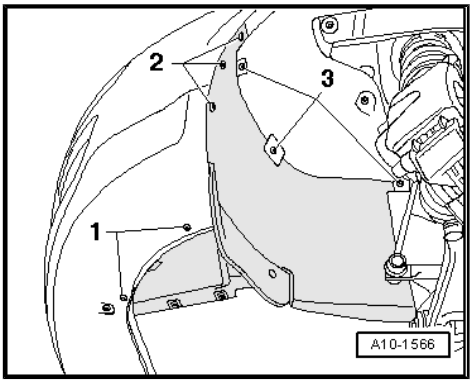
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

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



– Remove noise insulation (left and right) -fasteners 1 ... 3-.
– Unbolt drive shafts (left and right) from gearbox flange and centre bearing.
– Tie up the left drive shaft.
– Remove front exhaust pipe ⇒ page 304 .

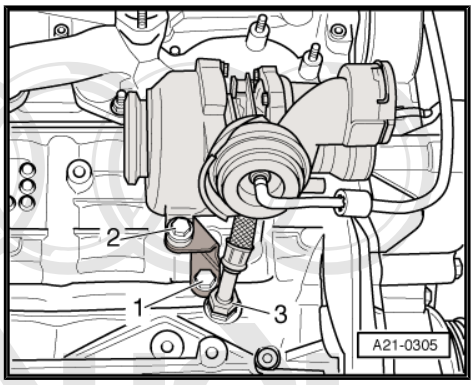


– Remove bolts -1- and -2- and detach support for turbocharger.

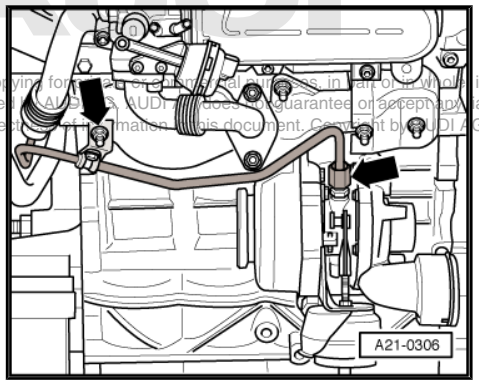
Note

Place a cloth underneath to catch any escaping oil.

– Remove oil return pipe -3- at cylinder block.

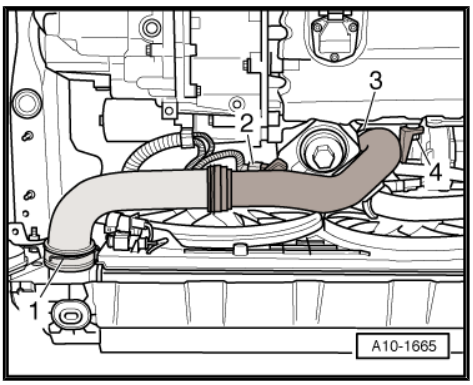


– Unscrew oil supply pipe at turbocharger and exhaust manifold -arrows-.

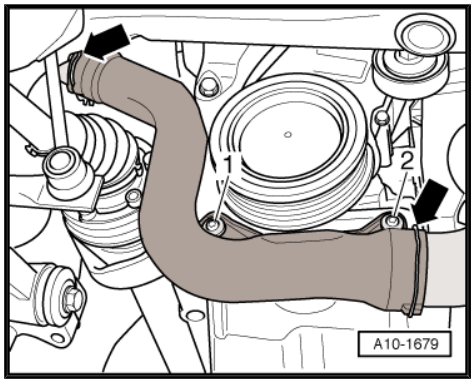


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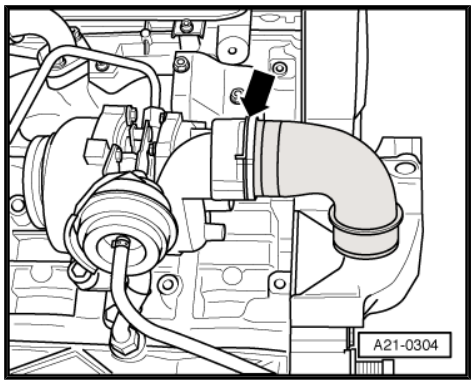
– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolt -4-.
– Remove front air pipe with air hose by lifting retaining clips slightly -1- and -3-.



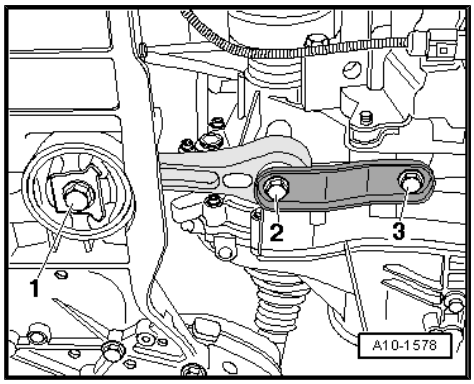
– Remove bolts -1- and -2-.
– Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.



– Detach air intake hose from turbocharger by lifting retaining clip -arrow- slightly.

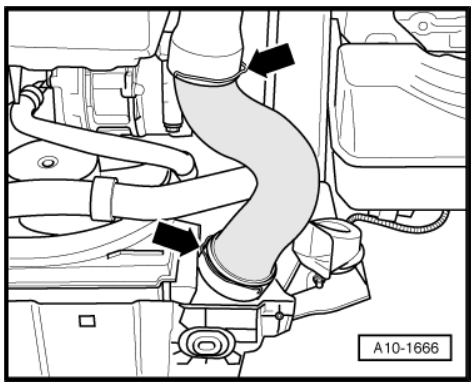


– Unscrew bolts -1 ... 3- and remove pendulum support.



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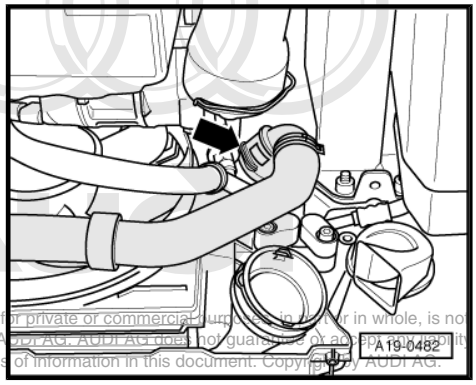
– Remove air intake hose (right-side) by lifting retaining clips -arrows- slightly.



Caution

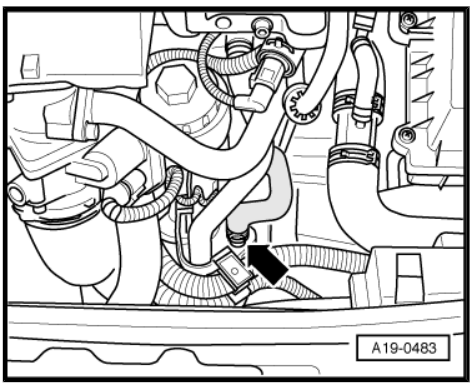
Seal opening of charge air cooler with a piece of clean foam or similar to prevent coolant from entering.

– Place drip tray for workshop hoist -VAS 6208- under engine.
– Pull out retaining clip at the bottom -arrow- and disconnect coolant hose from radiator.

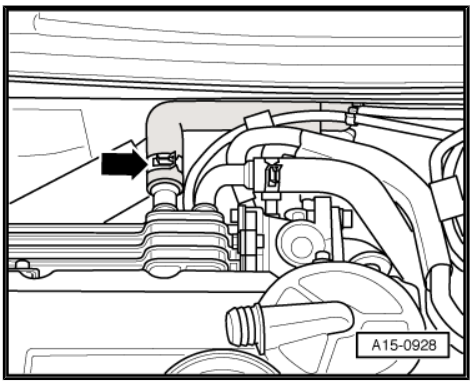


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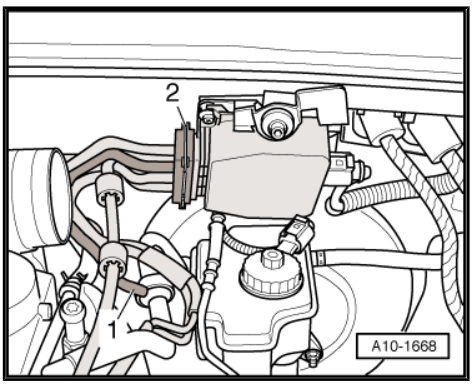
– Also detach upper coolant hose on oil cooler -arrow-, and drain off remaining coolant.
– Then remove the coolant hose completely.



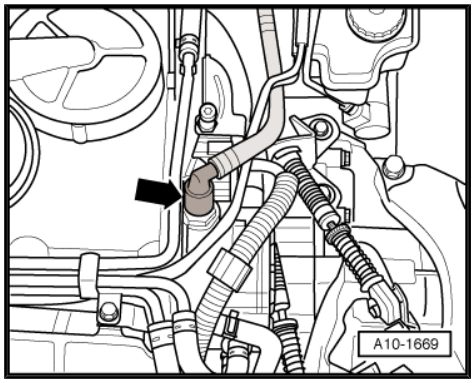
– Detach hose (rear) from exhaust gas recirculation cooler -arrow-.



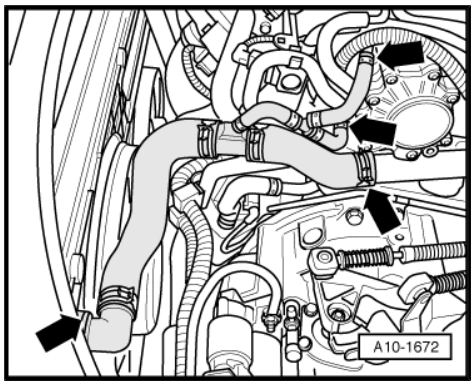
– Detach hose connection carrier -2- at solenoid valve block by releasing retaining tab.
– Detach vacuum hose -1- at non-return valve for brake servo.



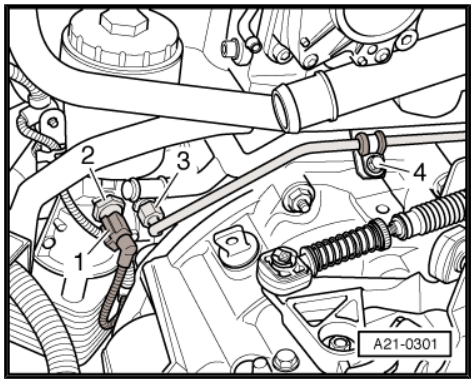
– Detach vacuum hose -arrow- at tandem pump and at brake servo.



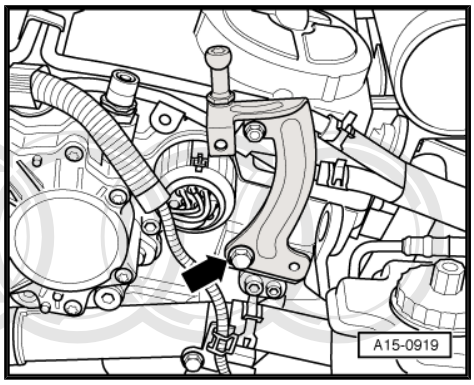
– Detach coolant hoses at the connections indicated -arrows-.



– Unplug electrical connector -1- at oil pressure switch -F1- .
– Remove oil pressure switch -2-.
– Detach oil supply pipe at oil filter bracket -3- and at coolant pipe -4-.

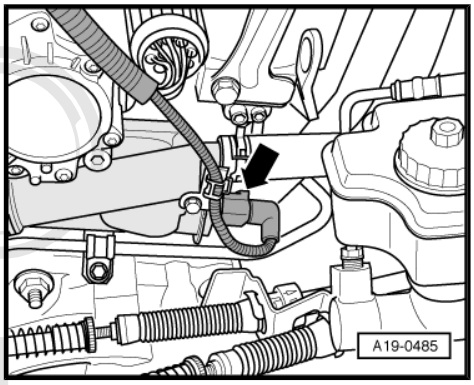


– Detach bracket for engine cover panel from cylinder head -arrow-.



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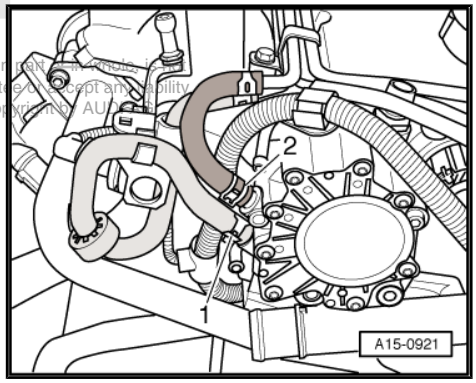
– Unplug electrical connector -arrow- at coolant temperature sender -G62- .



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Caution

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



WARNING

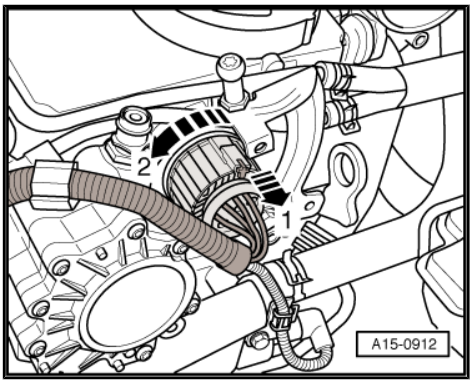
- ***In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.***
- ***Wear protective gloves.***
- ***Wear safety goggles.***

– Disconnect fuel supply hose -2- (white marking) and fuel return hose -1- (blue marking) from tandem pump.

– Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.

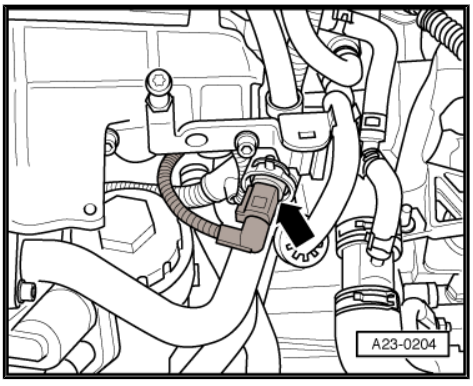
– Detach main connector for unit injectors and glow plugs.

– Move wiring harness clear.

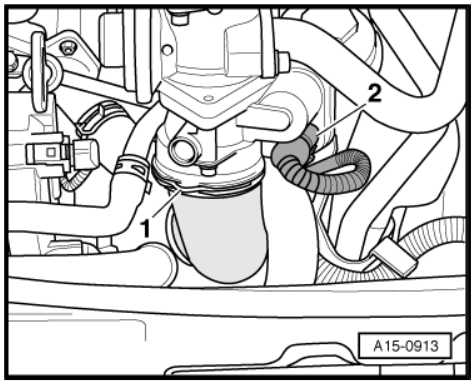


– Unplug electrical connector -arrow- at fuel temperature sender -G81- .

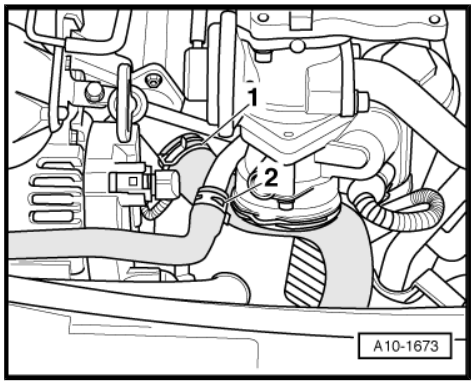
– Move wiring clear.



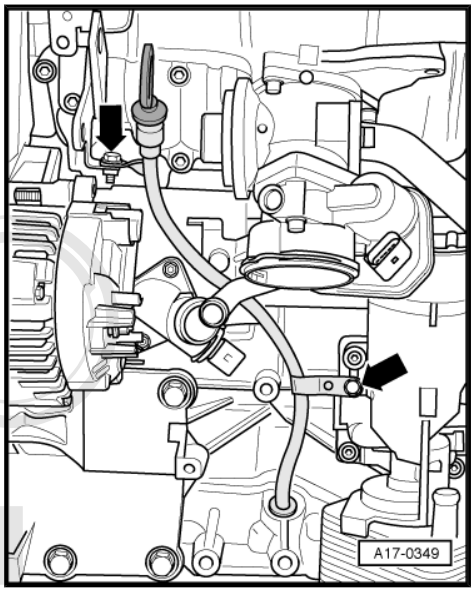
– Remove air intake hose at intake manifold flap by lifting retaining clip -1- slightly.
– Detach electrical connector -2- at intake manifold flap motor - V157- .



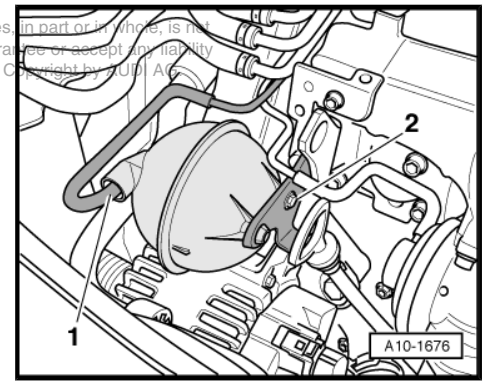
– Detach coolant hoses -1- and -2- at front of engine.



– Remove bolts -arrows-.
– Pull guide tube for oil dipstick upwards out of the cylinder block and swing towards front to remove.



– Detach vacuum hose -1-.
– Unscrew bolt -2- and detach vacuum reservoir from bracket.



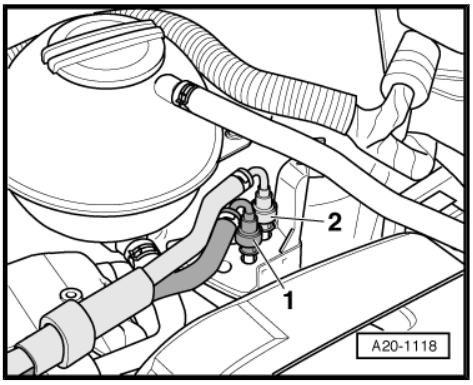
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Caution

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

WARNING

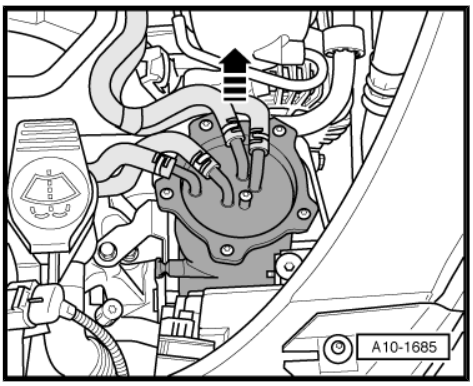
- *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with unit injector engine. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- *Wear protective gloves.*
- *Wear safety goggles.*



– Disconnect fuel supply pipe -2- and fuel return pipe -1- by pulling release tabs.

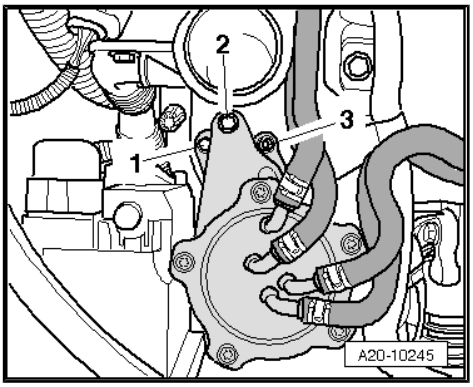
Fuel filter - version 1:

– Lift fuel filter out of bracket -arrow- with hoses connected and move it aside.



Fuel filter - version 2:

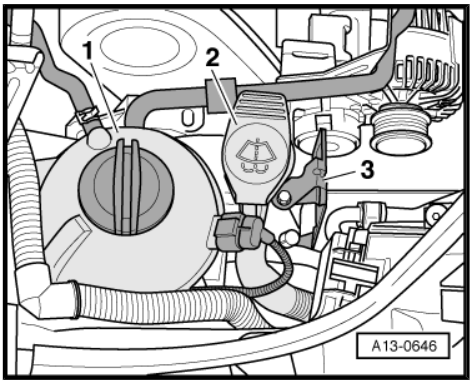
– Slacken bolt -1- one turn.
– Remove bolt -2- and nut -3-.
– Move fuel filter aside with hoses attached.



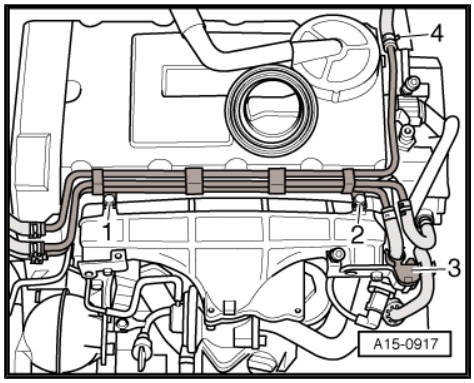
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All vehicles (continued):

– Unscrew bracket -3- for fuel filter.
– Unscrew bolt at filler neck -2- for washer fluid reservoir.
– Unscrew coolant expansion tank -1- and move clear to one side with the lines attached.



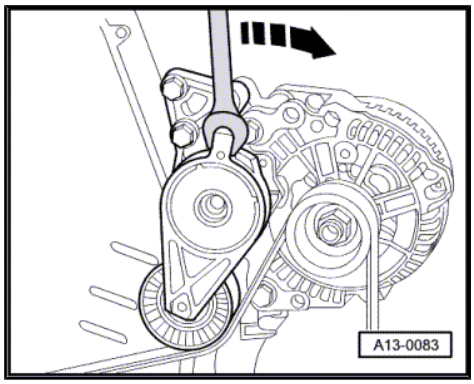
– Detach fuel hose -4-.
– Unclip bracket -3- for fuel hoses on left engine lifting eye.
– Remove bolts -1- and -2-.
– Remove coolant reservoir and fuel filter together with the pipes.



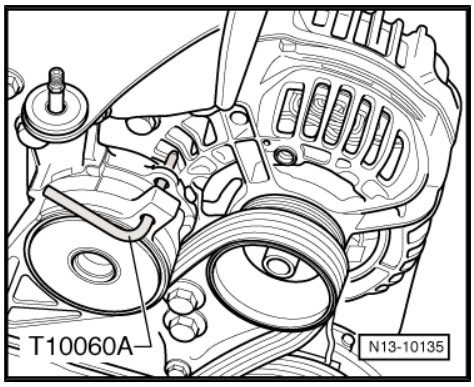
Note

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

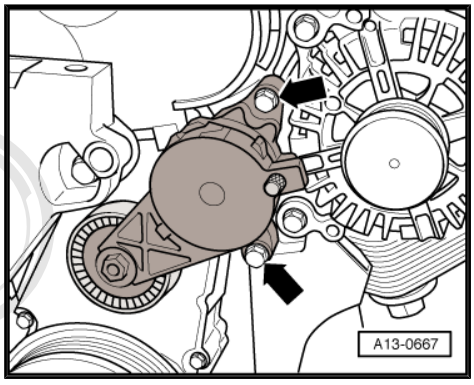
– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.



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

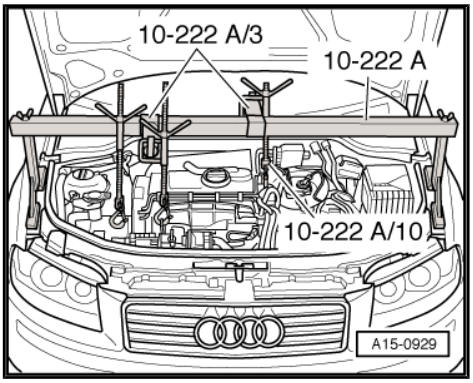


– Remove tensioner for poly V-belt -arrows-.

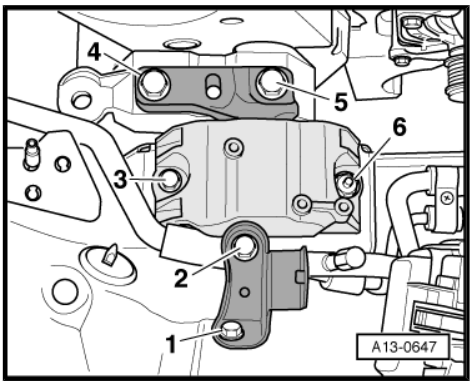


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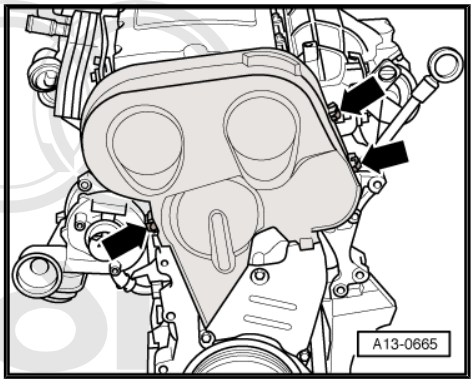
– Place support bracket -10 - 222 A- with adapters -10 - 222 A / 3- and 3 spindles on wing panel flange as shown in the illustration.
– Attach hooks of spindles to lifting eyes; the remaining spindle on the right side should not yet be attached.
– Take up weight of engine evenly with both spindles (but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



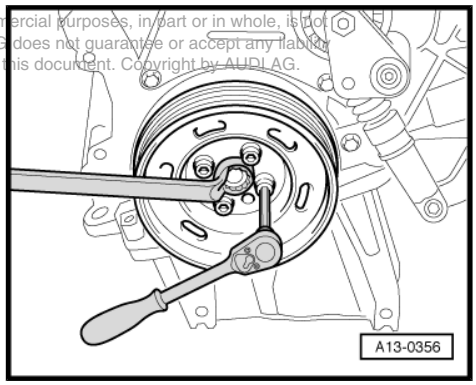
– Remove bolts -1- and -2- and detach connecting bracket.
– Remove bolts -3 ... 6- and remove engine mounting.



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

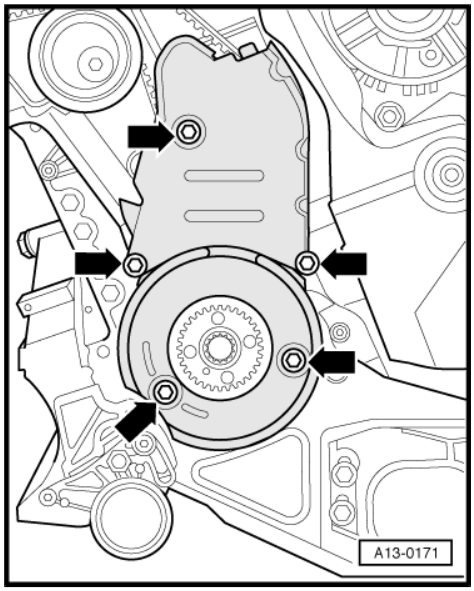


– Remove cover cap for vibration damper.
– Unbolt vibration damper; counterhold on centre bolt with ring spanner.

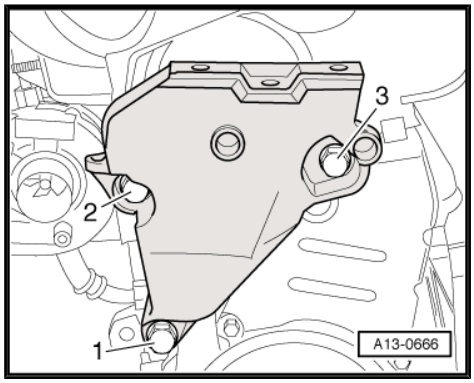


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– Unbolt toothed belt covers (bottom and centre) -arrows-.



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



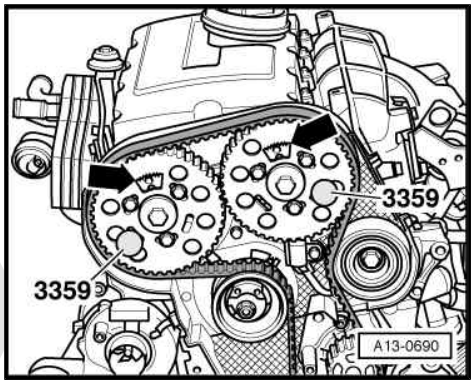
Note

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 with 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 for cylinder No. 1.

Note

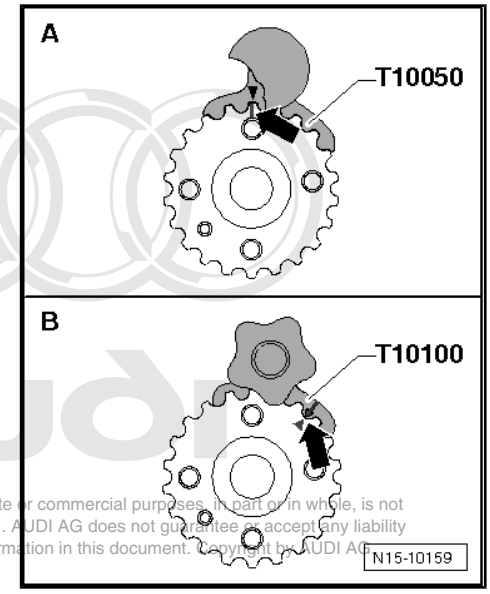
At TDC position the toothed segments -arrows- face upwards.

– Lock hubs with locking pin -3359- (2x).

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– Lock crankshaft sprocket using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.

• The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-. The pin of the crankshaft stop must engage in the aperture in the sealing flange.



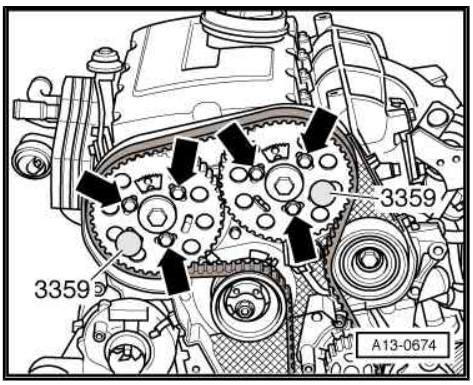
Note

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

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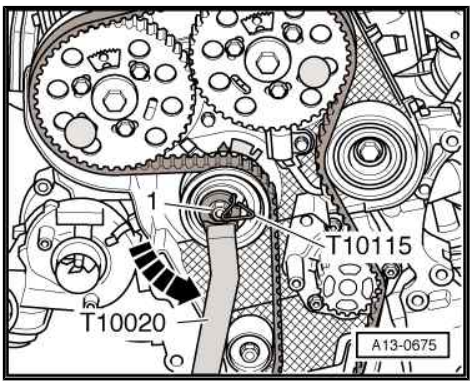
– Mark direction of rotation of toothed belt with chalk or felt pen.

– Loosen securing bolts for camshaft sprockets -arrows-.



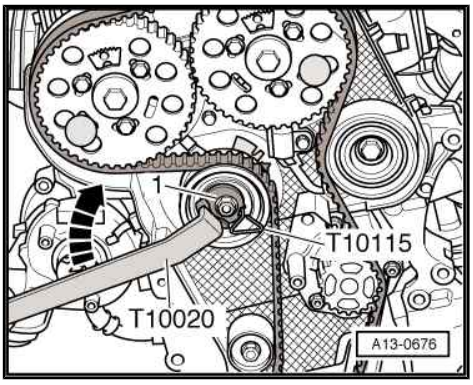
– Loosen securing nut -1- for tensioning roller.

– Turn eccentric adjuster of tensioning roller anti-clockwise using pin wrench -T10020- until tensioning roller can be secured with locking pin -T10115- .

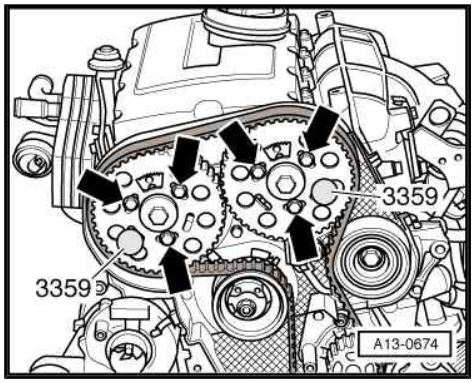


– Now turn eccentric adjuster of tensioning roller clockwise until stop and tighten securing nut -1- hand-tight.

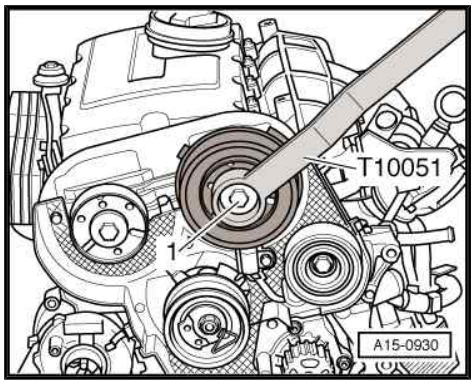
– Take off toothed belt first from coolant pump and then from the remaining sprockets.



– Remove locking pins -3359- .
– Remove securing bolts -arrows- for camshaft sprockets.
– Remove the camshaft sprockets from hubs.

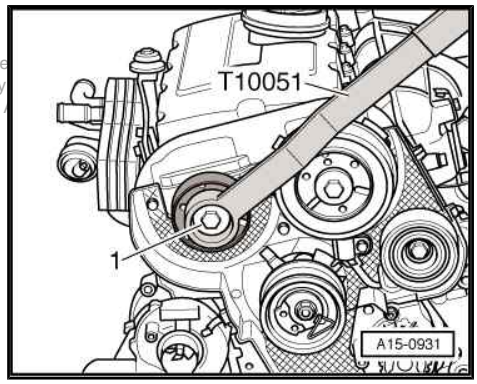


– Loosen securing bolt -1- for hub on inlet camshaft; use counterhold tool -T10051- .

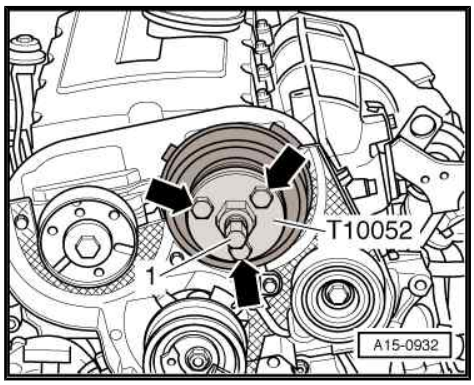


– Loosen securing bolt -1- for hub on exhaust camshaft; use counterhold tool -T10051- .
– Unscrew securing bolts of hubs approx. 2 turns.

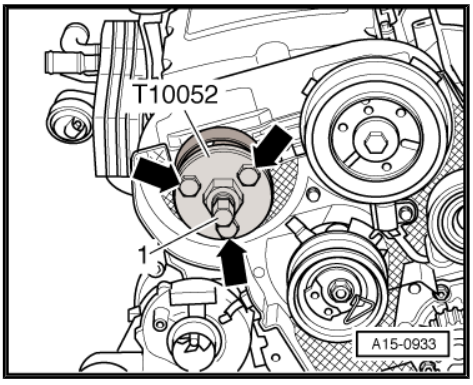
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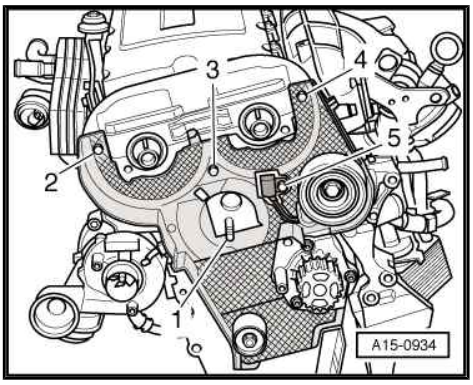
– Fit puller -T10052- on hub of inlet camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



– Fit puller -T10052- on hub of exhaust camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.
– Remove toothed belt tensioning roller.

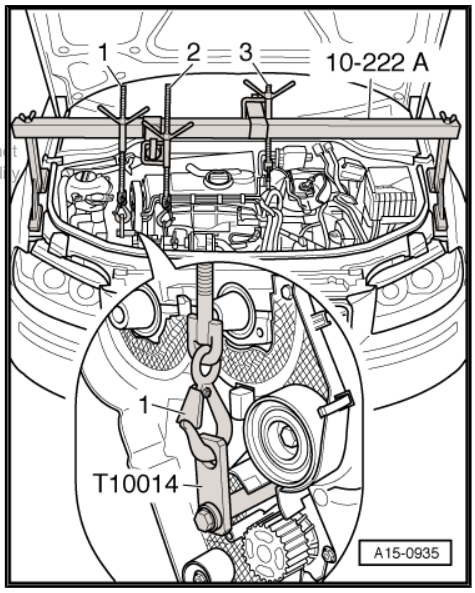


– Remove bolts -2 ... 4-.
– Unscrew bolt -5- and remove Hall sender -G40- from cylinder head.
– Unscrew stud -1- using two M8 locknuts.

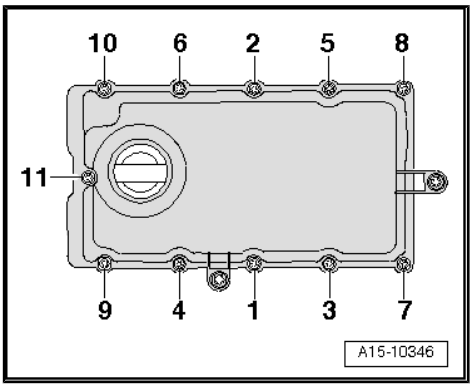


– Screw in bracket -T10014- into threaded hole above coolant pump.
– Attach spindle -1- of support bar -10-222 A- to bracket -T10014- .
– Lift engine using spindle -1- until spindles -2- and -3- are no longer carrying a load.
– Unhook spindles -2- and -3- and move to side.

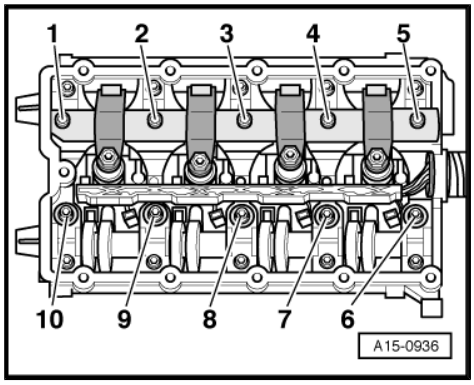
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– Remove cylinder head cover bolts in the sequence -11 ... 1-.
– Remove cylinder head cover.



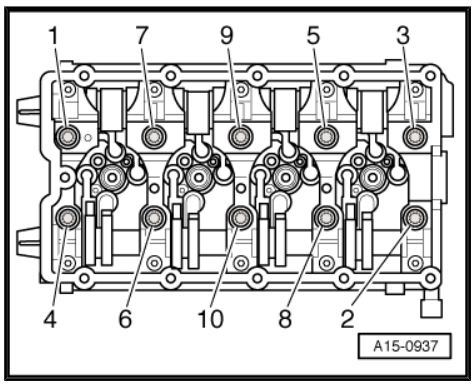
– Remove bolts -1-, -3- and -5-.
– Unscrew bolts -2- and -4- alternately in several stages.



Note

Do not pull bolts out of rocker arm shaft so that components remain attached to shaft. If necessary mark position on rocker arm.

– Detach rocker arm shaft.
– Remove bolts -6 ... 10-.



– Follow the sequence for loosening the cylinder head bolts.
– Lift out cylinder head with the help of a 2nd mechanic.
– Lay cylinder head aside on a clean surface with the combustion chamber side facing upwards.

Caution

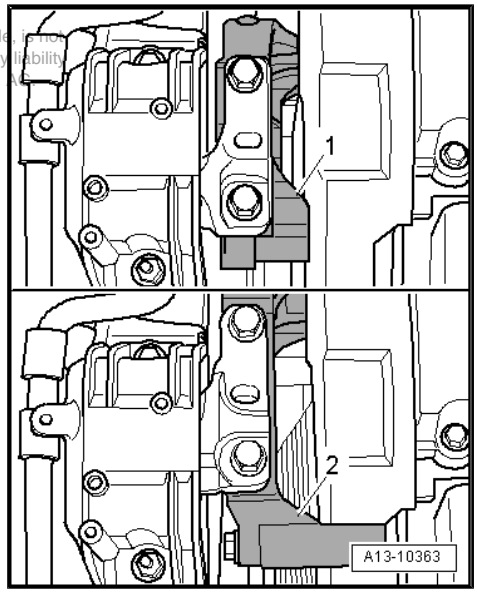
- *Vehicles with ceramic glow plugs: The ceramic glow plugs are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed.*
- *Handling ceramic glow plugs ⇒ page 153 .*

2.5 Removing cylinder head - vehicles with large engine support

Note

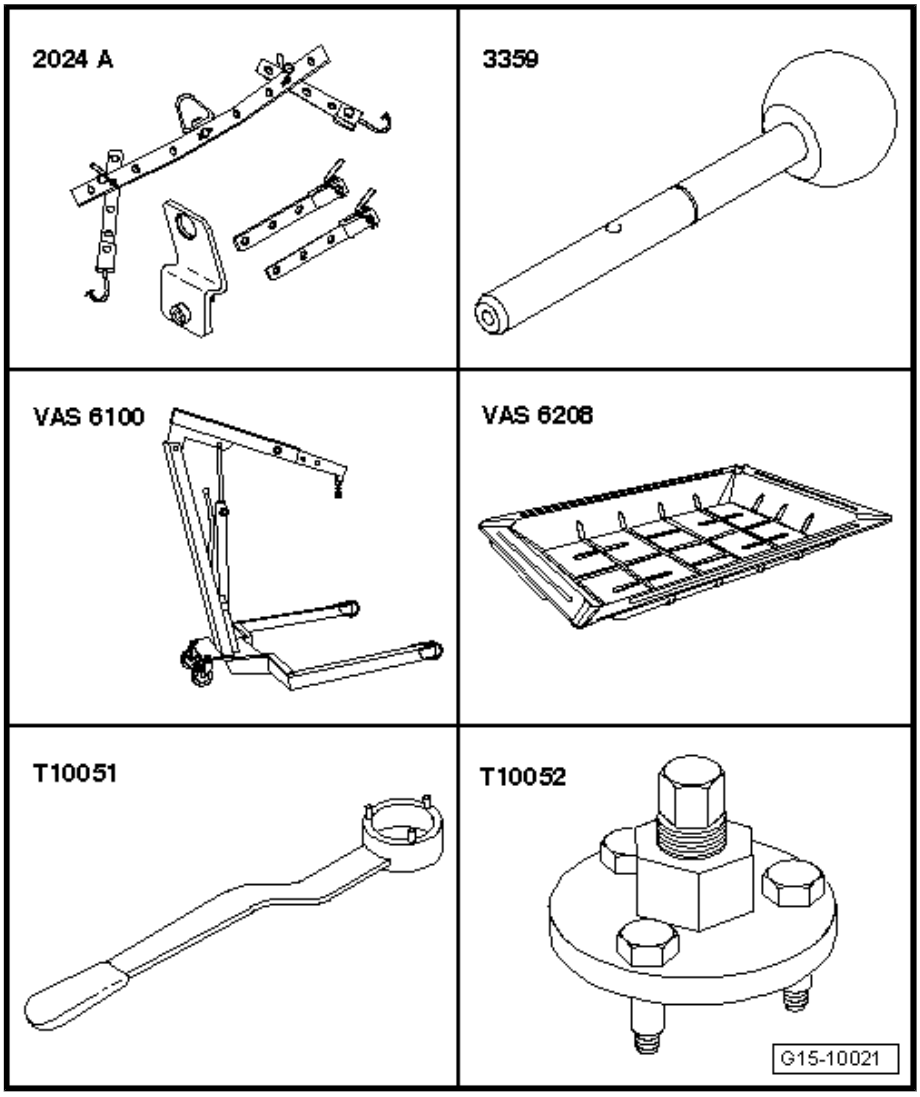
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The engine support does not have to be removed in order to remove the cylinder head on vehicles with large engine support -2-.



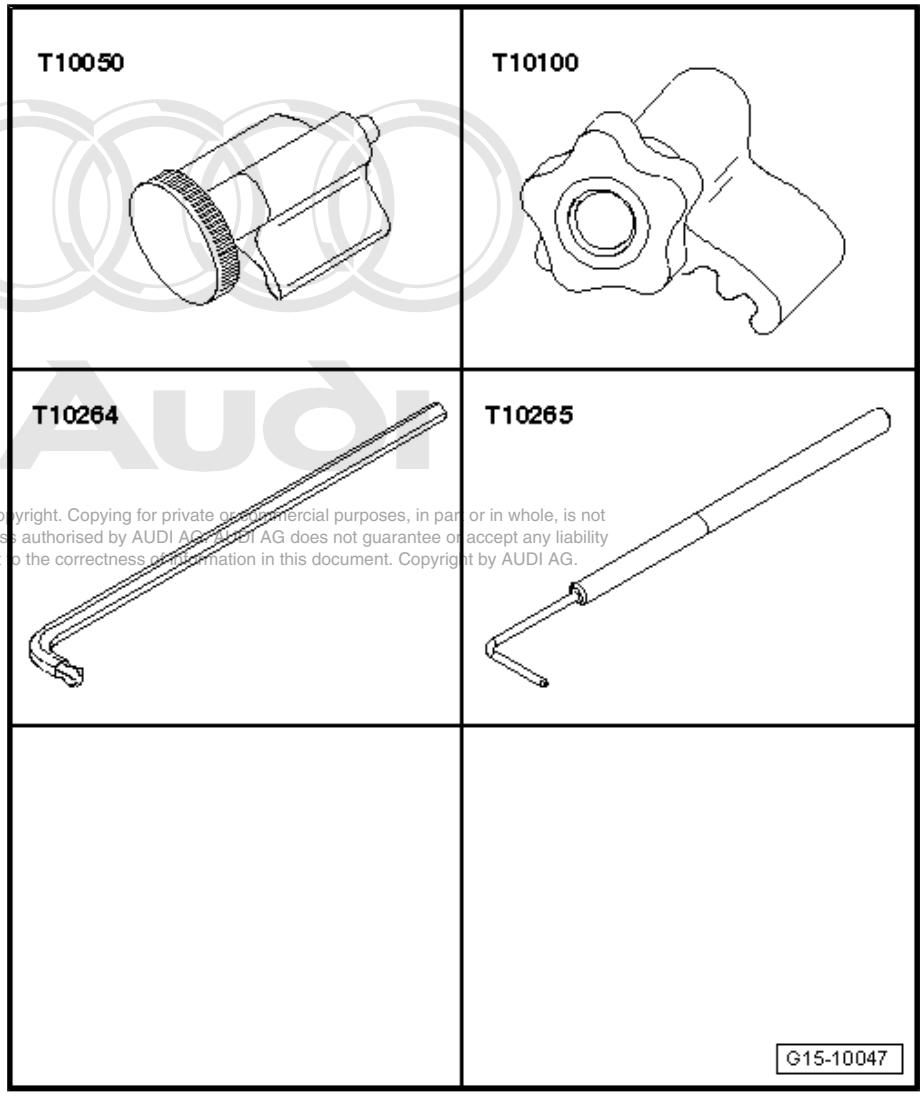
Special tools and workshop equipment required

- 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-



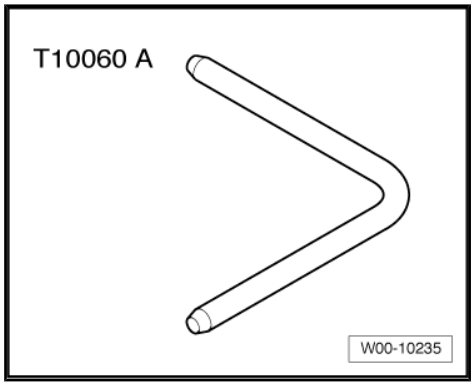
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- Crankshaft stop -T10050- for engines with circular crankshaft sprocket
- Crankshaft stop -T10100- for engines with oval crankshaft sprocket
- Special wrench, long reach -T10264-
- Locking pin -T10265-



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- Locking pin -T10060 A-



Procedure

Caution

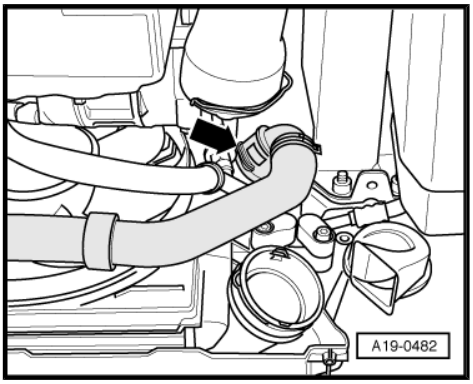
Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .

– With ignition switched off, disconnect earth cable at battery ⇒ Rep. Gr. 27 .

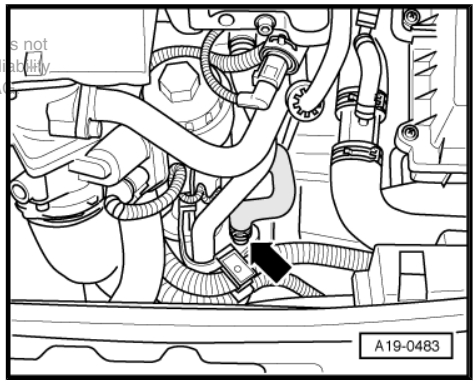
WARNING

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

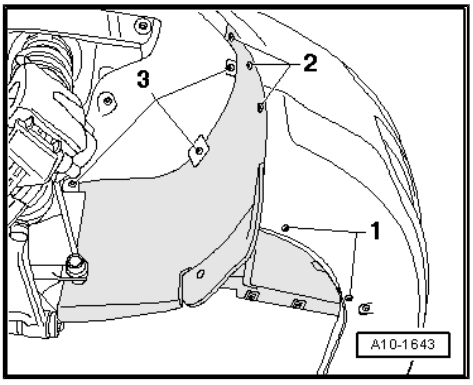
– Open filler cap on coolant expansion tank.
– Place drip tray for workshop hoist -VAS 6208- under engine.
– Pull out retaining clip at the bottom -arrow- and disconnect coolant hose from radiator.



– Also detach upper coolant hose on oil cooler -arrow-, and drain off remaining coolant.

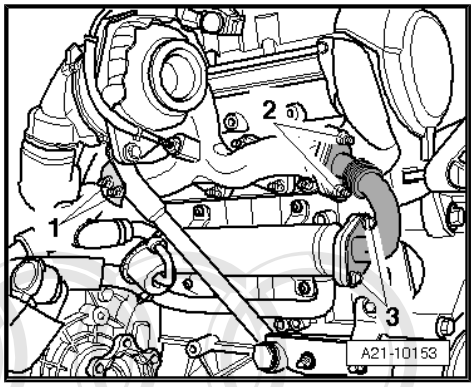


– Remove noise insulation (right-side) -fasteners 1 ... 3-.



Audi
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– Remove nuts -2- and bolts -3- and remove connecting pipe for exhaust gas recirculation.

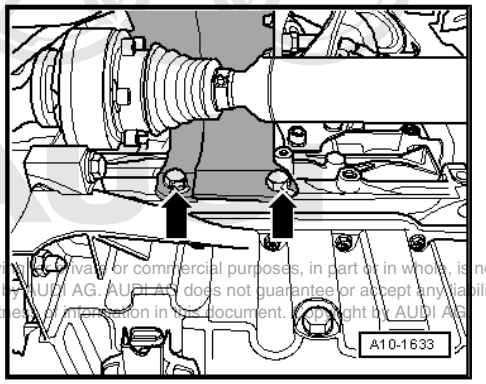


Note

Disregard -item 1-.

Vehicles with front-wheel drive:

– Unbolt heat shield for drive shaft (right-side) -arrows-.



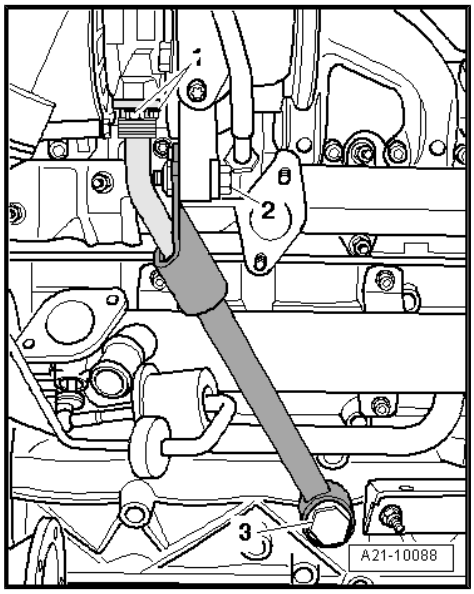
Vehicles with four-wheel drive:

– Remove flange shaft (right-side) ⇒ Rep. Gr. 39 .

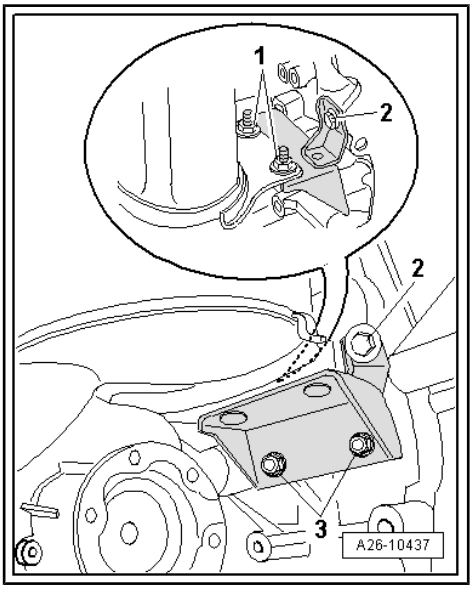
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All vehicles (continued):

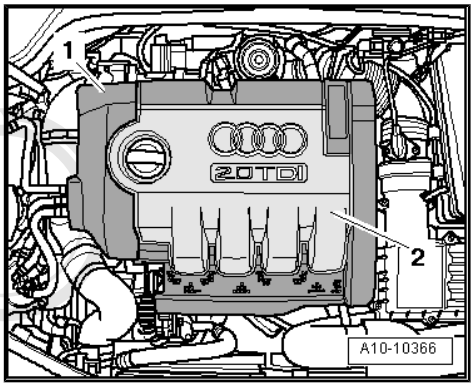
– Remove nuts -1-, bolt -2- and banjo bolt -3- and detach support for turbocharger.



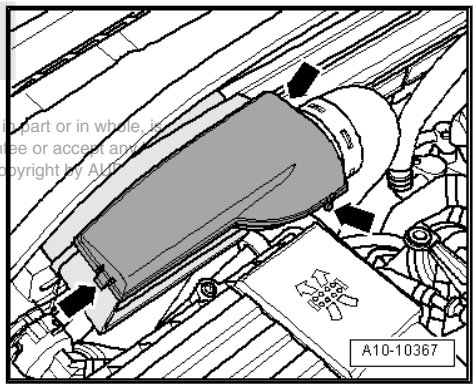
– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.



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

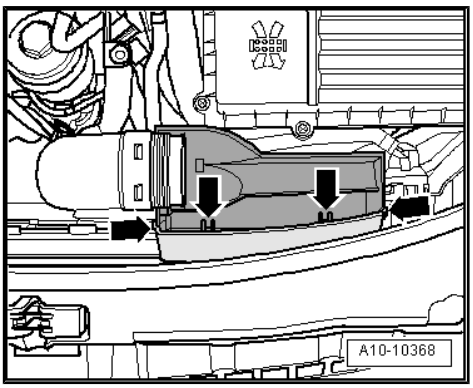


– Pull cover off air duct (release clips on sides) -arrows-.

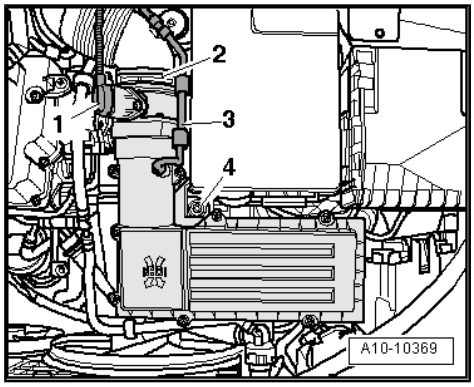


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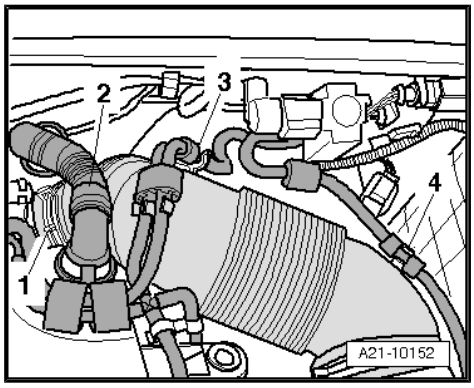
– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



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

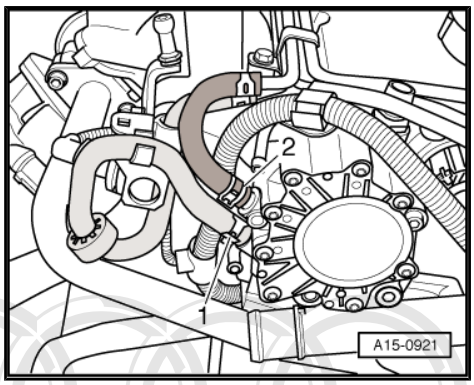


Caution

Rules for cleanliness when working on the injection system ⇒ page 6 .

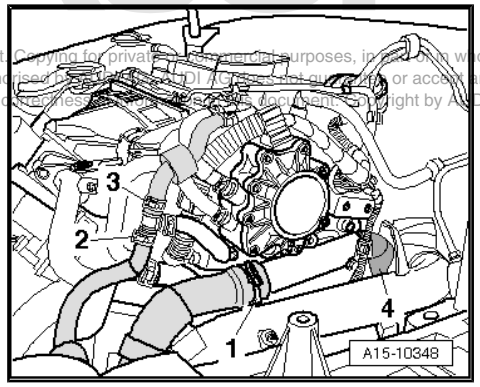
WARNING

- *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- (white marking) and fuel return hose -1- (blue marking) from tandem pump.

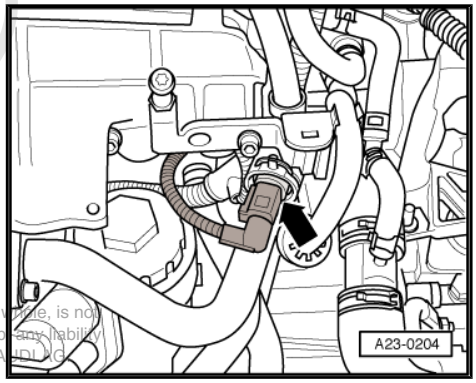
– Disconnect coolant hoses -1 … 4-.



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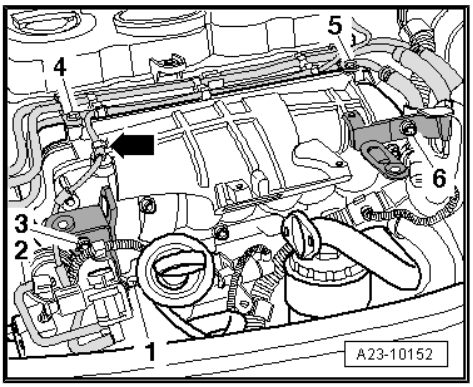
– Unplug electrical connector -arrow- at fuel temperature sender -G81- .
– Move wiring clear.



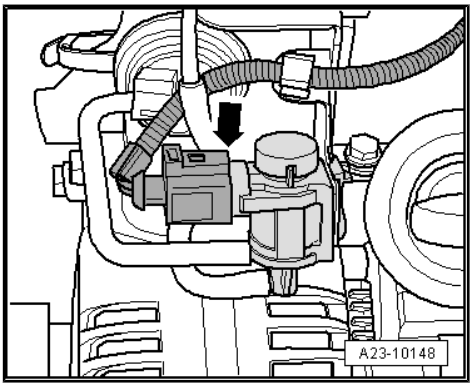
– Move vacuum hose clear -arrow- at retaining clip.
– Unscrew bolts -1, 4, 5-.
– Disconnect vacuum hose -2- leading to vacuum unit for air flow control.

Note

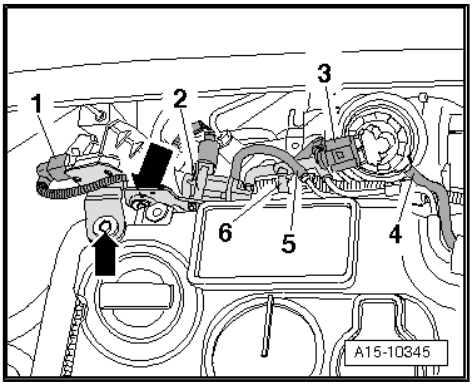
Disregard items marked -3- and -6-.



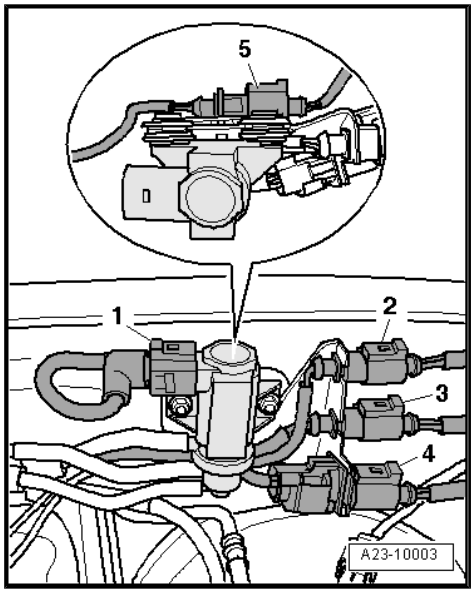
– Unclip intake manifold flap valve -N316- -arrow- from retainer.
– Remove intake manifold flap motor -V157- ⇒ Rep. Gr. 23 .
– Remove exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212- ⇒ page 350 .



– Unclip change-over valve for exhaust gas recirculation cooler -N345- -item 2- from bracket.
– Unplug electrical connectors -1- and -3- and move wiring clear.
– Detach vacuum line -4, 5, 6-.
– Remove bolts -arrows-.
– Move wiring and vacuum lines clear.



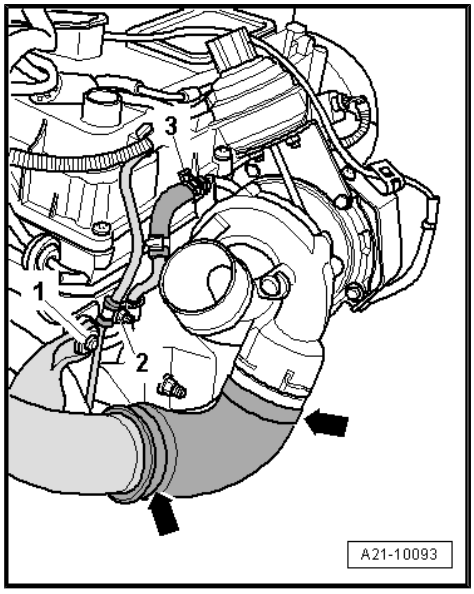
– Unplug electrical connector -3- for exhaust gas temperature sender 1 -G235- and move wiring clear.



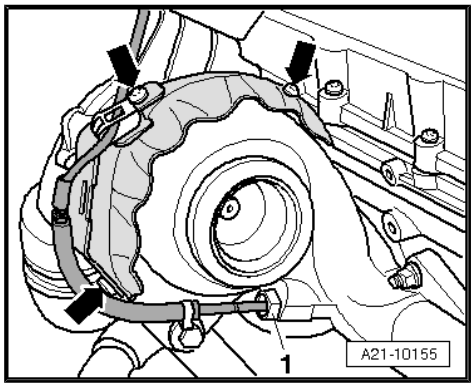
Note

Disregard -items 1, 2, 4 and 5-.

– Disconnect oil supply hose -3- from turbocharger.
– Remove bolt -1-.
– Pull retaining clips -arrows- out slightly and detach air intake hose.
– Remove nut -2-.
– Swivel vacuum line slightly to left.



– Move wiring for exhaust gas temperature sender 1 -G235- -item 1- clear.

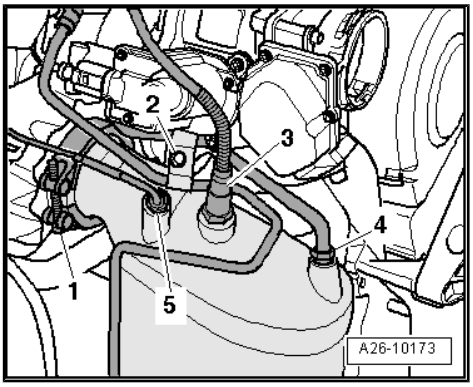


Note

Disregard -arrows-.

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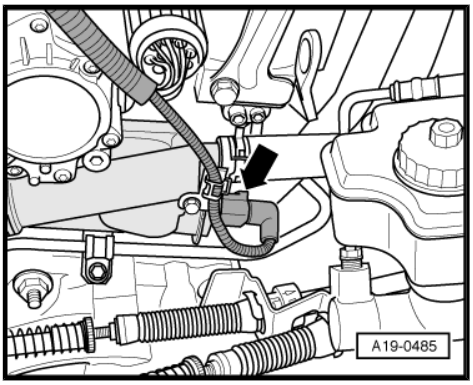
– Slacken and remove retaining clamp -1- for particulate filter.
– Push particulate filter slightly to rear.



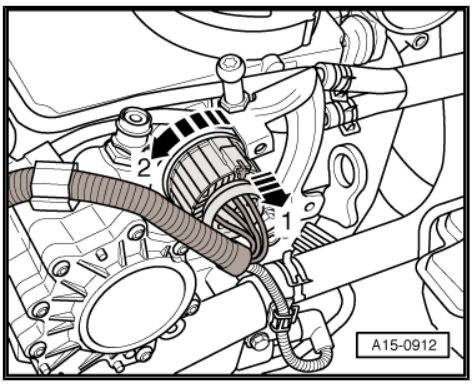
Note

Disregard items marked -2 ... 5-.

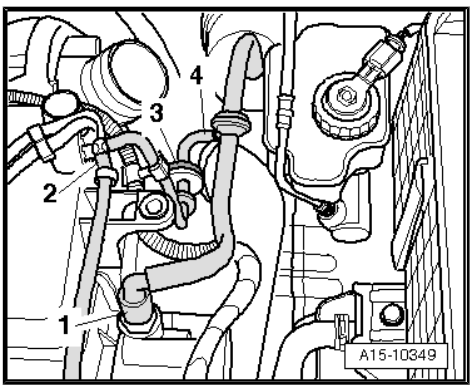
– Unplug electrical connector -arrow- at coolant temperature sender -G62- .



– Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
– Detach main connector for unit injectors and glow plugs.
– Move electrical wiring harness clear.

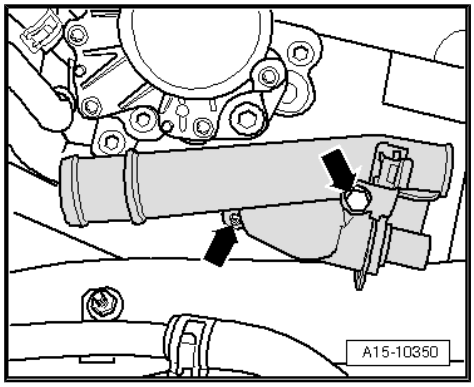


– Detach vacuum hose -1- at tandem pump.
– Disconnect vacuum hose -4- from non-return valve.
– Unplug vacuum hose -2-.
– Press rubber grommet -3- out of engine lifting eye.



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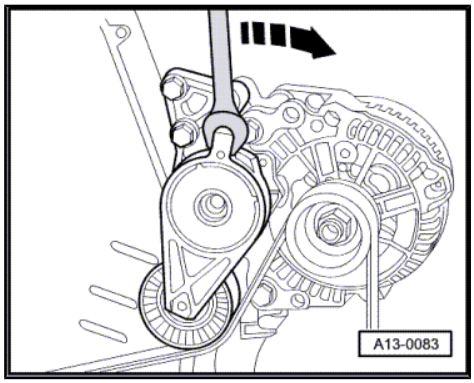
– Unscrew coolant connection -arrows-.



Note

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

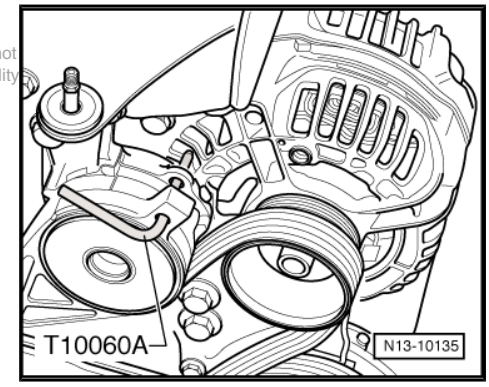
– Turn the tensioner in the direction of the -arrow- to slacken the poly V-belt.



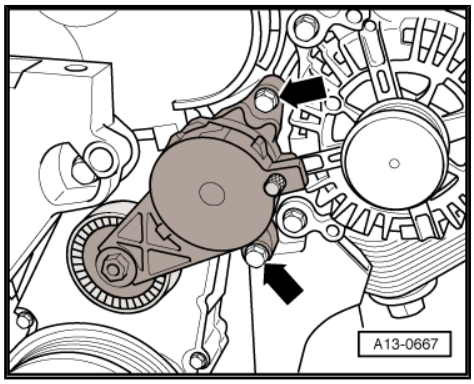
– Lock poly V-belt tensioner using locking pin -T10060 A- .

– Remove poly V-belt.

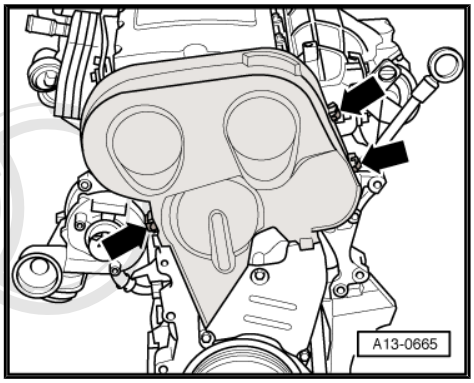
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– Remove tensioner for poly V-belt -arrows-.

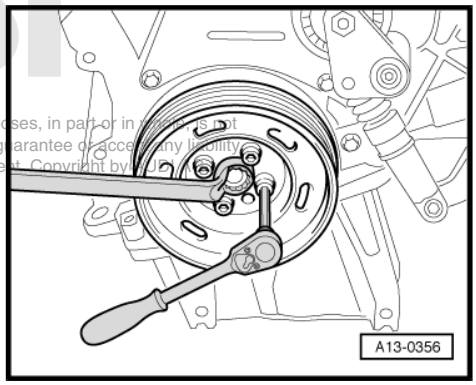


– Remove top toothed belt cover by releasing retaining clips -arrows-.

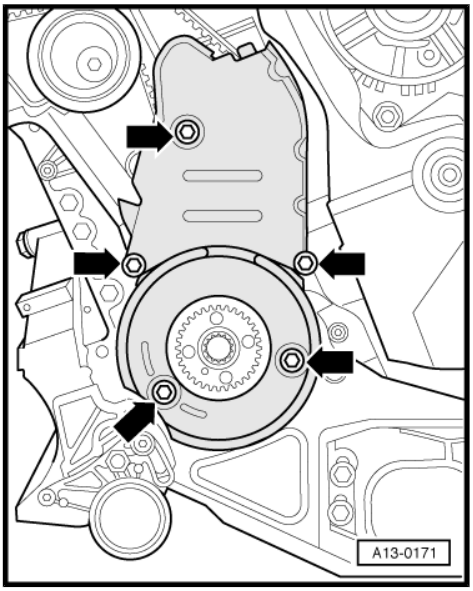


– Remove cover cap for vibration damper.
– Unbolt vibration damper; counterhold on centre bolt with ring spanner.

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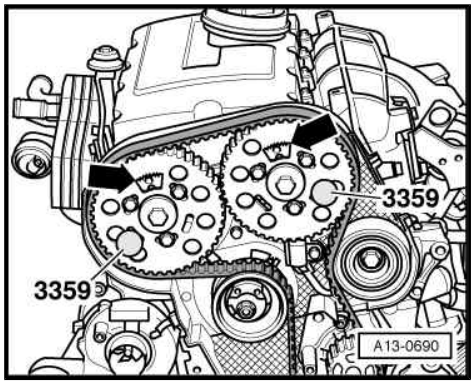
– Unbolt toothed belt covers (bottom and centre) -arrows-.



Caution

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

– Turn the crankshaft to TDC for cylinder No. 1.



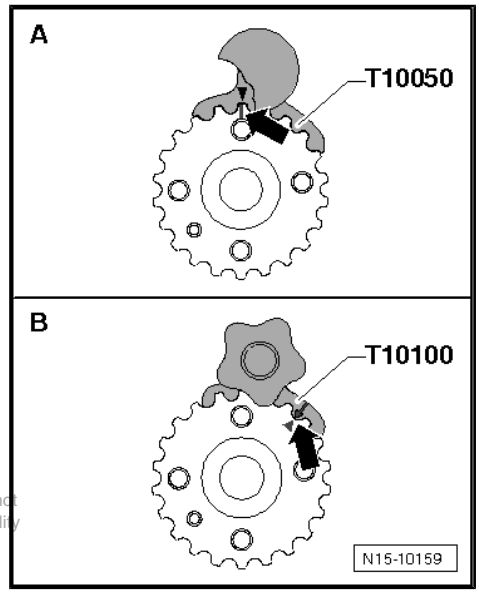
Note

At TDC position the toothed segments -arrows- face upwards.

– Lock hubs with locking pin -3359- (2x).

– Lock crankshaft sprocket using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.

• The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-. The pin of the crankshaft stop must engage in the aperture in the sealing flange.



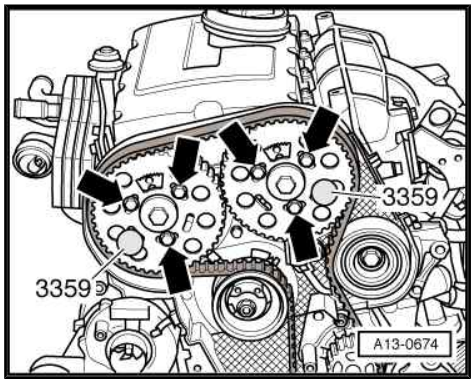
Note

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

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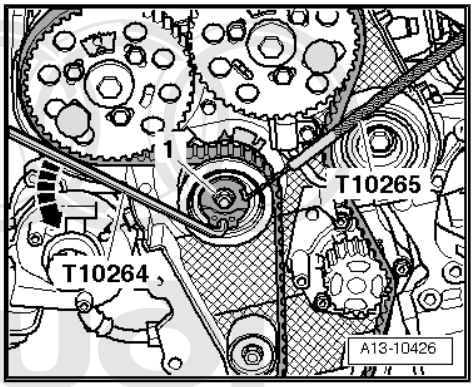
– Mark direction of rotation of toothed belt with chalk or felt pen.

– Loosen securing bolts for camshaft sprockets -arrows-.



– Loosen securing nut -1- for tensioning roller.

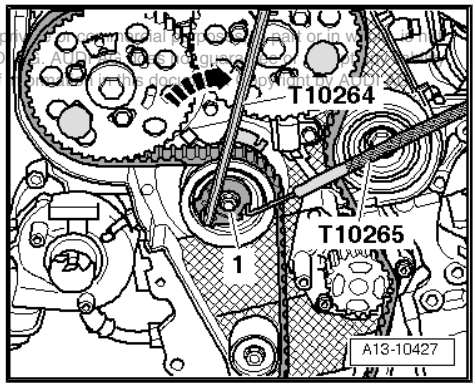
– Turn eccentric adjuster of tensioning roller anti-clockwise -arrow- using special wrench, long reach -T10264- until tensioning roller can be secured with locking tool -T10265- .



– 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.

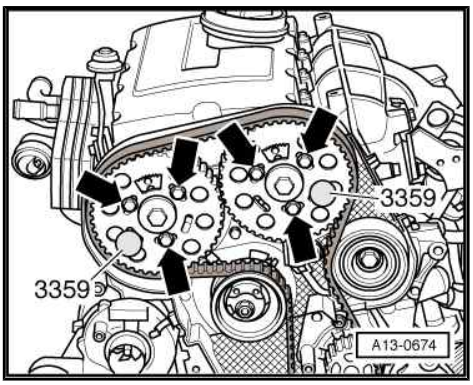
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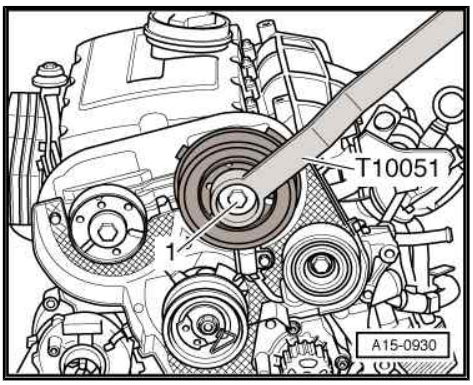
– Remove locking pins -3359- .

– Remove securing bolts -arrows- for camshaft sprockets.

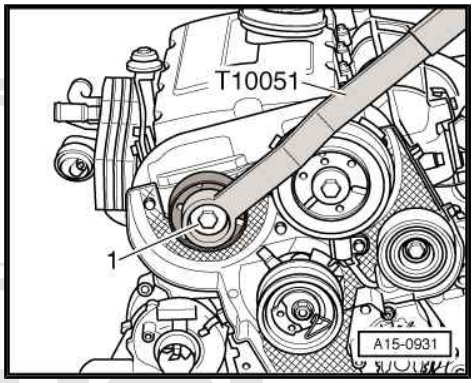
– Remove the camshaft sprockets from hubs.



– Loosen securing bolt -1- for hub on inlet camshaft; use counterhold tool -T10051- .

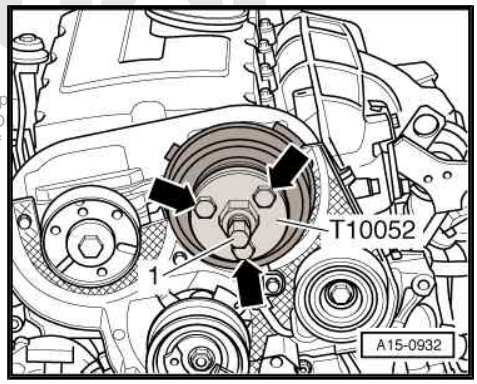


– Loosen securing bolt -1- for hub on exhaust camshaft; use counterhold tool -T10051- .
– Unscrew securing bolts of hubs approx. 2 turns.

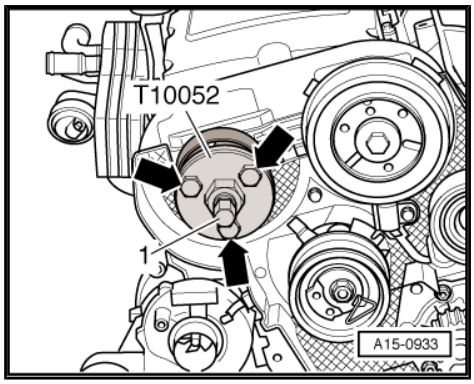


– Fit puller -T10052- on hub of inlet camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.

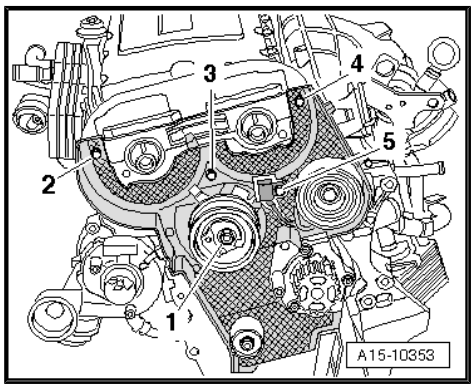
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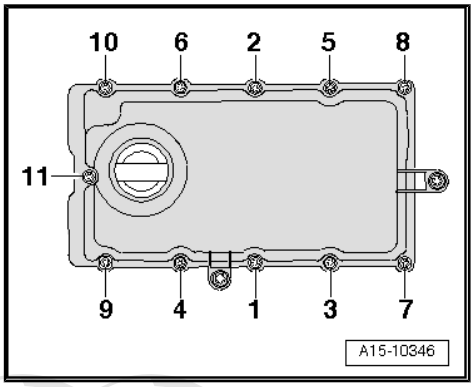
– Fit puller -T10052- on hub of exhaust camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.
– Remove toothed belt tensioning roller.



– Remove bolts -2 ... 4-.
– Unscrew bolt -5- and remove Hall sender -G40- from cylinder head.
– Unscrew nut -1- for tensioning roller.



– Remove cylinder head cover bolts in the sequence -11 ... 1-.
– Remove cylinder head cover.

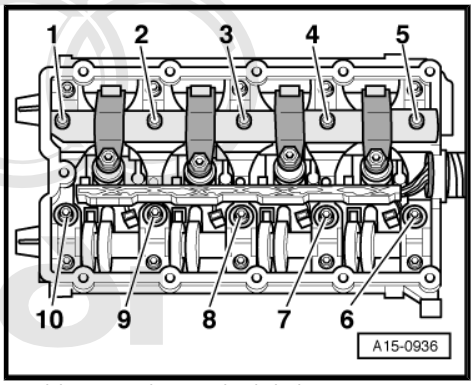


– Remove bolts -1-, -3- and -5-.
– Unscrew bolts -2- and -4- alternately in several stages.

Note

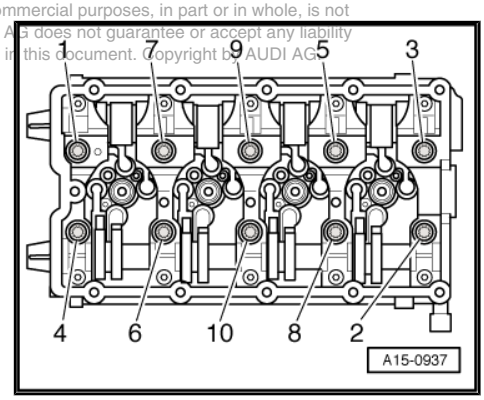
Do not pull bolts out of rocker arm shaft so that components remain attached to shaft. If necessary mark position on rocker arm.

– Detach rocker arm shaft.
– Remove bolts -6 ... 10-.

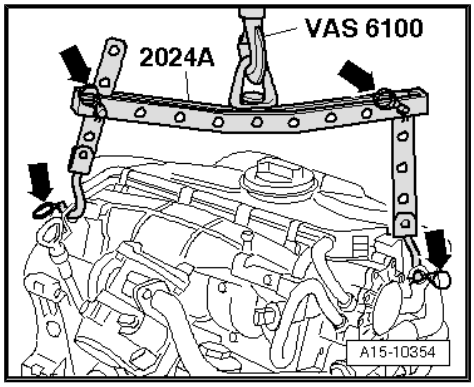


– Follow the sequence for loosening the cylinder head bolts.

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– 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-.

– 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 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 153 .*

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2.6 Installing cylinder head

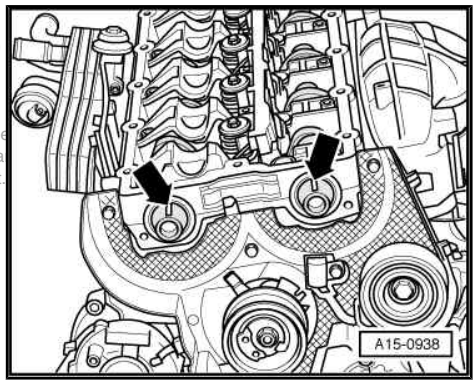
Note

- *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.*
- *Carefully remove any sealant residue from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- *Carefully remove any remaining emery and abrasive material.*
- *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*
- *Renew the cylinder head bolts.*
- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- *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.*
- *When installing an exchange cylinder head with fitted camshafts, the contact surfaces between roller rocker fingers and cams must be oiled after installing the head.*
- *The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*
- *After fitting a new cylinder head or cylinder head gasket, change the coolant and the engine oil.*
- *Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

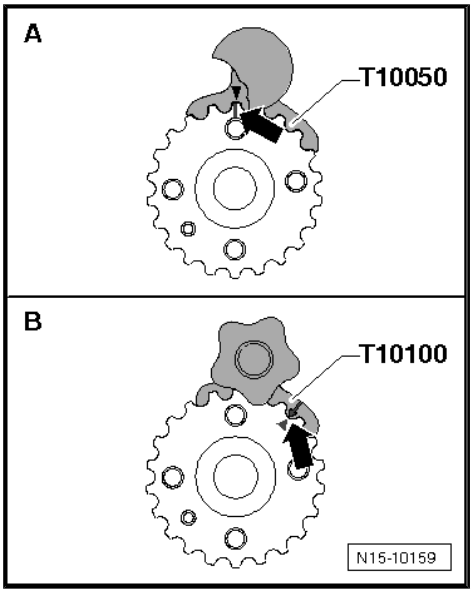
– Check whether both the camshafts and the crankshaft are positioned at TDC:

• The grooves -arrows- for the parallel keys must face upwards.

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- The crankshaft sprocket must be locked using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.

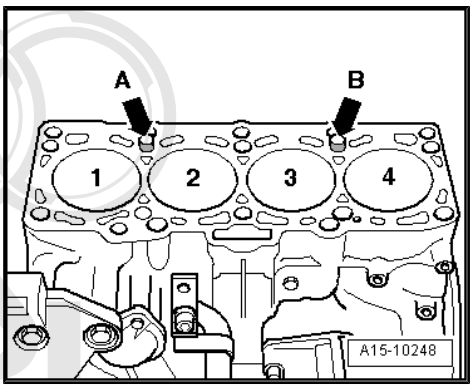


Note

The markings on the toothed belt sprocket and the crankshaft stop must align -arrow-.

– 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.

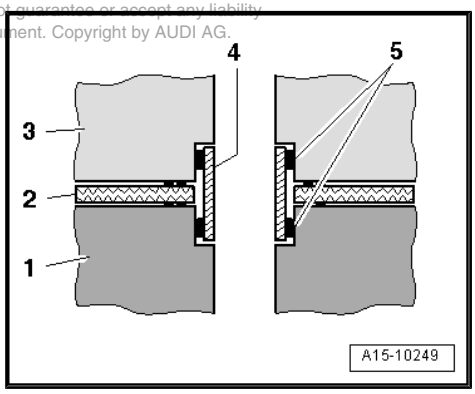
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– Blow out drilled holes for dowel sleeve in cylinder block -1- and in cylinder head -3- with compressed air.

– 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- -item 5-.

– Insert closed dowel sleeve -4-.



2 - Cylinder head gasket

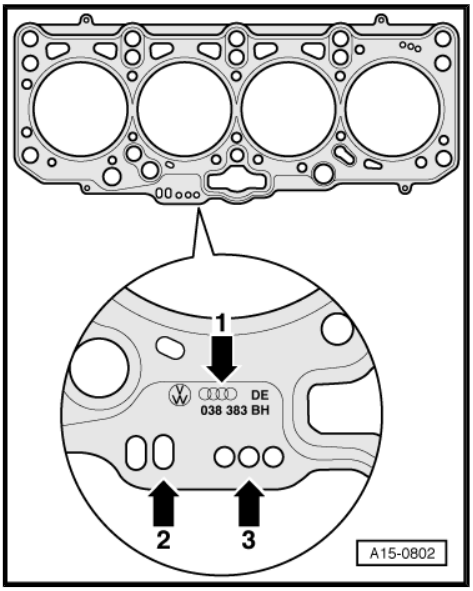
All vehicles (continued):

– Note identification markings on cylinder head gasket.

1 - Part No.

2 - Production code (can be disregarded)

3 - Holes

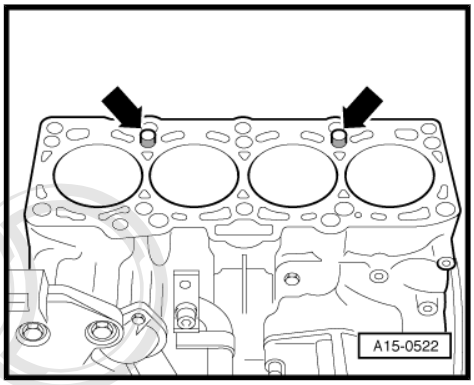


Note

- *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 150* *.*

– Fit cylinder head gasket onto dowel sleeves -arrows- in cylinder block.

• Check installation position of cylinder head gasket: the word “oben” (top) or the Part No. should face towards the cylinder head.



Vehicles with small engine support:

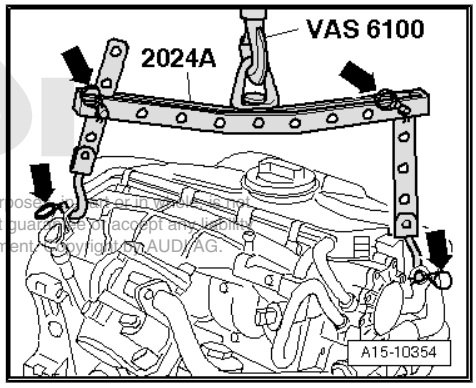
– Fit cylinder head onto cylinder block.

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-.



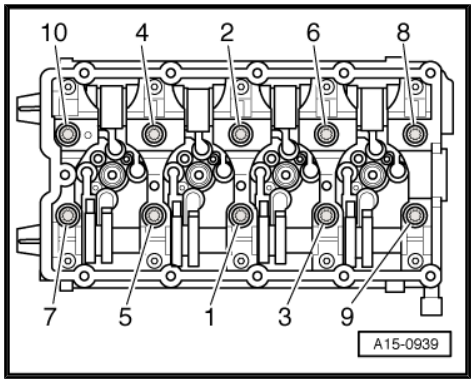
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– Slightly lift cylinder head using workshop hoist -VAS 6100- .

– 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):



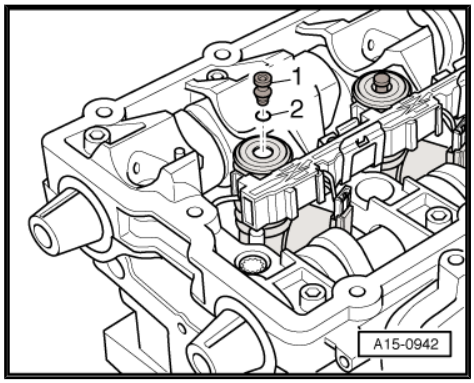
– Insert and hand-tighten cylinder head bolts.
– Tighten cylinder head bolts in 4 stages in the sequence shown:

1. Tighten with torque wrench to 40 Nm.
2. Tighten with torque wrench to 60 Nm.
3. Turn 90° ($^1/_4$ turn) further using a rigid wrench.
4. Turn 90° ($^1/_4$ turn) further using a rigid wrench.

Note

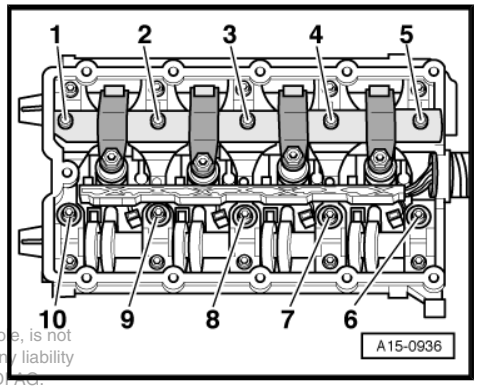
Cylinder head bolts do not have to be torqued down again later after repair work.

– Before installing rocker arm shaft, check that all ball studs -1- and O-rings -2- are fitted in unit injectors.



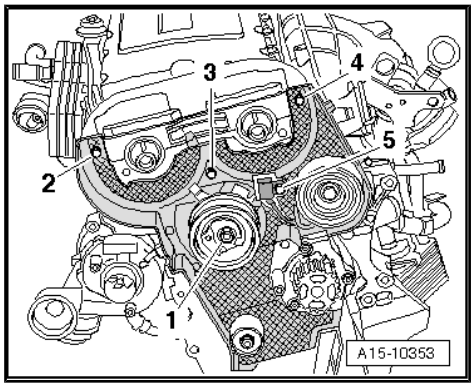
– Secure the rocker arm shaft as follows:

1. Tighten bolts -2- and -4- alternately in several stages until rocker arm shaft lies on bearing frame.
2. Tighten bolts -1-, -3- and -5- to 20 Nm + 90° ($^1/_4$ turn).
3. Tighten bolts -2- and -4- to 20 Nm + 90° ($^1/_4$ turn).
4. Tighten bolts -6 ... 10- to 20 Nm.

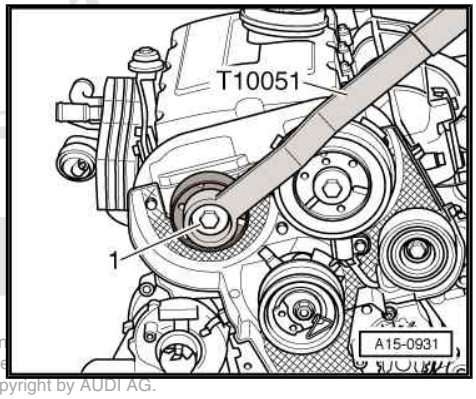


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– Apply locking fluid to bolts -2 … 5- and tighten bolts; for locking fluid refer to ⇒ Electronic parts catalogue .
– Screw nut -1- for toothed belt tensioner onto stud for toothed belt tensioner.

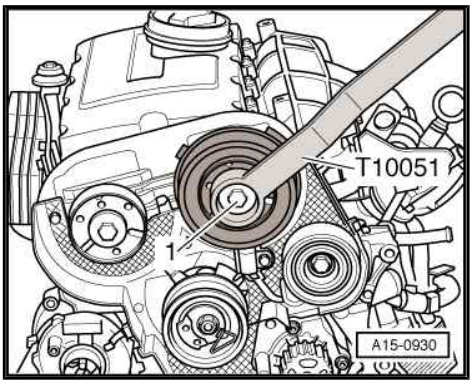


– Attach hub to exhaust camshaft.
– Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



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

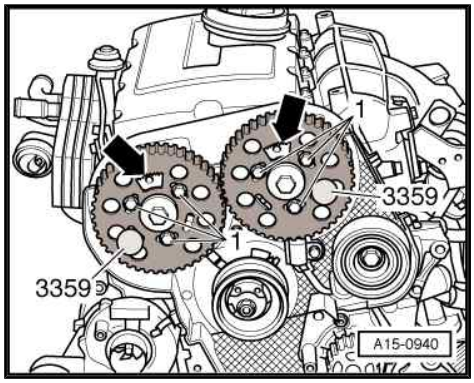


– Push camshaft sprockets onto hubs.

• The toothed segments -arrows- in the camshaft sprockets must both face upwards.

– Screw in bolts -1- finger-tight.

– Lock hubs with locking pins -3359- .



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

– Install toothed belt (adjust valve timing): vehicles with small engine support ⇒ page 111 , vehicles with large engine support ⇒ page 123

– Install vibration damper ⇒ page 89 .

– Install poly V-belt ⇒ page 86 .

– Install support for turbocharger: vehicles with engine codes AZV, BKD ⇒ page 272 , vehicles with engine codes BMN, BUY ⇒ page 283 .

– Install cylinder head cover: vehicles with engine codes AZV, BKD ⇒ page 157 , vehicles with engine codes BMN, BUY ⇒ page 160 .

Vehicles with engine codes AZV, BKD:

– Install front exhaust pipe ⇒ page 304 .

Vehicles with engine codes BMN, BUY:

– Install flange shaft (right-side) ⇒ Rep. Gr. 39 .

– Install particulate filter ⇒ page 313 .

All vehicles (continued):

– Install exhaust system and align it free of stress ⇒ page 308 .

– Install drive shaft (left-side) ⇒ Rep. Gr. 40 .

– Install air pipes: vehicles with engine codes AZV, BKD ⇒ page 279 , vehicles with engine codes BMN, BUY ⇒ page 299 .

– Connect battery. Procedures required ⇒ Rep. Gr. 27 .

– Change engine oil ⇒ Maintenance ; Booklet 808 .

– Fill cooling system with fresh coolant ⇒ page 251 .

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Tightening torques

Component		Nm
Rocker arm shaft to cylinder head		20 + 90° 1)2)
Bearing frame to cylinder head		20
Rear toothed belt cover to cylinder head		10 3)
Hall sender to cylinder head		10 3)
Stud to cylinder head		15
Hub to camshaft		100
Oil pressure switch to oil filter bracket		20
Oil supply pipe to turbocharger		22
Oil supply pipe to oil filter bracket		22
Oil return pipe to cylinder block		30
Pendulum support to subframe		Manual gearbox ⇒ Rep. Gr. 34 , automatic gearbox ⇒ Rep. Gr. 37
Guide tube for oil dipstick to:	Oil filter bracket	10
	Lifting eye	10
EGR connecting pipe to:	Exhaust gas recirculation cooler	22
	Exhaust manifold	25 1)
Drive shaft heat shield to cylinder block		35

- 1) Renew bolts/nuts.
- 2) 90° = one quarter turn.
- 3) Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue for locking fluid.

2.7 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”.

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3 Servicing valve gear

Note

- *After installing camshafts, wait for approx. 30 minutes before starting engine. 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 - Bracket for wiring -10 Nm-

2 - 20 Nm

- ❑ Note sequence for loosening and tightening ⇒ “3.4 Removing and installing camshafts”, page 210

3 - Rocker arm shaft

- ❑ Removing and installing ⇒ “3.4 Removing and installing camshafts”, page 210

4 - Bolt for rocker arm shaft

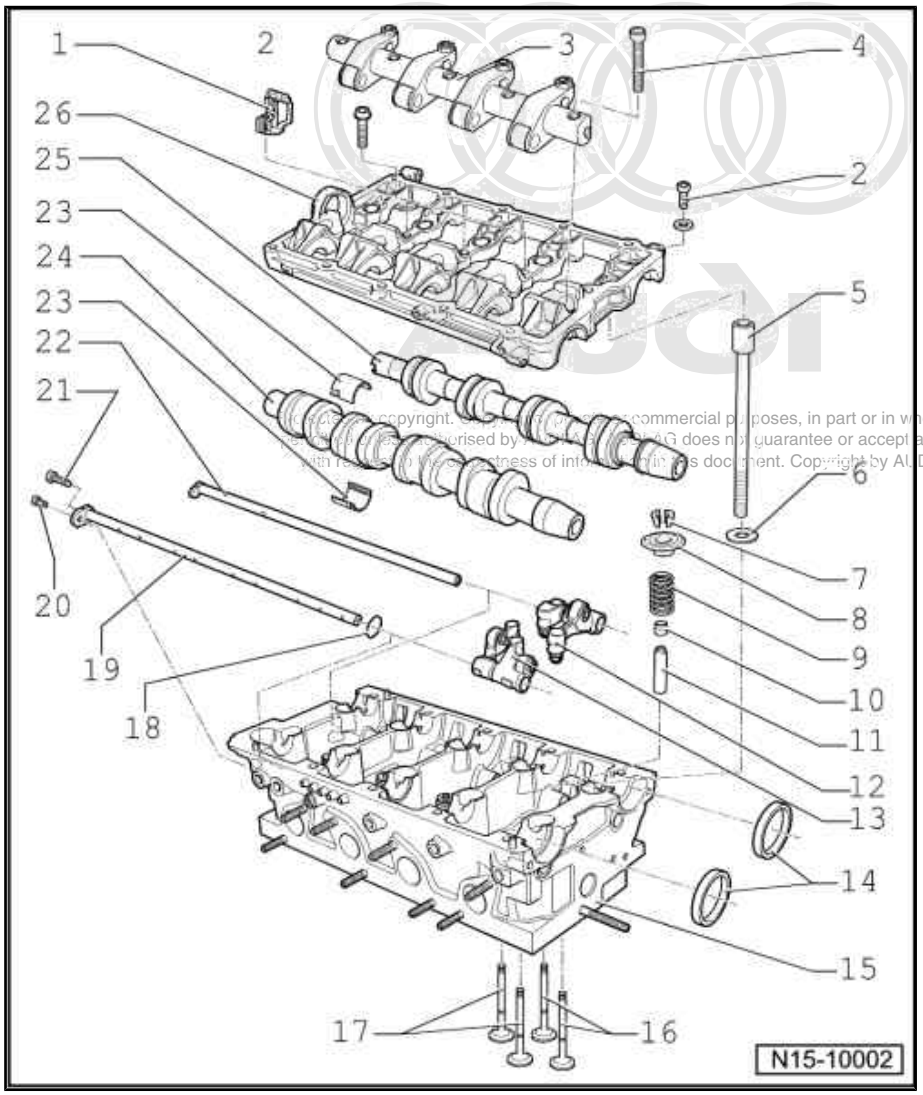
- ❑ Renew
- ❑ Note correct sequence when loosening ⇒ page 195
- ❑ Note correct sequence when tightening ⇒ page 200

5 - Cylinder head bolt

- ❑ Renew
- ❑ Note correct sequence when slackening: vehicles with small engine support ⇒ page 180 ; vehicles with large engine support ⇒ page 195
- ❑ Note correct sequence when tightening ⇒ page 200

6 - Washer

- ❑ For cylinder head bolts
- ❑ Insert in cylinder head before installing bearing frame



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7 - Valve cotters

8 - Valve spring plate

9 - Valve spring

10 - Valve stem oil seal

- ❑ Renewing: with cylinder head installed ⇒ page 218 , with cylinder head removed ⇒ page 221

11 - Valve guide

- ❑ Checking ⇒ page 227

12 - Roller rocker finger

- ❑ Inlet side
- ❑ With pressed-in hydraulic tappet
- ❑ Removing and installing ⇒ page 217
- ❑ Do not interchange used roller rocker fingers (mark)
- ❑ Check roller bearing for play and ease of movement

13 - Roller rocker finger

- ❑ Exhaust side
- ❑ With pressed-in hydraulic tappet
- ❑ Removing and installing ⇒ page 217
- ❑ Do not interchange used roller rocker fingers (mark)
- ❑ Check roller bearing for play and ease of movement

14 - Oil seals

- ❑ Renewing ⇒ page 207

15 - Cylinder head

16 - Inlet valves

- ❑ Checking valves ⇒ page 228
- ❑ Valve dimensions ⇒ page 227

17 - Exhaust valves

- ❑ Checking valves ⇒ page 228
- ❑ Valve dimensions ⇒ page 227

18 - O-ring

- ❑ Renew

19 - Shaft

- ❑ For roller rocker fingers
- ❑ Exhaust side
- ❑ Removing and installing ⇒ “3.5 Removing and installing roller rocker fingers”, page 217

20 - 10 Nm

21 - Screw plug, 10 Nm

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

22 - Shaft

- ❑ For roller rocker fingers
- ❑ Inlet side
- ❑ Removing and installing ⇒ “3.5 Removing and installing roller rocker fingers”, page 217

23 - Bearing shell

- ❑ Do not interchange used bearing shells (mark positions)
- ❑ Make sure that the retaining lugs are correctly seated in the bearing caps and the cylinder head

24 - Exhaust camshaft

- ❑ Checking axial clearance ⇒ page 206

❑ Removing and installing ⇒ page 210

25 - Inlet camshaft

❑ Checking axial clearance ⇒ page 206
❑ Removing and installing ⇒ page 210

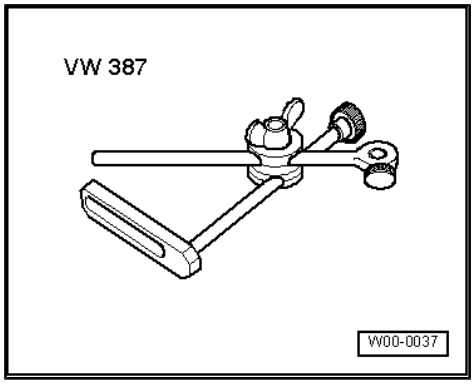
26 - Bearing frame

❑ Note sequence for loosening and tightening ⇒ “3.4 Removing and installing camshafts”, page 210

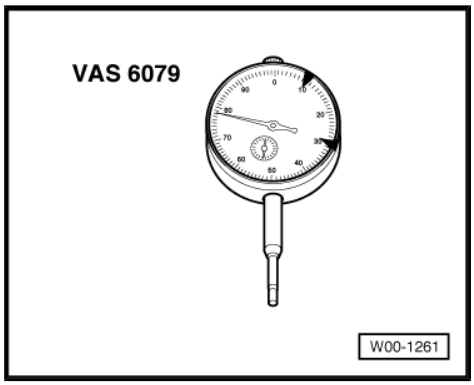
3.2 Checking axial clearance of camshafts

Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-

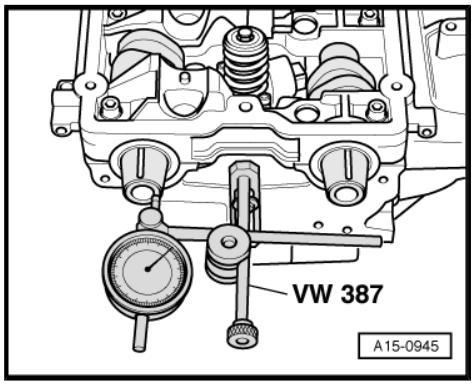


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Procedure

– Carry out procedure with roller rocker fingers removed and bearing frame installed.

• Wear limit: 0.15 mm.

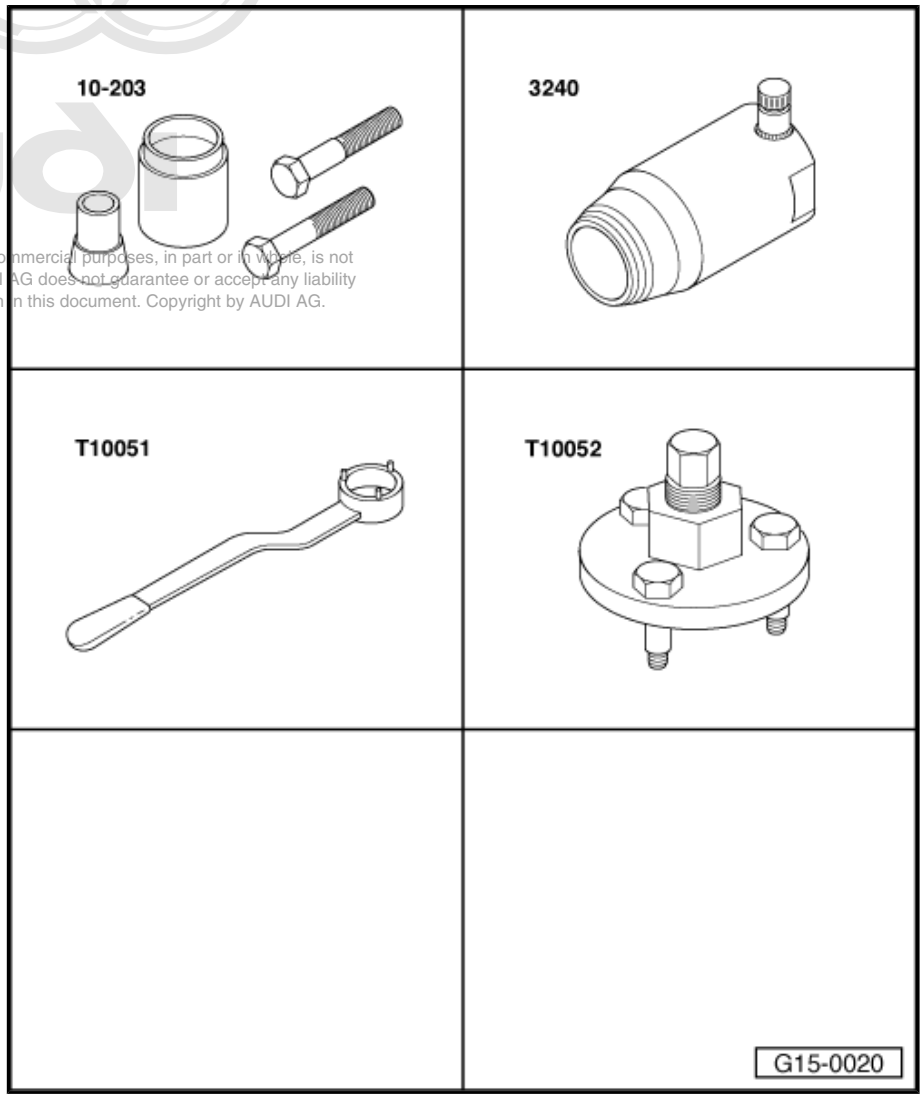


3.3 Renewing camshaft oil seals

Special tools and workshop equipment required

- Fitting tool -10 - 203-
- Oil seal extractor -3240-
- Counterhold tool -T10051-
- Puller -T10052-
- Bolt M12x60

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Procedure

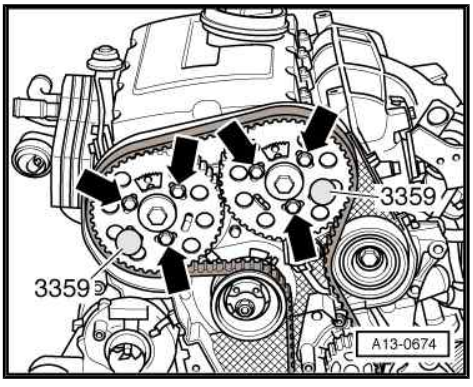
- Cylinder head installed.

– Remove toothed belt: vehicles with small engine support ⇒ page 102 , vehicles with large engine support ⇒ page 116

– Remove locking pins -3359- .

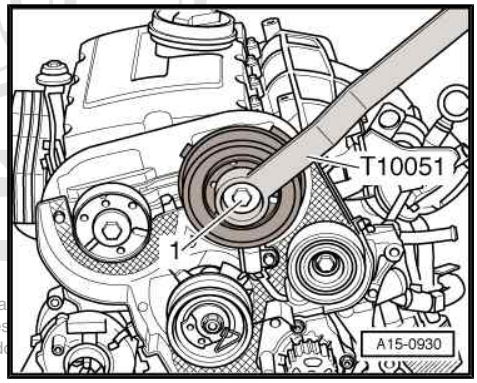
– Remove securing bolts -arrows- for camshaft sprockets.

– Remove the camshaft sprockets from hubs.

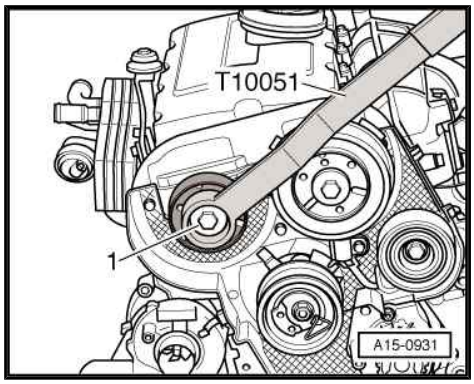


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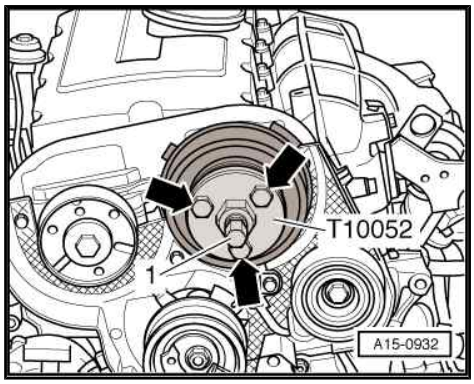
– Loosen securing bolt -1- for hub on inlet camshaft; use counterhold tool -T10051- .



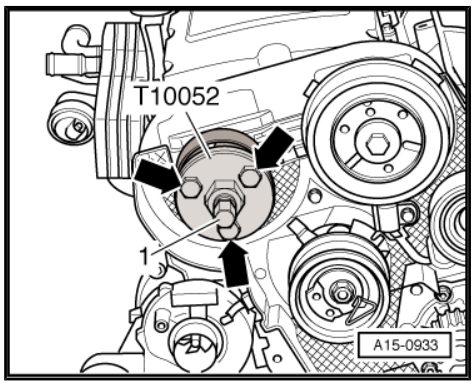
– Loosen securing bolt -1- for hub on exhaust camshaft; use counterhold tool -T10051- .
– Unscrew securing bolts of hubs approx. 2 turns.



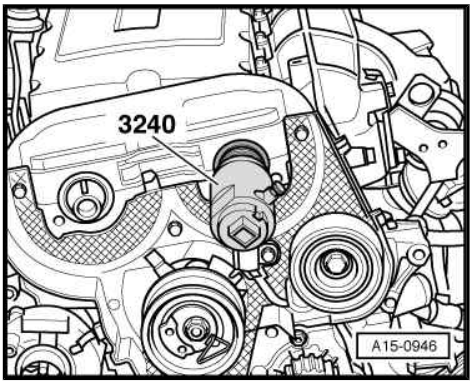
– Fit puller -T10052- on hub of inlet camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



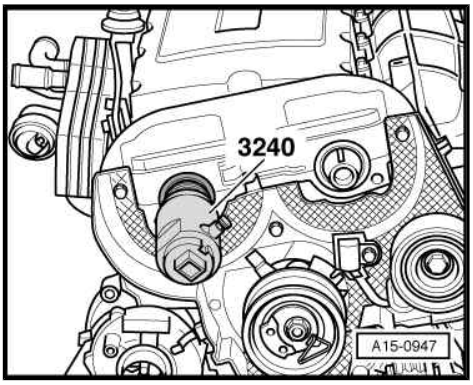
– Fit puller -T10052- on hub of exhaust camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.



– 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 exerting firm pressure, screw it into oil seal of inlet camshaft as far as possible.
– 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.



– 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 exerting firm pressure, screw it into oil seal of exhaust camshaft as far as possible.
– 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.

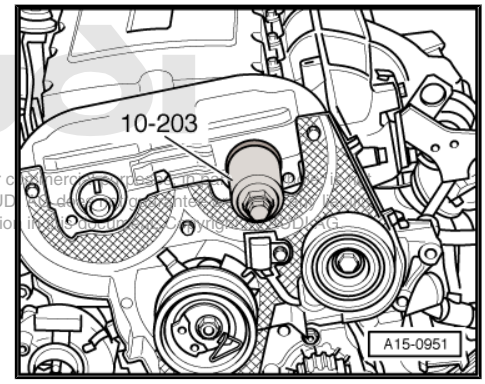


Note

Do not additionally lubricate or grease sealing lip of oil seal.

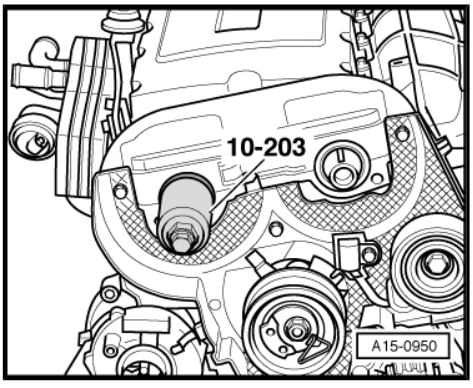
– Use a clean cloth to wipe off oil residue on camshaft journal.
– Tape off groove on taper of both camshafts with adhesive tape.

– Carefully position oil seal on inlet camshaft.
– Press in oil seal with press piece of fitting tool -10-203- and bolt M12×60 as far as the stop.

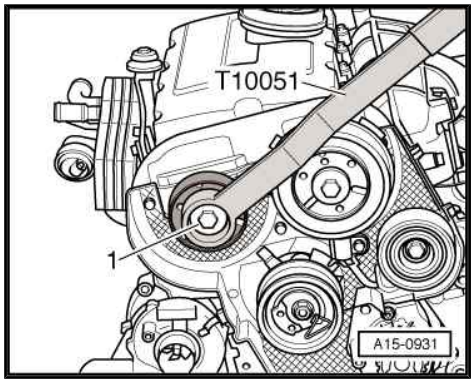


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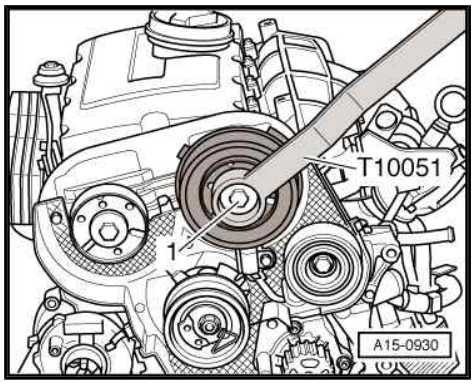
– Carefully position oil seal on exhaust camshaft.
– Press in oil seal with press piece of fitting tool -10-203- and bolt M12×60 as far as the stop.



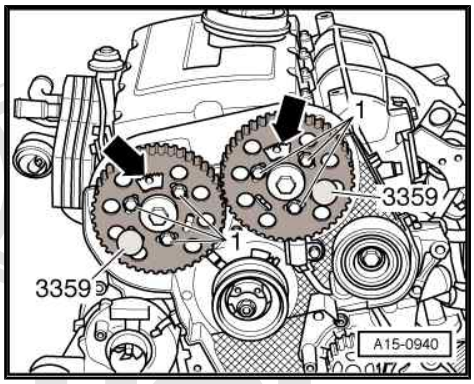
– Attach hub to exhaust camshaft.
– Tighten securing bolt -1- to 100 Nm (use counterhold tool - T10051-).



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



– Push camshaft sprockets onto hubs.
• The toothed segments -arrows- in the camshaft sprockets must both face upwards.
– Screw in bolts -1- finger-tight.
– Lock hubs with locking pins -3359- .
– Install toothed belt (adjust valve timing): vehicles with small engine support ⇒ page 111 , vehicles with large engine support ⇒ page 123
– Install vibration damper ⇒ page 89 .
– Install poly V-belt ⇒ page 86 .

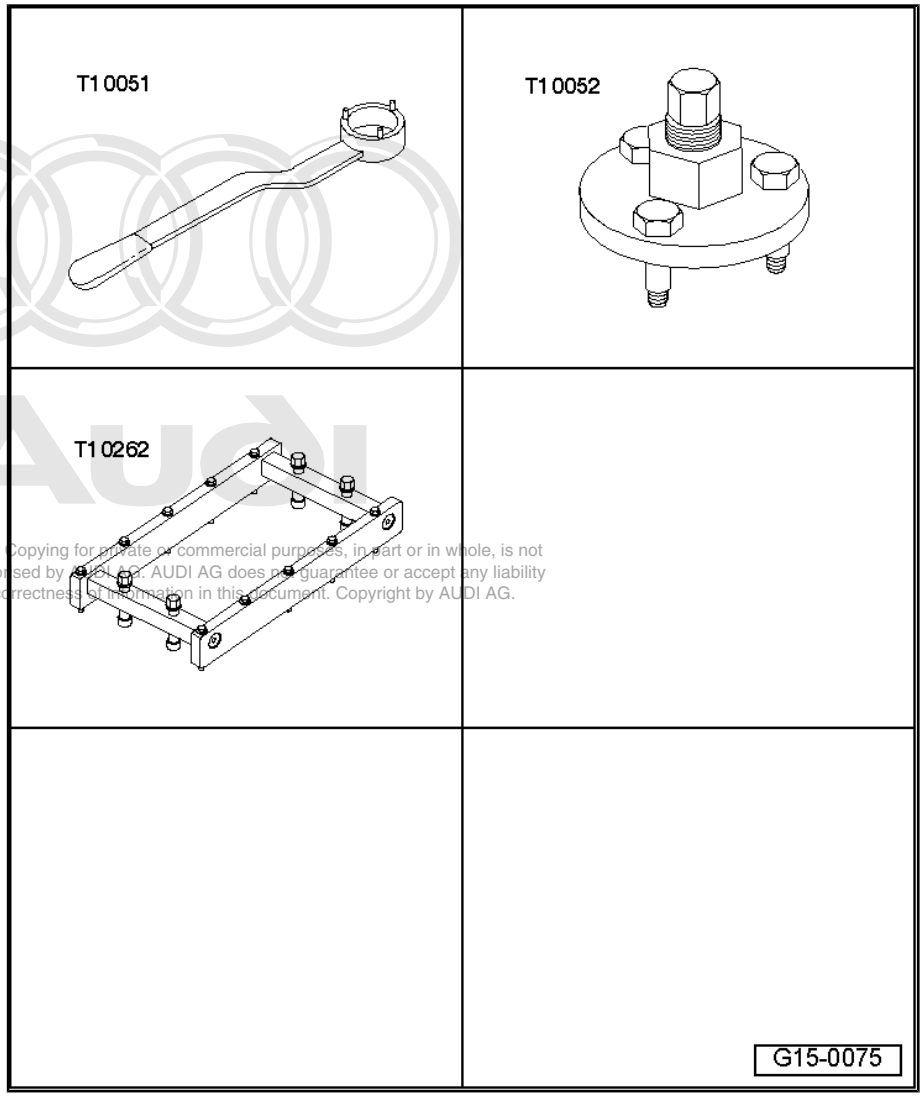


3.4 Removing and installing camshafts

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Special tools and workshop equipment required

- Counterhold tool -T10051-
- Puller -T10052-
- Rack -T10262-
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue



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Removing

- Cylinder head installed.

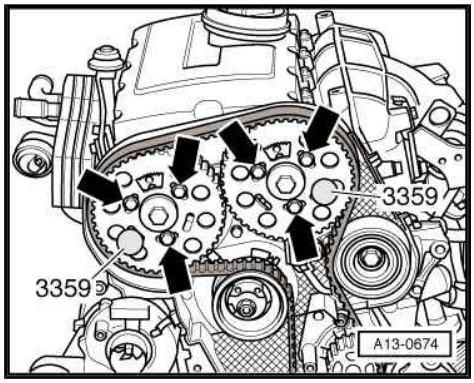
– Remove toothed belt: vehicles with small engine support ⇒ page 102 , vehicles with large engine support ⇒ page 116

– Remove tandem pump ⇒ Rep. Gr. 20 .

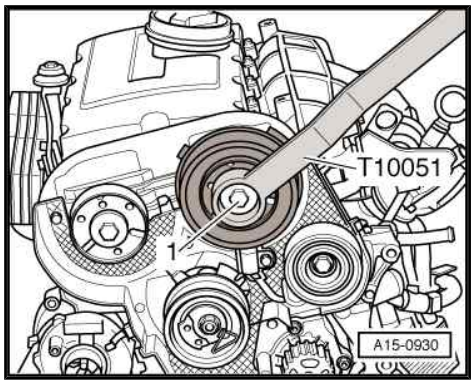
Note

The hoses can remain attached to the tandem pump.

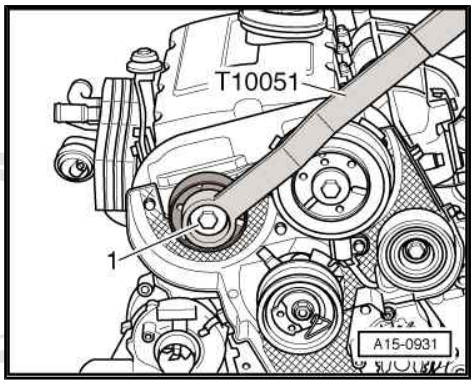
– Remove locking pins -3359- .
– Remove securing bolts -arrows- for camshaft sprockets.
– Remove the camshaft sprockets from hubs.



– Loosen securing bolt -1- for hub on inlet camshaft; use counterhold tool -T10051- .

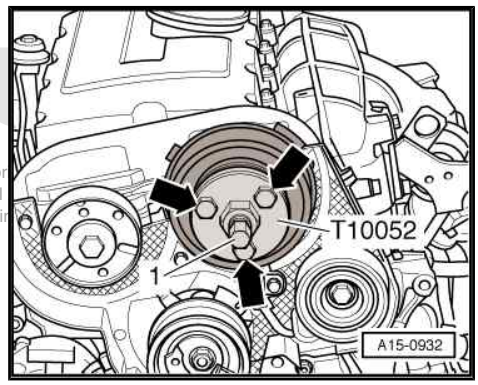


– Loosen securing bolt -1- for hub on exhaust camshaft; use counterhold tool -T10051- .
– Unscrew securing bolts of hubs approx. 2 turns.

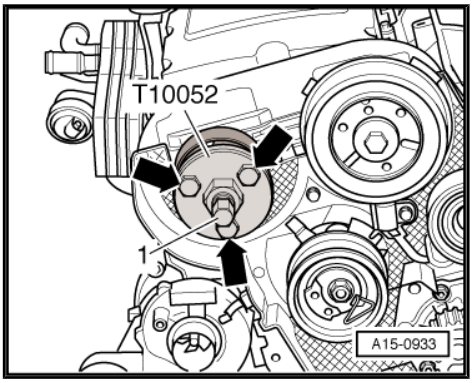


– Fit puller -T10052- on hub of inlet camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.

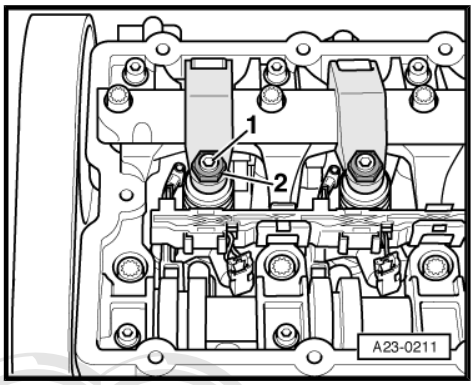
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– Fit puller -T10052- on hub of exhaust camshaft and screw bolts -arrows- into hub.
– Remove hub by screwing in bolt -1- while counterholding at hexagon flats (30 mm) of puller.
– Remove cylinder head cover: vehicles with engine codes AZV, BKD ⇒ page 157 , vehicles with engine codes BMN, BUY ⇒ page 160 .



– Loosen the lock nuts -2- of the adjuster screws -1- on all unit injectors.
– Unscrew the adjuster screws until each rocker arm touches the tappet spring of the unit injector.

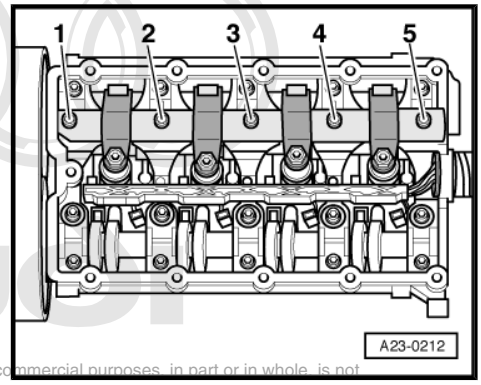


– Remove bolts -1-, -3- and -5-.
– Unscrew bolts -2- and -4- alternately in several stages.

Note

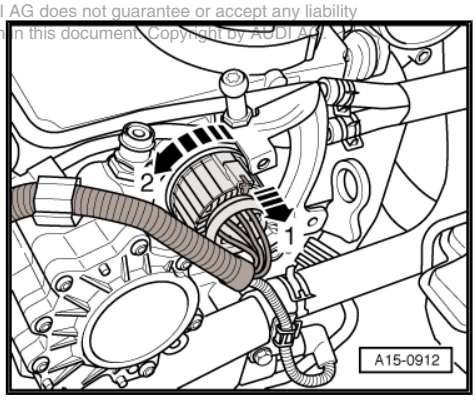
Do not pull bolts out of rocker arm shaft so that components remain attached to shaft. If necessary mark position on rocker arm.

– Detach rocker arm shaft.

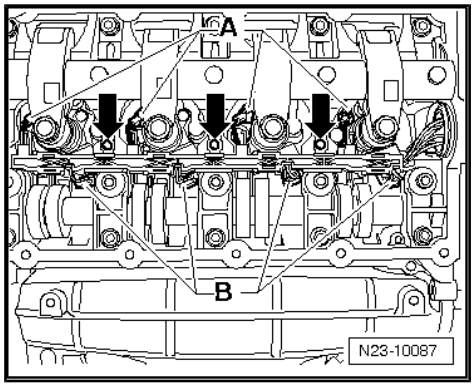


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– Pull the release pin -arrow 1- and unscrew knurled nut -arrow 2-.
– Detach main connector for unit injectors and glow plugs.



– Detach electrical connectors from glow plugs -A- and from unit injectors -B-.

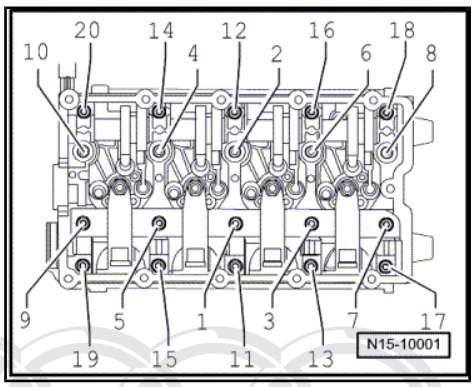


Caution

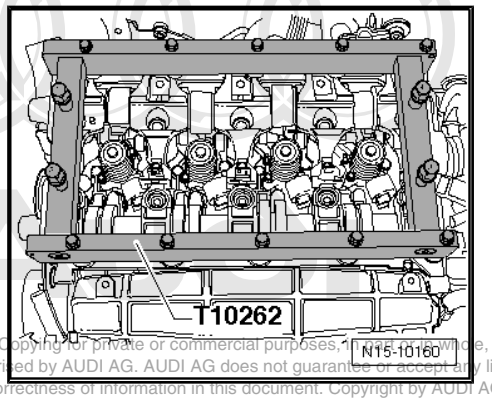
Only slacken or tighten the bolts at the retaining clips when removing the electrical wiring harness. If the electrical wiring harness is released at the retaining clips, the clips will become bent and this may lead to a break in the wiring because of the increased amount of play.

– Remove bolts -arrows- at retaining clips and move entire electrical wiring harness clear to one side.

– Unscrew remaining 15 bolts for bearing frame evenly, working from the outside inwards.



– Unscrew the 15 mm pressing-out bolts on the rack -T10262- anti-clockwise by hand as far as the stop.
– Position the rack -T10262- on the bearing frame as illustrated and tighten the 10 mm securing bolts to 10 Nm.
– Screw in the pressing-out bolts clockwise by hand until they make contact with the cylinder head bolts.
– Now tighten the pressing-out bolts evenly in the sequence 1 ... 4 (numbers are inscribed on the bolt heads) until the bearing frame detaches from the cylinder head.
– Remove the bearing frame.



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Note

Mark allocation of camshaft bearing shells on rear with a waterproof felt-tip pen.

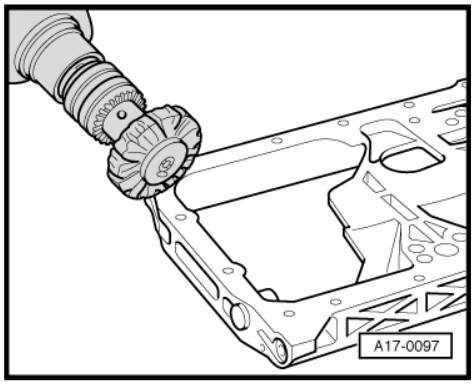
– Take out camshafts.

Installing

WARNING

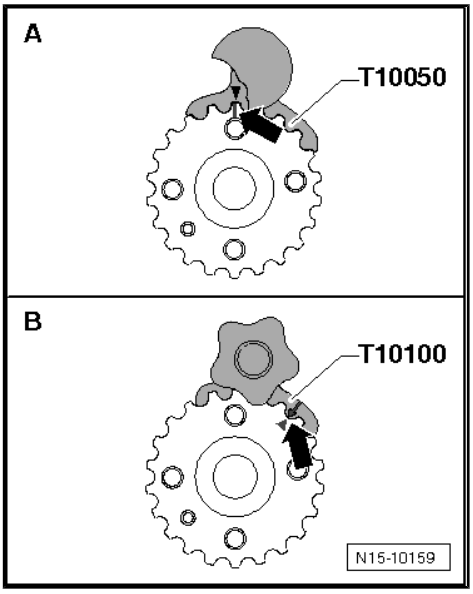
Wear safety goggles.

– Remove sealant residue from bearing frame and cylinder block with rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.



– Check whether the crankshaft is positioned at TDC.

• The crankshaft sprocket must be locked at cylinder 1 TDC using crankshaft stop -T10050- for engines with circular crankshaft sprocket, or crankshaft stop -T10100- for engines with oval crankshaft sprocket.



Note

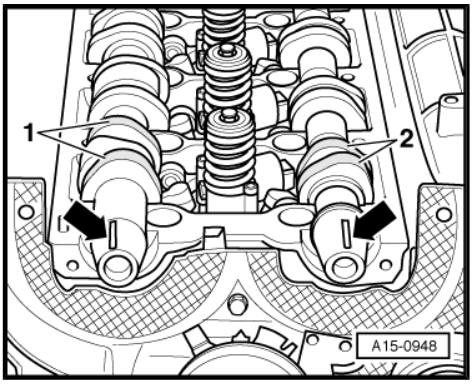
- *Make sure that the camshaft bearing shells are not interchanged.*
- *When installing the camshaft, make sure that the retaining lugs on the bearing shells are correctly seated in the bearing caps and the cylinder head.*

– Lubricate running surfaces of camshafts.

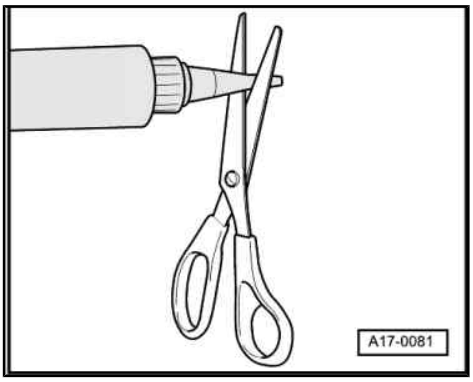
– Install camshafts in TDC position for cylinder 1:

• On both camshafts, the cams -1- and -2- for cylinder 1 must face upwards.

• The grooves -arrows- also face upwards.



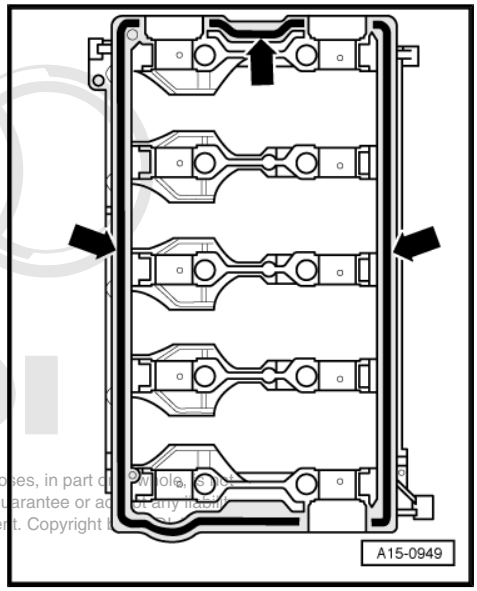
– Cut off tube nozzle at front marking (nozzle approx. 2 mm ∅).



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– Apply sealant onto the clean sealing surfaces of the bearing frame -arrows-.

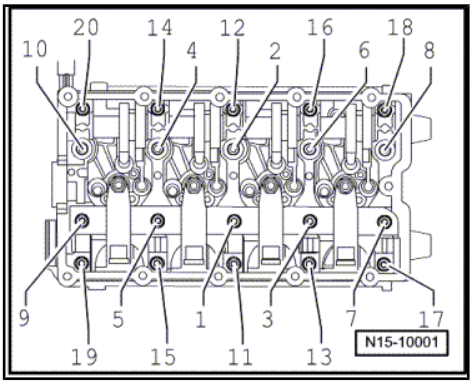
• Width of sealant bead: 2 mm.



Note

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

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– Tighten the bolts -1 ... 20- evenly from the inside outwards.
– Turn bolts -1-, -3-, -5-, -7- and -9- of rocker arm shaft 90° (1/4 turn) further.
– Connect main connector for unit injectors and glow plugs.

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

– Install oil seals for camshafts ⇒ page 207 .
– Install toothed belt (adjust valve timing): vehicles with small engine support ⇒ page 111 , vehicles with large engine support ⇒ page 123
– Install vibration damper ⇒ page 89 .
– Install poly V-belt ⇒ page 86 .
– Install tandem pump ⇒ Rep. Gr. 20 .
– Adjust unit injectors ⇒ Rep. Gr. 23 .
– Install cylinder head cover: vehicles with engine codes AZV, BKD ⇒ page 157 , vehicles with engine codes BMN, BUY ⇒ page 160 .

Note

- *After installing camshafts, wait for approx. 30 minutes before starting engine. 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 frame to cylinder head	20
Rocker arm shaft to cylinder head	20 + 90° 1)2)
Hub to camshaft	100

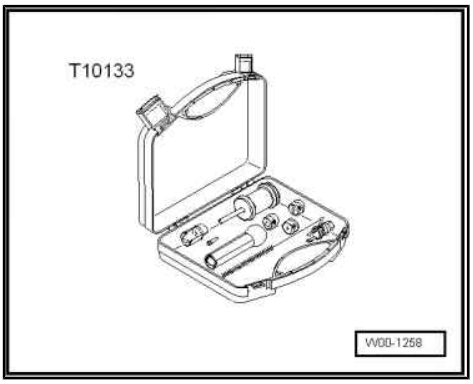
- 1) Renew bolts.
- 2) 90° = one quarter turn.

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3.5 Removing and installing roller rocker fingers

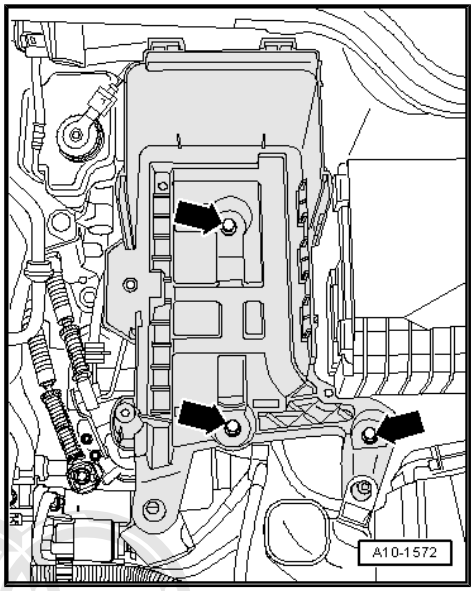
Special tools and workshop equipment required

- Tool set for FSI engines -T10133-

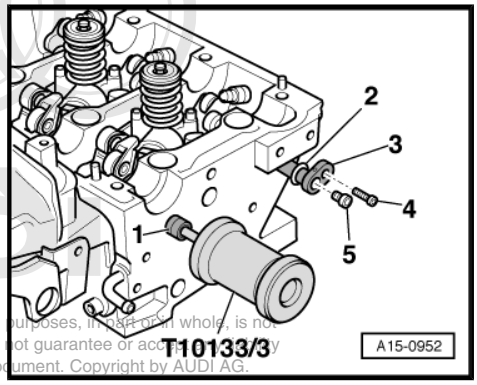


Removing

– Remove battery ⇒ Rep. Gr. 27 .
– Remove battery tray -arrows-.
– Remove camshafts ⇒ page 210 .



– To aid assembly, mark the allocation of the roller rocker fingers and the shafts for the fingers.
– Pull shaft for roller rocker fingers -1- (inlet side) out of cylinder head using puller -T10133/3- .
– Remove roller rocker fingers.
– Remove bolts -4- and -5-.
– Pull the shaft -3- for the roller rocker fingers (exhaust side) out of cylinder head.



Installing

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

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Note

Fit new O-ring -2-.

– Lubricate the bearings of the roller rocker fingers before installing.
– Install camshafts ⇒ page 210 .
– Install battery ⇒ Rep. Gr. 27 .

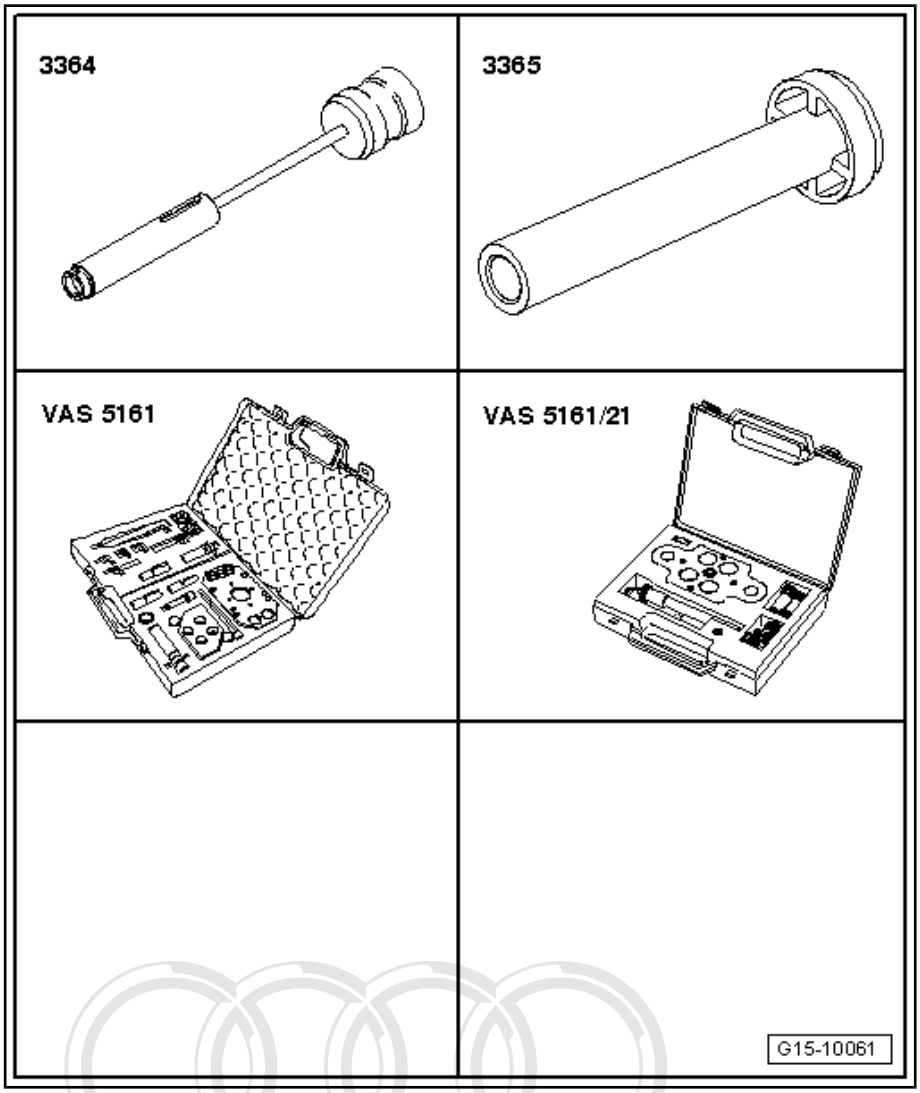
Tightening torques

Component	Nm
Shaft for roller rocker fingers to cylinder head	10
Screw plug for shaft (for roller rocker fingers) to cylinder head	10 1)
• 1) Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue for locking fluid.	

3.6 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters - VAS 5161-
- Guide plate for 2.0 ltr. TDI engine -VAS 5161/21-



Procedure

– Remove camshafts ⇒ page 210 .

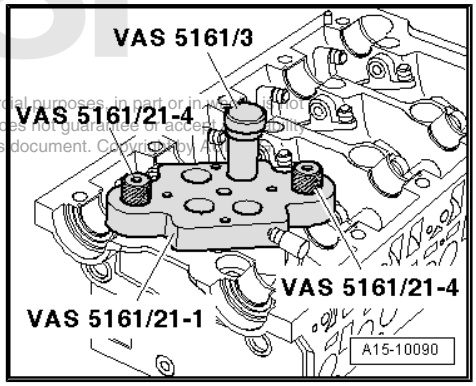
– Remove unit injectors ⇒ Rep. Gr. 23 .

– Set piston of the respective cylinder to “bottom dead centre”.

– Fit guide plate -VAS 5161/21-1- onto cylinder head.

– Secure guide plate using the knurled screws -VAS 5161/21-4- .

– Insert drift -VAS 5161/3- into guide plate and knock valve cotters loose using a plastic hammer.



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– Screw adapter -VAS 5161/21-2- finger-tight into guide plate.

– Secure snap-in device -VAS 5161/6- with engaging forks -VAS 5161/5- to cylinder head.

– Slide knurled spacer ring -VAS 5161/21-5- onto assembly cartridge -VAS 5161/8- .

– Insert assembly cartridge into guide plate.

– With cylinder head installed, connect the adapter -VAS 5161/21-2- to compressed air line using a commercially available connection piece, and apply constant air pressure.

• Air pressure: at least 6 bar

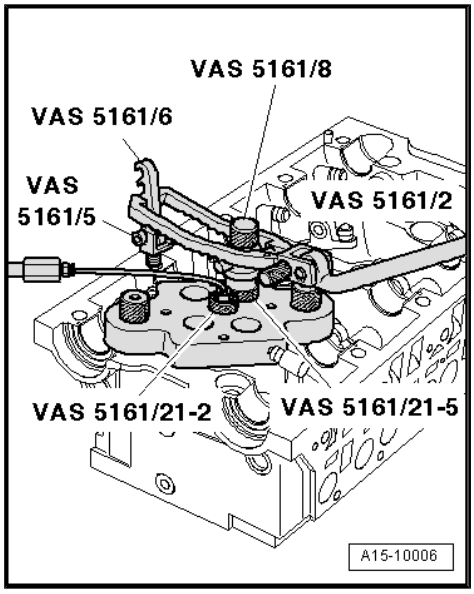
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.

– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.

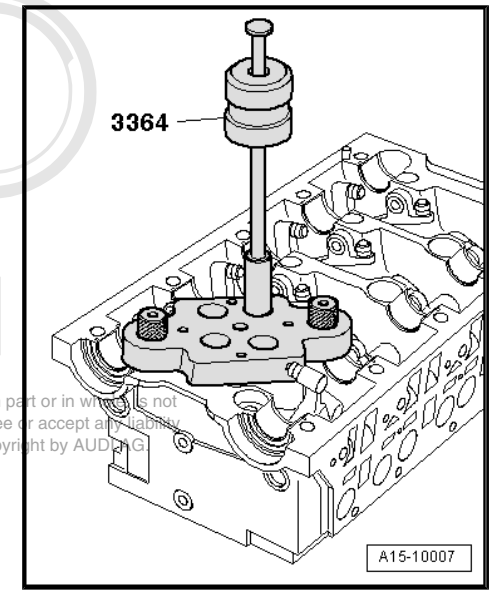
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.

– Release the pressure fork.

– Take out assembly cartridge with knurled spacer ring, valve spring plate and valve spring.



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



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Note

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

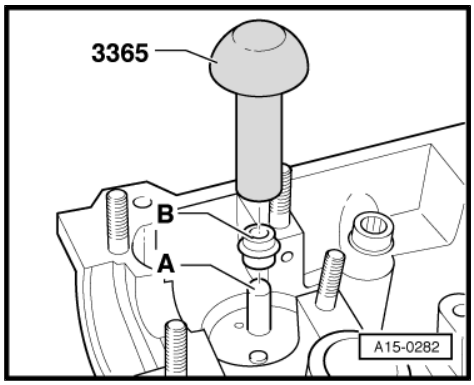
– Fit plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.

– Lightly lubricate sealing lip of valve stem oil seal.

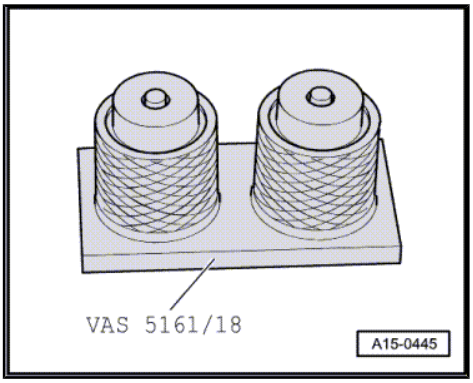
– Slip valve stem oil seal over plastic sleeve.

– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .

– Remove plastic sleeve.



– If valve cotters have been removed from assembly cartridge - VAS 5161/8- , they need to be put into insertion device for valve cotters -VAS 5161/18- first.



Note

Larger diameter of valve cotters faces upwards.

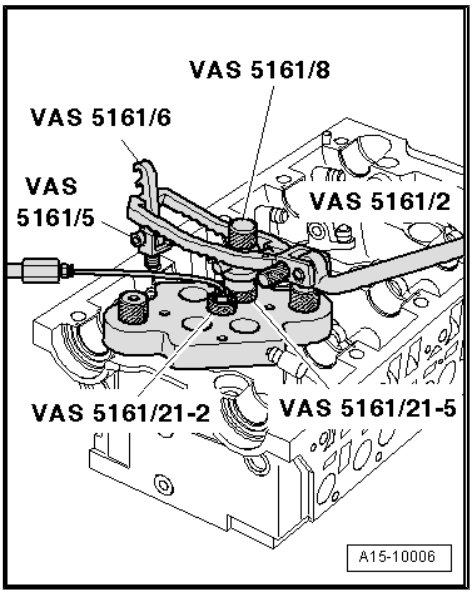
– Press assembly cartridge onto insertion device from above and take up valve cotters.

– Insert assembly cartridge into guide plate.

– Press down pressure fork and pull up knurled screw, thus inserting the valve cotters.

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

– Repeat procedure for each valve.



Assembling

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

– Install unit injectors ⇒ Rep. Gr. 23 .

– Install camshafts ⇒ page 210 .

Note

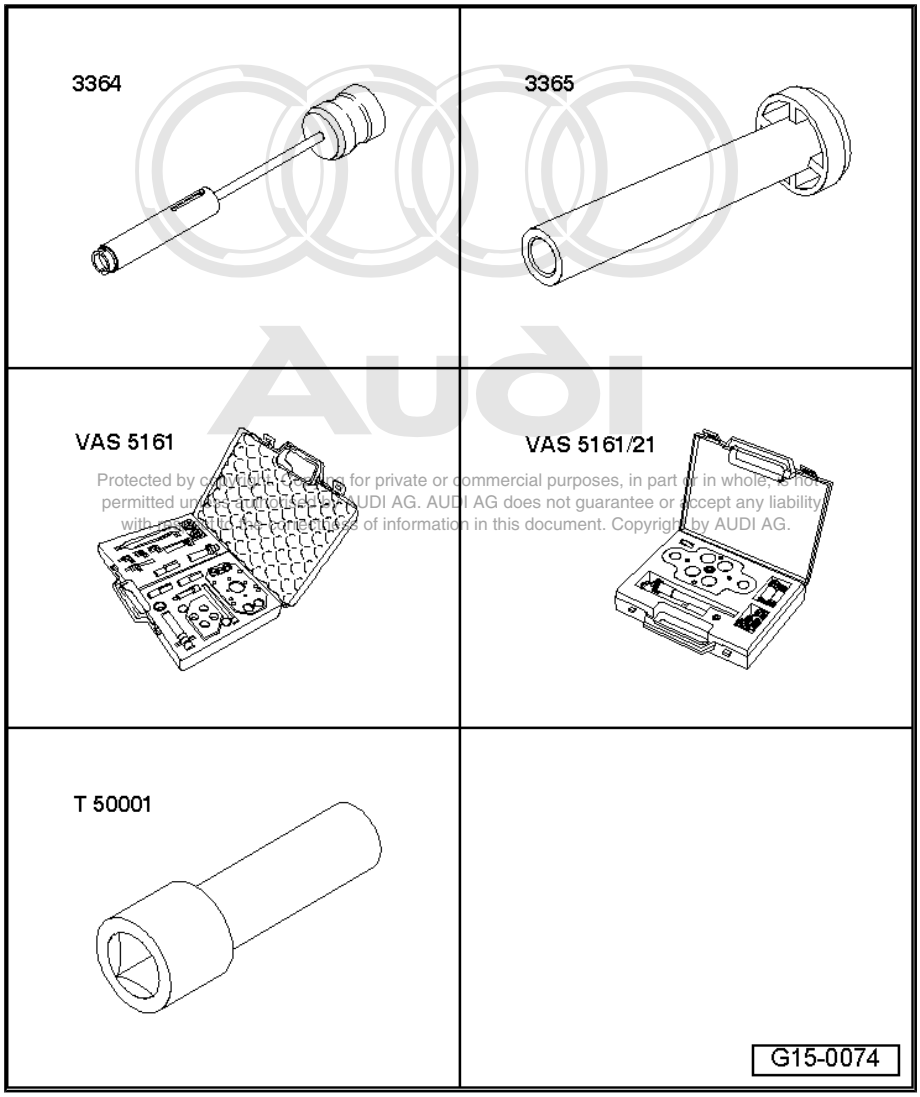
- *Engine is not to be rotated for approx. 30 minutes after installing camshafts. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

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3.7 Renewing valve stem oil seals with cylinder head removed

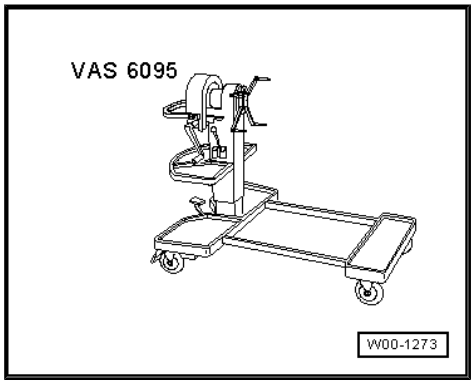
Special tools and workshop equipment required

- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters - VAS 5161-
- Guide plate for 2.0 ltr. TDI engine -VAS 5161/21-
- Socket -T50001-



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- Engine and gearbox support -VAS 6095-



- Cylinder head tensioning device -VAS 6419-

Handling ceramic glow plugs:

The Audi A3 with 4-cylinder 2.0 ltr. 4-valve TDI engine with particulate filter is equipped exclusively with NGK ceramic glow plugs.

Note

NGK ceramic glow plugs are colour-coded with a white, or possibly "silver-coloured" seal.

Caution

Important: Always observe the special instructions for 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).***

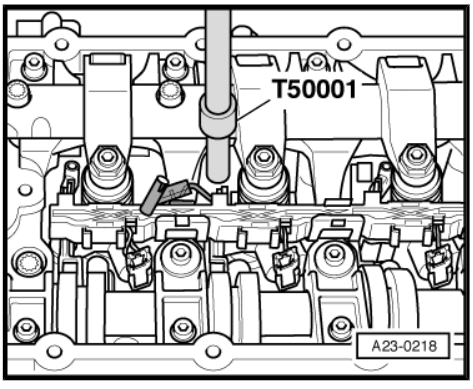
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Procedure

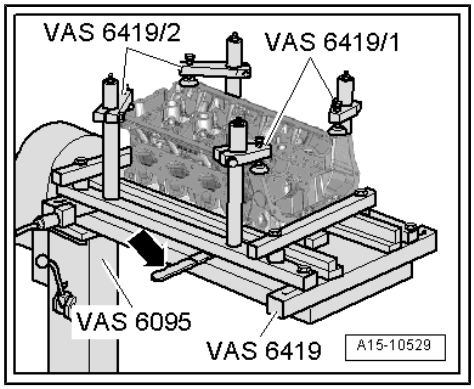
– Remove camshafts ⇒ page 210 .

– Remove unit injectors ⇒ Rep. Gr. 23 .

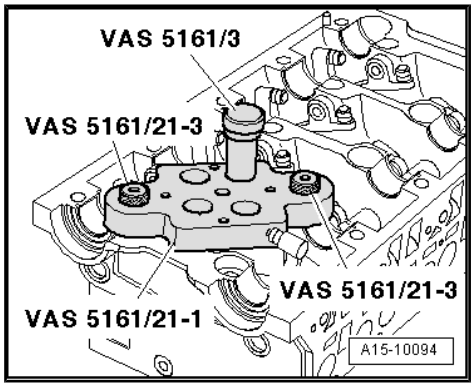
– Remove glow plugs using socket -T50001- .



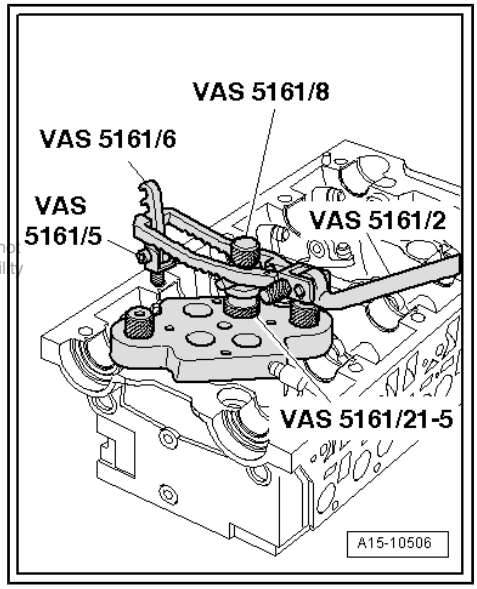
– Attach tensioning device -VAS 6419- to engine and gearbox support -VAS 6095- .
– Secure cylinder head in tensioning device -VAS 6419- as illustrated.
– Connect compressed air line to tensioning device -VAS 6419- .
– Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal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



– Fit guide plate -VAS 5161/21-1- onto cylinder head.
– Secure guide plate using the knurled screws - VAS 5161/21-3- .
– Insert drift -VAS 5161/3- into guide plate and knock valve cotters loose using a plastic hammer.

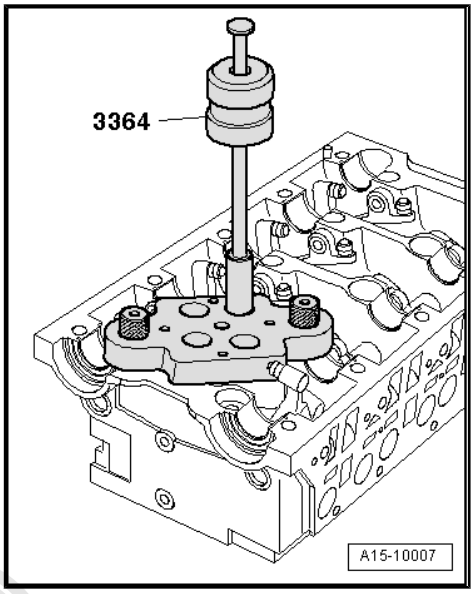


– Secure snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- to cylinder head.
– Slide knurled spacer ring -VAS 5161/21-5- onto assembly cartridge -VAS 5161/8- .
– Insert assembly cartridge into guide plate.
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
– Release the pressure fork.
– Take off assembly cartridge with knurled spacer ring.
– Remove valve spring plate and valve spring.



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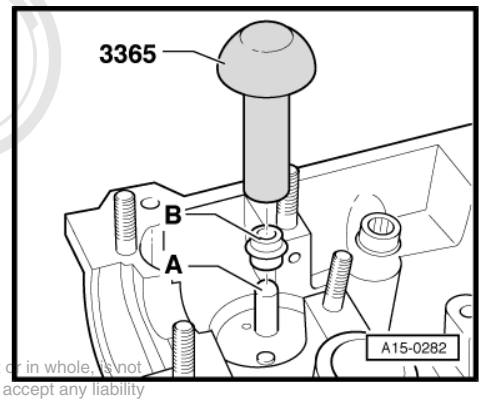
– Remove valve stem oil seals using the valve stem seal puller -3364- .



Note

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

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



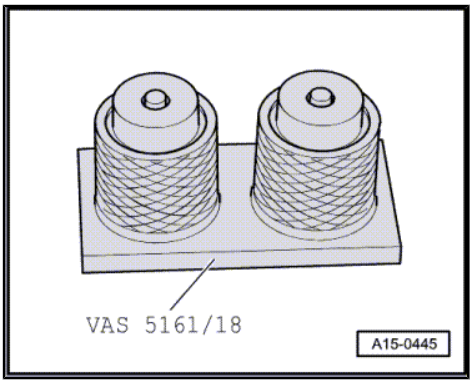
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– If valve cotters have been removed from assembly cartridge - VAS 5161/8- , they need to be put into insertion device - VAS 5161/18- first.

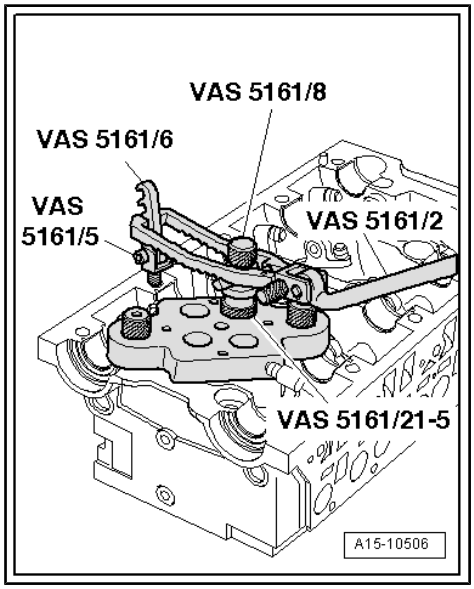
Note

Larger diameter of valve cotters faces upwards.

– Press assembly cartridge onto insertion device from above and take up valve cotters.
– Insert valve spring and valve spring plate.



– Insert assembly cartridge into guide plate.
– Press down pressure fork and pull up knurled screw, thus inserting the valve cotters.
– Release pressure fork with knurled screw still in pulled position.
– Repeat procedure for each valve.



Assembling

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

– Install unit injectors ⇒ Rep. Gr. 23 .
– Install camshafts ⇒ page 210 .
– Install glow plugs ⇒ Rep. Gr. 28 .

3.8 Checking hydraulic tappets

Special tools and workshop equipment required

♦ Feeler gauge

Note

♦ *The hydraulic tappets that are pressed into the roller rocker fingers cannot be serviced.*
♦ *Irregular valve noises when starting engine are normal.*

Procedure

– Start engine and let it run until the radiator fan has switched on once.
– Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).

Note

If the irregular valve 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 236) . 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 157 .
– Rotate crankshaft until cam of hydraulic tappet to be checked faces upwards. Procedure on

♦ Vehicles with manual gearbox: push vehicle forwards with 4th gear engaged and ignition switched off.
♦ Vehicles with direct shift gearbox: remove noise insulation, lever off cover cap from vibration damper and rotate crankshaft in clockwise direction via central bolt for vibration damper.

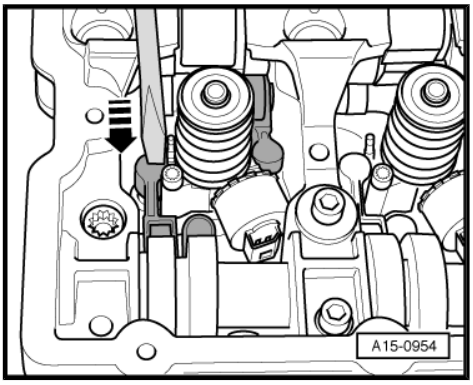
– Determine clearance between cam and roller rocker finger.

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– Press roller rocker finger down -arrow- using a screwdriver.

If it is possible to insert a feeler gauge of 0.20 mm between camshaft and roller rocker finger:

– Renew hydraulic tappet; to do so, remove roller rocker finger ⇒ page 217 .

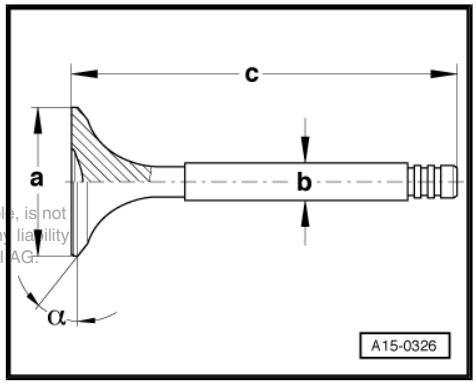


Note

- *After installing camshafts, wait for approx. 30 minutes before starting engine. 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
∅ a	mm	29.40	25.50
∅ b	mm	5.980	5.965
c	mm	88.50	88.20
α	°	45	45



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Note

Valves are not to be machined. Only grinding is permitted.

3.10 Machining valve seats

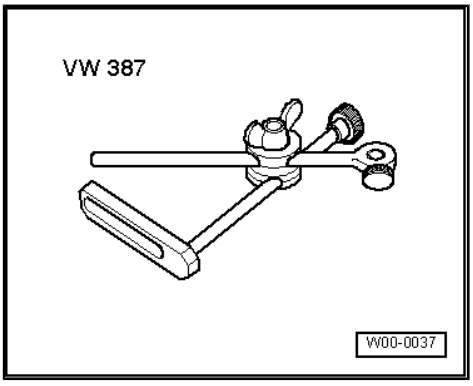
Note

Valve seats may not be machined due to the very small tolerances.

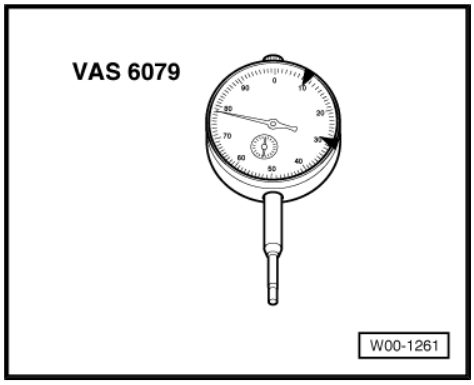
3.11 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-



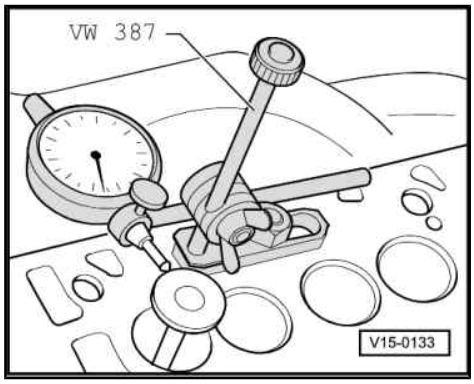
Procedure

– Insert valve into valve guide.

• End of valve stem must be flush with guide.

– Determine amount of sideways play.

• Wear limit: 0.8 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.*

3.12 Checking valves

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

If scoring is clearly visible:

– Renew the relevant valve.

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17 – Lubrication

1 Removing and installing parts of lubrication system

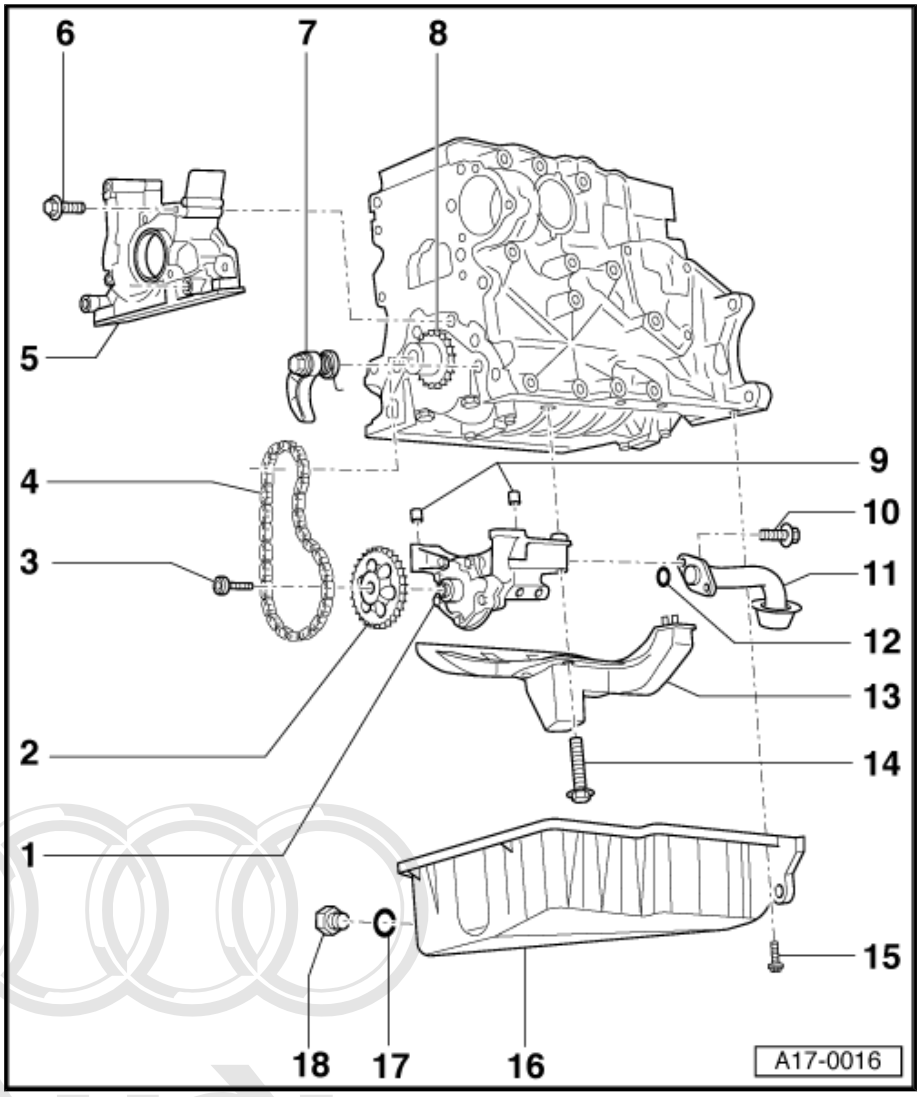
Note

- *If large quantities of metal particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler renewed in order to prevent further damage.*
- *The oil level must not be above the max. mark – otherwise the catalytic converter can be damaged.*
- *Oil spray jet and pressure relief valve ⇒ page 231 .*
- *Removing and installing oil level and oil temperature sender - G266- ⇒ page 231 .*

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

1.1 Sump, oil pump - exploded view

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1 - Oil pump

- ❑ With pressure relief valve (12 bar)
- ❑ Removing and installing ⇒ page 235
- ❑ Before installing, check that the two dowel sleeves -item 9- 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° (1/4 turn) further

- ❑ Renew

4 - Chain

- ❑ For oil pump
- ❑ Mark direction of rotation before removing
- ❑ Check for wear

5 - Sealing flange (pulley end)

- ❑ Apply sealant prior to installing ⇒ page 130
- ❑ Renewing crankshaft oil seal - pulley end ⇒ page 128

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 - Drive chain sprocket for oil pump

- ❑ Removing and installing ⇒ page 144

9 - Dowel sleeves

- ❑ 2x

10 - 15 Nm

11 - Suction pipe

- ❑ Clean strainer if dirty

12 - O-ring

- ❑ Renew

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13 - Baffle plate

14 - 16 Nm

15 - 15 Nm

16 - Sump

- ❑ Removing and installing ⇒ page 231

17 - Seal

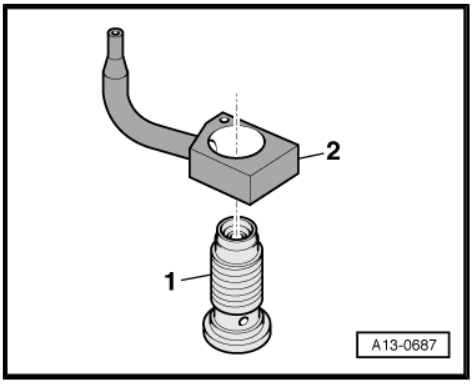
- ❑ Renew

18 - Oil drain plug, 30 Nm

Oil spray jet and pressure relief valve

1 - Bolt with pressure relief valve, 27 Nm

2 - Oil spray jet (for cooling of pistons)



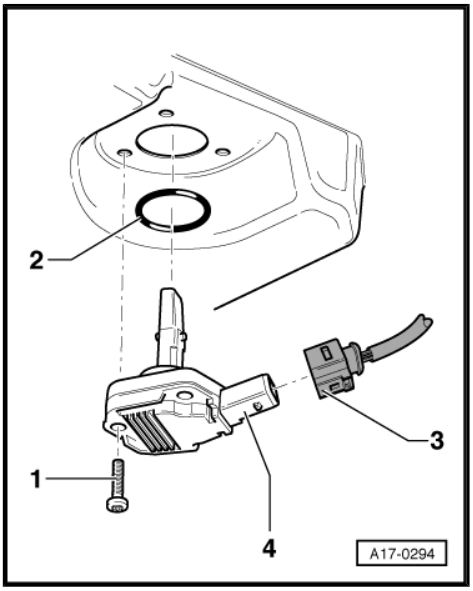
Removing and installing oil level and oil temperature sender - G266-

1 - Bolt, 10 Nm (self-locking); renew

2 - Seal; renew

3 - Electrical connector

4 - Oil level and oil temperature sender -G266-

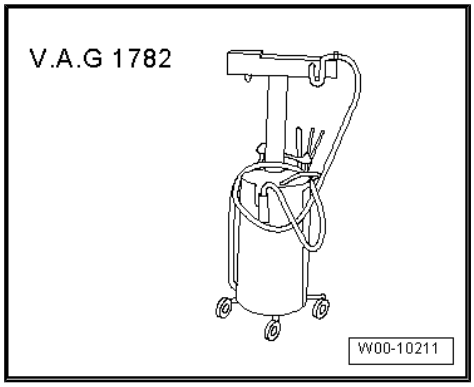


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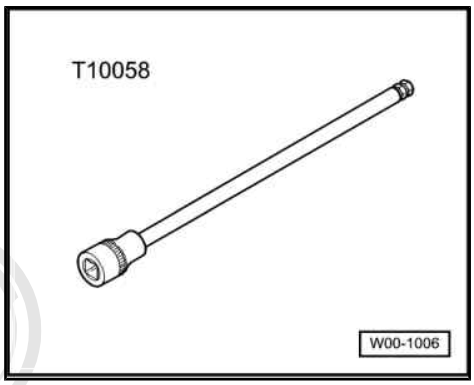
1.2 Removing and installing sump

Special tools and workshop equipment required

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



♦ Allen key (long reach) -T10058-



♦ Electric drill with plastic brush attachment

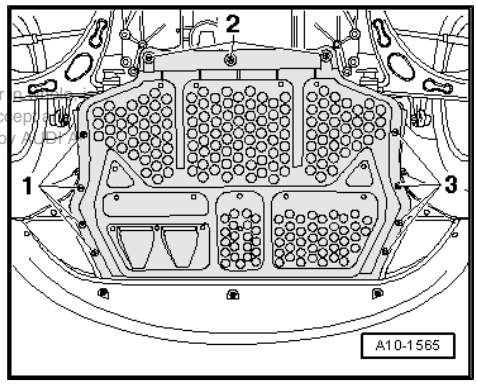
♦ Sealant ⇒ Electronic parts catalogue

♦ Safety goggles

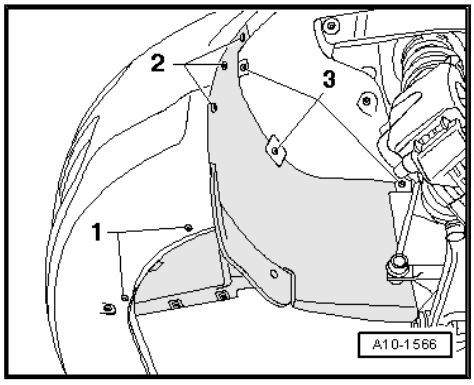
Removing

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

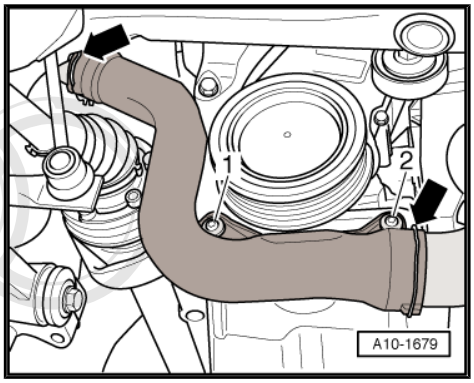
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– Remove noise insulation (right-side) -fasteners 1 ... 3-.

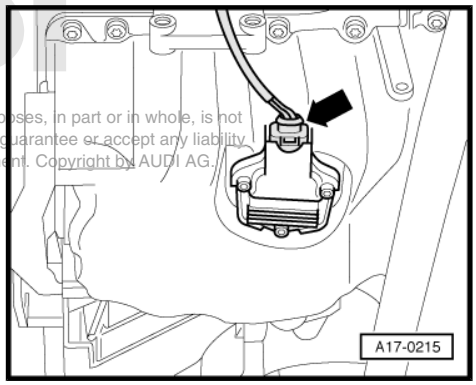


– Remove bolts -1- and -2-.
– Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.

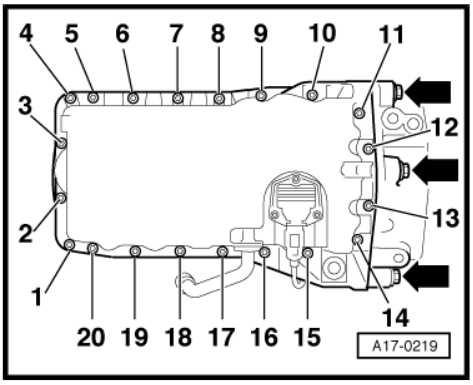


– Unplug electrical connector at oil level and oil temperature sender -G266- -arrow-.
– Place used oil collection and extraction unit -V.A.G 1782- under engine and drain engine oil.

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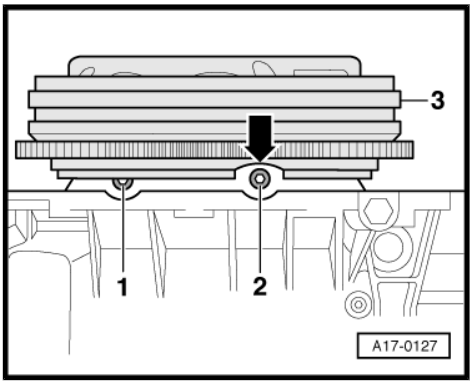
– Unscrew sump/gearbox bolts -arrows-.
– Slacken bolts -1 ... 20- in diagonal sequence and remove.



Note

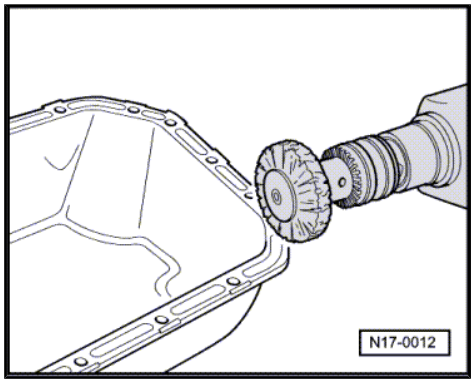
- *The two rear sump bolts -1- and -2- are accessible via the recess -arrow- on the flywheel -3- (turn the flywheel as required).*
- *The bolts can be unscrewed using Allen key (long reach) - T10058- .*

– Take off sump; if necessary loosen it by striking lightly with a rubber hammer.



Installing

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



Note

Renew seal.

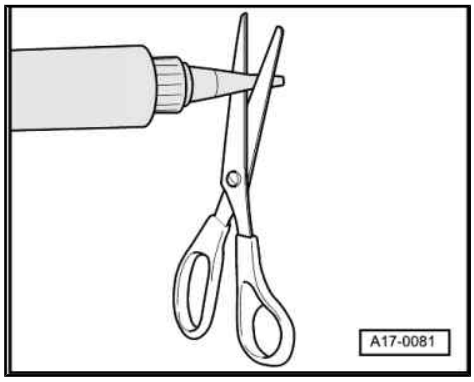
WARNING

Wear safety goggles.

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

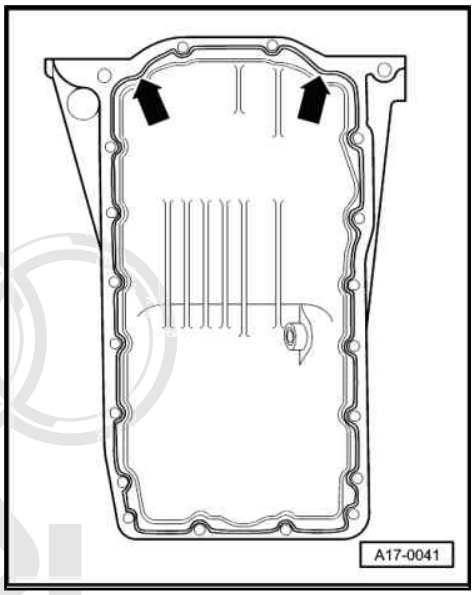
– Clean sealing surfaces; they must be free of oil and grease.

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



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

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

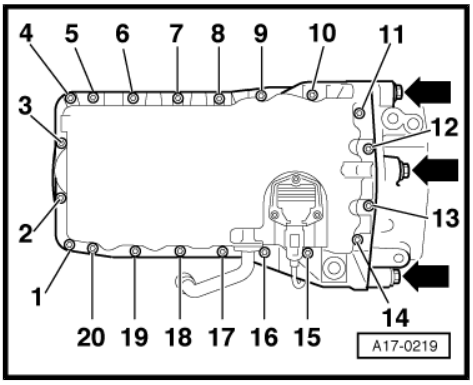


Note

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

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– Immediately install sump and tighten bolts in the following sequence:
– Pre-tighten bolts -1 ... 20- in diagonal sequence to 5 Nm.
– Tighten sump/gearbox bolts -arrows- to 40 Nm.
– Tighten bolts -1 ... 20- in diagonal sequence to 15 Nm.



Note

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

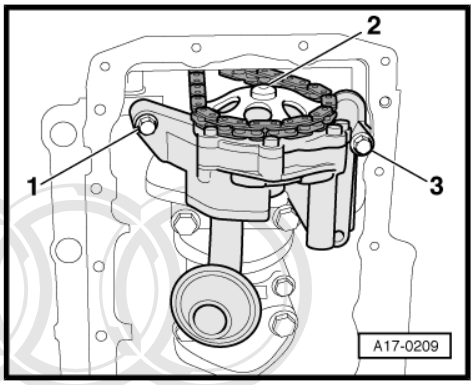
– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .
– Fill up with engine oil and check oil level ⇒ page 244 .

Tightening torques

Component	Nm
Sump to cylinder block	15
Sump to gearbox	40
Oil drain plug	30

1.3 Removing and installing oil pump

Removing



– Remove sump and baffle plate ⇒ page 231 .
– 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:

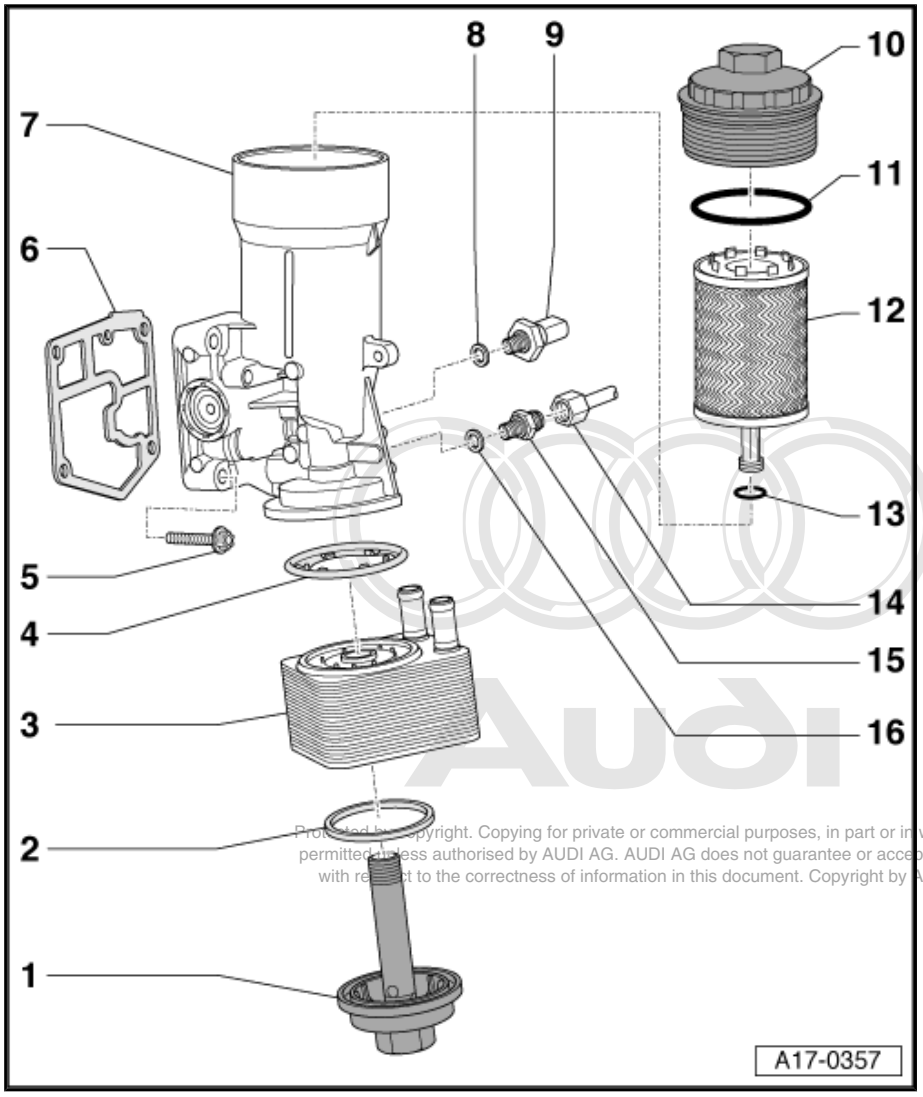
– Insert dowel sleeves ⇒ Item 9 (page 230) at top of oil pump.
• Chain sprocket can only be fitted in one position on oil pump shaft.
– Install sump ⇒ page 231 .

Tightening torques

Component	Nm
Chain sprocket to oil pump shaft	20 + 90° 1)2)
Oil pump to cylinder block	16
• 1) Renew bolts. • 2) 90° = one quarter turn.	

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1.4 Oil filter bracket with oil cooler - exploded view



1 - Screw plug, 25 Nm

2 - Seal

- ❑ Renew

3 - Oil cooler

- ❑ See note ⇒ page 229
- ❑ Connection diagram for coolant hoses: vehicles with manual gearbox ⇒ page 245 , vehicles with direct shift gearbox ⇒ page 246

4 - Seal

- ❑ Renew
- ❑ Installation position ⇒ page 237

5 - 14 Nm + 90° (1/4 turn) further

- ❑ Renew
- ❑ Tighten in diagonal sequence

6 - Gasket

- ❑ Renew

7 - Oil filter bracket

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

8 - Seal

- ❑ Renew

9 - Oil pressure switch -F1-

- ❑ 0.7 bar - brown
- ❑ Checking ⇒ page 241
- ❑ 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

- ❑ Renew

14 - Oil supply pipe

- ❑ Tighten to 22 Nm
- ❑ To turbocharger
- ❑ Note installation sequence:

– First attach both ends of pipe loosely.

– Then tighten connections to final torque.

– Finally, secure bracket.

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15 - Connection

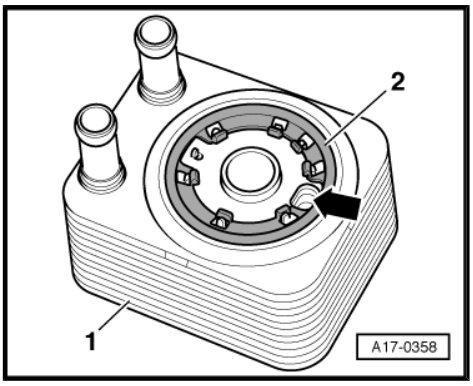
16 - Seal

❑ Renew

Installation position of seal for oil cooler

– Insert the seal -2- so that it can be attached to all tabs on the oil cooler -1-.

• The oil drilling -arrow- must not be covered by the seal.



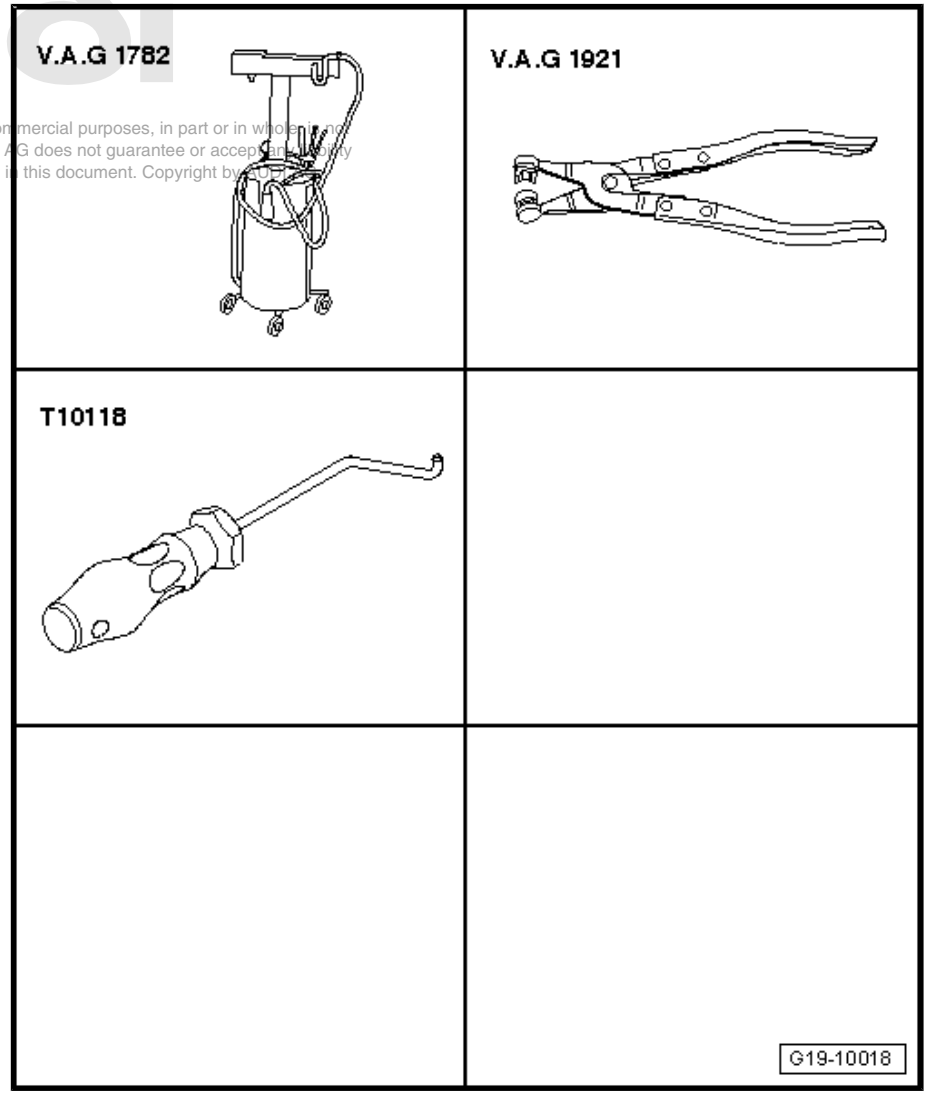
1.5 Removing and installing oil filter bracket with oil cooler

Special tools and workshop equipment required

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

♦ Hose clip pliers -V.A.G 1921-

♦ Assembly tool -T10118-



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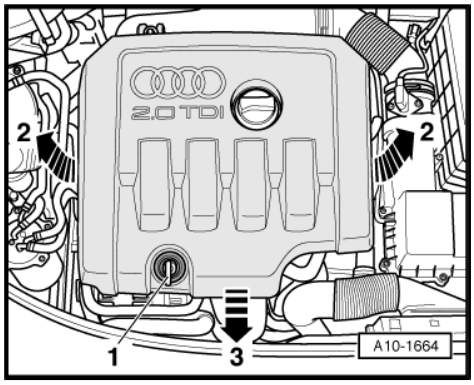
Removing

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

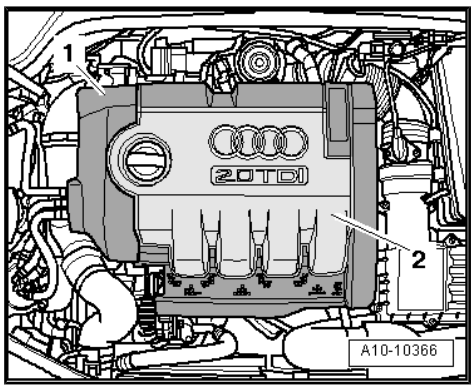
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



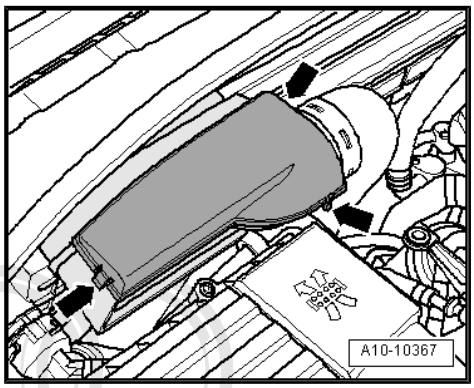
Engine cover panel (version 2):

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



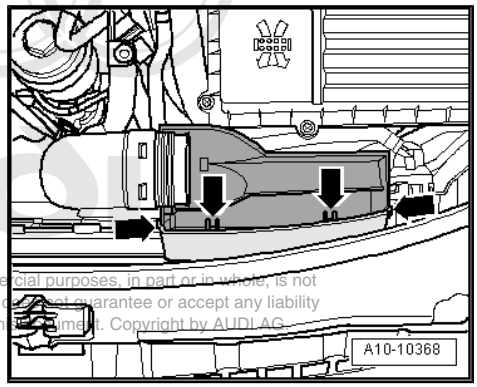
All vehicles (continued):

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



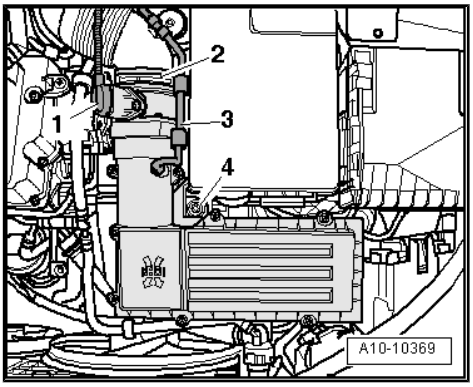
– Unclip air duct at the bottom by releasing clips -arrows-.

– Detach air duct (bottom) together with air hose.

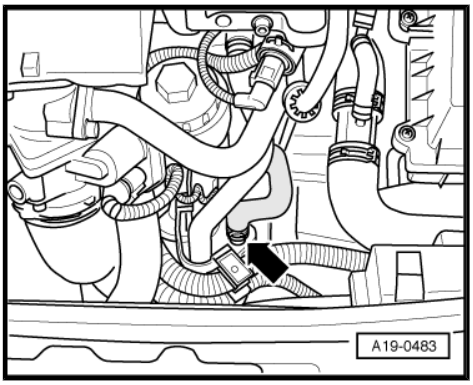


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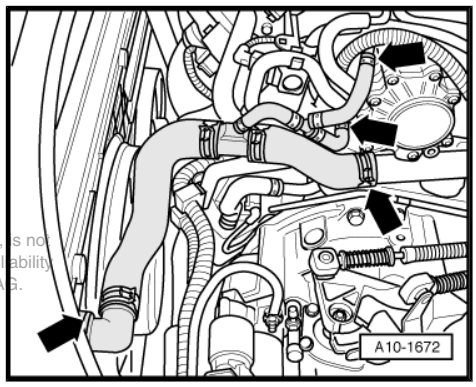
– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.
– Drain off coolant ⇒ page 248 .



– Detach coolant hose -arrow- also at cylinder block.

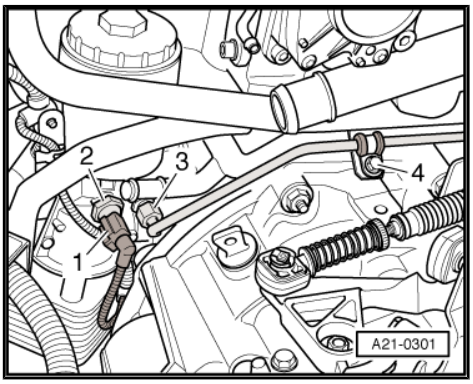


– Detach coolant hoses at the connections indicated -arrows-.

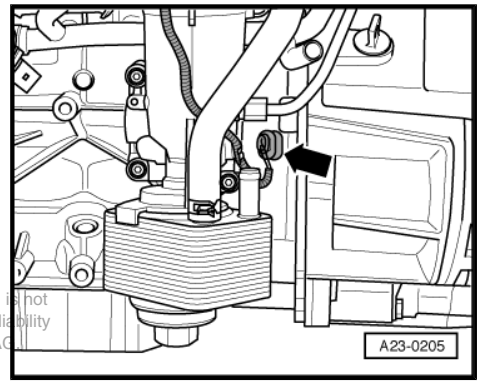


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– Unplug electrical connector -1- at oil pressure switch -F1- .
– Remove oil pressure switch -2-.
– Detach oil supply pipe at oil filter bracket -3- and at coolant pipe -4-.



– Unplug electrical connector at engine speed sender -G28- -arrow- using assembly tool -T10118- .

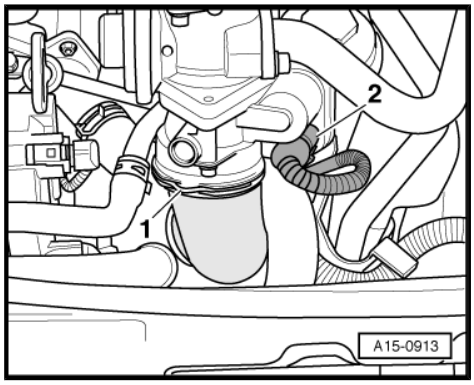


Note

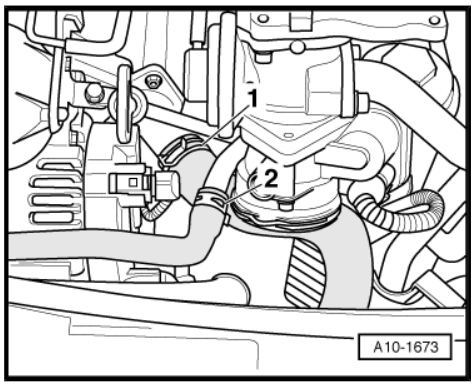
To release electrical connector without assembly tool -T10118- , press connector on engine speed sender in with a screwdriver and at the same time lift release tab with a thin wire hook.

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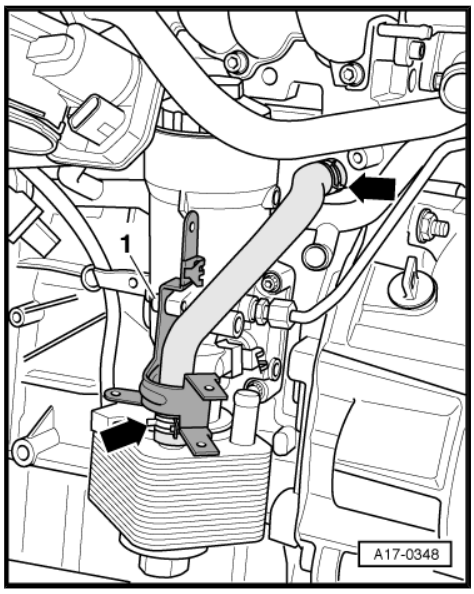
– Remove air intake hose at intake manifold flap by lifting retaining clip -1- slightly.
– Detach electrical connector -2- at intake manifold flap motor -V157- .



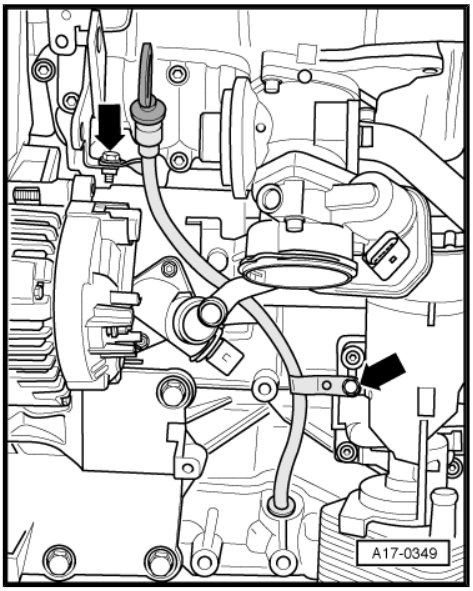
– Detach coolant hoses -1- and -2- at front of engine.



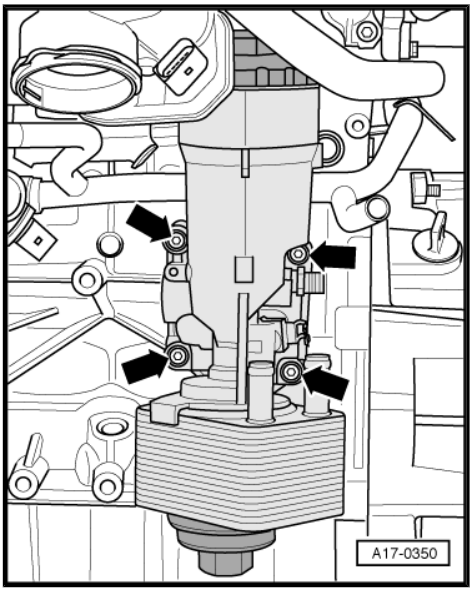
– Unscrew bolt -1- and remove bracket for wiring harness.
– Disconnect coolant hose -arrows- and remove.



– Remove bolts -arrows-.
– Pull guide tube for oil dipstick upwards out of the cylinder block and swing towards front to remove.



– Place used oil collection and extraction unit -V.A.G 1782- underneath.
– Remove bolts -arrows-.
– Remove oil filter bracket.



Installing

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

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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 .*

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .
– Fill up cooling system (or change coolant if the oil cooler has been renewed) ⇒ page 251 .
– Fill up with engine oil and check oil level ⇒ page 244 .

Tightening torques

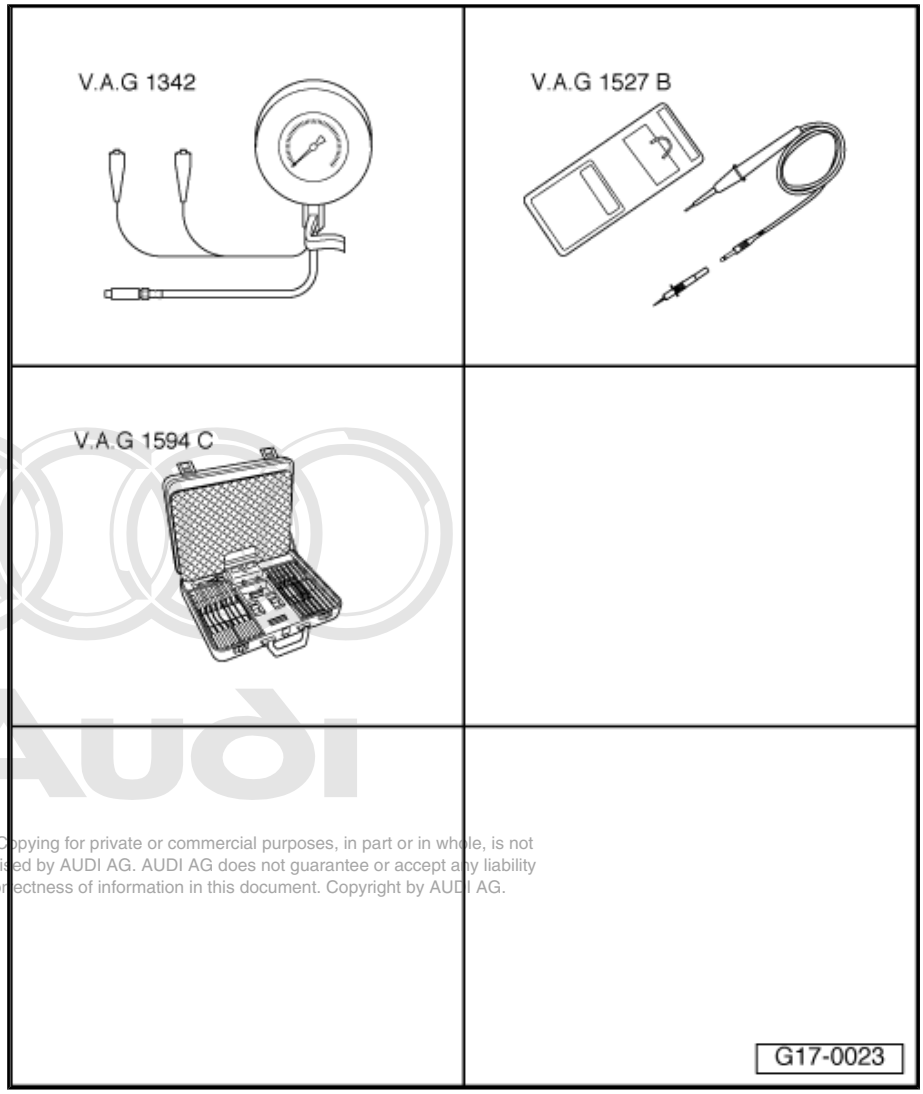
Component		Nm
Oil filter bracket to cylinder block		14 + 90° 1)2)
Guide tube for oil dipstick to:	Oil filter bracket	10
	Lifting eye	10
Bracket for wiring harness to oil filter bracket		10
Oil pressure switch to oil filter bracket		20

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

1.6 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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Procedure

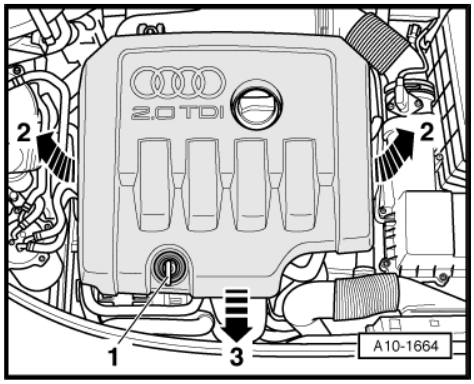
- Oil level OK
- Engine oil temperature approx. 80 °C

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

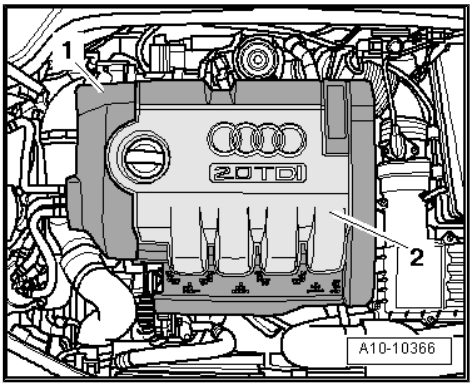
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

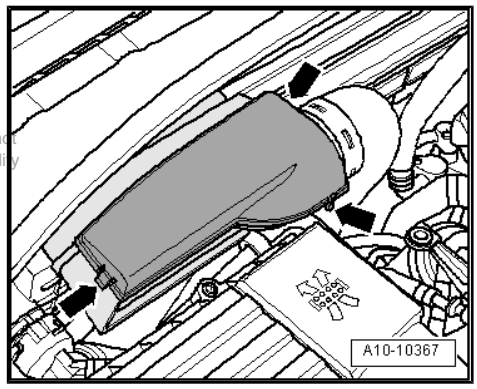
– Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



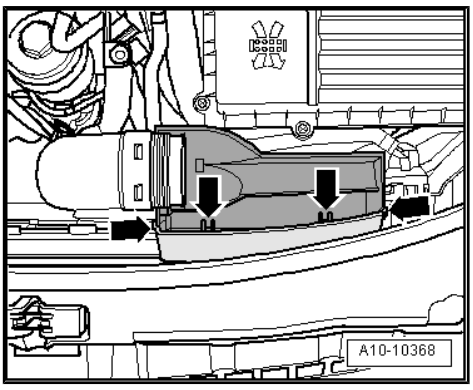
All vehicles (continued):

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

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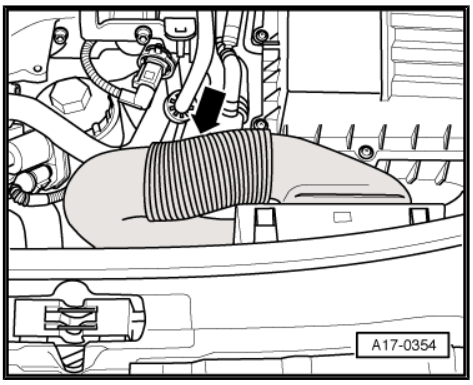


– Unclip air duct at the bottom by releasing clips -arrows-.

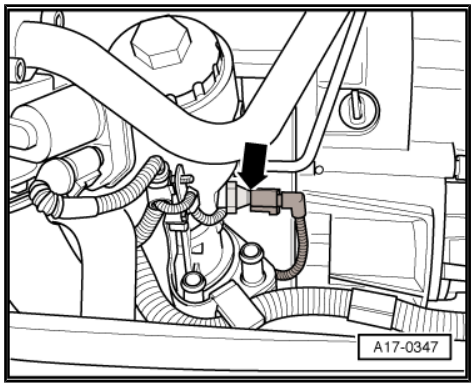


– Detach air duct (bottom) together with air hose.

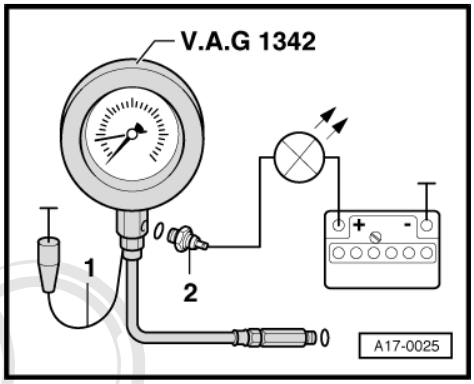
– Remove air intake hose -arrow- from between lock carrier and air cleaner housing.



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



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



Checking oil pressure switch

– Connect brown wire -1- of oil pressure tester to earth (–).
– Connect voltage tester -V.A.G 1527 B- with test leads from auxiliary measuring set -V.A.G 1594 C- to oil pressure switch and battery positive (+).

• LED should not light up.

If the LED lights up:

– 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.

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• 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 (engine oil temperature approx. 80 °C).

• Minimum oil pressure at idling speed: 0.8 bar
• Minimum oil pressure at 2000 rpm: 2.0 bar.

1.7 Engine oil

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

1.8 Checking oil level

⇒ Maintenance ; Booklet 808

19 – Cooling

1 Removing and installing parts of cooling system

WARNING

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

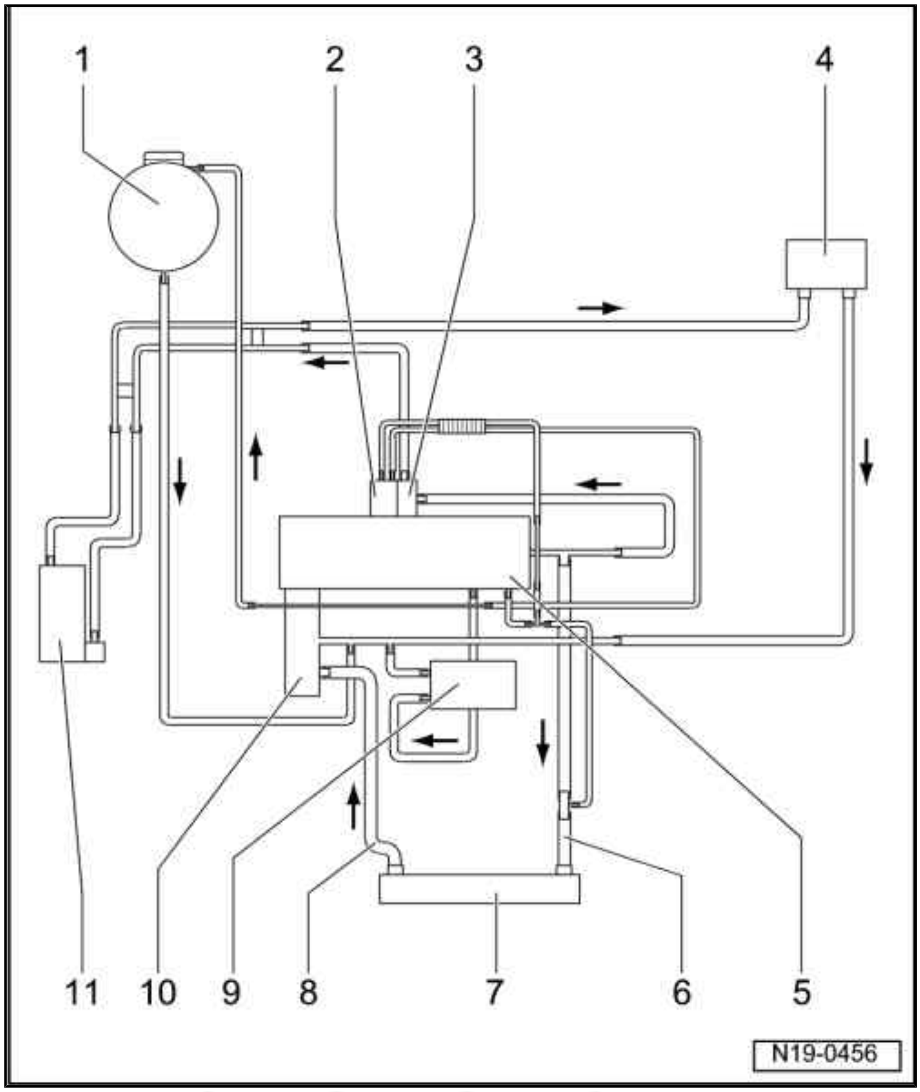
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Note

- *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

Vehicles with manual gearbox



1 - Expansion tank

- ❑ With filler cap
- ❑ Checking pressure relief valve in filler cap ⇒ page 266

2 - Change-over flap for exhaust gas recirculation cooler

Engine codes BMN, BUY:

- ❑ No separate coolant connection
- ❑ Integrated in exhaust gas recirculation cooler -item 7-

3 - Exhaust gas recirculation cooler

- ❑ If renewed, refill system with fresh coolant
- ❑ Removing and installing: vehicles with engine codes AZV, BKD ⇒ page 346 , vehicles with engine codes BMN, BUY ⇒ page 353

4 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

5 - Cylinder head/cylinder block

- ❑ If renewed, refill system with fresh coolant

6 - Coolant hose

- ❑ At top of radiator

7 - Radiator

- ❑ Removing and installing ⇒ page 259
- ❑ If renewed, refill system with fresh coolant

8 - Coolant hose

- ❑ At bottom of radiator

9 - Oil cooler

- ❑ If renewed, refill system with fresh coolant
- ❑ Removing and installing ⇒ “1.5 Removing and installing oil filter bracket with oil cooler”, page 237

10 - Coolant pump/thermostat

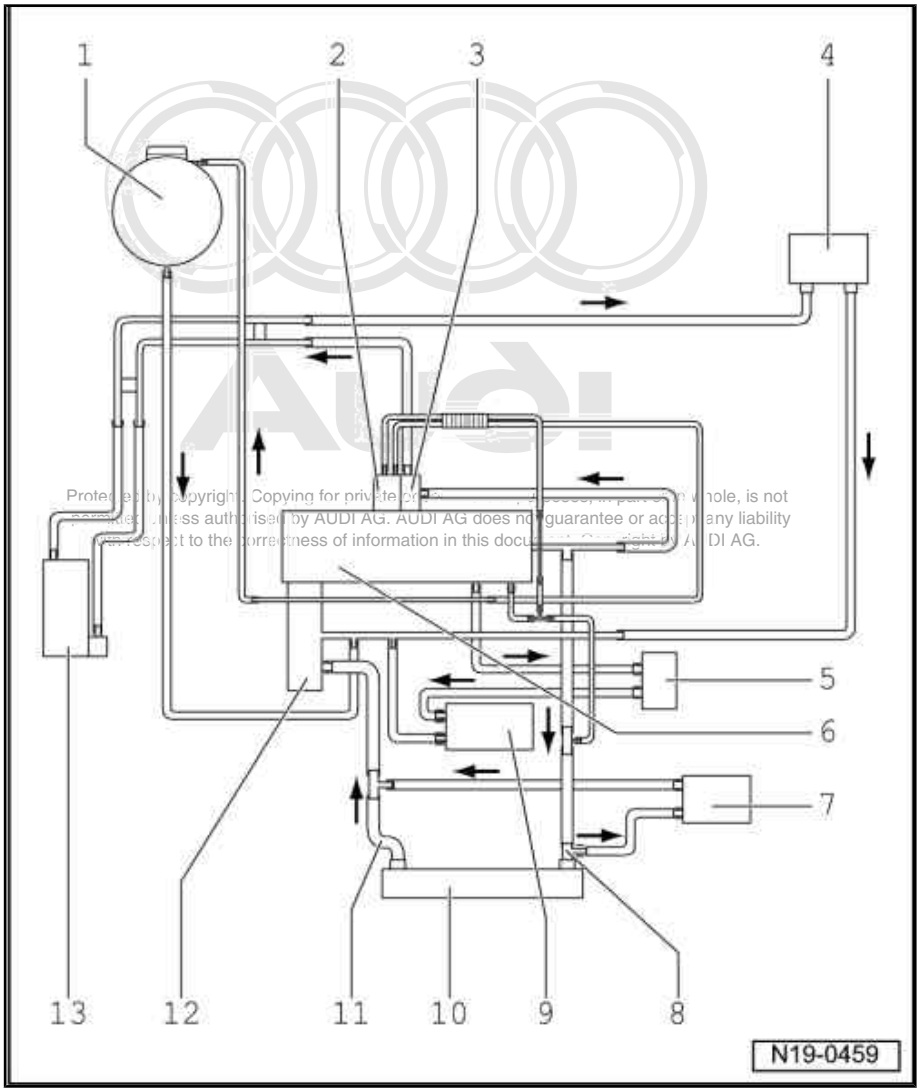
- ❑ Removing and installing coolant pump ⇒ page 254
- ❑ Removing and installing thermostat ⇒ page 254
- ❑ Checking thermostat ⇒ page 256

11 - Auxiliary heater

- ❑ Optional extra

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Vehicles with direct shift gearbox



1 - Expansion tank

- ❑ With filler cap
- ❑ Checking pressure relief valve in filler cap ⇒ page 266

2 - Change-over flap for exhaust gas recirculation cooler

Engine codes BMN, BUY:

- ❑ No separate coolant connection
- ❑ Integrated in exhaust gas recirculation cooler -item 7-

3 - Exhaust gas recirculation cooler

- ❑ If renewed, refill system with fresh coolant
- ❑ Removing and installing: vehicles with engine codes AZV, BKD ⇒ page 346 , vehicles with engine codes BMN, BUY ⇒ page 353

4 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

5 - ATF cooler

- ❑ If renewed, refill system with fresh coolant

6 - Cylinder head/cylinder block

- ❑ If renewed, refill system with fresh coolant

7 - Auxiliary radiator

- ❑ Depending on equipment

8 - Coolant hose

- ❑ At top of radiator

9 - Oil cooler

- ❑ If renewed, refill system with fresh coolant
- ❑ Removing and installing ⇒ “1.5 Removing and installing oil filter bracket with oil cooler”, page 237

10 - Radiator

- ❑ Removing and installing ⇒ page 259
- ❑ If renewed, refill system with fresh coolant

11 - Coolant hose

- ❑ At bottom of radiator

12 - Coolant pump/thermostat

- ❑ Removing and installing coolant pump ⇒ page 254
- ❑ Removing and installing thermostat ⇒ page 254
- ❑ Checking thermostat ⇒ page 256

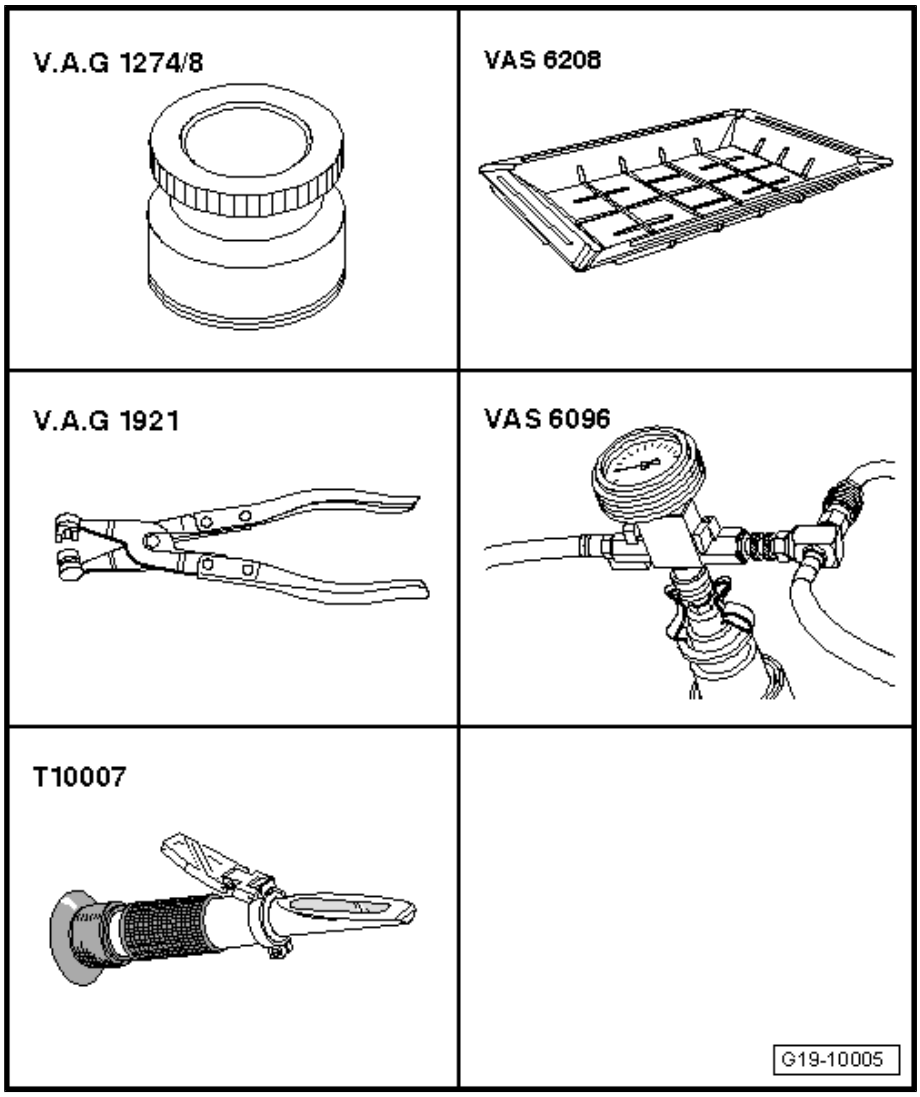
13 - Auxiliary heater

- ❑ Optional extra

1.2 Draining and filling cooling system

Special tools and workshop equipment required

- Adapter for cooling system tester -V.A.G 1274/8-
- Drip tray for workshop hoist -VAS 6208-
- Hose clip pliers - V.A.G 1921-
- Cooling system charge unit -VAS 6096-
- Refractometer -T10007-



Draining

Note

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

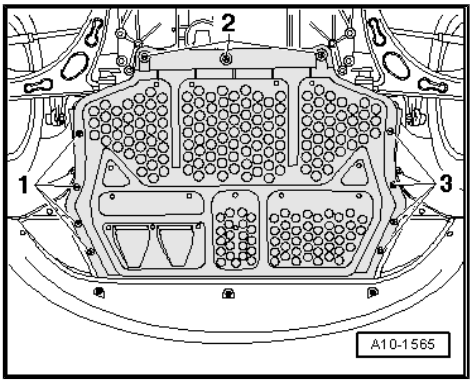
WARNING

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.

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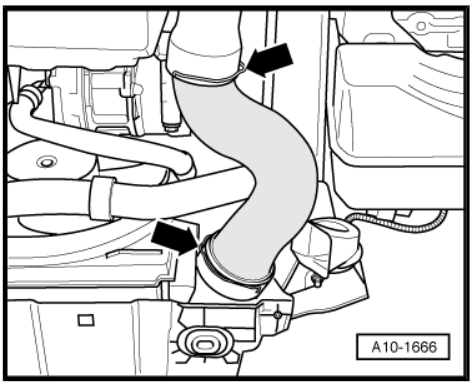
– Remove centre noise insulation -fasteners 1 ... 3-.



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

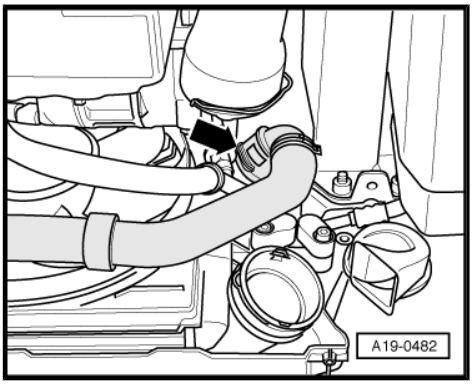
Caution

Seal opening of charge air cooler with a piece of clean foam or similar to prevent coolant from entering.



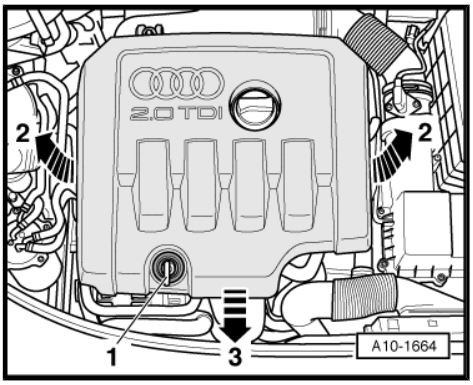
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– Place drip tray for workshop hoist -VAS 6208- under engine.
– Pull out retaining clip at the bottom -arrow- and disconnect coolant hose from radiator.



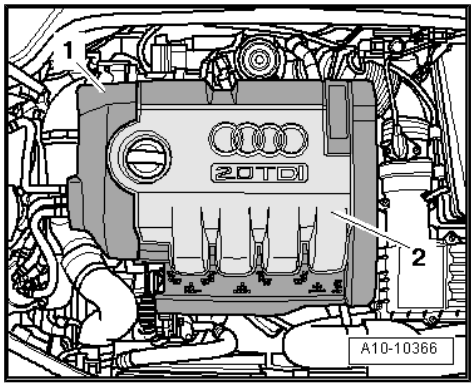
Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.
– Re-insert dipstick in guide tube.



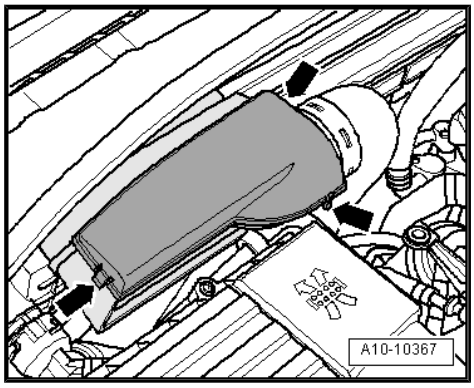
Engine cover panel (version 2):

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

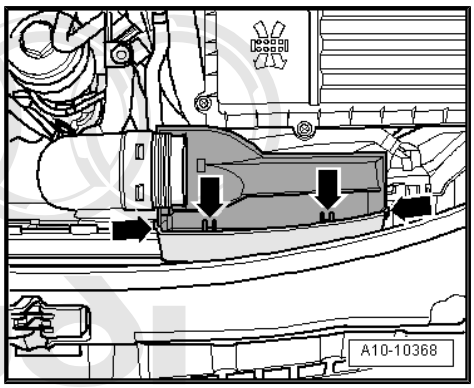


All vehicles (continued):

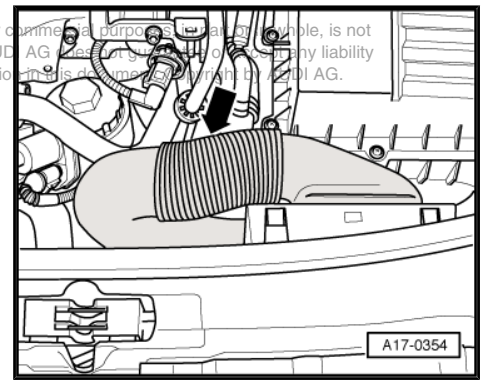
– Pull cover off air duct (release clips on sides) -arrows-.



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

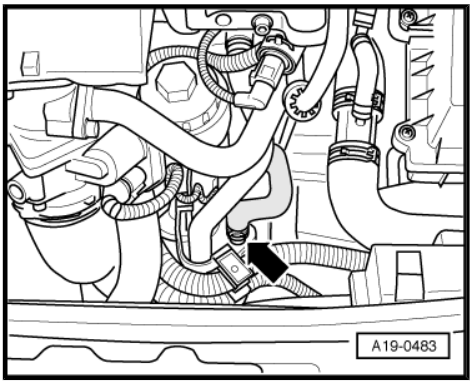


– Remove air intake hose -arrow- from between lock carrier and air cleaner housing.



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– Also detach upper coolant hose on oil cooler -arrow-, and drain off remaining coolant.



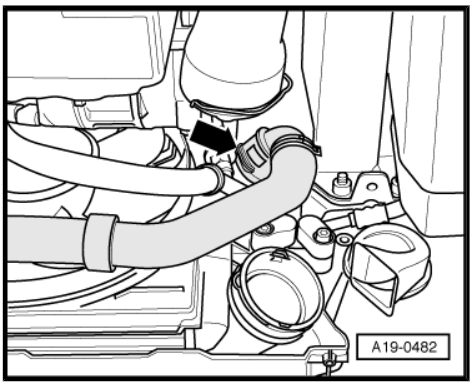
Filling

Note

- *The cooling system is filled all year round with a mixture of water and radiator antifreeze/anti-corrosion agent.*
- *Use only the radiator antifreeze/anti-corrosion agent approved for this engine ⇒ Electronic parts catalogue . 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.*
- *The specified radiator antifreeze/anti-corrosion agent prevents frost and corrosion damage and stops scaling. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct antifreeze and anticorrosion 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 –35 °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 concentration of radiator antifreeze/anti-corrosion agent can be increased, but only up to 60% (this gives frost protection to about –40 °C). If the concentration exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.*
- *Use only clean tap water for mixing coolant.*
- *Do not use drained coolant again if:*
- *the radiator, heat exchanger for heater, cylinder head, cylinder head gasket or cylinder block have been renewed.*
- *the coolant is contaminated or dirty.*
- *For checking anti-freeze protection in cooling system, use refractometer -T10007- .*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

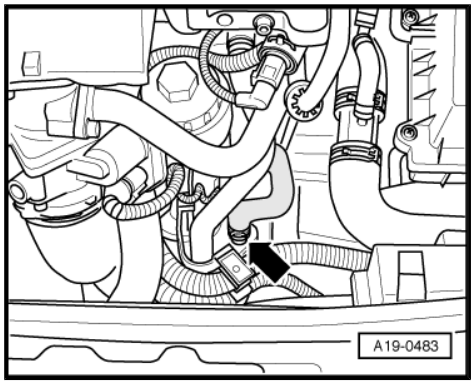
– Connect coolant hose to lower part of radiator -arrow-.

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .



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– Connect coolant hose to top of oil cooler -arrow-.



– Fill reservoir of -VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio):

• Radiator antifreeze/anti-corrosion agent (40 %) and water (60 %) for frost protection to –25 °C

• Radiator antifreeze/anti-corrosion agent (50 %) and water (50 %) for frost protection to –35 °C

• Radiator antifreeze/anti-corrosion agent (60 %) and water (40 %) for frost protection to –40 °C

– Screw adapter for cooling system tester -V.A.G 1274/8- onto coolant expansion tank.

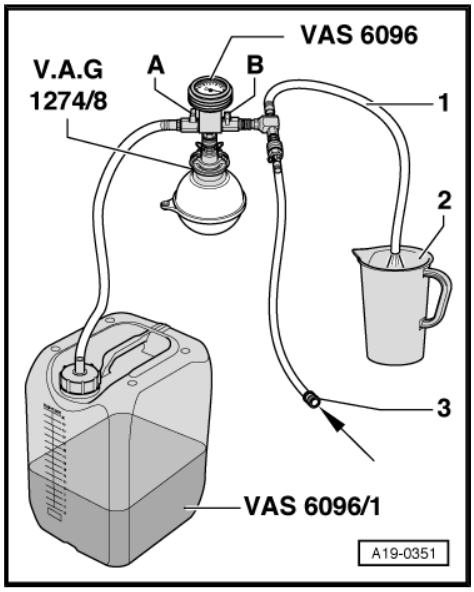
– Attach cooling system charge unit -VAS 6096- onto adapter -V.A.G 1274/8- .

– 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.

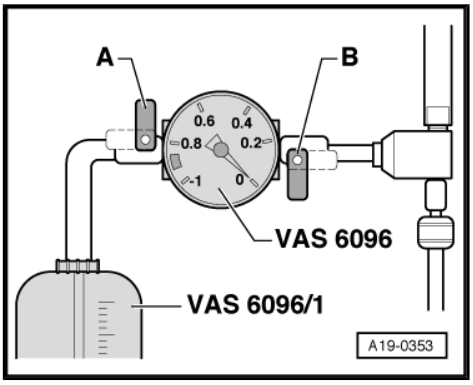
– Connect hose -3- to compressed air.

• Pressure: 6 ... 10 bar.



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– Open valve -B- by setting lever in direction of flow.



The suction jet pump generates a partial vacuum in the cooling system.

- The needle on the gauge should move into the green zone.

– Also briefly open valve -A- (turn lever in direction of flow) so that hose on charge unit reservoir -VAS 6096- 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.

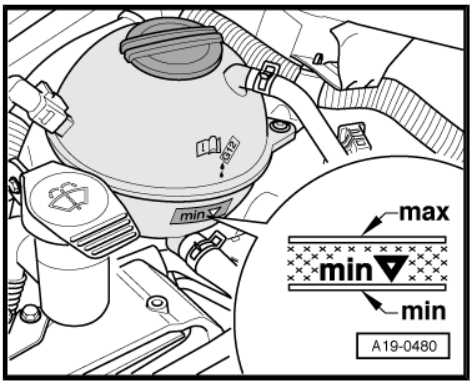
If the needle does not reach the green zone, repeat the process.

If the vacuum level drops, there is a leak in the cooling system.

– Detach compressed air hose.

– Open valve -A-.

The vacuum in the cooling system causes the coolant to be drawn out of the reservoir for cooling system charge unit -VAS 6096- ; the cooling system is then filled.



– 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) and then off again.

– Set temperature to “HI”.

– Switch off air conditioner compressor (press ECON button).

– Start engine, run for 2 minutes (maximum) at approx. 1500 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.

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1.3 Removing and installing coolant pump

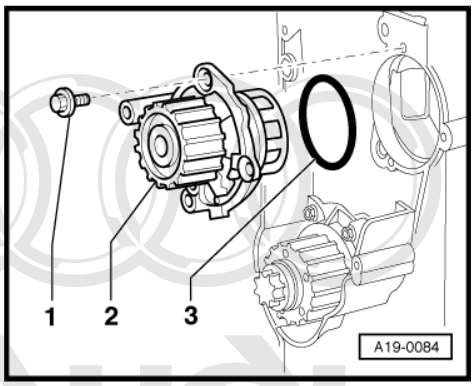
Removing

– Drain off coolant ⇒ page 248 .

– Remove toothed belt: vehicles with small engine support ⇒ page 102 , vehicles with large engine support ⇒ page 116

– 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 additive “G12+”.

– Fit coolant pump -2-.

• Installation position: Sealing plug in housing faces downwards.

– Tighten bolts -1- for coolant pump.

– Install toothed belt (adjust valve timing): vehicles with small engine support ⇒ page 111 , vehicles with large engine support ⇒ page 123

– Install poly V-belt ⇒ page 86 .

– Fill cooling system ⇒ page 251 .

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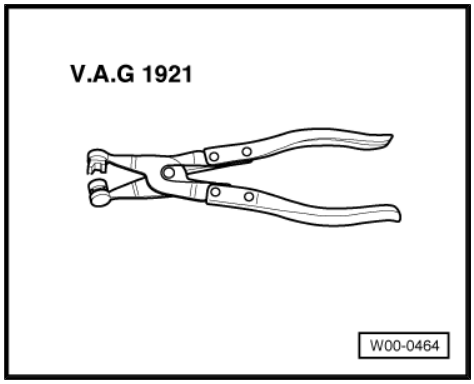
Tightening torque

Component	Nm
Coolant pump to cylinder block	15

1.4 Removing and installing thermostat

Special tools and workshop equipment required

♦ Hose clip pliers -V.A.G 1921-



Removing

Caution

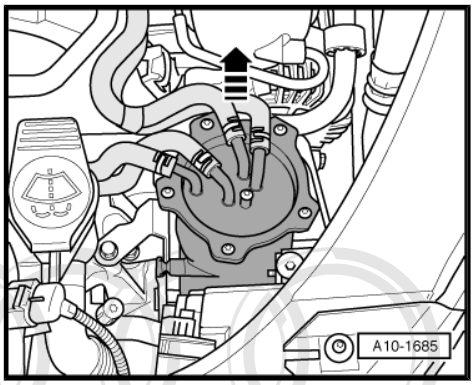
Observe notes on procedure for disconnecting the battery ⇒ Rep. Gr. 27 .

– Disconnect earth wire at battery with ignition switched off.

– Drain off coolant ⇒ page 248 .

Fuel filter - version 1:

– Lift fuel filter out of bracket -arrow- with hoses connected and move it aside.

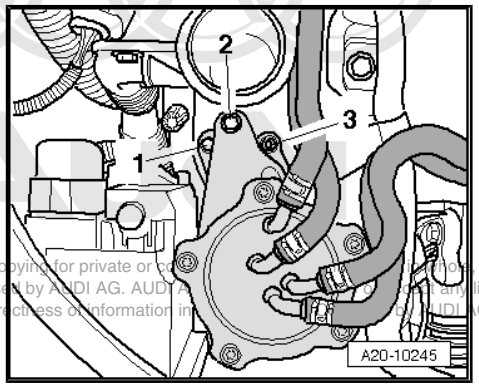


Fuel filter - version 2:

– Slacken bolt -1- one turn.

– Remove bolt -2- and nut -3-.

– Move fuel filter aside with hoses attached.

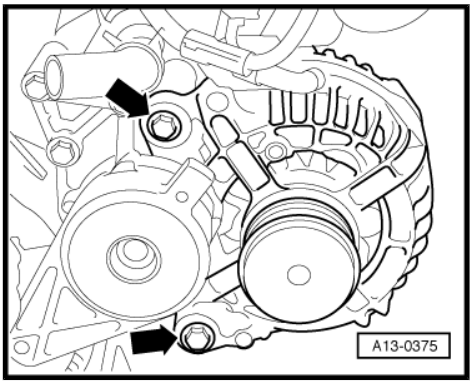


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All vehicles (continued):

– Remove poly V-belt ⇒ page 86 .

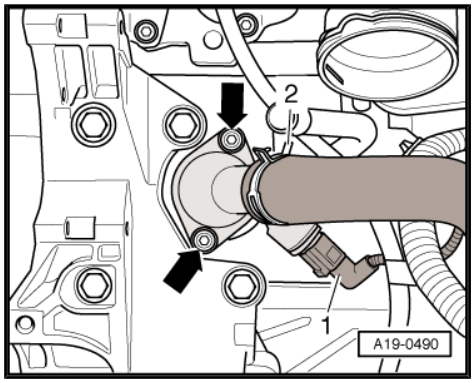
– Unbolt -alternator- and lay aside (to right). Leave wires connected.



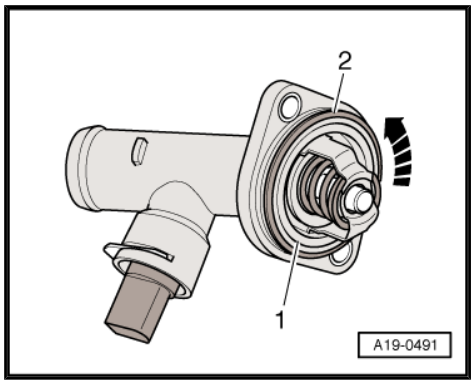
Note

- *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.*

– 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 -item 1- approx. 90° ($^1/_4$ turn) anti-clockwise and remove it from hose flange.
– Remove O-ring -2-.



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.
– Install thermostat with new O-ring.
• Installation position: Cross-piece on thermostat should be vertical.
– Lubricate new O-ring with coolant additive “G12+”.
– Install alternator ⇒ Rep. Gr. 27 .
– Install poly V-belt ⇒ page 86 .
– Connect battery. Procedures required ⇒ Rep. Gr. 27 .
– Fill cooling system ⇒ page 251 .

Tightening torques

Component	Nm
Connection to cylinder block	15
Alternator to bracket for ancillaries	23

1.5 Checking thermostat

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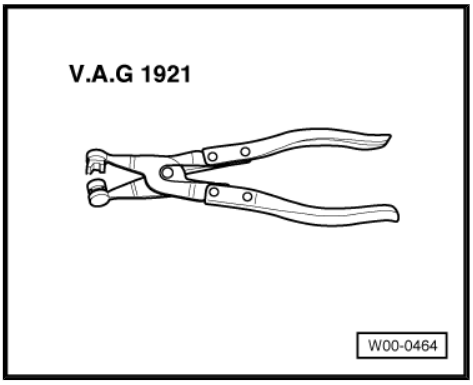
– Heat up the removed thermostat in hot water.

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

♦ Hose clip pliers -V.A.G 1921-



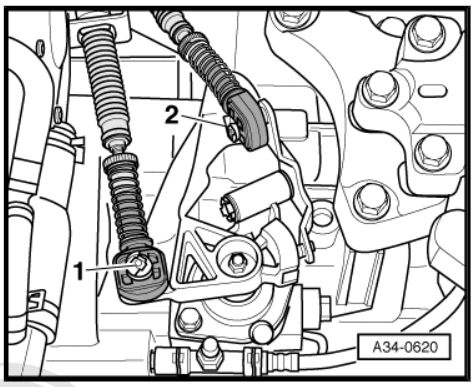
Removing

– Remove oil filter bracket
⇒ “1.5 Removing and installing oil filter bracket with oil cooler”, page 237 .

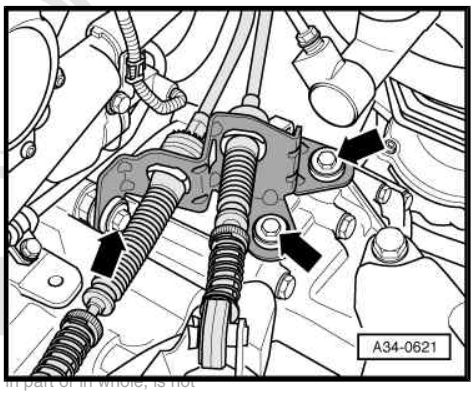
Vehicles with manual gearbox:

– Unclip securing clips -1- and -2- on both selector cables.

– Pull selector cable end-pieces off selector shaft lever and relay lever.



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

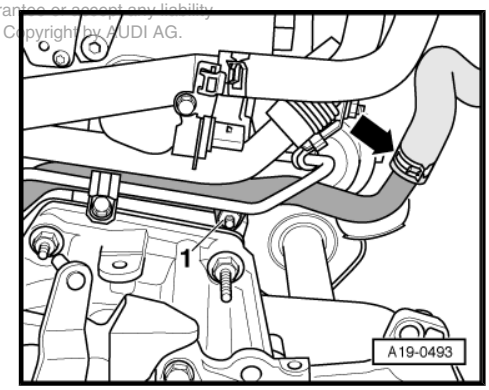


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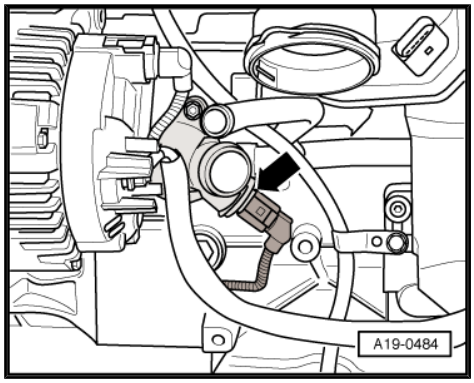
All vehicles (continued):

– Disconnect coolant hose -arrow- (leading to heat exchanger) from coolant pipe.

– Unscrew securing bolt -1- on coolant pipe.

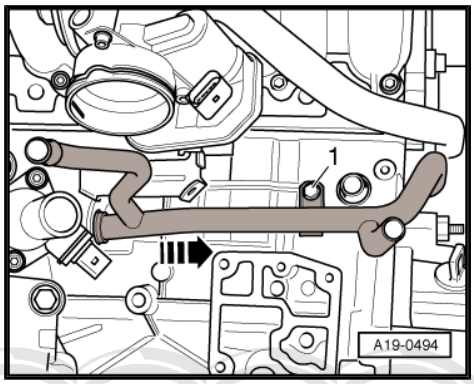


– Unplug electrical connector -arrow- at radiator outlet coolant temperature sender -G83- .



– Remove bolt -1-.

– Pull coolant pipe out of cylinder block -arrow-.



Installing

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

Note

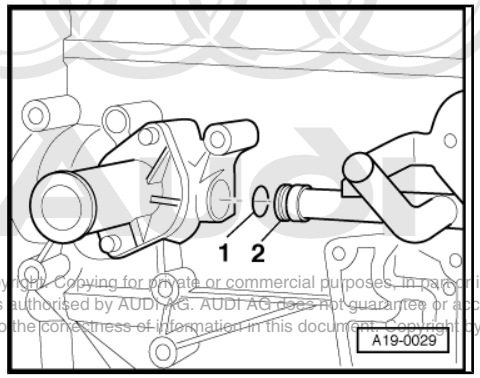
- *Renew gaskets, seals and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Clean and smoothen sealing surface for O-ring as required.

– Lubricate new O-ring -1- with “G 12+” and push onto coolant pipe -2-.

– Push coolant pipe into bore on cylinder block.

– Install oil filter bracket
⇒ “1.5 Removing and installing oil filter bracket with oil cooler”, page 237 .



Vehicles with manual gearbox:

– Attach and adjust selector mechanism at gearbox ⇒ Rep. Gr. 34 .

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Tightening torques

Component		Nm
Coolant pipe to cylinder block	M7	15
	M8	20

1.7 Radiator and radiator fans - exploded view

1 - Radiator fan -V7-

- ❑ With radiator fan control unit -J293-
- ❑ Removing and installing ⇒ page 266
- ❑ Note routing of wiring ⇒ page 268

2 - 5 Nm

3 - Radiator cowl

4 - Coolant hose (top)

- ❑ To connection at cylinder head

5 - O-ring

- ❑ Renew if damaged

6 - Radiator

- ❑ Removing and installing ⇒ page 259
- ❑ If renewed, change coolant in entire system

7 - O-ring

- ❑ Renew if damaged

8 - Coolant hose (bottom)

- ❑ To hose connection on thermostat

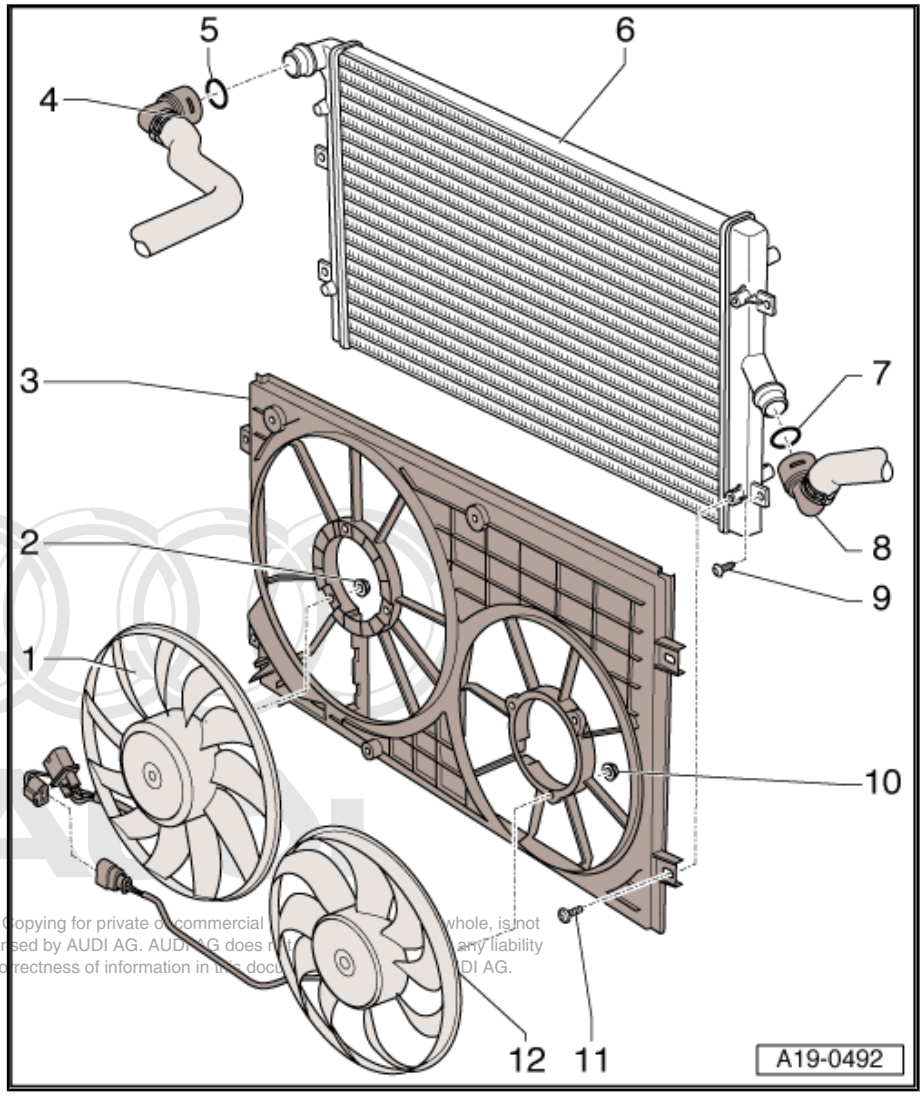
9 - 5 Nm

10 - 5 Nm

11 - 5 Nm

12 - Radiator fan 2 -V177-

- ❑ Removing and installing ⇒ page 266
- ❑ Note routing of wiring ⇒ page 268

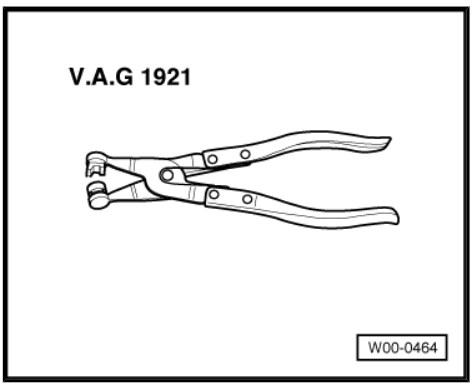


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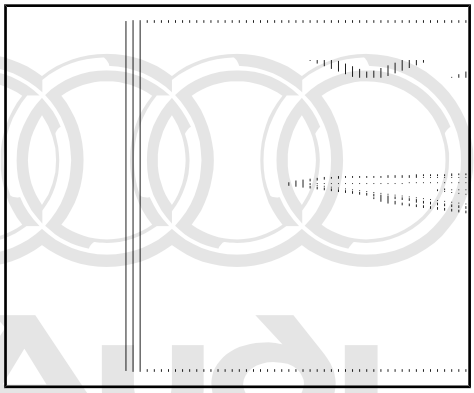
1.8 Removing and installing radiator

Special tools and workshop equipment required

♦ Hose clip pliers -V.A.G 1921-



♦ Drip tray for workshop hoist -VAS 6208-



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Removing

Note

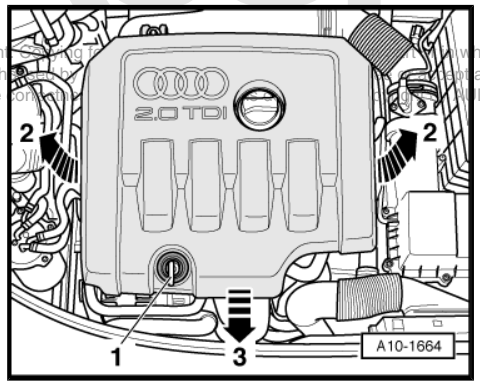
Even when the radiator and condenser are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator or the condenser.

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

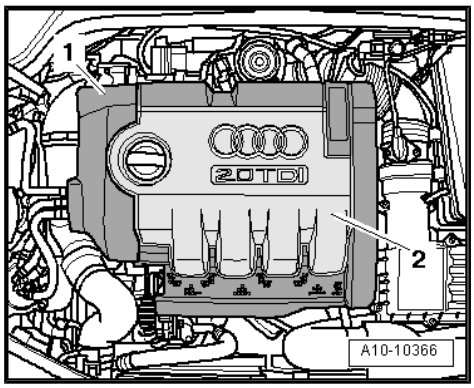
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

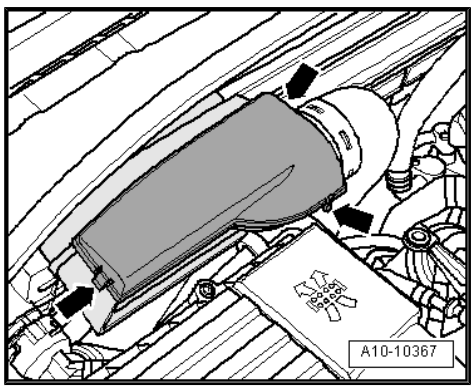
– Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



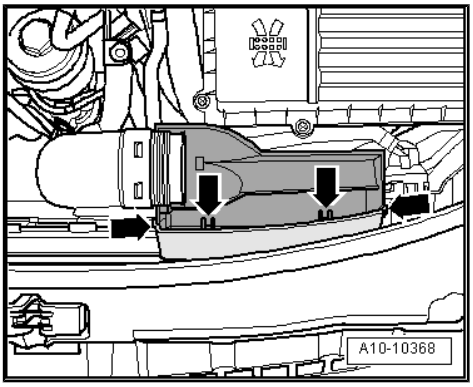
All vehicles (continued):

– Remove engine compartment seal from lock carrier and wing panel flanges.

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

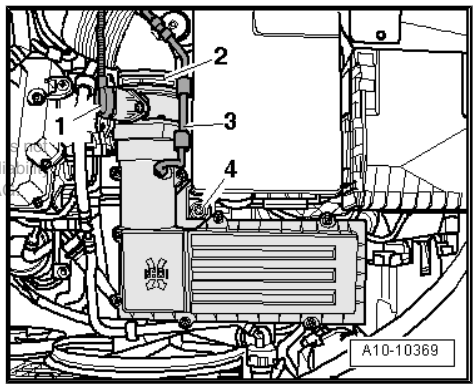


– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.

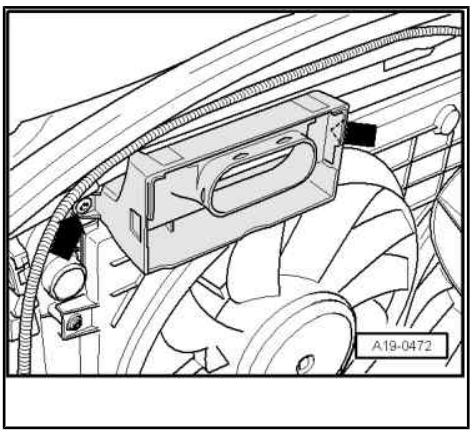


– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.

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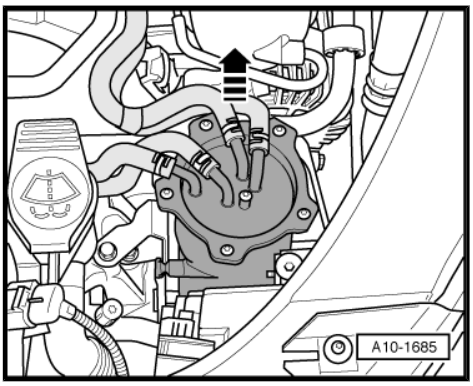


– Unscrew air duct at lock carrier -arrows-.

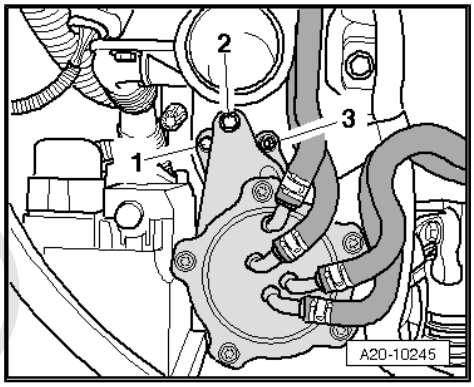


Fuel filter - version 1:

– Lift fuel filter out of bracket -arrow- with hoses connected and move it aside.

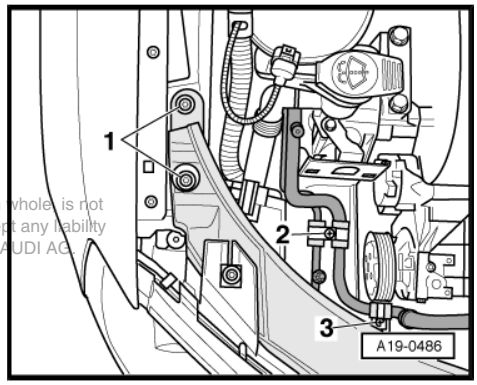


Fuel filter - version 2:



– Slacken bolt -1- one turn.
– Remove bolt -2- and nut -3-.
– Move fuel filter aside with hoses attached.

All vehicles (continued):



– Unscrew bolts -1- for lock carrier (right-side).

WARNING

The air conditioner refrigerant circuit must not be opened.

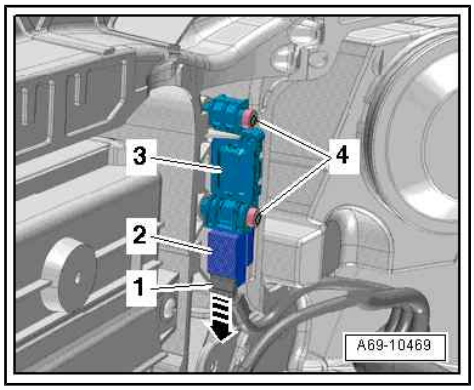
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Note

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

– Unscrew bolts -2- and -3- at brackets for refrigerant pipes.

– Remove bolts -4- and move crash sensor (right-side) with wiring to one side.



Note

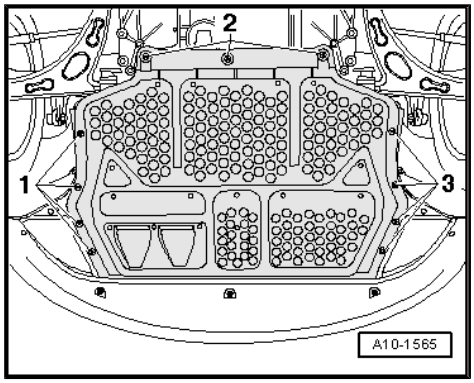
Disregard items marked -1, 2, 3- and -arrows-.

WARNING

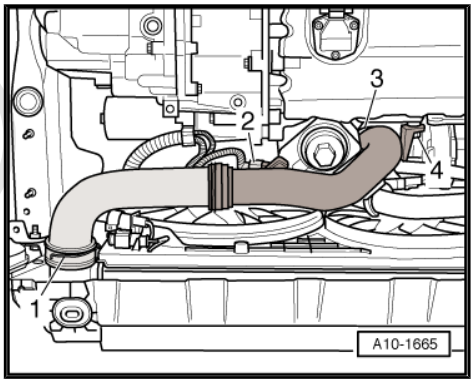
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

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

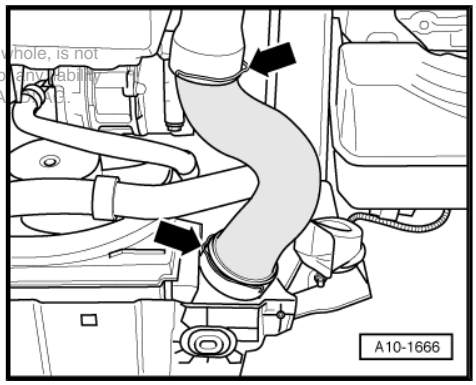


– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolt -4-.
– Remove front air pipe with air hose by lifting retaining clips slightly -1- and -3-.



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

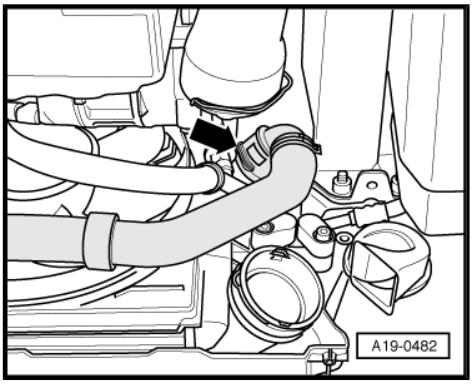
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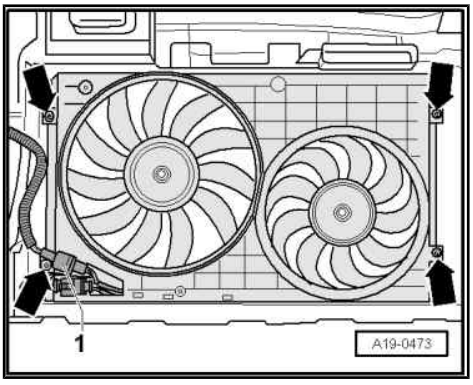
Caution

Seal opening of charge air cooler with a piece of clean foam or similar to prevent coolant from entering.

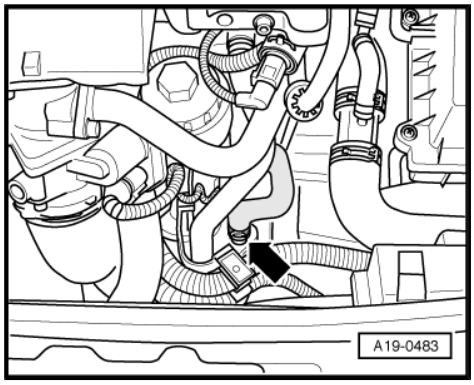
– Place drip tray for workshop hoist -VAS 6208- under engine.
– Pull out retaining clip at the bottom -arrow- and disconnect coolant hose from radiator.



– Unplug electrical connector -1-.
– Unscrew the bolts -arrows- and remove radiator cowl from below.

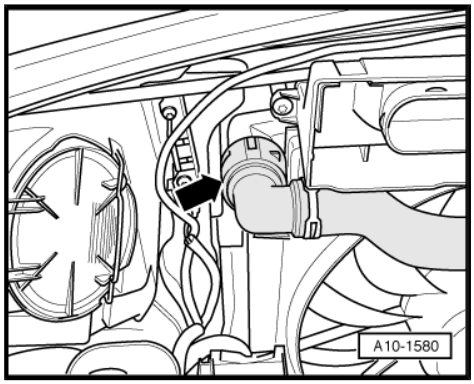


– Also detach upper coolant hose on oil cooler -arrow-, and drain off remaining coolant.

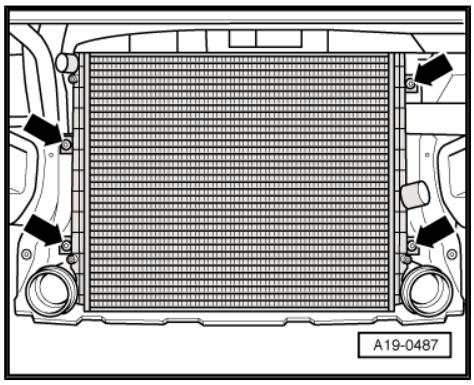


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– Detach top coolant hose from radiator -arrow-.



– Unscrew bolts -arrows- on backside of radiator.
– Lift out radiator from above.



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 .*

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .
– Install crash sensor ⇒ Rep. Gr. 69 .
– Fill cooling system ⇒ page 251 .
– Check headlight adjustment ⇒ Maintenance ; Booklet 808 .

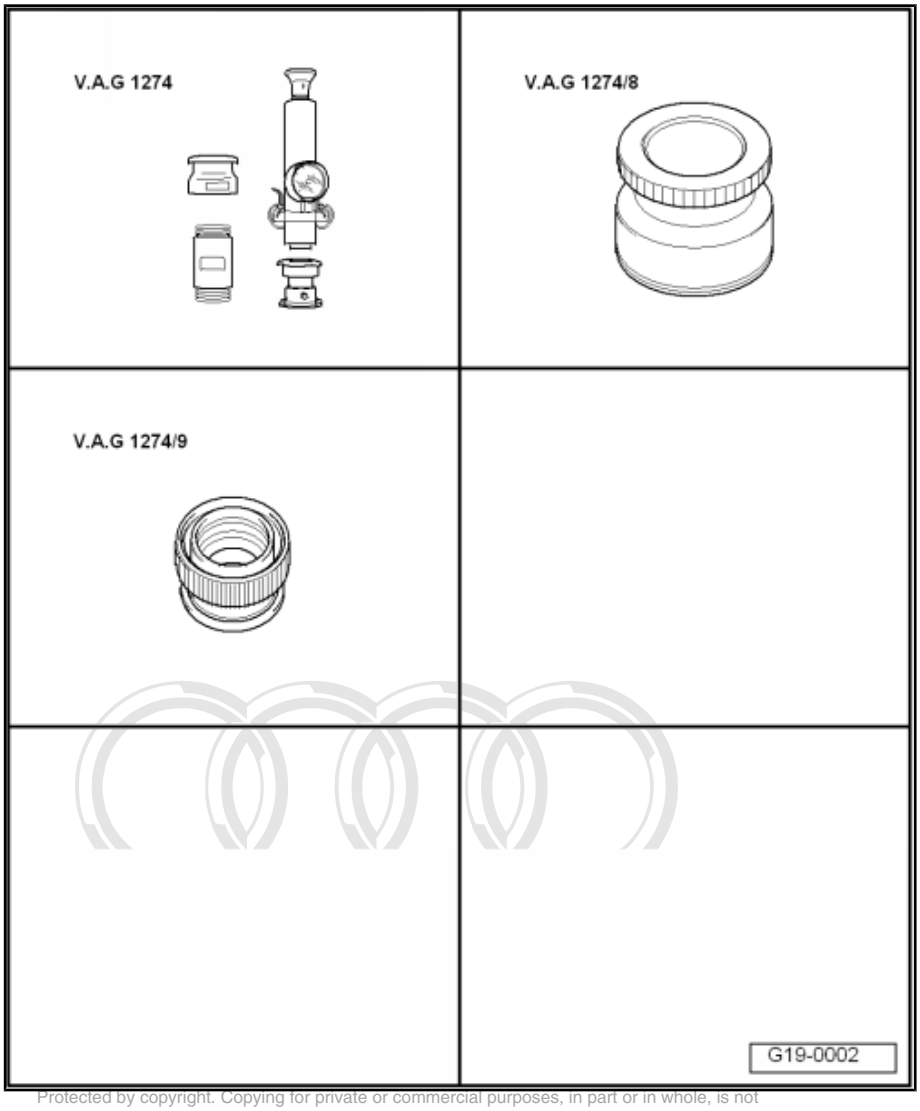
Tightening torques

Component	Nm
Radiator to charge air cooler	5
Radiator cowl to radiator	5

1.9 Checking cooling system for leaks

Special tools and workshop equipment required

- Cooling system tester -V.A.G 1274-
- Adapter for cooling system tester -V.A.G 1274/8-
- Adapter for cooling system tester -V.A.G 1274/9-

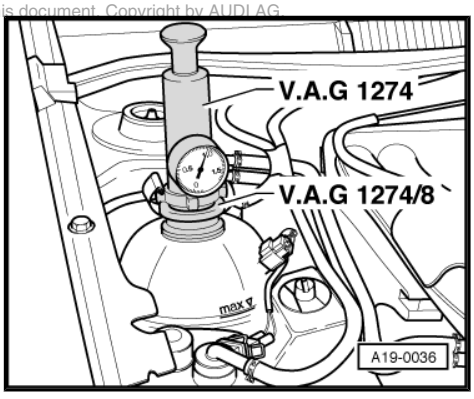


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Procedure

- 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.

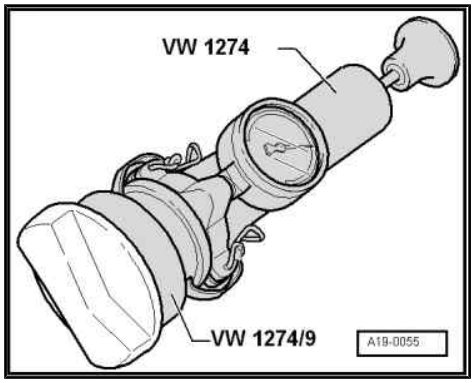
– Attach cooling system tester -V.A.G 1274- with adapter -V.A.G 1274/8- to expansion tank.

– 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- 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.

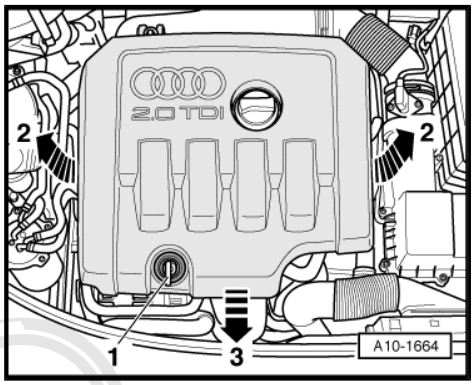
If the pressure relief valve does not open as described:

– Renew filler cap.

1.10 Removing and installing radiator fan -V7- and radiator fan 2 -V177-

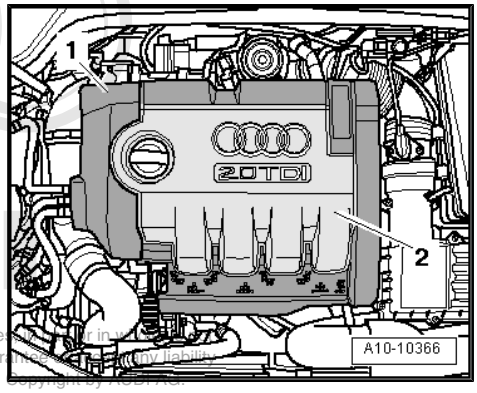
Removing

Engine cover panel (version 1):



– Pull dipstick -1- out of guide tube.
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.
– Re-insert dipstick in guide tube.

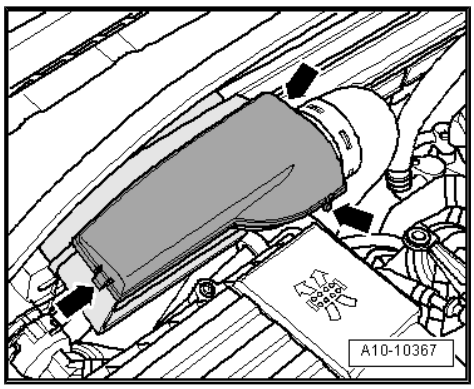
Engine cover panel (version 2):



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

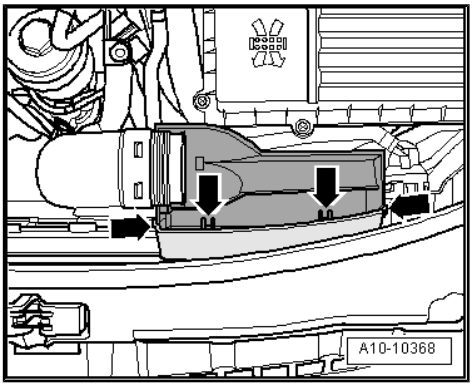
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All vehicles (continued):

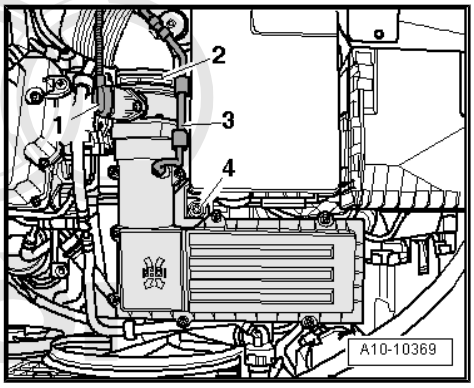


– Remove engine compartment seal from lock carrier and wing panel flanges.
– Pull cover off air duct (release clips on sides) -arrows-.

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

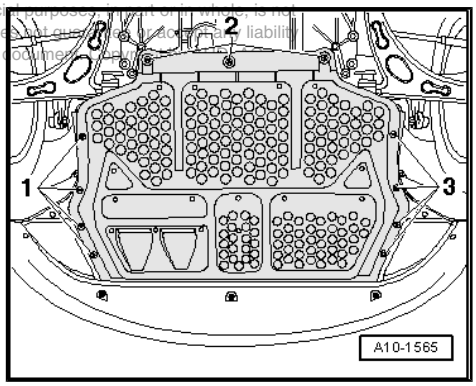


– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.

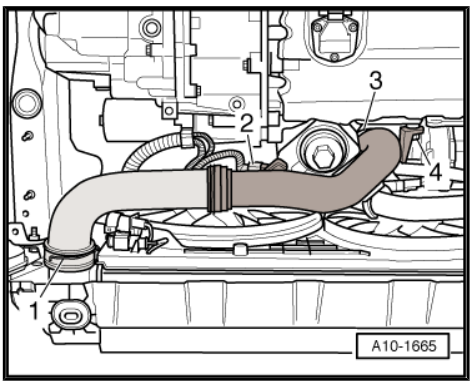


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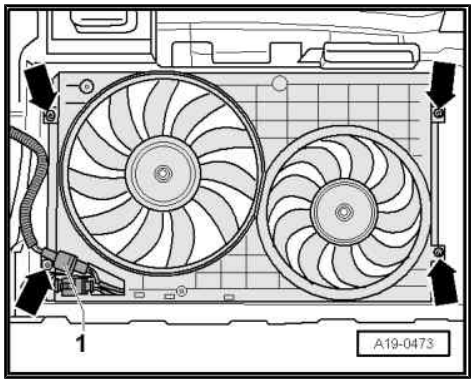
– Remove centre noise insulation -fasteners 1 - 3-.



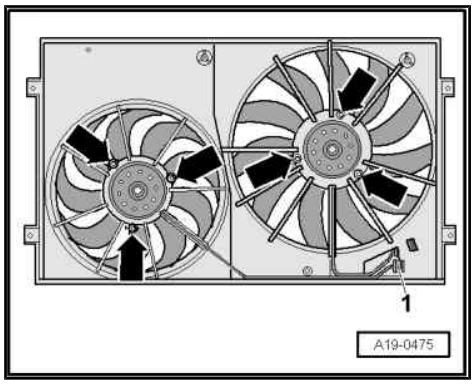
– Unplug electrical connector -2- at charge pressure sender -G31- / intake air temperature sender -G42- .
– Remove bolt -4-.
– Remove front air pipe with air hose by lifting retaining clips slightly -1- and -3-.



– Unplug electrical connector -1-.
– Unscrew bolts -arrows- and remove radiator cowl.



– Unplug electrical connector -1-.
– Move wiring clear.
– Unscrew nuts -arrows- and remove fans.

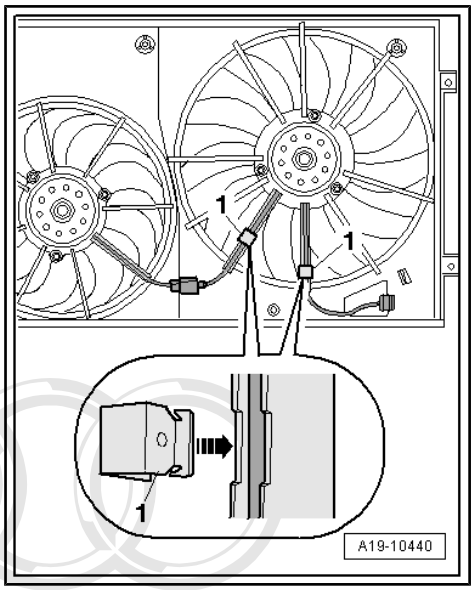


Installing

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

– Check that retaining clips -1- for radiator fan wiring are positioned correctly.

- The retaining clips must be fitted as illustrated.
- The retaining clips must be inserted into the slots provided on the ribs of the radiator cowl.



Caution

The radiator can be damaged if the retaining clips are not fitted in the correct positions.

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

Tightening torques

Component	Nm
Radiator fan to radiator cowl	5
Radiator cowl to radiator	5

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21 – Turbocharging/supercharging

1 Servicing charge air system with turbocharger

1.1 Removing and installing air pipes and hoses with plug-in connectors

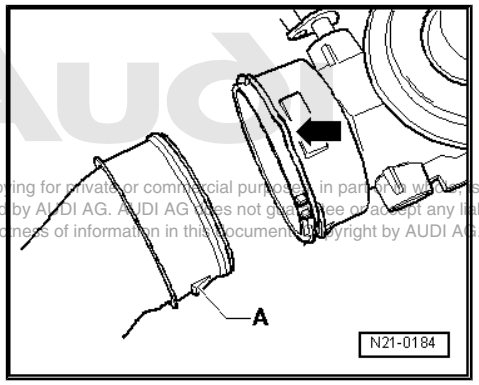
Note

- *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.*

Removing

– Release tab -A- on plug-in connector by pulling retaining clip -arrow-.

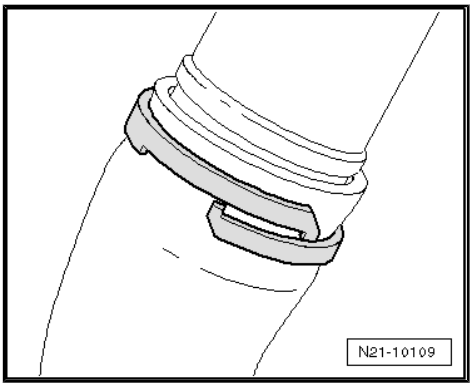
– Disconnect air pipes and hoses by hand (do not use a tool).



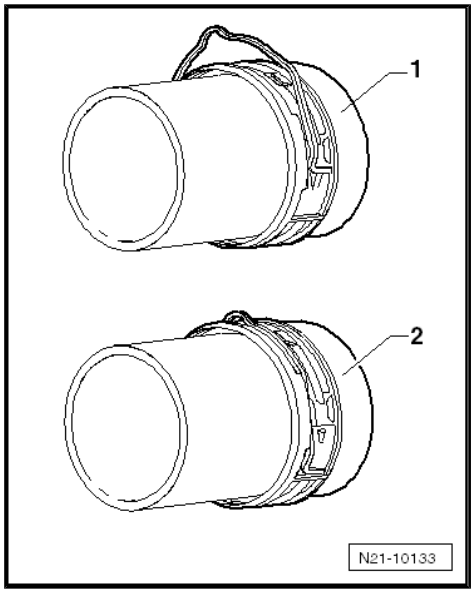
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Caution

- ***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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2 Turbocharger and charge air cooling - vehicles with engine codes AZV, BKD

2.1 Connection diagram for vacuum lines

1 - Mechanical exhaust gas recirculation valve

2 - Vacuum reservoir

3 - To vacuum unit for charge pressure control

4 - To vacuum unit for exhaust gas recirculation cooler change-over

5 - Solenoid valve block

- ❑ With exhaust gas recirculation valve -N18-
- ❑ With charge pressure control solenoid valve -N75-
- ❑ With exhaust gas recirculation cooler change-over valve -N345-
- ❑ Connection diagram ⇒ page 272

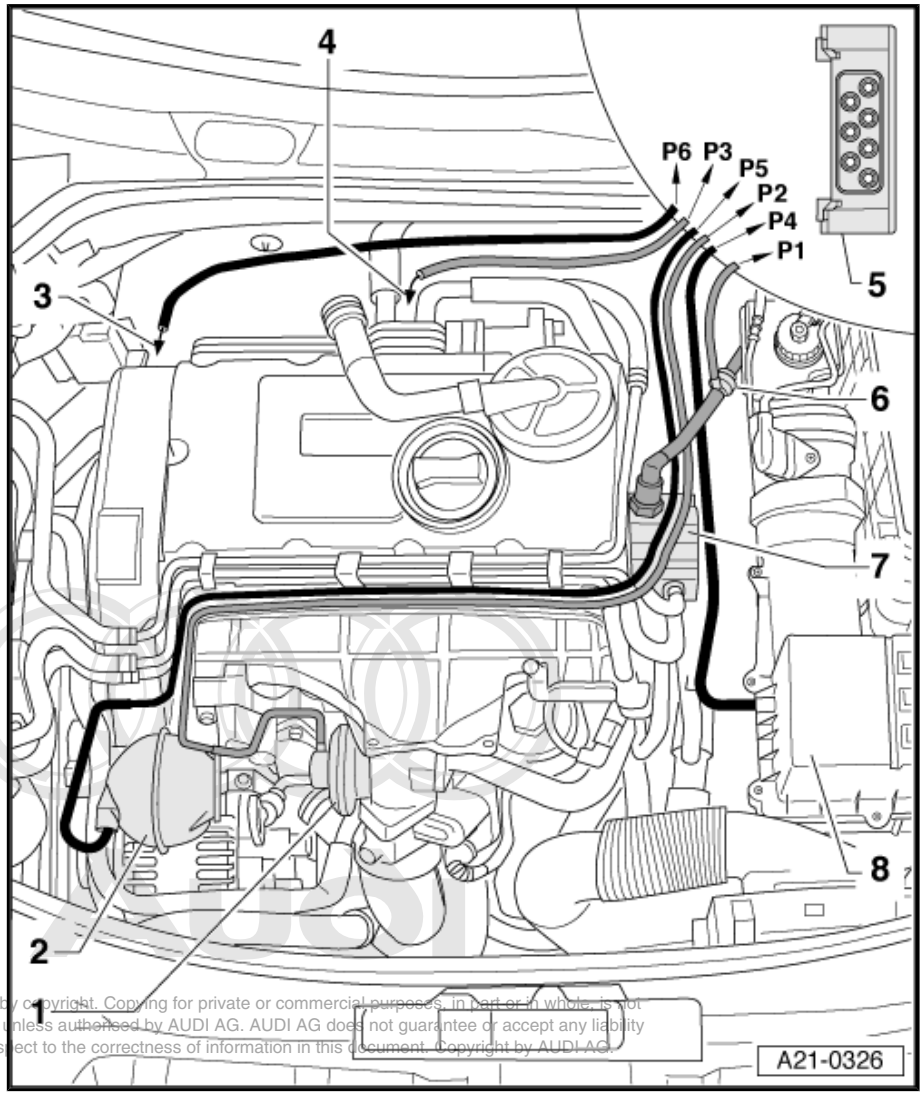
6 - Vacuum supply line

- ❑ From tandem pump to solenoid valve block

7 - Tandem pump

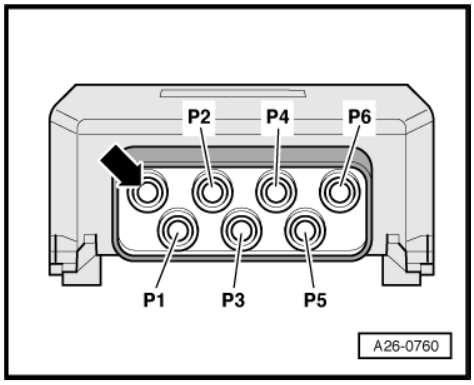
8 - Air cleaner housing

- ❑ With connection for vent hose



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2.2 Connection diagram for solenoid valve block



P1 - Vacuum supply hose from tandem pump

P2 - To mechanical exhaust gas recirculation valve

P3 - To vacuum unit for exhaust gas recirculation cooler change-over

P4 - Vent hose to air cleaner

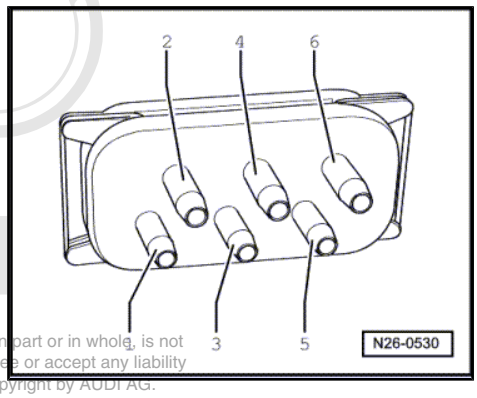
P5 - To vacuum reservoir

P6 - To vacuum unit for charge pressure control

Note

The vacuum connection marked with an -arrow- is not used and is plugged with a cap.

2.3 Connection diagram for vacuum hose connector



Note

Illustration shows hose connection side.

P1 - Vacuum supply hose from tandem pump

P2 - To mechanical exhaust gas recirculation valve

P3 - To vacuum unit for exhaust gas recirculation cooler change-over

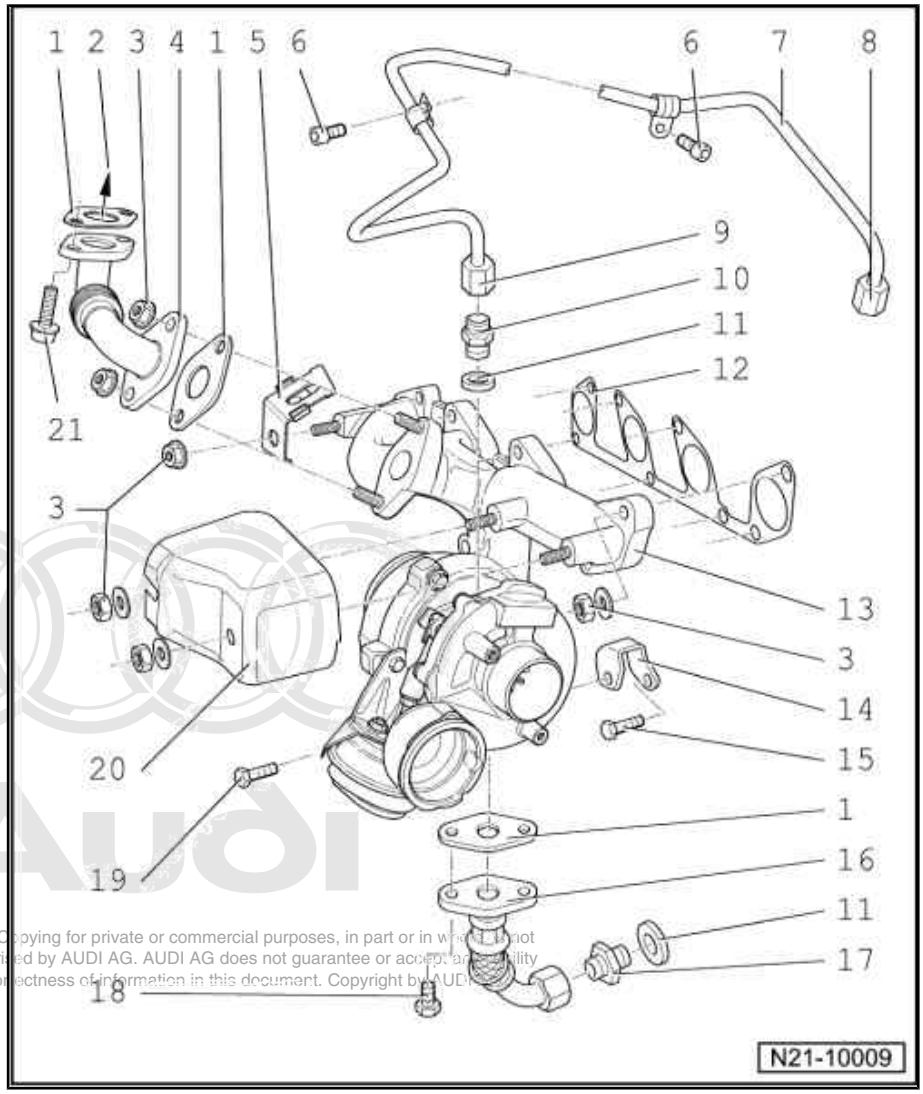
P4 - Vent hose to air cleaner

P5 - To vacuum reservoir

P6 - To vacuum unit for charge pressure control

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2.4 Turbocharger - exploded view



1 - Gasket
- ❑ Renew

2 - To bypass flap

3 - 25 Nm
- ❑ Renew

4 - Connecting pipe
- ❑ To exhaust gas recirculation cooler

5 - Bracket
- ❑ For oil supply pipe

6 - 10 Nm

7 - Oil supply pipe
- ❑ Check that the oil supply pipe is not obstructed before installing
- ❑ Before installing, fill turbocharger with engine oil at connection for oil supply pipe

8 - Union nut, 22 Nm

9 - Union nut, 22 Nm

10 - Connection, 30 Nm

11 - Seal
- ❑ Renew

12 - Gasket
- ❑ Renew
- ❑ Note installation position

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13 - Turbocharger
- ❑ Can only be renewed together with exhaust manifold and vacuum unit as one unit
- ❑ Removing and installing ⇒ page 274

14 - Support
- ❑ Between turbocharger and cylinder block

15 - 40 Nm
- ❑ First hand-tighten all bolts

16 - Oil return pipe
- ❑ To cylinder block
- ❑ Tighten union nut to 30 Nm

17 - Connection, 40 Nm

18 - 17 Nm

19 - 20 Nm
- ❑ First hand-tighten all bolts

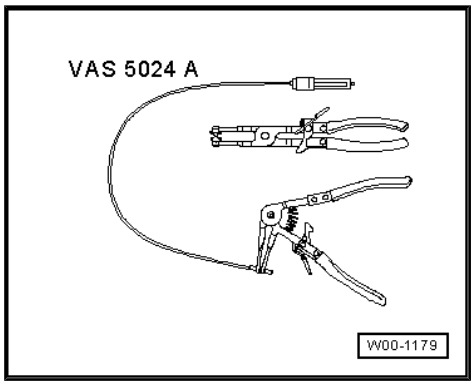
20 - Heat shield

21 - 20 Nm

2.5 Removing and installing turbocharger

Special tools and workshop equipment required

- Spring type clip pliers -VAS 5024 A-



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 intake 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.*

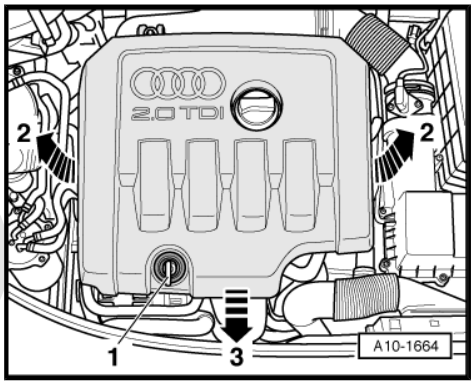
Observe rules for cleanliness when working on turbocharger *⇒ page 6*

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

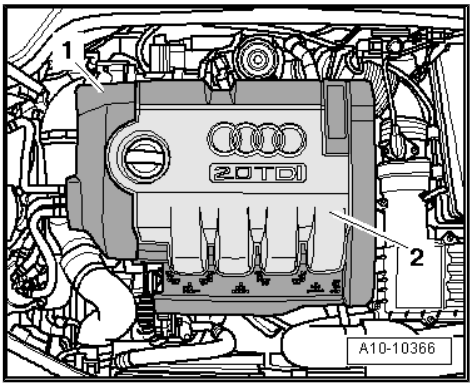
– Re-insert dipstick in guide tube.



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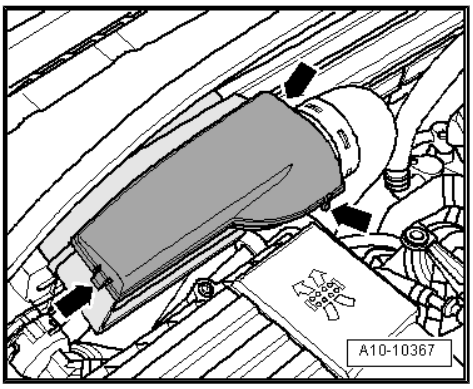
Engine cover panel (version 2):

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

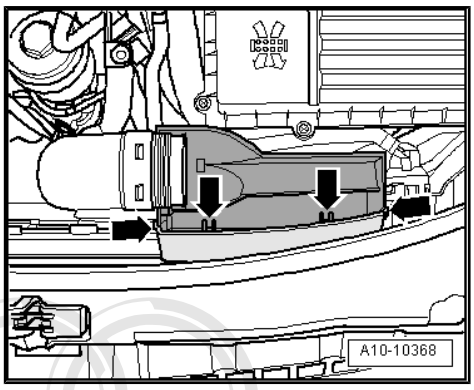


All vehicles (continued):

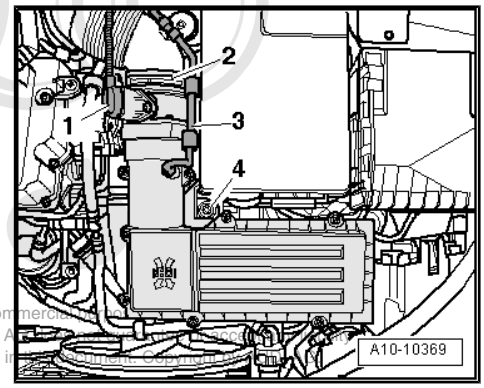
– Pull cover off air duct (release clips on sides) -arrows-.



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

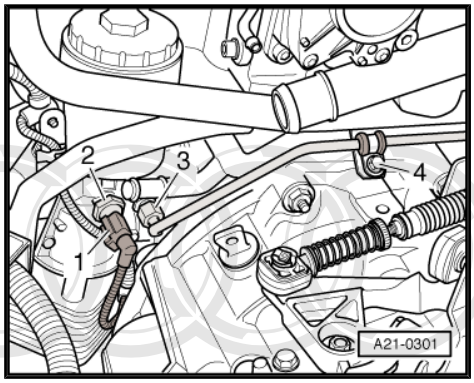


– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.



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– Unplug electrical connector -1- at oil pressure switch -F1- .
– Remove oil pressure switch -2-.
– Detach oil supply pipe at oil filter bracket -3- and at coolant pipe -4-.

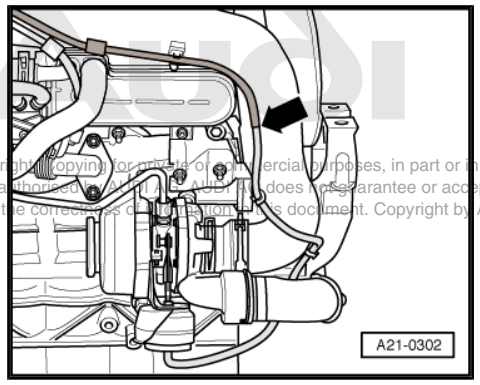


– Disconnect hose going to vacuum unit for charge pressure control at separating point -arrow-.

Note

Shown from rear with engine removed for illustration purposes.

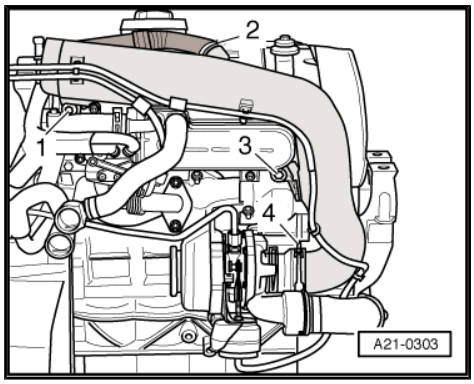
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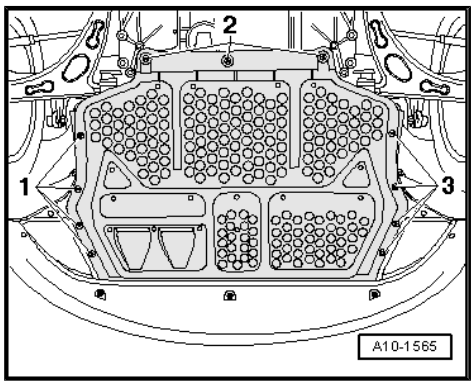
– Remove bolts -1- and -3-.
– Move vacuum hoses at rear intake pipe clear to one side.
– Disconnect hose -2- for crankcase breather system at air pipe.
– Release spring clip -4- with spring clip pliers -VAS 5024 A- and detach air pipe at connection for turbocharger.

Note

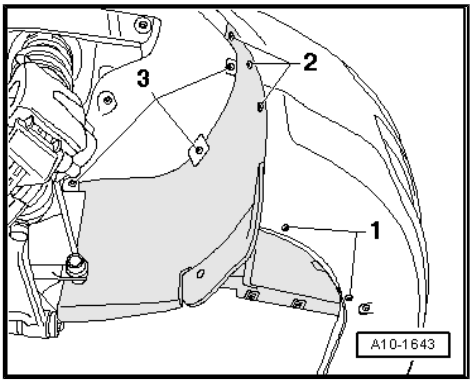
Shown from rear with engine removed for illustration purposes.



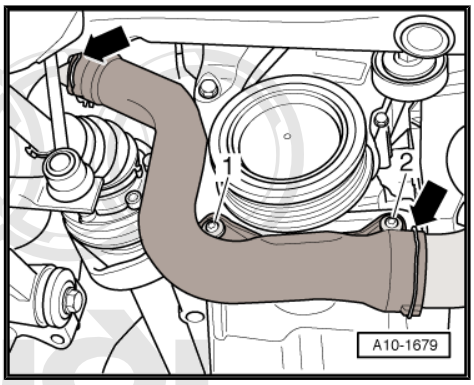
– Remove centre noise insulation -fasteners 1 ... 3-.



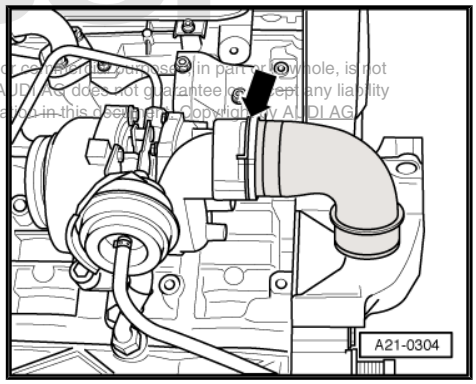
– Remove noise insulation (right-side) -fasteners 1 ... 3-.



– Remove bolts -1- and -2-.
– Remove air pipe (right-side) by lifting retaining clips -arrows- slightly.

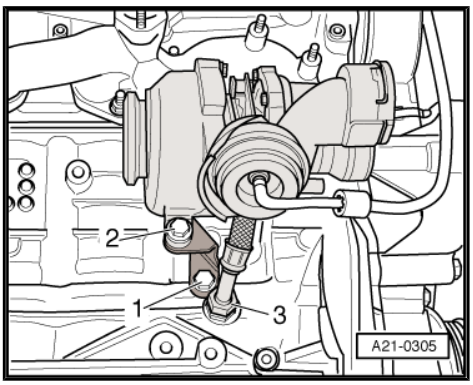


– Detach air intake hose from turbocharger by lifting retaining clip -arrow- slightly.
– Remove front exhaust pipe ⇒ page 304.

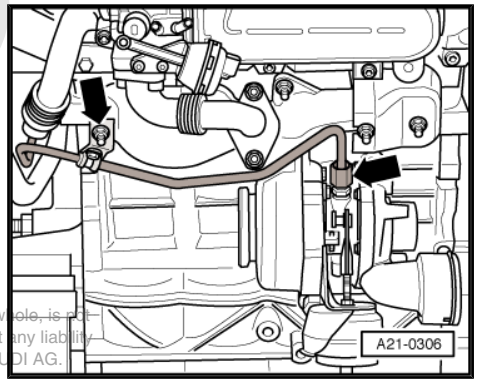


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– Remove bolts -1- and -2- and detach support for turbocharger.
– Remove oil return pipe -3- at cylinder block.

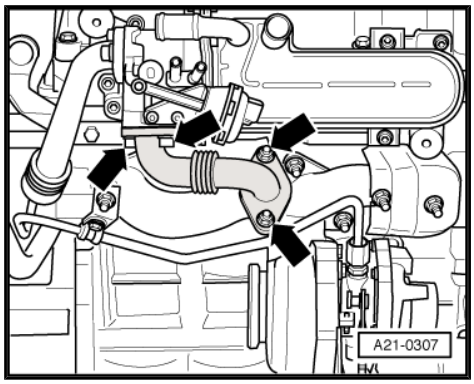


– Unscrew oil supply pipe at turbocharger and exhaust manifold -arrows-.
– Move oil supply pipe to the side.

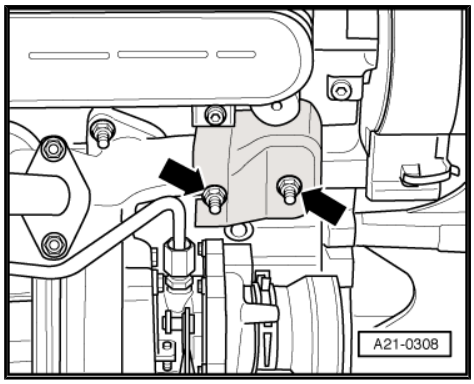


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– Remove connecting pipe for exhaust gas recirculation -arrows-.

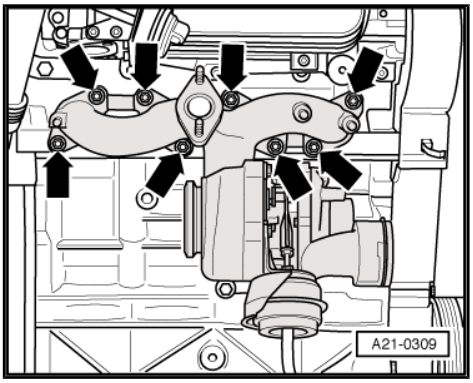


– Remove heat shield from exhaust manifold -arrows-.



– Unscrew nuts -arrows-.

– Take out exhaust manifold/turbocharger between subframe and body.



Installing

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

Note

- *Renew seals, gaskets and self-locking nuts.*
- *Fill turbocharger with engine oil at connection for oil supply pipe.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install exhaust system and align it free of stress ⇒ page 308 .

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

– Install air pipes ⇒ page 279 .

– Check oil level ⇒ page 244 .

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

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Component		Nm
Exhaust manifold/turbocharger to cylinder head		25 1)
Heat shield to exhaust manifold/turbocharger		25
EGR connecting pipe to:	Change-over flap	20
	Exhaust manifold	25
Oil supply pipe to turbocharger		22
Bracket for oil supply pipe to exhaust manifold		25
Bracket for turbocharger to:	Cylinder block	40
	Turbocharger	20
Oil return pipe to cylinder block		30
Oil supply pipe to oil filter bracket		22
Oil pressure switch to oil filter bracket		20

• 1) Renew nuts.

2.6 Charge air cooler - exploded view

1 - 5 Nm

2 - Mounting

3 - Charge air cooler

- ❑ Removing and installing ⇒ page 280

4 - Air hose

5 - 8 Nm

6 - Air hose

7 - To turbocharger

8 - Air pipe

9 - To intake manifold

10 - Air hose

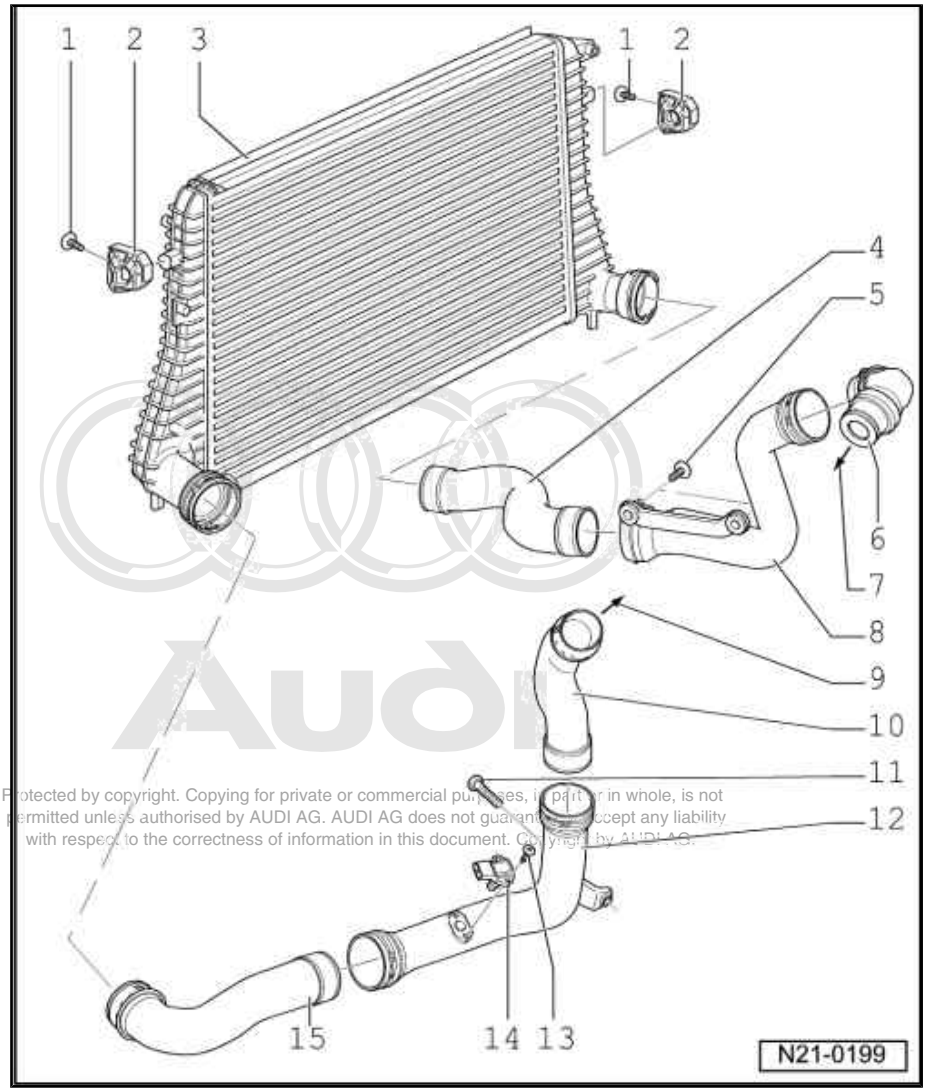
11 - 22 Nm

12 - Air pipe

13 - 8 Nm

14 - Charge pressure sender - G31- / intake air temperature sender -G42-

15 - Air hose



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2.7 Removing and installing charge air cooler

Removing

– Remove radiator ⇒ page 259 .

– Remove front bumper ⇒ Rep. Gr. 63 .

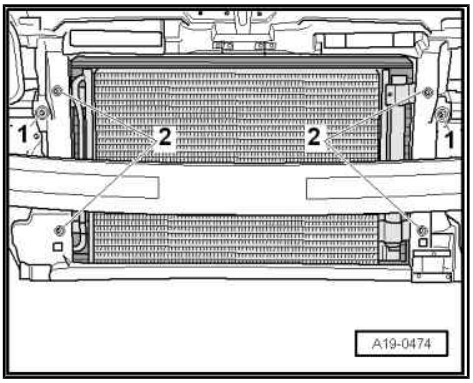
– Remove air ducts on left and right at charge air cooler.

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.



– Unscrew securing bolts -2- for the condenser.
– Unscrew bolts -1- at charge air cooler.
– Swing charge air cooler slightly to rear.
– Detach charge air cooler upwards and remove from below.

Installing

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

– Install front bumper ⇒ Rep. Gr. 63 .
– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .
– Install radiator ⇒ page 259 .

Tightening torques

Component	Nm
Charge air cooler to lock carrier	5
Condenser to charge air cooler	5

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3 Turbocharger and charge air cooling - vehicles with engine codes BMN, BUY

3.1 Connection diagram for vacuum lines

1 - Air cleaner housing
- ❑ With vent pipe connection for charge pressure control solenoid valve - N75-

2 - Charge pressure control solenoid valve -N75-

3 - Cylinder head cover
- ❑ With vacuum reservoir

4 - Non-return valve
- ❑ Note installation position

5 - Vacuum line to brake servo

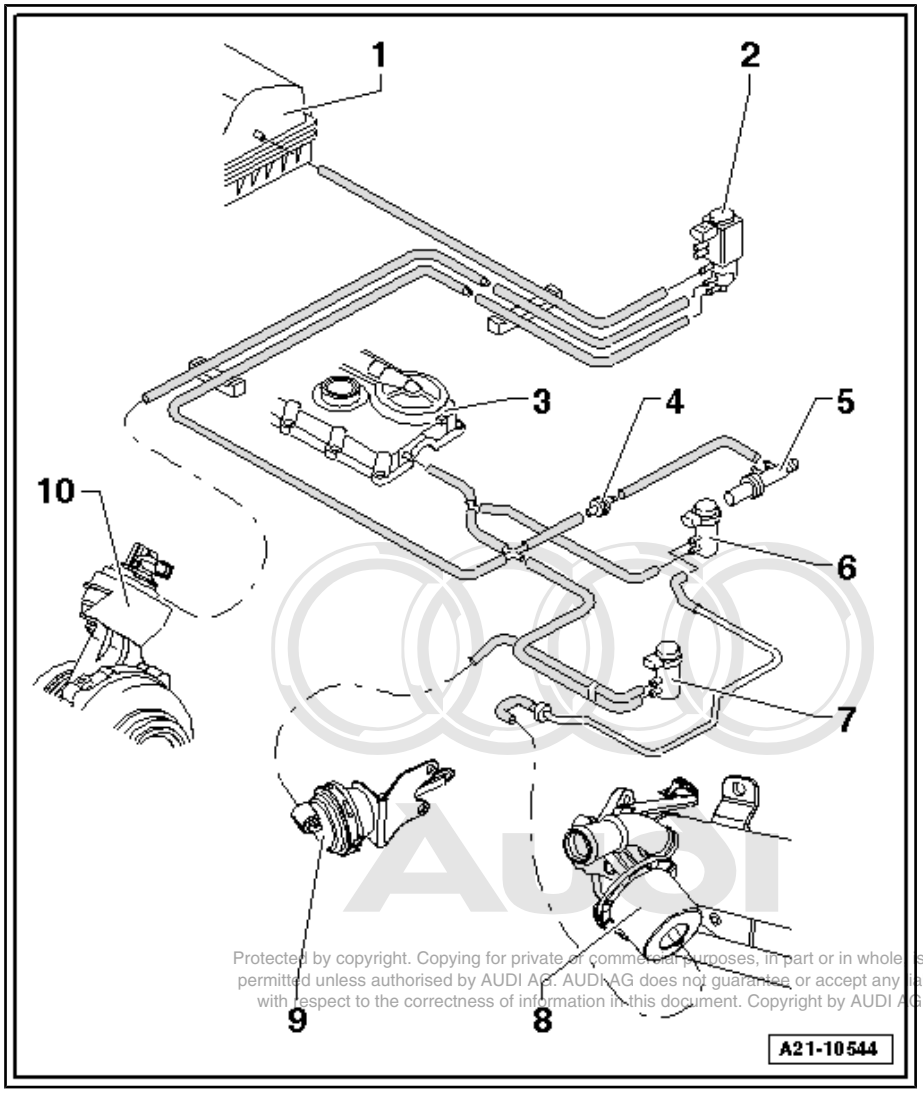
6 - Exhaust gas recirculation cooler change-over valve - N345-

7 - Intake manifold flap valve - N316-

8 - Vacuum unit
- ❑ For exhaust gas recirculation cooler change-over

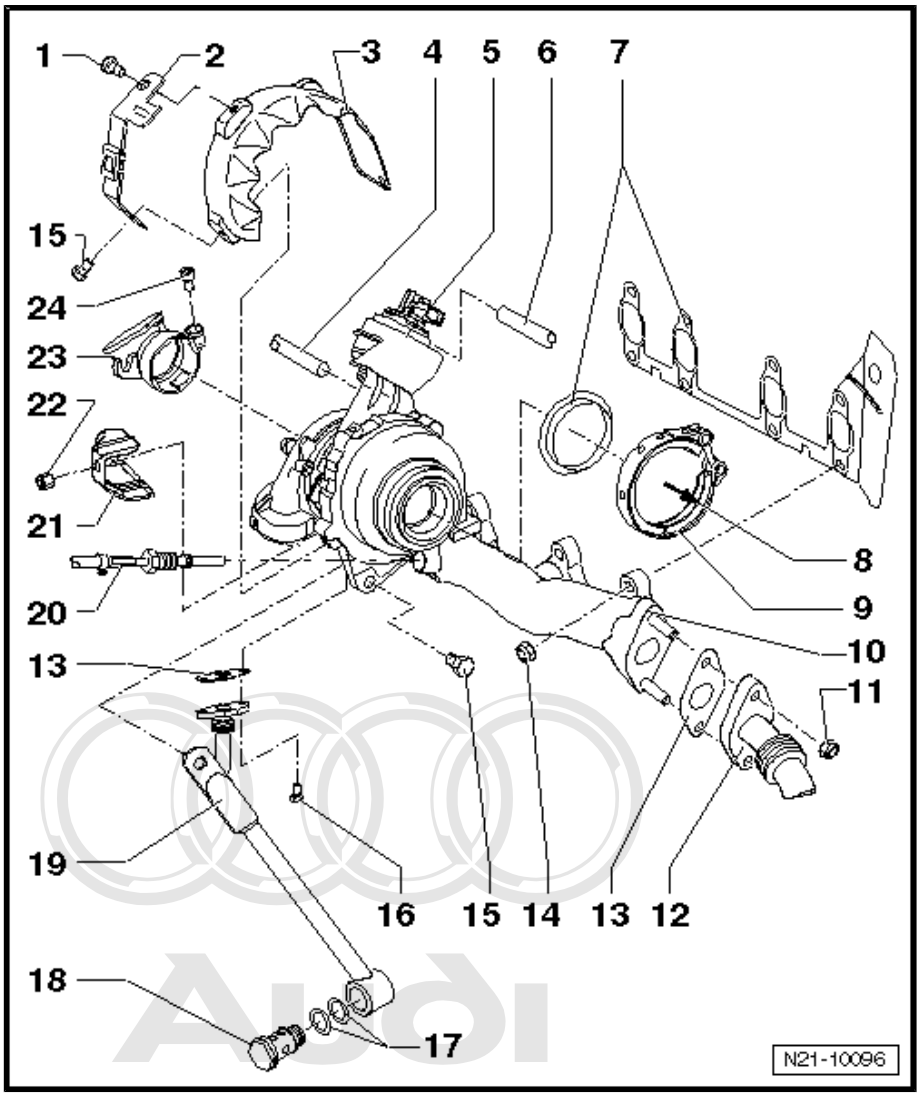
9 - Vacuum unit
- ❑ For air flow control

10 - Vacuum unit
- ❑ On turbocharger
- ❑ With position sender for charge pressure positioner -G581-



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3.2 Turbocharger - exploded view



1 - 10 Nm

2 - Bracket

3 - Heat shield

4 - Oil supply hose

- To connection for oil supply pipe at turbocharger

5 - Turbocharger

- With position sender for charge pressure positioner -G581-
- Can only be renewed with exhaust manifold
- Removing and installing: vehicles with front-wheel drive ⇒ page 284 , vehicles with four-wheel drive ⇒ page 292 .

6 - Vacuum hose

- From charge pressure control solenoid valve - N75-

7 - Gasket

- Renew
- Note installation position

8 - To particulate filter

9 - Securing clamp, 7 Nm

- For turbocharger/particulate filter

10 - Exhaust manifold

- Can only be renewed with turbocharger

11 - 25 Nm

- Renew

12 - Connecting pipe

- To exhaust gas recirculation cooler

13 - Gasket

- Renew

14 - 25 Nm

- Renew

15 - 25 Nm

16 - 15 Nm

17 - O-ring

- Renew

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18 - Banjo bolt, 60 Nm

19 - Support

- ❑ For turbocharger
- ❑ With oil return pipe

20 - Exhaust gas temperature sender 1 -G235-

- ❑ Removing and installing ⇒ page 332
- ❑ Coat thread of sender with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

21 - Heat shield

22 - 25 Nm

- ❑ Renew

23 - Connection

- ❑ For air cleaner/turbocharger air hose

24 - 9 Nm

3.3 Removing and installing turbocharger - vehicles with front-wheel drive

Removing

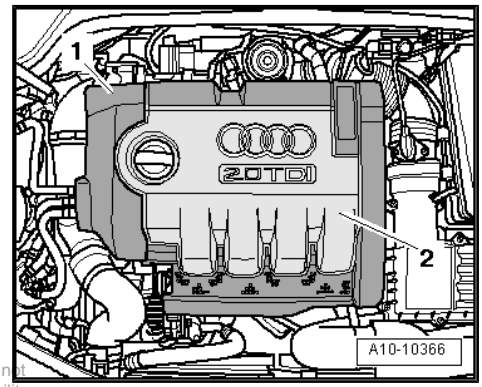
Caution

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 intake 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.*

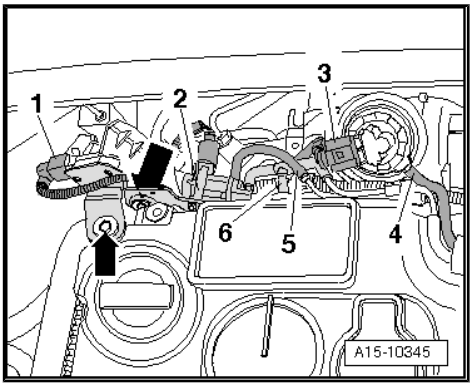
Observe rules for cleanliness when working on turbocharger ⇒ page 6

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



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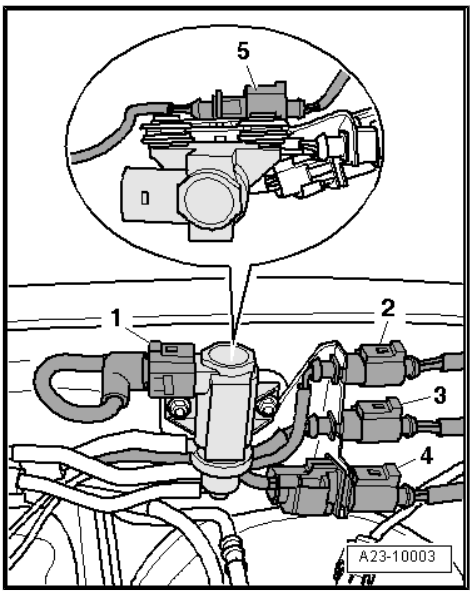
– Unclip change-over valve for exhaust gas recirculation cooler -N345- -item 2- from bracket.
– Unplug electrical connectors -1- and -3- and move wiring clear.
– Detach vacuum pipe -4-.
– Remove bolts -arrows-.



Note

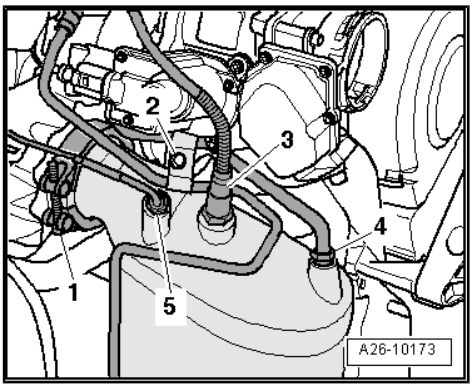
Disregard items marked -5- and -6-.

– Unplug electrical connector -5- for temperature sender before particulate filter -G506- and move wiring clear.



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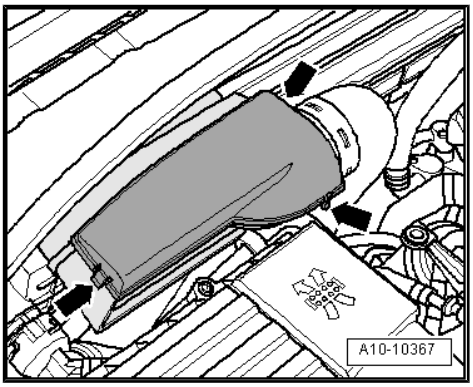
– Remove temperature sender before particulate filter -G506- -item 5-.



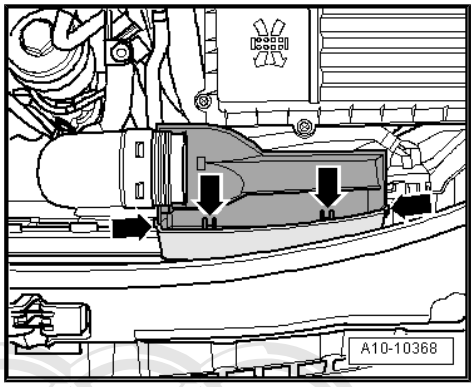
Note

Disregard items marked -1 ... 4-.

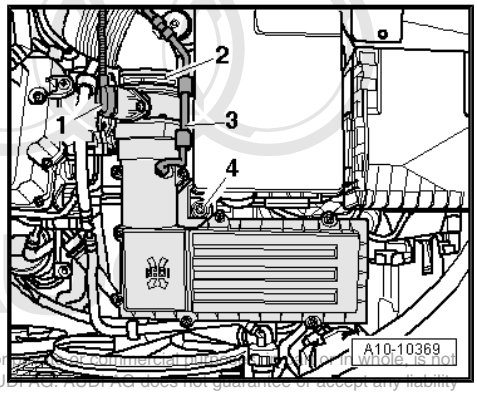
– Pull cover off air duct (release clips on sides) -arrows-.



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

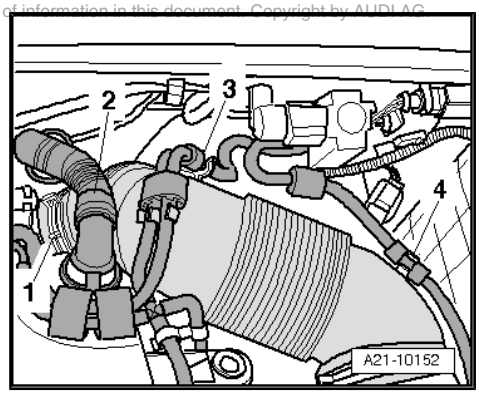


– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.



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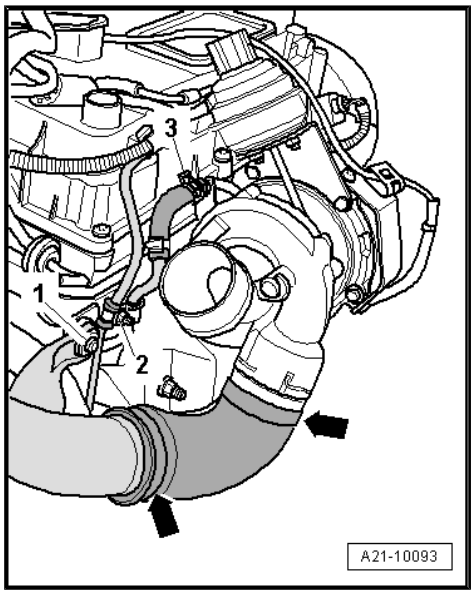
– Remove crankcase breather hose -2-.
– Move vent hose -4- and vacuum hoses -3- clear at air intake hose.
– Slacken hose clip -1-.
– Swing air hose to rear and detach from turbocharger.



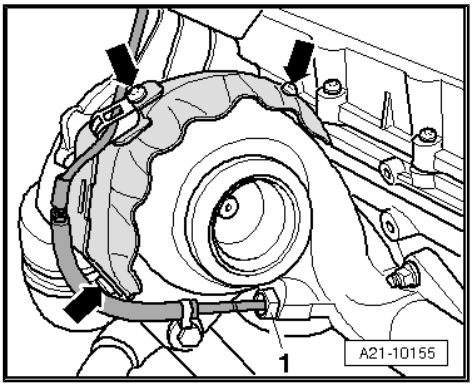
– Disconnect oil supply hose -3- from turbocharger.
– Pull retaining clips -arrows- out slightly and detach air intake hose.

Note

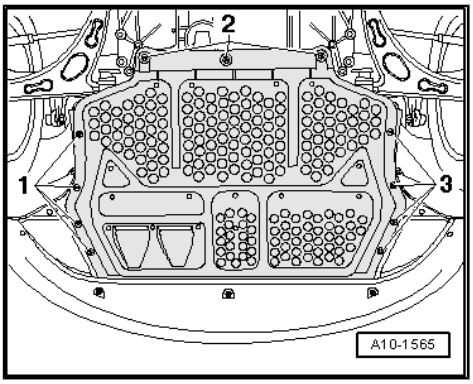
Disregard items marked -1- and -2-.



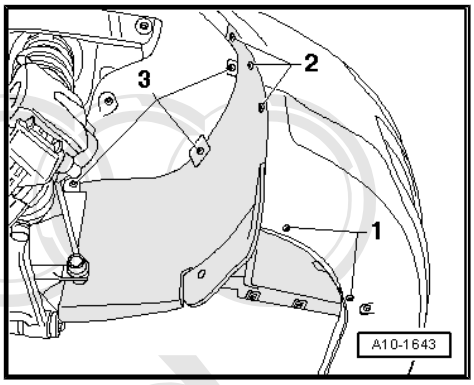
– Move wiring for exhaust gas temperature sender 1 -G235- -item 1- clear.
– Unscrew bolts -arrows- and remove heat shield.



– Remove front right wheel.
– Remove centre noise insulation -fasteners 1 ... 3-.



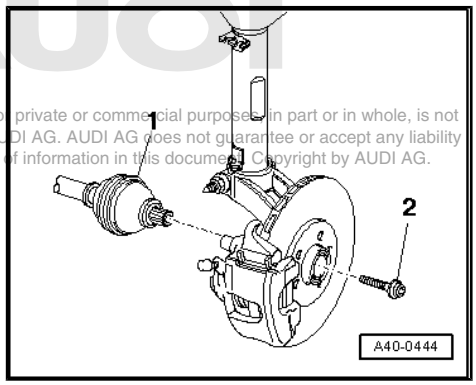
– Remove noise insulation (right-side) -fasteners 1 ... 3-.



Caution

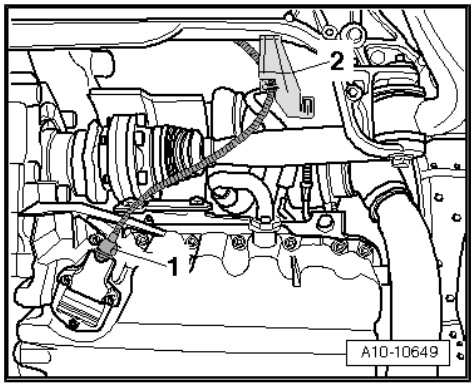
When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).

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

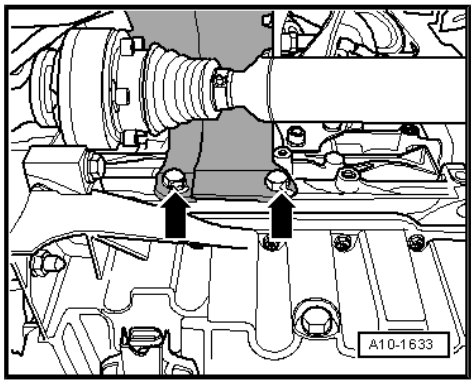


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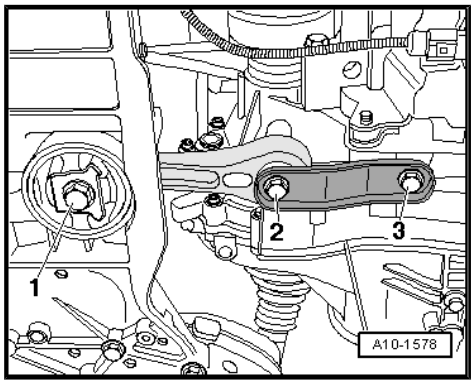
– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Unclip bracket -2- for wire to oil level and oil temperature sender -G266- from subframe.



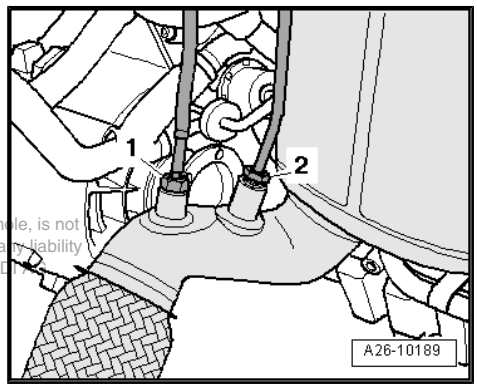
– Unbolt heat shield for drive shaft (right-side) -arrows-.
– Unbolt drive shaft (right-side) from gearbox flange.
– Push drive shaft (right-side) towards front of vehicle.



– Unscrew bolts -1 ... 3- and remove pendulum support.

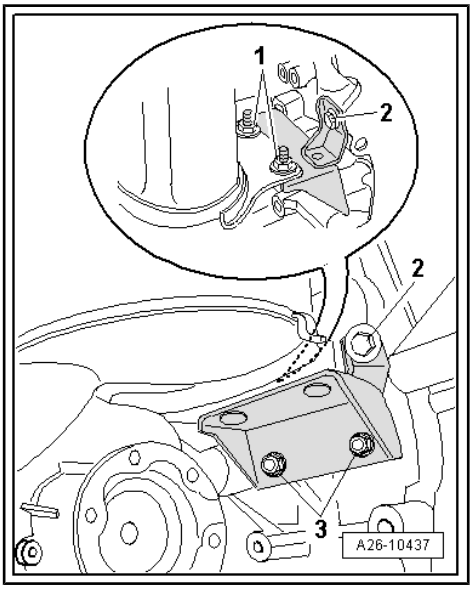


– Unscrew temperature sender after particulate filter -G527- -item 1- from exhaust pipe behind particulate filter.
– Unscrew pressure pipe -2- going to exhaust gas pressure sensor 1 -G450- .



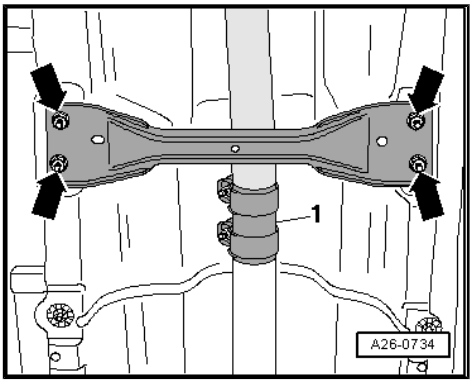
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– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.



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– Remove front cross-piece for underbody -arrows-.

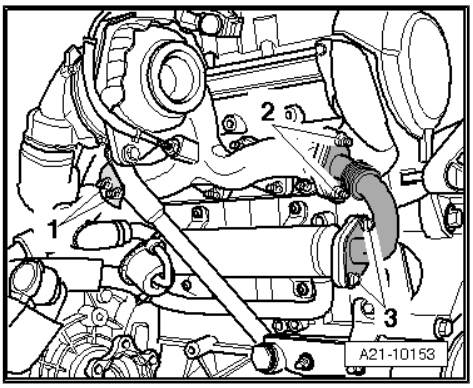


Note

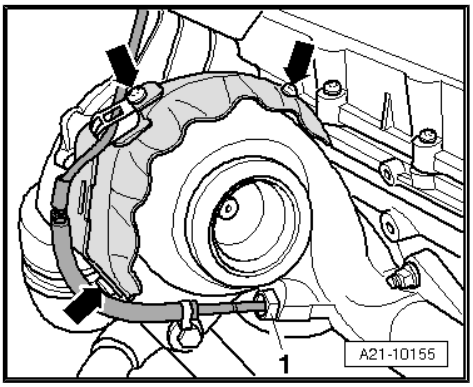
To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

– Loosen nuts on clamp -1-.
– Remove particulate filter by rotating clockwise through 180°.
– Remove drive shaft (right-side) through wheel housing.

– Unscrew nuts -1- and remove heat shield from exhaust manifold (left-side).
– Remove nuts -2- and bolts -3- and remove connecting pipe for exhaust gas recirculation.



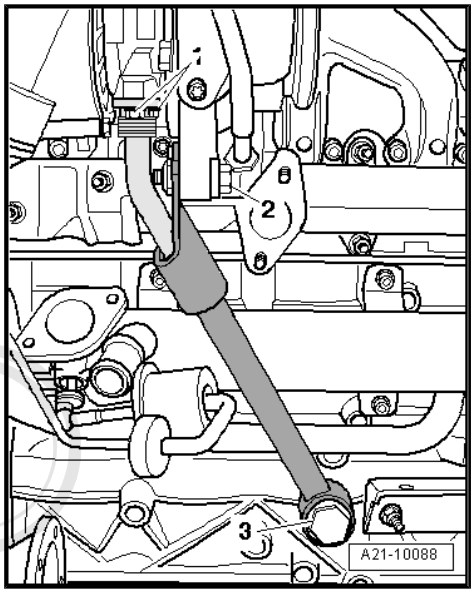
– Unscrew exhaust gas temperature sender 1 -G235- -item 1- from exhaust manifold.



Note

Disregard -arrows-.

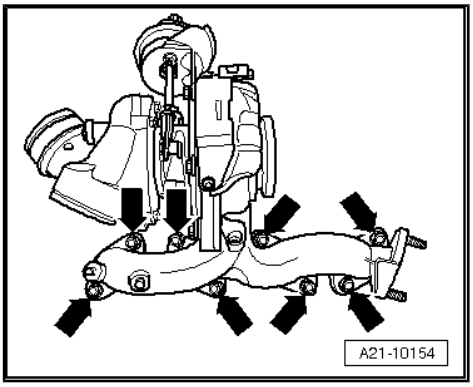
– Remove nuts -1-, bolt -2- and banjo bolt -3-.
– Remove support for turbocharger together with oil return pipe.



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– Remove bolts -arrows-.

– Remove turbocharger with exhaust manifold from below by pushing engine/gearbox 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 pipe.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install particulate filter ⇒ page 313 .

– Install temperature sender before particulate filter -G506- ⇒ page 334 .

– Install exhaust gas temperature sender 1 -G235- ⇒ page 332 .

– Install exhaust system and align it free of stress ⇒ page 308 .

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

– Check oil level ⇒ page 244 .

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.

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Tightening torques

Component		Nm
Exhaust manifold/turbocharger to cylinder head		25 1)
Oil return pipe to turbocharger		15
Support for turbocharger to:	Turbocharger	25
	Cylinder block	60
Heat shield to exhaust manifold		25 1)
EGR connecting pipe to:	Exhaust gas recirculation cooler	22
	Exhaust manifold	25 1)
Pendulum support to gearbox		Manual gearbox ⇒ Rep. Gr. 34 , automatic gearbox ⇒ Rep. Gr. 37
Drive shaft heat shield to cylinder block		35
Heat shield to turbocharger		10
Bracket for solenoid valves to cylinder head		10

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

3.4 Removing and installing turbocharger - vehicles with four-wheel drive

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:

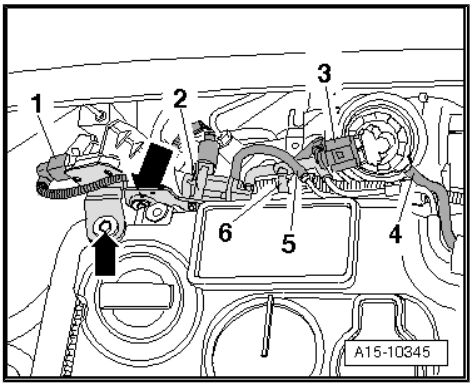
- *Check air cleaner housing, air filter element and air intake hoses for dirt and foreign particles.*
- *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

Observe rules for cleanliness when working on turbocharger ⇒ page 6

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– Remove particulate filter ⇒ page 322 .

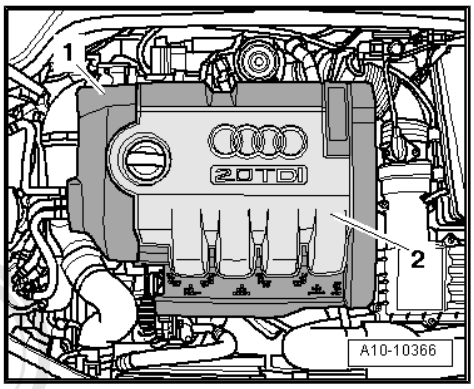
– Unplug electrical connector -3- and move wiring clear.



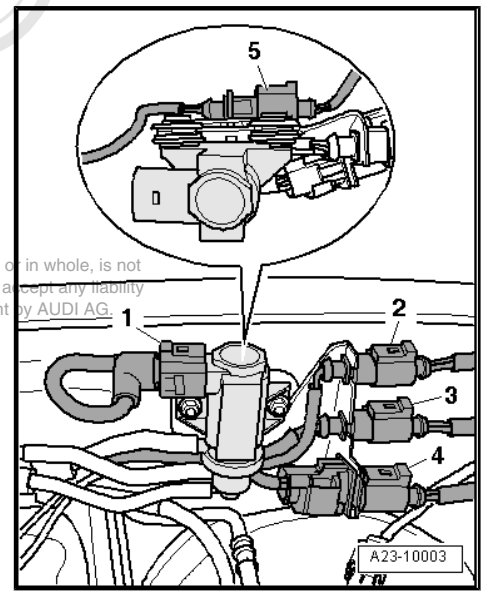
Note

Disregard -items 1, 2, 5 and 6-.

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

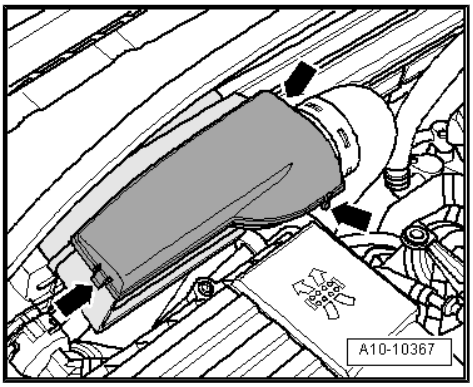


– Unplug electrical connector -5- for temperature sender before particulate filter -G506- and move wiring clear.

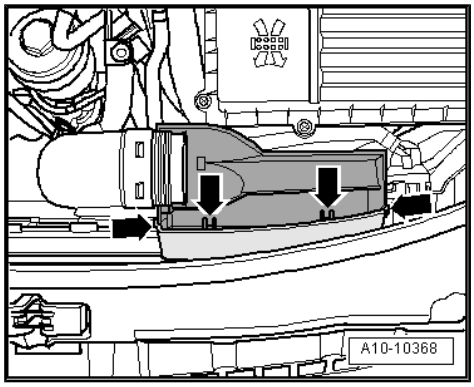


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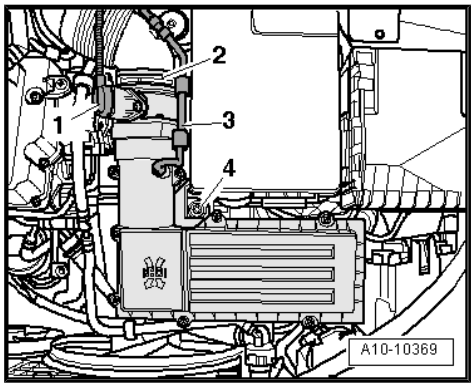
– Pull cover off air duct (release clips on sides) -arrows-.



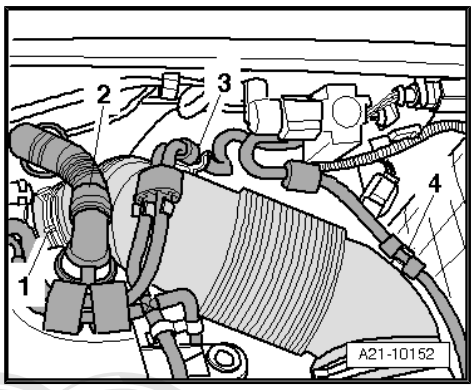
– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



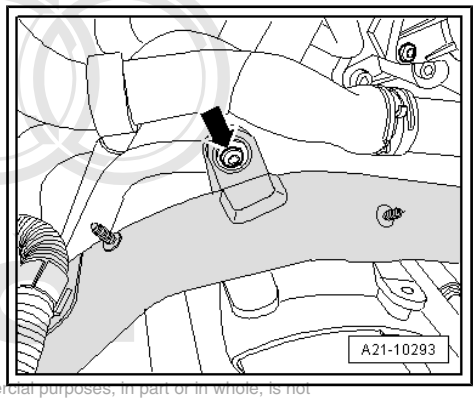
– Unplug electrical connector -1- at air mass meter -G70- .
– Detach vent hose -3- and air hose -2-.
– Unscrew bolt -4- and remove air cleaner housing.



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

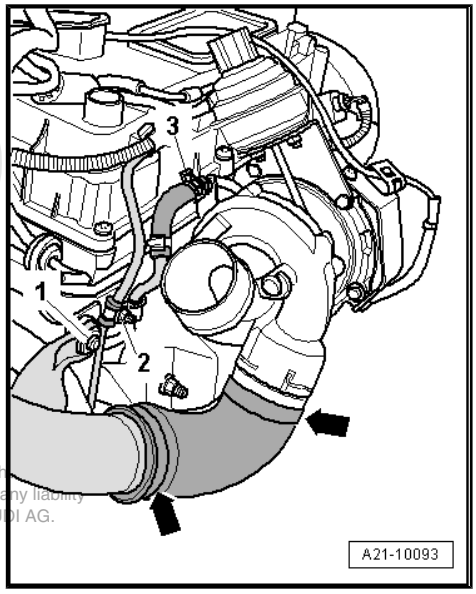


– Remove bolt -arrow- at front of air pipe.



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– Remove bolt -1-.
– Disconnect oil supply hose -3- from turbocharger.
– Pull retaining clips -arrows- out slightly and detach air intake hose.

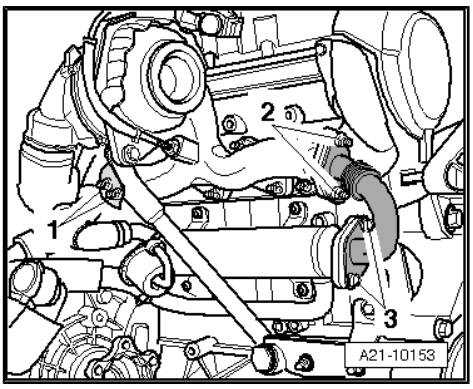


Note

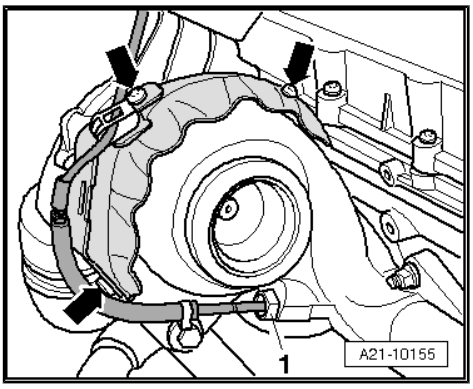
Disregard -item 2-.

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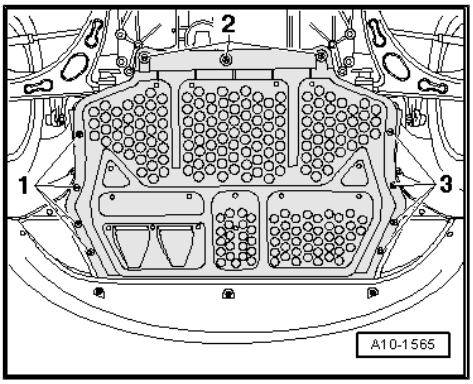
– Unscrew nuts -1- and remove heat shield from exhaust manifold (left-side).
– Remove nuts -2- and bolts -3- and remove connecting pipe for exhaust gas recirculation.
– Remove flange shaft (right-side) ⇒ Rep. Gr. 39 .



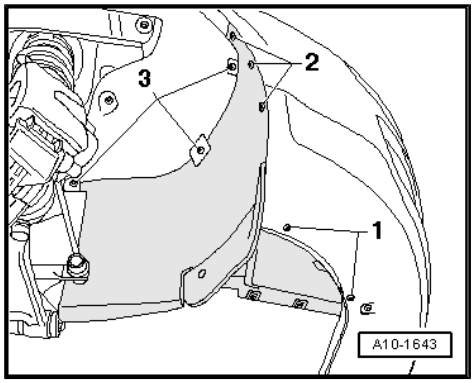
– Move wiring for exhaust gas temperature sender 1 -G235- -item 1- clear.
– Unscrew bolts -arrows- and remove heat shield.



– Remove front right wheel.
– Remove centre noise insulation -fasteners 1 ... 3-.

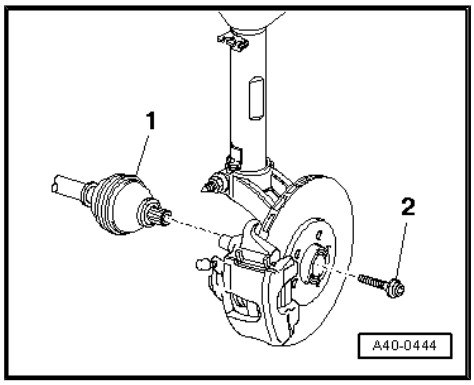


– Remove noise insulation (right-side) -fasteners 1 ... 3-.



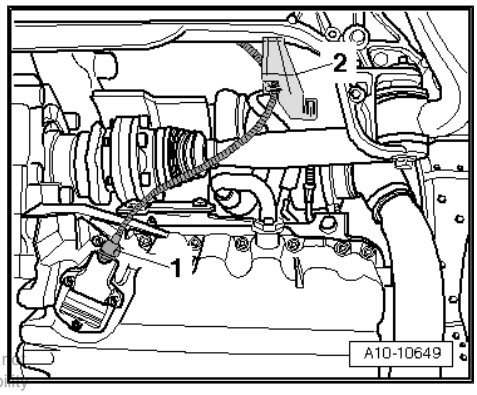
Caution

When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).



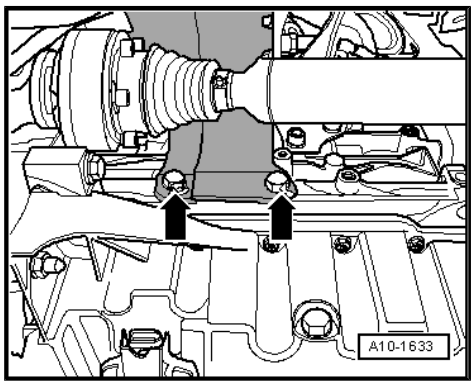
– Unscrew flange bolt -2- from drive shaft (right-side) -1-.

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

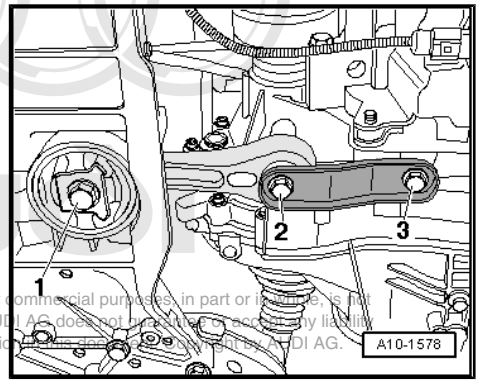


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– Unbolt heat shield for drive shaft (right-side) -arrows-.
– Unbolt drive shaft (right-side) from gearbox flange.
– Push drive shaft (right-side) towards front of vehicle.

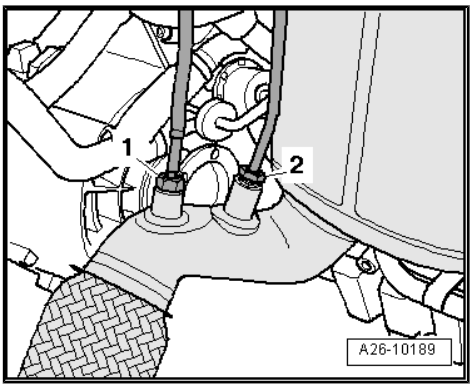


– Unscrew bolts -1 ... 3- and remove pendulum support.

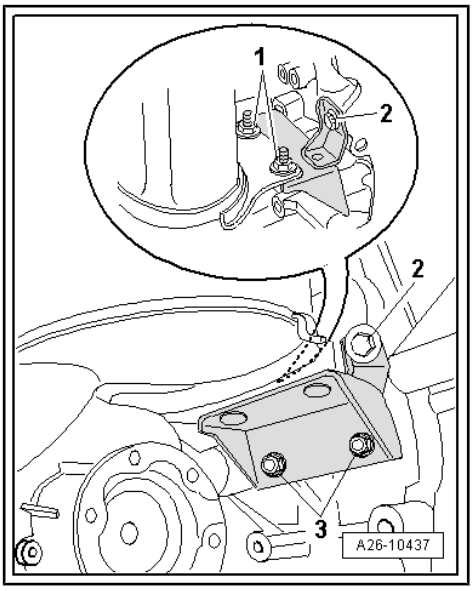


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– Unscrew temperature sender after particulate filter -G527- -item 1- from exhaust pipe behind particulate filter.
– Unscrew pressure pipe -2- going to exhaust gas pressure sensor 1 -G450- .



– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.

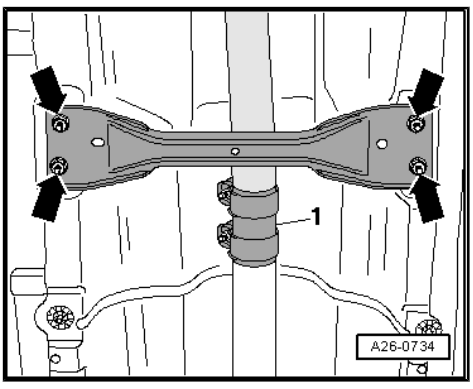


– Remove front cross-piece for underbody -arrows-.

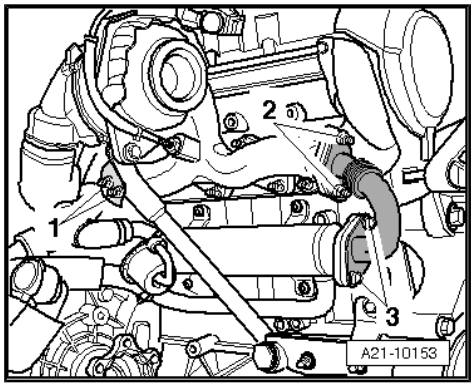
Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

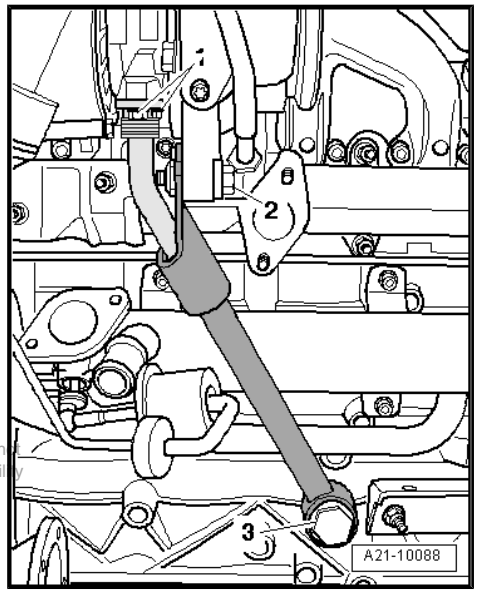
– Loosen nuts on clamp -1-.
– Remove particulate filter by rotating clockwise through 180°.
– Remove drive shaft (right-side) through wheel housing.



– Unscrew nuts -1- and remove heat shield from exhaust manifold (left-side).
– Remove nuts -2- and bolts -3- and remove connecting pipe for exhaust gas recirculation.



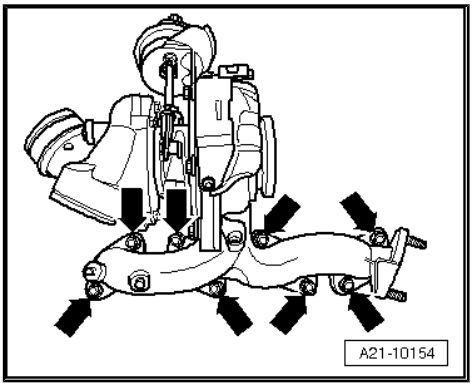
– Remove bolts -1-, -2- and banjo bolt -3-.
– Remove support for turbocharger together with oil return pipe.



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– Remove bolts -arrows-.

– Remove turbocharger with exhaust manifold from below and guide out to the right by pushing engine/gearbox 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 pipe.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install particulate filter ⇒ page 313 .

– Install flange shaft (right-side) ⇒ Rep. Gr. 39 .

– Install exhaust system and align it free of stress ⇒ page 308 .

– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

– Check oil level ⇒ page 244 .

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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)
Oil return pipe to turbocharger		15
Support for turbocharger to:	Turbocharger	25
	Cylinder block	60
Heat shield to exhaust manifold		25 1)
EGR connecting pipe to:	Exhaust gas recirculation cooler	22
	Exhaust manifold	25 1)
Pendulum support to gearbox		Manual gearbox ⇒ Rep. Gr. 34 , automatic gearbox ⇒ Rep. Gr. 37
Drive shaft heat shield to bevel box		23

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

3.5 Charge air cooler - exploded view

1 - 5 Nm

2 - Mounting

3 - Charge air cooler

- ❑ Removing and installing ⇒ page 300

4 - To turbocharger

5 - Air hose

6 - Spring-type clip

7 - Air pipe

8 - 8 Nm

9 - Charge pressure sender - G31- / intake air temperature sender -G42-

10 - 8 Nm

11 - Air hose

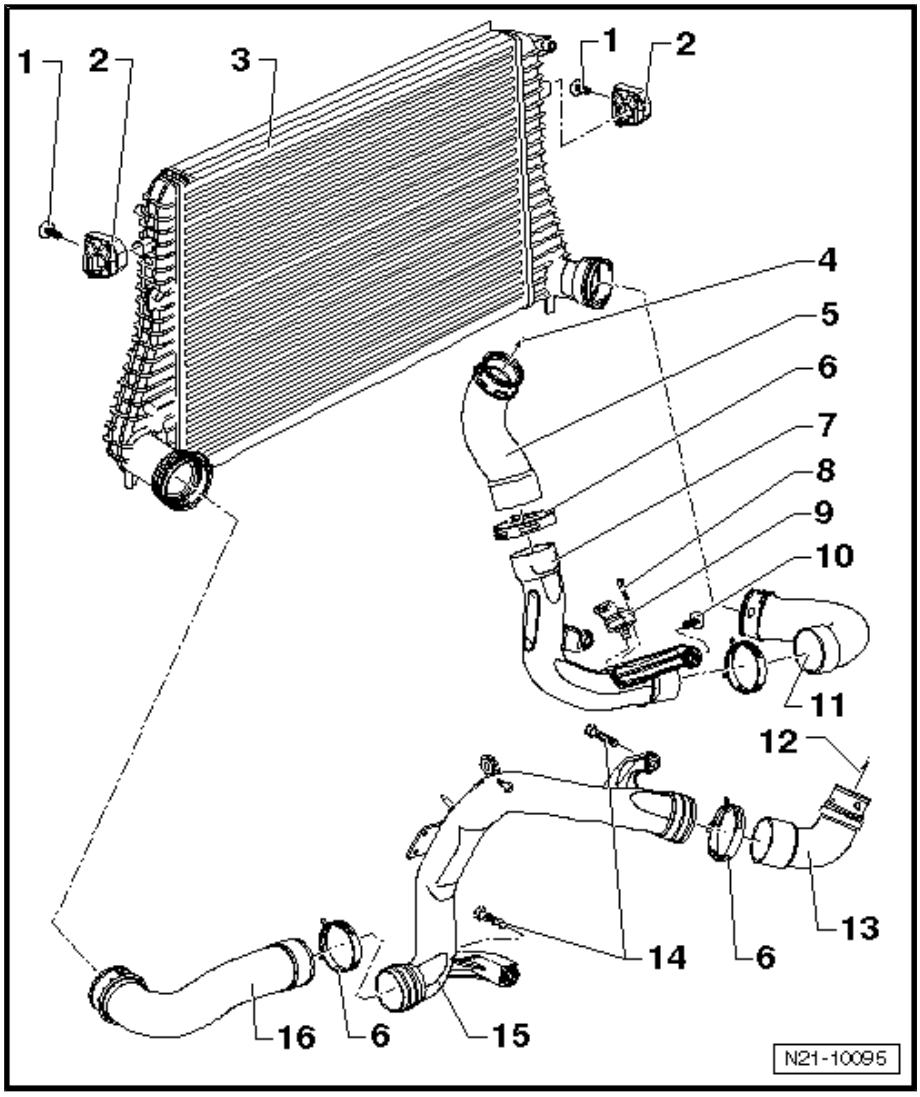
12 - To intake manifold

13 - Air hose

14 - 22 Nm

15 - Air pipe

16 - Air hose



3.6 Removing and installing charge air cooler

Removing

– Remove radiator ⇒ page 259 .

– Remove front bumper ⇒ Rep. Gr. 63 .

– Remove air ducts on left and right at charge air cooler.

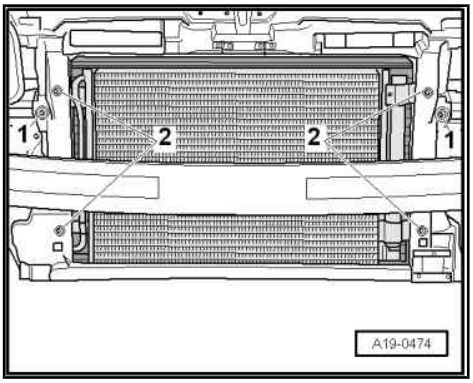
WARNING

The air conditioner refrigerant circuit must not be opened.

Note

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



– Unscrew securing bolts -2- for the condenser.
– Unscrew bolts -1- at charge air cooler.
– Swing charge air cooler slightly to rear.
– Detach charge air cooler upwards and remove from below.

Installing

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

– Install front bumper ⇒ Rep. Gr. 63 .
– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .
– Install radiator ⇒ page 259 .

Tightening torques

Component	Nm
Charge air cooler to lock carrier	5
Condenser to charge air cooler	5

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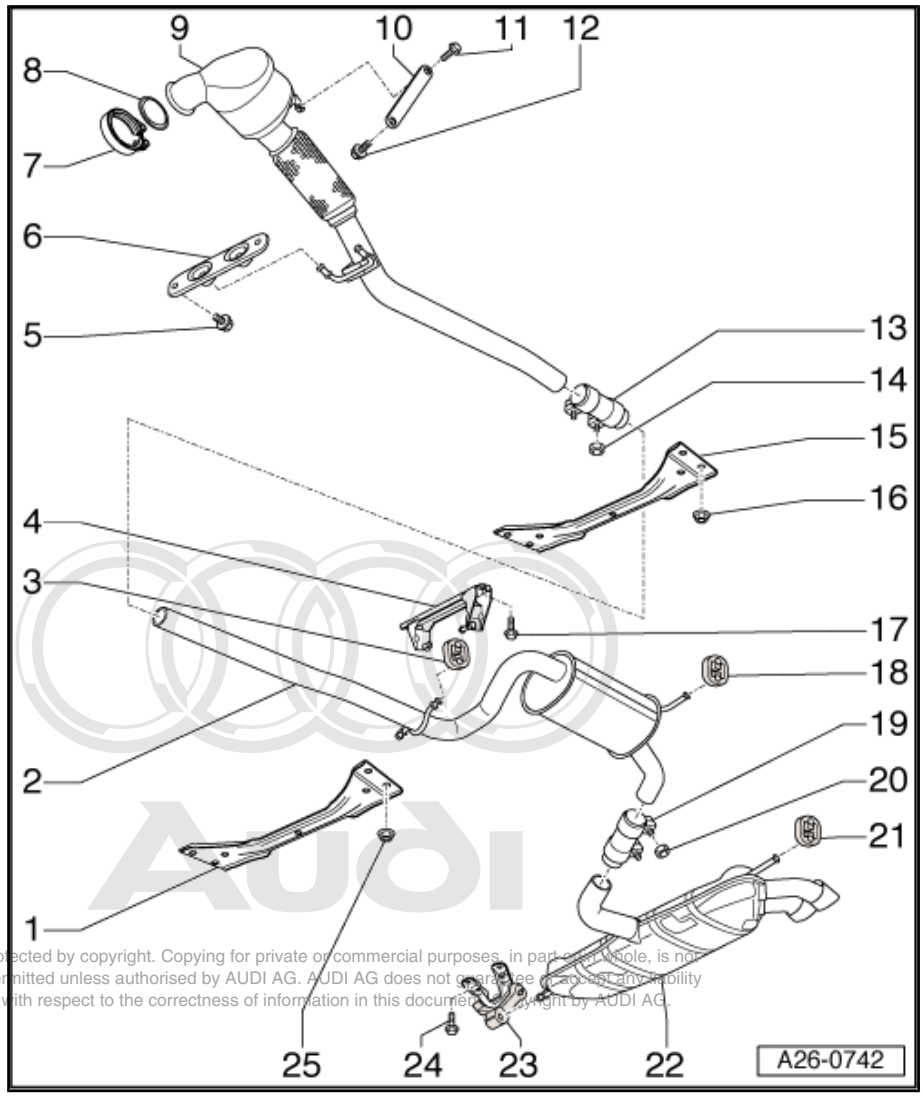
26 – Exhaust system

1 Exhaust system on vehicles without particulate filter

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

- ❑ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point ⇒ page 307
- ❑ Align exhaust system so it is free of stress ⇒ page 308

3 - Rubber mounting

- ❑ Renew if damaged

4 - Mounting

- ❑ Renew if damaged

5 - 23 Nm

6 - Bracket

- ❑ Renew if damaged

7 - Securing clamp, 7 Nm

- ❑ Renew

8 - Seal

- ❑ Renew

9 - Front exhaust pipe

- ❑ With catalytic converter
- ❑ Protect against knocks and impact
- ❑ With flexible joint
- ❑ Do not bend flexible joint more than 10° – otherwise it can be damaged
- ❑ Removing and installing ⇒ page 304
- ❑ Align exhaust system so it is free of stress ⇒ page 308

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10 - Support

11 - 40 Nm

12 - 40 Nm

13 - Clamp (front)

- ❑ Align exhaust system so it is free of stress before tightening clamp ⇒ page 308
- ❑ Installation position ⇒ page 303
- ❑ Tighten bolt connections evenly.

14 - 23 Nm

15 - Front cross member for underbody

16 - 23 Nm

17 - 23 Nm

18 - Rubber mounting

- ❑ Renew if damaged

19 - Clamp (rear)

- ❑ For separate replacement of centre and rear silencers
- ❑ Installation position ⇒ page 304
- ❑ Tighten bolt connections evenly.

20 - 23 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 307
- ❑ Align exhaust system so it is free of stress ⇒ page 308

23 - Mounting

- ❑ Renew if damaged

24 - 23 Nm

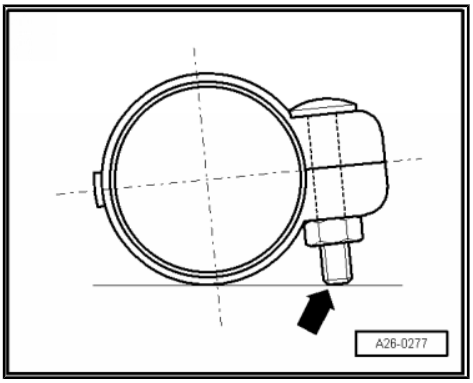
25 - 23 Nm

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Installation position of front clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

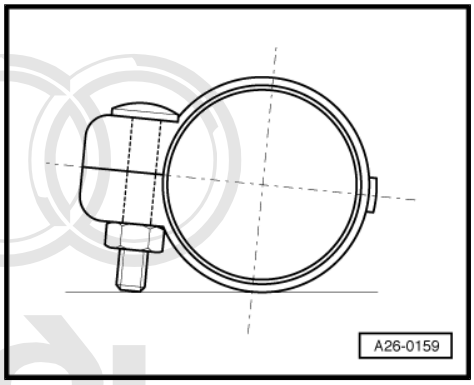
• Bolt connection faces to right.



Installation position of rear clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

• Bolt connection faces to rear

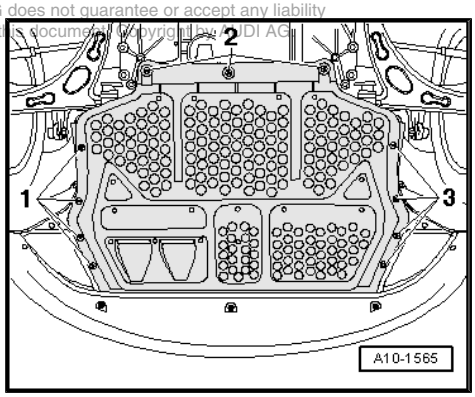


1.2 Removing and installing front exhaust pipe with catalytic converter

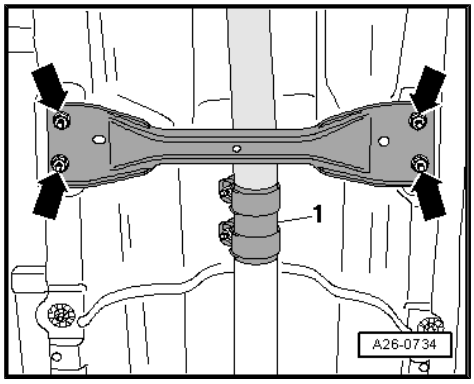
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Removing

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



– Remove front cross-piece for underbody -arrows-.



Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

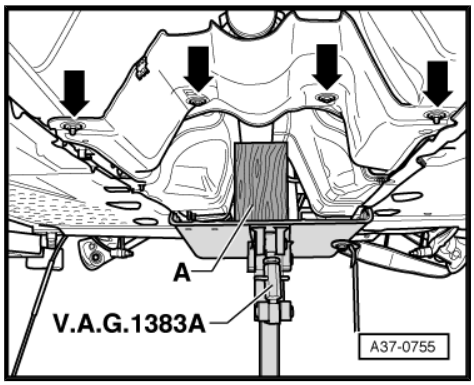
– Loosen nuts on clamp -1-.

– Push clamp back and tie up front exhaust pipe to underbody.

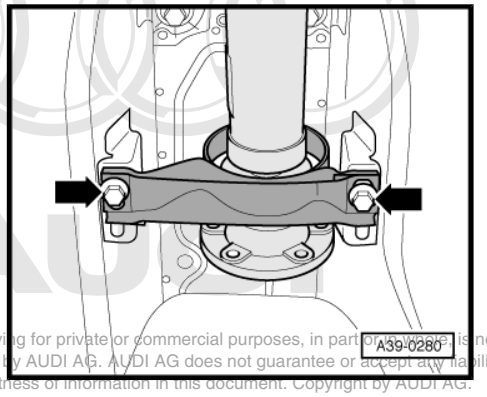
Vehicles with four-wheel drive:

– To support propshaft, position engine and gearbox jack -V.A.G 1383 A- underneath with a piece of wood -A- placed in between.

– Remove bolts -arrows- securing heat shield and propshaft centre bearing and detach heat shield.

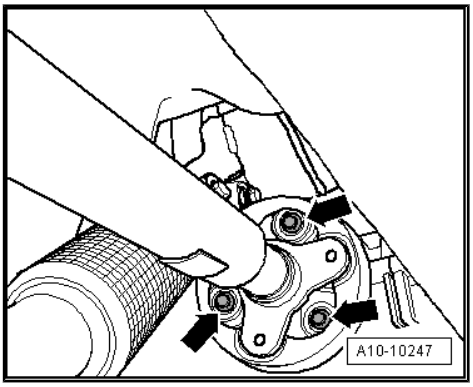


– Fit bolts -arrows- for propshaft centre bearing again.

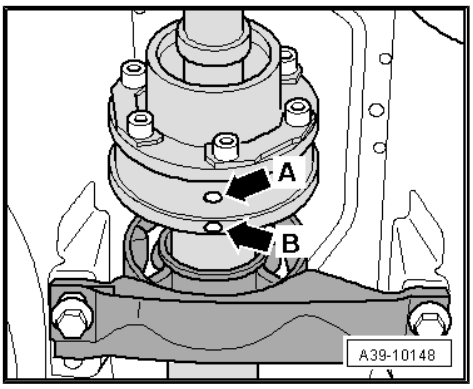


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– Unbolt flexible coupling for propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).



– Check whether markings -arrow A- and -arrow B- are visible on constant velocity joint and propshaft. Apply markings if necessary.

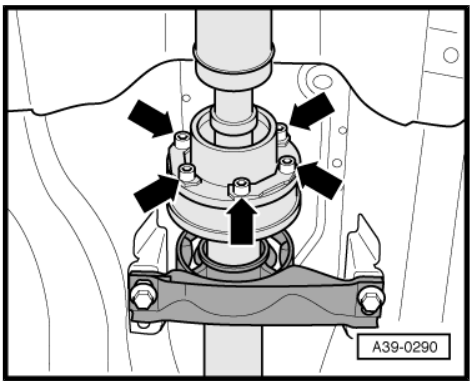


– Remove bolts -arrows-.

Caution

Take care to bend the front section of the propshaft tube downwards as little as possible when detaching.

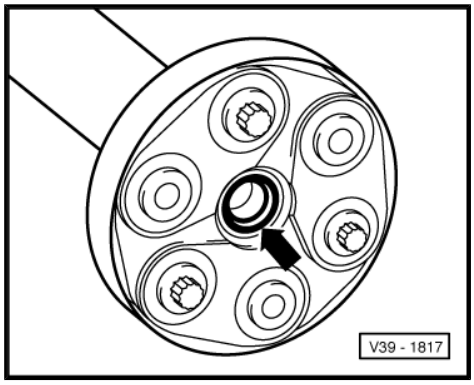
– Push front section of propshaft tube towards the front and swivel it out of rear section of propshaft tube.



Note

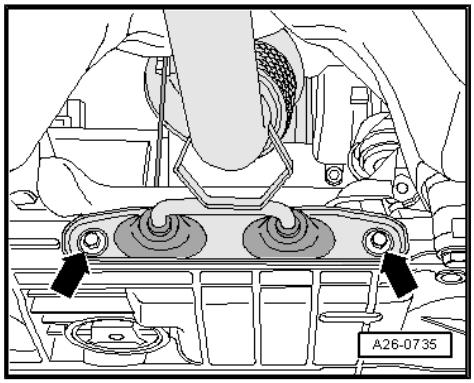
Avoid damaging the seal -arrow- in the propshaft flange when removing and installing.

– Pull front section of propshaft tube off centring pin on bevel box horizontally, swivel downwards and detach.

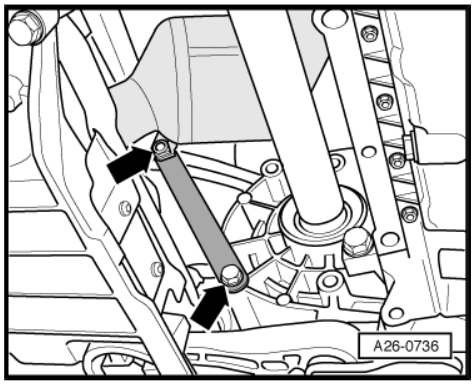


All vehicles (continued):

– Unbolt bracket for exhaust system -arrows-.

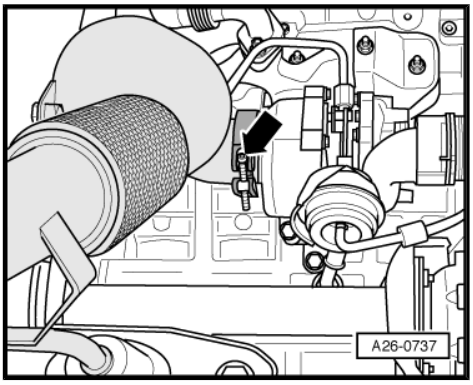


– Unbolt support for front exhaust pipe -arrows-.



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– Open clamp -arrow- and detach front exhaust pipe from turbocharger.



Installing

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

Note

Renew seals and gaskets.

– Align exhaust system so it is free of stress ⇒ page 308 .

Tightening torques

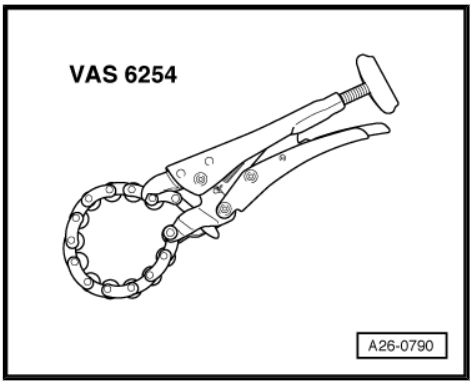
Component		Nm
Front exhaust pipe to turbocharger		7
Bracket for exhaust system to subframe		23
Support for front exhaust pipe to:	Gearbox	40
	Front exhaust pipe	40
Front cross member to body		23

1.3 Separating centre and rear silencers

- The connecting pipe can be cut through at the cutting point provided in order to renew the centre and rear silencers separately.
- The cutting point is marked by an indentation on the outside of the exhaust pipe.

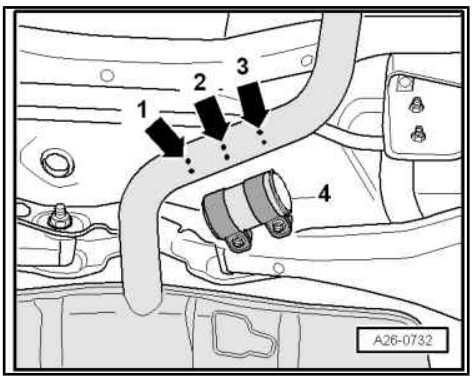
Special tools and workshop equipment required

- Chain pipe cutter -VAS 6254-



Procedure

– Cut through exhaust pipe at a right angle at cutting point -arrow 2- using chain-type pipe cutter -VAS 6254- .



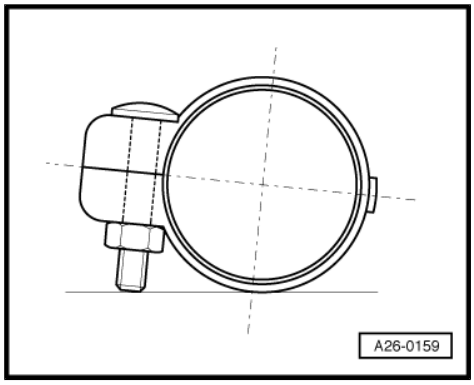
– When installing, position clamp -4- between marks -arrow 1- and -arrow 3- on side of exhaust pipe.

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– Install 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 308 .



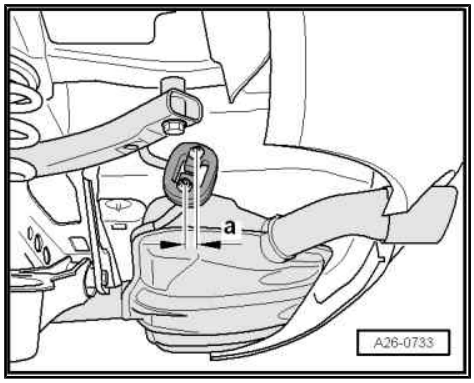
1.4 Stress-free alignment of exhaust system

Procedure

• The exhaust system must be aligned when it is cool.

– Loosen bolt connections of front clamp.

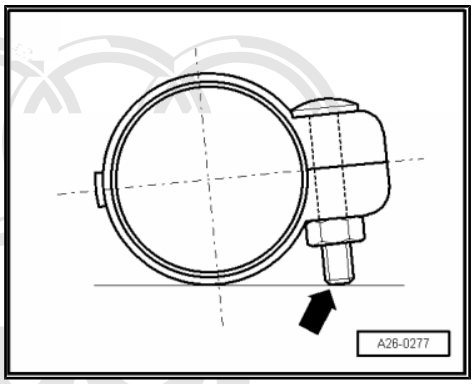
– Push exhaust system towards front of vehicle until preloading at mounting for rear silencer -a- = 15 ... 17 mm.



– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

• Bolt connection faces to right.

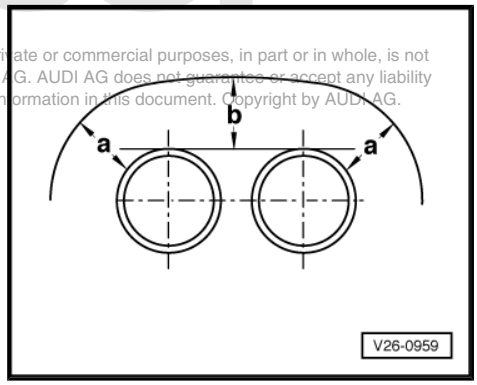
– Tighten bolt connections on clamp evenly to 25 Nm.



Aligning tailpipes

– 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.



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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.

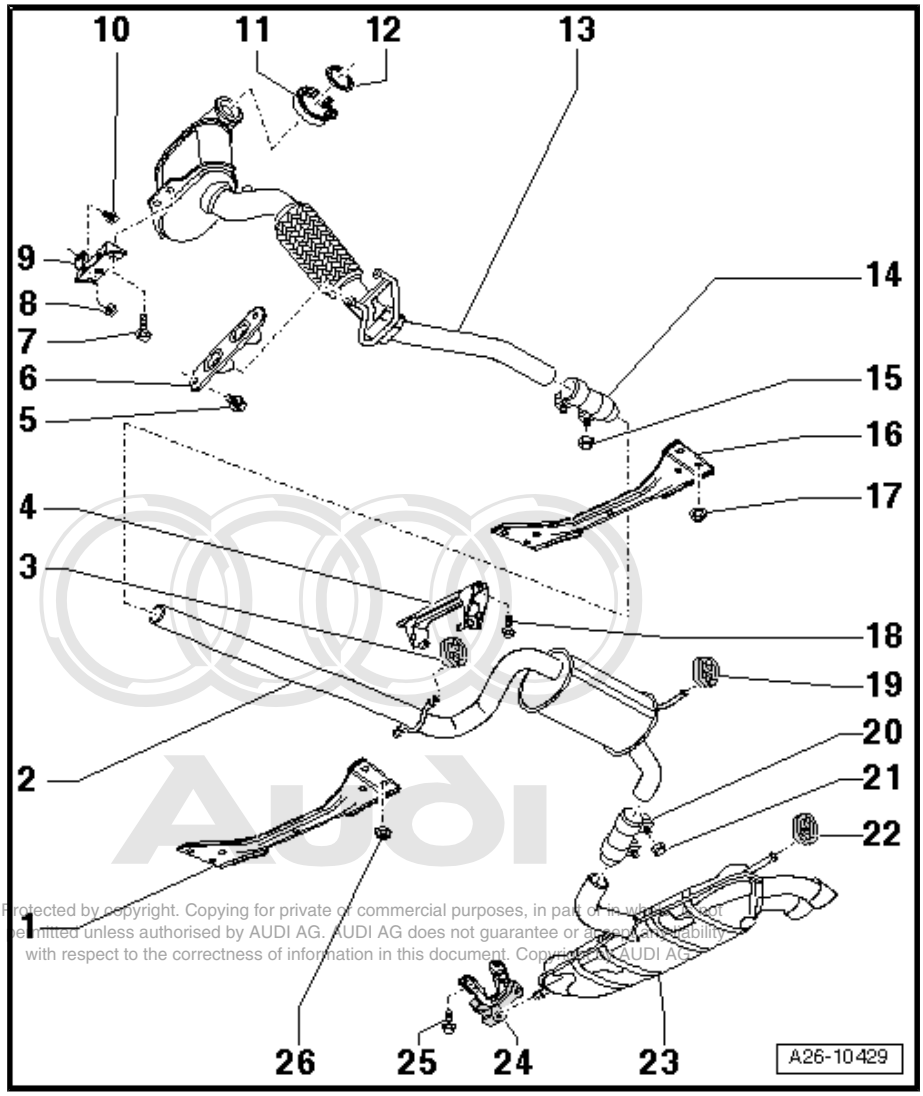
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2 Exhaust system on vehicles with front-wheel drive and particulate filter

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.*

2.1 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 317
- ❑ Align exhaust system so it is free of stress ⇒ page 318

3 - Rubber mounting

- ❑ Renew if damaged

4 - Mounting

- ❑ Renew if damaged

5 - 23 Nm

6 - Bracket

- ❑ 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

- ❑ Renew

13 - Particulate filter with main catalytic converter

- ❑ Fitting locations of components on top of particulate filter ⇒ page 312
- ❑ Fitting locations of components on underside of particulate filter ⇒ page 312
- ❑ Removing and installing ⇒ page 313

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- ❑ After renewing particulate filter, perform adaption in “Guided Functions” ⇒ Vehicle diagnosis, testing and information system VAS 5051.

14 - Clamp (front)

- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 318
- ❑ Installation position ⇒ page 312
- ❑ Tighten bolt connections evenly

15 - 23 Nm

16 - Front cross member for underbody

17 - 23 Nm

18 - 23 Nm

19 - Rubber mounting

- ❑ Renew if damaged

20 - Clamp (rear)

- ❑ For separate replacement of centre and rear silencers
- ❑ Installation position ⇒ page 313
- ❑ Tighten bolt connections evenly

21 - 23 Nm

22 - Rubber mounting

- ❑ Renew if damaged

23 - Rear silencer

- ❑ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point ⇒ page 317
- ❑ Align exhaust system so it is free of stress ⇒ page 318

24 - Mounting

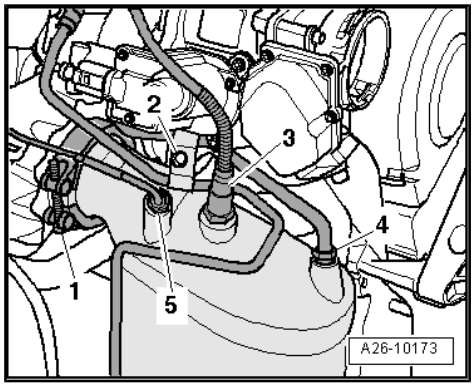
- ❑ Renew if damaged

25 - 23 Nm

26 - 23 Nm

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Fitting locations of components on top of particulate filter



3 - Lambda probe -G39-
- The screw threads on the new Lambda probes are coated with a special assembly paste.
- If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste.
- The assembly paste/high-temperature paste must not get into the slots on the probe body.
- Remove and install using ring spanner for Lambda probe -3337- ⇒ Rep. Gr. 23
- Tighten to 55 Nm.

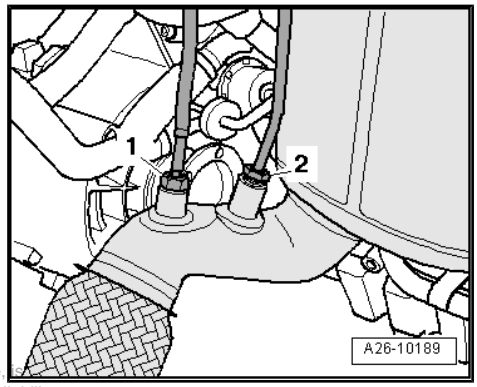
4 - Pressure pipe going to exhaust gas pressure sensor 1 -G450-
- Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
- Tighten union nut to 40 Nm.

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.

Note

Disregard items marked -1- and -2-.

Fitting locations of components on underside of particulate filter

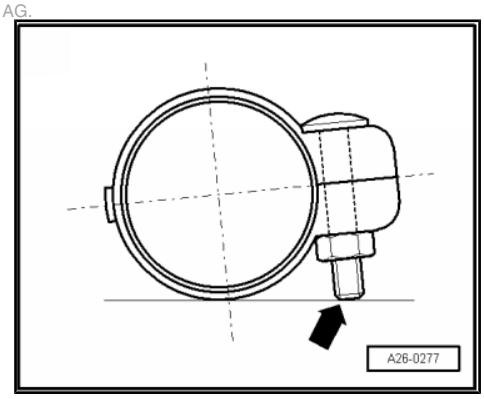


1 - Temperature sender after particulate filter -G527-
- Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
- Tighten to 45 Nm.

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.

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Installation position of front clamp



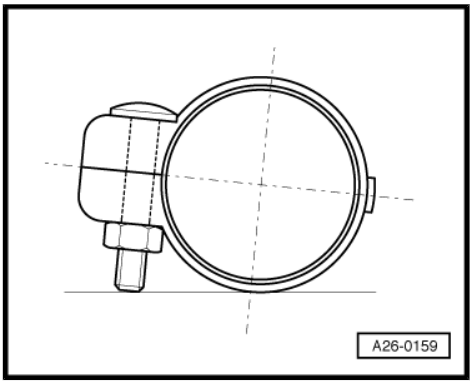
– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

• Bolt connection faces to right.

Installation position of rear clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

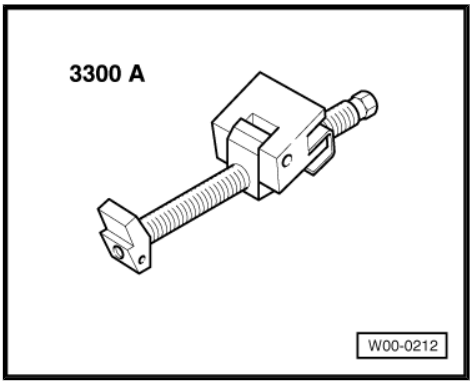
• Bolt connection faces to rear



2.2 Removing and installing particulate filter

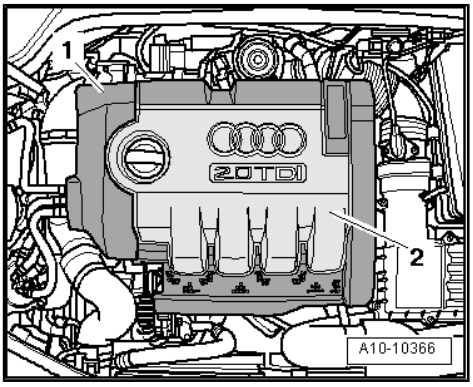
Special tools and workshop equipment required

♦ Engine support -3300 A-



Removing

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

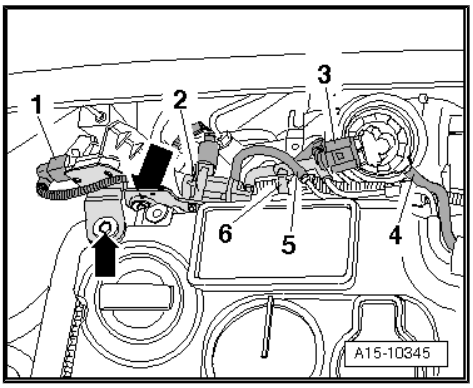


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– Unclip change-over valve for exhaust gas recirculation cooler -N345- -item 2- from bracket.

– Unplug electrical connector -1- and move wiring clear.

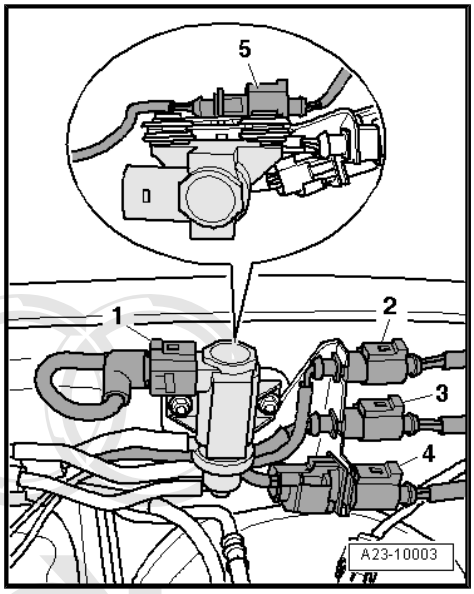
– Remove bolts -arrows-.



Note

Disregard -items 3, 4, 5 and 6-.

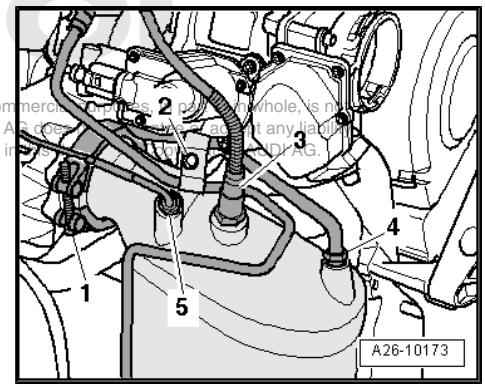
– Unplug electrical connector -4- for Lambda probe -G39- and move Lambda probe wiring clear.



Note

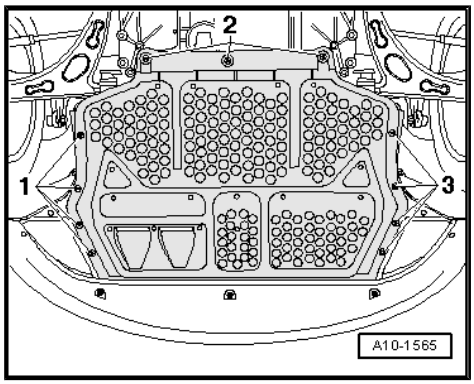
Disregard -items 1, 2, 3 and 5-.

– Unscrew Lambda probe -3- ⇒ Rep. Gr. 23 .
– Remove temperature sender before particulate filter -G506- -item 5-.
– Unbolt bracket -2- for pressure pipes.
– Detach pressure pipe -4- at particulate filter.
– Slacken and remove retaining clamp -1- for particulate filter.

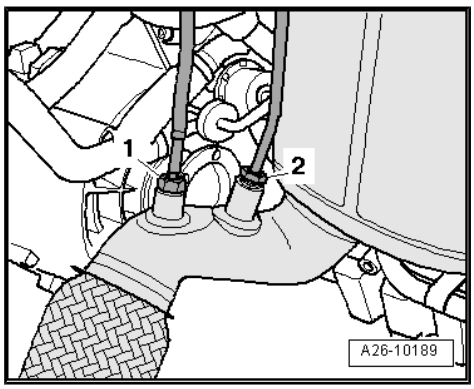


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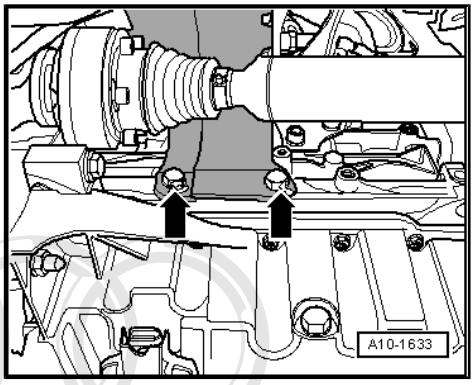
– Remove centre noise insulation -fasteners 1 ... 3-.



– 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- .
– Remove exhaust gas pressure sensor 1 -G450- together with pressure pipes.



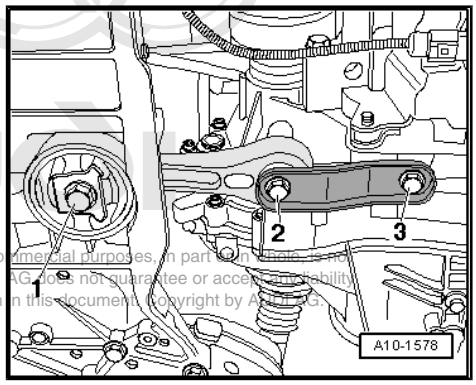
– Unbolt heat shield for drive shaft (right-side) -arrows-.
– Unbolt drive shaft (right-side) from gearbox flange.
– Push drive shaft (right-side) towards front of vehicle.



– Unscrew bolts -2- and -3- for pendulum support.

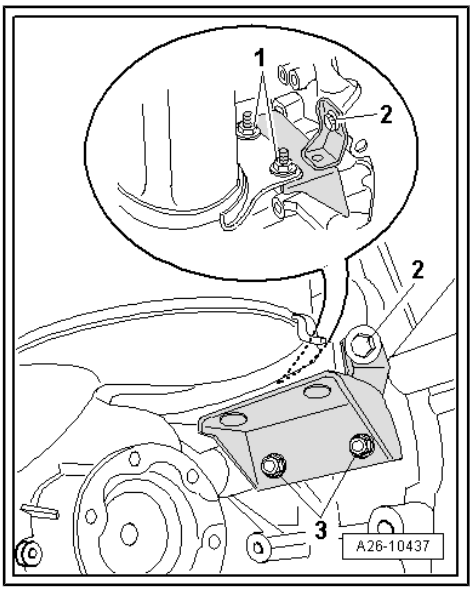
Note

Disregard -item 1-.



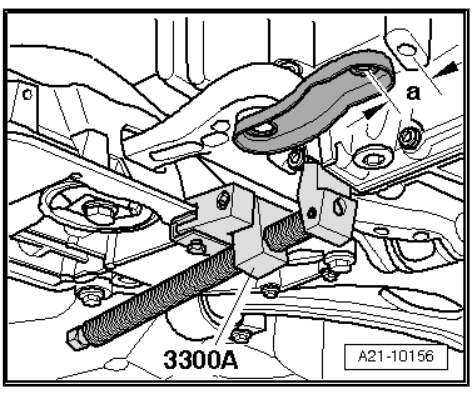
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– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.

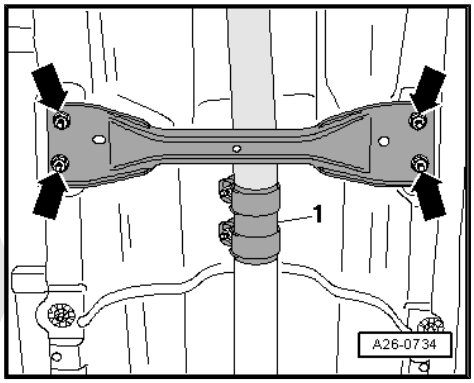


– Using engine support -3300 A- , push engine/gearbox assembly forwards by distance -a-.

• Dimension -a- = 35 mm.



– Remove front cross-piece for underbody -arrows-.

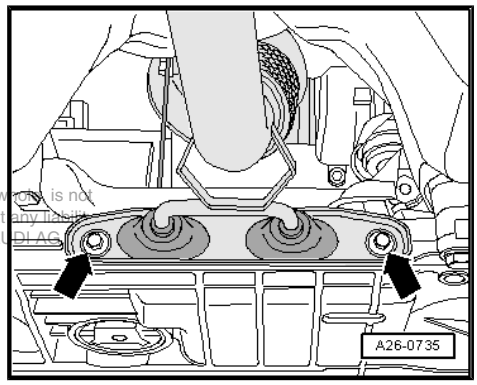


Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.

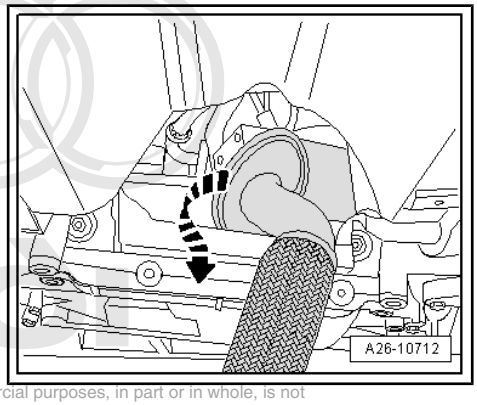
– Loosen nuts on clamp -1-.

– Unbolt bracket for exhaust system -arrows-.



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– Remove particulate filter by rotating through 180° and about its own axis.



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.*

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– Install temperature sender after particulate filter -G527- ⇒ page 335 .

– Install Lambda probe -G39- ⇒ Rep. Gr. 23 .

– Install temperature sender before particulate filter -G506- ⇒ page 334 .

– Install exhaust gas pressure sensor 1 -G450- ⇒ Rep. Gr. 23 .

– Install drive shaft ⇒ Rep. Gr. 40 .

– Align exhaust system so it is free of stress ⇒ page 308 .

– After renewing particulate filter, perform adaption in “Guided Functions” ⇒ Vehicle diagnosis, testing and information system VAS 5051

Tightening torques

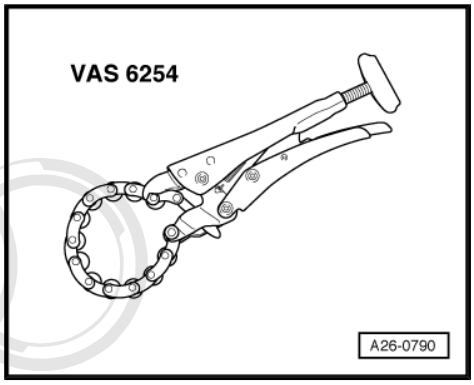
Component	Nm
Bracket for exhaust system to subframe	23
Front exhaust pipe to turbocharger	7
Bracket for particulate filter to particulate filter	23
Pendulum support to gearbox	Manual gearbox ⇒ Rep. Gr. 34 , automatic gearbox ⇒ Rep. Gr. 37
Heat shield to cylinder block	35
Underbody cross member (front) to body	23
Pressure pipe to particulate filter	40
• 1) Renew bolts. • 2) 90° = one quarter turn.	

2.3 Separating centre and rear silencers

- The connecting pipe can be cut through at the cutting point provided in order to renew the centre and rear silencers separately.
- The cutting point is marked by an indentation on the outside of the exhaust pipe.

Special tools and workshop equipment required

♦ Chain pipe cutter -VAS 6254-

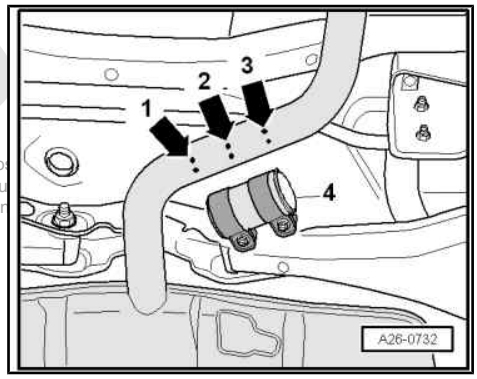


Procedure

– 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- between marks -arrow 1- and -arrow 3- on side of exhaust pipe.

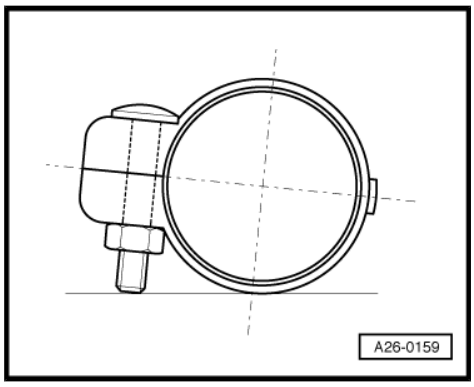
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– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

• Bolt connection faces to rear

– Align exhaust system so it is free of stress ⇒ page 308 .



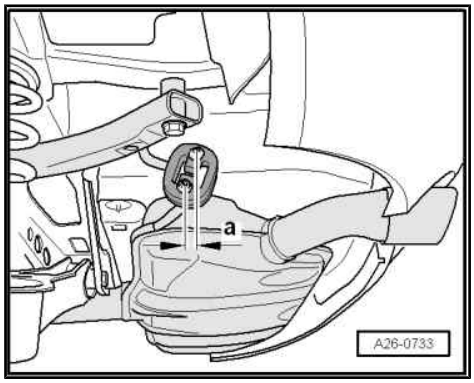
2.4 Stress-free alignment of exhaust system

Procedure

• The exhaust system must be aligned when it is cool.

– Loosen bolt connections of front clamp.

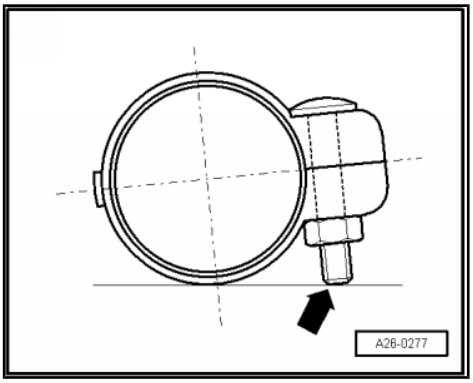
– Push exhaust system towards front of vehicle until preloading at mounting for rear silencer -a- = 15 ... 17 mm.



– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

• Bolt connection faces to right.

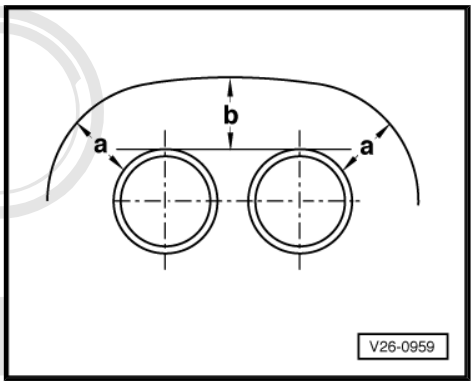
– Tighten bolt connections on clamp evenly to 25 Nm.



Aligning tailpipes

– 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.



2.5 Checking exhaust system for leaks

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– 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.

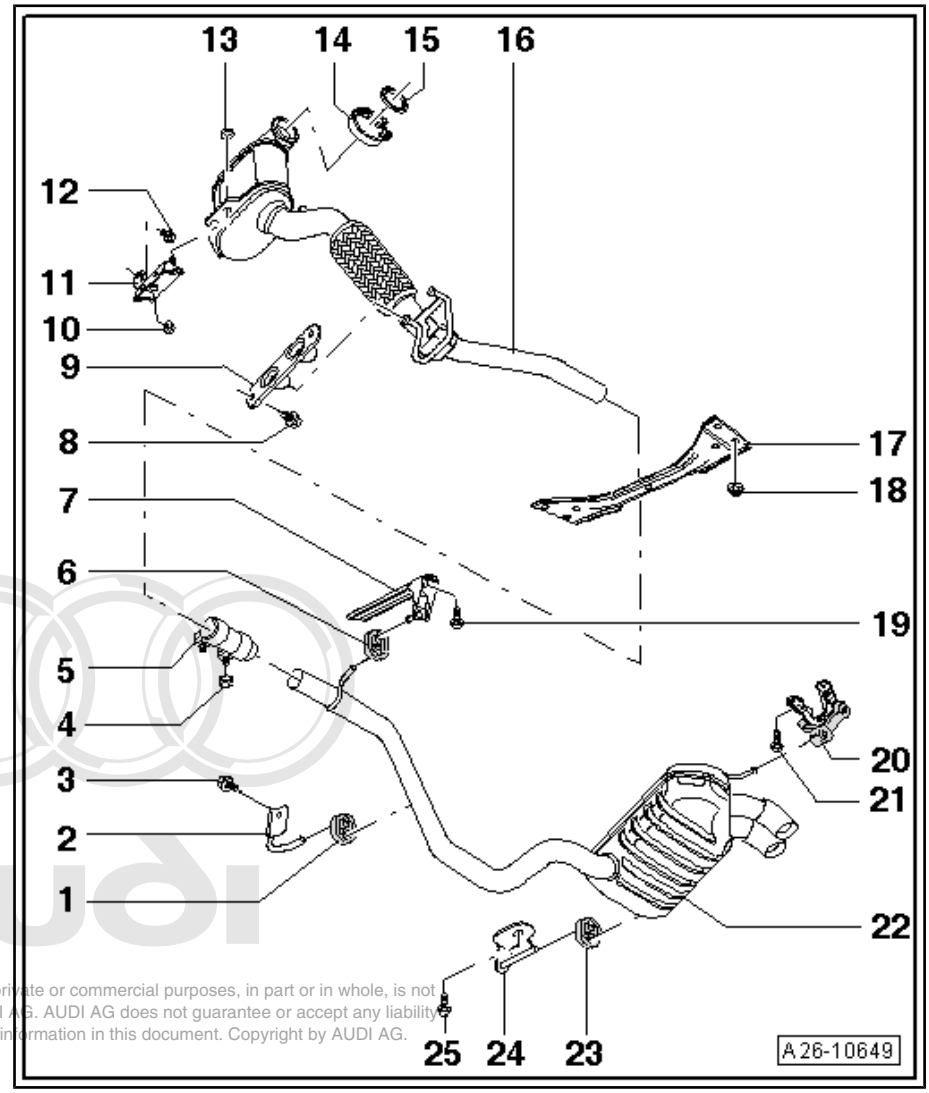
– Repair any leaks that are found.

3 Exhaust system on vehicles with four-wheel drive and particulate filter

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.*

3.1 Exhaust system - exploded view



1 - Rubber mounting
- ❑ Renew if damaged

2 - Mounting
- ❑ Renew if damaged

3 - 23 Nm

4 - 23 Nm

5 - Clamp (front)
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 331
- ❑ Installation position ⇒ page 322
- ❑ Tighten bolt connections evenly

6 - Rubber mounting
- ❑ Renew if damaged

7 - Mounting
- ❑ Renew if damaged

8 - 23 Nm

9 - Bracket
- ❑ Renew if damaged

10 - 23 Nm

11 - Bracket
- ❑ For particulate filter

12 - 23 Nm

13 - 23 Nm

14 - Securing clamp, 7 Nm
- ❑ Renew

15 - Gasket
- ❑ Renew

16 - Particulate filter with main catalytic converter
- ❑ Fitting locations of components on top of particulate filter ⇒ page 321

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- ❑ Fitting locations of components on underside of particulate filter ⇒ page 322
- ❑ Removing and installing ⇒ page 322
- ❑ After renewing particulate filter, perform adaption in “Guided Functions” ⇒ Vehicle diagnosis, testing and information system VAS 5051.

17 - Front cross member for underbody

18 - 23 Nm

19 - 23 Nm

20 - Mounting

- ❑ Renew if damaged

21 - 23 Nm

22 - Rear silencer

- ❑ Align exhaust system so it is free of stress ⇒ page 331

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23 - Rubber mounting

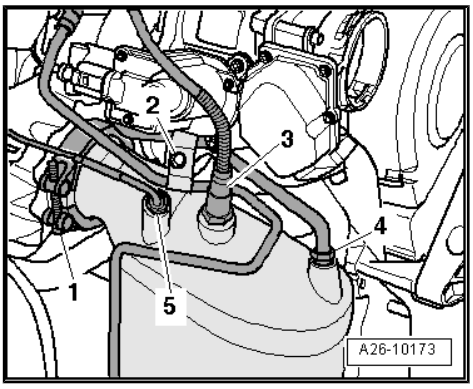
- ❑ Renew if damaged

24 - Bracket

- ❑ Renew if damaged

25 - 23 Nm

Fitting locations of components on top of particulate filter



3 - Lambda probe -G39-
- ♦ The screw threads on the new Lambda probes are coated with a special assembly paste.
- ♦ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Electronic parts catalogue for high-temperature paste.
- ♦ The assembly paste/high-temperature paste must not get into the slots on the probe body.
- ♦ Remove and install using ring spanner for Lambda probe -3337- ⇒ Rep. Gr. 23
- ♦ Tighten to 55 Nm.

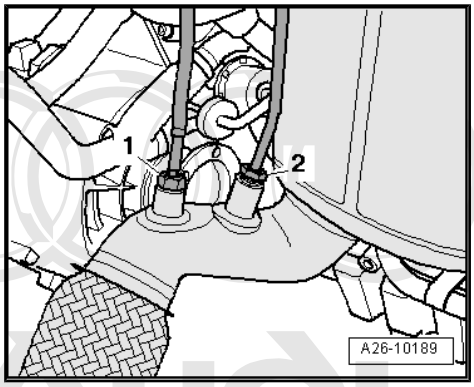
4 - Pressure pipe going to exhaust gas pressure sensor 1 -G450-
- ♦ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
- ♦ Tighten union nut to 40 Nm.

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.

Note

Disregard items marked -1- and -2-.

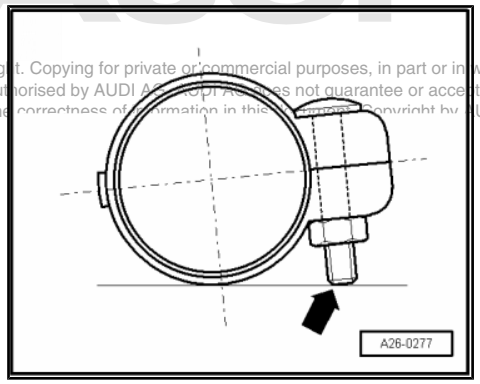
Fitting locations of components on underside of particulate filter



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



– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

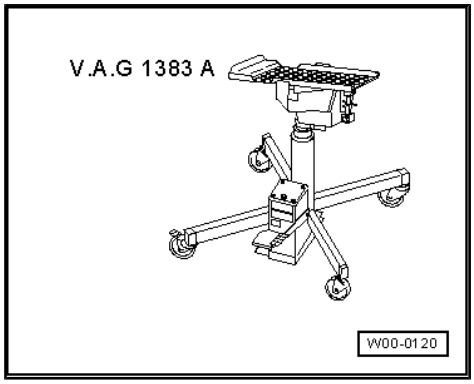
• Bolt connection faces to right.

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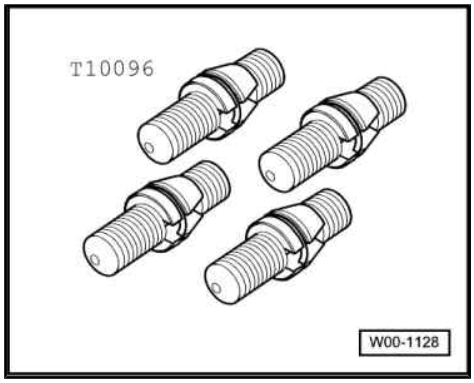
3.2 Removing and installing particulate filter

Special tools and workshop equipment required

♦ Engine and gearbox jack -V.A.G 1383 A-

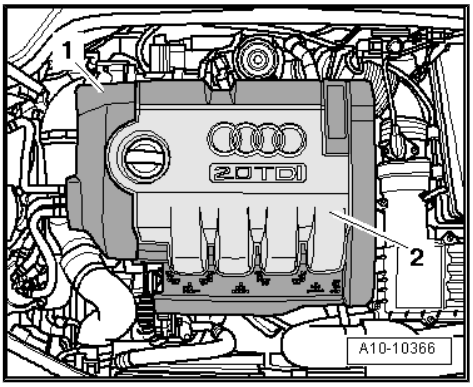


♦ Locating pins -T10096-

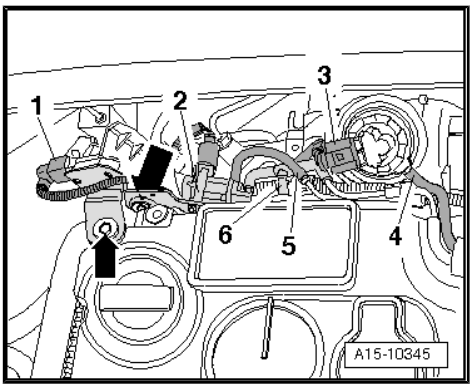


Removing

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



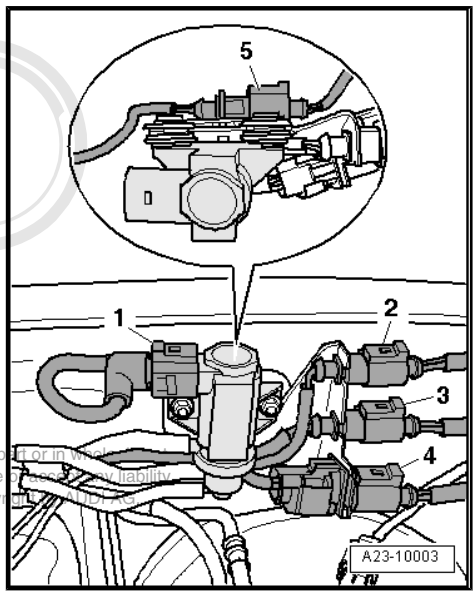
– Unclip change-over valve for exhaust gas recirculation cooler -N345- -item 2- from bracket.
– Unplug electrical connector -1- and move wiring clear.
– Remove bolts -arrows-.



Note

Disregard -items 3, 4, 5 and 6-.

– Unplug electrical connector -4- for Lambda probe -G39- and move Lambda probe wiring clear.

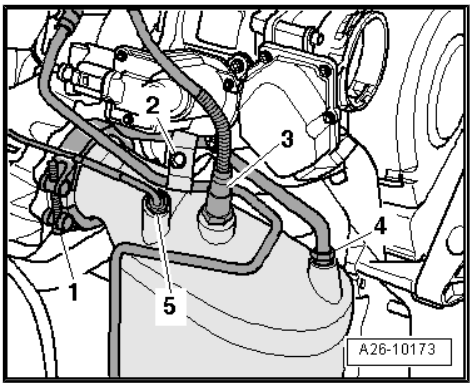


Note

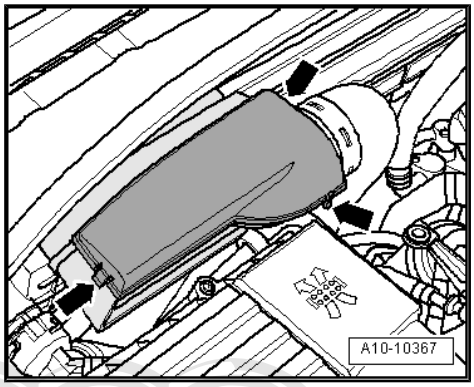
Disregard -items 1, 2, 3 and 5-.

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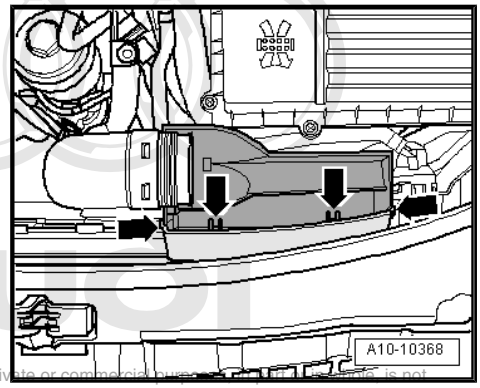
– Unscrew Lambda probe -3- ⇒ Rep. Gr. 23 .
– Remove temperature sender before particulate filter -G506- -item 5-.
– Unbolt bracket -2- for pressure pipes.
– Detach pressure pipe -4- at particulate filter.
– Slacken and remove retaining clamp -1- for particulate filter.



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

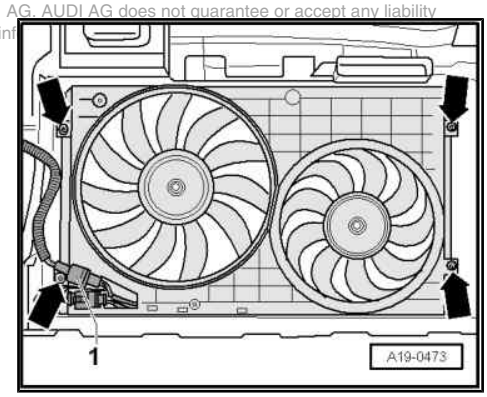


– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.

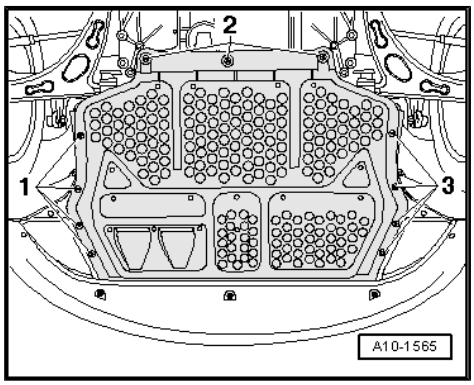


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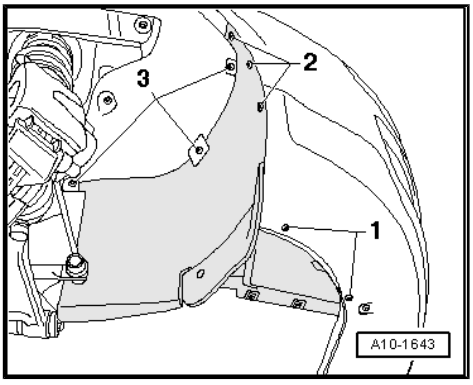
– Remove top bolts -upper arrows- for radiator cowl.



– Remove front right wheel.
– Remove centre noise insulation -fasteners 1 ... 3-.



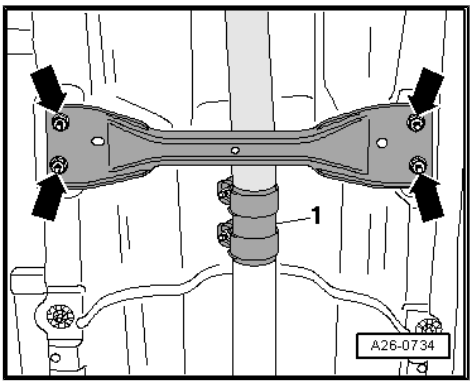
– Remove noise insulation (right-side) -fasteners 1 ... 3-.



– Remove front cross-piece for underbody -arrows-.

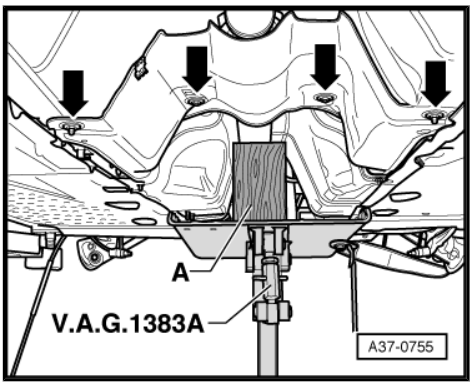
Note

To avoid damage, the flexible joints in the front exhaust pipe must not be bent more than 10°.



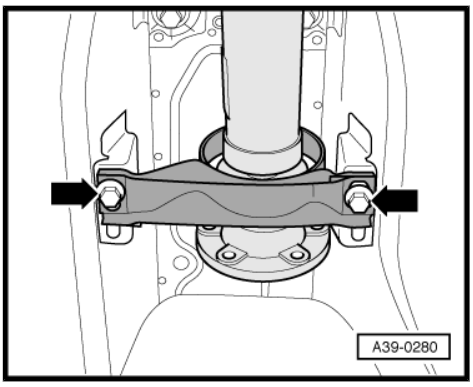
– Loosen nuts on clamp -1-.
– Push clamp back and tie up front exhaust pipe to underbody.

– To support propshaft, position engine and gearbox jack -V.A.G 1383 A- underneath with a piece of wood -A- placed in between.
– Remove bolts -arrows- securing heat shield and propshaft centre bearing and detach heat shield.

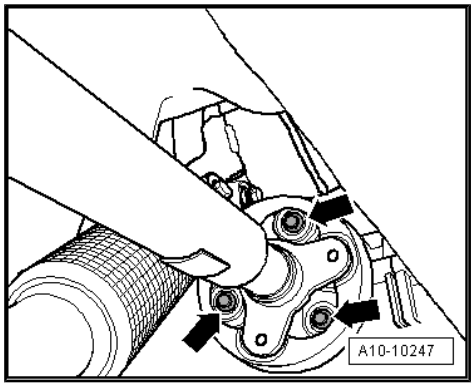


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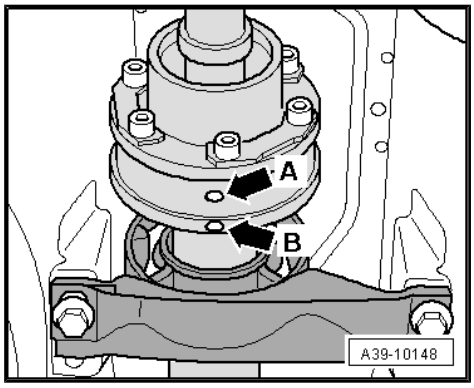
– Fit bolts -arrows- for propshaft centre bearing again.



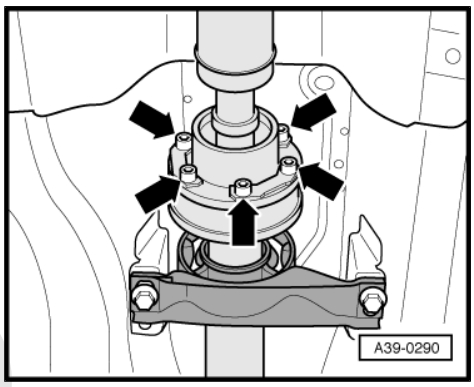
– Unbolt flexible coupling for propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).



– Check whether markings -arrow A- and -arrow B- are visible on constant velocity joint and propshaft. Apply markings if necessary.



– Remove bolts -arrows-.



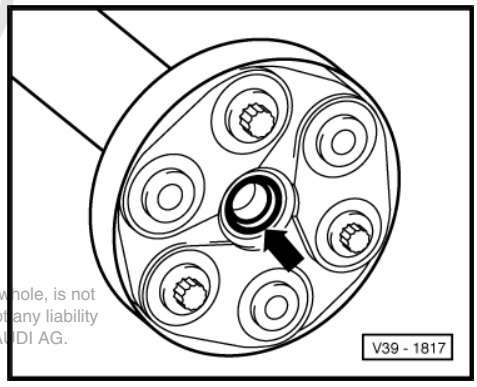
Caution

Take care to bend the front section of the propshaft tube downwards as little as possible when detaching.

– Push front section of propshaft tube towards the front and swivel it out of rear section of propshaft tube.

Note

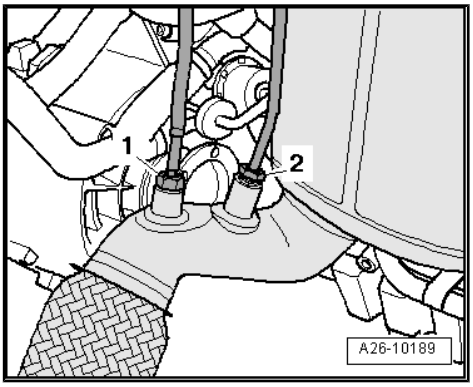
Avoid damaging the seal -arrow- in the propshaft flange when removing and installing.



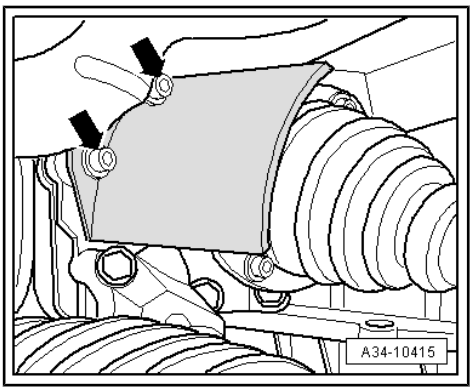
– Pull front section of propshaft tube off centring pin on bevel box horizontally, swivel downwards and detach.

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– 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- .
– Remove exhaust gas pressure sensor 1 -G450- together with pressure pipes.
– Unbolt drive shaft (right-side) from bevel box flange.



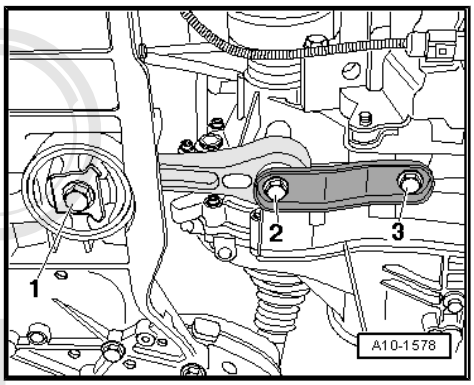
– Unbolt heat shield for drive shaft (right-side) -arrows-.
– Remove flange shaft (right-side) ⇒ Rep. Gr. 39 .



– Unscrew bolts -2- and -3- for pendulum support.

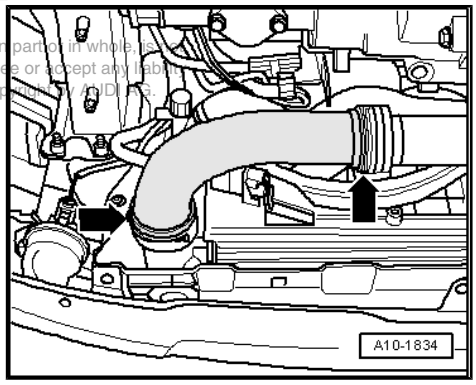
Note

Disregard -item 1-.

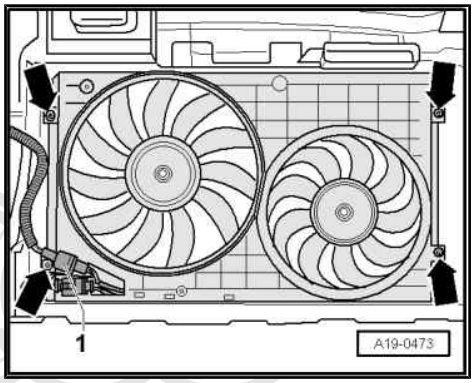


– Remove air intake hose (left-side) by lifting retaining clips -arrows- slightly.

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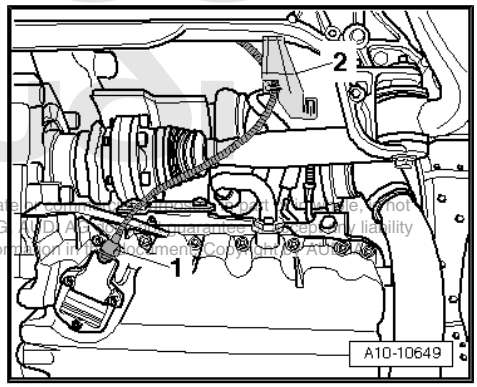


– Unplug electrical connector -1-.
– Unscrew bottom bolts -bottom arrows- and remove radiator cowl downwards while pressing engine to rear.

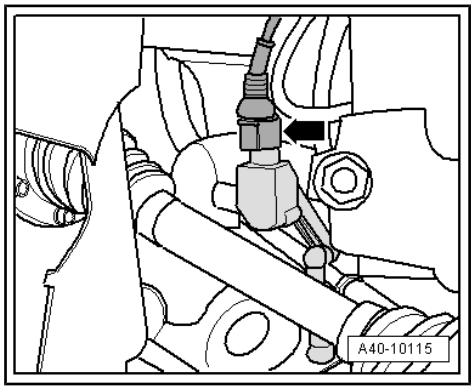


– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Unclip bracket -2- for wire to oil level and oil temperature sender -G266- from subframe.

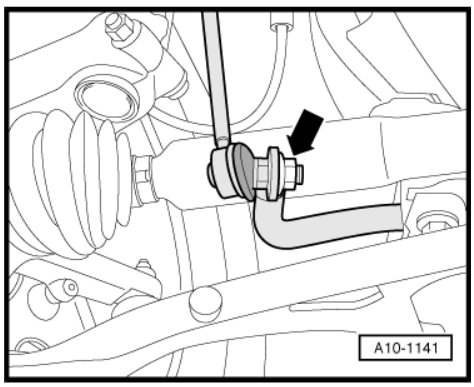
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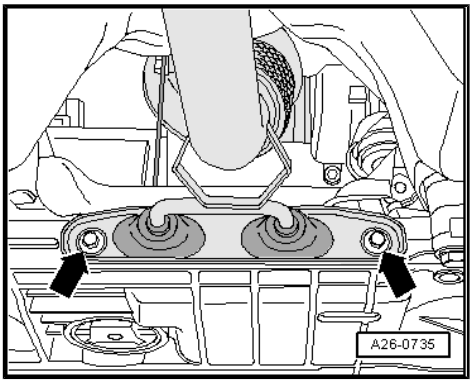
– Unplug electrical connector -arrow- at front left vehicle level sender -G78- .



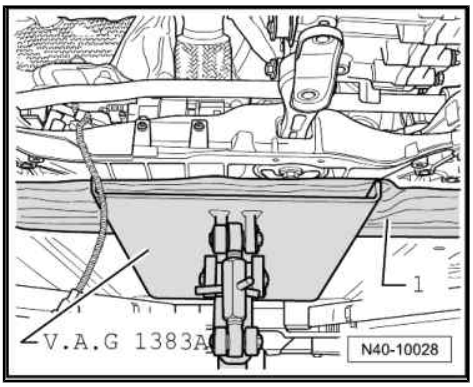
– Unbolt coupling rod (left and right) from anti-roll bar -arrow-.



– Unbolt bracket for exhaust system -arrows-.
– Pry bracket off pins on front exhaust pipe.



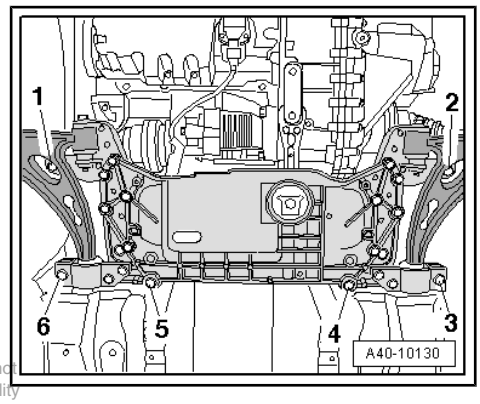
– To support subframe, position engine and gearbox jack -V.A.G 1383 A- underneath with a piece of wood -1- placed in between.



Note

Locate subframe and suspension brackets in position with locating pins -T10096- , as otherwise wheel alignment must be performed ⇒ Rep. Gr. 40 .

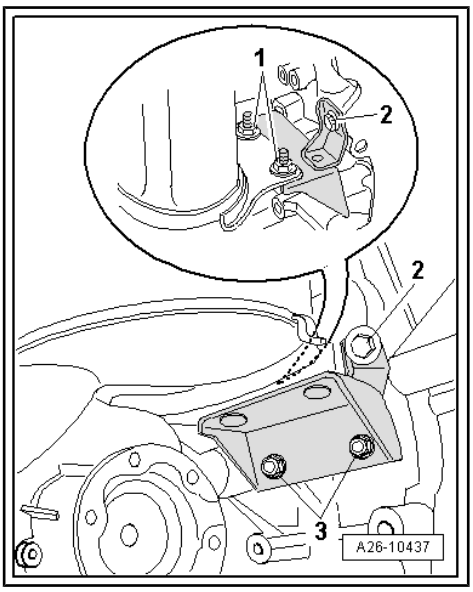
– Remove bolts -1 ... 6- for subframe, fit locating pins -T10096- one after the other ⇒ Rep. Gr. 40 .
– Slightly lower subframe with engine and gearbox jack -V.A.G 1383 A- .



• Guide subframe past steering column.

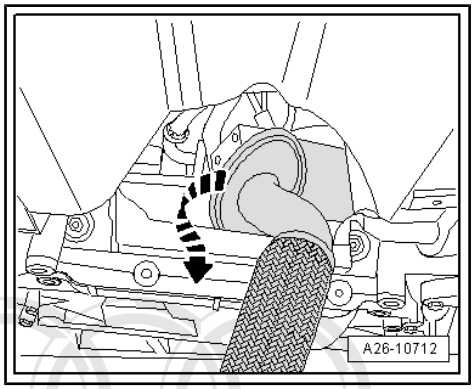
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– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.



– Have a 2nd mechanic push engine forwards.

– Rotate particulate filter by 180° and about its own axis to detach particulate filter and guide out between subframe and body.



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 subframe ⇒ Rep. Gr. 40 .

– Install temperature sender after particulate filter -G527- ⇒ page 335 .

– Install Lambda probe -G39- ⇒ Rep. Gr. 23 .

– Install temperature sender before particulate filter -G506- ⇒ page 334 .

– Install exhaust gas pressure sensor 1 -G450- ⇒ Rep. Gr. 23 .

– Install propshaft ⇒ Rep. Gr. 39 .

– Install drive shaft ⇒ Rep. Gr. 40 .

– Align exhaust system so it is free of stress ⇒ page 308 .

– After renewing particulate filter, perform adaption in “Guided Functions” ⇒ Vehicle diagnosis, testing and information system VAS 5051

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Tightening torques

Component	Nm
Bracket for exhaust system to subframe	23
Front exhaust pipe to turbocharger	7
Bracket for particulate filter to particulate filter and cylinder block	23
Pendulum support to gearbox	Manual gearbox ⇒ Rep. Gr. 34 , automatic gearbox ⇒ Rep. Gr. 37
Heat shield to bevel box	23
Underbody cross member (front) to body	23
Pressure pipe to particulate filter	40
• 1) Renew bolts. • 2) 90° = one quarter turn.	

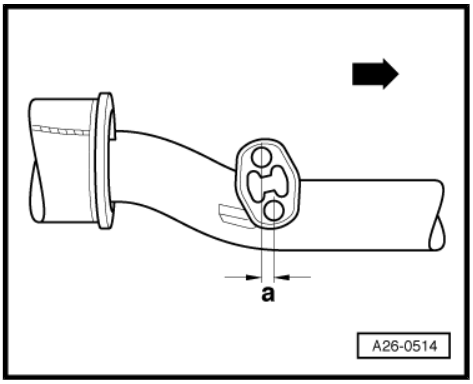
3.3 Stress-free alignment of exhaust system

Procedure

- The exhaust system must be aligned when it is cool.

– Loosen bolt connections of front clamp.

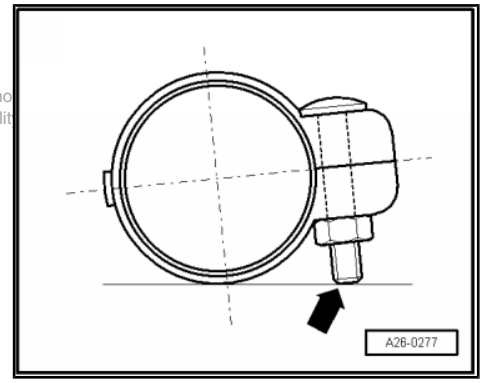
– Push exhaust system towards front of vehicle until preloading at mounting ⇒ Item 1 (page 320) -a- = 15 ... 17 mm.



– 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.

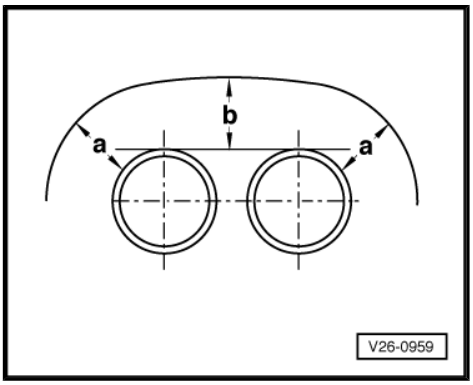


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Aligning tailpipes

– 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.



3.4 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.

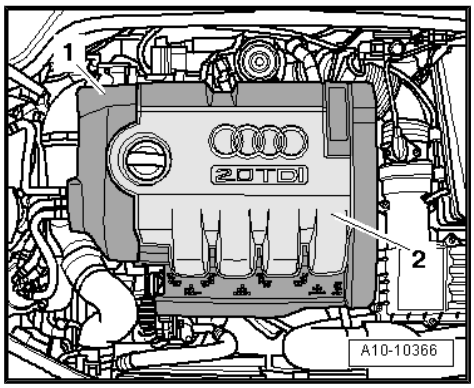
– Repair any leaks that are found.

4 Exhaust gas temperature control

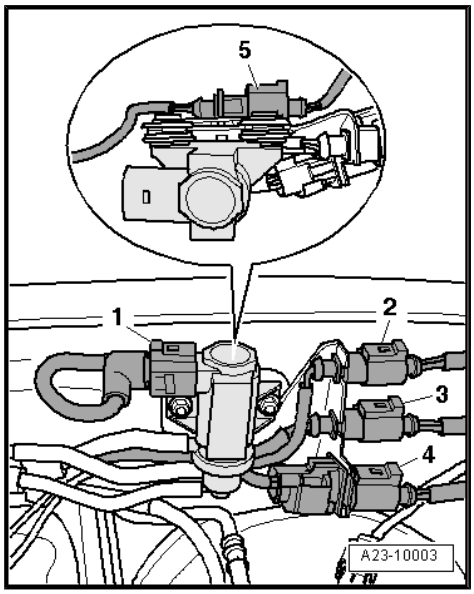
4.1 Removing and installing exhaust gas temperature sender 1 -G235-

Removing

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– Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.
– Unplug electrical connector -3- for exhaust gas temperature sender 1 -G235- and move wiring clear.

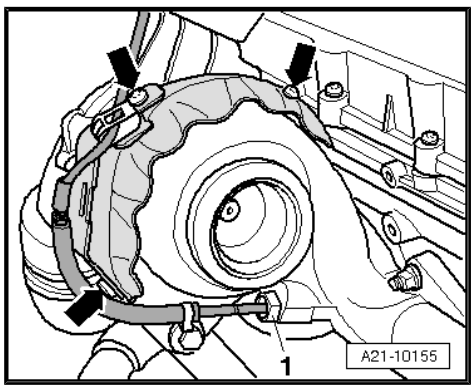


Front-wheel drive vehicles

Note

The connection can be accessed from below.

– Unscrew exhaust gas temperature sender 1 -G235- -item 1- from exhaust manifold.

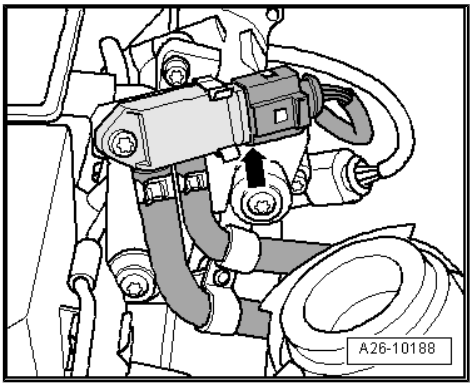


Note

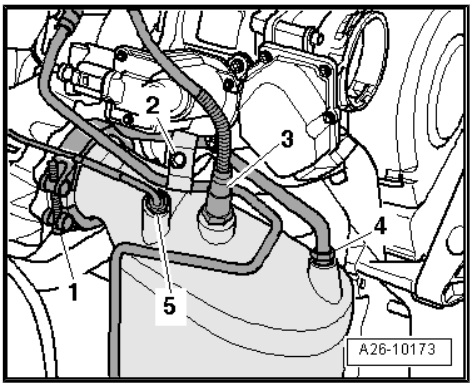
Disregard -arrows-.

Four-wheel drive vehicles

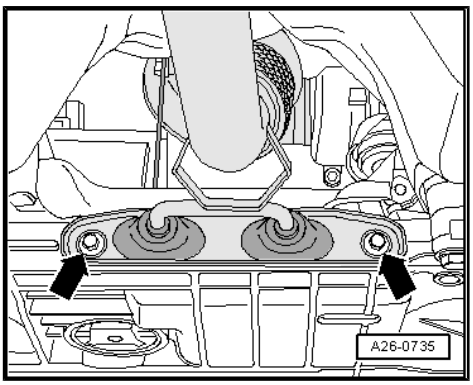
– Remove pressure sensor from bracket and move pressure pipes clear.



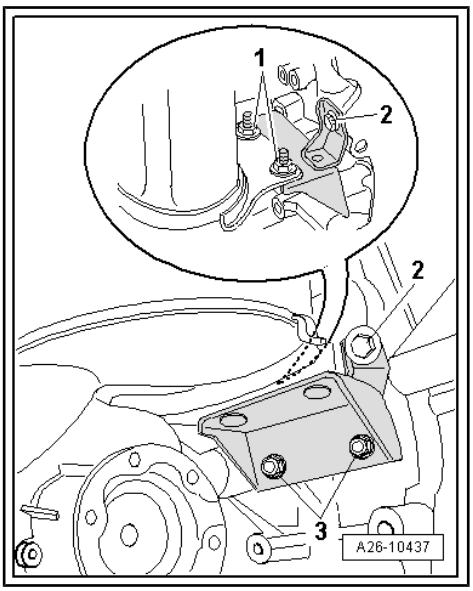
– Slacken and remove retaining clamp -1- for particulate filter.



– Unbolt bracket for exhaust system -arrows-.

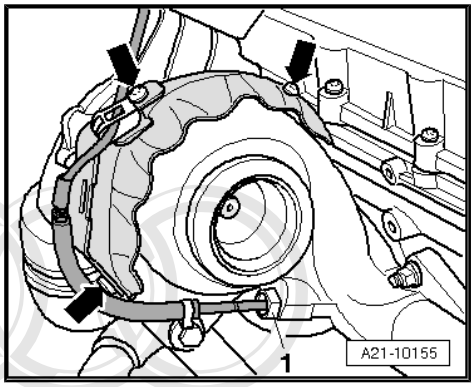


– Remove nuts -1- and -3- and bolt -2- and detach bracket for particulate filter.
– Swivel particulate filter to side and tie it up.



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– Unscrew exhaust gas temperature sender 1 -G235- -item 1- from exhaust manifold.



Note

Disregard -arrows-.

Installing

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

Note

- *Coat threads of exhaust gas temperature sender with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

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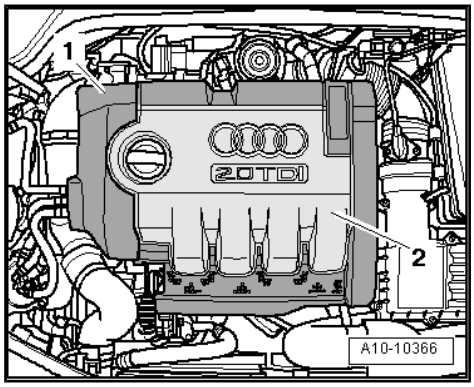
Tightening torque

Component	Nm
Exhaust gas temperature sender 1 -G235- to turbocharger	45

4.2 Removing and installing temperature sender before particulate filter -G506-

Removing

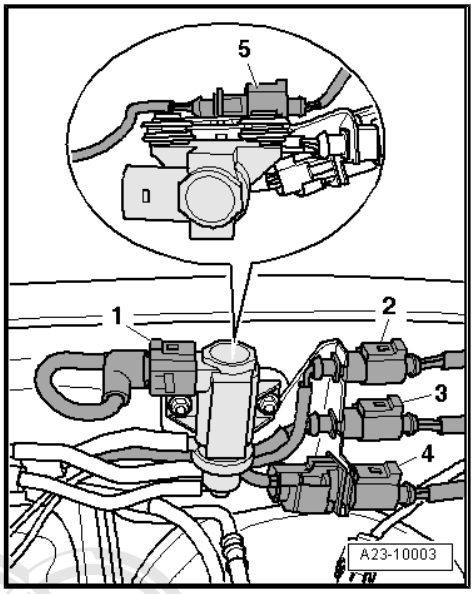
– Lift off outer engine cover panel -1- by pulling up evenly.



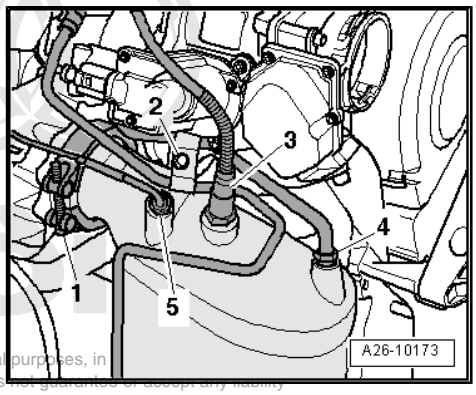
Note

Disregard -item 2-.

– Unplug electrical connector -5- for temperature sender before particulate filter -G506- and move wiring clear.



– Remove temperature sender before particulate filter -G506- -item 5-.



Note

Disregard -items 1, 2, 3 and 4-.

Installing

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

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Note

- *Coat threads of temperature sender before particulate filter with high-temperature paste ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

– When installing, make sure that angled end of temperature sender for particulate filter -5- points to left side of vehicle, as shown in illustration.

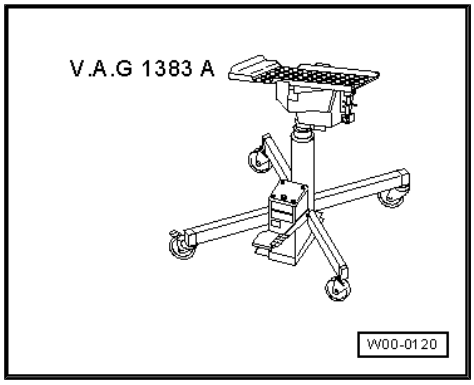
Tightening torque

Component	Nm
Temperature sender before particulate filter -G506- to particulate filter	45

4.3 Removing and installing temperature sender after particulate filter -G527-

Special tools and workshop equipment required

♦ Engine and gearbox jack -V.A.G 1383 A- for vehicles with four-wheel drive



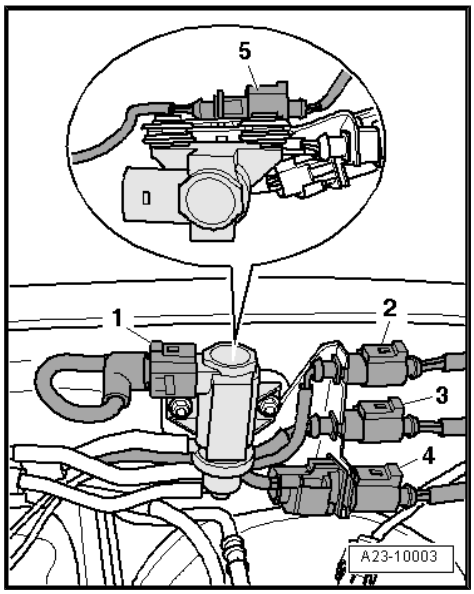
Removing

– Unplug electrical connector -2- for temperature sender after particulate filter -G527- and move wiring clear.

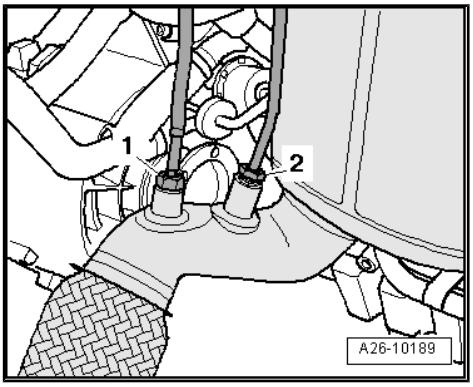
Note

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

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– Unscrew temperature sender after particulate filter -G527- -item 1- from exhaust pipe behind particulate filter.



Note

- *Disregard -item 2-.*
- *On vehicles with front-wheel drive, the connection is accessible from below.*
- *On vehicles with four-wheel drive the connection can be loosened from above using a crow foot wrench.*

Installing

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

Note

- *Coat threads of temperature sender after particulate filter with high-temperature paste ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

– Install propshaft ⇒ Rep. Gr. 39 .

Tightening torque

Component	Nm
Temperature sender after particulate filter - G527- to particulate filter	45

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5 Exhaust gas recirculation system and cooling for exhaust gas recirculation system

Exhaust gas recirculation system

- To improve exhaust emission values, exhaust gas is recirculated to the combustion chambers, thus reducing the combustion chamber temperature.
- The exhaust gas recirculation system is activated by the diesel direct injection system control unit -J248- via the exhaust gas recirculation valve -N18- and the mechanical exhaust gas recirculation valve.
- The tapered plunger in the mechanical exhaust gas recirculation valve varies the opening cross section according to valve travel.
- Pulsed actuation makes it possible to obtain any required valve position.
- The exhaust gas recirculation is switched off after approx. 2 minutes at idling speed.
- Restart engine or briefly increase engine speed above 1500 rpm when longer checks are necessary. Then repeat measurement.

Cooling for exhaust gas recirculation system

- 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 recirculation cooler change-over valve -N345- , and the vacuum unit in turn operates the change-over flap for the exhaust gas recirculation cooler.

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6 Exhaust gas recirculation system - vehicles with engine codes AZV, BKD

6.1 Connection diagram for vacuum lines

1 - Mechanical exhaust gas re-circulation valve

- ❑ Checking ⇒ page 340
- ❑ Removing and installing ⇒ page 341

2 - Vacuum reservoir

3 - To vacuum unit for charge pressure control

4 - To vacuum unit for exhaust gas recirculation cooler change-over

5 - Solenoid valve block

- ❑ With exhaust gas recir-culation valve -N18-
- ❑ With charge pressure control solenoid valve -N75-
- ❑ With exhaust gas recir-culation cooler change-over valve -N345-
- ❑ Connection diagram ⇒ page 340

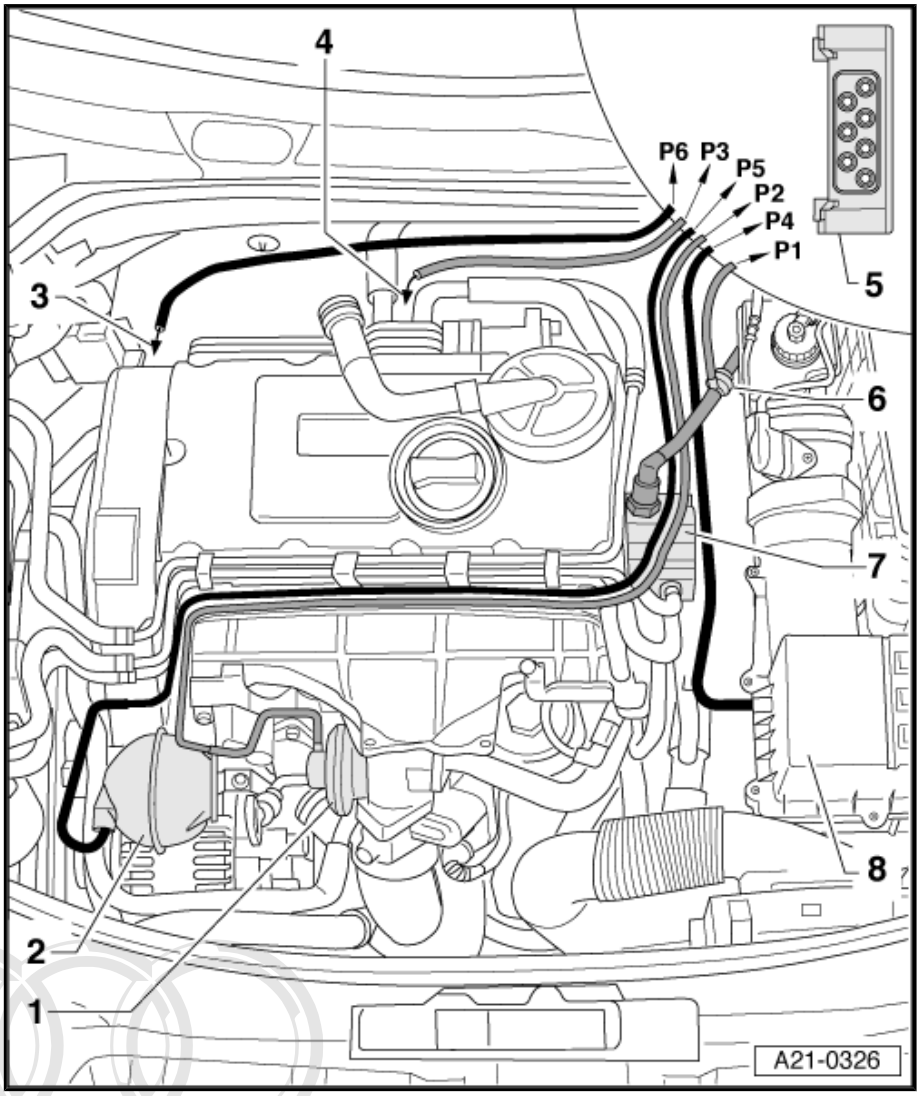
6 - Vacuum supply line

- ❑ From tandem pump to solenoid valve block

7 - Tandem pump

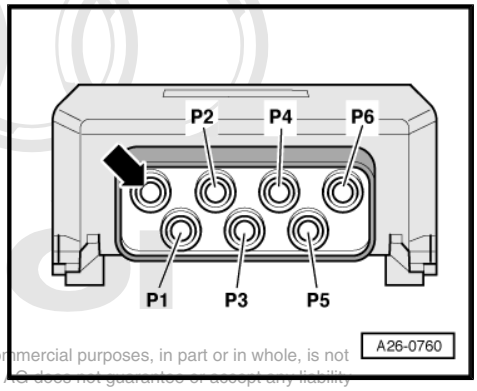
8 - Air cleaner housing

- ❑ With connection for vent hose



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6.2 Connection diagram for solenoid valve block



P1 - Vacuum supply hose from tandem pump

P2 - To mechanical exhaust gas recirculation valve

P3 - To vacuum unit for exhaust gas recirculation cooler change-over

P4 - Vent hose to air cleaner

P5 - To vacuum reservoir

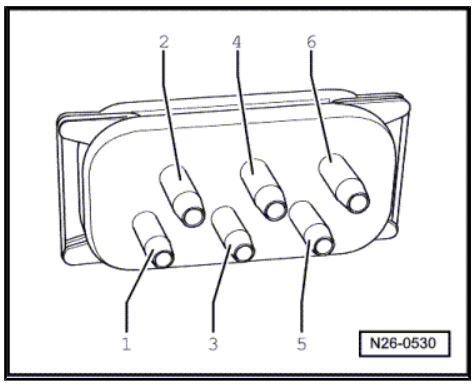
P6 - To vacuum unit for charge pressure control

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Note

The upper vacuum connection marked with an -arrow- is not used and is plugged with a cap.

6.3 Connection diagram for vacuum hose connector



Note

Illustration shows hose connection side.

P1 - Vacuum supply hose from tandem pump

P2 - To mechanical exhaust gas recirculation valve

P3 - To vacuum unit for exhaust gas recirculation cooler change-over

P4 - Vent hose to air cleaner

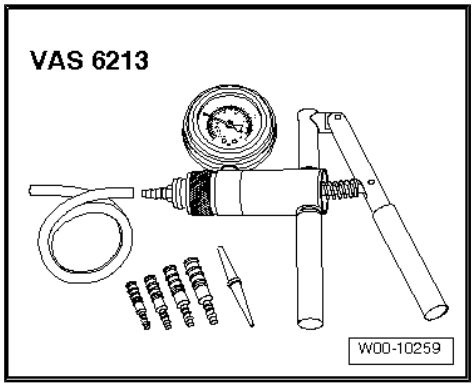
P5 - To vacuum reservoir

P6 - To vacuum unit for charge pressure control

6.4 Checking mechanical exhaust gas recirculation valve

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



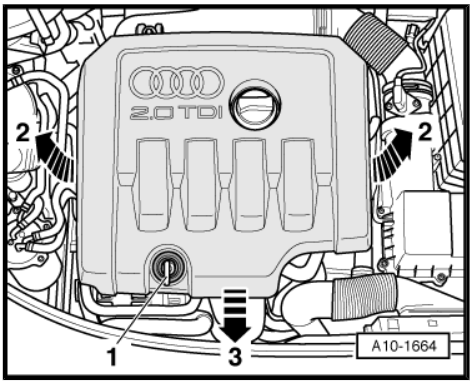
Procedure

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

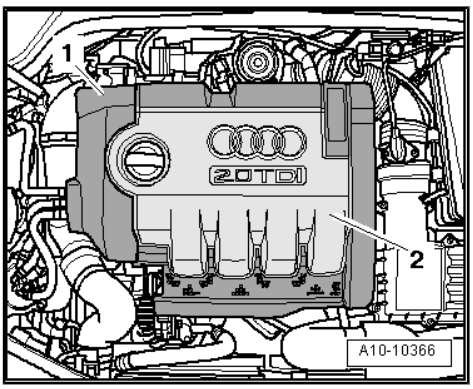
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

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



All vehicles (continued):

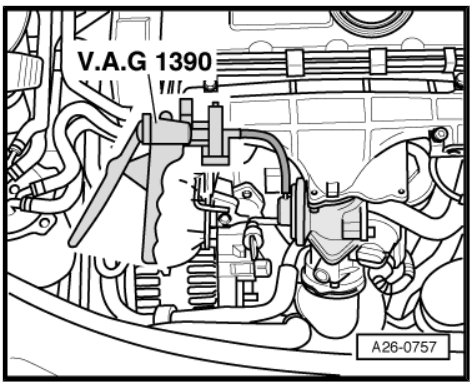
– Detach vacuum hose at mechanical exhaust gas recirculation valve.

– Connect hand vacuum pump to valve.

– Operate hand vacuum pump.

– Detach hose of hand vacuum pump at exhaust gas recirculation valve.

• The closing of the valve should be clearly audible.



6.5 Removing and installing mechanical exhaust gas recirculation valve

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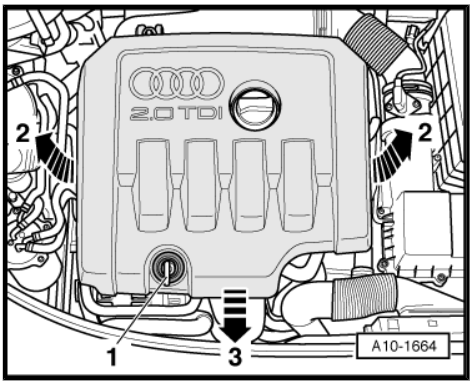
Removing

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

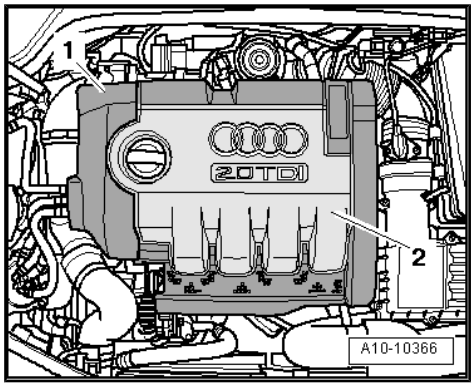
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



Engine cover panel (version 2):

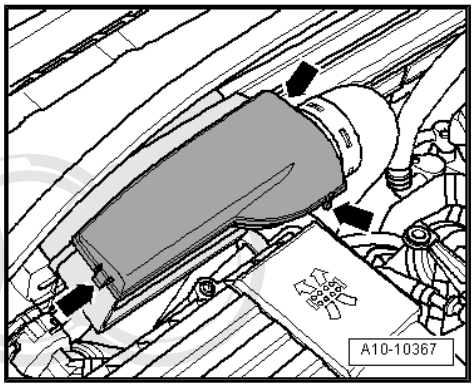
– Lift off engine cover panel (outside -1- and inside -2-) by pulling up evenly.



All vehicles (continued):

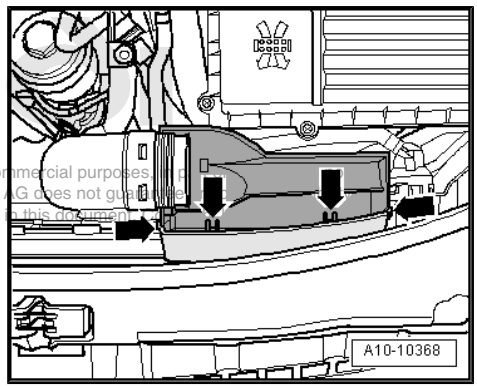
– Remove engine compartment seal from lock carrier and wing panel flanges.

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



– Unclip air duct at the bottom by releasing clips -arrows-.

– Detach air duct (bottom) together with air hose.

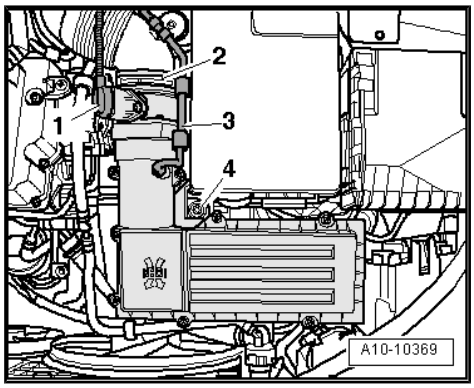


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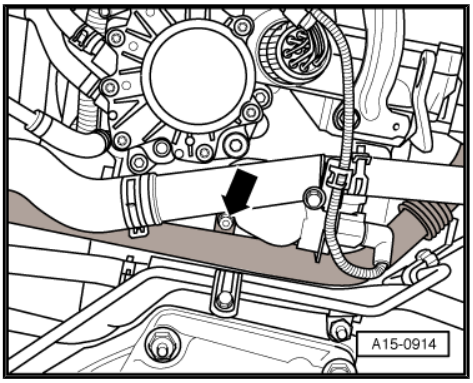
– Unplug electrical connector -1- at air mass meter -G70- .

– Detach vent hose -3- and air hose -2-.

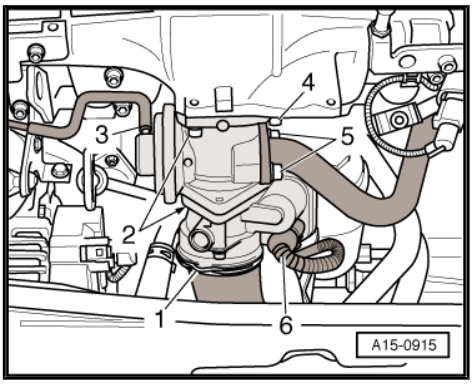
– Unscrew bolt -4- and remove air cleaner housing.



– Unscrew retaining lug for connecting pipe -arrow-.



– Remove bolts -5-.
– Detach electrical connector -6- at intake manifold flap motor -V157- .
– Disconnect vacuum hose -3- from mechanical exhaust gas recirculation valve.
– Detach front air intake hose from intake manifold flap motor -V157- by lifting retaining clip -1- slightly.
– Remove bolts -2- and -4- and detach intake manifold flap motor -V157- together with mechanical exhaust gas recirculation valve.
– Unbolt intake manifold flap motor -V157- from mechanical exhaust gas recirculation valve.



Installing

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

Note

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

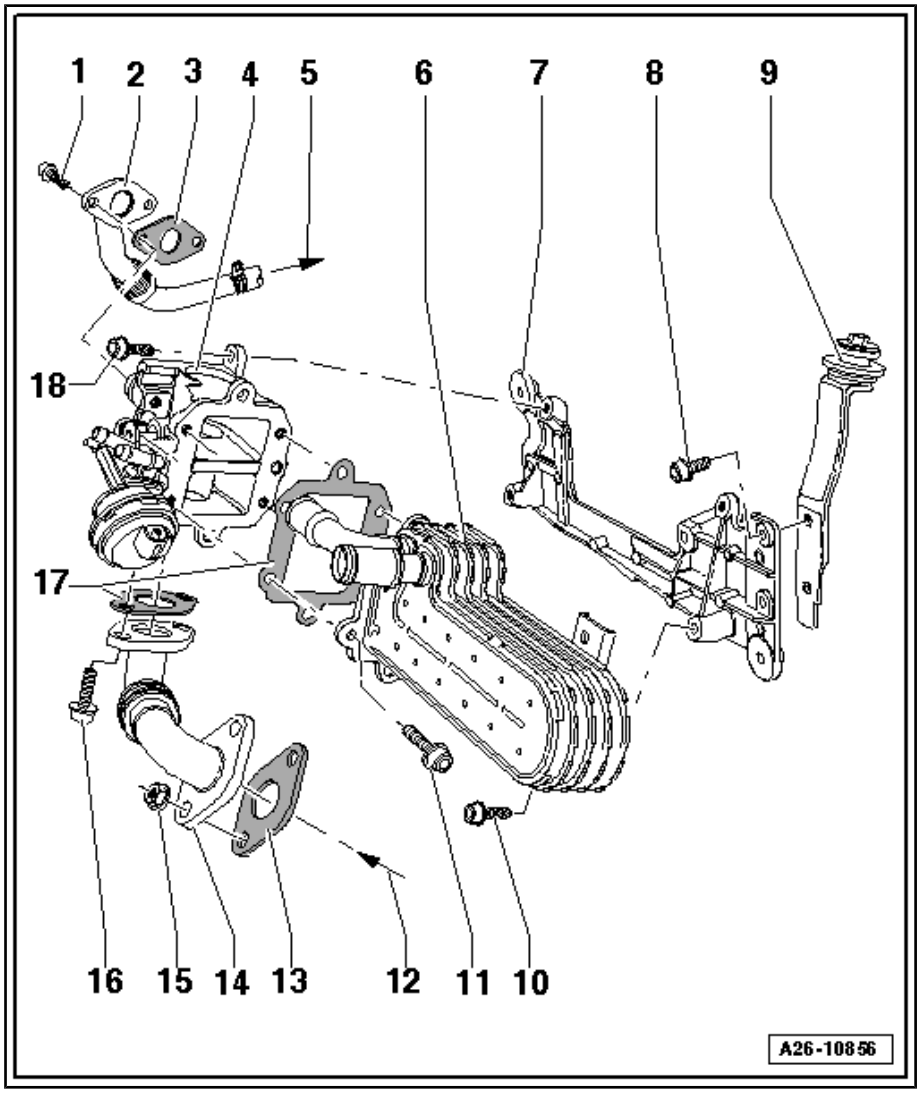
– Adhere to the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 269 .

Tightening torques

Component	Nm
Mechanical exhaust gas recirculation valve to intake manifold	10
EGR connecting pipe to mechanical exhaust gas recirculation valve	22
Connecting pipe for exhaust gas recirculation to connection	10
Intake manifold flap motor -V157- to mechanical exhaust gas recirculation valve	10

6.6 Exhaust gas recirculation cooler - exploded view

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1 - 22 Nm

2 - Connecting pipe for exhaust gas recirculation

3 - Gasket

- ❑ Renew

4 - Change-over flap for exhaust gas recirculation cooler

- ❑ Directs exhaust gas through exhaust gas recirculation cooler when activated
- ❑ Checking exhaust gas recirculation change-over ⇒ page 345

5 - To mechanical exhaust gas recirculation valve

6 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 346

7 - Bracket

- ❑ For change-over flap and exhaust gas recirculation cooler

8 - 10 Nm

9 - Bracket

- ❑ For engine cover

10 - 10 Nm

11 - 10 Nm

12 - From exhaust manifold

13 - Gasket

- ❑ Renew

14 - Connecting pipe for exhaust gas recirculation

- ❑ When installing observe tightening sequence ⇒ page 345

15 - Nut

- ❑ Tightening sequence ⇒ page 345

16 - Bolt

- ❑ Tightening sequence ⇒ page 345

17 - Gasket

- ❑ Renew

18 - 10 Nm

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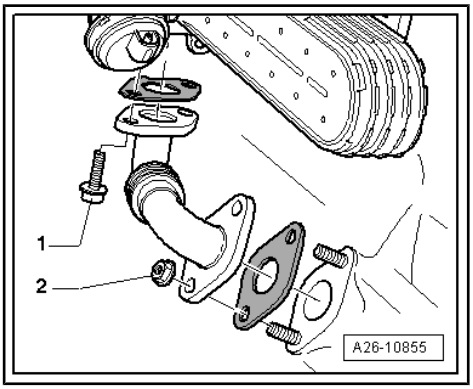
Connecting pipe for exhaust gas recirculation - tightening sequence:

1 - Position bolts -1-.

2 - Position nuts -2-.

3 - Tighten bolts -1- to 22 Nm.

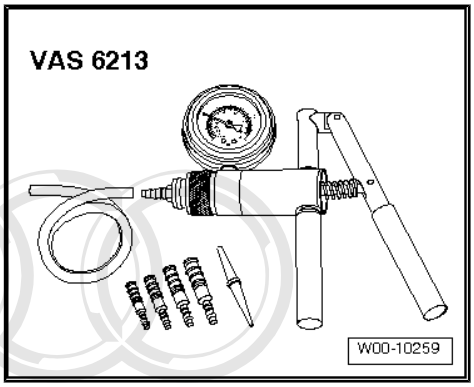
4 - Tighten nuts -2- to 25 Nm.



6.7 Checking exhaust gas recirculation cooler change-over

Special tools and workshop equipment required

♦ Hand vacuum pump -VAS 6213-



Procedure

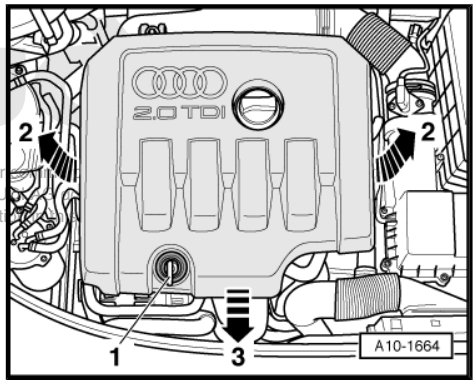
• Final control diagnosis carried out.

Engine cover panel (version 1):

– Pull dipstick -1- out of guide tube.

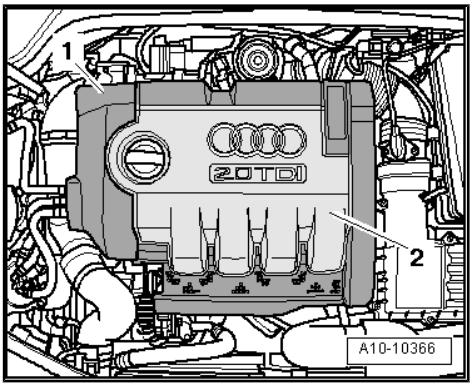
– Lift engine cover panel at sides -arrows 2- and pull off towards front -arrow 3-.

– Re-insert dipstick in guide tube.



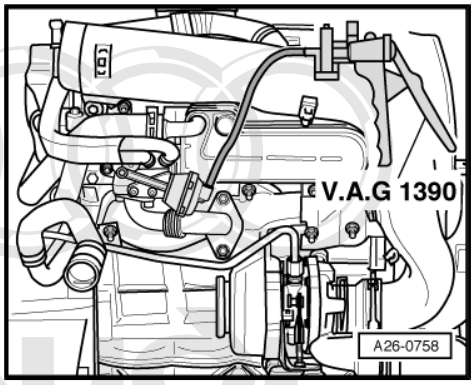
Engine cover panel (version 2):

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



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All vehicles (continued):



– 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.

If the linkage does not move or only moves jerkily:

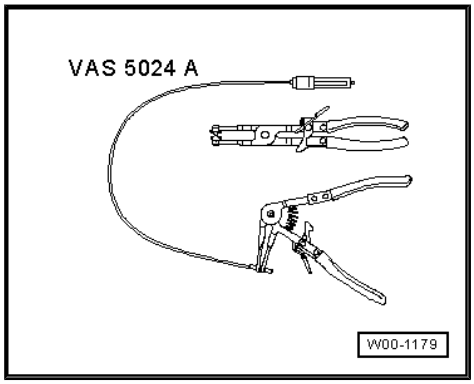
♦ The vacuum unit is defective.
♦ The change-over flap for exhaust gas recirculation is sticking.

6.8 Removing and installing exhaust gas re-circulation cooler

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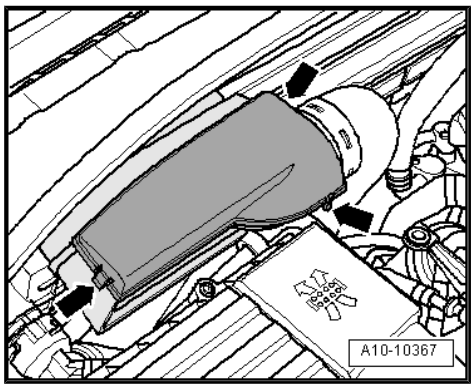
Special tools and workshop equipment required

♦ Spring type clip pliers -VAS 5024 A-

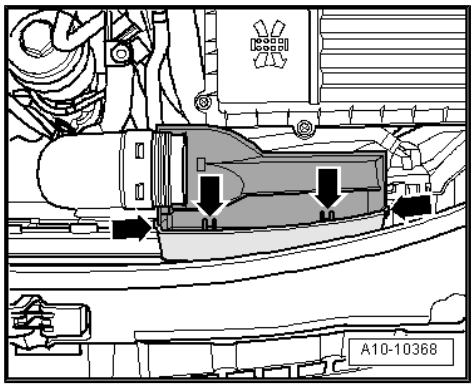


Removing

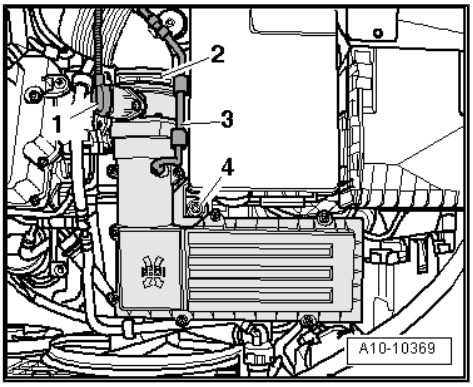
– Drain off coolant ⇒ page 248 .
– Pull cover off air duct (release clips on sides) -arrows-.



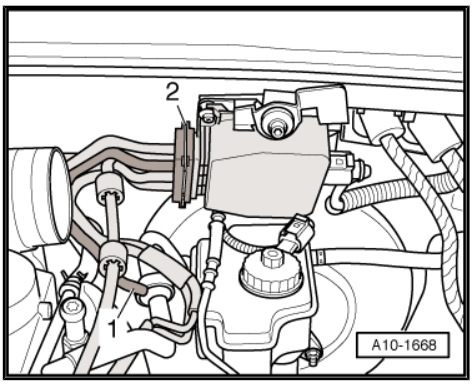
– Unclip air duct at the bottom by releasing clips -arrows-.
– Detach air duct (bottom) together with air hose.



– 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.



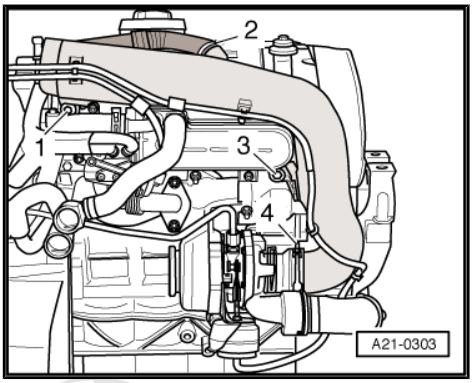
– Detach hose connection carrier -2- at solenoid valve block by releasing retaining tab.
– Detach vacuum hose -1- at non-return valve for brake servo.



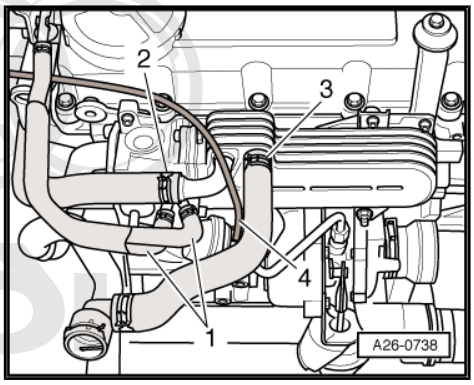
– Remove bolts -1- and -3-.
– Move vacuum hoses at rear intake pipe clear to one side.
– Disconnect hose -2- for crankcase breather system at air pipe.
– Release spring clip -4- with spring clip pliers -VAS 5024 A- and detach air pipe (rear) at connection on turbocharger.

Note

Shown from rear with engine removed for illustration purposes.

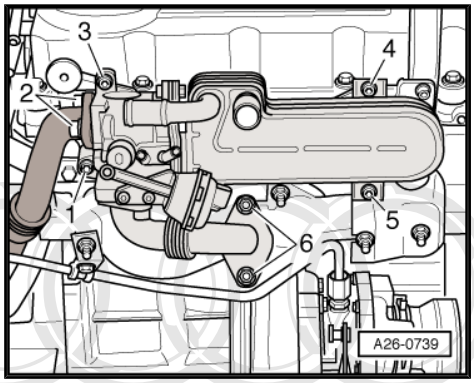


– Detach coolant hoses -1- from exhaust gas recirculation flap.
– Detach coolant hoses -2- and -3- from exhaust gas recirculation cooler.
– Detach vacuum hose -4- from vacuum unit for exhaust gas recirculation change-over flap.



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– Remove bolts -2- and -6-.
– Remove bolts -1, 3, 4, and 5-.
– Remove exhaust gas recirculation cooler with change-over flap.



Installing

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

Note

- *Renew gaskets, seals and self-locking nuts.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Fill cooling system ⇒ page 251 .

Tightening torques

Component		Nm
Exhaust gas recirculation cooler to bracket		10
EGR connecting pipe to:	Exhaust manifold	25 1)
	Exhaust gas recirculation cooler	22 1)
Air pipe (rear) to bracket		10

• 1) Renew nuts.

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7 Exhaust gas recirculation system - vehicles with engine codes BMN, BUY

7.1 Connection diagram for vacuum lines

1 - Air cleaner housing
- ❑ With vent pipe connection for charge pressure control solenoid valve - N75-

2 - Charge pressure control solenoid valve -N75-

3 - Cylinder head cover
- ❑ With vacuum reservoir

4 - Non-return valve
- ❑ Note installation position

5 - Vacuum line to brake servo

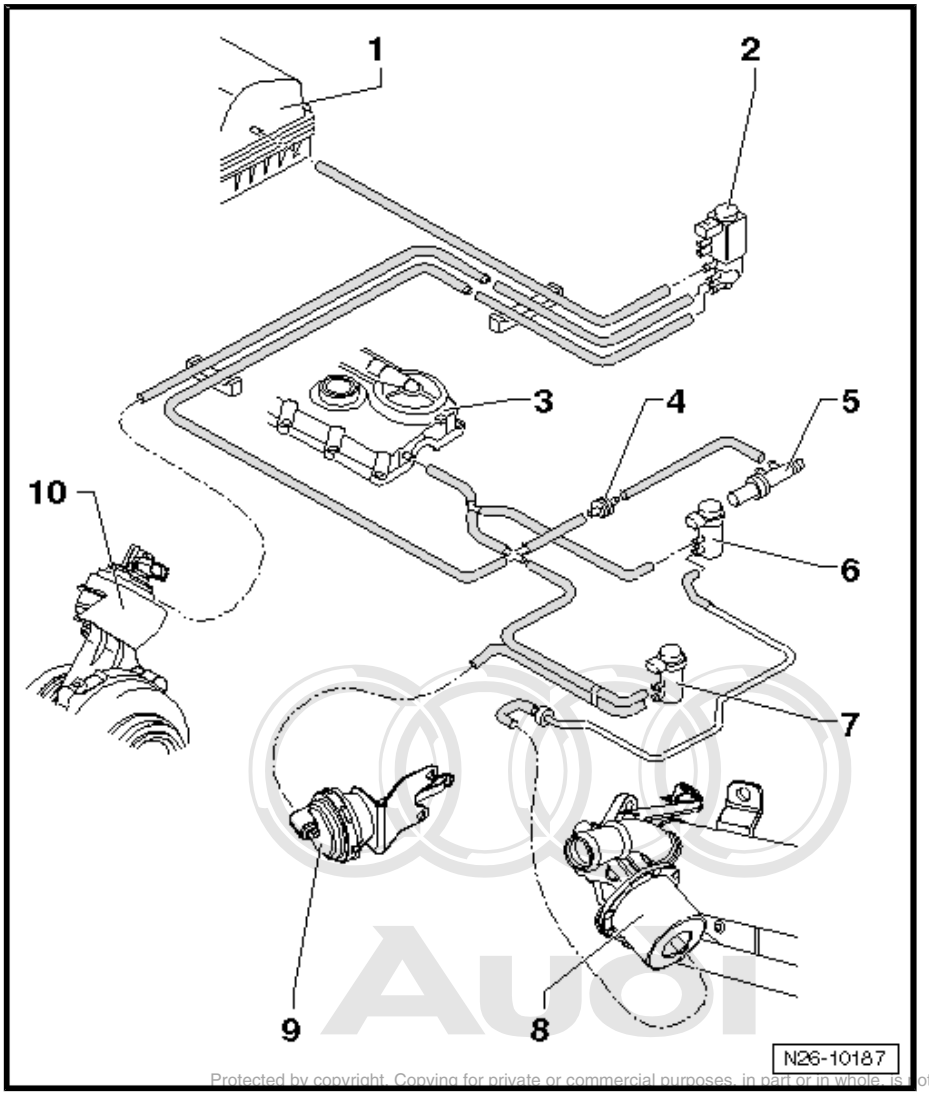
6 - Exhaust gas recirculation cooler change-over valve - N345-

7 - Intake manifold flap valve - N316-

8 - Vacuum unit
- ❑ For exhaust gas recirculation cooler change-over

9 - Vacuum unit
- ❑ For air flow control

10 - Vacuum unit
- ❑ On turbocharger
- ❑ With position sender for charge pressure positioner -G581-

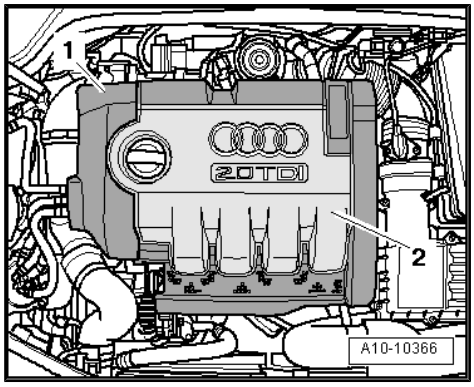


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7.2 Removing and installing exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

Removing

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

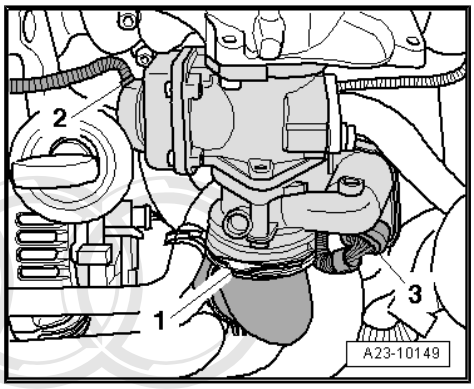


Note

Disregard -item 2-.

– Remove air intake hose at intake manifold flap motor -V157- by lifting retaining clip -1- slightly.

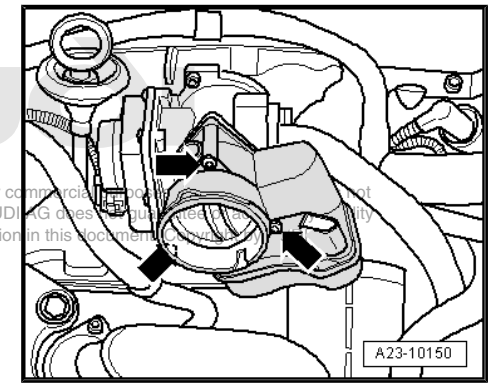
– Unplug electrical connector for intake manifold flap motor -V157- -item 3-.



Note

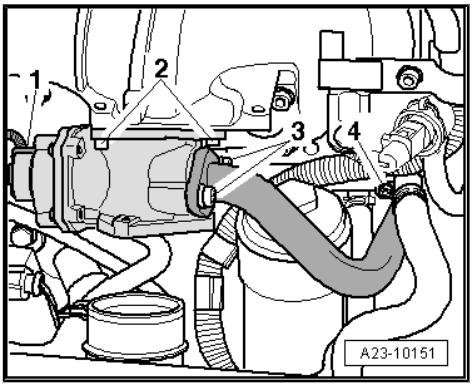
Disregard -item 2-.

– Remove bolts -arrows- and detach intake manifold flap motor -V157- .



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– Unplug electrical connector -1- at exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212- .
– Unscrew bolts -2, 3, 4- and detach exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212- .



Installing

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

Note

Renew O-ring.

Tightening torques

Component	Nm
Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212- to intake manifold	10
Intake manifold flap motor -V157- to exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-	10
EGR connecting pipe to exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-	22

7.3 Exhaust gas recirculation cooler - exploded view

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1 - 22 Nm

2 - Connecting pipe for exhaust gas recirculation

- ❑ To exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

3 - Gasket

- ❑ Renew

4 - 10 Nm

5 - From exhaust manifold

6 - 25 Nm

- ❑ Renew

7 - Connecting pipe

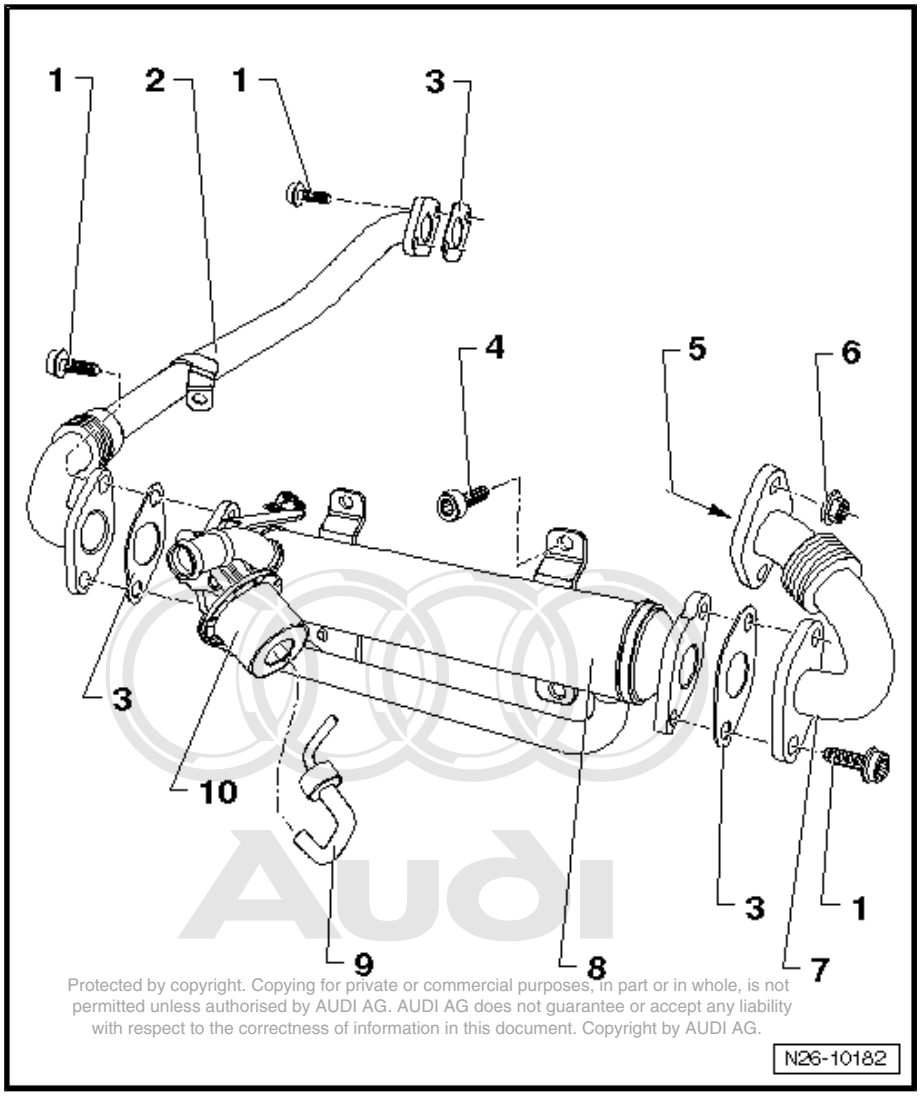
8 - Exhaust gas recirculation cooler

- ❑ With change-over flap
- ❑ Checking exhaust gas recirculation cooler change-over ⇒ page 352
- ❑ Removing and installing ⇒ page 353

9 - Vacuum hose

10 - Vacuum unit

- ❑ For change-over flap

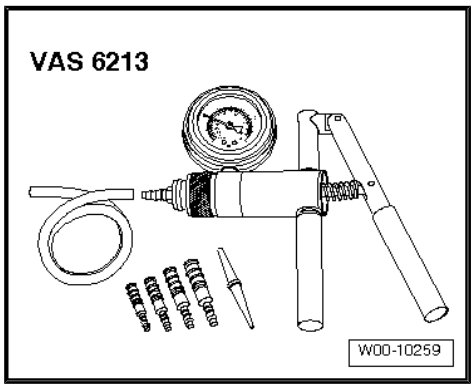


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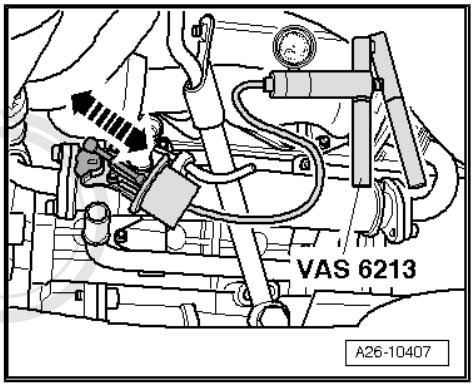
7.4 Checking exhaust gas recirculation cooler change-over

Special tools and workshop equipment required

- ♦ 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.

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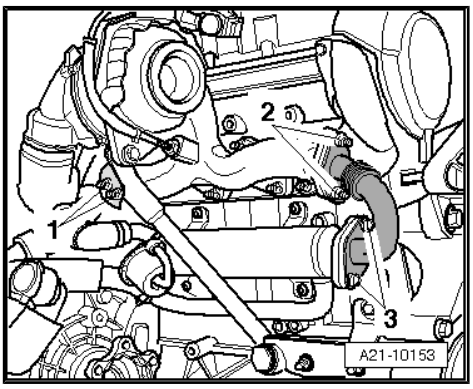
7.5 Removing and installing exhaust gas recirculation cooler

Special tools and workshop equipment required

♦ Hose clamps for hoses up to 25 mm Ø -3094-
♦ Hose clip pliers -V.A.G 1921-
♦ Drip tray for workshop hoist -VAS 6208-

Removing

– Remove particulate filter ⇒ page 313 .
– Remove nuts -2- and bolts -3- and remove connecting pipe for exhaust gas recirculation.

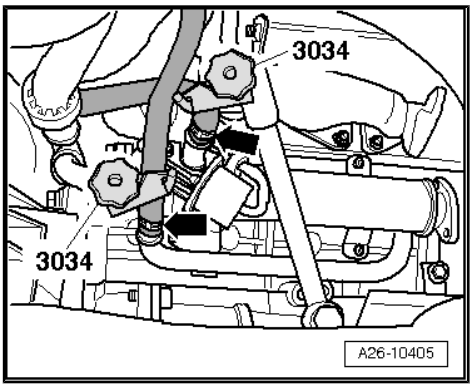


Note

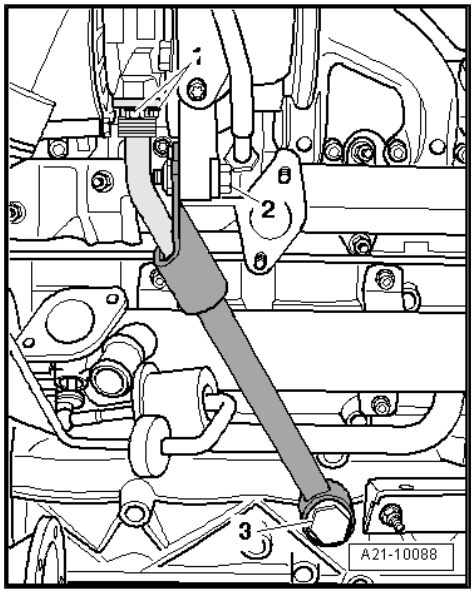
Disregard -item 1-.

– Place drip tray for workshop hoist -VAS 6208- under engine.

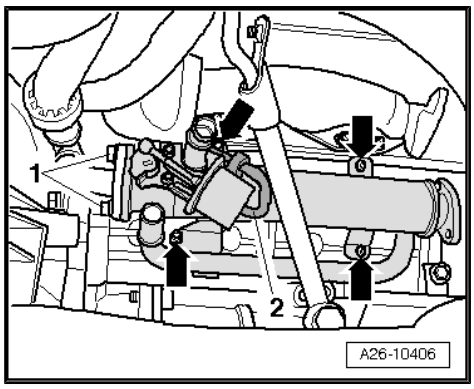
– Clamp off coolant hoses using hose clamps -3094- and disconnect coolant hoses from exhaust gas recirculation cooler.
– Remove heat insulation sleeve from vacuum unit.



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



– Remove bolts -1- from connecting pipe for exhaust gas recirculation.
– Disconnect vacuum hose -2- from vacuum unit and move vacuum hose aside.
– Remove bolts -arrows- and take off exhaust gas recirculation cooler.



Installing

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

Note

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- *Renew gaskets, seals and self-locking nuts.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install particulate filter ⇒ page 313 .

Tightening torques

Component		Nm
Exhaust gas recirculation cooler to cylinder block		10
Oil return pipe to turbocharger		15
Support for turbocharger to:	Turbocharger	25
	Cylinder block	60
EGR connecting pipe to:	Exhaust gas recirculation cooler	22
	Exhaust manifold	25 1)
Underbody cross member (front) to body		23
Heat shield to exhaust manifold		25 1)

• 1) Renew nuts.