Workshop Manual

Audi TT 2007 ➢

4-cylinder direct petrol injection engine (2.0 ltr. 4-valve turbo TTS), mechanics									
Engine ID	CDL A	CDL B	CDM A						

Edition 01.2008

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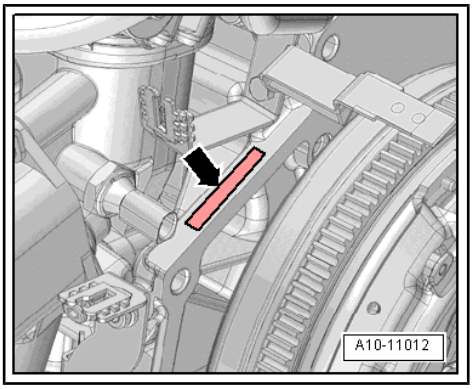
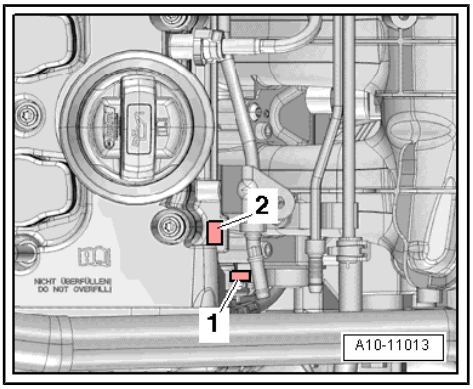
Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of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

Contents

00 – Technical data

1 Engine number





- The engine number (“Engine code” and “Serial number”) can be found on the left of the joint between engine and gearbox -arrow-.
- The engine code letters are also stamped on the right of the cylinder head -2- and on the cylinder block -1-.
- Additionally there is a sticker on the toothed belt cover with“Engine code” and “Serial number”.
- Starting with the letter “C”, the engine codes consist of 4 letters.
- The first 3 characters of the engine code stand for the engine capacity and the mechanical construction and design. They are stamped on the cylinder block, together with the serial number.
- The 4th character indicates the power output and torque of the engine, and is determined by the engine control unit.

Note

- *The 4-character engine code can be found on the type plate (in versions for some countries only) and on the vehicle data sticker and the engine control unit.*
- *Fitting locations of the type plate (certain countries only) and the vehicle data sticker ⇒ Maintenance ; Booklet 810 .*

2 Engine data

Code letters		CDLA	CDLB	CDMA
Capacity	ltr.	1.984	1.984	1.984
Power output	kW at rpm	195/6000	199/6000	195/6000
Torque	Nm at rpm	350/2500 … 5250	350/2500 … 5250	350/2500 … 5250
Bore	∅ in mm	82.5	82.5	82.5
Stroke	mm	92.8	92.8	92.8
Compression ratio		9.8	9.8	9.8
RON	not less than	98 1)	98 1)	98 1)
Firing order		1-3-4-2	1-3-4-2	1-3-4-2
Emission standards		EU4	EU4	EU4
Exhaust gas recirculation		no	no	no
Turbocharging/supercharging		Turbocharger	Turbocharger	Turbocharger
Knock control		yes	yes	yes
Charge air cooling		yes	yes	yes
Lambda control		2 probes	2 probes	2 probes
Variable valve timing		Inlet	Inlet	Inlet
Intake manifold change-over		no	no	no
Secondary air system		no	no	no
Valves per cylinder		4	4	4

- 1) Unleaded premium RON 95 can also be used, but results in reduced power

3 Safety precautions

When working on the fuel system note the following warnings:

WARNING

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

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

– Procedure before opening high-pressure section of injection system ⇒ page 5 .

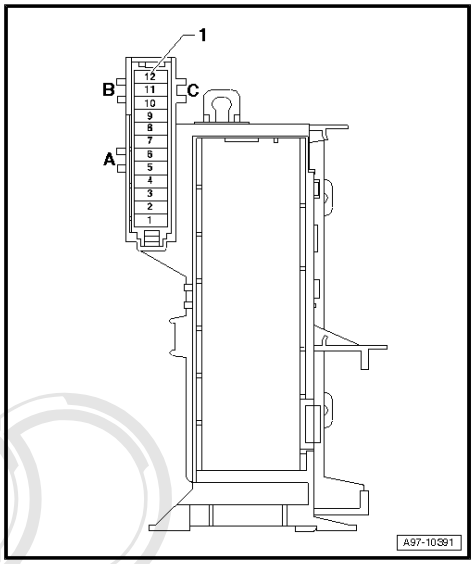
WARNING

Escaping fuel can cause a fire risk.

- *The power supply for the fuel pump control unit -J538- must be disconnected before opening the fuel system, as the fuel system pressurisation pump -G6- will be activated briefly when the driver's door is opened with the battery still connected.*

– Remove luggage compartment side trim (right-side) ⇒ Rep. Gr. 70 .

– Remove fuse 6 in fuse holder F -SF6- for fuel pump control unit -J538- in fuse holder in luggage compartment (right-side).



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

- Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- Always switch off ignition before washing engine.
- Faults are stored in engine control unit if electrical connectors have been unplugged:

– Connect vehicle diagnostic, testing and information system -VAS 5051B- .

– Start “Guided Functions” mode.

– Generate readiness code in engine control unit.

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 .

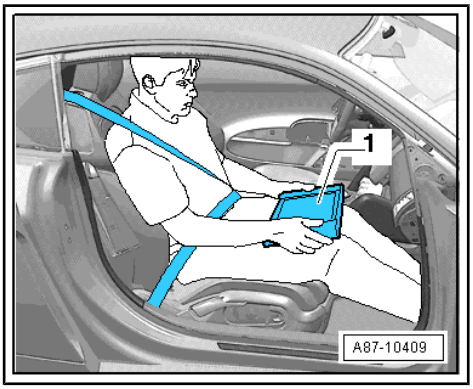
When working on the cooling system note the following warnings:

WARNING

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

- *The cooling system is under pressure when the engine is hot.*
- *Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.*

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.

Injuries can also be caused if the passenger's airbag is triggered in a collision.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*

TT Coupé:

Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.

TT Roadster:

- *Move the passenger's seat back as far as it will go.*
- *Use only vehicle diagnosis and service information system -VAS 5052- or diagnosis system -VAS 5053- .*
- *The test equipment -1- must rest flat on the passenger's thighs (as shown in illustration) and must be operated by the passenger.*

3.1 Procedure before opening high-pressure section of injection system

- The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 6 bar).
- Before removing a component in the high-pressure section of the injection system, the fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 6 bar; follow the procedure outlined below.

Special tools and workshop equipment required

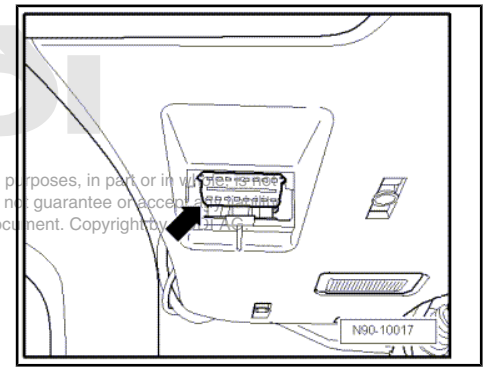
- Vehicle diagnostic, testing and information system -VAS 5051B-

Procedure

Proceed as follows:

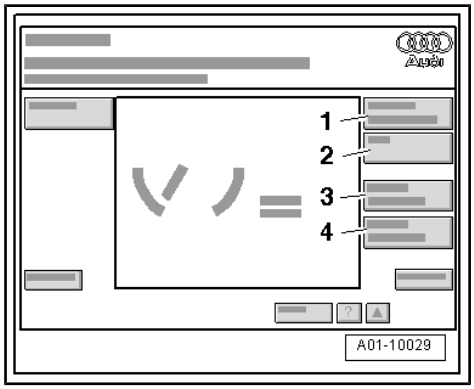
– With ignition switched off, connect vehicle diagnostic, testing and information system -VAS 5051B- with diagnosis lead to diagnosis connection.

– Start the engine and run at idling speed.



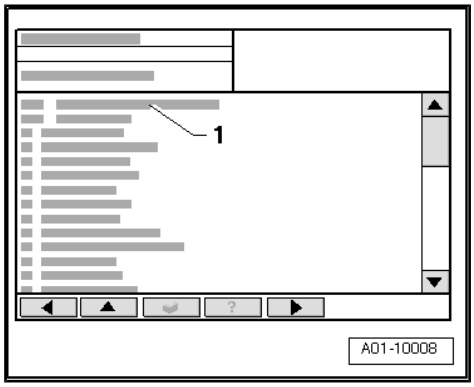
Display on -VAS 5051B- :

– Select Vehicle self-diagnosis from the list -item 1-.



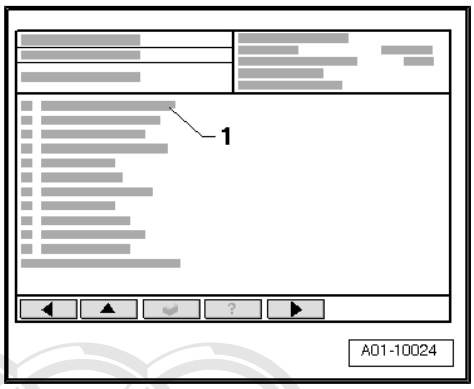
Display on -VAS 5051B- :

– From menu -1-, select vehicle system “Engine electronics” and press → key to continue.



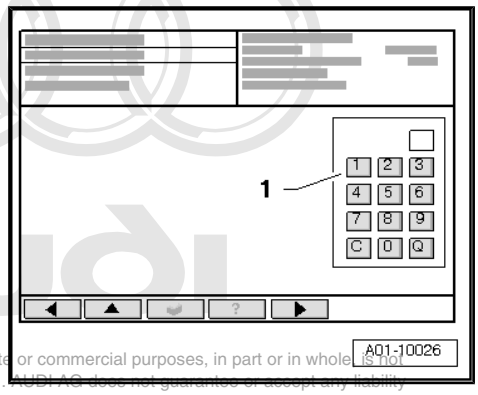
Display on -VAS 5051B- :

– From menu -1-, select function “Measured values” and press → key to continue.



Display on -VAS 5051B- :

– Press keys 1 4 0 on keypad -1- to select “Display group 140” and confirm entry by pressing Q key.

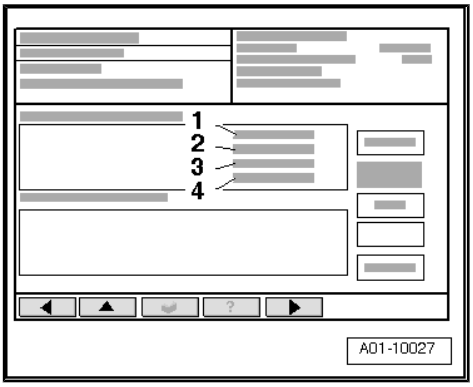


Display on -VAS 5051B- :

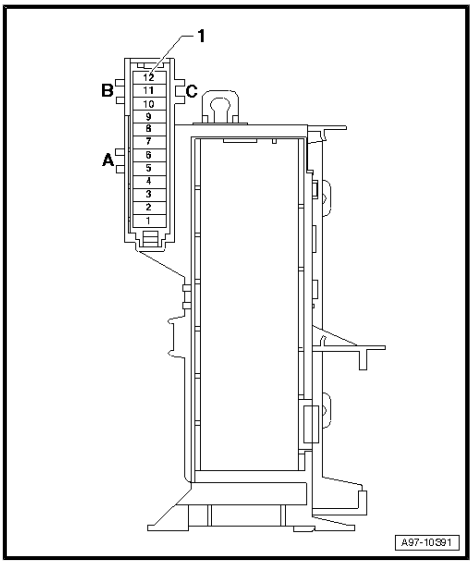
– Check display indicating fuel pressure in fuel rail in display zone -3-.

• With engine idling the figure displayed will be 35 ... 45 bar. The display shows the actual pressure in the fuel rail which is being generated by the high-pressure pump.

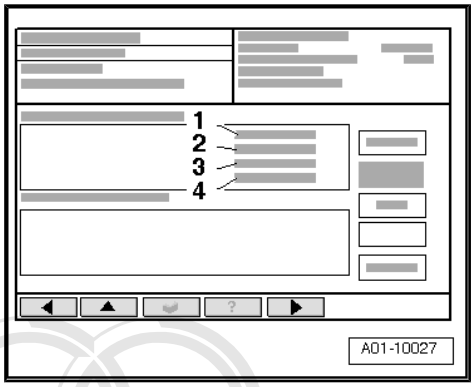
– Remove luggage compartment side trim (right-side) ⇒ Rep. Gr. 70 .



– Remove fuse 6 in fuse holder F -SF6- for fuel pump control unit -J538- in fuse holder in luggage compartment (right-side).



Display on -VAS 5051B- :



– With engine still running, check display zone -3- for fuel pressure in fuel system:

• The fuel pressure will decrease very quickly because the mechanical high-pressure pump is no longer being supplied with fuel from the fuel tank by the electric fuel pump.

– Switch off ignition as soon as fuel pressure has dropped to just below 8 bar.

Note

Fuel pressure must not fall below 6 bar, otherwise the engine will stall (this could damage the catalytic converter).

The fuel rail is still filled with fuel, however it is no longer under high pressure.

WARNING

There is a risk of injury: avoid skin contact with fuel.

- ***Wear safety goggles and protective clothing when opening the fuel system.***
- ***Before opening the high-pressure section of the fuel system, place a clean cloth around the connection to catch escaping fuel.***

– Disconnect a fuel line connection without delay.

Note

The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.

Additional steps required

– Re-fit fuse 6 in fuse holder F -SF6- .

– With ignition switched off, connect vehicle diagnostic, testing and information system -VAS 5051B- .

– Start “Guided Functions” mode.

– Generate readiness code in engine control unit ⇒ Vehicle diagnosis, testing and information system VAS 5051.

4 General repair instructions

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

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

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Seal off open lines and connections with clean plugs or sealing caps immediately.
- 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.

4.2 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.

4.3 Routing and attachment of pipes, hoses and wiring

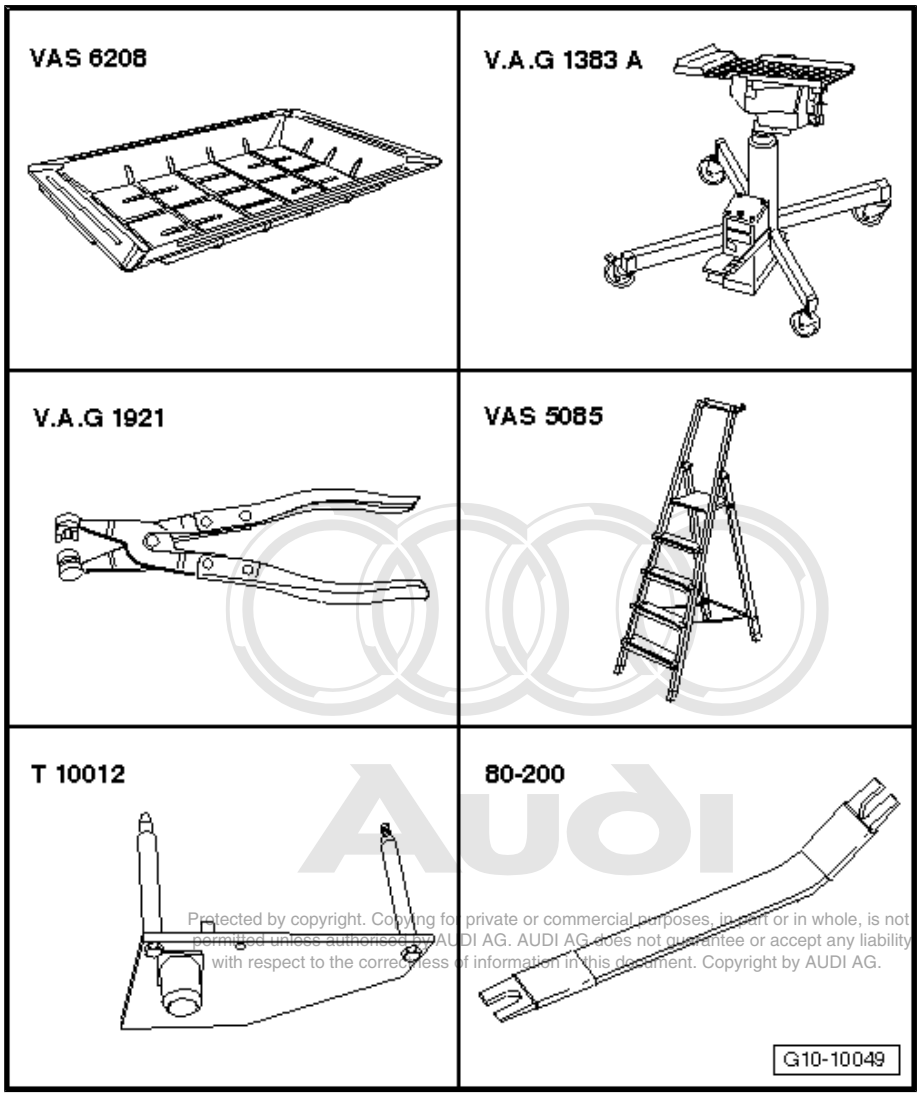
Mark hydraulic lines, vacuum lines and electrical wiring before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.

10 – Removing and installing engine

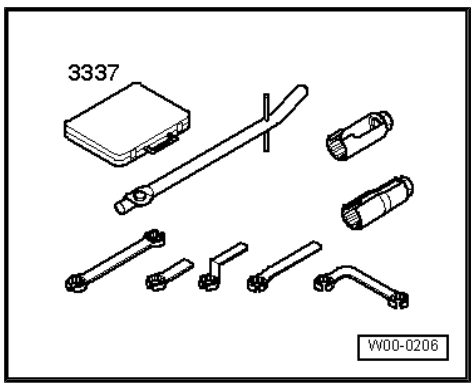
1 Removing engine

Special tools and workshop equipment required

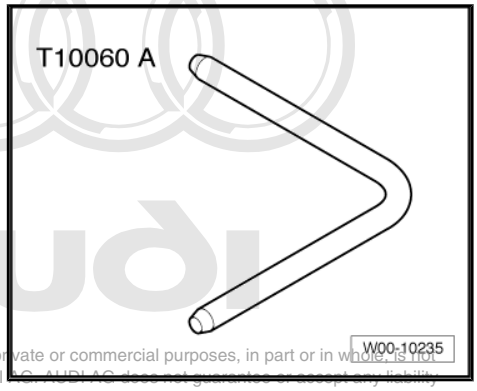
- Drip tray for workshop hoist -VAS 6208-
- Engine and gearbox jack -V.A.G 1383 A-
- Hose clip pliers -V.A.G 1921-
- Stepladder -VAS 5085-
- Engine bracket -T10012-
- Removal lever -80 - 200-



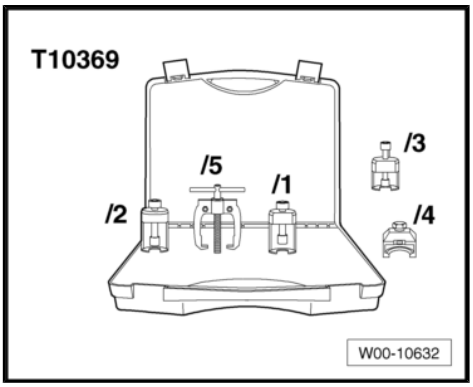
- Lambda probe open ring spanner set -3337-



- Locking pin -T10060A-



- Tool set for wiper arms -T10369-



- Engine bung set -VAS 6122-

Procedure

Proceed as follows:

Note

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

WARNING

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

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

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 5 .

Caution

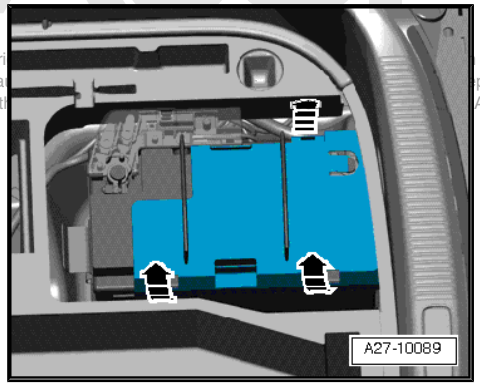
To prevent damage to the electronic components when disconnecting the battery:

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

– Take out luggage compartment floor covering.

– Remove rear cross panel trim if cover for negative terminal of battery is located under rear cross panel trim ⇒ Rep. Gr. 70 .

– Release retaining clips -arrows- and detach cover for negative terminal.

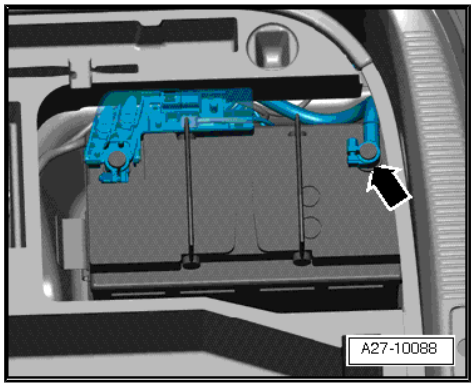


– Slacken nut a few turns and disconnect battery clamp on earth cable -arrow- from battery terminal.

WARNING

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

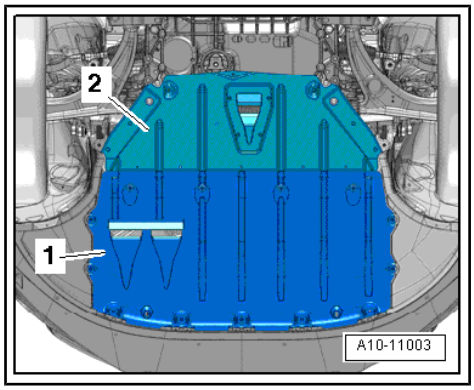
- *The cooling system is under pressure when the engine is hot.*
- *Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.*



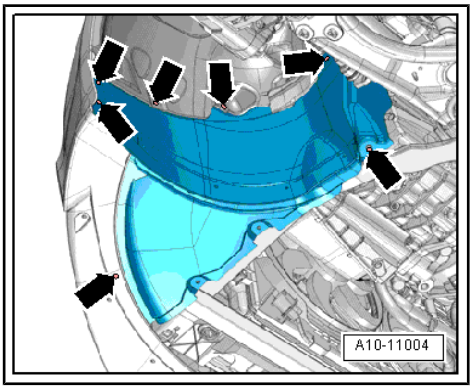
– Open filler cap on expansion tank.

– Remove both front wheels.

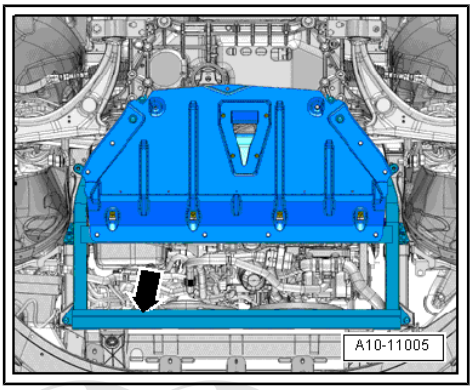
– Remove front noise insulation -1- ⇒ Rep. Gr. 66 .



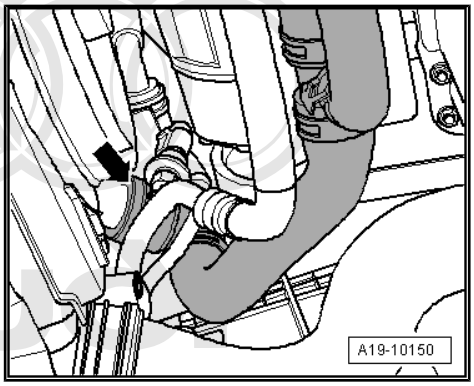
– Remove noise insulation on left and right sides -arrows-.



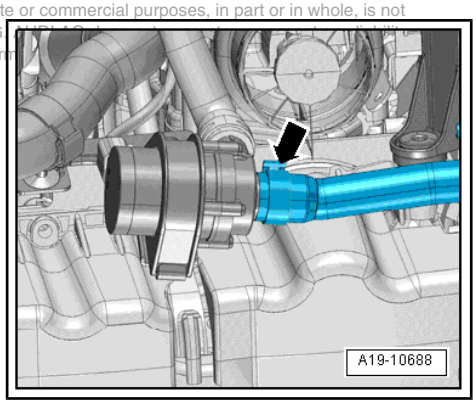
– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. Gr. 66 .



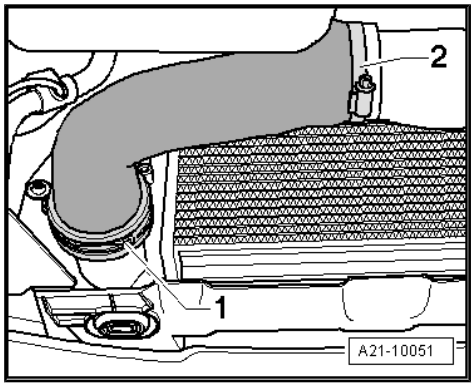
– Place drip tray for workshop hoist -VAS 6208- beneath engine.
– Lift retaining clip, disconnect coolant hose (bottom) -arrow- from radiator and drain off coolant.



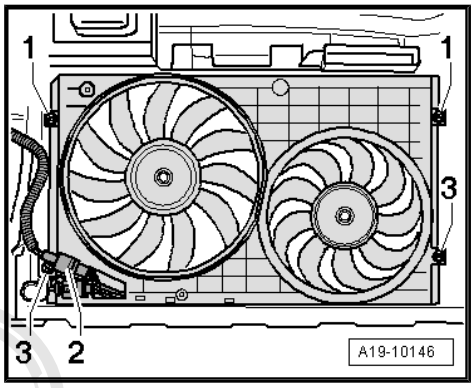
– Disconnect bottom coolant hose leading to continued coolant circulation pump -V51- -arrow- and drain off coolant.



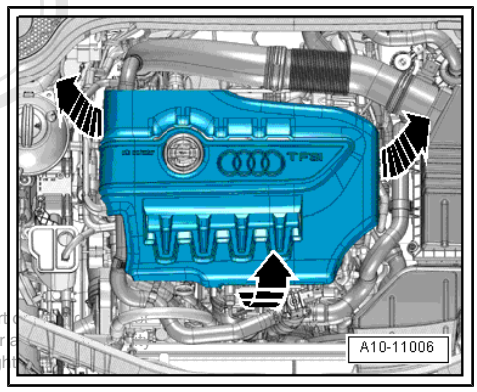
– Release hose clips -1- and -2- and remove air hose.



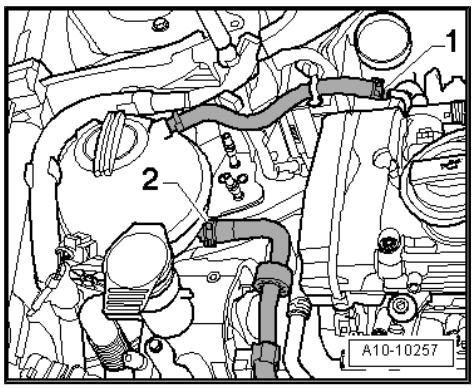
– Unplug electrical connector -2-.
– Remove bolts -3-.



– Remove engine cover panel -arrows-.



– Detach coolant hoses -1- and -2-.



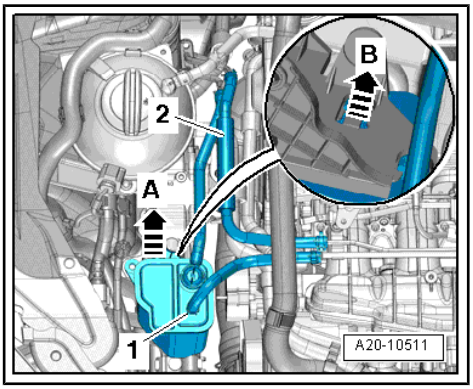
WARNING

Risk of injury caused by fuel.

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

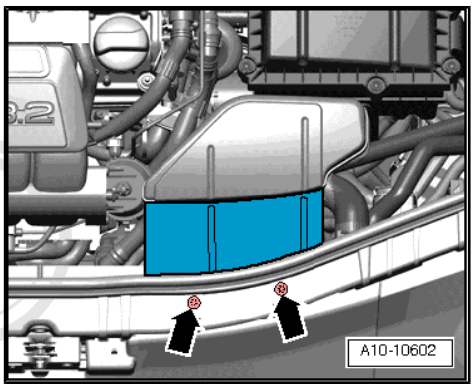
Caution

Observe rules for cleanliness when working on the fuel supply system ⇒ page 9 .

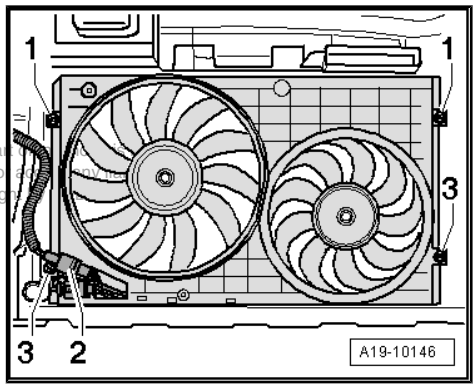


– Remove protective sleeve -2- and disconnect fuel hose by pressing release ring.
– Detach hose -1-.
– Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side.

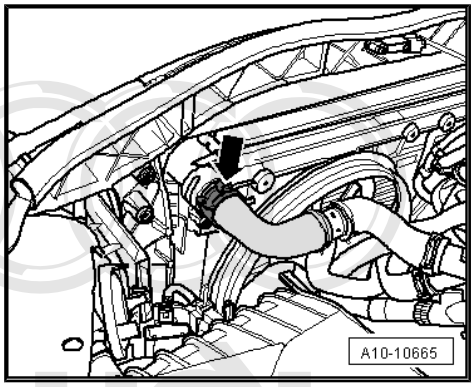
– Unscrew bolts -arrows- and remove air duct.



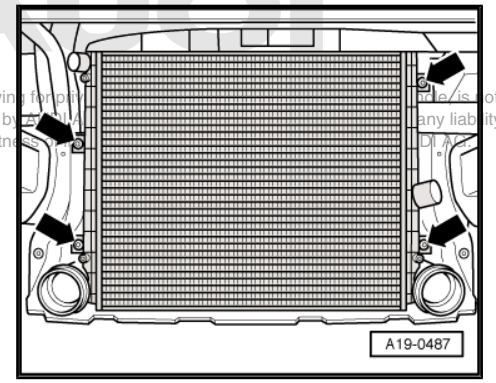
– Remove bolts -1- and lift out radiator cowl.



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



– Remove bolts -arrows- on reverse side of radiator.
– Remove radiator upwards.

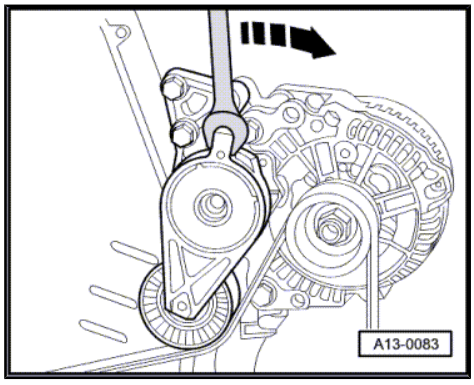


Vehicles with air conditioning:

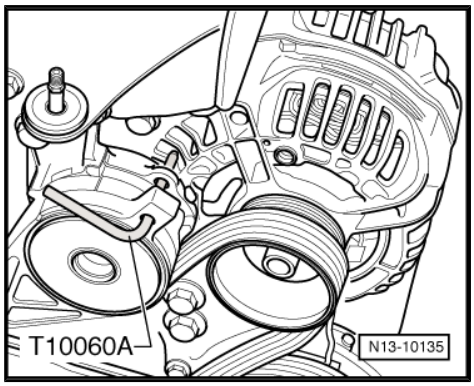
Caution

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

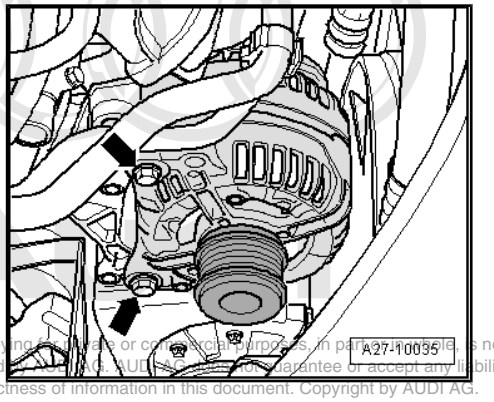
- ***Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen for re-installation.***



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



– Remove bolts -arrows- and detach alternator from bracket for ancillaries.

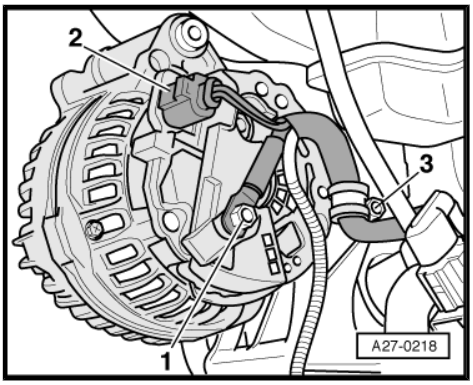


Note

- *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 electrical wiring connected.

– Unplug electrical connector -2-.
– Unscrew electrical wiring -1- and clamp -3- and remove from alternator.
– Lift out alternator.

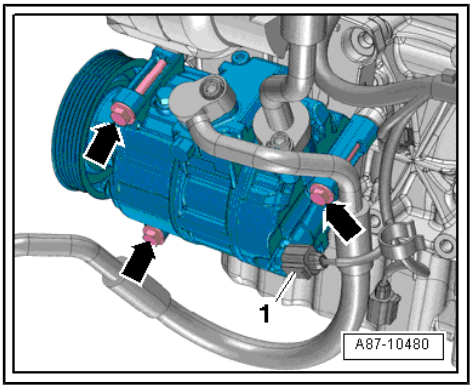


– Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

Caution

Danger of damage to refrigerant lines and hoses.

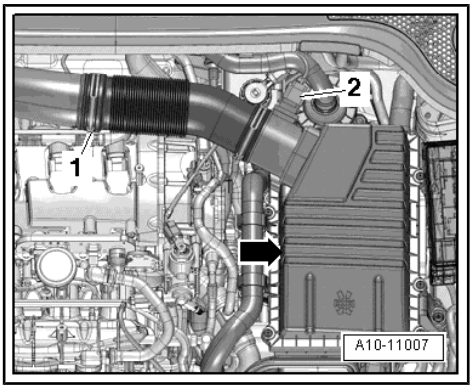
- *Do NOT stretch, kink or bend refrigerant lines and hoses.*



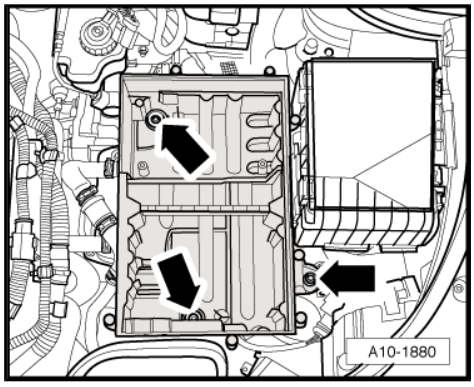
– Remove bolts -arrows-.
– Detach air conditioner compressor from bracket for ancillaries and tie up to the right side.

All vehicles (continued):

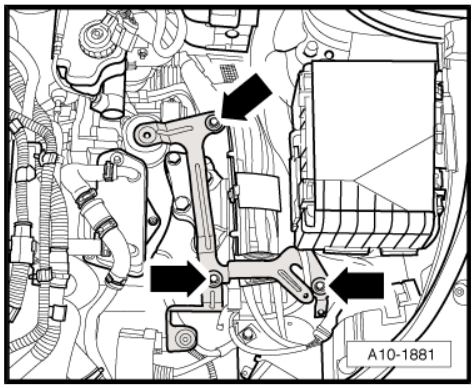
– Release hose clip -1- and detach air hose.
– Unplug electrical connector -2- for air mass meter -G70- .
– Unscrew top section of air cleaner housing -arrow- and remove air filter element.



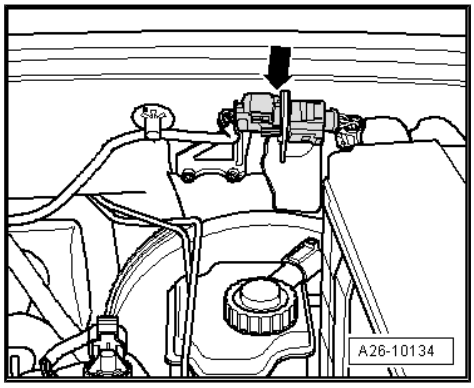
– Remove bolts -arrows- and detach bottom section of air cleaner housing.



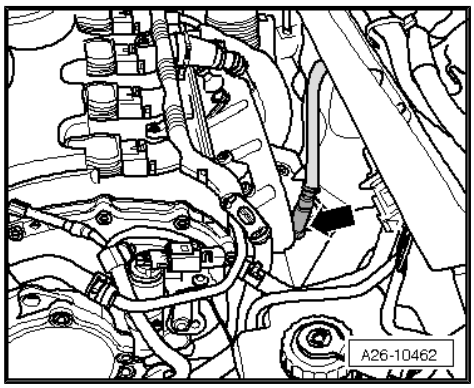
– Remove bolts -arrows- and detach bracket for air cleaner housing.



– Take electrical connector -arrow- for Lambda probe -G39- out of bracket, unplug and move clear.

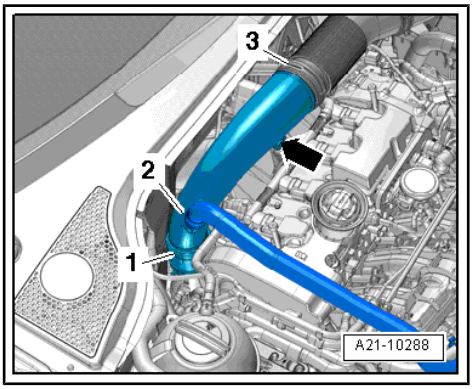


– Unscrew Lambda probe -G39- -arrow- using tool from Lambda probe open ring spanner set -3337- .



– Remove bolt -arrow-.

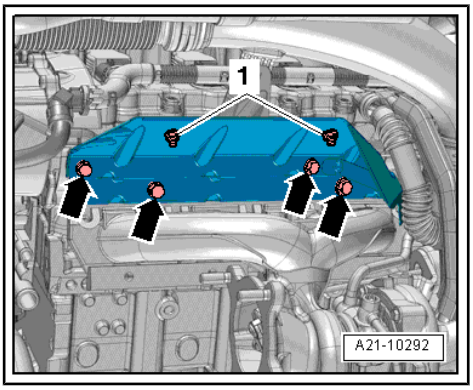
– Release hose clip -1- and lay air pipe on engine (hose -2- remains attached).



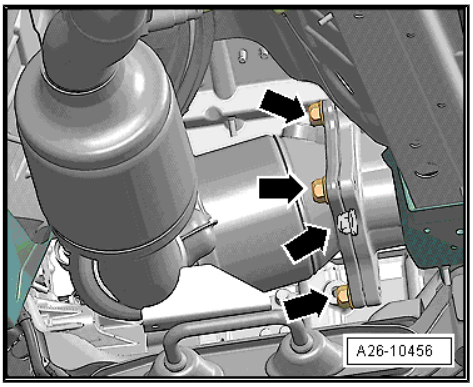
Note

Disregard item -3-.

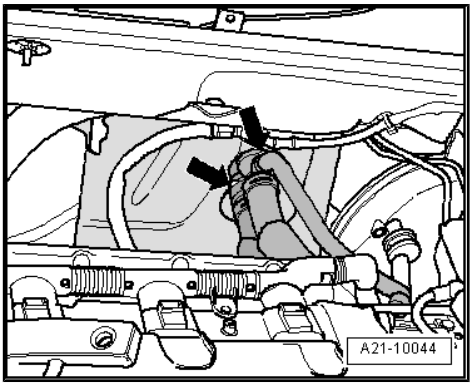
– Unscrew bolts -arrows- and nuts -1- and detach heat shield.



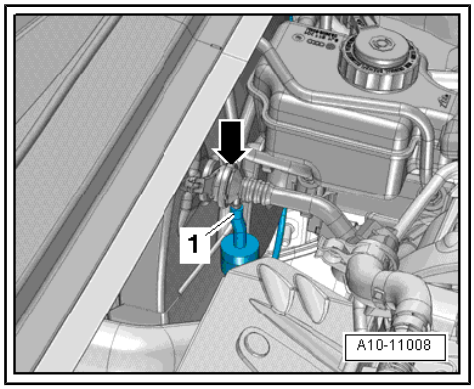
– Working from above, unscrew nuts -arrows- securing front exhaust pipe to turbocharger.



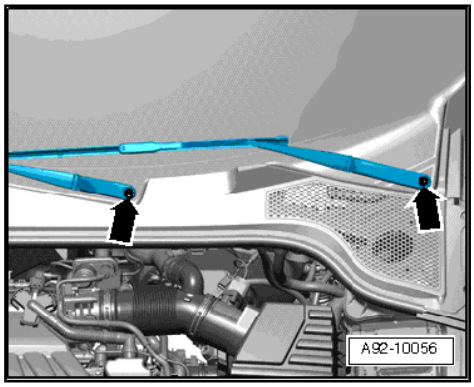
– Detach coolant hoses -arrows- leading to heat exchanger.



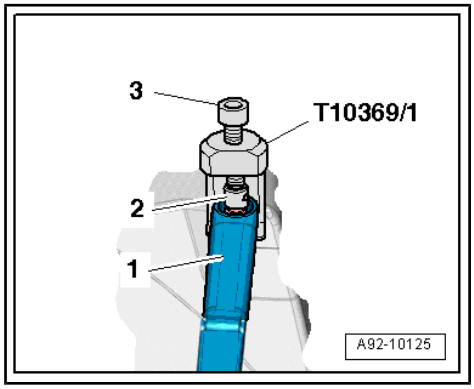
– Disconnect vacuum hose -1- coming from non-return valve.
– Pull non-return valve -arrow- off brake servo.



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



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

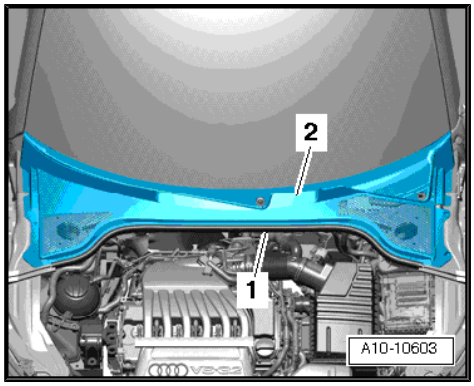


– Remove seal -1-.

Caution

Risk of damage to plenum chamber cover.

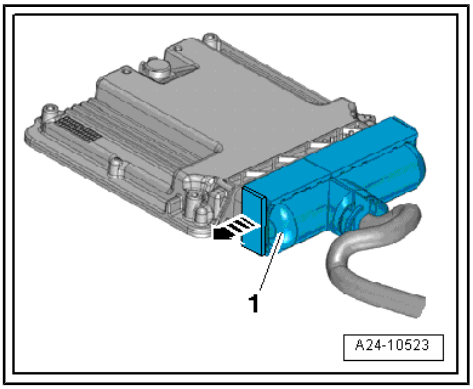
- *Apply a small quantity of soap solution to transition between windscreen and plenum chamber cover -2-. Then, starting at edge of windscreen, carefully pull plenum chamber cover upwards off retainer at windscreen.*



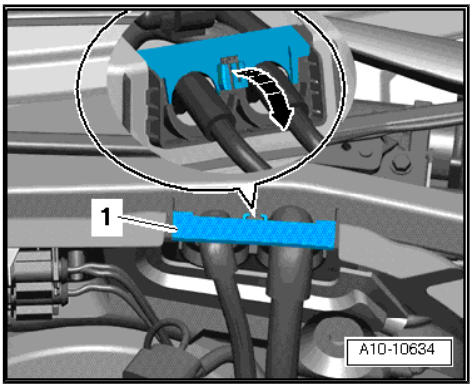
– Detach plenum chamber cover -2- by pulling it carefully off retainer at windscreen.
– Detach engine wiring harness (rear) at plenum chamber partition panel.

– Remove engine control unit ⇒ Rep. Gr. 24 .

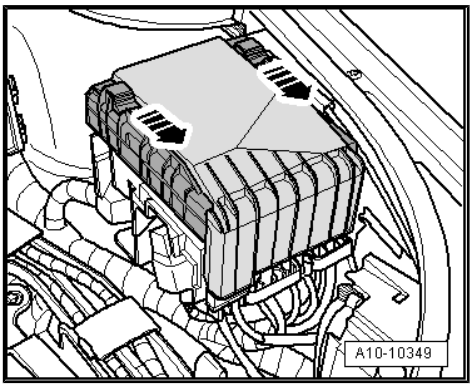
– Unplug electrical connector -1- for engine wiring harness -arrow-.



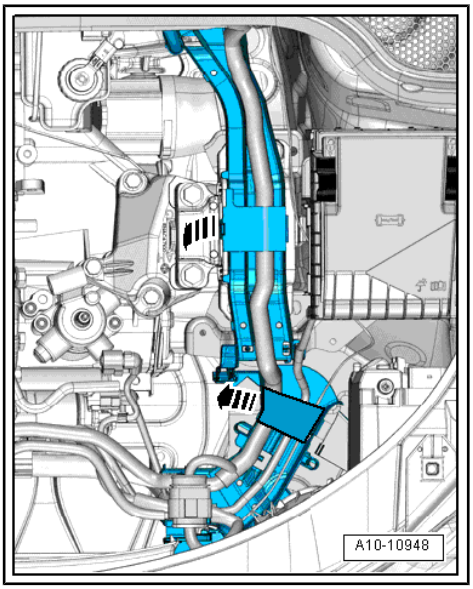
– Release wiring protector -1- for engine wiring harness -arrow- and lift off.



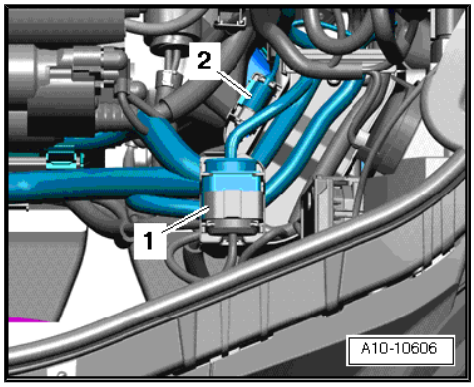
– Slide the two clips in the direction of the -arrows- and remove cover from electronics box in engine compartment.



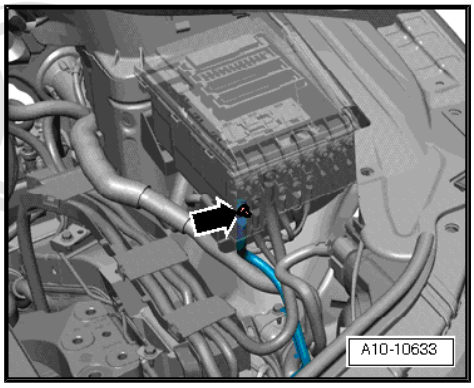
– Open wiring duct brackets -arrows-.



– Unclip electrical connector -1- from bracket and unplug.
– Open wiring duct bracket located underneath.
– Unclip wiring harness for engine control unit from wiring duct.
– Place engine wiring harness with engine control unit on top of engine.
– Secure engine control unit to prevent it falling.
– Unclip electrical connector -2- from bracket and unplug.

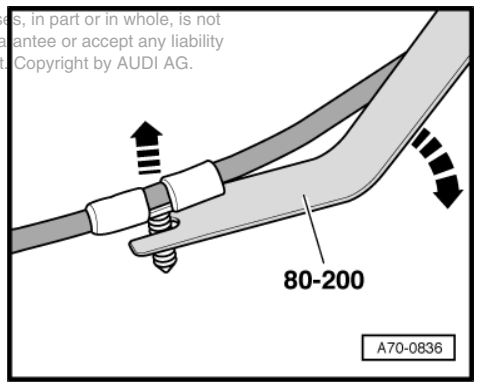


– Unscrew terminal 30 wire -arrow- from electronics box in engine compartment and move it clear.



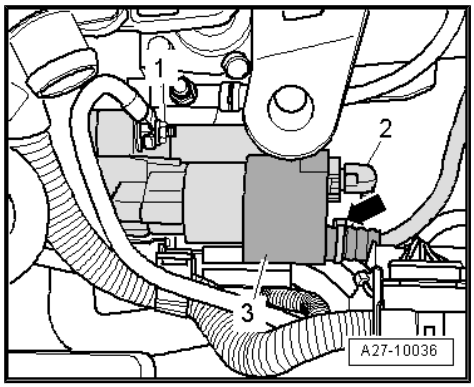
Note

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

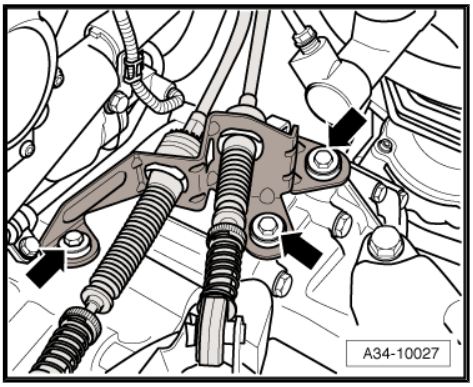


Vehicles with manual gearbox:

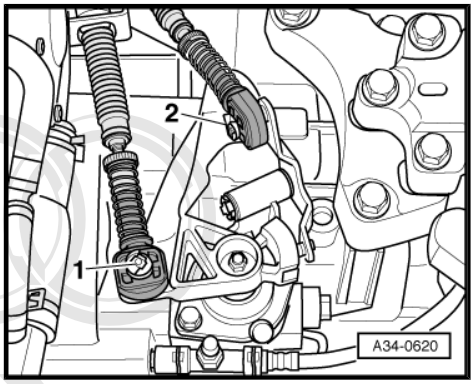
– Cut open cable tie -arrow- for protective cover -3-.
– Unplug electrical connector -2-.
– Push back protective cover and unscrew B+ cable at starter solenoid switch
– Remove nut -1- for earth wire.
– Remove top starter bolt.



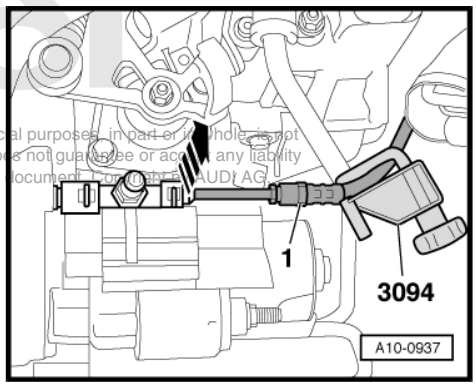
– Detach cable support bracket from gearbox -arrows-.



– Unclip circlip -1- from gear selector cable and circlip -2- from gate selector cable.
– Pull selector cable end-pieces with selector cables off selector shaft lever and relay lever.
– Tie selector cables with cable support bracket to one side.



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

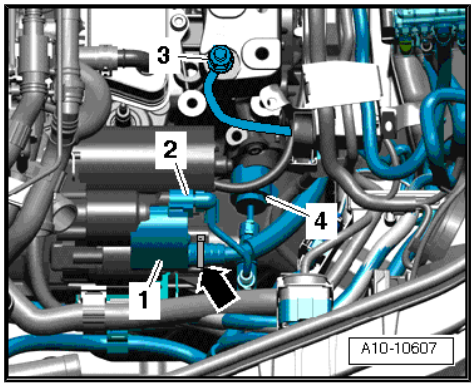


Caution

Risk of contamination by escaping brake fluid.

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

Vehicles with S tronic gearbox:



– Cut open cable tie -arrow- for protective cover -1-.
– Unplug electrical connector -2-.
– Push back protective cover and unscrew B+ cable at starter solenoid switch
– Unscrew earth wire -3-.

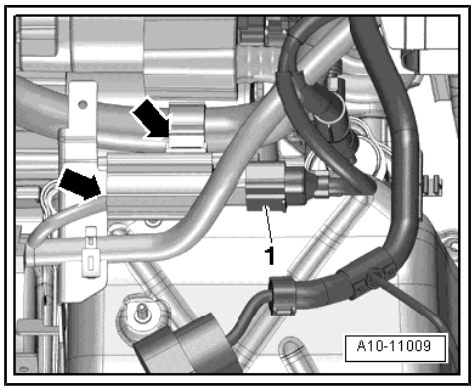
Caution

Risk of damage to control unit (mechatronic unit) by static discharge.

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

– Touch vehicle earth with bare hands to discharge any static charge.
– Turn retainer catch anti-clockwise and unplug electrical connector -4- at gearbox.

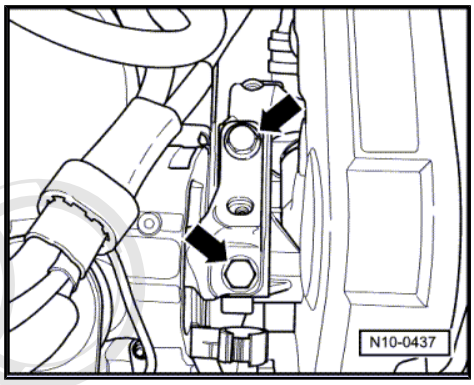
– Unplug electrical connector -1-.



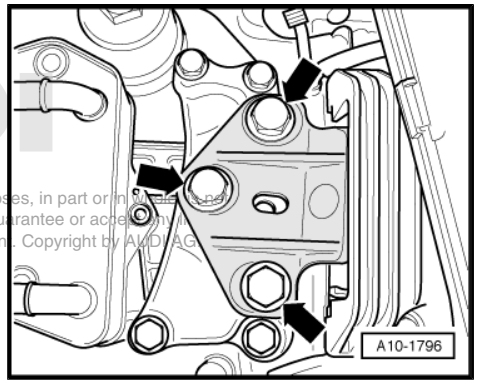
Note

Disregard -arrows-.

All vehicles (continued):

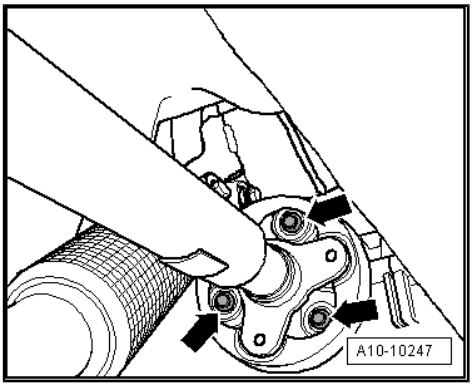


– Loosen bolts -arrows- for assembly mounting (engine end) approx. 2 turns.



– Loosen bolts -arrows- for assembly mounting (gearbox end) approx. 2 turns.

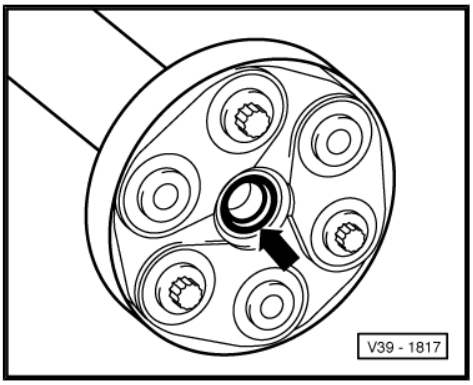
– Mark position of flexible coupling and flange for bevel box in relation to each other for re-installation.
– Remove bolts -arrows- for flexible coupling for propshaft at bevel box (counterhold using a suitable lever at the triangular flange).



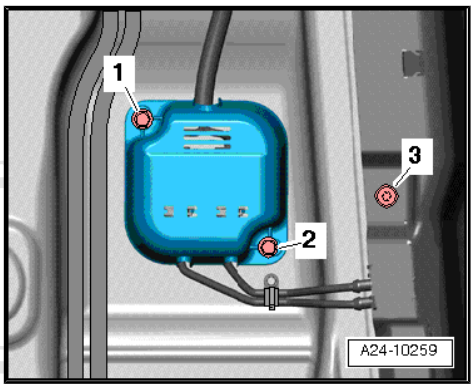
Caution

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

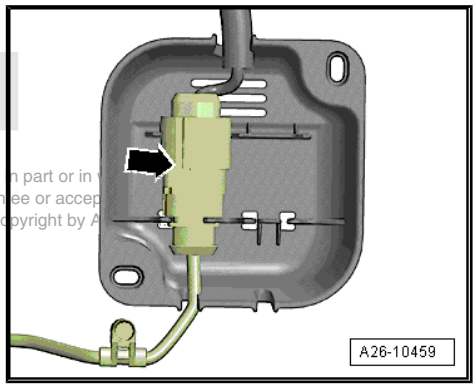
- ***Push the propshaft horizontally to the rear and towards the right side of vehicle as far as possible.***



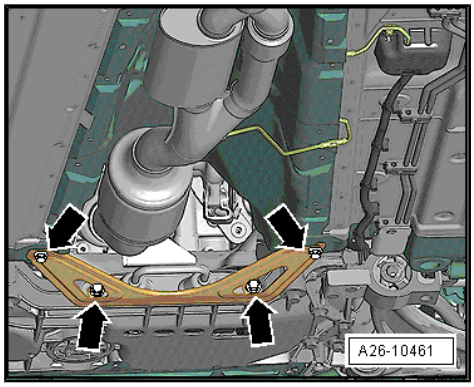
– Unscrew bolts -1- and -2- at bracket for electrical connector for Lambda probe (on underbody) and remove cover.
– Remove bolt -3- and move electrical wire to Lambda probe clear.



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



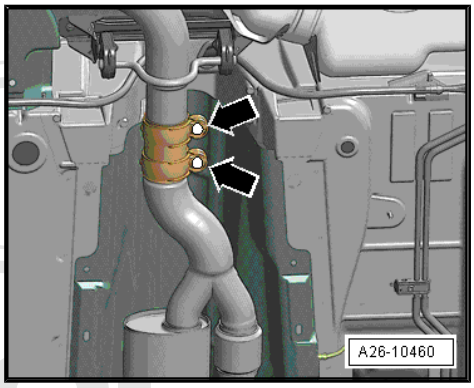
– Remove bolts -arrows- and detach bracket for exhaust system and tunnel brace.



Caution

Avoid damage to flexible joints.

- *Do not bend flexible joints in front exhaust pipe more than 10°.*



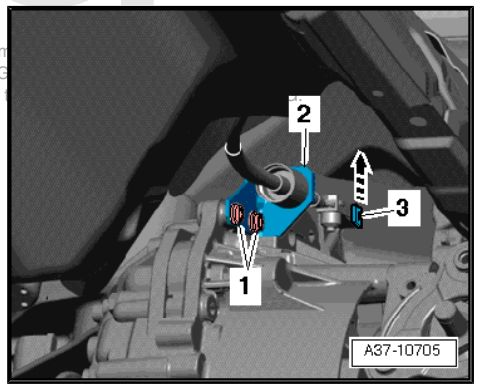
– Slacken nuts -arrows- at clamp and disconnect exhaust system.

– Detach front exhaust pipe with catalytic converter and front silencer.

Vehicles with S tronic gearbox:

– Remove bolts -1- for support bracket.

– Pull off securing clip -3- -arrow- and remove selector lever cable from gearbox.



Note

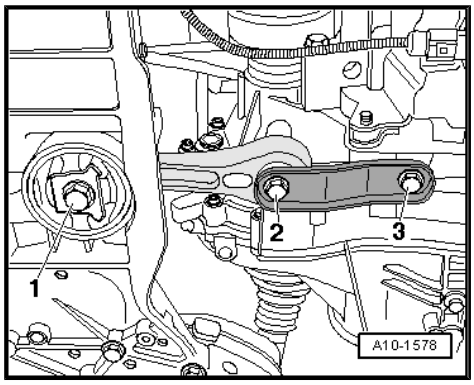
Disregard item -2-.

All vehicles (continued):

Caution

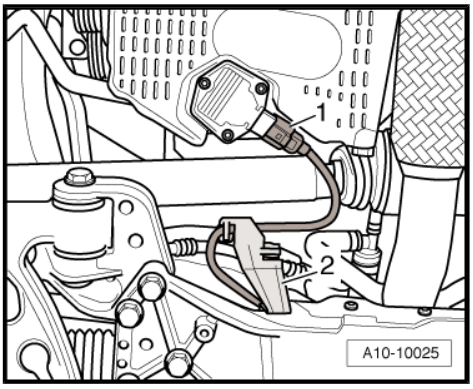
Make sure not to damage the oil seal in the propshaft flange.

- *When removing the bolts for the pendulum support/subframe, the engine/gearbox assembly swings slightly forward.*

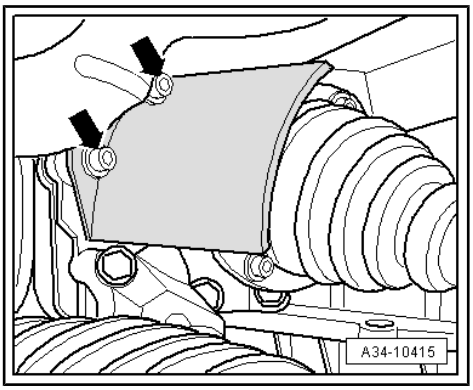


– Remove bolts -1, 2, 3- and remove pendulum support.

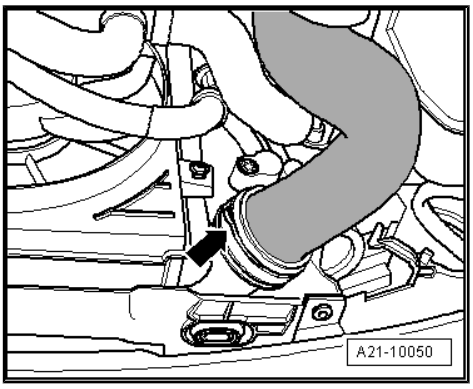
– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Unclip bracket -2- for wire to oil level and oil temperature sender -G266- from subframe.



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



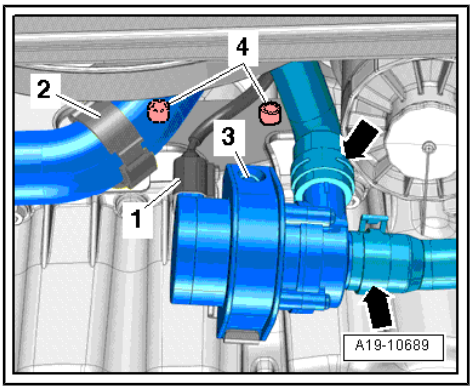
– Release hose clip -arrow- and detach air hose from charge air cooler.



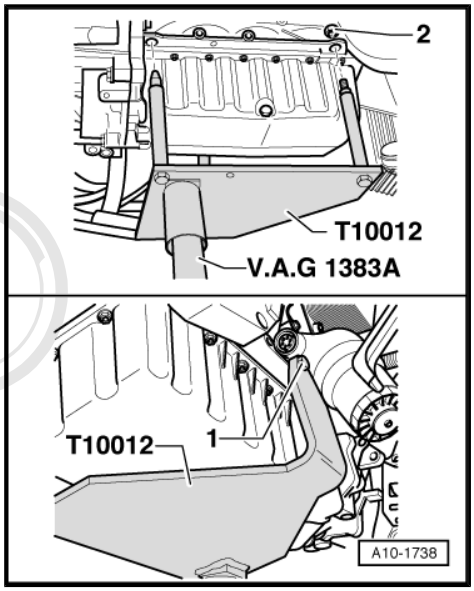
– Move coolant hose -2- clear.
– Unscrew bolts -4- and move continued coolant circulation pump -V51- to one side (coolant hoses -arrows- remain connected).

Note

Disregard -items 1 and 3-.



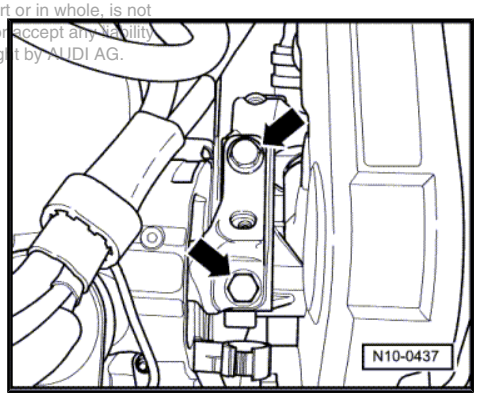
– Secure engine bracket -T10012- to cylinder block with bolt -1- and nut -2- (tightening torque: approx. 20 Nm).
– Insert engine and gearbox jack -V.A.G 1383 A- in engine support -T10012- and raise engine/gearbox assembly slightly.



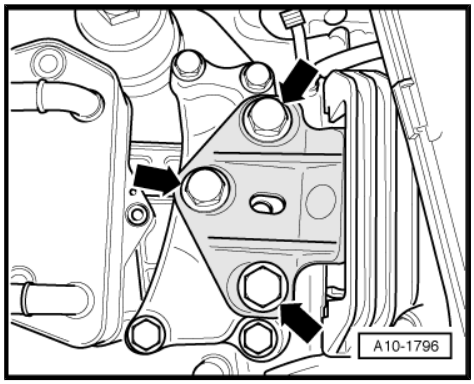
Note

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

– Remove bolts -arrows- for assembly mounting (engine end).



– Remove bolts -arrows- for assembly mounting (gearbox end).



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.*

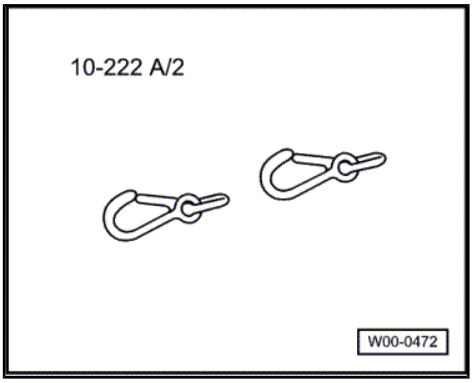
– Pull engine/gearbox assembly as far forward and to the left as possible, and lower gradually (pay attention to drive shafts).

2 Separating engine and gearbox

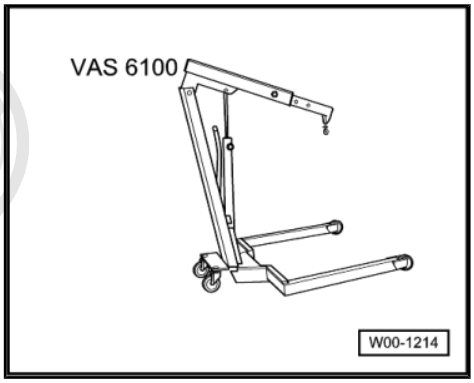
2.1 Separating engine from manual gearbox

Special tools and workshop equipment required

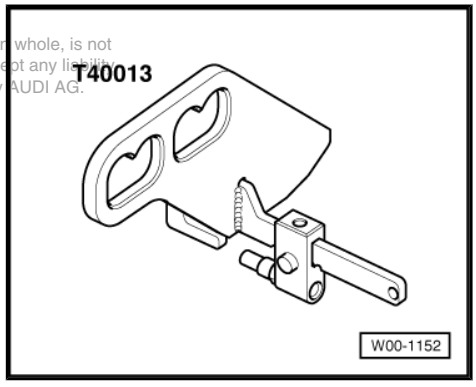
- Hooks -10 - 222 A /2-



- Workshop hoist -VAS 6100-



- Lifting tackle -T40013-

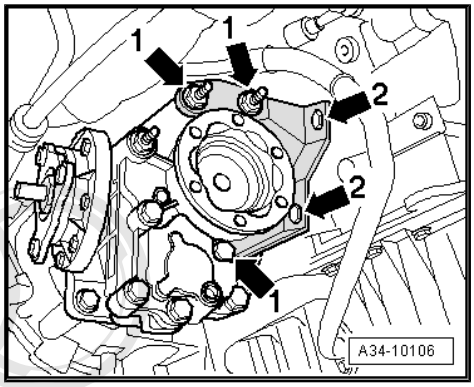


Procedure

Proceed as follows:

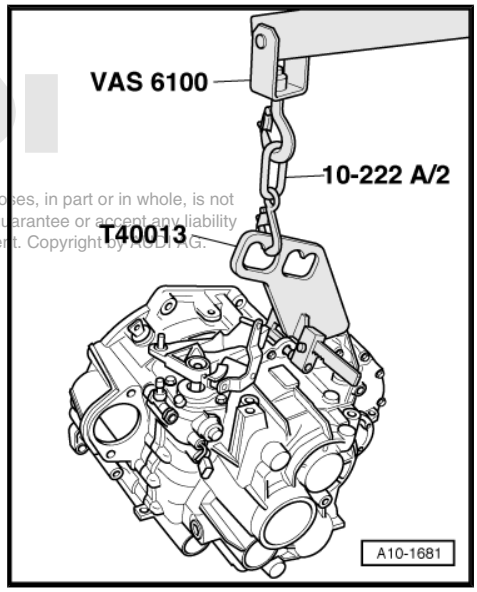
- Engine/gearbox assembly removed and attached to engine support -T10012- .

– Unscrew bolts -1- and -2- and detach bracket for bevel box.



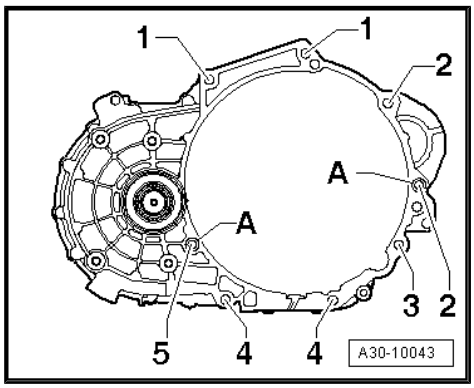
– Attach lifting tackle -T40013- to gearbox and close lock.

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



– Remove bolts -1 ... 5- securing gearbox to engine.

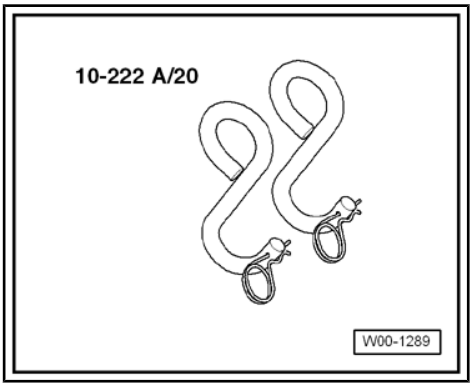
– Detach gearbox from engine.



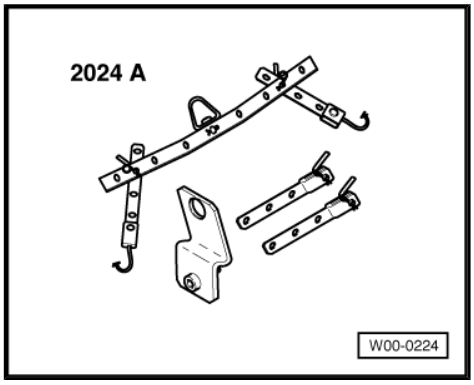
2.2 Separating engine and S tronic gearbox

Special tools and workshop equipment required

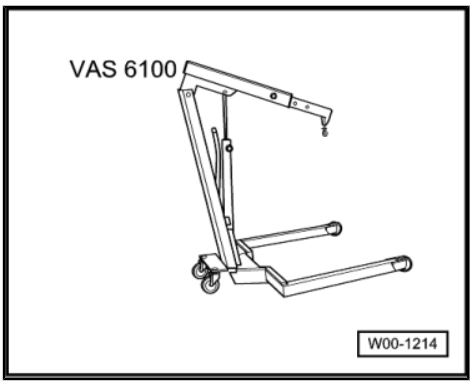
♦ Adapter -10 - 222 A /20-



♦ Lifting tackle -2024 A-



♦ Workshop hoist -VAS 6100-

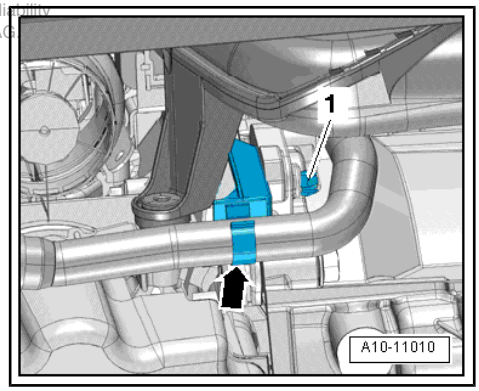


Procedure

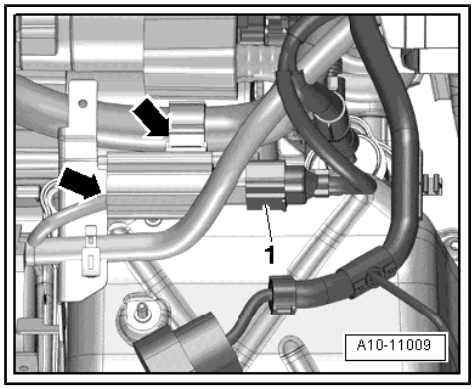
Proceed as follows:

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

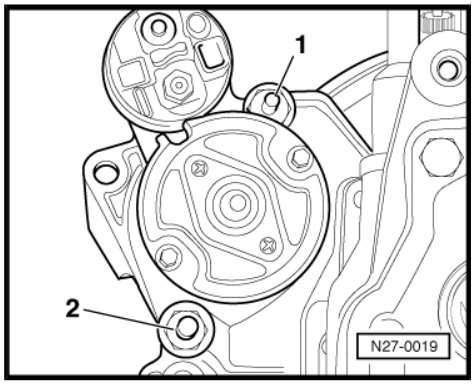
– Move coolant hose clear -arrow-.



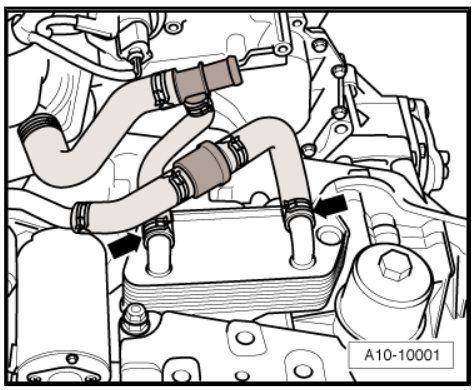
– Move wiring harnesses -arrows- and electrical connector -1- clear at bracket.



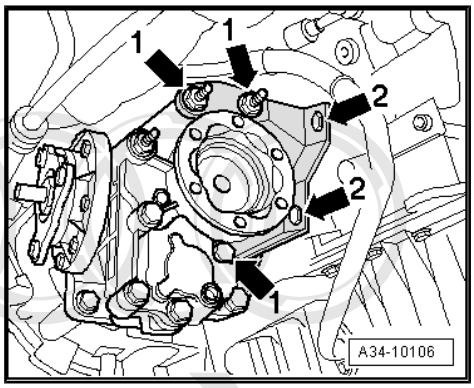
– Unscrew bolts -1- and -2- and remove starter from gearbox.



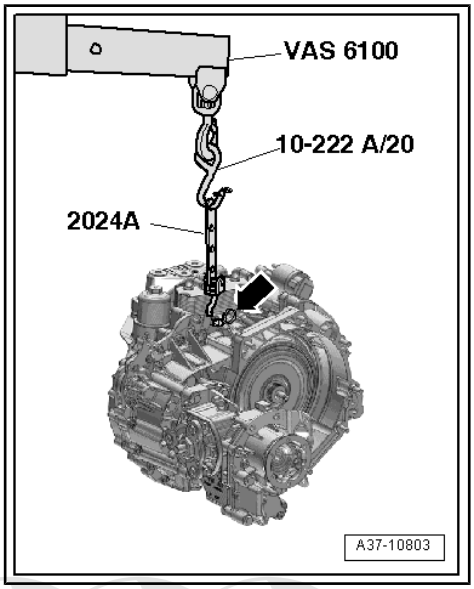
– Detach coolant hoses -arrows- from ATF cooler.



– Slacken bolts -1- and remove bolts -2-.



– Engage hook of lifting tackle -2024 A- in gearbox lifting eye and secure with locking pin -arrow-.
– Attach workshop hoist -VAS 6100- to lifting tackle -2024 A- with adapter -10 - 222 A /20- .

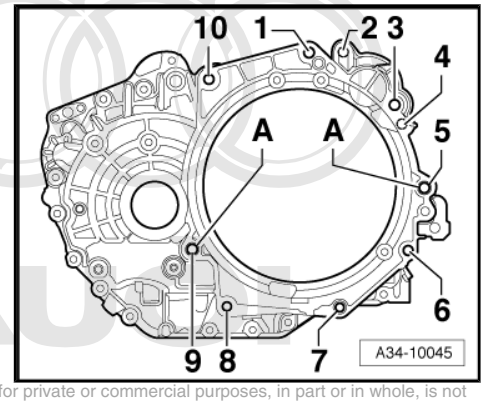


– Remove bolts -1, 3, 5, 6, 7, 8, 9, 10- securing gearbox to engine.

Note

Disregard items marked -2, 4 and A-.

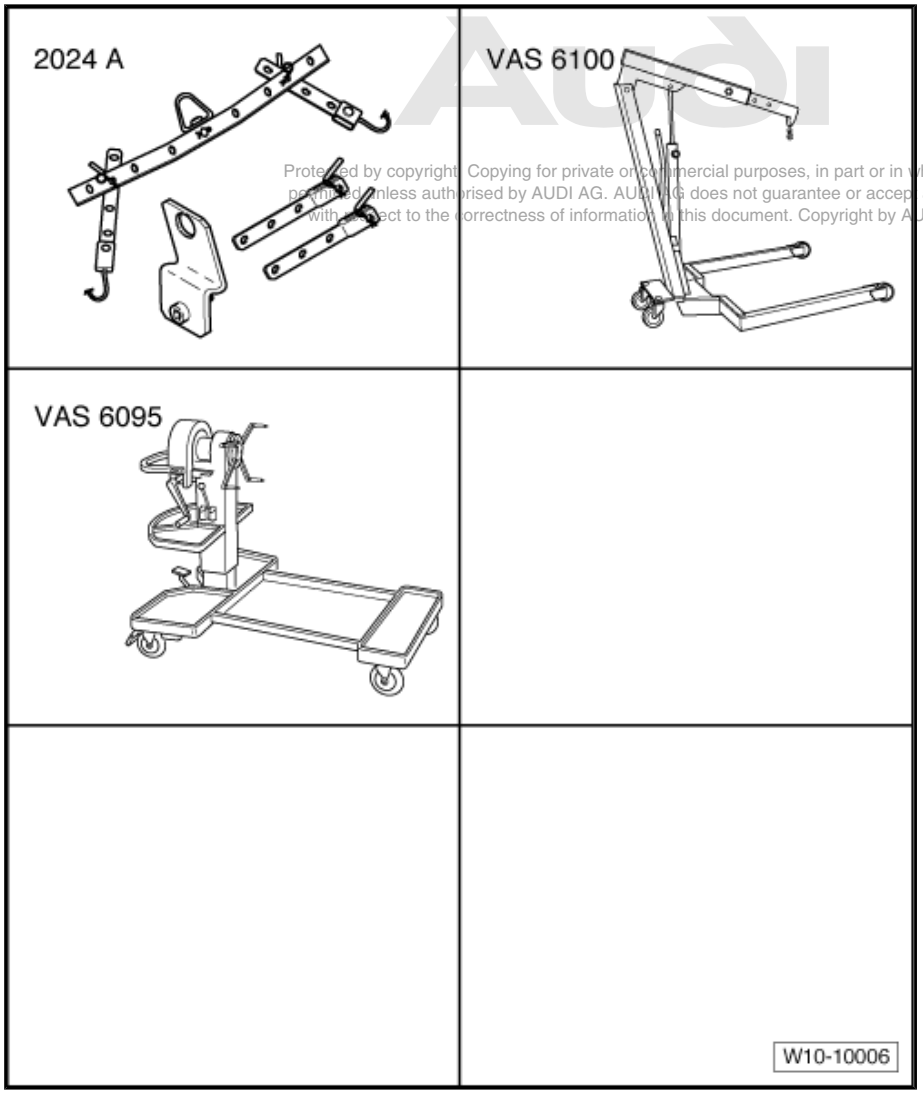
– Detach gearbox from engine.



3 Securing engine to engine and gearbox support

Special tools and workshop equipment required

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

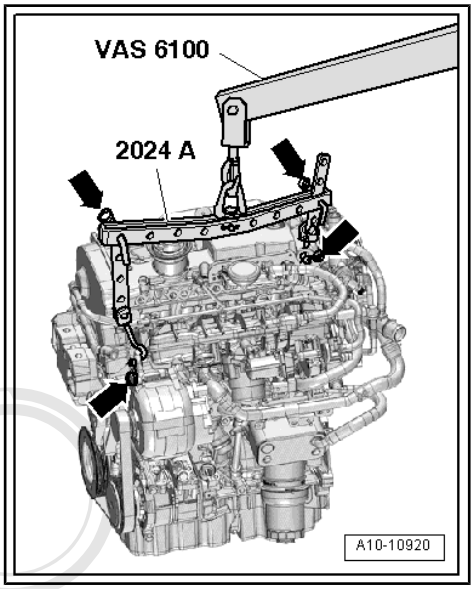


Procedure

Proceed as follows:

- Gearbox detached from engine.

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



Note

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

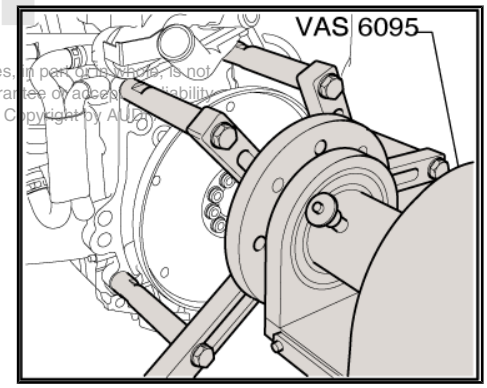
WARNING

Accident risk from loose components of lifting tackle.

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

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

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



4 Installing engine

Tightening torques

Note

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

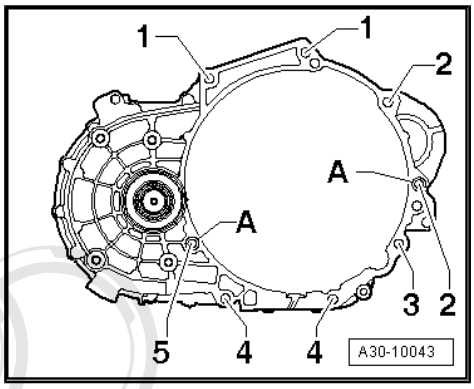
- Tightening torques ⇒ page 42
- Further tightening torques:

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

Securing manual gearbox to engine

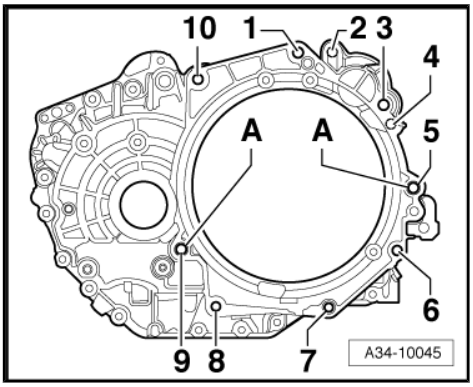
Item	Bolt	Nm
1 [1)]	M12x55	80
2 [1)]	M12x165	80
3	M10x105	40
4	M10x50	40
5 [2)]	M12x65	80
A	Dowel sleeves for centralising	

- [1)] Bolt with M8 stud
- [2)] Screwed into gearbox from engine side.



Securing S tronic gearbox to engine

Item	Bolt	Nm
1, 3	M12x55	80
5	M12x65	80
6	M12x50	80
7, 8	M10x50	40
9	M12x70	80
10	M12x55	80
2, 4	Securing starter ⇒ Rep. Gr. 27	
A	Dowel sleeves for centralising	



Procedure

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

Note

- *Renew self-locking nuts and bolts.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Fit cable ties in the original positions when installing.*

– If not already fitted, install dowel sleeves for centring engine and gearbox in cylinder block.

Vehicles with manual gearbox:

– Remove needle bearing in crankshaft if fitted ⇒ page 72 .

– Renew clutch release bearing if worn ⇒ Rep. Gr. 30 .

– Lubricate splines of gearbox input shaft lightly with grease for clutch plate splines ⇒ Electronic parts catalogue .

– Make sure that clutch plate is properly centred.

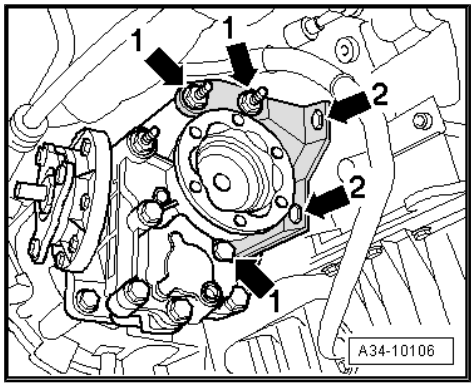
Vehicles with S tronic gearbox:

– Install needle bearing if not fitted in crankshaft ⇒ page 72 .

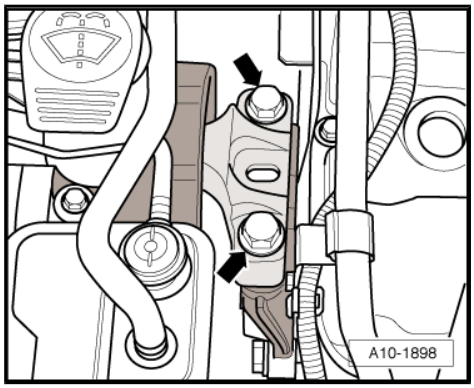
All vehicles (continued):

– Secure gearbox to engine.

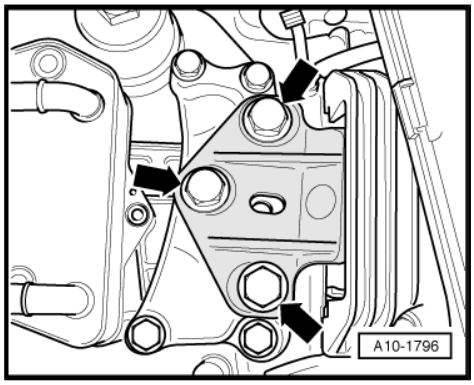
– Secure bracket for bevel box ⇒ Rep. Gr. 34 or ⇒ Rep. Gr. 39 .
– Guide engine/gearbox assembly into body.



– Initially hand-tighten bolts -arrows- for assembly mounting (engine end).



– Initially hand-tighten bolts -arrows- for assembly mounting (gearbox end).

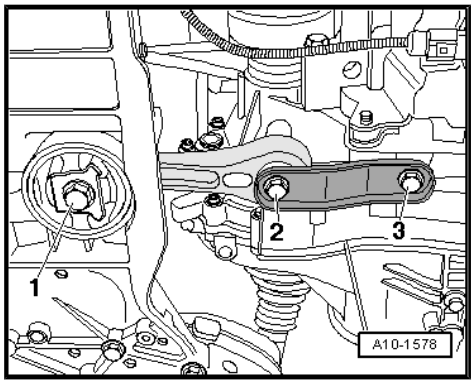


Note

The bolts are tightened to final torque only after adjusting the assembly mountings ⇒ page 44 .

– Remove engine support -T10012- from engine.

– Tighten bolts -2- and -3- securing pendulum support to gearbox ⇒ page 42 .



Vehicles with S tronic gearbox:

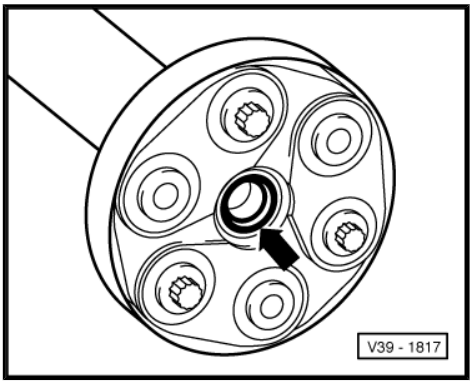
– Install selector lever cable ⇒ Rep. Gr. 34 .

All vehicles (continued):

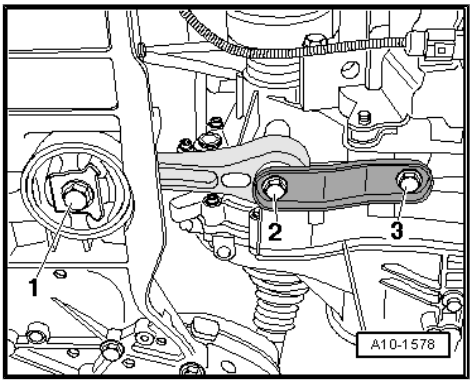
Caution

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

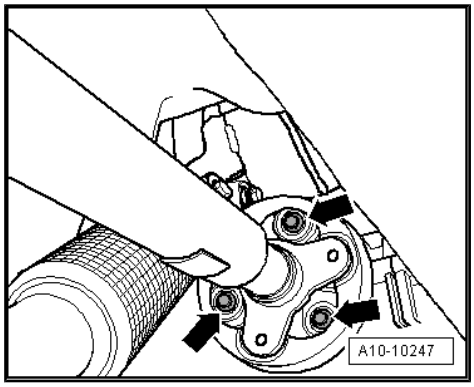
- *Push engine/gearbox assembly towards bulkhead, guiding pin on bevel box flange carefully into propshaft flange.*



– Tighten bolt -1- securing pendulum support to subframe ⇒ page 42 .



– Secure propshaft with flexible coupling to bevel box ⇒ Rear final drive 02D/0AV; Rep. Gr. 39 .



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

– Install front exhaust pipe with catalytic converter and front silencer ⇒ page 202 .
– Install exhaust system and align free of stress ⇒ page 206 .
– Install Lambda probe -G39- ⇒ Rep. Gr. 24
– Install drive shafts ⇒ Rep. Gr. 40 .
– Install heat shield for drive shaft ⇒ Rep. Gr. 39 .

Vehicles with manual gearbox:

– Installing and adjusting selector mechanism ⇒ Rep. Gr. 34 .

Caution

Risk of contamination by escaping brake fluid.

- *Do not operate clutch pedal before attaching pipe/hose assembly to bleeder connection on clutch slave cylinder.*

– Connect pipe/hose assembly to bleeder connection on clutch slave cylinder and bleed clutch system ⇒ Rep. Gr. 30 .

All vehicles (continued):

– Install air conditioner compressor ⇒ Rep. Gr. 87 .
– Install alternator ⇒ Rep. Gr. 27 .
– Install poly V-belt ⇒ page 52 .
– Install radiator ⇒ page 173 .
– Install radiator cowl ⇒ page 173 .
– Install starter ⇒ Rep. Gr. 27
– Install noise insulation frame and noise insulation ⇒ Rep. Gr. 66 .
– Adjust assembly mountings ⇒ page 44 .
– Install engine control unit ⇒ Rep. Gr. 24 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Install wiper arms ⇒ Rep. Gr. 92 .
– Observe notes on procedure for connecting the battery ⇒ Rep. Gr. 27 .
– Check engine oil level ⇒ Maintenance ; Booklet 810 .

Caution

Risk of damage to control units because of excessive voltage.

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

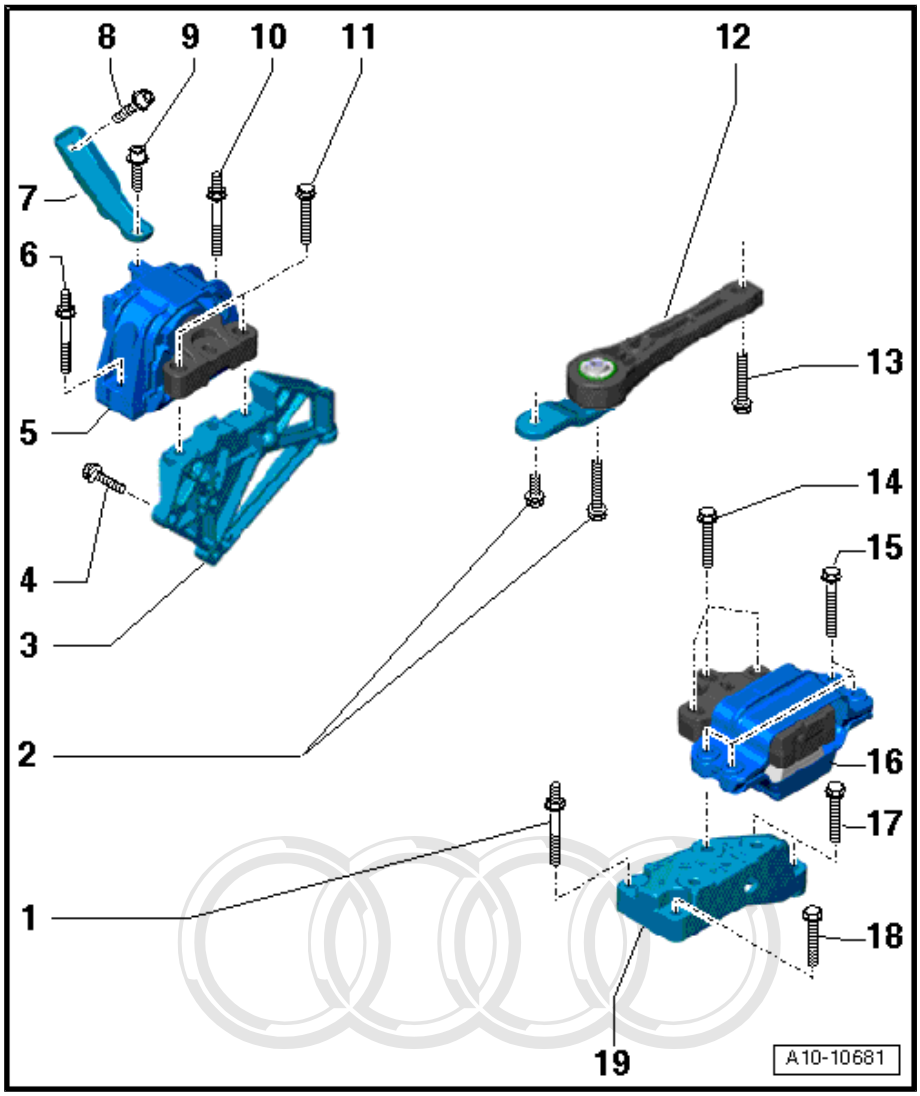
– Fill up with coolant ⇒ page 156 .

Note

- *Do not use drained coolant again if:*
- *the cylinder head or cylinder block have been renewed.*
- *the coolant is contaminated or dirty.*

5 Assembly mountings

5.1 Assembly mountings - exploded view



1 - Bolt
- ❑ Gearbox support to gearbox
- ❑ Tightening torque ⇒ Rep. Gr. 34

2 - Bolts
- ❑ Pendulum support to gearbox
- ❑ Different lengths
- ❑ Tightening torque ⇒ Rep. Gr. 34

3 - Engine support
- ❑ With support arm
- ❑ Version fitted in vehicle may differ from illustration

4 - Bolt
- ❑ Engine support to engine
- ❑ Different lengths
- ❑ 45 Nm

5 - Engine mounting
- ❑ With support arm

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

7 - Connecting bracket

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

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

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

11 - Bolts
- ❑ Engine mounting to engine support
- ❑ Renew

- ❑ 60 Nm + turn 90° further

12 - Pendulum support

13 - Bolt

- ❑ Pendulum support to subframe
- ❑ Tightening torque ⇒ Rep. Gr. 34

14 - Bolt

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

15 - Bolt

- ❑ Gearbox mounting to body
- ❑ Tightening torque ⇒ Rep. Gr. 34

16 - Gearbox mounting

- ❑ With support arm
- ❑ Illustration shows version for S tronic gearbox

17 - Bolt

- ❑ Gearbox support to gearbox
- ❑ Tightening torque ⇒ Rep. Gr. 34

18 - Bolt

- ❑ Gearbox support to gearbox
- ❑ Tightening torque ⇒ Rep. Gr. 34

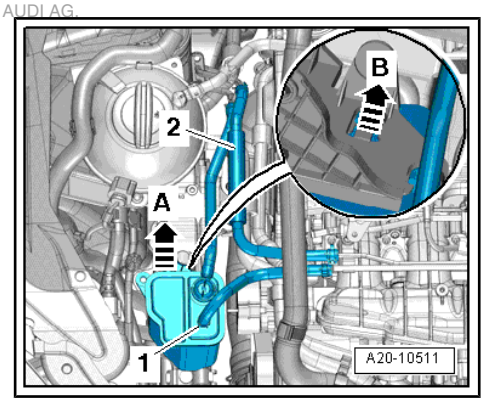
19 - Gearbox support

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

Procedure

Proceed as follows:

– Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side.

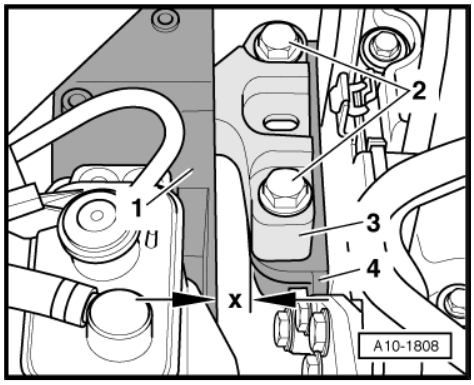


Note

Disregard -items 1 and 2-.

– Check distances at mounting (right-side) for engine and gearbox:

- The two bolt heads -2- must be parallel with edge of support arm -3- for engine mounting.
- There must be a distance of -x- = 16 mm between engine mounting -1- and engine support -4-.



Note

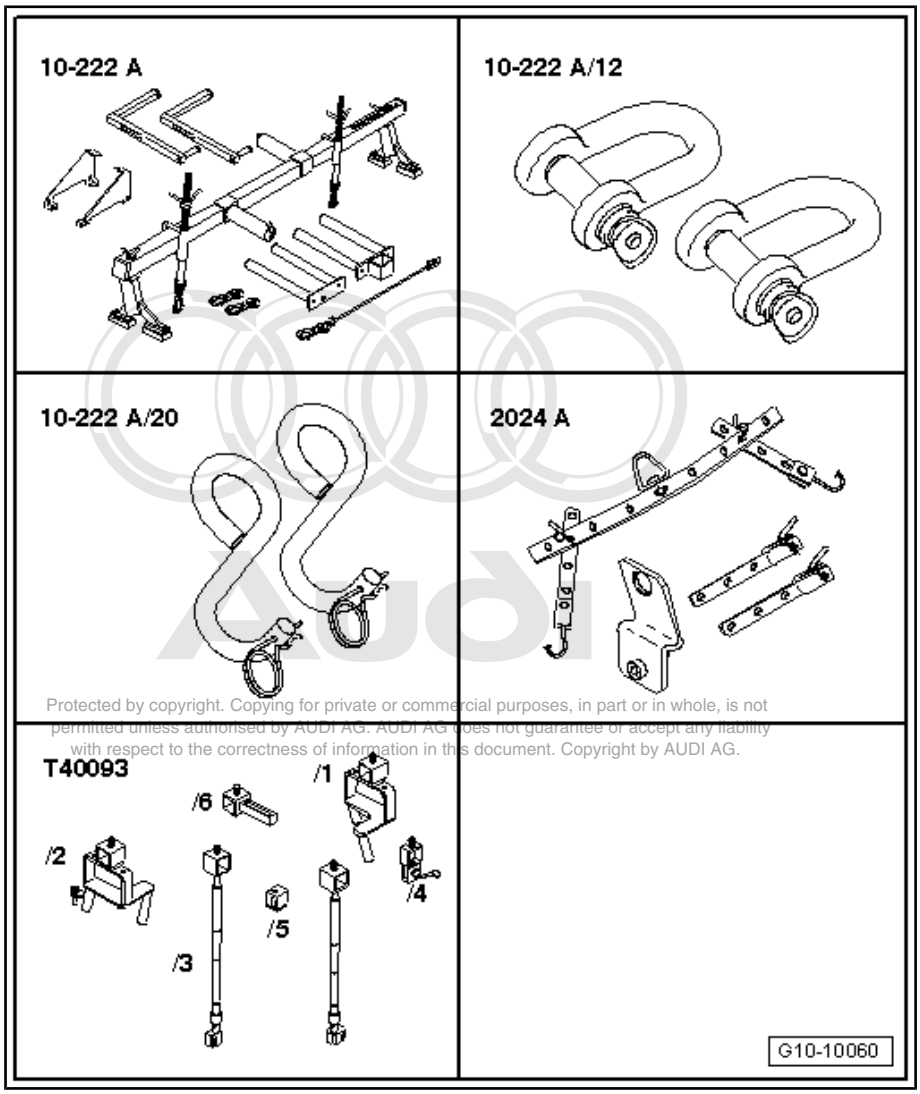
Distance -x- = 16 mm can also be checked with a metal rod of suitable size, or similar.

– If the distance measured is too large or small, the assembly mountings must be adjusted ⇒ page 44 .

5.3 Adjusting assembly mountings

Special tools and workshop equipment required

- Support bracket -10 - 222 A-
- Shackle -10 - 222 A /12-
- Adapter -10 - 222 A /20-
- Lifting tackle -2024 A-
- Adapter -T40093/6- (2x)

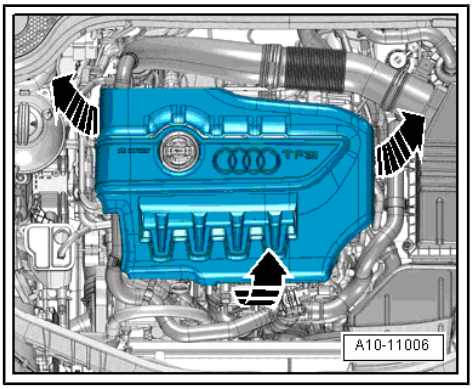


Procedure

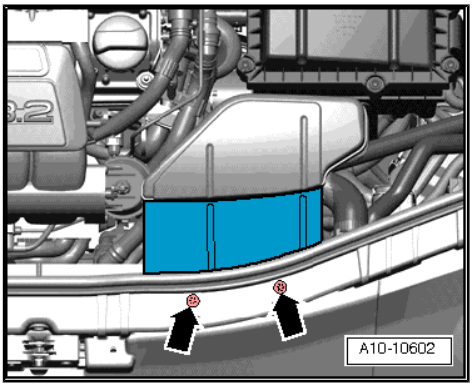
- Tightening torques ⇒ page 42

Proceed as follows:

– Remove engine cover panel -arrows-.



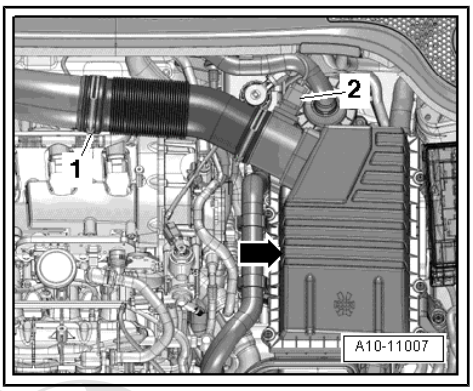
– Unscrew bolts -arrows- and remove air duct.



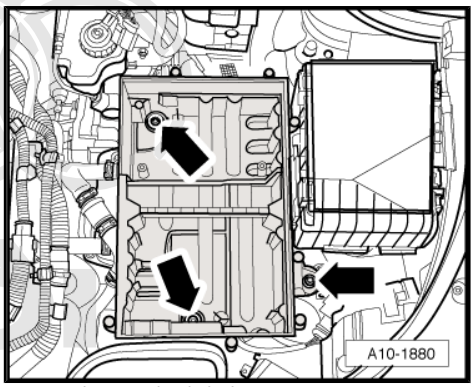
– Release hose clip -1- and detach air hose.

– Unplug electrical connector -2- for air mass meter -G70- .

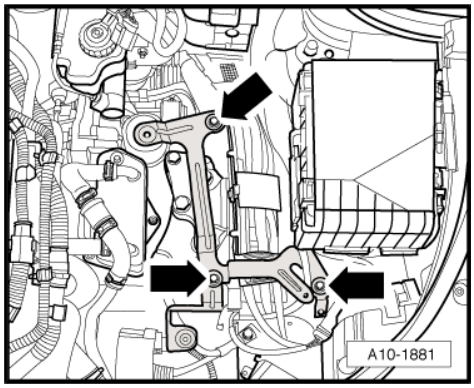
– Unscrew top section of air cleaner housing -arrow- and remove air filter element.



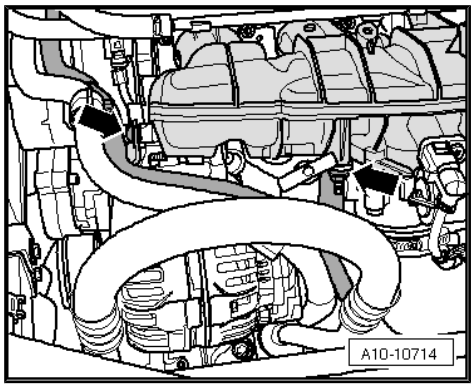
– Remove bolts -arrows- and detach bottom section of air cleaner housing.



– Remove bolts -arrows- and detach bracket for air cleaner housing.



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

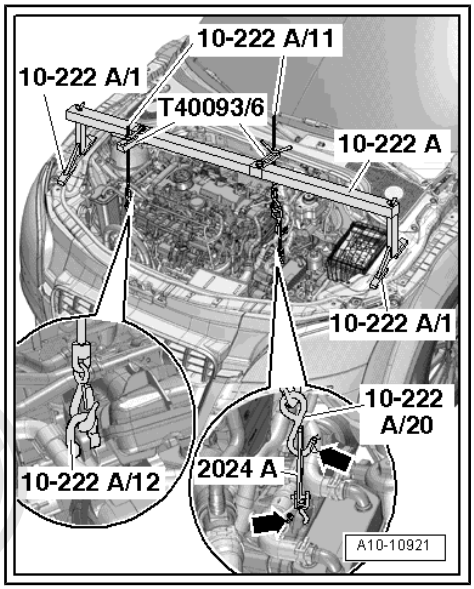


– Position support bracket -10 - 222 A- on top of body flanges using the following tools:

- Rack -10 - 222 A /1- (2x)
- Spindle -10 - 222 A /11- (2x)
- Shackle -10 - 222 A /12-
- Adapter -10 - 222 A /20-
- Hook of lifting tackle -2024 A-
- Adapter -T40093/6- (2x)

– Hook spindle -10 - 222 A /11- onto gearbox lifting eye (left-side) with shackle -10 - 222 A /12- .

– Engage spindle -10 - 222 A /11- at gearbox with adapter -10 - 222 A /20- and hook of lifting tackle -2024 A- .



WARNING

Risk of accident.

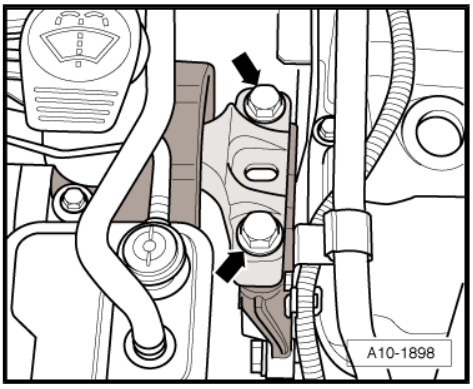
- *The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.*

Note

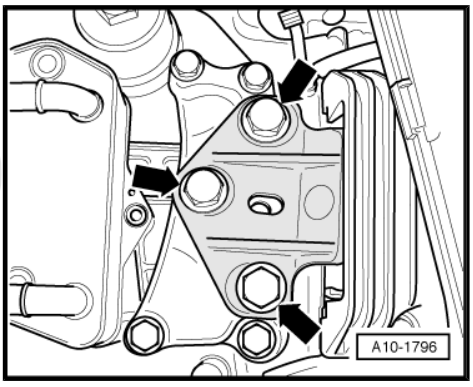
Illustration shows vehicle with S tronic gearbox.

– Take up weight of engine/gearbox assembly by evenly tightening two spindles.

– Remove bolts -arrows- for assembly mounting (engine end).

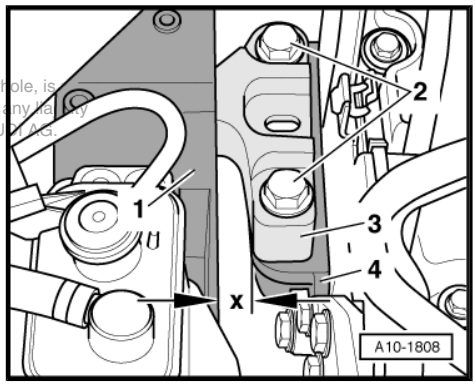


– Remove bolts -arrows- for assembly mounting (gearbox end).
– Renew each of the 5 bolts in turn (if not already done when installing engine) and hand-tighten.
– Slacken bolts on left and right-hand support arms by approx. two turns each.



– Using a tyre iron, adjust engine/gearbox assembly between engine mounting -1- and engine support -4- until the specifications listed below are obtained:

- The two bolt heads -2- must be parallel with the edge of the support arm -3-.
- There must be a distance of -x- = 16 mm between engine mounting -1- and engine support -4-.



Note

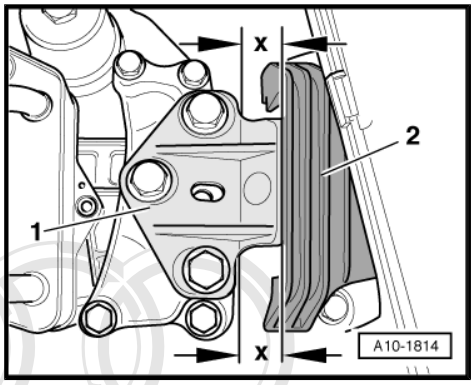
Distance -x- = 16 mm can also be checked with a metal rod of suitable size, or similar.

– Tighten bolts for assembly mounting (gearbox end).

– Ensure that the edges of the support arm (on the gearbox assembly mounting) -1- and gearbox mounting -2- are parallel.

• Dimension -x- must be identical on both sides of mounting.

– Tighten bolts for assembly mounting (engine end).



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

Note

♦ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*

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

– Tighten bolts for front section of longitudinal member ⇒ Rep. Gr. 50 .

– Detach support bracket -10 - 222 A- .

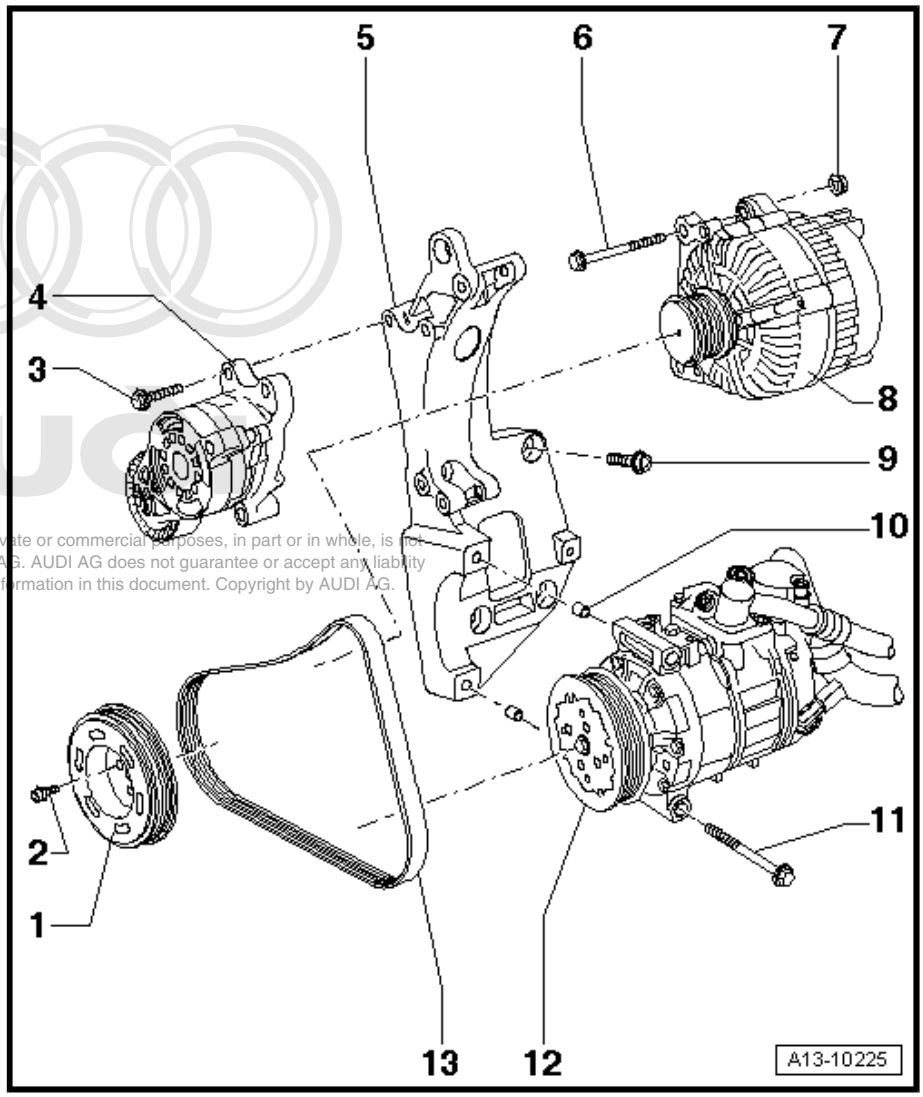
– Install coolant pipe (front right) ⇒ page 168 .

– Install air cleaner housing and air filter element ⇒ Rep. Gr. 24 .

13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Poly V-belt drive, bracket for ancillaries - exploded view



1 - Vibration damper
- ❑ With poly V-belt pulley
- ❑ Removing and installing ⇒ page 54
- ❑ Can only be installed in one position

2 - Bolt
- ❑ Renew
- ❑ 10 Nm + turn 90° further

3 - Bolt
- ❑ 23 Nm

4 - Poly V-belt tensioner
- ❑ Lock with locking pin - T10060 A-
- ❑ Removing and installing ⇒ page 52

5 - Bracket for ancillaries
- ❑ Removing and installing ⇒ page 53

6 - Bolt
- ❑ Tightening torque ⇒ Rep. Gr. 27

7 - Sliding bush

8 - Alternator
- ❑ Removing and installing ⇒ Rep. Gr. 27

9 - Bolt
- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ❑ Tightening torque and sequence ⇒ page 50

10 - Bush
- ❑ 2x

11 - Bolt
- ❑ Tightening torque ⇒ Rep. Gr. 87

12 - Air conditioner compressor
- ❑ Removing and installing ⇒ Rep. Gr. 87

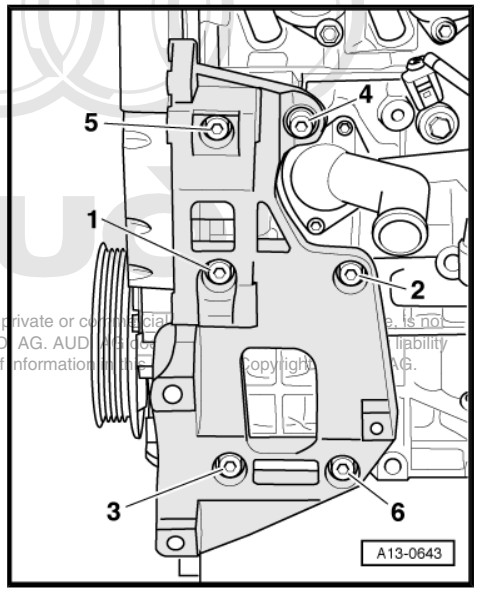
13 - Poly V-belt
- ❑ Check for wear
- ❑ Before removing, mark direction of rotation with chalk or felt-tipped pen
- ❑ Removing and installing ⇒ page 50

- ❑ Do not kink
- ❑ When installing, make sure it is properly seated on pulleys.

Bracket for ancillaries - tightening torque and tightening sequence

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

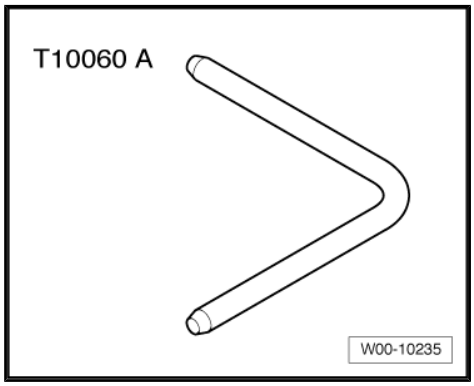
1. Screw in bolts by hand until they make contact.
2. Tighten to 40 Nm.



1.2 Removing and installing poly V-belt

Special tools and workshop equipment required

♦ Locking pin -T10060A-



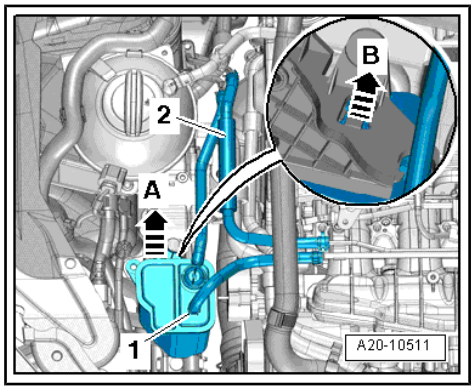
Removing

Proceed as follows:

– Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side.

Note

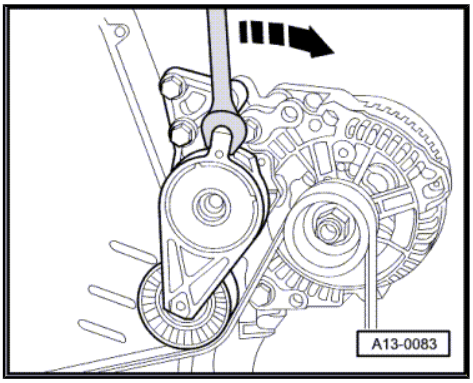
Disregard -items 1 and 2-.



Caution

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

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



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

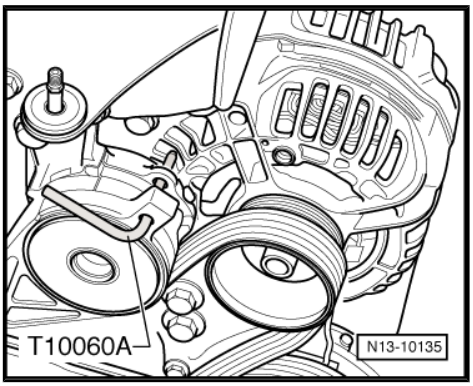
– Secure tensioner with locking pin -T10060 A-

– Take off poly V-belt.

Installing

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

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

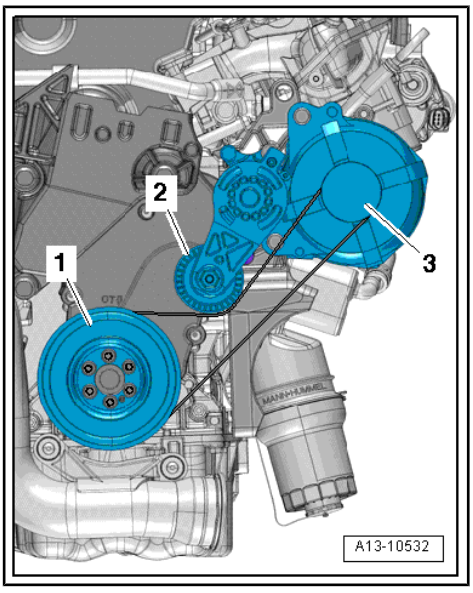


Vehicles not equipped with air conditioning:

1 - Crankshaft

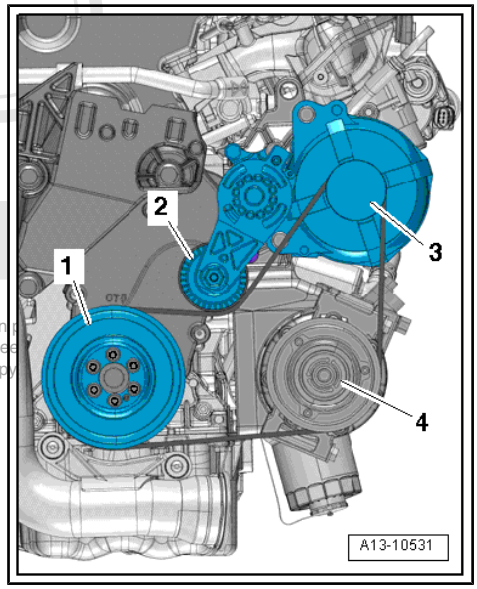
2 - Tensioner

3 - Alternator



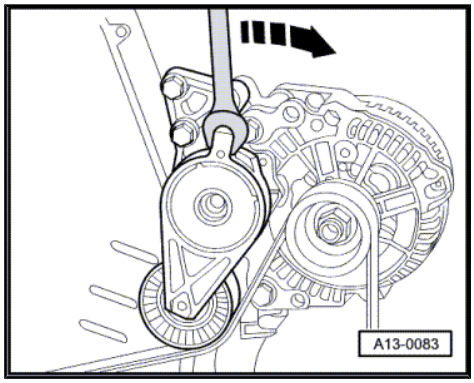
Vehicles with air conditioning:

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



All vehicles (continued):

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



1.3 Removing and installing tensioner for poly V-belt

Removing

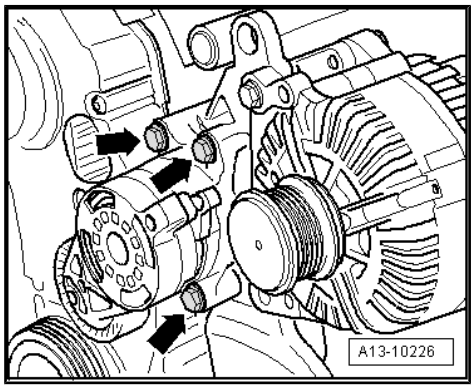
Proceed as follows:

– Remove poly V-belt ⇒ page 50 .

Note

The tensioner is not locked.

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



Installing

• Tightening torque ⇒ page 49

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

– Install poly V-belt ⇒ page 50 .

1.4 Removing and installing bracket for ancillaries

Removing

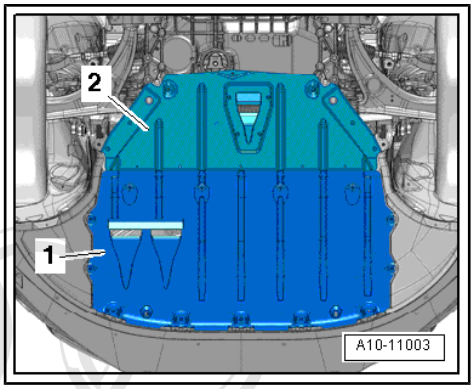
Proceed as follows:

– Remove poly V-belt tensioner ⇒ page 52 .

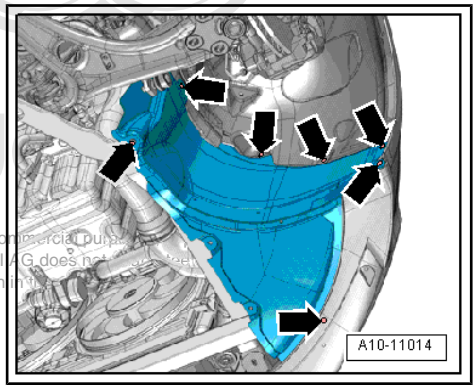
– Remove alternator ⇒ Rep. Gr. 27 .

– Remove front noise insulation -1- ⇒ Rep. Gr. 66 .

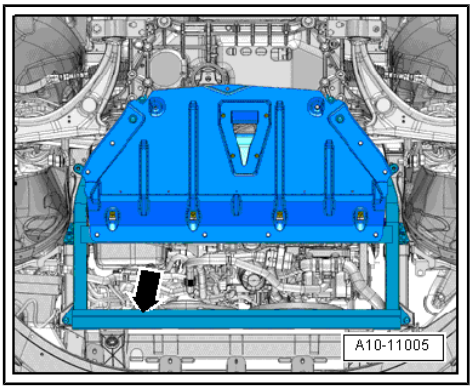
– Remove radiator cowl ⇒ page 173 .



– Remove noise insulation (right-side) -arrows-.

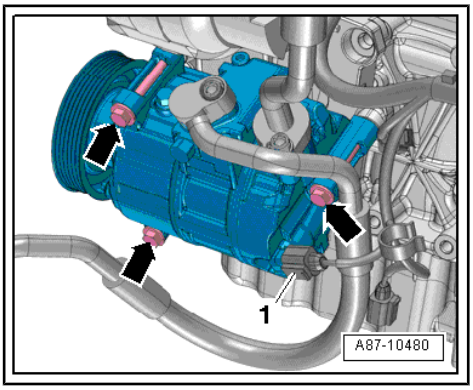


– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. Gr. 66 .



Vehicles with air conditioning:

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



Caution

Danger of damage to refrigerant lines and hoses.

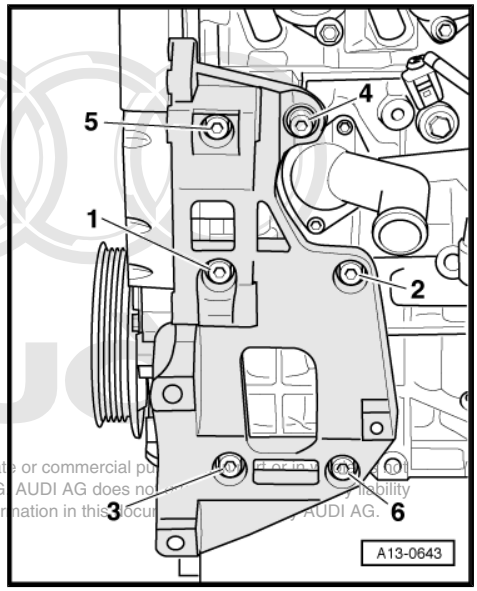
- *Do NOT stretch, kink or bend refrigerant lines and hoses.*

– Remove bolts -arrows-.

– Detach air conditioner compressor from bracket and tie up to lock carrier.

All vehicles (continued):

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



Installing

• Tightening torque ⇒ page 50

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

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

– Install radiator cowl ⇒ page 173 .

– Install noise insulation frame and noise insulation ⇒ Rep. Gr. 66 .

– Install alternator ⇒ Rep. Gr. 27 .

– Install poly V-belt tensioner ⇒ page 52 .

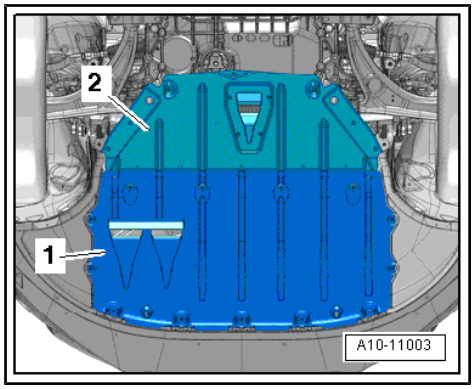
1.5 Removing and installing vibration damper

Removing

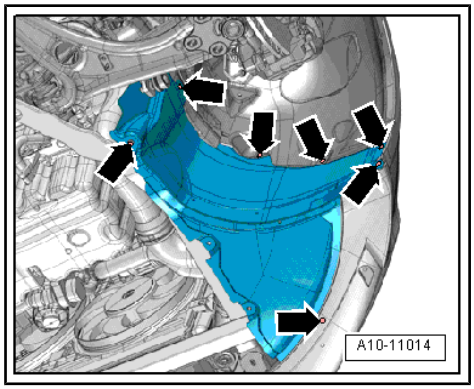
Proceed as follows:

– Remove poly V-belt ⇒ page 50 .

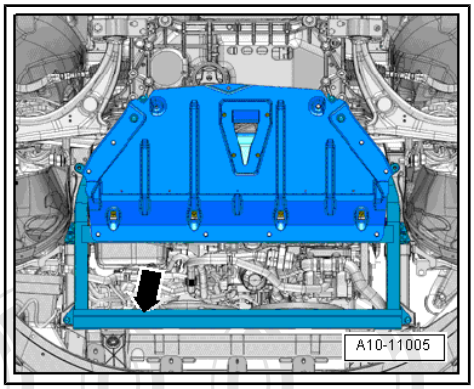
– Remove front noise insulation -1- ⇒ Rep. Gr. 66 .



– Remove noise insulation (right-side) -arrows-.



– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. Gr. 66 .



– Slacken bolts for vibration damper and remove (counterhold with ring spanner).

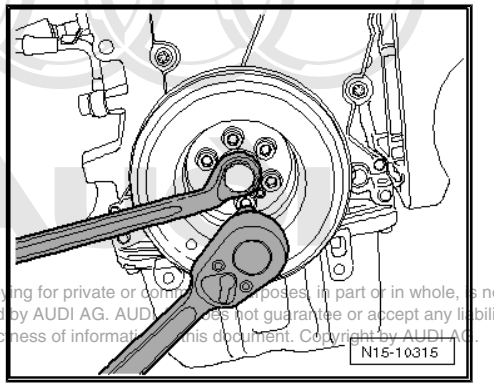
Installing

- Tightening torque ⇒ page 49

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

Note

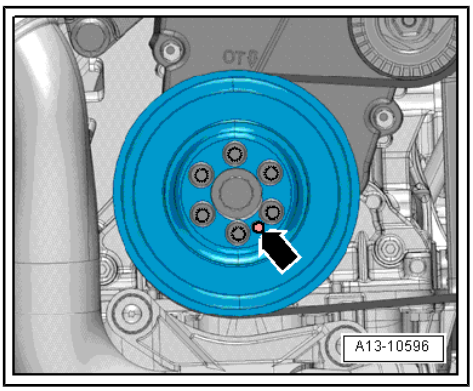
Renew bolts for vibration damper.



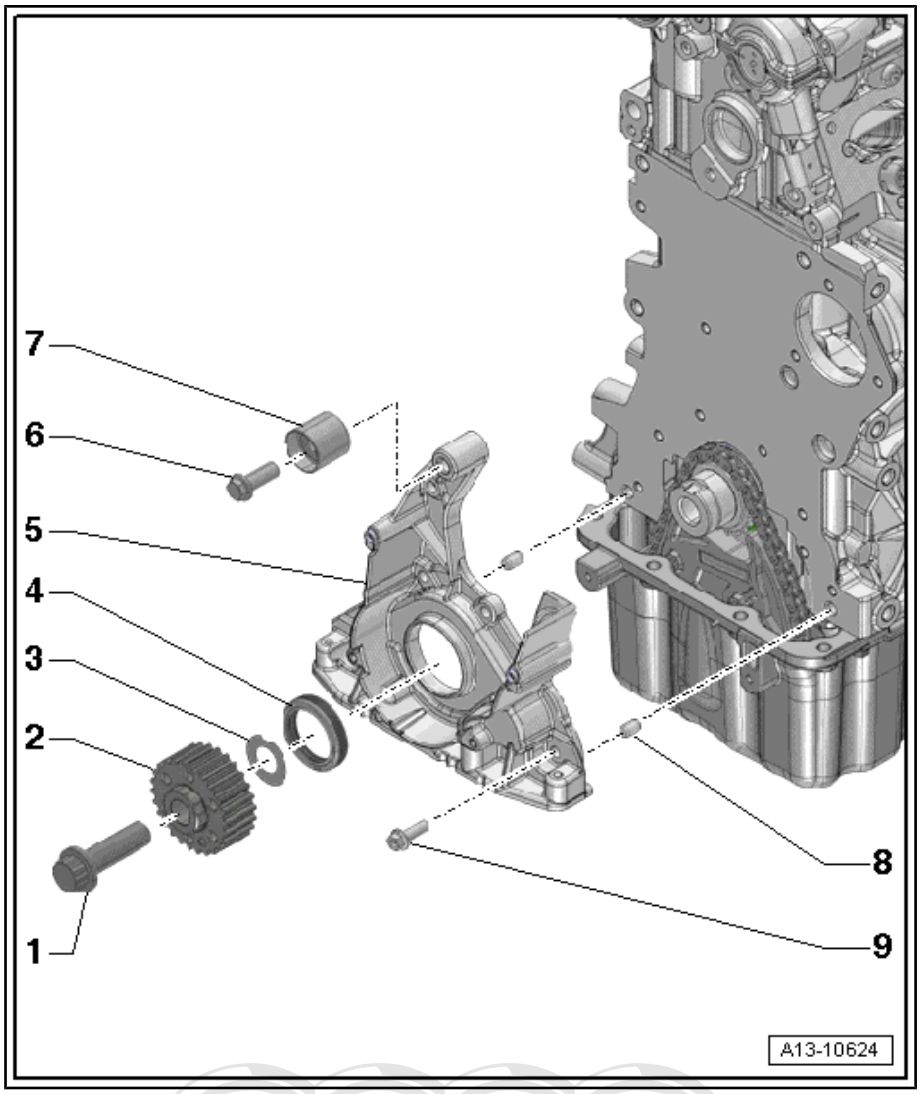
- The vibration damper can only be installed in one position. The hole -arrow- in the vibration damper must be located over the projection on the toothed belt sprocket.

– Install noise insulation frame and noise insulation ⇒ Rep. Gr. 66 .

– Install poly V-belt ⇒ page 54 .



1.6 Sealing flange (pulley end) - exploded view



1 - Bolt
- ❑ Tightening torque ⇒ Item 20 (page 82)

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

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

4 - Oil seal
- ❑ For crankshaft (pulley end)
- ❑ Renewing ⇒ page 57
- ❑ Do not lubricate with oil

5 - Sealing flange (pulley end)
- ❑ Should be positioned on dowel pins
- ❑ Removing and installing ⇒ page 59

6 - Bolt
- ❑ Tightening torque ⇒ Item 12 (page 81)

7 - Damper wheel
- ❑ For toothed belt

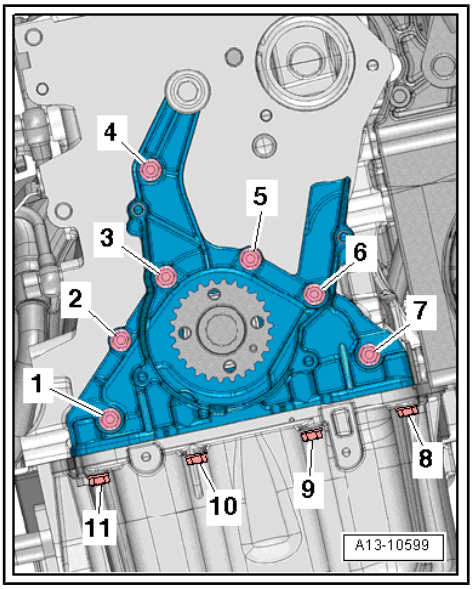
8 - Dowel pin
- ❑ 2x

9 - Bolt
- ❑ Tightening torque and sequence ⇒ page 57

Sealing flange (pulley end) - tightening torque and sequence

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

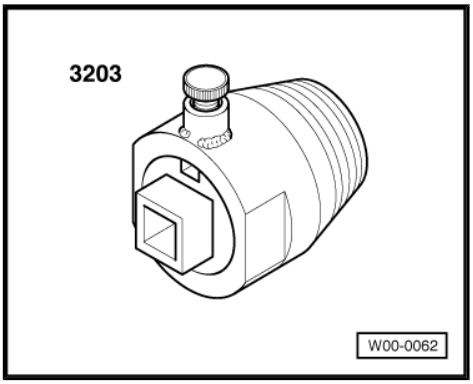
1. Hand-tighten bolts -1 ... 11- until they make contact.
2. Tighten bolts -1 ... 7- in diagonal sequence and in stages to 15 Nm.
3. Tighten bolts -8 ... 11- to 15 Nm.



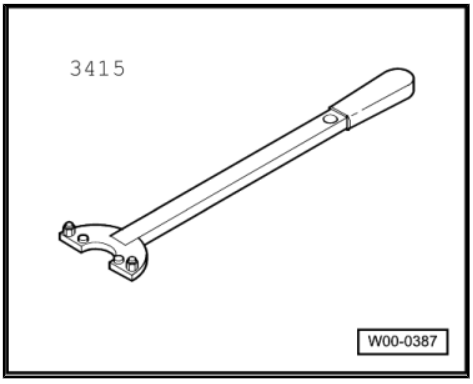
1.7 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

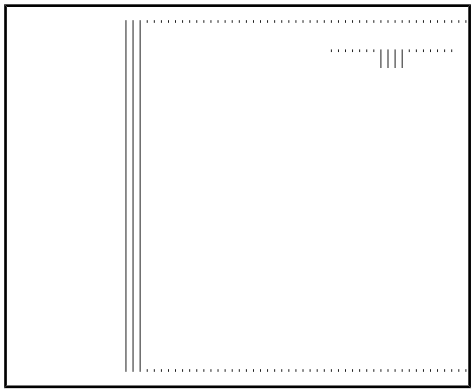
♦ Oil seal extractor -3203-



♦ Counterhold tool -3415-



♦ Assembly tool -T10053-

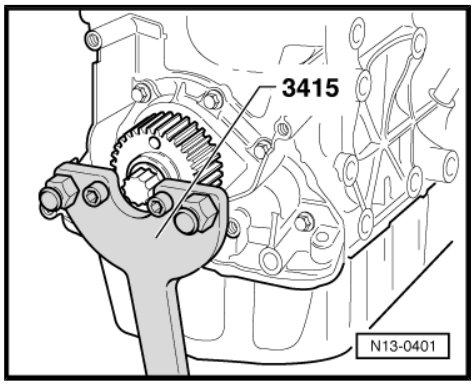


Procedure

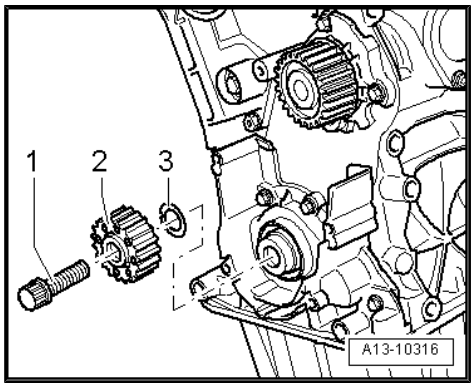
Proceed as follows:

– Remove toothed belt ⇒ page 82 .

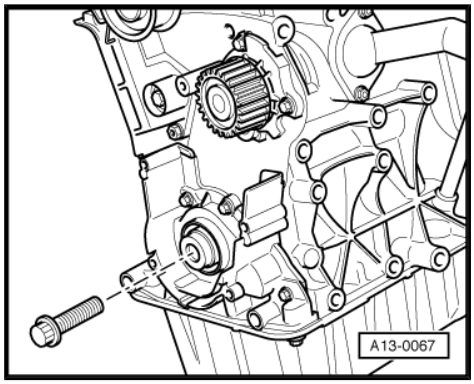
– Loosen bolt for crankshaft sprocket using counterhold tool -3415- .



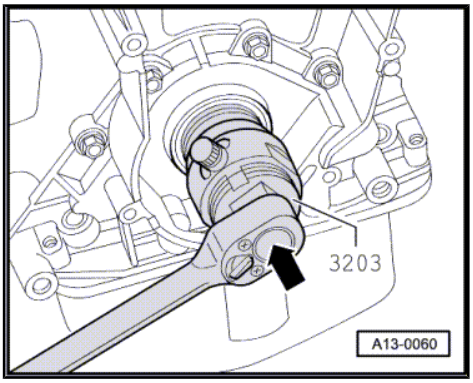
– Unscrew bolt -1- and detach crankshaft sprocket -2- and diamond-coated washer-3-



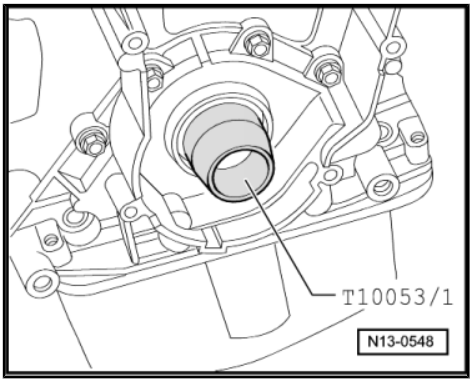
– To guide oil seal extractor, screw bolt for crankshaft sprocket into crankshaft onto stop by hand.



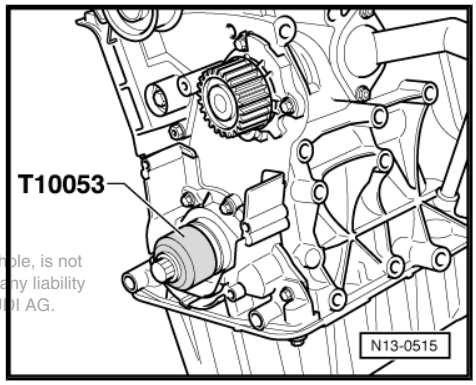
– Screw inner section of oil seal extractor -3203- nine turns (approx. 20 mm) out of outer section and lock with knurled screw.
– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
– Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
– Unscrew bolt for crankshaft sprocket.
– Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
– Clean contact surface and sealing surface for oil seal.
– Remove oil residue from crankshaft journal with a clean cloth.



– Fit guide sleeve -T10053/1- onto crankshaft journal.
– Push oil seal over guide sleeve onto crankshaft journal.



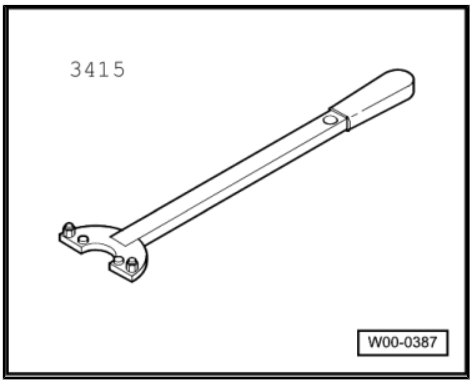
– Press in oil seal using bolt for crankshaft sprocket and thrust sleeve of assembly tool -T10053- until flush.
– Install crankshaft sprocket ⇒ page 82 .
– Install toothed belt (adjust valve timing) ⇒ page 87 .



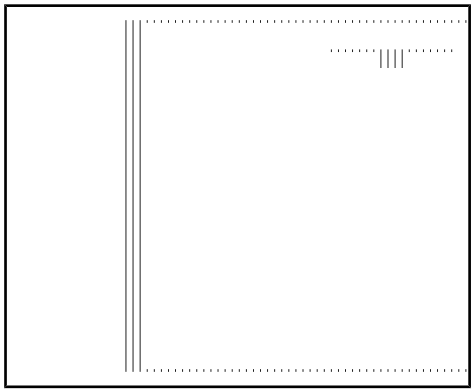
1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

♦ Counterhold tool -3415-



- Assembly tool -T10053-



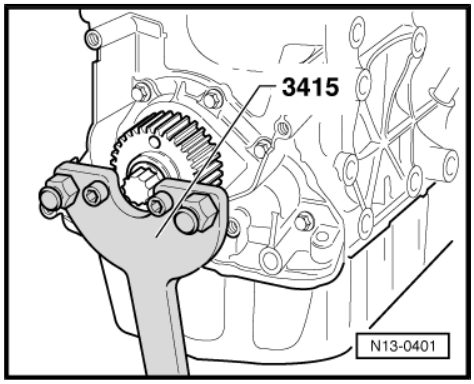
- Electric drill with plastic brush
- Safety goggles
- Sealant ⇒ Electronic parts catalogue

Removing

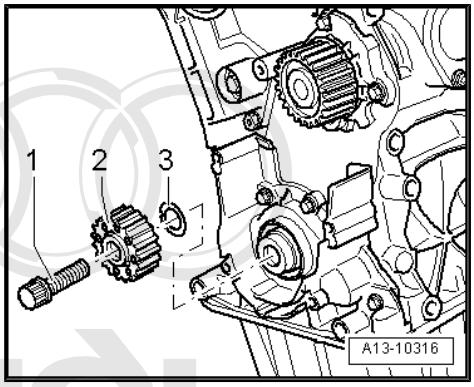
Proceed as follows:

– Remove toothed belt ⇒ page 82 .

– Loosen bolt for crankshaft sprocket using counterhold tool -3415- .



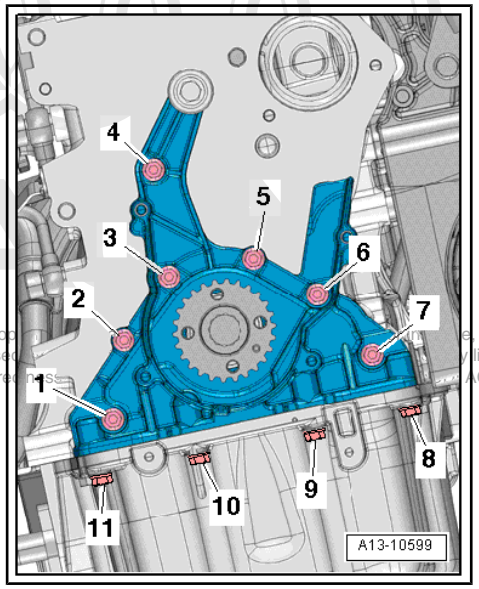
– Unscrew bolt -1- and detach crankshaft sprocket -2- and diamond-coated washer-3-



– Remove bolts -1 ... 11-.

– Carefully lever off sealing flange.

– If necessary, unscrew damper wheel from sealing flange ⇒ page 81 .



Installing

• Tightening torque ⇒ page 57

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

Caution

Make sure sealant residue does not enter lubrication system.

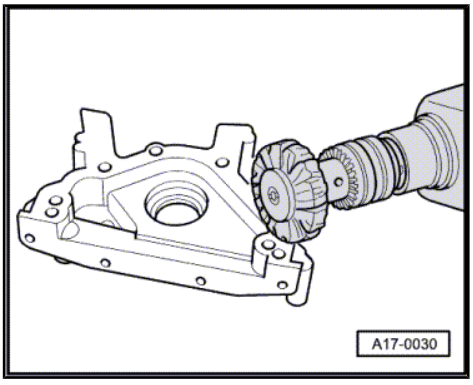
- ***Place a clean cloth over the exposed section of the sump.***

– Carefully remove sealant residue on cylinder block and sump.

WARNING

Protect eyes against injuries.

- ***Wear safety goggles.***



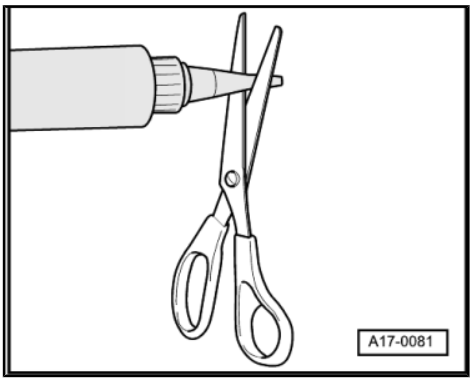
– Use e.g. rotating plastic brush to remove sealant residue on sealing flange.

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

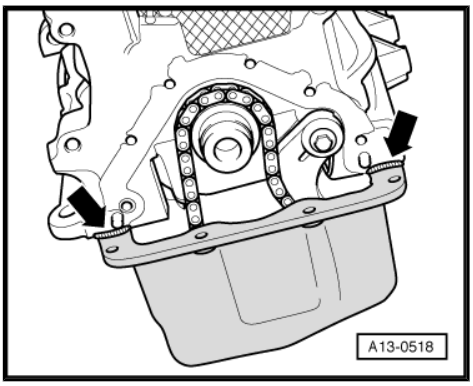
Note

Note the use-by date of the sealant.

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



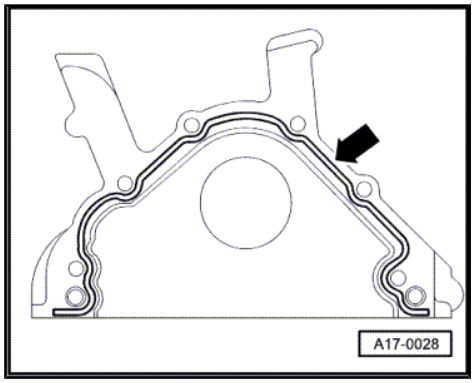
– Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



Caution

Make sure lubrication system is not clogged by excess sealant.

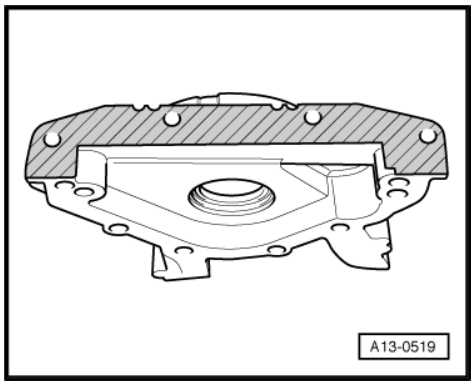
- ***The bead of sealant must not be thicker than specified.***



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

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

– Apply a thin coat of sealant to bottom sealing surface -shaded- on sealing flange.



Note

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

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

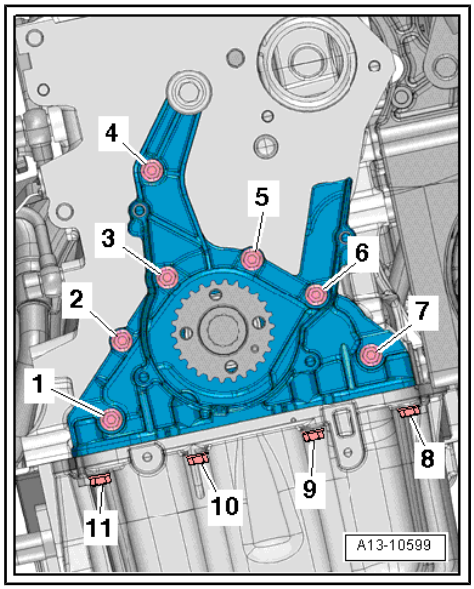
Note

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

– Tighten sealing flange ⇒ page 57 .

– Install crankshaft sprocket ⇒ page 82 .

– Install toothed belt (adjust valve timing) ⇒ page 87 .



2 Cylinder block (gearbox end)

Note

- *When performing assembly work, secure engine to engine and gearbox support ⇒ page 34 .*
- *Servicing clutch ⇒ Rep. Gr. 30*

2.1 Dual-mass flywheel and sealing flange (gearbox end) - exploded view

1 - Bolt
- ❑ Renew
- ❑ 60 Nm + turn 90° further

2 - Dual-mass flywheel
- ❑ Removing and installing ⇒ page 64
- ❑ Can only be installed in one position (holes are off-set)

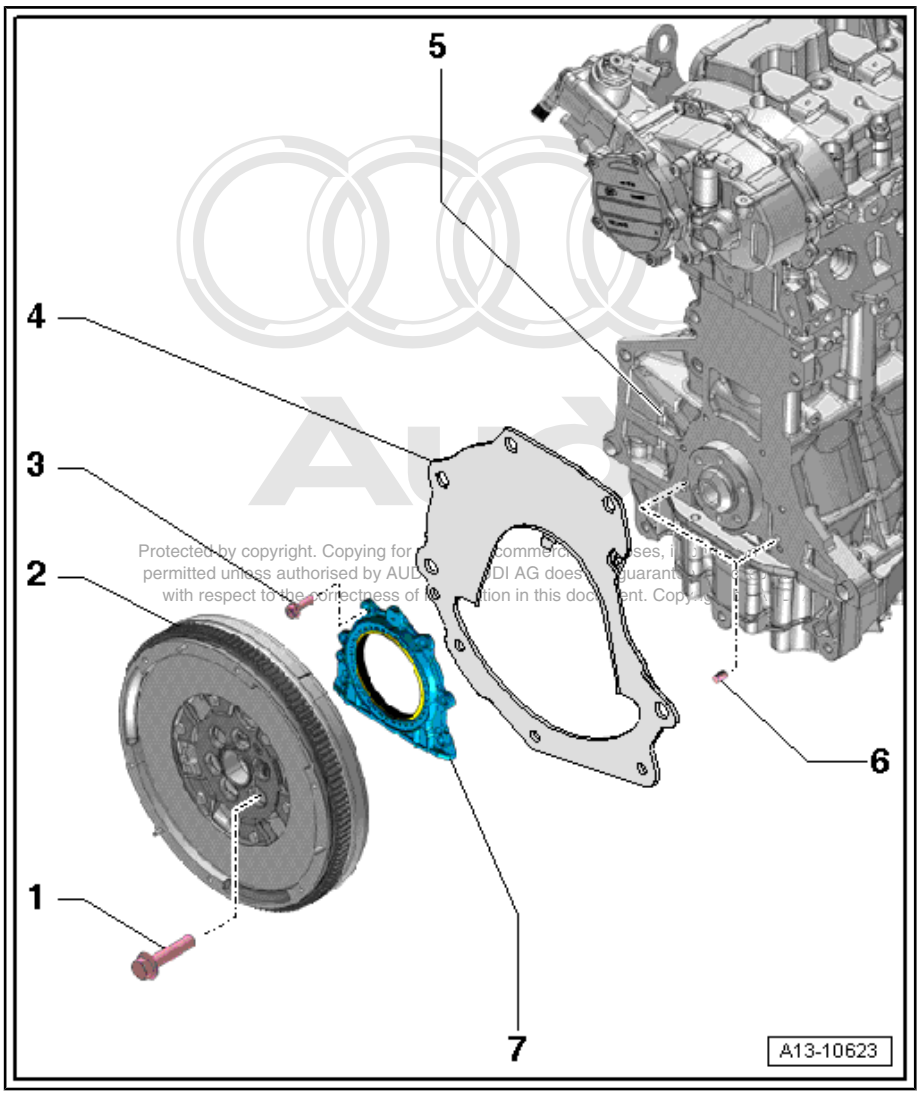
3 - Bolt
- ❑ Tightening torque and sequence ⇒ page 64

4 - Intermediate plate
- ❑ Should be positioned on dowel pins
- ❑ Do not damage or bend
- ❑ Is fitted onto sealing flange ⇒ page 64

5 - Cylinder block

6 - Dowel pin

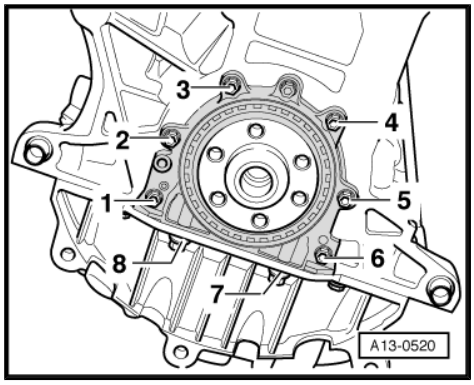
7 - Sealing flange (gearbox end)
- ❑ With oil seal
- ❑ Renew only as complete unit ⇒ page 65
- ❑ Do not lubricate/grease sealing lip of oil seal
- ❑ Use guide sleeve supplied when fitting
- ❑ Do not remove guide sleeve until sealing flange has been slipped onto crankshaft journal



Sealing flange (gearbox end) - tightening torque and sequence

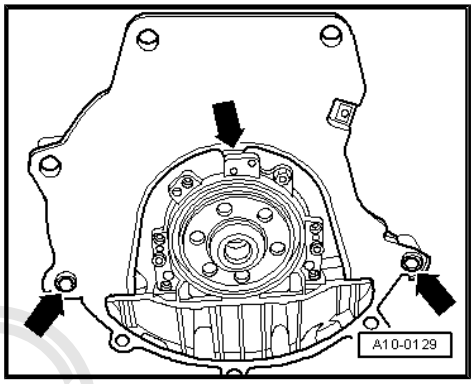
– Tighten sealing flange bolts (gearbox end) in three stages as follows:

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



Installing intermediate plate

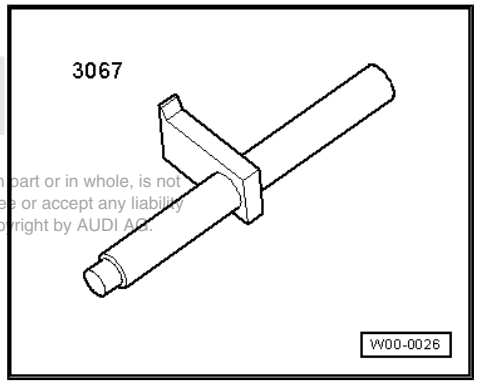
– Engage intermediate plate in sealing flange and slide onto dowel pins -arrows-.



2.2 Removing and installing dual-mass flywheel

Special tools and workshop equipment required

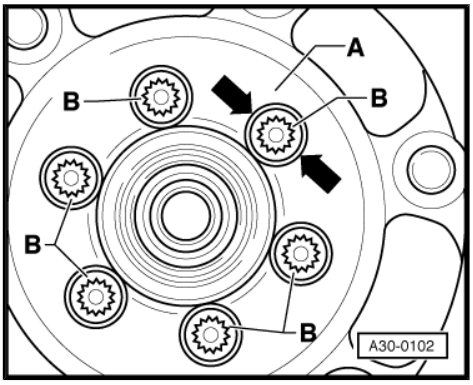
♦ Counterhold tool -3067-



Removing

Proceed as follows:

- Gearbox removed.



Caution

Make sure dual-mass flywheel is not damaged.

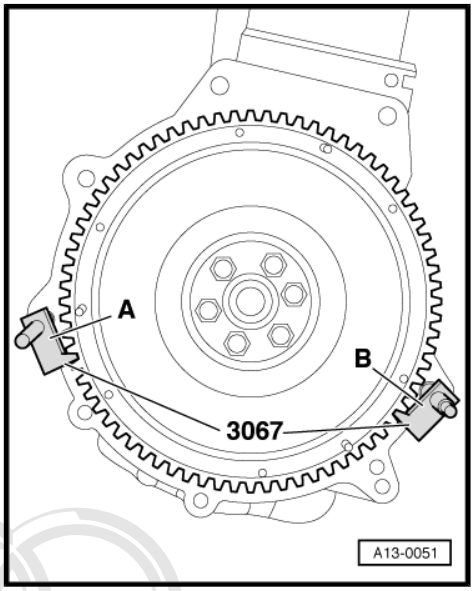
- *Remove bolts -B- using normal hand tools (do not use pneumatic wrench or impact driver, etc.).*
- *When removing the bolts, make sure that the bolt heads do not come into contact with the dual-mass flywheel.*
- *Rotate the dual-mass flywheel -A- so that the bolts -B- align centrally with the holes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

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

Installing

- Tightening torque ⇒ page 63

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



Note

Renew bolts for dual-mass flywheel.

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

2.3 Renewing sealing flange (gearbox end)

Special tools and workshop equipment required

- Sealant ⇒ Parts catalogue

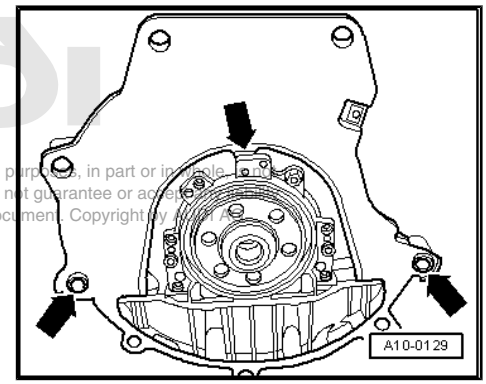
Procedure

Proceed as follows:

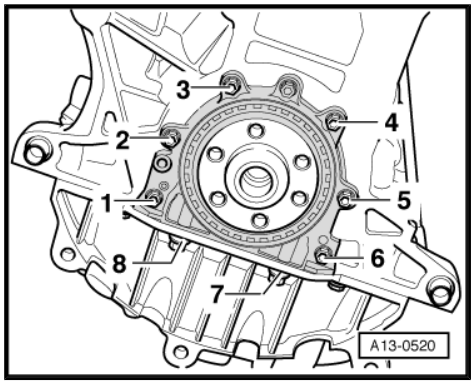
- Gearbox removed.
- Tightening torque ⇒ page 64

– Remove dual-mass flywheel ⇒ page 64.

– Detach intermediate plate from sealing flange and dowel pins -arrows-.



– Unscrew bolts -1 ... 8- and remove sealing flange.



Caution

Make sure sealant residue does not enter lubrication system.

- ***Cover exposed section of oil sump.***

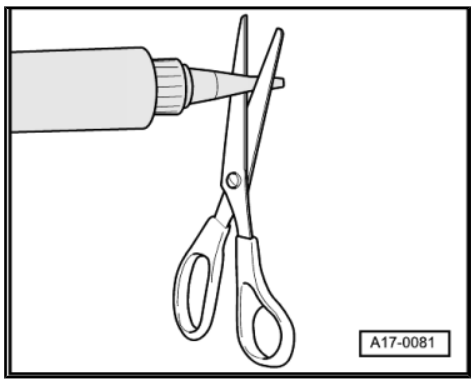
– Carefully remove sealant residue on cylinder block and sump.

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

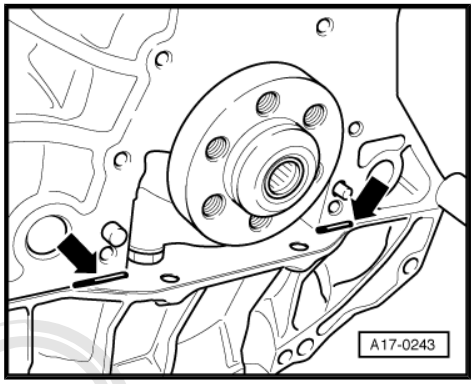
Note

Note the use-by date of the sealant.

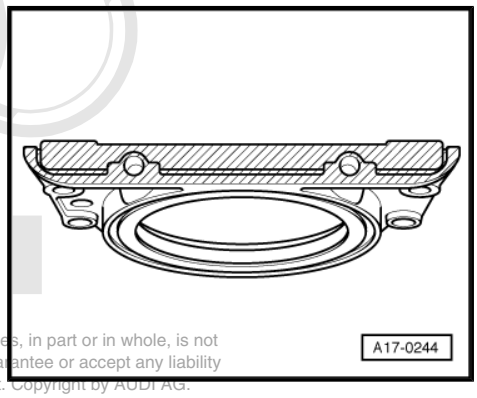
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 3 mm).



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



– Apply a thin coat of sealant to bottom sealing surface -shaded- on sealing flange.



Caution

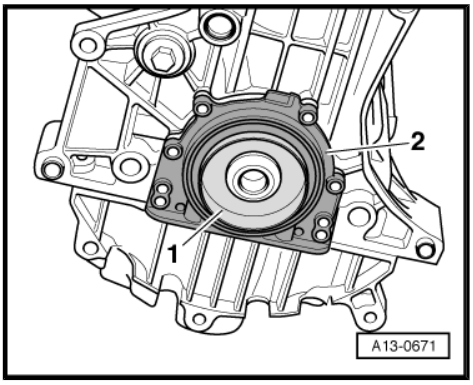
Make sure lubrication system is not clogged by excess sealant.

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

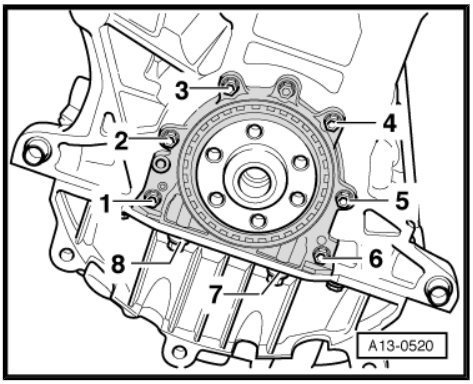
Note

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

– Push sealing flange -2- together with guide sleeve -1- (fitted on replacement part) onto crankshaft.
– Then carefully fit sealing flange onto dowel pins in cylinder block.

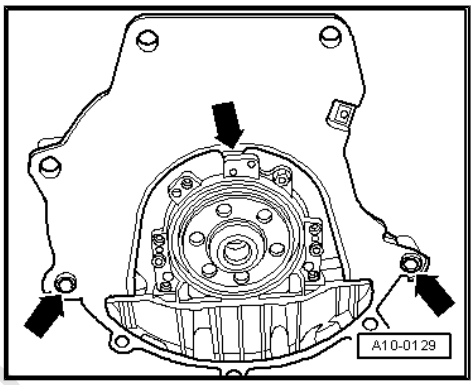


– Tighten sealing flange ⇒ page 64 .



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

– Install intermediate plate ⇒ page 64 .
– Install dual-mass flywheel ⇒ page 64 .

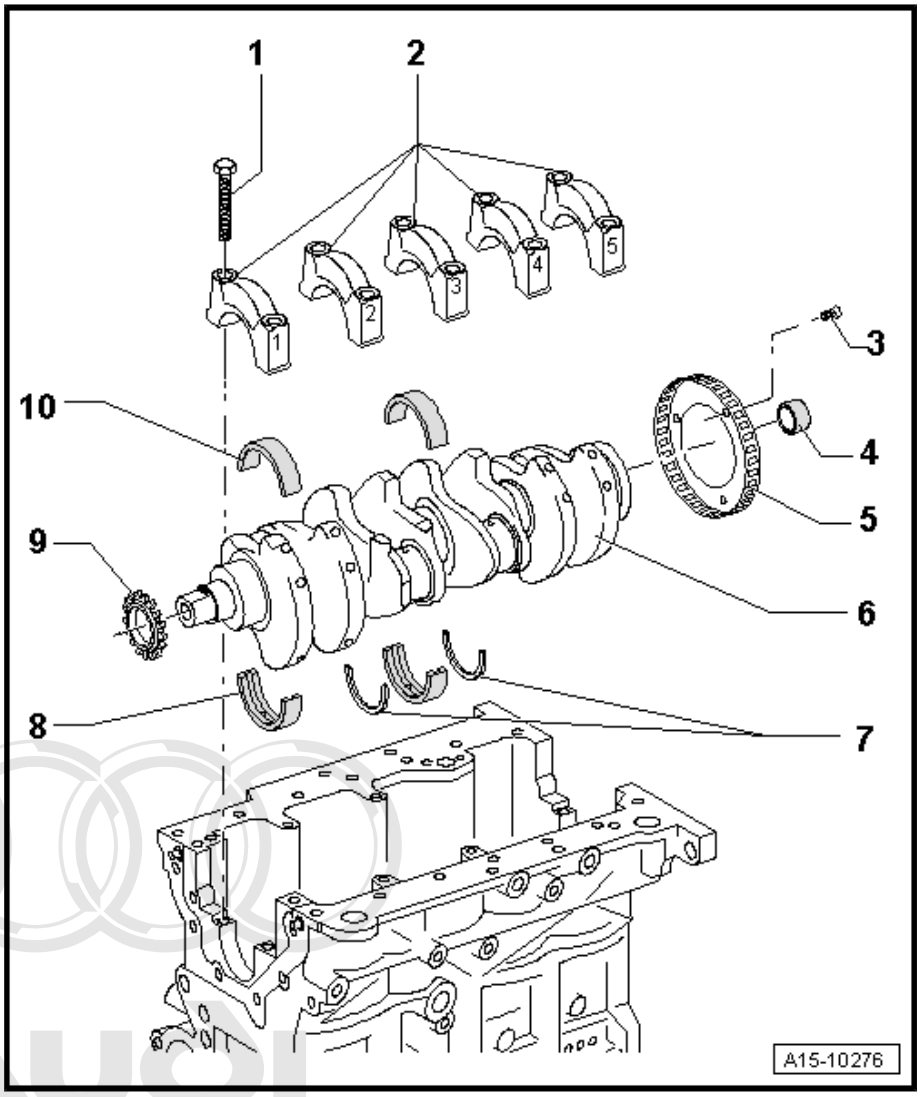


3 Crankshaft

Note

- *When performing assembly work, secure engine to engine and gearbox support ⇒ page 34 .*
- *If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil galleries carefully and renew the oil spray jets, oil cooler and oil filter.*

3.1 Crankshaft - exploded view



1 - Bolt
- ❑ Renew
- ❑ 65 Nm + turn 90° further

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

3 - Bolt
- ❑ Renew
- ❑ Sender wheel must be renewed if bolts are loosened ⇒ page 69
- ❑ 10 Nm + turn 90° further

4 - Needle bearing
- ❑ Only on vehicles with S tronic gearbox
- ❑ Extracting and driving in ⇒ page 72

5 - Sender wheel
- ❑ For engine speed sender -G28-
- ❑ Sender wheel must be renewed if bolts are loosened
- ❑ Removing and installing ⇒ page 69
- ❑ Can only be installed in one position (holes are off-set)

6 - Crankshaft
- ❑ Do not place on sender wheel -item 5- after removing
- ❑ Measuring axial clearance ⇒ page 70
- ❑ Measuring radial clearance ⇒ page 71
- ❑ Crankshaft dimensions ⇒ page 70

7 - Thrust washers

- ❑ For bearing No. 3

8 - Bearing shell

- ❑ For cylinder block (with oil groove)
- ❑ Mark used bearing shells for re-installation but not on bearing surface
- ❑ Bearing shells worn down to nickel layer must be renewed
- ❑ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ page 70

9 - Drive chain sprocket

- ❑ For drive chain for oil pump
- ❑ Removing and installing ⇒ page 73

10 - Bearing shell

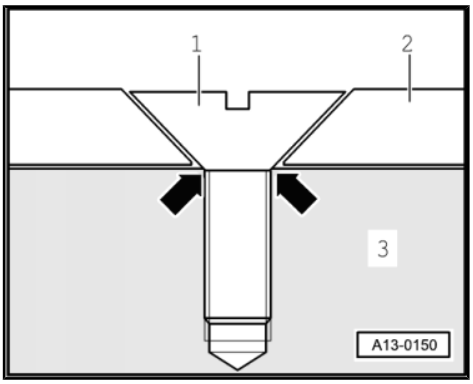
- ❑ For bearing cap (without oil groove)
- ❑ Mark used bearing shells for re-installation but not on bearing surface
- ❑ Bearing shells worn down to nickel layer must be renewed
- ❑ Installing new bearing shells for bearing cap with correct colour-coding ⇒ page 70

Removing and installing sender wheel

Caution

Safety risk from loose sender wheel.

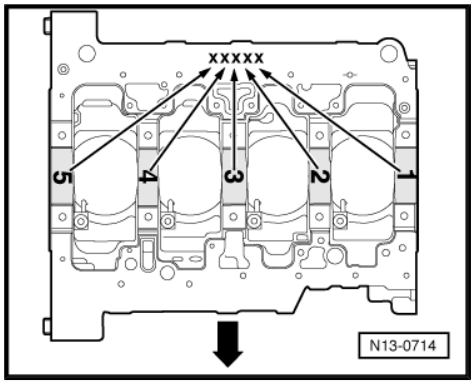
- ◆ ***Sender wheel -2- must always be renewed after slackening off bolts -1-.***
- ◆ ***If the countersunk bolts are tightened a second time, the seats for the bolt heads in the sender wheel will be deformed to such an extent that the bolt heads make contact with the crankshaft -3- -arrows- and the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



Note

Sender wheel can only be installed in one position (holes are offset).

Allocation of crankshaft bearing shells (top) for cylinder block



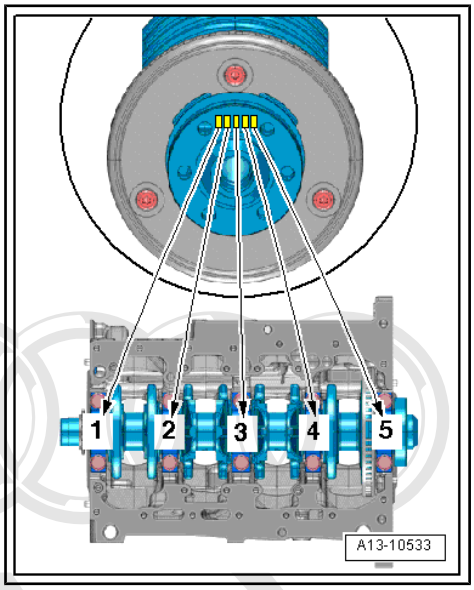
- Bearing shells of the correct thickness are matched to the bearings (top) in the cylinder block at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- Letter codes on the lower sealing surface of the cylinder block indicate the thickness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

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

Note

The -arrow- points in direction of travel.

Allocation of crankshaft bearing shells for bearing cap



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

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

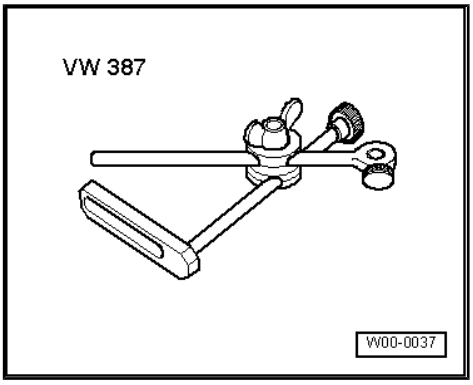
3.2 Crankshaft dimensions

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

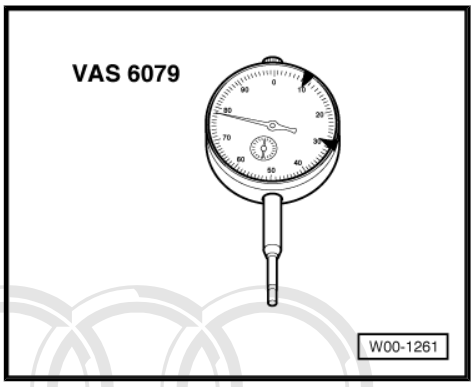
3.3 Measuring axial clearance of crankshaft

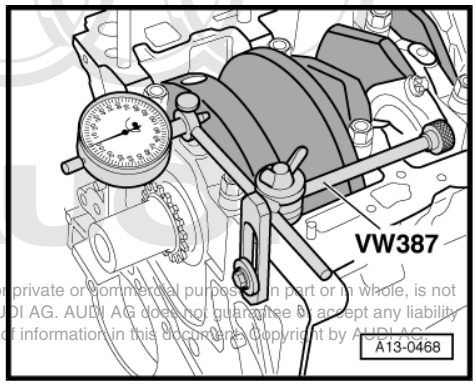
Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-





Procedure

Proceed as follows:

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

Axial clearance:

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

3.4 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

♦ Plastigage

Procedure

Proceed as follows:

Note

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

– Remove bearing cap.
– Clean bearing cap and bearing journal.

– Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shell.

• The Plastigage must be positioned in the centre of the bearing shell.

– Fit bearing cap and tighten bolts to 30 Nm without rotating crankshaft.

– Remove bearing cap again.

– Compare width of Plastigage with measurement scale.

Radial clearance:

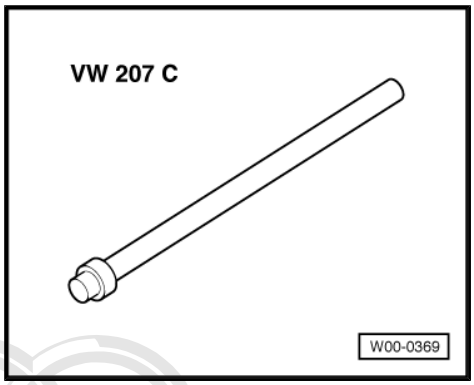
• New: 0.017 ... 0.037 mm.

• Wear limit: 0.10 mm.

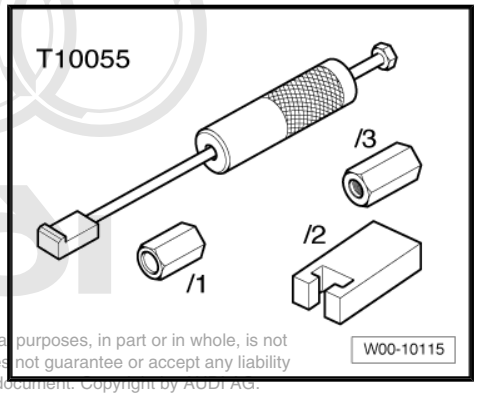
3.5 Extracting and driving in needle bearing for crankshaft

Special tools and workshop equipment required

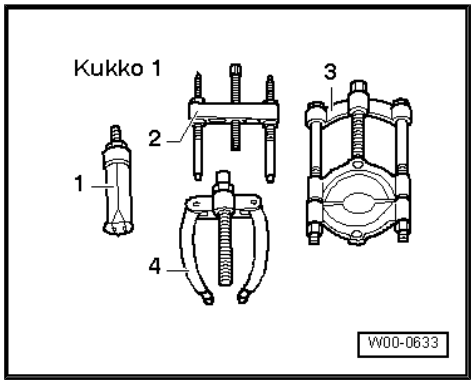
♦ Drift -VW 207 C-



♦ Puller -T10055- with adapter -T10055/3-



♦ -1- internal puller Kukko 21/2

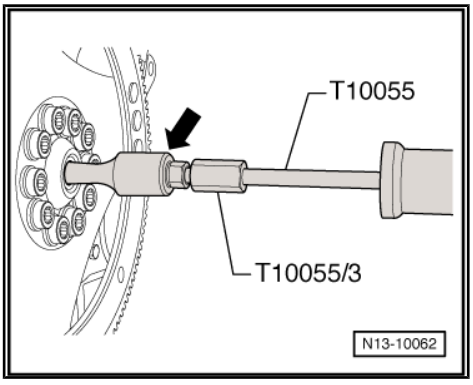


Procedure

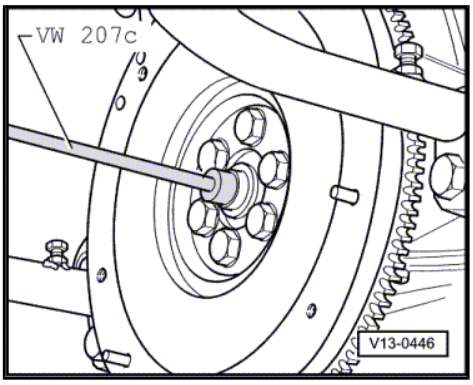
Proceed as follows:

- Gearbox removed.

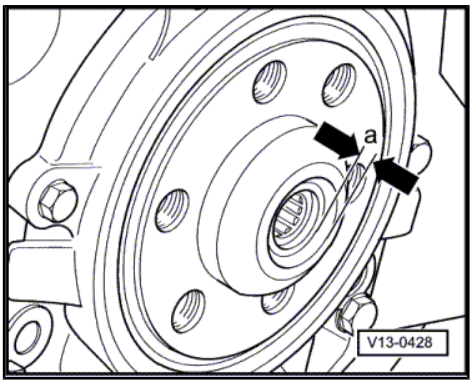
– Use internal puller Kukko 21/2 -arrow-, adapter -T10055/3- and puller -T10055- to pull out needle bearing.



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



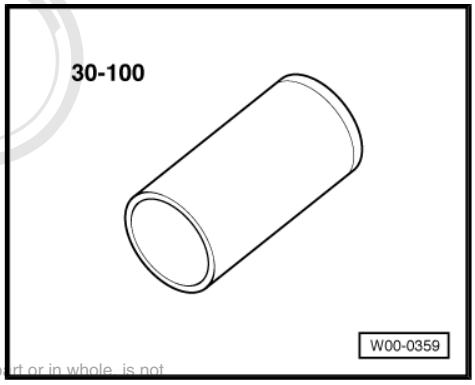
- Insertion depth: dimension -a- = 2 mm.



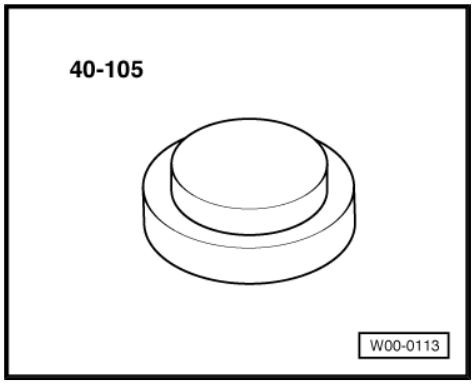
3.6 Removing and installing drive chain sprocket

Special tools and workshop equipment required

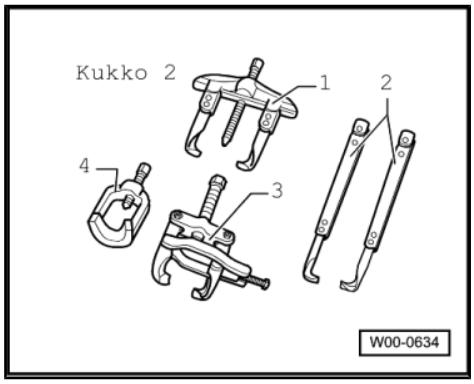
♦ Drift sleeve -30 - 100-



♦ Thrust plate -40 - 105-



♦ -1- Two-arm puller Kukko 44/1



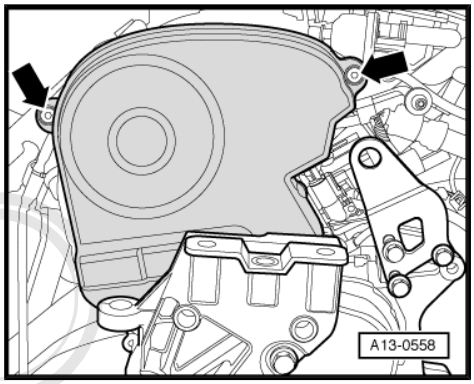
♦ Protective gloves

Removing

Proceed as follows:

– Remove sump ⇒ page 131 .

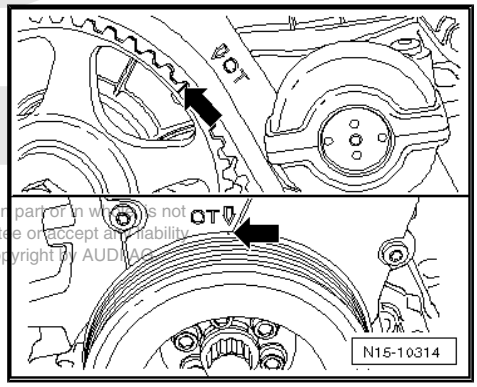
– Unscrew bolts -arrows- and remove toothed belt cover (top section).



Caution

Irreparable damage can be caused if the toothed belt slips.

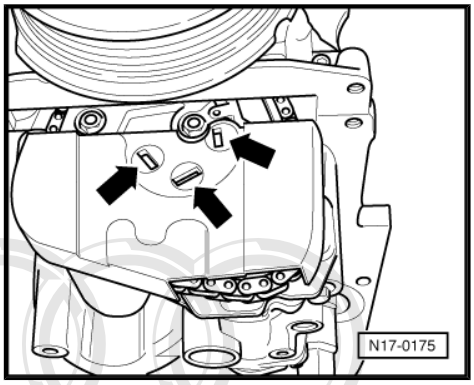
♦ ***Turn crankshaft only in direction of engine rotation.***



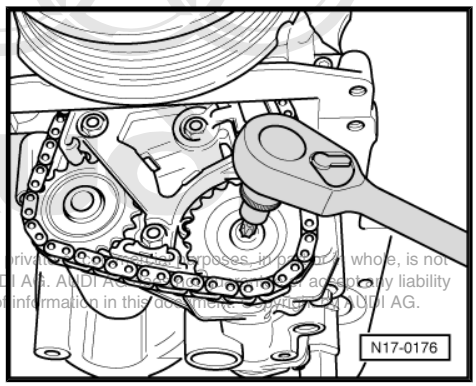
– Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at “TDC”.

- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.

– Pull off chain guard; if necessary, retaining tabs can be released with a small screwdriver (insert in openings -arrows-).

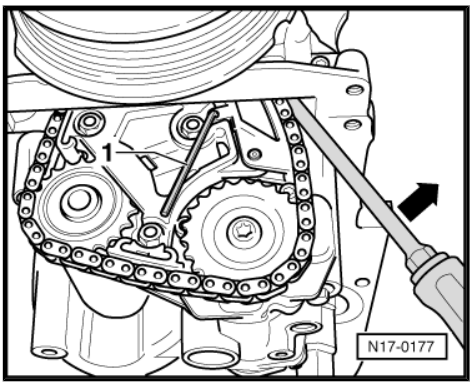


– Counterhold crankshaft at bolt for toothed belt sprocket and slacken bolt for chain sprocket for oil pump.



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

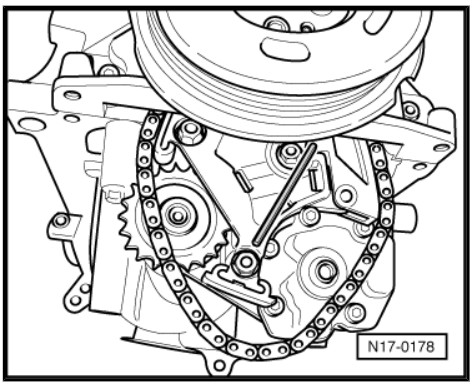
– Remove sealing flange (pulley end) ⇒ page 59 .



Caution

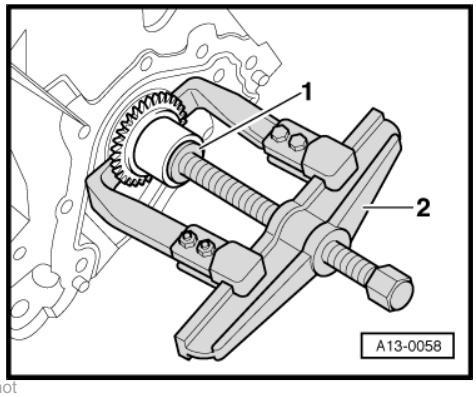
If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.

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



– Detach chain sprocket with drive chain for oil pump.

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



Installing

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

WARNING

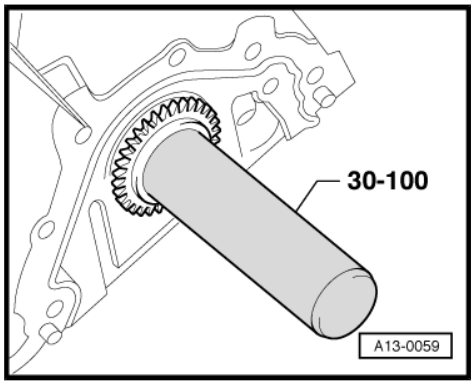
Risk of burn injuries.

- ***Wear protective gloves.***

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

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

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



– Fit drive chain according to marking for direction of rotation (made during removal).

– Install sealing flange (pulley end) ⇒ page 59 .

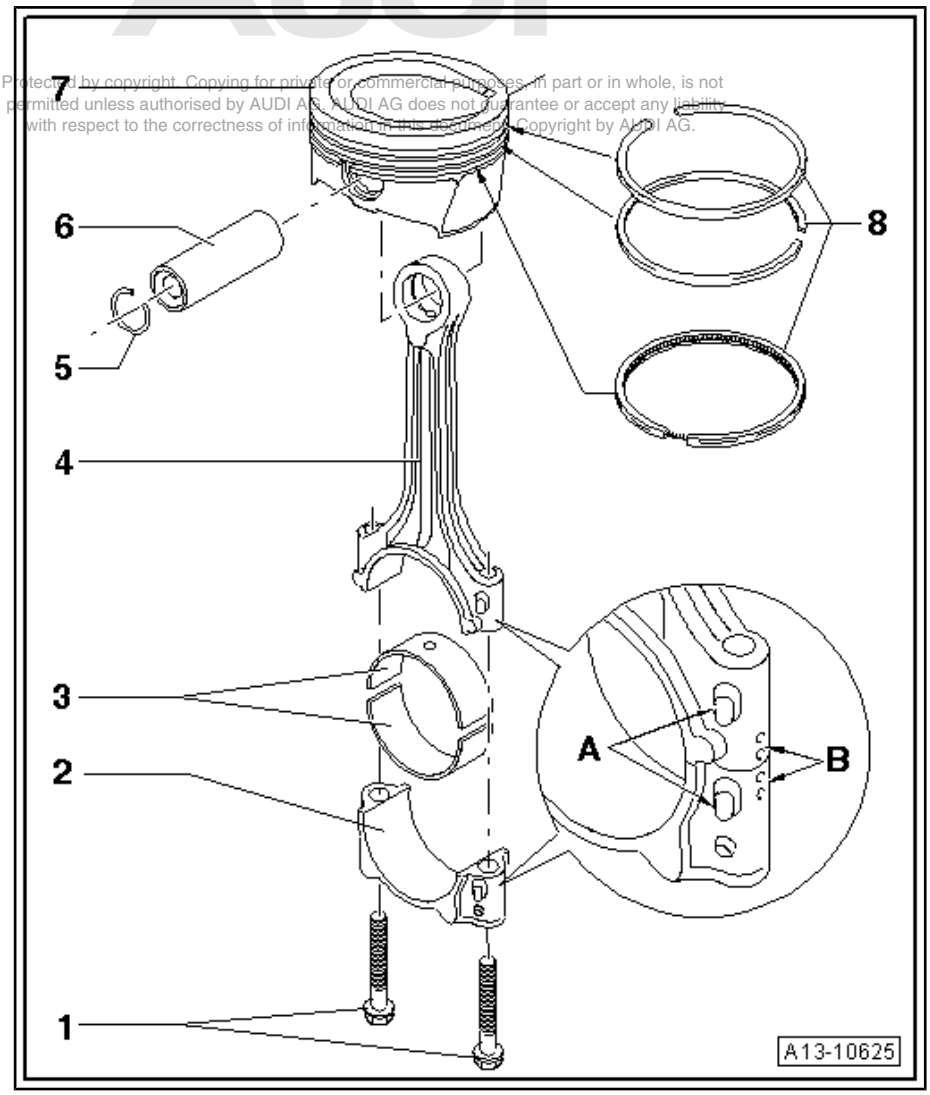
– Install balance shaft assembly with oil pump ⇒ page 136 .

4 Pistons and conrods

Note

- *All bearing and running surfaces must be oiled before assembling.*
- *Oil spray jet and pressure relief valve ⇒ page 79*

4.1 Pistons and conrods - exploded view



1 - Bolts

- When measuring radial clearance, tighten used bolt to 45 Nm but not further
- Renew
- Lubricate threads and contact surface
- 45 Nm + turn 90° further

2 - Conrod bearing cap

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

3 - Bearing shells

- Upper bearing shell with oil hole for piston pin lubrication
- Installation position ⇒ page 79
- Mark used bearing shells for re-installation but not on bearing surface
- Bearing shells worn down to nickel layer must be renewed

4 - Conrod

- With oil drilling for piston pin lubrication
- Only renew as a complete set
- Mark cylinder allocation in colour -B-
- Installation position: Markings -A- face towards pulley end
- Measuring axial clearance ⇒ page 79
- Measuring radial clearance ⇒ page 80

5 - Circlip

- Renew

6 - Piston pin

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

7 - Piston

- ❑ Checking ⇒ page 78
- ❑ Mark installation position to conrod and cylinder allocation
- ❑ Installation position: arrow on piston crown points to pulley end
- ❑ Install using piston ring clamp
- ❑ Checking cylinder bore ⇒ page 79
- ❑ Piston and cylinder dimensions ⇒ page 79

8 - Piston rings

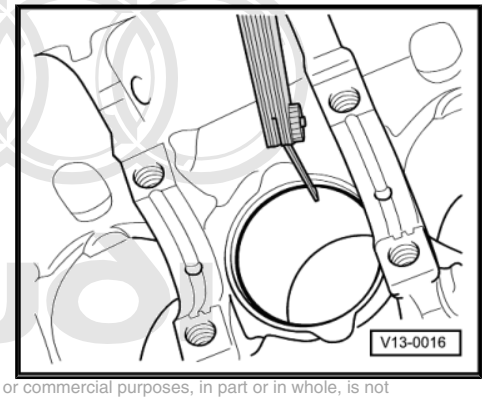
- ❑ Offset gaps by 120°
- ❑ Use piston ring pliers to remove and install
- ❑ Inscription “TOP” faces towards piston crown
- ❑ Checking ring gap ⇒ page 78
- ❑ Checking ring-to-groove clearance ⇒ page 78

Checking piston ring gap

– Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder.

– To do so, use a piston without rings.

– Check gap using feeler gauge.

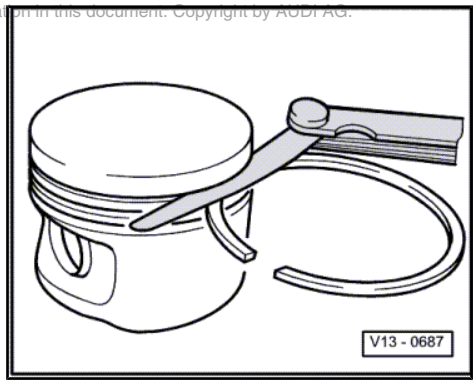


Piston ring Dimensions in mm	New	Wear limit
Compression ring	0.20 … 0.40	0.8
Oil scraper ring	0.25 … 0.55	0.8

Checking ring-to-groove clearance

– Clean annular groove of piston.

– Check gap using feeler gauge.



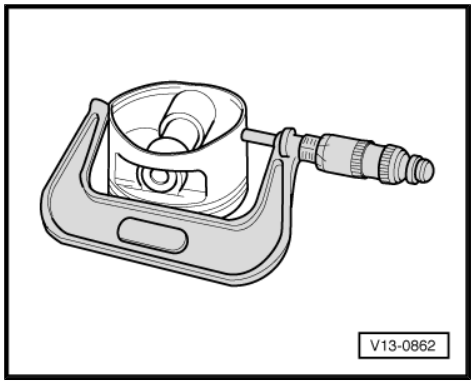
Piston ring Dimensions in mm	New	Wear limit
Compression ring	0.035 … 0.075	0.015
Oil scraper ring	0.03 … 0.06	0.15

Checking piston

– Using a micrometer (75 ... 100 mm), measure approx. 10 mm from the lower edge, perpendicular to the piston pin axis.

• Maximum deviation from nominal dimension: 0.04 mm.

Nominal dimension
⇒ “4.2 Piston and cylinder dimensions”, page 79 .

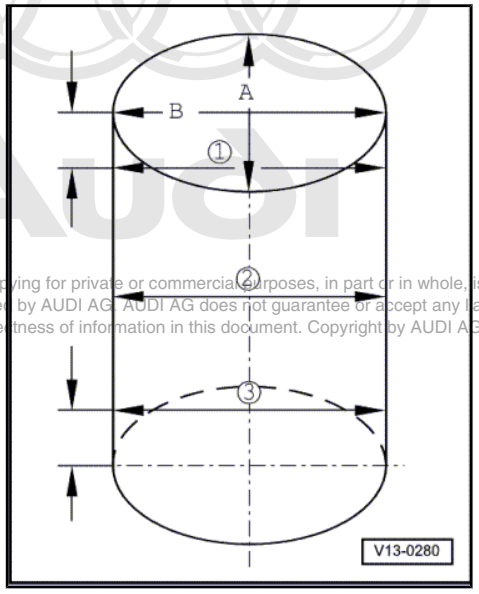


Checking cylinder bore

– Use an internal dial gauge -VAS 6078- to take measurements at 3 points in transverse direction -A- and in longitudinal direction -B-.

• Maximum deviation from nominal dimension: 0.08 mm.

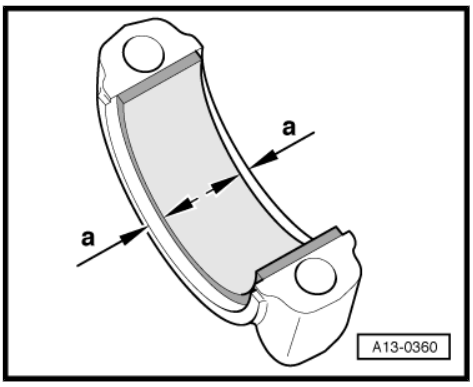
Nominal dimension
⇒ “4.2 Piston and cylinder dimensions”, page 79 .



Installation position of bearing shells in conrods

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

• Distance -a- = approx. 1.5 mm.



Oil spray jet and pressure relief valve

1 - Bolt with pressure relief valve, 27 Nm

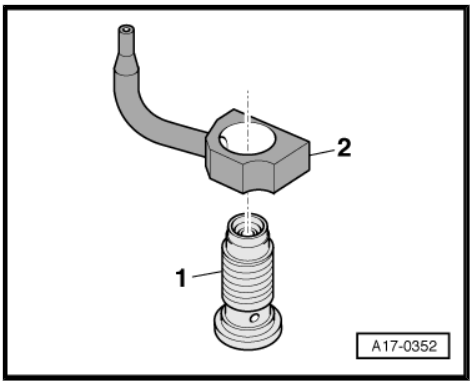
2 - Oil spray jet (for cooling of pistons)

• Installation position: align locating edge of oil spray jet with machined surface of cylinder block.

Note

♦ *Take care not to bend oil spray jets.*

♦ *Always renew bent oil spray jets.*



4.2 Piston and cylinder dimensions

Honing dimension (in mm)	Diameter of piston	Diameter of cylinder bore
Basic dimension	82.465 [1)]	82.510

• [1)] Dimension not including coating (thickness 0.02 mm). The coating wears down in service.

4.3 Measuring axial clearance of conrods

Special tools and workshop equipment required

♦ Feeler gauge

Procedure

Proceed as follows:

– Check gap using feeler gauge.

Axial clearance:

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

4.4 Measuring radial clearance of conrods

Special tools and workshop equipment required

♦ Plastigage

Procedure

Proceed as follows:

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

– Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shell.

- The Plastigage must be positioned in the centre of the bearing shell.

– Fit conrod bearing cap and tighten bolts to 45 Nm without rotating crankshaft.

– Remove conrod bearing cap again.

– Compare width of Plastigage with measurement scale.

Radial clearance:

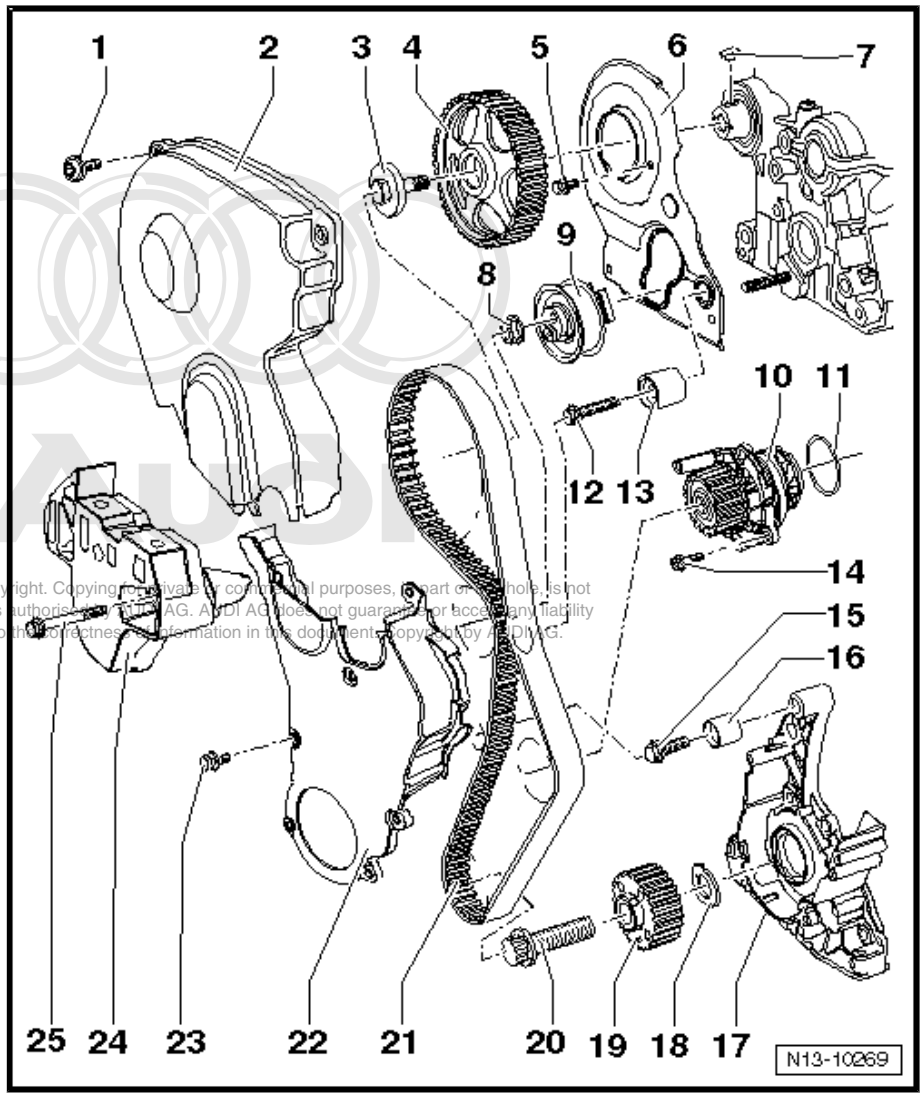
- New: 0.02 ... 0.06 mm.
- Wear limit: 0.09 mm.

– Renew conrod bolts.

15 – Cylinder head, valve gear

1 Toothed belt drive

1.1 Toothed belt drive - exploded view



1 - Bolt
- ❑ 9 Nm

2 - Toothed belt cover (top)

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

4 - Camshaft sprocket
- ❑ Located in position by Woodruff key -item 7-

5 - Bolt
- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ❑ 9 Nm

6 - Toothed belt cover (rear)

7 - Woodruff key
- ❑ Check for firm attachment

8 - Nut
- ❑ 23 Nm

9 - Tensioning roller

10 - Coolant pump
- ❑ Removing and installing ⇒ page 161

11 - O-ring
- ❑ Renew

12 - Bolt
- ❑ 23 Nm

13 - Damper wheel

14 - Bolt
- ❑ Tightening torque ⇒ Item 1 (page 160)

15 - Bolt
- ❑ 33 Nm

16 - Damper wheel

17 - Sealing flange
- ❑ Removing and installing ⇒ page 59

18 - Diamond-coated washer

- ❑ Between toothed belt sprocket and crankshaft
- ❑ Renew

19 - Crankshaft sprocket

- ❑ Removing and installing ⇒ page 82
- ❑ Contact surfaces between toothed belt sprocket, diamond-coated washer and crankshaft must be free of oil
- ❑ Can only be installed in one position

20 - Bolt

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

21 - Toothed belt

- ❑ Before removing, mark direction of rotation with chalk or felt-tipped pen
- ❑ Check for wear
- ❑ Removing ⇒ page 82
- ❑ Installing (adjusting valve timing) ⇒ page 87

22 - Toothed belt cover (bottom)

23 - Bolts

- ❑ 7x
- ❑ 9 Nm

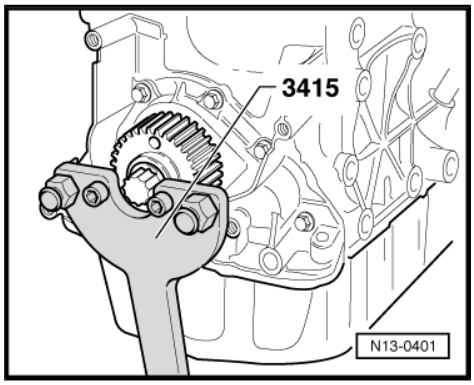
24 - Engine support

25 - Bolt

- ❑ Tightening torque ⇒ Item 4 (page 42)

Removing and installing crankshaft sprocket

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



Note

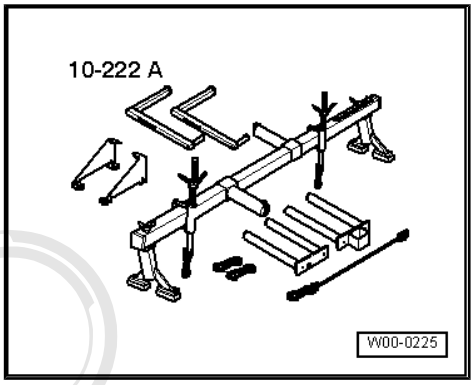
Contact surfaces between toothed belt sprocket, diamond-coated washer and crankshaft must be free of oil.

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

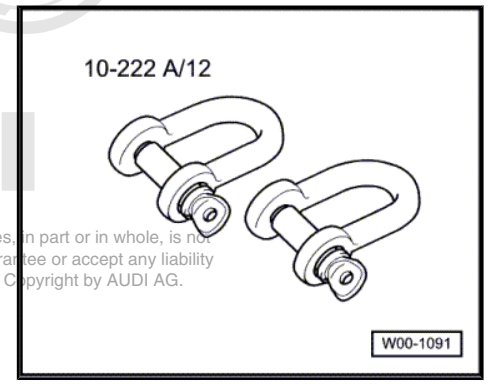
1.2 Removing and installing toothed belt

Special tools and workshop equipment required

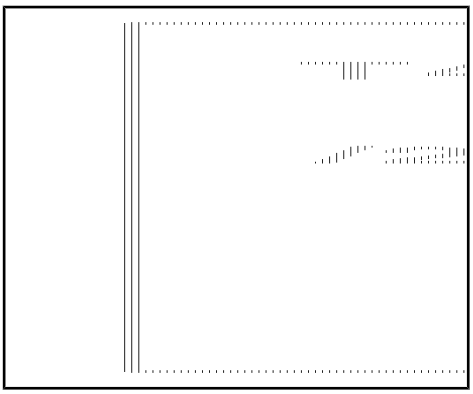
- Support bracket -10 - 222 A-



- Shackle -10 - 222 A /12-



- Adapter -T40093/6- (2x)

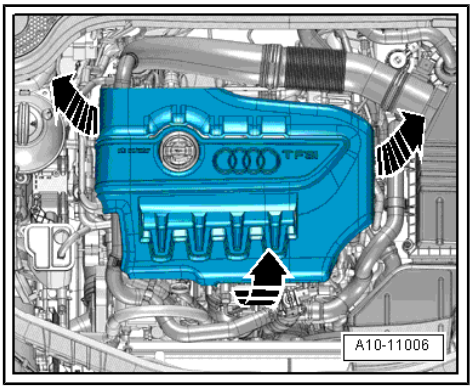


Removing

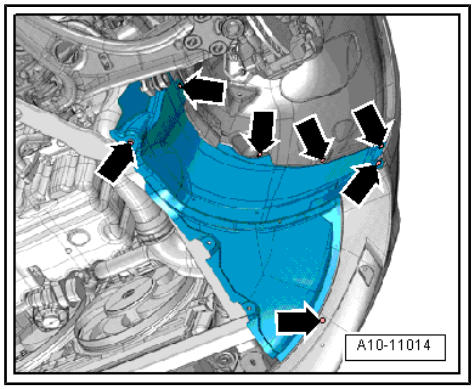
Proceed as follows:

– Remove engine cover panel -arrows-.

– Drain coolant ⇒ page 154 .



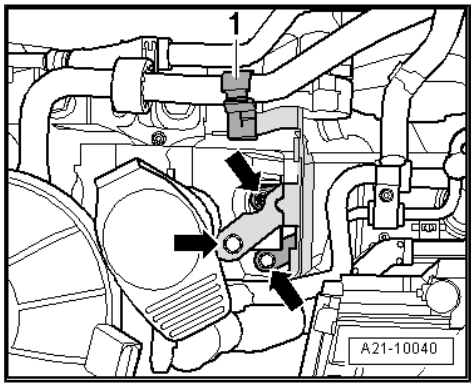
– Remove front right wheel.
– Remove noise insulation (right-side) -arrows-.
– Loosen front section of wheel housing liner (right-side) and press towards rear ⇒ Rep. Gr. 66 .
– Remove poly V-belt tensioner ⇒ page 52 .



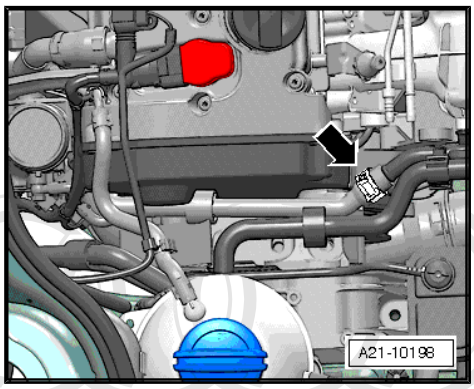
– Remove bolts -arrows- and detach bracket for activated charcoal filter.

Note

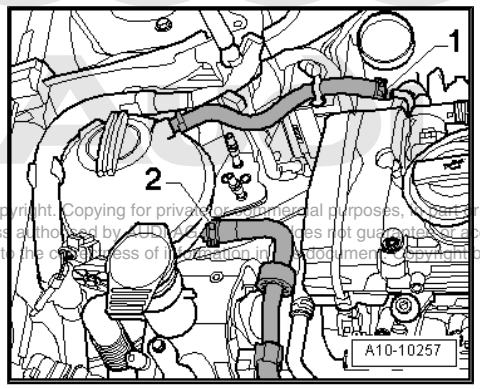
Disregard item -1-.



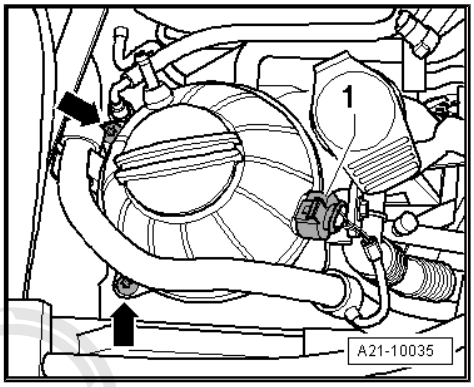
– Detach coolant hose -arrow-.



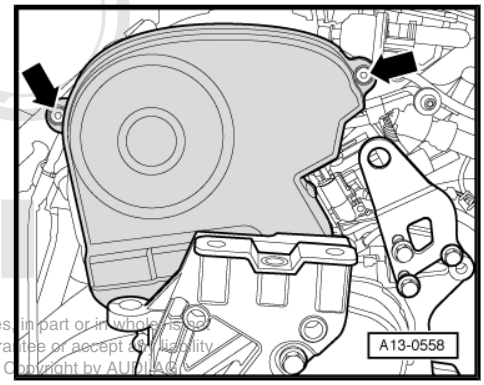
– Detach coolant hoses -1- and -2-.



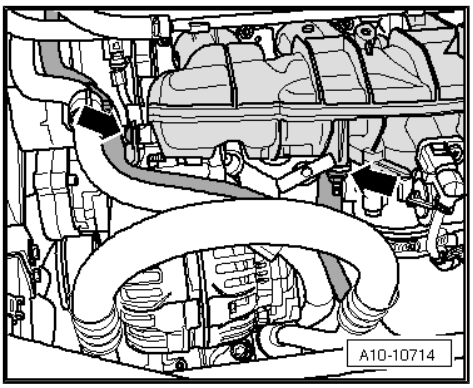
– Move electrical wiring clear at coolant expansion tank.
– Unplug electrical connector -1- at coolant shortage indicator switch -F66- .
– Remove bolts -arrows- and remove coolant expansion tank.



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

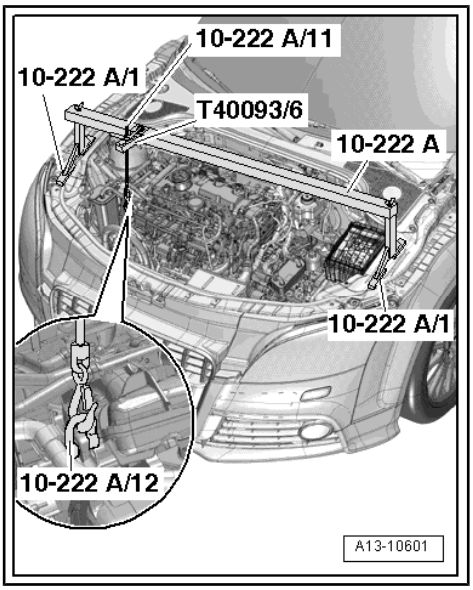


– Unscrew bolt and nut -arrows- and press coolant pipe (front right) to one side.



– Position support bracket -10 - 222 A- on top of body flanges using the following tools:
- ♦ Rack -10 - 222 A /1- (2x)
- ♦ Spindle -10 - 222 A /11-
- ♦ Shackle -10 - 222 A /12-
- ♦ Adapter -T40093/6- (2x)

– Hook spindle -10 - 222 A /11- with shackle -10 - 222 A /12- onto engine lifting eye.



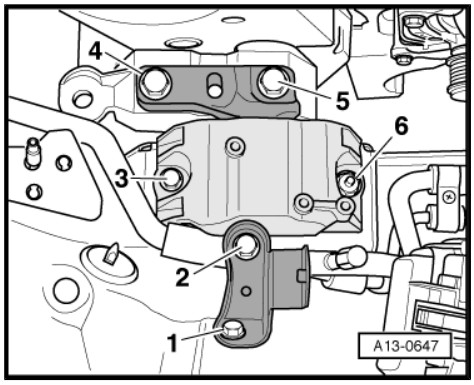
WARNING

Risk of accident.

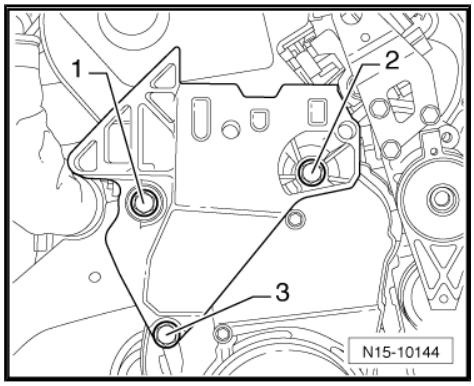
- ♦ *The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.*

– Take up weight of engine/gearbox assembly by tightening spindle.

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



– Remove bolts -1, 2, 3-.



Note

Bolt -2- can be accessed from the wheel housing end.

Caution

Danger of damage to components and hoses.

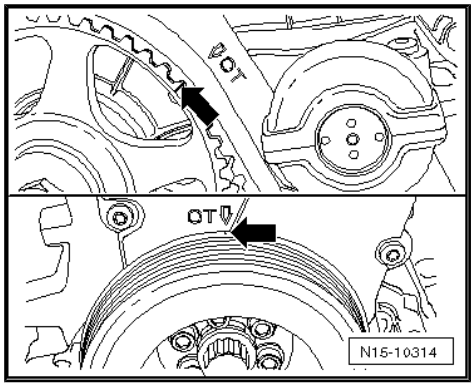
- *When raising the engine, take care that no components are damaged and no hoses are stretched.*

– Raise engine using support bracket -10 - 222 A- until engine support can be taken out.

Caution

Irreparable damage can be caused if the toothed belt slips.

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



– Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at “TDC”.
- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.

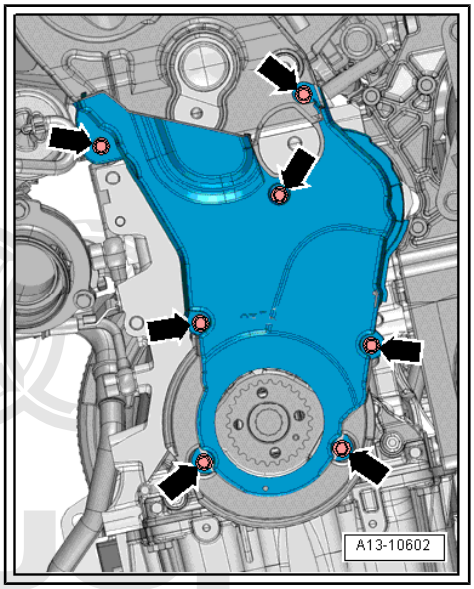
– Remove vibration damper ⇒ page 54 .

Caution

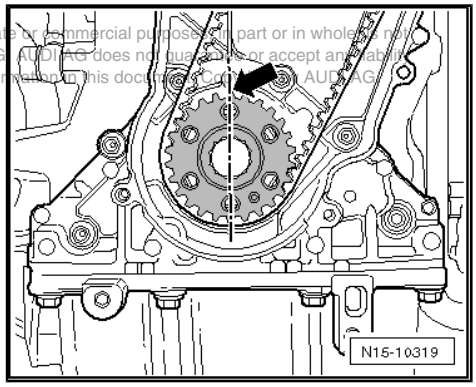
Risk of damage to engine.

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

– Remove toothed belt cover (bottom section) -arrows-.



– Mark “TDC” position -arrow-.



Caution

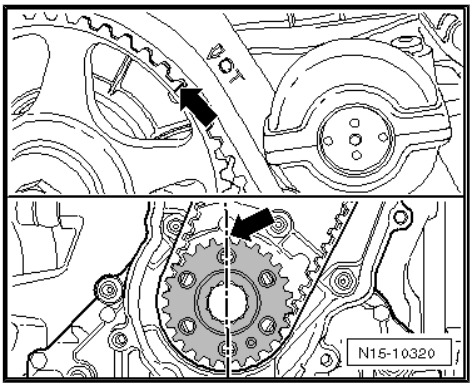
If a used belt runs in the opposite direction when it is refitted, this can cause breakage.

- *Before removing, mark direction of rotation of toothed belt with chalk or felt-tipped pen for re-installation.*

– Loosen tensioning roller and detach toothed belt.

Installing (adjusting valve timing)

- Tightening torques ⇒ page 81



Caution

Avoid damage to valves and piston crowns.

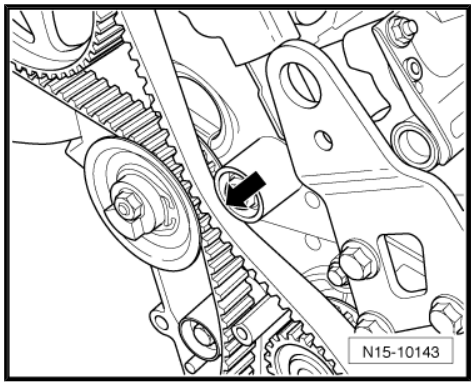
- *The crankshaft must not be at “TDC” at any cylinder when the camshaft is turned.*
- *The engine must be no more than warm to touch.*

– Check whether the camshaft and the crankshaft are positioned at “TDC”:

- The markings on the camshaft -top arrow- and the crankshaft -bottom arrow- must be aligned.

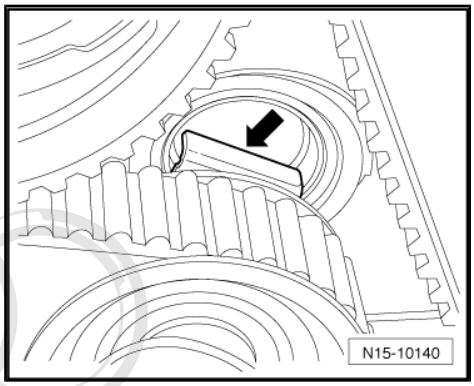
– Fit toothed belt according to marking for direction of rotation (made during removal) as follows:

• Crankshaft, tensioning roller, camshaft, coolant pump and idler roller -arrow-.



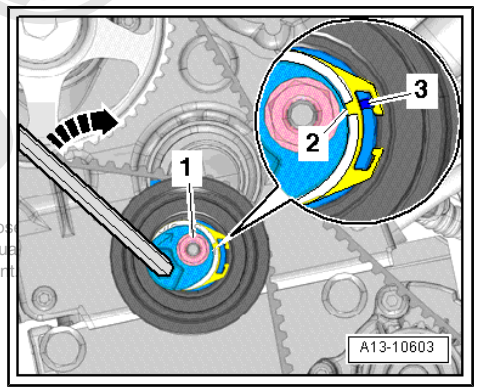
– Make sure tensioning roller is positioned correctly in cylinder head.

• Retaining bracket -arrow- must engage in slot on cylinder head.



– Tension toothed belt as follows:

1. Using hexagon key, turn eccentric adjuster clockwise -arrow- until notch -2- is above indicator -3- (toothed belt over-tensioned).
2. Let eccentric adjuster return to initial position (release toothed belt).
3. Using hexagon key, turn eccentric adjuster clockwise -arrow- until notch -2- is aligned with indicator -3-.



– Tighten nut -1- for tensioning roller.

Caution

Irreparable damage can be caused if the toothed belt slips.

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

– Turn crankshaft two rotations in direction of engine rotation by turning bolt for toothed belt sprocket until crankshaft is at “TDC” again.

• It is important that the engine is rotated without stopping during the final 45° ($^1/_8$ turn).

– Check toothed belt tension:

• Notch -2- and indicator -3- must be aligned.

– If necessary, tighten toothed belt further.

– Check valve timing:

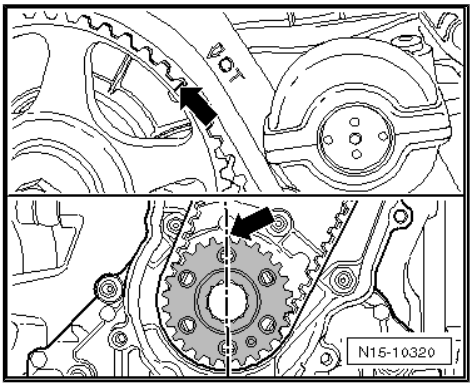
• The markings on the camshaft -top arrow- and the crankshaft -bottom arrow- must be aligned.

– Repeat adjustment of valve timing if markings are not aligned.

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

– Install toothed belt cover (bottom section) ⇒ page 81 .

– Install vibration damper ⇒ page 54 .



– Check valve timing again:

• Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.

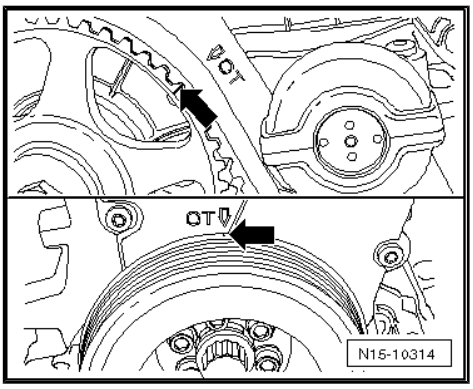
• Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.

– Install engine support and engine mounting ⇒ page 42 and adjust ⇒ page 44 .

– Install coolant pipe (front right) ⇒ page 168 .

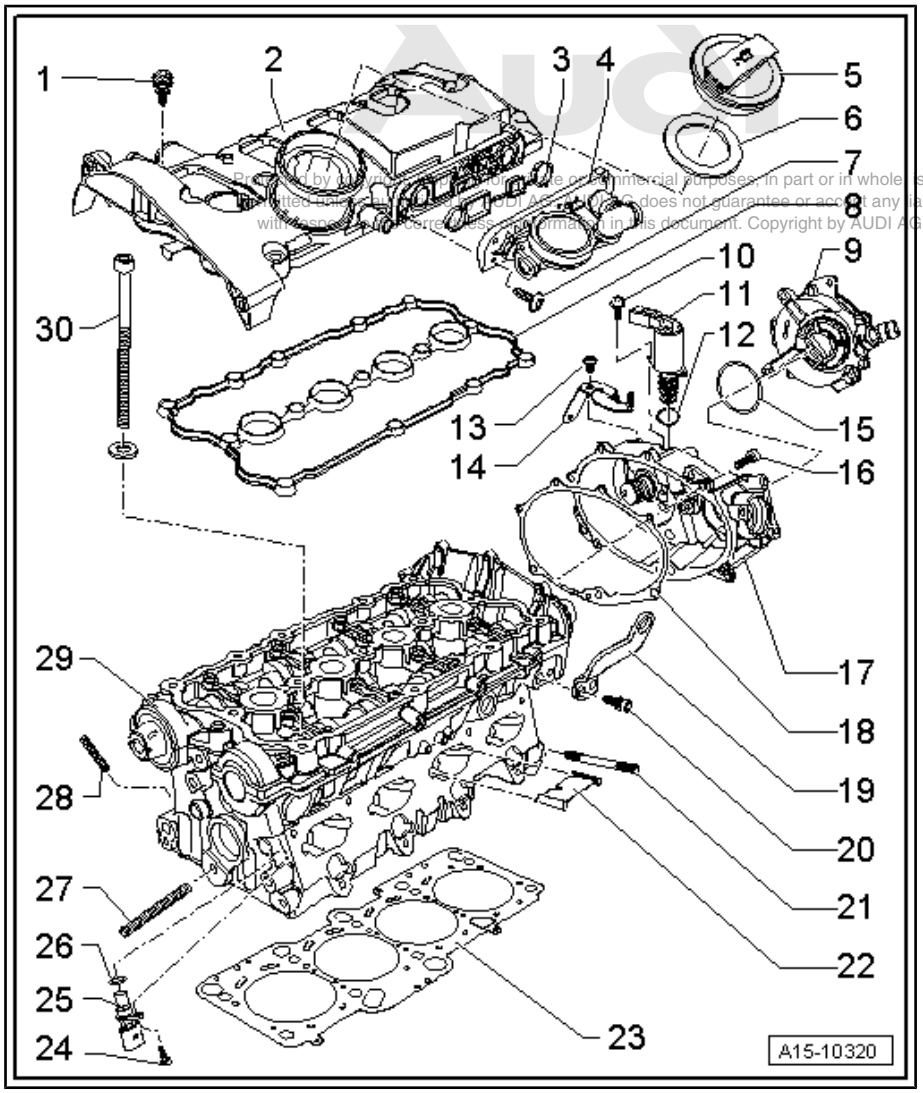
– Install poly V-belt tensioner ⇒ page 52 .

– Fill up with coolant ⇒ page 156 .



2 Cylinder head

2.1 Cylinder head cover and cylinder head - exploded view



1 - Bolt
- ❑ Renew if seal is damaged
- ❑ Tightening sequence ⇒ page 91

2 - Cylinder head cover

3 - Gasket
- ❑ Renew if damaged or leaking

4 - Pressure control valve
- ❑ For crankcase breather

5 - Filler cap

6 - Seal
- ❑ Renew if damaged or leaking

7 - Bolt
- ❑ 4 Nm

8 - Gasket for cylinder head cover
- ❑ Renew if damaged or leaking

9 - Exhauster pump

10 - Bolt
- ❑ 4 Nm

11 - Inlet camshaft control valve 1 -N205-
- ❑ Removing and installing ⇒ page 92

12 - Seal
- ❑ Renew

13 - Bolt
- ❑ 9 Nm

14 - Wiring bracket

15 - Seal
- ❑ Renew if damaged or leaking

16 - Bolt
- ❑ 9 Nm

17 - Housing
- ❑ For drive chain

18 - Gasket
- ❑ Renew

19 - Engine lifting eye

20 - Bolt

- ❑ 23 Nm

21 - Stud

- ❑ For intake manifold
- ❑ 9 Nm

22 - Separating plate

23 - Cylinder head gasket

- ❑ Renew
- ❑ Check installation position: Part No. towards cylinder head

24 - Bolt

- ❑ 9 Nm

25 - Hall sender -G40-

26 - Seal

27 - Stud

- ❑ For tensioning roller
- ❑ 15 Nm

28 - Stud

- ❑ For exhaust manifold
- ❑ 17 Nm

29 - Cylinder head

- ❑ Removing and installing ⇒ page 95
- ❑ ⇒ Fig. “ Checking cylinder head for distortion “ , page 92
- ❑ ⇒ Fig. “ Cylinder head machining limit “ , page 92
- ❑ If renewed, change coolant and engine oil

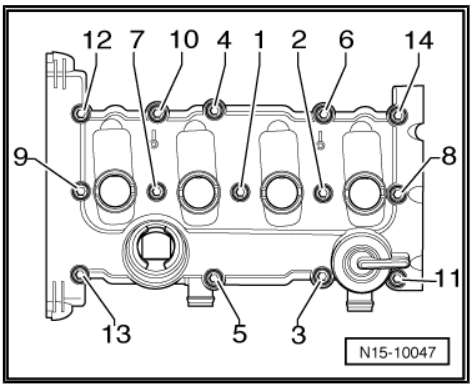
30 - Bolt

- ❑ Renew
- ❑ Note correct sequence when loosening ⇒ page 100
- ❑ Tightening torque and sequence ⇒ page 92

Cylinder head cover - tightening torque and sequence

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

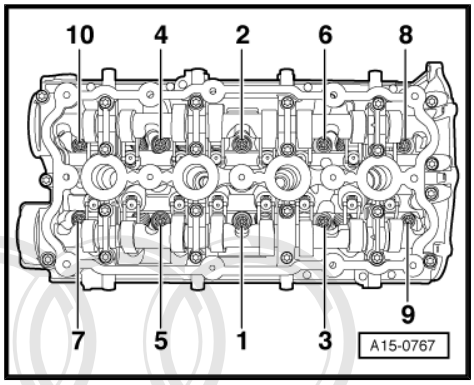
1. Screw in bolts by hand until they make contact.
2. Tighten to 10 Nm.



Cylinder head - tightening torque and sequence

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

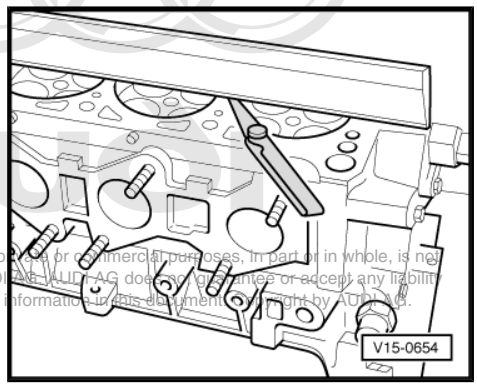
1. Tighten to 40 Nm.
2. Turn 90° further.
3. Turn 90° further.



Checking cylinder head for distortion

– Use straight edge and feeler gauge to measure cylinder head for distortion at several points.

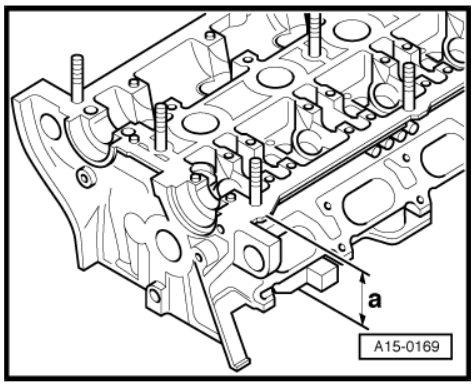
• Max. permissible distortion: 0.05 mm.



Cylinder head machining limit

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

• Minimum dimension: -a- = 139.20 mm

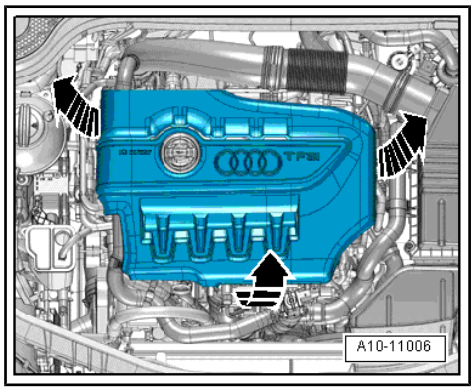


2.2 Removing and installing inlet camshaft control valve 1 -N205-

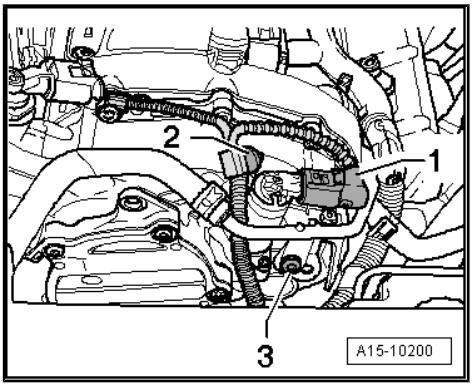
Removing

Proceed as follows:

– Remove engine cover panel -arrows-.



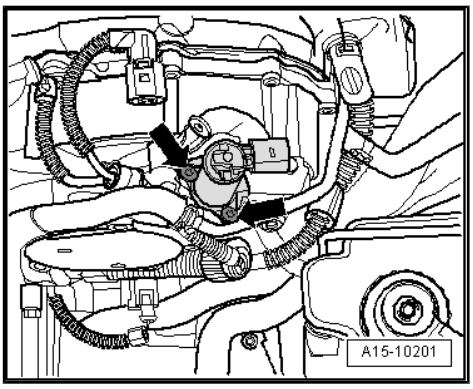
– Unplug electrical connector -1-.
– Release electrical wiring -2- from bracket.
– Remove bolt -3-.



Caution

Risk of damage to electrical wiring.

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



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

Installing

- Tightening torque ⇒ page 90

Note

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

Caution

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

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

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

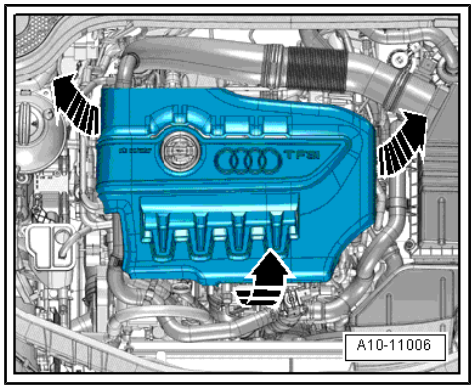
– Install coolant bleeder pipe ⇒ page 164 .

2.3 Removing and installing cylinder head cover

Removing

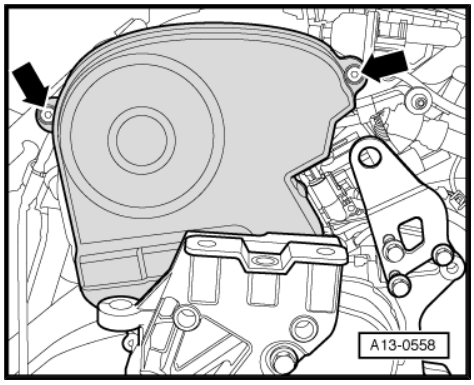
Proceed as follows:

– Remove engine cover panel -arrows-.



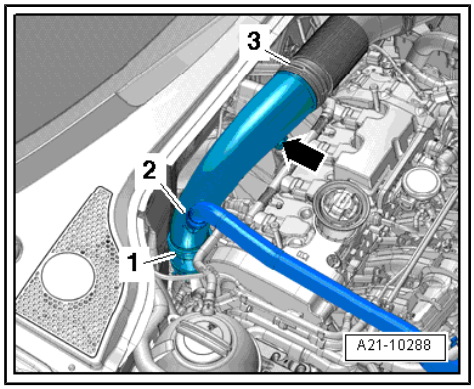
– Unscrew bolts -arrows- and press toothed belt cover (top) slightly to one side.

– Remove ignition coils ⇒ Rep. Gr. 28 .



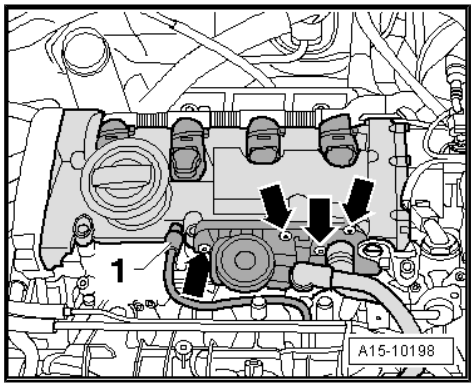
– Remove bolt -arrow-.

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

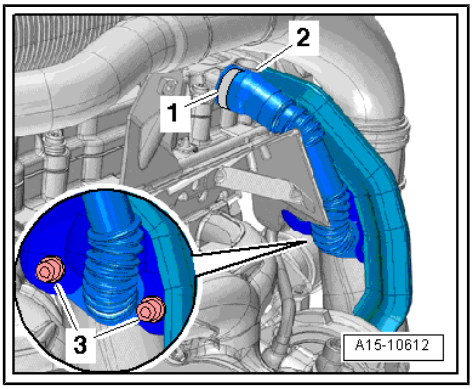


– Disconnect vacuum hose -1- from cylinder head cover.

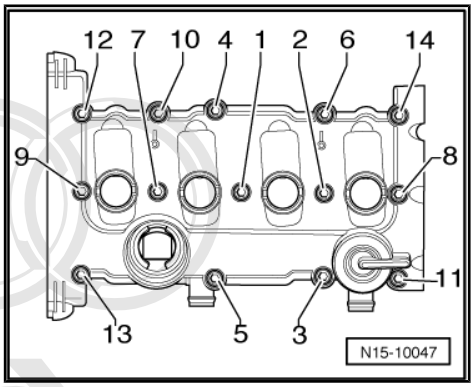
– Remove bolts -arrows- and detach pressure control valve for crankcase breather system.



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



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



Installing

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

- Tightening torques ⇒ page 90 , ⇒ page 91 .

Note

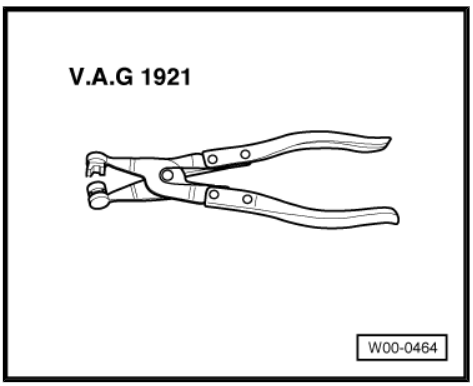
- *Renew gasket for cylinder head cover if damaged.*
- *Renew bolts for cylinder head cover if seals on bolts are damaged.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Tighten cylinder head cover bolts ⇒ page 91 .
– Install crankcase breather pipe ⇒ page 179 .
– Secure toothed belt cover (top section) ⇒ page 81 .
– Install ignition coils ⇒ Rep. Gr. 28 .

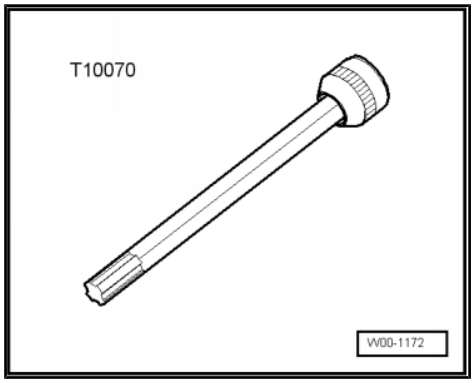
2.4 Removing and installing cylinder head

Special tools and workshop equipment required

- Hose clip pliers -V.A.G 1921-



♦ Special wrench, long reach -T10070-



Removing

Proceed as follows:

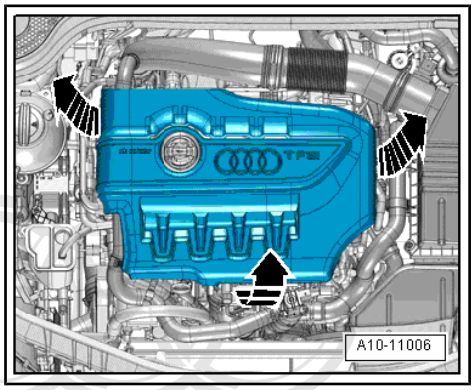
- Engine in vehicle.

– Drain coolant ⇒ page 154 .

– Remove engine cover panel -arrows-.

– Remove radiator cowl ⇒ page 173 .

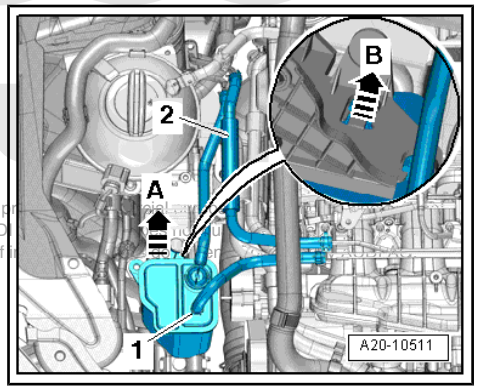
– Remove turbocharger ⇒ page 182 .



WARNING

Risk of injury caused by fuel.

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



Caution

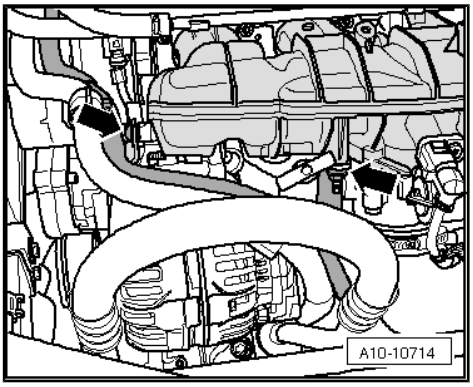
Observe rules for cleanliness when working on the fuel supply system ⇒ page 9 .

– Remove protective sleeve -2- and disconnect fuel hose by pressing release ring.

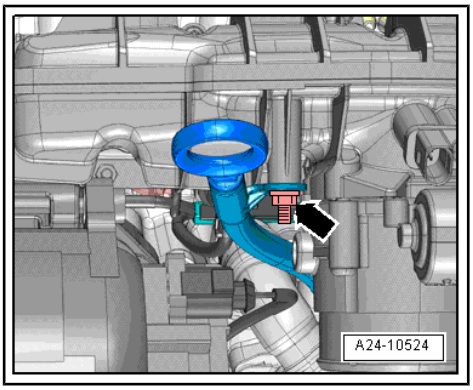
– Detach hose -1-.

– Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side.

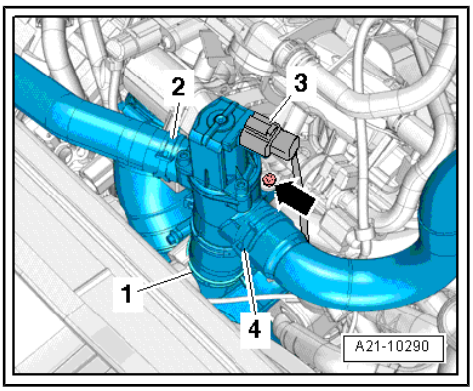
– Unscrew bolt and nut -arrows- and press coolant pipe (front right) to one side (coolant hoses remain attached).



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



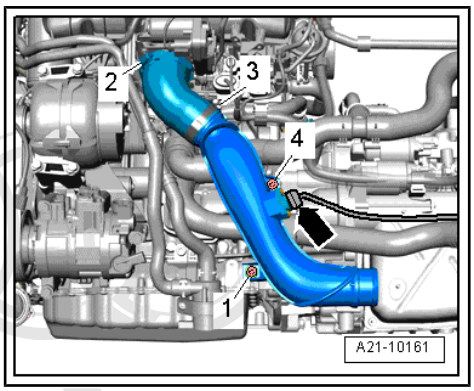
– Unplug electrical connector -3-.
– Remove bolt -arrow-.
– Detach hose -2-.
– Loosen hose clip -1-, pull turbocharger air recirculation valve -N249- off air pipe and move clear (hose -4- remains connected).



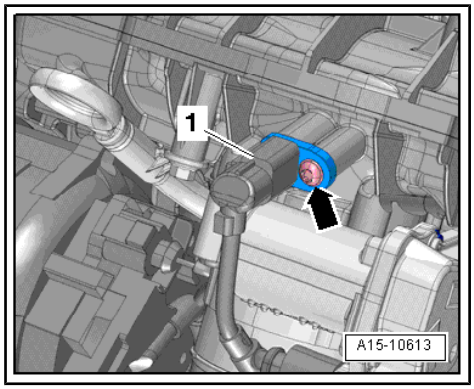
– Unplug electrical connector -arrow- at charge air pressure sender -G31- .
– Remove bolt -1- and nut -4-.
– Loosen hose clip -2- and detach air pipe.

Note

Disregard item -3-.



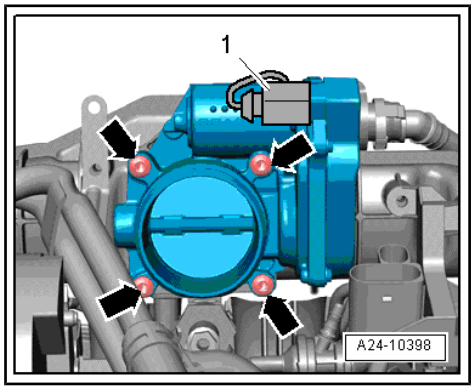
– Unplug electrical connector -1- at intake air temperature sender 2 -G299- .



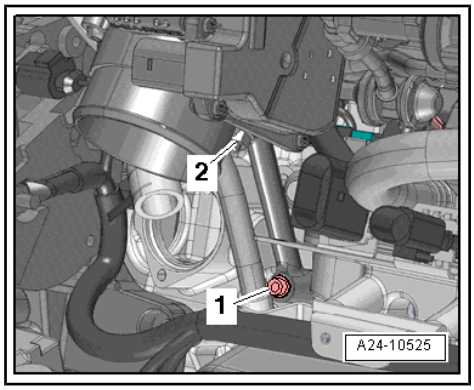
Note

Disregard -arrow-.

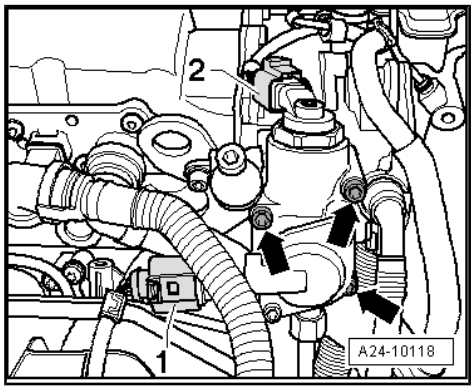
– Unplug electrical connector -1-.
– Remove bolts -arrows- and detach throttle valve module -J338- .



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



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



Note

Disregard -arrows-.

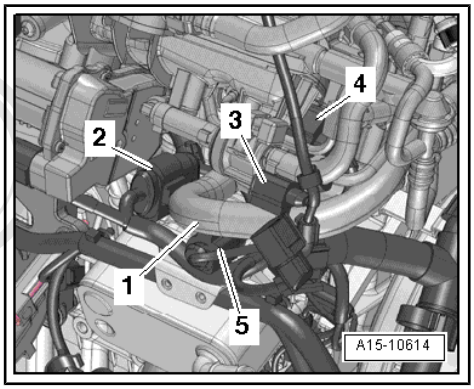
– Press release tabs and disconnect crankcase breather hose -1- from oil separator.
– Unplug electrical connectors:

2 - For injectors (remove electrical connectors from bracket)

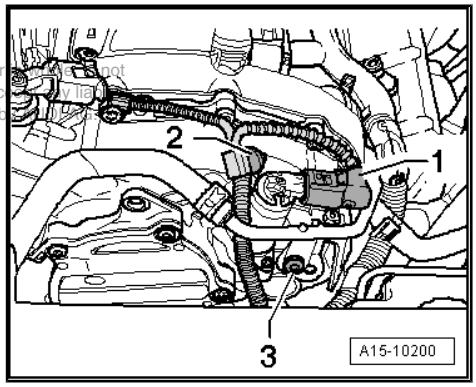
3 - For activated charcoal filter solenoid valve 1 -N80-

4 - For intake manifold flap motor -V157-

5 - For fuel pressure sender -G247- and Hall sender -G40- (remove electrical connectors from bracket)



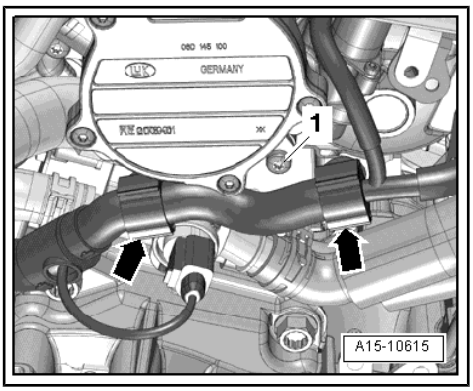
– Unplug electrical connector -1-.
– Release electrical wiring -2- from bracket.



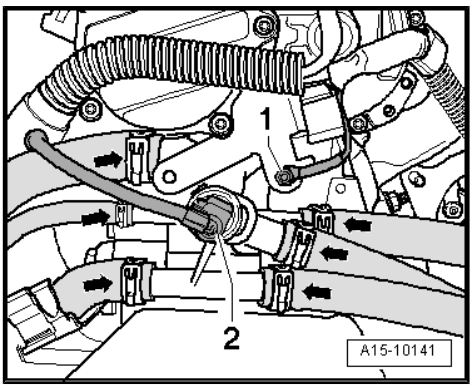
Note

Disregard item -3-.

– Move electrical wiring clear -arrows- and unscrew bolt -1- for bracket.

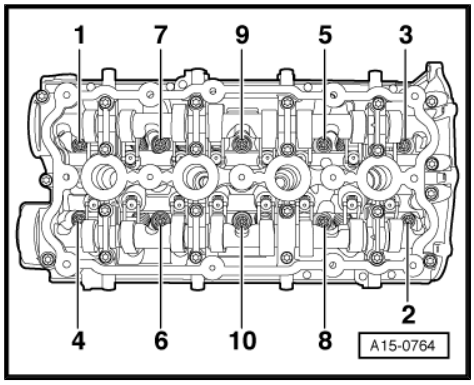


– Unscrew earth wire -1-.
– Unplug electrical connector -2-.
– Disconnect coolant hoses and vacuum hoses -arrows-.
– Remove toothed belt ⇒ page 82 .
– Remove cylinder head cover ⇒ page 94 .



– Slacken cylinder head bolts in the sequence -1 ... 10-.

– Remove bolts and detach cylinder head.



Installing

- Tightening torques ⇒ page 90 , ⇒ page 92

Caution

Avoid damage to sealing surfaces.

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

Avoid damage to cylinder block.

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

Risk of leaks at cylinder head gasket.

- *Carefully remove any sealant residue from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- *Carefully remove any remaining emery and abrasive material.*
- *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- *Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.*

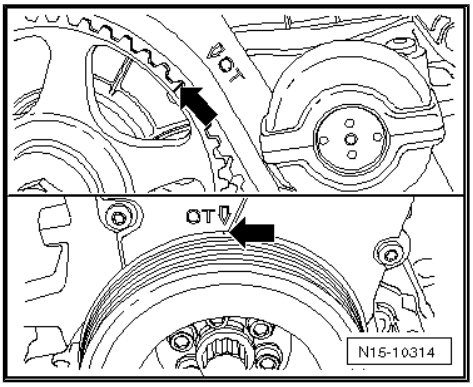
Avoid damage to open valves.

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

Note

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

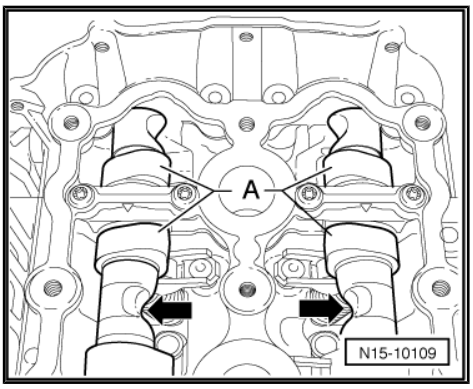
– Align mark on camshaft sprocket with mark on toothed belt cover -top arrow-.



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

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

– Check that crankshaft is still positioned at “TDC” and then turn back in the opposite direction of engine rotation by approx. 45°.

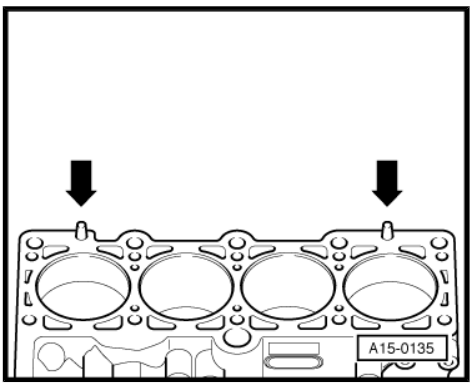


– Place cylinder head gasket in position.

- Installation position: Part No. must be visible.
- Note position of dowel sleeves in cylinder block.

– Fit cylinder head.

– Tighten bolts for cylinder head ⇒ page 92 .



Note

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

– Install cylinder head cover ⇒ page 94 .

– Rotate crankshaft in normal direction of rotation back to “TDC”.

– Install toothed belt (adjust valve timing) ⇒ page 87 .

– Install support for intake manifold throttle valve module -J338- ⇒ Rep. Gr. 24 .

– Secure dipstick guide tube ⇒ page 131 .

– Install air pipe ⇒ page 194 .

– Install coolant pipe (front right) ⇒ page 168 .

– Install turbocharger ⇒ page 182 .

– Install radiator cowl ⇒ page 173 .

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

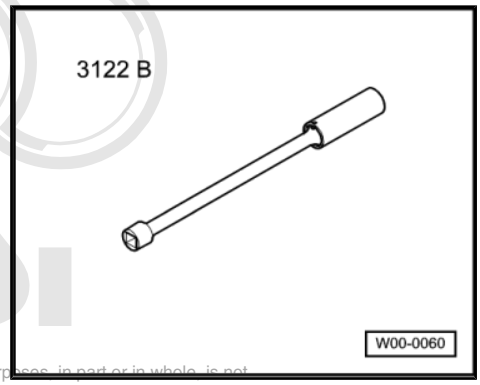
– Change engine oil ⇒ Maintenance ; Booklet 810 .

– Fill cooling system with fresh coolant ⇒ page 154 .

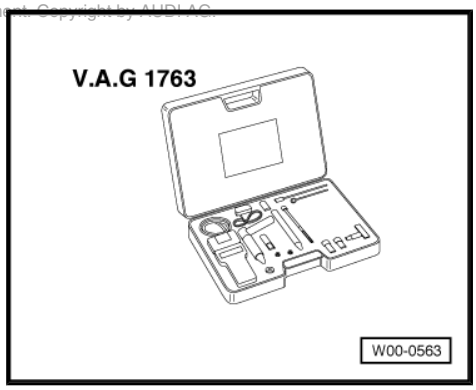
2.5 Checking compression

Special tools and workshop equipment required

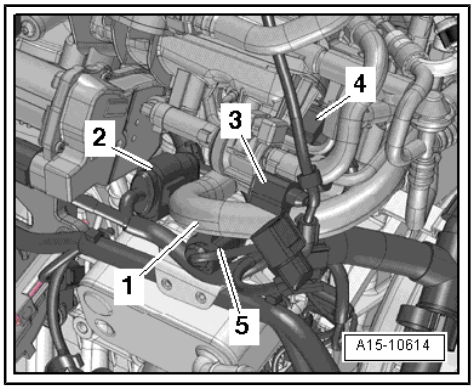
- Spark plug socket and extension -3122 B-



- Compression tester -V.A.G 1763-



Procedure



Proceed as follows:

- Engine oil temperature min. 30 °C.
- Battery voltage at least 12.5 V

– Unplug electrical connector -2- for injectors.

Note

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

– Remove ignition coils ⇒ Rep. Gr. 28 .

– Remove spark plugs with spark plug socket and extension -3122 B- .

– Check compression pressure with compression tester - V.A.G 1763- (see ⇒ operating instructions for details of how to use tester).

– Have a 2nd mechanic press down the accelerator pedal completely and at the same time operate the starter until the pressure on the tester display no longer increases.

– Repeat procedure on each cylinder.

Compression pressure	bar
When new	10.0 … 14.0
Wear limit	7.0
Maximum difference between cylinders	3.0

Assembling

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

– Install spark plugs ⇒ Maintenance ; Booklet 810 .

– Install ignition coils ⇒ Rep. Gr. 28 .

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

– Connect vehicle diagnostic, testing and information system - VAS 5051B- .

– Start “Guided Functions” mode.

– Generate readiness code in engine control unit.

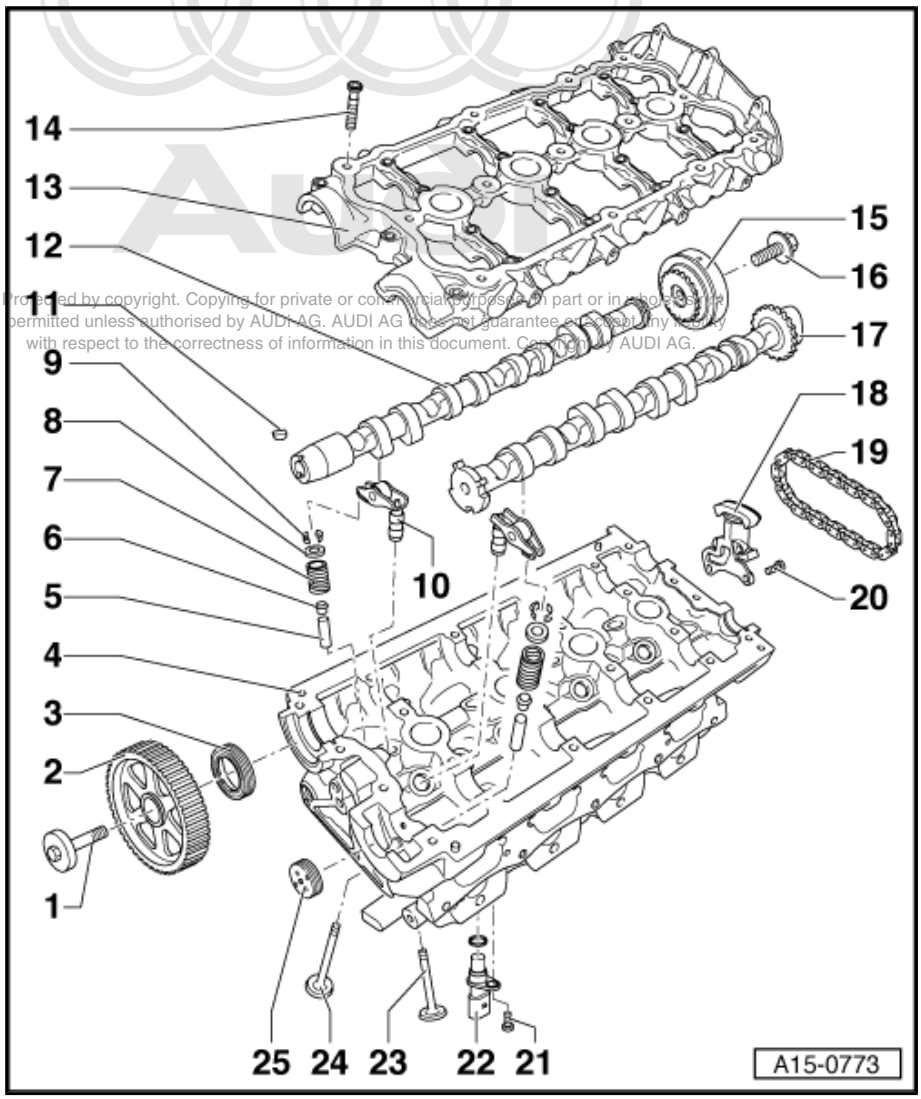
3 Valve gear

Caution

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

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

3.1 Valve gear - exploded view



1 - Bolt
- ❑ Renew
- ❑ Slacken and tighten with counterhold tool -3036-
- ❑ Tightening torque ⇒ Item 3 (page 81)

2 - Camshaft sprocket

3 - Oil seal
- ❑ For exhaust camshaft
- ❑ Renewing ⇒ page 108

4 - Cylinder head

5 - Valve guide
- ❑ Checking ⇒ page 127

6 - Valve stem oil seal
- ❑ Renewing: with cylinder head installed ⇒ page 120 , with cylinder head removed ⇒ page 123

7 - Valve spring

8 - Valve spring plate

9 - Valve cotters

10 - Hydraulic valve compensation element
- ❑ With roller rocker finger and securing clip
- ❑ Mark installation position for re-installation
- ❑ Lubricate running surfaces with oil

11 - Parallel key
- ❑ Check for firm attachment

12 - Exhaust camshaft
- ❑ Removing and installing ⇒ page 115
- ❑ Measuring axial clearance ⇒ page 106
- ❑ Measuring radial clearance ⇒ page 107

- ❑ Runout: max. 0.04 mm

13 - Retaining frame

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

14 - Bolt

- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 106

15 - Camshaft adjuster

- ❑ Removing and installing ⇒ page 111

16 - Bolt

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

17 - Inlet camshaft

- ❑ Removing and installing ⇒ “3.6 Removing and installing camshafts”, page 115
- ❑ Measuring axial clearance ⇒ page 106
- ❑ Measuring radial clearance ⇒ page 107
- ❑ Runout: max. 0.04 mm

18 - Chain tensioner

- ❑ Removing ⇒ “3.5 Removing and installing camshaft adjuster”, page 111
- ❑ Before removing, lock in place using locking pin -T10115-

19 - Drive chain

20 - Bolt

- ❑ Self-locking
- ❑ Renew
- ❑ 9 Nm

21 - Bolt

- ❑ Tightening torque ⇒ Item 24 (page 91)

22 - Hall sender -G40-

- ❑ Version fitted in vehicle may differ from illustration

23 - Exhaust valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Valve dimensions ⇒ page 127
- ❑ Checking valve guides ⇒ page 127

24 - Inlet valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Valve dimensions ⇒ page 127
- ❑ Checking valve guides ⇒ page 127

25 - Sealing cap

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

Retaining frame - tightening torque and sequence

– Renew bolts for retaining frame.

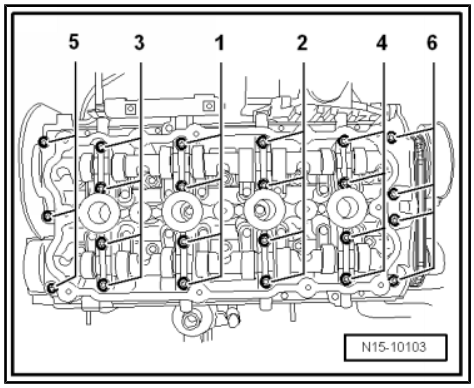
– Tighten bolts in the sequence -1 ... 6- in 3 stages as follows:

1. Screw in bolts by hand until they make contact.

• The retaining frame should make contact with the cylinder head over the full surface.

2. Tighten to 8 Nm.

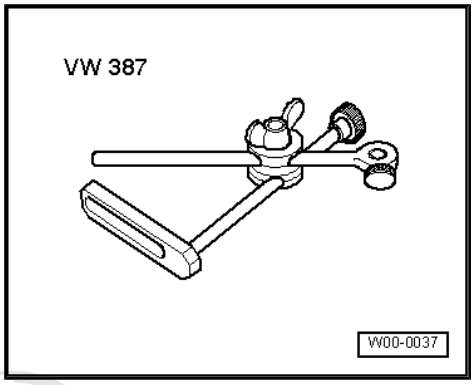
3. Turn 90° further.



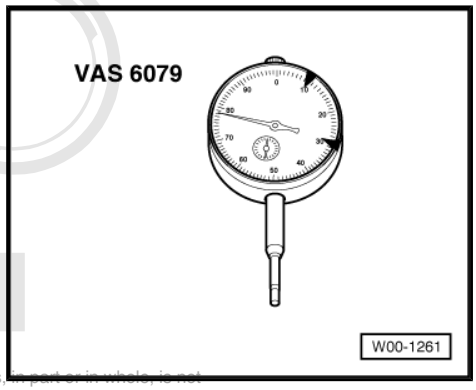
3.2 Measuring axial clearance of camshafts

Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-



Procedure

Proceed as follows:

– Remove retaining frame
⇒ “3.6 Removing and installing camshafts”, page 115 .

– Fit camshaft to be tested in retaining frame.

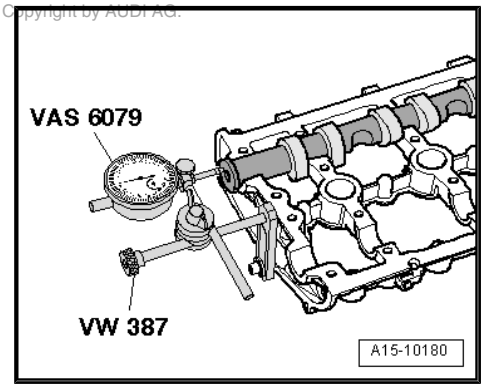
– Attach dial gauge -VAS 6079- with dial gauge bracket -VW 387- to cylinder head.

– Press camshaft against dial gauge by hand.

– Set dial gauge to “0”.

– Press camshaft away from dial gauge and read off value:

• Axial clearance: 0.05 ... 0.17 mm



3.3 Measuring radial clearance of camshafts

Procedure

Proceed as follows:

– Remove roller rocker fingers
⇒ “3.6 Removing and installing camshafts”, page 115 .

– Clean bearing and bearing journal.

– Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.

• The Plastigage must be positioned in the centre of the bearing.

– Fit retaining frame and tighten to 8 Nm without rotating camshafts ⇒ page 106 .

– Remove retaining frame again.

– Compare width of Plastigage with measurement scale.

Radial clearance:

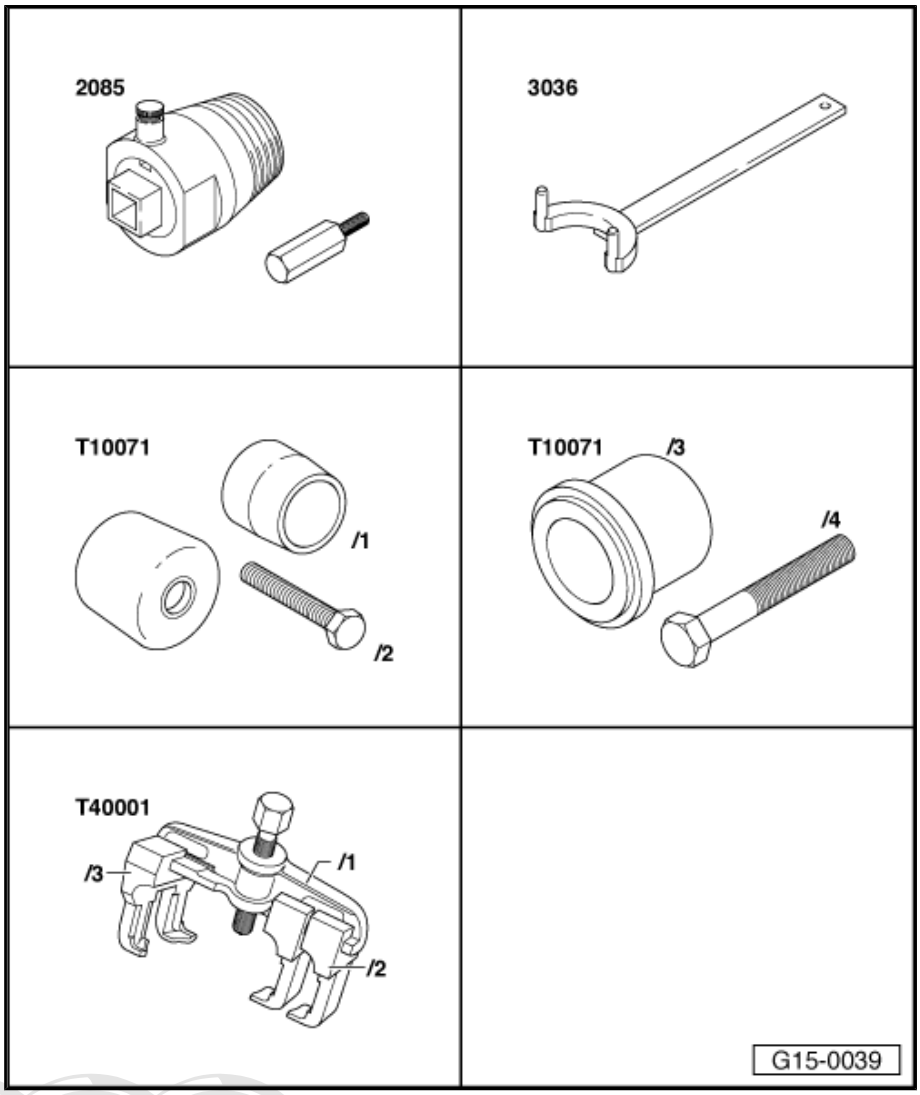
Bearing (∅ 24 mm): 0.024 ... 0.066 mm.

Bearing (∅ 32 mm): 0.030 ... 0.051 mm.

3.4 Renewing exhaust camshaft oil seal

Special tools and workshop equipment required

- Oil seal extractor -2085-
- Assembly tool -3066-
- Assembly tool -T10071-
- Puller -T40001-
- Nuts M12 (2x)



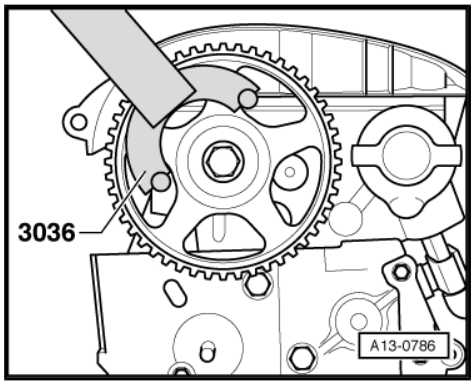
Procedure

- Tightening torque ⇒ page 104

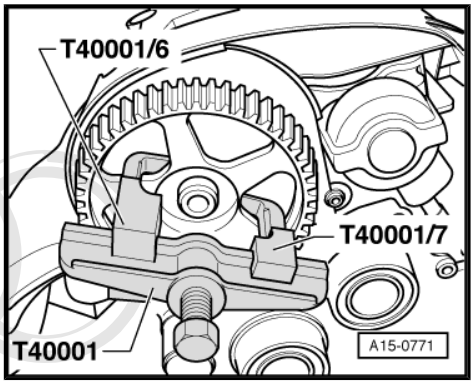
Proceed as follows:

– Remove toothed belt ⇒ page 82 .

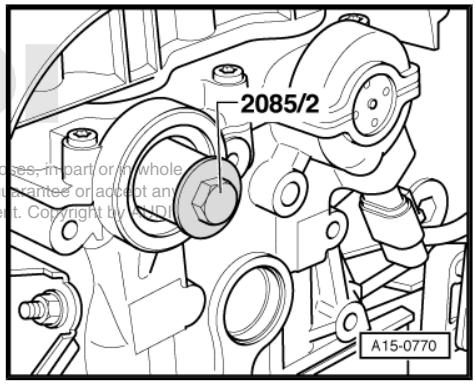
– Loosen bolt for camshaft sprocket using counterhold tool -3036- .



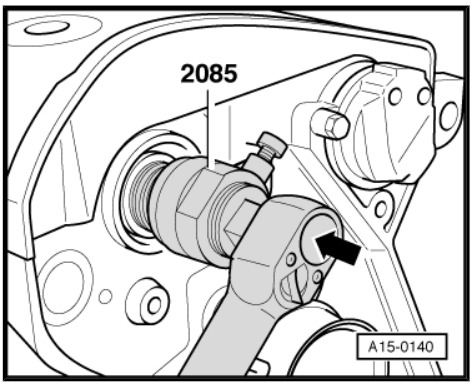
– Detach camshaft sprocket using two-arm puller -T40001- and claws -T40001/6- and -T40001/7-



– To guide oil seal extractor, screw adapter -2085/2- into camshaft by hand as far as it will go.
– Screw inner section of oil seal extractor -2085- two turns (approx. 3 mm) out of outer section and lock with knurled screw.



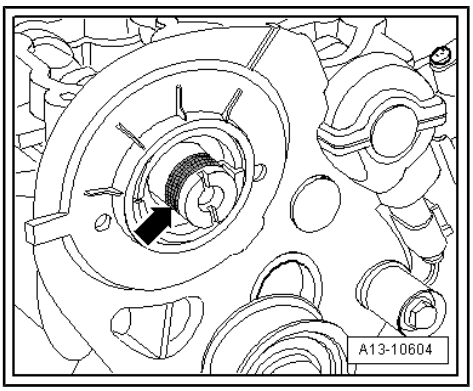
– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
– Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
– Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
– Clean contact surface and sealing surface for oil seal.



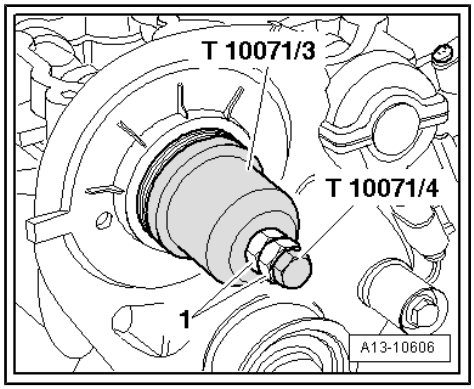
Note

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

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



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



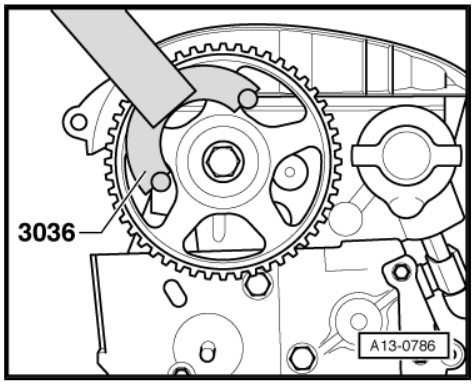
Note

Make sure parallel key for camshaft sprocket is correctly seated.

Caution

Avoid damage to valves and piston crowns.

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

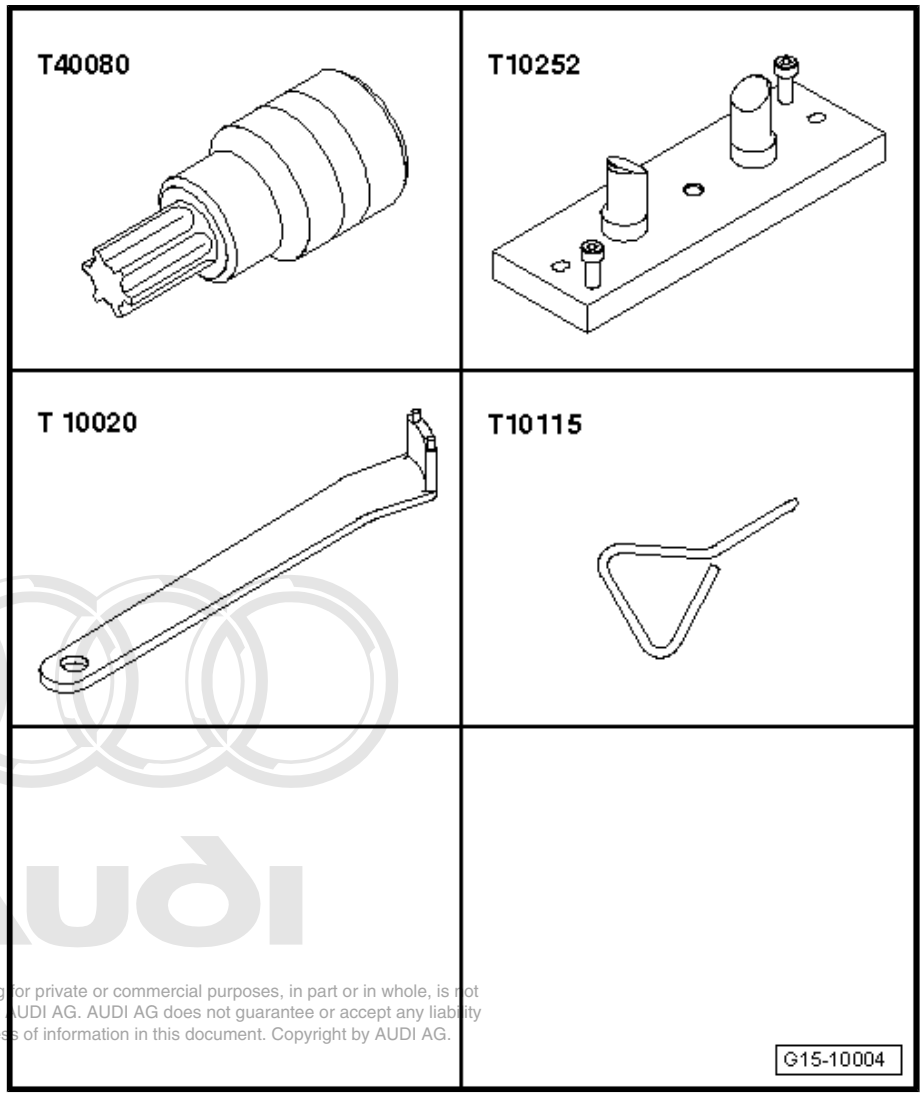


– Tighten bolt for camshaft sprocket using counterhold tool -3036- .
– Install toothed belt (adjust valve timing) ⇒ page 87 .

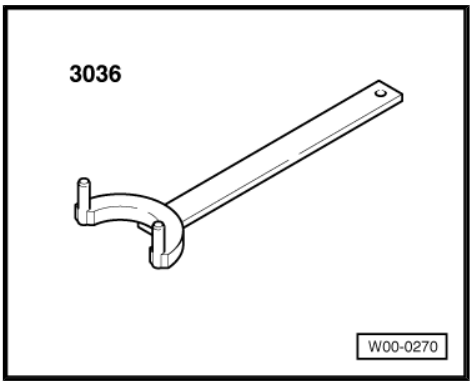
3.5 Removing and installing camshaft adjuster

Special tools and workshop equipment required

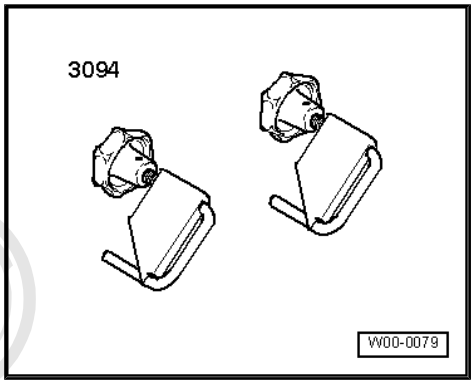
- Special wrench, long reach -T40080-
- Camshaft clamp -T10252-
- Pin wrench -T10020-
- Locking pin -T10115-



- Counterhold tool -3036-



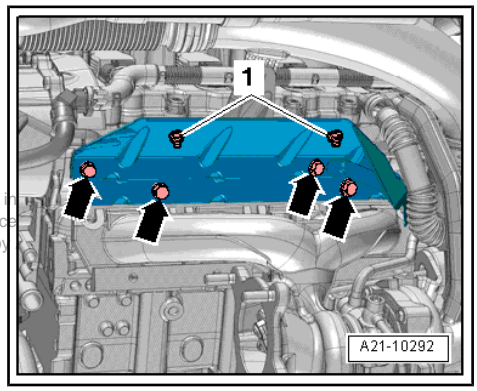
♦ Hose clamps for hoses up to 25 mm -3094-



Removing

Proceed as follows:

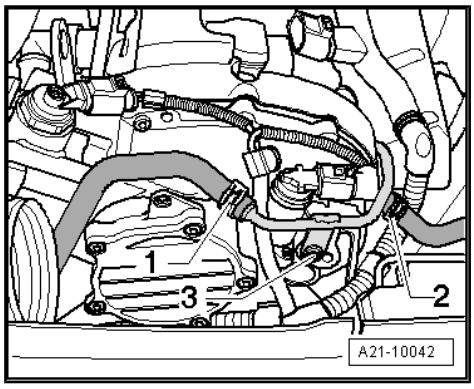
– Remove high-pressure pump ⇒ Rep. Gr. 24 .
– Remove cylinder head cover ⇒ page 94 .
– Remove exhauster pump ⇒ Rep. Gr. 47 .
– Remove bolts -arrows-.



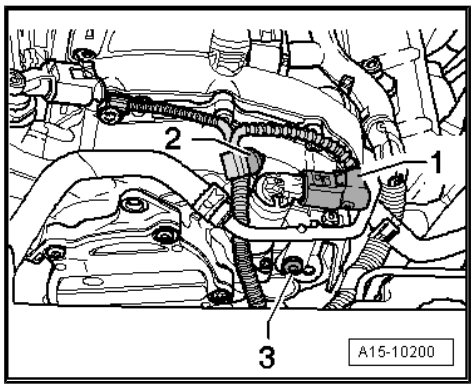
Note

Disregard item -1-.

– Use hose clamps -3094- to clamp off coolant hoses -1- and -2- and detach.
– Remove bolt -3- and press coolant bleeder pipe slightly towards rear.



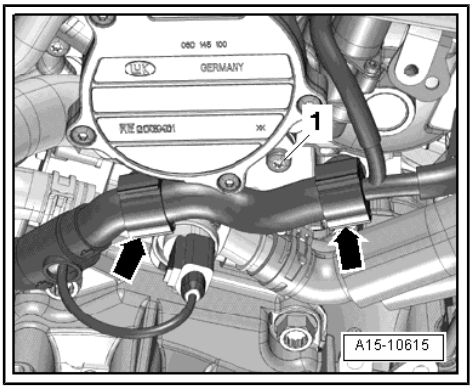
– Unplug electrical connector -1-.
– Release electrical wiring -2- from bracket.



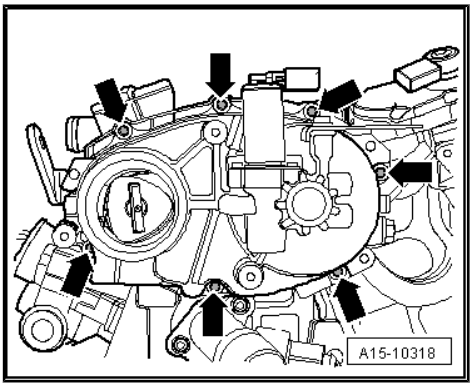
Note

Disregard item -3-.

– Move electrical wiring clear -arrows- and unscrew bolt -1- for bracket.



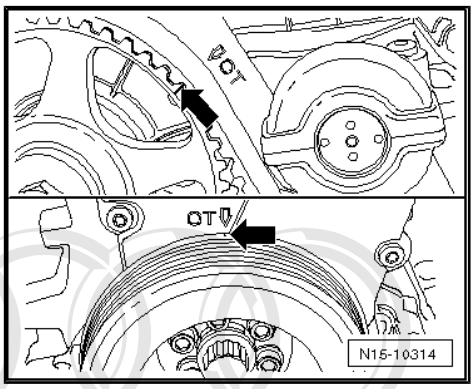
– Remove bolts -arrows- and detach housing for camshaft adjuster.



Caution

Irreparable damage can be caused if the toothed belt slips.

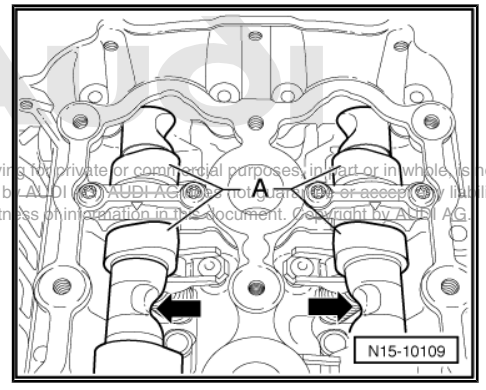
- *Turn crankshaft only in direction of engine rotation.*



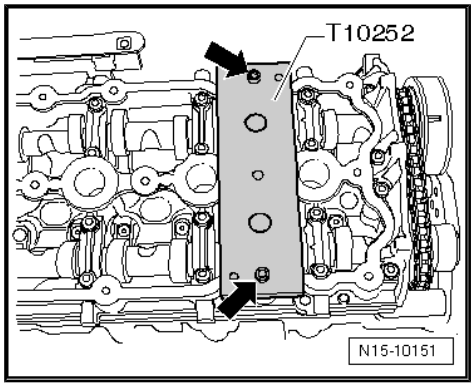
– Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at “TDC”.

- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.

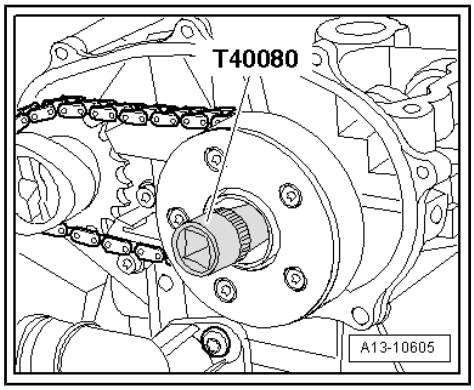
- Cams -A- on both camshafts should be symmetrically aligned.
- Recesses -arrows- on both camshafts must face each other.



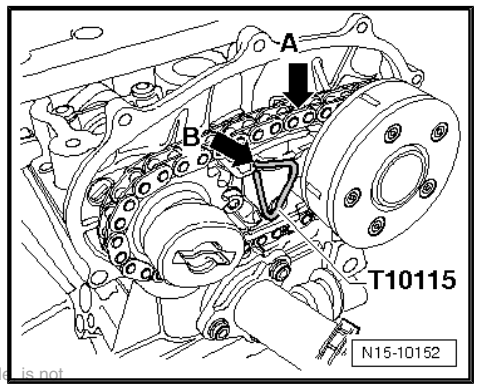
– Fit camshaft clamp -T10252- and tighten -arrows-, as shown in illustration.
– Additionally, counterhold camshaft sprocket with counterhold tool -3036- .



– Use special wrench, long reach -T40080- to slacken camshaft adjuster bolt approx. $^1/_2$ a turn.



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



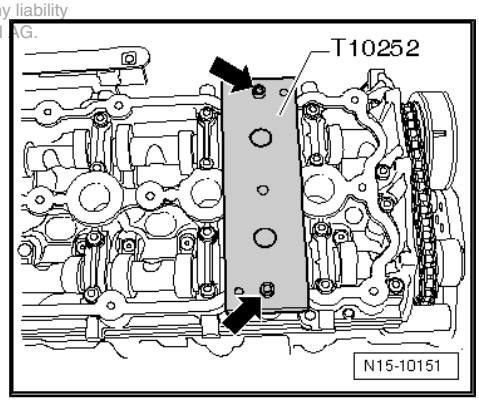
Installing

- Tightening torques ⇒ page 104
- Camshafts locked in position with camshaft clamp -T10252- .

Note

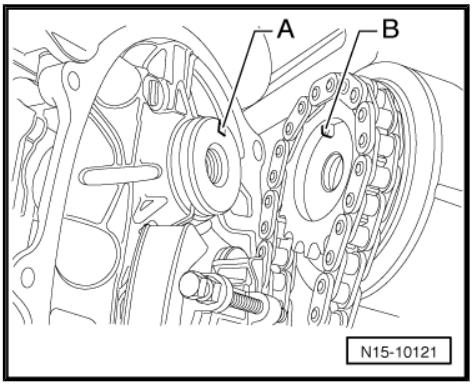
Renew camshaft adjuster bolt.

– Fit drive chain on camshaft adjuster.

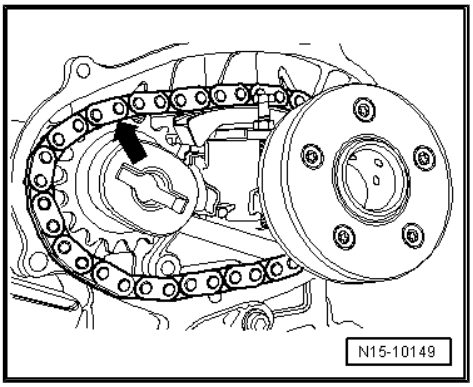


– Position camshaft adjuster in front of exhaust camshaft as follows:

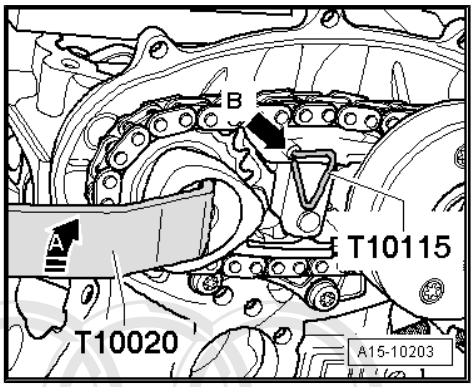
• Groove -A- and pin -B- must be aligned.



– Lay chain over inlet camshaft sprocket starting at top -arrow- without changing its position.



– Slowly turn inlet camshaft in clockwise direction -arrow A- using 2-hole pin wrench -T10020- until camshaft adjuster fits onto camshaft.



Note

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

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

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

– Install coolant bleeder pipe ⇒ page 164 .

– Install exhauster pump ⇒ Rep. Gr. 47 .

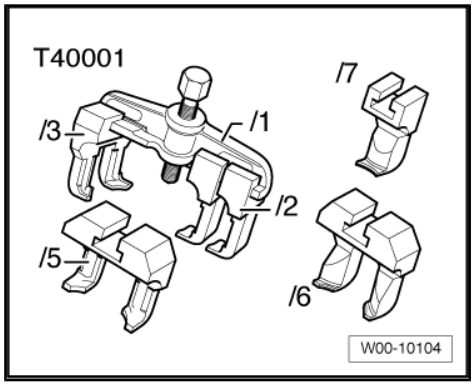
– Install cylinder head cover ⇒ page 94 .

– Install high-pressure pump ⇒ Rep. Gr. 24 .

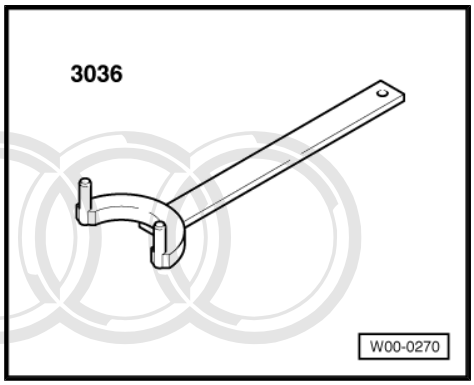
3.6 Removing and installing camshafts

Special tools and workshop equipment required

- Two-arm puller -T40001-



- Counterhold tool -3036-



- Sealant remover, commercially available
- Sealant ⇒ Electronic parts catalogue

Removing

Proceed as follows:

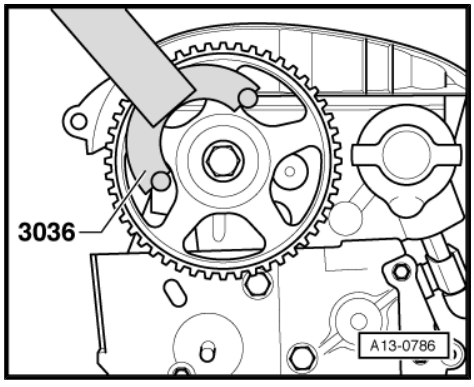
Note

- *Sealing surfaces at bottom of retaining frame and top of cylinder head may not be machined.*
- *The camshaft bearings are integrated into the cylinder head and retaining frame. Toothed belt must be slackened before removing retaining frame.*
- *If the retaining frame has been unfastened, oil seal for camshaft and sealing cap must be renewed.*

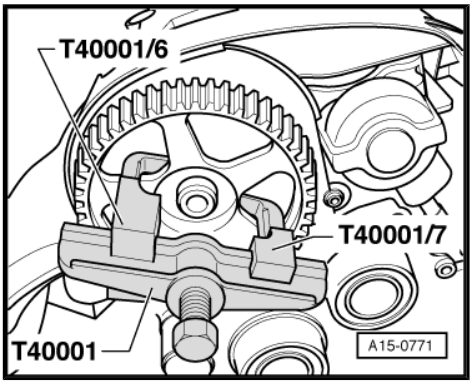
– Remove camshaft adjuster ⇒ page 111 .

– Remove toothed belt ⇒ page 82 .

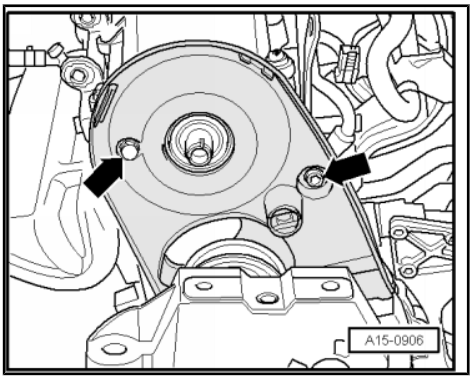
– Loosen bolt for camshaft sprocket using counterhold tool -3036- .



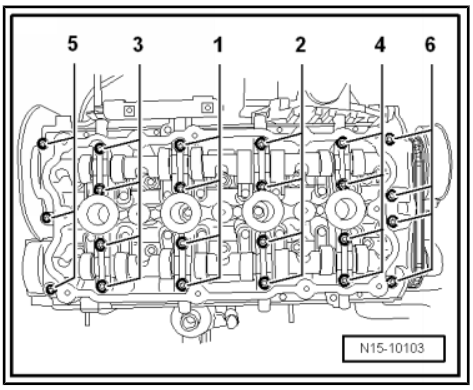
– Detach camshaft sprocket using two-arm puller -T40001- and claws -T40001/6- and -T40001/7-



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



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



Installing

• Tightening torque ⇒ page 106

Note

Renew bolts for retaining frame.

Caution

Protect lubrication system and bearings against contamination.

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

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

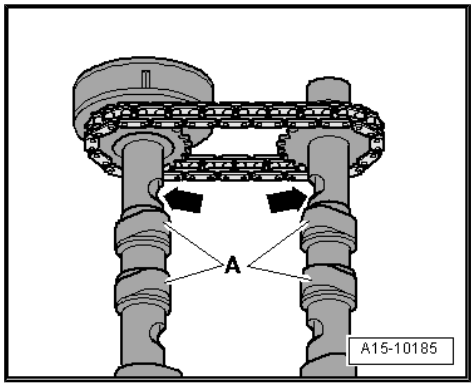
– Position drive chain as follows on chain sprockets of camshaft (removed):

• Cams -A- of cylinder 4 must face each other.

• Recesses -arrows- on both camshafts must face each other.

• The side surfaces of the recesses should be positioned exactly vertical.

– Insert camshafts together with drive chain into cylinder head and chain tensioner.

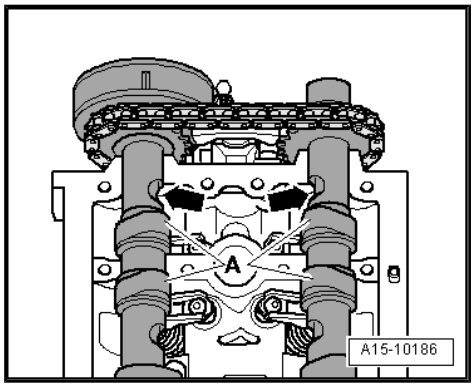


– Check “TDC” position of camshafts again:

• Cams -A- of cylinder 4 must face each other.

• Recesses -arrows- on both camshafts must face each other.

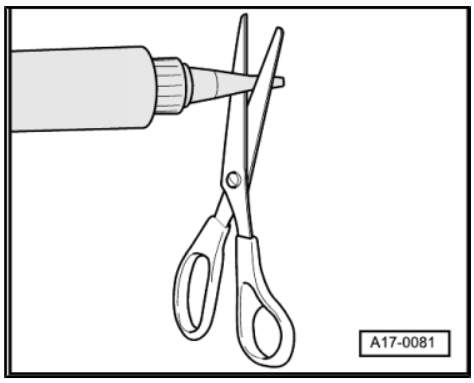
• The side surfaces of the recesses should be positioned in exactly vertical line to the cylinder head.



Note

Note the use-by date of the sealant.

– Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.0 mm).

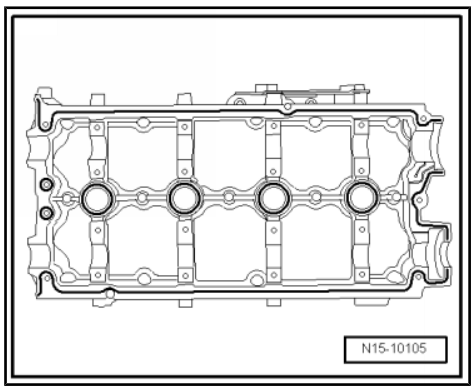


Caution

Make sure lubrication system is not clogged by excess sealant.

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

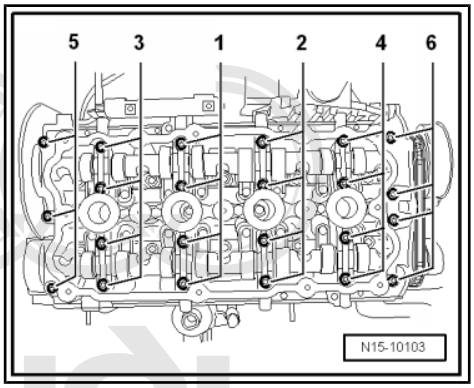
– Apply an even, slightly projecting sealant bead into the clean groove of the retaining frame.



Note

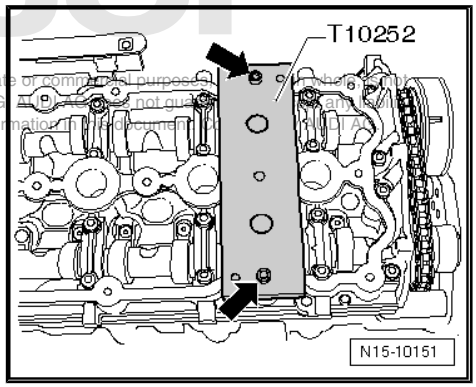
The retaining frame must be installed within 5 minutes after applying the sealant.

– Tighten bolts for retaining frame ⇒ page 106 .



– Check “TDC” position of camshafts:

• It should be possible to insert camshaft clamp -T10252- as far as stop.



Note

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

– Remove camshaft clamp -T10252- .

– Drive sealing cap ⇒ Item 25 (page 105) in approx. 1 ... 2 mm using thrust piece -3334- .

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

Caution

Avoid damage to valves and piston crowns.

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

– Install camshaft oil seal ⇒ page 108 .

– Secure toothed belt cover (rear) ⇒ page 81 .

– Insert parallel key into camshaft, ensuring it is correctly seated.

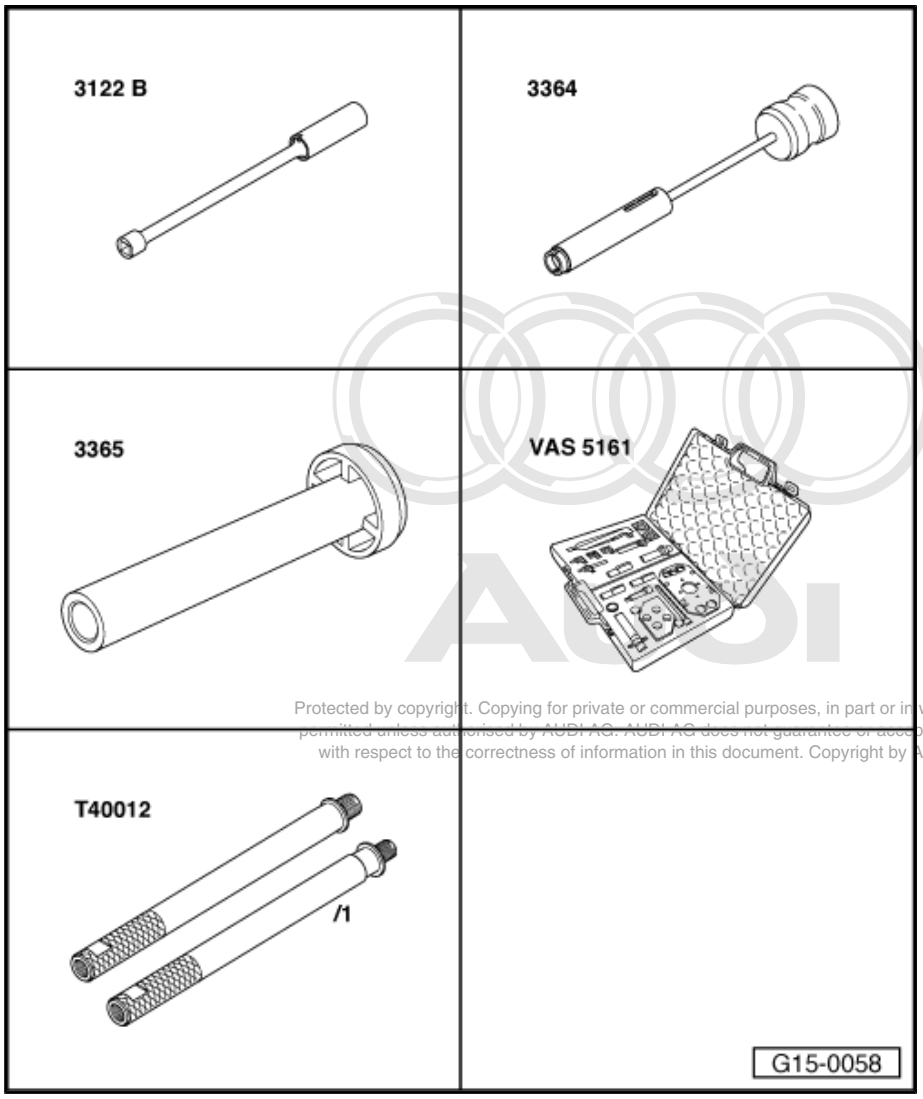
– Install camshaft adjuster ⇒ page 111 .

– Install toothed belt (adjust valve timing) ⇒ page 87 .

3.7 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

- Spark plug socket and extension -3122 B-
- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters - VAS 5161- with guide plate for 2.0 ltr. and 3.0 ltr. FSI engine -VAS 5161/19B-
- Adapter -T40012-



Procedure

Proceed as follows:

– Remove camshafts ⇒ page 115 .

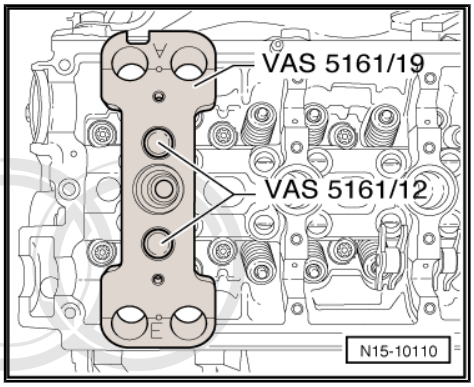
– Mark original positions of roller rocker fingers and hydraulic compensation elements for reinstallation.

– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.

– Remove spark plugs with spark plug socket and extension -3122 B- .

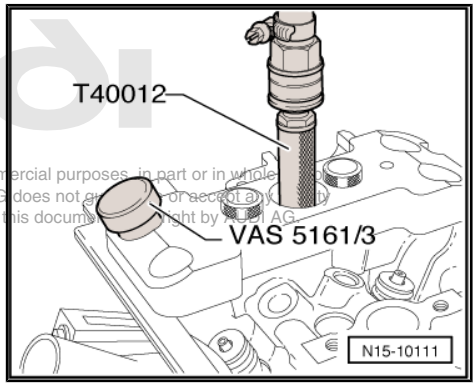
– Set piston of appropriate cylinder to “bottom dead centre”.

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



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

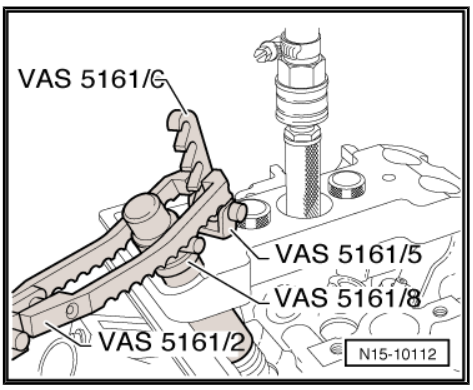
• Air pressure: at least 6 bar



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

Inlet side:

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



Exhaust side:

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

Continuation for both sides:

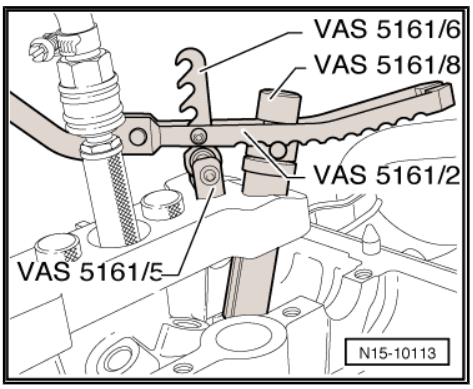
– Press down with pressure fork for assembly cartridge.
– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
– Turn knurled screw in both directions.

• The valve cotters are forced apart and are taken up by the cartridge.

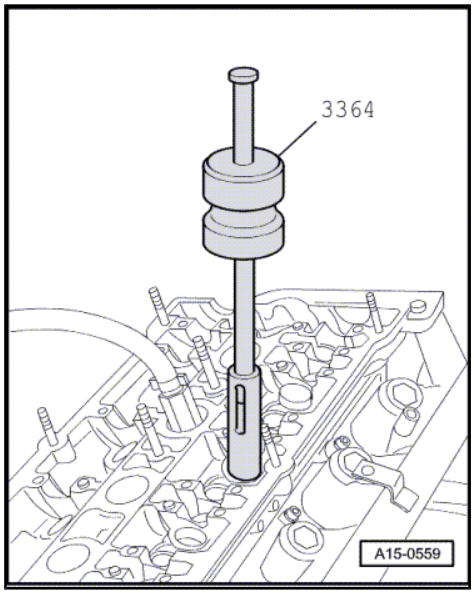
– Release pressure fork.
– Take out assembly cartridge.
– Detach guide plate and turn to one side.

• The compressed air hose remains connected.

– Detach valve spring with valve spring plate.

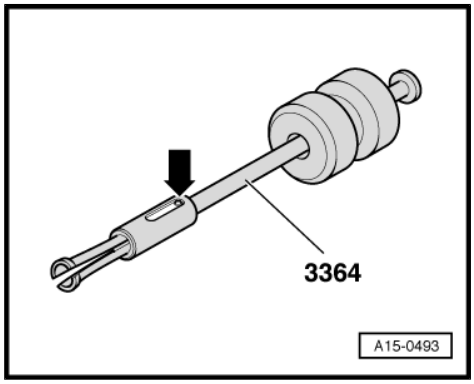


– Pull off valve stem oil seal with valve stem seal puller -3364- .

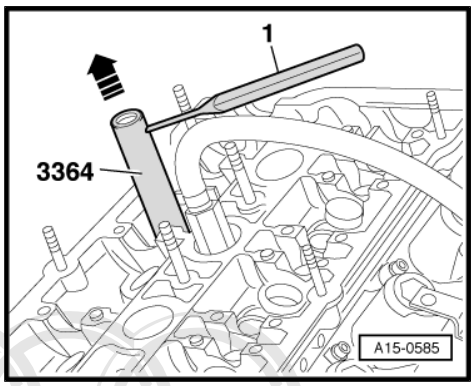


If the puller -3364- cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

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



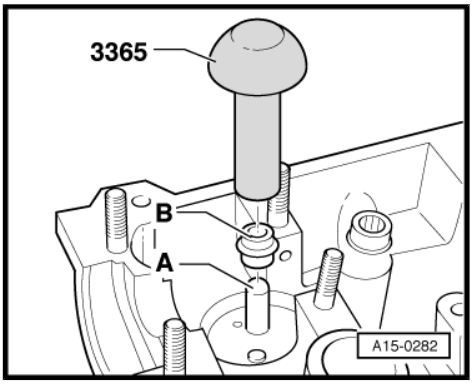
– Apply bottom section of puller -3364- to valve stem oil seal.
– Secure puller with a punch -1- or other suitable tool as shown in the illustration.
– Apply assembly lever to puller and pull out valve stem oil seal -arrow-.



Caution

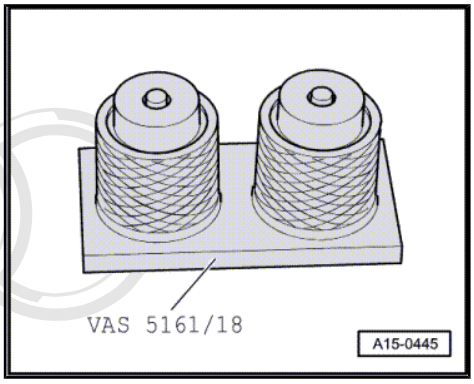
Make sure valve stem oil seals are not damaged when installing.

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



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

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



• Larger diameter of valve cotters faces upwards.
– Press assembly cartridge onto insertion device from above and take up valve cotters.
– Insert valve spring and valve spring plate.
– Secure guide plate back onto cylinder head.
– Insert assembly cartridge with knurled spacer ring in guide plate.
– Press down pressure fork and pull knurled screw upwards while turning screw in both directions.
• The valve cotters are thus inserted.
– Release the pressure fork with knurled screw still in pulled position.
– Repeat procedure for each valve.

Assembling

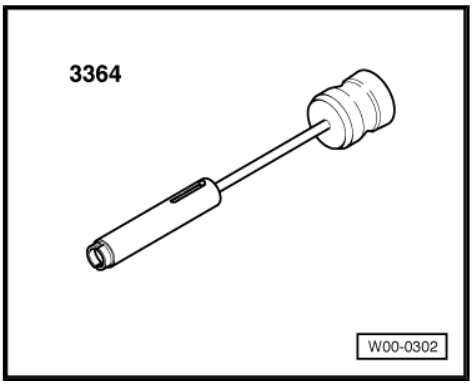
Installation is carried out in the reverse order; note the following:

– Install camshafts ⇒ page 115 .
– Install spark plugs ⇒ Maintenance ; Booklet 810 .

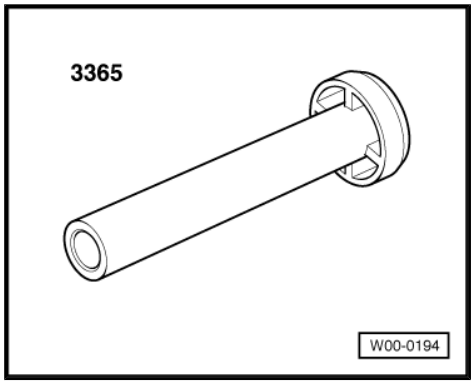
3.8 Renewing valve stem oil seals with cylinder head removed

Special tools and workshop equipment required

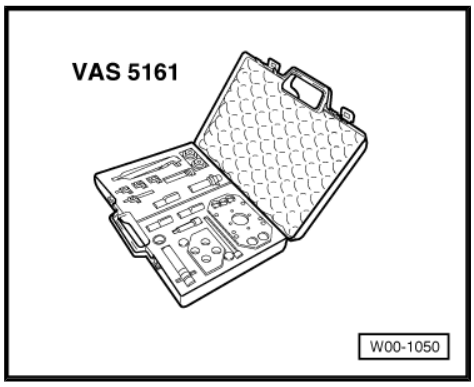
♦ Valve stem seal puller -3364-



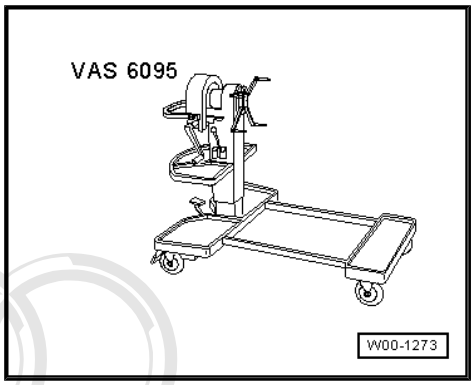
- Valve stem seal fitting tool -3365-



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



- Engine and gearbox support -VAS 6095-



- Clamping device -VAS 6419-

Procedure

Proceed as follows:

– Remove camshafts ⇒ page 115 .

– Mark original positions of roller rocker fingers and hydraulic compensation elements for reinstallation.

– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.

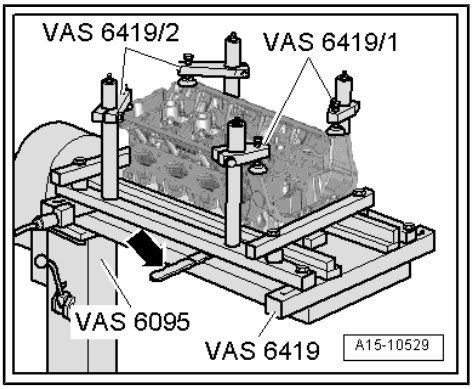
– Attach clamping device -VAS 6419- to engine and gearbox support -VAS 6095- .

– Secure cylinder head in clamping device -VAS 6419- as illustrated.

– Connect compressed air line to clamping device -VAS 6419- .

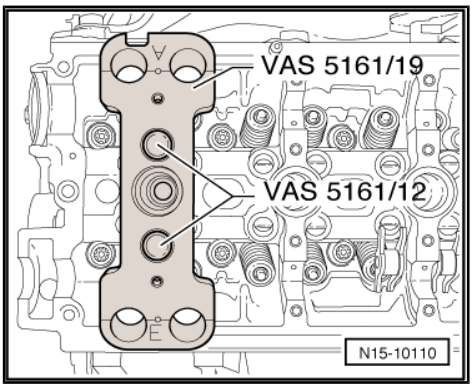
– Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.

– Apply just enough compressed air to bring air pad into contact with valve heads.

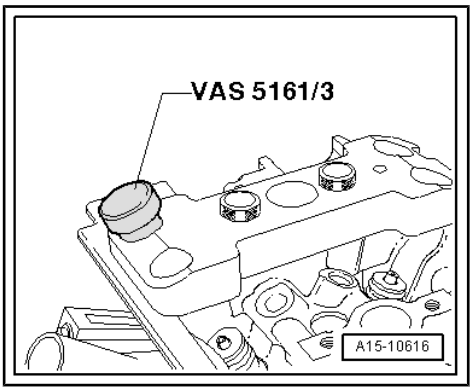


– Fit guide plate -VAS 5161/19B- from removal and installation device for valve cotters -VAS 5161- on cylinder head.

– Secure guide plate with knurled screws -VAS 5161/12- .



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

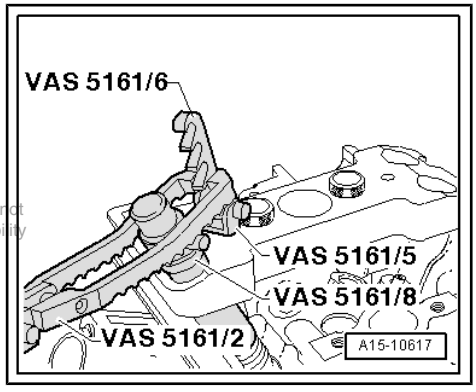


– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.

– Insert assembly cartridge -VAS 5161/8- in guide plate.

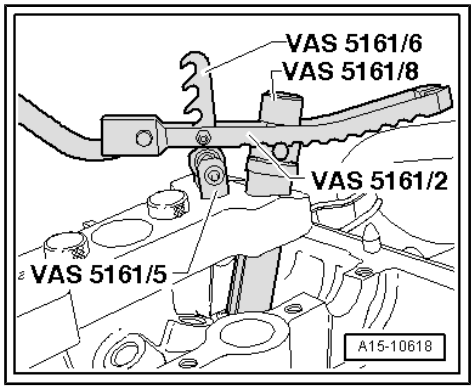
Inlet side:

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



Exhaust side:

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



Continuation for both sides:

– Press down with pressure fork for assembly cartridge.

– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.

– Turn knurled screw in both directions.

• The valve cotters are forced apart and are taken up by the cartridge.

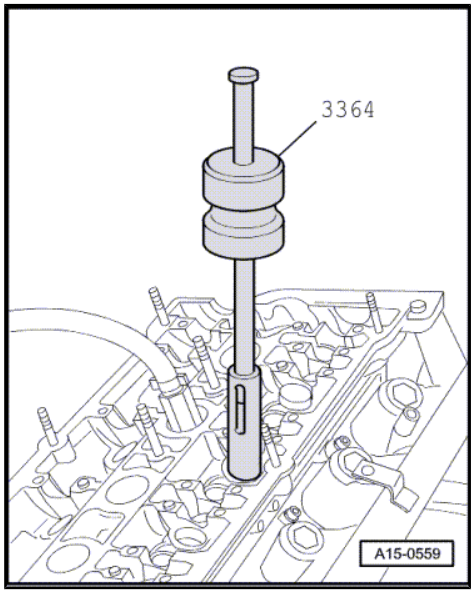
– Release pressure fork.

– Take out assembly cartridge.

– Detach guide plate and turn to one side.

– Detach valve spring with valve spring plate.

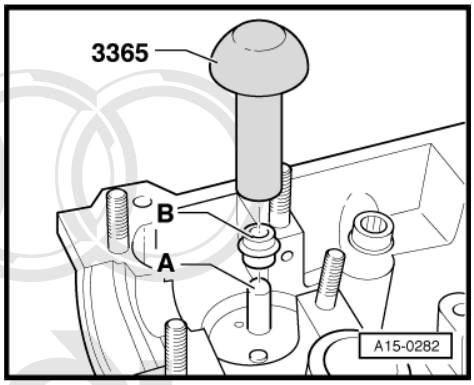
– Pull off valve stem oil seal with valve stem seal puller -3364- .



Caution

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

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



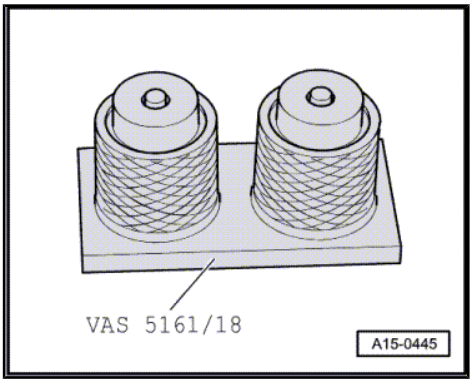
– Lightly oil sealing lip of valve stem oil seal.

– Slide valve stem oil seal onto plastic sleeve.

– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .

– Remove plastic sleeve.

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



- Larger diameter of valve cotters faces upwards.

– Press assembly cartridge onto insertion device from above and take up valve cotters.

– Insert valve spring and valve spring plate.

– Secure guide plate back onto cylinder head.

– Insert assembly cartridge with knurled spacer ring in guide plate.

– Press down pressure fork and pull knurled screw upwards while turning screw in both directions.

- The valve cotters are thus inserted.

– Release the pressure fork with knurled screw still in pulled position.

– Repeat procedure for each valve.

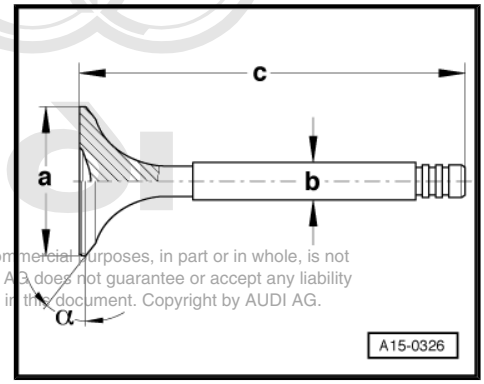
Installation is carried out in the reverse order; note the following:

– Install camshafts ⇒ page 115 .

3.9 Valve dimensions

Note

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



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

WARNING

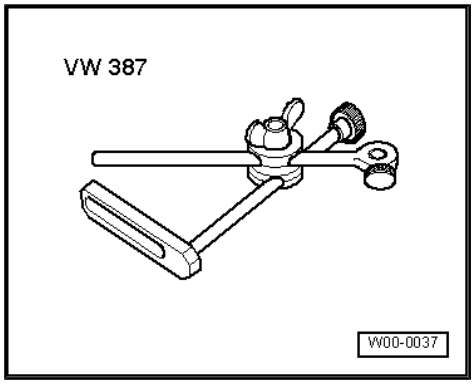
Care must be taken when disposing of old sodium-cooled exhaust valves - risk of injury.

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

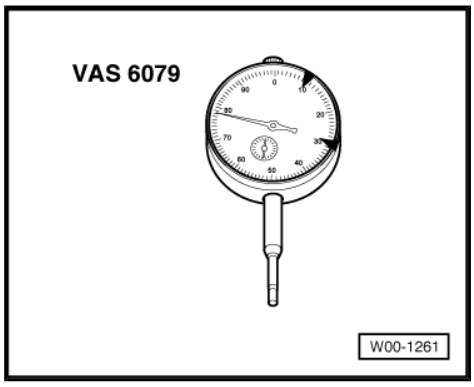
3.10 Checking valve guides

Special tools and workshop equipment required

♦ Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-



Procedure

Proceed as follows:

Note

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

♦ *Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.*

– Insert valve into guide.

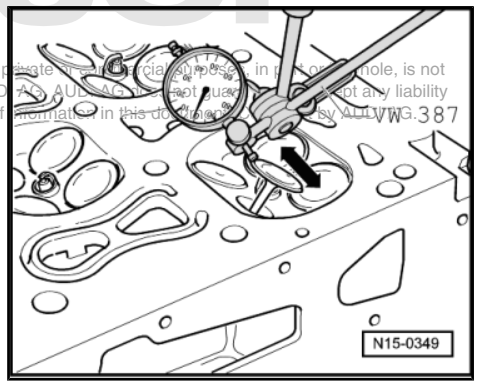
• End of valve stem must be flush with valve guide.

– Determine amount of sideways play.

• Wear limit: 0.8 mm.

– If the wear limit is exceeded, repeat the measurement with new valves.

– Renew cylinder head if wear limit is still exceeded.



Note

Valve guides cannot be renewed.

3.11 Checking valves

– Visually inspect for scoring on valve stems and valve seat surfaces.

– Renew valve if scoring is clearly visible.

17 – Lubrication

1 Oil pump and sump

Note

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

Caution

Risk of damage to catalytic converter.

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

1.1 Sump - exploded view

1 - Bolt
- ❑ 9 Nm

2 - Oil level and oil temperature sender -G266-
- ❑ Removing and installing ⇒ page 131

3 - Seal
- ❑ Renew

4 - Bolt
- ❑ Tightening torque and sequence ⇒ page 57

5 - Sump
- ❑ Clean sealing surface before installing
- ❑ Removing and installing ⇒ page 131

6 - Baffle plate

7 - Bolt
- ❑ 9 Nm

8 - Oil return pipe

9 - Bolt
- ❑ Tightening torque ⇒ Item 13 (page 180)

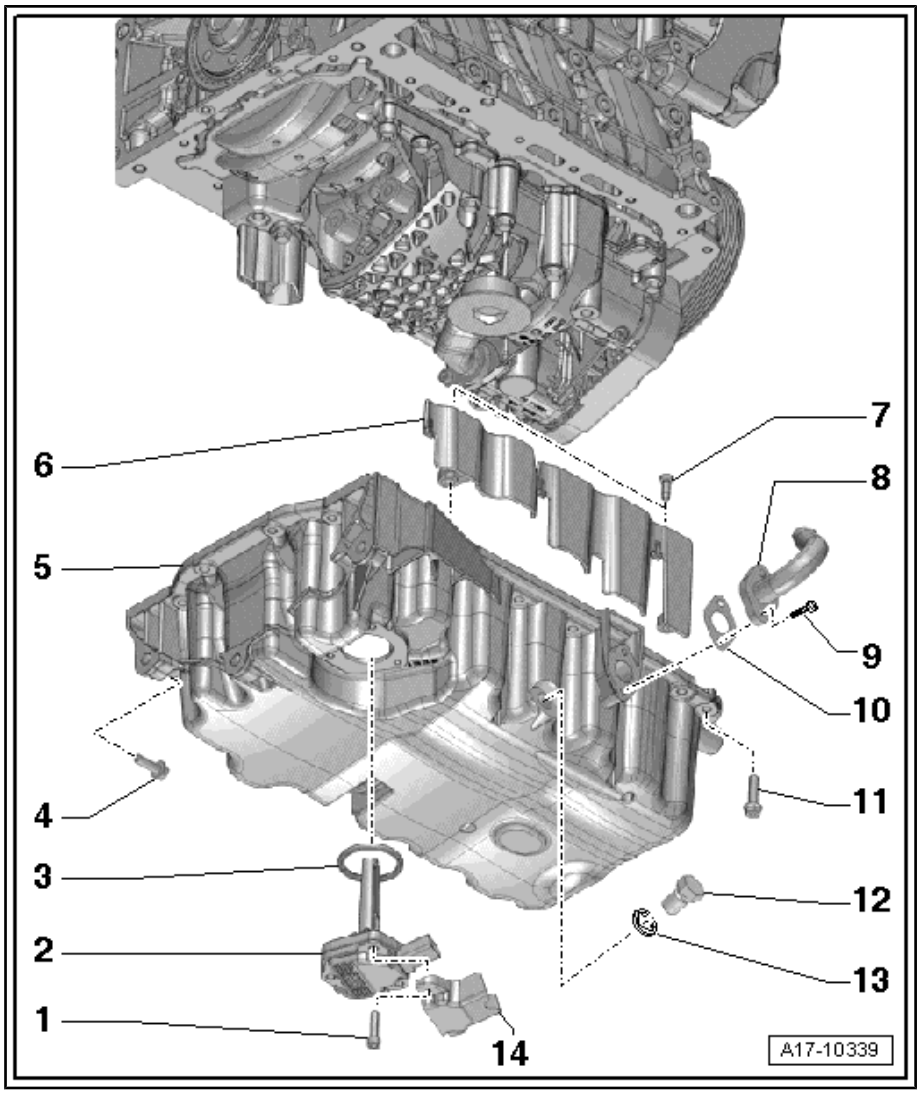
10 - Seal
- ❑ Renew

11 - Bolt
- ❑ Tightening torque and sequence ⇒ page 130

12 - Oil drain plug
- ❑ 30 Nm

13 - Seal
- ❑ Renew

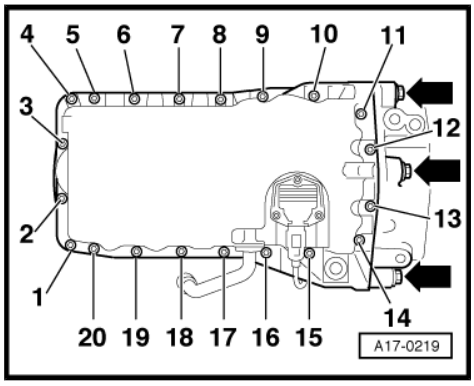
14 - Cover



Sump - tightening torque and sequence

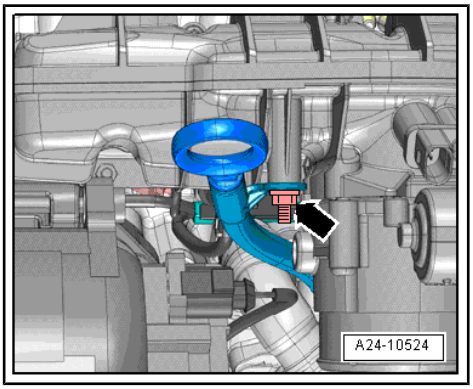
– Tighten bolts securing sump in three stages as follows:

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



Guide tube for oil dipstick - tightening torque

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



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

Removing

Proceed as follows:

– Drain off engine oil ⇒ Maintenance ; Booklet 810 .

– Unplug electrical connector -5-.

– Unscrew three bolts -1- and remove cover -2-.

– Pull oil level and oil temperature sender -G266- -item 3- off sump and remove together with seal -4-.

Installing

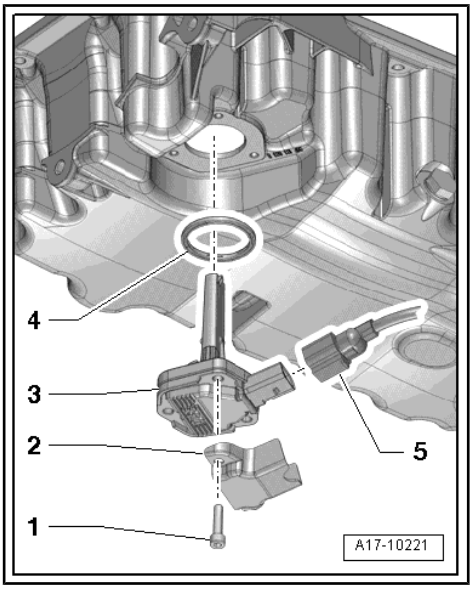
• Tightening torque ⇒ page 130

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

Note

Renew the seal.

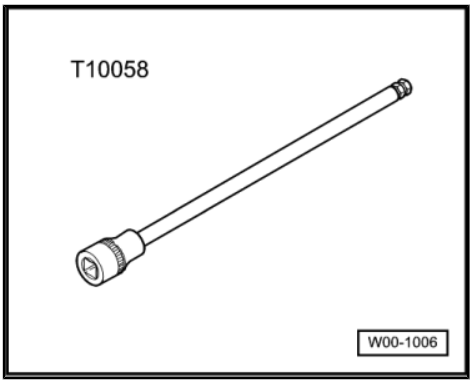
– Fill up with engine oil and check engine oil level ⇒ Maintenance ; Booklet 810 .



1.3 Removing and installing sump

Special tools and workshop equipment required

♦ Allen key (long reach) -T10058-



♦ Electric drill with plastic brush attachment

♦ Safety goggles

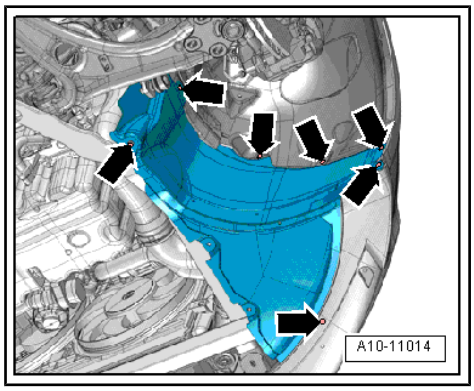
♦ Sealant ⇒ Electronic parts catalogue

Removing

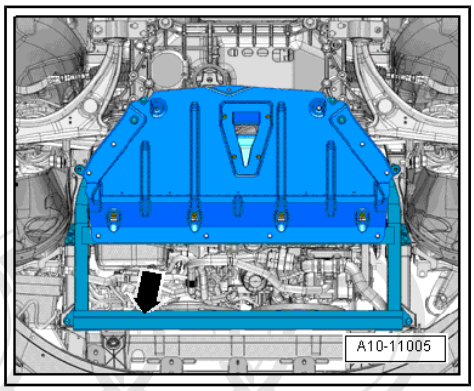
Proceed as follows:

– Drain off engine oil ⇒ Maintenance ; Booklet 810 .

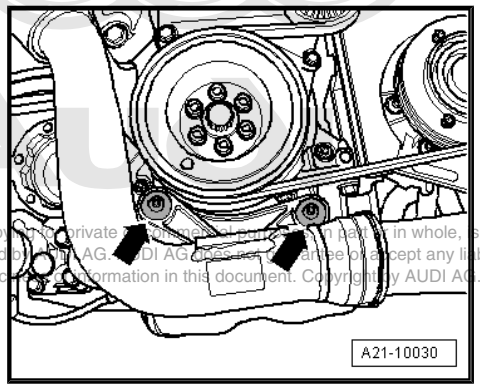
– Remove noise insulation (right-side) -arrows-.



– On TTS Roadster, remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. Gr. 66 .



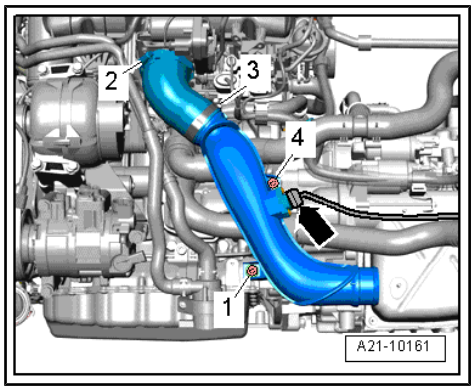
– Unscrew bolts -arrows- and remove air pipe.



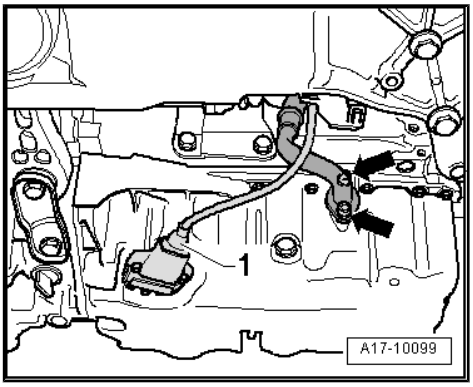
– Remove bolt -1-.

Note

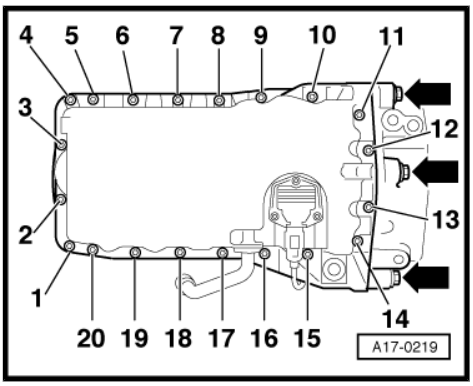
Disregard items marked -2, 3, 4- and -arrow-.



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



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



Installing

• Tightening torque ⇒ page 130

Caution

Protect lubrication system and bearings against contamination.

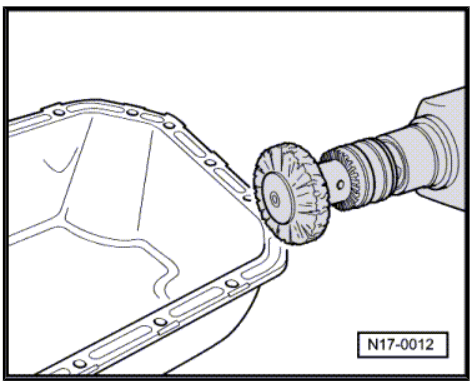
- *Cover exposed parts of the engine.*

WARNING

Protect eyes against injuries.

- *Wear safety goggles.*

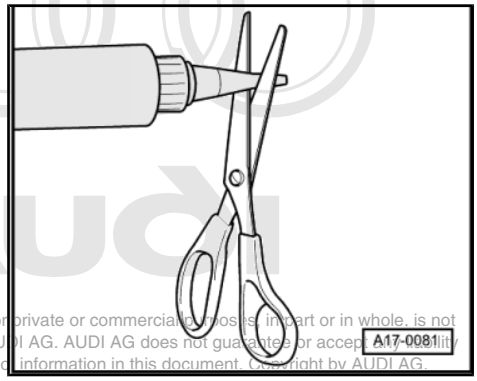
– Remove sealant residue from sump and cylinder block using rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.



Note

Note the use-by date of the sealant.

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



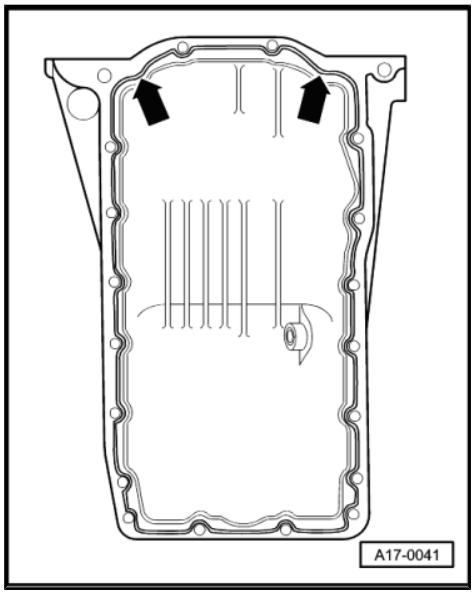
Caution

Make sure lubrication system is not clogged by excess sealant.

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

– Apply bead of sealant onto clean sealing surface of sump, as illustrated.

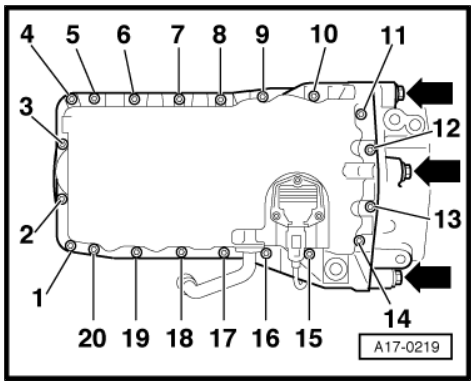
- Thickness of sealant bead: 2 ... 3 mm



Note

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

– Fit sump and tighten bolts ⇒ page 130 .



Note

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

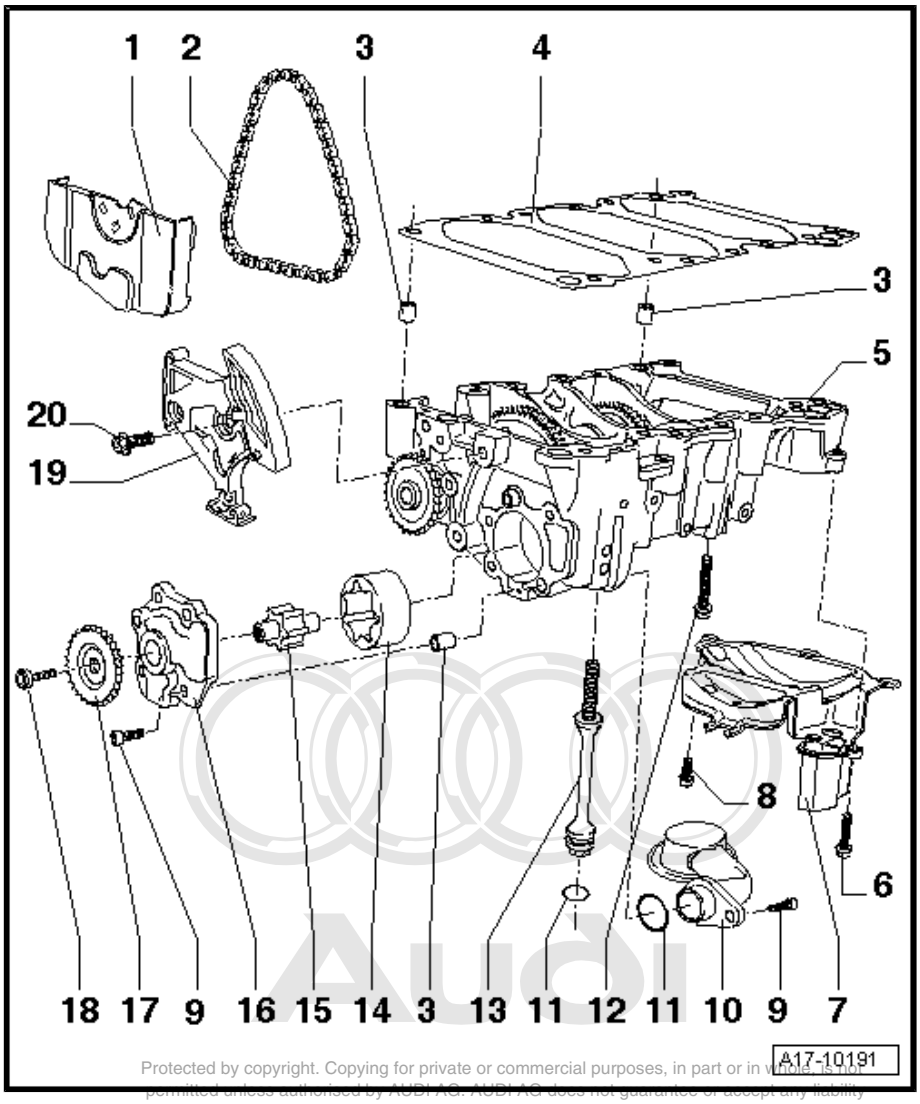
Remaining installation steps are carried out in reverse sequence; note the following:

– Install air pipe ⇒ page 194 .

– Install noise insulation frame ⇒ Rep. Gr. 66 .

– Fill up with engine oil and check engine oil level ⇒ Maintenance ; Booklet 810 .

1.4 Balance shaft assembly with oil pump - exploded view



1 - Chain guard

2 - Chain

- ❑ Before removing, mark running direction with paint

3 - Dowel sleeves

4 - Spacer plate

5 - Balance shaft assembly with oil pump

- ❑ Before installing, check that the two dowel sleeves for centralising oil pump and cylinder block are fitted
- ❑ Do not dismantle
- ❑ Do not unscrew chain sprocket for balance shaft assembly
- ❑ Removing and installing ⇒ page 136

6 - Bolt

- ❑ 9 Nm

7 - Baffle plate

8 - Bolt

- ❑ 20 Nm

9 - Bolt

- ❑ 8 Nm

10 - Oil intake pipe

- ❑ Clean strainer if dirty

11 - O-ring

- ❑ Renew

12 - Bolt

- ❑ Renew
- ❑ Different bolt lengths ⇒ page 136
- ❑ Tightening torque and sequence ⇒ page 136

13 - Bolt

- ❑ Renew
- ❑ Different bolt lengths ⇒ page 136
- ❑ Tightening torque and sequence ⇒ page 136

14 - Outer rotor

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

15 - Inner rotor

- ❑ Check contact surfaces for scores

16 - Oil pump cover

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

17 - Chain sprocket

- ❑ Can only be installed in one position

18 - Bolt

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

19 - Chain tensioner with tensioning rail

- ❑ To detach, remove balance shaft assembly ⇒ page 136
- ❑ Pre-tension before installing ⇒ page 139

20 - Bolt

- ❑ 15 Nm

Bolts for balance shaft housing

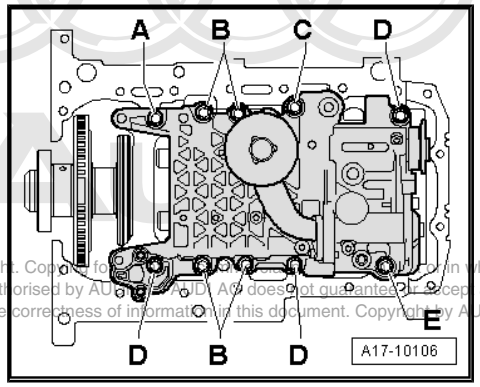
A - Flange bolt M7x40

B - Flange bolt M7x70

C - Flange bolt M7x90

D - Flange bolt M7x55

E - Screw plug with O-ring

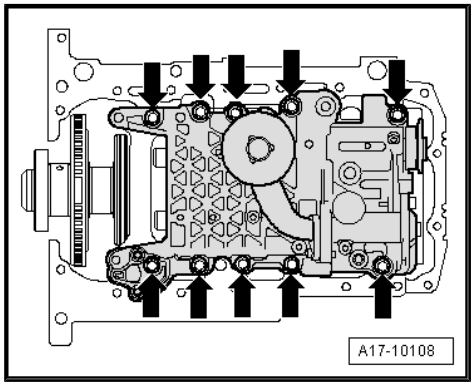


Balance shaft housing - tightening torque and sequence

– Renew bolts -arrows- for balance shaft housing.

– Tighten bolts in 3 stages as follows:

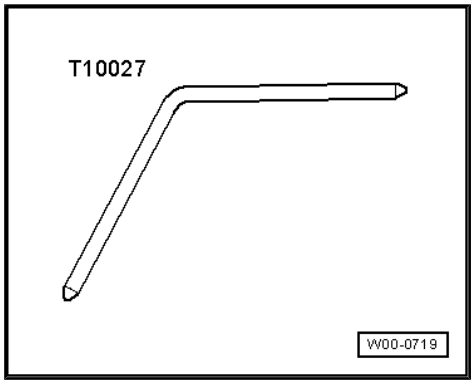
1. Screw in bolts by hand until they make contact.
2. Tighten bolts to 15 Nm in diagonal sequence starting from inside and working outwards.
3. Turn bolts 90° further in diagonal sequence starting from inside and working outwards.



1.5 Removing and installing balance shaft assembly with oil pump

Special tools and workshop equipment required

♦ Locking pin -T10027-

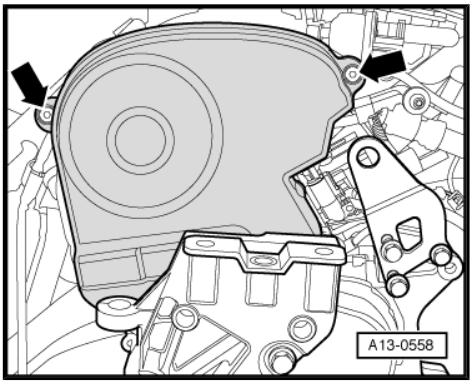


Removing

Proceed as follows:

– Remove sump ⇒ page 131 .

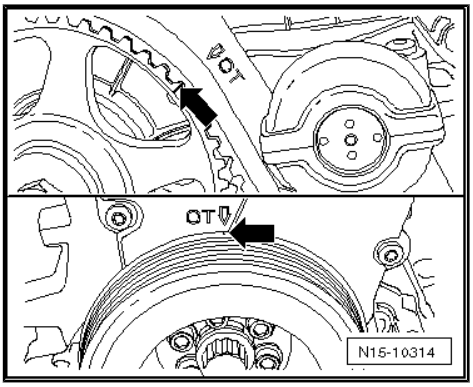
– Unscrew bolts -arrows- and remove toothed belt cover (top section).



Caution

Irreparable damage can be caused if the toothed belt slips.

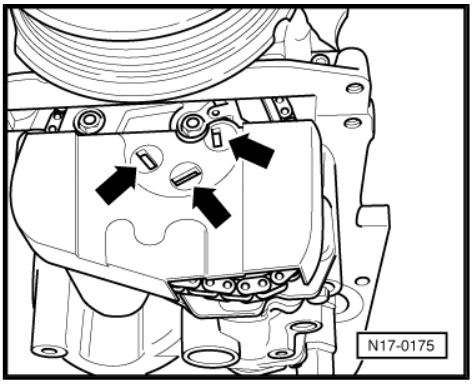
- ***Turn crankshaft only in direction of engine rotation.***



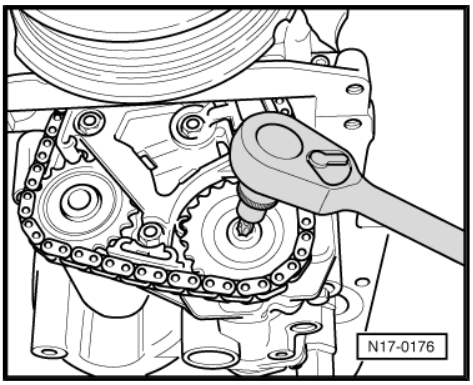
– Rotate crankshaft by turning bolt for toothed belt sprocket until camshaft sprocket is positioned at “TDC”.

- Marking on camshaft sprocket must face arrow on toothed belt cover -top arrow-.
- Notch on vibration damper must face arrow on toothed belt cover -bottom arrow-.

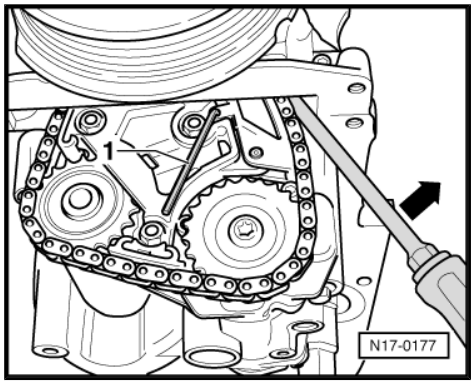
– Pull off chain guard; if necessary, retaining tabs can be released with a small screwdriver (insert in openings -arrows-).



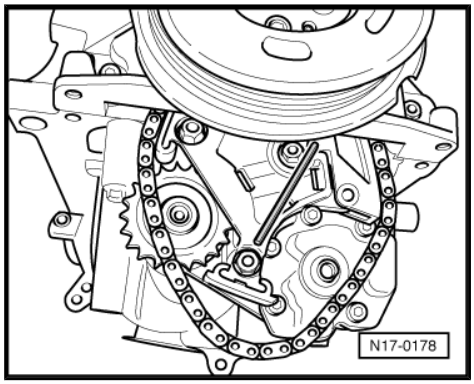
– Counterhold crankshaft at bolt for toothed belt sprocket and slacken bolt for chain sprocket for oil pump.



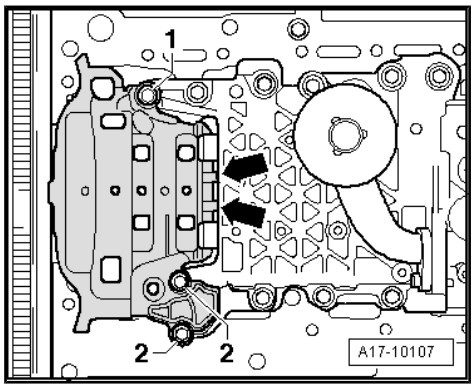
– Use screwdriver to slacken chain rail -arrow- and lock it in position with hexagon key (3 mm) -1-.



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



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

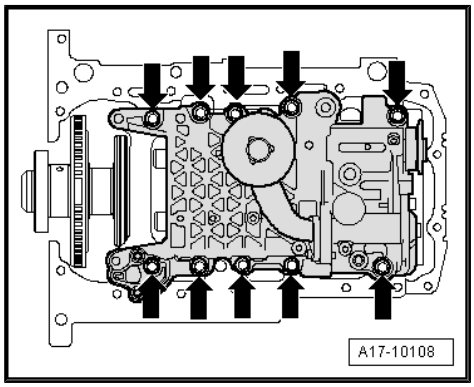


Note

Disregard -arrows-.

– Slacken bolts -arrows-, working from outside inwards.

– Remove bolts and detach balance shaft assembly.



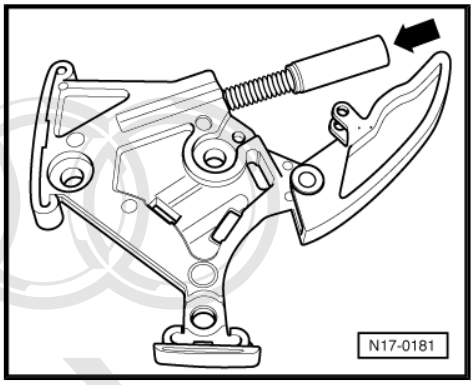
Installing

- Tightening torques ⇒ page 135 , ⇒ page 136

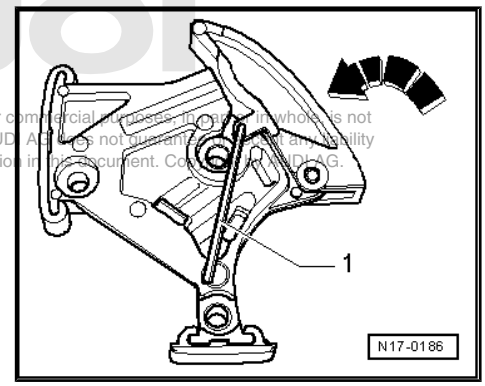
Note

- *Renew the bolts tightened with specified tightening angle.*
- *Renew seal on bolt for balance shaft assembly ⇒ Item 13 (page 135) .*

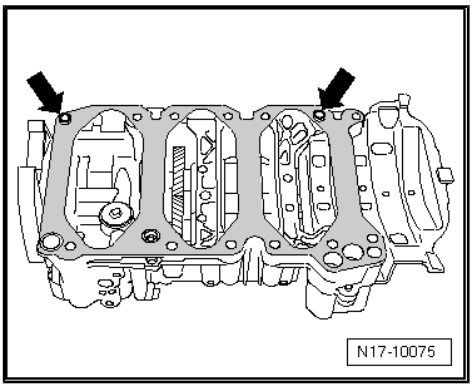
– If necessary, pre-tension chain tensioner:
– Pre-tension piston by hand -arrow-.



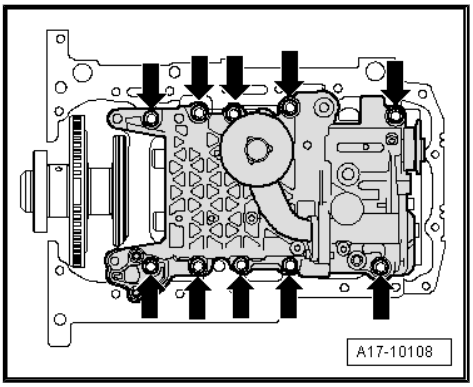
– Press chain rail in direction of -arrow- and lock in place using hexagon key (3 mm) -item 1-.



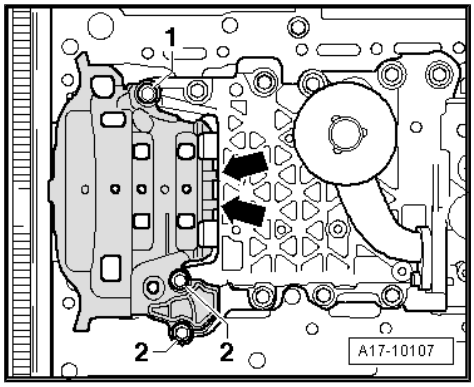
– Fit spacer plate onto dowel sleeves on balance shaft assembly as shown -arrows-.



– Fit balance shaft assembly with oil pump and spacer plate.
– Fit bolts -arrows- with correct length ⇒ page 136 and tighten ⇒ page 136 .

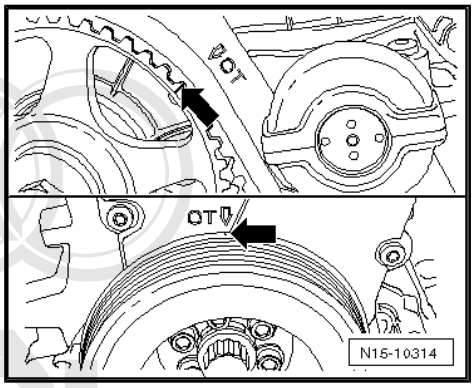


– To install baffle plate, insert lugs -arrows- into balance shaft assembly.



– Check whether the camshaft and the crankshaft are positioned at “TDC”:

• The markings on the camshaft -top arrow- and the crankshaft -bottom arrow- must be aligned.



– Align mark -arrow- on balance shaft sprocket with locating hole.

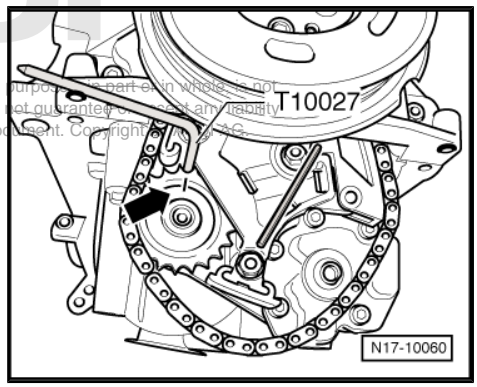
– Use locking pin -T10027- to lock balance shaft sprocket in this position.

– Fit drive chain onto balance shaft sprocket.

– Install chain sprocket for oil pump (hand-tighten bolts until they make contact).

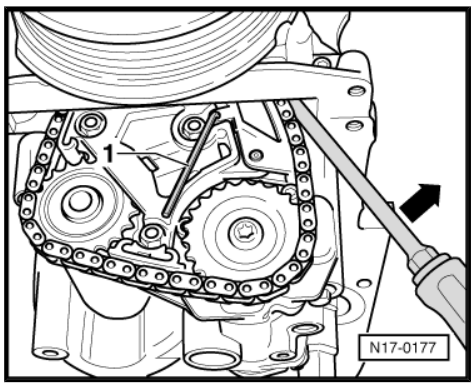
• Chain sprocket for oil pump can only be installed correctly in one position.

• When installing, you may turn ONLY the oil pump.



– Remove hexagon key (3 mm) -item 1-.

– Counterhold crankshaft at bolt for toothed belt sprocket and tighten bolt for chain sprocket for oil pump.



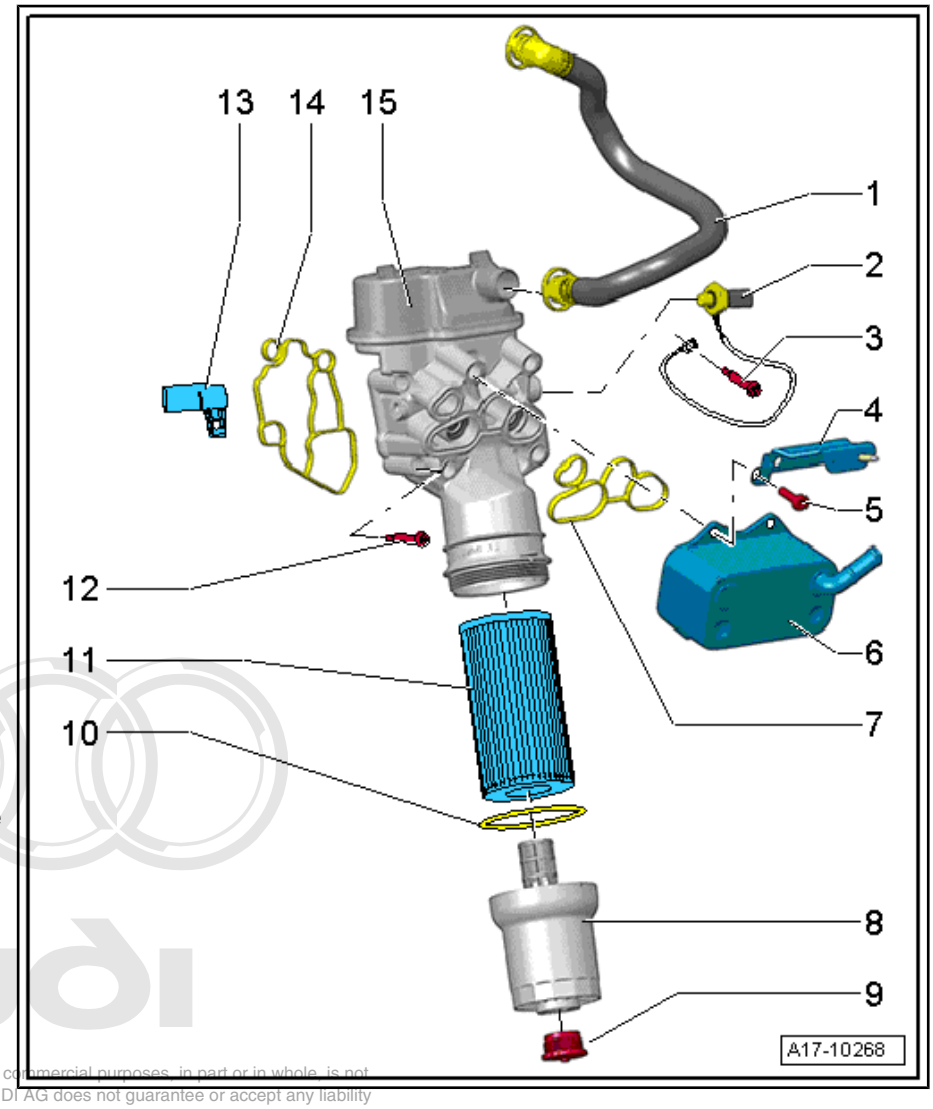
Remaining installation steps are carried out in reverse sequence; note the following:

– Install toothed belt cover (top section) ⇒ page 81 .

– Install sump ⇒ page 131 .

2 Oil filter bracket and oil cooler

2.1 Oil filter bracket and oil cooler - exploded view



1 - Pipe
- ❑ For crankcase breather

2 - Oil pressure switch -F1-
- ❑ Version fitted in vehicle may differ from illustration
- ❑ Black insulation
- ❑ Opening/closing pressure 1.2 ... 1.6 bar.
- ❑ Checking ⇒ page 149
- ❑ Removing and installing ⇒ page 147
- ❑ 21 Nm

3 - Not fitted

4 - Bracket

5 - Bolt
- ❑ 15 Nm

6 - Oil cooler
- ❑ See note ⇒ page 129
- ❑ Ensure clearance from surrounding components
- ❑ Diagram of coolant hose connections ⇒ page 153
- ❑ Removing and installing ⇒ page 143

7 - Gasket
- ❑ Renew

8 - Oil filter housing
- ❑ Removing and installing ⇒ Maintenance ; Booklet 810
- ❑ Draining ⇒ page 142

9 - Screw plug

10 - Seal
- ❑ Renew
- ❑ Lubricate lightly with oil
- ❑ Installation position ⇒ page 142

11 - Oil filter element
- ❑ Removing and installing ⇒ Maintenance ; Booklet 810

12 - Bolt
- ❑ 15 Nm

13 - Baffle plate
- ❑ Installation position ⇒ page 142

14 - Gasket

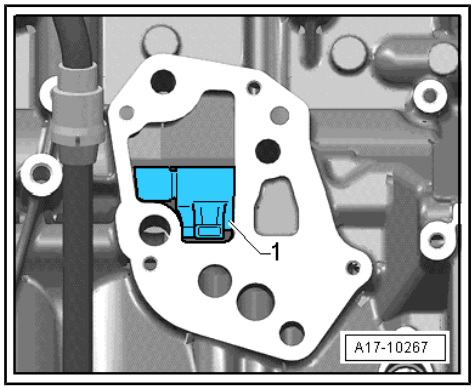
❑ Renew

15 - Oil filter bracket

❑ Removing and installing ⇒ page 147

Installation position of baffle plate

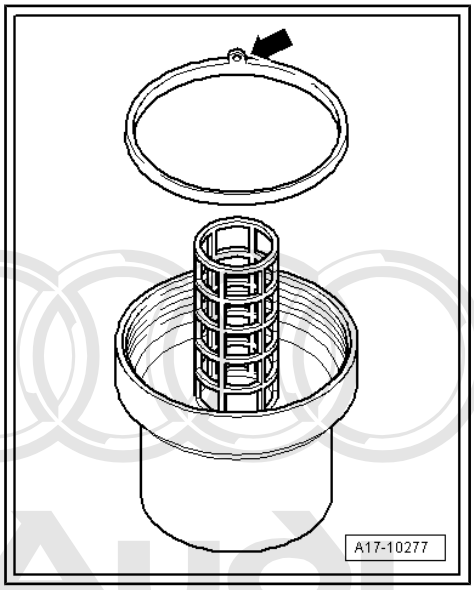
– Insert baffle plate -1- into cylinder block, as shown in illustration.



Installation position of seal

– Note position of tab on seal -arrow-.

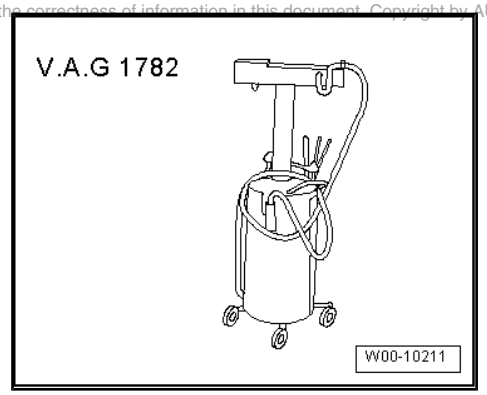
• Flat side of seal must face outwards.



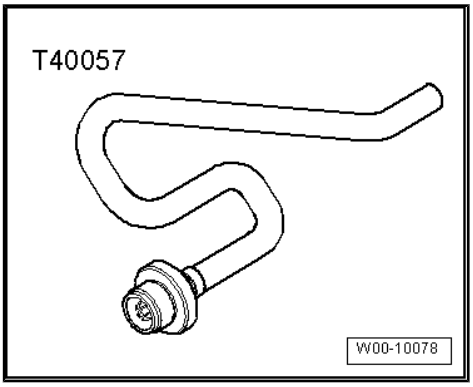
2.2 Draining oil filter housing

Special tools and workshop equipment required

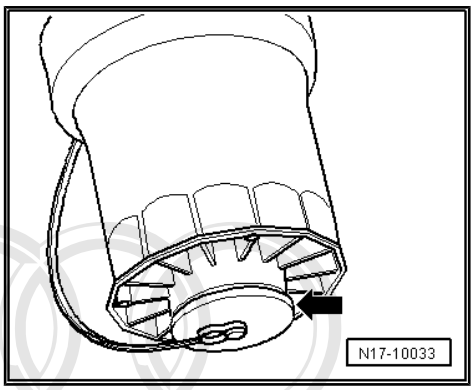
♦ Used oil collection and extraction unit -V.A.G 1782-



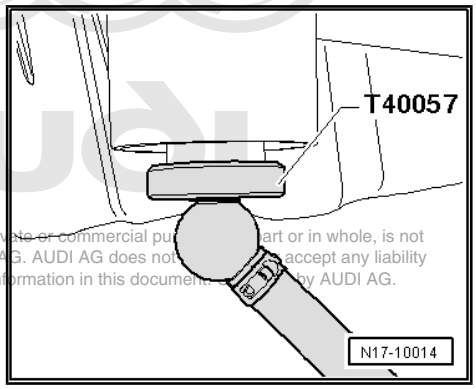
♦ Oil drain adapter -T40057-



– Remove dust cap -arrow- on oil filter housing.
– Hold hose of oil drain adapter -T40057- in used oil collection and extraction unit -V.A.G 1782- .



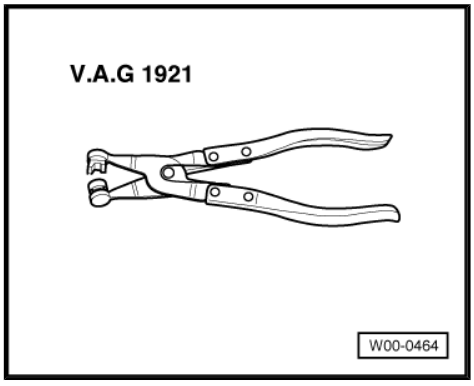
– Screw oil drain adapter into oil filter housing.
• A valve in the oil filter housing will be opened when the oil drain adapter is screwed in.
– Allow engine oil to drain out.



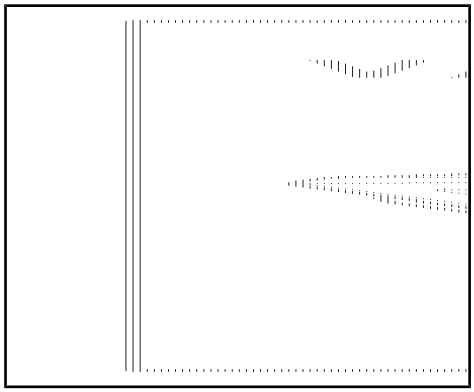
2.3 Removing and installing oil cooler

Special tools and workshop equipment required

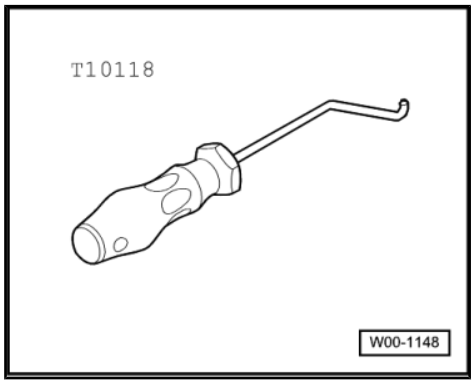
♦ Hose clip pliers -V.A.G 1921-



- Drip tray for workshop hoist -VAS 6208-



- Assembly tool -T10118-



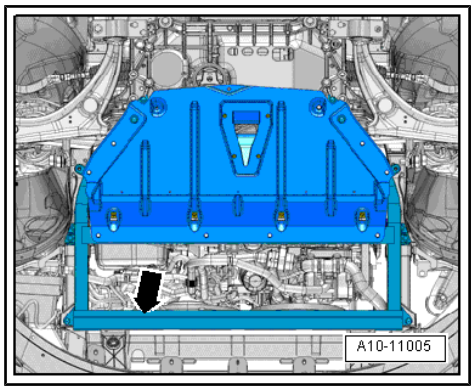
Removing

Proceed as follows:

– Drain coolant ⇒ page 154 .

– Remove radiator cowl ⇒ page 173 .

– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. Gr. 66 .

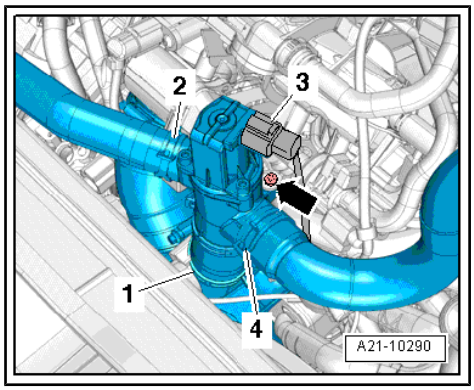


– Unplug electrical connector -3-.

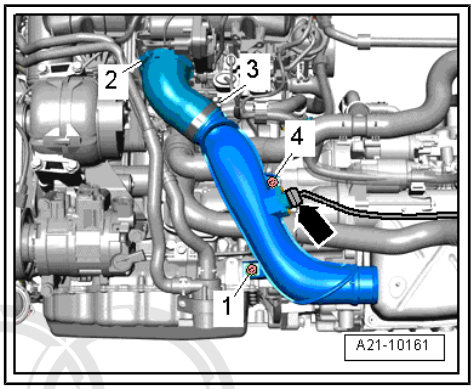
– Remove bolt -arrow-.

– Detach hose -2-.

– Loosen hose clip -1-, pull turbocharger air recirculation valve -N249- off air pipe and move clear (hose -4- remains connected).



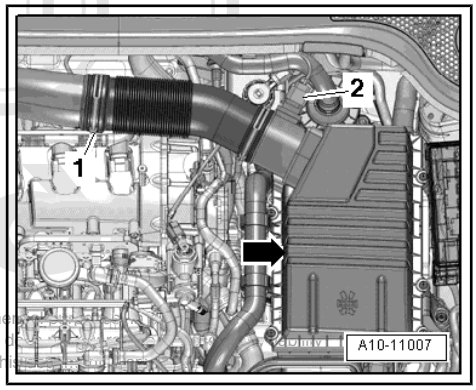
– Unplug electrical connector -arrow- at charge air pressure sender -G31- .
– Remove bolt -1- and nut -4-.
– Loosen hose clip -2- and detach air pipe.



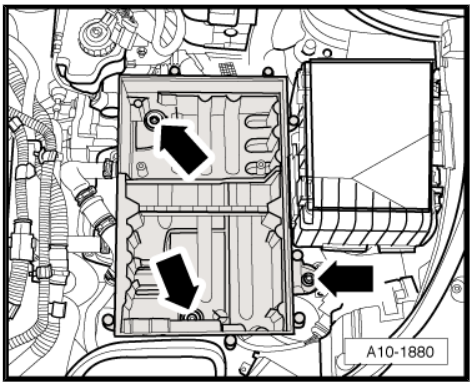
Note

Disregard item -3-.

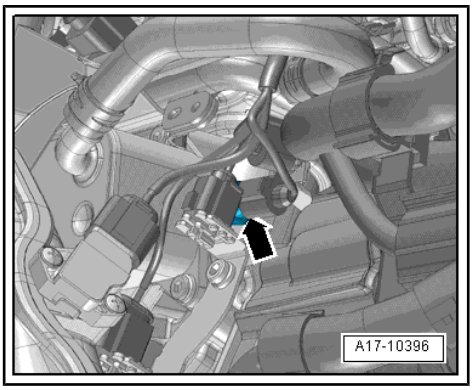
– Release hose clip -1- and detach air hose.
– Unplug electrical connector -2- for air mass meter -G70- .
– Unscrew top section of air cleaner housing -arrow- and remove air filter element.



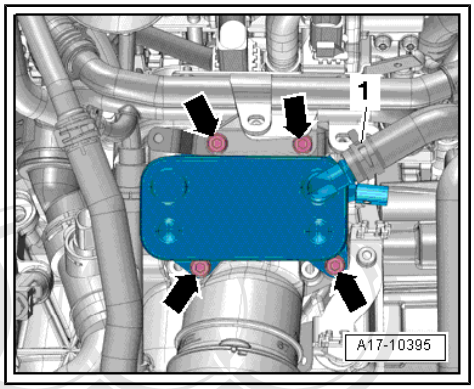
– Remove bolts -arrows- and detach bottom section of air cleaner housing.



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



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



Installing

• Tightening torques ⇒ page 141

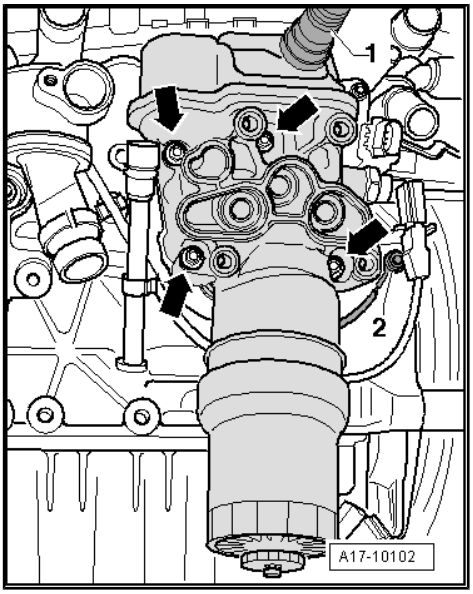
Installation is carried out in the reverse order; note the following:

Note

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

– Install air pipe ⇒ page 194 .
– Install air cleaner housing and air filter element ⇒ Rep. Gr. 24 .
– Install noise insulation frame ⇒ Rep. Gr. 66 .
– Install radiator cowl ⇒ page 173 .
– Fill up with coolant ⇒ page 156 .

2.4 Removing and installing oil filter bracket



Removing

Proceed as follows:

– Remove oil cooler ⇒ page 143 .
– Drain oil filter housing ⇒ page 142 .
– Press release tabs and disconnect crankcase breather pipe -1-.
– Unscrew bolts -arrows- and remove oil filter bracket.

Note

Disregard item -2-.

Installing

Tightening torques ⇒ page 141

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

Note

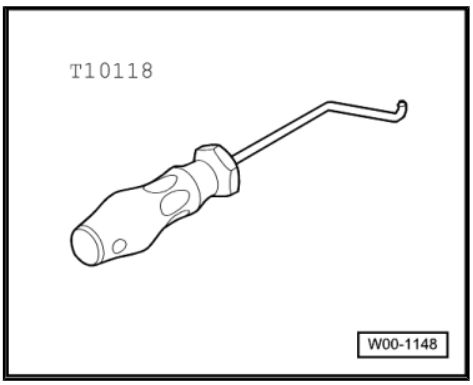
- *Renew seals and gaskets.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

– Install baffle plate ⇒ page 142 .
– Install oil cooler ⇒ page 143 .

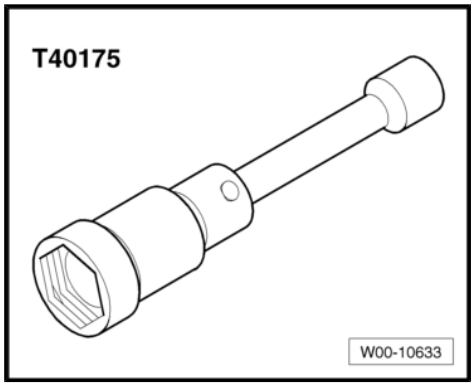
2.5 Removing and installing oil pressure switch -F1-

Special tools and workshop equipment required

- Assembly tool -T10118-



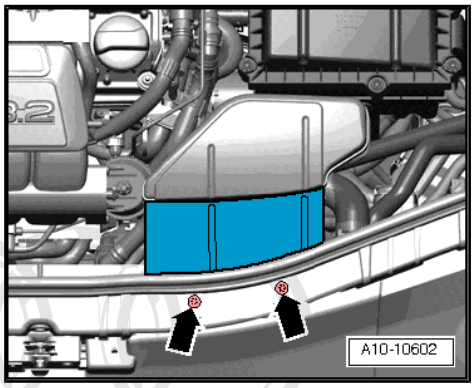
♦ U/J extension and socket for oil pressure switch -T40175-



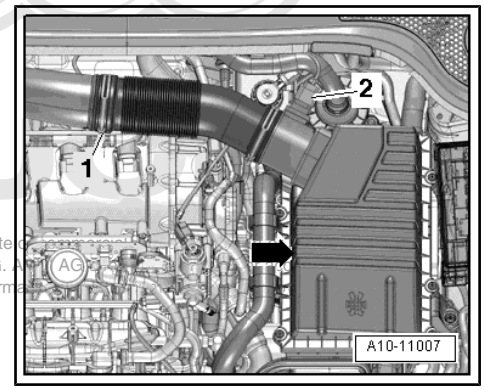
Removing

Proceed as follows:

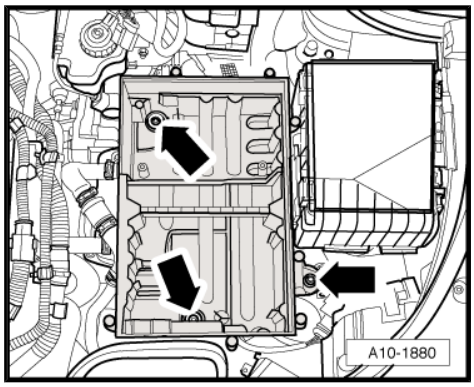
– Unscrew bolts -arrows- and remove air duct.



– Release hose clip -1- and detach air hose.
– Unplug electrical connector -2- for air mass meter -G70- .
– Unscrew top section of air cleaner housing -arrow- and remove air filter element.

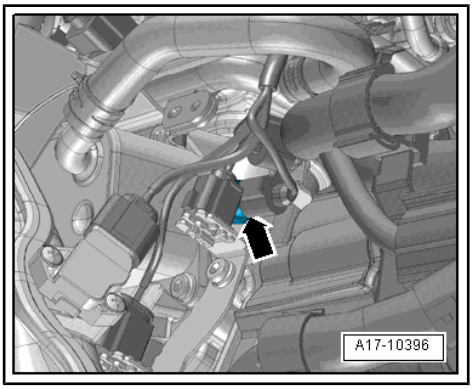


– Remove bolts -arrows- and detach bottom section of air cleaner housing.



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

– Unscrew oil pressure switch -F1- using U/J extension and socket for oil pressure switch -T40175- .



Installing

- Tightening torque ⇒ page 141

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

Note

♦ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*

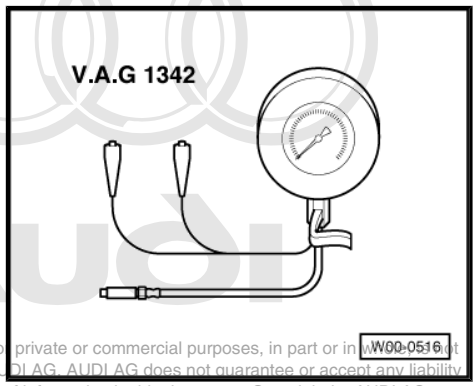
♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install air cleaner housing and air filter element ⇒ Rep. Gr. 24 .

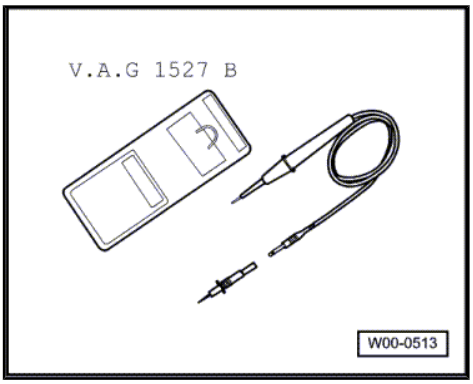
2.6 Checking oil pressure switch -F1-

Special tools and workshop equipment required

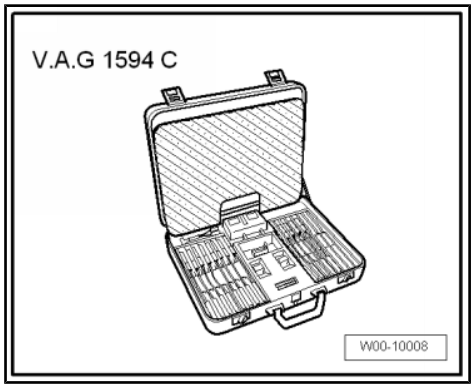
♦ Oil pressure tester -V.A.G 1342-



♦ Voltage tester -V.A.G 1527B-



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



Procedure

Proceed as follows:

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

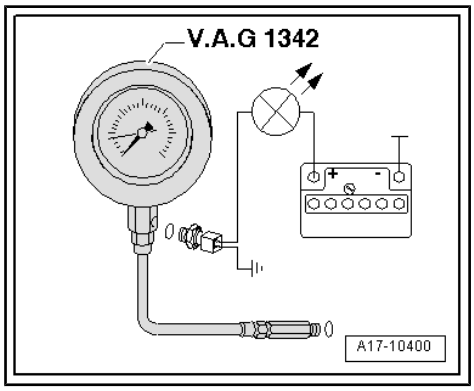
– Remove oil pressure switch ⇒ page 147 .

– Screw oil pressure switch into oil pressure tester -V.A.G 1342- .

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

– Connect voltage tester -V.A.G 1527B- with adapter leads from auxiliary measuring set -V.A.G 1594C- to positive battery terminal (“+”) and connect one connection of oil pressure switch.

– Connect second connection of oil pressure switch to earth (“–”).



- LED should not light up.

– Renew oil pressure switch if LED lights up when engine is not running.

– Start engine.

Note

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

- LED should light up at 1.2 ... 1.6 bar.

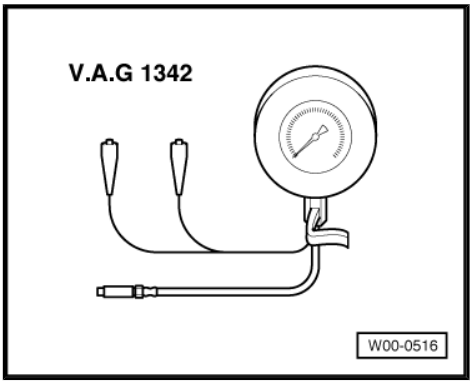
– Renew oil pressure switch if LED does not light up.

– Install oil pressure switch ⇒ page 147 .

2.7 Checking oil pressure

Special tools and workshop equipment required

♦ Oil pressure tester -V.A.G 1342-



Procedure

Proceed as follows:

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

– Remove oil pressure switch ⇒ page 147 .

– Screw oil pressure switch into oil pressure tester -V.A.G 1342- .

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

– Start engine.

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

– Install oil pressure switch ⇒ page 147 .

2.8 Engine oil

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

2.9 Checking engine oil level

⇒ Maintenance ; Booklet 810

19 – Cooling

1 Cooling system

WARNING

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

- *The cooling system is under pressure when the engine is hot.*
- *Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.*

Note

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

1.1 Diagram of coolant hose connections

1 - Radiator

- ❑ If renewed, refill system with fresh coolant

2 - Continued coolant circulation pump -V51-

3 - Thermostat with housing

4 - Coolant pump

5 - Cylinder head and cylinder block

- ❑ If renewed, refill system with fresh coolant

6 - Turbocharger

7 - Coolant expansion tank

- ❑ With filler cap and pressure relief valve
- ❑ Checking pressure relief valve ⇒ page 176

8 - Heat exchanger for heater

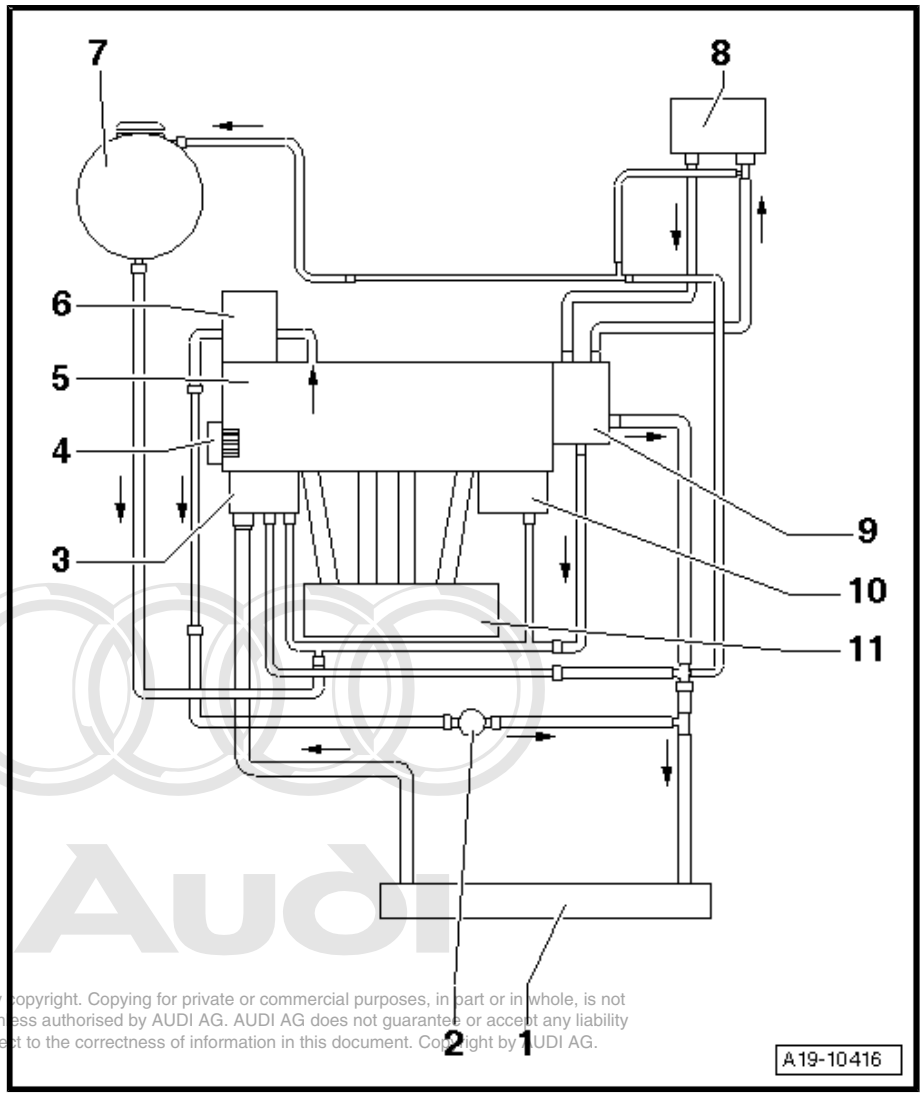
- ❑ If renewed, refill system with fresh coolant

9 - Coolant hose/pipe connection

10 - Oil cooler

- ❑ If renewed, refill system with fresh coolant

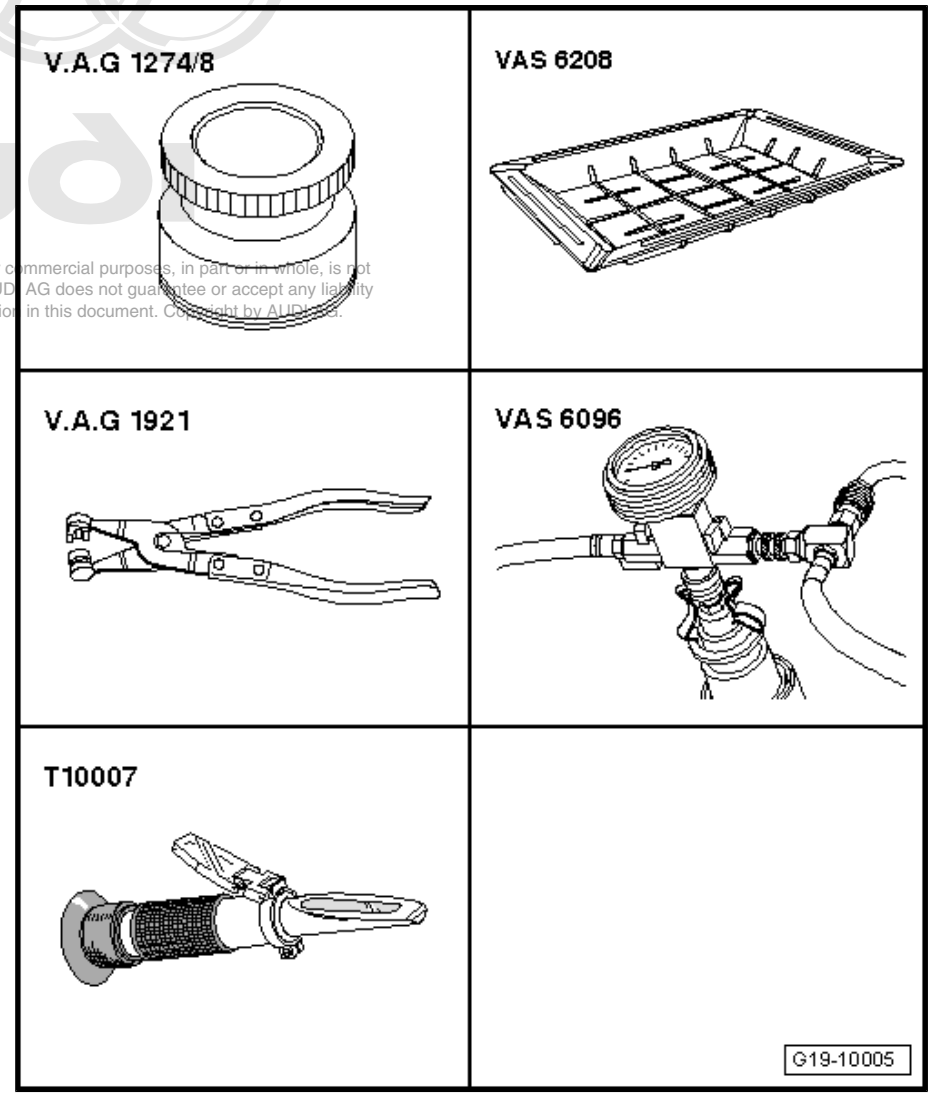
11 - Intake manifold



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

Proceed as follows:

Note

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

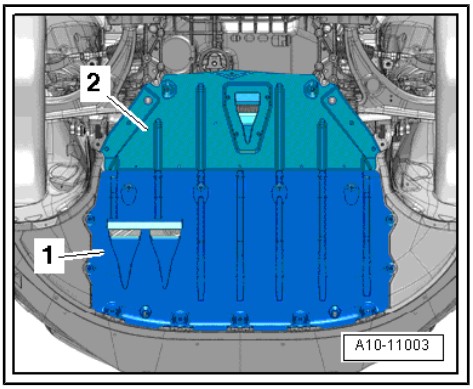
WARNING

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

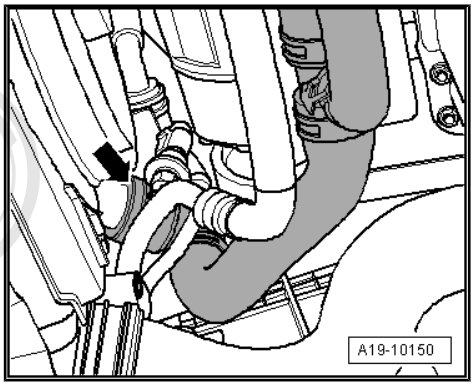
- ***The cooling system is under pressure when the engine is hot.***
- ***Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.***

– Open filler cap on expansion tank.

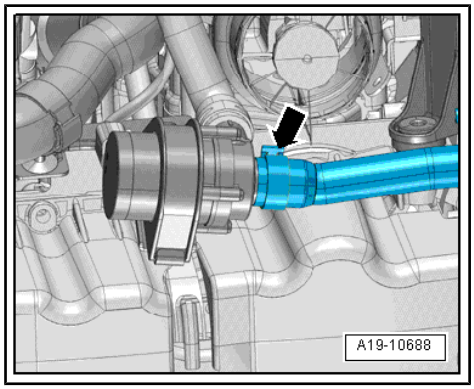
– Remove front noise insulation -1- ⇒ Rep. Gr. 66 .



– Place drip tray for workshop hoist -VAS 6208- beneath engine.
– Disconnect bottom coolant hose from radiator -arrow- and drain off coolant.



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



Note

Illustration shows coolant hose on vehicle with S tronic gearbox.

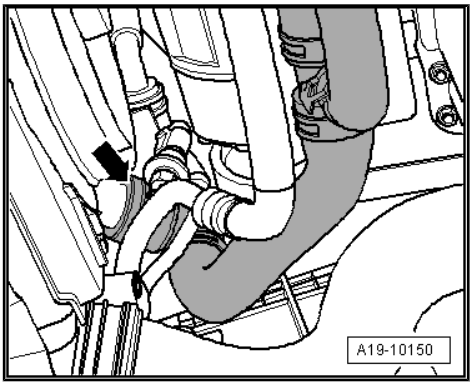
Filling

Proceed as follows:

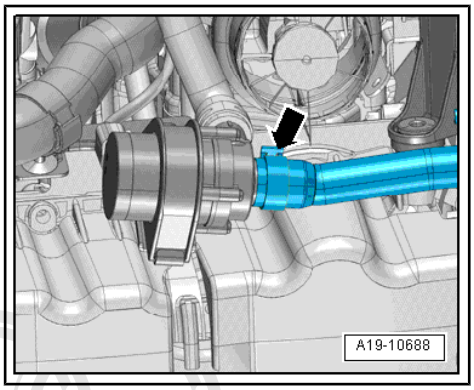
Note

- *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 anticorrosion 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 coolant concentration must be at least 40 %.*
- *If greater frost protection is required in very cold climates, the concentration of radiator antifreeze/anti-corrosion agent can be increased, but only up to 60% (this gives frost protection to about –40 °C). If the concentration exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.*
- *Use only clean tap water for mixing coolant.*
- *If radiator, heat exchanger, cylinder head, cylinder head gasket or cylinder block have been renewed, do not re-use old coolant.*
- *Contaminated or dirty coolant must not be used again.*
- *For checking anti-freeze protection in cooling system, use refractometer -T10007- .*

– Connect coolant hose with plug-in connector to radiator ⇒ page 172 .



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



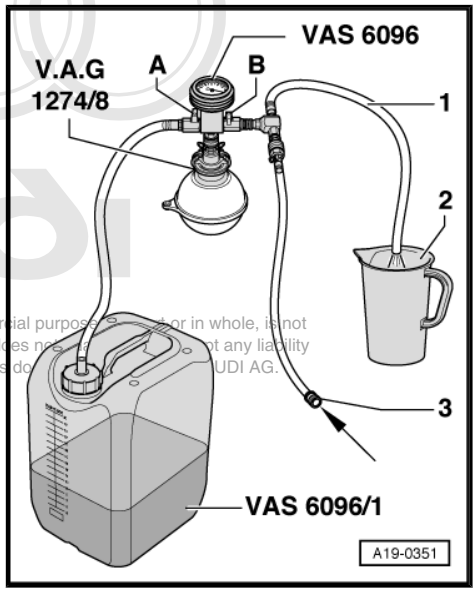
– Fill reservoir of -VAS 6096- with at least 10 litres of premixed coolant (according to recommended ratio):

- 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

– Fit adapter for cooling system tester -V.A.G 1274/8- onto coolant expansion tank.

– Attach cooling system charge unit -VAS 6096- to adapter -V.A.G 1274/8- .

– Run vent hose -1- into a small container -2-.



Note

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

– Close both valves -A- and -B- (turn lever at right angles to direction of flow).

– Connect hose -3- to compressed air.

- Pressure: 6 ... 10 bar.

– Open valve -B- by setting lever in direction of flow.

• The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.

– Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with coolant.

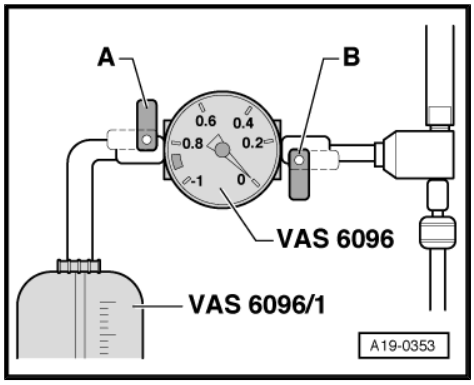
– Close valve -A- again.

– Leave valve -B- open for another 2 minutes.

• The suction jet pump continues to generate a partial vacuum in the cooling system; the needle on the gauge should remain in the green zone.

– Close valve -B-.

• The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.



Note

♦ *If the needle does not reach the green zone, repeat the process.*

♦ *Check cooling system for leaks if the vacuum is not maintained.*

– Detach compressed air hose.

– Open valve -A-.

• The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.

– Detach cooling system charge unit -VAS 6096- from coolant expansion tank.

– Top up coolant to “max” mark.

– Set temperature to “HI”.

– Switch off air conditioner compressor (press ECON button).

– Start engine and run for 2 minutes (maximum) at approx. 1500 rpm.

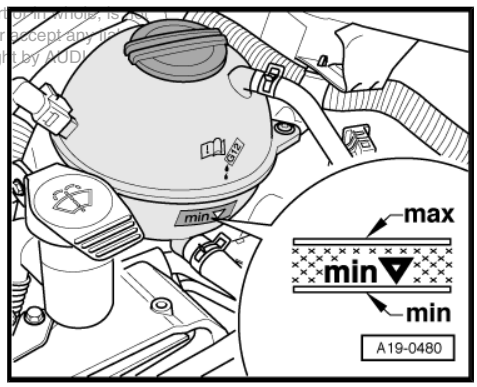
– Top up coolant to overflow hole on expansion tank with engine running.

– Close filler cap on coolant expansion tank.

– Allow engine to run at idling speed until two large coolant hoses at radiator become warm.

– Switch off ignition and allow engine to cool down.

– Install noise insulation ⇒ Rep. Gr. 66 .

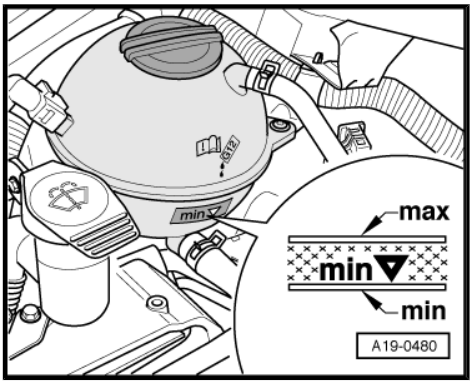


– Check coolant level.

• The coolant level must be between the “min” and “max” markings when the engine is cold.

• The coolant level can be at the “max” marking when the engine is warm.

– Top up with coolant again if necessary.



2 Coolant pump and coolant thermostat

WARNING

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

- *The cooling system is under pressure when the engine is hot.*
- *Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.*

2.1 Coolant pump and thermostat with housing - exploded view

1 - Bolt
- ❑ 15 Nm

2 - Coolant pump
- ❑ Removing and installing ⇒ page 161

3 - O-ring
- ❑ Renew

4 - Thermostat with housing
- ❑ Removing and installing ⇒ page 162

5 - O-ring
- ❑ Renew

6 - Coolant pipe 1 (front)
- ❑ Removing and installing ⇒ page 165

7 - Bolt
- ❑ Tightening torque ⇒ Item 17 (page 164)

8 - Radiator outlet coolant temperature sender -G83-
- ❑ Removing and installing ⇒ page 161

9 - O-ring
- ❑ Renew

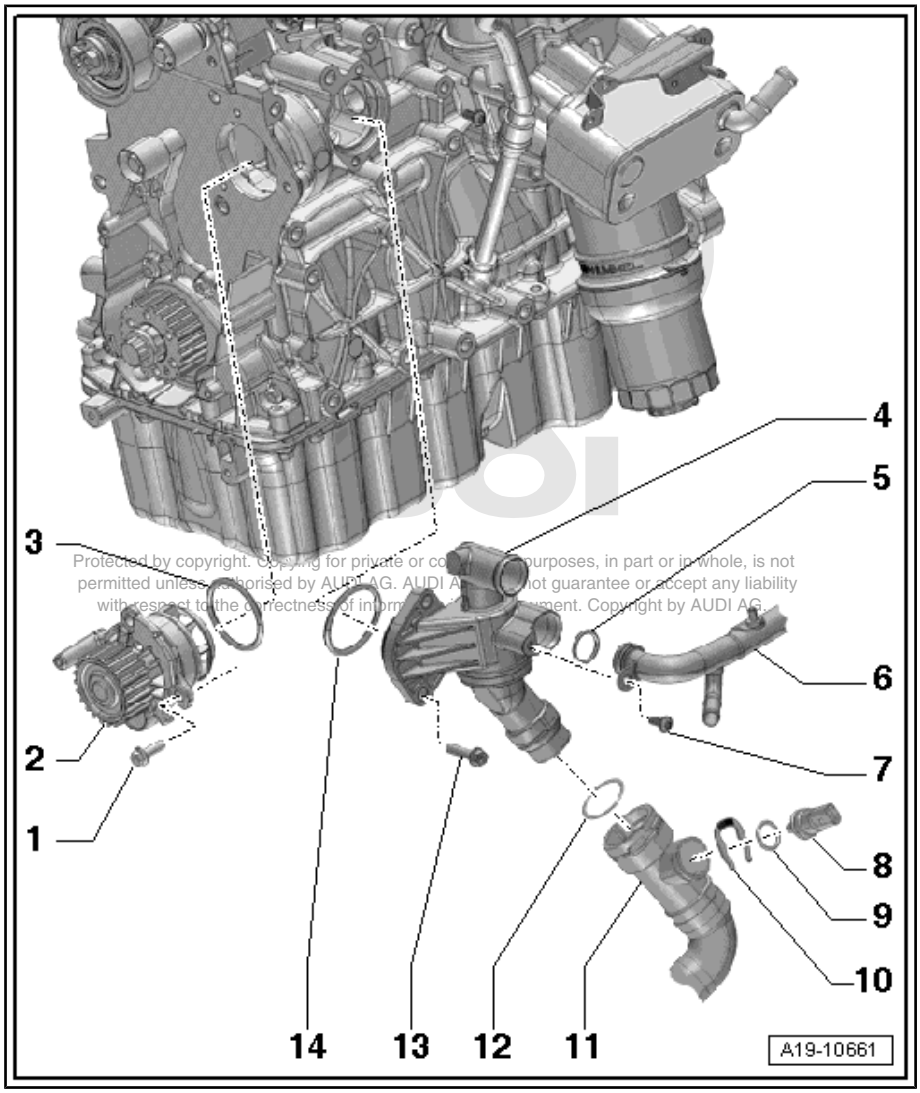
10 - Retaining clip

11 - Coolant hose
- ❑ With mounting for radiator outlet coolant temperature sender -G83-

12 - O-ring
- ❑ Renew

13 - Bolt
- ❑ 9 Nm

14 - O-ring
- ❑ Renew



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

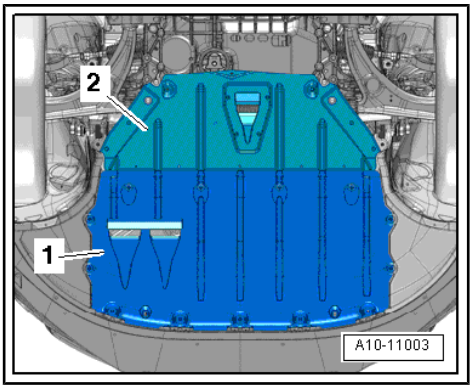
Removing

Proceed as follows:

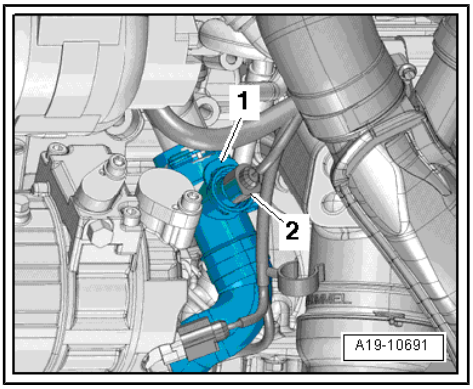
- Engine cold.

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

– Remove front noise insulation -1- ⇒ Rep. Gr. 66 .



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



Note

Place a cloth underneath to catch escaping coolant.

– Pull out retaining clip -1- and detach radiator outlet coolant temperature sender -G83- .

Installing

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

Note

- *Fit new O-ring.*
- *Insert new radiator outlet coolant temperature sender -G83- immediately into connection to avoid loss of coolant.*

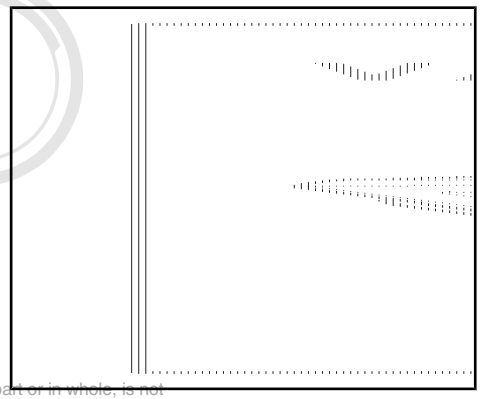
– Install noise insulation ⇒ Rep. Gr. 66 .

– Check coolant level ⇒ page 159 .

2.3 Removing and installing coolant pump

Special tools and workshop equipment required

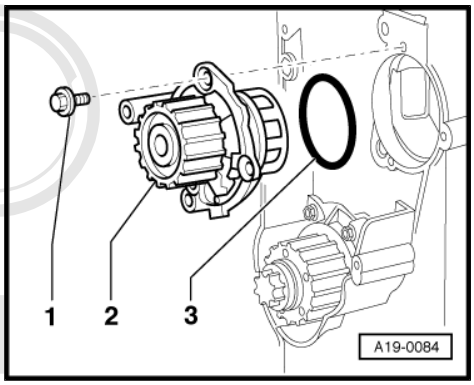
- Drip tray for workshop hoist -VAS 6208-



Removing

Proceed as follows:

– Remove toothed belt ⇒ page 82 .
– Place drip tray for workshop hoist -VAS 6208- beneath engine.
– Unscrew bolts -1- and remove coolant pump -2- with O-ring -3-.



Installing

• Tightening torque ⇒ page 160

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

Note

Fit new O-ring.

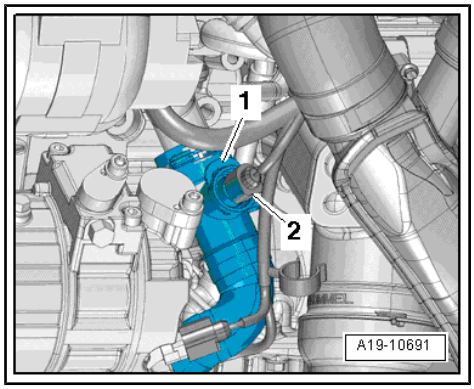
– Clean and smoothen sealing surface for O-ring.
– Lubricate O ring -3- with coolant additive.
– Fit coolant pump -2-.
• Installation position: Sealing plug in housing faces downwards.
– Install toothed belt (adjust valve timing) ⇒ page 87 .
– Fill up with coolant ⇒ page 156 .

2.4 Removing and installing thermostat with housing

Removing

Proceed as follows:

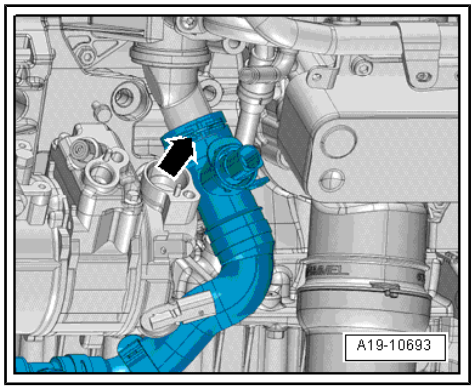
– Remove alternator ⇒ Rep. Gr. 27 .
– Remove coolant pipes ⇒ page 165 .
– Unplug electrical connector -2- for radiator outlet coolant temperature sender -G83- .



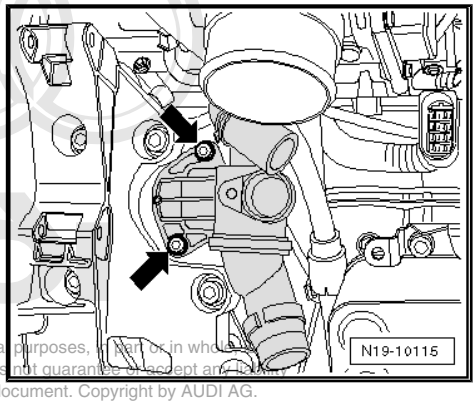
Note

Disregard item -1-.

– Lift retaining clip and detach coolant hose -arrow- from thermostat with housing.



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



Installing

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

- Tightening torque ⇒ page 160

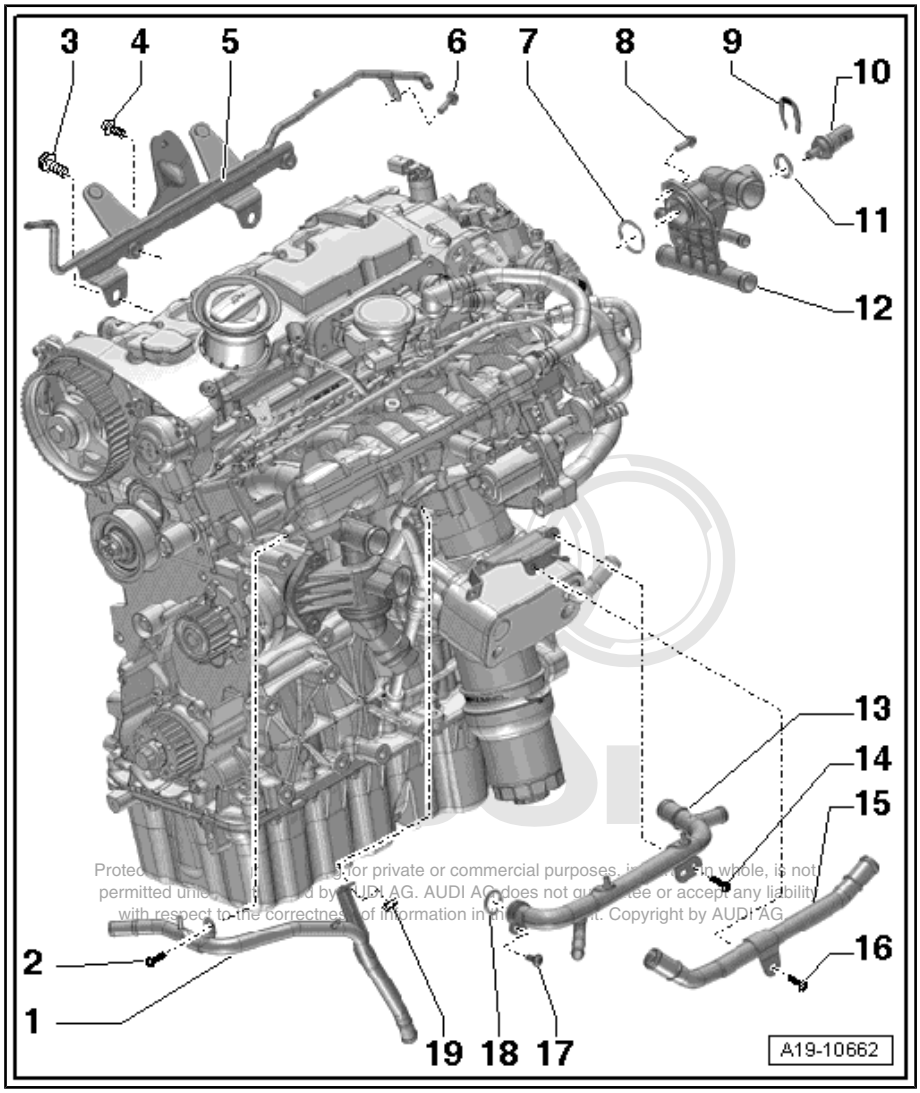
Note

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

– Clean and smoothen sealing surface for O-ring.
– Lubricate O ring with coolant additive.
– Install coolant pipes ⇒ page 165 .
– Install alternator ⇒ Rep. Gr. 27 .
– Fill up with coolant ⇒ page 156 .

3 Coolant pipes and continued coolant circulation pump -V51-

3.1 Coolant pipes - exploded view



1 - Coolant pipe (front right)
- ❑ Removing and installing ⇒ page 168

2 - Bolt
- ❑ 6 Nm

3 - Bolt
- ❑ 40 Nm

4 - Bolt
- ❑ 23 Nm

5 - Coolant bleeder pipe

6 - Bolt
- ❑ 9 Nm

7 - O-ring
- ❑ Renew

8 - Bolt
- ❑ 9 Nm

9 - Retaining clip

10 - Coolant temperature sender -G62-
- ❑ Removing and installing ⇒ page 165

11 - O-ring
- ❑ Renew

12 - Coolant hose/pipe connection

13 - Coolant pipe 1 (front)
- ❑ Removing and installing ⇒ page 165

14 - Bolt
- ❑ 9 Nm

15 - Coolant pipe 2 (front)
- ❑ Removing and installing ⇒ page 165

16 - Bolt
- ❑ 9 Nm

17 - Bolt
- ❑ 9 Nm

18 - O-ring
- ❑ Renew

19 - Nut
- ❑ 9 Nm

3.2 Removing and installing coolant temperature sender -G62-

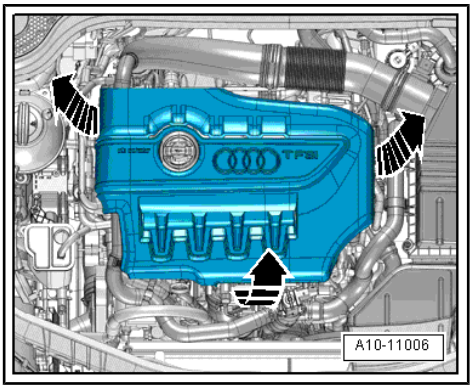
Removing

Proceed as follows:

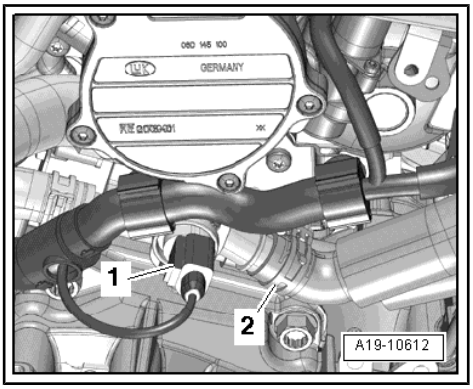
- Engine cold.

– Open filler cap on coolant expansion tank briefly and allow residual pressure in cooling system to dissipate.

– Remove engine cover panel -arrows-.



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



Note

- *Place a cloth underneath to catch escaping coolant.*
- *Disregard item -2-.*

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

Installing

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

Note

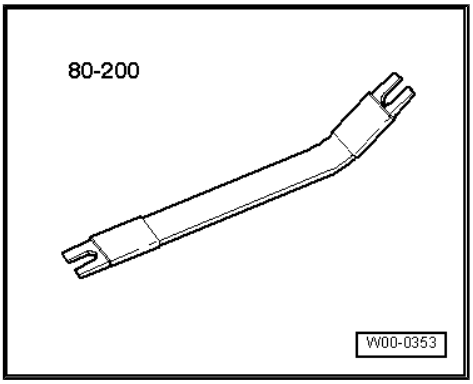
- *Fit new O-ring.*
- *Insert new coolant temperature sender -G62- immediately into connection to avoid loss of coolant.*

– Check coolant level ⇒ page 159 .

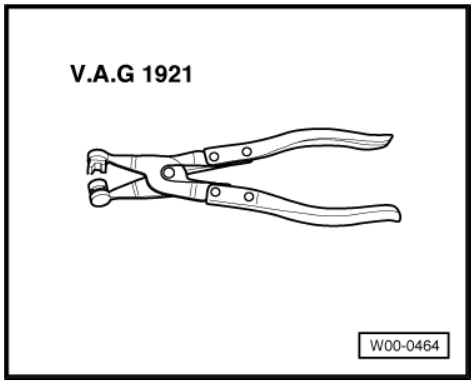
3.3 Removing and installing coolant pipes 1 and 2 (front)

Special tools and workshop equipment required

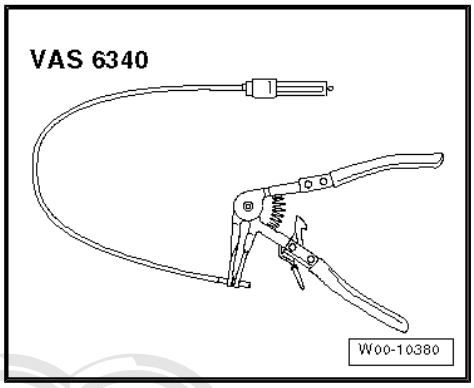
- Removal lever -80 - 200-



♦ Hose clip pliers -V.A.G 1921-



♦ Hose clip pliers -VAS 6340-



Removing

Proceed as follows:

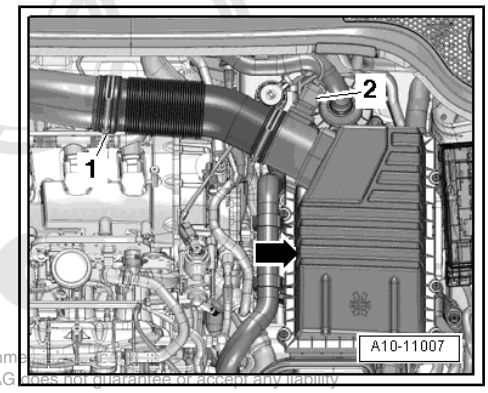
– Drain coolant ⇒ page 154 .

– Remove radiator cowl ⇒ page 173 .

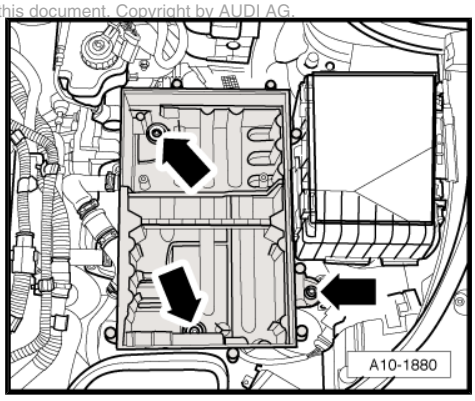
– Release hose clip -1- and detach air hose.

– Unplug electrical connector -2- for air mass meter -G70- .

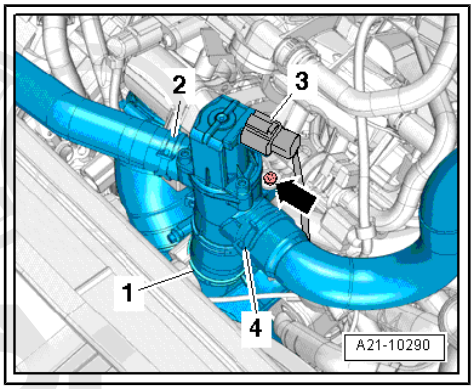
– Unscrew top section of air cleaner housing -arrow- and remove air filter element.



– Remove bolts -arrows- and detach bottom section of air cleaner housing.



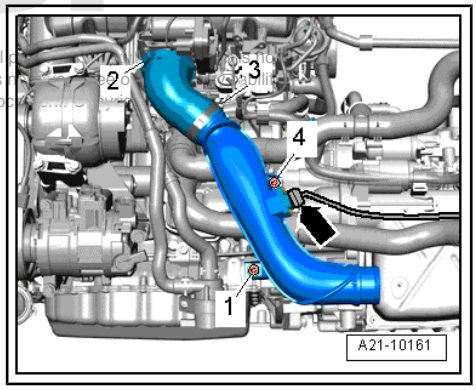
– Unplug electrical connector -3-.
– Remove bolt -arrow-.
– Detach hose -2-.
– Loosen hose clip -1-, pull turbocharger air recirculation valve -N249- off air pipe and move clear (hose -4- remains connected).



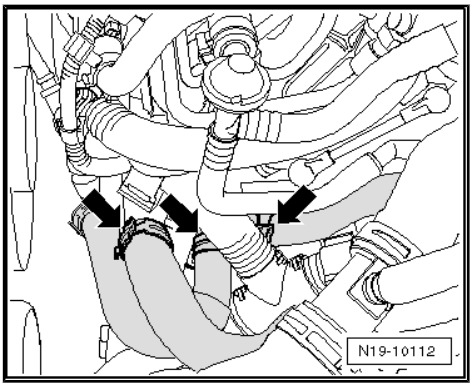
– Unplug electrical connector -arrow- at charge air pressure sender -G31- .
– Remove bolt -1- and nut -4-.
– Loosen hose clip -2- and detach air pipe.

Note

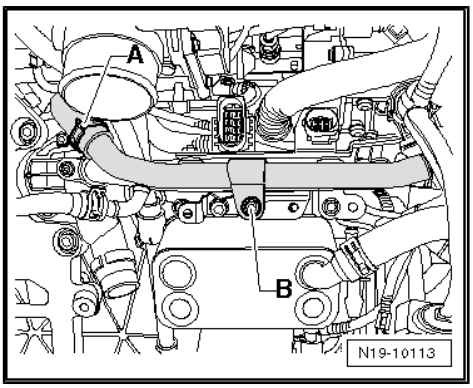
Disregard item -3-.



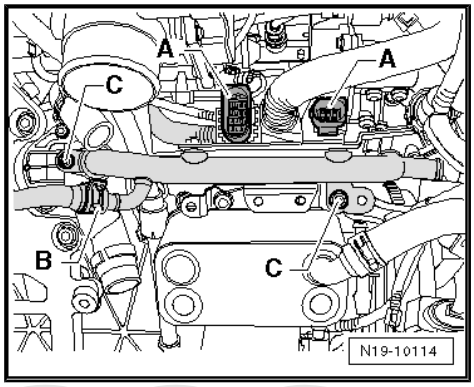
– Detach coolant hoses -arrows- from coolant pipes.



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



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



Installing

• Tightening torque ⇒ page 164

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

Note

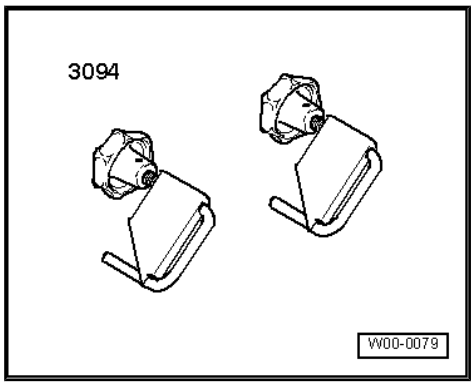
- *Renew seals and gaskets.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly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

– Install air pipe ⇒ page 194 .
– Install air cleaner housing and air filter element ⇒ Rep. Gr. 24 .
– Install radiator cowl ⇒ page 173 .
– Fill up with coolant ⇒ page 156 .

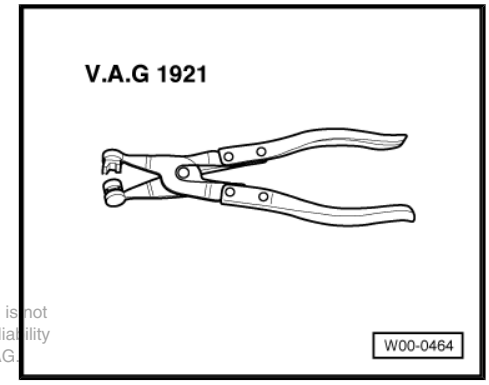
3.4 Removing and installing coolant pipe (front right)

Special tools and workshop equipment required

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



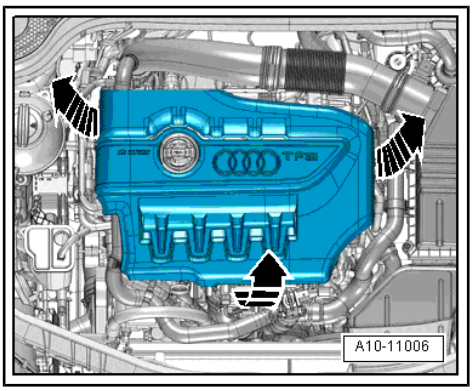
♦ Hose clip pliers -V.A.G 1921-



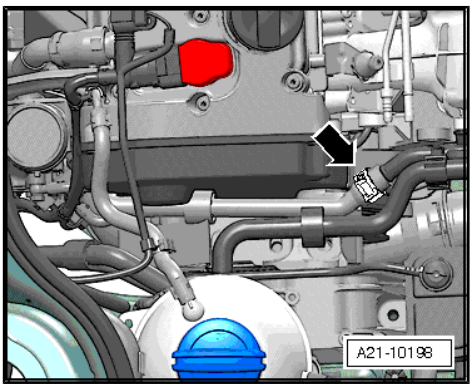
Removing

Proceed as follows:

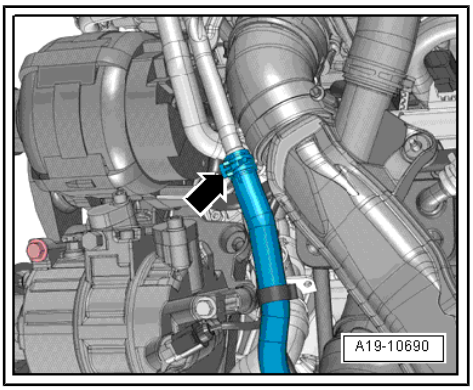
– Remove engine cover panel -arrows-.



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

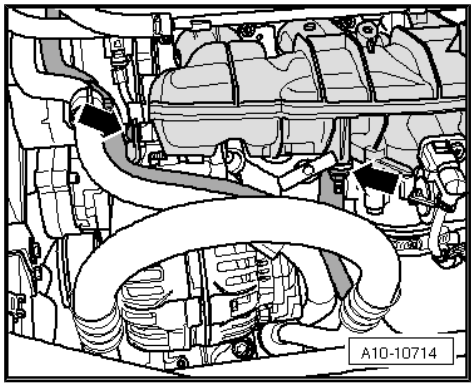


– Clamp off coolant hose -arrow- with hose clamp -3094- and detach.



Note

Place a cloth underneath to catch escaping coolant.



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

Installing

- Tightening torque ⇒ page 164

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

Note

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

– Check coolant level ⇒ page 159 .

3.5 Continued coolant circulation pump -V51- - exploded view

1 - Bracket

2 - Bolt

❑ 9 Nm

3 - Coolant hose

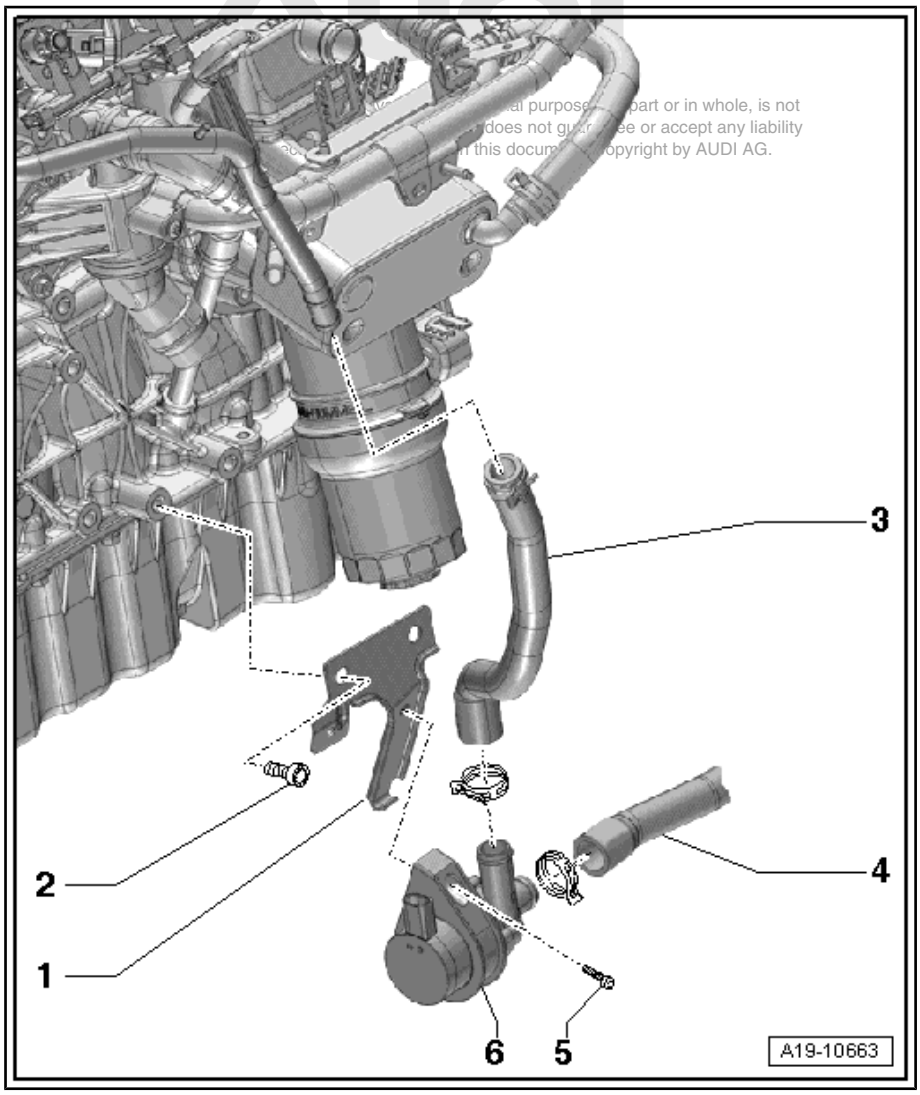
4 - Coolant hose

5 - Bolt

❑ 4 Nm

6 - Continued coolant circulation pump -V51-

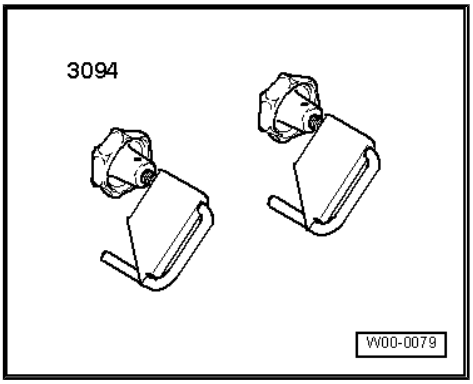
❑ Removing and installing ⇒ page 171



3.6 Removing and installing continued coolant circulation pump -V51-

Special tools and workshop equipment required

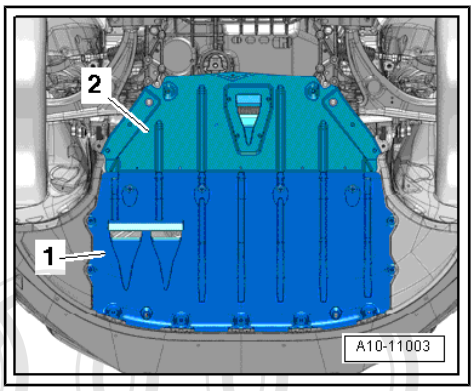
- Hose clamps for hoses up to 25 mm -3094-



Removing

Proceed as follows:

– Remove front noise insulation -1- ⇒ Rep. Gr. 66 .



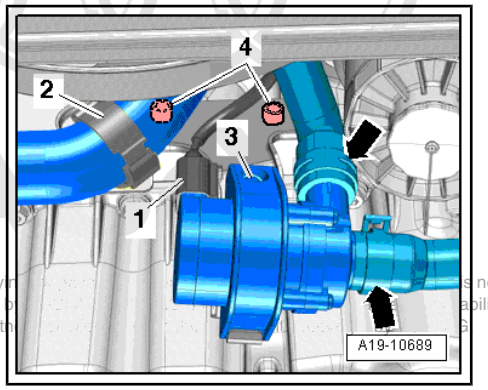
– Unplug electrical connector -1-.

Note

Place a cloth underneath to catch escaping coolant.

– Clamp off coolant hoses -arrows- with hose clamps -3094- and detach.

– Remove bolt -3- and detach continued coolant circulation pump -V51- .



Note

Disregard -items 2 and 4-.

Installing

- Tightening torque ⇒ page 170

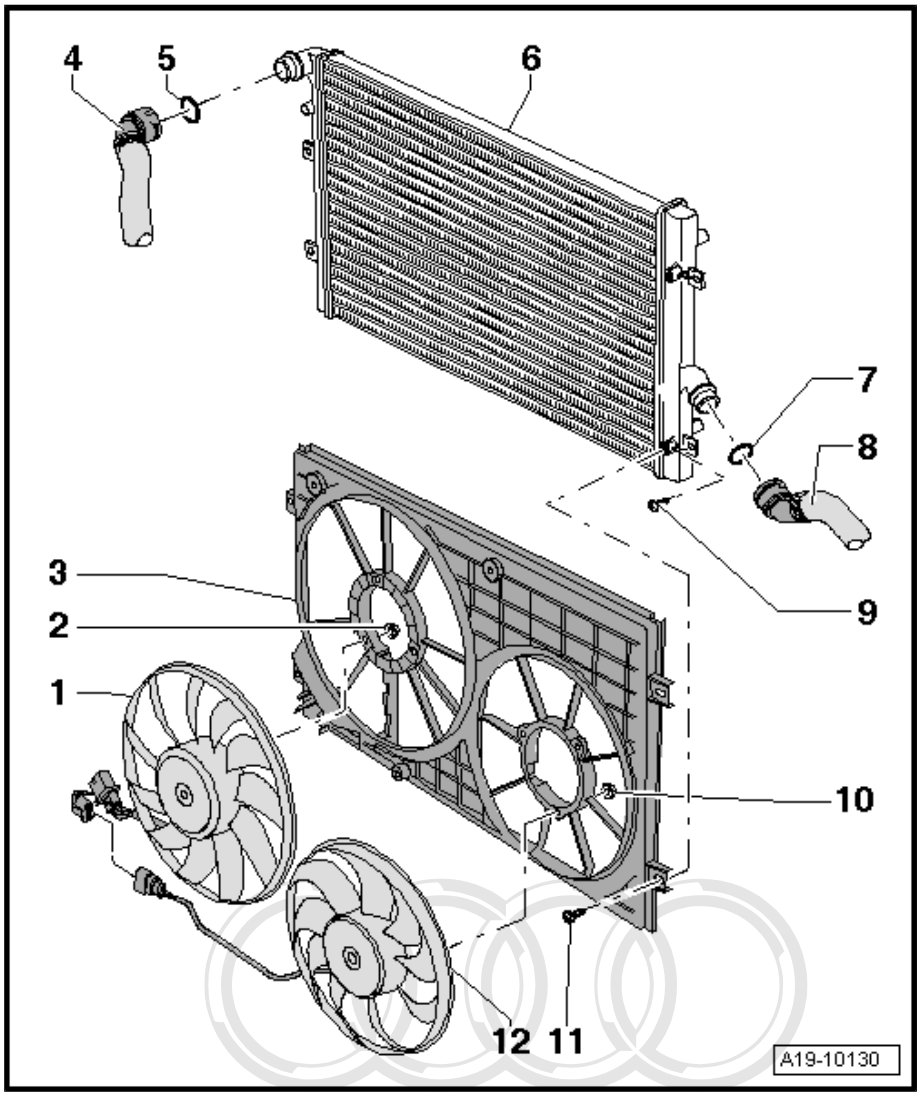
Installation is carried out in the reverse order; note the following:

– Install noise insulation ⇒ Rep. Gr. 66 .

– Check coolant level ⇒ page 159 .

4 Radiator and radiator fans

4.1 Radiator and radiator fans - exploded view



1 - Radiator fan -V7-
- ❑ Removing and installing ⇒ page 174

2 - Nut
- ❑ 10 Nm

3 - Radiator cowl
- ❑ Removing and installing ⇒ page 173

4 - Coolant hose (top)
- ❑ Connecting to radiator ⇒ page 172

5 - O-ring
- ❑ Renew

6 - Radiator
- ❑ Removing and installing ⇒ page 173
- ❑ If renewed, change coolant in entire system

7 - O-ring
- ❑ Renew

8 - Coolant hose (bottom)
- ❑ Connecting to radiator ⇒ page 172

9 - Bolt
- ❑ 5 Nm

10 - Nut
- ❑ 10 Nm

11 - Bolt
- ❑ 5 Nm

12 - Radiator fan 2 -V177-
- ❑ Removing and installing ⇒ page 174

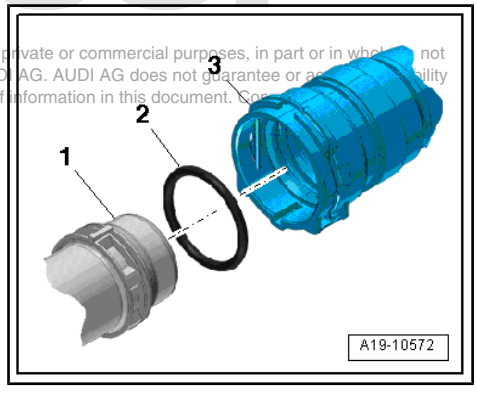
Connecting coolant hose with plug-in connector to radiator

– Remove old O-ring -2- from coolant hose -3-.

– Lubricate new O-ring with coolant additive and fit O-ring in coolant hose.

– Press coolant hose onto radiator -1- until it engages with a click.

– Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.



4.2 Removing and installing radiator

Removing

Proceed as follows:

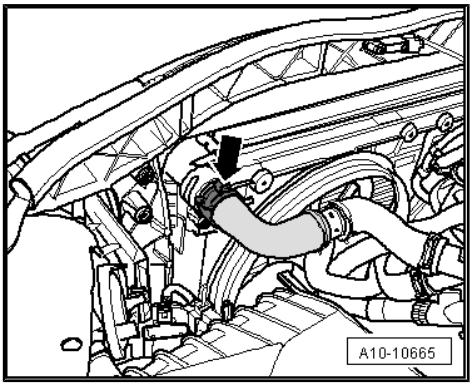
Note

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.

– Drain coolant ⇒ page 154 .

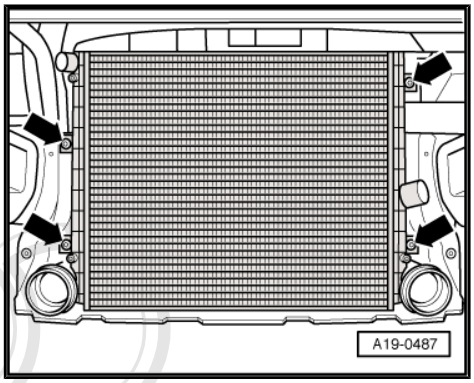
– Remove radiator cowl ⇒ page 173 .

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



– Remove bolts -arrows- on reverse side of radiator.

– Lift up radiator slightly and remove upwards.



Installing

• Tightening torque ⇒ page 172

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

– Install radiator cowl ⇒ page 173 .

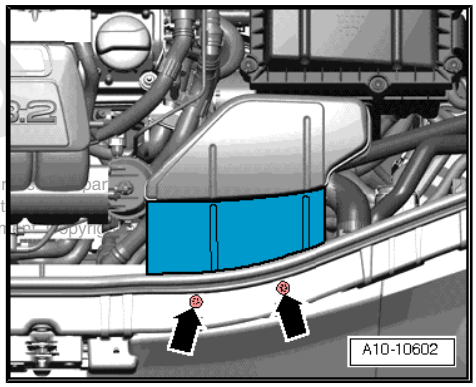
– Fill up with coolant ⇒ page 156 .

4.3 Removing and installing radiator cowl

Removing

Proceed as follows:

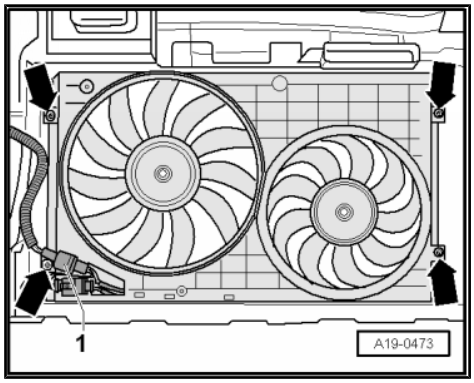
– Unscrew bolts -arrows- and remove air duct.



WARNING

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

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



– Unplug electrical connector -1-.
– Remove bolts -arrows- and lift out radiator cowl.

Installing

• Tightening torque ⇒ page 172

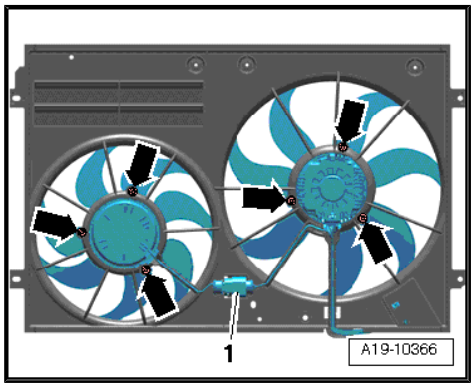
Install in reverse order.

4.4 Removing and installing radiator fan - V7- and radiator fan 2 -V177-

Removing

Proceed as follows:

– Remove radiator cowl ⇒ page 173 .
– Unplug electrical connector -1-.
– Move electrical wiring clear.
– Unscrew nuts -arrows- and remove radiator fans.



Installing

• Tightening torque ⇒ page 172

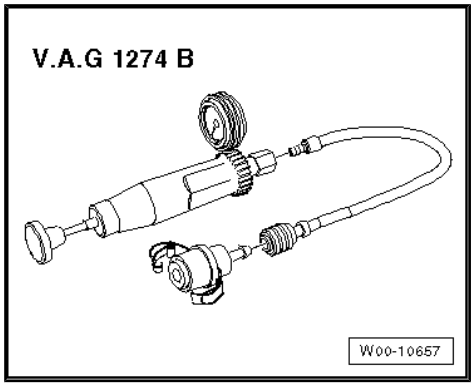
Installation is carried out in the reverse order; note the following:

– Install radiator cowl ⇒ page 173 .

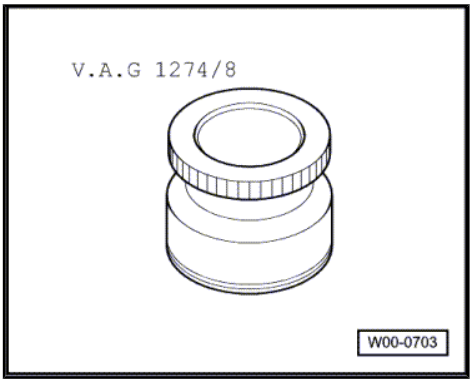
4.5 Checking cooling system for leaks

Special tools and workshop equipment required

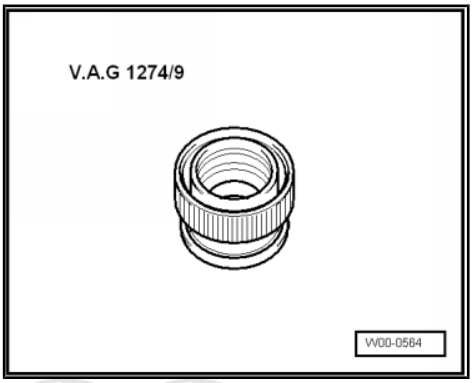
♦ Cooling system tester -V.A.G 1274 B-



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



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



Procedure

Proceed as follows:

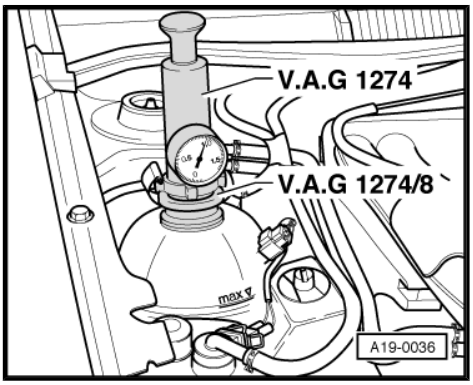
- Engine must be warm.

WARNING

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

- ***The cooling system is under pressure when the engine is hot.***
- ***Cover filler cap on expansion tank with a cloth and open carefully to dissipate pressure.***

– Open filler cap on expansion tank.
– Fit cooling system tester -V.A.G 1274 B- with adapter -V.A.G 1274/8- onto coolant expansion tank.
– Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.
– If this pressure is not maintained, locate and rectify leaks.



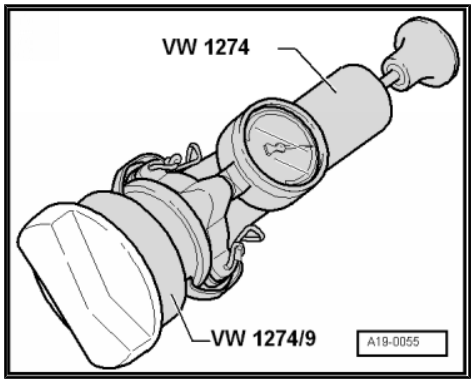
Checking pressure relief valve in filler cap

– Fit cooling system tester -V.A.G 1274 B- with adapter -V.A.G 1274/9- onto filler cap.

– Build up pressure with hand pump on cooling system tester.

• The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

– Renew filler cap if pressure relief valve does not open as described.



21 – Turbocharging/supercharging

1 Turbocharger

– Observe rules for cleanliness ⇒ page 9 .

Note

Check that all air pipes and hoses and vacuum lines are correctly fitted and that there are no leaks before carrying out tests or repairs.

1.1 Connection diagram

1 - Turbocharger air recirculation valve -N249-

2 - Throttle valve module -J338-

3 - Pressure control valve for crankcase breather system

4 - To activated charcoal filter

5 - Vacuum unit

6 - Solenoid valve for charge pressure control -N75-

7 - Turbocharger

8 - Brake servo

9 - Non-return valve

10 - Air mass meter -G70-

11 - Air cleaner

12 - Coolant hose/pipe connection

13 - Exhauster pump

14 - Non-return valve

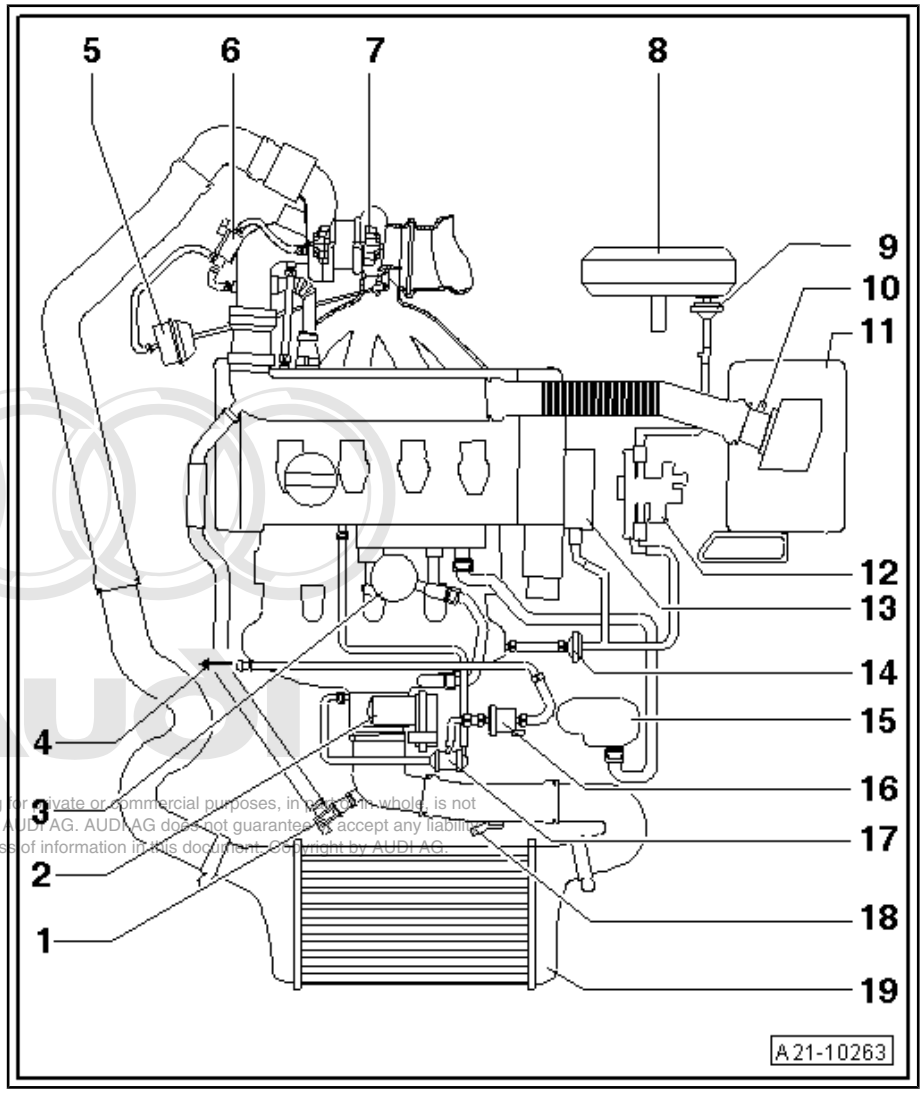
15 - Oil filter bracket

16 - Activated charcoal filter solenoid valve 1 -N80-

17 - Dual non-return valve

18 - Charge air pressure sender -G31-

19 - Charge air cooler



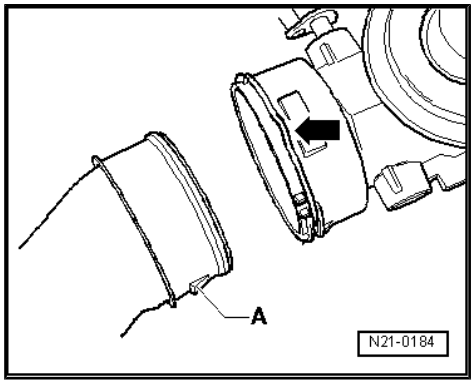
1.2 Removing and installing air pipes and hoses with plug-in connectors

Removing

Proceed as follows:

– Release tab -A- on plug-in connector by pulling retaining clip -arrow-.

– Disconnect air pipes and hoses by hand (do not use a tool).



Installing

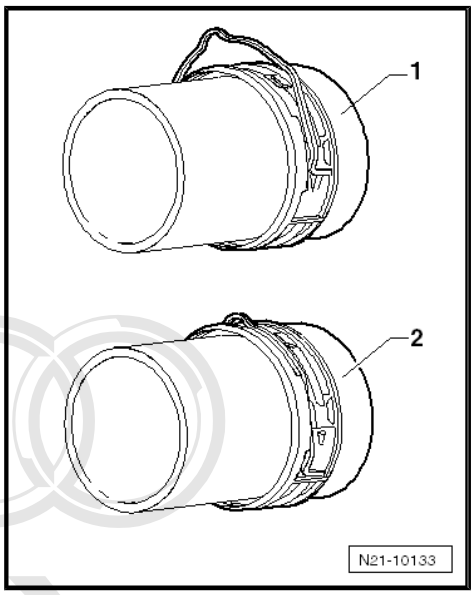
Note

- *Renew seal if damaged.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Make sure that the seal is correctly seated in the groove on the complete circumference of the air pipe/hose.*
- *Apply a thin coating of silicon-free lubricant to the sealing area and the seal.*

– Release retaining clip (position -1-).

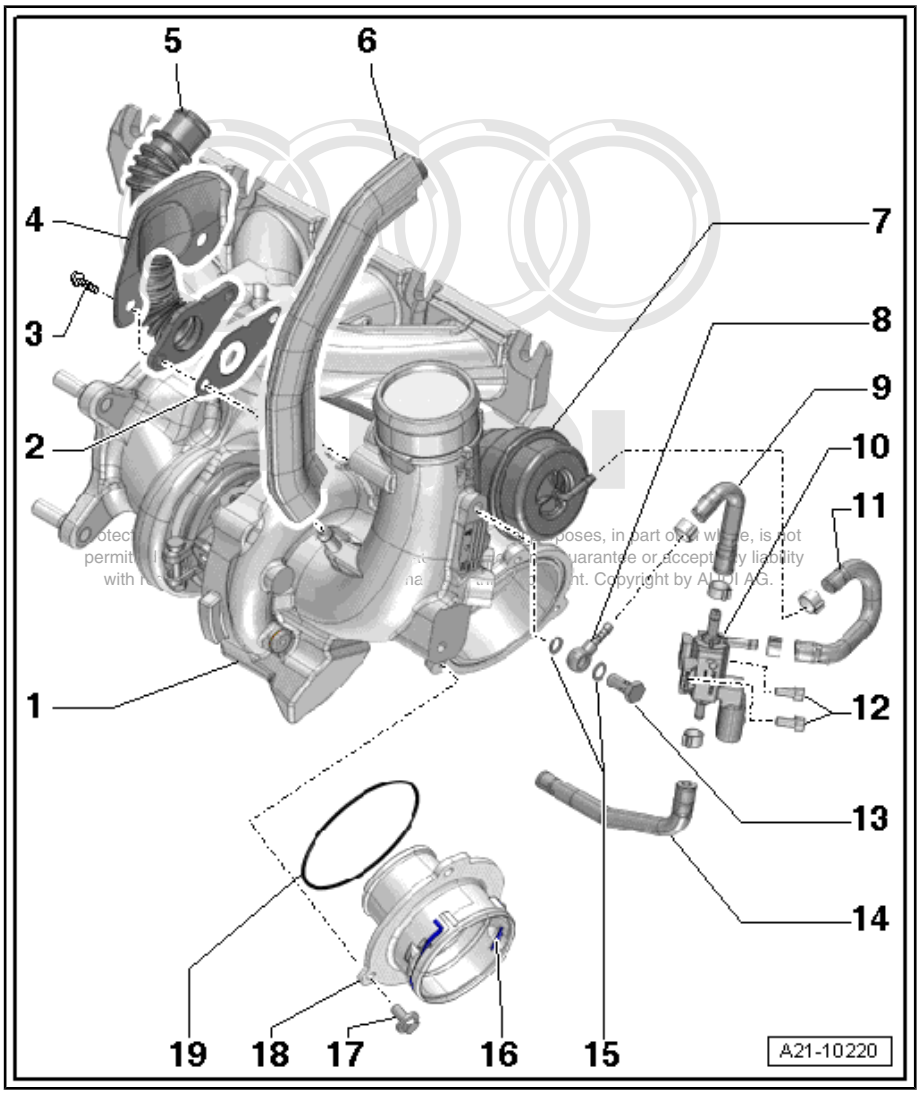
– Push air pipe/hose in as far as stop and press retaining clip to lock -2-.

– Press air pipe/hose again and pull again to check that plug-in connector is correctly engaged.



1.3 Turbocharger - exploded view

Part 1



1 - Turbocharger

- ❑ Combined with exhaust manifold
- ❑ Removing and installing ⇒ page 182

2 - Gasket

- ❑ Renew

3 - Bolt

- ❑ 9 Nm

4 - Heat shield

5 - Crankcase breather pipe

6 - Hose leading to activated charcoal filter

7 - Vacuum unit for turbocharger

- ❑ Checking ⇒ page 187
- ❑ Removing and installing ⇒ page 189
- ❑ Adjusting ⇒ page 190

8 - Ring connector

9 - Hose

10 - Solenoid valve for charge pressure control -N75-

11 - Hose

12 - Bolt

- ❑ 3 Nm

13 - Banjo bolt

- ❑ 8 Nm

14 - Hose

15 - Seals

- ❑ Renew

16 - Securing clip

17 - Bolt

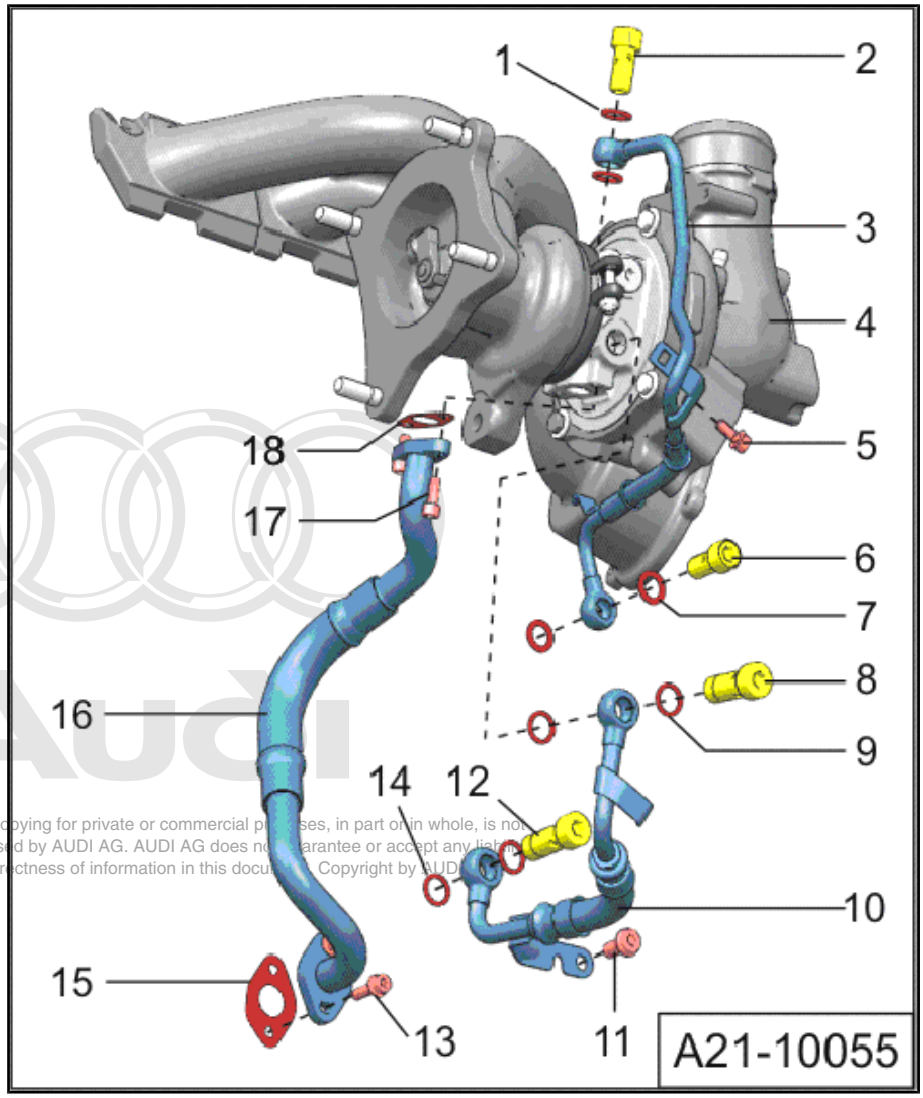
- ❑ 7 Nm

18 - Connection

19 - Seal

- ❑ Renew

Part 2



1 - Seal
- ❑ Renew

2 - Banjo bolt
- ❑ 30 Nm

3 - Oil supply pipe

4 - Turbocharger
- ❑ Combined with exhaust manifold
- ❑ Removing and installing ⇒ page 182

5 - Bolt
- ❑ 9 Nm

6 - Banjo bolt
- ❑ 30 Nm

7 - Seal
- ❑ Renew

8 - Banjo bolt
- ❑ 35 Nm

9 - Seal
- ❑ Renew

10 - Coolant supply pipe

11 - Bolt
- ❑ 23 Nm

12 - Banjo bolt
- ❑ 35 Nm

13 - Bolt
- ❑ 9 Nm

14 - Seal
- ❑ Renew

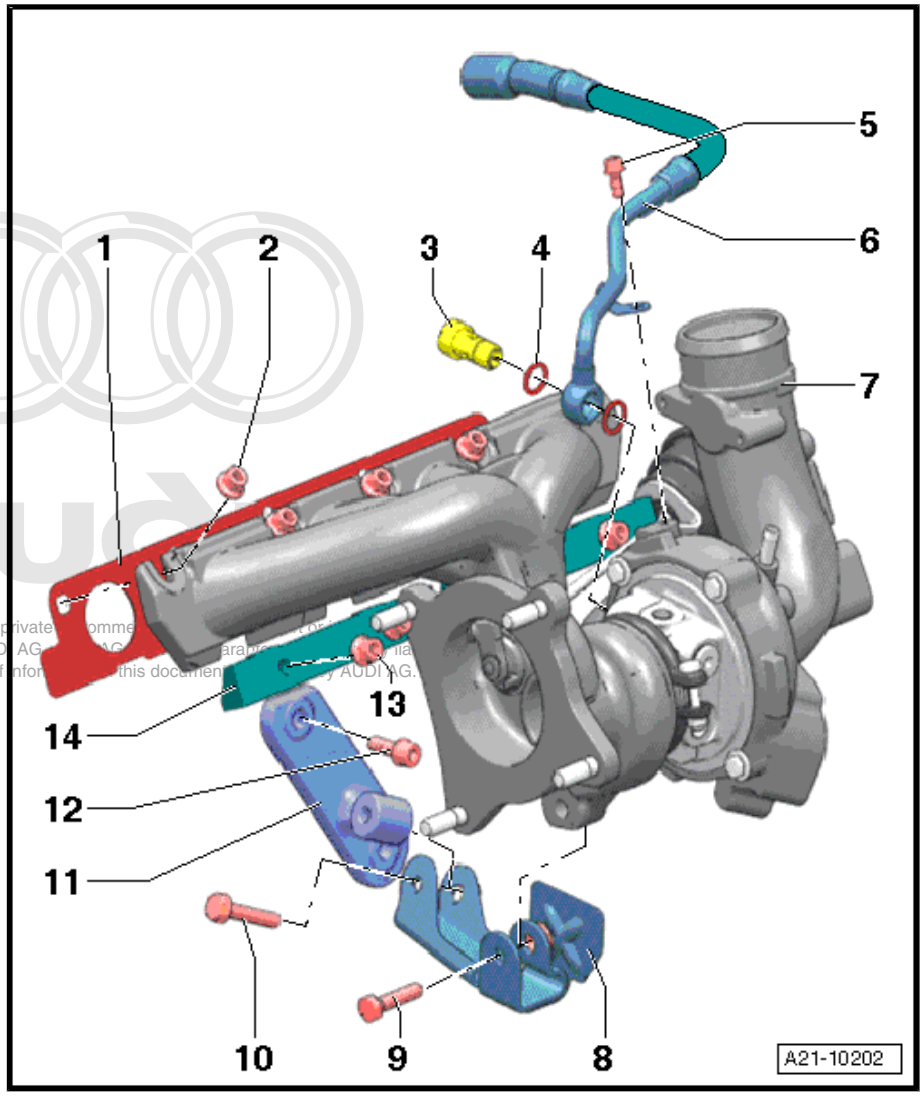
15 - Gasket
- ❑ Renew

16 - Oil return pipe

17 - Bolt
- ❑ 9 Nm

18 - Gasket
- ❑ Renew

Part 3



1 - Gasket

- ❑ Renew

2 - Nut

- ❑ Renew
- ❑ Lubricate exhaust manifold studs with high-temperature paste. For high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 21 Nm

3 - Banjo bolt

- ❑ 35 Nm

4 - Seal

- ❑ Renew

5 - Bolt

- ❑ 9 Nm

6 - Coolant return hose/pipe

7 - Turbocharger

- ❑ Combined with exhaust manifold
- ❑ Removing and installing ⇒ page 182

8 - Bracket

9 - Bolt

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

10 - Bolt

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

11 - Bracket

12 - Bolt

- ❑ 23 Nm

13 - Nut

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

14 - Fastening strip

Part 4

1 - Vacuum unit for turbocharger

- ❑ Checking ⇒ page 187
- ❑ Removing and installing ⇒ page 189
- ❑ Adjusting ⇒ page 190

2 - Pressure hose

3 - Bolts

- ❑ Self-locking
- ❑ Renew
- ❑ 9 Nm

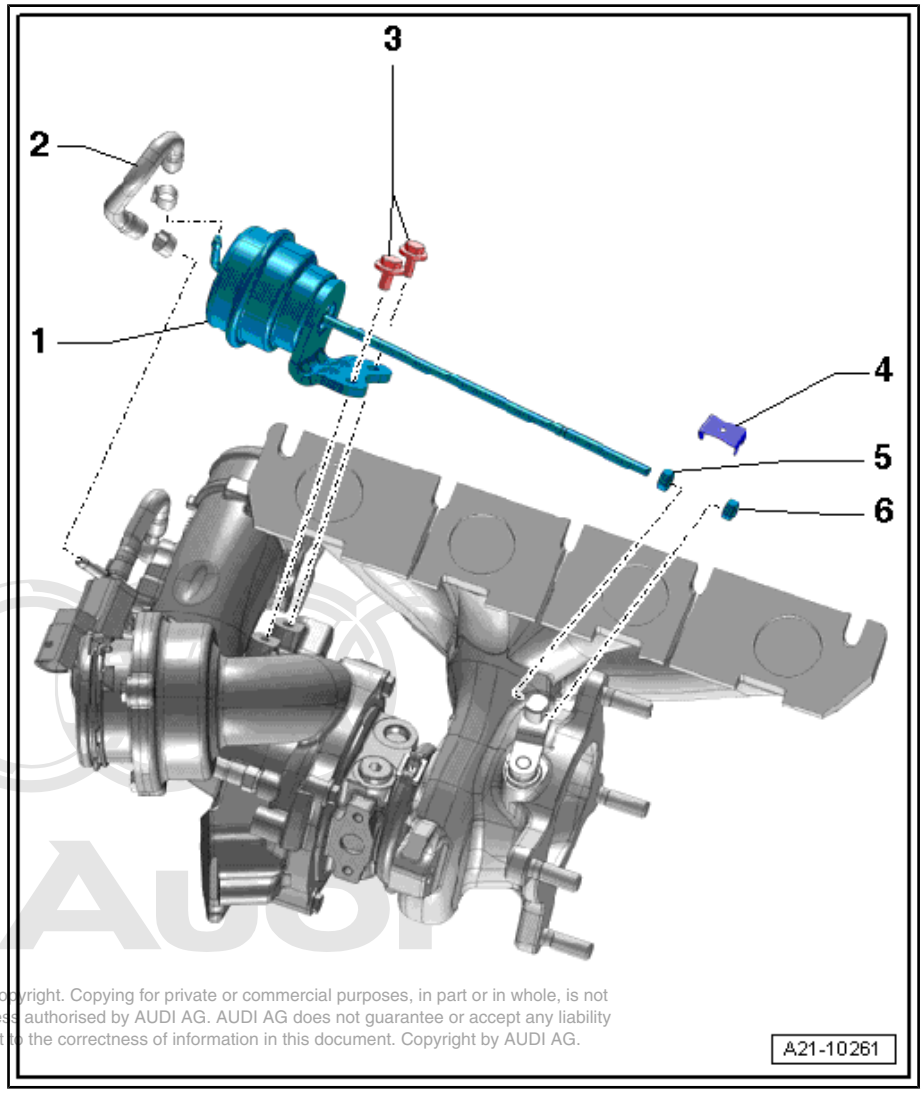
4 - Locking plate

5 - Lock nut

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

6 - Adjusting nut

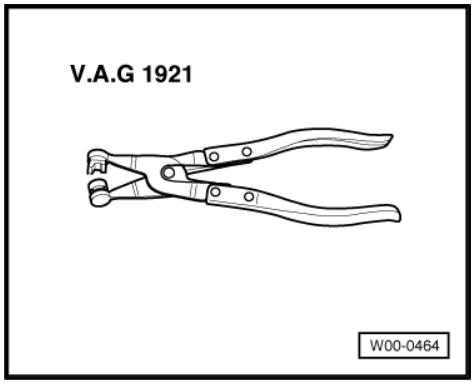
- ❑ After tightening, secure with sealant paint; for sealing paint refer to ⇒ Electronic parts catalogue



1.4 Removing and installing turbocharger

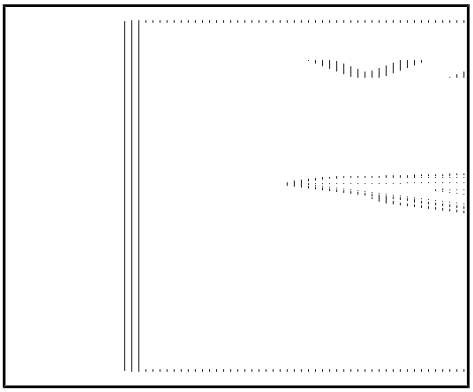
Special tools and workshop equipment required

- ♦ Hose clip pliers -V.A.G 1921-



- ♦ Engine bung set -VAS 6122-

- Drip tray for workshop hoist -VAS 6208-



Removing

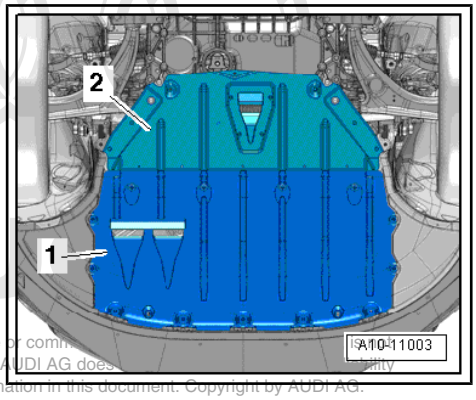
Proceed as follows:

> **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.*

– Remove noise insulation at front -1- and rear -2- ⇒ Rep. Gr. 66 .

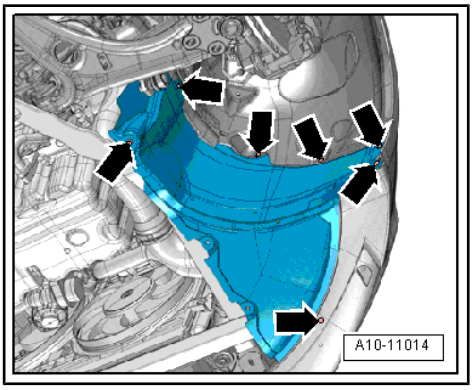
– Drain coolant ⇒ page 154 .

– Remove front exhaust pipe with catalytic converter and front silencer ⇒ page 202 .

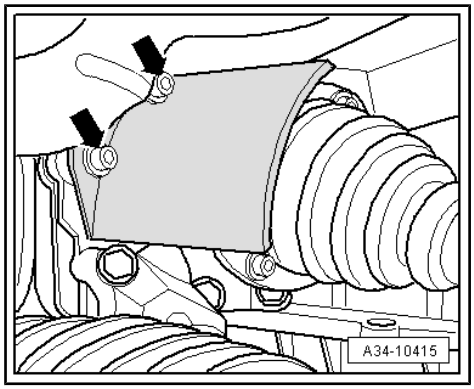


– Remove front right wheel.

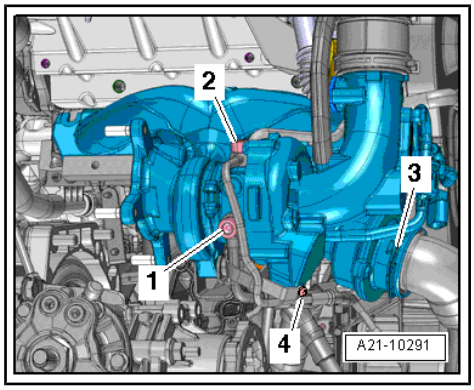
– Remove noise insulation (right-side) -arrows-.



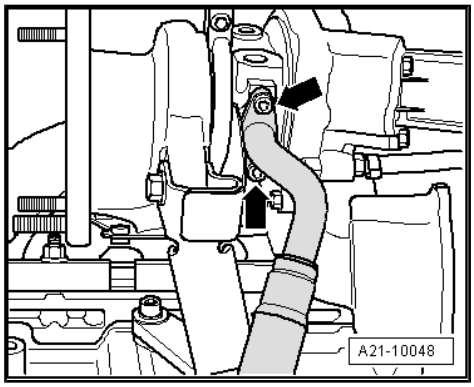
– Unbolt heat shield for drive shaft (right-side) from bevel box -arrows-.



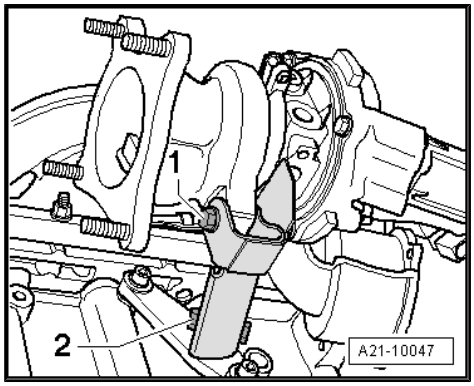
– Lift retaining clip -3- and remove bolt -4-.
– Place drip tray for workshop hoist -VAS 6208- beneath engine.
– Remove banjo bolt -1- for coolant supply pipe and -2- for oil supply pipe and press pipes to the side.



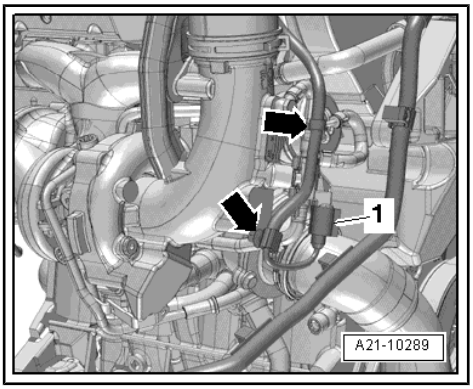
– Remove bolts -arrows- and detach oil return pipe from turbocharger.



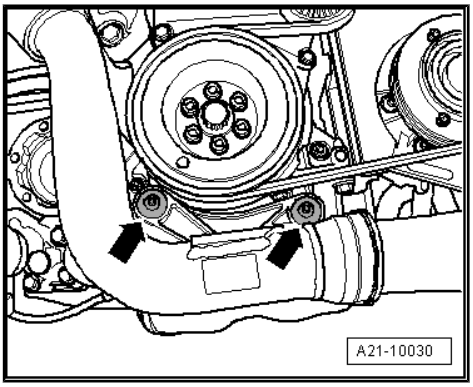
– Unscrew bolts -1- and -2- and remove support for turbocharger.



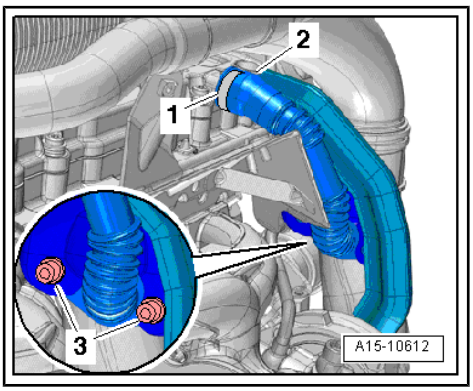
– Unplug electrical connector -1- and move electrical wiring harness clear -arrows-.



– Remove bolts -arrows- and pull air pipe off turbocharger (leave in installation position).



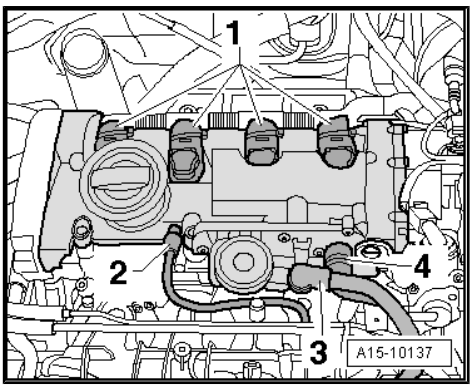
– Disconnect hose -2- coming from activated charcoal filter from cylinder head cover.
– Remove bolts -3-, release hose clip -1- and disconnect crankcase breather pipe with heat shield from cylinder head cover.



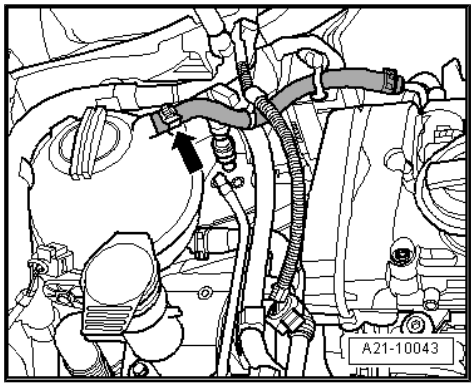
– Unplug electrical connectors -1- at ignition coils.
– Move wiring harness clear to the left.

Note

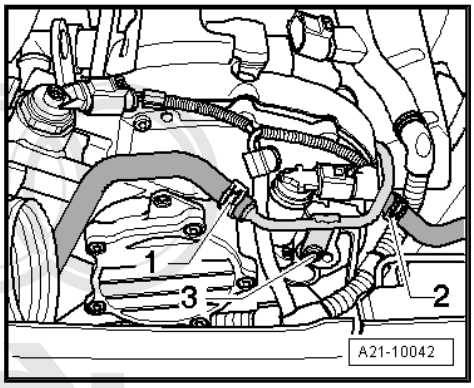
Disregard items -2, 3 and 4-.



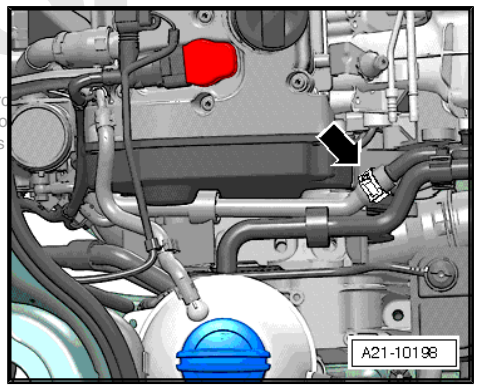
– Disconnect coolant hose -arrow- from coolant expansion tank.



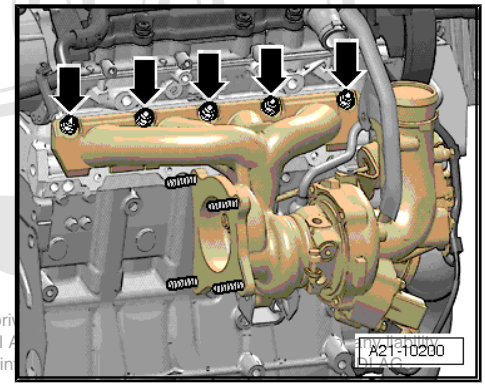
– Detach coolant hoses -1- and -2-.
– Unscrew bolt -3- and detach coolant bleeder pipe.



– Detach coolant hose -arrow-.



– Unscrew nuts -arrows- and lift off turbocharger with exhaust manifold.



Note

Seal off open pipes/lines and connections on turbocharger with clean plugs or protective caps to prevent dirt from entering.

Installing

• Tightening torques ⇒ page 179 , ⇒ page 194 .

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

Note

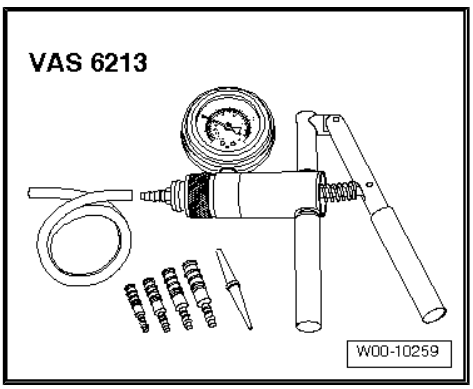
- ♦ *Renew seals, gaskets, O-rings and self-locking nuts.*
- ♦ *Fill turbocharger with engine oil at connection for oil supply pipe.*
- ♦ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ♦ *After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.*

– Install coolant bleeder pipe ⇒ page 164 .
– Observe the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 178 .
– Install front exhaust pipe with catalytic converter and front silencer ⇒ page 202 .
– Check engine oil level ⇒ Maintenance ; Booklet 810 .
– Install noise insulation ⇒ Rep. Gr. 66 .
– Fill up with coolant ⇒ page 156 .

1.5 Checking vacuum unit for turbocharger

Special tools and workshop equipment required

♦ Hand vacuum pump -VAS 6213-

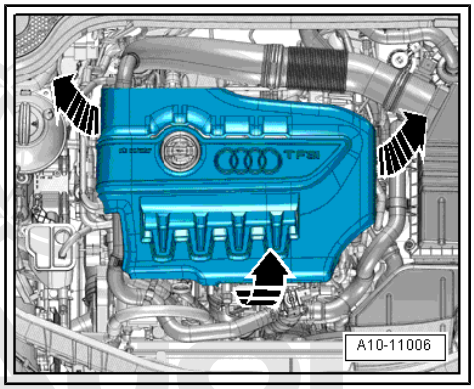


Procedure

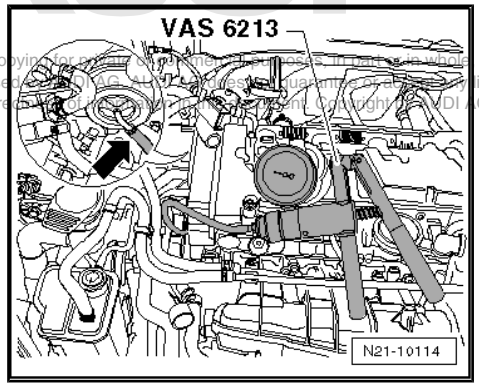
Proceed as follows:

- ♦ Hose from turbocharger via charge pressure solenoid valve -N75- to vacuum unit must not be blocked.
- ♦ Charge pressure control solenoid valve -N75- OK.

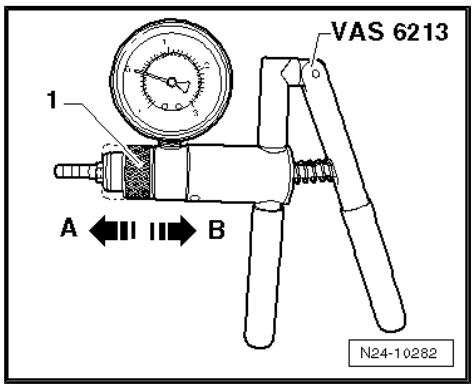
– Remove engine cover panel -arrows-.



– Connect hand vacuum pump -VAS 6213- to vacuum unit -arrow-.



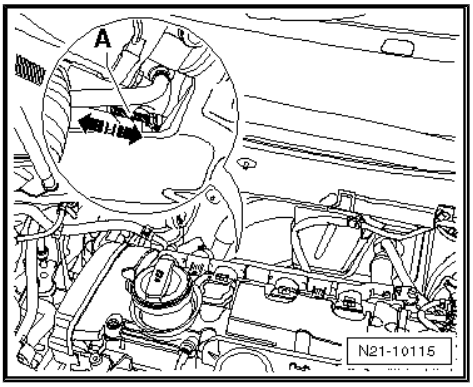
– Move adjuster ring -1- on hand vacuum pump to position “pressure” -arrow B-.



Caution

Risk of damage to vacuum unit.

- *The pressure must not exceed 850 mbar.*



– Operate hand vacuum pump repeatedly and observe linkage -A-.

- The linkage should move at a pressure of approx. 300 mbar and above.
- At approx. 800 mbar the linkage should be at its limit stop.
- The linkage should travel approx. 13 mm.

Note

- *If it is not possible to build up pressure with hand vacuum pump or if the pressure drops again immediately, check hand vacuum pump and connecting hoses for leaks.*
- *If no fault is found: renew vacuum unit ⇒ page 189 .*

1.6 Removing and installing vacuum unit for turbocharger

Removing

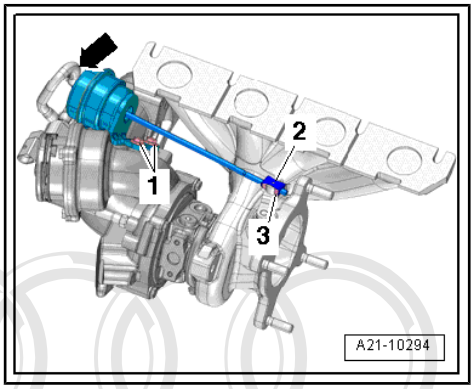
Proceed as follows:

– Remove turbocharger ⇒ page 182 .

– Detach locking plate -2- for linkage.

– Remove nut -3- and bolts -1-.

– Disconnect pressure hose -arrow- and vacuum unit.



Installing

- Tightening torques ⇒ page 179

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

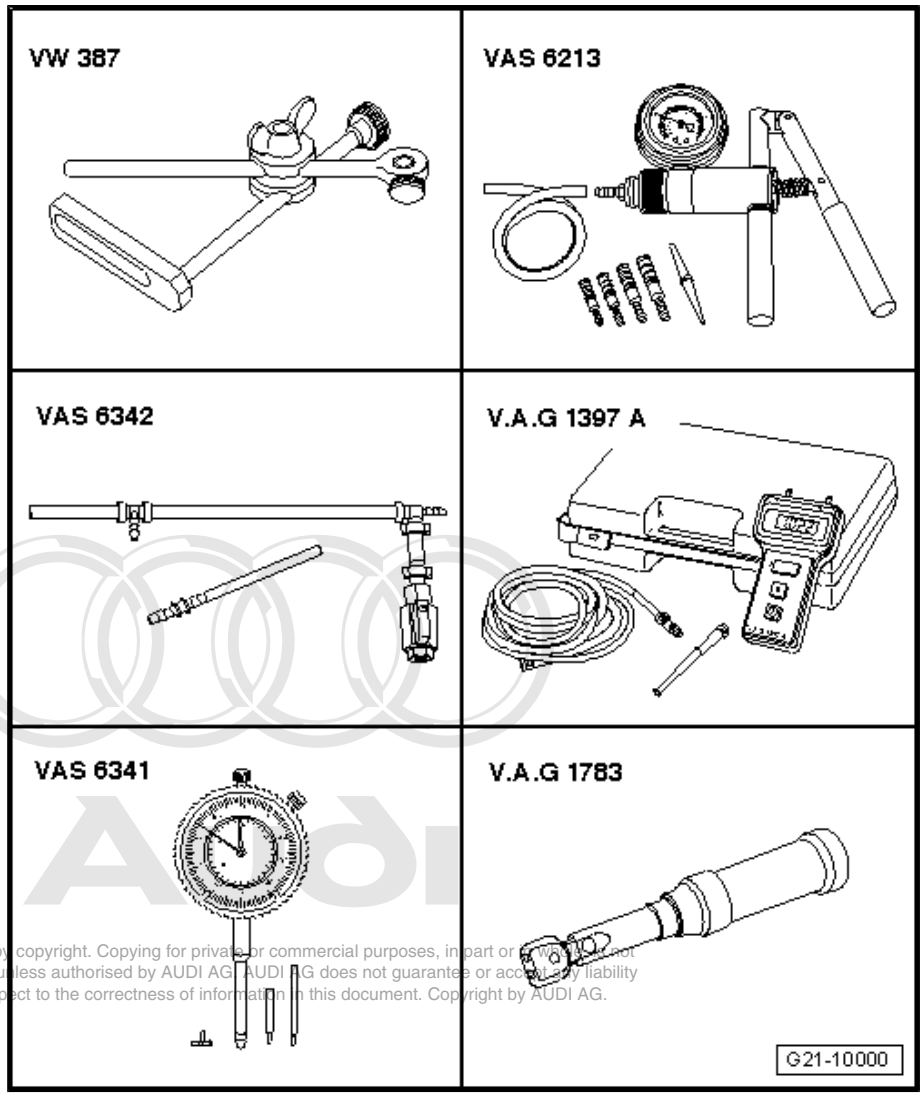
– Adjust vacuum unit for turbocharger ⇒ page 190 .

– Install turbocharger ⇒ page 182 .

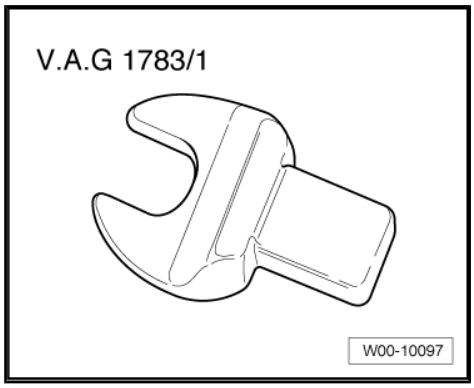
1.7 Adjusting vacuum unit for turbocharger

Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-
- Hand vacuum pump -VAS 6213-
- Pressure control valve -VAS 6342-
- Turbocharger tester -V.A.G 1397A-
- Dial gauge set, 4 pieces -VAS 6341-
- Torque wrench -V.A.G 1783-



- Open-end spanner insert AF 10 -V.A.G 1783/1-



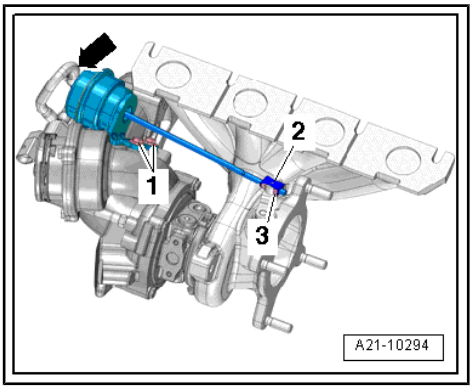
Procedure

Proceed as follows:

- Turbocharger removed ⇒ page 182
- Tightening torques ⇒ page 179

– Disconnect pressure hose -arrow-.

– Detach locking plate -2- for turbocharger linkage.



Note

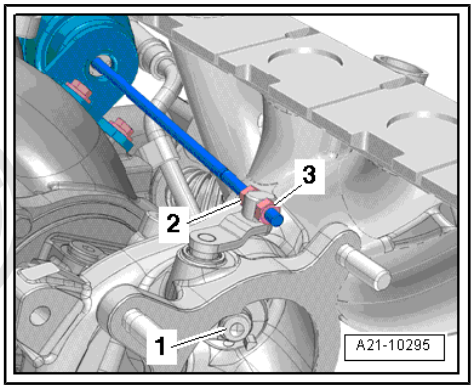
Disregard -items 1 and 3-.

– Slacken nut -2-.

– Adjust bypass flap via nut -3-.

- It must be possible to still just turn the bypass flap by hand.

– Hand-tighten nut -2-.



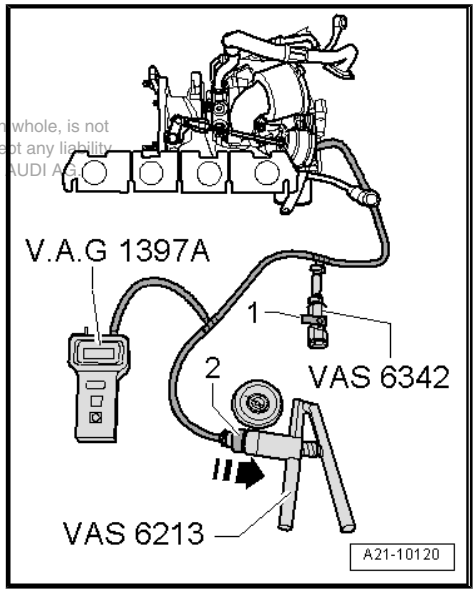
– Connect hand vacuum pump -VAS 6213- and pressure control valve -VAS 6342- to vacuum unit and connection “II” of turbocharger tester -V.A.G 1397A- , as shown in illustration.

– Close pressure control valve -VAS 6342-.

- Lever -1- should be horizontal.

– Move adjuster ring -1- on hand vacuum pump to position “pressure” -arrow-.

– Switch on turbocharger tester -V.A.G 1397A- and set sliding switch to position “II”.

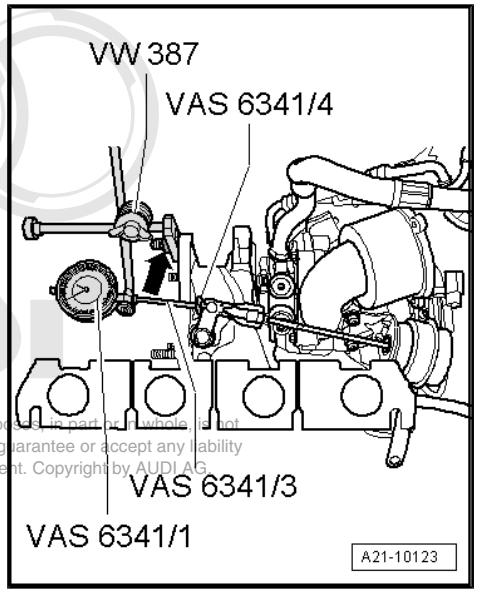


– Secure universal dial gauge bracket -VW 387- to turbocharger -arrow-.
– Attach dial gauge -VAS 6341/1- with extension, 30 mm -VAS 6341/3- and flat pickup -VAS 6341/4- to universal dial gauge bracket, as shown in illustration.
– With pressure at 0 bar, set dial gauge to 1 mm preload.
– Set scale of dial gauge to “0”.
– Make sure that dial gauge can move freely.
– Operate hand vacuum pump until turbocharger tester indicates the following value:

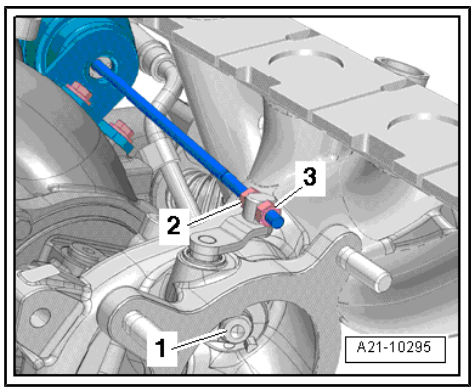
• 500 ± 5 mbar

– Read off value indicated on dial gauge.

• Specification: 3.75 … 4.25 mm.



– If specification is not attained or is exceeded, turn nut -3- accordingly.
– Lock nut -2- by hand and repeat measurement.



– Vent system via pressure control valve -VAS 6342- so that pressure reading drops to 0 mbar.
– Set dial gauge -VAS 6341/1- to “0”.

Note

The following measurements must be performed in the specified sequence. Do not allow the pressure to drop to 0 mbar between measurements.

– Operate hand vacuum pump -VAS 6213- until turbocharger tester -V.A.G 1397A- indicates the following value:

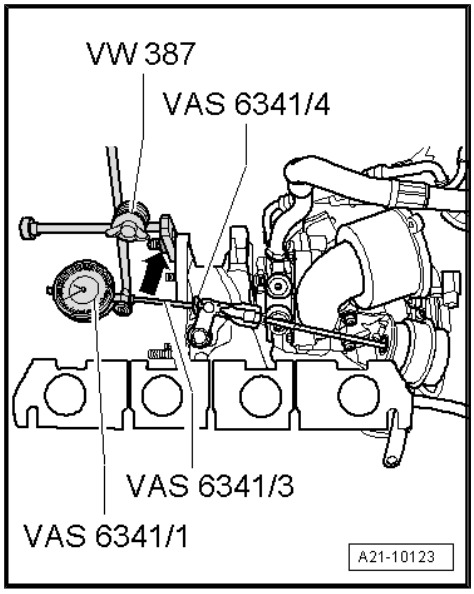
• 500 ± 5 mbar

– Read off and note value indicated on dial gauge -VAS 6341/1- .
– Operate hand vacuum pump until turbocharger tester indicates the following value:

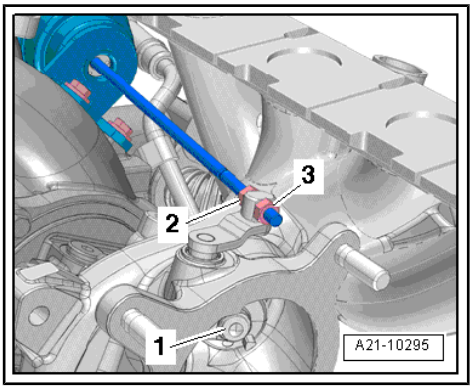
• 650 ... 700 mbar

– Vent system via pressure control valve -VAS 6342- so that pressure reading drops to 500 ± 5 mbar.
– Read off and note value indicated on dial gauge.
– Add values “1” and “2” together and divide by 2.

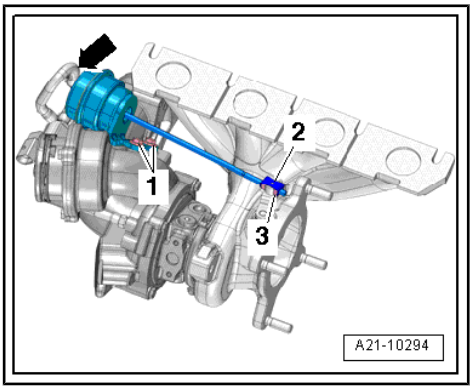
• Specification (mean value): 4 ± 0.25 mm



– If specification is not attained or is exceeded, turn nut -3- accordingly.
– Lock nut -2- by hand and repeat measurement.
– If the specification is attained, lock nuts and secure with sealing paint; for sealing paint refer to ⇒ Electronic parts catalogue .



– Secure locking plate -2- at linkage for vacuum unit and connect pressure hose -arrow-.

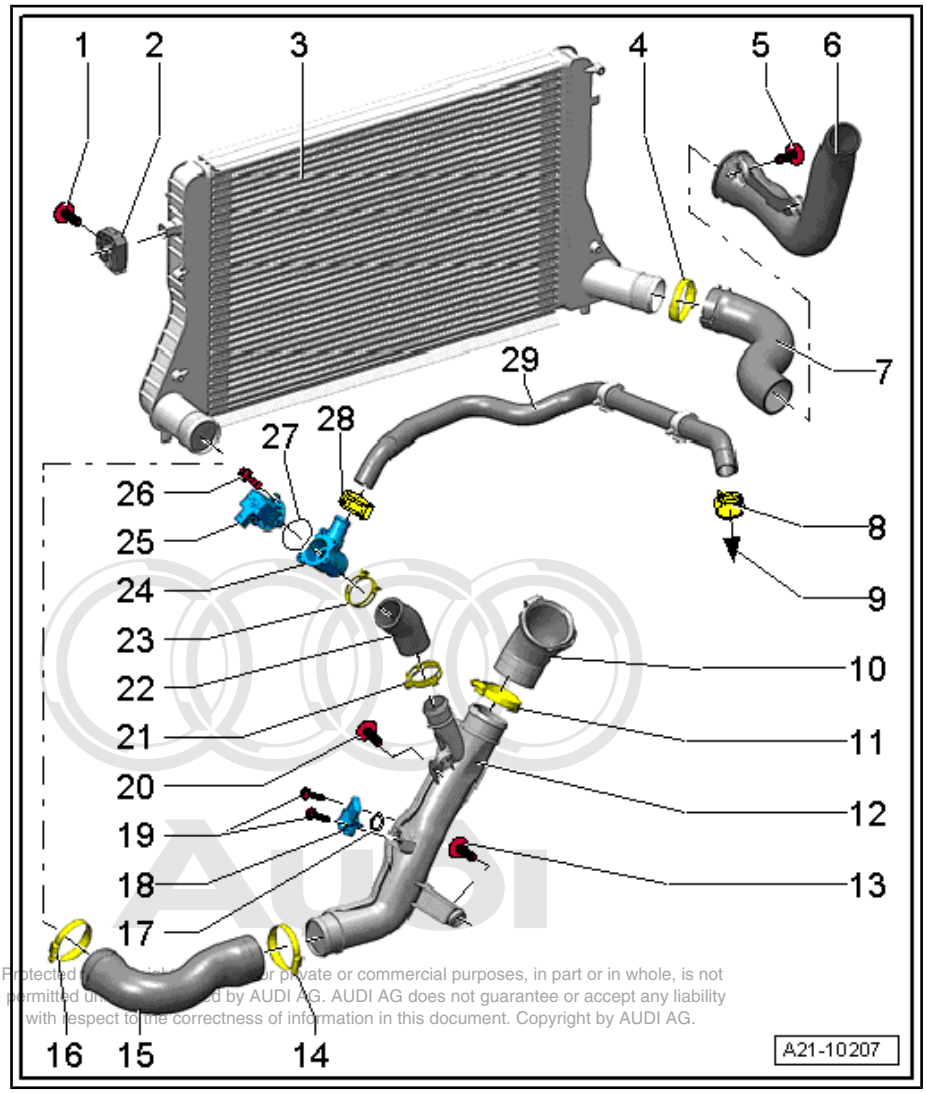


2 Charge air cooler

2.1 Charge air cooler - exploded view

Note

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



1 - Bolt
- ❑ 5 Nm

2 - Mounting
- ❑ For charge air cooler

3 - Charge air cooler
- ❑ Removing and installing ⇒ page 196

4 - Hose clip

5 - Bolt
- ❑ 10 Nm

6 - Air pipe
- ❑ Removing and installing ⇒ page 178

7 - Air hose
- ❑ Removing and installing ⇒ page 178

8 - Hose clip

9 - Leading to air hose

10 - Air hose
- ❑ To throttle valve module -J338-

11 - Hose clip

12 - Air pipe

13 - Bolt
- ❑ 10 Nm

14 - Hose clip

15 - Air hose

16 - Hose clip

17 - O-ring
- ❑ Renew

18 - Charge air pressure sender -G31-
- ❑ Removing and installing ⇒ page 195

19 - Bolts
- ❑ 5 Nm

20 - Bolt or nut
- ❑ 10 Nm

21 - Hose clip

22 - Hose

23 - Hose clip

24 - Housing

25 - Turbocharger air recirculation valve -N249-
- ❑ Removing and installing ⇒ page 195

26 - Bolt
- ❑ 3x
- ❑ 7 Nm

27 - O-ring
- ❑ Renew

28 - Hose clip

29 - Hose

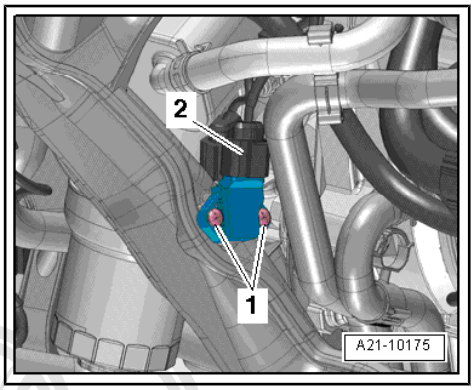
2.2 Removing and installing charge air pressure sender -G31-

Removing

Proceed as follows:

– Unplug electrical connector -2-.

– Unscrew bolts -1- and remove charge air pressure sender -G31- .



Installing

- Tightening torque ⇒ page 179

Install in reverse order.

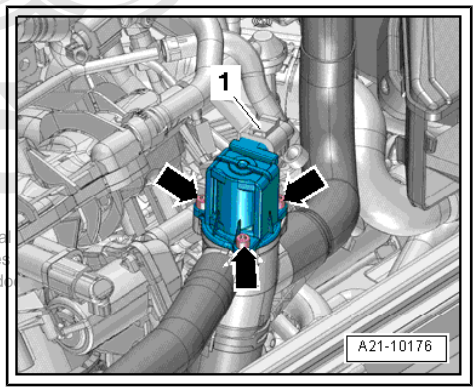
2.3 Removing and installing turbocharger air recirculation valve -N249-

Removing

Proceed as follows:

– Unplug electrical connector -1-.

– Unscrew bolts -arrows- and remove turbocharger air recirculation valve -N249- .

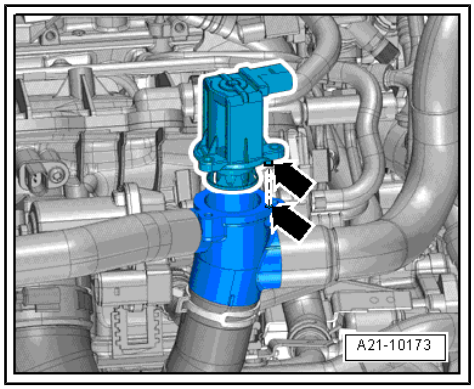


Installing

- Tightening torque ⇒ page 179

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

- Installation position: Markings must be on same side -arrows-.



2.4 Removing and installing charge air cooler

Removing

Proceed as follows:

– Remove radiator ⇒ page 173 .

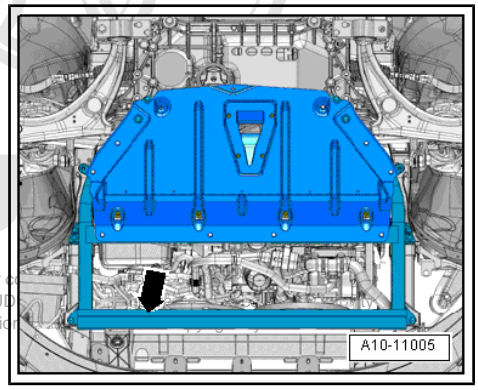
Caution

Make sure that condenser and refrigerant pipes and hoses are not damaged.

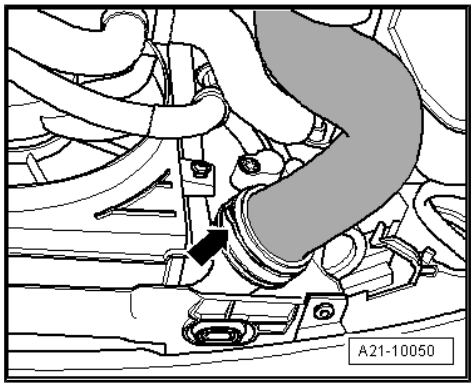
- ***Do NOT stretch, kink or bend refrigerant lines and hoses.***

– Remove bumper cover (front) ⇒ Rep. Gr. 63 .

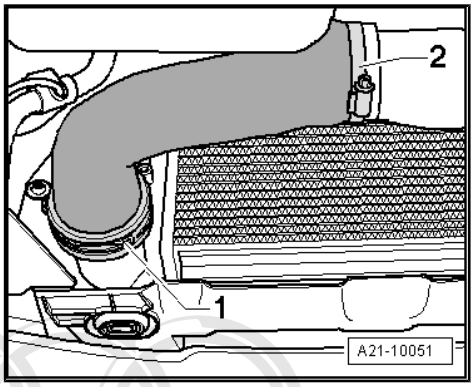
– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. Gr. 66 .



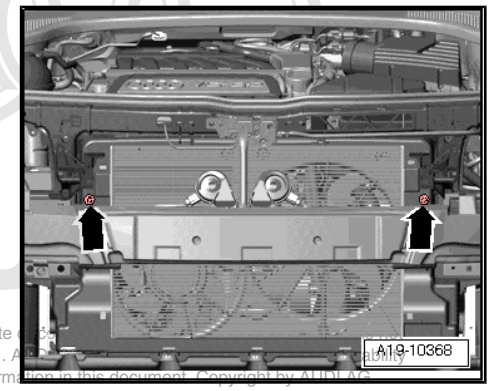
– Release hose clip -arrow- and detach air hose from charge air cooler.



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



– Unscrew bolts -arrows-; to do so, release air ducts (left and right) and swivel towards headlights.
– Swivel top edge of charge air cooler slightly towards rear.
– Lift charge air cooler out of bottom mounting points.
– Push charge air cooler towards engine and support from below to prevent it from dropping.



– Remove bolts -arrows-.
– Take out charge air cooler from underneath.

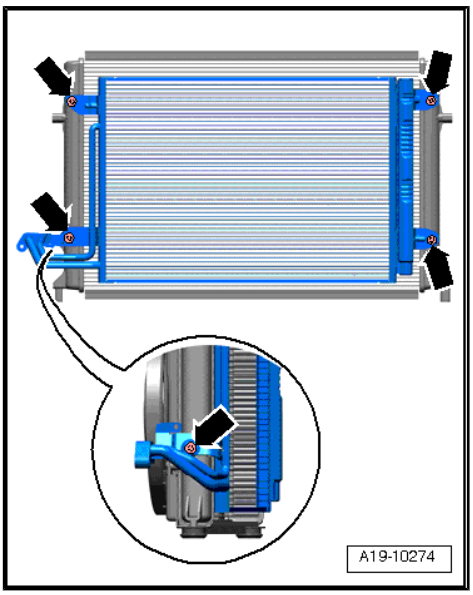
Installing

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

- Tightening torques ⇒ page 194

Installing

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



Note

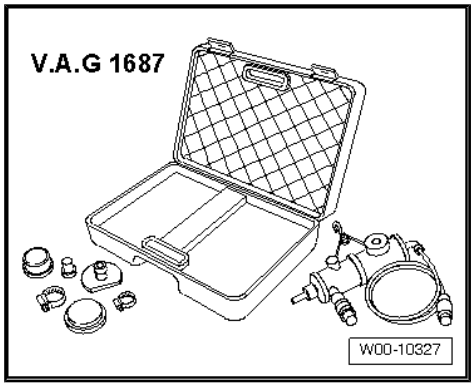
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the charge air hoses can be properly secured at their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

– Install radiator ⇒ page 173 .
– Install noise insulation frame ⇒ Rep. Gr. 66 .
– Install bumper cover (front) ⇒ Rep. Gr. 63 .
– Check coolant level ⇒ page 159 .

2.5 Checking charge air system for leaks

Special tools and workshop equipment required

♦ Charge air system tester -V.A.G 1687-

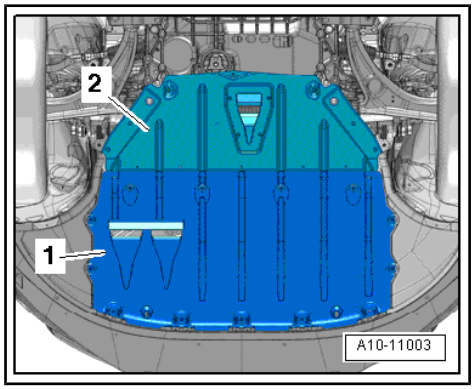


♦ Adapter -V.A.G 1687/5-

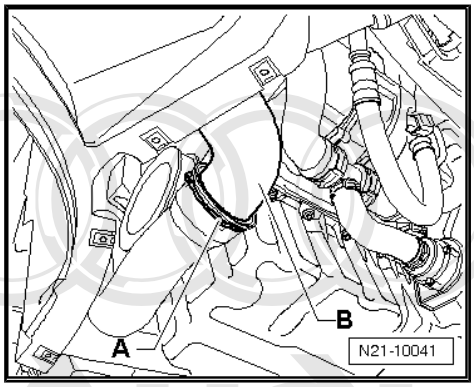
Procedure

Proceed as follows:

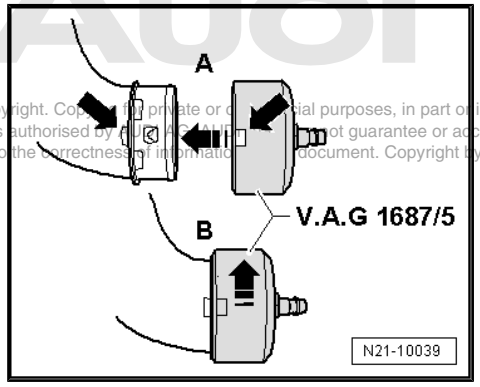
– Remove front noise insulation -1- ⇒ Rep. Gr. 66 .



– Lift retaining clip -A- and detach air hose -B-.

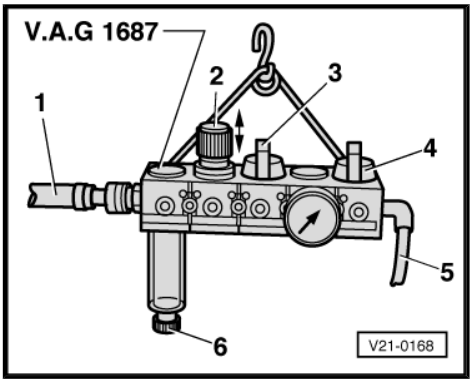


– Fit adapter -V.A.G 1687/5- onto air hose -A- and turn by approx. 90° -B-.



Prepare charge air system tester -V.A.G 1687- as follows:

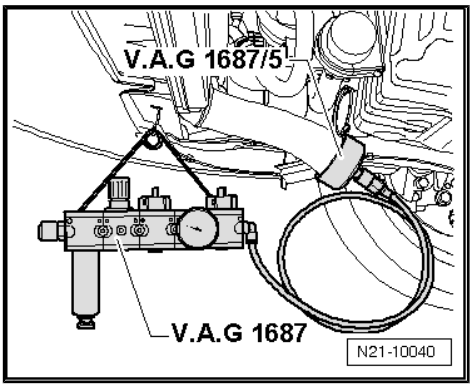
– Unscrew pressure control valve -2- completely and close valves -3- and -4-.



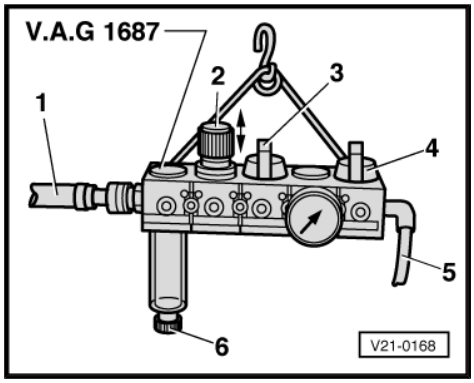
Note

Make sure knob is pulled out before turning pressure control valve -2-.

– Connect charge air system tester -V.A.G 1687- as shown on illustration.



– Using a commercially available connection piece, connect charge air system tester -V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

– Open valve -3-.

Caution

Risk of damage if pressure is set too high.

- ***The pressure must not exceed 0.5 bar.***

– Adjust pressure to 0.5 bar via pressure control valve -2-.

– Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.

– Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detecting spray or use ultrasonic tester -V.A.G 1842- .

Note

- *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- *For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .*
- *Release pressure by detaching coupling from adapter -V.A.G 1687/5- before removing adapter.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*

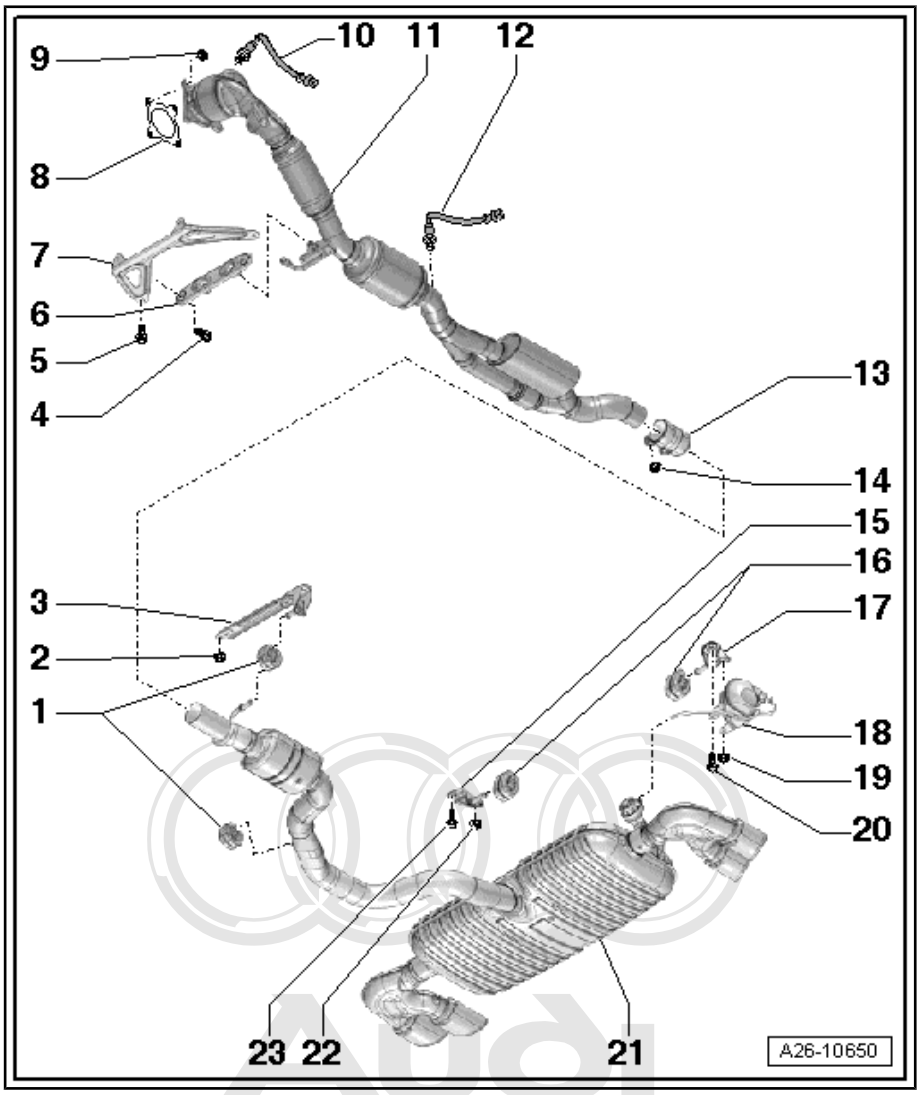
– Observe the instructions for installing air pipes and hoses with plug-in connectors ⇒ page 178 .

– Install noise insulation ⇒ Rep. Gr. 66 .

26 – Exhaust system

1 Silencers

1.1 Silencers - exploded view



1 - Rubber mounting
- ❑ Renew if damaged

2 - Nut
- ❑ 23 Nm

3 - Bracket for exhaust system

4 - Bolt
- ❑ 23 Nm

5 - Bolt
- ❑ 23 Nm

6 - Mounting
- ❑ Renew if damaged

7 - Tunnel brace

8 - Gasket
- ❑ Renew

9 - Nut
- ❑ Renew
- ❑ Coat studs with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 40 Nm

10 - Lambda probe -G39-
- ❑ Removing and installing ⇒ Rep. Gr. 24

11 - Front exhaust pipe with catalytic converter and front silencer
- ❑ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ❑ Install flexible joint so that it is not under tension.
- ❑ Take care not to damage wire mesh on flexible joint.
- ❑ Protect catalytic converter from damage by knocks and impact
- ❑ Removing and installing ⇒ page 202
- ❑ Do not remove protective packaging from replacement part until you are ready to fit the flexible joint
- ❑ Align exhaust system so it is free of stress ⇒ page 206

12 - Lambda probe 2 -G108-
- ❑ Removing and installing ⇒ Rep. Gr. 24

13 - Clamp
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 206
- ❑ Installation position ⇒ page 202

- ❑ Tighten bolt connections evenly

14 - Nut

- ❑ 23 Nm

15 - Bracket

16 - Rubber mounting

- ❑ Renew if damaged

17 - Bracket

18 - Exhaust flap valve -N220-

- ❑ With vacuum unit
- ❑ Checking vacuum unit for exhaust flap ⇒ page 209

19 - Nut

- ❑ 23 Nm

20 - Bolt

- ❑ 23 Nm

21 - Rear silencer

- ❑ Combined with centre silencer
- ❑ Align exhaust system so it is free of stress ⇒ page 206

22 - Nut

- ❑ 23 Nm

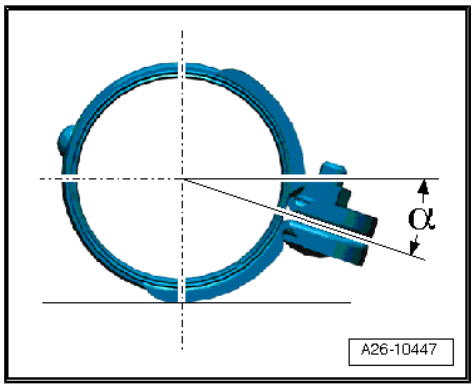
23 - Bolt

- ❑ 23 Nm

Installation position of clamp

– Fit the clamp at the angle shown.

- α = approx. 20°
- Bolt connections facing towards right
- Nuts facing upwards



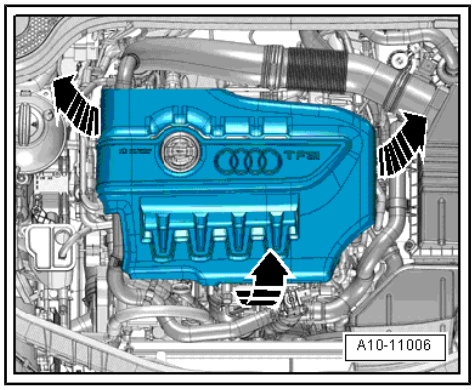
1.2 Removing and installing front exhaust pipe with catalytic converter and front silencer

Removing

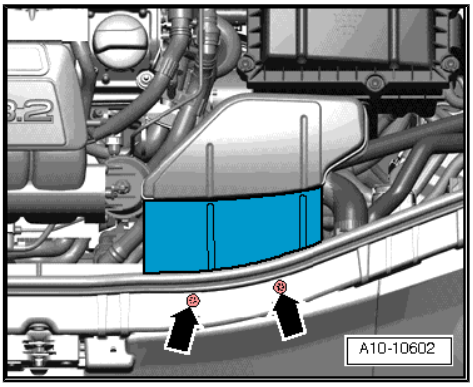
Proceed as follows:

– Remove Lambda probe -G39- ⇒ Rep. Gr. 24 .

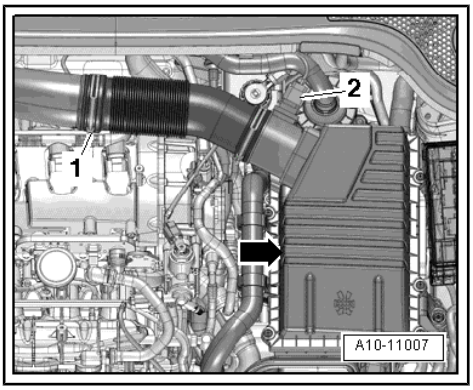
– Remove engine cover panel -arrows-.



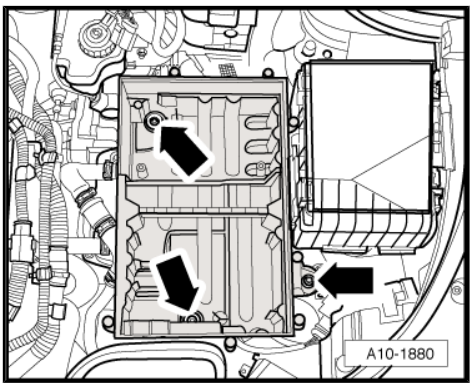
– Unscrew bolts -arrows- and remove air duct.



– Release hose clip -1- and detach air hose.
– Unplug electrical connector -2- for air mass meter -G70- .
– Unscrew top section of air cleaner housing -arrow- and remove air filter element.



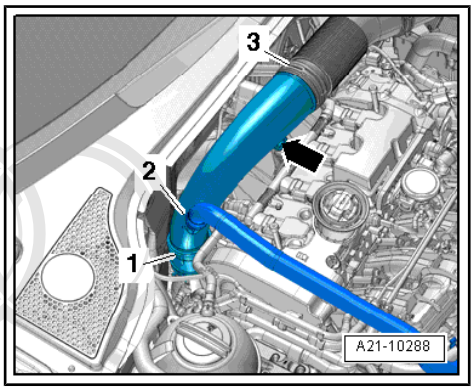
– Remove bolts -arrows- and detach bottom section of air cleaner housing.



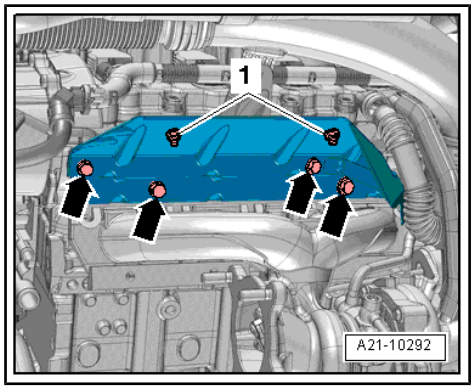
– Remove bolt -arrow-.
– Loosen hose clip -1- and move air pipe clear to one side (hose -2- remains connected).

Note

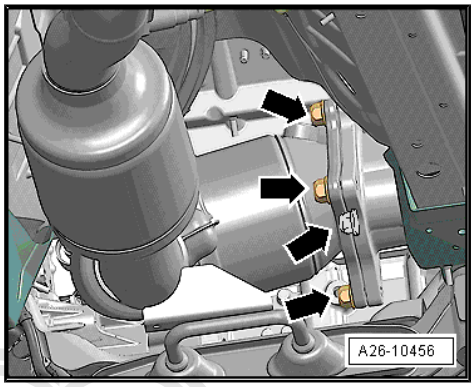
Disregard item -3-.



– Unscrew bolts -arrows- and nuts -1- and detach heat shield.



– Working from above, unscrew nuts -arrows- securing front exhaust pipe to turbocharger.

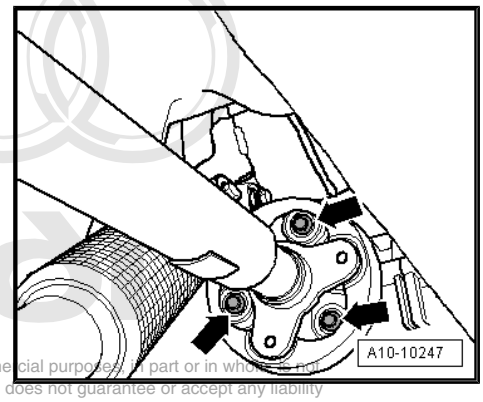


Note

The illustration shows the installation position from underneath.

– Mark position of flexible coupling and flange for bevel box in relation to each other for re-installation.

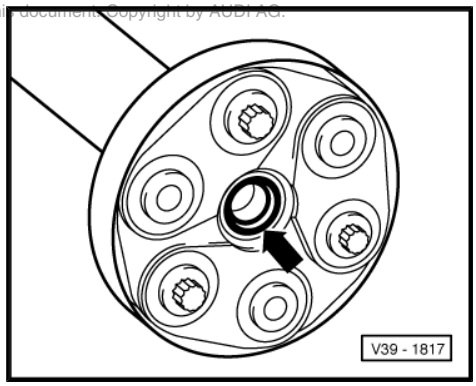
– Unbolt flexible coupling for propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).



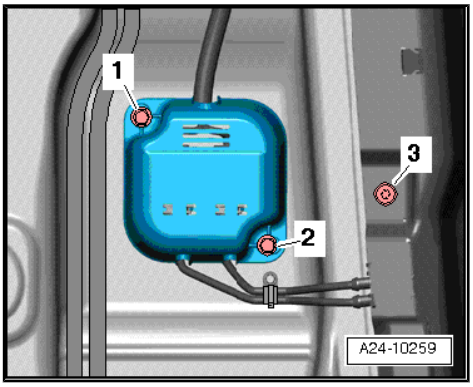
Caution

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

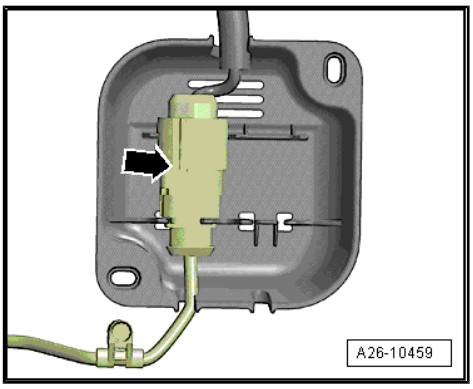
- ***Push the propshaft horizontally to the rear and towards the right side of vehicle as far as possible.***



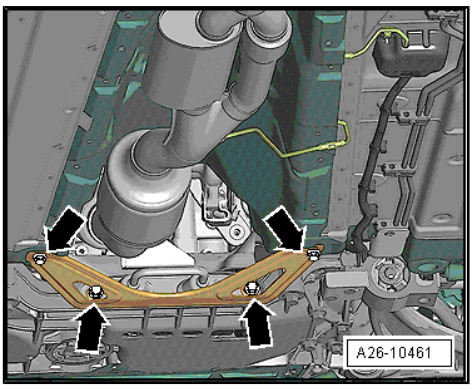
– Remove bolts -1- and -2- on underside of vehicle.
– Detach cover from bracket for electrical connector for Lambda probe.
– Remove bolt -3- and move electrical wire to Lambda probe clear.



– Remove electrical connector -arrow- for Lambda probe after catalytic converter -G130- from bracket and unplug connector.



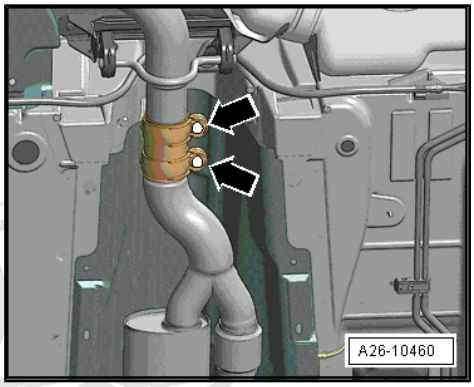
– Remove bolts -arrows- and detach bracket for exhaust system and tunnel brace.



Caution

Avoid damage to flexible joints.

- *Do not bend flexible joints in front exhaust pipe more than 10°.*



– Disconnect exhaust system at clamp -1-.

– Detach front exhaust pipe with catalytic converter and front silencer.

Installing

• Tightening torques ⇒ page 201

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

Note

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

– Align the exhaust system so it is free of stress ⇒ page 206 .

1.3 Stress-free alignment of exhaust system

Procedure

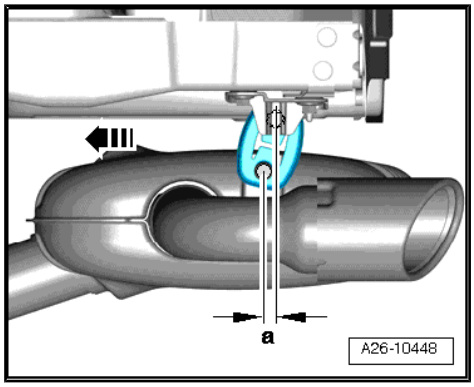
Proceed as follows:

• The exhaust system must be aligned when it is cool.

• Tightening torque ⇒ page 201

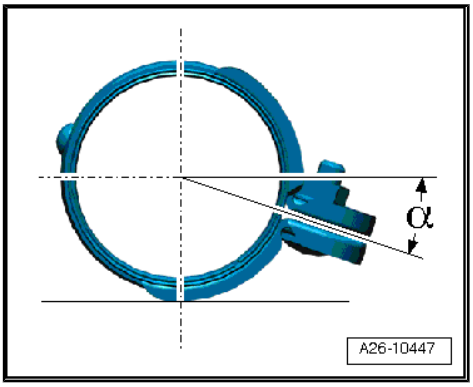
– Loosen bolt connections for clamp.

– Push rear silencer towards front of vehicle -arrow- so that rubber mounting (left-side) on rear silencer is preloaded by -a- = 11 ... 13 mm.



– Fit the clamp at the angle shown.

• α = approx. 20°
• Bolt connections facing towards right
• Nuts facing upwards



1.4 Aligning tailpipes

Procedure

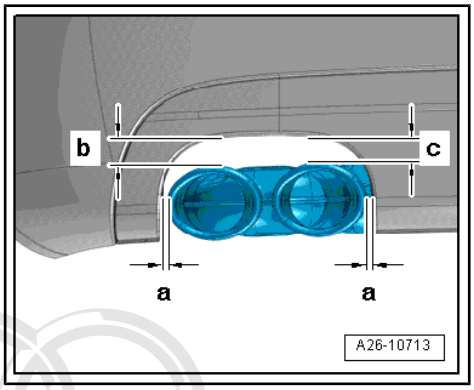
Proceed as follows:

– Adjust the rear silencer so that there is an even distance between the bumper cut-outs and the tailpipes.

• Distance -a- is the same on both sides.
• Distance -b- = approx. 19 mm.
• Distance -c- = approx. 22.5 mm.

– Unfasten rear silencer mounting to align tailpipes.

• Tightening torque ⇒ page 201



1.5 Checking exhaust system for leaks

Procedure

Proceed as follows:

– Start the engine and run at idling speed.
– Plug tailpipes during leak test (e.g. with cloth or plugs).
– Listen for leaks at joints between cylinder head and exhaust manifold with turbocharger, exhaust manifold/turbocharger and front exhaust pipe, etc.
– Rectify any leaks that are found.

2 Exhaust manifold

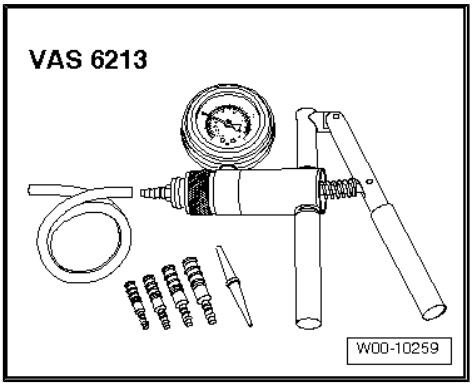
The exhaust manifold and the turbocharger are combined as one unit; removing and installing ⇒ page 177 .

3 Exhaust flap

3.1 Checking vacuum unit for exhaust flap

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-

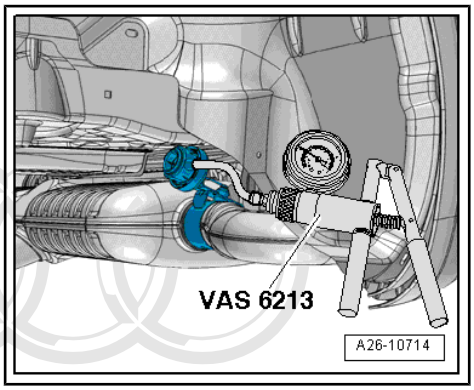


Procedure

Proceed as follows:

– Detach hose from vacuum unit for exhaust flap on rear silencer.

– Connect hand vacuum pump -VAS 6213- to vacuum unit.



– Operate hand vacuum pump.

• The linkage should move upwards.

– Vent vacuum pump.

• Linkage should move downwards.

– If linkage does not move, check linkage for ease of movement and check vacuum unit for leaks.