Workshop Manual

Audi TT 2007 ➢

5-cylinder direct petrol injection engine (2.5 ltr. 4-valve turbo), mechanics									
Engine ID	CEP A								

Edition 12.2010

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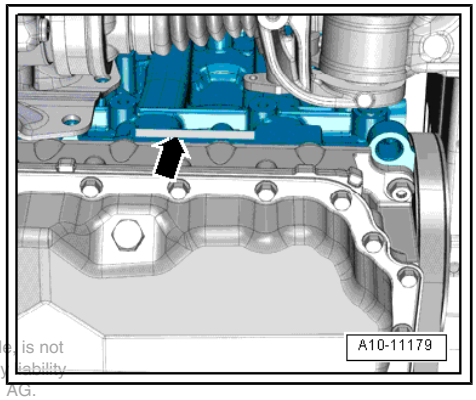
Repair Group

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 rear of the joint between cylinder block and sump (top section) -arrow-.
- There is also a sticker on the timing chain cover (top) showing the „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		CEPA
Capacity	ltr.	2.480
Power output	kW at rpm	250/5400 … 6500
Torque	Nm at rpm	450/1600 … 5300
Bore	∅ in mm	82.5
Stroke	mm	92.8
Compression ratio		10
RON	at least	98 1)
Injection/ignition system		Bosch Motronic
Firing order		1-2-4-5-3
Exhaust gas recirculation		no
Exhaust gas temperature control		1 senders
Turbocharging/supercharging		Turbocharger
Knock control		2 sensors
Charge air cooling		yes
Lambda control		1 probe before catalytic converter 1 probe after catalytic converter
Variable valve timing		Inlet Exhaust
Intake manifold change-over		no
Secondary air system		no
Valves per cylinder		4

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

3 Safety precautions

Overview

3.1 Working on the fuel system

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 ⇒ Rep. gr. 24 .

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(s) if electrical connectors were unplugged and engine was started: „Generate readiness code“ in „Guided Functions“ ⇒ Vehicle diagnostic, testing and information system VAS 5051.

Caution

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

- *Observe notes on procedure for disconnecting the battery.*
- *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 .

3.2 Procedure before opening high-pressure section of injection system

WARNING

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

- *The injection system consists of a high-pressure section (maximum approx. 140 bar) and a low-pressure section (approx. 6 bar).*
- *The fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 6 bar prior to opening the system. Procedure ⇒ Rep. gr. 24 .*

3.3 Working on the cooling system

When working on the cooling system note the following warnings:

WARNING

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

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

3.4 Working on vehicles with start/stop system

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

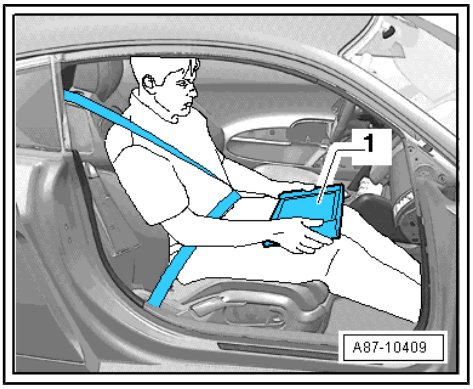
WARNING

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

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

3.5 Using testers and measuring instruments during a road test

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



WARNING

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

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

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

- *Move the passenger's seat back as far as it will go.*
- *Use only vehicle diagnosis and service information system -VAS 5052 A- 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.*

3.6 Working on the exhaust system

When working on the exhaust system please note the following:

Caution

Avoid damage to flexible joint.

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

4 General repair instructions

Overview

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

4.2 Checking fuel system for leaks

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

– Switch off ignition.

– Check complete fuel system for leaks.

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

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

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

4.3 Foreign particles in engine

- When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with

suitable plugs (e.g. from engine bung set -VAS 6122-) to prevent foreign particles from entering the engine.

4.4 Contact corrosion!

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

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

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

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

Note the following:

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

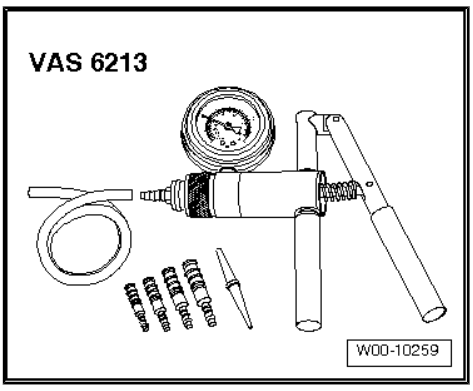
4.5 Routing and attachment of pipes, hoses and wiring

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

4.6 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Lines porous or leaking

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

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

4.7 Installing radiators, condensers and charge air coolers

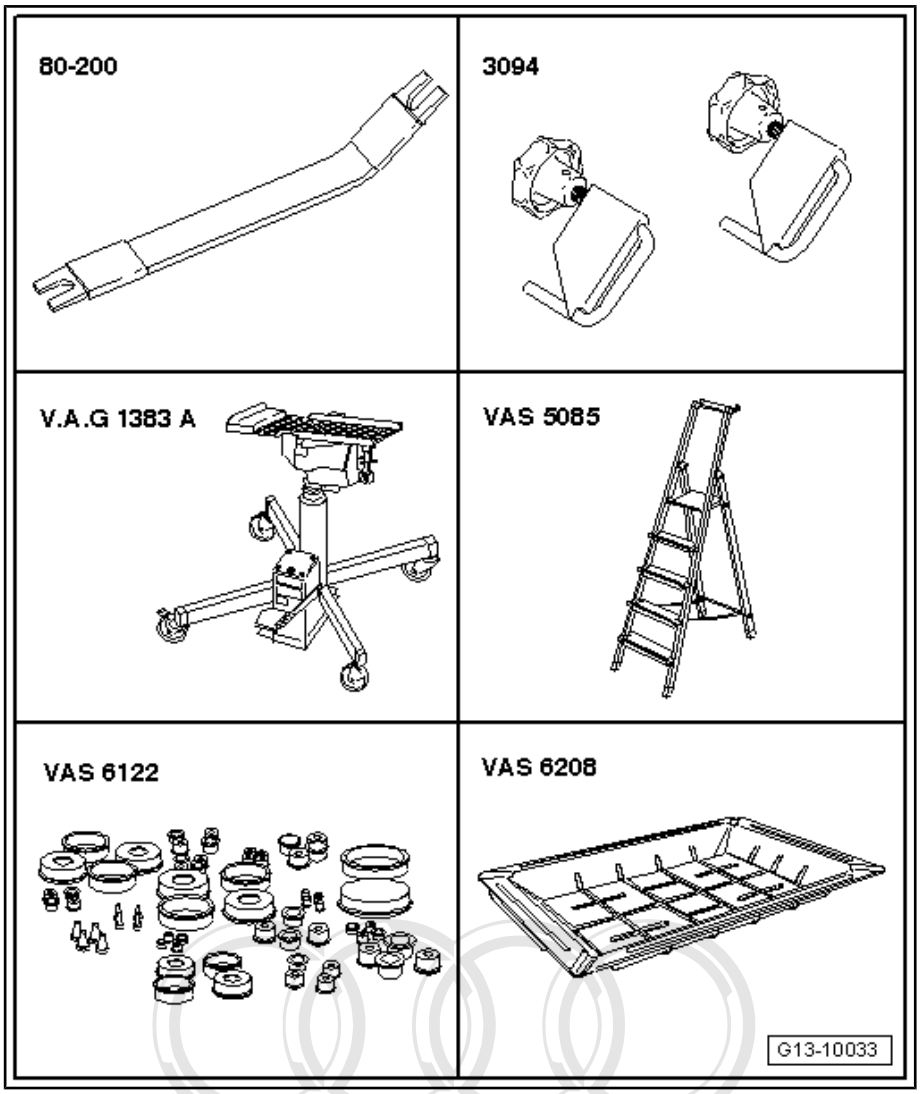
Even when the radiator, condenser and charge air cooler are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator, condenser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

10 – Removing and installing engine

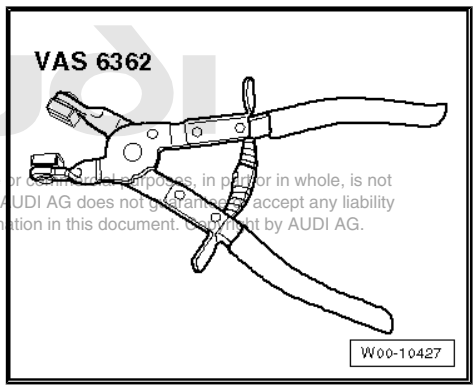
1 Removing engine

Special tools and workshop equipment required

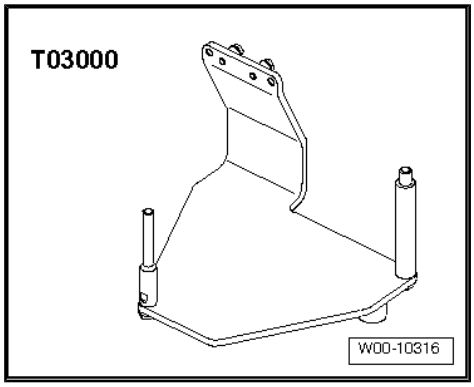
- Removal lever -80 - 200-
- Hose clamps for hoses up to 25 mm -3094-
- Engine and gearbox jack -V.A.G 1383 A-
- Stepladder -VAS 5085-
- Engine bung set -VAS 6122-
- Drip tray for workshop hoist -VAS 6208-



- Hose clip pliers -VAS 6362-



- Engine bracket -T03000-



Procedure

Note

- *The engine is removed from underneath together with the gearbox.*
- *Fit cable ties in the original positions when installing.*
- *Routing and attachment of pipes, hoses and wiring in engine compartment* *⇒ page 7* *.*

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.***

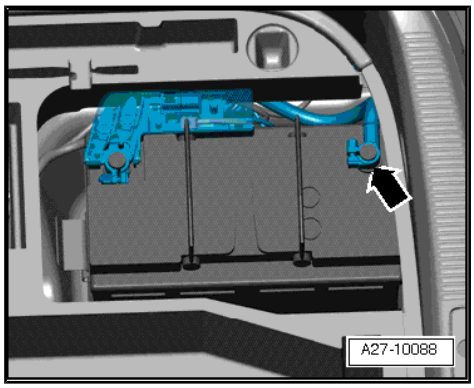
– Reduce fuel pressure in high-pressure section of injection system ⇒ Rep. gr. 24 .

Caution

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

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

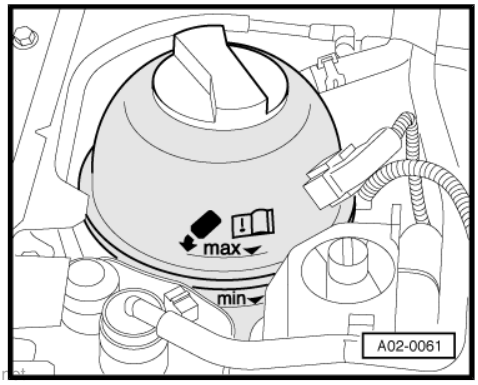
– With ignition switched off, disconnect earth cable -arrow- at battery ⇒ Electrical system; Rep. gr. 27 .



WARNING

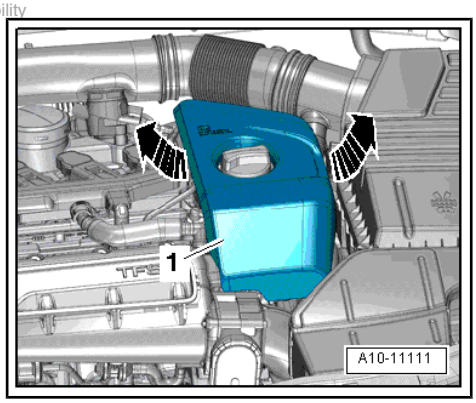
Hot steam/hot coolant can escape - risk of scalding.

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

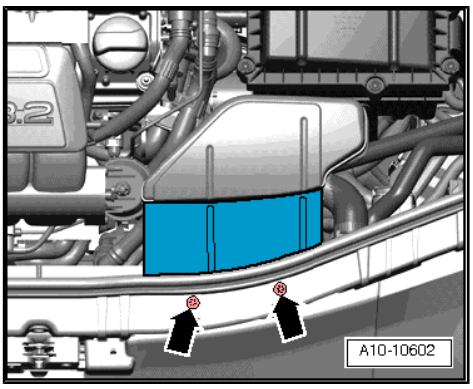


– Open filler cap on coolant expansion tank.

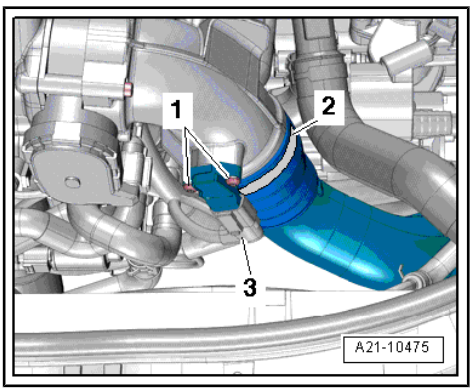
– Lift off engine cover panel -1- -arrows-.



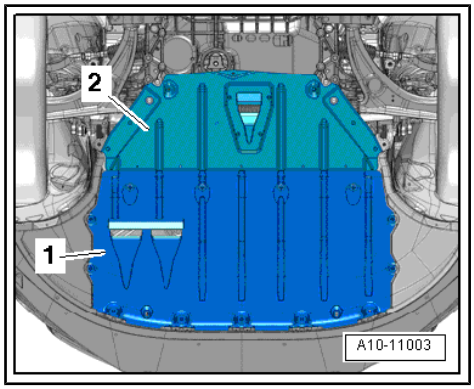
– Unscrew bolts -arrows- and remove air duct.



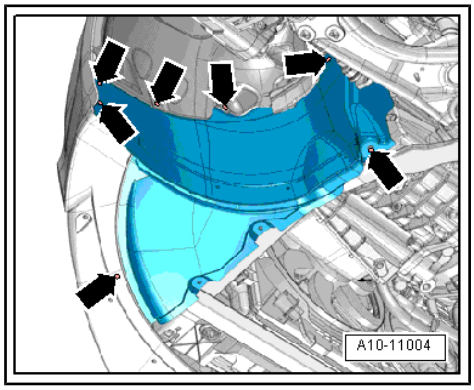
– Unplug electrical connector -3-.
– Unscrew bolts -1- and remove charge pressure sender -G31- / intake air temperature sender 2 -G299- .
– Loosen hose clip -2-.



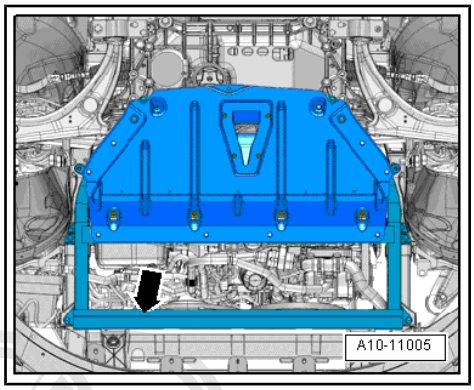
– Remove front wheels ⇒ Wheels and tyres; Rep. gr. 44 .
– Remove front noise insulation -1- ⇒ Rep. gr. 66 .



– Remove front bottom sections of wheel housing liners (left and right)⇒ Rep. gr. 66 .



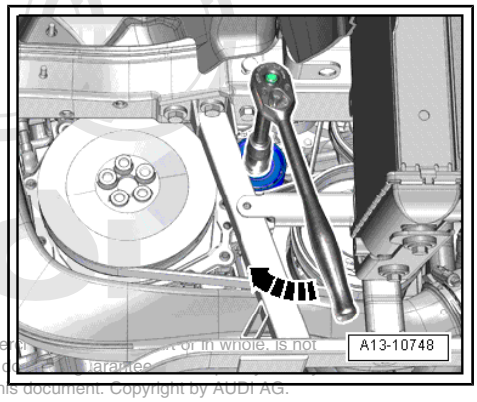
– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. gr. 50 .



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 for air conditioner compressor with chalk or felt-tipped pen for re-installation.***

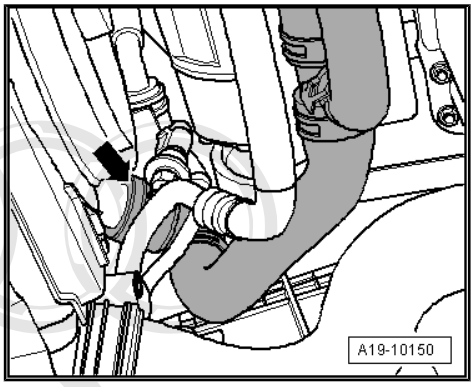


– To slacken poly V-belt turn tensioner in clockwise direction -arrow-.
– Detach poly V-belt for air conditioner compressor and release tensioner.

Note

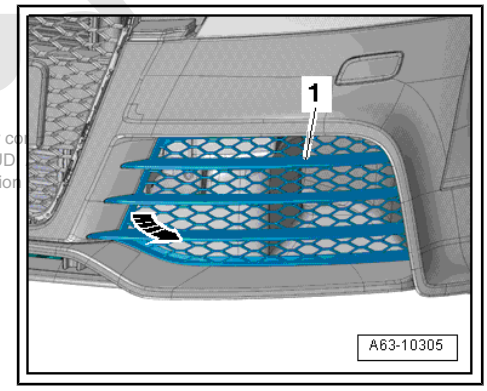
Collect drained coolant in a clean container for re-use or disposal.

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



Vehicles with manual gearbox:

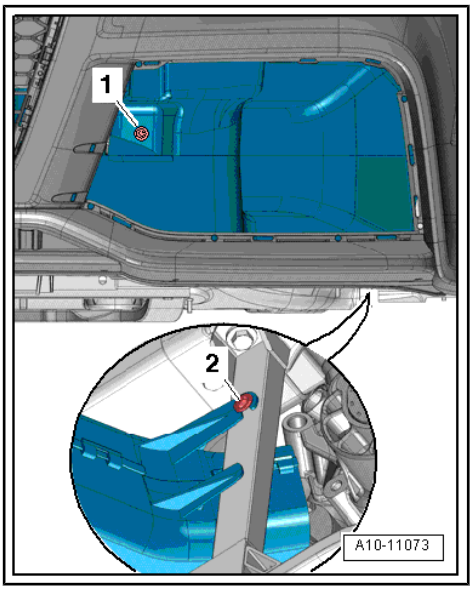
– Detach air intake grille -1- from bumper cover -arrow-.



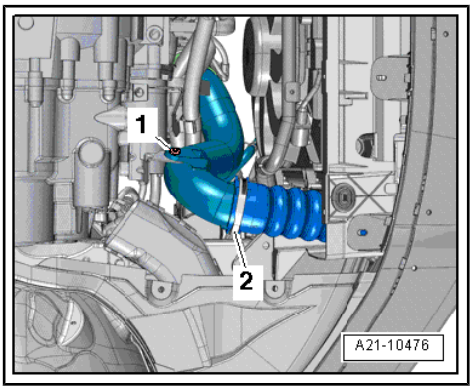
– Unscrew bolt -1- and remove air duct.

Note

Disregard -item 2-.



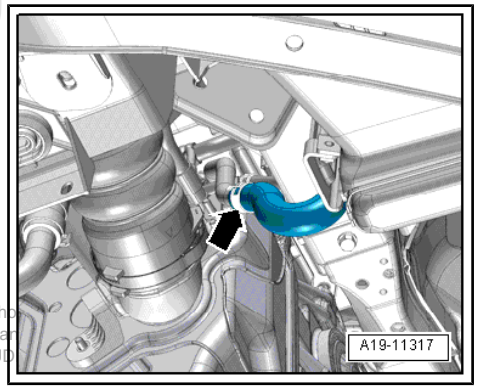
– Remove bolt -1-.
– Release hose clip -2- and detach air pipe.



Vehicles with dual clutch gearbox:

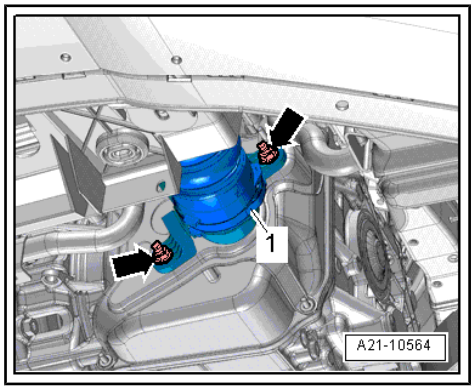
– Place drip tray for workshop hoist -VAS 6208- under connection.

– Release hose clip -arrow-, disconnect coolant hose and drain off coolant.



– Remove nuts -arrows-.

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



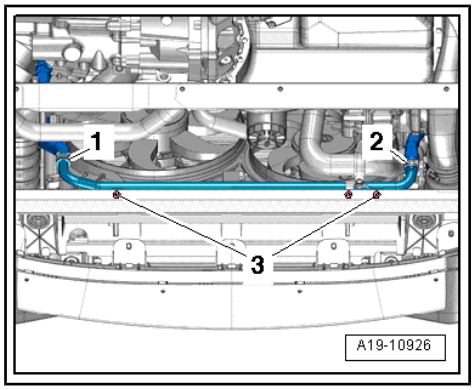
All vehicles (continued):

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

– Release hose clips, disconnect coolant hoses -1- and -2- and drain off coolant.

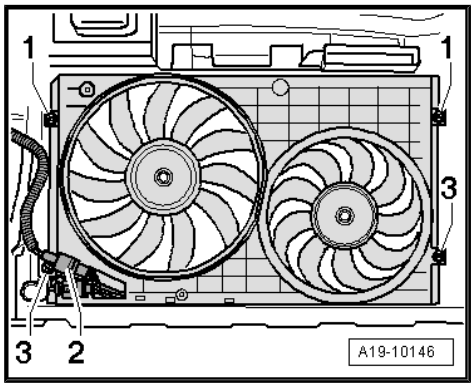
Note

Disregard -item 3-.



– Unplug electrical connector -2- for radiator fan.

– Remove bolts -3-.



WARNING

Risk of injury caused by fuel.

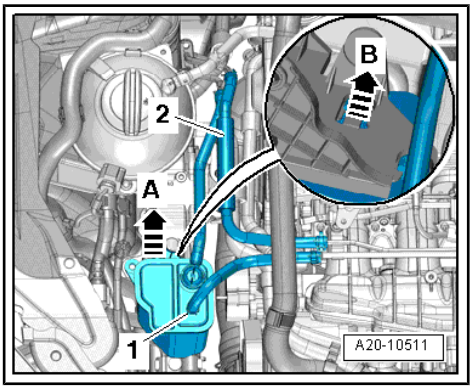
- ***To allow the fuel pressure to dissipate, wrap a clean cloth around the connection and carefully loosen the connection before opening the fuel system.***

Caution

Risk of damage caused by particles of dirt.

- ***Observe rules for cleanliness when working on the fuel supply system*** ***⇒ page 6*** ***.***

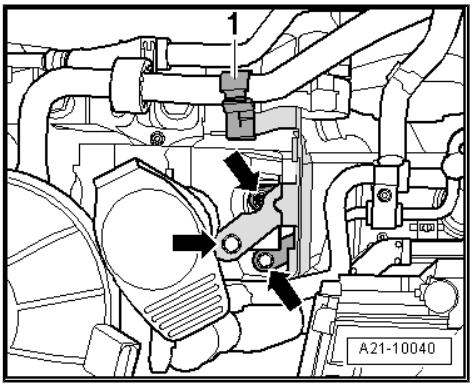
– Disengage fuel supply line from retainer and remove heat insulation sleeve -2- at fuel supply line connection.
– Disconnect fuel supply pipe (pull release ring).
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .
– Disconnect hose -1- from activated charcoal filter.
– Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side.



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

Note

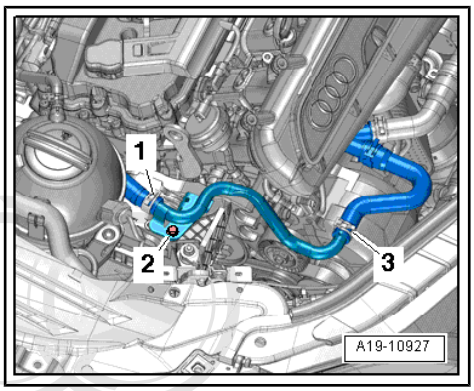
Disregard -item 1-.



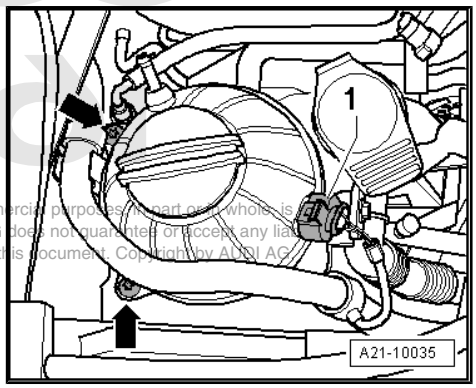
– Release hose clip -3- and detach coolant hose.
– Guide coolant hose downwards and drain off coolant.

Note

Disregard -items 1, 2-.



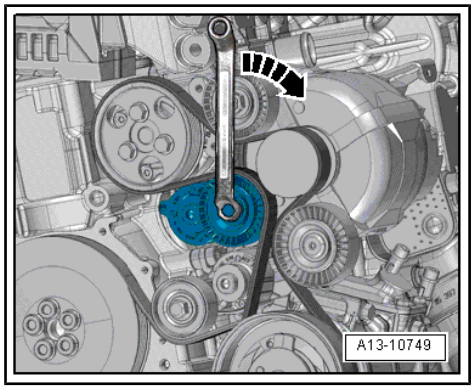
– Unplug electrical connector -1- for coolant shortage indicator switch -F66- .
– Remove bolts -arrows- and move coolant expansion tank with coolant pipe (right-side) to side.



Caution

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

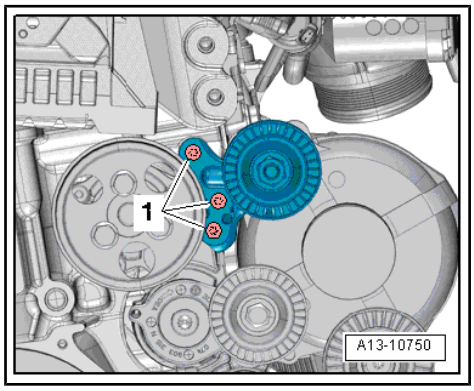
- *Before removing, mark direction of rotation of poly V-belt for alternator and coolant pump with chalk or felt-tipped pen for re-installation.*



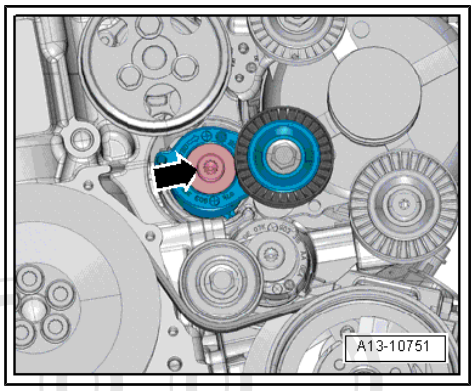
– To slacken poly V-belt turn tensioner in clockwise direction -arrow-.

– Detach poly V-belt for alternator and coolant pump and release tensioner.

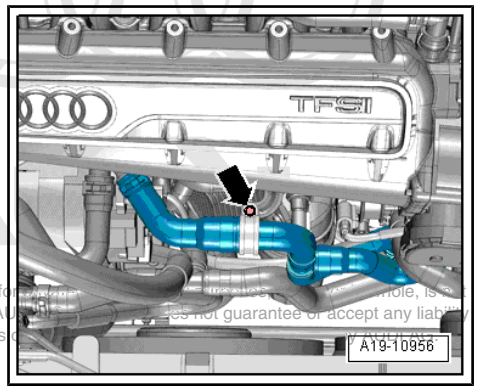
– Unscrew bolts -1- and remove idler roller.



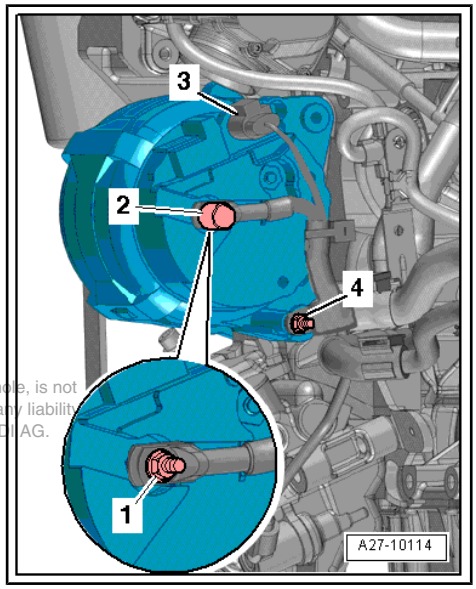
– Remove bolt -arrow- and take off tensioner.



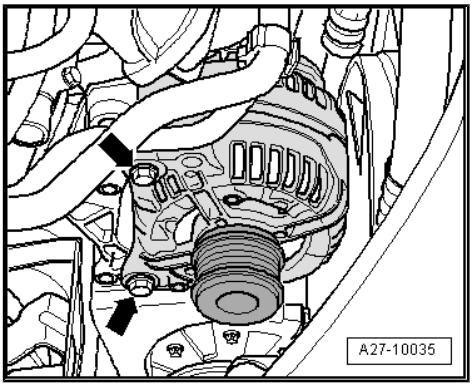
– Remove bolt -arrow- from retaining clamp.



– Unplug electrical connector -3- at alternator.
– Lever off protective cap -2- and remove nut -1- for terminal 30/ B+.
– Remove nut -4- and detach wiring clamp.

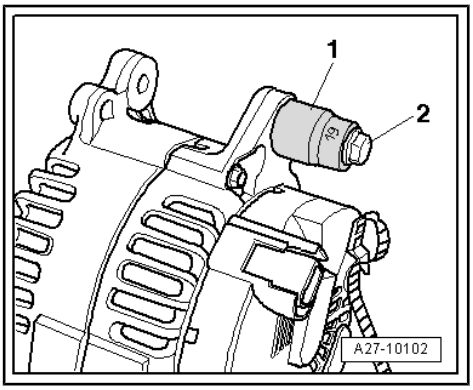


– Remove bolts -arrows- and lift out alternator.

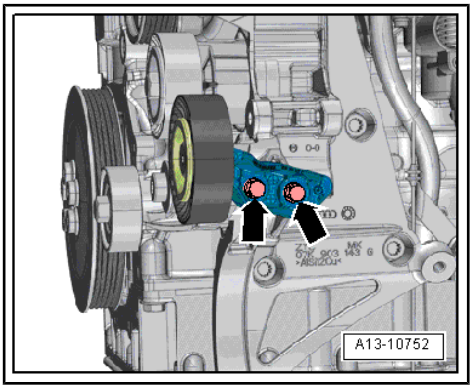


Note

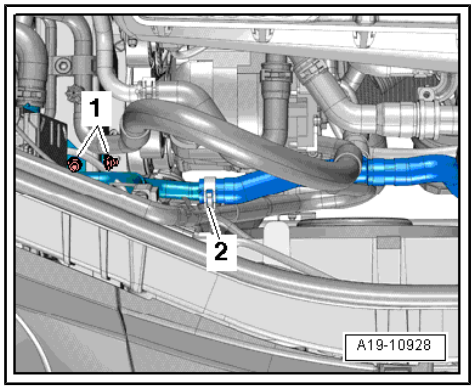
- *Apply 1/2" socket insert AF 19 -item 1- to sliding bush if alternator is stuck in bracket.*
- *Screw a bolt M8x45 -item 2- into sliding bush and pull sliding bush out of alternator by screwing in bolt.*



– Unscrew bolts -arrows- and remove idler roller.



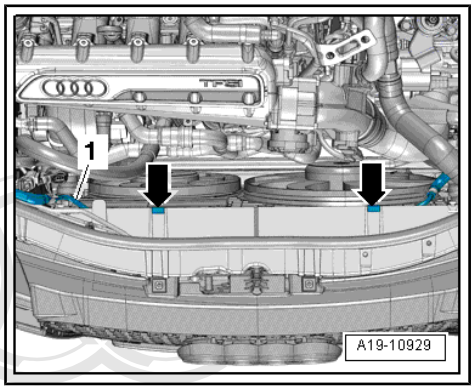
– Release hose clip -2- and detach coolant hose.



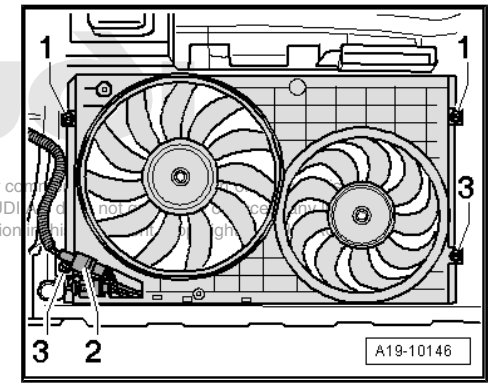
Note

Disregard -item 1-.

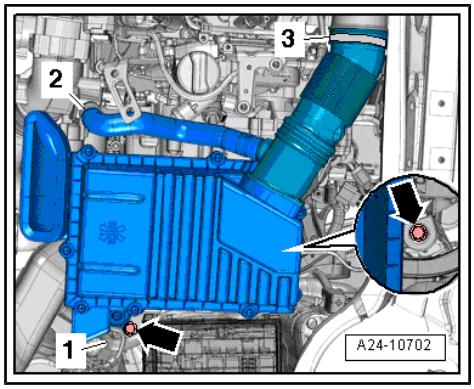
– Move clear coolant line -1- -arrows- and move to rear.



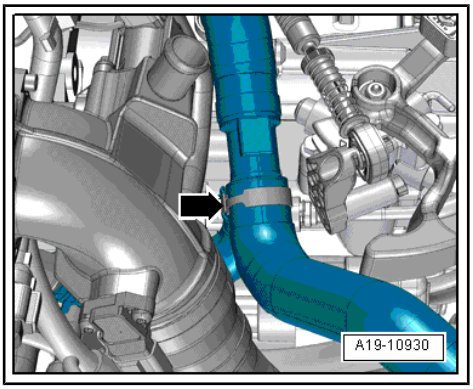
– Remove bolts -1- and lift out radiator cowl.



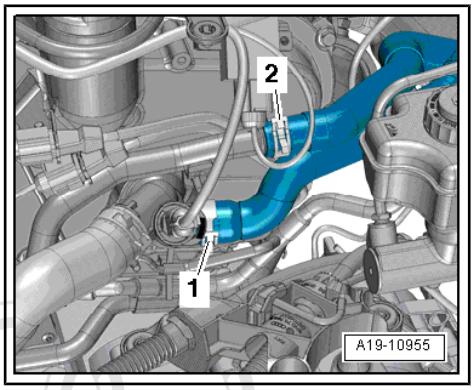
– Release hose clips -2- and -3- and disconnect air hoses.
– Move clear electrical wiring harness -1- at bracket for air cleaner housing.
– Unscrew bolts -arrows- and detach air cleaner housing.



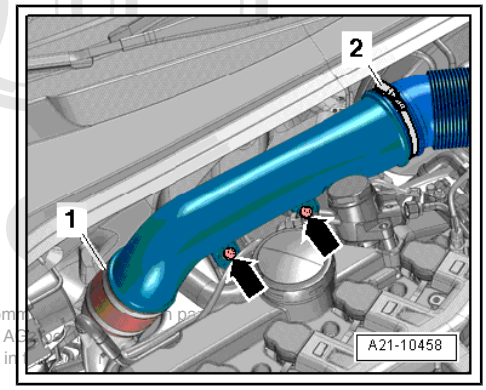
– Release hose clip -arrow- and detach coolant hose.



– Release hose clips -1- and -2- and detach coolant hoses.



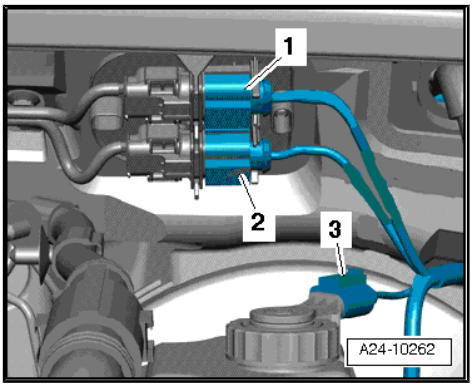
– Remove bolts -arrows-.
– Release hose clip -1- and detach air pipe.



Note

Disregard -item 2-.

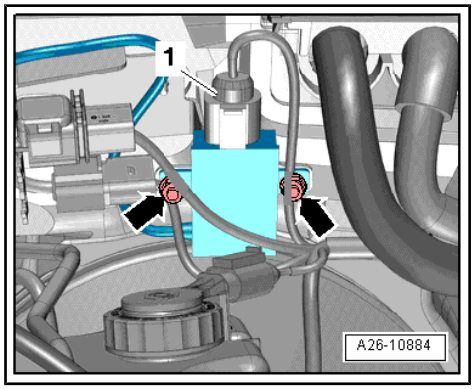
– Remove electrical connector -1- for Lambda probe -G39- from bracket and unplug connector.
– Move clear electrical wiring to Lambda probe.



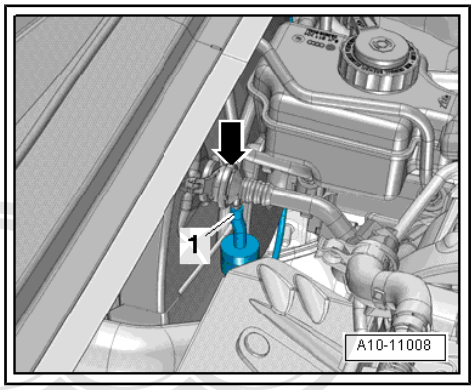
Note

Disregard -items 2, 3-.

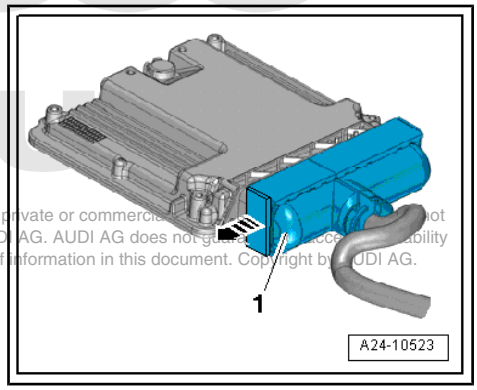
– Unplug electrical connector -1-.
– Remove bolts -arrows- and place exhaust gas temperature sender 1 -G235- onto cylinder head.



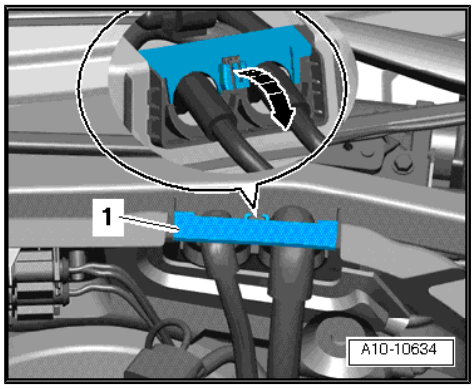
– Detach vacuum hose -1- from non-return valve -arrow-.
– Pull non-return valve off brake servo.



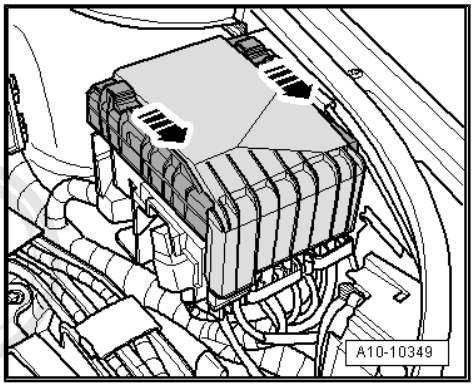
– Release electrical connector -1- for engine wiring harness -arrow- and detach ⇒ Removing and installing engine control unit -J623-; Rep. gr. 24 .



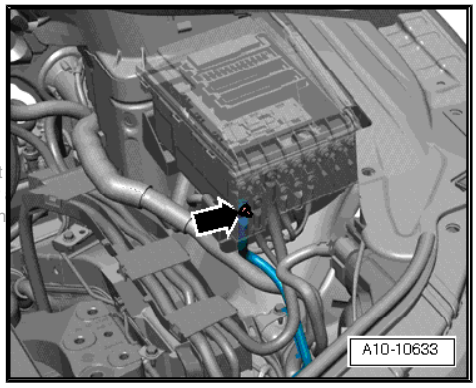
– Release wiring protector -1- for engine wiring harness -arrow- and lift off.



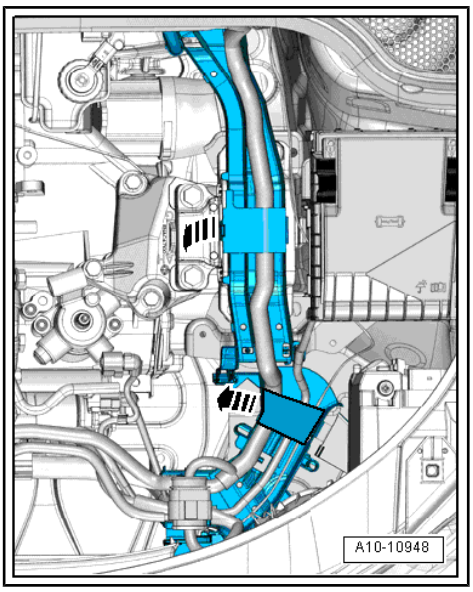
– Slide the two clips in the direction of the -arrows- and remove cover from electronics box in engine compartment.



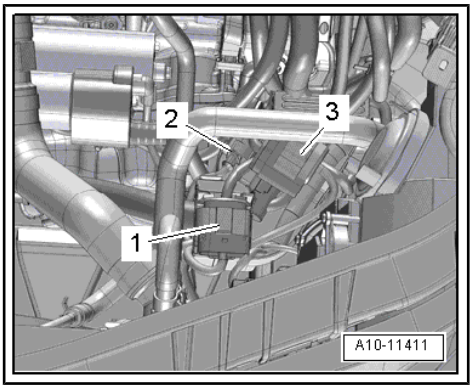
– Remove nut -arrow-, detach terminal 30 wire from electronics box in engine compartment and move it clear.



– Open wiring duct brackets -arrows-.

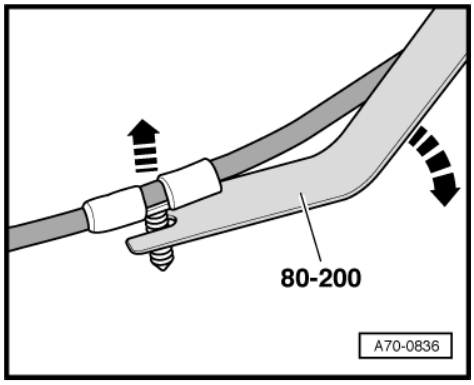


– Unclip electrical connectors -2- and -3- from bracket and unplug connectors.
– Unclip electrical connector -1- from bracket and unplug.
– Open wiring duct bracket located underneath.
– Unclip wiring harness for engine control unit from wiring duct.
– Place engine wiring harness on top of engine.
– Secure engine control unit to prevent it falling.



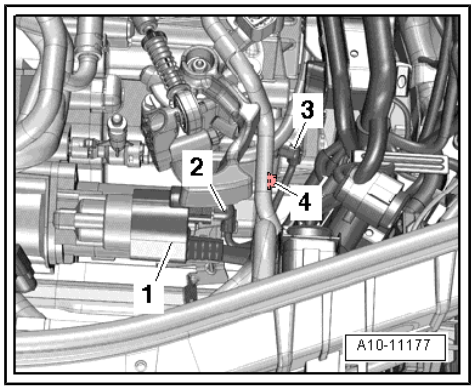
Note

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

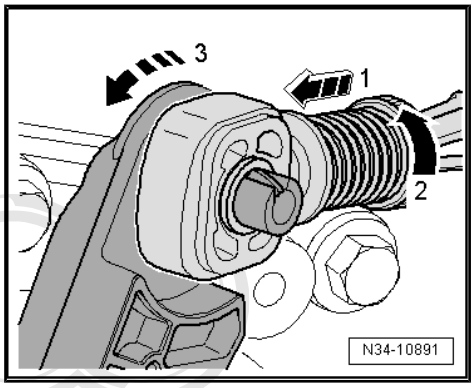


Vehicles with manual gearbox:

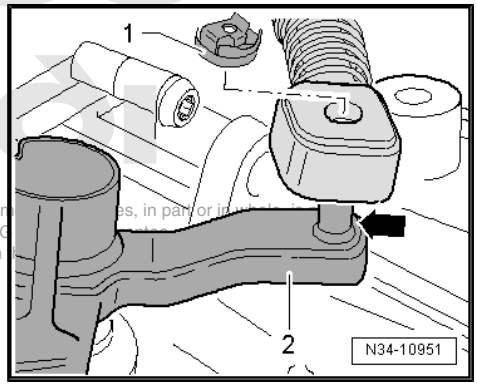
- Unplug electrical connector -2- at starter.
- Push back protective cover -1- and unscrew B+ cable at starter solenoid switch.
- Remove bolt -4- for earth connection.
- Unplug electrical connector -3- for reversing light switch -F4- .



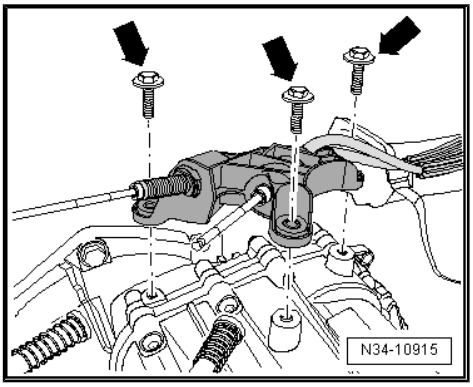
- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press relay lever towards front -arrow 3-, take gate selector cable out of end-piece.



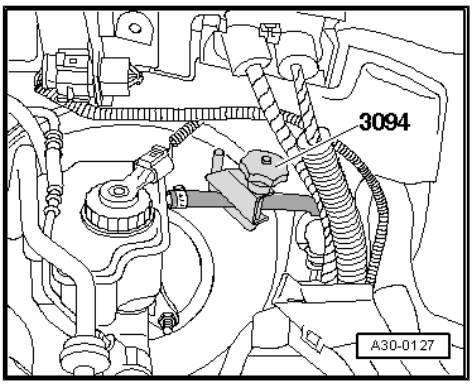
- Detach securing clip -1- for gear selector cable from gearbox selector lever -2- and pull cable off pin -arrow-.



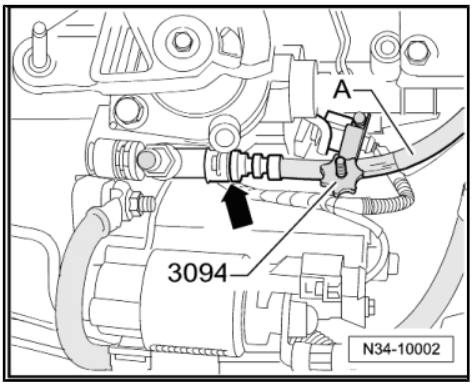
– Remove bolts -arrows-, detach cable support bracket from gearbox and tie up to the left side.



– If a plastic pipe is installed between clutch master cylinder and slave cylinder, clamp off supply hose to clutch master cylinder using hose clamps for hoses up to 25 mm -3094- .



– If a pipe/hose assembly is installed between clutch master cylinder and slave cylinder, clamp off hose -A- using hose clamps for hoses up to 25 mm -3094- .



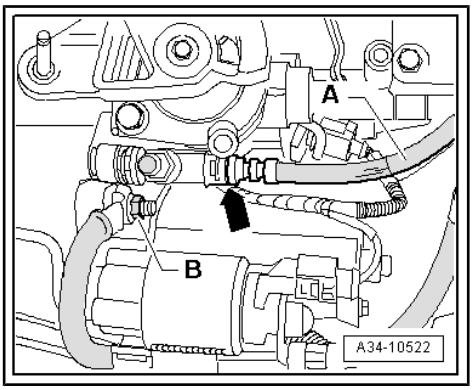
Note

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

– Pull out clip -arrow- as far as stop.

– Pull plastic pipe or pipe/hose assembly -A- out of bleeder connection for clutch slave cylinder.

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



Note

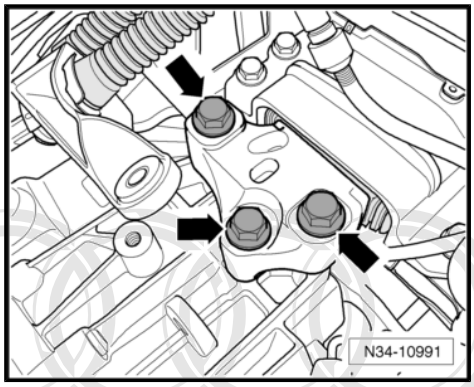
Disregard -item B-.

Caution

Risk of contamination by escaping brake fluid.

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

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

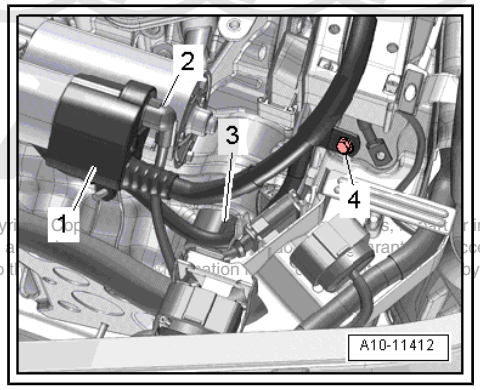


Vehicles with dual clutch gearbox:

– Unplug electrical connector -2- at starter.

– Push back protective cover -1- and unscrew B+ cable at starter solenoid switch.

– Remove bolt -4- for earth connection.



Caution

Risk of irreparable damage to gearbox control unit (mechatronic unit) because of static discharge.

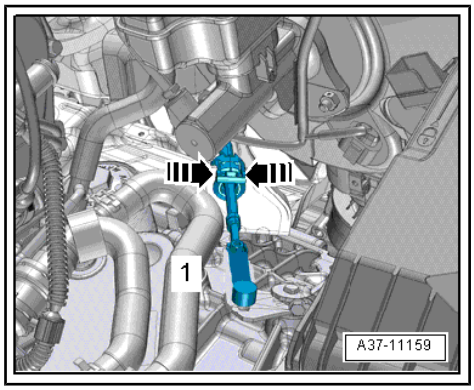
- ***Do NOT touch connector contacts in gearbox connector with your hands.***

– Touch gearbox housing with your hand (without wearing gloves) to eliminate static charge.

– Turn retainer catch anti-clockwise and unplug electrical connector -3- at gearbox.

– Pry ball socket of selector lever cable off gearbox selector lever using removal lever -80 - 200- .

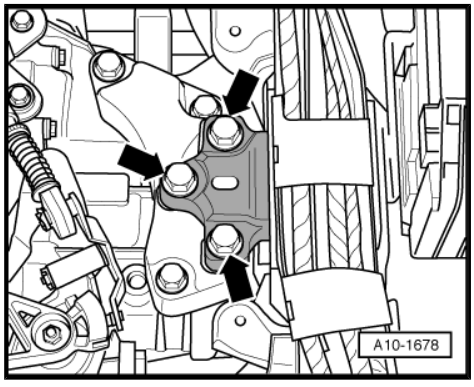
– Release fasteners -arrows- and move selector lever cable clear.



Note

Take care not to bend or kink selector lever cable.

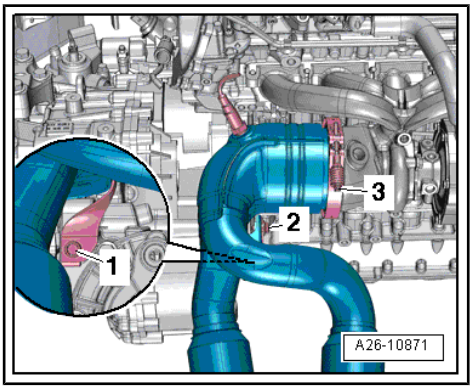
– Loosen bolts -arrows- for gearbox mounting approx. 2 turns.



All vehicles (continued):

– Loosen bolt -3- and push clamp onto starter catalytic converter.

– Remove bolt -2-, tie up starter catalytic converter to rear.

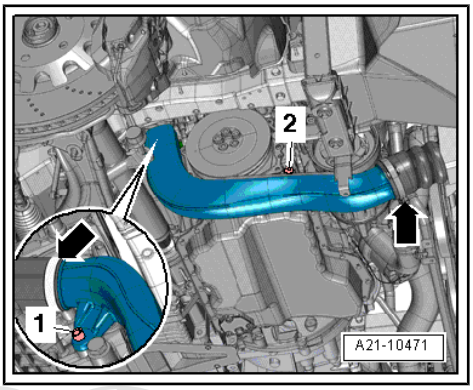


Note

Disregard -item 1-.

– Remove bolts -1- and -2-.

– Release hose clips -arrows- and remove air pipe.

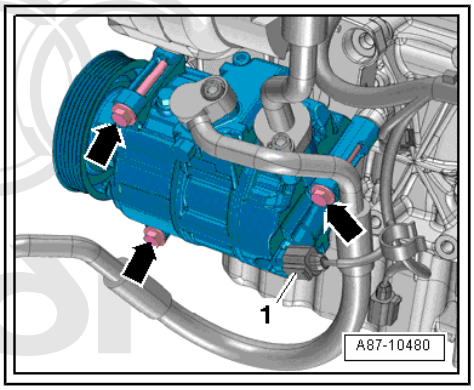


– Unplug electrical connector -1- on air conditioner compressor regulating valve -N280- .

Caution

Danger of damage to refrigerant lines and hoses.

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

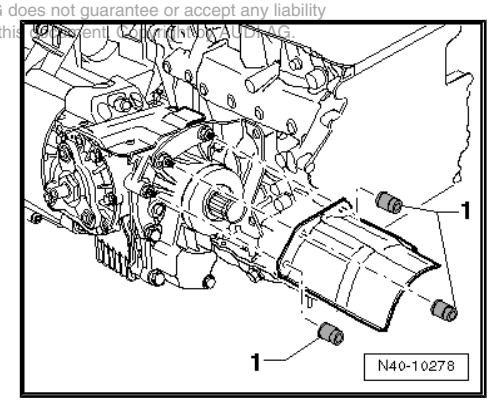


– Remove bolts -arrows-.

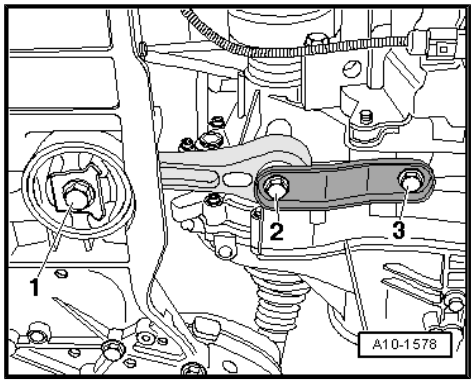
– Detach air conditioner compressor from bracket for ancillaries and tie up to the right side.

– Remove nuts -1- and detach heat shield for drive shaft (right-side).

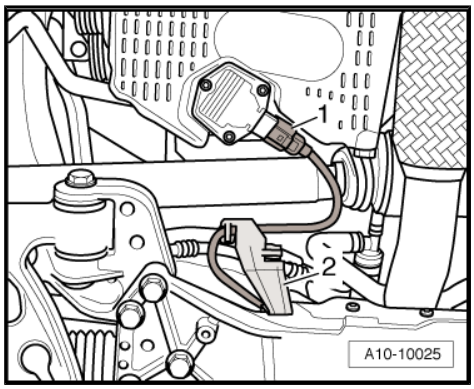
– Remove drive shaft (left and right) ⇒ Rep. gr. 40 .



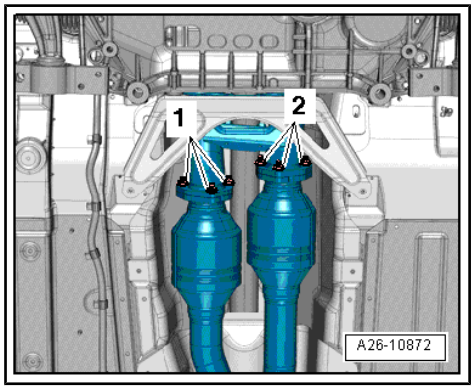
– Remove bolts -1, 2, 3- and detach pendulum support.



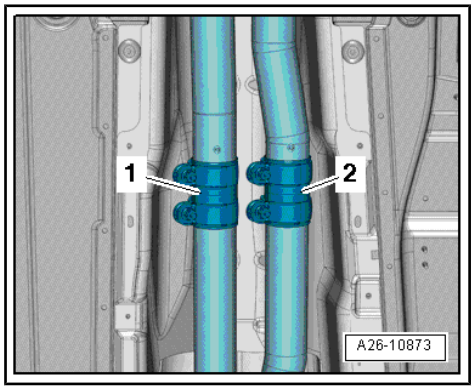
– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Unclip bracket -2- for electrical wiring from subframe.



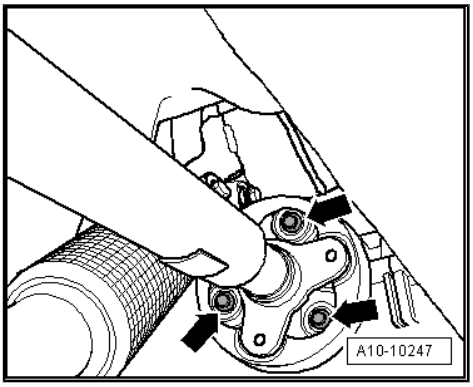
– Remove nuts -1- and -2-.



– Loosen clamps -1- and -2- and move to front.
– Detach catalytic converter (left and right).



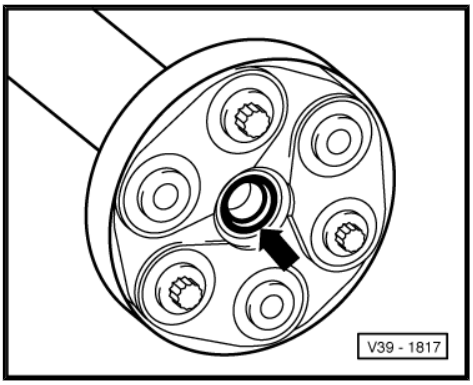
– Mark position of flexible coupling and flange for bevel box in relation to each other for re-installation.
– Remove bolts -arrows- for flexible coupling for propshaft at bevel box (select gear on gearbox).



Caution

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

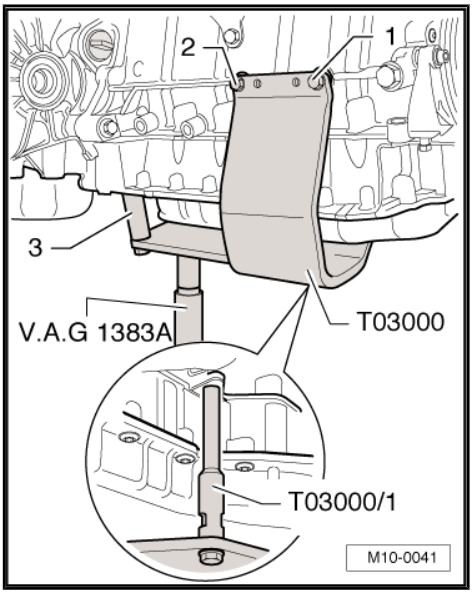
- ***Push the propshaft horizontally to the rear as far as possible.***



Note

The propshaft must be renewed if oil seal is damaged.

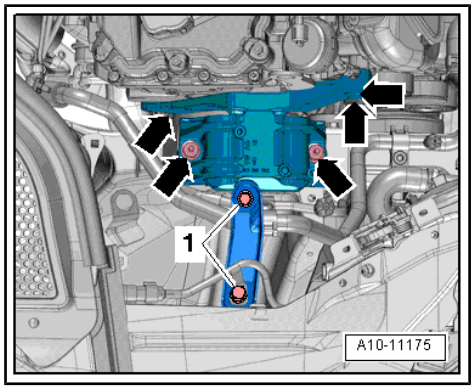
– Unscrew pin -T03000/1- from engine bracket -T03000- .
– Fit engine bracket -T03000- with remaining pin -3- to cylinder block, screw in bolts -1- and -2- by hand until they make contact.
– Fit pin -T03000/1- to cylinder block and tighten to 20 Nm.
– Tighten bolts -1- and -2- to 25 Nm.
– Insert engine and gearbox jack -V.A.G 1383 A- in engine bracket -T03000- and raise engine/gearbox assembly slightly.



Note

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

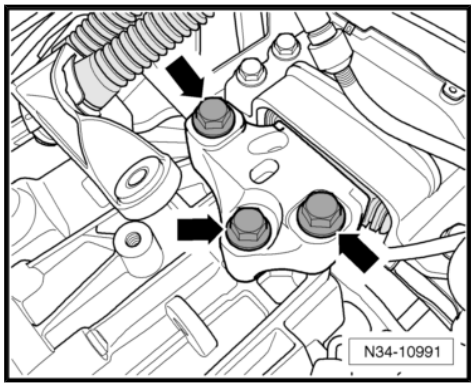
– Remove bolts -1- and -arrows- for engine mounting (left-side).



Note

The bolt at the rear of the cylinder block can be accessed from the wheel housing side.

– Remove bolts -arrows- securing gearbox mounting.



Caution

Danger of damage to hoses, pipes and wiring connections and to engine compartment.

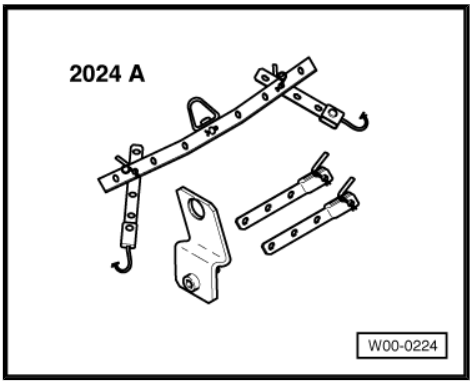
- ***Check that all hoses and wiring connections between engine, gearbox, subframe and body have been detached.***
- ***Carefully guide engine/gearbox assembly out of engine compartment when lowering.***
- ***Make sure there is sufficient clearance from air conditioner compressor.***

– Swing gearbox section of engine/gearbox assembly to front and only then lower further.

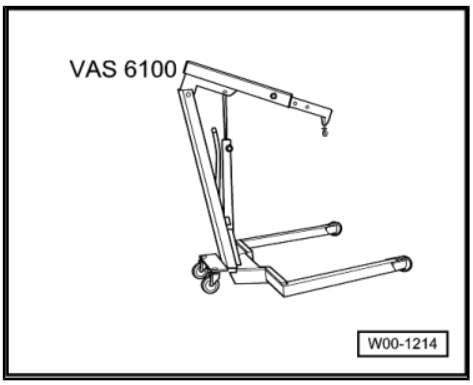
2 Separating engine from manual gearbox

Special tools and workshop equipment required

- Lifting tackle -2024 A-



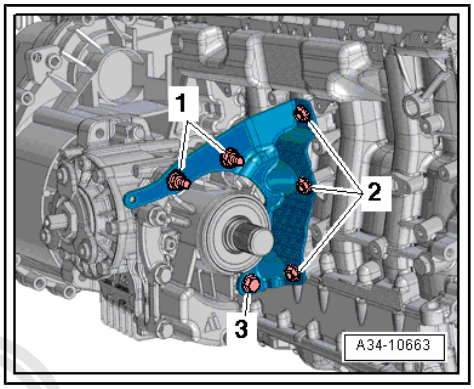
- Workshop hoist -VAS 6100-



Procedure

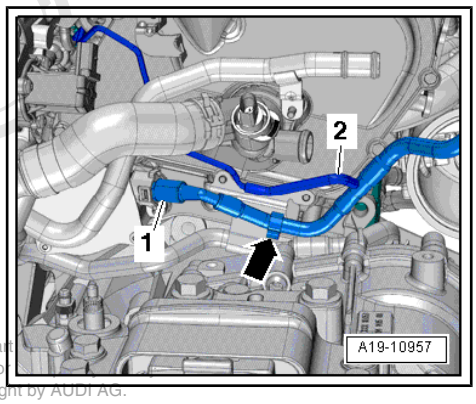
- Engine/gearbox assembly removed and attached to engine support -T03000- .

– Remove bolts -1, 2, 3- and detach bracket for bevel box.

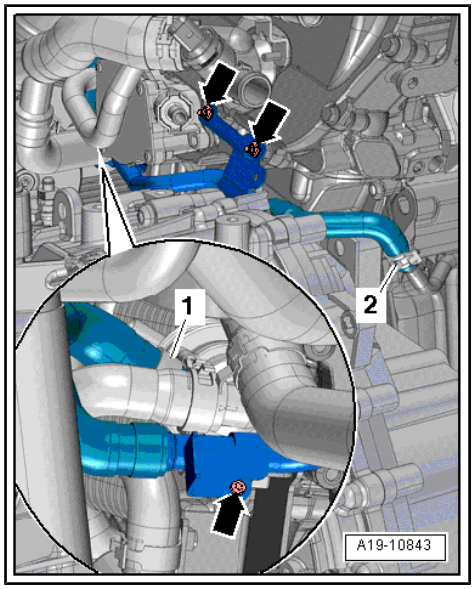


– Disconnect vacuum hose -2-.

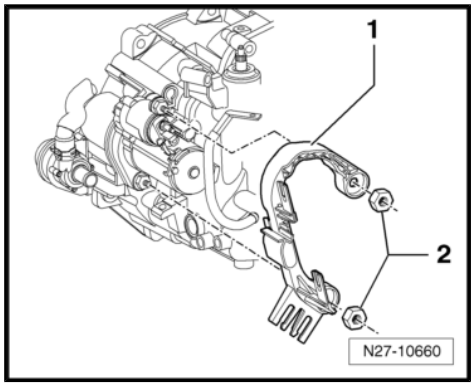
– Move clear vacuum hose -1- -arrow- and disconnect from vacuum pump for brake servo.



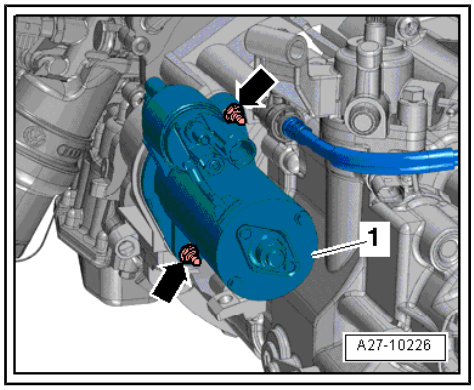
– Remove nuts and bolts -arrows-.
– Release hose clips -1- and -2- and detach coolant pipe (left-side).



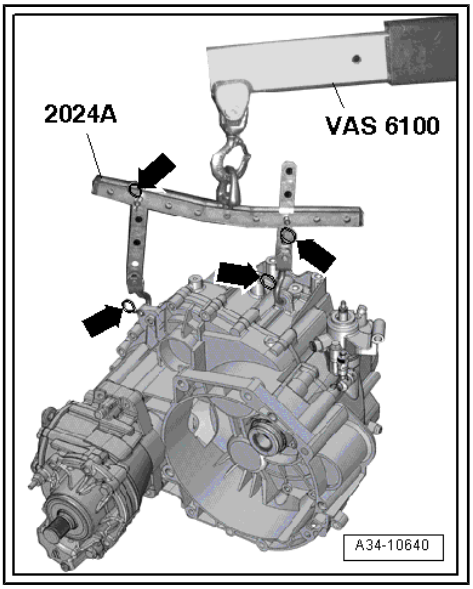
– Remove nuts -2- and detach wiring bracket -1- from starter.



– Remove bolts -arrows- for starter.
– Take out starter -1- downwards.



– Engage lifting tackle -2024 A- on gearbox and workshop hoist -VAS 6100- .



Note

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

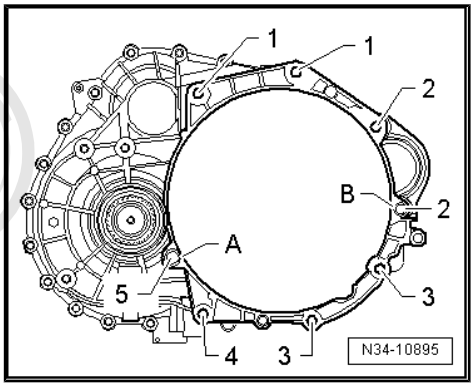
WARNING

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-.***

– Remove bolts -1, 3, 4, 5- securing gearbox to engine.

– Detach gearbox from engine.



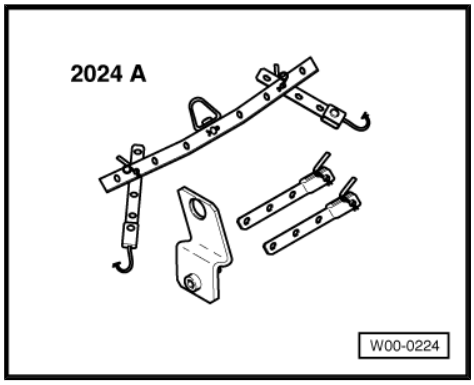
Note

Disregard -items 2, A, B-.

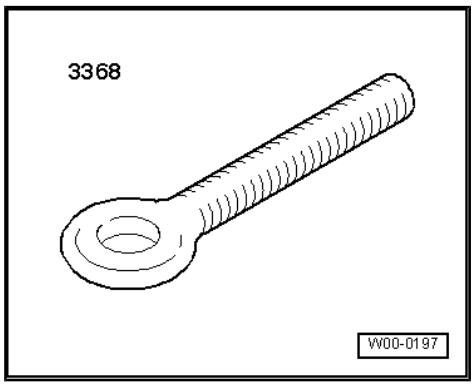
3 Separating engine and dual-clutch gearbox

Special tools and workshop equipment required

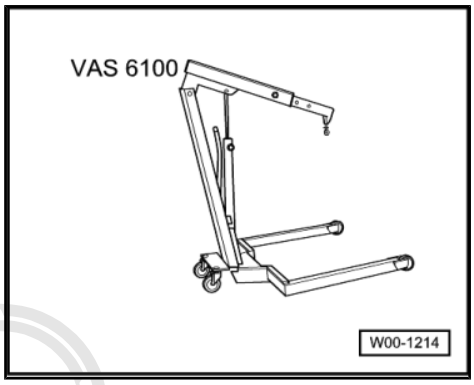
- Lifting tackle -2024 A-



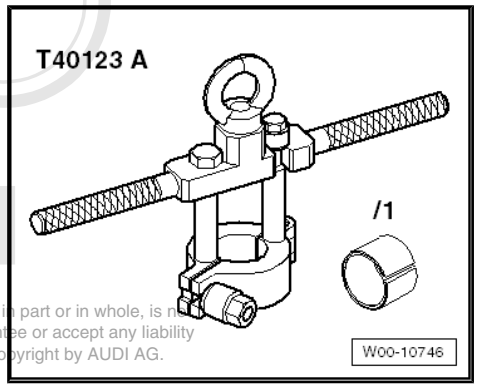
- Eye-head bolt -3368-



- Workshop hoist -VAS 6100-



- Puller for ATF-supply -T40123 A-



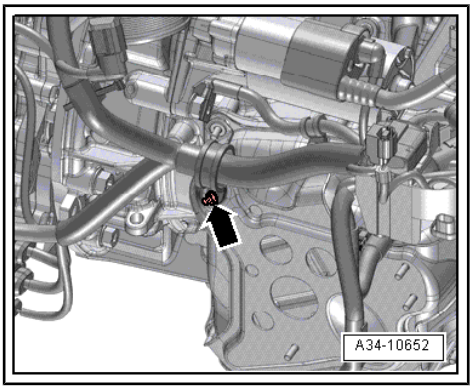
Procedure

- Engine/gearbox assembly removed and attached to engine support -T03000- .

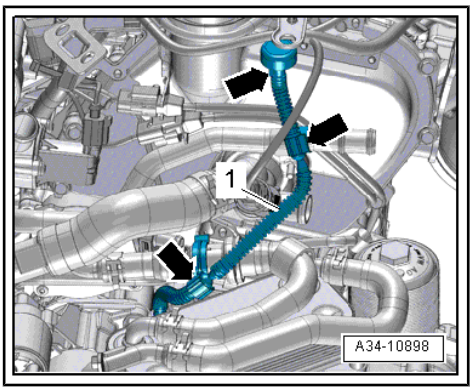
– Remove bevel box ⇒ Rep. gr. 34 .

– Remove starter ⇒ Electrical system; Rep. gr. 27 .

– Remove nut -arrow- and move electrical wiring harness clear.



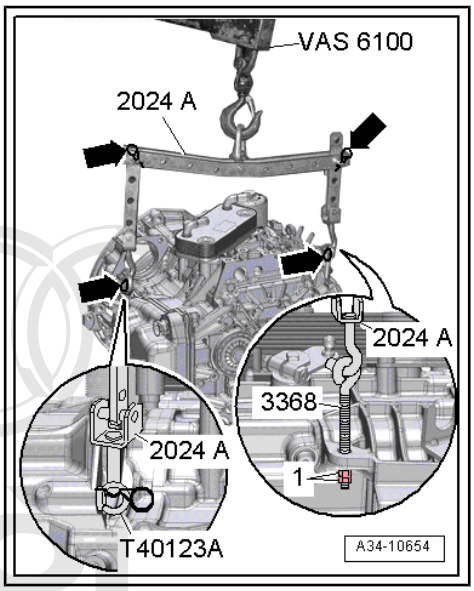
– Move breather hose -1- clear -arrows-.



– Remove eye on puller for ATF-supply -T40123 A- and screw into lower threaded hole for starter bolt as far as stop.

– Secure eye-head bolt -3368- to housing bore of gearbox with two lock nuts -1-.

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



Note

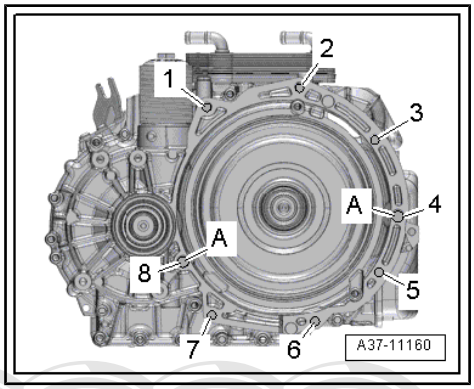
To adjust to the centre of gravity of the gearbox, the perforated rails of the support hooks must be positioned as shown.

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-.***

– Remove bolts -1 ... 8- securing gearbox to engine.
– Detach gearbox from engine.



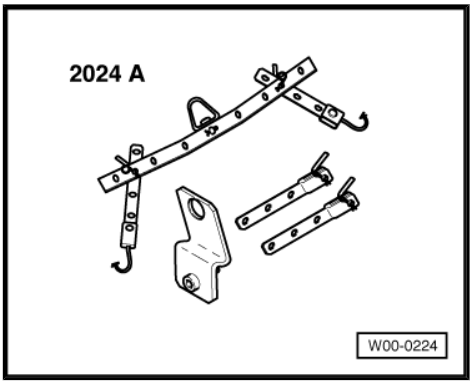
Note

Disregard -item A-.

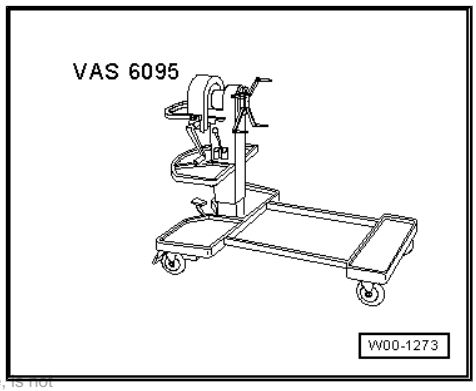
4 Securing engine to engine and gearbox support

Special tools and workshop equipment required

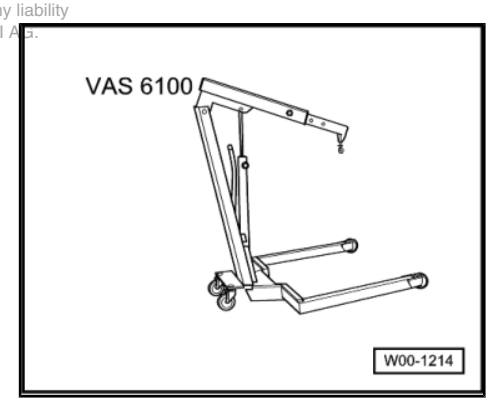
- Lifting tackle -2024 A-



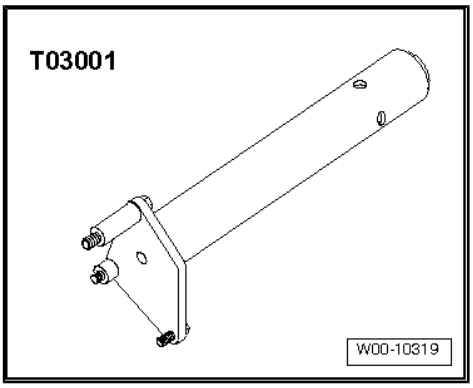
- Engine and gearbox support -VAS 6095-



- Workshop hoist -VAS 6100-



- Engine bracket -T03001-



Procedure

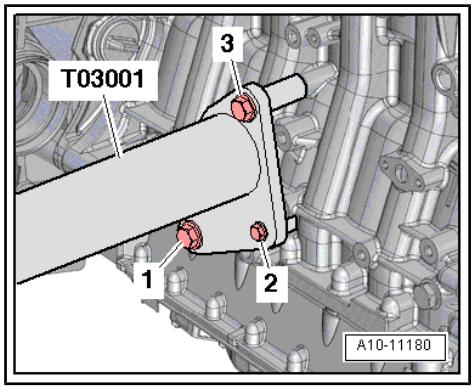
- Gearbox detached from engine.

– Secure engine support -T03001- to cylinder block.

1 - 40 Nm

2 - 25 Nm

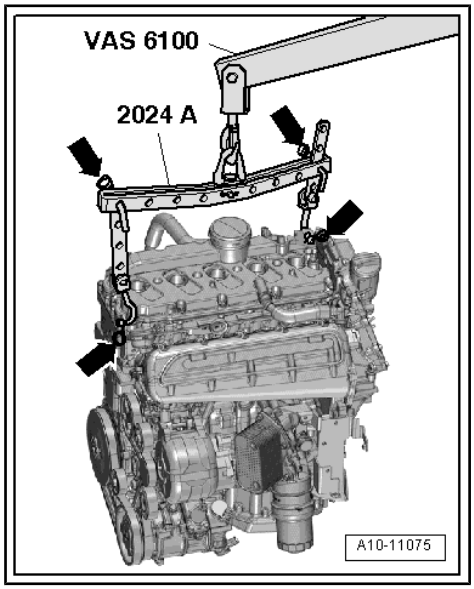
3 - 40 Nm



– Engage lifting tackle -2024 A- on engine and workshop hoist -VAS 6100- .

Note

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



WARNING

Accident risk from loose components of lifting tackle.

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

– Lift engine off engine bracket -T03000- using workshop hoist -VAS 6100- .

– Secure engine to engine and gearbox support -VAS 6095- using engine bracket -T03001- .

5 Installing engine

Tightening torques

Note

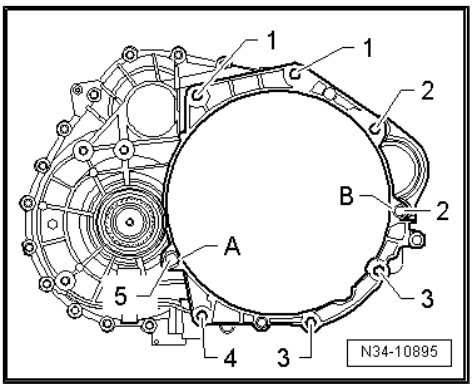
- *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.*
- *Do not use degreased parts.*
- *Tolerance for tightening torques: ± 15%.*

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	22
	M10	40
	M12	65

Manual gearbox to engine

Item	Bolt	Nm
1	M12x65	80
2	Securing starter ⇒ Electrical system; Rep. gr. 27	
3	M10x65	40
4	M10x75	40
5 [1)]	M12x95	80
A, B	Dowel sleeves for centralising	

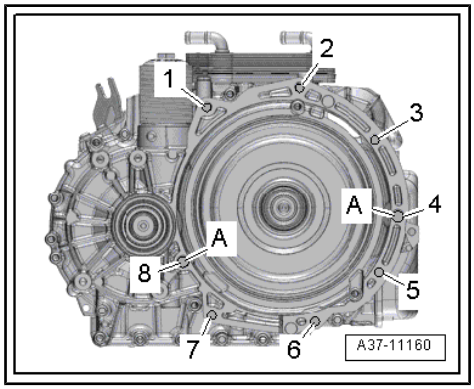
• [1)] Screwed into gearbox from engine side



Dual-clutch gearbox to engine

Item	Bolt	Nm
1	M12x65	80
2, 3, 4	M12x70	80
5, 6, 7	M10x60	40
8 1)	M12x95	80
A	Dowel sleeves for centralising	

• 1) Screwed into gearbox from engine side



Procedure

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

Note

- *Renew the bolts tightened with specified tightening angle.*
- *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Routing and attachment of pipes, hoses and wiring in engine compartment ⇒ page 7 .*
- *Fit all cable ties in the original positions when installing.*

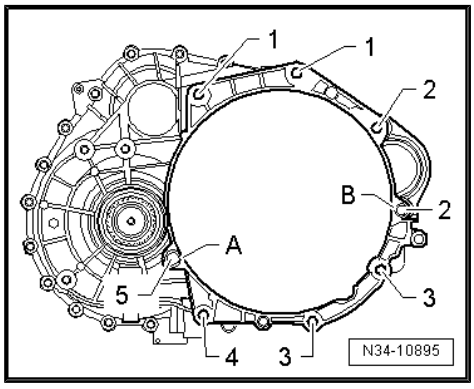
Vehicles with manual gearbox:

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

– 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 dual clutch gearbox:

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

All vehicles (continued):

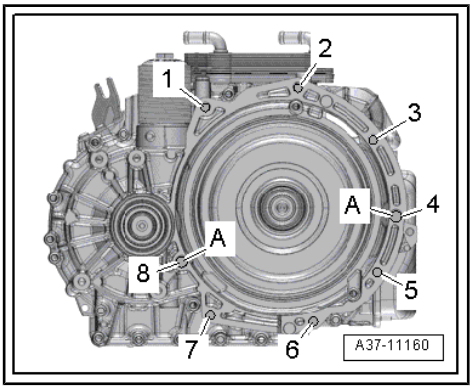
– Secure gearbox to engine.

– Secure bracket for bevel box ⇒ Rep. gr. 34 .

– Install coolant pipe (left-side) ⇒ page 184 .

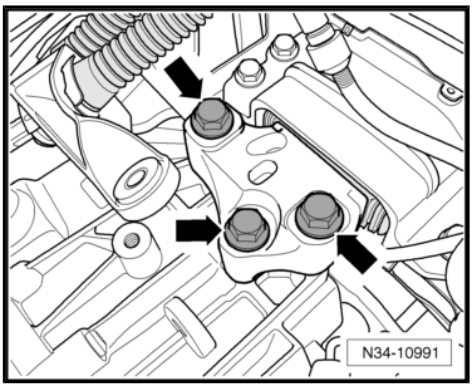
– Guide engine/gearbox assembly into body.

– Install engine mountings ⇒ page 42 .



Vehicles with manual gearbox:

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



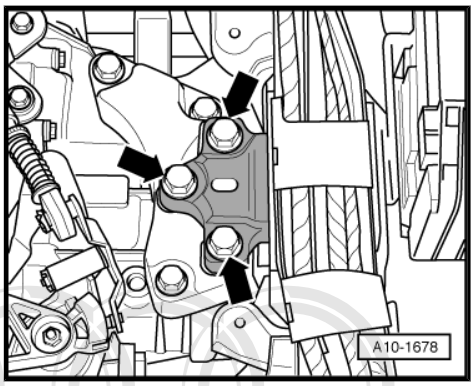
Vehicles with dual clutch gearbox:

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

All vehicles (continued):

– Detach engine support -T03000- from engine.

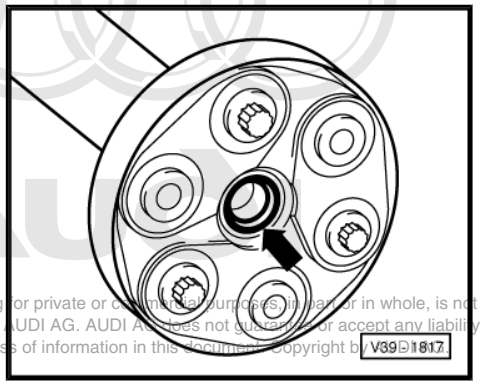
– Install pendulum support ⇒ Rep. gr. 34 .



Caution

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

- ***Push the propshaft horizontally to the rear as far as possible.***

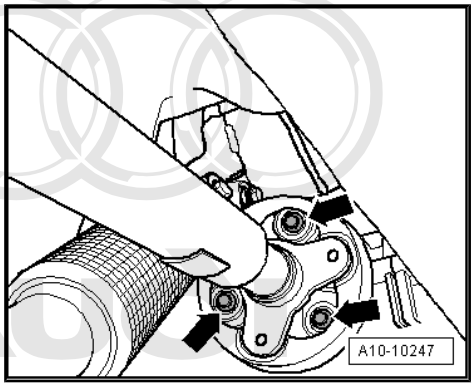


Note

The propshaft must be renewed if oil seal is damaged.

– Push engine/gearbox assembly towards plenum chamber partition panel, guiding pin on bevel box flange carefully into propshaft flange.

– Secure propshaft with flexible coupling to bevel box ⇒ Rear final drive 02D, 0AV, 0BR and 0BY; Rep. gr. 39 .



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

– Install catalytic converters ⇒ page 226 .
– Install starter catalytic converter ⇒ page 225 .
– Install wishbones and 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 .

Vehicles with dual clutch gearbox:

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

All vehicles (continued):

– Install coolant pipe (right-side) ⇒ page 182 .
– Install radiator ⇒ page 194 .
– Install air pipes ⇒ page 216 .
– Install idler rollers and poly V-belt tensioner ⇒ page 53 .
– Install alternator ⇒ Electrical system; Rep. gr. 27 .
– Install poly V-belt for alternator and coolant pump ⇒ page 56 .
– Install air conditioner compressor ⇒ Rep. gr. 87 .
– Install poly V-belt for air conditioner compressor ⇒ page 55 .
– Install starter ⇒ Electrical system; Rep. gr. 27 .
– Install noise insulation frame ⇒ Rep. gr. 50 .
– Install noise insulation and front wheel housing liners (bottom sections) ⇒ Rep. gr. 66 .
– Fit front wheels ⇒ Wheels and tyres; Rep. gr. 44 .
– Adjust assembly mountings ⇒ page 45 .
– Install engine control unit and air cleaner housing ⇒ Rep. gr. 24 .
– Install charge pressure sender -G31- / intake air temperature sender 2 -G299- ⇒ page 205 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Observe notes on procedure for connecting the battery ⇒ Electrical system; Rep. gr. 27 .
– Check oil level ⇒ Maintenance ; Booklet 810 .

Caution

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

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

– Fill up with coolant ⇒ page 166 .

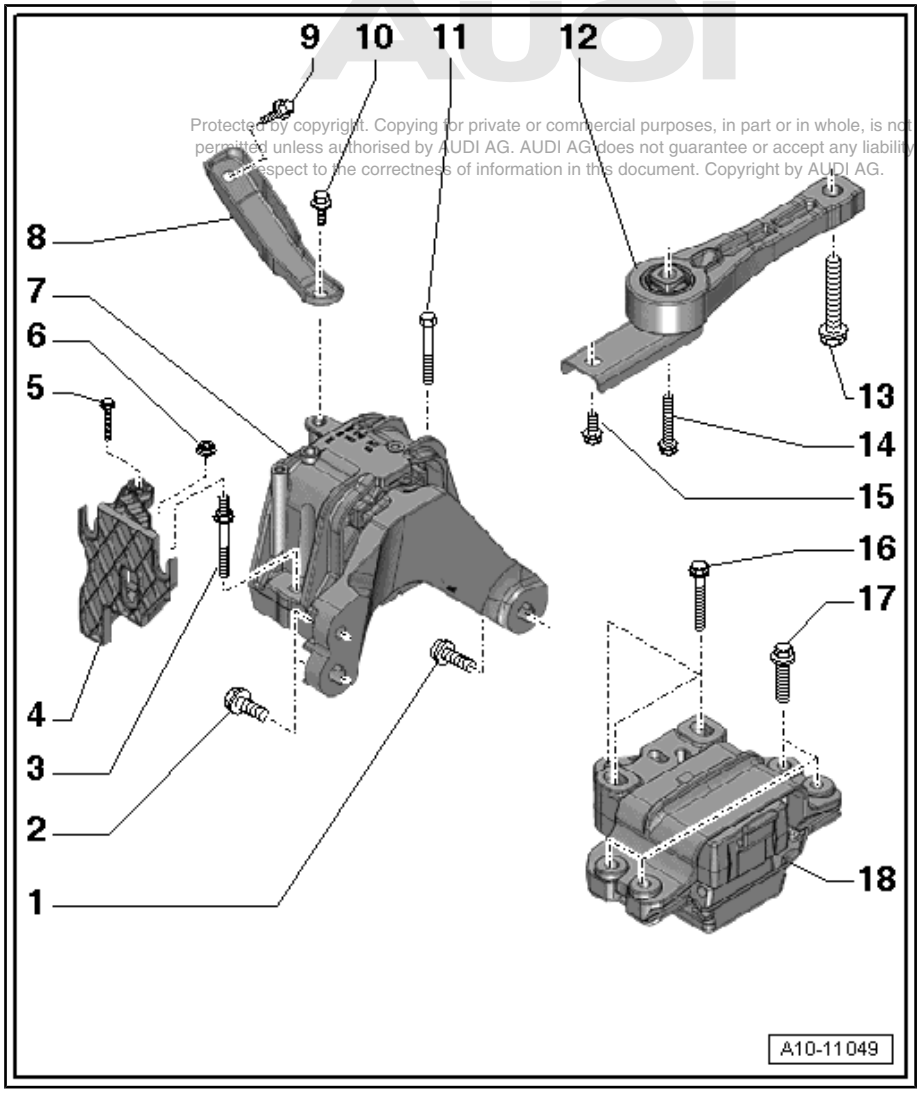
Note

Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.

6 Assembly mountings

Overview

6.1 Assembly mountings - exploded view



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

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

3 - Bolt
- ❑ Renew
- ❑ 40 Nm + turn 90° further

4 - Bracket
- ❑ For activated charcoal filter

5 - Bolt
- ❑ Tightening torque ⇒ Item 11 (page 182)

6 - Nut
- ❑ 8 Nm

7 - Engine mounting
- ❑ Checking adjustment ⇒ page 43
- ❑ Adjusting ⇒ page 45
- ❑ Removing and installing ⇒ page 49

8 - Connecting bracket

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

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

11 - Bolt
- ❑ Renew
- ❑ 40 Nm + turn 90° further

12 - Pendulum support
- ❑ Removing and installing ⇒ Rep. gr. 34

13 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 34

14 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 34

15 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 34

16 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 34

17 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 34

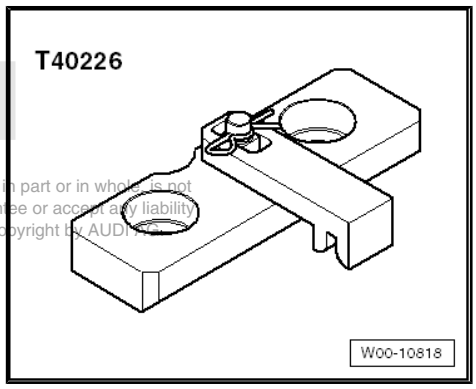
18 - Gearbox mounting

- ❑ Checking adjustment ⇒ page 43
- ❑ Adjusting ⇒ page 45
- ❑ Removing and installing ⇒ Rep. gr. 34

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

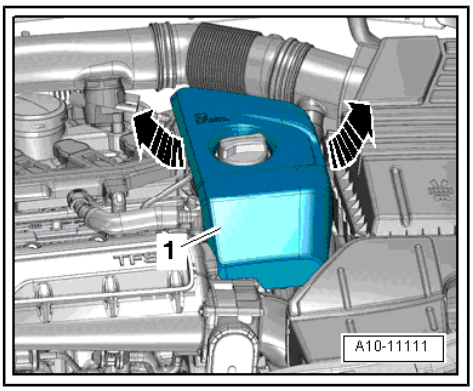
Special tools and workshop equipment required

- ♦ Gauge -T40226-

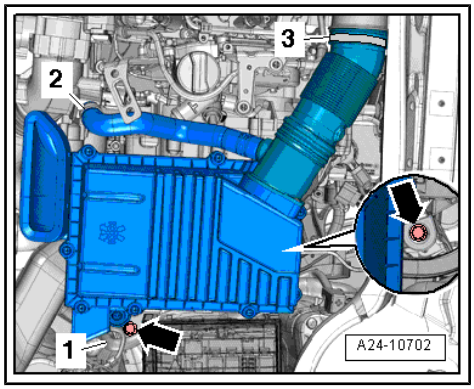


Procedure

– Lift off engine cover panel -1- -arrows-.

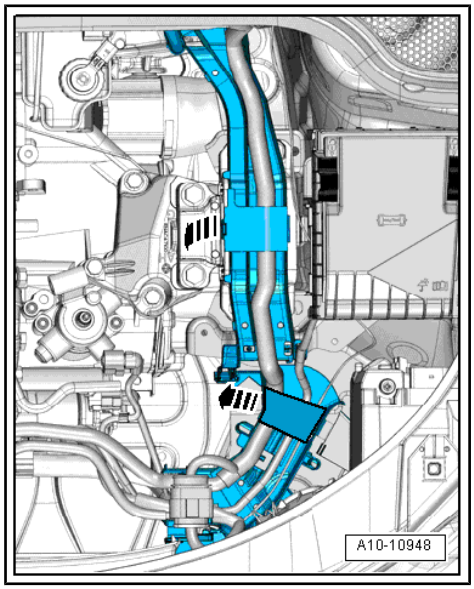


– Remove air cleaner housing ⇒ Rep. gr. 24 .



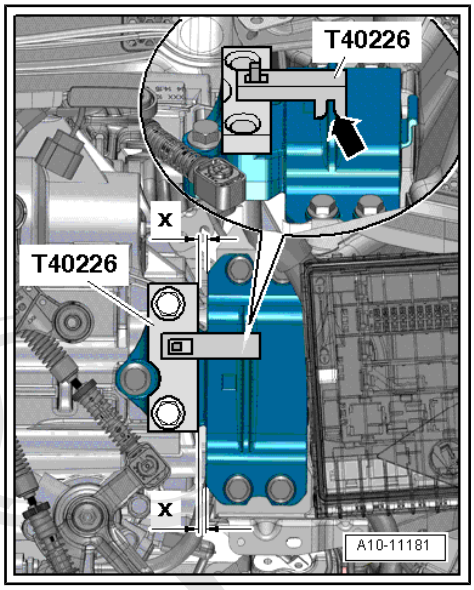
Vehicles with manual gearbox:

– Open wiring duct brackets -arrows-.
– Cut through cable ties and press electrical wiring to side.
– Unclip wiring duct.



– Fit gauge -T40226- onto bolt heads of gearbox mounting (left-side) and press in.
– Engage bridge of -T40226- onto rib on gearbox casting -arrow- as shown in illustration.

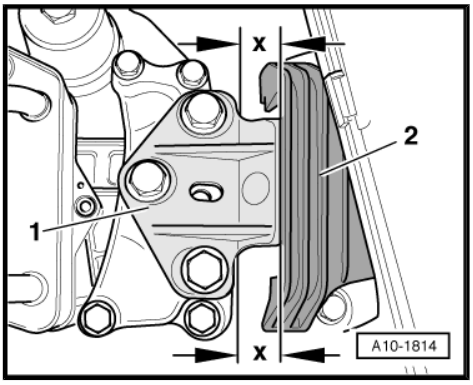
- Distance of gap between adjusting tool and gearbox mounting must be equal at front and rear.
- Distance -x- rear = -x- front (parallel) or
- Dimension -x- rear = dimension -x- front = „0“ (no gap).



Vehicles with dual clutch gearbox:

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

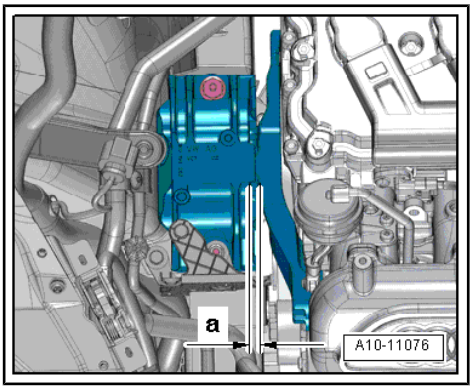
• Dimension -x- = dimension -x-.



All vehicles (continued):

– Check installation position at engine mounting:

• The distance -a- between support arm and engine mounting must be at least 9 mm.



Note

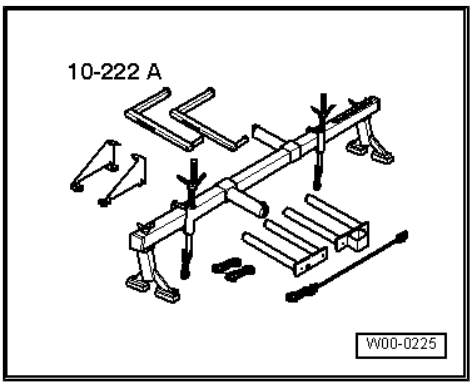
Distance -a- can be checked using a ∅ 9 mm drill bit or similar.

– If the distance measured is too small, the assembly mounting must be adjusted ⇒ page 45 .

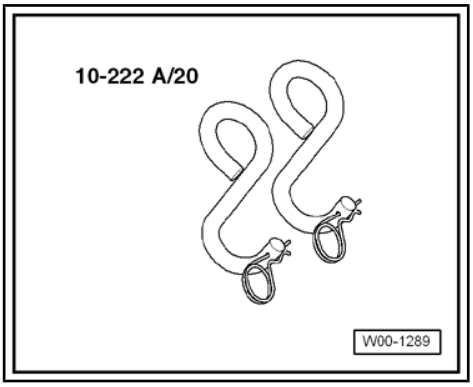
6.3 Adjusting assembly mountings

Special tools and workshop equipment required

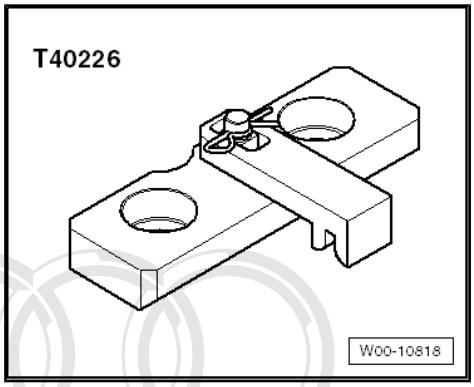
♦ Support bracket -10 - 222 A-



♦ Adapter -10 - 222 A /20-

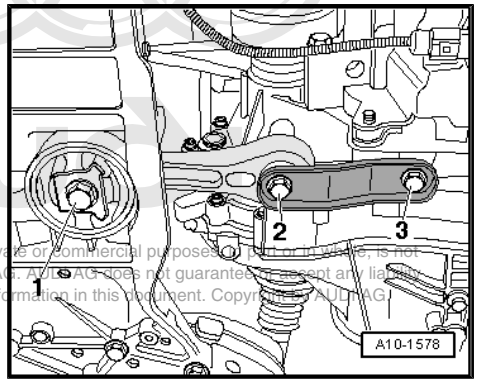


♦ Gauge -T40226-

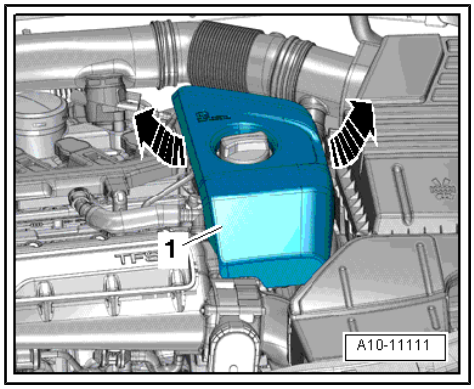


Procedure

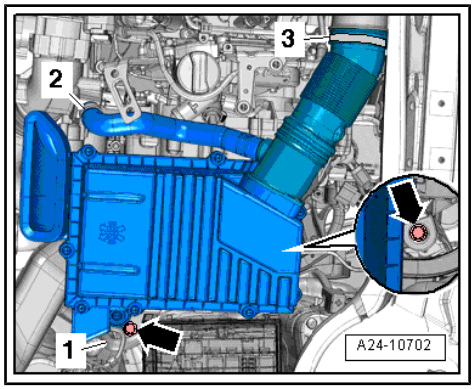
– Loosen bolts -1, 2, 3- for pendulum support approx. 1 turn (do not remove).



– Lift off engine cover panel -1- -arrows-.

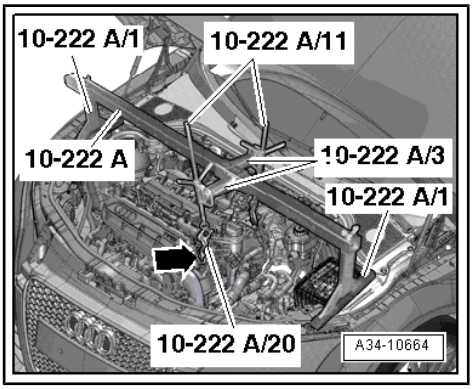


– Remove air cleaner housing ⇒ Rep. gr. 24 .



– Position support bracket -10 - 222 A- on top edges of body flanges as shown in illustration.

• One spindle -10 - 222 A /11- should be at front, one at rear.



WARNING

Risk of accident.

- *The support hooks and retaining pin on the lifting tackle must be secured with a locking pin -arrow-.*

– Attach spindle -10 - 222 A /11- (front) with adapter -10 - 222 A /20- to engine lifting eye (front left).

– Attach spindle -10 - 222 A /11- (rear) to engine lifting eye (rear left).

– Apply light tension to spindles.

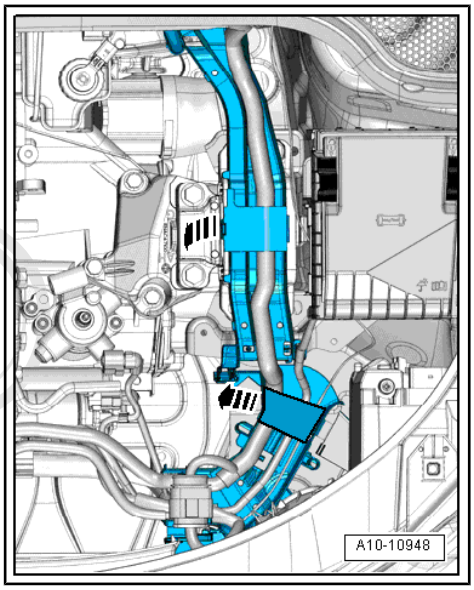
• The engine must be positioned in installation position, assembly mountings must not be under load.

Vehicles with manual gearbox:

– Open wiring duct brackets -arrows-.

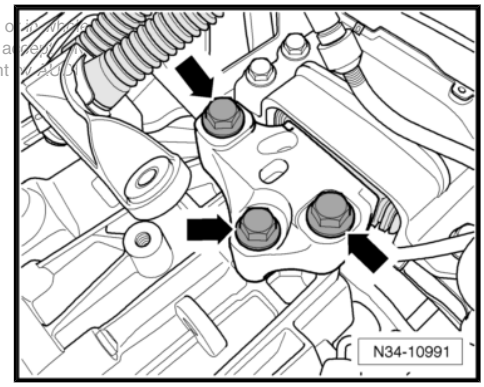
– Cut through cable ties and press electrical wiring to side.

– Unclip wiring duct.

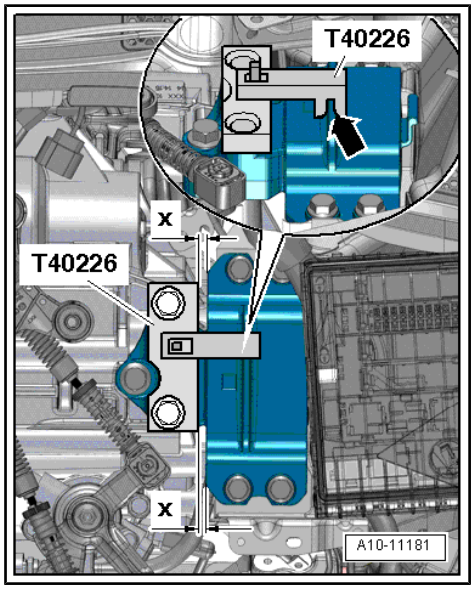


– Remove bolts -arrows- securing gearbox mounting.

– Renew all three bolts one by one and screw in by hand until they make contact.



– Fit gauge -T40226- onto bolt heads of gearbox mounting (left-side) and press in.
– Engage bridge of gauge -T40226- onto rib on gearbox casting -arrow- as shown in illustration.
– Place engine/gearbox assembly in installation position; ensure that it is free of stress by shaking assembly to align it.
• Distance of gap between adjusting tool and gearbox mounting must be equal at front and rear.
• Distance -x- rear = -x- front (parallel) or
• Dimension -x- rear = dimension -x- front = „0“ (no gap).

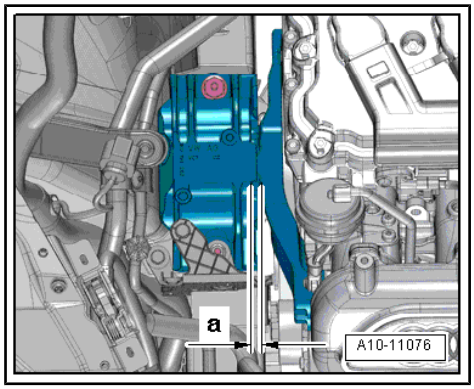


– Check installation position at engine mounting:
• The distance -a- between support arm and engine mounting must be at least 9 mm.

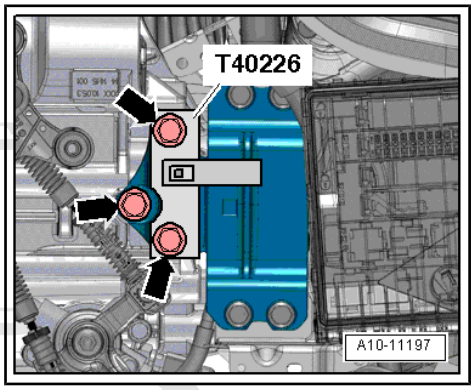
Note

Distance -a- can be checked using a ∅ 9 mm drill bit or similar.

– Move engine/gearbox assembly sideways if necessary.

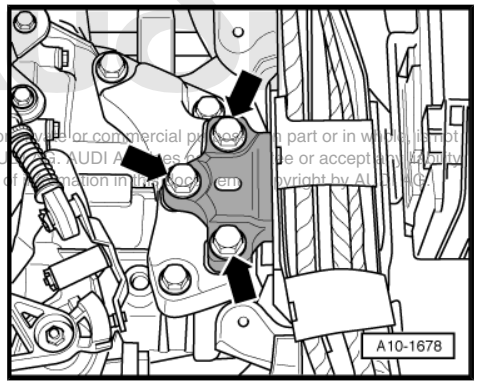


– Tighten gearbox mounting bolts -arrows- with fitted gauge -T40226- ⇒ Rep. gr. 34 .



Vehicles with dual clutch gearbox:

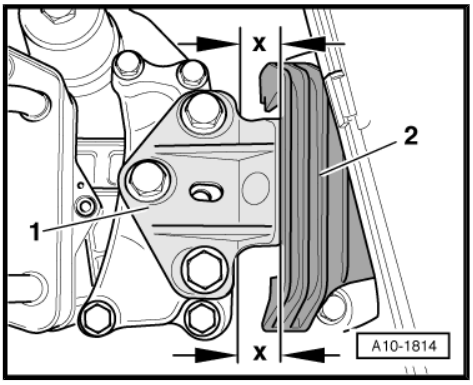
– Remove bolts -arrows- securing gearbox mounting.
– Renew all three bolts one by one and screw in by hand until they make contact.



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

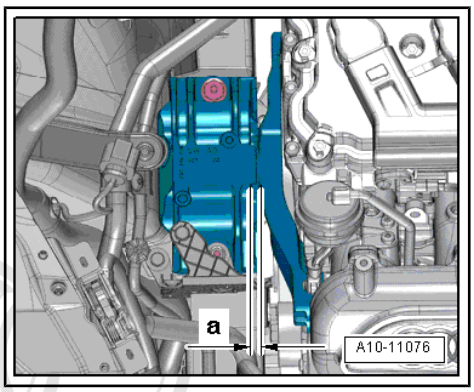
• Dimension -x- = dimension -x-.

– Tighten gearbox mounting bolts ⇒ Rep. gr. 34 .



– Check installation position at engine mounting:

• The distance -a- between support arm and engine mounting must be at least 9 mm.



Note

Distance -a- can be checked using a ∅ 9 mm drill bit or similar.

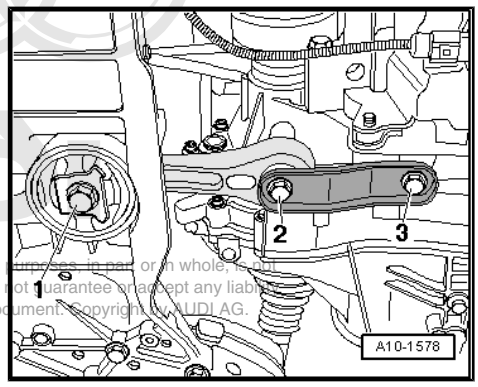
– Move engine/gearbox assembly sideways if necessary.

All vehicles (continued):

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

– Tighten bolts -1, 2, 3- for pendulum support ⇒ Rep. gr. 34 .

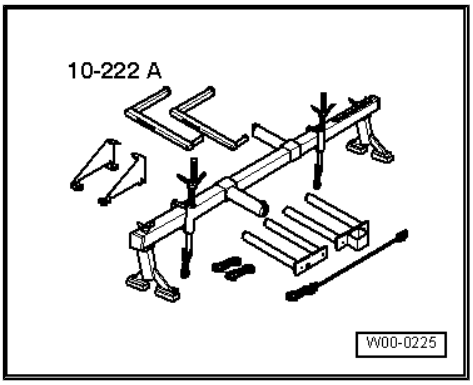
– Install air cleaner housing ⇒ Rep. gr. 24 .



6.4 Removing and installing engine mountings

Special tools and workshop equipment required

♦ Support bracket -10 - 222 A-

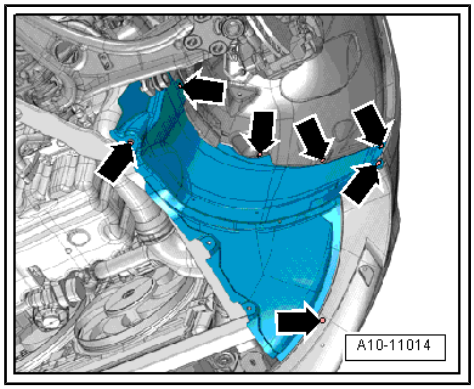


Removing

– Remove front wheel (right-side) ⇒ Wheels and tyres; Rep. gr. 44 .

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

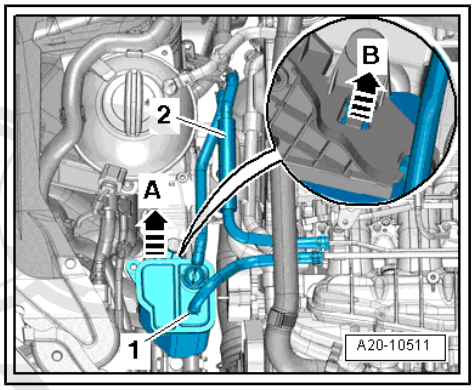
– Remove one bolt of front wheel housing (right-side).



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

Note

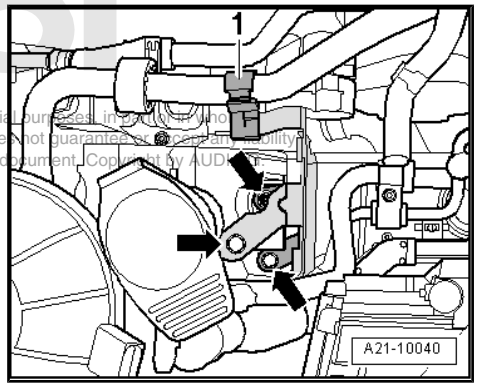
Disregard -item 2-.



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

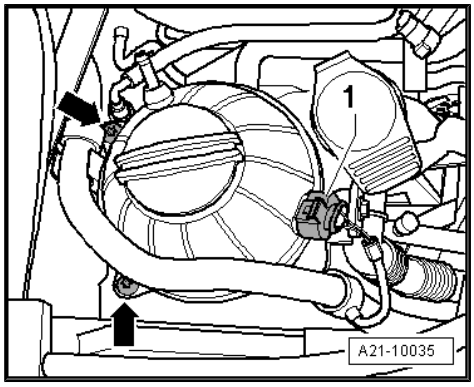
Note

Disregard -item 1-.



– Remove bolts -arrows-.

– Detach electrical connector -1- for coolant shortage indicator switch -F66- and move coolant expansion tank with coolant pipe (right-side) to side.

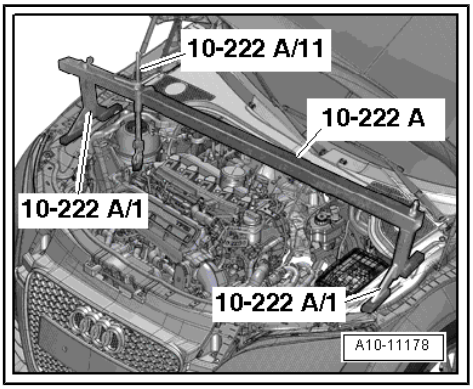


– Position support bracket -10 - 222 A- on top edges of body flanges as shown in illustration.

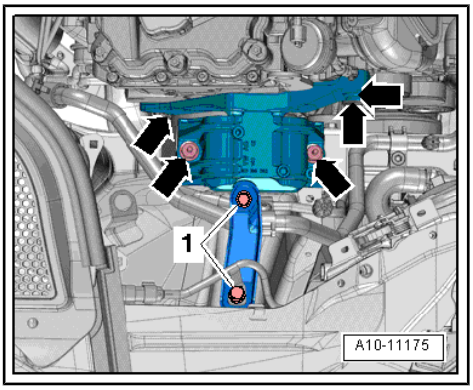
• The spindle -10 - 222 A /11- is located at the front.

– Attach hook of spindle to engine lifting eye (right-side).

– Apply light tension to spindle.



– Remove bolts -1- and -arrows- for engine mounting (left-side).



Note

The bolt at the rear of the cylinder block can be accessed from the wheel housing side.

Installing

• Tightening torques
⇒ „6.1 Assembly mountings - exploded view“, page 42

– Check adjustment of assembly mountings (engine/gearbox mountings) ⇒ page 43 .

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

– Install bottom section of front wheel housing liner ⇒ Rep. gr. 66 .

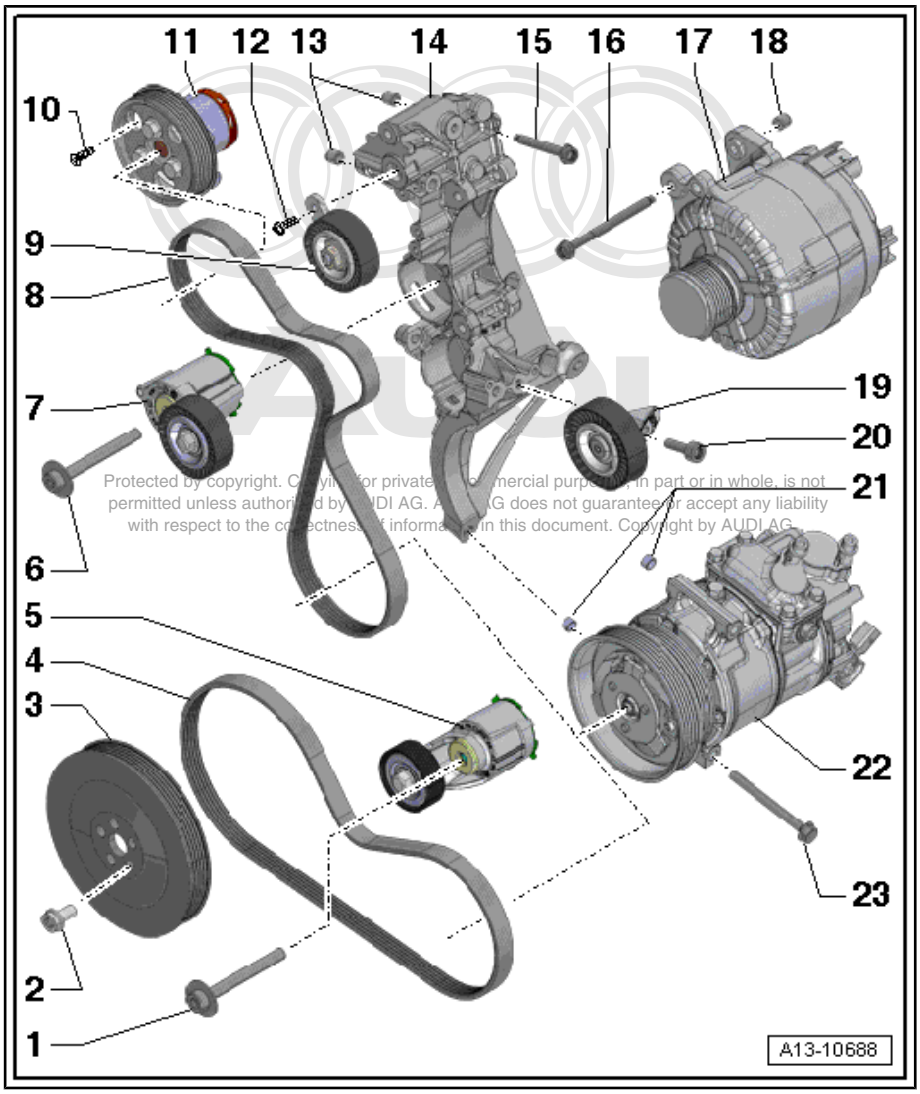
– Fit front wheel ⇒ Wheels and tyres; Rep. gr. 44 .

13 – Crankshaft group

1 Cylinder block (pulley end)

Overview

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



1 - Bolt
- ❑ 35 Nm

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

3 - Vibration damper
- ❑ Removing and installing ⇒ page 59
- ❑ Can only be installed in one position

4 - Poly V-belt for air conditioner compressor
- ❑ Check for wear
- ❑ Before removing, mark direction of rotation with chalk or felt-tipped pen
- ❑ Removing and installing ⇒ page 55
- ❑ Do not kink
- ❑ When installing, make sure it is properly seated on pulleys.

5 - Tensioner
- ❑ For poly V-belt for air conditioner compressor
- ❑ Removing and installing ⇒ page 57

6 - Bolt
- ❑ 35 Nm

7 - Tensioner
- ❑ For poly V-belt for alternator and coolant pump
- ❑ Removing and installing ⇒ page 57

8 - Poly V-belt for alternator and coolant pump
- ❑ Check for wear
- ❑ Before removing, mark direction of rotation with chalk or felt-tipped pen
- ❑ Removing and installing ⇒ page 56
- ❑ Do not kink
- ❑ When installing, make sure it is properly seated on pulleys.

9 - Idler roller

10 - Bolt
- ❑ Tightening torque ⇒ Item 2 (page 173)

11 - Coolant pump
- ❑ Removing and installing ⇒ page 176

12 - Bolt
- ❑ 8 Nm

13 - Dowel sleeves
- ❑ For bracket for ancillaries

14 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 58

15 - Bolt

- ❑ Different lengths
- ❑ Tightening torque and sequence ⇒ page 54

16 - Bolt

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

17 - Alternator

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

18 - Sliding bush

19 - Idler roller

20 - Bolt

- ❑ 23 Nm

21 - Dowel sleeves

- ❑ For air conditioner compressor

22 - Air conditioner compressor

- ❑ With double-sided poly V-belt pulley
- ❑ Removing and installing ⇒ Rep. gr. 87

23 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 87

Bracket for ancillaries - tightening torque and tightening sequence

– Renew bolts for bracket for ancillaries and fit as follows:

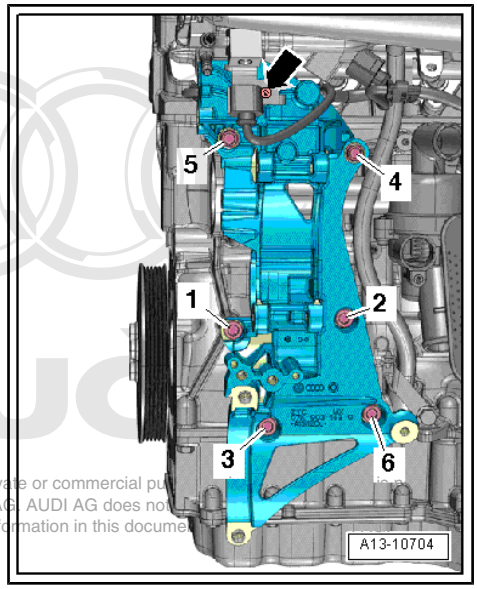
♦ Bolts -1, 2, 3, 6- M8x30.

♦ Bolt -4- M8x60.

♦ Bolt -5- M8x110.

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 … 6-	Screw in bolts by hand until they make contact
2.	-1 … 6-	23 Nm

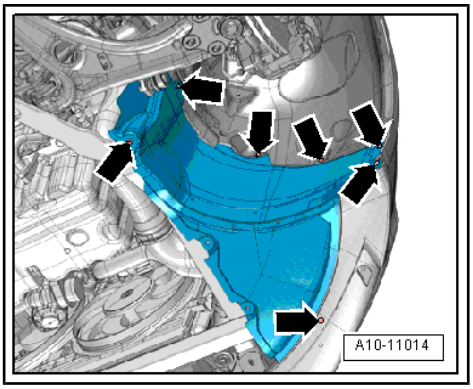


1.2 Removing and installing poly V-belt for A/C compressor

Removing

– Remove front wheel (right-side) ⇒ Wheels and tyres; Rep. gr. 44 .

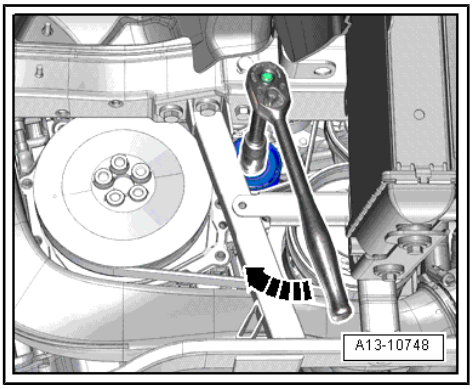
– Remove bottom section of front wheel housing liner (right-side) ⇒ Rep. gr. 66 .



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 for air conditioner compressor with chalk or felt-tipped pen for re-installation.***



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

– Detach poly V-belt for air conditioner compressor and release tensioner.

Installing

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

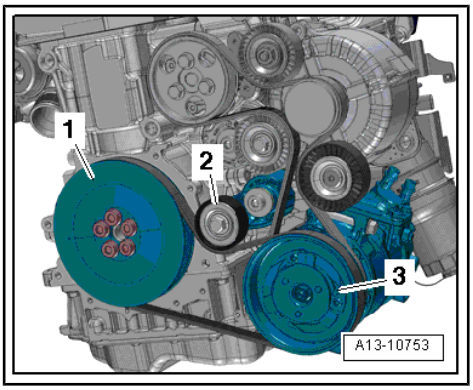
– Swivel tensioner in clockwise direction -arrow-.

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

1 - Vibration damper

2 - Tensioner

3 - Air conditioner compressor



– Slacken tensioner.

– Check that poly V-belt is properly seated.

– Start engine and check that belt runs properly.

– Install bottom section of front wheel housing liner ⇒ Rep. gr. 66 .

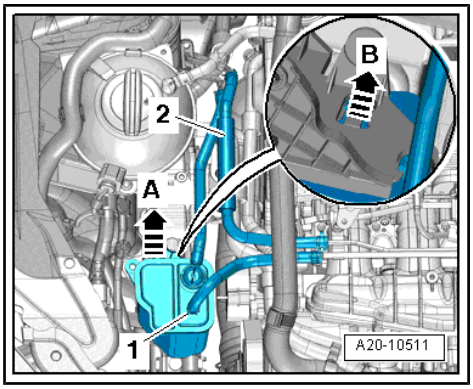
– Fit front wheel ⇒ Wheels and tyres; Rep. gr. 44 .

1.3 Removing and installing poly V-belt for alternator and coolant pump

Removing

– Remove poly V-belt for air conditioner compressor ⇒ page 55 .

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



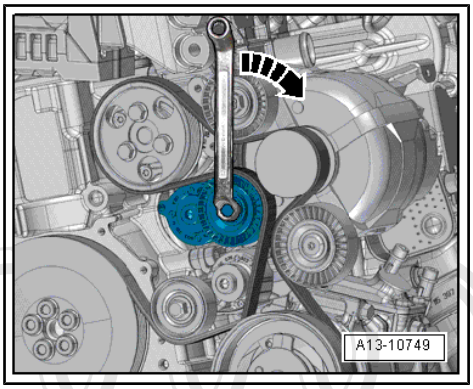
Note

Disregard -item 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 for alternator and coolant pump with chalk or felt-tipped pen for re-installation.***



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

– Detach poly V-belt for alternator and coolant pump and release tensioner.

Installing

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

– Swivel tensioner in clockwise direction -arrow-.

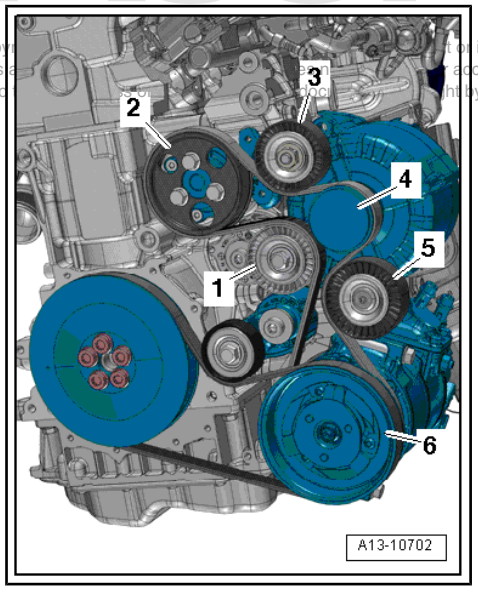
– Fit poly V-belt on poly V-belt pulleys (on alternator pulley last).

1 - Tensioner
2 - Coolant pump
3 - Idler roller
4 - Alternator
5 - Idler roller
6 - Air conditioner compressor

– Slacken tensioner.

– Check that poly V-belt is properly seated.

– Install poly V-belt for air conditioner compressor ⇒ page 55 .

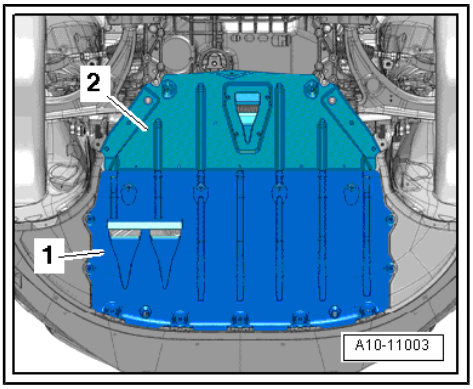


1.4 Removing and installing poly V-belt tensioner for air conditioner compressor

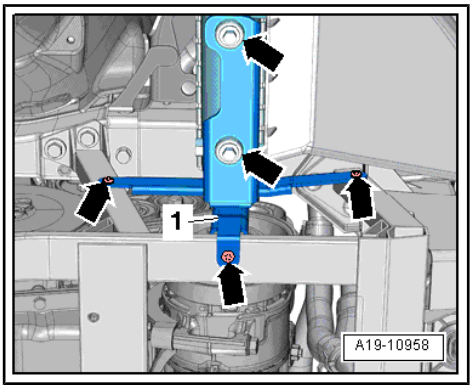
Removing

– Remove poly V-belt for air conditioner compressor ⇒ page 55 .

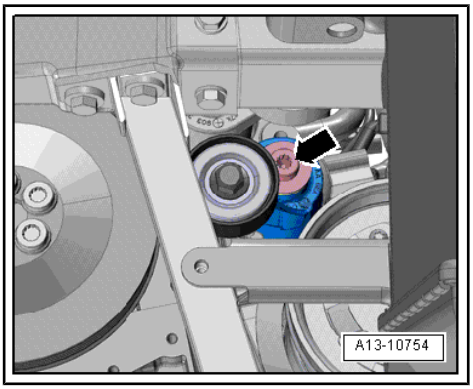
– Remove front noise insulation -1- ⇒ Rep. gr. 66 .



– Remove bolts -arrows- and detach bracket -1- for auxiliary radiator.



– Remove bolt -arrow- and take off tensioner.



Installing

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

- Tightening torque ⇒ „1.1 Poly V-belt drive, bracket for ancillaries - exploded view“, page 53

– Install bracket for auxiliary radiator ⇒ page 192 .

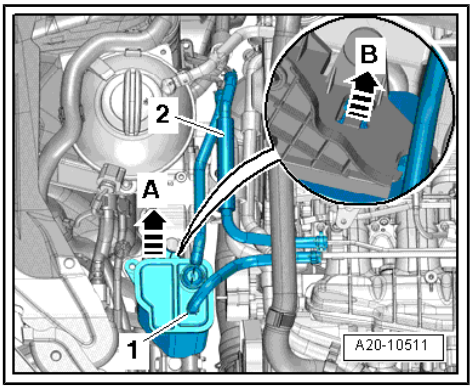
– Install front noise insulation ⇒ Rep. gr. 66 .

– Install poly V-belt for air conditioner compressor ⇒ page 55 .

1.5 Removing and installing poly V-belt tensioner for alternator and coolant pump

Removing

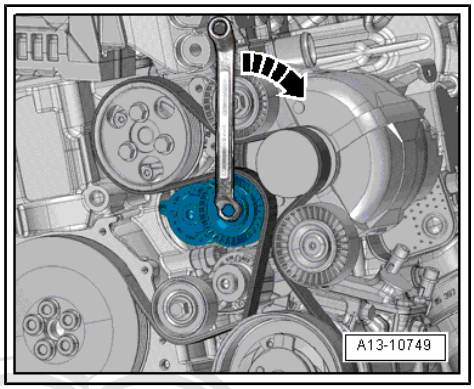
– Release activated charcoal filter -arrow B-, lift off -arrow A- and move clear to one side with hose -1- connected.



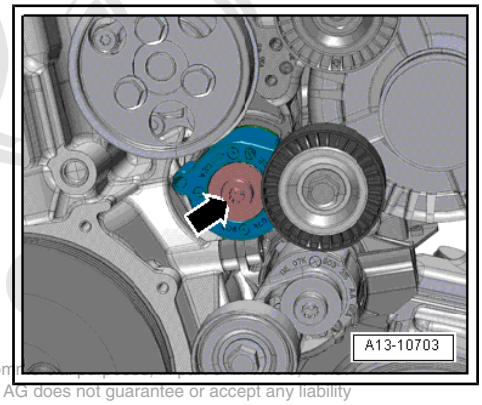
Note

Disregard -item 2-.

– To slacken poly V-belt turn tensioner in clockwise direction -arrow-.
– Remove poly V-belt from alternator and release tensioner.



– Remove bolt -arrow- and take off tensioner.



Installing

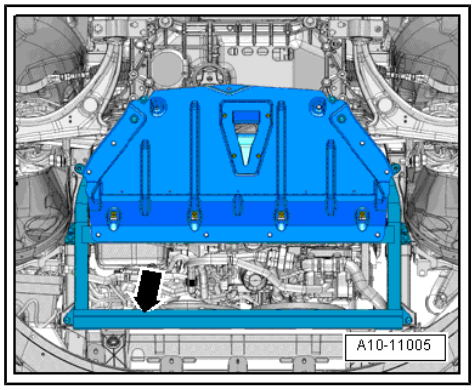
Installation is carried out in the reverse order; note the following:

- Tightening torque
  ⇒ „1.1 Poly V-belt drive, bracket for ancillaries - exploded view“, page 53
– Install poly V-belt for alternator and coolant pump
  ⇒ page 56 .

1.6 Removing and installing bracket for ancillaries

Removing

– Remove poly V-belt tensioner for air conditioner compressor
  ⇒ page 57 .
– Remove alternator ⇒ Electrical system; Rep. gr. 27 .
– Remove engine mounting ⇒ page 49 .
– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. gr. 50 .
– Remove radiator cowl ⇒ page 200 .

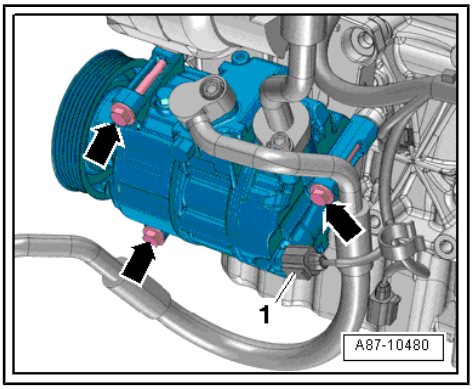


– Unplug electrical connector -1- on air conditioner compressor regulating valve -N280- .

Caution

Danger of damage to refrigerant lines and hoses.

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

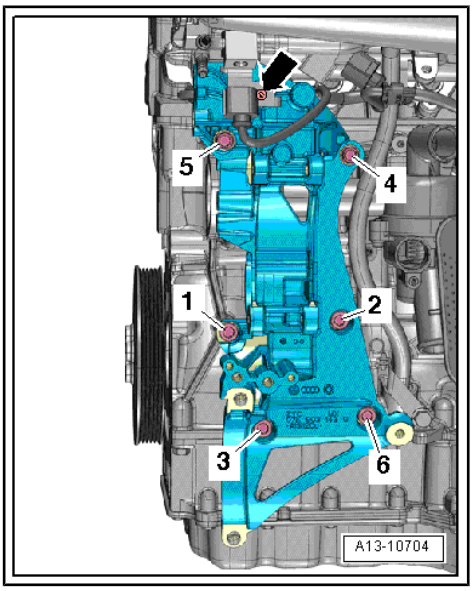


– Remove bolts -arrows-.

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

– Remove bolt -arrow-.

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



Installing

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

– Tighten bolts for bracket for ancillaries ⇒ page 54 .

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

– Install radiator cowl ⇒ page 200 .

– Install noise insulation frame ⇒ Rep. gr. 50 .

– Install engine mountings ⇒ page 49 .

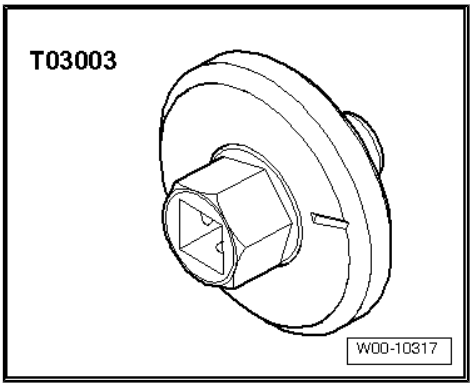
– Install alternator ⇒ Electrical system; Rep. gr. 27 .

– Install poly V-belt tensioner for air conditioner compressor ⇒ page 57 .

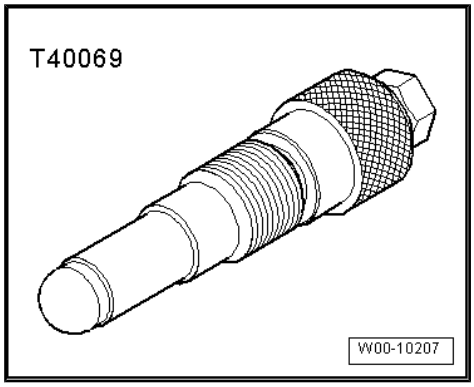
1.7 Removing and installing vibration damper

Special tools and workshop equipment required

- Socket -T03003-



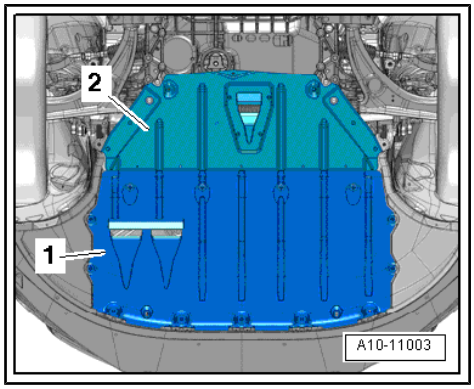
♦ Locking pin -T40069-



Removing

– Remove poly V-belt for air conditioner compressor ⇒ page 55 .

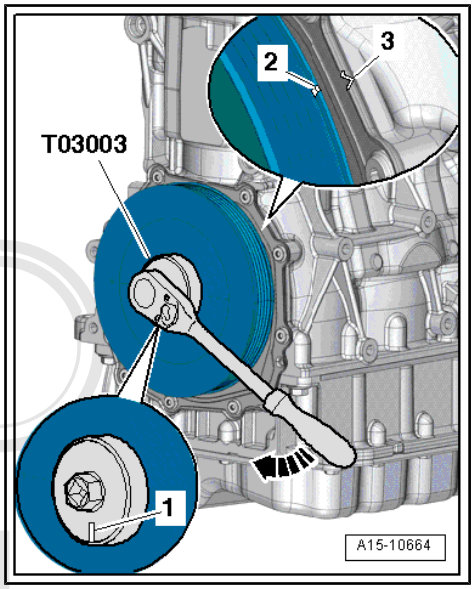
– Remove noise insulation panel -1- and -2- ⇒ Rep. gr. 66 .



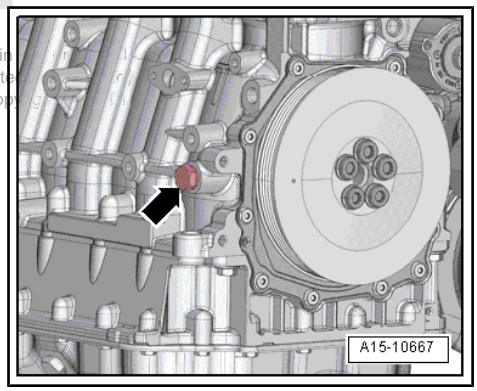
– Turn crankshaft with socket -T03003- in normal direction of rotation -arrow- to „TDC position“.

• Notch -1- in socket -T03003- must be perpendicular to sealing surface of sump.

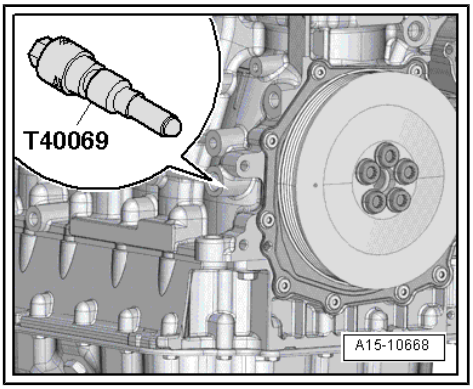
• Marking -2- on vibration damper must be opposite marking -3- on sealing flange.



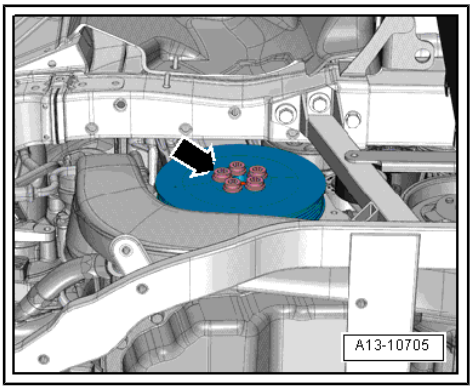
– Unscrew plug -arrow- for „TDC“ marking from cylinder block.



– Screw locking pin -T40069- into locating groove and tighten to 15 Nm. If necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



– Unscrew bolts -arrow- and remove vibration damper.



Installing

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

- Tightening torque
  ⇒ „1.1 Poly V-belt drive, bracket for ancillaries - exploded view“, page 53

Note

- *Renew the bolts tightened with specified tightening angle.*
- *The vibration damper can only be fitted in one position.*

– Remove locking pin -T40069- .

– Tighten plug for „TDC“ marking ⇒ page 72 .

– Install noise insulation panels ⇒ Rep. gr. 66 .

– Install poly V-belt for air conditioner compressor ⇒ page 55 .

1.8 Sealing flange (pulley end) - exploded view

1 - Bolt

- ❑ Tightening torque ⇒ Item 2 (page 53)

2 - Vibration damper

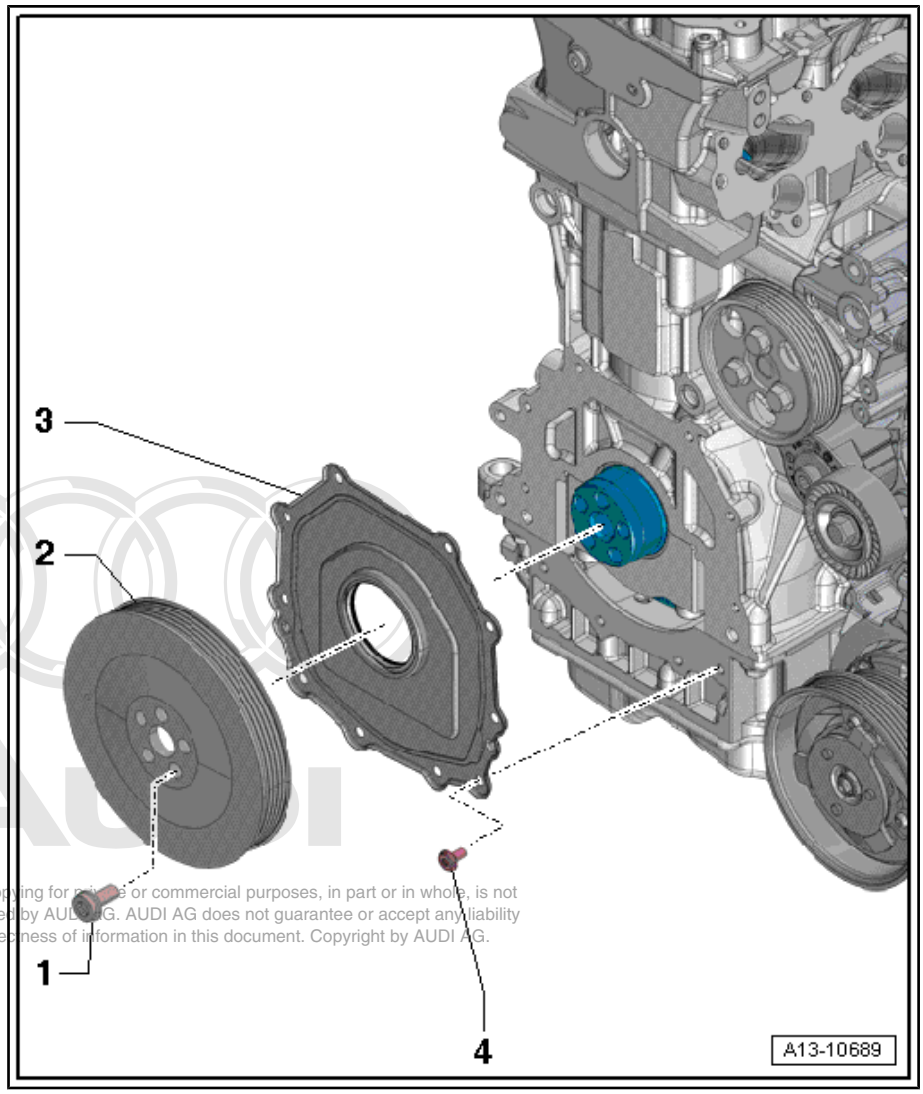
- ❑ Removing and installing ⇒ page 59
- ❑ Can only be installed in one position

3 - Sealing flange (pulley end)

- ❑ With centring collar
- ❑ Renewing ⇒ page 62
- ❑ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

4 - Bolt

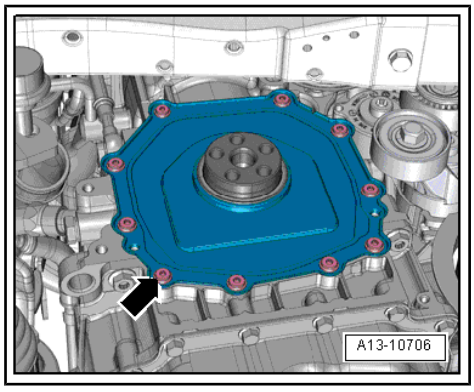
- ❑ Tightening torque and sequence ⇒ page 62



Sealing flange (pulley end) - tightening torque and sequence

– Tighten bolts in 2 stages:

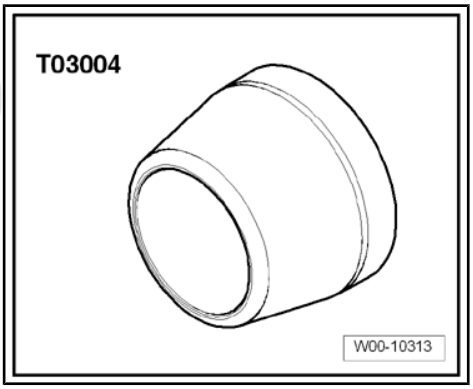
Stage	Bolts	Tightening torque
1.	-arrow-	Screw in bolts by hand until they make contact.
2.	-arrow-	Tighten in stages and in diagonal sequence; final torque 9 Nm.



1.9 Renewing sealing flange (pulley end)

Special tools and workshop equipment required

- Assembly sleeve -T03004-

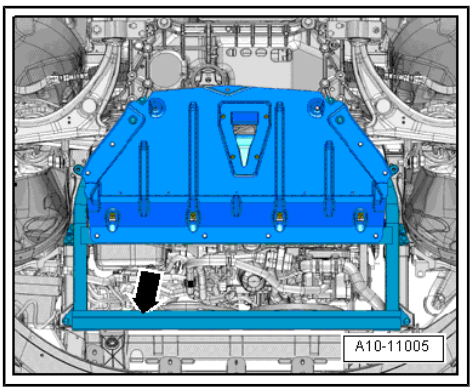


- Electric drill with plastic brush
- Safety goggles
- Sealant ⇒ Electronic parts catalogue

Procedure

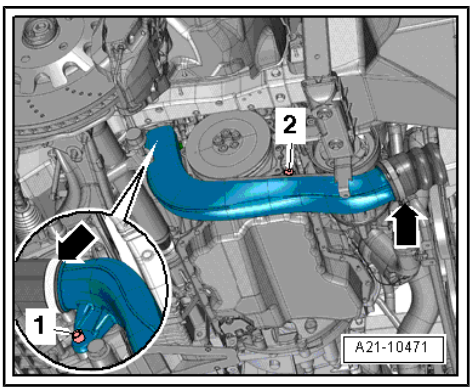
– Remove vibration damper ⇒ page 59 .

– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. gr. 50 .

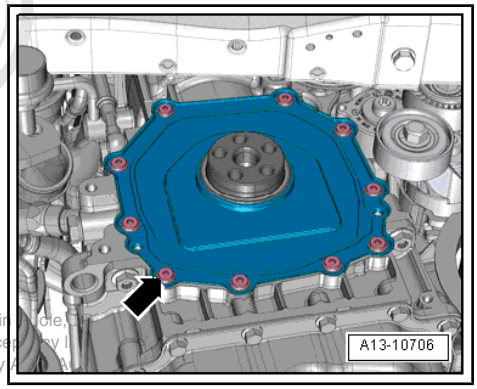


– Remove bolts -1- and -2-.

– Release hose clips -arrows- and remove air pipe.



– Remove bolts -arrows-.
– Carefully release sealing flange from bonded joint.



Note

Renew sealing flange.

Caution

Make sure sealant residue does not enter lubrication system.

- ***Cover open area of cylinder block with a cloth.***

WARNING

Protect eyes against injuries.

- ***Wear safety goggles.***

– Use e.g. rotating plastic brush to remove sealant residue on cylinder block.
– Clean sealing surfaces and crankshaft journal; they must be free of oil and grease.

Note

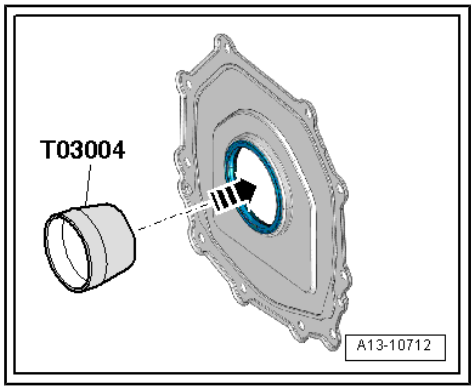
Do not additionally oil or grease sealing lip of oil seal in sealing flange.

Caution

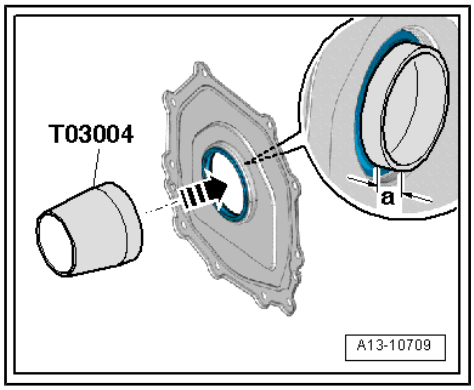
Risk of damage to oil seal in sealing flange.

- ***To make sure sealing lip of oil seal is folded over when installing, the following procedures must be performed.***

– Open out sealing lip of oil seal in sealing flange using assembly sleeve -T03004- as shown in illustration.
• Small diameter faces oil seal.



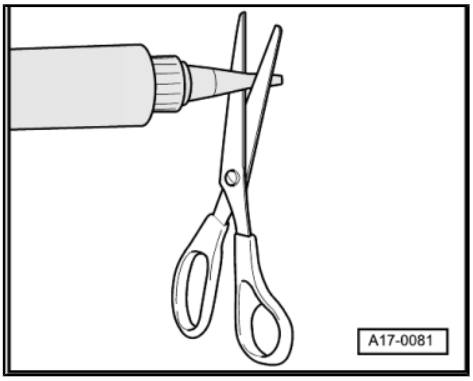
– Detach assembly sleeve -T03004- after a short while, turn over and insert in oil seal again.
• Large diameter faces oil seal.
• Assembly sleeve -T03004- must protrude by distance -a- at inside of flange
• Distance -a- = approx. 3 mm.



Note

Note the use-by date of the sealant.

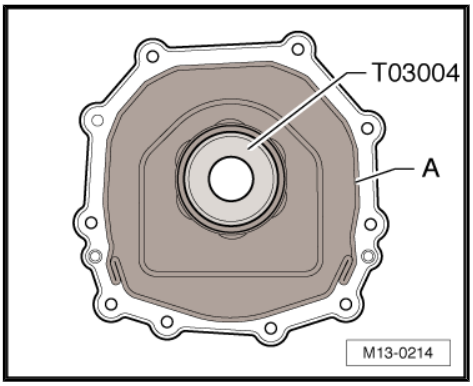
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 2 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

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



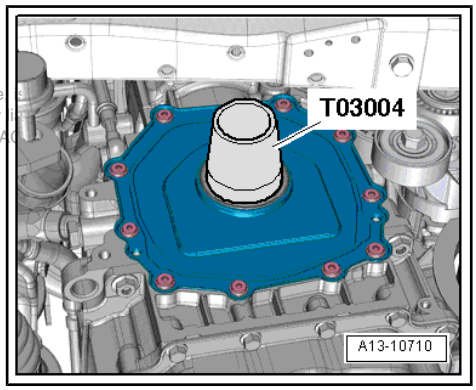
– Apply bead of sealant -A- onto clean sealing surface of sealing flange as shown in illustration.

- Width of sealant bead: 2.5 ... 3 mm
- The bead of sealant must project approx. 1.0 mm above the sealing surface.

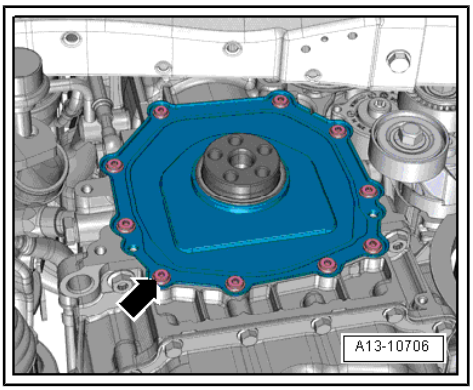
Note

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

– Use assembly sleeve -T03004- to carefully fit sealing flange onto crankshaft journal and press onto cylinder block evenly (note centring collar on left and right).



– Tighten sealing flange ⇒ page 62 .
– Install air pipe ⇒ page 216 .
– Install noise insulation frame ⇒ Rep. gr. 50 .
– Install vibration damper ⇒ page 59 .



2 Cylinder block (gearbox end)

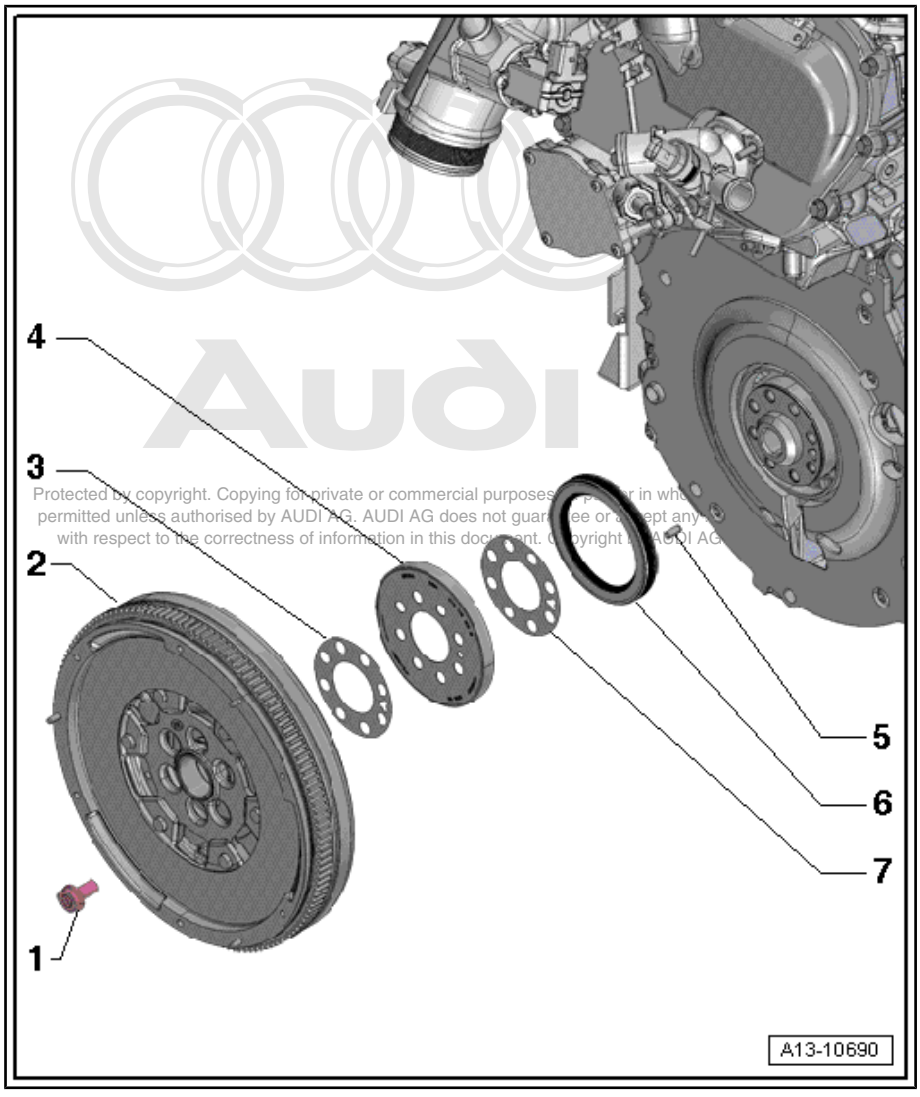
Overview

- ⇒ „2.1 Dual-mass flywheel - exploded view“, page 66
- ⇒ „2.2 Removing and installing dual-mass flywheel“, page 67
- ⇒ „2.3 Renewing crankshaft oil seal (gearbox end)“, page 68

Note

- *When performing assembly work, secure engine to engine and gearbox support ⇒ page 35 .*
- *Servicing clutch ⇒ Rep. gr. 30*

2.1 Dual-mass flywheel - exploded view



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

2 - Dual-mass flywheel
- ❑ Different versions available; for allocation refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ page 67
- ❑ Can only be installed in one position

3 - Diamond-coated washer
- ❑ Must always be renewed if bolts for dual-mass flywheel are loosened
- ❑ Can only be installed in one position

4 - Sender wheel
- ❑ For engine speed sender -G28-
- ❑ Can only be installed in one position

5 - Dowel pin

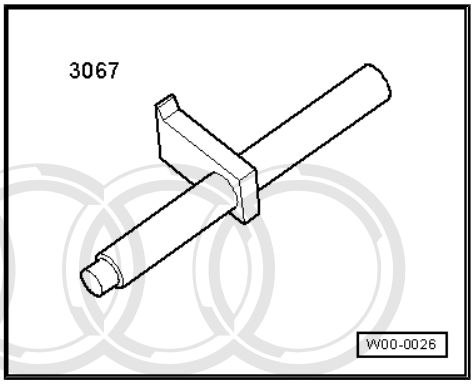
6 - Crankshaft oil seal (gearbox end)
- ❑ Renewing ⇒ page 68

7 - Diamond-coated washer
- ❑ Must always be renewed if bolts for dual-mass flywheel are loosened
- ❑ Can only be installed in one position

2.2 Removing and installing dual-mass flywheel

Special tools and workshop equipment required

- Counterhold tool -3067-



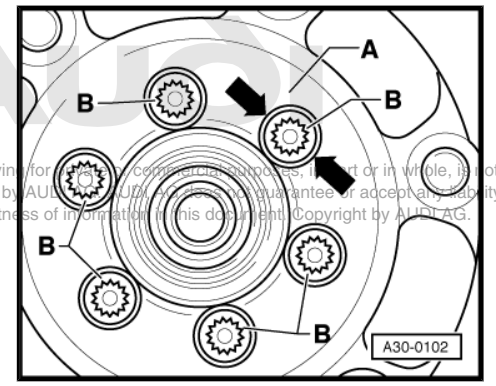
Removing

- 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

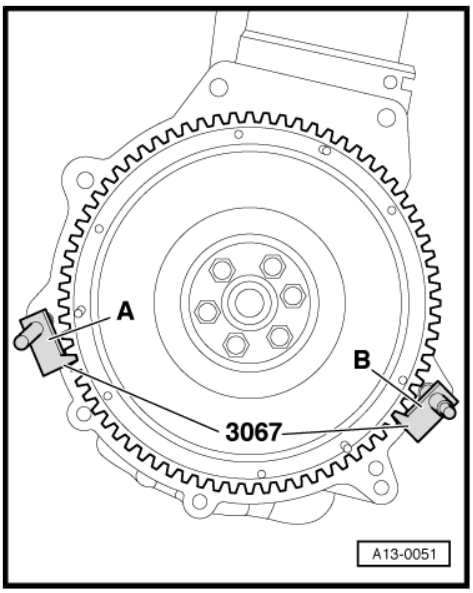
Installation is carried out in the reverse order; note the following:

- Tightening torque
  ⇒ „2.1 Dual-mass flywheel - exploded view“, page 66

Caution

Make sure friction is sufficient.

- *Always renew diamond-coated washers ⇒ Item 3 (page 66) and ⇒ Item 7 (page 66) after loosening bolts for dual-mass flywheel.*



Note

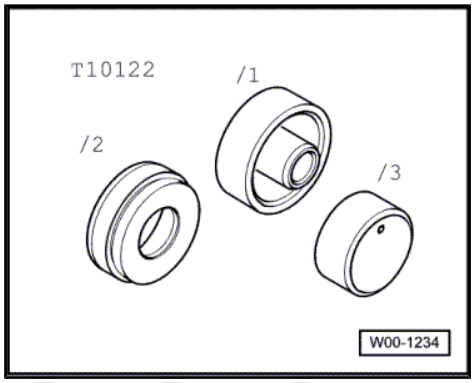
- *Renew the bolts tightened with specified tightening angle.*
- *Dual-mass flywheel with sender wheel and diamond-coated washers can only be fitted in one position.*

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

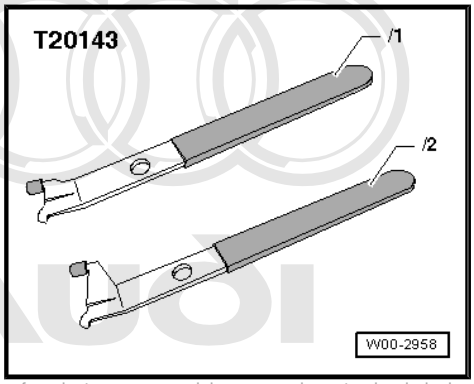
2.3 Renewing crankshaft oil seal (gearbox end)

Special tools and workshop equipment required

- Fitting tool -T10122-

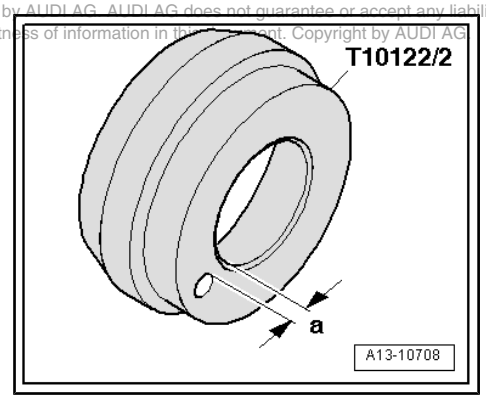


- Extractor tool -T20143/2-



Set up assembly sleeve -T10122/2- as follows:

– Machine drilling for dowel sleeve in assembly sleeve -T10122/2- until dimension -a- = 8 mm.



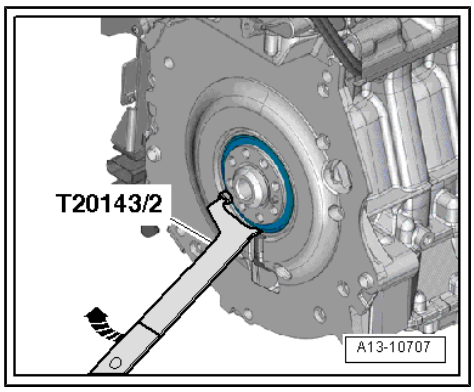
Procedure

- Gearbox removed.

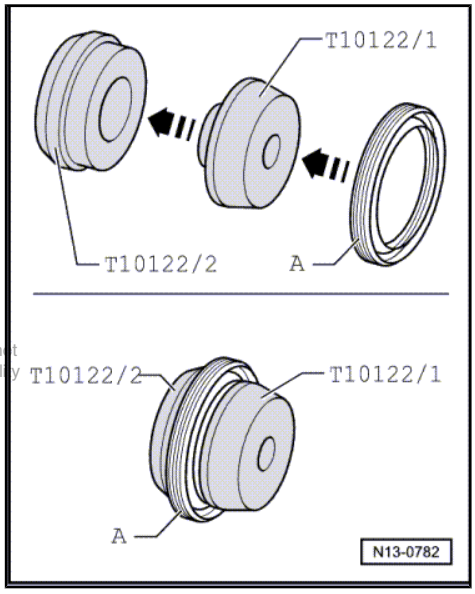
– Remove dual-mass flywheel ⇒ page 67 .

– Pry out oil seal using extractor tool -T20143/2- -arrow-.

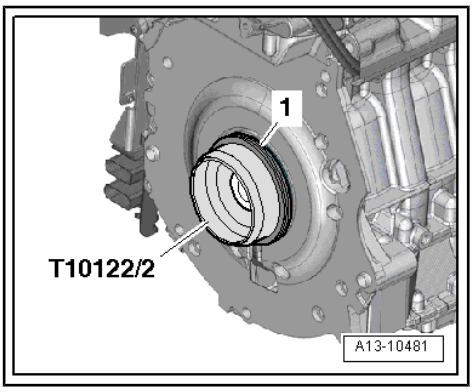
– Clean contact surface and sealing surface.



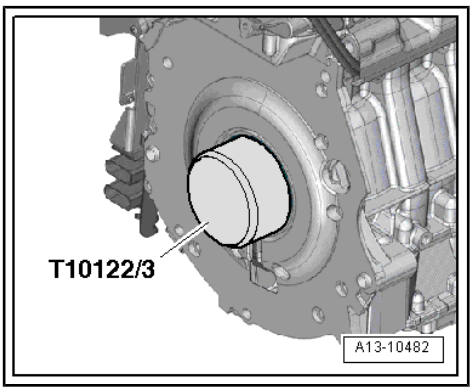
– Fit assembly aid -T10122/1- onto assembly sleeve -T10122/2- and slide oil seal -A- onto assembly sleeve.
– Detach assembly aid.



– Fit assembly sleeve -T10122/2- with oil seal -1- onto crankshaft.



– Press in oil seal uniformly until flush all round using thrust piece -T10122/3- .
– Install dual-mass flywheel ⇒ page 67 .



3 Crankshaft

Overview

Note

- *When performing assembly work, secure engine to engine and gearbox support ⇒ page 35 .*
- *If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil galleries carefully and renew the oil spray jets, engine oil cooler and oil filter.*

3.1 Crankshaft - exploded view

1 - Bolt

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

2 - Bearing caps

- ❑ 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 - Bearing shell

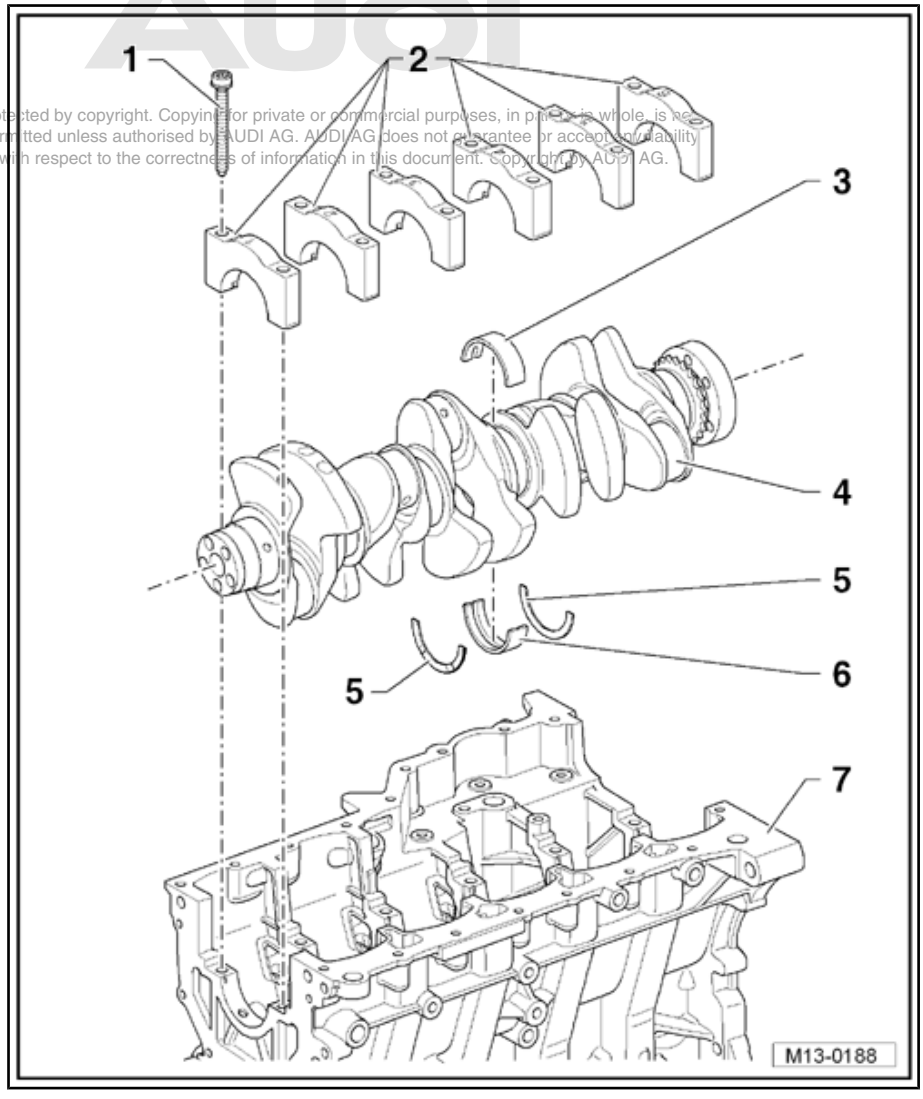
- ❑ For bearing cap (without oil groove)
- ❑ Mark used bearing shells for re-installation but not on bearing surface
- ❑ Bearing shells worn down to base layer must be renewed
- ❑ Insert new bearing shells with correct colour-coding ⇒ page 71

4 - Crankshaft

- ❑ Measuring axial clearance ⇒ page 72
- ❑ Measuring radial clearance ⇒ page 73
- ❑ Crankshaft dimensions ⇒ page 72

5 - Thrust washers

- ❑ For bearing No. 3

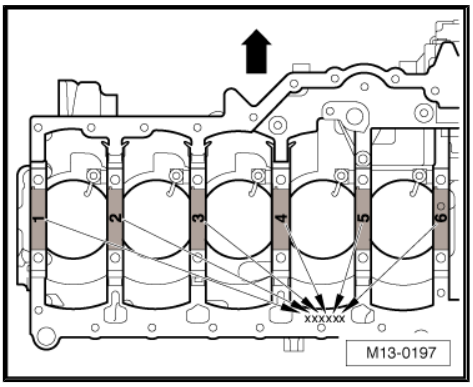


6 - Bearing shell

- ❑ For cylinder block (with oil groove)
- ❑ Mark used bearing shells for re-installation but not on bearing surface
- ❑ Bearing shells worn down to base layer must be renewed
- ❑ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ page 71

7 - Cylinder block

Allocation of crankshaft bearing shells for cylinder block



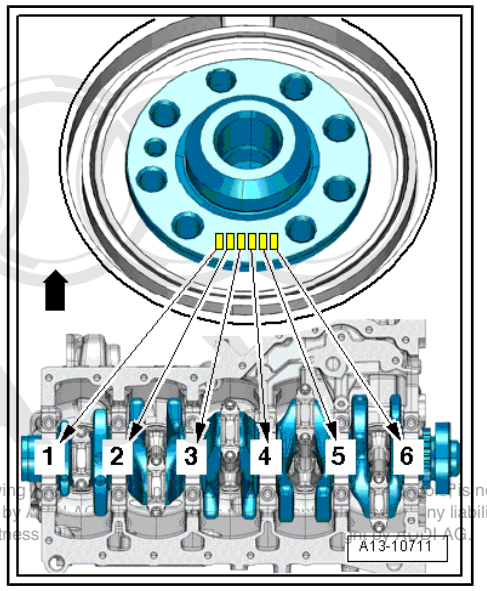
- ♦ Bearing shells of the correct thickness are matched to the bearings in the cylinder block at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- ♦ Letter codes on the lower sealing surface of the cylinder block indicate the thickness of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

Letter on cylinder block	Colour coding of bearing
G =	Yellow
B =	Blue
W =	White

Note

The -arrow- points in direction of travel.

Allocation of crankshaft bearing shells for bearing caps



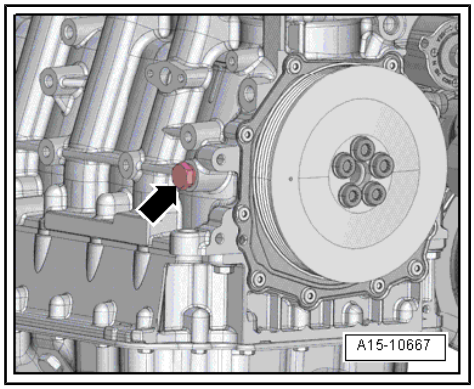
- ♦ Bearing shells of the correct thickness are assigned to the bearing caps at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- ♦ The correct allocation of bearing shells to bearing cap is indicated by a sequence of letters on the pulley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

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

Note

The -arrow- points in direction of travel.

Plug for „TDC“ marking - tightening torque



Note

Renew seal.

– Tighten plug -arrow- for „TDC“ marking to 45 Nm.

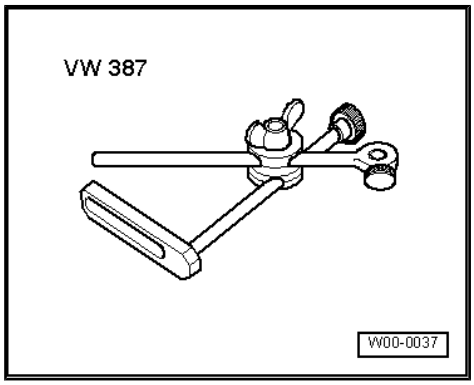
3.2 Crankshaft dimensions

Honing dimension	Main bearing journal ∅ mm	Conrod journal ∅ mm
Basic dimension	58.000 – 0.022 – 0.042	47.800 – 0.022 – 0.042

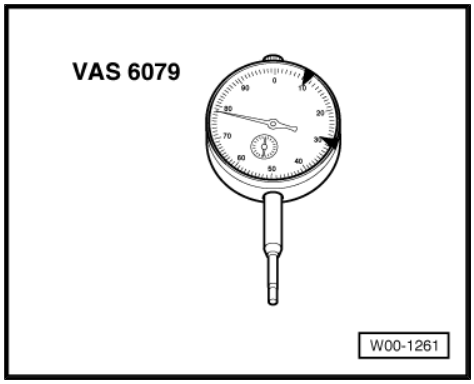
3.3 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

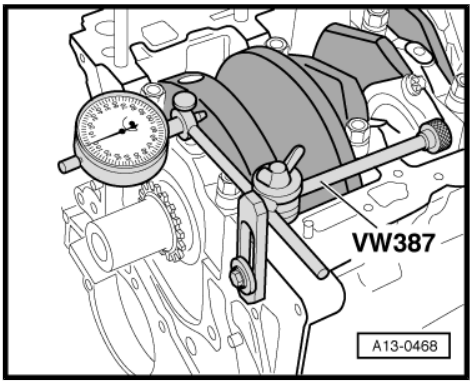
♦ Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-



Procedure



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

Axial clearance:

- New: 0.07 ... 0.21 mm.
- Wear limit: 0.30 mm.

3.4 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

♦ Plastigage

Procedure

Note

♦ *Mark used bearing shells for re-installation (but do not mark bearing surface).*
♦ *Bearing shells worn down to the base layer must be renewed.*

– Remove bearing cap.
– 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 40 Nm (do not turn further) without rotating crankshaft.
– Remove bearing cap again.
– Compare width of Plastigage with measurement scale.

Radial clearance:

- New: 0.023 ... 0.043 mm.
- Wear limit: 0.07 mm.

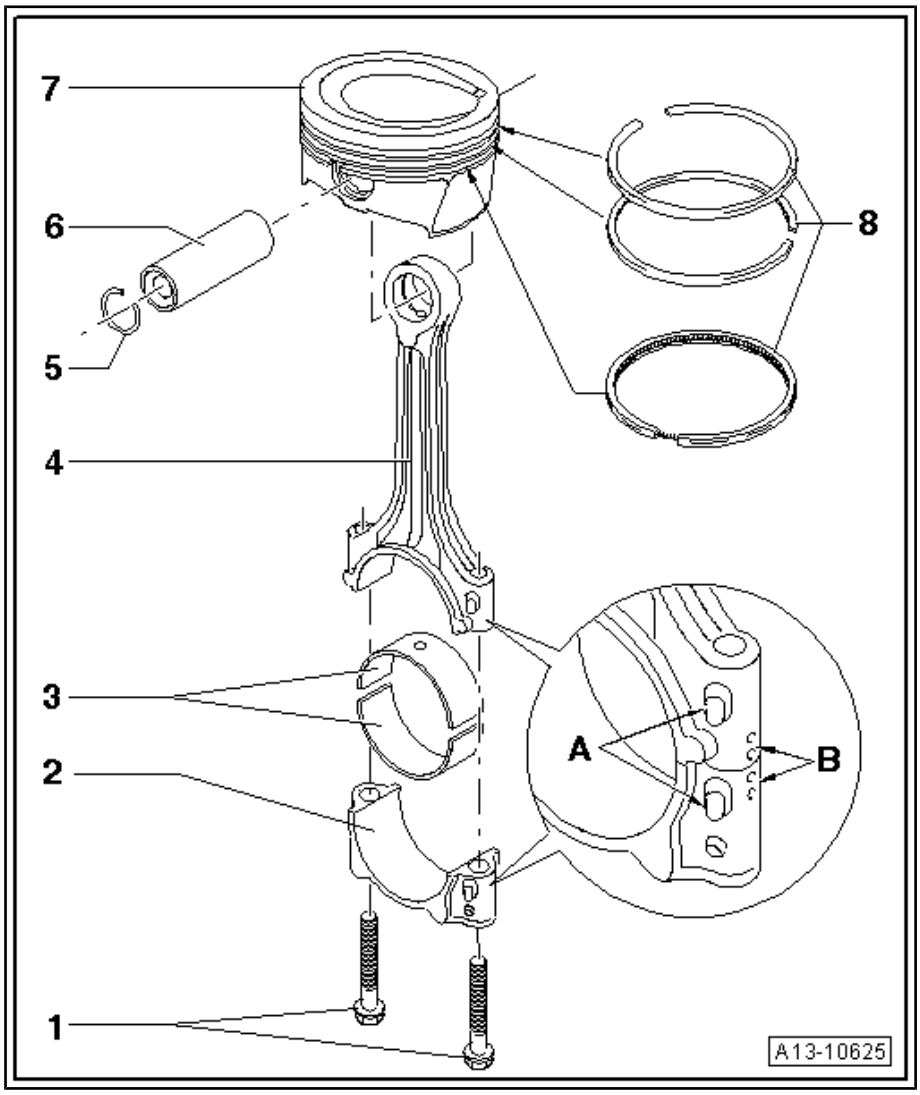
4 Pistons and conrods

Overview

Note

- *All bearing and running surfaces must be oiled before assembling.*
- *Oil spray jet and pressure relief valve ⇒ page 77*

4.1 Pistons and conrods - exploded view



1 - Bolts

- ❑ Renew
- ❑ Lubricate threads and contact surface
- ❑ 45 Nm + turn 90° further

2 - Conrod bearing cap

- ❑ Note installation position
- ❑ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ❑ Mark cylinder allocation in colour -B-
- ❑ Installation position: Markings -A- face towards pulley end

3 - Bearing shells

- ❑ Without oil drilling
- ❑ Installation position ⇒ page 76
- ❑ Mark used bearing shells for re-installation but not on bearing surface
- ❑ Bearing shells worn down to base layer must be renewed

4 - Conrod

- ❑ Only renew as a complete set
- ❑ Mark cylinder allocation in colour -B-
- ❑ Installation position: Markings -A- face towards pulley end
- ❑ Measuring radial clearance ⇒ page 77
- ❑ Separating parts of new conrod ⇒ page 76

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 76
- ❑ Mark installation position to conrod and cylinder allocation
- ❑ Installation position: arrow on piston crown points to pulley end
- ❑ Install using piston ring clamp
- ❑ Measuring cylinder bore ⇒ page 76
- ❑ Piston and cylinder dimensions ⇒ page 77

8 - Piston rings

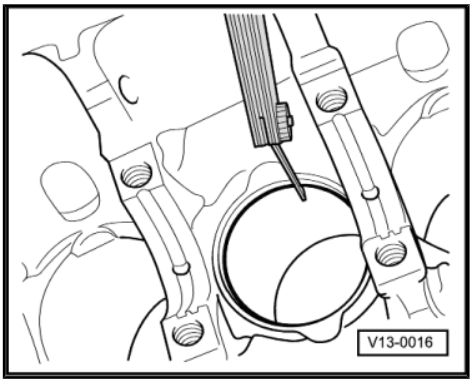
- ❑ Offset gaps by 120°
- ❑ Use piston ring pliers to remove and install
- ❑ Inscription „TOP“ faces towards piston crown
- ❑ Measuring ring gap ⇒ page 75
- ❑ Measuring ring-to-groove clearance ⇒ page 75

Measuring 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.

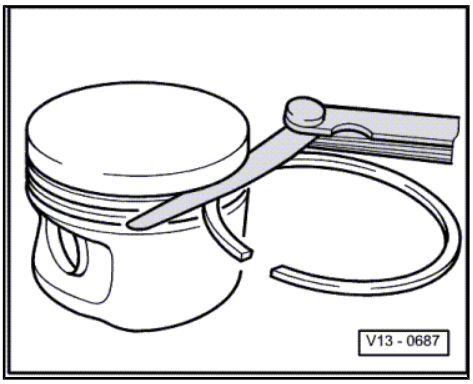


Piston ring	new mm	Wear limit mm
Compression rings	0.20 … 0.40	0.8
Oil scraper ring	0.25 … 0.50	0.8

Measuring ring-to-groove clearance

– Clean annular groove of piston.

– Check gap using feeler gauge.



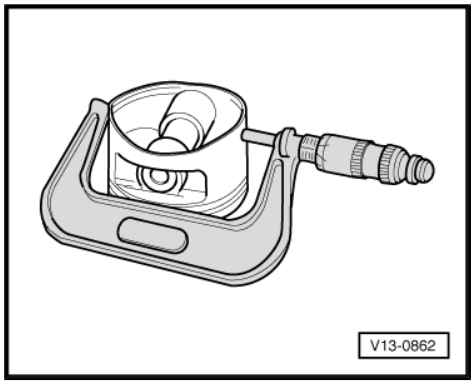
Piston ring	new mm	Wear limit mm
Compression rings	0.06 … 0.09	0.20
Oil scraper ring	0.03 … 0.06	0.15

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 77 .

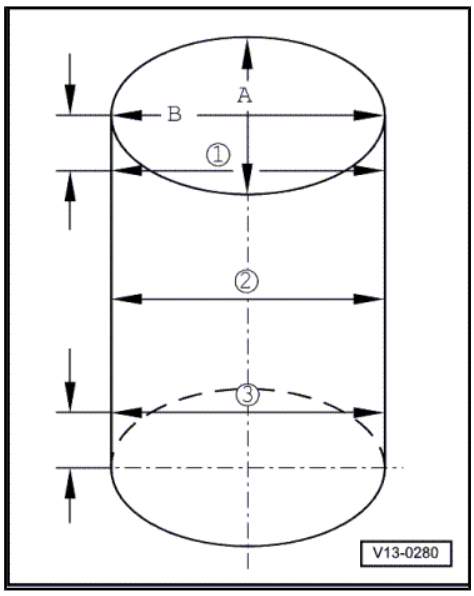


Checking cylinder bore

– 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.

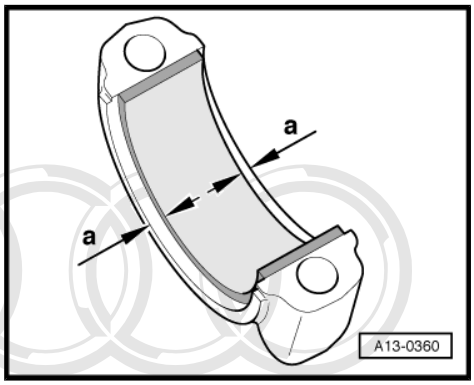
Nominal dimension
⇒ „4.2 Piston and cylinder dimensions“, page 77 .



Installation position of bearing shells in conrods

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

• Distance -a- = approx. 1.5 mm.



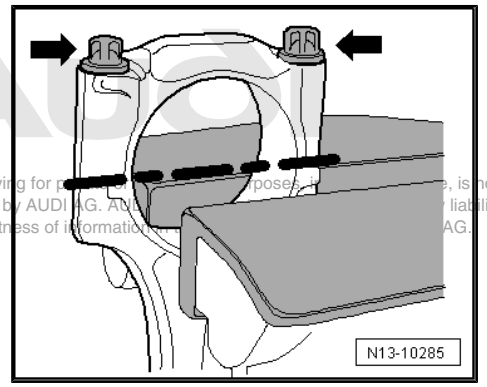
Separating parts of new conrod

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

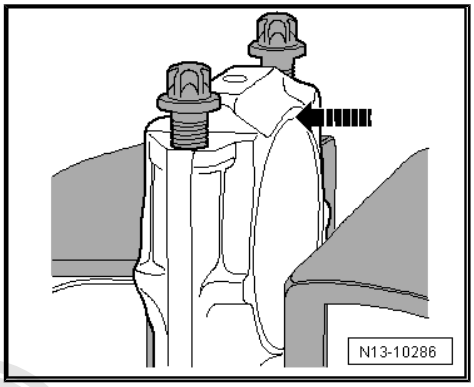
– To avoid any risk of damage, the conrod should only be clamped lightly in a vice using jaw covers as shown in illustration.

• The conrod is clamped in position below the dotted line.

– Unscrew bolts -arrows- approx. 5 turns.



– Using a plastic hammer, carefully knock conrod bearing cap loose -arrow-.

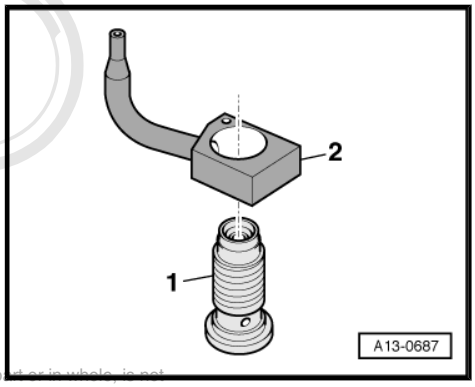


Oil spray jet and pressure relief valve

1 - Bolt with pressure relief valve, 27 Nm

2 - Oil spray jet (for cooling of pistons)

- 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	82.451 1)	82.510

- 1) Dimensions not including coating (thickness 0.02 mm). The coating will wear down in service.

4.3 Measuring radial clearance of conrods

Special tools and workshop equipment required

- Plastigage

Procedure

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

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

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

– Fit conrod bearing cap and tighten bolts to 45 Nm (do not turn further) 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.

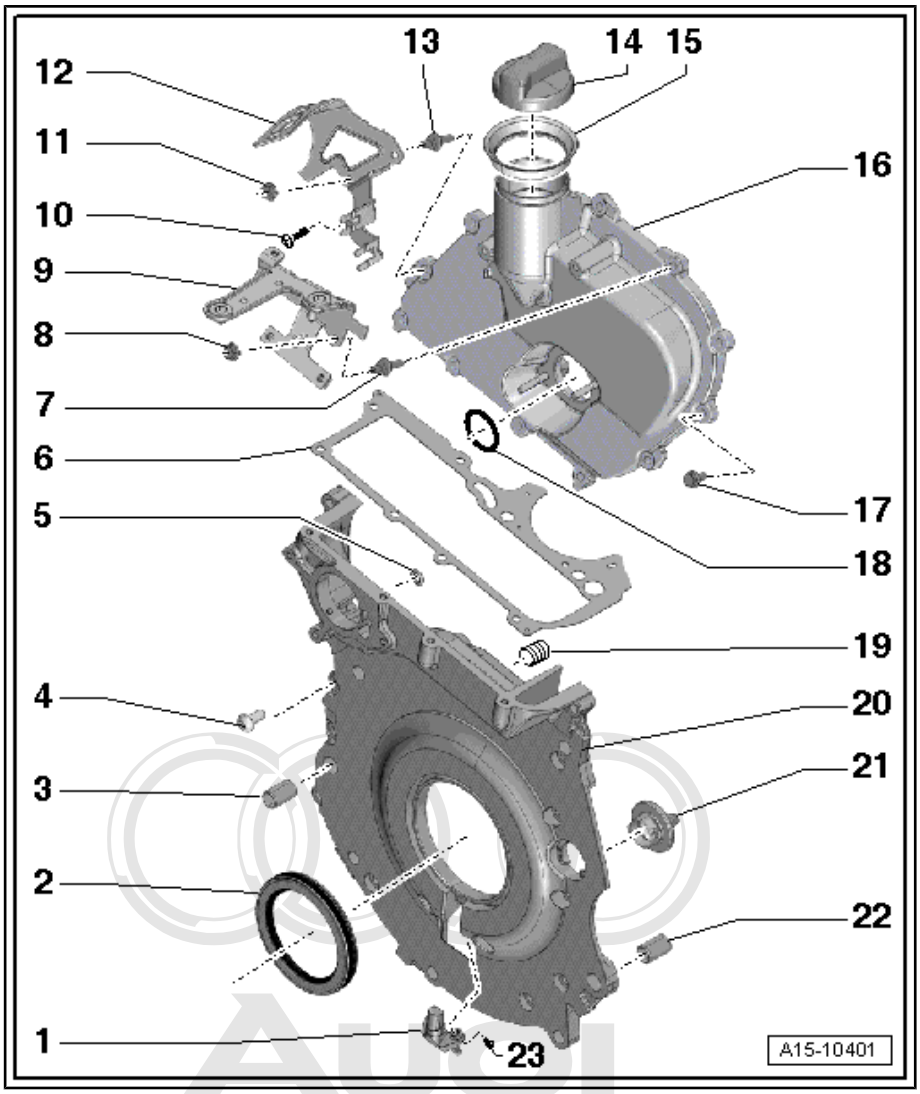
– Renew conrod bolts.

15 – Cylinder head, valve gear

1 Chain drive

Overview

1.1 Timing chain covers - exploded view



1 - Engine speed sender -G28-
- ❑ Removing and installing ⇒ Rep. gr. 28

2 - Crankshaft oil seal (gearbox end)
- ❑ Renewing ⇒ page 68

3 - Dowel sleeve

4 - Bolt
- ❑ Tightening torque and sequence ⇒ page 80

5 - O-ring
- ❑ Renew

6 - Cylinder head gasket

7 - Centre hex stud
- ❑ Tightening torque and sequence ⇒ page 80

8 - Nut
- ❑ 8 Nm

9 - Bracket
- ❑ For engine cover panel, high-pressure line and exhaust gas temperature sender 1 -G235-

10 - Bolt
- ❑ 8 Nm

11 - Nut
- ❑ 8 Nm

12 - Bracket
- ❑ For engine cover panel and electrical connectors

13 - Centre hex stud
- ❑ Tightening torque and sequence ⇒ page 80

14 - Filler cap for oil filler neck

15 - Grommet

16 - Upper cover for timing chains
- ❑ Removing and installing ⇒ page 80
- ❑ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

17 - Bolt
- ❑ Tightening torque and sequence ⇒ page 80

18 - Seal
- ❑ Renewing ⇒ page 83

19 - Sealing sleeve
- ❑ Renew

20 - Timing chain cover (bottom)
- ❑ Removing and installing ⇒ page 84

❑ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

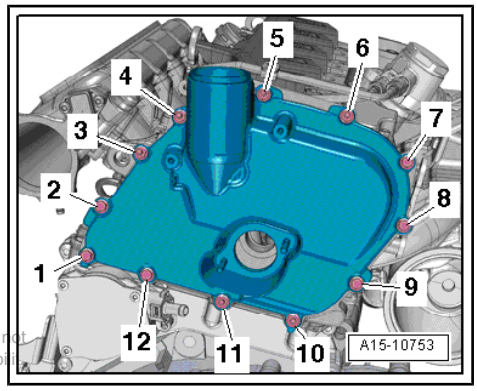
21 - Plug

22 - Dowel sleeve

23 - Bolt

❑ Tightening torque ⇒ Rep. gr. 28

Timing chain cover (top) - tightening torque and tightening sequence



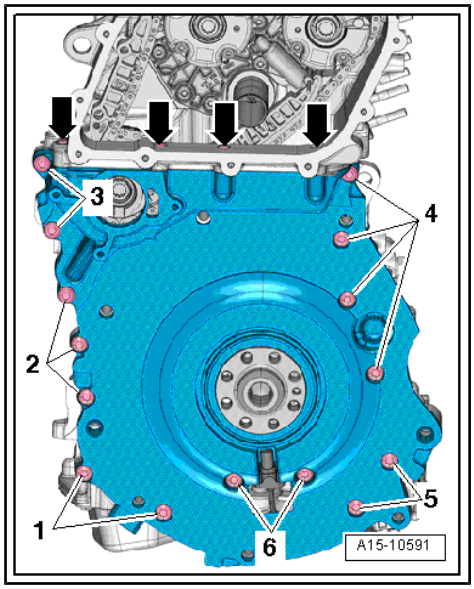
Note

Bolts -3, 4, 5, 6, 10, 11- are supplied as centre hex studs.

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 ... 12-	Screw in bolts by hand until they make contact
2.	-1 … 12-	9 Nm

Timing chain cover (bottom) - tightening torque and tightening sequence



Note

Renew the bolts tightened with specified tightening angle.

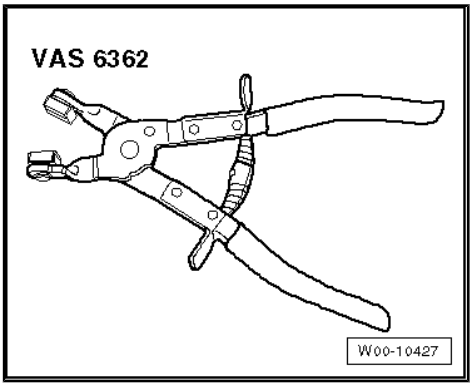
– Tighten bolts in 6 stages:

Stage	Bolts	Tightening torque
1.	-1 ... 6- and -arrows-	Screw in bolts by hand until they make contact
2.	-arrows-	5 Nm
3.	-1 … 6-	8 Nm in diagonal sequence
4.	-arrows-	8 Nm
5.	-1 … 6-	20 Nm in diagonal sequence
6.	-arrows-	turn 90° further

1.2 Removing and installing timing chain cover (top)

Special tools and workshop equipment required

♦ Hose clip pliers -VAS 6362-



♦ Electric drill with plastic brush attachment

♦ Safety goggles

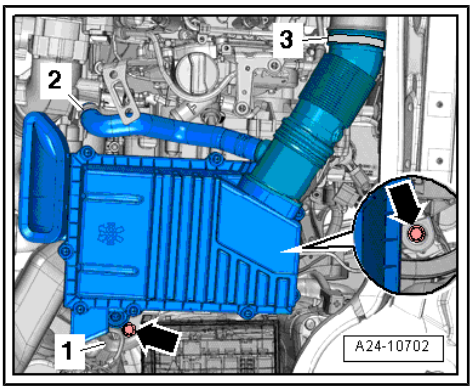
♦ Sealant ⇒ Electronic parts catalogue

Removing

Note

Routing and attachment of pipes, hoses and wiring in engine compartment ⇒ page 7 .

– Remove air cleaner housing ⇒ Rep. gr. 24 .

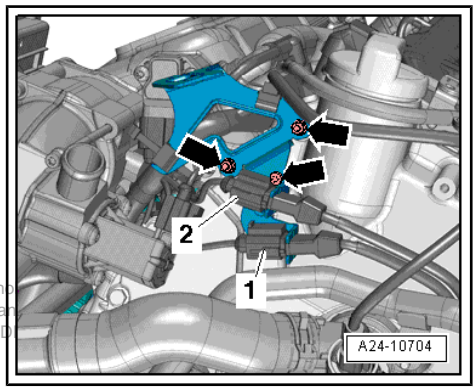


– Unplug electrical connectors -1- and -2-.

– Unscrew nuts and bolt -arrows- and move bracket for connectors to one side.

– Remove front coolant pipes ⇒ page 187 .

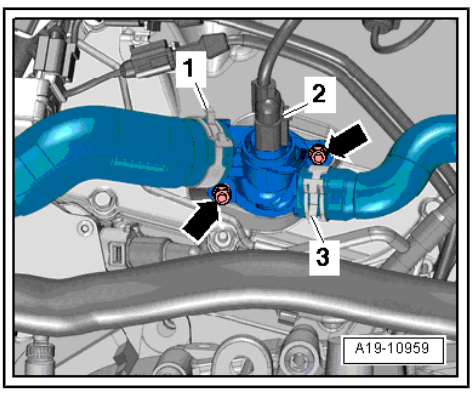
– Remove coolant pipe (left-side) ⇒ page 184 .



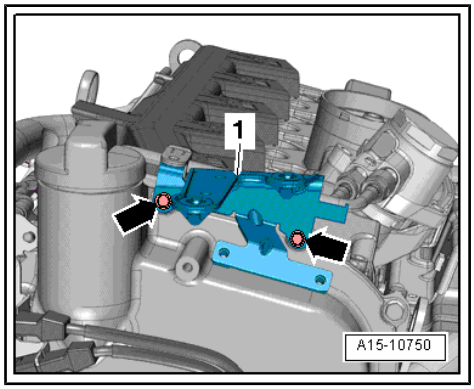
– Unplug electrical connector -2- at coolant temperature sender -G62- .

– Release hose clip -3- and detach coolant hose.

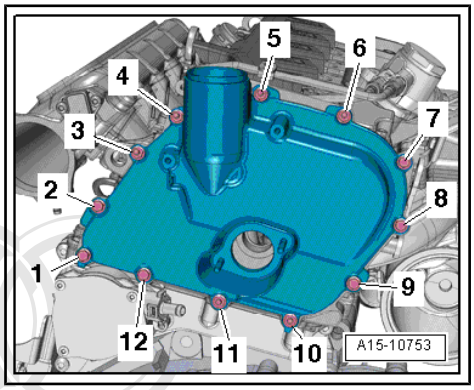
– Unscrew nuts -arrows- and move coolant connection to side with coolant hose -1- connected.



– Remove nuts -arrows- and detach bracket -1-.



– Remove bolts in the sequence -12 ... 1- and carefully release timing chain cover (top) from bonded joint.
– Drive out oil seal in timing chain cover (top) ⇒ page 83 .

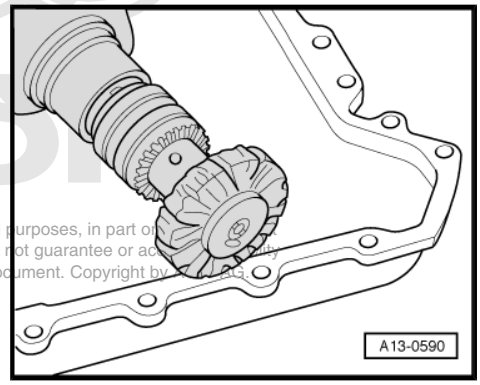


Installing

Caution

Protect lubrication system against contamination.

- *Cover exposed parts of the engine.*



WARNING

Protect eyes against injuries.

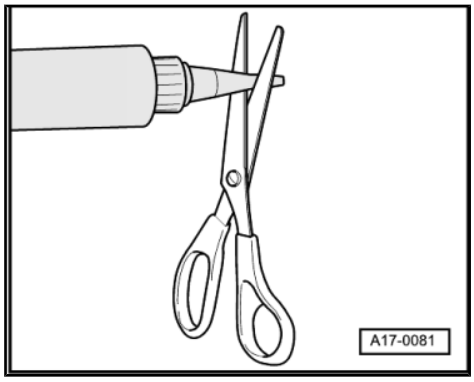
- *Wear safety goggles.*

– Remove remaining sealant on timing chain cover, cylinder block and cylinder head using rotating plastic brush or similar.
– Press in new oil seal in timing chain cover (top) ⇒ page 83 .
– Clean sealing surfaces; they must be free of oil and grease.

Note

Note the use-by date of the sealant.

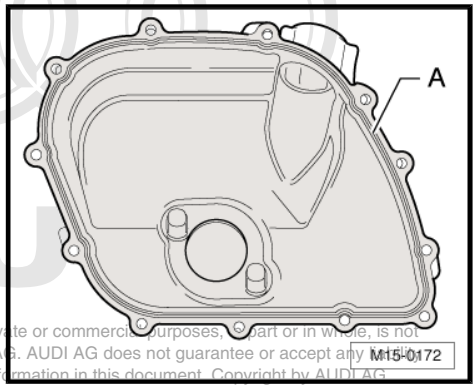
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

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



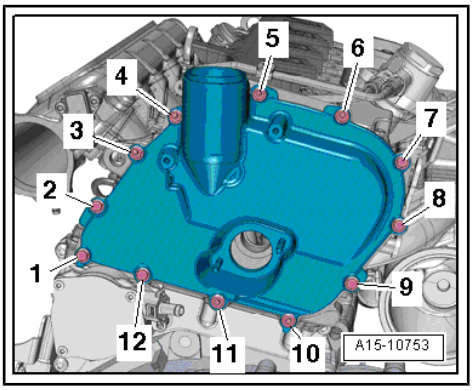
– Apply sealant bead -A- onto the clean sealing surface of the timing chain cover (top) as illustrated.

• Thickness of sealant bead: 1.5 ... 2.0 mm

Note

The timing chain cover (top) must be installed within 5 minutes after applying the sealant.

– Install timing chain cover (top) and tighten bolts ⇒ page 80 .



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

– Install coolant connection ⇒ page 182 .

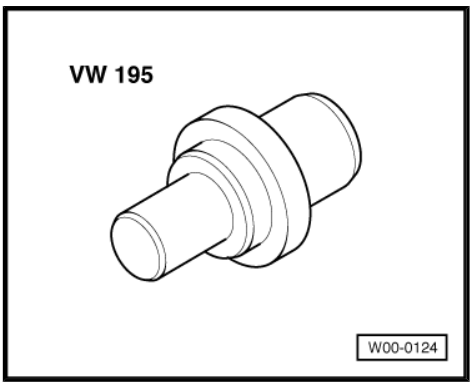
– Install coolant pipe (left-side) ⇒ page 184 .

– Install coolant pipes (front) ⇒ page 187 .

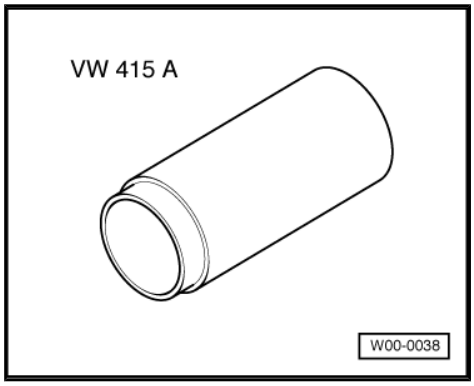
1.3 Renewing oil seal in timing chain cover (top)

Special tools and workshop equipment required

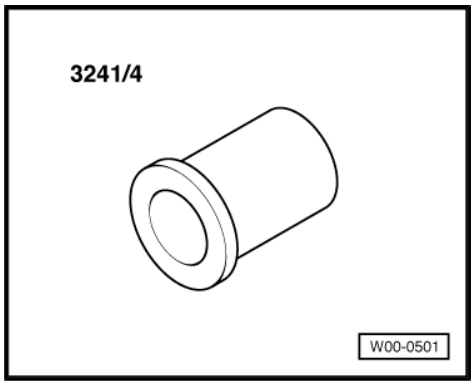
♦ Punch -VW 195-



- Tube -VW 415 A-



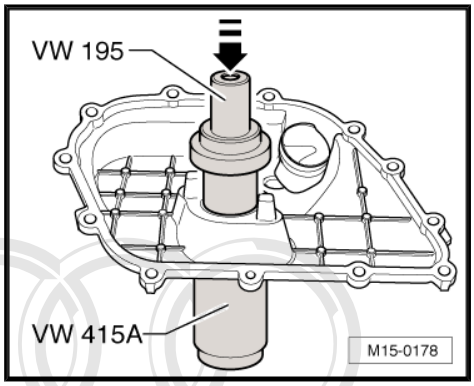
- Fitting sleeve -3241/4-



Procedure

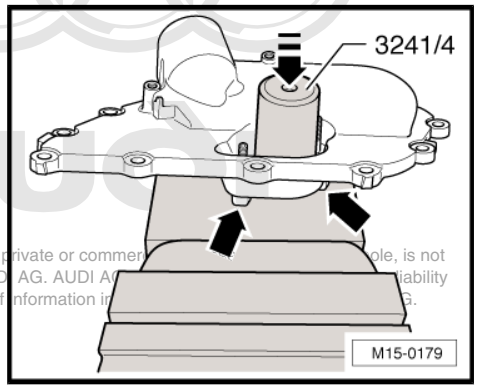
– Remove timing chain cover (top) ⇒ page 80 .

– Use punch -VW 195- to drive out oil seal -arrow-.



– Remove any sealant residue from timing chain cover (top), place cover on a fixed surface with lugs on casting -arrows- facing downwards and press in new seal until it makes contact using fitting sleeve -3241/4- .

– Install timing chain cover (top) ⇒ page 80 .



1.4 Removing and installing timing chain cover (bottom)

Special tools and workshop equipment required

- Electric drill with plastic brush attachment
- Safety goggles

♦ Sealant ⇒ Electronic parts catalogue

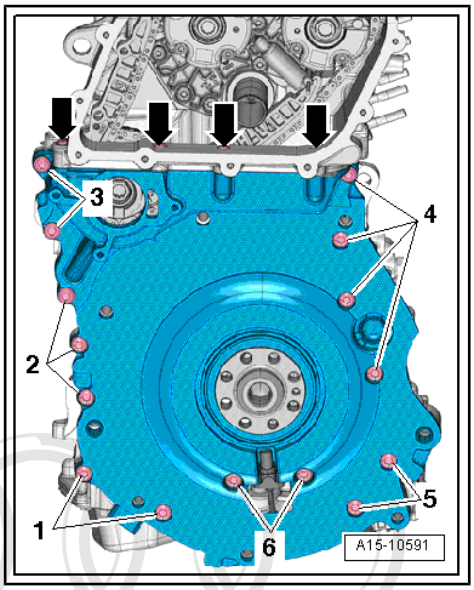
Removing

• Gearbox removed ⇒ Rep. gr. 34 .

Note

Fit all cable ties in the original positions when installing.

– Remove dual-mass flywheel ⇒ page 67 .
– Remove timing chain cover (top) ⇒ page 80 .
– Remove vacuum pump for brake servo ⇒ Rep. gr. 47 .
– Remove engine speed sender -G28- ⇒ Rep. gr. 28 .
– First remove bolts -arrows-, then -1 ... 6-.

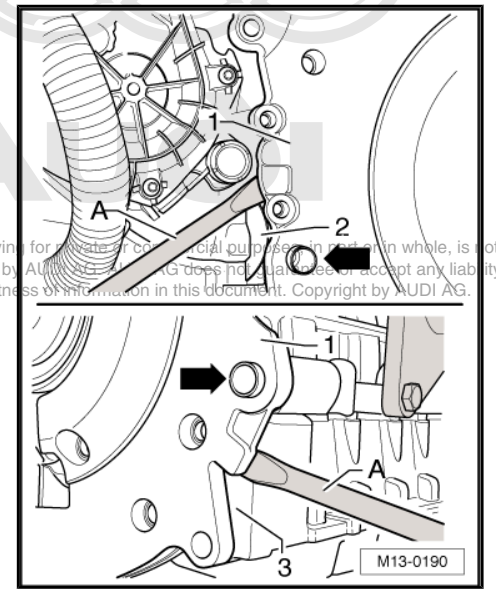


– Carefully release timing chain cover (bottom) -1- from bonded joint; to do so, apply screwdriver -A- at the correct positions at top and bottom.

2 - Cylinder block

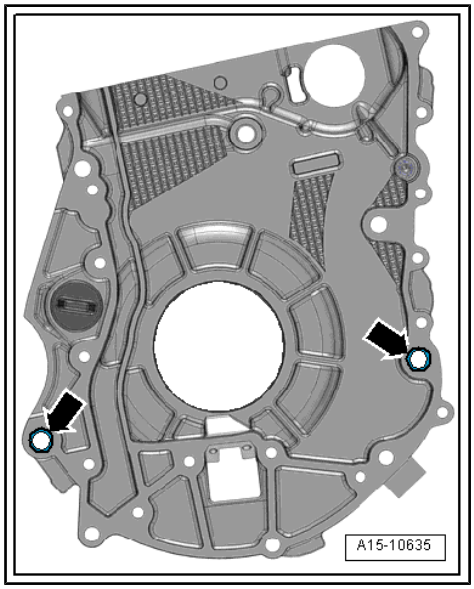
3 - Sump (top section)

– Always start to release cover in area of dowel sleeves -arrows-.
– Press crankshaft oil seal (gearbox end) out of timing chain cover (bottom).



Installing

– Drive back dowel sleeves -arrows- in timing chain cover (bottom) that they do not protrude beyond sealing surface.



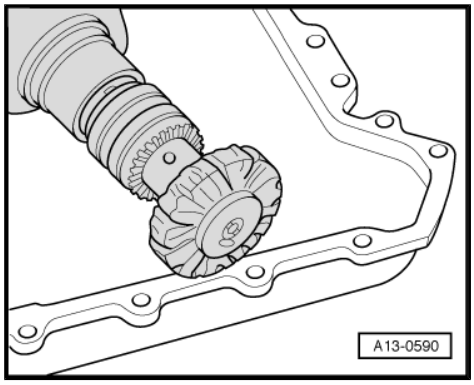
Note

Renew gaskets, seals and O-rings.

Caution

Protect lubrication system against contamination.

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



WARNING

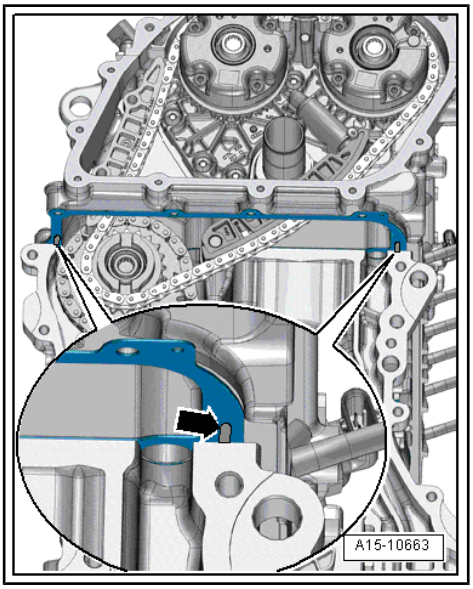
Protect eyes against injuries.

- ***Wear safety goggles.***

– Remove remaining sealant on timing chain cover (bottom), cylinder block and sump (top section) using rotating plastic brush or similar.

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

– Clean old sealant from holes -arrow- in cylinder head gasket.



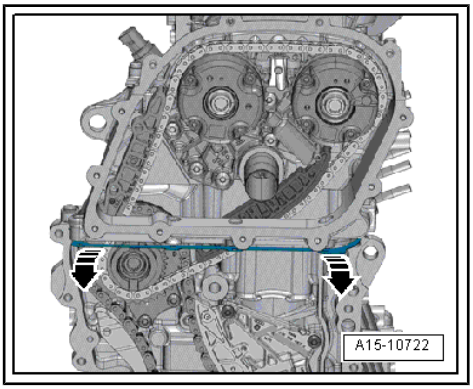
Note

With the cylinder head installed the holes in the cylinder head gasket are only half visible.

Caution

Avoid damage to cylinder head gasket.

- ***Only bend the end of the cylinder head gasket slightly and do not kink.***



Note

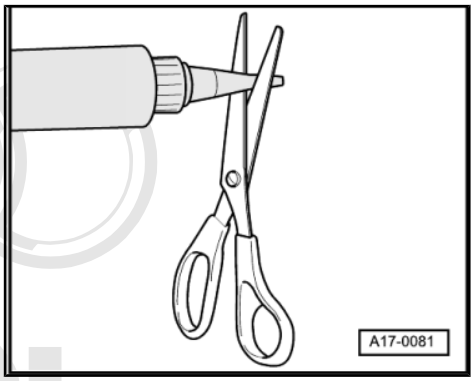
If the cylinder head gasket has been bent and kinked it must be renewed.

– Carefully bend the end of the cylinder head gasket down very slightly -arrows-, just far enough to be able to clean the upper sealing surface on the cylinder head gasket and cylinder head.
– Clean cylinder head gasket (top and bottom); it must be free of oil and grease.

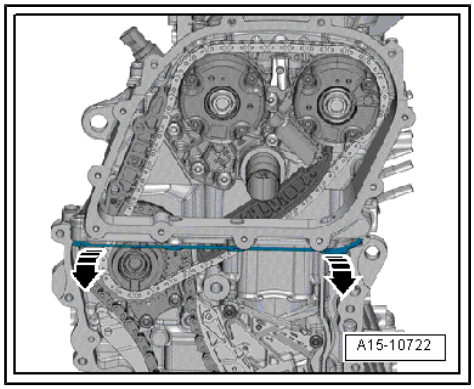
Note

Note the use-by date of the sealant.

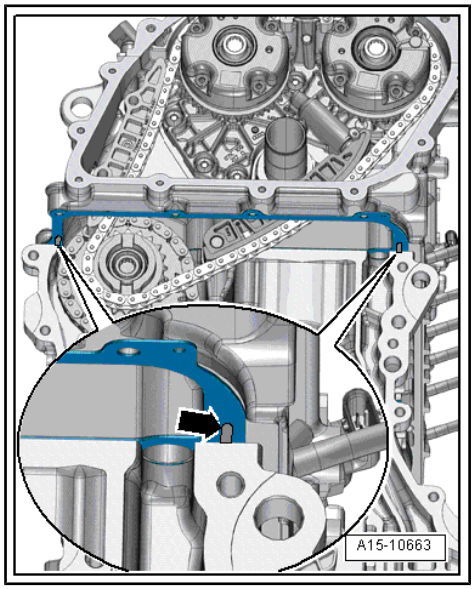
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 2 mm).



– Apply a small amount of sealant to sealing surface of cylinder head gasket (top and bottom). To do so, you again have to bend cylinder head gasket down very slightly -arrows-.
– Use a flat object (e.g. a feeler gauge) to apply sealant to the area between cylinder head and gasket.



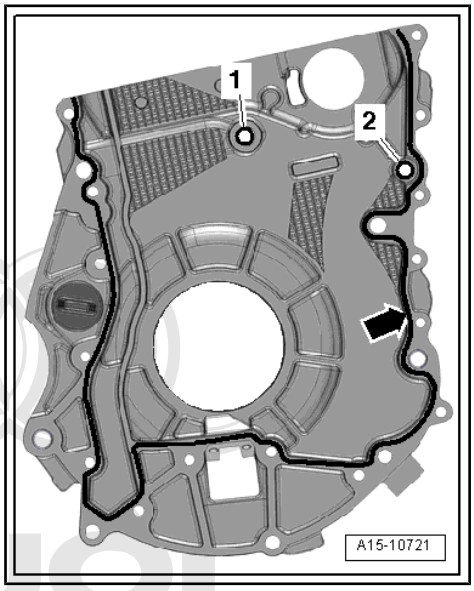
– Clean holes -arrow- in cylinder head gasket and fill them with sealant.



Caution

Make sure lubrication system is not clogged by excess sealant.

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



– Apply sealant bead -arrow- onto the clean sealing surface of the timing chain cover (bottom) as illustrated.

- Thickness of sealant bead: 1.5 ... 2.0 mm

Note

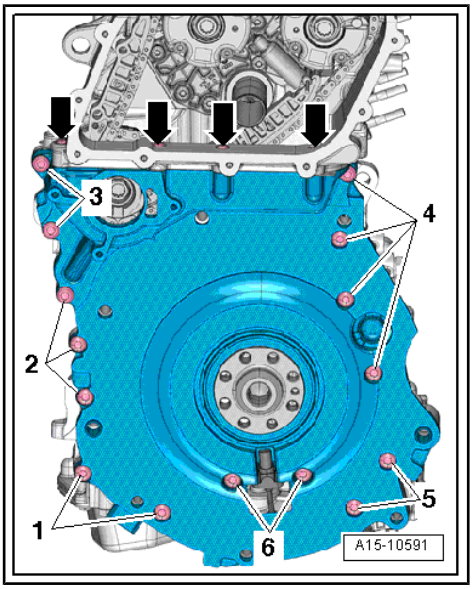
The timing chain cover (bottom) must be installed within 5 minutes after applying the sealant.

– Fit dowel sleeve -1- and O-ring -2-.
– Fit timing chain cover (bottom), guiding it towards the sealing surface on cylinder block and cylinder head at an angle and from below.
– Take care not to damage the cylinder head gasket when fitting the cover.

– Initially screw in bolts for timing chain cover (bottom) by hand until they make contact.
– Drive in dowel sleeves from timing chain cover (bottom) into cylinder block in each case until they make contact.
– Tighten bolts for timing chain cover (bottom) ⇒ page 80 .

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

– Install engine speed sender -G28- ⇒ Rep. gr. 28 .
– Install vacuum pump for brake servo ⇒ Rep. gr. 47 .
– Install timing chain cover (top) ⇒ page 80 .
– Install crankshaft oil seal (gearbox end) ⇒ page 68 .
– Install dual-mass flywheel ⇒ page 67 .



1.5 Camshaft timing chain - exploded view

1 - Chain sprocket for camshaft timing chain

2 - Guide rail

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

4 - Camshaft adjuster for inlet camshaft
- ❑ Identification: „IN“
- ❑ Removing and installing ⇒ „1.6 Removing and installing camshaft timing chain“, page 90

5 - Bolt
- ❑ 9 Nm

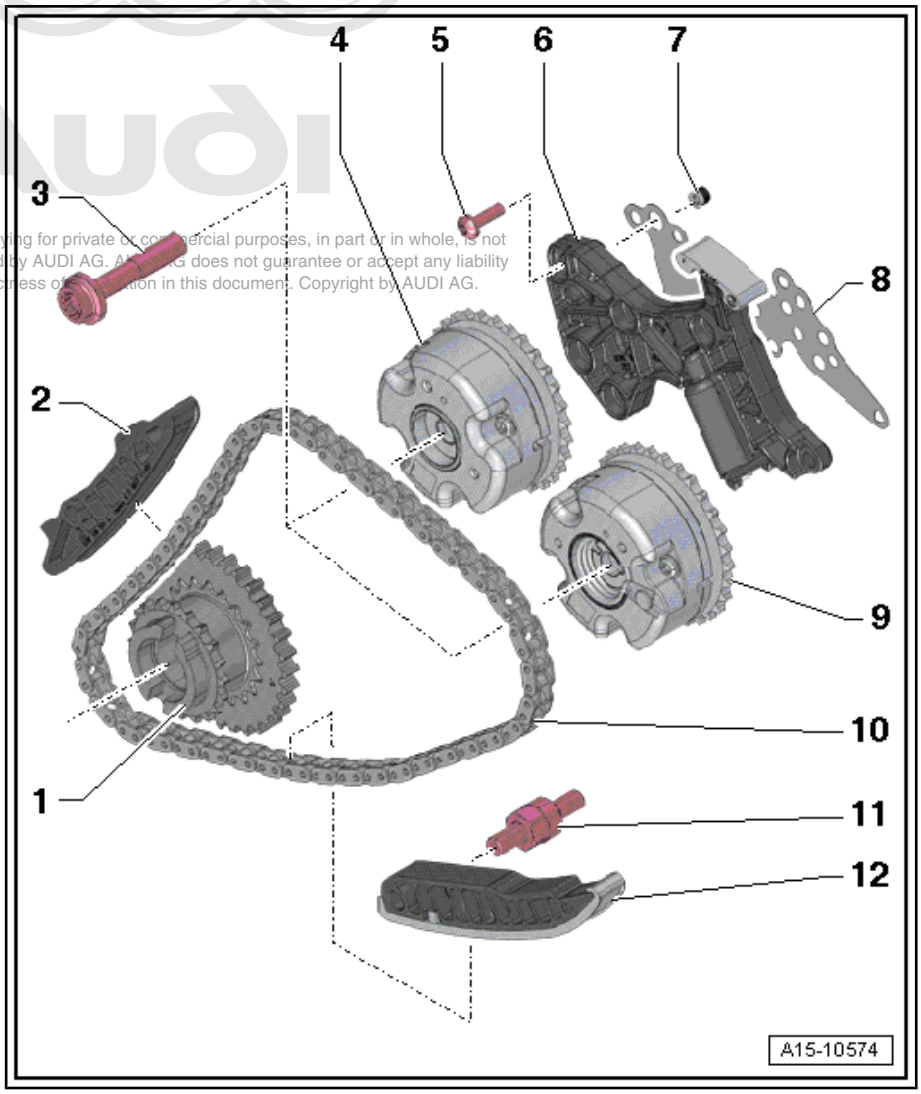
6 - Chain tensioner for camshaft timing chain

7 - Oil strainer
- ❑ Inserted into cylinder head

8 - Gasket
- ❑ Renew

9 - Camshaft adjuster for exhaust camshaft
- ❑ Identification: „EX“
- ❑ Removing and installing ⇒ „1.6 Removing and installing camshaft timing chain“, page 90

10 - Camshaft timing chain
- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 90



11 - Bearing mounting

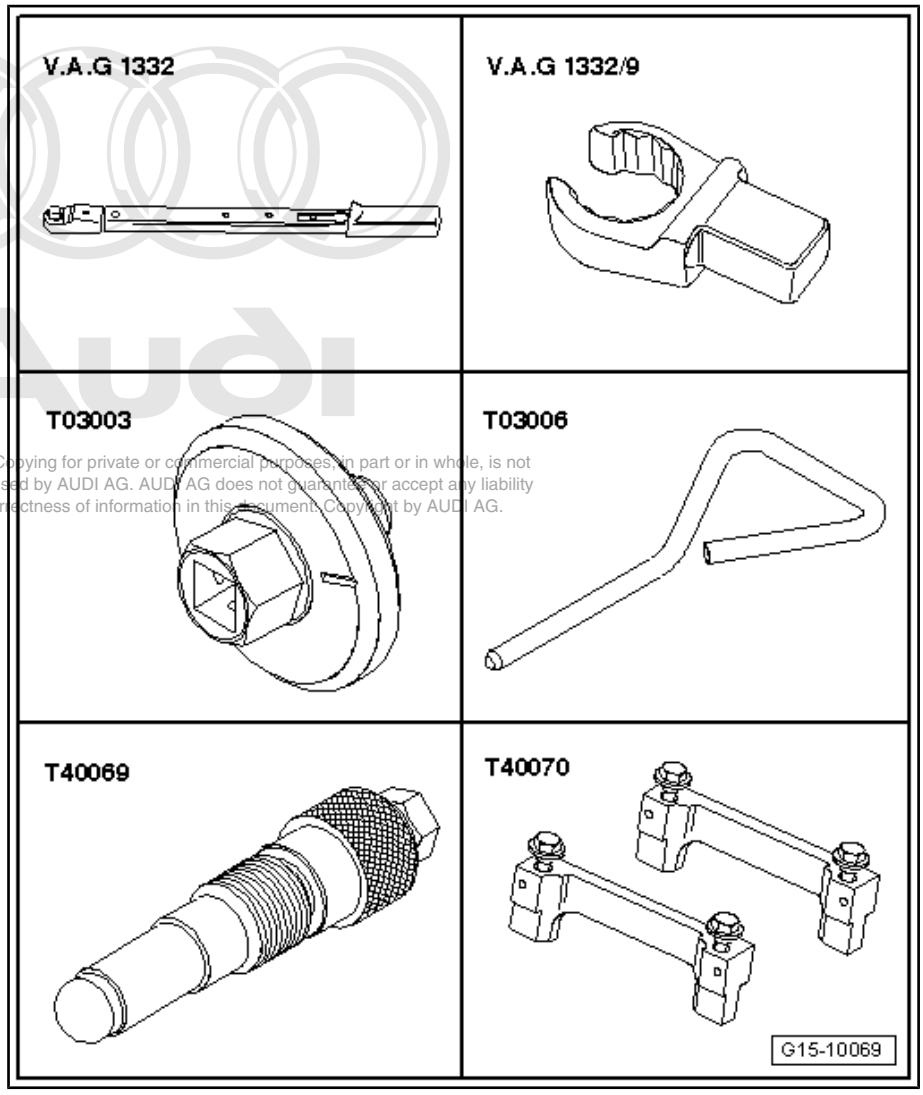
- ❑ 40 Nm

12 - Tensioning rail

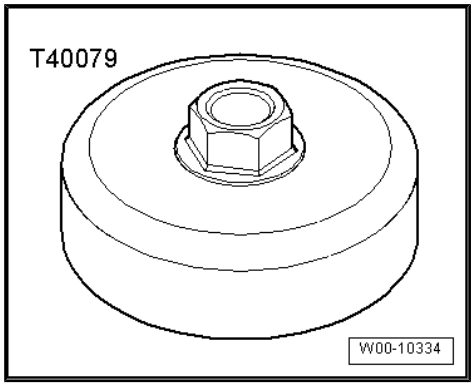
1.6 Removing and installing camshaft timing chain

Special tools and workshop equipment required

- ♦ Torque wrench -V.A.G 1332-
- ♦ Open ring spanner insert -V.A.G 1332/9-
- ♦ Socket -T03003-
- ♦ Locking pin -T03006-
- ♦ Locking pin -T40069-
- ♦ Camshaft clamp -T40070-



- ♦ Key -T40079-



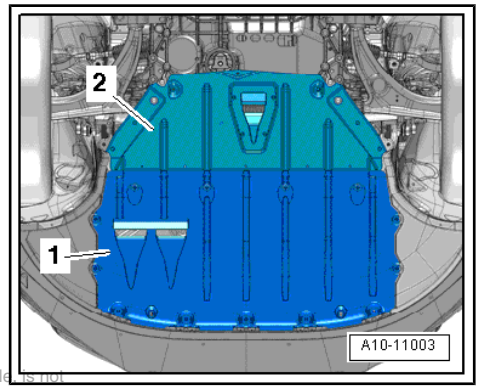
Removing

– Remove noise insulation panel -1- and -2- ⇒ Rep. gr. 66 .

– Remove vacuum pump for brake servo ⇒ Rep. gr. 47 .

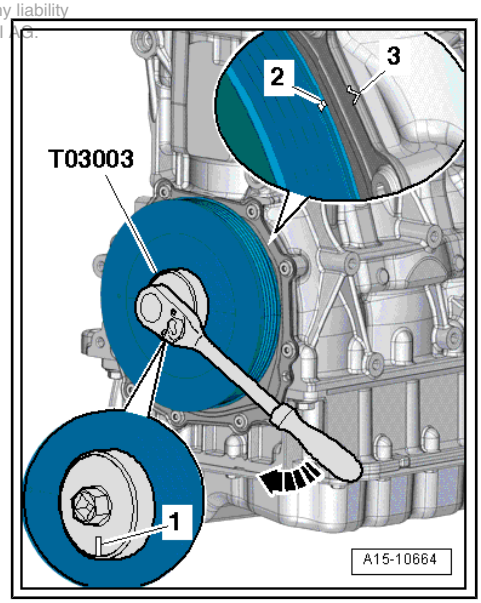
– Remove cylinder head cover ⇒ page 103 .

– Remove timing chain cover (top) ⇒ page 80 .

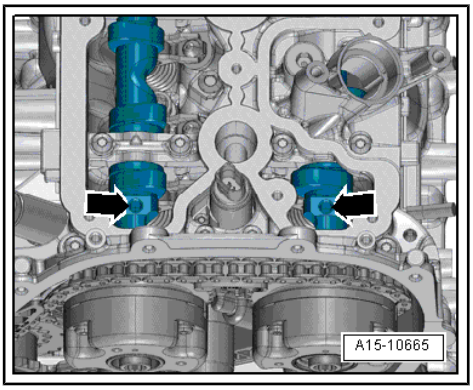


– Turn crankshaft with socket -T03003- in normal direction of rotation -arrow- to „TDC position“.

- Notch -1- in socket -T03003- must be perpendicular to sealing surface of sump.
- Marking -2- on vibration damper must be opposite marking -3- on sealing flange.



- The threaded holes -arrows- in the camshafts must face upwards.

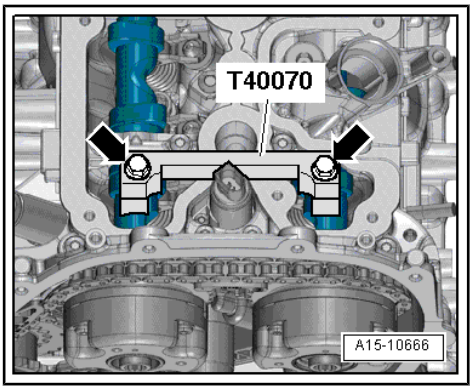


Note

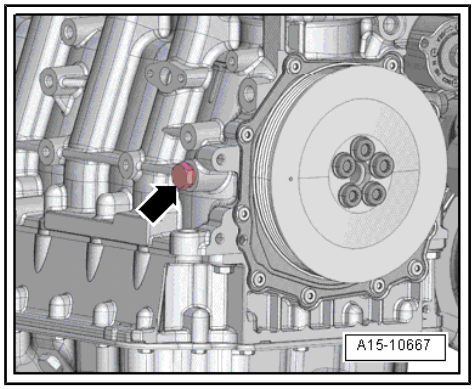
Turn crankshaft by 360° if the threaded holes do not point upwards.

– Fit camshaft clamp -T40070- onto cylinder head and tighten bolts -arrows- to 25 Nm.

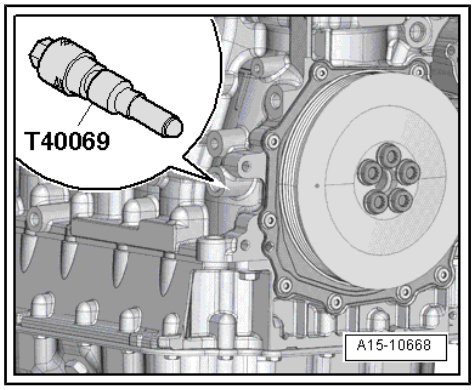
- The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.



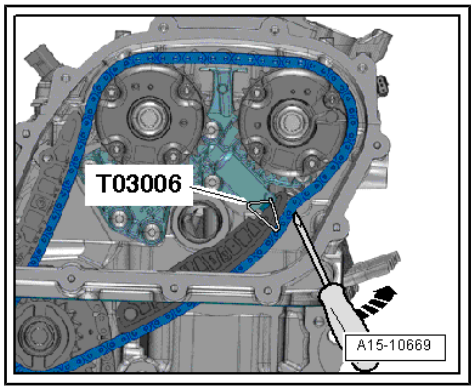
– Unscrew plug -arrow- for „TDC“ marking from cylinder block.



– Screw locking pin -T40069- into locating groove and tighten to 15 Nm. If necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



– Press guide rail of chain tensioner for camshaft timing chain inwards as far as the stop using a screwdriver. Then lock chain tensioner by inserting locking pin -T03006- .



Caution

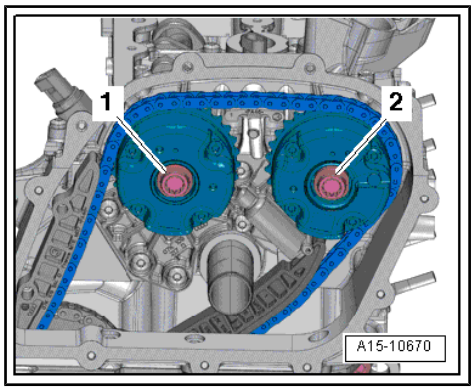
If a used timing chain rotates in the opposite direction when it is refitted, this can cause breakage.

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

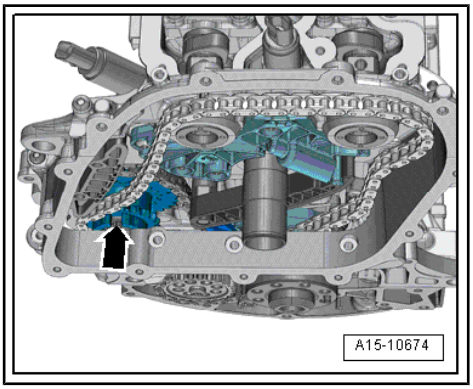
Risk of irreparable damage to engine.

- *Block off the opening in the valve timing housing with a clean cloth to prevent small items from dropping into the engine.*

– Unscrew bolts -1- and -2- and detach both camshaft adjusters.



– Detach camshaft timing chain from drive sprocket -arrow- for camshaft timing chain.



Installing

- Tightening torques
  ⇒ „1.5 Camshaft timing chain - exploded view“, page 89

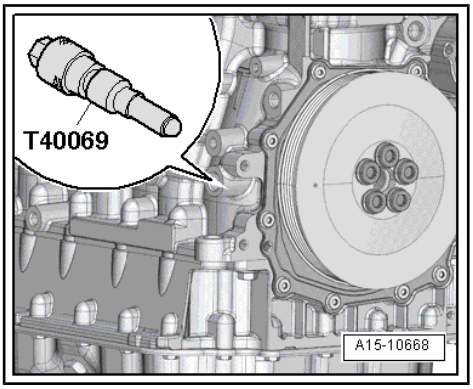
Note

Renew the bolts tightened with specified tightening angle.

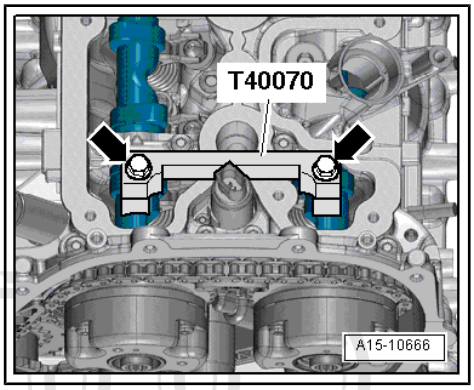
Caution

Avoid damage to valves and piston crowns.

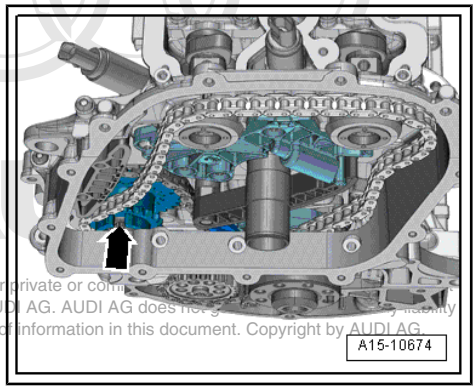
- ***The crankshaft must not be at „TDC“ at any cylinder when the camshafts are turned.***



- Drive chain for valve gear installed ⇒ page 97
- Crankshaft locked in position with locking pin -T40069- .
- Camshaft clamp -T40070- installed and tightened to 25 Nm -arrows-.



– Fit camshaft timing chain onto drive sprocket -arrow- for camshaft timing chain.

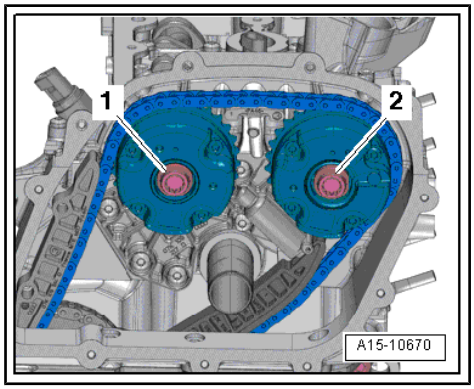


– Install camshaft adjusters according to marks applied when removing ⇒ Item 4 (page 89) and ⇒ Item 9 (page 89) .

– Attach camshaft adjusters with camshaft timing chain fitted, fit bolts -1- and -2- without tightening.

• It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.

– Remove locking pin -T03006- .



Note

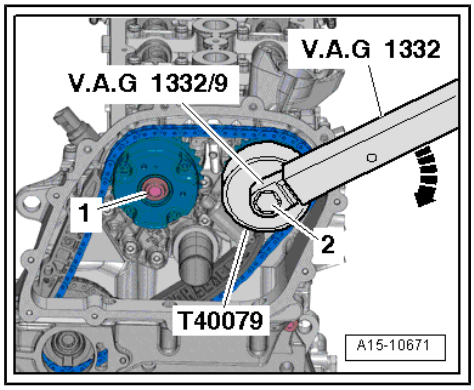
A second mechanic is required for the following work steps.

– Fit key -T40079- onto camshaft adjuster of exhaust camshaft.

– Apply torque wrench -V.A.G 1332- with open ring spanner insert -V.A.G 1332/9- to key -T40079- .

– Have a 2nd mechanic apply a torque of 25 Nm to camshaft adjuster in clockwise direction -arrow-.

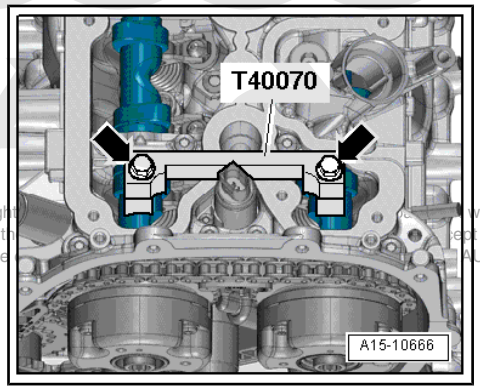
– Tighten bolts as follows while keeping camshaft adjuster under tension:



Stage	Bolt	Tightening torque
1.	-1-	on inlet camshaft 60 Nm
1.	-2-	on exhaust camshaft 60 Nm

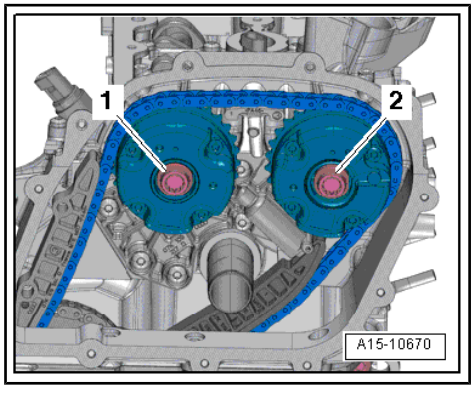
– Remove key -T40079- .

– Remove camshaft clamp -T40070- -arrows-.

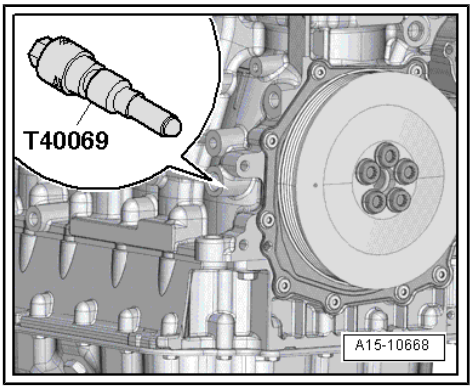


– Tighten bolts for camshaft adjusters in the following sequence:

Stage	Bolt	Angle to turn bolts
2.	-1-	90°
2.	-2-	90°



– Remove locking pin -T40069- .

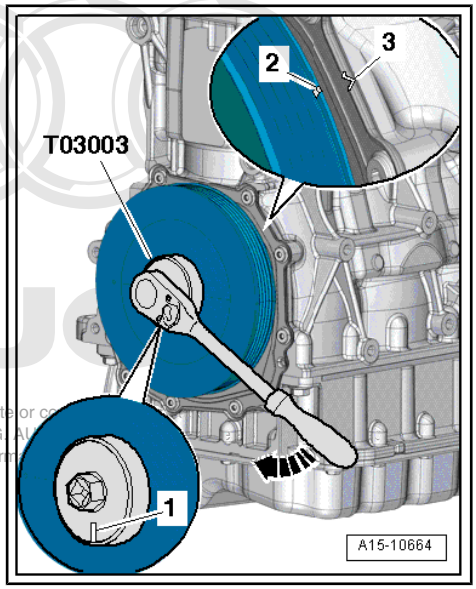


– Using socket -T03003- , turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is at „TDC“ again.

- Notch -1- in socket -T03003- must be perpendicular to sealing surface of sump.
- Marking -2- on vibration damper must be opposite marking -3- on sealing flange.

Note

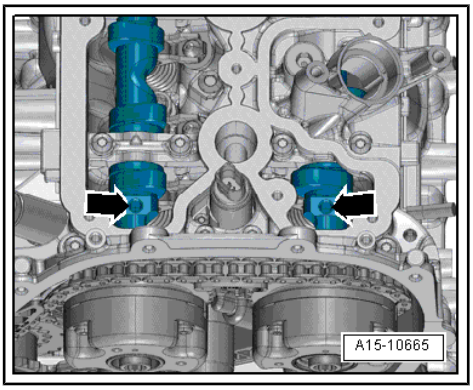
If you turn the crankshaft beyond „TDC“ by mistake, turn it back approx. 30° and set to „TDC“ again.



- The threaded holes -arrows- in the camshafts must face upwards.

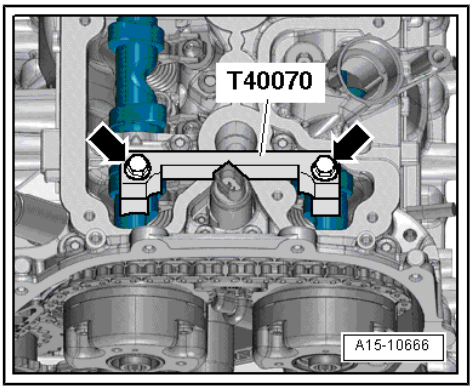
Note

Turn crankshaft by 360° if the threaded holes do not point upwards.



– Fit camshaft clamp -T40070- and tighten bolts -arrows- to 25 Nm.

- The camshaft clamp -T40070- is positioned correctly if the holes for the cylinder head bolts remain free.

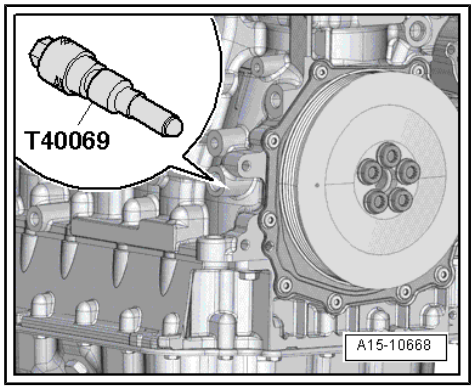


– Screw locking pin -T40069- into locating groove and tighten to 15 Nm.

• The locking pin -T40069- must engage in the groove in the crankshaft. If it does not, reset valve timing.

– Remove camshaft clamp.

– Remove locking pin.



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

– Tighten plug for „TDC“ marking ⇒ page 72 .

– Install timing chain cover (top) ⇒ page 80 .

– Install cylinder head cover ⇒ page 103 .

– Install vacuum pump for brake servo ⇒ Rep. gr. 47 .

– Install noise insulation panels ⇒ Rep. gr. 66 .

1.7 Drive chain for valve gear - exploded view

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

2 - Drive chain sprocket for oil pump

3 - Guide rail

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

5 - Drive chain for valve gear
- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 97

6 - Chain sprocket for camshaft timing chain
- ❑ To remove, unscrew bolts -item 4- and -item 9- and detach chain sprocket together with bearing journal -item 7-

7 - Bearing journal for chain sprocket

8 - Thrust washer

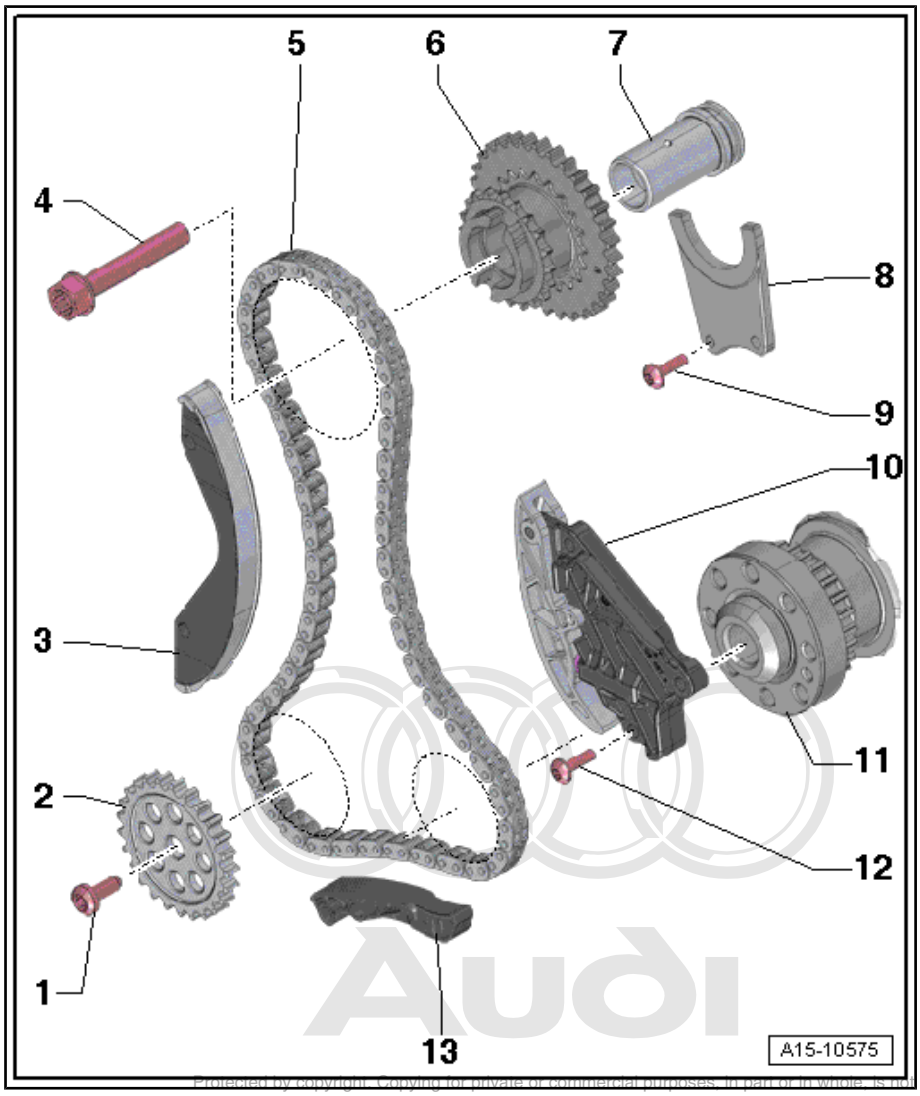
9 - Bolt
- ❑ 9 Nm

10 - Chain tensioner

11 - Crankshaft

12 - Bolt
- ❑ 9 Nm

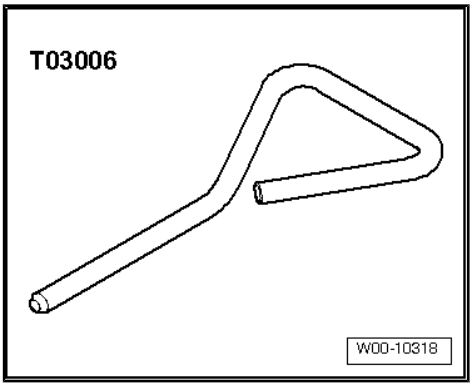
13 - Guide rail



1.8 Removing and installing drive chain for valve gear

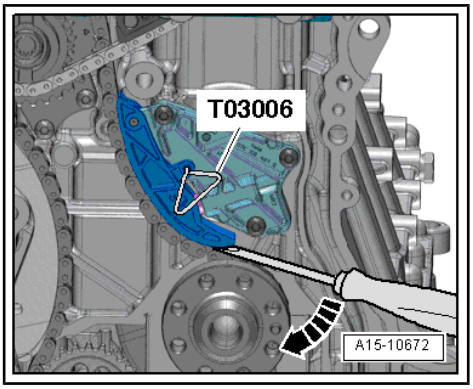
Special tools and workshop equipment required

- Locking pin -T03006-



Removing

- Gearbox removed ⇒ Rep. gr. 34 .
- – Remove camshaft timing chain ⇒ page 90 .
- – Remove timing chain cover (bottom) ⇒ page 84 .
- – Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting locking pin -T03006- .

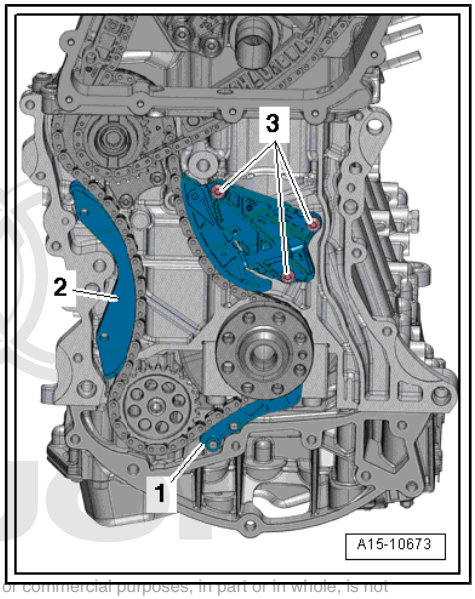


Caution

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.*

- – Remove bolts -3- and take off chain tensioner.
- – Detach guide rails -1- and -2-.
- – Detach drive chain for valve gear.



Installing

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

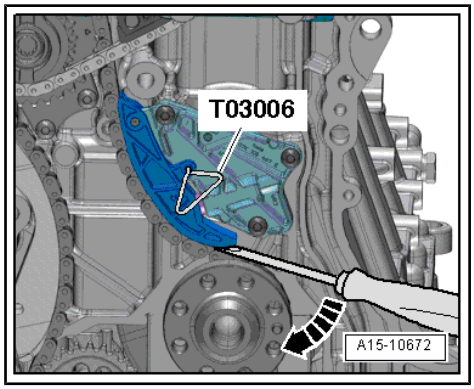
- Tightening torques
  ⇒ „1.7 Drive chain for valve gear - exploded view“, page 96

Note

Renew the bolts tightened with specified tightening angle.

- – Position drive chain for valve gear onto drive chain sprockets (according to marks applied when removing).
- – Install guide rails -1- and -2-.
- – Install chain tensioner and tighten bolts -3-.

– Press guide rail of chain tensioner for drive chain in direction of -arrow- and remove locking pin -T03006- .
– Install timing chain cover (bottom) ⇒ page 84 .
– Install camshaft timing chain ⇒ page 90 .

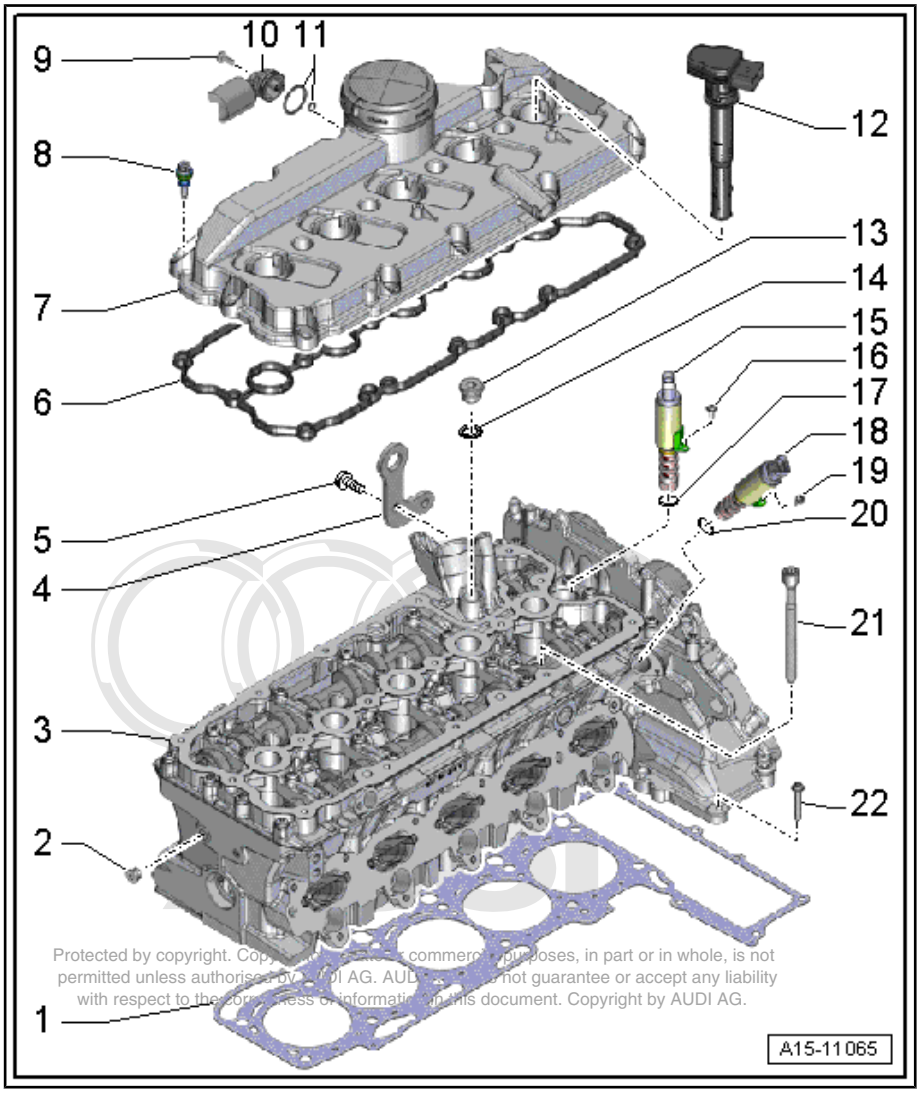


2 Cylinder head

Overview

- ⇒ „2.1 Cylinder head cover and cylinder head - exploded view“, page 99
- ⇒ „2.2 Removing and installing camshaft control valves N205 / N318 “, page 102
- ⇒ „2.3 Removing and installing cylinder head cover“, page 103
- ⇒ „2.4 Removing and installing cylinder head“, page 104
- ⇒ „2.5 Checking compression“, page 112

2.1 Cylinder head cover and cylinder head - exploded view



1 - Cylinder head gasket

- ❑ Renewing ⇒ „2.4 Removing and installing cylinder head“, page 104
- ❑ Note installation position: part number must face cylinder head
- ❑ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

2 - Screw plug

- ❑ Renew
- ❑ 15 Nm

3 - Cylinder head

- ❑ Removing and installing ⇒ page 104
- ❑ Should be positioned on dowel pins
- ❑ Checking for distortion ⇒ page 101
- ❑ Cylinder head machining limit ⇒ page 101
- ❑ If renewed, change coolant and engine oil

4 - Engine lifting eye

5 - Bolt

- ❑ 22 Nm

6 - Gasket

- ❑ For cylinder head cover
- ❑ Renew if damaged or leaking

7 - Cylinder head cover

8 - Bolt

- ❑ Renew if seal is damaged
- ❑ Tightening sequence ⇒ page 100

9 - Bolt

- ❑ 3.2 Nm

10 - Housing
- ❑ For crankcase breather

11 - Seals
- ❑ Renew

12 - Ignition coil
- ❑ Removing and installing ⇒ Rep. gr. 28

13 - Screw plug
- ❑ 35 Nm

14 - Seal
- ❑ Renew

15 - Camshaft control valve 1 -N205-
- ❑ Removing and installing ⇒ page 102

16 - Bolt
- ❑ 2.4 Nm

17 - O-ring
- ❑ Renew

18 - Exhaust camshaft control valve 1 -N318-
- ❑ Removing and installing ⇒ page 102

19 - Bolt
- ❑ 2.4 Nm

20 - O-ring
- ❑ Renew

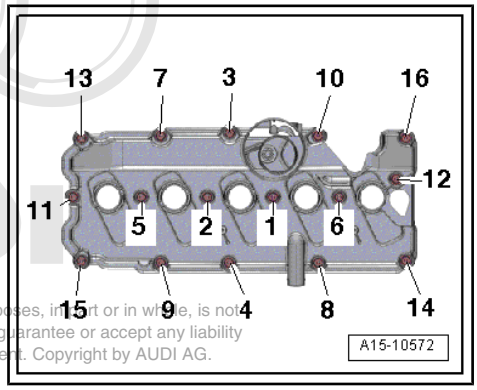
21 - Bolt
- ❑ Renew
- ❑ Note correct sequence when loosening ⇒ page 109
- ❑ Tightening torque and sequence ⇒ page 101

22 - Bolt
- ❑ Renew
- ❑ Note correct sequence when loosening ⇒ page 109
- ❑ Tightening torque and sequence ⇒ page 101

Cylinder head cover - tightening torque and sequence

– Tighten bolts in 2 stages in the sequence shown:

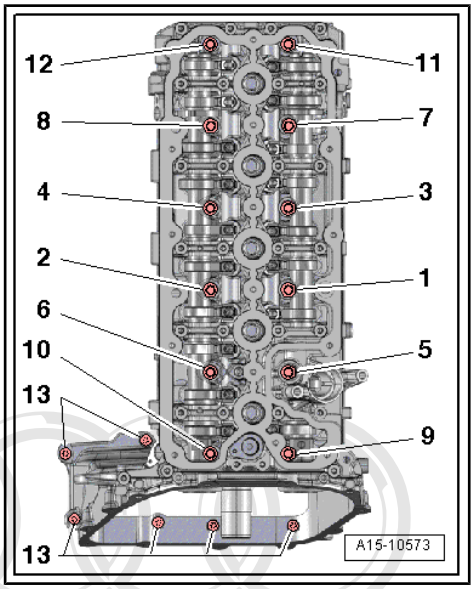
Stage	Bolt	Tightening torque
1.	-1 … 16-	Screw in bolts by hand until they make contact
2.	-1 … 16-	10 Nm



Cylinder head - tightening torque and sequence

– Tighten bolts in 6 stages in the sequence shown:

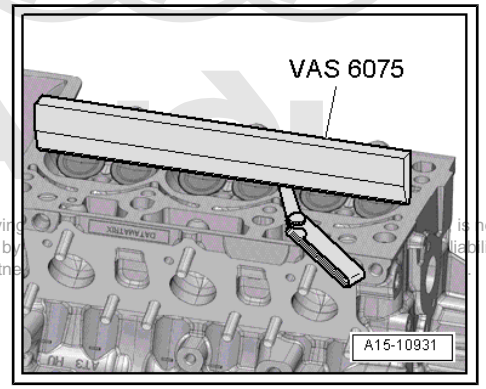
Stage	Bolts	Tightening torque/tightening angle
1.	-1 … 12-	10 Nm
2.	-1 … 12-	40 Nm
3.	-1 … 12-	turn 90° further
4.	-1 … 12-	turn 90° further
5.	-13-	8 Nm
6.	-13-	turn 90° further



Checking cylinder head for distortion

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

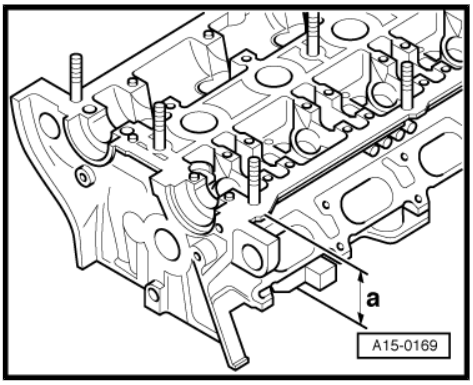
• Max. permissible distortion: 0.05 mm.



Cylinder head machining limit

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

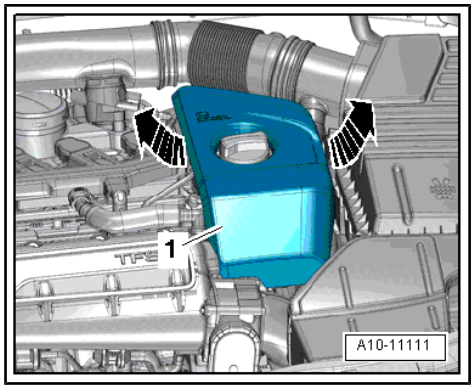
• Minimum dimension: -a- = 139.20 mm



2.2 Removing and installing camshaft control valves -N205- / -N318-

Removing

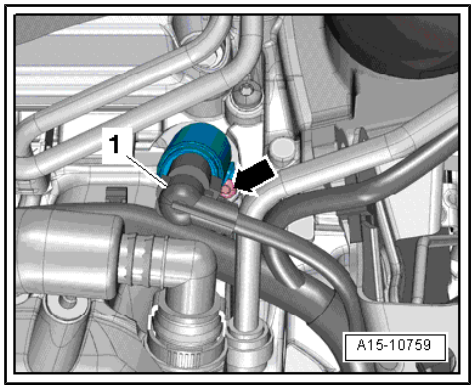
– Lift off engine cover panel -1- -arrows-.



Camshaft control valve 1 -N205- :

– Unplug electrical connector -1-.

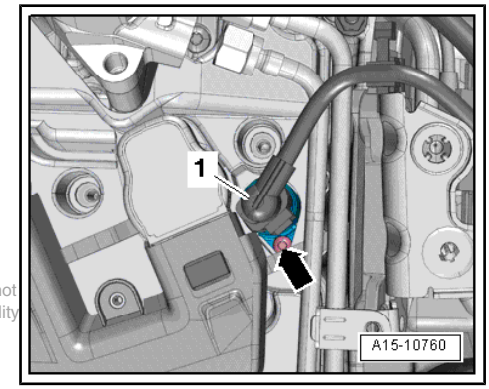
– Unscrew bolt -arrow- and remove camshaft control valve 1 -N205- .



Exhaust camshaft control valve 1 -N318- :

– Unplug electrical connector -1-.

– Remove bolt -arrow- and remove exhaust camshaft control valve 1 -N318- .



Installing

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

- Tightening torques
⇒ „2.1 Cylinder head cover and cylinder head - exploded view", page 99

Note

- *Fit new O-ring.*
- *Clean camshaft control valve and mounting in cylinder head from any kind of dirt.*

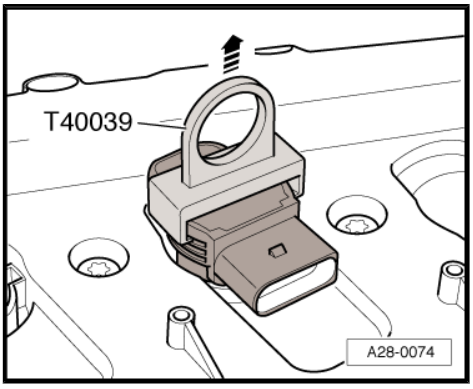
– Lubricate O-ring with engine oil.

2.3 Removing and installing cylinder head cover

Removing

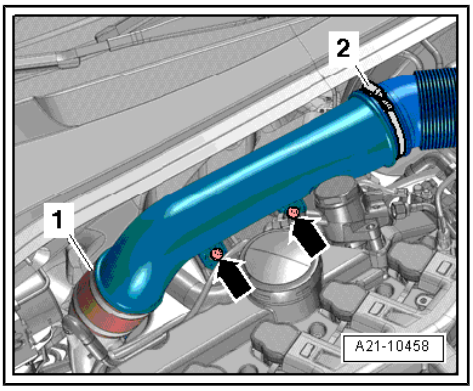
– Remove exhaust camshaft control valve 1 -N318- ⇒ page 102 .

– Remove ignition coils ⇒ Rep. gr. 28 .



– Remove bolts -arrows-.

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

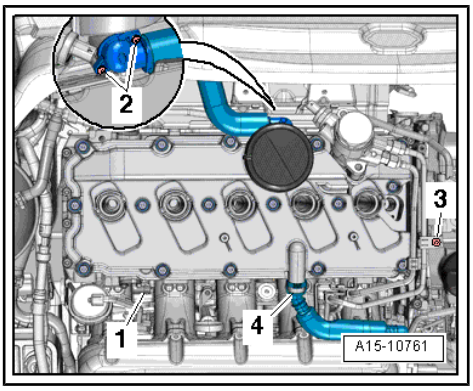


– Unplug electrical connector -1- and move electrical wiring harness clear.

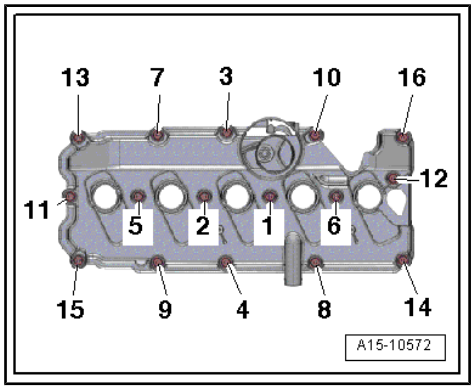
– Remove bolts -2- and detach crankcase breather hose.

– Detach crankshaft breather hose -4- on opposite side (press release tabs).

– Remove bolt -3-, detach retaining clip for fuel line.



– Slacken cylinder head cover bolts in the sequence -16 ... 1-.
– Remove bolts and take off cylinder head cover.



Installing

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

Note

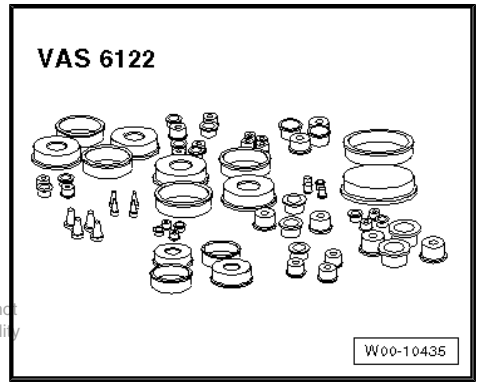
- *Renew gasket for cylinder head cover if damaged.*
- *Renew bolts for cylinder head cover if seals on bolts are damaged.*
- *Fit new O-rings.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Tighten cylinder head cover bolts ⇒ page 100 .
– Install air pipe ⇒ page 216 .
– Install ignition coils ⇒ Rep. gr. 28 .
– Install exhaust camshaft control valve 1 -N318- ⇒ page 102 .

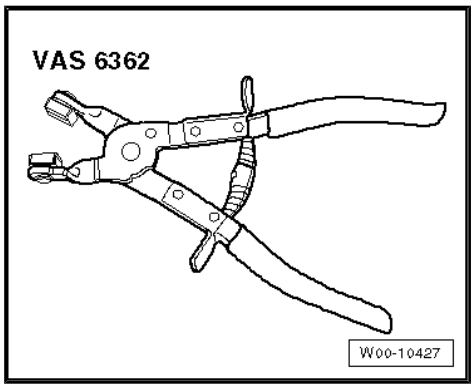
2.4 Removing and installing cylinder head

Special tools and workshop equipment required

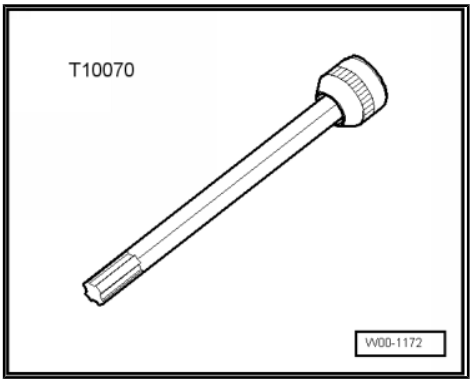
- Engine bung set -VAS 6122-



- Hose clip pliers -VAS 6362-



♦ Special wrench -T10070- or commercially available socket XZN M12 (at least 140 mm)



Removing

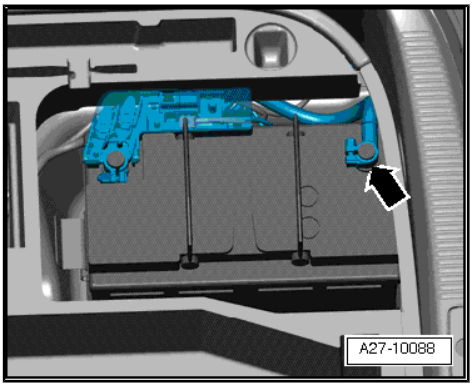
Note

Fit all cable ties in the original positions when installing.

Caution

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

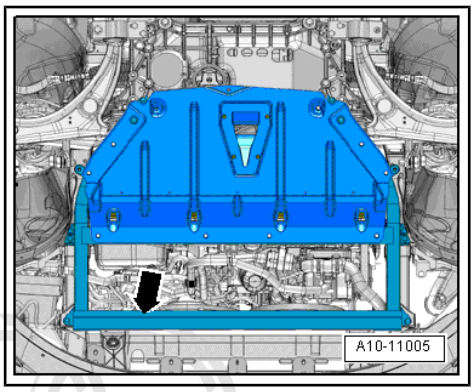
- ***Observe notes on procedure for disconnecting the battery.***



– With ignition switched off, disconnect earth cable -arrow- at battery ⇒ Electrical system; Rep. gr. 27 .

– Drain coolant ⇒ page 164 .

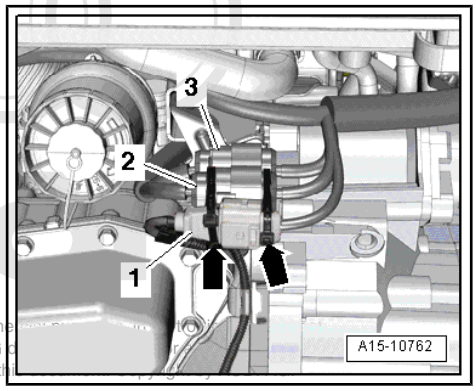
– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. gr. 50 .



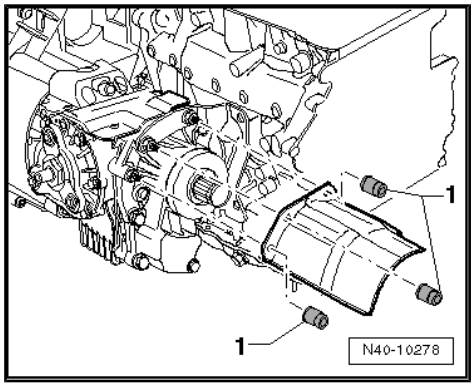
– Move clear electrical connector -1- (cut open cable ties -arrows-.

– Detach electrical connectors -2- and -3- from bracket and unplug connectors.

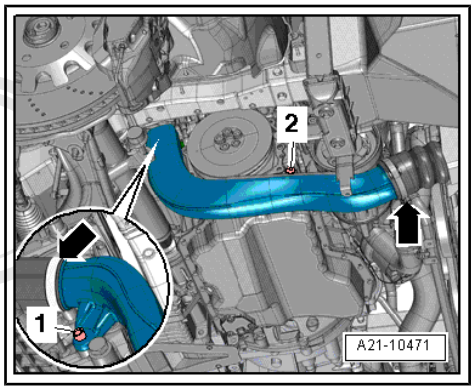
– Move clear electrical wiring harness.



– Remove nuts -1- and detach heat shield for drive shaft (right-side).



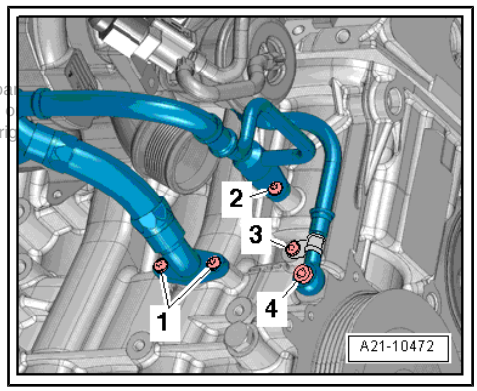
– Remove bolts -1- and -2-.
– Release hose clips -arrows- and remove air pipe.



Note

Place a cloth underneath to catch escaping coolant and engine oil.

– Unscrew bolts -1, 2, 3- and banjo bolt -4- and detach pipes from cylinder block.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .

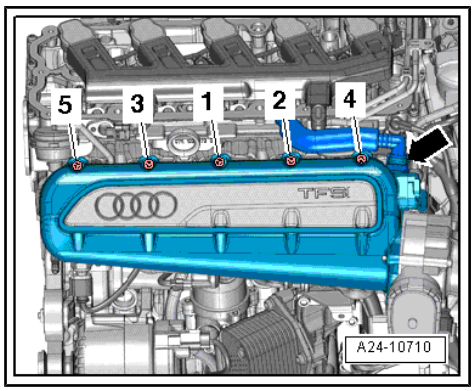


– Remove intake manifold (top section) ⇒ Rep. gr. 24 .

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.*

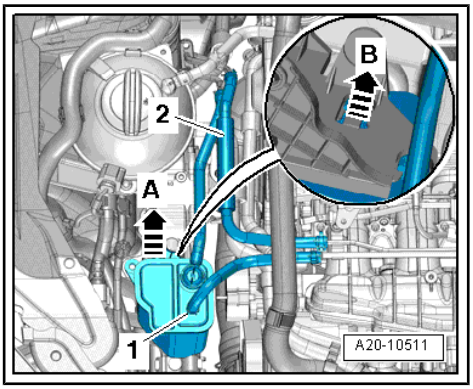


Caution

Risk of damage caused by particles of dirt.

- *Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .*

– Disengage fuel supply line from retainer and remove heat insulation sleeve -2- at fuel supply line connection.
– Disconnect fuel supply pipe (pull release ring).
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .
– Disconnect hose -1- from activated charcoal filter.



Note

Disregard -arrows A and B-.

– Remove bolt -4- and move earth wire clear.
– Unplug electrical connectors:

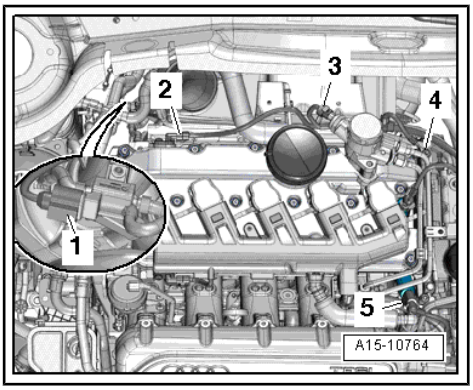
1 - Charge pressure control solenoid valve -N75-

2 - Hall sender 3 -G300-

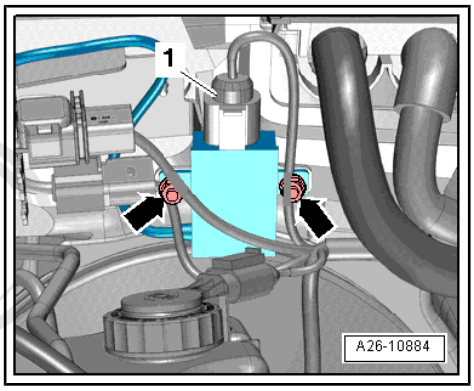
3 - Fuel metering valve -N290-

5 - Camshaft control valve 1 -N205-

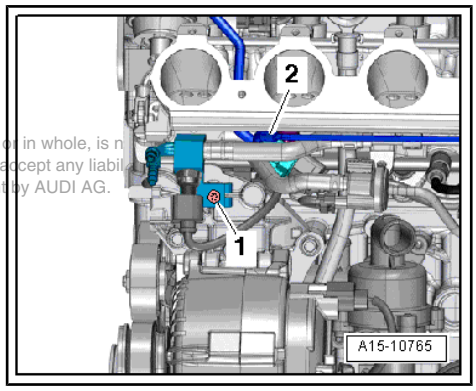
– Move clear electrical wiring harness.



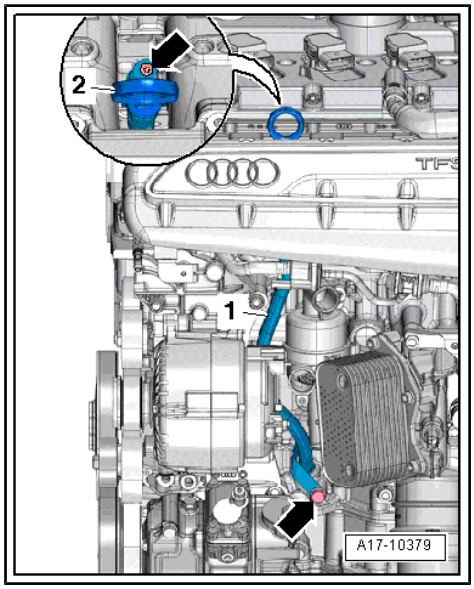
– Unplug electrical connector -1-.
– Remove bolts -arrows- and place exhaust gas temperature sender 1 -G235- onto cylinder head.



– Remove bolt -1-.
– Detach vacuum hose -2- and move clear.



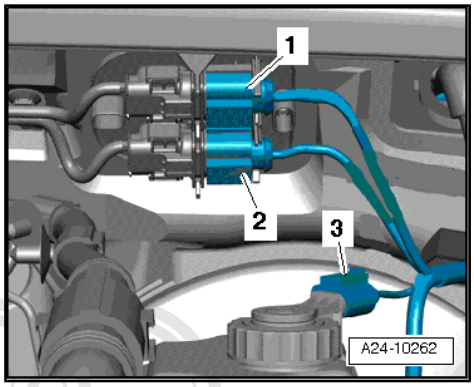
– Pull out oil dipstick -2-.
– Remove bolts -arrows- and lift off guide tube -1- for oil dipstick.
– Remove camshaft timing chain ⇒ page 90 .



– Remove electrical connector -1- for Lambda probe -G39- from bracket and unplug connector.
– Move clear electrical wiring to Lambda probe.

Note

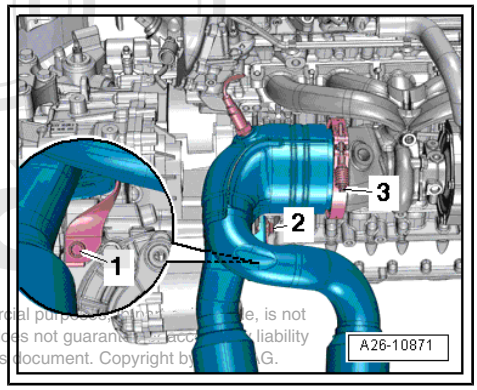
Disregard -items 2, 3-.



– Loosen bolt -3- and push clamp onto starter catalytic converter.
– Remove bolt -2-, tie up starter catalytic converter to rear.

Note

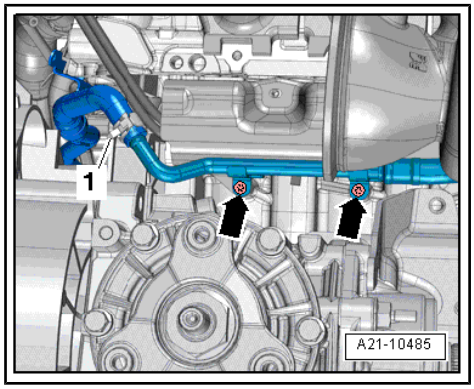
Disregard -item 1-.



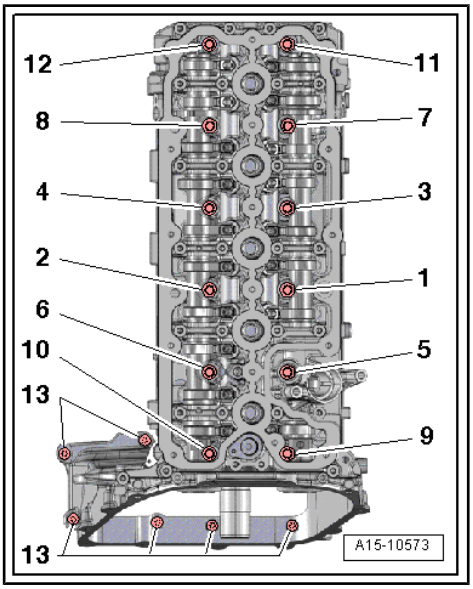
– Remove bolts -arrows-.

Note

Disregard -item 1-.



– Slacken cylinder head bolts in the sequence -13 ... 1- and remove.



Note

- *If bolt -12- cannot be removed with a magnet, loosen bolts of camshaft clamp -T40070- one turn, push -T40070- to front right and tighten bolts again.*
- *Two mechanics are needed to remove the cylinder head.*

– Take off cylinder head.

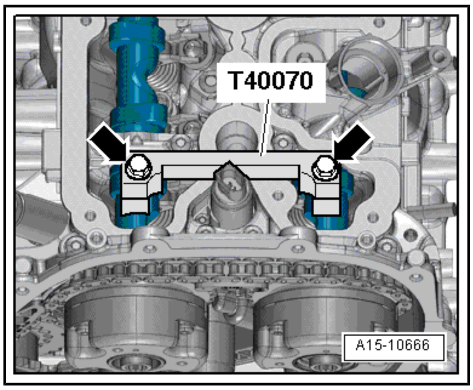
Caution

Risk of irreparable damage to engine.

- *Block off the opening in the valve timing housing with a clean cloth to prevent small items from dropping into the engine.*

Avoid damage to cylinder walls.

- *Cover cylinders with clean cloths to prevent metal particles and emery remains from entering the space between cylinder wall and piston.*



Installing

- Tightening torques ⇒ „2.1 Cylinder head cover and cylinder head - exploded view“, page 99
- Camshafts locked in position with camshaft clamp -T40070- .

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

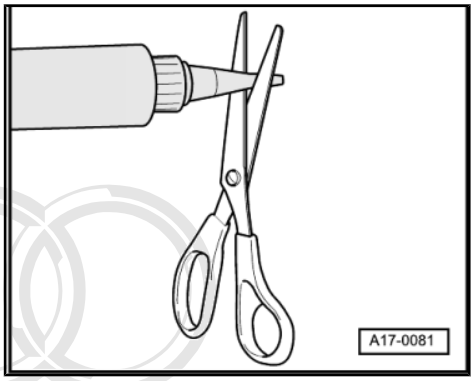
- ♦ *Renew the bolts tightened with specified tightening angle.*
- ♦ *Renew self-locking nuts as well as seals, gaskets and O-rings.*
- ♦ *When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the cylinder head.*
- ♦ *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 coolant.*

– 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. 2.0 mm).



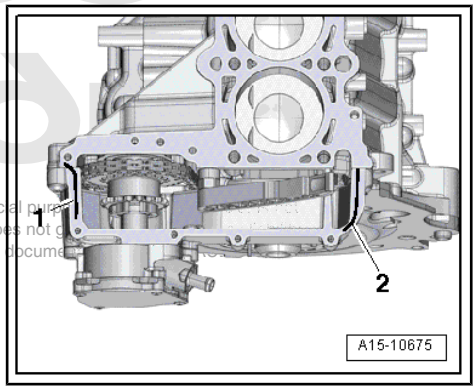
Caution

Make sure lubrication system is not clogged by excess sealant.

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

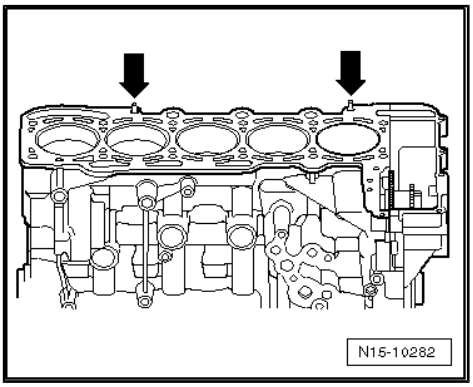
– Apply beads of sealant -1- and -2- onto clean sealing surfaces of cylinder block as shown in illustration.

- Thickness of sealant bead: 2.0 ... 2.5 mm



– Place cylinder head gasket in position.

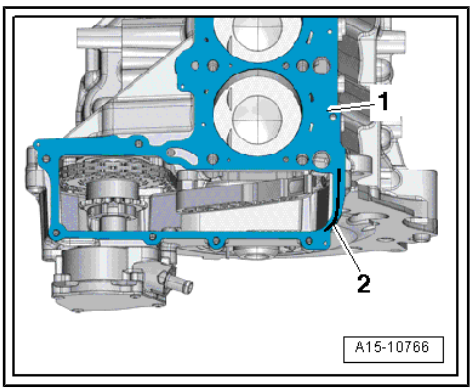
- Installation position: Part No. must be visible.
- Pay attention to dowel sleeves -arrows- in cylinder block.



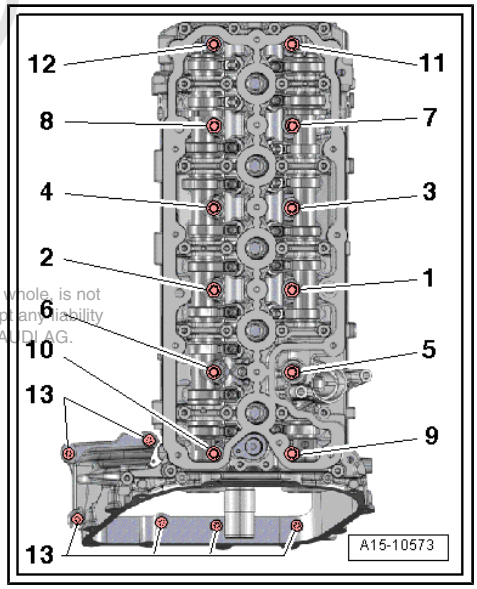
– Apply bead of sealant -2- onto cylinder head gasket -1- as shown in illustration.

Note

The cylinder head must be installed within 5 minutes after applying the sealant.



– Fit cylinder head.
– Tighten cylinder head bolts ⇒ page 101 .



Note

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

– Wipe off surplus sealant.

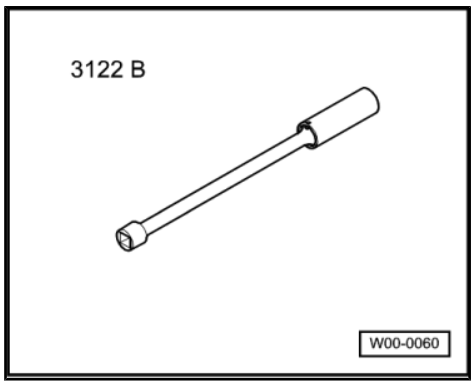
Remaining installation steps are carried out in reverse sequence; note the following:

– Install starter catalytic converter ⇒ page 225 .
– Install camshaft timing chain ⇒ page 90 .
– Secure dipstick guide tube ⇒ page 136 .
– Install exhaust gas temperature sender 1 -G235- ⇒ page 230 .
– Install intake manifold (top section) ⇒ Rep. gr. 24 .
– Install turbocharger ⇒ page 205 .
– Install heat shield for drive shaft ⇒ Rep. gr. 39 .
– Install noise insulation frame ⇒ Rep. gr. 50 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Observe notes on procedure for connecting the battery ⇒ Rep. gr. 27 .
– Change engine oil ⇒ Maintenance ; Booklet 810 .
– Fill cooling system with fresh coolant ⇒ page 164 .

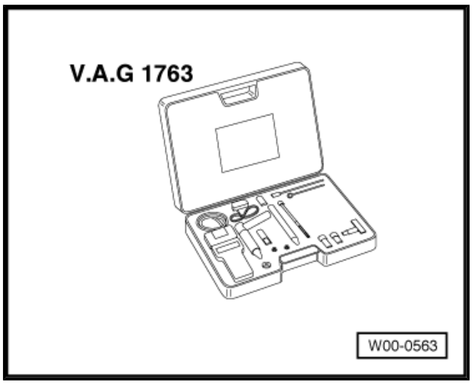
2.5 Checking compression

Special tools and workshop equipment required

♦ Spark plug socket and extension -3122 B-

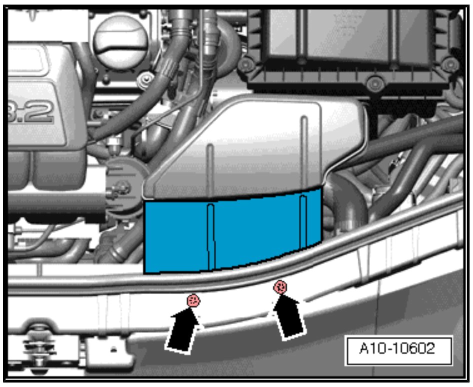


♦ Compression tester -V.A.G 1763-

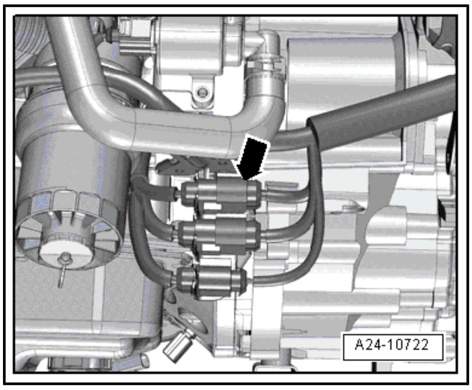


Procedure

- Engine oil temperature min. 30 °C.
- Battery voltage at least 12.5 V.
- Unscrew bolts -arrows- and remove front air duct.



- Unplug electrical connector -arrow- for injectors.
- 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 front air duct ⇒ Rep. gr. 24 .
- Install spark plugs ⇒ Maintenance ; Booklet 810 .
- Install ignition coils ⇒ Rep. gr. 28 .
- Faults are stored in engine control unit because electrical connectors were unplugged and engine was started: „Generate readiness code“ in „Guided Functions“ ⇒ Vehicle diagnostic, testing and information system VAS 5051.

3 Valve gear

Overview

Caution

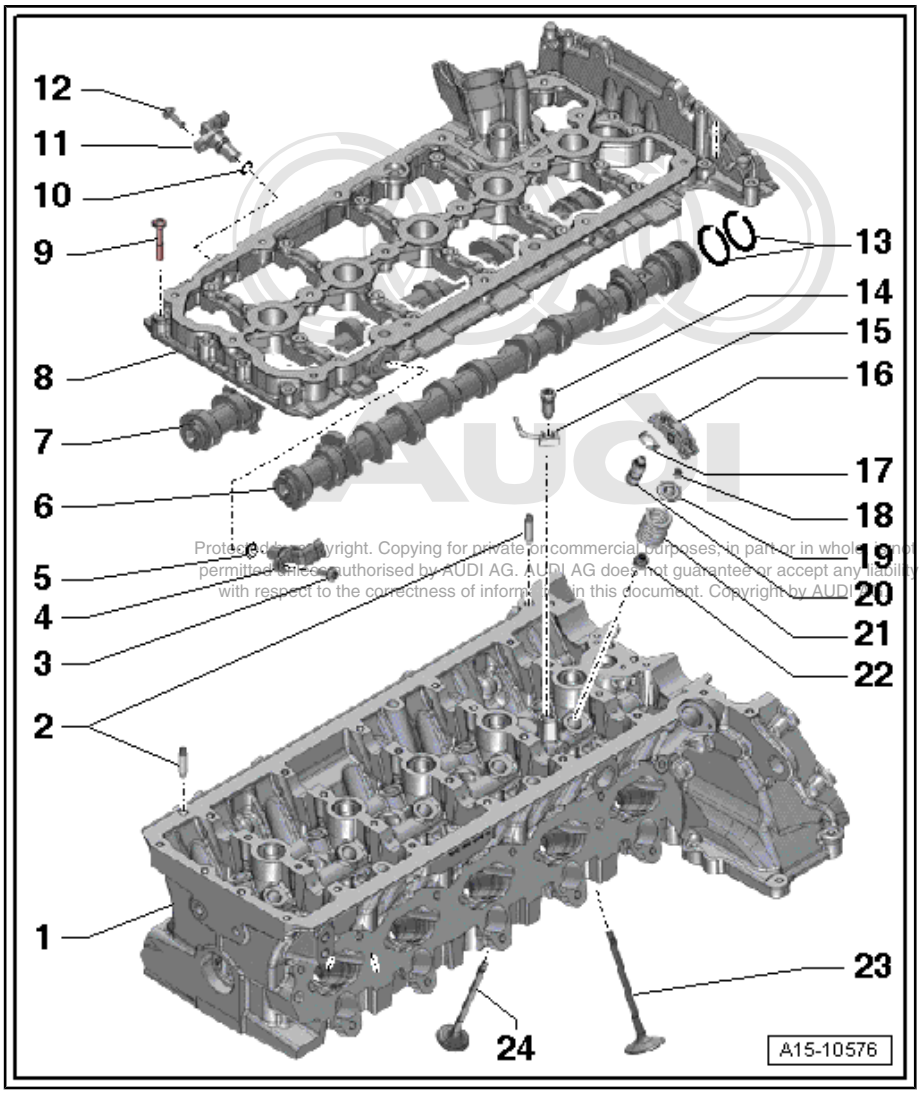
Avoid damage to valves and piston crowns after working on valve gear.

- *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.*

Note

Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.

3.1 Valve gear - exploded view



1 - Cylinder head

- ❑ Checking valve guides ⇒ page 131

2 - Dowel pins

3 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 28

4 - Hall sender 3 -G300-

- ❑ Exhaust side
- ❑ Removing and installing ⇒ Rep. gr. 28

5 - O-ring

- ❑ Renew

6 - Inlet camshaft

- ❑ Removing and installing ⇒ page 118
- ❑ Measuring axial clearance ⇒ page 117
- ❑ Measuring radial clearance ⇒ page 118
- ❑ Runout: max. 0.04 mm

7 - Exhaust camshaft

- ❑ With additional cam for high-pressure pump
- ❑ Removing and installing ⇒ page 118
- ❑ Measuring axial clearance ⇒ page 117
- ❑ Measuring radial clearance ⇒ page 118
- ❑ Runout: max. 0.04 mm

8 - Retaining frame

- ❑ With integrated camshaft bearings

9 - Bolt

- ❑ To avoid damage to retaining frame for camshafts, refer to tightening torque and sequence ⇒ page 117

10 - O-ring

- ❑ Renew

11 - Hall sender -G40-

- ❑ Inlet side
- ❑ Removing and installing ⇒ Rep. gr. 28

12 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 28

13 - Rectangular section seals

14 - Bolt

- ❑ With pressure relief valve
- ❑ 27 Nm

15 - Oil spray jet

16 - Roller rocker finger

- ❑ Mark installation position for re-installation
- ❑ Check roller bearings for ease of movement
- ❑ Lubricate contact surface before installing
- ❑ Assembly: attach to hydraulic compensation element -item 20- using securing clip -item 17-

17 - Securing clip

- ❑ Not supplied separately
- ❑ Check for firm attachment

18 - Valve cotters

19 - Valve spring plate

20 - Hydraulic valve compensation element

- ❑ Clipped into roller rocker finger -item 16-
- ❑ Checking ⇒ page 128
- ❑ Mark installation position for re-installation
- ❑ Lubricate contact surface before installing

21 - Valve spring

- ❑ Installation position ⇒ page 116

22 - Valve stem oil seal

- ❑ Renewing with cylinder head installed ⇒ page 123
- ❑ Renewing with cylinder head removed ⇒ page 126

23 - Inlet valve

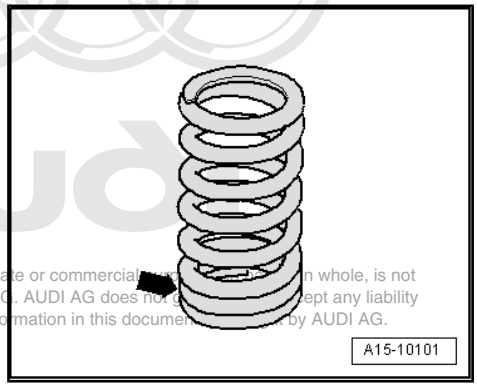
- ❑ Must not be machined; only grinding-in is permissible
- ❑ Mark installation position for re-installation
- ❑ Checking ⇒ page 132
- ❑ Valve dimensions ⇒ page 131
- ❑ Checking valve guides ⇒ page 131

24 - Exhaust valve

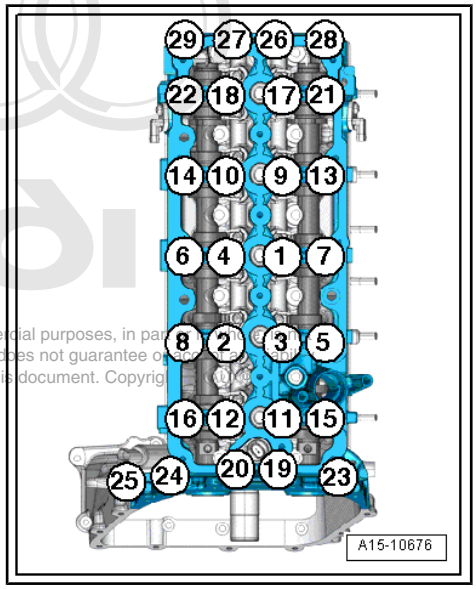
- ❑ Must not be machined; only grinding-in is permissible
- ❑ Mark installation position for re-installation
- ❑ Checking ⇒ page 132
- ❑ Valve dimensions ⇒ page 131
- ❑ Checking valve guides ⇒ page 131

Position of valve spring

- The closely spaced spring coils -arrow- face the cylinder head.



Retaining frame for camshafts - tightening torque and sequence



Note

Renew the bolts tightened with specified tightening angle.

Caution

Risk of damage to retaining frame for camshafts.

- ***It is important to tighten the bolts securing the retaining frame as described below.***

– Tighten bolts in 4 stages in the sequence shown:

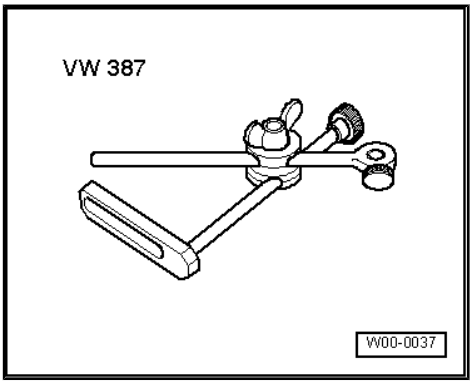
Stage	Bolts	Tightening torque/angle specification
1.	-1 … 29-	Screw in by hand until bolt heads make contact with retaining frame
2.	-1 … 29-	Continue tightening 1 turn at a time in several stages until retaining frame makes full contact with cylinder head and a torque of 8 Nm is reached
3.	-1 … 29-	8 Nm [1]
4.	-1 … 29-	turn 90° further

• [1] Performing this procedure guarantees all bolts are tightened to 8 Nm after retaining frame has settled.

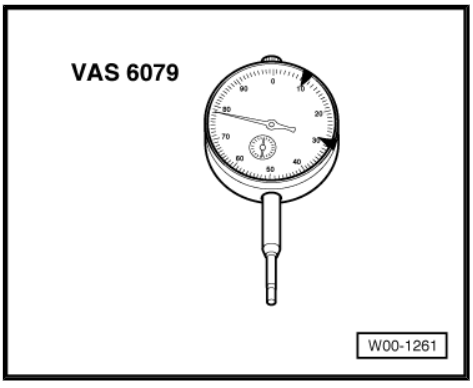
3.2 Measuring axial clearance of camshafts

Special tools and workshop equipment required

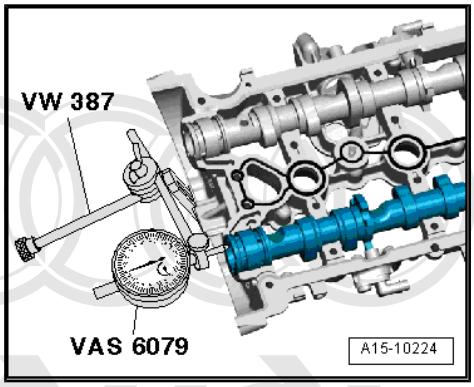
- Universal dial gauge bracket -VW 387-



- Dial gauge -VAS 6079-



Procedure



– Remove retaining frame
⇒ „3.4 Removing and installing camshafts“, page 118 .
– Fit camshaft to be tested in retaining frame.
– Attach dial gauge -VAS 6079- with universal dial gauge bracket -VW 387- to retaining frame.
– Press camshaft against dial gauge by hand.
– Set dial gauge to „0“.
– Press camshaft away from dial gauge and read off value:
• Axial clearance: 0.100 ... 0.191 mm

3.3 Measuring radial clearance of camshafts

Special tools and workshop equipment required

♦ Plastigage

Procedure

– Remove roller rocker fingers
⇒ „3.4 Removing and installing camshafts“, page 118 .
– Clean bearings and bearing journals.
– Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.
• The Plastigage must be positioned in the centre of the bearing.
– Fit retaining frame and tighten to 8 Nm (do not turn further) without rotating camshafts ⇒ page 117 .
– Remove retaining frame again.
– Compare width of Plastigage with measurement scale.

Radial clearance:

• 24 mm bearing diameter: 0.024 ... 0.066 mm.
• 36 mm bearing diameter: 0.050 ... 0.100 mm.

3.4 Removing and installing camshafts

Special tools and workshop equipment required

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

Removing

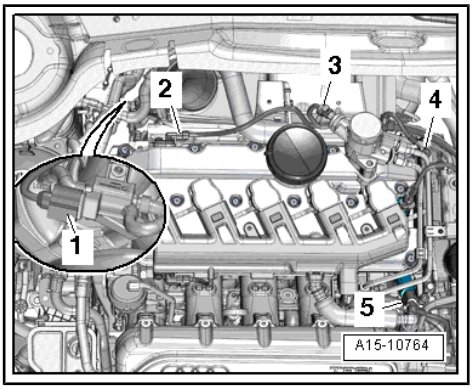
– Remove camshaft timing chain ⇒ page 90 .

– Remove bolt -4- and move earth wire clear.

– Unplug electrical connectors:

2 - Hall sender 3 -G300-

3 - Fuel metering valve -N290-



Note

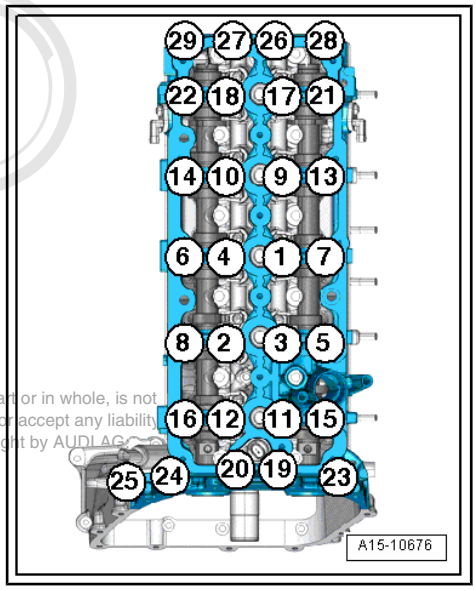
Disregard -items 1, 5-.

– Remove high-pressure pipe ⇒ Rep. gr. 24 .

– Remove high-pressure pump ⇒ Rep. gr. 24 .

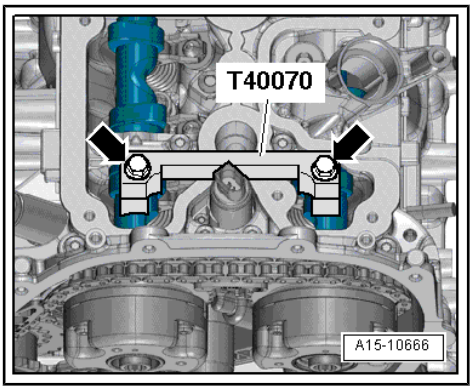
– Slacken retaining frame bolts in the sequence -29 ... 1-.

– Remove bolts, carefully release retaining frame from bonded joint and set it down on a soft surface on workbench.



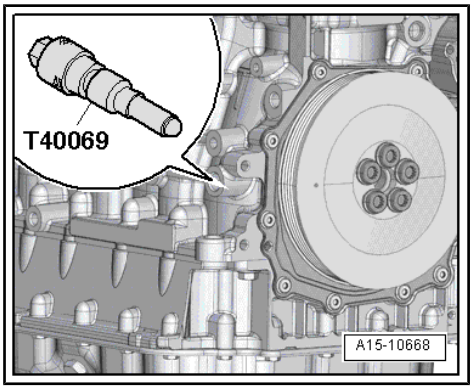
– Remove camshaft clamp -T40070- .

– Mark and remove camshafts.



Installing

- Crankshaft locked in position with locking pin -T40069- .
- Hydraulic compensation elements and roller rocker fingers installed.



Note

Renew seals/gaskets and sealing plugs.

Caution

Protect lubrication system and bearings against contamination.

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

WARNING

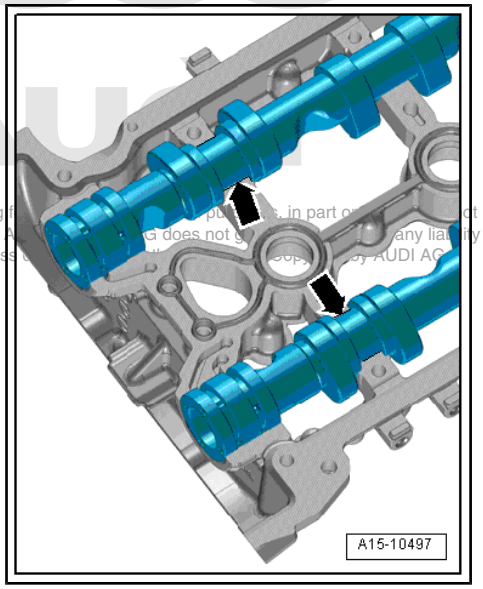
Protect eyes against injuries.

- ***Wear safety goggles.***

– Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.
– Clean sealing surfaces and grooves in sealing surfaces; they must be free of oil and grease.
– Oil running surfaces of both camshafts.

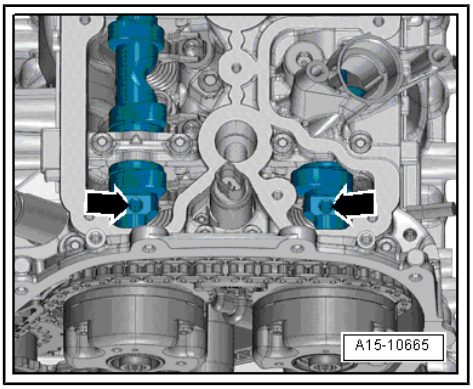
– Fit camshafts in retaining frame.
- The exhaust camshaft has an additional cam for high-pressure pump.
- Camshafts must be in correct position in axial bearings -arrows- in retaining frame.

– Turn retaining frame over with camshafts fitted, holding camshafts firmly in position.



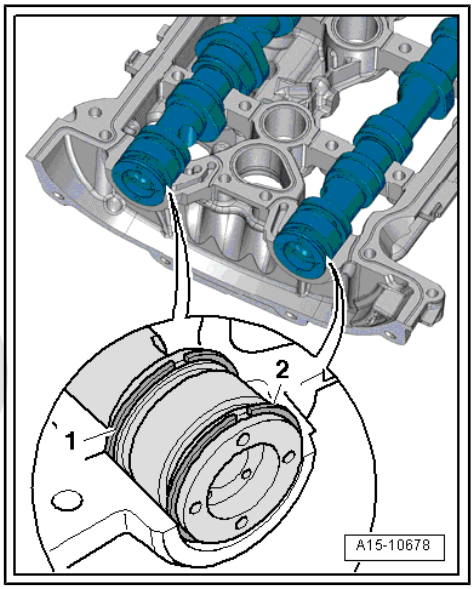
– Turn camshafts until threaded holes -arrows- point upwards.

– Check that camshafts are still in correct position in axial bearings in retaining frame.

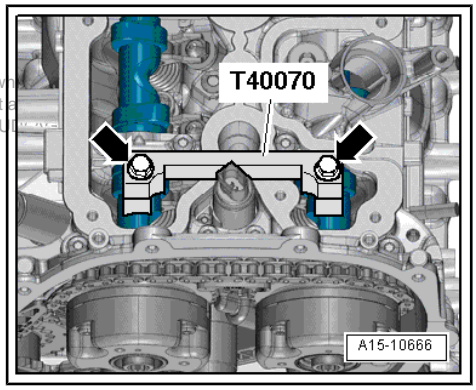


– Check position of ends of rectangular section seals.

• The ends of the rectangular section seals -1- and -2- must point up or down, never to the side.



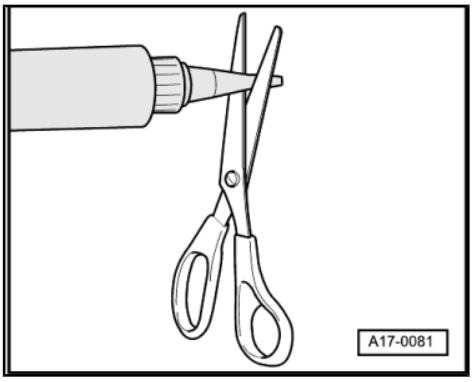
– Fit camshaft clamp -T40070- and tighten bolts -arrows- to 25 Nm.



Note

Note the use-by date of the sealant.

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

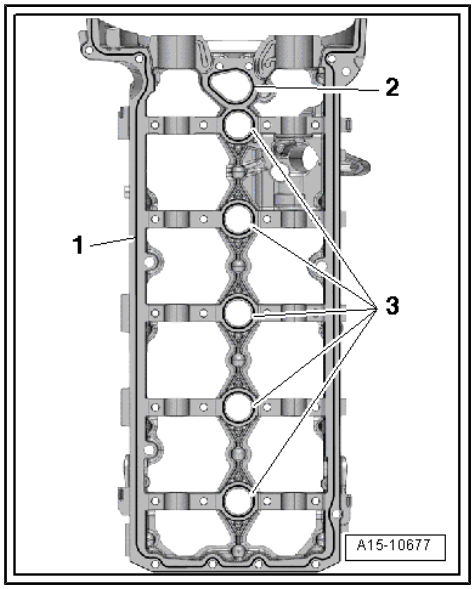


– Turn retaining frame upside down again.

Caution

Make sure lubrication system is not clogged by excess sealant.

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



– Apply even, slightly protruding sealant beads into clean grooves of retaining frame as shown in illustration.

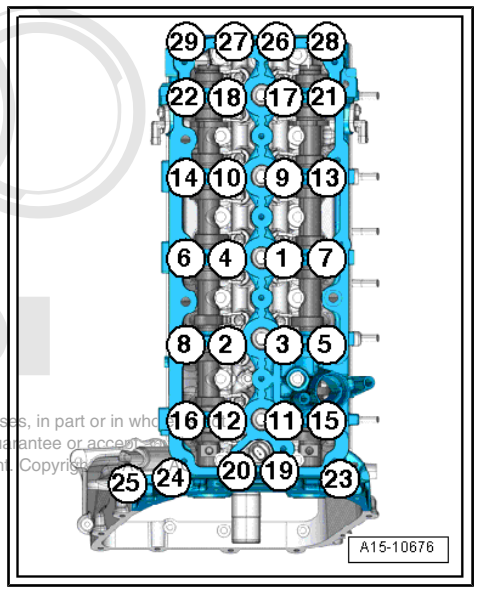
- Width of sealant bead -1-: 4.0 mm.
- Width of sealant beads -2, 3-: 3.0 mm.

Note

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

– Fit retaining frame with camshafts onto cylinder head.

– Fit bolts securing retaining frame for camshafts and tighten ⇒ page 117 .



Note

After installing the retaining frame, wait about 30 minutes for the sealant to dry.

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

– Install high-pressure pump and high-pressure line ⇒ Rep. gr. 24 .

– Install camshaft timing chain ⇒ page 90 .

Caution

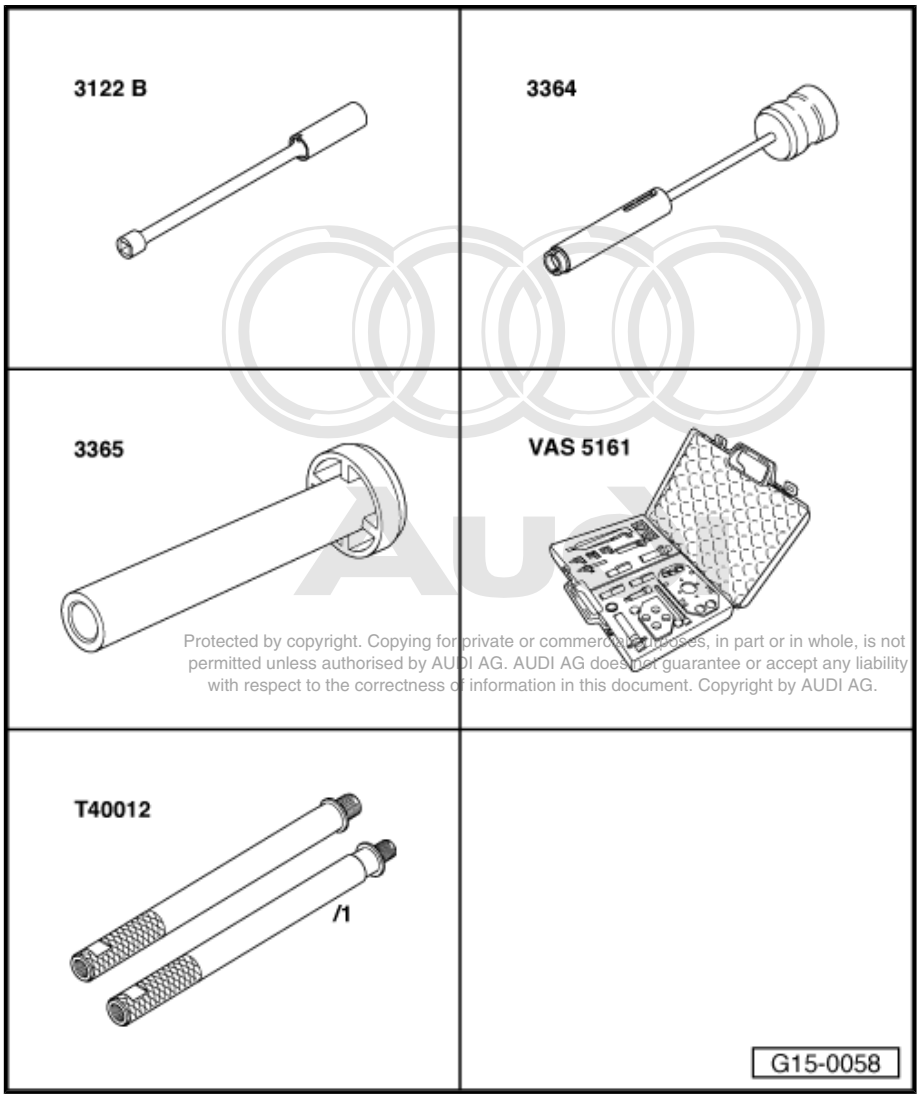
Avoid damage to valves and piston crowns after working on valve gear.

- ***Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.***

3.5 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

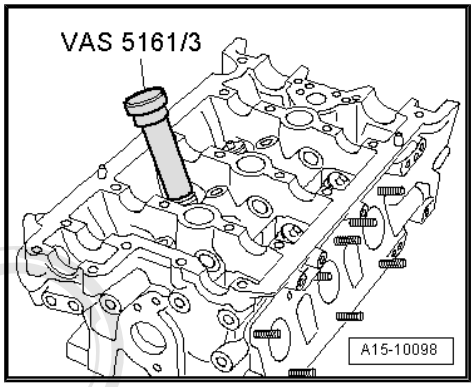
- Spark plug socket and extension -3122 B-
- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters - VAS 5161- with guide plate -VAS 5161/19B-
- Adapter -T40012-



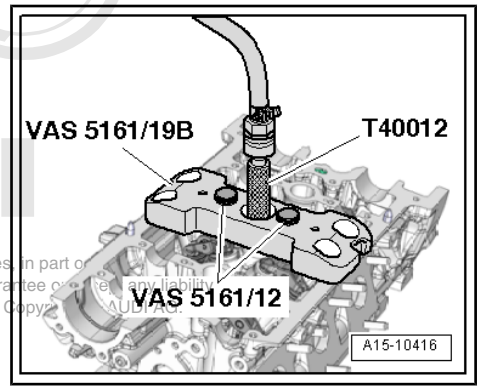
Removing

– Remove camshafts ⇒ page 118 .
– 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“.

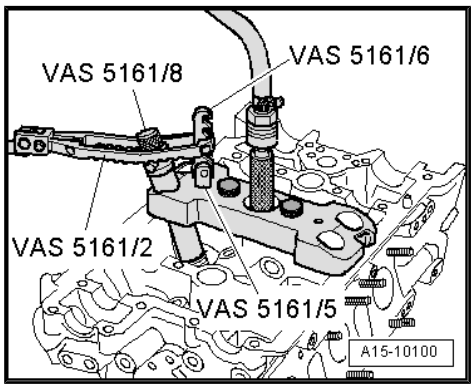
– Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.



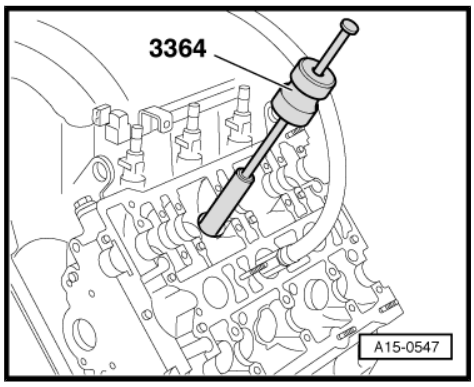
– Fit guide plate -VAS 5161/19B- onto cylinder head.
– Secure guide plate with knurled screws -VAS 5161/12- .
– Screw adapter -T40012- with seal hand-tight into the corresponding spark plug thread.
– Connect adapter to compressed air line using a commercially available connection piece, and apply constant air pressure.
• Minimum pressure: 6 bar



– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Insert assembly cartridge -VAS 5161/8- in guide plate.
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
– Release pressure fork.
– Take out assembly cartridge.
– Detach guide plate and turn to one side.
• The compressed air hose remains connected.
– Detach valve spring with valve spring plate.



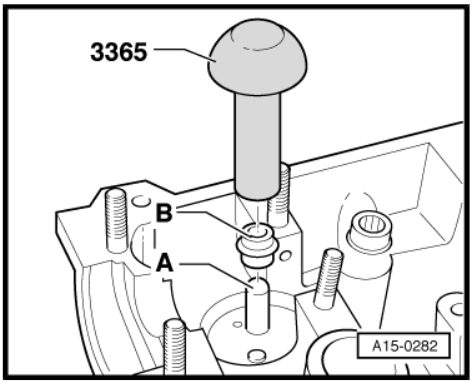
– Pull off valve stem oil seal with valve stem seal puller -3364- .



Caution

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

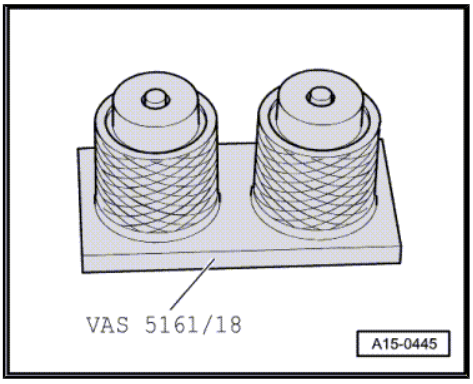
- ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***



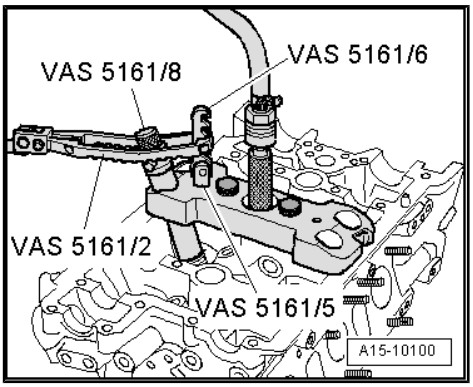
– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
– Take off plastic sleeve.

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

• Larger diameter of valve cotters faces upwards.
– Press assembly cartridge onto insertion device from above and take up valve cotters.
– Insert valve spring and valve spring plate ⇒ page 116 .



– Secure guide plate back onto cylinder head.
– Insert assembly cartridge in guide plate.
– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
– Release the pressure fork with knurled screw still in pulled position.
– Repeat procedure for each valve.



Assembling

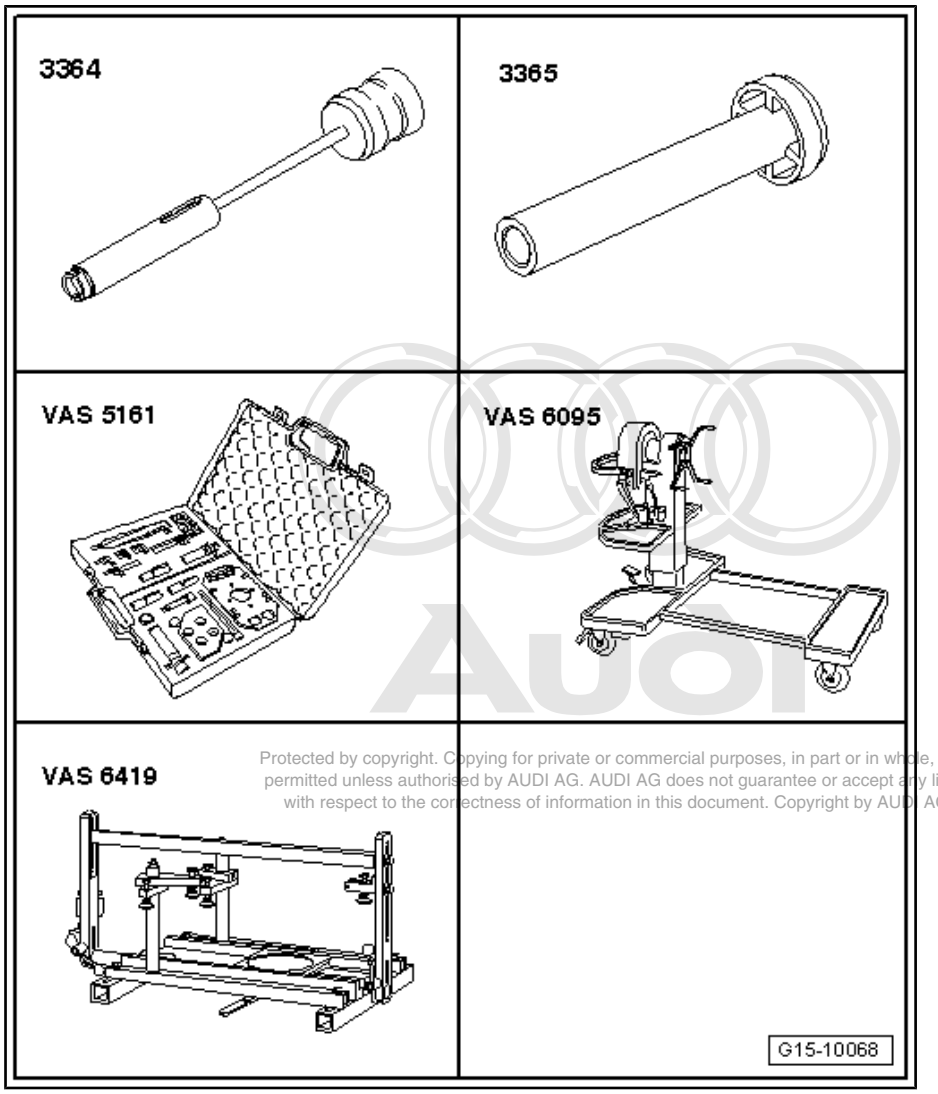
Installation is carried out in the reverse order; note the following:

– Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
– Install camshafts ⇒ page 118 .
– Install spark plugs ⇒ Maintenance ; Booklet 810 .

3.6 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- with guide plate for 2.0 ltr. and 3.0 ltr. FSI engine -VAS 5161/19B-
- Engine and gearbox support -VAS 6095-
- Cylinder head tensioning device -VAS 6419-



Procedure

– Remove camshafts ⇒ page 118 .

– 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.

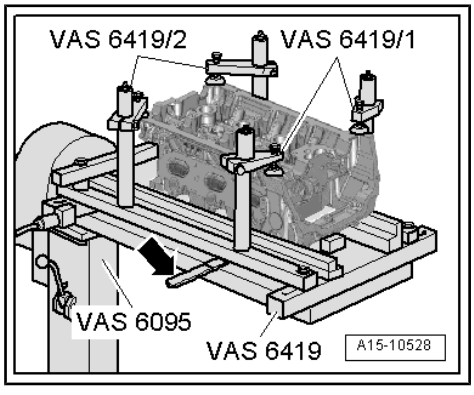
– Insert cylinder head tensioning device -VAS 6419- into engine and gearbox support -VAS 6095- .

– Secure cylinder head in cylinder head tensioning device, as shown in illustration.

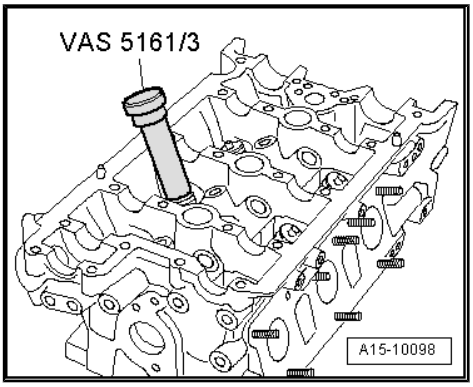
– Connect cylinder head tensioning device to compressed air.

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

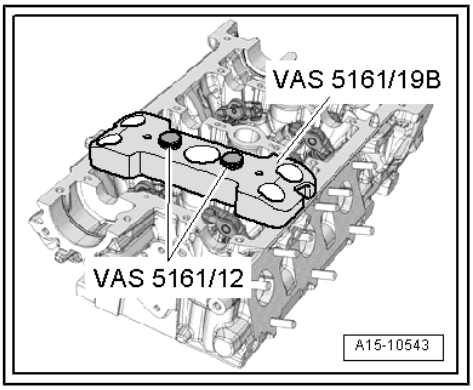
– Apply just enough compressed air to bring air pad into contact with valve heads.



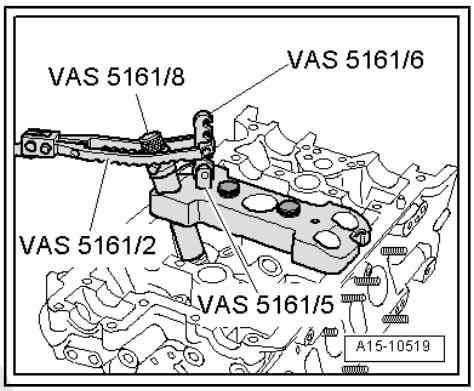
– Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.



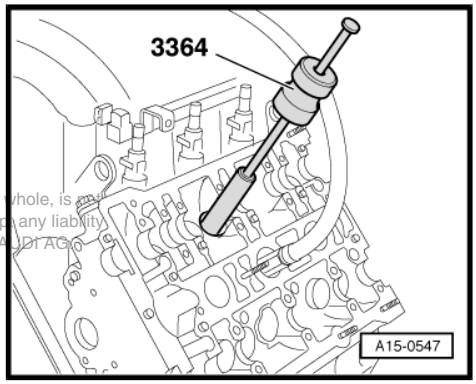
– Fit guide plate -VAS 5161/19B- onto cylinder head.
– Secure guide plate with knurled screws -VAS 5161/12- .



– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Insert assembly cartridge -VAS 5161/8- in guide plate.
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
– Release pressure fork.
– Take out assembly cartridge.
– Detach guide plate and turn to one side.
– Detach valve spring with valve spring plate.



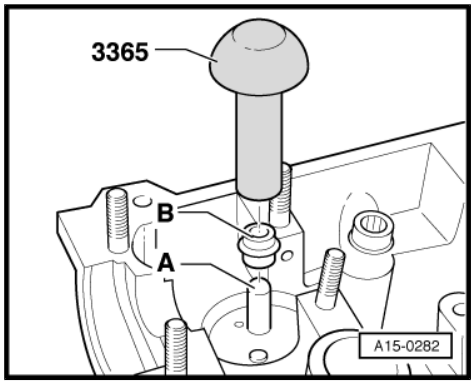
– Pull off valve stem oil seal with valve stem seal puller -3364- .



Caution

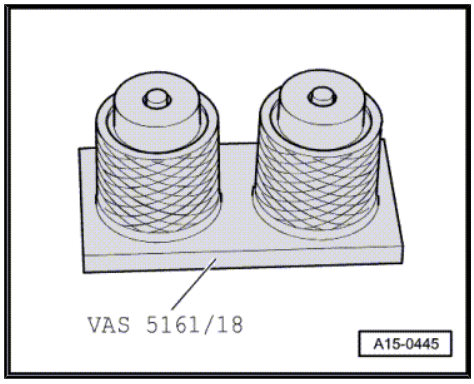
Make sure valve stem oil seals are not damaged when installing.

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



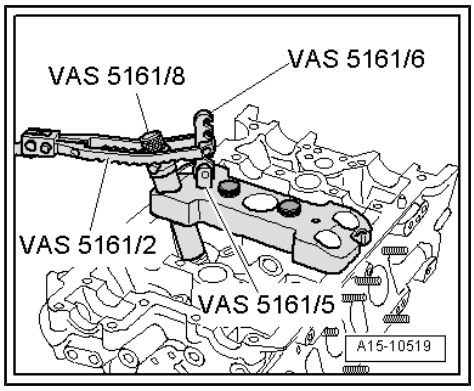
– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
– Take off plastic sleeve.

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



• Larger diameter of valve cotters faces upwards.
– Press assembly cartridge onto insertion device from above and take up valve cotters.
– Insert valve spring and valve spring plate ⇒ page 116 .

– Secure guide plate back onto cylinder head.
– Insert assembly cartridge in guide plate.
– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
– Release the pressure fork with knurled screw still in pulled position.
– Repeat procedure for each valve.



Assembling

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

– Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
– Install camshafts ⇒ page 118 .

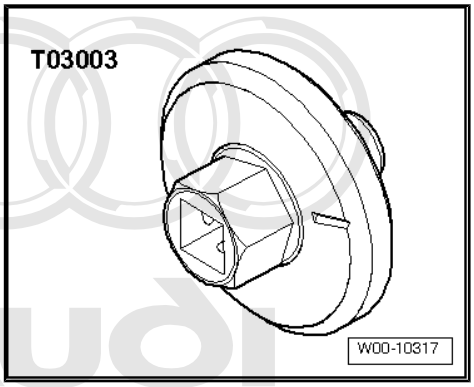
3.7 Checking hydraulic valve compensation elements

Note

- *The hydraulic compensation elements cannot be serviced.*
- *Irregular valve noises when starting engine are normal.*

Special tools and workshop equipment required

♦ Socket -T03003-



♦ Feeler gauge

Procedure

– Start engine and run until radiator fan has started up once.

– Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).

Note

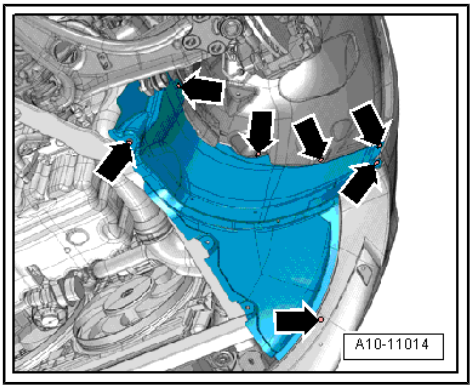
If irregular valve noise disappears but repeatedly re-occurs when travelling short distances, renew oil filter bracket with integrated oil retention valve.

– If the compensation elements are still noisy, locate the defective compensation element as follows:

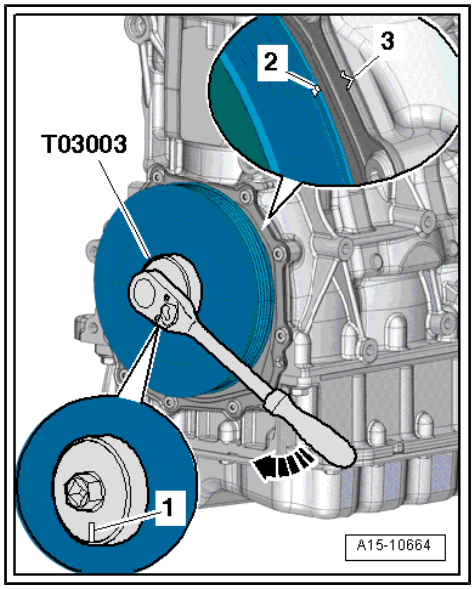
– Remove cylinder head cover ⇒ page 103 .

– Remove front wheel (right-side) ⇒ Wheels and tyres; Rep. gr. 44 .

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



– Turn crankshaft with socket -T03003- in direction of engine rotation -arrow- until cam of hydraulic compensation element to be tested faces upwards.

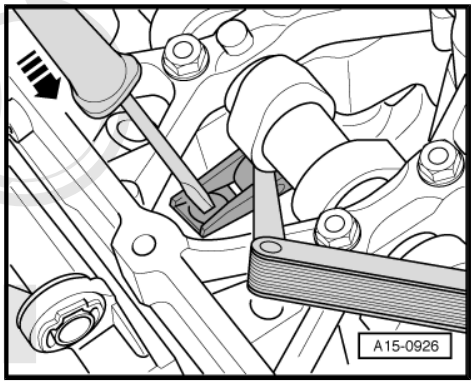


Note

Disregard -items 1, 2-.

– Press roller rocker finger down -arrow- to determine clearance between cam and roller rocker finger.

– If it is possible to insert a feeler gauge of 0.20 mm between cam and roller rocker finger, renew hydraulic compensation element
⇒ „3.4 Removing and installing camshafts“, page 118 .



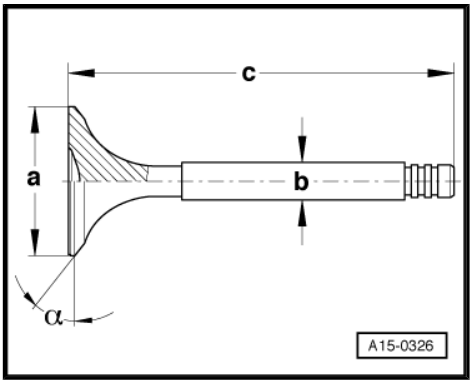
Additional steps required

– Install bottom section of front wheel housing liner ⇒ Rep. gr. 66 .

– Fit front wheel ⇒ Wheels and tyres; Rep. gr. 44 .

– Install cylinder head cover ⇒ page 103 .

3.8 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	5.965 ± 0.005	5.955 ± 0.007
c	mm	103.97 ± 0.20	101.87 ± 0.20
α	∠°	45	45

WARNING

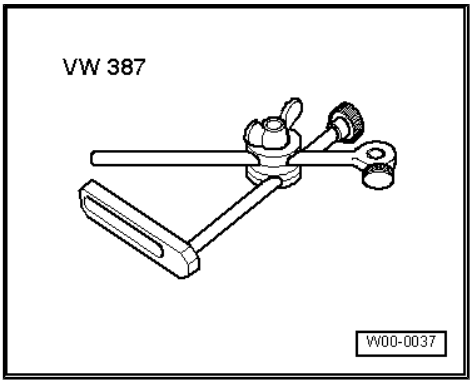
Care must be taken when disposing of old sodium-cooled exhaust valves - risk of injury.

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

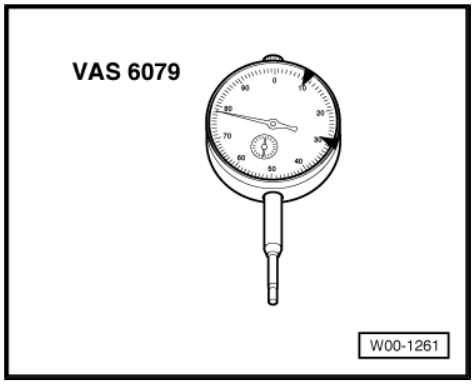
3.9 Checking valve guides

Special tools and workshop equipment required

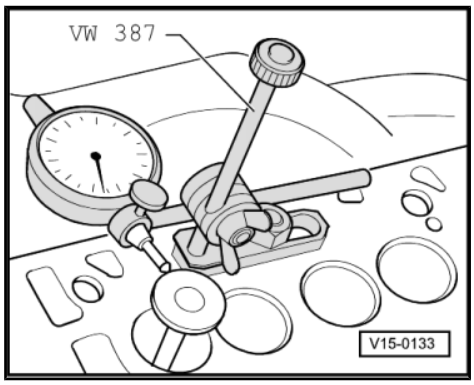
- Universal dial gauge bracket -VW 387-



♦ Dial gauge -VAS 6079-



Procedure



Note

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

♦ *Only insert inlet valve into inlet 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.

– Measure the amount of sideways play.

• Wear limit: 0.8 mm.

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

– Renew cylinder head if wear limit is still exceeded.

Note

Valve guides cannot be renewed.

3.10 Checking valves

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

– Renew valve if scoring is clearly visible.

17 – Lubrication

1 Sump and oil pump

Overview

Note

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

Caution

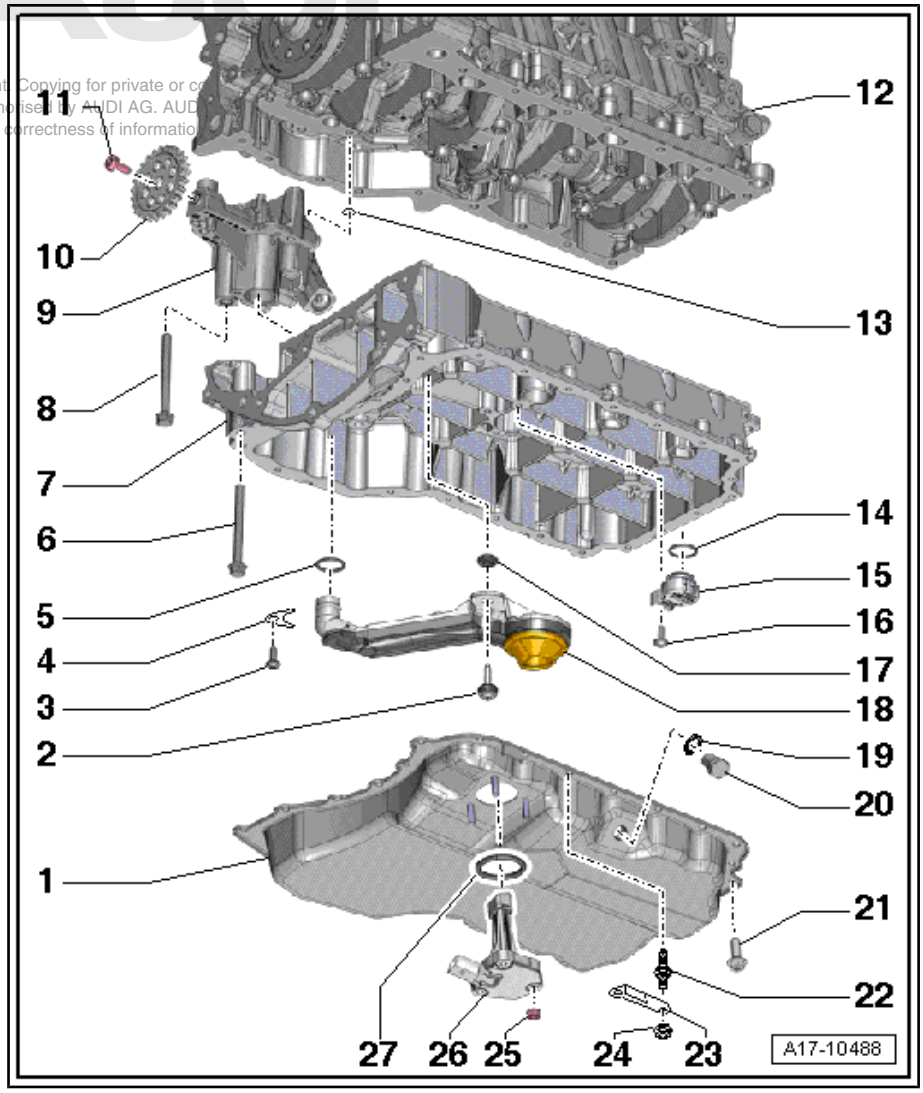
Risk of damage to catalytic converter.

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

1.1 Sump (bottom section), sump (top section), oil pump - exploded view

Note

Oil spray jet and pressure relief valve ⇒ page 77



1 - Sump (bottom section)
- ❑ Removing and installing ⇒ page 137
- ❑ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

2 - Bolt
- ❑ With bush and rubber ring
- ❑ 9 Nm

3 - Bolt
- ❑ 9 Nm

4 - Bracket
- ❑ For oil intake pipe

5 - Seal
- ❑ Renew

6 - Bolt
- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 136

7 - Sump (top section)
- ❑ Removing and installing ⇒ page 139
- ❑ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

8 - Bolt
- ❑ 20 Nm

9 - Oil pump
- ❑ Do not dismantle
- ❑ Removing and installing ⇒ page 146

10 - Drive chain sprocket
- ❑ For oil pump
- ❑ Installation position: lettering must be legible from outside

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

12 - Cylinder block

13 - O-ring
- ❑ Renew

14 - O-ring
- ❑ Renew

15 - Connection
- ❑ For oil return

16 - Bolt
- ❑ 9 Nm

17 - Rubber grommet

18 - Oil intake pipe

19 - Seal
- ❑ Renew

20 - Oil drain plug
- ❑ 25 Nm

21 - Bolt
- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 135

22 - Centre hex stud
- ❑ Tightening torque and sequence ⇒ page 135

23 - Bracket

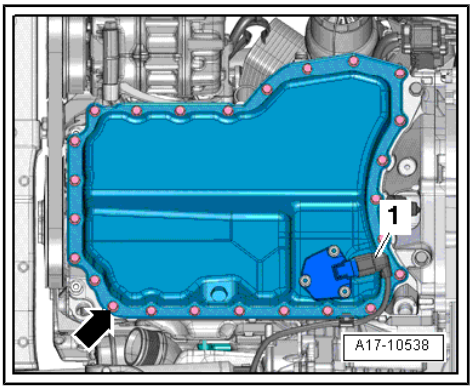
24 - Nut
- ❑ 9 Nm

25 - Nut
- ❑ 9 Nm

26 - Oil level and oil temperature sender -G266-
- ❑ Removing and installing ⇒ page 137

27 - Seal
- ❑ Renew

Sump (bottom section) - tightening torque and sequence



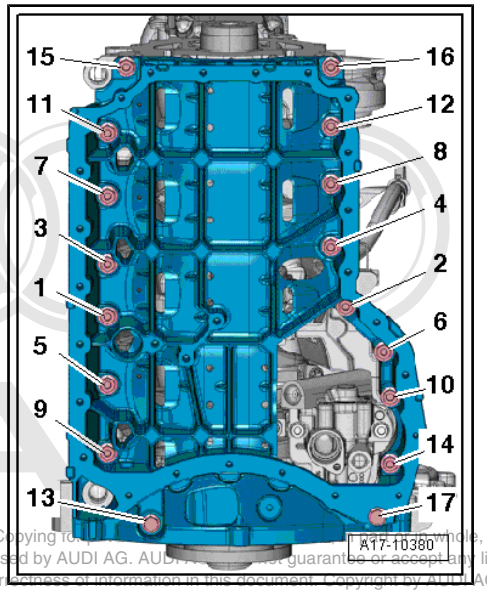
Note

Renew the bolts tightened with specified tightening angle.

– Tighten bolts in 3 stages:

Stage	Bolts	Tightening torque/angle specification
1.	-arrow-	Screw in bolts by hand until they make contact
2.	-arrow-	8 Nm in diagonal sequence
3.	-arrow-	Turn 45° further in diagonal sequence

Sump (top section) - tightening torque and sequence



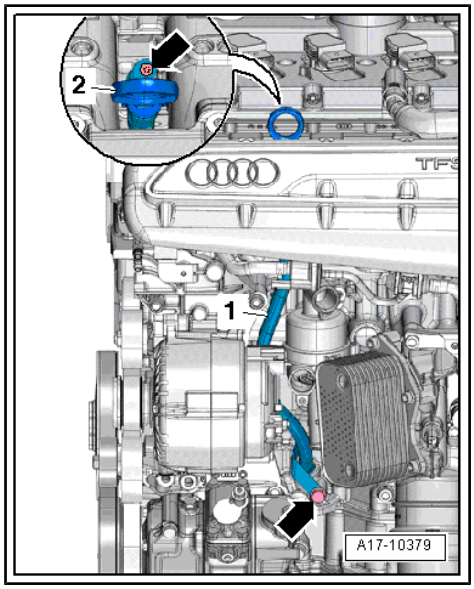
Note

Renew the bolts tightened with specified tightening angle.

– Tighten bolts in 3 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 17-	Screw in bolts by hand until they make contact
2.	-1 … 17-	20 Nm
3.	-1 … 17-	turn 90° further

Guide tube for oil dipstick - tightening torque

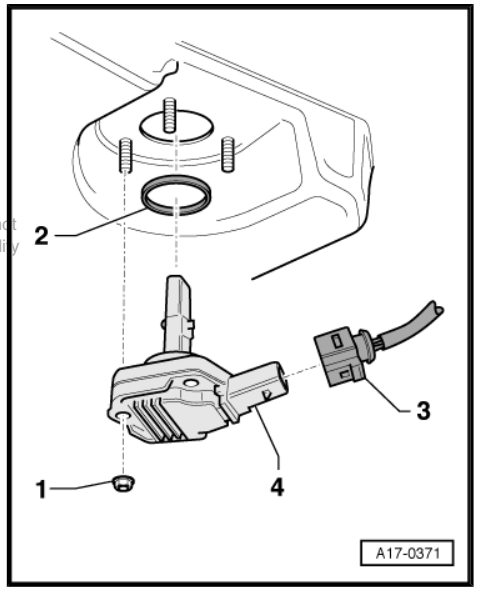


– Tighten bolts -arrows- as follows:

- M6: 9 Nm
- M8: 23 Nm

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

Removing



– Drain off engine oil ⇒ Maintenance ; Booklet 810 .
– Unplug electrical connector -3-.
– Remove nuts -1-.
– Pull oil level and oil temperature sender -G266- -item 4- off sump (bottom section) and remove together with seal -2-.

Installing

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

- Tightening torque
⇒ „1.1 Sump (bottom section), sump (top section), oil pump - exploded view“, page 134

Note

Renew seal.

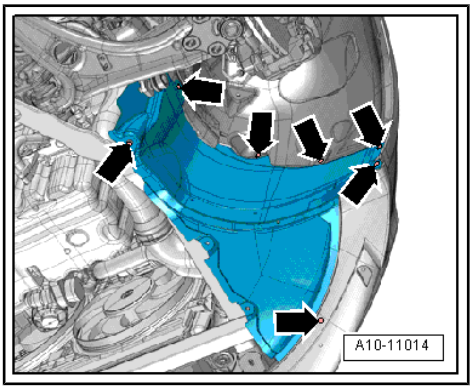
– Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 810 .

1.3 Removing and installing sump (bottom section)

Special tools and workshop equipment required

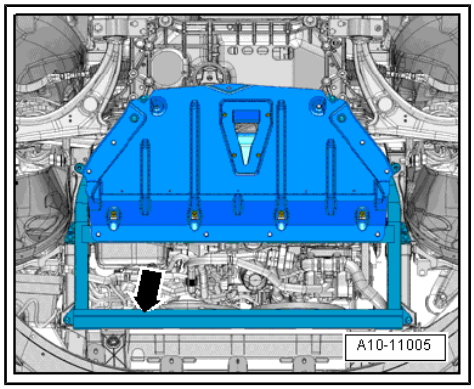
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue

Removing

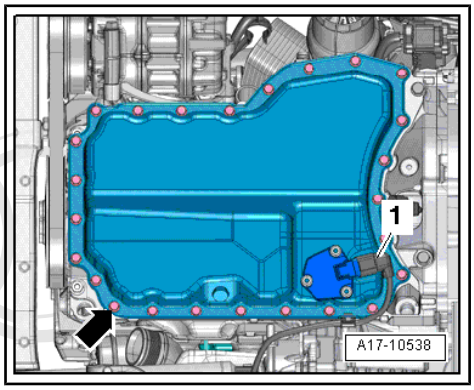


– Drain off engine oil ⇒ Maintenance ; Booklet 810 .
– Remove bottom section of front wheel housing liner (right-side) ⇒ Rep. gr. 66 .

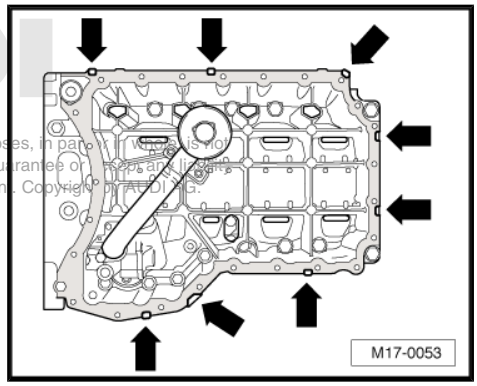
– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. gr. 50 .



– Unplug electrical connector -1- at oil level and oil temperature sender -G266- .
– Remove bolts -arrow- for sump (bottom section) in diagonal sequence.



– Carefully release sump (bottom section) from bonded joint; to do so, apply screwdriver at the slots -arrows- all round the sump.



Installing

Caution

Protect lubrication system against contamination.

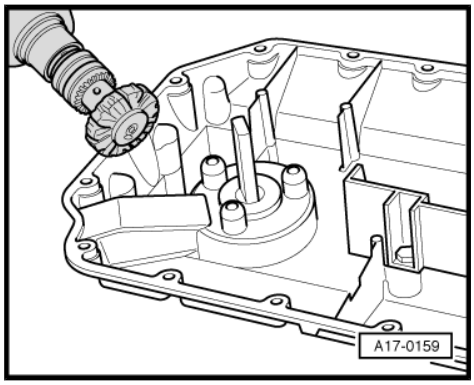
- *Cover exposed parts of the engine.*

WARNING

Protect eyes against injuries.

- *Wear safety goggles.*

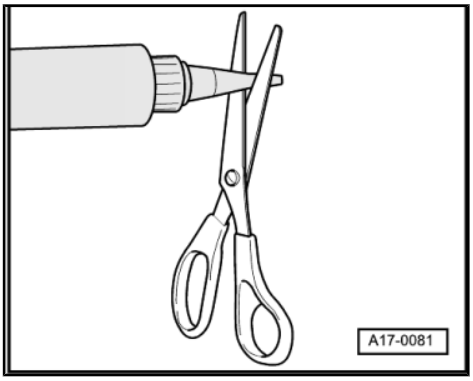
– Remove sealant residue from sump (bottom section) and sump (top section) using rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.



Note

Note the use-by date of the sealant.

– Cut off nozzle of tube at front marking (nozzle ∅ approx. 2.0 mm).



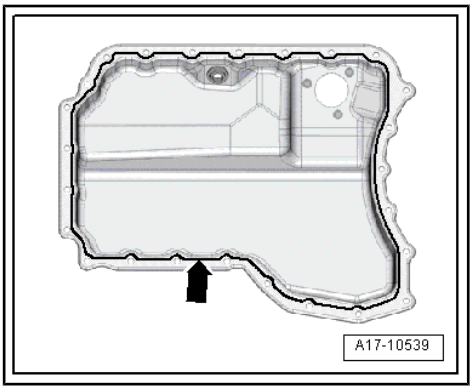
Caution

Make sure lubrication system is not clogged by excess sealant.

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

– Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as shown in illustration.

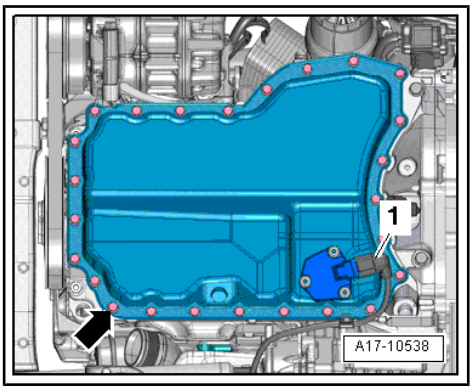
- Thickness of sealant bead: 1.5 ... 2.0 mm



Note

The sump (bottom section) must be installed within 5 minutes after applying the sealant.

– Fit sump (bottom section) and tighten bolts ⇒ page 135 .



Note

After installing the sump (bottom section), wait about 30 minutes for the sealant to dry. 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 216 .

– Install noise insulation frame ⇒ Rep. gr. 50 .

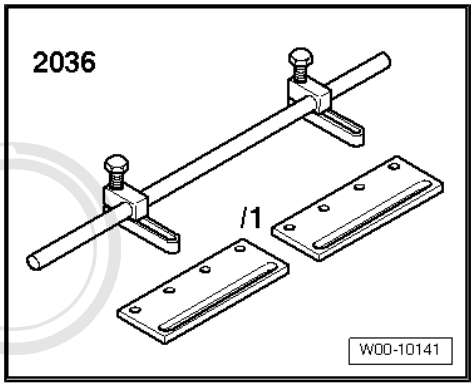
– Install bottom section of front wheel housing liner ⇒ Rep. gr. 66 .

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

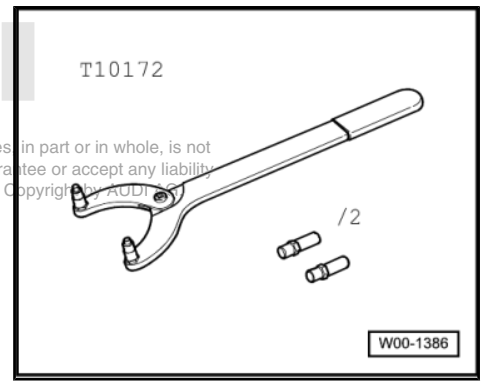
1.4 Removing and installing sump (top section)

Special tools and workshop equipment required

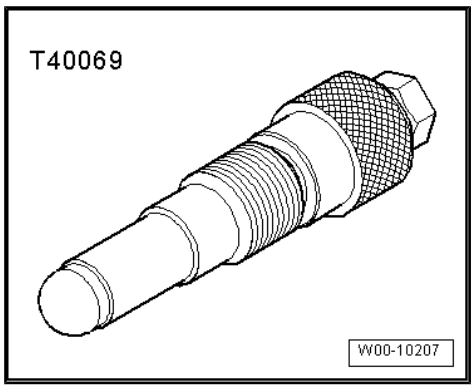
- Plates -2036/1- from valve assembly device -2036-



- Counterhold tool -T10172-



- Locking pin -T40069-



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

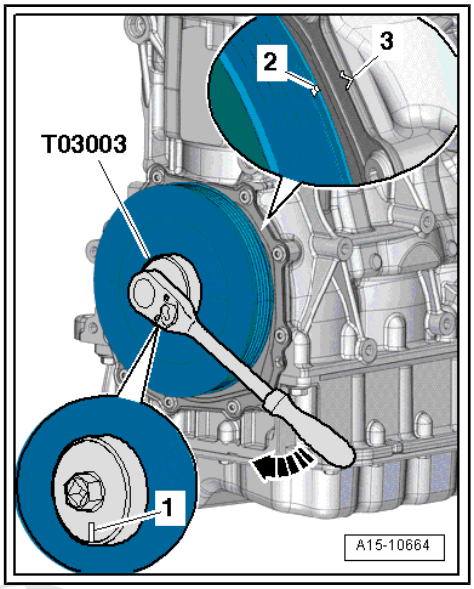
Removing

- Gearbox removed.

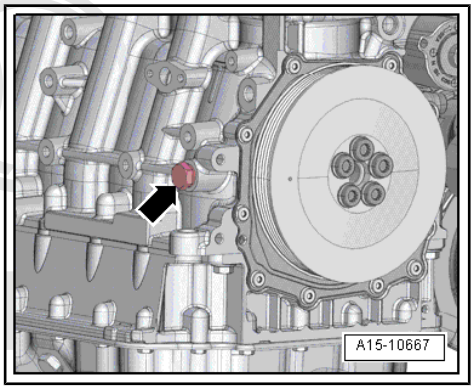
– Turn crankshaft with socket -T03003- in normal direction of rotation -arrow- to „TDC position“.

• Notch -1- in socket -T03003- must be perpendicular to sealing surface of sump.

• Marking -2- on vibration damper must be opposite marking -3- on sealing flange.



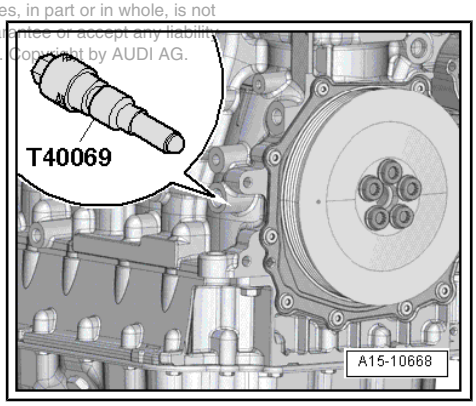
– Unscrew plug -arrow- for „TDC“ marking from cylinder block.



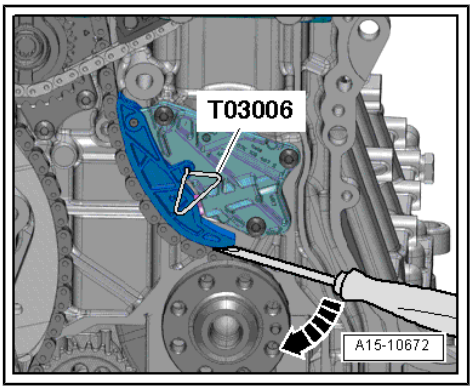
– Screw locking pin -T40069- into locating groove and tighten to 15 Nm. If necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.

– Remove sealing flange (pulley end) ⇒ page 62 .

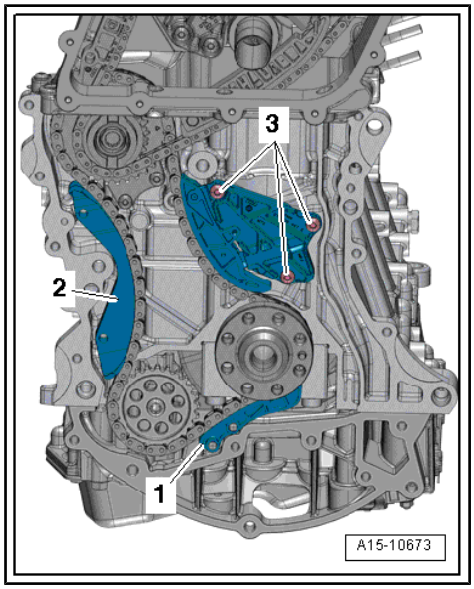
– Remove timing chain cover (bottom) ⇒ page 84 .



– Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting locking pin -T03006- .



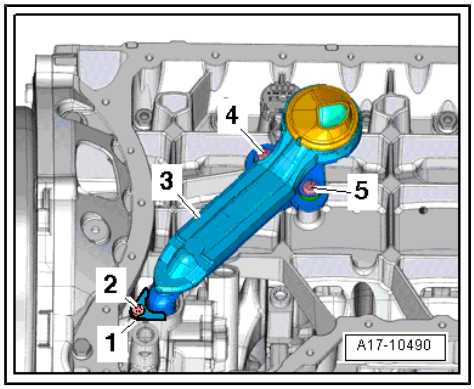
– Detach guide rail (bottom) -1-.



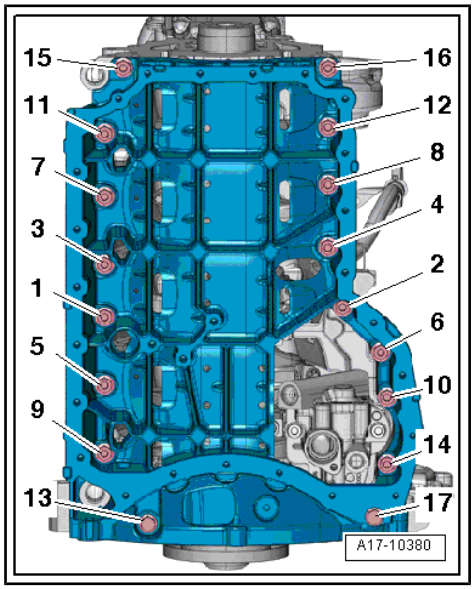
Note

Disregard -items 2, 3-.

– Remove sump (bottom section) ⇒ page 137 .
– Unscrew bolts -2, 4, 5- and remove bracket -1-.
– Detach oil intake pipe -3-.



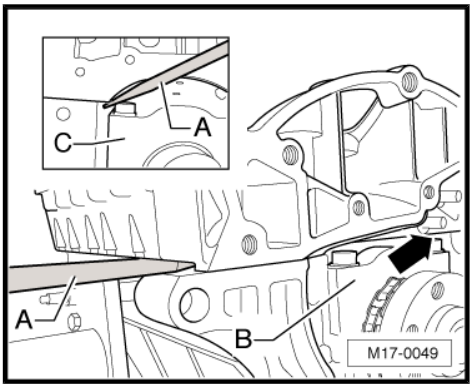
– Slacken and remove bolts in the sequence: -17 ... 1-.



– Carefully release sump (top section) from bonded joint; apply screwdriver -A- at positions shown in illustration.

B - Bearing cap 6 for crankshaft

C - Bearing cap 1 for crankshaft



Installing

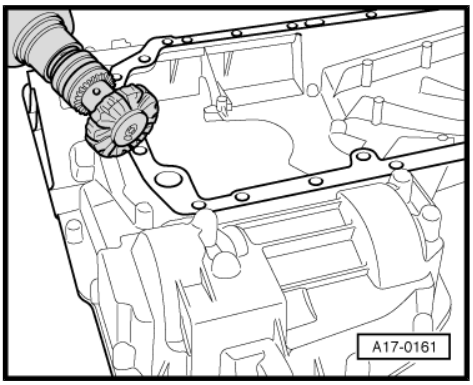
Note

Renew seals and O-rings.

Caution

Protect lubrication system against contamination.

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



WARNING

Protect eyes against injuries.

- ***Wear safety goggles.***

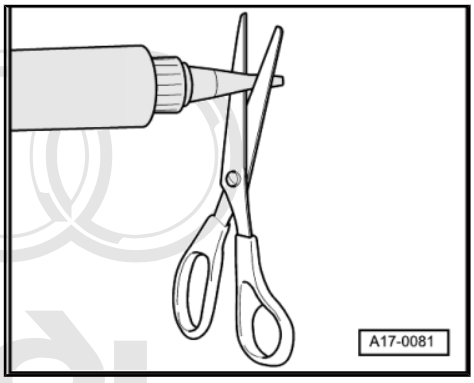
– Remove sealant residue from sump (top section) and cylinder block using rotating plastic brush or similar.

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

Note

Note the use-by date of the sealant.

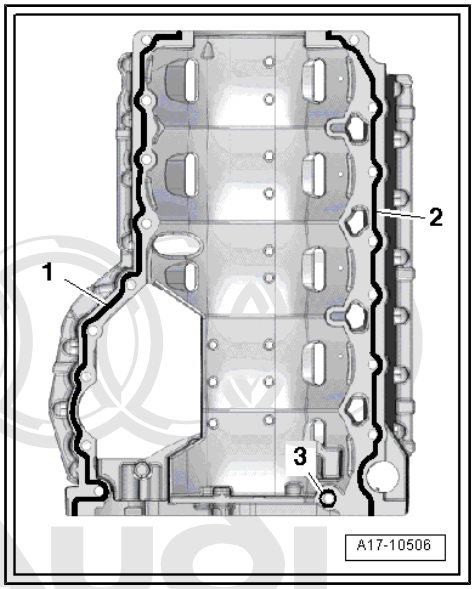
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

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



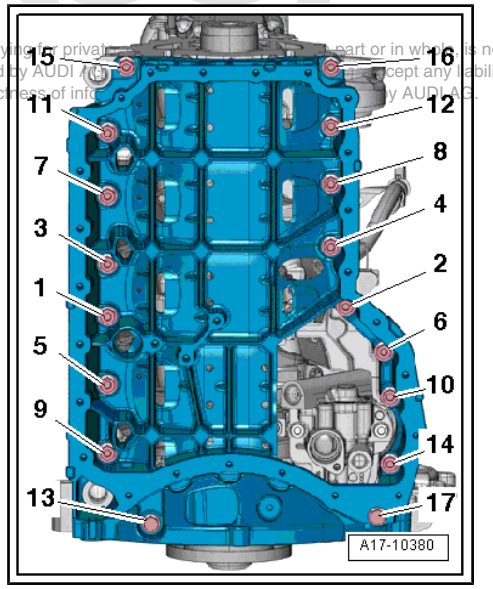
– Apply beads of sealant -1, 2, 3- onto clean sealing surface of sump (top section) as shown in illustration.

• Thickness of sealant bead: 1.5 ... 2.0 mm

Note

The sump (top section) must be installed within 5 minutes after applying the sealant.

– Fit sump (top section) and screw in bolts -13, 15, 16, 17- by hand until they make contact.



– Wipe off surplus sealant at the positions marked with -arrows-.

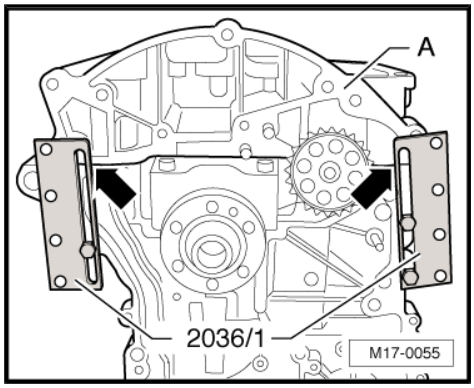
– Loosen bolts slightly.

– Secure plates -2036/1- to 20 Nm at cylinder block as shown in illustration.

– Press sump (top section) -A- firmly onto plates.

– Tighten bolts for sump (top section) ⇒ page 136 .

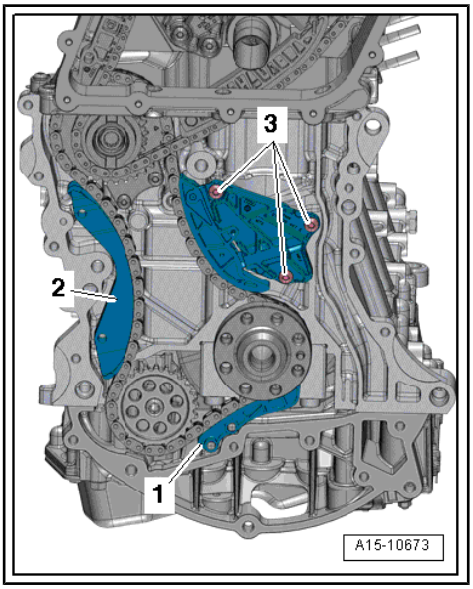
• The sump (top section) must remain in contact with plates.



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

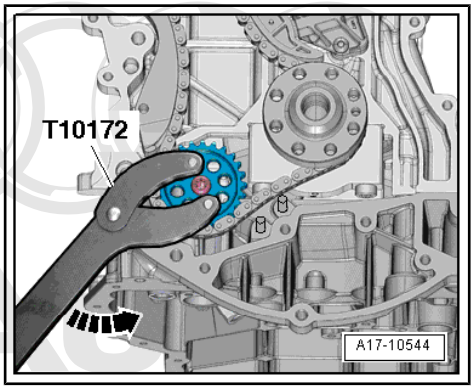
– Install sump (bottom section) ⇒ page 137 .

– Insert guide rail (bottom) -1-.

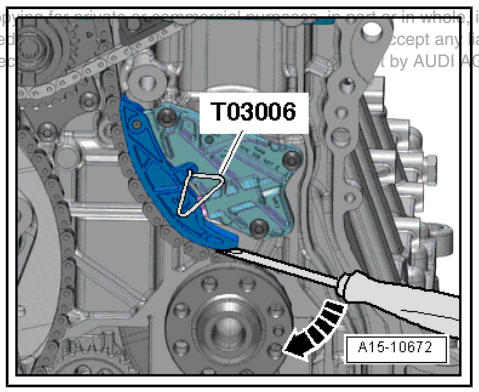


Note

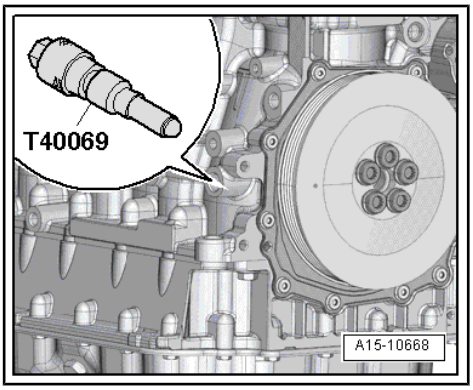
If necessary for insertion of guide rail, pre-tension drive chain for valve gear via oil pump drive sprocket using counterhold tool -T10172- .



– Press guide rail of chain tensioner for drive chain in direction of -arrow- and remove locking pin -T03006- .
– Install timing chain cover (bottom) ⇒ page 84 .
– Install sealing flange (pulley end) ⇒ page 62 .



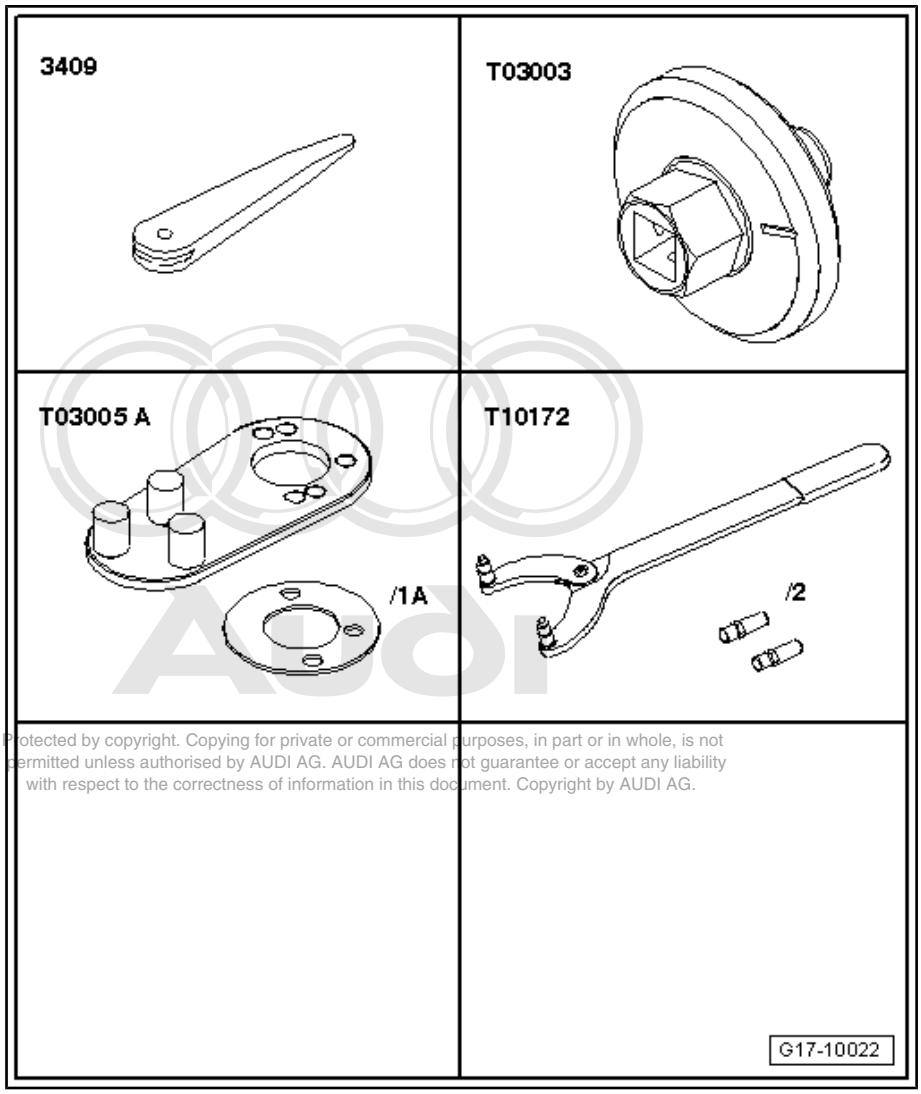
– Remove locking pin -T40069- .
– Tighten plug for „TDC“ marking ⇒ page 72 .



1.5 Removing and installing oil pump

Special tools and workshop equipment required

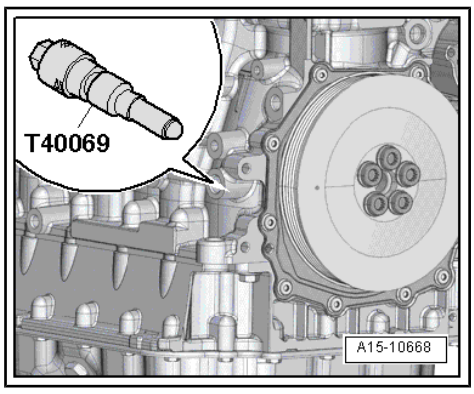
- Removal wedge -3409-
- Socket -T03003-
- Oil pump lock -T03005 A-
- Counterhold tool -T10172-



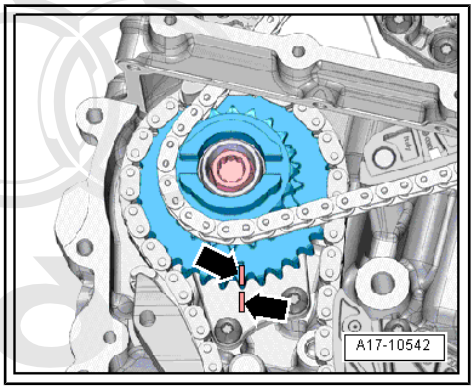
Removing

– Remove upper section of sump ⇒ page 139 .

• Crankshaft locked in position with locking pin -T40069- .



– Mark position of drive chain sprocket for camshaft timing chain and thrust washer with paint -arrows-.

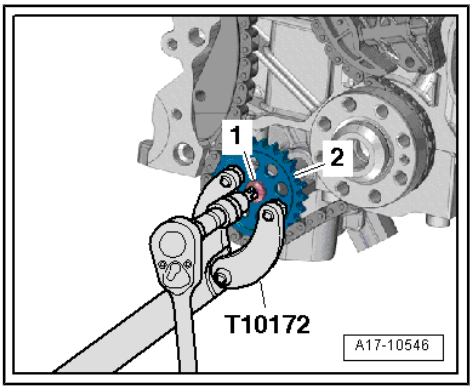


Caution

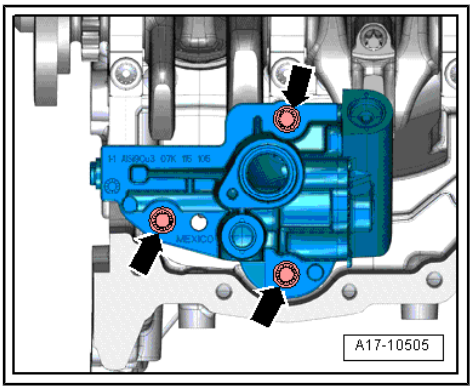
Risk of damage to engine.

- *The markings serve to check whether the position of the drive chain sprocket for camshaft (and, as a result, the position of the camshafts) has been changed during the following work steps.*
- *If the position was changed, the valve timing must be adjusted after completing work*
  ⇒ „1.6 Removing and installing camshaft timing chain“, page 90 .

– Counterhold using counterhold tool -T10172- , remove bolt -1- and detach drive chain sprocket -2-.

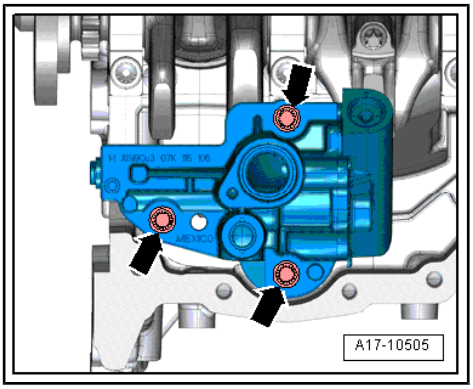


– Remove bolts -arrows- and detach oil pump.



Installing

- Tightening torques
  ⇒ „1.1 Sump (bottom section), sump (top section), oil pump - exploded view“, page 134



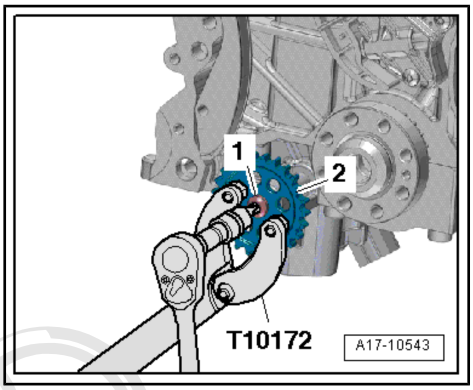
Note

Fit new O-ring.

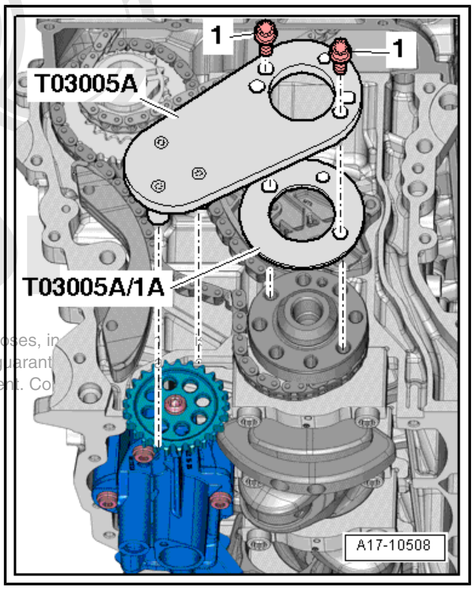
– Initially screw in bolts -arrows- for oil pump by hand until they make contact.

- It must still be possible to move oil pump by hand.

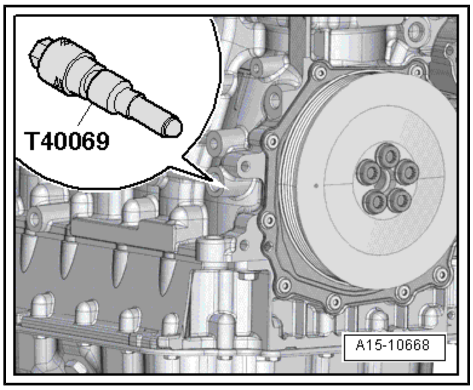
- Drive chain for valve gear must not be fitted.
– Fit drive chain sprocket -2- onto oil pump.
- Lettering on drive chain sprocket must be legible.
– Tighten bolt -1- to 20 Nm (counterhold using counterhold tool -T10172-).



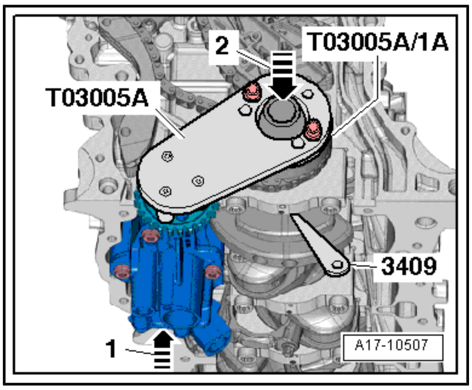
– Remove protective plates on magnets of oil pump lock -T03005 A- if fitted.
– Check if there are metal shavings on the magnets of oil pump lock.
- The contact surfaces on crankshaft, tools and drive chain sprocket must be clean.
– Fit plate -T03005 /1A- and oil pump lock -T03005 A- at crankshaft journal and tighten to 30 Nm with two bolts -1- for dual-mass flywheel.
- The oil pump is drawn nearer by the magnets.



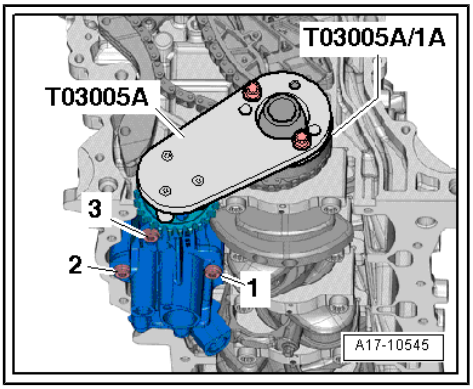
– Remove locking pin -T40069- .



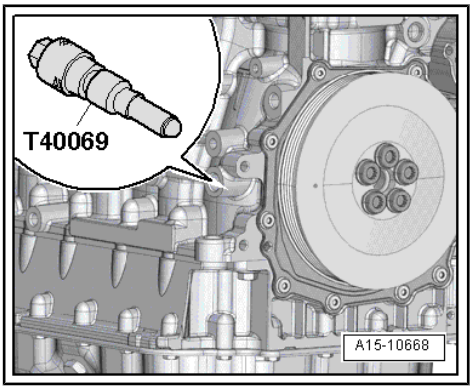
– Press crankshaft via axial bearing clearance towards pulley end -arrow 2- and secure in this position using removal wedge -3409- .
– Press oil pump via axial bearing clearance slightly towards gearbox end -arrow 1- and hold in position.



– Tighten bolts in the sequence -1, 2, 3-.

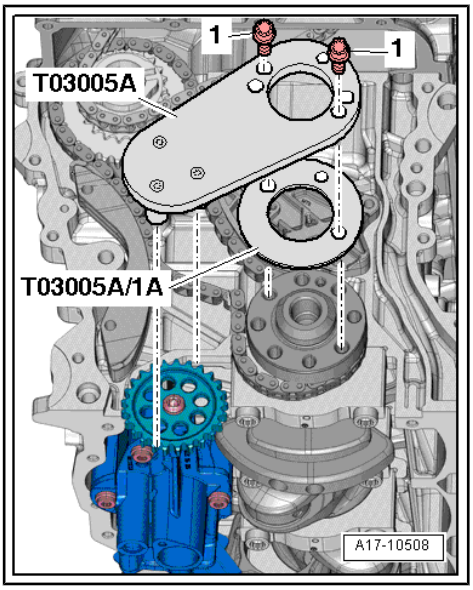


– Screw locking pin -T40069- into locating groove and tighten to 15 Nm.

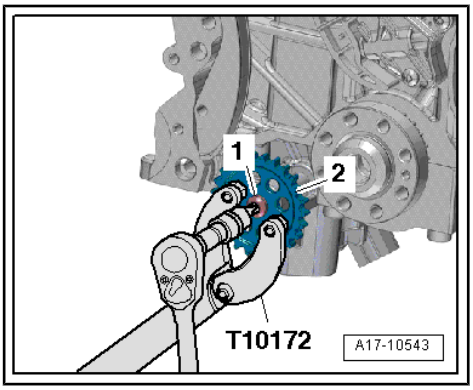


– Remove bolts -1- and detach oil pump lock -T03005 A- and plate -T03005 /1A- .

– If a new oil pump is fitted, fill in clean engine oil via intake port and turn oil pump several turns.

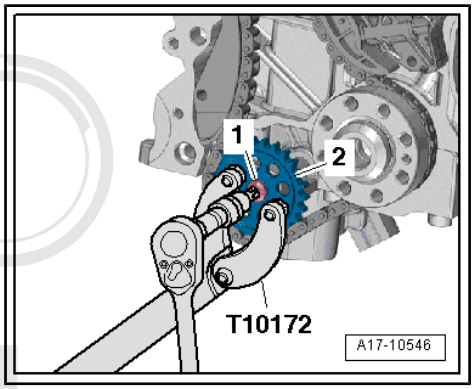


– Counterhold using counterhold tool -T10172- , remove bolt -1- and detach drive chain sprocket -2- again.

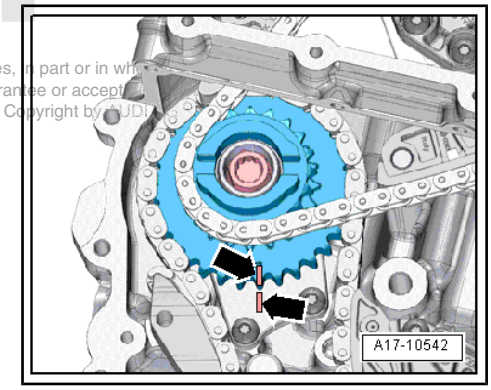


– Insert drive chain sprocket in drive chain, tighten bolt -1- (counterhold using counterhold tool -T10172-).

– Install sump (upper section) ⇒ page 139 .



– Check that colour codings -arrows- marking position between drive chain sprocket for camshaft timing chain and thrust washer still align.



• Continue installation if the markings align.

• Adjust valve timing if the markings do not align ⇒ „1.6 Removing and installing camshaft timing chain“, page 90 .

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

– Remove locking pin -T40069- .

– Tighten plug for „TDC“ marking ⇒ page 72 .

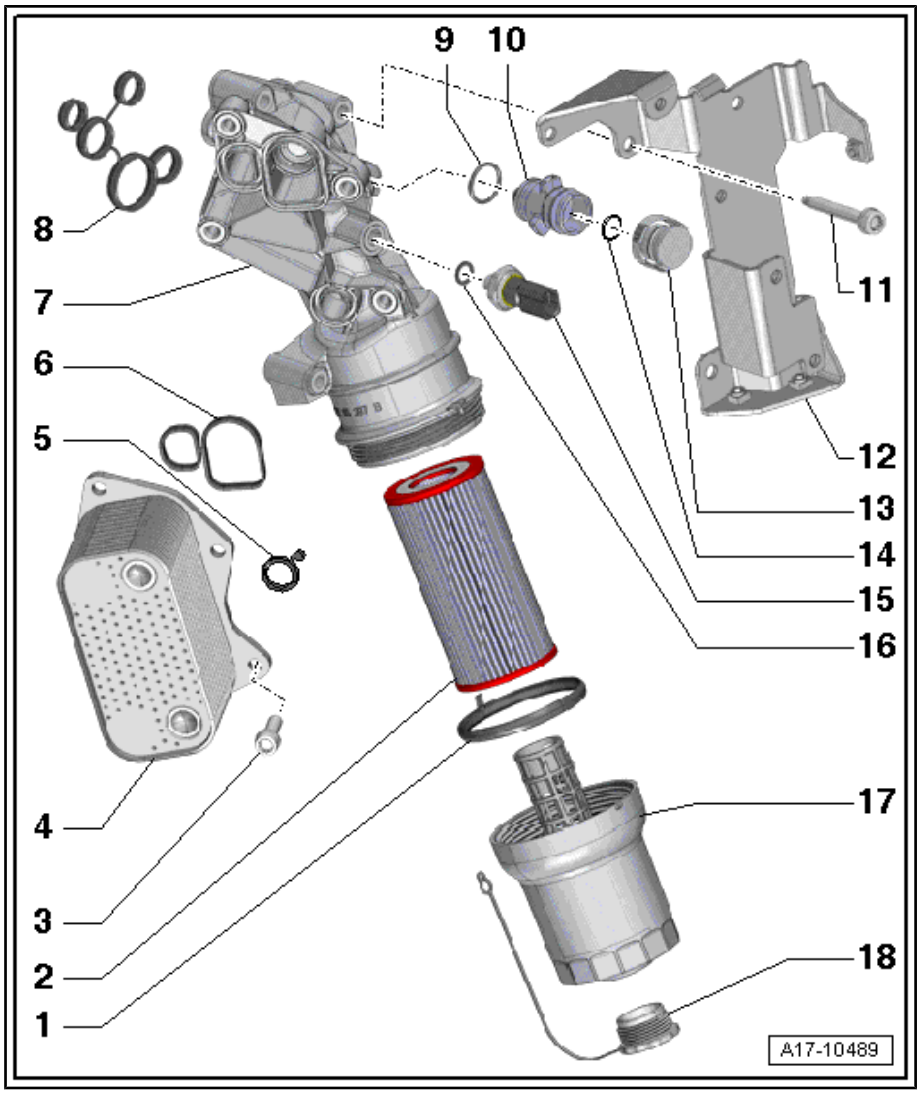
Note

Clean removal wedge -3409- thoroughly; normally wedge is used for body repairs in the interior.

2 Oil filter bracket and engine oil cooler

Overview

2.1 Oil filter bracket and engine oil cooler - exploded view



1 - Seal

- ❑ Renew
- ❑ Lubricate lightly with oil
- ❑ Installation position: service lug faces upwards

2 - Oil filter element

- ❑ Removing and installing ⇒ Maintenance ; Booklet 810

3 - Bolt

- ❑ 20 Nm

4 - Engine oil cooler

- ❑ See note ⇒ page 133
- ❑ Ensure clearance from surrounding components
- ❑ Diagram of coolant hose connections ⇒ page 162
- ❑ Removing and installing ⇒ page 153

5 - Seal

- ❑ Renew
- ❑ Insert positioning lug in groove on oil filter bracket

6 - Gasket

- ❑ Renew

7 - Oil filter bracket

- ❑ With bypass valve for engine oil cooler and oil retention valve
- ❑ Removing and installing ⇒ page 154

8 - Gasket

- ❑ Renew

9 - O-ring

- ❑ Renew

10 - Connection

11 - Bolt

- ❑ 20 Nm

12 - Bracket

13 - Cap

14 - O-ring

- ❑ Renew

15 - Oil pressure switch -F1- / oil pressure switch for reduced oil pressure -F378-

- ❑ up to 08.2010:

◆ Oil pressure switch -F1-

- Black insulation
- Opening/closing pressure 1.2 ... 1.6 bar.
  - from 09.2010 onwards:
- Oil pressure switch for reduced oil pressure -F378-
- Brown insulation
- Opening/closing pressure 0.55 ... 0.85 bar.
  - Checking in Guided Fault Finding ⇒ Vehicle diagnostic, testing and information system VAS 5051
  - Removing and installing oil pressure switch -F1- / oil pressure switch for reduced oil pressure -F378- ⇒ page 156
  - 20 Nm

16 - Seal

- Renew

17 - Oil filter housing

- Draining, removing and installing ⇒ Maintenance ; Booklet 810

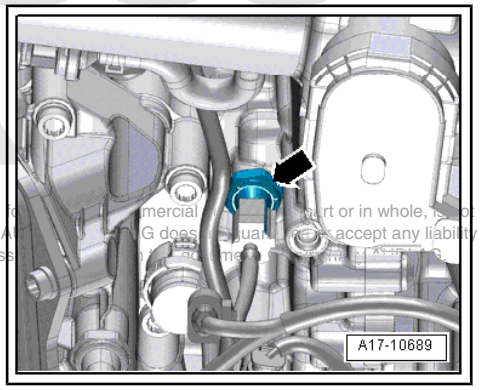
18 - Dust cap

Oil pressure switch -F22- from 09.2010 onwards

- Blue insulation
- Opening/closing pressure 2.15 ... 2.95 bar.
- 20 Nm
- Renew seal

Check in Guided Fault Finding ⇒ Vehicle diagnostic, testing and information system VAS 5051

Removing and installing ⇒ page 157



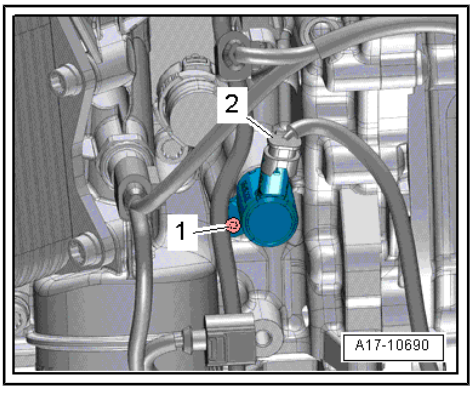
Valve for oil pressure control -N428- from 09.2010 onwards

1 - Bolt

- 9 Nm
- Renew O-ring

2 - Electrical connector

Removing and installing ⇒ page 157



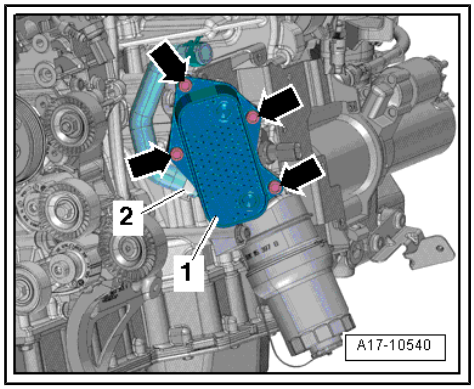
2.2 Removing and installing engine oil cooler

Removing

– Remove thermostat with housing ⇒ page 178 .

Note

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



– Remove bolts -arrows-.
– Detach engine oil cooler -1- and detach coolant hose (release hose clip -2-).

Installing

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

- Tightening torque
⇒ „2.1 Oil filter bracket and engine oil cooler - exploded view“, page 152

Note

Renew all seals and gaskets.

– Install thermostat with housing ⇒ page 178 .
– Check oil level ⇒ Maintenance ; Booklet 810 .

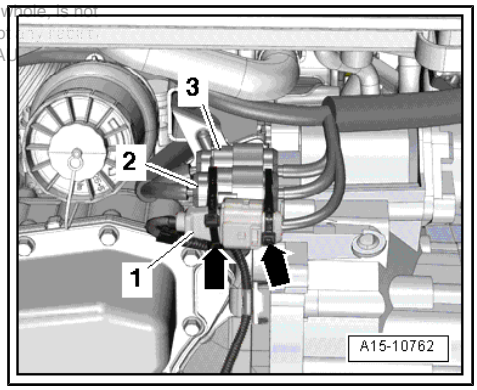
2.3 Removing and installing oil filter bracket with engine oil cooler

Removing

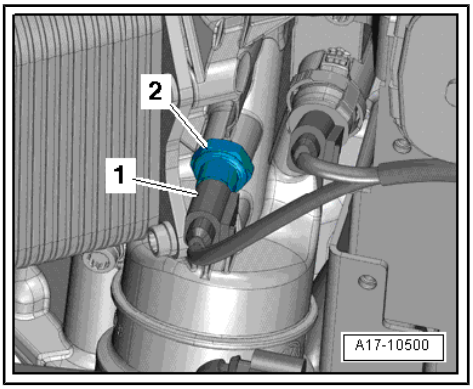
Note

Fit all cable ties in the original positions when installing.

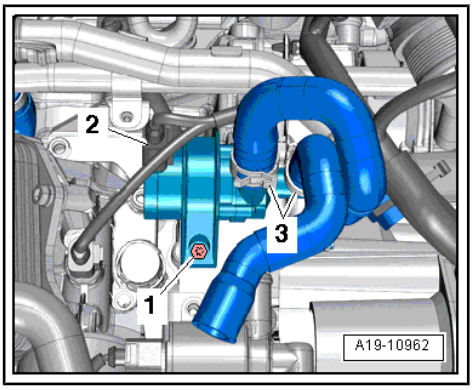
– Drain oil filter housing ⇒ Maintenance ; Booklet 810 .
– Remove front coolant pipes ⇒ page 187 .
– Move clear electrical connector -1- (cut open cable ties -arrows-.
– Detach electrical connectors -2- and -3- from bracket.



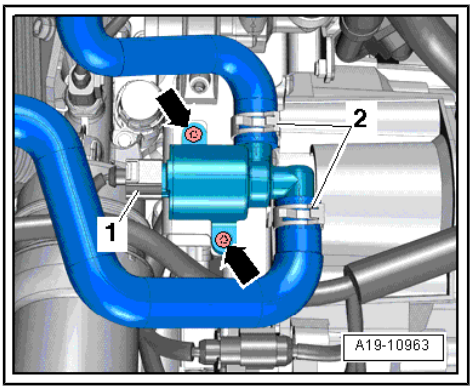
– Unplug electrical connector -1- on oil pressure switch -2-.



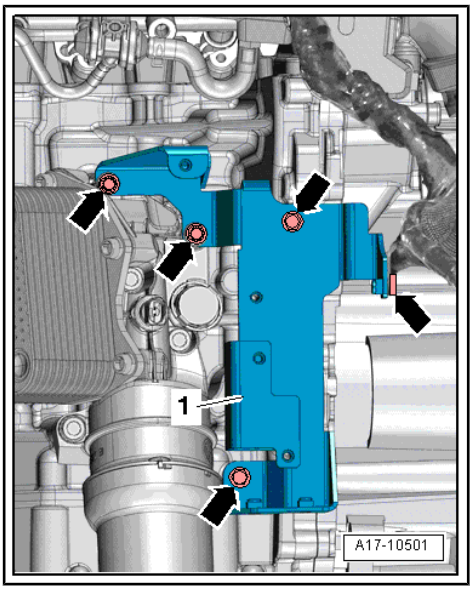
– Unplug electrical connector -2-.
– Unscrew bolt -1- and move continued coolant circulation pump -V51- to one side (coolant hoses -3- remain connected).



– Unplug electrical connector -1-.
– Unscrew bolts -arrows- and move solenoid valve for coolant circuit -N492- to one side (coolant hoses -2- remain connected).

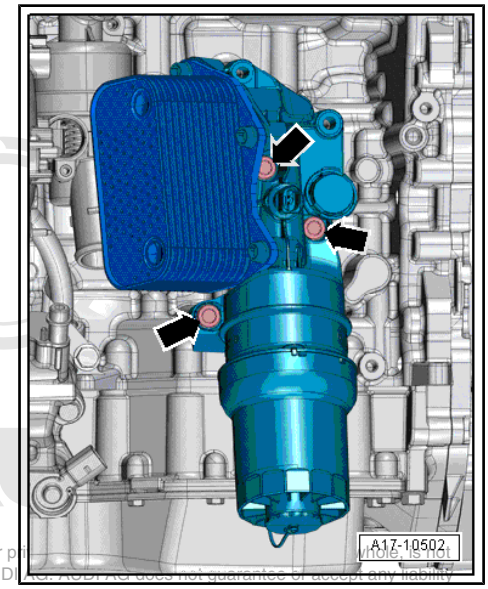


– Unscrew bolts -arrows- and detach bracket -1-.



Note

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



– Unscrew bolts -arrows- and remove oil filter bracket with engine oil cooler.

Installing

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

- Tightening torques
  ⇒ „2.1 Oil filter bracket and engine oil cooler - exploded view“, page 152

Note

Renew seals and/or gaskets.

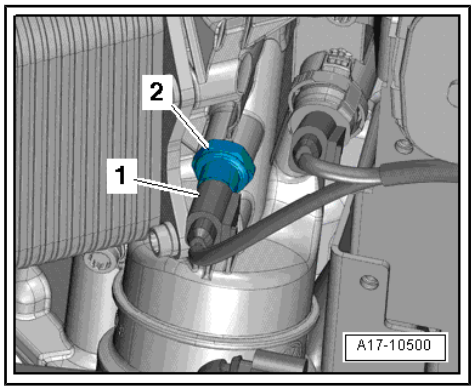
– Install continued coolant circuit pump -V51- and solenoid valve for coolant circuit -N492- ⇒ page 173 .
– Install coolant pipe (left-side) ⇒ page 184 .
– Install coolant pipes (front) ⇒ page 187 .

2.4 Checking oil pressure switch -F1- / oil pressure switch -F22- / oil pressure switch for reduced oil pressure -F378-

Checking oil pressure switch -F1- / oil pressure switch -F22- / oil pressure switch for reduced oil pressure -F378- in Guided Fault Finding ⇒ Vehicle diagnostic, testing and information system VAS 5051

2.5 Removing and installing oil pressure switch -F1- / oil pressure switch for reduced oil pressure -F378-

Removing



– Unplug electrical connector -1-.
– Remove oil pressure switch -2-.

Installing

Install in reverse order.

- Tightening torque
  ⇒ „2.1 Oil filter bracket and engine oil cooler - exploded view“, page 152

2.6 Removing and installing oil pressure switch -F22- / valve for oil pressure control -N428- from 09.2010 onwards

Removing

Note

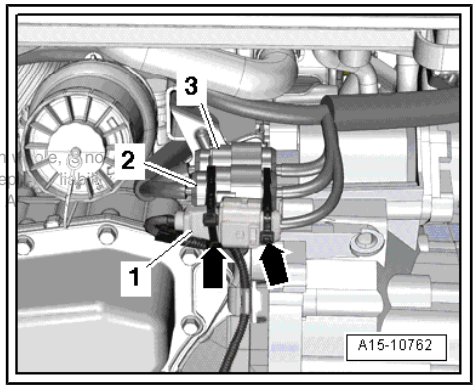
Fit all cable ties in the original positions when installing.

– Drain oil filter housing ⇒ Maintenance ; Booklet 810 .

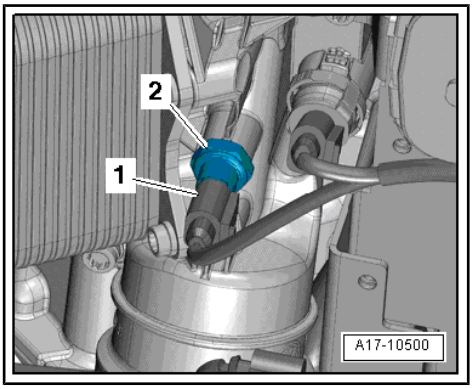
– Remove front coolant pipes ⇒ page 187 .

– Move clear electrical connector -1- (cut open cable ties -arrows-.

– Detach electrical connectors -2- and -3- from bracket.

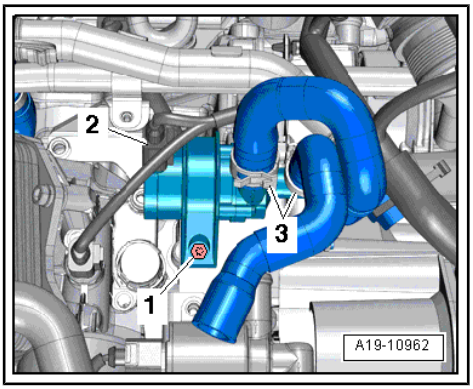


– Unplug electrical connector -1- on oil pressure switch -2-.

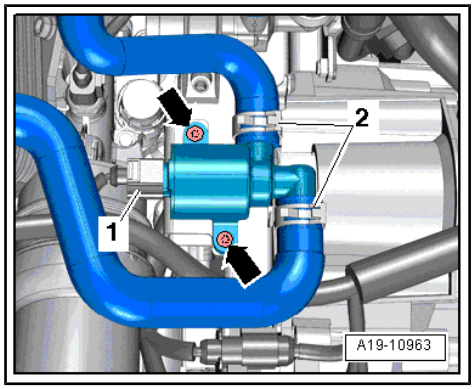


– Unplug electrical connector -2-.

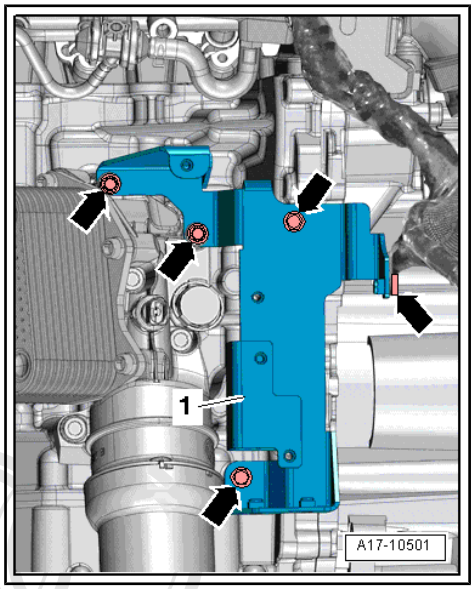
– Unscrew bolt -1- and move continued coolant circulation pump -V51- to one side (coolant hoses -3- remain connected).



– Unplug electrical connector -1-.
– Unscrew bolts -arrows- and move solenoid valve for coolant circuit -N492- to one side (coolant hoses -2- remain connected).



– Unscrew bolts -arrows- and detach bracket -1-.

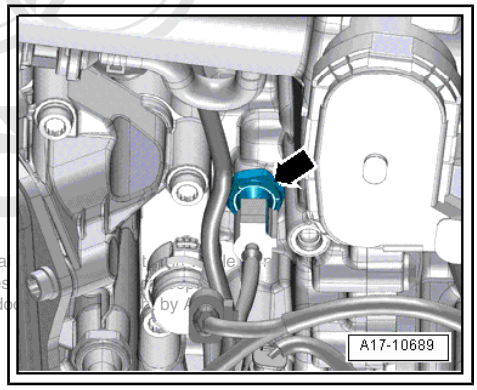


Oil pressure switch -F22- :

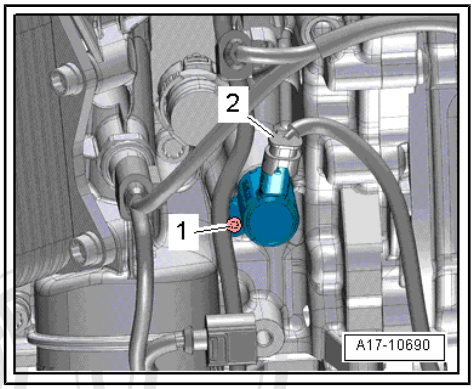
Note

Place a cloth underneath to catch escaping engine oil.

– Unplug electrical connector -arrow-.
– Unscrew oil pressure switch -F22-.



Valve for oil pressure control -N428- :



Note

Place a cloth underneath to catch escaping engine oil.

– Unplug electrical connector -2-.

– Remove bolt -1- and detach valve for oil pressure control -N428- .

Installing

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

Tightening torques

- ⇒ Fig. “ Oil pressure switch -F22- from 09.2010 onwards“ , page 153 .
- ⇒ Fig. “ Valve for oil pressure control -N428- from 09.2010 onwards“ , page 153 .

Note

Renew seal/O-ring.

– Install continued coolant circuit pump -V51- and solenoid valve for coolant circuit -N492- ⇒ page 173 .

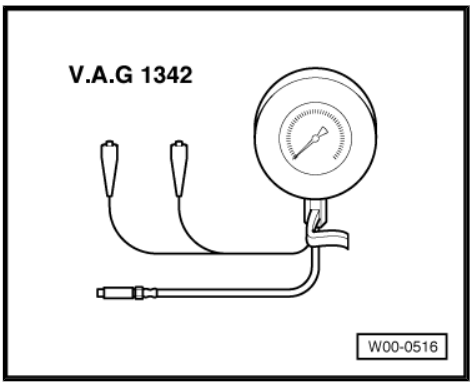
– Install coolant pipe (left-side) ⇒ page 184 .

– Install coolant pipes (front) ⇒ page 187 .

2.7 Checking oil pressure

Special tools and workshop equipment required

♦ Oil pressure tester -V.A.G 1342-



Procedure

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

– Remove oil pressure switch -F1- / oil pressure switch for reduced oil pressure -F378- ⇒ page 156 .

– 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 1.0 bar.
- Oil pressure at 2000 rpm: at least 2.5 bar.

– Install oil pressure switch -F1- / oil pressure switch for reduced oil pressure -F378- ⇒ page 156 .

2.8 Engine oil

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

2.9 Checking oil level

Check oil level ⇒ Maintenance ; Booklet 810 .

19 – Cooling

1 Cooling system

Overview

WARNING

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

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

Note

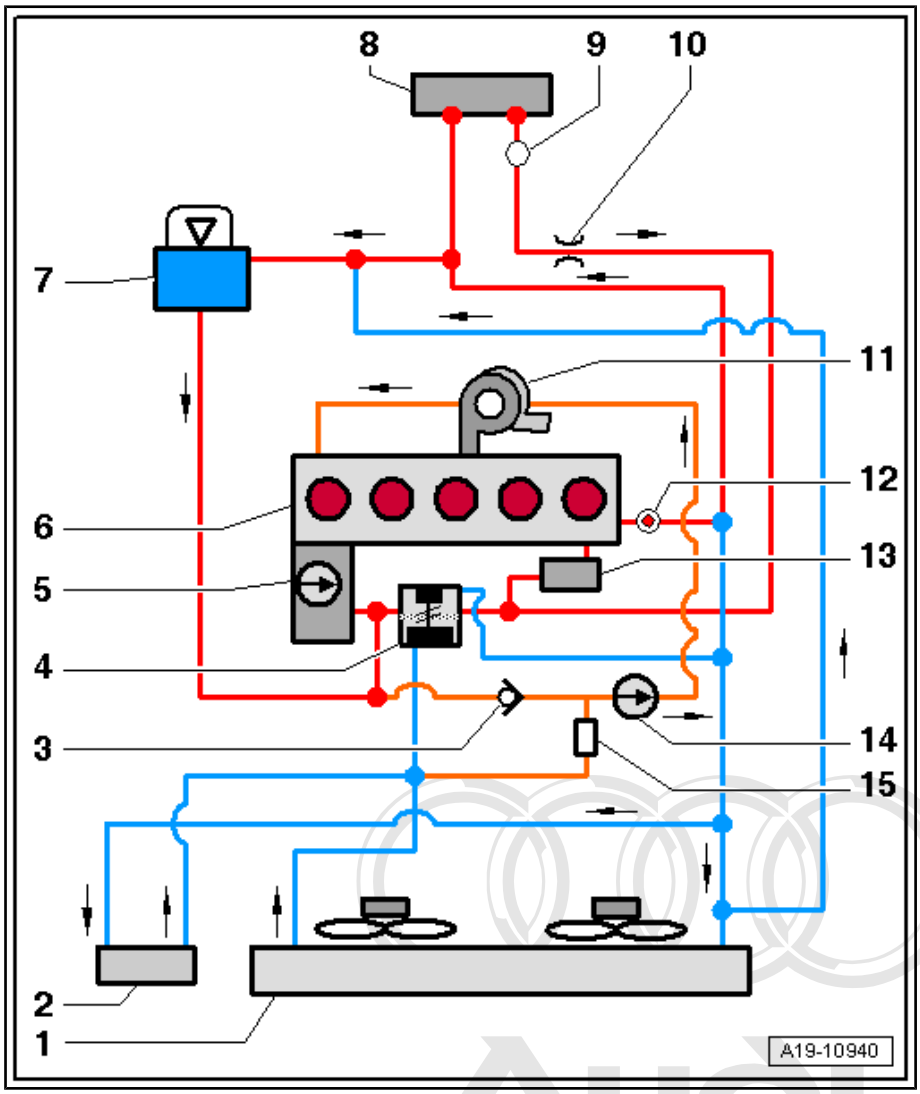
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *The arrow markings on coolant pipes and on ends of hoses must align when installing.*

1.1 Diagram of coolant hose connections

Vehicles with manual gearbox

Note

- *Blue = Large coolant circuit.*
- *Red = Small coolant circuit with heating circuit.*
- *Orange = Coolant circuit for turbocharger.*
- *Arrows show direction of coolant flow.*



1 - Radiator
- ❑ If renewed, refill system with fresh coolant

2 - Auxiliary radiator
- ❑ If renewed, refill system with fresh coolant

3 - Non-return valve
- ❑ Arrow indicates direction of flow

4 - Thermostat with housing

5 - Coolant pump

6 - Cylinder head and cylinder block
- ❑ If renewed, refill system with fresh coolant

7 - Coolant expansion tank
- ❑ With filler cap and pressure relief valve
- ❑ Checking pressure relief valve ⇒ page 171

8 - Heat exchanger for heater
- ❑ If renewed, refill system with fresh coolant

9 - Bleeder screw

10 - Restrictor

11 - Turbocharger

12 - Coolant temperature sender -G62-

13 - Engine oil cooler
- ❑ If renewed, refill system with fresh coolant

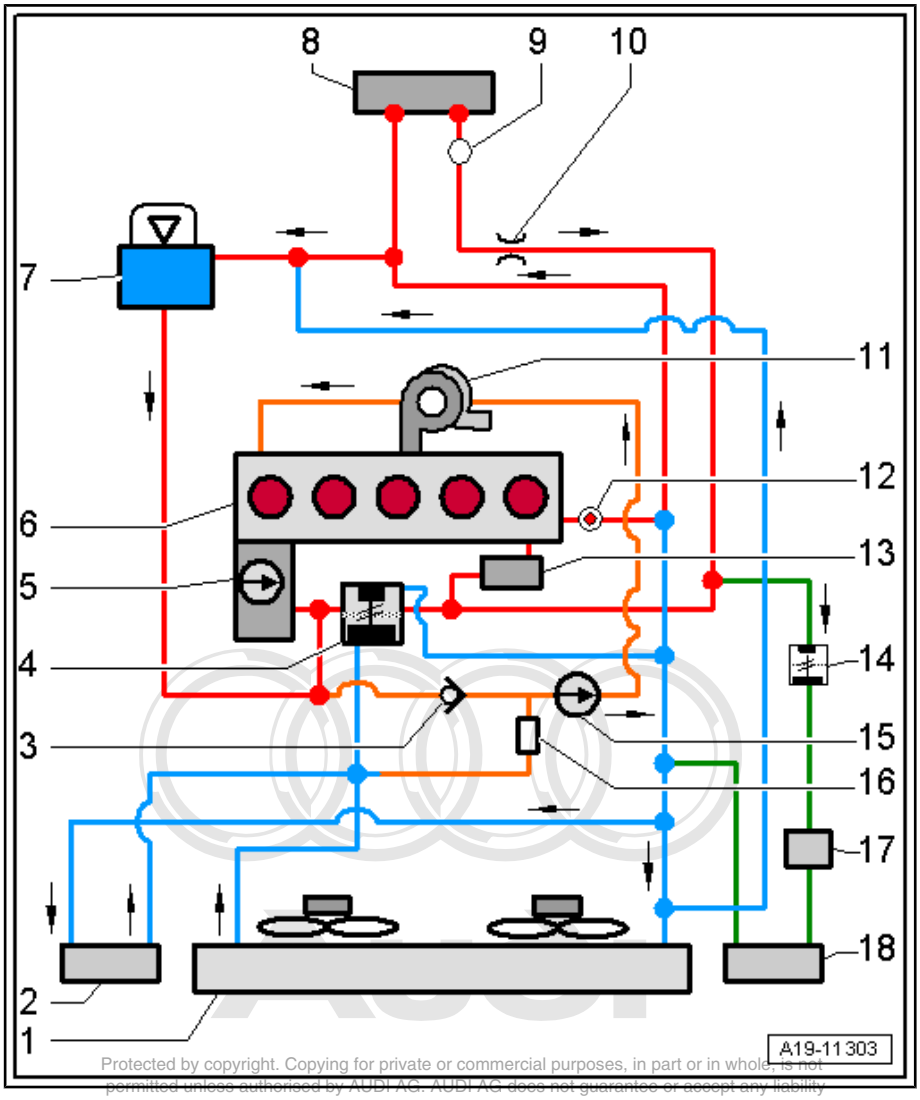
14 - Continued coolant circulation pump -V51-

15 - Solenoid for coolant circuit -N492-

Vehicles with dual clutch gearbox

Note

- *Blue = Large coolant circuit.*
- *Red = Small coolant circuit with heating circuit.*
- *Orange = Coolant circuit for turbocharger.*
- *Green = Gearbox coolant circuit.*
- *Arrows show direction of coolant flow.*



1 - Radiator

- ❑ If renewed, refill system with fresh coolant

2 - Auxiliary radiator (right-side)

- ❑ For coolant
- ❑ If renewed, refill system with fresh coolant

3 - Non-return valve

- ❑ Arrow indicates direction of flow

4 - Thermostat with housing

5 - Coolant pump

6 - Cylinder head and cylinder block

- ❑ If renewed, refill system with fresh coolant

7 - Coolant expansion tank

- ❑ With filler cap and pressure relief valve
- ❑ Checking pressure relief valve ⇒ page 171

8 - Heat exchanger for heater

- ❑ If renewed, refill system with fresh coolant

9 - Bleeder screw

10 - Restrictor

11 - Turbocharger

12 - Coolant temperature sender -G62-

13 - Engine oil cooler

- ❑ If renewed, refill system with fresh coolant

14 - Thermostat

- ❑ For gearbox coolant circuit

15 - Continued coolant circulation pump -V51-

16 - Solenoid for coolant circuit -N492-

17 - Heat exchanger

- ❑ For gear oil

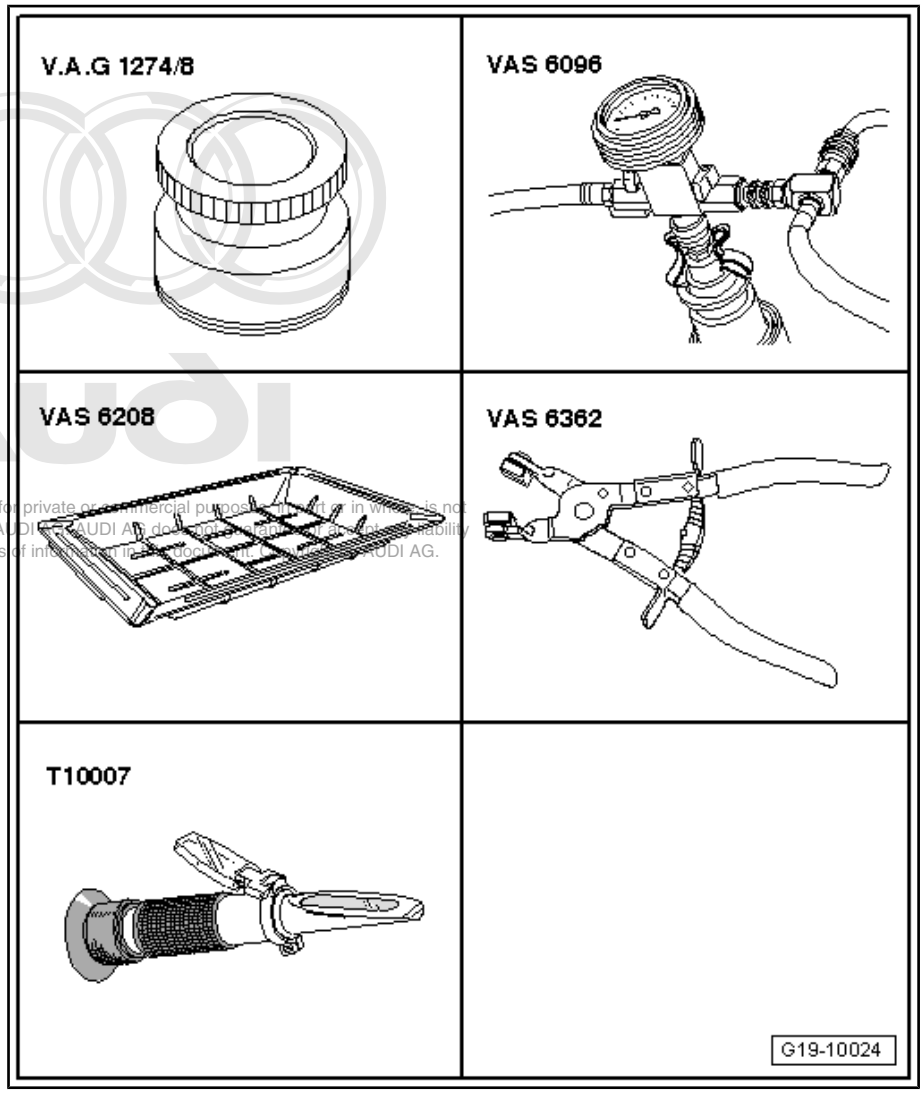
18 - Auxiliary radiator (left-side)

- ❑ For gearbox coolant circuit
- ❑ If renewed, refill system with fresh coolant

1.2 Draining and filling cooling system

Special tools and workshop equipment required

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



Draining

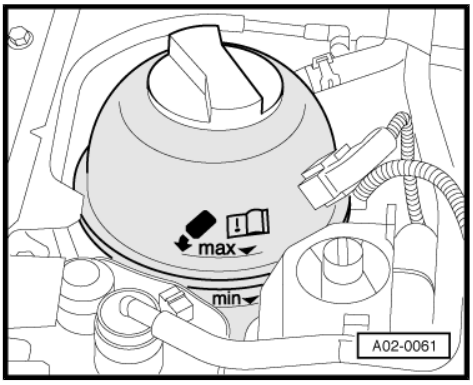
Note

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

WARNING

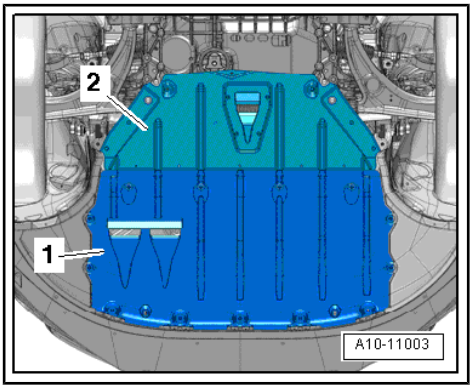
Hot steam/hot coolant can escape - risk of scalding.

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



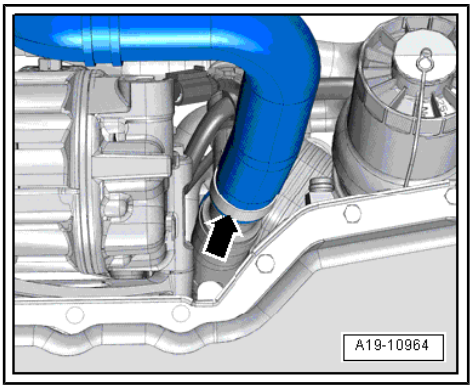
– Open filler cap on coolant expansion tank.

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

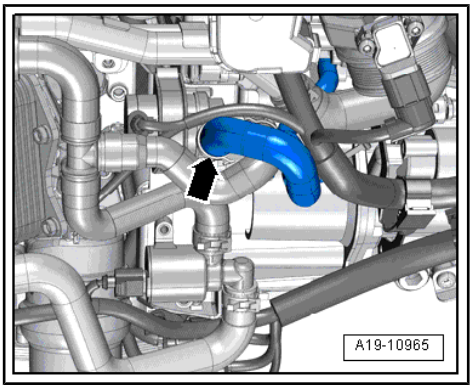


– Place drip tray for workshop hoist -VAS 6208- beneath engine.

– Release hose clip -arrow-, disconnect coolant hose and drain off coolant.

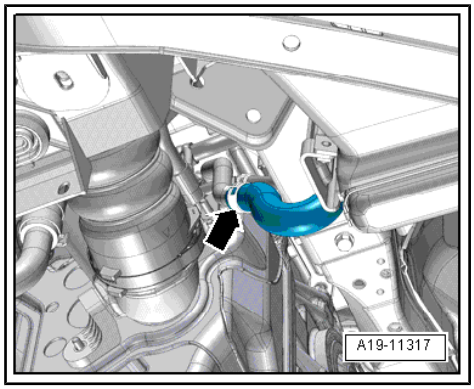


– Release hose clip -arrow-, disconnect coolant hose and drain off coolant.



Vehicles with dual clutch gearbox:

– Release hose clip -arrow-, disconnect coolant hose and drain off coolant.



Filling

Note

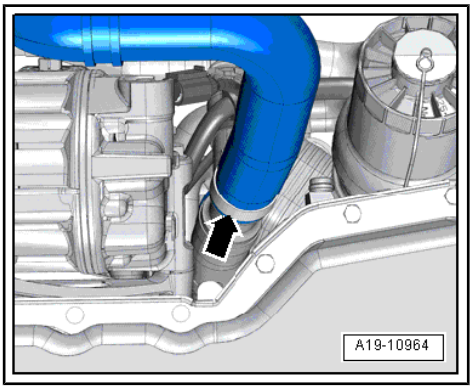
- *The cooling system is filled all year round with a mixture of water and coolant additive. Mixture ratio ⇒ page 166 .*
- *Use only the coolant additive listed in the ⇒ Electronic parts catalogue . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- *The specified coolant (based on recommended mixture ratio) ⇒ page 166 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 coolant additive.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *Frost protection is required down to about –25 °C (in countries with arctic climate: down to about –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 coolant additive 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- .*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

Recommended mixture ratio for coolant

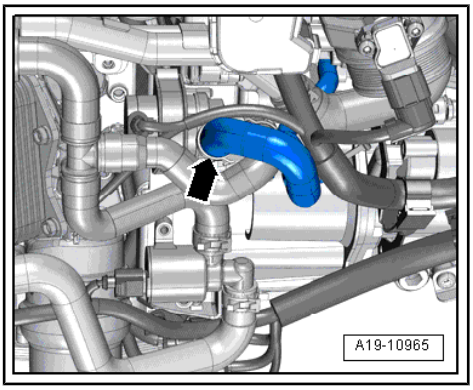
- Coolant (40 %) and water (60 %) for frost protection to –25 °C
- Coolant (50 %) and water (50 %) for frost protection to –35 °C
- Coolant (60 %) and water (40 %) for frost protection to –40 °C
- Coolant ⇒ Electronic parts catalogue

Procedure

– Connect coolant hose -arrow-.

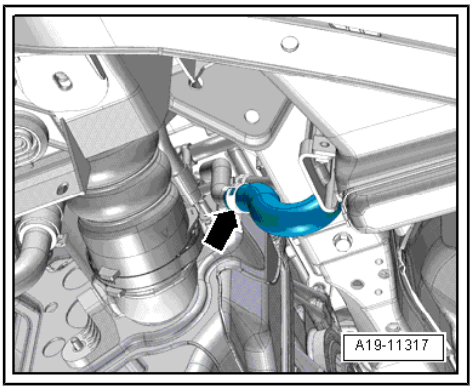


– Connect coolant hose -arrow-.

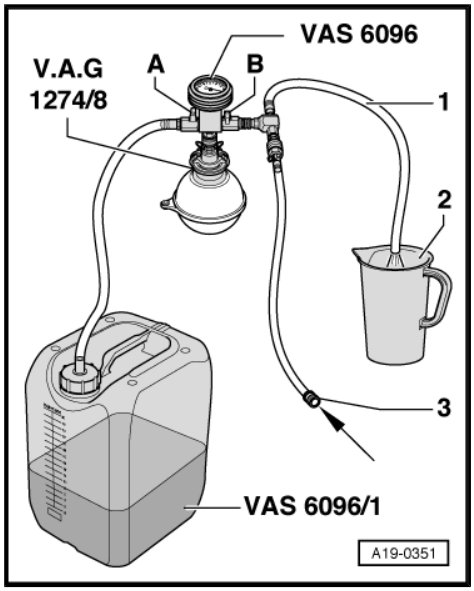


Vehicles with dual clutch gearbox:

– Connect coolant hose -arrow-.



All vehicles (continued):



– Fill reservoir of -VAS 6096- with 10 litres of premixed coolant (according to recommended ratio ⇒ page 166).

– 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-.

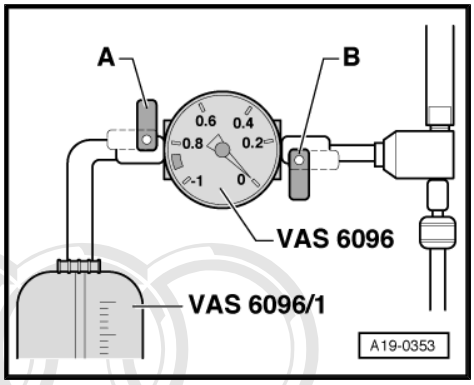
Note

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.*

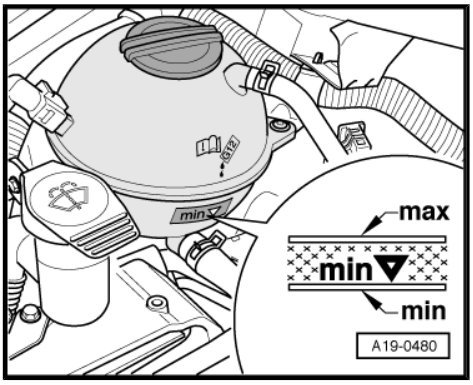
– Detach compressed air hose.

– 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 (make sure it engages).
– 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.



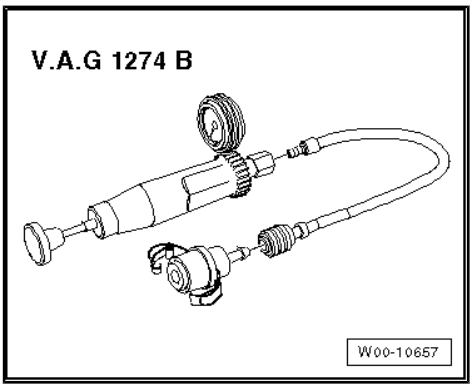
• The coolant level must be between the „min“ and „max“ markings when the engine is cold.
• The coolant level can be at the „max“ marking when the engine is warm.

– Top up with coolant again if necessary.

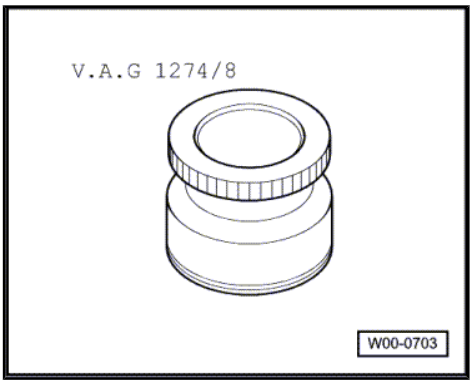
1.3 Checking cooling system for leaks

Special tools and workshop equipment required

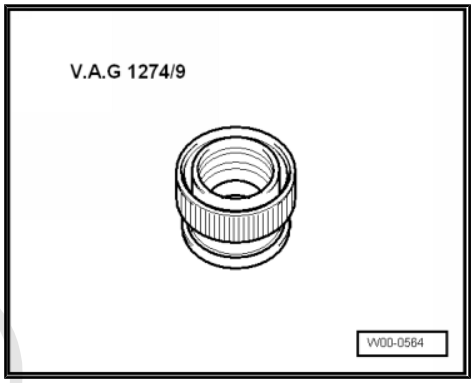
♦ Cooling system tester -V.A.G 1274 B-



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



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



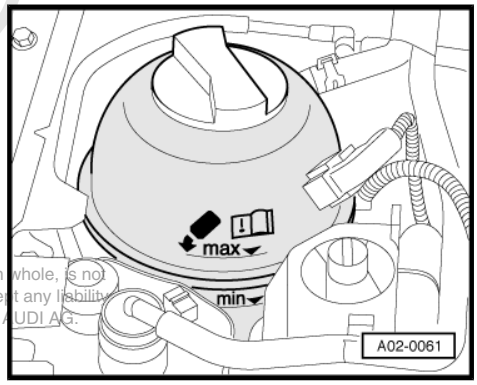
Procedure

- Engine must be warm.

WARNING

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

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

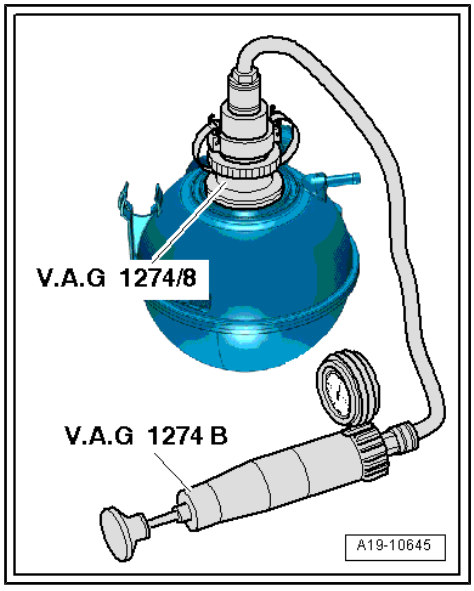


– Open filler cap on coolant expansion tank.

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

– Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.

– If this pressure is not maintained, locate and rectify leaks.



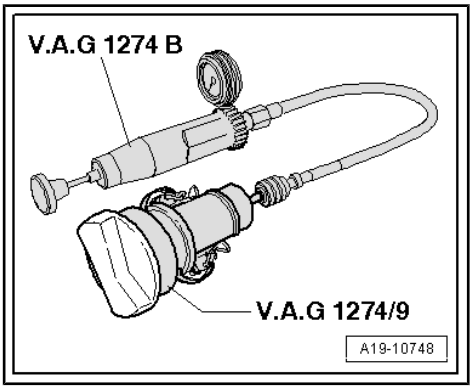
Checking pressure relief valve in filler cap

– Fit cooling system tester -V.A.G 1274 B- with adapter -V.A.G 1274/9- onto filler cap.

– Build up pressure with hand pump on cooling system tester.

• The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

– Renew filler cap if pressure relief valve does not open as described.



2 Coolant pump and thermostat

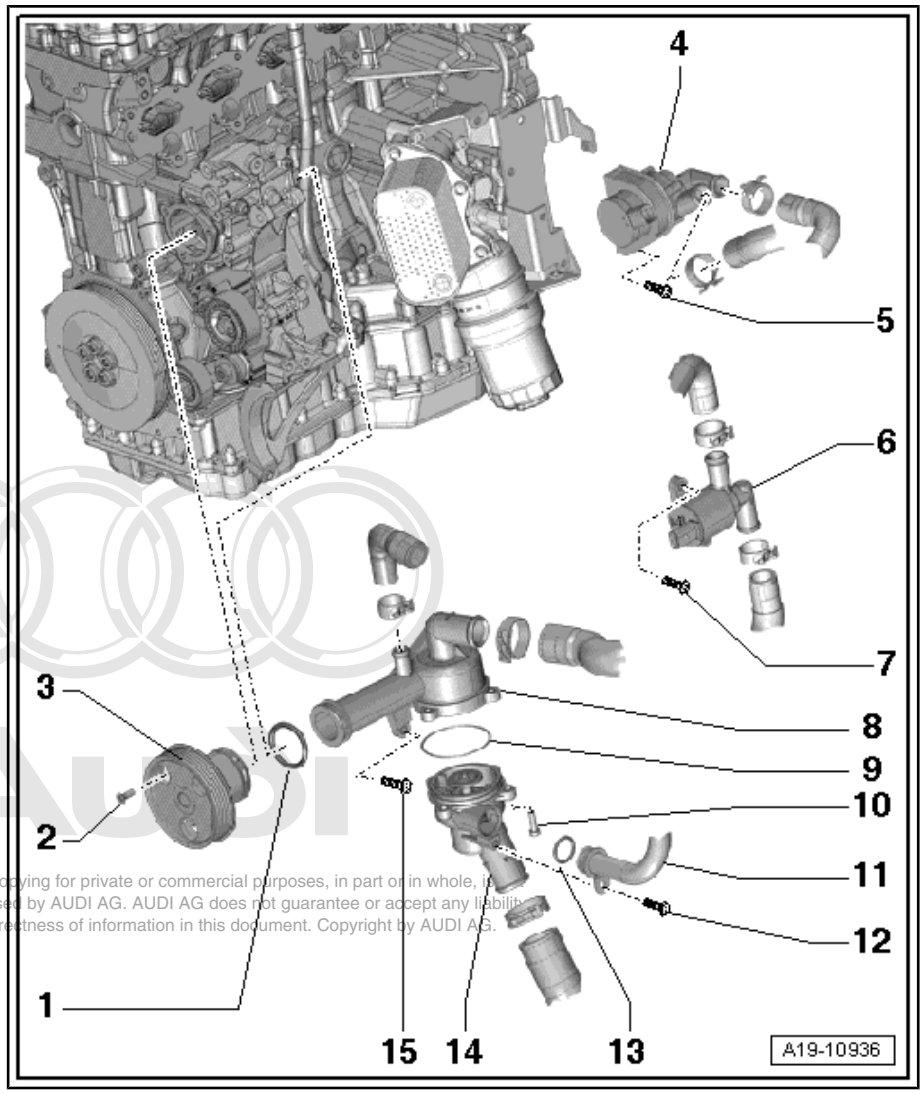
Overview

WARNING

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

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

2.1 Coolant pump and thermostat with housing - exploded view



1 - Seal
- ❑ Renew

2 - Bolt
- ❑ 9 Nm

3 - Coolant pump
- ❑ Removing and installing ⇒ page 176

4 - Continued coolant circulation pump -V51-
- ❑ Removing and installing ⇒ page 173

5 - Bolt
- ❑ 9 Nm

6 - Solenoid for coolant circuit -N492-
- ❑ Removing and installing ⇒ page 175

7 - Bolt
- ❑ 9 Nm

8 - Coolant distributor housing
- ❑ Removing and installing ⇒ page 180

9 - O-ring
- ❑ Renew

10 - Bolt
- ❑ 6 Nm

11 - Coolant pipes (front)

12 - Bolt
- ❑ 9 Nm

13 - O-ring
- ❑ Renew

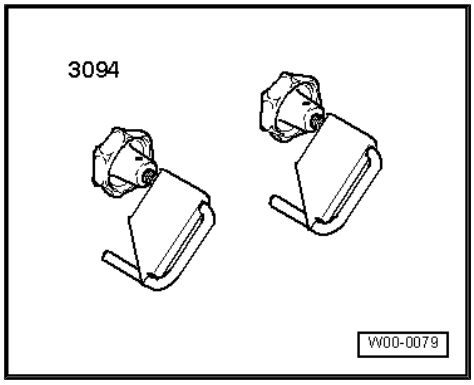
14 - Thermostat with housing
- ❑ Removing and installing ⇒ page 178

15 - Bolt
- ❑ 9 Nm

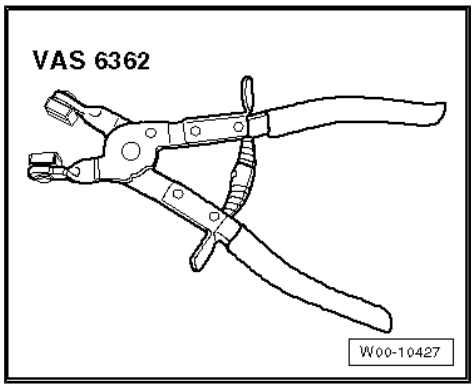
2.2 Removing and installing continued coolant circulation pump -V51-

Special tools and workshop equipment required

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

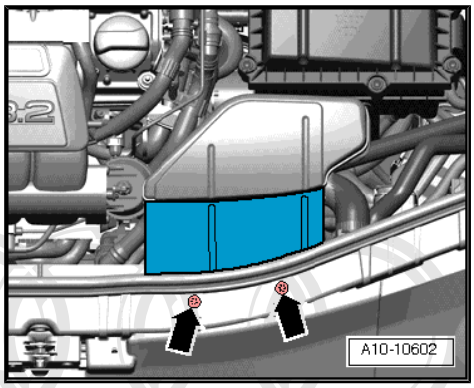


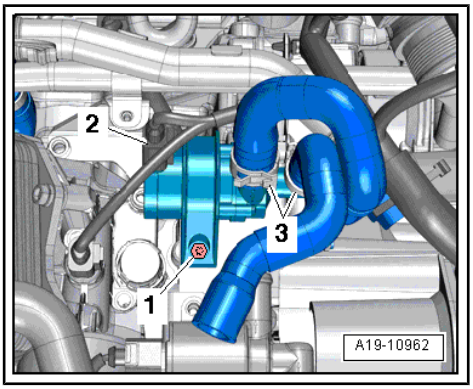
♦ Hose clip pliers -VAS 6362-



Removing

– Unscrew bolts -arrows- and remove front air duct.





Note

Place a cloth underneath to catch escaping coolant.

– Unplug electrical connector -2-.
– Clamp off coolant hoses -3- with hose clamps up to 25 mm -3094- and detach.
– Remove bolt -1- and detach continued coolant circulation pump -V51- .

Installing

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

- Tightening torque
⇒ „2.1 Coolant pump and thermostat with housing - exploded view“, page 173

Note

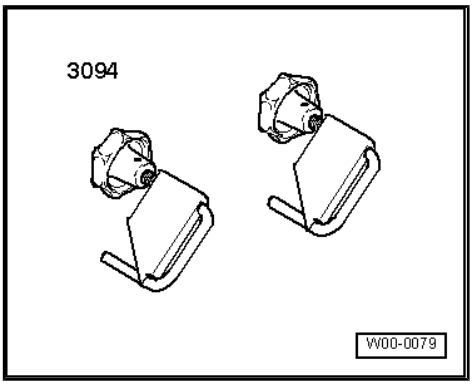
Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

– Install front air duct ⇒ Rep. gr. 24 .
– Check coolant level ⇒ page 169 .

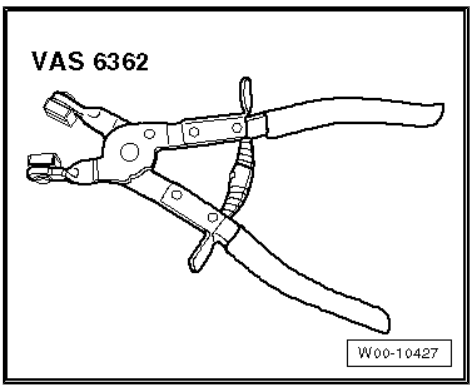
2.3 Removing and installing solenoid valve for coolant circuit -N492-

Special tools and workshop equipment required

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

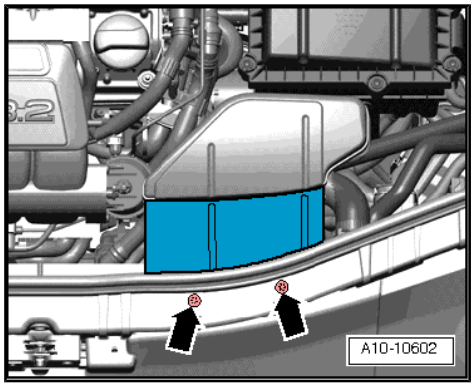


♦ Hose clip pliers -VAS 6362-



Removing

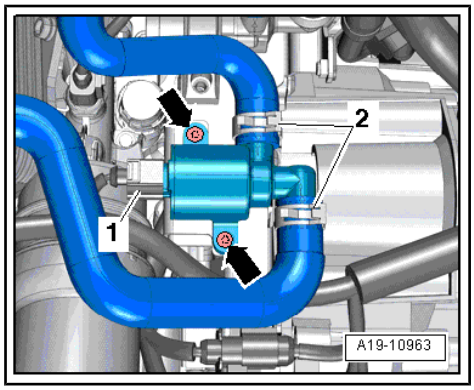
– Unscrew bolts -arrows- and remove air duct.



Note

Place a cloth underneath to catch escaping coolant.

– Unplug electrical connector -1-.
– Clamp off coolant hoses -2- with hose clamps up to 25 mm -3094- and detach.
– Remove bolts -arrows- and detach solenoid valve for coolant circuit -N492- .



Installing

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

- Tightening torque
  ⇒ „2.1 Coolant pump and thermostat with housing - exploded view“, page 173

Note

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

– Install front air duct ⇒ Rep. gr. 24 .
– Check coolant level ⇒ page 169 .

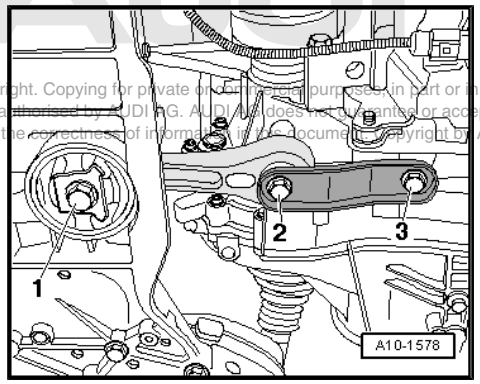
2.4 Removing and installing coolant pump

Removing

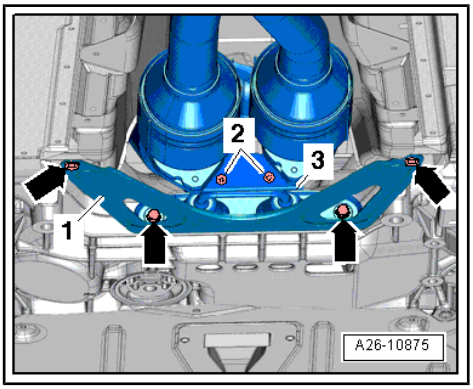
– Drain coolant ⇒ page 164 .
– Remove bolts -2- and -3-.

Note

Disregard -item 1-.



– Unscrew bolts -arrows- and detach cross piece -1-.



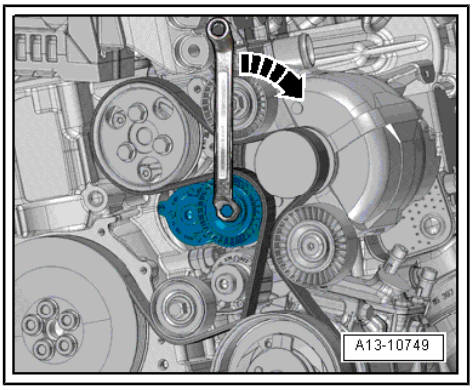
Note

Disregard -items 2, 3-.

– Remove engine mounting ⇒ page 49 .

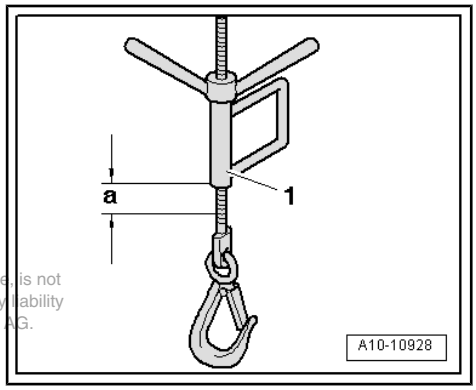
– To slacken poly V-belt turn tensioner in clockwise direction -arrow-.

– Remove poly V-belt from alternator and release tensioner.

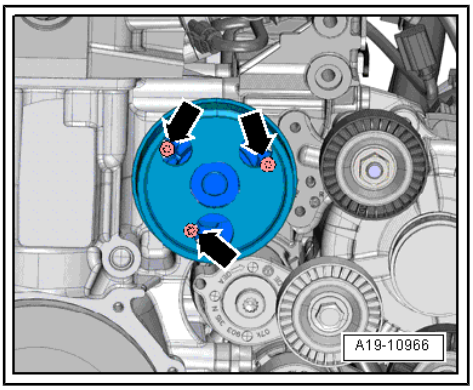


– Use spindle (left-side) to raise engine through distance -a-.

• Distance -55 mm-.



– Remove bolts -arrows- (access via holes in poly V-belt pulley) and detach coolant pump.



Installing

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

• Tightening torque
⇒ „2.1 Coolant pump and thermostat with housing - exploded view“, page 173

– Clean and smoothen sealing surface for integrated silicone seal on coolant pump.

– Install engine mountings ⇒ page 49 .

– Install poly V-belt for alternator and coolant pump ⇒ page 56 .

– Install cross piece ⇒ page 223 .

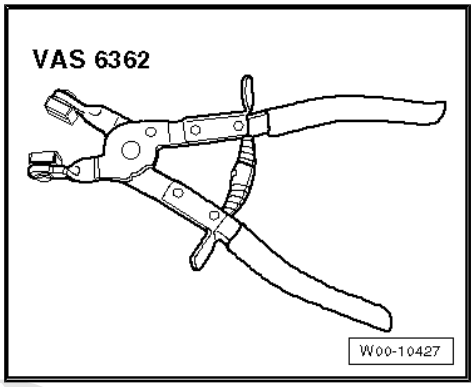
– Install pendulum support ⇒ Rep. gr. 34 .

– Fill up with coolant ⇒ page 166 .

2.5 Removing and installing thermostat with housing

Special tools and workshop equipment required

- Hose clip pliers -VAS 6362-

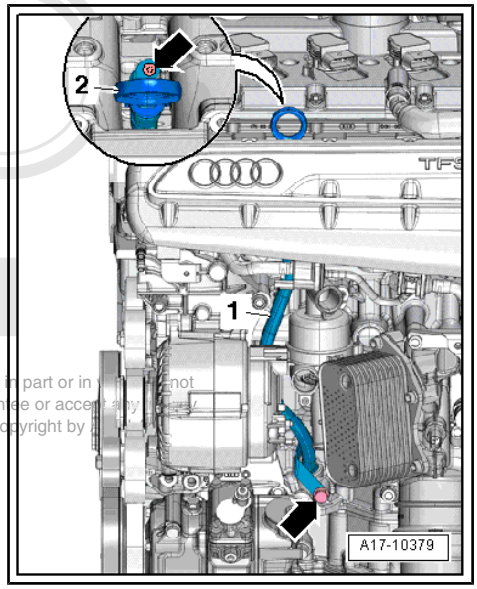


Removing

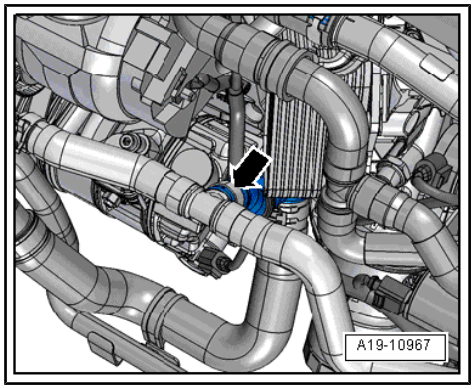
– Drain coolant ⇒ page 164 .

– Pull out oil dipstick -2-.

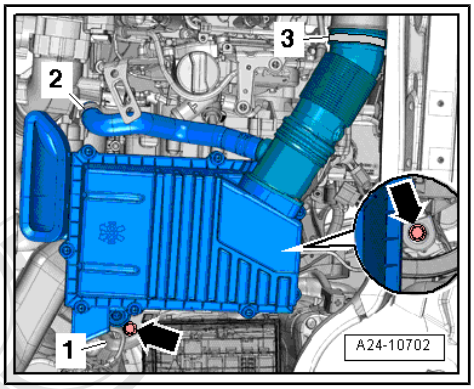
– Remove bolts -arrows- and lift off guide tube -1- for oil dipstick.



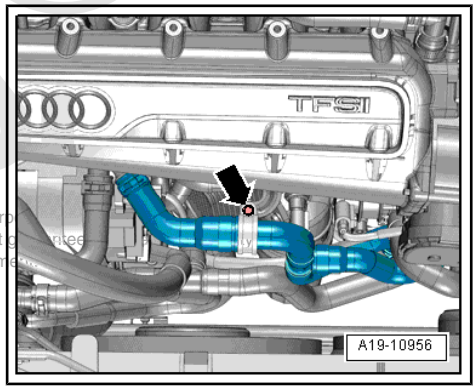
– Release hose clip -arrow- and disconnect coolant hose from T-piece.



– Remove air cleaner housing ⇒ Rep. gr. 24 .



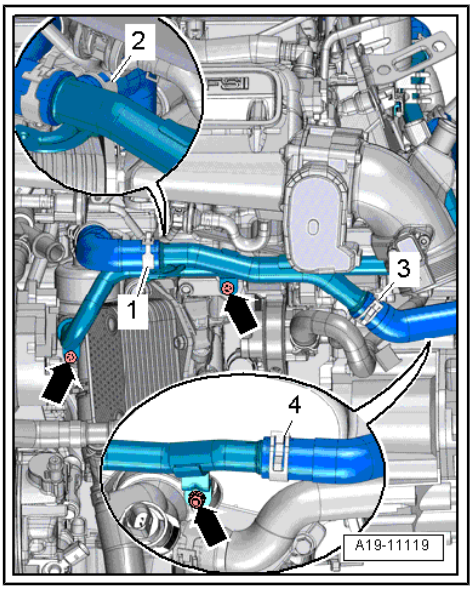
– Remove bolt -arrow- from retaining clamp.



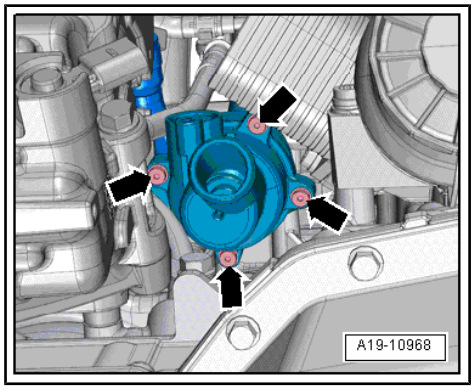
– Release hose clip -1- and detach coolant hose.
– Remove bolts and nut -arrows- and detach front coolant pipes from thermostat housing.

Note

Disregard -items 2, 3, 4-.



– Remove bolts -arrows- and detach thermostat housing.



Installing

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

- Tightening torque
  ⇒ „2.1 Coolant pump and thermostat with housing - exploded view“, page 173

Note

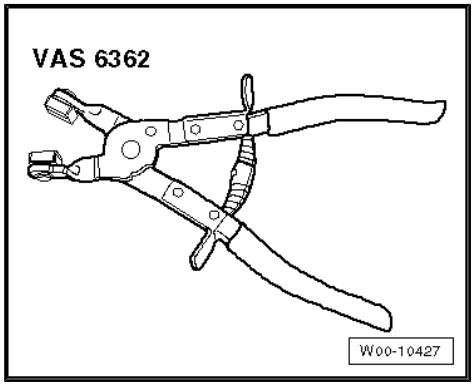
- *Fit new O-ring.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Clean and smoothen sealing surface for O-ring.
– Lubricate O-ring with coolant.
– Install coolant pipes (front) ⇒ page 187 .
– Install air cleaner housing ⇒ Rep. gr. 24 .
– Secure dipstick guide tube ⇒ page 136 .
– Fill up with coolant ⇒ page 166 .

2.6 Removing and installing coolant distributor housing

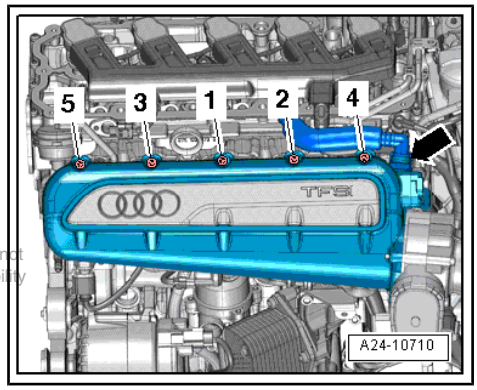
Special tools and workshop equipment required

- Hose clip pliers -VAS 6362-



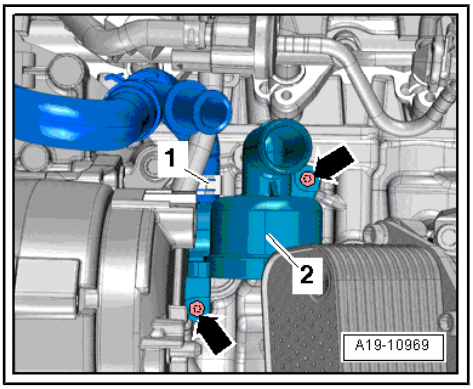
Removing

– Remove intake manifold (top section) ⇒ Rep. gr. 24 .
– Remove thermostat with housing ⇒ page 178 .



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

– Remove bolts -arrows- and detach coolant distributor housing -2- to the left from cylinder block.



Installing

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

- Tightening torques
  ⇒ „2.1 Coolant pump and thermostat with housing - exploded view“, page 173

Note

♦ *Fit new O-rings.*

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

– Clean and smoothen sealing surface for O-ring.

– Lubricate O-ring with coolant and slide onto coolant distributor housing.

– Slide coolant distributor housing into bore in cylinder block.

– Install thermostat with housing ⇒ page 178 .

– Install intake manifold (top section) ⇒ Rep. gr. 24 .

3 Coolant pipes

Overview

3.1 Coolant pipes - exploded view

1 - Coolant pipe (right-side)
- ❑ Removing and installing ⇒ page 186

2 - Bolt
- ❑ 9 Nm

3 - O-ring
- ❑ Renew

4 - Nut
- ❑ 9 Nm

5 - Retaining clip

6 - Coolant temperature sender -G62-
- ❑ Removing and installing ⇒ page 183

7 - O-ring
- ❑ Renew

8 - Coolant hose/pipe connection

9 - Nut
- ❑ 9 Nm

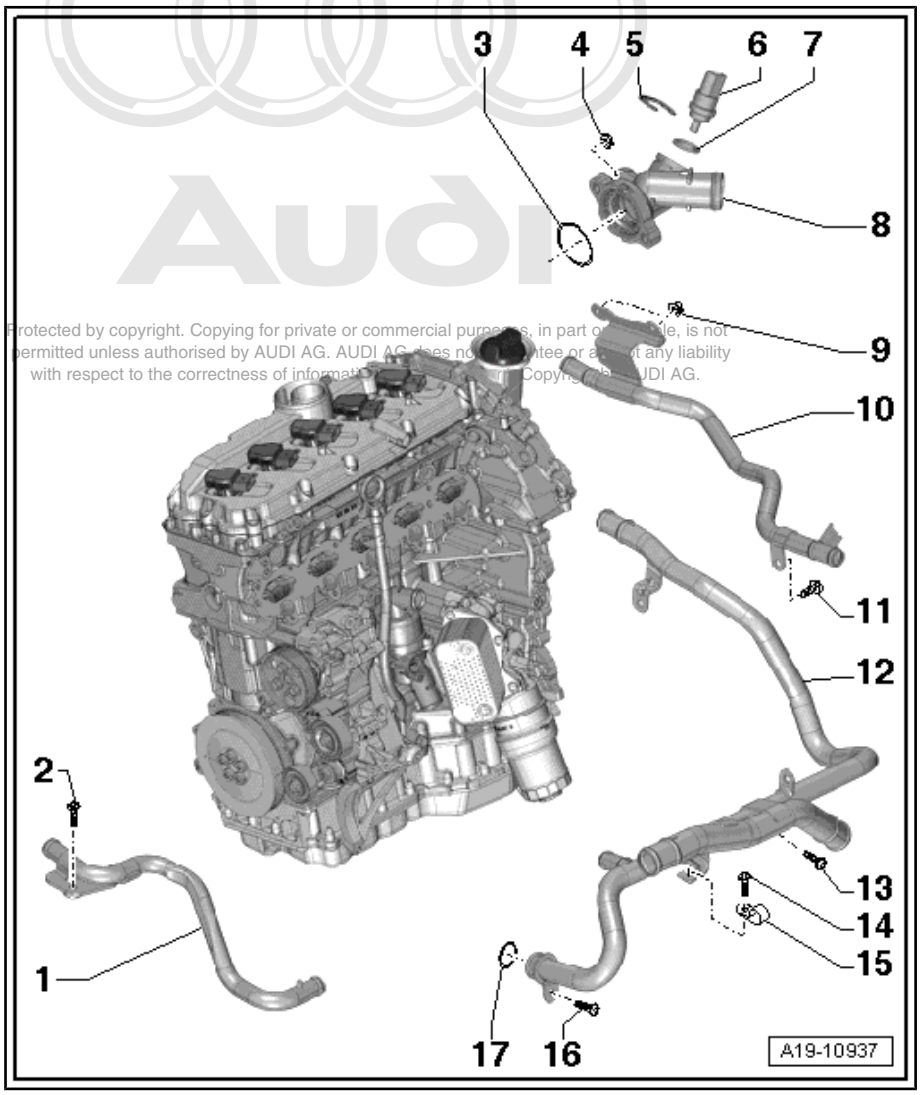
10 - Coolant pipe (left-side)
- ❑ Removing and installing ⇒ page 184

11 - Bolt
- ❑ 9 Nm

12 - Coolant pipes (front)
- ❑ Removing and installing ⇒ page 187

13 - Bolt
- ❑ 9 Nm

14 - Bolt
- ❑ 9 Nm



15 - Retaining clamp

16 - Bolt

❑ 9 Nm

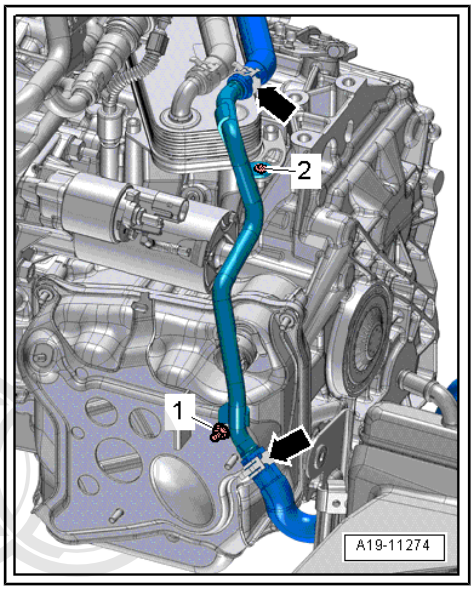
17 - O-ring

❑ Renew

Coolant pipe on gearbox for vehicles with dual clutch gearbox - tightening torques

1 - Nut, 9 Nm

2 - Bolt, 9 Nm

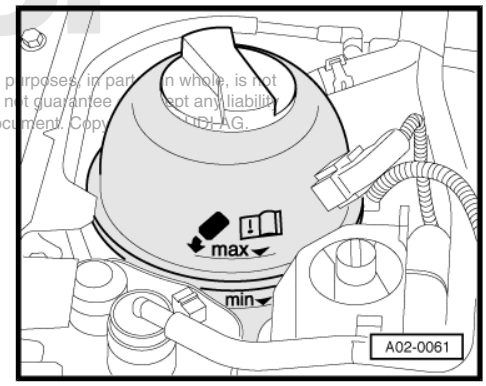


3.2 Removing and installing coolant temperature sender -G62-

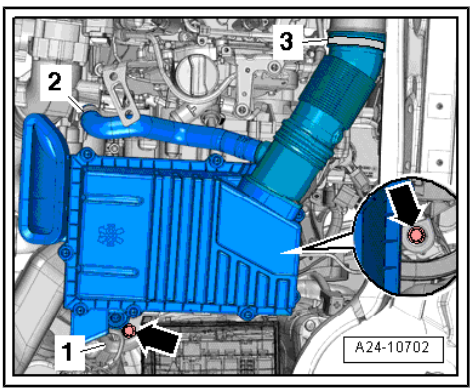
Removing

- Engine cold.

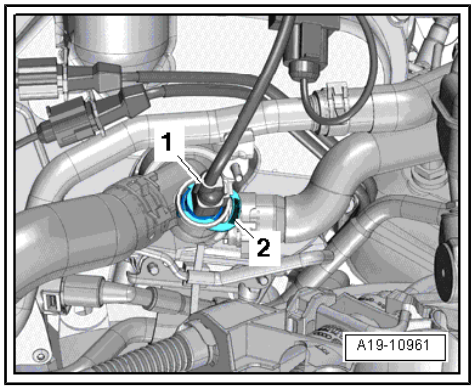
– Open filler cap on coolant expansion tank briefly and allow residual pressure in cooling system to dissipate.



– Remove air cleaner housing ⇒ Rep. gr. 24 .



– Unplug electrical connector -1-.



Note

Place a cloth underneath to catch escaping coolant.

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

Installing

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

Note

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

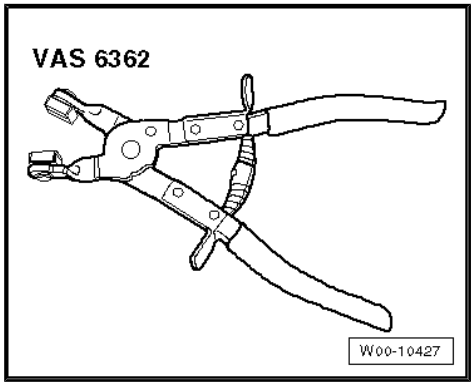
– Install air cleaner housing ⇒ Rep. gr. 24 .

– Check coolant level ⇒ page 169 .

3.3 Removing and installing coolant pipe (left-side)

Special tools and workshop equipment required

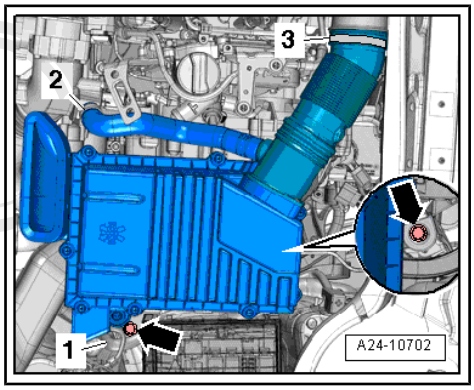
- Hose clip pliers -VAS 6362-



Removing

– Drain coolant ⇒ page 164 .

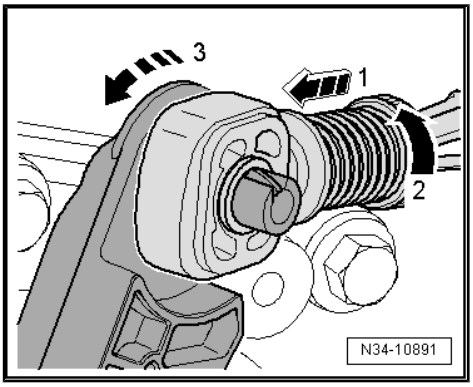
– Remove air cleaner housing ⇒ Rep. gr. 24 .



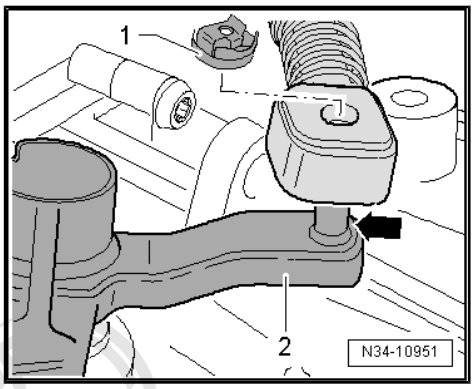
Vehicles with manual gearbox:

– Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.

– Press relay lever towards front -arrow 3-, take gate selector cable out of end-piece.



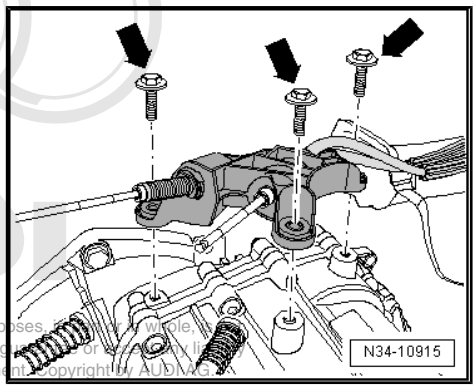
– Detach securing clip -1- for gear selector cable from gearbox selector lever -2- and pull cable off pin -arrow-.



– Remove bolts -arrows-, detach cable support bracket from gearbox and tie up to the left side.

Vehicles with dual clutch gearbox:

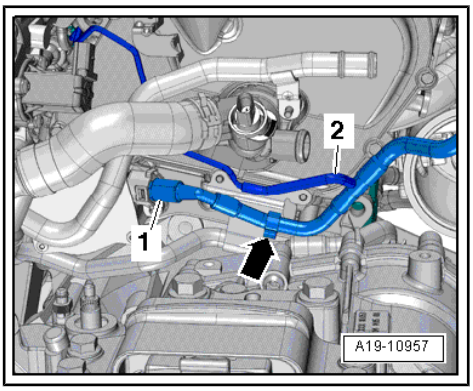
– Remove gearbox oil filter ⇒ Rep. gr. 34 if it is not difficult to access.



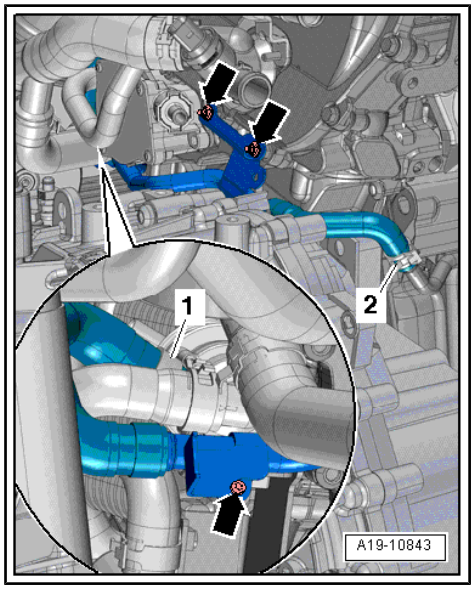
All vehicles (continued):

– Disconnect vacuum hose -2-.

– Move clear vacuum hose -1- -arrow- and disconnect from vacuum pump for brake servo.



– Remove nuts and bolts -arrows-.
– Release hose clip -2- and detach coolant pipe (left-side).



Note

Disregard -item 1-.

Installing

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

- Tightening torque
  ⇒ „3.1 Coolant pipes - exploded view“, page 182

Note

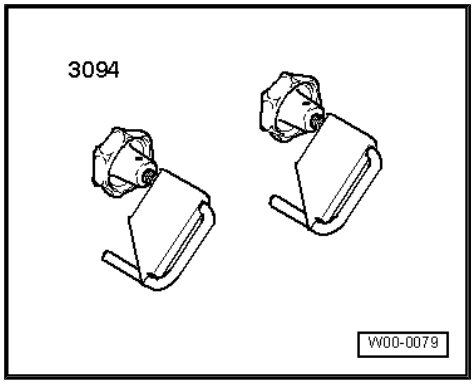
Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

– Installing and adjusting selector mechanism ⇒ Rep. gr. 34 .
– Install air cleaner housing ⇒ Rep. gr. 24 .
– Fill up with coolant ⇒ page 166 .

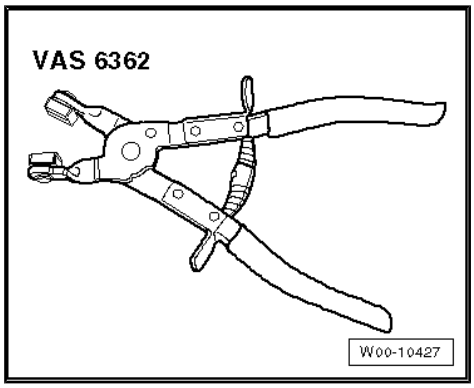
3.4 Removing and installing coolant pipe (right-side)

Special tools and workshop equipment required

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

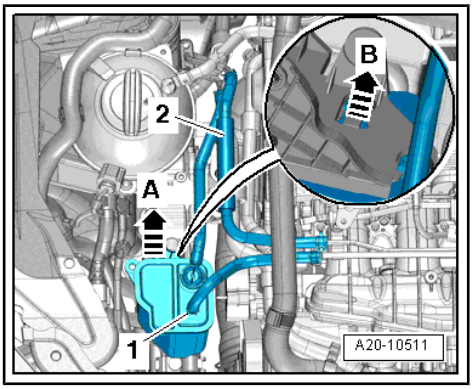


♦ Hose clip pliers -VAS 6362-



Removing

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



Note

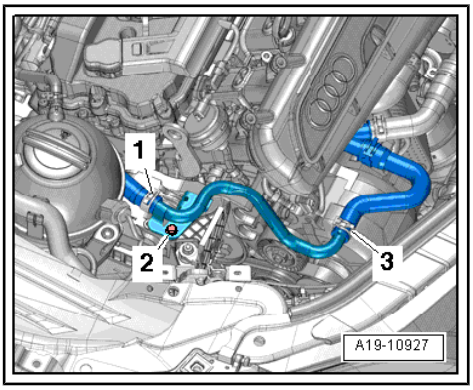
Disregard -item 2-.

Note

Place a cloth underneath to catch escaping coolant.

– Clamp off coolant hoses -1- and -3- using hose clamps for hoses up to 25 mm -3094- and disconnect hoses.

– Unscrew bolt -2- and remove coolant pipe (right-side).



Installing

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

- Tightening torque
  ⇒ „3.1 Coolant pipes - exploded view“, page 182

Note

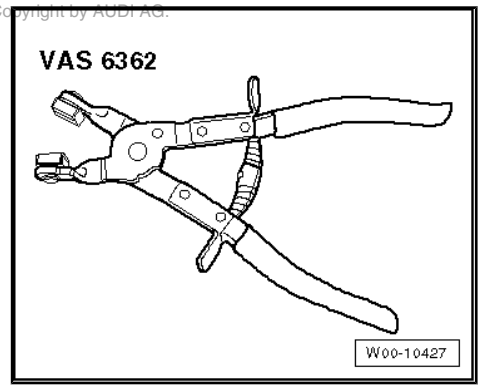
Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

– Check coolant level ⇒ page 169 .

3.5 Removing and installing coolant pipes (front)

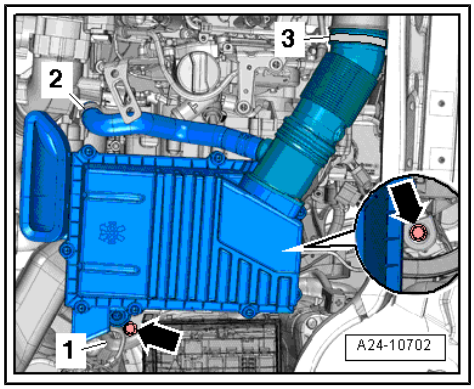
Special tools and workshop equipment required

♦ Hose clip pliers -VAS 6362-

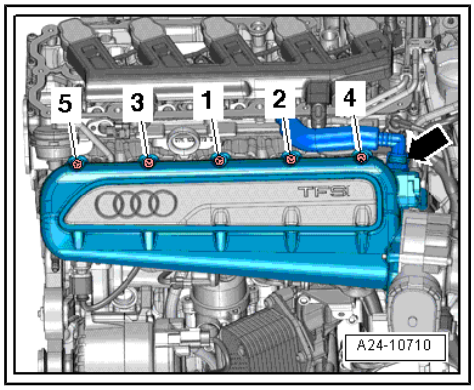


Removing

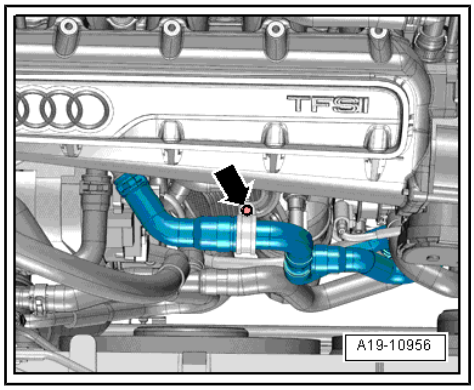
– Remove air cleaner housing ⇒ Rep. gr. 24 .



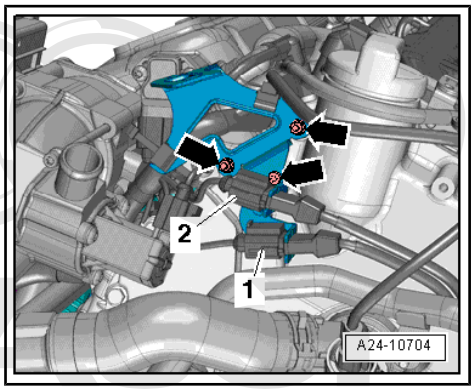
– Remove intake manifold (top section) ⇒ Rep. gr. 24 .
– Drain coolant ⇒ page 164 .



– Remove bolt -arrow- from retaining clamp.



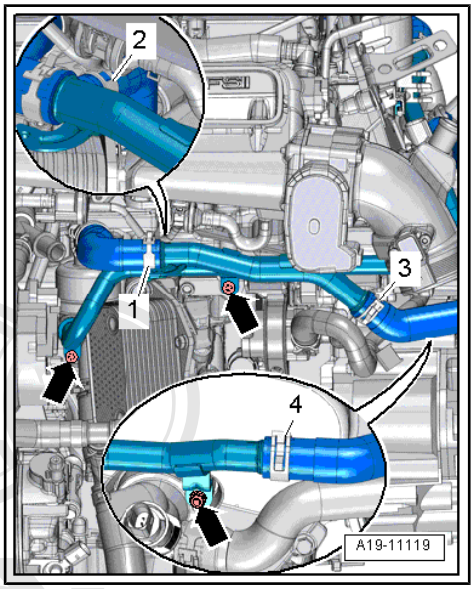
– Detach electrical connectors -1- and -2- from bracket.
– Remove nut and bolt -arrows- and detach bracket.



Vehicles with manual gearbox:

– Release hose clips -1 ... 4- and detach coolant hoses.

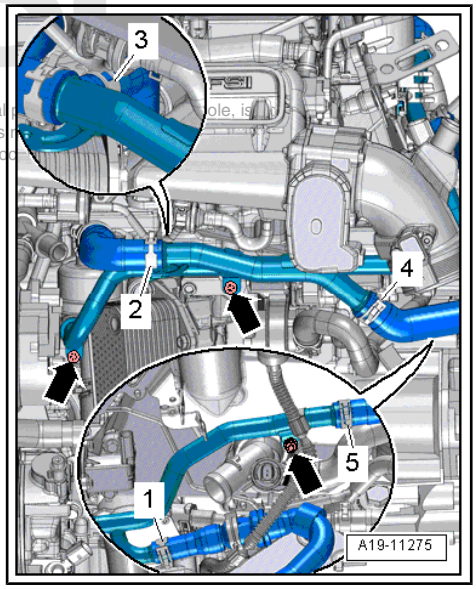
– Remove bolts and nut -arrows- and detach front coolant pipes from thermostat housing.



Vehicles with dual clutch gearbox:

– Release hose clips -1 ... 5- and detach coolant hoses.

– Remove bolts and nut -arrows- and detach front coolant pipes from thermostat housing.



Installing

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

Tightening torques

- ⇒ „3.1 Coolant pipes - exploded view“, page 182 .
- ⇒ „1.1 Timing chain covers - exploded view“, page 79 .

Note

- *Fit new O-ring.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Install exhaust gas temperature sender 1 -G235- ⇒ page 230 .

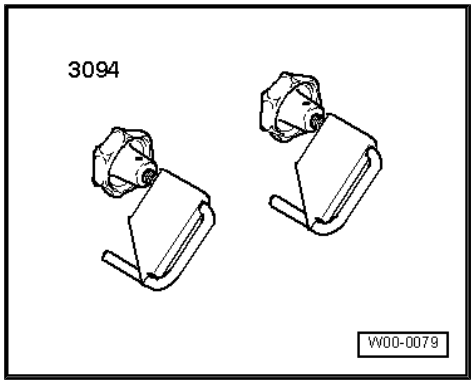
– Install intake manifold (top section) and air cleaner housing ⇒ Rep. gr. 24 .

– Fill up with coolant ⇒ page 166 .

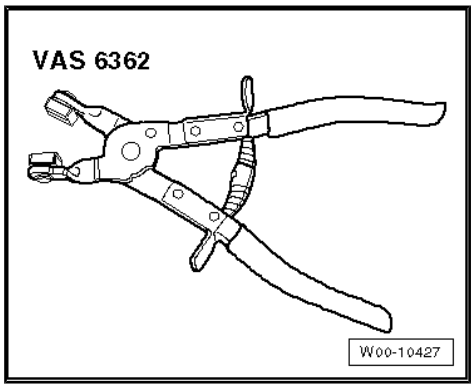
3.6 Removing and installing coolant pipe - vehicles with dual clutch gearbox

Special tools and workshop equipment required

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

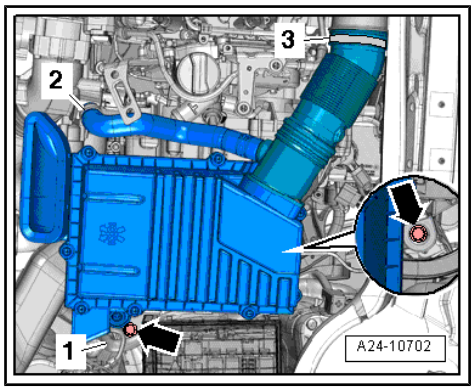


♦ Hose clip pliers -VAS 6362-

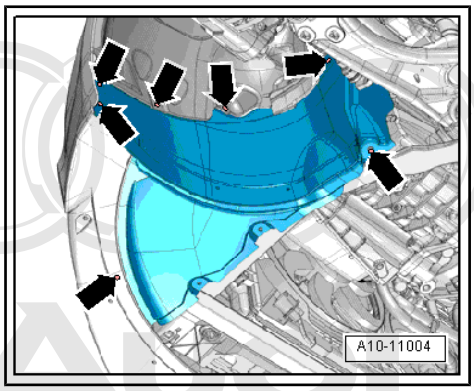


Removing

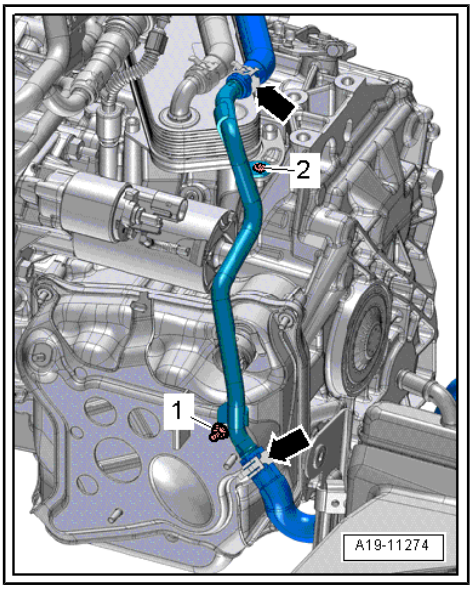
– Remove air cleaner housing ⇒ Rep. gr. 24 .



– Remove bottom section of front wheel housing liner (left-side) ⇒ Rep. gr. 66 .



– Remove nut -1- and bolt -2-.



Note

Place a cloth underneath to catch escaping coolant.

– Clamp off coolant hoses -arrows- with hose clamps up to 25 mm -3094- and detach from coolant pipe.

Installing

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

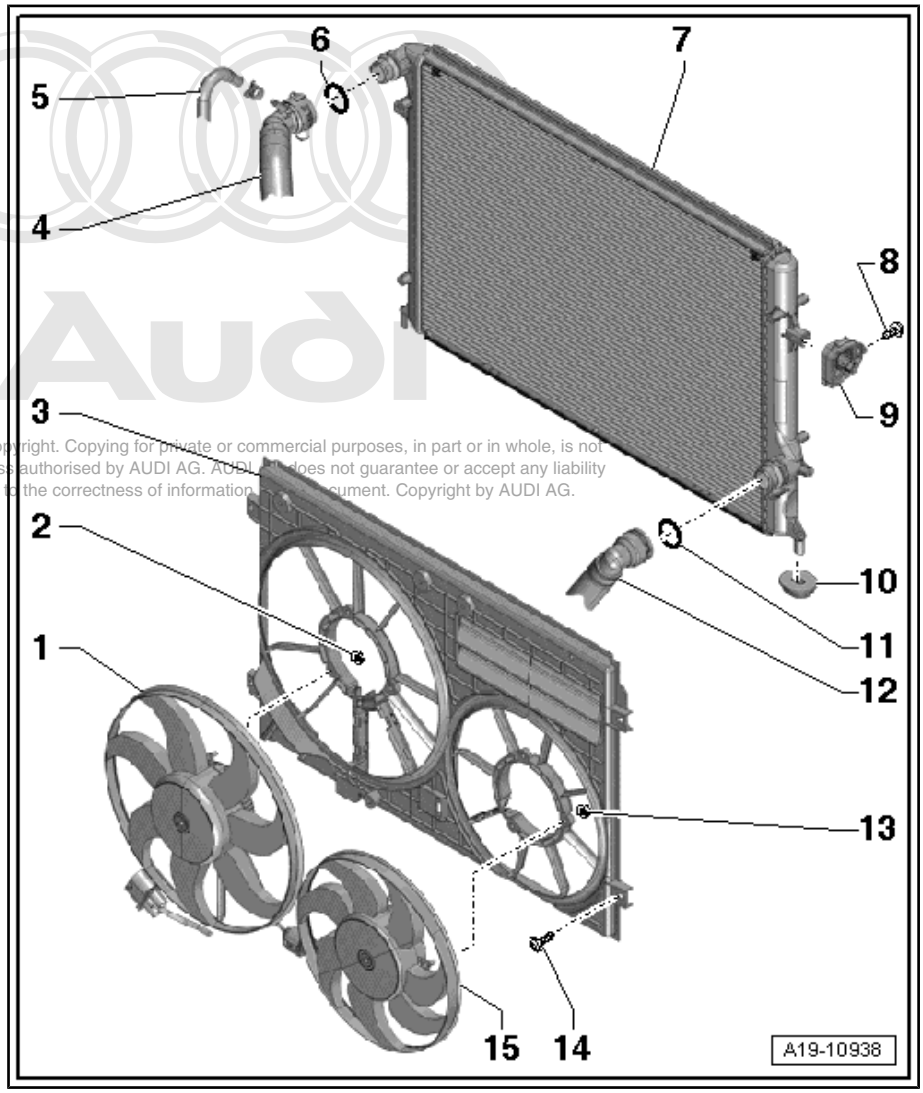
- Tightening torques
  ⇒ Fig. "„Coolant pipe on gearbox for vehicles with dual clutch gearbox - tightening torques"" , page 183
- Install bottom section of front wheel housing liner ⇒ Rep. gr. 66 .
- Install air cleaner housing ⇒ Rep. gr. 24 .
- Check coolant level ⇒ page 169 .

4 Radiators and radiator fans

Overview

4.1 Radiators and radiator fans - exploded view

Radiator, radiator fans



1 - Radiator fan -V7-
- ❑ Removing and installing ⇒ page 203

2 - Nut
- ❑ 10 Nm

3 - Radiator cowl
- ❑ Removing and installing ⇒ page 200

4 - Coolant hose (top)
- ❑ Connecting to radiator ⇒ page 193

5 - Coolant hose

6 - O-ring
- ❑ Renew

7 - Radiator
- ❑ Removing and installing ⇒ page 194
- ❑ If renewed, change coolant in entire system

8 - Bolt
- ❑ 5 Nm

9 - Mounting

10 - Mounting

11 - O-ring
- ❑ Renew

12 - Coolant hose (bottom)
- ❑ Connecting to radiator ⇒ page 193

13 - Nut
- ❑ 10 Nm

14 - Bolt

- ❑ 5 Nm

15 - Radiator fan 2 -V177-

- ❑ Removing and installing ⇒ page 203

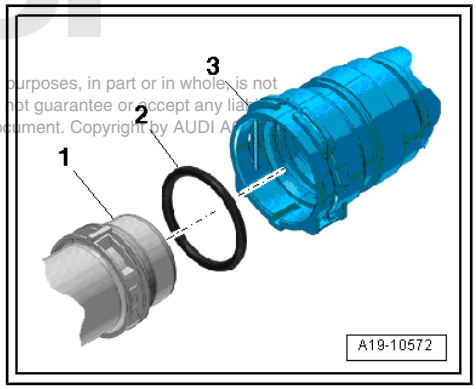
Connecting coolant hose with plug-in connector to radiator

– Remove old O-ring -2- from coolant hose -3-.

– Lightly lubricate new O-ring with coolant 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.



Auxiliary radiator (left-side)

1 - Air duct

2 - Grommet

3 - Bolt

- ❑ 8 Nm

4 - Bracket (top)

5 - Grommet

6 - Bolt

- ❑ 8 Nm

7 - Coolant hoses

8 - Auxiliary radiator (left-side)

- ❑ For gearbox coolant circuit
- ❑ Removing and installing ⇒ page 196

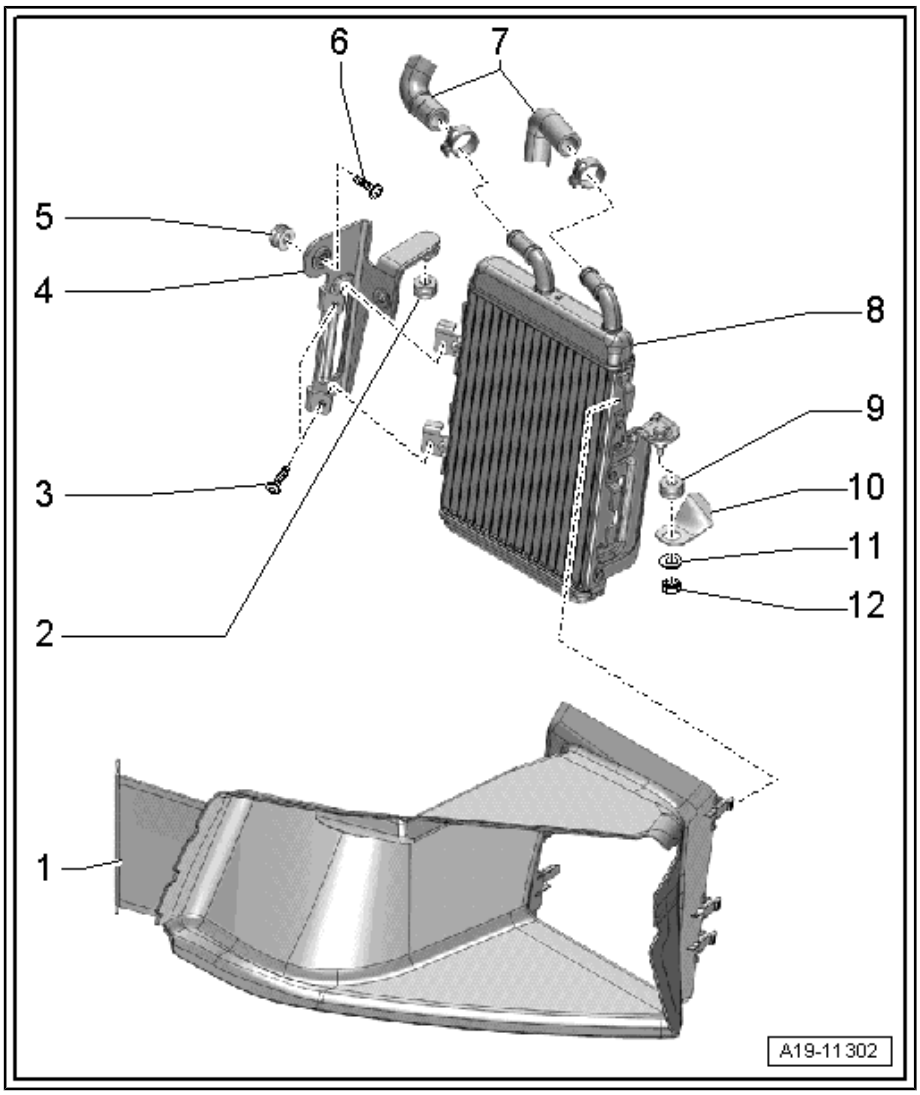
9 - Grommet

10 - Bracket (bottom)

11 - Washer

12 - Nut

- ❑ 8 Nm



Auxiliary radiator (right-side)

1 - Bolt
- ❑ 6.5 Nm

2 - Air duct

3 - Auxiliary radiator (right-side)
- ❑ For coolant
- ❑ Removing and installing ⇒ page 198

4 - Coolant hoses

5 - Bracket (top)

6 - Grommets

7 - Coolant hose

8 - Grommet

9 - Bush

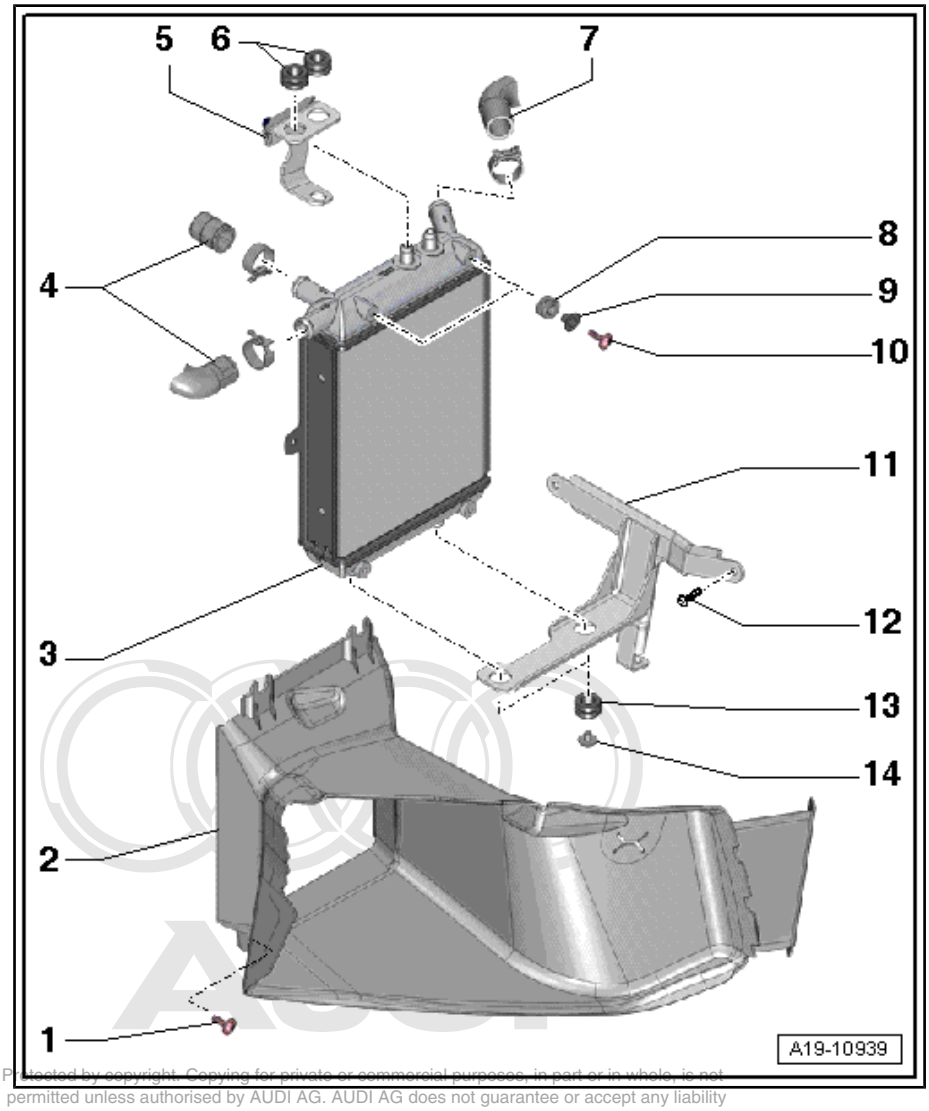
10 - Bolt
- ❑ 6.5 Nm

11 - Bracket (bottom)

12 - Bolt
- ❑ 8 Nm

13 - Grommet

14 - Bolt
- ❑ 6 Nm



4.2 Removing and installing radiator

Removing

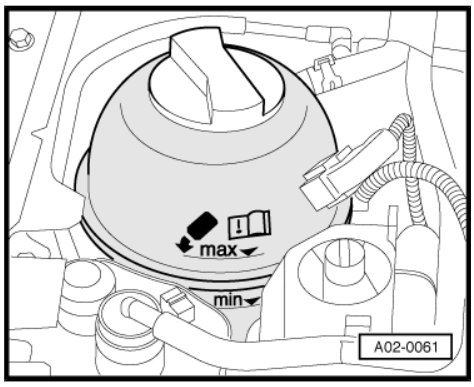
Note

If there are slight impressions on the fins, refer to ⇒ page 8 .

WARNING

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

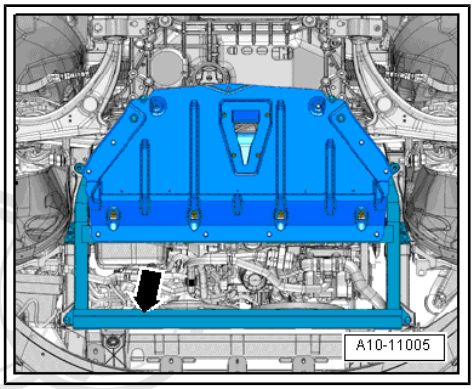
- ***The cooling system is under pressure when the engine is hot.***
- ***To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.***



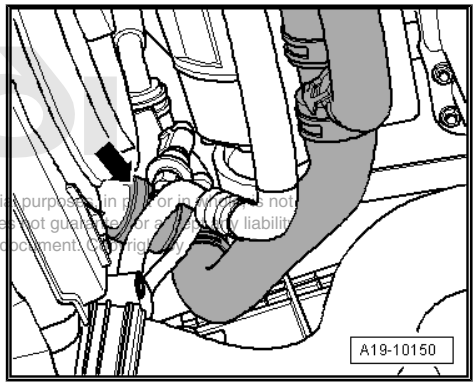
– Open filler cap on coolant expansion tank.

– Remove charge air cooler ⇒ page 218 .

– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. gr. 50 .
– Remove radiator cowl ⇒ page 200 .



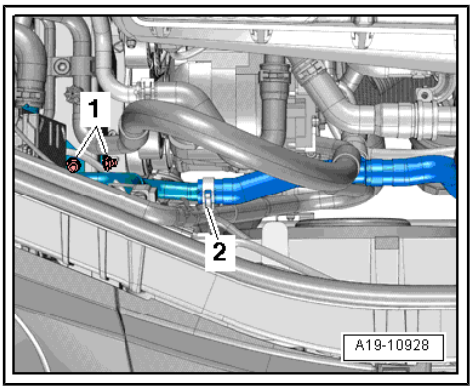
– Place drip tray for workshop hoist -VAS 6208- beneath engine.
– Lift retaining clip -arrow-, disconnect coolant hose (bottom) from radiator and drain off coolant.



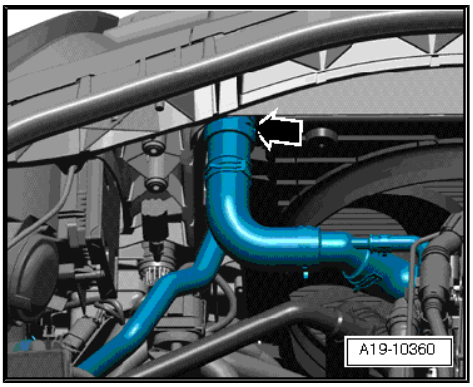
– Remove nuts -1-, press coolant pipe to the rear.

Note

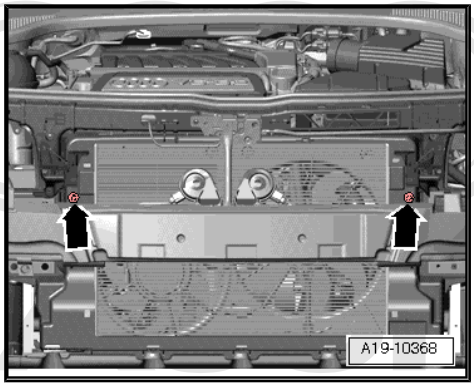
Disregard -item 2-.



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



– Remove bolts -arrows-.
– Swivel top edge of radiator slightly to rear.
– Lift radiator out of bottom mounting points.
– Push radiator towards engine.
– Support radiator from below to prevent radiator from dropping.



WARNING

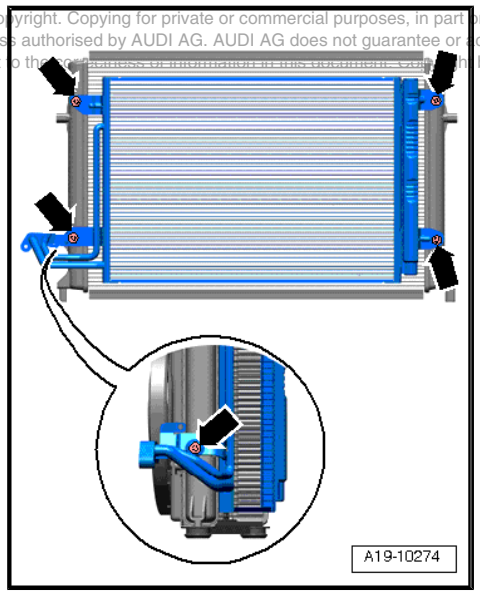
Risk of injury caused by refrigerant.

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

Caution

Make sure that condenser and refrigerant pipes and hoses are not damaged.

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



– Remove bolts -arrows-.
– Disconnect condenser from radiator.
– Move condenser to front and place in lock carrier, then secure with cable ties to prevent from dropping.
– Take out radiator downwards

Installing

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

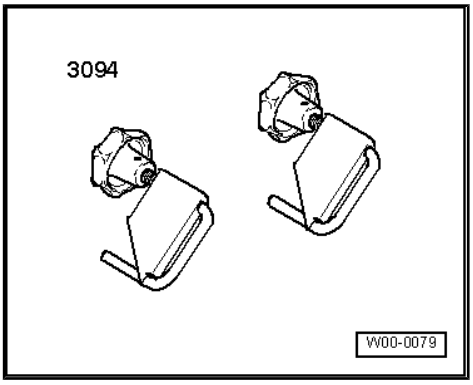
- Tightening torques
  ⇒ „4.1 Radiators and radiator fans - exploded view“, page 192

– Install condenser ⇒ Rep. gr. 87 .
– Install radiator cowl ⇒ page 200 .
– Connect coolant hose with plug-in connector to radiator ⇒ page 193 .
– Install noise insulation frame ⇒ Rep. gr. 50 .
– Install charge air cooler ⇒ page 218 .
– Fill up with coolant ⇒ page 166 .

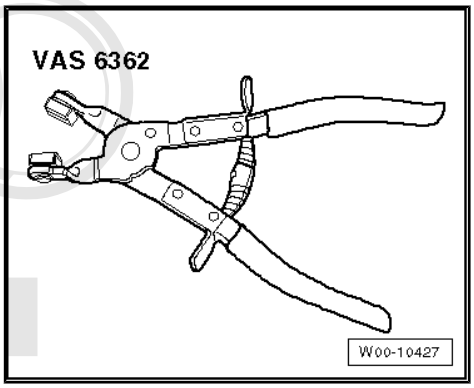
4.3 Removing and installing auxiliary radiator (left-side)

Special tools and workshop equipment required

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



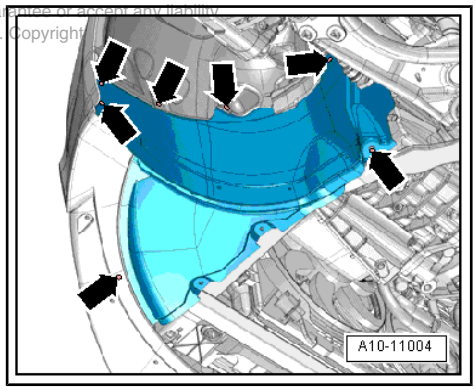
♦ Hose clip pliers -VAS 6362-



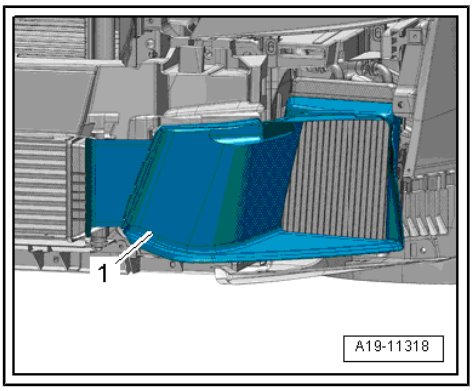
Removing

– Remove bottom front left wheel housing liner ⇒ Rep. gr. 66 .

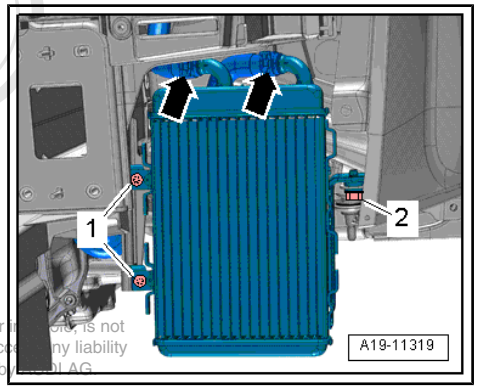
– Remove bumper cover ⇒ Rep. gr. 63 .



– Unclip air duct -1- towards front of vehicle.



– Remove bolts -1- and nut -2-.



Note

Place a cloth underneath to catch escaping coolant.

– Detach auxiliary radiator and lower slightly.

– Clamp off coolant hoses -arrows- with hose clamps up to 25 mm -3094- and detach.

Caution

Take care to keep components clean.

- ***There will still be some coolant in the auxiliary cooler.***

Installing

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

- Tightening torques
  ⇒ „4.1 Radiators and radiator fans - exploded view“, page 192

Note

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

– Install bumper cover ⇒ Rep. gr. 63 .

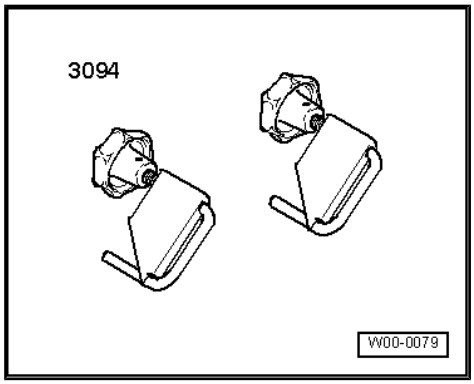
– Install bottom section of front wheel housing liner ⇒ Rep. gr. 66 .

– Fill up with coolant ⇒ page 166 .

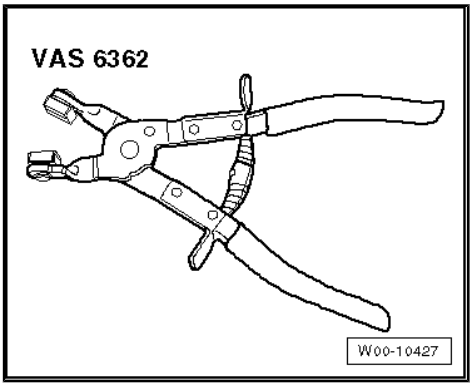
4.4 Removing and installing auxiliary radiator (right-side)

Special tools and workshop equipment required

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



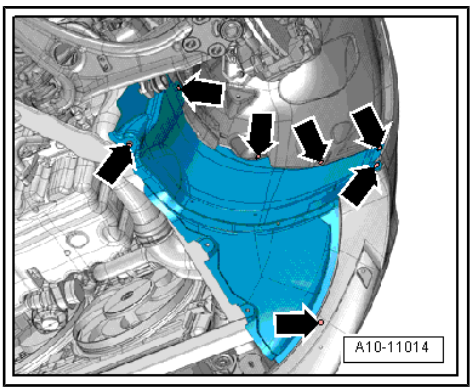
♦ Hose clip pliers -VAS 6362-



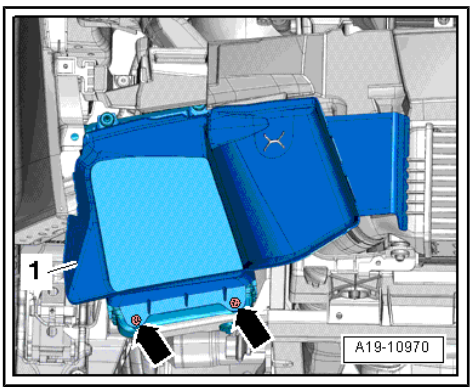
Removing

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

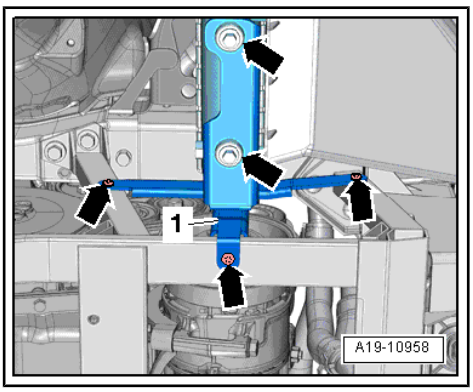
– Remove bumper cover ⇒ Rep. gr. 63 .



– Remove bolts -arrows- and take out air duct -1- downwards.



– Remove bolts -arrows- and detach bracket -1- for auxiliary radiator.

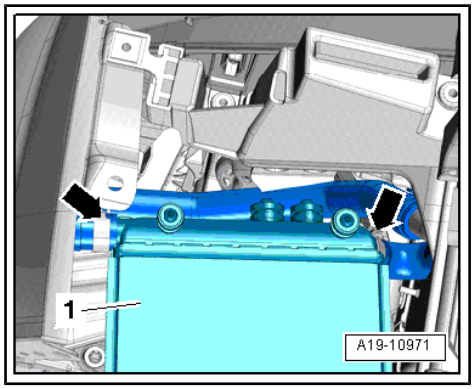


Note

Place a cloth underneath to catch escaping coolant.

– Lower auxiliary radiator -1- slightly.

– Clamp off coolant hoses -arrows- with hose clamps up to 25 mm -3094- and detach.



Caution

Take care to keep components clean.

- ***There will still be some coolant in the auxiliary cooler.***

Installing

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

- Tightening torques
  ⇒ „4.1 Radiators and radiator fans - exploded view“, page 192

Note

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

– Install bumper cover ⇒ Rep. gr. 63 .

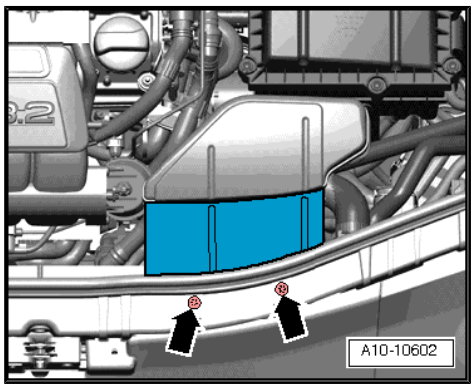
– Install bottom section of front wheel housing liner ⇒ Rep. gr. 66 .

– Fill up with coolant ⇒ page 166 .

4.5 Removing and installing radiator cowl

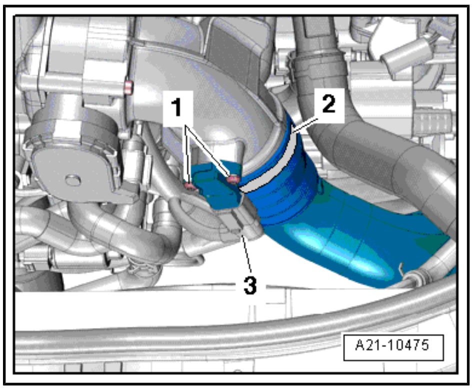
Removing

– Unscrew bolts -arrows- and remove front air duct.

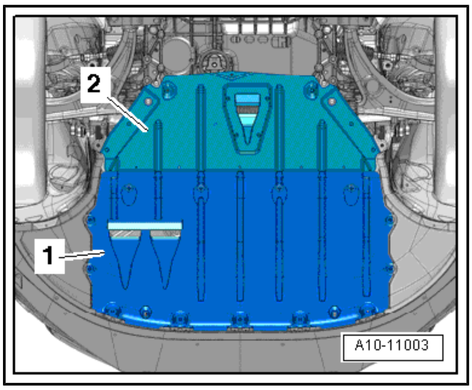


– Remove bolts -1- and move charge pressure sender -G31- / intake air temperature sender 2 -G299- with electrical connector -3- to one side (connector remains attached).

– Loosen hose clip -2-.



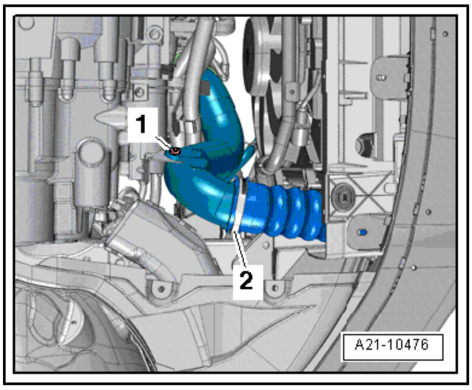
– Remove front noise insulation -1- ⇒ Rep. gr. 66 .



Vehicles with manual gearbox:

– Remove bolt -1-.

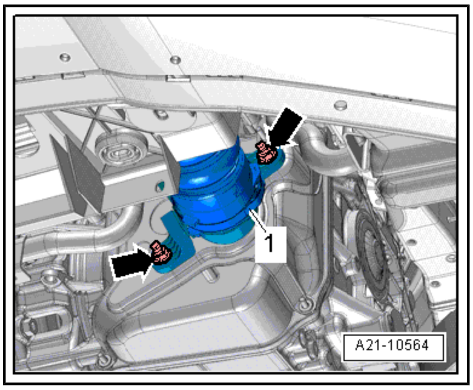
– Release hose clip -2- and detach air pipe.



Vehicles with dual clutch gearbox:

– Remove nuts -arrows-.

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

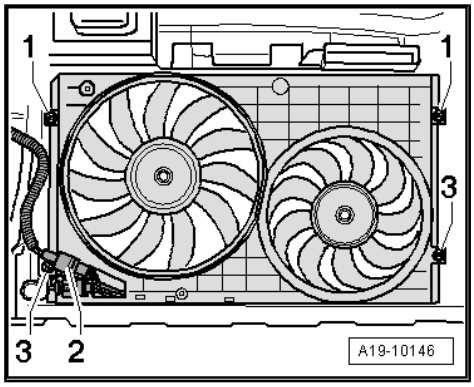


All vehicles (continued):

WARNING

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

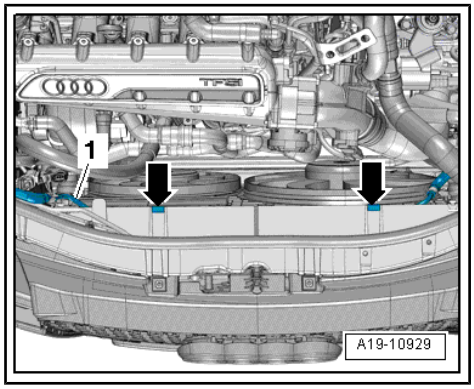
- *Unplug electrical connectors before performing work on radiator cowl.*



– Unplug electrical connector -2- for radiator fan.

– Remove bolts -3-.

– Unclip coolant line -1- at lock carrier -arrows- and move to rear.

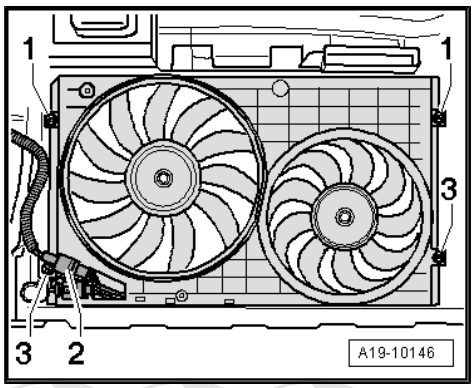


– Remove bolts -1- and lift out radiator cowl.

Installing

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

- Tightening torque
  ⇒ „4.1 Radiators and radiator fans - exploded view“, page 192



Note

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

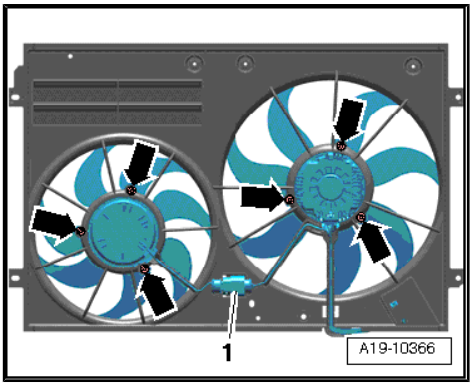
– Install air pipe ⇒ page 216 .

– Install noise insulation ⇒ Rep. gr. 66 .

– Install charge pressure sender -G31- / intake air temperature sender 2 -G299- ⇒ page 209 .

– Install front air duct ⇒ Rep. gr. 24 .

4.6 Removing and installing radiator fans - V7- / -V177-



Removing

– Remove radiator cowl ⇒ page 200 .

– Unplug electrical connector -1-.

– Move clear electrical wiring.

– Unscrew nuts -arrows- and remove corresponding radiator fan.

Installing

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

- Tightening torque ⇒ „4.1 Radiators and radiator fans - exploded view“, page 192

– Install radiator cowl ⇒ page 200 .

21 – Turbocharging/supercharging

1 Turbocharger

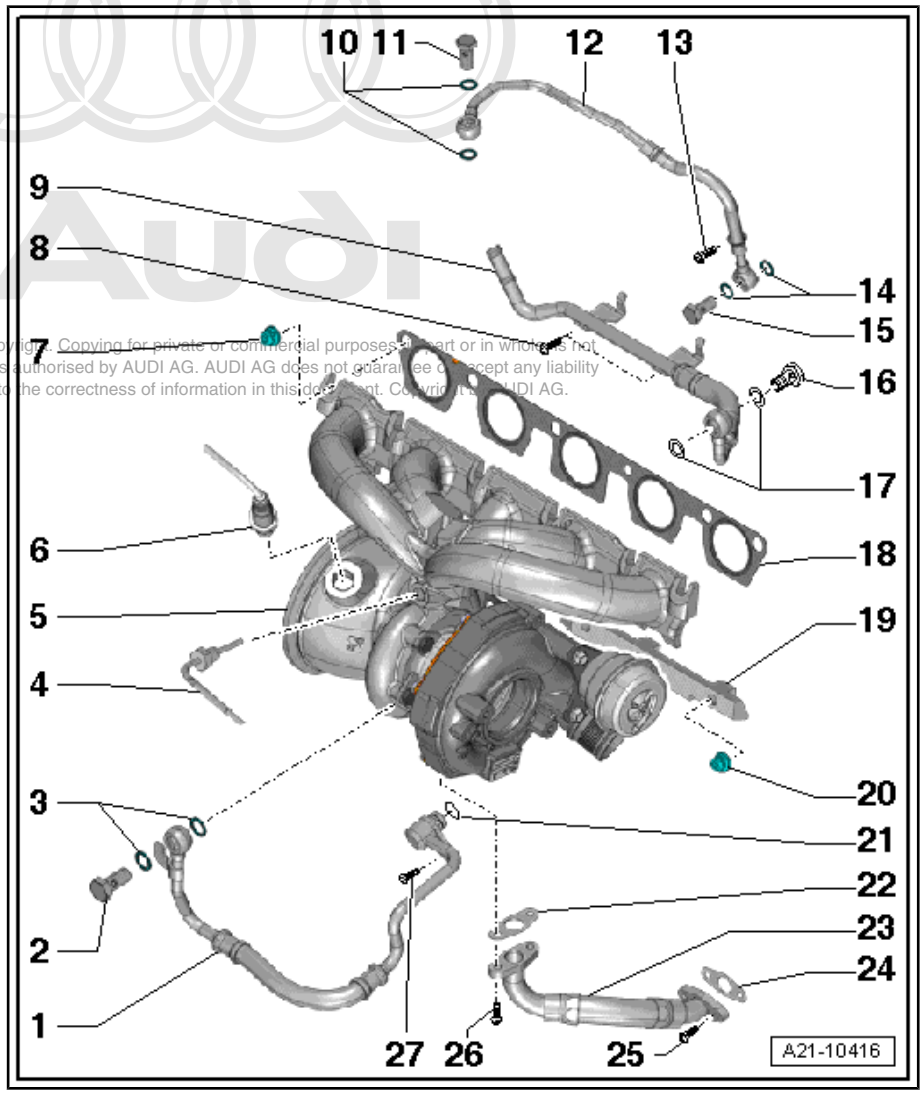
Overview

Note

- *Observe rules for cleanliness ⇒ page 6 .*
- *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 Turbocharger - exploded view

Part 1



1 - Coolant supply pipe

2 - Banjo bolt
- ❑ 37.5 Nm

3 - Seals
- ❑ Renew

4 - Exhaust gas temperature sender 1 -G235-
- ❑ Removing and installing ⇒ page 230

5 - Turbocharger
- ❑ Combined with exhaust manifold
- ❑ Removing and installing ⇒ page 210

6 - Lambda probe -G39- with Lambda probe heater -Z19-
- ❑ Removing and installing ⇒ Rep. gr. 24

7 - Nut
- ❑ Tightening torque and sequence ⇒ page 206

8 - Bolt
- ❑ 9 Nm

9 - Coolant return hose/pipe

10 - Seals
- ❑ Renew

11 - Banjo bolt
- ❑ 37.5 Nm

12 - Oil supply pipe

13 - Bolt
- ❑ 9 Nm

14 - Seals
- ❑ Renew

15 - Banjo bolt
- ❑ 37.5 Nm

16 - Banjo bolt
- ❑ 37.5 Nm

17 - Seals
- ❑ Renew

18 - Gasket
- ❑ Renew

19 - Mounting strip
- ❑ Remains installed when turbocharger is removed

20 - Nut

- ❑ Renew
- ❑ First tighten centre nut on mounting strip
- ❑ 30 Nm

21 - O-ring

- ❑ Renew

22 - Gasket

- ❑ Renew

23 - Oil return pipe

24 - Gasket

- ❑ Renew

25 - Bolt

- ❑ 9 Nm

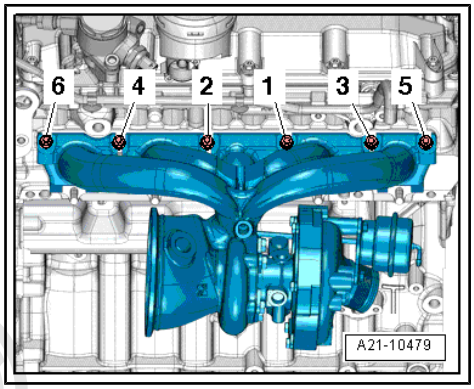
26 - Bolt

- ❑ 9 Nm

27 - Bolt

- ❑ 9 Nm

Turbocharger - tightening torque and sequence



Note

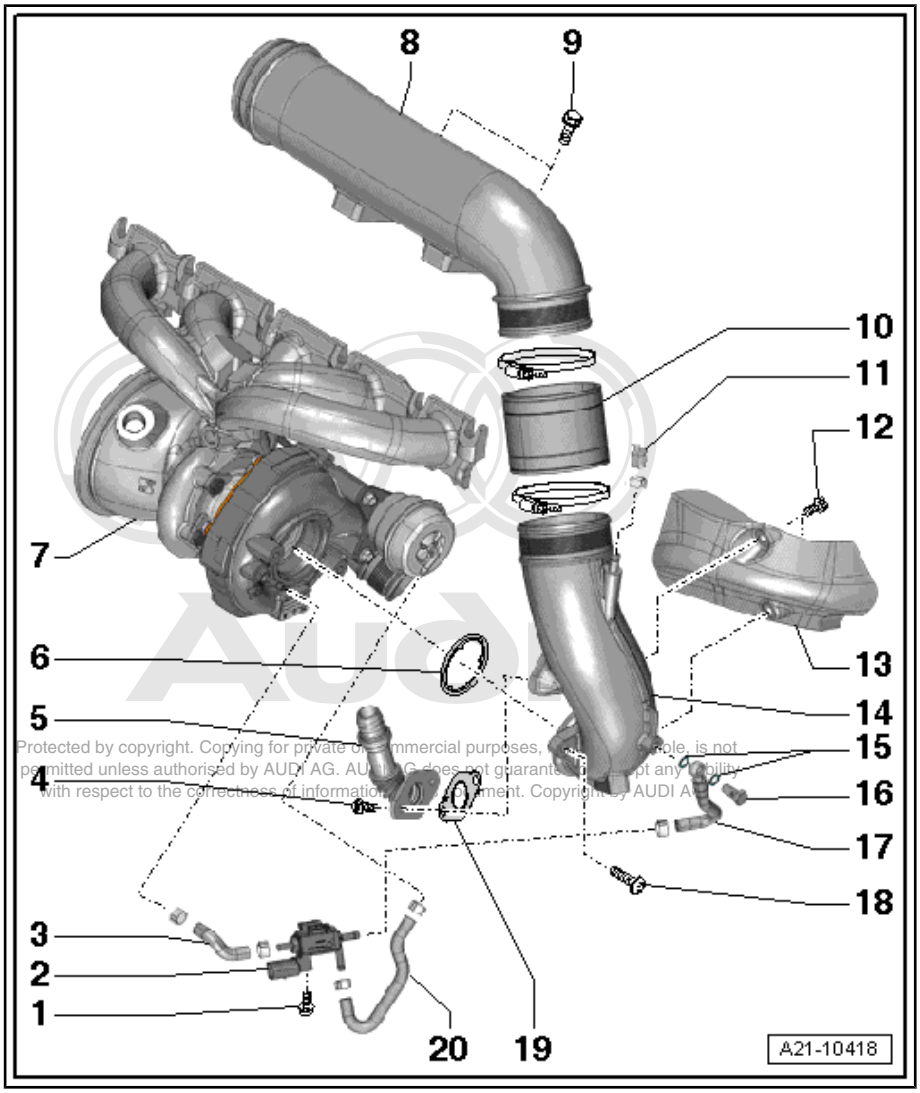
Renew nuts for turbocharger.

– Tighten bolts in 4 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 … 6-	15 Nm
2.	-1 … 6-	33 Nm
3.	-1 … 6-	33 Nm 1)
4.	-1 … 6-	33 Nm 1)

• 1) Performing this procedure guarantees all bolts remain tightened to 33 Nm after turbocharger gasket has settled.

Part 2



1 - Bolt
- ❑ 4 Nm

2 - Charge pressure control solenoid valve -N75-

3 - Hose

4 - Bolt
- ❑ 9 Nm

5 - Connection
- ❑ For crankcase breather

6 - Seal
- ❑ Renew
- ❑ Clip onto air pipe

7 - Turbocharger
- ❑ Combined with exhaust manifold
- ❑ Removing and installing ⇒ page 210

8 - Air pipe

9 - Bolt
- ❑ 9 Nm

10 - Air hose

11 - Hose

12 - Bolt
- ❑ 9 Nm

13 - Heat shield

14 - Air pipe

15 - Seals
- ❑ Renew

16 - Banjo bolt
- ❑ 15.5 Nm

17 - Hose

18 - Bolt
- ❑ 9 Nm

19 - Gasket
- ❑ Renew
- ❑ Clip onto connection

20 - Hose

Part 3

1 - O-ring

- ❑ Renew

2 - Throttle valve module - J338-

- ❑ Removing and installing ⇒ Rep. gr. 24

3 - Intake connecting pipe

- ❑ Removing and installing ⇒ Rep. gr. 24

4 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 24

5 - Turbocharger air recirculation valve -N249-

- ❑ Removing and installing ⇒ page 209

6 - Bolt

- ❑ 9 Nm

7 - O-ring

- ❑ Renew

8 - O-ring

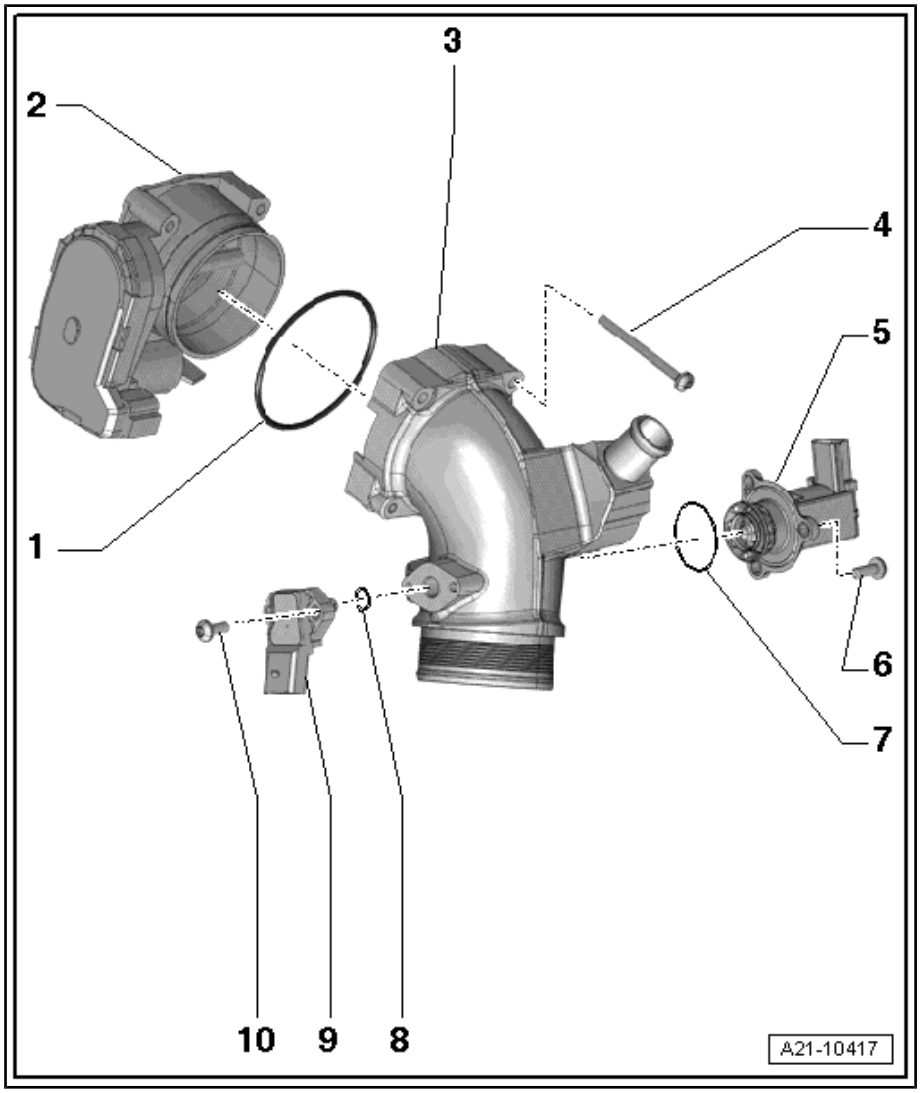
- ❑ Renew

9 - Charge pressure sender - G31- / intake air temperature sender 2 -G299-

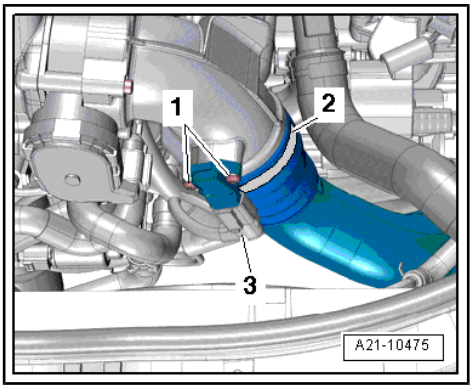
- ❑ Removing and installing ⇒ page 209

10 - Bolt

- ❑ 9 Nm



1.2 Removing and installing charge pressure sender -G31- / intake air temperature sender 2 -G299-



Removing

– Unplug electrical connector -3-.

– Unscrew bolts -1- and remove charge pressure sender -G31- / intake air temperature sender 2 -G299- .

Note

Disregard -item 2-.

Installing

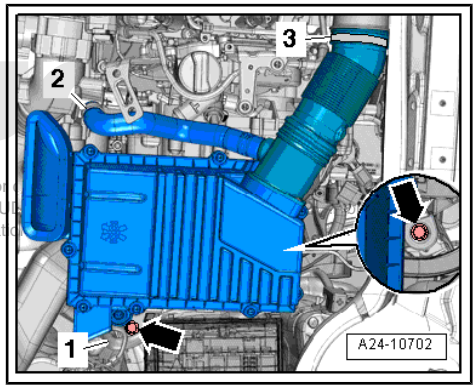
Installation is carried out in the reverse order; note the following:

- Tightening torque
⇒ „1.1 Turbocharger - exploded view“, page 205

Note

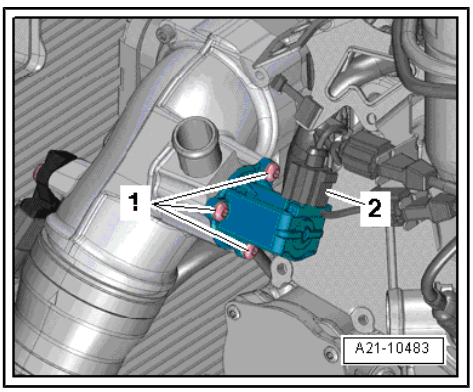
Fit new O-ring.

1.3 Removing and installing turbocharger air recirculation valve -N249-



Removing

– Remove air cleaner housing ⇒ Rep. gr. 24 .



– Unplug electrical connector -2-.

– Unscrew bolts -1- and remove turbocharger air recirculation valve -N249- .

Installing

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

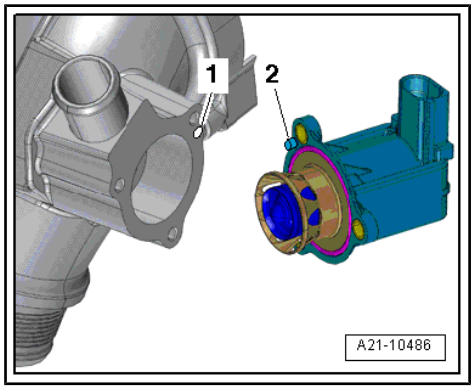
- Tightening torque
⇒ „1.1 Turbocharger - exploded view“, page 205

Note

Fit new O-ring.

- Installation position: Lug -2- on turbocharger air recirculation valve -N249- must be inserted in hole -1- on intake connection.

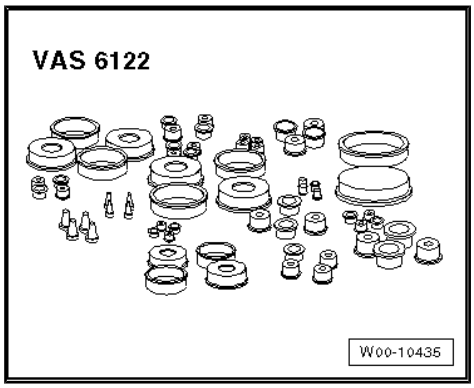
– Install air cleaner housing ⇒ Rep. gr. 24 .



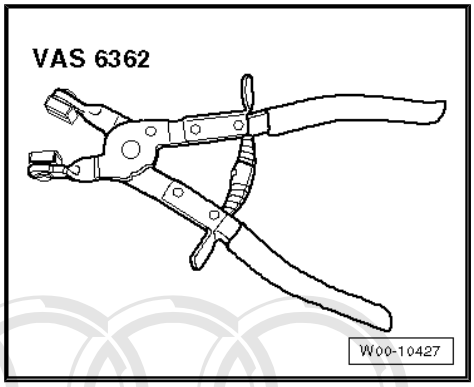
1.4 Removing and installing turbocharger

Special tools and workshop equipment required

♦ Engine bung set -VAS 6122-



♦ Hose clip pliers -VAS 6362-



Removing

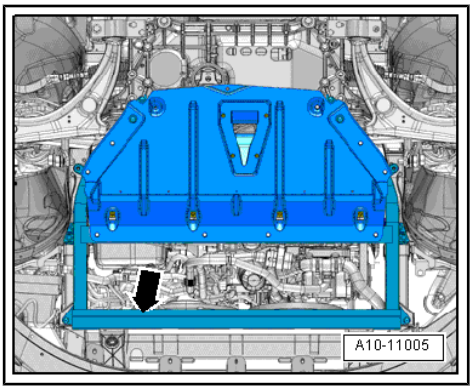
Caution

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

– Drain coolant ⇒ page 164 .

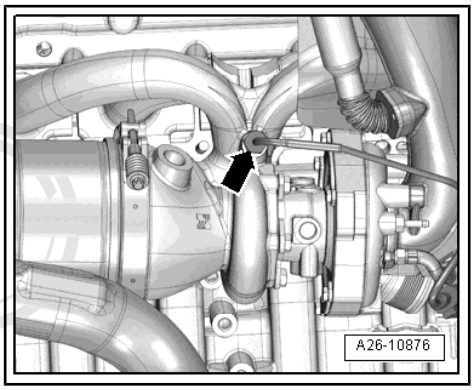
– Remove noise insulation frame -arrow- together with rear noise insulation ⇒ Rep. gr. 50 .



– Unscrew temperature sensor for exhaust gas temperature sender 1 -G235- -arrow-.

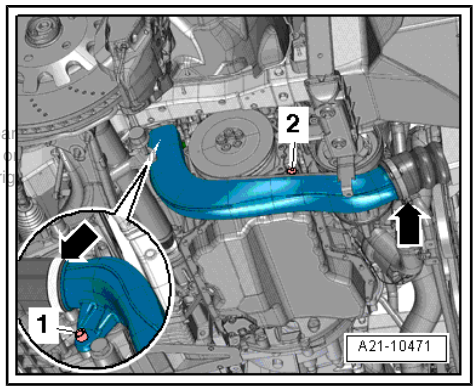
– Remove Lambda probe -G39- ⇒ Rep. gr. 24 .

– Remove high-pressure pump ⇒ Rep. gr. 24 .



– Remove bolts -1- and -2-.

– Release hose clips -arrows- and remove air pipe.

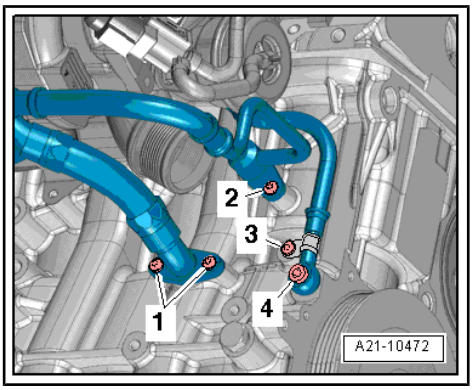


Note

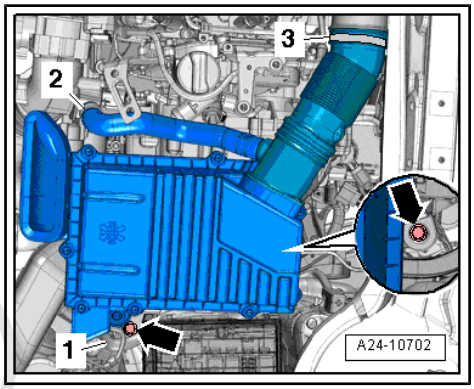
Place a cloth underneath to catch escaping coolant and engine oil.

– Unscrew bolts -1, 2, 3- and banjo bolt -4- and detach pipes from cylinder block.

– Seal openings on turbocharger and all relevant ducts and hoses of the charge air system with plugs from engine bung set -VAS 6122- .



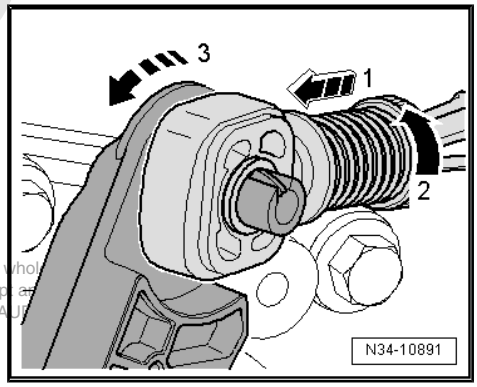
– Remove air cleaner housing ⇒ Rep. gr. 24 .



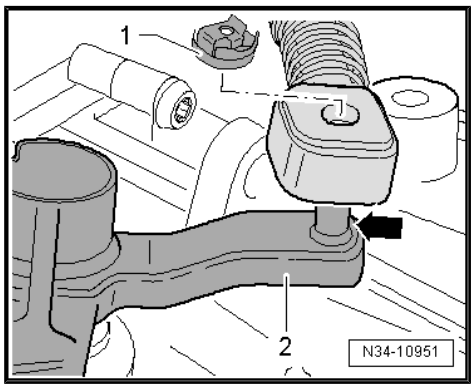
Vehicles with manual gearbox:

– Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.

– Press relay lever towards front -arrow 3-, take gate selector cable out of end-piece.



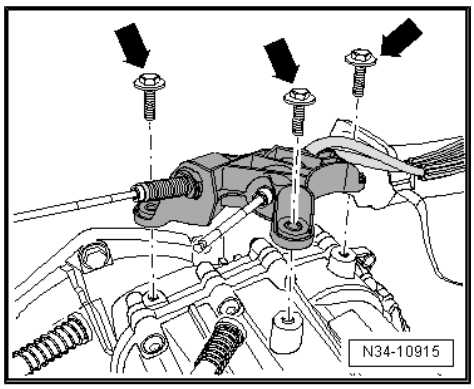
– Detach securing clip -1- for gear selector cable from gearbox selector lever -2- and pull cable off pin -arrow-.



– Remove bolts -arrows-, detach cable support bracket from gearbox and tie up to the left side.

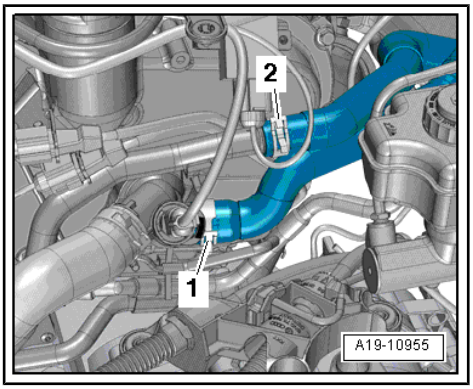
Vehicles with dual clutch gearbox:

– Remove gearbox oil filter ⇒ Rep. gr. 34 if it is not difficult to access.



All vehicles (continued):

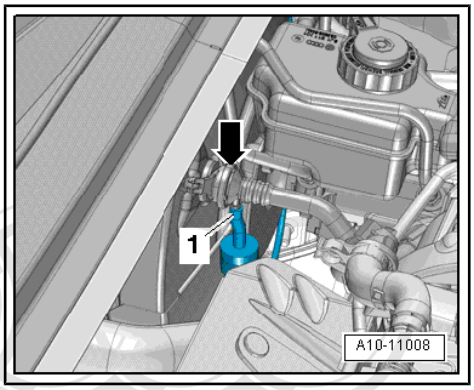
– Release hose clip -1- and detach coolant hose.



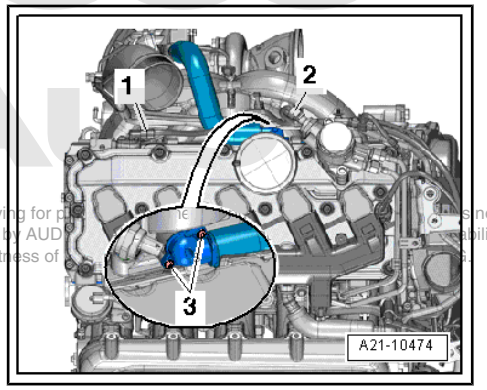
Note

Disregard -item 2-.

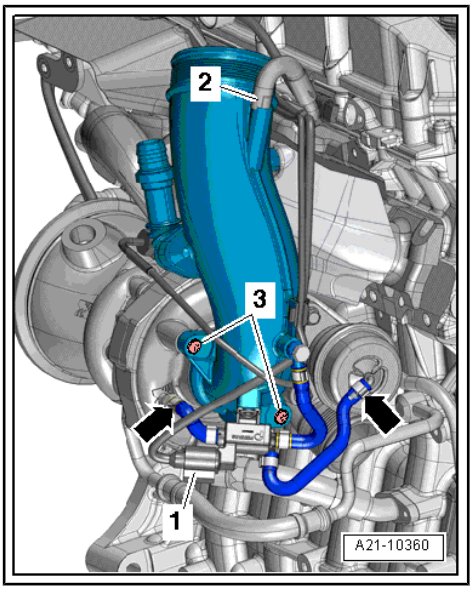
– Detach vacuum hose -1- from non-return valve -arrow-.
– Pull non-return valve off brake servo.



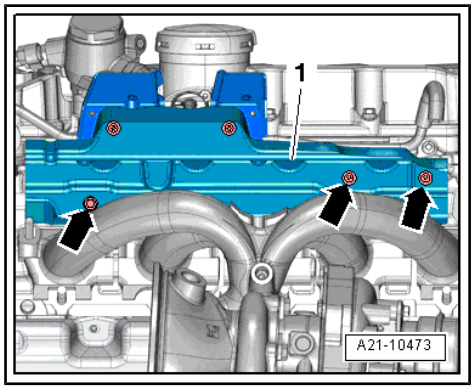
– Unplug electrical connectors -1- and -2-.
– Remove bolts -3- and detach connection from cylinder head cover.



– Unplug electrical connector -1- at charge pressure control solenoid valve -N75- and move electrical wiring clear.
– Release hose clips -arrows- and -2- and detach hoses.
– Remove bolts -3- and move intake connecting pipe to rear.



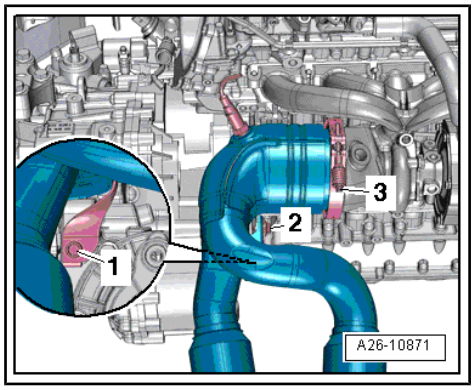
– Move clear electrical wiring harness at heat shield -1-.
– Remove bolts -arrows- and detach heat shield.
– Detach intake connecting pipe.



– Loosen bolt -3- and push clamp onto starter catalytic converter.
– Remove bolt -2-, tie up starter catalytic converter to rear.

Note

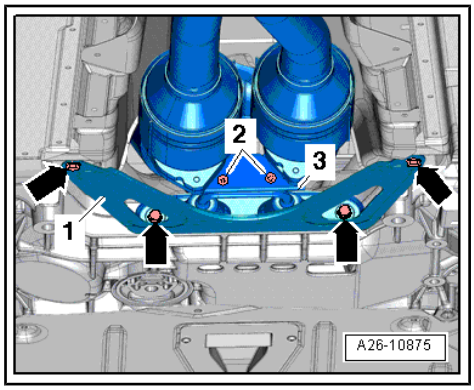
Disregard -item 1-.



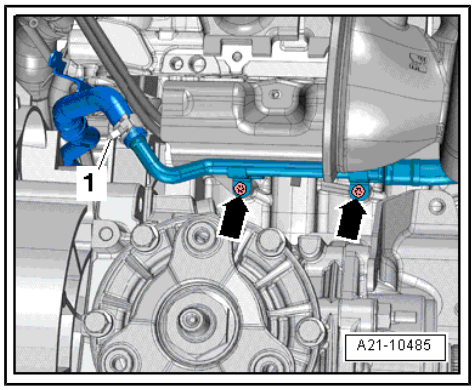
– Unscrew bolts -arrows- and detach cross piece -1-.

Note

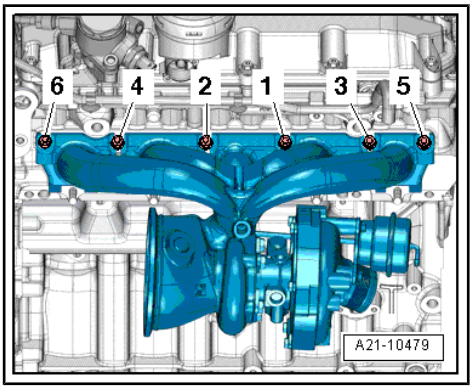
Disregard -items 2, 3-.



– Remove bolts -arrows-.
– Release hose clip -1- and detach coolant hose.
– Remove cylinder head cover ⇒ page 103 .



– Remove nuts in the sequence: -6 ... 1- and detach turbocharger.
– Seal off open pipes/lines and connections with clean plugs from engine bung set -VAS 6122- .



Installing

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

Tightening torques

- ⇒ „1.1 Turbocharger - exploded view“, page 205
- ⇒ „2.1 Charge air cooler - exploded view“, page 216
- ⇒ „2.1 Cylinder head cover and cylinder head - exploded view“, page 99

Note

- *Renew gaskets, seals and O-rings.*
- *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 cylinder head cover ⇒ page 103 .
– Install Lambda probe -G39- and high-pressure pump ⇒ Rep. gr. 24 .
– Install exhaust gas temperature sender 1 -G235- ⇒ page 230 .
– Install air pipes ⇒ page 216 .
– Installing and adjusting selector mechanism ⇒ Rep. gr. 34 .
– Install air cleaner housing ⇒ Rep. gr. 24 .
– Check oil level ⇒ Maintenance ; Booklet 810 .
– Install noise insulation frame ⇒ Rep. gr. 50 .
– Fill up with coolant ⇒ page 166 .

Note

If turbocharger is renewed, it is important to check that the additional coolant pump relay -J496- , the continued coolant circulation pump -V51- and the solenoid for coolant circuit -N492- are working properly. The continued coolant circulation pump -V51- is included in the fault finding programme for the additional coolant pump relay -J496- ; there is a separate fault finding programme for the solenoid for coolant circuit -N492- .

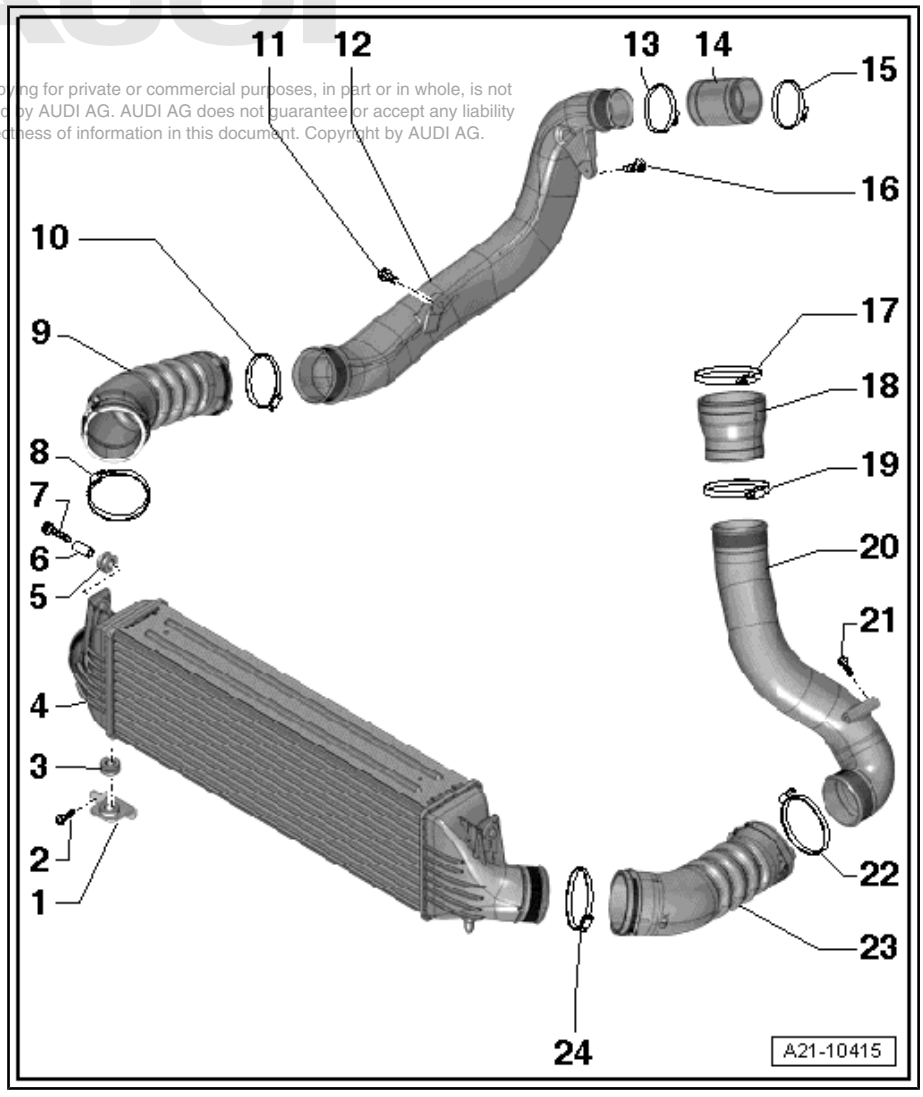
2 Charge air cooler

Overview

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 - Bracket

2 - Bolt
- ❑ 5 Nm

3 - Grommet

4 - Charge air cooler
- ❑ Removing and installing ⇒ page 218

5 - Grommet

6 - Bush

7 - Bolt
- ❑ 5 Nm

8 - Hose clip
- ❑ Tightening torque ⇒ page 217

9 - Air hose
- ❑ Installation position ⇒ page 217

10 - Hose clip
- ❑ Tightening torque ⇒ page 217

11 - Bolt
- ❑ 9 Nm

12 - Air pipe (right-side)

13 - Hose clip
- ❑ Tightening torque ⇒ page 218

14 - Air hose
- ❑ Installation position ⇒ page 218

15 - Hose clip
- ❑ Tightening torque ⇒ page 218

16 - Bolt

❑ 9 Nm

17 - Hose clip

❑ Tightening torque ⇒ page 217

18 - Air hose

❑ Installation position ⇒ page 217

19 - Hose clip

❑ Tightening torque ⇒ page 217

20 - Air pipe (left-side)

21 - Bolt

❑ 9 Nm

22 - Hose clip

❑ Tightening torque ⇒ page 217

23 - Air hose

❑ Installation position ⇒ page 217

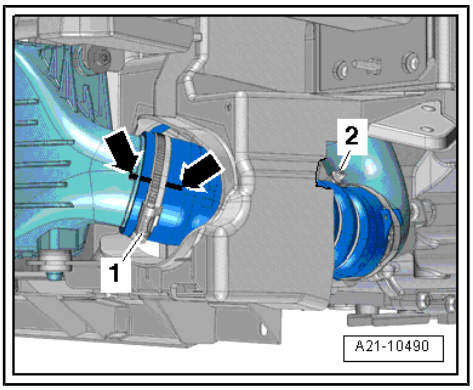
24 - Hose clip

❑ Tightening torque ⇒ page 217

Air hoses to charge air cooler - installation position and tightening torque

- The marks -arrows- must align.
- The fastening screws of hose clips -1- and -2- fitted must be positioned as shown.

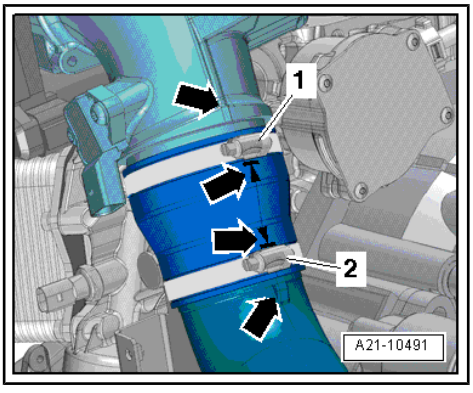
– Tighten hose clips to 5.5 Nm



Air duct (left-side) to intake connecting pipe - installation position and tightening torque

- The marks -arrows- must align.
- The fastening screws of hose clips -1- and -2- fitted must be positioned as shown.

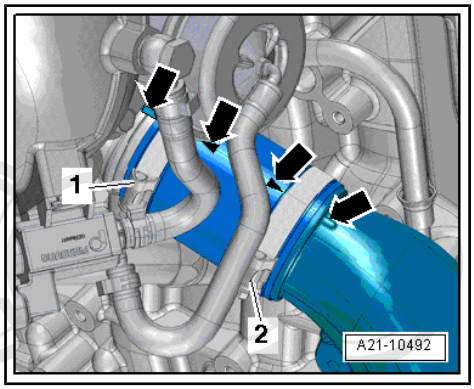
– Tighten hose clips to 5.5 Nm



Air duct (right-side) to turbocharger - installation position and tightening torque

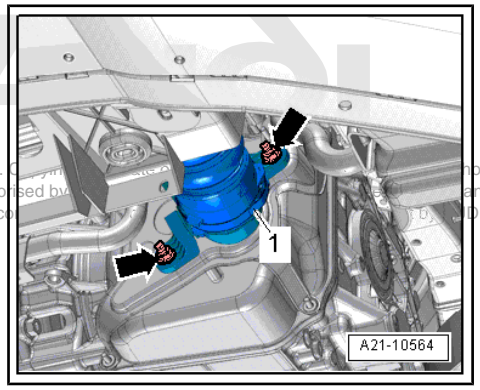
- The marks -arrows- must align.
- The fastening screws of hose clips -1- and -2- fitted must be positioned as shown.

– Tighten hose clips to 5.5 Nm



Air pipe (left-side) on vehicles with dual clutch gearbox - tightening torque

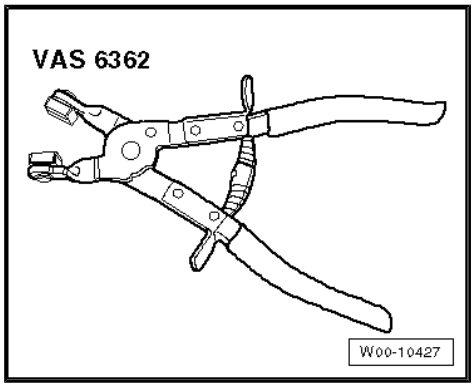
– Tighten nuts -arrows- to 9 Nm.



2.2 Removing and installing charge air cooler

Special tools and workshop equipment required

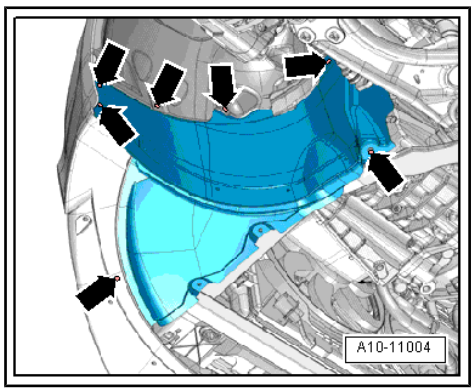
♦ Hose clip pliers -VAS 6362-



Removing

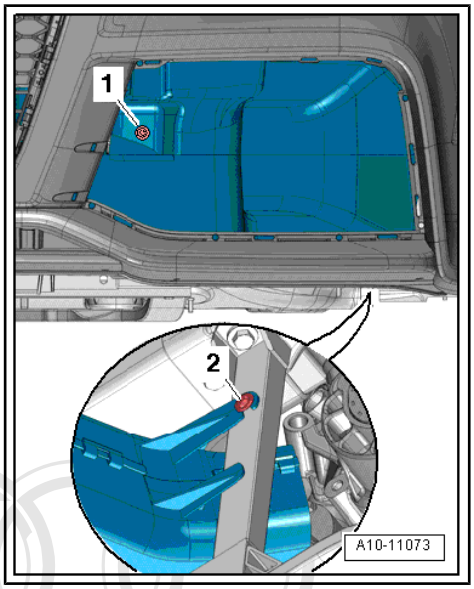
– Remove bumper cover (front) ⇒ Rep. gr. 63 .

– Remove bottom left and bottom right wheel housing liners (front only)⇒ Rep. gr. 66 .



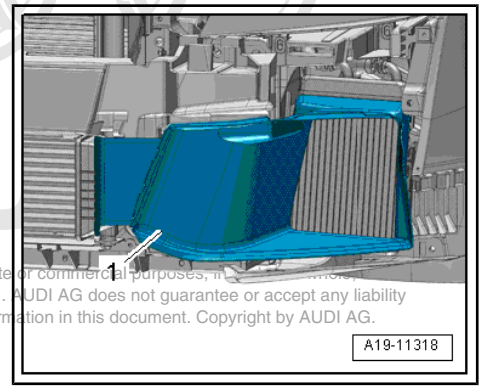
Vehicles with manual gearbox:

– Remove bolts -1- and -2-, detach air duct.



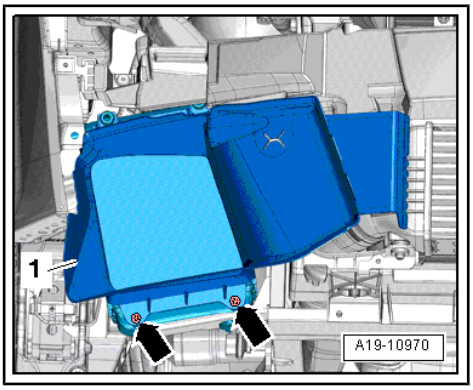
Vehicles with dual clutch gearbox:

– Unclip air duct -1- towards front of vehicle.



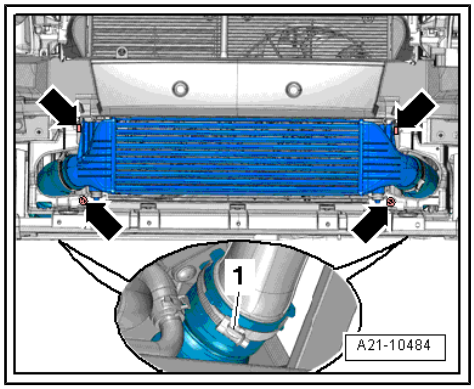
All vehicles (continued):

– Remove bolts -arrows- and take out air duct -1- downwards.



– Release hose clips -1- (left and right) and remove air hoses.

– Remove bolts -arrows- and detach charge air cooler.



Installing

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

Tightening torques

- ⇒ „2.1 Charge air cooler - exploded view“, page 216 .
- ⇒ „4.1 Radiators and radiator fans - exploded view“, page 192 .

Note

- *If there are slight impressions on the fins, refer to ⇒ page 8 .*
- *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.*

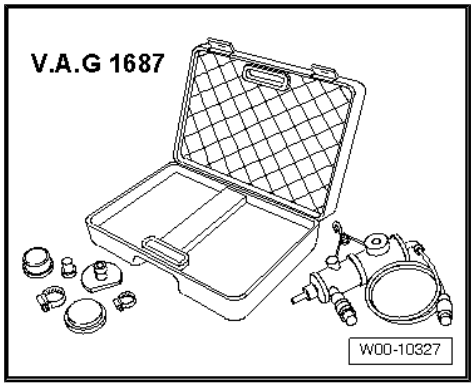
– Install bottom sections of front wheel housing liners ⇒ Rep. gr. 66 .

– Install bumper cover (front) ⇒ Rep. gr. 63 .

2.3 Checking charge air system for leaks

Special tools and workshop equipment required

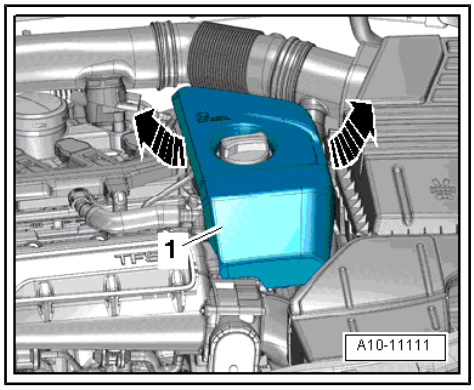
- Charge air system tester -V.A.G 1687-



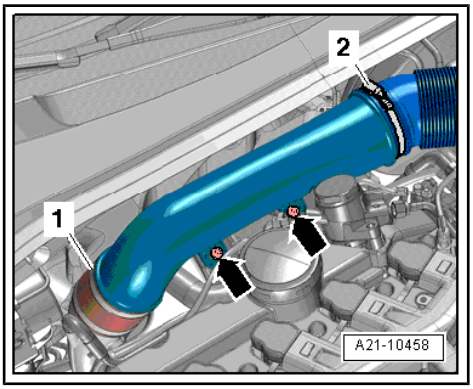
- Adapter -V.A.G 1687/12-

Procedure

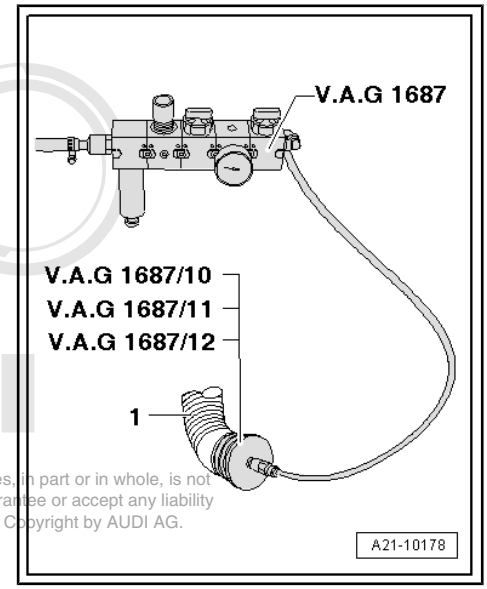
– Lift off engine cover panel -1- -arrows-.



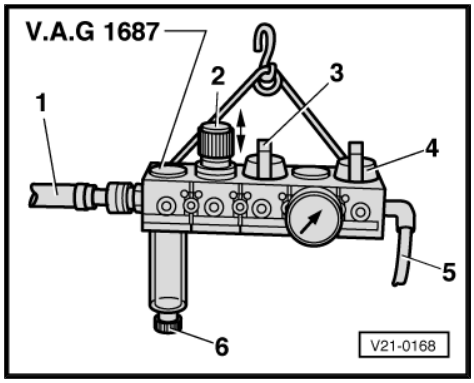
– Remove bolts -arrows-.
– Release hose clips -1- and -2- and remove air pipe.



– Insert adapter -1687/12- into air hose -1- and secure with hose clip.
– Connect charge air system tester -V.A.G 1687- to adapter.



Prepare charge air system tester -V.A.G 1687- as follows:



– Unscrew pressure control valve -2- completely and close valves -3- and -4-.

• Make sure knob is pulled out before turning pressure control valve -2-.

– Using a commercially available connection piece, connect charge air system tester -V.A.G 1687- to compressed air -1-.

Note

If there is water in sight glass, remove drain plug -6- and drain water.

– Open valve -3-.

Caution

Risk of damage if pressure is set too high.

- ***The pressure must not exceed 0.2 bar.***

– Adjust pressure to 0.2 bar via pressure control valve -2-.

– Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.2 bar again.

– Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detecting spray or use ultrasonic tester -V.A.G 1842- .

Note

- *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- *For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .*
- *Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.*

Assembling

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 .*
- *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

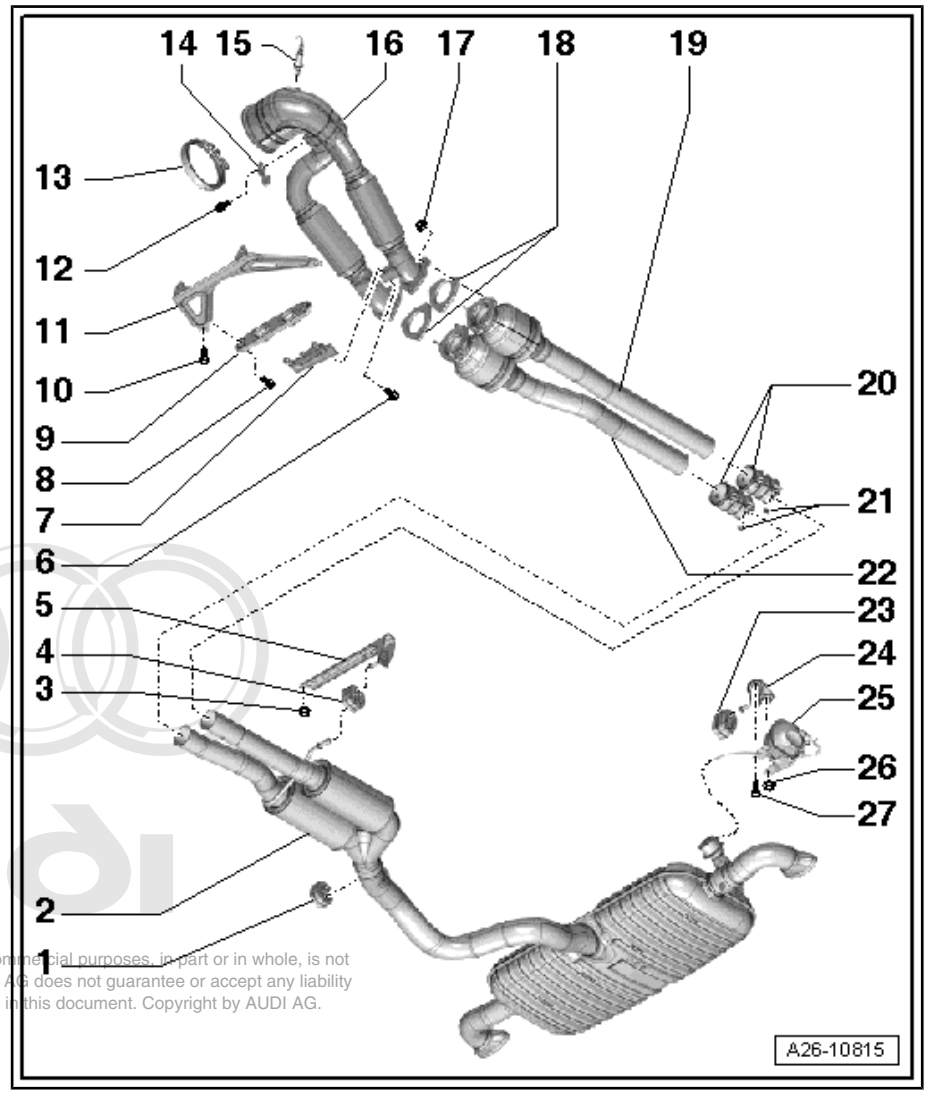
– Install air pipe ⇒ page 216 .

26 – Exhaust system

1 Silencers

Overview

1.1 Silencers - exploded view



1 - Rubber mounting
- ❑ Renew if damaged

2 - Centre silencer
- ❑ Combined with rear silencer
- ❑ Align exhaust system so it is free of stress ⇒ page 226

3 - Nut
- ❑ 20 Nm

4 - Rubber mounting
- ❑ Renew if damaged

5 - Bracket for exhaust system

6 - Bolt
- ❑ 25 Nm

7 - Bracket for exhaust system

8 - Bolt
- ❑ 23 Nm

9 - Mounting

10 - Bolt
- ❑ 23 Nm

11 - Cross piece

12 - Bolt
- ❑ 23 Nm

13 - Clamp
- ❑ 7 Nm

14 - Retainer

15 - Lambda probe after catalytic converter -G130- with Lambda probe 1 heater after catalytic converter -Z29-
- ❑ Removing and installing ⇒ Rep. gr. 24

16 - Starter catalytic converter
- ❑ 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 starter catalytic converter against knocks and impact
- ❑ Removing and installing ⇒ page 225
- ❑ 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 226

17 - Nut

- ❑ Renew
- ❑ Coat threaded pins with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 23 Nm

18 - Gaskets

- ❑ Renew

19 - Catalytic converter (left-side)

- ❑ Removing and installing ⇒ page 226
- ❑ Align exhaust system so it is free of stress ⇒ page 226

20 - Clamp

- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 226
- ❑ Installation position ⇒ page 224
- ❑ Tighten bolt connections evenly

21 - Nuts

- ❑ Tighten bolt connections evenly
- ❑ 23 Nm

22 - Catalytic converter (right-side)

- ❑ Removing and installing ⇒ page 226
- ❑ Align exhaust system so it is free of stress ⇒ page 226

23 - Rubber mounting

- ❑ Renew if damaged

24 - Bracket

25 - Exhaust flap valve -N220-

- ❑ With vacuum reservoir
- ❑ Checking vacuum unit for exhaust flap ⇒ page 231

26 - Nut

- ❑ 20 Nm

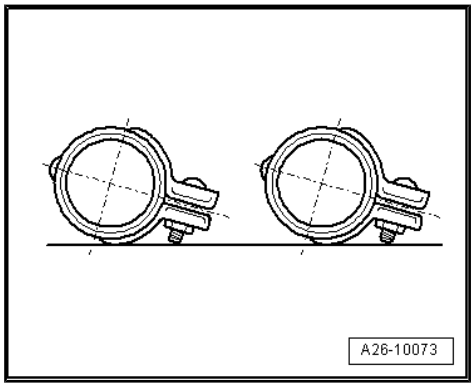
27 - Bolt

- ❑ 20 Nm

Installation position of clamps

– Install clamps so that ends of bolts do not protrude beyond bottom of clamps.

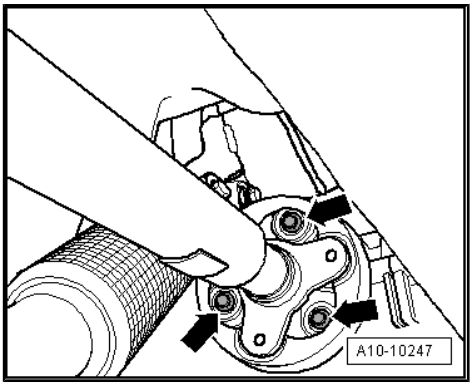
• Bolt connections facing towards right



1.2 Removing and installing starter catalytic converter

Removing

– Remove propshaft ⇒ Rear final drive 02D, 0AV, 0BR and 0BY; Rep. gr. 39 .

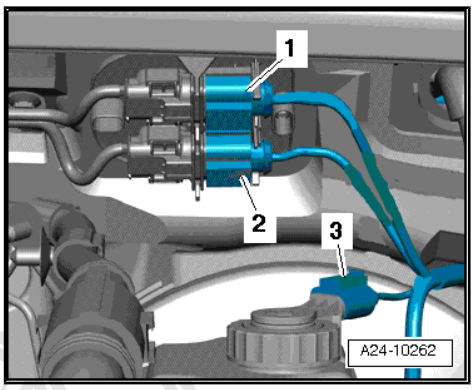


– Remove electrical connector -2- for Lambda probe after catalytic converter -G130- from bracket and unplug connector.

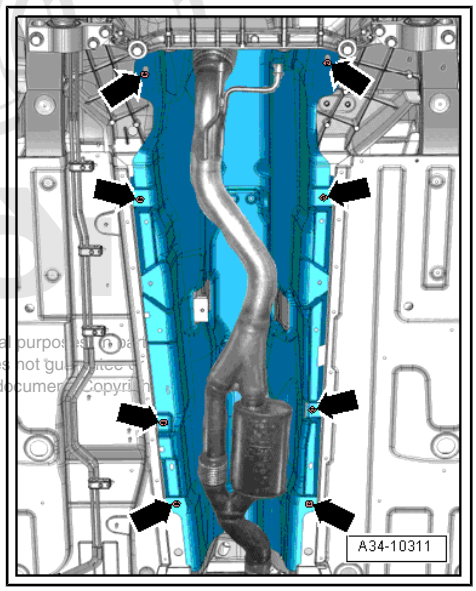
– Move clear electrical wiring to Lambda probe.

Note

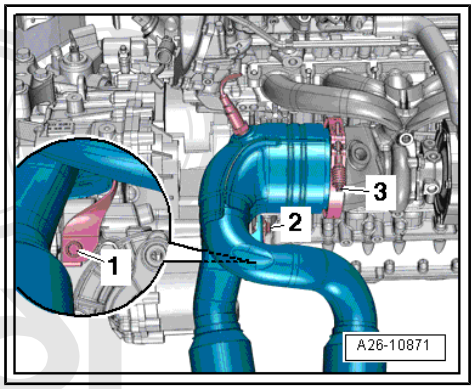
Disregard -items 1, 3-.



– Remove bolts and nuts -arrows- and detach heat shield to the rear.



– Unscrew bolts -1- and -2- and remove bracket for starter catalytic converter.
– Slacken bolt -3- and remove clamp from flange
– Remove starter catalytic converter.



Installing

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

- Tightening torques
  ⇒ „1.1 Silencers - exploded view“, page 223

Note

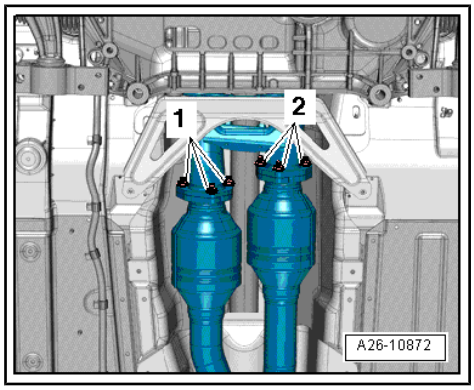
Renew gasket and self-locking nuts.

– Install propshaft ⇒ Rear final drive 02D, 0AV, 0BR and 0BY; Rep. gr. 39 .
– Align the exhaust system so it is free of stress ⇒ page 226 .

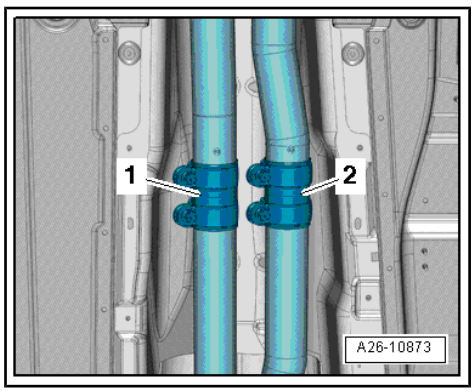
1.3 Removing and installing catalytic converters

Removing

– Remove nuts -1- or -2-.



– Detach clamp -1- or -2- and detach catalytic converter with clamp.



Installing

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

- Tightening torques
  ⇒ „1.1 Silencers - exploded view“, page 223

Note

Renew gasket and self-locking nuts.

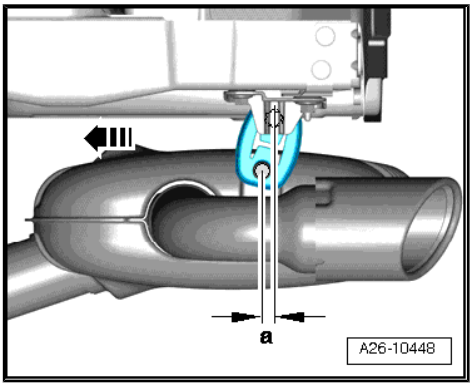
1.4 Stress-free alignment of exhaust system

Procedure

- The exhaust system must be aligned when it is cool.
- Tightening torque ⇒ page 223

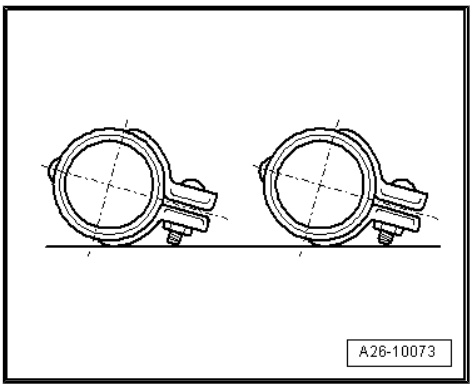
– Loosen bolt connections for clamp.

– Push rear silencer towards front of vehicle -arrow- so that rubber mounting (left-side) on rear silencer is preloaded by -a- = 11 ... 13 mm.



– Install clamps so that ends of bolts do not protrude beyond bottom of clamps.

• Bolt connections facing towards right



1.5 Checking exhaust system for leaks

Procedure

– Start the engine and run at idling speed.

– Plug tailpipes during leak test (e.g. with cloth or plugs).

– Listen for noise at connections between cylinder head/exhaust manifold with turbocharger, exhaust manifold with turbocharger/starter catalytic converter etc. to locate any leaks.

– Rectify any leaks that are found.

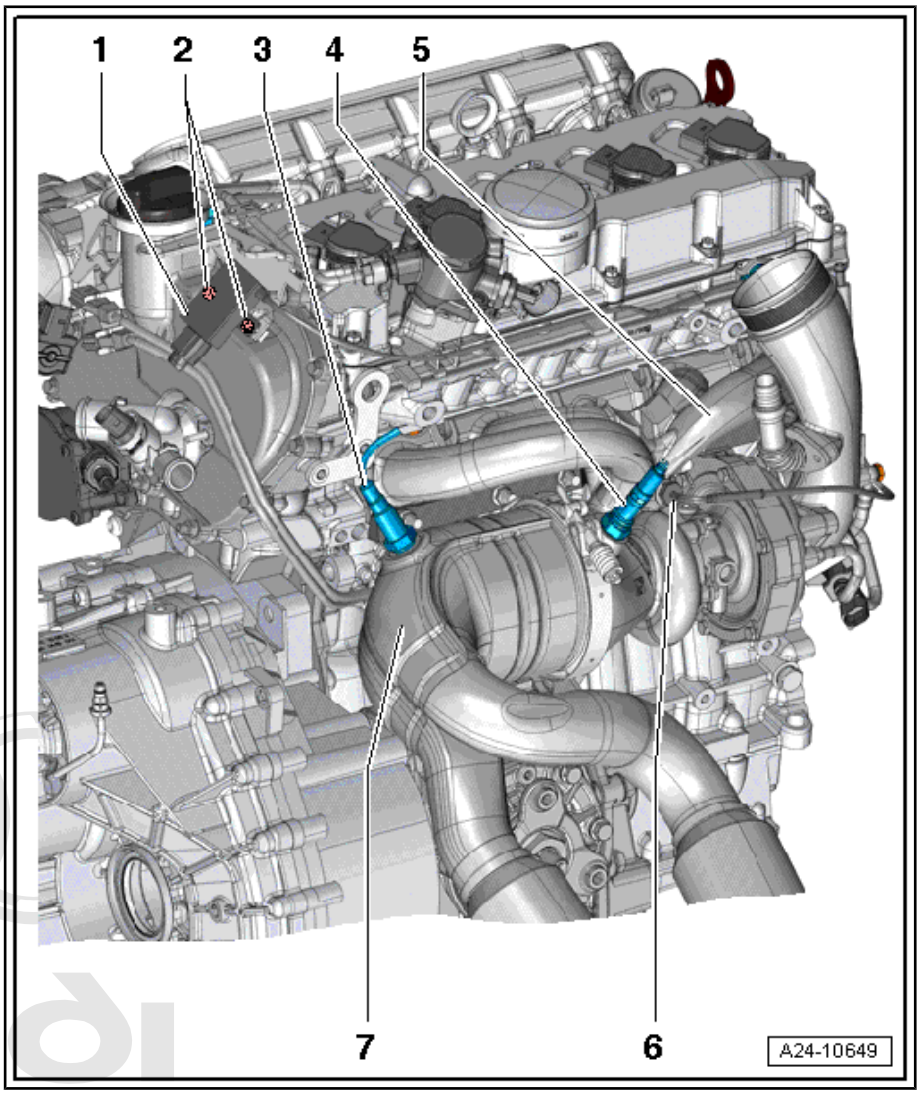
2 Exhaust manifold

The exhaust manifold and the turbocharger are combined as one unit; removing and installing ⇒ page 210 .

3 Exhaust gas temperature control

Overview

3.1 Exhaust gas temperature control - exploded view



1 - Exhaust gas temperature sender 1 -G235-

- ❑ Combined in one unit with -item 6-
- ❑ Removing and installing ⇒ page 230
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

2 - Bolts

- ❑ 5 Nm

3 - Lambda probe after catalytic converter -G130- with Lambda probe 1 heater after catalytic converter -Z29-

- ❑ Removing and installing ⇒ Rep. gr. 24

4 - Lambda probe -G39- with Lambda probe heater -Z19-

- ❑ Removing and installing ⇒ Rep. gr. 24

5 - Turbocharger

6 - Temperature sensor

- ❑ Combined in one unit with -item 1-
- ❑ For exhaust gas temperature sender 1 - G235-
- ❑ Removing and installing ⇒ page 230
- ❑ 45 Nm

7 - Starter catalytic converter

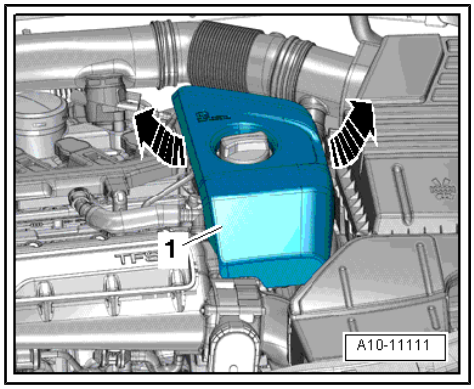
3.2 Removing and installing exhaust gas temperature sender 1 -G235-

Removing

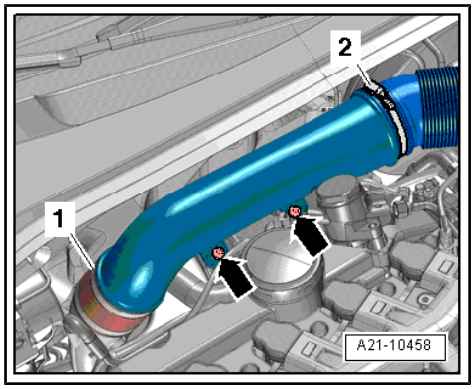
Note

Fit all cable ties in the original positions when installing.

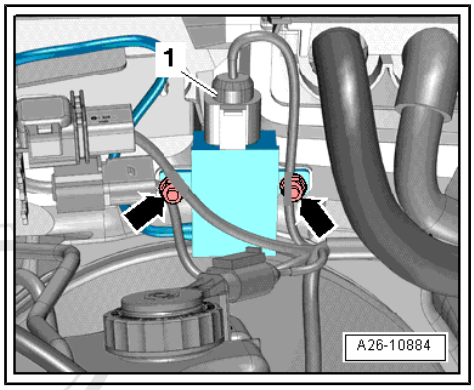
– Lift off engine cover panel -1- -arrows-.



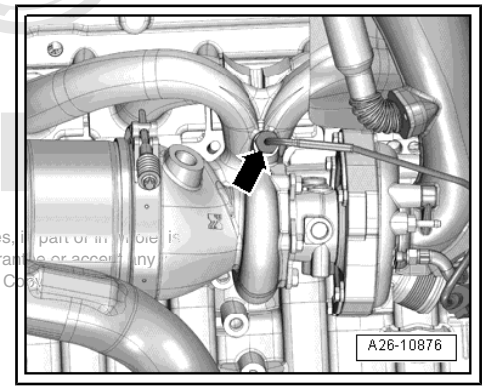
– Remove bolts -arrows-.
– Release hose clips -1- and -2- and remove air pipe.



– Unplug electrical connector -1-.
– Remove bolts -arrows-.
– Move clear electrical wiring harness to temperature sensor for exhaust gas temperature sender 1 -G235- .



– Unscrew temperature sensor for exhaust gas temperature sender 1 -G235- -arrow-.



Installing

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

- Tightening torque
  ⇒ „3.1 Exhaust gas temperature control - exploded view“, page 229

Note

Coat threads of exhaust gas temperature sender 1 -G235- with high-temperature paste; high-temperature paste ⇒ Electronic parts catalogue .

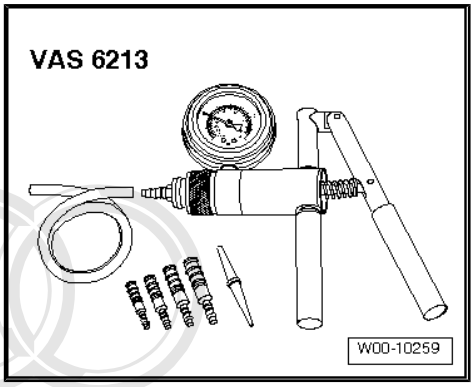
– Install air pipe ⇒ page 216 .

4 Exhaust flap

4.1 Checking vacuum unit for exhaust flap

Special tools and workshop equipment required

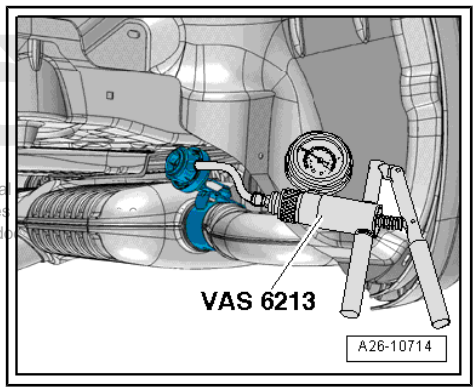
- Hand vacuum pump -VAS 6213-



Procedure

– 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.