



Workshop Manual Audi A1 2011 ➤

4-cylinder direct injection engine (1.4 ltr. 4-valve TFSI EA211)

Engine ID	CPT A	CZC A	CZE A	CZD B	CZD D				
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Edition 09.2019



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



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00 – Technical data

1 Identification

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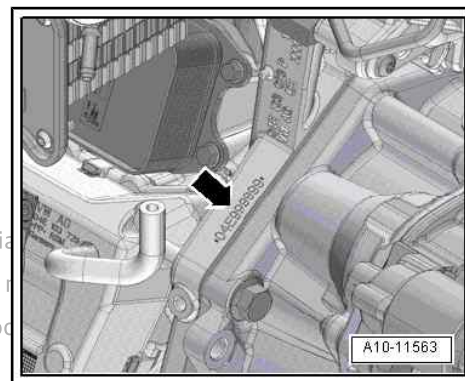
⇒ ["1.1 Engine number/engine data", page 1](#)

1.1 Engine number/engine data

Engine number

- ◆ The engine number ("engine code" and "serial number") is located on the left side at the joint between engine and gearbox -arrow-.
- ◆ Additionally there is a sticker on the toothed belt cover (top) with engine code and serial number.
- ◆ Engine codes starting with the letter "C" have four letters (previously three letters).
- ◆ The first 3 characters of the engine code stand for the engine capacity and the mechanical construction and design. They are stamped onto 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.
- ◆ The four-letter engine code is found on the type plate (certain countries only), vehicle data sticker and engine control unit.
- ◆ Fitting locations of the type plate (certain countries only) and the vehicle data sticker ⇒ Maintenance ; Booklet 819

For engine data refer to ⇒ Maintenance ; Booklet 819 or ⇒ Technical data for engines; Rep. gr. 00 ; Overview of engines .





2 Safety precautions

⇒ [“2.1 Safety precautions when working on the fuel supply system”, page 2](#)

⇒ [“2.2 Safety precautions when working on vehicles with start/stop system”, page 2](#)

⇒ [“2.3 Safety precautions when using testers and measuring instruments during a road test”, page 3](#)

⇒ [“2.4 Safety precautions when working on the cooling system”, page 3](#)

⇒ [“2.5 Safety precautions when working on the ignition system”, page 3](#)

⇒ [“2.6 Safety precautions when working on the exhaust system”, page 3](#)

2.1 Safety precautions when working on the fuel supply system

Risk of injury - fuel system operates under high pressure

The fuel system is pressurised. There is a risk of injury as fuel may spray out.

Before opening the fuel system:

- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap a clean cloth around connection and open connection carefully).

Risk of fire due to escaping fuel

If the battery is connected, the door contact switch activates the fuel pump when the driver's door is opened. Escaping fuel may ignite, causing a fire.

- Before opening the fuel system, disconnect power supply to fuel pump.

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

Risk of injury - engine may start unexpectedly

The engine can start unexpectedly if the vehicle's start/stop system is activated. A message in the instrument cluster indicates whether the start/stop system is activated.

- To deactivate the start/stop system, switch off the ignition.



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

Risk of injury if test equipment is not secured

If an accident occurs and the front passenger's airbag is triggered, test equipment which is not secured adequately may be catapulted through the vehicle with potentially serious consequences.

- Secure test equipment on the rear seat with a strap.

Or:

- Have a second mechanic operate test equipment on the rear seat.

2.4 Safety precautions when working on the cooling system

Risk of scalding as hot coolant can escape

The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant.

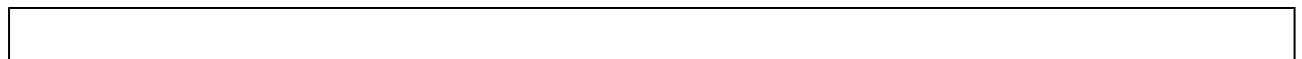
- Put on protective gloves.
- Put on safety goggles.
- Cover filler cap on expansion tank with a cloth and open carefully to release pressure.

2.5 Safety precautions when working on the ignition system

Risk of injury due to electric shock

When the engine is running, there are high voltage levels in the ignition system. There is a risk of electric shock when touching the ignition system!

- Never touch or disconnect ignition wiring when the engine is running or being turned at cranking speed.



Risk of damage to components

Washing the engine or connecting/disconnecting electrical wiring may result in components being damaged if the engine is running.

- Switch off ignition before connecting/disconnecting electrical wiring.
- Switch off ignition before cleaning engine.

2.6 Safety precautions when working on the exhaust system

Risk of damage to flexible joint

The flexible joint can be damaged or develop leaks if it is handled incorrectly.

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- Do not bend flexible joint more than 10°.
- Install flexible joint so that it is not under tension.



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3 Repair instructions

⇒ [“3.1 Rules for cleanliness”, page 5](#)

⇒ [“3.2 General notes”, page 5](#)

⇒ [“3.3 General repair instructions”, page 6](#)

⇒ [“3.4 Foreign particles in engine”, page 6](#)

⇒ [“3.5 Contact corrosion”, page 6](#)

⇒ [“3.6 Routing and attachment of pipes, hoses and wiring”, page 7](#)

⇒ [“3.7 Installing radiators and condensers”, page 7](#)

⇒ [“3.8 Nuts, bolts”, page 7](#)

⇒ [“3.9 Identification plates”, page 7](#)

⇒ [“3.10 Use of impact wrenches”, page 7](#)

⇒ [“3.11 Checking vacuum system”, page 8](#)

3.1 Rules for cleanliness

Even small quantities of dirt can lead to defects. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

- ◆ Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- ◆ Seal off open pipes and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- ◆ After removal, place parts on a clean surface and cover them. Only use lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ Do not work with compressed air when the system is open. If possible, do not move vehicle.
- ◆ Make sure that no fuel runs onto the fuel hoses. Should this occur, the fuel hoses must be cleaned again immediately.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

3.2 General notes

- ◆ The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.
- ◆ The vehicles are fitted with a crash fuel shut-off system. This system is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the fuel pump relay.



- ◆ At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system

⇒ ["2.1 Safety precautions when working on the fuel supply system", page 2](#)

3.3 General repair instructions

- ◆ Clean tools and workbench etc. before working on the injection system.
- ◆ If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- ◆ Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- ◆ Never attempt to bend high-pressure fuel lines to shape.
- ◆ When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- ◆ All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.

3.4 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.
- ◆ In the event of mechanical damage to one of the cylinder banks, the intake and exhaust systems and combustion chambers of the opposite cylinder bank must always be examined for foreign particles to prevent further damage occurring later.
- ◆ If the turbocharger has suffered mechanical damage
⇒ ["1.2 Removing and installing turbocharger", page 264](#)

3.5 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 fitted.

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 .

Please note:

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



3.6 Routing and attachment of pipes, hoses and wiring

- ◆ Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.
- ◆ Because of the limited space in the engine compartment, it is important to ensure that there is adequate clearance to any moving or hot components to avoid damage to lines and wiring.

3.7 Installing radiators and condensers

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

3.8 Nuts, bolts

- ◆ Loosen bolts in reverse sequence to specified tightening sequence.
- ◆ Bolts and nuts used to secure covers and housings must be tightened in steps according to the specified tightening sequence and method.
- ◆ Bolts and nuts which secure covers and housings should be loosened and tightened in diagonal sequence and in stages if no tightening sequence is specified.
- ◆ Always renew self-locking bolts and nuts.
- ◆ Unless otherwise specified, use a wire brush to clean the threads of bolts which are secured with locking fluid. Then install bolts with locking fluid; for locking fluid refer to ⇒ Electronic parts catalogue.
- ◆ Threaded holes which take self-locking bolts or bolts coated with locking fluid must be cleaned using a thread tap or similar. Otherwise there is a danger of the bolts shearing off the next time they are removed.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.

3.9 Identification plates

When renewing vehicle components, the identification plates on the old parts that have a replacement part number (see ⇒ Electronic parts catalogue) must be attached to the new parts due to approval regulations.

3.10 Use of impact wrenches

In general, it is permitted to use an impact wrench to unscrew bolts and nuts. An exception to this is when work is performed inside an open high-voltage battery. For this work, it is not permitted to use an impact wrench.

An impact wrench may be used to screw in bolts and nuts when performing repair work if the following requirements are observed. In general, electric and compressed-air impact wrenches should be used.



Requirements:

- Only screw in bolts with locking fluid or self-locking nuts at low speed.
- Use a suitable impact wrench with variable speed and adjustable torque range.
- Use suitable bits when working in the vicinity of sensitive surfaces, e.g. plastic-coated bits for aluminium rims.
- When working in the vicinity of natural gas systems, observe the information in the Workshop Manual "Natural gas engines - General information".

Use:

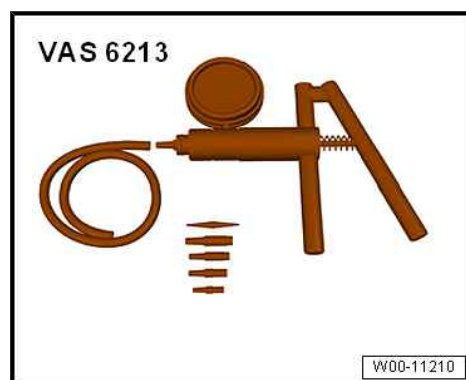
- Fit bolts/nuts by hand.
- Only use an impact wrench to screw in bolts/nuts until the head of the bolt/nut makes contact and then continue tightening with a torque wrench.
- Clean threaded pins before unscrewing the bolt/nut.

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3.11 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
 - ◆ Porous or leaking lines
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If an entry is stored in the event memory, check all vacuum lines leading to the corresponding component and also check the remaining vacuum lines leading to other components.
- If it is not possible to build up pressure with the hand vacuum pump - VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.



10 – Removing and installing engine

1 Removing and installing engine

⇒ [“1.1 Removing engine”, page 9](#)

⇒ [“1.2 Separating engine and gearbox”, page 22](#)

⇒ [“1.3 Securing engine to engine and gearbox support”, page 25](#)

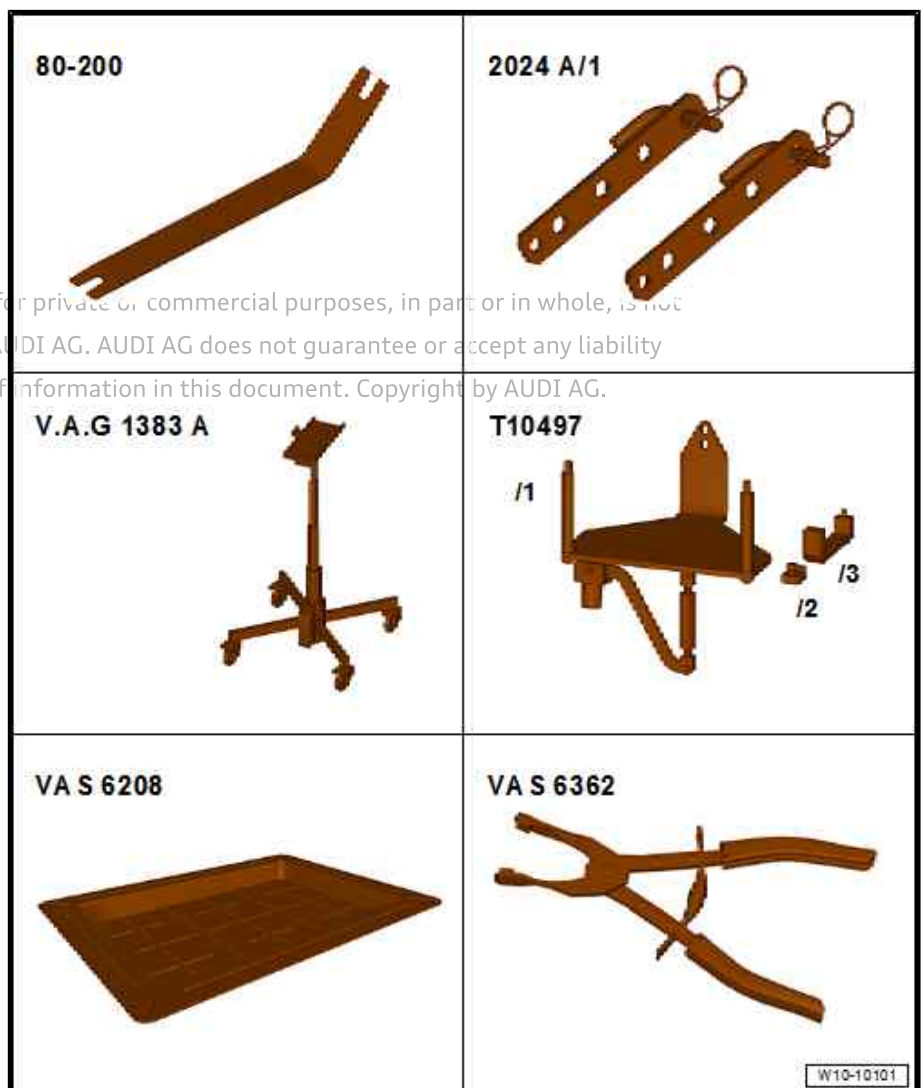
⇒ [“1.4 Installing engine”, page 27](#)

1.1 Removing engine

Special tools and workshop equipment required



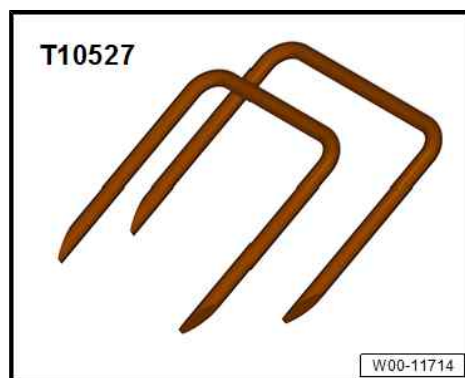
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- ◆ Removal lever - 80 - 200-
- ◆ Extension -2024 A /1- for lifting tackle - 2024 A-
- ◆ Engine and gearbox jack - V.A.G 1383 A- or -VAS 6931-
- ◆ Engine bracket - T10497-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-



- ◆ Release tool - T10527-



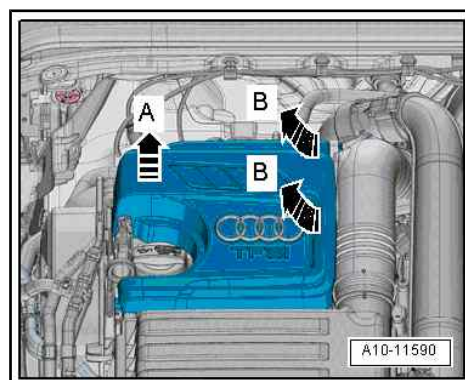
- ◆ Locking pin - T10060 A-



- ◆ Step ladder, commercially available
- ◆ Safety goggles
- ◆ Protective gloves

Procedure

- The engine is removed from underneath together with the gearbox.
- Re-install all cable ties in original positions.
- First pull engine cover panel off ball studs on right side -arrow A-, then detach towards right side -arrows B-.

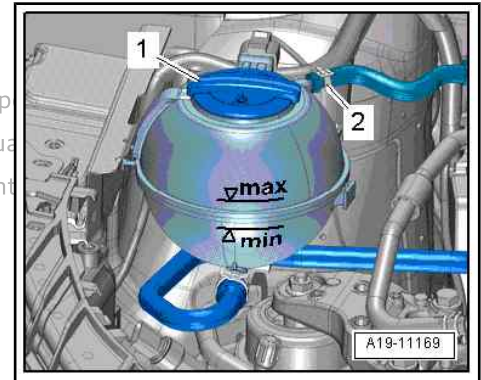




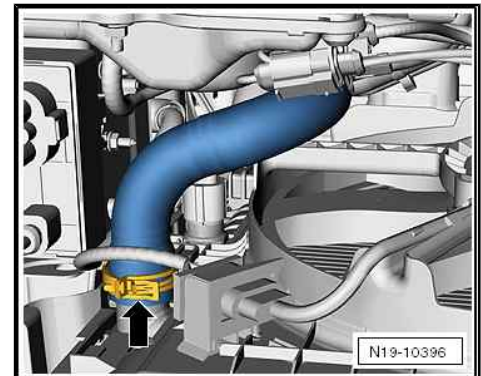
⚠ CAUTION

The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant. Danger of scalding skin and other parts of the body.

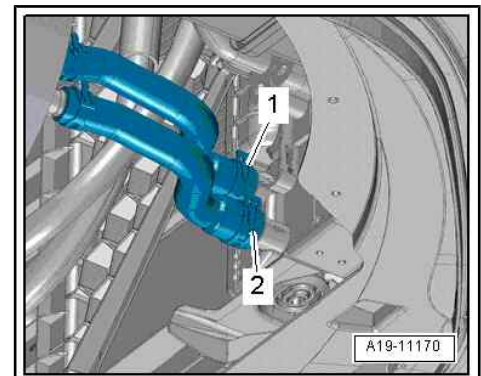
- Put on protective gloves.
- Put on safety goggles.
- Cover filler cap on expansion tank with a cloth and open carefully to release pressure.



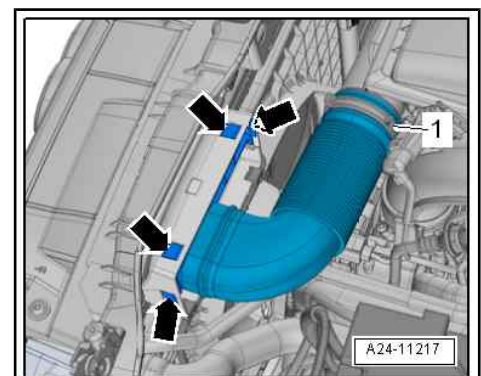
- Open filler cap -1- on coolant expansion tank.
- Release hose clip -2- and detach coolant hose.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove wheel housing liners (front left and front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Release hose clip -arrow-, disconnect coolant hose (bottom left) from radiator and drain off coolant.



- Release hose clips -1 and 2-, disconnect coolant hoses (bottom right) from water radiator for charge air cooling circuit and drain off remaining coolant.

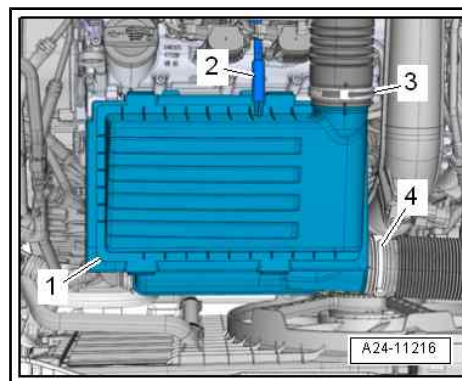


- Release hose clip -1-.
- Release fasteners -arrows- and remove air duct.

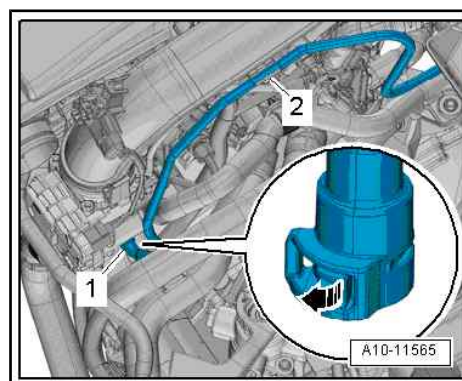




- Detach air hose -2-.
- Lift air cleaner housing -1- off ball studs.
- Release hose clip -3- and detach air pipe.
- Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

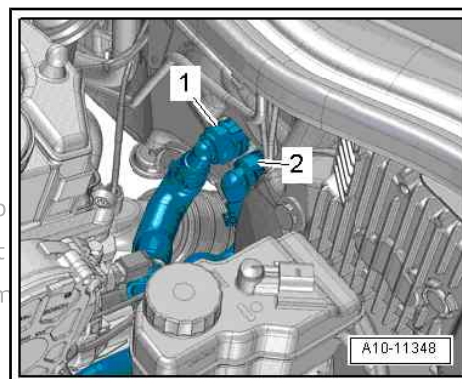


- Release catch -arrow- and disconnect vacuum hose -1-.
- Move vacuum hose clear at air pipe -2-.



- Place drip tray for workshop hoist - VAS 6208- under connection.
- Lift retaining clips -1 and 2- and disconnect coolant hoses from heat exchanger for heater.
- Guide coolant hoses downwards and drain off coolant.

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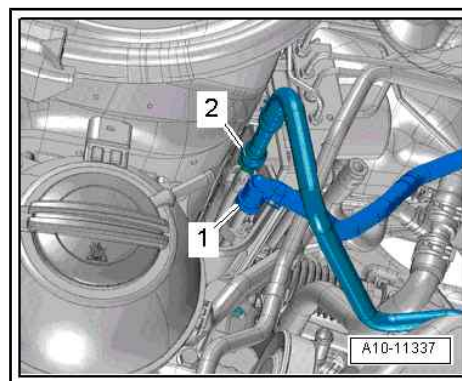


- Press release tabs and disconnect vacuum hose -2- from activated charcoal filter.

CAUTION

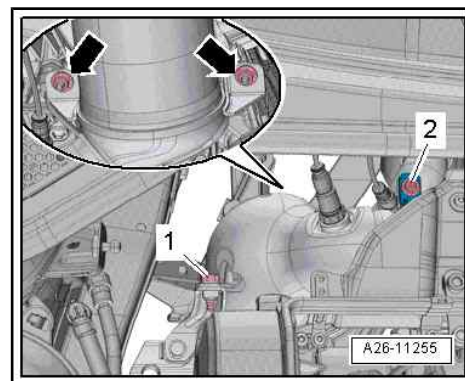
The fuel system is pressurised.
Risk of injury as fuel may spray out.

- Put on safety goggles.
 - Put on protective gloves.
 - Release pressure (wrap a clean cloth around connection and open connection carefully).
- Disconnect fuel supply line -1- ⇒ Fuel supply system; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .
 - Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

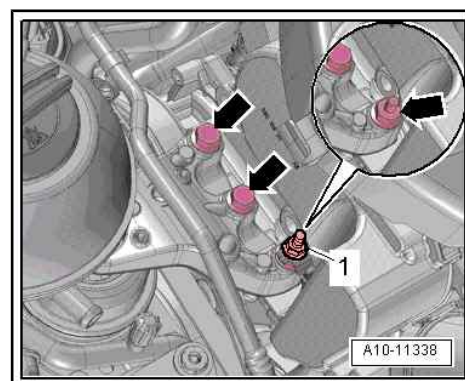




- Unscrew bolt -2- and remove screw-type clip.
- Remove bolt -1- and nuts -arrows- and tie up catalytic converter.

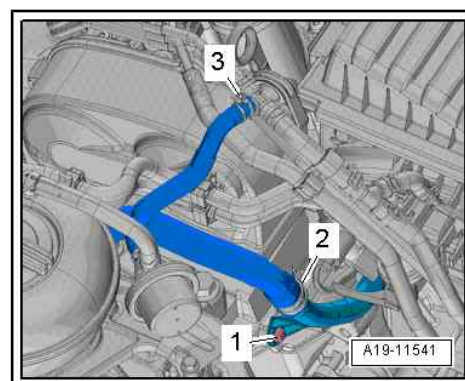


- Remove nut -1- and move earth wire clear.
- Loosen bolts -arrows- for support arm of engine mounting approx. 2 turns.



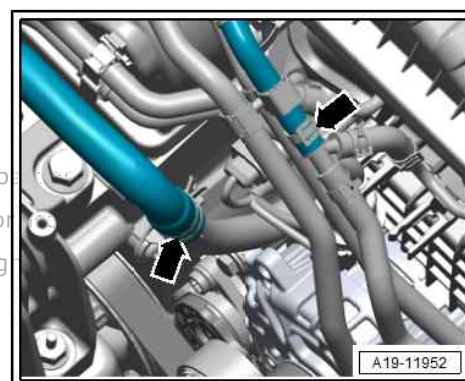
Routing of hoses, version I:

- Release hose clip -2- and disconnect coolant hose.



Routing of hoses, version II:

- Release hose clips -arrows- and disconnect coolant hoses.



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All versions (continued):

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



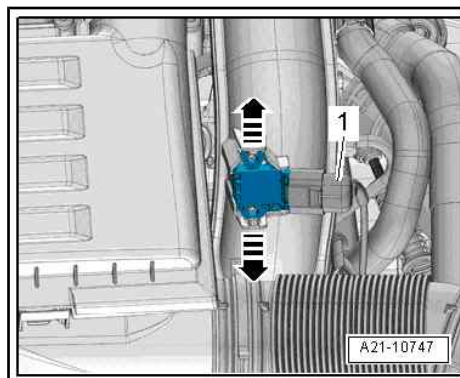
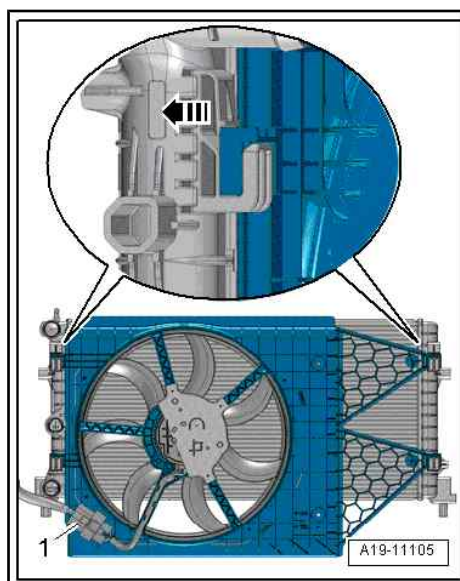
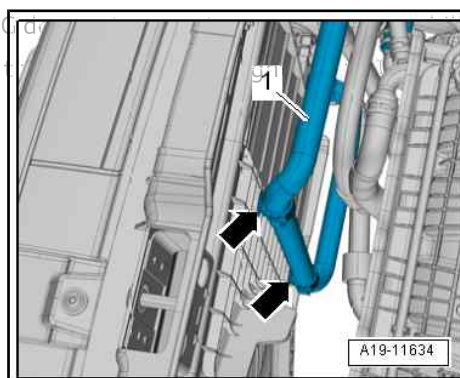
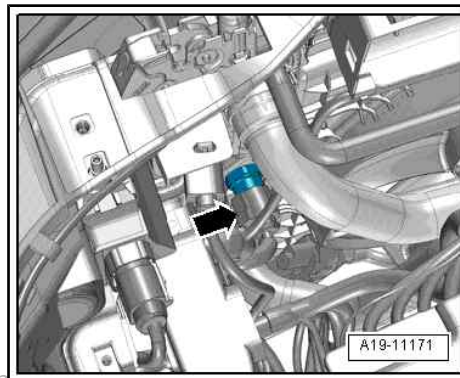
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- Move coolant hose 1 -clear arrows-

with respect to the correctness of information in this manual.

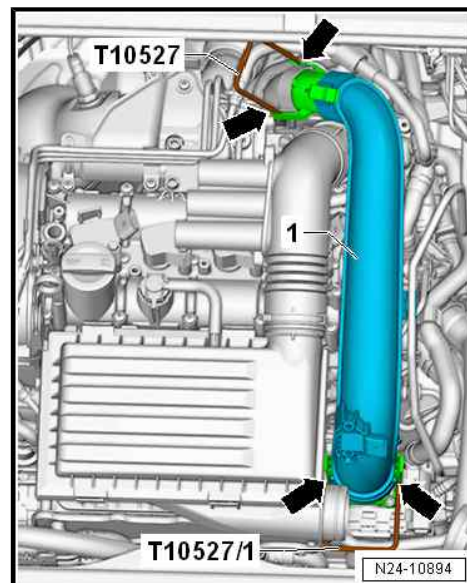
- Unplug electrical connector -1- for radiator fan.
- Press locking tabs (left and right) for radiator cowl -arrow- simultaneously.
- Lift radiator cowl off radiator and detach it downwards.

- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .

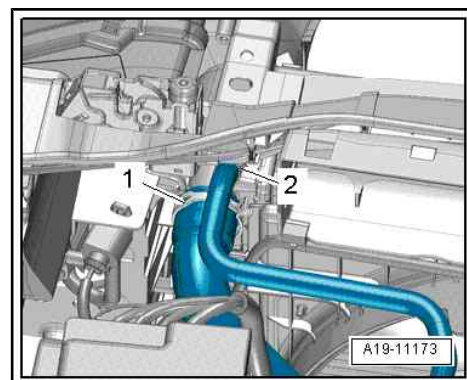




- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe -1-.

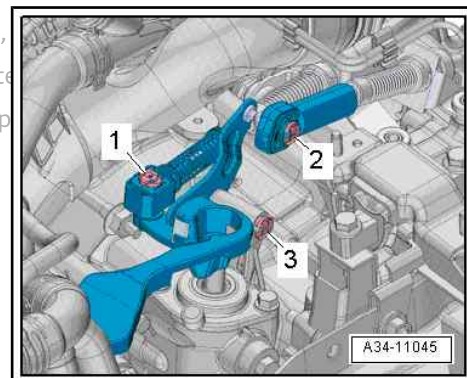


- Release hose clips -1 and 2- and detach coolant hoses (top left) from radiator.

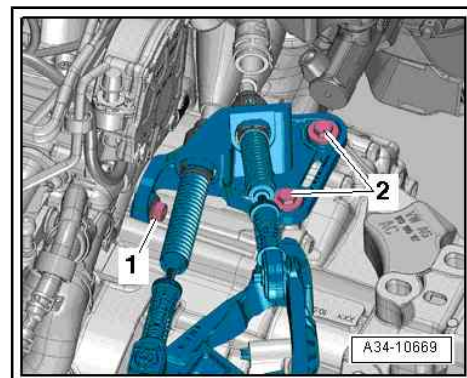


Vehicles with manual gearbox:

- Detach securing clips -1, 2-.
- Move gear selector cable and gate selector cable clear.
- Remove securing clip -3- and detach gate relay lever.

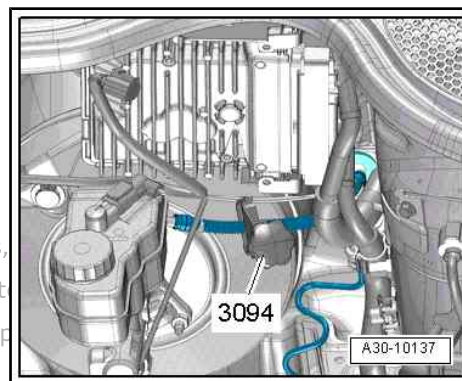


- Remove nut -1- and bolts -2-, detach cable support bracket and place to one side (selector cables remain fitted).

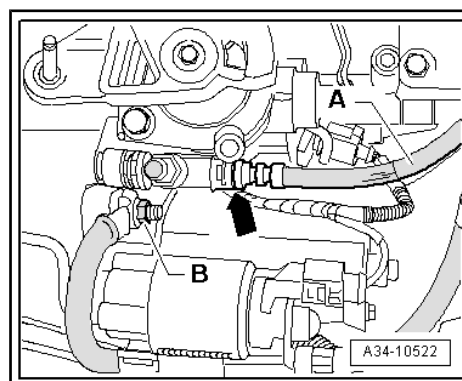




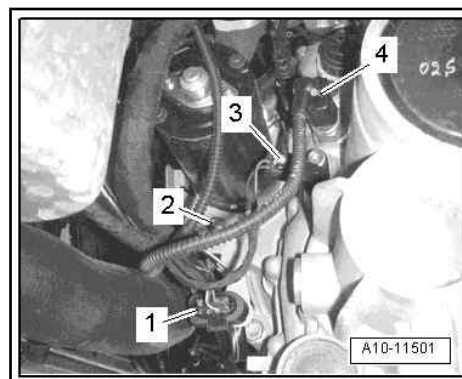
- Clamp off supply hose at brake fluid reservoir using hose clamp -3094- .
 - The supply hose is permanently deformed when it is clamped off with the hose clamp - 3094- .
 - However, this does not damage the supply hose.
 - After the removing the hose clamp -3094- , the supply hose must be returned to its original shape.
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- Pull out securing clip -arrow- as far as stop.
- Pull pipe/hose assembly -A- out of bleeder connection.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

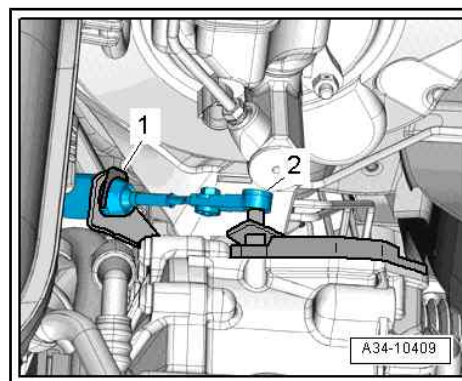


- Unplug electrical connector -1-.
- Vehicles with start/stop system: unplug electrical connector -3- for gearbox neutral position sender - G701- .
- Unplug electrical connector -4- at reversing light switch - F4- .
- Unplug electrical connector -1-.



Vehicles with dual clutch gearbox:

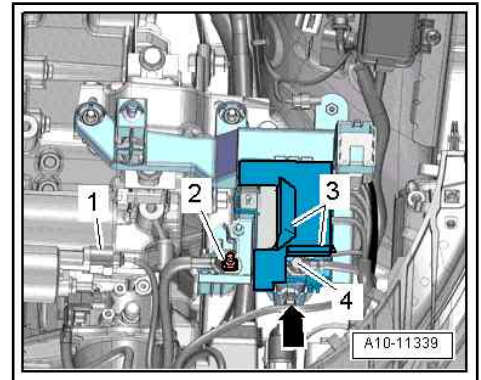
- Use removal lever - 80 - 200- to prise selector lever cable -2- off gearbox selector lever.
- Pull off retaining clip -1-, detach selector lever cable and move clear to one side.
- Take care not to bend or kink selector lever cable.



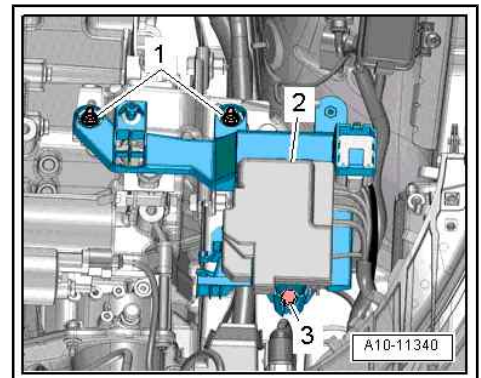


Electronics box, version 1:

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

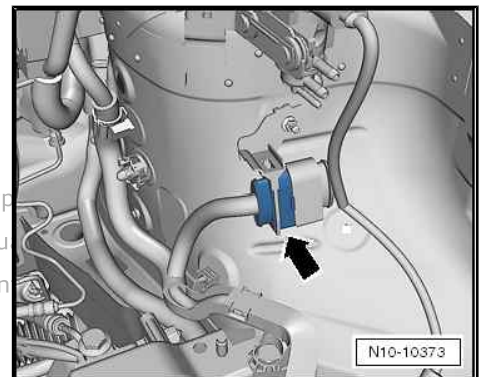


- Unscrew nut -1- and bolt -3-, and push electronics box -2- to the side.

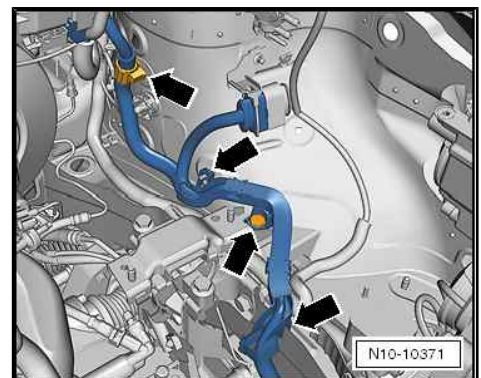


- Unplug electrical connector -arrow-.
- Remove engine control unit
⇒ ["8.2 Removing and installing engine control unit J623", page 317](#).

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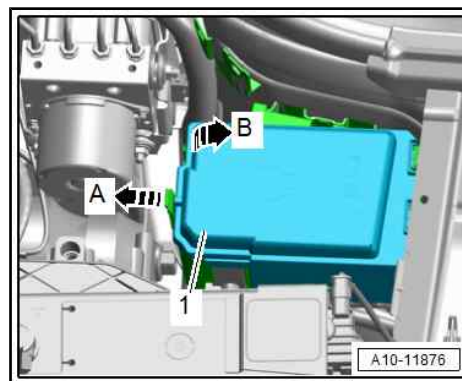
- Move engine wiring harness clear -arrows- and lay on top of engine.



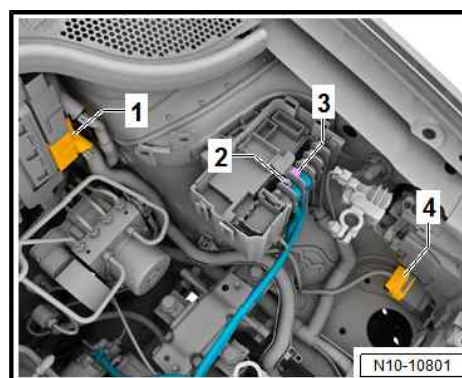


Electronics box, version 2:

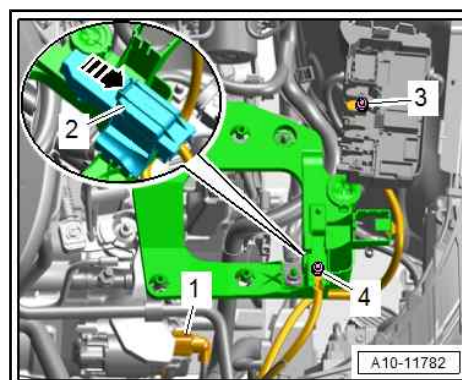
- Release fastener -arrow A-.
- Open and remove cover -1- for electronics box -arrow B-.



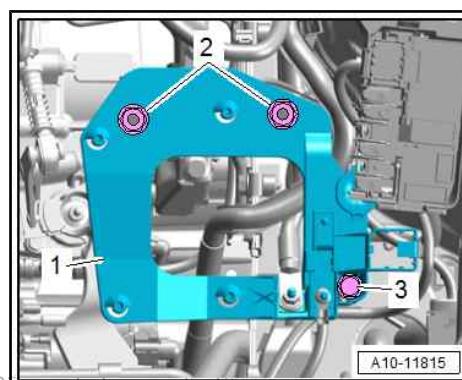
- Release and unplug electrical connector (bottom) -1- at engine control unit - J623-
⇒ ["8.2 Removing and installing engine control unit J623", page 317](#) .
- Unplug electrical connector -4-.
- Remove bolts -2, 3-, detach electrical wiring and move clear.
- Remove battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .



- Unplug electrical connector -1- at starter.
- Release catch -arrow- and open cover -2-.
- Remove B+ stud -4- and move electrical wiring clear.
- Remove nut -3-, detach electrical wiring and move clear.



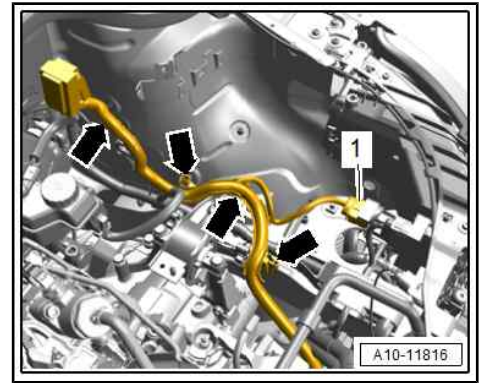
- Remove nuts -2- and bolt -3-.
- Push bracket -1- for air cleaner housing slightly to one side.



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- Move engine wiring harness clear using removal lever - 80-200- -arrows- and lay down on top of engine.

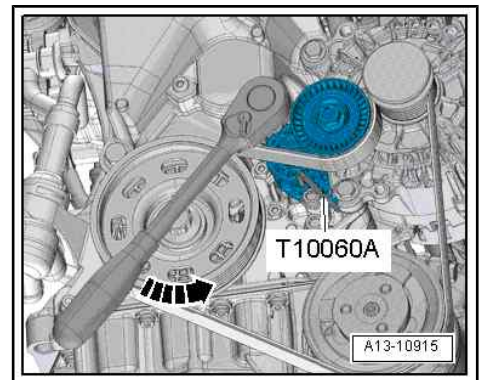


Vehicles with air conditioner compressor:

! NOTICE

Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

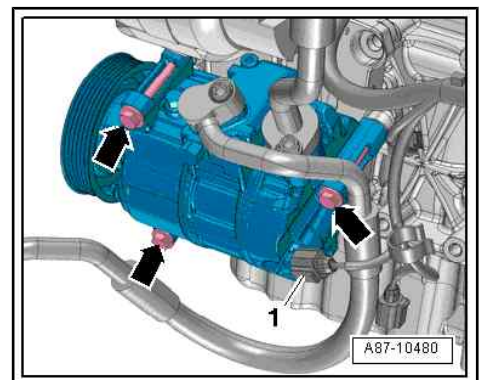
- Mark running direction before removing.
- Pay attention to running direction when reinstalling.
- To slacken poly V-belt, swivel tensioner in anti-clockwise direction -arrow- and detach poly V-belt from pulley for air conditioner compressor.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.



! NOTICE

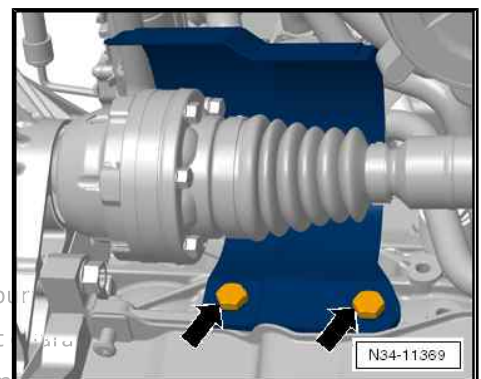
Risk of damage to refrigerant lines and hoses when detaching and pivoting air conditioner compressor.

- Do NOT stretch, kink or bend refrigerant lines and hoses.
- Unplug electrical connector -1- on air conditioner compressor regulating valve - N280- .
- Remove bolts -arrows- for air conditioner compressor.
- Detach air conditioner compressor with refrigerant lines still connected and tie up to right side.



All vehicles (continued):

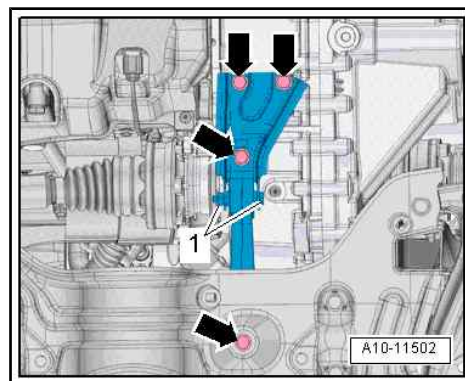
- If fitted, remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Unbolt drive shaft (left and right) from gearbox flange shafts
⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft;
Removing and installing drive shaft.
- Take care not to damage surface coating of drive shaft.



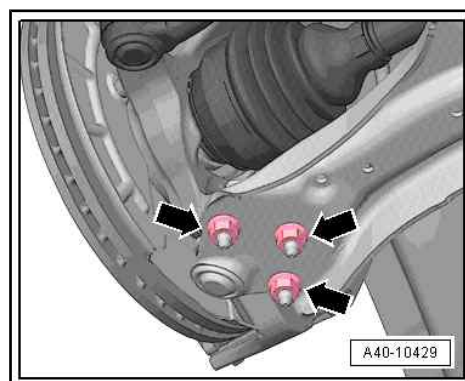
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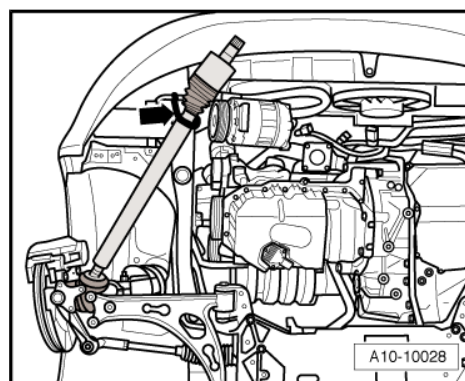
- Remove bolts -arrows- and detach pendulum support.
- The illustration shows a vehicle with a manual gearbox.



- Remove nuts -arrows- for swivel joint on both sides.
- If fitted, loosen nut on bracket for front left vehicle level sender -G78- .
- Detach swivel joints from wishbones.

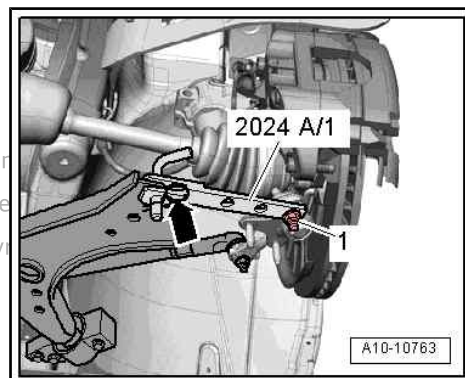


- Pivot drive shaft (right-side) forwards; to do so, push engine/ gearbox assembly slightly forwards.
- Tie up drive shaft to longitudinal member -arrow-.
- Take care not to damage surface coating of drive shaft.



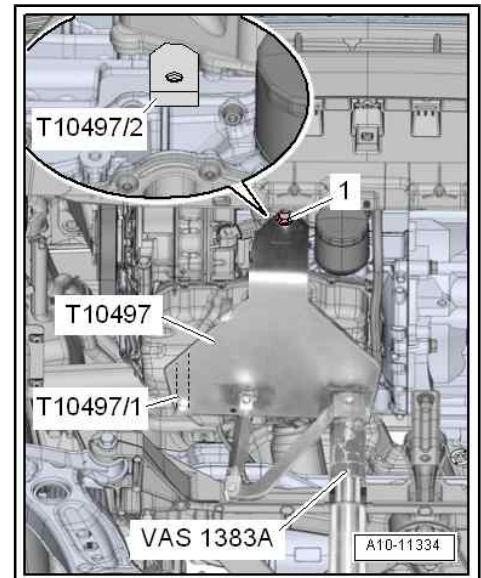
- Swivel suspension strut (left-side) outwards and support with support bracket -2024 A /1- , as shown in illustration.
- Secure retaining pin and swivel joint with locking pin -arrow- and nut -1-.

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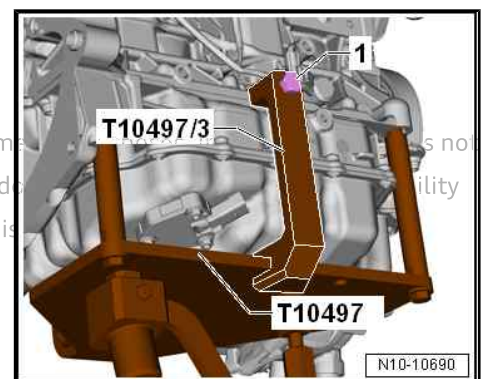


- Apply clamping piece T10497/2 at housing rib on cylinder block, as shown in illustration.
- Position engine bracket - T10497- on cylinder block using pin T10497/1 .
- Screw bolt -1- through hole “B” on engine bracket T10497 and tighten to 20 Nm.

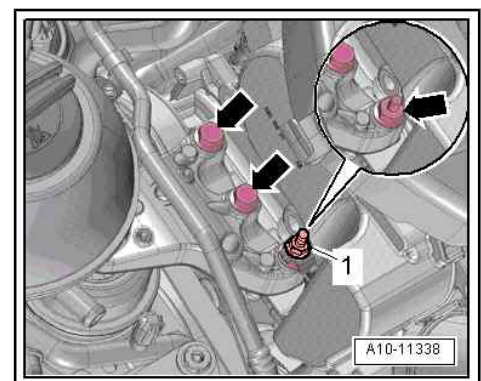


- Fit adapter - T10497/3- onto engine bracket - T10497- and tighten bolt -1- to 20 Nm.
- Insert engine and gearbox jack - V.A.G 1383 A- in engine bracket T10497 and raise engine/gearbox assembly slightly.

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

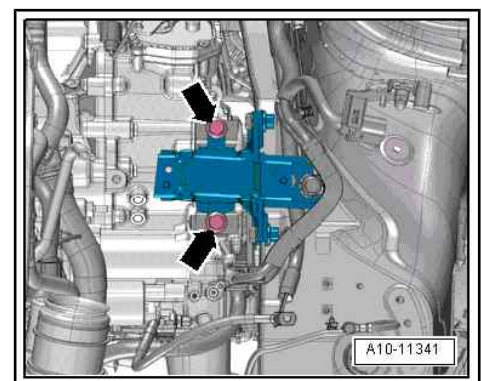


- Remove bolts -arrows- securing gearbox mounting -1-.

! NOTICE

Risk of damage to lines/pipes, hoses and engine compartment when lowering engine/gearbox assembly.

- Check that all connections between engine, gearbox, sub-frame and body have been detached.
- Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering.
- Pull engine/gearbox assembly as far forward as possible, and lower gradually.





1.2 Separating engine and gearbox

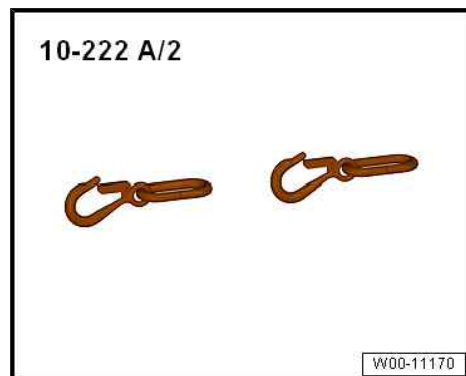
⇒ ["1.2.1 Separating engine and gearbox - vehicles with manual gearbox", page 22](#)

⇒ ["1.2.2 Separating engine and gearbox - vehicles with dual clutch gearbox", page 23](#)

1.2.1 Separating engine and gearbox - vehicles with manual gearbox

Special tools and workshop equipment required

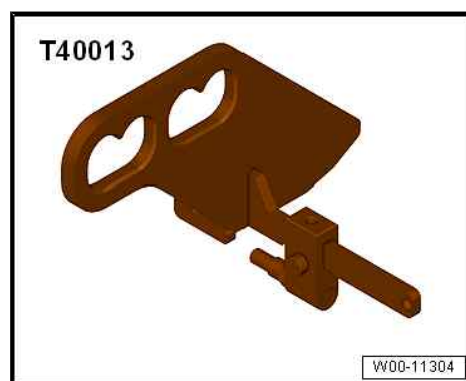
- ◆ Hooks - 10 - 222 A /2-



- ◆ Workshop hoist - VAS 6100-



- ◆ Lifting tackle - T40013-

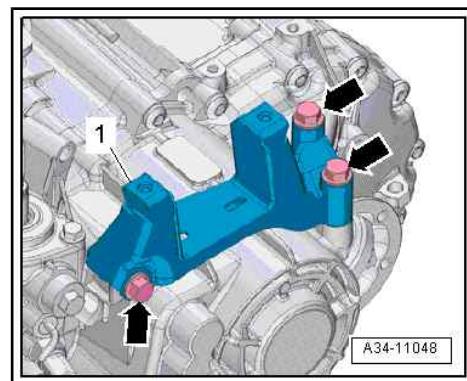


Procedure

- Engine/gearbox assembly removed and attached to engine bracket - T10497- .
- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter .



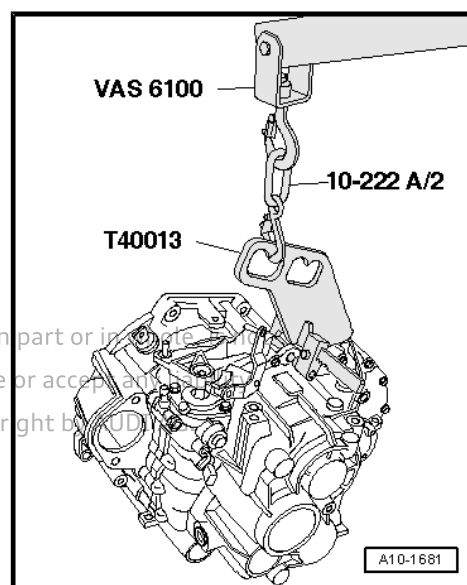
- Unscrew bolts -arrows- and detach gearbox support -1-.



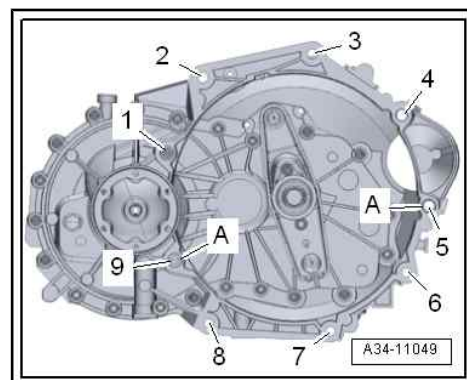
- Attach lifting tackle - T40013- to gearbox and close lock.
- Attach workshop hoist - VAS 6100- with hooks - 10 - 222 A / 2- to the lifting tackle.



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- Remove bolts -2, 3, 6, 7, 8, 9- securing gearbox to engine.
- Detach gearbox from engine.



1.2.2 Separating engine and gearbox - vehicles with dual clutch gearbox

Special tools and workshop equipment required



◆ Shackle - 10 - 222 A /12-

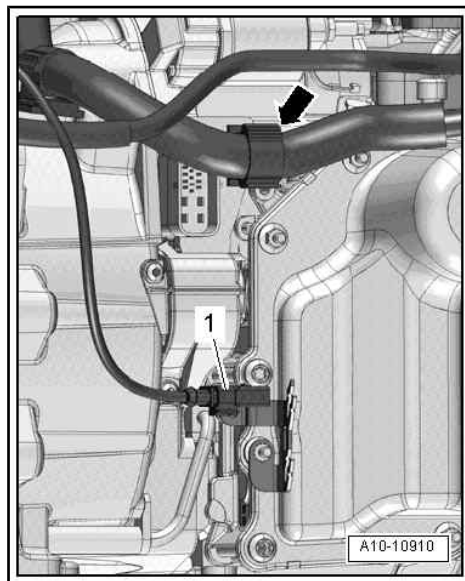


◆ Workshop hoist - VAS 6100-



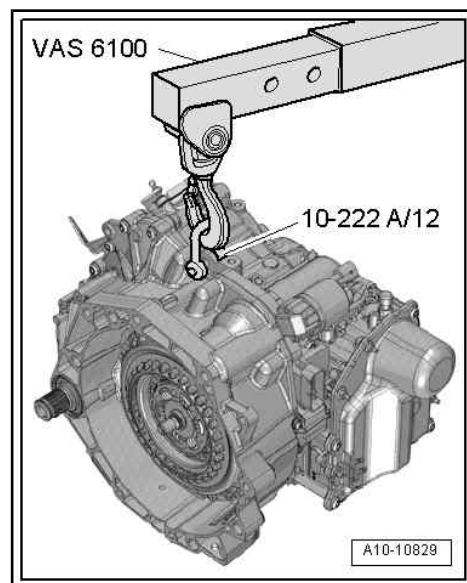
Procedure

- Engine/gearbox assembly removed and attached to engine bracket - T10497- .
- Move electrical wiring harness clear -arrow-.
- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter .

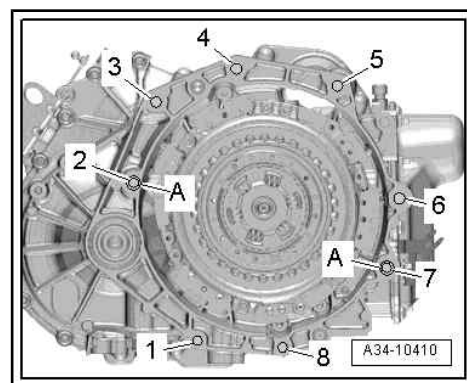




- Secure gearbox to workshop hoist - 10 - 222 A /12- using shackle - VAS 6100- .



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



1.3 Securing engine to engine and gearbox support

Special tools and workshop equipment required

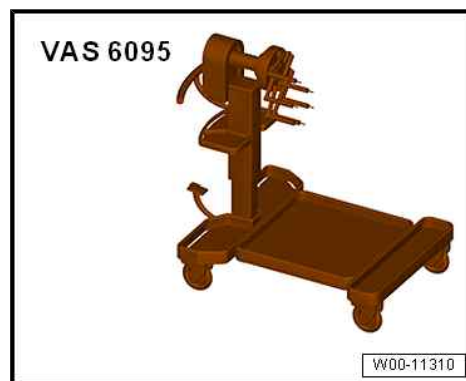
- ♦ Lifting tackle - 2024 A-

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◆ Engine and gearbox support - VAS 6095-



◆ Workshop hoist - VAS 6100-

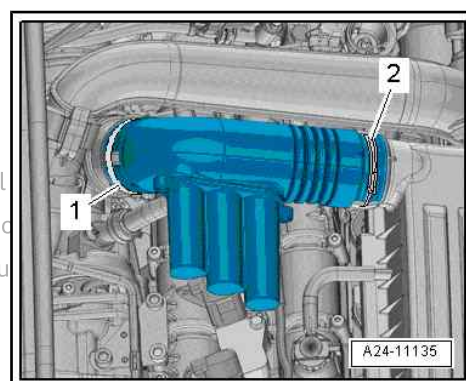


Procedure

- Gearbox detached from engine
⇒ ["1.2 Separating engine and gearbox", page 22](#) .

- Flywheel removed
⇒ ["2.2 Removing and installing flywheel", page 57](#) .

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



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

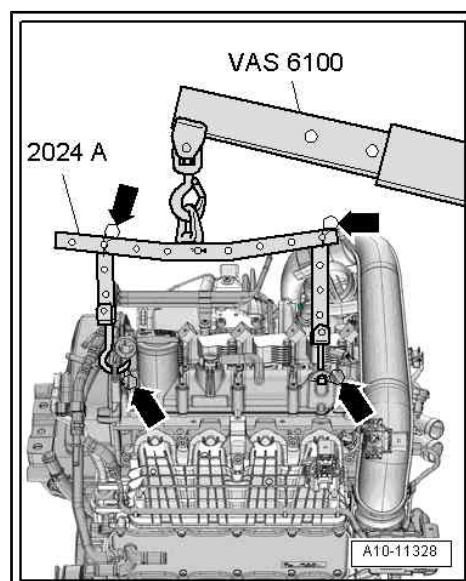
- To adjust to the centre of gravity of the assembly, the perforated rails must be positioned as shown.

CAUTION

Risk of injury if power unit drops when it is lifted.

Danger of trapping or crushing parts of the body.

- The support hooks and retaining pins on the lifting tackle must be secured with locking pins.
- Secure support hooks and retaining pins with locking pins -arrows-.
- Lift engine off T10497 using workshop hoist - VAS 6100- .

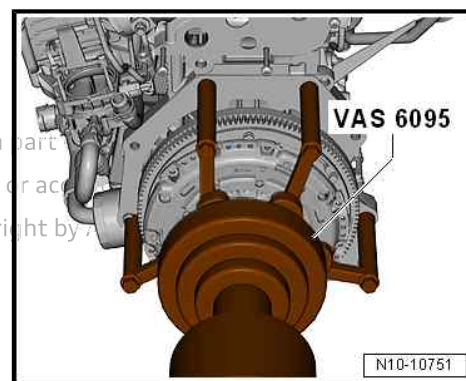




- Secure engine to engine and gearbox support - VAS 6095A- using universal support - VAS 6095/1- .
- Fit spacers so that mounting pin (bottom right in illustration) of -VAS 6095A- makes contact with crankcase free of tension.
- Thickness of spacers: approx. 10 mm

Tightening torque

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65



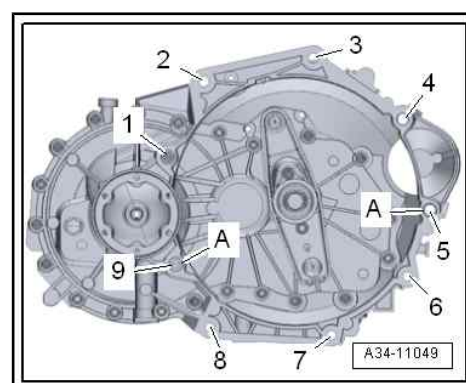
1.4 Installing engine

Procedure

- Engine/gearbox assembly attached to engine bracket T10497 .
- Renew bolts tightened with specified tightening angle.
- Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.
- Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .
- Fit all cable ties in the original positions when installing.
- Vehicles with dual clutch gearbox: The needle bearing in the crankshaft must always be renewed if the engine has been separated from the gearbox
⇒ [“3.3 Renewing needle bearing in crankshaft”, page 67](#) .
- Install intermediate plate
⇒ [Fig. ““Installing intermediate plate””, page 57](#) .

Vehicles with manual gearbox:

- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Remove needle bearing in crankshaft if fitted
⇒ [“3.3 Renewing needle bearing in crankshaft”, page 67](#) .



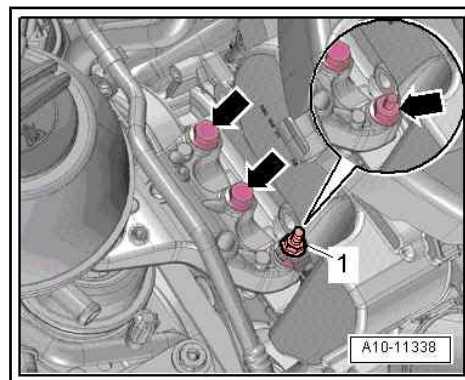
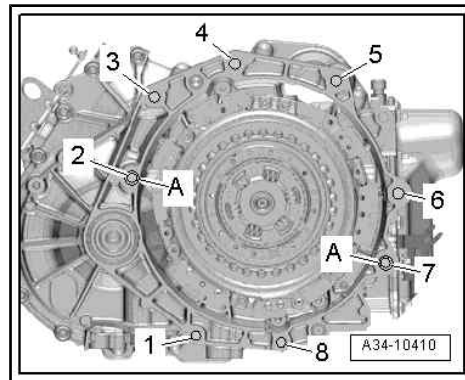


Vehicles with dual clutch gearbox:

- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Install needle bearing if not fitted in crankshaft
⇒ ["3.3 Renewing needle bearing in crankshaft", page 67](#) .

All vehicles (continued):

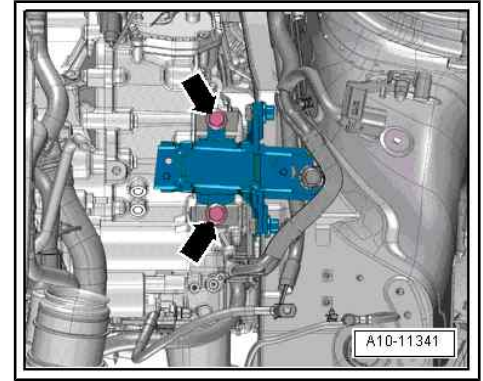
- If removed previously: install flywheel
⇒ ["2.2 Removing and installing flywheel", page 57](#) ; install clutch ⇒ 6-speed manual gearbox 0A8, front-wheel drive; Rep. gr. 30 ; Clutch; Removing and installing clutch , or ⇒ 7-speed automatic gearbox 0AM, 0CW (S tronic); Rep. gr. 30 ; Clutch .
- Secure gearbox to engine.
- Install gearbox support.
- Take up engine/gearbox assembly with engine bracket T10497 .
- Guide engine/gearbox assembly into body.
- Initially hand-tighten bolts -arrows- for support arm of engine mounting until they make contact.



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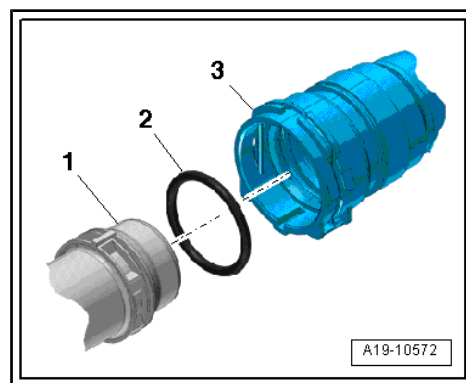
- Initially screw in bolts -arrows- for gearbox mounting by hand until they make contact.
- Remove engine bracket - T10497- from engine.
- Install starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Exploded view - starter .
- Bleed clutch system ⇒ Rep. gr. 30 ; Clutch mechanism; Bleeding clutch mechanism .
- Install cables with cable support bracket or selector lever cable ⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector cables .
- Install catalytic converter
⇒ ["2.2 Removing and installing catalytic converter", page 325](#) .
- Install drive shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .
- Install pendulum support
⇒ ["2.4 Removing and installing pendulum support", page 37](#) .
- Install wishbone, swivel joint and coupling rod ⇒ Running gear, axles, steering; Rep. gr. 40 ; Lower wishbone, swivel joint; Exploded view - lower wishbone, swivel joint .
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit .
- Install poly V-belt
⇒ ["1.3 Removing and installing poly V-belt", page 45](#) .
- Install radiator cowl
⇒ ["4.3 Removing and installing radiator cowl", page 258](#) .
- Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .
- Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Install throttle valve module - J338-
⇒ ["3.3 Removing and installing throttle valve module J338", page 296](#) .
- Install engine control unit - J623-
⇒ ["8.2 Removing and installing engine control unit J623", page 317](#) .



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- Remove damaged O-ring -2- from coolant hose -3-.
- Lubricate new O-ring lightly with coolant and fit O-ring in coolant hose.
- Press coolant hose onto connection -1- until it engages audibly.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.
- Install wheel housing liners ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Install air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”, page 291](#) .
- Install air pipe ⇒ [Item 12 \(page 293\)](#) .
- Check oil level ⇒ Maintenance ; Booklet 819 .
- Fill up with coolant ⇒ [page 226](#) .



Tightening torques

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

Component		Nm
Bolts/nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65

- ◆ Assembly mountings
⇒ [“2.1 Exploded view - assembly mountings”, page 31](#)
- ◆ Securing gearbox to engine ⇒ Rep. gr. 34 : Removing and installing gearbox; Tightening torques for gearbox
- Connect ⇒ Vehicle diagnostic tester.
- ◆ Erase entries in event memory, Guided Functions, Interrogate event memory.
- After renewing engine:
- ◆ Reset misfire adaption by selecting 01 - Reset adaptations misfires in Guided Functions.
- ◆ Delete adaption values for injectors using ⇒ Vehicle diagnostic tester: select Delete adaption values for injectors in Guided Functions.



2 Assembly mountings

⇒ [“2.1 Exploded view - assembly mountings”, page 31](#)

⇒ [“2.2 Removing and installing engine mountings”, page 32](#)

⇒ [“2.3 Removing and installing gearbox mounting”, page 35](#)

⇒ [“2.4 Removing and installing pendulum support”, page 37](#)

2.1 Exploded view - assembly mountings

1 - Engine support

- ☐ Tightening torque and sequence
⇒ [Fig. “Engine support - tightening torque and sequence”, page 32](#)
- ☐ Removing and installing
⇒ [“1.5 Removing and installing engine support”, page 48](#)

2 - Bolt

- ☐ Renew after removing
- ☐ Tightening sequence
⇒ [Fig. “Engine support - tightening torque and sequence”, page 32](#)

3 - Engine mounting

- ☐ With support arm
- ☐ Do not separate engine mounting and support arm
- ☐ Removing and installing
⇒ [“2.2 Removing and installing engine mountings”, page 32](#)

4 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm +90°

5 - Threaded pin

- ☐ Renew after removing
- ☐ 30 Nm +90°

6 - Bolt

- ☐ Renew after removing
- ☐ 30 Nm +90°

7 - Pendulum support

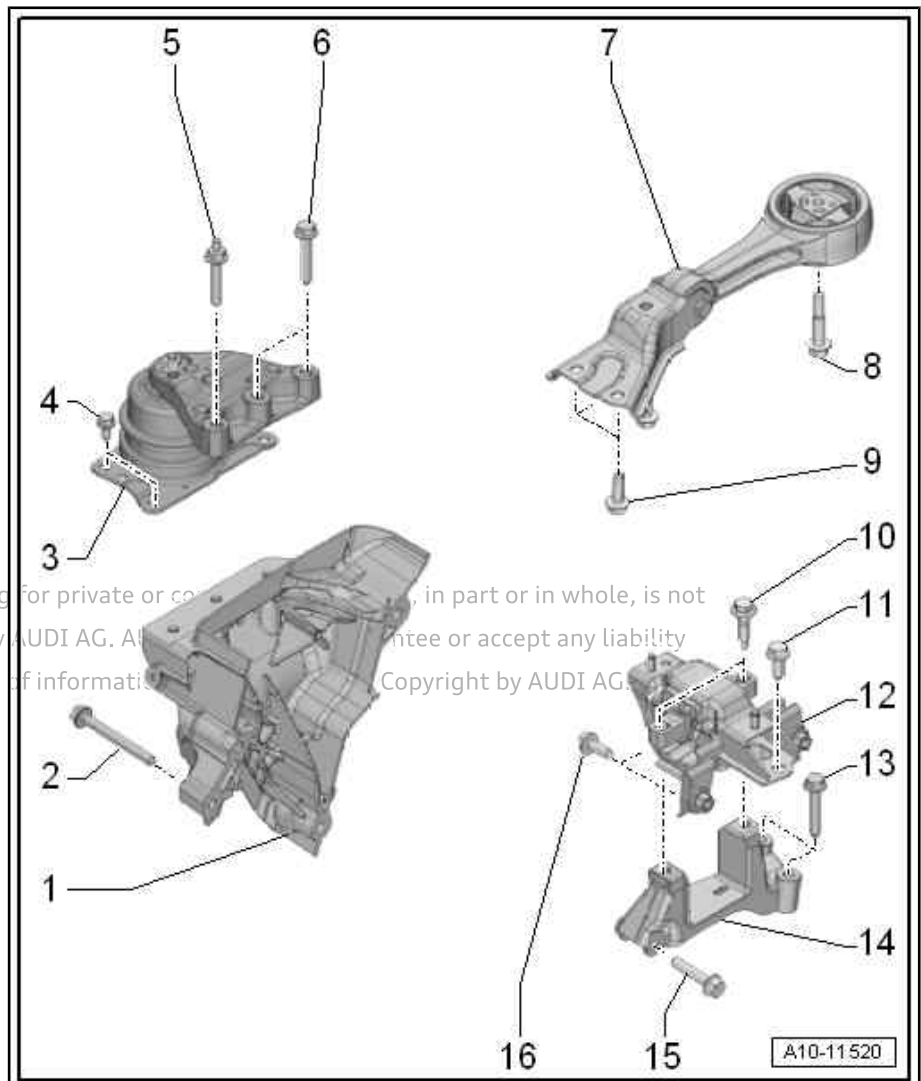
- ☐ Removing and installing ⇒ [“2.4 Removing and installing pendulum support”, page 37](#)

8 - Bolt

- ☐ Renew after removing
- ☐ 40 Nm +90°

9 - Bolt

- ☐ Renew after removing
- ☐ 30 Nm +90°
- ☐ Depending on version: 2x or 3x



**10 - Bolt**

- ☐ Renew after removing
- ☐ 40 Nm +90°

11 - Bolt

- ☐ Renew after removing
- ☐ 50 Nm +90°

12 - Gearbox mounting

- ☐ With support arm
- ☐ Removing and installing ⇒ [“2.3 Removing and installing gearbox mounting”, page 35](#)

13 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

14 - Gearbox support

- ☐ Removing and installing ⇒ [“2.3 Removing and installing gearbox mounting”, page 35](#)

15 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

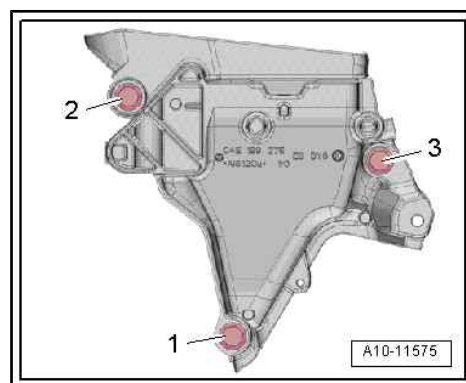
16 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

Engine support - tightening torque and sequence

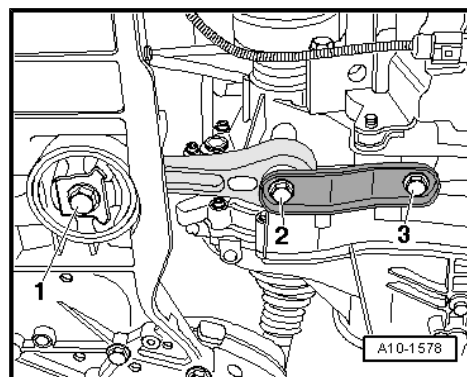
- Renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 3-	7 Nm
2.	-1 ... 3-	40 Nm
3.	-1 ... 3-	Turn 90° further

**Installing pendulum support**

- Renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-2, 3-	⇒ Item 9 (page 31)
2.	-1-	⇒ Item 8 (page 31)
3.	-1 ... 3-	Turn 90° further

**2.2 Removing and installing engine mountings****Special tools and workshop equipment required**



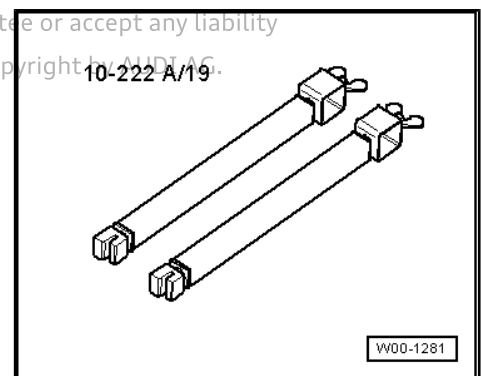
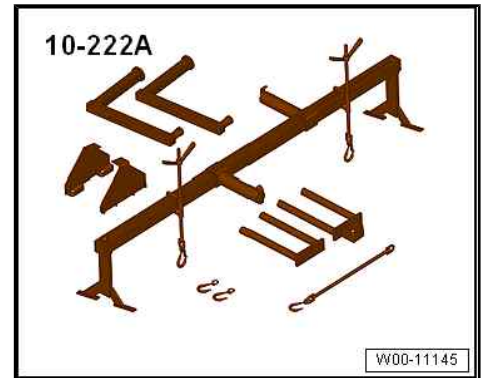
◆ Support bracket - 10 - 222 A-



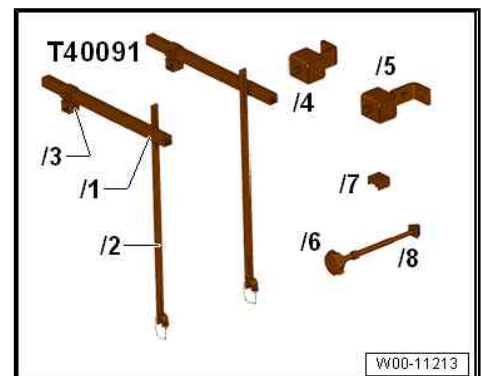
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◆ Adapters 10 - 222 A/19-

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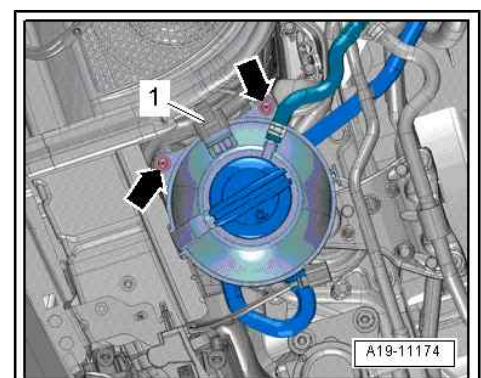


◆ Engine support basic set - T40091-



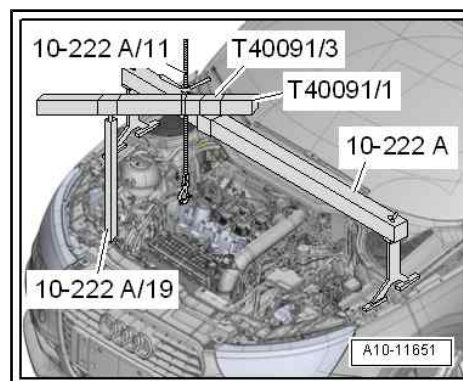
Removing

- Remove engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#).
- Remove bolts -arrows-.
- Detach electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.
- Remove filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 ; Windscreen washer system; Removing and installing washer fluid reservoir .

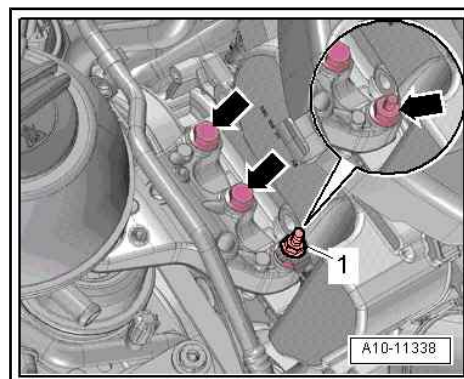




- Set up support bracket - 10 - 222 A- on top edges of body flanges (left and right) and longitudinal member (right-side), as shown in illustration.
- Attach hook of spindle - 10 - 222 A /11- to engine lifting eye (right-side).
- Take up weight of engine/gearbox assembly slightly; do not lift.



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

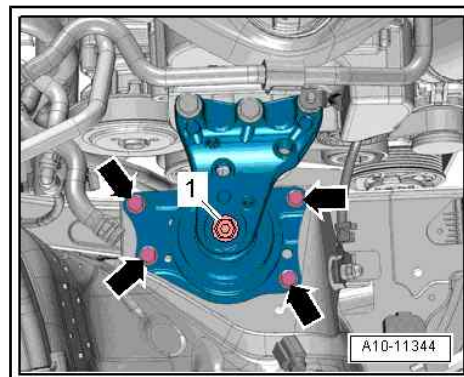


- Do NOT loosen nut -1-.
- Remove bolts -arrows- and detach engine mounting.

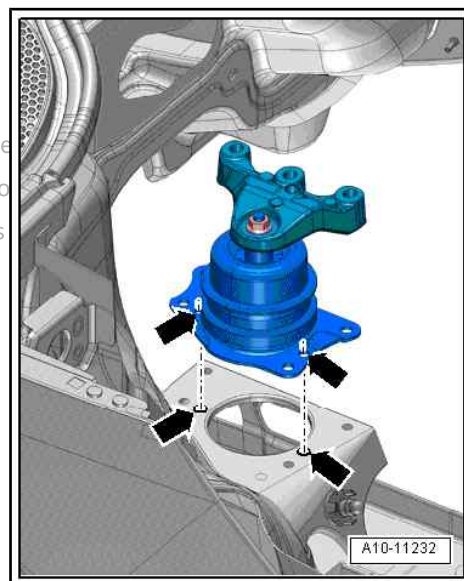
Installing

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

- Renew bolts tightened with specified tightening angle.



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



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



- Initially hand-tighten bolts -arrows- for support arm of engine mounting until they make contact.
- The support arm must not turn when you tighten the bolts.
- Tighten bolts.
- Install filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 ; Windscreen washer system; Removing and installing washer fluid reservoir .
- Install engine cover panel
⇒ ["3.1 Removing and installing engine cover panel", page 39](#) .

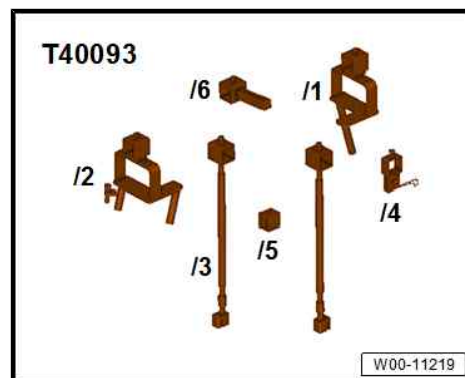
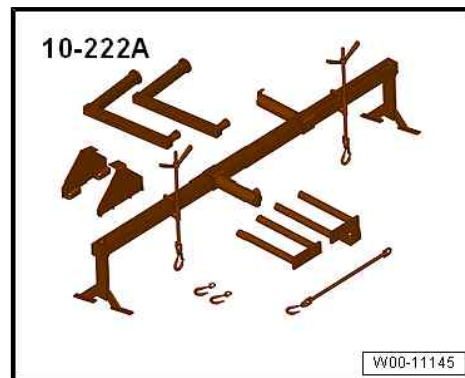
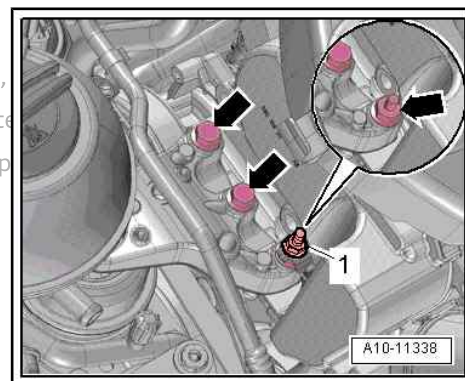
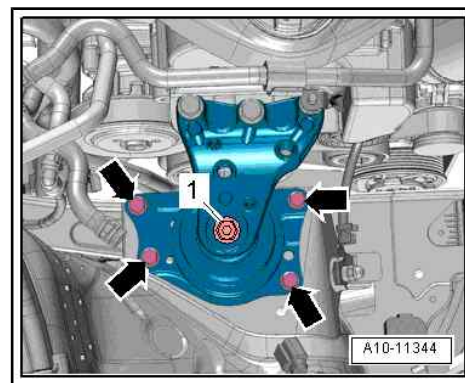
Tightening torques

- ◆ ⇒ ["2.1 Exploded view - assembly mountings", page 31](#)

2.3 Removing and installing gearbox mounting

Special tools and workshop equipment required

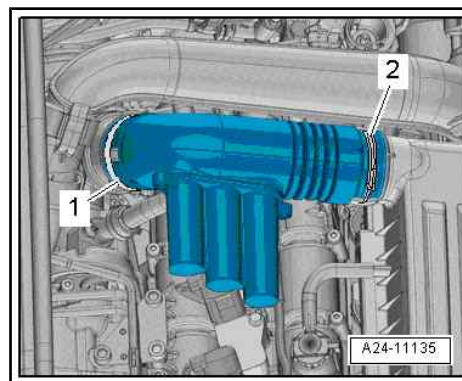
- ◆ Support bracket - 10 - 222 A-
- ◆ Engine support supplement set - T40093-





Removing

- Remove air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”, page 291](#).
- Release hose clip -1- and detach air pipe.



Electronics box, version 1:

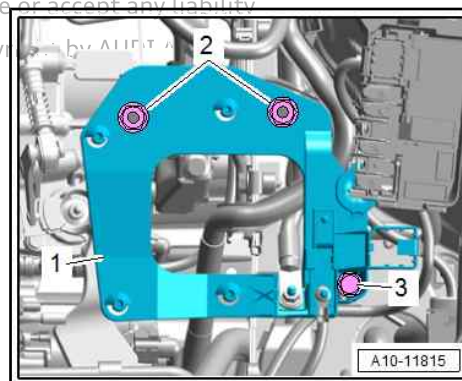
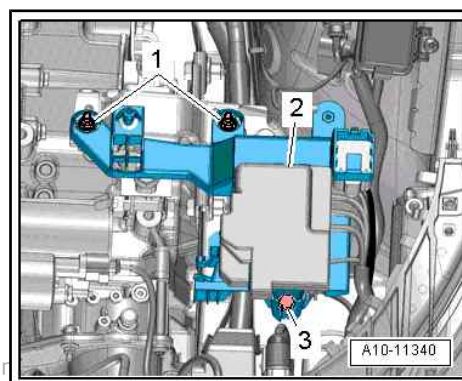
- Unscrew nuts -1- and bolt -3-, and push electronics box -2- to the side.



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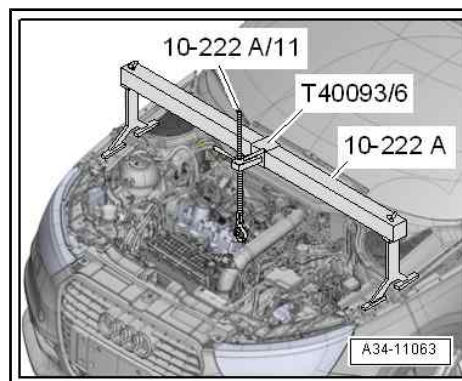
Electronics box, version 1:

- Remove nuts -2- and bolt -3-.
- Push bracket -1- for air cleaner housing slightly to one side.



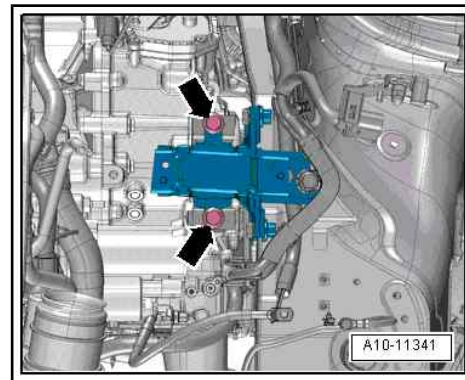
All vehicles (continued):

- Position support bracket - 10 - 222 A- on top edges of body flanges as shown in illustration.
- Attach hook of spindle - 10 - 222 A /11- to engine lifting eye (front left).
- Take up weight of engine/gearbox assembly slightly.





- Remove bolts -arrows- securing gearbox mounting.



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

Installing

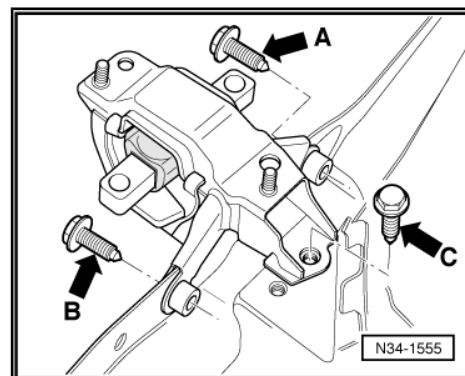
Installation is carried out in reverse order; note the following:

- Renew bolts tightened with specified tightening angle.
- Install air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”](#),
[page 291](#) .

Tightening torques

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

- ◆ Electronics box ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes: Overview of fitting locations - relay carriers, fuse carriers, electronics boxes



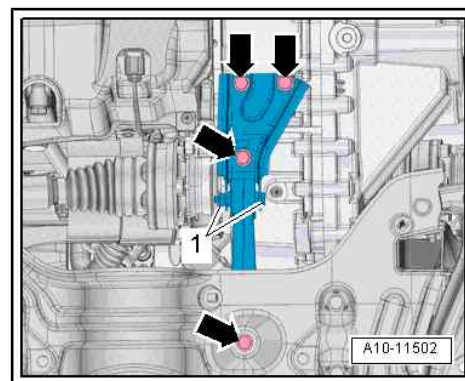
2.4 Removing and installing pendulum support

Removing

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

Version with three bolted connections:

- Do NOT loosen bolted connection -1-.
- Remove bolts -arrows- and detach pendulum support.





Version with two bolted connections:

- Do NOT loosen bolted connection -1-.
- Remove bolts -arrows- and detach pendulum support.

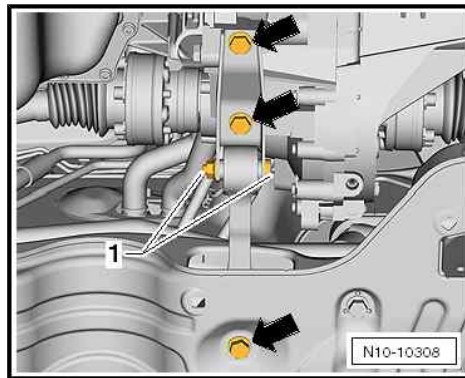
Installing

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

- Renew bolts tightened with specified tightening angle.
- Secure pendulum support first to gearbox and then to sub-frame.

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 31](#)



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3 Engine cover panel

⇒ ["3.1 Removing and installing engine cover panel", page 39](#)

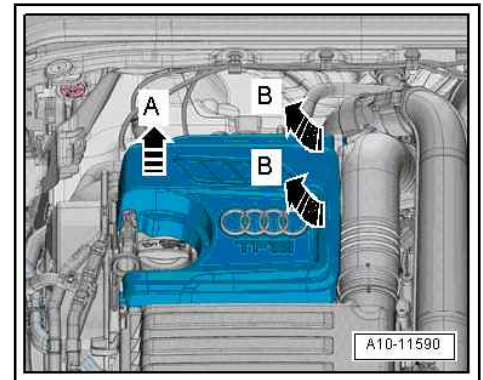
3.1 Removing and installing engine cover panel

Removing

- Lift right side of engine cover panel -arrow A- and detach towards right -arrows B-.

Installing

- To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.
- Position engine cover panel, paying attention to oil filler neck and dipstick.
- Press engine cover panel into rubber grommets first on the left side and then at front.



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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ [“1.1 Exploded view - poly V-belt drive”, page 40](#)

⇒ [“1.2 Exploded view - sealing flange \(pulley end\)”, page 44](#)

⇒ [“1.3 Removing and installing poly V-belt”, page 45](#)

⇒ [“1.4 Removing and installing tensioner for poly V-belt”, page 47](#)

⇒ [“1.5 Removing and installing engine support”, page 48](#)

⇒ [“1.6 Removing and installing pulley”, page 50](#)

⇒ [“1.7 Renewing crankshaft oil seal \(pulley end\)”, page 52](#)

1.1 Exploded view - poly V-belt drive

⇒ [“1.1.1 Exploded view - poly V-belt drive, vehicles without air conditioner compressor”, page 40](#)

⇒ [“1.1.2 Exploded view - poly V-belt drive, vehicles with air conditioner compressor”, page 42](#)

1.1.1 Exploded view - poly V-belt drive, vehicles without air conditioner compressor



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**1 - Bolt**

- ☐ Renew after removing
- ☐ Use counterhold tool - T10475- when loosening and tightening
- ☐ 150 Nm +180°

2 - Belt pulley/vibration damper

- ☐ Allocation ⇒ Electronic parts catalogue

- ☐ Removing and installing

⇒ ["1.6 Removing and installing pulley", page 50](#)

3 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Do not kink
- ☐ Routing of poly V-belt
⇒ [page 46](#)
- ☐ Removing and installing
⇒ ["1.3 Removing and installing poly V-belt", page 45](#)
- ☐ Assigning to decoupler pulley
⇒ [Fig. "Different versions of decoupler pulley", page 42](#)
- ☐ When installing, make sure it is properly seated on pulleys.

4 - Bolt

- ☐ 23 Nm

5 - Tensioner for poly V-belt

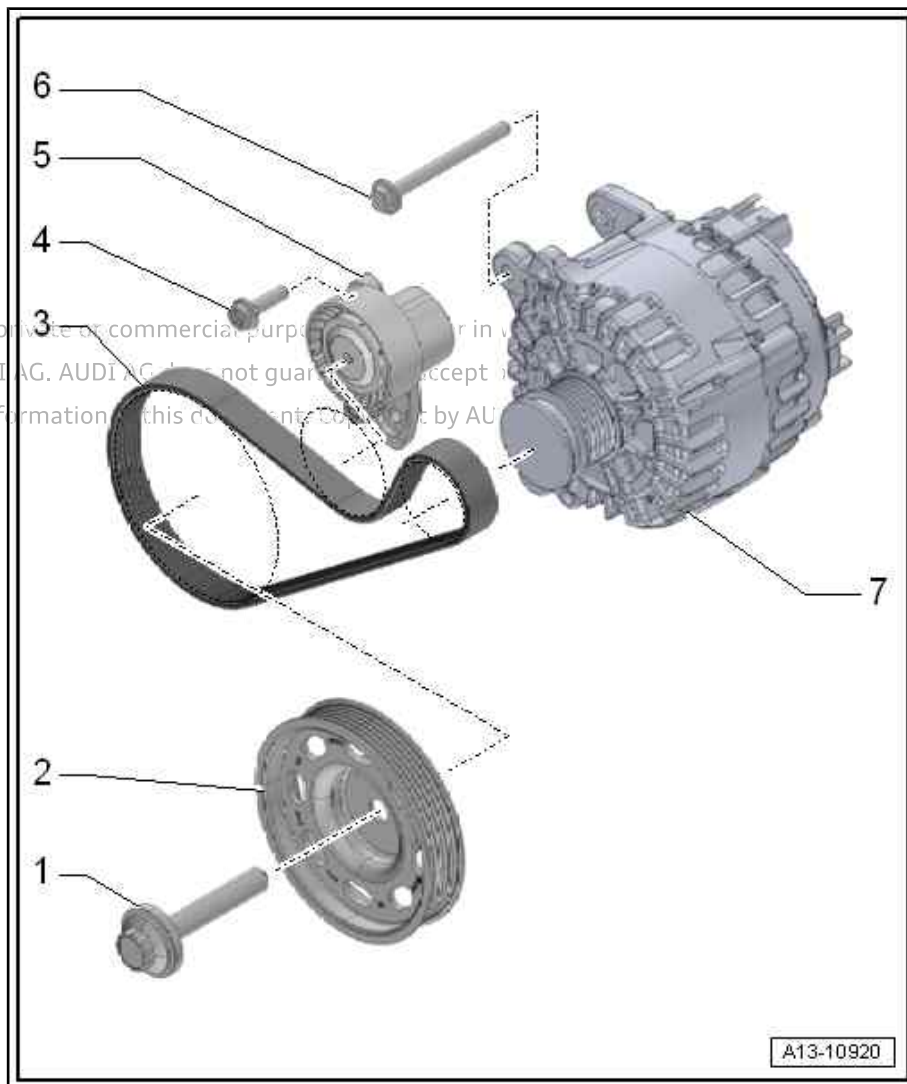
- ☐ Pivot with socket to slacken poly V-belt
- ☐ Lock in position with locking pin - T10060 A- .
- ☐ Removing and installing ⇒ ["1.4 Removing and installing tensioner for poly V-belt", page 47](#)

6 - Bolt

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

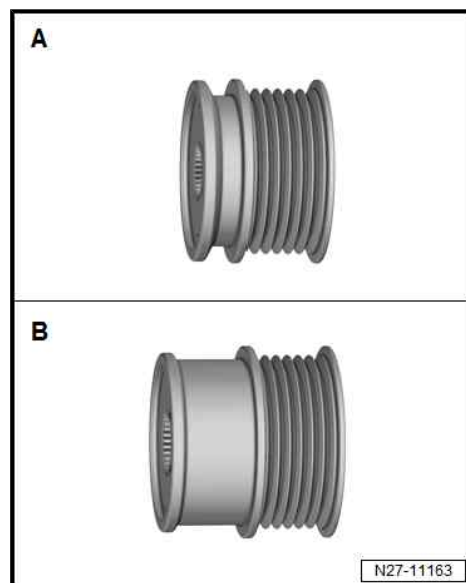
7 - Alternator

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



**Different versions of decoupler pulley**

- Poly V-belts of different lengths are assigned to decoupler pulleys -A, B-.
- Allocate poly V-belt ⇒ Electronic parts catalogue .

**1.1.2 Exploded view - poly V-belt drive, vehicles with air conditioner compressor****1 - Poly V-belt**

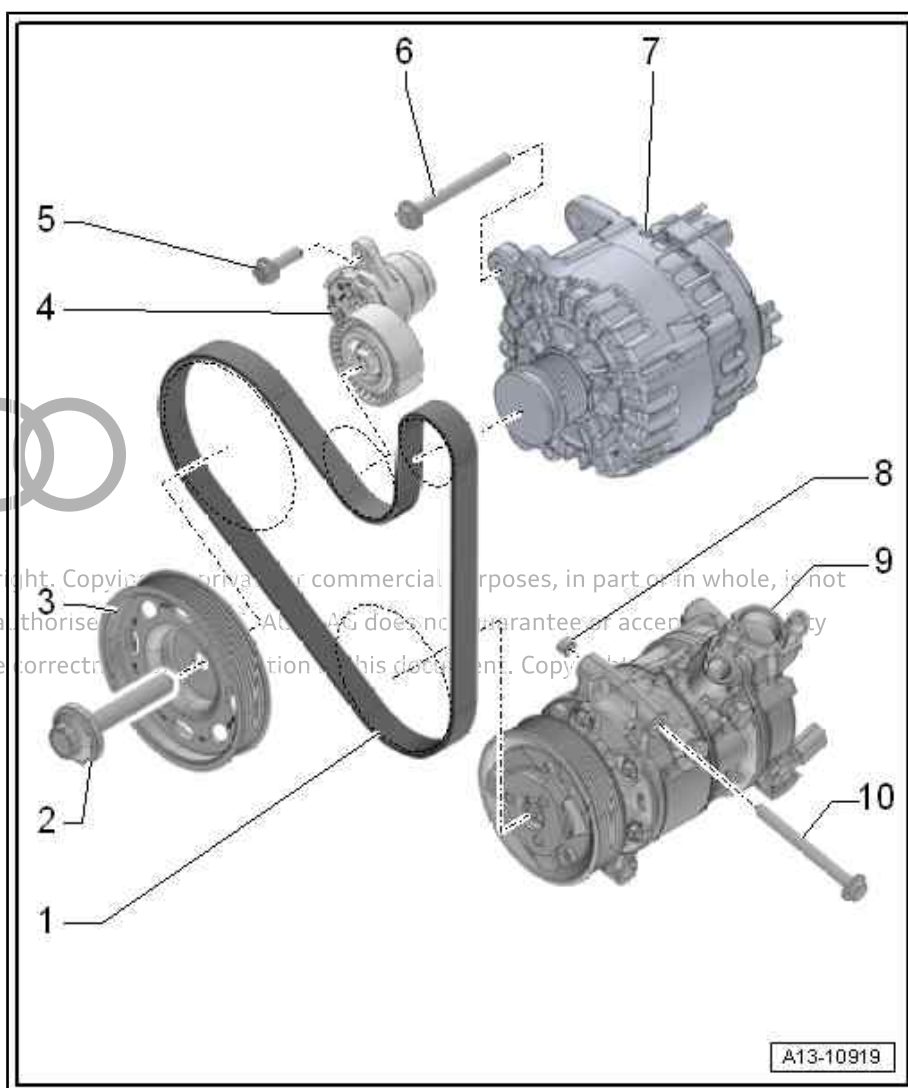
- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Do not kink
- ☐ Routing of poly V-belt ⇒ [page 47](#)
- ☐ Removing and installing ⇒ [“1.3.1 Removing and installing poly V-belt - vehicles without air conditioner compressor”](#), [page 45](#)
- ☐ Assigning to decoupler pulley ⇒ [Fig. “Different versions of decoupler pulley”](#), [page 42](#)
- ☐ When installing, make sure it is properly seated on pulleys

2 - Bolt

- ☐ Tightening torque ⇒ [Item 1 \(page 41\)](#)
- ☐ Use counterhold tool - T10475- when loosening and tightening

3 - Belt pulley/vibration damper

- ☐ Allocation ⇒ Electronic parts catalogue
- ☐ Removing and installing ⇒ [“1.6 Removing and installing pulley”](#), [page 50](#)





4 - Tensioner for poly V-belt

- ☐ Pivot with socket to slacken poly V-belt
- ☐ Lock in position with locking pin - T10060 A- .
- ☐ Removing and installing ⇒ ["1.4 Removing and installing tensioner for poly V-belt", page 47](#)

5 - Bolt

- ☐ 23 Nm

6 - Bolt

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

7 - Alternator

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

8 - Dowel sleeve

- ☐ For air conditioner compressor

9 - Air conditioner compressor

- ☐ Do not unscrew or disconnect refrigerant hoses or pipes
- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

10 - Bolt

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



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1.2 Exploded view - sealing flange (pulley end)

1 - Bolt

- ❑ Tightening torque
⇒ [Item 1 \(page 41\)](#)

2 - Belt pulley/vibration damper

- ❑ Allocation ⇒ Electronic parts catalogue
- ❑ Removing and installing
⇒ ["1.6 Removing and installing pulley", page 50](#)

3 - Oil seal

- ❑ For crankshaft (pulley end)
- ❑ Renewing
⇒ ["1.7 Renewing crankshaft oil seal \(pulley end\)", page 52](#)
- ❑ Do not lubricate with oil

4 - Sealing flange (pulley end)

- ❑ Should be positioned on dowel pins
- ❑ Removing and installing
⇒ ["1.8 Removing and installing sealing flange \(pulley end\)", page 54](#)

5 - Bolt

- ❑ Different thread diameters ⇒ Electronic parts catalogue
- ❑ Renew after removing
- ❑ Tightening torque and sequence
⇒ [Fig. "Sealing flange \(pulley end\) - tightening torque and sequence", page 45](#)

6 - Gasket

- ❑ Renew after removing

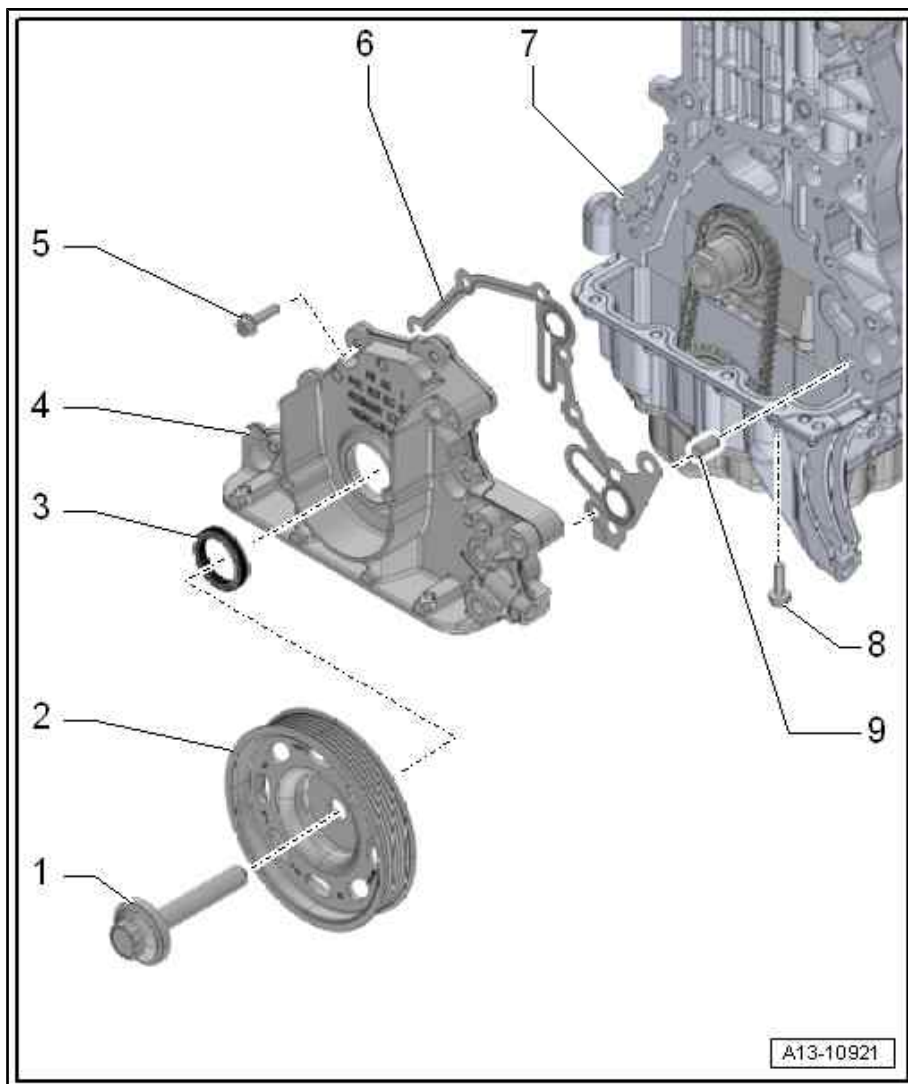
7 - Cylinder block

8 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence
⇒ [Fig. "Sealing flange \(pulley end\) - tightening torque and sequence", page 45](#)

9 - Dowel pin

- ❑ 2x



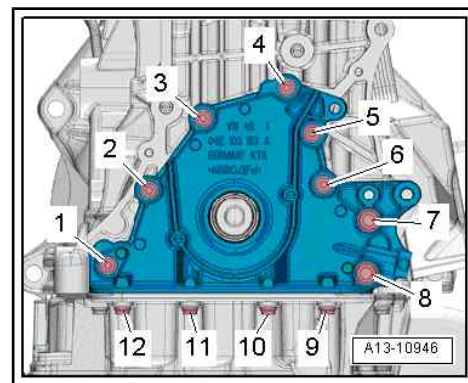
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Sealing flange (pulley end) - tightening torque and sequence

- Renew bolts tightened with specified tightening angle.
- Tighten bolts in stages:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 12-	Screw in by hand until contact is made
2.	-1 ... 12-	8 Nm in diagonal sequence
3.	-7, 8-	20 Nm
4.	-1 ... 12-	Turn 90° further in diagonal sequence



1.3 Removing and installing poly V-belt

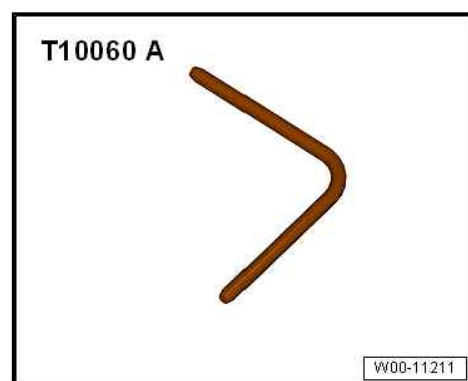
⇒ "1.3.1 Removing and installing poly V-belt - vehicles without air conditioner compressor", page 45

⇒ "1.3.2 Removing and installing poly V-belt - vehicles with air conditioner compressor", page 46

1.3.1 Removing and installing poly V-belt - vehicles without air conditioner compressor

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-

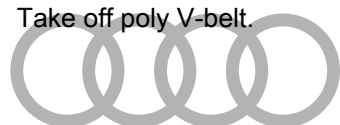
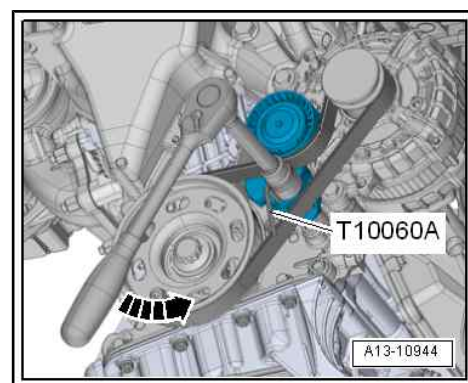


Removing



Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

- Mark running direction before removing.
- Pay attention to running direction when reinstalling.
- To slacken poly V-belt, turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.





Installing

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

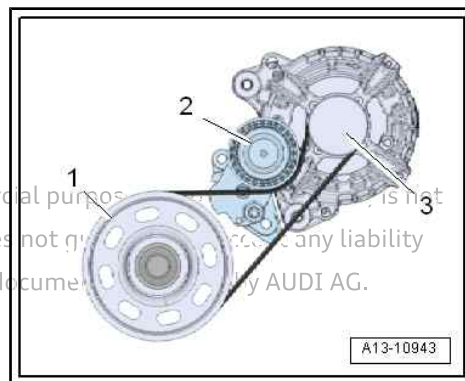
- Fit poly V-belt as shown in illustration.

1 - Pulley

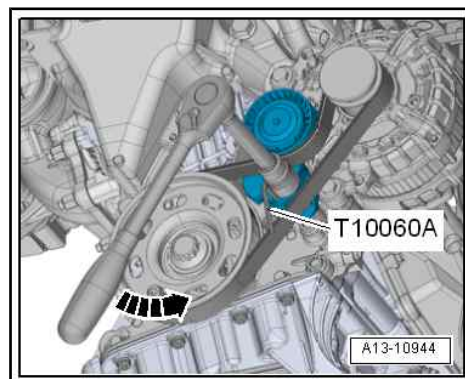
2 - Tensioner for poly V-belt

3 - Alternator

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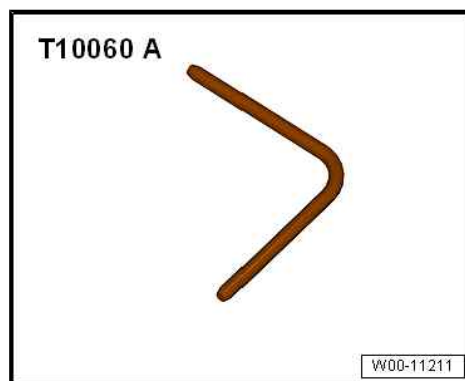
- Turn tensioner in direction of -arrow- and remove locking pin - T10060 A- .
- Release tensioner.
- Check that poly V-belt is properly seated.
- Start engine and check that poly V-belt runs properly.



1.3.2 Removing and installing poly V-belt - vehicles with air conditioner compressor

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-



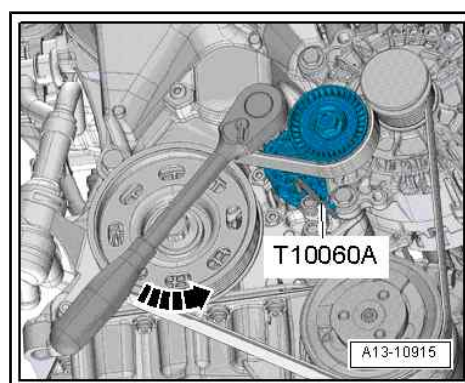
Removing



NOTICE

Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

- Mark running direction before removing.
- Pay attention to running direction when reinstalling.
- To slacken poly V-belt, turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.



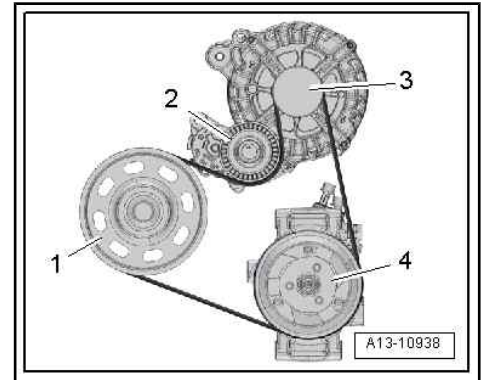


Installing

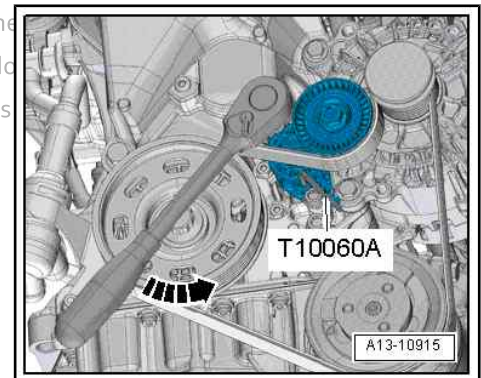
Installation is carried out in reverse order; note the following:

- Fit poly V-belt as shown in illustration:

- 1 - Pulley
- 2 - Tensioner for poly V-belt
- 3 - Alternator
- 4 - Air conditioner compressor



- Turn tensioner anti-clockwise -arrow- and remove locking pin - T10060 A- .
- Release tensioner.
- Check that poly V-belt is properly seated.
- Start engine and check that poly V-belt runs properly.



1.4 Removing and installing tensioner for poly V-belt

⇒ [“1.4.1 Removing and installing tensioner for poly V-belt - vehicles without air conditioner compressor”, page 47](#)

⇒ [“1.4.2 Removing and installing tensioner for poly V-belt - vehicles with air conditioner compressor”, page 48](#)

1.4.1 Removing and installing tensioner for poly V-belt - vehicles without air conditioner compressor

Removing

- Detach poly V-belt from tensioner
⇒ [“1.3.1 Removing and installing poly V-belt - vehicles without air conditioner compressor”, page 45](#) .
- Remove bolts -arrows- and detach tensioner -1- for poly V-belt.

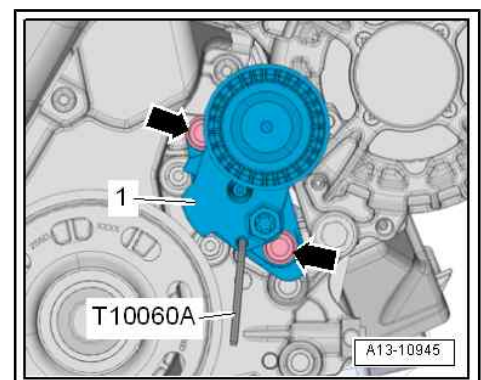
Installing

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

- Install poly V-belt
⇒ [“1.3.1 Removing and installing poly V-belt - vehicles without air conditioner compressor”, page 45](#) .

Tightening torques

- ◆ ⇒ [“1.1.1 Exploded view - poly V-belt drive, vehicles without air conditioner compressor”, page 40](#)





1.4.2 Removing and installing tensioner for poly V-belt - vehicles with air conditioner compressor

Removing

- Detach poly V-belt from tensioner
⇒ [“1.3.2 Removing and installing poly V-belt - vehicles with air conditioner compressor”, page 46](#) .
- Remove bolts -arrows- and detach tensioner -1- for poly V-belt.

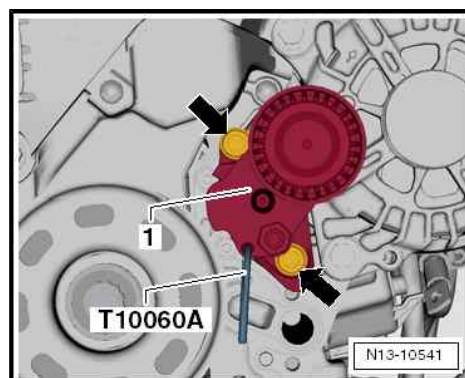
Installing

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

- Install poly V-belt
⇒ [“1.3.2 Removing and installing poly V-belt - vehicles with air conditioner compressor”, page 46](#) .

Tightening torques

- ◆ ⇒ [“1.1.2 Exploded view - poly V-belt drive, vehicles with air conditioner compressor”, page 42](#)

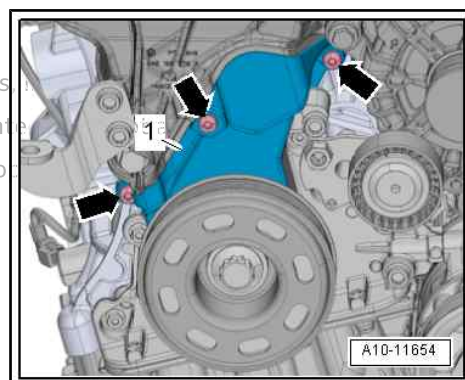


1.5 Removing and installing engine support

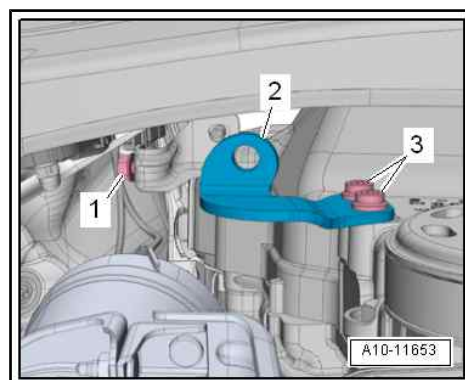
Removing

- Remove engine mounting
⇒ [“2.2 Removing and installing engine mountings”, page 32](#) .
- Remove tensioner for poly V-belt
⇒ [“1.4 Removing and installing tensioner for poly V-belt”, page 47](#) .
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove bolts -arrows- for toothed belt cover (bottom) -1-.

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- Unscrew bolts -1, 3- and remove bracket -2-.



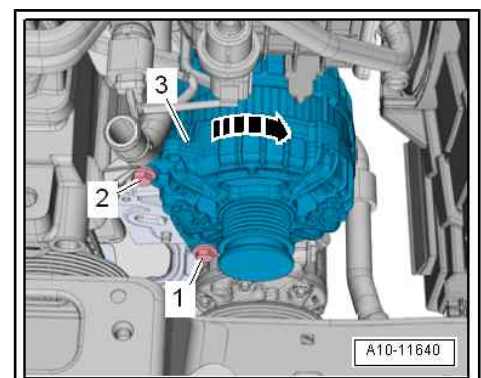
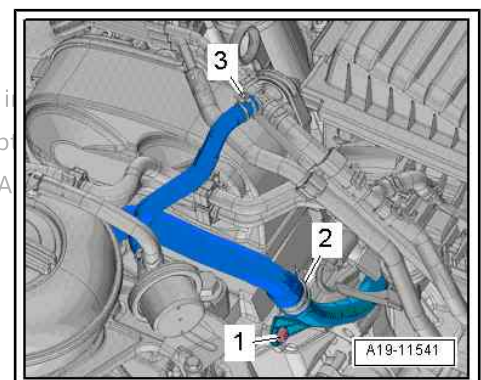
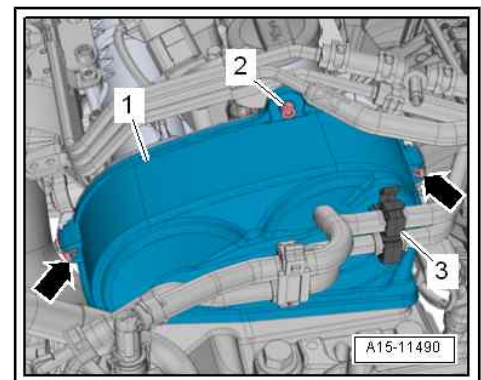
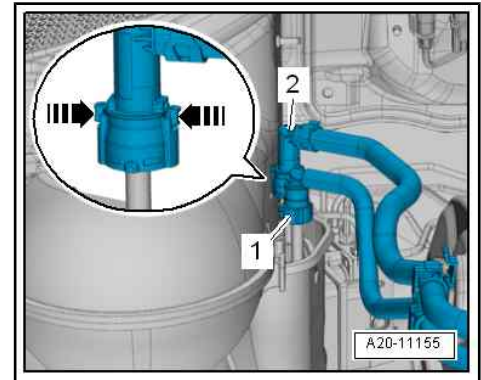


- Observe rules for cleanliness when working on the fuel supply system ⇒ ["3.1 Rules for cleanliness", page 5](#).

⚠ CAUTION

The fuel system is pressurised.
Risk of injury as fuel may spray out.

- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap a clean cloth around connection and open connection carefully).
- Disconnect fuel supply line -2-; to do so, push connection piece downwards, then press release tabs -arrows-.
- Pull off connection piece, keeping release tabs depressed.
- Press release tab on hose -1- connected to activated charcoal filter.
- Disconnect hose and move it clear.
- Move clear hoses at bracket -3-.
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.



- Loosen bolt -1- but do not remove.
- Remove bolt -2-.
- Swivel alternator -3- towards front.



- Remove bolt -1-.

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**NOTICE**

Risk of irreparable damage to engine due to oil on toothed belt.

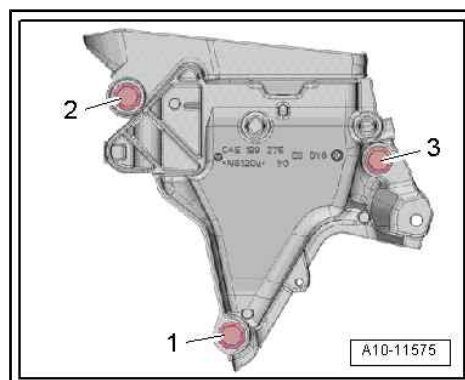
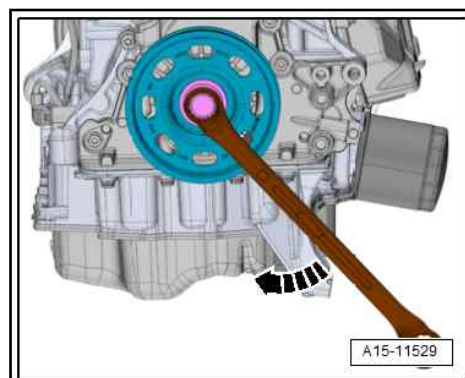
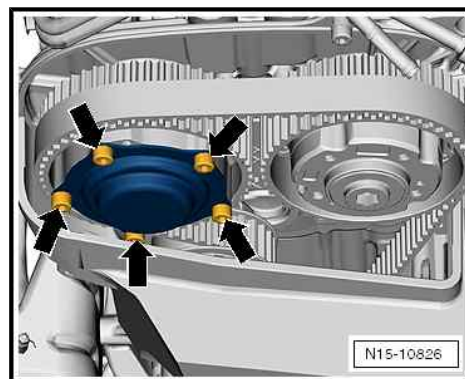
- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.
- If fitted, remove bolts -arrows- ⇒ [Item 4 \(page 79\)](#).
- To remove all bolts, rotate crankshaft in direction of engine rotation by turning bolt for vibration damper pulley in direction of -arrow-.
- Detach cover from camshaft adjuster of exhaust camshaft.
- Unscrew bolts -1, 2 and 3-, carefully guide engine support past refrigerant line and detach it upwards.
- Press refrigerant line to the side if necessary.

Installing

Installation is carried out in reverse sequence.

Tightening torques

- ◆ ⇒ [“1.2.2 Exploded view - toothed belt, version with two camshaft adjusters”, page 79](#)
- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 31](#)
- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 40](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 76](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 250](#)
- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 290](#)
- ◆ ⇒ [Fig. ““Installing catalytic converter - tightening torque and sequence””, page 325](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

**1.6 Removing and installing pulley****Special tools and workshop equipment required**

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◆ Counterhold tool - T10475-



Removing

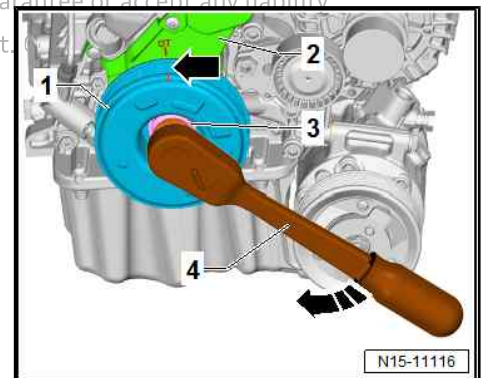
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

- Remove poly V-belt

⇒ "1.3 Removing and installing poly V-belt", page 45 .

Moving crankshaft and camshafts into »TDC« position

- Turn crankshaft to "TDC" position in normal direction of engine rotation -arrow- by applying a ratchet -4- to central bolt -3-.
- Crankshaft has reached "TDC" position when marking -arrow- on vibration damper -1- aligns with "TDC" marking on toothed belt cover (bottom) -2-.



- Loosen bolt -arrow- using counterhold tool - T10475- .
- Remove bolt and take off pulley/vibration damper.

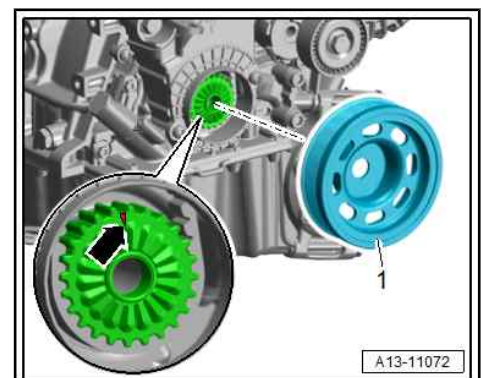
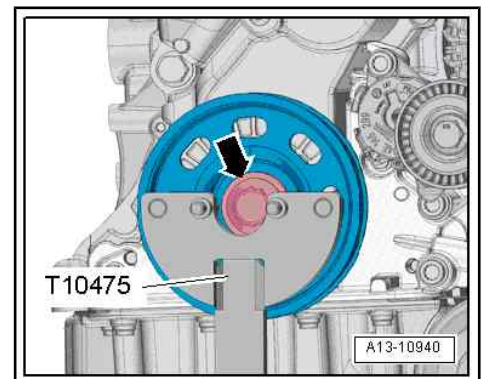
! NOTICE

Risk of irreparable damage to engine if valve timing is incorrect

- Do not rotate crankshaft out of TDC position.

Installing

- Renew bolts tightened with specified tightening angle.
- All contact surfaces between bolt, pulley/vibration damper and crankshaft sprocket must be free of oil and grease.
- Fit pulley/vibration damper -1- (pay attention to tooth-shaped profile -arrow-).





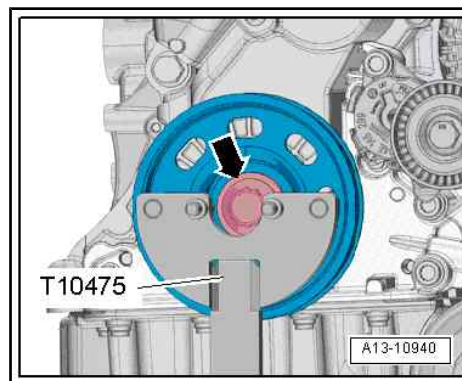
- Screw in bolt -arrow- by hand until it makes contact (lubricate thread of bolt).
- Tighten bolt using counterhold tool - T10475- .

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

- Install poly V-belt
⇒ [“1.3 Removing and installing poly V-belt”, page 45](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 40](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



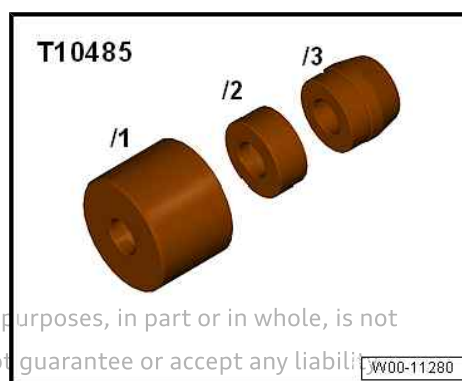
1.7 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

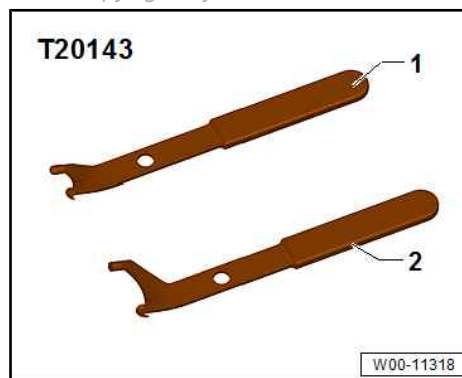
- ◆ Assembly tool - T10485-



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- ◆ Extractor tool - T20143-



Procedure

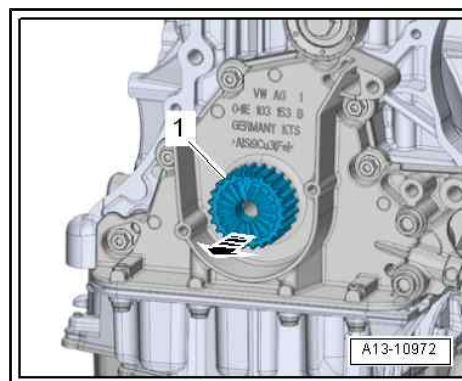
- Remove toothed belt
⇒ [“1.4 Removing and installing toothed belt”, page 120](#) .
- Detach crankshaft sprocket -1- -arrow-.



NOTICE

Risk of irreparable damage to engine if valve timing is incorrect

- Do not rotate crankshaft out of TDC position.

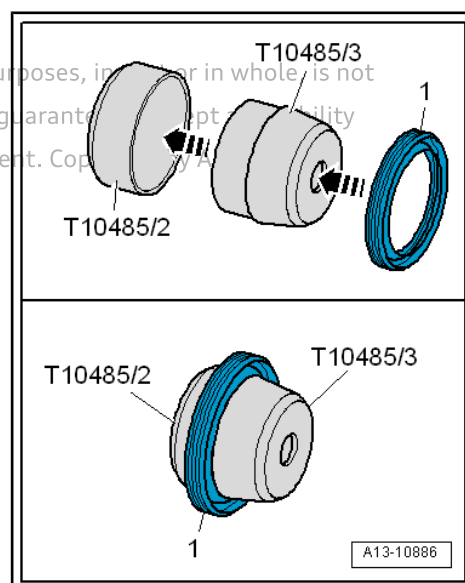
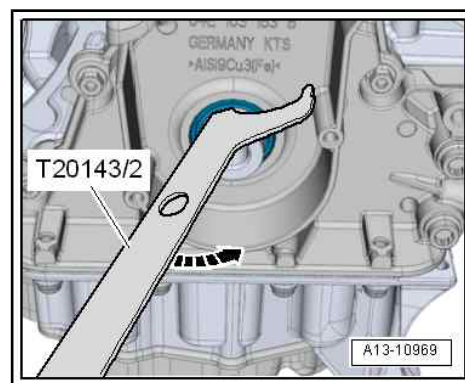




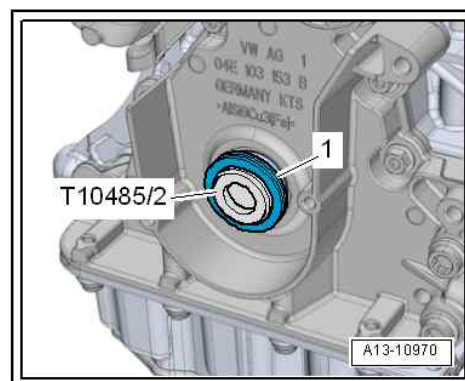
- Pry out oil seal using extractor tool -T20143/2- -arrow-.
- Clean contact surface and sealing surface.



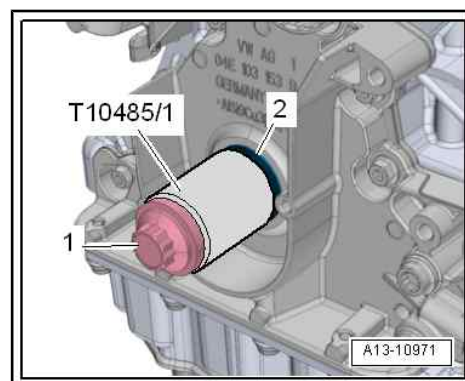
- Do not lubricate new oil seal.
- Slide oil seal -1- over fitting sleeve -T10485/3- onto guide sleeve -T10485/2-.
- Fitting position: closed side of oil seal faces guide sleeve.
- Detach fitting sleeve from guide sleeve.



- Fit guide sleeve -T10485/2- with oil seal -1- onto crankshaft.

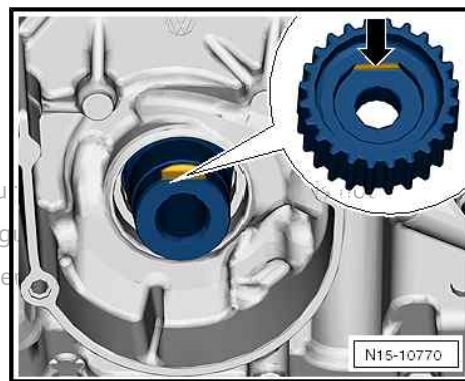


- Use thrust piece -T10485/1- and bolt -1- for poly V-belt pulley to pull in oil seal -2- onto stop.





- Fit crankshaft sprocket onto crankshaft.
- Contact surface between poly V-belt pulley and crankshaft sprocket must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.
- Install toothed belt (adjust valve timing)
⇒ ["1.4 Removing and installing toothed belt", page 120](#).



1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

- ◆ Flat scraper
- ◆ Sealant ⇒ Electronic parts catalogue

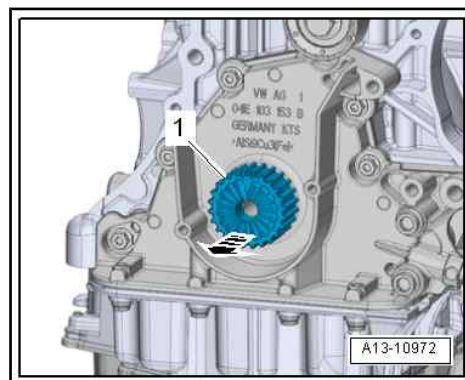
Removing

- Remove air conditioner compressor from bracket ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove toothed belt
⇒ ["1.4 Removing and installing toothed belt", page 120](#) .
- Detach crankshaft sprocket -1- -arrow-.

NOTICE

Risk of irreparable damage to engine if valve timing is incorrect

- Do not rotate crankshaft out of TDC position.

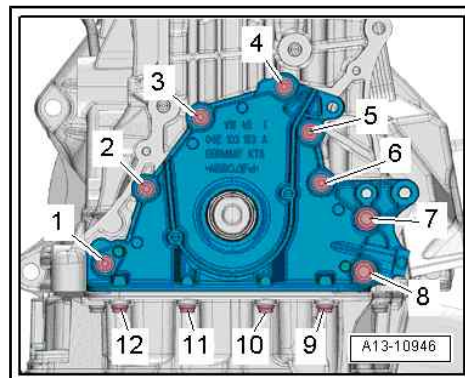


- Remove bolts -1 ... 12- and carefully release sealing flange from bonded joint.
- Drive out oil seal with sealing flange removed.

Installing

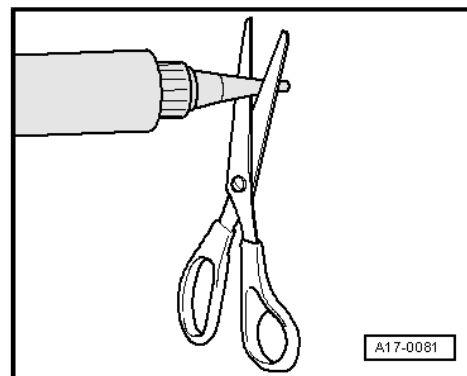
Installation is carried out in reverse order; note the following:

- Cover exposed parts of the engine.
- Remove sealant residue from sealing flange and sump (top section).
- Clean sealing surfaces; they must be free of oil and grease.





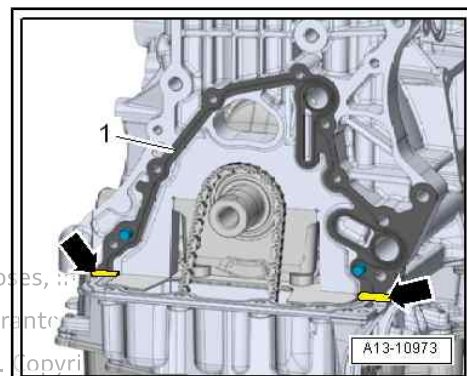
- Note expiry date of sealant.
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).



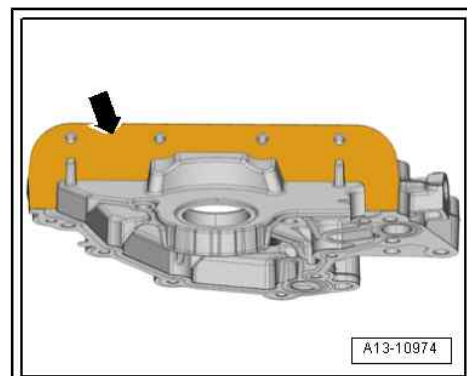
- Slide gasket -1- onto dowel pins in cylinder block.
- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



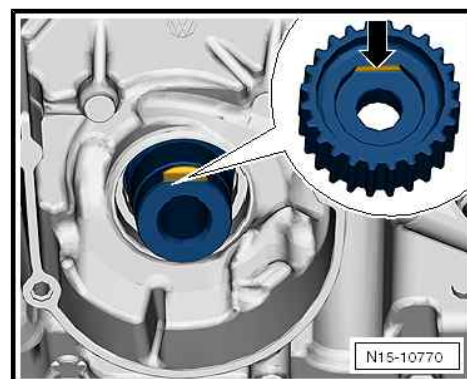
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- Apply a thin coat of sealant to bottom sealing surface -arrow- on sealing flange.
- Install sealing flange within 5 minutes of applying the sealant.
- Carefully fit sealing flange onto dowel pins in cylinder block.
- Tighten sealing flange bolts
⇒ Fig. “Sealing flange (pulley end) - tightening torque and sequence”, page 45 .
- Install crankshaft oil seal (pulley end)
⇒ “1.7 Renewing crankshaft oil seal (pulley end)”, page 52 .



- Fit crankshaft sprocket onto crankshaft.
- Contact surface between poly V-belt pulley and crankshaft sprocket must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.
- Install toothed belt (adjust valve timing)
⇒ “1.4 Removing and installing toothed belt”, page 120 .



Tightening torques

- ◆ ⇒ Fig. “Sealing flange (pulley end) - tightening torque and sequence”, page 45
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator



2 Cylinder block (gearbox end)

⇒ [“2.1 Exploded view - cylinder block \(gearbox end\)”, page 56](#)

⇒ [“2.2 Removing and installing flywheel”, page 57](#)

⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 58](#)

2.1 Exploded view - cylinder block (gearbox end)

1 - Bolt

- ☐ Renew after removing
- ☐ 60 Nm +90°

2 - Flywheel

- ☐ Removing and installing
⇒ [“2.2 Removing and installing flywheel”, page 57](#)
- ☐ Can only be installed in one position

3 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Removing and installing
⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 58](#)

4 - Engine speed sender - G28-

- ☐ Exploded view
⇒ [“1.1 Exploded view - ignition system”, page 328](#)
- ☐ Note installation position ⇒ [page 335](#)

5 - Bolt

- ☐ Tightening torque
⇒ [Item 15 \(page 329\)](#)

6 - Dowel pin

- ☐ 2x

7 - Intermediate plate

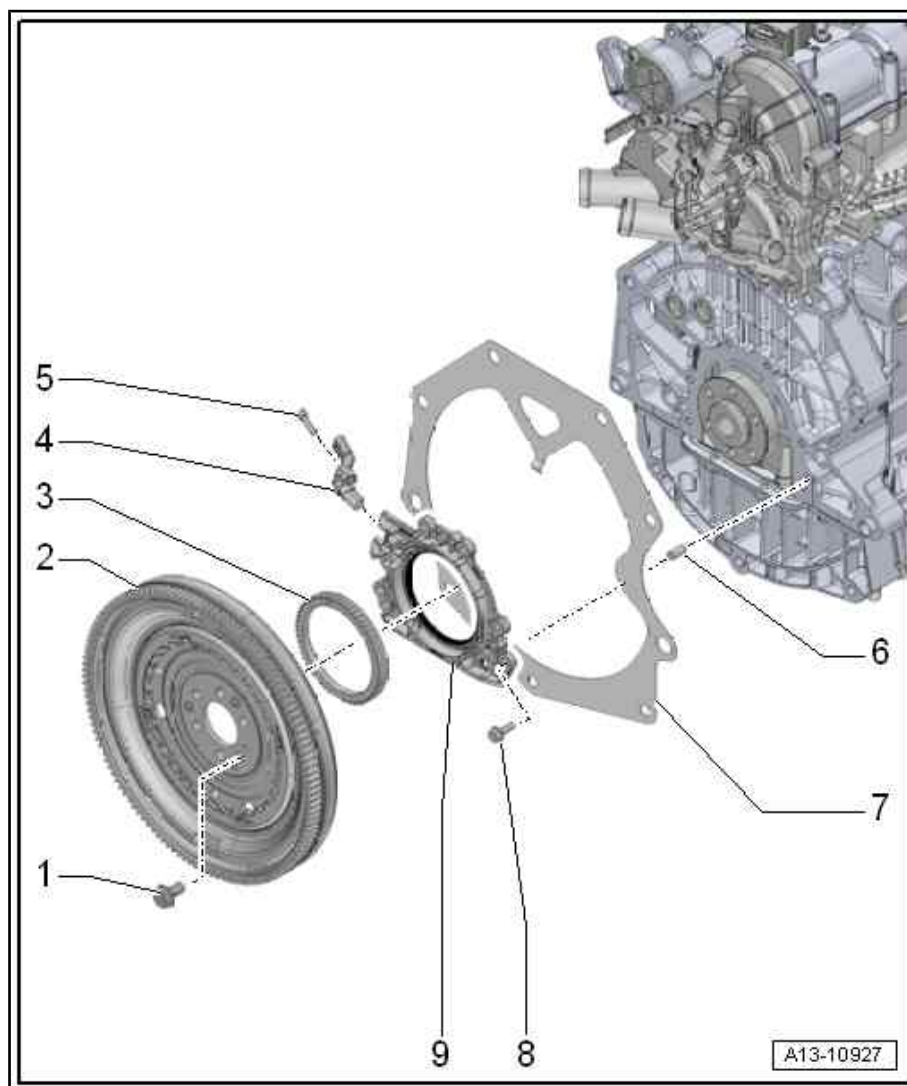
- ☐ Do not damage or bend when assembling
- ☐ Installing ⇒ [Fig. “Installing intermediate plate”, page 57](#)

8 - Bolt

- ☐ Tightening torque and sequence
⇒ [Fig. “Sealing flange \(gearbox end\) - tightening torque and sequence”, page 57](#)

9 - Sealing flange (gearbox end)

- ☐ With oil seal
- ☐ Renewing ⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 58](#)

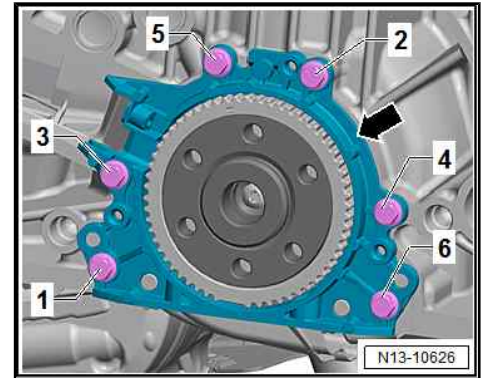




Sealing flange (gearbox end) - tightening torque and sequence

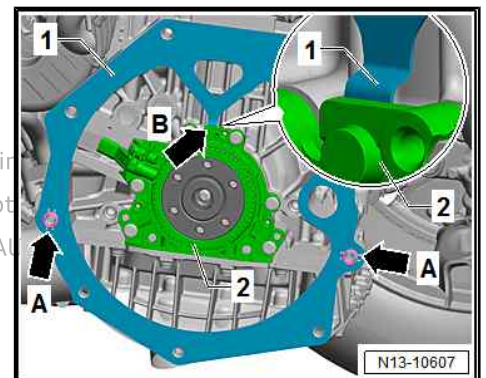
- Tighten bolts in stages as follows:

Stage	Bolts	Tightening torque
1.	-1 ... 6-	Screw in by hand until contact is made
2.	-1 ... 6-	Tighten in stages and in diagonal sequence; final torque 10 Nm.



Installing intermediate plate

- Engage intermediate plate -1- on sealing flange -2- -arrow B- and push onto dowel sleeves -arrows A-.

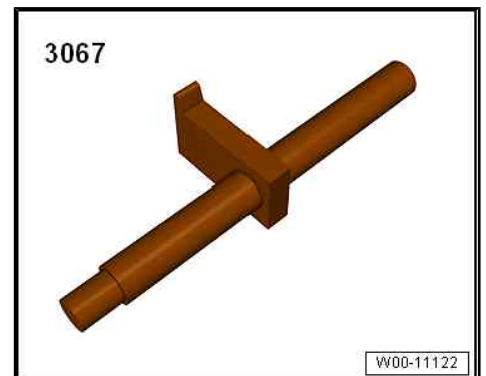


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2.2 Removing and installing flywheel

Special tools and workshop equipment required

- ◆ Counterhold tool - 3067-



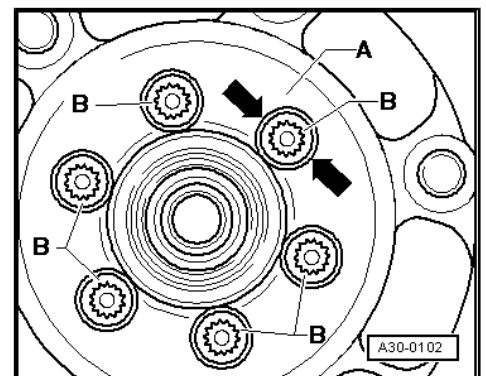
Removing

- Gearbox removed

! NOTICE

Risk of damage to thread if an impact driver (or similar) is used.

- When screwing in bolts, fit them manually and perform the first few turns by hand.
- Do not use an impact driver to loosen or tighten bolts.
- Position flywheel -A- so that bolt heads -B- align centrally with holes -arrows-.





- Insert counterhold tool - 3067- in hole on cylinder block -item B-.
- Loosen and remove flywheel bolts.

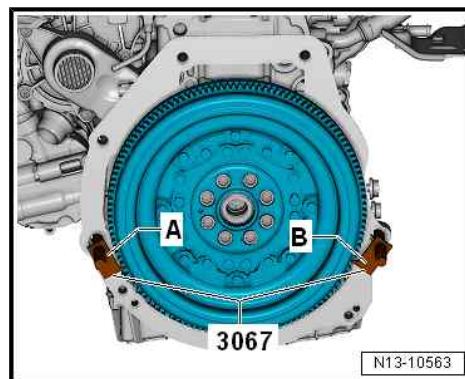
Installing

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

- Renew bolts tightened with specified tightening angle.
- Flywheel with sender wheel can only be fitted in one position.
- Insert counterhold - 3067- in hole on cylinder block -item A-.

Tightening torques

- ♦ ⇒ [“2.1 Exploded view - cylinder block \(gearbox end\)”, page 56](#)



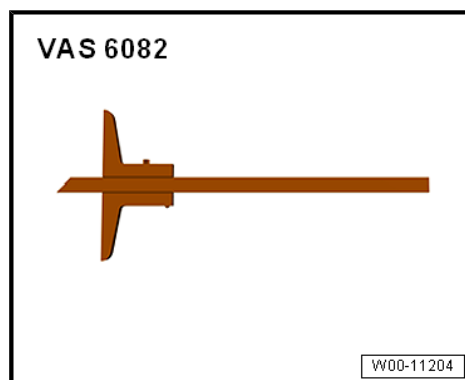
2.3 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

- ♦ Open ring spanner - V.A.G 1332/11-

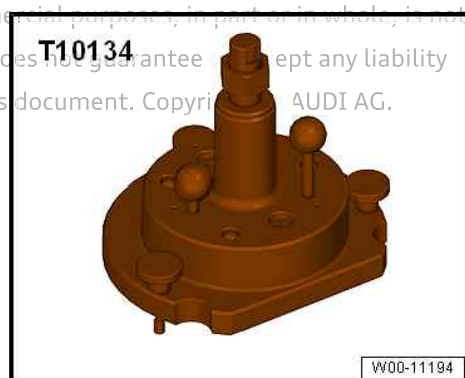


- ♦ Depth gauge - VAS 6082-



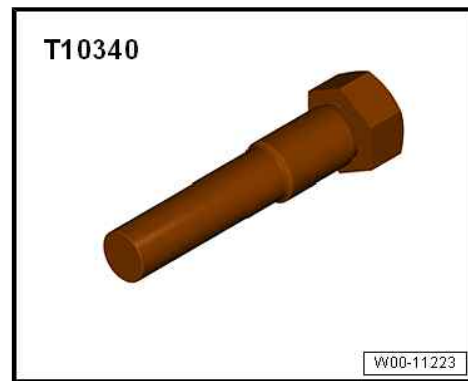
- ♦ Assembly tool - T10134-

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◆ Locking pin - T10340-



◆ Bolt, M6x35 (3x)

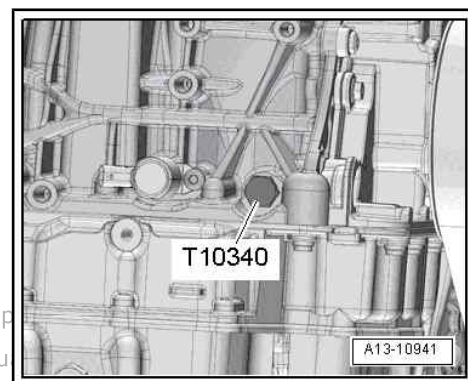
◆ Hexagon key

Procedure

- Gearbox removed
- Remove flywheel
⇒ [“2.2 Removing and installing flywheel”, page 57](#) .

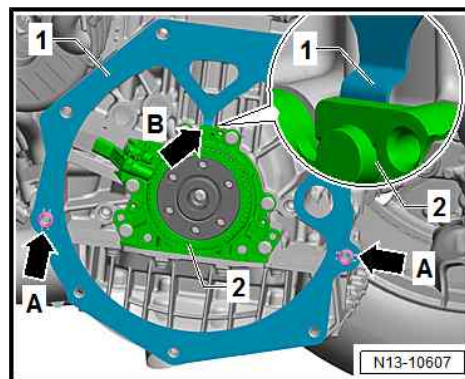
Rotate crankshaft to “TDC” as follows:

- Unscrew plug for “TDC” hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop.
- If the locking pin - T10340- cannot be screwed in as far as the stop, the crankshaft is not in the correct position. Remove locking pin.
- Turn crankshaft by 90° in direction of engine rotation.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft further in normal direction of rotation as far as stop.
- The crank web is now in contact with the locking pin. (The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.)
- Remove sump (bottom section)
⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 202](#) .
- Remove sump (top section)
⇒ [“1.4 Removing and installing sump \(top section\)”, page 205](#) .
- Remove engine speed sender - G28-
⇒ [“1.6 Removing and installing engine speed sender G28 ”, page 334](#) .

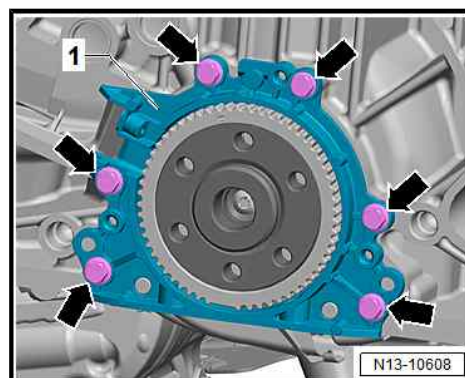




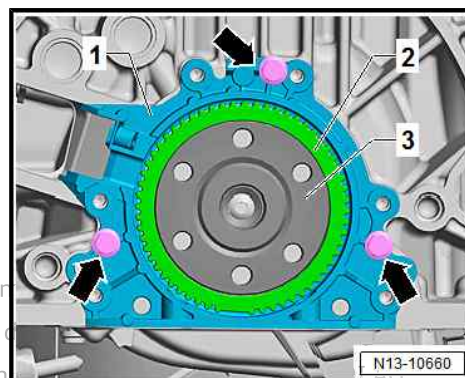
- Detach intermediate plate -1- from dowel sleeves -arrows A-.
- Guide intermediate plate upwards; at the same time, pull retaining tab -arrow B- out of opening behind sealing flange -2-.



- Remove bolts -arrows- for sealing flange -1-.



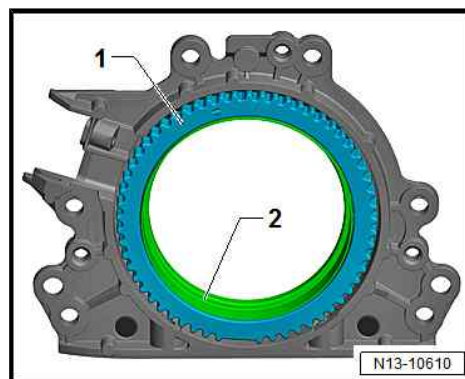
- The sealing flange -1- is pressed off the crankshaft -3- together with the sender wheel -2-.
- To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than 1/2 turn at a time.
- Detach sealing flange together with sender wheel.



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Pressing in sealing flange with sender wheel

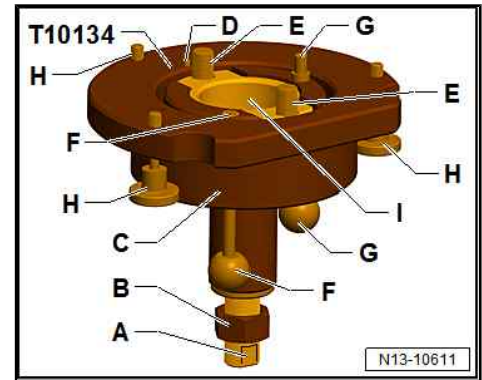
- ◆ The sealing flange with PTFE oil seal is fitted with a sealing lip support ring -2-. This support ring acts as an assembly sleeve and must not be removed before installation.
- ◆ Sealing flange and sender wheel -1- must not be separated or rotated out of position after removal from packaging.
- ◆ The sender wheel is held in its installation position by a locating pin on the assembly tool - T10134- .
- ◆ The sealing flange and oil seal are one unit and can only be replaced together with the sender wheel.
- ◆ The assembly tool - T10134- is held in the correct position relative to the crankshaft by a guide pin which is inserted into a hole in the crankshaft.





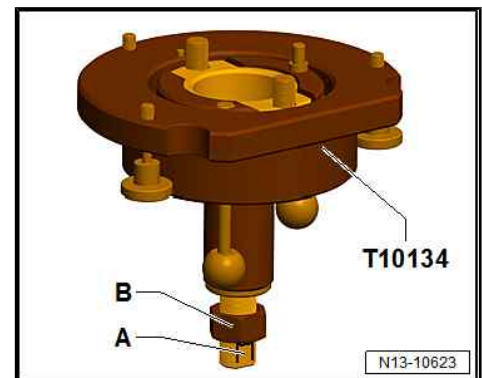
Construction of assembly tool - T10134- :

- A - Tensioning flats
- B - Nut
- C - Assembly housing
- D - Locating pin
- E - Hexagon socket head bolts (2x)
- F - Guide pin for diesel engines (black handle)
- G - Guide pin for petrol engines (red handle)
- H - Knurled screws (3x)

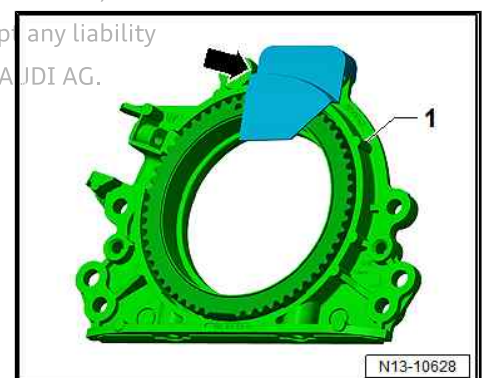
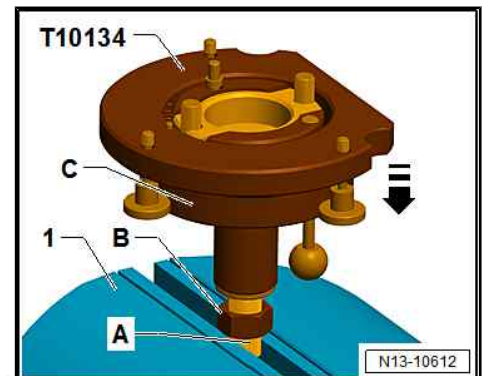


Fitting sealing flange with sender wheel onto assembly tool - T10134- :

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



- Clamp assembly tool - T10134- in a vice -1- on tightening flats -A- of threaded spindle.
- Press assembly housing -C- downwards -arrow- so that it rests on nut -B-.
- Inner part of assembly device and assembly housing must align (be level) with each other.



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- If fitted, remove securing clip -arrow- from new sealing flange.
- Do not take the sender wheel out of the sealing flange or rotate it out of position.



- Place sealing flange (with front side downwards) on a clean flat surface.
- Press sealing lip support ring -1- downwards in direction of -arrow- until it touches flat surface.

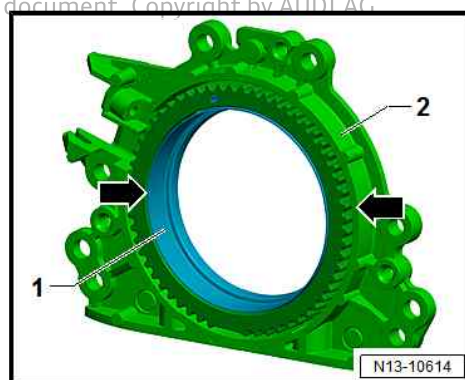
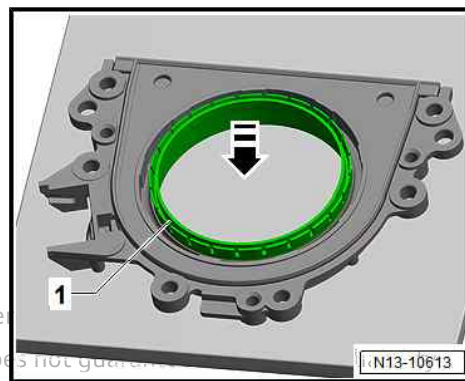


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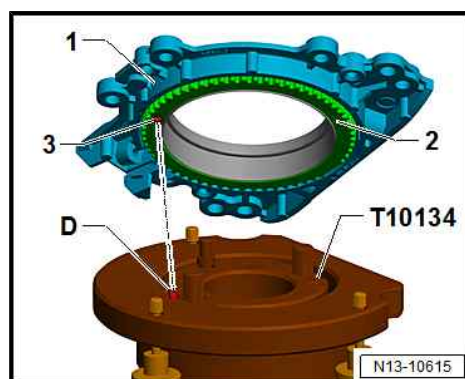
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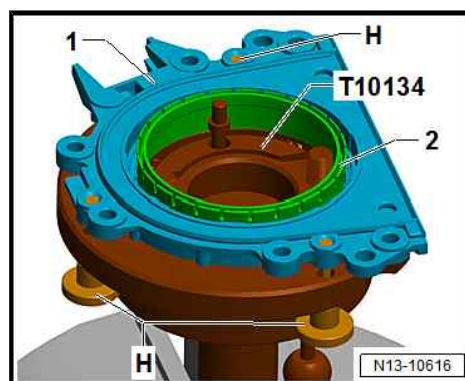
- Upper edge of sealing lip support ring -1- must be flush -arrows- with front edge of sealing flange -2-.



- Place front side of sealing flange -1- on assembly tool -T10134- so that locating pin -D- is seated in hole -3- in sender wheel -2-.
- Ensure that sealing flange lies flat on assembly tool.



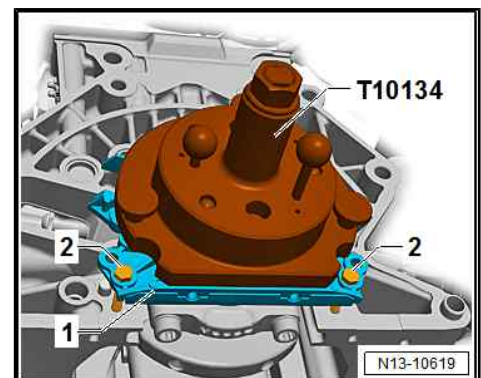
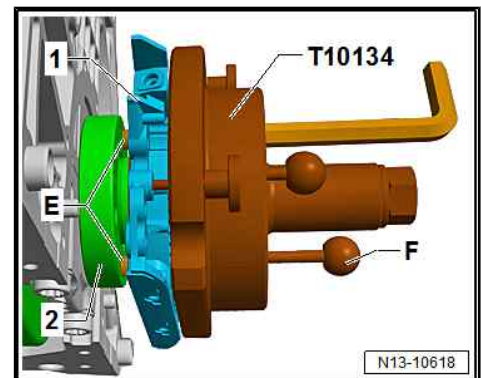
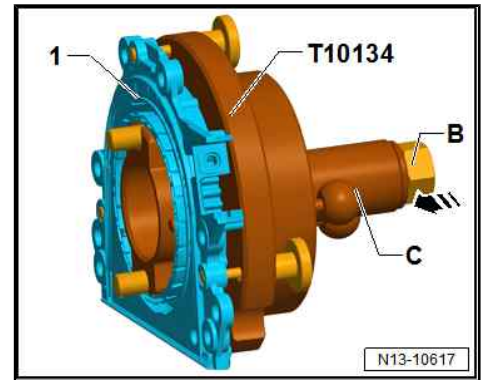
- Screw knurled screws -H- onto sealing flange -1-.
- When tightening, press sealing flange and sealing lip support ring -2- against surface of assembly tool -T10134- .
- This prevents locating pin from sliding out of hole in sender wheel.
- Ensure that sender wheel remains fixed on assembly tool when installing sealing flange.





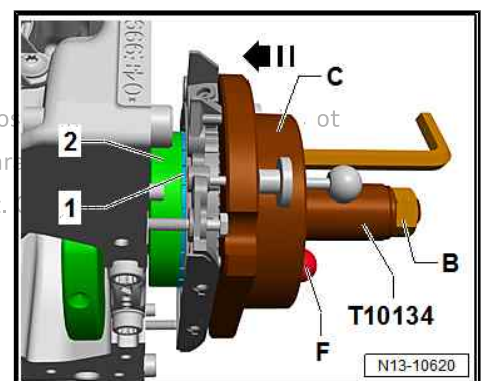
Securing assembly tool - T10134- with sealing flange -1- on crankshaft flange:

- Crankshaft flange must be free of oil and grease.
- Engine is at "TDC" position.
- Screw nut -B- to end of threaded spindle.
- Press threaded spindle of assembly tool - T10134- in direction of -arrow- until nut -B- makes contact with assembly housing -C-.
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.
- Secure assembly tool - T10134- with sealing flange -1- to crankshaft flange -2-.
- To do so, screw hexagon socket head bolts -E- approx. 5 turns into crankshaft flange with hexagon key.
- Insert guide pin for petrol engines (red handle) -F- into crankshaft flange.
- Screw 2 bolts M6x35 -item 2- into cylinder block to guide sealing flange -1-.



Securing assembly tool - T10134- on crankshaft flange:

- Press assembly housing -C- by hand in direction of -arrow- until sealing lip support ring -1- touches surface of crankshaft flange -2-.
- Check that guide pin for petrol engines (red handle) -F- is fitted correctly in hole in crankshaft. This ensures that sender wheel reaches its final installation position.
- The guide pin for diesel engines (black handle) must not be inserted into threaded hole in crankshaft.
- Tighten the two hexagon socket head bolts on assembly tool hand-tight.
- Screw nut -B- onto threaded spindle by hand until it touches assembly housing -C-.





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

- Tighten nut -B- on assembly tool - T10134- to 35 Nm.
- There must be a small gap between cylinder block and sealing flange -1- after nut has been tightened to 35 Nm.

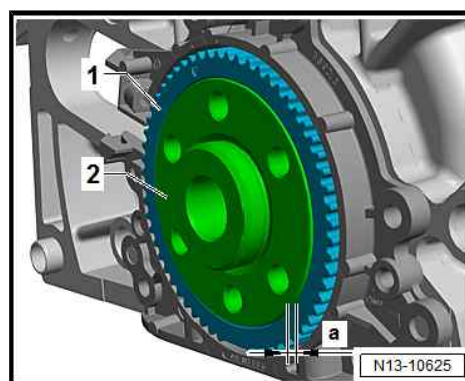
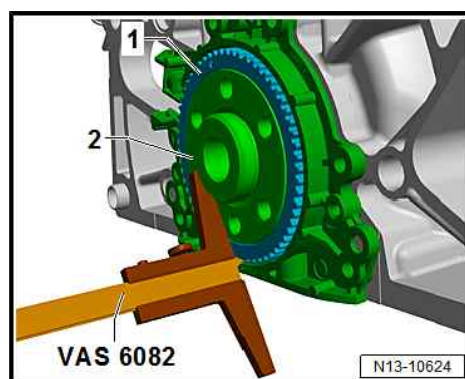
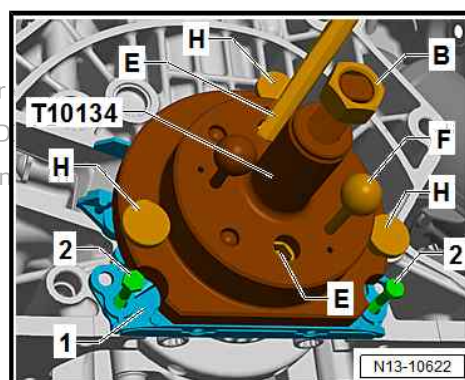
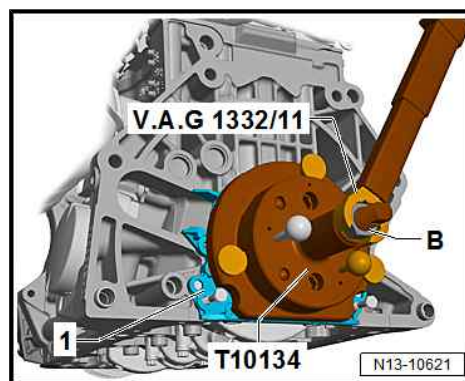


Checking installation position of sender wheel on crankshaft:

- Screw nut -B- to end of threaded spindle.
- Remove both bolts -2- from cylinder block.
- Unscrew knurled screws -H- from sealing flange -1-.
- Unbolt assembly tool - T10134- from crankshaft flange (remove hexagon socket head bolts -E- from crankshaft flange).
- Detach sealing lip support ring.

- Apply depth gauge - VAS 6082- to crankshaft flange -2-.

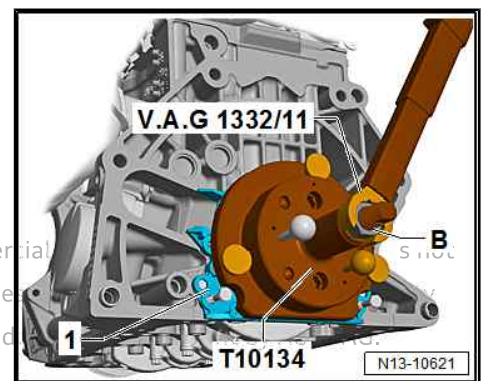
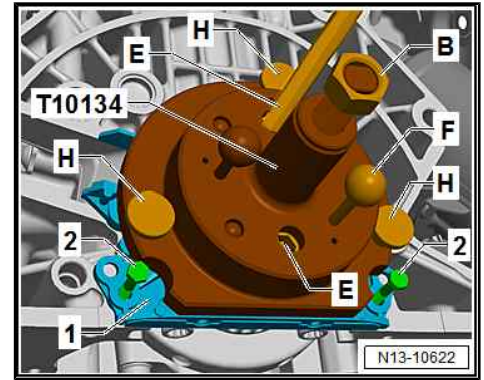
- Measure distance -a- between crankshaft flange -2- and sender wheel -1-.
- Specification: Distance -a- = 0.5 mm.
- Press sender wheel in further if measurement is too small
⇒ [page 65](#) .
- If reading matches specification, continue with assembly
⇒ [page 65](#) .





Pressing sender wheel in further:

- Secure assembly tool - T10134- to crankshaft flange.
- Ensure that locating pin of assembly tool - T10134- is fitted in hole in sender wheel.
- Hand-tighten hexagon socket head bolts -E-.
- Slide assembly tool - T10134- onto sealing flange -1- by hand.
- Screw nut -B- onto threaded spindle by hand until it touches assembly tool - T10134- .
- Insert guide pin for petrol engines (red handle) -F- into crankshaft flange.
- Screw 2 bolts M6x35 -item 2- into cylinder block to guide sealing flange -1-.
- Tighten nut -B- on assembly tool - T10134- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 64](#) .
- Tighten nut on assembly tool - T10134- to 45 Nm if measurement is too small.
- Check installation position of sender wheel on crankshaft again ⇒ [page 64](#) .



Assembling:

- Tighten bolts for sealing flange in diagonal sequence.
- Install sump
⇒ ["1.3 Removing and installing sump \(bottom section\)", page 202](#) .
- Install intermediate plate
⇒ [Fig. "Installing intermediate plate", page 57](#) .
- Install flywheel
⇒ ["2.2 Removing and installing flywheel", page 57](#) .
- After renewing sender wheel, misfire adaption must be reset. To do so, select **01 - Reset adaptations misfires** in **Guided Functions** mode of ⇒ Vehicle diagnostic tester.

Tightening torques

- ◆ ⇒ [Fig. "Sealing flange \(gearbox end\) - tightening torque and sequence", page 57](#)
- ◆ ⇒ ["2.1 Exploded view - cylinder block \(gearbox end\)", page 56](#)
- ◆ Engine speed sender - G28-
⇒ ["1.1 Exploded view - ignition system", page 328](#)
- ◆ ⇒ [Fig. "Plug for TDC drilling in cylinder block - tightening torque", page 78](#)



3 Crankshaft

⇒ **"3.1 Crankshaft dimensions", page 66**

⇒ **"3.2 Measuring axial clearance of crankshaft", page 66**

⇒ **"3.3 Renewing needle bearing in crankshaft", page 67**

3.1 Crankshaft dimensions

NOTICE

Risk of damage to bearing pedestals if crankshaft is removed.

Loosening the bolts for the crankshaft bearing cap results in deformation of the cylinder block bearing pedestals and in damage to the bearings.

- Never remove the crankshaft.

Honing dimension	Conrod journal Ø mm
Basic dimension	48.00 -0.022 -0.042

3.2 Measuring axial clearance of crankshaft

NOTICE

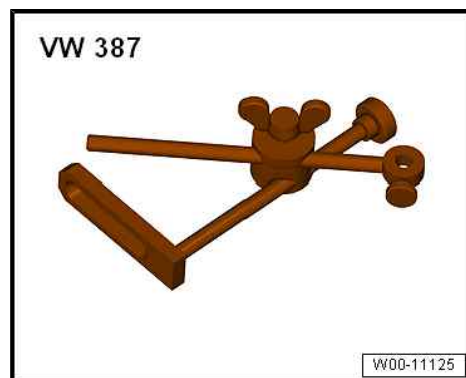
Risk of damage to bearing pedestals if crankshaft is removed.

Loosening the bolts for the crankshaft bearing cap results in deformation of the cylinder block bearing pedestals and in damage to the bearings.

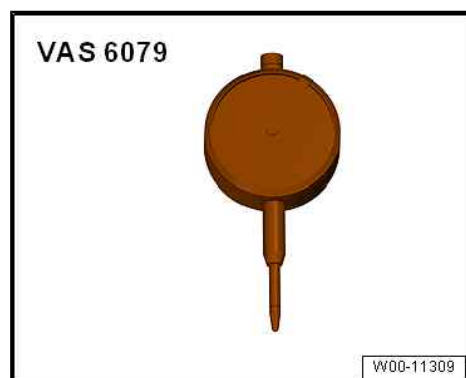
- Never remove the crankshaft.

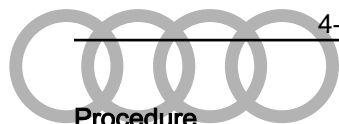
Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



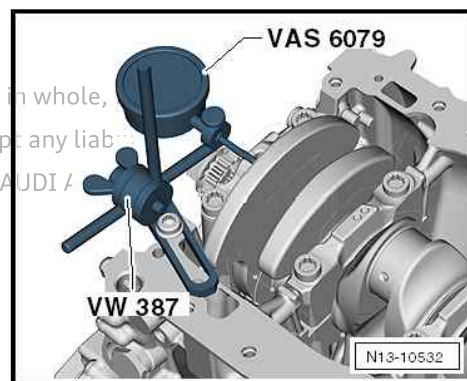
- ◆ Dial gauge - VAS 6079-





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: 0.066 ... 0.233 mm



3.3 Renewing needle bearing in crankshaft

Only fitted on vehicles with dual clutch gearbox

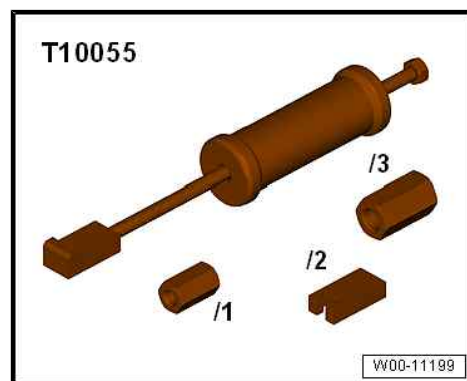
- There should be no needle bearing fitted in the crankshaft on vehicles with manual gearbox.
- A needle bearing must be fitted in the crankshaft on vehicles with dual clutch gearbox ⇒ Electronic parts catalogue .

Special tools and workshop equipment required

- ◆ Centring mandrel - 3176-



- ◆ Puller - T10055- with adapter -T10055/3-



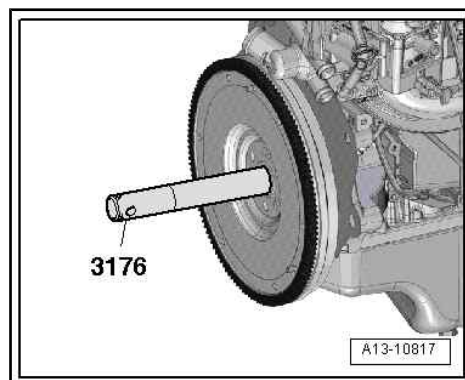
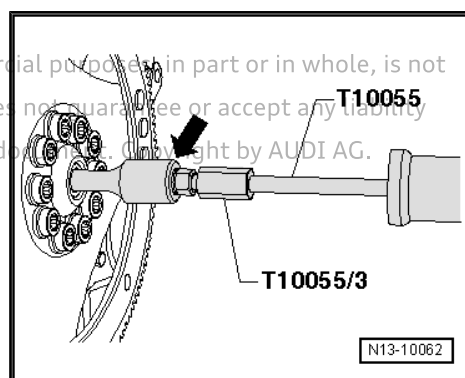


- ◆ -1- Internal puller Kukko 21/2



Procedure

- Gearbox removed
- Remove flywheel
⇒ ["2.2 Removing and installing flywheel", page 57](#)
- Use internal puller Kukko 21/2 -arrow-, puller - T10055- and adapter -T10055/3- to pull out needle bearing.
- Drive in needle bearing using centring mandrel - 3176- ; needle bearing must be flush.
- Install flywheel
⇒ ["2.2 Removing and installing flywheel", page 57](#) .





4 Pistons and conrods

⇒ [“4.1 Exploded view - pistons and conrods”, page 69](#)

⇒ [“4.2 Removing and installing pistons”, page 71](#)

⇒ [“4.3 Removing and installing oil spray jets”, page 72](#)

⇒ [“4.4 Checking pistons and cylinder bores”, page 73](#)

⇒ [“4.5 Separating parts of new conrod”, page 74](#)

⇒ [“4.6 Checking radial clearance of conrod bearings”, page 74](#)

4.1 Exploded view - pistons and conrods

- All bearing points and running surfaces must be oiled before assembling.

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1 - Bolts

- ☐ Renew after removing
- ☐ Use old bolts when measuring radial clearance
- ☐ Lubricate threads and contact surface
- ☐ 30 Nm +90°

2 - Conrod bearing cap

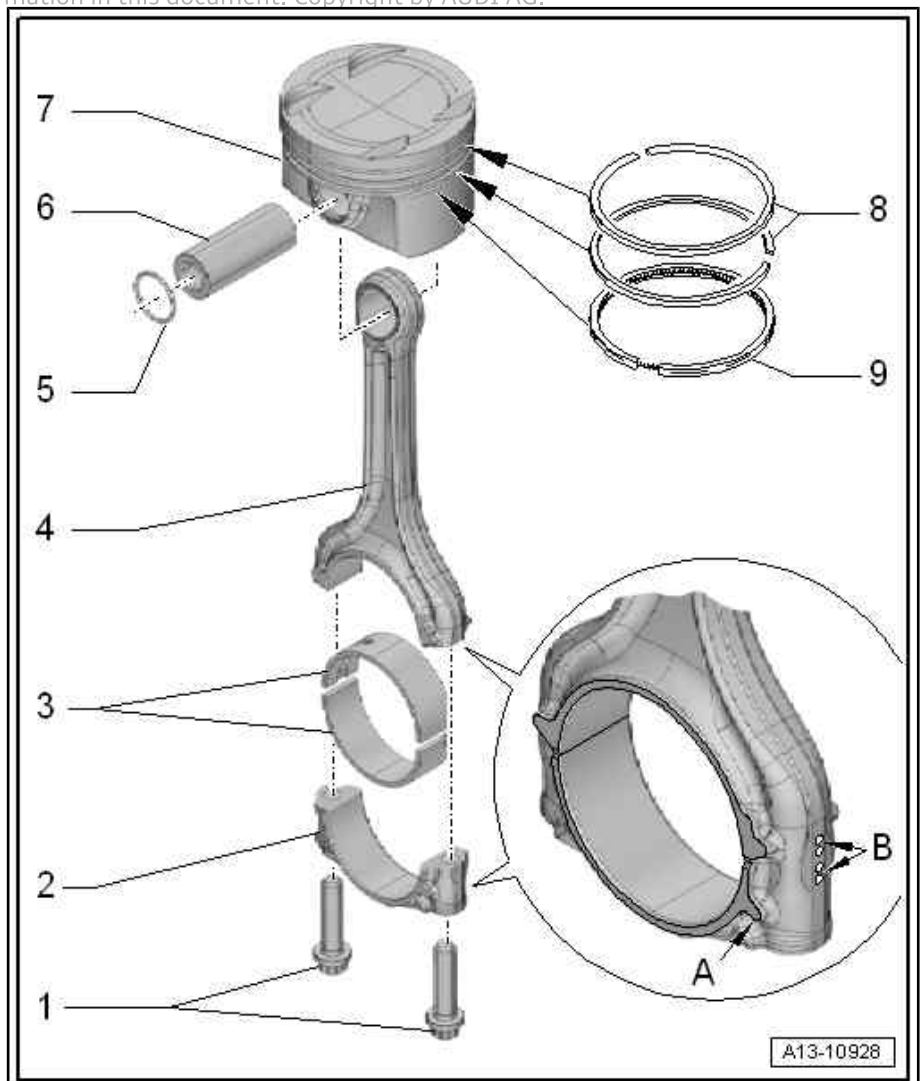
- ☐ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ☐ Mark cylinder and conrod bearing cap allocation in colour -B-
- ☐ Installation position: Lug -A- on conrod bearing cap faces towards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

3 - Bearing shells

- ☐ Installation position
⇒ [Fig. “Installation position of bearing shell”, page 71](#)
- ☐ Renew used bearing shells
- ☐ Check that it is securely seated

4 - Conrod

- ☐ With industrially cracked conrod bearing cap
- ☐ Only renew as a complete set
- ☐ Mark cylinder and conrod bearing cap allocation in colour -B-
- ☐ Measuring radial clearance ⇒ [“4.6 Checking radial clearance of conrod bearings”, page 74](#)
- ☐ Separating parts of new conrod ⇒ [Fig. “”, page 74](#)
- ☐ Installation position: Lug -A- on conrod bearing cap faces towards pulley end





5 - Circlip

- ☐ 2x
- ☐ Renew after removing

6 - Piston pin

- ☐ Removing and installing ⇒ [“4.2 Removing and installing pistons”, page 71](#)

7 - Piston

- ☐ With combustion chamber
- ☐ Mark installation position and cylinder number
⇒ [Fig. “Installation position of pistons and allocation of piston/cylinder””, page 70](#)
- ☐ Removing and installing ⇒ [“4.2 Removing and installing pistons”, page 71](#)
- ☐ Checking pistons and cylinder bores ⇒ [“4.4 Checking pistons and cylinder bores”, page 73](#)

8 - Piston rings

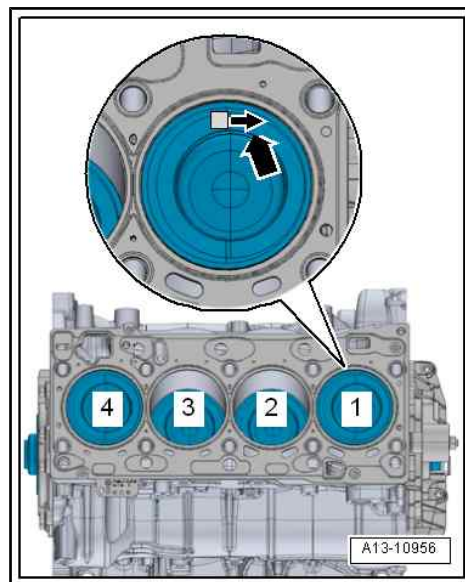
- ☐ Compression rings
- ☐ Measuring ring gap ⇒ [Fig. “Measuring piston ring gap””, page 73](#)
- ☐ Measuring ring-to-groove clearance ⇒ [Fig. “Measuring ring-to-groove clearance””, page 73](#)
- ☐ Use piston ring pliers (commercially available) to remove and install
- ☐ Installation position: marking “TOP” or side with lettering faces towards piston crown
- ☐ Offset gaps by 120°

9 - Piston ring

- ☐ Oil scraper ring
- ☐ Measuring ring gap ⇒ [Fig. “Measuring piston ring gap””, page 73](#)
- ☐ Measuring ring-to-groove clearance ⇒ [Fig. “Measuring ring-to-groove clearance””, page 73](#)
- ☐ Use piston ring pliers to remove and install
- ☐ Installation position: marking “TOP” or side with lettering faces towards piston crown
- ☐ Offset gap 120° from bottom compression ring

Installation position of pistons and allocation of piston/cylinder

- If you intend to re-install used pistons, mark the cylinder number on the piston crown using paint.
- Arrow on piston crown points to pulley end -arrow-.

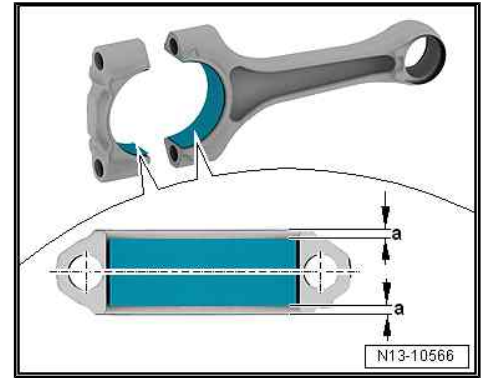


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Installation position of bearing shell

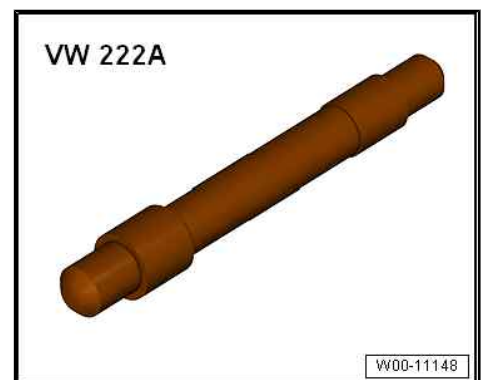
- Insert bearing shells centrally in conrod and conrod bearing cap.
- Distance -a- = 2.5 mm



4.2 Removing and installing pistons

Special tools and workshop equipment required

- ◆ Pin - VW 222 A-



- ◆ Piston ring clamp, commercially available

Removing

- Remove cylinder head
⇒ ["2.3 Removing and installing cylinder head", page 165](#).
- Remove sump (top section)
⇒ ["1.4 Removing and installing sump \(top section\)", page 205](#) and detach baffle plate.
- Mark installation position and cylinder number of piston.
- Mark installation position and matching of cylinder and conrod bearing cap to conrod ⇒ [Item 4 \(page 69\)](#).
- Remove conrod bearing cap and pull out piston and conrod upwards.

Note:

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

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

Installing

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

- Renew bolts tightened with specified tightening angle.
- Oil running surfaces of bearing shells.
- Install piston using commercially available piston ring clamp; note installation position
⇒ [Fig. "Installation position of pistons and allocation of piston/cylinder", page 70](#).



- Install conrod bearing cap; note installation position
⇒ [Item 2 \(page 69\)](#) .
- Install cylinder head
⇒ [“2.3 Removing and installing cylinder head”, page 165](#) .
- Install sump (upper section)
⇒ [“1.4 Removing and installing sump \(top section\)”, page 205](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - pistons and conrods”, page 69](#)

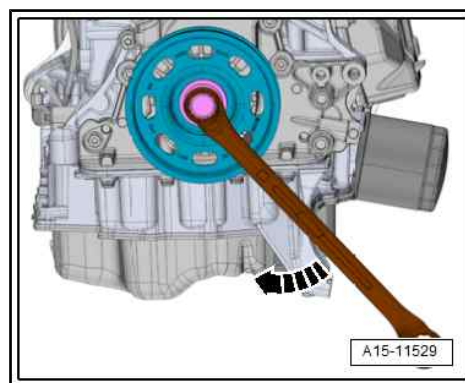
4.3 Removing and installing oil spray jets

Special tools and workshop equipment required

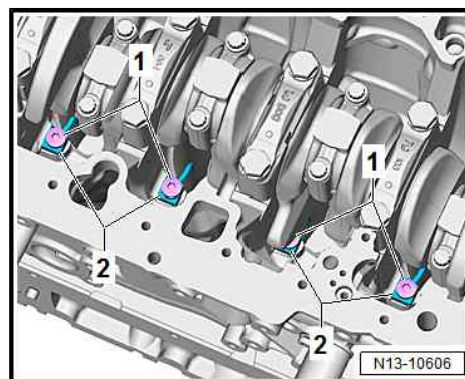
- ◆ Socket - T10545-

Removing

- Remove sump (top section)
⇒ [“1.4 Removing and installing sump \(top section\)”, page 205](#) and detach baffle plate.
- Turn crankshaft at pulley/vibration damper in direction of engine rotation -arrow- until corresponding bolt is accessible.



- Unscrew pressure relief valve -1- using socket - T10545- .
- Remove oil spray jet -2-.





Installing

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

- Installation position: Align locating edge of oil spray jet -2- with machined surface of cylinder block.

1 - Pressure relief valve



Risk of damage to oil spray jets due to deformation.

- **Never bend oil spray jets.**
- Install sump (upper section)
⇒ ["1.4 Removing and installing sump \(top section\)", page 205](#).

Tightening torques

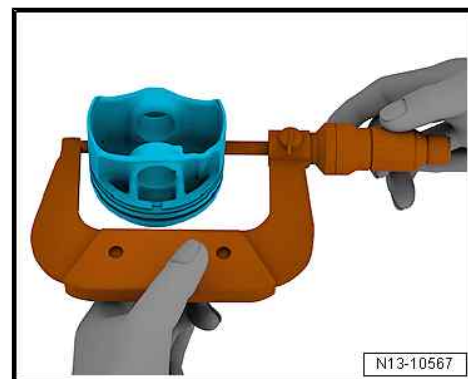
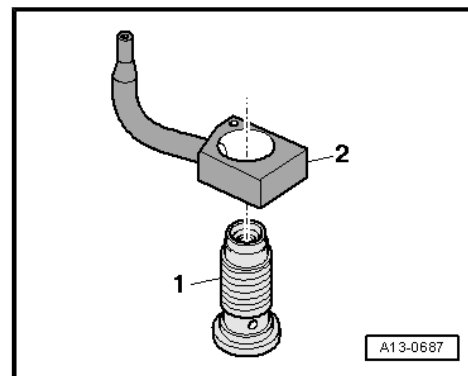
- ◆ ⇒ ["4.1 Exploded view - pistons and conrods", page 69](#)
- ◆ ⇒ ["1.1 Exploded view - sump/oil pump", page 199](#)

4.4 Checking pistons and cylinder bores

Checking piston

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

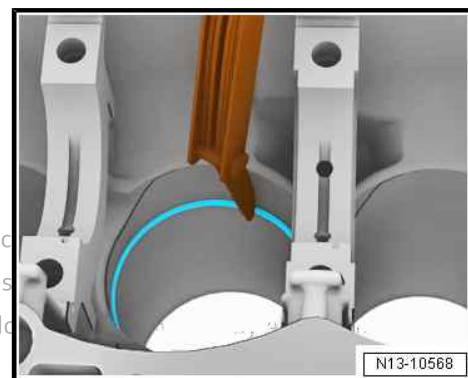
Piston Ø mm	
Nominal dimension	74.42 ¹⁾
• ¹⁾ Dimensions not including coating (thickness 0.018 mm on each side).	



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.

Piston ring	new mm	Wear limit mm
Compression ring	0.20 + 0.15	1.0
Oil scraper ring	0.20 + 0.20	3.0



Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
1st compression ring	0.05 ... 0.09	0.15
2nd compression ring	0.03 ... 0.07	0.15
Oil scraper rings	Cannot be measured	



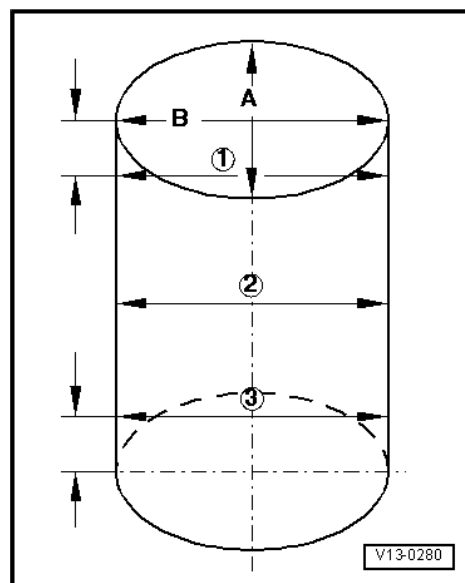


Measuring cylinder bore

- Use a cylinder gauge - VAS 6078- to take measurements at 3 points in transverse direction -A- and in longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.08 mm.

Cylinder bore Ø mm	
Nominal dimension	74.5 +0.015 +0.005

Do not measure the cylinder bore when the cylinder block is mounted to the engine and gearbox support - VAS 6095A- , as this may result in incorrect measurements.

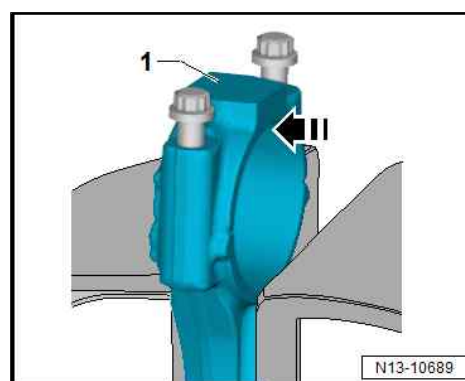
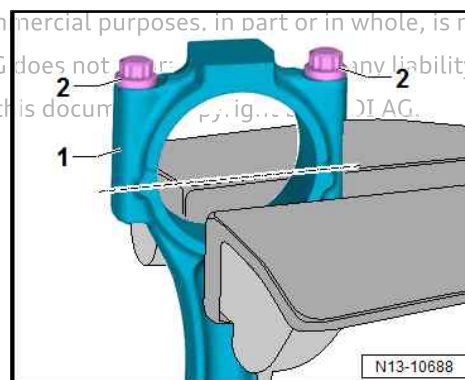


4.5 Separating parts of new conrod

Procedure

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

- Clamp conrod -1- lightly in a vice using aluminium jaw covers as shown in illustration.
- To avoid any risk of damage, the conrod should only be clamped lightly.
- The conrod is clamped in a position below the dotted line.
- Loosen the two bolts -2- approx. 5 turns.
- Using a plastic hammer, carefully knock conrod bearing cap -1- loose in direction of -arrow-.



4.6 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

- ◆ Plastigauge

Procedure

- Remove conrod bearing cap.
- Clean bearing cap and bearing journal.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or in the bearing shell.



- Fit conrod bearing cap and secure with old bolts
⇒ [Item 1 \(page 69\)](#) without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigauge with measurement scale.
 - Radial clearance: 0.028 ... 0.065 mm
- Renew conrod bolts.



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15 – Cylinder head, valve gear

1 Toothed belt drive

⇒ [“1.1 Exploded view - toothed belt cover”, page 76](#)

⇒ [“1.2 Exploded view - toothed belt”, page 77](#)

⇒ [“1.3 Detaching toothed belt from camshaft”, page 80](#)

⇒ [“1.4 Removing and installing toothed belt”, page 120](#)

1.1 Exploded view - toothed belt cover

1 - Toothed belt cover (bottom)

2 - Bolt

□ 8 Nm

3 - Engine support

□ Tightening torque and sequence

⇒ [Fig. “Engine support - tightening torque and sequence”, page 32](#)

4 - Bolt

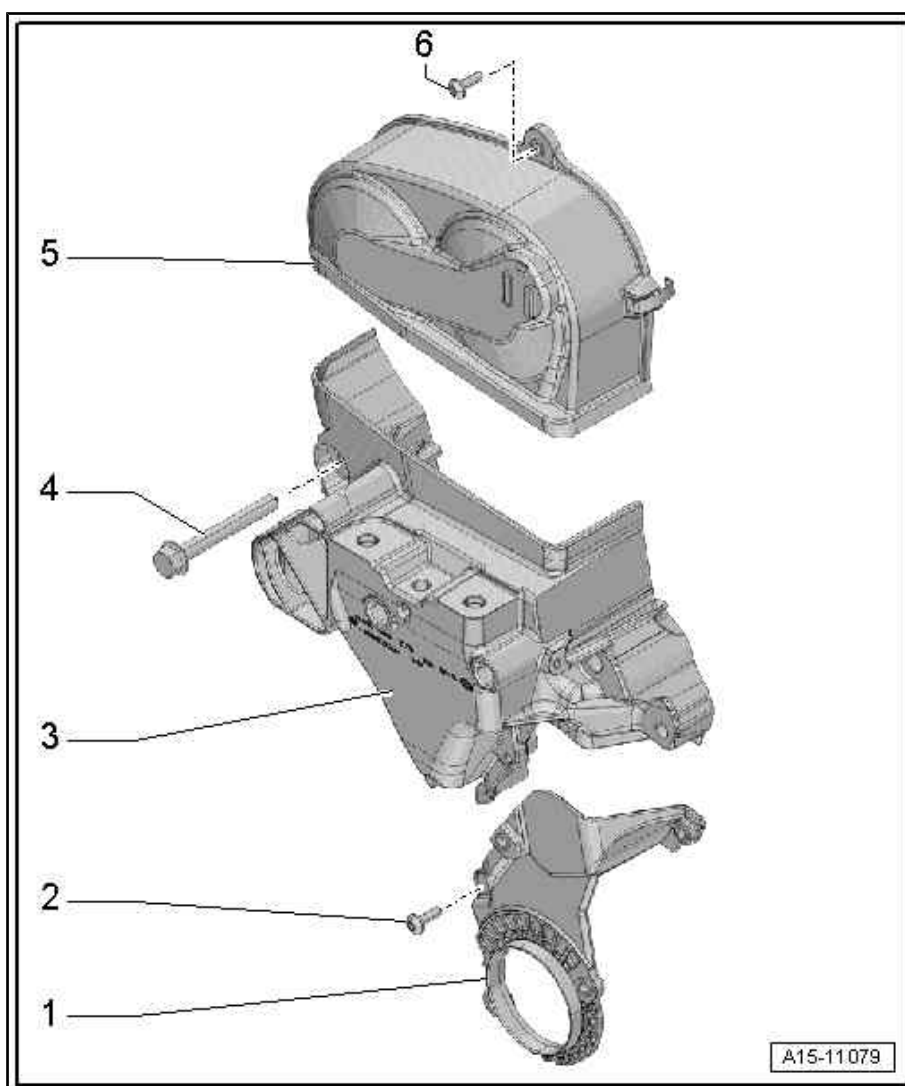
□ Tightening torque and sequence

⇒ [Fig. “Engine support - tightening torque and sequence”, page 32](#)

5 - Toothed belt cover (top)

6 - Bolt

□ 8 Nm



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1.2 Exploded view - toothed belt

⇒ "1.2.1 Exploded view - toothed belt, version with one camshaft adjuster", page 77

⇒ "1.2.2 Exploded view - toothed belt, version with two camshaft adjusters", page 79

1.2.1 Exploded view - toothed belt, version with one camshaft adjuster

1 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Check for wear
- ☐ ⇒ "1.3.1 Detaching toothed belt from camshaft - version with one camshaft adjuster", page 80
- ☐ ⇒ "1.4.1 Removing and installing toothed belt - version with one camshaft adjuster", page 120
- ☐ Adjusting valve timing
⇒ page 88

2 - Bolt

- ☐ 25 Nm

3 - Tensioning roller

- ☐ Removal and installation involve taking out engine support
⇒ "1.5 Removing and installing engine support", page 48

4 - Bolt

- ☐ Renew after removing
- ☐ 50 Nm +90°

5 - Camshaft sprocket for exhaust camshaft

6 - Camshaft sprocket for inlet camshaft

- ☐ With camshaft adjuster

7 - Guide sleeve

8 - Bolt

- ☐ Renew after removing
- ☐ 50 Nm +135°

9 - O-ring

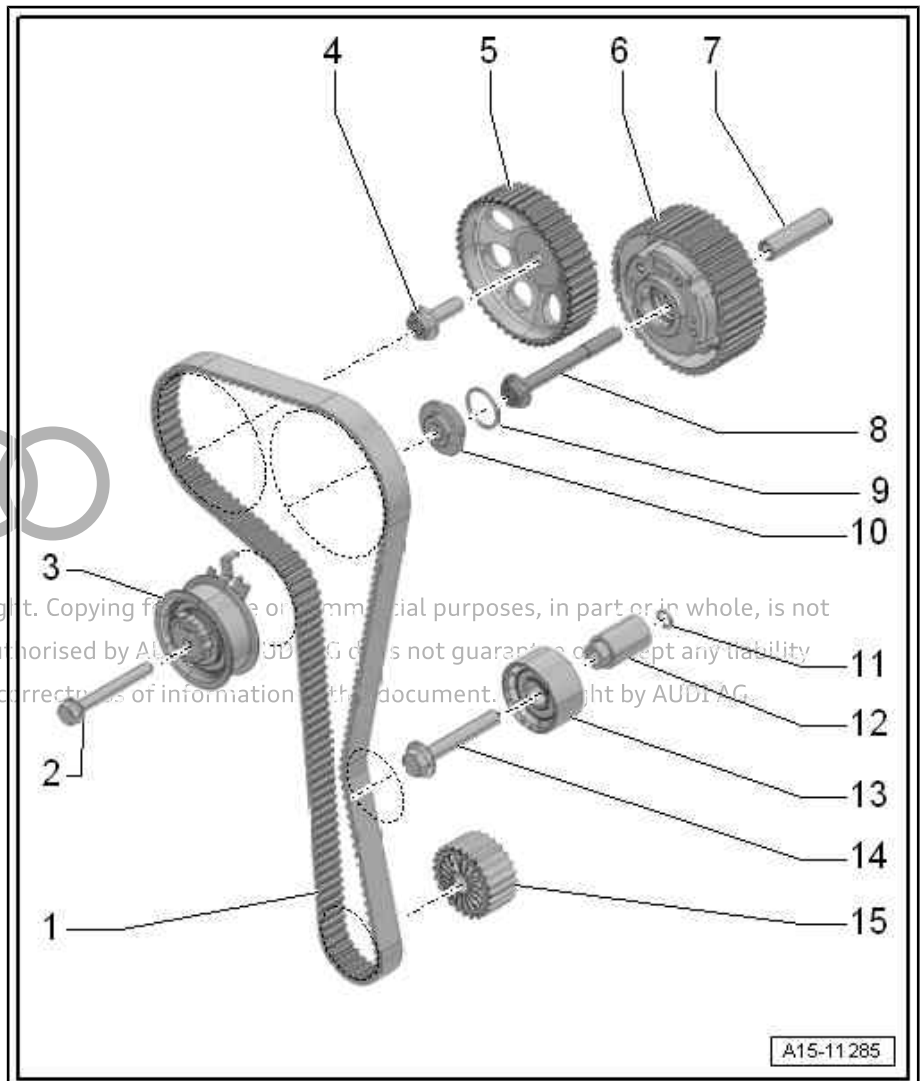
- ☐ Renew after removing

10 - Plug

- ☐ 20 Nm

11 - O-ring

- ☐ Retaining element
- ☐ Renew after removing





12 - Spacer sleeve

13 - Idler roller

14 - Bolt

- ❑ 45 Nm

15 - Crankshaft sprocket

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

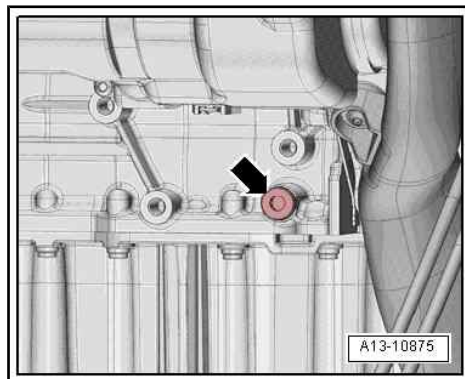
Plug for "TDC" drilling in cylinder block - tightening torque



Note

Renew O-ring if damaged.

- Tighten bolt -arrow- to 30 Nm.



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1.2.2 Exploded view - toothed belt, version with two camshaft adjusters

1 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Check for wear
- ☐ ⇒ "1.3 Detaching toothed belt from camshaft", page 80
- ☐ ⇒ "1.4 Removing and installing toothed belt", page 120
- ☐ Adjusting valve timing - version without cylinder shut-off ⇒ page 101
- ☐ Adjusting valve timing - version with cylinder shut-off ⇒ page 115

2 - Bolt

- ☐ 25 Nm

3 - Tensioning roller

- ☐ Removal and installation involve taking out engine support
- ⇒ "1.5 Removing and installing engine support", page 48

4 - Bolt

- ☐ 8 Nm
- ☐ Renew if damaged
- ☐ Slacken off and tighten alternately in stages (diagonal sequence)
- ⇒ "3.8 Nuts, bolts", page 7

5 - Cap

6 - O-ring

- ☐ Renew after removing

7 - Bolt

- ☐ Renew after removing
- ☐ 50 Nm +135°

8 - Camshaft sprocket for exhaust camshaft

- ☐ With camshaft adjuster

9 - Diamond-coated washer

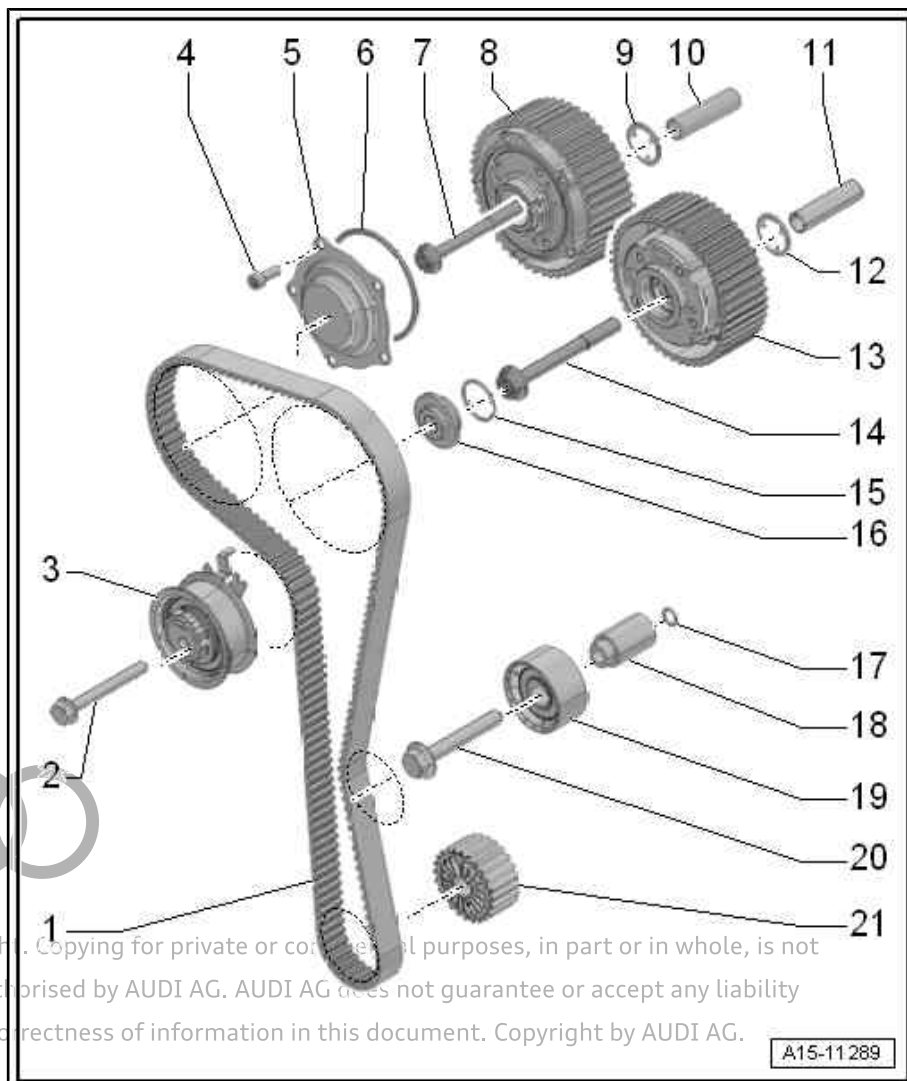
- ☐ Not fitted on all versions ⇒ Electronic parts catalogue
- ☐ Renew after removing

10 - Guide sleeve

11 - Guide sleeve

12 - Diamond-coated washer

- ☐ Not fitted on all versions ⇒ Electronic parts catalogue
- ☐ Renew after removing





13 - Camshaft sprocket for inlet camshaft

- ☐ With camshaft adjuster

14 - Bolt

- ☐ Renew after removing
- ☐ 50 Nm +135°

15 - O-ring

- ☐ Renew after removing

16 - Plug

- ☐ 20 Nm

17 - O-ring

- ☐ Retaining element
- ☐ Renew after removing

18 - Spacer sleeve

19 - Idler roller

20 - Bolt

- ☐ 45 Nm

21 - Crankshaft sprocket

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

1.3 Detaching toothed belt from camshaft

⇒ [“1.3.1 Detaching toothed belt from camshaft - version with one camshaft adjuster”, page 80](#)

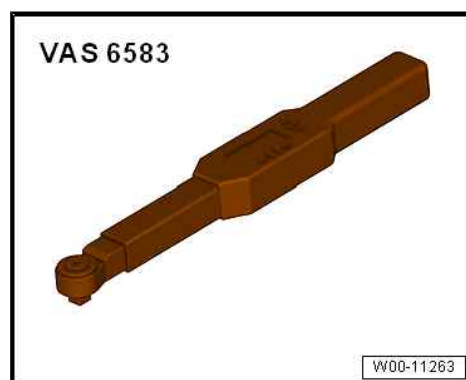
⇒ [“1.3.2 Detaching toothed belt from camshaft - version with two camshaft adjusters”, page 92](#)

⇒ [“1.3.3 Detaching toothed belt from camshaft - version with two camshaft adjusters and cylinder shut-off”, page 106](#)

1.3.1 Detaching toothed belt from camshaft - version with one camshaft adjuster

Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-





- ◆ Counterhold tool - T10475-



- ◆ Counterhold tool - T10172 A- with adapters -T10172/1-



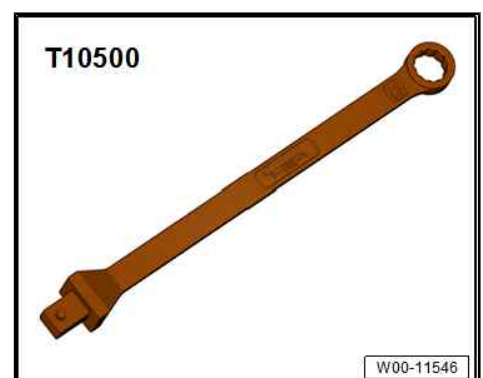
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- ◆ Special wrench, 30 mm - T10499 A-



- ◆ Open end spanner insert, AF 13 - T10500-



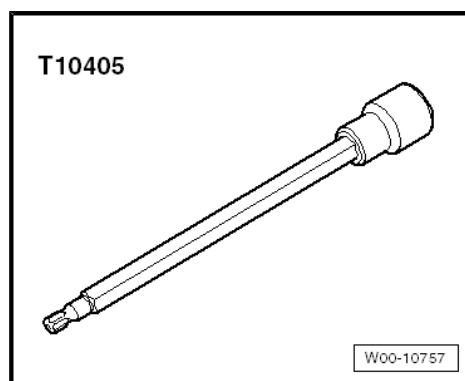


◆ Locking pin - T10340-

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◆ Socket Torx T30 - T10405-



◆ Assembly tool - T10487-



◆ Camshaft clamp - T10494-





- ◆ Release tool - T10527- and -T10527/1-



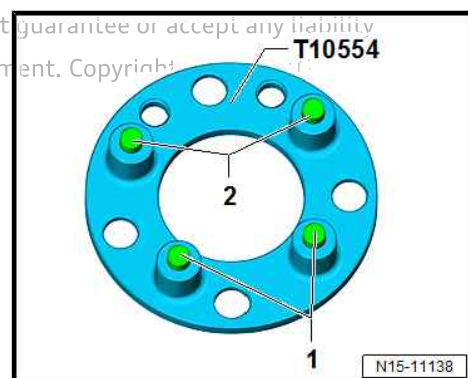
- ◆ Counterhold tool - T10554-



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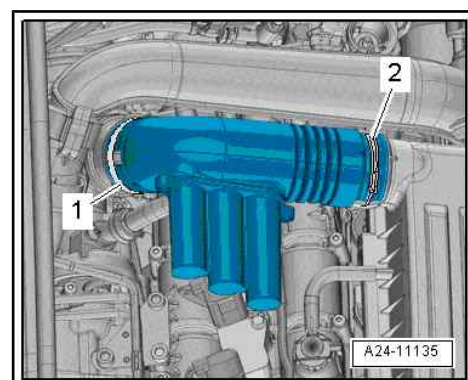
Counterhold tool - T10554-

- The lugs -1- and -2- on counterhold tool -T10554- are different distances apart.
- Counterhold tool - T10554- can only be applied in one position.
- Position counterhold tool - T10554- flush against camshaft adjusters.



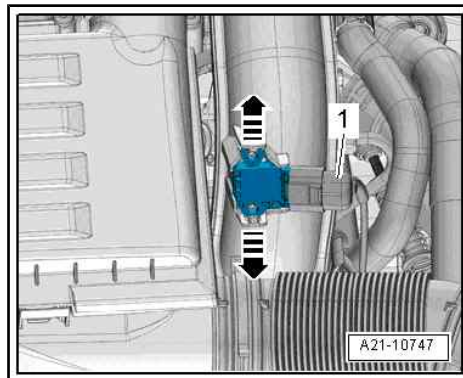
Procedure

- Remove engine cover panel
⇒ "3 Engine cover panel", page 39 .
- Loosen hose clips -1, 2- and remove air pipe.

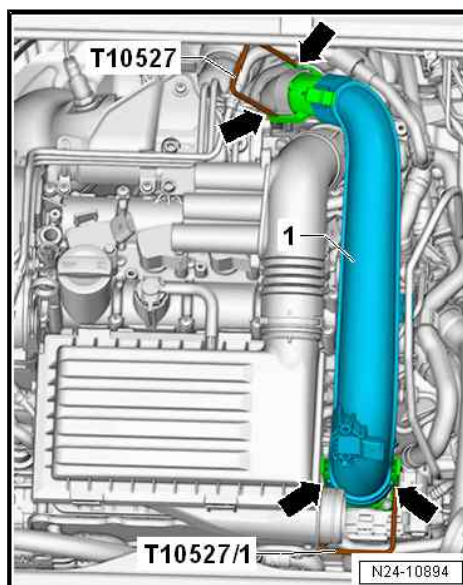




- Unplug electrical connector -1- from charge pressure sender - G31- .



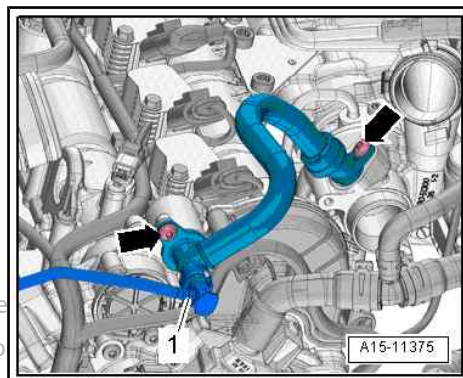
- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe.



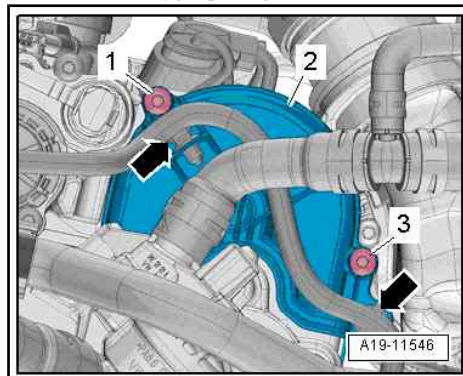
- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



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- Move electrical wiring harness clear -arrows-.
- Unscrew bolts -1, 3- and remove cover -2- for toothed belt for coolant pump.

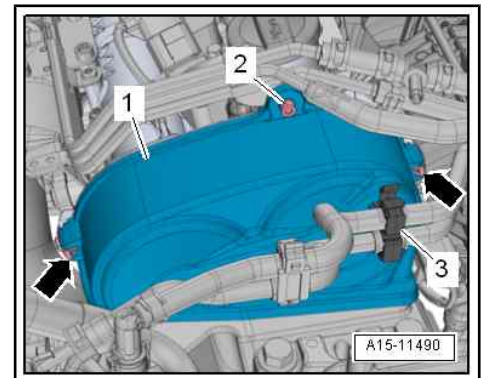
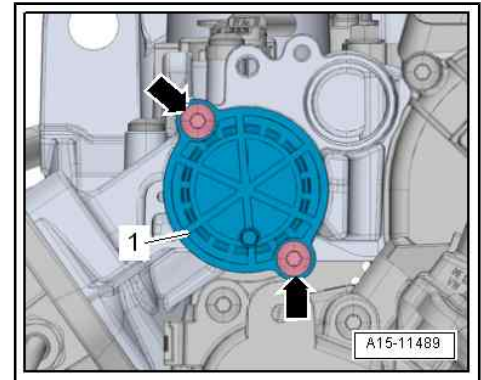




NOTICE

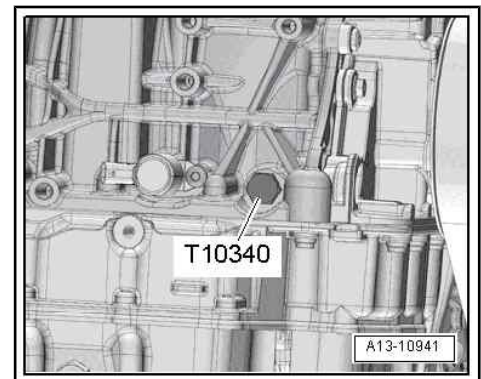
Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Unscrew bolts -arrows- and detach sealing cap -1-.
- Move clear hoses at bracket -3-.
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.

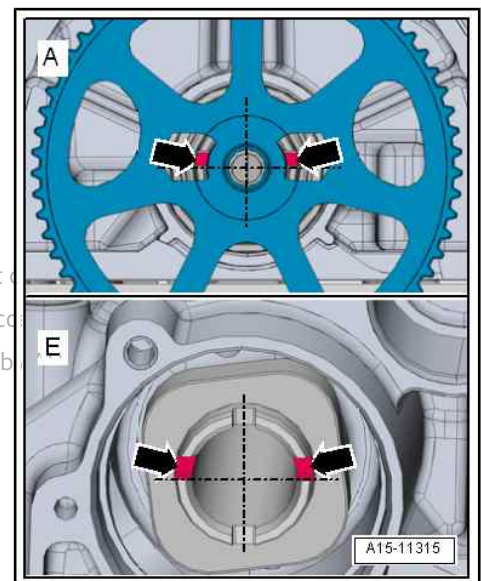


Rotate crankshaft to "TDC" as follows:

- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

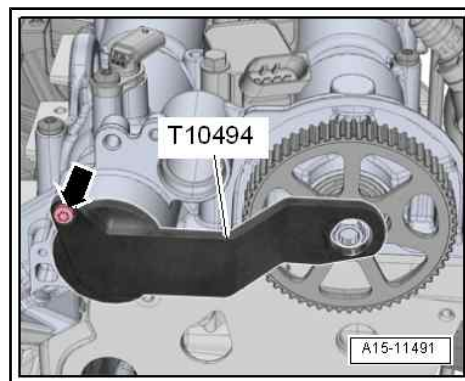


- The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In TDC position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.
- If camshafts are not positioned as described, turn crankshaft one rotation further and return to TDC position.
- On both camshafts, asymmetrically positioned grooves -top and bottom arrows- on gearbox end must now face upwards, as shown in illustration.
- On exhaust camshaft -A-, grooves -top arrows- are accessible via openings in coolant pump drive sprocket.
- On inlet camshaft -E-, grooves -bottom arrows- must be positioned above centre of camshaft.





- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- When camshafts are positioned as described, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt -arrow-.



Note

If it is difficult to insert camshaft clamp - T10494- , press against toothed belt -arrow- with assembly tool - T10487- . At the same time, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.

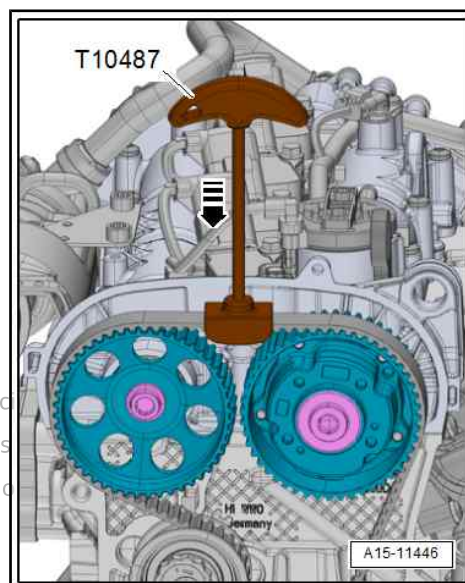


NOTICE

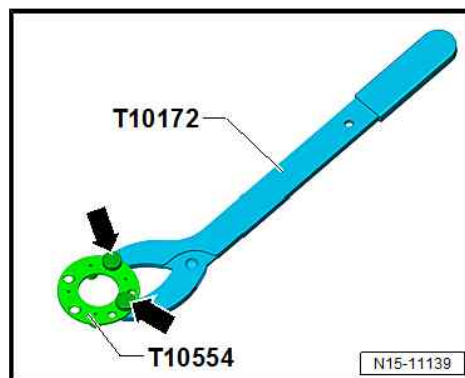
Risk of damage to camshaft if handled incorrectly

- Never use camshaft clamp as a counterhold tool.

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- Assemble tools as shown.
- Attach counterhold tool - T10172- to counterhold tool - T10554- using knurled screws -arrows-.



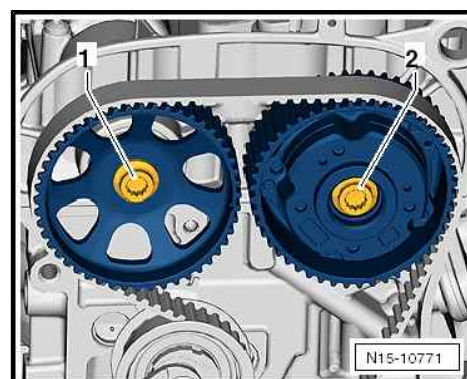
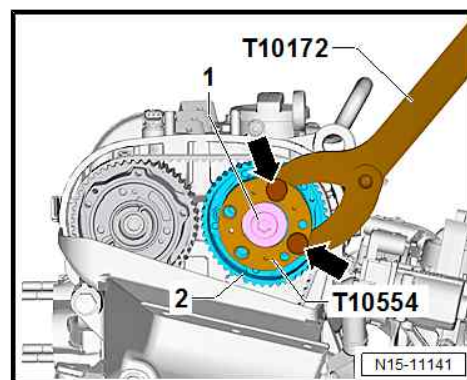
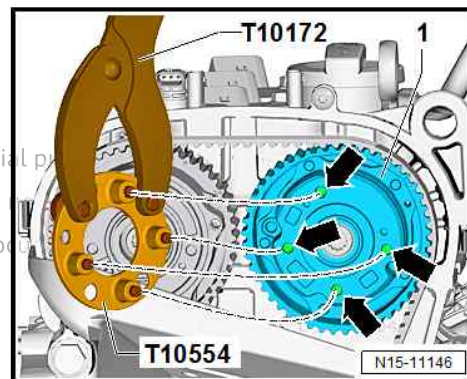


- Apply counterhold tool - T10554- with counterhold tool - T10172- to camshaft sprocket -1-, as shown.
- Pins must be inserted correctly into holes -arrows-.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.
- Secure camshaft with counterhold tool - T10554- and counterhold tool - T10172- so that it cannot turn.

! NOTICE

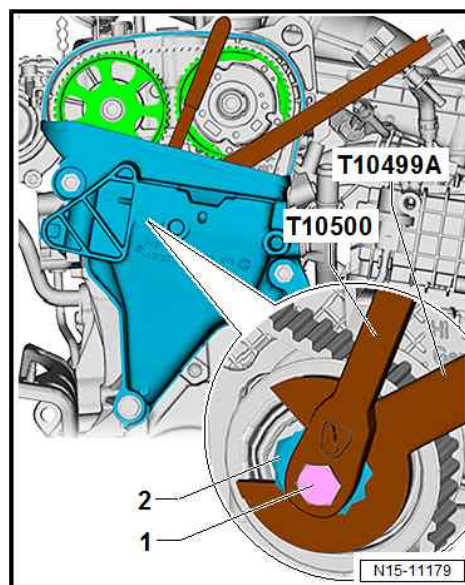
Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
 - Clean any spaces/cavities that have filled with engine oil.
-
- Unscrew plug -1- on camshaft sprocket (inlet side).
 - Use counterhold tool - T10554- and counterhold tool - T10172- to do so.
-
- Loosen bolt -2- approx. one turn using counterhold tool - T10554- and counterhold tool - T10172- .
 - Loosen bolt -1- approx. one turn using counterhold tool - T10172A- with adapters -T10172/2- .



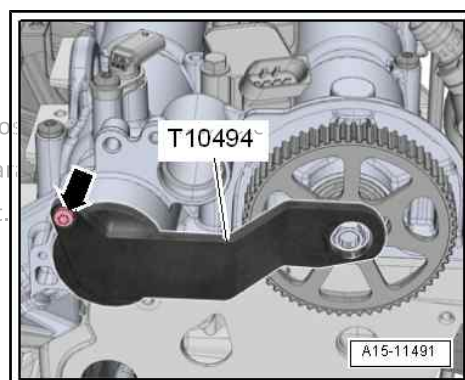


- Loosen bolt -1- using insert tool, 13 mm - T10500- and release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499 A- .
- Detach toothed belt from camshaft sprockets.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).

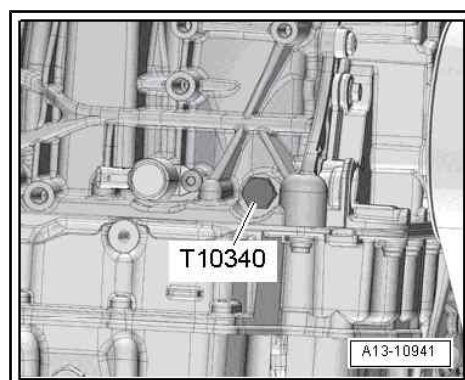


Installing (adjusting valve timing)

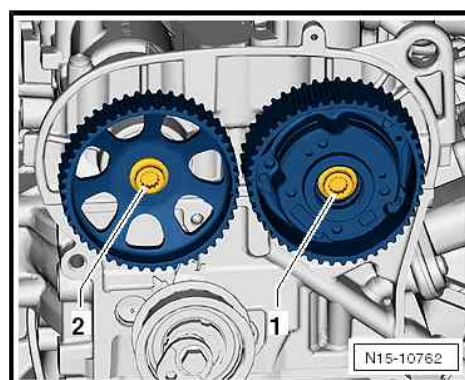
- Renew bolts tightened with specified tightening angle.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Renew O-rings.
- Check "TDC" position of camshaft and crankshaft:
- Camshaft clamp - T10494- must be fitted to camshaft housing.



- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.

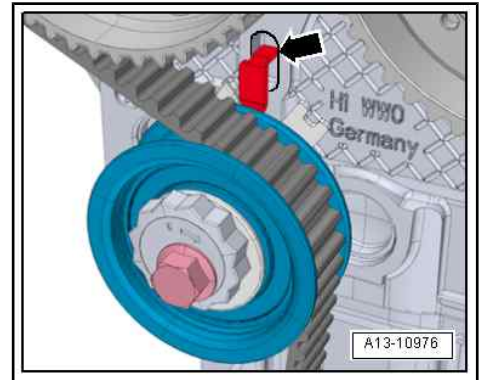


- Fit new bolts -1, 2- for camshaft sprockets and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



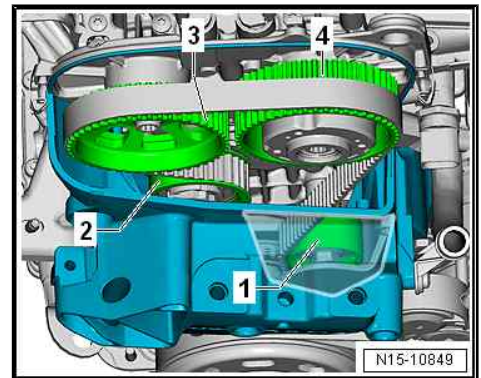


- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



Note correct sequence for fitting toothed belt:

- Pull toothed belt upwards and fit onto idler roller -1-, tensioning roller -2- and camshaft sprockets -3, 4-.



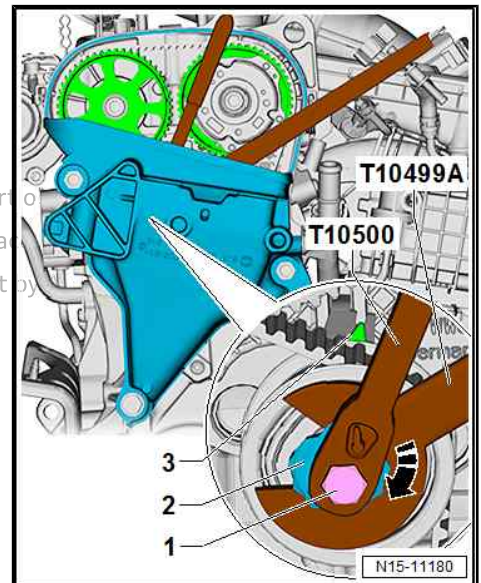
- Using special wrench, 30 mm - T10499 A- , turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster -2- back until adjustment indicator -3- is positioned exactly in adjustment window.

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NOTICE

Risk of damage to engine if tightening torque is incorrect.

- Torque wrench - VAS 6583- must be used to tighten the bolts.
- When setting the tightening torque on the torque wrench - VAS 6583- , the reading on the insert tool, 13 mm - T10500- must be entered in the torque wrench.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - T10500- with torque wrench - VAS 6583- .



Note:

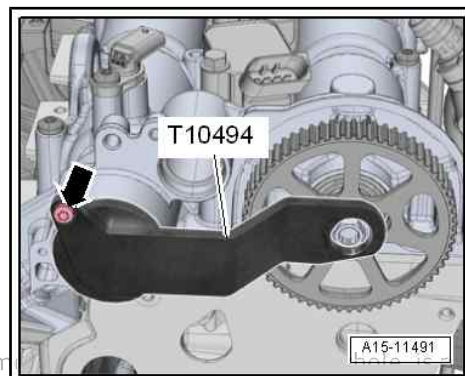
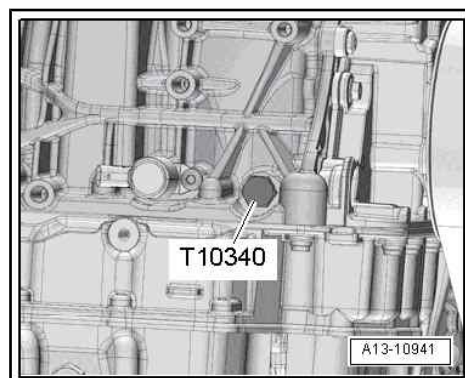
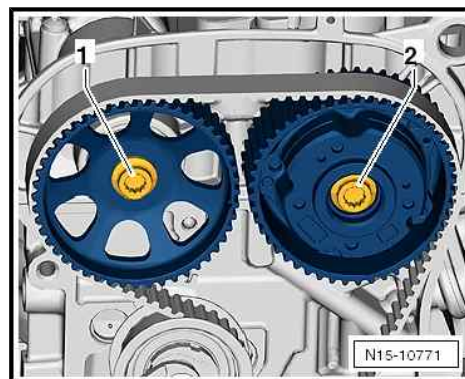
Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension.



NOTICE

Risk of damage to camshaft if handled incorrectly

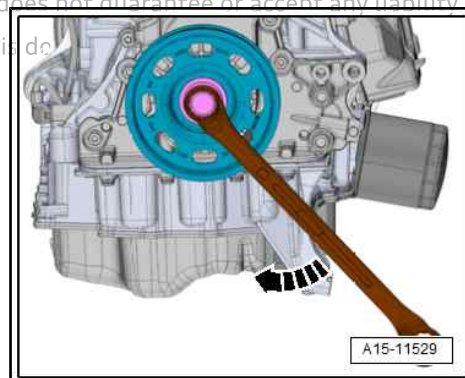
- **Never use camshaft clamp as a counterhold tool.**
- Tighten bolt -1- initially to 50 Nm using counterhold tool - T10172A- with adapters -T10172/2- .
- Tighten bolt -2- initially to 50 Nm using counterhold tool - T10554- and counterhold tool - T10172- .
- Remove locking pin - T10340- .
- Remove bolt -arrow- and detach camshaft clamp - T10494- .



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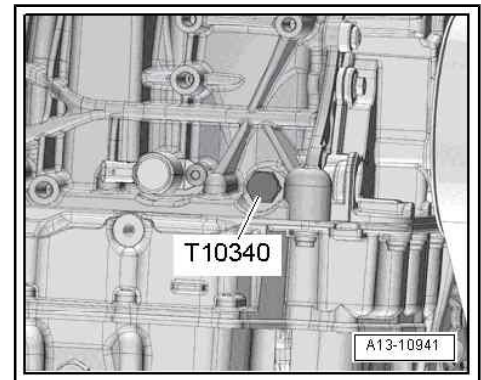
Checking valve timing:

- Turn crankshaft 2 rotations in normal direction of engine rotation -arrow-.

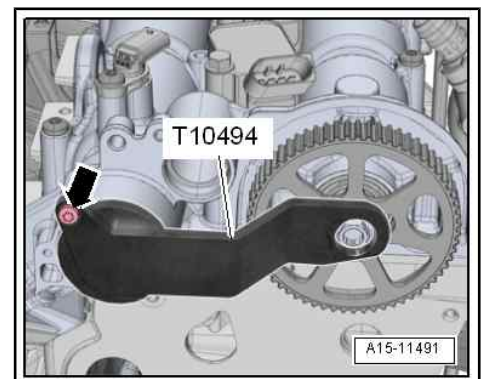




- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.

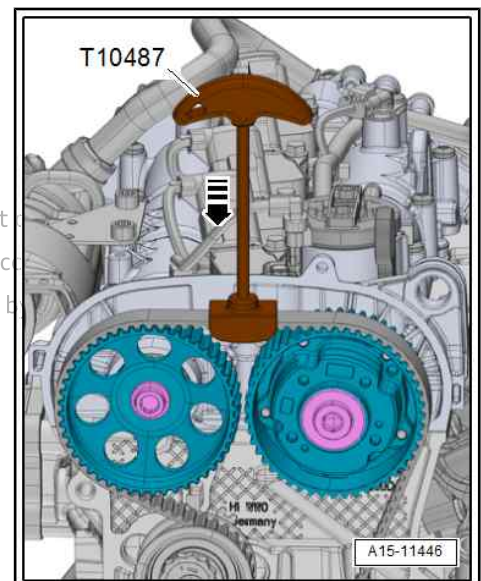


Note:

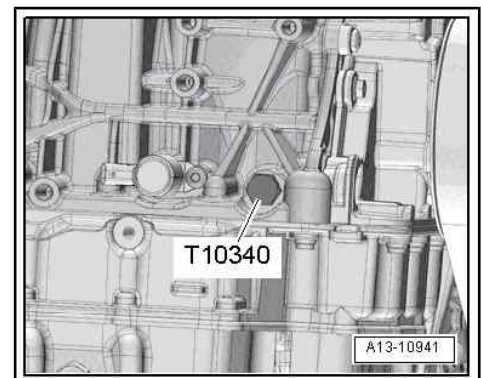
- If it is not possible to insert the camshaft clamp - T10494- easily:
- Press down toothed belt -arrow- using assembly tool -T10487- and then insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.

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- If it is not possible to insert camshaft clamp - T10494- , valve timing is not OK.
- Adjust valve timing again [=> page 88](#) .
- If it is possible to insert camshaft clamp - T10494- , valve timing is OK.



- Remove locking pin - T10340- .



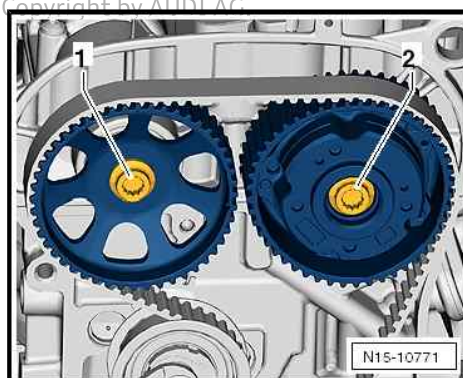
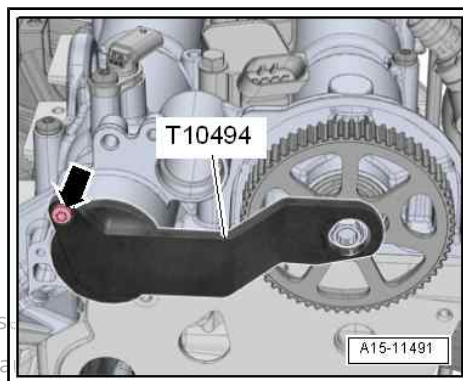


- Remove bolt -arrow- and detach camshaft clamp - T10494- .



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- Tighten bolts -1, 2- to final tightening torque ⇒ [page 77](#) using counterhold tool - T10554- with adapters -T10172/2- , or counterhold tool - T10172A- and counterhold tool - T10172- .

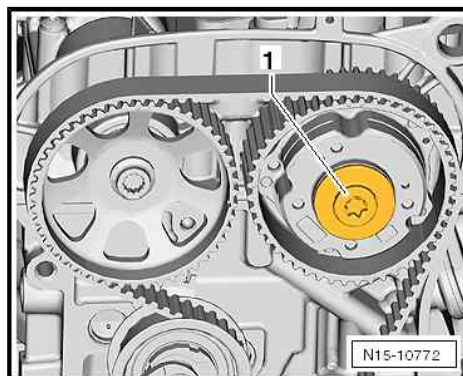


- Tighten plug -1- using counterhold tool - T10554- and counterhold tool - T10172- .

The remaining installation steps are carried out in the reverse sequence.

Tightening torques

- ◆ ⇒ [“1.2.1 Exploded view - toothed belt, version with one camshaft adjuster”, page 77](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 76](#)
- ◆ ⇒ [Fig. “Plug for TDC drilling in cylinder block - tightening torque”, page 78](#)
- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 212](#)
- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 231](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“1.1.3 Exploded view - pipes, lines and hoses on turbocharger”, page 263](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

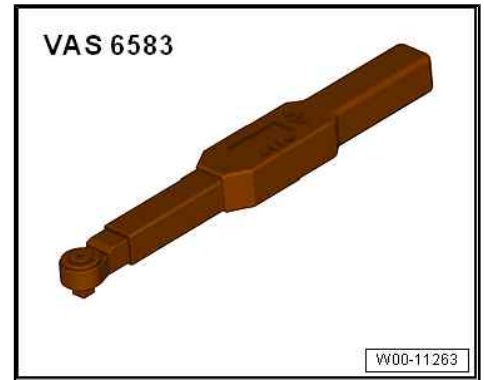


1.3.2 Detaching toothed belt from camshaft - version with two camshaft adjusters

Special tools and workshop equipment required



- ◆ Torque wrench - VAS 6583-



- ◆ Counterhold tool - T10475-



- ◆ Counterhold tool - T10172 A- with adapters -T10172/1-



- ◆ Special wrench, 30 mm - T10499 A-

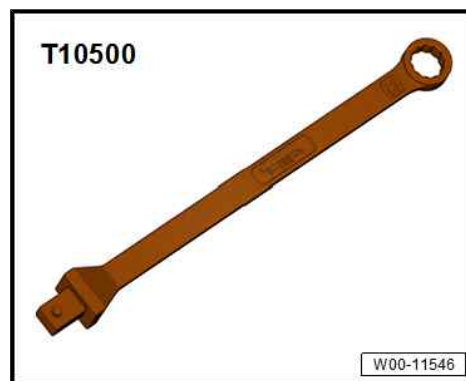


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- ◆ Open end spanner insert, AF 13 - T10500-



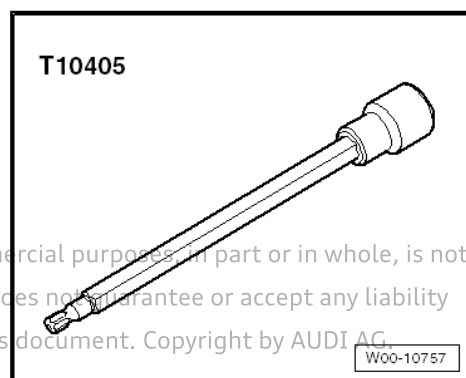
- ◆ Locking pin - T10340-



- ◆ Socket Torx T30 - T10405-



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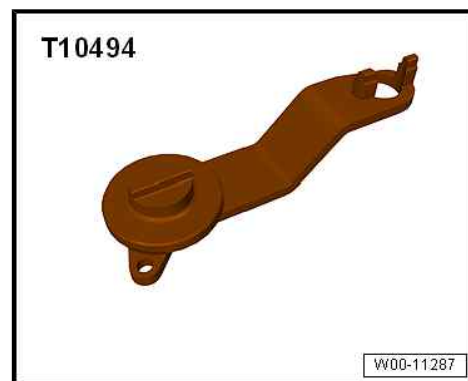


- ◆ Assembly tool - T10487-





◆ Camshaft clamp - T10494-



◆ Release tool - T10527- and -T10527/1-

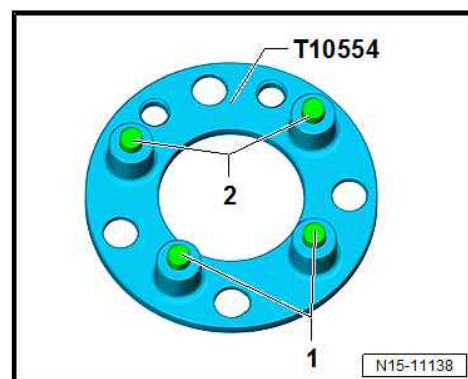


◆ Counterhold tool - T10554-



Counterhold tool - T10554-

- The lugs -1- and -2- on counterhold tool - T10554- are different distances apart.
- Counterhold tool - T10554- can only be applied in one position.
- Position counterhold tool - T10554- flush against camshaft adjusters.

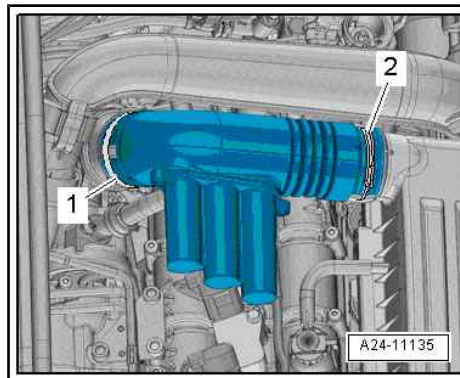


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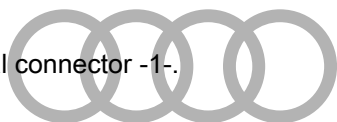


Procedure

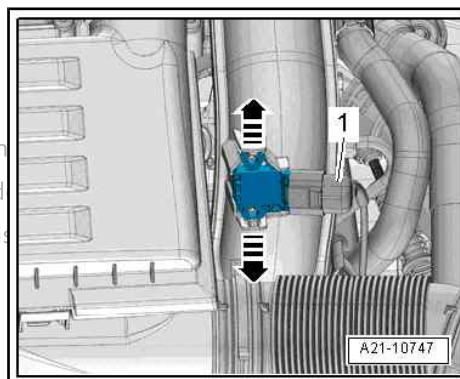
- Remove engine cover panel
⇒ [“3 Engine cover panel”, page 39](#) .
- Loosen hose clips -1, 2- and remove air pipe.



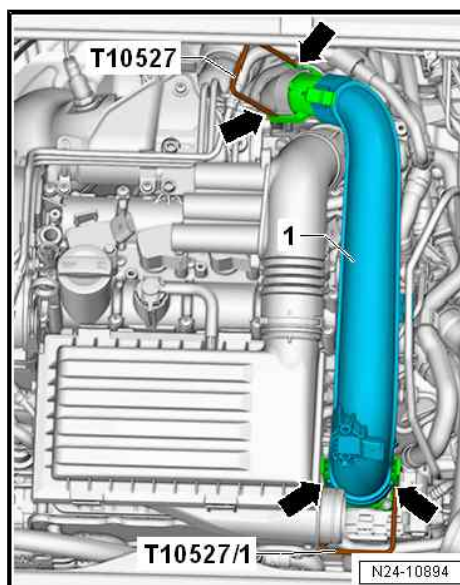
- Unplug electrical connector -1-.



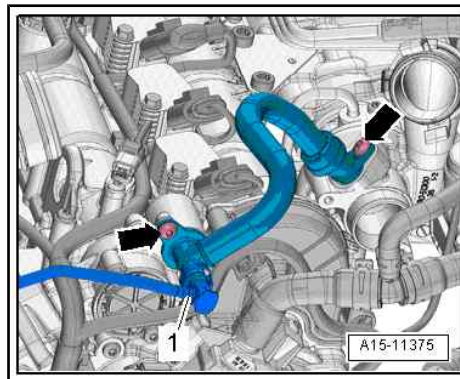
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- Release fasteners -arrows- with release tool - T10527- and - T10527/1- .
- Detach air pipe -1-.

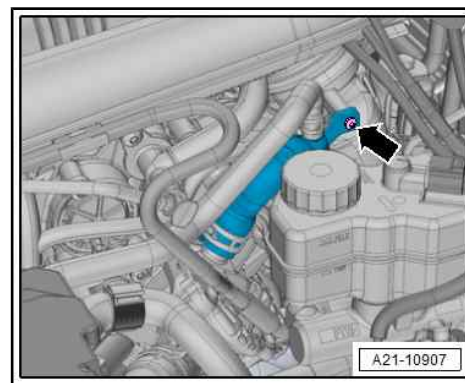


- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).





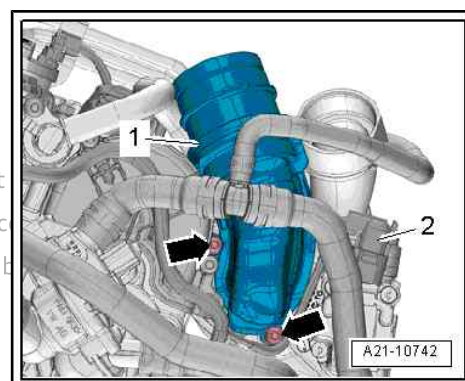
- If fitted, remove bolt -arrow- from connection and press coolant hose slightly forwards.



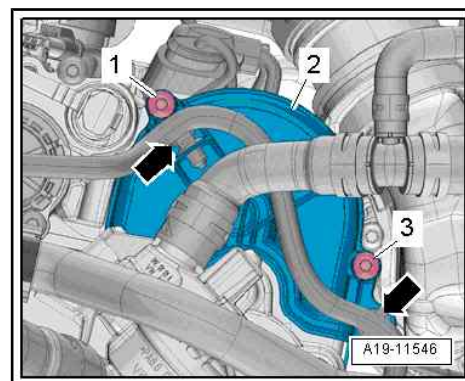
- Unscrew bolts -arrows- using socket Torx T30 - T10405- and detach connection -1-.



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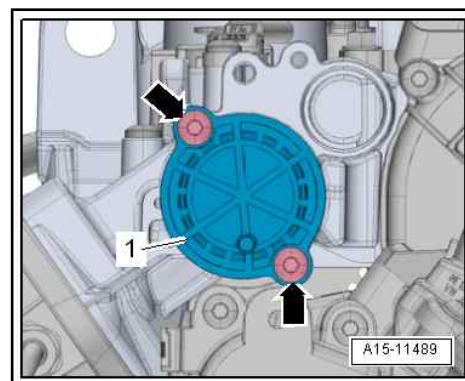
- Move electrical wiring harness clear -arrows-.
- Unscrew bolts -1, 3- and remove cover -2- for toothed belt for coolant pump.



! NOTICE

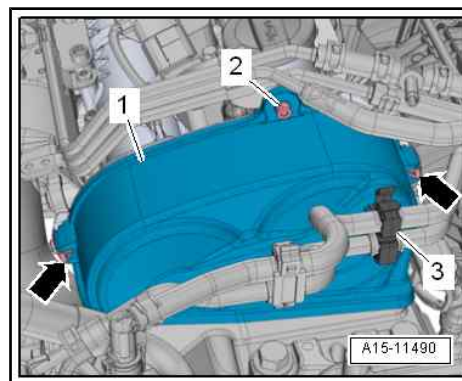
Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Unscrew bolts -arrows- and detach sealing cap -1-.





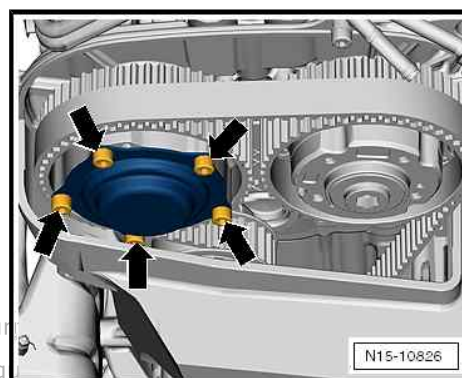
- Move clear hoses at bracket -3-.
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.



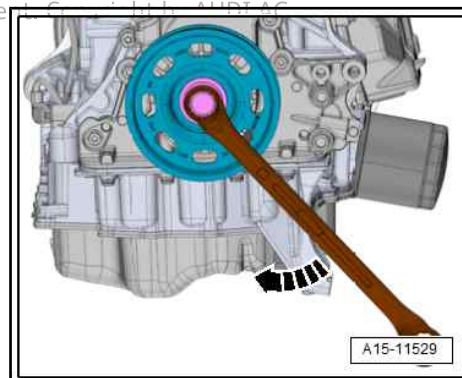
NOTICE

Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.
- Remove bolts -arrows- → [Item 4 \(page 79\)](#) .

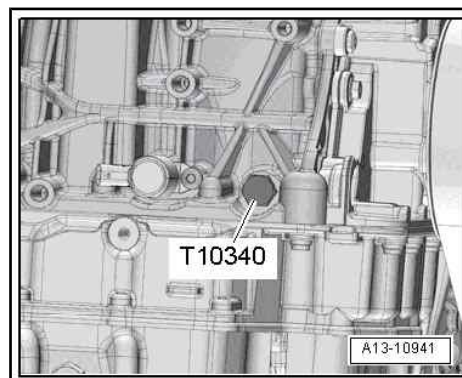


- Rotate crankshaft at vibration damper in normal direction of rotation so you can access all bolts -arrows- and unscrew them.
- Detach cover from camshaft adjuster of exhaust camshaft.



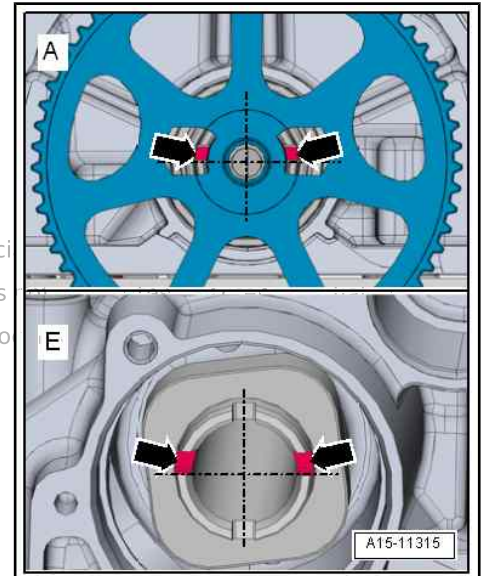
Rotate crankshaft to “TDC” as follows:

- Unscrew plug for “TDC” hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

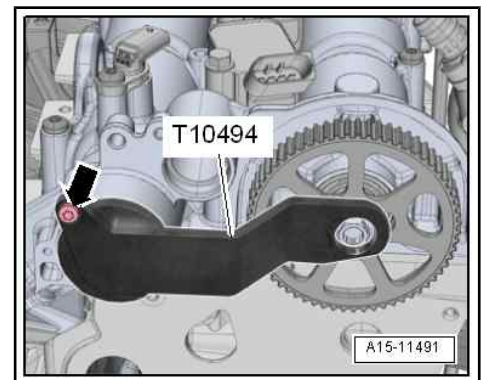




- The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In TDC position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.
- If camshafts are not positioned as described, turn crankshaft one rotation further and return to TDC position.
- On both camshafts, asymmetrically positioned grooves -top and bottom arrows- on gearbox end must now face upwards, as shown in illustration.
- On exhaust camshaft -A-, grooves -top arrows- are accessible via openings in coolant pump drive sprocket.
- On inlet camshaft -E-, grooves -bottom arrows- must be positioned above centre of camshaft.



- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- When camshafts are positioned as described, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt -arrow-.



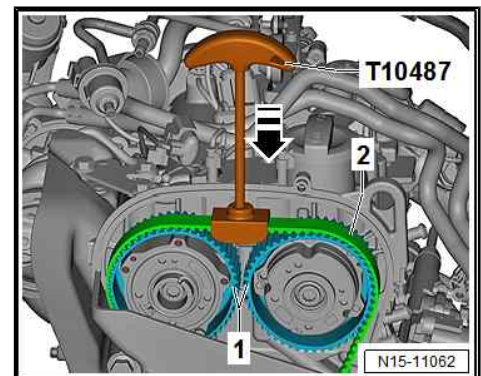
Note

If it is difficult to insert camshaft clamp - T10494- , press against toothed belt -arrow- with assembly tool - T10487- . At the same time, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.



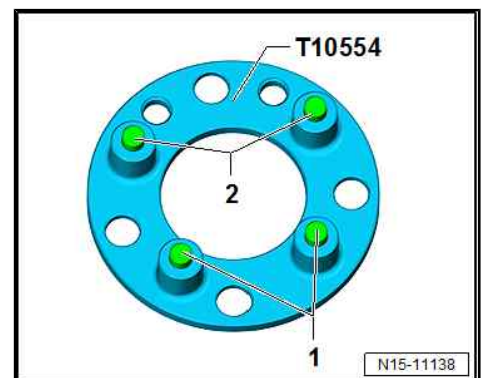
Risk of damage to camshaft if handled incorrectly

- Never use camshaft clamp as a counterhold tool.



Exhaust camshaft:

- Guide in counterhold tool - T10554- between camshaft adjuster and engine support.
- To do so, first guide area between lugs -2- on counterhold tool - T10554- past camshaft adjuster.

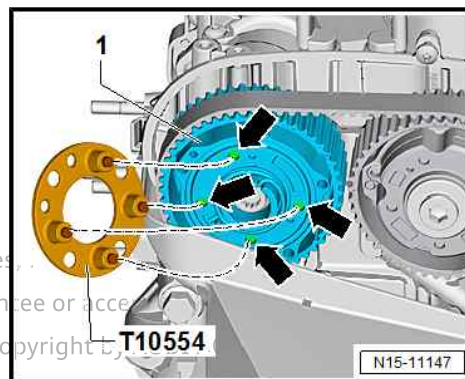




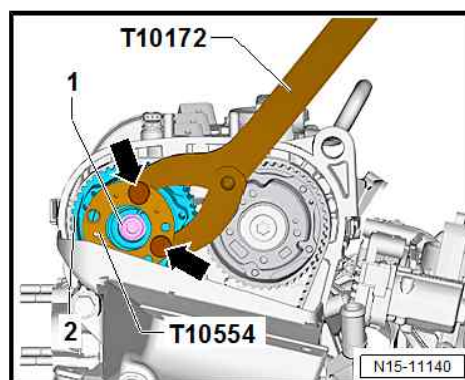
- Turn counterhold tool - T10554- so that it can be inserted in holes -arrows- as shown.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.



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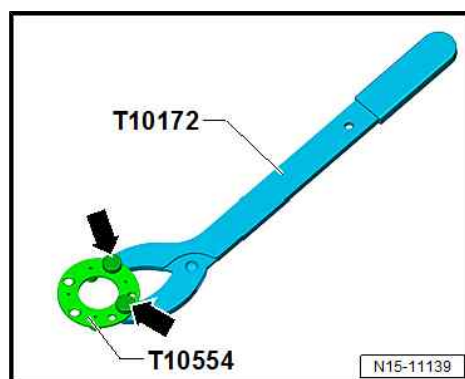


- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172- .



Inlet camshaft

- Assemble tools as shown.
- Attach counterhold tool - T10172- to counterhold tool - T10554- using knurled screws -arrows-.



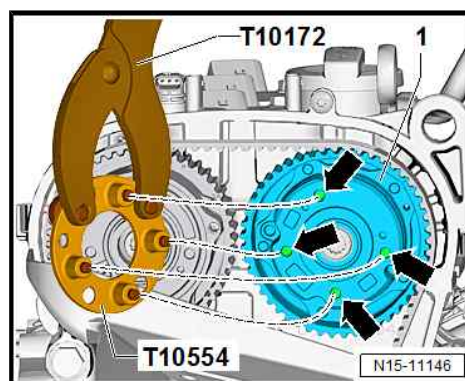
- Apply counterhold tool - T10554- with counterhold tool - T10172- to camshaft sprocket -1-, as shown.
- Pins must be inserted correctly into holes -arrows-.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.
- Secure camshaft with counterhold tool - T10554- and counterhold tool - T10172- so that it cannot turn.



NOTICE

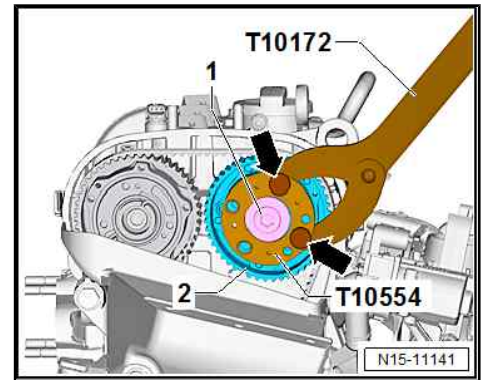
Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.



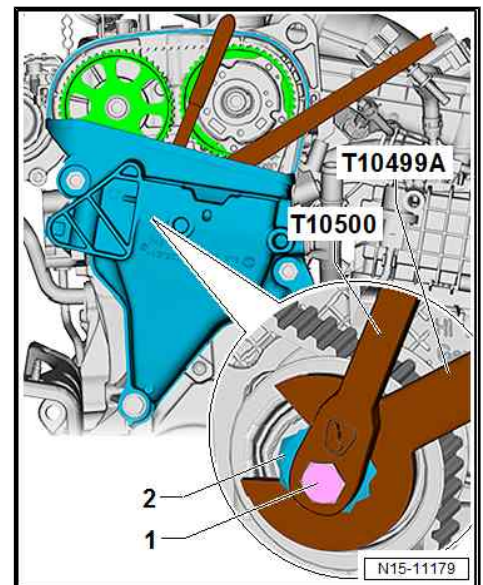


- Unscrew plug -1- on camshaft sprocket (inlet side).
- Use counterhold tool - T10554- with counterhold tool - T10172- to do so.
- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172- .



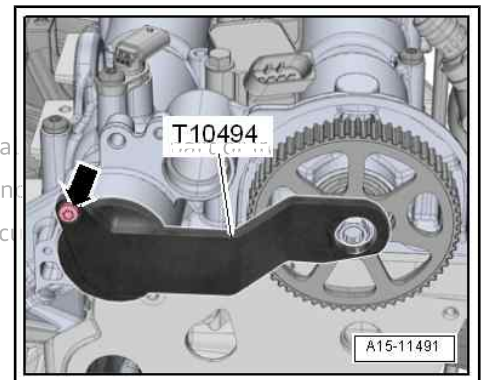
Both sides (continued):

- Fit special wrench, 30 mm - T10499 A- onto eccentric adjuster -2- of tensioning roller.
- Loosen bolt -1- using insert tool, 13 mm - T10500- .
- Release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499 A- .
- Detach toothed belt from camshaft sprockets.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).

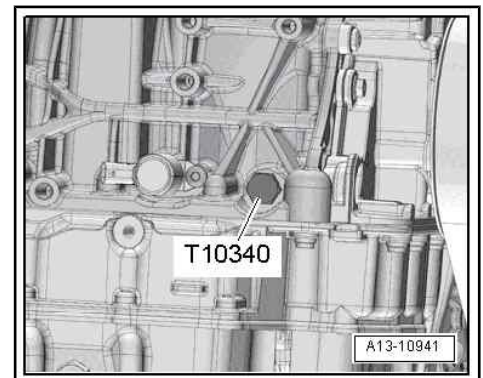


Installing (adjusting valve timing)

- Renew bolts tightened with specified tightening angle.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue
- Renew O-rings.
- Check “TDC” position of camshaft and crankshaft:
- Camshaft clamp - T10494- must be fitted to camshaft housing.

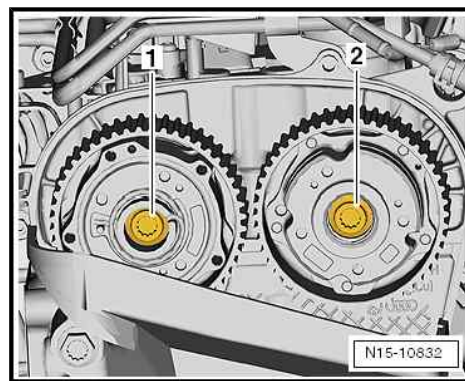


- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = “TDC” position.

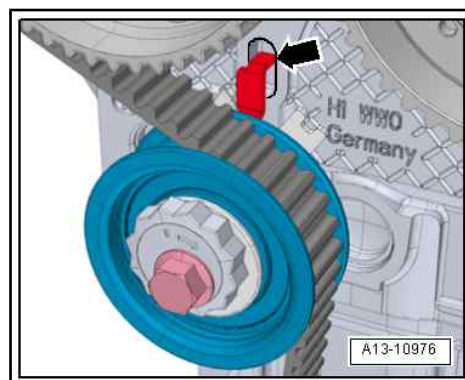




- Fit new bolts -1, 2- for camshaft sprockets and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.

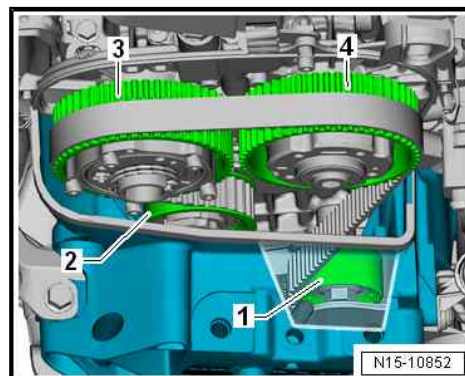


- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



Note correct sequence for fitting toothed belt:

- Pull toothed belt upwards and fit onto idler roller -1-, tensioning roller -2- and camshaft sprockets -3, 4-.



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- Using special wrench, 30 mm - T10499 A- , turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster -2- back until adjustment indicator -3- is positioned exactly in adjustment window.

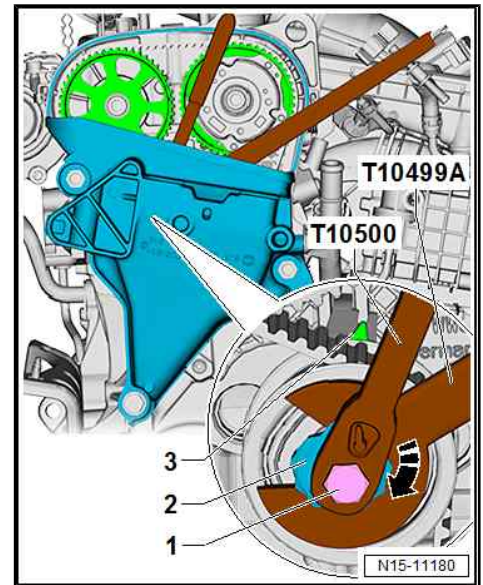
NOTICE

Risk of damage to engine if tightening torque is incorrect.

- Torque wrench - VAS 6583- must be used to tighten the bolts.
- When setting the tightening torque on the torque wrench - VAS 6583- , the reading on the insert tool, 13 mm - T10500- must be entered in the torque wrench.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - T10500- with torque wrench - VAS 6583- .

Note:

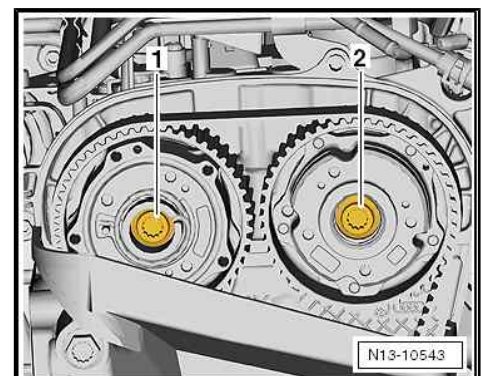
Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension.



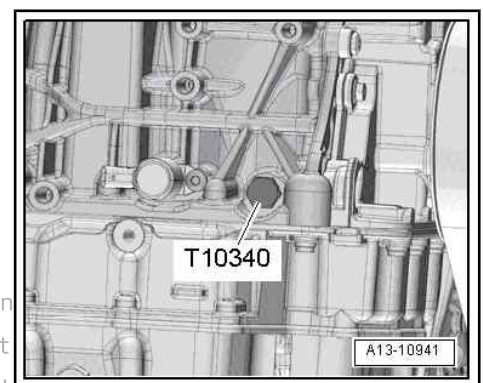
NOTICE

Risk of damage to camshaft if handled incorrectly

- Never use camshaft clamp as a counterhold tool.
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool - T10172A- with adapters -T10172/2- , or counterhold tool - T10554- and counterhold tool - T10172- .



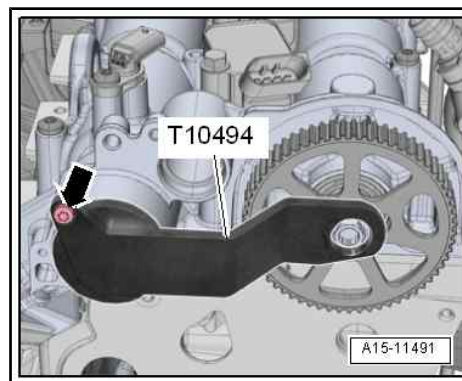
- Remove locking pin - T10340- .



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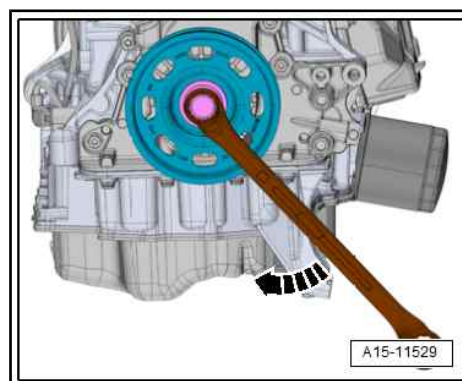


- Remove bolt -arrow- and detach camshaft clamp - T10494- .

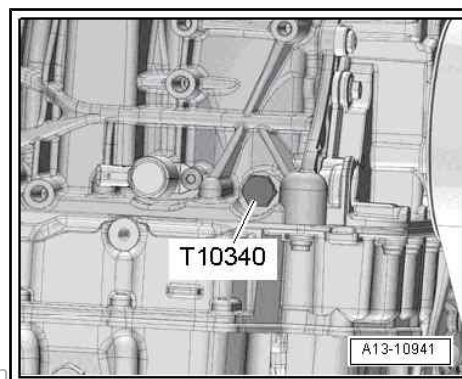


Checking valve timing:

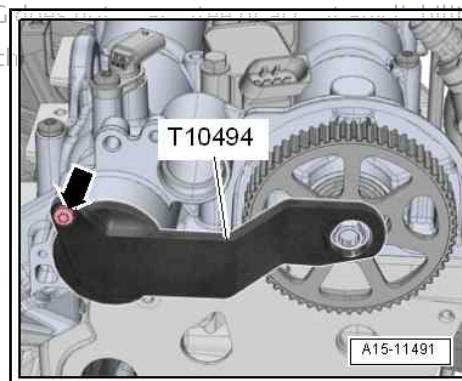
- Turn crankshaft 2 rotations in normal direction of engine rotation -arrow-.



- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



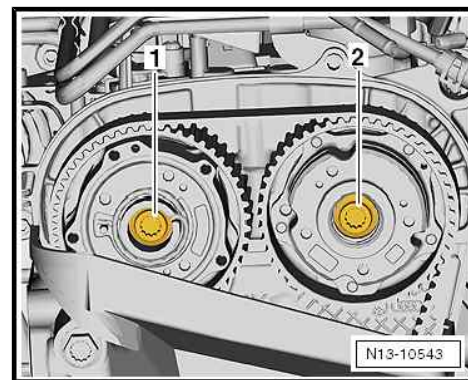
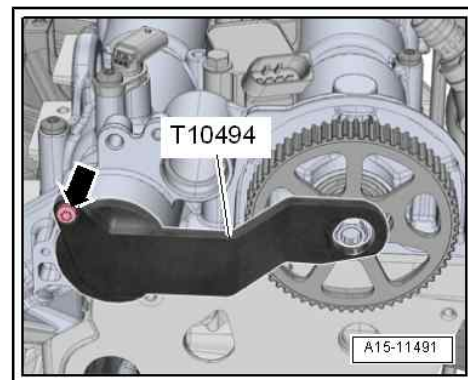
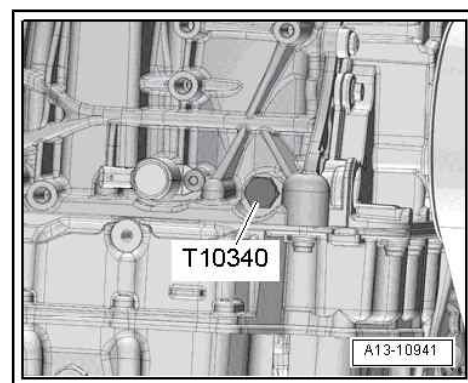
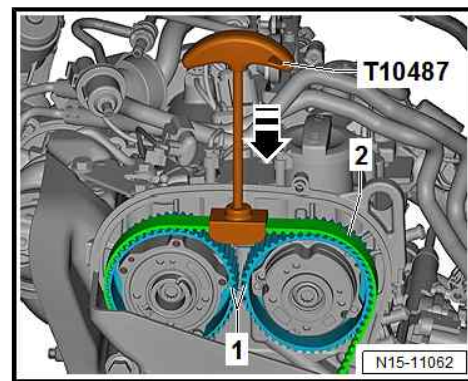
- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.





Note:

- If it is not possible to insert the camshaft clamp - T10494- easily:
- Press down toothed belt -arrow- using assembly tool -T10487- and then insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.
- If it is not possible to insert camshaft clamp - T10494- , valve timing is not OK.
- Adjust valve timing again ⇒ [page 88](#) .
- If it is possible to insert camshaft clamp - T10494- , valve timing is OK.
- Remove locking pin - T10340- .
- Remove bolt -arrow- and detach camshaft clamp - T10494- .
- Tighten bolts -1, 2- to final tightening torque ⇒ [page 79](#) using counterhold tool - T10554- with adapters -T10172/2- , or counterhold tool - T10172A- and counterhold tool - T10172- .





- Tighten plug -1- using counterhold tool - T10172- with counterhold tool - T10554- .

Further installation is carried out in the reverse order; note the following:

- Install engine cover panel
⇒ [“3 Engine cover panel”, page 39](#) .

Tightening torques

- ◆ ⇒ [“1.2.2 Exploded view - toothed belt, version with two camshaft adjusters”, page 79](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 76](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 78](#)
- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 212](#)
- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 231](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)
- ◆ ⇒ [“1.1.3 Exploded view - pipes, lines and hoses on turbocharger”, page 263](#)

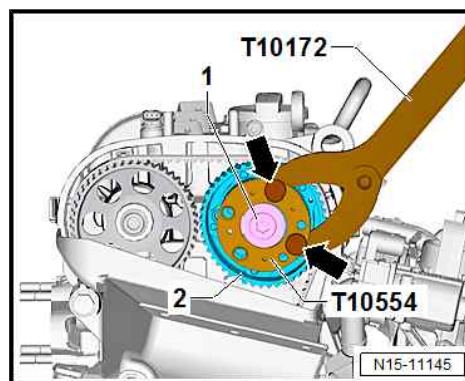
1.3.3 Detaching toothed belt from camshaft - version with two camshaft adjusters and cylinder shut-off

- ◆ Torque wrench - VAS 6583-



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- ◆ Counterhold tool - T10475- with respect to the correctness of information in this document. Copyright © 2019 AUDI AG.





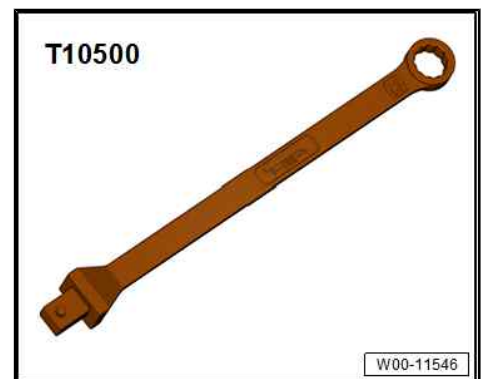
- ◆ Counterhold tool - T10172 A- with adapters -T10172/1-



- ◆ Special wrench, 30 mm - T10499 A-



- ◆ Open end spanner insert, AF 13 - T10500-



- ◆ Locking pin - T10340-

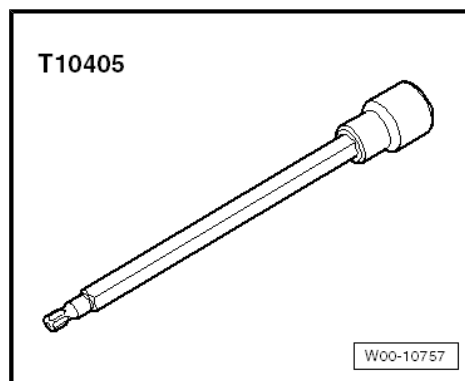


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◆ Socket Torx T30 - T10405-



◆ Assembly tool - T10487-



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◆ Camshaft clamp - T10504-



◆ Release tool - T10527- and -T10527/1-





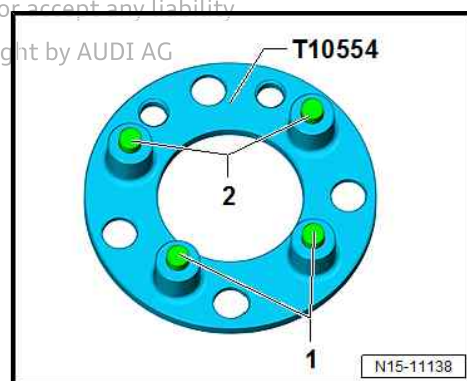
◆ Counterhold tool - T10554-



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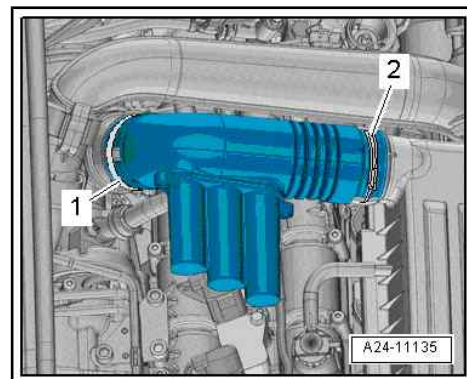
Counterhold tool - T10554-

- The lugs -1- and -2- on counterhold tool - T10554- are different distances apart.
- Counterhold tool - T10554- can only be applied in one position.
- Position counterhold tool - T10554- flush against camshaft adjusters.

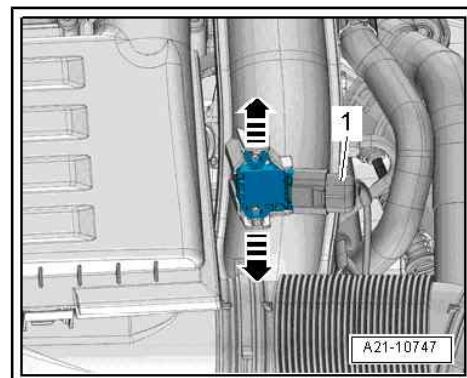


Procedure

- Remove engine cover panel
⇒ ["3 Engine cover panel", page 39](#) .
- Loosen hose clips -1, 2- and remove air pipe.

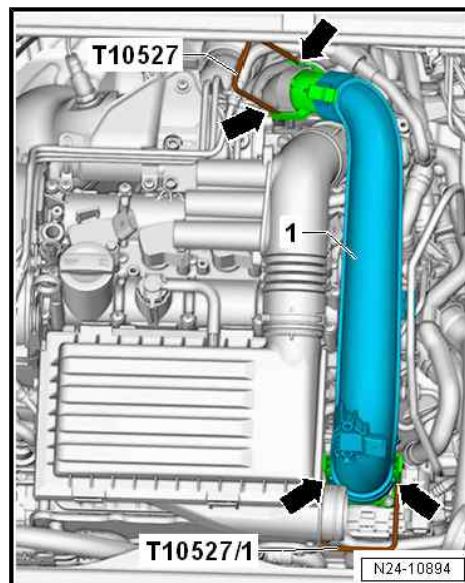


- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .

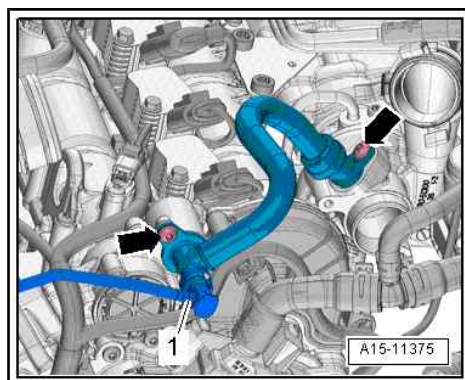




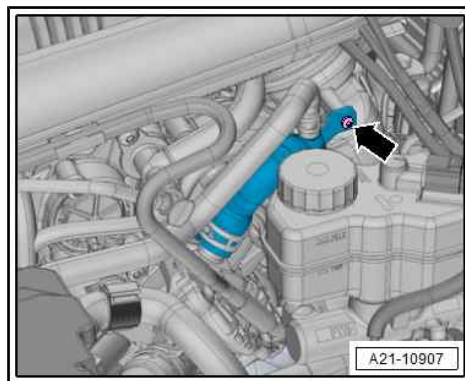
- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe -1-.



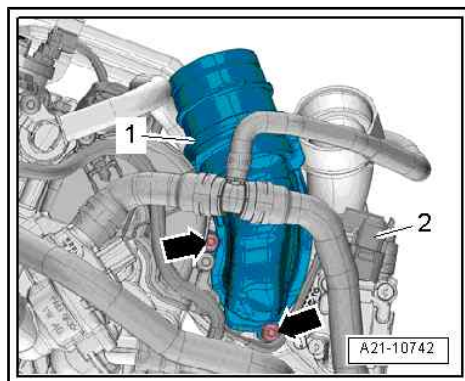
- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



- If fitted, remove bolt -arrow- from connection and press coolant hose slightly forwards.



- Unscrew bolts -arrows- using socket Torx T30 - T10405- and detach connection -1-.



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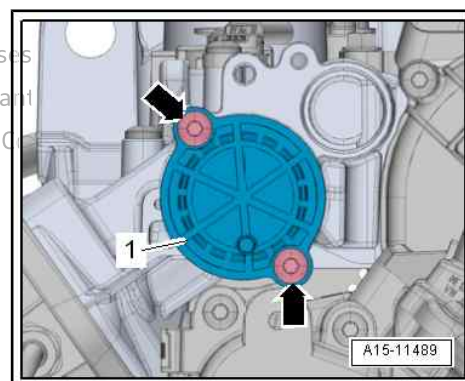
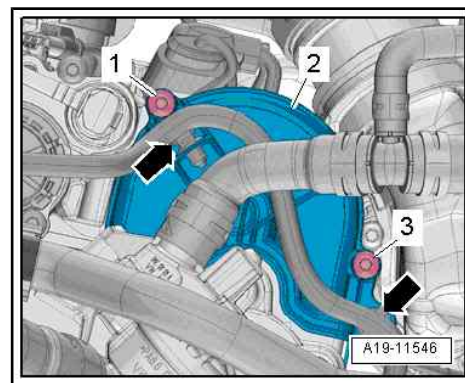
- Move electrical wiring harness clear -arrows-.
- Unscrew bolts -1, 3- and remove cover -2- for toothed belt for coolant pump.



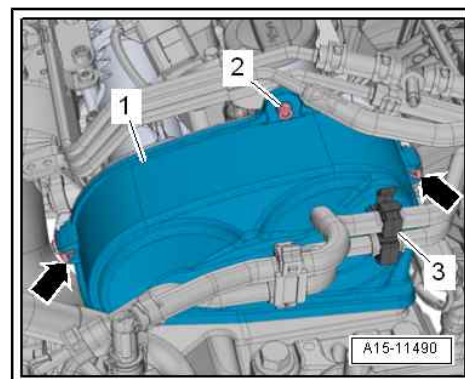
! NOTICE

Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Unscrew bolts -arrows- and detach sealing cap -1-.



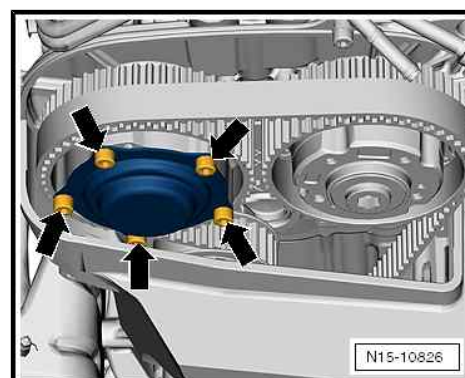
- Move clear hoses at bracket -3-.
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.



! NOTICE

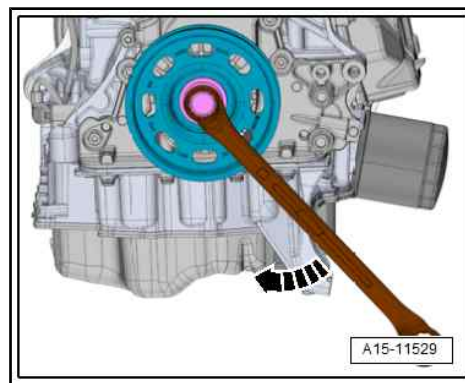
Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.
- Remove bolts -arrows- → [Item 4 \(page 79\)](#) .



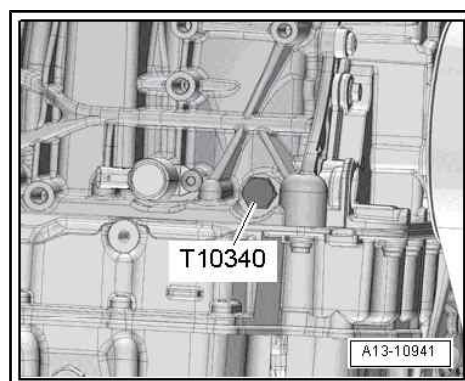


- Rotate crankshaft at vibration damper in normal direction of rotation so you can access all bolts -arrows- and unscrew them.
- Detach cover from camshaft adjuster of exhaust camshaft.

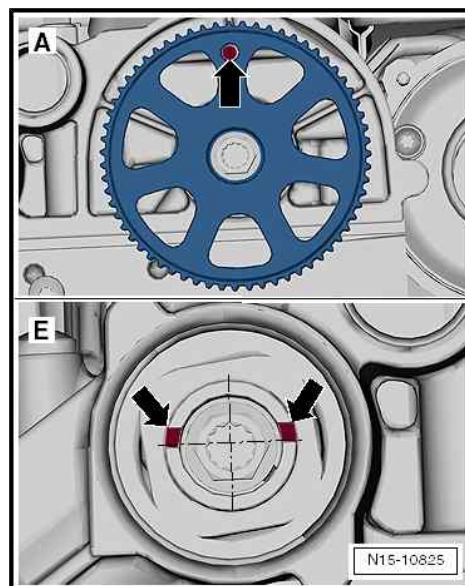


Rotate crankshaft to "TDC" as follows:

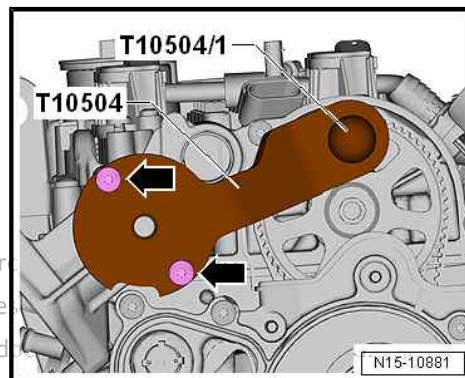
- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



- On exhaust camshaft -A-, hole -arrow- in coolant pump drive sprocket must be aligned with hole in camshaft housing.
- On inlet camshaft -E-, grooves -arrows- must be positioned above centre of camshaft.
- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to TDC position.
- It should be possible to insert the camshaft clamp - T10504- easily.
- Do not knock camshaft clamp into place with any kind of tool.



- When camshafts are positioned as described, insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).
- Insert locating pin -T10504/1- as far as stop.
- Screw in bolts -arrows- hand-tight.



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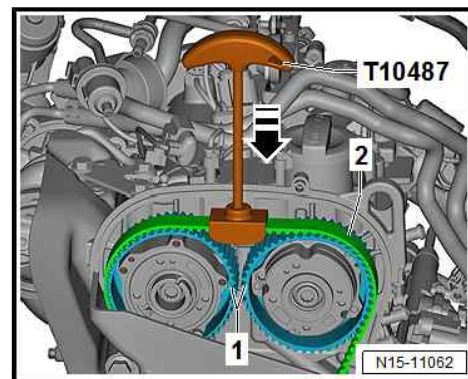
Note

If it is difficult to insert camshaft clamp - T10504- , press against toothed belt -arrow- with assembly tool - T10487- . At the same time, insert camshaft clamp - T10504- into camshafts as far as stop and hand-tighten bolts. Insert locating pin -T10504/1- as far as stop.

! NOTICE

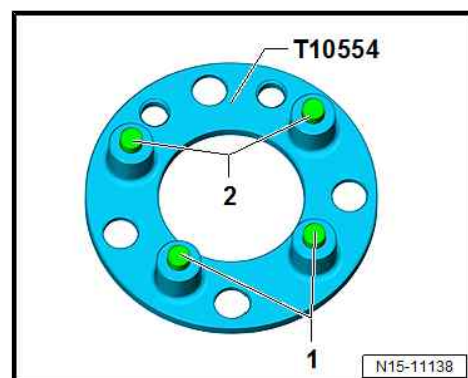
Risk of damage to camshaft if handled incorrectly

- Never use camshaft clamp as a counterhold tool.

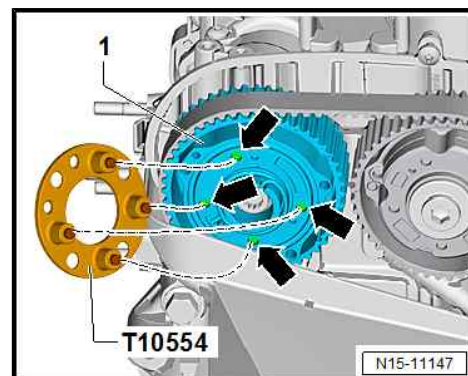


Exhaust camshaft:

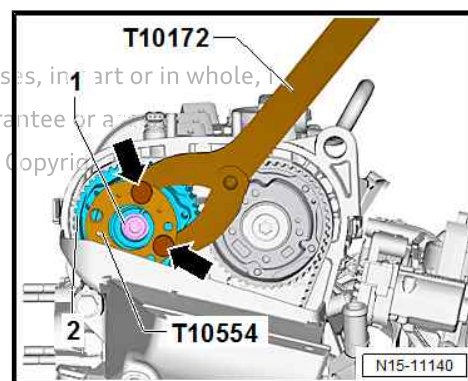
- Guide in counterhold tool - T10554- between camshaft adjuster and engine support.
- To do so, first guide area between lugs -2- on counterhold tool - T10554- past camshaft adjuster.



- Turn counterhold tool - T10554- so that it can be inserted in holes -arrows- as shown.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.



- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172-.

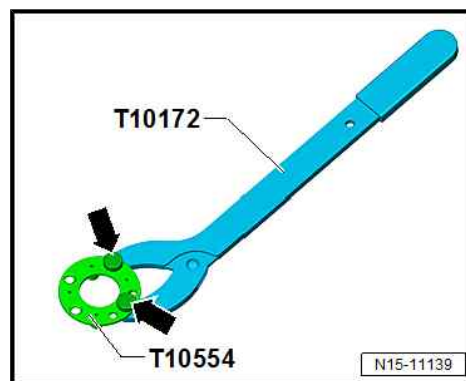


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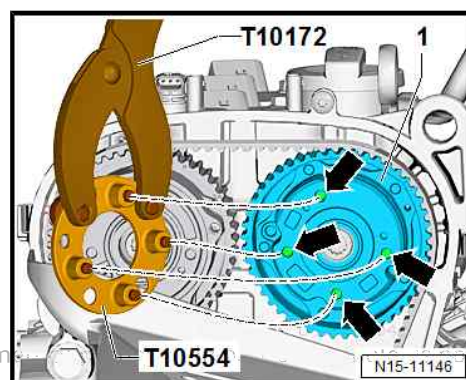


Inlet camshaft

- Assemble tools as shown.
- Attach counterhold tool - T10172- to counterhold tool - T10554- using knurled screws -arrows-.



- Apply counterhold tool - T10554- with counterhold tool - T10172- to camshaft sprocket -1-, as shown.
- Pins must be inserted correctly into holes -arrows-.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.
- Secure camshaft with counterhold tool - T10554- and counterhold tool - T10172- so that it cannot turn.

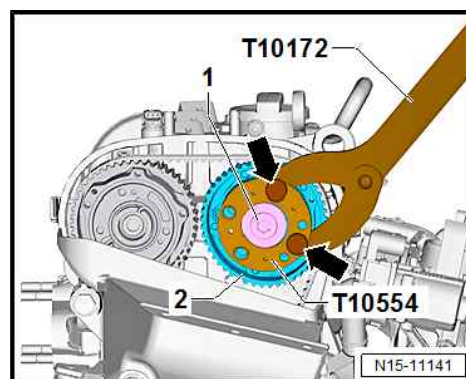


NOTICE

Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.

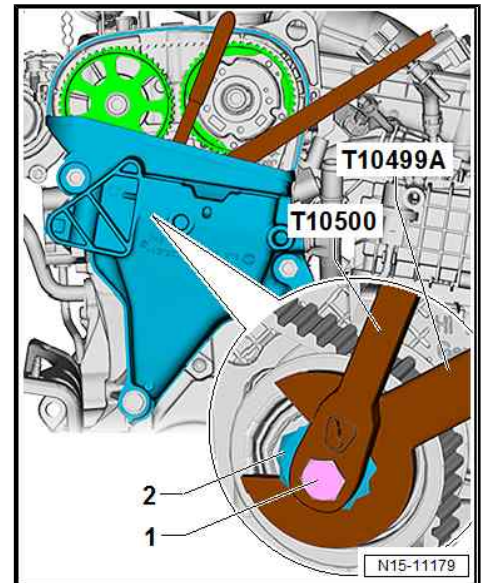
- Unscrew plug -1- on camshaft sprocket (inlet side).
- Use counterhold tool - T10554- with counterhold tool - T10172- to do so.
- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172- .





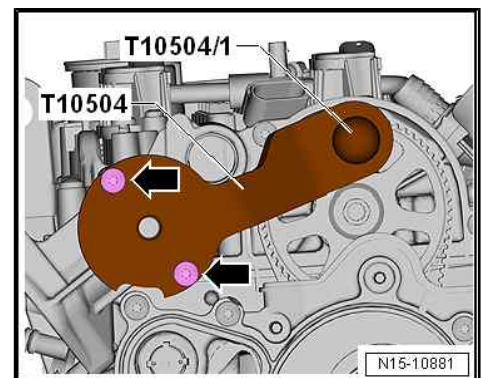
Both sides (continued):

- Fit special wrench, 30 mm - T10499 A- onto eccentric adjuster -2- of tensioning roller.
- Loosen bolt -1- using insert tool, 13 mm - T10500- .
- Release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499 A- .
- Detach toothed belt from camshaft sprockets.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).

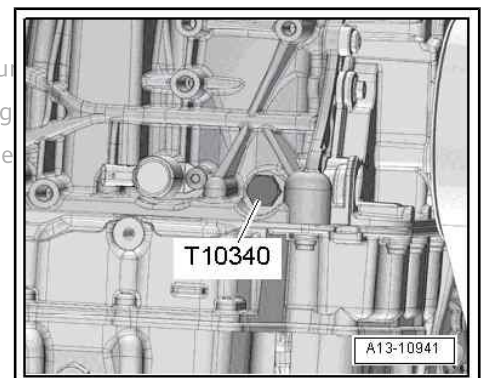


Installing (adjusting valve timing)

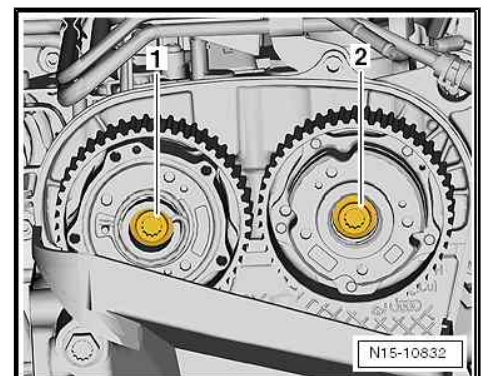
- Renew bolts tightened with specified tightening angle.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Renew O-rings.
- Check “TDC” position of camshaft and crankshaft:
- Camshaft clamp - T10504- with locating pin -T10504/1- must be fitted to camshaft housing.



- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = “TDC” position.



- Fit new bolts -1, 2- for camshaft sprockets and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.





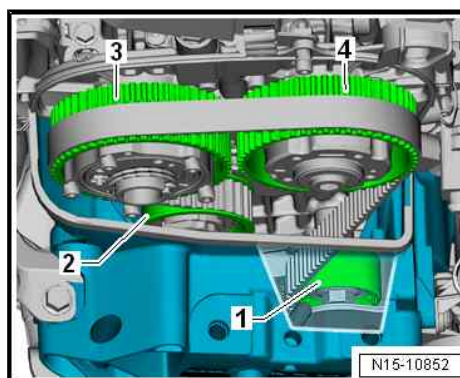
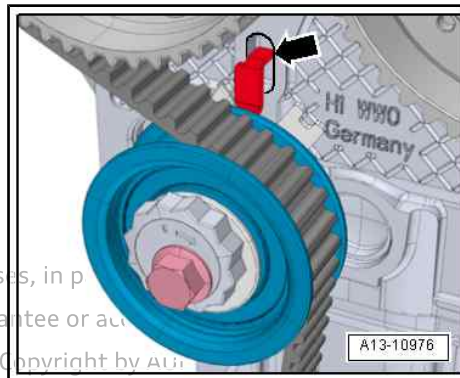
- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



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Note correct sequence for fitting toothed belt:

- Pull toothed belt upwards and fit onto idler roller -1-, tensioning roller -2- and camshaft sprockets -3, 4-.



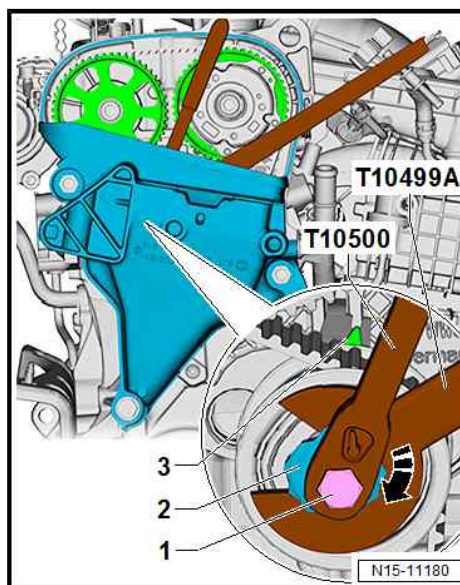
- Using special wrench, 30 mm - T10499 A -, turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.



NOTICE

Risk of damage to engine if tightening torque is incorrect.

- Torque wrench - VAS 6583- must be used to tighten the bolts.
- When setting the tightening torque on the torque wrench - VAS 6583- , the reading on the insert tool, 13 mm - T10500- must be entered in the torque wrench.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - T10500- with torque wrench - VAS 6583- .



Note:

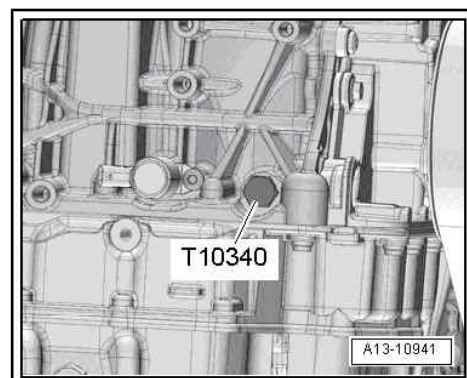
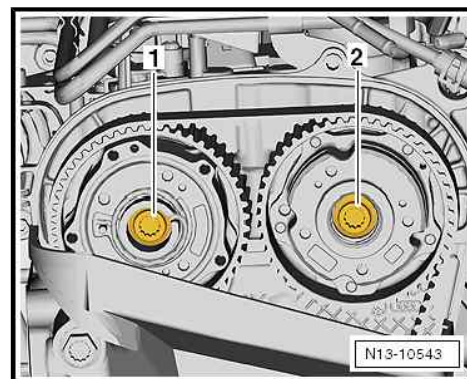
Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension.



! NOTICE

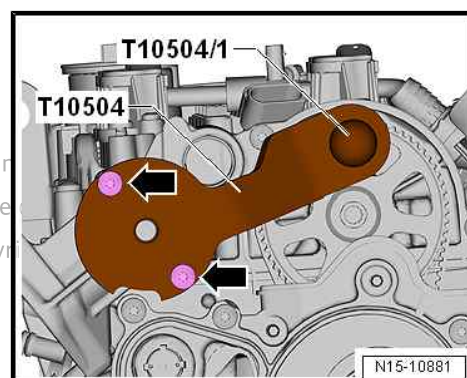
Risk of damage to camshaft if handled incorrectly

- **Never use camshaft clamp as a counterhold tool.**
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool - T10172A- with adapters -T10172/2- , or counterhold tool - T10554- and counterhold tool - T10172- .
- Remove locking pin - T10340- .



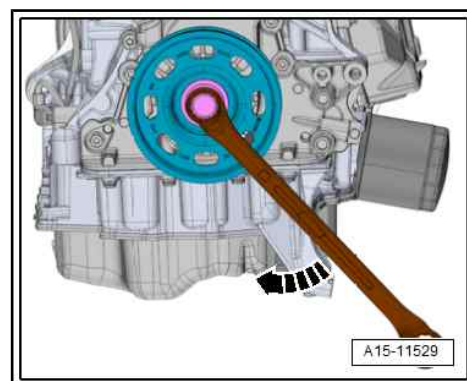
- Remove locating pin -T10504/1- .
- Remove bolts -arrows- and detach camshaft clamp - T10504- .

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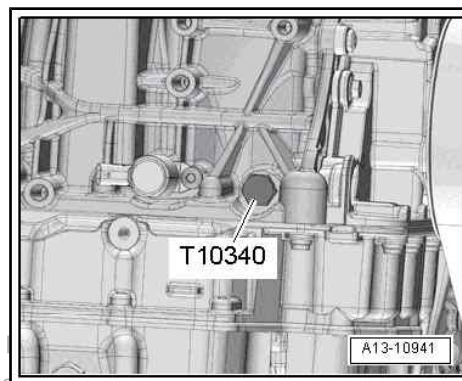
Checking valve timing:

- Turn crankshaft 2 rotations in normal direction of engine rotation -arrow-.



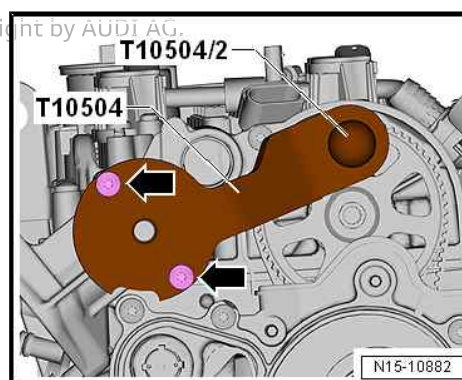


- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



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- It should be possible to insert the camshaft clamp - T10504- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).
- Insert test pin -T10504/2- as far as stop.
- Screw in bolts -arrows- hand-tight.

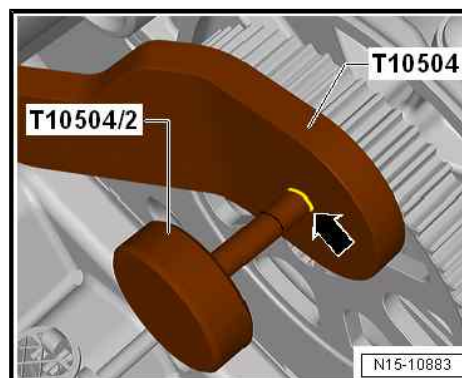


Risk of damage to engine

- If groove -arrow- is not flush with camshaft clamp - T10504- , test pin -T10504/2- is not inserted far enough.
- Risk of damage to engine if valve timing is adjusted incorrectly.
- Check whether groove -arrow- on test pin -T10504/2- is flush with camshaft clamp - T10504- .

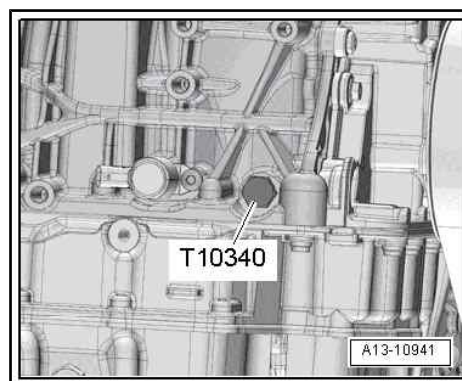
If it is not possible to insert camshaft clamp - T10504- with test pin -T10504/2- , valve timing is not OK:

- Adjust valve timing again ⇒ [page 115](#) .



If it is possible to insert camshaft clamp - T10504- with test pin - T10504/2- , valve timing is OK.

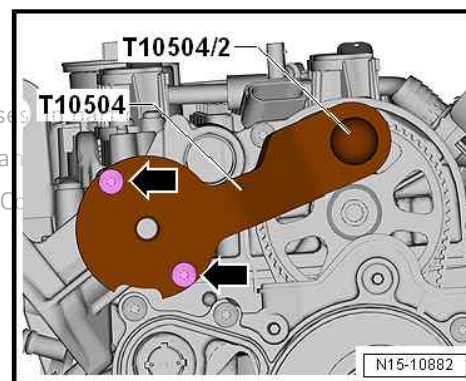
- Remove locking pin - T10340- .



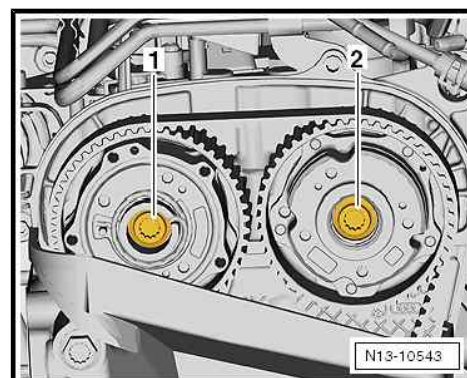


- Remove bolts -arrows- and detach camshaft clamp - T10504- with test pin -T10504/2- .

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- Tighten bolts -1, 2- to final tightening torque ⇒ [page 79](#) using counterhold tool - T10554- with adapters -T10172/2- , or counterhold tool - T10172A- and counterhold tool - T10172- .



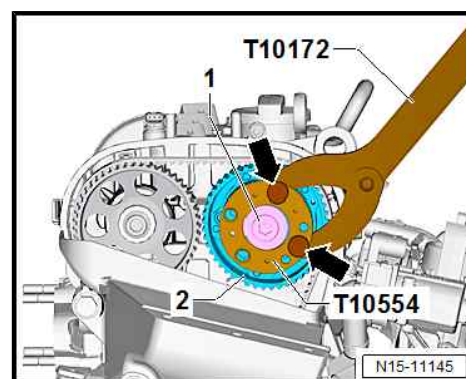
- Tighten plug -1- using counterhold tool - T10172- with counterhold tool - T10554- .

Further installation is carried out in the reverse order; note the following:

- Fill up with coolant ⇒ [page 230](#) .

Tightening torques

- ◆ ⇒ [“1.2.2 Exploded view - toothed belt, version with two camshaft adjusters”, page 79](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 76](#)
- ◆ ⇒ [Fig. “Plug for TDC drilling in cylinder block - tightening torque”, page 78](#)
- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 212](#)
- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 231](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)
- ◆ ⇒ [“1.1.3 Exploded view - pipes, lines and hoses on turbocharger”, page 263](#)





1.4 Removing and installing toothed belt

⇒ ["1.4.1 Removing and installing toothed belt - version with one camshaft adjuster", page 120](#)

⇒ ["1.4.2 Removing and installing toothed belt - version with two camshaft adjusters", page 133](#)

⇒ ["1.4.3 Removing and installing toothed belt - version with two camshaft adjusters and cylinder shut-off", page 147](#)

1.4.1 Removing and installing toothed belt - version with one camshaft adjuster

Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-



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- ◆ Counterhold tool - T10172 A- with adapters -T10172/1-



- ◆ Counterhold tool - T10475-

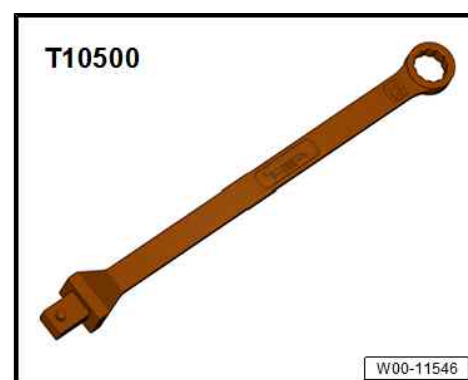




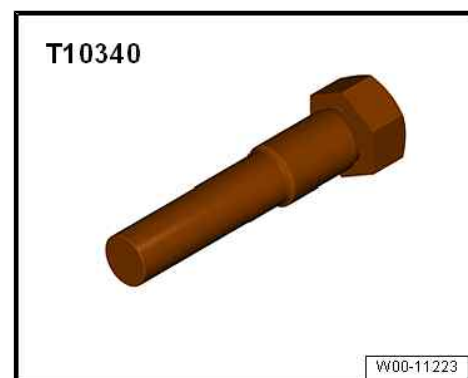
- ◆ Special wrench, 30 mm - T10499 A-



- ◆ Open end spanner insert, AF 13 - T10500-



- ◆ Locking pin - T10340-



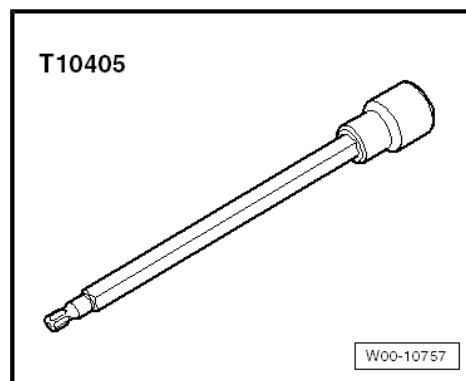
- ◆ Assembly tool - T10487-

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◆ Socket Torx T30 - T10405-



◆ Camshaft clamp - T10494-



◆ Release tool - T10527- and -T10527/1-

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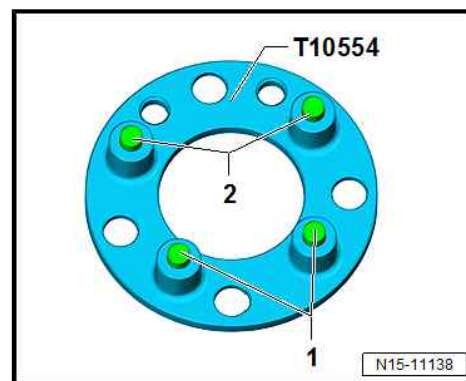
◆ Counterhold tool - T10554-





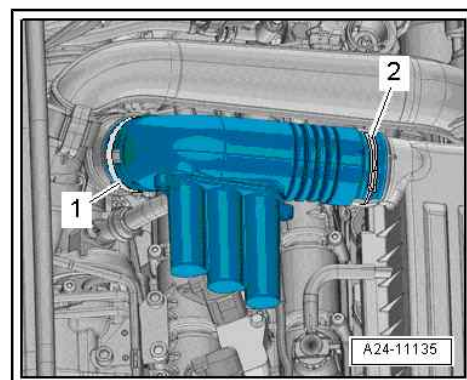
Counterhold tool - T10554-

- The lugs -1- and -2- on counterhold tool - T10554- are different distances apart.
- Counterhold tool - T10554- can only be applied in one position.
- Position counterhold tool - T10554- flush against camshaft adjusters.

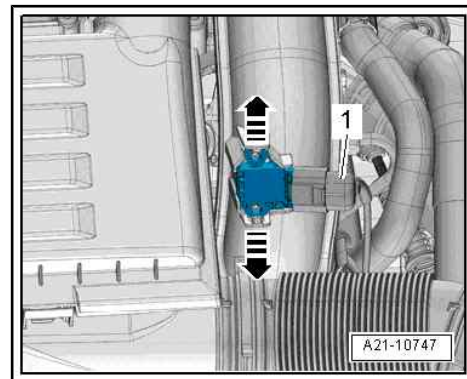


Removing

- Remove engine cover panel
⇒ [“3 Engine cover panel”, page 39](#) .
- Loosen hose clips -1, 2- and remove air pipe.



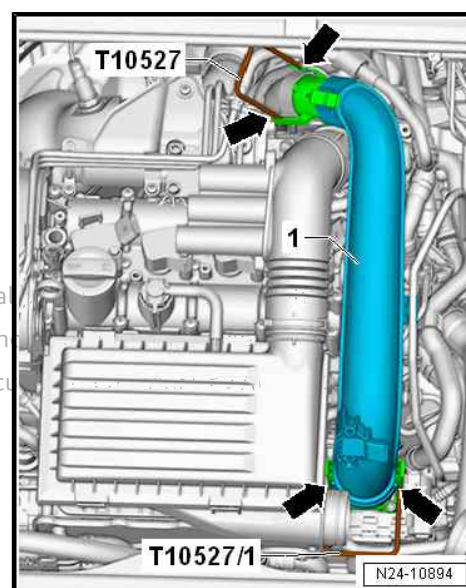
- Unplug electrical connector -1- from charge pressure sender - G31- .



- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe.

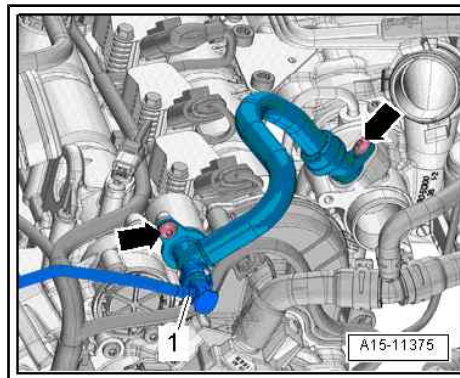


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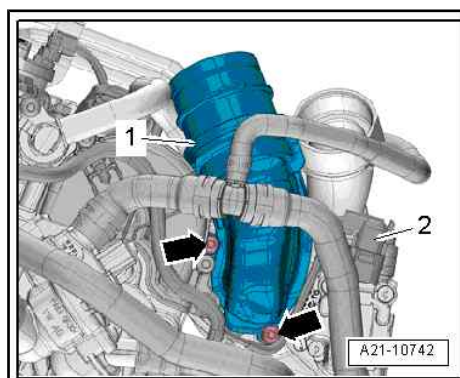




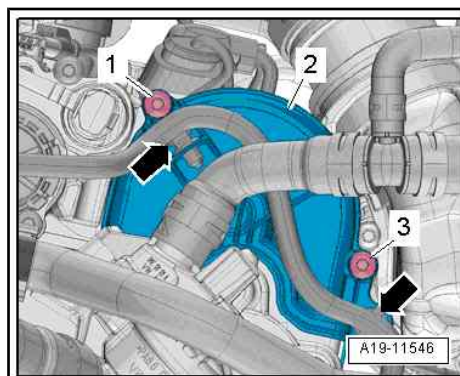
- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



- Unscrew bolts -arrows- using socket Torx T30 - T10405- and detach connection -1-.



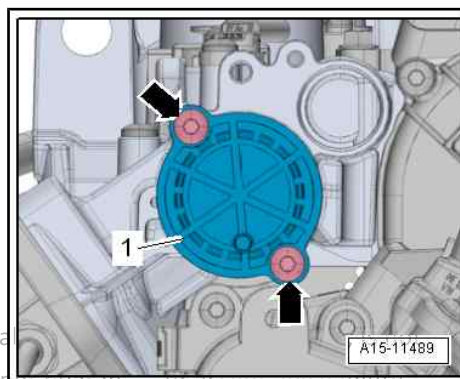
- Move electrical wiring harness clear -arrows-.
- Unscrew bolts -1, 3- and remove cover -2- for toothed belt for coolant pump.



NOTICE

Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

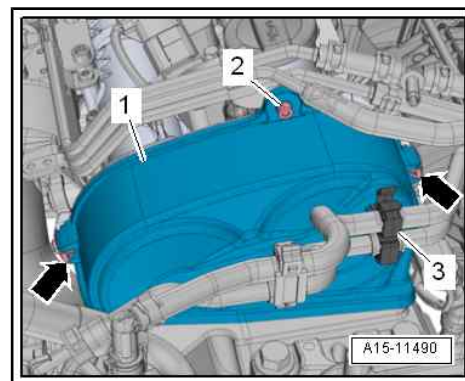
- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Unscrew bolts -arrows- and detach sealing cap -1-.



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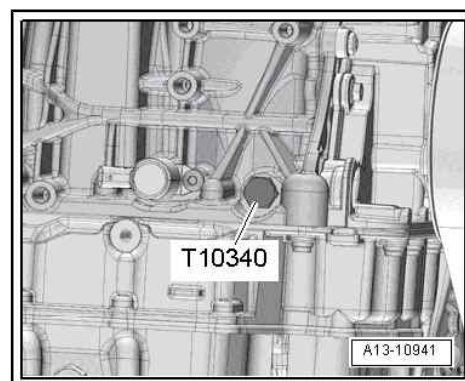


- Move clear hoses at bracket -3-.
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.

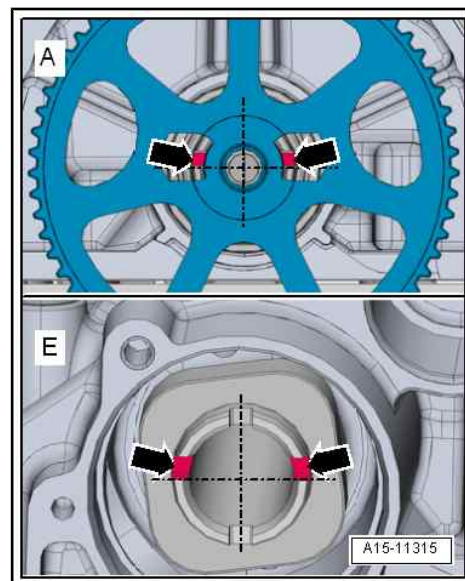


Rotate crankshaft to "TDC" as follows:

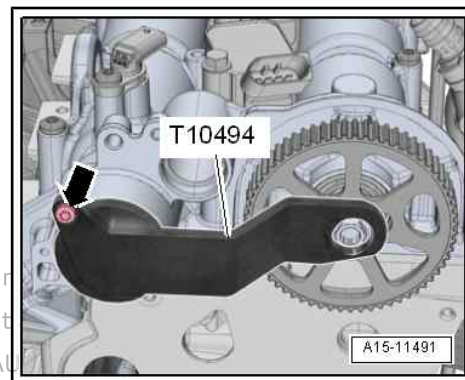
- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



- The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In TDC position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.
- If camshafts are not positioned as described, turn crankshaft one rotation further and return to TDC position.
- On both camshafts, asymmetrically positioned grooves -top and bottom arrows- on gearbox end must now face upwards, as shown in illustration.
- On exhaust camshaft -A-, grooves -top arrows- are accessible via openings in coolant pump drive sprocket.
- On inlet camshaft -E-, grooves -bottom arrows- must be positioned above centre of camshaft.



- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- When camshafts are positioned as described, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt -arrow-.



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Note:

If it is not possible to insert the camshaft clamp - T10494- easily, press down toothed belt -arrow- using assembly tool - T10487- and then insert camshaft clamp - T10494- into camshafts as far as stop and tighten bolt hand-tight.

- Remove poly-V-belt pulley

⇒ ["1.6 Removing and installing pulley" page 50](#).

- Remove bolts -arrows- and detach toothed belt cover (bottom).

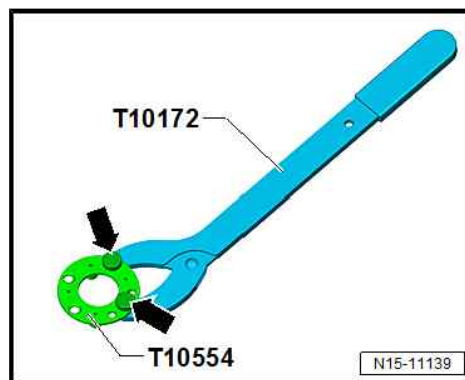
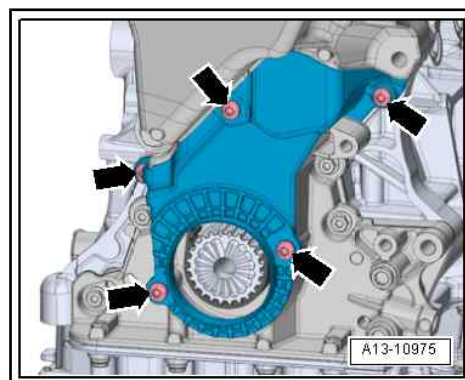
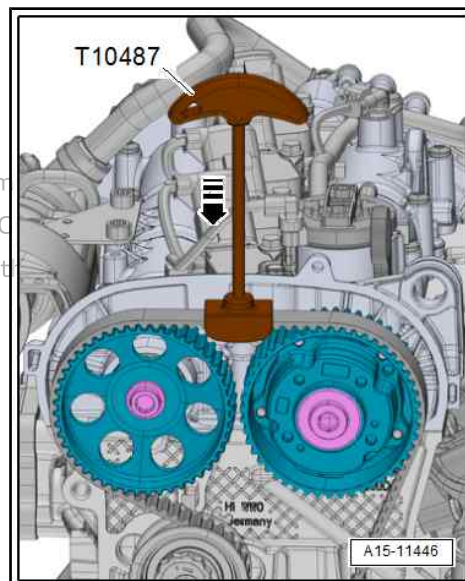


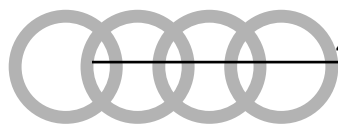
NOTICE

Risk of damage to camshaft if handled incorrectly

- Never use camshaft clamp as a counterhold tool.

- Assemble tools as shown.
- Attach counterhold tool - T10172- to counterhold tool - T10554- using knurled screws -arrows-.



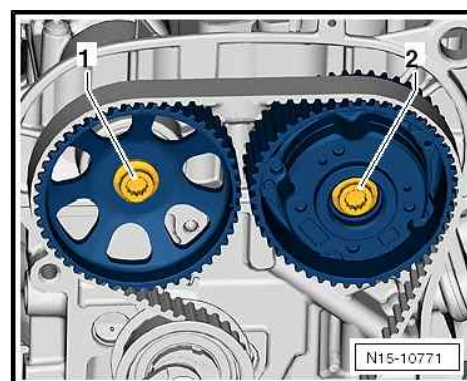
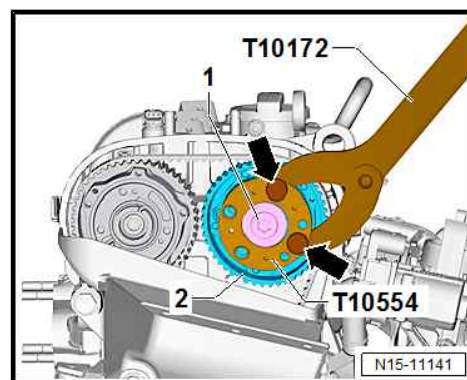
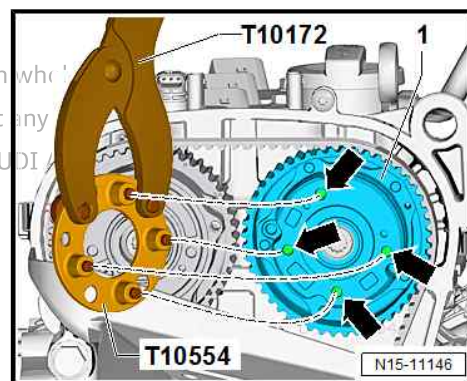


- Apply counterhold tool - T10554- with counterhold tool - T10172- to camshaft sprocket -1-, as shown.
- Pins must be inserted correctly into holes -arrows-.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.
- Secure camshaft with counterhold tool - T10554- and counterhold tool - T10172- so that it cannot turn.

! NOTICE

Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
 - Clean any spaces/cavities that have filled with engine oil.
-
- Unscrew plug -1- on camshaft sprocket (inlet side).
 - Use counterhold tool - T10554- and counterhold tool - T10172- to do so.
-
- Loosen bolt -2- approx. one turn using counterhold tool - T10554- and counterhold tool - T10172- .
 - Loosen bolt -1- approx. one turn using counterhold tool - T10172A- with adapters -T10172/2- .



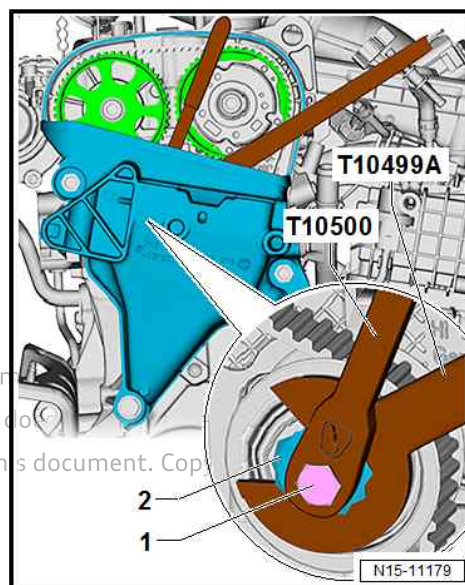


- Loosen bolt -1- using insert tool, 13 mm - T10500- and release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499 A- .

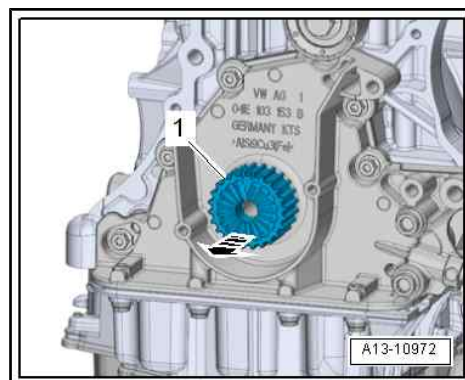
NOTICE

Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

- Mark running direction before removing.
- Pay attention to running direction when reinstalling.
- Take off toothed belt.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).



- Detach crankshaft sprocket -1- -arrow-.



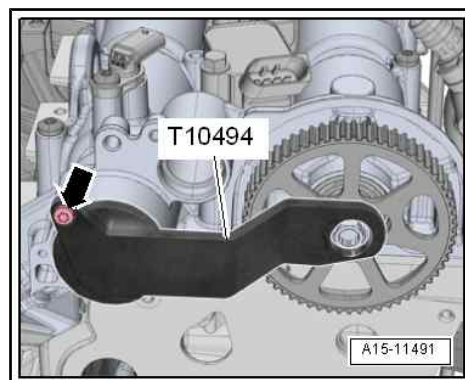
Installing (adjusting valve timing)

- Renew bolts tightened with specified tightening angle.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Renew O-rings.
- Check “TDC” position of camshaft and crankshaft:
- Camshaft clamp - T10494- must be fitted to camshaft housing -arrow-.

NOTICE

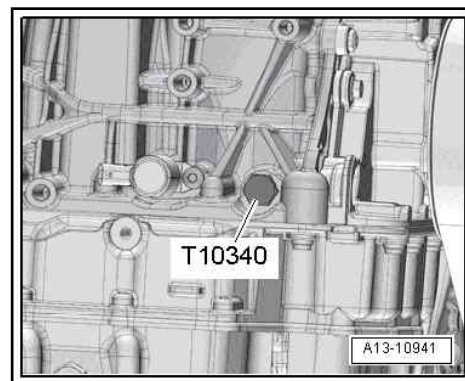
Risk of damage to camshaft if handled incorrectly

- Never use camshaft clamp as a counterhold tool.

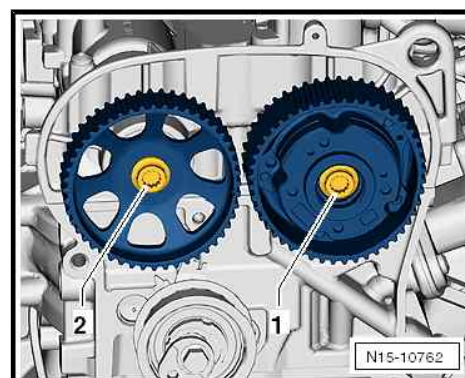




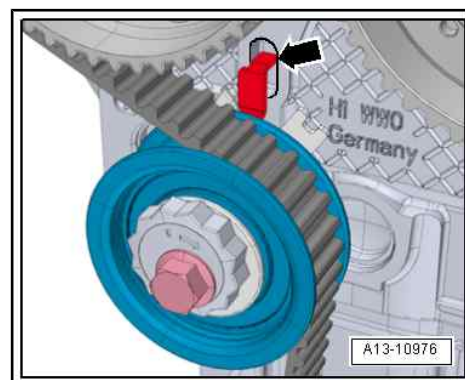
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.



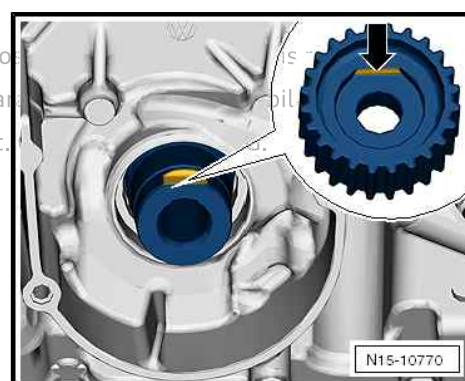
- Fit new bolts -1, 2- for camshaft sprockets and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



- Fit crankshaft sprocket onto crankshaft.
- Contact surface between poly V-belt pulley and crankshaft sprocket must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.





- Fit toothed belt in the specified sequence.

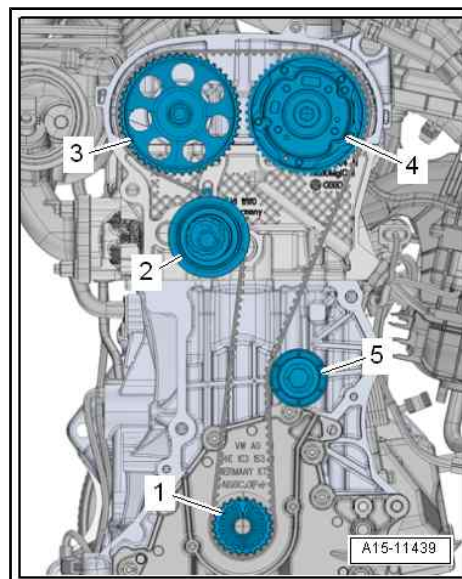
1 - Crankshaft sprocket

5 - Idler roller

2 - Tensioning roller

3 - Camshaft sprocket, exhaust side

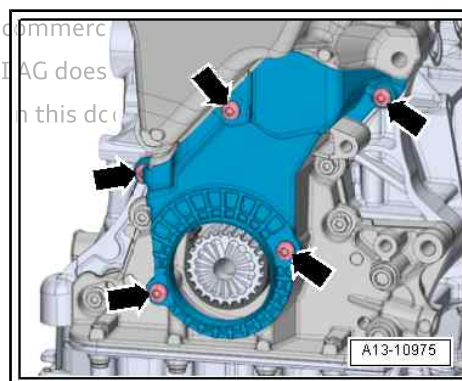
4 - Camshaft sprocket, inlet side



- Install toothed belt cover (bottom section).

- Install poly-V-belt pulley.

⇒ "1.6 Removing and installing pulley", page 50.



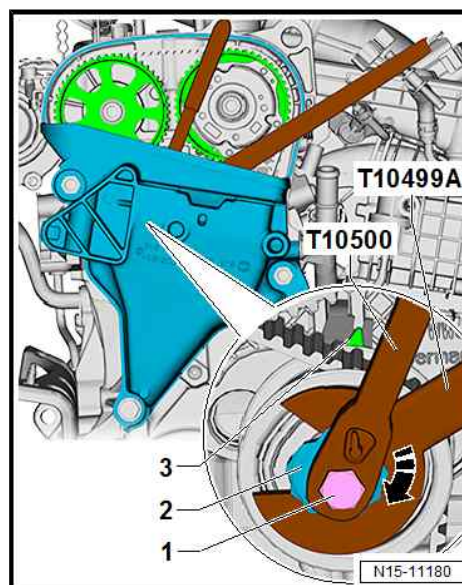
- Using special wrench, 30 mm - T10499 A- , turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.



NOTICE

Risk of damage to engine if tightening torque is incorrect.

- Torque wrench - VAS 6583- must be used to tighten the bolts.
- When setting the tightening torque on the torque wrench - VAS 6583- , the reading on the insert tool, 13 mm - T10500- must be entered in the torque wrench.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - T10500- with torque wrench - VAS 6583- .



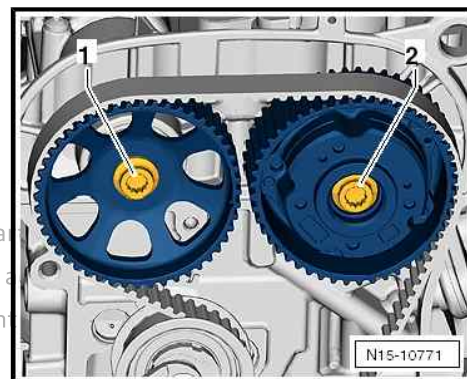
Note:

Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension.

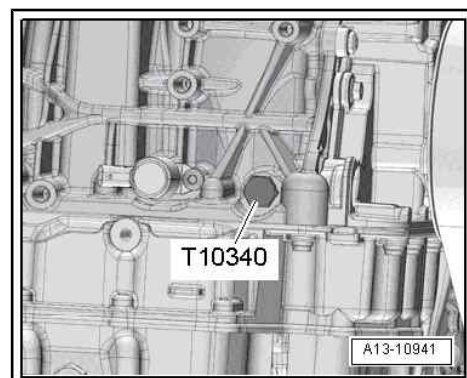


- Tighten bolt -1- initially to 50 Nm using counterhold tool - T10172A- with adapters -T10172/2- .
- Tighten bolt -2- initially to 50 Nm using counterhold tool - T10554- and counterhold tool - T10172- .

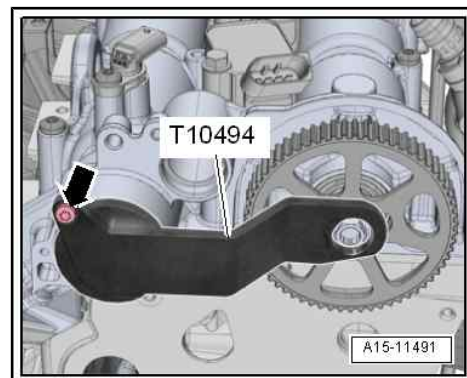
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- Remove locking pin - T10340- .

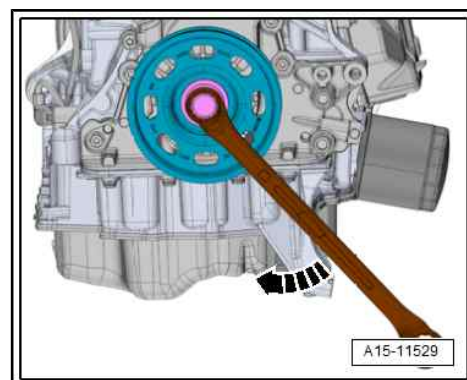


- Remove bolt -arrow- and detach camshaft clamp - T10494- .



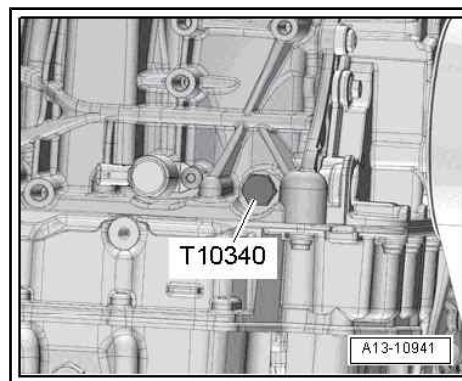
Checking valve timing:

- Turn crankshaft 2 rotations in normal direction of engine rotation -arrow-.

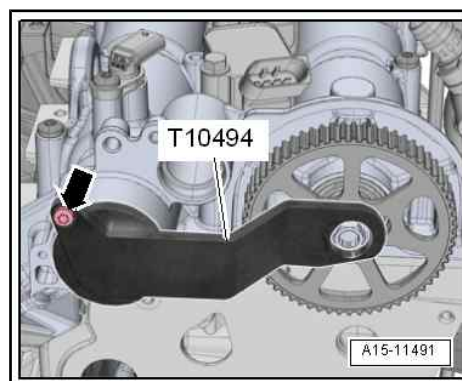




- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.

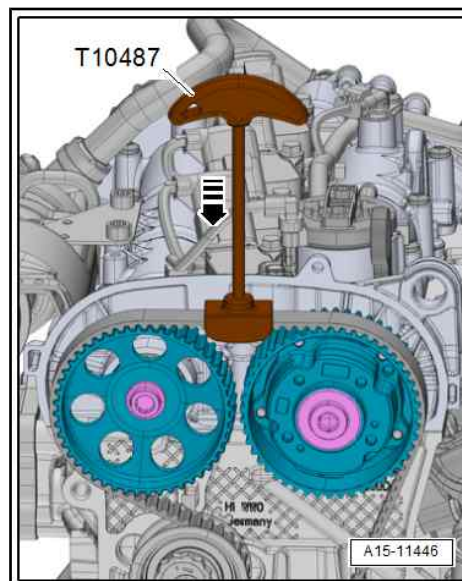


Note:

If it is not possible to insert the camshaft clamp - T10494- easily, press down toothed belt -arrow- using assembly tool -T10487- and then insert camshaft clamp - T10494- into camshafts as far as stop and tighten bolt hand-tight.

If it is not possible to insert camshaft clamp - T10494- , valve timing is not OK.

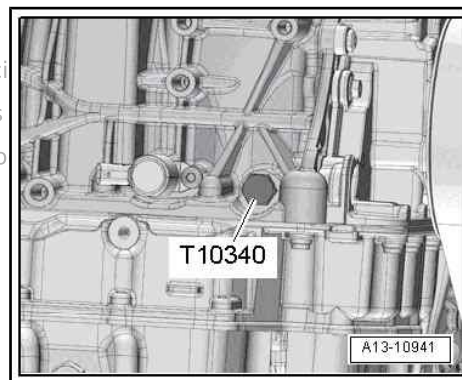
- Adjust valve timing again ⇒ [page 88](#) .



If it is possible to insert camshaft clamp - T10494- , valve timing is OK.

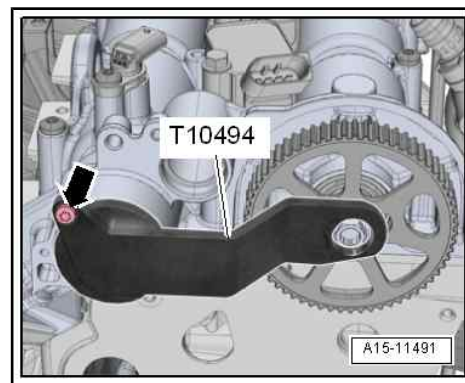
- Remove locking pin - T10340- .

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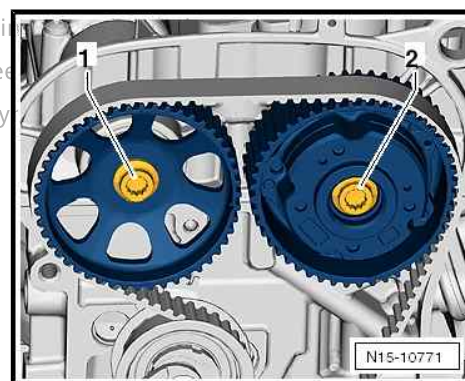


- Remove bolt -arrow- and detach camshaft clamp - T10494- .



- Tighten bolts -1, 2- to final tightening torque ⇒ [page 79](#) using counterhold tool - T10554- with adapters -T10172/2- , or counterhold tool - T10172A- and counterhold tool - T10172- .

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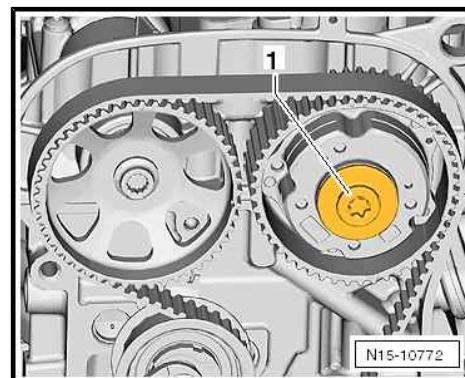


- Tighten plug -1- using counterhold tool - T10554- and counterhold tool - T10172- .

The remaining installation steps are carried out in the reverse sequence.

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 40](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 76](#)
- ◆ ⇒ [“1.2.1 Exploded view - toothed belt, version with one camshaft adjuster”, page 77](#)
- ◆ ⇒ [Fig. “Plug for TDC drilling in cylinder block - tightening torque”, page 78](#)
- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 212](#)
- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 231](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)
- ◆ ⇒ [“1.1.3 Exploded view - pipes, lines and hoses on turbocharger”, page 263](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



1.4.2 Removing and installing toothed belt - version with two camshaft adjusters

Special tools and workshop equipment required



- ◆ Torque wrench - VAS 6583-



- ◆ Counterhold tool - T10475-



- ◆ Counterhold tool - T10172 A- with adapters -T10172/1-



- ◆ Special wrench, 30 mm - T10499 A-



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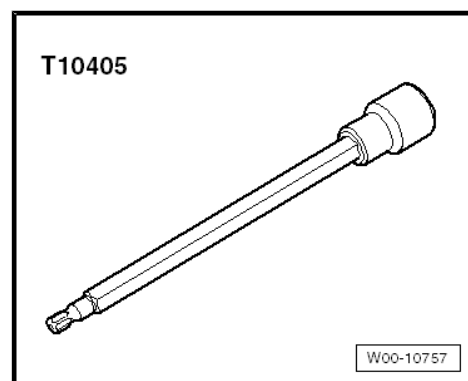
- ◆ Open end spanner insert, AF 13 - T10500-



- ◆ Locking pin - T10340-



- ◆ Socket Torx T30 - T10405-



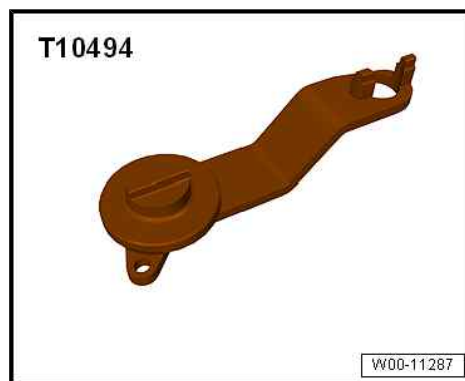
- ◆ Assembly tool - T10487-



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◆ Camshaft clamp - T10494-



◆ Release tool - T10527- and -T10527/1-

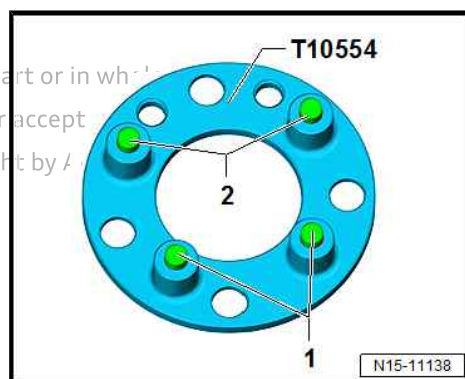


◆ Counterhold tool - T10554-



Counterhold tool - T10554-

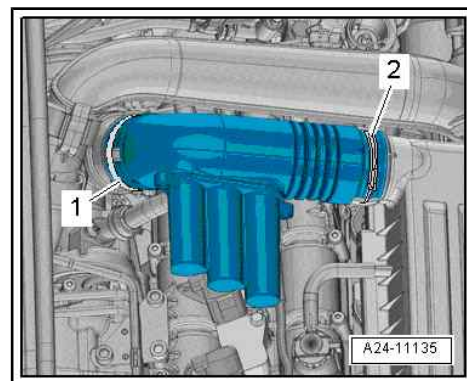
- The lugs -1- and -2- on counterhold tool - T10554- are different distances apart.
- Counterhold tool - T10554- can only be applied in one position.
- Position counterhold tool - T10554- flush against camshaft adjusters.



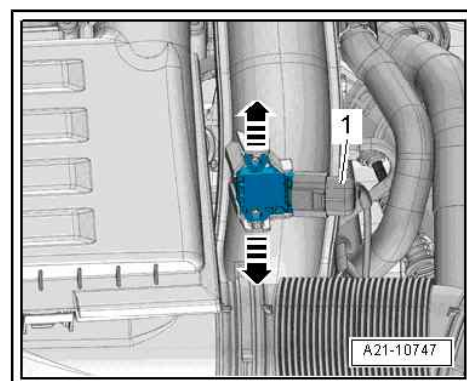


Removing

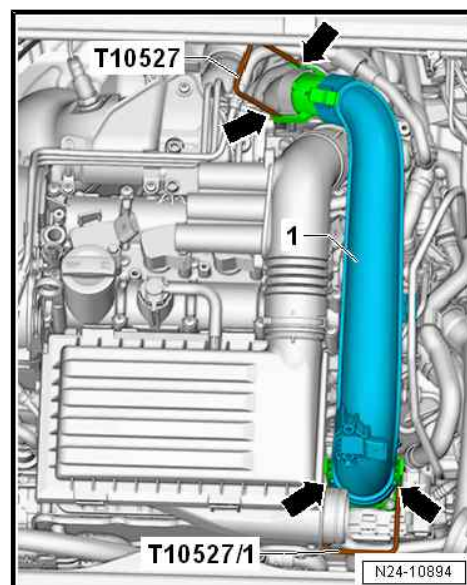
- Remove engine cover panel
⇒ [“3 Engine cover panel”, page 39](#) .
- Loosen hose clips -1, 2- and remove air pipe.



- Unplug electrical connector -1-.



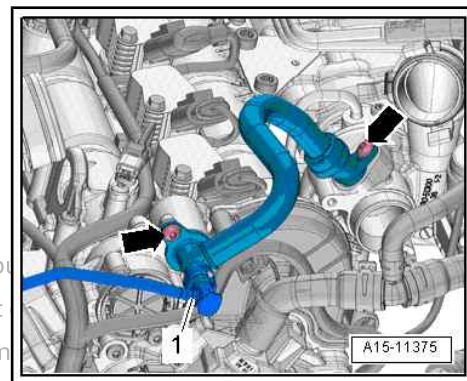
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- .
- Detach air pipe -1-.



- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



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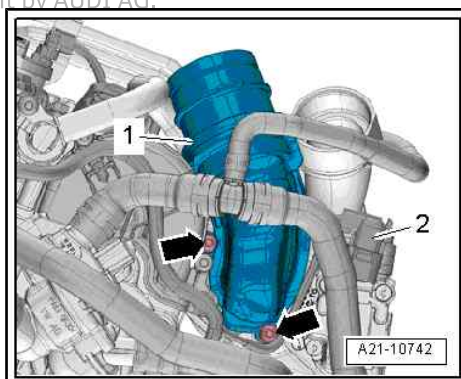
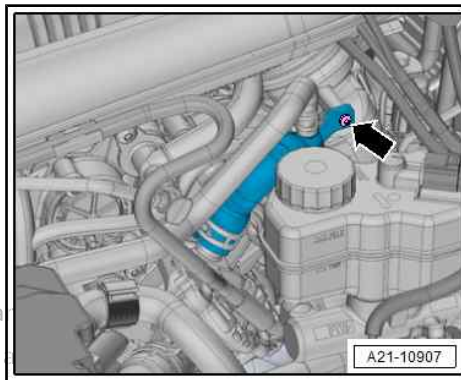


- If fitted, remove bolt -arrow- from connection and press coolant hose slightly forwards.

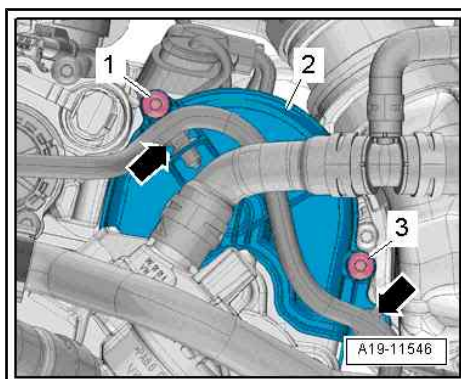


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- Unscrew bolts -arrows- using socket Torx T30 - T10405- and detach connection -1-.



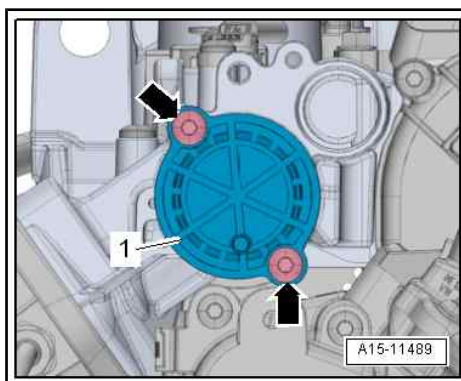
- Move electrical wiring harness clear -arrows-.
- Unscrew bolts -1, 3- and remove cover -2- for toothed belt for coolant pump.



NOTICE

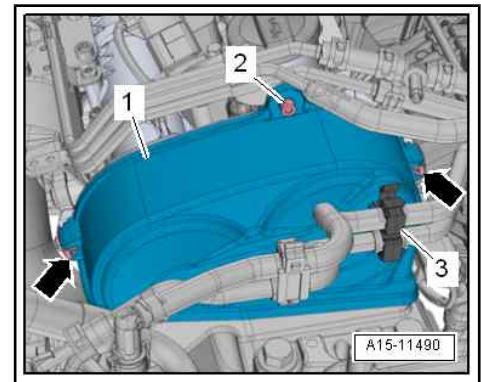
Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Unscrew bolts -arrows- and detach sealing cap -1-.





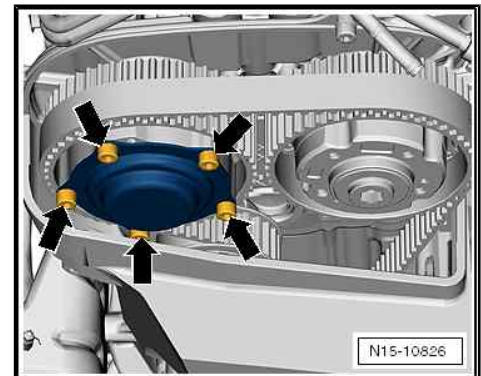
- Move clear hoses at bracket -3-.
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.



! NOTICE

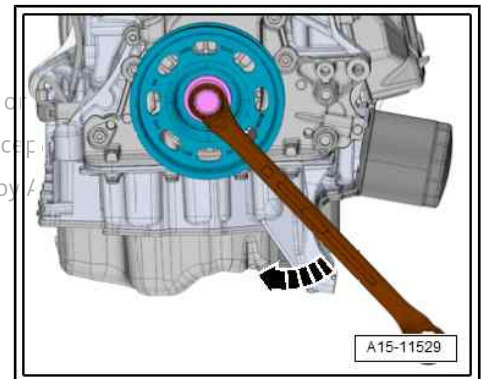
Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.
- Remove bolts -arrows- → [Item 4 \(page 79\)](#) .



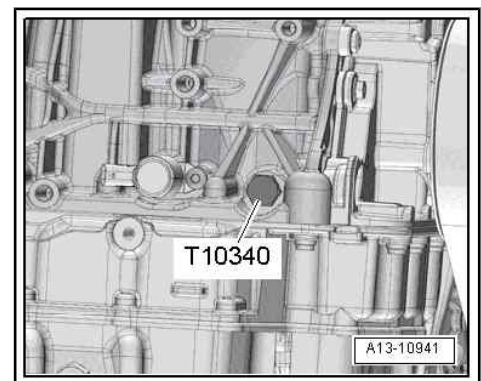
- Rotate crankshaft at vibration damper in normal direction of rotation so you can access all bolts -arrows- and unscrew them.
- Detach cover from camshaft adjuster of exhaust camshaft.

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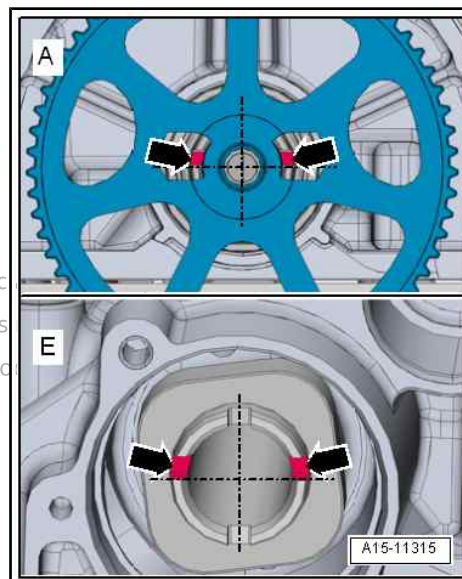
Rotate crankshaft to "TDC" as follows:

- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

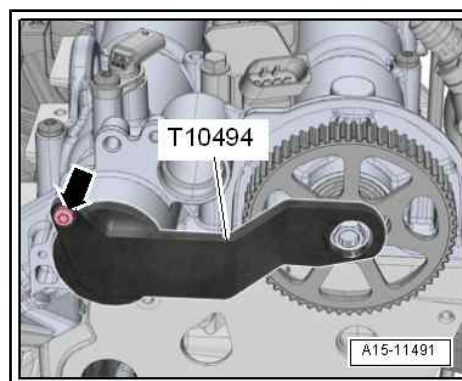




- The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In TDC position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.
- If camshafts are not positioned as described, turn crankshaft one rotation further and return to TDC position.
- On both camshafts, asymmetrically positioned grooves -top and bottom arrows- on gearbox end must now face upwards, as shown in illustration.
- On exhaust camshaft -A-, grooves -top arrows- are accessible via openings in coolant pump drive sprocket.
- On inlet camshaft -E-, grooves -bottom arrows- must be positioned above centre of camshaft.



- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- When camshafts are positioned as described, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt -arrow-.



Note

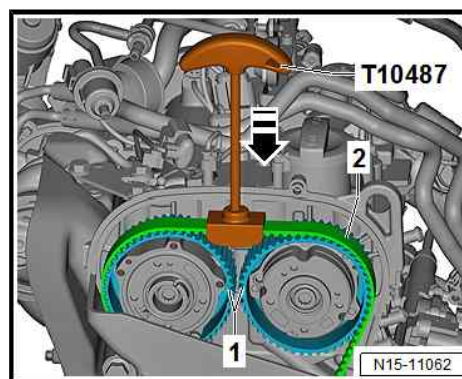
If it is difficult to insert camshaft clamp - T10494- , press against toothed belt -arrow- with assembly tool - T10487- . At the same time, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.



NOTICE

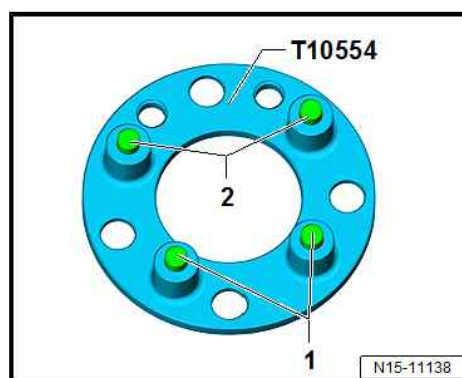
Risk of damage to camshaft if handled incorrectly

- Never use camshaft clamp as a counterhold tool.
- Remove poly-V-belt pulley
⇒ ["1.6 Removing and installing pulley", page 50](#) .



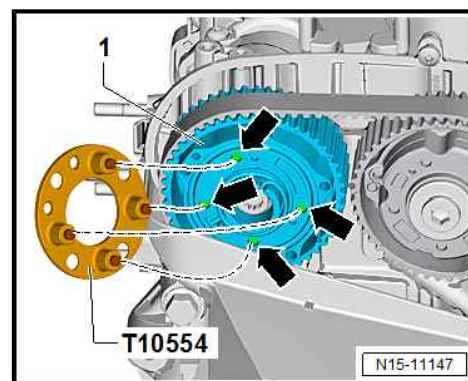
Exhaust camshaft:

- Guide in counterhold tool - T10554- between camshaft adjuster and engine support.
- To do so, first guide area between lugs -2- on counterhold tool - T10554- past camshaft adjuster.

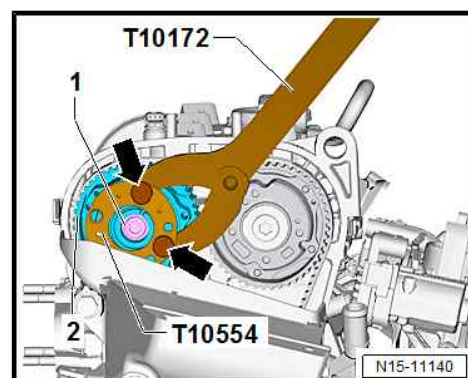




- Turn counterhold tool - T10554- so that it can be inserted in holes -arrows- as shown.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.

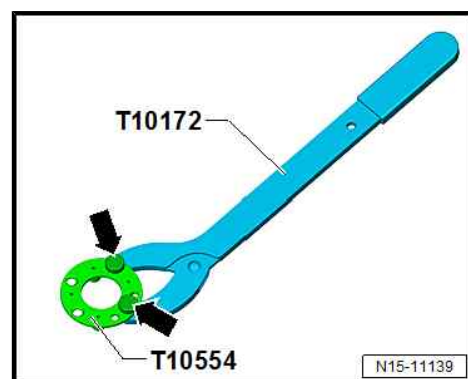


- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172- .

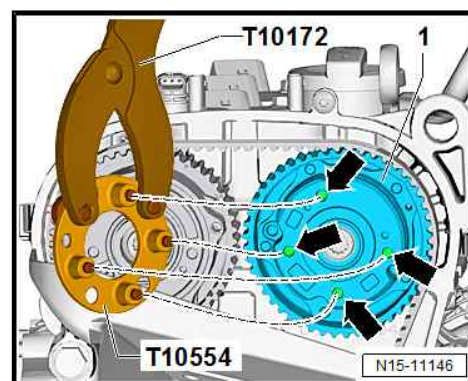


Inlet camshaft

- Assemble tools as shown.
- Attach counterhold tool - T10172- to counterhold tool - T10554- using knurled screws -arrows-.



- Apply counterhold tool - T10554- with counterhold tool - T10172- to camshaft sprocket -1-, as shown.
- Pins must be inserted correctly into holes -arrows-.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.
- Secure camshaft with counterhold tool - T10554- and counterhold tool - T10172- so that it cannot turn.



NOTICE

Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.

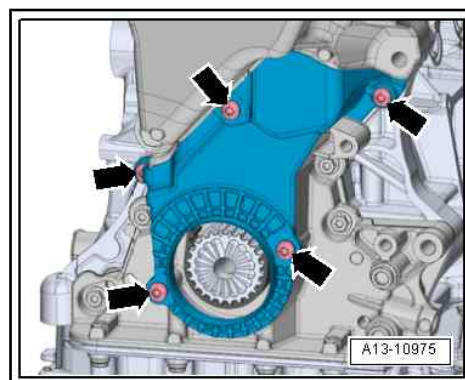
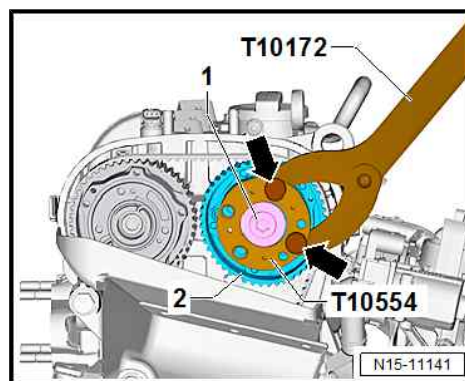
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- Unscrew plug -1- on camshaft sprocket (inlet side).
- Use counterhold tool - T10554- with counterhold tool - T10172- to do so.
- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172- .

Both sides (continued):

- Remove pulley
⇒ ["1.6 Removing and installing pulley", page 50](#) .
- Remove bolts -arrows- and detach toothed belt cover (bottom).

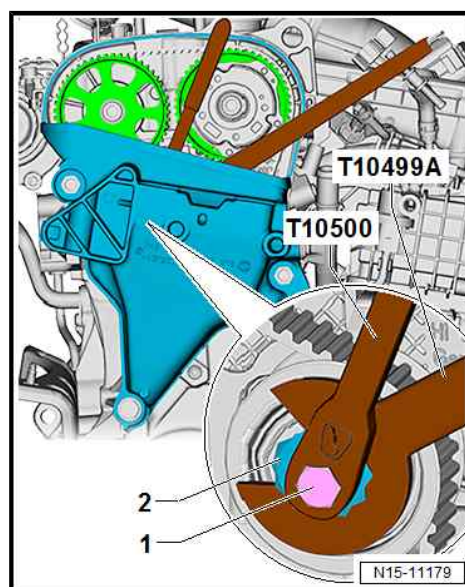


- Fit special wrench, 30 mm - T10499- onto eccentric adjuster -2- of tensioning roller.
- Fit special wrench, 30 mm - T10499 A- onto eccentric adjuster -2- of tensioning roller.
- Loosen bolt -1- using insert tool, 13 mm - T10500- .
- Release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499 A- .

NOTICE

Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

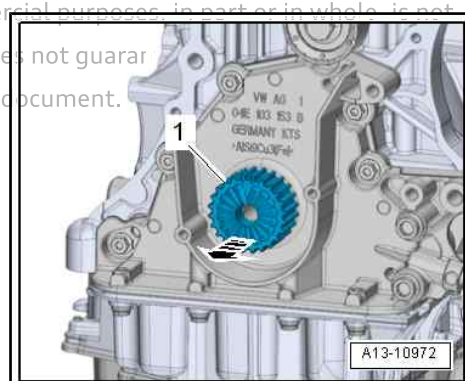
- Mark running direction before removing.
- Pay attention to running direction when reinstalling.
- Take off toothed belt.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).



- Detach crankshaft sprocket -1- -arrow-.

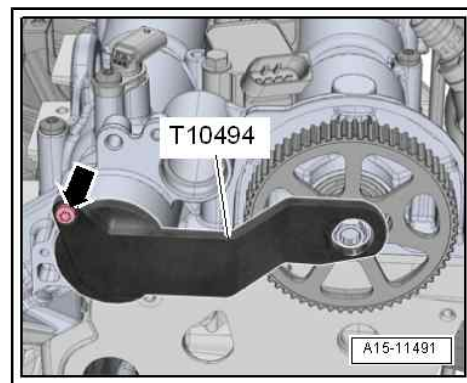
Installing (adjusting valve timing)

- Renew bolts tightened with specified tightening angle.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Renew O-rings.

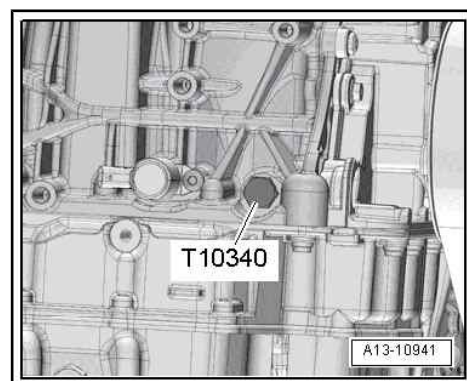




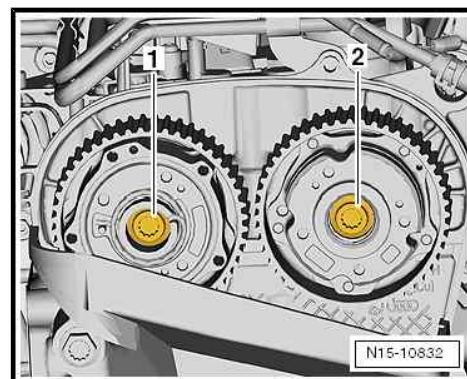
- Check “TDC” position of camshaft and crankshaft:
- Camshaft clamp - T10494- must be fitted to camshaft housing -arrow-.



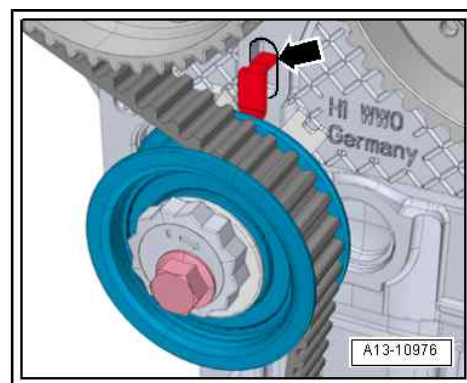
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = “TDC” position.



- Fit new bolts -1, 2- for camshaft sprockets and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



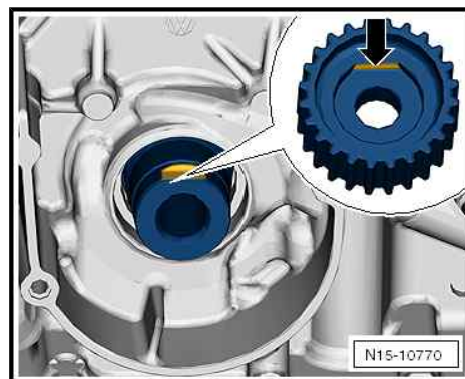
- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



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- Fit crankshaft sprocket onto crankshaft.
- Contact surface between poly V-belt pulley and crankshaft sprocket must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.



- Fit toothed belt in the specified sequence.

1 - Crankshaft sprocket

2 - Idler roller

3 - Tensioning roller

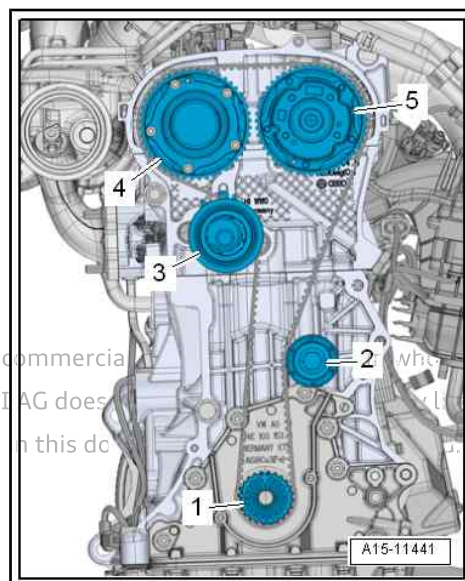
4 - Camshaft sprocket, exhaust side

5 - Camshaft sprocket, inlet side

- Install toothed belt cover (bottom section).

- Install pulley ⇒ [page 50](#).

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- Using special wrench, 30 mm - T10499 A- , turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster -2- back until adjustment indicator -3- is positioned exactly in adjustment window.

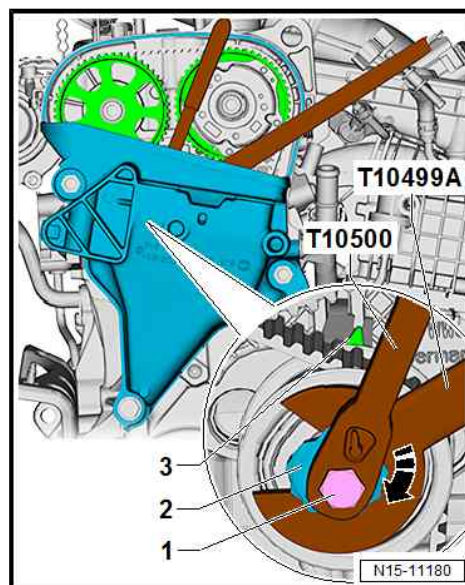
NOTICE

Risk of damage to engine if tightening torque is incorrect.

- Torque wrench - VAS 6583- must be used to tighten the bolts.
- When setting the tightening torque on the torque wrench - VAS 6583- , the reading on the insert tool, 13 mm - T10500- must be entered in the torque wrench.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - T10500- with torque wrench - VAS 6583- .

Note:

Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension.

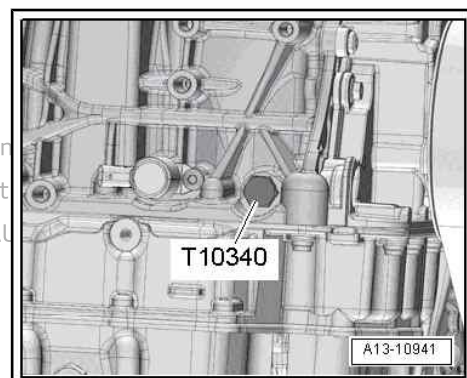
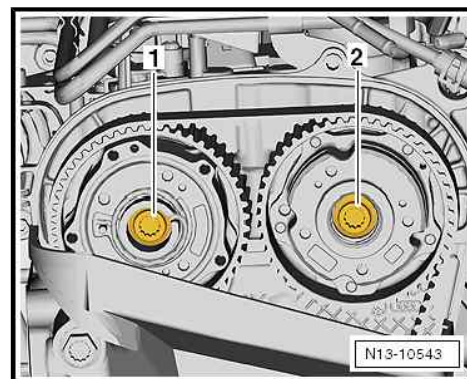




! NOTICE

Risk of damage to camshaft if handled incorrectly

- **Never use camshaft clamp as a counterhold tool.**
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool - T10172A- with adapters -T10172/2- , or counterhold tool - T10554- and counterhold tool - T10172- .

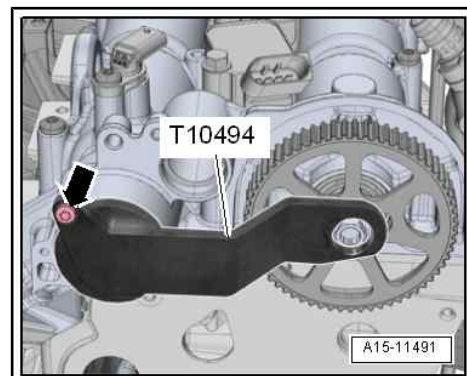


- Remove locking pin - T10340- .



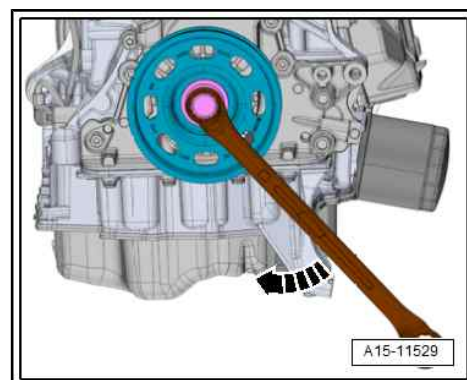
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- Remove bolt -arrow- and detach camshaft clamp - T10494- .



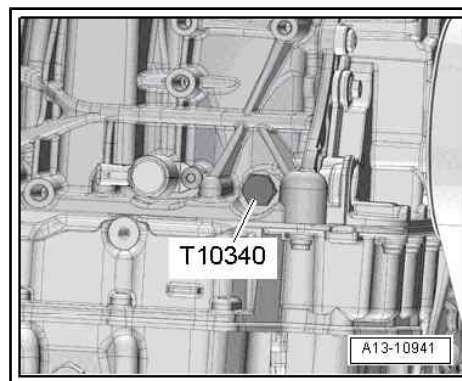
Checking valve timing:

- Turn crankshaft 2 rotations in normal direction of engine rotation -arrow-.

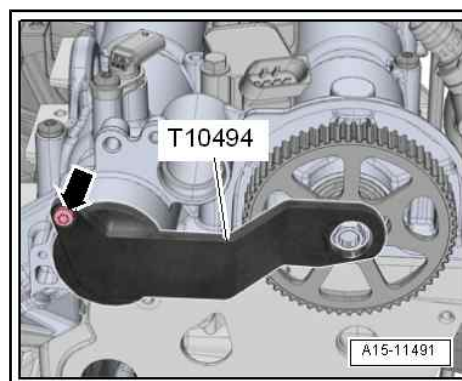




- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

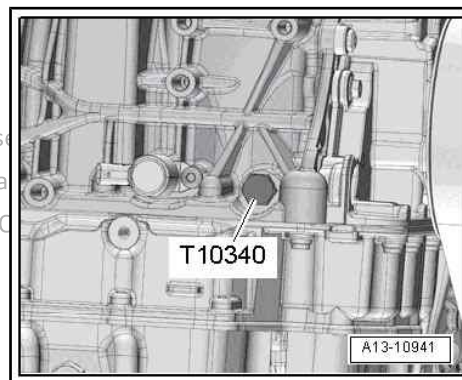
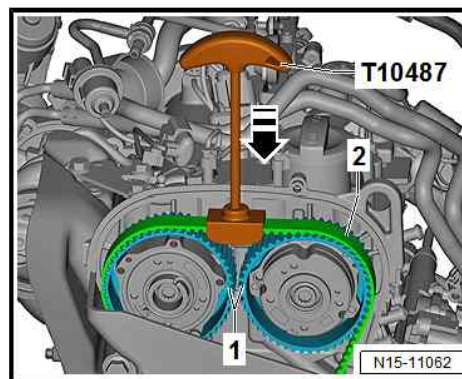


- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.



Note:

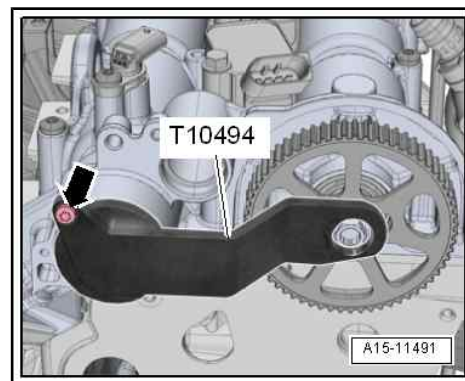
- If it is not possible to insert the camshaft clamp - T10494- easily:
- Press down toothed belt -arrow- using assembly tool -T10487- and then insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.
- If it is not possible to insert camshaft clamp - T10494- , valve timing is not OK.
- Adjust valve timing again ⇒ [page 101](#) .
- If it is possible to insert camshaft clamp - T10494- , valve timing is OK.
- Remove locking pin - T10340- .



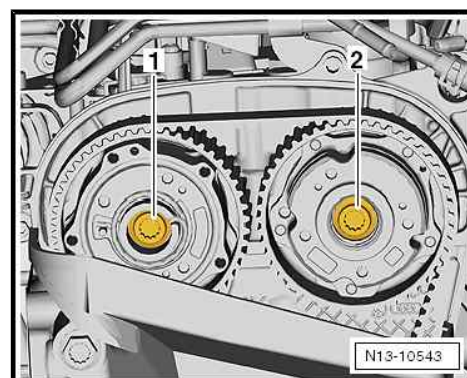
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- Remove bolt -arrow- and detach camshaft clamp - T10494- .



- Tighten bolts -1, 2- to final tightening torque ⇒ [page 79](#) using counterhold tool - T10554- with adapters -T10172/2- , or counterhold tool - T10172A- and counterhold tool - T10172- .

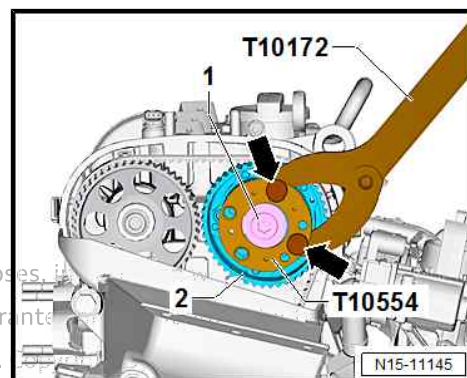


- Tighten plug -1- using counterhold tool - T10172- with counterhold tool - T10554- .

The remaining installation steps are carried out in the reverse sequence.

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 40](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 76](#)
- ◆ ⇒ [“1.2.2 Exploded view - toothed belt, version with two camshaft adjusters”, page 79](#)
- ◆ ⇒ [Fig. “Plug for TDC drilling in cylinder block - tightening torque”, page 78](#)
- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 212](#)
- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 231](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)
- ◆ ⇒ [“1.1.3 Exploded view - pipes, lines and hoses on turbocharger”, page 263](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



1.4.3 Removing and installing toothed belt - version with two camshaft adjusters and cylinder shut-off

Special tools and workshop equipment required



- ◆ Torque wrench - VAS 6583-



- ◆ Counterhold tool - T10475-



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- ◆ Counterhold tool - T10172 A- with adapters -T10172/1-

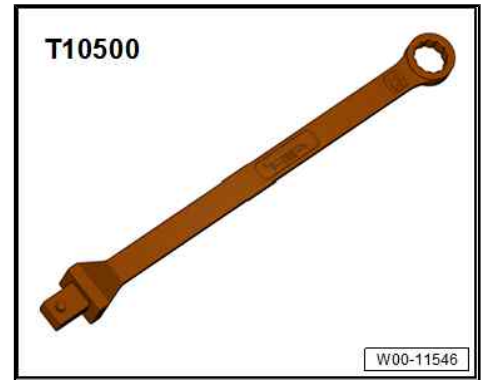


- ◆ Special wrench, 30 mm - T10499 A-

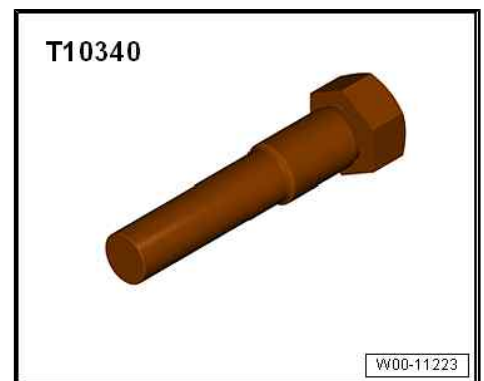




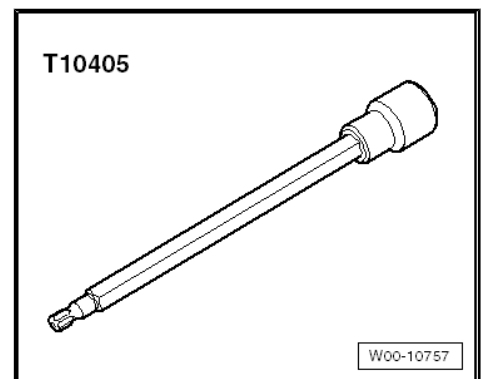
- ◆ Open end spanner insert, AF 13 - T10500-



- ◆ Locking pin - T10340-



- ◆ Socket Torx T30 - T10405-



- ◆ Assembly tool - T10487-



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◆ Camshaft clamp - T10504-



◆ Release tool - T10527- and -T10527/1-

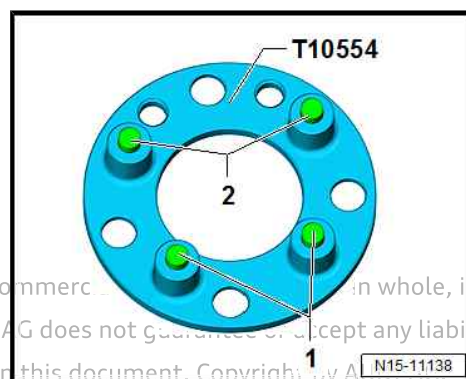


◆ Counterhold tool - T10554-



Counterhold tool - T10554-

- The lugs -1- and -2- on counterhold tool - T10554- are different distances apart.
- Counterhold tool - T10554- can only be applied in one position.
- Position counterhold tool - T10554- flush against camshaft adjusters.



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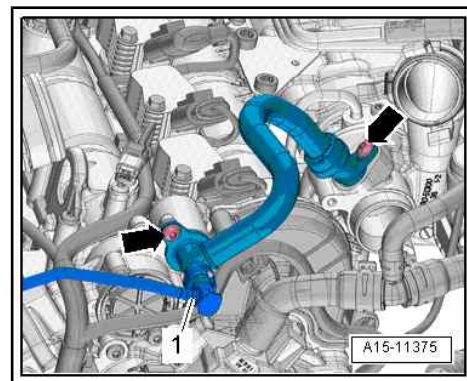
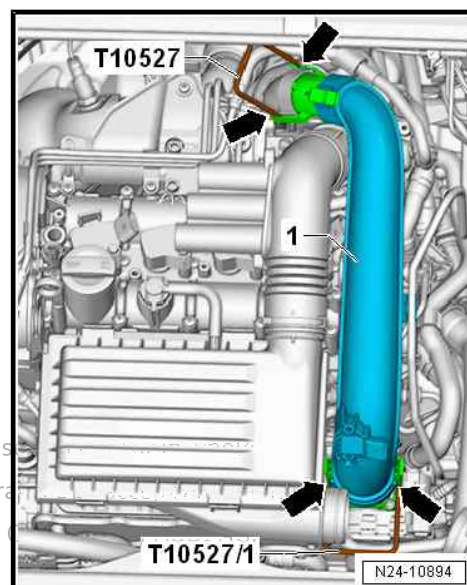
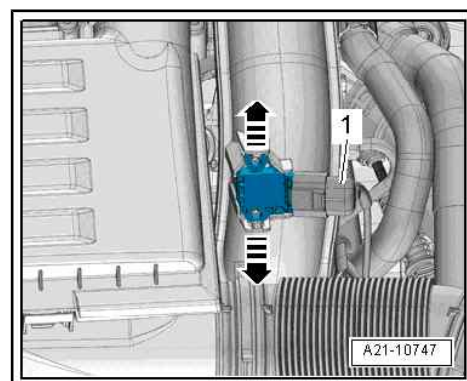
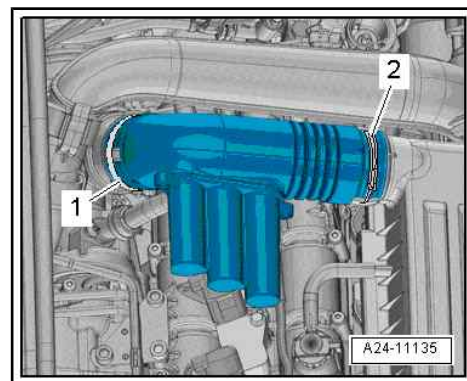
Removing

- Loosen hose clips -1, 2- and remove air pipe.
- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .
- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe -1-.



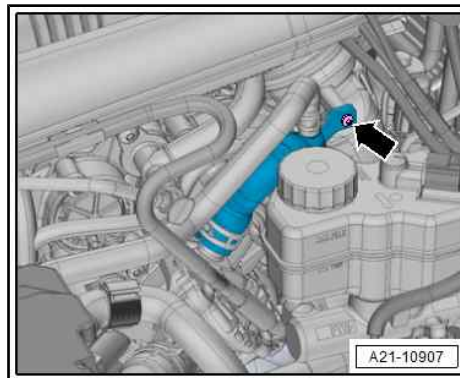
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- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).

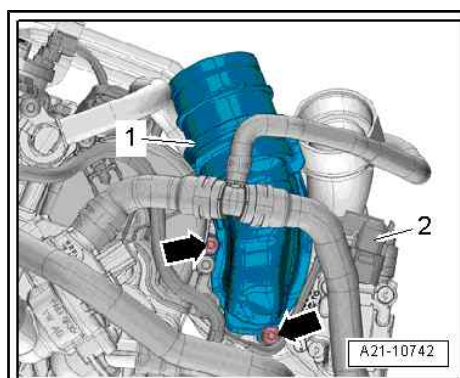




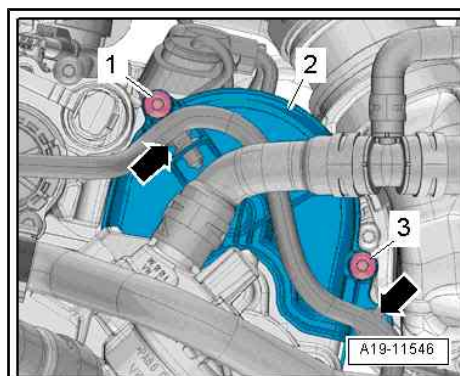
- If fitted, remove bolt -arrow- from connection and press coolant hose slightly forwards.



- Unscrew bolts -arrows- using socket Torx T30 - T10405- and detach connection -1-.



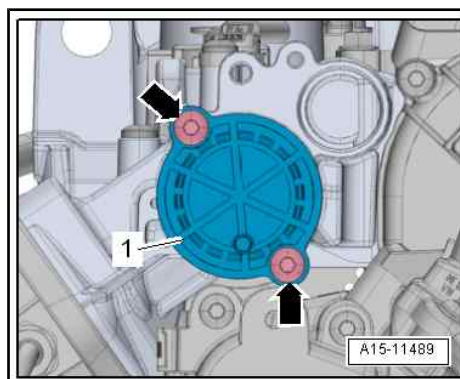
- Move electrical wiring harness clear -arrows-.
- Unscrew bolts -1, 3- and remove cover -2- for toothed belt for coolant pump.



NOTICE

Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

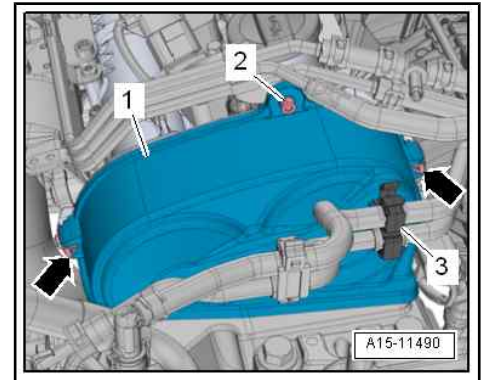
- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Unscrew bolts -arrows- and detach sealing cap -1-.



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- Move clear hoses at bracket -3-.
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.

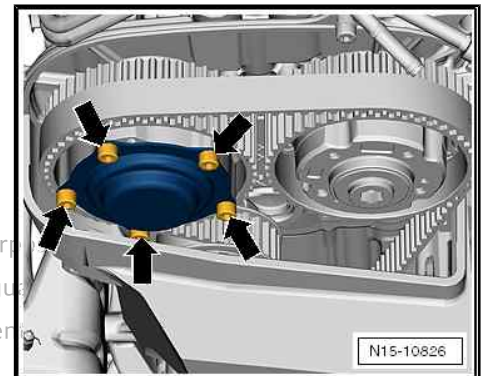


! NOTICE

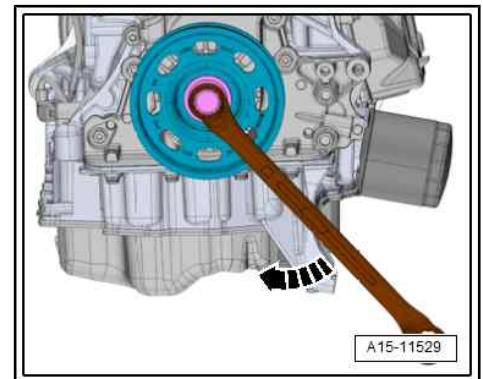
Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.
- Remove bolts -arrows- → **Item 4 (page 79)**

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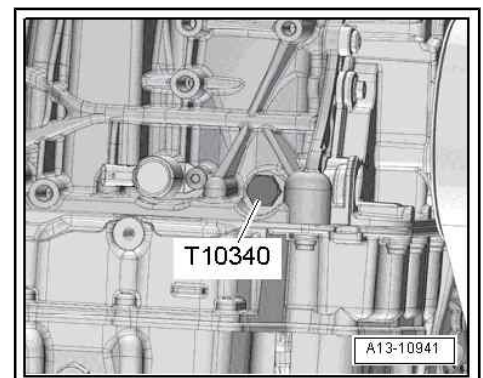


- Rotate crankshaft at vibration damper in normal direction of rotation so you can access all bolts -arrows- and unscrew them.
- Detach cover from camshaft adjuster of exhaust camshaft.



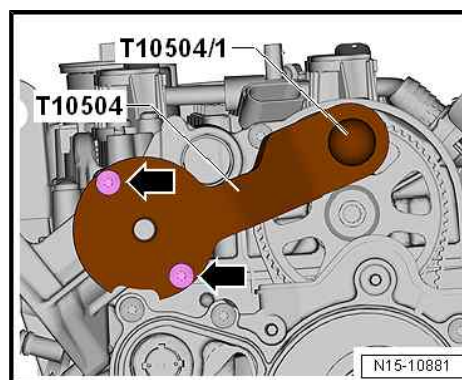
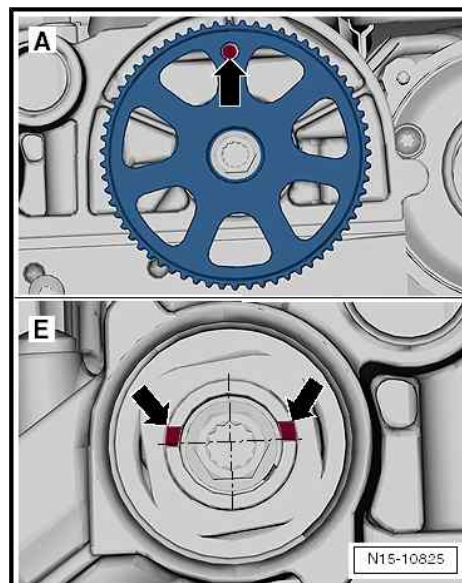
Rotate crankshaft to "TDC" as follows:

- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.





- On exhaust camshaft -A-, hole -arrow- in coolant pump drive sprocket must be aligned with hole in camshaft housing.
- On inlet camshaft -E-, grooves -arrows- must be positioned above centre of camshaft.
- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to TDC position.
- It should be possible to insert the camshaft clamp - T10504- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- When camshafts are positioned as described, insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).
- Insert locating pin -T10504/1- as far as stop.
- Screw in bolts -arrows- hand-tight.



Note

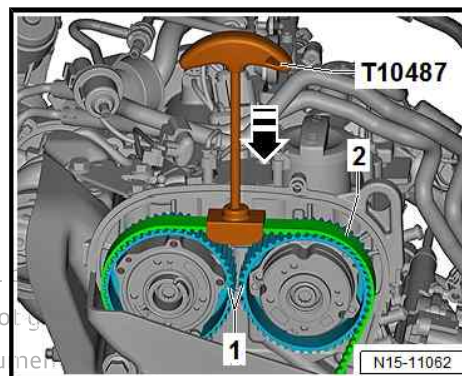
If it is difficult to insert camshaft clamp - T10504- , press against toothed belt -arrow- with assembly tool - T10487- . At the same time, insert camshaft clamp - T10504- into camshafts as far as stop and hand-tighten bolts. Insert locating pin -T10504/1- as far as stop.



NOTICE

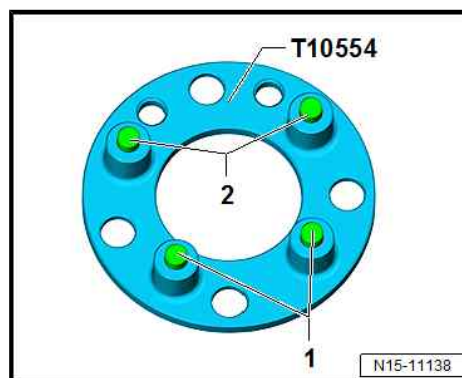
Risk of damage to camshaft if handled incorrectly

- **Never use camshaft clamp as a counterhold tool.** AUDI AG does not give any warranty with respect to the correctness of information in this document.



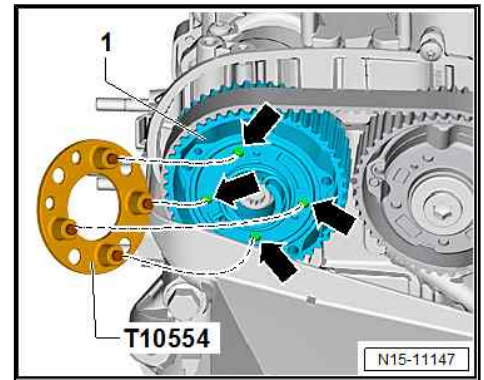
Exhaust camshaft:

- Guide in counterhold tool - T10554- between camshaft adjuster and engine support.
- To do so, first guide area between lugs -2- on counterhold tool - T10554- past camshaft adjuster.

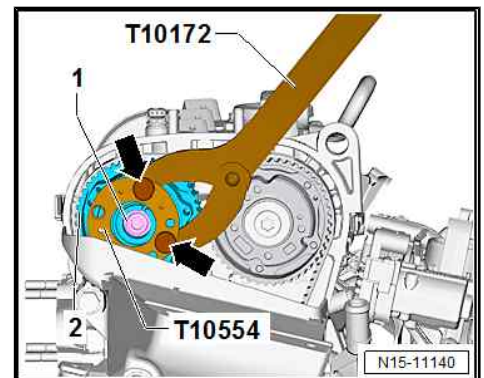




- Turn counterhold tool - T10554- so that it can be inserted in holes -arrows- as shown.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.

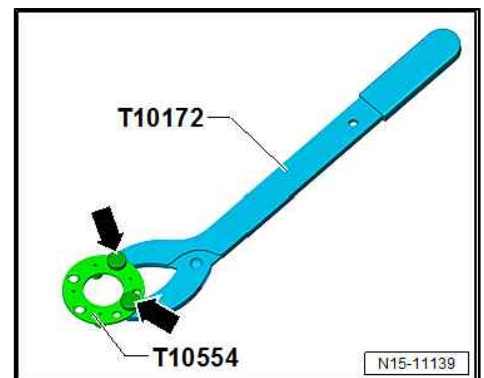


- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172- .

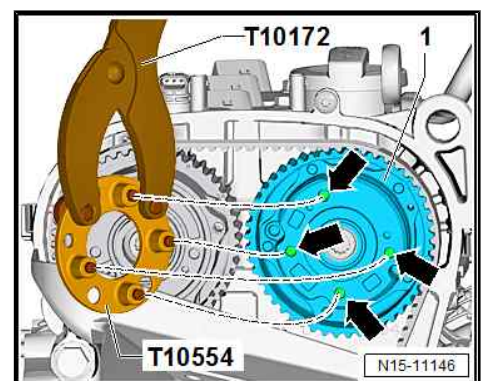


Inlet camshaft

- Assemble tools as shown.
- Attach counterhold tool - T10172- to counterhold tool - T10554- using knurled screws -arrows-.



- Apply counterhold tool - T10554- with counterhold tool - T10172- to camshaft sprocket -1-, as shown.
- Pins must be inserted correctly into holes -arrows-.
- Position counterhold tool - T10554- flush against camshaft adjuster -1-.
- Secure camshaft with counterhold tool - T10554- and counterhold tool - T10172- so that it cannot turn.



NOTICE

Risk of irreparable damage to engine due to oil on toothed belt.

- Catch escaping engine oil with a cloth.
- Clean any spaces/cavities that have filled with engine oil.

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- Unscrew plug -1- on camshaft sprocket (inlet side).
- Use counterhold tool - T10554- with counterhold tool - T10172- to do so.
- Loosen bolt -1- one turn. Secure camshaft sprocket in place with counterhold tool - T10554- and counterhold tool - T10172- .

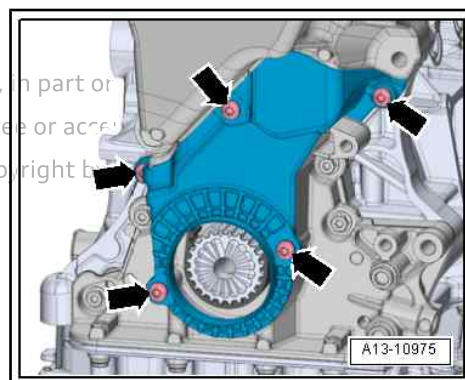
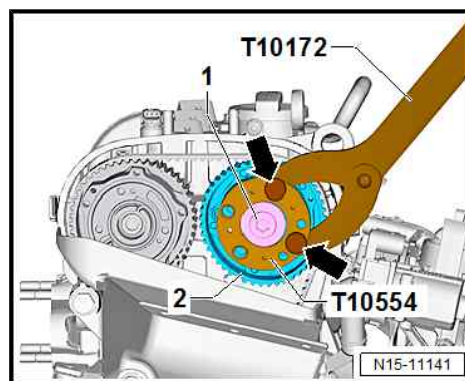
Both sides (continued):

- Remove pulley
⇒ ["1.6 Removing and installing pulley", page 50](#) .



- Remove bolts -arrows- and detach toothed belt cover (bottom).

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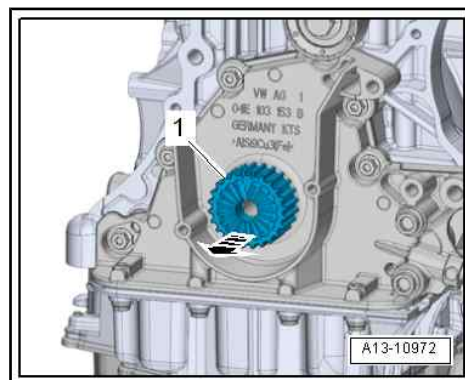
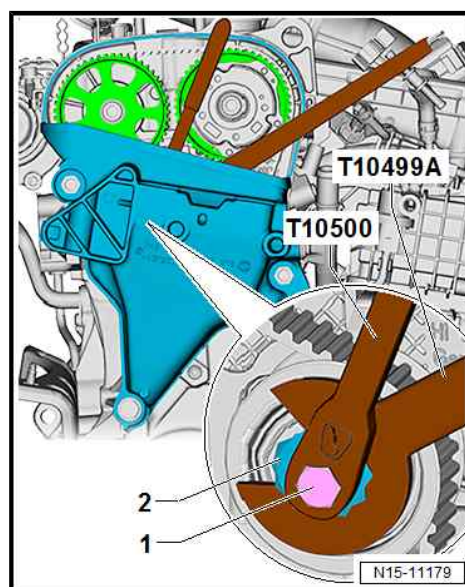


- Fit special wrench, 30 mm - T10499 A- onto eccentric adjuster -2- of tensioning roller.
- Loosen bolt -1- using insert tool, 13 mm - T10500- .
- Release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499- .

NOTICE

Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

- Mark running direction before removing.
- Pay attention to running direction when reinstalling.
- Take off toothed belt.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).
- Detach crankshaft sprocket -1- -arrow-.





Installing (adjusting valve timing)

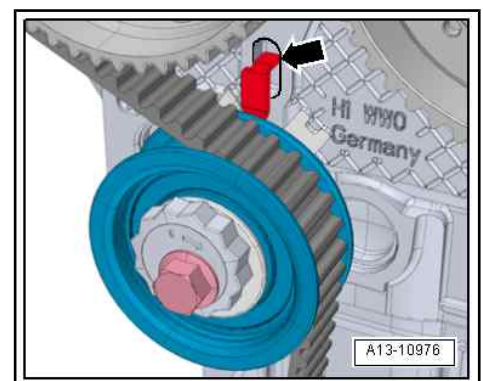
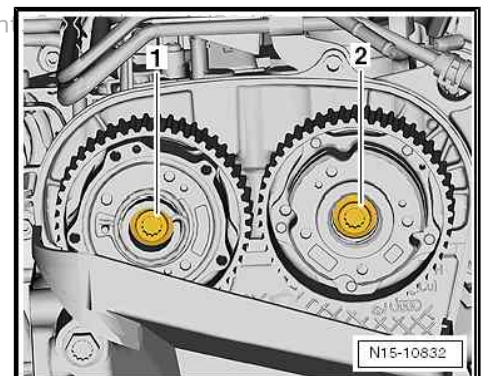
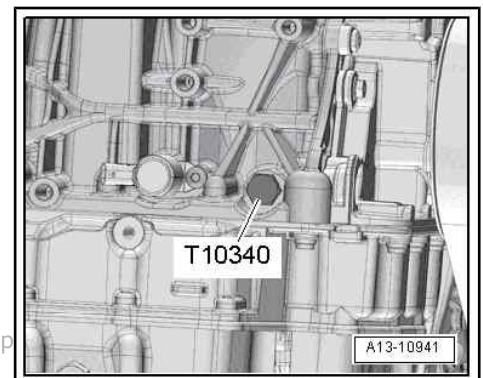
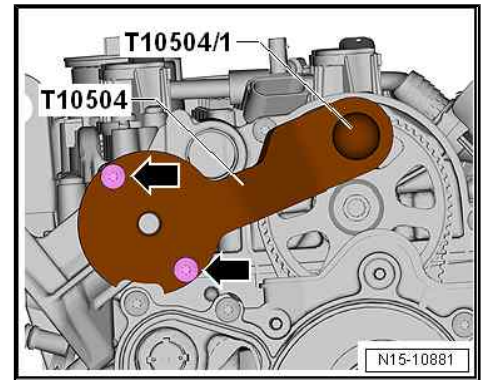
- Renew bolts tightened with specified tightening angle.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Renew O-rings.
- Check “TDC” position of camshaft and crankshaft:
- Camshaft clamp - T10504- with locating pin -T10504/1- must be fitted to camshaft housing.
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = “TDC” position.



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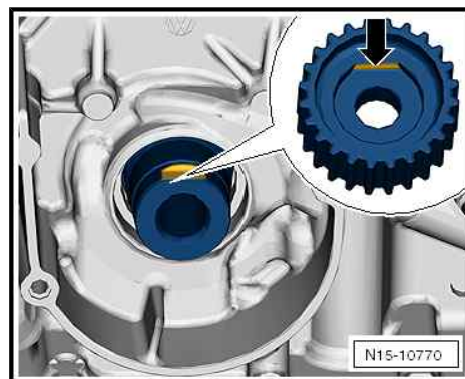
- Fit new bolts -1, 2- for camshaft sprockets and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.

- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.

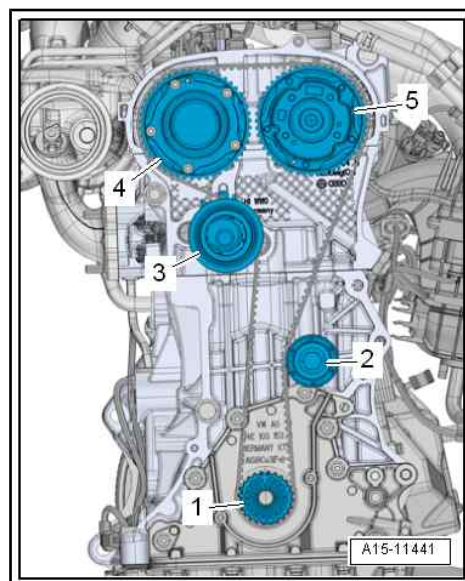




- Fit crankshaft sprocket onto crankshaft.
- Contact surface between poly V-belt pulley and crankshaft sprocket must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.



- Fit toothed belt in the specified sequence.
- 1 - Crankshaft sprocket
- 2 - Idler roller
- 3 - Tensioning roller
- 4 - Camshaft sprocket, exhaust side
- 5 - Camshaft sprocket, inlet side
- Install toothed belt cover (bottom section).
- Install pulley
⇒ ["1.6 Removing and installing pulley", page 50](#).



- Using special wrench, 30 mm - T10499 A-, turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.

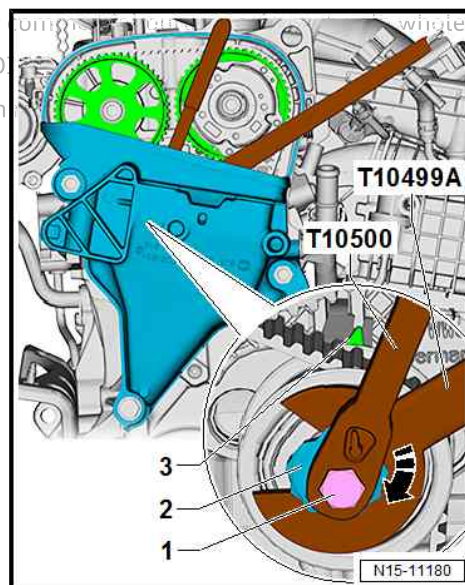
NOTICE

Risk of damage to engine if tightening torque is incorrect.

- Torque wrench - VAS 6583- must be used to tighten the bolts.
- When setting the tightening torque on the torque wrench - VAS 6583- , the reading on the insert tool, 13 mm - T10500- must be entered in the torque wrench.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - T10500- with torque wrench - VAS 6583- .

Note:

Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension.

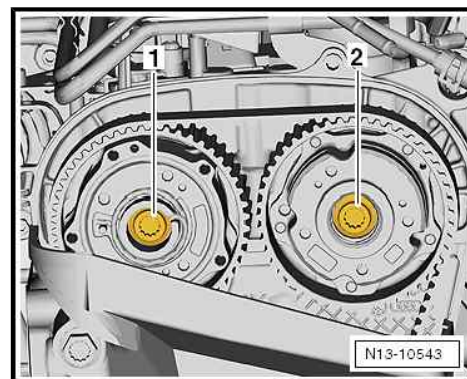




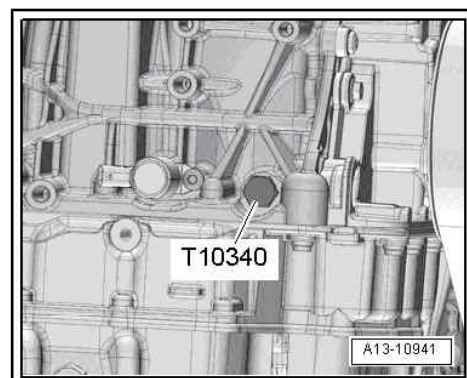
NOTICE

Risk of damage to camshaft if handled incorrectly

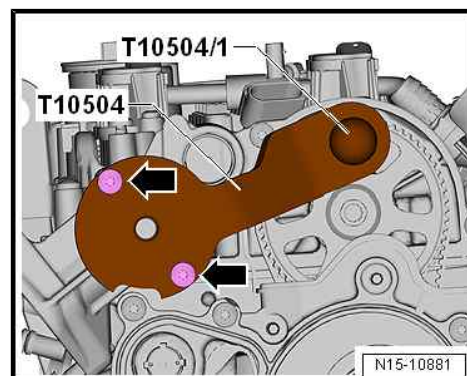
- Never use camshaft clamp as a counterhold tool.
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool - T10172A- with adapters -T10172/2- , or counterhold tool - T10554- and counterhold tool - T10172- .



- Remove locking pin - T10340- .

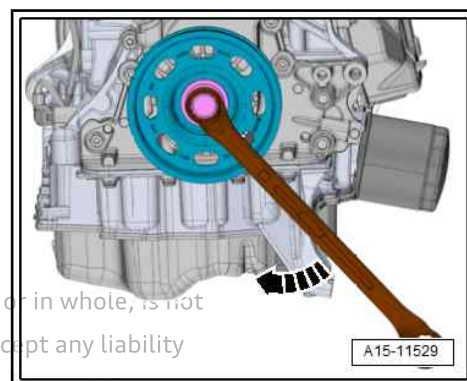


- Remove locating pin -T10504/1- .
- Remove bolts -arrows- and detach camshaft clamp - T10504- .



Checking valve timing:

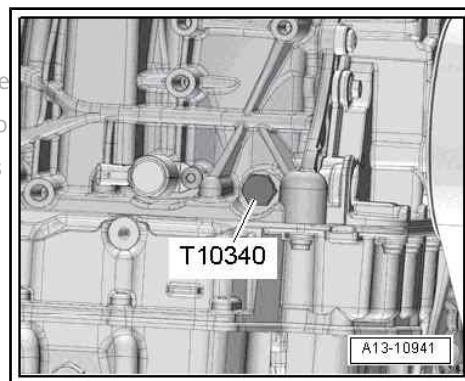
- Turn crankshaft 2 rotations in normal direction of engine rotation -arrow-.



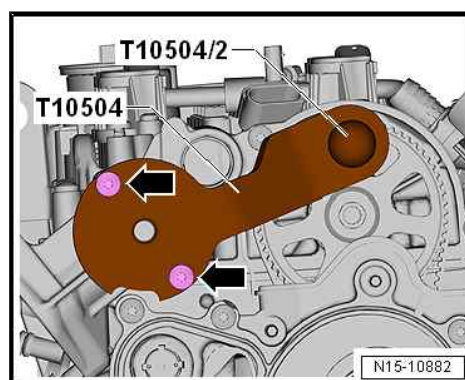
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- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin - T10340- is now in contact with the crank web.
- The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.



- It should be possible to insert the camshaft clamp - T10504- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).
- Insert test pin -T10504/2- as far as stop.
- Screw in bolts -arrows- hand-tight.

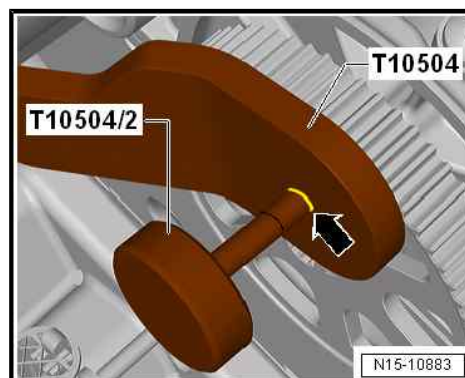


Risk of damage to engine

- If groove -arrow- is not flush with camshaft clamp - T10504- , test pin -T10504/2- is not inserted far enough.
- Risk of damage to engine if valve timing is adjusted incorrectly.
- Check whether groove -arrow- on test pin -T10504/2- is flush with camshaft clamp - T10504- .

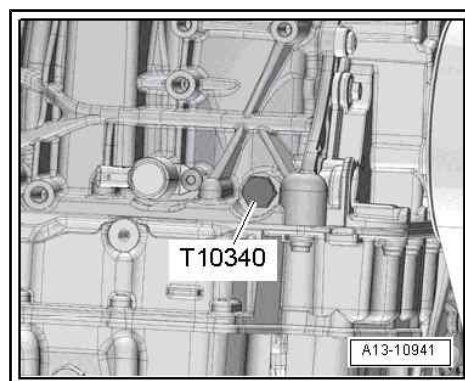
If it is not possible to insert camshaft clamp - T10504- with test pin -T10504/2- , valve timing is not OK:

- Adjust valve timing again ➔ [page 101](#) .



If it is possible to insert camshaft clamp - T10504- with test pin - T10504/2- , valve timing is OK.

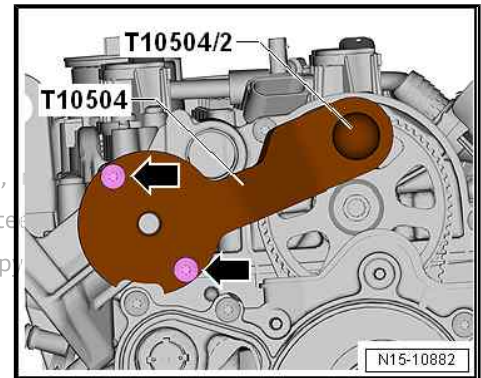
- Remove locking pin - T10340- .



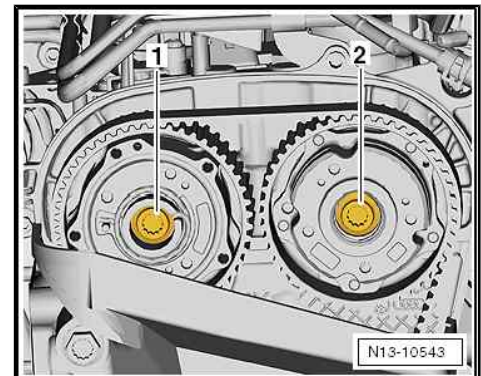


- Remove bolts -arrows- and detach camshaft clamp - T10504- with test pin -T10504/2- .

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- Tighten bolts -1, 2- to final tightening torque $\Rightarrow$ [page 79](#) using counterhold tool - T10554- with adapters -T10172/2- , or counterhold tool - T10172A- and counterhold tool - T10172- .



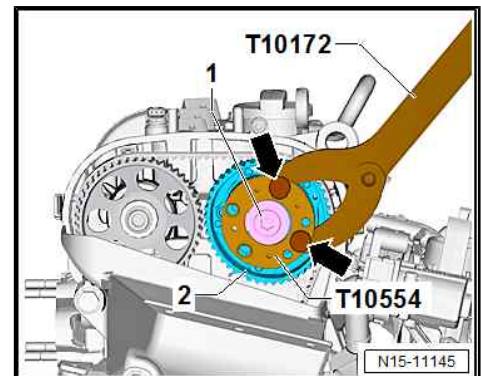
- Tighten plug -1- using counterhold tool - T10172- with counterhold tool - T10554- .

Further installation is carried out in the reverse order; note the following:

- Fill up with coolant $\Rightarrow$ [page 230](#) .

Tightening torques

- ◆ $\Rightarrow$ [“1.1 Exploded view - poly V-belt drive”, page 40](#)
- ◆ $\Rightarrow$ [“1.1 Exploded view - toothed belt cover”, page 76](#)
- ◆ $\Rightarrow$ [“1.2.2 Exploded view - toothed belt, version with two camshaft adjusters”, page 79](#)
- ◆ $\Rightarrow$ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 78](#)
- ◆ $\Rightarrow$ [“3.1 Exploded view - crankcase breather system”, page 212](#)
- ◆ $\Rightarrow$ [“2.2 Exploded view - camshaft housing”, page 163](#)
- ◆ $\Rightarrow$ [“2.1 Exploded view - coolant pump/thermostat”, page 231](#)
- ◆ $\Rightarrow$ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ $\Rightarrow$ [“2.1 Exploded view - charge air system”, page 277](#)
- ◆ $\Rightarrow$ [“1.1.3 Exploded view - pipes, lines and hoses on turbocharger”, page 263](#)
- ◆ $\Rightarrow$ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation





2 Cylinder head

⇒ [“2.1 Exploded view - cylinder head”, page 162](#)

⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)

⇒ [“2.3 Removing and installing cylinder head”, page 165](#)

⇒ [“2.4 Removing and installing camshaft housing”, page 169](#)

⇒ [“2.5 Checking compression”, page 174](#)

2.1 Exploded view - cylinder head

1 - Cylinder head gasket

- ☐ Renewing
⇒ [“2.3 Removing and installing cylinder head”, page 165](#)
- ☐ Different versions available; for allocation refer to ⇒ Electronic parts catalogue
- ☐ Note installation position: part number must face cylinder head

2 - Dowel sleeve

- ☐ 2x

3 - Cylinder head

- ☐ Removing and installing
⇒ [“2.3 Removing and installing cylinder head”, page 165](#)
- ☐ Checking for distortion
⇒ [Fig. “Checking cylinder head for distortion”, page 163](#)

4 - Dowel pins

5 - Oil strainer

- ☐ Inserted into cylinder head
- ☐ Not fitted on later versions; allocation ⇒ Electronic parts catalogue

6 - Gasket

- ☐ Renew after removing

7 - Camshaft housing

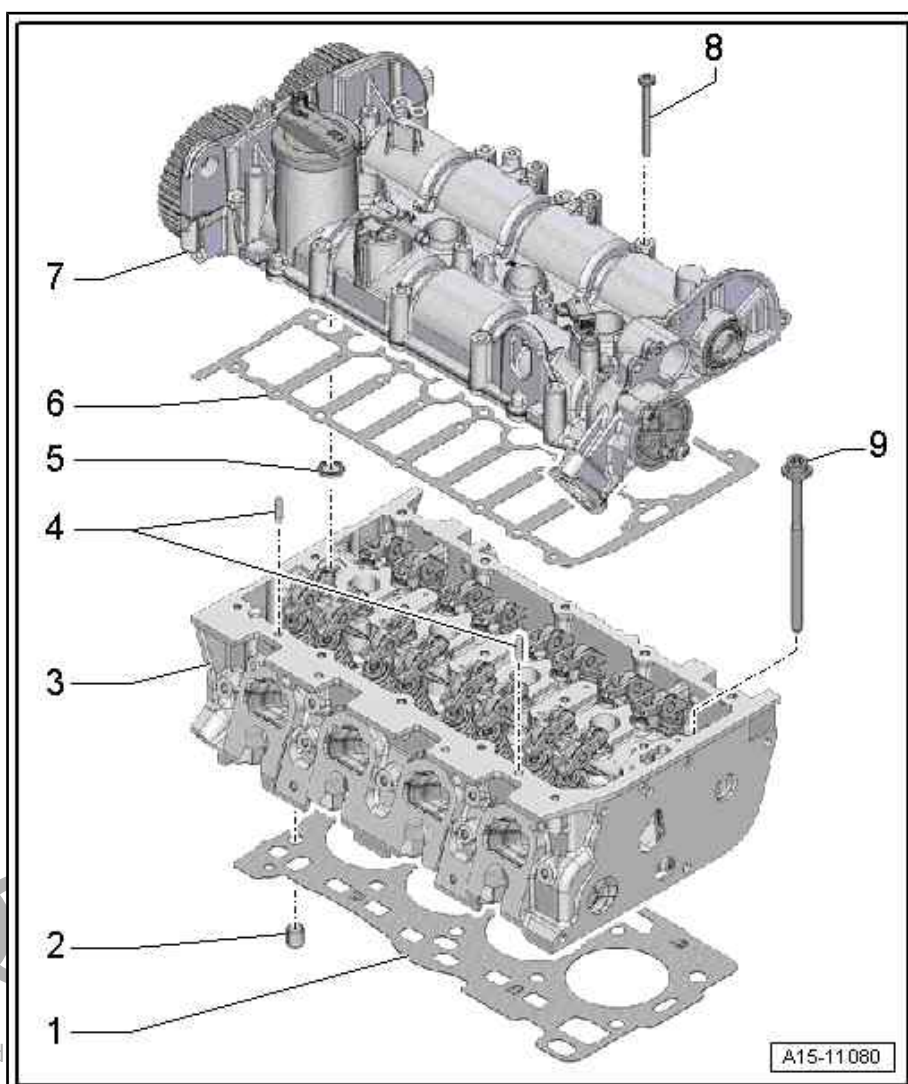
- ☐ Version with cylinder shut-off has cam actuator fitted
- ☐ Removing and installing ⇒ [“2.4 Removing and installing camshaft housing”, page 169](#)

8 - Bolt

- ☐ Tightening torque and sequence
⇒ [Fig. “Camshaft housing - tightening torque and sequence”, page 165](#)

9 - Bolt

- ☐ Renew after removing
- ☐ Correct sequence when slackening ⇒ [page 168](#)
- ☐ Tightening torque and sequence ⇒ [Fig. “Cylinder head - tightening torque and sequence”, page 163](#)

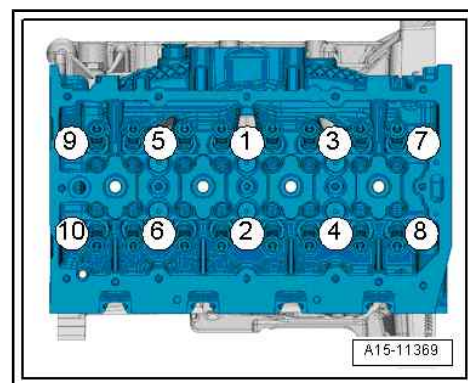




Cylinder head - tightening torque and sequence

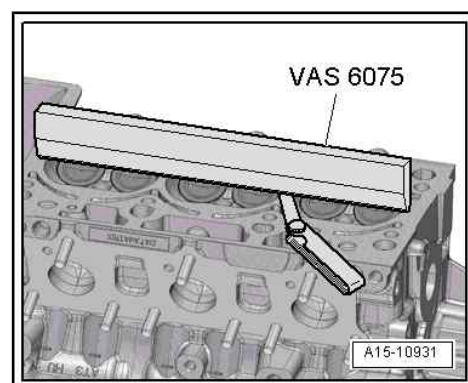
- After removing, renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 10-	40 Nm
2.	-1 ... 10-	Turn 90° further
3.	-1 ... 10-	Turn 90° further
4.	-1 ... 10-	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.



2.2 Exploded view - camshaft housing



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**1 - Dowel pin****2 - Oil strainer**

- ☐ Inserted into cylinder head
- ☐ Not fitted on later versions; allocation ⇒ Electronic parts catalogue

3 - Oil seal

- ☐ For inlet camshaft
- ☐ Renewing
⇒ ["3.3.1 Removing and installing inlet camshaft oil seal", page 179](#)

4 - Oil seal

- ☐ For exhaust camshaft (pulley end)
- ☐ Renewing
⇒ ["3.3.2 Removing and installing exhaust camshaft oil seal \(pulley end\)", page 181](#)

5 - Camshaft housing

- ☐ Removing and installing
⇒ ["2.4 Removing and installing camshaft housing", page 169](#)

6 - Bolt

- ☐ Tightening torque and sequence
⇒ [Fig. "Camshaft housing - tightening torque and sequence", page 165](#)

7 - O-ring

- ☐ Renew after removing

8 - Camshaft control valve 1 - N205-

- ☐ Additionally on version with two camshaft adjusters: exhaust camshaft control valve 1 - N318-
⇒ ["3.6 Removing and installing exhaust camshaft control valve 1 N318", page 189](#)
- ☐ Removing and installing ⇒ ["3.5 Removing and installing camshaft control valve 1 N205", page 189](#)

9 - Bolt

- ☐ 8 Nm

10 - Seal

- ☐ For filler cap

11 - Filler cap**12 - O-ring**

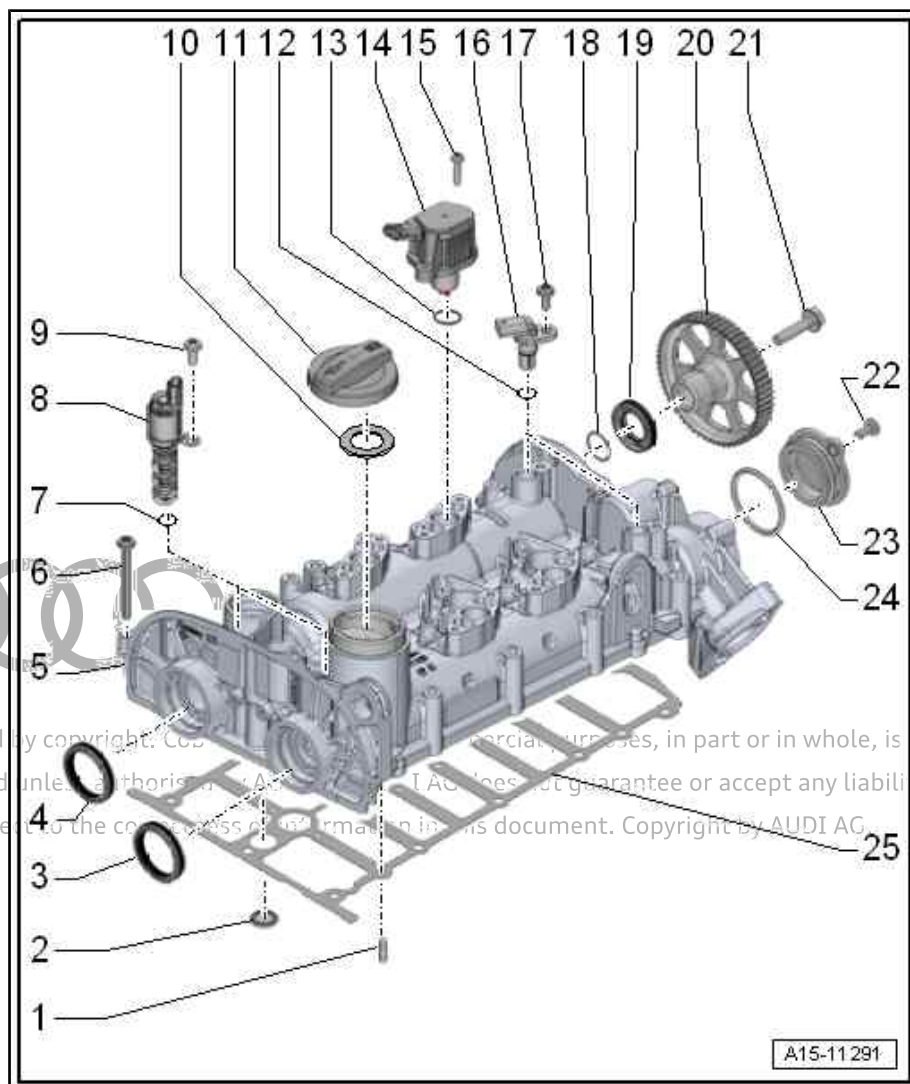
- ☐ Renew after removing

13 - O-ring

- ☐ Only for version with cylinder shut-off
- ☐ Renew after removing

14 - Cam actuator

- ☐ Only for version with cylinder shut-off
- ☐ -N583- ... -N597-
- ☐ Removing and installing ⇒ ["3.4 Removing and installing cam actuators", page 187](#)





15 - Bolt

- ☐ Only for version with cylinder shut-off
- ☐ 8 Nm

16 - Hall sender - G40-

- ☐ Additionally on version with two camshaft adjusters: Hall sender 2 - G163-
- ☐ Exploded view ⇒ [“1.1 Exploded view - ignition system”, page 328](#)

17 - Bolt

- ☐ Tightening torque ⇒ [“1.1 Exploded view - ignition system”, page 328](#)

18 - O-ring

- ☐ Only for version with cylinder shut-off
- ☐ Renewing
⇒ [“2.7.2 Removing and installing toothed belt sprocket for coolant pump - engines with cylinder shut-off”, page 245](#)

19 - Oil seal

- ☐ For exhaust camshaft (gearbox end)
- ☐ Renewing ⇒ [“3.3 Removing and installing camshaft oil seal”, page 179](#)

20 - Toothed belt drive sprocket

- ☐ For coolant pump
- ☐ Removing and installing
⇒ [“2.7 Removing and installing toothed belt sprocket for coolant pump”, page 244](#)

21 - Bolt

- ☐ Tightening torque ⇒ [Item 8 \(page 232\)](#)

22 - Bolt

- ☐ 8 Nm

23 - Filler cap

24 - O-ring

- ☐ Renew after removing

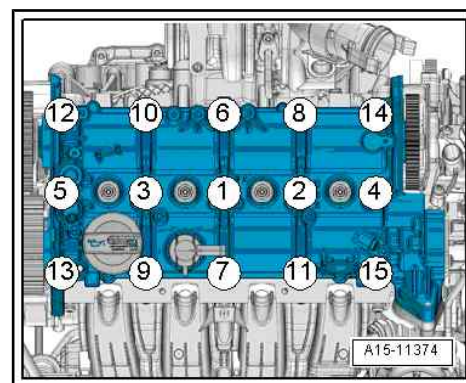
25 - Gasket

- ☐ Renew after removing

Camshaft housing - tightening torque and sequence

- After removing, renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 15-	10 Nm
2.	-1 ... 15-	Turn 180° further



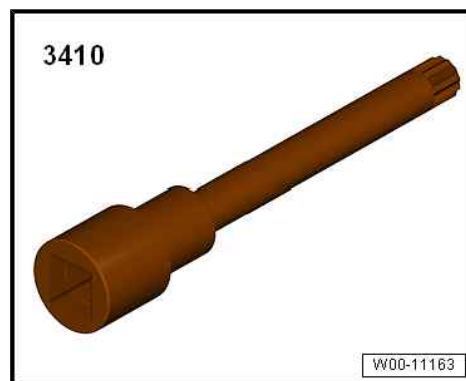
2.3 Removing and installing cylinder head

Special tools and workshop equipment required

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◆ Socket - 3410-



- ◆ Blade scraper; blade width at least 40 mm (commercially available)

Removing

- All open inlet and exhaust ports must be sealed with suitable plugs from engine bung set - VAS 6122- .
- Cover openings on gearbox with a cloth so that no coolant or other liquids can get into the clutch housing.
- Secure cable ties in the same locations when installing.
- Reinstall heat insulation sleeves in the same locations when installing.

- Remove camshaft housing

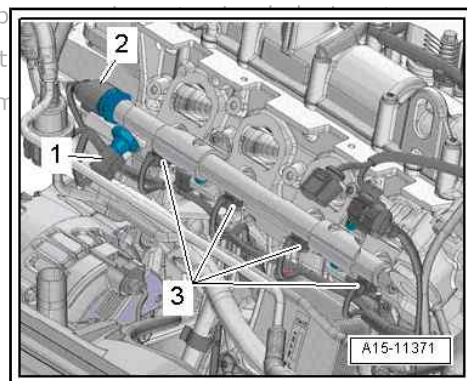
⇒ [“2.4 Removing and installing camshaft housing”, page 169](#) .

- Remove intake manifold

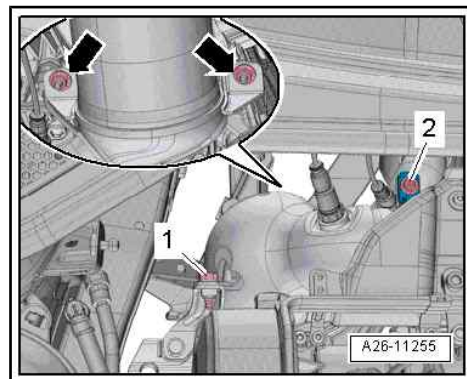
⇒ [“3.2 Removing and installing intake manifold”, page 293](#) .

- Unplug electrical connectors:

- 1 - At oil pressure switch for reduced oil pressure - F378-
- 2 - At fuel pressure sender - G247-
- 3 - At injectors -N30- ... -N33-

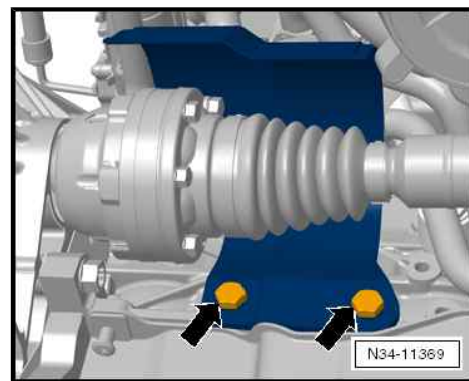


- Unscrew bolt -2- and remove screw-type clip.
- Remove bolt -1- and nuts -arrows- and tie up catalytic converter.

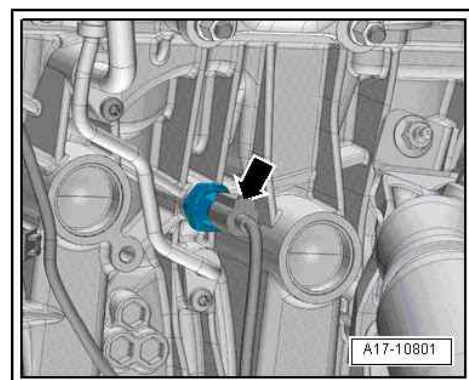




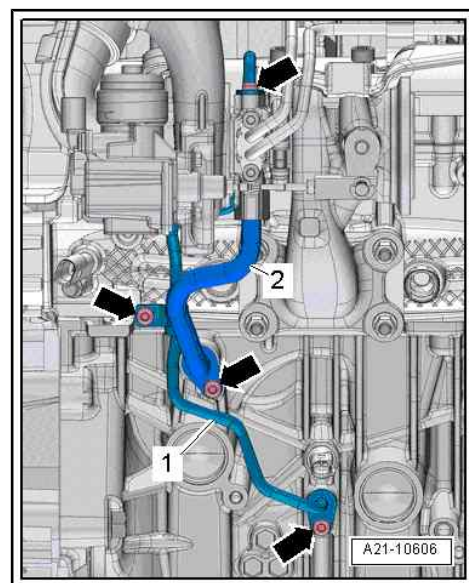
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).



- Detach heat insulation sleeve.
- Unplug electrical connector -arrow- on oil pressure switch - F22- .

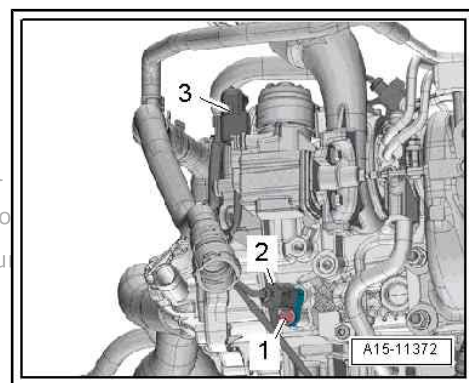


- Unscrew bolts -arrows- and detach oil supply pipe -1- and oil return pipe -2-.



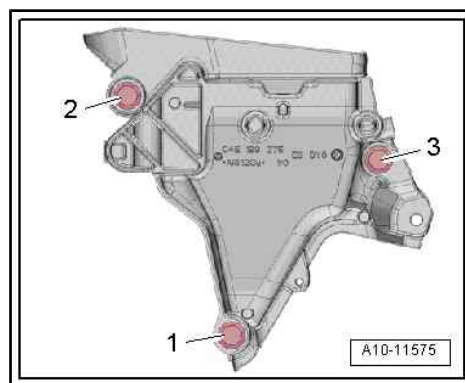
- Unplug electrical connectors:
- 2 - For coolant temperature sender - G62-
- 3 - For charge pressure positioner - V465-

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- Remove bolt -2- on engine support.



- Loosen and remove cylinder head bolts in sequence -1 ... 10-.
- Take off cylinder head and set it down on a soft surface (foam plastic).

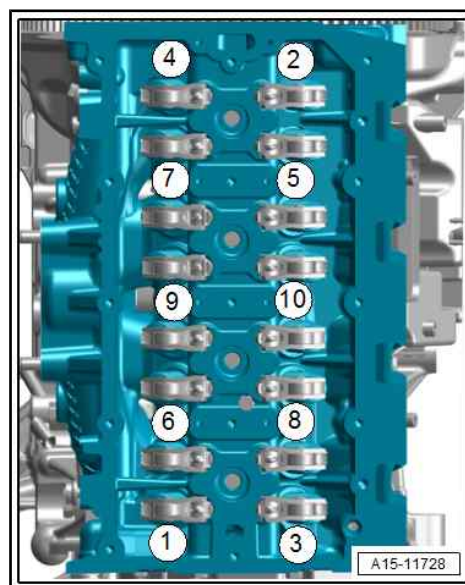
Installing



NOTICE

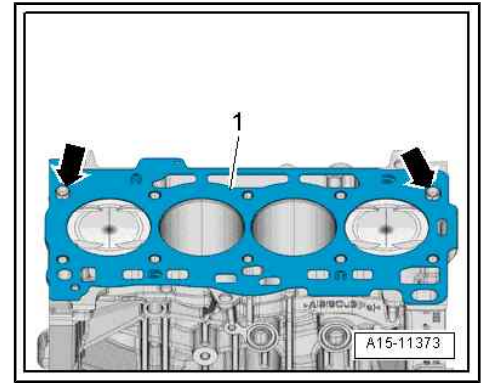
Risk of damage to sealing surfaces if handled incorrectly.

- **Carefully remove sealant residue from cylinder head and cylinder block.**
- Use of impermissible abrasive materials can lead to subsequent damage to the turbocharger, conrod bearings or similar.
- Do NOT use abrasive materials (sandpaper, sanding discs, sanding pads, abrasive web, wire wool, etc.).
- When removing sealant residue, make sure none of the residue enters the open channels of the engine.
- Ensure that nearby workspaces are kept clean and that the abrasive materials listed above are not being used there.
- Sealant residue may only be removed from the cylinder head and cylinder block using a commercially available blade scraper (blade width at least 40 mm).
- Remove loose residue with a lint-free cloth.
- No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.
- Renew bolts tightened with specified tightening angle.
- Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.
- When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the camshaft housing.
- Secure all hose connections with correct type of hose clips (as original equipment) → Electronic parts catalogue.
- After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.
- Do not remove new cylinder head gasket from packaging until it is ready to be fitted.
- Handle the cylinder head gasket very carefully to ensure it is not damaged.





- Fit cylinder head gasket -1-.
- ◆ Note position of centring pins in cylinder block -arrows-.
- ◆ Note installation position of cylinder head gasket. Part No. should be legible from inlet side.
- If crankshaft has been rotated: Set piston of cylinder 1 to top dead centre and then turn crankshaft back slightly.
- Fit cylinder head.
- Insert and hand-tighten cylinder head bolts.
- Tighten cylinder head bolts
⇒ [Fig. "Cylinder head - tightening torque and sequence"](#), [page 163](#).



Note:

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

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

- Install camshaft housing
⇒ ["2.4 Removing and installing camshaft housing"](#), [page 169](#).
- Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Change engine oil ⇒ Maintenance ; Booklet 819 .
- Fill cooling system with fresh coolant
⇒ ["1.3 Draining and filling cooling system"](#), [page 224](#) .

Tightening torques

- ◆ ⇒ [Fig. "Engine support - tightening torque and sequence"](#), [page 32](#)
- ◆ ⇒ ["2.1 Exploded view - cylinder head"](#), [page 162](#)
- ◆ ⇒ ["1.1 Exploded view - turbocharger"](#), [page 260](#)
- ◆ ⇒ ["3.1 Exploded view - intake manifold"](#), [page 292](#)
- ◆ ⇒ [Fig. "Installing catalytic converter - tightening torque and sequence"](#), [page 325](#)
- ◆ Heat shield for drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft

2.4 Removing and installing camshaft housing

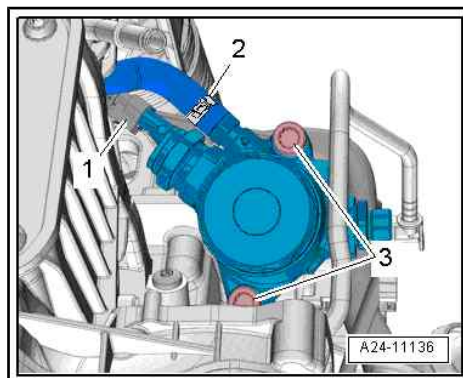
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Removing

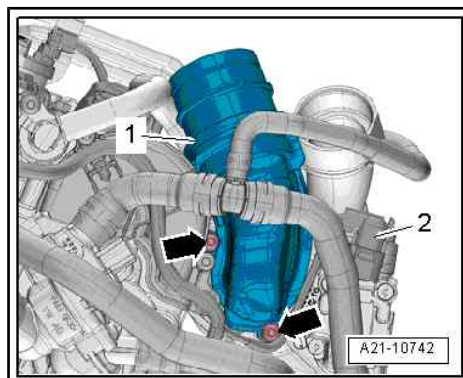
- Remove engine cover panel
⇒ ["3.1 Removing and installing engine cover panel"](#), [page 39](#) .
- Remove coolant pump
⇒ ["2.5 Removing and installing coolant pump"](#), [page 237](#) .
- Remove air cleaner housing
⇒ ["2.2 Removing and installing air cleaner housing"](#), [page 291](#) .



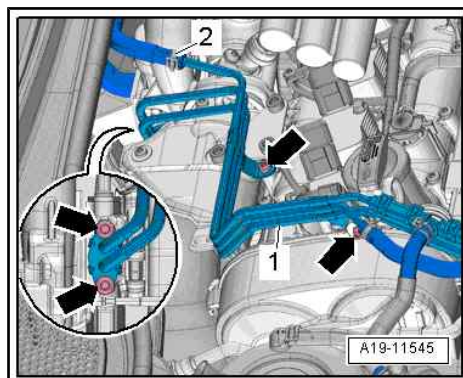
- Remove ignition coils
⇒ ["1.3 Removing and installing ignition coils with output stages", page 329](#) .
- Detach toothed belt from camshafts
⇒ ["1.3 Detaching toothed belt from camshaft", page 80](#) .
- Remove high-pressure pipe
⇒ ["6.3 Removing and installing high-pressure pipe", page 313](#) .
- Unplug electrical connector -1-.
- Release hose clip -2- and disconnect hose.



- Unplug electrical connector -2-.



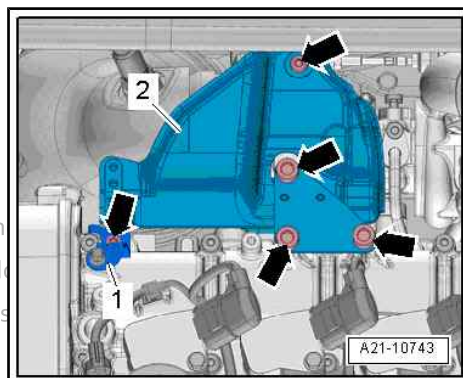
- If fitted, release hose clip -2- and detach coolant hose.
- Remove bolts -arrows- and pivot coolant lines to right side.



- Remove bolts -arrows- and detach bracket with heat shield -2- and bracket -1- for engine cover panel.

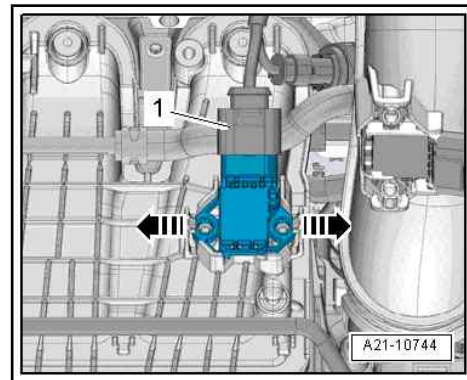


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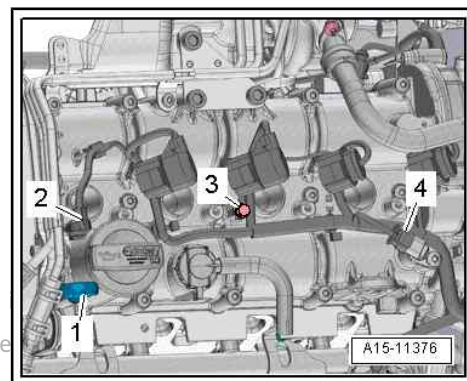


- Unplug electrical connector -1- at intake air temperature sender - G42- / intake manifold pressure sender - G71- .



Version with one camshaft adjuster:

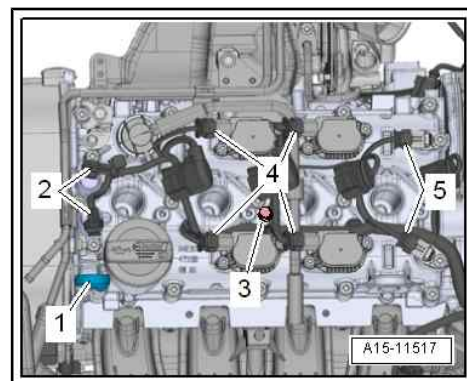
- Unplug electrical connectors:
2 - For camshaft control valve 1 - N205-
4 - For Hall sender - G40-
- Remove bolt -3-, move wiring harness clear and place to left side.
- Pull out oil dipstick -1-.



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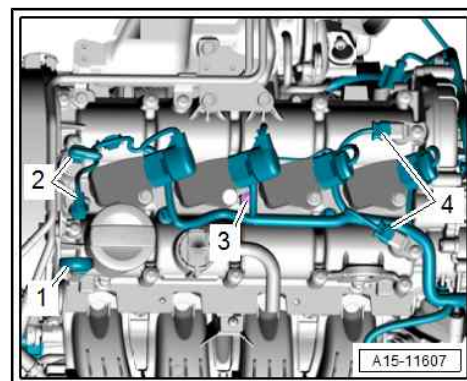
Version with cylinder shut-off:

- Unplug electrical connectors:
2 - For camshaft control valve 1 - N205- / exhaust camshaft control valve 1 - N318-
4 - For cam actuators -N583- ... -N597-
5 - For Hall sender - G40- / Hall sender 2 - G163-
- Remove bolt -3-, move wiring harness clear and place to left side.
- Pull out oil dipstick -1-.



Version with two camshaft adjusters:

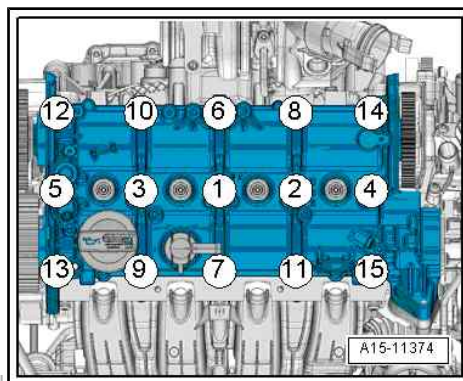
- Unplug electrical connectors:
2 - For camshaft control valve 1 - N205- / exhaust camshaft control valve 1 - N318-
4 - For Hall sender - G40- / Hall sender 2 - G163-
- Remove bolt -3-, move wiring harness clear and place to left side.
- Pull out oil dipstick -1-.





All versions (continued):

- Loosen and remove bolts for camshaft housing in the sequence -15 ... 1-.
- Carefully release camshaft housing from bonded joint and detach.
- Mark original positions of roller rocker fingers and compensation elements for re-installation.
- Remove roller rocker fingers together with compensation elements and put down on a clean surface.

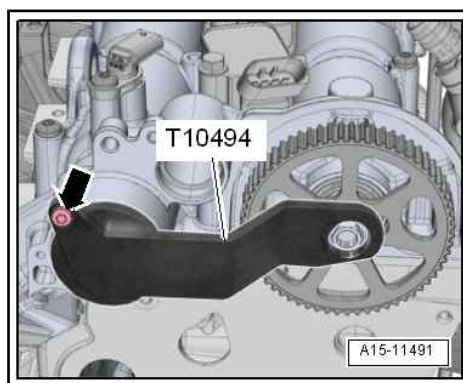


Installing

- After removing, renew bolts tightened with specified tightening angle.
- Renew gasket and seal with oil strainer.
- Check "TDC" position of camshaft and crankshaft:

Version without cylinder shut-off:

- Camshaft clamp - T10494- must be fitted to camshaft housing.



Version with cylinder shut-off:

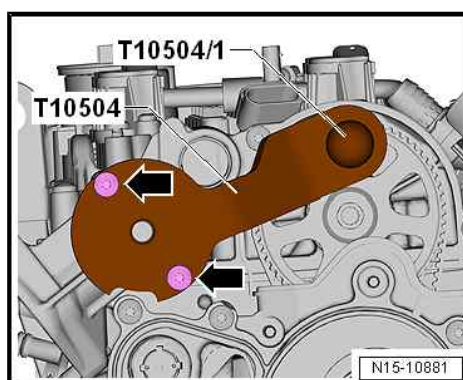
- Camshaft clamp - T10504- with locating pin -T10504/1- must be fitted to camshaft housing.

All engine versions (continued):

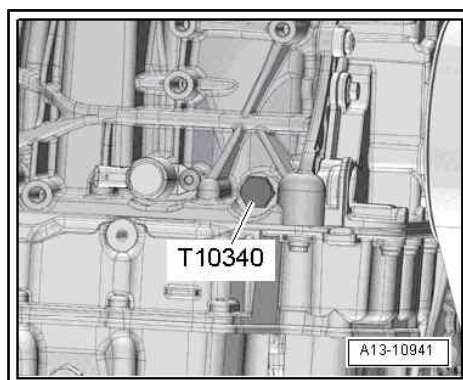


Risk of damage to valve gear if camshafts are moved axially.

- Never move camshafts axially when turning.

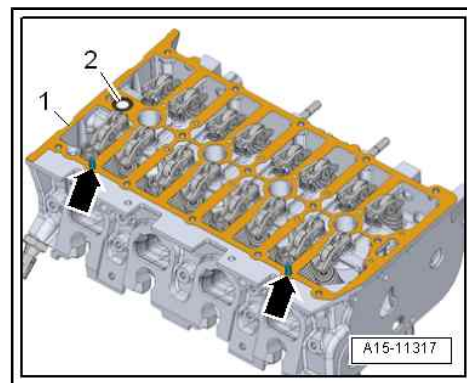


- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.





- Make sure that all roller rocker fingers make contact with the valve ends correctly and are clipped into their respective support elements.
- If originally fitted, fit oil strainer -2- into cylinder head -1-.
- Fit gasket onto dowel pins -arrows-.

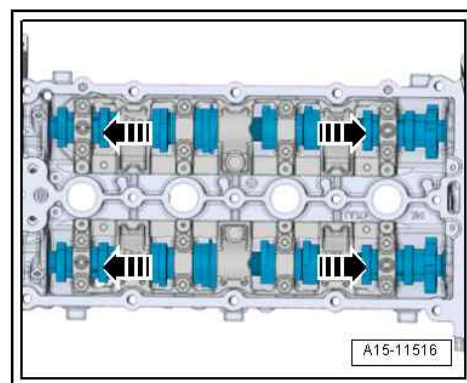


Version with cylinder shut-off:



Irreparable engine damage can be caused if sliders are installed in wrong position.

- Move sliders into correct installation position.
- Bring camshaft sliders into installation position -arrows-:
- Sliders must be moved towards both ends of each camshaft.



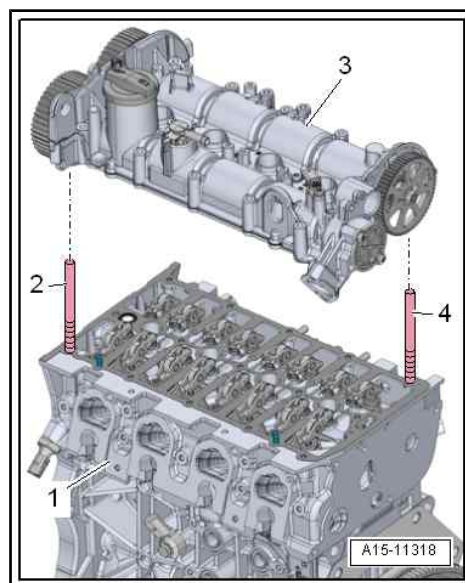
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**All versions (continued):**

- Screw 2 studs -items 2, 4- (e.g. -T10288/4-) into cylinder head.
- Carefully lower camshaft housing -3- vertically onto studs in cylinder head, taking care not to tilt it.
- Tighten camshaft housing bolts
⇒ [Fig. ““Camshaft housing -tightening torque and sequence””, page 165](#) .

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

- Install high-pressure pipe
⇒ [“6.3 Removing and installing high-pressure pipe”, page 313](#) .
- Install toothed belt (adjust valve timing)
⇒ [“1.3 Detaching toothed belt from camshaft”, page 80](#) .
- Install ignition coils
⇒ [“1.3 Removing and installing ignition coils with output stages”, page 329](#) .
- Install coolant pump
⇒ [“2.5 Removing and installing coolant pump”, page 237](#) .
- Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install air pipe
⇒ [“3.1 Exploded view - intake manifold”, page 292](#) .
- Install engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#) .

**NOTICE**

Risk of 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.

Tightening torques

- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 290](#)

2.5 Checking compression

Special tools and workshop equipment required

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- ◆ Spark plug spanner - 3122 B-



- ◆ Compression tester - V.A.G 1763-



Procedure

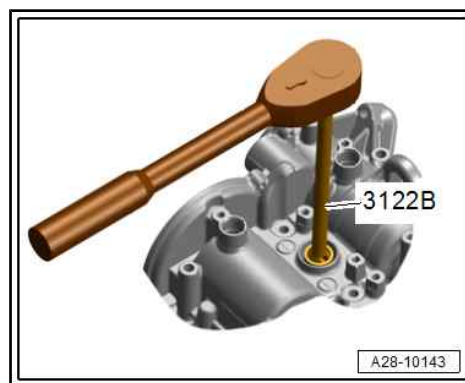
- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Remove ignition coils
⇒ [“1.3 Removing and installing ignition coils with output stages”, page 329](#) .



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- Remove spark plugs with spark plug spanner - 3122 B- .
- Unplug electrical connector for engine speed sender - G28-
⇒ [“1.6 Removing and installing engine speed sender G28”](#),
[page 334](#) .
- Check compression pressure with compression tester -
V.A.G 1763- (see ⇒ operating instructions for details of how
to use tester).
- Have a second 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 ... 15.0
Wear limit	7.0
Maximum difference between cylinders	3.0

Assembling

Assembly is performed in reverse sequence; note the following:

- Install spark plugs ⇒ Maintenance ; Booklet 819 .
- Install ignition coils
⇒ [“1.3 Removing and installing ignition coils with output
stages”](#), [page 329](#) .
- Erase any entries in event memory resulting from testing ⇒ Ve-
hicle diagnostic tester, Interrogate event memory.

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3 Valve gear

⇒ [“3.1 Exploded view - valve gear”, page 177](#)

⇒ [“3.2 Measuring axial clearance of camshaft”, page 178](#)

⇒ [“3.3 Removing and installing camshaft oil seal”, page 179](#)

⇒ [“3.4 Removing and installing cam actuators”, page 187](#)

⇒ [“3.5 Removing and installing camshaft control valve 1 N205”, page 189](#)

⇒ [“3.6 Removing and installing exhaust camshaft control valve 1 N318”, page 189](#)

⇒ [“3.7 Removing and installing valve stem oil seals”, page 189](#)

3.1 Exploded view - valve gear

1 - Inlet valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Valve dimensions
⇒ [“4.3 Valve dimensions”, page 198](#)
- ☐ Checking valve guides
⇒ [“4.1 Checking valve guides”, page 197](#)

2 - Exhaust valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Valve dimensions
⇒ [“4.3 Valve dimensions”, page 198](#)
- ☐ Checking valve guides
⇒ [“4.1 Checking valve guides”, page 197](#)

3 - Cylinder head

4 - Valve stem oil seal

- ☐ Renewing
⇒ [“3.7 Removing and installing valve stem oil seals”, page 189](#)

5 - Valve spring

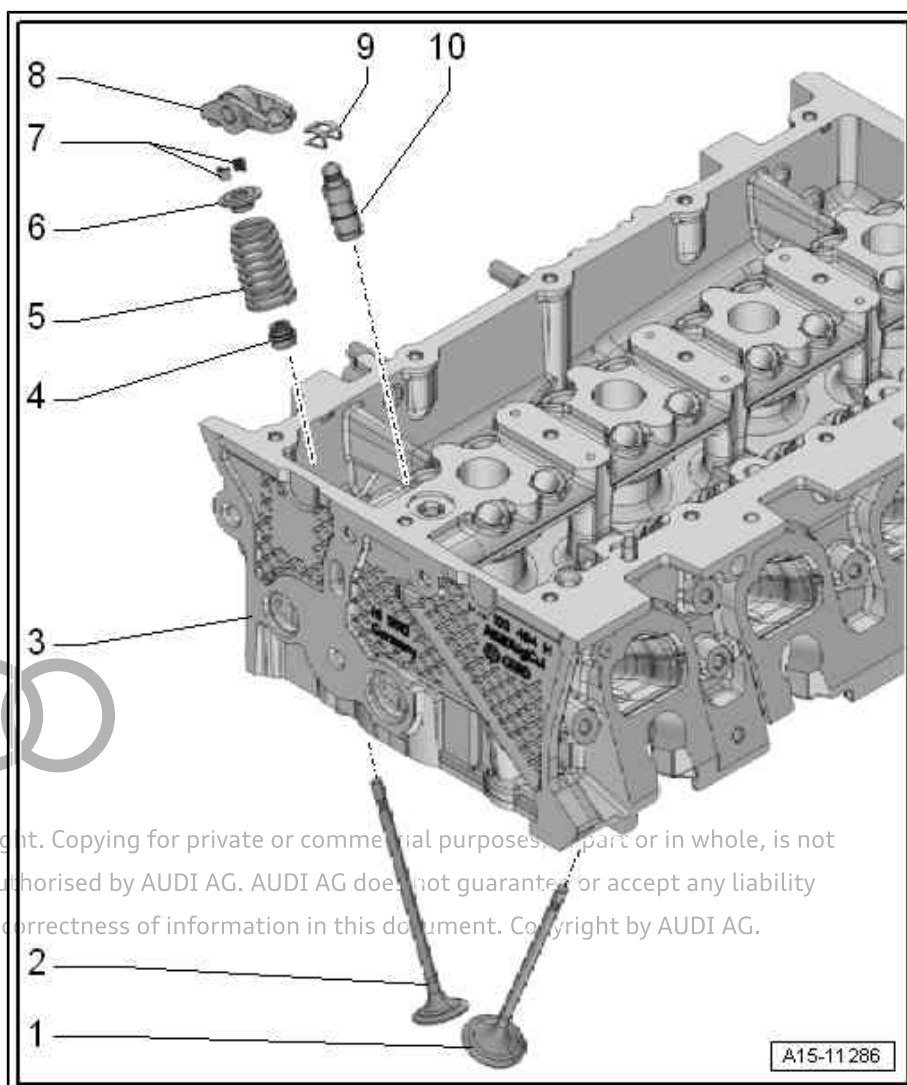
- ☐ Installation position
⇒ [Fig. 1 “Position of valve spring”, page 178](#)

6 - Valve spring plate

7 - Valve cotters

8 - Roller rocker finger

- ☐ Removing and installing
⇒ [“2.4 Removing and installing camshaft housing”, page 169](#)
- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surfaces before installing





9 - Securing clip

- ☐ For hydraulic compensation element

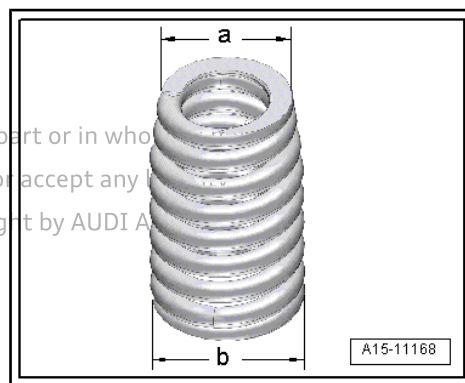
10 - Hydraulic compensation element

- ☐ Do not interchange
- ☐ Lubricate contact surface

Position of valve spring

- The smaller $\varnothing$ -a- faces the valve spring plate.
- The larger $\varnothing$ -b- faces the cylinder head.

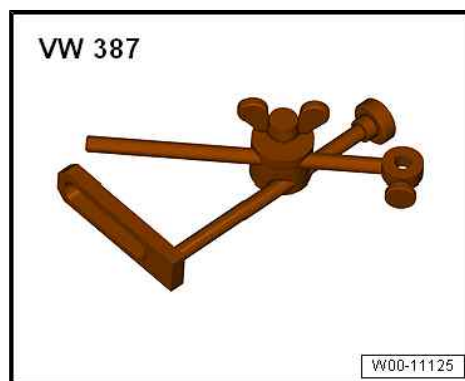
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3.2 Measuring axial clearance of camshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-



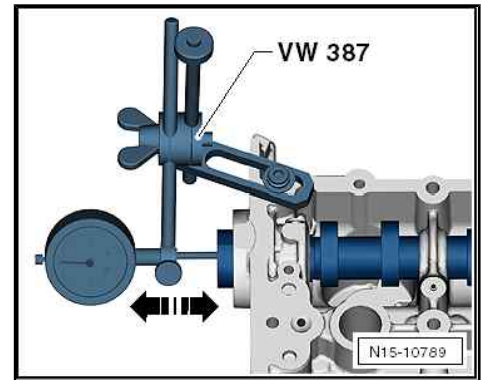


Procedure

- Remove camshaft housing
⇒ [“2.4 Removing and installing camshaft housing”](#),
[page 169](#).
- Secure universal dial gauge bracket - VW 387- with dial gauge
- VAS 6080- to camshaft housing, as shown in illustration.
- Press camshaft against dial gauge by hand.
- Set dial gauge to “0”.
- Press camshaft away from dial gauge and read off value:

Axial clearance:

- Wear limit: 0.25 mm.



3.3 Removing and installing camshaft oil seal

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⇒ [“3.3.1 Removing and installing inlet camshaft oil seal”](#),
[page 179](#)

⇒ [“3.3.2 Removing and installing exhaust camshaft oil seal \(pulley end\)”](#), [page 181](#)

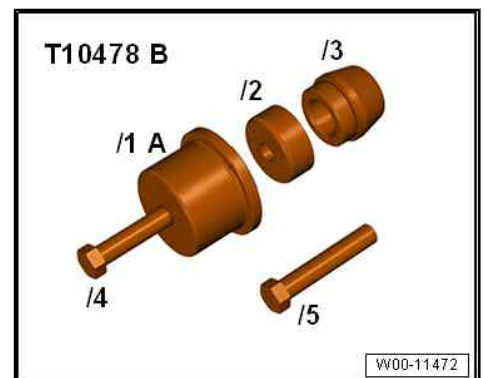
⇒ [“3.3.3 Removing and installing exhaust camshaft oil seal \(gear-box end\) - version without cylinder shut-off”](#), [page 184](#)

⇒ [“3.3.4 Removing and installing exhaust camshaft oil seal \(gear-box end\) - version with cylinder shut-off”](#), [page 186](#)

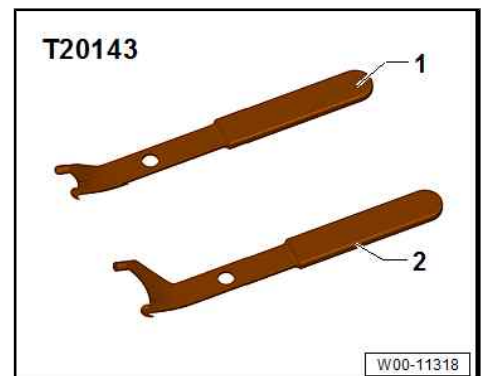
3.3.1 Removing and installing inlet camshaft oil seal

Special tools and workshop equipment required

- ◆ Assembly tool - T10478 B-



- ◆ Extractor tool - T20143-



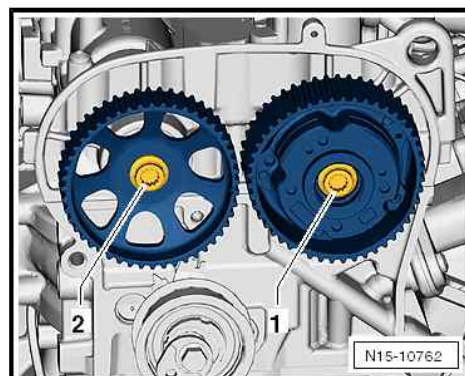


Removing

- Detach toothed belt from camshafts
⇒ [“1.3 Detaching toothed belt from camshaft”, page 80](#) .

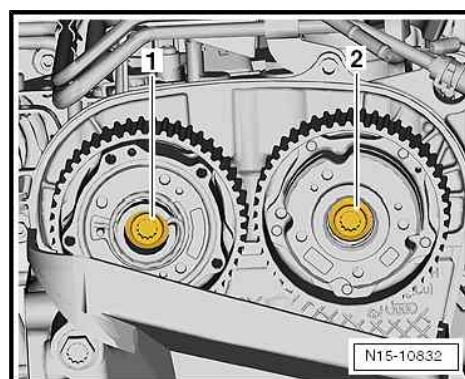
Version with one camshaft adjuster:

- Unscrew bolt -1- and remove camshaft sprocket.



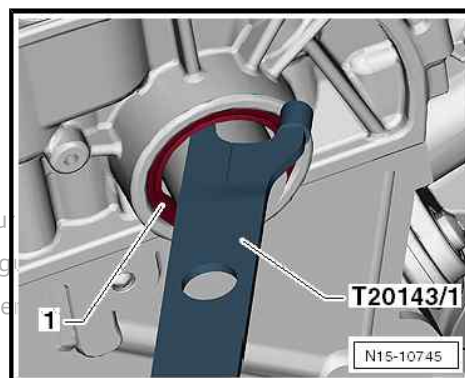
Version with two camshaft adjusters:

- Unscrew bolt -2- and remove camshaft sprocket.



All versions (continued):

- Pull out oil seal -1- using extractor tool -T20143/1- .

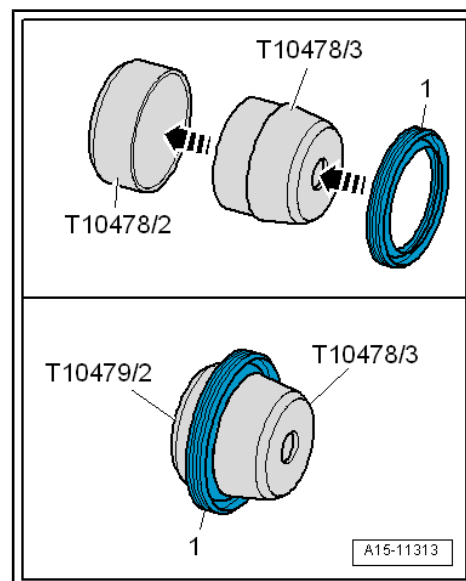


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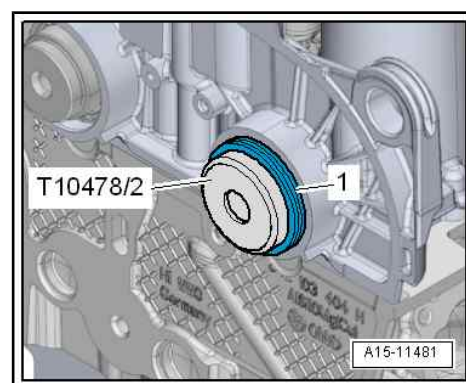


Installing

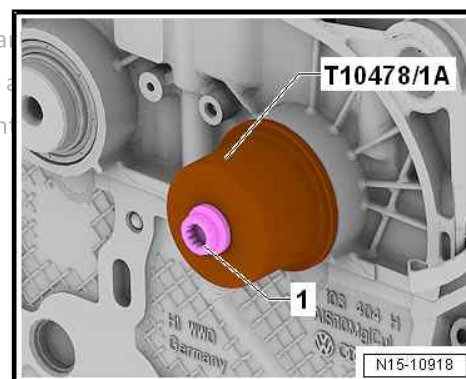
- Do not lubricate new oil seal.
- Slide oil seal -1- over fitting sleeve -T10478/3- onto guide sleeve -T10478/2- .
- Fitting position: closed side of oil seal faces guide sleeve.
- Detach fitting sleeve from guide sleeve.



- Fit guide sleeve -T10478/2- with oil seal -1- onto camshaft.



- Use thrust piece -T10478/1A- and bolt -1- for camshaft sprocket to pull in oil seal onto stop.
 - Install toothed belt (adjust valve timing)
- => **1.3 Detaching toothed belt from camshaft**, page 80

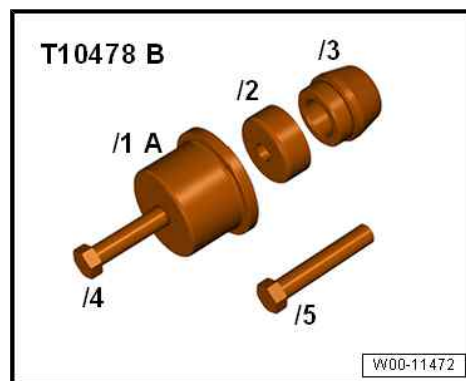


3.3.2 Removing and installing exhaust camshaft oil seal (pulley end)

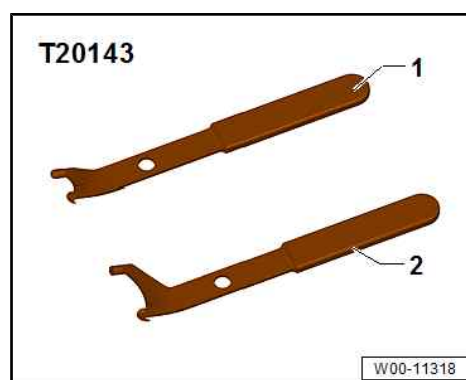
Special tools and workshop equipment required



- ◆ Assembly tool - T10478 B-



- ◆ Extractor tool - T20143-



Removing

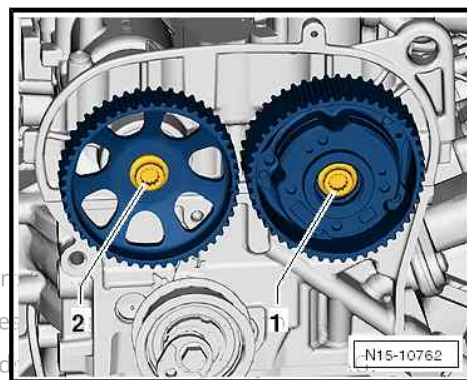
- Detach toothed belt from camshafts
⇒ [“1.3 Detaching toothed belt from camshaft”, page 80](#) .

Version with one camshaft adjuster:

- Unscrew bolt -1- and remove camshaft sprocket.

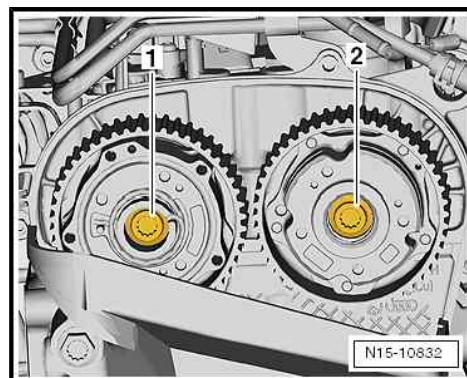


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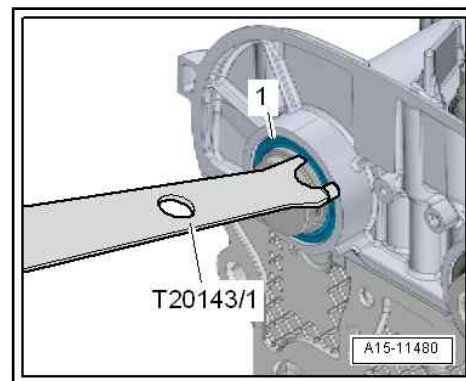
Version with two camshaft adjusters:

- Remove engine support
⇒ [“1.5 Removing and installing engine support”, page 48](#) .
- Unscrew bolt -1- and remove camshaft sprocket.



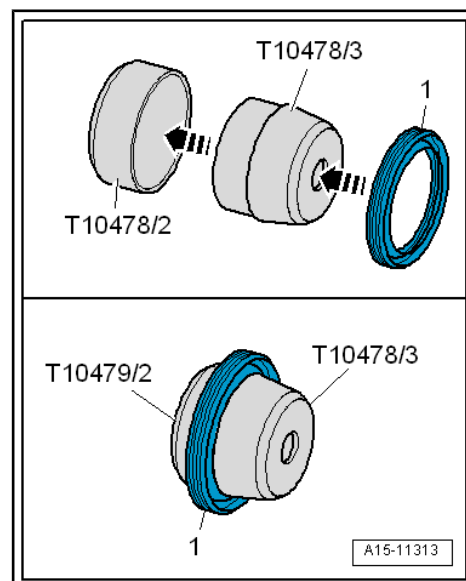


- Pull out oil seal -1- using extractor tool -T20143/1- .



Installing

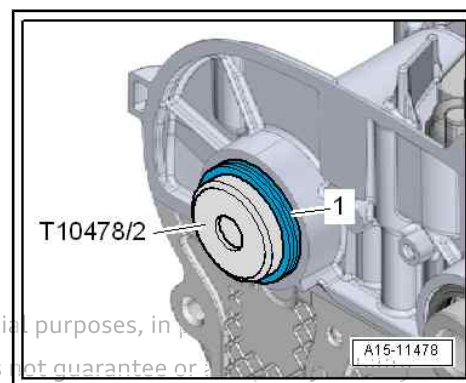
- Do not lubricate new oil seal.
- Slide oil seal -1- over fitting sleeve -T10478/3- onto guide sleeve -T10478/2- .
- Fitting position: closed side of oil seal faces guide sleeve.
- Detach fitting sleeve from guide sleeve.



- Fit guide sleeve -T10478/2- with oil seal -1- onto camshaft.



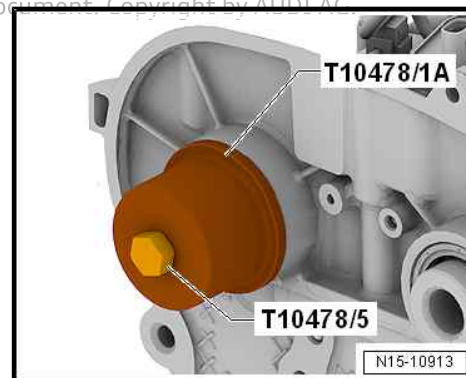
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- Pull in thrust piece -T10478/1A- with bolt -T10478/5- as far as stop.
- Install toothed belt (adjust valve timing)
⇒ [“1.3 Detaching toothed belt from camshaft”, page 80](#) .

Version with two camshaft adjusters:

- Install engine support
⇒ [“1.5 Removing and installing engine support”, page 48](#) .





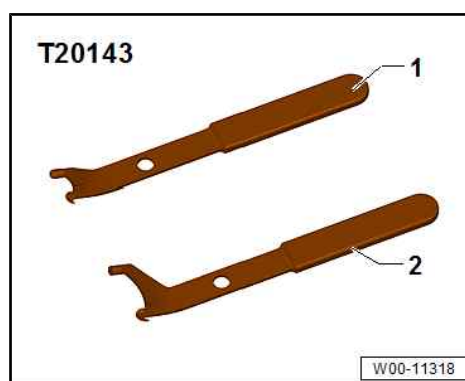
3.3.3 Removing and installing exhaust camshaft oil seal (gearbox end) - version without cylinder shut-off

Special tools and workshop equipment required

- ◆ Assembly tool - T10479 A



- ◆ Extractor tool - T20143-



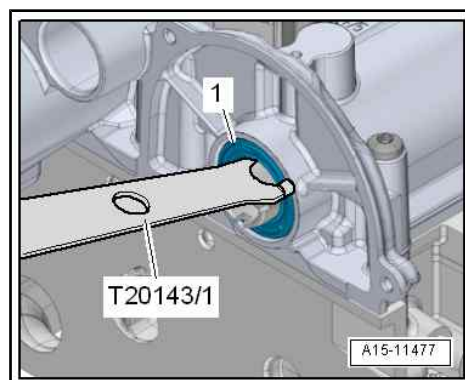
Removing



NOTICE

Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

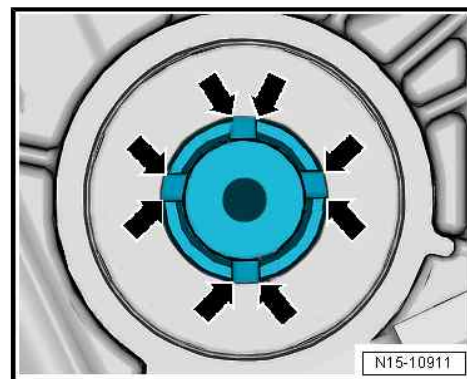
- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Remove toothed belt sprocket for coolant pump
⇒ ["2.7 Removing and installing toothed belt sprocket for coolant pump", page 244](#) .
- Carefully slide extractor tool -T20143/1- between camshaft and oil seal -1-.
- Pry out oil seal.



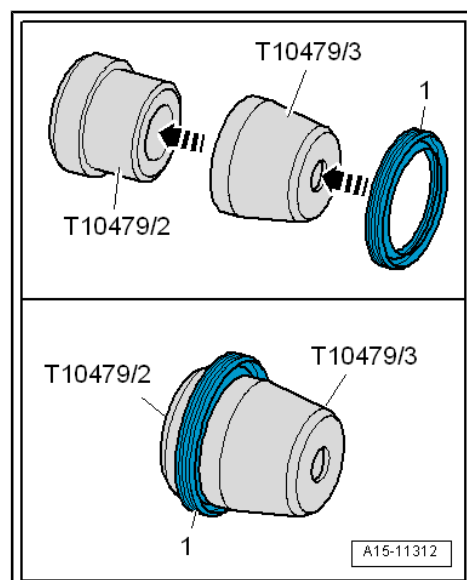


Installing

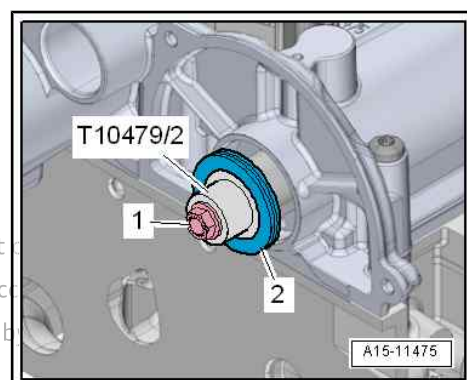
- If necessary, use fine sandpaper (grit 220 ... 1000) to remove any burrs that have formed on the outside of the outer grooves on the exhaust camshaft -arrows-.
- Do not lubricate new oil seal.



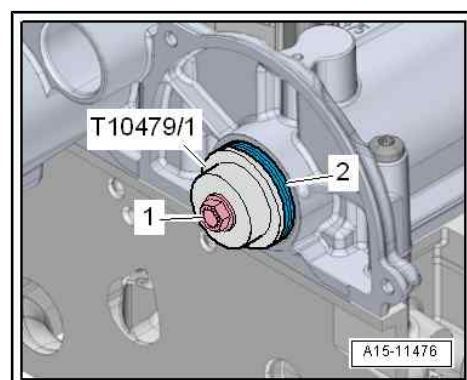
- Slide oil seal -1- over fitting sleeve -T10479/3- onto guide sleeve -T10479/2- .
- Fitting position: closed side of oil seal faces guide sleeve.
- Detach fitting sleeve from guide sleeve.



- Fit guide sleeve -T10479/2- with oil seal -2- onto camshaft so that it is centred.
- Secure guide sleeve onto camshaft using bolt -1- for coolant pump drive sprocket.
- Slide oil seal onto camshaft and unbolt guide sleeve.



- Use thrust piece -T10479/1- and bolt -1- for coolant pump drive sprocket to pull in oil seal -2- onto stop.
- Install toothed belt sprocket for coolant pump
⇒ ["2.7 Removing and installing toothed belt sprocket for coolant pump", page 244](#) .



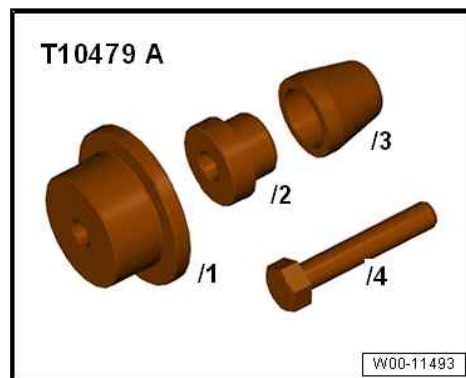
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3.3.4 Removing and installing exhaust camshaft oil seal (gearbox end) - version with cylinder shut-off

Special tools and workshop equipment required

- ◆ Assembly tool - T10479-



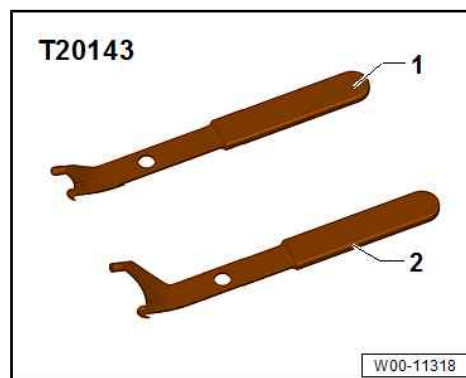
- ◆ Assembly sleeve - T10505-



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- ◆ Extractor tool - T20143-



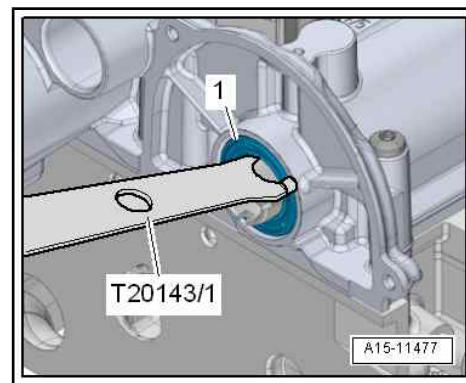


Removing

! NOTICE

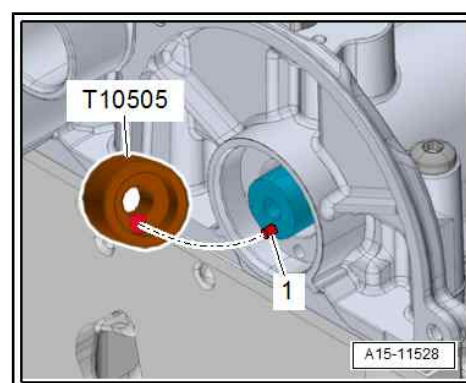
Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.

- Cover coolant pump with a cloth.
- Catch escaping engine oil with a cloth.
- Remove toothed belt drive sprocket for coolant pump
⇒ ["2.7 Removing and installing toothed belt sprocket for coolant pump", page 244](#) .
- Carefully slide extractor tool -T20143/1- between camshaft and oil seal -1-.
- Pry out oil seal.

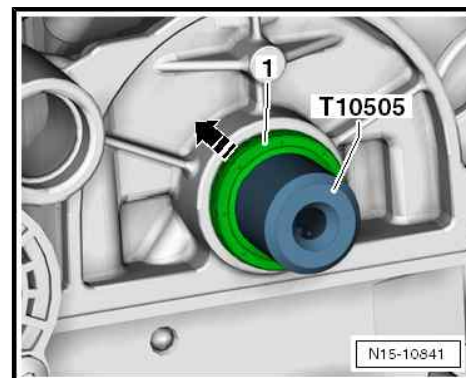


Installing

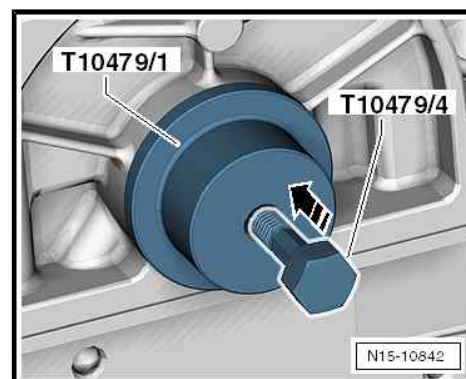
- Do not lubricate new oil seal.
- Fit assembly tool - T10505- onto exhaust camshaft.
- Pin -1- on camshaft must engage in recess on assembly tool.



- Fit oil seal -1- onto camshaft housing -arrow-.
- Installation position: open side of oil seal faces camshaft housing.



- Pull in oil seal onto stop using press tool -T10479/1- and bolt -T10479/4- .
- Install toothed belt drive sprocket for coolant pump
⇒ ["2.7 Removing and installing toothed belt sprocket for coolant pump", page 244](#) .



3.4 Removing and installing cam actuators

The following procedure applies to the version with cylinder shut-off.

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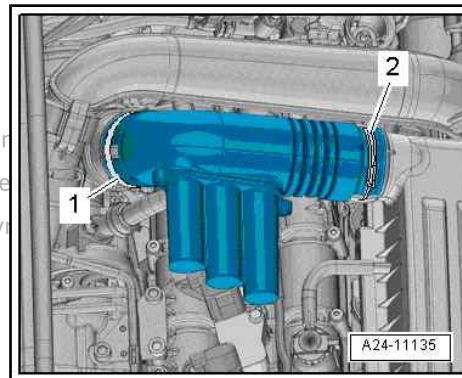


Removing

- Remove engine cover panel
⇒ ["3.1 Removing and installing engine cover panel", page 39](#).

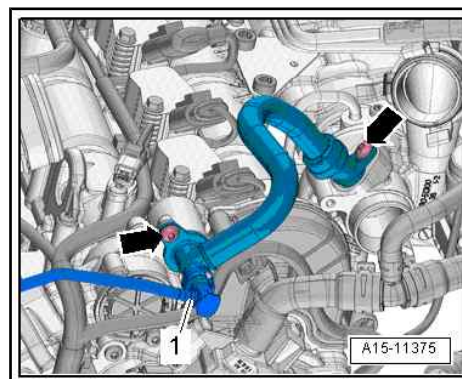
- Loosen hose clips -1, 2- and remove air pipe.

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Exhaust cam actuator, cylinder 3:

- Remove bolts -arrows-, detach crankcase breather hose (with hose -1- going to activated charcoal filter attached) and push slightly to one side.

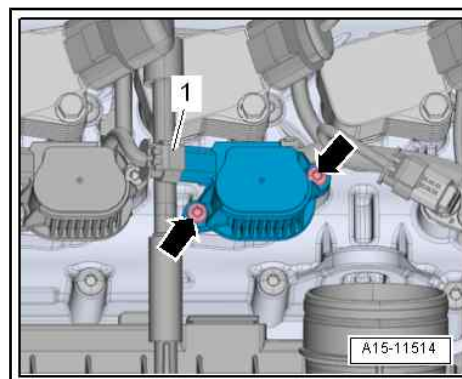


Continued for all cam actuators:

- Unplug relevant electrical connector -1-.
- Remove bolts -arrows- and detach cam actuator.

Installing

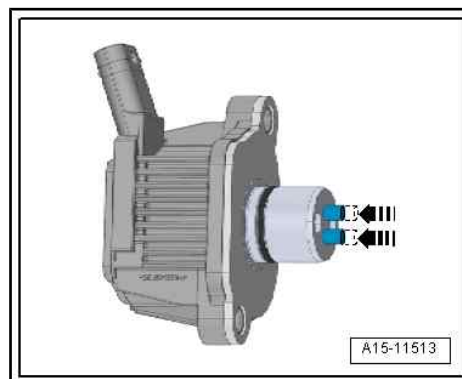
Installation is carried out in reverse order; note the following:



- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Renew O-rings.
- Bring pins of actuators for camshaft adjustment into installation position.
- Pins of all actuators must be inserted completely -arrows-.

Tightening torques

- ⇒ ["3.1 Exploded view - valve gear", page 177](#)
- ⇒ ["1.1 Exploded view - turbocharger", page 260](#)





3.5 Removing and installing camshaft control valve 1 - N205-

Removing

- Remove engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#).
- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove camshaft control valve 1 - N205-.

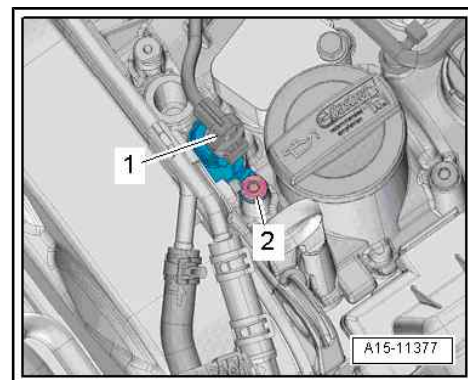
Installing

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

- Renew O-ring.

Tightening torques

- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)



3.6 Removing and installing exhaust camshaft control valve 1 - N318-

Removing

- Remove engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#).
- Unplug electrical connector -3-.
- Remove bolt -4- and remove exhaust camshaft control valve 1 - N318-.

Installing

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

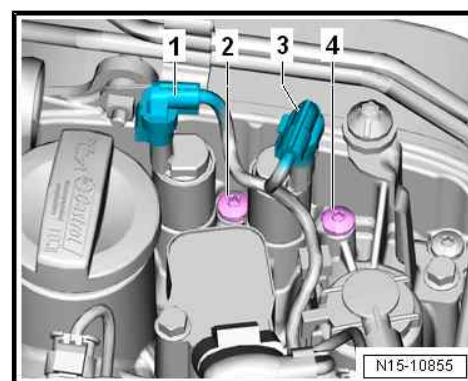


Note

Renew O-ring.

Tightening torques

- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)



3.7 Removing and installing valve stem oil seals

⇒ [“3.7.1 Removing and installing valve stem oil seals \(cylinder head installed\)”, page 189](#)

⇒ [“3.7.2 Removing and installing valve stem oil seals \(cylinder head removed\)”, page 193](#)

3.7.1 Removing and installing valve stem oil seals (cylinder head installed)

Special tools and workshop equipment required

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- ◆ Spark plug spanner - 3122 B-



- ◆ Valve stem oil seal fitting tool - 3365-



- ◆ Removal and installation device for valve cotters - VAS 5161 A- with set -VAS 5161 A/32-



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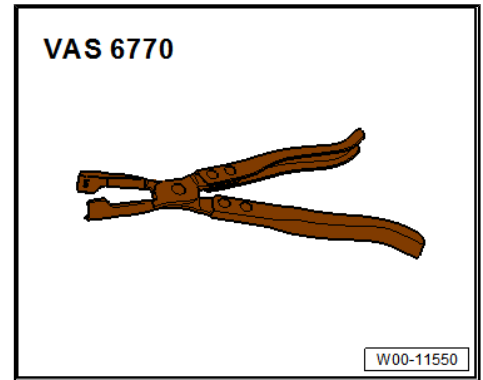


- ◆ Adapter - T40012-



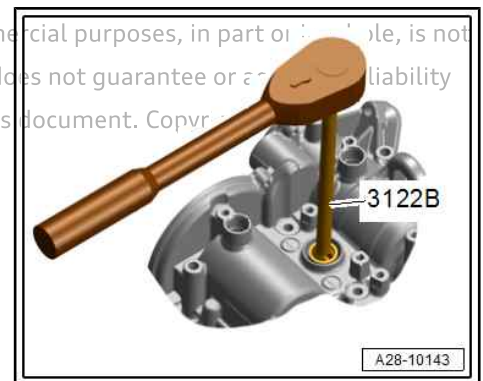


◆ Valve shaft pliers - VAS 6770-

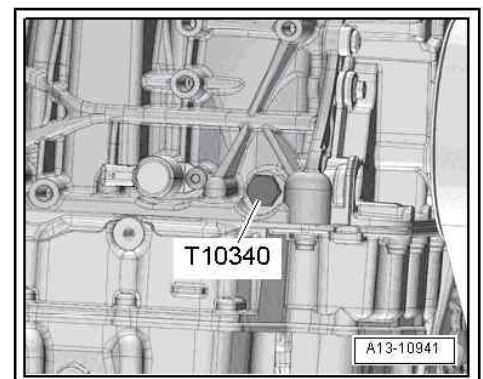


Procedure

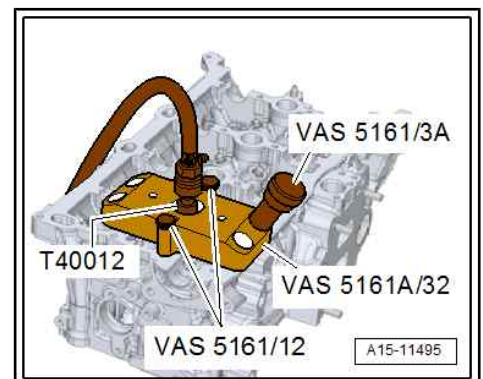
- Remove camshaft housing
⇒ ["2.4 Removing and installing camshaft housing", page 169](#).
- Unscrew spark plugs using spark plug socket - 3122 B- .



- Remove locking pin - T10340- .
- Set piston of appropriate cylinder to "bottom dead centre".

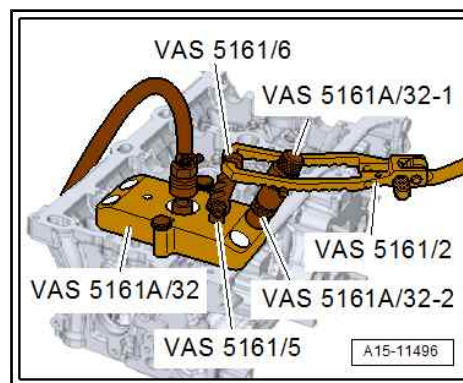


- Fit guide plate -VAS 5161 A/32- onto cylinder head and secure with knurled screws -VAS 5161/12- .
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.
- Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
 - Minimum pressure: 6 bar
- Apply drift -VAS 5161/3A- to guide plate and use plastic-headed hammer to release sticking valve cotters.





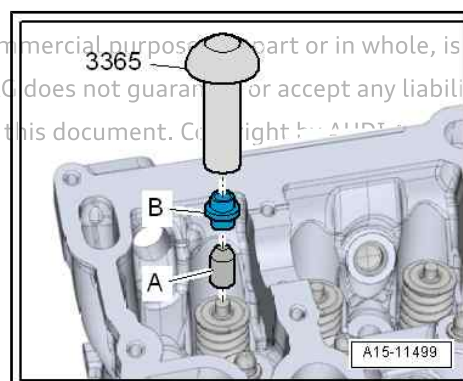
- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161 A/32-1- (slide on sleeve -VAS 5161 A/32-2-) in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled 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 shaft pliers - VAS 6770- .



NOTICE

Risk of damage to valve stem oil seals if installed incorrectly.

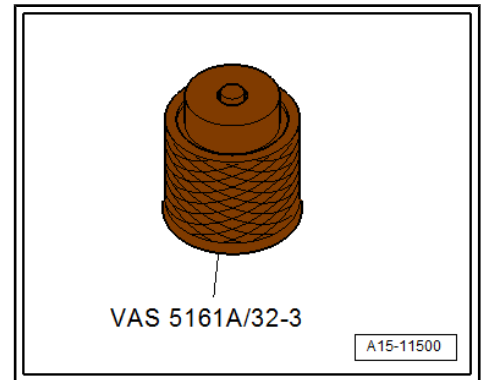
- Install new valve stem oil seals using the plastic sleeve supplied.
- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal -B- onto plastic sleeve -A-.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.



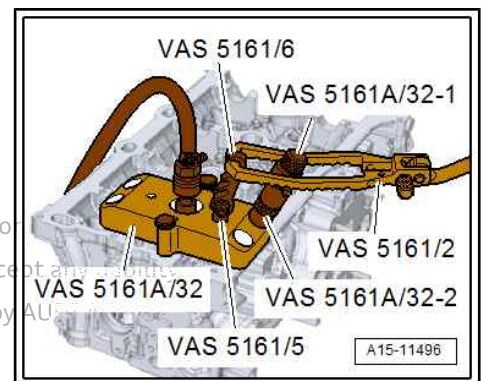


If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161 A/32-3- .

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and pick up valve cotters.
- Insert valve spring and valve spring plate; installation position of valve spring ⇒ [Fig. "Position of valve spring", page 178](#) .



- Secure guide plate -VAS 5161 A/32- back onto cylinder head.
- Insert assembly cartridge -VAS 5161 A/32-1- with sleeve -VAS 5161 A/32-2- into guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.



- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Install spark plugs ⇒ Maintenance ; Booklet 819 .
- Install camshaft housing
⇒ ["2.4 Removing and installing camshaft housing", page 169](#) .

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

Special tools and workshop equipment required

- ◆ Valve stem oil seal fitting tool - 3365-





- ◆ Removal and installation device for valve cotters - VAS 5161 A- with set -VAS 5161/32-

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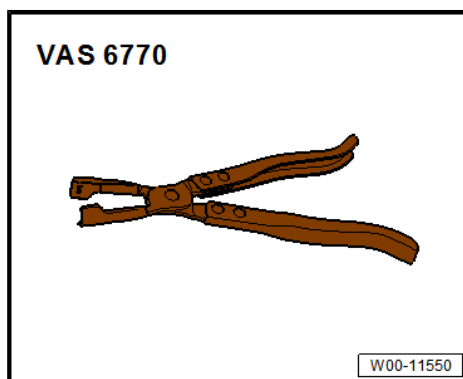
- ◆ Engine and gearbox support - VAS 6095-



- ◆ Cylinder head tensioning device - VAS 6419-



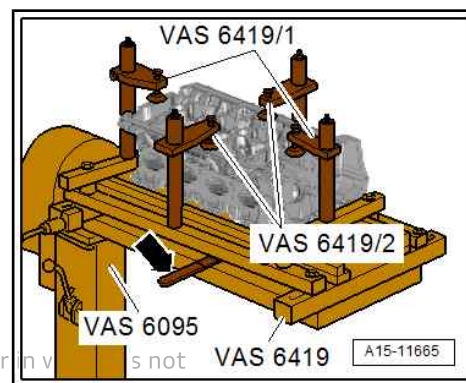
- ◆ Valve shaft pliers - VAS 6770-





Procedure

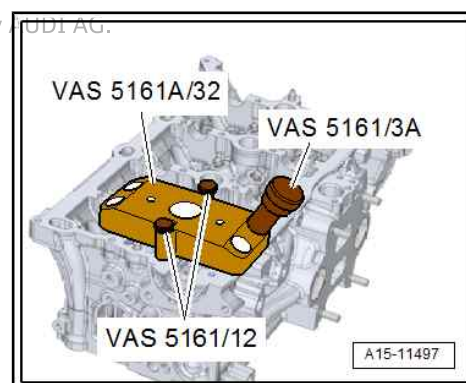
- Insert cylinder head tensoning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensoning device, as shown in illustration.
- Connect cylinder head tensoning device to compressed air supply.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.



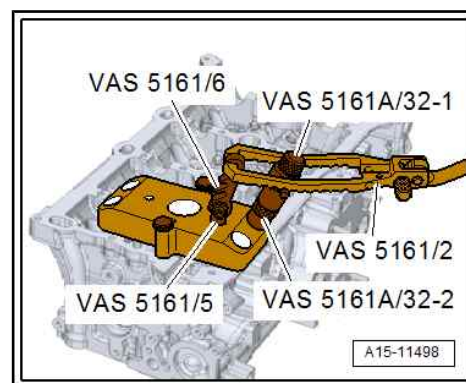
Apply just enough compressed air to bring air pad into contact with valve heads.

Fit guide plate -VAS 5161 A/32- onto cylinder head and secure with knurled screws -VAS 5161/12- .

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



- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161 A/32-1- (slide on sleeve -VAS 5161 A/32-2-) 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 shaft pliers - VAS 6770- .



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NOTICE

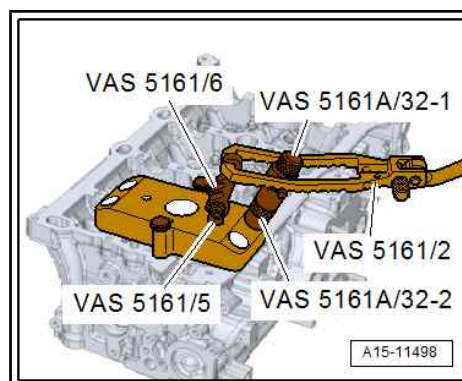
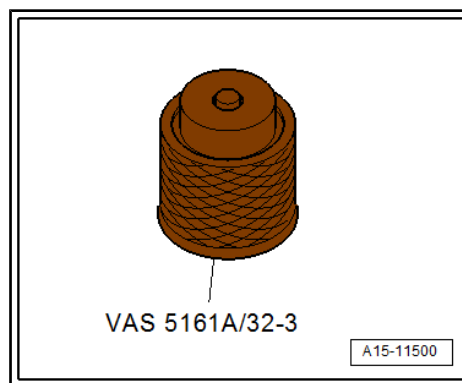
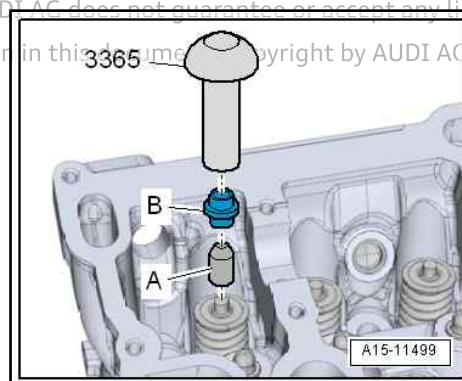
Risk of damage to valve stem oil seals if installed incorrectly.

- Install new valve stem oil seals using the plastic sleeve supplied.
- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal -B- onto plastic sleeve -A-.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.

If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161 A/32-3- .

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and pick up valve cotters.
- Insert valve spring and valve spring plate; installation position of valve spring ⇒ [Fig. "Position of valve spring", page 178](#) .

- Secure guide plate -VAS 5161 A/32- back onto cylinder head.
- Insert assembly cartridge -VAS 5161 A/32-1- with sleeve -VAS 5161 A/32-2- into guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.





4 Inlet and exhaust valves

⇒ ["4.1 Checking valve guides", page 197](#)

⇒ ["4.2 Checking valves", page 197](#)

⇒ ["4.3 Valve dimensions", page 198](#)

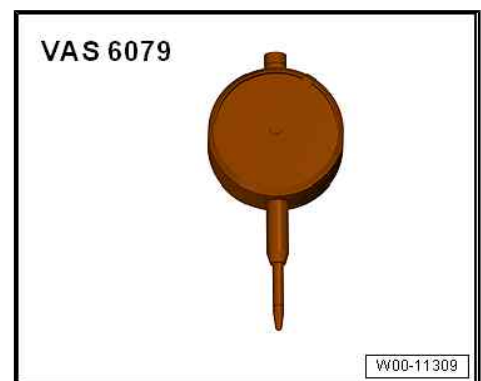
4.1 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

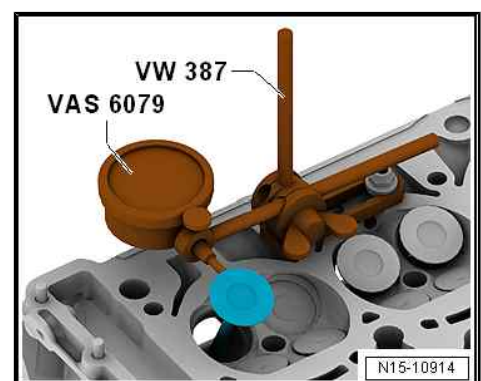


- ◆ Dial gauge - VAS 6079-



Test sequence

- Insert valve into guide. End of valve stem must be flush with guide. Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.
- Measure the amount of sideways play.
 - Wear limit: 0.5 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.



4.2 Checking valves

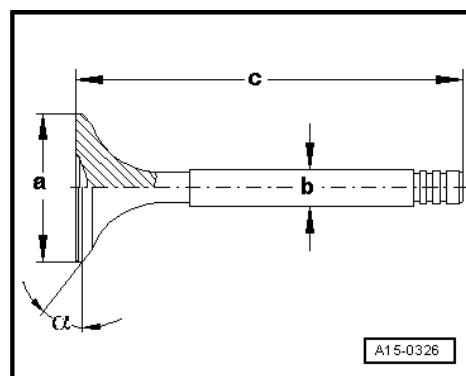
- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.



4.3 Valve dimensions

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

Dimension		Inlet valve	Exhaust valve
Ø a	mm	28.5	25.0
Ø b	mm	4.973	4.963
c	mm	110.25	110.09
α	°	45	30



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17 – Lubrication

1 Sump/oil pump

⇒ [“1.1 Exploded view - sump/oil pump”, page 199](#)

⇒ [“1.6 Removing and installing oil level and oil temperature sender G266”, page 208](#)

⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 202](#)

⇒ [“1.5 Removing and installing oil pump”, page 207](#)

⇒ [“1.4 Removing and installing sump \(top section\)”, page 205](#)

⇒ [“1.2 Engine oil”, page 202](#)

1.1 Exploded view - sump/oil pump

- 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 passages carefully and renew the oil spray jets, engine oil cooler and oil filter.
- Oil spray jet and pressure relief valve
⇒ [“4.3 Removing and installing oil spray jets”, page 72](#)



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**1 - Nut**

- ☐ 9 Nm

2 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing
⇒ ["1.6 Removing and installing oil level and oil temperature sender G266", page 208](#)

3 - Seal

- ☐ Renew after removing

4 - Oil drain plug

- ☐ With attached seal on new vehicles
- ☐ Renewed when first oil change is performed
- ☐ The oil drain plug with separate seal (fitted when first oil change is performed) can be re-used
- ☐ 30 Nm

5 - Seal

- ☐ For oil drain plug, fitted when first oil change is performed
- ☐ Renew after removing

6 - Sump (bottom section)

- ☐ Removing and installing
⇒ ["1.3 Removing and installing sump \(bottom section\)", page 202](#)

7 - Bolt

- ☐ Renew after removing
- ☐ 5 Nm +90°

8 - Dowel sleeve

- ☐ 2x

9 - Cover

- ☐ For oil pump drive chain sprocket

10 - Drive chain

- ☐ For oil pump
- ☐ Before removing, mark running direction with paint

11 - Bolt

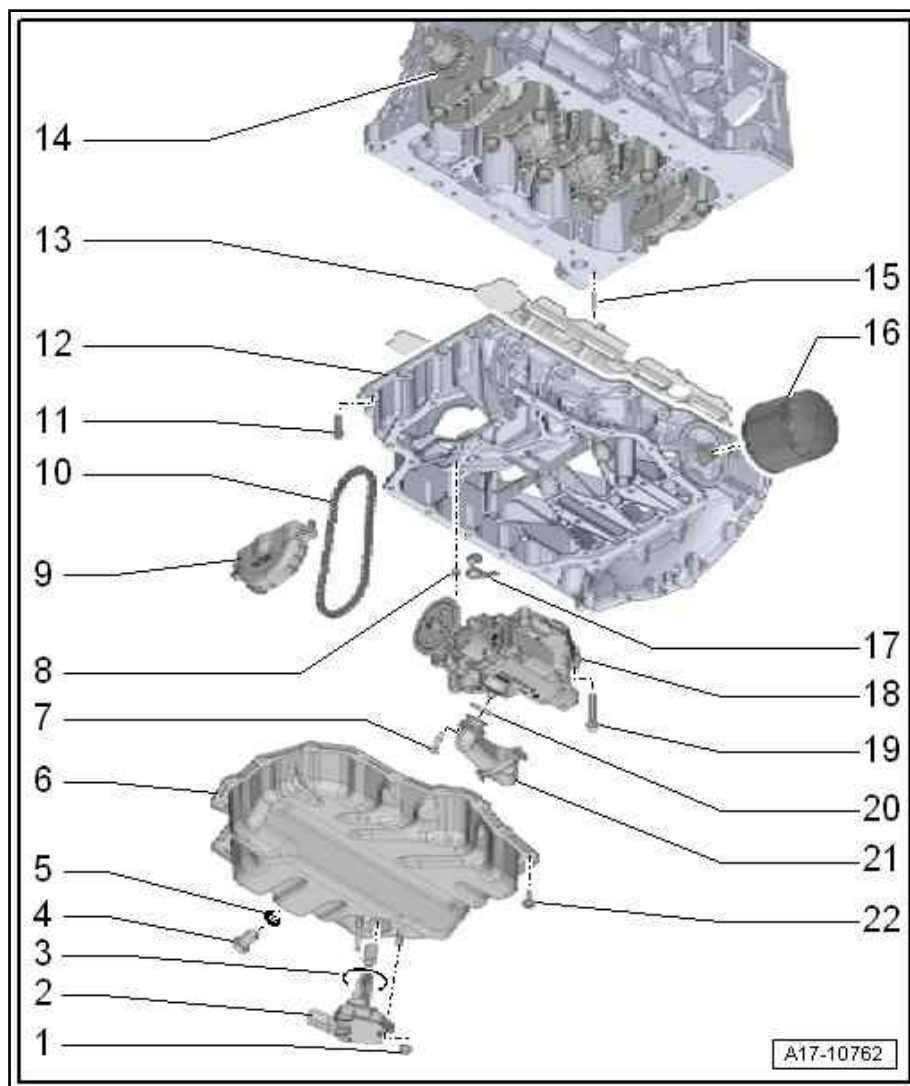
- ☐ Renew after removing
- ☐ Tightening torque and sequence
⇒ [Fig. "Sump \(top section\) - tightening torque and sequence", page 202](#)

12 - Sump (top section)

- ☐ Removing and installing ⇒ ["1.4 Removing and installing sump \(top section\)", page 205](#)

13 - Baffle plate**14 - Chain sprocket**

- ☐ For oil pump drive





15 - Dowel pin

16 - Oil filter

- ☐ ⇒ Fig. ““Securing threaded connection for oil filter””, page 216

17 - Seal

- ☐ With oil strainer

18 - Oil pump

- ☐ Removing and installing ⇒ “1.5 Removing and installing oil pump”, page 207

19 - Bolt

- ☐ 10 Nm

20 - O-ring

- ☐ Renew after removing

21 - Oil intake pipe

- ☐ Clean strainer if dirty

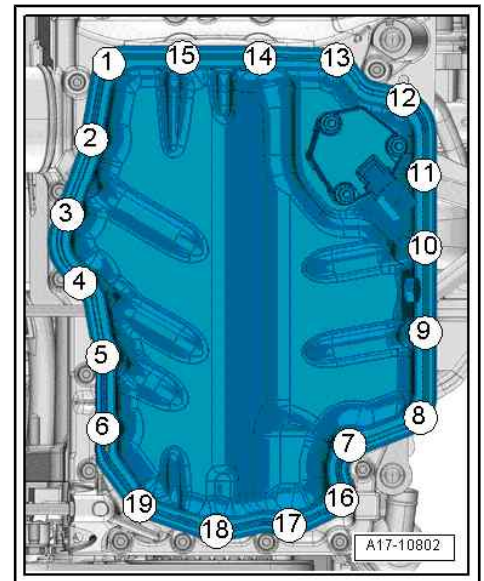
22 - Bolt

- ☐ Renew after removing
- ☐ Tightening sequence ⇒ Fig. ““Sump (bottom section) - tightening torque and sequence””, page 201

Sump (bottom section) - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 ... 19-	Screw in by hand until contact is made
2.	-1 ... 19-	12 Nm

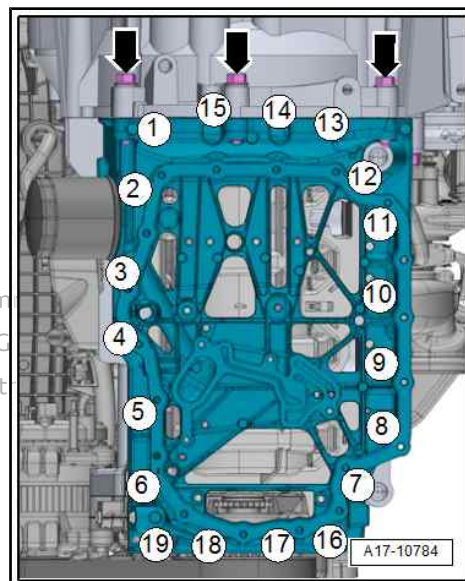


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**Sump (top section) - tightening torque and sequence**

- Renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

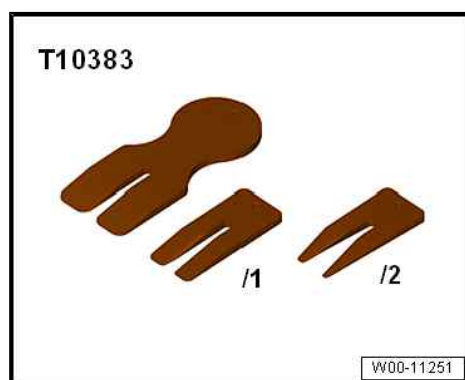
Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 19-	Screw in by hand until contact is made
2.	-Arrows-	Screw in by hand until contact is made
3.	-1 ... 19-	8 Nm
4.	-1 ... 19-	Turn 90° further
5.	-Arrows-	Tightening torque ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox

**1.2 Engine oil**

For engine oil capacity, oil specifications and viscosity grades, refer to ⇒ Maintenance tables or ⇒ Technical data for engines; Rep. gr. 00 ; Overview of engines .

1.3 Removing and installing sump (bottom section)**Special tools and workshop equipment required**

- ◆ Wedge - T10383/2-

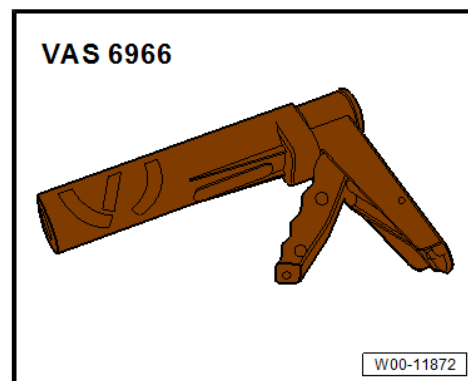


- ◆ Separating device - T10561-





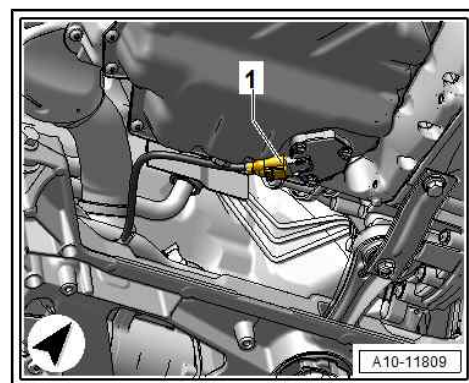
- ◆ Metering gun - VAS 6966-



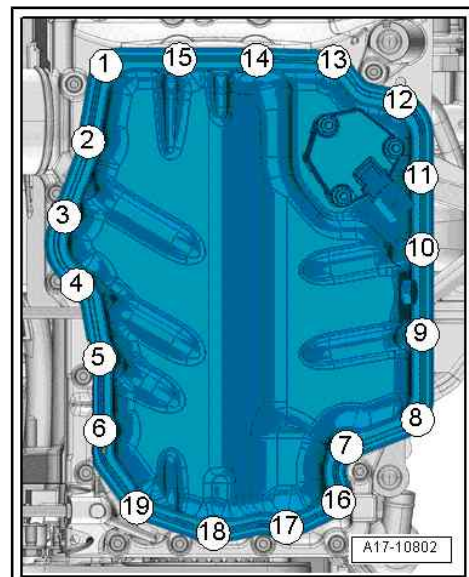
- ◆ Flat scraper
- ◆ Sealant remover
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 819
- Unplug electrical connector -1- at oil level and oil temperature sender - G266- .



- Slacken and remove bolts in the sequence: -19 ... 1-.



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- Carefully lever off sump (bottom section) with a screwdriver at position marked by “arrow”.
- Carefully release sump (bottom section) from bonded joint using a spatula (commercially available).
- Cover exposed parts of the engine.

Installing

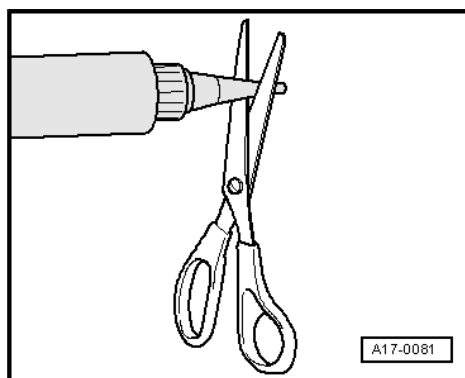
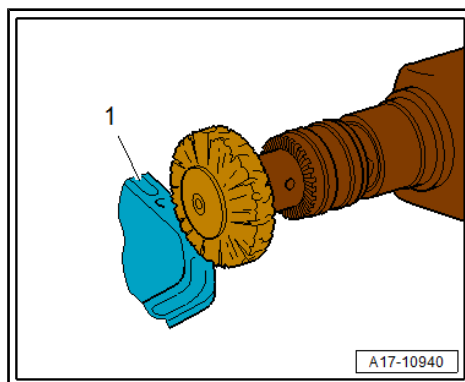
- Spray sealing surface with sealant remover and wait for it to take effect.
- Remove sealant remaining on sump (top section) with flat scraper.



CAUTION

Risk of eye injury due to sealant residue.

- Put on safety goggles.
-
- Remove sealant residue on sump (bottom section) using rotating plastic brush or similar.
 - Clean sealing surfaces; they must be free of oil and grease.
-
- Note expiry date of sealant.
 - Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).



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- Thickness of sealant bead: 2 ... 3 mm
- Apply sealant bead -arrow- onto clean sealing surface of sump (bottom section) as shown in illustration.
- Take particular care when applying sealant bead in area of sealing flange.
- The sump (bottom section) must be installed within 5 minutes after applying the sealant.
- Fit sump (bottom section) and tighten bolts
⇒ [Fig. “Sump \(bottom section\) - tightening torque and sequence”](#), page 201 .
- 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.
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .

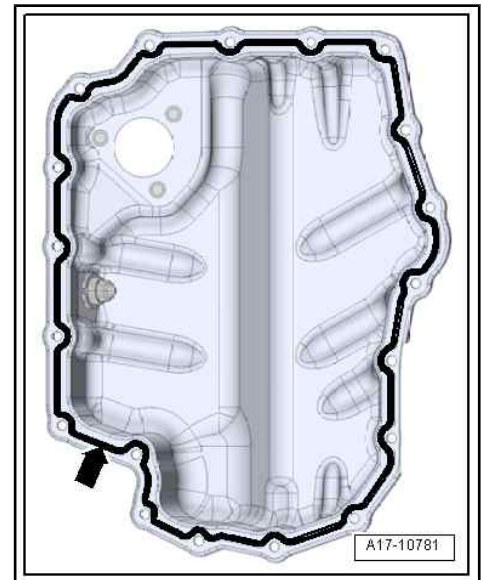
Tightening torques

- ◆ ⇒ [Fig. “Sump \(bottom section\) - tightening torque and sequence”](#), page 201

1.4 Removing and installing sump (top section)

Special tools and workshop equipment required

- ◆ Socket - T10058-



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

Removing

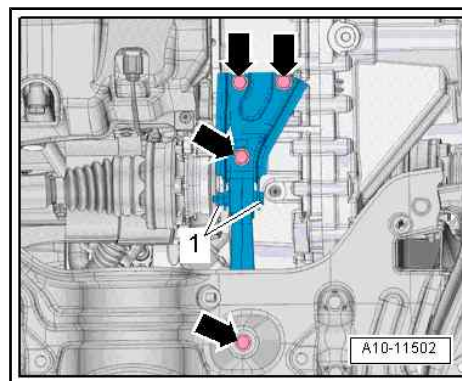
- Vehicles with air conditioning: Detach air conditioner compressor from bracket and tie up ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Remove oil pump
⇒ [“1.5 Removing and installing oil pump”](#), page 207 .





- Remove bolts -arrows- and detach pendulum support.
- Do NOT loosen bolted connection -1-.

The illustration shows a vehicle with a manual gearbox.



- Remove bolts -arrows- securing gearbox to sump (top section).
- Slacken and remove bolts in the sequence: -19 ... 1-.
- Carefully release sump (top section) from bonded joint.
- Detach baffle plate.
- Cover exposed parts of the engine.

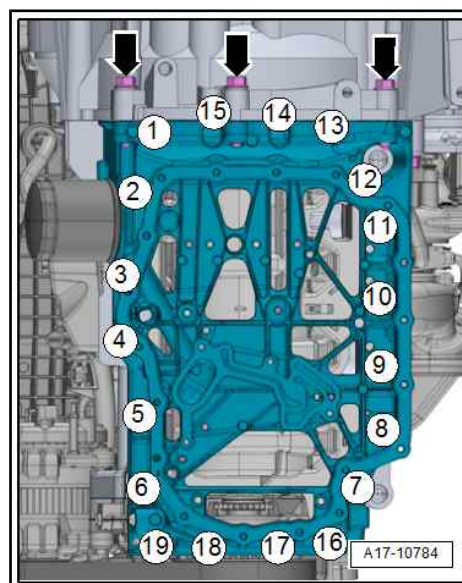
Installing

- Renew bolts tightened with specified tightening angle.
- Renew seals, gaskets and self-locking nuts.
- Remove sealant remaining on cylinder block with flat scraper.

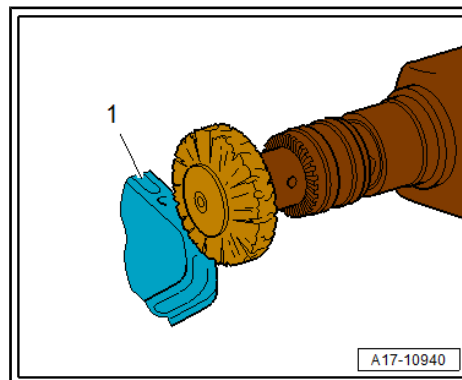
⚠ CAUTION

Risk of eye injury due to sealant residue.

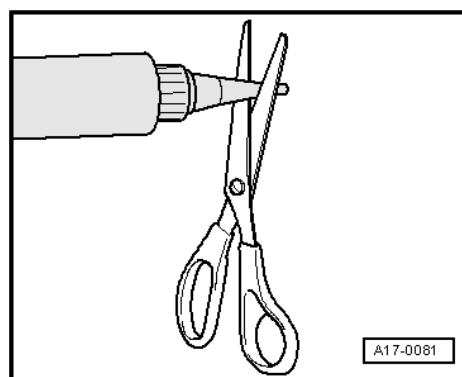
- Put on safety goggles.



- Use e.g. a rotating plastic brush to remove sealant residue on sump (top section) flange.
- Check oil passages in sump (top section) and in cylinder block for dirt.
- Clean sealing surfaces; they must be free of oil and grease.



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

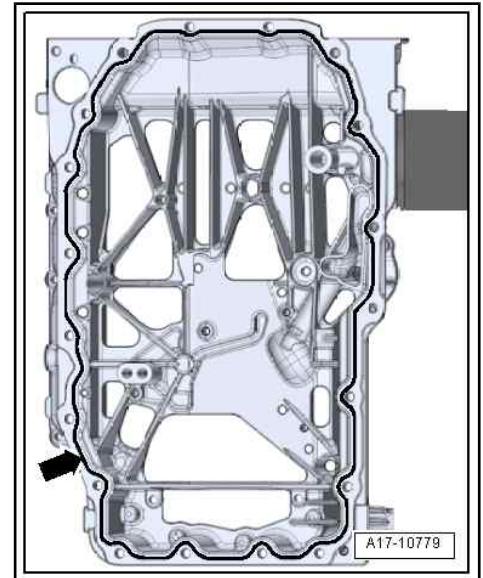


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- Thickness of sealant bead: 2 ... 3 mm
- Apply bead of sealant -arrow- onto clean sealing surface of sump (top section) as shown in illustration.
- Apply sealant bead carefully.
- The sump (bottom section) must be installed within 5 minutes after applying the sealant.



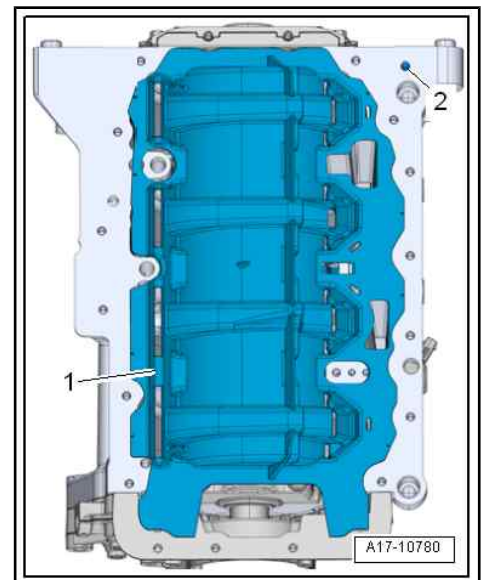
- Check that dowel pin -2- is securely seated in cylinder block.
- Attach baffle plate -1- to cylinder block.
- Fit sump (top section) and tighten bolts
⇒ [Fig. "Sump \(top section\) - tightening torque and sequence", page 202](#).

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

- Install oil pump ⇒ [page 207](#).
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819.

Tightening torques

- ⇒ ["1.1 Exploded view - sump/oil pump", page 199](#)
- ⇒ ["2.1 Exploded view - assembly mountings", page 31](#)
- ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

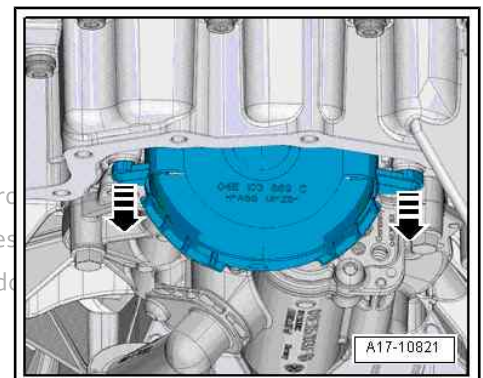


1.5 Removing and installing oil pump

Removing

- Remove sump (bottom section)
⇒ ["1.3 Removing and installing sump \(bottom section\)", page 202](#).
- Unclip cover for oil pump drive chain sprocket -arrows-.

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- Remove bolts -arrows-.
- Guide out oil pump with drive chain sprocket under drive chain.



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Installing

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

- Check that dowel sleeves -1, 3- are fitted in oil pump.
- Fit seal with strainer -2- in oil pump.
- Turn oil pump drive chain sprocket by hand to check oil pump for ease of movement.

Note:

- Renew oil pump if it does not turn easily.
- Fit oil pump with drive chain sprocket into drive chain and secure.
- Install sump (bottom section)
⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 202](#).
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .

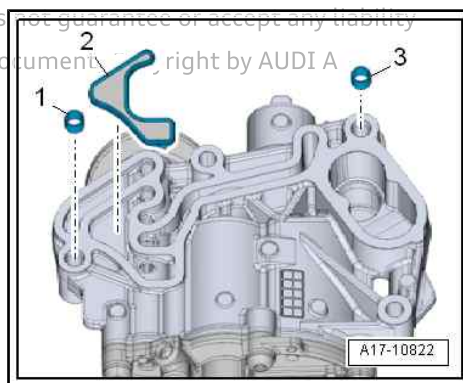
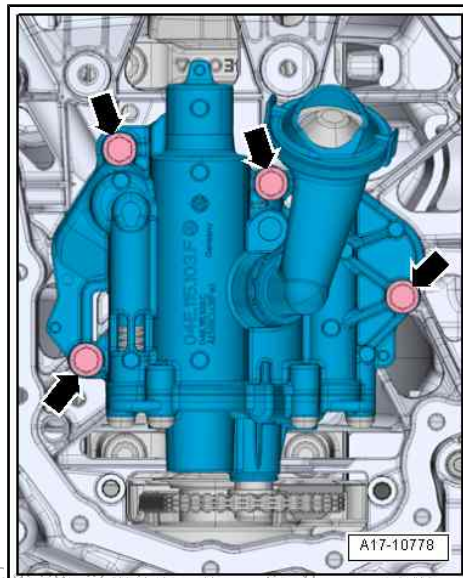
Tightening torques

- ♦ ⇒ [“1.1 Exploded view - sump/oil pump”, page 199](#)

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

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 819





- Unplug electrical connector -2-.
- Remove nuts -1- and detach oil level and oil temperature sender - G266- -item 3-.

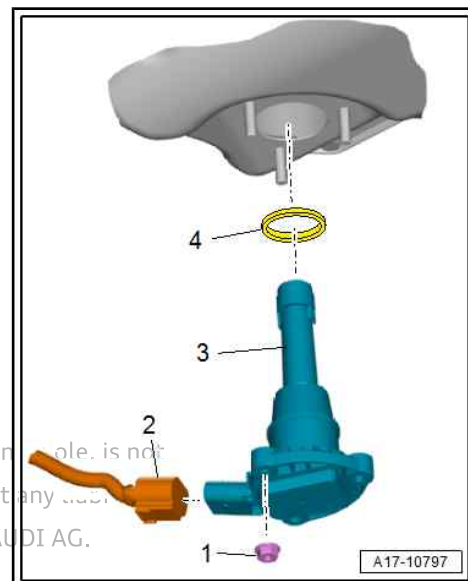
Installing

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

- Renew seal -4-.
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - sump/oil pump", page 199](#)



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2 Engine oil cooler

⇒ [“2.1 Exploded view - engine oil cooler”, page 210](#)

⇒ [“2.2 Removing and installing engine oil cooler”, page 210](#)

2.1 Exploded view - engine oil cooler

1 - Engine oil cooler

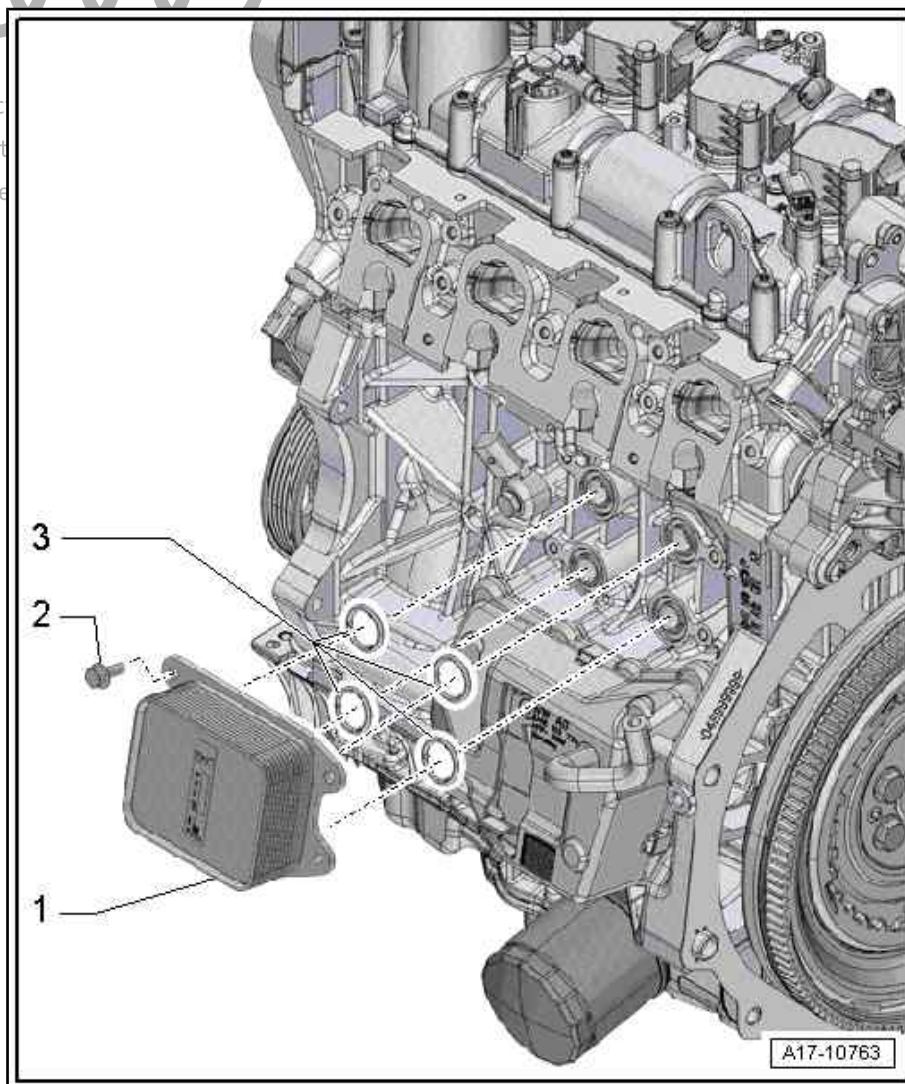
- ☐ See note
⇒ [“1 Sump/oil pump”, page 199](#)
- ☐ Removing and installing
⇒ [“2.2 Removing and installing engine oil cooler”, page 210](#)
- ☐ If renewed, refill system with fresh coolant

2 - Bolt

- ☐ Renew after removing
- ☐ 8 Nm +90°

3 - Seals

- ☐ Renew after removing



2.2 Removing and installing engine oil cooler

Removing

- Remove intake manifold
⇒ [“3.2 Removing and installing intake manifold”, page 293](#) .



- Unscrew bolts -arrows- and detach engine oil cooler -1-.

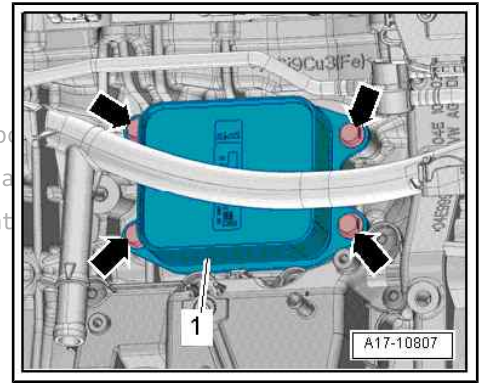
Installing

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

- Renew seals.
- Do not reuse coolant.
- Fill up with coolant ⇒ [page 230](#) .

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - engine oil cooler”, page 210](#)
- ◆ ⇒ [“3.1 Exploded view - intake manifold”, page 292](#)





3 Crankcase breather

⇒ "3.1 Exploded view - crankcase breather system", page 212

⇒ "3.2 Removing and installing oil separator", page 213

3.1 Exploded view - crankcase breather system

1 - Hose

- ☐ For crankcase breather

2 - Cover

- ☐ For oil separator

3 - Oil separator

- ☐ Removing and installing

⇒ "3.2 Removing and installing oil separator", page 213

- ☐ Renew if damaged

4 - Hose

- ☐ For crankcase breather
- ☐ Different versions available; for allocation refer to ⇒ Electronic parts catalogue

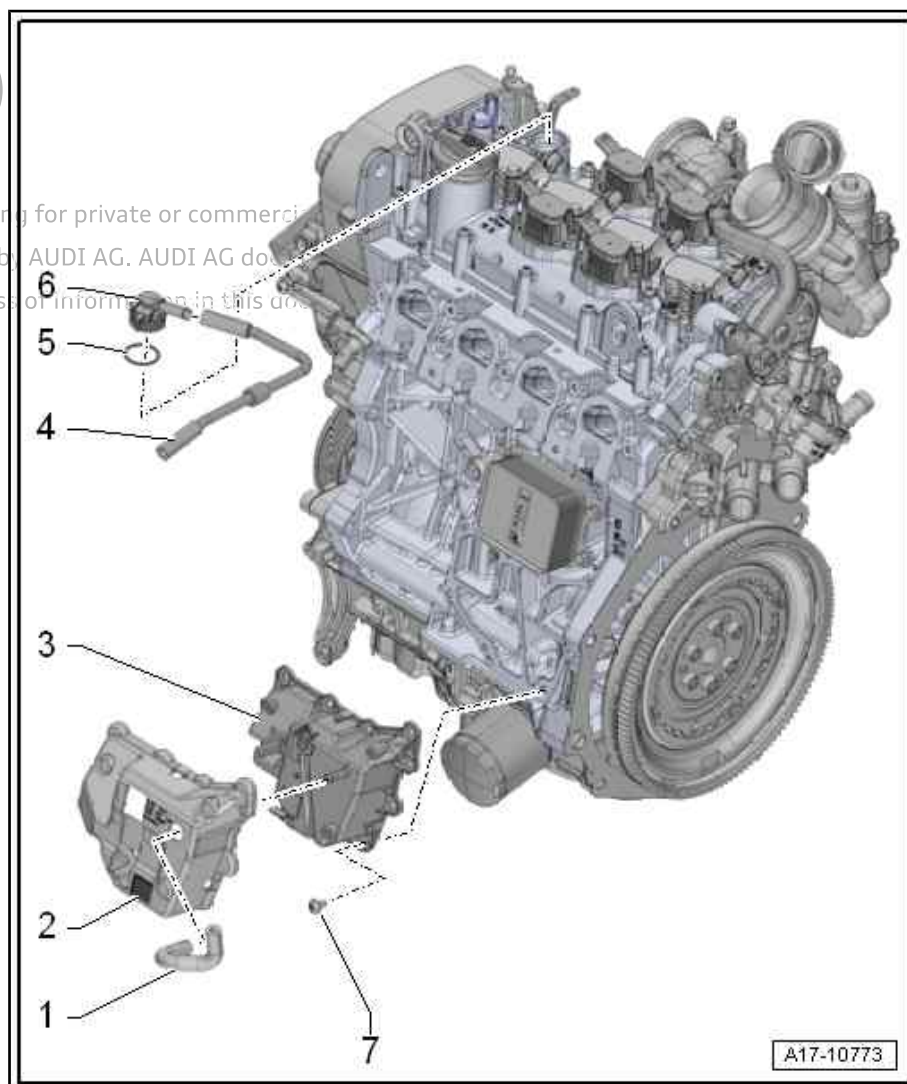
5 - O-ring

- ☐ Lubricate lightly with engine oil
- ☐ Check for damage and renew if necessary

6 - Connection

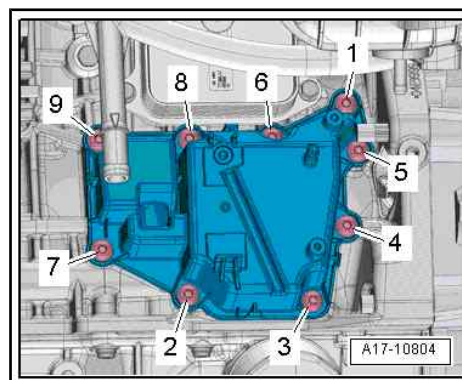
7 - Bolt

- ☐ Self-locking
- ☐ Renew after removing
- ☐ 9 Nm



Oil separator - tightening torque and sequence

- Tighten bolts in the sequence -1 ... 9- to 9 Nm.





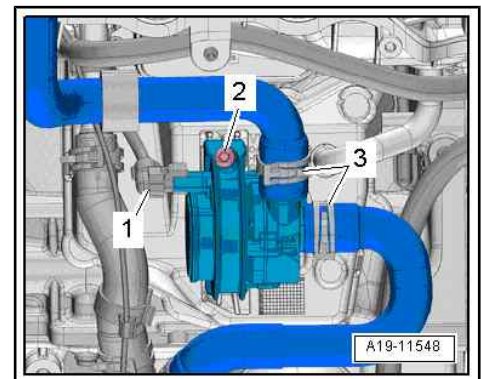
3.2 Removing and installing oil separator

Special tools and workshop equipment required

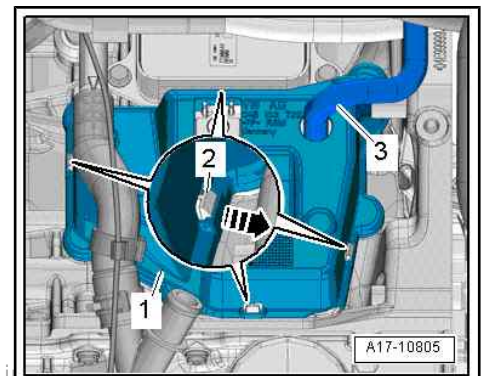
- ◆ Flat scraper
- ◆ Studs, M6x20 mm
- ◆ Sealant remover
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -1-.
- Remove bolt -2- and press continued coolant circulation pump - V51- to side.



- Disconnect crankcase breather hose -3-.
- Release fasteners -2- -arrow- on cover -1- for oil separator and detach cover.



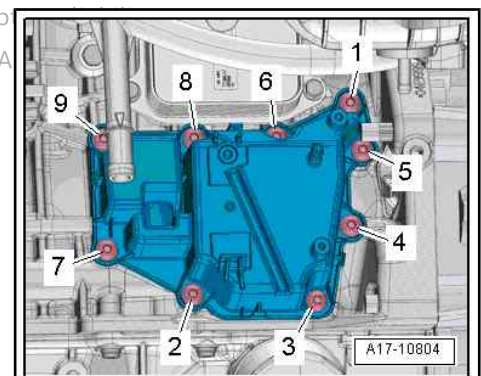
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- Slacken and remove bolts in the sequence: -9...1-.
- Carefully release oil separator from bonded joint.
- Cover exposed parts of the engine.

Installing

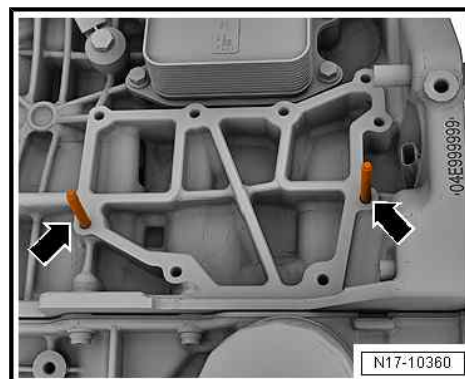
Installation is carried out in reverse order; note the following:

- Remove sealant remaining on cylinder block with flat scraper.
- Clean sealing surfaces; they must be free of oil and grease.

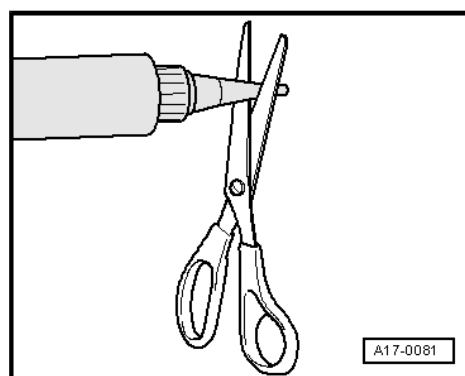




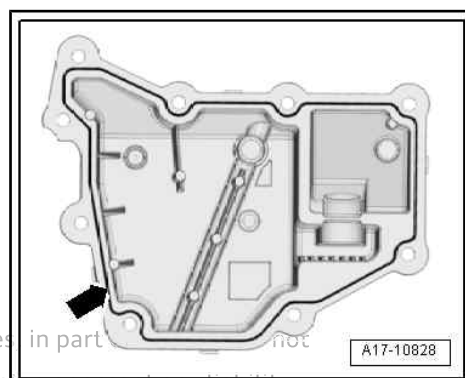
- Screw 2 studs a few turns into holes -arrows-.



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



- Thickness of sealant bead: 2 ... 3 mm
- Apply bead of sealant -arrow- onto clean sealing surface of oil separator as shown in illustration.
- Install oil separator within 5 minutes after applying the sealant.

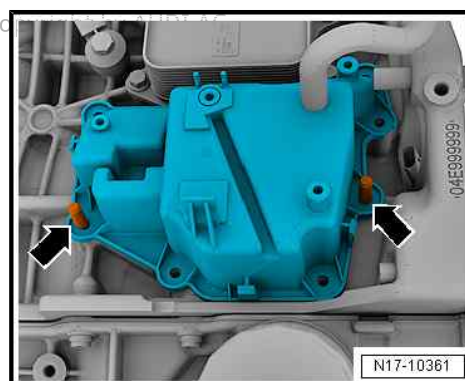


- Place oil separator onto studs and crankcase.
- Remove studs again.
- Tighten bolts in sequence to specified torque
⇒ [Fig. "Oil separator - tightening torque and sequence", page 212](#).

The remaining installation steps are carried out in the reverse sequence.

Tightening torques

- ◆ ⇒ [Fig. "Oil separator - tightening torque and sequence", page 212](#)
- ◆ ⇒ ["2.2 Exploded view - electric coolant pump", page 233](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation





4 Oil filter/oil pressure switches

⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 215](#)

⇒ [“4.2 Removing and installing oil pressure switch F1”, page 216](#)

⇒ [“4.3 Removing and installing oil pressure switch for reduced oil pressure F378”, page 217](#)

⇒ [“4.4 Checking oil pressure”, page 218](#)

⇒ [“4.5 Removing and installing valve for oil pressure control N428”, page 219](#)

4.1 Exploded view - oil filter/oil pressure switches

1 - Oil filter

- ☐ See note ⇒ [page 199](#)
- ☐ Removing and installing
⇒ Maintenance ; Book-let 819
- ☐ ⇒ Fig. [““Securing threaded connection for oil filter””, page 216](#)

2 - Oil pressure switch for reduced oil pressure - F378-

- ☐ Opening/closing pressure 0.3 ... 0.6 bar
- ☐ Green insulation
- ☐ Check in [Guided Fault Finding](#) ⇒ Vehicle diagnostic tester
- ☐ Removing and installing
⇒ [“4.3 Removing and installing oil pressure switch for reduced oil pressure F378”, page 217](#)
- ☐ If seal -3- is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal

☐ 20 Nm

3 - Seal

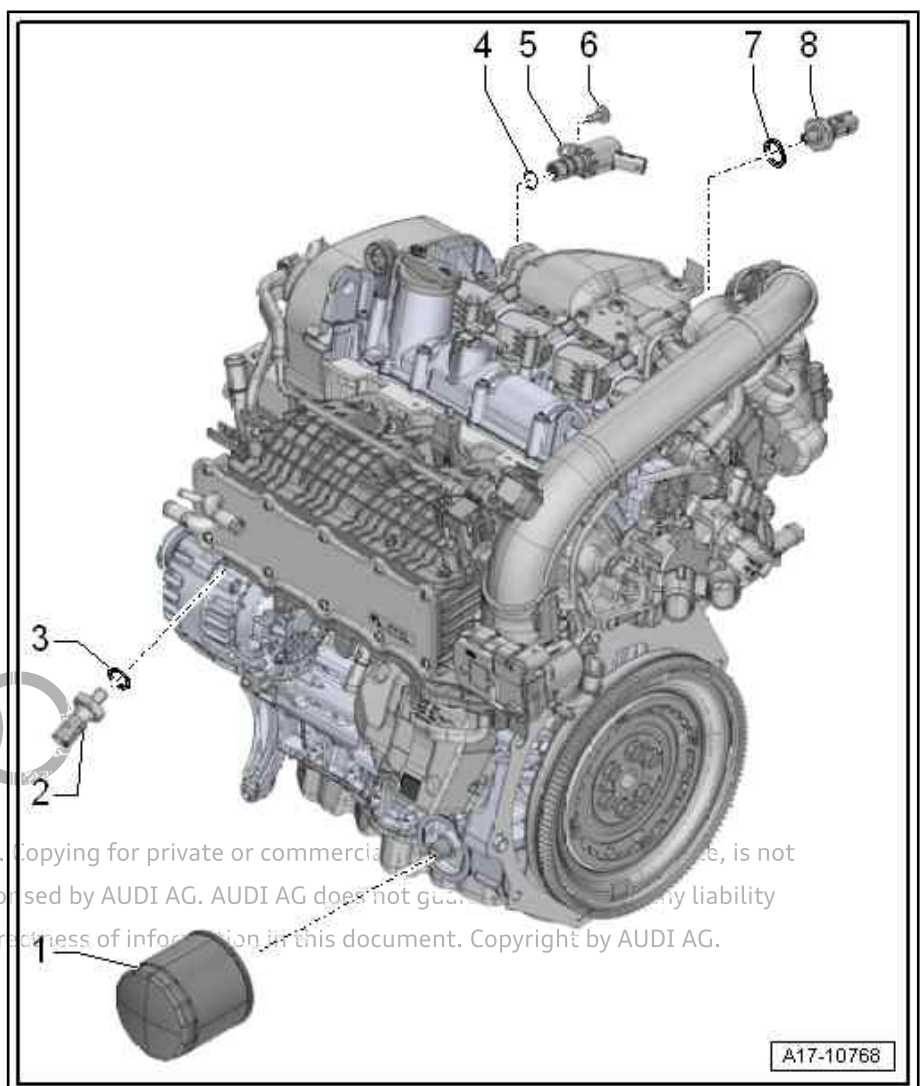
- ☐ Renew if removed; check availability in ⇒ Electronic parts catalogue
- ☐ Cut seal open to renew

4 - O-ring

- ☐ Renew after removing

5 - Valve for oil pressure control - N428-

- ☐ Removing and installing
⇒ [“4.5 Removing and installing valve for oil pressure control N428”, page 219](#)



**6 - Bolt**

- ☐ 8 Nm

7 - Seal

- ☐ Renew if removed; check availability in ⇒ [Electronic parts catalogue](#)
- ☐ Cut seal open to renew

8 - Oil pressure switch - F1-

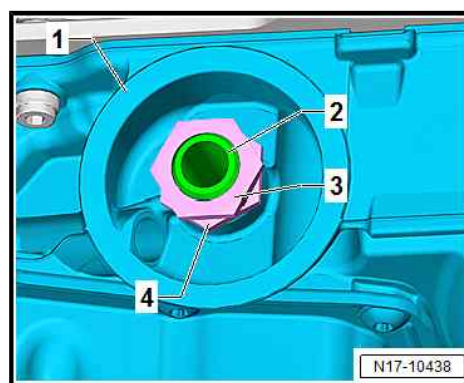
- ☐ Opening/closing pressure 2.15 ... 2.95 bar
- ☐ Blue insulation
- ☐ Check in [Guided Fault Finding](#) ⇒ Vehicle diagnostic tester
- ☐ Removing and installing ⇒ ["4.2 Removing and installing oil pressure switch F1", page 216](#)
- ☐ If seal -3- is not available separately, refer to ⇒ [Electronic parts catalogue](#) ; renew oil pressure switch after removal
- ☐ 20 Nm

Securing threaded connection for oil filter

- Secure threaded connection -2- as described below if it has come loose from sump (top section) -1-.

Carry out this procedure using the two nuts -3 and 4- only.

- Hexagon nuts -068 115 723- (2x) ⇒ [Electronic parts catalogue](#)
- Fit nuts -3- and -4- onto threaded connection -2- and screw them against one another to counter-lock.
- Tighten connection -2- via nut -3-.
- Unscrew and remove both nuts, taking care not to loosen connection when doing so.

**Tightening torques**

Threaded connection	Tightening torque
-2-	50 Nm

4.2 Removing and installing oil pressure switch - F1-**Special tools and workshop equipment required**

- ◆ Articulated wrench, 24 mm - T40175-

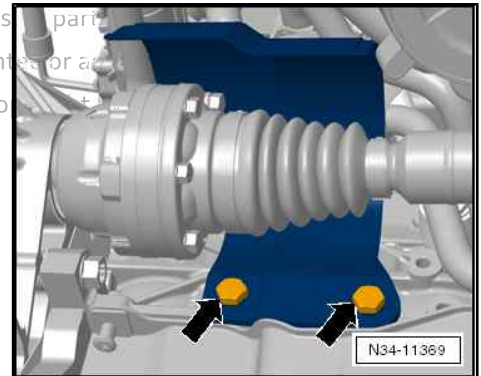
**Removing**

- Re-install all heat insulation sleeves in the same locations when installing.



- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).

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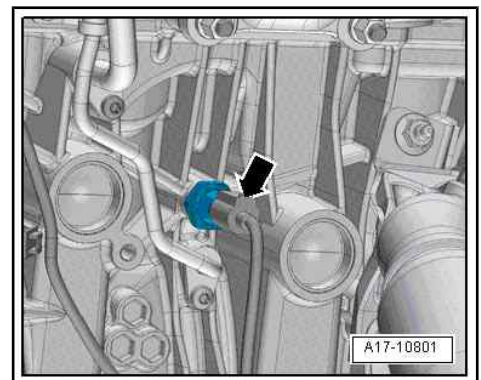


- Detach heat insulation sleeve.
- Unplug electrical connector -arrow-.
- Place a cloth underneath to catch escaping engine oil.
- Unscrew oil pressure switch - F1- .

Installing

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

- If seal is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal.
- Cut seal open to renew.
- Fit the oil pressure switch - F1- into hole immediately to avoid loss of oil.
- Check oil level ⇒ Maintenance ; Booklet 819 .



Tightening torques

- ◆ ⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 215](#)
- ◆ Heat shield for drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

4.3 Removing and installing oil pressure switch for reduced oil pressure - F378-

Special tools and workshop equipment required

- ◆ Articulated wrench, 24 mm - T40175-





Removing

- Detach solenoid valve 1 for activated charcoal filter - N80-item 3- from intake manifold and press downwards slightly.
- Unplug electrical connector -2-.
- Place a cloth underneath to catch escaping engine oil.
- Unscrew oil pressure switch for reduced oil pressure - F378-item 1-.

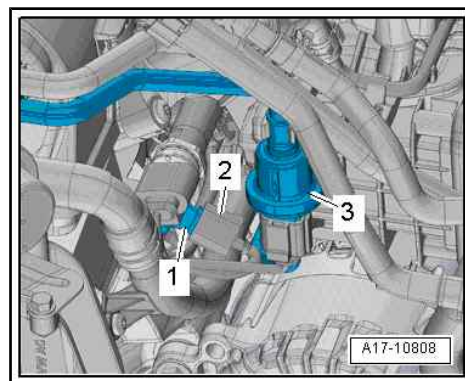
Installing

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

- If seal is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal.
- Cut seal open to renew.
- Fit oil pressure switch for reduced oil pressure - F378- into hole immediately to avoid loss of oil.
- Check oil level ⇒ Maintenance ; Booklet 819 .

Tightening torques

- ♦ ⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 215](#)



4.4 Checking oil pressure

Special tools and workshop equipment required

- ♦ Oil pressure tester - V.A.G 1342-



Procedure

- Oil level has been checked and is OK ⇒ Maintenance ; Booklet 819
- Engine oil temperature at least 80 °C (radiator fan must have run once).
- Remove oil pressure switch for reduced oil pressure - F378- ⇒ [“4.2 Removing and installing oil pressure switch F1”, page 216](#) .
- Screw oil pressure tester - V.A.G 1342- into hole for oil pressure switch.
- Screw oil pressure switch for reduced oil pressure - F378- into hole in oil pressure tester - V.A.G 1342- to seal it off.
- Start engine.
- Oil pressure at idling speed: at least 0.6 bar.
- Minimum oil pressure at 2000 rpm: 1.5 bar.
- Minimum oil pressure at 4500 rpm: 2.8 bar.



Assembling

- Install oil pressure switch for reduced oil pressure - F378-
⇒ [“4.3 Removing and installing oil pressure switch for reduced oil pressure F378”, page 217](#) .

4.5 Removing and installing valve for oil pressure control - N428-

Removing

- Re-install all heat insulation sleeves in the same locations when installing.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Detach heat insulation sleeves.
- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping engine oil.
- Remove bolt -2- and detach valve for oil pressure control - N428- .

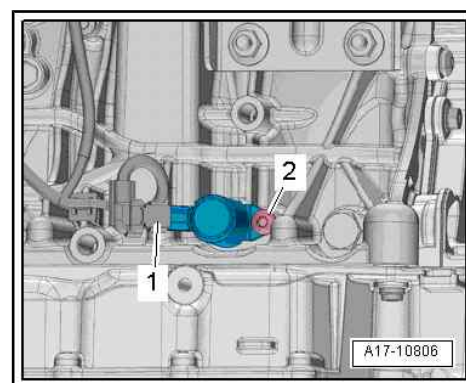
Installing

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

- Renew O-ring.

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 215](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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19 – Cooling

1 Cooling system/coolant

⇒ [“1.1 Connection diagram - coolant hoses”, page 220](#)

⇒ [“1.3 Draining and filling cooling system”, page 224](#)

⇒ [“1.2 Checking cooling system for leaks”, page 223](#)

1.1 Connection diagram - coolant hoses

⇒ [“1.1.1 Connection diagram - coolant hoses, vehicles up to 06.2013”, page 220](#)

⇒ [“1.1.2 Connection diagram - coolant hoses, vehicles from 06.2013 onwards”, page 222](#)

1.1.1 Connection diagram - coolant hoses, vehicles up to 06.2013

- ◆ Blue = Large coolant circuit
- ◆ Red = Small coolant circuit
- ◆ Orange = Charge air cooling circuit.
- ◆ Brown = Heating circuit
- ◆ Arrows show direction of coolant flow.



**1 - Coolant expansion tank****2 - Filler cap**

- ☐ For coolant expansion tank
- ☐ Checking pressure relief valve ⇒ [page 224](#)

3 - Cylinder head/cylinder block**4 - Not fitted****5 - Turbocharger****6 - Exhaust manifold**

- ☐ Integrated in turbocharger

7 - Heat exchanger for heater**8 - Coolant temperature sender - G62-****9 - Coolant pump**

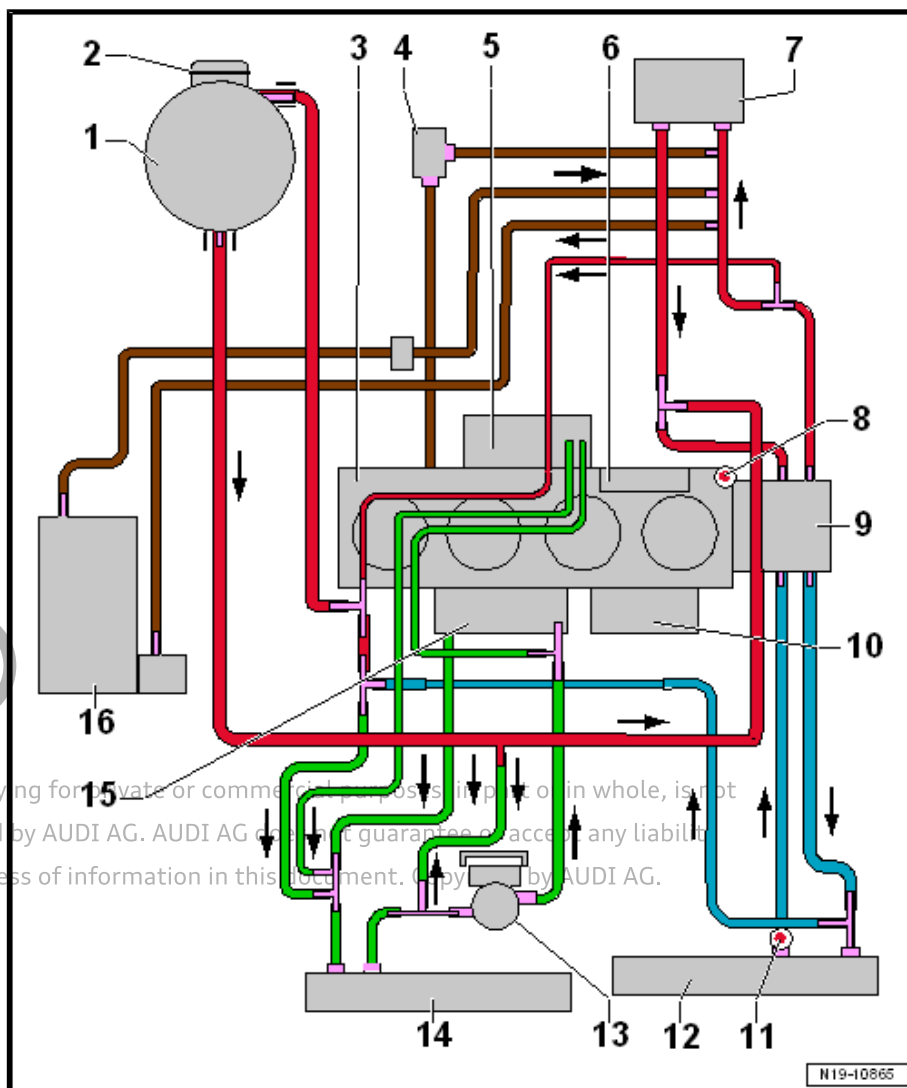
- ☐ With thermostat housing

10 - Engine oil cooler**11 - Radiator outlet coolant temperature sender - G83-****12 - Radiator****13 - Continued coolant circulation pump - V51-****14 - Water radiator for charge air cooling circuit****15 - Charge air cooler**

- ☐ In intake manifold

16 - Auxiliary heater

- ☐ Optional equipment





1.1.2 Connection diagram - coolant hoses, vehicles from 06.2013 onwards

1 - Coolant expansion tank

2 - Filler cap

- ☐ For coolant expansion tank
- ☐ Checking pressure relief valve ➔ [page 224](#)

3 - Cylinder head/cylinder block

4 - Not fitted

5 - Turbocharger

6 - Exhaust manifold

- ☐ Integrated in turbo-charger

7 - Heat exchanger for heater

8 - Coolant temperature sender - G62-

9 - Coolant pump

- ☐ With thermostat housing

10 - Engine oil cooler

11 - Radiator outlet coolant temperature sender - G83-

12 - Radiator

13 - Continued coolant circulation pump - V51-

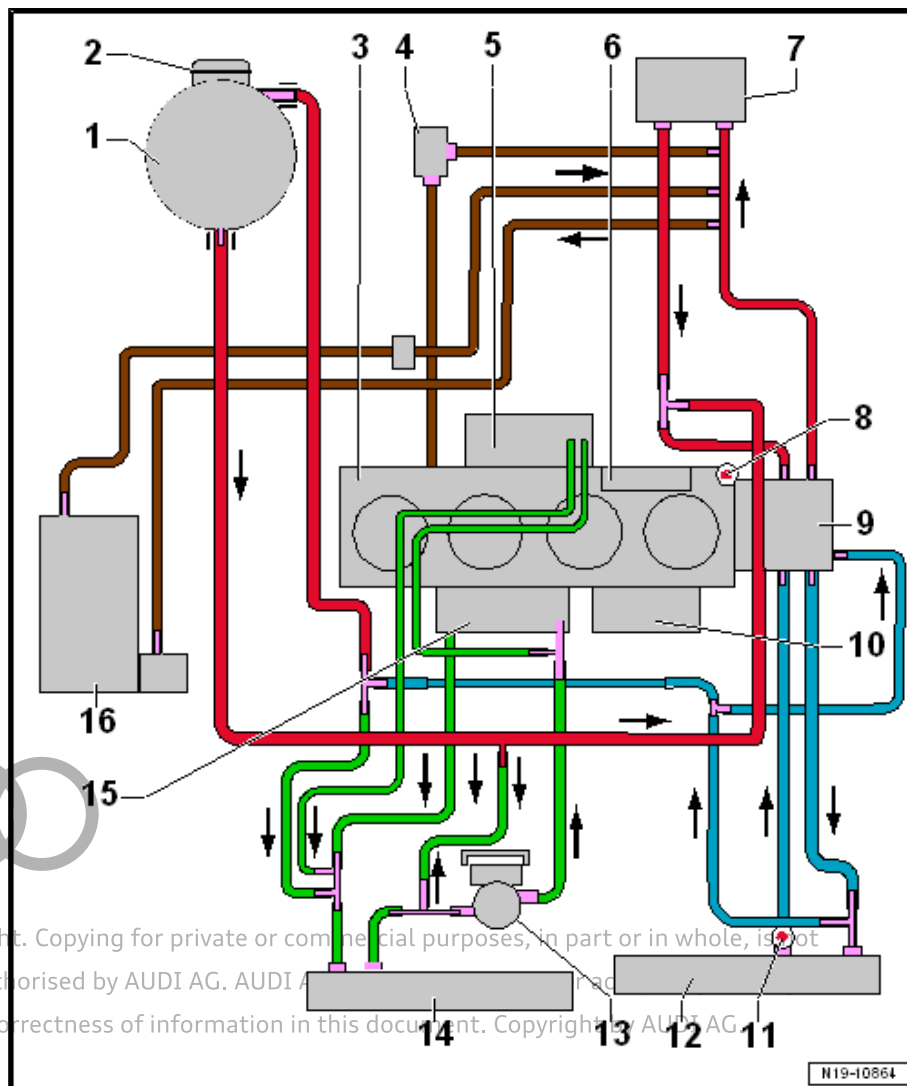
14 - Water radiator for charge air cooling circuit

15 - Charge air cooler

- ☐ In intake manifold

16 - Auxiliary heater

- ☐ Optional equipment





1.2 Checking cooling system for leaks

Special tools and workshop equipment required

V.A.G 1274/8	V.A.G 1274/9
	
V.A.G 1274 B	
	

W19-10069

- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Adapter for cooling system tester - V.A.G 1274/9-
- ◆ Cooling system tester - V.A.G 1274 B-

Procedure

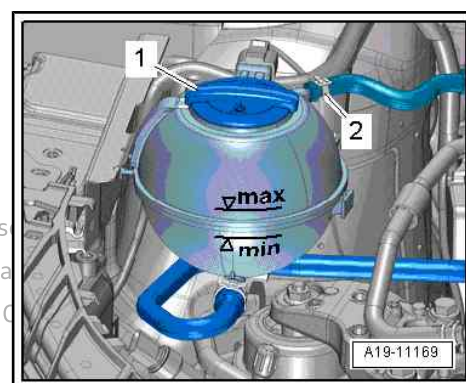
- Engine must be warm.

CAUTION

The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant.

Danger of scalding skin and other parts of the body.

- Put on protective gloves.
- Put on safety goggles.
- Cover filler cap on expansion tank with a cloth and open carefully to release pressure.



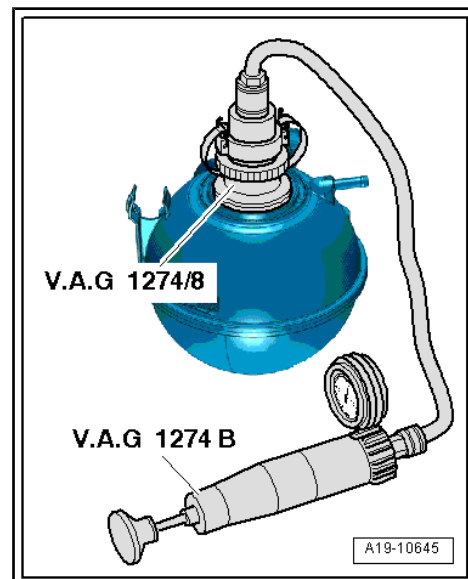
- Open filler cap -1- on coolant expansion tank.



- 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. 1.5 bar.
- The pressure should not drop more than 0.2 bar within 10 minutes.
- If the pressure drops more than 0.2 bar, locate leak and eliminate fault.

Note:

The drop in pressure of 0.2 bar within 10 minutes is caused by the decrease in coolant temperature. The colder the engine is, the less the pressure will fall. If necessary, check again when the engine is cold.



Checking pressure relief valve in filler cap

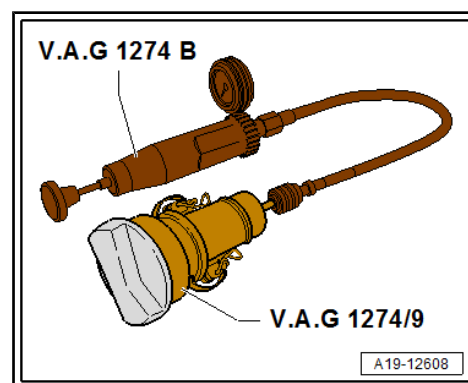
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
- Build up pressure with hand pump on cooling system tester.

Blue filler cap

- ◆ The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

Black filler cap

- ◆ The pressure relief valve should open at a pressure of 1.6 ... 1.8 bar.
- Renew filler cap if pressure relief valve does not open as described.



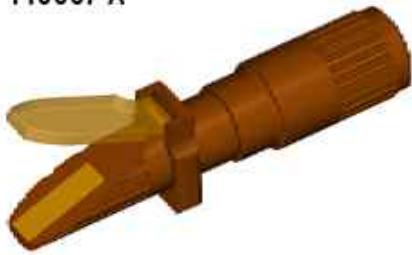
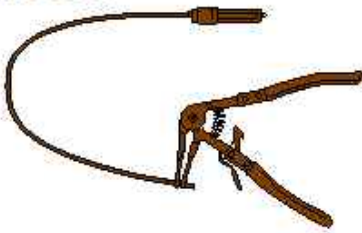
1.3 Draining and filling cooling system



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Special tools and workshop equipment required

T10007 A 	VA S 6208 
VA S 6340 	VA S 6096 
V.A.G 1274/8 	

W19-10066

- ◆ Refractometer - T10007A-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6340-
- ◆ Cooling system charge unit - VAS 6096-
- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Safety goggles
- ◆ Protective gloves





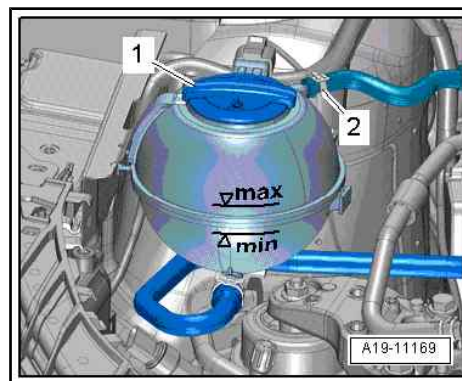
Draining

⚠ CAUTION

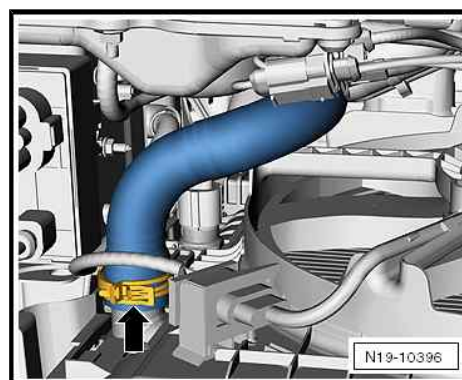
The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant.

Danger of scalding skin and other parts of the body.

- Put on protective gloves.
- Put on safety goggles.
- Cover filler cap on expansion tank with a cloth and open carefully to release pressure.



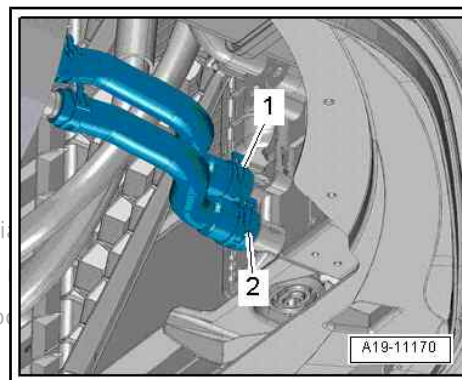
- Open filler cap -1- on coolant expansion tank.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Release hose clip -arrow- and detach coolant hose (bottom left) from radiator.
- Release hose clips -1, 2- and disconnect coolant hoses at bottom right from water radiator for charge air cooling circuit.



Filling

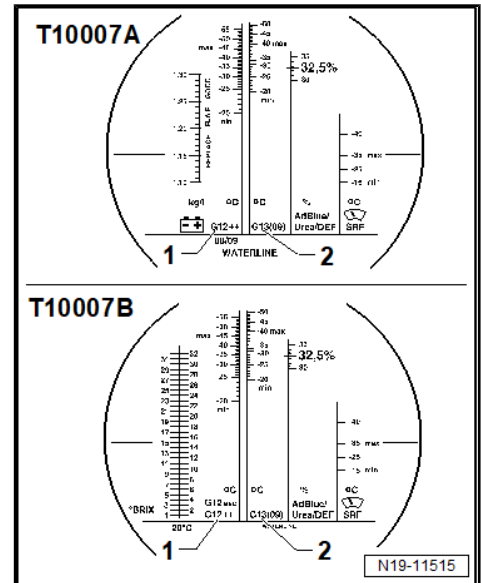


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**Note**

- ◆ The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.
- ◆ Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . If you use other coolant additives, this can significantly impair in particular the corrosion protection effect. The resulting damage could lead to loss of coolant and consequently to serious damage to the power unit.
- ◆ Coolant with the recommended mixture ratio prevents frost and corrosion damage and stops scaling. At the same time it raises the boiling point of the fluid in the system. For this reason the cooling system must be filled all year round with the correct coolant additive.
- ◆ Because of its high boiling point, the coolant improves power unit reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Refractometer - T10007A- or refractometer - T10007B- MUST be used to determine the current level of frost protection.
- ◆ Scale -1- on the refractometer applies to coolant additives G12 ++ and G12evo.
- ◆ Scale -2- on the refractometer applies to coolant additive G13.
- ◆ If more than one type of coolant additive has been used: Always use the scale for G13 to determine the anti-freeze protection.
- ◆ The mixture must guarantee frost protection down to at least -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze should only be increased if greater frost protection is required in very cold climates. This must only be down to -48 °C, however, as otherwise the cooling efficiency of the coolant is impaired.
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be provided to at least -25 °C.
- ◆ The temperature indicated on the refractometer corresponds to the temperature at which the first ice crystals can form in the coolant.
- ◆ Do not reuse coolant.
- ◆ Only use water/coolant additive as a lubricant for coolant hoses.

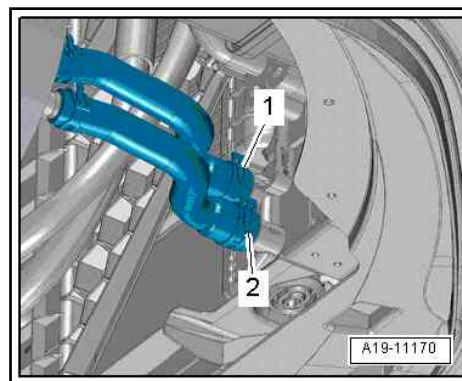
**Recommended mixture ratio for coolant**

- Coolant (40 %) and distilled water (60 %) for frost protection to -25 °C
- Coolant (50 %) and distilled water (50 %) for frost protection to -36 °C
- Coolant ⇒ Electronic parts catalogue



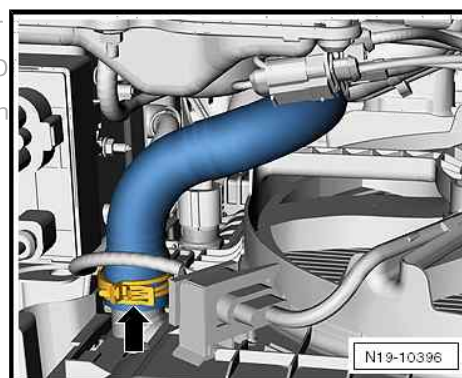
Procedure

- Connect coolant hoses with hose clips -1, 2- to water radiator for charge air cooling circuit.



- Connect coolant hose to radiator (bottom) with hose clip -arrow-.

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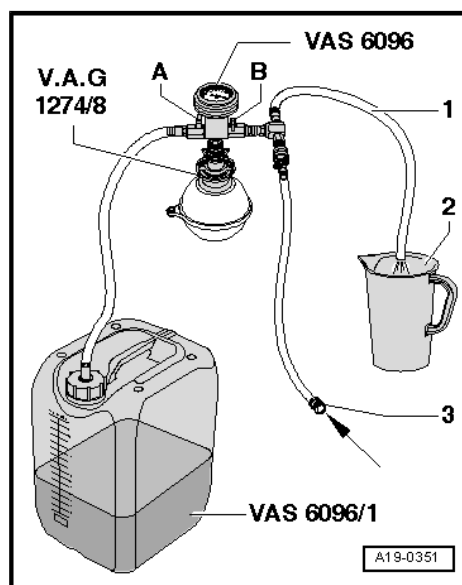


- Fill reservoir of -VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio).
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-.

Note:

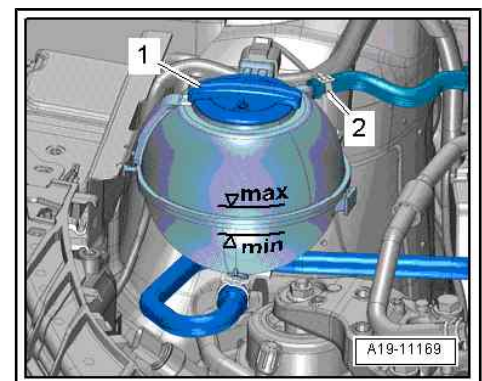
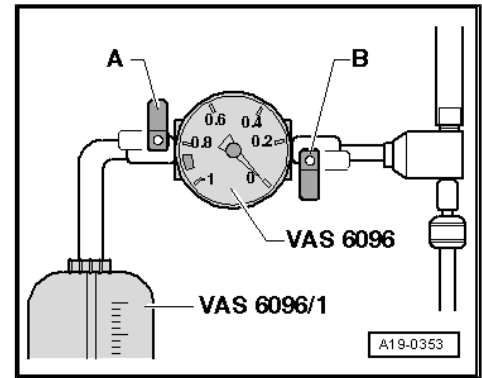
The vented air draws along a small amount of coolant, which should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -3- to compressed air supply.
- Pressure: 7 ... 10 bar.



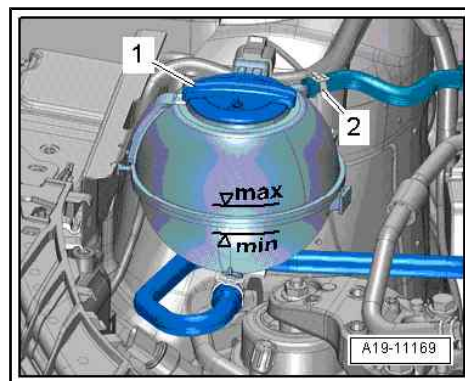


- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with 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.
- 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.
- Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Set temperature to "HI".
- Set fresh air blower to lowest setting.
- Switch off air conditioner compressor (press **AC** button).
- LED in button should not light up.
- 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 both large coolant hoses at radiator become warm.
- Switch off ignition and allow engine to cool down.





- 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 or above the “max” marking when the engine is warm.
- Top up with coolant again if necessary.



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2 Coolant pump/thermostat assembly

⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 231](#)

⇒ [“2.2 Exploded view - electric coolant pump”, page 233](#)

⇒ [“2.3 Exploded view - coolant temperature senders”, page 235](#)

⇒ [“2.4 Removing and installing electric coolant pump”, page 235](#)

⇒ [“2.5 Removing and installing coolant pump”, page 237](#)

⇒ [“2.6 Removing and installing thermostat”, page 241](#)

⇒ [“2.7 Removing and installing toothed belt sprocket for coolant pump”, page 244](#)

⇒ [“2.8 Removing and installing coolant temperature sender G62”, page 248](#)

⇒ [“2.9 Removing and installing radiator outlet coolant temperature sender G83”, page 249](#)

2.1 Exploded view - coolant pump/thermostat

1 - Thermostat housing

- ☐ Removing and installing
⇒ [“2.5 Removing and installing coolant pump”, page 237](#)

2 - Thermostat

- ☐ For small coolant circuit
- ☐ Removing and installing
⇒ [“2.6.2 Removing and installing thermostat for small coolant circuit”, page 243](#)

3 - Gasket

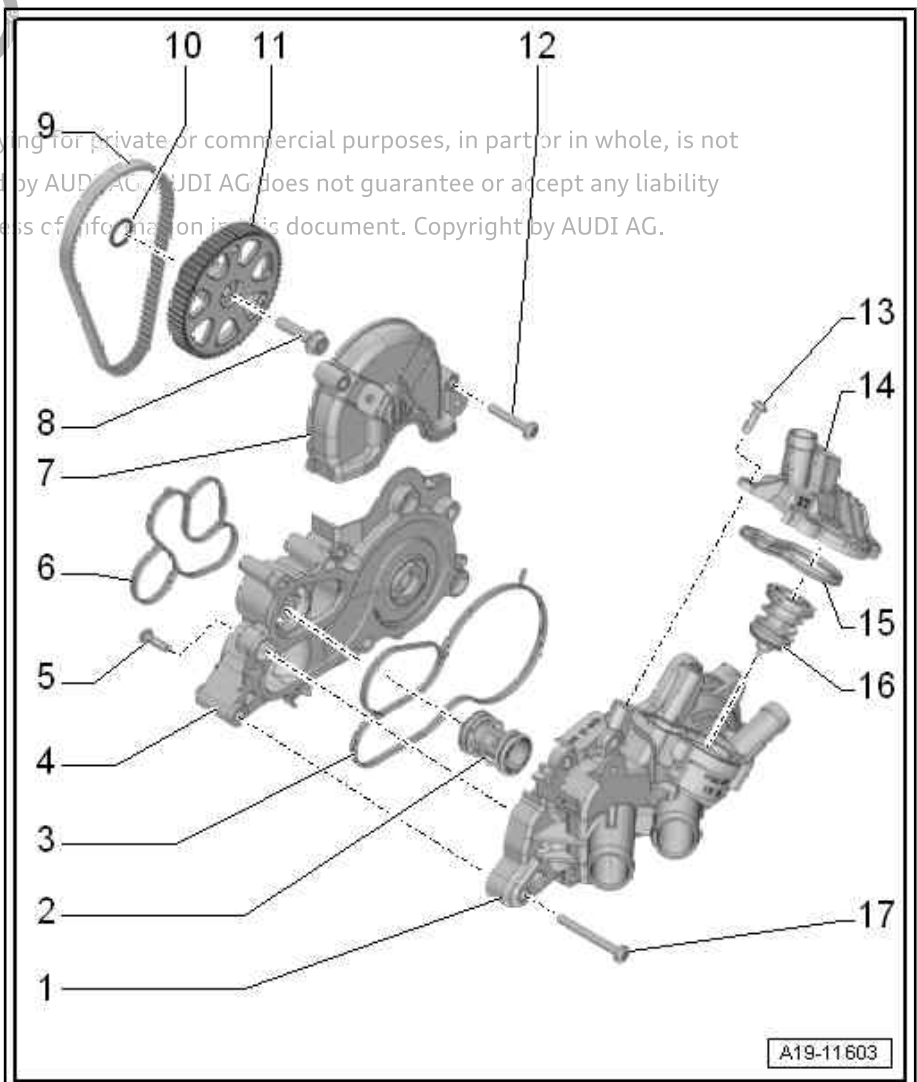
- ☐ Renew after removing

4 - Coolant pump

- ☐ Removing and installing
⇒ [“2.5 Removing and installing coolant pump”, page 237](#)
- ☐ Renew toothed belt as well when renewing coolant pump

5 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ Tightening torque and sequence
⇒ [Fig. “Thermostat housing to coolant pump - tightening torque and sequence””, page 233](#)





6 - Gasket

- ☐ Renew after removing

7 - Toothed belt cover

- ☐ For toothed belt for coolant pump

8 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm +90°

9 - Toothed belt

- ☐ For coolant pump
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ When reinstalling, check for damage and renew if necessary

10 - O-ring

- ☐ Renew after removing
- ☐ Only for vehicles with cylinder shut-off
- ☐ Removing and installing
⇒ [“2.7.2 Removing and installing toothed belt sprocket for coolant pump - engines with cylinder shut-off”, page 245](#)

11 - Toothed belt sprocket

- ☐ For coolant pump
- ☐ Removing and installing
⇒ [“2.7 Removing and installing toothed belt sprocket for coolant pump”, page 244](#)
- ☐ Renew O-ring -item 10- after removing
- ☐ Installation position ⇒ [page 245](#)
- ☐ Apply sealant when installing

12 - Bolt

- ☐ 8 Nm

13 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ Tightening torque and sequence
⇒ [Fig. “Cover for thermostat to thermostat housing - tightening torque” , page 233](#)

14 - Cover

- ☐ For thermostat

15 - Gasket

- ☐ Renew after removing

16 - Thermostat

- ☐ For large coolant circuit
- ☐ Removing and installing
⇒ [“2.6.1 Removing and installing thermostat for large coolant circuit”, page 241](#)
- ☐ Installation position ⇒ [Fig. “Installation position of thermostat for large coolant circuit” , page 233](#)

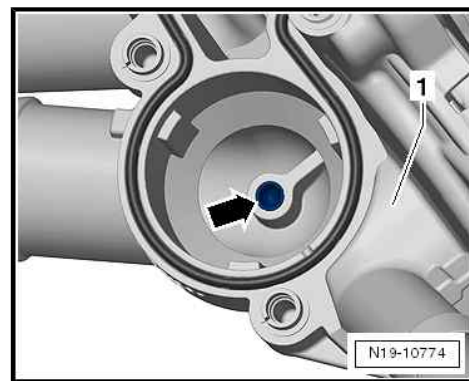
17 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 240](#)



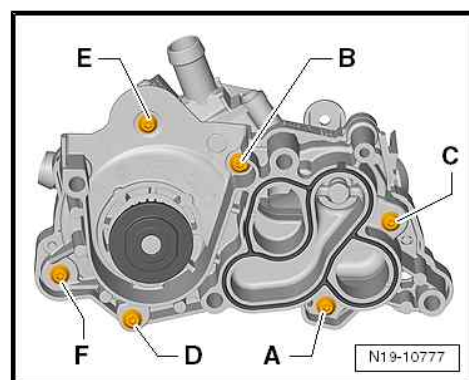
Installation position of thermostat for large coolant circuit

- Must be positioned with centring pin in guide -arrow- in thermostat housing.



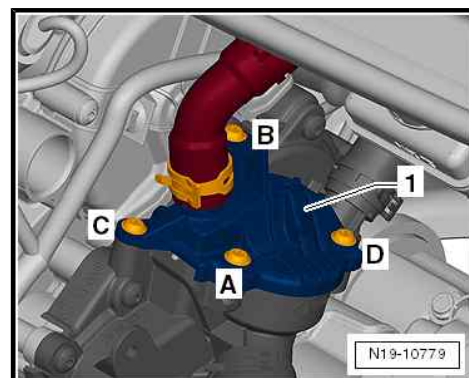
Thermostat housing to coolant pump - tightening torque and sequence

- Tighten bolts in the sequence -A ... F- to 7 Nm.



Cover for thermostat to thermostat housing - tightening torque

- Tighten bolts for cover -1- in the sequence -A ... D- to 7 Nm.



2.2 Exploded view - electric coolant pump



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1 - Continued coolant circulation pump - V51-

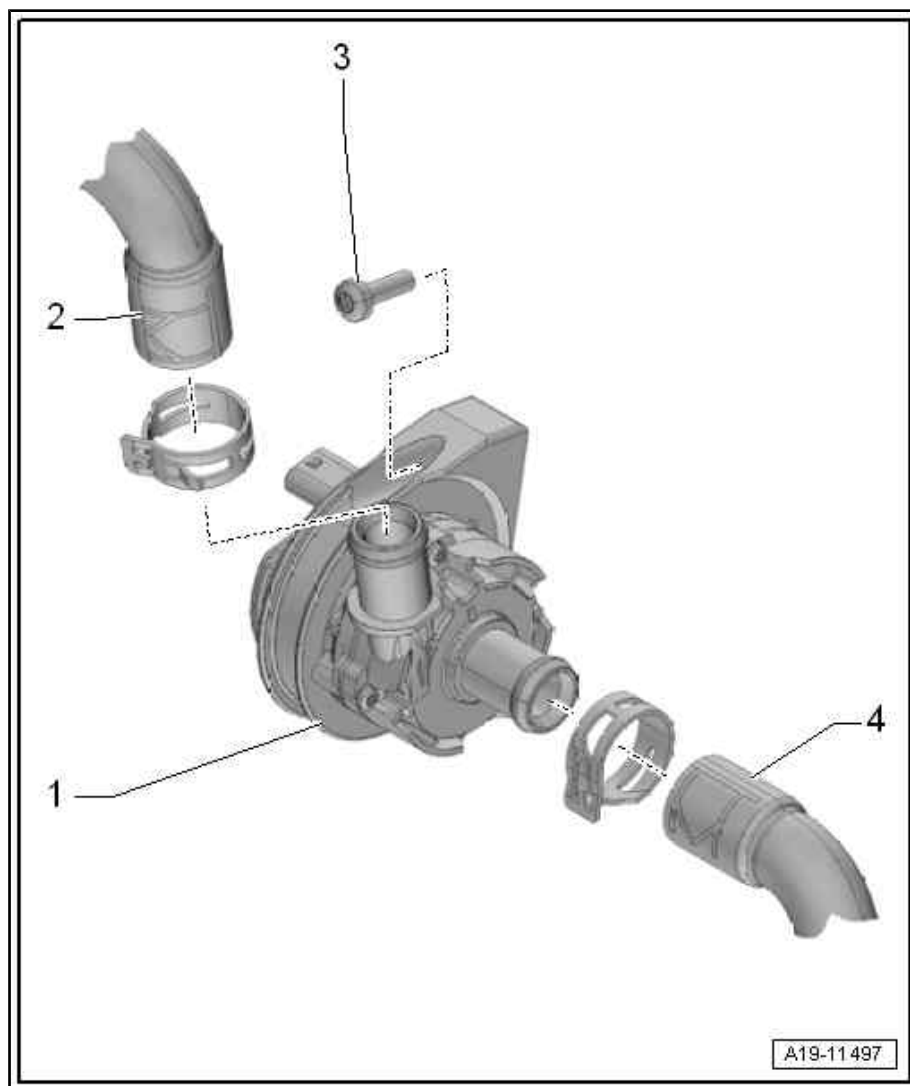
- ☐ With bracket
- ☐ Removing and installing
⇒ ["2.4 Removing and installing electric coolant pump", page 235](#)

2 - Coolant hose

3 - Bolt

- ☐ 8 Nm

4 - Coolant hose



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2.3 Exploded view - coolant temperature senders

1 - Seal

- ☐ Renew after removing

2 - Radiator outlet coolant temperature sender - G83-

- ☐ Removing and installing
⇒ ["2.9 Removing and installing radiator outlet coolant temperature sender G83"](#),
page 249
- ☐ Tightening torque
⇒ [Item 5 \(page 254\)](#)

3 - Support ring

4 - O-ring

- ☐ Renew after removing

5 - Coolant temperature sender - G62-

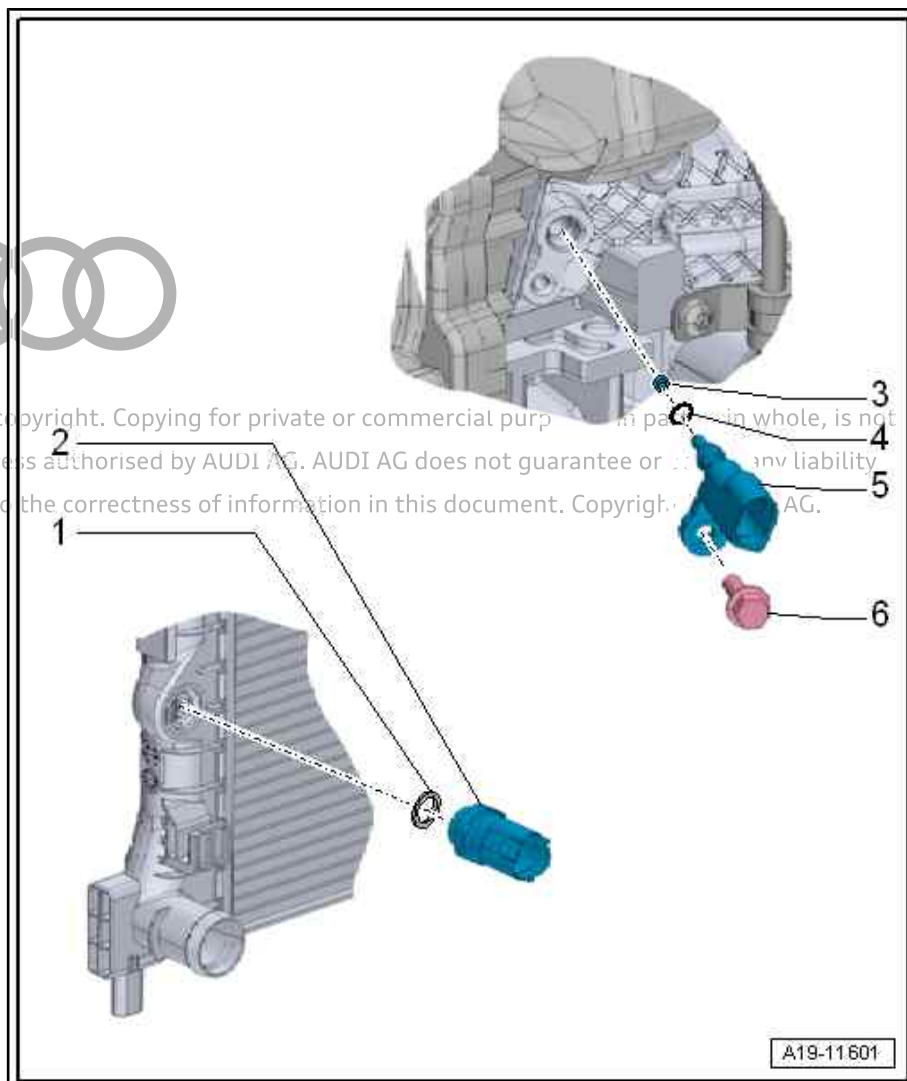
- ☐ Removing and installing
⇒ ["2.8 Removing and installing coolant temperature sender G62"](#),
page 248

6 - Bolt

- ☐ 8 Nm

7 - Retaining clip

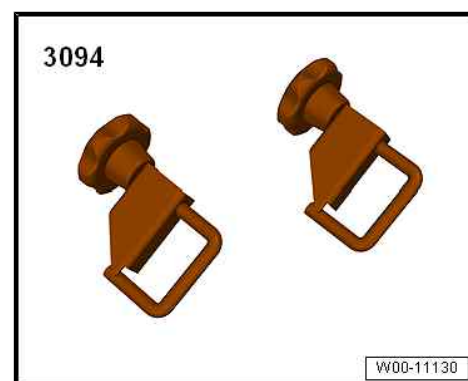
- ☐ Check for firm attachment



2.4 Removing and installing electric coolant pump

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-





- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - VAS 6362-



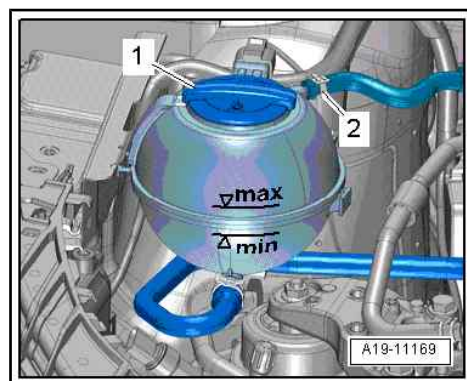
Removing

⚠ CAUTION

The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant.

Danger of scalding skin and other parts of the body.

- Put on protective gloves.
 - Put on safety goggles.
 - Cover filler cap on expansion tank with a cloth and open carefully to release pressure.
-
- Open filler cap -1- on coolant expansion tank.
 - Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



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- Unplug electrical connector -1-.
- Place drip tray for workshop hoist - VAS 6208- underneath.
- Use hose clamps up to 25 mm - 3094- to clamp off coolant hoses at continued coolant circulation pump - V51- .
- Release hose clips -3- and disconnect coolant hoses.
- Remove bolt -2- and detach continued coolant circulation pump - V51- .

Installing

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

- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Check coolant level ⇒ [page 230](#) .

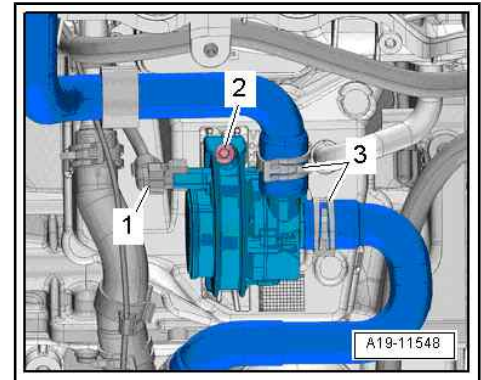
Tightening torques

- ◆ ⇒ [“2.2 Exploded view - electric coolant pump”, page 233](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

2.5 Removing and installing coolant pump

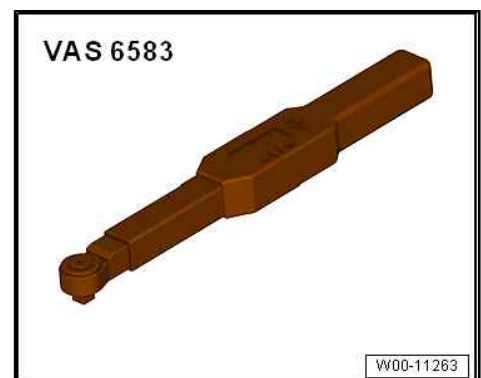
Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-



- ◆ Release tool - T10527- and -T10527/1-

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Removing

- Remove engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#) .
- Drain coolant
⇒ [“1.3 Draining and filling cooling system”, page 224](#) .

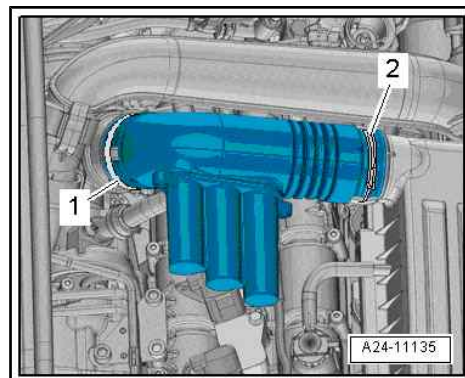


Vehicles with manual gearbox:

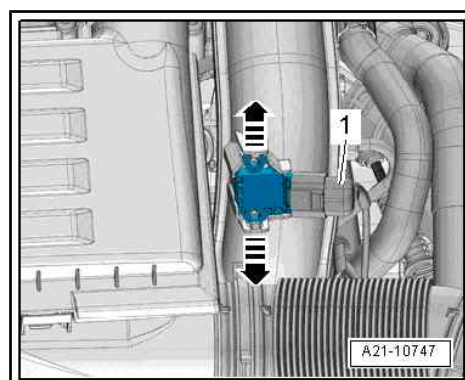
- Engage fifth gear.

All vehicles (continued):

- Loosen hose clips -1, 2- and remove air pipe.

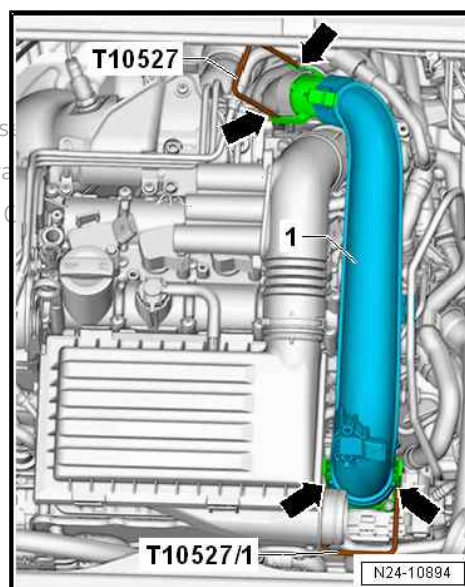


- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .



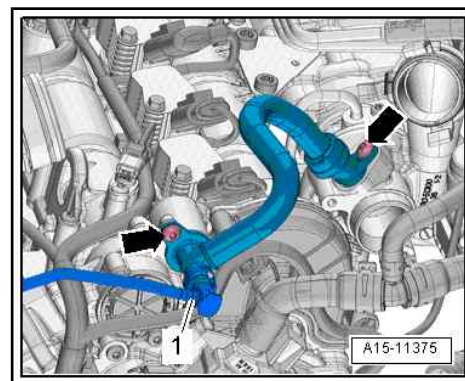
- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe -1-.

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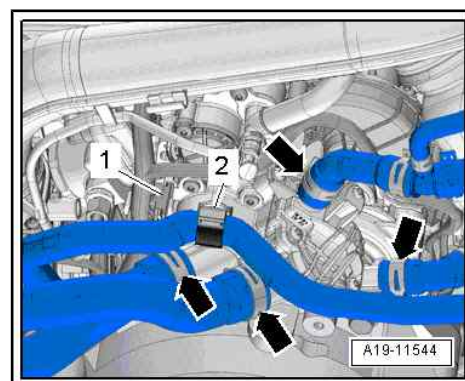


- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



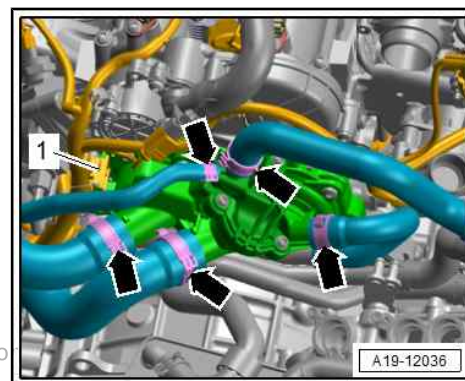
Version 1:

- Move clear electrical wiring harness -1- and coolant hose -2-.
- Release hose clips -arrows- and disconnect coolant hoses.



Version 2:

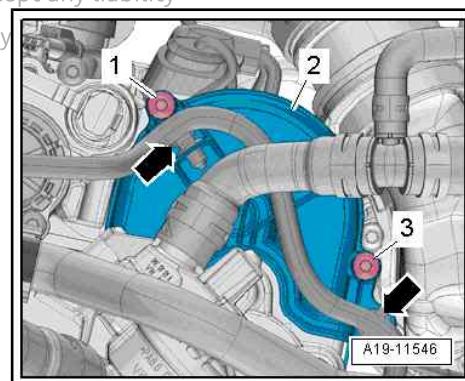
- Move electrical wiring harness -1- clear.
- Release hose clips -arrows- and disconnect coolant hoses.



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All engine versions (continued):

- Move electrical wiring harness clear -arrows-.
- Unscrew bolts -1, 3- and remove cover -2- for toothed belt for coolant pump.

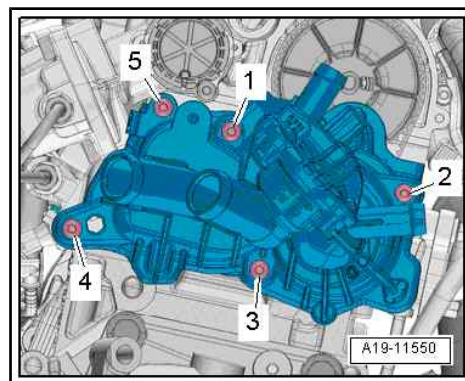




- Slacken and remove bolts in the sequence: -5 ... 1-.
- Detach coolant pump with toothed belt.

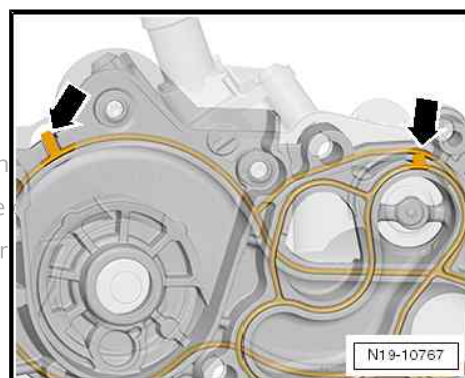
Installing

- Renew gasket and O-rings after removal.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Set cylinder 1 to TDC position (for description of procedure refer to [⇒ “1.4 Removing and installing toothed belt”, page 120](#)).



- Check that gaskets are correctly seated -arrows-.
- Lubricate gasket for coolant pump lightly with coolant.
- Fit toothed belt so that it is centred and move coolant pump into installation position.

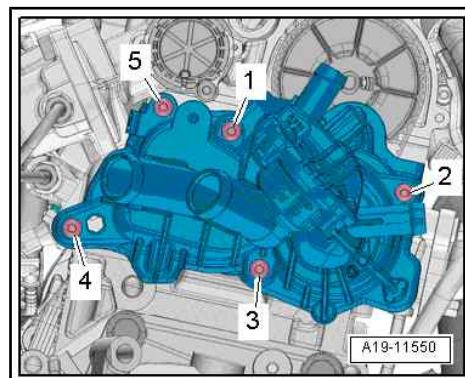
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- Tighten bolts to initial torque in the specified sequence:

Stage	Bolts	Tightening torque
1.	-1 ... 5-	Screw in by hand until contact is made
2.	-1 ... 5-	10 Nm

- Loosen all bolts again by one turn.



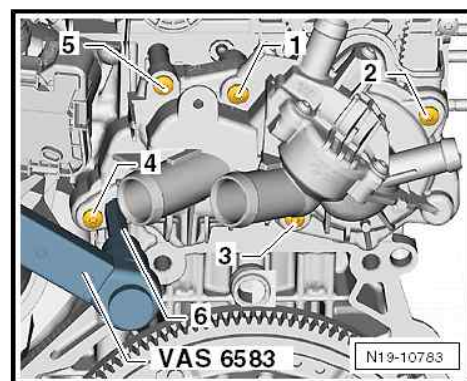


- Apply torque wrench -VAS 6583- with hexagon key (10 mm) -item 6- to coolant pump.

Note:

For ease of handling, apply torque wrench -VAS 6583- vertically.

- Have a second mechanic apply a torque of 30 Nm to coolant pump.
- Do not support torque wrench with your other hand.
- Do not apply excessive force to torque wrench.
- While keeping coolant pump under tension, tighten bolts for coolant pump in specified sequence:



Stage	Bolts	Tightening torque
3.	-2, 1, 5-	10 Nm
4.	-3, 4, 5, 1, 2-	12 Nm

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

- Disengage fifth gear.
- Fill up with coolant ⇒ [page 226](#) .

Tightening torques

- ◆ Coolant pump ⇒ [page 240](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)

2.6 Removing and installing thermostat

⇒ [“2.6.1 Removing and installing thermostat for large coolant circuit”, page 241](#)

⇒ [“2.6.2 Removing and installing thermostat for small coolant circuit”, page 243](#)

2.6.1 Removing and installing thermostat for large coolant circuit

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



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◆ Key - T10508-

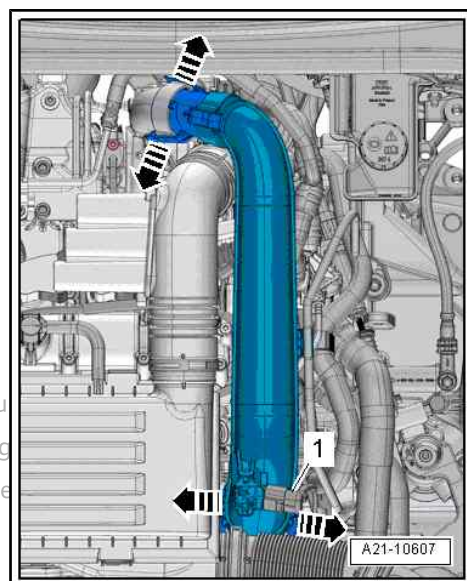


Removing

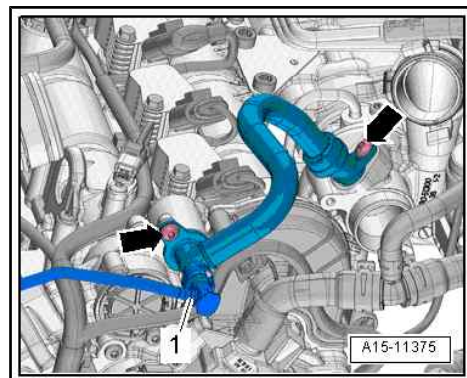
- Drain coolant
⇒ [“1.3 Draining and filling cooling system”, page 224](#).
- Move air hoses clear at air pipe.



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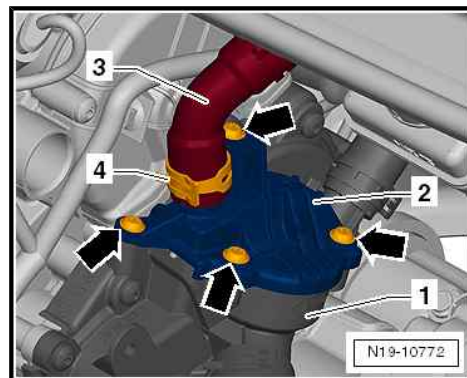
- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



- Disconnect coolant hose -3- from connection on turbocharger.

On some versions cover -2- of thermostat housing has two connections for coolant hoses. If this is the case, disconnect second coolant hose from cover -2-.

- Release hose clip -4- and detach coolant hose -3-.
- Remove bolts -arrows- and detach cover -2- from thermostat housing -1-.





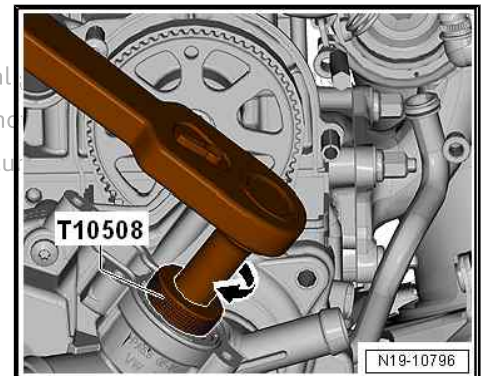
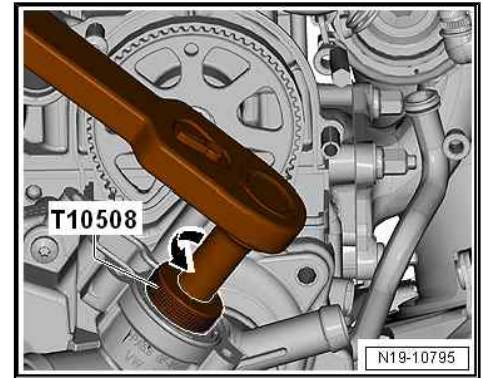
- Turn thermostat anti-clockwise -arrow- using special wrench - T10508- and detach.



Installing

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

- Renew seal and O-rings after removal.
- Lubricate gasket lightly with coolant.
- Installation position of thermostat
 ⇒ Fig. ““Installation position of thermostat for large coolant circuit””, page 233 .
- Bring thermostat into position with special wrench - T10508- , press down slightly and turn clockwise -arrow- as far as stop.
- Fill up with coolant ⇒ page 226 .



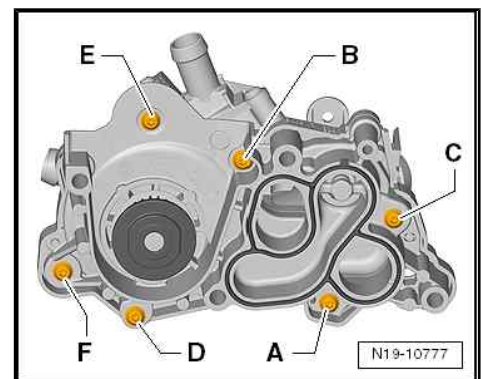
Tightening torques

- ◆ ⇒ Fig. ““Cover for thermostat to thermostat housing - tightening torque””, page 233
- ◆ ⇒ “2.1 Exploded view - charge air system”, page 277

2.6.2 Removing and installing thermostat for small coolant circuit

Removing

- Remove coolant pump
 ⇒ “2.5 Removing and installing coolant pump”, page 237 .
- Remove bolts in the sequence -F ... A-.
- Detach coolant pump from thermostat housing.

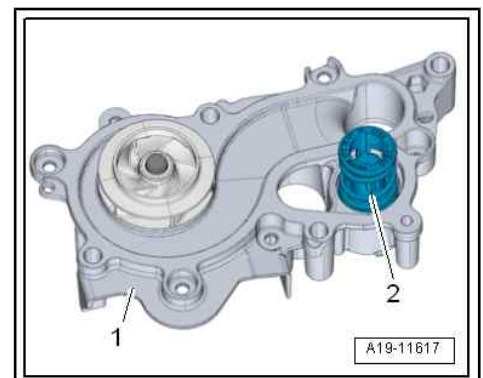


- Detach thermostat -2- from coolant pump -1-.

Installing

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

- Renew gasket after removing.
- Lubricate gasket lightly with coolant.

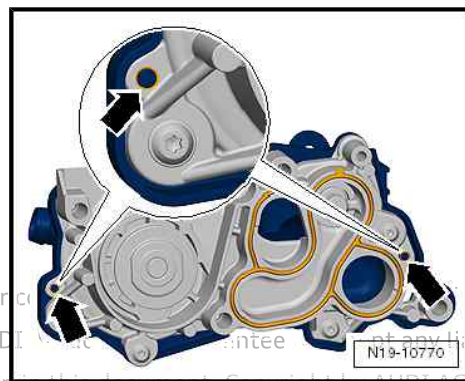




- Fit thermostat housing onto coolant pump.
- Centring pins on thermostat must be fitted in guides -arrows- on coolant pump.
- Tighten bolts for thermostat housing
⇒ [Fig. "Thermostat housing to coolant pump - tightening torque and sequence", page 233](#).
- Install coolant pump
⇒ ["2.5 Removing and installing coolant pump", page 237](#).
- Fill up with coolant ⇒ [page 226](#).

Tightening torques

- ◆ ⇒ [Fig. "Thermostat housing to coolant pump - tightening torque and sequence", page 233](#)
- ◆ ⇒ ["2.1 Exploded view - charge air system", page 277](#)



2.7 Removing and installing toothed belt sprocket for coolant pump

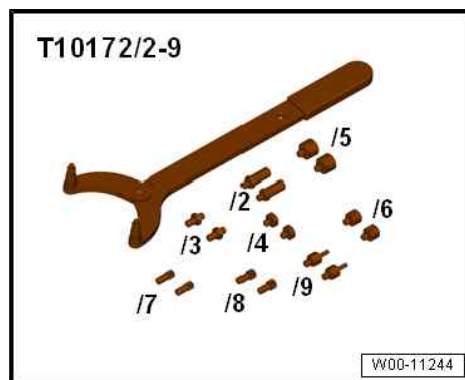
⇒ ["2.7.1 Removing and installing toothed belt sprocket for coolant pump - engines without cylinder shut-off", page 244](#)

⇒ ["2.7.2 Removing and installing toothed belt sprocket for coolant pump - engines with cylinder shut-off", page 245](#)

2.7.1 Removing and installing toothed belt sprocket for coolant pump - engines without cylinder shut-off

Special tools and workshop equipment required

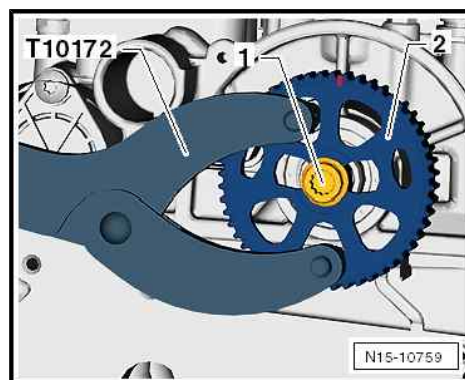
- ◆ Counterhold tool - T10172A- with adapters -T10172/2-



- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove coolant pump
⇒ ["2.5 Removing and installing coolant pump", page 237](#).
- Loosen bolt -1- using counterhold tool - T10172A- with adapters -T10172/2-.
- Remove bolt and take off toothed belt drive sprocket -2-.





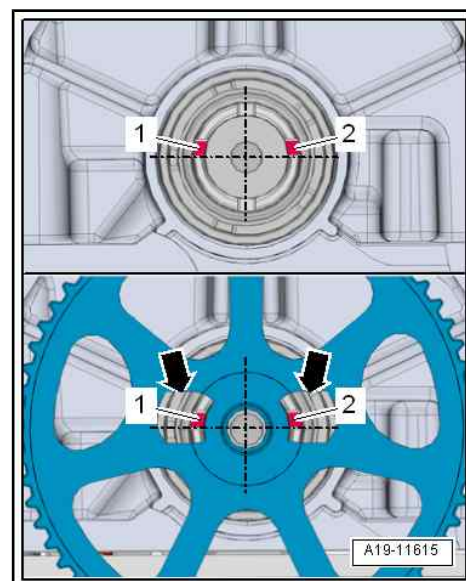
Installing

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

- Fit toothed belt drive sprocket:
- Grooves -1, 2- in camshaft are arranged asymmetrically.
- Openings -arrows- in toothed belt sprocket are also arranged asymmetrically.
- Fit toothed belt sprocket onto camshaft so that asymmetrical grooves are positioned exactly in centre of openings.

Tightening torques

- ◆ ⇒ "2.1 Exploded view - coolant pump/thermostat", page 231
- ◆ ⇒ "2.1 Exploded view - charge air system", page 277

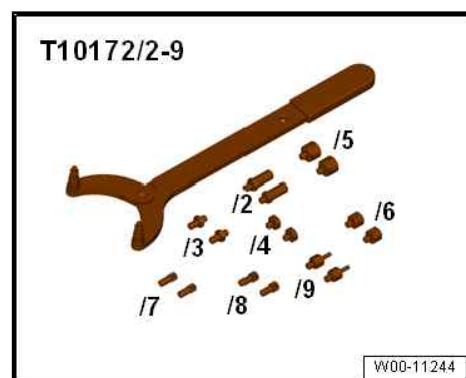


2.7.2 Removing and installing toothed belt sprocket for coolant pump - engines with cylinder shut-off

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Special tools and workshop equipment required

- ◆ Counterhold tool - T10172A- with adapters -T10172/2-



- ◆ Assembly tool - T10498-





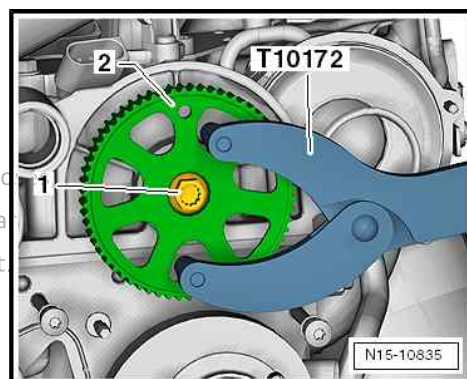
◆ Assembly sleeve - T10505-



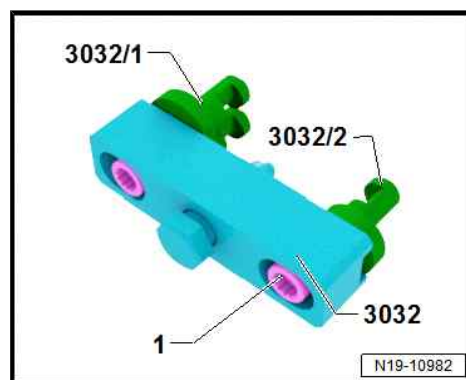
Removing

- Remove coolant pump
⇒ ["2.5 Removing and installing coolant pump", page 237](#).
- Loosen bolt -1- using counterhold tool - T10172A- .
- Remove bolt and take off toothed belt drive sprocket -2-.

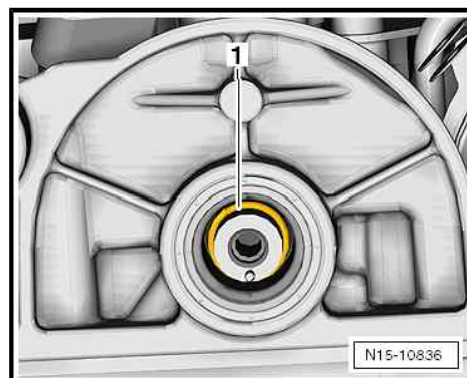
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- If it is not possible to detach toothed belt drive sprocket, tighten bolt -1- for adapter -3032/2- in centre of elongated hole.
- Apply puller - 3032- to toothed belt drive sprocket.
- Slide adapter - 3032/1- to right as far as stop and tighten bolt hand-tight.
- Detach toothed belt drive sprocket by turning centre bolt.

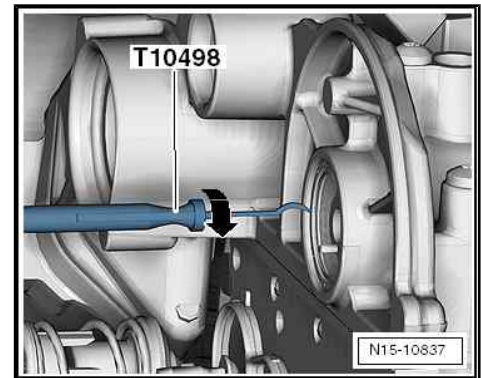


- The O-ring -1- in the camshaft must be renewed every time the toothed belt drive sprocket is removed.
- The O-ring is positioned approx. 15 mm behind stub of camshaft.





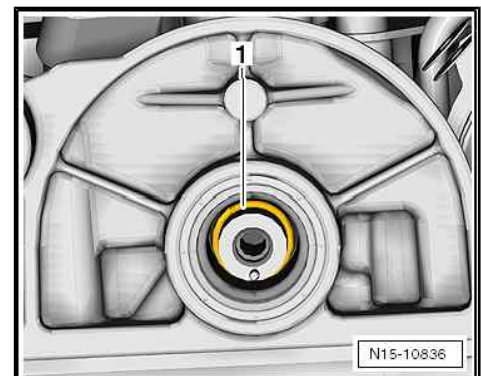
- Guide release tool - T10498- above camshaft as far as O-ring.
- Turn release tool -T10498- -arrow- to bring point of tool under O-ring.
- Pull O-ring off camshaft.



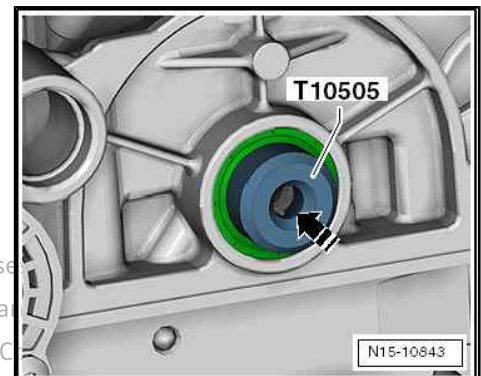
Installing

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

- Fit new O-ring -1- onto stub of camshaft.



- Pin on camshaft must engage in recess on assembly tool - T10505- .
- Fit assembly tool - T10505- onto camshaft and press onto stop by hand -arrow-.
- Remove assembly tool.
- O-ring must be positioned in groove on camshaft.

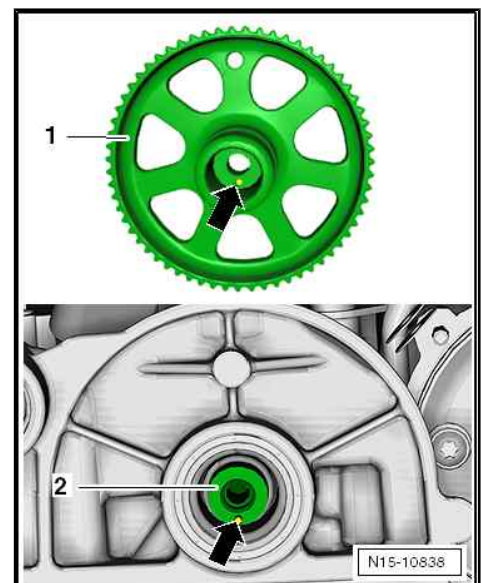


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- Fit toothed belt drive sprocket -1- onto camshaft -2-:
- Pin on camshaft must engage in hole on toothed belt drive sprocket -arrows-.
- Install coolant pump
⇒ ["2.5 Removing and installing coolant pump", page 237](#) .

Tightening torques

- ◆ ⇒ ["2.1 Exploded view - coolant pump/thermostat", page 231](#)
- ◆ ⇒ ["2.1 Exploded view - charge air system", page 277](#)





2.8 Removing and installing coolant temperature sender - G62-

Removing

- Engine cold.
- To relieve residual pressure in cooling system, open filler cap -1- on coolant expansion tank briefly and then close cap again (it should click into place).
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- If fitted, remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Unplug electrical connector.
- Place a cloth underneath to catch escaping coolant.
- Unscrew bolt -1- and pull off coolant temperature sender - G62- -item 2-.

Note:

If O-ring with support ring remains lodged in cylinder head, lift it out using a piece of wire.

Insert new coolant temperature sender - G62- immediately into cylinder head to avoid loss of coolant.

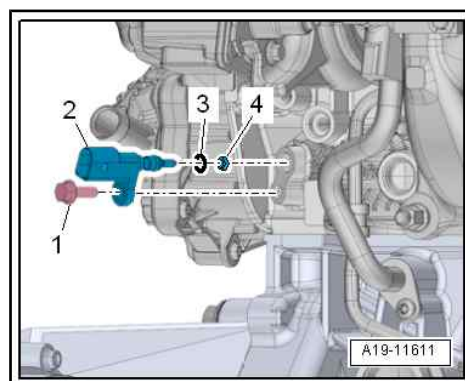
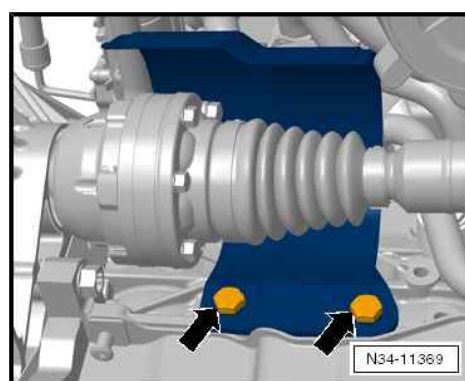
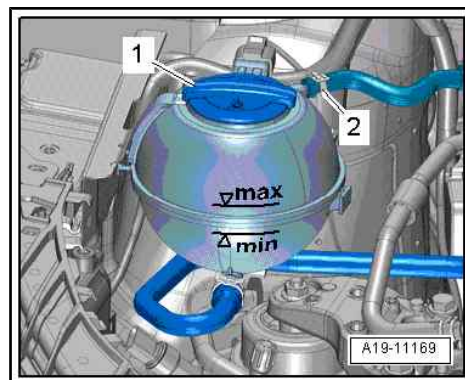
Installing

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

- Renew O-ring after removal.
- Reinstall heat insulation sleeves in the same locations when installing.
- Check coolant level ⇒ [page 230](#) .

Tightening torques

- ◆ ⇒ [“2.3 Exploded view - coolant temperature senders”, page 235](#)
- ◆ Heat shield for drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

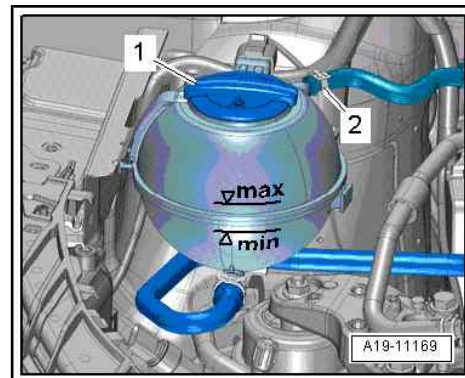




2.9 Removing and installing radiator outlet coolant temperature sender - G83-

Removing

- Engine cold.
- To relieve residual pressure in cooling system, open filler cap -1- on coolant expansion tank briefly and then close cap again (it should click into place).



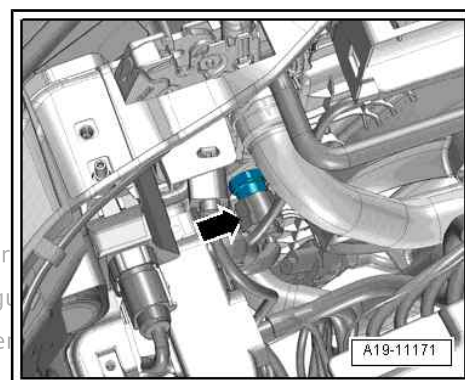
- Unplug electrical connector -arrow-.
- Place a cloth underneath to catch escaping coolant.
- Unscrew radiator outlet coolant temperature sender - G83- .

Installing

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

Tightening torques

- ◆ ⇒ "2.3 Exploded view coolant temperature senders", page 235
- Renew O-ring after removal.



Note:

To avoid loss of coolant, screw in new radiator outlet coolant temperature sender - G83- immediately.

- Check coolant level ⇒ page 230 .



3 Coolant pipes

⇒ ["3.1 Exploded view - coolant pipes", page 250](#)

⇒ ["3.2 Removing and installing coolant pipes", page 250](#)

3.1 Exploded view - coolant pipes

- The arrow markings on coolant pipes and on ends of hoses must align.

1 - Coolant hose

2 - Coolant pipe

- Removing and installing
⇒ ["3.2 Removing and installing coolant pipes", page 250](#)

3 - Bolt

- 8 Nm

4 - Coolant hose

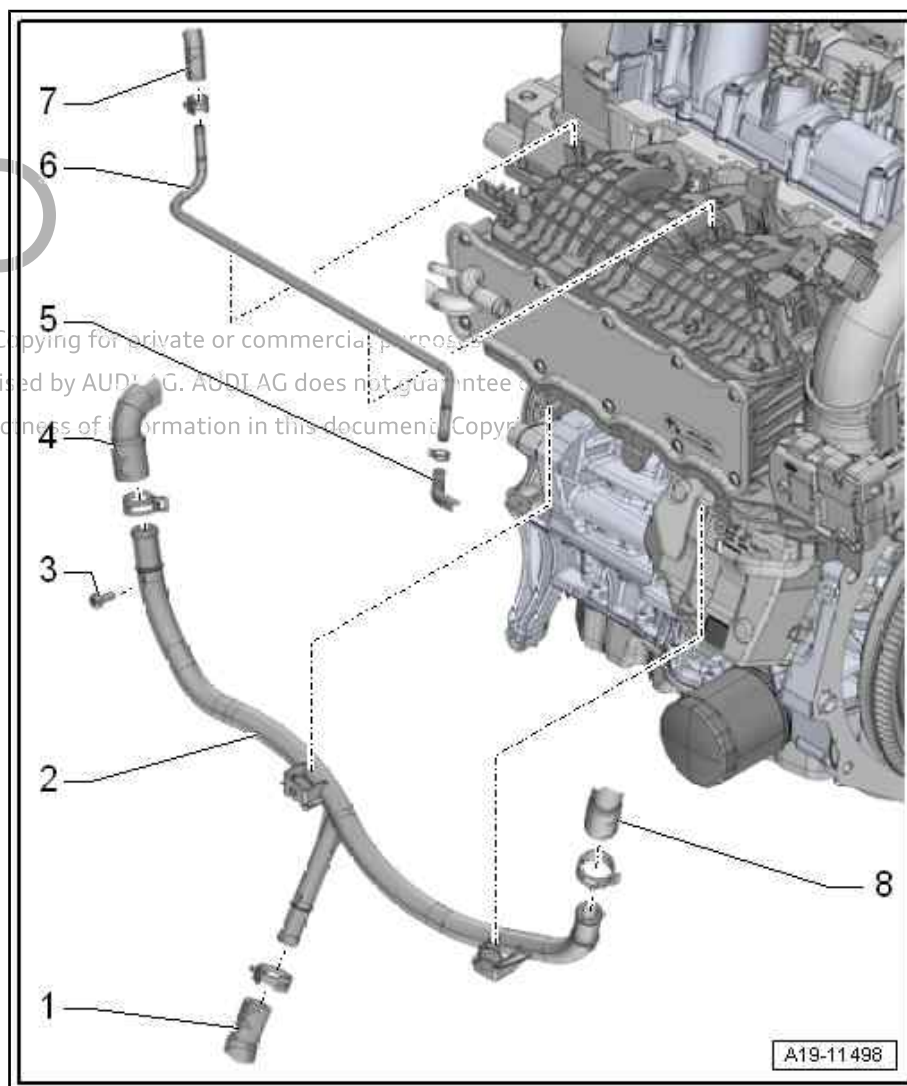
5 - Coolant hose

6 - Coolant pipe

- Clipped onto intake manifold (top)

7 - Coolant hose

8 - Coolant hose

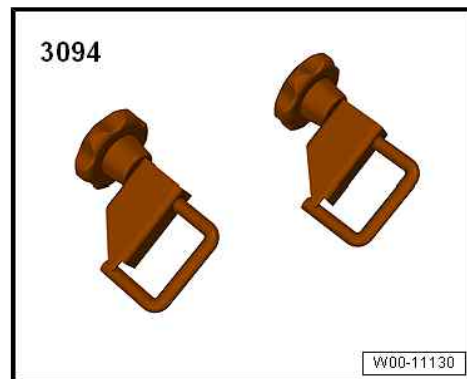


3.2 Removing and installing coolant pipes

Special tools and workshop equipment required



- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6362-



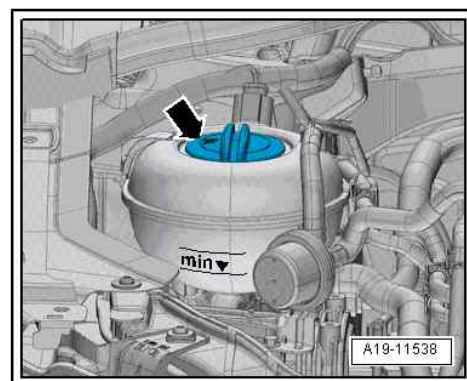
Removing

⚠ CAUTION

The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant.

Danger of scalding skin and other parts of the body.

- Put on protective gloves.
- Put on safety goggles.
- Cover filler cap on expansion tank with a cloth and open carefully to release pressure.



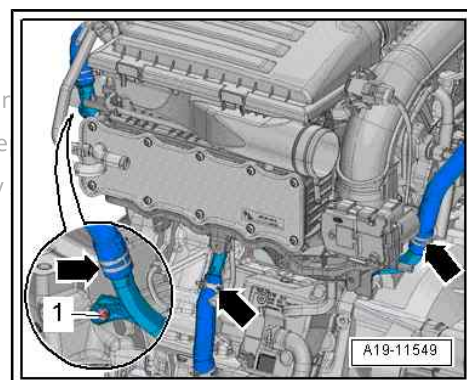
- Open filler cap -arrow- on coolant expansion tank.
- Place a cloth underneath to catch escaping coolant.
- Clamp off coolant hoses at coolant pipe with hose clamps up to 25 mm - 3094-

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permitted. Release hose clips -arrows- and disconnect coolant hoses.

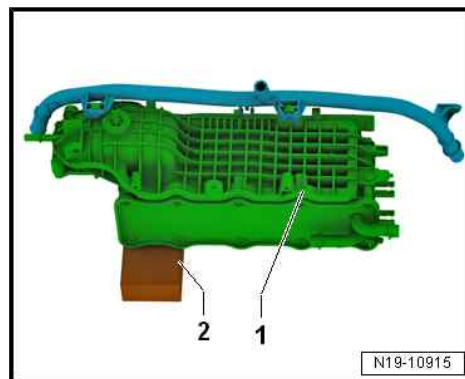
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⇒ ["3.2 Removing and installing intake manifold", page 293](#).





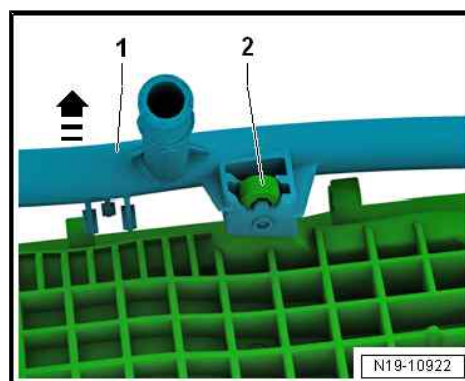
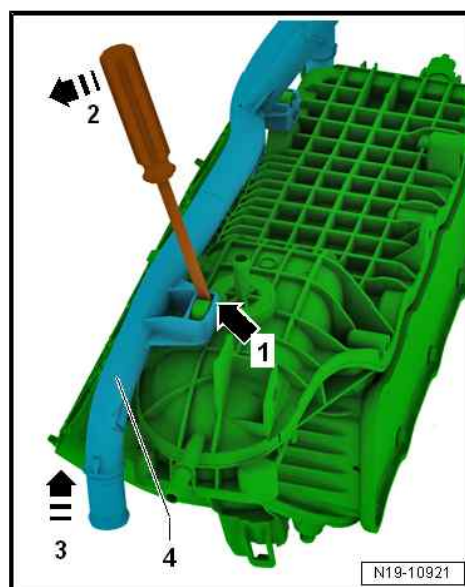
- Place intake manifold -1- on workbench (as shown in illustration).
- Place a piece of wood -2- (or similar) under intake manifold to support it.



NOTICE

Danger of damage to intake manifold and coolant pipe.

- Proceed very carefully when performing this work.
- Insert a flat-bladed screwdriver into opening -arrow 1-.
- Press screwdriver carefully in direction of -arrow 2- and at the same time lift coolant pipe -4- in direction of -arrow 3- until it is released from mounting.
- Keep lifting coolant pipe -1- in direction of -arrow- until it is released from mounting -2-.



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Installing

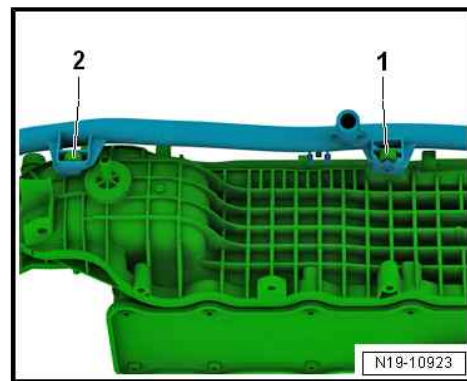
- Start by pressing coolant pipe onto mounting -1- until it engages.
- Then press coolant pipe onto mounting -2- until it engages.
- Check that coolant pipe is properly engaged in both mountings by pulling it.

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

- Renew seals and O-rings.
- Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#)
- Install intake manifold ⇒ [“3.2 Removing and installing intake manifold”, page 293](#)
- Check coolant level ⇒ [page 230](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - intake manifold”, page 292](#)





4 Radiator/radiator fan

⇒ [“4.1 Exploded view - radiator/radiator fan”, page 254](#)

⇒ [“4.2 Removing and installing radiator”, page 255](#)

⇒ [“4.3 Removing and installing radiator cowl”, page 258](#)

⇒ [“4.4 Removing and installing radiator fan”, page 259](#)

4.1 Exploded view - radiator/radiator fan

Radiator

1 - Coolant hoses

- ☐ For coolant circuit for charge air cooler

2 - Air guide

3 - Water radiator for charge air cooling circuit

- ☐ Radiator and water radiator for charge air cooling circuit are removed together
- ☐ If renewed, change coolant in entire system
- ☐ Removing and installing ⇒ [“4.2 Removing and installing radiator”, page 255](#)

4 - Coolant hose (bottom)

5 - Radiator outlet coolant temperature sender - G83-

- ☐ Removing and installing ⇒ [“2.9 Removing and installing radiator outlet coolant temperature sender G83”, page 249](#)
- ☐ 35 Nm

6 - Seal

- ☐ Renew after removing

7 - Coolant hose (top)

8 - Air duct

9 - Coolant hose

- ☐ To coolant expansion tank

10 - Radiator

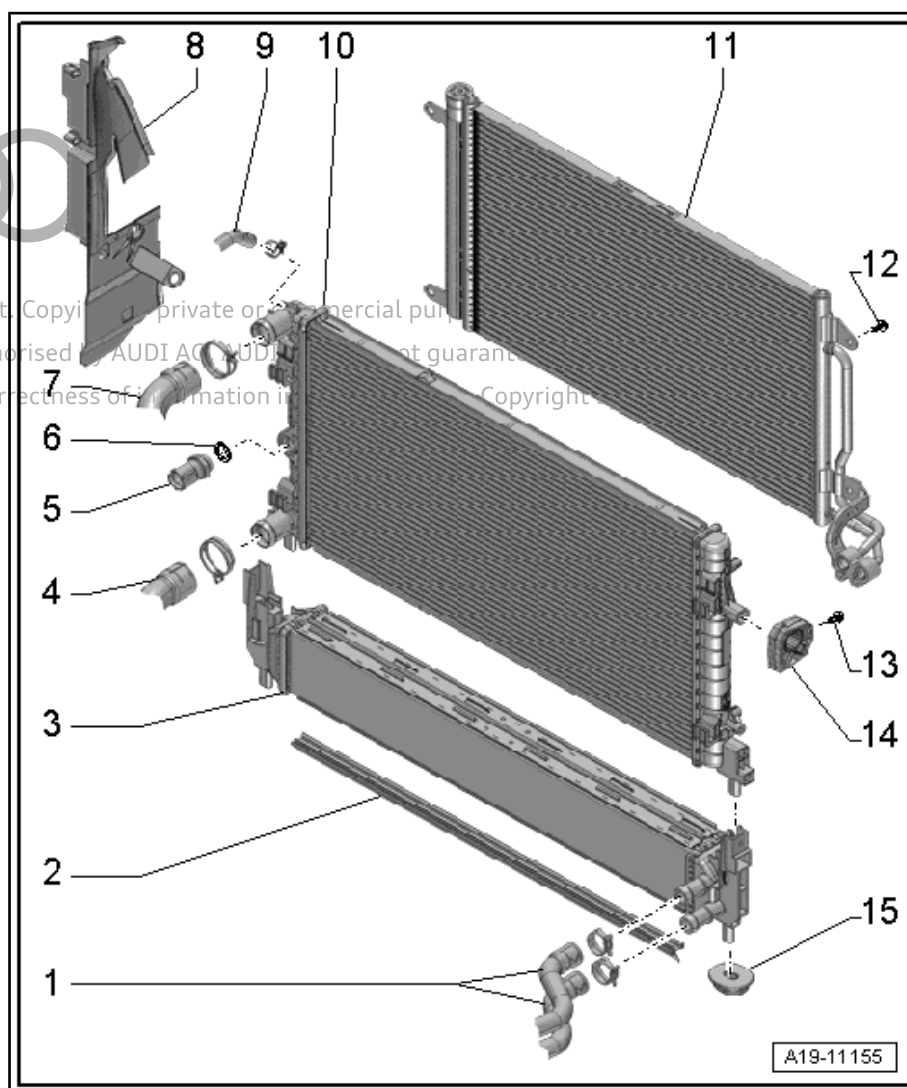
- ☐ Removing and installing ⇒ [“4.2 Removing and installing radiator”, page 255](#)
- ☐ If renewed, change coolant in entire system

11 - Condenser

- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser

12 - Bolt

- ☐ Tightening torque ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Exploded view - condenser





13 - Bolt

- ☐ 5 Nm

14 - Mounting

- ☐ Note installation position

15 - Mounting

- ☐ For water radiator for charge air cooling circuit

Radiator cowl and radiator fan

1 - Radiator cowl

- ☐ Removing and installing
⇒ ["4.3 Removing and installing radiator cowl"](#),
[page 258](#)

2 - Bolt

- ☐ 1.5 Nm

3 - Not fitted

4 - Nut

- ☐ 9 Nm

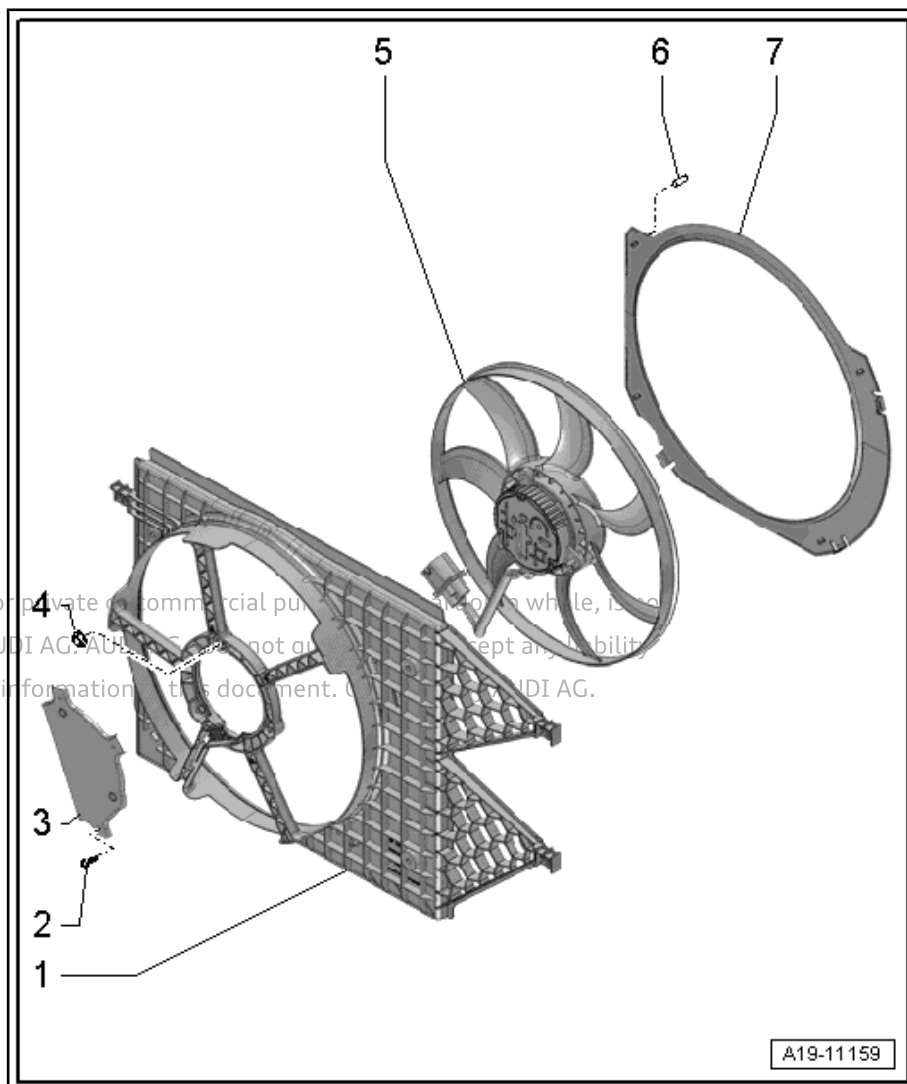
5 - Radiator fan - V7-

- ☐ With radiator fan control unit - J293-
- ☐ Removing and installing
⇒ ["4.4 Removing and installing radiator fan"](#),
[page 259](#)

6 - Pin

7 - Trim

- ☐ For radiator fan



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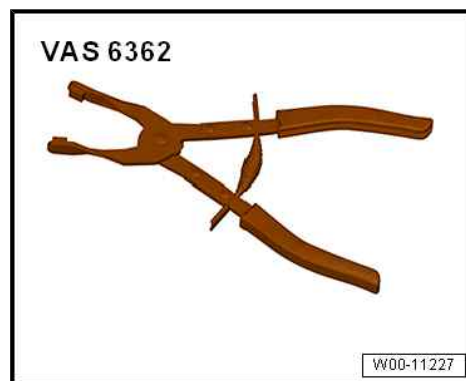
4.2 Removing and installing radiator

- Radiator and water radiator for charge air cooling circuit are removed together.

Special tools and workshop equipment required

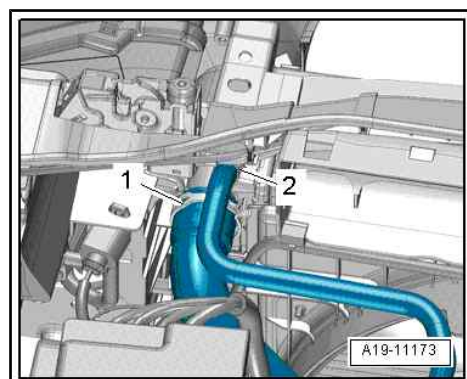
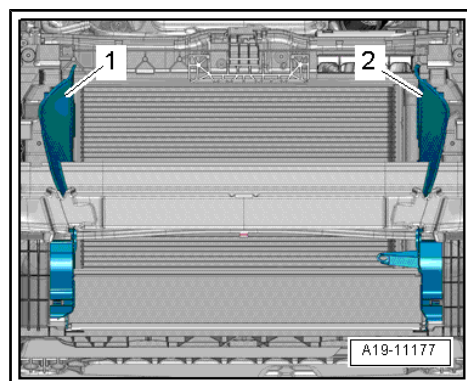


- ◆ Hose clip pliers - VAS 6362-

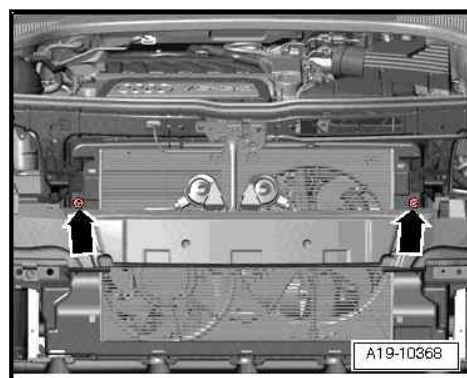


Removing

- Drain coolant
⇒ ["1.3 Draining and filling cooling system", page 224](#) .
 - Remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .
 - Remove radiator cowl
⇒ ["4.3 Removing and installing radiator cowl", page 258](#) .
 - Release fasteners and detach air ducts -1 and 2-.
-
- Release hose clips -1 and 2- and detach coolant hoses (top left) from radiator.



- Remove bolts -arrows-.
- Swivel top edge of radiator slightly to rear.
- Lift radiator, disengage it from bottom mounting points and press it to the rear.



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Vehicles with air conditioner:

CAUTION

Risk of injury caused by refrigerant.

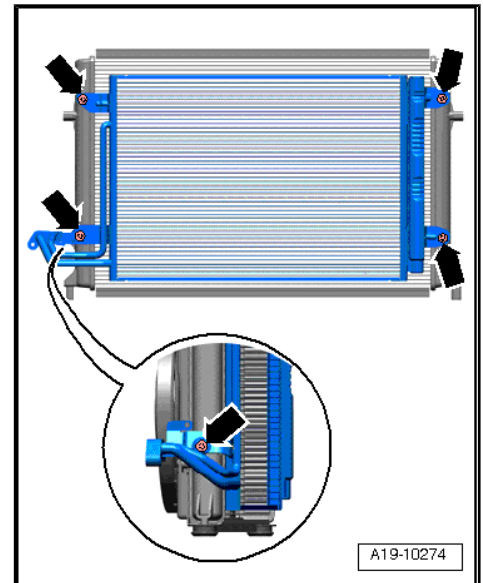
- The air conditioner refrigerant circuit must not be opened.

- Remove bolts -arrows-.

NOTICE

Risk of damage to refrigerant lines and hoses

- Do NOT stretch, kink or bend refrigerant lines and hoses.
- Move condenser to front and place in lock carrier, then secure with cable ties to prevent from dropping.



All vehicles (continued):

- Release fasteners at water radiator for charge air cooler -1- -arrows A-.
- Detach water radiator for charge air cooling circuit from radiator -2- -arrow B- and disengage -arrow C-.
- Remove both radiators.

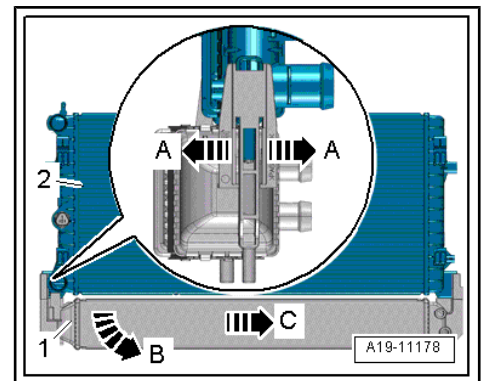
Installing

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

- If there are slight impressions on the fins, refer to [⇒ "3.7 Installing radiators and condensers", page 7](#).
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue.
- Renew O-rings after removing.
- Vehicles with air conditioning: Install condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser.
- Install radiator cowl [⇒ "4.3 Removing and installing radiator cowl", page 258](#).
- Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover.
- Fill up with coolant [⇒ page 230](#).

Tightening torques

- ◆ [⇒ "4.1 Exploded view - radiator/radiator fan", page 254](#)
- ◆ [⇒ "2.1 Exploded view - air cleaner housing", page 290](#)



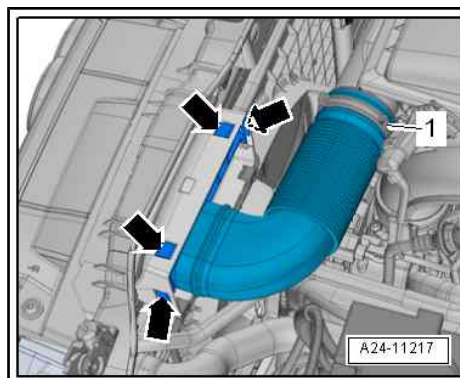
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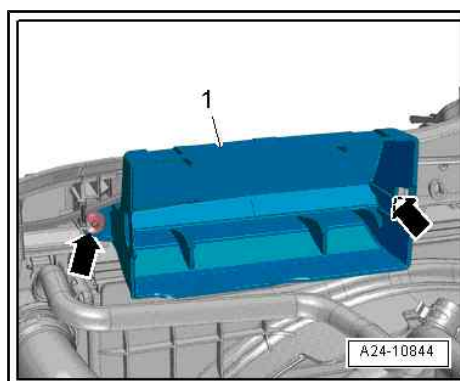
4.3 Removing and installing radiator cowl

Removing

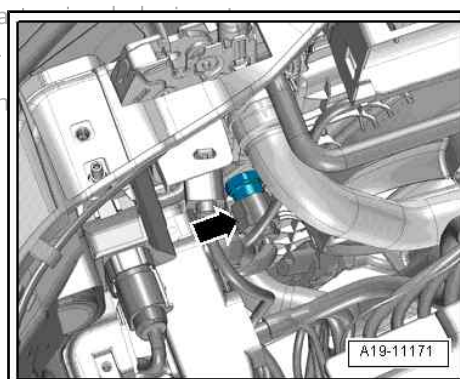
- Release hose clip -1-.
- Release fasteners -arrows- and remove air duct.
- Remove air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”, page 291](#).



- Remove bolts -arrows- and detach air duct -1-.



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



- Detach coolant hoses at radiator cowl.

CAUTION

Your hands can be injured if the radiator fan starts up automatically.

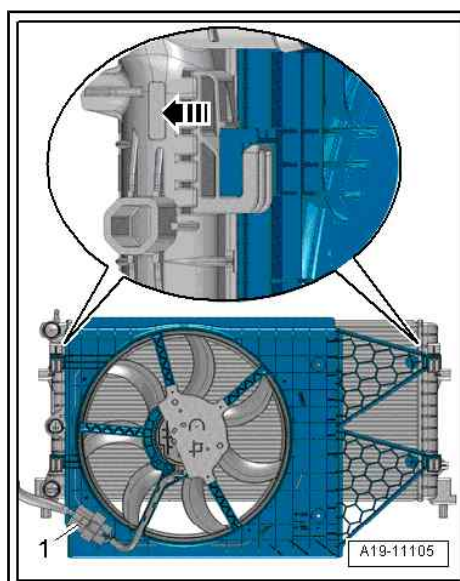
- Do not reach into the radiator fan when unplugging the connector.
- Unplug electrical connector -1- for radiator fan at bottom of radiator cowl.
- Press locking tabs on left and right sides of radiator cowl together -arrow- and lift radiator cowl off radiator.

Installing

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

Tightening torques

- ♦ ⇒ [“2.1 Exploded view - air cleaner housing”, page 290](#)

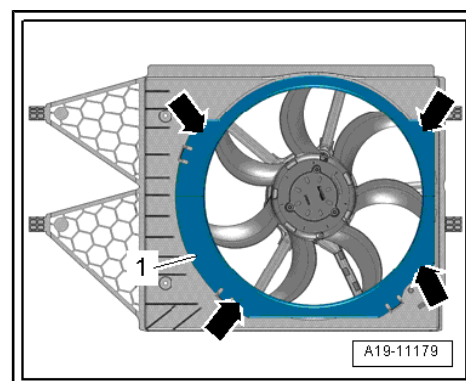




4.4 Removing and installing radiator fan

Removing

- Remove radiator cowl
⇒ [“4.3 Removing and installing radiator cowl”, page 258](#) .
- Press out clamping pins -arrows- and detach ring -1- of fan.



- Take electrical wiring -1- out of cable guide.
- Unscrew nuts -arrows- and detach radiator fan - V7- .

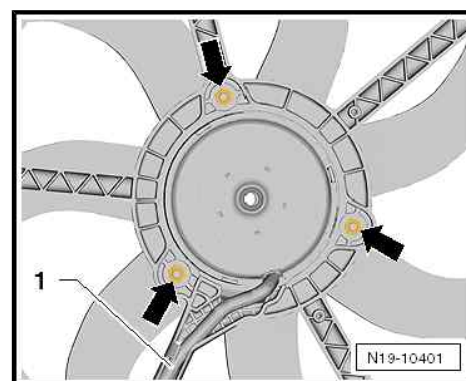
Installing

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

- Install radiator cowl
⇒ [“4.3 Removing and installing radiator cowl”, page 258](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiator/radiator fan”, page 254](#)



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21 – Turbocharging/supercharging

1 Turbocharger

⇒ [“1.1 Exploded view - turbocharger”, page 260](#)

⇒ [“1.2 Removing and installing turbocharger”, page 264](#)

⇒ [“1.3 Removing and installing charge pressure positioner V465”, page 270](#)

⇒ [“1.4 Removing and installing connection for turbocharger”, page 273](#)

1.1 Exploded view - turbocharger

⇒ [“1.1.1 Exploded view - turbocharger, version 1”, page 260](#)

⇒ [“1.1.2 Exploded view - turbocharger, version 2”, page 262](#)

⇒ [“1.1.3 Exploded view - pipes, lines and hoses on turbocharger”, page 263](#)

1.1.1 Exploded view - turbocharger, version 1

1 - Turbocharger

- ☐ Removing and installing
⇒ [“1.2 Removing and installing turbocharger”, page 264](#)

2 - Bolt

- ☐ 8 Nm

3 - Connection

4 - O-ring

- ☐ Renew after removing

5 - Gasket

- ☐ Renew after removing

6 - Heat shield

7 - Bolt

- ☐ 20 Nm

8 - Bracket

- ☐ With ball stud for engine cover panel

9 - Bolt

- ☐ 8 Nm

10 - Bolt

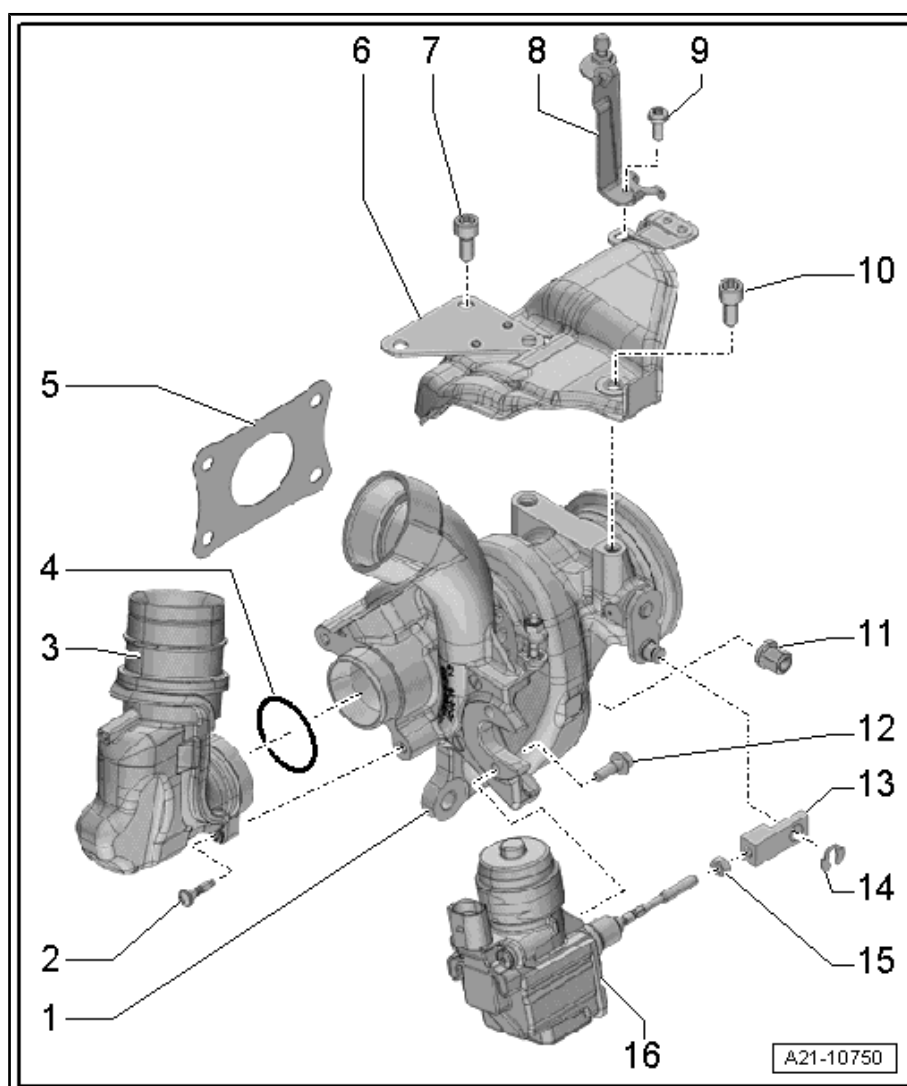
- ☐ 20 Nm

11 - Nut

- ☐ Renew after removing
- ☐ 1st stage: 10 Nm
- ☐ 1st stage: 14 Nm

12 - Bolt

- ☐ 9 Nm





13 - Actuating lever

- ☐ Version: Actuating lever without pins
- ☐ Version ⇒ [Fig. "" Charge pressure positioner -V465- , version: actuating lever with pins"" , page 261](#)

14 - Securing clip

15 - Lock nut

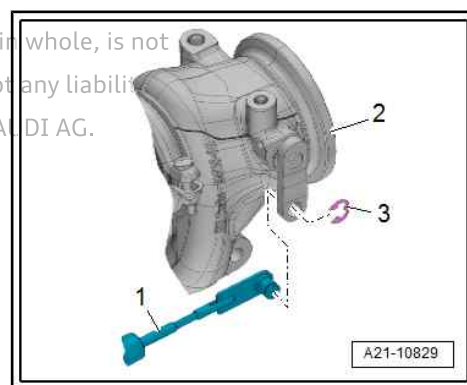
- ☐ Version: Actuating lever without pins
- ☐ 10 Nm

16 - Charge pressure positioner - V465-

- ☐ Version: Actuating lever without pins
- ☐ Version: Actuating lever with pins
⇒ [Fig. "" Charge pressure positioner -V465- , version: actuating lever with pins"" , page 261](#)
- ☐ Removing and installing ⇒ ["1.3 Removing and installing charge pressure positioner V465 " , page 270](#)

Charge pressure positioner - V465- , version: actuating lever with pins

- 1 - Actuating lever
- 2 - Turbocharger
- 3 - Securing clip





1.1.2 Exploded view - turbocharger, version 2

1 - Bolt

- 25 Nm

2 - Bolt/nut

- 8 Nm

3 - Heat shield

4 - Turbocharger

- Removing and installing
⇒ ["1.2 Removing and installing turbocharger"](#),
[page 264](#)

5 - Nut

- Renew after removing
- 1st stage: 10 Nm
- 2nd stage: 14 Nm

6 - Securing clip

- Renew

7 - Actuating lever

8 - Control rod

9 - Lock nut

- 6 Nm
- Seal with sealing paint

10 - Securing clip

- Renew

11 - Actuating lever

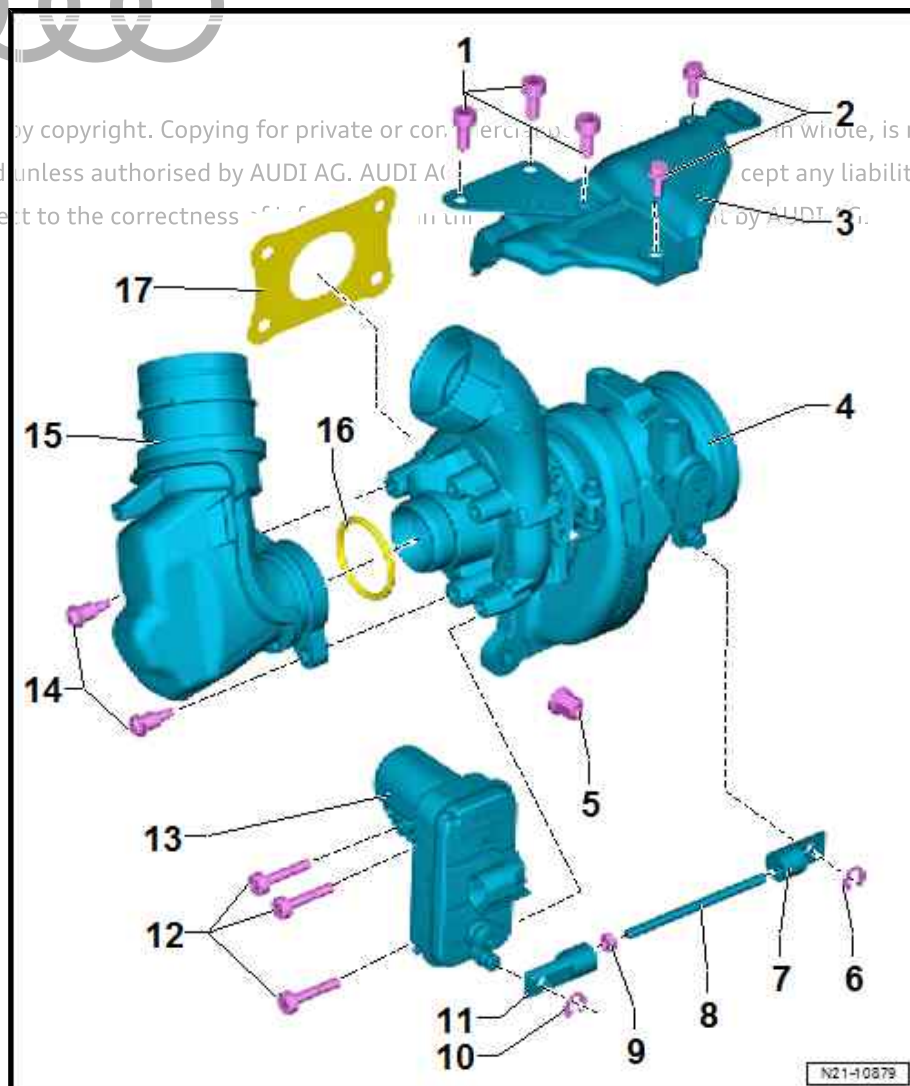
12 - Bolt

- 3x ⇒ Electronic parts catalogue (ETKA)
- 8 Nm + 45°



Note

Always renew all three bolts if one or more are loose.



13 - Charge pressure positioner - V465-

- Version: Actuating lever without pins
- Version: Actuating lever with pins
⇒ [Fig. "Charge pressure positioner -V465-, version: actuating lever with pins"](#), [page 261](#)
- Removing and installing ⇒ ["1.3 Removing and installing charge pressure positioner V465"](#), [page 270](#)

14 - Bolt

- 8 Nm

15 - Connection

- Removing and installing ⇒ ["1.4 Removing and installing connection for turbocharger"](#), [page 273](#)

16 - O-ring

- Renew after removing
- Before installing, lubricate lightly with clean engine oil



17 - Gasket

- ☐ Renew

1.1.3 Exploded view - pipes, lines and hoses on turbocharger

1 - Oil return line

2 - O-ring

- ☐ Renew after removing

3 - Bolt

- ☐ 9 Nm

4 - O-ring

- ☐ Renew after removing

5 - Bolt

- ☐ 9 Nm

6 - Oil supply line

7 - O-ring

- ☐ Renew after removing

8 - Bolt

- ☐ 9 Nm

9 - Bolt

- ☐ Renew after removing
- ☐ 5 Nm

10 - O-ring

- ☐ Renew crankcase breather hose if damaged
⇒ [Item 11 \(page 263\)](#)

11 - Hose

- ☐ For crankcase breather

12 - Bolt

- ☐ Renew after removing
- ☐ 5 Nm

13 - O-ring

- ☐ Renew crankcase breather hose if damaged ⇒ [Item 11 \(page 263\)](#)

14 - Turbocharger

- ☐ Removing and installing ⇒ ["1.2 Removing and installing turbocharger", page 264](#)

15 - Gasket

- ☐ Renew after removing

16 - Coolant lines

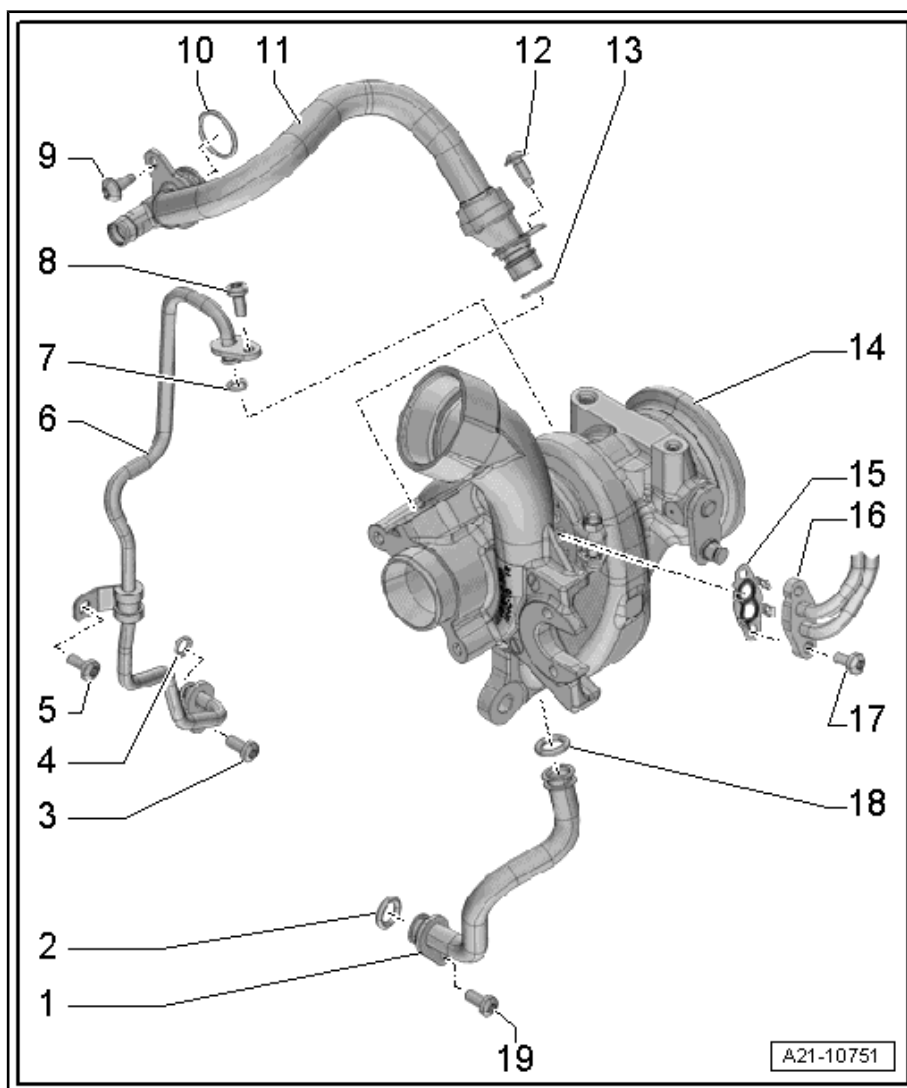
- ☐ Supply and return

17 - Bolt

- ☐ 8 Nm

18 - O-ring

- ☐ Renew after removing



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19 - Bolt

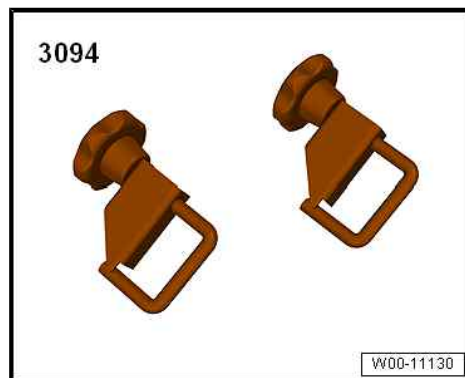
□ 9 Nm

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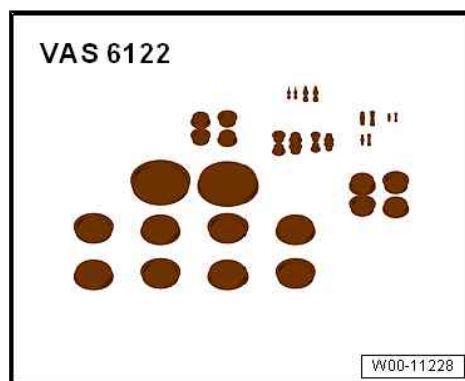
1.2 Removing and installing turbocharger

Special tools and workshop equipment required

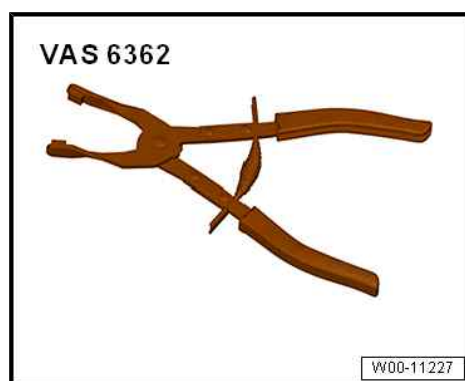
◆ Hose clamps up to 25 mm - 3094-



◆ Engine bung set - VAS 6122-

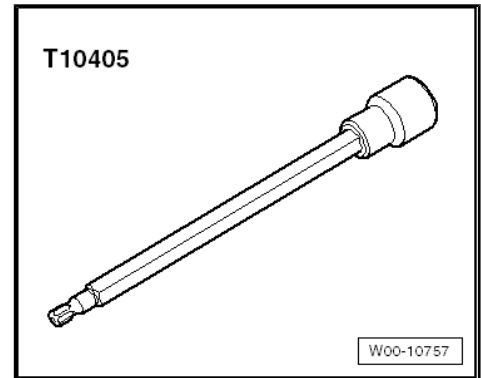


◆ Hose clip pliers - VAS 6362-





- ◆ Socket Torx T30 - T10405-



- ◆ Release tool - T10527- and -T10527/1-



- ◆ Vehicle diagnostic tester

Removing

- Observe rules for cleanliness
⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Reinstall heat insulation sleeves in the same locations when installing.

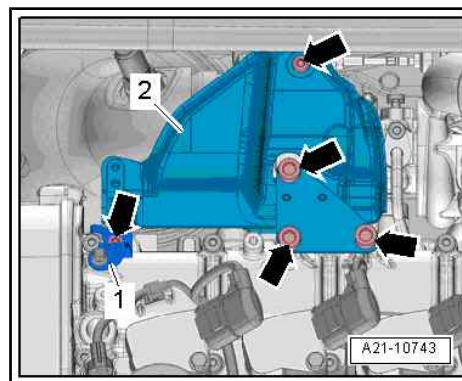
If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- ◆ 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.
- Remove engine cover panel
⇒ ["3.1 Removing and installing engine cover panel", page 39](#) .
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

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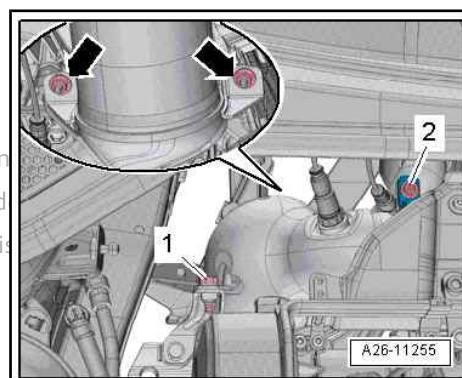


- Remove bolts -arrows- and detach bracket with heat shield -2- and bracket -1- for engine cover panel.

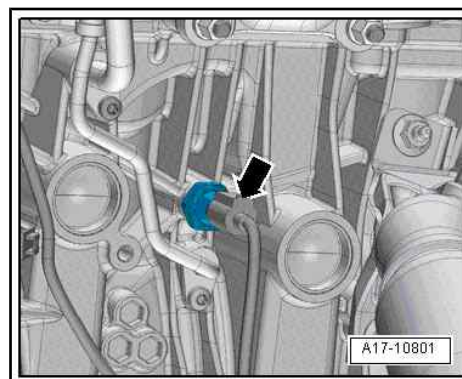


- Unscrew bolt -2- and remove screw-type clip.
- If fitted, remove bolt -1- and nuts -arrows-.
- Tie up catalytic converter to rear.

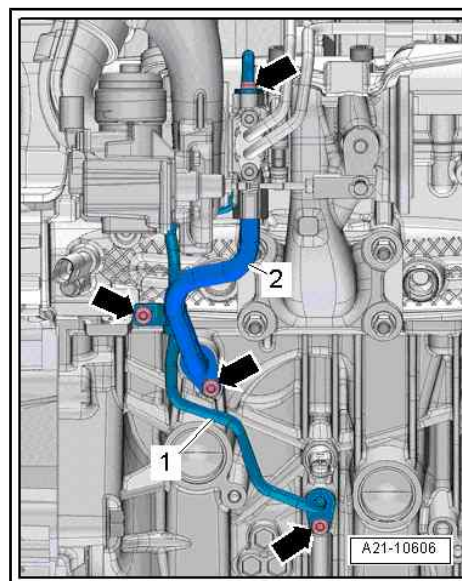
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- Detach heat insulation sleeve.
- Unplug electrical connector -arrow- at oil pressure switch for reduced oil pressure - F378- .

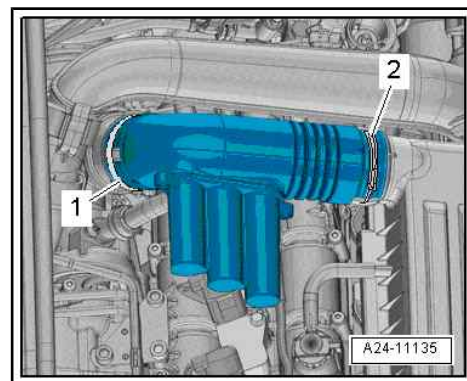


- Remove bolts -arrows- and detach oil supply line -1- and oil return line -2-.



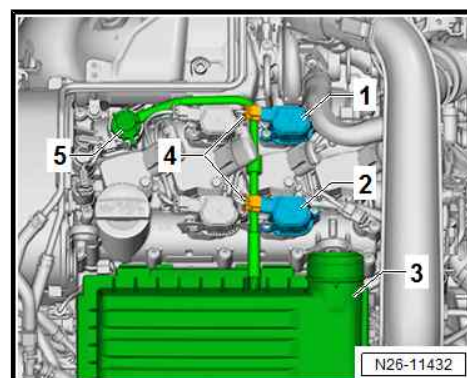


- Loosen hose clips -1, 2- and remove air pipe.



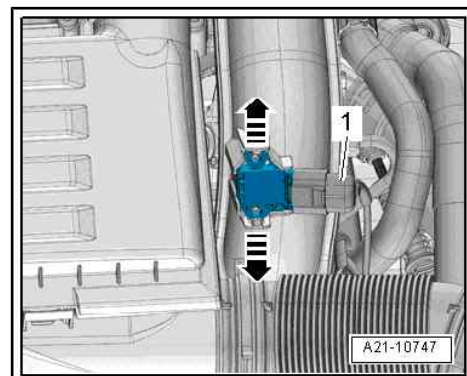
Version with cylinder shut-off:

- Release and unplug electrical connector -4- from exhaust cam actuator for cylinder 3 - N595- -1- and inlet cam actuator for cylinder 3 - N591- -2-.
- Disconnect hose from air cleaner housing -3- and from breather connection -5-.

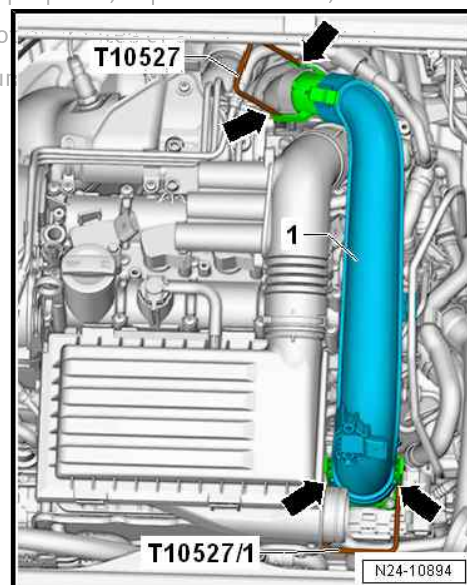


All versions (continued):

- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .

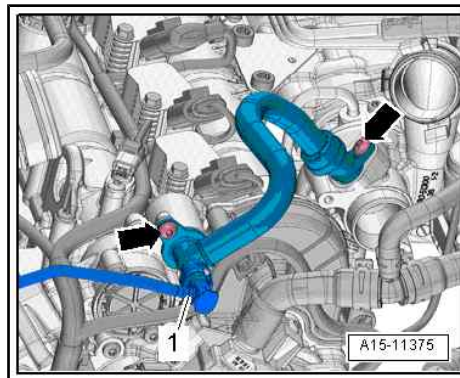


- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and T10527/1- , and detach air pipe -1-.

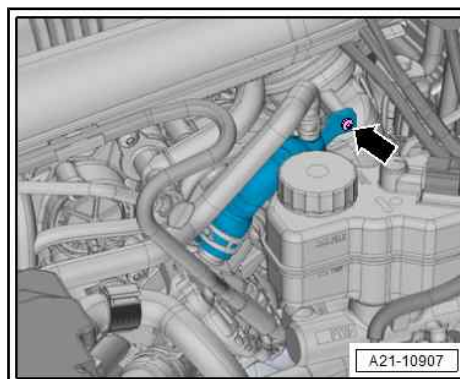




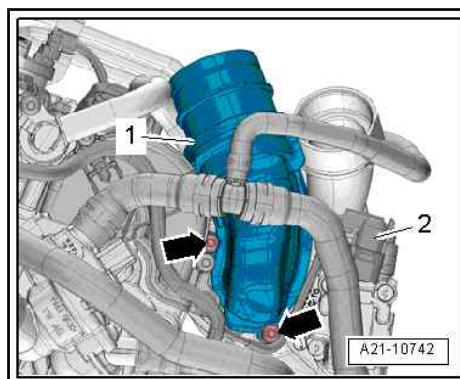
- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



- If fitted, remove bolt -arrow- from connection and press coolant hose slightly forwards.



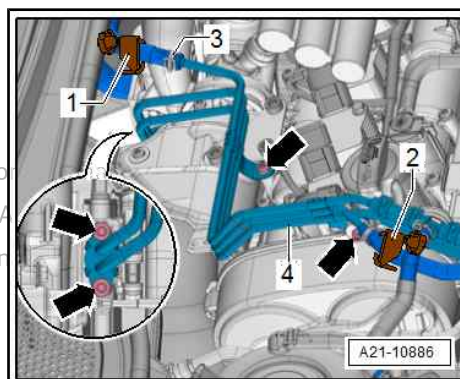
- Unplug electrical connector -2-.
- Unscrew bolts -arrows- using socket Torx T30 - T10405- and detach connection -1-.



Vehicles with 3 coolant lines:

- Clamp off coolant hoses with hose clamps up to 25 mm - 3094- -1 and 2-.
- Release hose clip -3- and disconnect coolant hose.

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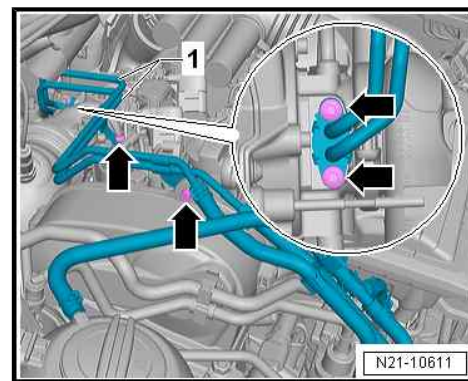


Vehicles with 2 coolant lines:

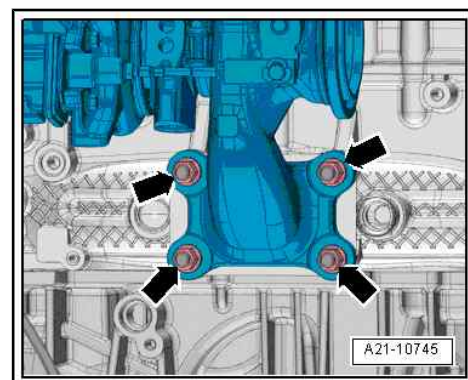
- Remove bolts -arrows- and pivot coolant lines -1- to right side.

All engine versions (continued):

- Remove bolts -arrows- and pivot coolant lines -4- to right side.



- Remove nuts -arrows- and detach turbocharger.

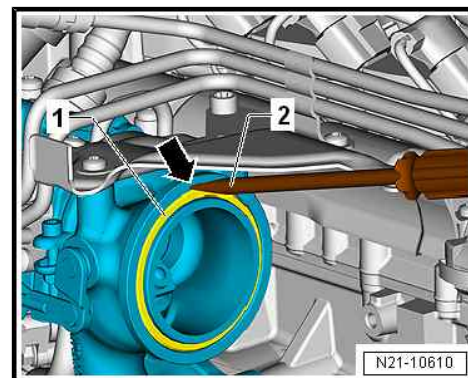


- Insert screwdriver -2- into groove -arrow- on turbocharger and lever out seal -1-.

Installing

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

- Renew seals, nuts and O-rings after removal.
- Fill turbocharger with engine oil at connection for oil supply line.
- Secure all hose connections with correct type of hose clips (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.
- Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fill up with coolant ⇒ [page 230](#) .



If a new turbocharger with charge pressure positioner has been installed:

- Adapt engine control unit - J623- to charge pressure positioner - V465- using ⇒ Vehicle diagnostic tester.

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)

- ◆ ⇒ [Fig. “Installing catalytic converter - tightening torque and sequence”, page 325](#)

- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)

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1.3 Removing and installing charge pressure positioner - V465-

⇒ ["1.3.1 Removing and installing charge pressure positioner V465 - version 1", page 270](#)

⇒ ["1.3.2 Removing and installing charge pressure positioner V465 - version 2", page 271](#)

1.3.1 Removing and installing charge pressure positioner - V465- - version 1

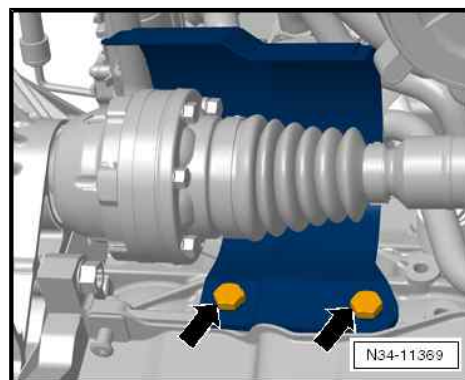
Removing

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- If fitted, remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Unbolt drive shaft (right-side) from gearbox flange shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .
- Push drive shaft towards the front.
- Take care not to damage surface coating of drive shaft.



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- Unplug electrical connector -1-.
- Detach securing clip -2-.
- Remove bolts -arrows- and detach charge pressure positioner - V465- .

Installing

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

Charge pressure positioner with adjustable linkage

- Fit thread of charge pressure positioner -V465- at central position in joint element.
- Adjust charge pressure positioner - V465- ; to do so, switch on ignition, and select and run following menu option on ⇒ Vehicle diagnostic tester:

◆ [01 - Electrical components]

◆ [V465 - Charge pressure positioner]

- Adjust to specified value by turning linkage. For specified value, see ⇒ Vehicle diagnostic tester.
- Tighten lock nut to 6 Nm and seal with sealing paint.

Charge pressure positioner without adjustable linkage

- Switch on ignition, and select and run following menu option on ⇒ Vehicle diagnostic tester:

◆ [01 - Engine electronics functions]

◆ [01 - Setting of charge pressure adjuster V465]

Tightening torques

- ◆ ⇒ ["1.1.1 Exploded view - turbocharger, version 1", page 260](#)
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

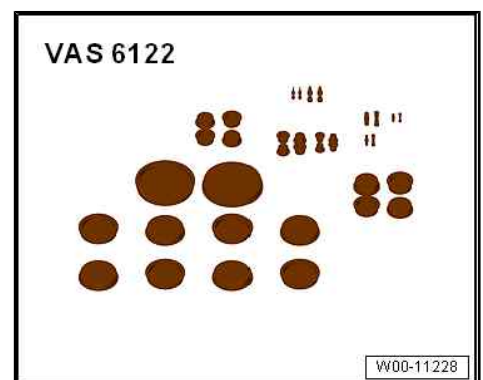
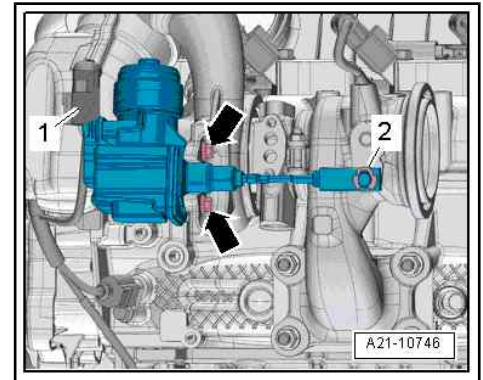
1.3.2 Removing and installing charge pressure positioner - V465- - version 2

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

Special tools and workshop equipment required

- ◆ Engine bung set - VAS 6122-





- ◆ Socket Torx T30 - T10405-



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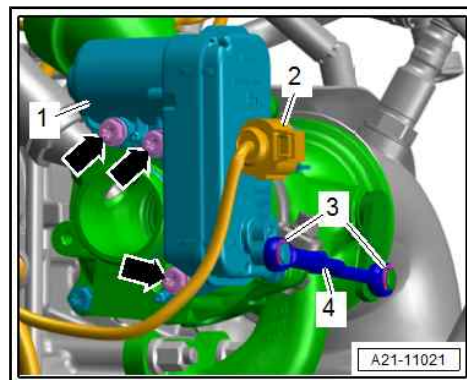
Removing

- Switch off ignition.
- Remove connection for turbocharger
⇒ [“1.4 Removing and installing connection for turbocharger”, page 273](#).
- Remove securing clips -3- and detach operating lever -4-.
- Remove bolts -arrows-.
- Unplug connector -2- and detach charge pressure positioner -V465- -1-.

Installing

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

- Securing bolts and retaining clips must be renewed.
- Renew O-rings after removing.
- Lightly lubricate O-rings with clean engine oil prior to installation.



Charge pressure positioner without adjustable linkage

- Switch on ignition, and select and run following menu option on ⇒ Vehicle diagnostic tester:

- ◆ 01 - Engine electronics functions
- ◆ 01 - Setting of charge pressure adjuster V465

Charge pressure positioner with adjustable linkage

- Fit thread of charge pressure positioner -V465- at central position in joint element.
- Adjust charge pressure positioner -V465- ; to do so, switch on ignition, and select and run following menu option on ⇒ Vehicle diagnostic tester:
- ◆ 01 - Electrical components
- ◆ V465 - Charge pressure positioner
- Adjust to specified value by turning linkage. For specified value, see ⇒ Vehicle diagnostic tester.
- Tighten lock nut to 6 Nm and seal with sealing paint.

Tightening torques

- ◆ ⇒ [“1.1.2 Exploded view - turbocharger, version 2”, page 262](#)
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft



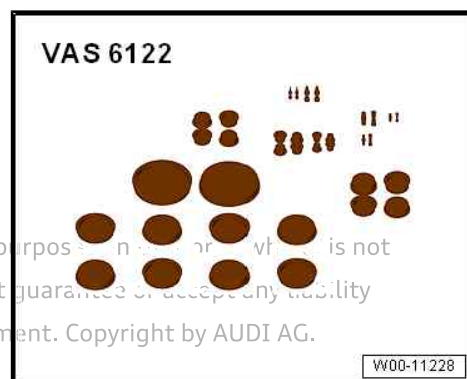
1.4 Removing and installing connection for turbocharger

Special tools and workshop equipment required

- ◆ Engine bung set - VAS 6122-



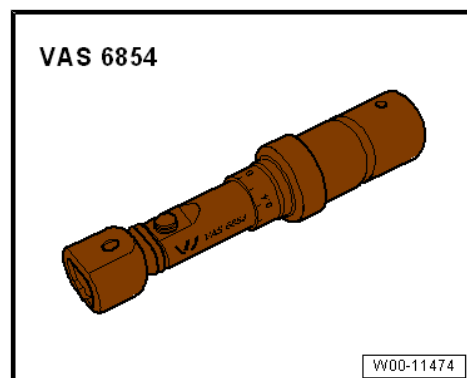
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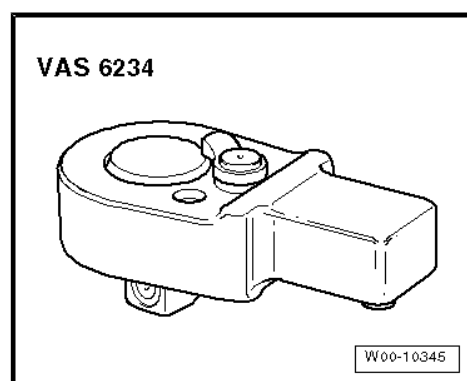
- ◆ Socket Torx T30 - T10405-



- ◆ Torque wrench - VAS 6854-



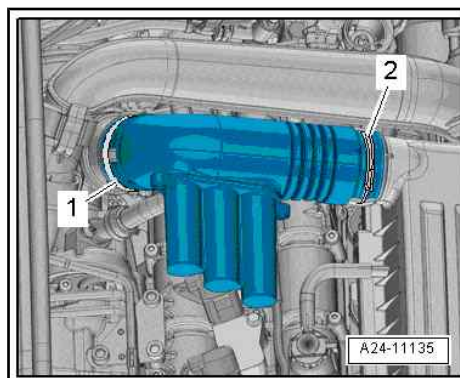
- ◆ Ratchet insert 1/4" - VAS 6234-



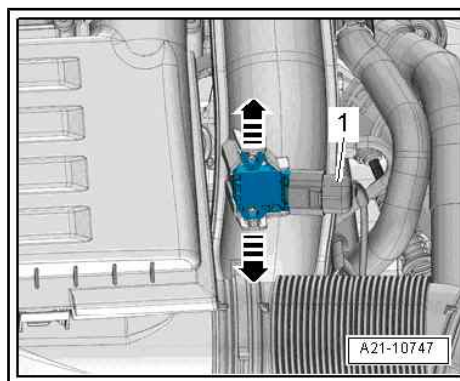


Removing

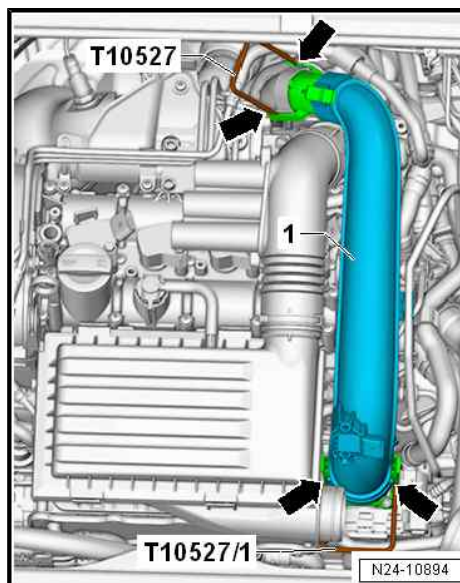
- Loosen hose clips -1, 2- and remove air pipe.



- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .



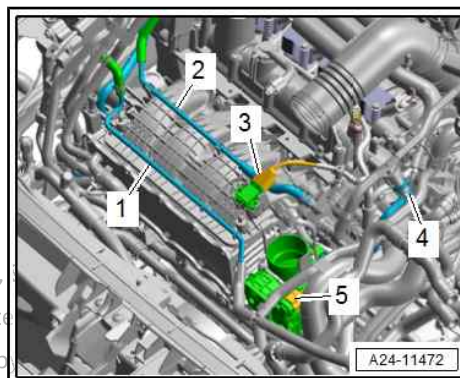
- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe -1-.



- Release and detach vacuum line -4-.



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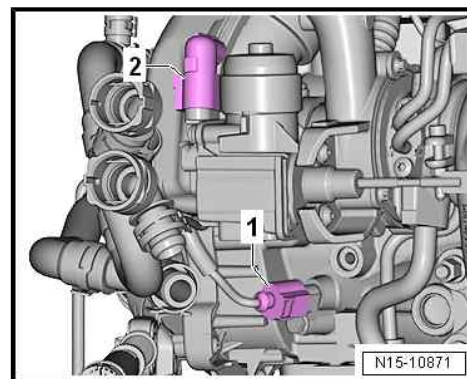




- Release and unplug electrical connectors -1- from coolant temperature sender - G62- .

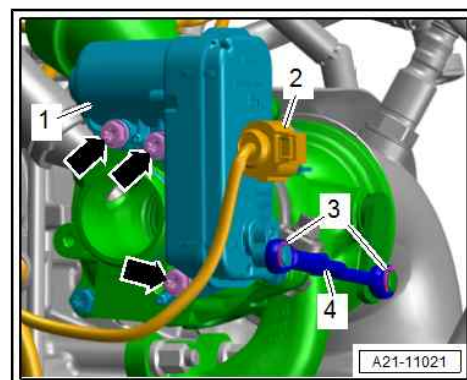
Vehicles with charge pressure positioner - V465- , version 1:

- Release and unplug electrical connectors -2- from charge pressure positioner - V465- .



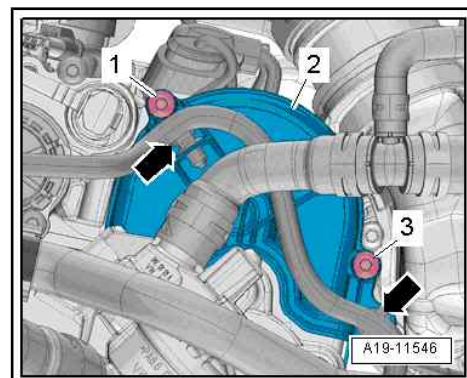
Vehicles with charge pressure positioner - V465- , version 2:

- Release and unplug electrical connectors -2- from charge pressure positioner - V465- .

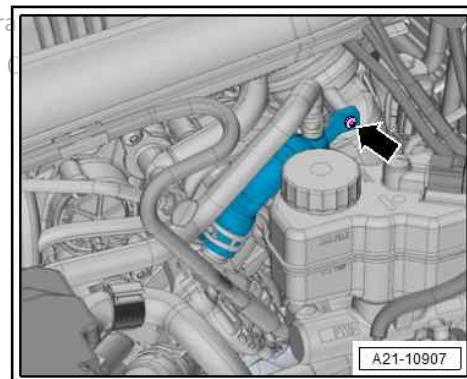


All vehicles (continued):

- Move electrical wiring harness clear -arrows- at cover -2-.
- Unscrew bolts -1 and 3-, remove toothed belt cover -2- for toothed belt for coolant pump and press to side.



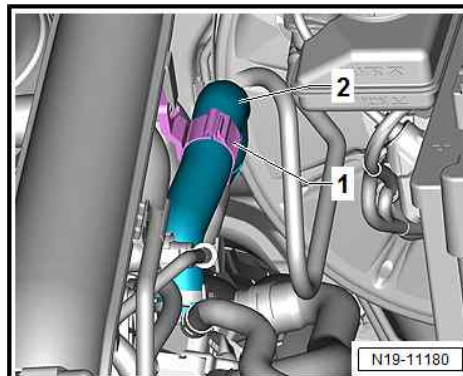
- If fitted, remove bolt -arrow- from connection and press coolant hose slightly forwards.



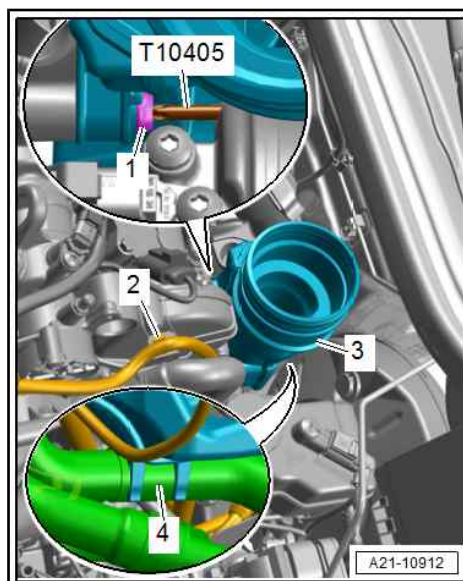
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- Release hose clip -1- and push coolant hose -2- to one side.



- Move electrical wiring harness -2- and coolant hose -4- clear and push to one side.
- Unscrew bolt -1- using socket Torx T30 - T10405- .



- Remove bolts -arrows-.
- Remove connection -1- together with vacuum line.

Installing:

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



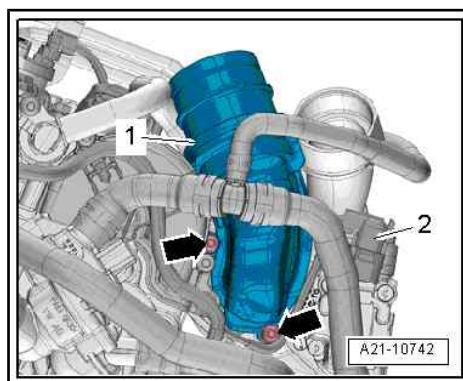
Note

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

- Renew gaskets, seals and O-rings.
- Lightly lubricate O-rings with clean engine oil prior to installation.

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 260](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)



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2 Charge air system

⇒ [“2.1 Exploded view - charge air system”, page 277](#)

⇒ [“2.2 Removing and installing charge air cooler”, page 278](#)

⇒ [“2.3 Removing and installing charge pressure sender G31 / intake air temperature sender 2 G299”, page 280](#)

⇒ [“2.4 Checking charge air system for leaks”, page 280](#)

2.1 Exploded view - charge air system

- Check that all air pipes, air hoses and vacuum lines are correctly fitted and that there are no leaks before carrying out tests or repairs.
- Observe rules for cleanliness
⇒ [“3.1 Rules for cleanliness”, page 5](#).

1 - Coolant hose

2 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 15 Nm

3 - Coolant hose

4 - Coolant hose

5 - Charge air cooler

- ☐ Removing and installing
⇒ [“2.2 Removing and installing charge air cooler”, page 278](#)
- ☐ If renewed, refill system with fresh coolant

6 - Sealing lip

- ☐ Renew after removal (apply thin coating of clean engine oil prior to installation)

7 - Gasket

- ☐ Renew after removing

8 - Intake manifold

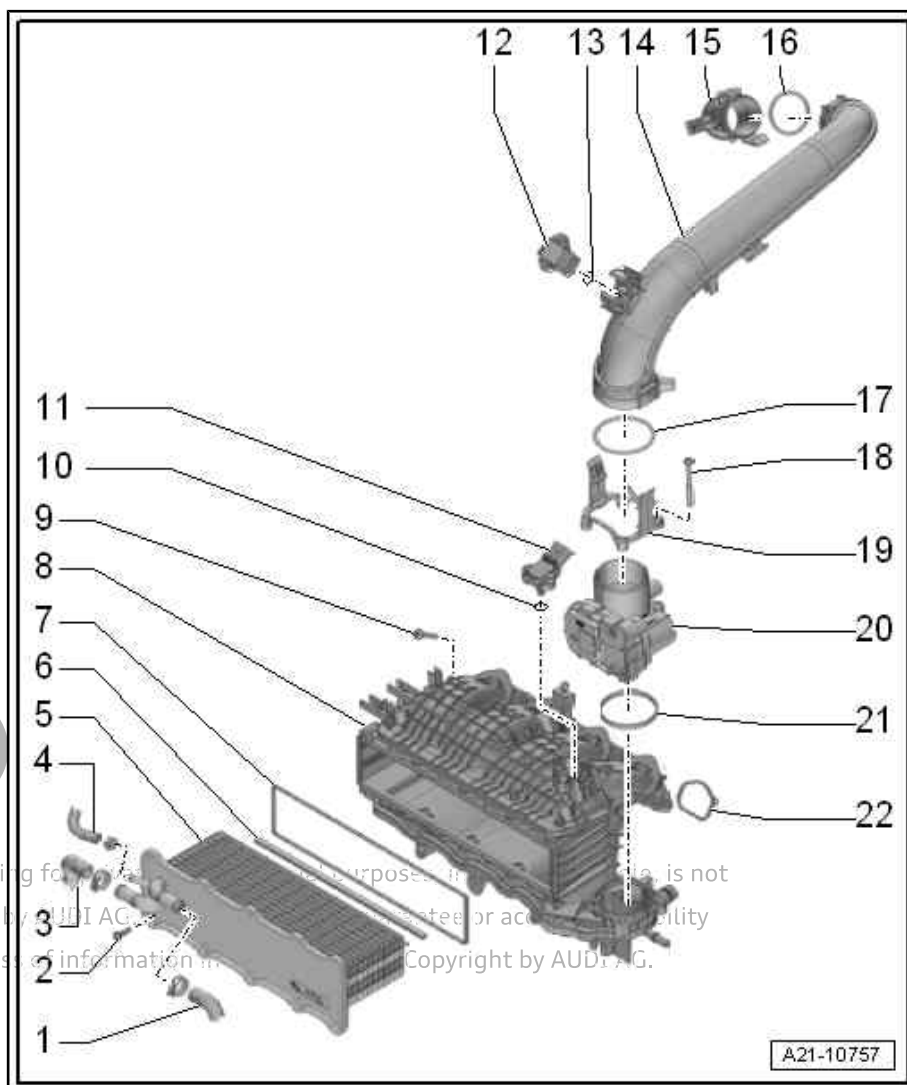
Removing and installing
⇒ [“3.2 Removing and installing intake manifold”, page 293](#)

9 - Bolt

- ☐ Tightening torque and sequence ⇒ [“3.1 Exploded view - intake manifold”, page 292](#)

10 - O-ring

- ☐ If necessary, renew after removing





11 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

- ☐ Removing and installing
⇒ ["5.3 Removing and installing intake air temperature sender G42 / intake manifold pressure sender G71", page 310](#)

12 - Charge pressure sender - G31- / intake air temperature sender 2 - G299-

- ☐ Removing and installing
⇒ ["2.3 Removing and installing charge pressure sender G31 / intake air temperature sender 2 G299", page 280](#)

13 - O-ring

- ☐ If necessary, renew after removing

14 - Air pipe

15 - Connection

16 - O-ring

- ☐ Renew after removal (apply thin coating of clean engine oil prior to installation)

17 - O-ring

- ☐ Renew after removal (apply thin coating of clean engine oil prior to installation)

18 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 7 Nm

19 - Retaining clip

- ☐ For air pipe

20 - Throttle valve module - J338-

- ☐ Removing and installing ⇒ ["3.3 Removing and installing throttle valve module J338", page 296](#)

21 - Seal

- ☐ Renew after removing

22 - Gasket

- ☐ 4x
- ☐ Renew after removing

2.2 Removing and installing charge air cooler

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-





- ◆ Drip tray for workshop hoist - VAS 6208-

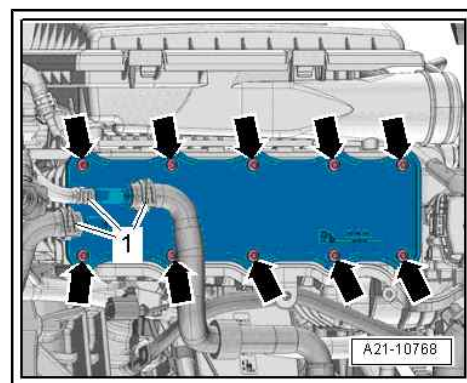


- ◆ Hose clip pliers - VAS 6362-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove radiator cowl
⇒ ["4.3 Removing and installing radiator cowl", page 258](#) .
- Place drip tray for workshop hoist - VAS 6208- underneath.
- Clamp off coolant hoses on charge air cooler with hose clamps up to 25 mm - 3094- .
- Release hose clips -1- and disconnect coolant hoses.
- Remove bolts -arrows- and detach charge air cooler.



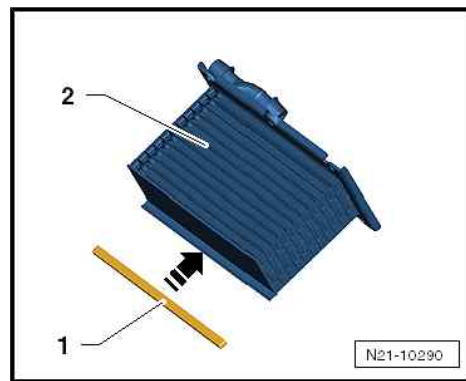
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Installing

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

- If there are slight impressions on the fins, refer to
⇒ [“3.7 Installing radiators and condensers”, page 7](#) .
- Renew gasket after removing
⇒ [“2.1 Exploded view - charge air system”, page 277](#) .
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Attach sealing strip -1- to charge air cooler -2- (-arrow-).
- Insert new gasket into groove on intake manifold.
- Install radiator cowl
⇒ [“4.3 Removing and installing radiator cowl”, page 258](#) .
- Check coolant level ⇒ [page 230](#) .



Tightening torques

- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 277](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

2.3 Removing and installing charge pressure sender - G31- / intake air temperature sender 2 - G299-

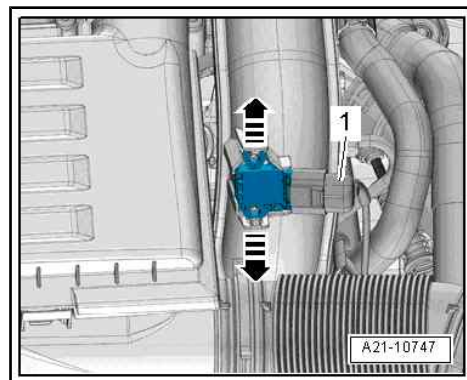
Removing

- Unplug electrical connector -1-.
- Release catches -arrows- and detach charge pressure sender - G31- / intake air temperature sender 2 - G299- .

Installing

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

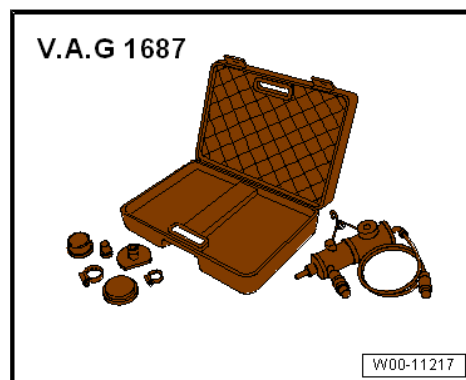
- If necessary, renew O-ring after removal.
- If fasteners on air pipe have broken off, secure charge pressure sender - G31- / intake air temperature sender 2 - G299- with bolts; for bolts, refer to ⇒ Electronic parts catalogue .



2.4 Checking charge air system for leaks

Special tools and workshop equipment required

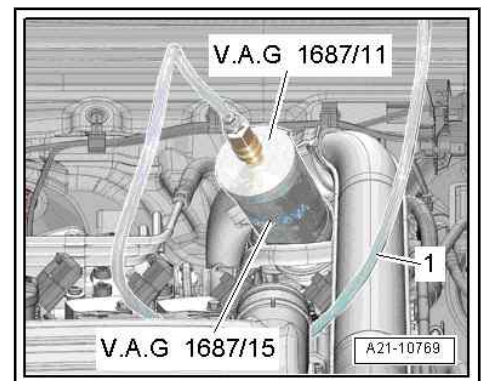
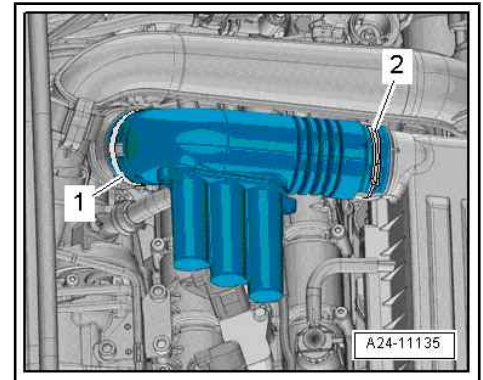
- ◆ Charge air system tester - V.A.G 1687-





Procedure

- Loosen hose clips -1, 2- and remove air pipe.
- Connect adapter - V.A.G 1687/15- with -V.A.G 1687/11- to turbocharger.
- Connect hose -1- of charge air system tester -V.A.G 1687- to adapter.



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Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Make sure knob is pulled out before turning pressure control valve -2-.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.
- If there is water in sight glass, remove drain plug -6- and drain water.
- Open valve -3-.

Risk of damage if pressure is set too high.

- 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 detection spray or use ultrasonic tester - V.A.G 1842- . (Refer to ⇒ operating instructions -V.A.G 1842- .)

Note:

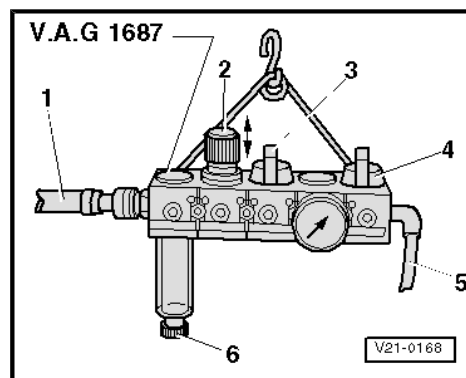
A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.

- Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.

Assembling

Assembly is performed in reverse sequence; note the following:

- Renew seal and O-rings after removal.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .



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24 – Mixture preparation - injection

1 Injection system

⇒ [“1.1 Overview of fitting locations - injection system”, page 283](#)

1.1 Overview of fitting locations - injection system

Overview of fitting locations - engine compartment

1 - Lambda probe - G39- and Lambda probe heater - Z19-

- ❑ Exploded view
⇒ [“7.1 Exploded view - Lambda probe”, page 315](#)

2 - Brake servo pressure sensor - G294-

- ❑ Fitting location
⇒ [Fig. “Fitting location of brake servo pressure sensor -G294-”, page 285](#)

3 - Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-

- ❑ Exploded view
⇒ [“7.1 Exploded view - Lambda probe”, page 315](#)

4 - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ❑ Fitting location
⇒ [Fig. “Accelerator position sender -G79- and accelerator position sender 2 -G185-”, page 284](#)

5 - Brake light switch - F- / brake pedal switch - F63-

- ❑ Fitting location
⇒ [Fig. “Fitting location of brake light switch -F- / brake pedal switch -F63-”, page 284](#)

6 - Clutch position sender - G476-

- ❑ Fitting location ⇒ [Fig. “Fitting location of clutch position sender -G476-”, page 285](#)

7 - Engine control unit - J623-

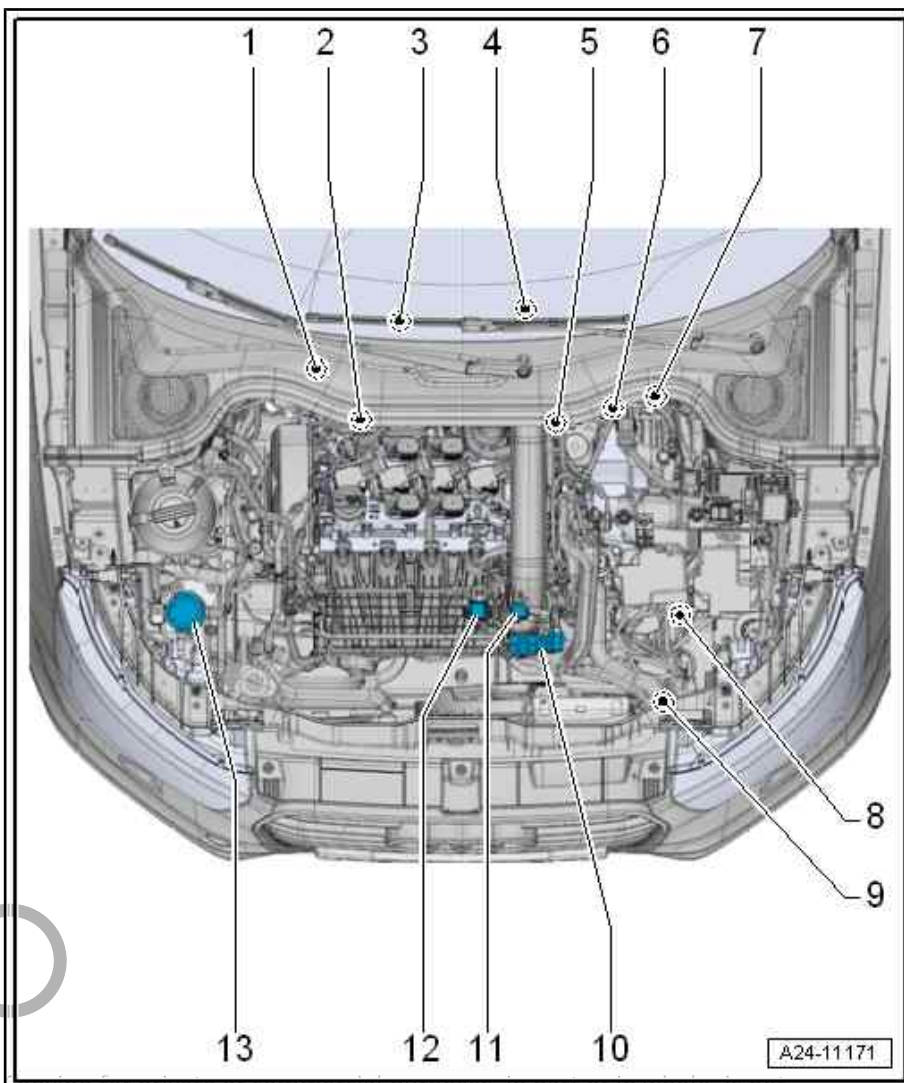
- ❑ Fitting location ⇒ [Fig. “Fitting location of engine control unit -J623-”, page 284](#)
- ❑ Removing and installing ⇒ [“8.2 Removing and installing engine control unit J623”, page 317](#)

8 - Gearbox neutral position sender - G701-

- ❑ Fitting location ⇒ [Fig. “Fitting location of gearbox neutral position sender -G701-”, page 285](#)

9 - Radiator outlet coolant temperature sender - G83-

- ❑ Exploded view ⇒ [“2.3 Exploded view - coolant temperature senders”, page 235](#)



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**10 - Throttle valve module - J338-**

- ❑ Including throttle valve drive for electric throttle - G186- , throttle valve drive angle sender 1 for electric throttle - G187- and throttle valve drive angle sender 2 for electric throttle - G188-
- ❑ Exploded view ⇒ ["3.1 Exploded view - intake manifold", page 292](#)

11 - Charge pressure sender - G31- / intake air temperature sender 2 - G299-

- ❑ Exploded view ⇒ ["2.1 Exploded view - charge air system", page 277](#)

12 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

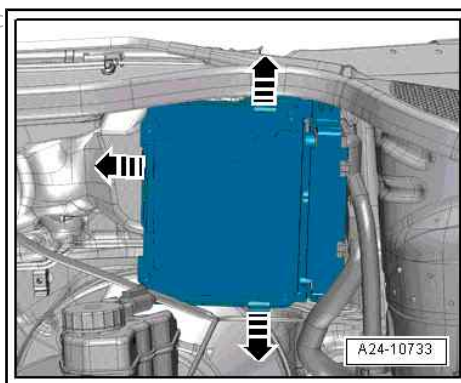
- ❑ Exploded view ⇒ ["3.1 Exploded view - intake manifold", page 292](#)

13 - Vacuum pump for brakes - V192-

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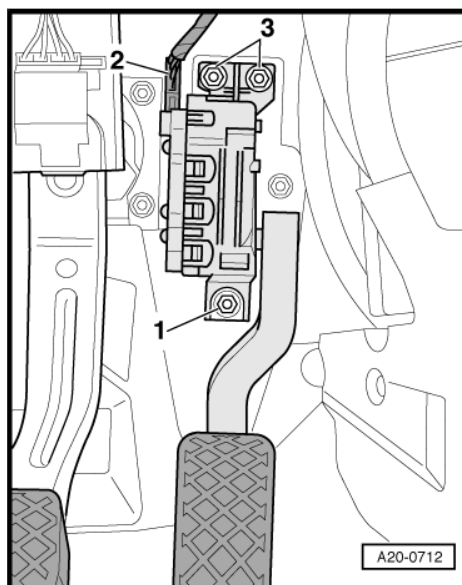
Fitting location of engine control unit - J623-

- ◆ At plenum chamber partition panel (left-side)

**Accelerator position sender - G79- and accelerator position sender 2 - G185-**

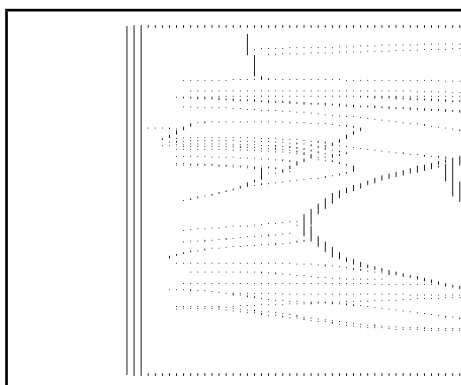
- ◆ In accelerator pedal module
- 2 - Electrical connector for accelerator pedal module
- ◆ The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.

Removing and installing ⇒ Fuel supply system, petrol engines; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-

**Fitting location of brake light switch - F- / brake pedal switch - F63-**

- ◆ On brake master cylinder
- C - Brake light switch - F- / brake pedal switch - F63-

Removing and installing ⇒ Brake system; Rep. gr. 45 ; Sensors; Removing and installing brake light switch

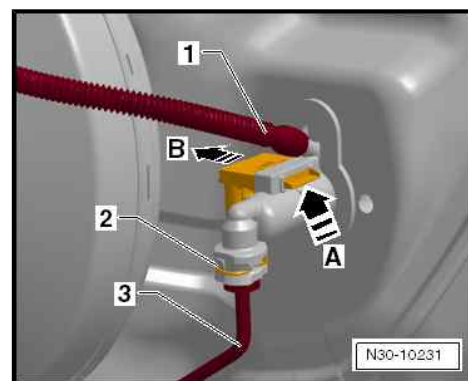




Fitting location of clutch position sender - G476-

- ◆ On clutch master cylinder, next to brake servo

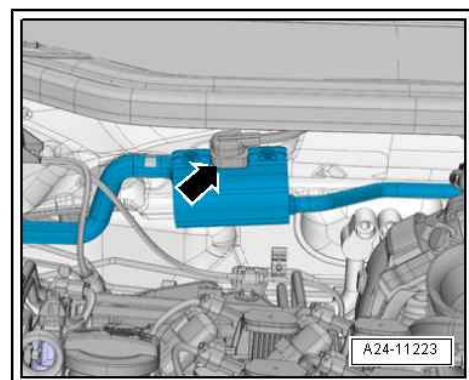
Removing and installing ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch position sender - G476-



Fitting location of brake servo pressure sensor - G294-

Version 1:

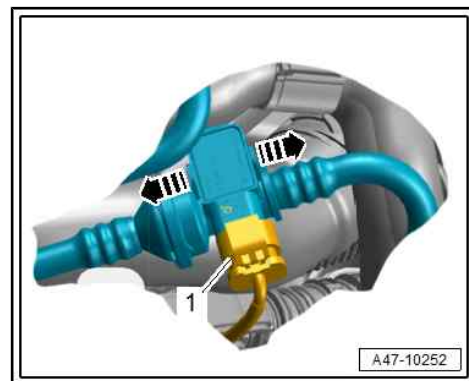
- ◆ At plenum chamber partition panel -arrow-.



Version 2:

- ◆ In vacuum line

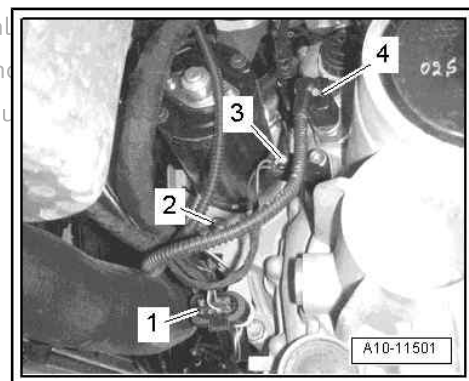
- 1 - Electrical connector for brake servo pressure sensor - G294-



Fitting location of gearbox neutral position sender - G701-

- ◆ On gearbox (front left)

- 4 - Electrical connector for gearbox neutral position sender - G701-



Overview of fitting locations - engine (view from above), engine with two camshaft adjusters



1 - Exhaust camshaft control valve 1 - N318-

- ❑ Exploded view
⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)

2 - Ignition coil 1 with output stage - N70-

- ❑ Exploded view
⇒ [“1.1 Exploded view - ignition system”, page 328](#)

3 - Ignition coil 2 with output stage - N127-

- ❑ Exploded view
⇒ [“1.1 Exploded view - ignition system”, page 328](#)

4 - Ignition coil 3 with output stage - N291-

- ❑ Exploded view
⇒ [“1.1 Exploded view - ignition system”, page 328](#)

5 - Ignition coil 4 with output stage - N292-

- ❑ Exploded view
⇒ [“1.1 Exploded view - ignition system”, page 328](#)

6 - Hall sender 2 - G163-

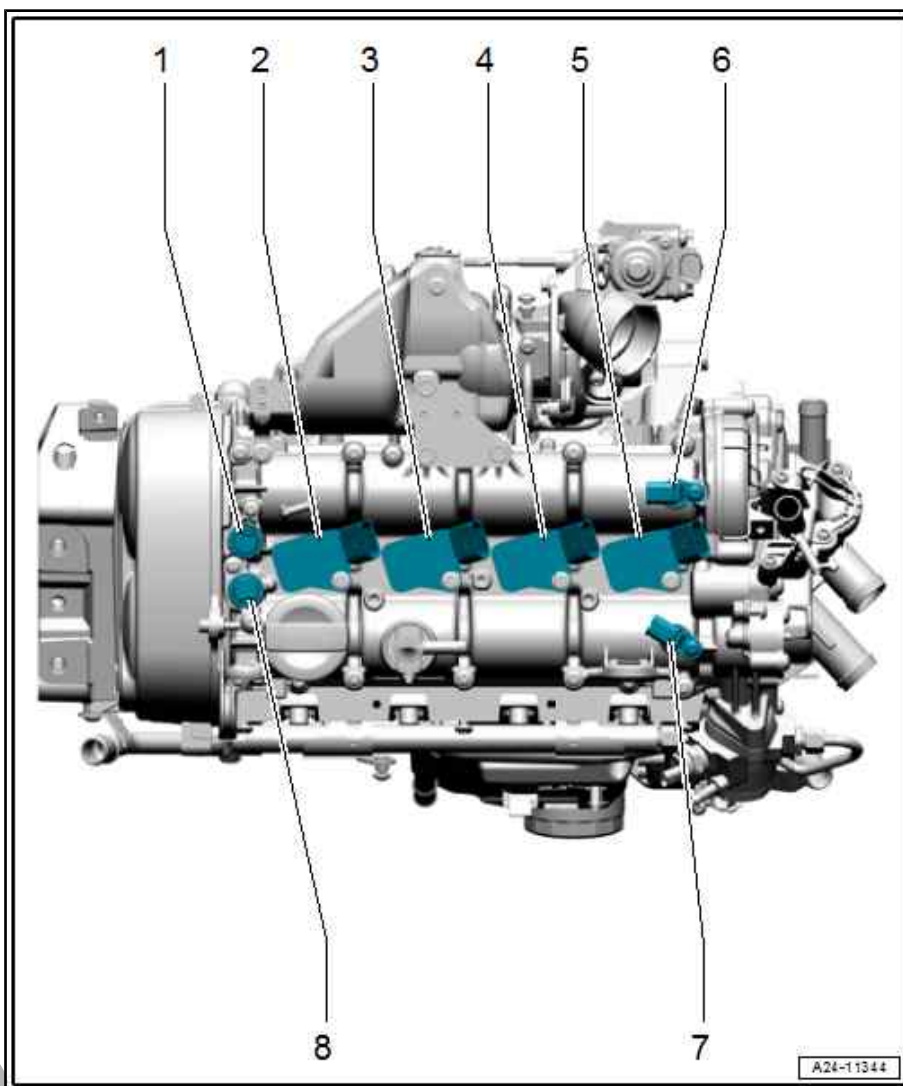
- ❑ Exploded view
⇒ [“1.1 Exploded view - ignition system”, page 328](#)

7 - Hall sender - G40- (camshaft position sensor)

- ❑ Exploded view ⇒ [“1.1 Exploded view - ignition system”, page 328](#)

8 - Camshaft control valve 1 - N205-

- ❑ Exploded view ⇒ [“2.2 Exploded view - camshaft housing”, page 163](#)



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Overview of fitting locations - engine (view from above), engine with two camshaft adjusters and cylinder shut-off



1 - Exhaust camshaft control valve 1 - N318-

- ☐ Exploded view
⇒ ["3.1 Exploded view - valve gear", page 177](#)

2 - Ignition coil 1 with output stage - N70-

- ☐ Exploded view
⇒ ["1.1 Exploded view - ignition system", page 328](#)

3 - Exhaust cam actuator for cylinder 2

- ◆ Exhaust cam actuator for cylinder 2 - N587-
- ◆ Exhaust cam actuator A for cylinder 2 - N588-
- ◆ Exhaust cam actuator B for cylinder 2 - N589-
- ☐ Exploded view
⇒ ["3.1 Exploded view - valve gear", page 177](#)

4 - Ignition coil 3 with output stage - N291-

- ☐ Exploded view
⇒ ["1.1 Exploded view - ignition system", page 328](#)

5 - Exhaust cam actuator for cylinder 3

- ◆ Exhaust cam actuator for cylinder 3 - N595-
- ◆ Exhaust cam actuator A for cylinder 3 - N596-
- ◆ Exhaust cam actuator B for cylinder 3 - N597-
- ☐ Exploded view ⇒ ["3.1 Exploded view - valve gear", page 177](#)

6 - Hall sender 2 - G163-

- ☐ Exploded view ⇒ ["1.1 Exploded view - ignition system", page 328](#)

7 - Hall sender - G40- (camshaft position sensor)

- ☐ Exploded view ⇒ ["1.1 Exploded view - ignition system", page 328](#)

8 - Ignition coil 4 with output stage - N292-

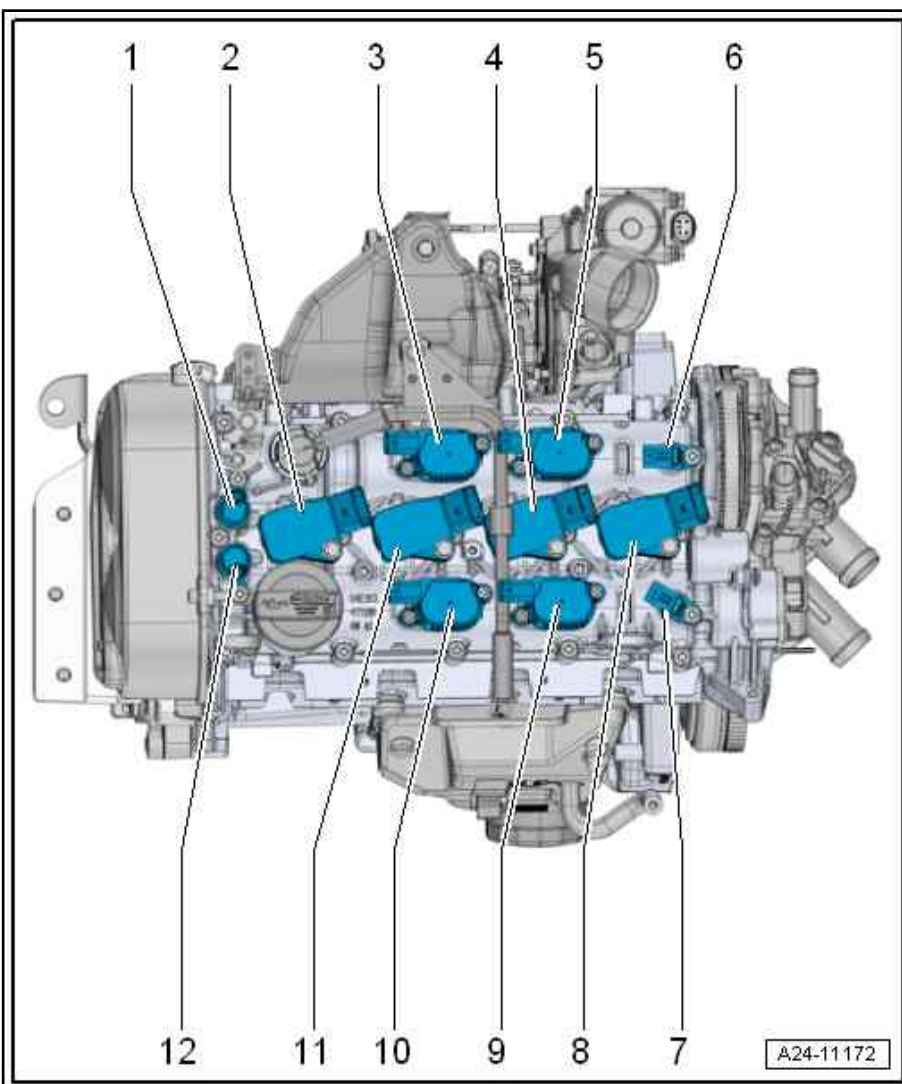
- ☐ Exploded view ⇒ ["1.1 Exploded view - ignition system", page 328](#)

9 - Inlet cam actuator for cylinder 3

- ◆ Inlet cam actuator for cylinder 3 - N591-
- ◆ Inlet cam actuator A for cylinder 3 - N592-
- ◆ Inlet cam actuator B for cylinder 3 - N593-
- ☐ Exploded view ⇒ ["3.1 Exploded view - valve gear", page 177](#)

10 - Inlet cam actuator for cylinder 2

- ◆ Inlet cam actuator for cylinder 2 - N583-
- ◆ Inlet cam actuator A for cylinder 2 - N584-
- ◆ Inlet cam actuator B for cylinder 2 - N585-



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- ❑ Exploded view ⇒ [“3.1 Exploded view - valve gear”, page 177](#)

11 - Ignition coil 2 with output stage - N127-

- ❑ Exploded view ⇒ [“1.1 Exploded view - ignition system”, page 328](#)

12 - Camshaft control valve 1 - N205-

- ❑ Exploded view ⇒ [“3.1 Exploded view - valve gear”, page 177](#)

Overview of fitting locations - engine (inlet side)

1 - Knock sensor 1 - G61-

- ❑ Exploded view
⇒ [“1.1 Exploded view - ignition system”, page 328](#)

2 - Oil pressure switch for reduced oil pressure - F378-

- ❑ Exploded view
⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 215](#)

3 - Fuel pressure sender - G247-

- ❑ Exploded view
⇒ [“4.1 Exploded view - fuel rail with injectors”, page 300](#)

4 - Activated charcoal filter solenoid valve 1 - N80-

- ❑ Removing and installing
⇒ [“3.5 Removing and installing activated charcoal filter solenoid valve 1 N80”, page 298](#)

5 - Injectors

- ◆ Injector, cylinder 1 - N30-
- ◆ Injector, cylinder 2 - N31-
- ◆ Injector, cylinder 3 - N32-
- ◆ Injector, cylinder 4 - N33-

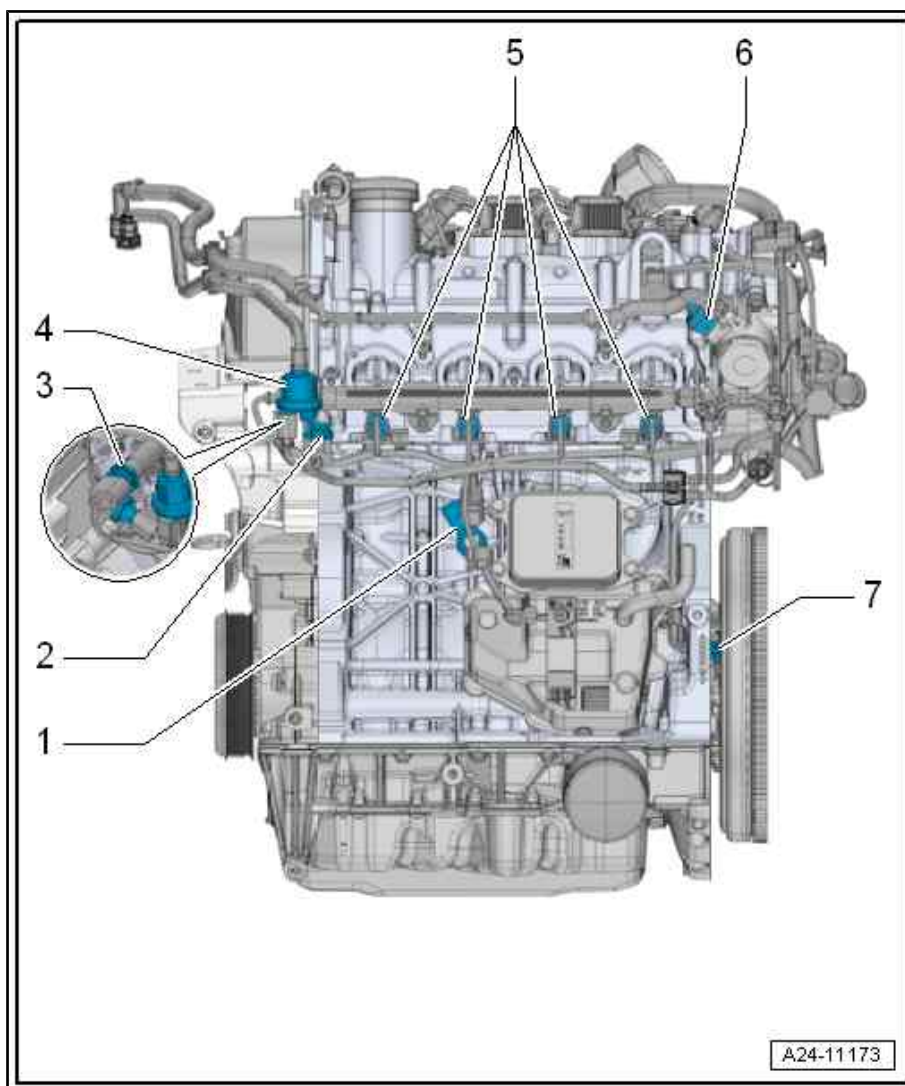
- ❑ Exploded view
⇒ [“4.1 Exploded view - fuel rail with injectors”, page 300](#)

6 - Fuel pressure regulating valve - N276-

- ❑ At high-pressure pump
- ❑ Exploded view ⇒ [“6.1 Exploded view - high-pressure pump”, page 311](#)

7 - Engine speed sender - G28-

- ❑ Exploded view ⇒ [“1.1 Exploded view - ignition system”, page 328](#)



Overview of fitting locations - engine (exhaust side)

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1 - Oil level and oil temperature sender - G266-

- ❑ Exploded view
⇒ ["1.1 Exploded view - sump/oil pump", page 199](#)

2 - Coolant temperature sender - G62-

- ❑ Exploded view
⇒ ["2.3 Exploded view - coolant temperature senders", page 235](#)

3 - Charge pressure positioner - V465-

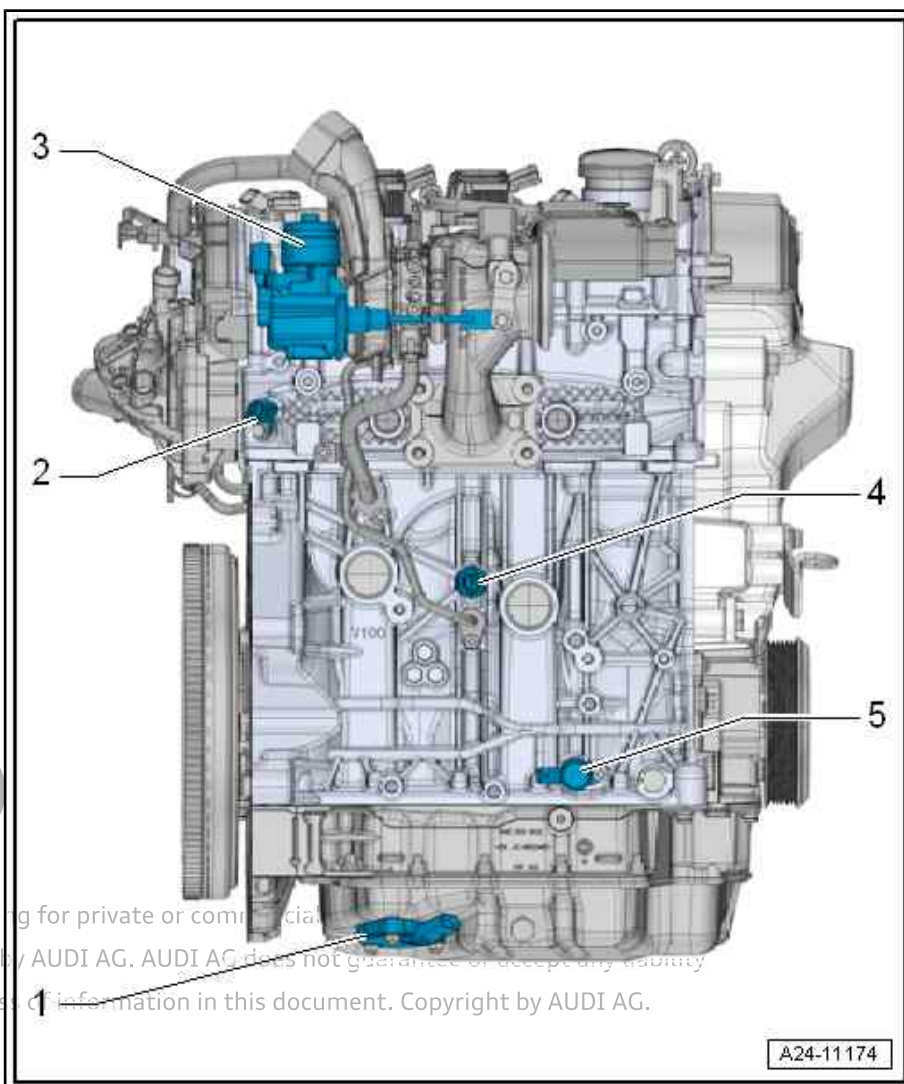
- ❑ Exploded view
⇒ ["1.1 Exploded view - turbocharger", page 260](#)

4 - Oil pressure switch - F22-

- ❑ Exploded view
⇒ ["4.1 Exploded view - oil filter/oil pressure switches", page 215](#)

5 - Valve for oil pressure control - N428-

- ❑ Exploded view
⇒ ["4.1 Exploded view - oil filter/oil pressure switches", page 215](#)



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A24-11174



2 Air cleaner

⇒ "2.1 Exploded view - air cleaner housing", page 290

⇒ "2.2 Removing and installing air cleaner housing", page 291

2.1 Exploded view - air cleaner housing

1 - Water drain valve

2 - Water drain hose

- ☐ Clean

3 - Air cleaner (bottom section)

- ☐ Remove any salt residue, dirt and leaves

4 - Air filter element

- ☐ Use genuine air filter element ⇒ Electronic parts catalogue
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing ⇒ Maintenance ; Booklet 819

5 - Air cleaner (top section)

- ☐ Remove any salt residue, dirt and leaves

6 - Hose

- ☐ For crankcase breather
- ☐ Different versions available; for allocation refer to ⇒ Electronic parts catalogue

7 - Air pipe

8 - Rubber buffer

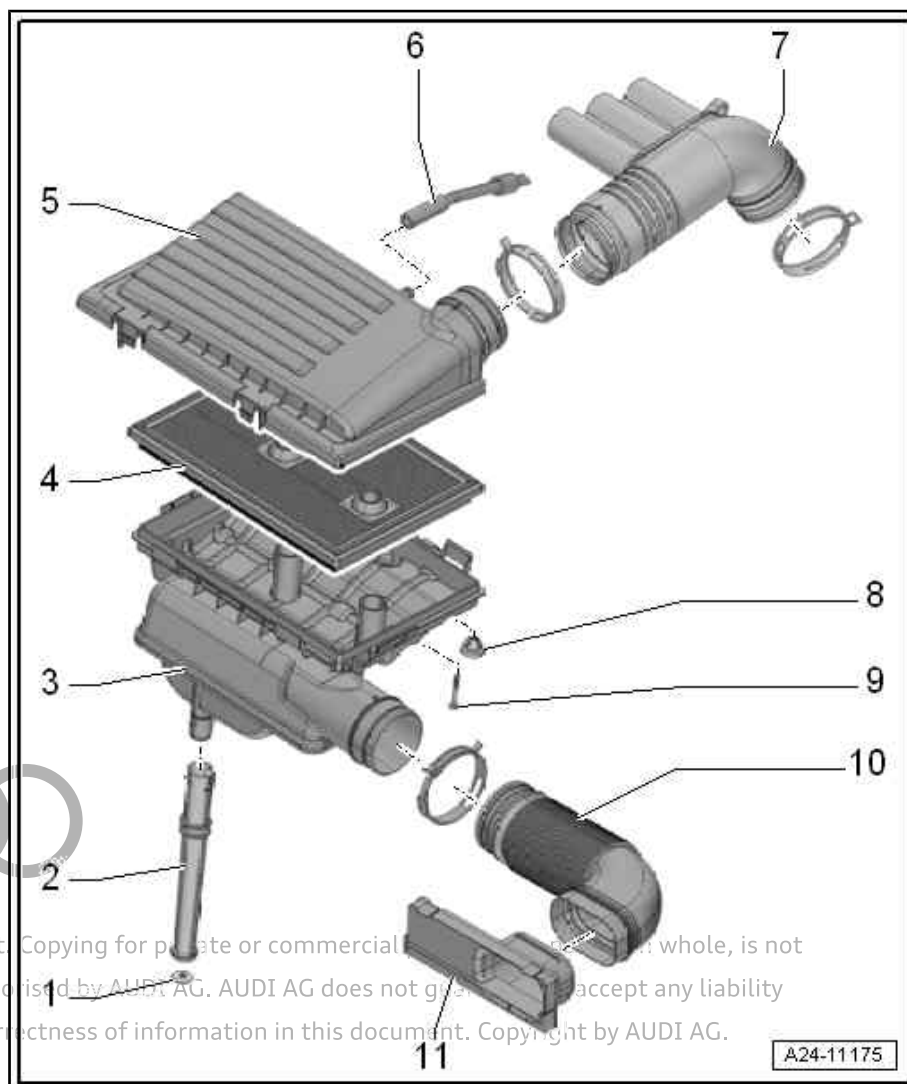
9 - Bolt

- ☐ 1.5 Nm

10 - Air hose

11 - Air duct

- ☐ On lock carrier



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A24-11175



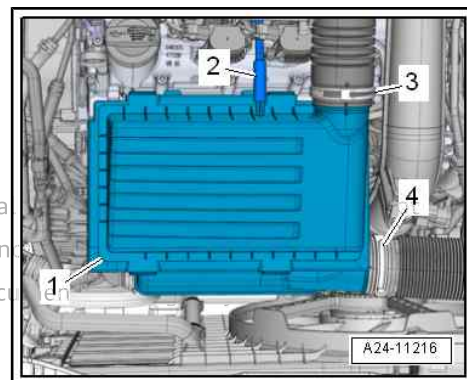
2.2 Removing and installing air cleaner housing

Removing

- Remove engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#).
- Lift air cleaner housing -1- off ball studs.
- Release hose clips -3 and 4- and detach air ducts and crank case breather hose -2-.

Installing

- Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.
- Use a lubricant (silicone-free) when installing air hoses.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#).
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.
- Blow out water drain with compressed air.
- Install engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#).





3 Intake manifold

⇒ [“3.1 Exploded view - intake manifold”, page 292](#)

⇒ [“3.2 Removing and installing intake manifold”, page 293](#)

⇒ [“3.3 Removing and installing throttle valve module J338”, page 296](#)

⇒ [“3.4 Cleaning throttle valve module”, page 298](#)

⇒ [“3.5 Removing and installing activated charcoal filter solenoid valve 1 N80”, page 298](#)

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3.1 Exploded view - intake manifold

1 - Coolant pipe

- ☐ Clipped onto intake manifold

2 - Intake manifold

- ☐ Combined with charge air cooler
- ☐ Removing and installing
⇒ [“3.2 Removing and installing intake manifold”, page 293](#)

3 - Coolant pipe

- ☐ Clipped onto intake manifold

4 - Bolt

- ☐ Tightening torque and sequence
⇒ [Fig. “Intake manifold - tightening torque and sequence”, page 293](#)

5 - O-ring

- ☐ If necessary, renew after removing

6 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

- ☐ Removing and installing
⇒ [“5.3 Removing and installing intake air temperature sender G42 / intake manifold pressure sender G71”, page 310](#)

7 - Gaskets

- ☐ Renew after removing

8 - Charge pressure sender - G31- / intake air temperature sender 2 - G299-

- ☐ Exploded view ⇒ [“2.1 Exploded view - charge air system”, page 277](#)

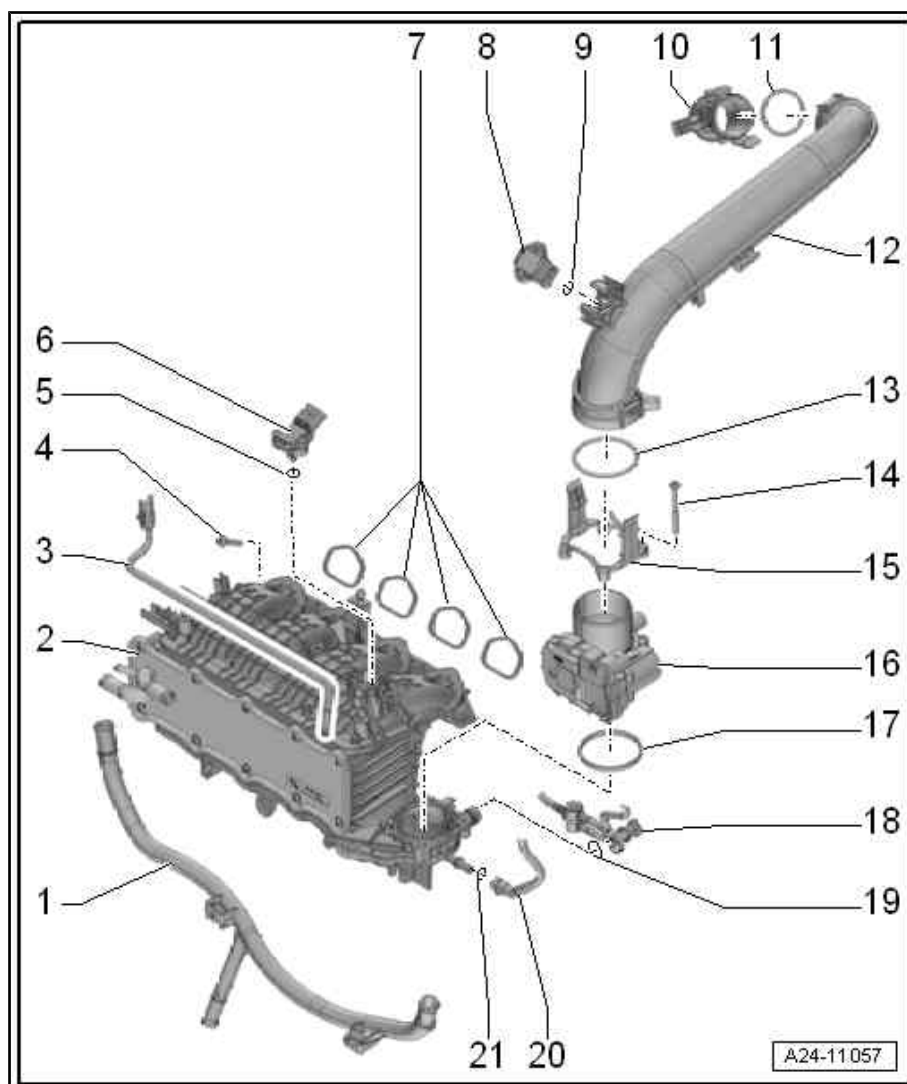
9 - O-ring

- ☐ If necessary, renew after removing

10 - Connection

11 - O-ring

- ☐ Renew after removal (apply thin coating of clean engine oil prior to installation)



**12 - Air pipe****13 - O-ring**

- ☐ Renew after removal (apply thin coating of clean engine oil prior to installation)

14 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 7 Nm

15 - Retaining clip

- ☐ For air pipe

16 - Throttle valve module - J338-

- ☐ Removing and installing ⇒ ["3.3 Removing and installing throttle valve module J338", page 296](#)
- ☐ Cleaning ⇒ ["3.4 Cleaning throttle valve module", page 298](#)
- ☐ After throttle valve module - J338- has been renewed, it must be re-adapted to engine control unit - J623- . Use vehicle diagnostic tester

17 - Seal

- ☐ Renew after removing

18 - Pipe

- ☐ With activated charcoal filter system solenoid valve 1 - N80-
- ☐ Removing and installing
⇒ ["3.5 Removing and installing activated charcoal filter solenoid valve 1 N80", page 298](#)

19 - O-ring

- ☐ Check for damage and renew if necessary

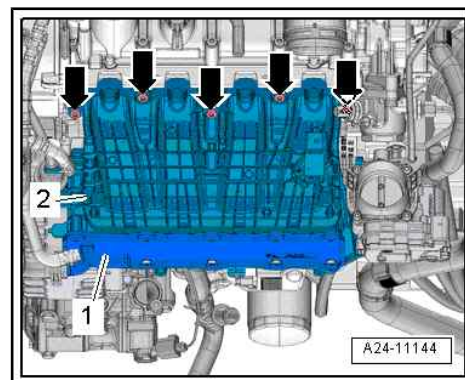
20 - Vacuum line**21 - O-ring**

- ☐ Check for damage and renew if necessary

Intake manifold - tightening torque and sequence

– Tighten bolts in stages as follows:

Stage	Bolts	Tightening torque
1.	-Arrows-	Starting in centre, screw in bolts alternately by hand until they make contact
2.	-Arrows-	Starting in centre, screw in bolts alternately: 8 Nm

**3.2 Removing and installing intake manifold**

Special tools and workshop equipment required



- ◆ Release tool - T10527- and -T10527/1-



Removing

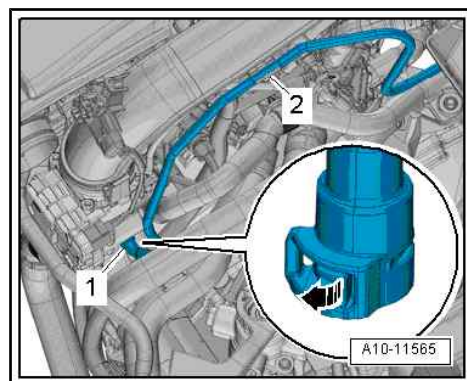
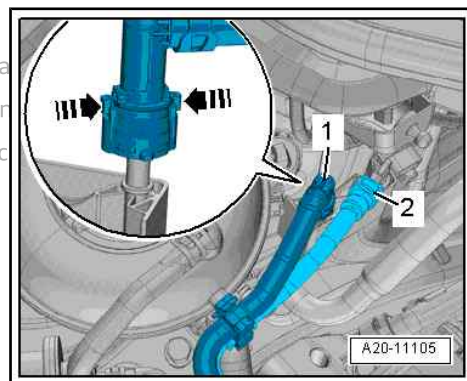
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Drain coolant
⇒ [“1.3 Draining and filling cooling system”, page 224](#) .
- Remove air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”, page 291](#) .
- First press hose connector -1- downwards, and then press release tabs -arrows-.

CAUTION

The fuel system is pressurised.

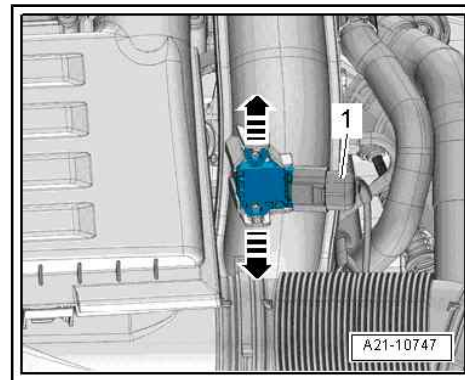
Risk of injury as fuel may spray out.

- Put on safety goggles.
 - Put on protective gloves.
 - Release pressure (wrap a clean cloth around connection and open connection carefully).
-
- Pull off hose connector, keeping release tabs depressed.
 - Press release tab on hose -2- for activated charcoal filter.
 - Disconnect hose and move it clear.
-
- Release catch -arrow- and disconnect vacuum hose -1-.
 - Move vacuum hose clear at air pipe -2-.

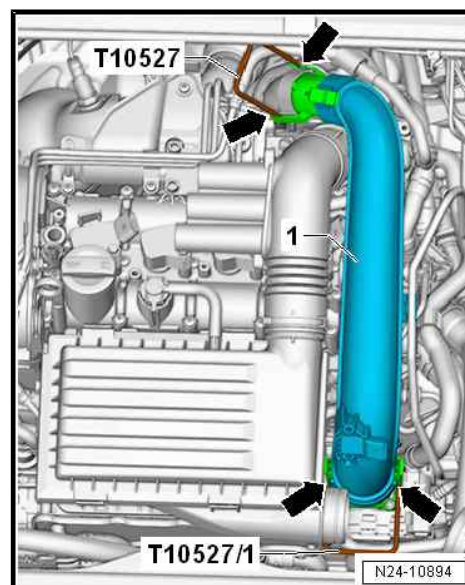




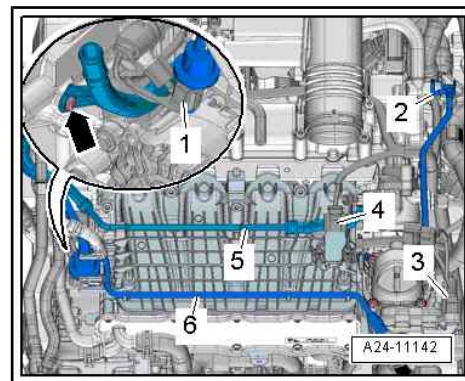
- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .



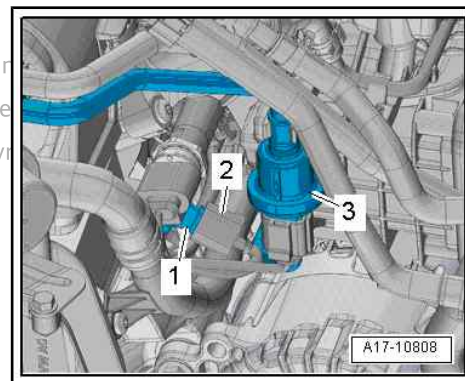
- Move clear air hoses at charge air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe -1-.



- Unplug electrical connectors:
 - 1 - For activated charcoal filter solenoid valve 1 - N80-
 - 3 - For throttle valve module - J338-
 - 4 - For intake manifold pressure sender - G71-
- Press release tabs and disconnect hose -2- for activated charcoal filter.
- Unclip fuel supply line -5- and coolant line -6- from intake manifold and push them to one side.



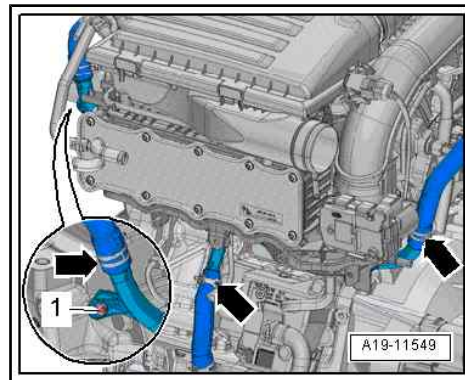
- Unplug electrical connector -2- on oil pressure switch for reduced oil pressure - F378- -item 1-.



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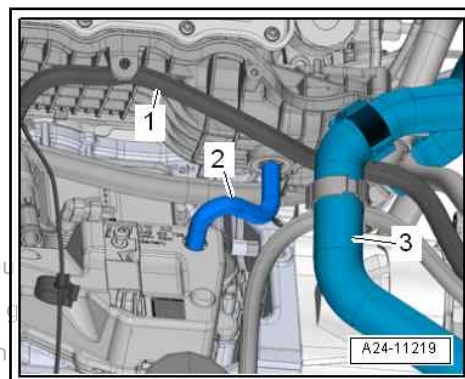
- Remove bolt -1-.
- Release hose clips -arrows- and disconnect coolant hoses.



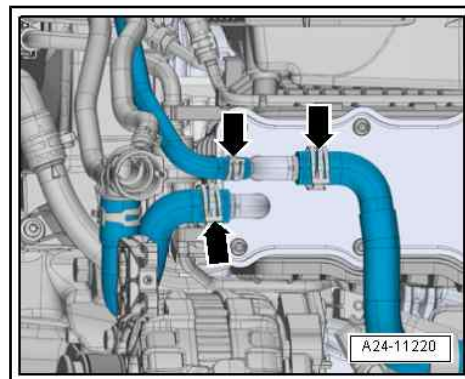
- Move electrical wiring harness -1- and coolant hose -3- clear at intake manifold.
- Disconnect crankcase breather hose -2-.



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- Release hose clips -arrows- and disconnect coolant hoses.



- Remove bolts -arrows-.
- Detach intake manifold -2-.

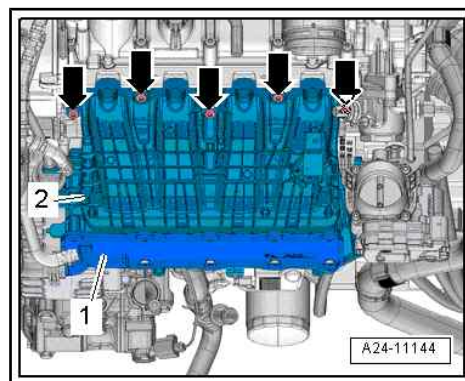
Installing

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

- Renew gaskets/seals and O-rings after removal
⇒ [“3.1 Exploded view - intake manifold”, page 292](#) .
- Fill up with coolant ⇒ [page 230](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 250](#)
- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 290](#)
- ◆ ⇒ [“3.1 Exploded view - intake manifold”, page 292](#)

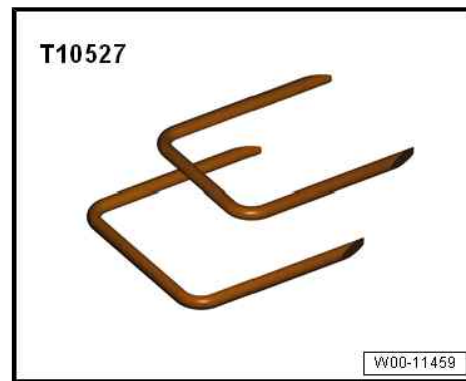


3.3 Removing and installing throttle valve module - J338-

Special tools and workshop equipment required

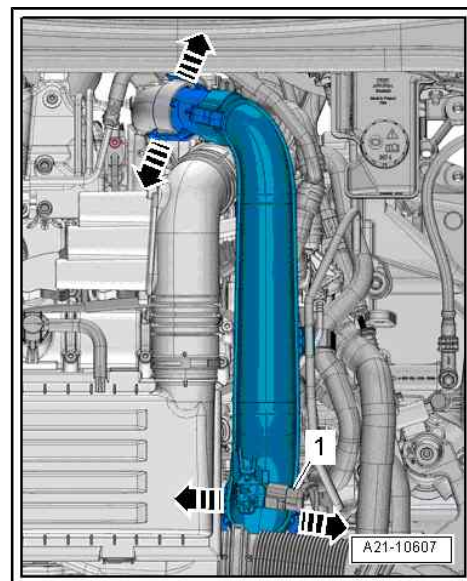


- ◆ Release tool - T10527- and -T10527/1-

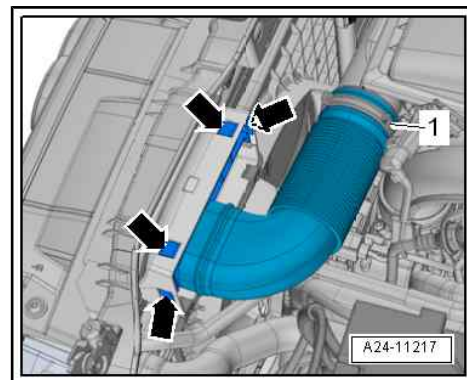


Removing

- Move clear air hoses at charge air pipe.
- Unplug electrical connector -1-.
- Release fasteners -arrows- and detach charge air pipe.



- Open hose clip -1- and detach air duct.
- Release fasteners -arrows- and remove air duct.



- Unplug electrical connector -3-.
- Remove bolts -arrows- and detach throttle valve module - J338- -item 1- with adapter -2-.

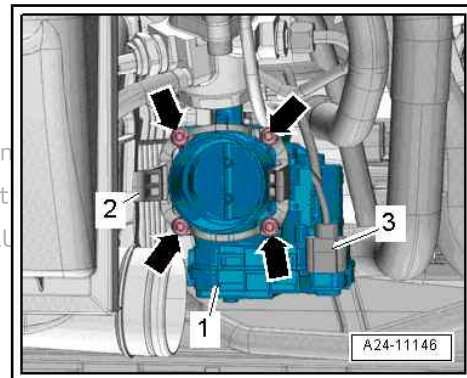
Installing

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

- After throttle valve module - J338- has been renewed, it must be re-adapted to engine control unit - J623- . Use vehicle diagnostic tester .

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - intake manifold", page 292](#)





3.4 Cleaning throttle valve module

Note:

Carbon deposits and dirt in the limit stop can lead to incorrect adaption values.

- Take care not to scratch the throttle valve housing when cleaning it.

Special tools and workshop equipment required

- ◆ Acetone (commercially available)
- ◆ Brush

Procedure

- Remove throttle valve module - J338-
⇒ [“3.3 Removing and installing throttle valve module J338”, page 296](#).
- Open throttle valve by hand and lock it in open position with a wedge (plastic or wood) -arrow-.

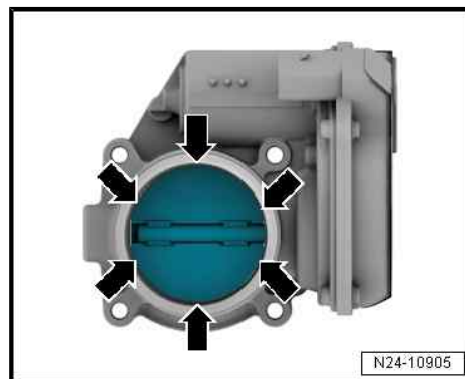


CAUTION

Risk of injury caused by acetone. Acetone is highly flammable and can cause irritation to the eyes and skin.

- Put on safety goggles.
- Put on protective gloves.

- Clean throttle valve housing thoroughly, especially around the points -arrows- where the throttle valve closes, using commercially available acetone and a small brush.
- Wipe out throttle valve housing with a lint-free cloth.
- Allow acetone to flash off completely.
- Install throttle valve module - J338-
⇒ [“3.3 Removing and installing throttle valve module J338”, page 296](#).
- Erase learnt values and adapt engine control unit - J623- to throttle valve module - J338-. Use vehicle diagnostic tester.



3.5 Removing and installing activated charcoal filter solenoid valve 1 - N80-

Activated charcoal filter solenoid valve 1 - N80- and connecting pipe are a single component and cannot be removed separately.

Removing

- Intake manifold removed
⇒ [“3.2 Removing and installing intake manifold”, page 293](#).
- Turn intake manifold over and place on a soft surface.



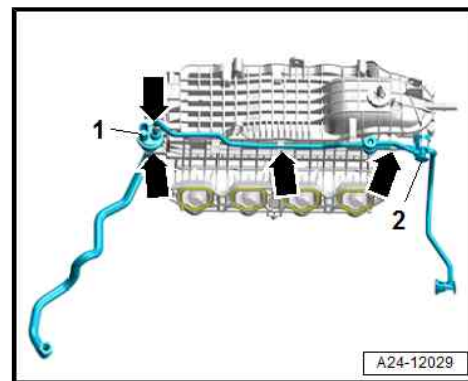
- Unclip activated charcoal filter solenoid valve 1 - N80- -1- (with connecting pipe) from retainers -arrows- on intake manifold.
- Press release tab on quick connector -2-, unplug activated charcoal filter solenoid valve 1 - N80- -1- (with connecting pipe) from intake manifold and remove.

Installing

Installation is carried out in reverse sequence.

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - intake manifold", page 292](#)



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4 Injectors

⇒ [“4.1 Exploded view - fuel rail with injectors”, page 300](#)

⇒ [“4.2 Removing and installing fuel rail”, page 301](#)

⇒ [“4.3 Removing and installing injectors”, page 301](#)

⇒ [“4.4 Cleaning injectors”, page 305](#)

4.1 Exploded view - fuel rail with injectors

1 - Fuel pressure sender G247-

☐ Renew after removing

☐ Checking

⇒ [“5.2 Checking fuel pressure sender G247”, page 308](#)

☐ Removing and installing

⇒ [“5.1 Removing and installing fuel pressure sender G247”, page 307](#)

☐ Lubricate taper and threads lightly with clean engine oil

☐ 22 Nm

2 - Fuel rail

☐ Removing and installing

⇒ [“4.2 Removing and installing fuel rail”, page 301](#)

3 - High-pressure pipe

☐ Connections must not be damaged

☐ Do not alter shape

☐ Removing and installing

⇒ [“6.3 Removing and installing high-pressure pipe”, page 313](#)

☐ Lubricate threads of union nuts with clean engine oil

☐ 16 Nm + 45°

4 - Bolt

☐ Renew after removing

☐ 8 Nm + 90°

5 - Support ring

☐ Renew after removing

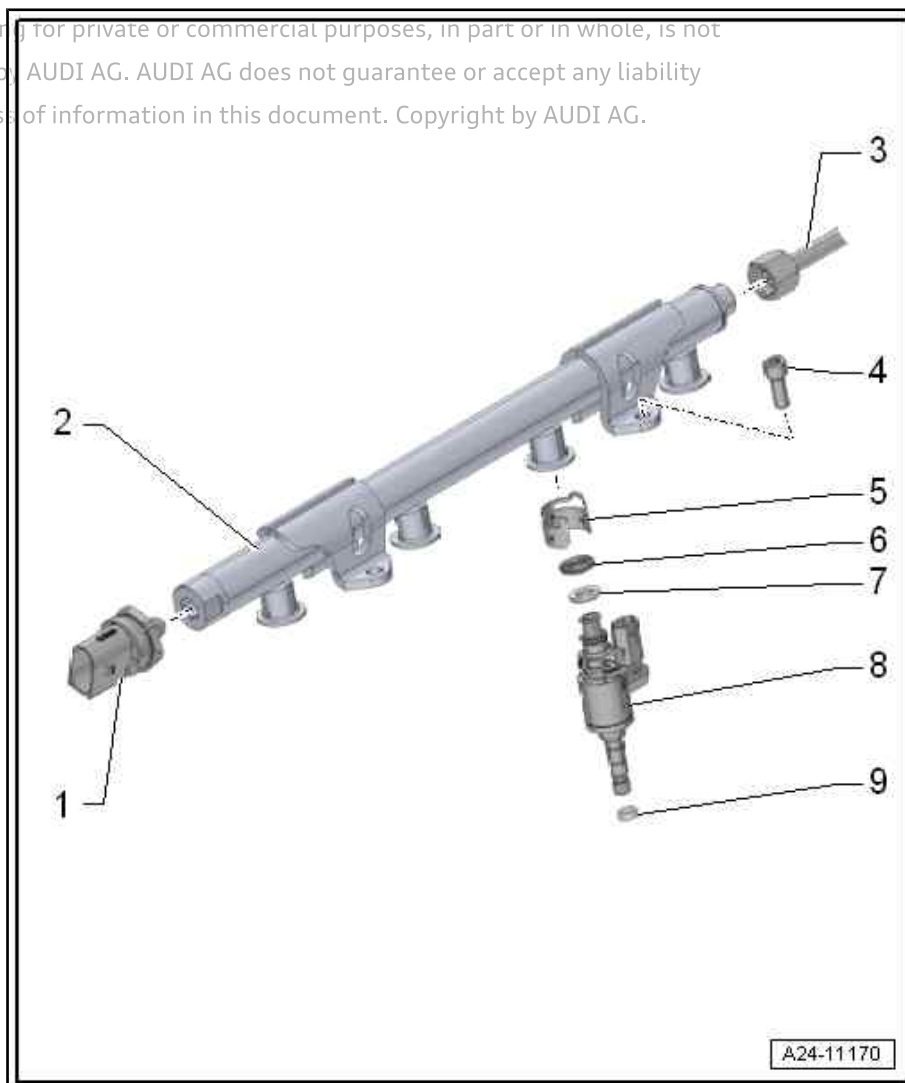
☐ Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head

☐ Clipped to -item 8-

6 - O-ring

☐ Renew after removing

☐ Lubricate lightly with clean engine oil





7 - Spacer ring

- Renew if damaged

8 - Injector

- Removing and installing ⇒ [“4.3 Removing and installing injectors”, page 301](#)

9 - Combustion chamber ring seal

- Do not apply grease or use any other lubricants
- Renewing ⇒ [“4.3 Removing and installing injectors”, page 301](#)

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4.2 Removing and installing fuel rail

Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove intake manifold
⇒ [“3.2 Removing and installing intake manifold”, page 293](#) .
- Remove high-pressure pipe
⇒ [“6.3 Removing and installing high-pressure pipe”, page 313](#) .
- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping fuel.
- Remove bolts -arrows- and pull fuel rail off injectors.

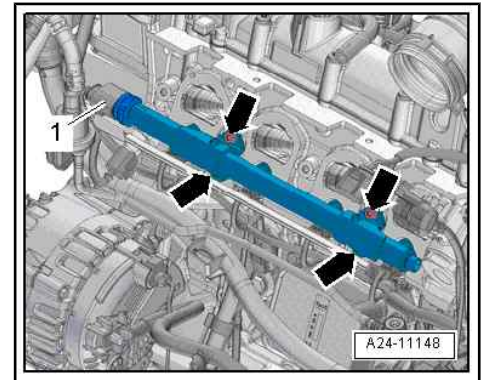
Installing

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

- Renew O-rings after removing.
- Renew support rings after removing.
- Apply mountings on fuel rail onto injectors.
- Press fuel rail onto injectors as far as stop (first on right side, then on left side).
- Press fuel rail down firmly in vicinity of bracket and hold, and screw bolts in up to base.
- Tighten bolts to specified torque.
- The fuel rail must not be pulled on using the bolts.
- Install high-pressure pipe
⇒ [“6.3 Removing and installing high-pressure pipe”, page 313](#) .
- Install intake manifold
⇒ [“3.2 Removing and installing intake manifold”, page 293](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - fuel rail with injectors”, page 300](#)

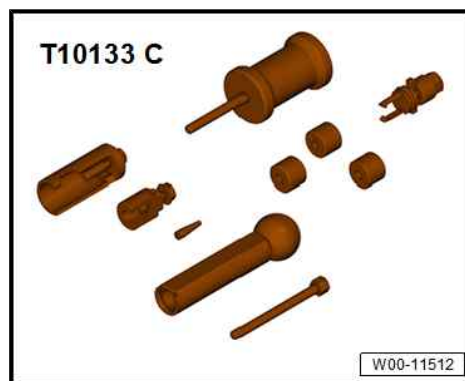


4.3 Removing and installing injectors

Special tools and workshop equipment required

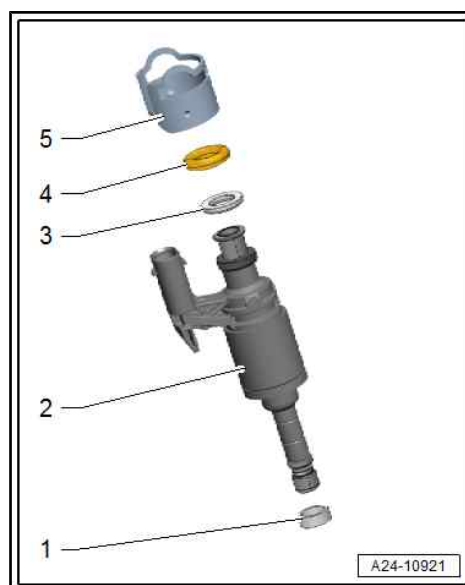


- ◆ Tool set for FSI engines - T10133 C- with -T10133/16A- and -T10133/19-



Removing

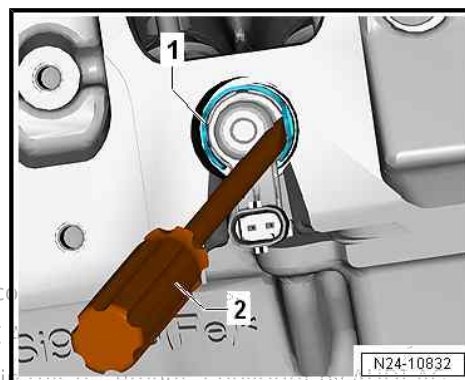
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Injectors must only be installed when engine is cold.
- Remove fuel rail
⇒ [“4.2 Removing and installing fuel rail”, page 301](#) .
- Remove O-ring -4- from injector -2-.
- Unplug electrical connector from corresponding injector.



- Use screwdriver -2- to prise support ring -1- off injector.

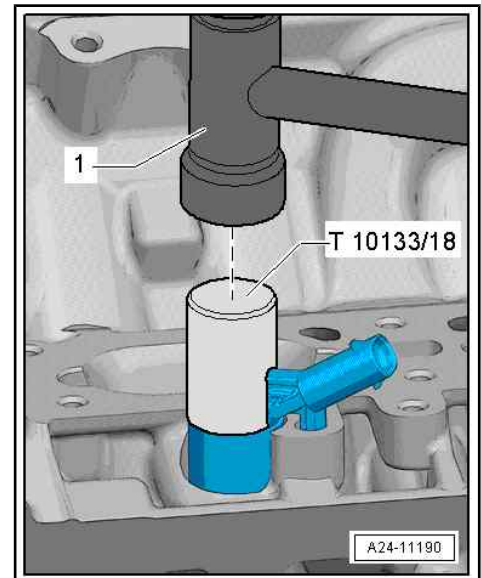


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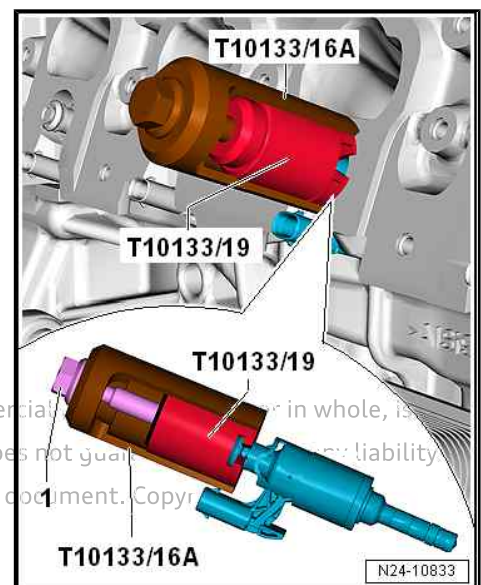




- Slide stop sleeve -T10133/18- over injector.
- Carefully knock against stop sleeve several times with a plastic hammer -1- to loosen injector.
- Use a torque wrench to pull out injector.
- Set torque wrench to 5 Nm.
- Observe correct torque to avoid irreparable damage to injector.



- Apply puller -T10133/19- to groove on injector -1-.
- Attach removal tool -T10133/16A- to puller.
- Pull out injector by screwing in bolt on puller.
- If injector does not come loose after limit torque of 5 Nm is reached, remove puller and repeat procedure using stop sleeve to loosen injector.
- Repeat procedure for each injector.
- Detach gasket for intake manifold (bottom section).



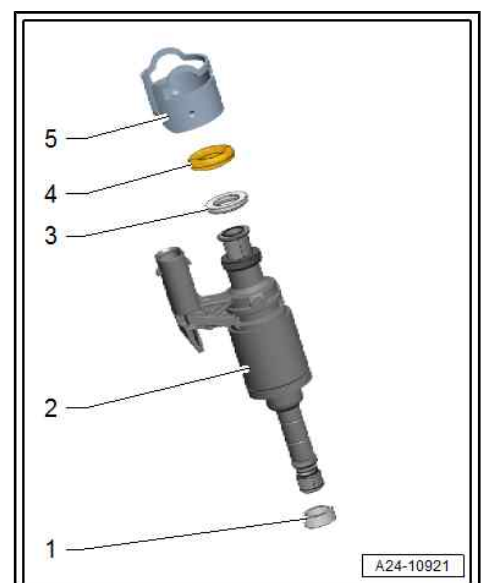
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Dismantling injector

- Pull support ring -5- and spacer ring -3- off injector -2-.
- Carefully remove old combustion chamber ring seal -1-. To do so, cut open seal using knife or prise open with small screwdriver and then pull off forwards.
- Take care not to damage groove on injector.
- The injector must be renewed if the groove is damaged.

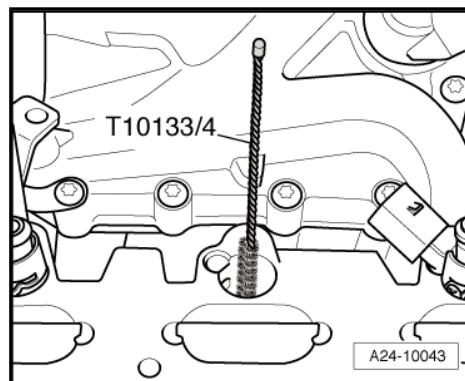
Installing

- Use complete repair set when installing.
- Renew support rings.
- Renew combustion chamber ring seal before re-installing injector.
- Lightly lubricate O-rings for injectors with clean engine oil.

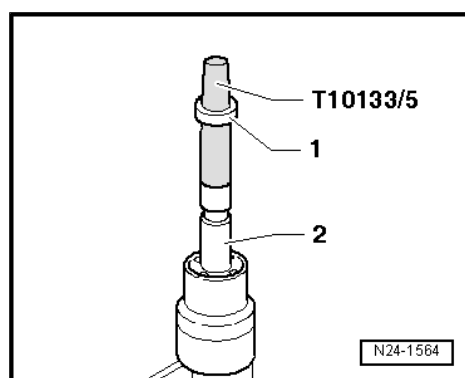




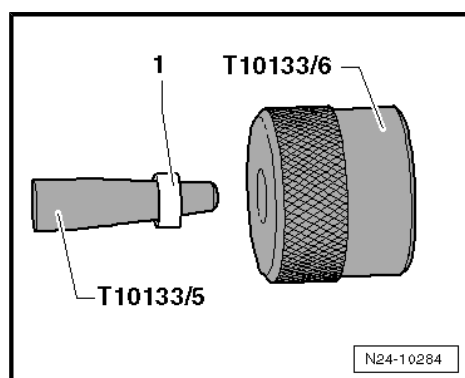
- Clean bore in cylinder head with nylon cylinder brush - T10133/4- .
- When re-installing an injector, clean any combustion residue off groove for combustion chamber ring seal and injector stem with a clean cloth.



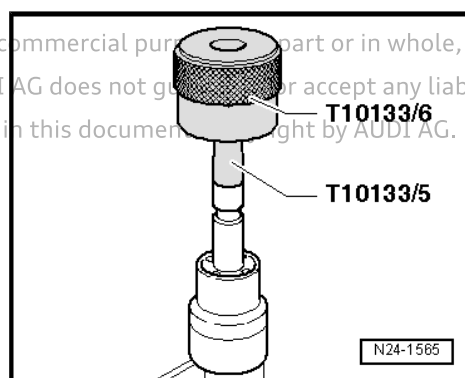
- Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



- Using assembly sleeve -T10133/6- , push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go.

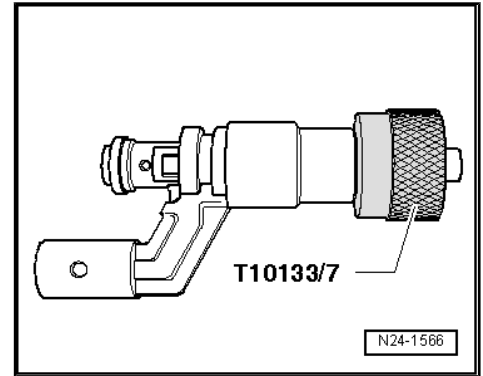


- Turn round assembly sleeve -T10133/6- and slide combustion chamber ring seal into groove.

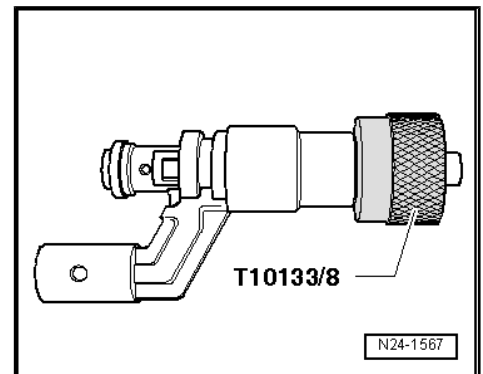




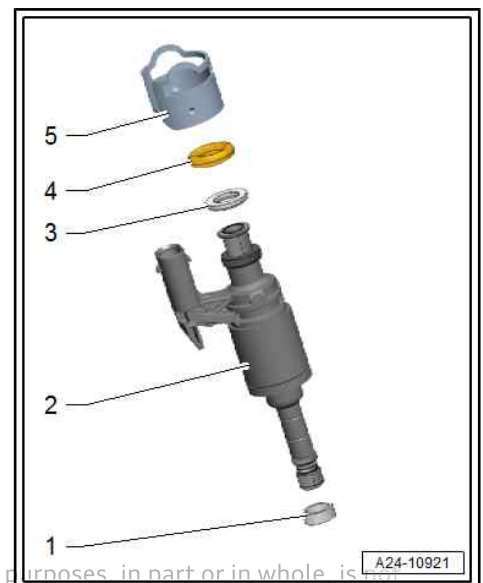
- The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.
- Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.



- Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.



- Before installing new injector -1-, lubricate new O-ring -3- lightly with clean engine oil.
- The combustion chamber ring seal -1- must not be lubricated.
- Fit gasket for intake manifold (bottom section).
- Push injector by hand as far as it will go into aperture in cylinder head (do not use oil or grease). Ensure that the injector is properly seated in the cylinder head.
- Electrical connector of injector must engage in recess in cylinder head.
- It should be possible to insert injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.
- Install fuel rail
⇒ ["4.2 Removing and installing fuel rail", page 301](#) .
- Connect ⇒ Vehicle diagnostic tester and perform the function "Delete adaption values for injectors" in Guided Functions.



4.4 Cleaning injectors

Special tools and workshop equipment required

- ◆ Ultrasonic cleaning unit - VAS 6418-
- ◆ Mounting plate for injectors - VAS 6418/1-
- ◆ Cleaning fluid - VAS 6418/2-

Cleaning

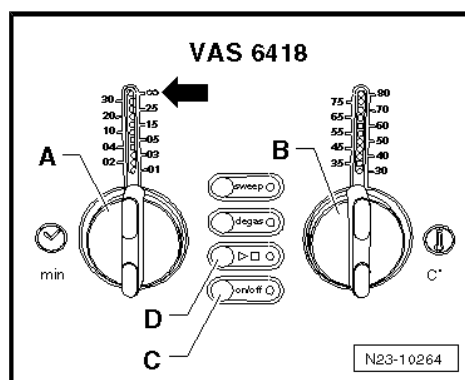
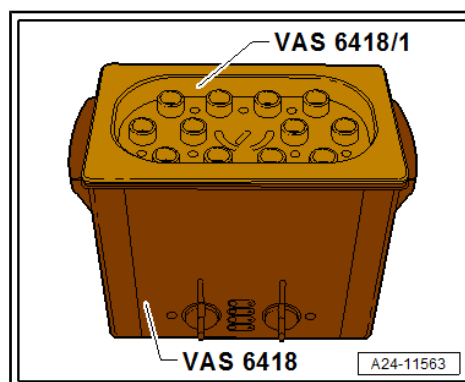
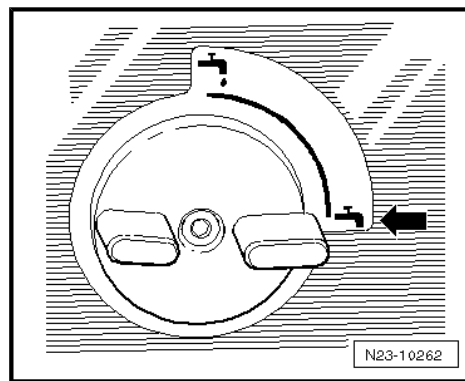
- Remove injectors
⇒ ["4.3 Removing and installing injectors", page 301](#) .



- Close drain tap -arrow- on ultrasonic cleaning unit - VAS 6418- (located on right side of housing).
- Fill ultrasonic unit with 2,120 ml of water which has been allowed to settle for a few minutes and cleaning fluid - VAS 6418/2- .

Mixture ratio for cleaning fluid

- 2,100 ml of tap water which has been allowed to settle for a few minutes and 20 ml of cleaning fluid - VAS 6418/2-
- Place mounting plate for injectors - VAS 6418/1- on top of cleaning unit.
- It is important to read the safety notes in the operating instructions before switching on the ultrasonic cleaning unit - VAS 6418- .
- The ideal fluid level is approx. 1-4 mm above the base of the mounting plate. The ultrasonic cleaning unit - VAS 6418- can be damaged if the fluid level is too low.
- Insert FSI injectors all the way into guides of mounting plate for injectors - VAS 6418/1- .
- Switch on cleaning unit by pressing **on/off** button -C-.
- Select a cleaning time of 30 minutes with rotary control -A-.
- Set rotary control -B- to a temperature of 50°C.
- Press **▶** button -D- to start cleaning procedure.
- The temperature-controlled cleaning process is now started. While the fluid is being heated, the ultrasound is activated at intervals in order to circulate the cleaning solution. The ultrasound is activated continuously when the preselected temperature is reached.
- The actual cleaning process commences when the temperature reaches at least 50 °C and must last for at least 30 minutes.
- After cleaning, renew combustion chamber ring seal for each injector ⇒ ["4.3 Removing and installing injectors", page 301](#) .



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5 Senders and sensors

⇒ ["5.1 Removing and installing fuel pressure sender G247", page 307](#)

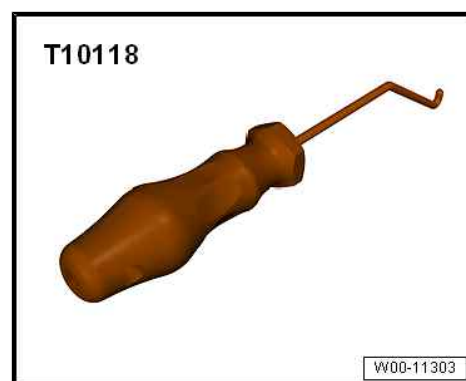
⇒ ["5.2 Checking fuel pressure sender G247", page 308](#)

⇒ ["5.3 Removing and installing intake air temperature sender G42 / intake manifold pressure sender G71", page 310](#)

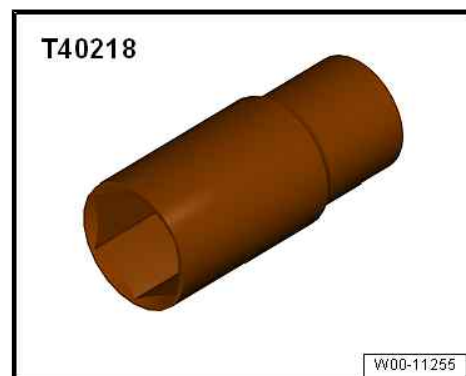
5.1 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

◆ Assembly tool - T10118-

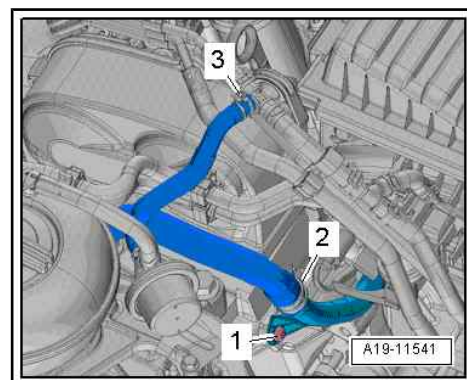


◆ Bit (27 mm) - T40218- or commercially available socket (27 mm)



Removing

- Observe rules for cleanliness
⇒ ["3.1 Rules for cleanliness", page 5](#)
- Remove bolt -1- from coolant pipe.



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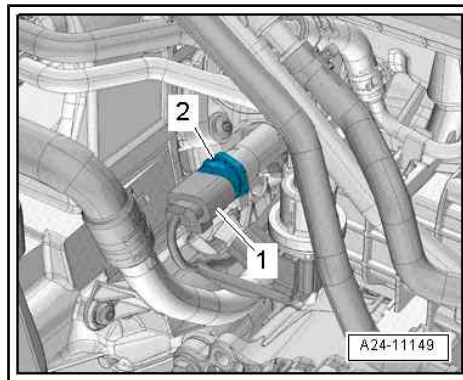
- Unplug electrical connector -1-.

⚠ CAUTION

The fuel system is pressurised.

Risk of injury as fuel may spray out.

- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap a clean cloth around connection and open connection carefully).



- Unscrew fuel pressure sender - G247- -2- using bit, 27 mm - T40218-

Installing

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

- Lubricate taper and threads lightly with clean engine oil

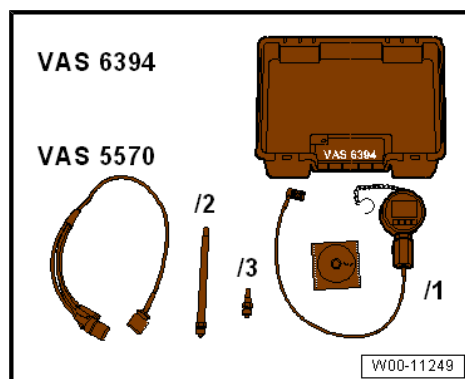
Tightening torques

- ◆ ⇒ [“4.1 Exploded view - fuel rail with injectors”, page 300](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 250](#)

5.2 Checking fuel pressure sender - G247-

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester
- ◆ Test instrument adapter/DSO (3-pin) - VAS 5570-



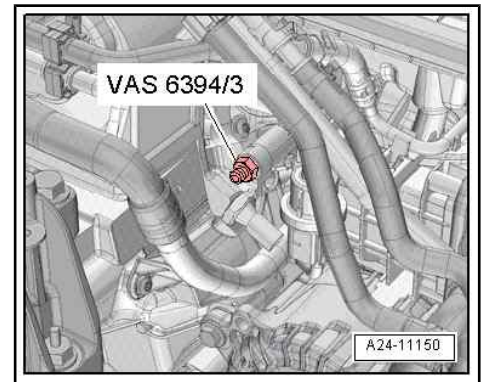
- ◆ Pressure sensor tester - VAS 6394-
- ◆ Socket, 27 mm (commercially available)

Procedure

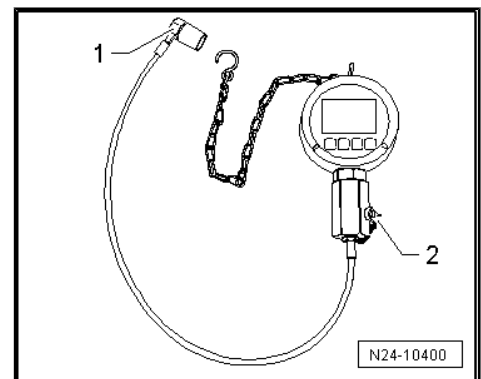
- Observe rules for cleanliness
⇒ [“3.1 Rules for cleanliness”, page 5](#)
- Remove fuel pressure sender - G247-
⇒ [“5.1 Removing and installing fuel pressure sender G247 ”, page 307](#) .



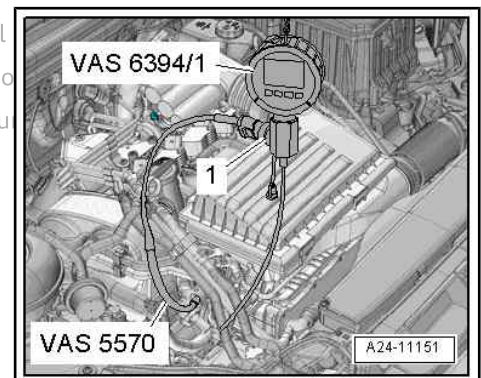
- Lubricate taper seal of adapter -VAS 6394/3- with clean engine oil and screw into fuel rail (22 Nm).



- Unscrew plug -2- and screw fuel pressure sender - G247- into tester -VAS 6394/1- .
- Connect pressure line -1- of tester to adapter - VAS 6394/3- .

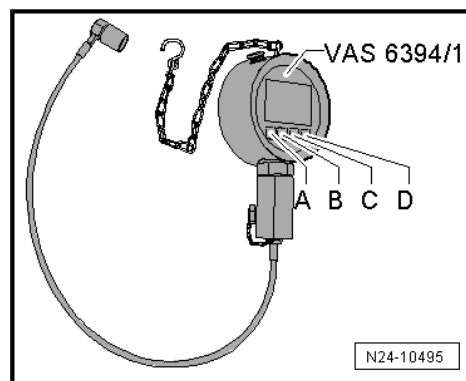


- Connect vehicle and fuel pressure sender - G247- electrically using test instrument adapter/DSO (3-pin) - VAS 5570- .





- Switch on tester -VAS 6394/1- by pressing button -A- once briefly.
- You can press and hold button -A- for 2 seconds to switch on the illumination for 20 seconds.
- If tester -VAS 6394/1- does not indicate 0 bar, zero the tester
⇒ Operating instructions .
- Connect a vehicle diagnostic tester .
- Start engine and run at idling speed.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select “Measured values”.
- Select “Fuel pressure” from the list.
- Compare fuel pressure indicated on tester -VAS 6394/1- with value displayed on vehicle diagnostic tester .
- Observe fuel pressure displayed on vehicle diagnostic tester .
 - The pressure readings must not deviate by more than 5 bar.
- If deviation is more than 5 bar, renew fuel pressure sender - G247- .
- Repeat the test with the new fuel pressure sender - G247- and compare the two pressure values.
- If measured values are now the same, install new fuel pressure sender - G247- .
- If measured values are not the same again, check electrical connection between fuel pressure sender - G247- and engine control unit - J623- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



5.3 Removing and installing intake air temperature sender - G42- / intake manifold pressure sender - G71-

Removing

- Remove air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”, page 291](#) .
- Unplug electrical connector -1-.
- Release catches -arrows- and detach intake air temperature sender - G42- / intake manifold pressure sender - G71- .

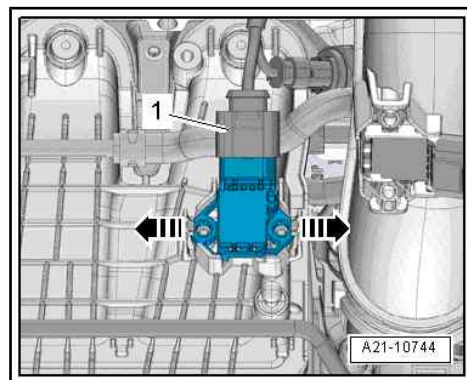
Installing

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

- If necessary, renew O-ring after removal.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- If fasteners on intake manifold have broken off, secure intake air temperature sender - G42- / intake manifold pressure sender - G71- with bolts; for bolts, refer to ⇒ Electronic parts catalogue .

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 290](#)





6 High-pressure pump

⇒ [“6.1 Exploded view - high-pressure pump”, page 311](#)

⇒ [“6.2 Removing and installing high-pressure pump”, page 312](#)

⇒ [“6.3 Removing and installing high-pressure pipe”, page 313](#)

6.1 Exploded view - high-pressure pump

1 - Fuel supply hose

- ☐ Always renew hose clip if removed

2 - Electrical connector

3 - High-pressure pump

- ☐ Different types available depending on version ⇒ Electronic parts catalogue
- ☐ With fuel metering valve - N290-
- ☐ Do not dismantle
- ☐ Removing and installing ⇒ [“6.2 Removing and installing high-pressure pump”, page 312](#)

4 - Roller tappet

- ☐ When installing lubricate lightly with clean engine oil

5 - O-ring

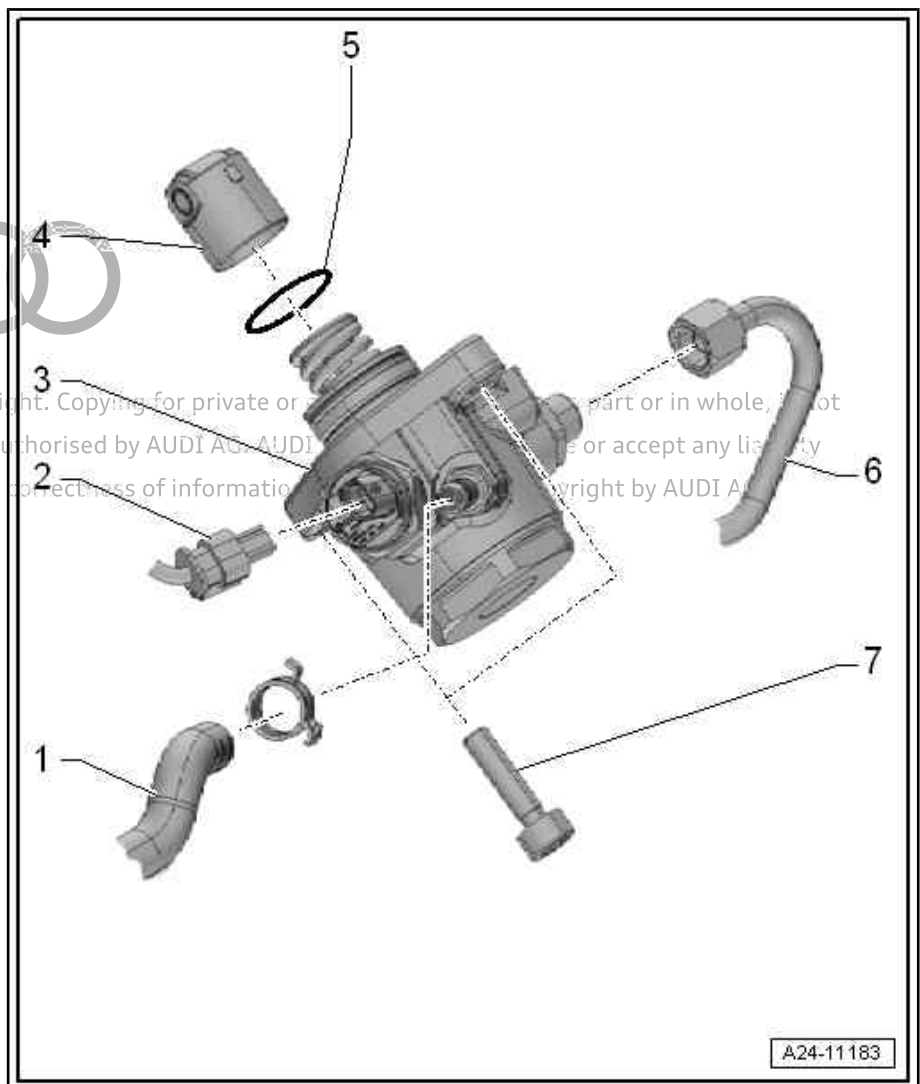
- ☐ Renew after removing
- ☐ When installing lubricate lightly with clean engine oil

6 - High-pressure pipe

- ☐ Removing and installing ⇒ [“6.3 Removing and installing high-pressure pipe”, page 313](#)
- ☐ Do not alter shape
- ☐ Connections must not be damaged
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 16 Nm +45°

7 - Bolt

- ☐ Renew after removing
- ☐ Different types available depending on version ⇒ Electronic parts catalogue
- ☐ Tightening torque and sequence ⇒ [Fig. “High-pressure pump - tightening torque and sequence, version I””, page 312](#)





High-pressure pump - tightening torque and sequence, version I



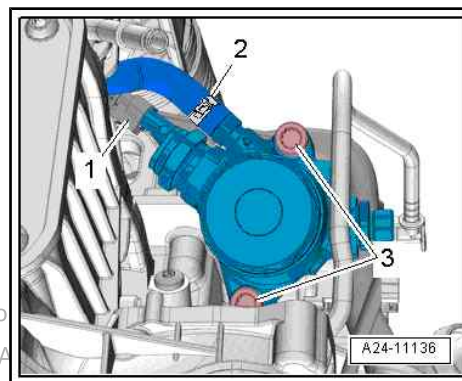
Note

Renew bolts tightened with specified tightening angle.

To prevent flange of high-pressure pump from being deformed during installation, fit high-pressure pump as follows:

- Tighten bolts in stages as follows:

Stage	Bolts	Tightening torque/angle specification
1.	-3-	Screw in by hand until contact is made
2.	-3-	Tighten one turn alternately until flange of high-pressure pump makes contact with camshaft housing
3.	-3-	M6: 8 Nm M8: 20 Nm
4.	-3-	Turn 90° further

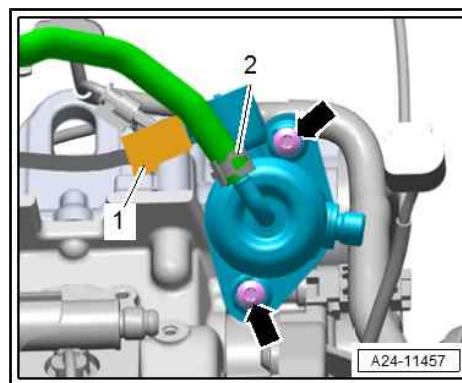


High-pressure pump - tightening torque and sequence, version II

To prevent flange of high-pressure pump from being deformed during installation, fit high-pressure pump as follows:

- Tighten new bolts in stages as follows:

Stage	Bolts	Tightening torque/angle specification
1.	-Arrows-	Screw in by hand until contact is made
2.	-Arrows-	Tighten one turn alternately until flange of high-pressure pump makes contact with camshaft housing
3.	-Arrows-	M6: 8 Nm M8: 20 Nm
4.	-Arrows-	Turn 90° further



6.2 Removing and installing high-pressure pump

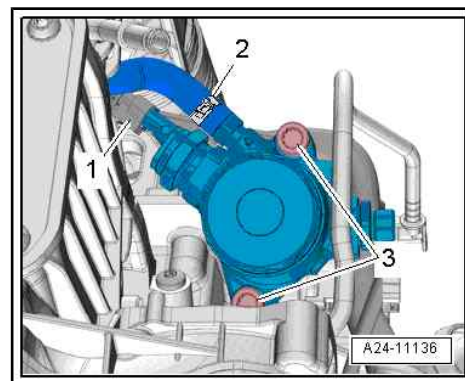
Removing

- Engine cold.
- Observe rules for cleanliness
⇒ [“3.1 Rules for cleanliness”, page 5](#).
- Remove high-pressure pipe
⇒ [“6.3 Removing and installing high-pressure pipe”, page 313](#).



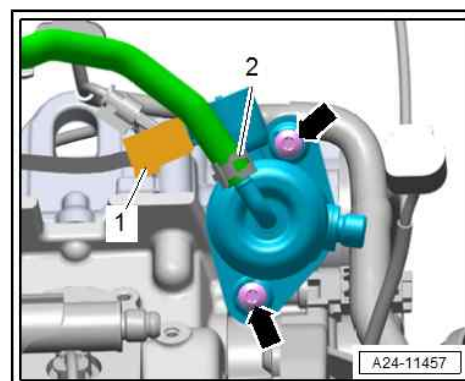
Version 1:

- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping fuel.
- Release hose clip -2- and detach fuel supply hose.
- Unscrew bolts -3- and detach high-pressure pump with roller tappet.



Version 2

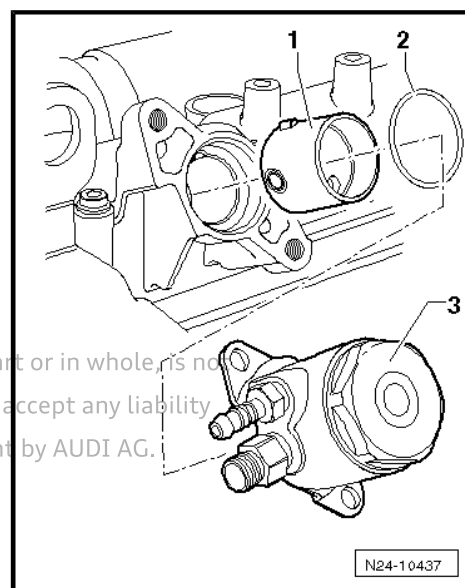
- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping fuel.
- Release hose clip -2- and detach fuel supply hose.
- Unscrew bolts -arrows- and detach high-pressure pump with roller tappet.



Installing

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

- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Renew O-ring and spring-type clip after removal.
- Check roller tappet for damage and renew if necessary.
- Lubricate roller tappet -1- with clean engine oil.
- Insert lubricated roller tappet -1- into camshaft housing.
- Turn crankshaft in direction of engine rotation until roller tappet is positioned at lowest point.
- Insert a new oiled O-ring -2- into groove on high-pressure pump -3-.
- Tighten bolts hand-tight.
- Tighten bolts in diagonal sequence to specified torque
⇒ ["6.1 Exploded view - high-pressure pump", page 311](#) .
- Install high-pressure pipe
⇒ ["6.3 Removing and installing high-pressure pipe", page 313](#) .
- Check fuel system for leaks.

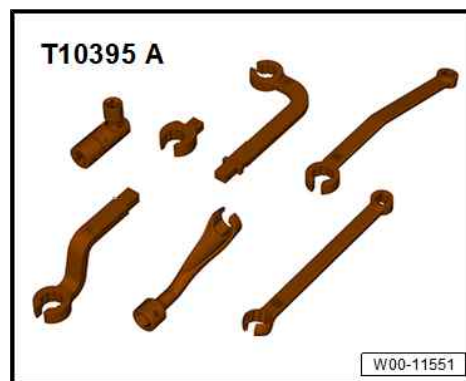


6.3 Removing and installing high-pressure pipe

Special tools and workshop equipment required



- ◆ Tool insert - T10395/3- from tool set - T10395 A-



Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove throttle valve module - J338-
⇒ [“3.3 Removing and installing throttle valve module J338 ”, page 296](#) .

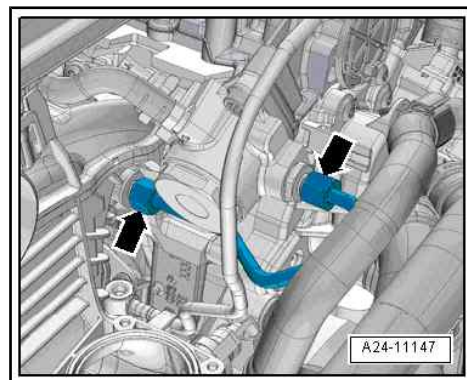


CAUTION

The fuel system is pressurised.

Risk of injury as fuel may spray out.

- Put on safety goggles.
 - Put on protective gloves.
 - Release pressure (wrap a clean cloth around connection and open connection carefully).
-
- Unscrew union nuts -arrows- and detach high-pressure pipe.



Installing

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

- The high-pressure pipe may be re-installed after removal.
- Counterhold connection on high-pressure pump when tightening.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#) .
- Lubricate threads of union nuts with clean engine oil.
- Hand-tighten union nuts for high-pressure pipe (make sure that pipe is not under tension).
- First tighten union nut at high-pressure pump and then at high-pressure pipe.
- Install throttle valve module - J338-
⇒ [“3.3 Removing and installing throttle valve module J338 ”, page 296](#) .

Tightening torques

- ◆ ⇒ [“6.1 Exploded view - high-pressure pump”, page 311](#)



7 Lambda probe

⇒ [“7.1 Exploded view - Lambda probe”, page 315](#)

⇒ [“7.2 Removing and installing Lambda probe”, page 315](#)

7.1 Exploded view - Lambda probe

- New Lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.
- In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic parts catalogue
- The electrical wiring of the lambda probe must be secured at the original locations when installing. The wiring must NOT come into contact with the exhaust pipe.

1 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29-

- ❑ Removing and installing
⇒ [“7.2 Removing and installing Lambda probe”, page 315](#)

❑ 55 Nm

2 - Electrical connector

- ❑ For Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29-

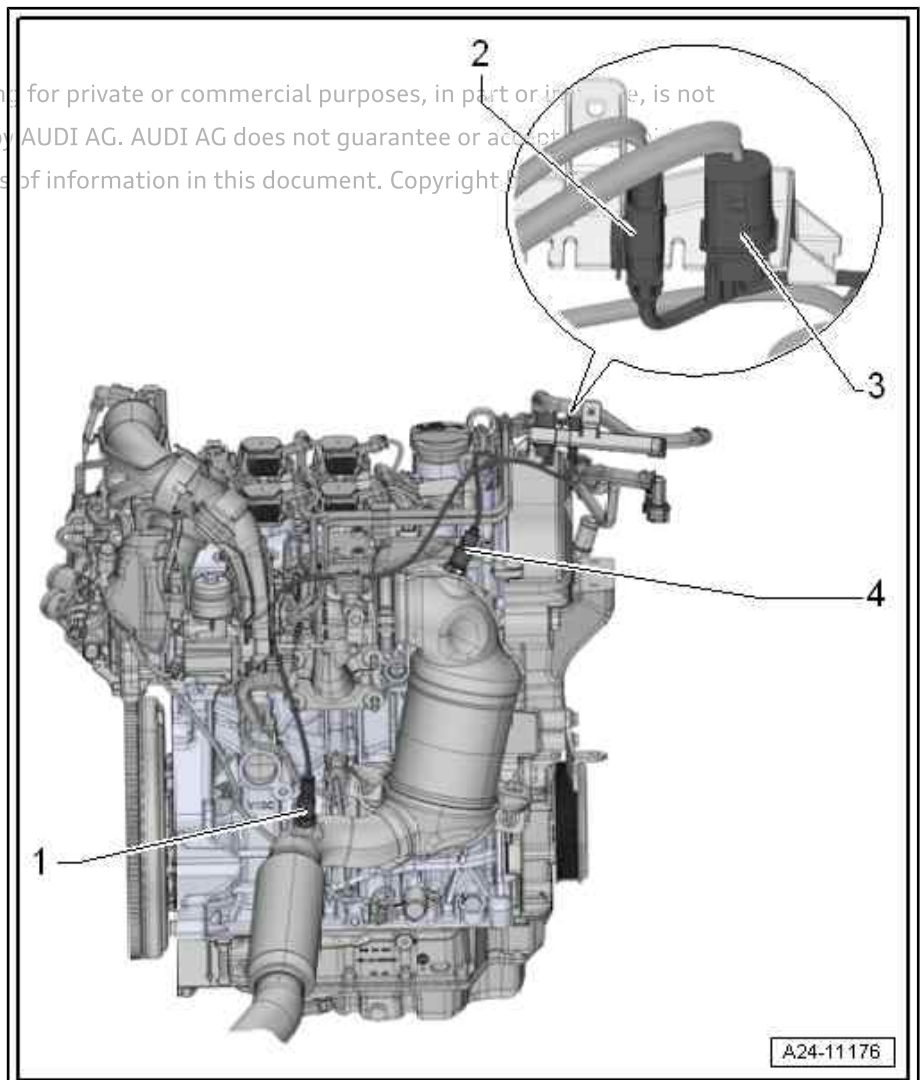
3 - Electrical connector

- ❑ For Lambda probe - G39- with Lambda probe heater - Z19-

4 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing
⇒ [“7.2 Removing and installing Lambda probe”, page 315](#)

❑ 55 Nm

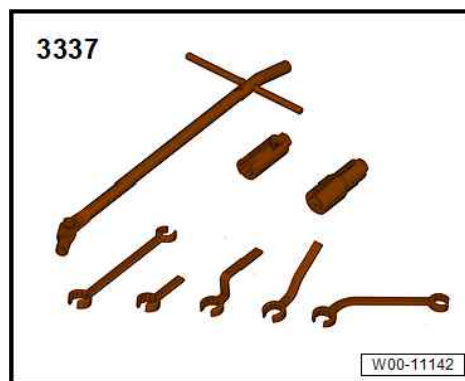


7.2 Removing and installing Lambda probe

Special tools and workshop equipment required



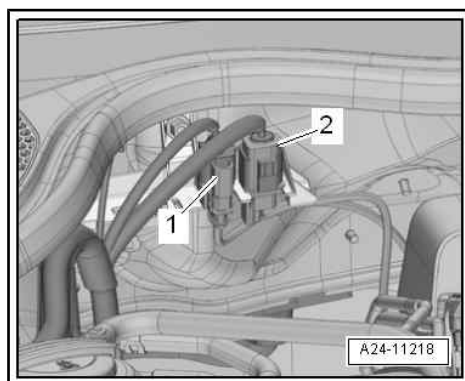
◆ Lambda probe open ring spanner set - 3337-



Removing

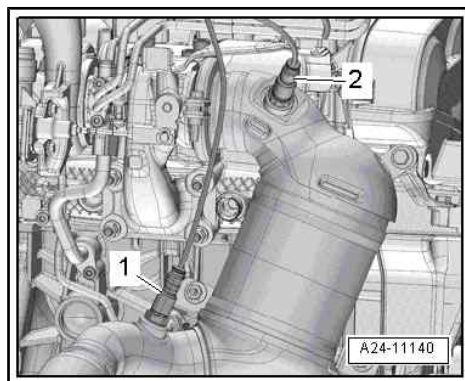
– Unplug corresponding electrical connector:

- 1 - For Lambda probe after catalytic converter - G130- and Lambda probe heater - Z19-
- 2 - For Lambda probe - G39- and Lambda probe heater - Z19-



– Unscrew corresponding Lambda probe using a tool from Lambda probe open ring spanner set - 3337- .

- 1 - Lambda probe after catalytic converter - G130-
- 2 - Lambda probe - G39-



Installing

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

- New Lambda probes are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.
- In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste → Electronic parts catalogue
- The electrical wiring of the lambda probe must be secured at the original locations when installing. The wiring must NOT come into contact with the exhaust pipe.

Tightening torques

- ◆ ⇒ ["7.1 Exploded view - Lambda probe" page 315](#)

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8 Engine control unit

⇒ "8.1 Exploded view - engine control unit", page 317

⇒ "8.2 Removing and installing engine control unit J623 ", page 317

8.1 Exploded view - engine control unit

1 - Bracket

2 - Engine control unit - J623-

- ☐ Removing and installing
⇒ "8.2 Removing and installing engine control unit J623 ", page 317

3 - Locking element

- ☐ Whether a locking element is fitted depends on the vehicle equipment; refer to ⇒ Electronic parts catalogue (ETKA)

4 - Bolt

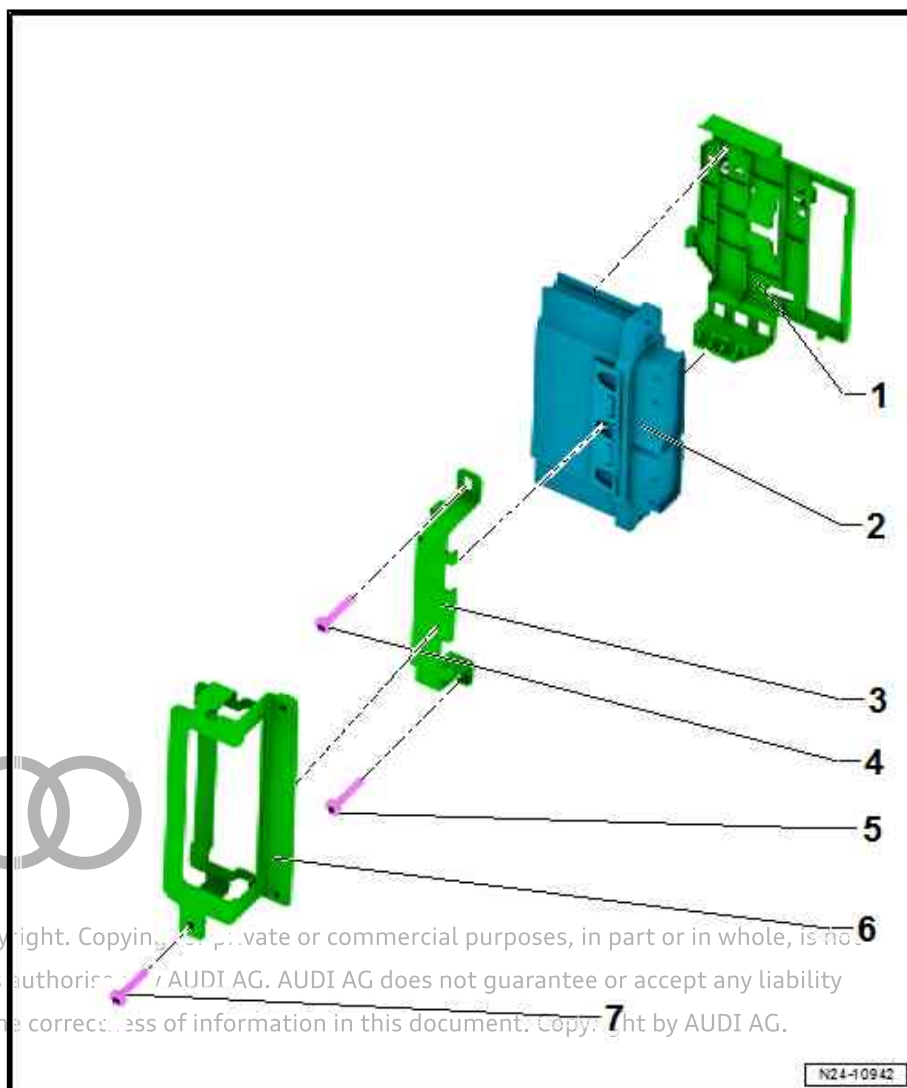
- ☐ Screw in shear bolts evenly until head shears off
- ☐ Renew after removing; for correct version refer to ⇒ Electronic parts catalogue (ETKA)

5 - Bolt

- ☐ Screw in shear bolts evenly until head shears off
- ☐ Renew after removing; for correct version refer to ⇒ Electronic parts catalogue (ETKA)

6 - Protective housing

Whether a protective housing is fitted depends on the vehicle equipment; refer to ⇒ Electronic parts catalogue (ETKA)



7 - Bolt

- ☐ Screw in shear bolts evenly until head shears off
- ☐ Renew after removing; for correct version refer to ⇒ Electronic parts catalogue (ETKA)

8.2 Removing and installing engine control unit - J623-

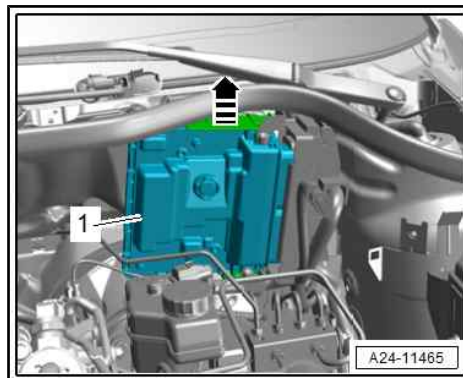
- ◆ Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the vehicle equipment; refer to ⇒ Electronic parts catalogue (ETKA) .

Removing

Special tools and workshop equipment required

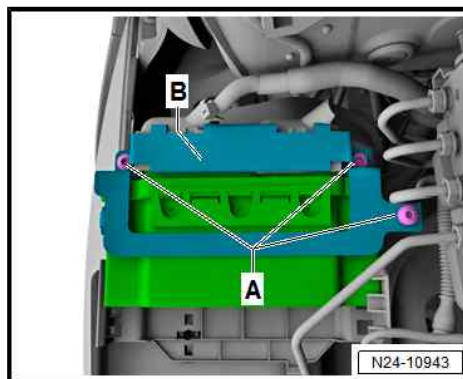


- ◆ Vehicle diagnostic tester
- ◆ Vice-grip pliers (commercially available)
- If engine control unit is to be renewed, select test sequence/ function “Replace engine control unit” in “Guided Functions” mode ⇒ Vehicle diagnostic tester.
- Switch off ignition and remove ignition key.
- Release catch -arrow- and detach engine control unit - J623- item 1- from bracket.
- Press tab (not visible in illustration) downwards if necessary and move engine control unit - J623- clear.



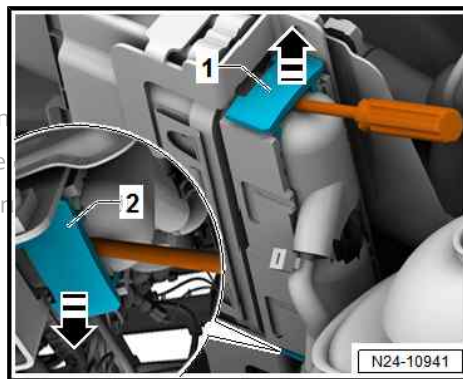
Engine control unit with protective housing

- Move wiring harness clear and push as far to side as possible.
- Unscrew bolts -A- with vice-grip pliers or similar. Detach locking element -B-.
- Take engine control unit out of protective housing.



All versions

- Lever locking bar -1- of top wiring harness in direction of -arrow- using a screwdriver.
- Lever locking bar -2- of bottom wiring harness in direction of -arrow- using a screwdriver.
- Unplug connectors from engine control unit.
- Remove engine control unit.



Installing

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

- If previously fitted, re-install protective housing on engine control unit.
- Use new shear bolts.
- Install air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”, page 291](#).

The procedure required after connecting the new engine control unit is described in “Guided Fault Finding” or “Guided Functions”.
Use ⇒ Vehicle diagnostic tester.



26 – Exhaust system

1 Exhaust pipes/silencers

⇒ [“1.1 Exploded view - silencers”, page 319](#)

⇒ [“1.2 Removing and installing silencers”, page 320](#)

⇒ [“1.3 Separating exhaust pipes/silencers”, page 321](#)

⇒ [“1.4 Stress-free alignment of exhaust system”, page 322](#)

⇒ [“1.5 Checking exhaust system for leaks”, page 323](#)

1.1 Exploded view - silencers

1 - Rear silencer

- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed separately for repair purposes
- ☐ Removing and installing
⇒ [“1.2 Removing and installing silencers”, page 320](#)
- ☐ Disconnecting exhaust pipes/silencers
⇒ [“1.3 Separating exhaust pipes/silencers”, page 321](#)
- ☐ Align exhaust system so it is free of stress
⇒ [“1.4 Stress-free alignment of exhaust system”, page 322](#)

2 - Bolt

- ☐ 20 Nm

3 - Rubber mounting

- ☐ Renew if damaged

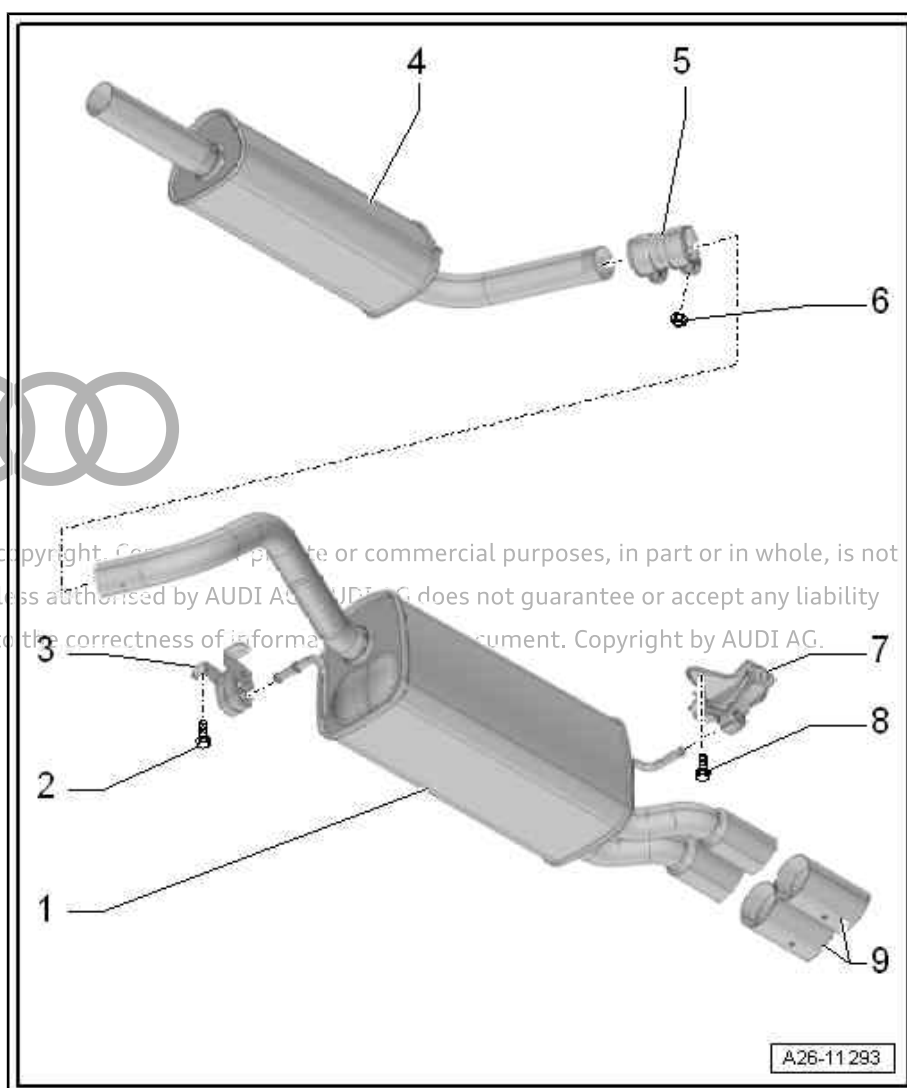
4 - Centre silencer

- ☐ Combined in one unit with rear silencer as original equipment. Can be renewed separately for repair purposes
- ☐ Removing and installing
⇒ [“1.2 Removing and installing silencers”, page 320](#)
- ☐ Disconnecting exhaust pipes/silencers
⇒ [“1.3 Separating exhaust pipes/silencers”, page 321](#)

- ☐ Align exhaust system so it is free of stress ⇒ [“1.4 Stress-free alignment of exhaust system”, page 322](#)

5 - Clamp (rear)

- ☐ Before tightening, align exhaust system so it is free of stress
⇒ [“1.4 Stress-free alignment of exhaust system”, page 322](#)
- ☐ Installation position ⇒ [Fig. “Installation position of rear clamp”, page 320](#)
- ☐ Tighten bolted connections evenly





6 - Nut

- ☐ 30 Nm

7 - Mounting

- ☐ Renew if damaged

8 - Bolt

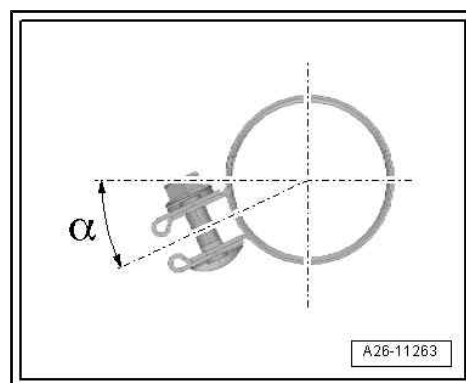
- ☐ 20 Nm

9 - Trim

- ☐ For tailpipes
- ☐ Slide onto tailpipes as far as stop

Installation position of rear clamp

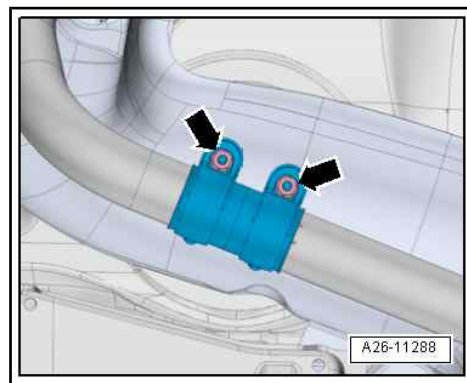
- Fit clamp in position shown.
- Angle α = approx. 20°
- Bolt connections face to rear.
- Nuts facing upwards



1.2 Removing and installing silencers

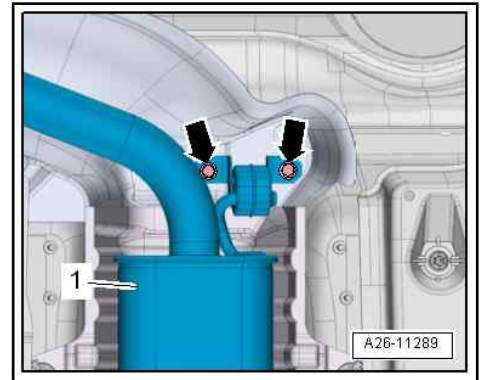
Removing centre silencer

- Remove tunnel cross-piece (rear) ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .
- Vehicles without connection point: separate exhaust pipe/silencer
⇒ [“1.3 Separating exhaust pipes/silencers”, page 321](#) .
- Vehicles with connection point: release clamp -arrows- and push to right side.



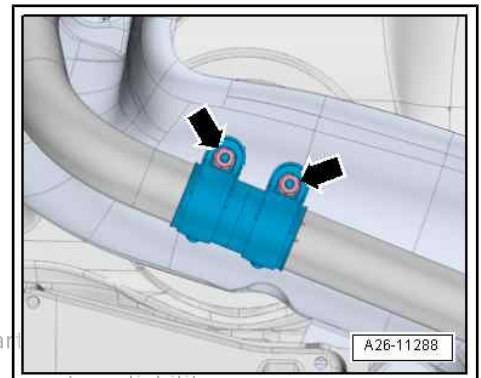


- Remove bolt -2- and detach centre silencer.



Removing rear silencer

- Vehicles without connection point: separate exhaust pipe/silencer
⇒ [“1.3 Separating exhaust pipes/silencers”, page 321](#) .
- Vehicles with connection point: release clamp -arrows- and push to right side.



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- Unscrew bolts -1- 3- and detach rear silencer -2-

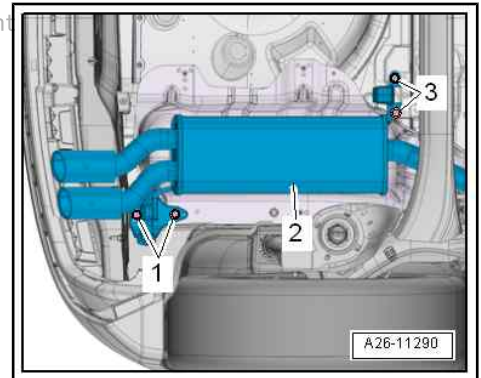
Installing

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

- Align the exhaust system so it is free of stress
⇒ [“1.4 Stress-free alignment of exhaust system”, page 322](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - silencers”, page 319](#)
- ◆ ⇒ [“2.1 Exploded view - emission control system”, page 324](#)
- ◆ Tunnel cross-piece ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim



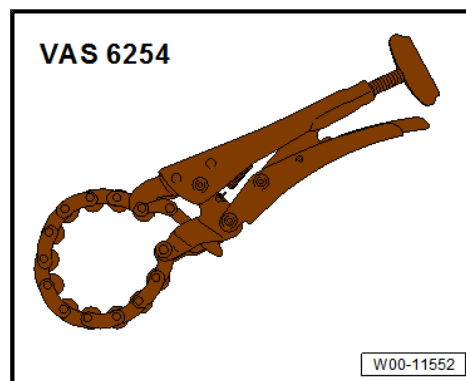
1.3 Separating exhaust pipes/silencers

- ◆ The connecting pipe can be cut through at the cutting location in order to renew the centre and rear silencers separately.
- ◆ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

Special tools and workshop equipment required

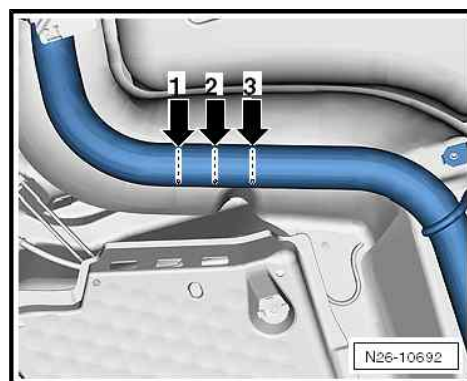


- ◆ Chain pipe cutter - VAS 6254-



Procedure

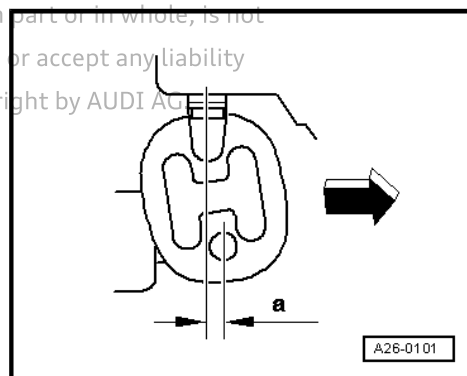
- Cut through exhaust pipe at right angles at the position marked -arrow 2- using chain pipe cutter - VAS 6254- .
- Position clamp centrally at side marks -arrows 1, 3- when installing.
- Fit rear clamp
⇒ [Fig. "Installation position of rear clamp" , page 320](#) .
- Align the exhaust system so it is free of stress
⇒ ["1.4 Stress-free alignment of exhaust system" , page 322](#) .



1.4 Stress-free alignment of exhaust system

Procedure

- The exhaust system must be aligned when it is cool.
- Loosen bolted connections on front clamp.
- Push exhaust system towards front of vehicle until preloading at mounting for rear silencer -a- = 15... 17 mm.
- Fit front clamp
⇒ [Fig. "Installation position of front clamp" , page 325](#) .

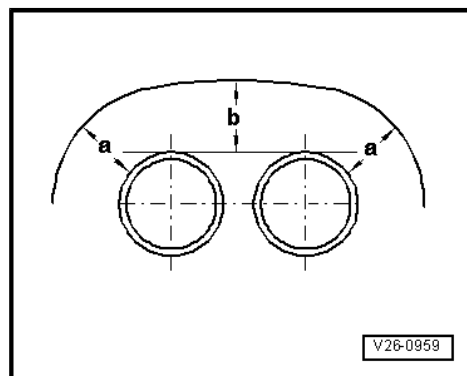


Aligning tailpipes

- Align rear silencer so that there is an equal distance -a- and -b- between bumper cut-out and tailpipes.
- Unfasten rear silencer mounting to align tailpipes.

Tightening torques

- ◆ ⇒ ["2.1 Exploded view - emission control system" , page 324](#)





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 plug).
- Listen for noise at the connection points of cylinder head/exhaust manifold, turbocharger/front exhaust pipe etc. to locate any leaks.
- Rectify any leaks that are found.



2 Emission control system

⇒ [“2.1 Exploded view - emission control system”, page 324](#)

⇒ [“2.2 Removing and installing catalytic converter”, page 325](#)

2.1 Exploded view - emission control system

1 - Rubber mounting

- ☐ Renew if damaged

2 - Bracket

- ☐ Renew if damaged

3 - Nut

- ☐ Tightening torque and sequence
⇒ [Fig. “Installing catalytic converter - tightening torque and sequence”](#), page 325

4 - Nut

- ☐ Tightening torque and sequence
⇒ [Fig. “Installing catalytic converter - tightening torque and sequence”](#), page 325

5 - Front exhaust pipe with catalytic converter

- ☐ Do not bend flexible joint more than 10° - otherwise it can be damaged
- ☐ Install flexible joint so that it is not under tension.
- ☐ Take care not to damage wire mesh on flexible joint
- ☐ Protect catalytic converter from damage by knocks and impact
- ☐ Removing and installing
⇒ [“2.2 Removing and installing catalytic converter”, page 325](#)

- ☐ 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 ⇒ [“1.4 Stress-free alignment of exhaust system”, page 322](#)

6 - Screw-type clip

- ☐ Tightening torque and sequence
⇒ [Fig. “Installing catalytic converter - tightening torque and sequence”](#), page 325

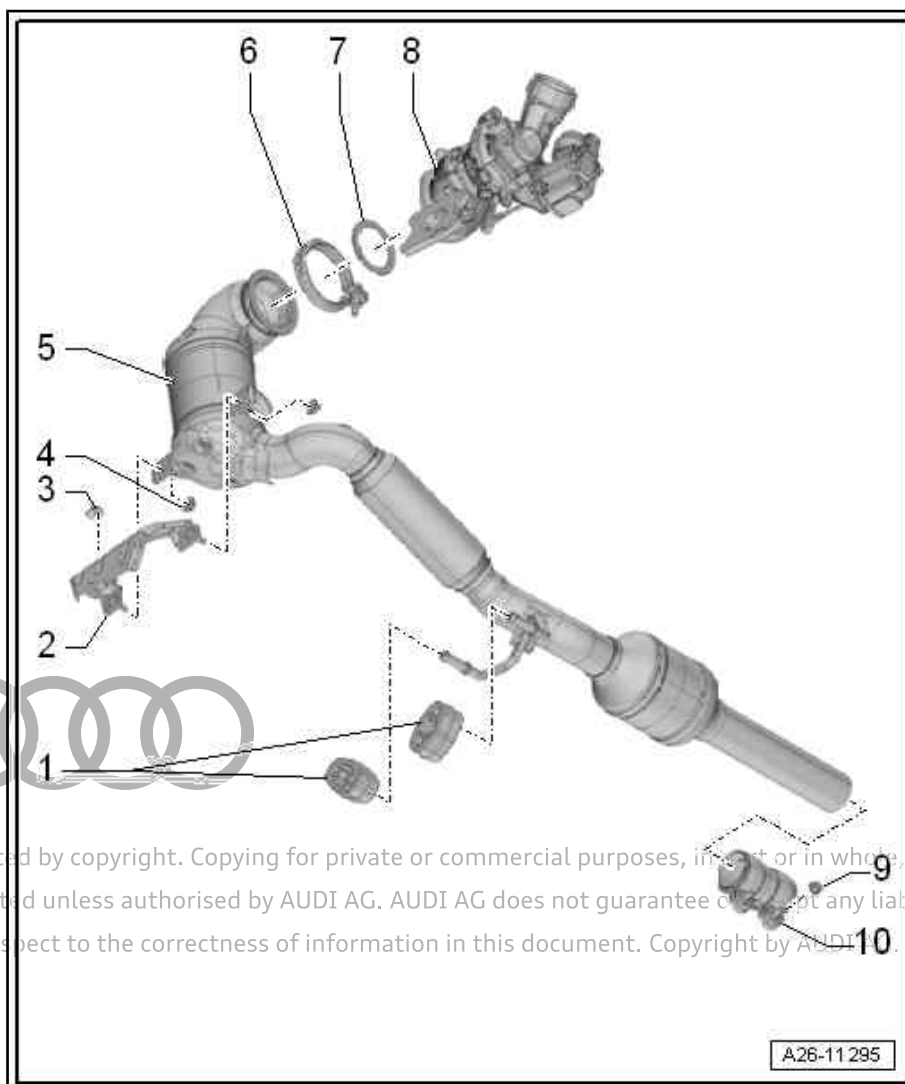
7 - Gasket

- ☐ Renew after removing

8 - Turbocharger

9 - Nut

- ☐ 30 Nm



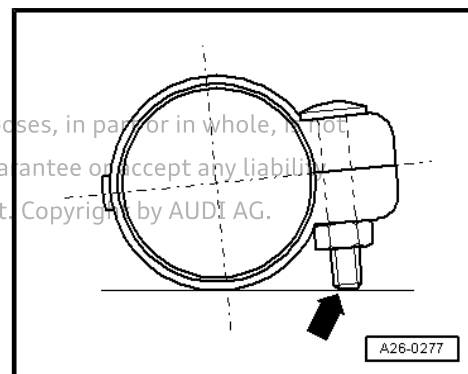


10 - Clamp (front)

- ❑ Before tightening, align exhaust system so it is free of stress
⇒ ["1.4 Stress-free alignment of exhaust system", page 322](#)
- ❑ Installation position ⇒ [Fig. "Installation position of front clamp", page 325](#)
- ❑ Tighten bolted connections evenly

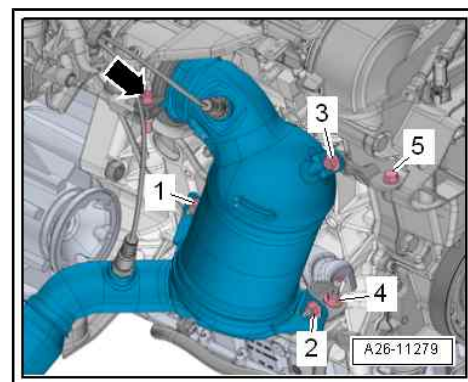
Installation position of front clamp

- Install clamp so that ends of bolts do not protrude beyond bottom of clamp -arrow-.
- Bolted connection facing towards right
- Tighten bolted connections evenly.



Installing catalytic converter - tightening torque and sequence

1.	- Fit catalytic converter to turbocharger, attach screw-type clip -arrow- without tightening	
2.	- Loosely screw in bolts -3, 5- and bolts -1, 2, 4- by hand	• It must still be possible to move catalytic converter and bracket
3.	- Tighten screw-type clip -arrow-	15 Nm
4.	- Tighten bolts and nuts in the sequence -1 ... 5-	20 Nm



2.2 Removing and installing catalytic converter

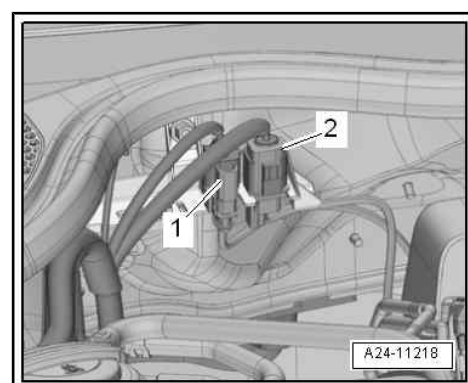
- The catalytic converter is removed together with the front exhaust pipe.

Special tools and workshop equipment required

- ◆ High-temperature paste ⇒ Electronic parts catalogue

Removing

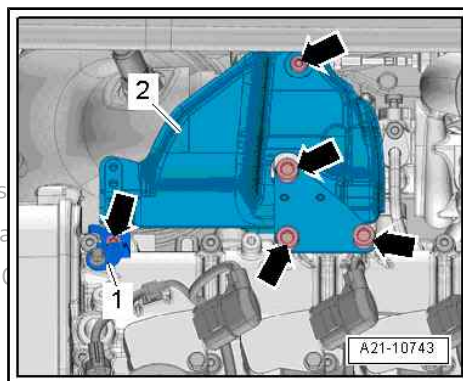
- Re-install all cable ties in original positions.
- Detach electrical connectors -1, 2- from bracket, unplug connectors and move electrical wiring clear.
- Remove Lambda probes
⇒ ["7.2 Removing and installing Lambda probe", page 315](#).



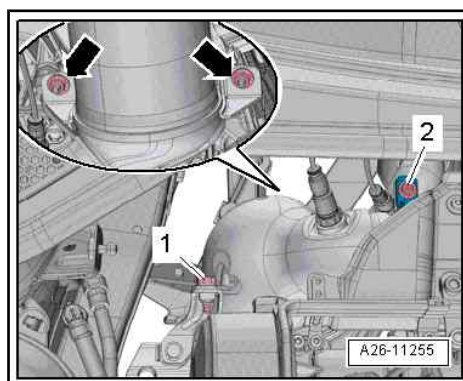


- Remove bolts -arrows- and detach bracket with heat shield -2- and bracket -1- for engine cover panel.

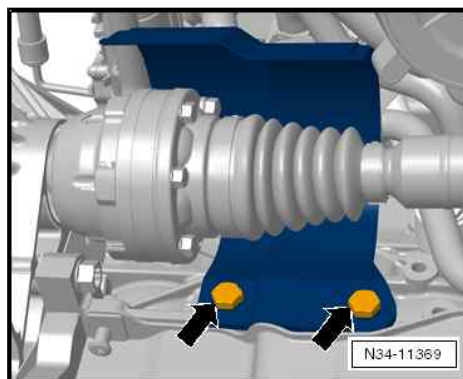
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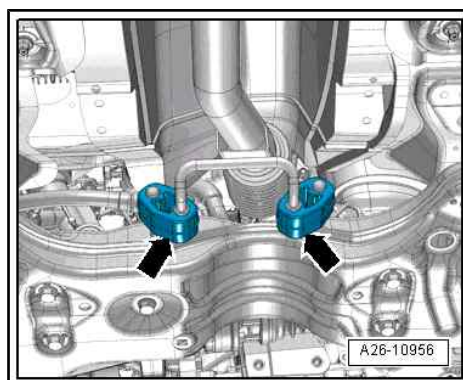
- Unscrew bolt -2- and remove screw-type clip.
- If fitted, remove bolt -1- and nuts -arrows-.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



- If fitted, remove bolts -arrows- and detach heat shield for drive shaft (right-side).

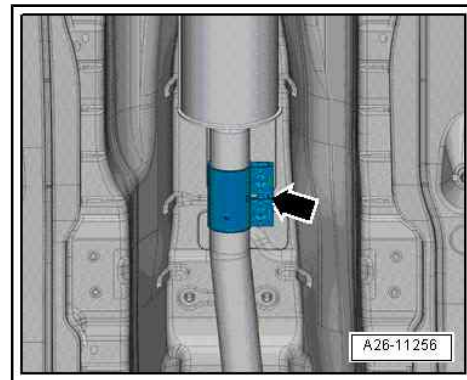


- Detach catalytic converter with front exhaust pipe from rubber mountings -arrows-.





- Loosen clamp -arrow- and push towards rear.
- Detach catalytic converter with front exhaust pipe.

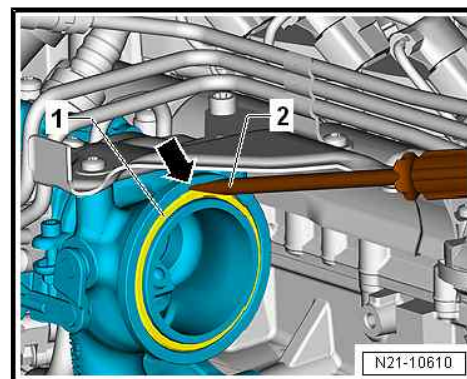


- Insert screwdriver -2- into groove -arrow- on turbocharger and lever out seal -1-.

Installing

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

- Renew gasket and self-locking nuts after removal.
- Lubricate exhaust manifold studs with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .
- The electrical wiring of the lambda probe must be secured at the original locations when installing. The wiring must NOT come into contact with the exhaust pipe.
- Align the exhaust system so it is free of stress
⇒ ["1.4 Stress-free alignment of exhaust system", page 322](#) .



Tightening torques

- ◆ ⇒ [Fig. "Installing catalytic converter - tightening torque and sequence", page 325](#)
- ◆ ⇒ ["7.1 Exploded view - Lambda probe", page 315](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

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28 – Ignition system

1 Ignition system

⇒ [“1.1 Exploded view - ignition system”, page 328](#)

⇒ [“1.2 Test data - spark plugs”, page 329](#)

⇒ [“1.3 Removing and installing ignition coils with output stages”, page 329](#)

⇒ [“1.4 Removing and installing knock sensor”, page 332](#)

⇒ [“1.5 Removing and installing Hall senders”, page 332](#)

⇒ [“1.6 Removing and installing engine speed sender G28”, page 334](#)

1.1 Exploded view - ignition system

1 - Bolt

- ☐ Tightening torque influences the function of the knock sensor
- ☐ 20 Nm

2 - Knock sensor 1 - G61-

- ☐ Removing and installing
⇒ [“1.4 Removing and installing knock sensor”, page 332](#)

3 - Spark plug

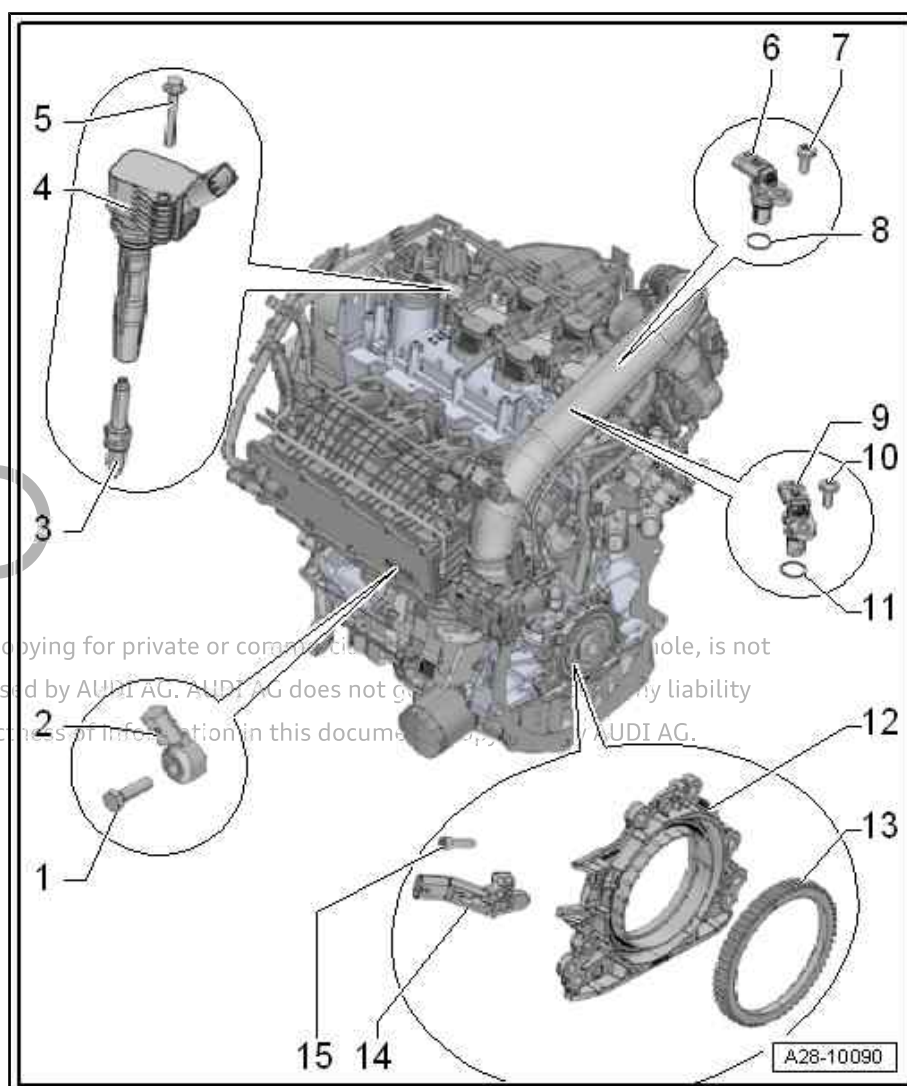
- ☐ Remove and install with spark plug socket and extension - 3122 B-
⇒ Maintenance ; Booklet 819
- ☐ Change interval ⇒ Maintenance tables
- ☐ Tightening torque
⇒ Maintenance ; Booklet 819

4 - Ignition coil with output stage

- ◆ Ignition coil 1 with output stage - N70-
- ◆ Ignition coil 2 with output stage - N127-
- ◆ Ignition coil 3 with output stage - N291-
- ◆ Ignition coil 4 with output stage - N292-
- ☐ Removing and installing
⇒ [“1.3 Removing and installing ignition coils with output stages”, page 329](#)

5 - Bolt

- ☐ 8 Nm





6 - Hall sender 2 - G163-

- ☐ Camshaft position sensor
- ☐ Removing and installing ⇒ [“1.5 Removing and installing Hall senders”, page 332](#)

7 - Bolt

- ☐ 8 Nm

8 - O-ring

- ☐ Renew if damaged

9 - Hall sender - G40-

- ☐ Camshaft position sensor
- ☐ Removing and installing ⇒ [“1.5 Removing and installing Hall senders”, page 332](#)

10 - Bolt

- ☐ 8 Nm

11 - O-ring

- ☐ Renew if damaged

12 - Sealing flange (gearbox end)

- ☐ Removing and installing ⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 58](#)

13 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Removing and installing ⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 58](#)

14 - Engine speed sender - G28-

- ☐ Removing and installing ⇒ [“1.6 Removing and installing engine speed sender G28”, page 334](#)
- ☐ Note installation position ⇒ [page 335](#)

15 - Bolt

- ☐ 4.5 Nm

1.2 Test data - spark plugs

Engine data		1.4 ltr. TFSI engine
Idling speed is not adjustable; controlled by the idling speed stabilisation		640 ... 800 rpm
Engine speed limiter (deactivates injectors/closes throttle valve)		approx. 6500 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.		
Ignition system		Multi-coil system with 4 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Electronic parts catalogue
	Tightening torque	⇒ Maintenance ; Booklet 819
Firing order		1-3-4-2

1.3 Removing and installing ignition coils with output stages

Special tools and workshop equipment required



◆ Puller - T10530-

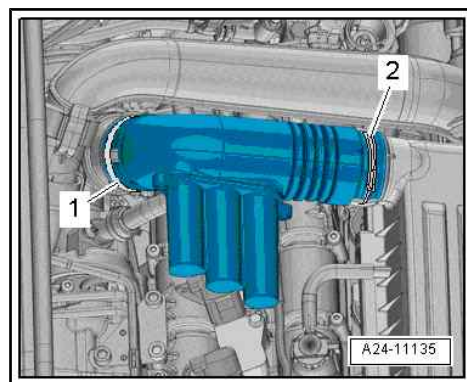


Removing

- Remove engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”](#),
[page 39](#) .

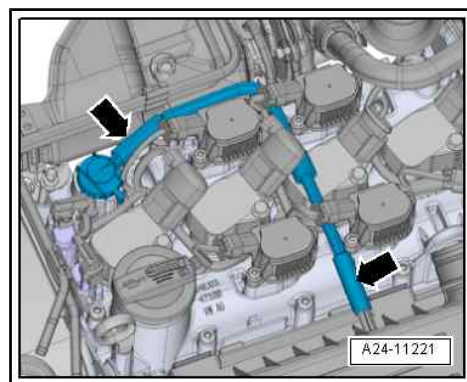
Ignition coils for cylinders 2, 3 and 4:

- Loosen hose clips -1, 2- and remove air pipe.



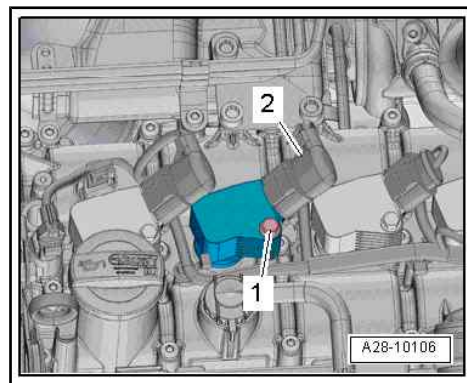
Vehicles with cylinder shut-off:

- Unplug electrical connector on ignition coil for cyl. 2 and move breather hose -arrows- to one side.



All ignition coils (continued):

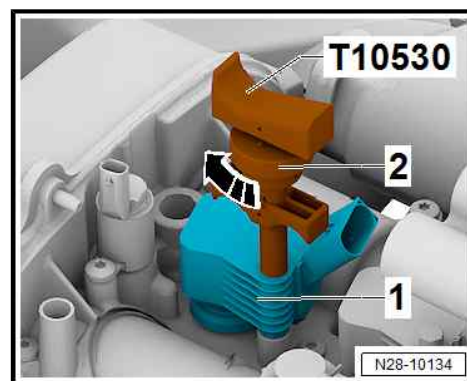
- Unplug electrical connector -2-.
- Remove bolt -1-.



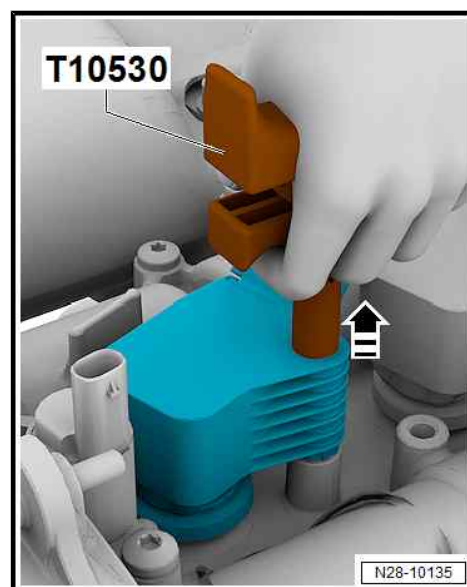
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- Press puller - T10530- into hole in ignition coil -1- as far as stop.
- Tighten knurled nut -2- in direction of -arrow-.



- Pull ignition coil out of camshaft housing with puller - T10530- in direction of -arrow-.



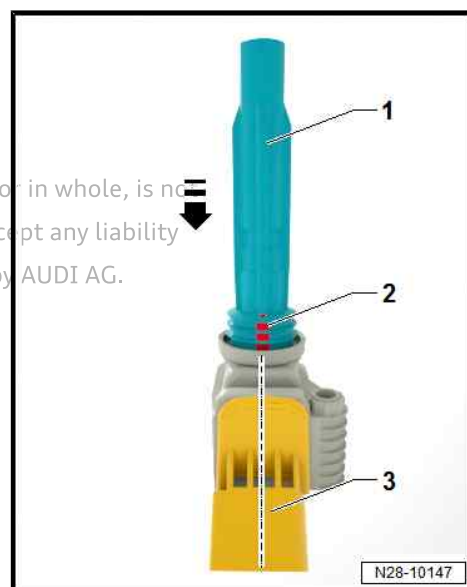
Installing

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

- Push spark plug connector -1- onto ignition coil by hand as far as stop.

Protective channel 2 must be positioned so that it is aligned centrally with connector housing -3-.

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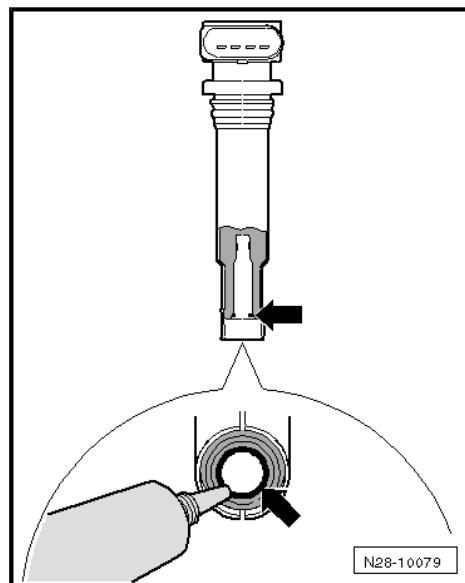
- Apply a thin bead of silicone paste all around end of sealing hose of ignition coil with output stage -arrow-.

Silicone paste ⇒ Electronic parts catalogue (ETKA) .

- Fit all ignition coils loosely into spark plug holes.
- Align ignition coils with connectors and attach all connectors onto ignition coils simultaneously.
- Press ignition coils onto spark plugs by hand evenly (do not knock in with tools).
- Install engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”, page 328](#)



1.4 Removing and installing knock sensor

Removing

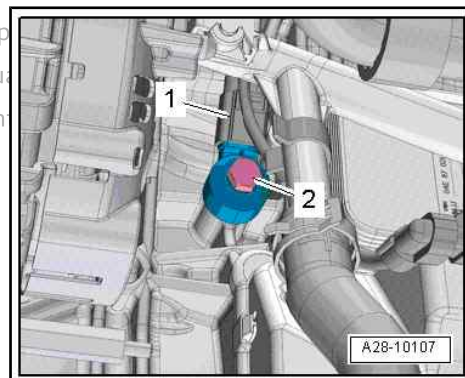
- Detach air conditioner compressor from bracket and tie up ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Unplug electrical connector -1-
- Unscrew bolt -2- and remove knock sensor 1 -G61-

Installing

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

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”, page 328](#)
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit



1.5 Removing and installing Hall senders

Special tools and workshop equipment required

- ◆ Release tool - T10527- and -T10527/1-



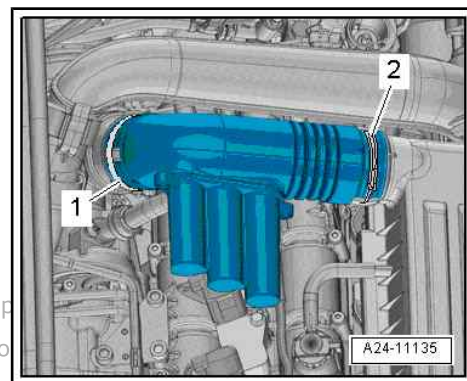


Removing

- Remove engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”, page 39](#).
- Loosen hose clips -1, 2- and remove air pipe.

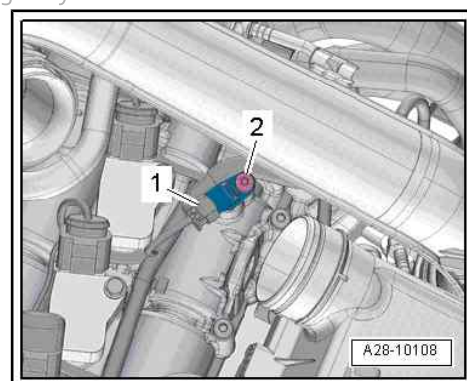


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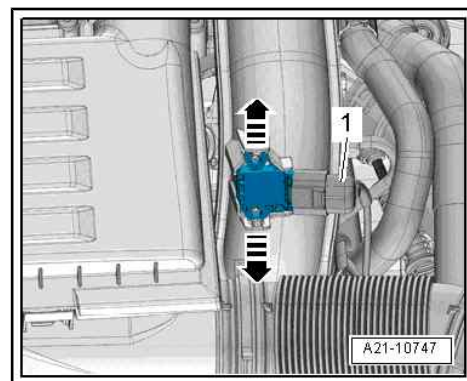
Hall sender - G40- :

- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove Hall sender - G40- .

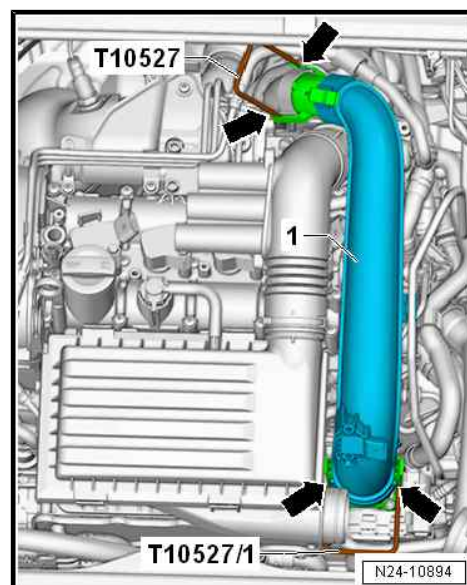


Hall sender 2 - G163- :

- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .

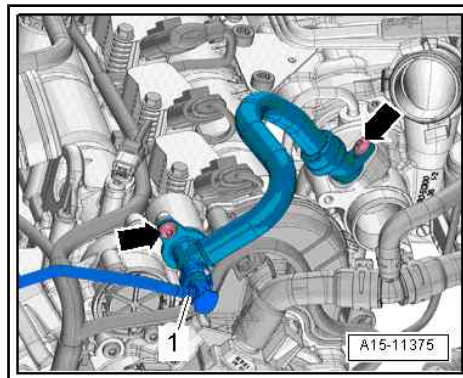


- Move air hoses clear at air pipe.
- Release fasteners -arrows- with release tool - T10527- and - T10527/1- , and detach air pipe -1-.





- Remove bolts -arrows- and detach crankcase breather hose (with hose -1- going to activated charcoal filter attached).



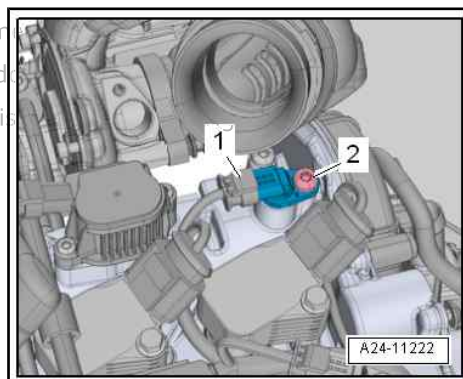
- Unplug electrical connector -1-
- Unscrew bolt -2- and remove Hall sender 2 - G163-

Installing

- Installation is carried out in reverse sequence.
- Install engine cover panel
⇒ [“3.1 Removing and installing engine cover panel”](#),
[page 39](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”](#), [page 328](#)
- ◆ ⇒ [“3.1 Exploded view - intake manifold”](#), [page 292](#)



1.6 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

- ◆ Socket, 4 mm - T10370-

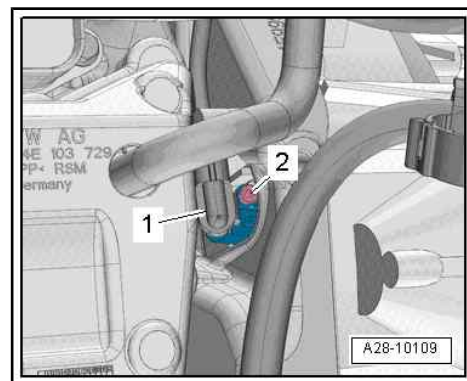


Removing

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



- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove engine speed sender - G28- .



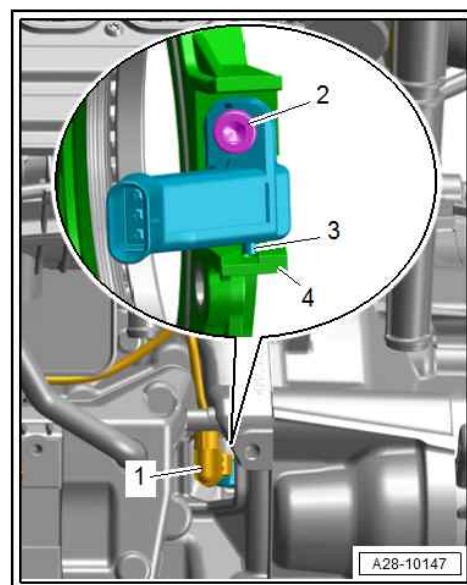
Installing

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

- Move engine speed sender - G28- into installation position, ensuring that tab -3- slides into guide slot on sealing flange -4-, as shown in illustration.
- Tighten bolt -2- and plug in electrical connector -1-.

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”, page 328](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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