



Workshop Manual

Audi A1 2011 ➤

Audi A1 Sportback 2012 ➤

3-cylinder TDI engine, 1.4 ltr. 4-valve common rail (EA 288 Gen. I)

Engine ID	CUS B								
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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

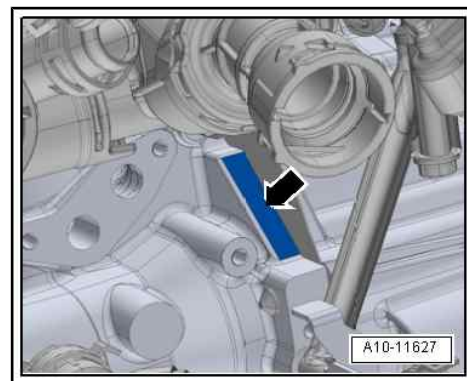
(ARL006639; Edition 09.2019)

⇒ [“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 front of the joint between the engine and the 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 .



Engine data

For allocation of engine code, refer to ⇒ Technical data for engines; Rep. gr. 00 ; Overview of engines .



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2 Safety precautions

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

⇒ [“2.2 Safety precautions when using testers and measuring instruments during a road test”, page 3](#)

⇒ [“2.3 Safety precautions when working on the cooling system”, page 3](#)

⇒ [“2.4 Safety precautions when working on vehicles with start/stop system”, page 4](#)

⇒ [“2.5 Safety precautions when working on the exhaust system”, page 4](#)

2.1 Safety precautions when working on the fuel supply system

When working on the fuel system note the following warnings:

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.
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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.

If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled

⇒ [“1.3 Filling and bleeding fuel system”, page 232](#) .



Risk of irreparable damage to fuel pump

After working on the fuel system, the fuel pump may be irreparably damaged if it is allowed to run while empty.

- Never allow fuel pump to run while it is empty.
- Fill/bleed fuel pump.

Risk of irreparable damage to electronic components

When disconnecting the battery there is a risk of irreparable damage to electronic components.

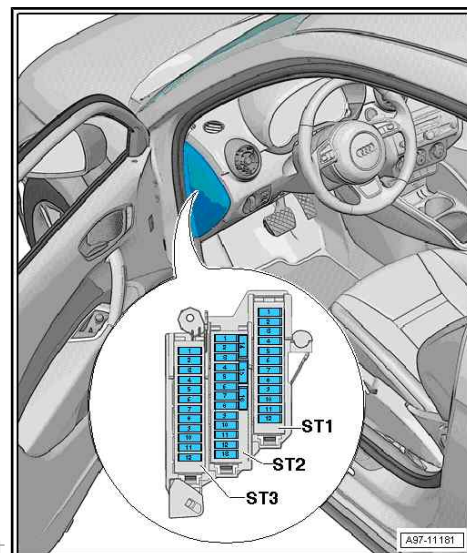
- Always switch off the ignition before disconnecting the battery.



WARNING

Danger due to escaping fuel.

- ◆ *The power supply for the fuel system pressurisation pump - G6- must be disconnected before opening the fuel system, since -G6- will be activated briefly when the driver's door is opened with the battery still connected.*
- ◆ *Remove fuse for fuel pump control unit - J538- in fuse holder C - SC- under dash panel cover (driver's side); for identification of fuses refer to ➔ Current flow diagrams, Electrical fault finding and Fitting locations.*



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2.2 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.

2.3 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.

2.4 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.
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2.5 Safety precautions when working on the exhaust system

Risk of injury when disconnecting the exhaust system

There is a risk of eye irritation caused by soot particles in the air.

- Put on safety goggles.

Danger from toxic exhaust gases

The auxiliary/supplementary heater produces toxic exhaust gases during operation. There is a risk of poisoning and of damage to the respiratory tract.

- In enclosed spaces, only switch on the auxiliary/supplementary heater if there is an exhaust extraction system.
- In enclosed spaces without an exhaust extraction system, switch off the auxiliary/supplementary heater.

Risk of damage to flexible joint

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

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

Components of the exhaust system can pose health risk

Risk to health if exhaust gas temperature sender is dismantled.

- Do not dismantle exhaust gas temperature sender.



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3 Repair instructions

⇒ [“3.1 Rules for cleanliness”, page 6](#)

⇒ [“3.2 General notes”, page 6](#)

⇒ [“3.3 General repair instructions”, page 7](#)

⇒ [“3.4 Performing adaptations after renewing a component”, page 8](#)

⇒ [“3.5 Nuts, bolts”, page 8](#)

⇒ [“3.6 Identification plates”, page 8](#)

⇒ [“3.7 Use of impact wrenches”, page 8](#)

⇒ [“3.8 Foreign particles in engine”, page 9](#)

⇒ [“3.9 Contact corrosion”, page 9](#)

⇒ [“3.10 Routing and attachment of pipes, hoses and wiring”, page 10](#)

⇒ [“3.11 Installing radiators and condensers”, page 10](#)

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- .
- ◆ Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be reused in new, sealable plastic bags.
- ◆ 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 not been stored in the proper packaging (e.g. in tool boxes 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.
- ◆ Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.
- ◆ 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 ⇒ [page 2](#).

3.3 General repair instructions

- ◆ Clean tools and workbench etc. before working on the injection system.
- ◆ Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- ◆ 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.
- ◆ Take care not to damage the injectors when removing the old copper seals.
- ◆ Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- ◆ 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.
- ◆ Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.
- ◆ Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.
- ◆ When the engine is running, do not perform any repairs to the common rail system.
- ◆ Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- ◆ 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 Performing adaptations after renewing a component

The learnt values must be adapted if components of the engine or reducing agent system have been renewed or if a reducing agent line has been opened.

After renewing engine, pistons, cylinder head or turbocharger, "run-in function with increased oil pressure" must be activated.

- Select the correct Guided Function in the Guided Fault Finding routine.
- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options one after the other:
 - ◆ **Systems with diagnostic capability**
 - ◆ **01 - Engine electronics J623**
 - ◆ **0001 - Engine electronics, functions**
 - ◆ **0001 - Work steps after component replacement**

3.5 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.

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3.6 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.

3.7 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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3.8 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.



Note

*If the turbocharger has suffered mechanical damage
⇒ [page 209](#)*

3.9 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 the use of Audi Genuine Parts.
- ◆ Damage caused by contact corrosion is not covered by warranty.



3.10 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.

3.11 Installing radiators and condensers

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



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10 – Removing and installing engine

1 Removing and installing engine

⇒ [“1.1 Removing engine”, page 11](#)

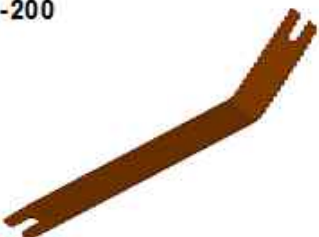
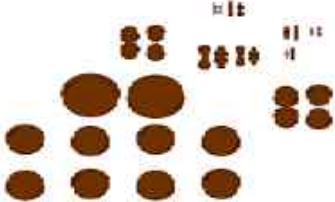
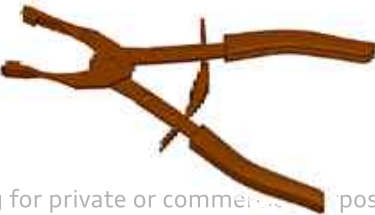
⇒ [“1.2 Separating engine and gearbox”, page 22](#)

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

⇒ [“1.4 Installing engine”, page 28](#)

1.1 Removing engine

Special tools and workshop equipment required

80-200 	VA S 5085 
VA S 6122 	VA S 6208 
VA S 6362 	VA S 6931 

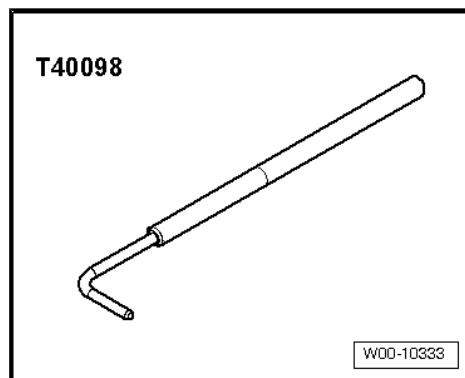


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- ◆ Removal lever - 80-200-
- ◆ Stepladder (commercially available) or -VAS 5085-
- ◆ Engine bung set - VAS 6122-
- ◆ Coolant collecting system - VAS 5014- or drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-



- ◆ Engine and gearbox jack - VAS 6931-
- ◆ Locking tool - T40098-



- ◆ Engine bracket - T10536- with bolt - T10536/5- and nut - T10536/4-



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- ◆ Safety goggles
- ◆ Protective gloves

Procedure



Note

- ◆ *The engine is removed from underneath together with the gearbox.*
- ◆ *Re-install all cable ties in original positions.*
- ◆ *Re-install all heat insulation sleeves in the same locations when installing.*
- ◆ *For coolant hoses with quick-release clips: When disconnecting the coolant hose, the quick-release clip must be fixed in open position using hose clip pliers.*



WARNING

Risk of scalding due to hot steam and hot coolant.

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

- Open filler cap -1- on coolant expansion tank.

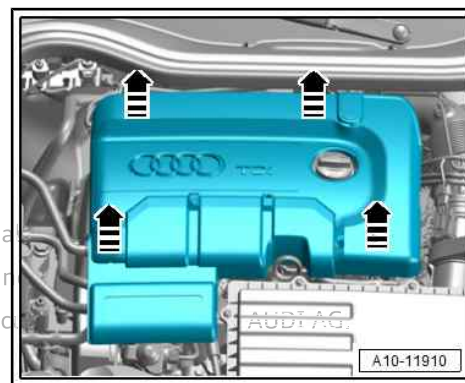
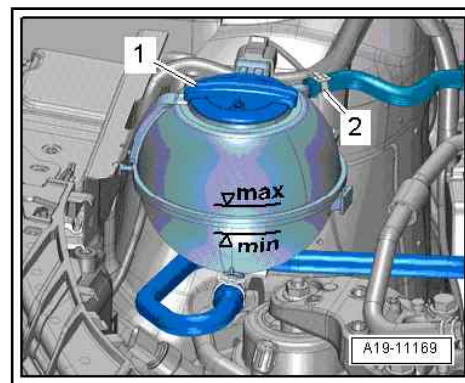


Note

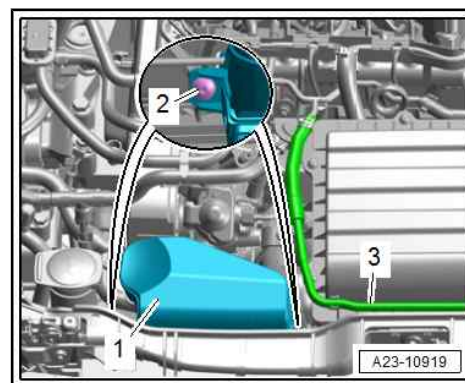
Disregard -item 2-.

- Remove engine cover panel -arrows-.
- Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

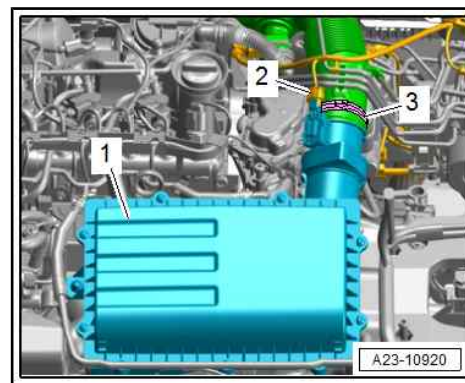
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- Move coolant line -3- clear at air cleaner housing.
- Remove bolts -2- and detach air duct -1- from lock carrier.

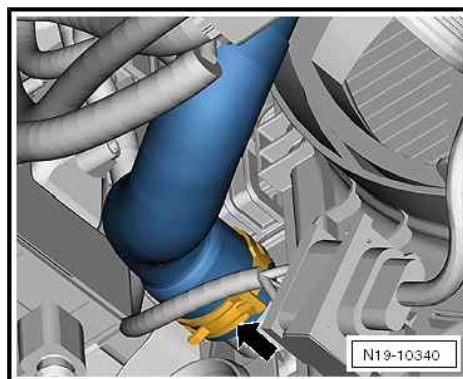


- Unplug electrical connector -2- at air mass meter - G70- .
- Release hose clip -3- and detach air hose.
- Carefully detach air cleaner housing -1- from retaining pins.
- Remove subframe with steering rack ⇒ Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .

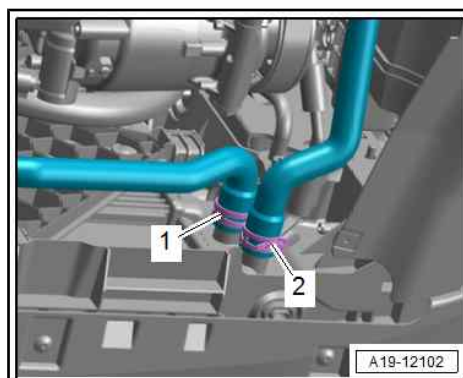




- Place collector tank from coolant collecting system -VAS 5014- or drip tray for workshop hoist - VAS 6208- underneath.
- Release hose clip -arrow-, disconnect coolant hose (bottom) from radiator and drain off coolant.



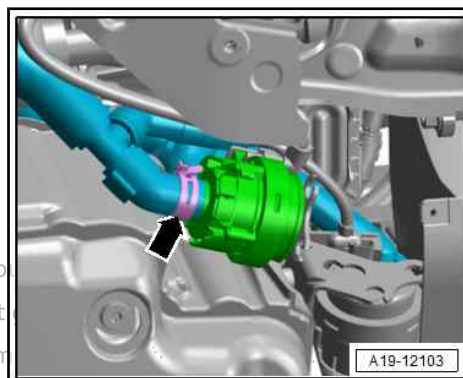
- Release hose clips -1 and 2-, disconnect coolant hoses (bottom right) from water radiator for charge air cooling circuit and drain off remaining coolant.



- Release hose clip -arrow-, disconnect coolant hose (bottom) from auxiliary pump for heating - V488- and drain off coolant.



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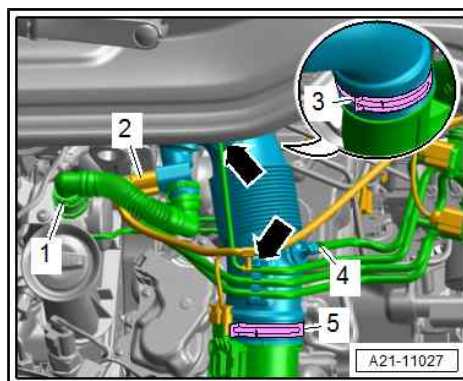


- Unplug electrical connector -2- and move clear.
- Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from cylinder head cover.
- Move clear vacuum hoses at air pipe -arrows-.
- Disconnect vacuum hose -4-.
- Release hose clip -3- and detach air pipe from turbocharger.



Note

Disregard -item 5-.



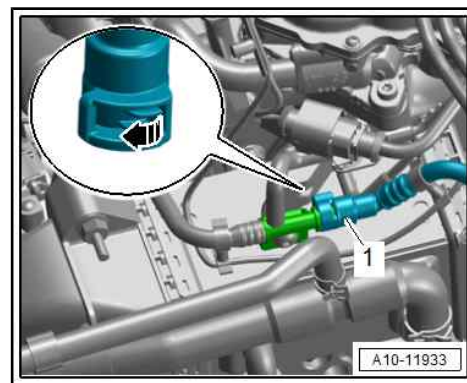


- Release catch -arrow-, disconnect vacuum hose -1- and place it to left side.

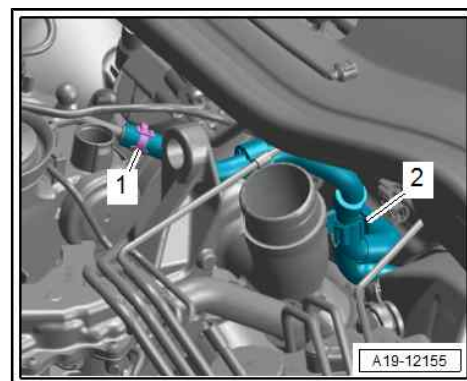


Note

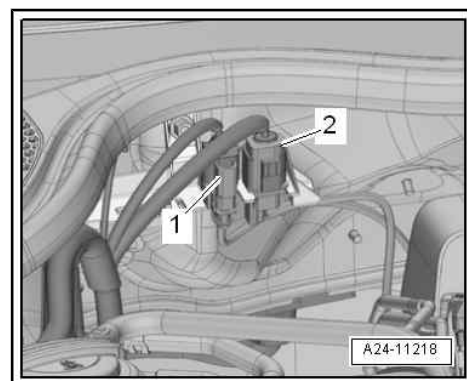
Make sure that you do not damage vacuum hose. If damaged, vacuum hose must be renewed.



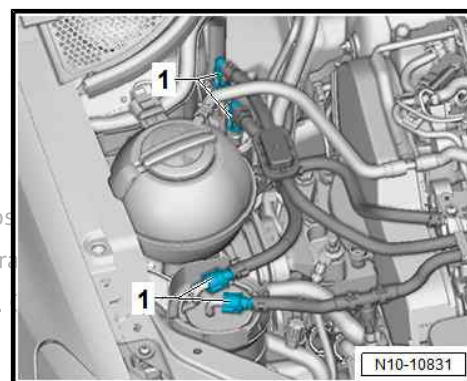
- Release hose clip -1-, detach coolant hose and move clear at clip -2-.



- Detach electrical connectors -1, 2- from bracket, unplug connectors and move electrical wiring clear.



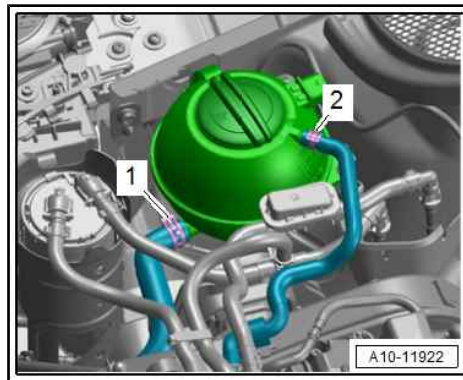
- Disconnect fuel hoses -1- ⇒ Fuel supply system; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



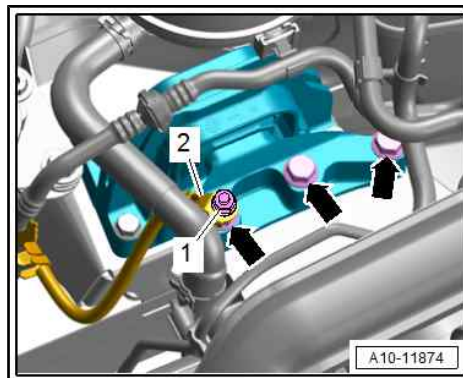
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- Release hose clips -1, 2- and disconnect coolant hoses.



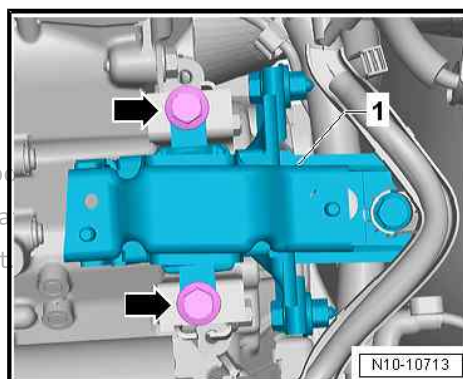
- Remove nut -1- and move earth wire -2- clear.
- Loosen bolts -arrows- for support arm of engine mounting approx. 2 turns.



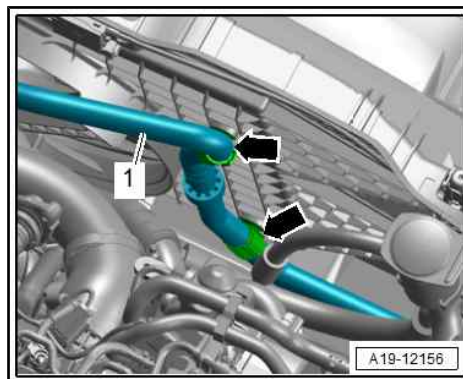
- Loosen bolts -arrows- for support arm of engine mounting -1- approx. 2 turns.



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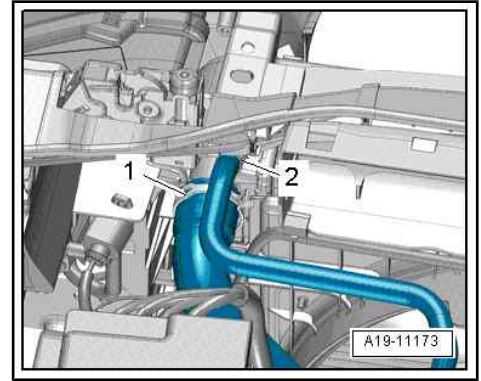


- Move coolant hose -1- clear at retaining clips -arrows-.



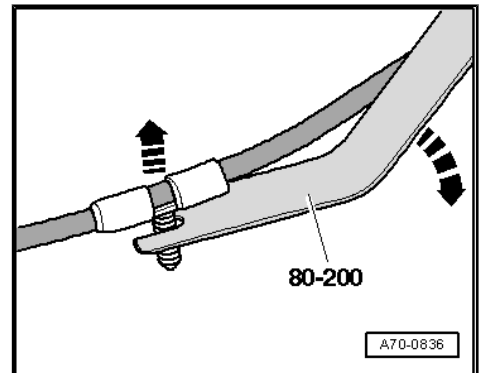


- Release hose clips -1 and 2- and detach coolant hoses (top left) from radiator.



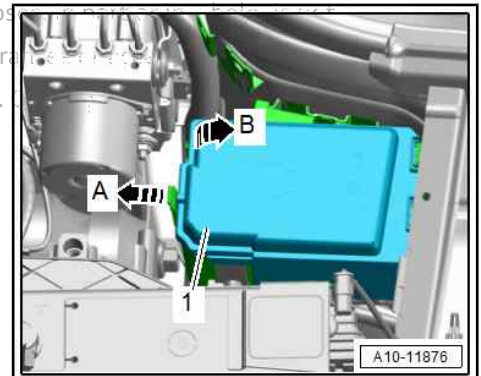
Note

Use removal lever - 80-200- to lever out the wiring clips when performing the next work steps.



- Release catch -arrow A-, open cover -1- for electronics box in engine compartment -arrow B- and detach.

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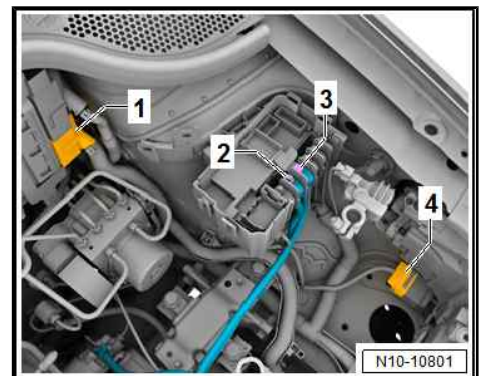


- Unplug electrical connector -1- (bottom) at engine control unit - J623- ➔ [page 286](#) .
- Take electrical connector -4- out of bracket, unplug it and move electrical wiring clear.
- Remove nut -2-, detach electrical wiring and move wiring clear.



Note

Disregard -item 3-.



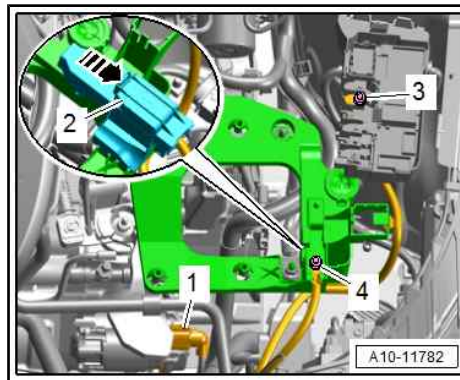


- Unplug electrical connector -1- at starter.
- Release catch -arrow- and open cover -2-.
- Remove B+ stud -4- and move electrical wiring clear.

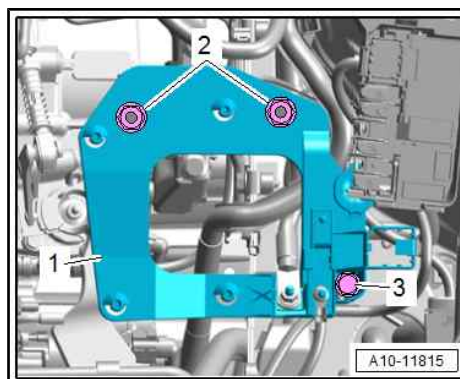


Note

Disregard -item 3-.



- Remove nuts -2- and bolt -3-.
- Push mounting -1- for jump start terminal slightly to one side.

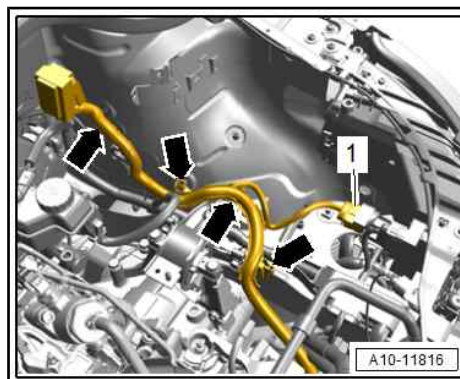


- Move engine wiring harness clear -arrows- and lay on top of engine.



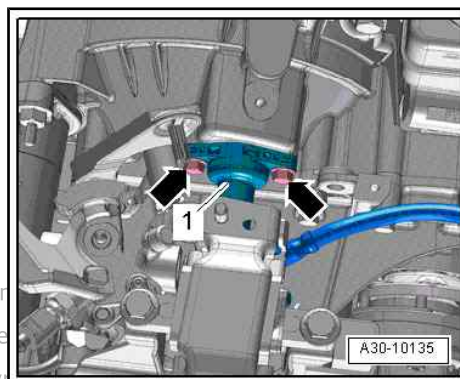
Note

Disregard -item 1-.



Vehicles with manual gearbox:

- Detach gear selector cable and gate selector cable from gear-box, remove cable support bracket and place to one side with selector cables attached ➤ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- Remove bolts -arrows-, detach clutch slave cylinder -1- and place to one side; do not open pipes.



Caution

Risk of irreparable damage to clutch slave cylinder.

◆ **Do not operate clutch pedal with slave cylinder removed.**

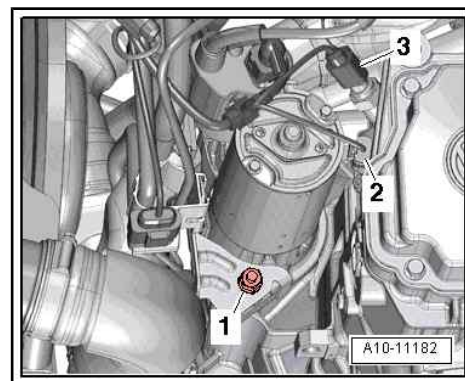


- Unplug electrical connectors:
- 2 - For reversing light switch - F4-
- 3 - For gearbox neutral position sender - G701-



Note

Disregard -item 1-.



Vehicles with dual clutch gearbox:

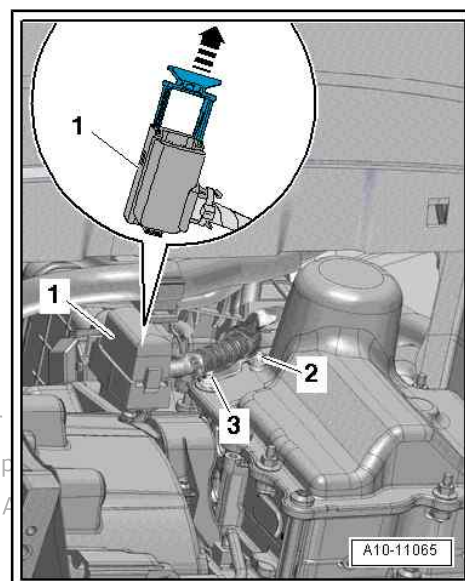
- Detach selector lever cable from selector lever and place to one side ➔ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .



Caution

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

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



Protected by copyright. Copying for private or commercial purposes, in part or permitted. Pull locking device upwards -arrow- and disconnect connector plug -1- for mechatronic unit for dual clutch gearbox - J743- . with respect to the correctness of information in this document. Copyright by A

- Unscrew nuts -2, 3- and detach bracket for electrical wiring.

Vehicles with air conditioner compressor:

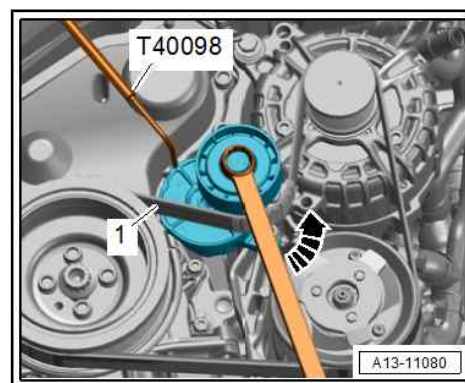


Caution

Running a used poly V-belt in the opposite direction could cause irreparable damage.

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

- To slacken poly V-belt -1- turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking tool - T40098- .
- Take off poly V-belt.





- Unplug electrical connector -2- on air conditioner compressor regulating valve - N280- .

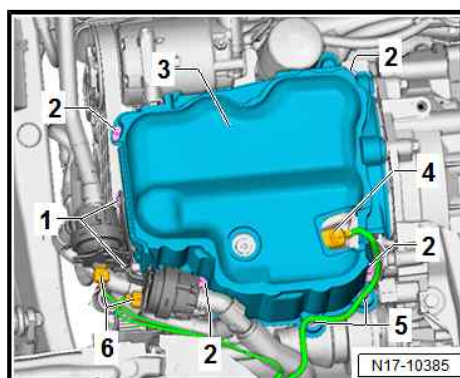
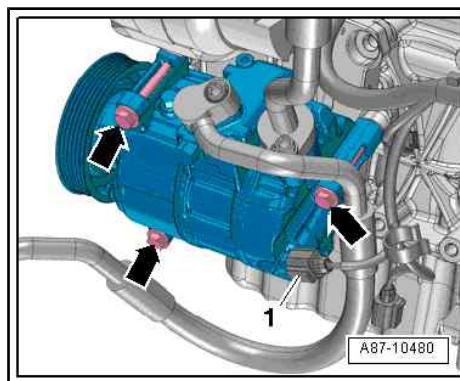


Caution

Risk of damage to air conditioner compressor and refrigerant pipes/hoses.

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

- Remove bolts -arrows-, detach air conditioner compressor with pipe/hose assemblies connected and tie up to front.
- Unplug electrical connector -4- for oil level and oil temperature sender - G266- , release clips -5- and move electrical wiring clear.
- Unplug electrical connectors -6-.
- Loosen bolts -1- and push bracket with electric coolant pumps to one side.
- Release clips -2- and detach noise insulation -3- for sump (bottom section).

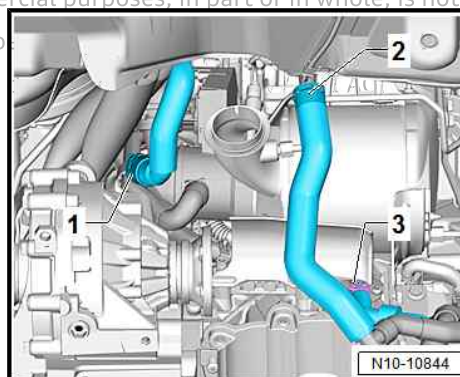


- Lift retaining clips -1, 2- and disconnect coolant hoses.

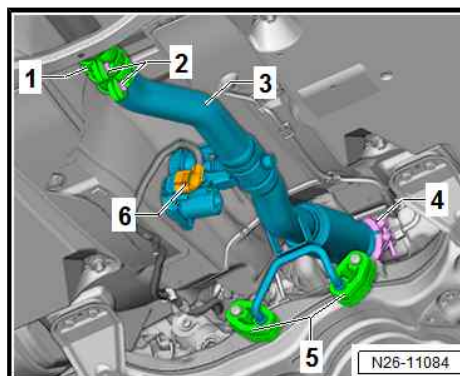


Note

Disregard -item 3-.

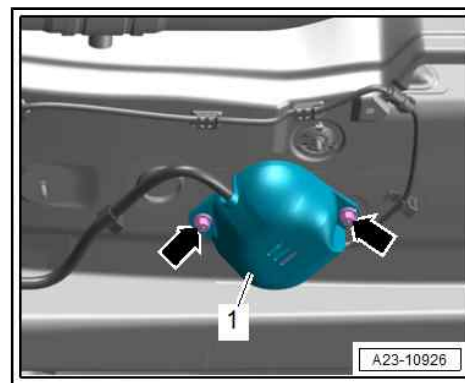


- Unplug electrical connector -6- for exhaust flap control unit - J883- .
- Loosen bolt -4- and remove screw-type clip.
- Unscrew bolts -2- for clamp -1-, push back clamp and detach front exhaust pipe -3-.
- Unfasten underbody trim (right-side) on inside and press downwards ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .





- Unscrew nuts -arrows- and detach cover -1-.

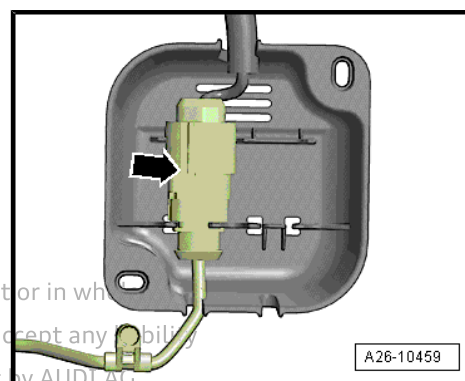


- Unplug electrical connector -arrow- for Lambda probe after catalytic converter - G130- and move wiring clear.
- Detach drive shaft (left and right) from gearbox and tie up to rear ⇒ Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .

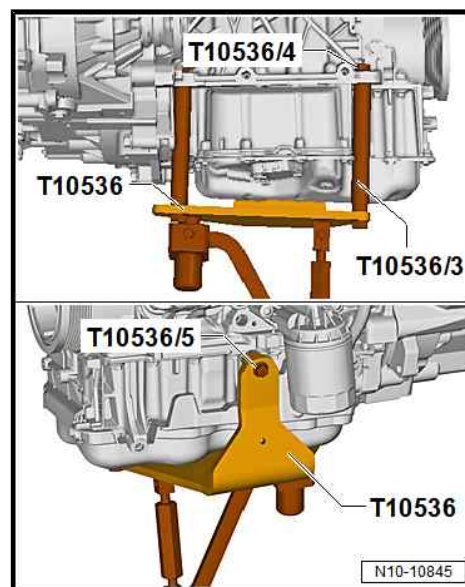


Note

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



- Attach engine bracket - T10536- with pin - T10536/3- and secure with bolt - T10536/5- and nut - T10536/4- , as shown in illustration.
- Insert engine and gearbox jack - VAS 6931- in engine bracket - T10536- and raise engine/gearbox assembly slightly.

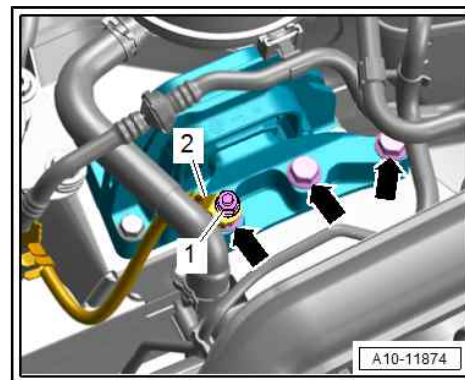


- Remove bolts -arrows- for support arm of engine mounting.



Note

Disregard items -1 and 2-.





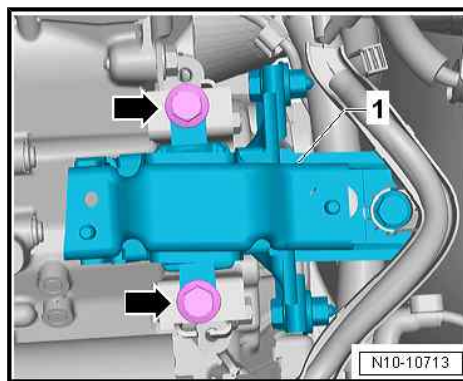
- Remove bolts -arrows- securing support arm of gearbox mounting -1-.



Caution

Danger of damage to vacuum lines or electrical wiring and to engine compartment.

- ◆ ***Check that all vacuum lines and electrical wiring between engine, gearbox and body have been detached.***
- ◆ ***Carefully guide engine/gearbox assembly out of engine compartment when lowering.***



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

1.2 Separating engine and gearbox

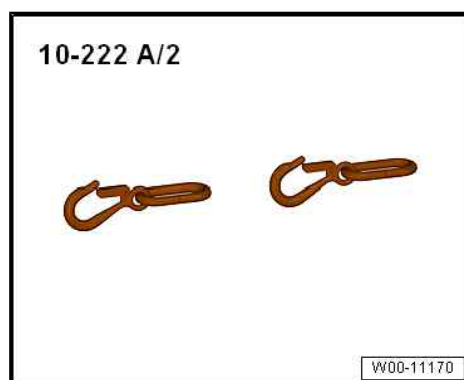
⇒ **"1.2.1 Separating engine and gearbox - vehicles with manual gearbox", page 22**

⇒ **"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-



- ◆ Hook - 10-222A/20-

- ◆ Workshop hoist - VAS 6100-



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◆ Bracket - T10358-

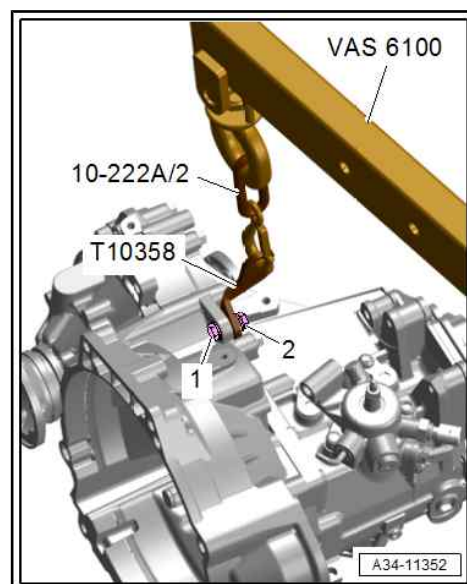


◆ M10x35 bolt

◆ Nut M10

Procedure

- Engine/gearbox assembly removed and secured to engine support - T10536- .
- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter .
- Secure bracket - T10358- to gearbox using bolt M10x35 and nut M10 (tighten to 25 Nm), as shown in illustration.
- Attach workshop hoist - VAS 6100- with hook - 10-222 A/2- to bracket.

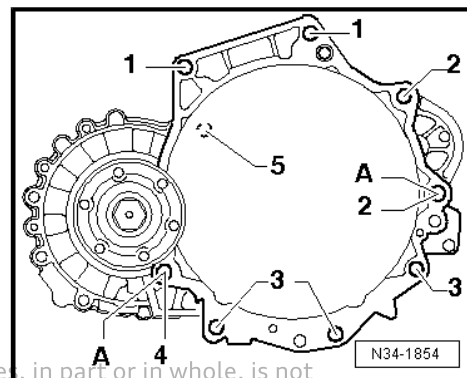


- Remove bolts -1, 3, 4- securing gearbox to engine.
- Detach gearbox from engine (pay attention to intermediate plate).



Note

Disregard -items 2, 5, A-.



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1.2.2 Separating engine and gearbox - vehicles with dual clutch gearbox

Special tools and workshop equipment required

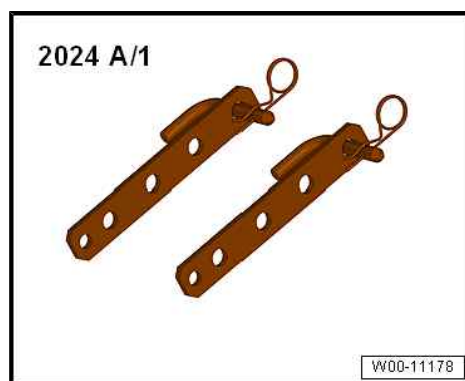


◆ Hook - 10-222A/20-

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◆ Extension -2024 A/1- for lifting tackle - 2024A-

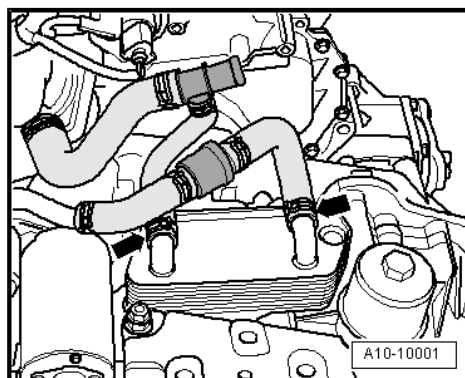


◆ Workshop hoist - VAS 6100-



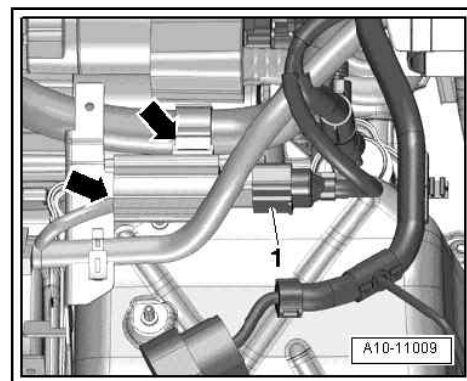
Procedure

- Engine/gearbox assembly removed and secured to engine support - T10536- .
- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Exploded view - starter .
- Slacken hose clips -arrows- and detach coolant hoses from gear oil cooler.

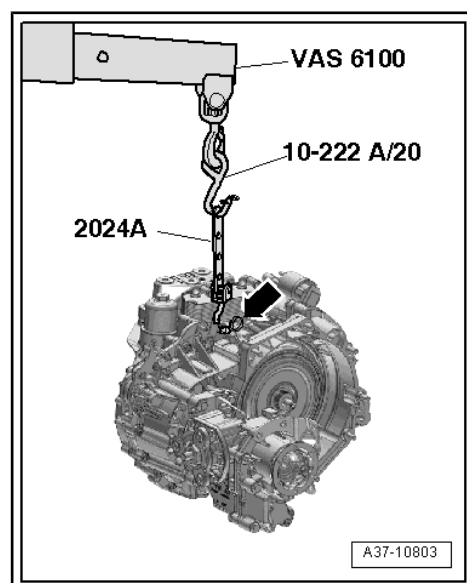




- Move electrical wiring harnesses -arrows- and electrical connector -1- clear at bracket.

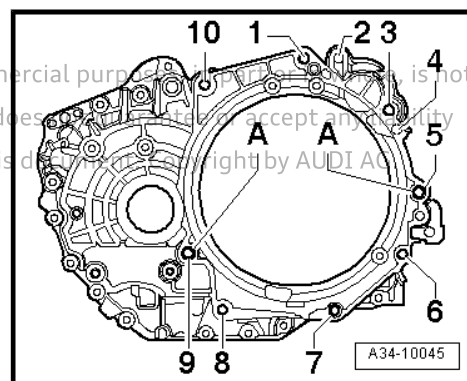


- Engage extension of lifting tackle - 2024A- in gearbox lifting eye and secure with locking pin -arrow-.
- Engage workshop hoist - VAS 6100- with adapter - 10-222A/20- in extension.



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

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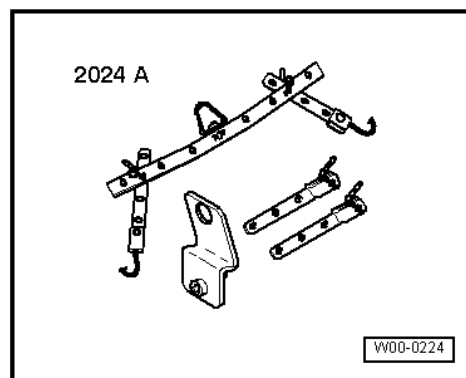
1.3 Securing engine to engine and gearbox support

When carrying out repairs, secure engine to engine and gearbox support - VAS 6095A- using universal support - VAS 6095/1- .

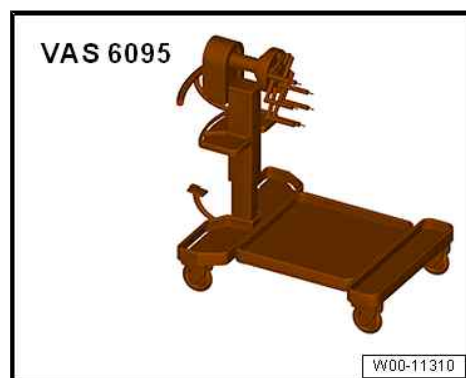
Special tools and workshop equipment required



◆ Lifting tackle - 2024A-



◆ Engine and gearbox support - VAS 6095A-



◆ Workshop hoist - VAS 6100-



◆ Nut M12



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Procedure

- Gearbox detached from engine ⇒ [page 22](#) .
- To transport engine, engage lifting tackle - 2024A- on engine and workshop hoist - VAS 6100- .



Note

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

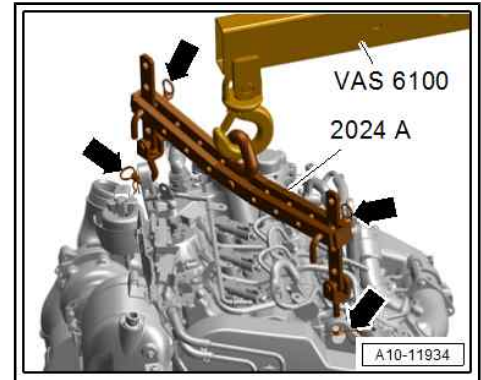


WARNING

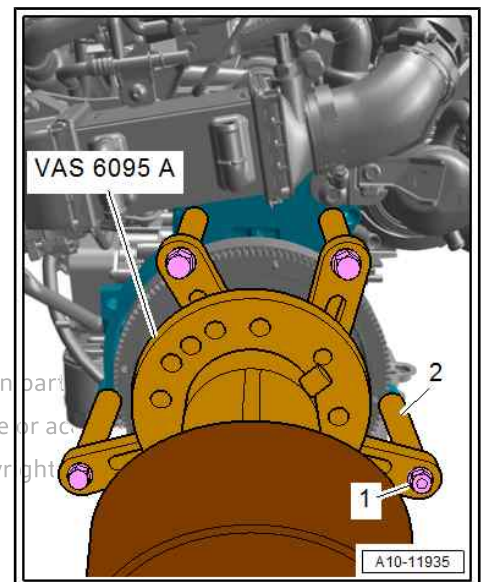
Accident risk from loose components of lifting tackle.

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

- Lift engine off engine bracket - T10536- using workshop hoist - VAS 6100- .
- Attach engine to engine and gearbox support - VAS 6095A- by securing support element -2- with a nut, M12 -item 1-.



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1.4 Installing engine

When installing a new base engine, you must check whether there is a sticker on the cylinder head cover.

If a sticker is attached which states Spannpratzen auf vorgeschriebenes Drehmoment angezogen (clamping pieces tightened to specified torque), the clamping pieces have already been tightened to the specified final torque at the factory.

If no sticker is attached, it is essential that the clamping pieces for the injectors are tightened to the specified torque after installing the high-pressure pipes. If these instructions are not observed, the engine could be damaged.

Procedure



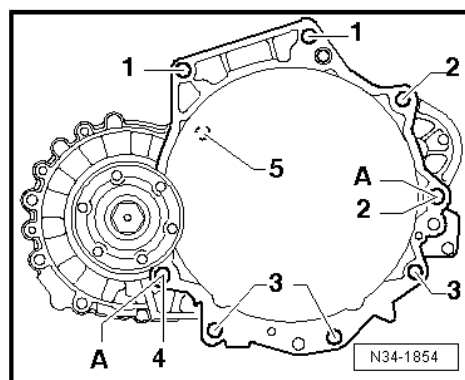
Note

- ◆ *Vehicles with dual clutch gearbox: The needle bearing in the crankshaft must always be renewed if the engine has been separated from the gearbox
⇒ ["3.4 Renewing needle bearing in crankshaft", page 75](#).*
- ◆ *After removing, renew bolts tightened with specified tightening angle.*
- ◆ *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings after removal.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#).*
- ◆ *Re-install all cable ties in original positions.*

- Install intermediate plate ⇒ [page 64](#).

Vehicles with manual gearbox

- Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install dowel sleeves where necessary.
- Remove needle bearing in crankshaft if fitted ⇒ [page 75](#).
- Renew clutch release bearing if worn ⇒ Rep. gr. 30 ; Clutch mechanism; Servicing clutch release mechanism.
- Lubricate splines of gearbox input shaft lightly with grease for clutch plate splines ⇒ [Electronic parts catalogue](#).
- Make sure that clutch plate is properly centred.





Vehicles with dual clutch gearbox

- Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install dowel sleeves where necessary.
- Install needle bearing if not fitted in crankshaft ⇒ [page 75](#) .
- On vehicles with a dual clutch gearbox, the splines for the dual clutch in the flywheel must be pre-tensioned and locked in place. When the engine is started for the first time, this pre-tension is released; this in turn jams the splines between the flywheel and the dual clutch ⇒ [page 65](#) .

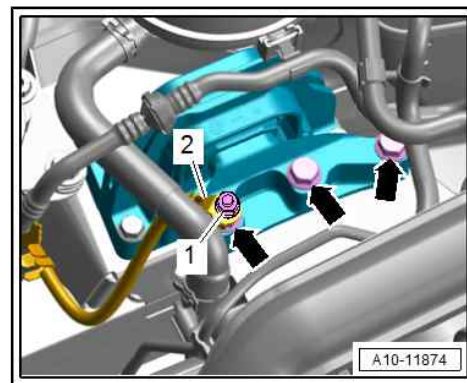
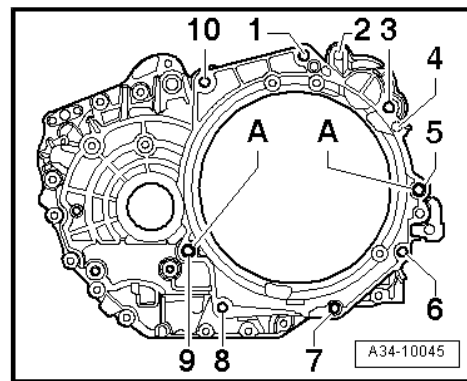
All vehicles (continued)

- Secure gearbox to engine.
- Take up engine/gearbox assembly with engine bracket - T10536- .
- Guide engine/gearbox assembly into body.
- Initially hand-tighten bolts -arrows- for support arm of engine mounting until they make contact.



Note

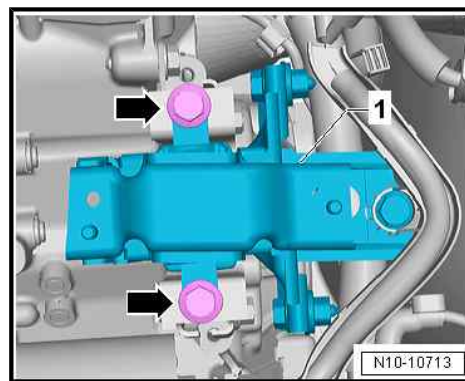
Disregard items -1 and 2-.



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- Initially hand-tighten bolts -arrows- for support arm of gearbox mounting -1- until they make contact.
- Remove engine bracket - T10536- from engine.
- Install starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Exploded view - starter .
- Install drive shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .
- Install underbody trim ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .
- Install front exhaust pipe ⇒ [page 294](#) .
- Install electric coolant pumps ⇒ [page 177](#) .
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit .
- Install poly V-belt ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch slave cylinder .
- Install and adjust selector lever cable or gear selector cable and gate selector cable ⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector mechanism .
- Install clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch slave cylinder .
- Install mounting for jump start terminal ⇒ Electrical system; Rep. gr. 27 ; Jump start terminal; Exploded view - jump start terminal .
- Install engine control unit - J623- ⇒ [page 286](#) .
- 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.
- Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Connect vacuum hoses ⇒ [page 234](#) .
- Connect fuel hoses ⇒ Fuel supply system; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .
- Install subframe ⇒ Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
- Install air cleaner housing ⇒ [page 236](#) .
- Check oil level ⇒ Maintenance ; Booklet 819 .



Caution

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

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

- Bleed fuel system ⇒ [page 232](#) .
- Connect coolant hoses with plug-in connector ⇒ [page 200](#) .
- Connect coolant hoses using quick-release clips ⇒ [page 200](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ *Only fill and bleed fuel system using ⇒ Vehicle diagnostic tester ⇒ [page 172](#) .*



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .
- Install front wheel housing liners ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .



Note

After new parts have been installed (engine/short engine, cylinder head, crankshaft housing or turbocharger), the oil pressure must be regulated to the higher pressure stage for approx. 1000 km. This compensates for the higher friction when running in new parts, and ensures the best means of removing particles of residue worn off during the running-in process.

- Perform adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ ["3.4 Performing adaptations after renewing a component", page 8](#) .

Tightening torques



Note

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- ◆ *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: ± 15 %*

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	20
	M10	40
	M12	65

- ◆ ⇒ ["2.1 Exploded view - assembly mountings", page 32](#)
- ◆ Securing engine to gearbox ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox



2 Assembly mountings

⇒ ["2.1 Exploded view - assembly mountings", page 32](#)

⇒ ["2.2 Supporting engine in installation position", page 33](#)

⇒ ["2.3 Removing and installing engine mountings", page 36](#)

⇒ ["2.4 Removing and installing gearbox mounting", page 38](#)

⇒ ["2.5 Removing and installing pendulum support", page 40](#)

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2.1 Exploded view - assembly mountings

1 - Engine support

- ☐ Removing and installing
⇒ [page 54](#)

2 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 33](#)

3 - Engine mounting

- ☐ With support arm
- ☐ Removing and installing
⇒ [page 36](#)

4 - Bolt

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

5 - Bolt

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

6 - Bolt

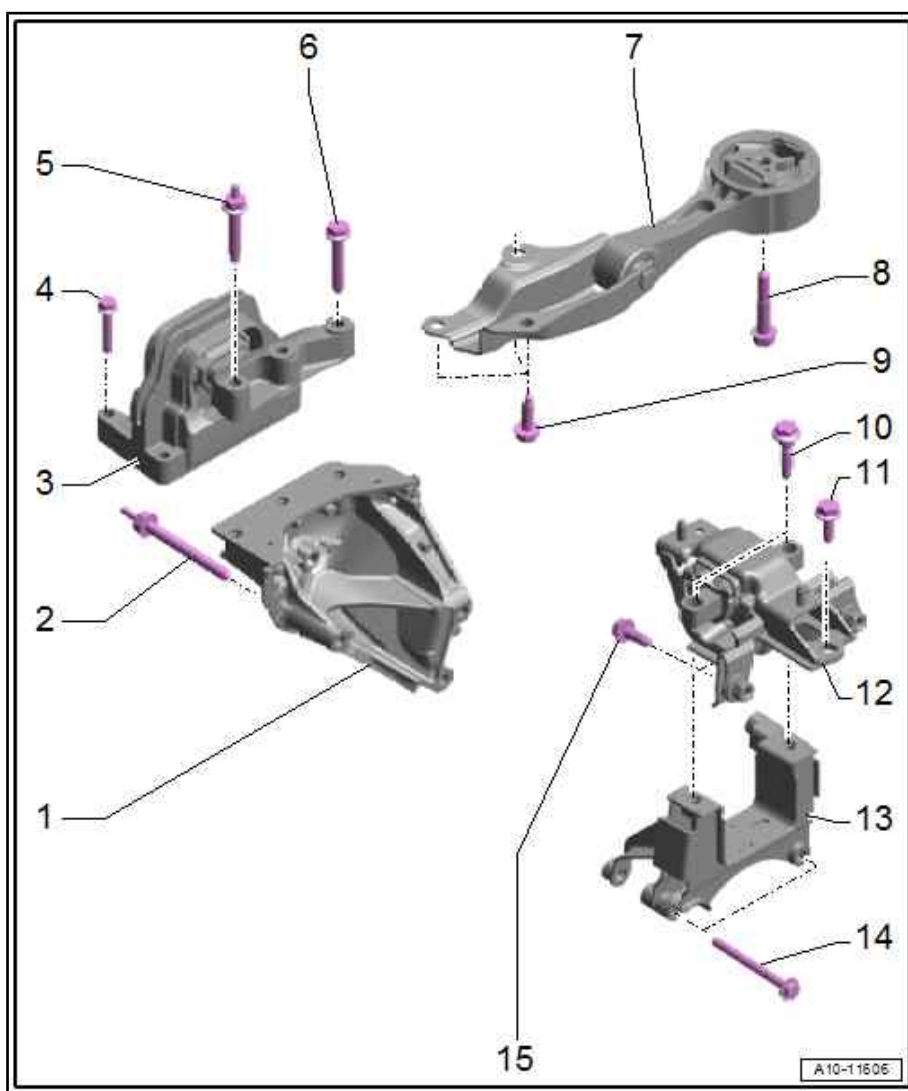
- ☐ Renew after removing
- ☐ 30 Nm +90°

7 - Pendulum support

- ☐ Removing and installing
⇒ [page 40](#)

8 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and





sequence ⇒ [page 33](#)

9 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 33](#)

10, 11 - Bolts

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

12 - Gearbox mounting

- ☐ With support arm
- ☐ Removing and installing ⇒ [page 38](#)

13 - Gearbox support

14, 15 - Bolts

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

Engine support - tightening torque and sequence

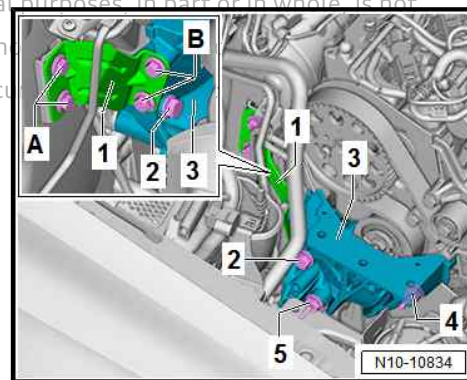


Note

After removing, renew bolts tightened with specified tightening angle.

- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-2, 4, 5-	7 Nm
2.	-2, 4, 5-	50 Nm
3.	-2, 4, 5-	Turn 180° further



Installing pendulum support

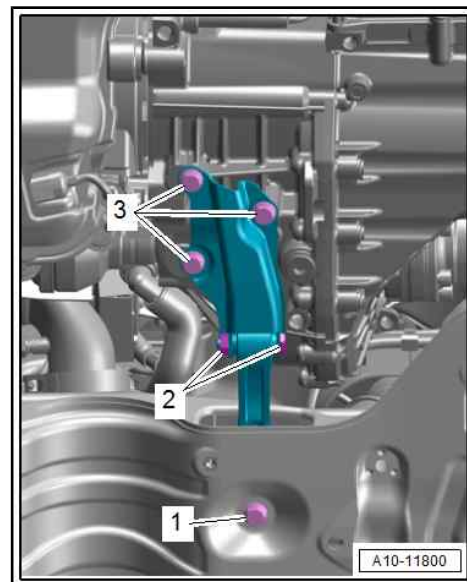


Note

After removing, renew bolts tightened with specified tightening angle.

- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-3-	30 Nm
2.	-1-	40 Nm
3.	-1, 3-	Turn 90° further



2.2 Supporting engine in installation position

Special tools and workshop equipment required



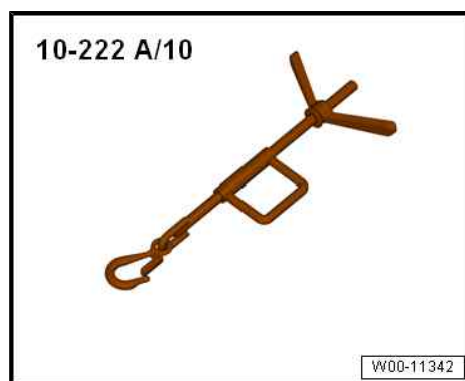
◆ Support bracket - 10-222A-



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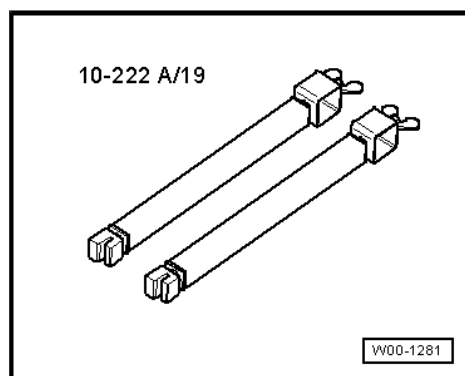
◆ Hook - 10-222A/10-



◆ Shackle - 10-222A/12-

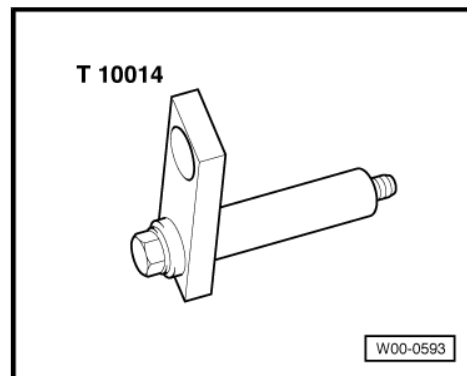


◆ Adapters - 10-222A/19-

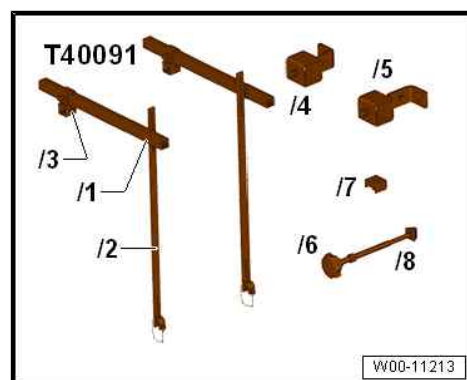




◆ Bracket - T10014-



◆ Engine support (basic set) - T40091-



◆ Flange nut (M10)

Procedure

- Remove engine cover panel ➔ [page 41](#) .
- 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 - 10-222A- on top edges of body flanges (left and right) and longitudinal member (right-side), as shown in illustration.

- Attach retainer - T10014- to engine lifting eye (left-side) and secure with flange nut (M10) -item 1- .

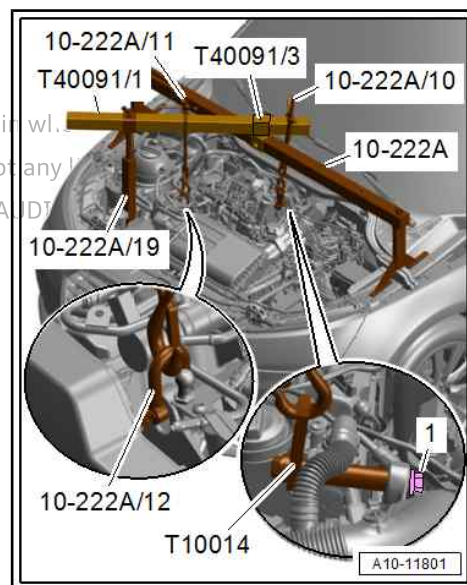
- Screw shackle - 10-222A/12- onto engine lifting eye (right-side).

- Attach snap element of hook -10-222A/10- and spindle - 10-222A/11- .
- Tighten spindle and hook slightly to take up weight of engine/gearbox assembly; do not lift.

Attaching

Assembly is performed in reverse sequence; note the following:

- Detach support bracket - 10-222A- .
- 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 ➔ [page 41](#) .

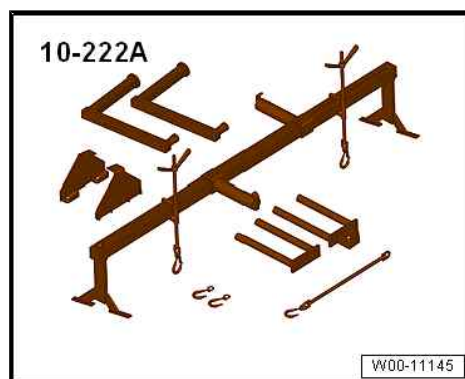




2.3 Removing and installing engine mountings

Special tools and workshop equipment required

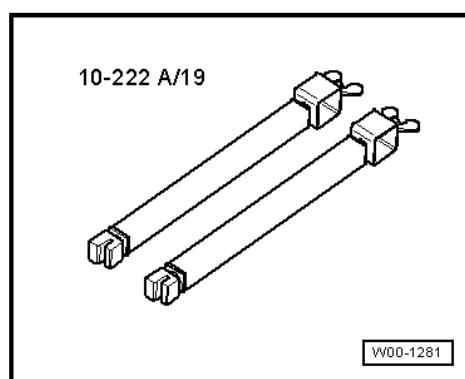
- ◆ Support bracket - 10-222A-



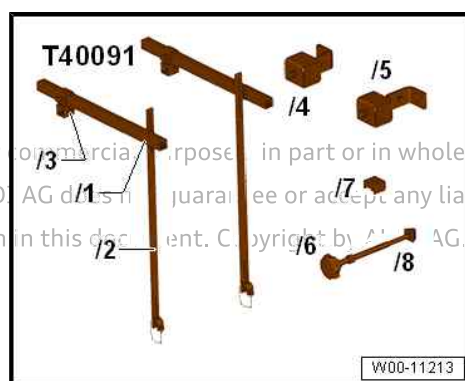
- ◆ Shackle - 10-222A/12-



- ◆ Adapters - 10-222A/19-



- ◆ Engine support (basic set) - T40091-

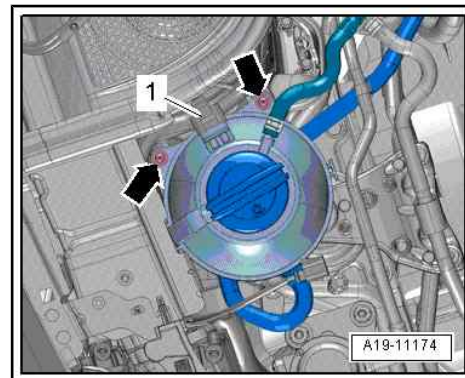


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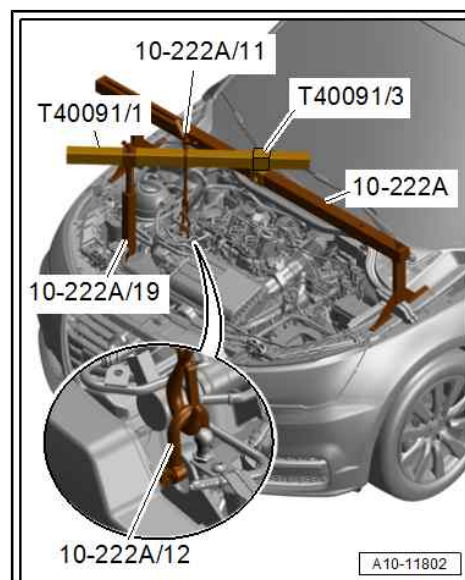


Removing

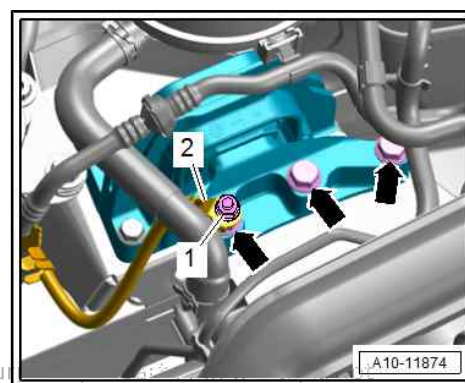
- Remove engine cover panel ➔ [page 41](#) .
- Remove filler neck for washer fluid reservoir ➔ Electrical system; Rep. gr. 92 ; Windscreen washer system; Removing and installing washer fluid reservoir .
- Remove bolts -arrows-.
- Detach electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.



- Set up support bracket - 10-222A- on top edges of body flanges (left and right) and longitudinal member (right-side), as shown in illustration.
- Screw shackle - 10-222A/12- onto engine lifting eye (right-side) and attach hook of spindle - 10-222A/11- .
- Tighten spindle slightly to take up weight of engine/gearbox assembly; do not lift.



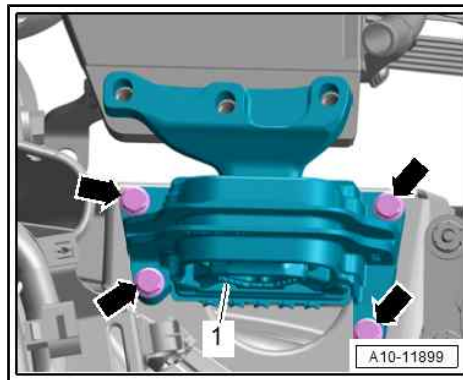
- Remove nut -1- and move earth wire -2- clear.
- Remove bolts -arrows- for support arm of engine mounting.



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- Remove bolts -arrows- and detach engine mounting -1-.



Installing



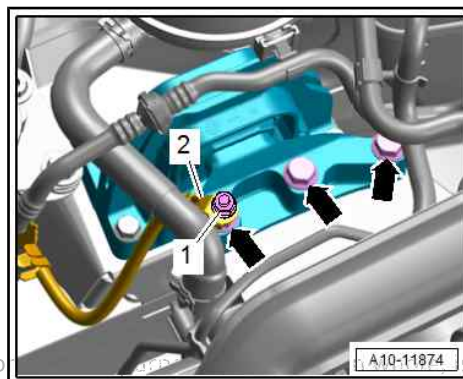
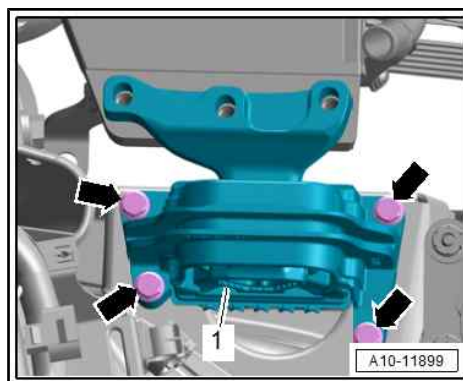
Note

After removing, renew bolts tightened with specified tightening angle.

- Fit engine mounting -1- on longitudinal member.
- Initially screw in bolts -arrows- by hand until they make contact.
- 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.

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

- Detach support bracket - 10-222A- .
- 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 ⇒ [page 41](#)



Tightening torques

- ♦ ⇒ [“2.1 Exploded view - assembly mountings”, page 32](#)
- ♦ Nut -1- for earth wire -2- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

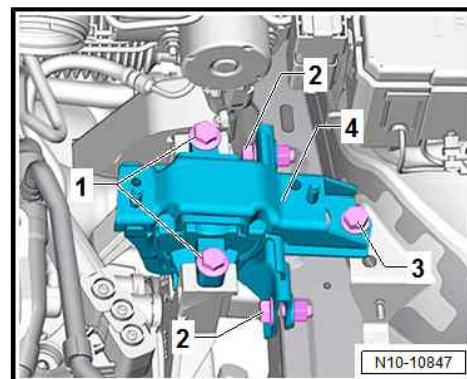
2.4 Removing and installing gearbox mounting

Removing

- Remove mounting for jump start terminal ⇒ Electrical system; Rep. gr. 27 ; Jump start terminal; Removing and installing jump start terminal .
- Support engine in installation position ⇒ [page 33](#) .



- Remove bolts -1, 2, 3- and detach gearbox mounting -4-.



Installing

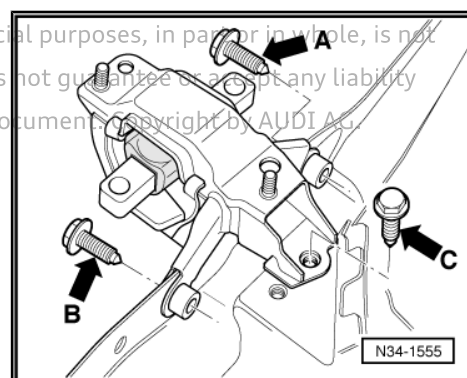
Installation is carried out in reverse order; note the following:



Note

After removing, renew bolts tightened with specified tightening angle.

- Move gearbox mounting into installation position on longitudinal member and tighten bolts in sequence -A, B, C-.



Caution

Bolts must be fitted straight to avoid damage to threads in gearbox support.

- ◆ **Gearbox support and support arm of gearbox mounting must be perfectly parallel to each other before screwing in bolts. If necessary, lift gearbox at rear using trolley jack.**
- ◆ **Only remove support bracket - 10-222A- when bolts on assembly mounting have been tightened to specified torque.**

- Lift gearbox with spindle of support bracket until gearbox support makes contact with support arm of gearbox mounting.

Tightening torques

- ◆ ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Jump start terminal; Exploded view - jump start terminal



2.5 Removing and installing pendulum support

Removing

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



Note



Do NOT loosen bolted connection -2-.

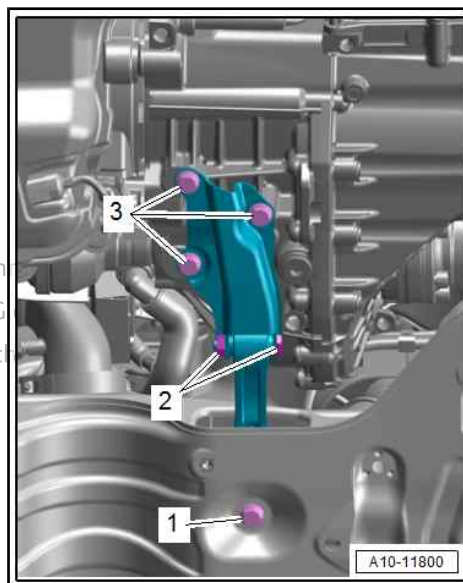
- Remove bolts -1, 3- and detach pendulum support.

Installing

Installation is carried out in reverse sequence.

Tightening torques

- ♦ ⇒ [“2.1 Exploded view - assembly mountings”, page 32](#)
- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation





3 Engine cover panel

⇒ **"3.1 Removing and installing engine cover panel", page 41**

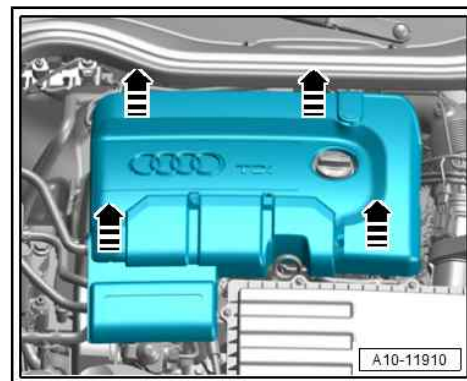
3.1 Removing and installing engine cover panel

Removing

- Carefully pull engine cover panel off retaining pins one after another -arrows-. Do not jerk engine cover panel away, and do not try to pull on one side only.

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 (as seen in the direction of travel) and then on the right side.



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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ [“1.1 Exploded view - cylinder block \(pulley end\)”, page 42](#)

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

⇒ [“1.3 Removing and installing poly V-belt”, page 46](#)

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

⇒ [“1.5 Removing and installing vibration damper”, page 49](#)

⇒ [“1.6 Removing and installing bracket for ancillaries”, page 50](#)

⇒ [“1.7 Removing and installing engine support”, page 54](#)

⇒ [“1.8 Renewing crankshaft oil seal \(pulley end\)”, page 55](#)

⇒ [“1.9 Removing and installing sealing flange \(pulley end\)”, page 58](#)

1.1 Exploded view - cylinder block (pulley end)

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
⇒ [page 46](#)
- ☐ When installing, make sure it is properly seated on pulleys.

2 - Vibration damper

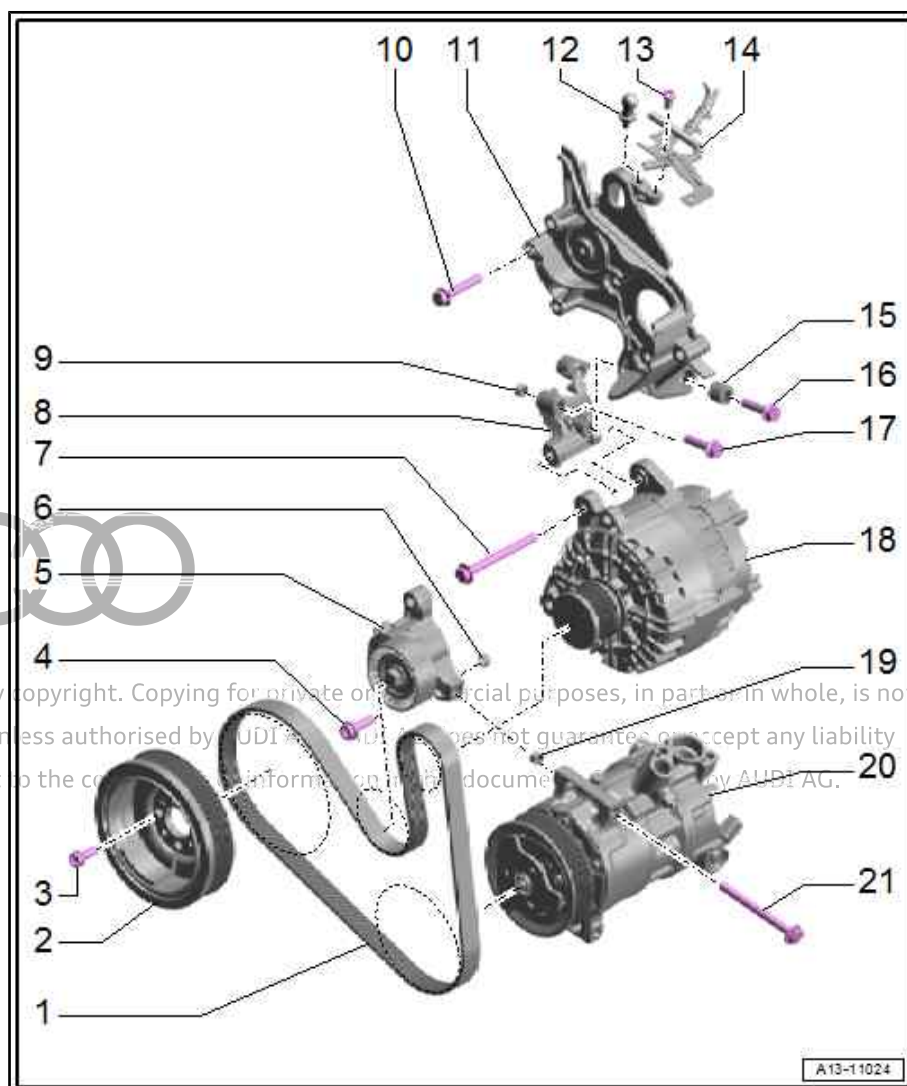
- ☐ With poly V-belt pulley
- ☐ Installation position: hole in vibration damper must be positioned over raised section of crankshaft sprocket
- ☐ Removing and installing
⇒ [page 49](#)

3 - Bolt

- ☐ Renew after removing
- ☐ Use only genuine bolts
⇒ [Electronic parts catalogue](#)
- ☐ 10 Nm +90°

4 - Bolt

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





5 - Tensioner for poly V-belt

- ☐ Removing and installing
⇒ [page 47](#)

6 - Dowel sleeve

- ☐ 2x
- ☐ Ensure correct seating in cylinder block

7 - Bolt

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

8 - Bracket

- ☐ For alternator
- ☐ Bolted to cylinder block
- ☐ Removing and installing ⇒ [page 53](#)

9 - Dowel sleeve

- ☐ 2x
- ☐ Ensure correct seating in cylinder block

10 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 44](#)

11 - Bracket

- ☐ For high-pressure pump
- ☐ Removing and installing ⇒ [page 50](#)

12 - Ball stud

- ☐ For engine cover panel
- ☐ 5 Nm

13 - Bolt

- ☐ 8 Nm

14 - Fuel return line

15 - Sliding bush

- ☐ Ensure that sliding bush moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque

16 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 44](#)

17 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 44](#)

18 - Alternator

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

19 - Dowel sleeve

- ☐ 2x
- ☐ Ensure correct seating in air conditioner compressor

20 - Air conditioner compressor

- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

21 - Bolt

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



Bracket for alternator - tightening torque and tightening sequence

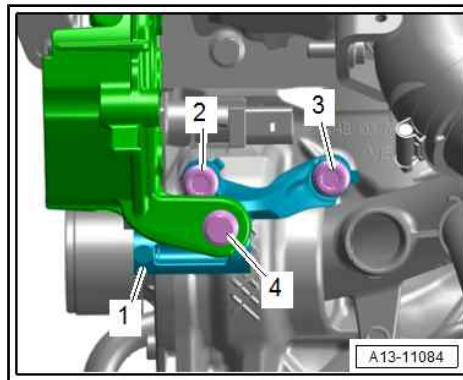


Note

After removing, renew bolts tightened with specified tightening angle.

- Tighten bolts in stages in the sequence described:

Stage	Bolts	Tightening torque/angle specification
1.	-2, 3-	Screw in by hand until contact is made
2.	-2, 3-	20 Nm
3.	-2, 3-	Turn 180° further
4.	-4-	20 Nm
5.	-4-	Turn 90° further



Bracket for high-pressure pump - tightening torque and tightening sequence

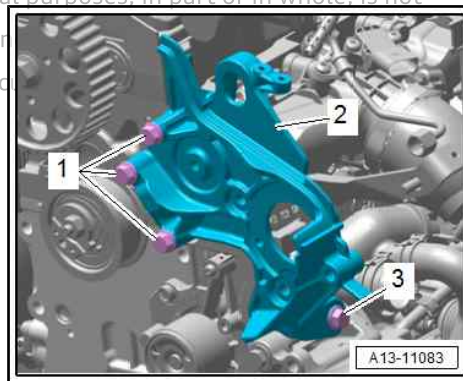


Note

After removing, renew bolts tightened with specified tightening angle.

- Tighten bolts in stages in the sequence described:

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



1.2 Exploded view - sealing flange (pulley end)



1 - Bolt

- ❑ Tightening torque
⇒ [Item 1 \(page 87\)](#)

2 - Crankshaft sprocket

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

3 - Oil seal

- ❑ For crankshaft (pulley end)
- ❑ Renewing ⇒ [page 55](#)

4 - Bolt

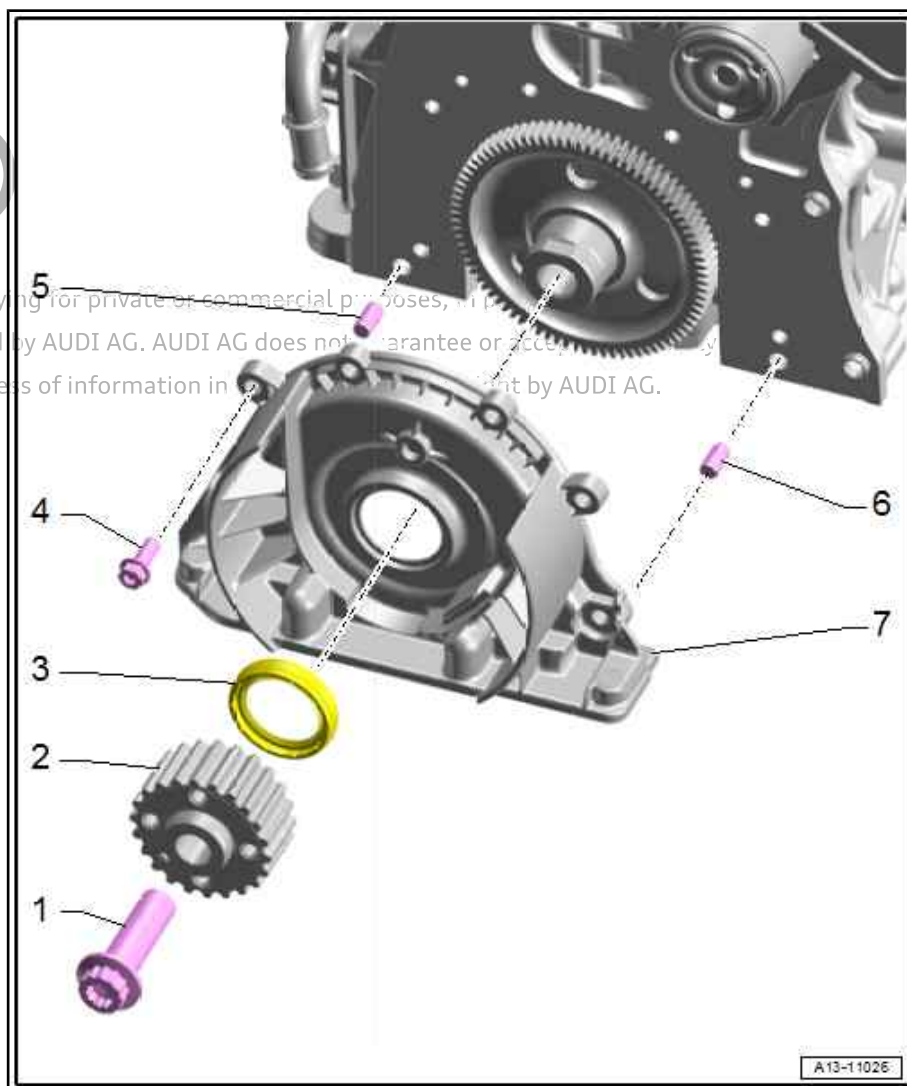
- ❑ Tightening torque and sequence ⇒ [page 45](#)

5 - Dowel pin

6 - Dowel pin

7 - Sealing flange (pulley end)

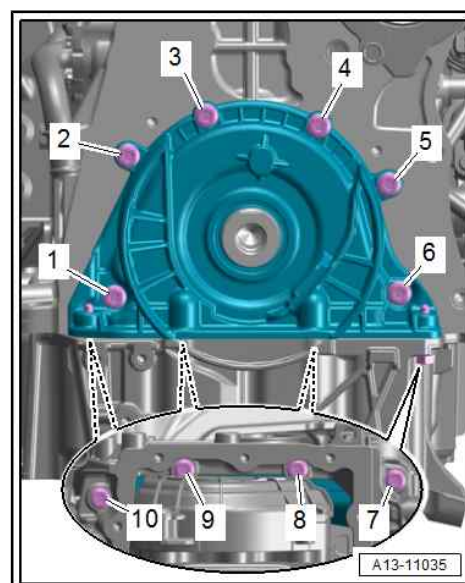
- ❑ Removing and installing
⇒ [page 58](#)



Sealing flange (pulley end) - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 ... 10-	Screw in by hand until contact is made
2.	-1 ... 6-	Tighten in stages and in diagonal sequence; final torque 13 Nm
3.	-7 ... 10-	13 Nm (this step is performed to allow for settling of sealing flange)





1.3 Removing and installing poly V-belt

⇒ [“1.3.1 Removing and installing poly V-belt - vehicles without air conditioner compressor”, page 46](#)

⇒ [“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

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

Procedure



Note

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

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Follow procedure specified in illustrated instructions (included in poly V-belt repair set with assembly tool).

Installation is carried out in reverse sequence.

Tightening torques

- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

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

Special tools and workshop equipment required

- ♦ Locking pin - T10060A-



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Removing

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

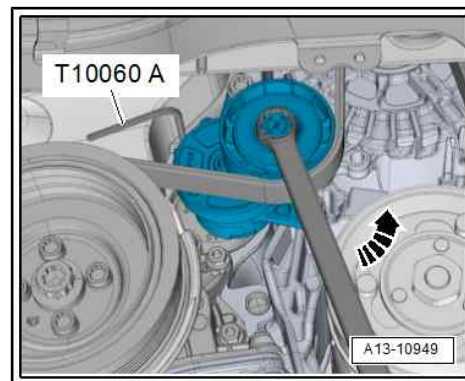


Caution

Running a used poly V-belt in the opposite direction could cause irreparable damage.

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

- To slacken poly V-belt turn tensioner in anti-clockwise direction -arrow- using ring spanner.
- Lock tensioner with locking pin - T10060A- .
- Take off poly V-belt.



Installing

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

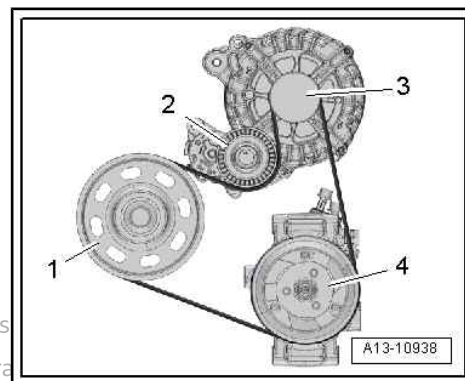
- Fit poly V-belt on poly V-belt pulleys:

- 1 - Vibration damper
- 2 - Tensioning roller
- 3 - Alternator
- 4 - Air conditioner compressor

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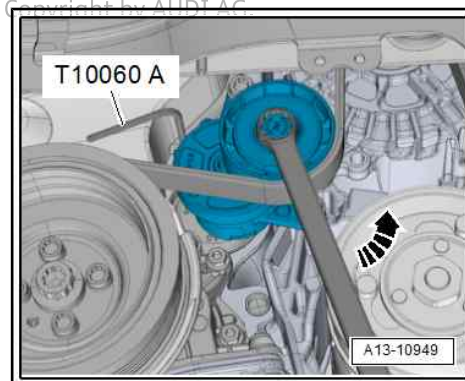
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- Counterhold tensioner with ring spanner -arrow- and pull out locking pin - T10060A- .
- Release tensioner.
- Check that poly V-belt is in correct position.
- Start engine and check that poly V-belt(s) run properly.



Tightening torques

- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

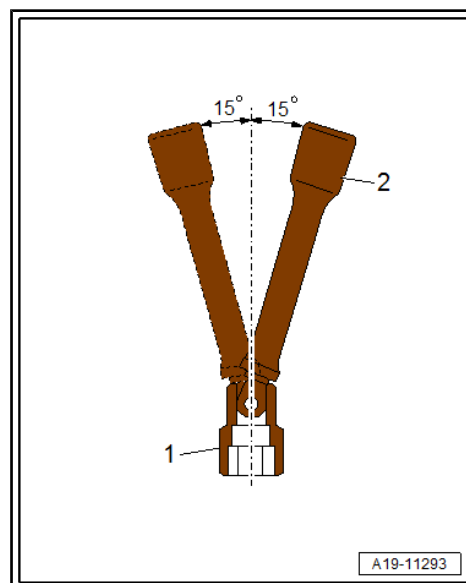


1.4 Removing and installing tensioner for poly V-belt

Special tools and workshop equipment required



- ◆ Twelve-point socket, 13 mm -item 1- with jointed extension -2-, commercially available



Removing

- Remove wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Remove poly V-belt ⇒ [page 46](#) .
- Remove air conditioner compressor from bracket ⇒ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .



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- Remove bolts -1 and 3- and loosen bolt -5-.



Note

Loosen bolt -5- using twelve-point socket, 13 mm, with jointed extension.

- Pivot alternator -4- towards front -arrow- and detach poly V-belt tensioner -2-.

Installing

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



Note

After removing, renew bolts tightened with specified tightening angle.

- Check whether dowel sleeves for centring poly V-belt tensioner are fitted in cylinder block; install dowel sleeves where necessary.
- Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Install air conditioner compressor ⇒ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Install poly V-belt ⇒ [page 46](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - cylinder block \(pulley end\)”, page 42](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)

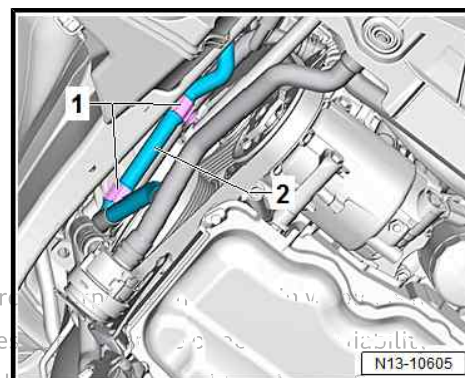
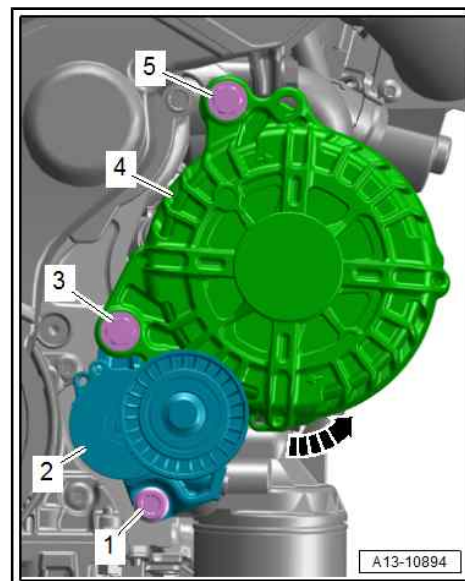
1.5 Removing and installing vibration damper

Removing

- Remove poly V-belt ⇒ [page 46](#) .
- Remove wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Open clips -1-, move coolant hose -2- clear and push to one side.



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- Loosen bolts -arrows- for vibration damper (counterhold by applying ring spanner to bolt for crankshaft sprocket).
- Remove bolts and take off vibration damper.

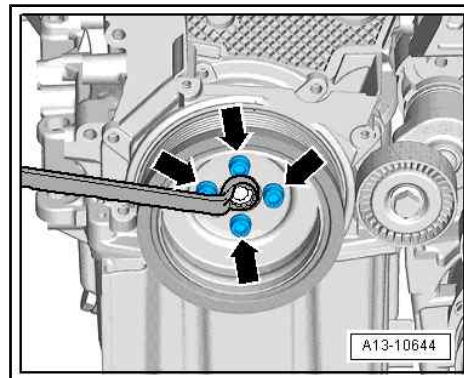
Installing

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



Note

- ◆ After removing, renew bolts tightened with specified tightening angle.
 - ◆ The vibration damper can only be fitted in one position.
- Install poly V-belt ➔ [page 46](#) .



Tightening torques

- ◆ ➔ [“1.1 Exploded view - cylinder block \(pulley end\)”, page 42](#)
- ◆ ➔ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)

1.6 Removing and installing bracket for ancillaries

➔ [“1.6.1 Removing and installing bracket for high-pressure pump”, page 50](#)

➔ [“1.6.2 Removing and installing bracket for alternator”, page 53](#)

1.6.1 Removing and installing bracket for high-pressure pump

Special tools and workshop equipment required

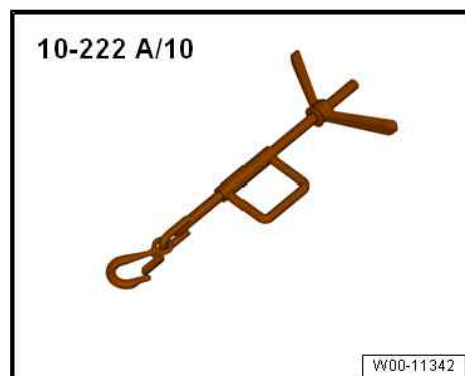
- ◆ Support bracket - 10-222A-



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- ◆ Hook - 10-222A/10-

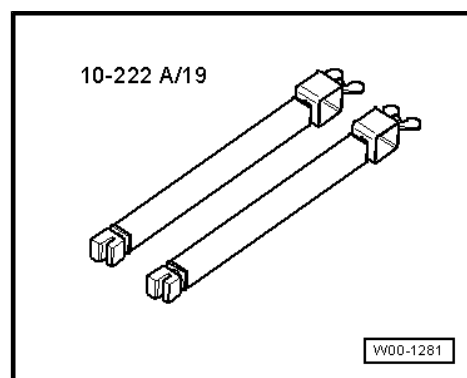




◆ Shackle - 10-222A/12-



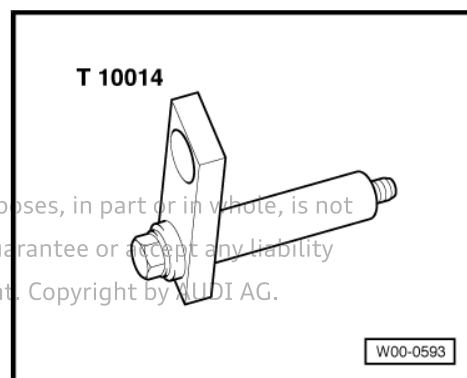
◆ Adapters - 10-222A/19-



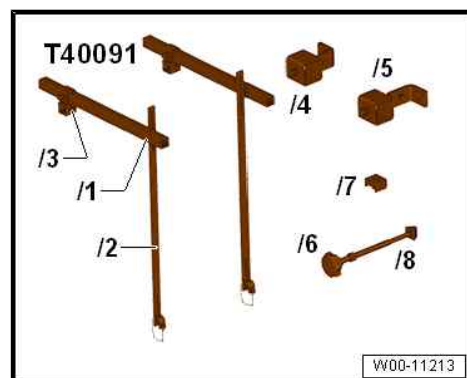
◆ Bracket - T10014-



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◆ Engine support (basic set) - T40091-



◆ Flange nut (M10)

Removing

- Remove high-pressure pump ⇒ [page 267](#) .
- 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 - 10-222A- on top edges of body flanges (left and right) and longitudinal member (right-side), as shown in illustration.
- Screw shackle - 10-222A/12- onto engine lifting eye (right-side) and attach snap element of hook -10-222A/10- .
- Tighten hook slightly to take up weight of engine/gearbox assembly; **do not lift**.

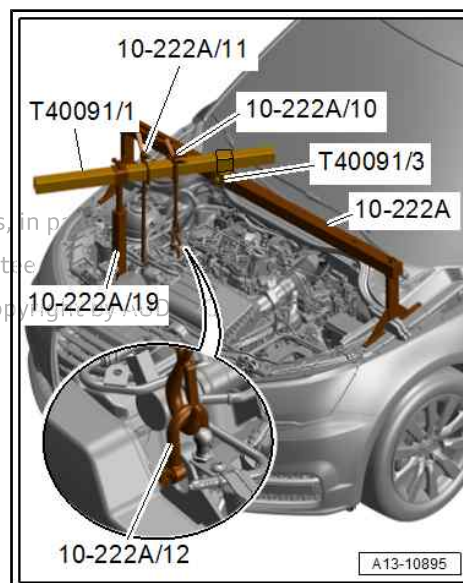


Note

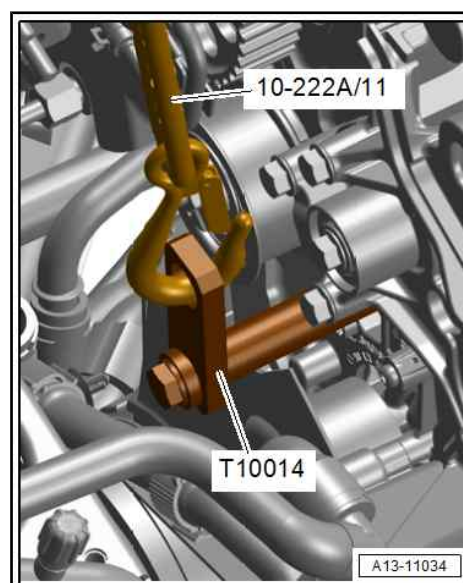
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The spindle - 10-222A/11- is not used until a later step.

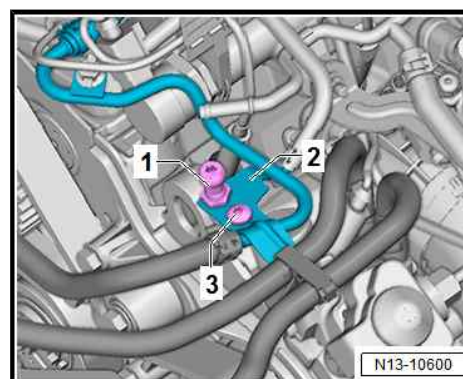
- Remove engine support ➔ [page 54](#) .



- Screw retainer - T10014- into threaded hole for engine support (tighten to 25 Nm) and attach hook of spindle - 10-222A/11- , as shown in illustration.
- Unhook snap element of hook -10-222A/10- .

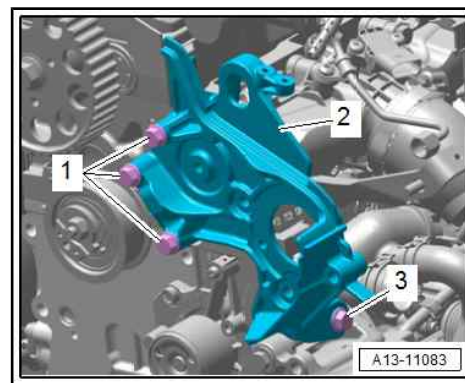


- Remove bolt -3- and move fuel return line -2- clear at ball stud -1-.





- Unscrew bolts -1- and remove bracket -2- for high-pressure pump.



Installing

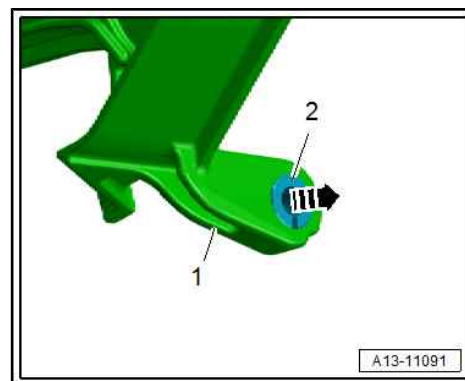
Installation is carried out in reverse order; note the following:

- Knock back sliding bush -2- in bracket for high-pressure pump slightly -arrow-.



Note

Ensure that sliding bush moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque.



- Install filler neck for washer fluid reservoir ➔ Electrical system; Rep. gr. 92 ; Windscreen washer system; Removing and installing washer fluid reservoir .
- Install high-pressure pump ➔ [page 267](#) .
- Install engine support ➔ [page 54](#) .

Tightening torques

- ◆ ➔ Fig. [“Bracket for high-pressure pump - tightening torque and tightening sequence”](#) , page 44

1.6.2 Removing and installing bracket for alternator

Special tools and workshop equipment required

- ◆ Bit XZN 10 - T10501-



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- ◆ M8x50 bolt



Removing

- Remove poly V-belt ⇒ [page 46](#) .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove bolts -2, 3, 4- from bracket -1- for alternator.



Note

Bolt -2- remains in bracket.

- Apply a bit, 18 mm with $\frac{3}{8}$ " drive -item 1- to sliding bush.
- Pull out sliding bush by screwing in bolt M8x50 -item 2- as far as it will go.
- Remove bolt again and detach bracket for alternator.

Installing

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

- Check whether dowel sleeves for centring bracket for alternator are fitted in cylinder block; install dowel sleeves where necessary.



Note

Ensure that sliding bush in bracket for high-pressure pump moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque.

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

- Install poly V-belt ⇒ [page 46](#) .

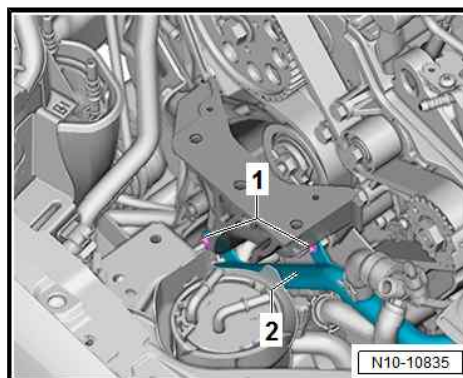
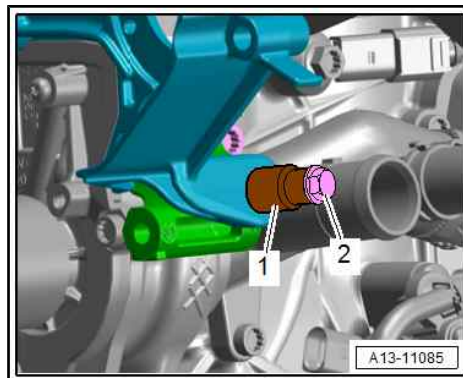
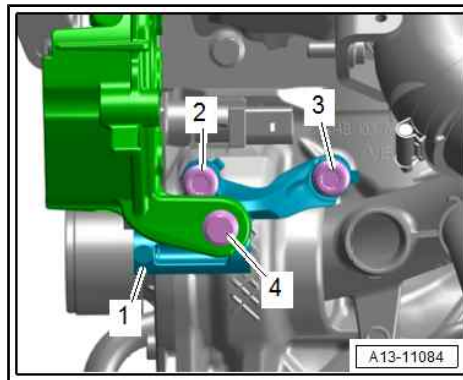
Tightening torques

- ♦ ⇒ [“1.1 Exploded view - cylinder block \(pulley end\)”, page 42](#)

1.7 Removing and installing engine support

Removing

- Remove toothed belt cover (top) ⇒ [page 88](#) .
- Remove engine mounting ⇒ [page 36](#) .
- Use spindle - 10-222A/11- to raise/lower engine until appropriate bolt of engine support is accessible.
- Remove nuts -1- and detach coolant pipe (right-side) -2- from centre hex studs.



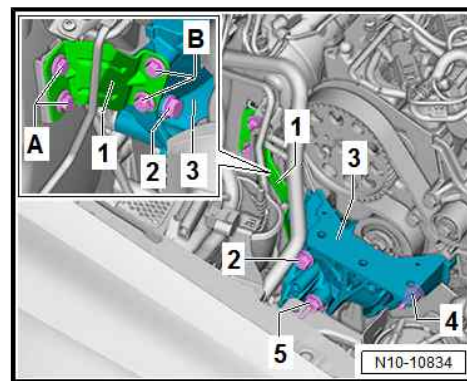


- Unscrew bolts -A- by one turn; remove bolts -B-.
- Remove bolts -2, 4, 5- and lift out engine support -3-.

Installing

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

- Insert bolt -2- in hole in engine support before fitting engine support.
- Bring engine support into installation position and tighten bolts ⇒ [page 33](#) .
- First screw in bolts -A, B- for bracket -1- until they make contact, then tighten ⇒ [page 304](#) .
- Install toothed belt cover (top) ⇒ [page 88](#) .
- Install engine mountings ⇒ [page 36](#) .



Tightening torques

- ◆ ⇒ [Fig. ““Engine support - tightening torque and sequence””, page 33](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 190](#)

1.8 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

- ◆ Counterhold tool - 3415-

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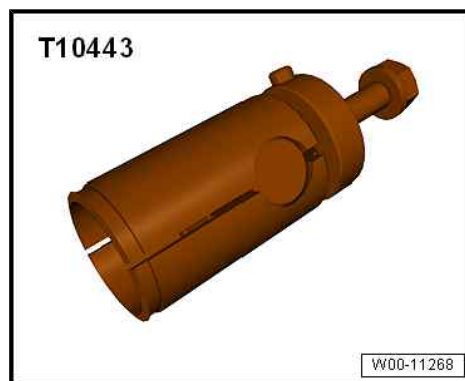


- ◆ Assembly tool - T10117- with bolt - T10117/3-





◆ Puller - T10443-



Procedure

- Remove toothed belt cover (top) ⇒ [page 88](#) .
- Remove toothed belt cover (bottom) ⇒ [page 89](#) .
- Detach toothed belt from camshafts ⇒ [page 90](#) .
- Remove crankshaft stop - T10490- .



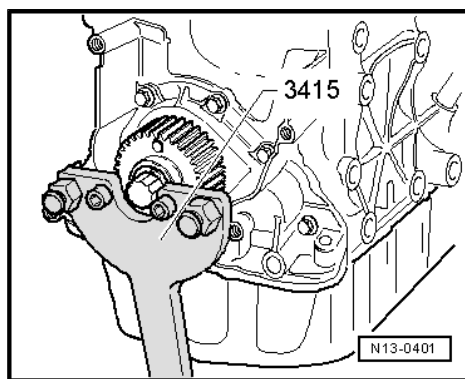
Caution

Risk of damage to valves and piston crowns.

- ◆ *Do not turn crankshaft when toothed belt is detached with camshafts installed.*

Risk of damage to toothed belt.

- ◆ *Do not stretch or kink toothed belt.*

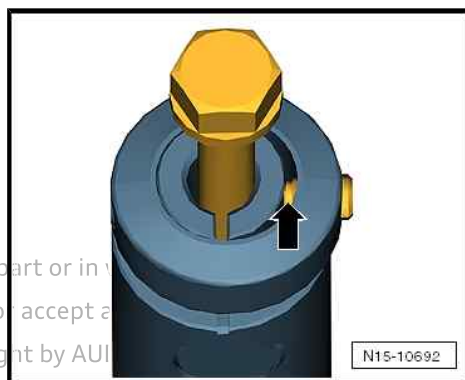


- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .
- Remove bolt and detach crankshaft sprocket.



Caution

- ◆ *If the grub screw is unscrewed too far the thrust plate inside the puller -T10443- will come loose from the thrust bolt. If this happens, the thrust plate must be pushed back onto the thrust bolt.*



- Carefully unscrew grub screw -arrow- of puller -T10443- until slight resistance is felt.

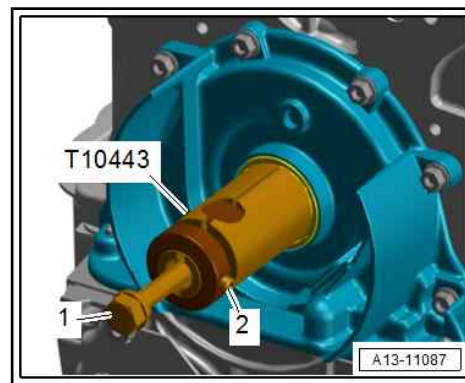


- Apply puller - T10443- in a straight line, as shown in illustration, and lock by screwing in grub screw -2-.
- Screw in thrust bolt -1- until oil seal is pulled out.
- Clean contact surface and sealing surface.

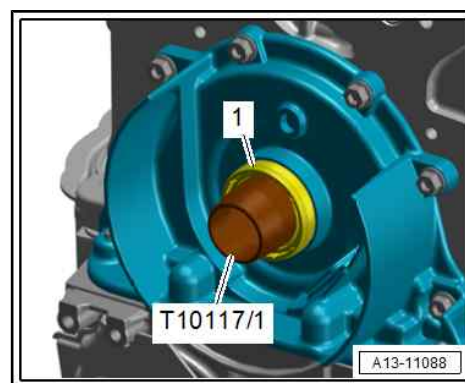


Note

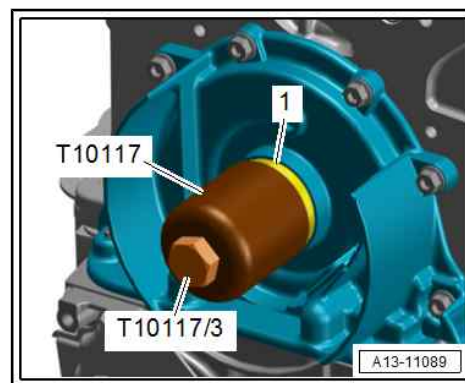
The sealing lip of the oil seal must not be additionally oiled or greased.



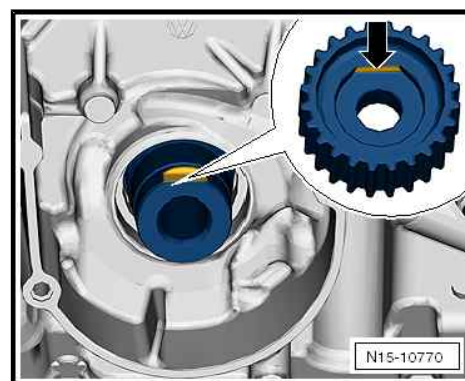
- Apply guide sleeve -T10117/1- to crankshaft as shown in illustration.
- Carefully push oil seal -1- over guide sleeve and onto crankshaft.
- Side of oil seal with lettering must face outwards.
- When pressing in oil seal, guide sleeve remains on crankshaft.



- Apply assembly tool - T10117- with bolt - T10117/3- to crankshaft.
- Pull oil seal -1- in as far as stop.



- Fit crankshaft sprocket onto crankshaft.
- Contact surface between vibration damper 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.





Caution

Risk of damage to valves and piston crowns.

- ◆ **Do not turn crankshaft when toothed belt is detached with camshafts installed.**

- Tighten bolt for crankshaft sprocket (use counterhold tool - 3415-).
- Lock crankshaft sprocket in position with crankshaft stop - T10490-.
- Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.
- Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.



Note

For illustration purposes, the installation position is shown with the toothed belt cover (bottom) removed.

- Install toothed belt (adjust valve timing) ⇒ [page 101](#) .

Tightening torques

- ◆ Crankshaft sprocket ⇒ [Item 1 \(page 87\)](#)

1.9 Removing and installing sealing flange (pulley end)

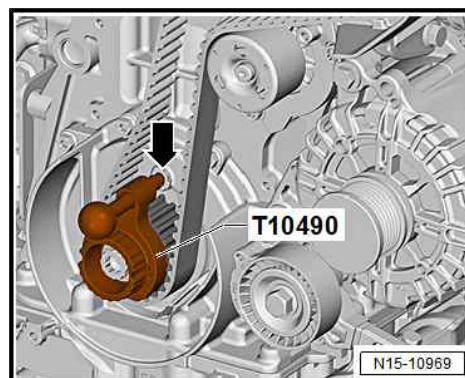
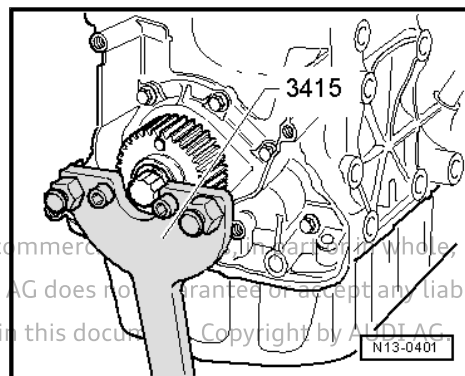
Special tools and workshop equipment required

- ◆ Counterhold tool - 3415-

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

Removing

- Remove sump (bottom section) ⇒ [page 142](#) .
- Remove toothed belt cover (bottom) ⇒ [page 89](#) .
- Detach toothed belt from camshafts ⇒ [page 90](#) .





- Remove crankshaft stop - T10490- , detach toothed belt from crankshaft sprocket and move it to rear.



Caution

Risk of damage to valves and piston crowns.

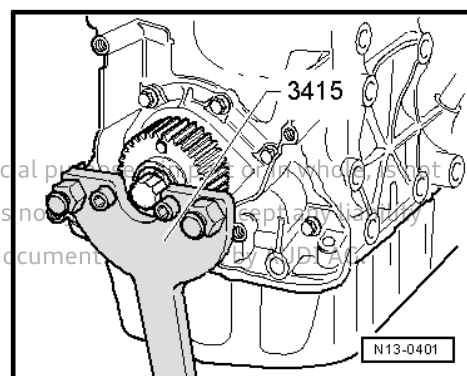
- ◆ *Do not turn crankshaft when toothed belt is detached with camshafts installed.*

Risk of damage to toothed belt.

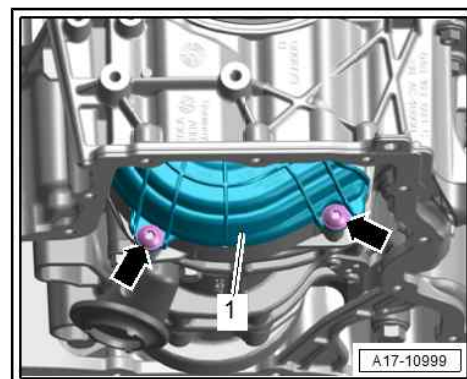
- ◆ *Do not stretch or kink toothed belt.*

- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .
- Remove bolt and detach crankshaft sprocket.

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- Unscrew bolts -arrows- and remove cover -1-.



- Remove bolts -1 ... 10- and carefully release sealing flange from bonded joint.
- Drive oil seal out of sealing flange (after flange has been removed).

Installing

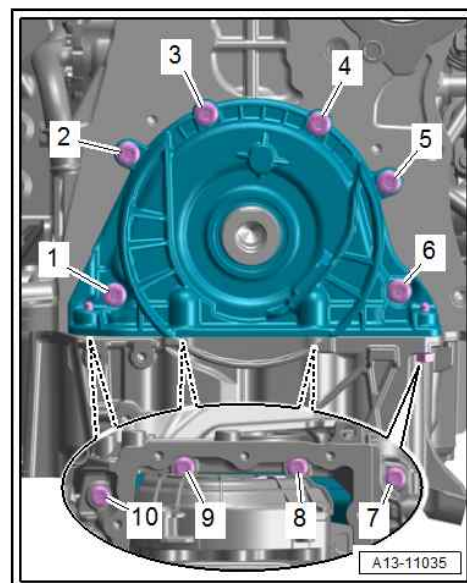
Installation is carried out in reverse order; note the following:



Caution

Make sure sealant residue does not enter lubrication system.

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





WARNING

Risk of eye injury.

◆ **Put on safety goggles.**

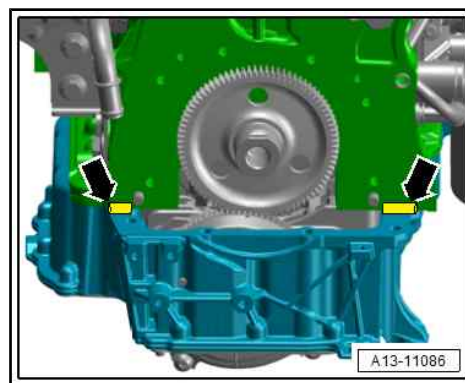
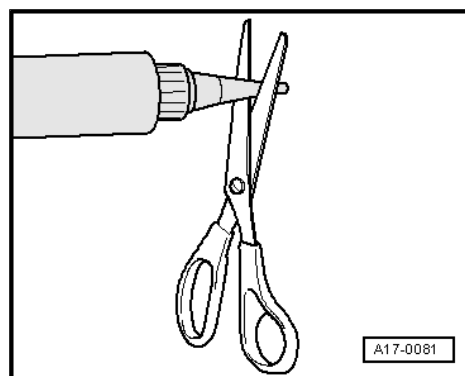
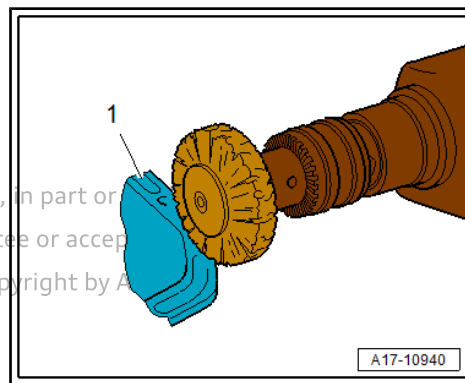
- Remove sealant residue from sump -1- using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Check whether dowel pins for centring sealing flange are fitted in cylinder block; install dowel pins where necessary.



Note

Note expiry date of sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).
- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



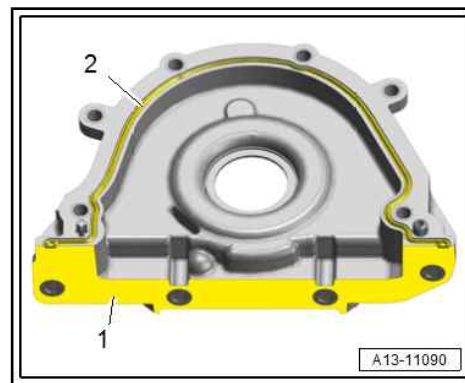


Caution

Make sure lubrication system is not clogged by excess sealant.

◆ ***The sealant bead must not be thicker than specified.***

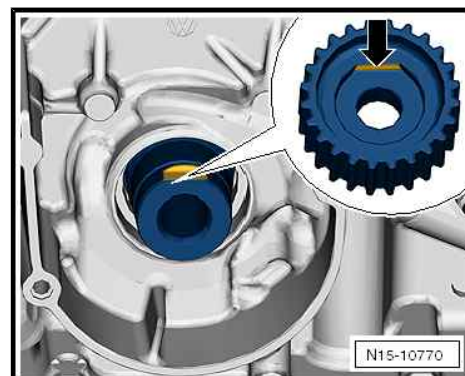
- Apply sealant bead -2- onto clean sealing surface of sealing flange, as shown in illustration.
- Thickness of sealant bead: 2 ... 3 mm
- Apply a thin coat of sealant to bottom sealing surface -1- on sealing flange.



Note

Install sealing flange within 5 minutes of applying the sealant.

- Carefully fit sealing flange onto dowel pins in cylinder block.
- Tighten sealing flange bolts ➔ [page 45](#) .
- Install crankshaft oil seal (pulley end) ➔ [page 55](#) .
- Install sump (bottom section) ➔ [page 142](#) .
- Fit crankshaft sprocket onto crankshaft.
- Contact surface between vibration damper 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.

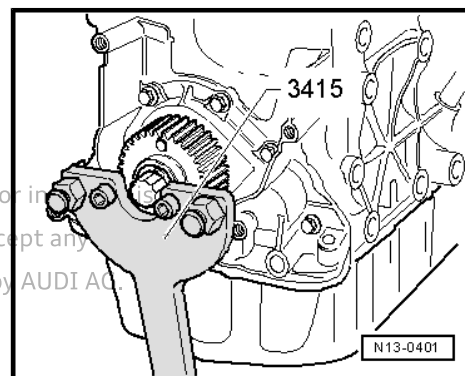


Caution

Risk of damage to valves and piston crowns.

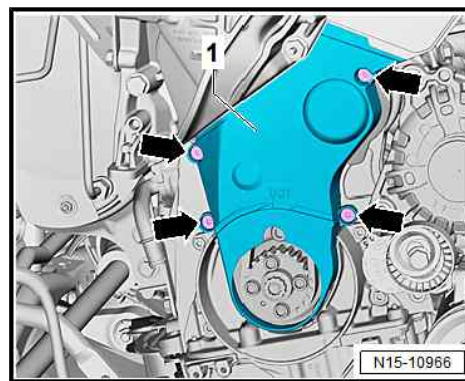
◆ ***Do not turn crankshaft when toothed belt is detached with camshafts installed.***

- Tighten bolt for crankshaft sprocket (use counterhold tool 3415-).





- Fit toothed belt onto coolant pump sprocket and crankshaft sprocket.
- Move toothed belt cover (bottom) -1- into installation position and tighten bolts -arrows-.

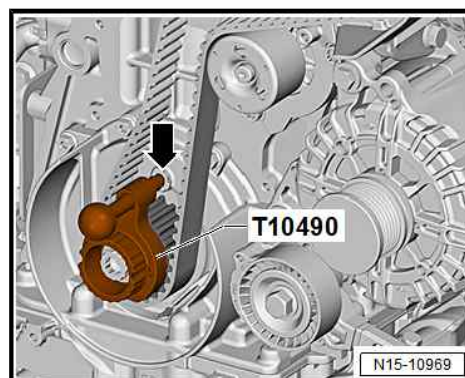


- Lock crankshaft sprocket in position with crankshaft stop - T10490- .
- Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.
- Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.



Note

For illustration purposes, the installation position is shown with the toothed belt cover (bottom) removed.



- Install toothed belt (adjust valve timing) ⇒ [page 101](#) .
- Install toothed belt cover (bottom) ⇒ [page 89](#) .
- Install sump (bottom section) ⇒ [page 142](#) .

Tightening torques

- ♦ ⇒ [Fig. “Sealing flange \(pulley end\) - tightening torque and sequence”](#), [page 45](#)
- ♦ ⇒ [“1.1 Exploded view - sump/oil pump”](#), [page 140](#)
- ♦ Crankshaft sprocket ⇒ [Item 1 \(page 87\)](#)



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2 Cylinder block (gearbox end)

⇒ ["2.1 Exploded view - cylinder block \(gearbox end\)", page 63](#)

⇒ ["2.2 Removing and installing flywheel", page 64](#)

⇒ ["2.3 Removing and installing sealing flange \(gearbox end\)", page 65](#)

2.1 Exploded view - cylinder block (gearbox end)

1 - Bolt

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

2 - Flywheel

- ☐ Removing and installing
⇒ [page 64](#)
- ☐ Can only be installed in one position
- ☐ Pre-tension splines before installing a dual clutch gearbox
⇒ [page 65](#)

3 - Engine speed sender - G28-

- ☐ Exploded view
⇒ [page 323](#)

4 - Bolt

- ☐ 4.5 Nm

5 - Intermediate plate

- ☐ Do not damage or bend when assembling
- ☐ Installing ⇒ [page 64](#)

6 - Dowel pin

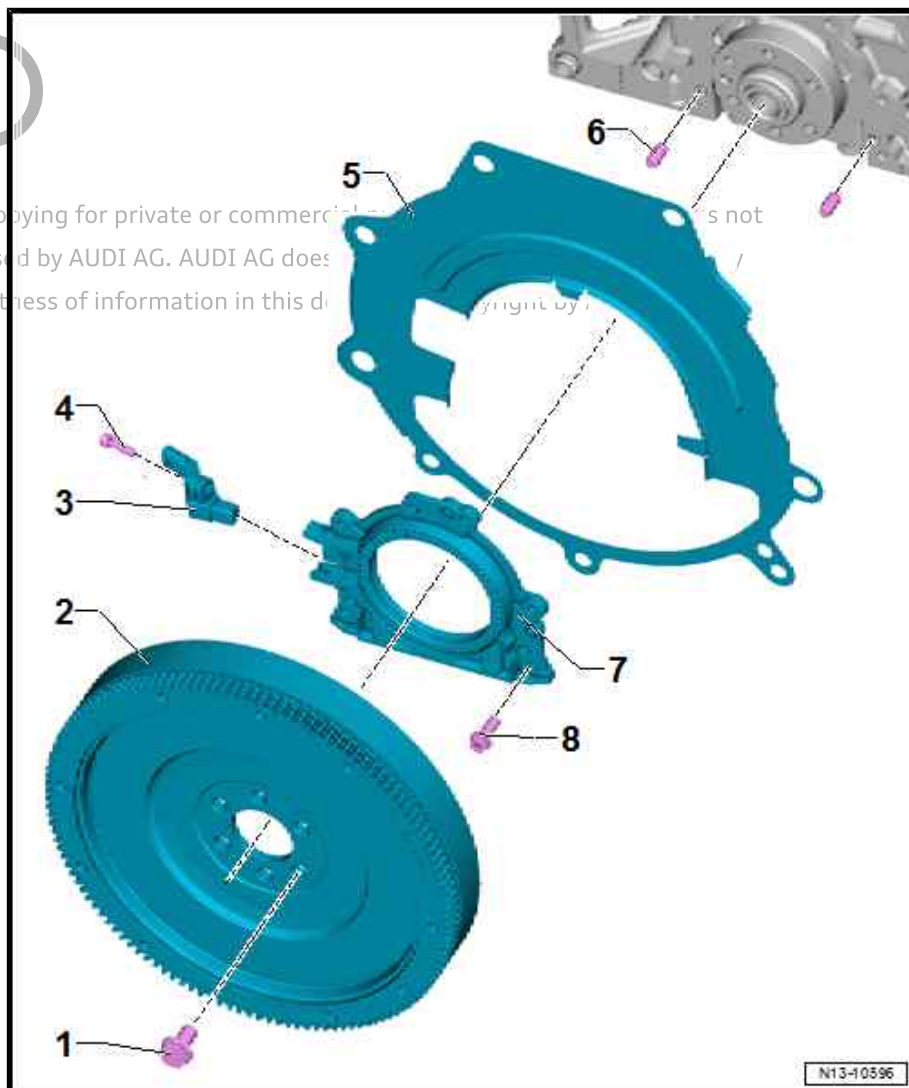
- ☐ 2x

7 - Sealing flange (gearbox end)

- ☐ Only renew together with seal and sender wheel
- ☐ Do not take sender wheel out of sealing flange or rotate it out of position
- ☐ Renewing ⇒ [page 65](#)

8 - Bolt

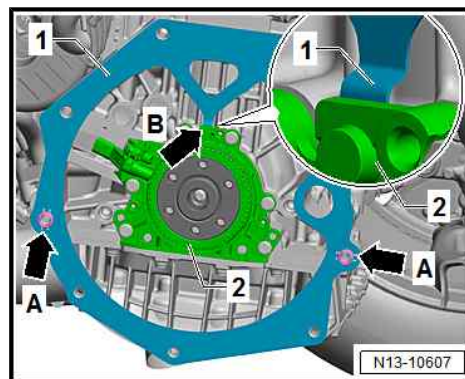
- ☐ Tightening torque and sequence ⇒ [page 64](#)





Installing intermediate plate

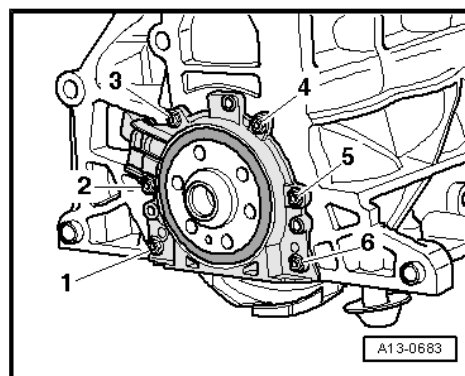
- Engage intermediate plate -1- on sealing flange -2- -arrow B- and push onto dowel sleeves -arrows A-.



Sealing flange (gearbox end) - tightening torque and sequence

- Tighten bolts in stages in the sequence shown:

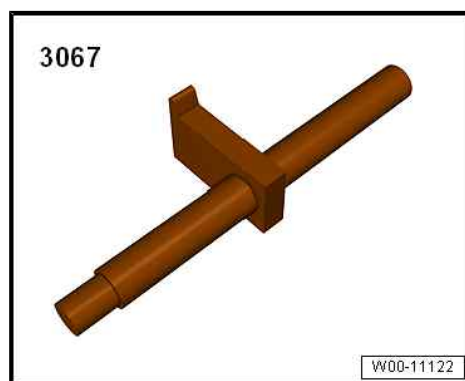
Stage	Bolts	Tightening torque
1.	-1 ... 6-	Screw in by hand until contact is made
2.	-1 ... 6-	Tighten in stages and in diagonal sequence; final torque 13 Nm



2.2 Removing and installing flywheel

Special tools and workshop equipment required

- Counterhold tool - 3067-



Removing

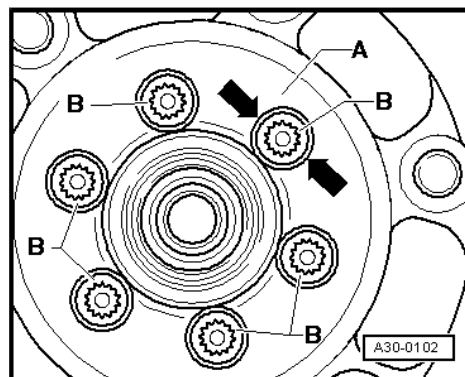
- Gearbox removed ⇒ Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox



Caution

Risk of serious damage to flywheel.

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



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- Insert counterhold tool - 3067- in hole on cylinder block -item B-, slacken bolts for flywheel.
- Remove bolts and take off flywheel.

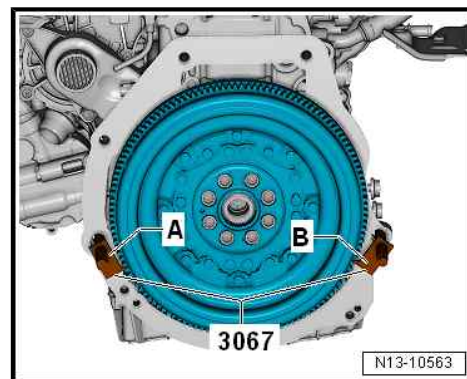
Installing

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



Note

After removing, renew bolts tightened with specified tightening angle.



Caution

On vehicles with a dual clutch gearbox, the splines for the dual clutch in the flywheel must be pre-tensioned and locked in place. When the engine is started for the first time, this pre-tension is released; this in turn jams the splines between the flywheel and the dual clutch ➔ [page 65](#) .

- Insert counterhold tool - 3067- into hole -A- in cylinder block on opposite side.

Tightening torques

- ◆ ➔ [“2.1 Exploded view - cylinder block \(gearbox end\)”, page 63](#)

2.2.1 Pre-tensioning splines in flywheel - vehicles with dual clutch gearbox

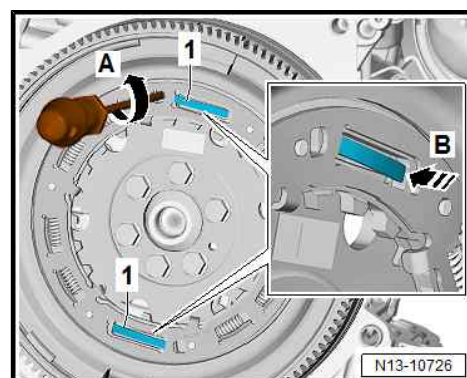


Note

On vehicles with a dual clutch gearbox, the splines for the dual clutch in the flywheel must be pre-tensioned and locked in place. When the engine is started for the first time, this pre-tension is released; this in turn jams the splines between the flywheel and the dual clutch.

- Apply screwdriver (size 2; blade width 6.5 mm) in opening and turn it 90° in direction of -arrow A- until locking tab -1- is positioned freely above opening.
- Using a suitable tool, press locking tab inwards in direction of -arrow B- and release screwdriver again.
- Repeat procedure for second locking tab.

The splines in the flywheel are now pre-tensioned in readiness for the gearbox to be installed.



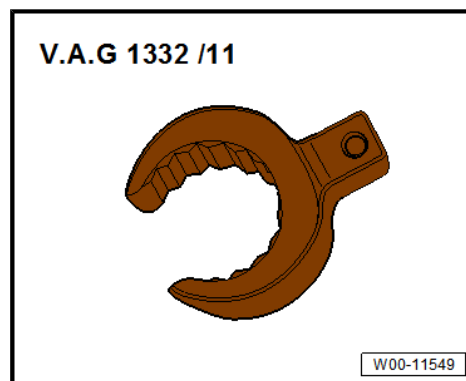
2.3 Removing and installing sealing flange (gearbox end)

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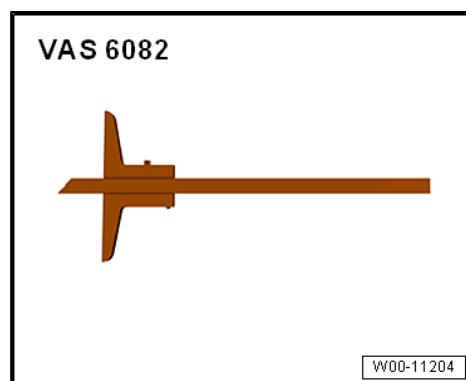
Special tools and workshop equipment required



- ◆ Open end spanner insert, AF 24 - V.A.G 1332/11-



- ◆ Depth gauge - VAS 6082-



- ◆ Assembly tool - T10134-



- ◆ Bolt, M6x35 (3x)

- ◆ Bolt, M7x35 (2x)

Pressing out sealing flange with sender wheel

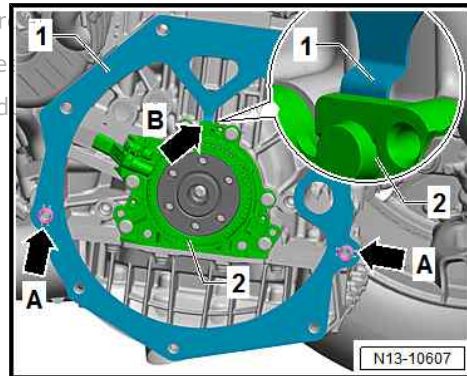
- Gearbox removed ➔ Rep. gr. 34; Removing and installing gearbox; Removing gearbox
- Remove flywheel ➔ [page 64](#) .



Note

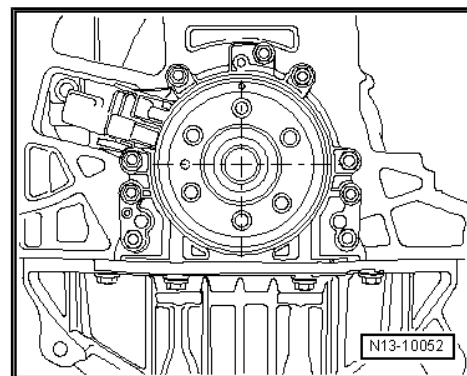
For clarity, the engine is removed in the following illustrations.

- 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-.

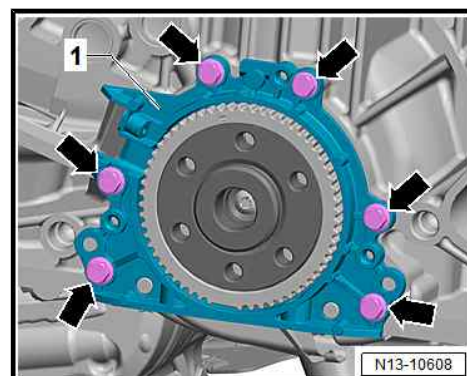




- Rotate crankshaft by turning bolt for toothed belt sprocket until crankshaft is positioned at "TDC", as shown in illustration.
- Remove sump (top section) ➔ [page 146](#) .
- Remove engine speed sender - G28- ➔ [page 328](#) .



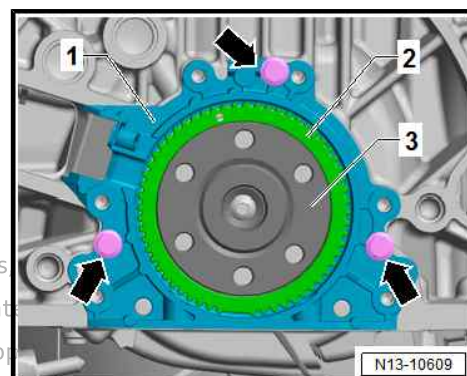
- Remove bolts -arrows- for sealing flange -1-.



Note

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.

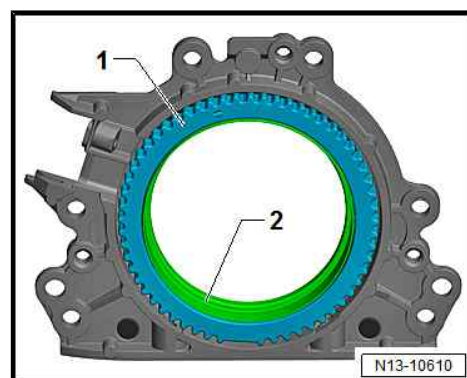


Pressing in sealing flange with sender wheel



Note

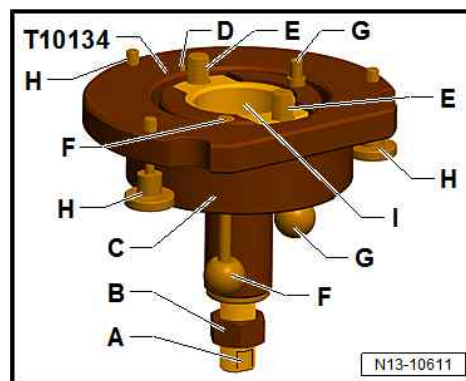
- ◆ *The sealing flange with PTFE oil seal is fitted with a sealing lip support ring -2-. This support ring acts as an assembly sleeve and must not be removed before installation.*
- ◆ *Sealing flange and sender wheel -1- must not be separated or rotated out of position after removal from packaging.*
- ◆ *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.*





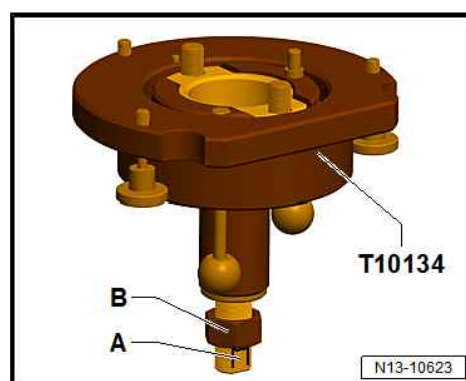
Construction of assembly tool - T10134- :

- 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)
- I - Inner section

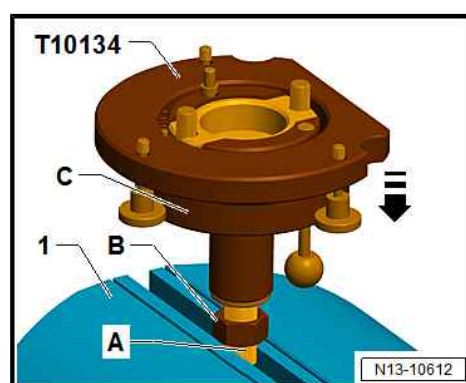


Fitting sealing flange with sender wheel onto assembly tool - T10134- :

- 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.

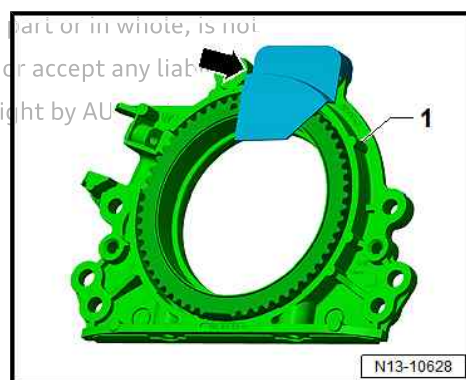


- If fitted, remove securing clip -arrow- from new sealing flange -1-.



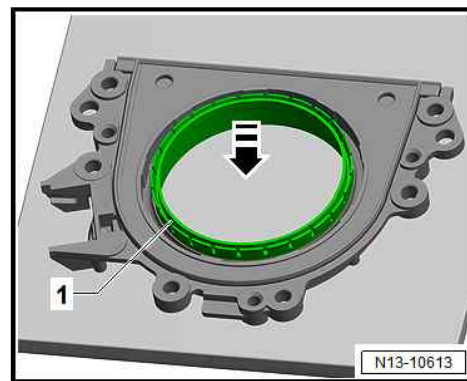
Note

Do not take the sender wheel out of the sealing flange or rotate it out of position.

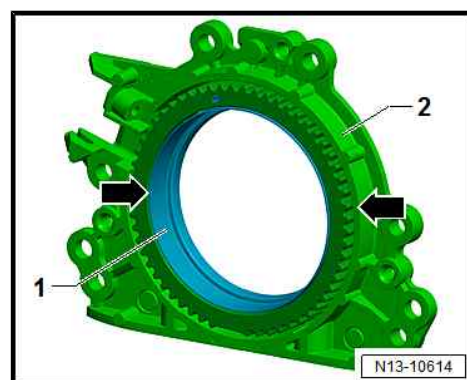




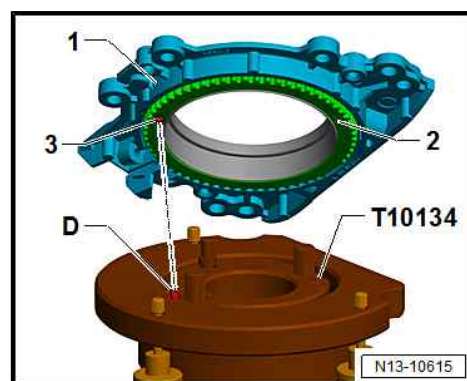
- Place sealing flange (with front side downwards) on a clean flat surface.
- Press sealing lip support ring -1- downwards in direction of -arrow- until it touches flat surface.



- 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.



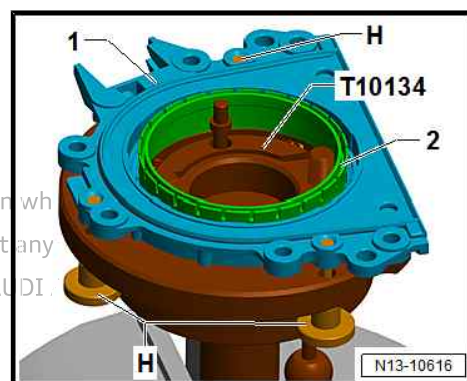
- Screw 2 knurled screws -H- of the correct size into sealing flange -1-.



Note

On the 3-cylinder engine, it is not possible to screw all three knurled screws -H- into the sealing flange. Screwing in two knurled screws is sufficient to fix the sealing flange in place.

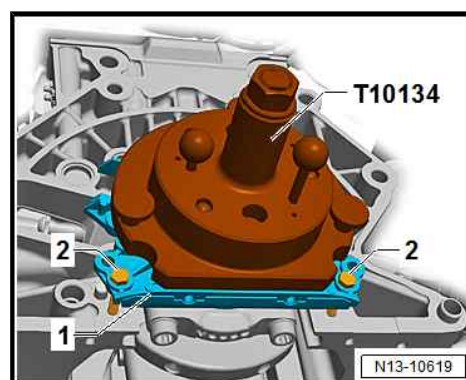
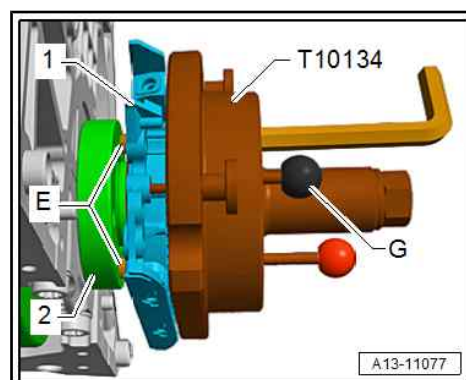
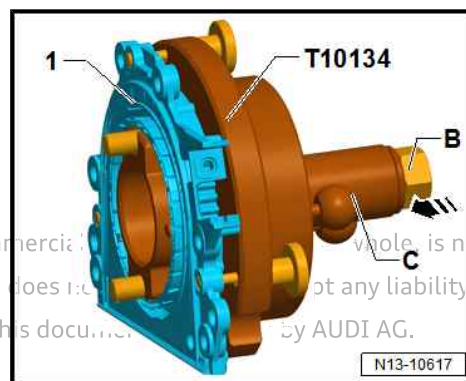
- When tightening, press sealing flange and sealing lip support ring -2- against surface of assembly tool -T10134- .
- This prevents locating pin from sliding out of hole in sender wheel.
- Ensure that sender wheel remains fixed on assembly tool when installing sealing flange.





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 diesel engines (black handle) -G- into crankshaft flange.
- Screw 2 bolts M6x35 -item 2- into cylinder block to guide sealing flange -1-.



Securing assembly tool - T10134- on crankshaft flange:

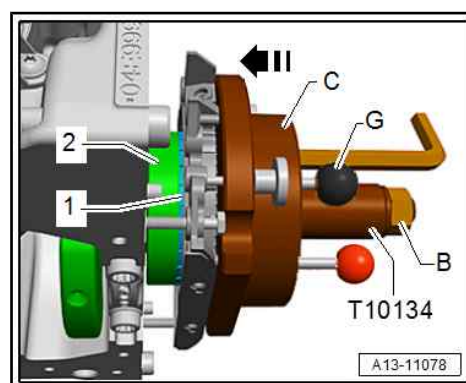
- Press assembly housing -C- by hand in direction of -arrow- until sealing lip support ring -1- touches surface of crankshaft flange -2-.
- Check that guide pin for diesel engines (black handle) -G- is fitted correctly in hole in crankshaft. This ensures that sender wheel reaches its final installation position.



Note

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

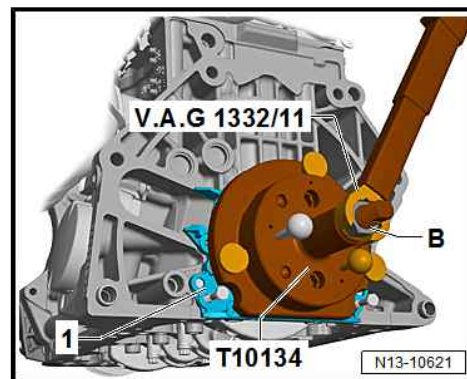
- Tighten the two hexagon socket head bolts on assembly tool hand-tight.
- Screw nut -B- onto threaded spindle by hand until it touches assembly housing -C-.





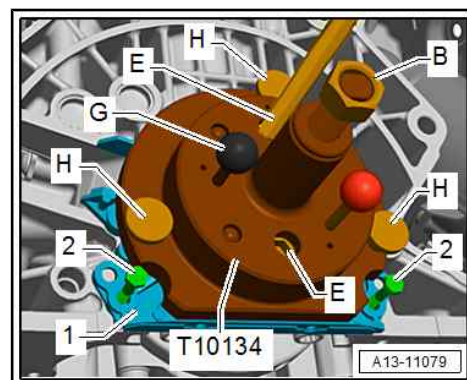
Pressing sender wheel onto crankshaft flange with assembly tool - T10134- :

- 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:

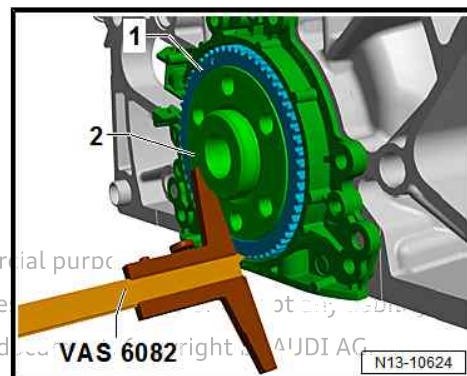
- Screw nut -B- to end of threaded spindle.
- Remove both bolts -2- from cylinder block.
- Unscrew knurled screws -H- from sealing flange -1-.
- Unbolt assembly tool - T10134- from crankshaft flange (remove hexagon socket head bolts -E- from crankshaft flange).
- Detach sealing lip support ring.



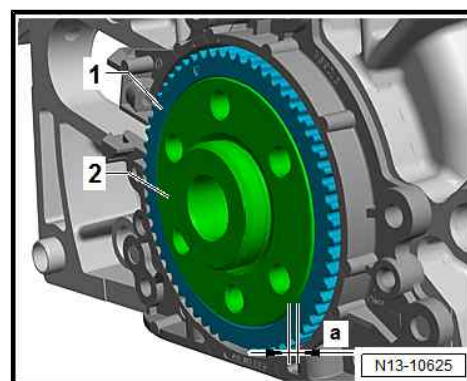
- Apply depth gauge - VAS 6082- to crankshaft flange -2-.



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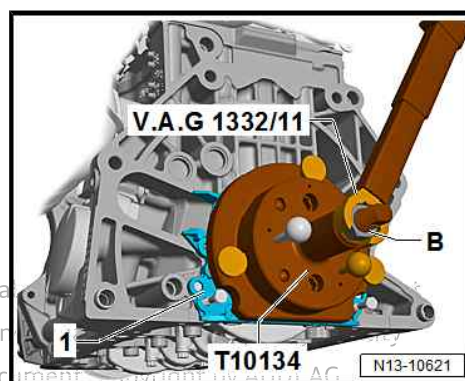
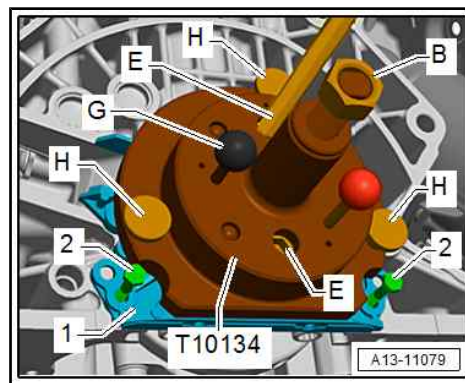
- Measure distance -a- between crankshaft flange -2- and sender wheel -1-.
- Specification: Distance -a- = 0.5 mm.
- Press sender wheel in further if measurement is too small
⇒ [page 72](#) .
- If reading matches specification, continue with assembly
⇒ [page 72](#) .





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 diesel engines (black handle) -G- 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 71](#) .
- Tighten nut on assembly tool - T10134- to 45 Nm if measurement is too small.
- Check installation position of sender wheel on crankshaft again ⇒ [page 71](#) .



Assembling: Protected by copyright. Copying for private or commercial

Assembly is performed in reverse sequence, note the following:

- Install sump (upper section) ⇒ [page 146](#) .
- Install intermediate plate ⇒ [page 64](#) .
- Install flywheel ⇒ [page 64](#) .

Tightening torques

- ♦ ⇒ [Fig. "Sealing flange \(gearbox end\) - tightening torque and sequence", page 64](#)
- ♦ ⇒ ["1.1 Exploded view - glow plug system", page 323](#)



3 Crankshaft

⇒ [“3.1 Exploded view - crankshaft”, page 73](#)

⇒ [“3.2 Crankshaft dimensions”, page 74](#)

⇒ [“3.3 Measuring axial clearance of crankshaft”, page 74](#)

⇒ [“3.4 Renewing needle bearing in crankshaft”, page 75](#)

3.1 Exploded view - crankshaft

1 - Drive chain sprocket

- ☐ For oil pump
- ☐ Not available as separate replacement part

2 - Crankshaft

- ☐ There should be no needle bearing fitted in the crankshaft on vehicles with manual gearbox; remove needle bearing if necessary
⇒ [page 75](#)
- ☐ A needle bearing must be fitted in the crankshaft on vehicles with dual-clutch gearbox; install needle bearing if not yet fitted
⇒ [page 75](#)
- ☐ Measuring axial clearance ⇒ [page 74](#)
- ☐ Check radial clearance with Plastigauge
- ☐ Radial clearance when new: 0.03 ... 0.08 mm; wear limit 0.17 mm
- ☐ Do not rotate the crankshaft when checking the radial clearance
- ☐ Crankshaft dimensions
⇒ [page 74](#)

3 - Bearing shell

- ☐ For bearing cap (without oil groove)
- ☐ Renew used bearing shells

4 - Bearing caps

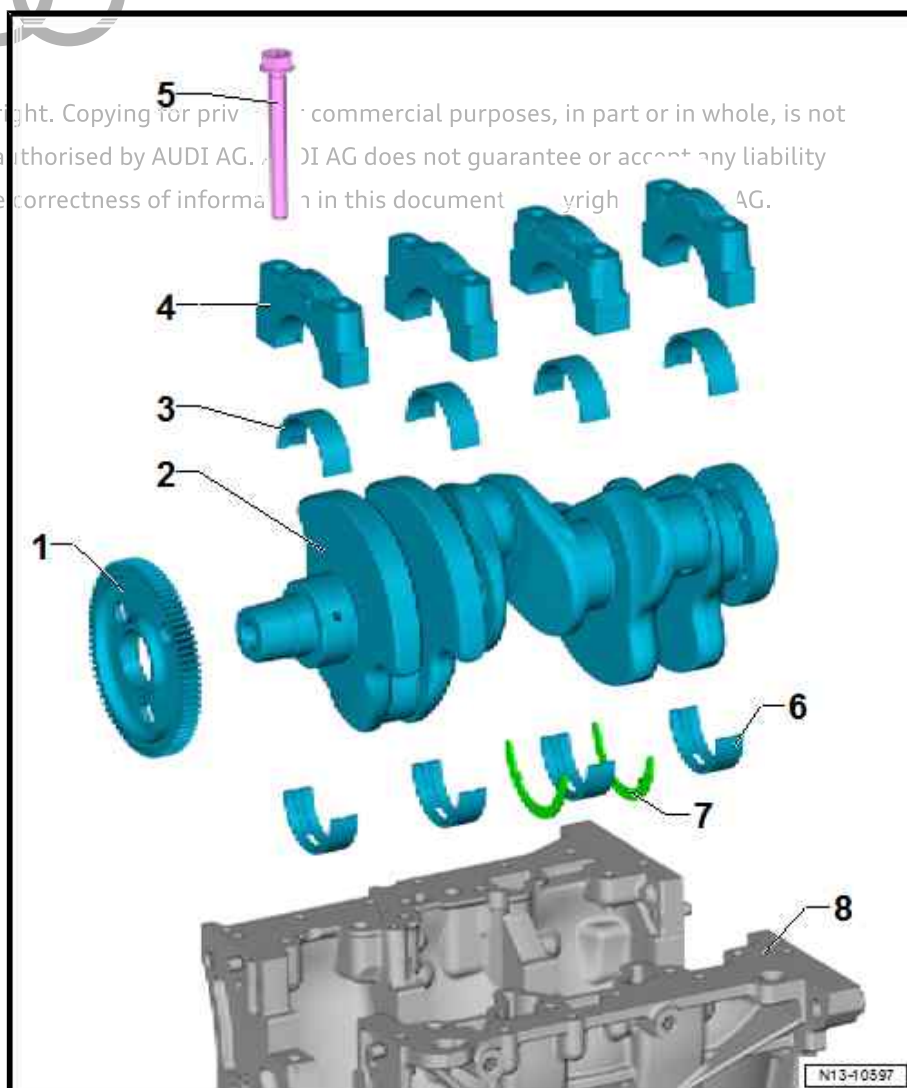
- ☐ Bearing cap 1: Pulley end
- ☐ Installation position: retaining lugs on bearing shells in cylinder block and bearing caps must be on the same side

5 - Bolt

- ☐ Renew after removing
- ☐ Use old bolts when measuring radial clearance
- ☐ 50 Nm +90°

6 - Bearing shell

- ☐ For cylinder block (with oil groove)





- ☐ Renew used bearing shells

7 - Thrust washer

- ☐ For bearing No. 3
- ☐ Only for cylinder block
- ☐ Note location

8 - Cylinder block

3.2 Crankshaft dimensions

Honing dimension	Main bearing journal Ø mm	Conrod journal Ø mm
Basic dimension	54.00 -0.022 -0.042	47.80 -0.022 -0.042

3.3 Measuring axial clearance of crankshaft

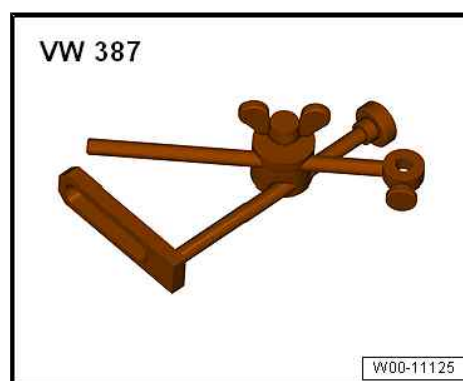
Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-

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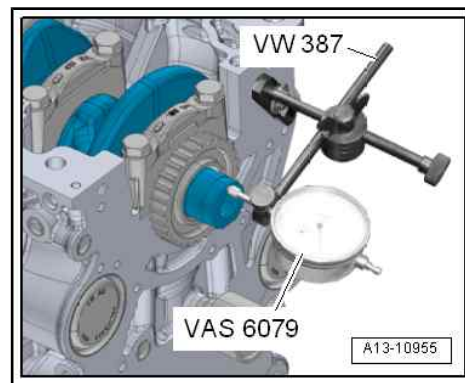


Procedure

- Bolt dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- onto cylinder block (as shown in illustration) and set it against crankshaft.
- Press crankshaft against dial gauge by hand.
- Set dial gauge to "0".
- Push crankshaft away from dial gauge and read off value.

Axial clearance:

- New: 0.07 ... 0.17 mm
- Wear limit: 0.37 mm



3.4 Renewing needle bearing in crankshaft

Only fitted on vehicles with dual clutch gearbox

Special tools and workshop equipment required

- ◆ Pin - VW 207 C-



- ◆ Internal puller - VAS 251 635-



- ◆ Counter-support - VAS 251 621-





Note:

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 .

The needle bearing must always be renewed if the engine is separated from the gearbox.

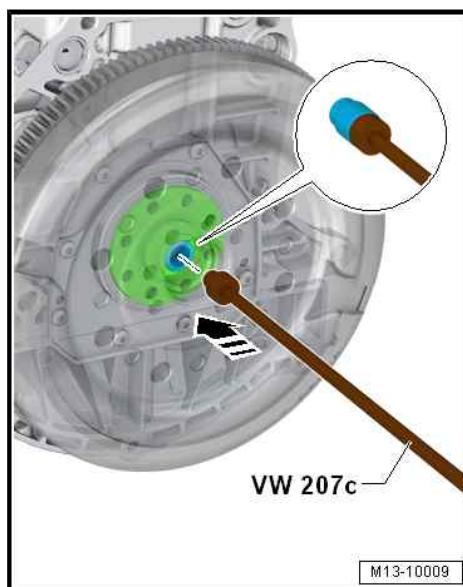
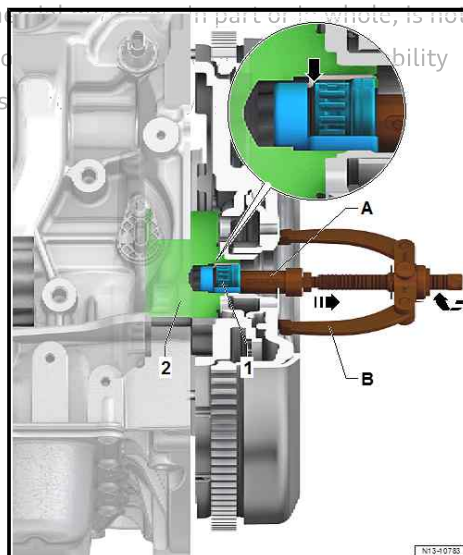
Extracting needle bearing

- Remove needle bearing -1- from crankshaft -2- using internal puller - VAS 251 635 -A- and counter-support -VAS 251 621 -B-.
- Internal puller must be positioned behind needle roller -arrow-.

Installing

- The lettering on the needle bearing must be visible when installed.
- Clean bearing seat in crankshaft and grease lightly.

- Drive in with drift - VW 207 C- or centring mandrel - 3176- .

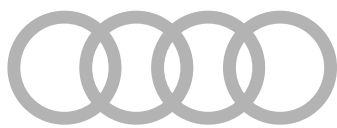




Installation depth: dimension -a- = 2.0 mm

Note:

Renew needle bearing if you drive it in too far (needle bearing is damaged when it is pulled out again).



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4 Pistons and conrods

⇒ ["4.1 Exploded view - pistons and conrods", page 78](#)

⇒ ["4.2 Removing and installing pistons", page 80](#)

⇒ ["4.3 Measuring piston projection at TDC", page 82](#)

⇒ ["4.4 Checking pistons and cylinder bores", page 83](#)

⇒ ["4.5 Checking radial clearance of conrod bearings", page 84](#)

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4.1 Exploded view - pistons and conrods



Note

Oil spray jet and pressure relief valve ⇒ [page 80](#)

1 - Bolts

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

2 - Conrod bearing cap

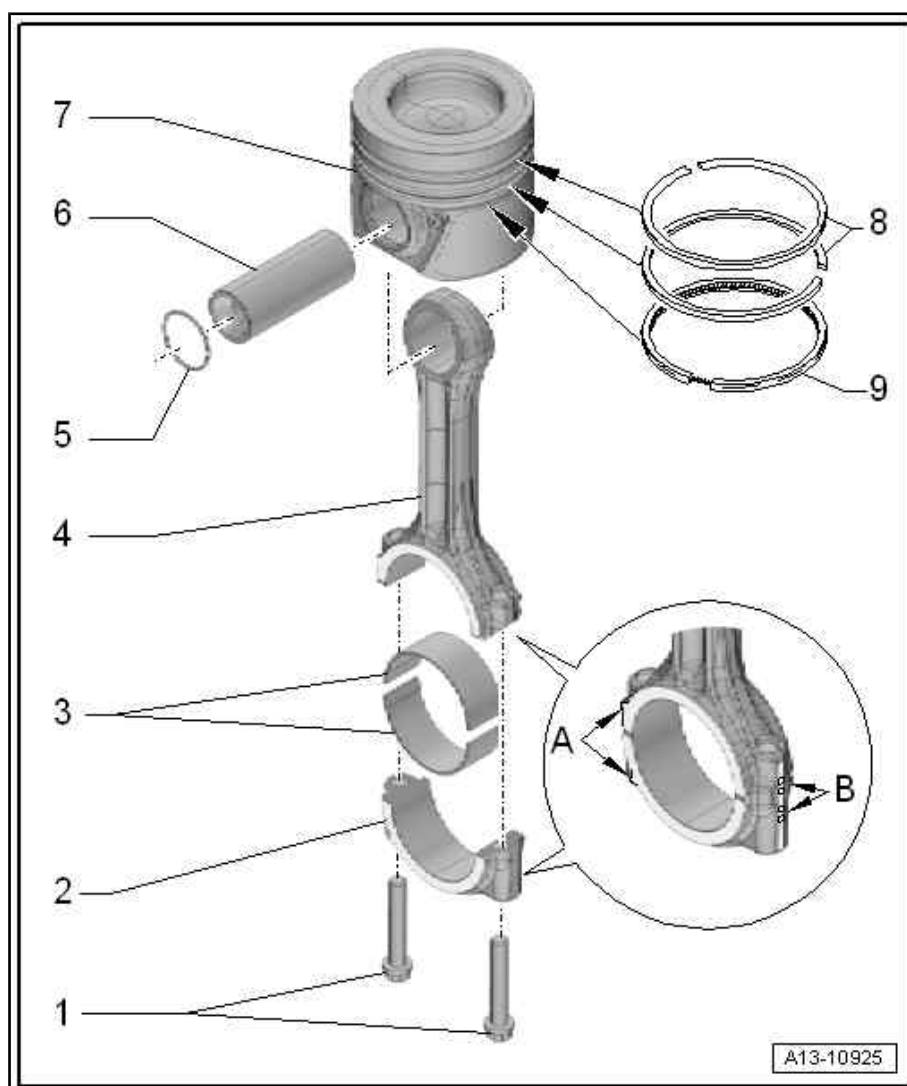
- ☐ Note installation position
- ☐ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ☐ Mark conrod and cylinder allocation with paint -B-
- ☐ Installation position: The two markings -A- face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

3 - Bearing shells

- ☐ Installation position ⇒ [page 80](#)
- ☐ Renew used bearing shells
- ☐ Note version: Upper bearing shell (closest to piston) is constructed from a more wear-resistant material; refer to ⇒ Electronic parts catalogue
- ☐ Check that it is securely seated

4 - Conrod

- ☐ With industrially cracked conrod bearing cap
- ☐ Only renew as a complete set





- ☐ Mark conrod bearing cap and cylinder allocation with paint -B-
- ☐ Axial clearance: wear limit: 0.37 mm
- ☐ Measuring radial clearance ⇒ [page 84](#)
- ☐ Separating parts of new conrod ⇒ [page 80](#)
- ☐ Installation position: The two markings -A- face towards pulley end

5 - Circlip

- ☐ 2x
- ☐ Renew after removing

6 - Piston pin

- ☐ Removing and installing ⇒ [“4.2 Removing and installing pistons”, page 80](#)

7 - Piston

- ☐ With combustion chamber
- ☐ Renew piston if cracking is visible on piston crown or piston skirt
- ☐ Mark installation position and cylinder number ⇒ [page 79](#)
- ☐ Removing and installing ⇒ [page 80](#)
- ☐ Checking pistons and cylinder bores ⇒ [page 83](#)
- ☐ Measuring piston projection at “TDC” ⇒ [page 82](#)

8 - Compression rings

- ☐ Measuring ring gap ⇒ [page 84](#)
- ☐ Measuring ring-to-groove clearance ⇒ [page 84](#)
- ☐ 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 - Oil scraper ring

- ☐ Measuring ring gap ⇒ [page 84](#)
- ☐ Measuring ring-to-groove clearance ⇒ [page 84](#)
- ☐ 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

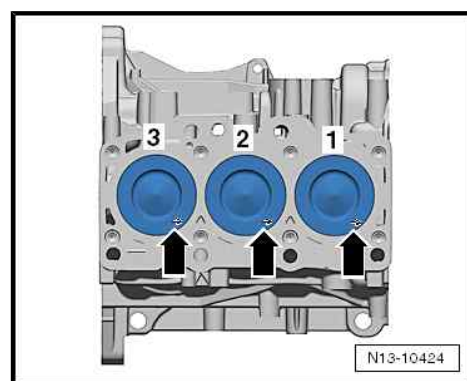


Caution

Risk of damage to piston crown.

- ◆ ***If you intend to re-install used pistons, mark the cylinder number on the piston crown using paint. Do not attempt to mark the piston crown with a centre punch or by making a scratch, notch or similar.***

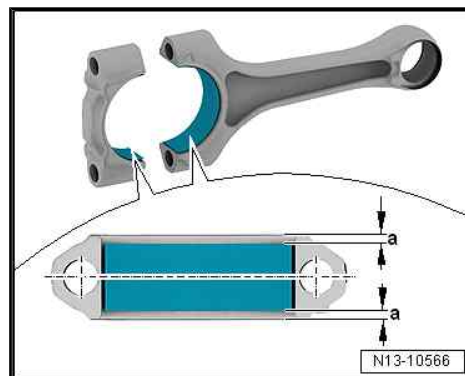
- Arrow on piston crown points to pulley end -arrows-.





Installation position of bearing shells in conrods

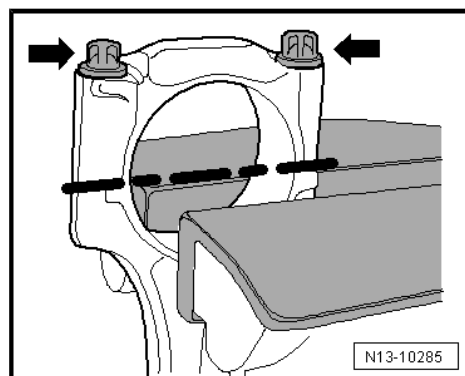
- Insert bearing shells centrally in conrod and conrod bearing cap.
- Dimension -a- = 2.5 mm



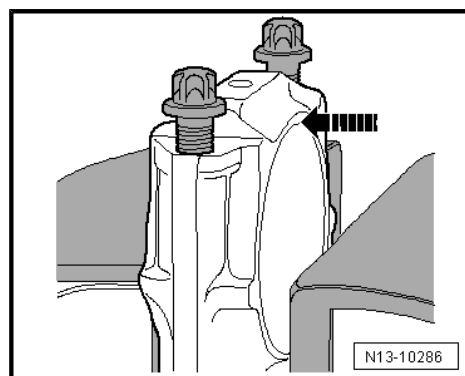
Separating parts of new conrod

On new conrods, the rod and the bearing cap may be very firmly attached to one another. If it is not possible to take off the conrod bearing cap by hand, proceed as follows:

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

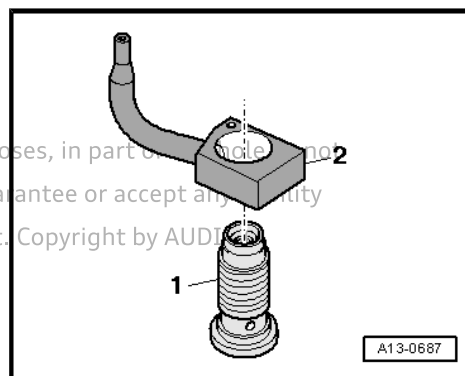


- Using a plastic hammer, carefully knock conrod bearing cap loose -arrow-.



Oil spray jet and pressure relief valve

- 1 - Bolt with pressure relief valve, 24 Nm
 - 2 - Oil spray jet (for cooling of pistons)
- Installation position: align locating edge of oil spray jet with machined surface of cylinder block.



Caution

Risk of damage to oil spray jets.

- ◆ *Do not bend oil spray jets.*
- ◆ *Check that oil spray jets have adequate clearance after re-installing pistons.*
- ◆ *Always renew bent oil spray jets.*

4.2 Removing and installing pistons

Special tools and workshop equipment required



◆ Pin - VW222A-



◆ Piston ring clamp, commercially available

Removing

- Engine secured to engine and gearbox support ⇒ [page 25](#) .
- Remove cylinder head ⇒ [page 118](#) .
- Remove oil pump ⇒ [page 144](#) .
- Mark installation position and matching of conrod bearing caps to cylinder and to conrods for re-installation ⇒ [Item 2 \(page 78\)](#) .
- Unbolt conrod bearing caps.
- Pull out pistons upwards with conrods.



Note

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

- Take circlip out of piston pin boss.
- Use drift - VW222A- to drive out piston pin.

Installing

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



Note

Renew bolts tightened with specified tightening angle.

- Oil running surfaces of bearing shells.
- Install pistons using piston ring clamp.

Installation position:

- **Pistons** ⇒ [page 79](#)
- **Bearing shells in conrods** ⇒ [page 80](#)
- Install conrod bearing caps according to markings.
- Install oil pump ⇒ [page 144](#) .
- Install cylinder head ⇒ [page 118](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - pistons and conrods”, page 78](#)



4.3 Measuring piston projection at TDC

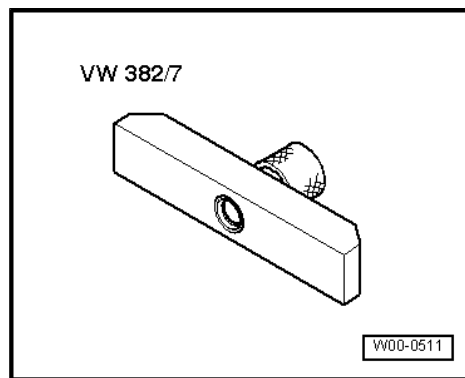


Note

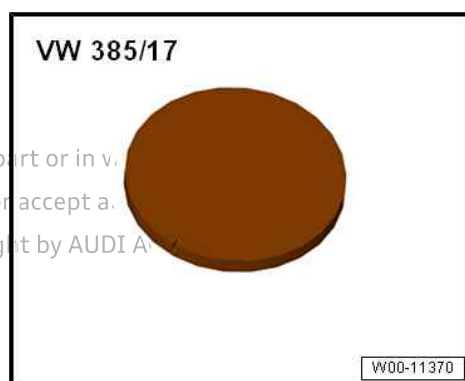
Measure piston projection at "TDC" when installing new pistons or a short engine.

Special tools and workshop equipment required

- ◆ Measuring bridge - VW 382/7-



- ◆ Measuring plate - VW 385/17- from universal measuring tool - VW 385-



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- ◆ Dial gauge - VAS 6079-

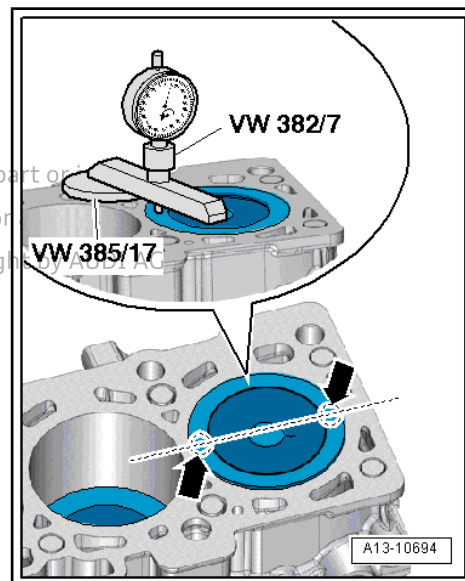




Procedure

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

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



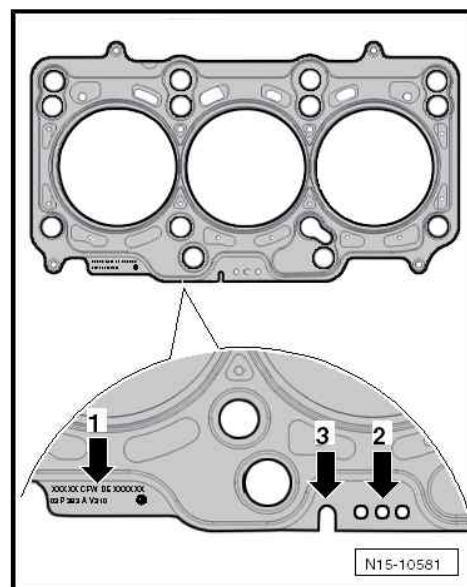
Identification of cylinder head gasket

- Part number
- Ignore
- Holes



Note

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



4.4 Checking pistons and cylinder bores

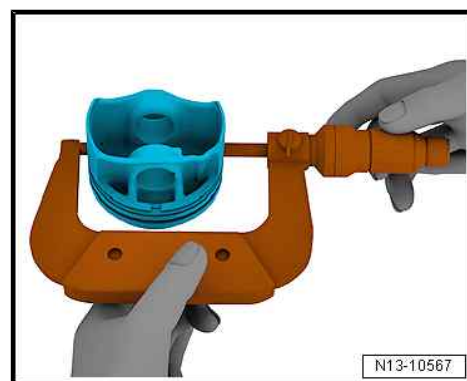
Checking piston

- Using a micrometer (75 ... 100 mm), measure approx. 15 mm from the lower edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.



Note

- Check for wear on piston skirt coating and for any carbon deposits.
- Renew piston if cracking is visible on piston skirt.



Piston Ø mm	
Nominal dimension	79.45 ¹⁾
¹⁾ Dimensions including coating (thickness 0.02 mm). The coating will wear down in service.	



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: 0.10 mm.

Checking cylinder bore



Note

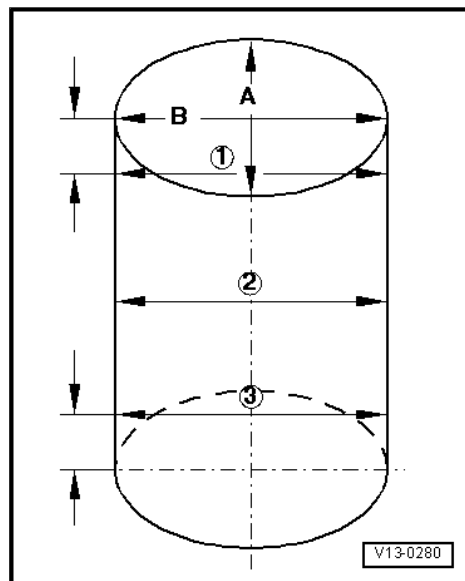
Check cylinder wall for scratches, wear on honing and other abnormalities.

Cylinder bore Ø mm	
Nominal dimension	79.53



Note

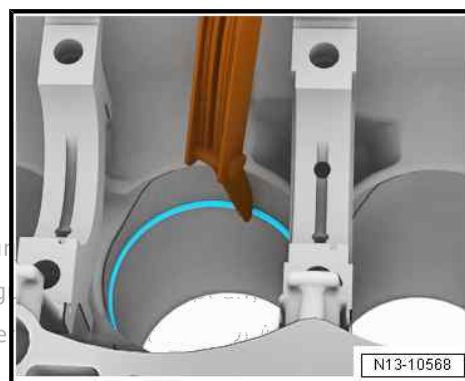
Measuring the cylinder bores must not be done when the cylinder block is mounted to the engine and gearbox support - VAS 6095A- , as incorrect measurements may result.



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
1st compression ring	0.30 ... 0.40	0.55
2nd compression ring	0.20 ... 0.45	0.95
Oil scraper ring	0.20 ... 0.40	0.65



Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
1st compression ring	0.06 ... 0.09	0.08
2nd compression ring	0.05 ... 0.08	0.08
Oil scraper ring	0.03 ... 0.06	0.08



4.5 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 \(page 78\)](#) without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigauge with measurement scale.

Radial clearance:

- Wear limit: 0.08 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 86](#)

⇒ [“1.2 Exploded view - toothed belt”, page 87](#)

⇒ [“1.3 Removing and installing toothed belt cover”, page 88](#)

⇒ [“1.4 Detaching toothed belt from camshaft”, page 90](#)

⇒ [“1.5 Removing and installing toothed belt”, page 97](#)

1.1 Exploded view - toothed belt cover

1 - Bolt

- ☐ 5 Nm

2 - Metering tubes

- ☐ To pressure differential sender - G505-

3 - Toothed belt cover (top)

- ☐ Removing and installing
⇒ [page 88](#)

4 - Bolt

- ☐ With collar
- ☐ Captive in toothed belt cover
- ☐ 12 Nm

5 - Toothed belt cover (bottom)

- ☐ Removing and installing
⇒ [page 89](#)

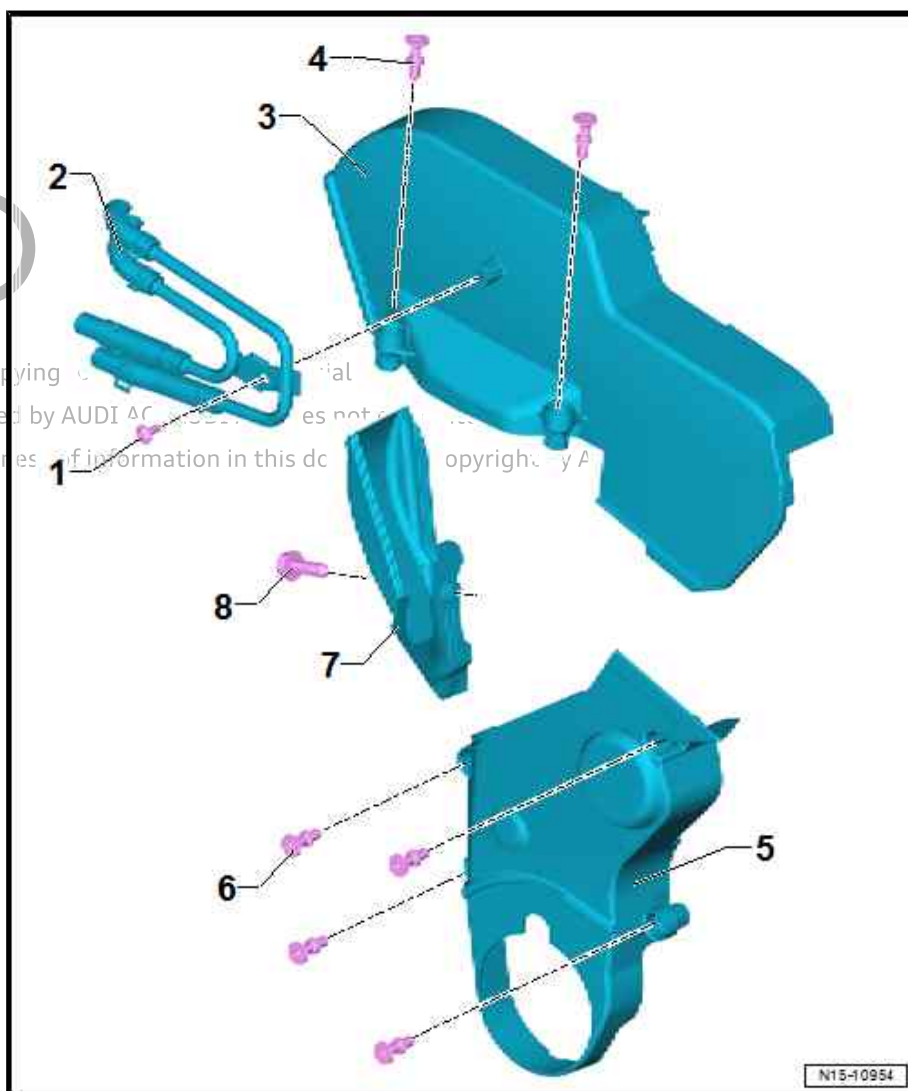
6 - Bolt

- ☐ With collar
- ☐ Captive in toothed belt cover
- ☐ 12 Nm

7 - Toothed belt cover (rear)

8 - Bolt

- ☐ 20 Nm





1.2 Exploded view - toothed belt

1 - Bolt

- ☐ Renew after removing
- ☐ Slacken and tighten with counterhold tool - 3415-
- ☐ Do not additionally oil threads and shoulder
- ☐ 180 Nm + 135° (can be turned in two stages to reach specified angle, e.g. 90° + 45°)

2 - Crankshaft sprocket

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

3 - Nut

- ☐ Renew after removing
- ☐ 20 Nm + 45°

4 - Tensioning roller

5 - Stud

- ☐ 15 Nm

6 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Check for wear
- ☐ Removing from camshafts ⇒ [page 90](#)
- ☐ Removing ⇒ [page 97](#)
- ☐ Installing (adjusting valve timing) ⇒ [page 101](#)

7 - Bolt

- ☐ Slacken and tighten with counterhold tool - T10172A- and adapters -T10172/11-
- ☐ Do not additionally oil threads and shoulder
- ☐ 100 Nm

8 - Locking bolt

- ☐ 9 Nm

9 - Camshaft sprocket

- ☐ Contact surface between sprocket and camshaft must be free of oil

10 - Locating arm for camshaft

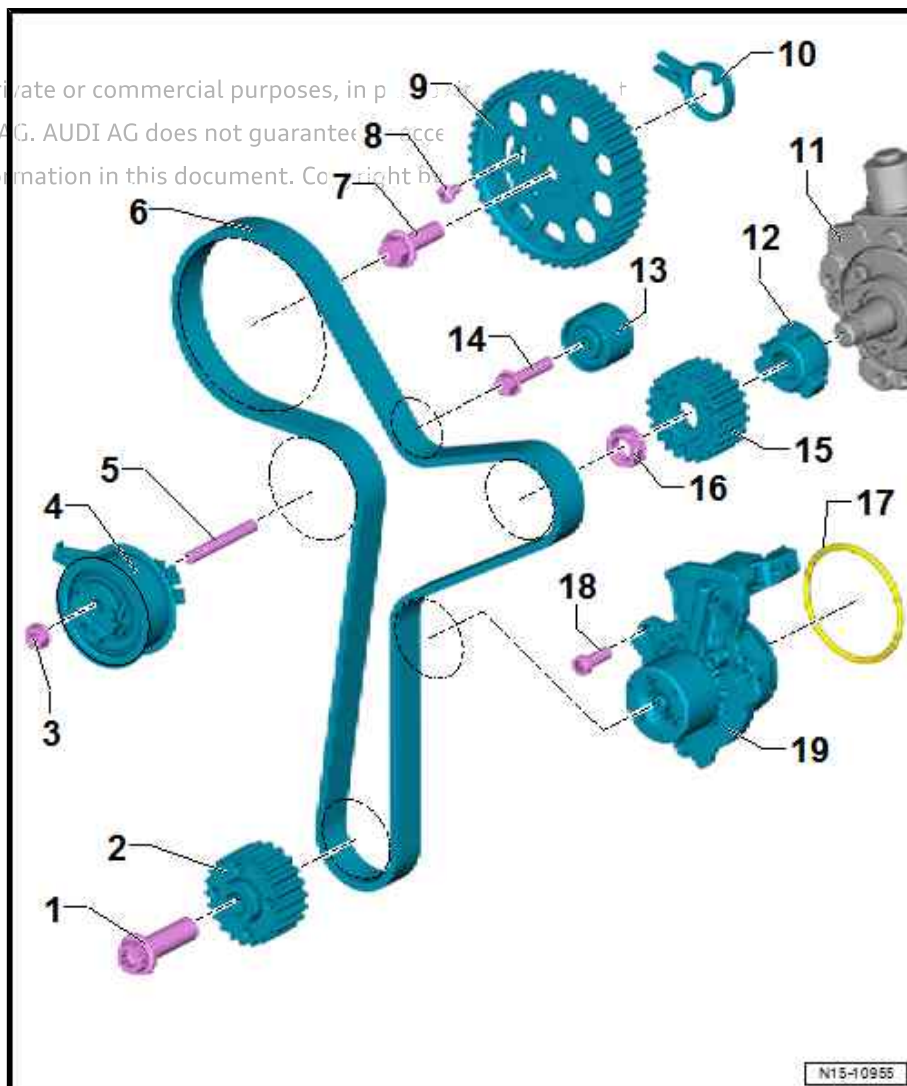
- ☐ Removing and installing ⇒ ["2.5 Removing and installing camshaft housing", page 114](#)

11 - High-pressure pump

- ☐ Exploded view ⇒ [page 266](#)

12 - High-pressure pump hub

- ☐ Exploded view ⇒ [page 266](#)





13 - Idler roller

14 - Bolt

- ❑ 23 Nm

15 - High-pressure pump sprocket

- ❑ Exploded view ⇒ [page 266](#)

16 - Nut

- ❑ Tightening torque ⇒ [Item 2 \(page 266\)](#)

17 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

18 - Bolt

- ❑ Tightening torque ⇒ [Item 5 \(page 174\)](#)

19 - Coolant pump

- ❑ Removing and installing ⇒ [page 181](#)

1.3 Removing and installing toothed belt cover

⇒ ["1.3.1 Removing and installing toothed belt cover \(top\)", page 88](#)

⇒ ["1.3.2 Removing and installing toothed belt cover \(bottom\)", page 89](#)

1.3.1 Removing and installing toothed belt cover (top)

Removing

- Remove engine cover panel ⇒ [page 41](#) .

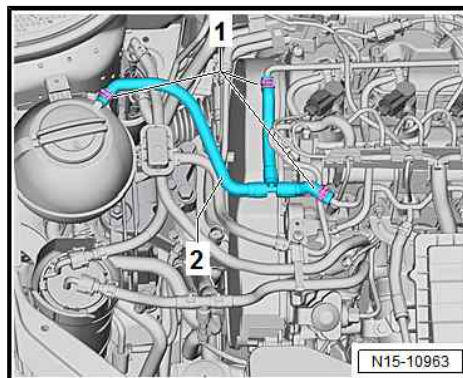


Caution

Risk of damage caused by particles of dirt.

- ◆ *Observe rules for cleanliness when working on the fuel supply system ⇒ [page 6](#) .*

- Open clamps -1-, disconnect ends of coolant hose -2- and remove hose.





- Release clamp -1-, disconnect fuel return line and place it to one side.



- Unscrew bolts -1 and 2- and detach toothed belt cover upwards.

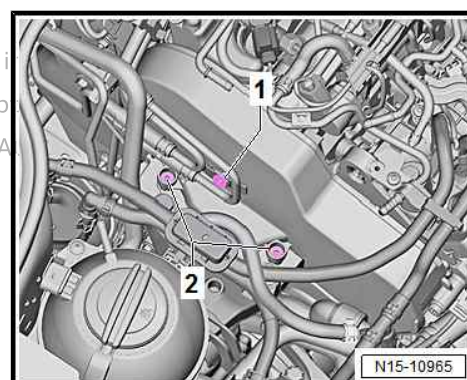
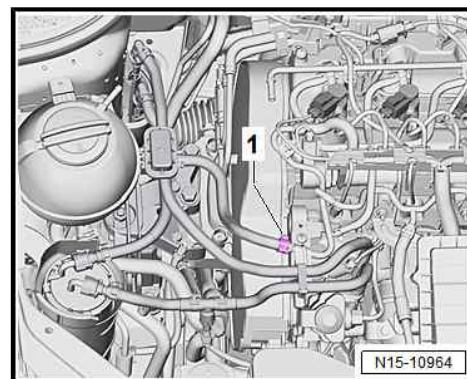
Installing

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

- Install engine cover panel ➔ [page 41](#) .

Tightening torques

- ◆ ➔ [“1.1 Exploded view - toothed belt cover”, page 86](#)



1.3.2 Removing and installing toothed belt cover (bottom)

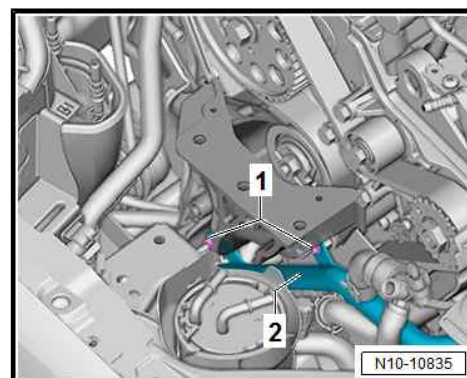
Removing

- Remove vibration damper ➔ [page 49](#) .
- Remove nuts -1-, detach coolant pipe (right-side) -2- from centre hex studs and push to one side.



Note

For illustration purposes, the installation position is shown with the engine mounting removed.



- Remove bolts -arrows- and detach toothed belt cover (bottom) -1-.

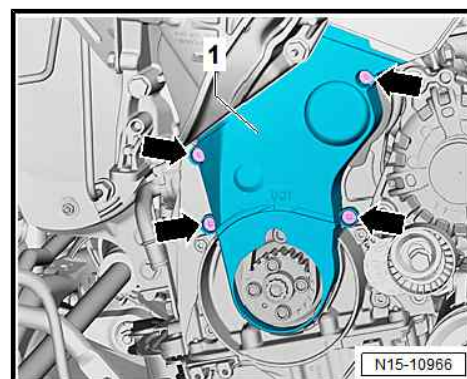
Installing

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

- Install vibration damper ➔ [page 49](#) .

Tightening torques

- ◆ ➔ [“1.1 Exploded view - toothed belt cover”, page 86](#)
- ◆ ➔ [“3.1 Exploded view - coolant pipes”, page 190](#)

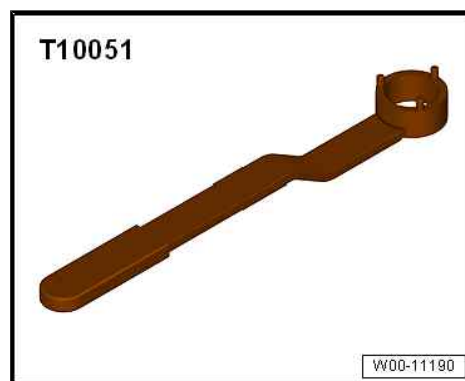




1.4 Detaching toothed belt from camshaft

Special tools and workshop equipment required

- ◆ Counterhold tool - T10051-



- ◆ Counterhold tool - T10172A- with adapters -T10172/11-



- ◆ Offset screwdriver - T10264-



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- ◆ Locking tool - T10265-

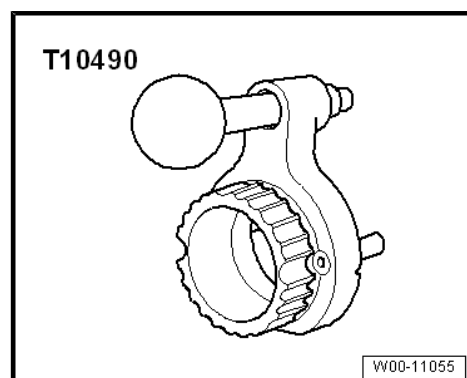




◆ Locking pin - T10492-



◆ Crankshaft stop - T10490-



Removing

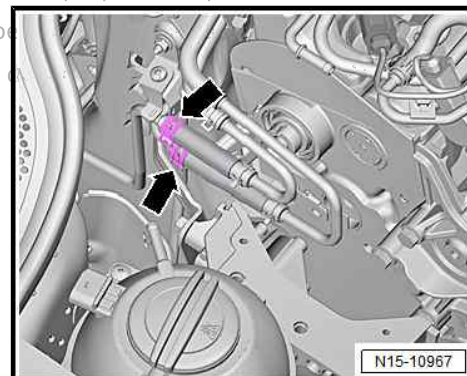
- Remove toothed belt cover (top) ⇒ [page 88](#).
- Release hose clips -arrows-, disconnect hoses from metering tubes of exhaust gas pressure sensors and move to rear.
- Remove vibration damper ⇒ [page 49](#).



Caution

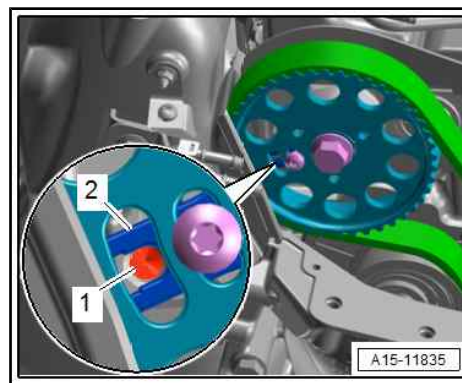
Risk of damage to engine.

- ◆ **Turn the crankshaft only in the direction of normal engine rotation to prevent the toothed belt from slipping.**
- ◆ **The torque applied to loosen or tighten the bolt for the camshaft sprocket and the nut for the high-pressure pump sprocket MUST NOT be transferred to the respective locking pin. This can cause damage to the locating arms, even if counterhold tools are used. This damage may not be visible in some cases, but can cause damage to the engine. When loosening or tightening the central bolt, pull out the locking pin and re-insert it later if necessary.**





- Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at “TDC”.
- Locating arm -2- on hub must align with hole -1- behind it.

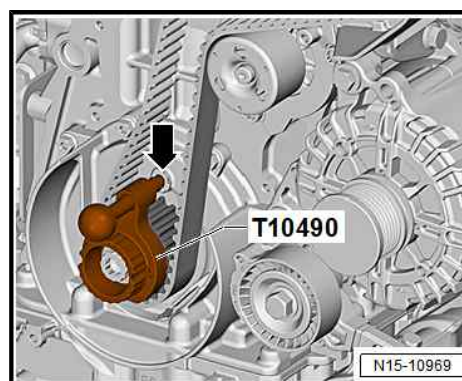


- Lock crankshaft sprocket in position with crankshaft stop - T10490- .
- Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.
- Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.

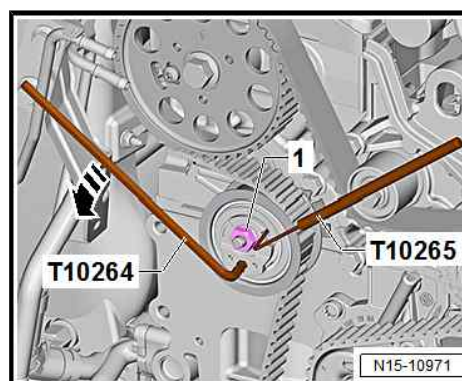


Note

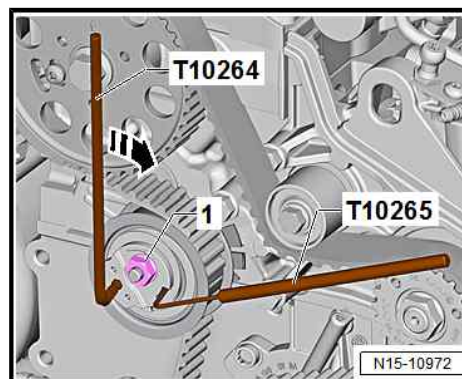
For illustration purposes, the installation position is shown with the toothed belt cover (bottom) removed.



- Slacken nut -1- for tensioning roller.
- Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until tensioning roller can be secured with locking tool - T10265- .



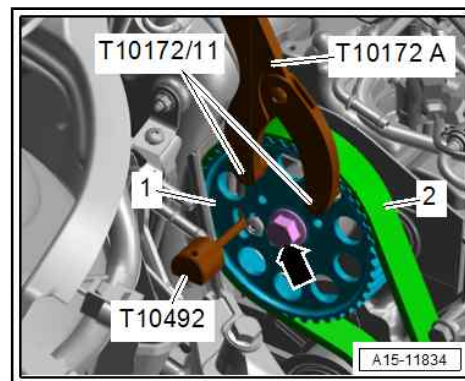
- Then use offset screwdriver - T10264- to turn eccentric adjuster of tensioning roller clockwise -arrow- as far as stop and tighten nut -1- by hand.



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- Loosen bolt -arrow- (use counterhold tool - T10172A- with adapters -T10172/11-).
- Detach camshaft sprocket -1- and push toothed belt -2- slightly towards front.
- Bring camshaft sprocket back into installation position and screw in bolt until it makes contact.
- Lock locating arm on camshaft hub in place using locking pin - T10492- , as outlined in description of continued steps.

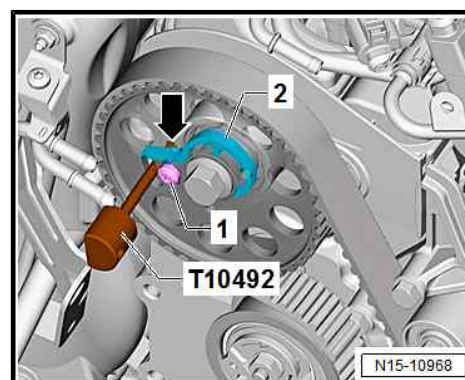


Caution

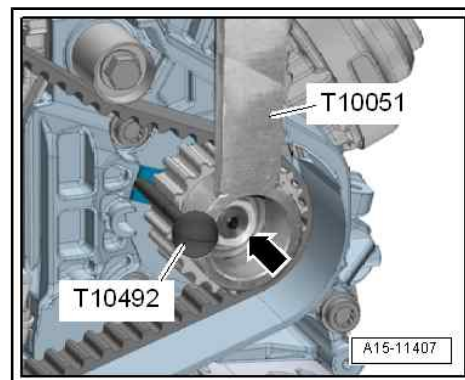
Risk of damage to valves and piston crowns.

- ◆ **The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.**
- ◆ **Do not turn crankshaft when toothed belt is detached with camshafts installed.**

- Insert locking pin - T10492- through locating arm -2- on camshaft hub and into hole -arrow- behind it in cylinder head.
- If necessary, align camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .
- Loosen locking bolt -1- one half turn, but do not remove it.



- Slacken nut -arrow- for toothed belt sprocket of high-pressure pump approx. 90° using counterhold tool - T10051- .
- Lock fork on hub of high-pressure pump in place using locking pin - T10492- , as outlined in description of continued steps.



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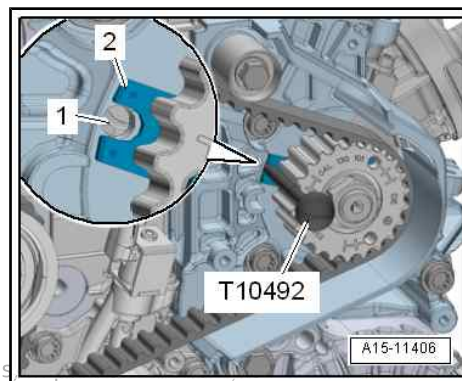
- Insert locking pin - T10492- into fork -2- on hub and into hole -1- behind it in bracket for high-pressure pump.
- To do so, adjust toothed belt sprocket for high-pressure pump using counterhold tool - T10051- .

Installing (adjusting valve timing)



Note

Perform adjustments on toothed belt only when engine is cold.



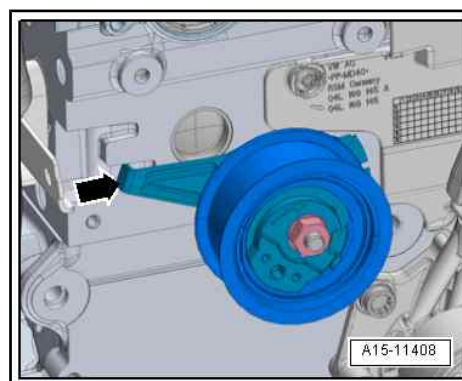
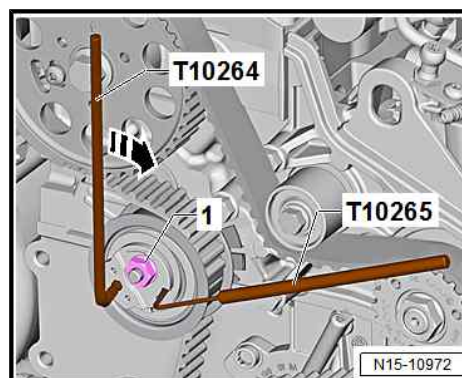
Caution

Risk of damage to valves and piston crowns.

- ♦ *The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.*
- ♦ *Do not turn crankshaft when toothed belt is detached with camshafts installed.*

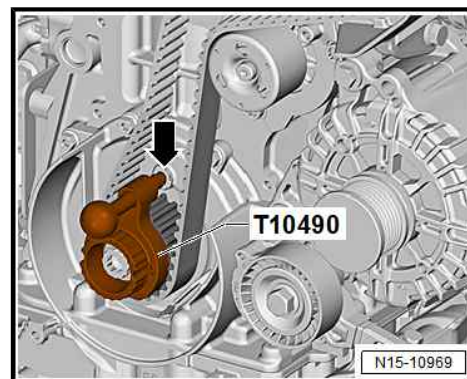
Requirements:

- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut -1-.
- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.

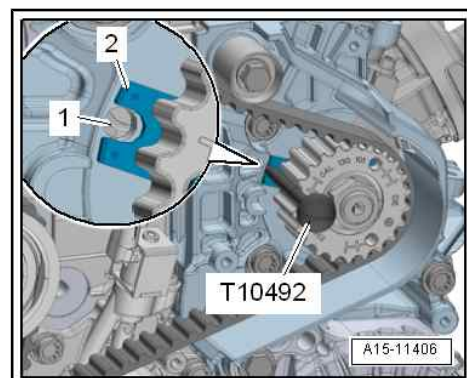




- Crankshaft is locked in position with crankshaft stop - T10490-
-arrow-.



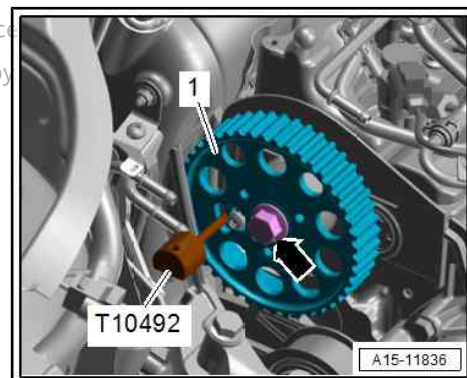
- Hub of high-pressure pump locked in place with locking pin - T10492- .
- Nut for high-pressure pump sprocket screwed on loosely. It should just be possible to easily turn the high-pressure pump sprocket, but there must be no axial movement.



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- Unscrew bolt -arrow- and remove locking pin - T10492-
- Detach camshaft sprocket -1-



- Install toothed belt in the specified sequence:

1 - Tensioning roller

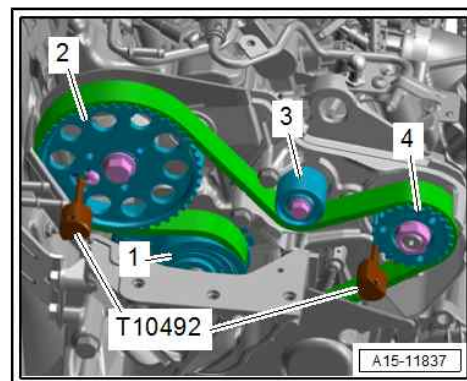
4 - High-pressure pump sprocket

3 - Idler roller

- As a last step, bring camshaft sprocket -2- into installation position with toothed belt fitted and screw in bolt -arrow- loosely.

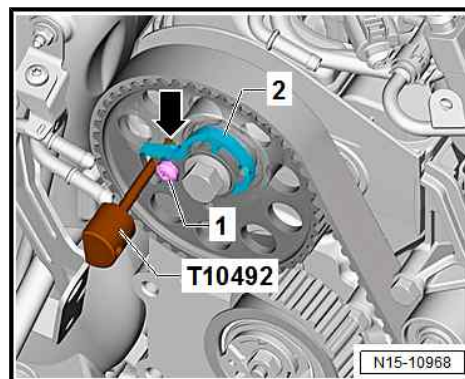
- It should just be possible to turn the sprocket on the camshaft easily without axial movement.

- Lock locating arm on camshaft hub with locking pin - T10492- .





- To do so, insert locking pin - T10492- through locating arm -2- on hub and into hole -arrow- behind it in cylinder head.
- Locking bolt -1- in locating arm must be loosened one half turn and must be positioned at bottom of elongated hole.



- Turn camshaft sprocket -3- by hand as far as stop in direction of -arrow- and hold it in place.
- Locking bolt -1- should now be positioned in approx. the bottom half of elongated hole -2-, as shown in illustration.



Caution

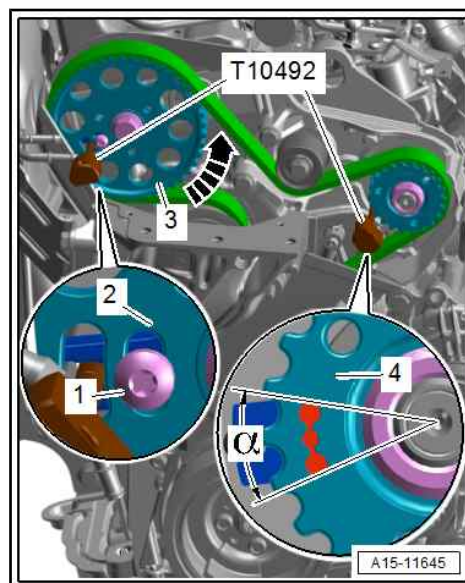
- ◆ **Locking bolt must not come into contact with top or bottom end of elongated hole after toothed belt has been tensioned.**

- At approx. centre of area of rotation - α -, toothed belt sprocket for high-pressure pump -4- should now be aligned with locking pin - T10492- , as shown in illustration.



Caution

- ◆ **Toothed belt sprocket for high-pressure pump must not reach upper or lower end of area of rotation - α - after toothed belt has been tensioned.**



Note

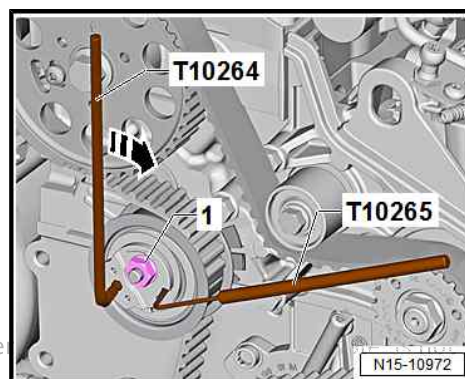
If the installation position of the toothed belt sprockets is not correct, adjust position of toothed belt on sprocket in question.

- Loosen nut -1- for tensioning roller and detach locking tool - T10265- .



Note

- ◆ **Metal lug of tensioning roller must remain engaged in cast recess on cylinder head.**
- ◆ **Disregard -arrow-.**



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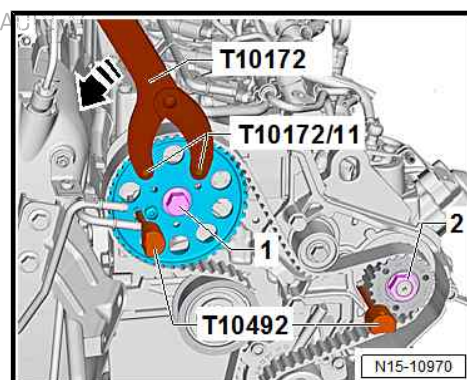
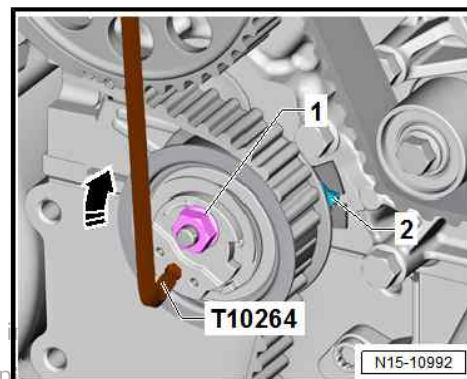
- Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -2- aligns with centre of slot on base plate.
- Nut -1- must not turn.
- Hold tensioning roller in this position and tighten nut.



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- Position counterhold tool -T10172A- with adapters -T10172/11- on camshaft sprocket as shown in illustration.
- Apply force to counterhold tool in anti-clockwise direction -arrow- and maintain tension.
- Tighten bolt -1- for camshaft sprocket and nut -2- for high-pressure pump sprocket to 10 Nm.
- Remove locking pins -T10492- and crankshaft stop - T10490- and check valve timing ➔ [page 105](#) .

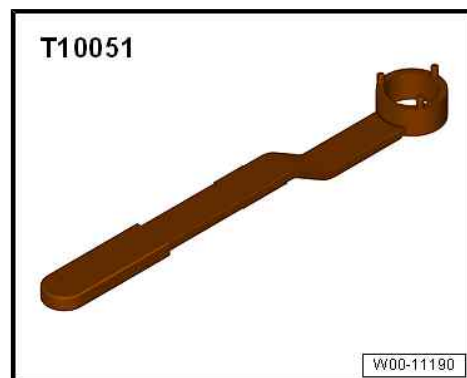
Checking valve timing ➔ [page 105](#)



1.5 Removing and installing toothed belt

Special tools and workshop equipment required

- ◆ Counterhold tool - T10051-
- ◆ Counterhold tool - T10172A- with adapters -T10172/11-





- ◆ Offset screwdriver - T10264-



- ◆ Locking tool - T10265-



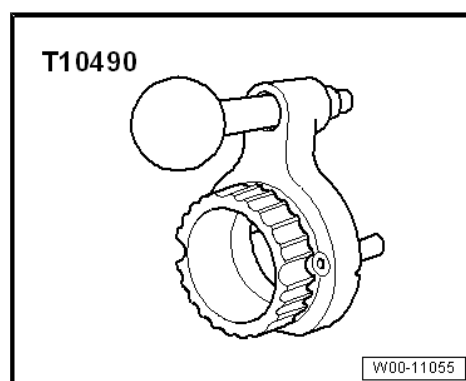
- ◆ Locking pin - T10492-



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- ◆ Crankshaft stop - T10490-





Removing

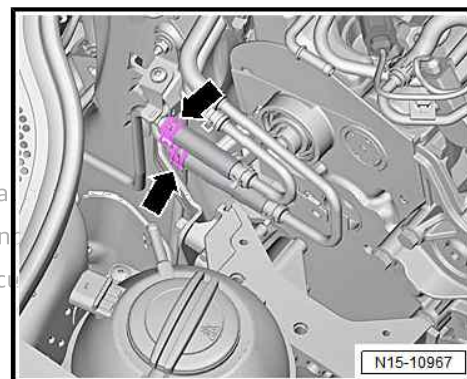
- Remove engine support ➔ [page 54](#) .
- Remove toothed belt cover (bottom) ➔ [page 89](#) .
- Release hose clips -arrows-, disconnect hoses from metering tubes of exhaust gas pressure sensors and move to rear.



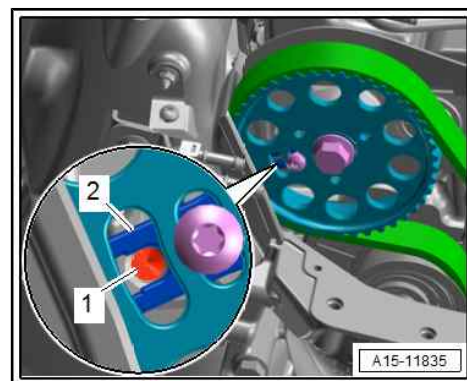
Caution

Risk of damage to engine.

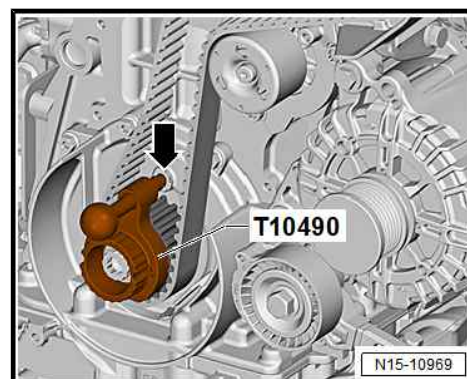
- ◆ **Turn the crankshaft only in the direction of normal engine rotation to prevent the toothed belt from slipping.**
- ◆ **The torque applied to loosen or tighten the bolt for the camshaft sprocket and the nut for the high-pressure pump sprocket *MUST NOT* be transferred to the respective locking pin. This can cause damage to the locating arms, even if counterhold tools are used. This damage may not be visible in some cases, but can cause damage to the engine. When loosening or tightening the central bolt, pull out the locking pin and re-insert it later if necessary.**



- Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at "TDC".
- Locating arm -2- on hub must align with hole -1- behind it.

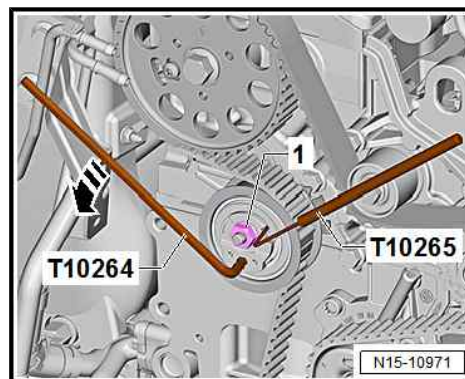


- Lock crankshaft sprocket in position with crankshaft stop - T10490- .
- Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.
- Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.

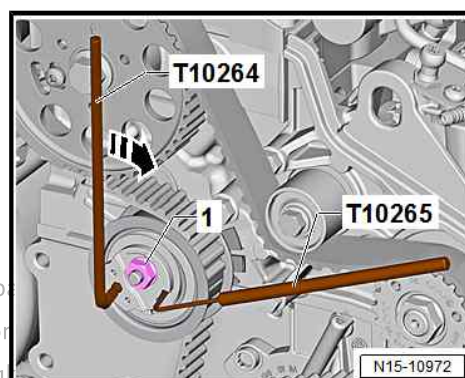




- Slacken nut -1- for tensioning roller.
- Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until tensioning roller can be secured with locking tool - T10265- .



- Then use offset screwdriver - T10264- to turn eccentric adjuster of tensioning roller clockwise -arrow- as far as stop and tighten nut -1- by hand.



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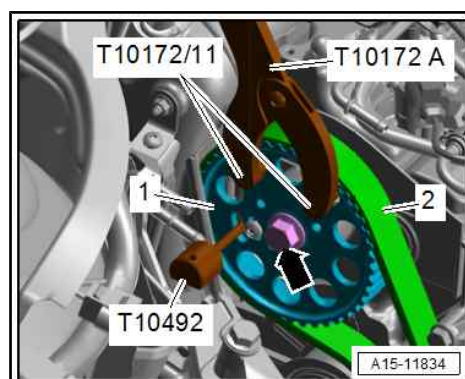
- Loosen bolt -arrow- (use counterhold tool - T10172A- with adapters -T10172/11-).



Caution

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

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



- Detach camshaft sprocket -1- and toothed belt -2-.



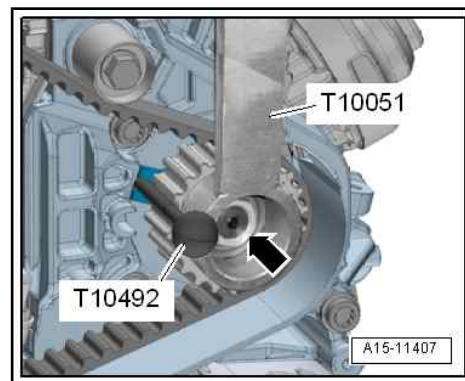
Caution

Risk of damage to valves and piston crowns.

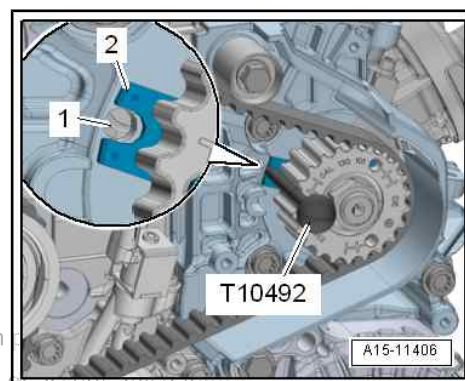
- ◆ *The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.*
- ◆ *Do not turn crankshaft when toothed belt is detached with camshafts installed.*



- Slacken nut -arrow- for toothed belt sprocket of high-pressure pump approx. 90° using counterhold tool - T10051- .
- Lock fork on hub of high-pressure pump in place using locking pin - T10492- , as outlined in description of continued steps.



- Insert locking pin - T10492- into fork -2- on hub and into hole -1- behind it in bracket for high-pressure pump.
- To do so, adjust toothed belt sprocket for high-pressure pump using counterhold tool - T10051- .



Installing (adjusting valve timing)



Note

Perform adjustments on toothed belt only when engine is cold.

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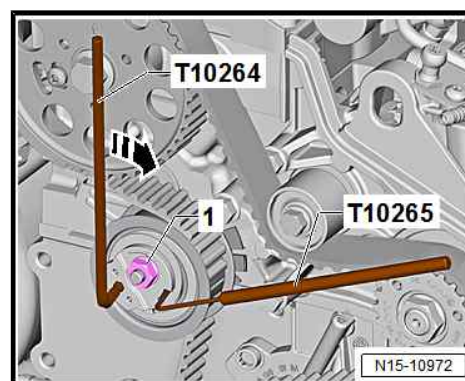
Caution

Risk of damage to valves and piston crowns.

- ◆ *The crankshaft must not be at "TDC" at any cylinder when the camshafts are turned.*
- ◆ *Do not turn crankshaft when toothed belt is detached with camshafts installed.*

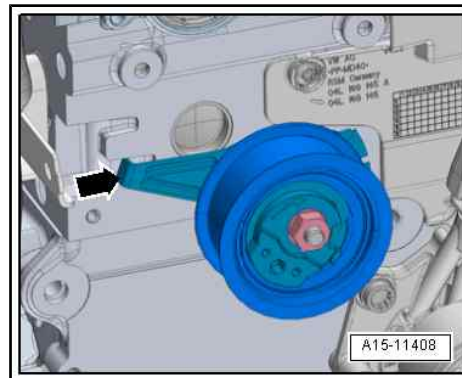
Requirements:

- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut -1-.

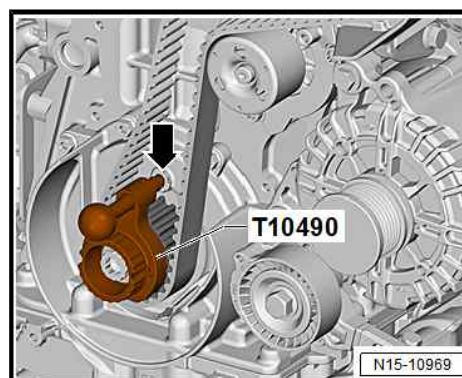




- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



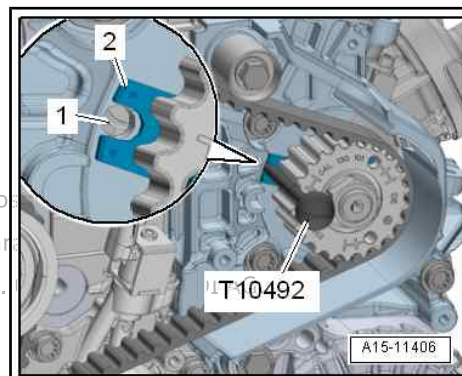
- Crankshaft is locked in position with crankshaft stop - T10490 -arrow-.



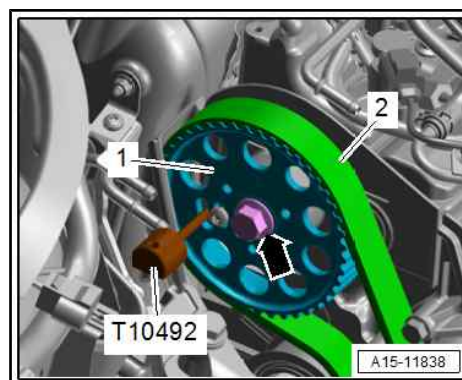
- Hub of high-pressure pump locked in place with locking pin - T10492- .

- Nut for high-pressure pump sprocket screwed on loosely. It should just be possible to easily turn the high-pressure pump sprocket, but there must be no axial movement.

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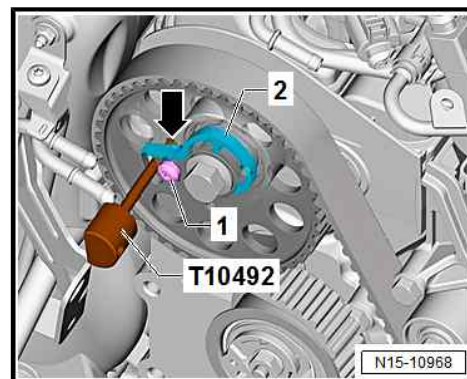


- Bring camshaft sprocket -1- with toothed belt -2- into installation position and screw in bolt -arrow- loosely.
- It should just be possible to turn the sprocket on the camshaft easily without axial movement.
- Lock locating arm on camshaft hub with locking pin - T10492- .

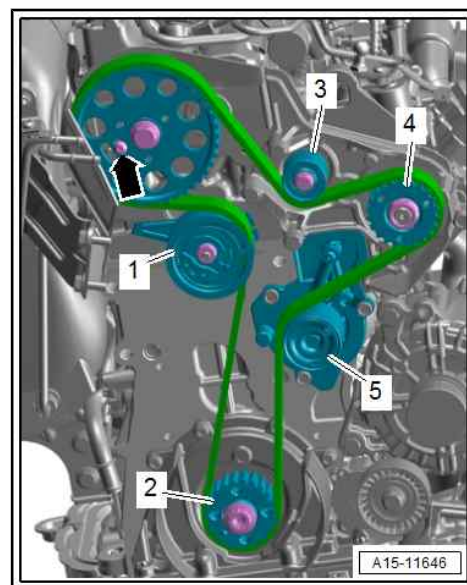




- To do so, insert locking pin - T10492- through locating arm -2- on camshaft hub and into hole -arrow- behind it in cylinder head.
- If necessary, align camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .
- Loosen locking bolt -1-, turn camshaft sprocket clockwise as far as stop and tighten locking bolt again.



- Continue fitting toothed belts in the sequence given:
 - 1 - Tensioning roller
 - 2 - Crankshaft sprocket
 - 3 - Idler roller
 - 4 - High-pressure pump sprocket
 - 5 - Coolant pump sprocket
- Loosen locking bolt -arrow- one half turn, but do not remove it.



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- Turn camshaft sprocket -3- by hand as far as stop in direction of -arrow- and hold it in place.
- Locking bolt -1- should now be positioned in approx. the bottom half of elongated hole -2-, as shown in illustration.



Caution

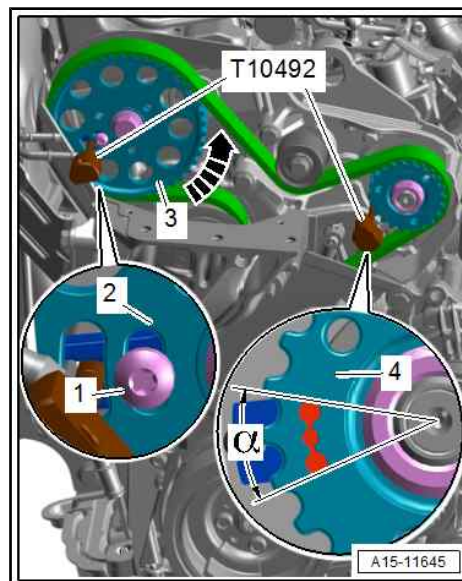
- ◆ **Locking bolt must not come into contact with top or bottom end of elongated hole after toothed belt has been tensioned.**

- At approx. centre of area of rotation - α -, toothed belt sprocket for high-pressure pump -4- should now be aligned with locking pin - T10492- , as shown in illustration.



Caution

- ◆ **Toothed belt sprocket for high-pressure pump must not reach upper or lower end of area of rotation - α - after toothed belt has been tensioned.**



Note

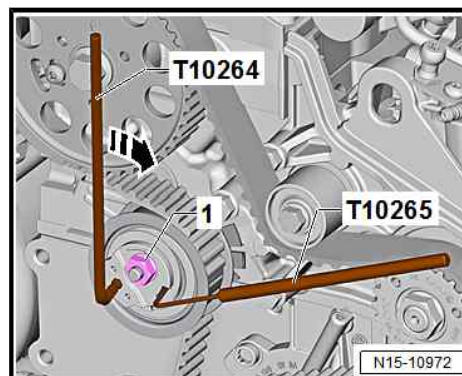
If the installation position of the toothed belt sprockets is not correct, adjust position of toothed belt on sprocket in question.

- Loosen nut -1- for tensioning roller and detach locking tool - T10265- .

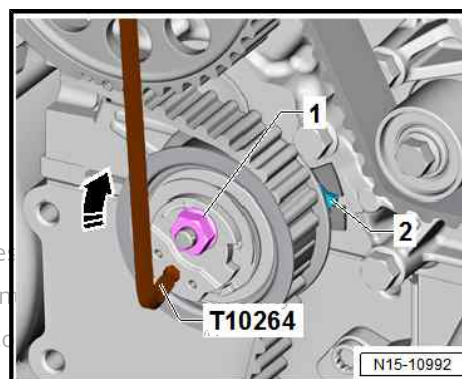


Note

- ◆ **Metal lug of tensioning roller must remain engaged in cast recess on cylinder head.**
- ◆ **Disregard -arrow-.**



- Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -2- aligns with centre of slot on base plate.
- Nut -1- must not turn.
- Hold tensioning roller in this position and tighten nut.



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- Position counterhold tool - T10172A- with adapters - T10172/11- on camshaft sprocket as shown in illustration.
- Apply force to counterhold tool in anti-clockwise direction -arrow- and maintain tension.
- Tighten bolt -1- for camshaft sprocket and nut -2- for high-pressure pump sprocket to 20 Nm.
- Remove locking pins -T10492- and crankshaft stop - T10490- and check valve timing ➔ [page 105](#) .

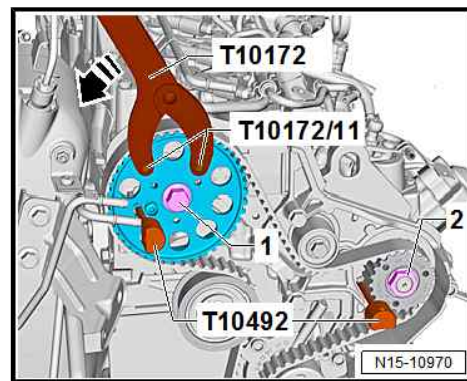
Checking valve timing:



Caution

Risk of damage to engine.

- ◆ **Turn the crankshaft only in the direction of normal engine rotation to prevent the toothed belt from slipping.**



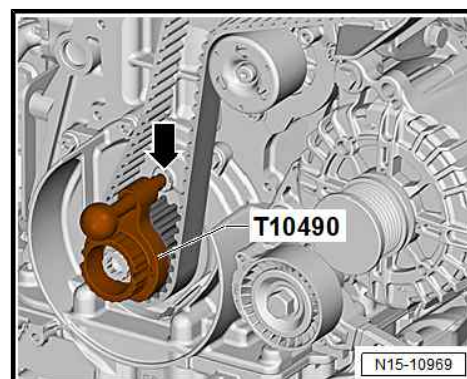
- Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before "TDC".
- Fit crankshaft stop - T10490- to crankshaft sprocket again.
- Then turn crankshaft in direction of engine rotation until pin on crankshaft stop - T10490- engages in hole -arrow- in sealing flange as crankshaft rotates.



Caution

The crankshaft must be exactly in "TDC" position to ensure accurate valve timing adjustment.

- ◆ **If crankshaft has been turned past "TDC" position, turn crankshaft two further rotations until it is again positioned just before "TDC". Then turn further in the same direction and lock crankshaft with crankshaft stop - T10490- .**



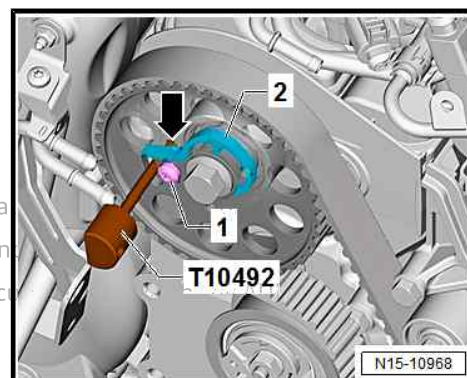
- It must be possible to lock hub on camshaft using locking pin - T10492- .



Note

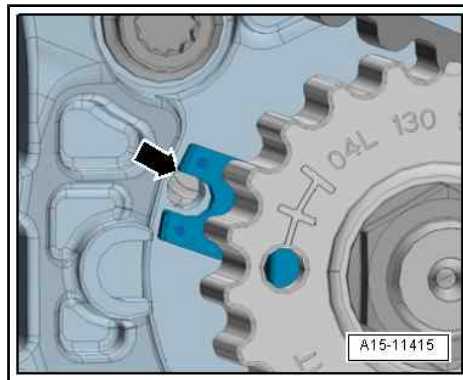
Disregard items -1 and 2-

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- It is very difficult to reproduce the locking position of the high-pressure pump hub. However, a slight deviation -arrow- does not influence engine operation.



- Pointer -2- on tensioner roller must be centred between tabs -1- and -3- on base plate.



Note

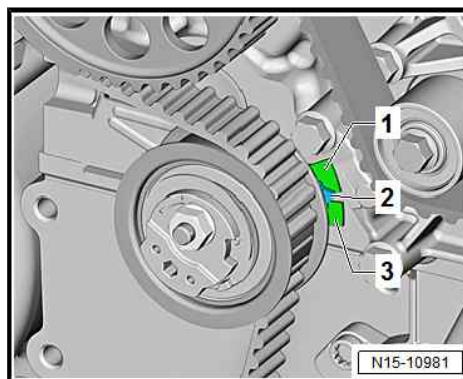
The maximum permissible sideways deviation from the specified position is 5 mm.

If requirements are met, continue with procedure after adjusting valve timing correctly as described below ➔ [page 107](#) .

Re-adjust valve timing if requirements are not met ➔ [page 106](#) .

Re-adjusting valve timing:

- If camshaft hub cannot be locked, withdraw crankshaft stop - T10490- until pin is clear of bore.
- Turn crankshaft in opposite direction of engine rotation slightly past "TDC".
- Now turn crankshaft slowly in direction of engine rotation until it is possible to lock camshaft hub with locking pin - T10492- .
- After locking camshaft in place, unscrew locking bolt and bolt for camshaft sprocket.



Caution

The torque applied to loosen or tighten the bolt for the camshaft sprocket and the nut for the high-pressure pump sprocket MUST NOT be transferred to the respective locking pin. This can cause damage to the locating arms, even if counterhold tools are used. This damage may not be visible in some cases, but can cause damage to the engine. When loosening or tightening the central bolt, pull out the locking pin and re-insert it later if necessary.

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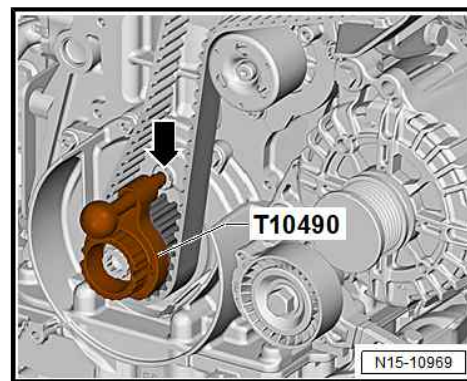


If pin of crankshaft stop - T10490- is on left side of hole:

- Then turn crankshaft in direction of engine rotation until pin on crankshaft stop - T10490- engages in hole -arrow- in sealing flange as crankshaft rotates.
- Tighten bolt for camshaft sprocket to 20 Nm; to do so, remove locking pin - T10492- and counterhold camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .

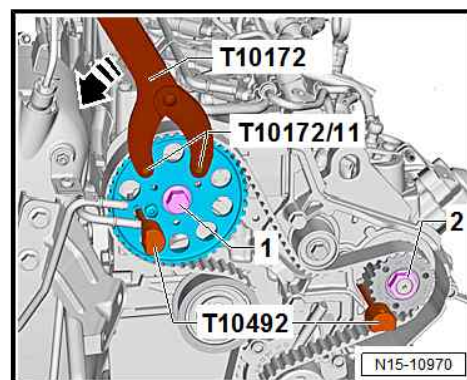
If pin of crankshaft stop - T10490- is on right side of hole:

- Turn crankshaft slightly in opposite direction to engine rotation.
- Turn crankshaft in direction of engine rotation again until pin of crankshaft stop engages in sealing flange as crankshaft rotates.
- Tighten bolt for camshaft sprocket to 20 Nm; to do so, remove locking pin - T10492- and counterhold camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .



Procedure after adjusting valve timing correctly:

- Remove locking pin - T10492- and crankshaft stop - T10490- .
- Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before "TDC".
- Check valve timing once again ➔ [page 105](#) .
- If camshaft hub can now be locked, tighten bolt -1- for camshaft sprocket to final torque ➔ [Item 7 \(page 87\)](#) ; to do so, remove locking pin - T10492- and counterhold camshaft sprocket using counterhold tool - T10172A- with adapters - T10172/11- .
- Tighten bolts -2- for high-pressure pump sprocket to final torque ➔ [Item 2 \(page 266\)](#) ; to do so, use counterhold tool - T10051- .
- Check valve timing once again ➔ [page 105](#) .



Attaching

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



Note

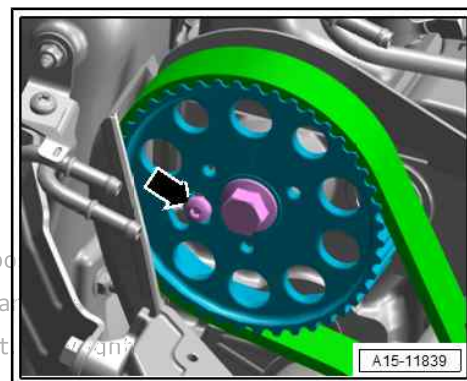
- ◆ *Renew seals after removing.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ➔ [Electronic parts catalogue](#) .*

- Tighten locking bolt -arrow-.
- Install vibration damper ➔ [page 49](#) .
- Install engine support ➔ [page 54](#) .
- Install toothed belt cover ➔ [page 88](#) .

Tightening torques

- ◆ ➔ ["1.2 Exploded view - toothed belt" page 87](#)
- ◆ ➔ ["1.1 Exploded view - toothed belt cover" page 86](#)

with respect to the correctness of information in this document





2 Cylinder head

⇒ [“2.1 Exploded view - cylinder head cover”, page 108](#)

⇒ [“2.2 Exploded view - cylinder head”, page 110](#)

⇒ [“2.3 Removing and installing cylinder head cover”, page 112](#)

⇒ [“2.4 Removing and installing seals for injectors”, page 113](#)

⇒ [“2.5 Removing and installing camshaft housing”, page 114](#)

⇒ [“2.6 Removing and installing cylinder head”, page 118](#)

⇒ [“2.7 Checking compression”, page 124](#)

2.1 Exploded view - cylinder head cover

1 - Gasket

- ☐ Renew if damaged or leaking

2 - Cylinder head cover

- ☐ Removing and installing
⇒ [page 112](#)

3 - Heat shield

4 - Bolt

- ☐ 4 Nm

5 - Bracket

- ☐ For exhaust gas pressure sensor 1 - G505- and pressure differential sender - G450-

6 - Bolt

- ☐ 8 Nm

7 - O-ring

- ☐ Renew after removing

8 - Hall sender - G40-

- ☐ Removing and installing
⇒ [page 327](#)

9 - Bolt

- ☐ 9 Nm

10 - Grommet

- ☐ In cylinder head cover

11 - Clamping piece

12 - Bolt

- ☐ Tightening torque
⇒ [Item 10 \(page 190\)](#)

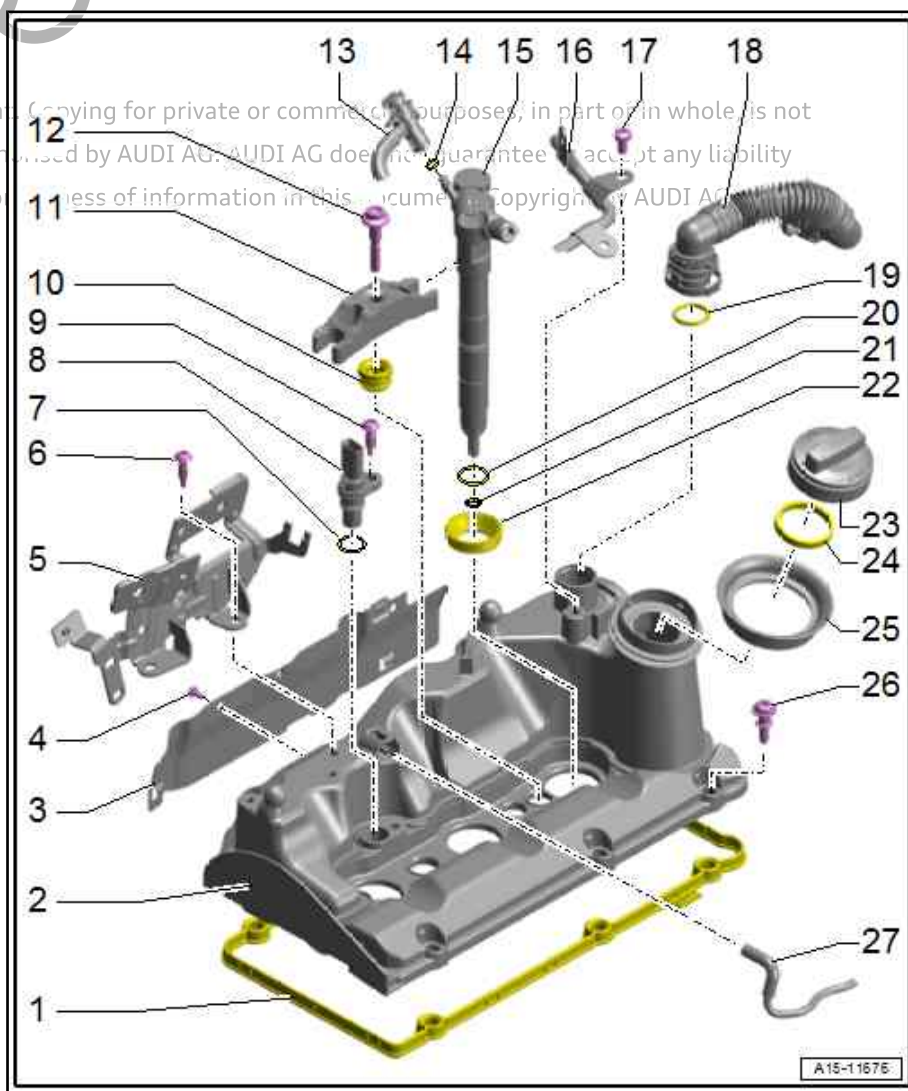
13 - Fuel return line

14 - O-ring

- ☐ Renew after removing

15 - Injector

- ☐ Observe rules for cleanliness ⇒ [page 6](#)
- ☐ Exploded view ⇒ [page 245](#)





16 - Coolant pipe (top)

- ☐ Exploded view ➔ [page 190](#)

17 - Bolt

- ☐ Tightening torque ➔ [Item 12 \(page 190\)](#)

18 - Hose

- ☐ For crankcase breather
- ☐ Press release tabs to detach

19 - O-ring

- ☐ Renew if damaged

20 - O-ring

- ☐ Renew after removing

21 - Insulating seal

- ☐ Renew after removing

22 - Seal

- ☐ For injector
- ☐ Renewing ➔ [page 113](#)

23 - Filler cap

24 - Seal

- ☐ For sealing cap

25 - Grommet

26 - Bolt

- ☐ Renew if seal is damaged
- ☐ Tighten in stages and in diagonal sequence; final torque 8 Nm.

27 - Vacuum line



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2.2 Exploded view - cylinder head

1 - Cylinder block

2 - Cylinder head gasket

- ☐ Renewing
⇒ ["2.6 Removing and installing cylinder head"](#),
[page 118](#)
- ☐ Identification of cylinder head gasket
⇒ [page 111](#)
- ☐ If renewed, change coolant and engine oil

3 - Cylinder head

- ☐ Removing and installing
⇒ [page 118](#)
- ☐ To prevent damage to glow plugs, always place cylinder head on a soft foam surface after removal.
- ☐ Checking for distortion
⇒ [page 111](#)
- ☐ Must not be machined
- ☐ If renewed, change coolant and engine oil

4 - Seal

- ☐ Renew after removing

5 - Plug

- ☐ 14 Nm

6 - Dowel pin

- ☐ For camshaft housing

7 - Bolt

- ☐ Renew after removing
- ☐ Correct sequence when slackening ⇒ [page 112](#)
- ☐ Tightening torque and sequence ⇒ [page 112](#)

8 - Dowel pin

- ☐ For camshaft housing

9 - O-ring

- ☐ Renew after removing
- ☐ Lubricate with coolant

10 - Bracket

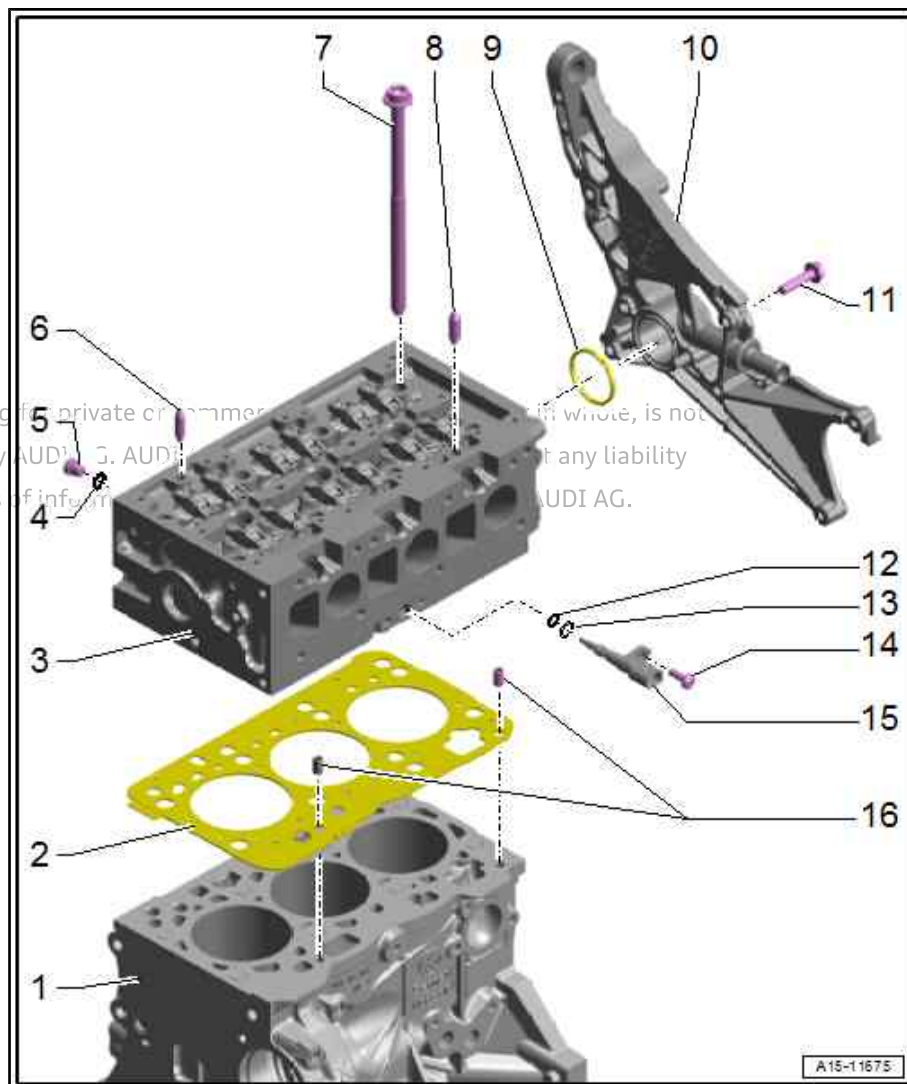
- ☐ For charge air cooler and exhaust gas recirculation valve
- ☐ With connection for coolant hoses
- ☐ With engine lifting eye

11 - Bolt

- ☐ 20 Nm

12 - Support ring

- ☐ Renew after removing
- ☐ Lubricate with coolant





13 - O-ring

- ☐ Renew after removing
- ☐ Lubricate with coolant

14 - Bolt

- ☐ Tightening torque ➔ [Item 4 \(page 176\)](#)

15 - Coolant temperature sender - G62-

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

16 - Dowel sleeves

- ☐ Renewing after dismantling cylinder head

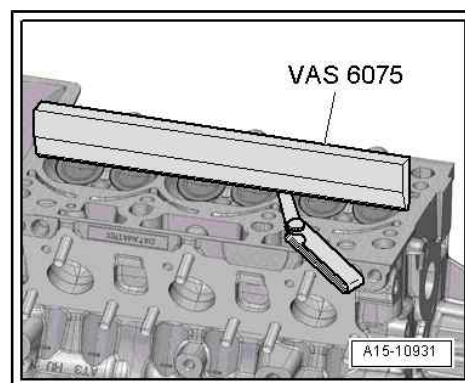
Checking cylinder head for distortion

- Use straight edge 500 mm - VAS 6075- and feeler gauge to measure cylinder head for distortion at several points.
- Max. permissible distortion: 0.1 mm.



Note

Cylinder heads must not be reworked on TDI engines.



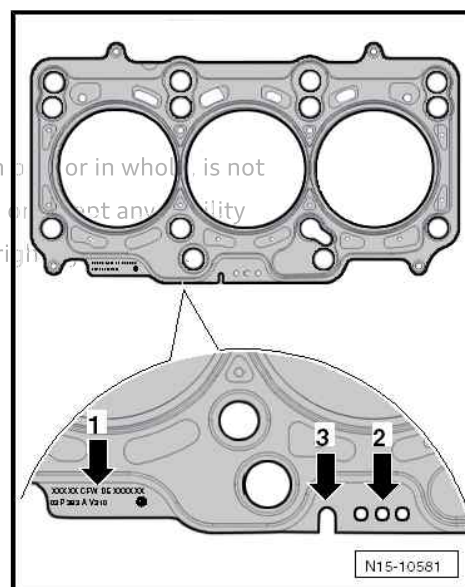
Identification of cylinder head gasket

- 1 - Part number
- 2 - Holes
- 3 - Ignore



Note

Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection ➔ [page 82](#). When renewing only the cylinder head gasket, the new gasket should have the same identification as the old one.





Cylinder head - tightening torque and sequence

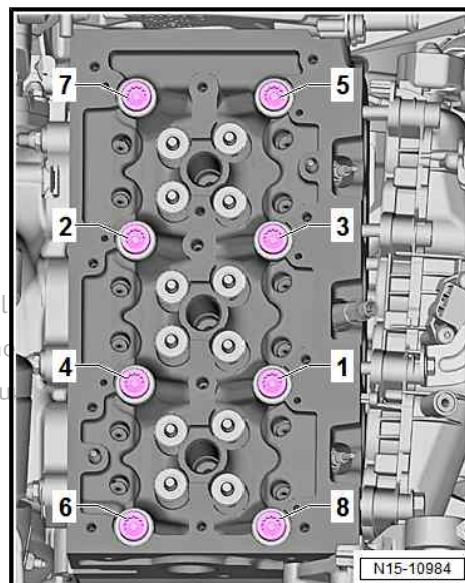


Note

After removing, renew bolts tightened with specified tightening angle.

- Tighten bolts in stages in the sequence shown:

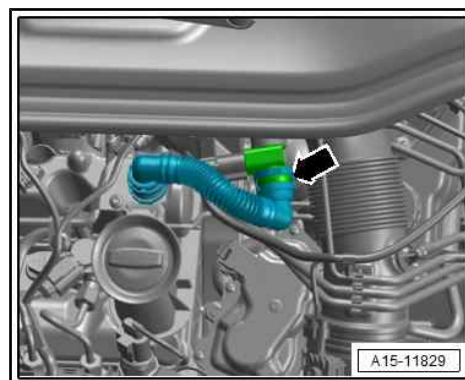
Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 8-	30 Nm
2.	-1 ... 8-	90 Nm
3.	-1 ... 8-	Turn 90° further
4.	-1 ... 8-	Turn 90° further



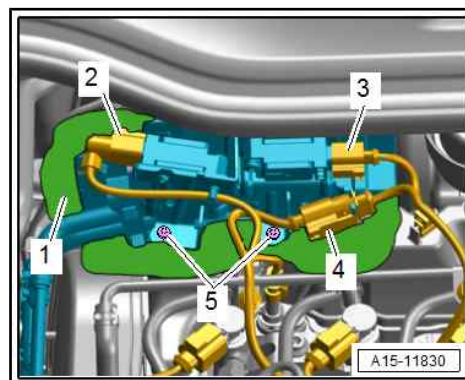
2.3 Removing and installing cylinder head cover

Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Remove toothed belt cover (top) ⇒ [page 88](#) .
- Remove injectors ⇒ [page 256](#) .
- Press release tabs on both sides of crankcase breather hose -arrow- and disconnect hose from air pipe.

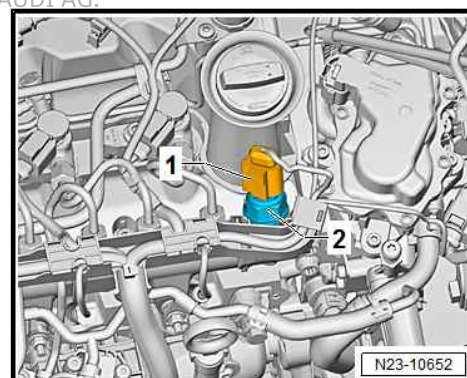
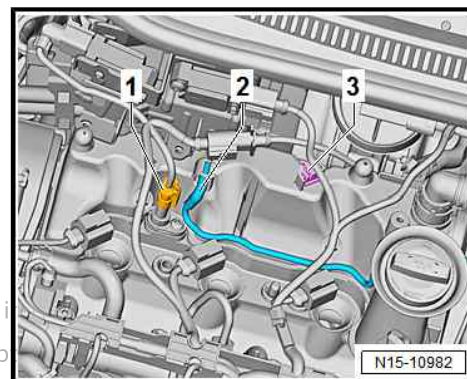


- Open heat insulation sleeve -1-.
- Unplug electrical connectors -2, 3- and move electrical wiring clear.
- Detach electrical connector -4- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.
- Remove bolts -5- and press bracket with exhaust gas pressure sensors towards rear.





- Unplug electrical connector -1- for Hall sender - G40- .
- Detach vacuum line -2-.
- Move electrical wiring -3- clear.



- Remove bolts -1- and detach cylinder head cover -2-.

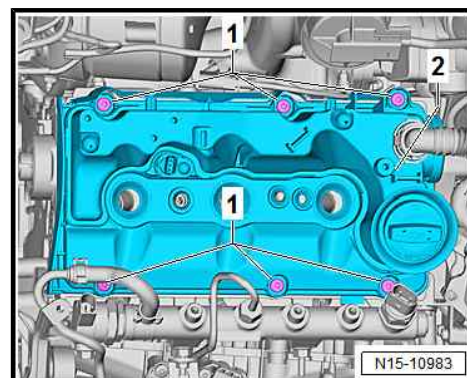
Installing

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



Note

- ◆ *Renew O-ring after removal.*
- ◆ *Renew gasket and bolts for cylinder head cover if damaged or leaking.*
- 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 injectors ⇒ [page 256](#) .
- Connect vacuum hose ⇒ [page 234](#) .
- Install engine cover panel ⇒ [page 41](#) .



Tightening torques

- ◆ ⇒ [“2.1 Exploded view - cylinder head cover”, page 108](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 86](#)

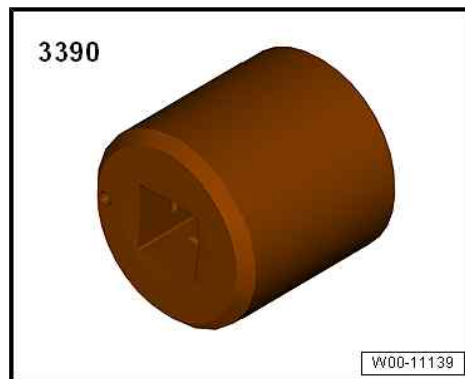
2.4 Removing and installing seals for injectors

Special tools and workshop equipment required

- ◆ Pliers -VAS 211 007- (not illustrated)

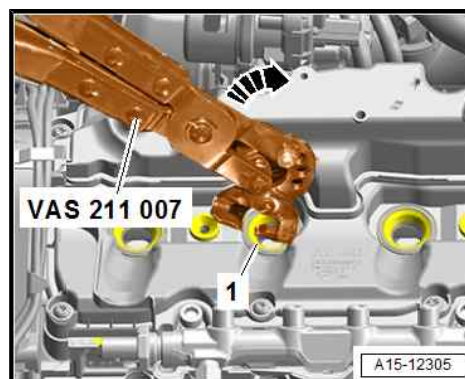


◆ Carrier - 3390-

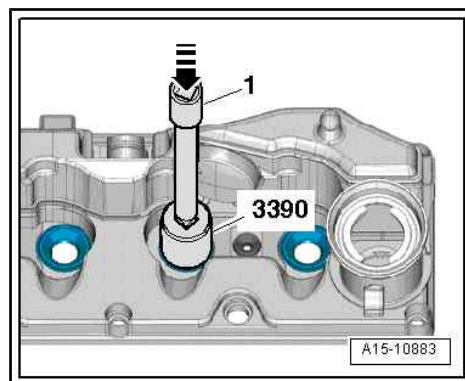


Procedure

- Remove corresponding injector ➔ [page 245](#) .
- Pull off seal -1- using pliers -VAS 211 007- -arrow-.



- Use carrier - 3390- and short extension -1- to press new injector seal in from above -arrow- as far as stop.



2.5 Removing and installing camshaft housing

Special tools and workshop equipment required

- ◆ Bit XZN 10 - T10501-



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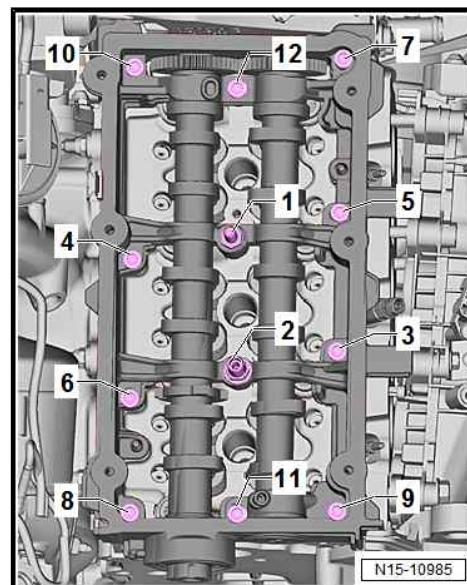
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles



◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove cylinder head cover ⇒ [page 112](#) .
- Detach toothed belt from camshaft ⇒ [page 90](#) .
- Remove high-pressure reservoir (rail) ⇒ [page 264](#) .
- Remove bracket for charge air cooler ⇒ [page 222](#) .
- Unscrew bolts for camshaft housing in the sequence -12 ... 1-.



- Push with a screwdriver in direction of -arrow- to release camshaft housing -1- carefully from bonded joint and detach it.

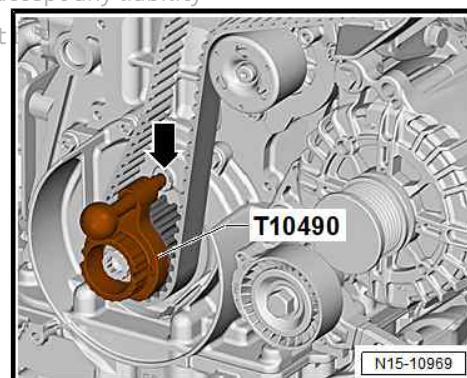
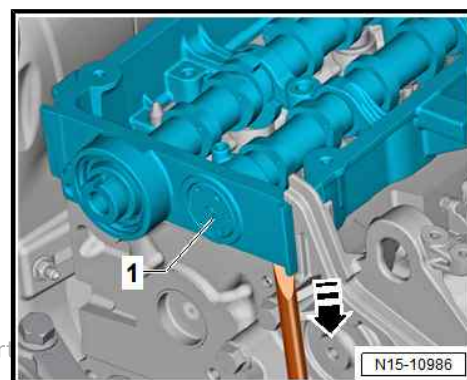


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Installing

Requirements:

- Crankshaft is locked in position with crankshaft stop - T10490-
-arrow-.





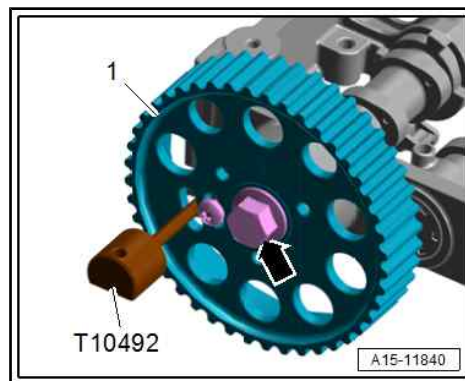
- Camshaft sprocket -1- is in installation position and bolt -arrow- is screwed in loosely.
- Hub on camshaft is locked with locking pin - T10492- .



Caution

Protect lubrication system and bearings against contamination.

- ◆ *Cover exposed parts of the engine.*

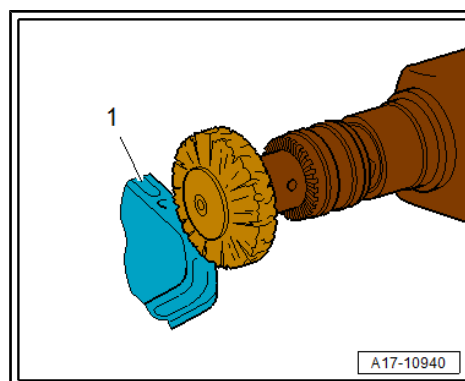


WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

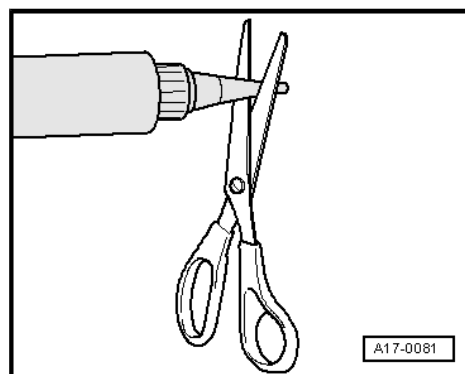
- Remove remaining sealant from cylinder head and camshaft housing -1- using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.



Note

Note expiry date of sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 1.5 mm).



Caution

Make sure excess sealant does not contaminate camshaft bearings.

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



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- Apply bead of sealant -1- onto clean sealing surfaces of cylinder head as shown in illustration.
- Width of sealant beads: 2 mm.



Note

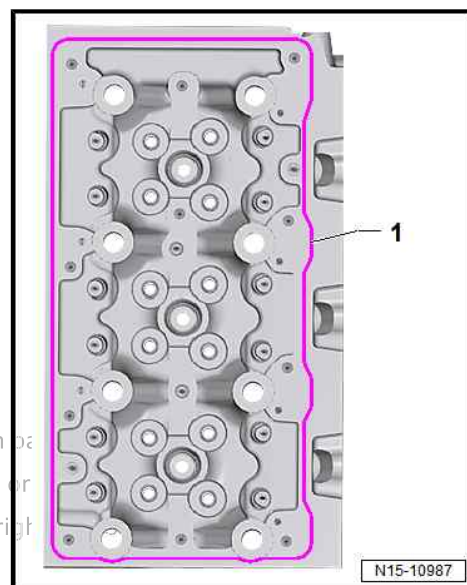
- ◆ *Install camshaft housing within 5 minutes after applying the sealant.*
- ◆ *After installing the camshaft housing, wait about 30 minutes for the sealant to dry.*

- Carefully fit camshaft housing on cylinder head, paying attention to dowel pins.

- Tighten camshaft housing bolts ⇒ [page 127](#)

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

- Install bracket for charge air cooler ⇒ [page 222](#) .
- Install high-pressure reservoir (rail) ⇒ [page 264](#) .
- Install cylinder head cover ⇒ [page 112](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 101](#) .



Caution

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

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



Note

After new parts have been installed (engine/short engine, cylinder head, crankshaft housing or turbocharger), the oil pressure must be regulated to the higher pressure stage for approx. 1000 km. This compensates for the higher friction when running in new parts, and ensures the best means of removing particles of residue worn off during the running-in process.

- Perform adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester)
 ⇒ [“3.4 Performing adaptations after renewing a component”](#), [page 8](#) .

Tightening torques

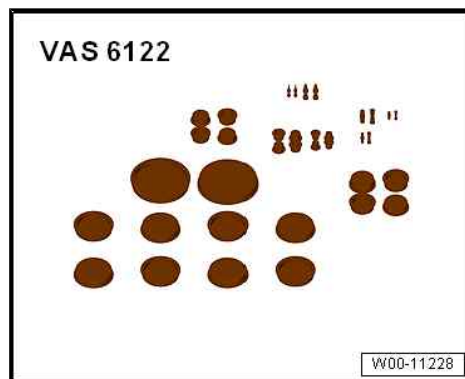
- ◆ ⇒ [Fig. “Camshaft housing - tightening torque and sequence”](#), [page 127](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”](#), [page 214](#)
- ◆ ⇒ [“5.2 Exploded view - high-pressure reservoir \(rail\)”](#), [page 247](#)



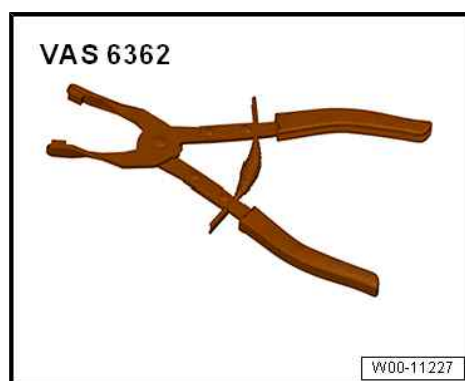
2.6 Removing and installing cylinder head

Special tools and workshop equipment required

◆ Engine bung set - VAS 6122-



◆ Hose clip pliers - VAS 6362-



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

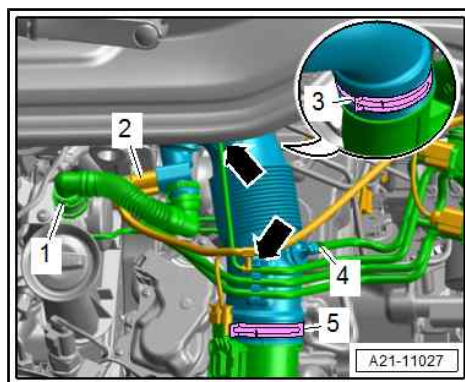
Removing

- Remove emission control module ➔ [page 299](#) .
- Remove camshaft housing ➔ [page 114](#) .
- Remove throttle valve module - J338- ➔ [page 240](#) .
- Unplug electrical connector -2-.
- Move clear vacuum hoses at air pipe -arrows-.
- Disconnect vacuum hose -4-.
- Release hose clip -3- and detach air pipe from turbocharger.



Note

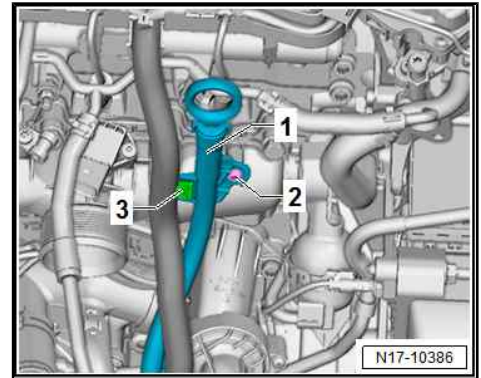
Disregard items -1 and 5-.



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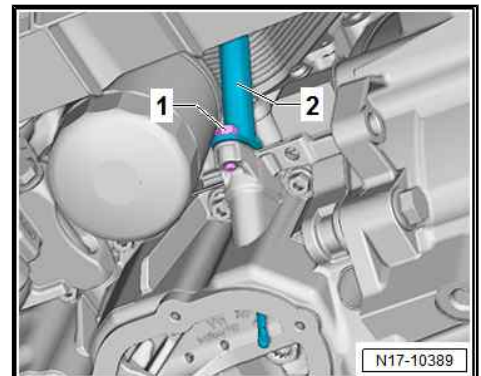
- Unscrew bolt -2- for oil dipstick guide tube -1- on intake manifold.
- Cut through cable ties -3- at top and bottom of guide tube.



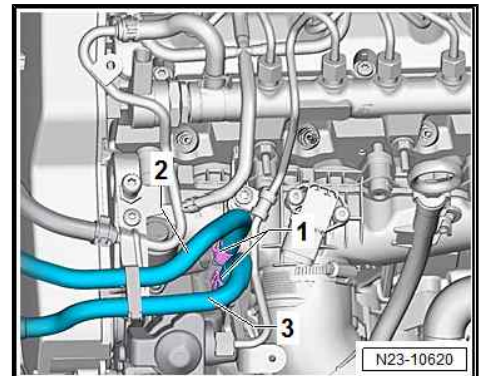
Caution

Risk of coolant entering lubrication system.

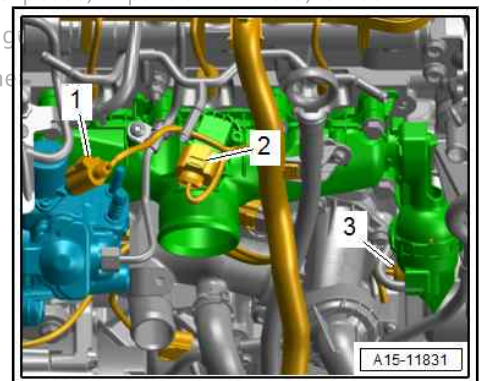
- ◆ ***After removing guide tube, it is very important to seal off hole for guide tube in sump using sealing plugs from engine bung set - VAS 6122-.***



- Remove bolt -1- and pull out oil dipstick guide tube -2- upwards.
- Release hose clips -1- and disconnect fuel hoses -2, 3- from high-pressure pump.



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- Unplug electrical connectors -1, 2, 3- and move clear.

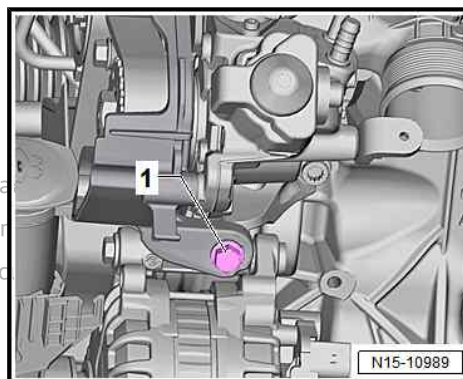




- Remove bolt -1-.



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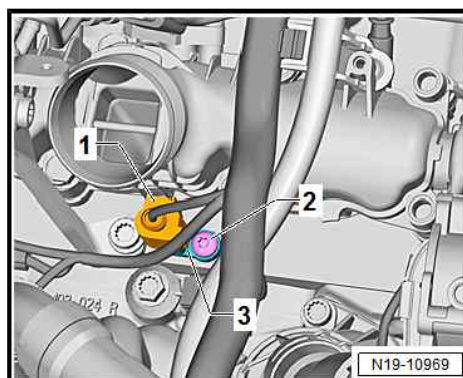


- Unplug electrical connector -1- at coolant temperature sender - G62- -item 3- using assembly tool - T10118- .

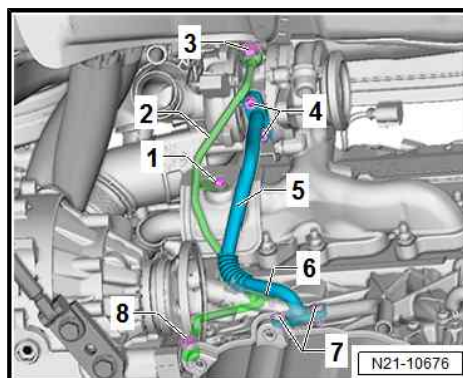


Note

Disregard -item 2-.



- Unscrew bolts -4, 7- and detach oil return line -5-.
- Remove bolts -1, 6- and banjo bolts -3, 8- and detach oil supply line -2-.



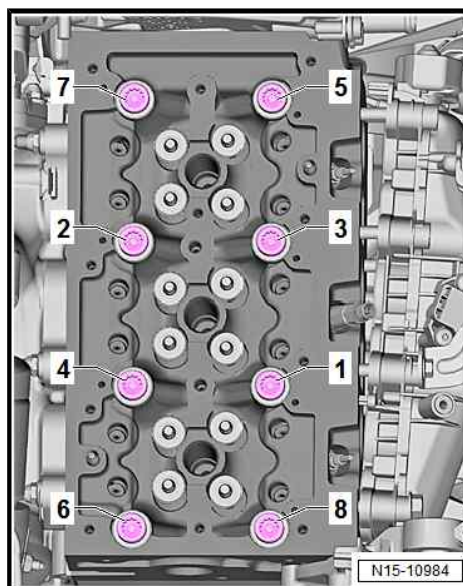
- Remove bolts in the sequence -8 ... 1- and remove cylinder head carefully.



Caution

Risk of damage to glow plugs when putting down cylinder head.

- ◆ After removal, the cylinder head must not be put down on the gasket side with the glow plugs still installed, because the glow plugs project slightly beyond the gasket surface.

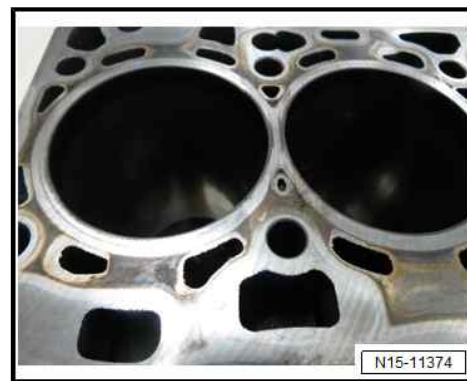


Installing



Note

- ◆ *Do NOT use abrasive materials (sandpaper, sanding discs, sanding pads, abrasive web, wire wool, etc.).*
- ◆ *Sealing surface (see photo) must not be raised.*
- ◆ *Dark discolouration (see photo) does not have to be removed.*
- ◆ *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.*
- ◆ *Use of non-approved abrasive materials can lead to subsequent damage to the turbocharger, conrod bearings, etc.*

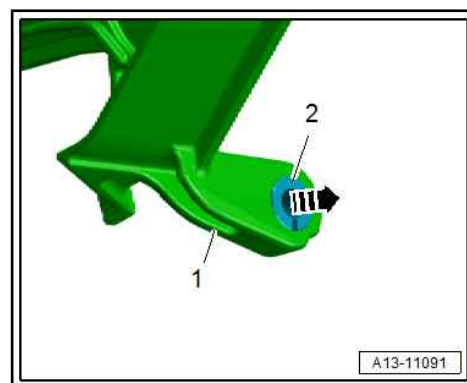


- Remove sealant residue from the cylinder head and cylinder block using a commercially available blade scraper.
- Sealing surfaces must NOT be damaged.
- No oil or coolant must be allowed to remain in the blind holes for the bolts.
- Do not remove new cylinder head gasket from packaging until it is ready to be fitted.
- If a new cylinder head is installed, the contact surfaces between the roller rocker fingers and the running surface of the cam must be lubricated.
- Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.
- Turn the crankshaft carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- After removing, renew bolts tightened with specified tightening angle.
- After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.
- Remove loose residue with a lint-free cloth.
- Knock back sliding bush -2- in bracket for high-pressure pump slightly -arrow-.



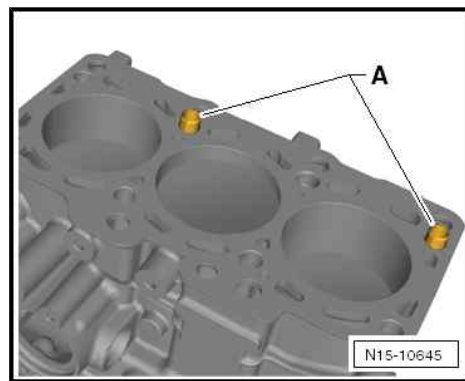
Note

Ensure that sliding bush moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque.





- Pull out dowel sleeves -A- for centring cylinder block and cylinder head and fit new dowel sleeves in cylinder block.



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– Note cylinder head gasket identification:

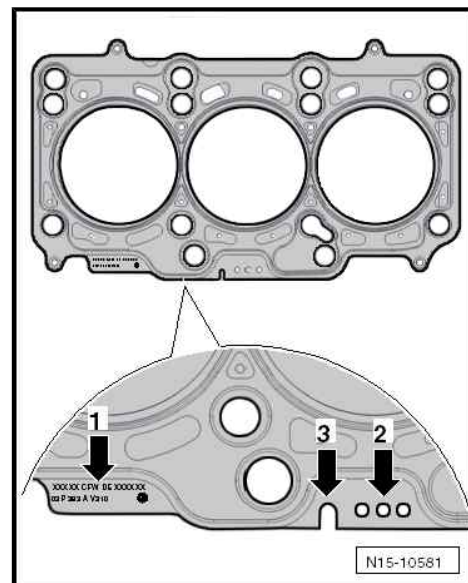
- 1 - Part number
- 2 - Holes
- 3 - Ignore



Note

- ◆ If the cylinder head gasket or cylinder head have been replaced, select the new cylinder head gasket according to the number of holes on the old gasket.
- ◆ If parts of the crankshaft drive have been renewed, select the new cylinder head gasket by measuring the piston projection at "TDC" ⇒ [page 82](#).

- Fit cylinder head gasket onto dowel sleeves in cylinder block.
- Installation position of cylinder head gasket: the word "oben" (top) or the part number should face towards the cylinder head.



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 A second mechanic is required for fitting cylinder head.



Note

- Fit cylinder head.
- Renew and tighten cylinder head bolts ⇒ [page 112](#).



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:

- 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 throttle valve module - J338- ⇒ [page 240](#).
- Install camshaft housing ⇒ [page 114](#).
- Install emission control module ⇒ [page 299](#).
- Install engine cover panel ⇒ [page 41](#).
- Change engine oil ⇒ Maintenance ; Booklet 819.
- Fill and bleed coolant circuit ⇒ [page 168](#).



Note

After new parts have been installed (engine/short engine, cylinder head, crankshaft housing or turbocharger), the oil pressure must be regulated to the higher pressure stage for approx. 1000 km. This compensates for the higher friction when running in new parts, and ensures the best means of removing particles of residue worn off during the running-in process.



- Perform adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ [“3.4 Performing adaptations after renewing a component”, page 8](#).

Tightening torques

- ♦ ⇒ [“2.2 Exploded view - cylinder head”, page 110](#)
- ♦ ⇒ [“1.1 Exploded view - sump/oil pump”, page 140](#)
- ♦ ⇒ [Fig. “Bracket for high-pressure pump - tightening torque and tightening sequence”, page 44](#)
- ♦ ⇒ [“1.1 Exploded view - turbocharger”, page 207](#)

2.7 Checking compression

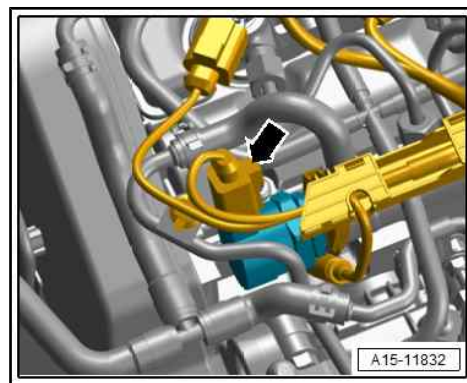
Special tools and workshop equipment required

- ♦ Compression tester - V.A.G 1763- with adapter - V.A.G 1763/8-



Procedure

- Engine oil temperature approx. 80 °C
- Battery voltage at least 12.5 V
- Remove engine cover panel ⇒ [page 41](#).
- Unplug electrical connector at fuel pressure regulating valve - N276- -arrow-.
- Briefly start engine to relieve fuel pressure in high-pressure reservoir.
- Remove all glow plugs ⇒ [page 324](#).





- Screw adapter - V.A.G 1763/8- into threaded hole for glow plug of cylinder being checked and connect compression tester - V.A.G 1763- .



Note

Protected by copyright. Copying for private or commercial purposes, in part or in full, is prohibited unless authorised by AUDI AG. AUDI AG does not guarantee the accuracy of the information with respect to the correctness of information in this document. Copying and distribution is prohibited. Using the compression tester ⇒ *Operating instructions* .

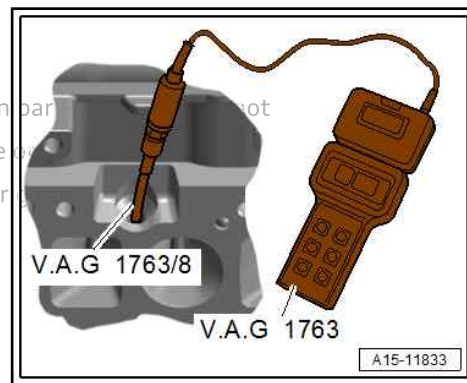
- Have a second mechanic operate starter until tester shows no further pressure increase.
- Repeat procedure on each cylinder.

Compression pressure	bar
When new	25.0 ... 31.0
Wear limit	19.0
Maximum difference between cylinders	5.0

Attaching

Assembly is performed in reverse sequence; note the following:

- Install all glow plugs ⇒ [page 324](#) .
- Install engine cover panel ⇒ [page 41](#) .
- Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester, [Guided Functions], then [01 - Interrogate/erase event memory].





3 Valve gear

⇒ [“3.1 Exploded view - valve gear”, page 126](#)

⇒ [“3.2 Removing and installing camshaft oil seal”, page 127](#)

⇒ [“3.3 Checking hydraulic compensation elements”, page 129](#)

⇒ [“3.4 Removing and installing valve stem oil seals”, page 130](#)

3.1 Exploded view - valve gear



Caution

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

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

1 - Sealing cap

- ☐ Renew after removing
- ☐ Removing: With camshaft housing installed, pierce on one side of sealing cap with an awl and pry out
- ☐ Installing: Drive in without sealant until flush using carrier - 3390-

2 - Camshaft oil seal

- ☐ Renewing ⇒ [page 127](#)

3 - Camshaft housing

- ☐ With integrated camshafts
- ☐ Removing and installing ⇒ [page 114](#)

4 - Bolt

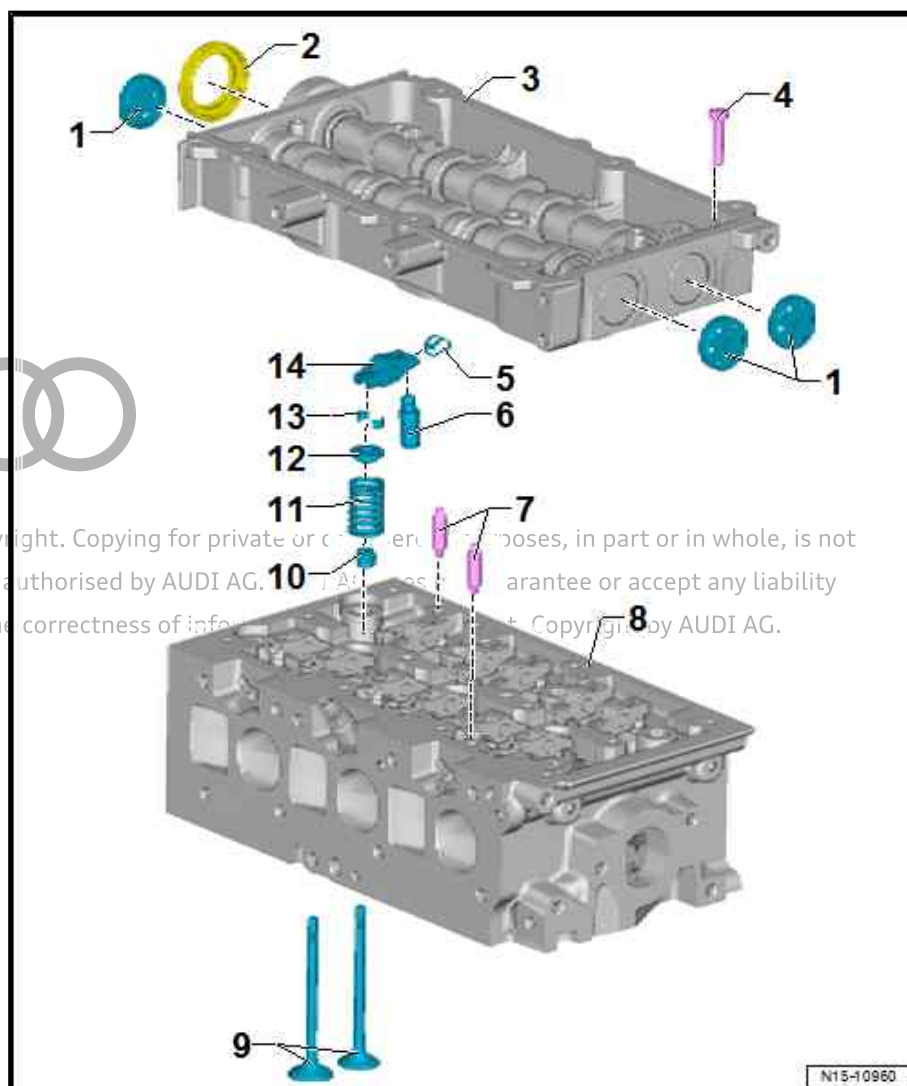
- ☐ Correct sequence when slackening ⇒ [page 115](#)
- ☐ Tightening torque and sequence ⇒ [page 127](#)

5 - Securing clip

- ☐ For hydraulic compensation element

6 - Hydraulic compensation element

- ☐ Checking ⇒ [page 129](#)
- ☐ Mark installation position for re-installation
- ☐ Lubricate contact surfaces before installing





7 - Dowel pin

- ☐ For camshaft housing

8 - Cylinder head

- ☐ Valve seats may not be machined due to the very small tolerances

9 - Valves

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Mark installation position for re-installation
- ☐ Checking ⇒ [page 139](#)
- ☐ Valve dimensions ⇒ [page 139](#)
- ☐ Checking valve guides ⇒ [page 138](#)

10 - Valve stem oil seal

- ☐ Renewing ⇒ [page 130](#)

11 - Valve spring

12 - Valve spring plate

13 - Valve cotters

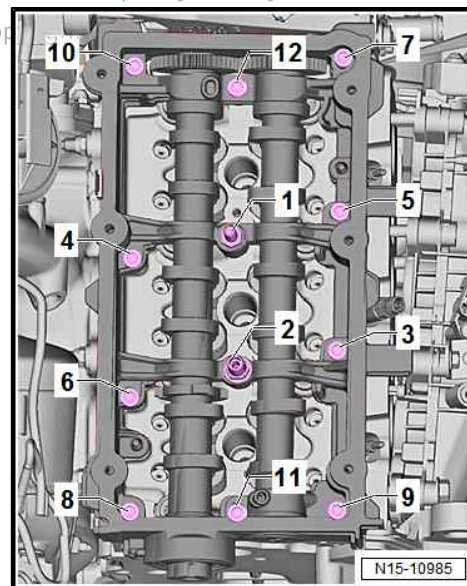
14 - Roller rocker finger

- ☐ Removing and installing ⇒ [“2.5 Removing and installing camshaft housing”, page 114](#)
- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surfaces before installing

Camshaft housing - tightening torque and sequence

- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 ... 12-	Screw in by hand until contact is made • The camshaft housing should make contact with the cylinder head over the full surface.
2.	-1, 2-	20 Nm
3.	-3 ... 12-	8 Nm

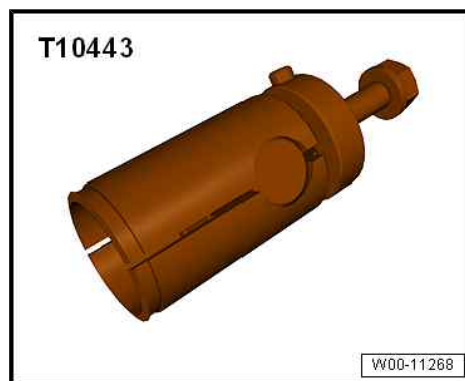


3.2 Removing and installing camshaft oil seal

Special tools and workshop equipment required



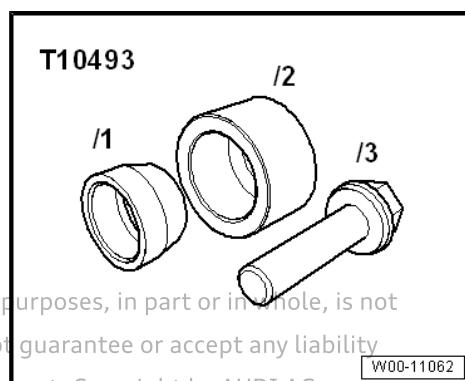
◆ Puller - T10443-



◆ Assembly tool - T10493-



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Procedure

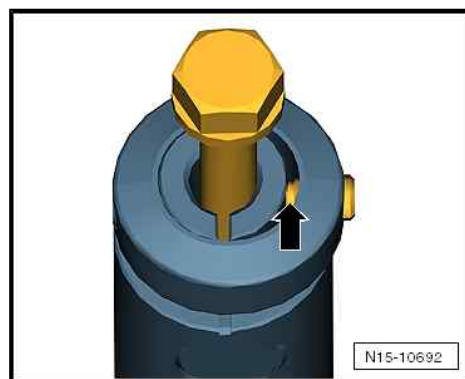
- Detach toothed belt from camshaft ➔ [page 90](#) .



Caution

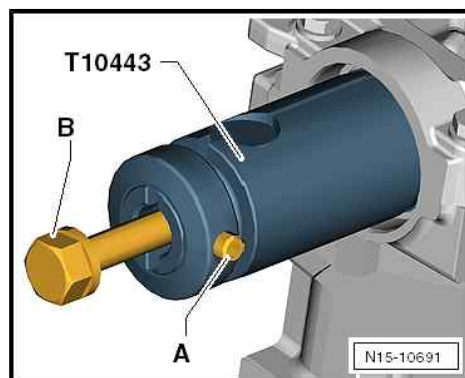
- ◆ *If the grub screw is unscrewed too far the thrust plate inside the puller -T10443- will come loose from the thrust bolt. If this happens, the thrust plate must be pushed back onto the thrust bolt.*

- Carefully unscrew grub screw -arrow- of puller -T10443- until slight resistance is felt.
- Apply puller - T10443- in a straight line, as shown in illustration, and lock by screwing in grub screw.-A-.
- Screw in thrust bolt -B- until oil seal is pulled out.
- Clean contact surface and sealing surface.



Note

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



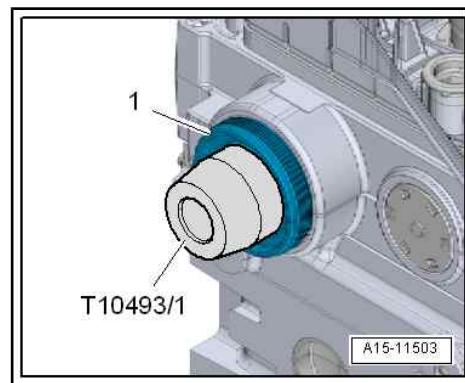


- Apply guide sleeve -T10493/1- to camshaft as shown in illustration.
- Carefully push oil seal -1- over guide sleeve and onto camshaft.

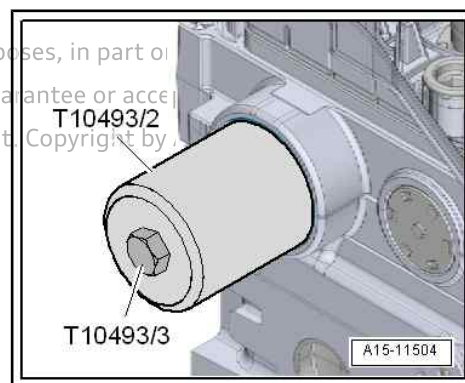


Note

When pressing in oil seal, guide sleeve remains on camshaft as a stop.



- Press oil seal in as far as stop using thrust piece -T10493/2- and bolt -T10493/3-.
- Install toothed belt (adjust valve timing) ➔ [page 101](#)



3.3 Checking hydraulic compensation elements



Note

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

Special tools and workshop equipment required

- ◆ Feeler gauge

Procedure

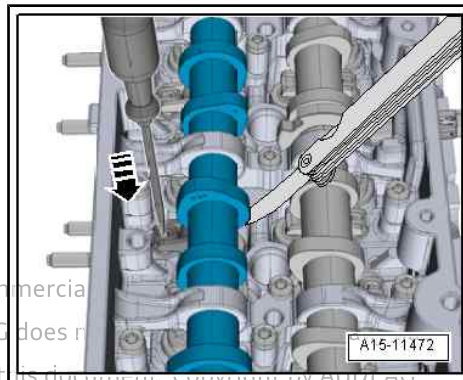
- Start engine and run until radiator fan has started up once.
- Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).
- If the compensation elements are still noisy, locate the defective compensation element as follows:
- Remove cylinder head cover ➔ [page 112](#).
- Rotate crankshaft by turning bolt for toothed belt sprocket until cam of supporting element to be tested is facing upwards.



- Press roller rocker finger down -arrow- to determine clearance between cam and roller rocker finger.
- If it is possible to insert a feeler gauge of 0.20 mm between cam and roller rocker finger, renew hydraulic compensation element
⇒ [“2.5 Removing and installing camshaft housing”, page 114](#).

Additional steps required

- Install cylinder head cover ⇒ [page 112](#).



3.4 Removing and installing valve stem oil seals

⇒ [“3.4.1 Removing and installing valve stem oil seals \(cylinder head installed\)”, page 130](#)

⇒ [“3.4.2 Removing and installing valve stem oil seals \(cylinder head removed\)”, page 133](#)

3.4.1 Removing and installing valve stem oil seals (cylinder head installed)

Special tools and workshop equipment required

- ◆ Valve stem seal puller - 3364-



- ◆ Valve stem oil seal fitting tool - 3365-





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

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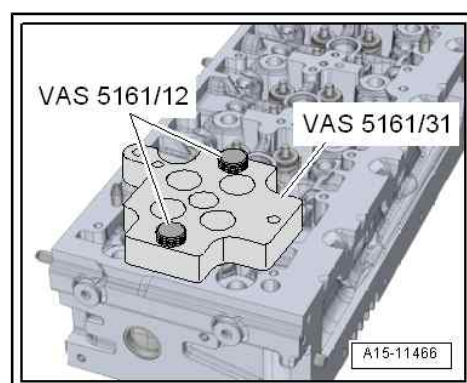
- ◆ Sealing pin -VAS 5161/29-1-
- ◆ Guide plate -VAS 5161 A/31-
- ◆ Sleeve -VAS 5161 A/31-1-

Procedure

- Remove all glow plugs ➔ [page 324](#) .
- Remove camshaft housing ➔ [page 114](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Set piston of appropriate cylinder to “bottom dead centre”.

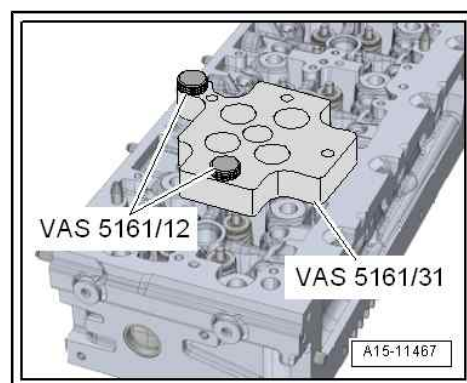
Cylinders 1, 3:

- Fit guide plate -VAS 5161/31- onto cylinder head.
- The lettering -A- faces towards exhaust side
- The lettering -E- faces towards intake side
- Secure guide plate with knurled screws -VAS 5161/12- by hand.
- Position of knurled screws, as shown in illustration



Cylinder 2:

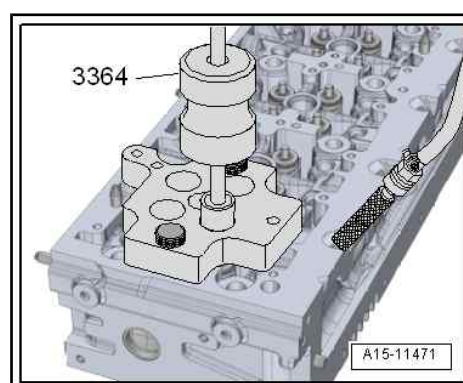
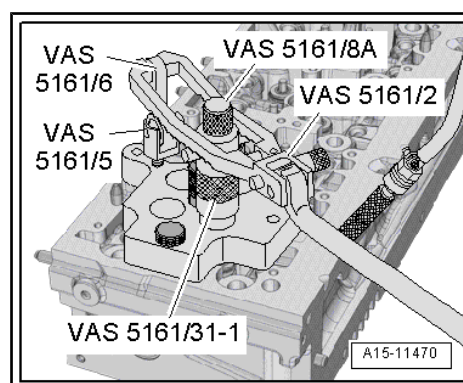
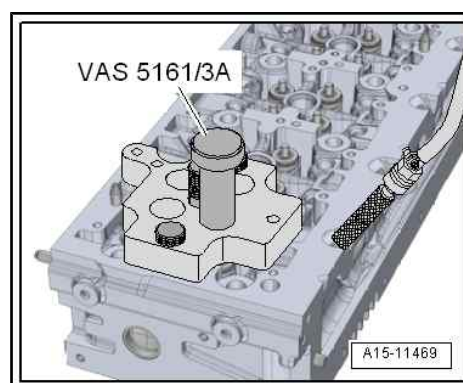
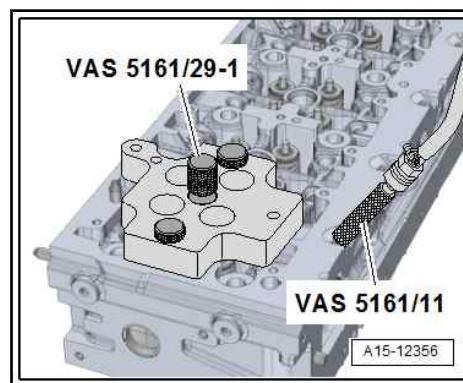
- Fit guide plate -VAS 5161/31- onto cylinder head.
- The lettering -A- faces towards exhaust side
- The lettering -E- faces towards intake side
- Secure guide plate with knurled screws -VAS 5161/12- by hand.
- Position of knurled screws, as shown in illustration





Continued for all cylinders:

- Screw sealing pin -VAS 5161/29-1- into guide plate.
- Screw adapter -VAS 5161/11- hand-tight into corresponding glow plug thread.
- Insert drift -VAS 5161/3A- into 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 5161/8A- (slide on sleeve -VAS 5161/31-1-) in guide plate.
- Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
- Minimum pressure: 6 bar
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take off assembly cartridge with sleeve.
- Detach valve spring with valve spring plate.
- Pull off valve stem oil seal with valve stem seal puller - 3364- .





Caution

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

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

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

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

- Larger diameter of valve cotters faces upwards.
- Insert valve spring and valve spring plate.
- Press assembly cartridge onto insertion device from above and take up valve cotters.

- Insert assembly cartridge in guide plate -VAS 5161/31- again.
- 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.

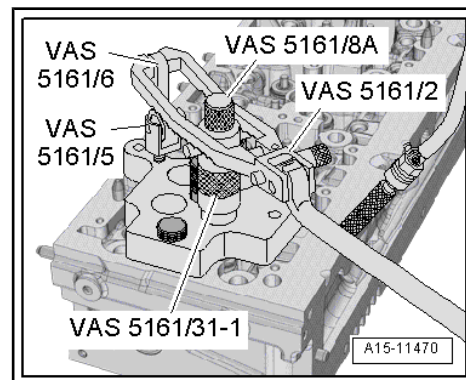
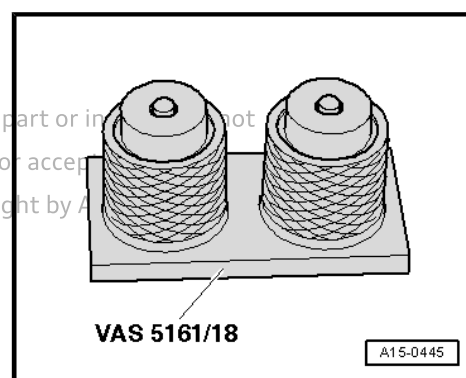
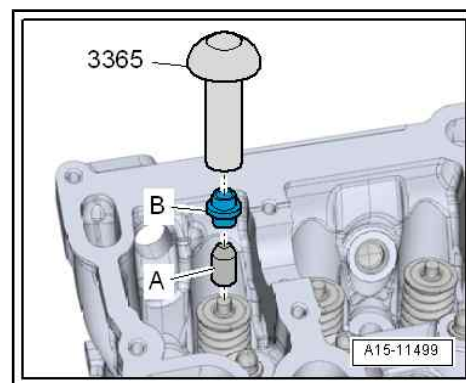
Attaching

Assembly is performed in reverse sequence; note the following:

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshaft housing ➔ [page 114](#) .
- Install glow plugs ➔ [page 324](#) .

3.4.2 Removing and installing valve stem oil seals (cylinder head removed)

Special tools and workshop equipment required





- ◆ Valve stem seal puller - 3364-



- ◆ Valve stem oil seal fitting tool - 3365-



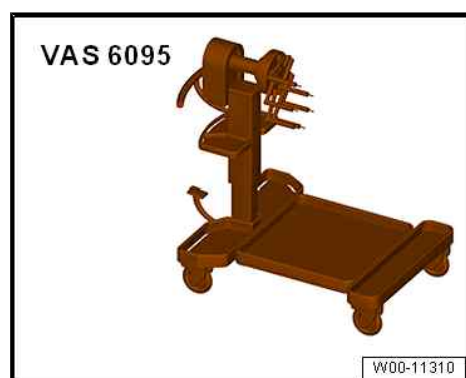
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- ◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate -VAS 5161/31- and sleeve -VAS 5161/31-1- .



- ◆ Engine and gearbox support - VAS 6095A-





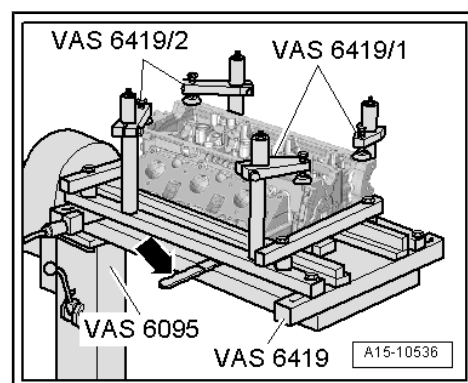
◆ Cylinder head tensioning device - VAS 6419-



Procedure

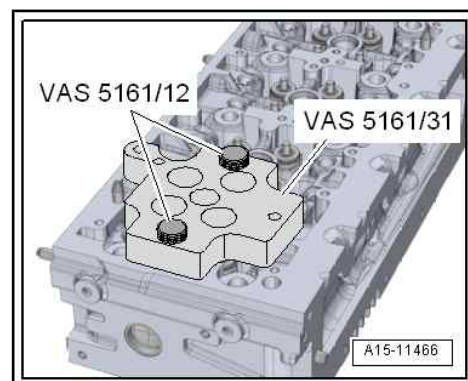
Important:

- Intake manifold removed ⇒ [page 239](#)
- Exhaust manifold/turbocharger removed ⇒ [page 207](#)
- Bracket for high-pressure pump detached ⇒ [page 50](#)
- Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095A- .
- Secure cylinder head in cylinder head tensioning device, as shown in illustration.
- Connect cylinder head tensioning device to compressed air supply.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.



Cylinders 1, 3:

- Fit guide plate -VAS 5161/31- onto cylinder head.
- The lettering -A- faces towards exhaust side
- The lettering -E- faces towards intake side
- Secure guide plate with knurled screws -VAS 5161/12- by hand.
- Position of knurled screws, as shown in illustration



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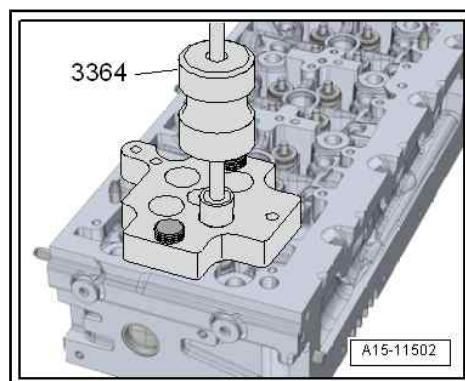
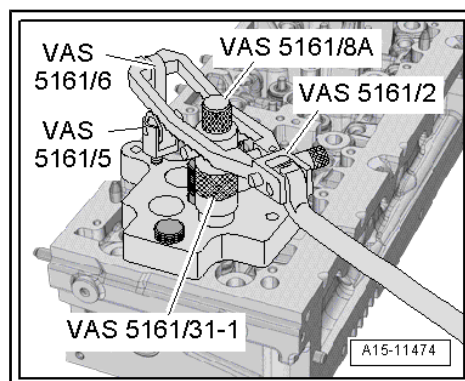
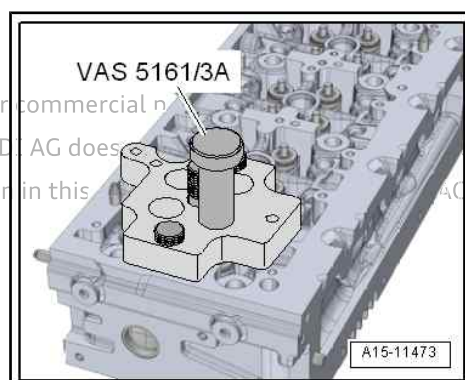
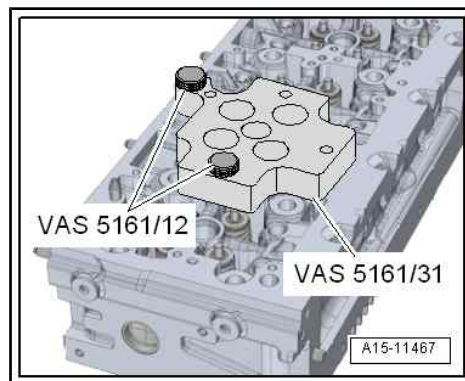
Cylinder 2:

- Fit guide plate -VAS 5161/31- onto cylinder head.
- The lettering -A- faces towards exhaust side
- The lettering -E- faces towards intake side
- Secure guide plate with knurled screws -VAS 5161/12- by hand.
- Position of knurled screws, as shown in illustration



Continued for all cylinders:

- Insert drift -VAS 5161/3A- into 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 5161/8A- (slide on sleeve -VAS 5161/31-1-) 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 off assembly cartridge with sleeve.
- Detach valve spring with valve spring plate.
- Pull off valve stem oil seal with valve stem seal puller - 3364- .





Caution

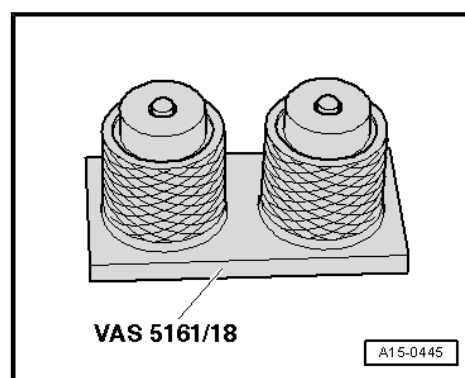
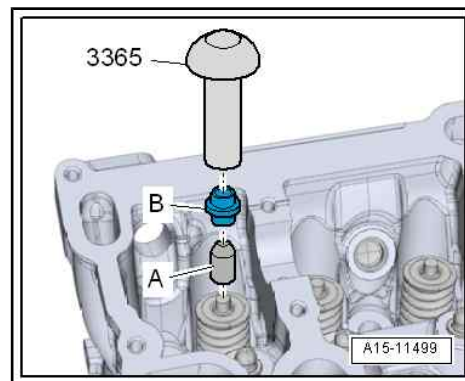
Make sure valve stem oil seals are not damaged when installing.

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

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

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

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and take up valve cotters.
- Insert valve spring and valve spring plate.

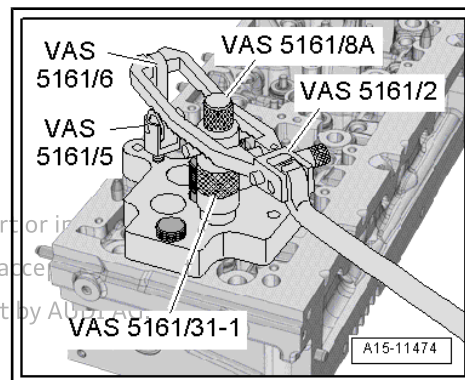


- Insert assembly cartridge in guide plate -VAS 5161/31- again.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Attaching

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

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshaft housing ➔ [page 114](#) .





4 Inlet and exhaust valves

⇒ ["4.1 Checking valve guides", page 138](#)

⇒ ["4.2 Checking valves", page 139](#)

⇒ ["4.3 Valve dimensions", page 139](#)

4.1 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



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- ◆ Dial gauge - VAS 6079-



Procedure

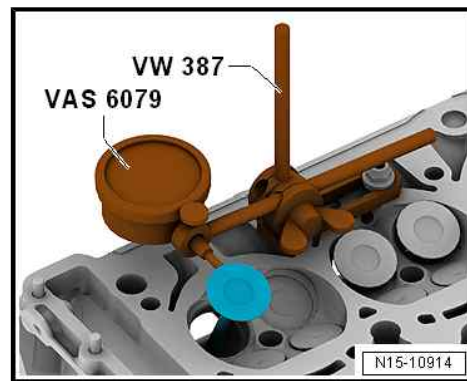


Note

- ◆ If the valve has to be renewed as part of a repair, use a new valve for the measurement.
- ◆ Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.



- Attach dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder head.
- Insert valve into guide.
 - End of valve stem must be flush with guide.
- Measure the amount of sideways play.
 - Wear limit: 1.0 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded.



Note

Valve guides cannot be renewed.

4.2 Checking valves

- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.

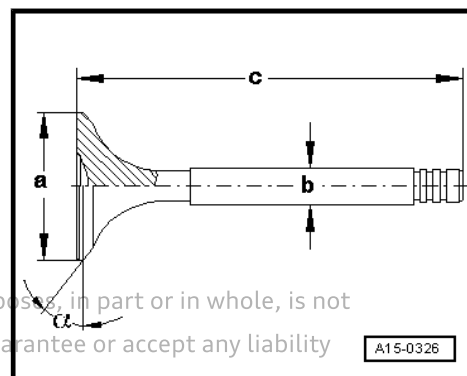
4.3 Valve dimensions



Note

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

Dimension		Inlet valve	Exhaust valve
Ø a	mm	26.60	24.50
Ø b	mm	5.94	5.94
c	mm	99.30	99.10
α	°	45	45





17 – Lubrication

1 Sump/oil pump

⇒ [“1.1 Exploded view - sump/oil pump”, page 140](#)

⇒ [“1.2 Engine oil”, page 142](#)

⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 142](#)

⇒ [“1.4 Removing and installing oil pump”, page 144](#)

⇒ [“1.5 Removing and installing sump \(top section\)”, page 146](#)

⇒ [“1.6 Removing and installing oil level and oil temperature sender G266”, page 150](#)

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1.1 Exploded view - sump/oil pump



Note

- ◆ *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, take the following steps after completing repairs: clean the oil passages carefully and renew the oil spray jets, engine oil cooler and oil filter.*
- ◆ *Oil spray jet and pressure relief valve ⇒ [page 80](#)*



1 - Bolt

- ☐ 8 Nm

2 - Cover

3 - Oil pump

- ☐ With vacuum pump
- ☐ With balance weights
- ☐ Renew after removing (backlash between crankshaft sprocket and drive chain sprocket of oil pump cannot be set)
- ☐ Removing and installing ⇒ [page 144](#)

4 - Seal

- ☐ Renew after removing

5 - Cylinder block

6 - O-ring

- ☐ Renew after removing

7 - Valve for oil pressure control - N428-

- ☐ Removing and installing ⇒ [page 159](#)

8 - Bolt

- ☐ 8 Nm

9 - Oil dipstick

10 - Bolt

- ☐ 8 Nm

11 - Dipstick guide tube

12 - Bolt

- ☐ 8 Nm

13 - O-ring

- ☐ Renew after removing

14 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 142](#)

15 - Sump (top section)

- ☐ Removing and installing ⇒ [page 146](#)

16 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 142](#)

17 - Gasket

- ☐ Renew after removing

18 - Sump (bottom section)

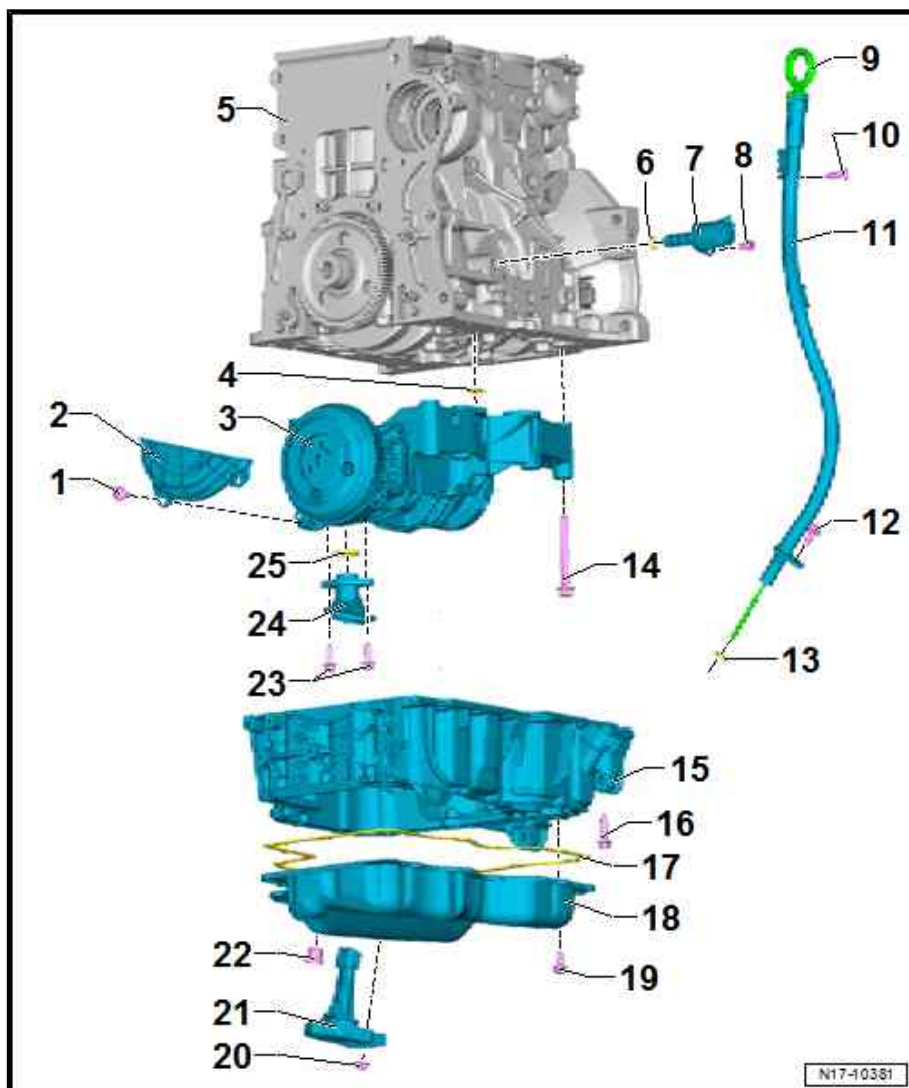
- ☐ Removing and installing ⇒ [page 142](#)

19 - Bolt

- ☐ Tighten in stages and in diagonal sequence; final torque 10 Nm.

20 - Nut

- ☐ 10 Nm





21 - Oil level and oil temperature sender - G266-

- ❑ Removing and installing ⇒ [page 150](#)

22 - Oil drain plug

- ❑ 30 Nm

23 - Bolt

- ❑ 8 Nm

24 - Oil intake pipe

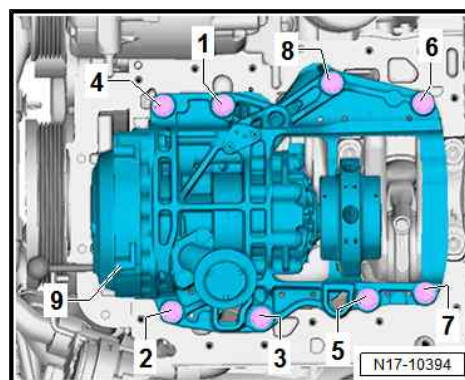
25 - Seal

- ❑ Renew after removing

Oil pump - tightening torque and sequence

- Tighten bolts in stages in the sequence shown.

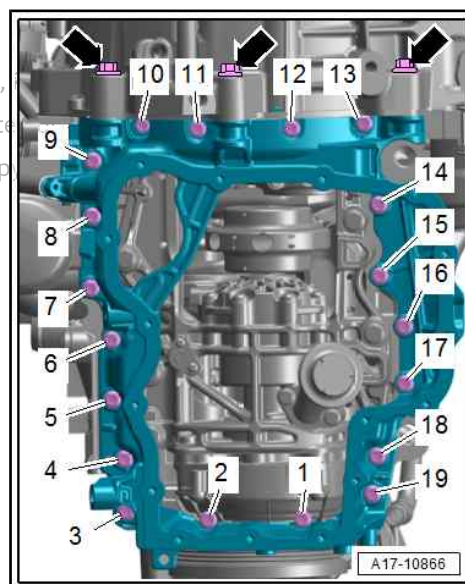
Stage	Bolts	Tightening torque
1.	-1 ... 8-	Screw in by hand until contact is made
2.	-1 ... 8-	20 Nm



Sump (top section) - tightening torque and sequence

- Tighten bolts in stages as follows:

Stage	Bolts	Tightening torque
1.	-1 ... 19-	5 Nm in diagonal sequence
2.	-Arrows-	40 Nm
3.	-1 ... 19-	13 Nm in diagonal sequence



1.2 Engine oil

Oil capacities, oil specifications and viscosity grades ⇒ Maintenance tables .

1.3 Removing and installing sump (bottom section)

Special tools and workshop equipment required



- ◆ Articulated wrench, 10 mm - 3185-



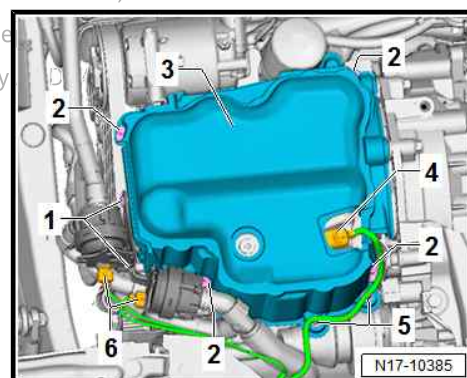
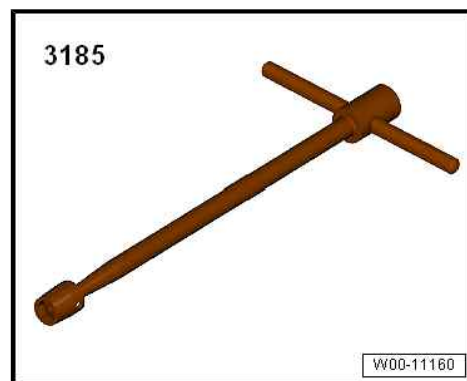
Removing

- Engine oil drained ⇒ Maintenance ; Booklet 819

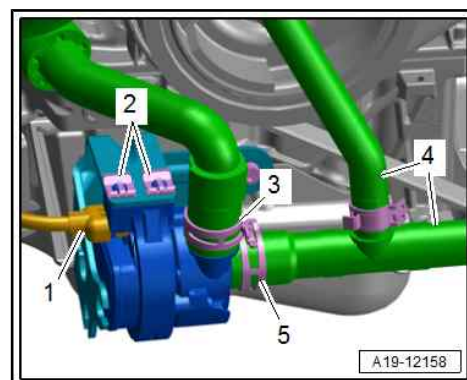
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- Unplug electrical connector -4- for oil level and oil temperature sender - G266- , release clips -5- and move electrical wiring clear.

- Remove bolts -1-.
- Release clips -2- and detach noise insulation -3- for sump (bottom section).



- Unplug electrical connector -1-.
- Detach retaining clips -2- and press charge air cooling pump - V188- to one side.



- Remove bolts -2- and detach sump (bottom section) -1- with gasket.

Installing

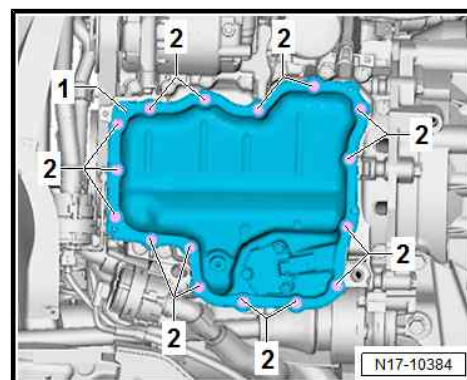
Installation is carried out in reverse order; note the following:



Note

Renew gasket after removing.

- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .



Tightening torques

- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 140](#)
- ◆ ⇒ [“2.3 Exploded view - electric coolant pump”, page 177](#)



1.4 Removing and installing oil pump



Note

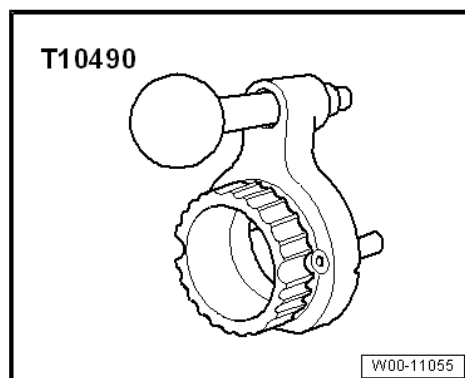
Do not re-install a used oil pump! If this is done, the backlash between the crankshaft sprocket and the drive chain sprocket of the oil pump cannot be set. The drive chain sprocket of a new oil pump has a coating that automatically creates the backlash and wears down as the engine runs.

Special tools and workshop equipment required

- ◆ Locking pin - 3359-



- ◆ Crankshaft stop - T10490-



Removing

- Remove vibration damper ➔ [page 49](#) .
- Remove sump (bottom section) ➔ [page 142](#) .
- Remove sump (top section) ➔ [page 146](#) .



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- Remove bolts in sequence -8 ... 1- and detach oil pump -9-.

Installing

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



Note

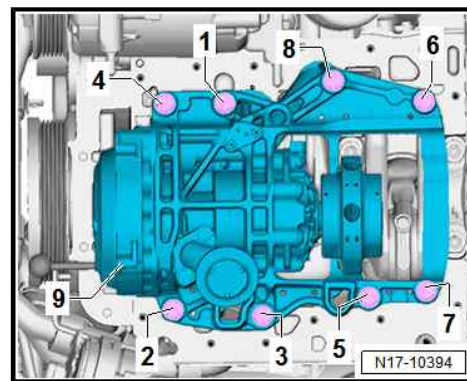
Renew oil pump and seal after removing.



Caution

Risk of damage to engine.

- ◆ ***Turn the crankshaft only in the direction of normal engine rotation to prevent the toothed belt from slipping.***

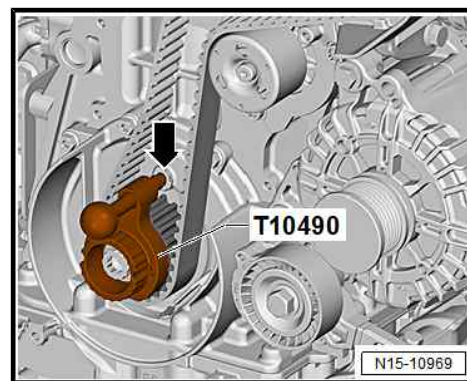


- Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at "TDC".
- Lock crankshaft sprocket in position with crankshaft stop - T10490- .
- Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.
- Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.



Note

For illustration purposes, the installation position is shown with the toothed belt cover (bottom) removed.

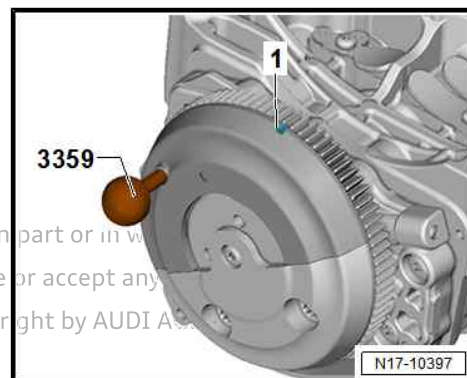
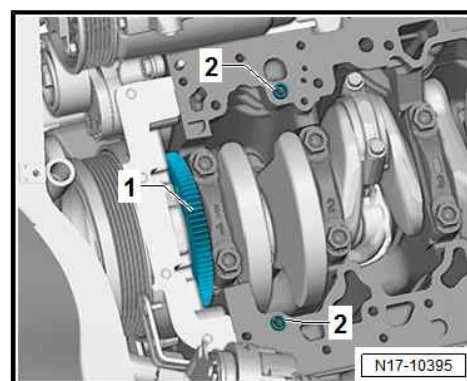


WARNING

Risk of eye injury.

- ◆ ***Put on safety goggles.***

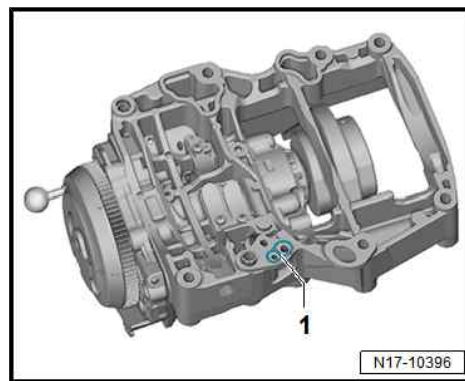
- Use compressed air to remove excess oil from between teeth of crankshaft sprocket -1-.
- Check that dowel sleeves -2- are fitted in cylinder block; install dowel sleeves as necessary.
- Lock drive chain sprocket -1- of new oil pump in place using locking pin - 3359- , as shown in illustration.



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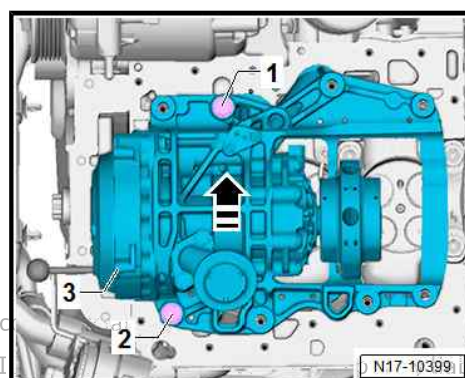
- Fit new seal -1- in oil pump housing.



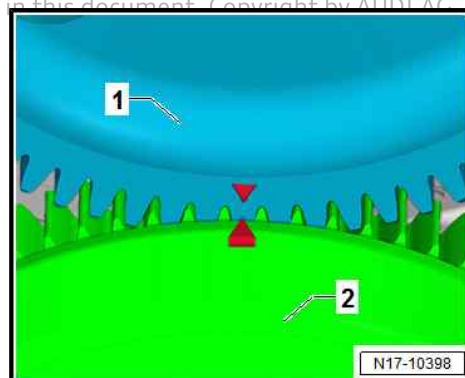
- Bring oil pump -3- into installation position and screw in bolts -1, 2- by hand until they make contact.
- Push oil pump in direction of -arrow- as far as it will go and tighten bolts by hand in this position.



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- Check that markings on drive chain sprocket -1- and oil pump -2- are aligned exactly, as shown in illustration.
- Fit and tighten remaining bolts ➔ [page 142](#) .
- Remove crankshaft stop - T10490- and locking pin - 3359- .
- Install sump (upper section) ➔ [page 146](#) .
- Install vibration damper ➔ [page 49](#) .
- Fill with engine oil and check oil level ➔ Maintenance ; Booklet 819 .



Tightening torques

- ♦ ➔ [Fig. "Oil pump - tightening torque and sequence"](#) , [page 142](#)

1.5 Removing and installing sump (top section)

Special tools and workshop equipment required

- ♦ Socket - T10058-



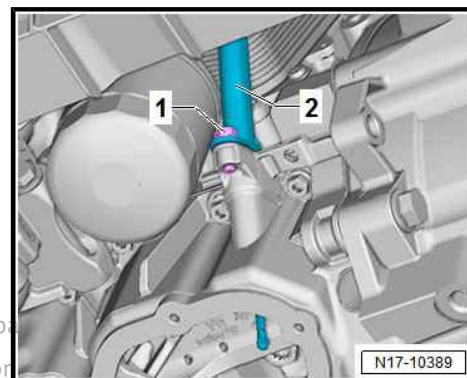
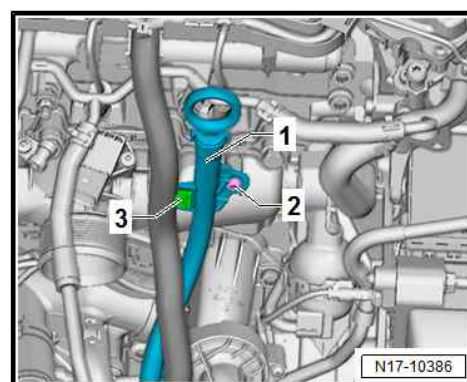
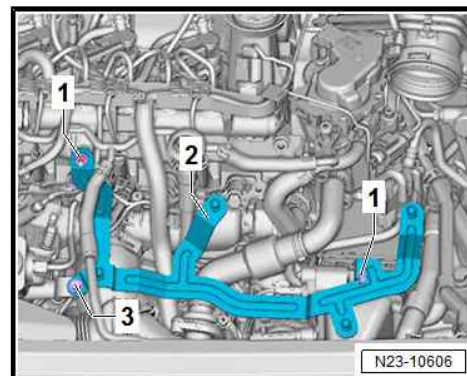
- ♦ Electric drill with plastic brush



- ◆ Sealant ⇒ Electronic parts catalogue
- ◆ Protective gloves
- ◆ Safety goggles

Removing

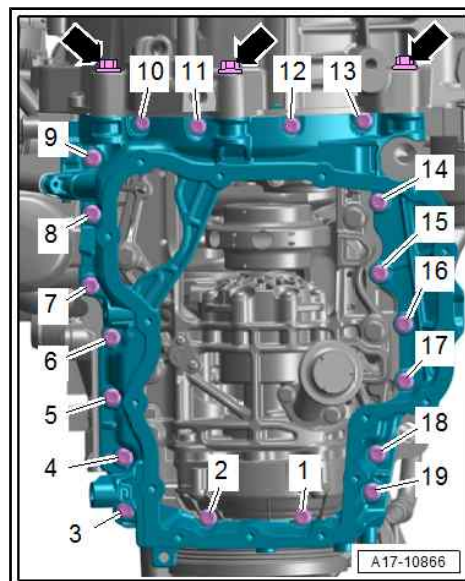
- Remove air cleaner housing ⇒ [page 236](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.
- Unscrew bolt -2- for oil dipstick guide tube -1- on intake manifold.
- Cut through cable ties -3- at top and bottom of guide tube.
- Remove bolt -1- and pull out oil dipstick guide tube -2- upwards.
- Remove sump (bottom section) ⇒ [page 142](#) .
- Remove pendulum support ⇒ [page 40](#) .
- Remove air conditioner compressor from bracket ⇒ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .



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- Remove bolts -arrows-.
- Remove bolts for sump (top section) in the sequence -19 ... 1-.



Caution

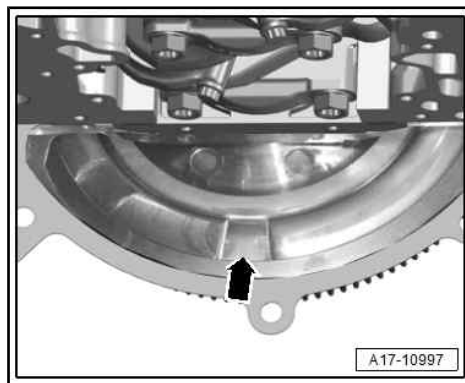
Risk of damage to engine.

- ◆ Turn the crankshaft only in the direction of normal engine rotation to prevent the toothed belt from slipping.



Note

To unscrew the two middle bolts on the flywheel end, turn the crankshaft so that the recess -arrow- is aligned with the bolt in question.



- Apply a suitable lever to cylinder block -arrow- and detach sump (top section) -1- from bonded joint.

Installing

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



Note

Renew O-ring after removal.

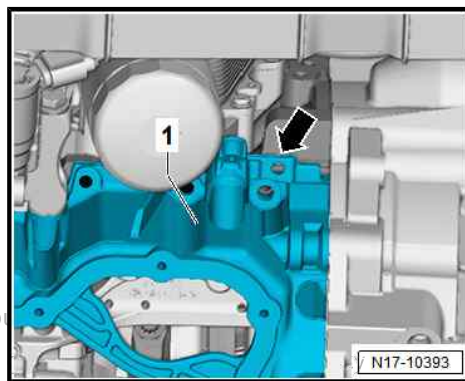
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Caution

Make sure sealant residue does not enter lubrication system.

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



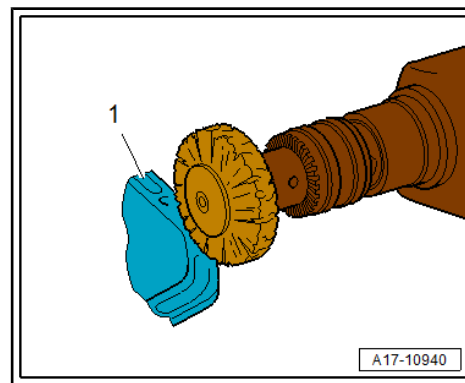


WARNING

Risk of eye injury.

◆ *Put on safety goggles.*

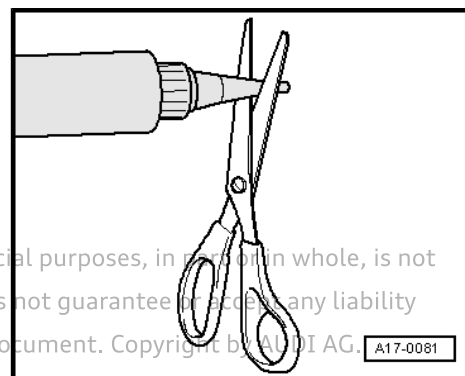
- Remove sealant residue from sump (top section) -1- and sealing flange using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.



Note

Note expiry date of sealant.

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



Caution

Make sure lubrication system is not clogged by excess sealant.

◆ *The sealant bead must not be thicker than specified.*

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- Apply sealant bead -1- onto clean sealing surface of sump as shown in illustration.
- Thickness of sealant bead: 2 ... 3 mm



Note

Take particular care when applying sealant bead in area of sealing flanges.

- Fit sump (top section) and tighten bolts ➔ [page 142](#).
- The sump (top section) must make flush contact with intermediate plate/gearbox flange.



Note

- ◆ When installing the sump (top section) with the gearbox out of the vehicle, ensure that the sump (top section) is flush with the cylinder block at the flywheel end.
- ◆ After fitting sump, sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.

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

- Install sump (bottom section) ➔ [page 142](#).
- Install pendulum support ➔ [page 40](#).
- Install air conditioner compressor ➔ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket.
- Fill with engine oil and check oil level ➔ Maintenance ; Booklet 819.

Tightening torques

- ◆ ➔ [Fig. “Sump \(top section\) - tightening torque and sequence”](#), [page 142](#)
- ◆ ➔ [“3.1 Exploded view - air cleaner housing”](#), [page 236](#)

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

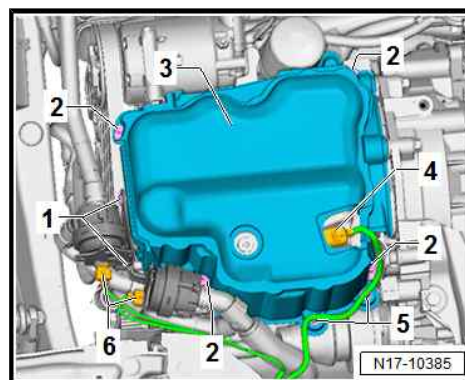
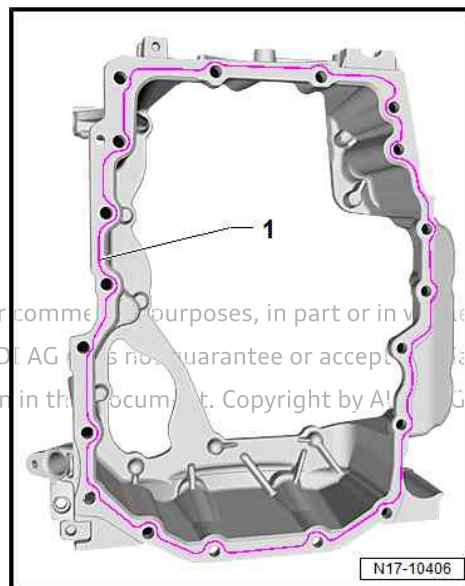
Removing

- Engine oil drained ➔ Maintenance ; Booklet 819
- Unplug electrical connector -4- for oil level and oil temperature sender - G266- , release clips -5- and move electrical wiring clear.
- Release clips -2- and move noise insulation -3- to right side.



Note

Disregard items -1 and 6-.





- 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:

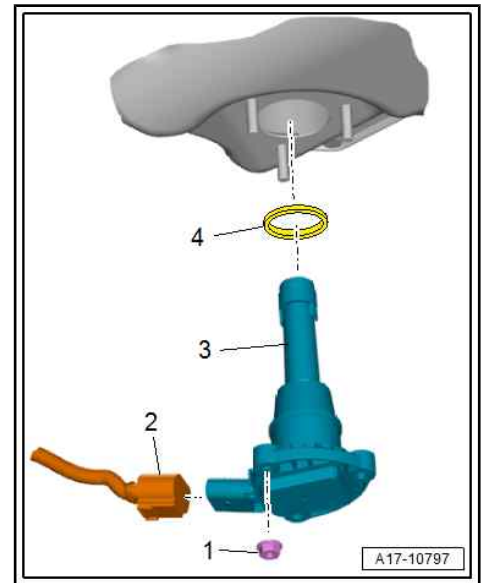


Note

- ◆ *Renew seal -4- after removing.*
- ◆ *Disregard -item 2-.*
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 140](#)



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2 Engine oil cooler



Note

Engine oil cooler must not be separated from oil filter housing. If defective, engine oil cooler must be renewed together with oil filter housing ➔ [page 155](#).



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3 Oil filter/oil pressure switches

⇒ ["3.1 Exploded view - oil filter housing/oil pressure switch", page 153](#)

⇒ ["3.2 Removing and installing oil pressure switch F1", page 154](#)

⇒ ["3.5 Checking oil pressure", page 160](#)

⇒ ["3.3 Removing and installing oil filter housing", page 155](#)

⇒ ["3.4 Removing and installing valve for oil pressure control N428", page 159](#)

3.1 Exploded view - oil filter housing/oil pressure switch

1 - Bolt

- ☐ 2 Nm

2 - Connection

3 - O-ring

- ☐ Renew after removing

4 - Securing clip

5 - Oil pressure switch - F1-

- ☐ Opening/closing pressure 0.3 ... 0.6 bar
- ☐ Check in [Guided Fault Finding](#) ⇒ Vehicle diagnostic tester
- ☐ Removing and installing ⇒ [page 154](#)



Caution

*Risk of damage to oil filter housing.
Do NOT turn oil pressure switch - F1- in oil filter housing.*

- ☐ 20 Nm

6 - Seal

7 - Adapter

- ☐ With oil pressure switch - F1- screwed on, insert into oil filter housing and secure with securing clip -item 4-

8 - O-ring

- ☐ Renew after removing

9 - Seal

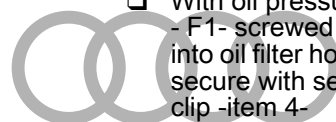
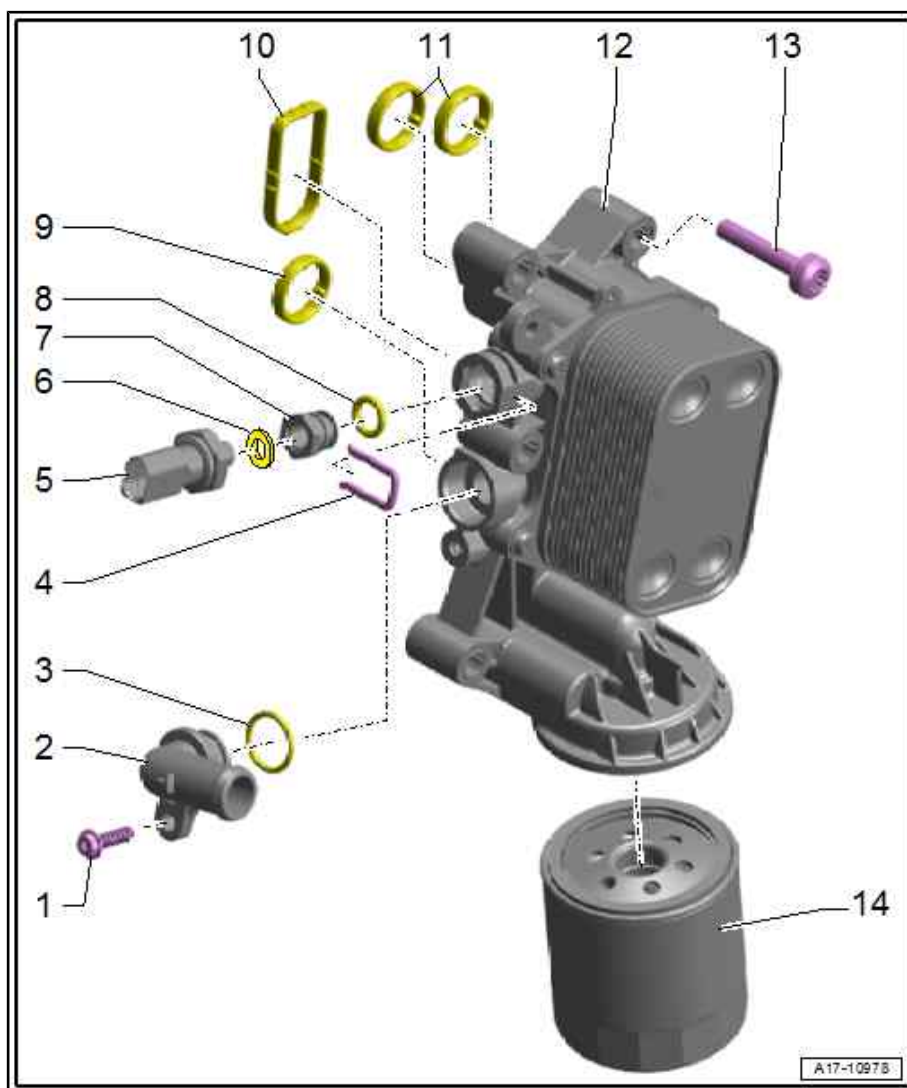
- ☐ Renew after removing

10 - Seal

- ☐ Renew after removing

11 - Seals

- ☐ Renew after removing



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12 - Oil filter housing

- ❑ Do not separate oil filter housing and engine oil cooler
- ❑ Removing and installing ⇒ [page 155](#)

13 - Bolt

- ❑ Tighten in stages and in diagonal sequence; final torque 20 Nm.

14 - Oil filter

- ❑ See note ⇒ [page 140](#)
- ❑ Removing and installing ⇒ Maintenance ; Booklet 819

3.2 Removing and installing oil pressure switch - F1-

Special tools and workshop equipment required

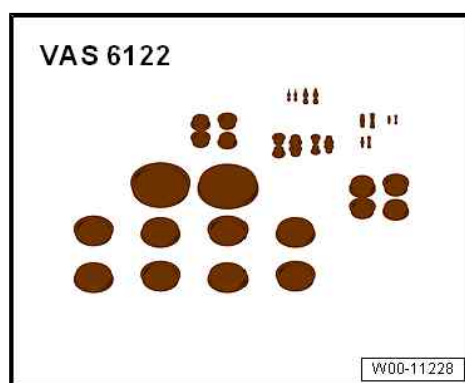
- ♦ Engine bung set - VAS 6122-



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Removing

- Remove air cleaner housing ⇒ [page 237](#).
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.

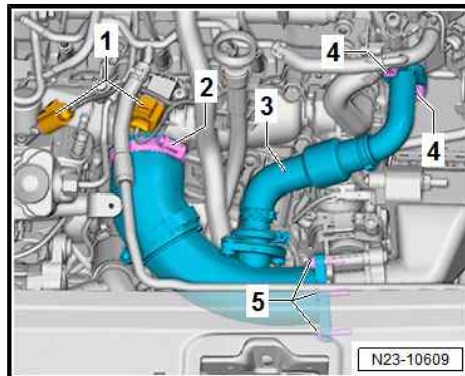
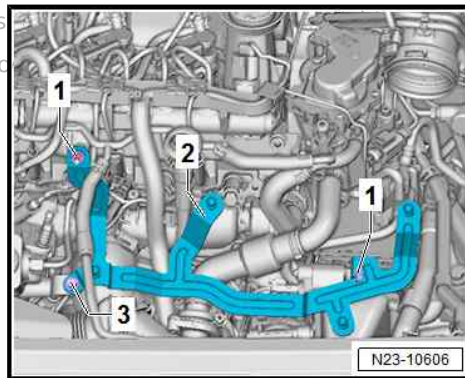


- Release hose clip -2- and remove bolts -4, 5-.
- Detach air duct with exhaust gas recirculation pipe -3-.



Note

Disregard -item 1-.





- Unplug electrical connector -1-.

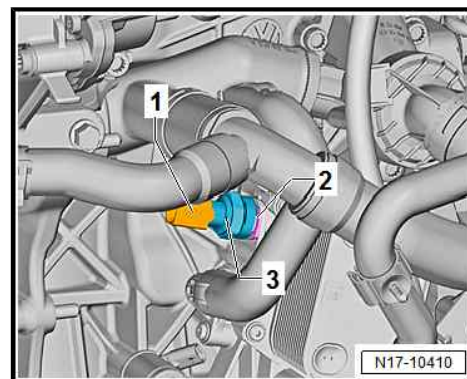


Caution

Risk of damage to oil filter housing.

- ◆ **Do NOT turn oil pressure switch - F1- in oil filter housing.**

- Remove securing clip -2- and detach oil pressure switch - F1- -item 3-.



- Unscrew oil pressure switch - F1- -item 1- from adapter -2-.

Installing

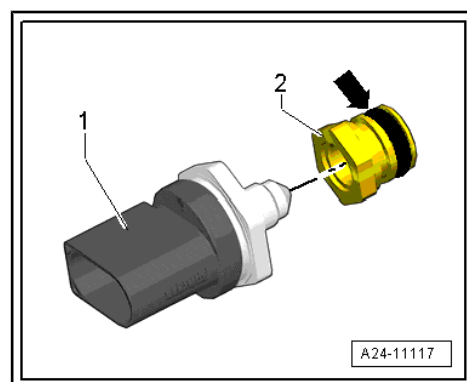
Installation is carried out in reverse order; note the following:



Note

Renew O-ring -arrow- after removal.

- Screw adapter -2- onto oil pressure switch - F1- -item 1-.



Note

Ensure that securing clip is positioned correctly.

- Check oil level ⇒ Maintenance ; Booklet 819 .
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 216](#)
- ◆ ⇒ [“4.1.2 Exploded view - exhaust gas recirculation system, high-pressure”, page 312](#)

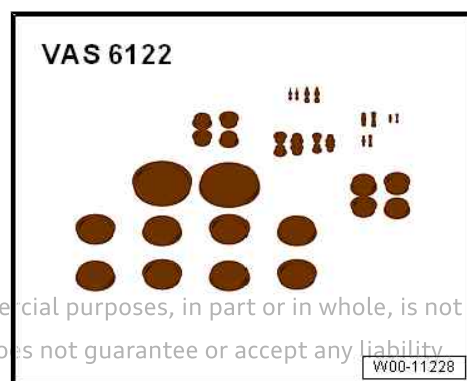
3.3 Removing and installing oil filter housing

Special tools and workshop equipment required

- ◆ Engine bung set - VAS 6122-

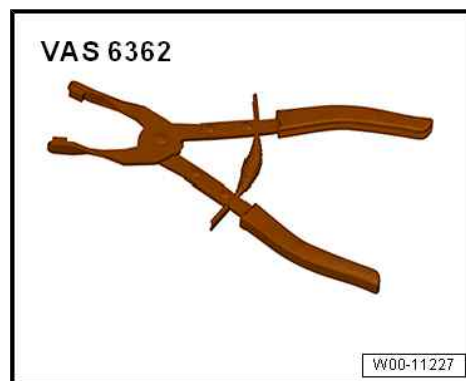


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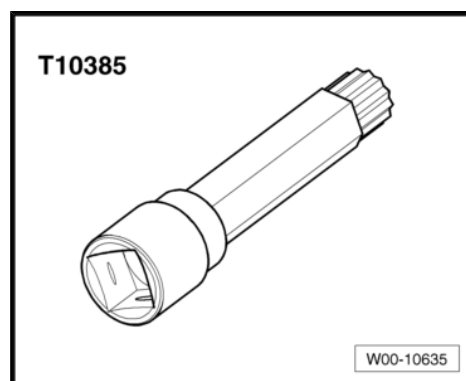




- ◆ Hose clip pliers - VAS 6362-

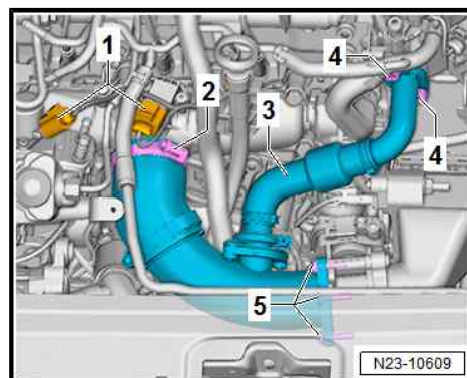
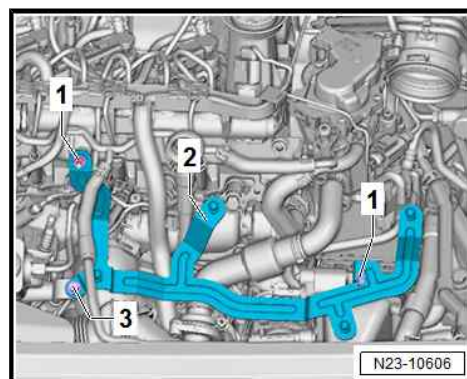


- ◆ Bit XZN 10 - T10385-



Removing

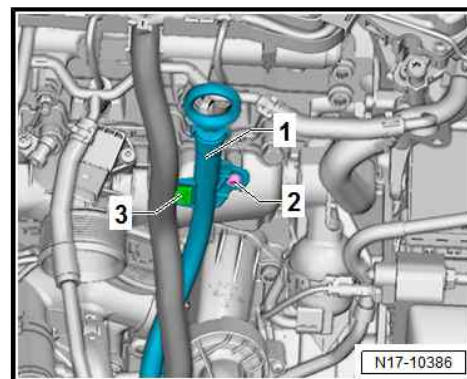
- Remove air cleaner housing ⇒ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.
- Release hose clip -2- and remove bolts -4, 5-.
- Detach air duct with exhaust gas recirculation pipe -3-.



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- Unscrew bolt -2- for oil dipstick guide tube -1- on intake manifold.



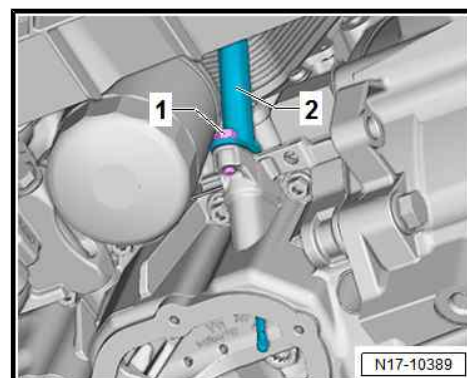
- Cut through cable ties -3- at top and bottom of guide tube.
- Drain coolant ➔ [page 165](#) .



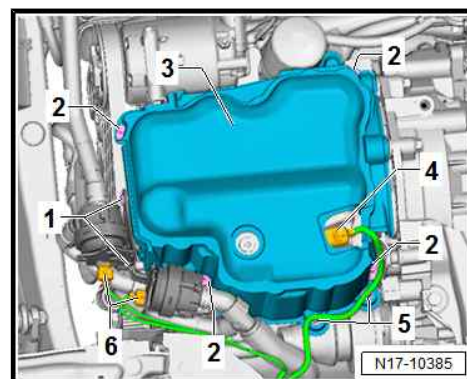
Caution

Risk of coolant entering lubrication system.

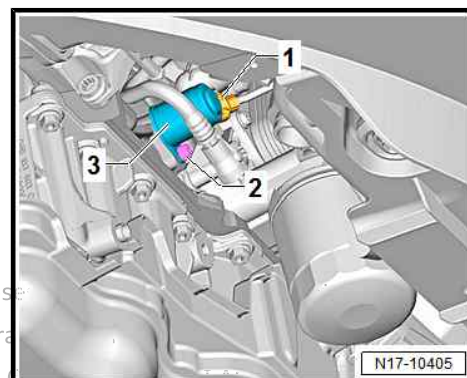
- ◆ **After removing guide tube, it is very important to seal off hole for guide tube in sump using sealing plugs from engine bung set - VAS 6122- .**



- Remove bolt -1- and pull out oil dipstick guide tube -2- upwards.
- Unplug electrical connector -4- for oil level and oil temperature sender - G266- , release clips -5- and move electrical wiring clear.
- Release clips -2- and move noise insulation -3- to right side.
- Remove poly V-belt ➔ [page 46](#) .
- Remove air conditioner compressor from bracket ➔ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .



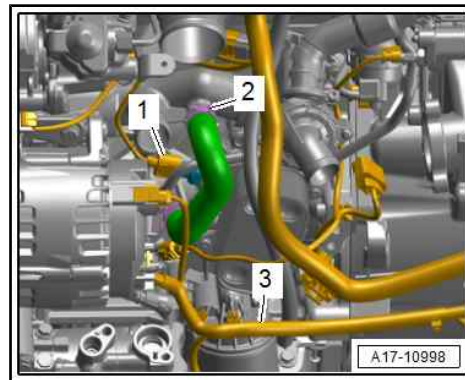
- Unplug electrical connector -1- at valve for oil pressure control - N428- -item 3-.



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- Unplug electrical connector -1- and move wiring harness -3- clear.
- Release hose clip -2- and disconnect coolant hose.



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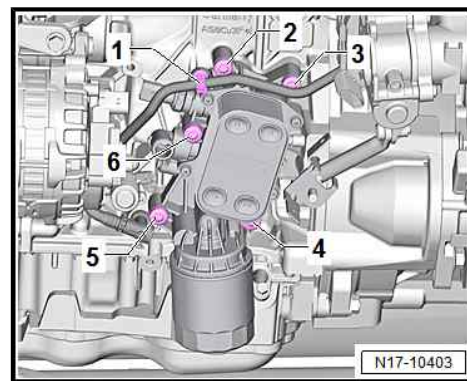
Note

Place a cloth underneath to catch escaping engine oil.

- Open clip -1- and move vacuum line clear.
- Remove bolts -2 ... 6-.
- Remove oil filter housing downwards.

Installing

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



Note

- ◆ *Renew gaskets and O-rings after removal.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- Install air conditioner compressor ⇒ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Install poly V-belt ⇒ [page 46](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ *After it is filled, the cooling system must be bled with the ⇒ Vehicle diagnostic tester.*



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - oil filter housing/oil pressure switch", page 153](#)
- ◆ ⇒ ["1.1 Exploded view - sump/oil pump", page 140](#)
- ◆ ⇒ ["2.2 Exploded view - hose connections for charge air system", page 216](#)
- ◆ ⇒ ["4.1.2 Exploded view - exhaust gas recirculation system, high-pressure", page 312](#)
- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 236](#)

3.4 Removing and installing valve for oil pressure control - N428-

Removing

- Remove poly V-belt ⇒ [page 46](#) .



- Remove air conditioner compressor from bracket ⇒ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .



Note

Place a cloth underneath to catch escaping engine oil.

- Unplug electrical connector -1-.
- Remove bolt -2- and detach valve for oil pressure control - N428- -item 3-.

Installing

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



Note

Renew O-ring after removal.

- Install air conditioner compressor ⇒ Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Install poly V-belt ⇒ [page 46](#) .
- Check oil level ⇒ Maintenance ; Booklet 819 .

Tightening torques

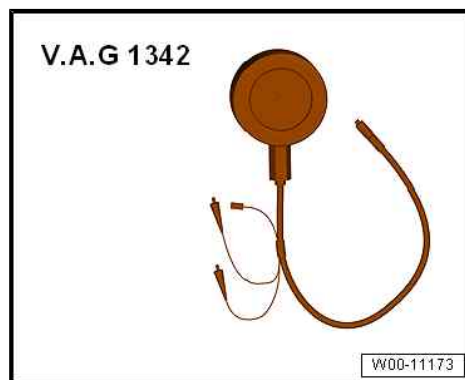
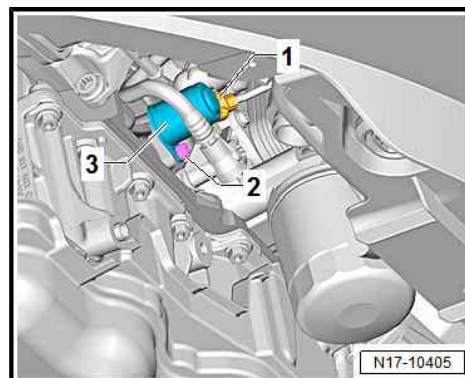
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- ♦ ⇒ [“1.1 Exploded view – sump/oil pump”, page 140](#)

3.5 Checking oil pressure

Special tools and workshop equipment required

- ♦ Oil pressure tester - V.A.G 1342-



- ♦ Vehicle diagnostic tester

Procedure

- Oil level OK
- Remove oil pressure switch - F1- ⇒ [page 154](#) .
- Connect oil pressure tester - V.A.G 1342- to threaded hole for oil pressure switch - F1- .
- Screw a used oil pressure switch into threaded hole on oil pressure tester - V.A.G 1342- to seal hole.
- Start engine.



- Oil pressure when starting and then at idling speed: at least 0.6 bar.

If specification is not obtained, switch off engine immediately and check oil pump drive; renew oil pump if necessary ⇒ [page 144](#) .

If specification is obtained, higher oil pressure must be checked using a vehicle diagnostic tester .

- Let engine warm up.



Note

It is not possible to test all levels of the oil pressure control system while the vehicle is stationary. The higher oil pressure must therefore be checked using the vehicle diagnostic tester .

- Connect vehicle diagnostic tester .
- Switch on ignition.
- Select **Engine electronics** in vehicle self-diagnosis.
- Then select **Basic setting**.
- Select **Checking oil pressure valve change-over** from the list.
- Press **Start** button.
- To perform basic setting, press brake and accelerator simultaneously.
- Oil pressure must rise to at least 3.5 bar.



19 – Cooling

1 Cooling system/coolant

⇒ [“1.1 Connection diagram - coolant hoses”, page 162](#)

⇒ [“1.2 Checking cooling system for leaks”, page 163](#)

⇒ [“1.3 Draining and filling cooling system”, page 165](#)

1.1 Connection diagram - coolant hoses



Note

- ◆ *Blue = Large coolant circuit*
- ◆ *Red = Small coolant circuit*
- ◆ *Violet = Coolant circuit for charge air cooler*
- ◆ *Brown = Heating circuit*
- ◆ *Arrows show direction of coolant flow.*

1 - Water radiator for charge air cooling circuit

2 - Charge air cooling pump - V188-

3 - Coolant pump

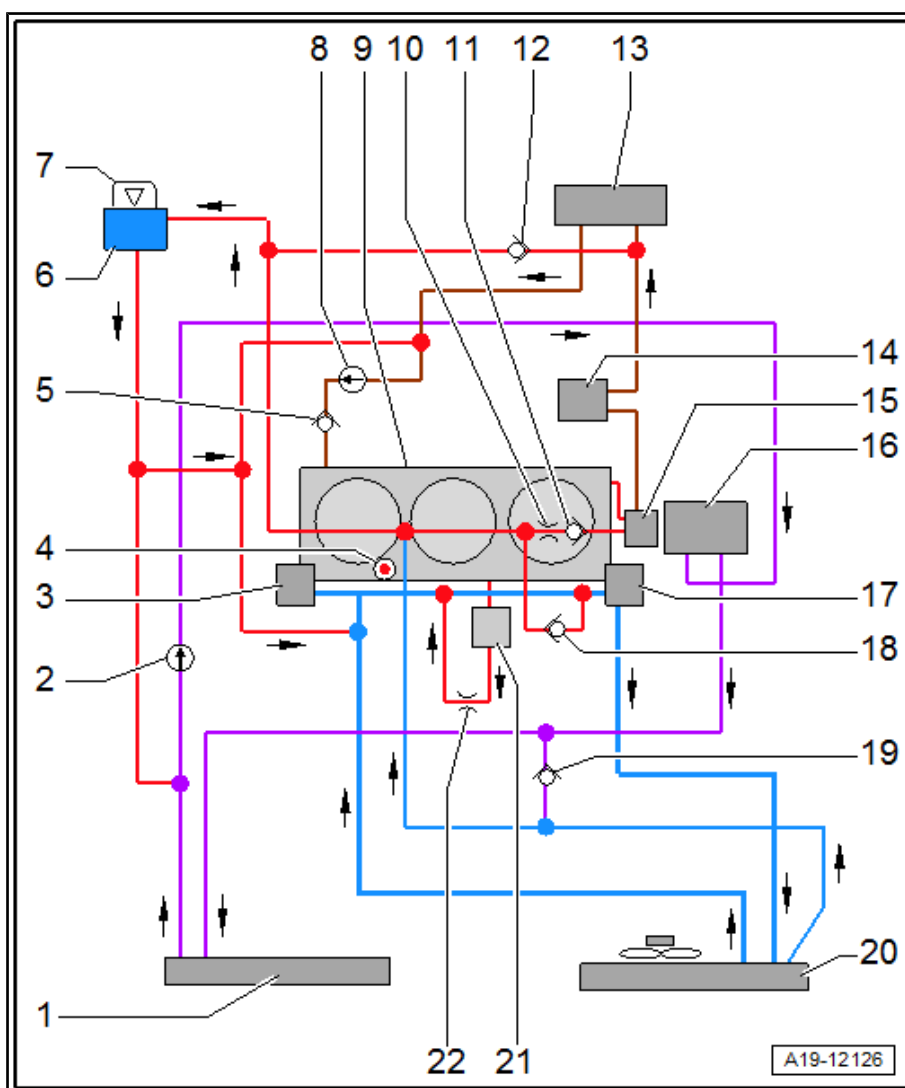
4 - Coolant temperature sender - G62-

5 - Non-return valve

6 - Coolant expansion tank

7 - Filler cap

- ☐ For coolant expansion tank
- ☐ Checking pressure relief valve ⇒ [page 165](#)





- 8 - Auxiliary pump for heating - V488-
- 9 - Cylinder head/cylinder block
- 10 - Restrictor
- 11 - Non-return valve
- 12 - Non-return valve
- 13 - Heat exchanger for heater
- 14 - Exhaust gas recirculation cooler (low-pressure)
- 15 - Exhaust gas recirculation cooler (high-pressure)
- 16 - Charge air cooler
- 17 - Thermostat
- 18 - Non-return valve
- 19 - Non-return valve
- 20 - Radiator
- 21 - Engine oil cooler
- 22 - Restrictor

1.2 Checking cooling system for leaks

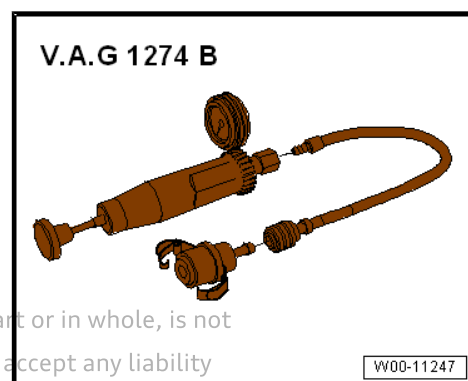
Special tools and workshop equipment required

- ◆ Cooling system tester - V.A.G 1274 B-



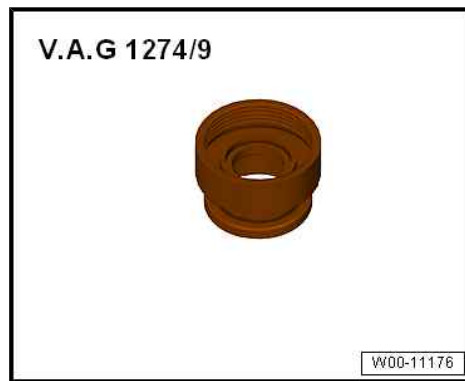
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- ◆ Adapter for cooling system tester - V.A.G 1274/8-





- ◆ Adapter for cooling system tester - V.A.G 1274/9-



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- To ensure that the leak test is carried out correctly, a self-test must first be performed on the cooling system tester - V.A.G 1274 B-.

Checking cooling system tester - V.A.G 1274 B- (self-test)

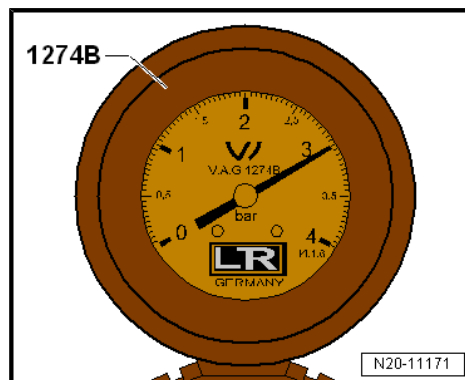
- Operate cooling system tester - V.A.G 1274 B- several times.
- Build up a pressure of 3.0 bar on cooling system tester.
- Monitor pressure on pressure gauge of cooling system tester - V.A.G 1274 B- for 30 seconds.

If pressure does not build up, or if pressure dissipates again:

- Cooling system tester - V.A.G 1274 B- is leaking and must not be used.

Checking cooling system for leaks

- Engine must be warm.
- Ignition switched off.



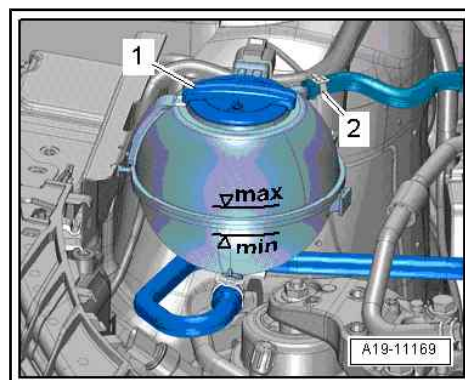
WARNING

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.



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.

If the pressure drops by more than 0.2 bar:

- Examine engine and radiator to find and eliminate the leak.
- If no leaks can be found, check for leaks in water-cooled charge air cooler and exhaust gas recirculation cooler.

Checking pressure relief valve in filler cap

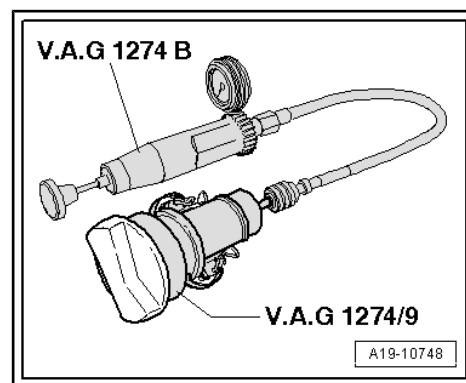
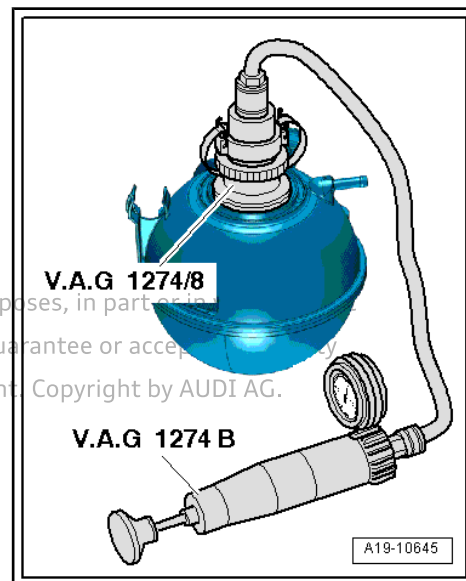
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
- Build up pressure with hand pump on cooling system tester.

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

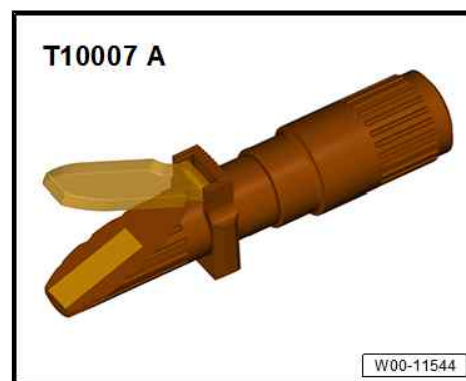
Drain coolant ➔ [page 167](#) .

Fill and bleed coolant circuit ➔ [page 168](#) .

Bleed cooling system ➔ [page 172](#) .

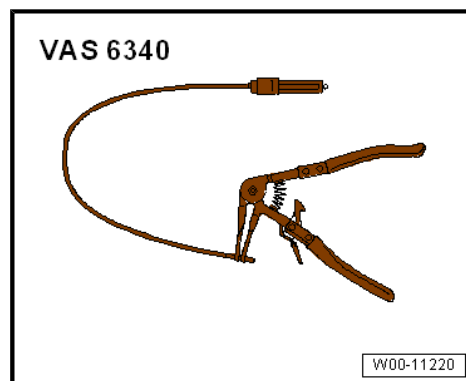
Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester
- ◆ Refractometer - T10007A-

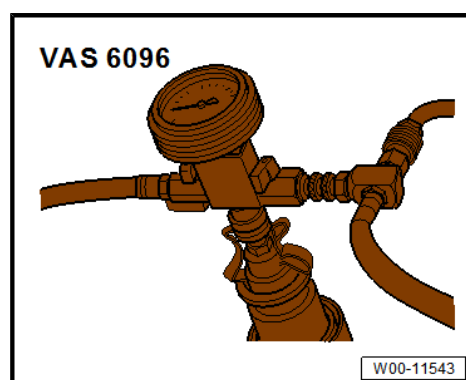




- ◆ Hose clip pliers - VAS 6340-



- ◆ Cooling system charge unit - VAS 6096-



- ◆ Adapter for cooling system tester - V.A.G 1274/8-

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- ◆ Coolant collecting system - VAS 5014- or drip tray for workshop hoist - VAS 6208-





- ◆ Release tool - VAS 531 001-



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- ◆ Safety goggles
- ◆ Protective gloves

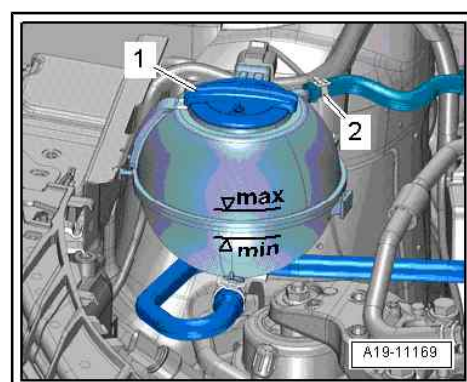
Draining



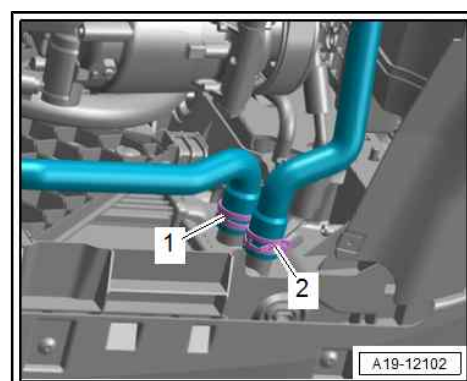
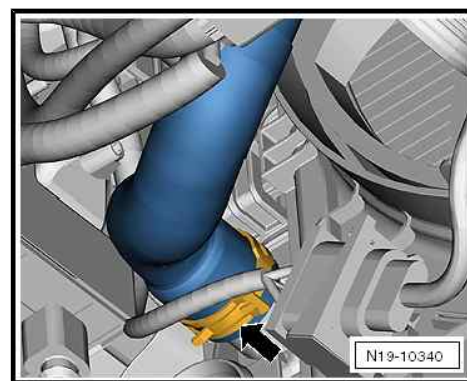
WARNING

Risk of scalding due to hot steam and hot coolant.

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



- 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 collector tank from coolant collecting system -VAS 5014- or drip tray for workshop hoist - VAS 6208- underneath.
- Release hose clip -arrow-, disconnect coolant hose (bottom) 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 -arrow-, disconnect coolant hose (bottom) from auxiliary pump for heating - V488- and drain off coolant.

Filling and bleeding coolant circuit:



Caution

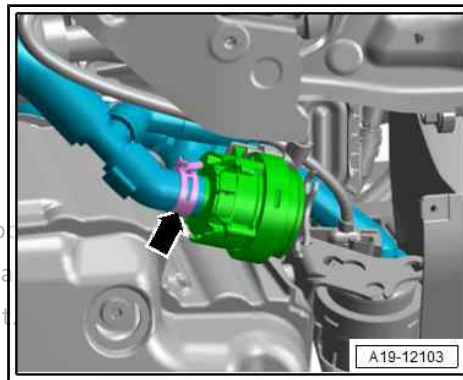
Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ ***After it is filled, the cooling system must be bled with the ⇒ Vehicle diagnostic tester.***



Caution

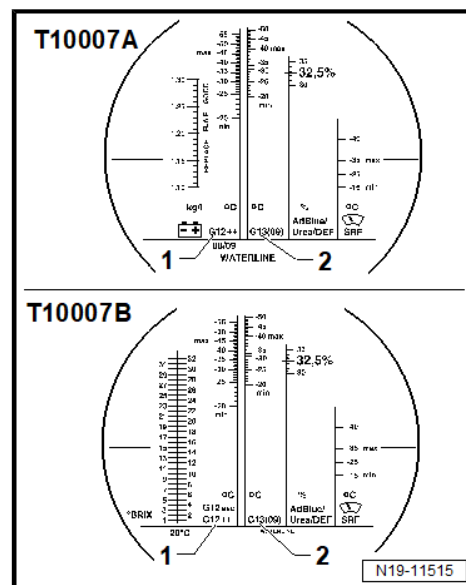
To ensure optimal corrosion protection, only distilled water may be mixed with coolant additives.





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 additive ⇒ Electronic parts catalogue

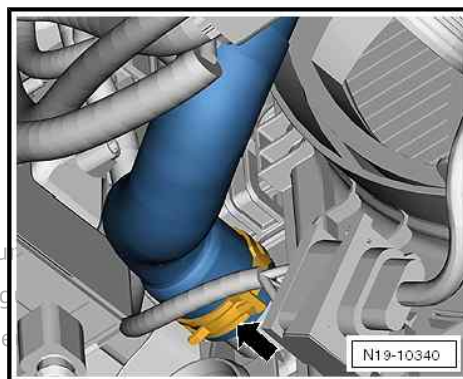


Only if coolant has been drained off:

- Connect coolant hose (bottom) to radiator using hose clip -arrow-.

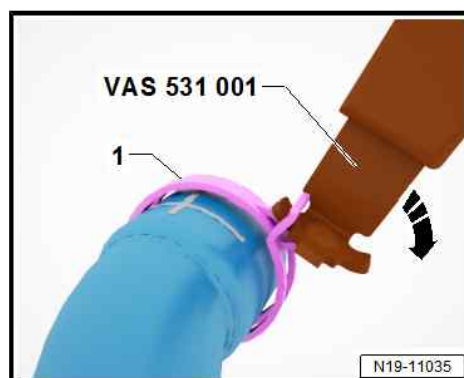


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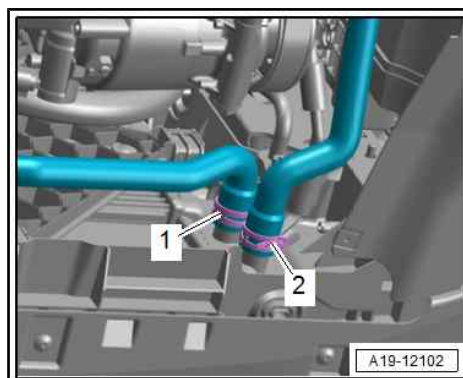


Note

Release pre-tensioned clip -1- in direction of -arrow- using release tool - VAS 531 001- .

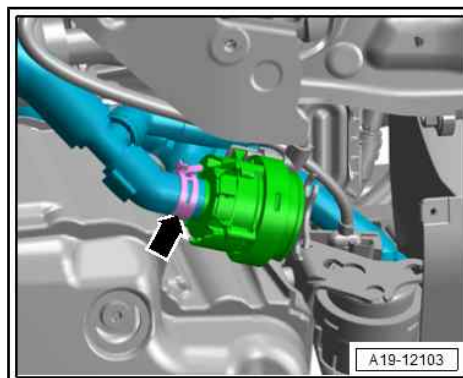


- Connect coolant hoses to water radiator for charge air cooling circuit at bottom right with hose clips -1 and 2-.



- Connect coolant hose leading to auxiliary pump for heating - V488- at bottom with hose clip -arrow-.

To fill up with coolant:





- 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 -2- into a small container -3-.

i Note

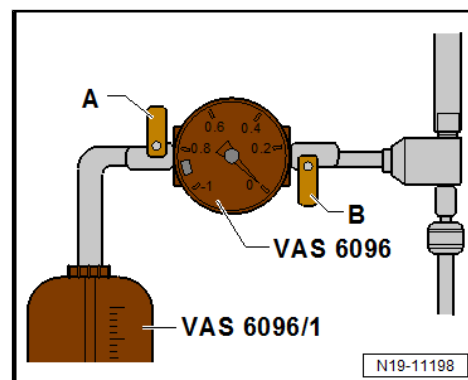
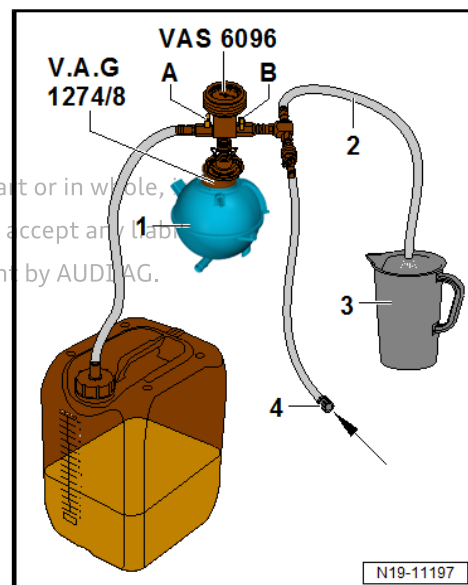
The vented air draws along a small amount of coolant, which should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -4- 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.

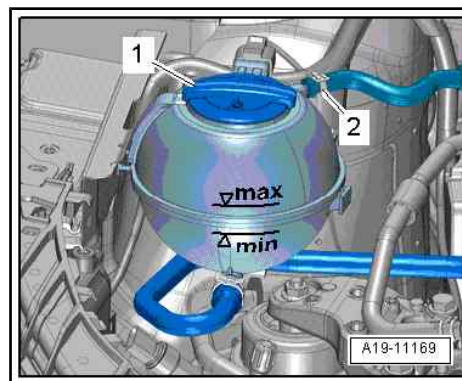
i Note

- ♦ *If the needle does not reach the green zone, repeat the process.*
- ♦ *Check cooling system for leaks if the vacuum is not maintained.*
- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of the cooling system charge unit - 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 .



Bleeding coolant circuit:

- Coolant must be topped up to "max" mark.
- Start engine.
- Set temperature to "HI".
- Switch off air conditioner compressor (press **AC** button).
- LED in button should not light up.
- Set fresh air blower to lowest setting.
- Connect ⇒ Vehicle diagnostic tester.
- Start Guided Fault Finding.
- Choose **Select own test** tab and select following options one after the other:
 - ◆ **Drive train**
 - ◆ **Select engine code and engine**
 - ◆ **01 - Self-diagnosis compatible systems**
 - ◆ **01 - Engine electronics**
 - ◆ **01 - Engine electronics functions**
 - ◆ **01 - Coolant circuit charge**

- Follow instructions shown on ⇒ Vehicle diagnostic tester.
- Switch off engine.



Checking coolant level:



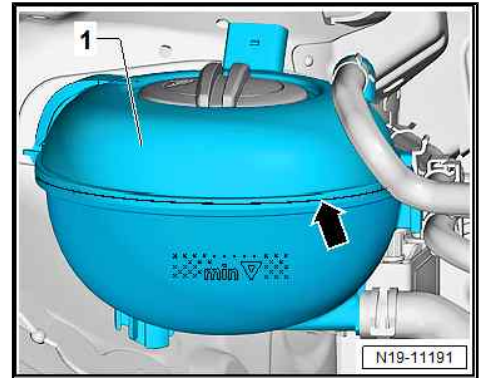
WARNING

Risk of scalding due to hot steam and hot coolant.

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



- The coolant level must not be above the -seam- -arrow- when the engine is warm.



- The coolant level should be about 5 mm above the MAX mark -arrow- when the engine is cold.

Note

The increased coolant level is necessary as the coolant level can drop during the bleeding process.

- Top up with coolant again if necessary.
- Erase event memory ⇒ Vehicle diagnostic tester.



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2 Coolant pump/thermostat assembly

⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 174](#)

⇒ [“2.2 Exploded view - coolant temperature senders”, page 176](#)

⇒ [“2.3 Exploded view - electric coolant pump”, page 177](#)

⇒ [“2.4 Removing and installing electric coolant pump”, page 178](#)

⇒ [“2.5 Removing and installing coolant pump”, page 181](#)

⇒ [“2.6 Removing and installing thermostat”, page 183](#)

⇒ [“2.7 Removing and installing coolant valve for cylinder head N489”, page 185](#)

⇒ [“2.8 Checking thermostat”, page 187](#)

⇒ [“2.9 Removing and installing coolant temperature sender G62”, page 187](#)

2.1 Exploded view - coolant pump/thermostat

1 - Coolant pipe (front)

- ❑ Removing and installing
⇒ [page 191](#)

2 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

3 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

4 - Coolant pump

- ❑ Removing and installing
⇒ [page 181](#)

5 - Bolt

- ❑ 20 Nm

6 - O-rings

- ❑ Renew after removing
- ❑ Lubricate with coolant

7 - Coolant valve for cylinder head - N489-

- ❑ Removing and installing
⇒ [page 185](#)

8 - Bolt

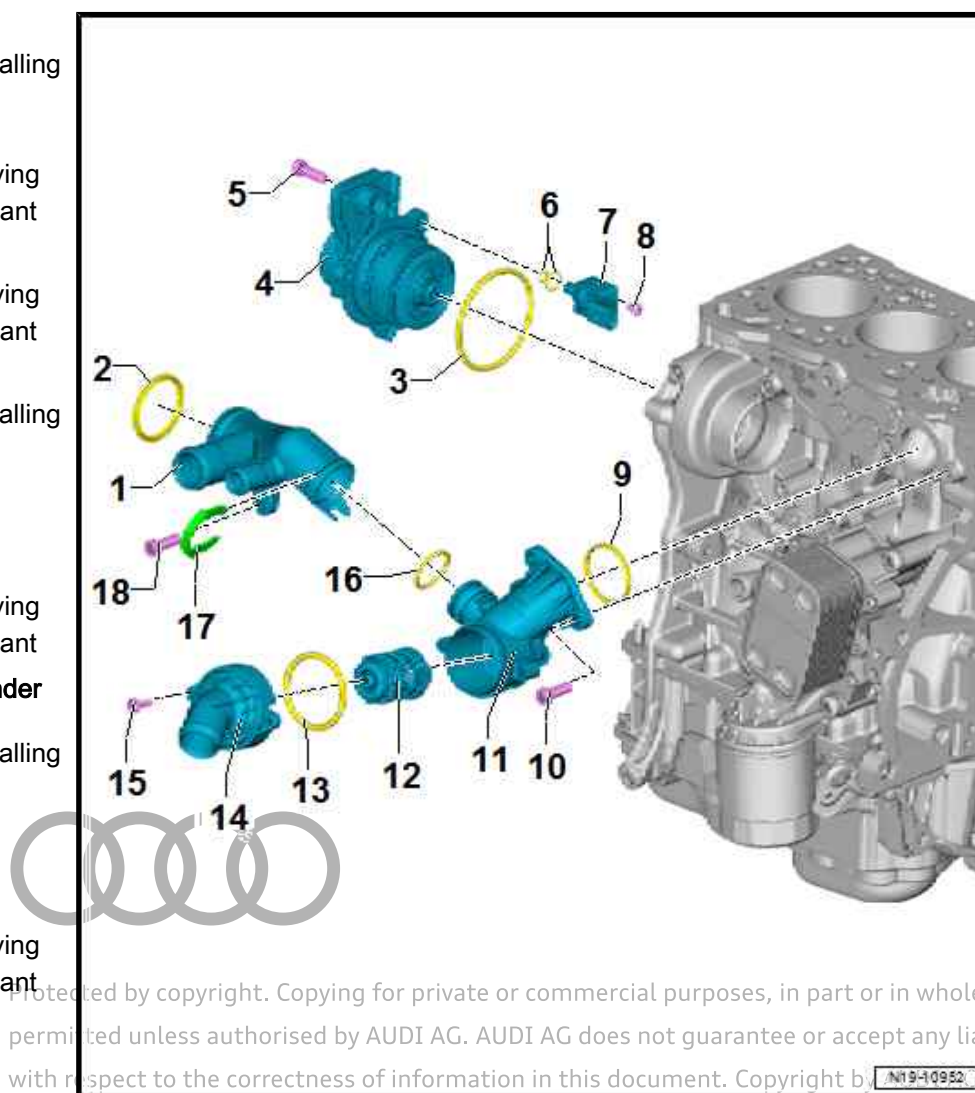
- ❑ 8 Nm

9 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

10 - Bolt

- ❑ 20 Nm





11 - Thermostat housing

12 - Thermostat

- ☐ Removing and installing ⇒ [page 183](#)

13 - O-ring

- ☐ Renew after removing
- ☐ Lubricate with coolant

14 - Connection

15 - Bolt

- ☐ 8 Nm

16 - O-ring

- ☐ Renew after removing
- ☐ Lubricate with coolant

17 - Retaining clip

- ☐ Check that it is securely seated

18 - Bolt

- ☐ 20 Nm

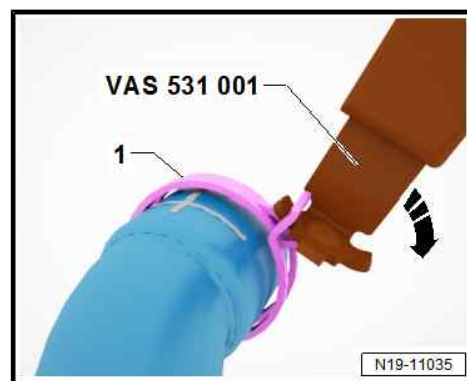
Releasing pre-tensioned spring-type clips

- Insert release tool - VAS 531 001- into spring-type clip -1- as shown and release fastener.



Note

Depending on the installation position of the spring-type clip, the tool may have to be inserted in a different position.



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2.2 Exploded view - coolant temperature senders

1 - Support ring

- ☐ Renew after removing
- ☐ Lubricate with coolant

2 - O-ring

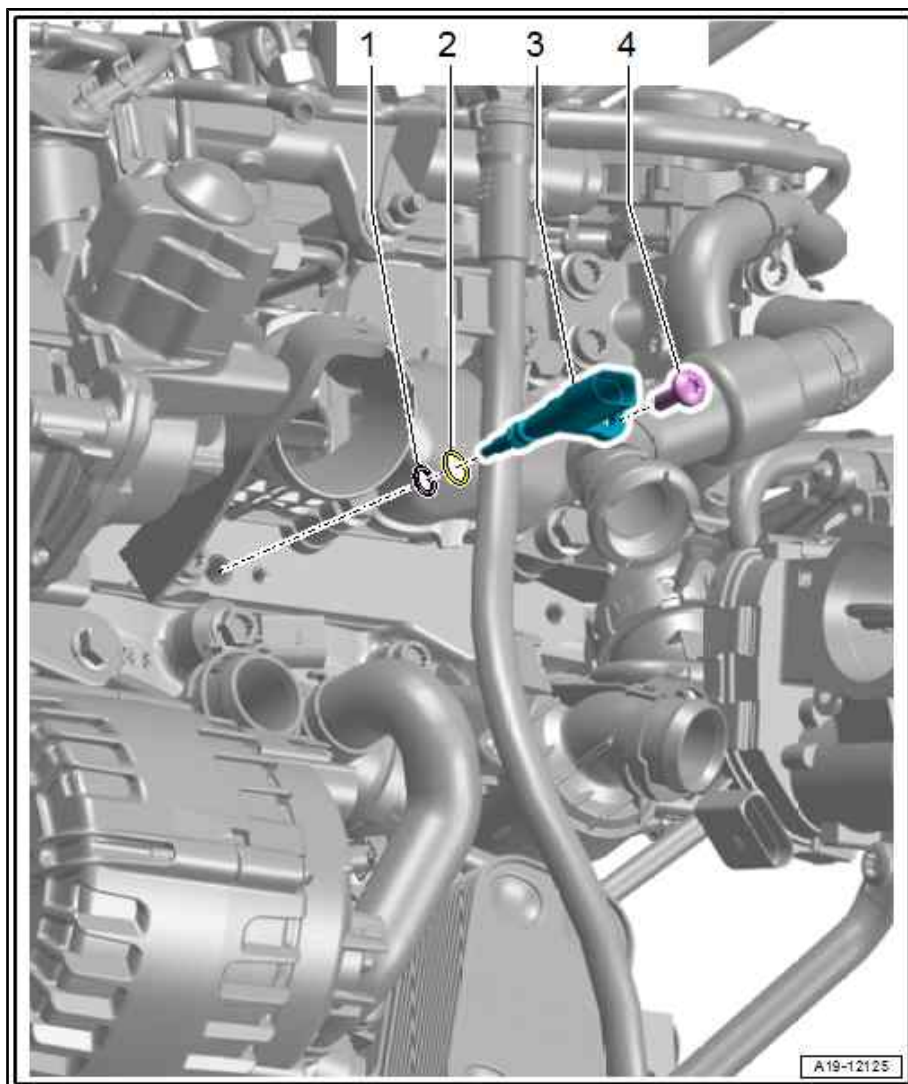
- ☐ Renew after removing
- ☐ Lubricate with coolant

3 - Coolant temperature sender - G62-

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

4 - Bolt

- ☐ 8 Nm



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2.3 Exploded view - electric coolant pump

1 - Charge air cooling pump - V188-

- ☐ Removing and installing
⇒ [page 178](#)

2 - Coolant hose

- ☐ Connection diagram
⇒ [page 162](#)

3 - Bracket

- ☐ For charge air cooling pump - V188-

4 - Retaining clips

5 - Bracket

- ☐ For auxiliary pump for heating - V488-

6 - Auxiliary pump for heating - V488-

- ☐ Removing and installing
⇒ [page 178](#)

7 - Retaining clips

8 - Coolant hose

- ☐ Connection diagram
⇒ [page 162](#)

9 - Coolant hose

- ☐ Connection diagram
⇒ [page 162](#)

10 - Bolt

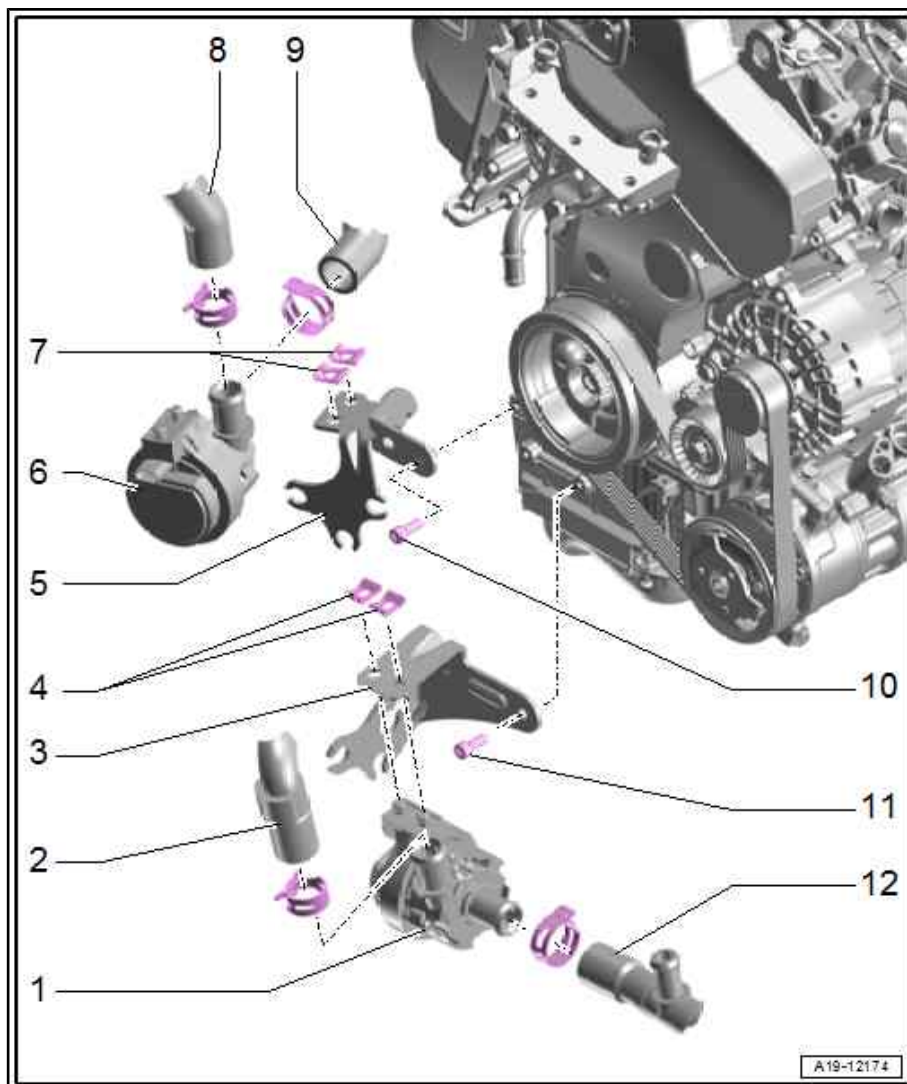
- ☐ 8 Nm

11 - Bolt

- ☐ 8 Nm

12 - Coolant hose

- ☐ Connection diagram ⇒ [page 162](#)



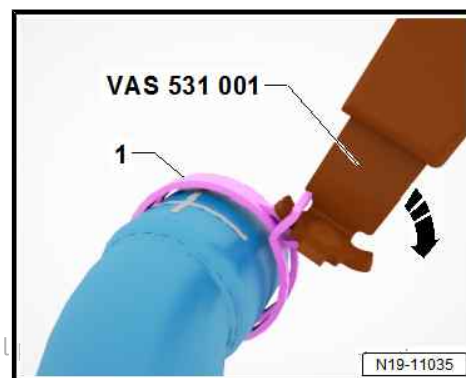
Releasing pre-tensioned spring-type clips

- Insert release tool - VAS 531 001- into spring-type clip -1- as shown and release fastener.



Note

Depending on the installation position of the spring-type clip, the tool may have to be inserted in a different position.



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2.4 Removing and installing electric coolant pump

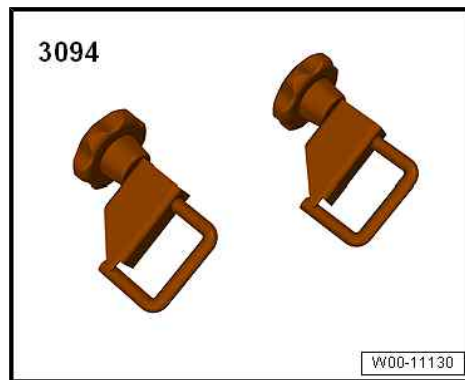
⇒ ["2.4.1 Removing and installing charge air cooling pump V188"](#), page 178

⇒ ["2.4.2 Removing and installing auxiliary pump for heating V488"](#), page 179

2.4.1 Removing and installing charge air cooling pump - V188-

Special tools and workshop equipment required

◆ Hose clamps up to 25 mm - 3094-

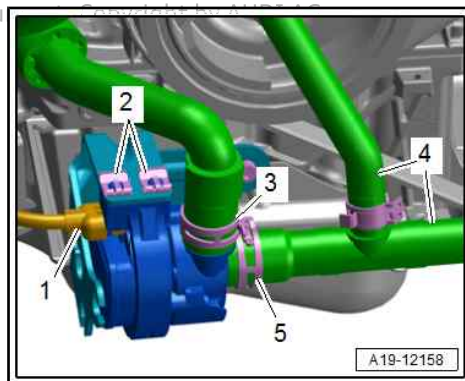


◆ Hose clip pliers - VAS 6362-



Removing

- Remove noise insulation ➤ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation
- Unplug electrical connector -1-
- Remove retaining clips -2- and detach charge air cooling pump - V188- .
- Clamp off coolant hoses -3, 4- with hose clamps up to 25 mm - 3094- .





i Note

- ◆ Place a cloth underneath to catch escaping coolant.
- ◆ Insert release tool - VAS 531 001- into spring-type clip -1- as shown and release fastener.
- ◆ Depending on the installation position of the spring-type clip, the tool may have to be inserted in a different position.

– Release hose clips and disconnect coolant hoses -3 and 5-.

Installing

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

i Note

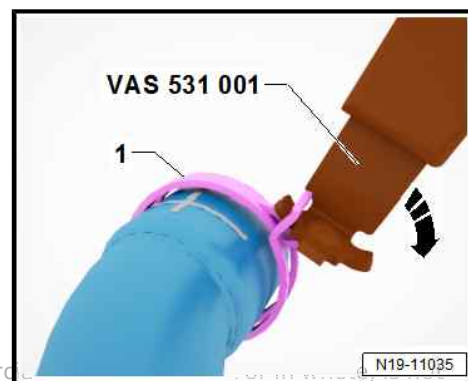
Secure all hose connections with correct type of hose clips (as original equipment) ⇒ *Electronic parts catalogue* .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ After it is filled, the cooling system must be bled with the
⇒ *Vehicle diagnostic tester*.



i Note

Do not reuse coolant.

– Bleed coolant circuit ⇒ [page 172](#) .

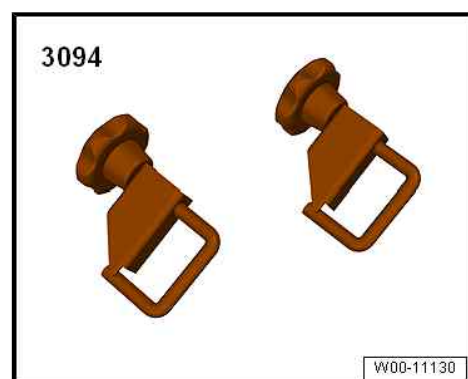
Tightening torques

- ◆ ⇒ [“2.3 Exploded view - electric coolant pump”, page 177](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

2.4.2 Removing and installing auxiliary pump for heating - V488-

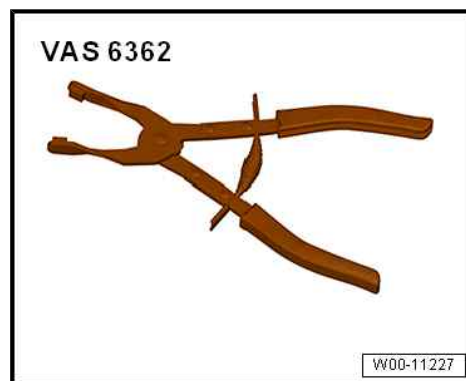
Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



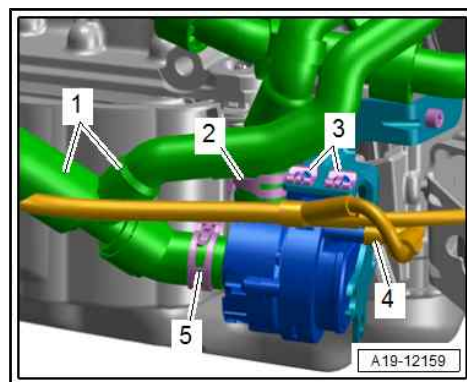


- ◆ Hose clip pliers - VAS 6362-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -4-.
- Pull out retaining clips -3- and detach auxiliary pump for heating - V488- .
- Clamp off coolant hoses -1- with hose clamps up to 25 mm - 3094- .

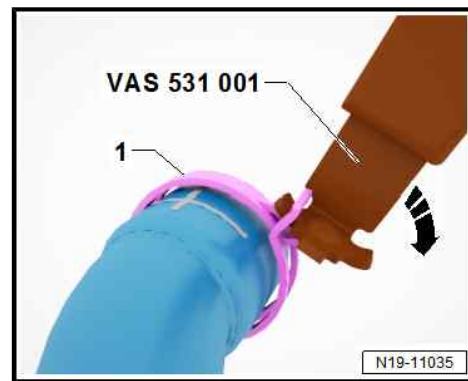


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Note

- ◆ Place a cloth underneath to catch escaping coolant.
- ◆ Insert release tool - VAS 531 001- into spring-type clip -1- as shown and release fastener.
- ◆ Depending on the installation position of the spring-type clip, the tool may have to be inserted in a different position.
- Clamp off coolant hose using hose clamps, up to 25 mm - 3094- , release hose clip -2- and disconnect hose.
- Release hose clip -5- and disconnect coolant hose.



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* .

 **Caution**
Risk of damage to power unit if cooling system is insufficiently filled/bled.
 ◆ After it is filled, the cooling system must be bled with the
 ⇒ **Vehicle diagnostic tester.**

Note

Do not reuse coolant.

- Bleed coolant circuit ⇒ [page 172](#) .

Tightening torques

- ◆ ⇒ [“2.3 Exploded view - electric coolant pump”, page 177](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

2.5 Removing and installing coolant pump

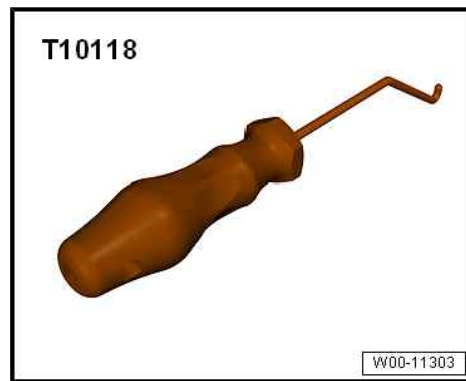
Special tools and workshop equipment required

- ◆ Counterhold tool - 3415-



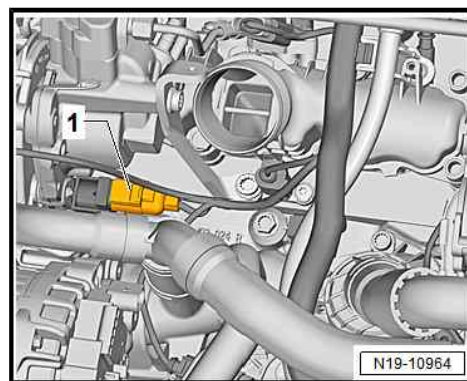


◆ Assembly tool - T10118-



Removing

- Remove air cleaner housing ➔ [page 237](#) .
- Release and unplug electrical connector -1- for coolant valve for cylinder head - N489- using assembly tool - T10118- .
- Drain coolant ➔ [page 165](#) .
- Remove toothed belt cover (bottom) ➔ [page 89](#) .
- Detach toothed belt from camshafts ➔ [page 90](#) .
- Remove crankshaft stop - T10490- , detach toothed belt from crankshaft sprocket and move it to rear.



Caution

Risk of damage to valves and piston crowns.

- ◆ **Do not turn crankshaft when toothed belt is detached with camshafts installed.**

Risk of damage to toothed belt.

- ◆ **Do not stretch or kink toothed belt.**

- Unscrew bolts -1- and remove coolant pump -2-.

Installing

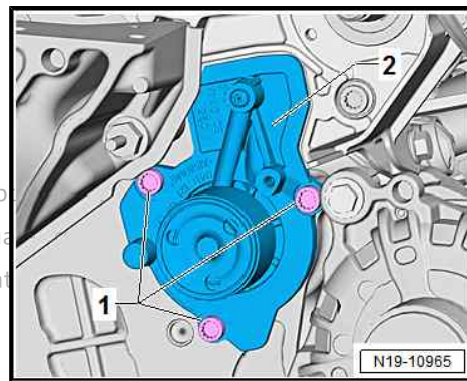
Installation is carried out in reverse order; note the following:



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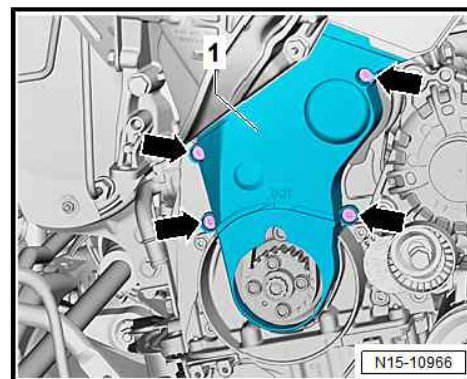
Renew O-ring after removal.

- Clean and smoothen sealing surfaces for O-ring.
- Lubricate O-ring with coolant.

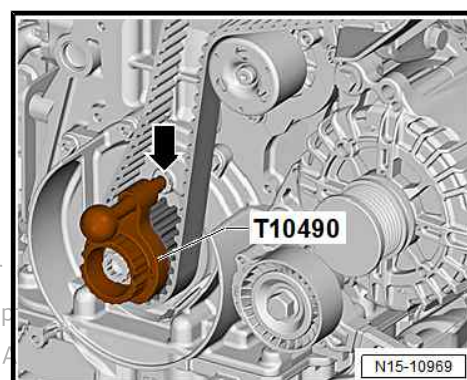




- Fit toothed belt onto coolant pump sprocket and crankshaft sprocket.
- Move toothed belt cover (bottom) -1- into installation position and tighten bolts -arrows-.



- Lock crankshaft sprocket in position with crankshaft stop - T10490- .
- Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.
- Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.



Note

For illustration purposes, the installation position is shown with the toothed belt cover (bottom) removed.

- Install toothed belt (adjust valve timing) ⇒ [page 94](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ **After it is filled, the cooling system must be bled with the ⇒ Vehicle diagnostic tester.**



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .

Tightening torques

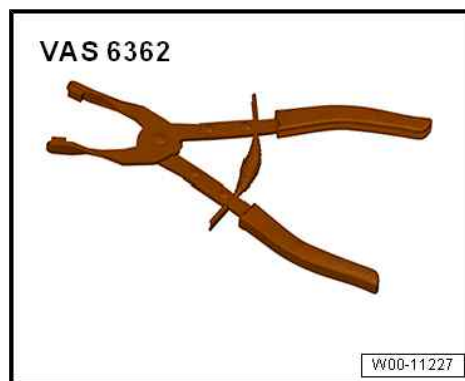
- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 174](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 86](#)

2.6 Removing and installing thermostat

Special tools and workshop equipment required

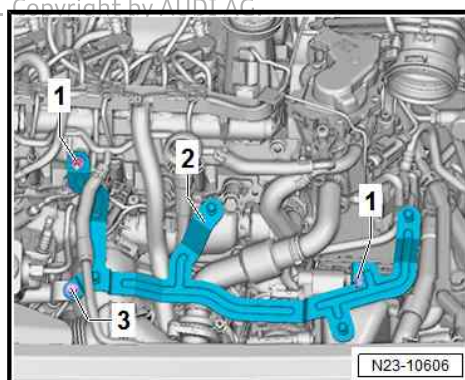


- ◆ Hose clip pliers - VAS 6362-



Removing

- Drain coolant ➔ [page 165](#) .
- Remove air cleaner housing ➔ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.

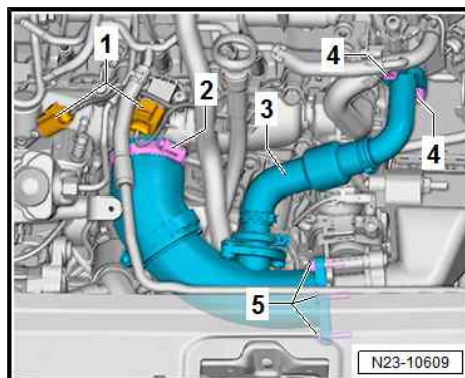


- Release hose clip -2- and remove bolts -4, 5-.
- Detach air duct with exhaust gas recirculation pipe -3-.
- Move engine wiring harness clear at guide tube for oil dipstick and push it to one side.



Note

Disregard -item 1-.



- Release hose clip -1- and disconnect coolant hose.
- Unscrew bolts -arrows- and detach housing cover -2-.
- Pull out thermostat.

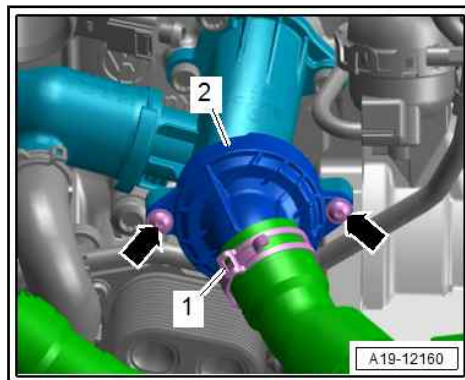
Installing

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



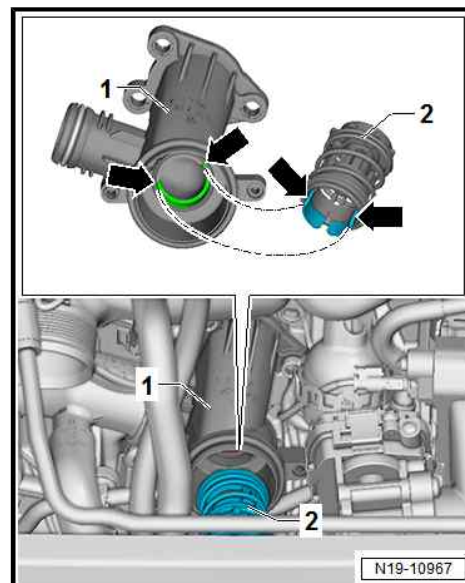
Note

- ◆ Renew O-ring after removal.
- ◆ Secure all hose connections with correct type of hose clips (as original equipment) ➔ *Electronic parts catalogue* .
- Clean and smoothen sealing surface for O-ring.
- Lubricate O-ring with coolant.





- Fit thermostat -2- in thermostat housing -1-.
- Retaining lugs must engage in guides -arrows-.



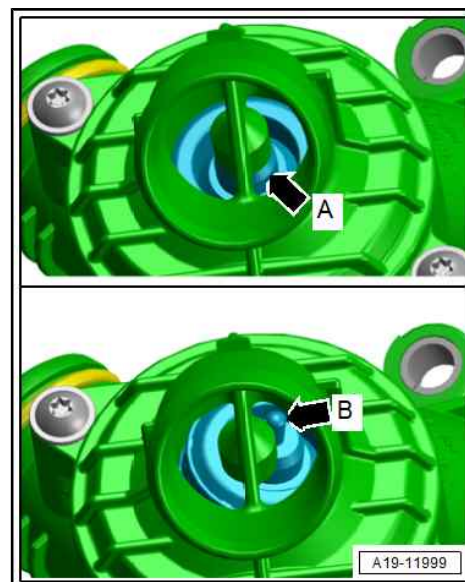
- Fit housing cover.
- Look through opening in housing cover and check installation position of thermostat:
 - -Arrow A- = installation position OK
 - -Arrow B- = installation position not OK
- Secure housing cover.



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ **After it is filled, the cooling system must be bled with the
⇒ Vehicle diagnostic tester.**



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .

Tightening torques

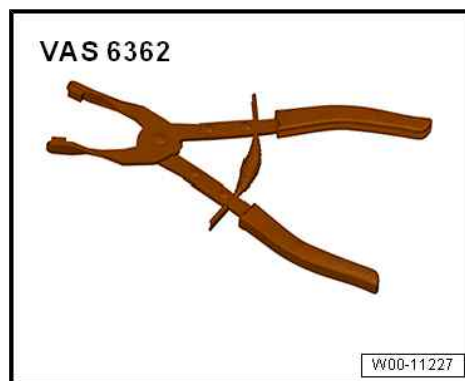
- ◆ ⇒ ["2.1 Exploded view - coolant pump/thermostat", page 174](#)
- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 236](#)
- ◆ ⇒ ["2.2 Exploded view - hose connections for charge air system", page 216](#)
- ◆ ⇒ ["4.1.2 Exploded view - exhaust gas recirculation system, high-pressure", page 312](#)

2.7 Removing and installing coolant valve for cylinder head - N489-

Special tools and workshop equipment required



- ◆ Hose clip pliers - VAS 6362-

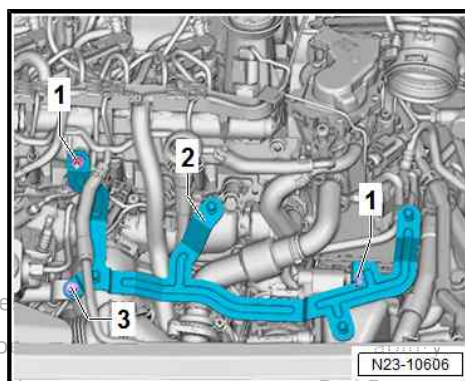


Removing

- Remove air cleaner housing ⇒ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.



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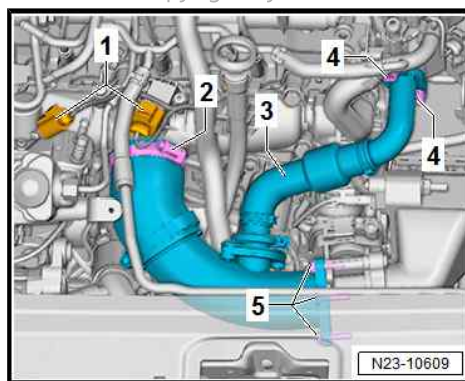


- Release hose clip -2- and remove bolts -4, 5-.
- Detach air duct with exhaust gas recirculation pipe -3-.



Note

Disregard -item 1-.





- Unplug electrical connector -1-.
- Remove bolt -2- and detach coolant valve for cylinder head - N489- .

Installing

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



Note

- ◆ *Renew O-rings after removing.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#) .*

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- Bleed coolant circuit ⇒ [page 172](#)

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 174](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 216](#)
- ◆ ⇒ [“4.1.2 Exploded view - exhaust gas recirculation system, high-pressure”, page 312](#)

2.8 Checking thermostat

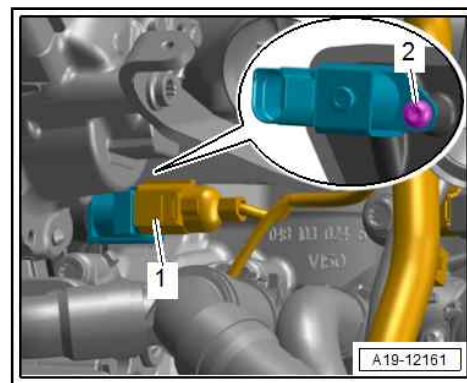
- Remove thermostat and heat it in a water bath.

Starts to open	Fully open	Opening travel
87 ± 2 °C	approx. 102 °C ¹⁾	at least 9 mm
• ¹⁾ Cannot be tested.		

2.9 Removing and installing coolant temperature sender - G62-

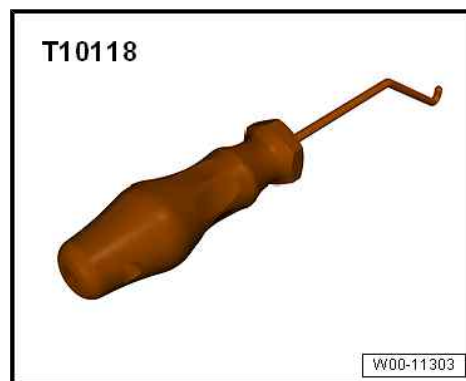
Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



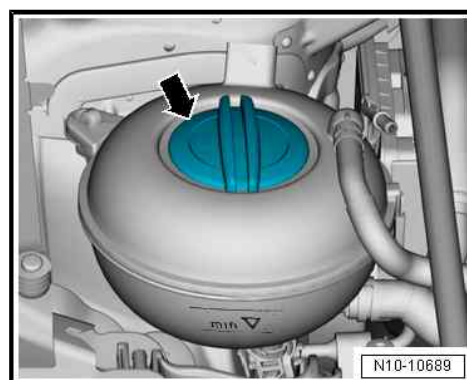


- ◆ Assembly tool - T10118-

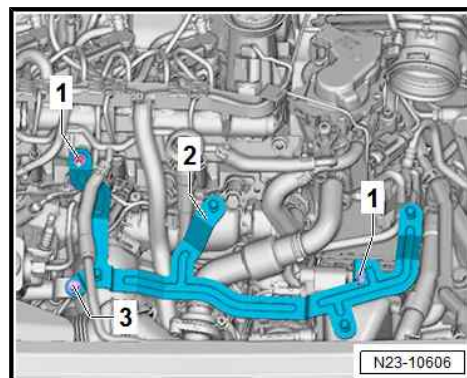


Removing

- Engine cold.
- Open filler cap -arrow- on coolant expansion tank briefly to relieve residual pressure in cooling system.



- Remove air cleaner housing ⇒ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.



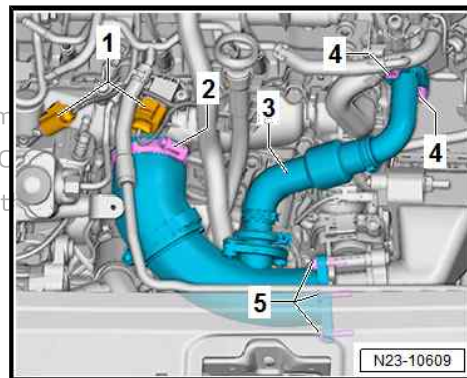
- Release hose clip -2- and remove bolts -4, 5-.
- Detach air duct with exhaust gas recirculation pipe -3-.



Note

Disregard -item 1-.

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- Use assembly tool - T10118- to release electrical connector -1-, unplug it and remove bolt -2-.
- Pull out coolant temperature sender - G62- towards front.



Note

If an O-ring or spacer ring remains lodged in cylinder head, lift it out with a piece of wire.

Installing

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

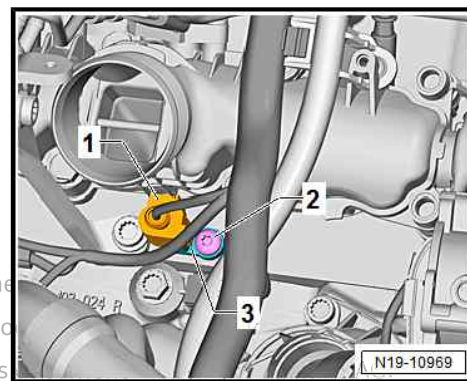


Note

- ◆ *Renew O-rings after removing.*
 - ◆ *Renew spacer ring if damaged.*
 - ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- Bleed coolant circuit ⇒ [page 172](#) .

Tightening torques

- ◆ ⇒ [“2.2 Exploded view - coolant temperature senders”, page 176](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 216](#)
- ◆ ⇒ [“4.1.2 Exploded view - exhaust gas recirculation system, high-pressure”, page 312](#)





3 Coolant pipes

⇒ "3.1 Exploded view - coolant pipes", page 190

⇒ "3.2 Removing and installing coolant pipes", page 191

3.1 Exploded view - coolant pipes



Note

The arrow markings on coolant pipes and on ends of hoses must align.

1 - Coolant pipe (right-side)

- ❑ Removing and installing
⇒ [page 197](#)

2 - Nut

- ❑ 8 Nm

3 - Nut

- ❑ 8 Nm

4 - Gasket

- ❑ Renew after removing

5 - Coolant pipe (rear right)

- ❑ Removing and installing
⇒ [page 193](#)

6 - Bolt

- ❑ 8 Nm

7 - Bolt

- ❑ 8 Nm

8 - Coolant pipe (rear)

- ❑ Removing and installing
⇒ [page 193](#)

9 - Bolt

- ❑ 8 Nm

10 - Bolt

- ❑ 8 Nm

11 - Coolant pipe (top)

12 - Bolt

- ❑ 8 Nm

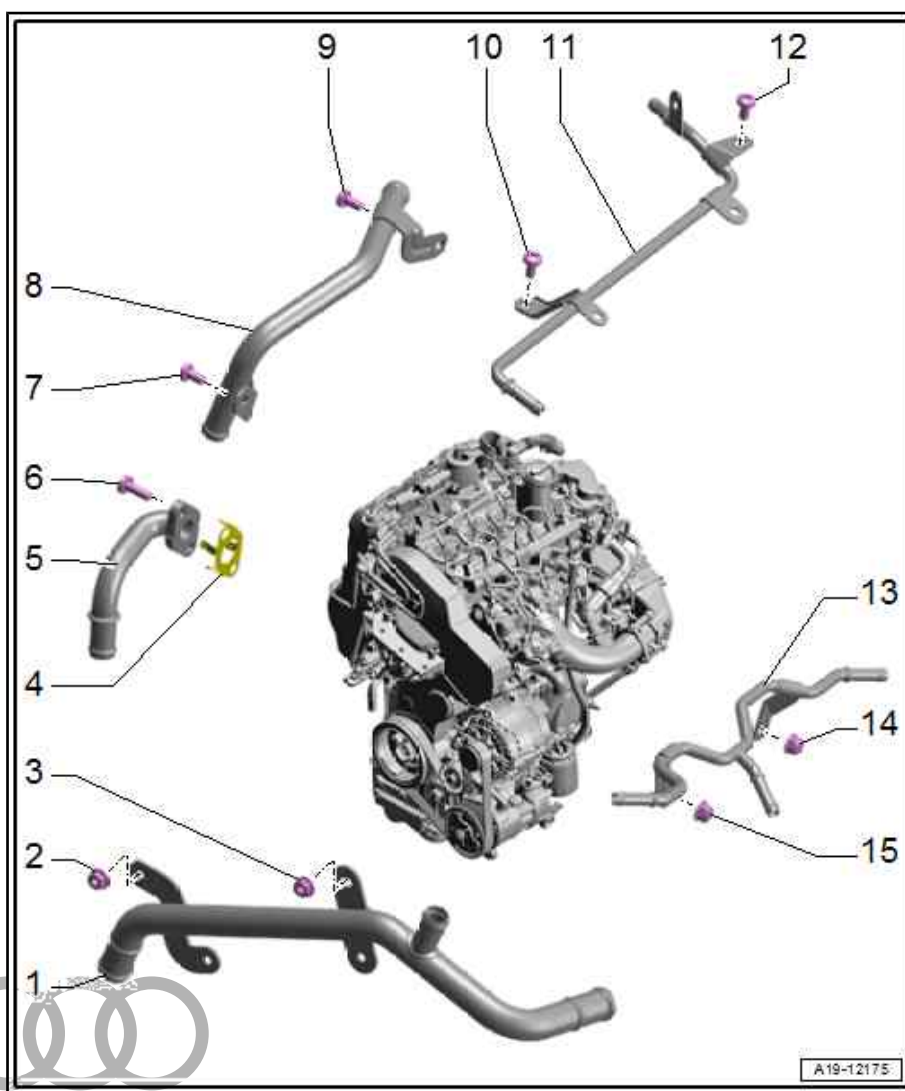
13 - Coolant pipe (front)

14 - Nut

- ❑ 10 Nm

15 - Nut

- ❑ 10 Nm



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3.2 Removing and installing coolant pipes

⇒ ["3.2.1 Removing coolant pipe \(front\)", page 191](#)

⇒ ["3.2.2 Removing and installing coolant pipes \(rear\)", page 193](#)

⇒ ["3.2.3 Removing and installing coolant pipe \(right-side\)", page 197](#)

3.2.1 Removing coolant pipe (front)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



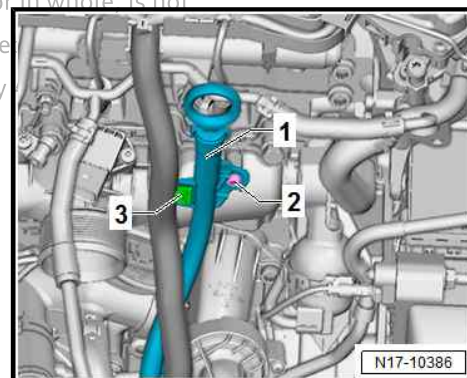
Removing

- Remove throttle valve module - J338- ⇒ [page 240](#) .

- Drain coolant ⇒ [page 165](#) .

- Unscrew bolt -2- for oil dipstick guide tube -1- on intake manifold.

- Cut through cable ties -3- at top and bottom of guide tube.

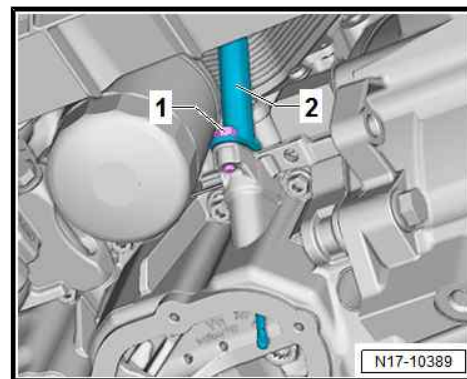


Caution

Risk of coolant entering lubrication system.

- ◆ ***After removing guide tube, it is very important to seal off hole for guide tube in sump using sealing plugs from engine bung set - VAS 6122- .***

- Remove bolt -1- and pull out oil dipstick guide tube -2- upwards.



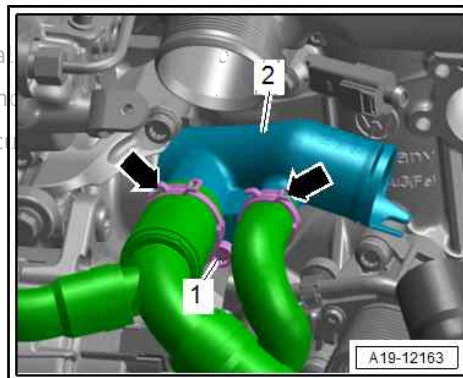
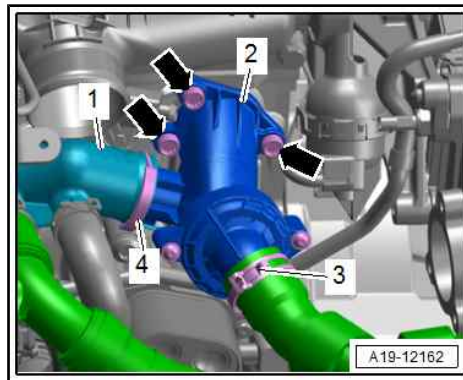


- Release hose clip -3- and disconnect coolant hose.
- Remove bolts -arrows-.
- Pull off securing clip -4-, disconnect thermostat housing -2- from coolant pipe (front) -1- and detach.



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

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- Unplug electrical connector -1- from oil pressure switch - F1- .
- Remove bolt -1-.
- Disconnect and remove coolant pipe (front) -2-.

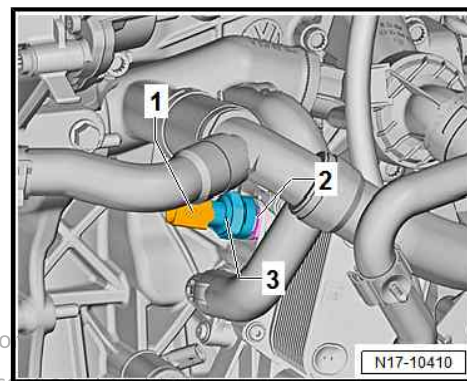
Installing

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



Note

- ◆ **Renew O-rings after removing.**
- ◆ **Secure all hose connections with correct type of hose clips (as original equipment) ⇒ *Electronic parts catalogue***



- Install throttle valve module - J338- ⇒ [page 240](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ ***After it is filled, the cooling system must be bled with the ⇒ *Vehicle diagnostic tester*.***



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ [Item 1 \(page 174\)](#)
- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 140](#)

3.2.2 Removing and installing coolant pipes (rear)

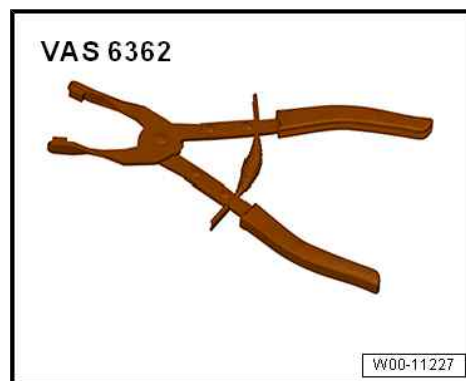
Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-





- ◆ Hose clip pliers - VAS 6362-



Removing

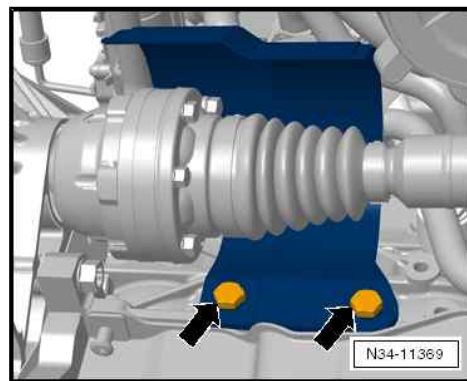
- Remove front exhaust pipe ➔ [page 294](#) .
- Remove air cleaner housing ➔ [page 237](#) .
- Detach drive shaft (right-side) from gearbox and tie it up to-wards rear ➔ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .



Note

Take care not to damage surface coating of drive shaft.

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



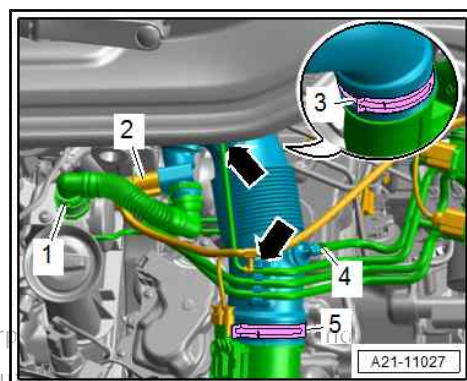
- Unplug electrical connector -2-.
- Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from cylinder head cover.
- Move clear vacuum hoses at air pipe -arrows-.
- Disconnect vacuum hose -4-.
- Release hose clip -3- and detach air pipe from turbocharger.



Note

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~~Disregard item 5.~~ed unless authorised by AUDI AG. AUDI AG does not gu-

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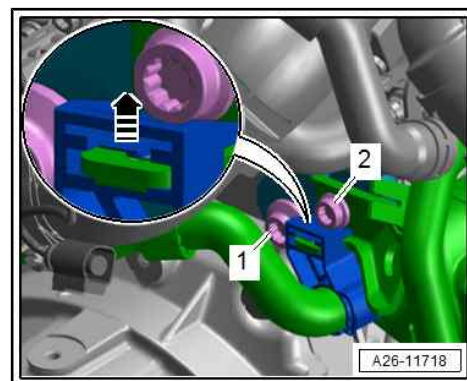
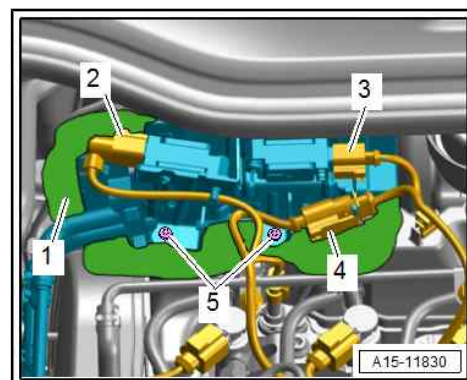
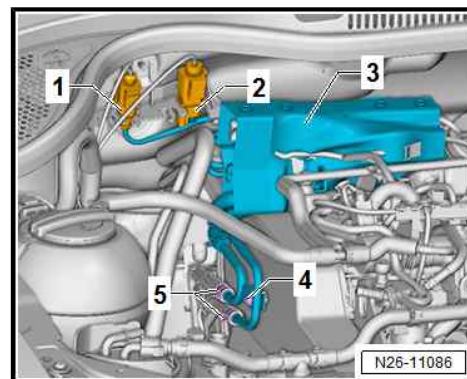
- Take electrical connectors -1, 2- out of bracket, unplug connectors and move electrical wiring clear.
- Remove bolt -4-.
- Release hose clips -5- and disconnect hoses from metering tubes of exhaust gas pressure sensors.



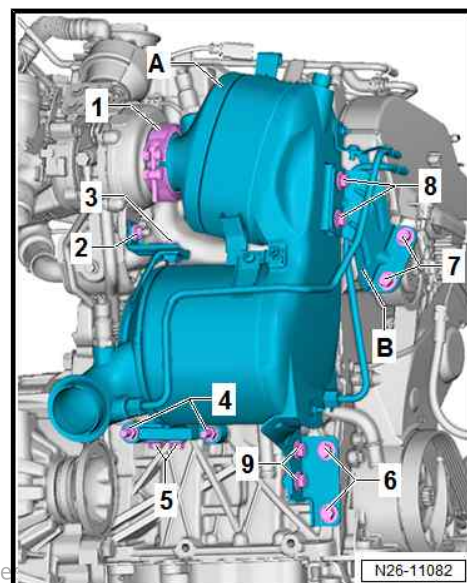
Note

Disregard -item 3-.

- Open heat insulation sleeve -1-.
- Unplug electrical connectors -2, 3- and move electrical wiring clear.
- Detach electrical connector -4- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.
- Unscrew bolts -5- and detach bracket with exhaust gas pressure sensors.
- Detach gear selector cable and gate selector cable from gear-box, remove cable support bracket and place to one side with selector cables attached ➔ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- Release catch -arrow- and move bracket for coolant hose clear at exhaust gas recirculation cooler.
- Loosen bolt -1- and remove bolt -2-.



- Loosen nut -2- and bolts -4, 6- by one turn.
- Remove bolts -3, 5, 7, 8, 9- and detach bracket -B-.
- Release screw-type clip -1- and place it on intake funnel of emission control module -A-.
- Press emission control module slightly towards rear and secure it.



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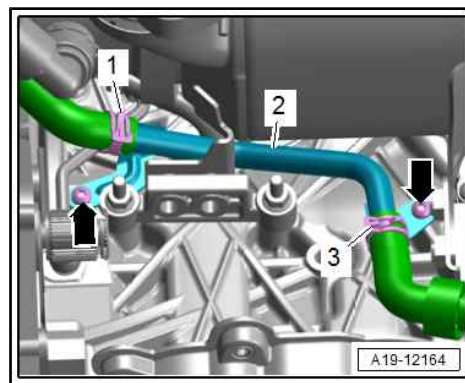
Coolant pipe (rear):



Note

Place a cloth underneath to catch escaping coolant.

- Clamp off coolant hoses with hose clamps up to 25 mm - 3094- .
- Release hose clips -1, 3- and disconnect coolant hoses.
- Remove bolts -arrows-.
- Push emission control module -2- towards rear and disconnect coolant pipe (rear).



Coolant pipe (rear right):

- Place collector tank from coolant collecting system -VAS 5014- or drip tray for workshop hoist - VAS 6208- underneath.
- Release hose clip -1- and disconnect coolant hose.
- Unscrew bolts -arrows- and remove coolant pipe (rear right). If necessary, push emission control module slightly to left side.

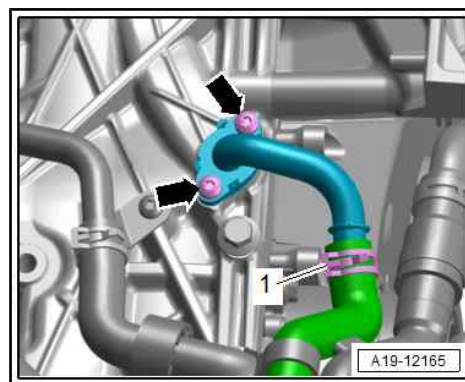
Installing

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



Note

- ◆ *Renew seal and O-ring after removal.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*



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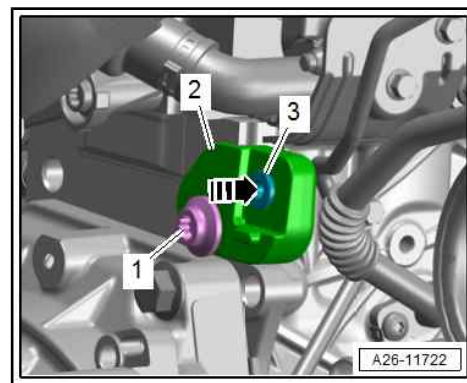


- Unscrew bolt -1- and remove bracket -2-.
- Bring bracket into installation position and screw in bolt until it makes contact.



Note

Ensure that sliding bush moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque.



- Install gear selector cable and gate selector cable ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- Install emission control module ⇒ [page 299](#) .
- 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.



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ **After it is filled, the cooling system must be bled with the ⇒ Vehicle diagnostic tester.**



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 190](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)
- ◆ ⇒ [“1.1 Exploded view - silencer”, page 289](#)
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft

3.2.3 Removing and installing coolant pipe (right-side)

Removing

- Drain coolant ⇒ [page 165](#) .
- Remove wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .



- Release retaining clips -2- and move coolant hose clear.
- Remove nuts -1-.
- Release hose clips -arrows- and disconnect coolant hoses.
- Detach coolant pipe (right-side).

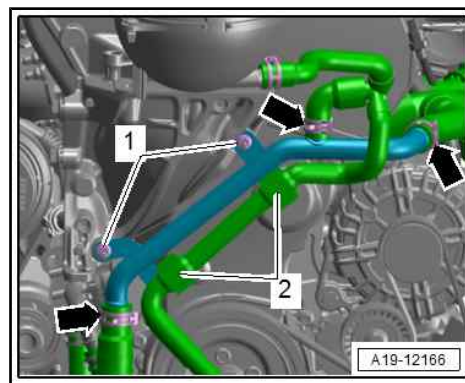
Installing

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* .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ ***After it is filled, the cooling system must be bled with the ⇒ Vehicle diagnostic tester.***



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 190](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)



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4 Radiators/radiator fan

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⇒ ["4.1 Exploded view - radiators/radiator fan", page 199](#)

⇒ ["4.2 Removing and installing radiator", page 201](#)

⇒ ["4.3 Removing and installing radiator cowl", page 204](#)

⇒ ["4.4 Removing and installing radiator fan V7", page 205](#)

4.1 Exploded view - radiators/radiator fan



Note

- ◆ For coolant hoses with quick-release clips: When disconnecting the coolant hose, the quick-release clip must be fixed in open position using hose clip pliers.
- ◆ Connect coolant hoses using quick-release clips ⇒ [page 200](#).

Radiators

1 - Coolant hoses

- ☐ For coolant circuit for charge air cooler

2 - Air duct

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 201](#)

4 - Coolant hose (bottom)

5 - Not fitted

6 - Not fitted

7 - Coolant hose (top)

8 - Air duct

9 - Coolant hose

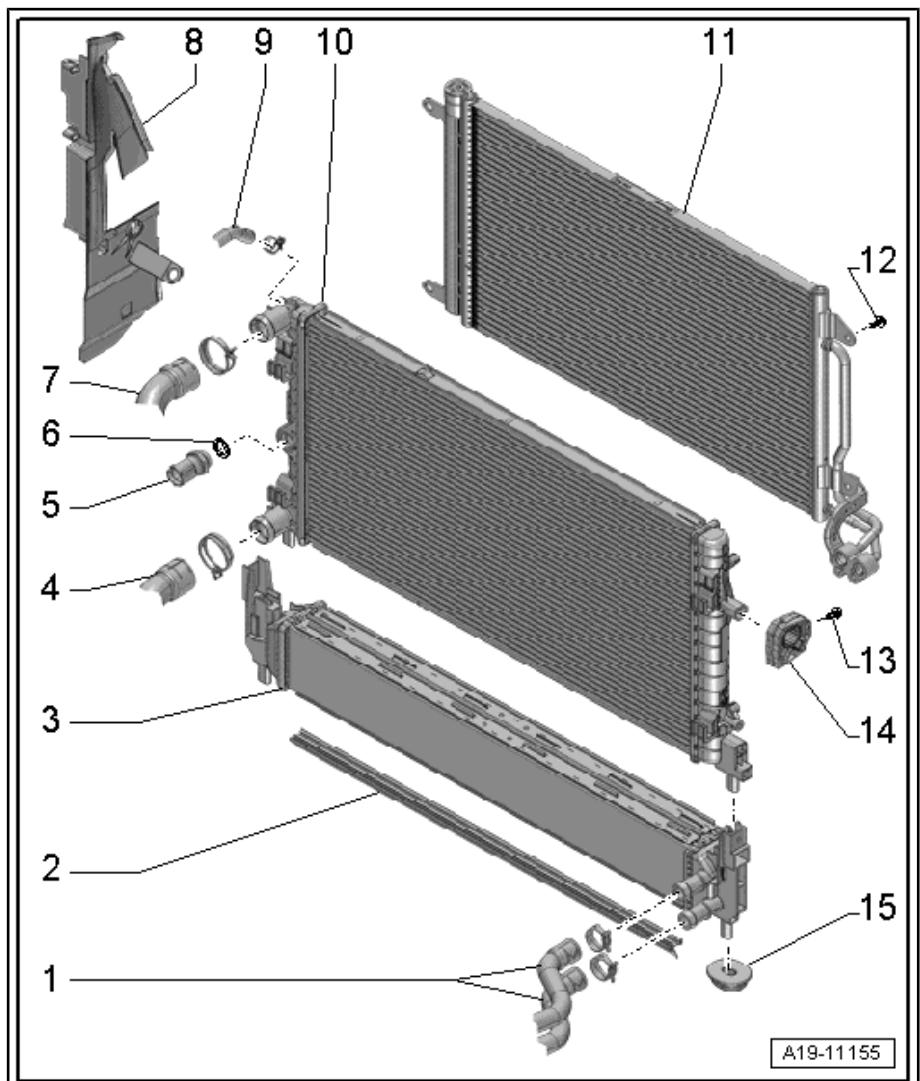
- ☐ To coolant expansion tank

10 - Radiator

- ☐ Removing and installing ⇒ [page 201](#)
- ☐ 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 - Retainer

- ❑ Note installation position

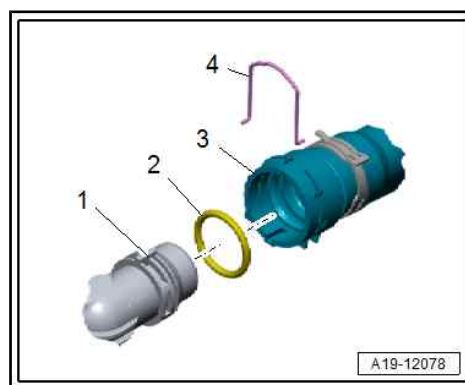
15 - Retainer

- ❑ For water radiator for charge air cooling circuit

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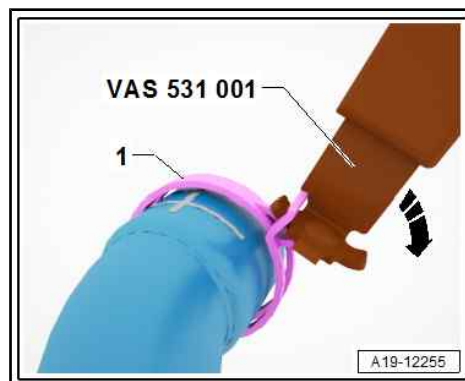
Connecting coolant hose with plug-in connector

- If damaged, renew retaining clip -4-.
- If damaged, renew O-ring. To do so, remove O-ring -2- from plug-in connector -3- using a suitable tool (do not use a sharp tool). Take care not to damage the plug-in connector or the surface on which the O-ring is seated.
- Lightly lubricate new O-ring 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.



Connecting coolant hose with quick-release clips

- To connect coolant hose, release quick-release clip -1- from locked position using release tool - VAS 531 003- .



Radiator cowl and radiator fan



1 - Pin

- ☐ For spreader clip

2 - Air flow ring

- ☐ Depending on version

3 - Radiator fan - V7-

- ☐ With radiator fan control unit - J293-
- ☐ Removing and installing
⇒ [page 205](#)

4 - Radiator cowl

- ☐ Removing and installing
⇒ [page 204](#)

5 - Air flow flap

6 - Clip

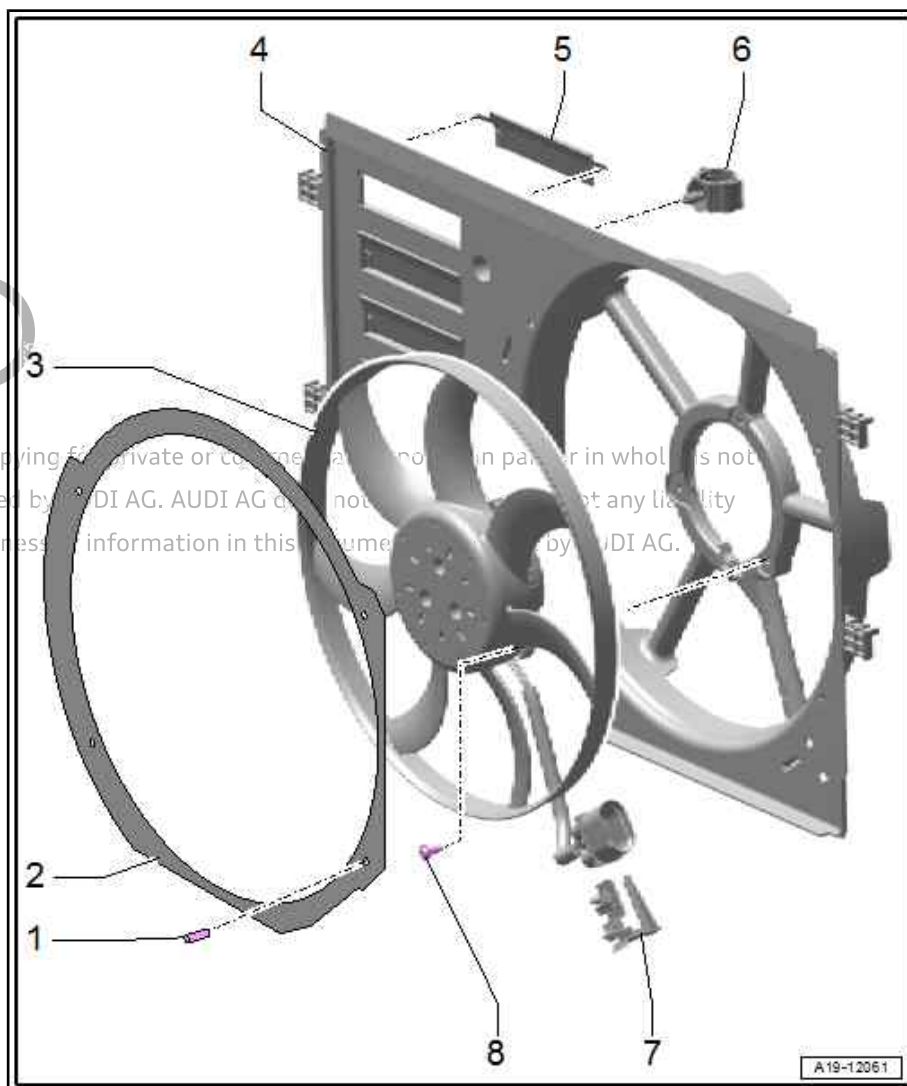
- ☐ For coolant hose

7 - Bracket

- ☐ For electrical connector

8 - Bolt

- ☐ 1.5 Nm



4.2 Removing and installing radiator



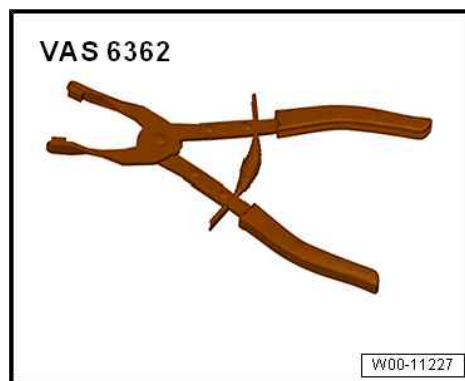
Note

- ◆ *Radiator and water radiator for charge air cooling circuit must be removed and installed together.*
- ◆ *For coolant hoses with quick-release clips: When disconnecting the coolant hose, the quick-release clip must be fixed in open position using hose clip pliers.*
- ◆ *Connect coolant hoses using quick-release clips
⇒ [page 200](#).*

Special tools and workshop equipment required



- ◆ Hose clip pliers - VAS 6362-

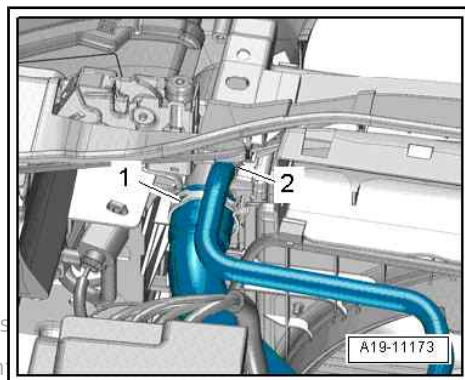


Removing

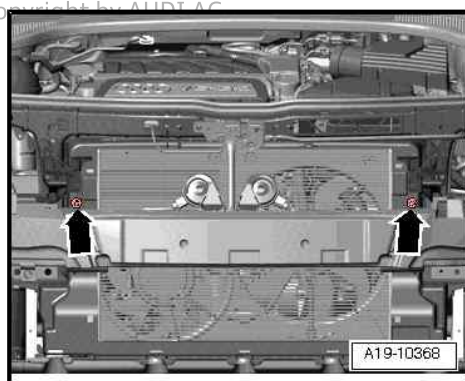
- Remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .
- Remove radiator cowl ⇒ [page 204](#) .
- Release hose clips -1 and 2- and detach coolant hoses (top left) from radiator.



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- 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.





Vehicles with air conditioner:



WARNING

Risk of injury caused by refrigerant.

- ◆ *The air conditioner refrigerant circuit must not be opened.*

- Remove bolts -arrows-.

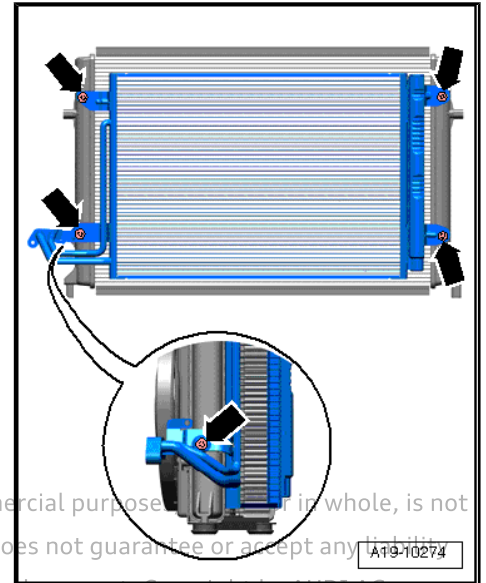


Caution

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.



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All vehicles (continued):

- Release fasteners at water radiator for charge air cooling circuit -1- -arrows A-.
- Pull water radiator for charge air cooling circuit off radiator -2- -arrow B- and disengage -arrow C-.
- Remove both radiators.

Installing

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



Note

- ♦ If there are slight impressions on the fins, refer to [⇒ page 10](#) .
- ♦ Secure all hose connections with correct type of hose clips (as original equipment) ⇒ *Electronic parts catalogue* .
- Vehicles with air conditioning: Install condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser .
- Install radiator cowl [⇒ page 204](#) .
- Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .
- Connect coolant hoses using quick-release clips [⇒ page 200](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ♦ After it is filled, the cooling system must be bled with the ⇒ *Vehicle diagnostic tester*.



Note

Do not reuse coolant.

- Fill and bleed coolant circuit [⇒ page 168](#) .

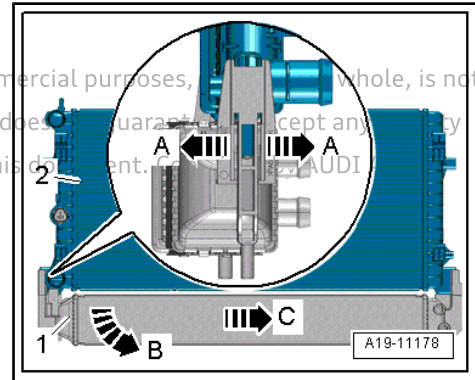
Tightening torques

- ♦ [⇒ “4.1 Exploded view - radiators/radiator fan”, page 199](#)

4.3 Removing and installing radiator cowl

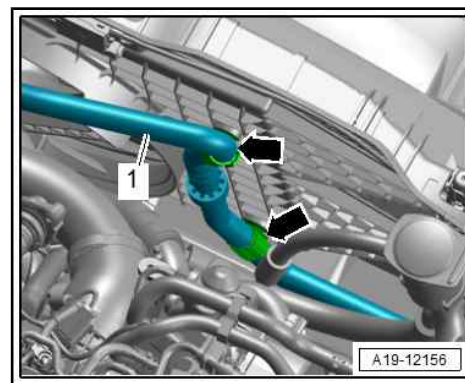
Removing

- Remove air cleaner housing [⇒ page 237](#) .
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .





- Move coolant hose -1- clear at retaining clips -arrows-.



WARNING

Risk of injury as the radiator fans may start up automatically.

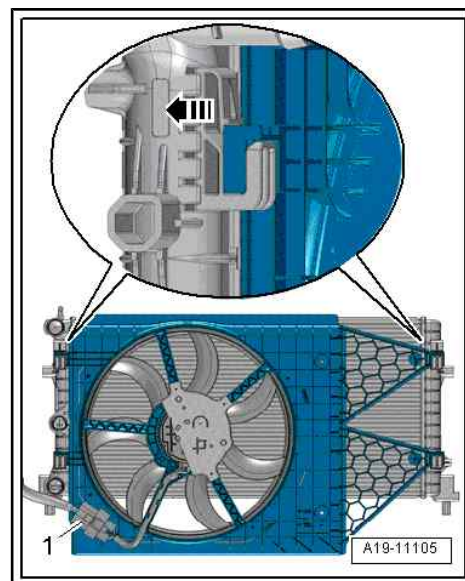
- ◆ *Unplug electrical connectors before performing work on radiator cowl.*

- Unplug electrical connector -1- 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:

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



Tightening torques

- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 236](#)

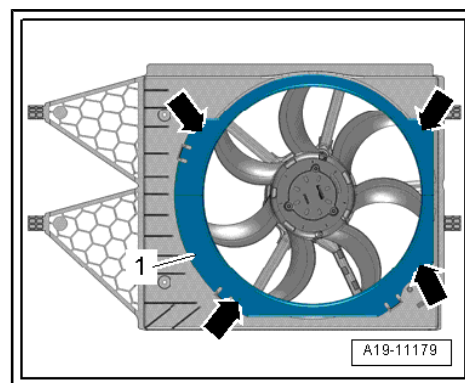
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4.4 Removing and installing radiator fan - V7-

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Removing

- Remove radiator cowl ⇒ [page 204](#) .
- 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

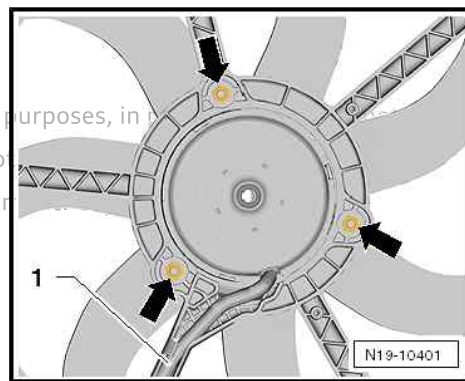
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Installation is carried out in reverse order; note the following:

- Install radiator cowl -> [page 204](#).

Tightening torques

- ♦ ⇒ ["4.1 Exploded view - radiators/radiator fan", page 199](#)





21 – Turbocharging/supercharging

1 Turbocharger

⇒ [“1.1 Exploded view - turbocharger”, page 207](#)

⇒ [“1.2 Removing and installing turbocharger”, page 209](#)

1.1 Exploded view - turbocharger

1 - Banjo bolt

- ☐ 27 Nm
- ☐ Tighten banjo bolt using a commercially available open-end spanner insert and a suitable torque wrench

2 - Bolt

- ☐ 10 Nm

3 - Oil supply line

4 - Bolt

- ☐ 10 Nm

5 - Banjo bolt

- ☐ 16 Nm

6 - Seals

- ☐ Renew after removing

7 - Bolt

- ☐ 10 Nm

8 - Heat shield

9 - Turbocharger

- ☐ Removing and installing
⇒ [page 209](#)

10 - Bolt

- ☐ 8 Nm

11 - Pulsation damper

12 - O-ring

- ☐ Renew after removing

13 - Nut

- ☐ 20 Nm

14 - Exhaust gas recirculation pipe

15 - Gasket

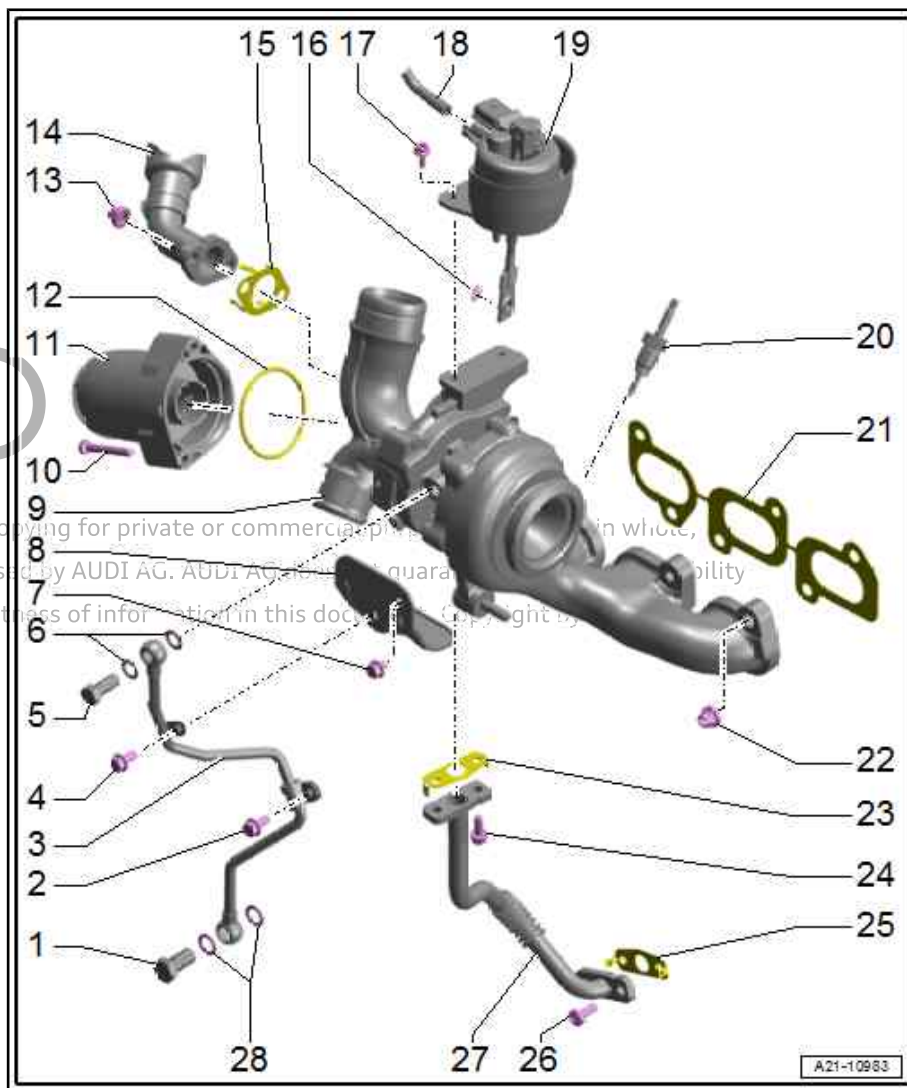
- ☐ Renew after removing

16 - Securing clip

- ☐ Renew after removing

17 - Bolt

- ☐ 10 Nm





18 - Vacuum hose

19 - Vacuum unit

- ☐ For turbocharger
- ☐ With position sender for charge pressure positioner - G581-
- ☐ Repair method is under development

20 - Exhaust gas temperature sender 1 - G235-

- ☐ Exploded view ⇒ [page 306](#)

21 - Gasket

- ☐ Renew after removing

22 - Nut

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 208](#)

23 - Gasket

- ☐ Renew after removing

24 - Bolt

- ☐ 14 Nm

25 - Gasket

- ☐ Renew after removing

26 - Bolt

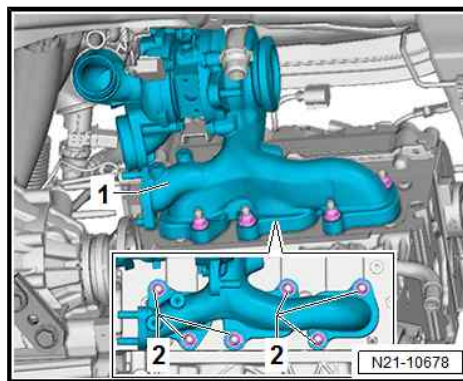
- ☐ Renew after removing
- ☐ 8 Nm +45°

27 - Oil return line

Turbocharger - tightening torque and sequence

- Tighten bolts in stages in the sequence described:

Stage	Nuts	Tightening torque
1.	-2-	Tighten to 11 Nm in diagonal sequence, working from centre outwards
2.	-2-	Tighten to 22 Nm in diagonal sequence, working from centre outwards
3.	-2-	Tighten to 22 Nm in diagonal sequence, working from centre outwards • This procedure has been specified in order to compensate for the settling of the components.



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1.2 Removing and installing turbocharger



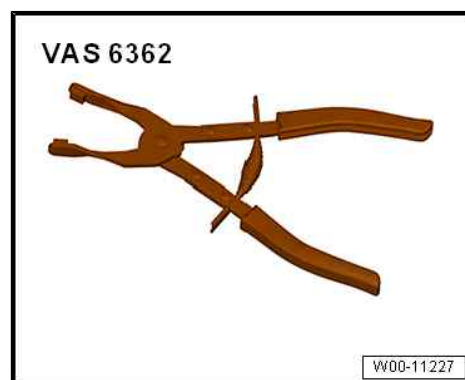
Caution

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing

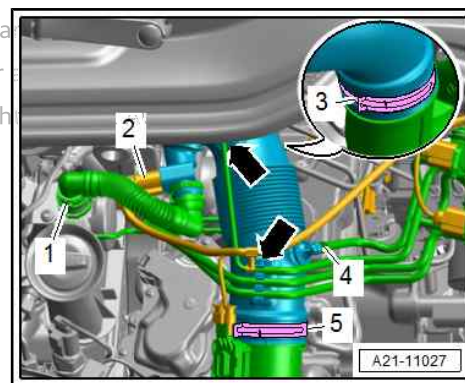
- Observe rules for cleanliness ➔ [page 6](#) .
- Remove air cleaner housing ➔ [page 237](#) .
- Drain coolant ➔ [page 165](#) .
- Unplug electrical connector -2-
- Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from cylinder head cover.
- Move clear vacuum hoses at air pipe -arrows-.
- Disconnect vacuum hose -4-.
- Release hose clip -3- and detach air pipe from turbocharger.



Note

Disregard -item 5-.

- Remove charge air cooler ➔ [page 220](#) .



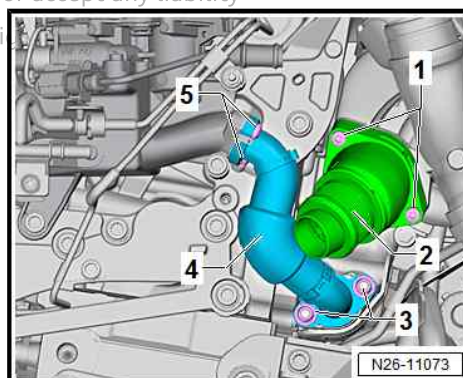
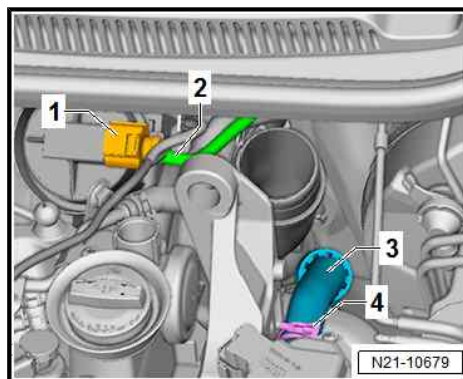


- Unplug electrical connector -1- for position sender for charge pressure positioner - G581- .
- Disconnect vacuum hose -2-.
- Release hose clip -4- and detach coolant hose -3-.

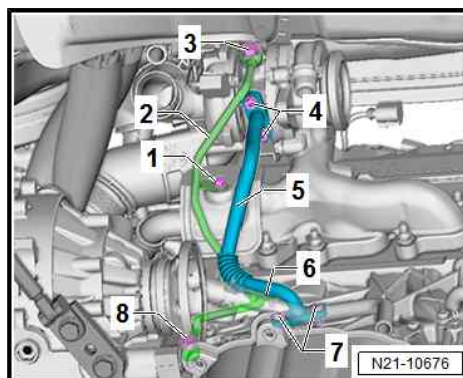


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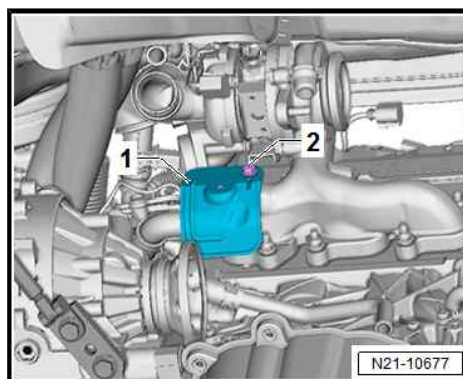
- Remove bolts -1- and detach pulsation damper -2-.
- Unscrew nuts -3- and bolts -5- and detach exhaust gas recirculation pipe -4-.
- Remove emission control module ⇒ [page 299](#) .



- Unscrew bolts -4, 7- and detach oil return line -5-.
- Remove bolts -1, 6- and banjo bolts -3, 8- and detach oil supply line -2-.



- Remove bolt -2- and detach heat shield -1-.



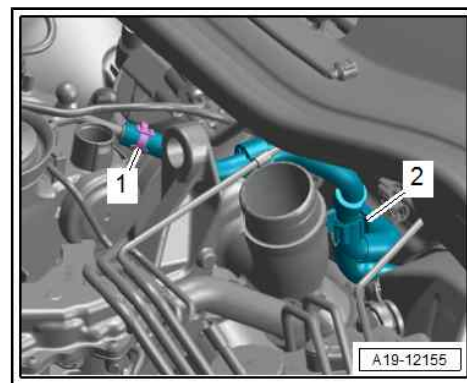


- Move electrical wiring clear.
- Move coolant hose -2- clear at clip.



Note

Disregard -item 1-.



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- Unscrew nuts -2- and take out turbocharger -1- downwards.

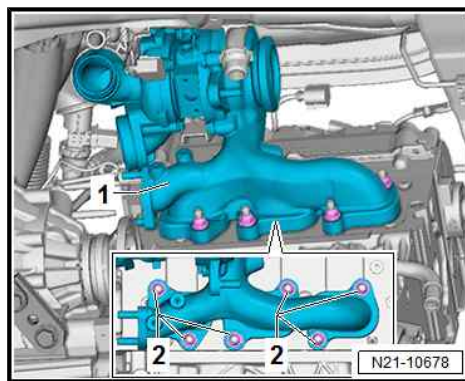
Installing

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



Note

- ◆ *Secure all heat insulation sleeves in the same locations when installing.*
- ◆ *Renew gaskets, seals, O-rings and self-locking nuts after removal.*
- ◆ *Fill turbocharger with engine oil at connection for oil supply line.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *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.*



- Install emission control module ⇒ [page 299](#) .
- Install charge air cooler ⇒ [page 220](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ ***After it is filled, the cooling system must be bled with the ⇒ Vehicle diagnostic tester.***

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Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 168](#) .



Note

After new parts have been installed (engine/short engine, cylinder head, crankshaft housing or turbocharger), the oil pressure must be regulated to the higher pressure stage for approx. 1000 km. This compensates for the higher friction when running in new parts, and ensures the best means of removing particles of residue worn off during the running-in process.

- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options one after the other:
 - ◆ **Drive train**
 - ◆ **Select engine code and engine**



- ◆ 01 - Self-diagnosis compatible systems
- ◆ 01 - Engine electronics
- ◆ 01 - Engine electronics, functions
- ◆ 01 - Activate oil pressure control/running-in function

Tightening torques

- ◆ ⇒ "1.1 Exploded view - turbocharger", page 207
- ◆ ⇒ "2.1 Exploded view - charge air system", page 214
- ◆ ⇒ "3.1 Exploded view - air cleaner housing", page 236
- ◆ ⇒ "4.1.2 Exploded view - exhaust gas recirculation system, high-pressure", page 312



2 Charge air system

⇒ [“2.1 Exploded view - charge air system”, page 214](#)

⇒ [“2.2 Exploded view - hose connections for charge air system”, page 216](#)

⇒ [“2.3 Checking charge air system for leaks”, page 216](#)

⇒ [“2.4 Removing and installing charge air cooler”, page 220](#)

⇒ [“2.6 Removing and installing charge air temperature sender before charge air cooler G810”, page 224](#)

⇒ [“2.5 Removing and installing charge pressure sender G31”, page 223](#)

⇒ [“2.6 Removing and installing charge air temperature sender before charge air cooler G810”, page 224](#)

2.1 Exploded view - charge air system

1 - Air pipe

2 - Air hose

- ☐ Tighten screw-type clips
⇒ [page 220](#)

3 - Connection

4 - Bolt

- ☐ 9 Nm

5 - Screw-type clip

- ☐ Renew after removing
- ☐ 8 Nm

6 - Exhaust gas recirculation pipe

- ☐ To exhaust gas recirculation cooler (high-pressure)

7 - Bolt

- ☐ Tightening torque
⇒ [Item 18 \(page 313\)](#)

8 - Gasket

- ☐ Renew after removing

9 - Bracket

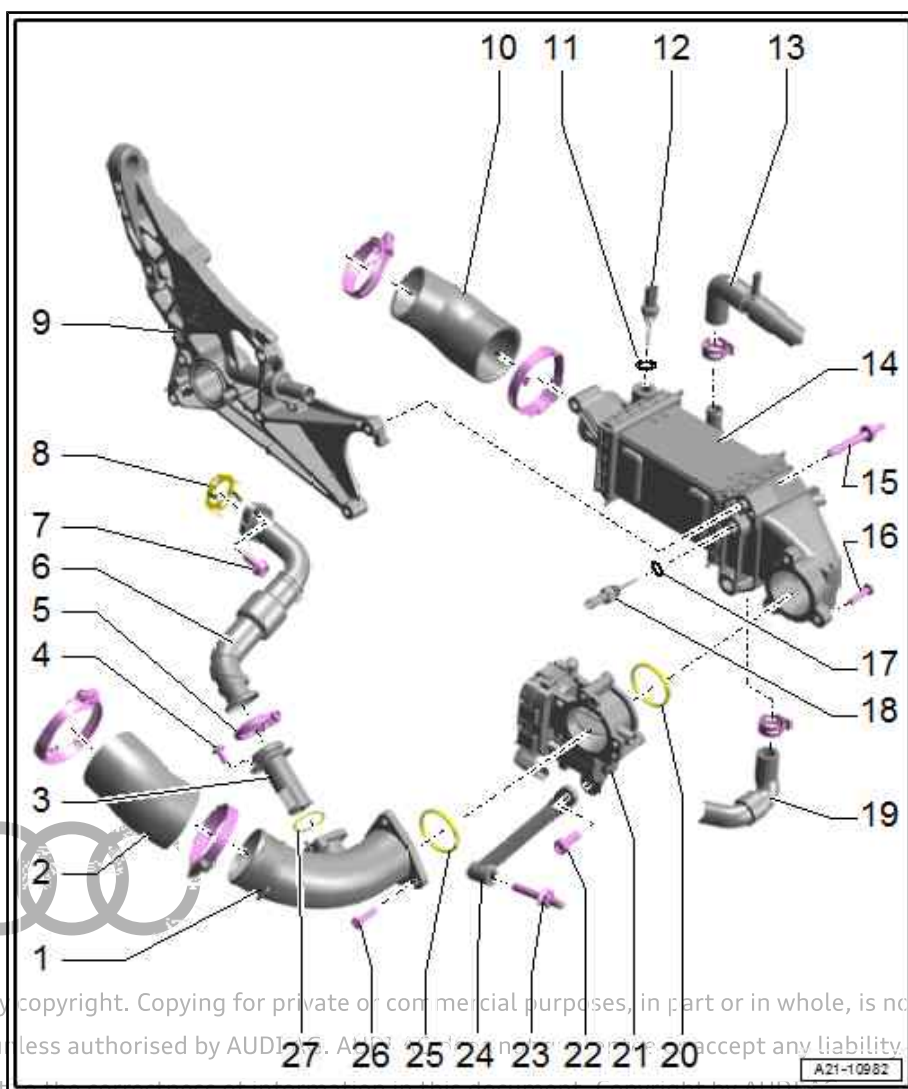
- ☐ For charge air cooler and exhaust gas recirculation valve
- ☐ With connection for coolant hoses
- ☐ With engine lifting eye
- ☐ Removing and installing
⇒ [page 222](#)

10 - Air hose

- ☐ Tighten screw-type clips ⇒ [page 216](#)

11 - O-ring

- ☐ Renew after removing





12 - Charge air temperature sender before charge air cooler - G810-

- ☐ Removing and installing ⇒ [page 224](#)
- ☐ 22 Nm

13 - Coolant hose

14 - Charge air cooler

- ☐ Removing and installing ⇒ [page 220](#)

15 - Bolt

- ☐ 20 Nm

16 - Bolt

- ☐ 8 Nm

17 - O-ring

- ☐ Renew after removing

18 - Charge air temperature sender after charge air cooler - G811-

- ☐ Removing and installing
⇒ ["2.7 Removing and installing charge air temperature sender after charge air cooler G811 ", page 224](#)
- ☐ 22 Nm

19 - Air hose

- ☐ Tighten screw-type clips ⇒ [page 216](#)

20 - O-ring

- ☐ Renew after removing

21 - Throttle valve module - J338-

- ☐ With throttle valve potentiometer - G69-
- ☐ Removing and installing ⇒ [page 240](#)

22 - Bolt

- ☐ 20 Nm

23 - Bolt

- ☐ 20 Nm

24 - Support

- ☐ For throttle valve module - J338-

25 - O-ring

- ☐ Renew after removing

26 - Bolt

- ☐ 8 Nm

27 - O-ring

- ☐ Renew after removing

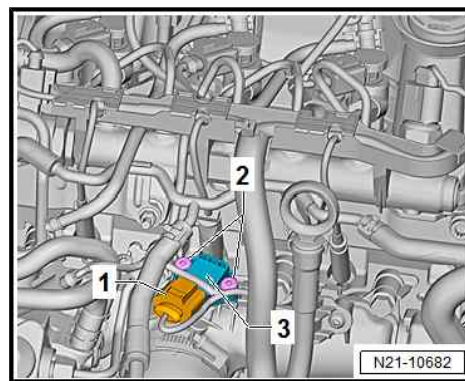


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Charge pressure sender - G31- - tightening torque

- Tighten bolts -2- to 9 Nm.



2.2 Exploded view - hose connections for charge air system

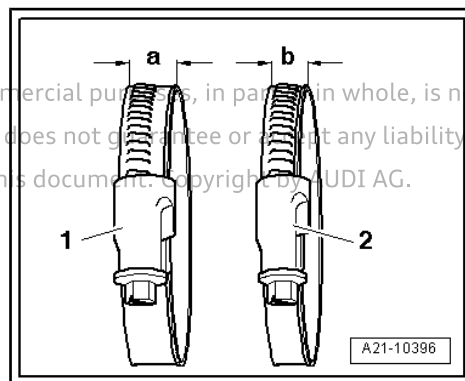


Note

- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *If using used hose clips to secure the air hoses at their connections, spray rust remover onto the worm threads before installing.*

Tightening torque for

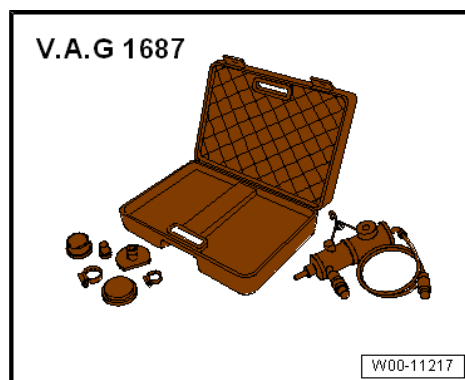
- 1 - Hose clip with width -a- = 13 mm: 5.5 Nm
- 2 - Hose clip with width -b- = 9 mm: 3 Nm



2.3 Checking charge air system for leaks

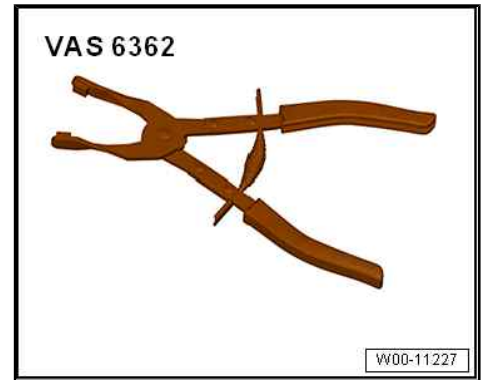
Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687- with adapter - V.A.G 1687/12-





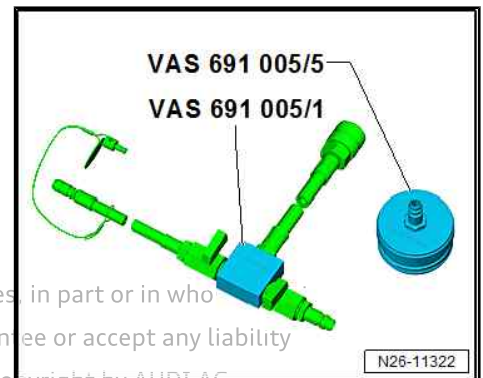
- ◆ Hose clip pliers - VAS 6362-



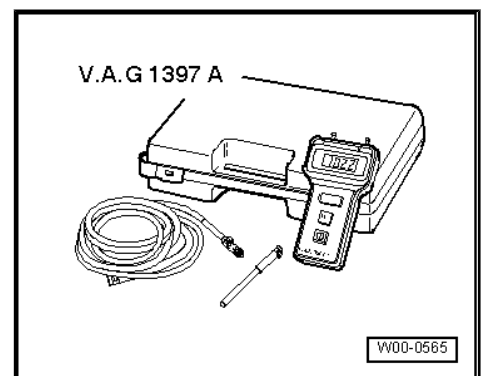
- ◆ Adapter - V.A.G 1687/11-
- ◆ Adapter - V.A.G 1687/15- for exhaust pipes with 60 mm and 65 mm diameter
- ◆ Adapter - V.A.G 1687/16- for exhaust pipe with 55 mm diameter
- ◆ Y-connector - VAS 691 005/1-



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- ◆ Test instrument adapter - VAS 691 005/5-
- ◆ Turbocharger tester - V.A.G 1397A-



Procedure

- Remove engine cover panel ➔ [page 41](#) .



Connecting turbocharger tester - V.A.G 1397A- :

- Fit test adapter - VAS 691 005/5- onto coolant expansion tank.
- Fit Y-connector - VAS 691 005/1- onto test adapter - VAS 691 005/5- .
- Close valve -1- for connection »C« and open valve -2- for connection »A«.
- Attach hose from connection »A« on Y-connector to connection »II« on turbocharger tester - V.A.G 1397A- .
- Set turbocharger tester - V.A.G 1397A- to switch position »II« (relative pressure measurement) and switch it on. The »II« must be visible.

Connecting tester - V.A.G 1687- :

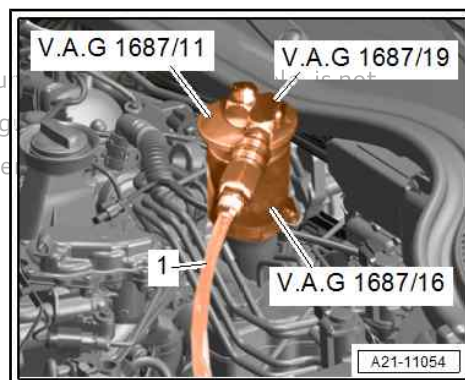
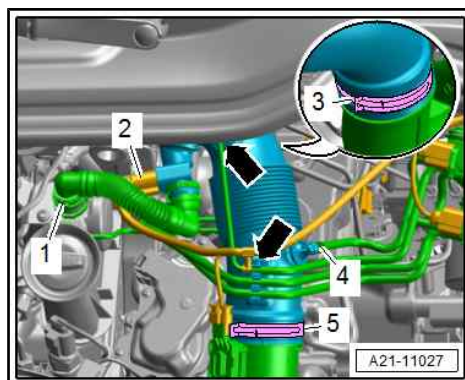
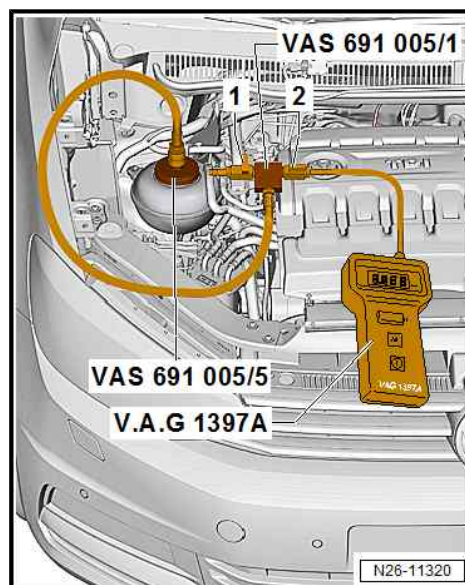
- Unplug electrical connector -2-.
- Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from cylinder head cover.
- Move clear vacuum hoses at air pipe -arrows-.
- Disconnect vacuum hose -4-.
- Release hose clips -3, 5- and detach air pipe from turbocharger.



- Connect adapter - V.A.G 1687/11- with -V.A.G 1687/16- and -V.A.G 1687/19- to turbocharger.

- Connect pressure 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:

- Leave hose -5- connected to adapter.
- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Make sure knob is pulled out before turning pressure control valve -2-.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

- Open valve -3-.



Caution

Risk of damage if pressure is set too high.

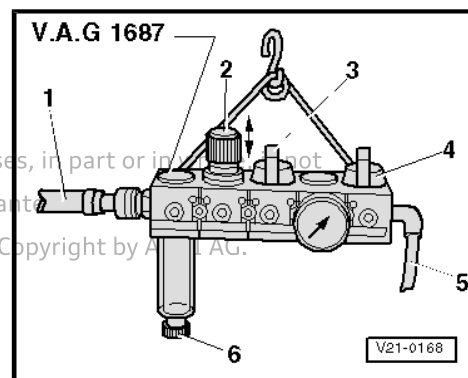
- ◆ ***The pressure must not exceed 0.5 bar.***

- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
- Check entire charge air system for leaks:
 - ◆ By listening and feeling
 - ◆ Using a commercially available leak detection spray
 - ◆ Using ultrasonic tester - V.A.G 1842-



Note

A small amount of air escapes through the valves and enters the engine and the exhaust gas recirculation cooler. Therefore it is not possible to perform a pressure retention test.





Reading off values from turbocharger tester - V.A.G 1397A- :

- Observe turbocharger tester - V.A.G 1397A- for approx. 5 minutes.
- The pressure displayed on the turbocharger tester - V.A.G 1397A- must not rise.
- If pressure displayed on turbocharger tester - V.A.G 1397A- rises, this means that compressed air is escaping into the cooling system. The charge air cooler has a leak. Renew charge air cooler.

Attaching

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



Note

- ◆ *Renew O-ring after removal.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*

Cleaning Y-connector - VAS 691 005/1- :



Note

After the leak test has been completed, the Y-connector - VAS 691 005/1- must be cleaned to remove any water which may have entered.

- Insert cleaning nozzle -D- in hose from connection -A- on Y connector .
- Fit compressed air hose on connection -C-.
- Open cut-off valves and blow through hose for approx. 15 seconds.
- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 216](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)

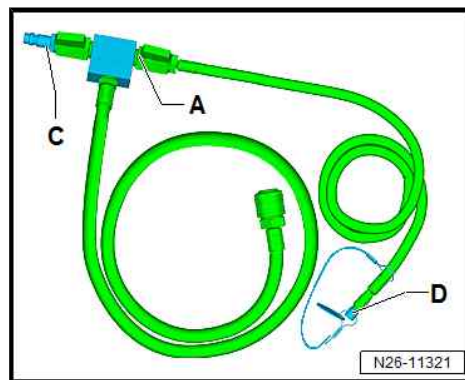
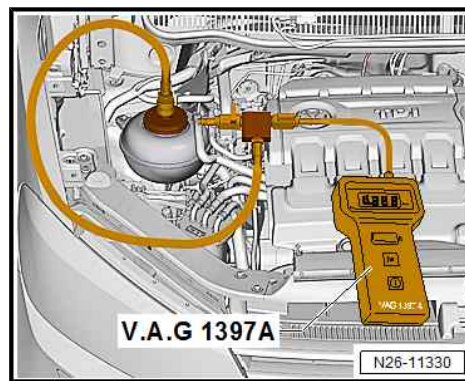
2.4 Removing and installing charge air cooler

⇒ [“2.4.1 Removing and installing charge air cooler”, page 220](#)

⇒ [“2.4.2 Removing and installing bracket for charge air cooler”, page 222](#)

2.4.1 Removing and installing charge air cooler

Special tools and workshop equipment required



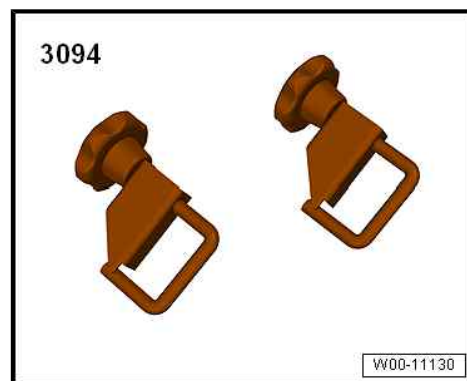


- ◆ Hose clamps up to 25 mm - 3094-



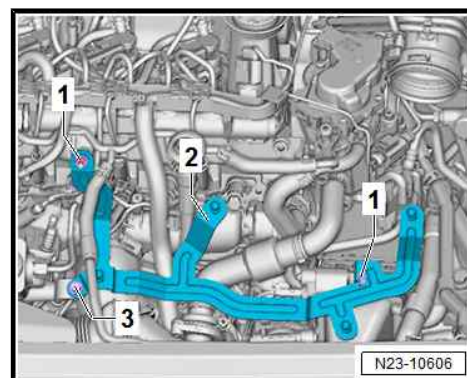
- ◆ Hose clip pliers - VAS 6362-

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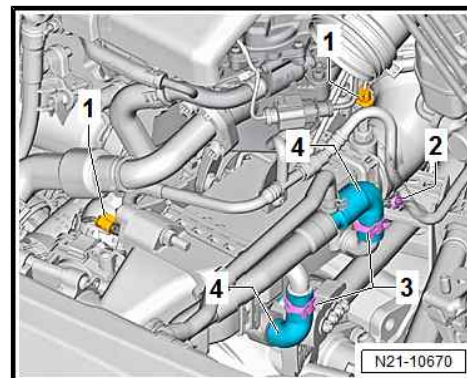


Removing

- Remove air cleaner housing ➔ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.



- Unplug electrical connectors -1-.
- Clamp off coolant hoses -4- with hose clamps, up to 25 mm - 3094- , release hose clips -3- and disconnect coolant hoses.
- Release hose clip -2-.





- Unscrew bolts in sequence -2, 3, 4, 5-, pull charge air cooler
-1- out of air hose and detach it.

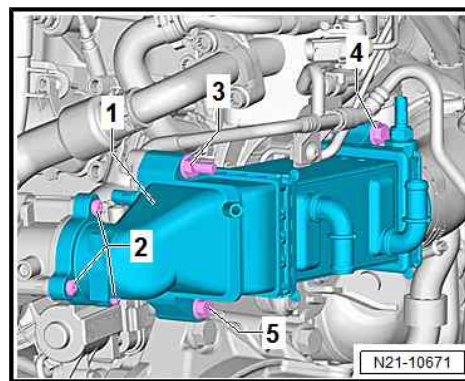
Installing

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



Note

- ◆ *Renew O-ring after removal.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ *Electronic parts catalogue* .*
- Fill and bleed coolant circuit ⇒ [page 168](#) .



Tightening torques

- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 214](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 216](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)

2.4.2 Removing and installing bracket for charge air cooler

Removing

- Drain coolant ⇒ [page 165](#) .
- Remove exhaust gas recirculation cooler (high-pressure)
⇒ [page 315](#) .



- Disconnect vacuum line -1- and -2- and unscrew bolt -3-.
- Remove bolts -4-. Guide out vacuum line and detach bracket for charge air cooler.

Installing

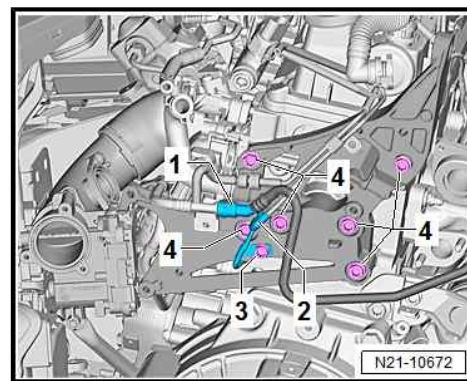
Installation is carried out in reverse order; note the following:



Note

Renew O-ring after removal.

- Install exhaust gas recirculation cooler (high-pressure)
⇒ [page 315](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ ***After it is filled, the cooling system must be bled with the
⇒ Vehicle diagnostic tester.***



Note

Do not reuse coolant.

- Fill and bleed coolant circuit ⇒ [page 168](#) .

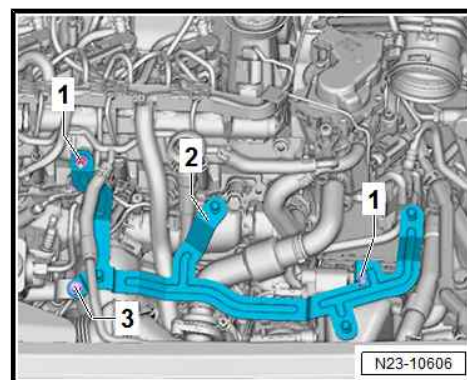
Tightening torques

- ◆ ⇒ [“2.2 Exploded view - cylinder head”, page 110](#)

2.5 Removing and installing charge pressure sender - G31-

Removing

- Remove air cleaner housing ⇒ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.





- Unplug electrical connector -1-.
- Unscrew bolts -2- and remove charge pressure sender - G31- -item 3-.

Installing

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

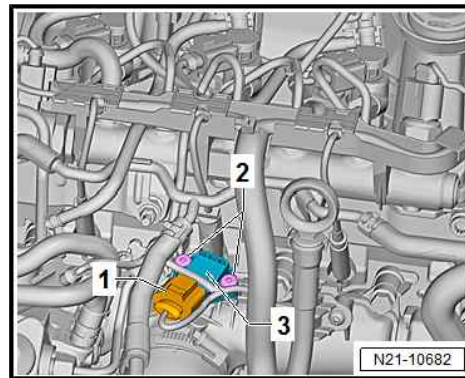


Note

Renew O-ring after removal.

Tightening torques

- ♦ ⇒ [page 216](#)



2.6 Removing and installing charge air temperature sender before charge air cooler - G810-

Removing

- Unplug electrical connector -1-.
- Unscrew charge air temperature sender before charge air cooler - G810- -item 2-.

Installing

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

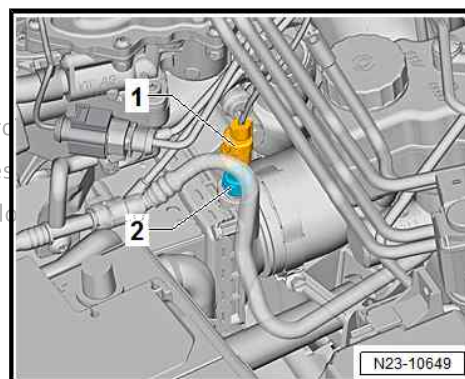


Note

Renew O-rings after removing.

Tightening torques

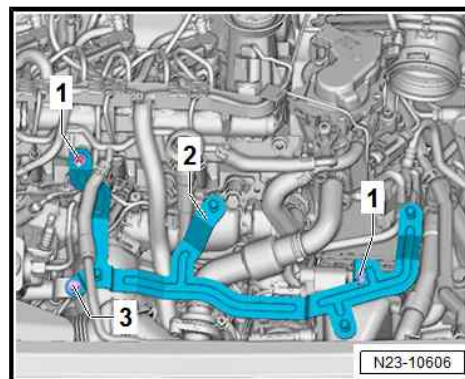
- ♦ ⇒ [“2.1 Exploded view - charge air system”, page 214](#)
- ♦ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)



2.7 Removing and installing charge air temperature sender after charge air cooler - G811-

Removing

- Remove air cleaner housing ⇒ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.





- Unplug electrical connector -1-.
- Unscrew charge air temperature sender after charge air cooler - G811- -item 2-.

Installing

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

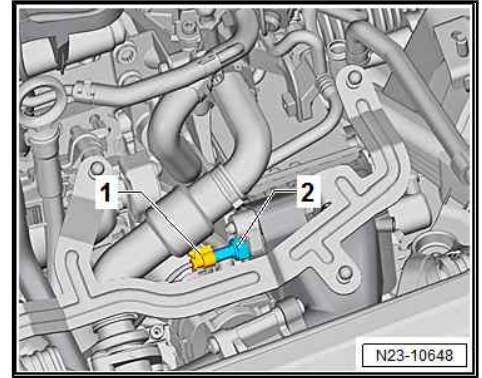


Note

Renew O-rings after removing.

Tightening torques

- ◆ ⇒ ["2.1 Exploded view - charge air system", page 214](#)
- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 236](#)



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23 – Mixture preparation - injection

1 Injection system

⇒ [“1.1 Overview of fitting locations - injection system”, page 226](#)

⇒ [“1.2 Overview - fuel system”, page 231](#)

⇒ [“1.3 Filling and bleeding fuel system”, page 232](#)

⇒ [“1.4 Checking fuel system for leaks”, page 233](#)

1.1 Overview of fitting locations - injection system

Engine compartment

1 - Heating element for crankcase breather - N79-

2 - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ❑ Fitting location
⇒ [page 227](#)

3 - Brake light switch - F- / brake pedal switch - F47-

- ❑ Fitting location
⇒ [page 227](#)

4 - Engine control unit - J623-

- ❑ Removing and installing
⇒ [page 286](#)

5 - Charge pressure control solenoid valve - N75-

- ❑ Connection diagram
⇒ [page 234](#)

6 - Intake manifold flap valve - N316-

- ❑ Connection diagram
⇒ [page 234](#)

7 - Automatic glow period control unit - J179-

- ❑ Fitting location
⇒ [page 228](#)

8 - Clutch position sender - G476-

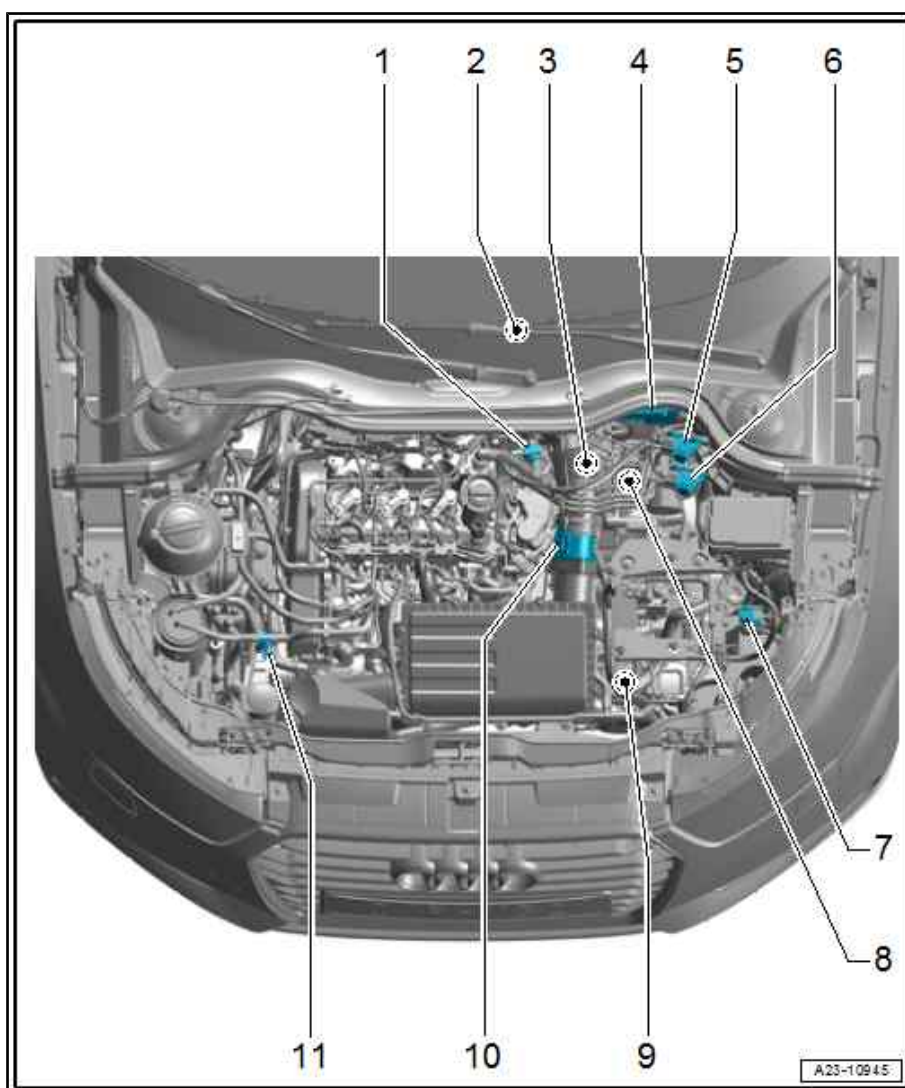
- ❑ For vehicles with manual gearbox
- ❑ Fitting location
⇒ [page 227](#)

9 - Gearbox neutral position sender - G701- / reversing light switch - F4-

- ❑ For vehicles with manual gearbox
- ❑ Fitting location ⇒ [page 228](#)

10 - Air mass meter - G70-

- ❑ Exploded view ⇒ [page 236](#)





11 - Fuel temperature sender - G81-

- ❑ In fuel supply line
- ❑ 2 Nm
- ❑ Removing and installing ⇒ [page 273](#)

Fitting location of accelerator position sender - G79- / accelerator position sender 2 - G185-

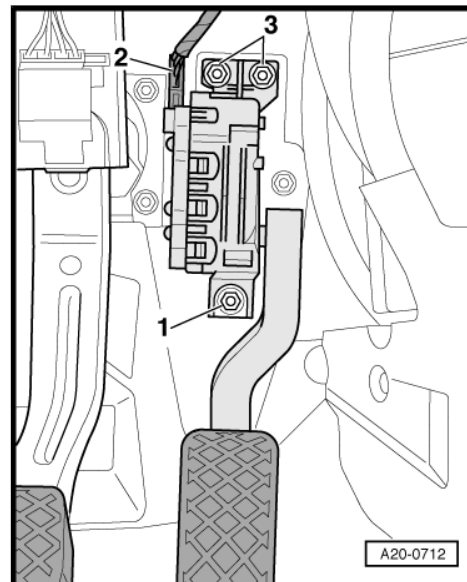
- ◆ In accelerator pedal module



Note

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; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-



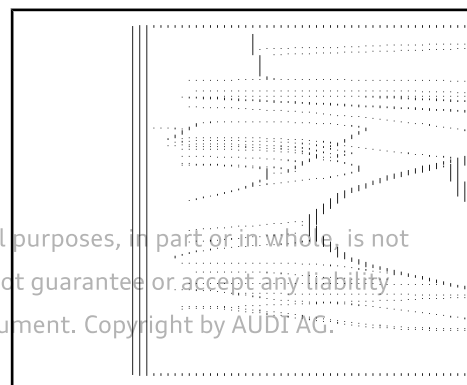
Fitting location of brake light switch - F- / brake pedal switch - F47-

- ◆ On brake master cylinder

C - Brake light switch - F- / brake pedal switch - F47-

Removing and installing ⇒ Brake system; Rep. gr. 47 ; Brake servo/brake master cylinder; Removing and installing brake light switch

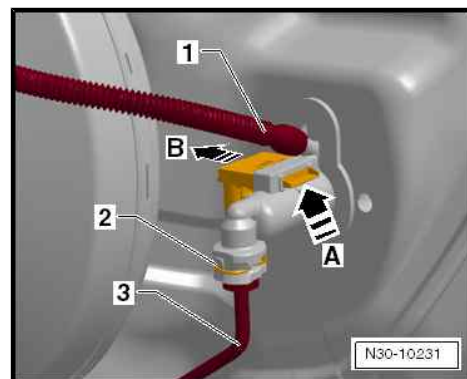
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Fitting location of clutch position sender - G476-

- ◆ On clutch master cylinder, next to brake servo

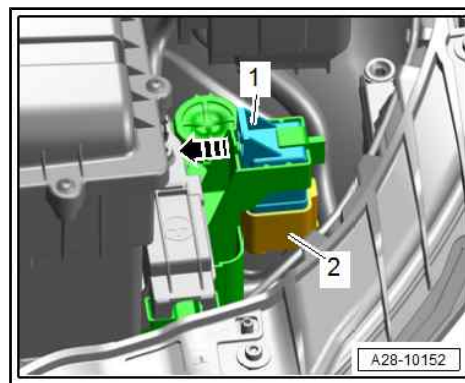
Removing and installing ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch position sender - G476-





Fitting location of automatic glow period control unit - J179-

- ◆ -Item 1- in mounting for fuse holder B - SB- in engine compartment (front left) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

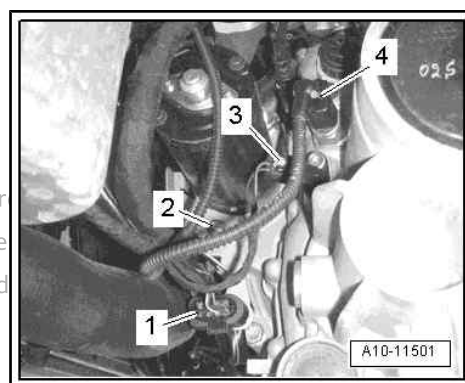


Fitting location of gearbox neutral position sender - G701- / reversing light switch - F4-

- ◆ On gearbox (front left)

3 - Electrical connector for gearbox neutral position sender - G701-

4 - Electrical connector for reversing light switch - F4-



Engine (from above)



1 - Fuel metering valve - N290-

- ☐ Integrated in high-pressure pump
- ☐ Exploded view
[⇒ page 266](#)

2 - Fuel pressure regulating valve - N276-

- ☐ Exploded view
[⇒ page 247](#)

3 - Injector, cylinder 1 - N30-

- ☐ Exploded view
[⇒ page 245](#)

4 - Hall sender - G40- (camshaft position sensor)

- ☐ Exploded view
[⇒ page 323](#)

5 - Pressure differential sender - G505-

- ☐ Exploded view
[⇒ page 282](#)

6 - Exhaust gas pressure sensor 1 - G450-

- ☐ Exploded view
[⇒ page 282](#)

7 - Injector, cylinder 2 - N31-

- ☐ Exploded view
[⇒ page 245](#)

8 - Injector, cylinder 3 - N32-

- ☐ Exploded view
[⇒ page 245](#)

9 - Fuel pressure sender - G247-

- ☐ Exploded view [⇒ page 247](#)

10 - Charge air temperature sender before charge air cooler - G810-

- ☐ Exploded view [⇒ page 239](#)

11 - Glow plug 3 - Q12-

- ☐ Exploded view [⇒ page 323](#)

12 - Glow plug 2 - Q11- with cylinder 2 combustion chamber pressure sender - G678-

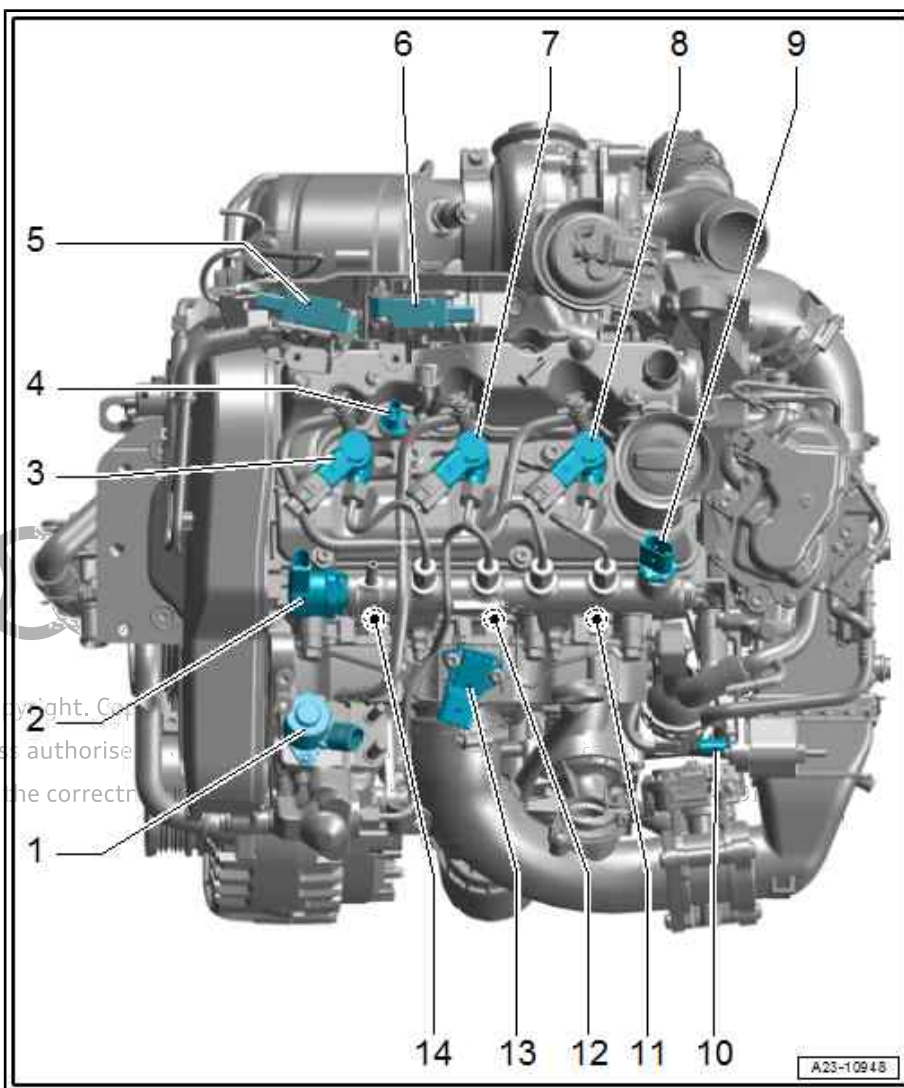
- ☐ Exploded view [⇒ page 323](#)

13 - Charge pressure sender - G31-

- ☐ Exploded view [⇒ page 214](#)

14 - Glow plug 1 - Q10-

- ☐ Exploded view [⇒ page 323](#)



Engine (inlet side)



1 - Valve for oil pressure control - N428-

- ❑ Removing and installing
⇒ [page 159](#)

2 - Oil pressure switch - F1-

- ❑ Exploded view
⇒ [page 153](#)

3 - Knock sensor 1 - G61-

- ❑ Removing and installing
⇒ [page 327](#)
- ❑ 20 Nm

4 - Coolant valve for cylinder head - N489-

- ❑ Removing and installing
⇒ [page 185](#)

5 - Coolant temperature sender - G62-

- ❑ Exploded view
⇒ [page 176](#)

6 - Exhaust gas recirculation control motor - V338- with exhaust gas recirculation potentiometer - G212-

- ❑ Exploded view
⇒ [page 310](#)

7 - Variable intake manifold position sender - G513-

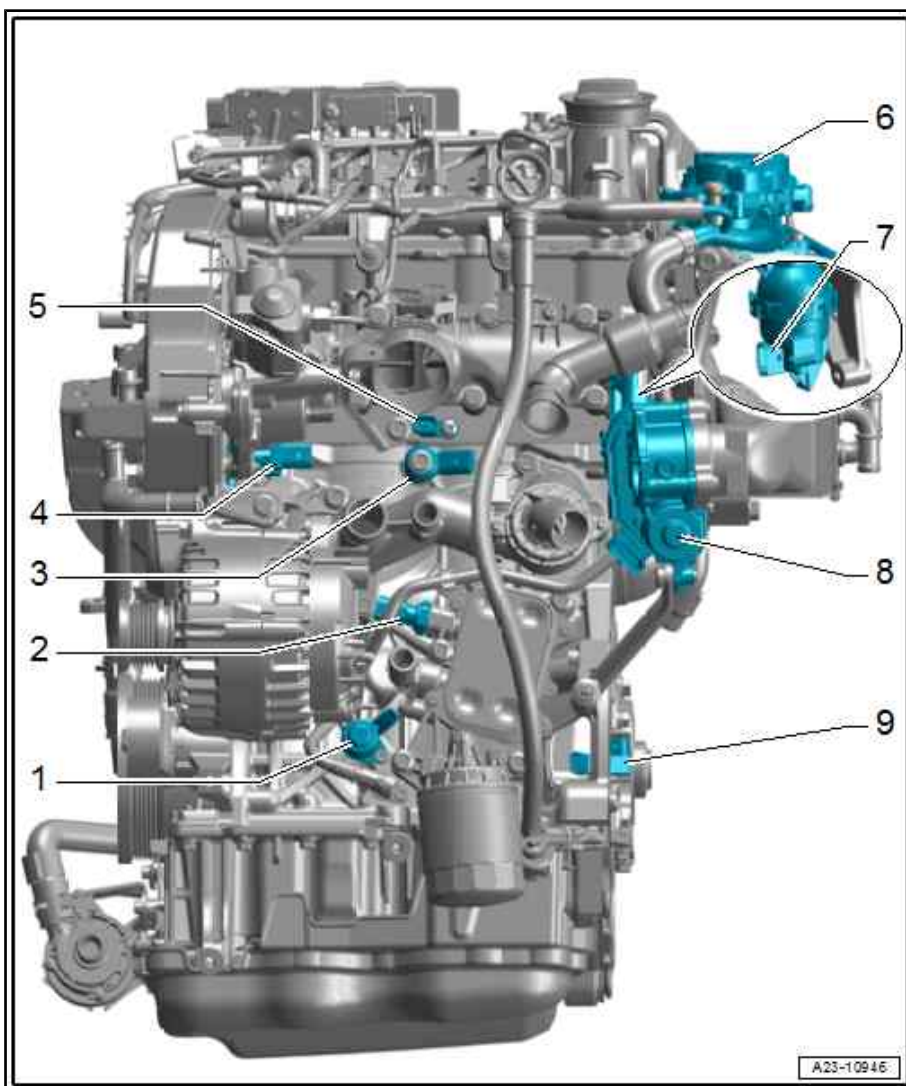
- ❑ Exploded view
⇒ [page 239](#)

8 - Throttle valve module - J338-

- ❑ With throttle valve potentiometer - G69-
- ❑ Exploded view ⇒ [page 214](#)

9 - Engine speed sender - G28-

- ❑ Exploded view ⇒ [page 323](#)



Engine (exhaust side)



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1 - Oil level and oil temperature sender - G266-

- ☐ Exploded view
 ⇒ [page 140](#)

2 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29-

- ☐ Exploded view
 ⇒ [page 282](#)

3 - Exhaust gas recirculation control motor 2 - V339- / exhaust gas recirculation potentiometer 2 - G466-

- ☐ Exploded view
 ⇒ [page 310](#)

4 - Charge air temperature sender after charge air cooler - G811-

- ☐ Exploded view
 ⇒ [page 214](#)

5 - Position sender for charge pressure positioner - G581-

6 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Exploded view
 ⇒ [page 282](#)

7 - Exhaust gas temperature sender 3 - G495-

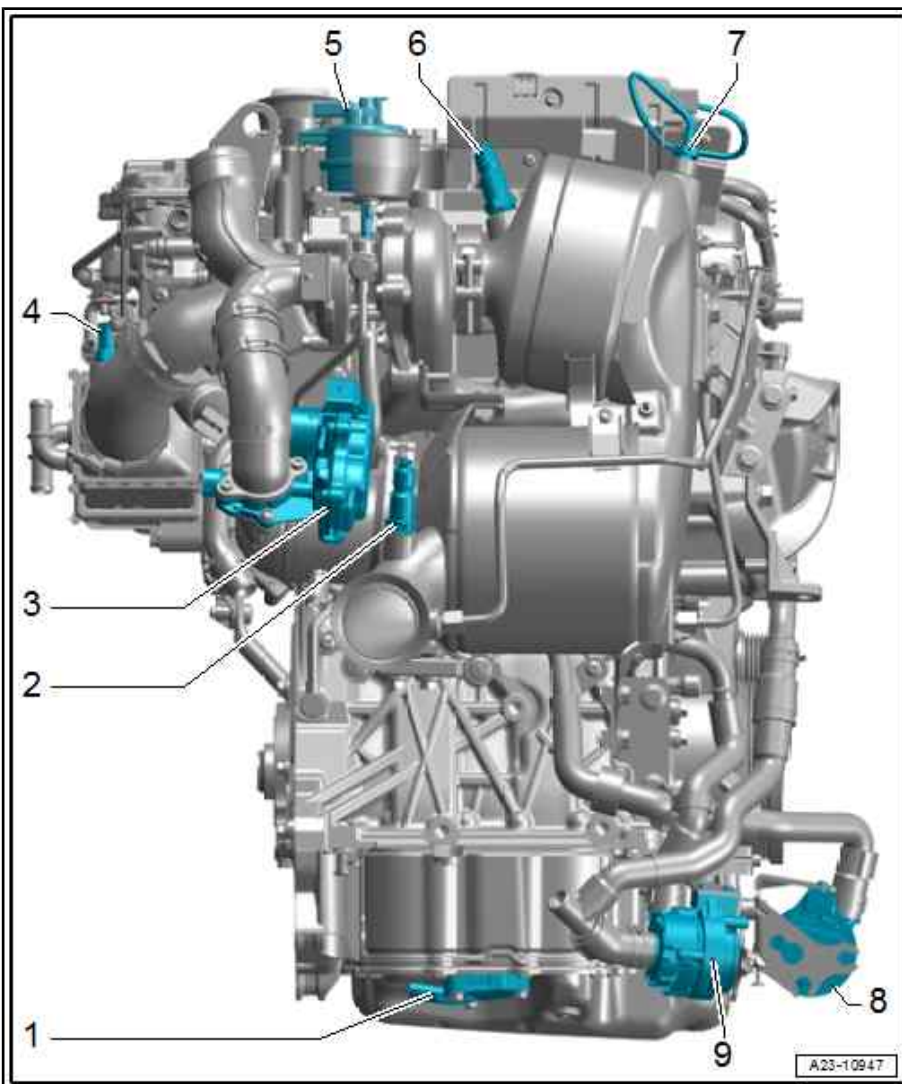
- ☐ Removing and installing
 ⇒ [page 308](#)
- ☐ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ☐ 45 Nm

8 - Charge air cooling pump - V188-

- ☐ Exploded view ⇒ [page 177](#)

9 - Auxiliary pump for heating - V488-

- ☐ Exploded view ⇒ [page 177](#)



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1.2 Overview - fuel system



Note

- ◆ Green = fuel supply
- ◆ Blue = fuel return
- ◆ Arrows show direction of fuel flow.



1 - Fuel tank

- ☐ With fuel system pressurisation pump - G6-
- ☐ Exploded view ⇒ Rep. gr. 20 ; Fuel tank; Exploded view - fuel tank

2 - Injectors

- ☐ Exploded view
⇒ [page 245](#)

3 - High-pressure reservoir (rail)

- ☐ With fuel pressure sender - G247-
- ☐ With fuel pressure regulating valve - N276-
- ☐ Exploded view
⇒ [page 247](#)

4 - High-pressure pump

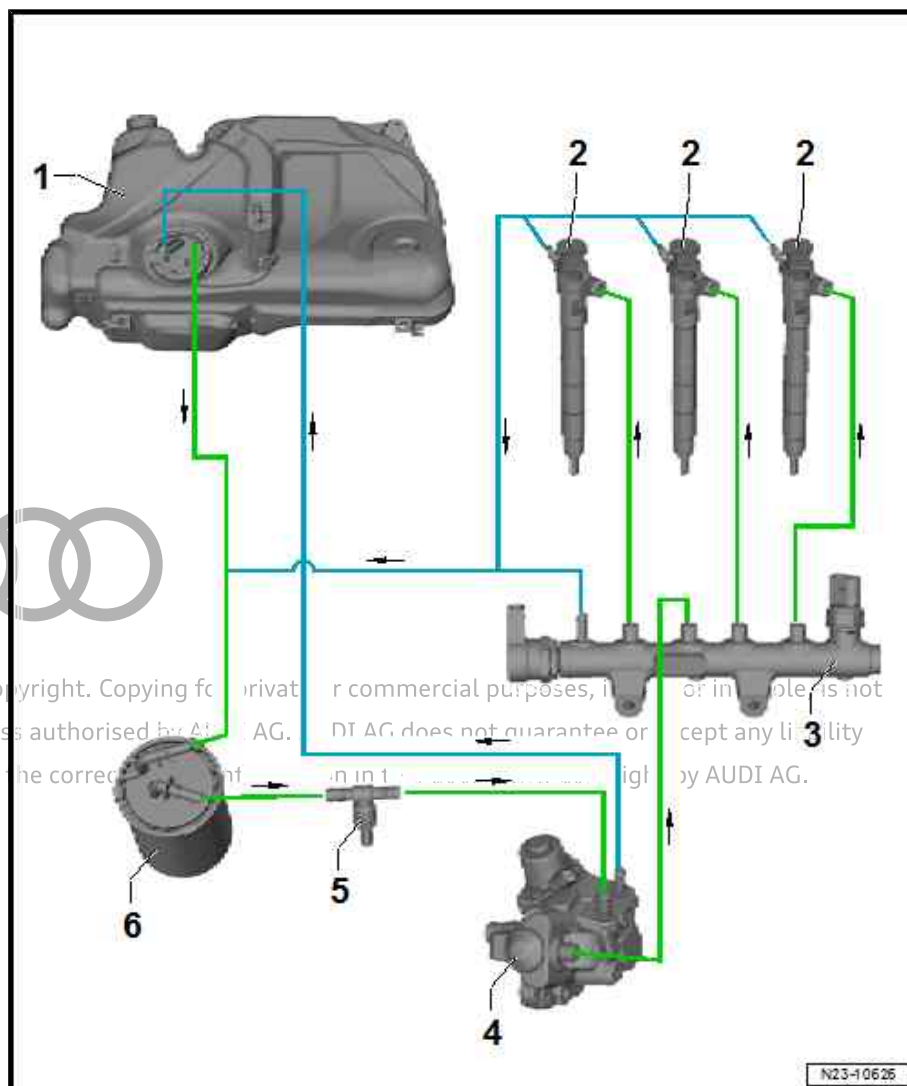
- ☐ With fuel metering valve - N290-
- ☐ Exploded view
⇒ [page 266](#)

5 - Fuel temperature sender - G81-

- ☐ In fuel supply line
- ☐ 2 Nm
- ☐ Removing and installing
⇒ [page 273](#)

6 - Fuel filter

- ☐ Exploded view ⇒ Rep. gr. 20 ; Fuel filter; Exploded view - fuel filter



1.3 Filling and bleeding fuel system

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled.

Risk of irreparable damage to fuel pump

After working on the fuel system, the fuel pump may be irreparably damaged if it is allowed to run while empty.

- Never allow fuel pump to run while it is empty.
- Fill/bleed fuel pump.

Proceed as follows to fill high-pressure pump with fuel.

- Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.



- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options one after the other:
 - ◆ **Drive train**
 - ◆ **Select engine code and engine**
 - ◆ **01 - Self-diagnosis compatible systems**
 - ◆ **01 - Engine electronics**
 - ◆ **01 - Engine electronics, functions**
 - ◆ **Activate fuel pump**
 - ◆ Press **Carry out check**
 - ◆ Select 120 seconds.
- The fuel pump must run for 120 seconds to ensure that the fuel system is filled sufficiently with fuel.
- Start engine after filling fuel system.
- Run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Road-test vehicle and accelerate with full throttle at least once.
- Then check high-pressure system again for leaks.

1.4 Checking fuel system for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check complete fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Road-test vehicle and accelerate with full throttle at least once.
- Then check high-pressure system again for leaks.



2 Vacuum system

⇒ "2.1 Connection diagram - vacuum system", page 234

⇒ "2.2 Checking vacuum system", page 234

2.1 Connection diagram - vacuum system

1 - Vacuum unit

- ☐ For charge pressure control
- ☐ On turbocharger

2 - Air hose

3 - Charge pressure control solenoid valve - N75-

- ◆ a - Vacuum supply
- ◆ b - To intake manifold flap
- ◆ c - To vacuum unit on turbocharger
- ◆ d - Vent line to air hose

4 - Intake manifold flap valve - N316-

- ◆ a - Vacuum supply
- ◆ b - To intake manifold flap
- ◆ c - To vacuum unit on turbocharger
- ◆ d - Vent line to air hose

5 - Non-return valve

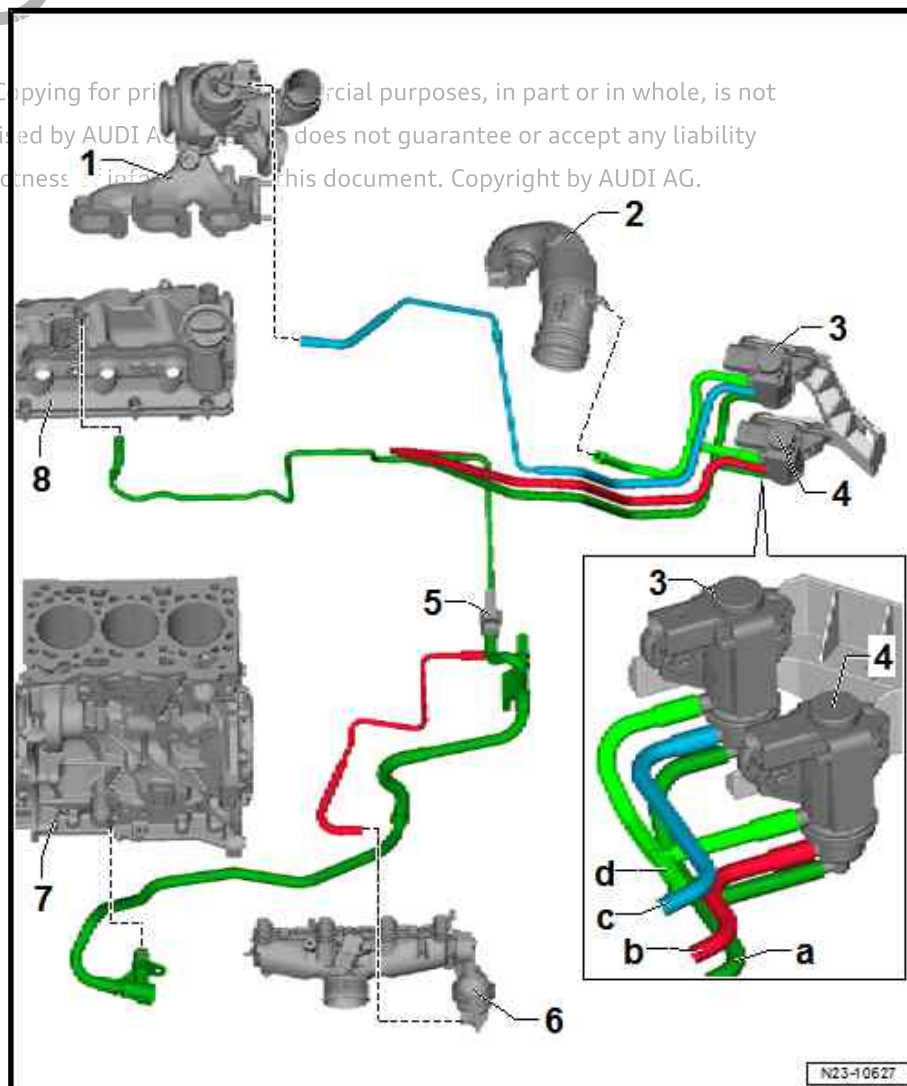
- ☐ Note installation position

6 - Intake manifold flap

7 - Cylinder block

8 - Cylinder head cover

- ☐ With vacuum reservoir

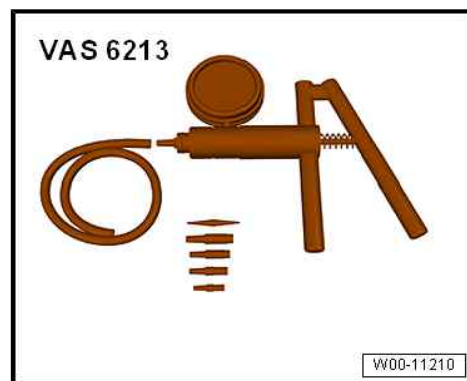


2.2 Checking vacuum system

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 a vacuum with the hand vacuum pump - VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.



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3 Air cleaner

⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)

⇒ [“3.2 Removing and installing air cleaner housing”, page 237](#)

3.1 Exploded view - air cleaner housing

1 - Air duct

- ☐ To air cleaner (bottom section)

2 - Air duct (bottom section)

- ☐ On lock carrier

3 - Air duct (top section)

- ☐ On lock carrier

4 - Cover

- ☐ For air duct

5 - Bolt

- ☐ 2 Nm

6 - Air cleaner (top section)

- ☐ Remove any salt residue, dirt and leaves

7 - Air mass meter - G70-

- ☐ Removing and installing
⇒ [page 272](#)

8 - Spring-type clip

9 - Spring-type clip

10 - Air hose

11 - Bolt

- ☐ 2 Nm

12 - O-ring

- ☐ Renew if damaged

13 - Air filter element

- ☐ Use genuine air filter element ⇒ Electronic parts catalogue
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing ⇒ Maintenance ; Booklet 819

14 - Air cleaner (bottom section)

- ☐ Remove any salt residue, dirt and leaves

15 - O-ring

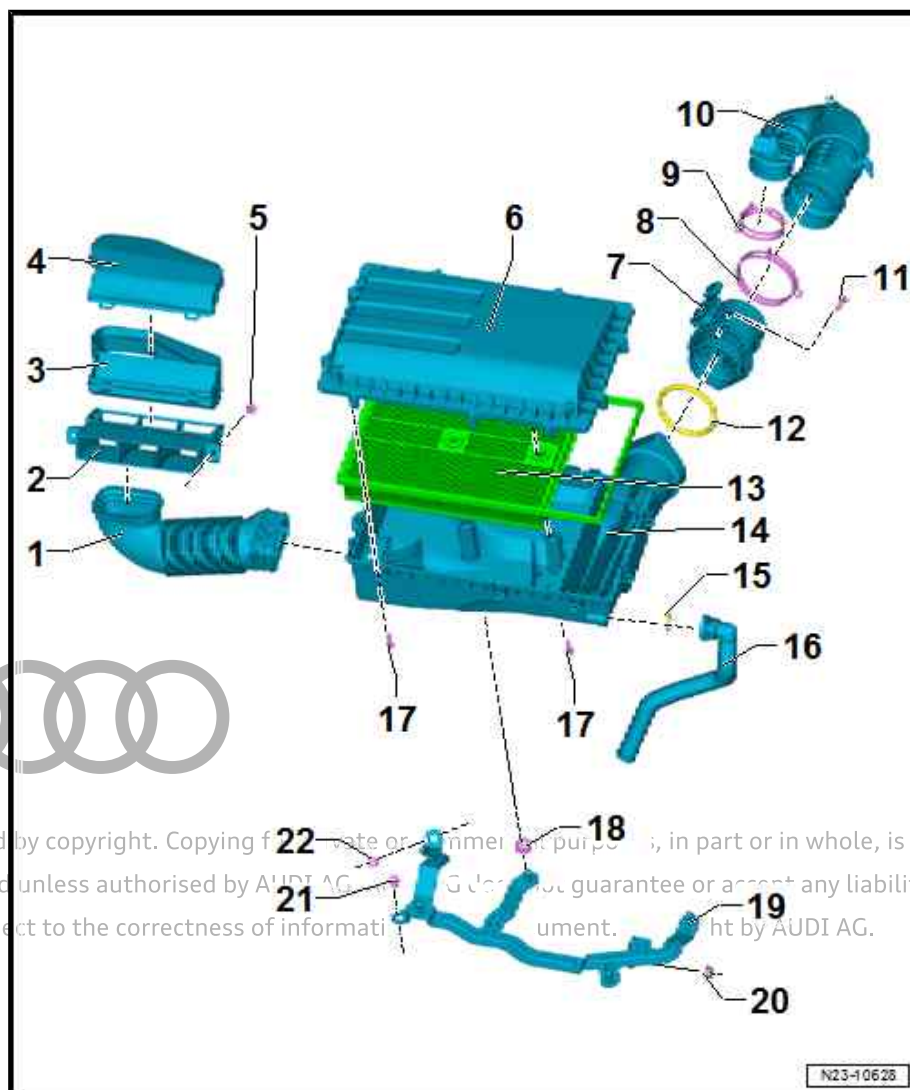
- ☐ Renew if damaged

16 - Water drain hose

- ☐ With valve
- ☐ Clean

17 - Bolt

- ☐ 5 Nm



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N23-10628



18 - Rubber buffer

19 - Bracket

20 - Nut

□ 20 Nm

21 - Nut

□ 10 Nm

22 - Bolt

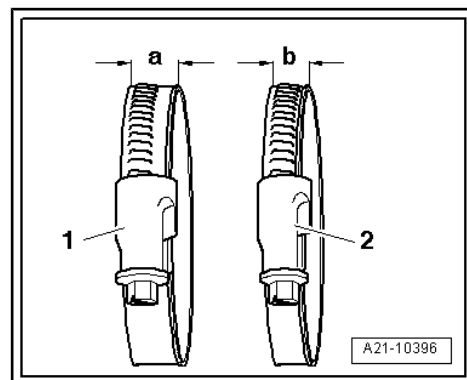
□ 8 Nm

Installing air ducts with screw-type clips



Note

- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*



Tightening torque for

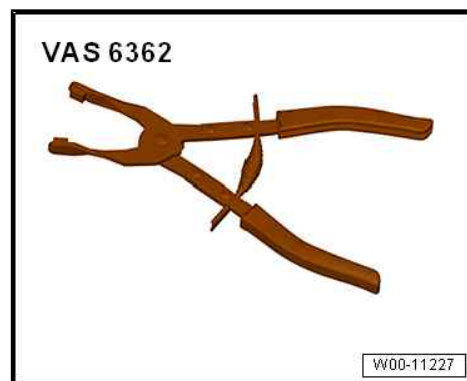
1 - Hose clip with width -a- = 13 mm: 5.5 Nm

2 - Hose clip with width -b- = 9 mm: 3 Nm

3.2 Removing and installing air cleaner housing

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-

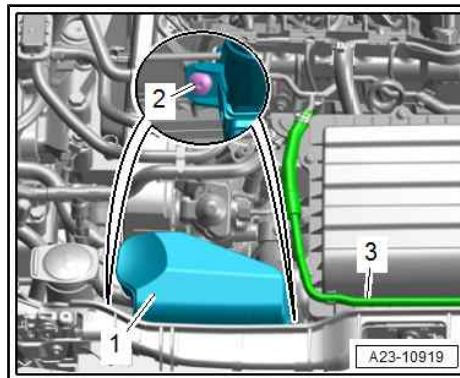


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Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Move coolant line -3- clear at air cleaner housing.
- Remove bolts -2- and detach air duct -1- from lock carrier.



- Unplug electrical connector -2- at air mass meter - G70-.
- Release hose clip -3- and detach air hose.
- Carefully detach air cleaner housing -1- from retaining pins.

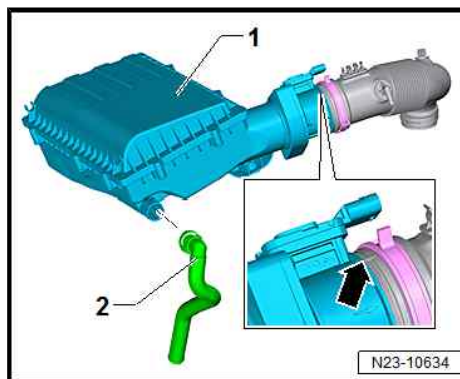
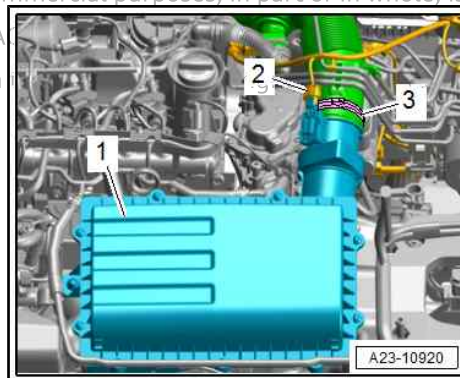
Installing

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



Note

- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Use silicone-free lubricant when fitting air hose.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#) .*
- Press release tabs and disconnect water drain hose -2- from air cleaner housing.
- Clean dirt and leaves out of connection on air cleaner (bottom section) and water drain hose.
- When fitting intake connecting pipe on air cleaner housing, pay attention to installation markings -arrow-.
- Fit air cleaner housing on bracket and press on so that it engages.
- Press air cleaner housing on again and then pull to check that housing is correctly engaged.
- Install engine cover panel ⇒ [page 41](#) .



Tightening torques

- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)



4 Intake manifold

⇒ ["4.1 Exploded view - intake manifold", page 239](#)

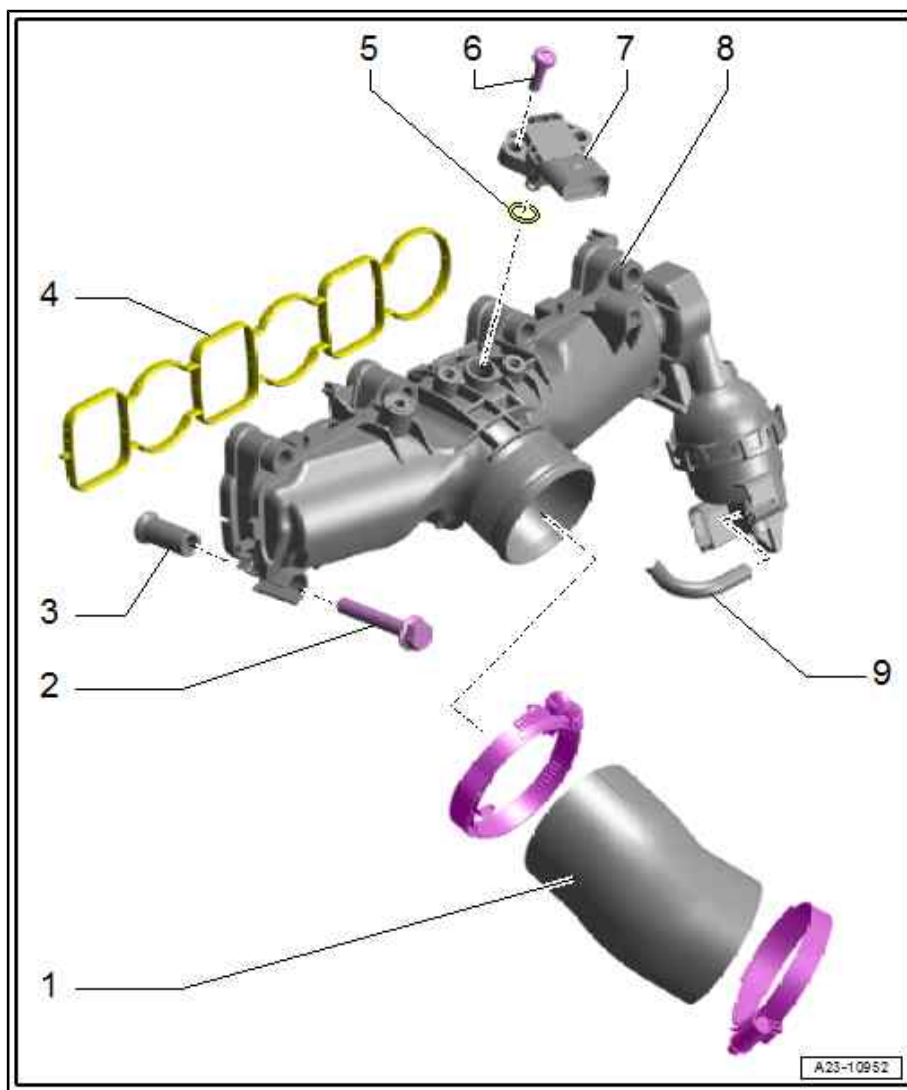
⇒ ["4.2 Removing and installing throttle valve module J338", page 240](#)

⇒ ["4.3 Removing and installing intake manifold", page 240](#)

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4.1 Exploded view - intake manifold

- 1 - Air hose
- 2 - Bolt
 - ☐ 20 Nm
- 3 - Spacer sleeve
- 4 - Gasket
 - ☐ Renew after removing
- 5 - O-ring
 - ☐ Renew after removing
- 6 - Bolt
 - ☐ Thread-forming
 - ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
 - ☐ 8 Nm
- 7 - Charge pressure sender - G31-
 - ☐ Removing and installing
⇒ [page 223](#)
- 8 - Intake manifold
 - ☐ With intake manifold flap and variable intake manifold position sender - G513-
 - ☐ Removing and installing
⇒ [page 240](#)
- 9 - Vacuum line
 - ☐ For intake manifold flap
 - ☐ Connection diagram
⇒ [page 234](#)

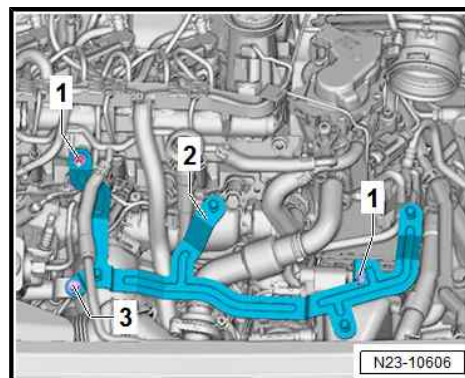




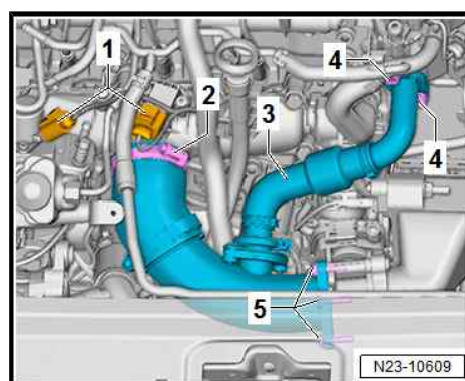
4.2 Removing and installing throttle valve module - J338-

Removing

- Remove air cleaner housing ⇒ [page 237](#) .
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.



- Release hose clip -2- and remove bolts -4 and 5-.
- Remove air duct with exhaust gas recirculation pipe.



- Unplug connector -2-.
- Remove bolts -1- and -4- and detach throttle valve module - J338- -3-.

Installing

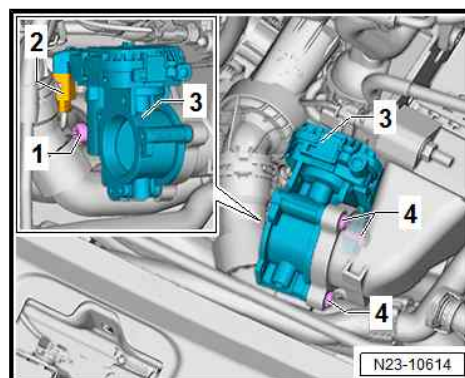
Installation is carried out in reverse order; note the following:



Note

Renew seals and O-ring after removal.

- Install air cleaner housing ⇒ [page 237](#) .



Tightening torques

- ♦ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)
- ♦ ⇒ [“2.1 Exploded view - charge air system”, page 214](#)
- ♦ ⇒ [“4.1.2 Exploded view - exhaust gas recirculation system, high-pressure”, page 312](#)

4.3 Removing and installing intake manifold

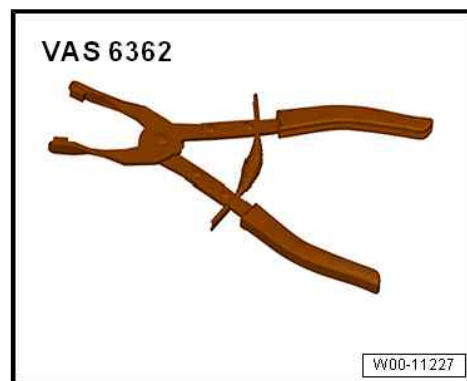
Special tools and workshop equipment required



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- ◆ Hose clip pliers - VAS 6362-

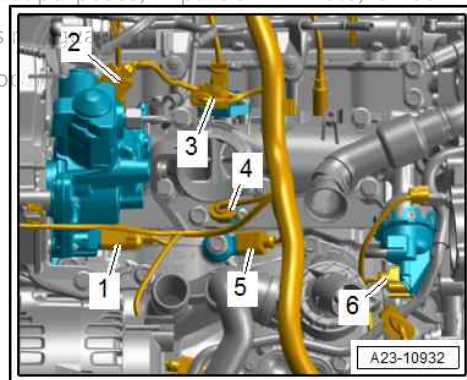


- ◆ Tool insert - T10535-



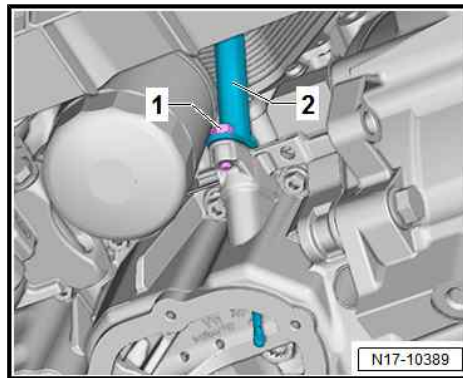
Removing

- Remove air cleaner housing ⇒ [page 237](#) .
- Remove throttle valve module - J338- ⇒ [page 240](#) .
- Remove high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump ⇒ [page 260](#) .
- Remove charge air temperature sender after charge air cooler - G811- ⇒ [page 224](#) .
- Unplug electrical connectors -1 ... 6-.
- Move electrical wiring harness clear and pull slightly towards front.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .





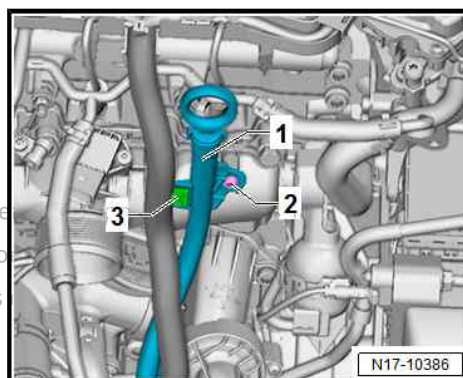
- Unscrew bolt -1- for oil pipe on sump.



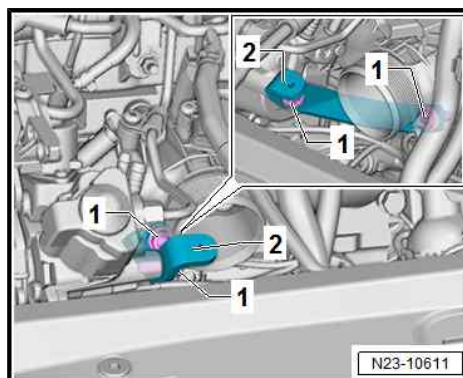
- Unscrew bolt -2- for oil pipe on intake manifold and pull out oil pipe -1- upwards.



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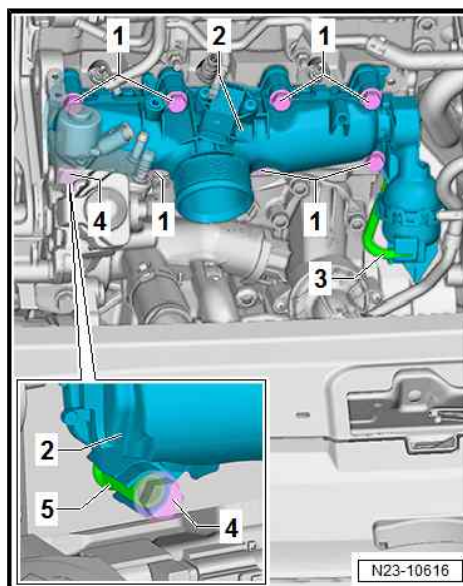
- Remove bolts -1- and detach support -2-.



Note

The bolted connection of the intake manifold (hidden by the high-pressure pump) has an open drilling. Loosen this bolt by one turn only. Bolt -4- and sleeve -5- remain in cylinder head.

- Disconnect vacuum line -3- and unscrew bolts -1- for intake manifold -2-.

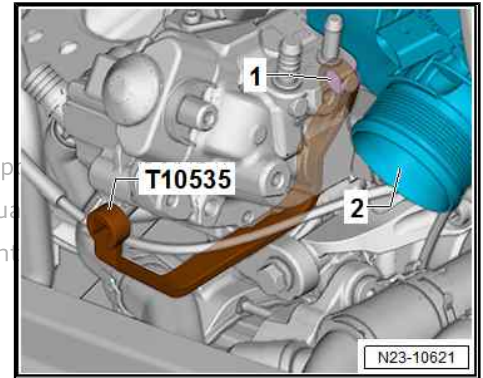




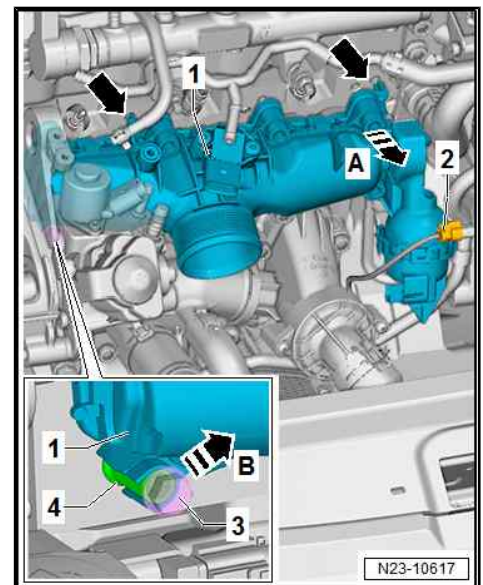
- Loosen bolt -1- one turn using insert tool - T10535- .



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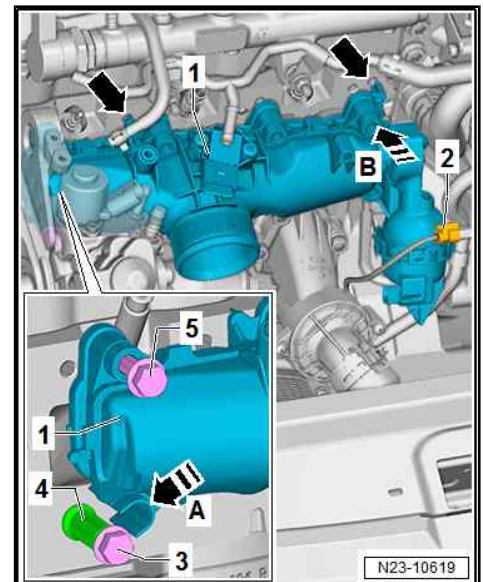


- In area of vacuum unit, pull intake manifold -1- in direction of -arrow A- until positioning aids -arrows- are exposed.
- Pull intake manifold -1- out of sleeve -4- in direction of -arrow B- and detach it.



Installing

- Insert bolt -5- into hole before fitting intake manifold.
- Push intake manifold -1- onto sleeve -4- in direction of -arrow A-.
- Fit intake manifold onto cylinder block in direction of -arrow B-.
- Positioning aids -arrows- must engage in holes.





- Tighten bolts -1, 4- for intake manifold -2- in diagonal sequence, working from inside to outside.



Note

Use insert tool - T10535- to tighten bolt -4-.

- Connect vacuum line -3-.

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



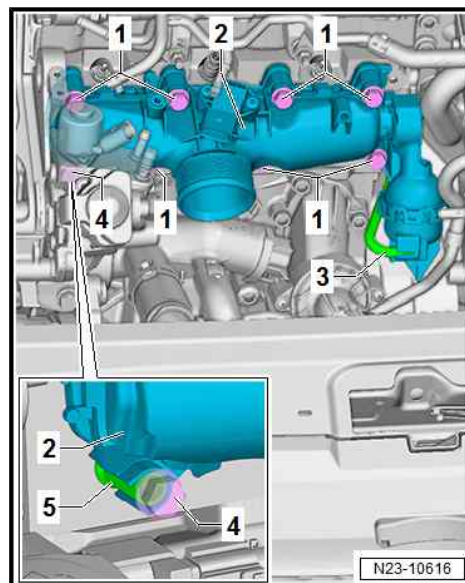
Note

Renew seals and O-ring after removal.

- 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 charge air temperature sender after charge air cooler - G811- ⇒ [page 224](#) .
- Install high-pressure pipe ⇒ [page 262](#) .
- Install throttle valve module - J338- ⇒ [page 240](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - intake manifold”, page 239](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)
- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 140](#)
- ◆ ⇒ [“6.1 Exploded view - high-pressure pump”, page 266](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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5 Injectors/high-pressure reservoir (rail)

⇒ ["5.1 Exploded view - injectors", page 245](#)

⇒ ["5.2 Exploded view - high-pressure reservoir \(rail\)", page 247](#)

⇒ ["5.3 Checking injectors", page 248](#)

⇒ ["5.4 Performing adaption of correction values for injectors", page 248](#)

⇒ ["5.5 Checking for injectors sticking open", page 248](#)

⇒ ["5.6 Checking return flow rate of injectors with engine running", page 251](#)

⇒ ["5.7 Checking return flow rate of injectors at starter cranking speed", page 254](#)

⇒ ["5.8 Removing and installing injectors", page 256](#)

⇒ ["5.9 Removing and installing high-pressure pipes", page 260](#)

⇒ ["5.10 Removing and installing high-pressure reservoir \(rail\)", page 264](#)

5.1 Exploded view - injectors

1 - Seal

- ☐ In cylinder head cover
- ☐ Renew if leaking
⇒ [page 113](#)

2 - Copper seal

- ☐ Renew after removing

3 - O-ring

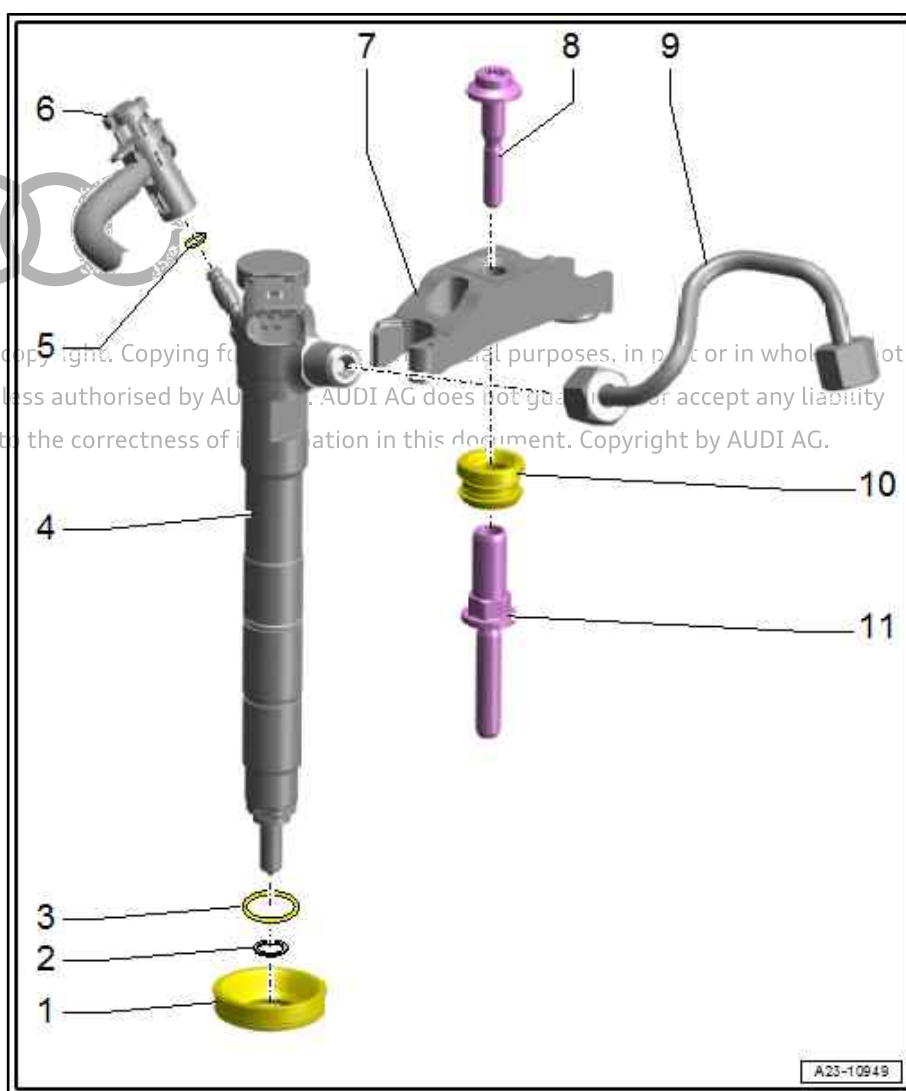
- ☐ Renew after removing

4 - Injector

- ☐ Use a coloured pen to mark allocation of injectors to corresponding clamping piece and high-pressure pipe, and to corresponding cylinder for re-installation; pay attention to markings when installing
- ☐ Always renew copper seal when removing and installing
- ☐ To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- (it is important to do this to avoid leaks)
- ☐ Removing and installing
⇒ [page 256](#)

5 - O-ring

- ☐ Renew after removing





6 - Fuel return line

- ☐ Must not be kinked, damaged or clogged
- ☐ Do not dismantle

7 - Clamping piece

- ☐ Use a coloured pen to mark injectors and corresponding clamping piece and cylinder for re-installation; pay attention to markings when installing
- ☐ The clamping pieces can be re-used when installing new injectors
- ☐ Installation position ➔ [page 246](#)

8 - Bolt

- ☐ Renew
- ☐ Tighten initially to 2 Nm, then screw on union nuts for high-pressure pipes hand-tight and align injectors
- ☐ 8 Nm + 270° (3x 90° further)

9 - High-pressure pipe

- ☐ Between high-pressure reservoir and injectors
- ☐ Observe all instructions for installing high-pressure pipes ➔ [page 262](#)
- ☐ Install free of stress
- ☐ 28 Nm

10 - Grommet

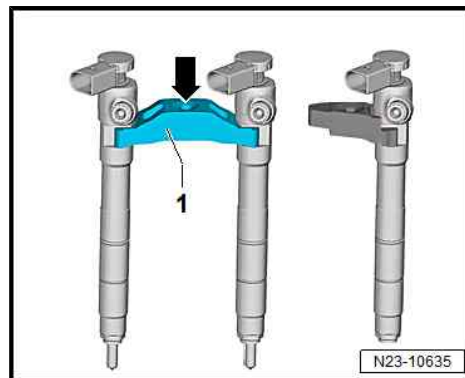
- ☐ In cylinder head cover
- ☐ Renew if damaged or leaking

11 - Ball stud

- ☐ 20 Nm

Installation position of clamping piece

- One clamping piece secures the injectors for cylinder 1 and cylinder 2.
- The bulge -arrow- of the clamping piece should point upwards.
- The injector for cylinder 3 has an individual clamping piece.





5.2 Exploded view - high-pressure reservoir (rail)

1 - Bolt

- ☐ 8 Nm

2 - Fuel return line

- ☐ Must not be kinked, damaged or clogged

3 - Fuel pressure regulating valve - N276-

- ☐ When re-installing fuel pressure regulating valve - N276- , check for damage on deformable sealing lip and thread. Renew fuel pressure regulating valve - N276- if damaged
- ☐ If old fuel pressure regulating valve - N276- is reinstalled, O-Ring must be renewed
- ☐ Removing and installing
⇒ [page 274](#)
- ☐ Performing adaptations required after renewing a component (using
⇒ Vehicle diagnostic tester)
⇒ ["3.4 Performing adaptations after renewing a component", page 8](#)
- ☐ 80 Nm

4 - O-ring

- ☐ Renew after removing

5 - High-pressure pipe

- ☐ Between high-pressure reservoir and injectors
- ☐ Observe all instructions for installing high-pressure pipes ⇒ [page 262](#)
- ☐ Install free of stress
- ☐ 28 Nm

6 - High-pressure reservoir (rail)

- ☐ Removing and installing ⇒ [page 264](#)

7 - Fuel pressure sender - G247-

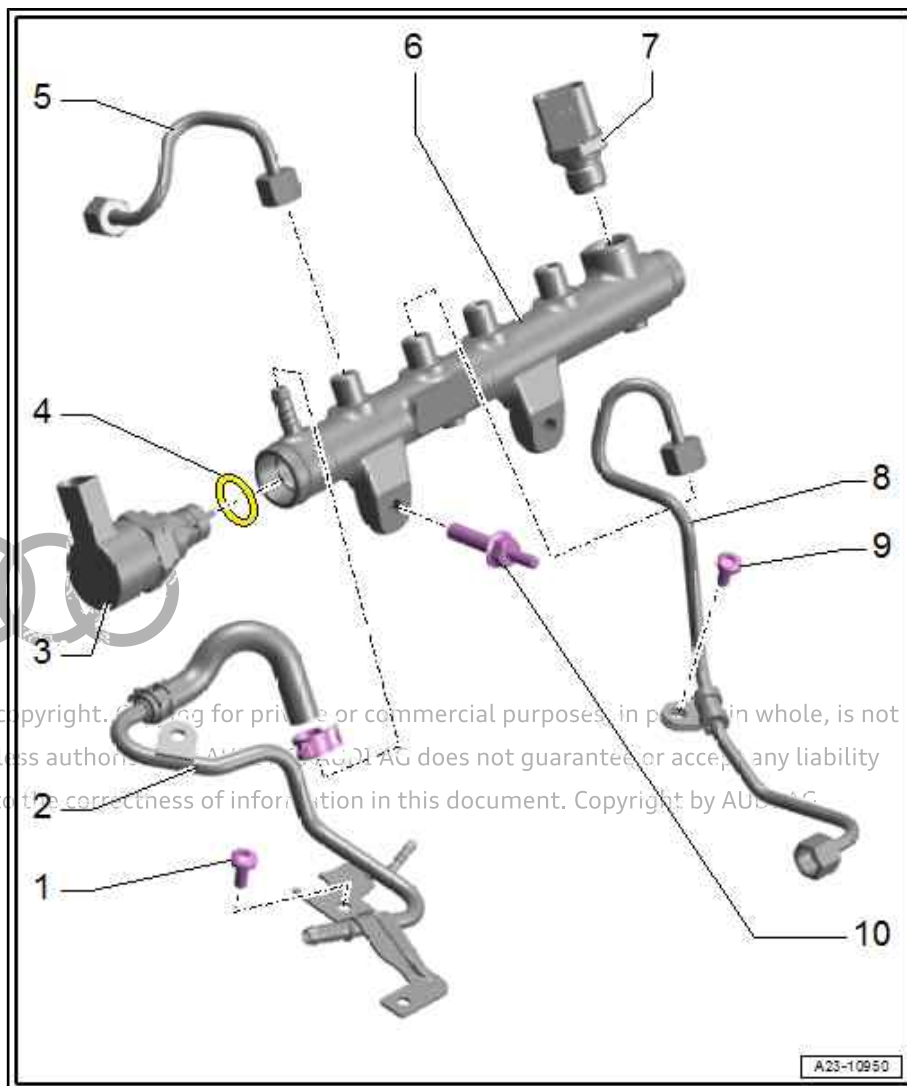
- ☐ If deformable sealing lip and thread of fuel pressure sender - G247- are not damaged, sender can be re-used once.
- ☐ Removing and installing ⇒ [page 277](#)
- ☐ 100 Nm

8 - High-pressure pipe

- ☐ Between high-pressure pump and high-pressure reservoir
- ☐ Observe all instructions for installing high-pressure pipes ⇒ [page 262](#)
- ☐ 28 Nm

9 - Bolt

- ☐ 8 Nm





10 - Bolt

- 20 Nm

5.3 Checking injectors

There are four different tests for checking the operation of the injectors.

- ◆ ⇒ [“5.4 Performing adaption of correction values for injectors”, page 248](#)
- ◆ ⇒ [“5.5 Checking for injectors sticking open”, page 248](#)
- ◆ ⇒ [“5.6 Checking return flow rate of injectors with engine running”, page 251](#)
- ◆ ⇒ [“5.7 Checking return flow rate of injectors at starter cranking speed”, page 254](#)

Perform the following tests first if the engine does not start at all:

- ◆ ⇒ [“5.5 Checking for injectors sticking open”, page 248](#)
- ◆ ⇒ [“5.7 Checking return flow rate of injectors at starter cranking speed”, page 254](#)
- ◆ ⇒ [“7.3 Checking fuel pressure regulating valve N276 ”, page 273](#)

5.4 Performing adaption of correction values for injectors

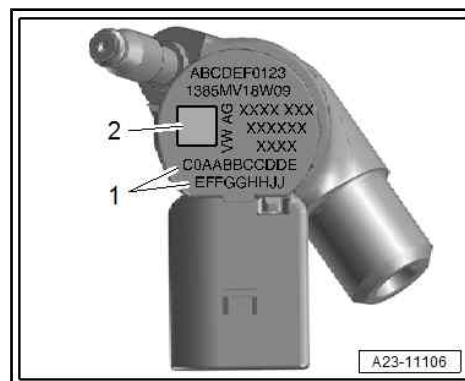
- ◆ The “Injector delivery calibration values” function serves to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.
- ◆ The 7-digit adaption values are marked on each injector. The values may consist of letters and/or numbers.

Injector (view from above)

- 1 - Adaption value (checksum; details in illustration are only an example)
- 2 - Data matrix code

- ◆ When a new injector is installed, the adaption value must be written into the engine control unit.
- ◆ When a new engine control unit is installed, the “Adaption values for injectors” must be written into the new control unit.
- ◆ Additionally, check that the “injector delivery calibration values” are correctly entered for all the other injectors. **Do NOT** attempt to re-enter these values if the correct values are already stored in the engine control unit.

- Perform adaptions required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ [“3.4 Performing adaptions after renewing a component”, page 8](#).



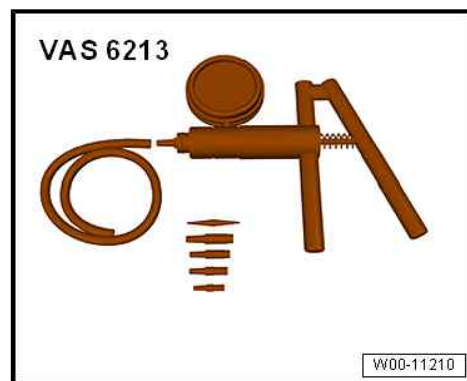
5.5 Checking for injectors sticking open

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester



- ◆ Hand vacuum pump - VAS 6213-



- ◆ Adapter C6 of return flow meter - VAS 6684-

- ◆ Front-end hook - 3370-



Procedure

- Remove engine cover panel ➔ [page 41](#) .
- Observe rules for cleanliness when working on the fuel supply system ➔ [“3.1 Rules for cleanliness”, page 6](#) .
- Clean all connections (with commercial cleaning solution or similar) before removing.



Note

- ◆ *Make sure all parts are clean; no dirt must be allowed to enter the fuel system.*
- ◆ *Check all cylinders in turn.*

- Dry all components after cleaning.

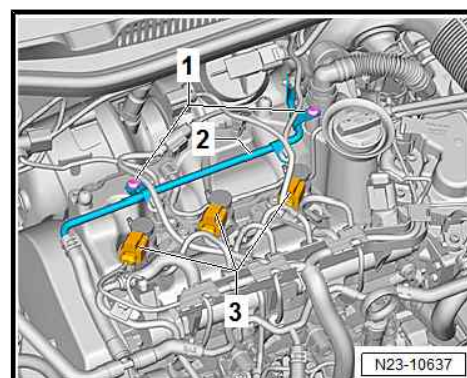
Start with cylinder No. 1.

- Remove bolts -1- and press coolant pipe -2- slightly towards rear.



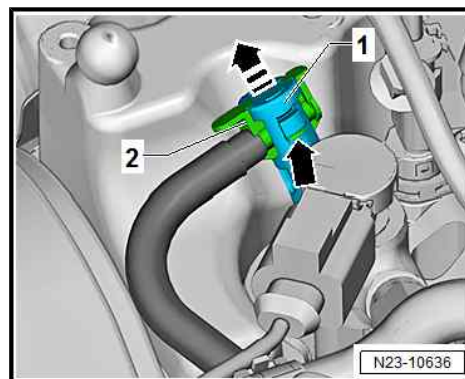
Note

DO NOT use the solenoid valves of the injectors as a fulcrum for levering out with a screwdriver.





- Insert front-end hook - 3370- into lower recess -arrow- and release centre piece of return line connection slowly in direction of -arrow-.
- Then take hold of both tabs on return line connections and disconnect connections carefully from injectors.

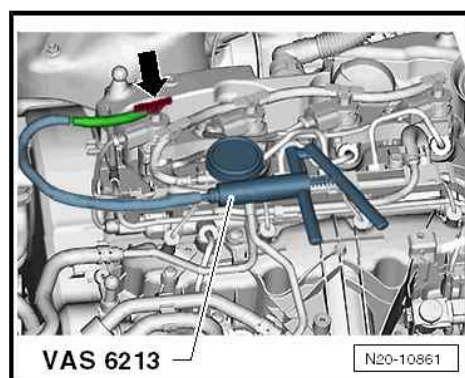


- Connect adapter C6 of return flow meter - VAS 6684- to return line connection of injector to be tested -arrow- after adapter has been cleaned and blown out.
- Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .

If the vacuum reading remains the same for 30 seconds, the injector is OK.

If the injector is faulty, the vacuum reading will fall back to 0 bar within 2 to 3 seconds.

- Repeat test if necessary; note drop in vacuum reading on hand vacuum pump - VAS 6213- .
- Renew faulty injectors ➔ [page 256](#) .



Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all seals with engine oil or assembly oil before installing.

- Push return line connections carefully onto injectors. The catch should engage audibly. Then press release pin down carefully.
- Erase any entries in event memory resulting from testing ➔ Vehicle diagnostic tester, [Guided Functions], then [01 - Interrogate/erase event memory].

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.
- Renew the affected component if leakage occurs.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Install engine cover panel ➔ [page 41](#) .



5.6 Checking return flow rate of injectors with engine running

Checking return flow rate of all injectors

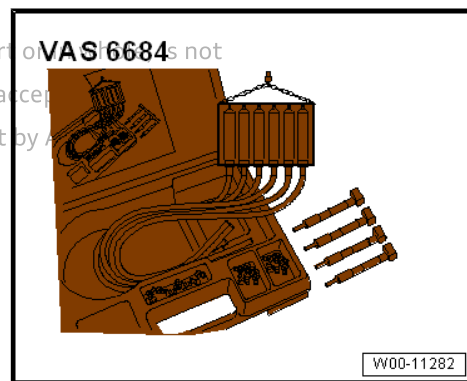
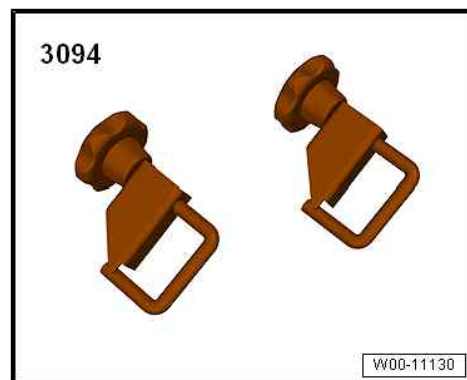
Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester
- ◆ Fuel-resistant extension hose
- ◆ Fuel-resistant measuring container
- ◆ Hose clamps up to 25 mm - 3094-



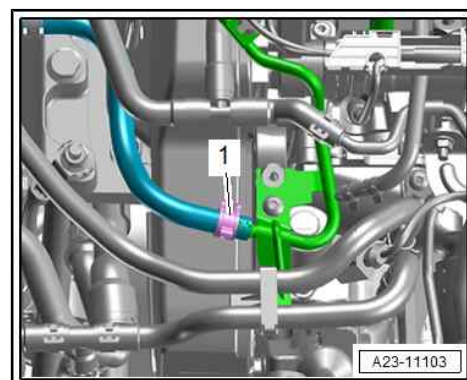
- ◆ Return flow meter - VAS 6684- and adapter C6

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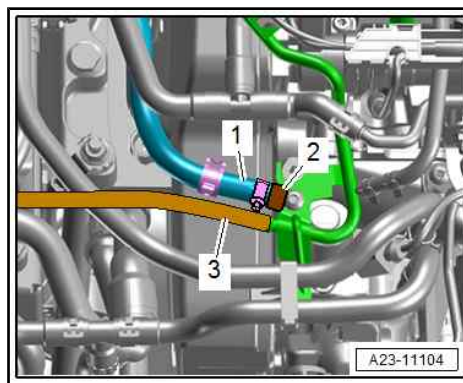
Procedure

- Remove engine cover panel ⇒ [page 41](#) .
- Release hose clamp -1- and disconnect hose connection at fuel return line.
- Observe rules for cleanliness when working on the fuel supply system ⇒ [“3.1 Rules for cleanliness”, page 6](#) .

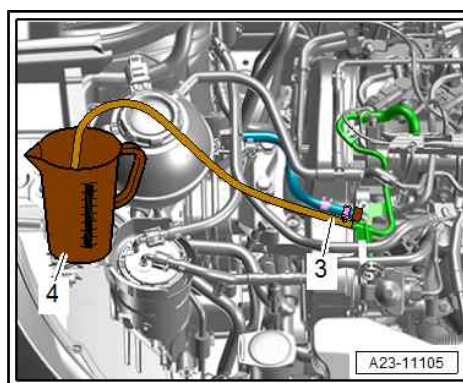




- Seal off open return line -1- with plug -2-.



- Hold extension hose -3- into a measuring container -4- to measure total return flow rate.
- Start engine and let it idle for 2 minutes.
 - Specification for 2 minutes: 0 ml to 50 ml
- If specification is attained, switch off engine and empty measuring container in readiness for new test.
- Increase engine speed to 2000 ... 2500 rpm for approx. 2 minutes and then check return flow rate again.
 - Specification for 2 minutes: less than 250 ml



Note

1000 ml = 1 litre

If specification is exceeded, this indicates that one or more injectors are defective. Check return flow rate from each injector individually.

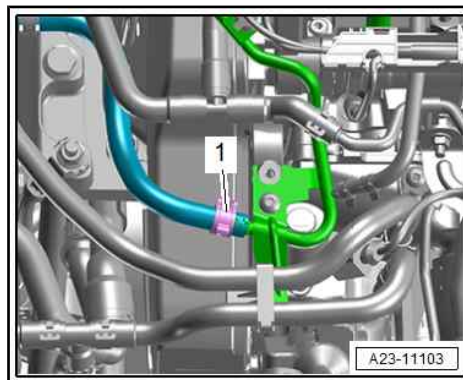
Checking return flow rate of individual injectors



Note

Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.
- Dry all components after cleaning.
- Clamp off fuel return hose -1- using hose clamp up to 25 mm -3094- .



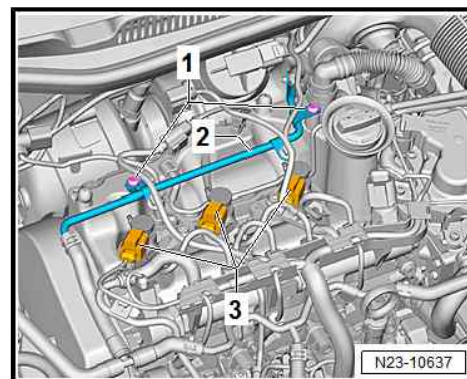


- Remove bolts -1- and press coolant pipe -2- slightly towards rear.

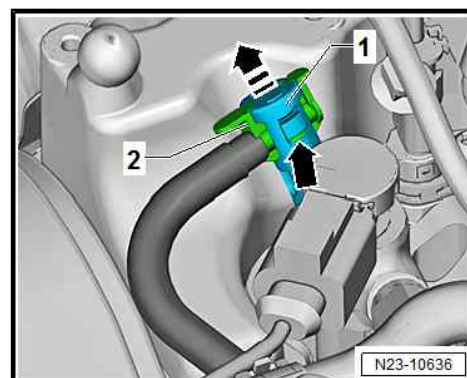


Note

DO NOT use the solenoid valves of the injectors as a fulcrum for levering out with a screwdriver.



- Insert front-end hook - 3370- into lower recess -arrow- and release centre piece of return line connection slowly in direction of -arrow-.
- Then take hold of both tabs on return line connections and disconnect connections carefully from injectors.
- Connect adapter C6 of return flow meter - VAS 6684- to return line connections of all 3 injectors.



Caution

Risk of damage to injectors when return lines are disconnected.

- ◆ *Do NOT press the accelerator during this test; the engine must only run at idling speed.*

- Start engine and let it idle for several minutes.



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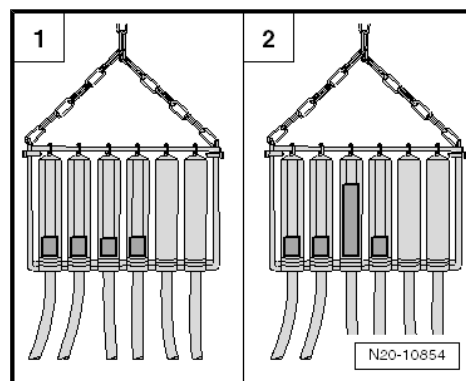
- When the engine is warm and running at idling speed, the return flow rates at each of the 3 return lines must not differ by more than a small amount (example -1-).



Note

The illustrations are only an example of the layout on the 4-cylinder engine.

- 1 - Injectors OK. Return flow rate approx. identical on all injectors.
- 2 - Injector for cylinder 3 not OK. Return flow rate greater than three times the volume of smallest measured return flow rate.



Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate.

- If one injector has a significantly higher return flow rate than the others (example -2-), it must be renewed ⇒ [page 256](#) .

Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all seals with engine oil or assembly oil before installing.

- Push return line connections carefully onto injectors. The catch should engage audibly. Then press release pin down carefully.
- Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester, Guided Functions, then [01 - Interrogate/erase event memory].

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.
- Renew the affected component if leakage occurs.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Install engine cover panel ⇒ [page 41](#) .

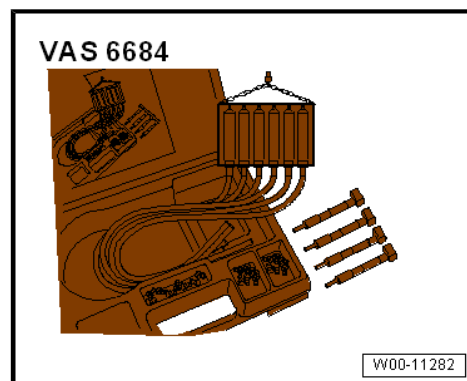
5.7 Checking return flow rate of injectors at starter cranking speed

Only perform this test if the engine does not start at all.

Special tools and workshop equipment required



- ◆ Return flow meter - VAS 6684- and adapter C6



Procedure

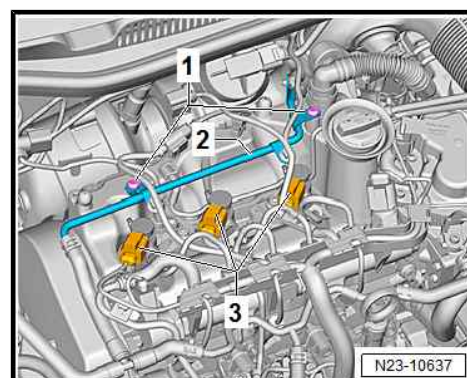
Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Remove engine cover panel ➤ [page 41](#).
- Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.
- Dry all components after cleaning.
- Observe rules for cleanliness when working on the fuel supply system ➤ [“3.1 Rules for cleanliness”, page 6](#).
- Remove bolts -1- and press coolant pipe -2- slightly towards rear.



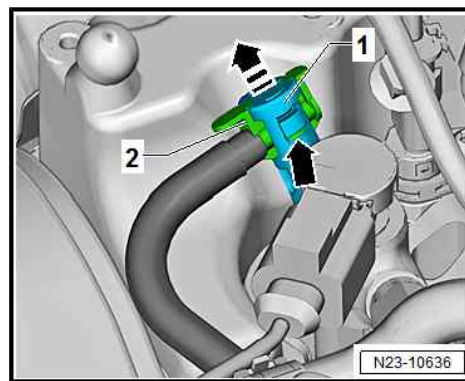
Note

DO NOT use the solenoid valves of the injectors as a fulcrum for levering out with a screwdriver.





- Insert front-end hook - 3370- into lower recess -arrow- and release centre piece of return line connection slowly in direction of -arrow-.
- Then take hold of both tabs on return line connections and disconnect connections carefully from injectors.
- Connect hoses of return flow meter - VAS 6684- to return line connections of all three injectors.
- Operate starter three times (wait approx. 20 seconds each time after operating starter to prevent it from overheating).
- Specification of return flow rate: 0 ml
- If fuel comes out of an injector, that injector must be renewed.



Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all seals with engine oil or assembly oil before installing.

- Push return line connections carefully onto injectors. The catch should engage audibly. Then press release pin down carefully.
- Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester, Guided Functions, then 01 - Interrogate/erase event memory.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.
- Renew the affected component if leakage occurs.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Install engine cover panel ⇒ [page 41](#) .

5.8 Removing and installing injectors

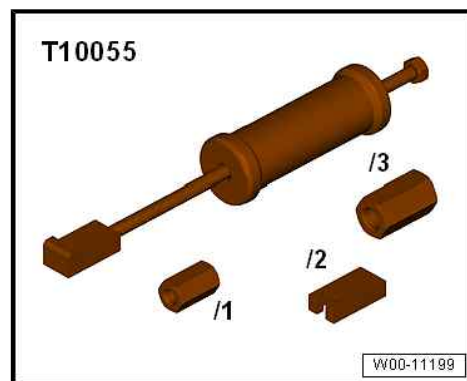
Special tools and workshop equipment required

- ◆ Cleaning kit - VAS 6811-





◆ Puller - T10055-



◆ Assembly sleeve - T10377-



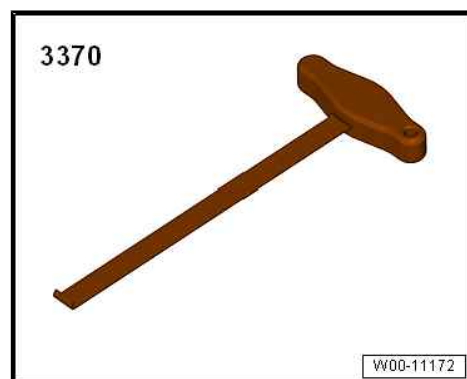
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◆ Puller T10537- we cannot be responsible for the correctness of information in this document. Copyright by AUDI AG.



◆ Front-end hook - 3370-



Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Observe rules for cleanliness when working on the fuel supply system ⇒ [“3.1 Rules for cleanliness”, page 6](#) .



- Remove bolts -1- and press coolant pipe -2- slightly towards rear.
- Unplug electrical connectors -3- of injectors being removed.

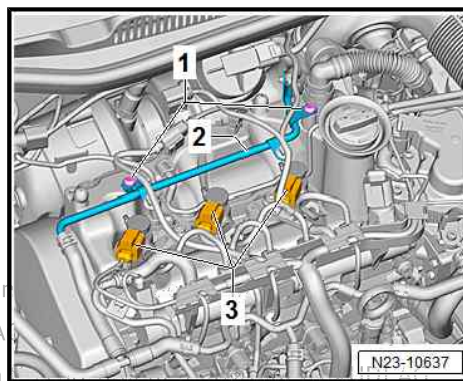


Note



DO NOT use the solenoid valves of the injectors as a fulcrum for levering out with a screwdriver.

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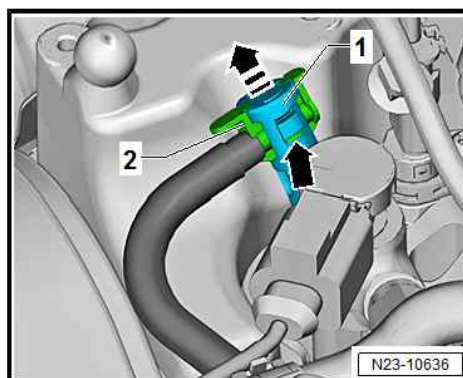


- Insert front-end hook - 3370- into lower recess -arrow- and release centre piece of return line connection carefully in direction of -arrow-.
- Take hold of both tabs on return line connections and disconnect connections carefully from injectors.

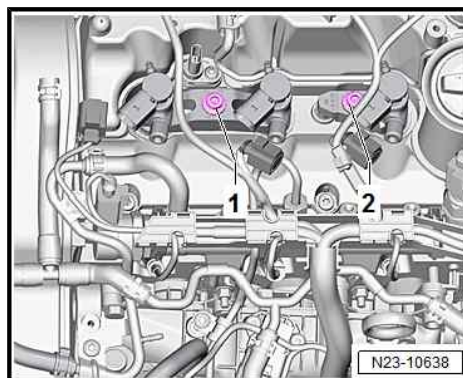


Note

The clamping piece for cylinder 1 and cylinder 2 secures two injectors and can only be taken out if both injectors are removed.



- Remove high-pressure pipe to injector being removed
⇒ [page 261](#).
- Seal off open lines and connections with clean plugs.
- Remove bolts -1- and/or -2-.





- Apply puller - T10055- with puller - T10537- as shown in illustration, and pull out injectors upwards.
- Detach clamping piece before taking injector out.



Note

To avoid damaging the sealing lip, rotate the injector while pulling it out.

- Place removed injectors on a clean cloth.

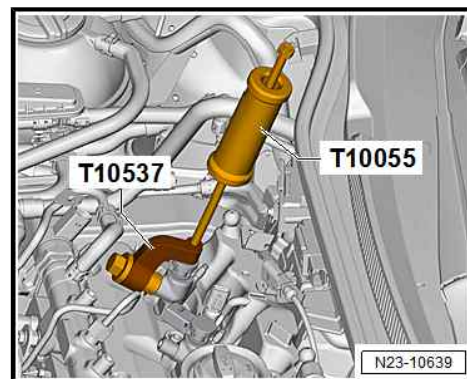
Installing



Caution

Risk of damage to injector sealing surface.

- ◆ ***To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- ➔ Instructions for use .***



Installing new injectors

When installing new injectors, the following components must be renewed:

- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection
- Observe all instructions for installing high-pressure pipes
➔ [page 262](#) .

Installing used injectors

When re-installing used injectors, the following components must be renewed:

- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection
- Spray tip of injector nozzle with rust-releasing spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.
- To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.
- Clean off deposits under the copper seal using a suitable scraper.

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- Renew seal for injector using assembly sleeve - T10377- .

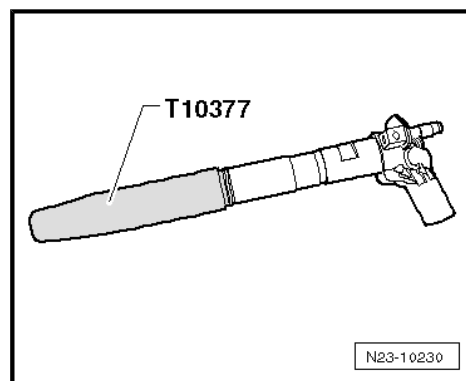
Continued (same procedure for used and new injectors):



Note

Lubricate all O-rings with assembly oil, engine oil or diesel fuel before installing.

- Install injectors.
- Press return line connections onto injectors until they engage audibly.
- Then press down catches on both sides.
- Tighten union nuts on high-pressure pipes hand-tight initially. Make sure that connections are not under tension.
- When one or more injectors have been renewed, the adaption of the correction values for the new injectors must be written into the engine control unit ➔ Vehicle diagnostic tester.
- Reset learnt value for fuel pressure regulating valve - N276- ➔ Vehicle diagnostic tester
⇒ “3.4 Performing adaptations after renewing a component”, page 8 .
- Install engine cover panel ⇒ page 41 .



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Tightening torques

- ◆ ⇒ “5.1 Exploded view - injectors”, page 245
- ◆ ⇒ “3.1 Exploded view - coolant pipes”, page 190

5.9 Removing and installing high-pressure pipes

⇒ “5.9.1 Removing high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump”, page 260

⇒ “5.9.2 Removing high-pressure pipe between high-pressure reservoir (rail) and injectors”, page 261

⇒ “5.9.3 Installing high-pressure pipes”, page 262

5.9.1 Removing high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump

Removing



Caution

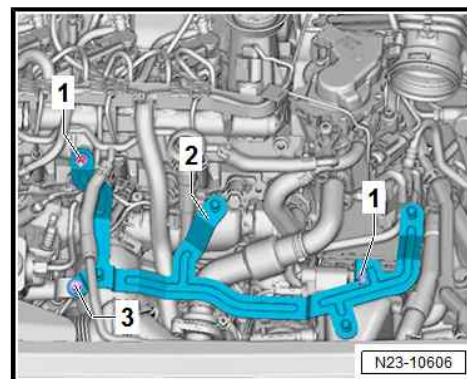
Risk of malfunctions caused by dirt.

- ◆ **Observe** ⇒ “3.1 Rules for cleanliness”, page 6 .

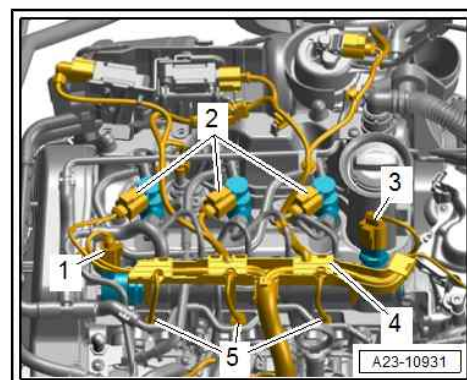
- Remove engine cover panel ⇒ page 41 .
- Remove air cleaner housing ⇒ page 237 .



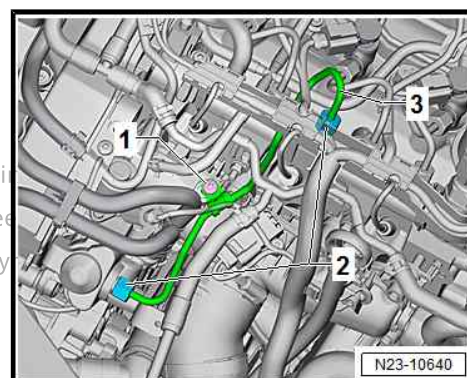
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.
- Clean high-pressure pipe and end of pipe using cleaning solution and dry with compressed air.



- Unplug electrical connectors and move clear:
1 - For fuel pressure regulating valve - N276-
2 - For injectors
4 - For fuel pressure sender - G247-
5 - For glow plugs
- Lift wiring duct -3- slightly off high-pressure reservoir.



- Clean high-pressure pipe and end of pipe using cleaning solution and dry with compressed air.
- Remove bolt -1-.
- Unscrew union nuts -2- and guide out high-pressure pipe -3- upwards.
- Seal off open lines and connections with clean plugs.



5.9.2 Removing high-pressure pipe between high-pressure reservoir (rail) and injectors

Removing



Caution

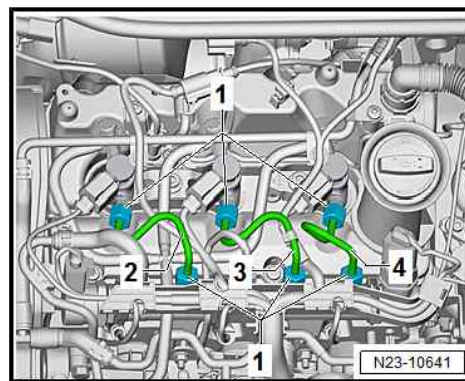
Risk of malfunctions caused by dirt.

◆ Observe ➔ ***“3.1 Rules for cleanliness”, page 6*** .

- Remove engine cover panel ➔ [page 41](#) .



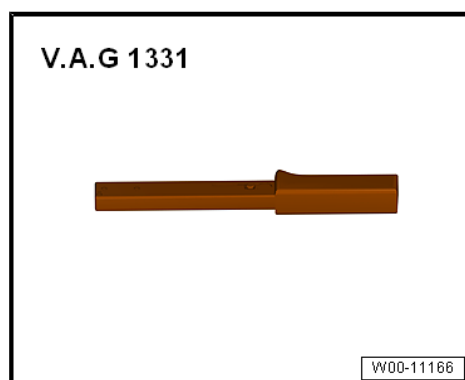
- Clean high-pressure pipe and end of pipe using cleaning solution and dry with compressed air.
- Detach high-pressure line; to do so, remove corresponding union nuts.
- Seal off open lines and connections with clean plugs.



5.9.3 Installing high-pressure pipes

Special tools and workshop equipment required

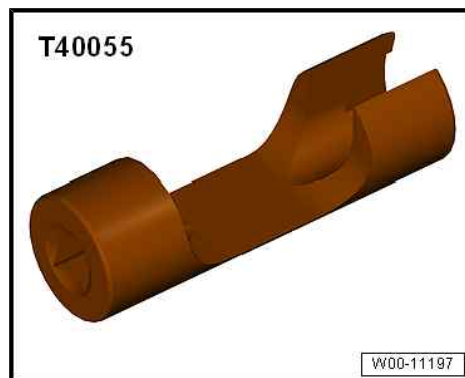
- ◆ Torque wrench - V.A.G 1331-



- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



- ◆ Socket - T40055-



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Procedure



Note

- ◆ *Before removing, clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.*
- ◆ *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- ◆ *The high-pressure pipes can be re-used after performing the following checks:*
- ◆ *Check taper seats of high-pressure pipes for deformation and cracks.*
- ◆ *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- ◆ *Corroded pipes must not be used again.*



Caution

Risk of malfunctions caused by dirt.

- ◆ **Observe ⇒ ["3.1 Rules for cleanliness", page 6](#) .**

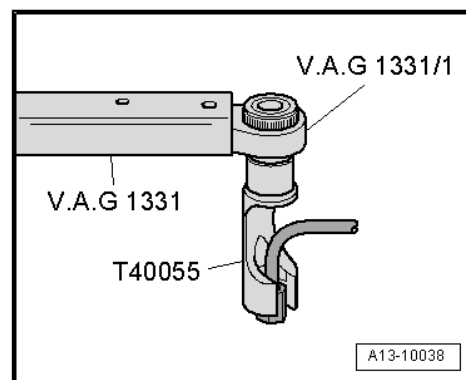
Risk of high-pressure pipe breaking if it is under tension.

- ◆ **If necessary, the high-pressure reservoir can be slackened and moved slightly so that the injector pipes are not installed under tension. Never bend the pipes or subject them to tension.**

- Use vacuum cleaner to remove dirt from taper seat at high-pressure reservoir.
- Hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).
- To tighten unions of high-pressure pipes at high-pressure reservoir and injectors, use torque wrench - V.A.G 1331- with open-end spanner insert SW 17 - V.A.G 1331/6- or socket - T40055- .
- Check fuel system for leaks ⇒ [page 233](#) .
- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

- ◆ ⇒ ["5.1 Exploded view - injectors", page 245](#)
- ◆ ⇒ ["5.2 Exploded view - high-pressure reservoir \(rail\)", page 247](#)
- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 236](#)
- ◆ ⇒ ["1.1 Exploded view - cylinder block \(pulley end\)", page 42](#)





5.10 Removing and installing high-pressure reservoir (rail)

Removing



Caution

Risk of malfunctions caused by dirt.

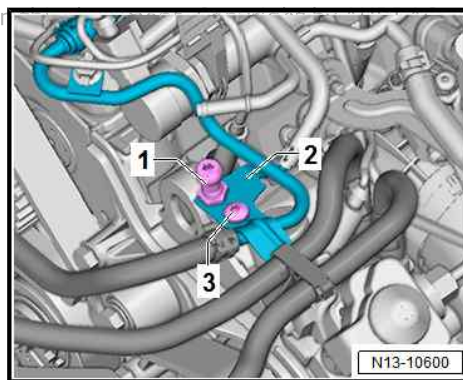
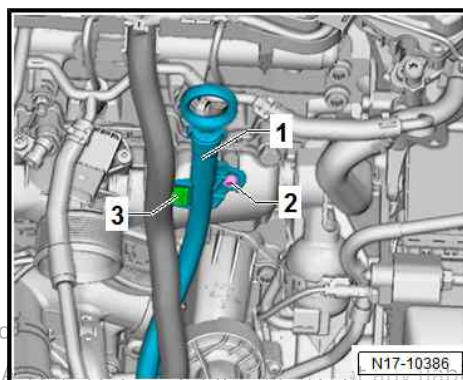
◆ *Observe ➔ "3.1 Rules for cleanliness", page 6 .*

- Remove engine cover panel ➔ [page 41](#) .
- Remove air cleaner housing ➔ [page 237](#) .
- Remove high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump ➔ [page 260](#) .
- Removing high-pressure pipes between high-pressure reservoir (rail) and injectors ➔ [page 261](#) .
- Cut open cable tie -3- on oil pipe -1-.

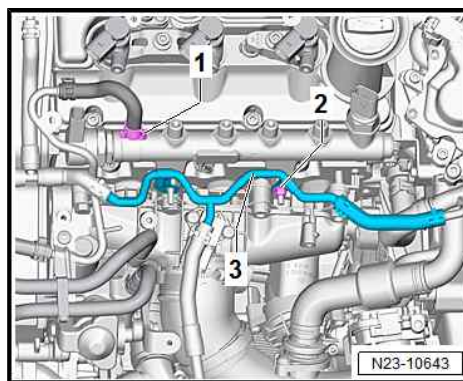


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- Remove bolt -3- and move fuel return line -2- clear at ball stud -1-.



- Open hose clip -1- and detach return line. Unscrew nut -2-.
- Unfasten coolant line -3- from centre hex studs.





- Unscrew centre hex studs -1- and remove high-pressure reservoir (rail) -2- to one side.

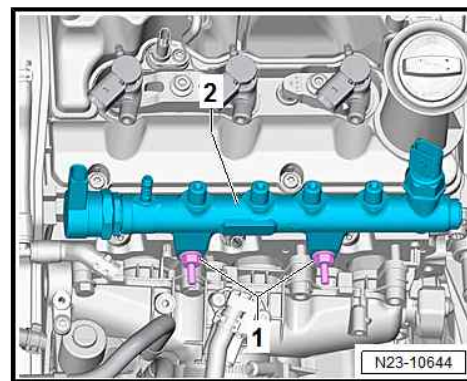
Installing

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

- Observe all instructions for installing high-pressure pipes
⇒ [“5.9.3 Installing high-pressure pipes”, page 262](#) .

Tightening torques

- ◆ ⇒ [“5.1 Exploded view - injectors”, page 245](#)
- ◆ ⇒ [“5.2 Exploded view - high-pressure reservoir \(rail\)”, page 247](#)



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6 High-pressure pump

⇒ [“6.1 Exploded view - high-pressure pump”, page 266](#)

⇒ [“6.2 Removing and installing high-pressure pump”, page 267](#)

6.1 Exploded view - high-pressure pump

1 - Bolt

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

2 - Nut

- ☐ Use counterhold tool - T10051- when loosening and tightening
- ☐ Do not additionally oil threads and shoulder
- ☐ 95 Nm

3 - High-pressure pump sprocket

- ☐ Contact surface between hub and toothed belt sprocket must be free of oil

4 - Hub

- ☐ To remove, use puller - T10489-
- ☐ Contact surface between hub and toothed belt sprocket must be free of oil

5 - Bolt

- ☐ Short version
- ☐ 2x
- ☐ Renew after removing
- ☐ 20 Nm +45°

6 - Bracket for ancillaries

- ☐ Removing and installing
⇒ [page 50](#)

7 - Fuel supply hose

8 - Fuel return hose

9 - Spring-type clip

10 - Connector

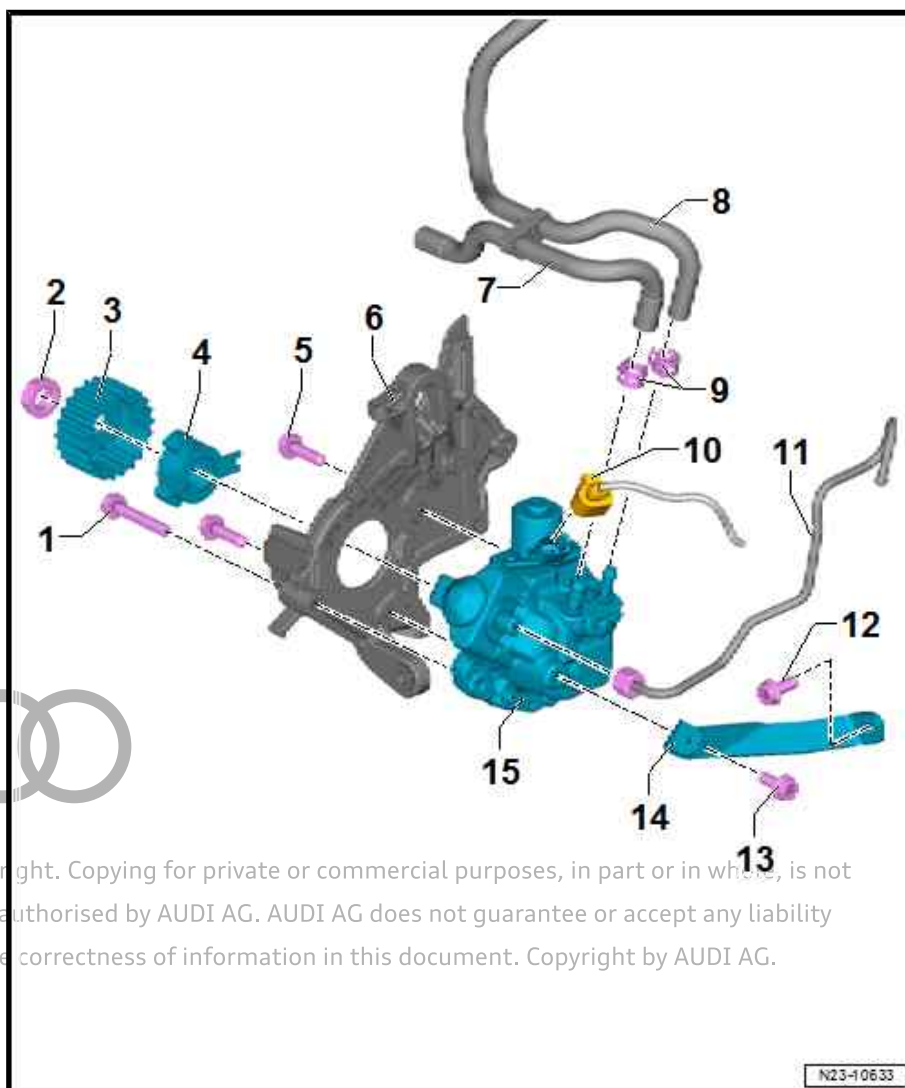
- ☐ For fuel metering valve - N290-

11 - High-pressure pipe

- ☐ Between high-pressure reservoir (rail) and high-pressure pump
- ☐ Removing ⇒ [page 260](#)
- ☐ Observe all instructions for installing high-pressure pipes ⇒ [page 262](#)

12 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm + 45°





13 - Bolt

- ☐ Renew after removing
- ☐ 20 Nm + 45°

14 - Support

- ☐ Between high-pressure pump and cylinder head

15 - High-pressure pump

- ☐ With fuel metering valve - N290- (do not open)
- ☐ Removing and installing ⇒ [page 267](#)
- ☐ If the high-pressure pump is removed or renewed, it is important to fill and bleed the fuel system before the engine is started for the first time ⇒ [page 232](#) .
- ☐ Performing adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester) ⇒ ["3.4 Performing adaptations after renewing a component", page 8](#)

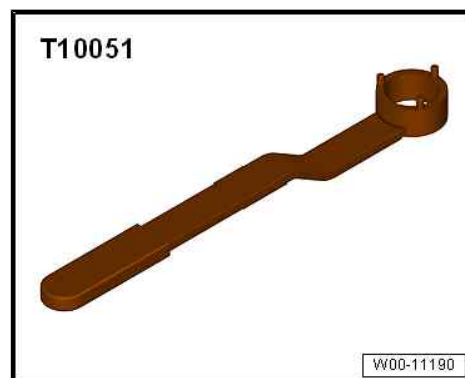
6.2 Removing and installing high-pressure pump

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



- ◆ Counterhold tool - T10051-





◆ Locking pin - T10492-

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T10492



W00-11286

◆ Puller - T10489-

T10489



W00-11284

Removing



Caution

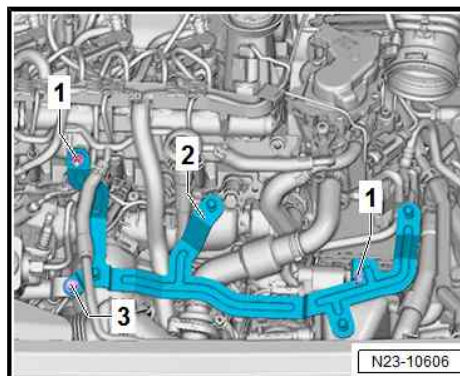
Risk of malfunctions caused by dirt.

- ◆ Observe ⇒ **"3.1 Rules for cleanliness", page 6**.

Running when dry causes irreparable damage to high-pressure pump.

- ◆ If the high-pressure pump has been removed or renewed, it is important to fill and bleed the fuel system before the engine is started for the first time ⇒ **page 232**.

- Remove engine cover panel ⇒ **page 41**.
- Remove air cleaner housing ⇒ **page 237**.
- Unscrew nuts -1- and bolt -3- and detach bracket -2- for air cleaner housing.



N23-10606



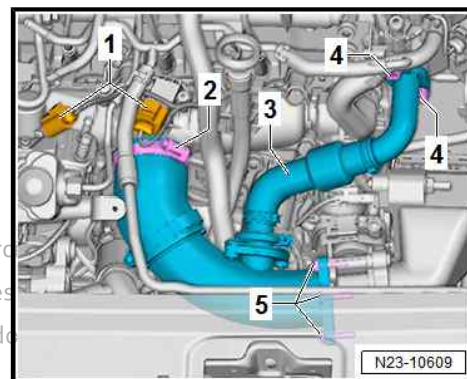
- Unplug electrical connector -1- and open screw-type clip -2-.
- Unscrew bolts -4 and 5- and detach air duct together with exhaust gas recirculation pipe.
- Remove high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump ➔ [page 260](#) .
- Detach toothed belt from camshaft ➔ [page 90](#) .



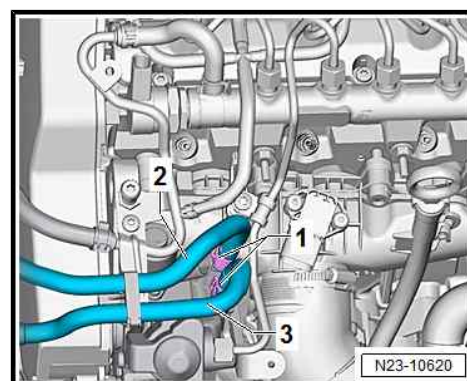
Caution

Risk of damage to toothed belt.

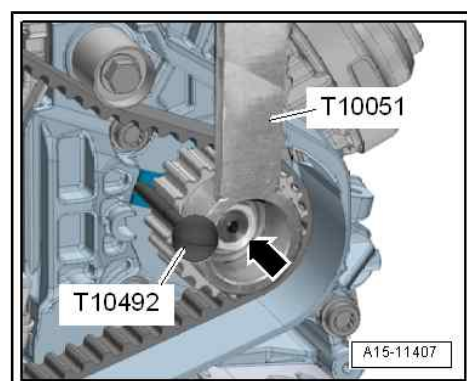
◆ ***Do not stretch or kink toothed belt.***



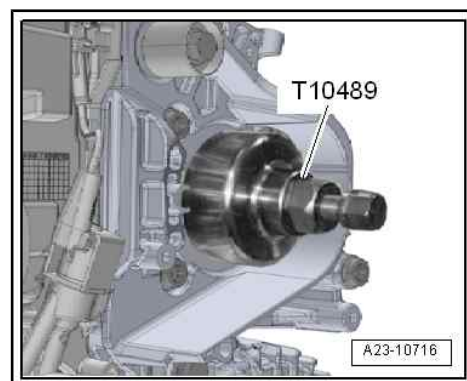
- Release hose clips -1- and disconnect fuel hoses -2 and 3- from high-pressure pump.



- Remove nut -arrow- and detach counterhold tool - T10051- .
- Remove locking pin - T10492- .
- Detach high-pressure pump sprocket.



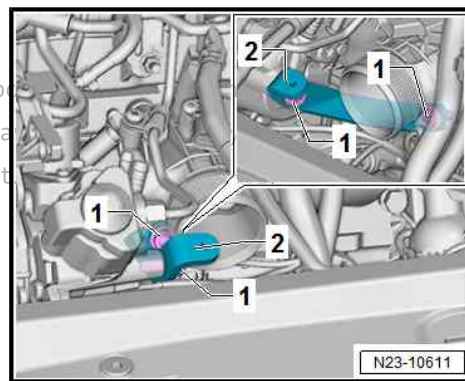
- Engage puller - T10489- at hub of high-pressure pump by turning it clockwise.
- Detach hub of high-pressure pump.



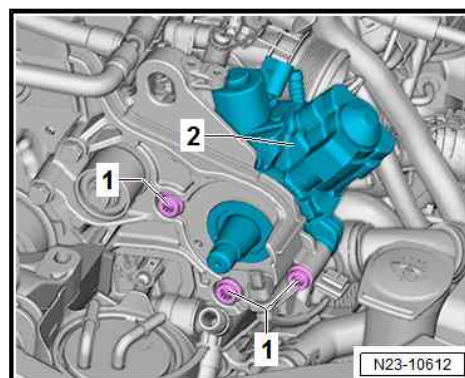


- Remove bolts -1- and remove support -2-.

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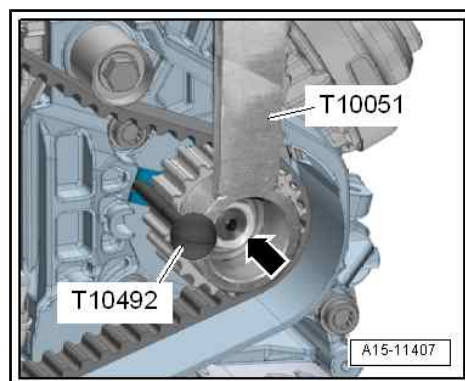
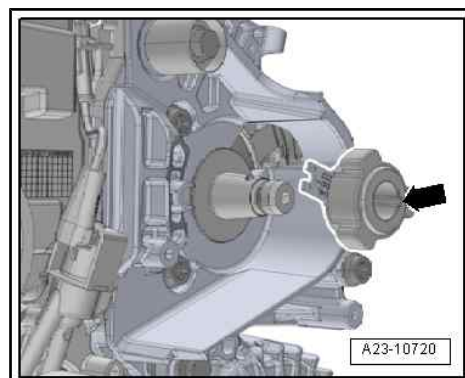
- Remove bolts -1- and carefully take out high-pressure pump -2-.



Installing

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

- Apply hub -arrow- to high-pressure pump shaft.
- The parallel key on the high-pressure pump shaft must engage in the groove in the hub.
- Fit high-pressure pump sprocket onto hub.
- Contact surface between counterhold tool and toothed belt sprocket must be free of oil.
- Loosely screw on nut -arrow- for toothed belt sprocket for high-pressure pump.
- It should just be possible to easily turn the high-pressure pump sprocket, but there must be no axial movement.
- Lock fork on hub of high-pressure pump in place using locking pin - T10492- , as outlined in description of continued steps.





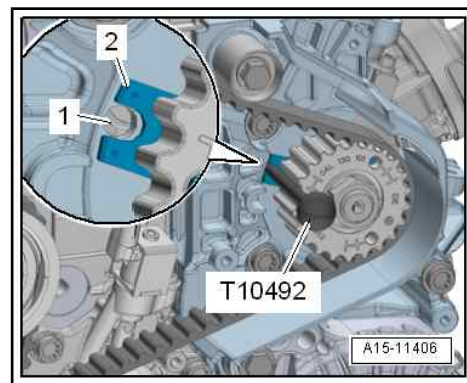
- Insert locking pin - T10492- into fork -2- on hub and into hole -1- behind it in bracket for high-pressure pump.
- To do so, turn high-pressure pump sprocket anti-clockwise with counterhold tool - T10051- until it can be locked in position with locking pin - T10492- .
- Install toothed belt ⇒ [page 101](#) .
- Install high-pressure pipe ⇒ [page 262](#) .



Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ ***If the high-pressure pump has been removed or renewed, it is important to fill and bleed the fuel system before the engine is started for the first time ⇒ [page 232](#) .***



- Install air cleaner housing ⇒ [page 237](#) .
- Install engine cover panel ⇒ [page 41](#) .
- Perform adaption required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ ["3.4 Performing adaption after renewing a component", page 8](#) .

Tightening torques

- ◆ ⇒ ["6.1 Exploded view - high-pressure pump", page 266](#)
- ◆ ⇒ ["1.2 Exploded view - toothed belt", page 87](#)
- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 236](#)
- ◆ ⇒ ["2.1 Exploded view - charge air system", page 214](#)
- ◆ ⇒ ["4.1.2 Exploded view - exhaust gas recirculation system, high-pressure", page 312](#)



7 Senders and sensors

⇒ [“7.1 Removing and installing air mass meter G70 ”, page 272](#)

⇒ [“7.2 Removing and installing fuel temperature sender G81 ”, page 273](#)

⇒ [“7.3 Checking fuel pressure regulating valve N276 ”, page 273](#)

⇒ [“7.4 Removing and installing fuel pressure regulating valve N276 ”, page 274](#)

⇒ [“7.5 Removing and installing fuel pressure sender G247 ”, page 277](#)

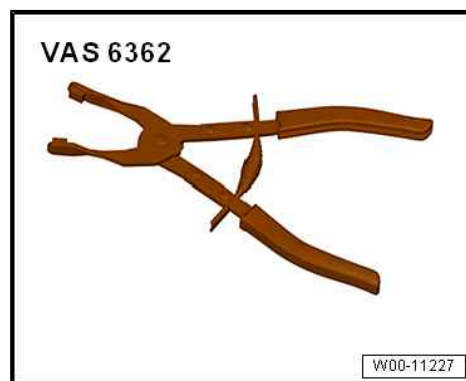
⇒ [“7.6 Removing and installing exhaust gas pressure sensor 1 G450 / pressure differential sender G505 ”, page 279](#)

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7.1 Removing and installing air mass meter - G70-

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Remove air cleaner housing ⇒ [page 237](#) .



- Unscrew bolts -1- and take out air mass meter - G70- .
- Unplug air mass meter - G70- -2-.

Installing

To ensure the proper function of the air mass meter - G70- it is important to observe the following instructions.



Note

- ◆ *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter and falsify the detected air mass values. This will cause a loss of power as the calculated injection quantities will be too low.*
- ◆ *Always use genuine air filter elements (same as original equipment).*
- ◆ *Always renew seal if damaged (air leaks in intake system).*
- ◆ *Use a silicone-free lubricant when installing the air hose and seal.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- Check air mass meter and air hose (engine intake side) for salt residue, dirt and leaves.
- Check intake duct as far as air filter element for dirt. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required.
- Install air cleaner housing ⇒ [page 237](#) .
- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 236](#)

7.2 Removing and installing fuel temperature sender - G81-

Removing

- Unplug electrical connector -1- and unscrew fuel temperature sender - G81- -2-.

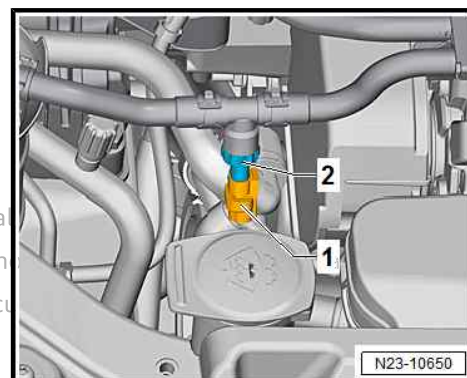
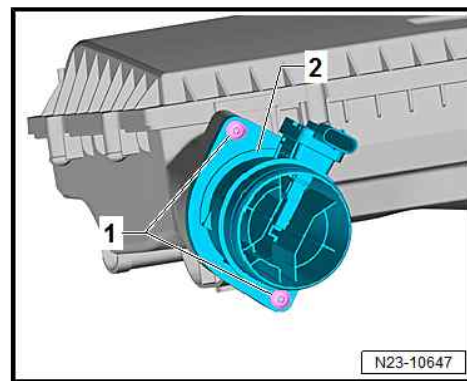
Installing

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

- Check fuel system for leaks ⇒ [page 233](#) .

Tightening torques

- ◆ ⇒ [“1.2 Overview - fuel system”, page 231](#)



7.3 Checking fuel pressure regulating valve - N276-

Special tools and workshop equipment required

- ◆ Fuel-resistant measuring container



Procedure

- Remove engine cover panel ➔ [page 41](#) .
- Release hose clip -1- and detach fuel return hose from high-pressure reservoir.
- Seal off open return line connection with a plug.
- Connect test hose to return line connection of high-pressure reservoir and hold end of hose in measuring container.

1) Checking while engine is running

- Start the engine and run at idling speed.
- Specification: more than 75 ml in 30 seconds

If specification is not obtained, fuel pressure regulating valve - N276- is defective.

2) Checking while engine is running

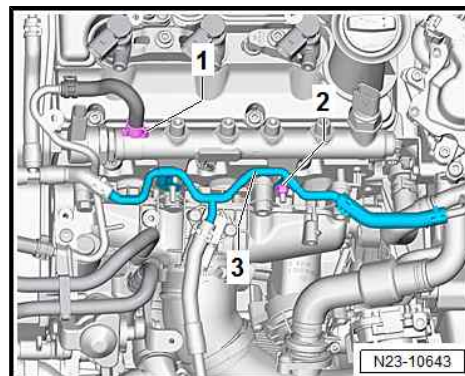
If condition for 1) is met, start engine and increase engine speed to ≥ 2000 rpm.

- Fuel is still discharged in the first few seconds after the engine is started
- Specification of return flow rate: 0 ml
- Drip leaks are permissible
- If specification is not obtained, fuel pressure regulating valve - N 276- is defective.

3) If engine can no longer be started

Perform check at cranking speed.

- Specification of return flow rate: 0 ml
- Drip leaks are permissible
- If specification is not obtained, fuel pressure regulating valve - N 276- is defective.
- Install engine cover panel ➔ [page 41](#) .



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7.4 Removing and installing fuel pressure regulating valve - N276-

Special tools and workshop equipment required

- ◆ Open-end spanner insert, 30 mm - T10553-



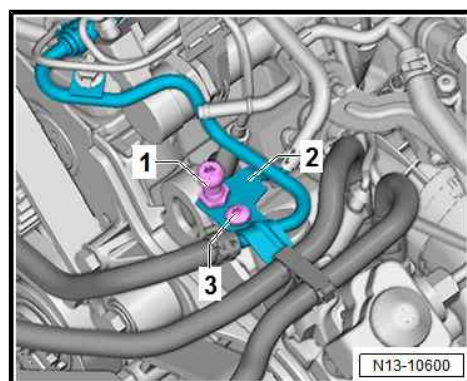
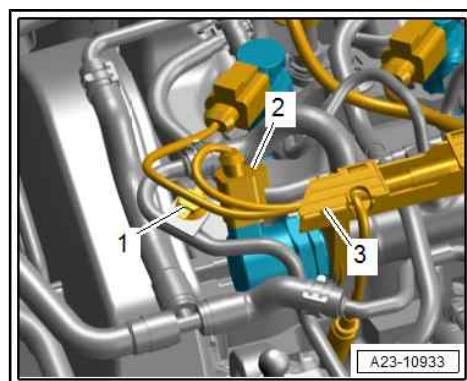


- ◆ Torque wrench - V.A.G 1332-



Removing

- Remove engine cover panel ➔ [page 41](#) .
- Unplug electrical connector -2- and move electrical wiring clear at clip -1-.
- Push wiring duct -3- slightly to one side.
- Unclip fuel lines.
- Unscrew bolt -3- for fuel return line -2-.
- Unfasten fuel return line from pin -1- and push it slightly to one side.
- Before removal, clean area around thread for fuel pressure regulating valve - N276- using e.g. commercial cleaning solution.
- Make sure no dirt gets into opening in high-pressure reservoir.
- Clean carefully; cleaning solution must not enter the electrical connector.



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- Dry off fuel pressure regulating valve - N276-.
- Loosen union nut -1- using open-end spanner insert, 30 mm - T10553- (at the same time, counterhold at hexagon flats on housing). Then unscrew and remove by hand.
- Extract dirt from opening in high-pressure reservoir (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.
- Seal off open connection in high-pressure reservoir with clean plug.

Installing

- Check that deformable sealing lip and thread on fuel pressure regulating valve - N276- are not damaged. Renew fuel pressure regulating valve - N276- if damaged.
- Check sealing surface at opening in high-pressure reservoir.
- If old fuel pressure regulating valve - N276- is reinstalled, O-Ring must be renewed.
- Coat beginning of thread, deformable sealing lip and O-ring of regulating valve lightly with diesel fuel.
- Screw on union nut by hand.
- Align regulating valve so that connecting wire is free of tension after connector is attached.
- Hold regulating valve in this position by holding hexagon flats on housing of regulating valve with open-end spanner or pliers (water pump pliers or similar).
- Tighten union nut using open-end spanner insert, 30 mm - T10553- (at the same time, counterhold at hexagon flats on housing).
- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

- ◆ ⇒ [“5.2 Exploded view - high-pressure reservoir \(rail\)”, page 247](#)
- ◆ ⇒ [“1.1 Exploded view - cylinder block \(pulley end\)”, page 42](#)

Performing adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester)

⇒ [“3.4 Performing adaptations after renewing a component”, page 8](#)

- After installing fuel pressure regulating valve - N276- , leave engine running at moderate speed for a few minutes to bleed fuel system and then switch off again.

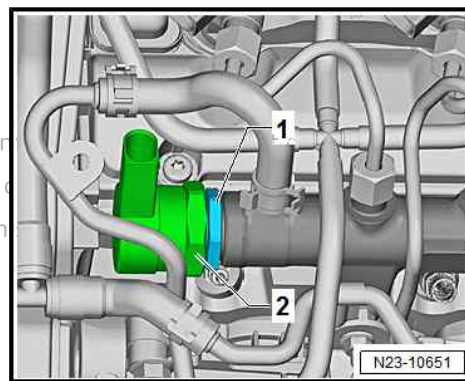


Note

The fuel system is “self-bleeding”; do NOT open the high-pressure connections.

- Interrogate event memory.
- Switch off ignition.
- Carefully check the entire fuel system for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.





- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- After road test, interrogate event memory again.
- Install engine cover panel ➔ [page 41](#) .

7.5 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

- ◆ Bit (27 mm) - T40218- or commercially available socket (27 mm)



Note

- ◆ *The fuel pressure sender - G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623- .*
- ◆ *Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.*

Removing

- Remove engine cover panel ➔ [page 41](#) .
- Before removal, clean area around thread for fuel pressure sender - G247- using e.g. commercial cleaning solution.
- Make sure no dirt gets into opening in high-pressure reservoir.
- Clean carefully; cleaning solution must not enter the electrical connector.
- Dry off fuel pressure sender - G247- .



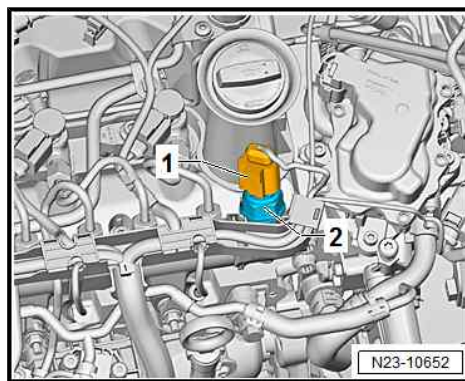
- Unplug connector -1- and unscrew fuel pressure sender - G247- using socket, 27 mm - T40218- .



Note

An open-end spanner must not be used for loosening or tightening.

- Extract dirt from opening in high-pressure reservoir (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.
- Seal off opening in high-pressure reservoir with a plug.



Installing

- If the deformable sealing lip and the thread of the fuel pressure sender - G247- are not damaged, the sender can be re-used once.
- Check sealing surface at opening in high-pressure reservoir.
- The beginning of the thread and the deformable sealing lip of the fuel pressure sender must be coated with diesel fuel.
- Screw in fuel pressure sender - G247- by hand.
- Then tighten fuel pressure sender - G247- to specified torque.
- Install engine cover panel ⇒ [page 41](#)

Tightening torques

- ♦ ⇒ [“5.2 Exploded view - high-pressure reservoir \(rail\)”, page 247](#)
- After installing fuel pressure sender - G247- , leave engine running at moderate speed for a few minutes when bleeding fuel system and then switch off again.



Note

The fuel system is “self-bleeding”; do NOT open the high-pressure connections.

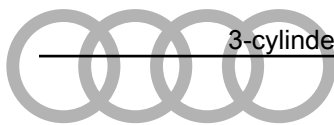
- Switch off ignition.
- Carefully check the entire fuel system for leaks.
- Renew affected component if leakage still occurs after tightening to correct torque.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- After road test, interrogate event memory again.



7.6 Removing and installing exhaust gas pressure sensor 1 - G450- / pressure differential sender - G505-

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Note

The pressure differential sender - G505- detects the amount of deposits in the particulate filter.

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing



Note

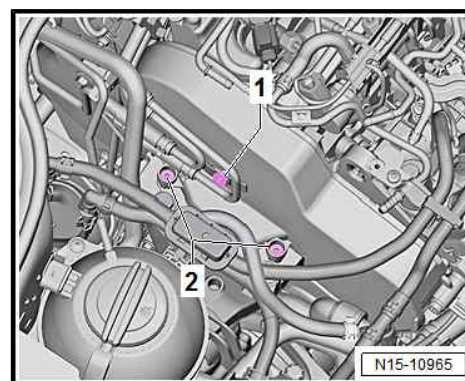
Secure all heat insulation sleeves in the same locations when installing.

- Remove engine cover panel ➔ [page 41](#) .
- Remove bolt -1-.

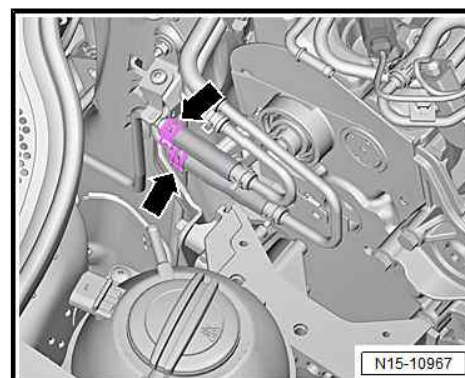


Note

Disregard -item 2-.

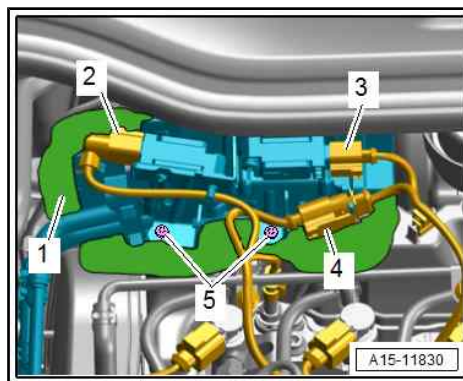


- Release hose clips -arrows- and disconnect hoses from metering tubes of exhaust gas pressure sensors.





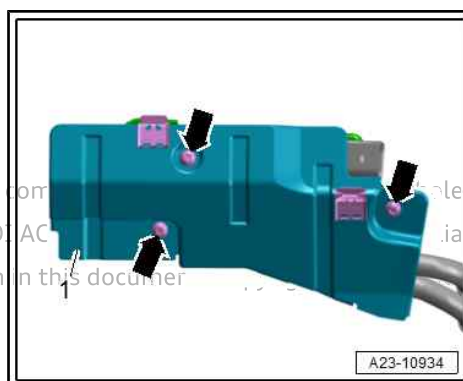
- Open heat insulation sleeve -1-.
- Unplug electrical connectors -2, 3- and move electrical wiring clear.
- Detach electrical connector -4- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.
- Unscrew bolts -5- and detach bracket with exhaust gas pressure sensors.



- Remove bolts -arrows- and detach heat shield -1-.



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Exhaust gas pressure sensor 1 - G450- :

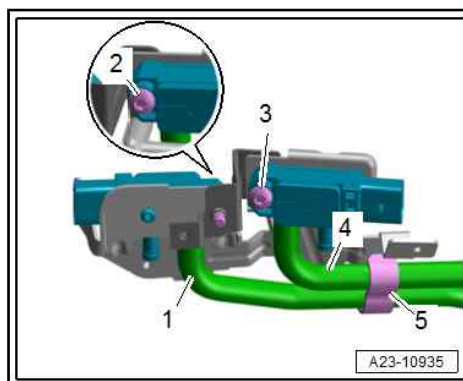
- Remove bolt -2- and detach exhaust gas pressure sensor 1 - G450- from bracket.
- Spray hose with suitable release agent before disconnecting it from exhaust gas pressure sensor 1 - G450- .
- Release hose clip -1-.



Caution

Risk of irreparable damage to pressure sensor if the connection breaks off.

- ◆ ***Carefully disconnect hose from connection, taking care to keep hose straight.***





Pressure differential sender - G505- :

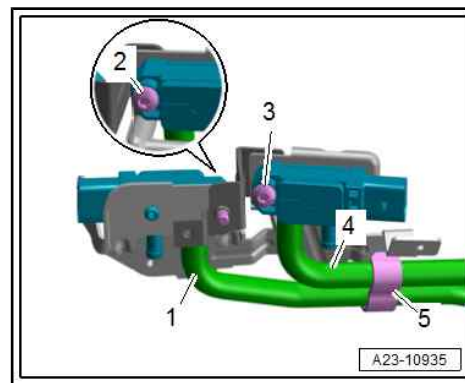
- Remove bolt -3- and detach pressure differential sender - G505- from bracket.
- Spray hose -4- with suitable release agent before disconnecting it from pressure differential sender - G505- .
- Release hose clip -2-.



Caution

Irreparable damage to pressure differential sender can be caused if the connection breaks off.

- ◆ *Carefully disconnect hose from connection, taking care to keep hose straight.*



Installing

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



Note

- ◆ *Before installing, blow out control pipes from exhaust gas pressure sensors to particulate filter towards particulate filter with compressed air (pipes can become obstructed or may ice up due to condensation).*
- ◆ *Make sure that hose is securely fitted and that there are no leaks.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*
- Install engine cover panel ⇒ [page 41](#) .
- Perform adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ [“3.4 Performing adaptations after renewing a component”, page 8](#) .

Tightening torques

- ◆ ⇒ [“8.1 Exploded view - Lambda probe”, page 282](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 86](#)
- ◆ ⇒ [“2.1 Exploded view - cylinder head cover”, page 108](#)



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8 Lambda probe

⇒ **"8.1 Exploded view - Lambda probe", page 282** for private or commercial purposes, in part or in whole, is not
⇒ **"8.2 Removing and installing Lambda probe", page 283** Audi AG does not guarantee or accept any liability

8.1 Exploded view - Lambda probe

1 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing
⇒ [page 307](#)
- ☐ Coat with high-temperature paste when installing; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 45 Nm

2 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing
⇒ [page 283](#)

3 - Bolts

- ☐ 8 Nm

4 - Exhaust gas pressure sensor 1 - G450-

- ☐ Removing and installing
⇒ [page 279](#)

5 - Bracket

- ☐ For pressure differential sender

6 - Pressure differential sender - G505-

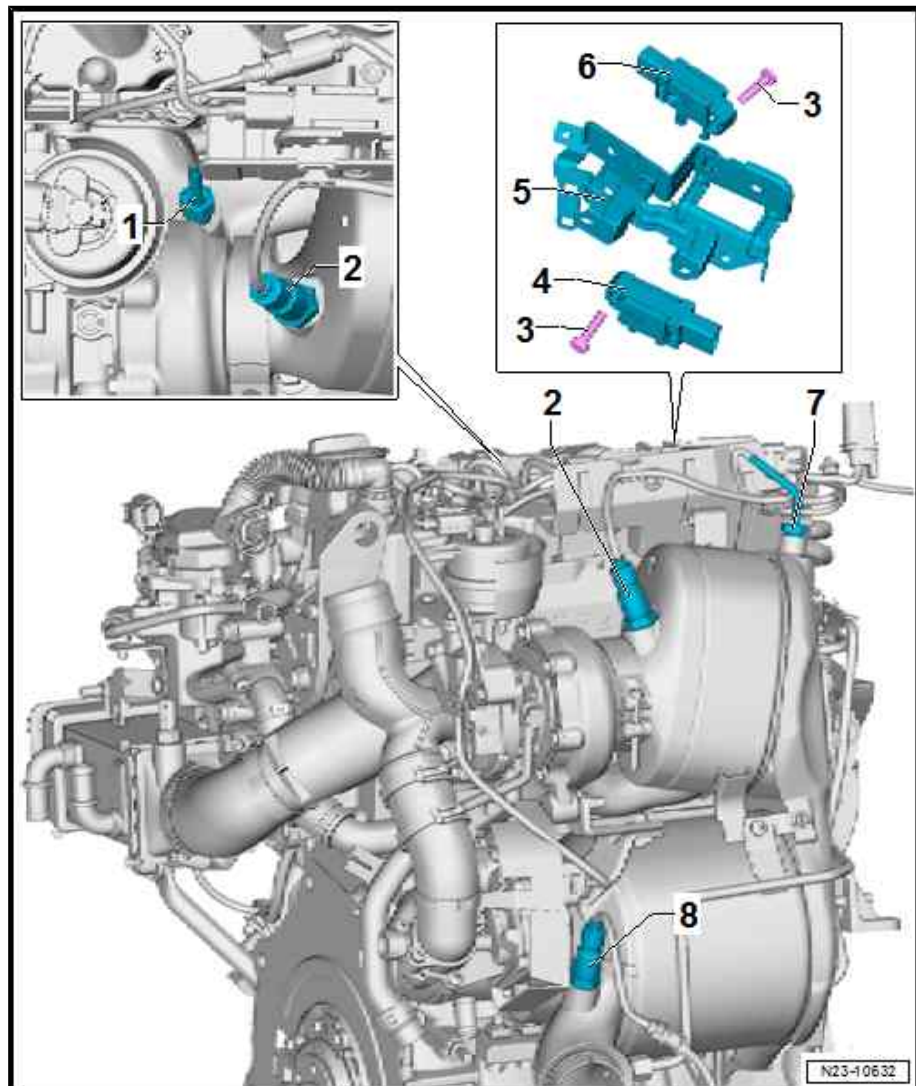
- ☐ Removing and installing
⇒ [page 279](#)

7 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing
⇒ [page 308](#)
- ☐ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ☐ 45 Nm

8 - Lambda probe after catalytic converter - G130-

- ☐ With Lambda probe 1 heater after catalytic converter - Z29-
- ☐ Removing and installing ⇒ [page 284](#)





8.2 Removing and installing Lambda probe

⇒ ["8.2.1 Removing and installing Lambda probe G39", page 283](#)

⇒ ["8.2.2 Removing and installing Lambda probe after catalytic converter G130", page 284](#)

8.2.1 Removing and installing Lambda probe - G39-

Special tools and workshop equipment required

- ◆ Socket, 22 mm - T10491-



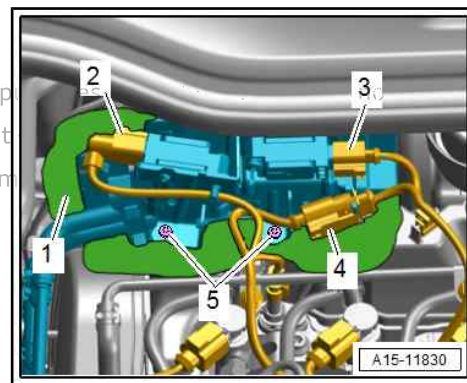
Removing



Note

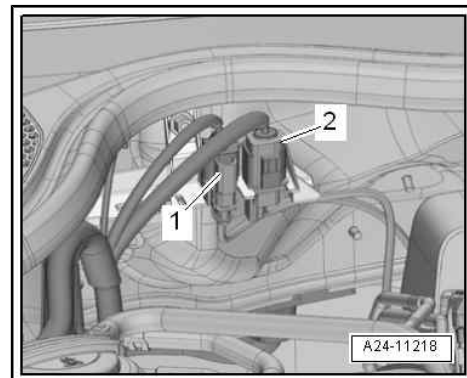
Secure all heat insulation sleeves in the same locations when installing.

- Remove engine cover panel ⇒ [page 41](#) .
- Open heat insulation sleeve -1-.
- Unplug electrical connectors -2, 3- and move electrical wiring clear.
- Detach electrical connector -4- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.
- Remove bolts -5- and press bracket with exhaust gas pressure sensors towards front.
- Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.



Note

Disregard -item 1-.





- Unscrew Lambda probe - G39- -arrow- using socket, AF 22 mm - T10491- .

Installing

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



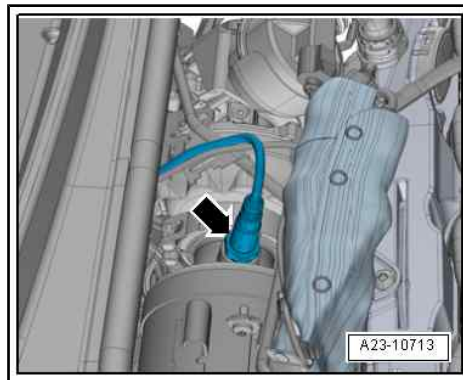
Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the 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. For high-temperature paste refer to ⇒ *Electronic parts catalogue**
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*

- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

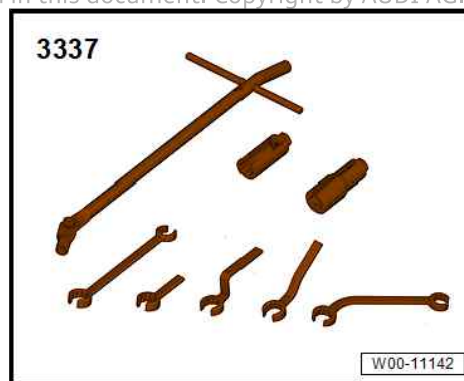
- ◆ ⇒ [“8.1 Exploded view - Lambda probe”, page 282](#)
- ◆ ⇒ [“2.1 Exploded view - cylinder head cover”, page 108](#)



8.2.2 Removing and installing Lambda probe after catalytic converter - G130-

Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set - 3337-



Removing

- Unfasten underbody trim (right-side) on inside and press downwards ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .

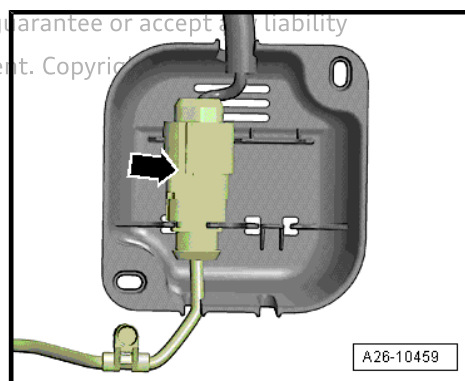
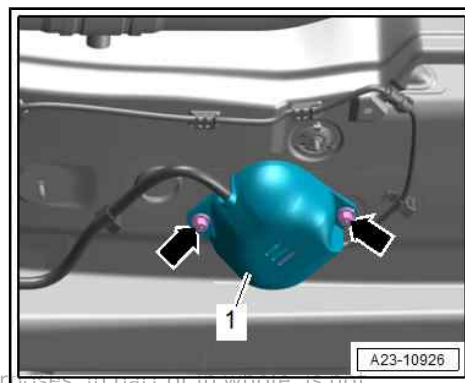


- Unscrew nuts -arrows- and detach cover -1-.



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- Take electrical connector -arrow- for Lambda probe after catalytic converter - G130- out of bracket, unplug and move electrical wiring clear.
- Remove front exhaust pipe ➔ [page 294](#) .



- Remove Lambda probe after catalytic converter - G130- -arrow-.

Installing

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



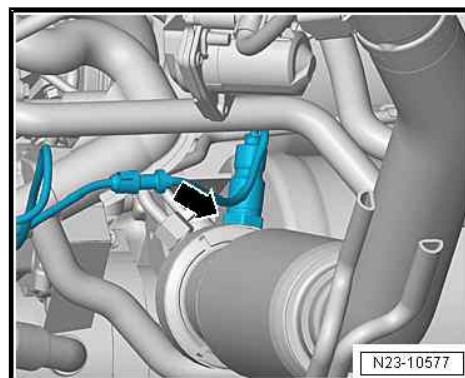
Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the 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. For high-temperature paste refer to ➔ *Electronic parts catalogue**
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*

- Install front exhaust pipe ➔ [page 294](#) .

Tightening torques

- ◆ ➔ ["8.1 Exploded view - Lambda probe", page 282](#)
- ◆ ➔ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim





9 Engine control unit

⇒ "9.1 Removing and installing engine control unit J623",
page 286

9.1 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.

Special tools and workshop equipment required

- ◆ Small mole grips -3- (commercially available)
- ◆ Vehicle diagnostic tester

Removing

- If the engine control unit - J623- is renewed, the adaption values must be read out and stored before the engine control unit - J623- is removed.

- Connect ⇒ Vehicle diagnostic tester.

- Select **Diagnosis** mode and then **Start diagnosis**.

- Choose **Select own test** tab and select following options one after the other:

- ◆ **Drive train**

- ◆ **Select engine code and engine**

- ◆ **01 - Self-diagnosis compatible systems**

- ◆ **01 - Engine electronics**

- ◆ **01 - Engine electronics, functions**

- ◆ **01 - Replace control unit**

- Switch off ignition and remove ignition key after storing electronic file containing adaption values.

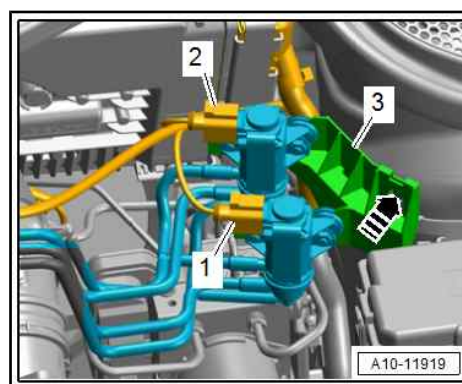
- If the adaption values of the injectors cannot be read out of the old (defective) engine control unit, the adaption values must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.

- Unplug electrical connectors:

- 1 - For turbocharger air recirculation valve - N249-

- 2 - For intake manifold flap valve - N316-

- Release retainer -arrow-, detach bracket -3- with change-over valves upwards and place to one side.





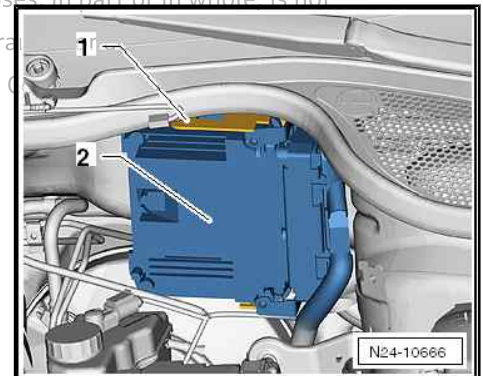
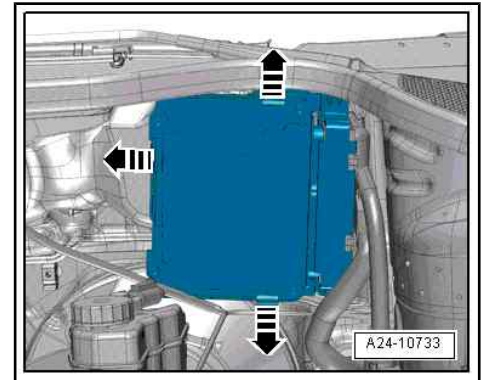
Engine control unit without protective housing

- Release fasteners -arrows- and detach engine control unit - J623- from bracket.

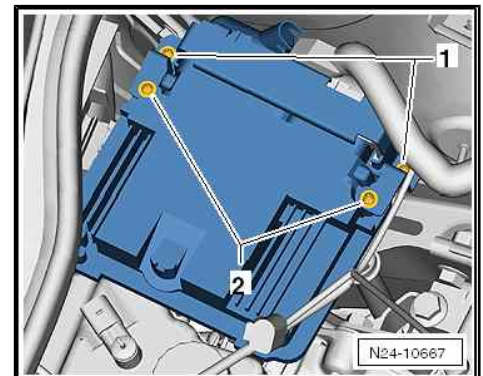
Engine control unit with protective housing



- Lift fastener -1- and detach engine control unit -2-.
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- Remove shear bolts -1- using pliers.





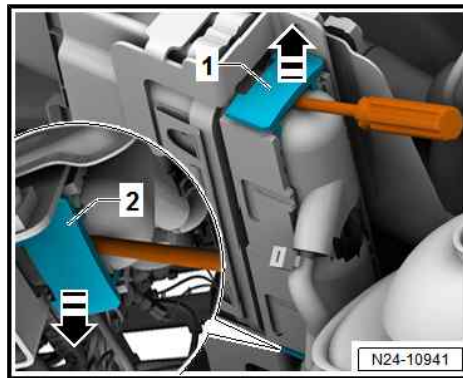
All versions

- 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.



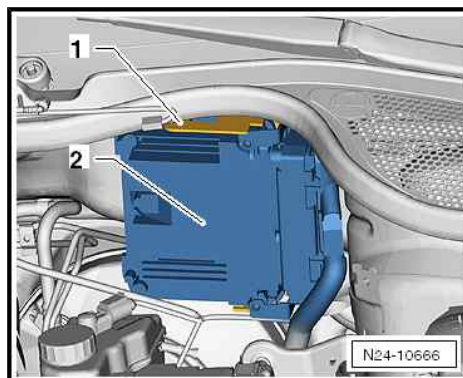
Note

If the engine control unit is to be renewed, the shear bolts -2- must also be removed.



Installing

- Plug electrical connectors back into engine control unit.
- If previously fitted, re-install protective housing on engine control unit.
- Install bracket for protective housing with new shear bolts.
- Tighten shear bolts evenly until bolt heads shear off.
- Insert engine control unit -2- into retainer on plenum chamber partition panel until fastener -1- engages audibly.
- Perform adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ [“3.4 Performing adaptations after renewing a component”, page 8](#).



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26 – Exhaust system

1 Exhaust pipes/silencer

⇒ [“1.1 Exploded view - silencer”, page 289](#)

⇒ [“1.2 Separating exhaust pipes/silencer”, page 291](#)

⇒ [“1.3 Removing and installing silencer”, page 293](#)

⇒ [“1.4 Removing and installing front exhaust pipe”, page 294](#)

⇒ [“1.5 Stress-free alignment of exhaust system”, page 295](#)

⇒ [“1.6 Checking exhaust system for leaks”, page 295](#)

1.1 Exploded view - silencer



WARNING

When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system*
⇒ [“2.5 Safety precautions when working on the exhaust system”, page 4](#) .

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1 - Rear silencer

- ☐ Combined with exhaust pipe
- ☐ With cutting point for easier removal
⇒ [page 291](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 295](#)

2 - Bolt

- ☐ 20 Nm

3 - Mounting

- ☐ Renew if damaged

4 - Exhaust pipe

- ☐ Combined with rear silencer
- ☐ With cutting point for easier removal
⇒ [page 291](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 295](#)

5 - Rubber mounting

- ☐ Renew if damaged

6 - Front exhaust pipe

- ☐ With cutting point for easier removal of exhaust system
- ☐ Removing and installing
⇒ [page 294](#)
- ☐ Align exhaust system so it is free of stress
⇒ [page 295](#)

7 - Screw-type clip

- ☐ Renew after removing
- ☐ Installation position ⇒ [page 291](#)
- ☐ 7 Nm

8 - Gasket

- ☐ Renew after removing

9 - Nut

- ☐ Renew after removing
- ☐ 9 Nm

10 - Exhaust flap control unit - J883-

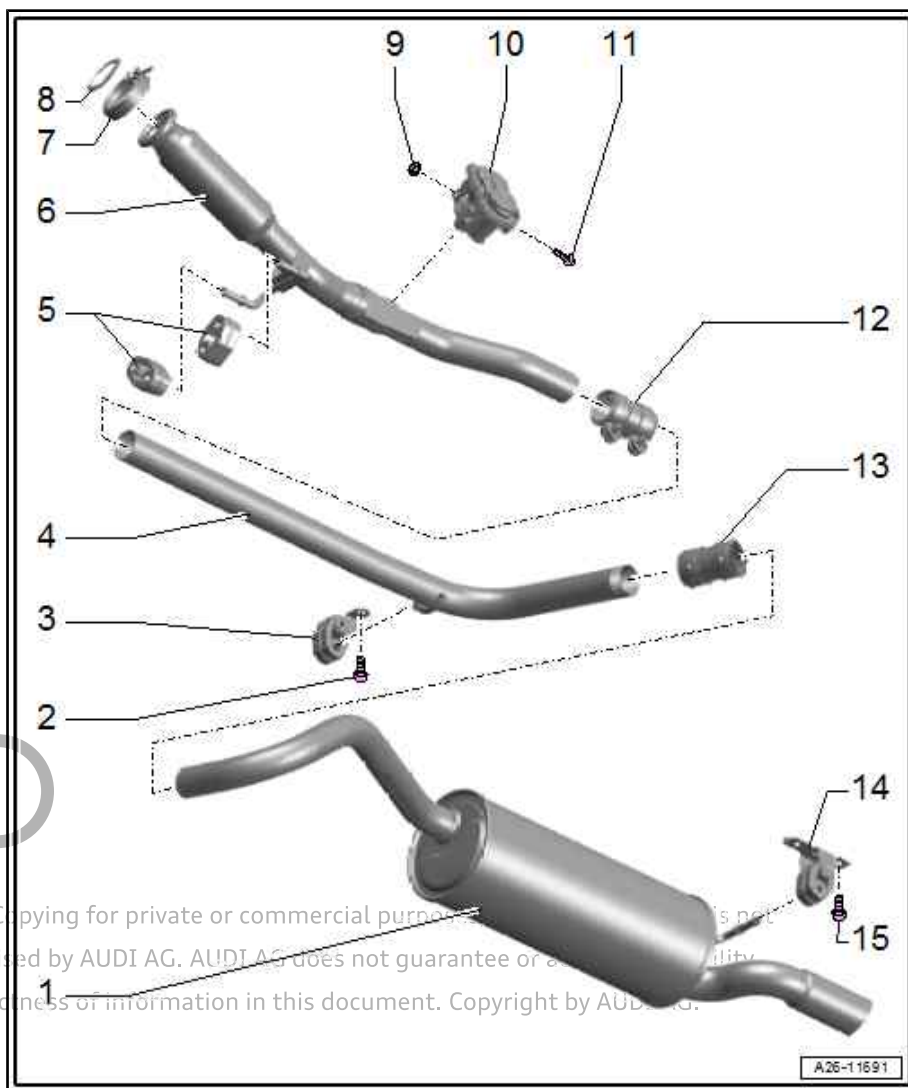
- ☐ Removing and installing ⇒ [page 305](#)

11 - Bolt

- ☐ Renew after removing

12 - Clamp (front)

- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 295](#)
- ☐ Installation position ⇒ [page 291](#)
- ☐ Versions and tightening torques ⇒ [page 291](#)
- ☐ Tighten bolted connections evenly





13 - Clamp (rear)

- ☐ Before tightening, align exhaust system so it is free of stress ➔ [page 295](#)
- ☐ Installation position ➔ [page 291](#)
- ☐ Versions and tightening torques ➔ [page 291](#)
- ☐ Tighten bolted connections evenly

14 - Mounting

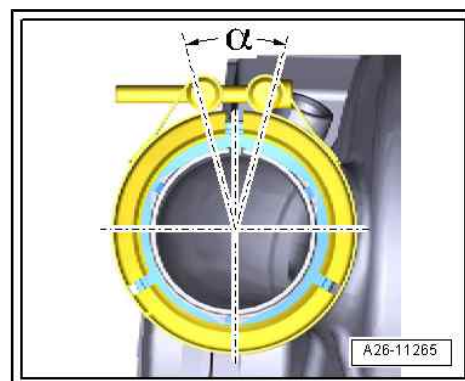
- ☐ Renew if damaged

15 - Bolt

- ☐ 20 Nm

Installation position of screw-type clip for front exhaust pipe

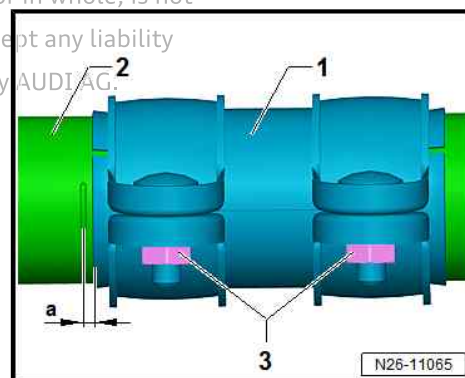
- Angle $-\alpha-$ = $0 \pm 30^\circ$



Clamp - installation position and tightening torques

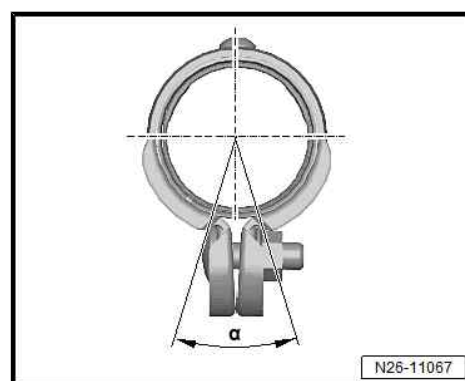
- a - Installation position for front clamp -1- = 5 mm from marking on exhaust pipe -2-

- Tighten unions -3- to 20 Nm.



Installation position of clamps (front and rear)

- Fit clamp in position shown:
- Angle $-\alpha-$ = 15°
- Bolt connections face downwards.

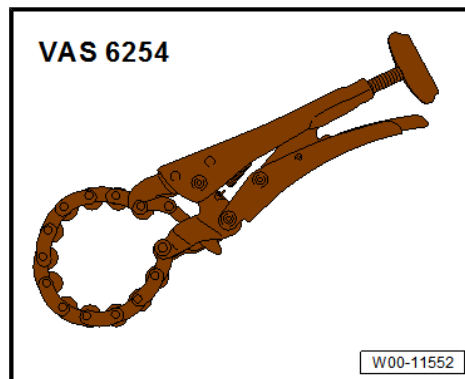


1.2 Separating exhaust pipes/silencer

Special tools and workshop equipment required



- ◆ Chain pipe cutter - VAS 6254-



- ◆ Torque wrench - V.A.G 1331-

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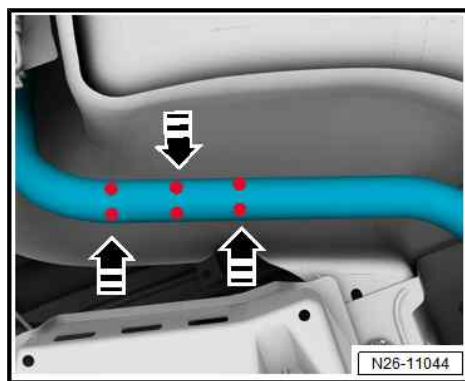
WARNING

Wear safety goggles and protective clothing to avoid any risk of injury from sharp metal parts.

- ◆ Use the cutting points provided to remove the sections of the exhaust system separately.
- ◆ The cutting points are indicated with markings on the circumference of the exhaust pipe.
- Cut through exhaust pipe at right angles at centre cutting point -top arrow- using chain pipe cutter - VAS 6254- .
- Position clamp centrally between outer marks -bottom arrows-.
- Fit clamp ⇒ [page 291](#) .

Tightening torques

- ◆ ⇒ [Fig. "Clamp - installation position and tightening torques"](#), [page 291](#)





1.3 Removing and installing silencer

Removing

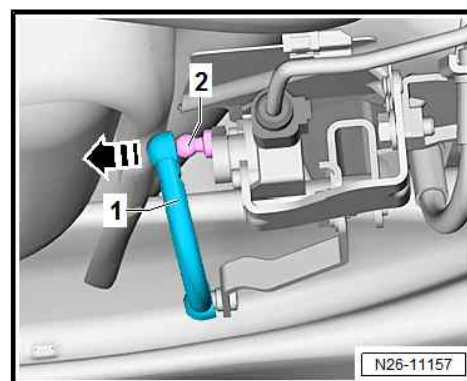


WARNING

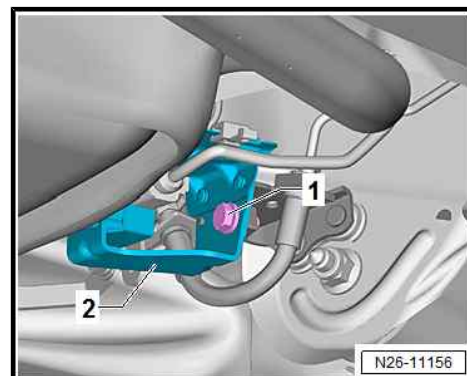
When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system*
⇒ ***"2.5 Safety precautions when working on the exhaust system", page 4*** .

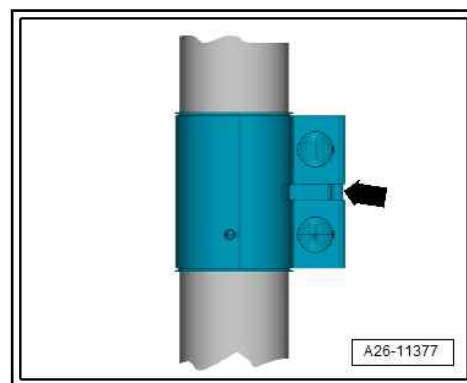
- Press coupling rod of rear left vehicle level sender -G76- off ball stud -2- -arrow-.



- Remove bolt -1- and press bracket -2- with rear left vehicle level sender - G76- to one side.
- Vehicles without connection point: separate exhaust pipe/silencer ⇒ [page 291](#) .



- Vehicles with connection point: release rear clamp -arrow- and push to right side.



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- Unscrew bolts -1- and detach rear silencer -2-.

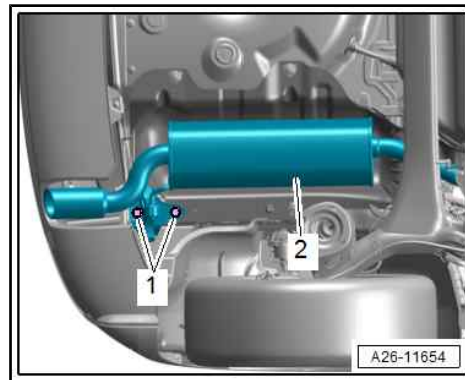
Installing

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

- Align the exhaust system so it is free of stress ⇒ [page 295](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - silencer”, page 289](#)
- ◆ ⇒ [Fig. ““Clamp - installation position and tightening torques””, page 291](#)
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 43 ; Vehicle level sender; Exploded view - rear vehicle level sender



1.4 Removing and installing front exhaust pipe

Removing

- Loosen bolts -2- of clamp -1- and push clamp towards rear.
- Unplug connector -6- for exhaust flap control unit - J883- .
- Release screw-type clip -4- and disengage screw.
- Pull front exhaust pipe -3- out of rubber mountings -5- and detach.

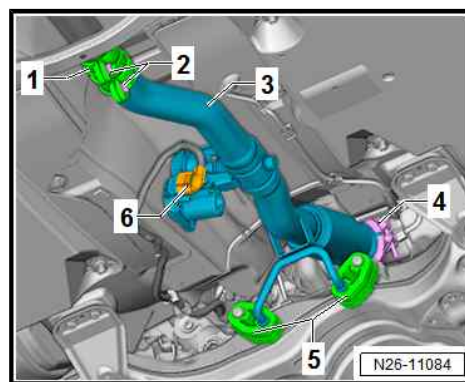
Installing

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

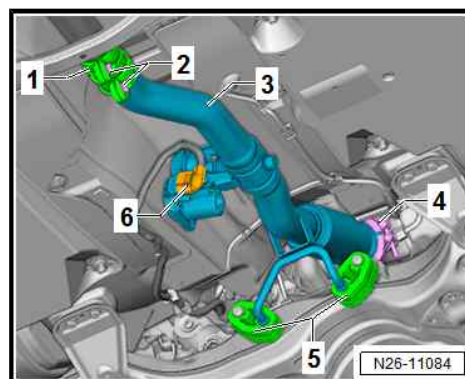


Note

Renew gasket after removing.



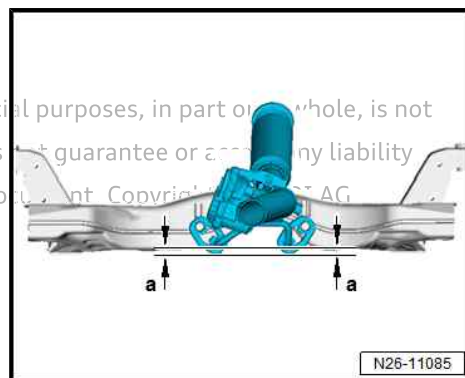
- Disengage screw and position screw-type clip -4- over entire intake funnel of front exhaust pipe.
- Bring front exhaust pipe -3- into installation position, press it into mountings -5- and fit clamp -1-.



- Turn front exhaust pipe to align it so that dimension -a- is the same on left and right.



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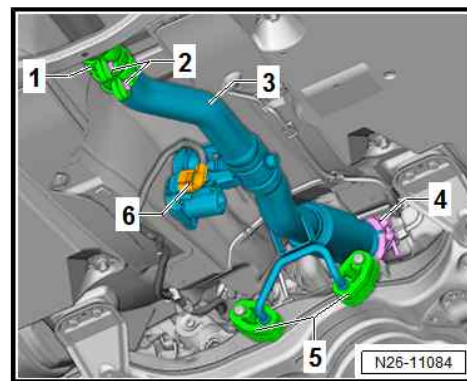




- Tighten bolts -2- of clamp.
- Position screw-type clip -4- over sealing flange and engage and tighten screw.
- Plug in electrical connector -6-.
- Align the exhaust system so it is free of stress ➔ [page 295](#) .

Tightening torques

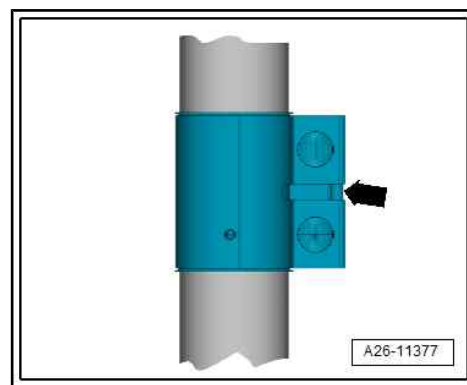
- ◆ ➔ ["1.1 Exploded view - silencer", page 289](#)



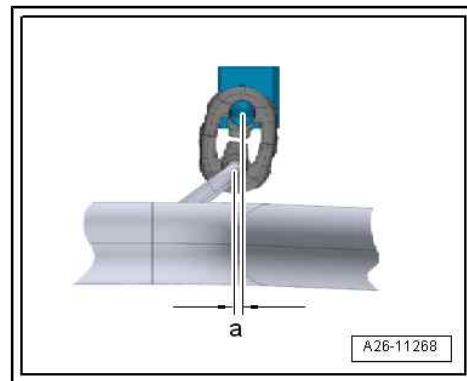
1.5 Stress-free alignment of exhaust system

Procedure

- The exhaust system must be aligned when it is cool.
- Loosen bolt connections for front clamp -arrow-.



- Push exhaust system towards front of vehicle until preloading at mounting for exhaust pipe -a- = 5 mm.
- Fit clamp ➔ [page 291](#) .



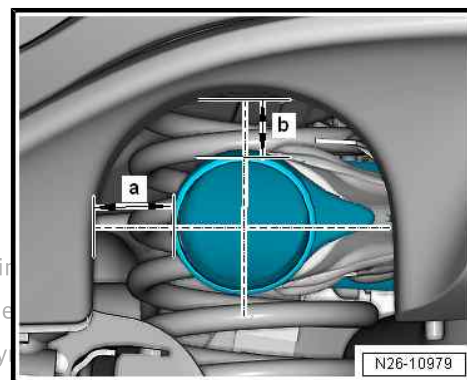
Aligning tailpipes

- Unfasten rear silencer mounting to align tailpipes.
- Align rear silencer so that there is an equal distance -a- and -b- between bumper cut-out and tailpipe.

Tightening torques

- ◆ ➔ ["1.1 Exploded view - silencer", page 289](#)

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1.6 Checking exhaust system for leaks

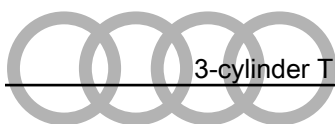
- Start the engine and run at idling speed.



- 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.



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2 Emission control system

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⇒ "2.1 Exploded view - emission control system", page 297

⇒ "2.2 Removing and installing emission control module", page 299

⇒ "2.3 Removing and installing exhaust flap control unit J883 ", page 305

2.1 Exploded view - emission control system

1 - Exhaust gas recirculation cooler (low-pressure)

- ❑ Removing and installing
⇒ [page 318](#)

2 - Bolt

- ❑ Tightening torque
⇒ [page 310](#)

3 - Bolt

- ❑ Tightening torque
⇒ [page 310](#)

4 - Bracket

- ❑ For exhaust gas recirculation cooler

5 - Turbocharger

- ❑ Removing and installing
⇒ [page 209](#)

6 - Nut

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ [page 304](#)

7 - Bolt

- ❑ Tightening torque and sequence ⇒ [page 304](#)

8 - Bracket

- ❑ For emission control module

9 - Bracket

- ❑ For emission control module

10 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ [page 304](#)

11 - Bolt

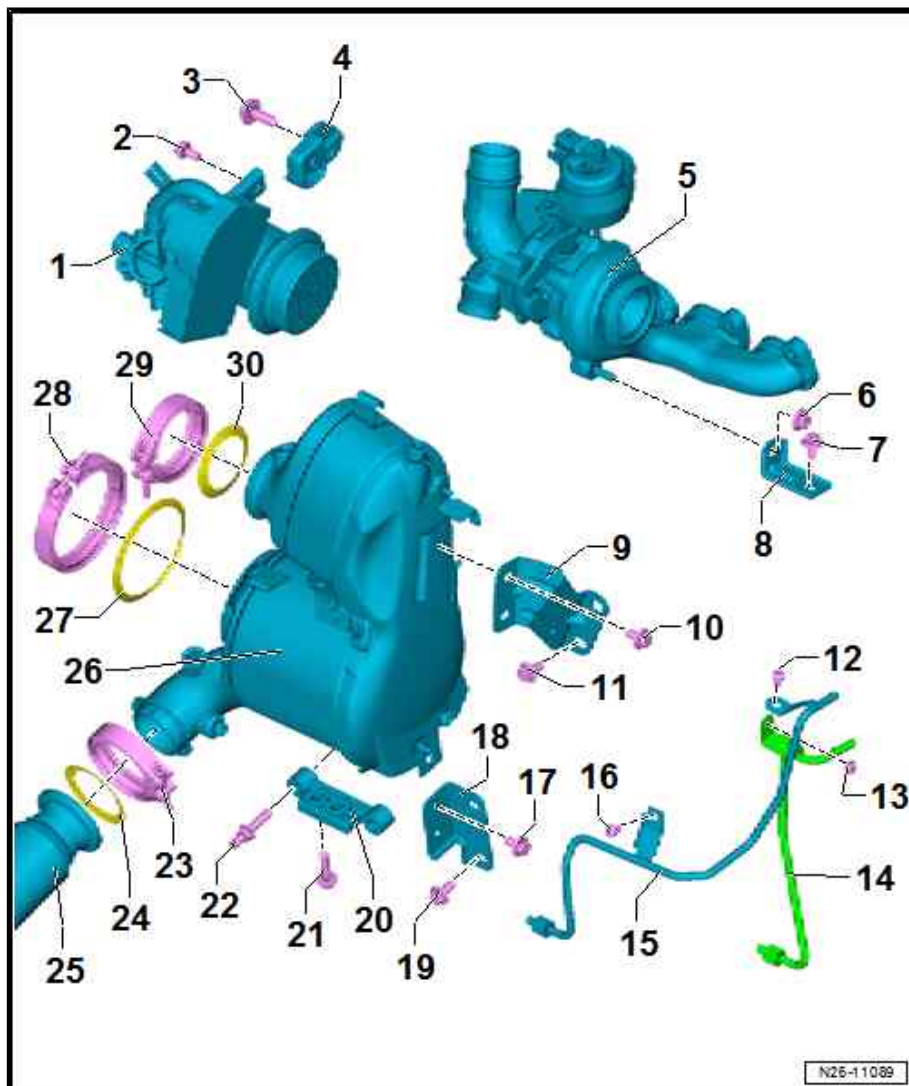
- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ [page 304](#)

12 - Bolt

- ❑ 9 Nm

13 - Nut

- ❑ 10 Nm





14 - Measuring tube

- ☐ To pressure differential sender - G505-
- ☐ Tightening torque for union nut: 45 Nm

15 - Measuring tube

- ☐ To exhaust gas pressure sensor 1 - G450-
- ☐ Tightening torque for union nut: 45 Nm

16 - Bolt

- ☐ 9 Nm

17 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 304](#)

18 - Bracket

- ☐ For emission control module

19 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 304](#)

20 - Bracket

- ☐ For emission control module

21 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 304](#)

22 - Bolt

- ☐ Renew after removing
 - ☐ Tightening torque and sequence ⇒ [page 304](#)
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23 - Screw-type clip

- ☐ Renew after removing
- ☐ Tightening torque ⇒ [Item 7 \(page 290\)](#)

24 - Gasket

- ☐ Renew after removing

25 - Front exhaust pipe

- ☐ Removing and installing ⇒ [page 294](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 295](#)

26 - Emission control module

- ☐ Particulate filter with catalytic converter
- ☐ Removing and installing ⇒ [page 299](#)

27 - Gasket

- ☐ Renew after removing

28 - Screw-type clip

- ☐ Renew after removing
- ☐ 8 Nm

29 - Screw-type clip

- ☐ Renew after removing
- ☐ Tightening torque and sequence ⇒ [page 304](#)

30 - Gasket

- ☐ Renew after removing



2.2 Removing and installing emission control module

Special tools and workshop equipment required

- ◆ Engine support - T10533-



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Removing

- Remove subframe with steering rack ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Detach drive shaft (right-side) from gearbox and tie it up towards rear ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .



Note

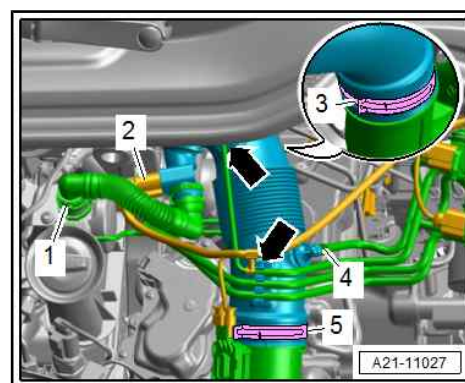
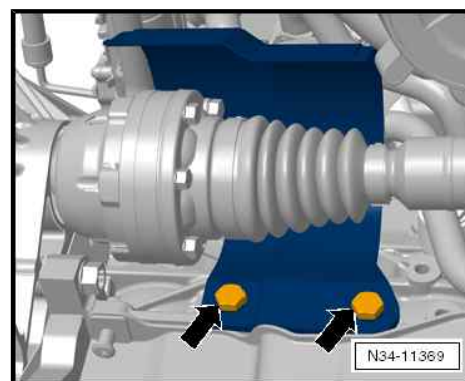
Take care not to damage surface coating of drive shaft.

- Remove front exhaust pipe ⇒ [page 294](#) .
- Remove air cleaner housing ⇒ [page 237](#) .
- Unplug electrical connector -2-.
- Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from cylinder head cover.
- Move clear vacuum hoses at air pipe -arrows-.
- Disconnect vacuum hose -4-.
- Release hose clip -3- and detach air pipe from turbocharger.



Note

Disregard -item 5-.





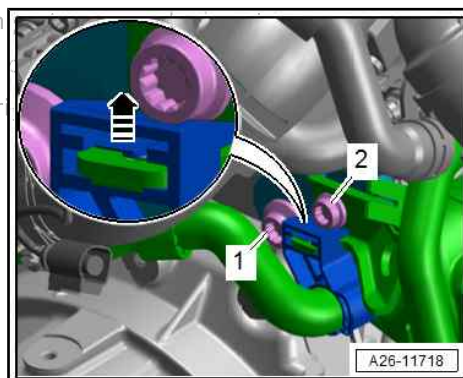
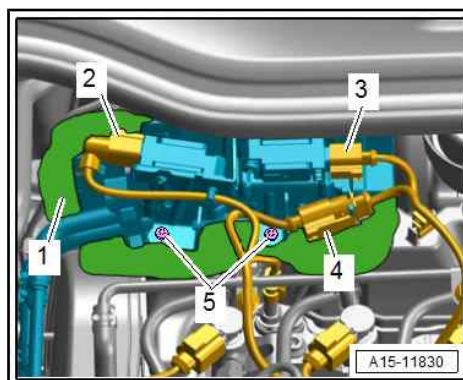
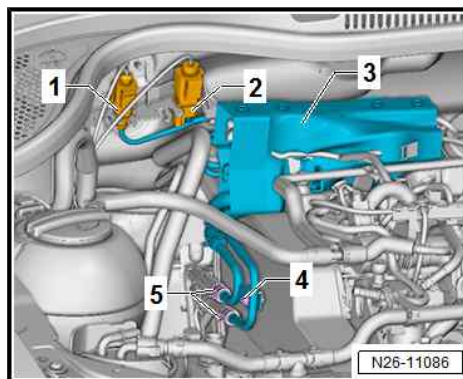
- Take electrical connectors -1, 2- out of bracket, unplug connectors and move electrical wiring clear.
- Remove bolt -4-.
- Release hose clips -5- and disconnect hoses from metering tubes of exhaust gas pressure sensors.



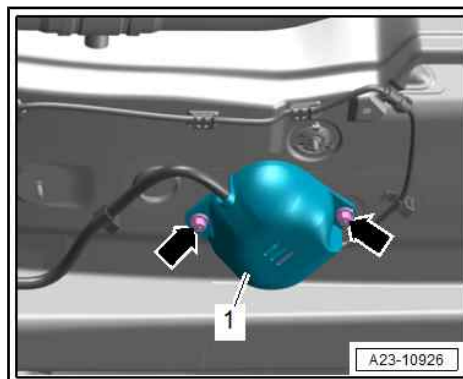
Note

Disregard -item 3-.

- Open heat insulation sleeve -1-.
- Unplug electrical connectors -2, 3- and move electrical wiring clear.
- Detach electrical connector -4- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.
- Unscrew bolts -5- and take out bracket with exhaust gas pressure sensors and hoses.
- Detach gear selector cable and gate selector cable from gear-box, remove cable support bracket and place to one side with selector cables attached ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- Release catch -arrow- and move bracket for coolant hose clear at exhaust gas recirculation cooler.
- Loosen bolt -1- and remove bolt -2-.
- Unfasten underbody trim (right-side) on inside and press downwards ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .

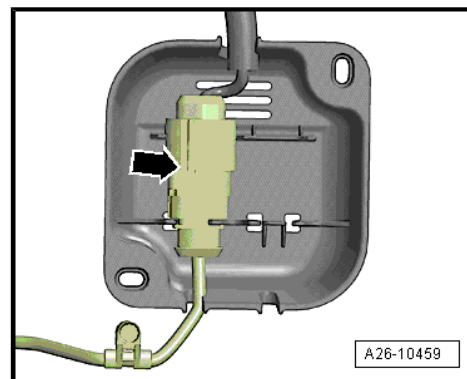


- Unscrew nuts -arrows- and detach cover -1-.





- Take electrical connector -arrow- for Lambda probe after catalytic converter - G130- out of bracket, unplug and move electrical wiring clear.

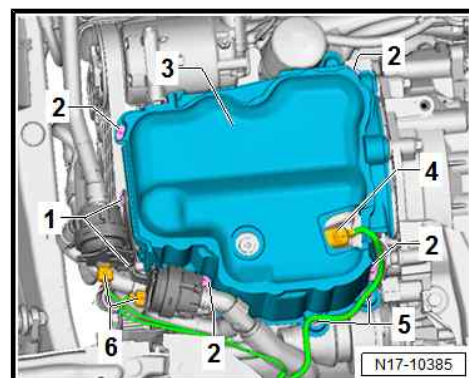


- Unplug electrical connector -4- for oil level and oil temperature sender - G266- , release clips -5- and move electrical wiring clear.
- Unscrew bolts -1- and push electric coolant pipe to one side.



Note

Disregard -items 2, 3, 6-.



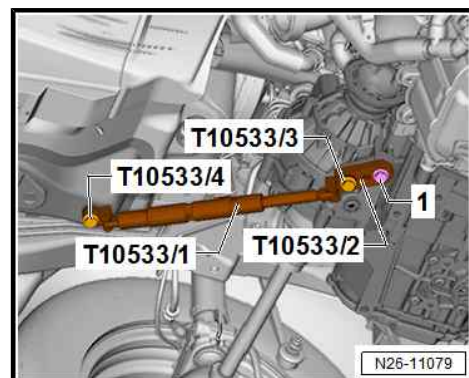
- Attach engine support - T10533- as shown and hand-tighten bolts for engine support.
- In addition, hand-tighten bolt -1- for pendulum support.



Caution

Risk of damage to components.

- ◆ **When pushing the engine/gearbox assembly forwards, it is important that no components press against the radiator cowl.**



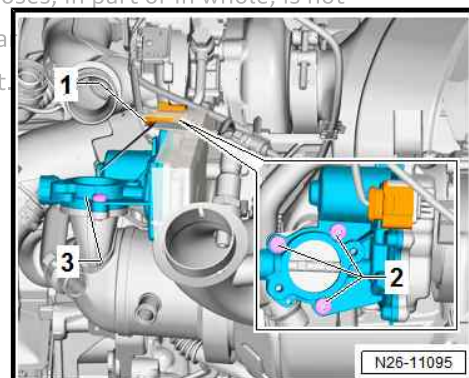
- Push engine/gearbox assembly forwards as far as possible by tightening spindle on engine support - T10533- .

- Unplug electrical connector -1- at exhaust gas recirculation control motor 2 - V339- -item 3-.



Note

Disregard -item 2-.



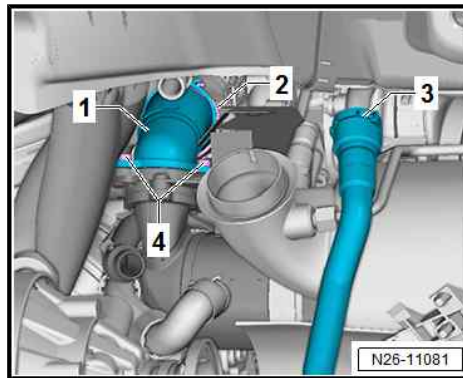


- Release hose clip -2-, unscrew bolts -4- and remove exhaust gas recirculation pipe -1-.



Note

Disregard -item 3-.

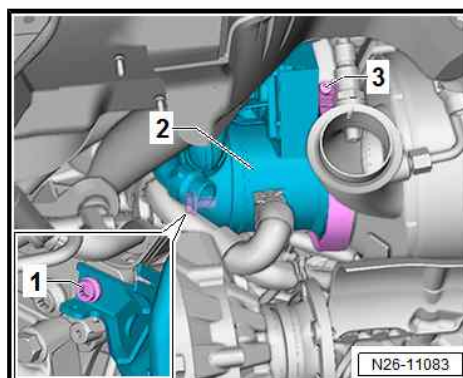


- Loosen screw-type clip -3-.
- Detach exhaust gas recirculation cooler -2- from emission control module and tie it up.



Note

Disregard -item 1-.



Removal sequence for emission control module

Stage	Bolt	Task
1.	Nut -2-, bolts -4- and -6-	Loosen by one turn
2.	Bolt -3-	Unscrew using ratchet wrench 13 mm - T10384-
3.	Bolts -7- and -8-	Unscrew and detach bracket -B-
4.	Bolts -5- and -9-	Unscrew
5.	Screw-type clip -1-	Release and detach

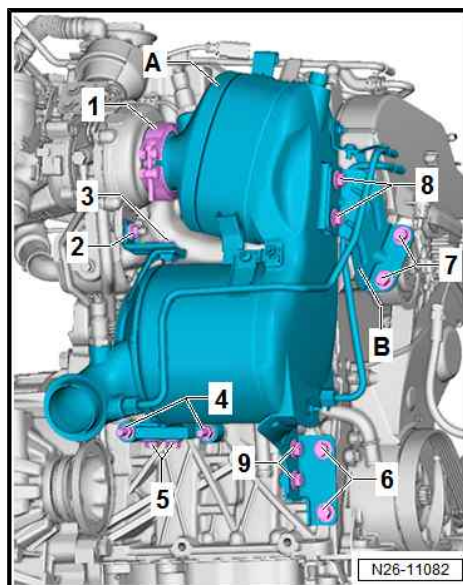
- Pivot lower part of emission control module -A- away from engine and remove it downwards.

Installing



Note

- ◆ *Renew seal, nut and screw-type clip for emission control module after removal.*
- ◆ *Re-fit all cable ties and heat insulation sleeves in the same locations when installing.*



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- Unscrew bolt -1- and remove bracket -2-.
- Drive in sliding bush -3- as far as stop -arrow-.
- Bring bracket into installation position and screw in bolt until it makes contact.



Note

Ensure that sliding bush moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque.

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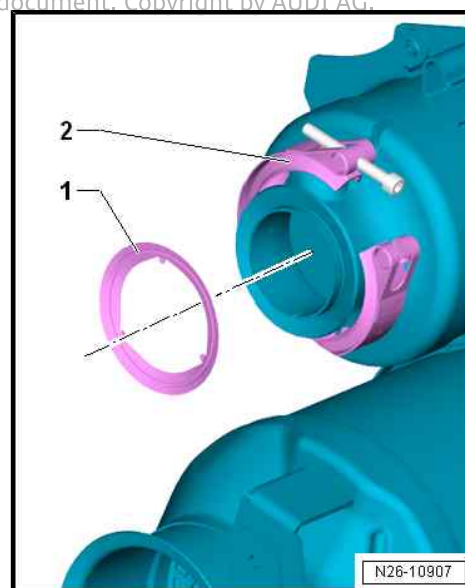
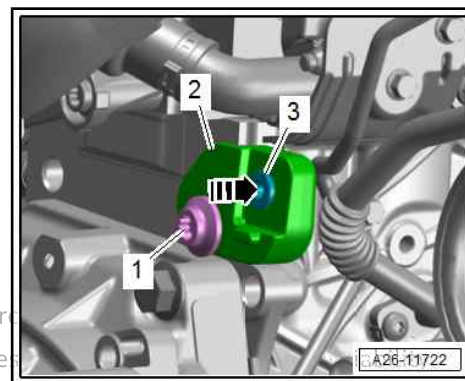
- Fit seal -1- onto emission control module.
- Disengage screw on clip -2- and move clip onto intake funnel of emission control module.



Note

Do not bend screw-type clip open.

- Move emission control module into installation position from below.
- Screw in bolts -3, 4, 5, 6, 9- by hand until they make contact.

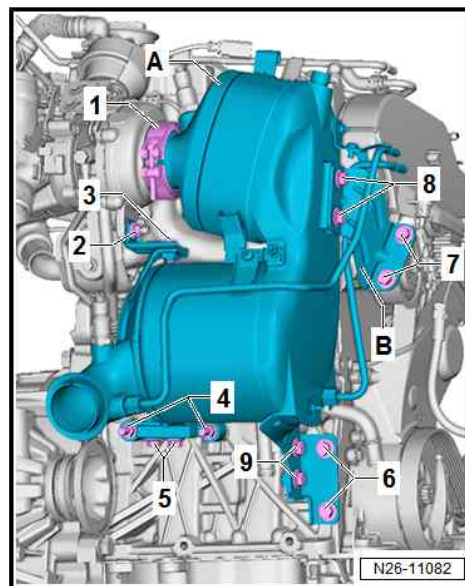


**Emission control module - tightening torques and sequence**

Stage	Bolts	Task
1.	Screw-type clip -1-	Fit over sealing flange and engage screw
2.	Screw-type clip -1-	Tighten to 8 Nm
3.	Nut -2-	Tighten to 20 Nm
4.	Bolt -3-	Tighten to 20 Nm using ratchet wrench 13 mm - T10384-
5.		Position bracket -B-
6.	Bolts -7- and -8-	Screw in by hand
7.	Bolts -4- to -9-	Tighten in numerical order to 20 Nm

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

- Install exhaust gas recirculation cooler ⇒ [page 315](#) .
- Install subframe ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
- Install heat shield for drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing heat shield for drive shaft .
- Install gear selector cable and gate selector cable ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- 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.
- Perform adaption required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ ["3.4 Performing adaption after renewing a component"](#), [page 8](#) .

**Tightening torques**

- ◆ Bolt for pressure differential lines
⇒ ["1.1 Exploded view - toothed belt cover"](#), [page 86](#)
- ◆ ⇒ ["2.1 Exploded view - cylinder head cover"](#), [page 108](#)
- ◆ ⇒ ["3.1 Exploded view - air cleaner housing"](#), [page 236](#)
- ◆ ⇒ ["1.1 Exploded view - silencer"](#), [page 289](#)
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim



2.3 Removing and installing exhaust flap control unit - J883-

Removing

- If fitted, detach heat shield sleeve from electrical connector.
- Unplug electrical connector -1-.
- Unscrew bolts -arrows- and remove exhaust flap control unit - J883- .

Installing

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



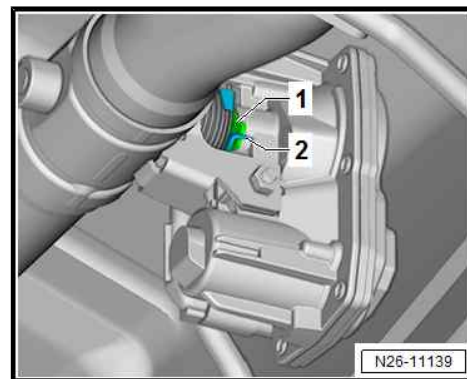
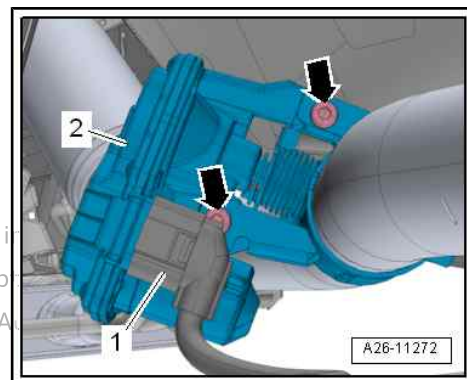
Note

Renew bolts after removing.

- Move exhaust flap control unit into installation position.
- Coupling -1- on exhaust flap control module must engage in retainer of exhaust flap -2-.
- Tighten upper bolt first, then tighten lower bolt. Tightening torque: 10 Nm
- Perform adaptations required after renewing a component (using ⇒ Vehicle diagnostic tester)
⇒ ["3.4 Performing adaptations after renewing a component"](#), [page 8](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - silencer"](#), [page 289](#)



⇒ “3.3 Removing and installing exhaust gas temperature sender 3 G495”, page 308

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◆ **The threads of the exhaust gas temperature senders - G235- and -G495- are coated. It is important that you do NOT coat them additionally with high-temperature paste and that you tighten them to the specified torque.**

- ❑ Removing and installing
⇒ [page 308](#)





- ☐ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ☐ 45 Nm

8 - Lambda probe after catalytic converter - G130-

- ☐ With Lambda probe 1 heater after catalytic converter - Z29-
- ☐ Removing and installing ⇒ [page 284](#)

3.2 Removing and installing exhaust gas temperature sender 1 - G235-

Special tools and workshop equipment required

- ◆ Flared ring spanner tool insert (17 mm) - V.A.G 1331/10-

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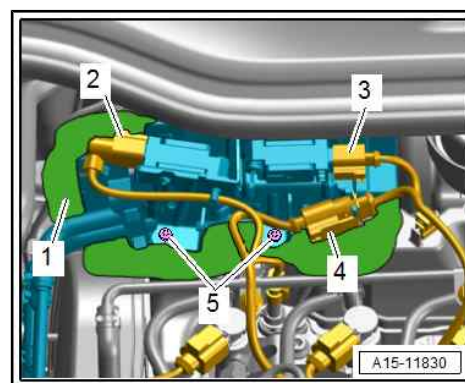


Removing



Note

- ◆ *Fit all cable ties in the original positions when installing.*
- ◆ *When removing, the electrical wiring must not be cut, otherwise a fault diagnosis would no longer be possible.*
- Remove engine cover panel ⇒ [page 41](#) .
- Open heat insulation sleeve -1-.
- Unplug electrical connectors -2, 3- and move electrical wiring clear.
- Detach electrical connector -4- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.
- Remove bolts -5- and move bracket with exhaust gas pressure sensors towards front.





- Remove exhaust gas temperature sender 1 - G235- -item 1- using flared ring spanner tool insert (17 mm) - V.A.G 1331/10- .

Installing

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



Note

- ♦ *Take care to protect exhaust gas temperature sender from knocks and impact; if dropped, the exhaust gas temperature sender can no longer be used.*
- ♦ *Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ *Electronic parts catalogue* .*
- 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 engine cover panel ⇒ [page 41](#) .

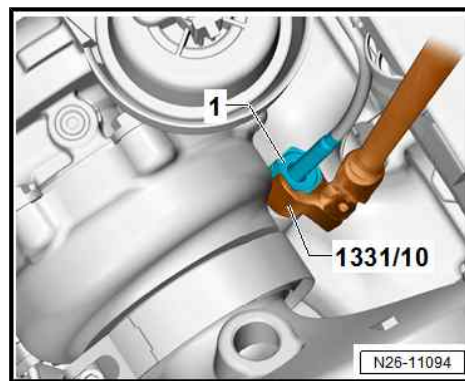
Tightening torques

- ♦ ⇒ [“3.1 Exploded view - exhaust gas temperature control”, page 306](#)
- ♦ ⇒ [“2.1 Exploded view - cylinder head cover”, page 108](#)

3.3 Removing and installing exhaust gas temperature sender 3 - G495-

Special tools and workshop equipment required

- ♦ Tool set - T10395A-



Removing



Note

- ♦ *Fit all cable ties in the original positions when installing.*
- ♦ *When removing, the electrical wiring must not be cut, otherwise a fault diagnosis would no longer be possible.*
- Remove engine cover panel ⇒ [page 41](#) .

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- Unplug electrical connector -1- and move wiring clear.
- Unscrew exhaust gas temperature sender 3 - G495- -item 2- using a tool from tool set - T10395A- .

Installing

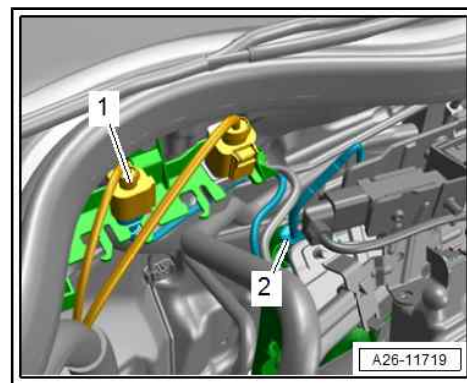
Installation is carried out in reverse order; note the following:



Caution

Risk of malfunctions caused by improperly secured exhaust gas temperature senders.

- ◆ ***The exhaust gas temperature sender 3 - G495- has a coated thread. It is important that you do NOT coat it additionally with high-temperature paste and that you tighten it to the specified torque.***



Note

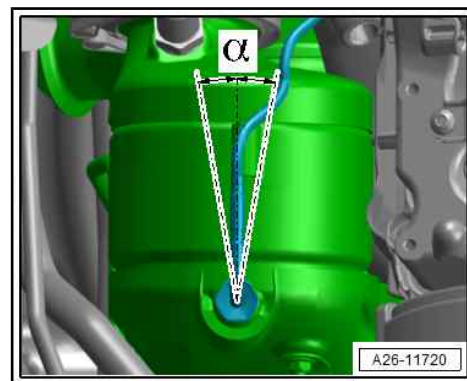
Take care to protect exhaust gas temperature sender from knocks and impact; if dropped, the exhaust gas temperature sender can no longer be used.

Installation position of exhaust gas temperature sender 3 - G495-

- Angle $\alpha = 5^\circ$
- 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 engine cover panel ⇒ [page 41](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - exhaust gas temperature control”, page 306](#)





4 Exhaust gas recirculation

⇒ ["4.1 Exploded view - exhaust gas recirculation system", page 310](#)

⇒ ["4.2 Removing and installing exhaust gas recirculation control motor 2 V339", page 313](#)

⇒ ["4.3 Removing and installing exhaust gas recirculation cooler", page 315](#)

4.1 Exploded view - exhaust gas recirculation system

⇒ ["4.1.1 Exploded view - exhaust gas recirculation system, low-pressure", page 310](#)

⇒ ["4.1.2 Exploded view - exhaust gas recirculation system, high-pressure", page 312](#)

4.1.1 Exploded view - exhaust gas recirculation system, low-pressure

1 - Exhaust gas recirculation control motor 2 - V339-

- ❑ Removing and installing
⇒ [page 313](#)



Caution

The control motor for exhaust gas recirculation is protected from heat damage by an insulation mat. If the insulation mat is damaged, it must be renewed. The control motor must then be checked for heat damage and renewed if necessary.

2 - Seal

- ❑ Renew after removing

3 - Bolt

- ❑ 9 Nm

4 - Air hose

- ❑ To turbocharger

5 - Bolt

- ❑ 9 Nm

6 - Gasket

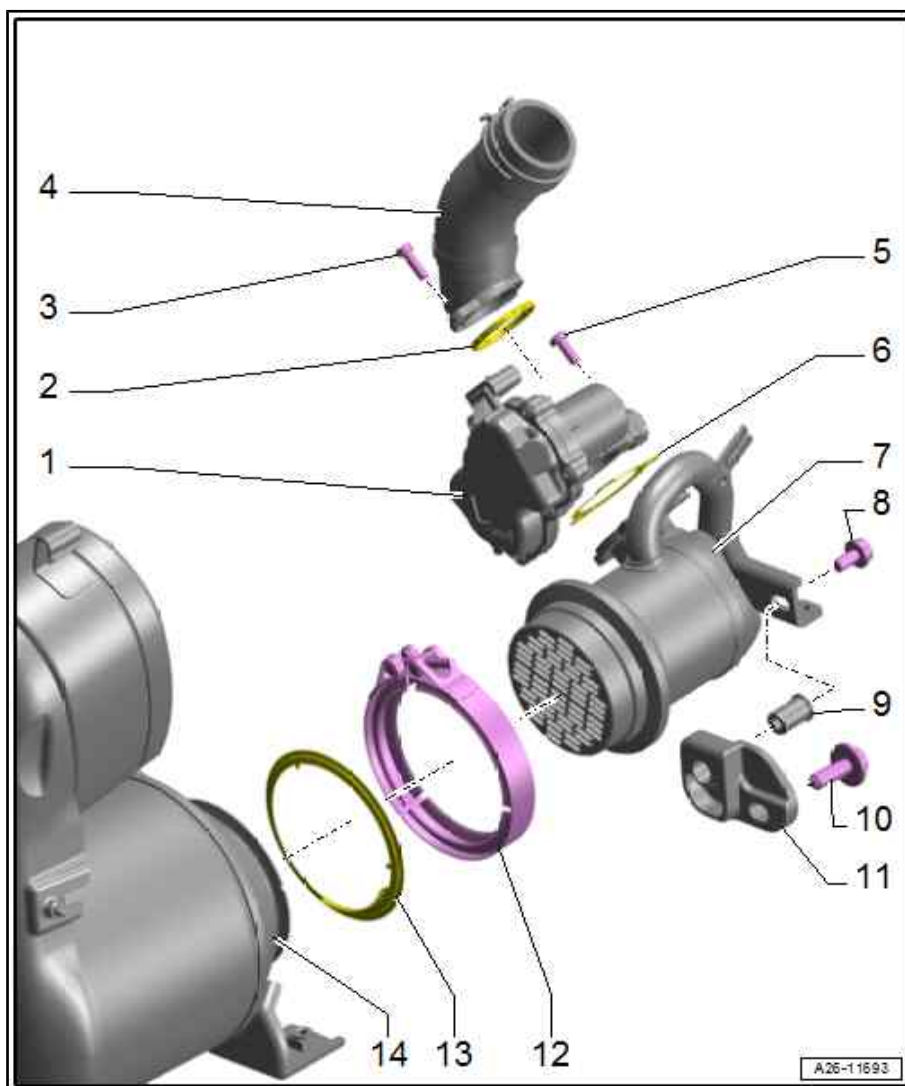
- ❑ Renew after removing

7 - Exhaust gas recirculation cooler (low-pressure)

- ❑ Removing and installing
⇒ [page 315](#)

8 - Bolt

- ❑ Tightening torque and sequence ⇒ [page 311](#)





9 - Sliding bush

- ☐ Ensure that sliding bush moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque

10 - Bolt

- ☐ Tightening torque and sequence ➔ [page 311](#)

11 - Bracket

- ☐ For exhaust gas recirculation cooler

12 - Screw-type clip

- ☐ Renew after removing
- ☐ Installation position ➔ [page 311](#)
- ☐ Tightening torque and sequence ➔ [page 311](#)

13 - Gasket

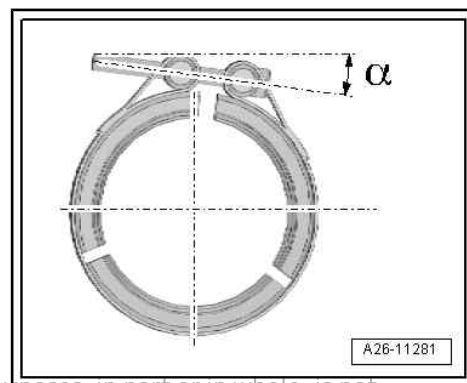
- ☐ Renew after removing

14 - Emission control module

- ☐ Removing and installing ➔ [page 299](#)

Installation position of screw-type clip for exhaust gas recirculation cooler

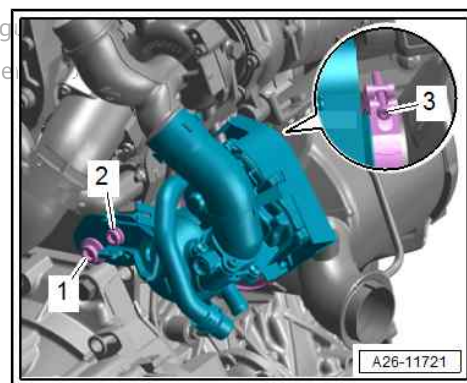
- Angle $-\alpha-$ = 10 ... 15°



Exhaust gas recirculation cooler - tightening torque and sequence

- Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	Screw-type clip -3-	7 Nm
2.	-1, 2-	Screw in by hand until contact is made
3.	-1, 2-	20 Nm





4.1.2 Exploded view - exhaust gas recirculation system, high-pressure

1 - Screw-type clip

- ☐ Tightening torque
⇒ [Item 5 \(page 214\)](#)

2 - Exhaust gas recirculation pipe

- ☐ To air pipe

3 - Bracket

4 - Bolt

- ☐ 9 Nm

5 - Bolt

- ☐ 20 Nm

6 - Bracket

- ☐ For charge air cooler and exhaust gas recirculation valve
- ☐ With connection for coolant hoses
- ☐ With engine lifting eye

7 - Ball stud

- ☐ For engine cover panel
- ☐ 4 Nm

8 - Exhaust gas recirculation cooler (high-pressure)

- ☐ With integrated exhaust gas recirculation control motor - V338- / exhaust gas recirculation potentiometer - G212-
- ☐ Exhaust gas recirculation control motor - V338- and exhaust gas recirculation potentiometer - G212- cannot be renewed separately
- ☐ Checking for leaks ⇒ [page 319](#)
- ☐ Removing and installing ⇒ [page 315](#)

9 - Gasket

- ☐ Renew after removing

10 - Exhaust gas recirculation pipe

- ☐ From exhaust manifold

11 - Bolt

- ☐ 9 Nm

12 - Nut

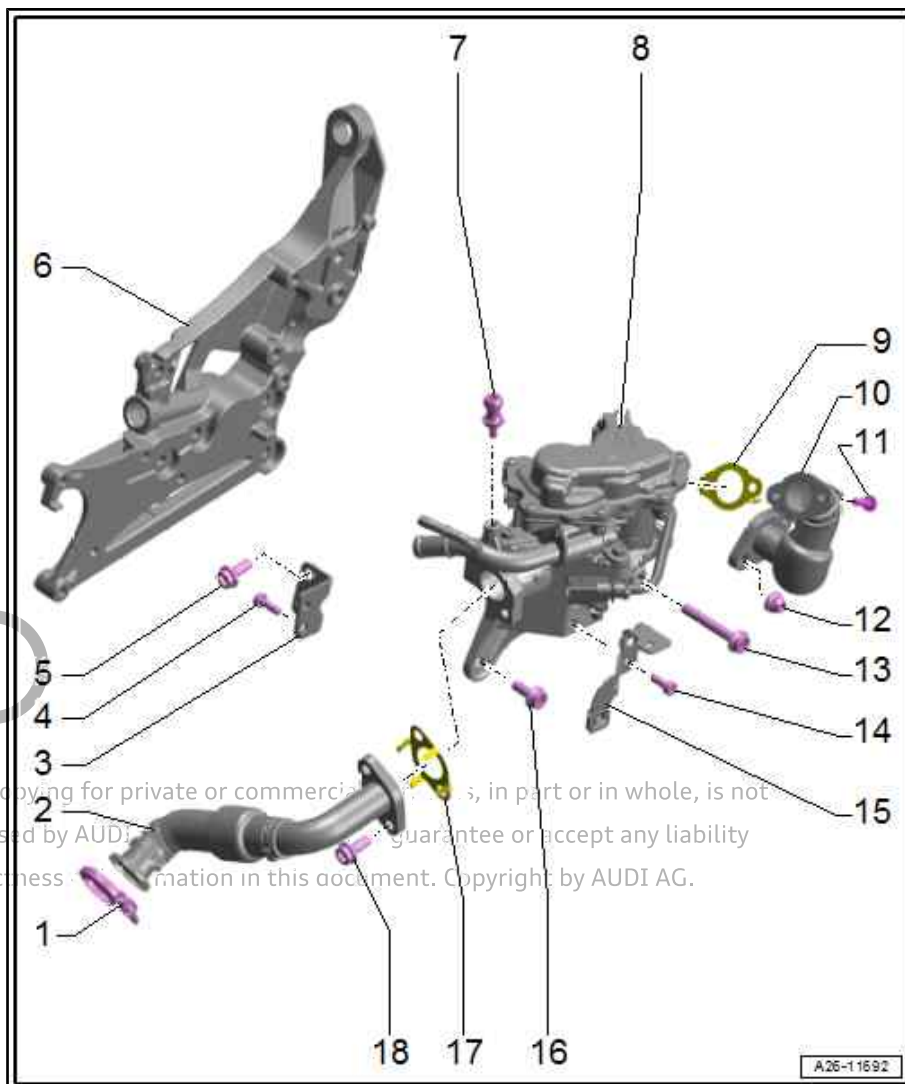
- ☐ Tightening torque ⇒ [Item 13 \(page 207\)](#)

13 - Bolt

- ☐ 20 Nm

14 - Bolt

- ☐ 9 Nm





15 - Bracket

16 - Bolt

- ☐ 20 Nm

17 - Gasket

- ☐ Renew after removing

18 - Bolt

- ☐ 20 Nm

4.2 Removing and installing exhaust gas re-circulation control motor 2 - V339-

Special tools and workshop equipment required

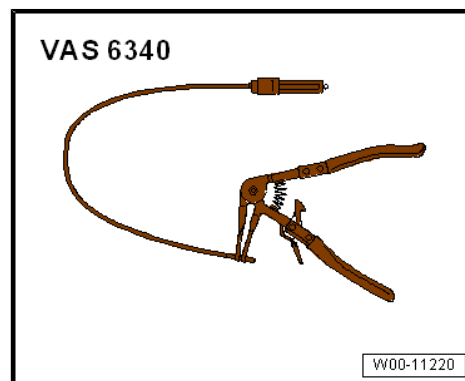
- ◆ Engine support - T10533-



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- ◆ Coolant collecting system - VAS 5014- or drip tray for workshop hoist - VAS 6208-

- ◆ Hose clip pliers - VAS 6340-



Removing

- Drain coolant ➔ [page 165](#) .
- Remove front exhaust pipe ➔ [page 294](#) .



- Remove pendulum support ⇒ [page 40](#) .
- Attach engine support - T10533- and secure with a nut -1- and bolt -2-, as shown in illustration.

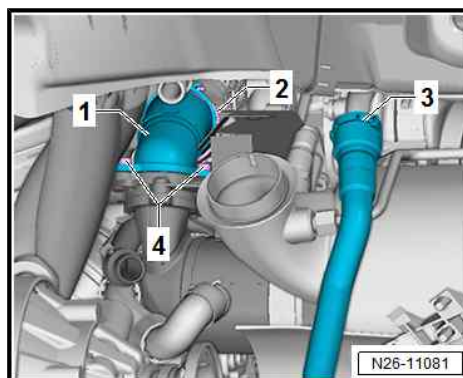
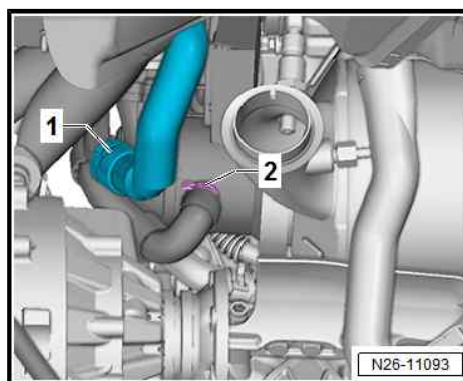
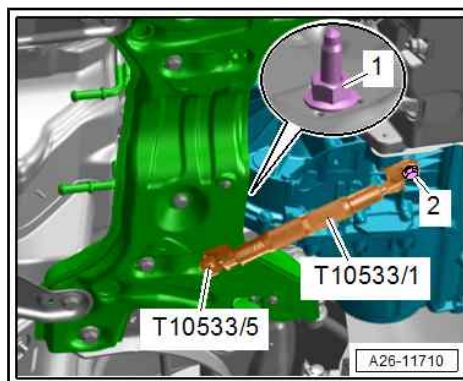


Caution

Risk of damage to components.

- ◆ *When pushing the engine/gearbox assembly forwards, it is important that no components press against the radiator cowl.*

- Push engine/gearbox assembly forwards as far as possible by tightening spindle on engine support - T10533- .
- Lift retaining clip -1- and disconnect coolant hose.
- Release hose clip -2-, unscrew bolts -4- and remove exhaust gas recirculation pipe -1-.



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- Unplug electrical connector -1-.
- Unscrew bolts -2- and take out exhaust gas recirculation control motor 2 - V339- -3- downwards.

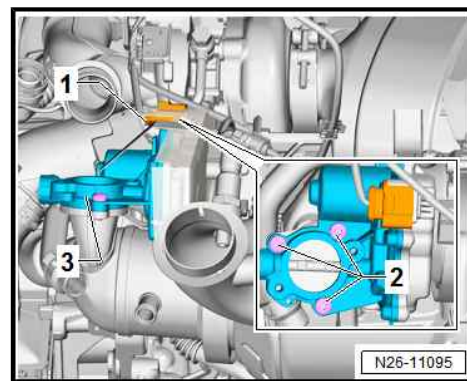
Installing

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



Note

- ◆ *Renew seal and O-ring after removal.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#) .*
- ◆ *Check insulation mat for damage and renew if necessary.*
- ◆ *If insulation mat is damaged, check exhaust gas recirculation control motor 2 - V339- for heat damage and renew if necessary.*



- Connect coolant hoses with plug-in connector ⇒ [page 200](#) .



Caution

Risk of damage to power unit if cooling system is insufficiently filled/bled.

- ◆ *After it is filled, the cooling system must be bled with the ⇒ [Vehicle diagnostic tester](#).*



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 168](#) .
- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

- ◆ ⇒ [“4.1.1 Exploded view - exhaust gas recirculation system, low-pressure”, page 310](#)
- ◆ ⇒ [Fig. ““Installing pendulum support”“, page 33](#)
- ◆ ⇒ [“1.1 Exploded view - silencer”, page 289](#)

4.3 Removing and installing exhaust gas recirculation cooler

⇒ [“4.3.1 Removing and installing exhaust gas recirculation cooler \(high-pressure\) with exhaust gas recirculation control motor V338”, page 315](#)

⇒ [“4.3.2 Removing and installing exhaust gas recirculation cooler \(low-pressure\)”, page 318](#)

⇒ [“4.4 Checking exhaust gas recirculation cooler for leaks”, page 319](#)

4.3.1 Removing and installing exhaust gas recirculation cooler (high-pressure) with



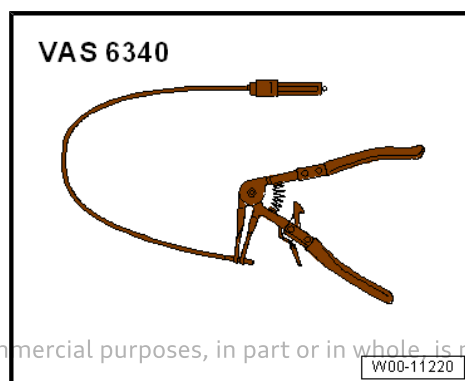
exhaust gas recirculation control motor - V338-

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6340-



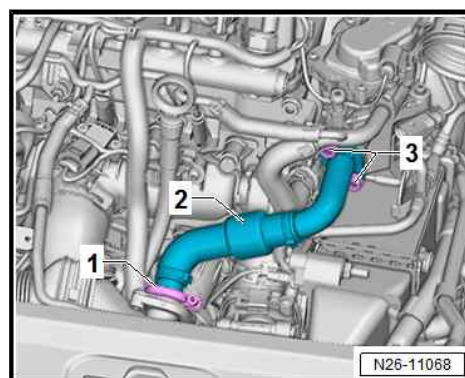
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- ◆ Bit XZN 10 - T10501



Removing

- Remove air cleaner housing ⇒ [page 237](#) .
- Remove charge air cooler ⇒ [page 220](#) .
- Release screw-type clip -1-, remove bolts -3- and detach exhaust gas recirculation pipe -2-.





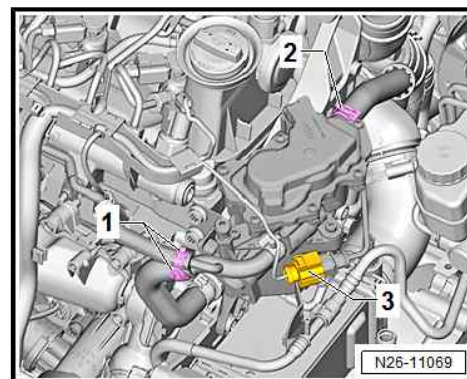
- Unplug electrical connector -3- and move clear.



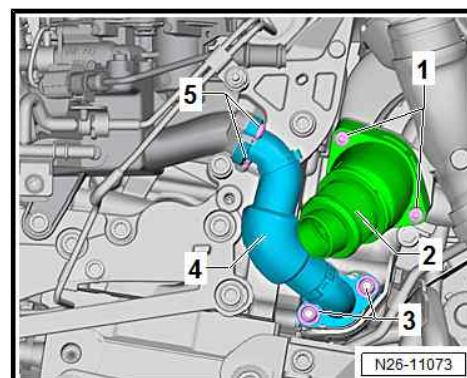
Note

Place a cloth underneath to catch escaping coolant.

- Clamp off coolant hoses using hose clamps, up to 25 mm - 3094- , release hose clips -1 and 2- and disconnect hoses.



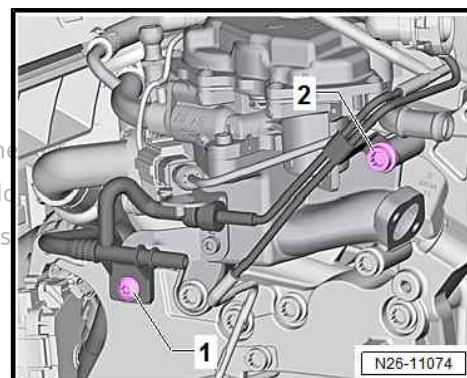
- Remove bolts -1- and detach pulsation damper -2-.
- Remove nuts -3- for exhaust gas recirculation pipe.



- Remove bolts -1 and 2-.



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- Unscrew bolts -1- to -4- and detach exhaust gas recirculation cooler -5-.

Installing

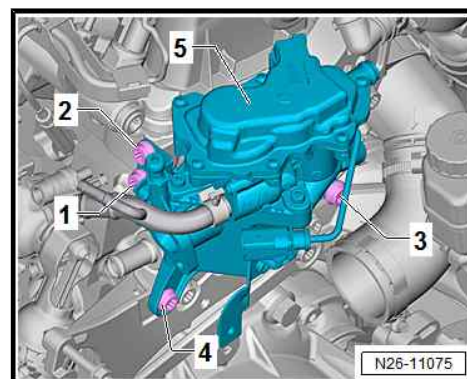
Installation is carried out in reverse order; note the following:



Note

- ◆ *Renew seal and O-ring after removal.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*

- Install charge air cooler ⇒ [page 220](#) .
- Install air cleaner housing ⇒ [page 237](#) .



Tightening torques

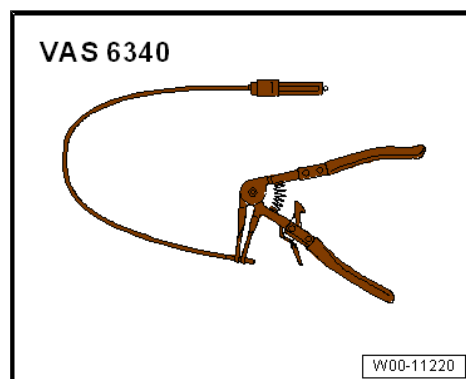
- ◆ ⇒ [“4.1 Exploded view - exhaust gas recirculation system”, page 310](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 207](#)



4.3.2 Removing and installing exhaust gas recirculation cooler (low-pressure)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6340-

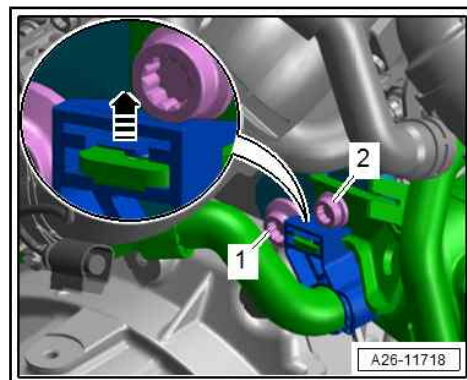


- ◆ Bit XZN 10 - T10501-



Removing

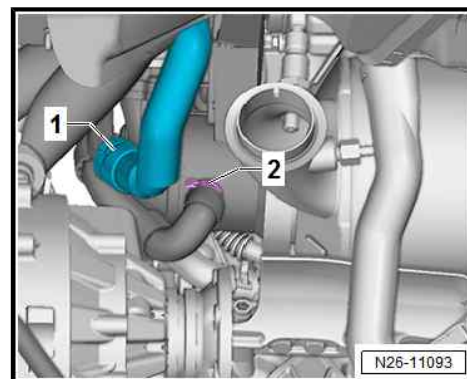
- Remove exhaust gas recirculation control motor 2 - V339-
⇒ [page 313](#) .
- Detach gear selector cable and gate selector cable from gear-box, remove cable support bracket and place to one side with selector cables attached ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- Release catch -arrow- and move bracket for coolant hose clear at exhaust gas recirculation cooler.
- Loosen bolt -1- and remove bolt -2-.



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



- Loosen screw-type clip -3- and push towards emission control module.
- Detach exhaust gas recirculation cooler -2-.

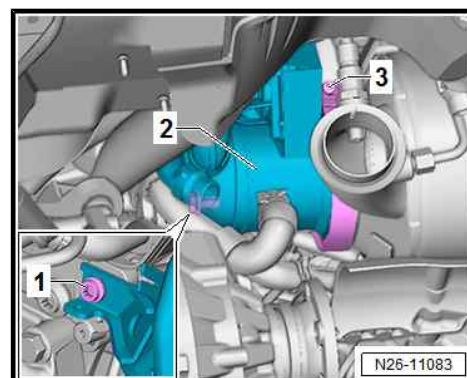
Installing

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



Note

- ◆ *Renew seals, screw-type clip and hose clips after removal.*
- ◆ *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue*



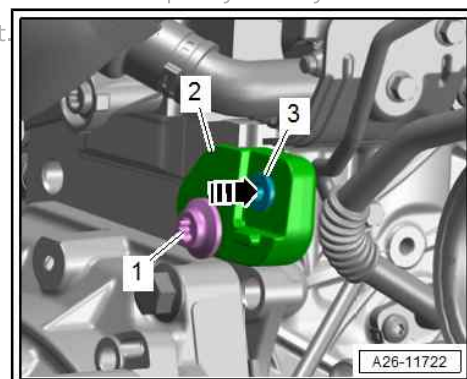
- Unscrew bolt -1- and remove bracket -2-.
- Drive in sliding bush -3- as far as stop -arrow-.
- Bring bracket into installation position and screw in bolt until it makes contact.



Note

Ensure that sliding bush moves easily (unstick if necessary); otherwise clamping force of sliding bush will be insufficient even at correct torque.

- Install gear selector cable and gate selector cable ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- Install exhaust gas recirculation control motor 2 - V339- ⇒ [page 313](#) .
- Install front exhaust pipe ⇒ [page 294](#) .



Tightening torques

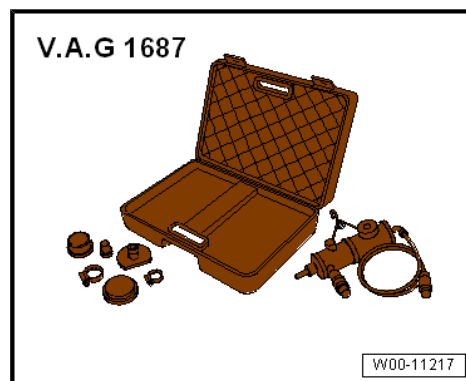
- ◆ ⇒ [“4.1.1 Exploded view - exhaust gas recirculation system, low-pressure”, page 310](#)

4.4 Checking exhaust gas recirculation cooler for leaks

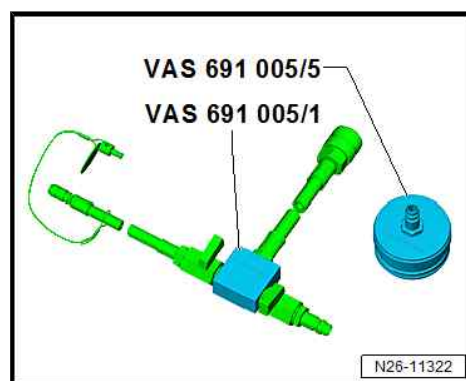
Special tools and workshop equipment required



- ◆ Charge air system tester - V.A.G 1687-

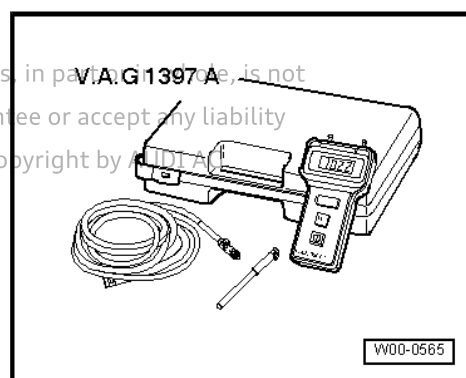


- ◆ Adapter - V.A.G 1687/11-
- ◆ Adapter - V.A.G 1687/15- for exhaust pipes with 60 mm and 65 mm diameter
- ◆ Adapter - V.A.G 1687/16- for exhaust pipe with 55 mm diameter
- ◆ Y-connector - VAS 691 005/1-



- ◆ Test instrument adapter - VAS 691 005/5-
- ◆ Turbocharger tester - V.A.G 1397A-

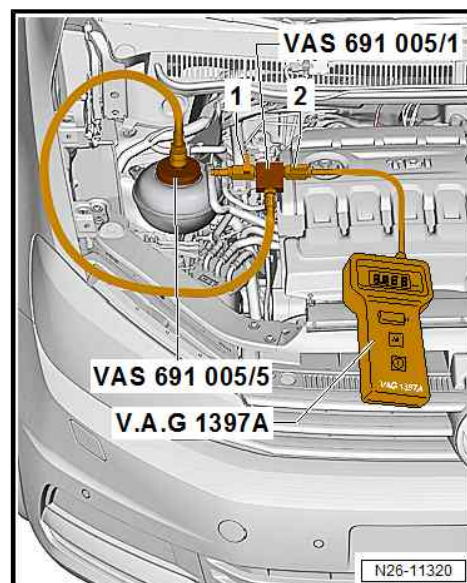
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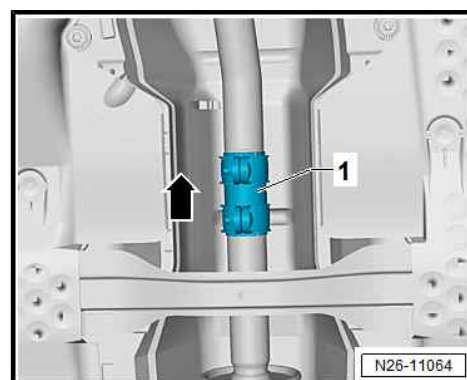
Connecting turbocharger tester - V.A.G 1397A- :

- Fit test adapter - VAS 691 005/5- onto coolant expansion tank.
- Fit Y-connector - VAS 691 005/1- onto test adapter - VAS 691 005/5- .
- Close valve -1- for connection »C« and open valve -2- for connection »A«.
- Attach hose from connection »A« on Y-connector to connection »II« on turbocharger tester - V.A.G 1397A- .
- Set turbocharger tester - V.A.G 1397A- to switch position »II« (relative pressure measurement) and switch it on. The »II« must be visible.



Connecting tester - V.A.G 1687- :

- Loosen clamp -1- on exhaust pipe and push to rear -arrow-.

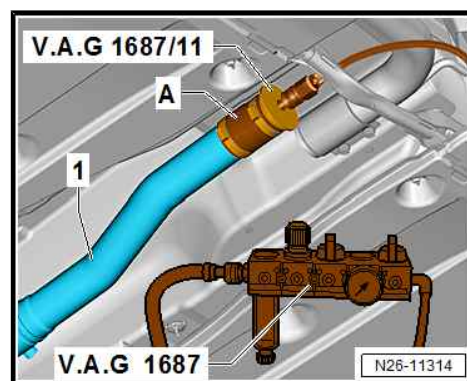


- Connect adapter - V.A.G 1687/11- with hose -A- to exhaust pipe (engine end). Secure hose with hose clips.

Hose -A- for exhaust pipes with 55 mm diameter: Use hose - V.A.G 1687/16- .

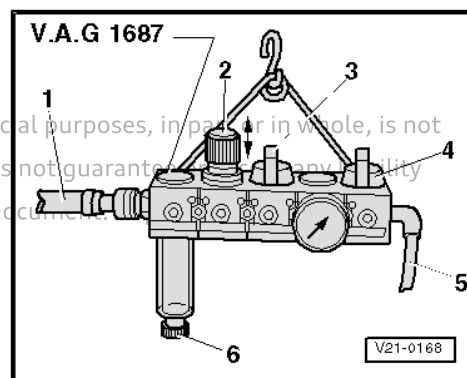
Hose -A- for exhaust pipes with 60 mm or 65 mm diameter: Use hose - V.A.G 1687/15- .

- Connect charge air system tester - V.A.G 1687- to adapter - V.A.G 1687/11- .



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-.
- Connect charge air system tester - V.A.G 1687- to compressed air hose -1-.
- If there is water in sight glass, remove drain plug -6- and drain water.



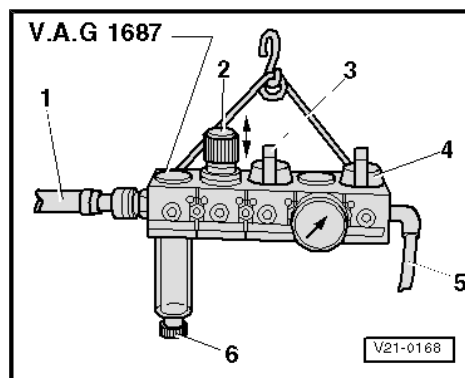


- Open valve -3-.
- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.



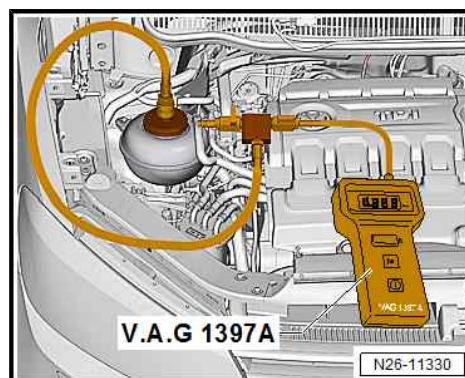
Note

A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.



Reading off values from turbocharger tester - V.A.G 1397A- :

- Observe turbocharger tester for approx. 5 minutes.
- The pressure displayed on the turbocharger tester must not rise.
- If pressure displayed on turbocharger tester rises, this means that compressed air is escaping from the exhaust end into the cooling system. There is a leak in exhaust gas recirculation cooler; renew exhaust gas recirculation cooler.



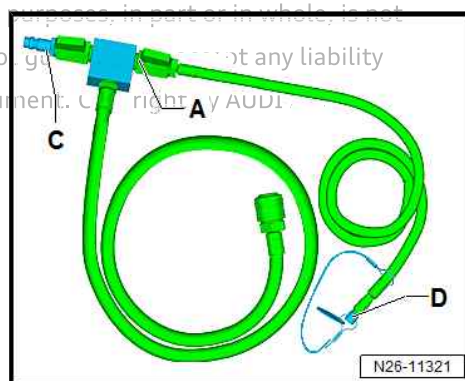
Cleaning Y-connector - VAS 691 005/1- :



Note

After the leak test has been completed, the Y-connector - VAS 691 005/1- must be cleaned to remove any water which may have entered.

- Insert cleaning nozzle -D- in hose from connection -A- on Y connector .
- Fit compressed air hose on connection -C-.
- Open cut-off valves and blow through hose for approx. 15 seconds.





28 – Glow plug system

1 Glow plug system

⇒ ["1.1 Exploded view - glow plug system", page 323](#)

⇒ ["1.2 Removing and installing glow plug", page 324](#)

⇒ ["1.3 Removing and installing automatic glow period control unit J179", page 326](#)

⇒ ["1.5 Removing and installing Hall sender G40", page 327](#)

⇒ ["1.6 Removing and installing engine speed sender G28", page 328](#)

1.1 Exploded view - glow plug system

1 - Glow plug

- ◆ Glow plug 1 - Q10-
- ◆ Glow plug 2 - Q11- with cylinder 2 combustion chamber pressure sender - G678-
- ◆ Glow plug 3 - Q12-
 - ❑ Glow plug versions
⇒ [page 325](#)
 - ❑ Glow plug without combustion chamber pressure sender: 17 Nm
 - ❑ Glow plug with combustion chamber pressure sender: 12 Nm
 - ❑ Removing and installing
⇒ [page 324](#)

2 - Electrical connector

- ❑ For glow plug

3 - O-ring

- ❑ No replacement part available; if damaged, renew Hall sender

4 - Hall sender - G40-

- ❑ Removing and installing
⇒ [page 327](#)

5 - Bolt

- ❑ 4.5 Nm

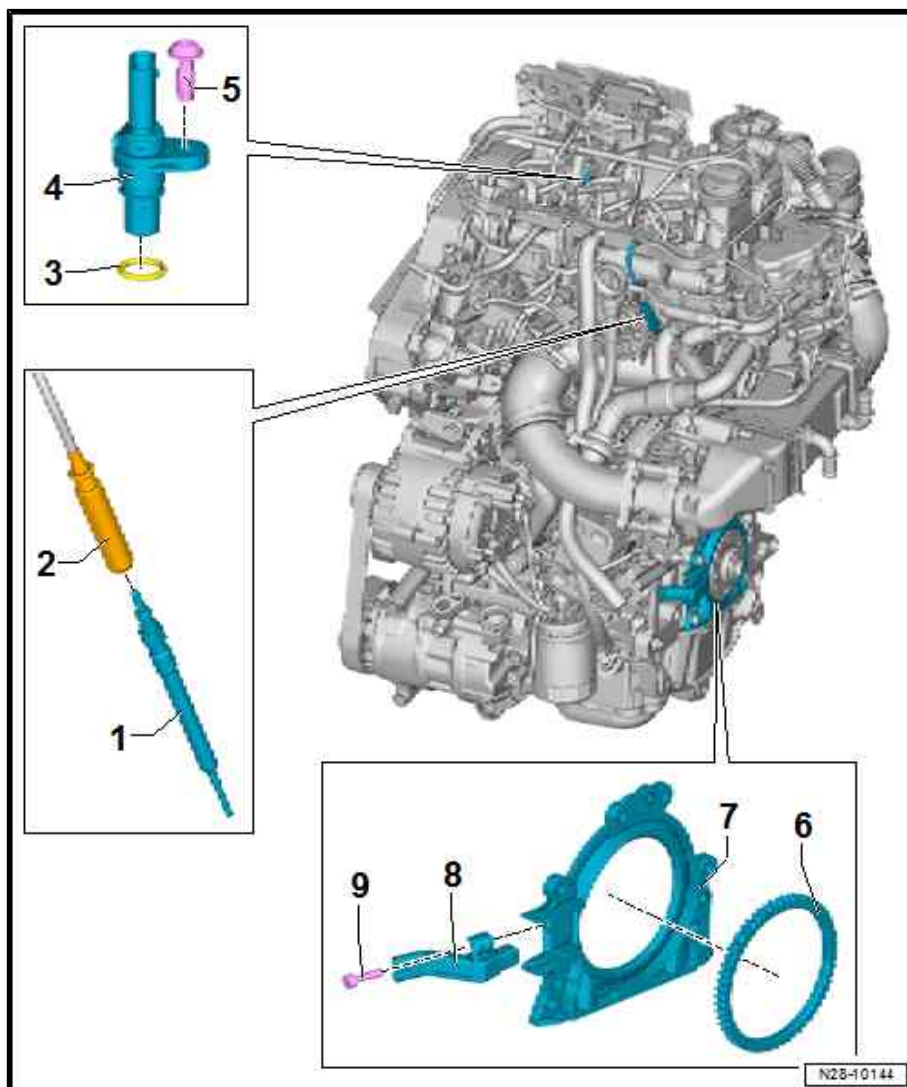
6 - Sender wheel

- ❑ For engine speed sender - G28-
- ❑ Must not be separated from sealing flange

⇒ ["2.3 Removing and installing sealing flange \(gearbox end\)", page 65](#)

7 - Sealing flange (gearbox end)

- ❑ Removing and installing ⇒ [page 65](#)



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8 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ [page 328](#)

9 - Bolt

- ❑ 9 Nm

Glow plug versions and tightening torques

1 - Glow plug with internal cylinder pressure sender

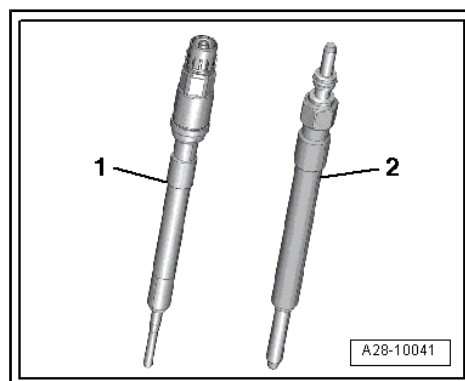
- ◆ Cylinder 2 only

- ◆ 12 Nm

2 - Glow plug without combustion chamber pressure sender

Cylinders 1 and 3

- ◆ 17 Nm



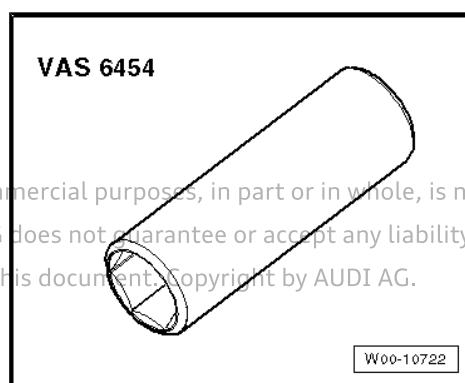
1.2 Removing and installing glow plug

Special tools and workshop equipment required

- ◆ Articulated wrench, 10 mm - 3220-



- ◆ Socket, AF 12 mm - VAS 6454- for cylinder 2



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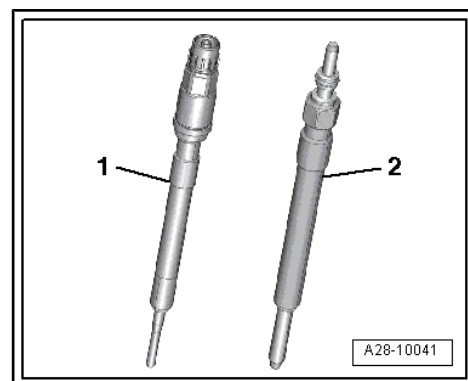
◆ Pliers - 3314-



Removing

Glow plug versions

- 1 - Glow plug with internal cylinder pressure sender - for cylinder 2 only
- 2 - Glow plug without combustion chamber pressure sender
- Remove engine cover panel ➔ [page 41](#) .

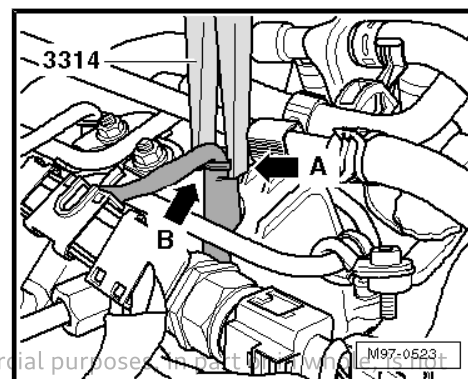


Caution

Risk of damage to support sleeves.

- ◆ *Use pliers - 3314- to remove glow plug connectors, squeezing just enough to grasp the collar of the support sleeve securely without damaging it.*

- Release retaining clips at electrical wiring harness and detach electrical connectors from glow plugs as follows.
- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B- as shown in illustration.
- Carefully detach glow plug connectors from glow plugs.
- Clean glow plug apertures in cylinder head; make sure no dirt gets into cylinder.



Note

- ◆ *Cleaning procedure:*
- ◆ *Use a vacuum cleaner to remove coarse dirt.*
- ◆ *Spray brake cleaner or suitable cleaning agent into glow plug apertures, let it work in briefly, and blow out with compressed air.*
- ◆ *Then clean the glow plug apertures using a cloth moistened with oil.*



WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

- Loosen glow plugs using tool and unscrew by hand:



With T-bar and socket, 10 mm - 3220-

- Cylinders 1 and 3



With socket insert AF 12 for glow plugs 4-cyl. TDI CR diesel - VAS 6454-

- **Cylinder 2 only**

Installing

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

- Fit glow plug connectors -1- back onto glow plugs -arrow-.



Note

Check that glow plug connectors are securely seated.

- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

- ♦ Note different tightening torques
⇒ [“1.1 Exploded view - glow plug system”, page 323](#) .

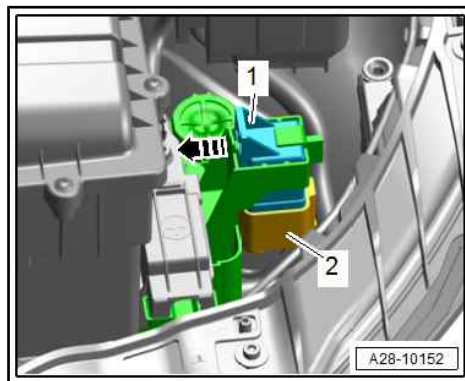
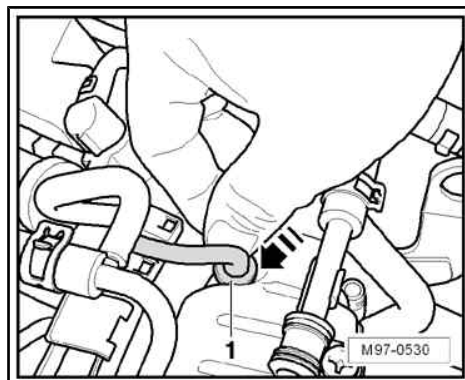
1.3 Removing and installing automatic glow period control unit - J179-

Removing

- Release catch -arrow-, detach automatic glow period control unit - J179- -item 1- downwards and unplug electrical connector -2-.

Installing

Installation is carried out in reverse sequence.

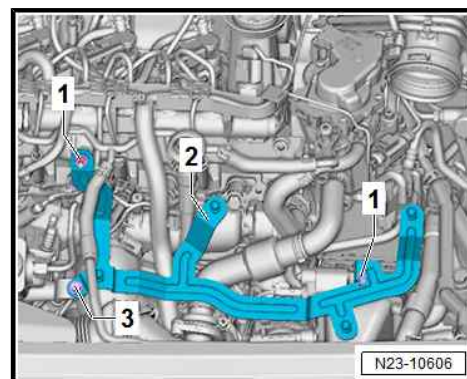




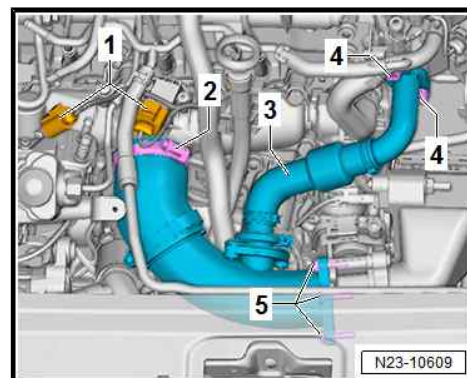
1.4 Removing and installing knock sensor 1 - G61-

Removing

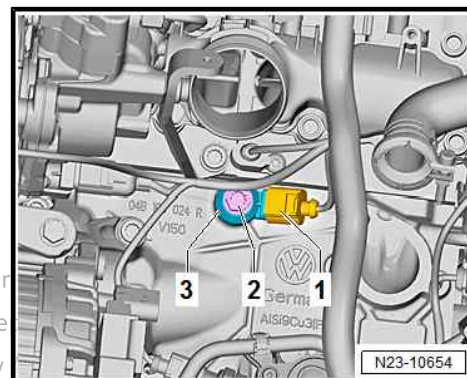
- Remove engine cover panel ➔ [page 41](#) .
- Remove air cleaner housing ➔ [page 237](#) .
- Unscrew nuts -1- and bolts -3-, and remove bracket -2-.



- Release clamp -2- and unscrew bolts -4- and -5-.
- Remove air duct with exhaust gas recirculation pipe.



- Release and unplug connector -1-, and unscrew bolt -2-.
- Detach knock sensor 1 - G61- .



Installing

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

- Install engine cover panel ➔ [page 41](#) .
- Install air cleaner housing ➔ [page 237](#) .

Tightening torques

- ◆ ➔ [Item 3 \(page 230\)](#)

1.5 Removing and installing Hall sender - G40-

Removing

- Remove engine cover panel ➔ [page 41](#) .



- Unplug electrical connector -1- and unscrew bolt -2-.
- Pull out Hall sender - G40- -3- upwards.

Installing

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



Note

Renew O-ring after removal.

- Install engine cover panel ⇒ [page 41](#) .

Tightening torques

- ⇒ [“1.1 Exploded view - glow plug system”, page 323](#)

1.6 Removing and installing engine speed sender - G28-

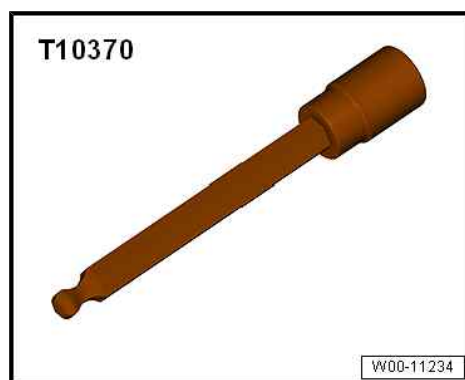
Special tools and workshop equipment required

- ◆ Assembly tool - T10118-

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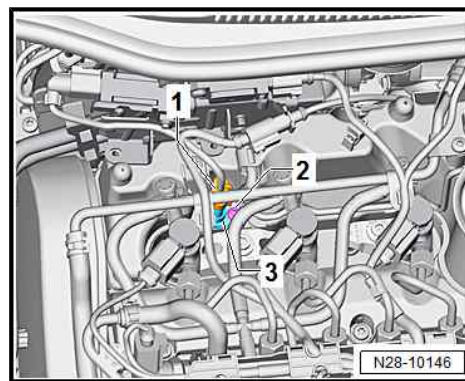


- ◆ Socket (4 mm) - T10370-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .





- Use assembly tool - T10118- to release electrical connector -1- and unplug it.



Note

- ◆ To release electrical connector without assembly tool - T10118- , use a screwdriver.
 - ◆ Press in connector on engine speed sender.
 - ◆ At the same time, lift release tab with a thin wire hook.
- Unscrew bolt -2- and detach 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 - glow plug system", page 323](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

