



Workshop Manual Audi A1 2011 ➤

4-cylinder TDI engine (1.6 ltr. 4-valve common rail)

Engine ID	CAY C	CAY B							
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Edition 05.2019



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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

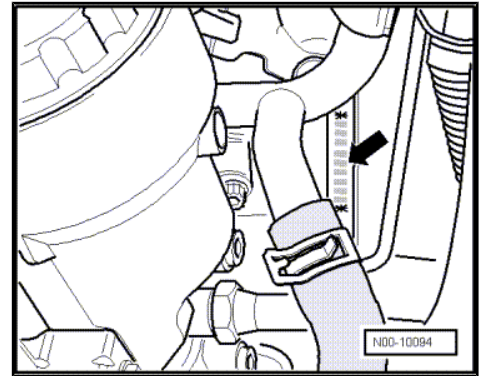
(ARL006475; Edition 05.2019)

⇒ **"1.1 Engine number/engine data", page 1**

1.1 Engine number/engine data

Engine number

- ◆ The engine number ("engine code" and "serial number") -arrow- can be found at the front of the joint between engine and gearbox.
- ◆ There is also a sticker with "engine code" and "serial number" attached to the toothed belt cover.
- ◆ 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.



Note

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- ◆ *The four-letter engine code is found on the type plate (certain countries only), vehicle data sticker and engine control unit.*
- ◆ *Fitting locations of the type plate (certain countries only) and the vehicle data sticker ⇒ Maintenance ; Booklet 819 .*

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



2 Safety precautions

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

⇒ [“2.2 Safety precautions when working on vehicles with start/stop system”, page 4](#)

⇒ [“2.3 Safety precautions when using testers and measuring instruments during a road test”, page 4](#)

⇒ [“2.4 Safety precautions when working on the cooling system”, page 4](#)

⇒ [“2.5 Safety precautions when working on the exhaust system”, page 5](#)

2.1 Safety precautions when working on the fuel 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.

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).



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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 222](#) .

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.

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Caution

The high-pressure pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start quickly after parts have been renewed, it is important to observe the following:

- ◆ *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 ⇒ [page 222](#) .*
- ◆ *If the high-pressure pump is removed or renewed, the first fuel filling operation must be performed before the engine is started for the first time ⇒ [page 222](#) .*

Observe the following points to prevent personal injuries and damage to the injection and glow plug system:

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as injectors and gas-discharge headlights.
- ◆ Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off ignition before washing engine.
- ◆ When installing, note colour coding of plug-in connectors.
- ◆ Plug-in connectors should engage audibly when connecting.
- ◆ Pull plug-in connectors to check that they are correctly engaged.
- ◆ Erase any entries in event memory resulting from testing or installation ⇒ Vehicle diagnostic tester, Vehicle self-diagnosis, then Interrogate event memory.



Caution

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

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .*



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

Please note the following when working on vehicles with start/stop system:

Risk of injury - engine may start unexpectedly

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

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

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

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

Risk of injury if test equipment is not secured

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

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

Or:

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

2.4 Safety precautions when working on the cooling system

When working on the cooling system note the following:

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.



Caution

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

- ◆ *Close filler cap on coolant expansion tank (make sure it engages).*



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.

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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 Nuts, bolts”, page 8](#)

⇒ [“3.5 Identification plates”, page 8](#)

⇒ [“3.6 Use of impact wrenches”, page 8](#)

⇒ [“3.7 Foreign particles in engine”, page 9](#)

⇒ [“3.8 Contact corrosion”, page 9](#)

⇒ [“3.9 Routing and attachment of pipes, hoses and wiring”, page 9](#)

⇒ [“3.10 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.
- ◆ Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- ◆ After removal, place parts on a clean surface and cover them. Only use lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have 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.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.
- ◆ 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.
- ◆ 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](#).
- ◆ The glow plug system is activated via the automatic glow period control unit - J179-. The automatic glow period control unit - J179- is capable of self-diagnosis.
- ◆ A fault is stored in the event memory of the engine control unit - J623- if a fault occurs in the glow plug system.
- ◆ The procedure for checking the glow plug system is described in the "Guided Fault Finding".
- ◆ For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit.
- ◆ Each glow plug is activated and diagnosed separately.

3.3 General repair instructions



Caution

The high-pressure pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start quickly after parts have been renewed, it is important to observe the following:

- ◆ ***If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be filled and bled before the engine is started for the first time ⇒ [page 222](#).***

- ◆ 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

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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 Nuts, bolts

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

3.5 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.



3.6 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.

3.7 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 202](#)*

3.8 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).
For this reason, only fasteners with a special surface coating are fitted.

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

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

Please note:

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

3.9 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.

- ◆ To avoid damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (limited space in engine compartment).

3.10 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

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⇒ "1.2 Separating engine and gearbox", page 24

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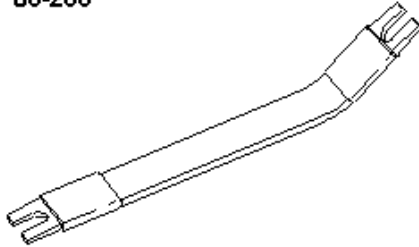
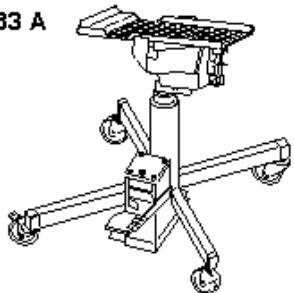
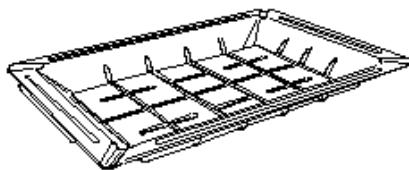
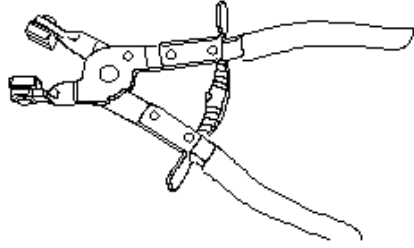
⇒ "1.3 Securing engine to engine and gearbox support",

page 27

⇒ "1.4 Installing engine", page 29

1.1 Removing engine

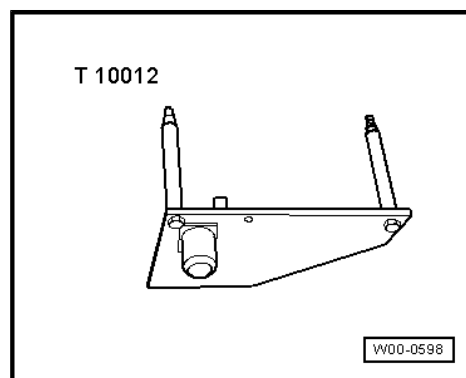
Special tools and workshop equipment required

80-200 	V.A.G 1383 A 
VAS 5085 	VAS 6122 
VAS 6208 	VAS 6362  G13-10035

- ◆ Removal lever - 80 - 200-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Stepladder - VAS 5085-
- ◆ Engine bung set - VAS 6122-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-



◆ Engine bracket - T10012-



- ◆ Safety goggles
- ◆ Protective gloves

Procedure



Note

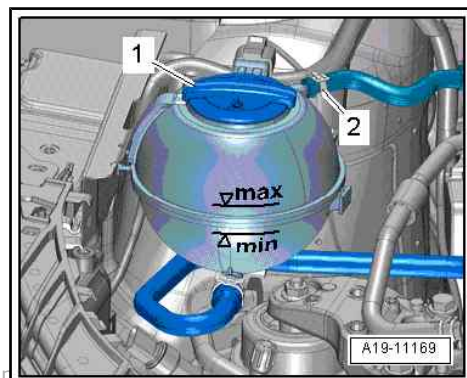
- ◆ The engine is removed from underneath together with the gearbox.
- ◆ Fit cable ties in the original positions when installing.



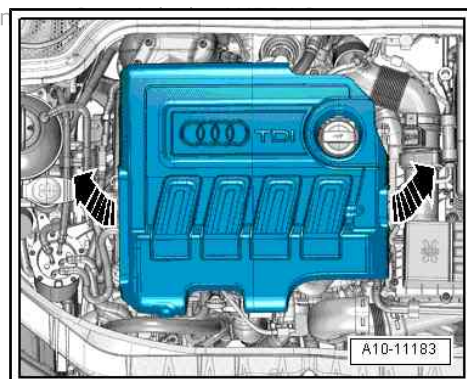
WARNING

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.

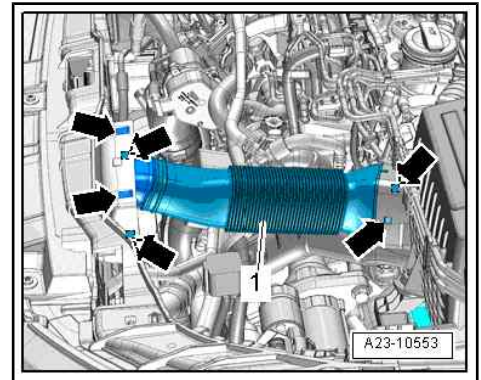


- Open filler cap -1- on coolant expansion tank.
- Release hose clip -2- and detach coolant hose.
- Remove engine cover panel -arrows-.
- Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

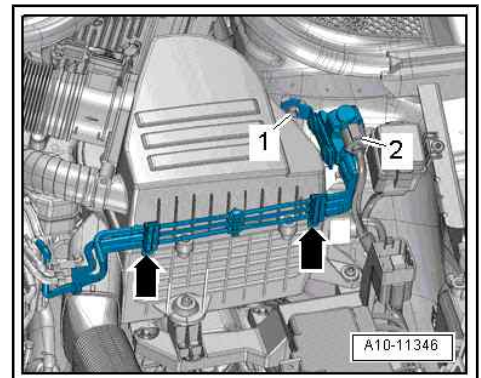




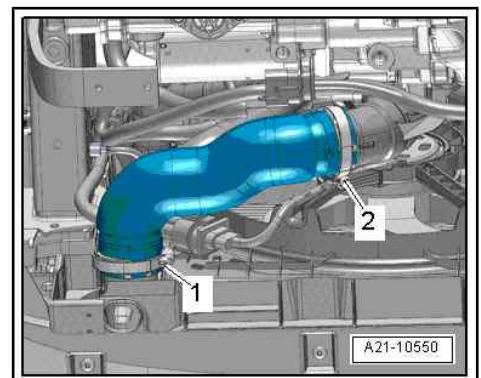
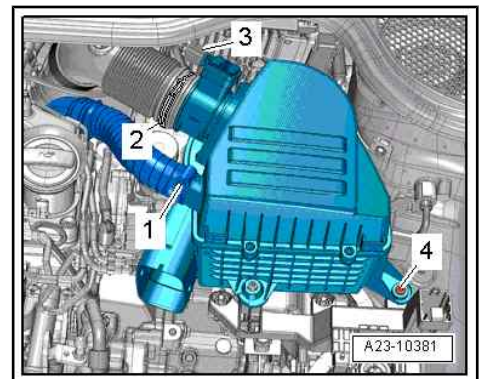
- Release fasteners -arrows- and detach air pipe -1-.



- Unplug electrical connector -2-.
- Remove bolt -1-.
- Move clear vacuum hoses -arrows- and lay turbocharger air recirculation valve - N249- on top of engine.



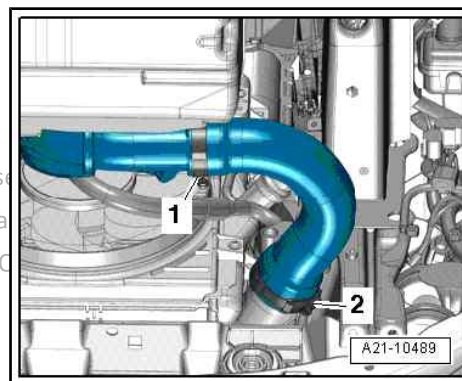
- Unplug electrical connector -3- at air mass meter - G70- .
- Release hose clip -2- and detach air hose.
- Version for countries with cold climates: Release hose clip -1- and detach air hose.
- Unscrew bolt -4- and detach air cleaner housing.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove wheel housing liners (front left and front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Release hose clips -1- and -2- and remove air hose (bottom left).
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .



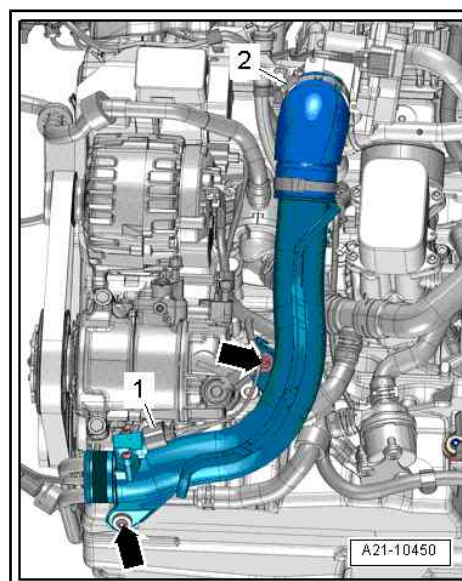


- Release hose clips -1- and -2- and remove air hose (bottom right).
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .

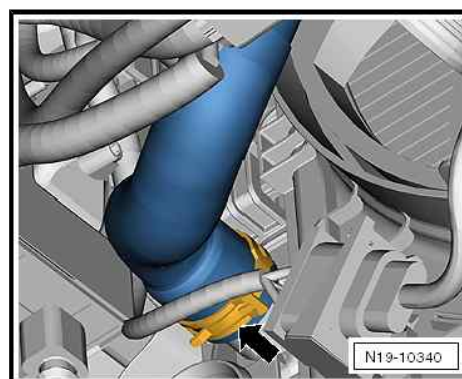
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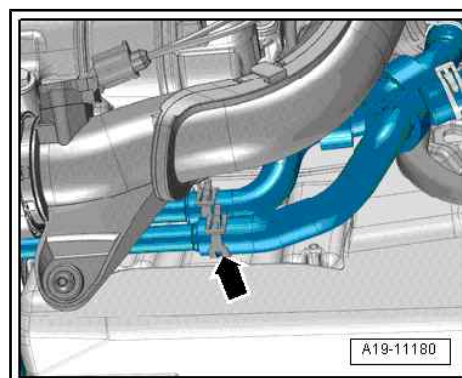
- Remove bolts -arrows-.
- Release hose clip -2-.
- Unplug electrical connector -1- on charge pressure sender - G31- / intake air temperature sender - G42- and move clear electrical wiring.
- Detach air pipe (right-side).



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Release hose clip -arrow-, disconnect coolant hose from bottom of radiator and drain off coolant.

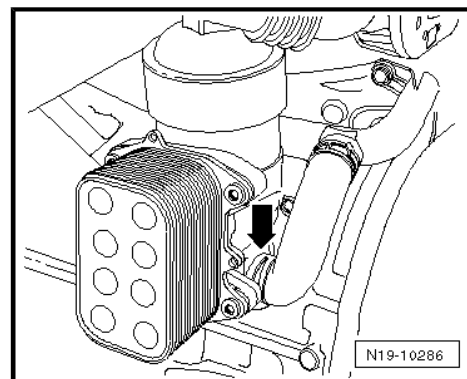


- Release hose clip -arrow-, disconnect coolant hose from coolant pipes (right-side) and drain off coolant.

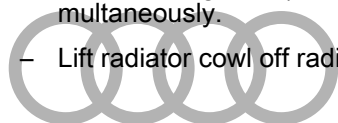




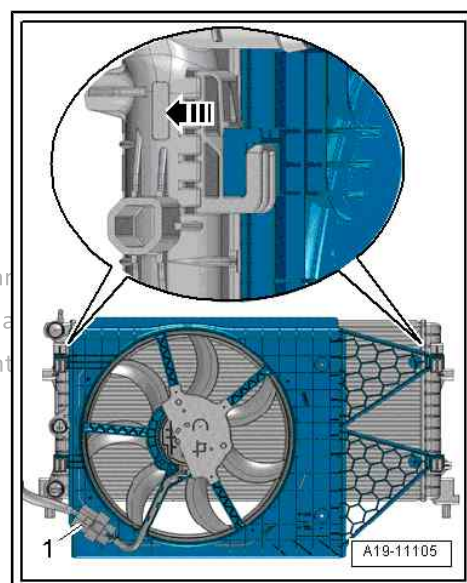
- Release hose clip -arrow-, disconnect coolant hose at oil filter housing and drain off remaining coolant.



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



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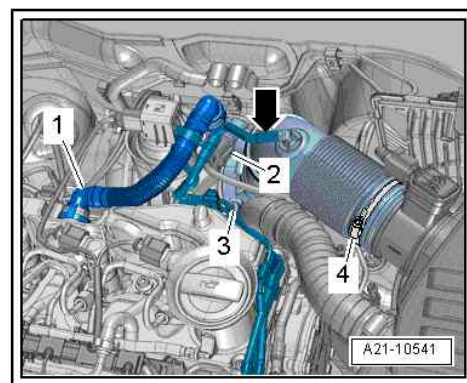


- Version for countries with cold climates: Unplug electrical connector -2-.
- Disconnect vacuum hose -arrow-.
- Press release tabs and disconnect crankcase breather hose -1- from cylinder head cover.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.

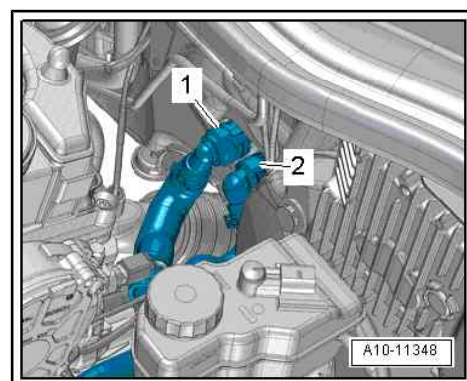


Note

Disregard -item 4-.

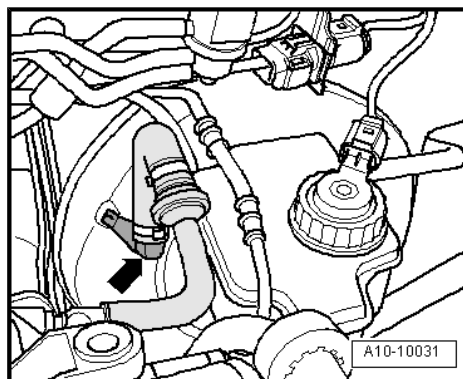


- Place drip tray for workshop hoist - VAS 6208- under connection.
- Lift retaining clips -1 and 2- and disconnect coolant hoses from heat exchanger for heater.
- Guide coolant hoses downwards and drain off coolant.

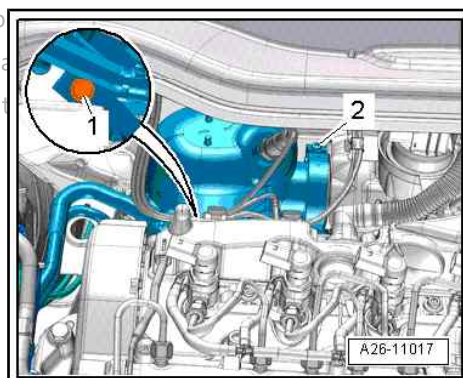




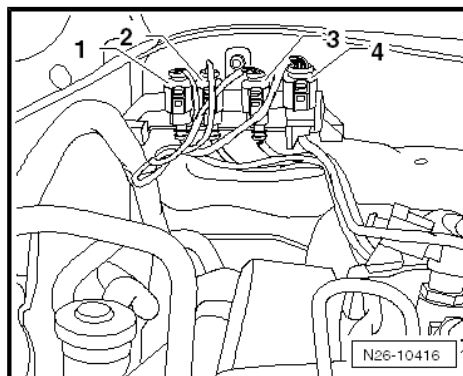
- Detach vacuum hose from brake servo -arrow-.



- Slacken bolt -2- and remove clamp.
- Remove bolt -1-.

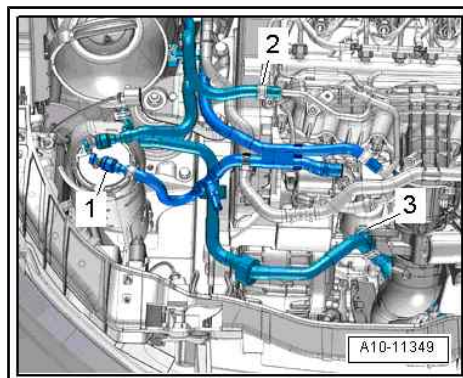


- Take electrical connector -1- for exhaust gas temperature sender 1 - G235- out of bracket and unplug.
 - Move clear electrical wiring at engine:
- 2 - For exhaust gas temperature sender 3 - G495-
 - 3 - For exhaust gas temperature sender 4 - G648-
 - 4 - For Lambda probe - G39-

**WARNING**

Very hot fuel - risk of burn injuries!

- ◆ *After switching off the engine, the temperature of fuel pipes and the fuel itself can be up to 100 °C in extreme cases. Let fuel cool off before opening any connections; otherwise there is a danger of scalding!*
- ◆ *Put on protective gloves.*
- ◆ *Put on safety goggles.*

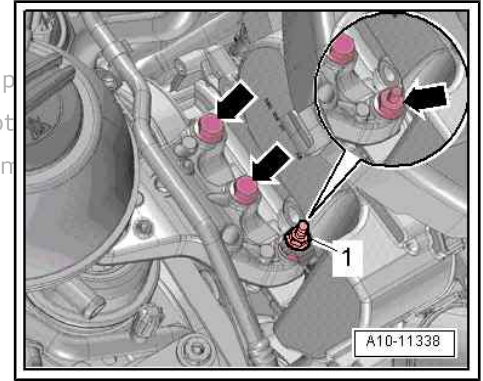


- Press release tabs at connector -1-, release hose clip -2- and detach fuel hoses.
- Release hose clip -3- and detach coolant hose.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

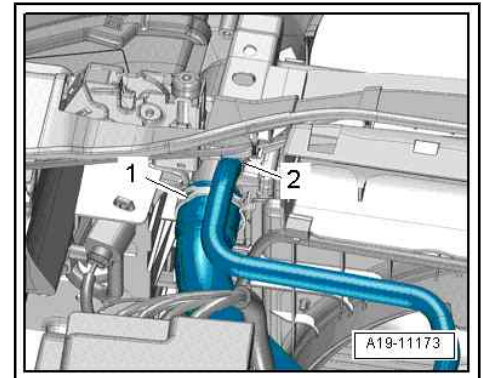


- Remove nut -1- and move earth wire clear.
- Loosen bolts -arrows- for support arm of engine mounting approx. 2 turns.

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

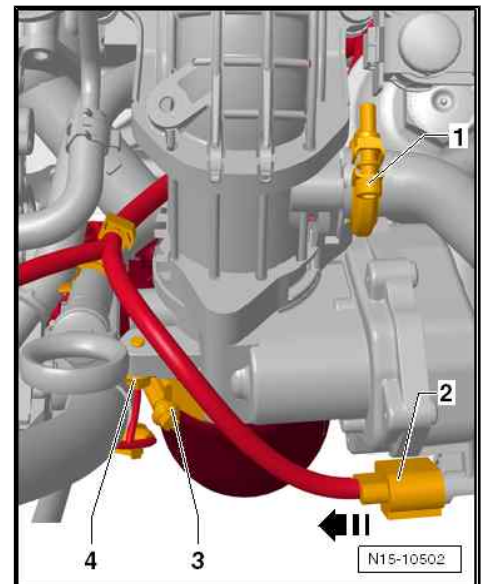


- Unplug electrical connector -2- at throttle valve module -J338- -arrow-.



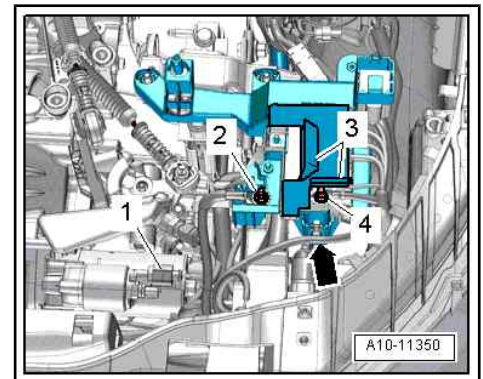
Note

Disregard -items 1, 3, 4-.



Vehicles with manual gearbox:

- Unplug electrical connector -1- at starter.
- Open covers -3-.
- Remove nuts -2 and 4- and move electrical wiring clear -arrow-.



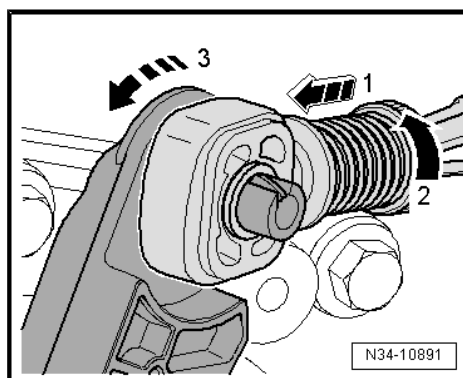
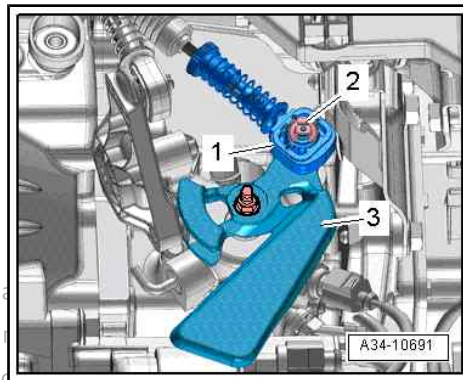


- Detach securing clip -2-.
- Detach gear selector cable -1- from gearbox selector lever -3-.

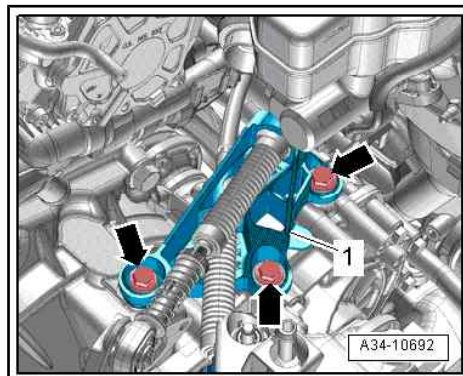


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- To prevent damage to gate selector cable, cable end-piece must be detached from gate selector cable before removing.
- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press relay lever towards front -arrow 3-.



- Remove bolts -arrows-, detach cable support bracket -1- and place to one side with selector cables attached.



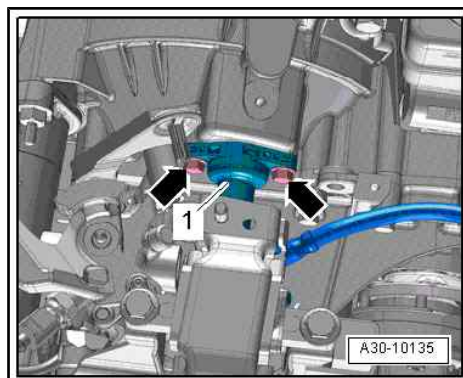
- Remove bolts -arrows-, detach clutch slave cylinder -1- and place to one side; do not open pipes.



Caution

Risk of irreparable damage to clutch slave cylinder.

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



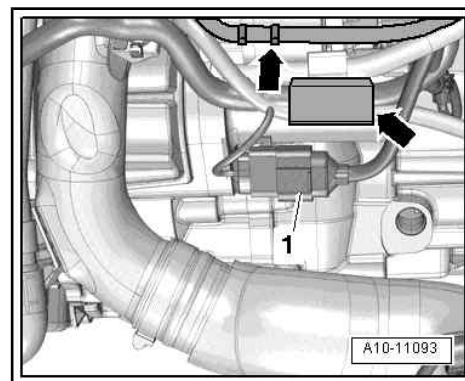


- Unplug electrical connector -1-.

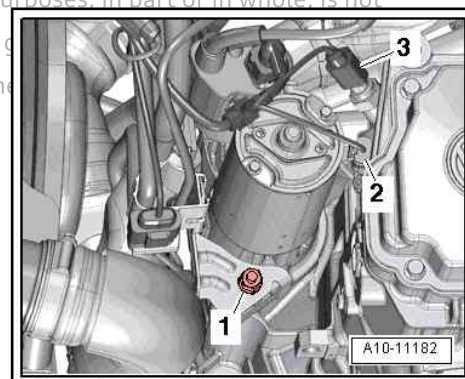


Note

Disregard -arrows-.



- Vehicles with start/stop system: unplug electrical connector -3- for gearbox neutral position sender - G701-.
- Unplug electrical connector -2- at reversing light switch - F4-.
- Unscrew nut -1- and detach bracket for electrical wiring.



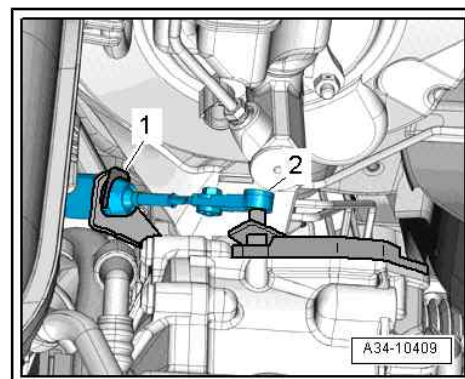
Vehicles with 7-speed dual clutch gearbox 0AM:

- Use removal lever - 80 - 200- to prise selector lever cable -2- off gearbox selector lever.
- Pull off securing clip -1-, detach selector lever cable and move clear to one side.



Note

Take care not to bend or kink selector lever cable.

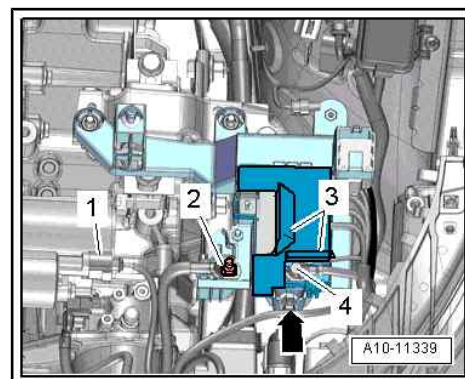


- Unplug electrical connector -1- at starter.
- Open covers -3-.
- Unscrew nut -2- and move clear electrical wiring going to starter.
- Move clear electrical wiring -arrow-.



Note

Disregard -item 4-.





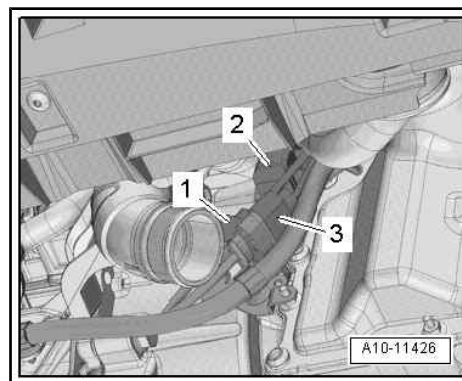
- Detach electrical connectors -1 and 3- from bracket and unplug.



Caution

Risk of serious damage to gearbox components.

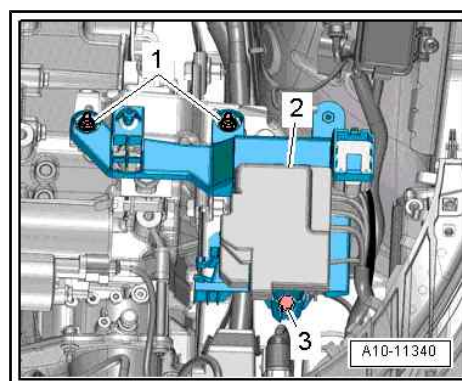
- ◆ **Do NOT touch connector contacts in gearbox connector with your hands. Doing so could cause static discharge to damage the control unit and the mechatronic unit irreparably.**



- Touch vehicle earth with bare hands to eliminate any static charge.
- Unplug electrical connector -2- for mechatronic unit for dual clutch gearbox - J743- .

All vehicles (continued):

- Unscrew nuts -1- and bolt -3-, and push electronics box -2- to the side.
- Remove engine control unit ⇒ [page 282](#) .

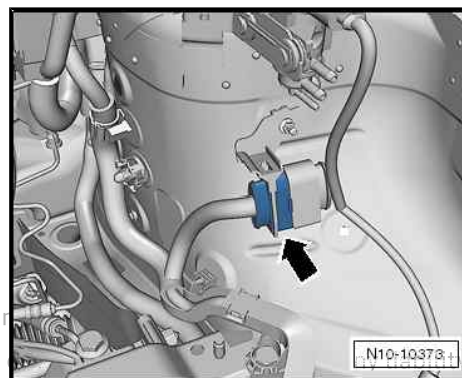


- Unplug electrical connector -arrow-.

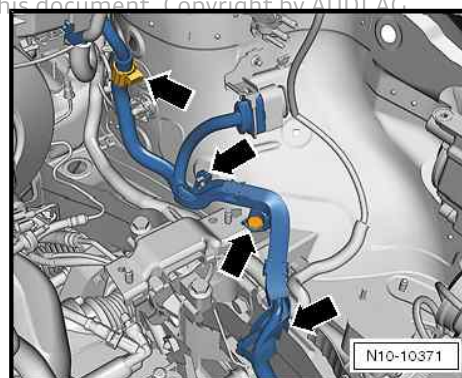


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- Move engine wiring harness clear -arrows- and lay on top of engine.





Vehicles with air conditioner compressor and tensioner:

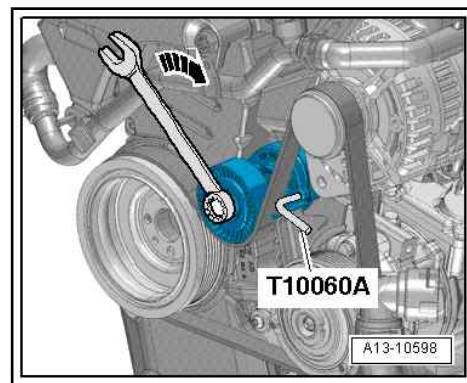


Caution

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.*

- Move tensioner in clockwise direction -arrow- to slacken poly V-belt.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.



Vehicles with air conditioner compressor and tensioning roller:

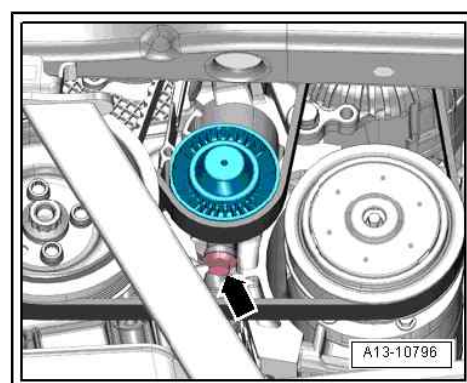


Caution

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.*

- Remove bolt -arrow- and detach tensioner to slacken poly V-belt.
- Take off poly V-belt.



All vehicles with air conditioner compressor (continued):

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

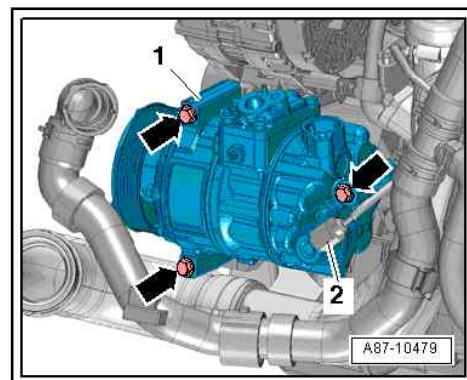


Caution

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 -1- with pipe/hose assemblies connected and tie up to front.
- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .



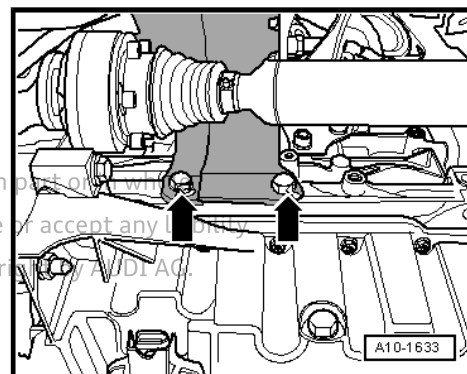
All vehicles (continued):

- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Unbolt drive shaft (left and right) from gearbox flange shaft.
- Tie up drive shaft (left-side).



Note

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





WARNING

Risk of accident.

- ◆ **Do NOT loosen bolted connection -1-.**

- Remove bolts -arrows- and detach pendulum support.

- Unscrew nuts -arrows- for swivel joint (right-side).
- Disengage swivel joint (right-side) from wishbone.



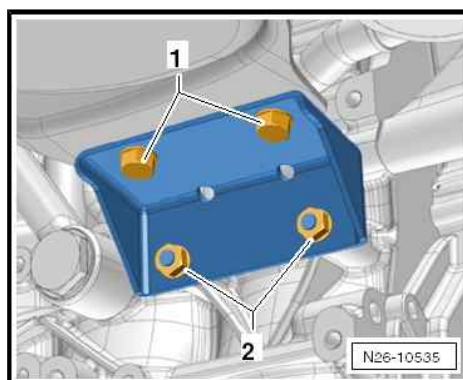
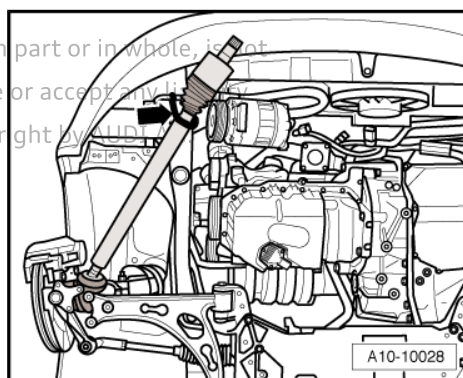
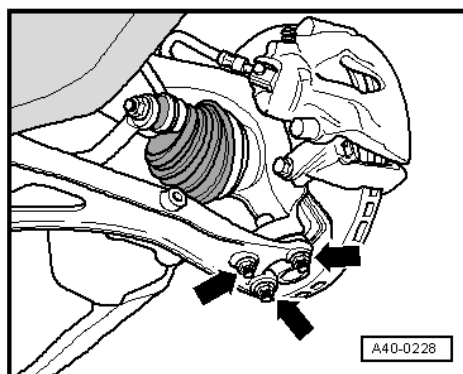
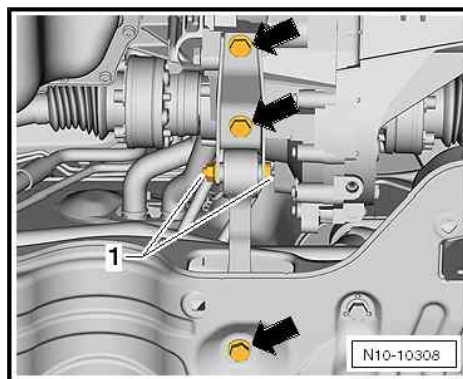
- Pivot drive shaft (right-side) forwards; to do so, push engine/gearbox assembly slightly forwards.
- Tie up drive shaft to longitudinal member -arrow-.



Note

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

- Remove bolts -1- and nuts -2- and detach bracket for particulate filter.
- Tie up particulate filter.



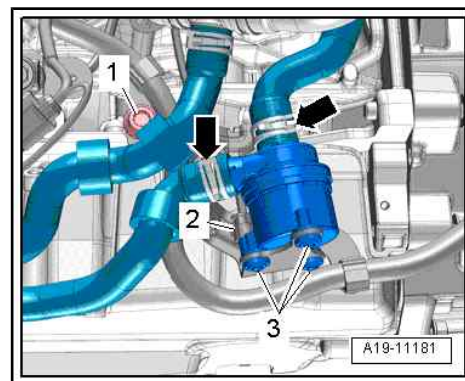


- Unscrew bolt -1- and press pump for exhaust gas recirculation cooler - V400- to the side.

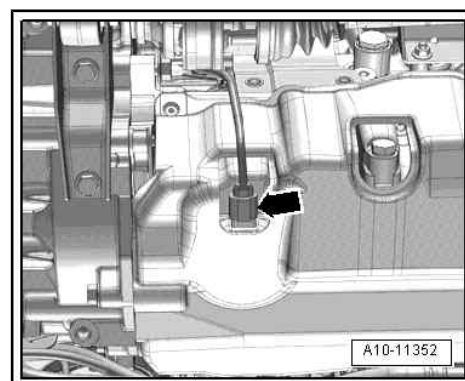


Note

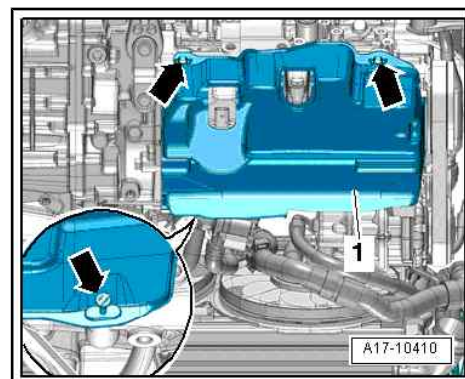
Disregard items marked -2, 3- and -arrows-.



- Unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .



- Release fasteners -arrows- and remove noise insulation -1- for sump.



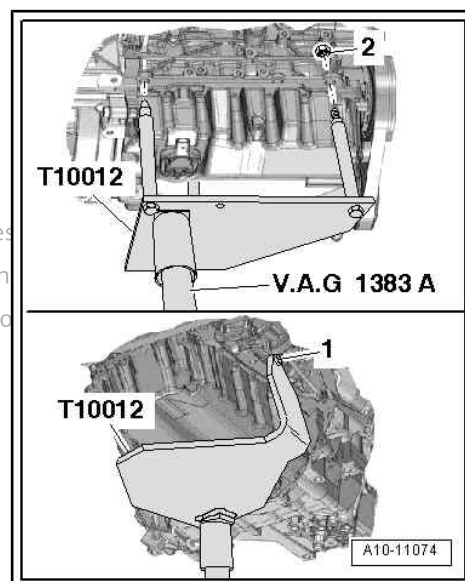
- Secure engine bracket - T10012- to cylinder block with bolt -1- and nut -2- (tightening torque: approx. 20 Nm).
- Insert engine and gearbox jack - V.A.G 1383 A- in engine bracket - T10012- and raise engine/gearbox assembly slightly.



Note

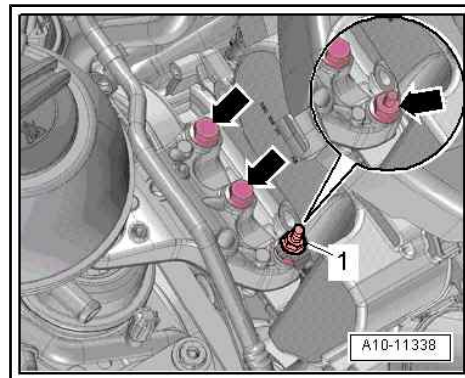
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To unscrew bolts for assembly mounting use stepladder - VAS 5085- .

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



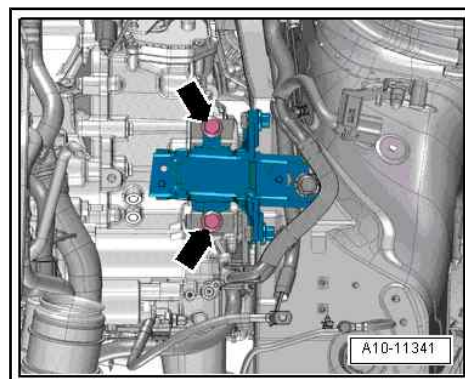
- Remove bolts -arrows- securing gearbox mounting -1-.



Caution

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

- ◆ ***Check that all hydraulic lines, vacuum lines and electrical wiring between engine, gearbox, subframe 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 24**

⇒ **"1.2.2 Separating engine and gearbox - vehicles with dual clutch gearbox", page 26**

1.2.1 Separating engine and gearbox - vehicles with manual gearbox

Special tools and workshop equipment required

- ◆ Hooks - 10 - 222 A /2-



10-222 A/2



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- ◆ Workshop hoist - VAS 6100-



- ◆ Lifting tackle - T40013-

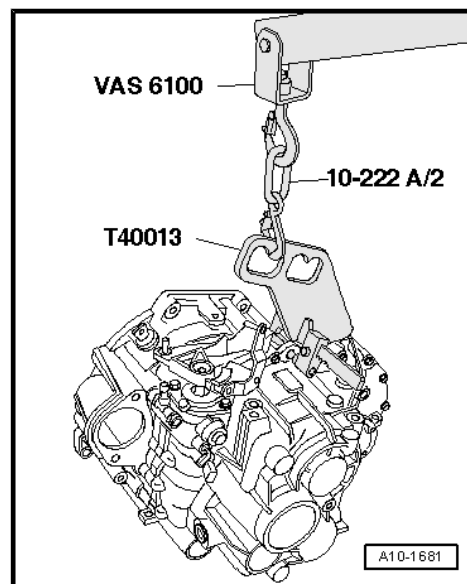


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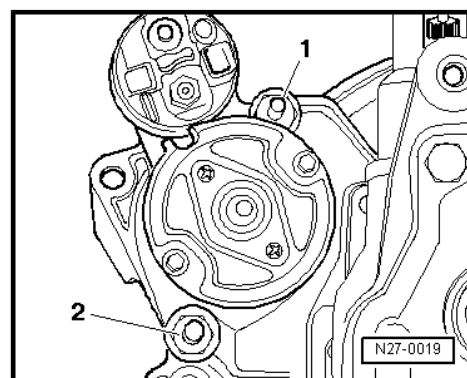


Procedure

- Engine/gearbox assembly removed and attached to engine support - T10012- .
- Attach lifting tackle - T40013- to gearbox and close lock.
- Attach workshop hoist - VAS 6100- with hooks - 10 - 222 A / 2- to the lifting tackle.



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



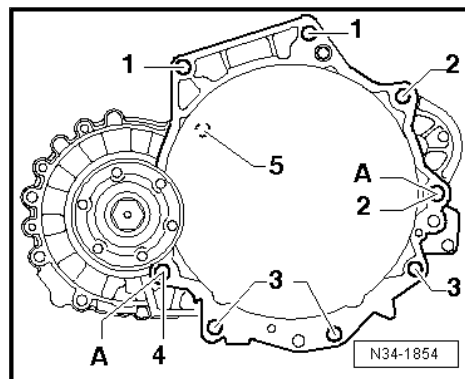


- Remove bolts -1, 3, 4- securing gearbox to engine.
- Detach gearbox from engine.



Note

Disregard -items 2, 5, A-.



1.2.2 Separating engine and gearbox - vehicles with dual clutch gearbox

Special tools and workshop equipment required

- ◆ Shackle - 10 - 222 A /12-



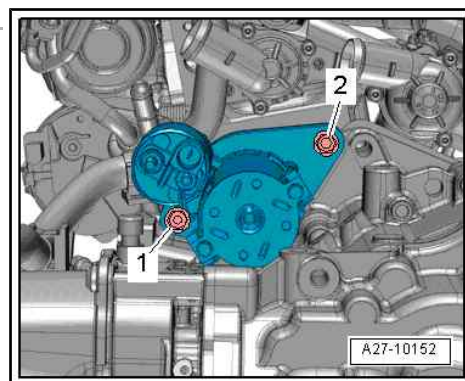
- ◆ Workshop hoist - VAS 6100-



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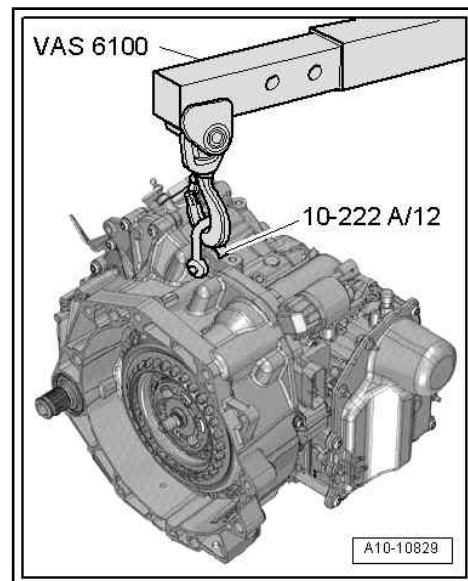
Procedure

- Engine/gearbox assembly removed and attached to engine support - T10012- .
- Move electrical wiring harness clear at gearbox.
- Unscrew bolts -1 and 2- and detach starter from gearbox.





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



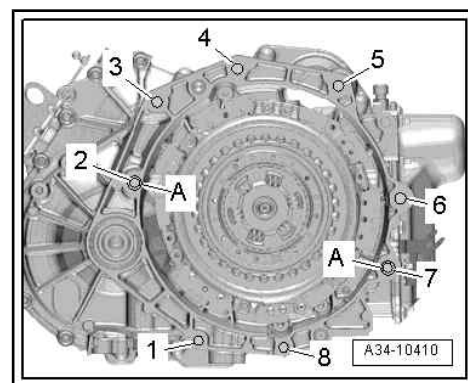
- Remove bolts -1 ... 8- securing gearbox to engine.



Note

Disregard -item A-.

- Detach gearbox from engine.



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

- ♦ Engine and gearbox support - VAS 6095A-





◆ Workshop hoist - VAS 6100-



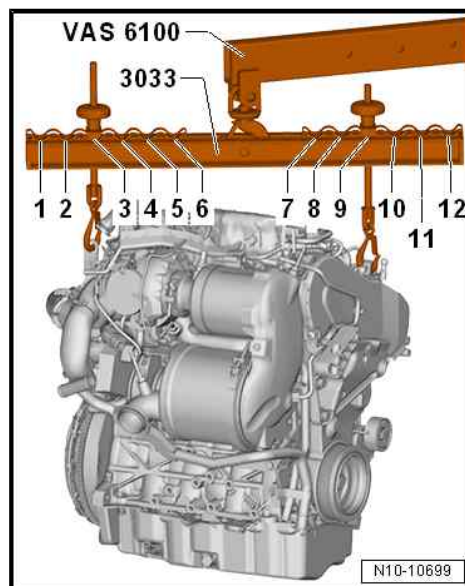
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◆ Lifting tackle - 3033-

**Procedure**

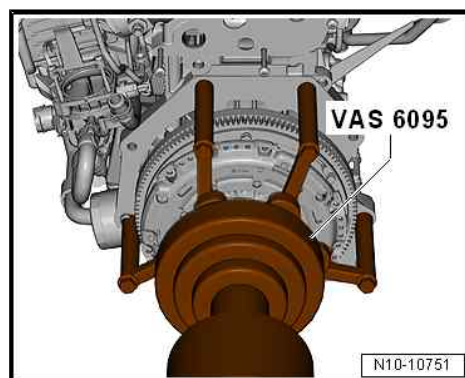
- Gearbox detached from engine.
 - Attach lifting tackle - 3033- to engine and workshop hoist - VAS 6100- as shown in illustration.
- ◆ Gearbox end: position 3.
- ◆ Pulley end: position 9.
- Lift engine off engine bracket - T10012- using workshop hoist - VAS 6100- .



- Secure engine to engine and gearbox support - VAS 6095A- using universal support - VAS 6095/1- .

Tightening torque

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





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 vor-geschriebenes 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.

Tightening torques



Note

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

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

- ◆ Assembly mountings
⇒ ["2.1 Exploded view - assembly mountings", page 33](#)
- ◆ Securing gearbox to engine ⇒ Rep. gr. 34 : Removing and installing gearbox; Tightening torques for gearbox

Procedure

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

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



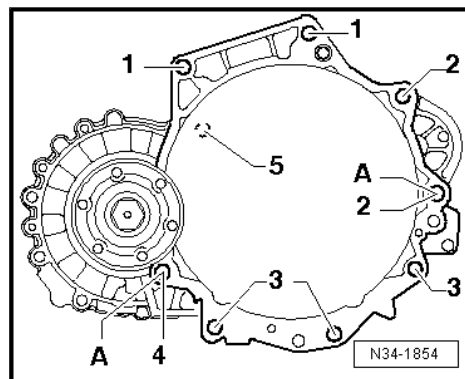
Note

- ◆ Vehicles with dual clutch gearbox: The needle bearing in the crankshaft must always be renewed if the engine has been separated from the gearbox
⇒ ["3.3 Renewing needle bearing in crankshaft", page 74](#) .
 - ◆ Renew the bolts tightened with specified tightening angle.
 - ◆ Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.
 - ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue* .
 - ◆ Fit all cable ties in the original positions when installing.
- Install intermediate plate ⇒ [page 64](#) .



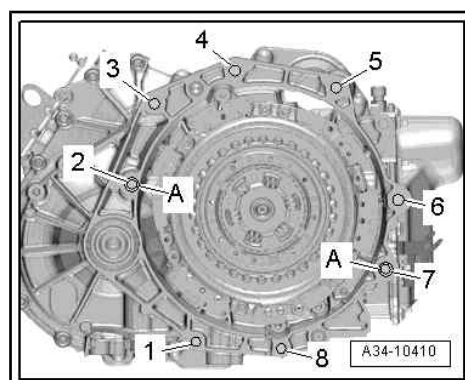
Vehicles with manual gearbox:

- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Renew clutch release bearing if worn ⇒ Rep. gr. 30 ; Clutch mechanism; Exploded view - 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.



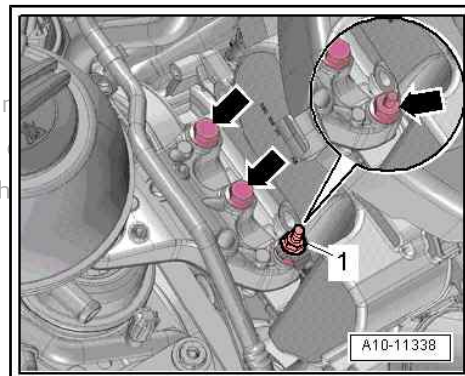
Vehicles with 7-speed dual clutch gearbox 0AM:

- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Install needle bearing if not fitted in crankshaft ⇒ [page 74](#) .



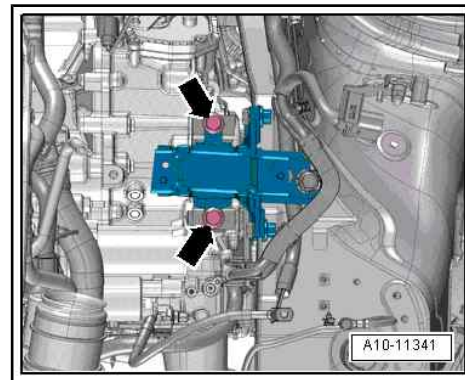
All vehicles (continued):

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





- Initially screw in bolts -arrows- for gearbox mounting by hand until they make contact.
- Remove engine bracket - T10012- from engine.
- Install clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch slave cylinder .
- Install starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Exploded view - starter .
- Install pump for exhaust gas recirculation cooler - V400- ⇒ [page 183](#) .
- Install pendulum support ⇒ [page 42](#) .
- Install drive shafts and heat shield ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft
- Install wishbone, swivel joint and coupling rod ⇒ Running gear, axles, steering; Rep. gr. 40 ; Lower wishbone, swivel joint; Exploded view - lower wishbone, swivel joint .
- Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator .
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit .
- Install poly V-belt ⇒ [page 51](#) .
- Install cables with cable support bracket or selector lever cable ⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector cables .
- Install engine control unit ⇒ [page 282](#) .
- Install electronics box ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes .
- Install support arm of engine mounting ⇒ [page 33](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install particulate filter ⇒ [page 294](#) .
- Connect coolant hoses with plug-in connector ⇒ [page 193](#) .
- Install air pipe with connection ⇒ [page 200](#) .
- Install air pipe ⇒ [page 206](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install radiator cowl ⇒ [page 197](#) .
- Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Install air cleaner housing ⇒ [page 229](#) .
- Install wheel housing liners ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Check oil level ⇒ Maintenance ; Booklet 819 .



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Caution

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

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



Note

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Do not reuse coolant.

– Fill up with coolant ⇒ [page 164](#) .



2 Assembly mountings

⇒ "2.1 Exploded view - assembly mountings", page 33

⇒ "2.2 Removing and installing engine mountings", page 34

⇒ "2.3 Removing and installing gearbox mounting", page 38

⇒ "2.4 Removing and installing pendulum support", page 42

2.1 Exploded view - assembly mountings

1 - Engine support

2 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 34](#)

3 - Engine mounting

- ☐ Removing and installing ⇒ [page 34](#)

4 - Bolt

- ☐ Renew
- ☐ 20 Nm +90°

5 - Support arm

6 - Nut

- ☐ Do not loosen unless renewing engine mounting - item 3-
- ☐ Renew
- ☐ 40 Nm +90°

7 - Threaded pin

- ☐ Renew
- ☐ 30 Nm +90°

8 - Bolt

- ☐ Renew
- ☐ 30 Nm +90°

9 - Pendulum support

- ☐ Removing and installing ⇒ [page 42](#)

10 - Bolt

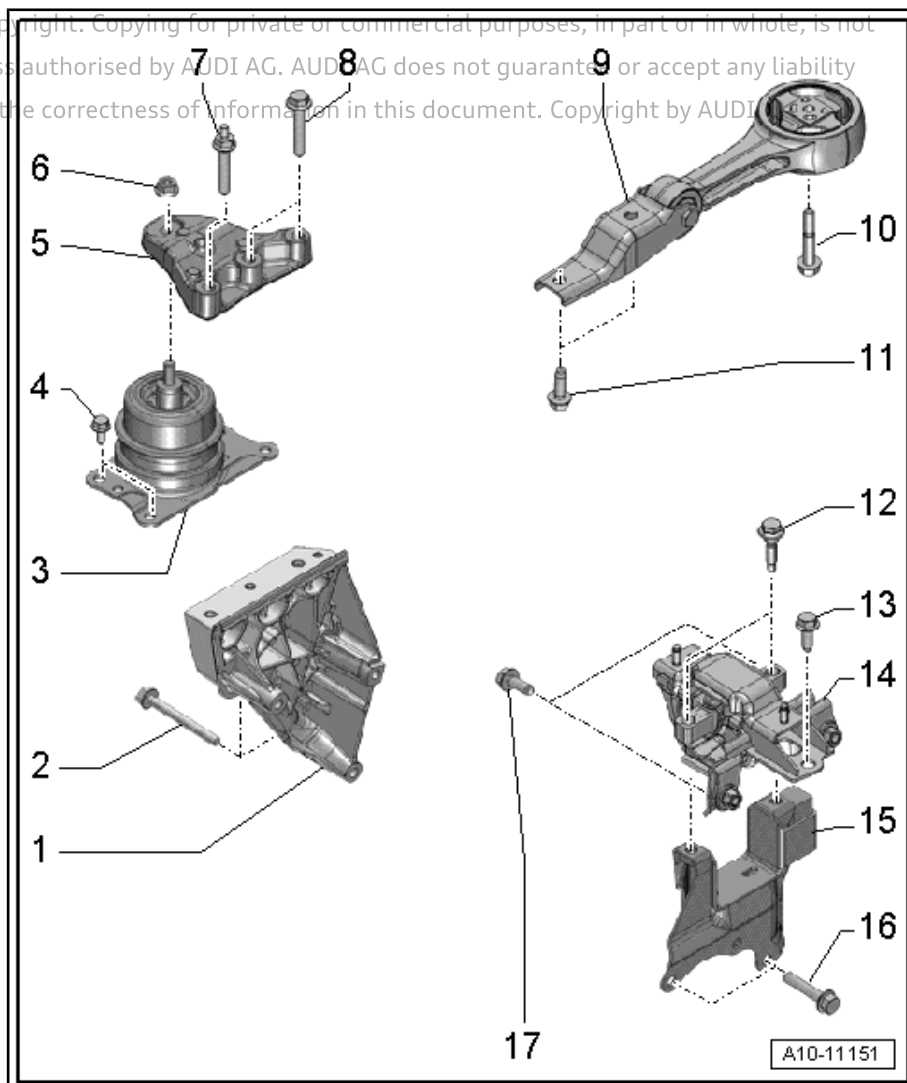
- ☐ Pendulum support to subframe
- ☐ Renew after removing
- ☐ 40 Nm +90°

11 - Bolt

- ☐ Pendulum support to gearbox
- ☐ Renew after removing
- ☐ 30 Nm +90°

12 - Bolt

- ☐ Gearbox mounting to body
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings





13 - Bolt

- ☐ Gearbox mounting to body
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

14 - Gearbox mounting

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

15 - Gearbox support

- ☐ Removing and installing ⇒ ["2.3 Removing and installing gearbox mounting", page 38](#)

16 - Bolt

- ☐ Gearbox support to gearbox
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

17 - Bolt

- ☐ Gearbox support to gearbox
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

18 - Bolt

- ☐ Gearbox mounting to body
- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

Engine support - tightening torque and sequence



Note

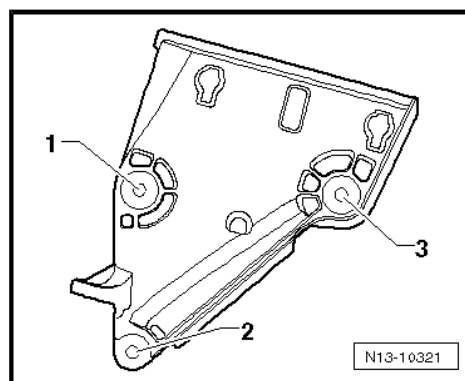
Renew the bolts tightened with specified tightening angle.



Caution

There is a risk of the engine support breaking due to strain.

- ◆ *It is important that you observe the tightening torque and sequence.*



– Tighten bolts in 3 stages in the sequence shown:

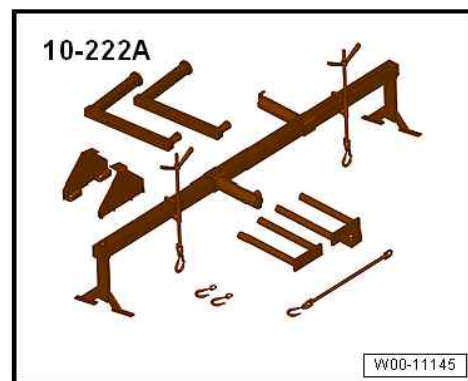
Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 3-	7 Nm
2.	-1 ... 3-	40 Nm
3.	-1 ... 3-	Turn 180° further

2.2 Removing and installing engine mountings

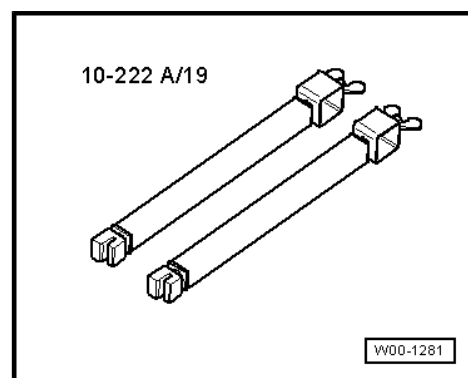
Special tools and workshop equipment required



◆ Support bracket - 10 - 222 A-

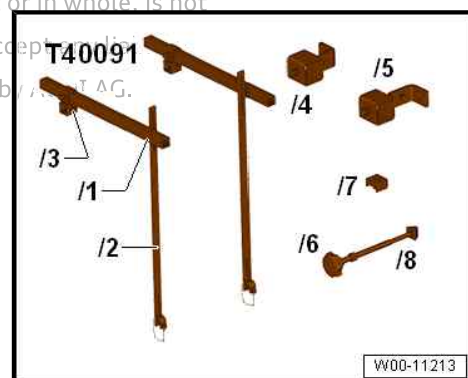


◆ Adapters - 10 - 222 A /19-



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◆ Engine support basic set - T40091-



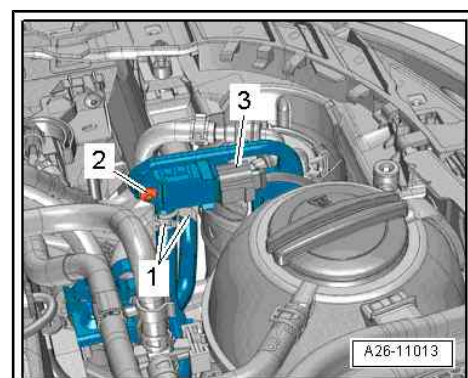
Removing

- Remove engine cover panel ⇒ [page 43](#) .
- Unplug electrical connector -3-.
- Remove bolt -2- and move pressure differential sender - G505- clear to one side.



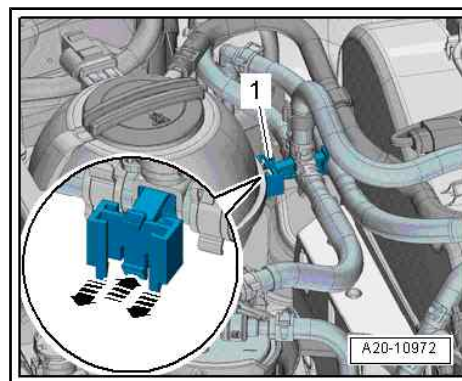
Note

Disregard -item 1-.

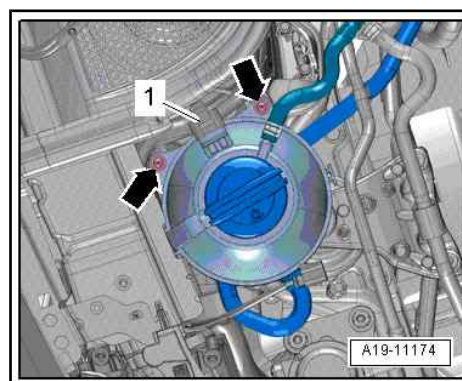




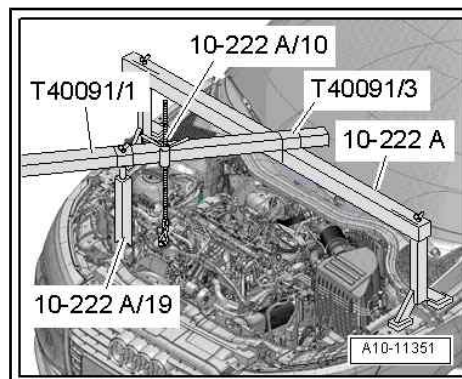
- Release catches -arrows- and pull fuel connection out of guide on coolant expansion tank.



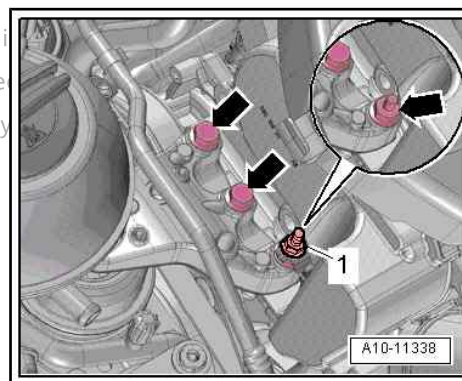
- Remove bolts -arrows-.
- Detach electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.



- Set up support bracket - 10 - 222 A- on top edges of body flanges (left and right) and longitudinal member (right-side), as shown in illustration.
- Attach hook of spindle - 10 - 222 A /11- to engine lifting eye.
- Apply light tension to spindle.



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



WARNING

Risk of accident.

- ◆ *Do not loosen nut -1- unless renewing engine mounting.*

Installing

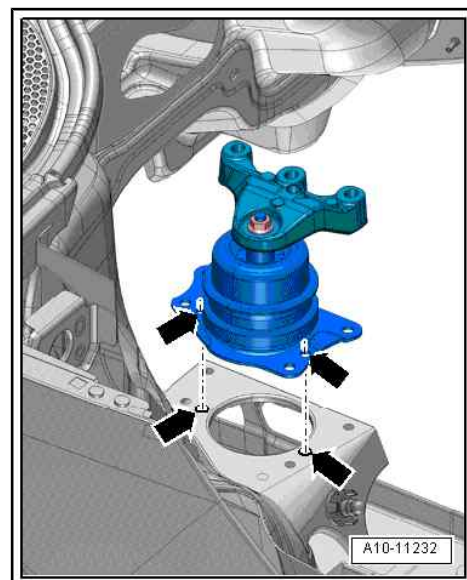
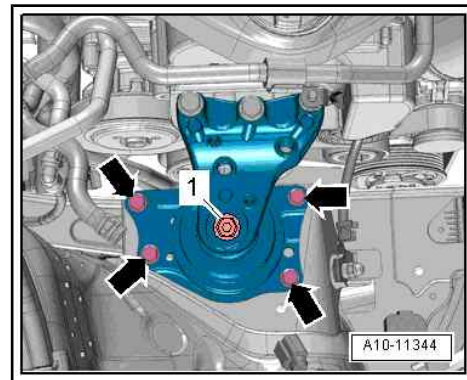
Installation is carried out in reverse order; note the following:



Note

Renew the bolts tightened with specified tightening angle.

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

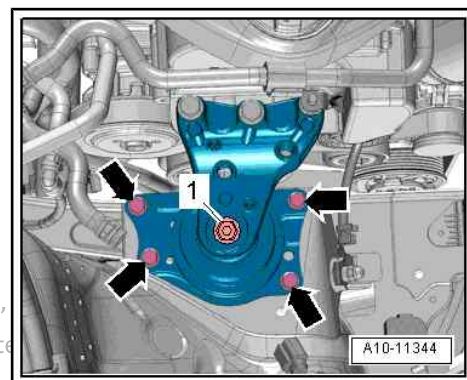


- Initially screw in bolts -arrows- by hand until they make contact.
- Tighten bolts.



Note

Disregard -item 1-.



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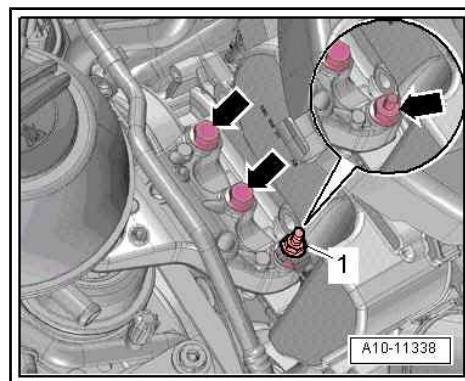
- Initially hand-tighten bolts -arrows- for support arm of engine mounting until they make contact.
- The support arm must not turn when you tighten the bolts.
- Tighten bolts.

**Note**

Disregard -item 1-.

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 33](#)



2.3 Removing and installing gearbox mounting

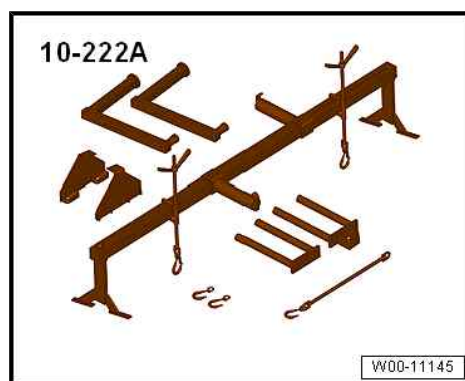
⇒ [“2.3.1 Removing and installing gearbox mounting - vehicles with manual gearbox”, page 38](#)

⇒ [“2.3.2 Removing and installing gearbox mounting - vehicles with dual clutch gearbox”, page 40](#)

2.3.1 Removing and installing gearbox mounting - vehicles with manual gearbox

Special tools and workshop equipment required

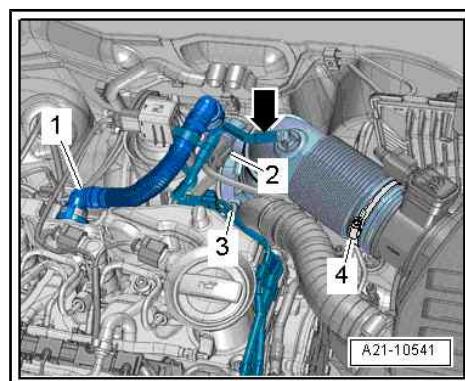
- ◆ Support bracket - 10 - 222 A-

**Removing**

- Remove air cleaner housing ⇒ [page 229](#) .
- Version for countries with cold climates: Unplug electrical connector -2-.
- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.

**Note**

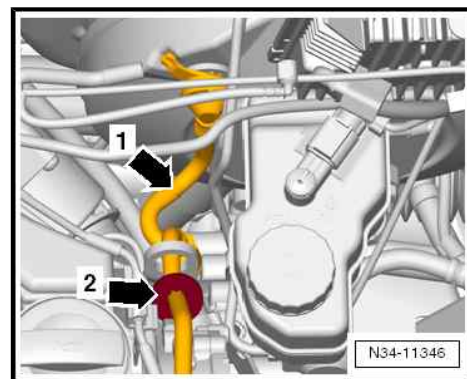
Disregard -item 4-.



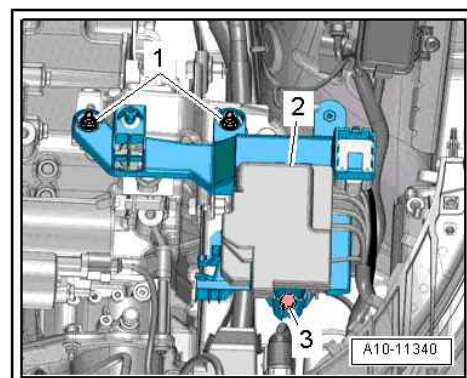
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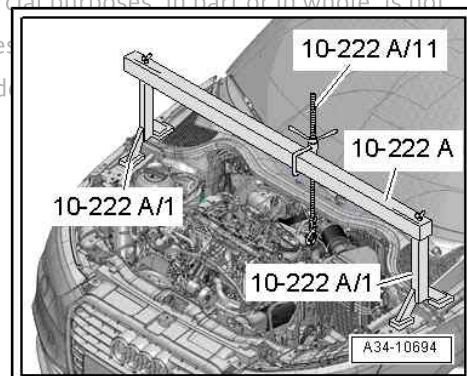
- Remove vacuum hose -arrow 1- for brake servo with grommet -arrow 2-.



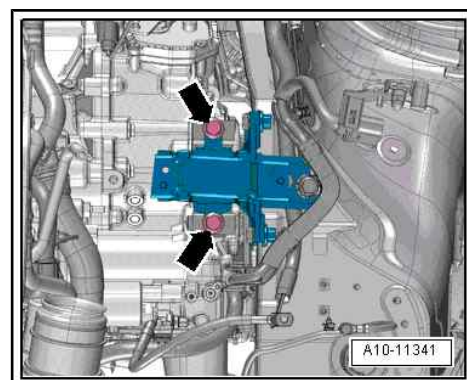
- Unscrew nuts -1- and bolt -3-, and push electronics box -2- to the side.



- Position support bracket - 10 - 222 A- on bolted flanges of wing panels as shown in illustration.
- Attach hook of spindle - 10 - 222 A /11- to engine lifting eye (rear left).



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





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

Installing

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



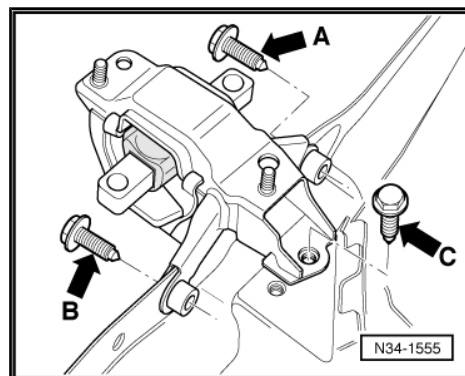
Note

Renew the bolts tightened with specified tightening angle.

- Install air cleaner housing ⇒ [page 229](#) .

Tightening torques

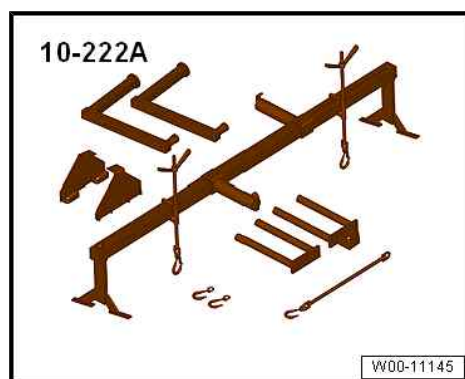
- ♦ Gearbox mounting: tightening torque and sequence ⇒ Rep. gr. 34; Assembly mountings, Exploded view - assembly mountings
- ♦ Electronics box ⇒ Electrical system: Rep. gr. 97; Relay carriers, fuse carriers, electronics boxes, Overview of fitting locations - relay carriers, fuse carriers, electronics boxes



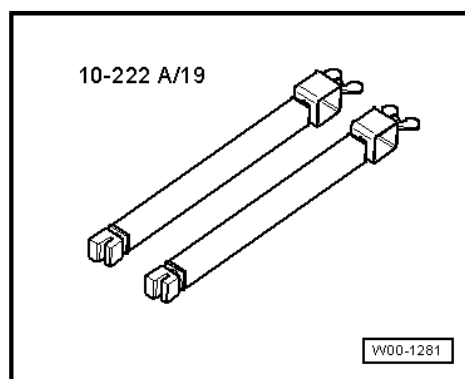
2.3.2 Removing and installing gearbox mounting - vehicles with dual clutch gearbox

Special tools and workshop equipment required

- ♦ Support bracket - 10 - 222 A-

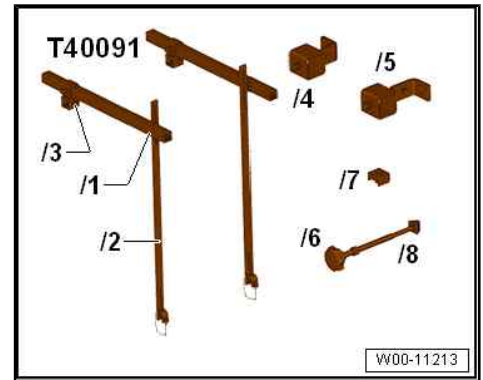


- ♦ Adapters - 10 - 222 A /19-



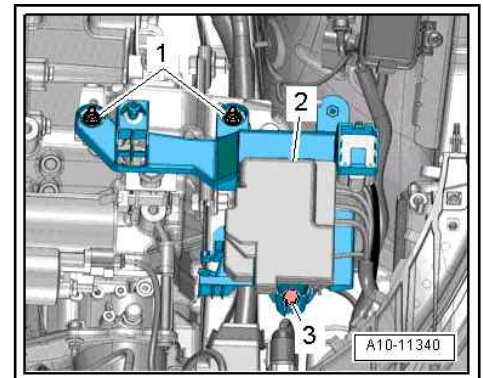


◆ Engine support basic set - T40091-

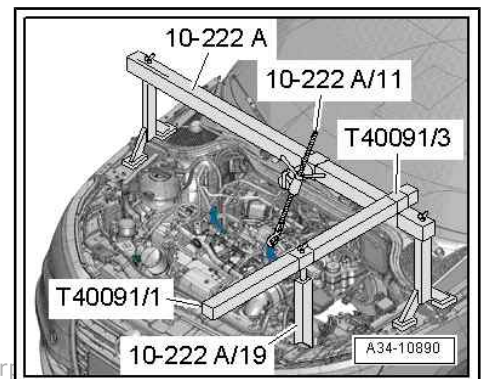


Removing

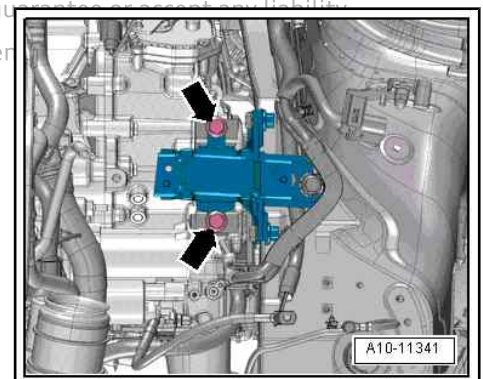
- Remove air cleaner housing ⇒ [page 229](#) .
- Unscrew nut -1- and bolt -3-, and push electronics box -2- to the side.



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



- Remove bolts -arrows- securing gearbox mounting.
- Lower engine/gearbox assembly slightly using spindle of support bracket - 10 - 222 A- .





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

Installing

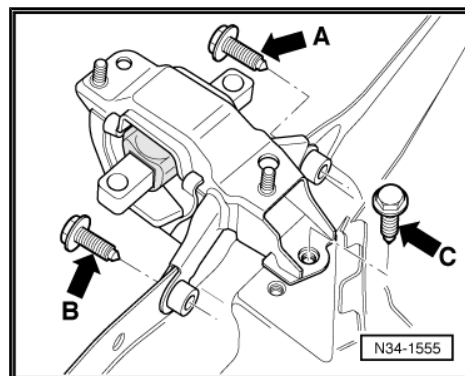
Installation is carried out in reverse order; note the following:



Note

Renew the bolts tightened with specified tightening angle.

- Secure gearbox mounting to body; observe tightening torque and sequence.
- Lift gearbox with spindle of support bracket up to support arm of gearbox mounting and tighten bolts securing gearbox mounting to gearbox support.
- Install air cleaner housing ⇒ [page 229](#).



Tightening torques

- ◆ Gearbox mounting: tightening torque and sequence ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings
- ◆ Electronics box ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes

2.4 Removing and installing pendulum support

Removing

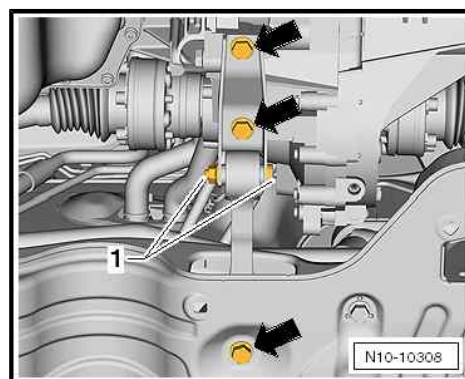
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



WARNING

Risk of accident.

- ◆ **Do NOT loosen bolted connection -1-.**



- Remove bolts -arrows- and detach pendulum support.

Installing

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



Note

Renew the bolts tightened with specified tightening angle.

- Secure pendulum support first to gearbox and then to sub-frame.

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 33](#)
- ◆ ⇒ 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 43**

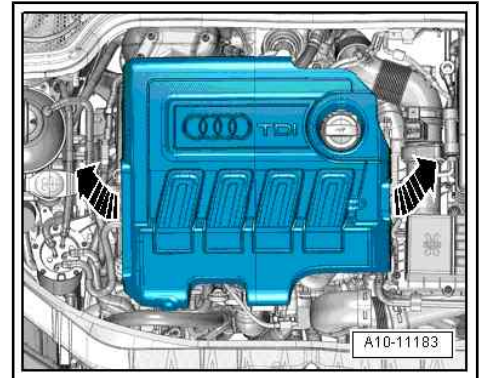
3.1 Removing and installing engine cover panel

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.
- When fitting engine cover panel, take care not to damage oil filler neck.
- First press engine cover panel onto rear retaining pins and then onto front retaining pins with both hands.



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13 – Crankshaft group

1 Cylinder block (pulley end)

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⇒ “1.1 Exploded view - poly V-belt drive”, page 44

⇒ “1.2 Exploded view - sealing flange (pulley end)”, page 50

⇒ “1.3 Removing and installing poly V-belt”, page 51

⇒ “1.4 Removing and installing tensioner for poly V-belt”, page 54

⇒ “1.5 Removing and installing vibration damper”, page 55

⇒ “1.6 Removing and installing bracket for ancillaries”, page 56

⇒ “1.7 Renewing crankshaft oil seal (pulley end)”, page 58

⇒ “1.8 Removing and installing sealing flange (pulley end)”, page 60

1.1 Exploded view - poly V-belt drive

⇒ “1.1.1 Exploded view - poly V-belt drive without air conditioner compressor”, page 44

⇒ “1.1.2 Exploded view - poly V-belt drive with air conditioner compressor and tensioner”, page 46

⇒ “1.1.3 Exploded view - poly V-belt drive with air conditioner compressor and tensioning roller”, page 48

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



1 - Poly V-belt

- ☐ Renew
- ☐ Removing and installing
⇒ [page 51](#)

2 - Vibration damper

- ☐ With poly V-belt pulley
- ☐ Installation position:
hole in vibration damper
must be positioned over
raised section of crank-
shaft sprocket
- ☐ Removing and installing
⇒ [page 55](#)

3 - Bolt

- ☐ Renew
- ☐ Use only genuine bolts
⇒ Electronic parts cata-
logue
- ☐ 10 Nm +90°

4 - Dowel sleeve

- ☐ 2x
- ☐ Ensure correct seating
in bracket for ancillaries

5 - Bolt

- ☐ Tightening torque
⇒ [Item 2 \(page 274\)](#)

6 - Bolt

- ☐ Tightening torque
⇒ [Item 22 \(page 87\)](#)

7 - Idler roller

- ☐ For toothed belt

8 - Bolt

- ☐ Tightening torque ⇒ [Item 8 \(page 86\)](#)

9 - Idler roller

- ☐ For toothed belt

10 - Bracket for ancillaries

- ☐ Removing and installing ⇒ [page 56](#)

11 - High-pressure pump

- ☐ Removing and installing ⇒ [page 275](#)

12 - Bolt

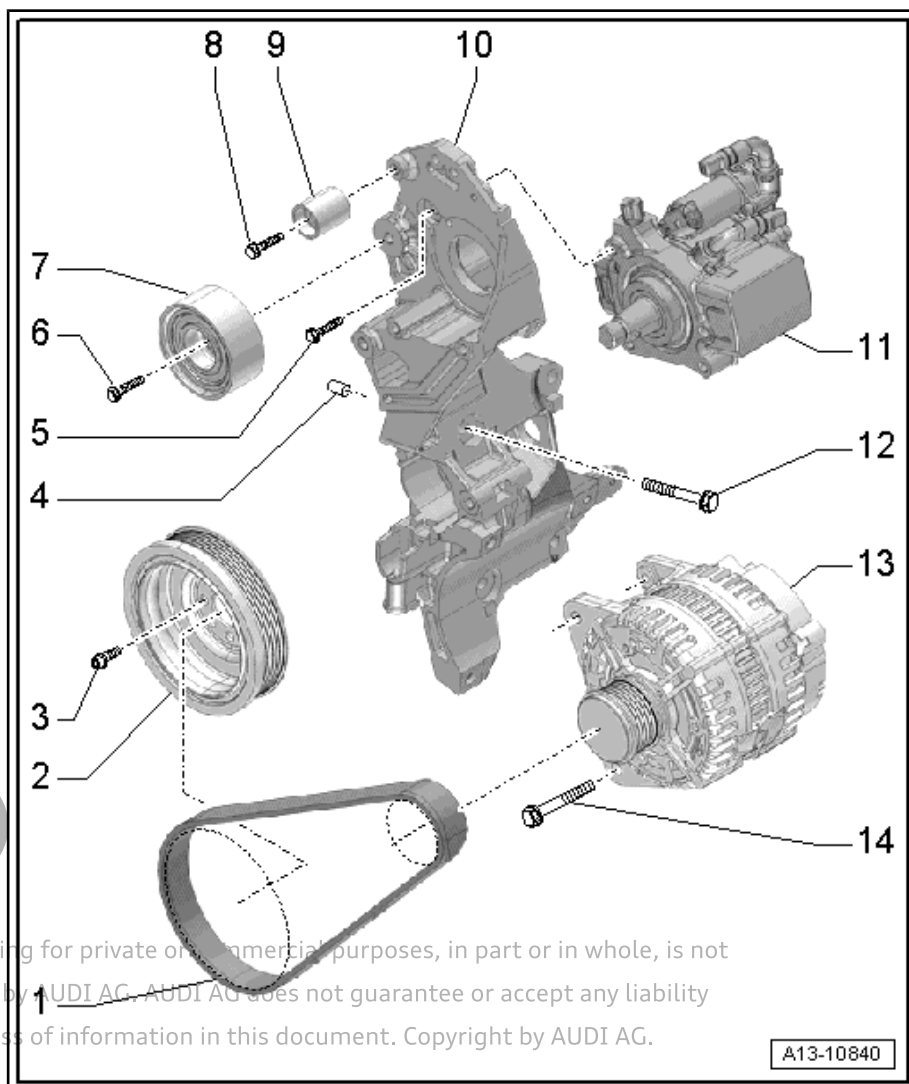
- ☐ Different lengths ⇒ [page 47](#)
- ☐ Tightening torque and sequence ⇒ [page 47](#)

13 - Alternator

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

14 - Bolt

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





1.1.2 Exploded view - poly V-belt drive with air conditioner compressor and tensioner

1 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Removing and installing ⇒ [page 51](#)
- ☐ Do not kink
- ☐ When installing, make sure it is properly seated on pulleys.

2 - Poly V-belt tensioner

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

3 - 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 55](#)

4 - Bolt

- ☐ Renew
- ☐ Use only genuine bolts ⇒ Electronic parts catalogue
- ☐ 10 Nm +90°

5 - Bolt

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

6 - Dowel sleeve

- ☐ Ensure correct seating in bracket for ancillaries

7 - Bolt

- ☐ Tightening torque ⇒ [Item 2 \(page 274\)](#)

8 - Bolt

- ☐ Tightening torque ⇒ [Item 22 \(page 87\)](#)

9 - Idler roller

- ☐ For toothed belt

10 - Bolt

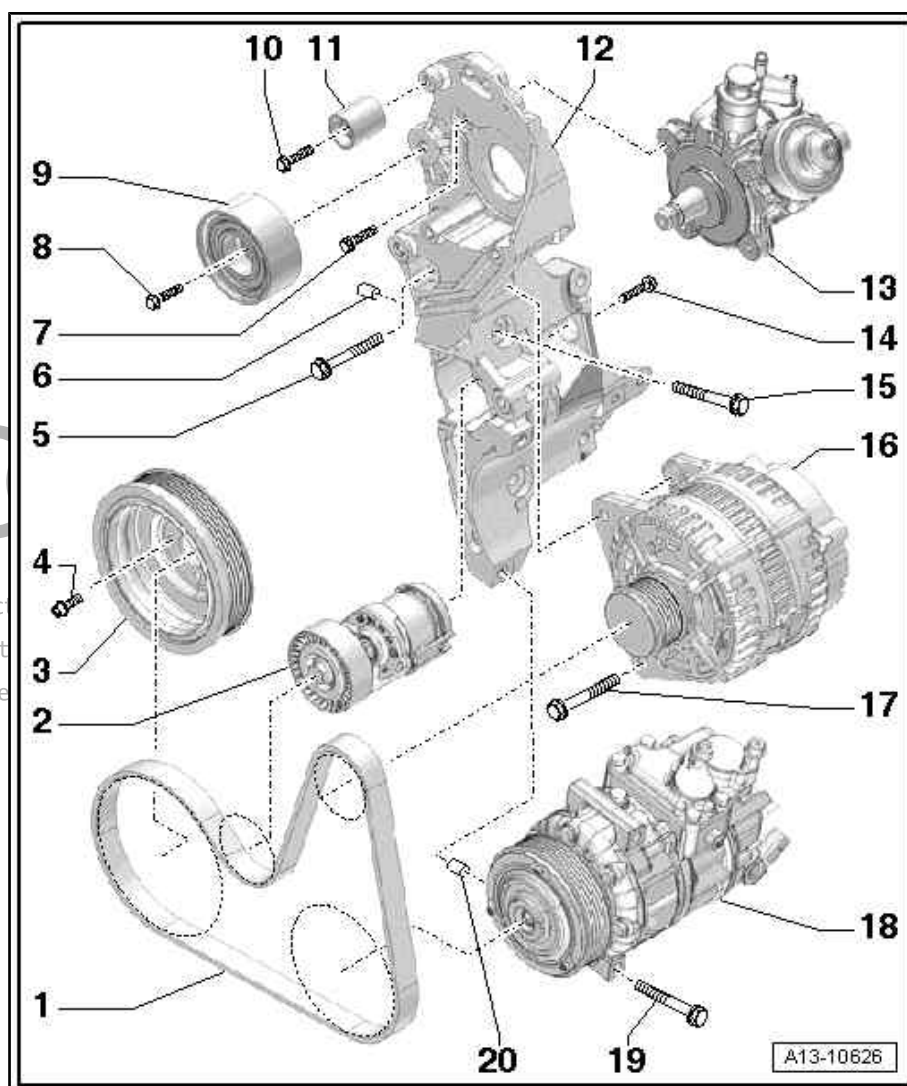
- ☐ Tightening torque ⇒ [Item 8 \(page 86\)](#)

11 - Idler roller

- ☐ For toothed belt

12 - Bracket for ancillaries

- ☐ Removing and installing ⇒ [page 56](#)





13 - High-pressure pump

- ☐ Removing and installing ⇒ [page 275](#)

14 - Bolt

- ☐ Bolt can be re-used; tightening torque for re-used bolt: 20 Nm + 90°
- ☐ New bolt: 20 Nm +180°

15 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 47](#)

16 - Alternator

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

17 - Bolt

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

18 - Air conditioner compressor

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

19 - Bolt

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

20 - Dowel sleeve

- ☐ Ensure correct seating in bracket for ancillaries

Bracket for ancillaries - tightening torque and tightening sequence

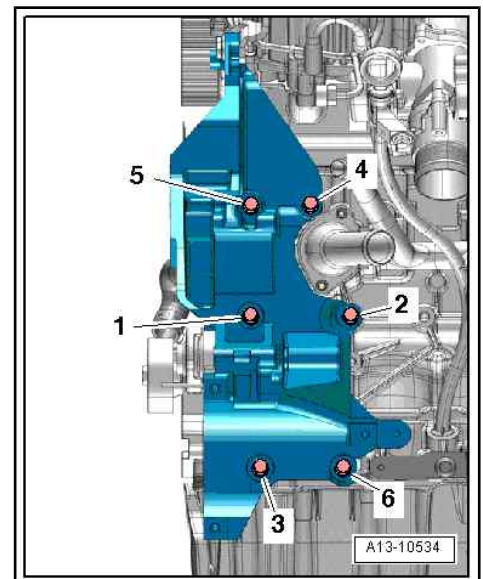


Note

Renew the bolts tightened with specified tightening angle.

- Fit bolts in the following sequence:
 - ◆ Bolts -1- and -2- M10x52.
 - ◆ Bolts -3- and -6- M10x30.
 - ◆ Bolts -4- and -5- M10x60.
- Tighten bolts in 4 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 6-	Screw in by hand until contact is made
2.	-1 ... 6-	40 Nm
3.	-3- and -6-	Turn 45° further
4.	-1, 2, 4, 5-	Turn 90° further





1.1.3 Exploded view - poly V-belt drive with air conditioner compressor and tensioning roller

1 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Removing and installing [⇒ page 51](#)
- ☐ Do not kink
- ☐ When installing, make sure it is properly seated on pulleys

2 - Tensioning roller for poly V-belt

- ☐ Removing and installing [⇒ page 53](#)
- ☐ Coat contact surfaces with lubricating paste; for lubricating paste refer to [⇒ Electronic parts catalogue](#)

3 - 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 55](#)

4 - Bolt

- ☐ Tightening torque [⇒ Item 4 \(page 46\)](#)

5 - Dowel sleeve

- ☐ Ensure correct seating in bracket for ancillaries

6 - Bolt

- ☐ Tightening torque [⇒ Item 2 \(page 274\)](#)

7 - Bolt

- ☐ Tightening torque [⇒ Item 22 \(page 87\)](#)

8 - Idler roller

- ☐ For toothed belt

9 - Bolt

- ☐ Tightening torque [⇒ Item 8 \(page 86\)](#)

10 - Idler roller

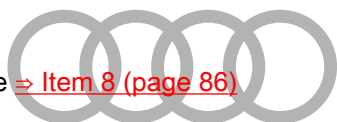
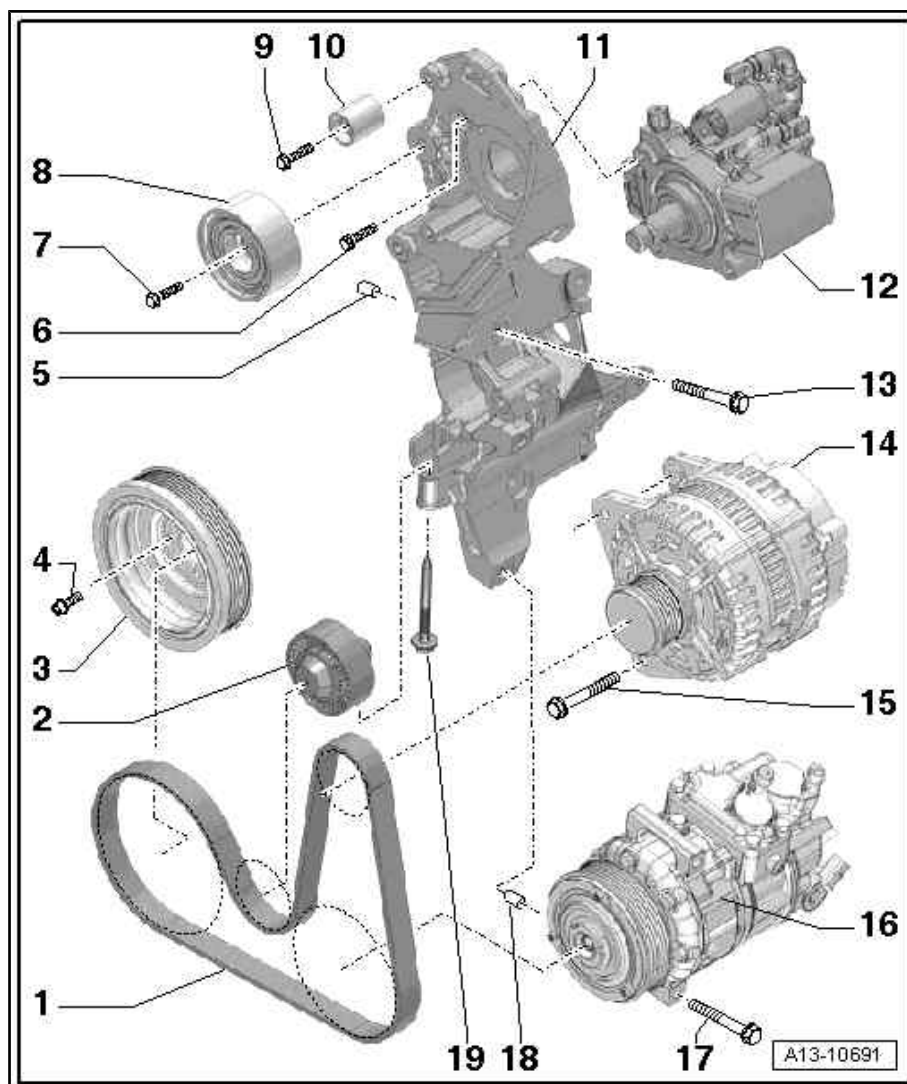
- ☐ For toothed belt

11 - Bracket for ancillaries

- ☐ Removing and installing [⇒ page 56](#)

12 - High-pressure pump

- ☐ Removing and installing [⇒ page 275](#)



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13 - Bolt

- ☐ Different lengths ⇒ [page 47](#)
- ☐ Tightening torque and sequence ⇒ [page 47](#)

14 - Alternator

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

15 - Bolt

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

16 - Air conditioner compressor

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

17 - Bolt

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

18 - Dowel sleeve

- ☐ 2x
- ☐ Ensure correct seating in bracket for ancillaries

19 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 49](#)

Tensioning roller for poly V-belt - tightening torque and tightening sequence

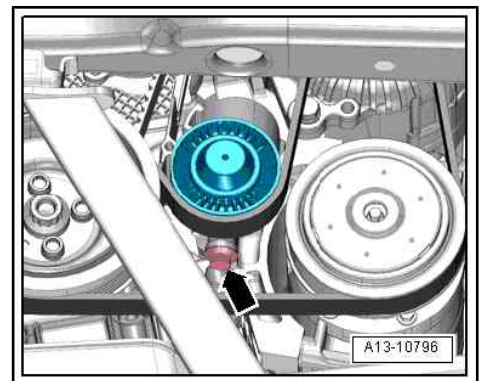


Note

- ◆ *Renew bolt for tensioning roller.*
- ◆ *Use a brush to coat guide surfaces of tensioning roller with lubricating paste; lubricating paste ⇒ Electronic parts catalogue .*

– Tighten bolt in 5 stages as follows:

Stage	Bolt	Tightening torque/angle specification
1.	-arrow-	Screw in by hand until contact is made • The poly V-belt is tensioned
2.	-arrow-	Turn until the pin on the tensioning roller has contacted the stop • The poly V-belt is tensioned further
3.	-arrow-	Loosen by 90°
4.	-arrow-	30 Nm
5.	-arrow-	Turn 90° further



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1.2 Exploded view - sealing flange (pulley end)

1 - Bolt

- ❑ Tightening torque
⇒ [Item 27 \(page 87\)](#)

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 58](#)
- ❑ Do not lubricate with oil

4 - Sealing flange (pulley end)

- ❑ Should be positioned on dowel pins
- ❑ Removing and installing
⇒ [page 60](#)

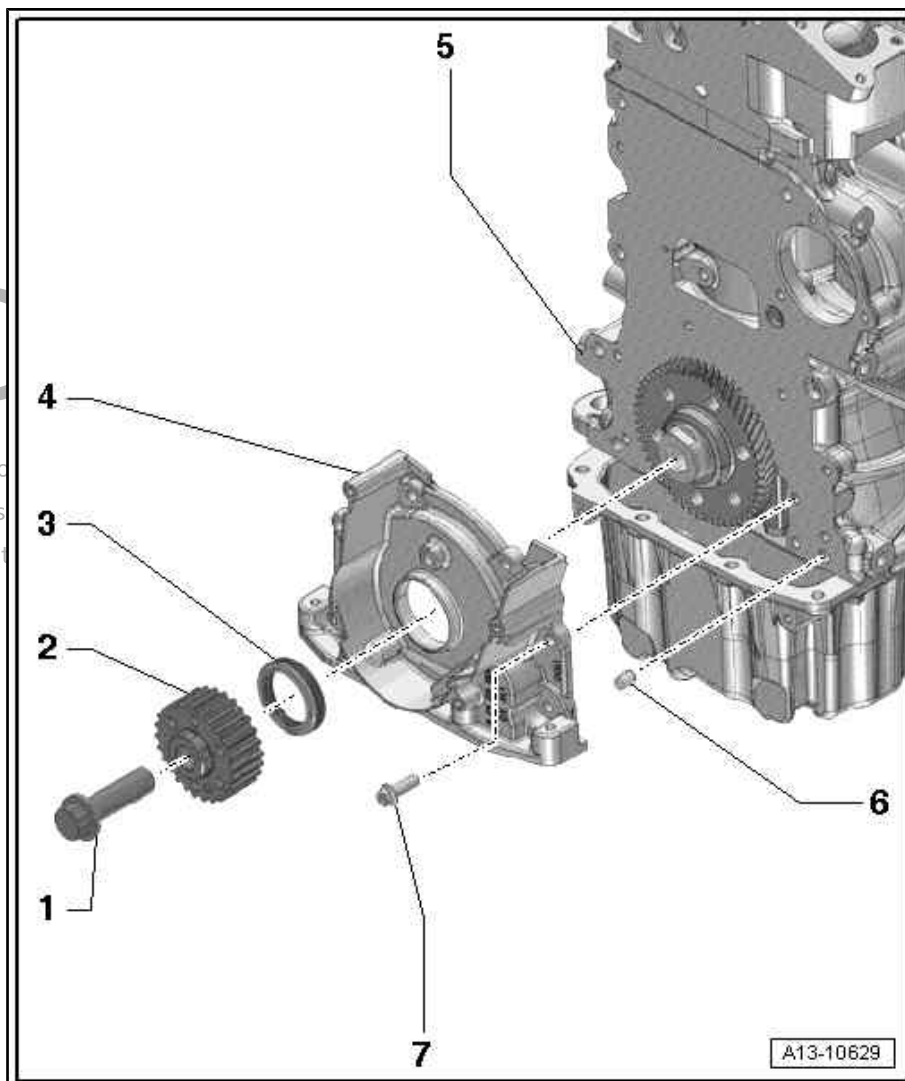
5 - Cylinder block

6 - Dowel pin

- ❑ 2x

7 - Bolt

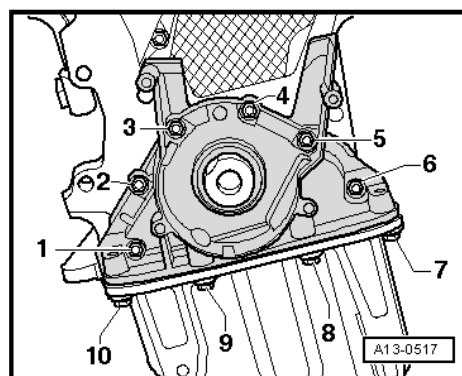
- ❑ Tightening torque and sequence ⇒ [page 50](#)



Sealing flange (pulley end) - tightening torque and sequence

– Tighten bolts in 3 stages as follows:

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 15 Nm
3.	-7 ... 10-	15 Nm





1.3 Removing and installing poly V-belt

⇒ [“1.3.1 Removing and installing poly V-belt - vehicles without air conditioner compressor”, page 51](#)

⇒ [“1.3.2 Removing and installing poly V-belt - vehicles with air conditioner compressor and tensioner”, page 51](#)

⇒ [“1.3.3 Removing and installing poly V-belt - vehicles with air conditioner compressor and tensioning roller”, page 53](#)

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 .
- Remove wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Follow procedure specified in illustrated instructions (included in poly V-belt repair set with assembly tool).

Installation is carried out in reverse sequence.

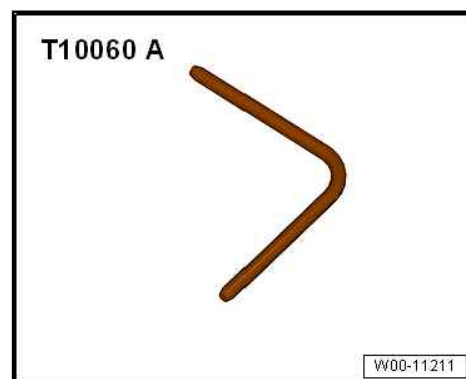
Tightening torques

- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)

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

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-





Removing

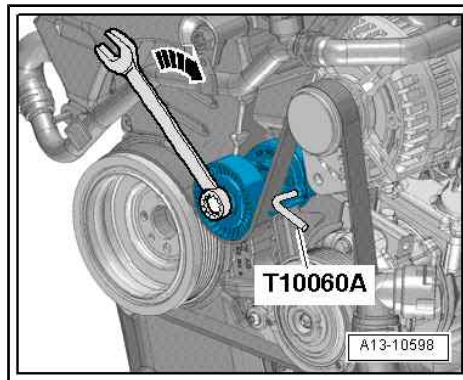
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



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.*



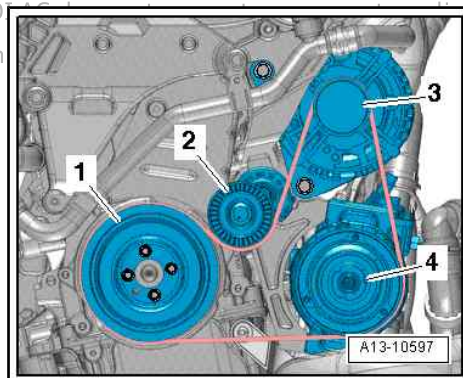
- Move tensioner in clockwise direction -arrow- to slacken poly V-belt.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.

Installing

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

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

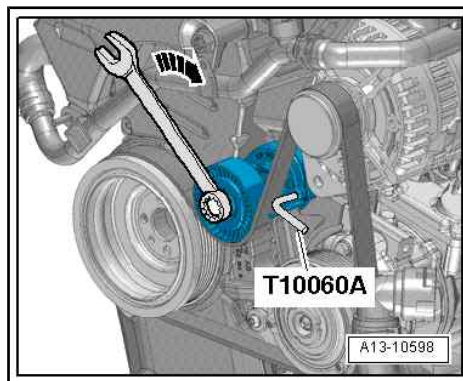
- 1 - Crankshaft
- 2 - Tensioner
- 3 - Alternator
- 4 - Air conditioner compressor



- Hold tensioner with ring spanner and remove locking pin - T10060 A- .
- 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





1.3.3 Removing and installing poly V-belt - vehicles with air conditioner compressor and tensioning roller

Removing

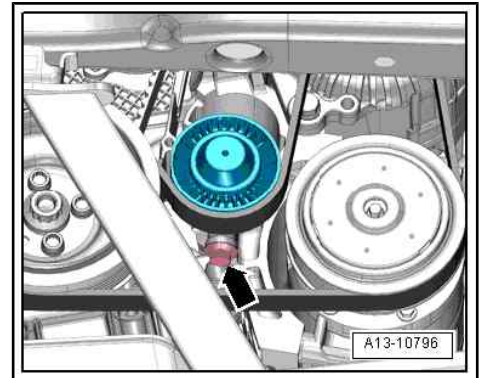
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



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.*



- Remove tensioning bolt -arrow- and detach tensioning roller to slacken poly V-belt.
- Take off poly V-belt.

Installing

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

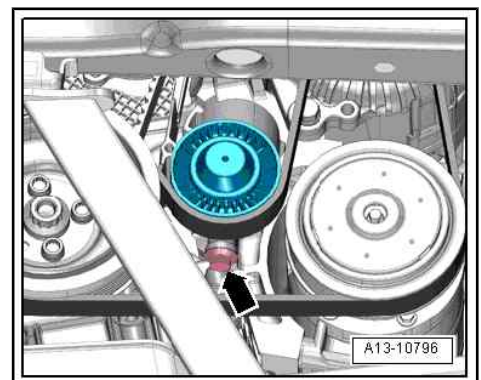
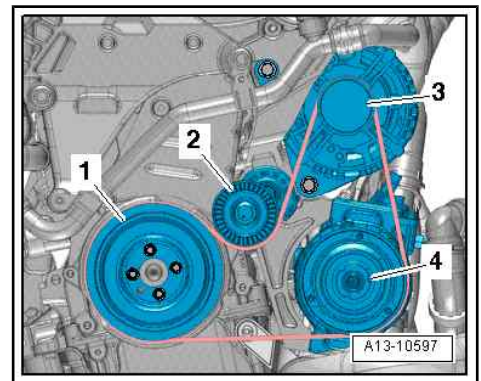
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Note

Renew the bolts tightened with specified tightening angle.

- Fit poly V-belt on poly V-belt pulleys:
 - Vibration damper
 - Tensioning roller
 - Alternator
 - Air conditioner compressor
- Use a brush to coat guide surfaces of tensioning roller with lubricating paste; lubricating paste ⇒ Electronic parts catalogue .
- Insert tensioning roller with pin into guide on bracket for ancillaries.
- Tightening bolt for tensioning roller ⇒ [page 49](#) .

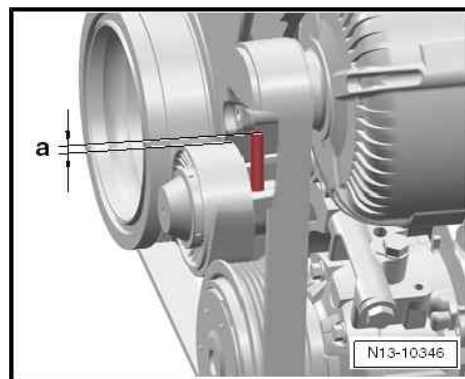




- Check that end of bolt for tensioning roller protrudes beyond contact surface of tensioning roller as far as dimension -a-.
- Distance -a- = approx. 2.5 mm.
- This ensures that the pin is at its limit stop.
- Start engine and check that poly V-belt(s) run properly.

Tightening torques

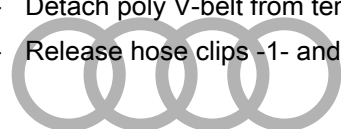
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



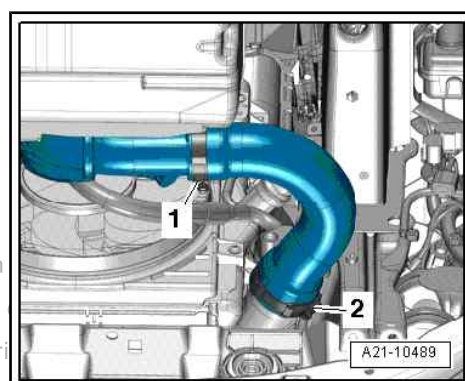
1.4 Removing and installing tensioner for poly V-belt

Removing

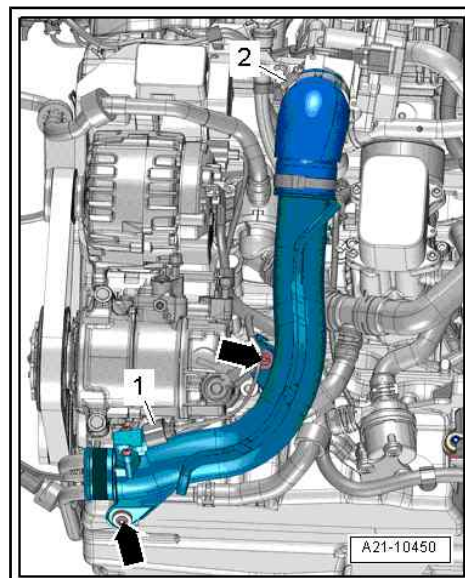
- Detach poly V-belt from tensioner ⇒ [page 51](#) .
- Release hose clips -1- and -2- and remove air hose.



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- Remove bolts -arrows-.
- Move coolant hose -3- clear.
- Release hose clip -2-.
- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender - G42- and detach air pipe (right-side).





- Remove bolt -2- and take off poly V-belt tensioner -1-.

**Note**

- ◆ *If bolt -2- makes contact, leave it in installation position.*
- ◆ *Due to lack of space, the tensioner must be guided out upwards by rotating it.*

Installing

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

**Note**

Renew the bolts tightened with specified tightening angle.

- Install air pipe ⇒ [page 206](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install poly V-belt ⇒ [page 51](#) .

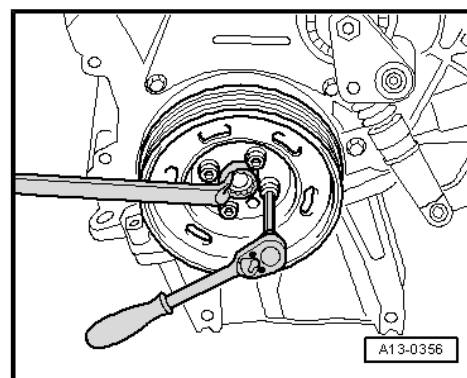
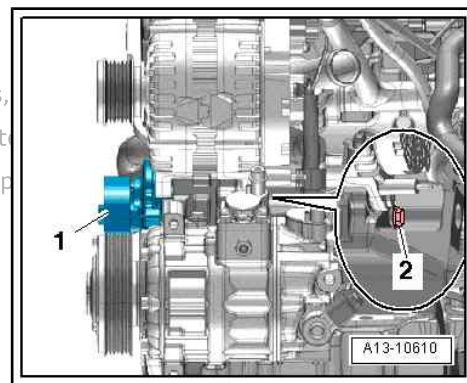
Tightening torques

- ◆ ⇒ [“1.1.2 Exploded view - poly V-belt drive with air conditioner compressor and tensioner”, page 46](#)

1.5 Removing and installing vibration damper

Removing

- Vehicles with air conditioner compressor and tensioning roller:
Remove wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Remove poly V-belt ⇒ [page 51](#) .
- Counterhold by applying ring spanner to bolt for crankshaft sprocket and slacken bolts for vibration damper.
- Remove bolts and take off vibration damper.





Installing

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



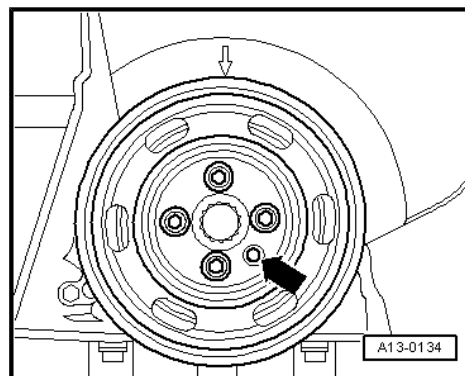
Note

Renew the bolts tightened with specified tightening angle.

- Installation position: hole -arrow- in vibration damper must be positioned over raised section of crankshaft sprocket.
- Install poly V-belt ⇒ [page 51](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - poly V-belt drive", page 44](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)



1.6 Removing and installing bracket for ancillaries

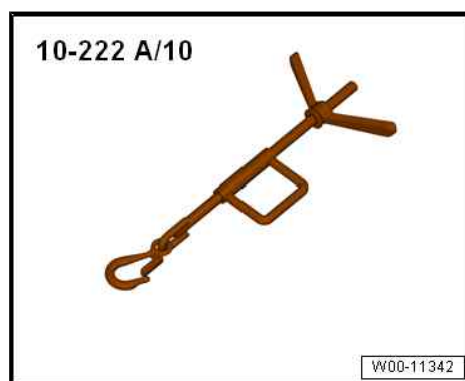
Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-

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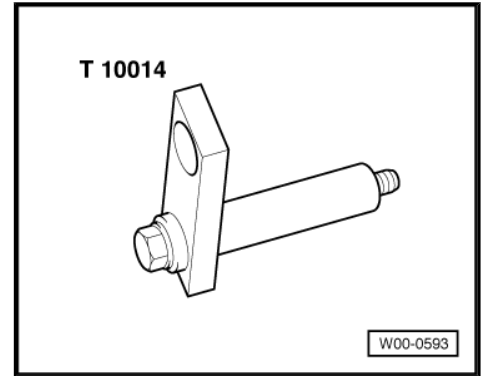


- ◆ Hook - 10 - 222 A /10-

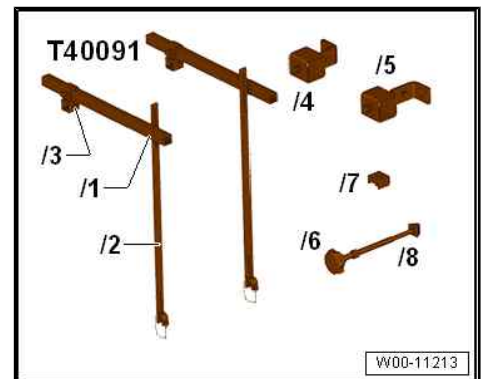




◆ Bracket - T10014-



◆ Engine support basic set - T40091-



Removing

– Remove alternator → Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .

– Set up support bracket - 10 - 222 A- on top edges of body flanges (left and right) and longitudinal member (right-side), as shown in illustration.

– Attach snap element of hook -10 - 222 A /10- to engine lifting eye.

– Apply light tension to spindle.

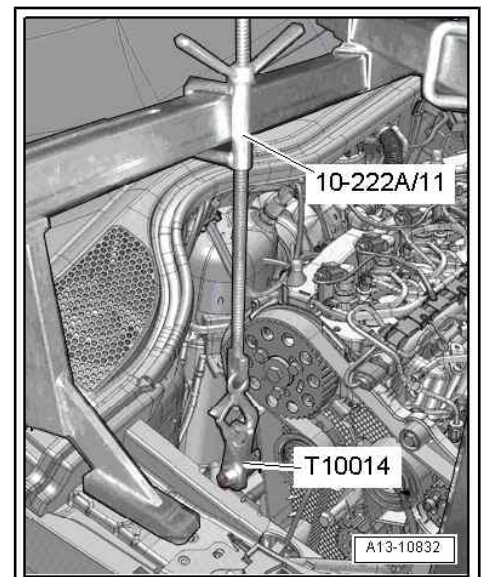
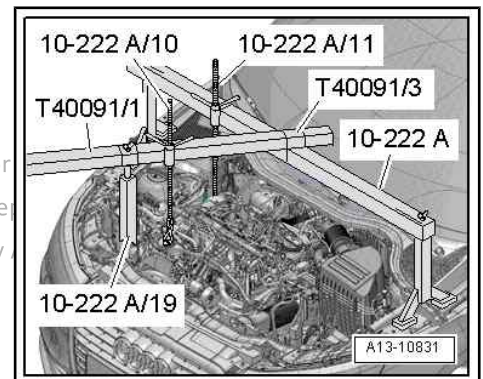
– Remove high-pressure pump ⇒ [page 275](#) .

– Screw retainer - T10014- into threaded hole for engine support, as shown in illustration, and tighten to 20 Nm.

– Engage hook of spindle - 10 - 222 A /11- in retainer - T10014- .

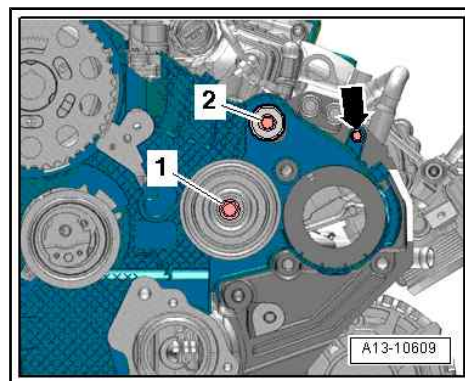
– Apply light tension to spindle.

– Release and disengage hook - 10 - 222 A /10- .





- Remove bolt -arrow-.
- Remove bolts -1- and -2- and remove idler rollers for toothed belt.



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

Installing

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



Note

Renew the bolts tightened with specified tightening angle.

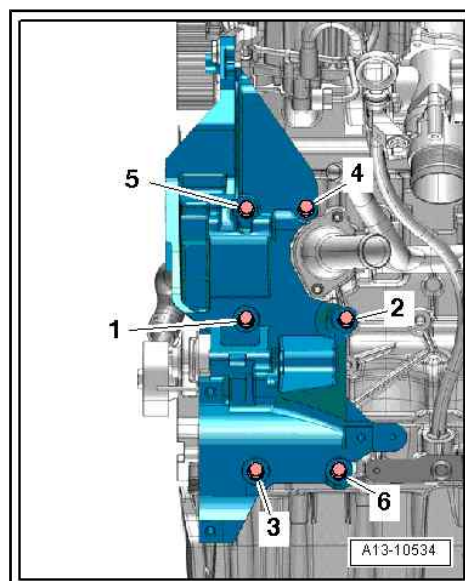
- Check that dowel sleeve at top right between bracket for ancillaries and cylinder block is fitted; insert dowel sleeve if necessary.
- Tighten bolts for bracket for ancillaries ⇒ [page 47](#) .
- Install high-pressure pump ⇒ [page 275](#) .

Tightening torques

- ♦ ⇒ [Fig. "Bracket for ancillaries - tightening torque and tightening sequence"](#), [page 47](#)

- ♦ ⇒ ["1.1 Exploded view - toothed belt"](#), [page 86](#)

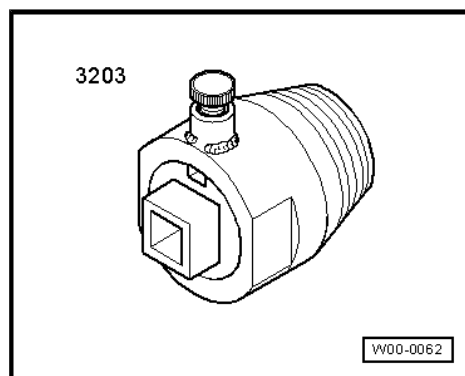
- ♦ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit



1.7 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

- ♦ Oil seal extractor - 3203-





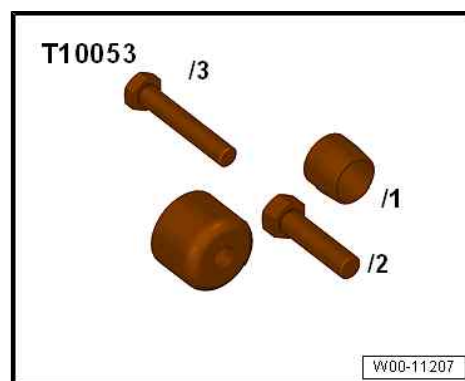
◆ Counterhold tool - 3415-



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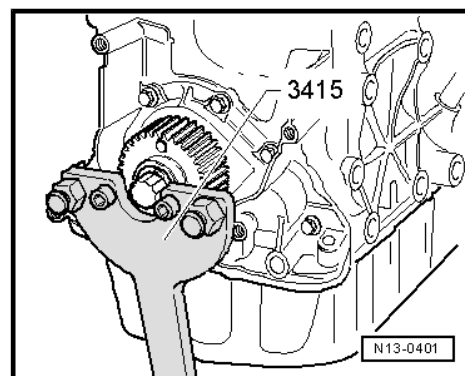


◆ Assembly tool - T10053-

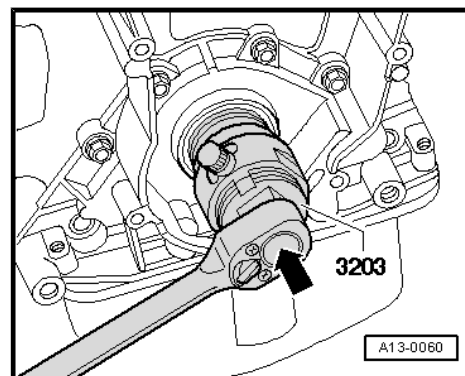


Procedure

- Remove toothed belt ⇒ [page 88](#) .
- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .
- Remove bolt and detach crankshaft sprocket.



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

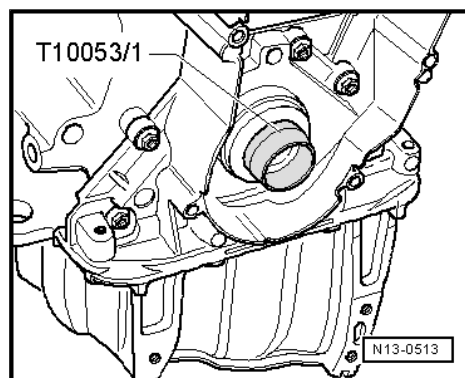


Note

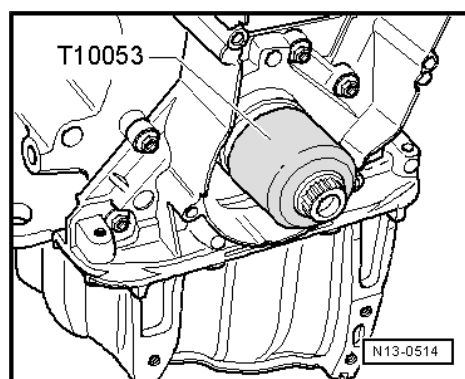
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Do not lubricate sealing lip and outer rim of oil seal before pressing in.*



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



- Press in oil seal using bolt for crankshaft sprocket and thrust sleeve of assembly tool - T10053- until flush.
- Install crankshaft sprocket ⇒ [page 86](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 93](#) .



1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

- ◆ Counterhold tool - 3415-



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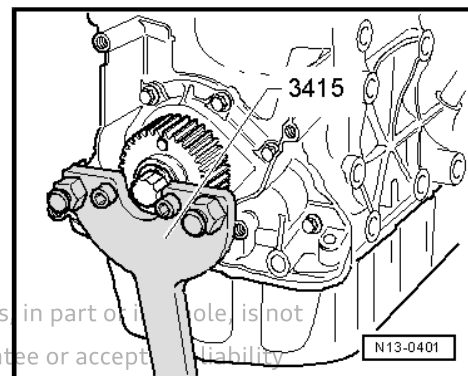


- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue



Removing

- Remove toothed belt ⇒ [page 88](#) .
- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .
- Remove bolt and detach crankshaft sprocket.



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- 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

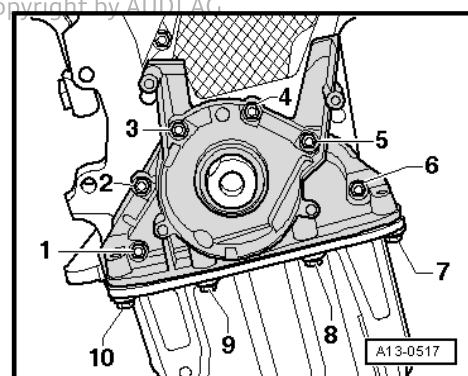
Installation is carried out in reverse order; note the following:



Caution

Make sure sealant residue does not enter lubrication system.

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



- Carefully remove sealant residue on cylinder block and sump.

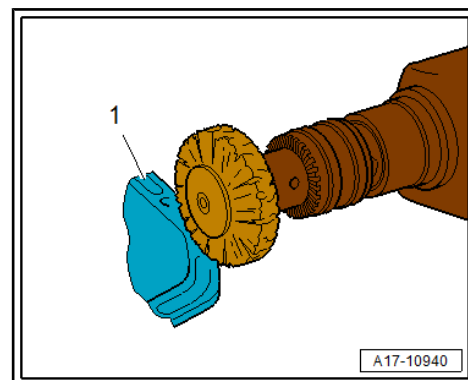


WARNING

Risk of eye injury.

- ◆ ***Put on safety goggles.***

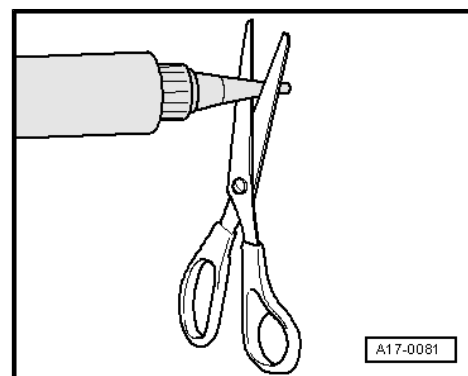
- Use e.g. rotating plastic brush to remove sealant residue on sealing flange.
- Clean sealing surfaces; they must be free of oil and grease.
- Check that dowel pins for positioning sealing flange are fitted in cylinder block; insert if necessary.



Note

Note the use-by date of the sealant.

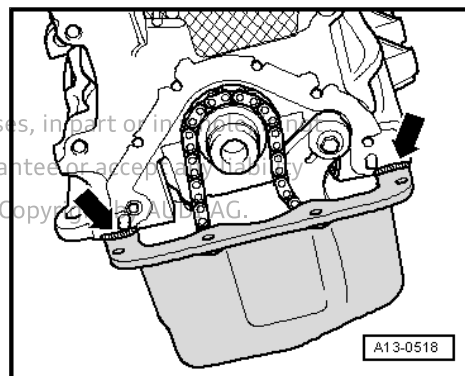
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).





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

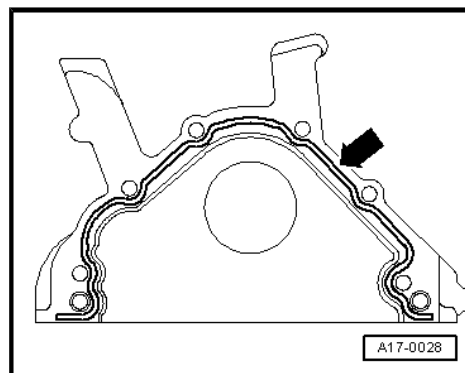
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**Caution**

Make sure lubrication system is not clogged by excess sealant.

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

- Apply sealant bead -arrow- 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 -shaded- on sealing flange.

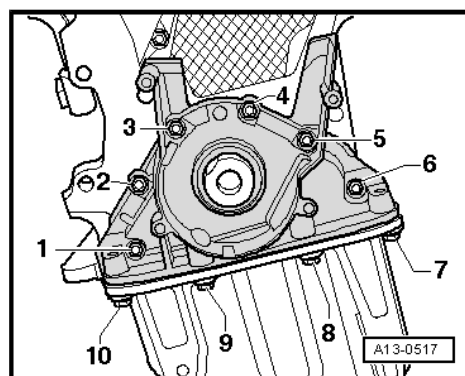
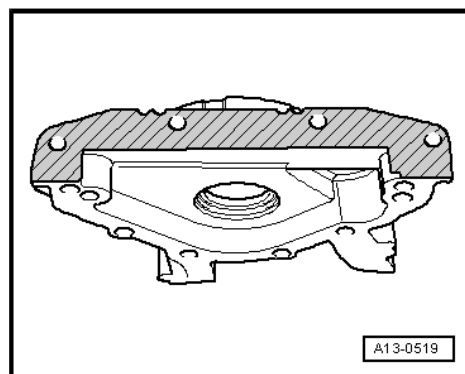
**Note**

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

- Carefully fit sealing flange onto dowel pins in cylinder block.
- Tighten sealing flange bolts ⇒ [page 50](#) .
- Install crankshaft oil seal (pulley end) ⇒ [page 58](#) .

Tightening torques

- ◆ ⇒ [“1.2 Exploded view - sealing flange \(pulley end\)”, page 50](#)





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 66](#)

2.1 Exploded view - cylinder block (gearbox end)

1 - Bolt

- ☐ Renew
- ☐ 60 Nm +90°

2 - Flywheel

- ☐ Different versions available; for allocation refer to ⇒ Electronic parts catalogue
- ☐ Removing and installing ⇒ [page 64](#)
- ☐ Can only be installed in one position (holes are off-set)

3 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Cannot be renewed separately
- ☐ Removing and installing ⇒ ["2.3 Removing and installing sealing flange \(gearbox end\)", page 66](#)

4 - Engine speed sender - G28-

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

5 - Bolt

- ☐ Tightening torque ⇒ [Item 5 \(page 323\)](#)

6 - Dowel pin

- ☐ 2x

7 - Intermediate plate

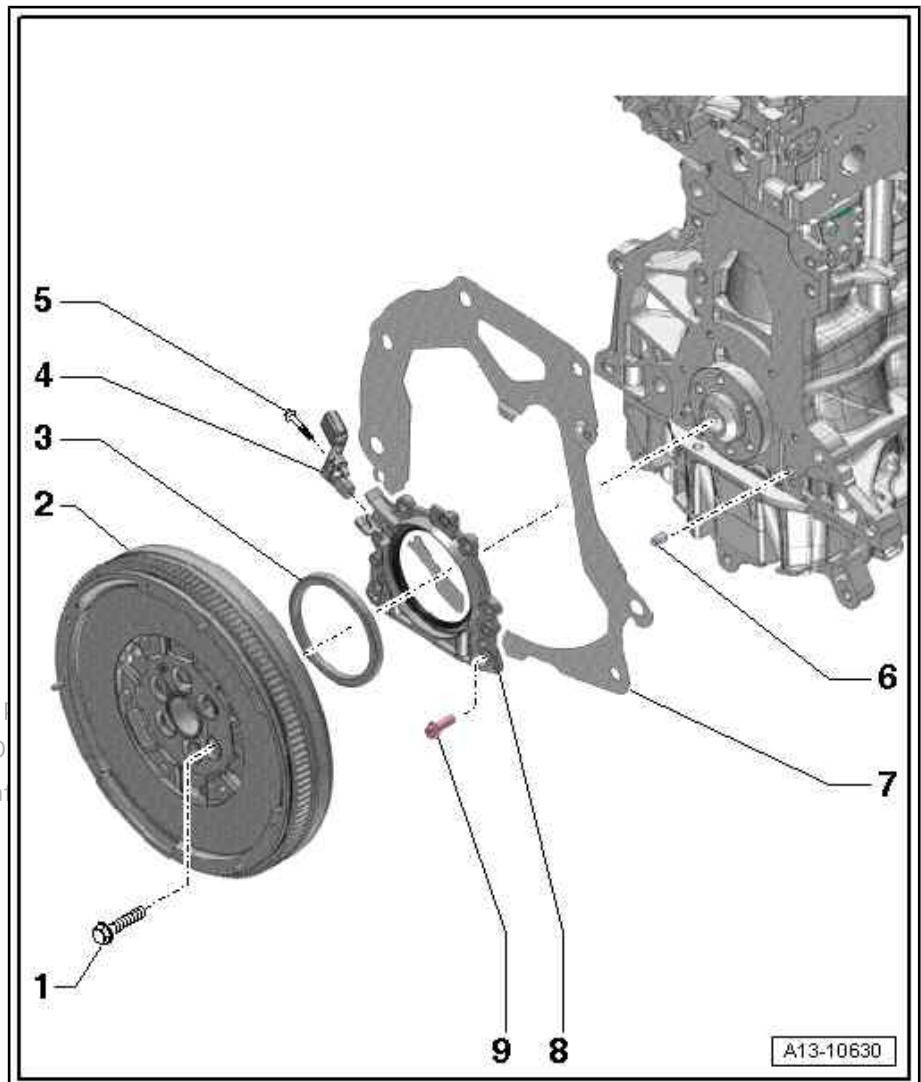
- ☐ Do not damage or bend when assembling
- ☐ Installing ⇒ [page 64](#)

8 - Sealing flange (gearbox end)

- ☐ With oil seal
- ☐ Renewing ⇒ [page 66](#)

9 - Bolt

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

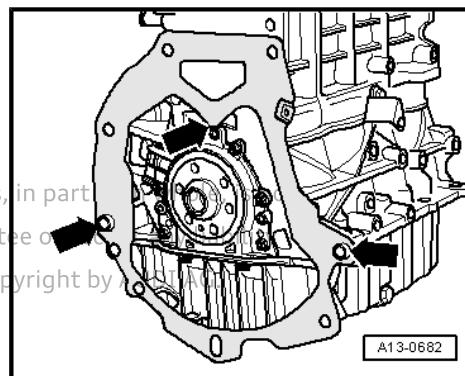




Installing intermediate plate

- Engage intermediate plate on sealing flange -top arrow- and push onto dowel sleeves -bottom arrows-.

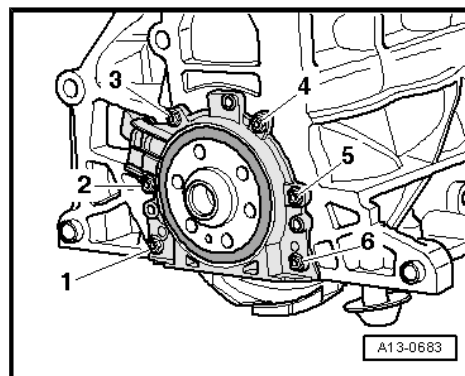
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Sealing flange (gearbox end) - tightening torque and sequence

- Tighten bolts in 2 stages as follows:

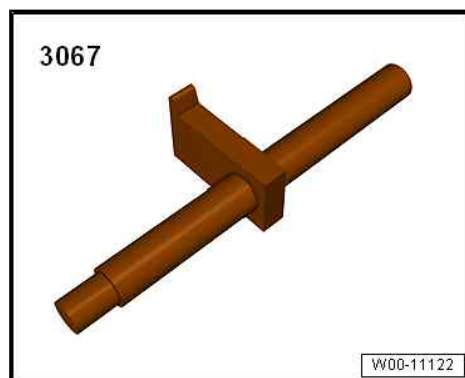
Stage	Bolts	Tightening torque
1.	-1 ... 6-	Screw in by hand until contact is made
2.	-1 ... 6-	Tighten in stages and in diagonal sequence; final torque 15 Nm.



2.2 Removing and installing flywheel

Special tools and workshop equipment required

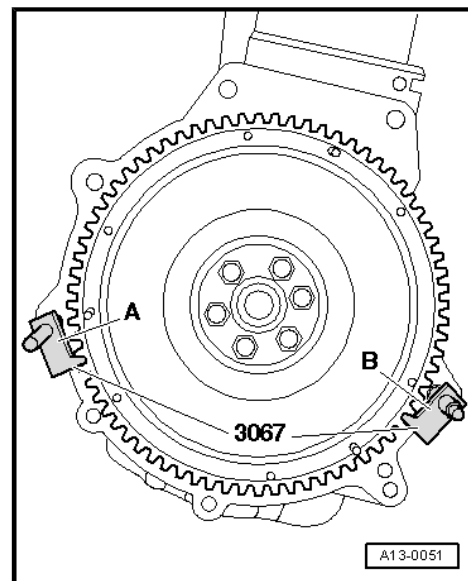
- ◆ Counterhold tool - 3067-





Removing

- Gearbox or engine removed.
- To loosen bolts, insert counterhold tool - 3067- in hole on cylinder block -item B-.



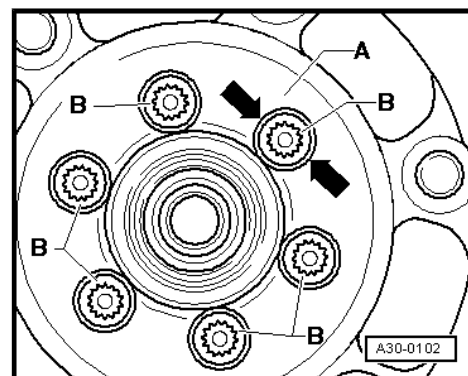
Vehicles with dual-mass flywheel:



Caution

Risk of irreparable damage to dual-mass 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 dual-mass flywheel.*
- ◆ *Rotate the dual-mass flywheel -A- so that the bolts -B- align centrally with the holes -arrows-.*



All vehicles (continued):

- Remove bolts and take off flywheel.

Installing

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



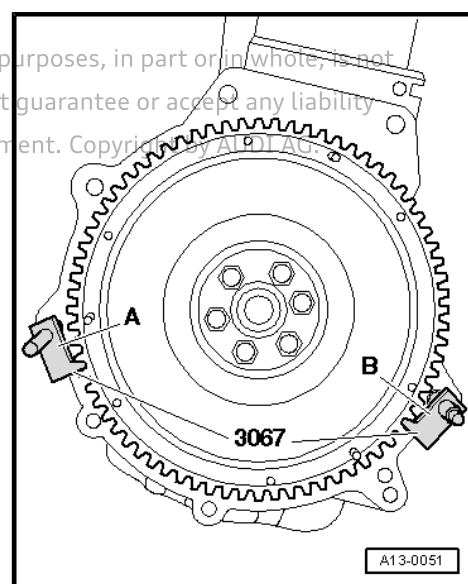
Note

Renew the bolts tightened with specified tightening angle.

- To tighten bolts, insert counterhold tool - 3067- in hole on cylinder block -item A-.

Tightening torques

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





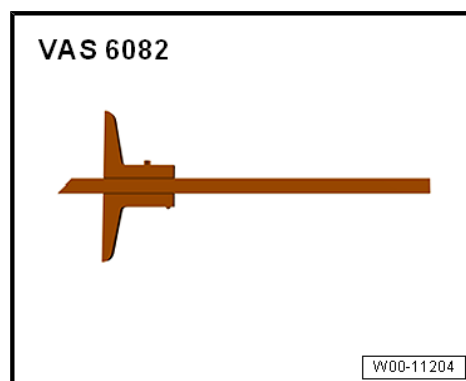
2.3 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

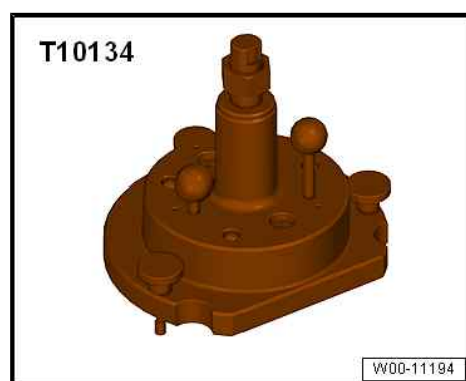
- ◆ Open end spanner insert, AF 24 - V.A.G 1332/11-



- ◆ Depth gauge - VAS 6082-

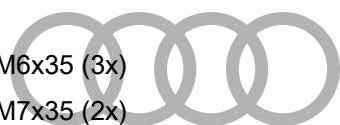


- ◆ Assembly tool - T10134-



- ◆ Bolt, M6x35 (3x)

- ◆ Bolt, M7x35 (2x)



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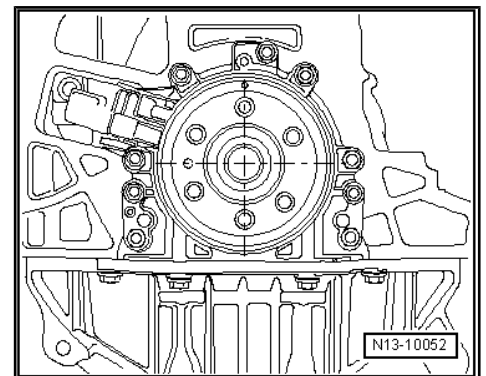
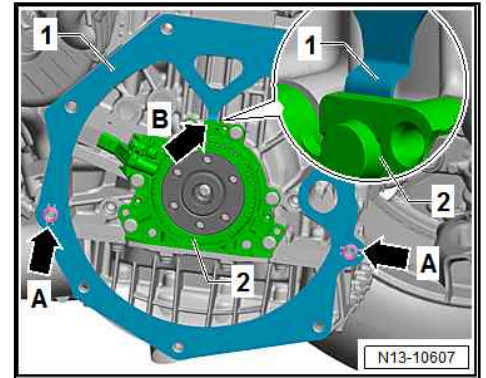
Pressing out sealing flange with sender wheel

- Gearbox removed
- Remove flywheel ⇒ [page 64](#) .

Note

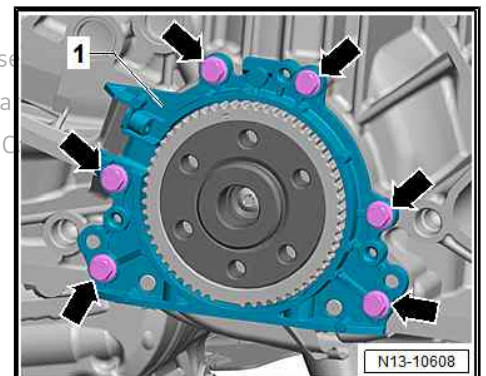
For clarity, the engine is removed in the following illustrations.

- 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 ⇒ [page 145](#) .
- Remove engine speed sender - G28- ⇒ [page 327](#) .



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

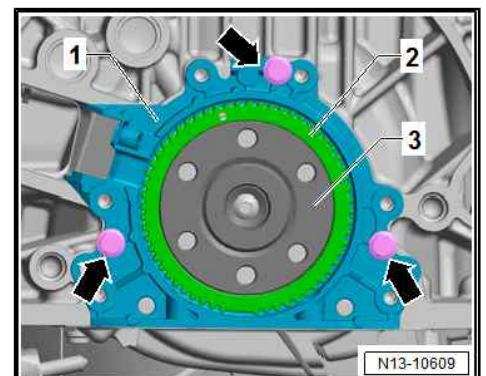
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Note

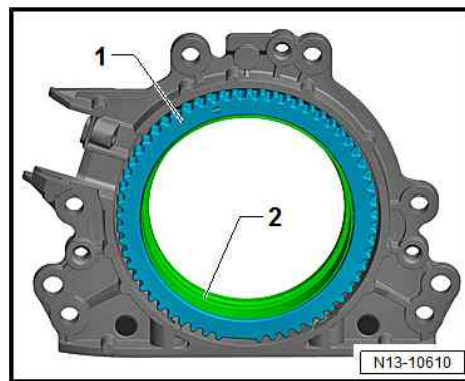
The sealing flange -1- is pressed off the crankshaft -3- together with the sender wheel -2-.

- 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**

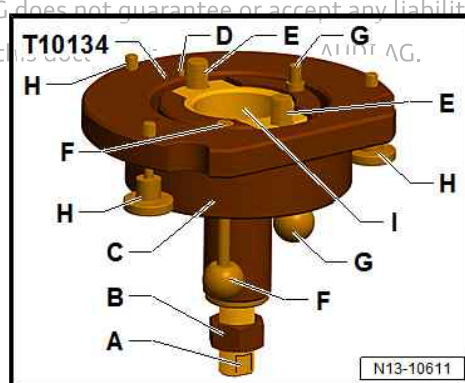
- ◆ The sealing flange with PTFE oil seal is fitted with a sealing lip support ring -2-. This support ring acts as an assembly sleeve and must not be removed before installation.
- ◆ Sealing flange and sender wheel -1- must not be separated or rotated out of position after removal from packaging.
- ◆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



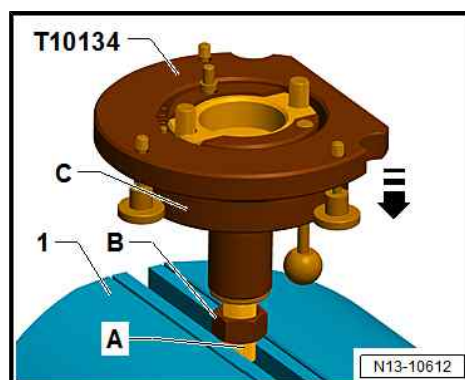
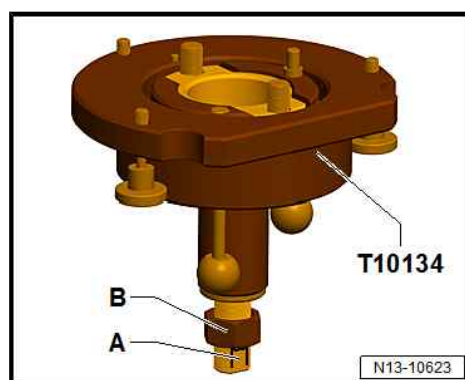
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Construction of assembly tool - T10134- :

- 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.



Note

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

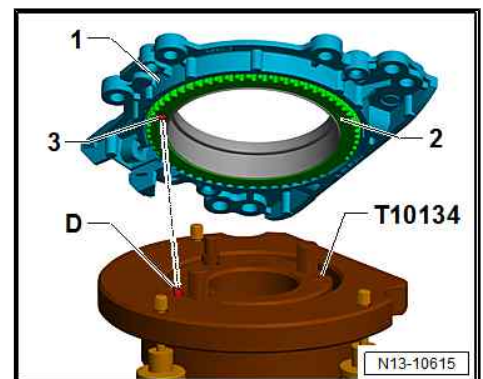
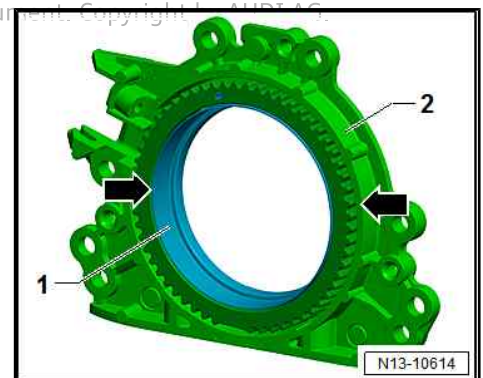
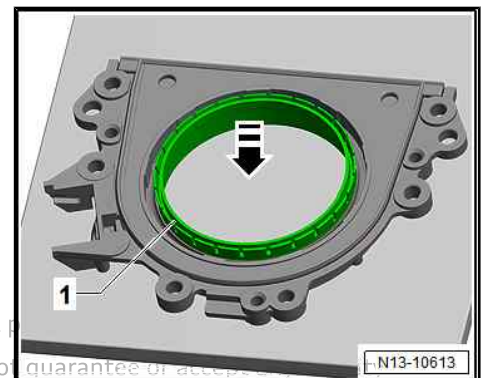
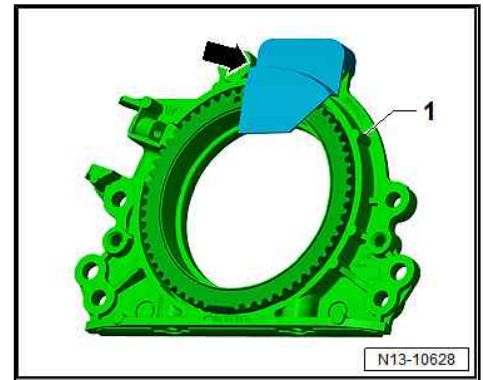
- Place sealing flange (with front side downwards) on a clean flat surface.
- Press sealing lip support ring -1- downwards in direction of -arrow- until it touches flat surface.



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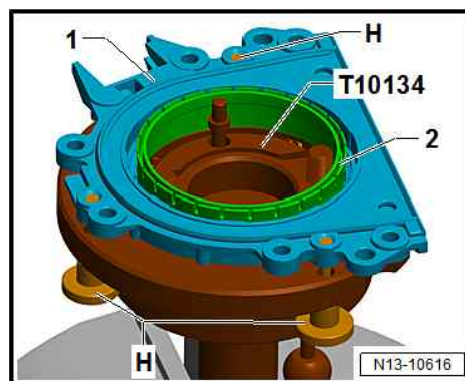
- Upper edge of sealing lip support ring -1- must be flush -arrows- with front edge of sealing flange -2-.

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



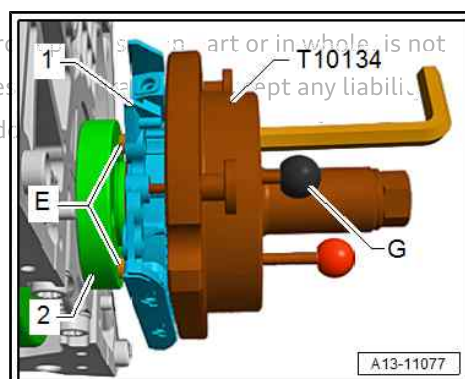
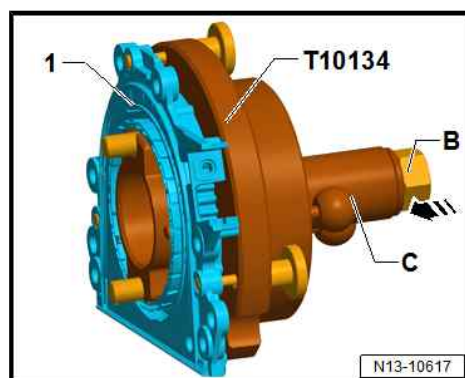


- Screw knurled screws -H- onto sealing flange -1-.
- When tightening, press sealing flange and sealing lip support ring -2- against surface of assembly tool - T10134- .
- This prevents locating pin from sliding out of hole in sender wheel.
- Ensure that sender wheel remains fixed on assembly tool when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

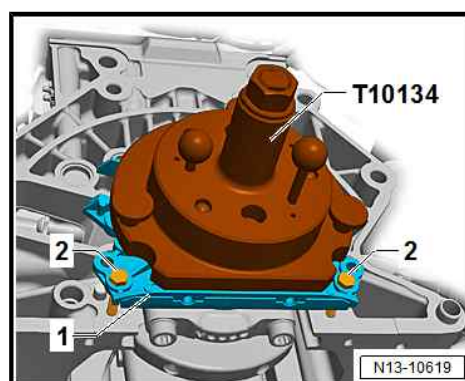


Securing assembly tool - T10134- with sealing flange -1- on crankshaft flange:

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



- Screw 2 bolts M6x35 -item 2- into cylinder block to guide sealing flange -1-.





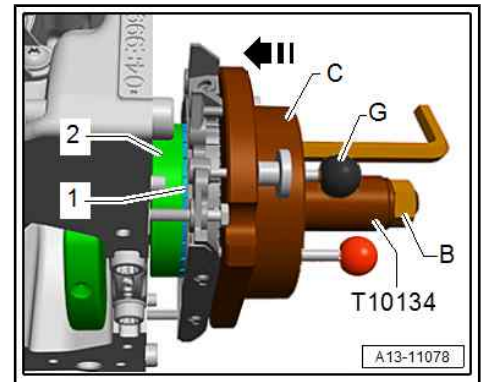
Securing assembly tool - T10134- on crankshaft flange:

- 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

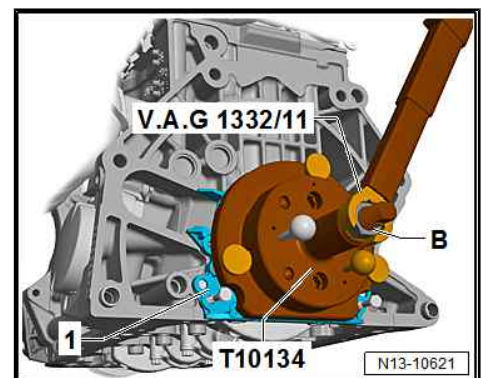
The guide pin for PETROL engines (red handle) MUST NOT be inserted into the threaded hole in the crankshaft.



- 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-.

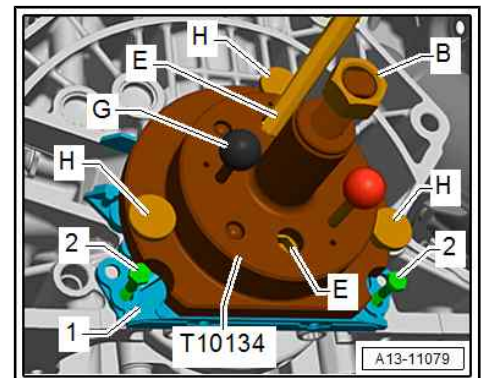
Pressing sender wheel onto crankshaft flange with assembly tool - T10134- :

- 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:

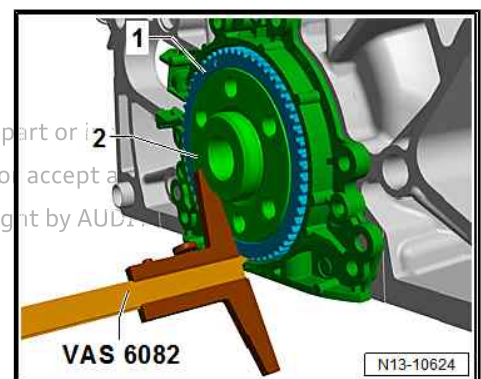
- Screw nut -B- to end of threaded spindle.
- Remove both bolts -2- from cylinder block.
- Unscrew knurled screws -H- from sealing flange -1-.
- Unbolt assembly tool - T10134- from crankshaft flange (remove hexagon socket head bolts -E- from crankshaft flange).
- Detach sealing lip support ring.



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



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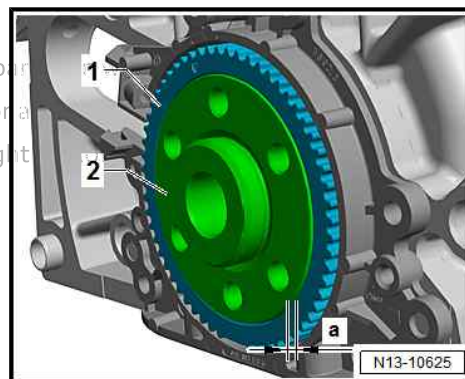


- Measure distance -a- between crankshaft flange -2- and sender wheel -1-.

• Specification: Distance -a- = 0.5 mm.

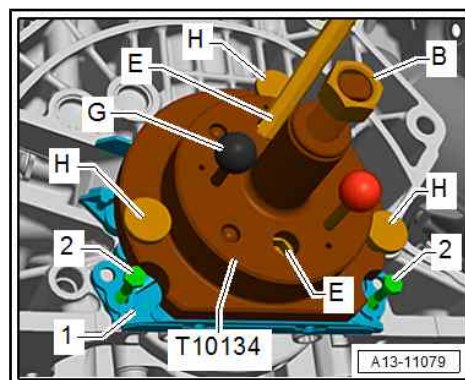
- Press sender wheel in further if measurement is too small
⇒ [page 72](#).

- 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](#).

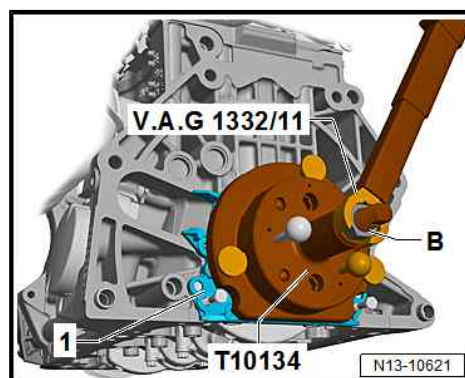
Assembling:

Assembly is performed in reverse sequence; note the following:

- Install sump ⇒ [page 145](#).
- Install intermediate plate ⇒ [page 64](#).
- Install flywheel ⇒ [page 64](#).

Tightening torques

- ♦ ⇒ [Fig. "Sealing flange \(gearbox end\) - tightening torque and sequence"](#), [page 64](#)





3 Crankshaft

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

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

⇒ [“3.3 Renewing needle bearing in crankshaft”, page 74](#)

⇒ [“3.4 Measuring axial clearance of crankshaft”, page 76](#)

⇒ [“3.5 Measuring radial clearance of crankshaft”, page 77](#)

3.1 Exploded view - crankshaft



Note

When performing assembly work, secure engine to engine and gearbox support ⇒ [page 27](#).

1 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Renew used bearing shells

2 - Toothed belt sprocket

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

3 - Bearing shell

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

4 - Thrust washers

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

5 - Bolts

- ☐ Renew
- ☐ Use old bolts when measuring radial clearance
- ☐ 65 Nm +90°

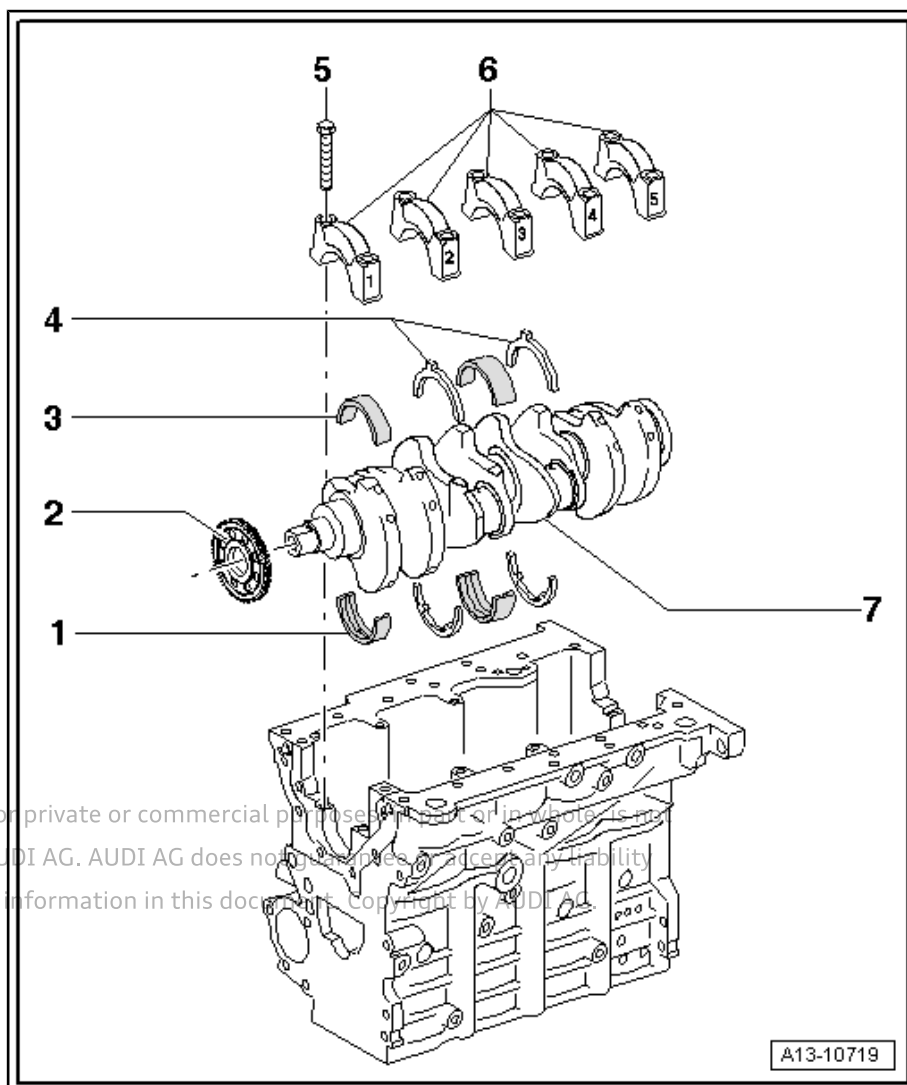
6 - Bearing caps

- ☐ Bearing cap 1: Pulley end
- ☐ Bearing cap 3 with recesses for thrust washers

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

7 - Crankshaft

- ☐ Only vehicles with 7-speed dual clutch gearbox 0AM: with needle bearing in the crankshaft
- ☐ Extracting and driving in needle bearing ⇒ [page 74](#)



A13-10719



- ❑ Measuring axial clearance ⇒ [page 76](#)
- ❑ Measuring radial clearance ⇒ [page 77](#)
- ❑ Crankshaft dimensions ⇒ [page 74](#)

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 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-



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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 .

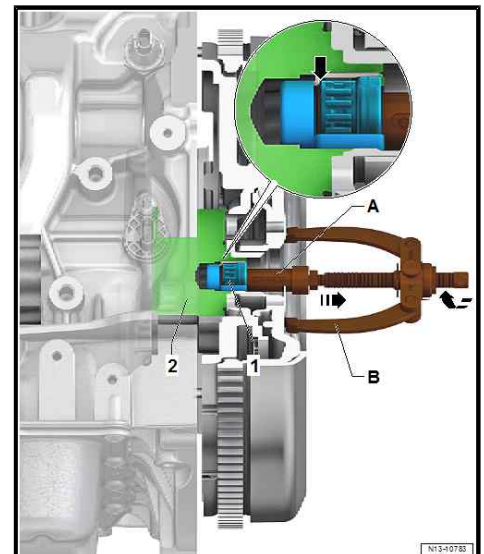
The needle bearing must always be renewed if the engine is separated from the gearbox.

Extracting needle bearing

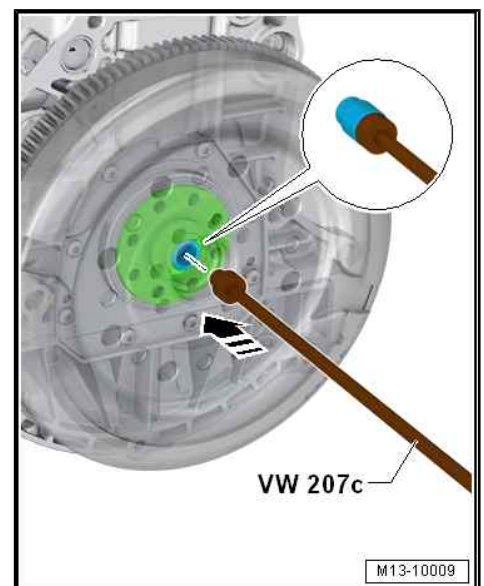
- Remove needle bearing -1- from crankshaft -2- using internal puller - VAS 251 635- -A- and counter-support - VAS 251 621- -B-.
- Internal puller must be positioned behind needle roller -arrow-.

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- .



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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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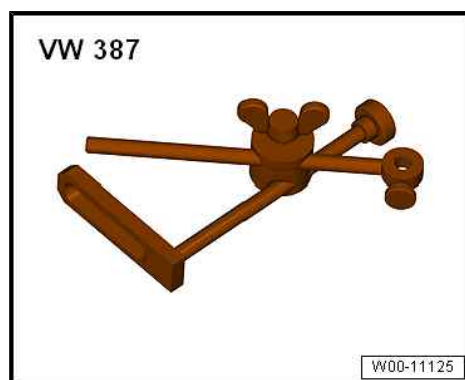
with respect to the correctness of information in this document. Cop



3.4 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6080-



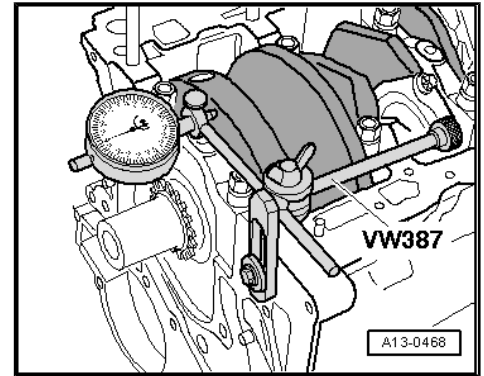


Procedure

- Secure dial gauge - VAS 6080- with universal dial gauge bracket - VW 387- to cylinder block as shown in illustration.
- Apply dial gauge to crank web.
- Press crankshaft against dial gauge by hand and set gauge to "0".
- Push crankshaft away from dial gauge and read off value.

Axial clearance:

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



3.5 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Plastigauge

Procedure

- Remove 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.
- The Plastigauge must be positioned in the centre of the bearing shell.
- Fit bearing cap and secure with old bolts ⇒ [Item 5 \(page 73\)](#) without rotating crankshaft.
- Remove bearing cap again.
- Compare width of Plastigauge with measurement scale.

Radial clearance:

- New: 0.03 ... 0.08 mm.
- Wear limit: 0.17 mm.
- When carrying out final assembly, renew bolts.



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 84

⇒ "4.5 Checking radial clearance of conrod bearings", page 85

4.1 Exploded view - pistons and conrods



Note

Oil spray jet and pressure relief valve ⇒ page 80

1 - Bolt

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

2 - Conrod bearing cap

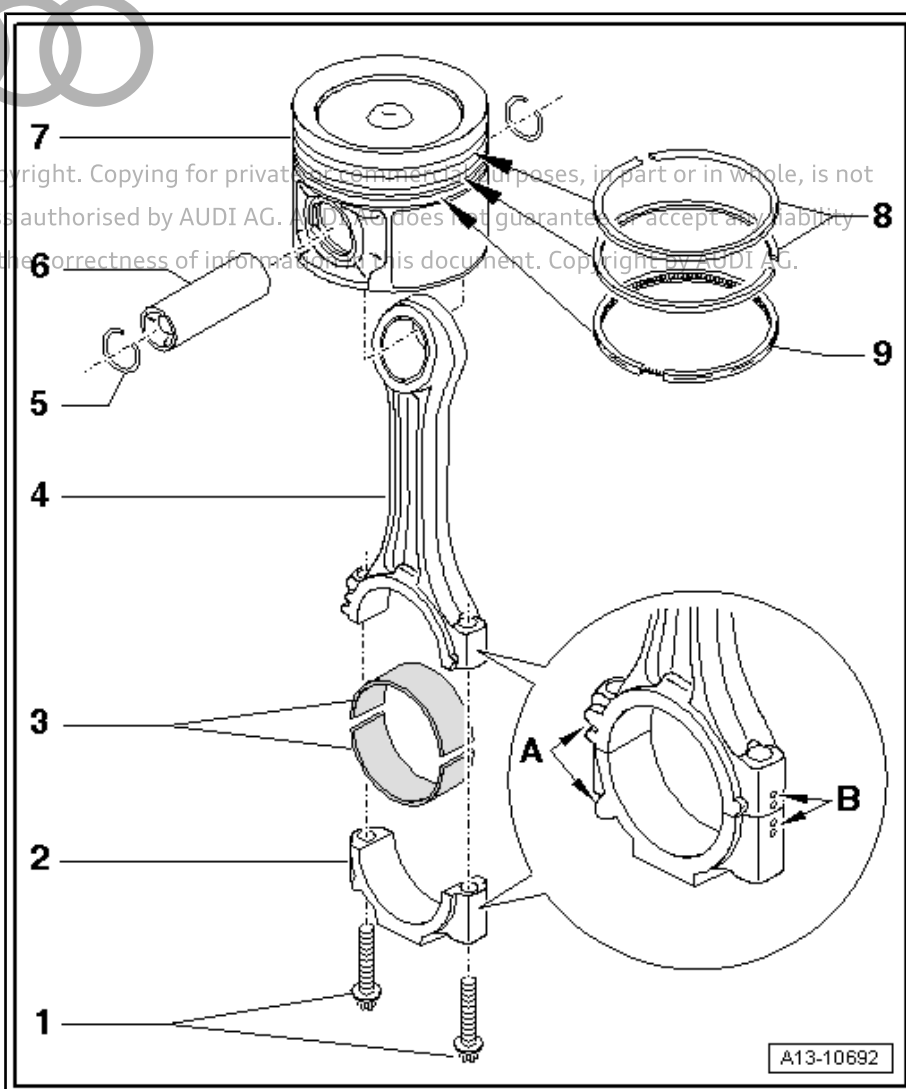
- ☐ Note installation position
- ☐ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ☐ Mark conrod and cylinder allocation with paint -B-
- ☐ Installation position: Markings -A- face towards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

3 - Bearing shell

- ☐ 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
- ☐ Mark cylinder allocation in colour -B-





- ☐ Axial clearance: wear limit: 0.37 mm
- ☐ Measuring radial clearance ⇒ [page 85](#)
- ☐ Only renew as a complete set
- ☐ Separating parts of new conrod ⇒ [page 80](#)
- ☐ Installation position: Markings -A- face towards pulley end

5 - Circlip

- ☐ Renew

6 - Piston pin

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

7 - Piston

- ☐ 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 84](#)
- ☐ Measuring piston projection at "TDC" ⇒ [page 82](#)

8 - Piston rings

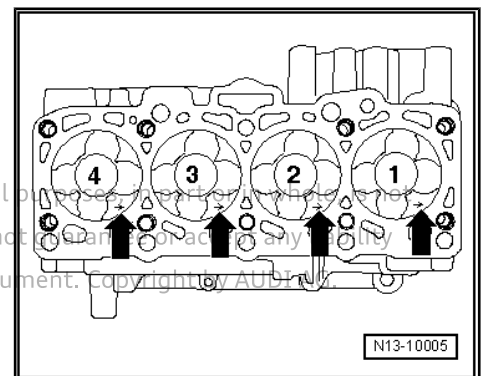
- ☐ Compression rings
- ☐ Use piston ring pliers to remove and install
- ☐ Measuring ring gap ⇒ [page 84](#)
- ☐ Measuring ring-to-groove clearance ⇒ [page 85](#)
- ☐ Installation position: marking "TOP" or side with lettering faces towards piston crown
- ☐ Offset gaps by 120°

9 - Piston ring

- ☐ Oil scraper ring
- ☐ Use piston ring pliers to remove and install
- ☐ Measuring ring gap ⇒ [page 84](#)
- ☐ Measuring ring-to-groove clearance ⇒ [page 85](#)
- ☐ Offset gap 120° from bottom compression ring

Installation position of pistons and allocation of piston/cylinder

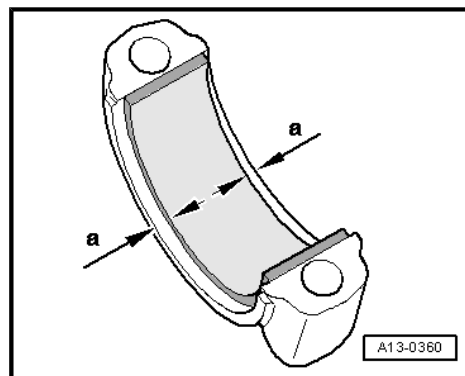
- Arrow on piston crown points to pulley end -arrows-.



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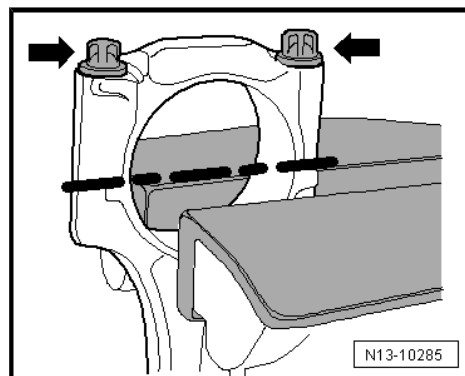
**Installation position of bearing shells in conrods**

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

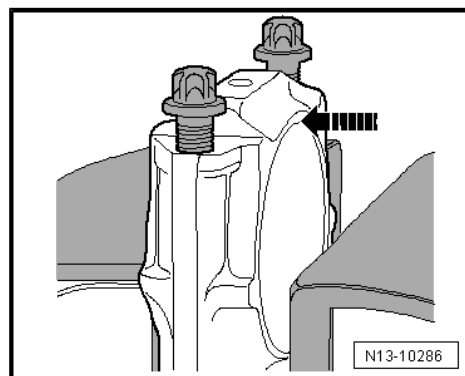
**Separating parts of new conrod**

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

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



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

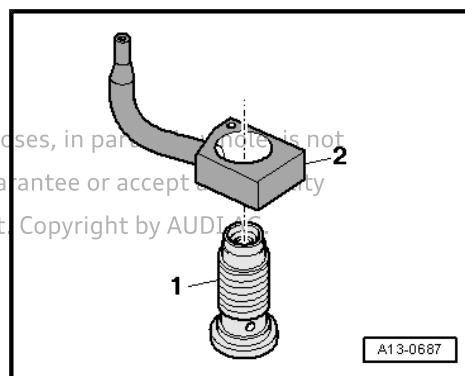
**Oil spray jet and pressure relief valve**

- 1 - Bolt with pressure relief valve, 27 Nm
- 2 - Oil spray jet (for cooling of pistons)

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

**Note**

- ◆ Take care not to bend oil spray jets.
- ◆ Always renew bent oil spray jets.

**4.2 Removing and installing pistons**

Special tools and workshop equipment required



◆ Pin - VW 222 A-



◆ Piston ring clamp, commercially available

Removing

- Engine secured to engine and gearbox support ⇒ [page 27](#) .
- Remove cylinder head ⇒ [page 105](#) .
- Remove oil pump ⇒ [page 150](#) .
- 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 - VW 222 A- 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 150](#) .
- Install cylinder head ⇒ [page 105](#) .

Tightening torques

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



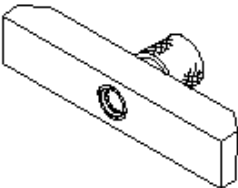
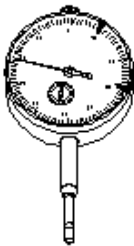
4.3 Measuring piston projection at TDC



Note

Piston projection at "TDC" must be measured when installing new pistons or a short engine.

Special tools and workshop equipment required

VW 382/7 	VW 385/17 
VAS 6079 	
	G13-0064

- ◆ Measuring bridge -VW 382/7- from measuring tool - VW 382-
- ◆ Measuring plate -VW 385/17- from universal measuring tool - VW 385-
- ◆ Dial gauge - VAS 6079-



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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).

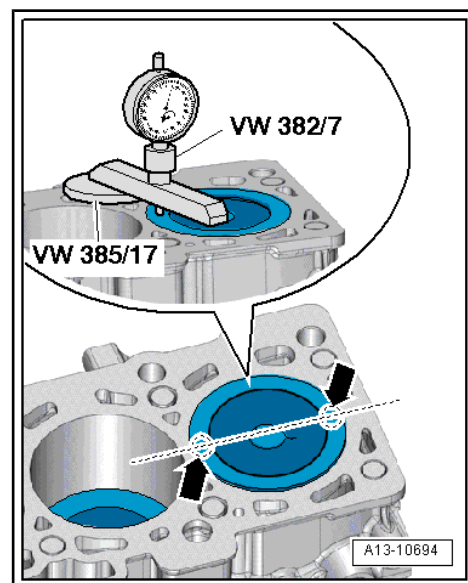


Note

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

- 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



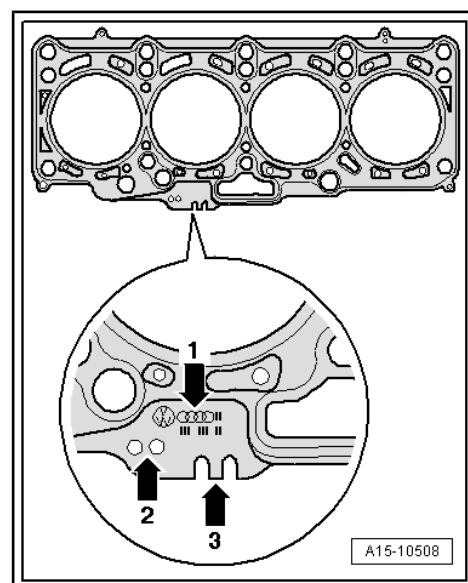
Identification of cylinder head gasket

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



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.



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4.4 Checking pistons and cylinder bores

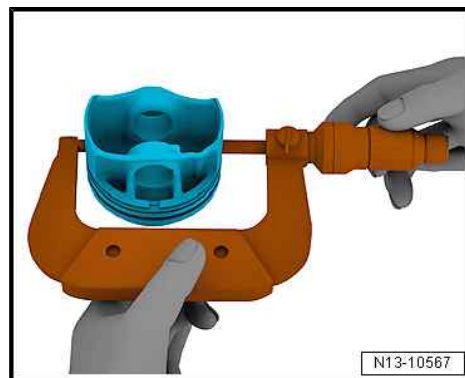
Checking piston

- 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	79.455 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

- Check cylinder bore for wear, scoring and other abnormalities.

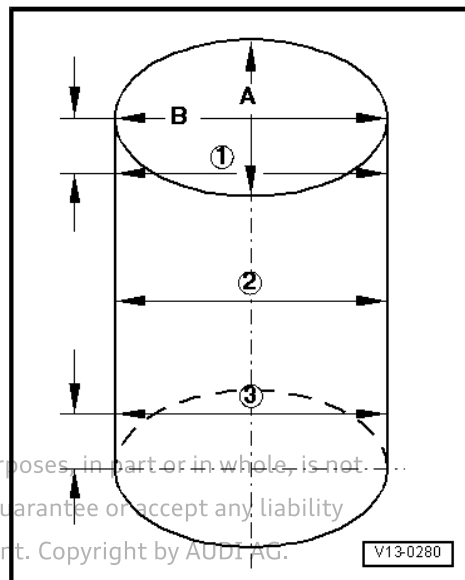
Cylinder bore Ø mm	
Nominal dimension	79.5



Note

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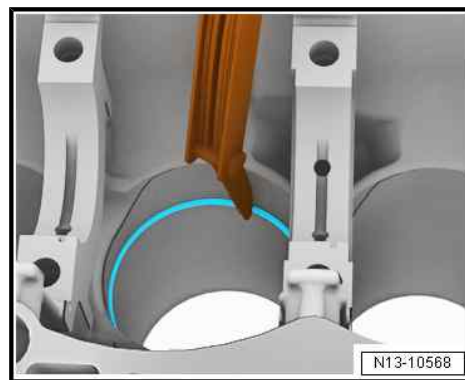
~~Measuring the cylinder bores must not be done when the cylinder block is mounted to the engine and gearbox support - VAS 6095-, as incorrect measurements may result.~~



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	0.3 ... 0.40	0.55
2nd compression ring	0.20 ... 0.45	0.95
Oil scraper ring	0.25 ... 0.50	0.75

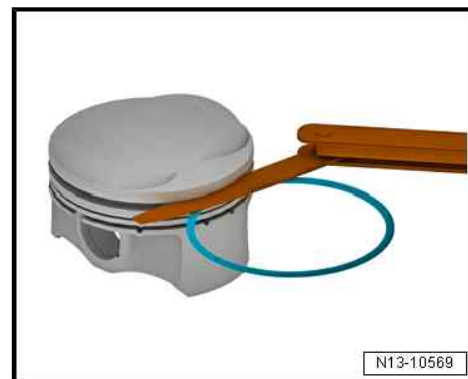




Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	Wear limit mm
1st compression ring	0.08
2nd compression ring	0.08
Oil scraper ring	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
- When carrying out final assembly, renew bolts.



15 – Cylinder head, valve gear

1 Toothed belt drive

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

⇒ [“1.2 Removing and installing toothed belt”, page 88](#)

1.1 Exploded view - toothed belt

1 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Check for wear
- ☐ Removing ⇒ [page 88](#)
- ☐ Installing (adjusting valve timing)
⇒ [page 93](#)

2 - Idler roller

3 - Nut

- ☐ Make sure that stud is fitted securely
- ☐ 20 Nm

4 - Stud

- ☐ 15 Nm

5 - Nut

- ☐ Renew nut
- ☐ Make sure that stud is fitted securely
- ☐ 20 Nm +45°

6 - Tensioning roller

- ☐ Different versions
⇒ [page 88](#)

7 - Stud

- ☐ 15 Nm

8 - Bolt

- ☐ 20 Nm

9 - Idler roller

10 - Bolt

- ☐ Renew
- ☐ 20 Nm +45°

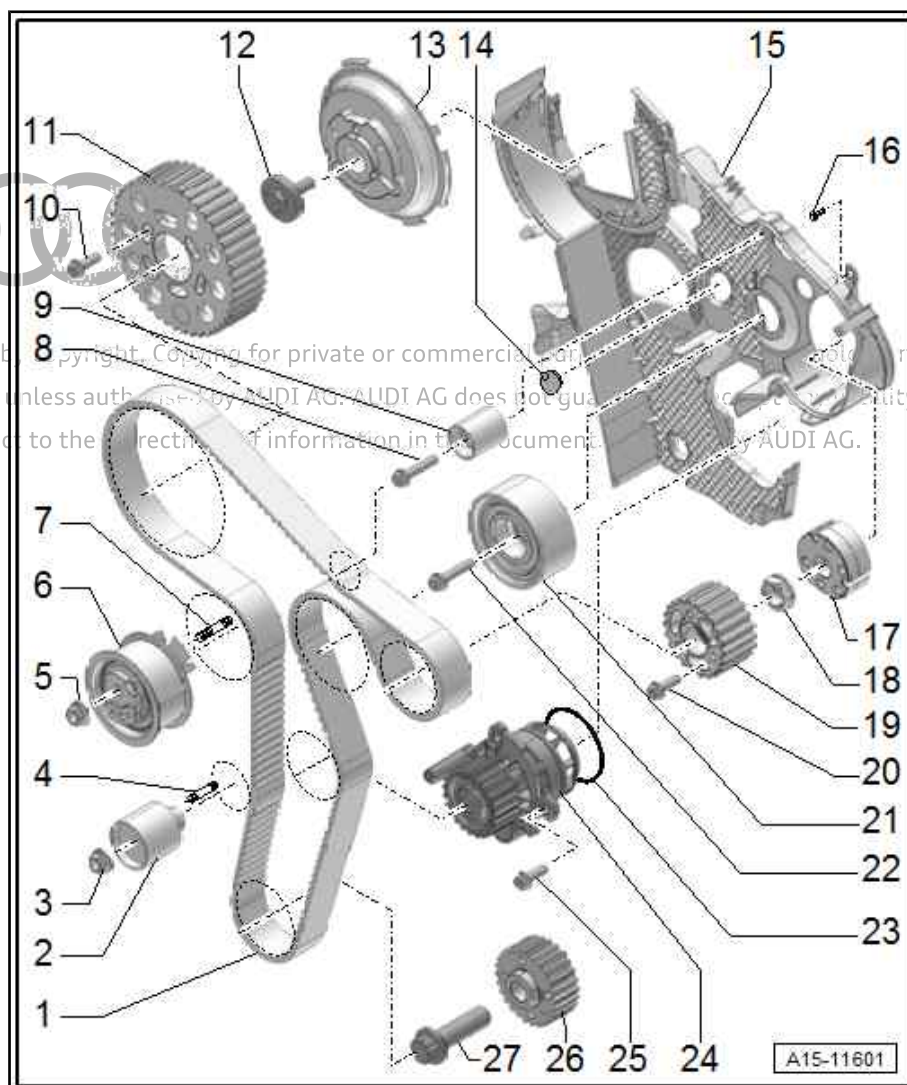
11 - Camshaft sprocket

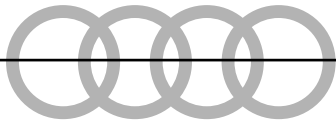
12 - Bolt

- ☐ Slacken and tighten with counterhold tool - T10051-
- ☐ 100 Nm

13 - Camshaft hub

- ☐ Removing and installing ⇒ [“3.5 Removing and installing camshaft”, page 127](#)





14 - Plug

15 - Toothed belt cover (rear)

16 - Bolt

- ☐ 9 Nm

17 - High-pressure pump hub

- ☐ Removing and installing ⇒ [page 274](#)

18 - Nut

- ☐ Tightening torque ⇒ [Item 6 \(page 274\)](#)

19 - High-pressure pump sprocket

20 - Bolt

- ☐ Tightening torque ⇒ [Item 5 \(page 274\)](#)

21 - Idler roller

22 - Bolt

- ☐ Renew
- ☐ 50 Nm +90°

23 - O-ring

- ☐ Renew

24 - Coolant pump

- ☐ Removing and installing ⇒ [page 173](#)

25 - Bolt

- ☐ Tightening torque ⇒ [Item 2 \(page 170\)](#)

26 - Crankshaft sprocket

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

27 - Bolt

- ☐ Renew
- ☐ Slacken and tighten with counterhold tool - 3415-
- ☐ Do not additionally oil threads and shoulder

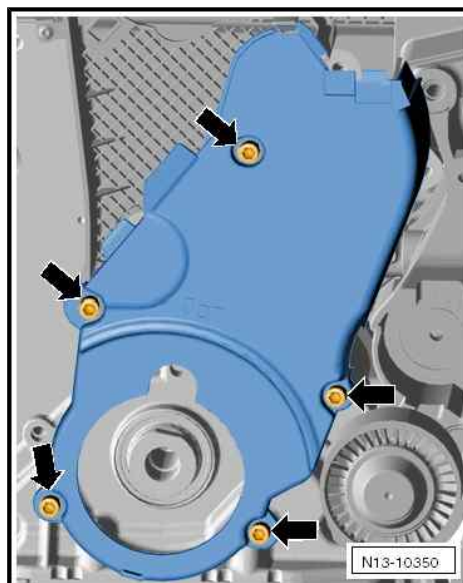
Tighten in three stages as follows:

- ◆ 1st stage: 180 Nm
- ◆ 2nd stage: Use rigid wrench to turn 90° further
- ◆ 3rd stage: Use rigid wrench to turn 45° further



Toothed belt cover (bottom) - tightening torque

- Tighten bolts -arrows- to 9 Nm.



Different tensioning roller versions

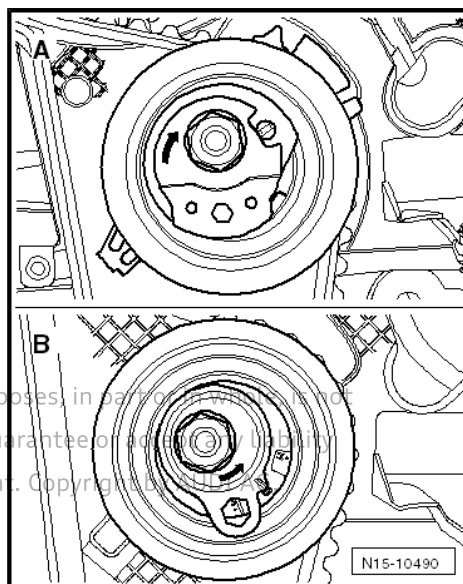
Depending on version, two different types of tensioning roller may have been installed. It is possible to switch between them. When making adjustments, check which type of tensioning roller is installed.

Tensioning roller version -A-:

- ◆ Use locking tool - T10265- for installation.
- ◆ Make sure tensioning roller is positioned correctly in toothed belt cover.
- ◆ To tension toothed belt, turn eccentric adjuster clockwise -arrow-.

Tensioning roller version -B-:

- ◆ No locking tool is necessary for installation.
- ◆ The tensioning roller is not located in the toothed belt cover.
- ◆ To tension toothed belt, turn eccentric adjuster anticlockwise -arrow-.



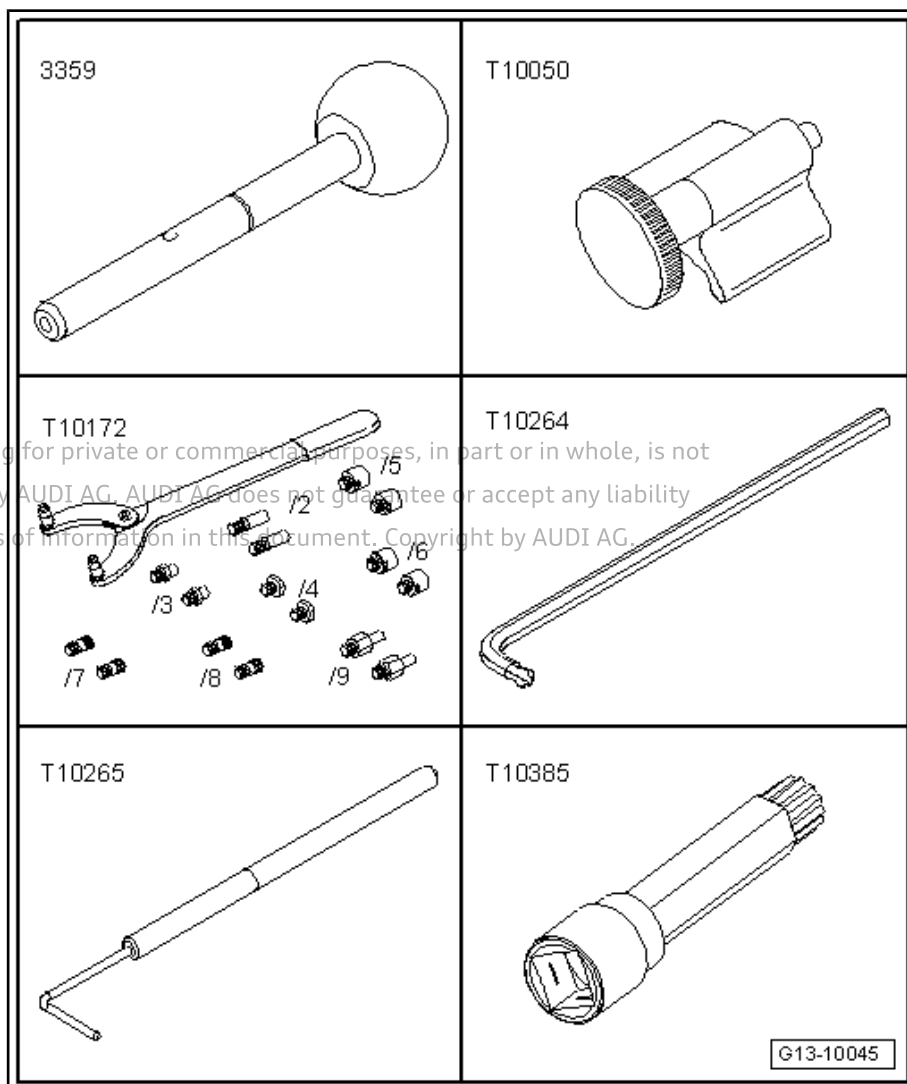
1.2 Removing and installing toothed belt



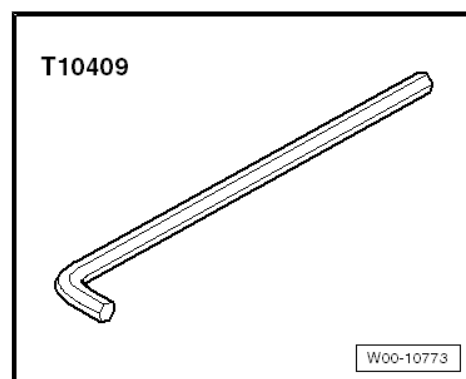
Special tools and workshop equipment required



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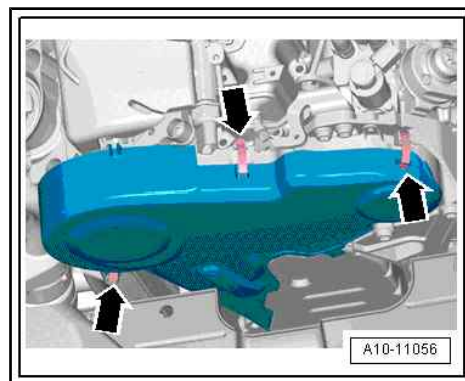
- ◆ 2x diesel injection pump locking pin - 3359-
- ◆ Crankshaft stop - T10050-
- ◆ Counterhold tool - T10172- with adapters -T10172/2-
- ◆ Offset screwdriver - T10264- for vehicles with tensioning roller version -A- → [page 88](#)
- ◆ Locking tool - T10265-
- ◆ Bit XZN 10 - T10385-
- ◆ Offset screwdriver, 8 mm - T10409- for vehicles with tensioning roller version -B- → [page 88](#)



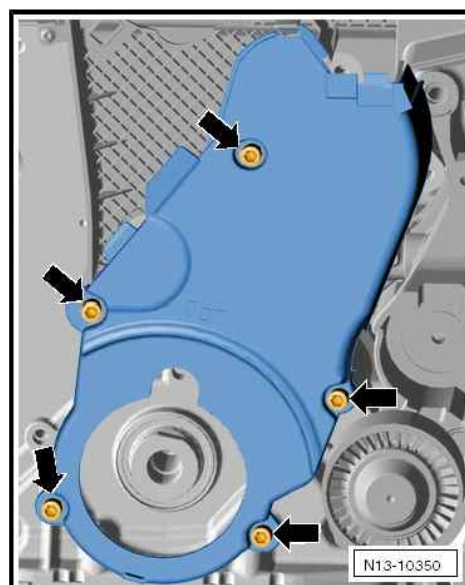


Removing

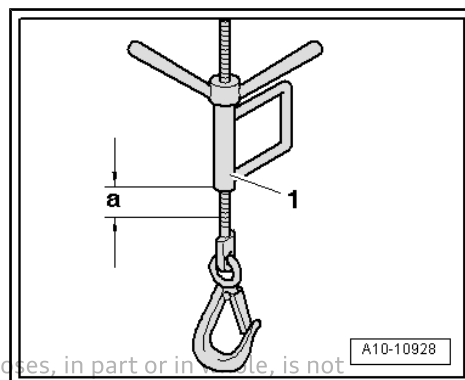
- Remove engine cover panel ⇒ [page 43](#) .
- Release retaining clips -arrows- and detach toothed belt cover (top).
- Remove vibration damper ⇒ [page 55](#) .



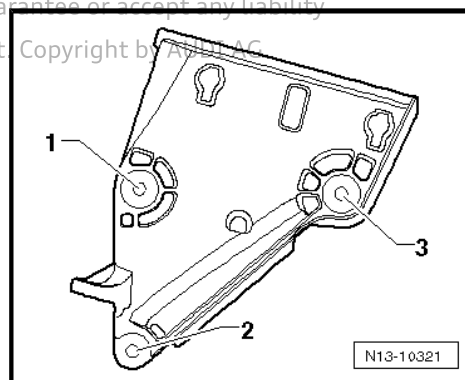
- Remove bolts -arrows- and detach toothed belt cover (bottom).
- Remove engine mounting ⇒ [page 34](#) .



- Using hook - 10 - 222 A /10- -item 1-, raise engine through distance -a-.
- Dimension -a- = 45 mm



- Unscrew bolts -1, 2 and 3- and detach engine support.



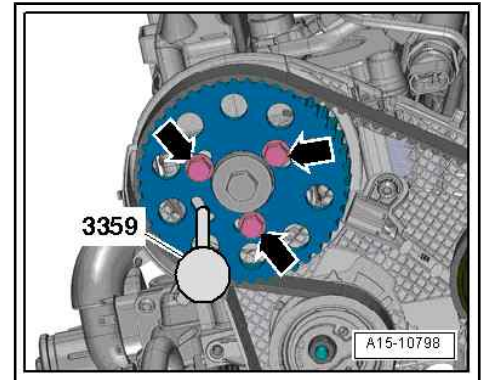


Caution

Irreparable damage can be caused if the toothed belt slips.

◆ *Only turn crankshaft in direction of engine rotation.*

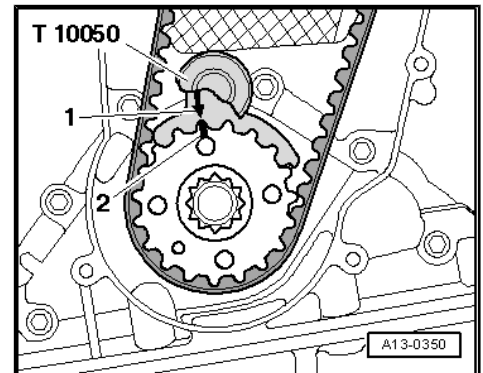
- Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at "TDC".
- Lock camshaft hub with diesel injection pump locking pin - 3359- .



Note

Disregard -arrows-.

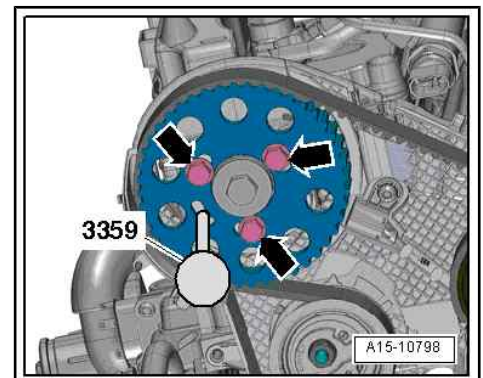
- Lock crankshaft sprocket in position with crankshaft stop - T10050- .
- The markings on the sprocket -2- and the crankshaft stop -1- must align -arrow-. The pin of the crankshaft stop must engage in the aperture in the sealing flange.



Note

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

- Slacken bolts -arrows- for camshaft sprocket approx. 90°.

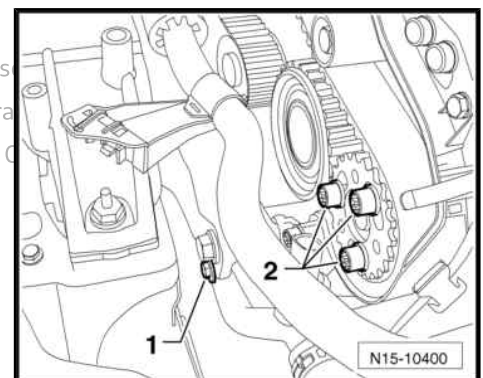


- Using bit XZN 10 - T10385- , loosen bolts -2- for high-pressure pump sprocket approx. 90°.



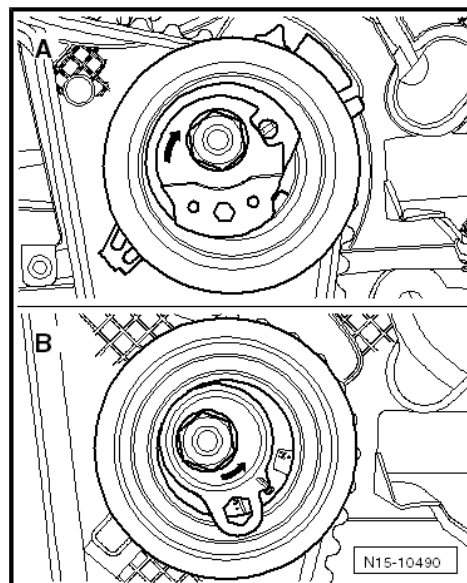
Note

Disregard -item 1-.



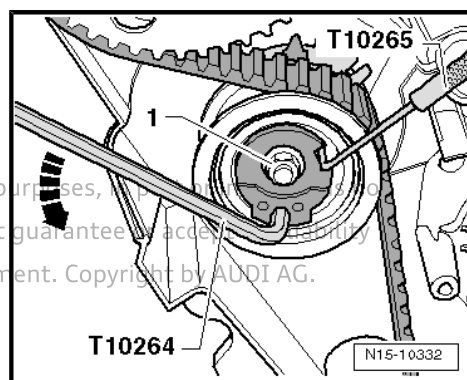


Vehicles with tensioning roller version "A":

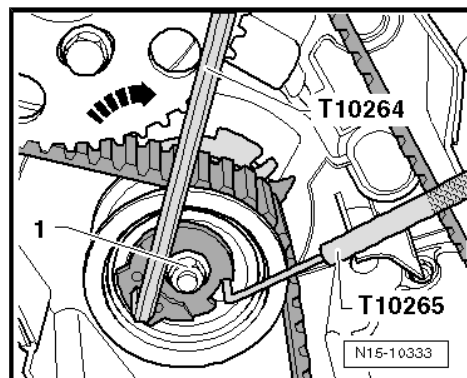


- Slacken nut -1- for tensioning roller.
- Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until tensioning roller can be secured with locking tool - T10265- .

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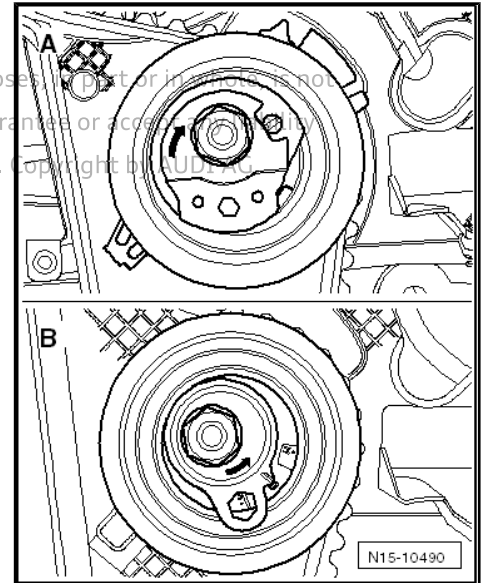
- Then use offset screwdriver - T10264- to turn eccentric adjuster of tensioning roller clockwise -arrow- as far as stop and tighten nut -1- by hand.





Vehicles with tensioning roller version "B":

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- Slacken nut -1- for tensioning roller.
- Turn eccentric adjuster of tensioning roller with offset screwdriver, 8 mm - T10409- clockwise -arrow- until tensioning roller is slackened.
- Tighten nut for tensioning roller hand-tight again.

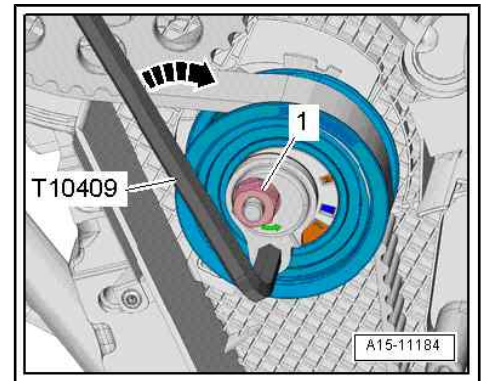
All vehicles (continued):



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.*



- Take off toothed belt first from idler roller and then from remaining sprockets.

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 camshaft is turned.*

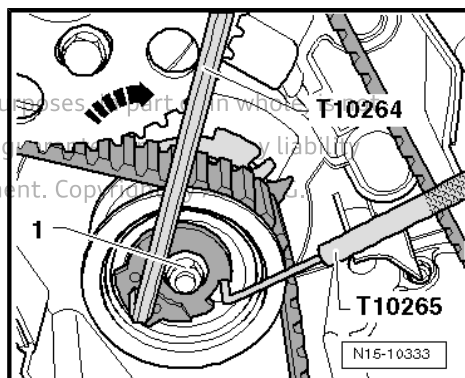
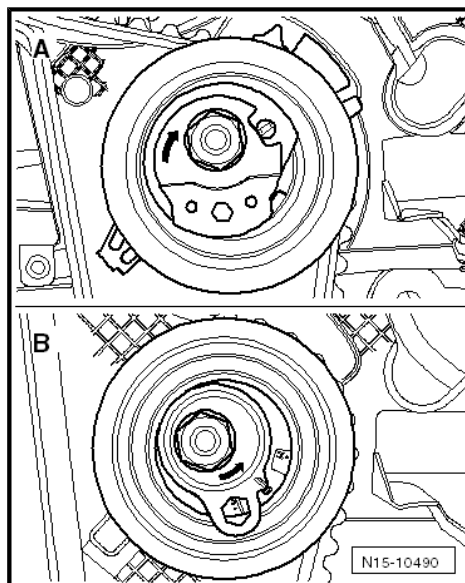


Vehicles with tensioning roller version -A-:

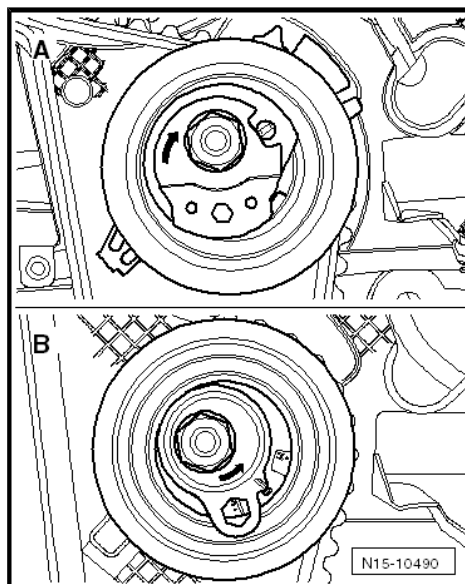


- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut.

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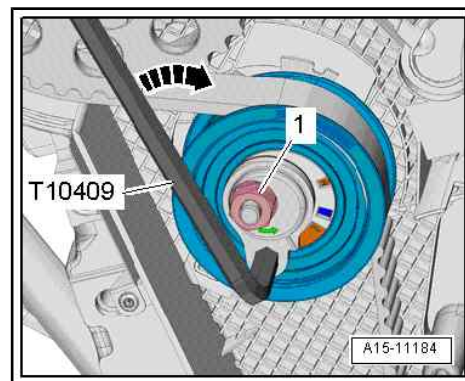


Vehicles with tensioning roller version -B-:



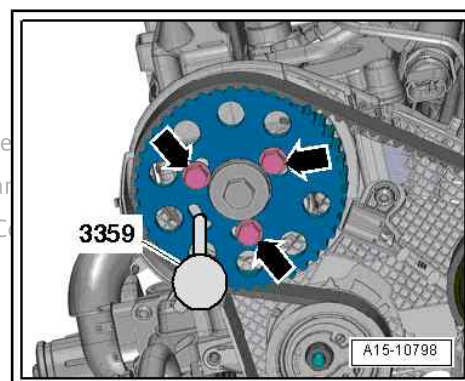


- Tensioning roller slackened and nut -1- tightened to approx 3 Nm.

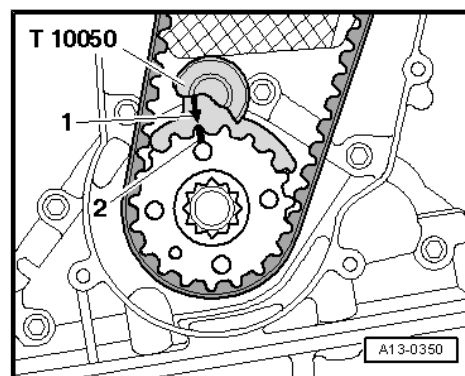


All vehicles (continued):

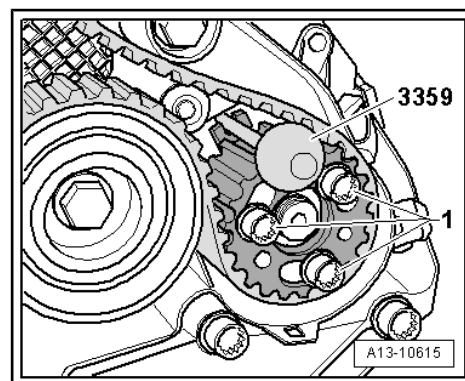
- Camshaft hub locked with diesel injection pump locking pin - 3359- .
- Bolts -arrows- are fitted but not tightened.
- It should just be possible to turn the sprocket on the camshaft without axial movement.



- Crankshaft is locked in position with crankshaft stop - T10050- .

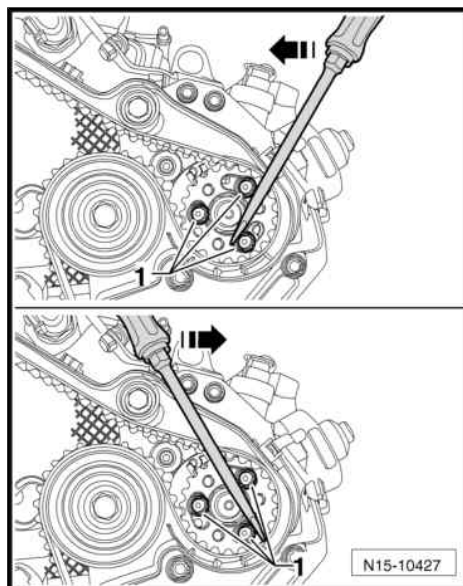


- Hub of high-pressure pump locked with diesel injection pump locking pin - 3359- .
- Bolts -1- are fitted but not tightened.
- The high-pressure pump sprocket should still just turn, but there must be no axial movement.



**Note**

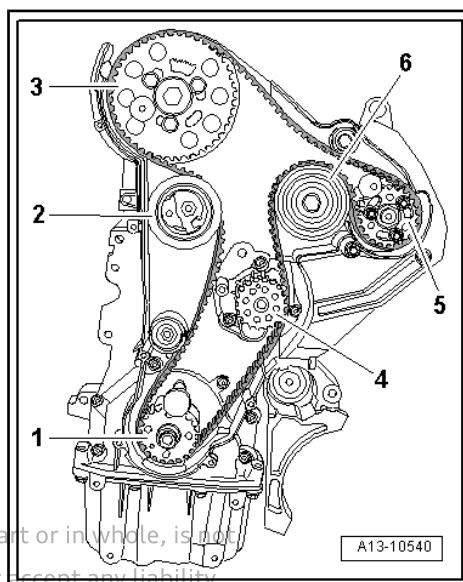
If necessary, apply a screwdriver to bolt heads -1- and turn the high-pressure pump hub until it can be locked with the locking pin.



– Turn the camshaft sprocket and high-pressure pump sprocket in their elongated holes clockwise as far as the stop.

– Install toothed belt in the specified sequence:

- 1 - Crankshaft sprocket
- 2 - Tensioning roller
- 3 - Camshaft sprocket
- 4 - Coolant pump sprocket
- 5 - High-pressure pump sprocket
- 6 - Idler roller

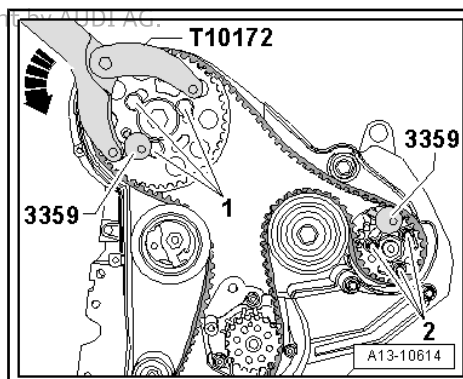


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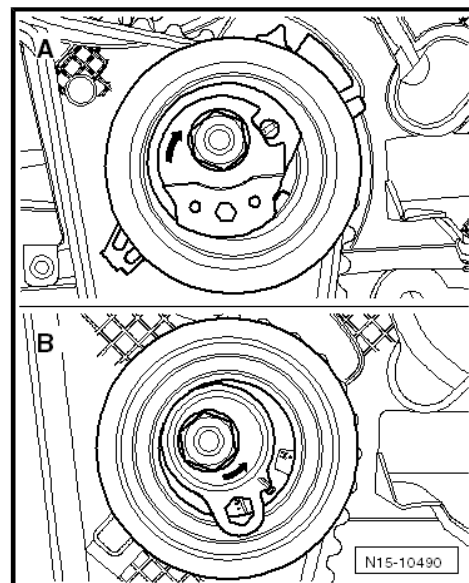
– Position counterhold tool - T10172 - with adapter - T10172/2 - on camshaft sprocket as shown in illustration.

- 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 an initial torque of 20 Nm.





Vehicles with tensioning roller version -A-:

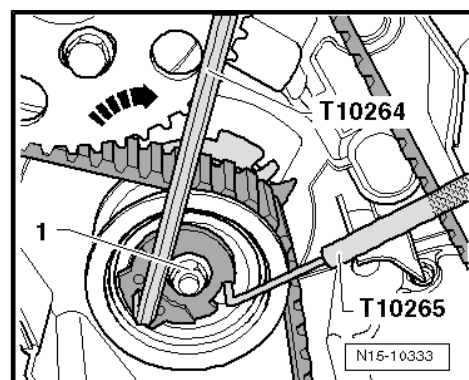


- Loosen nut -1- for tensioning roller and detach locking tool - T10265- .



Note

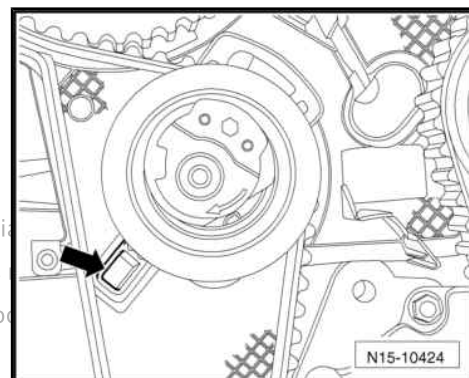
Disregard -arrow-.



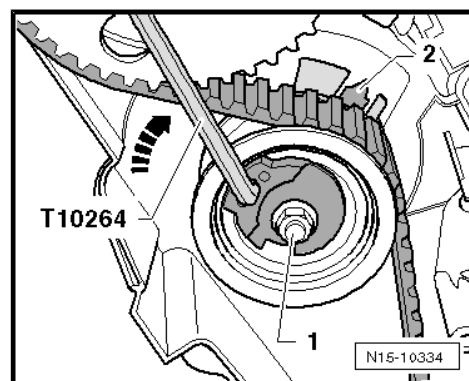
Note

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

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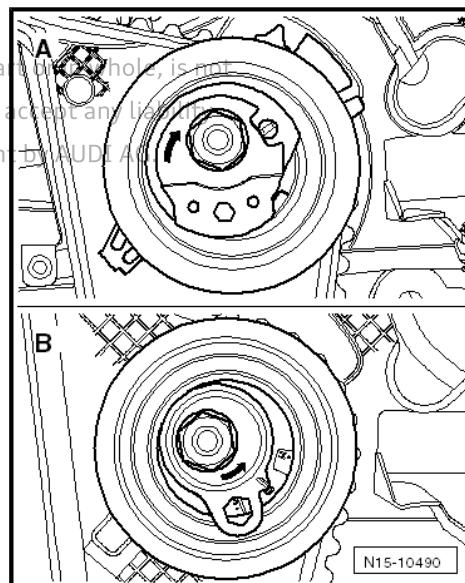


- Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -2- aligns with centre of slot on base plate.
- Nut -1- must not turn.
- Hold tensioning roller in this position and tighten nut.
- Remove locking pins -3359- and crankshaft stop - T10050- .



**Vehicles with tensioning roller version -B-:**

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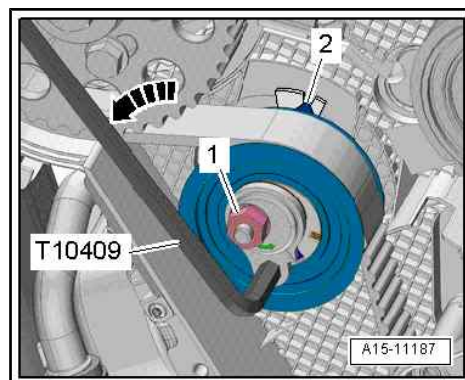


- Carefully turn eccentric adjuster of tensioning roller anti-clockwise -arrow- using offset screwdriver, 8 mm - T10409- until pointer -2- aligns approximately above the centre of the slot on the base plate.
- Nut -1- must not turn.
- Hold tensioning roller in this position and tighten nut.
- Remove locking pins -3359- and crankshaft stop - T10050- .

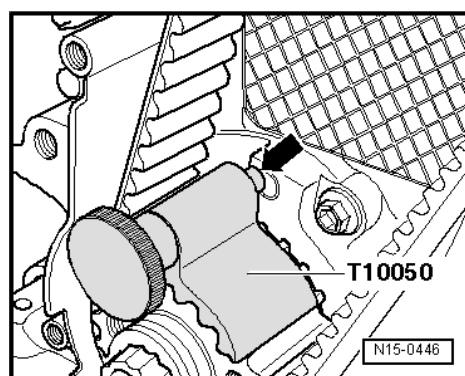
Checking valve timing:**Caution**

Irreparable damage can be caused if the toothed belt slips.

- ◆ *Only turn crankshaft in direction of engine rotation.*



- Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before "TDC".
- Fit crankshaft stop - T10050- to crankshaft sprocket again.
- Turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop engages in sealing flange as crankshaft rotates.



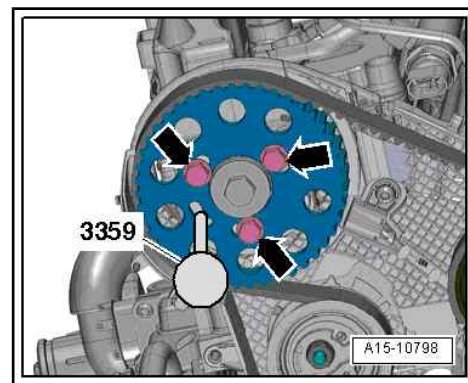


- It should now be possible to lock camshaft hub with diesel injection pump locking pin - 3359- .



Note

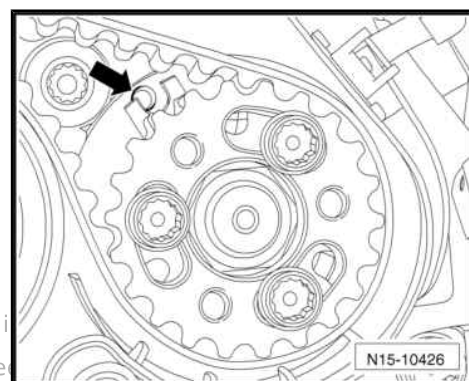
Disregard -arrows-.



- 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.



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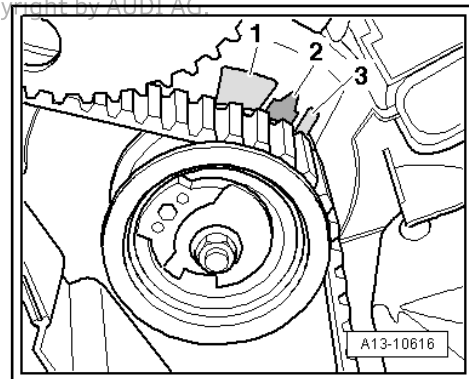


- Pointer -2- on tensioner roller must be centred between tabs -1- and -3- on base plate.



Note

- ◆ *This applies to both versions of tensioner roller.*
- ◆ *The maximum permissible sideways deviation from the specified position is 5 mm.*
- ◆ Re-adjust valve timing if requirements are not met
⇒ [page 99](#) .
- ◆ If requirements are met, continue with procedure after adjusting valve timing correctly as described below ⇒ [page 100](#) .



Re-adjusting valve timing:

- If camshaft hub cannot be locked, withdraw crankshaft stop - T10050- 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.
- Loosen bolts for camshaft sprocket after locking hub.

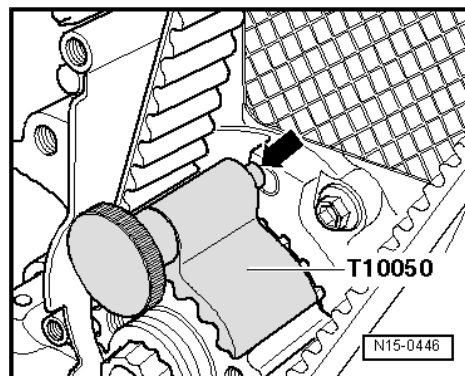


A - If pin -arrow- of crankshaft stop - T10050- is on left side of bore:

- Turn crankshaft in direction of engine rotation until pin of crankshaft stop engages in sealing flange as crankshaft rotates.
- Tighten camshaft sprocket bolts to 20 Nm initially.

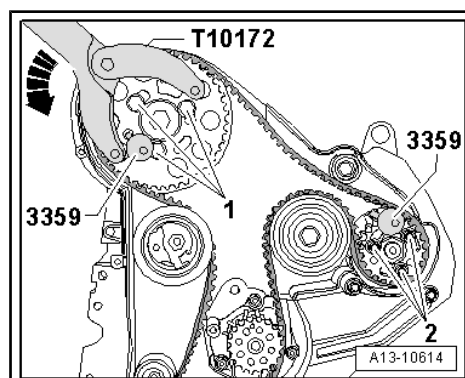
B - If pin -arrow- of crankshaft stop - T10050- is on right side of bore:

- 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 camshaft sprocket bolts to 20 Nm initially.



Procedure after adjusting valve timing correctly:

- Remove diesel injection pump locking pin - 3359- and crankshaft stop - T10050- .
- 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 98](#) .
- If camshaft hub can now be locked, tighten camshaft sprocket bolts -1- to final torque ⇒ [Item 10 \(page 86\)](#) .
- Tighten bolts -2- for high-pressure pump sprocket to final torque ⇒ [Item 5 \(page 274\)](#) .
- Check valve timing once again ⇒ [page 98](#) .



Assembling

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



Note

- ◆ *Renew seals and/or gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Install engine support ⇒ [page 34](#) .
- Install engine mounting and support arm ⇒ [page 34](#) .
- Install vibration damper ⇒ [page 55](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - toothed belt", page 86](#)
- ◆ ⇒ [Fig. "Toothed belt cover \(bottom\) - tightening torque", page 88](#)

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2 Cylinder head

⇒ ["2.1 Exploded view - cylinder head", page 101](#)

⇒ ["2.2 Exploded view - cylinder head cover", page 103](#)

⇒ ["2.3 Removing and installing cylinder head", page 105](#)

⇒ ["2.4 Removing and installing cylinder head cover", page 117](#)

⇒ ["2.5 Removing and installing seals for injectors", page 119](#)

⇒ ["2.6 Checking compression", page 120](#)

2.1 Exploded view - cylinder head

1 - Cylinder head

- ☐ Removing and installing
⇒ [page 105](#)
- ☐ To prevent damage to glow plugs, always place cylinder head on a soft foam surface after removal.
- ☐ Checking for distortion
⇒ [page 102](#)
- ☐ Must not be machined
- ☐ If renewed, change coolant and engine oil

2 - Washer

3 - Bolt

- ☐ Renew
- ☐ Correct sequence when slackening ⇒ [page 113](#)
- ☐ Tightening torque and sequence ⇒ [page 103](#)

4 - Bolt

- ☐ Version fitted in vehicle may differ from illustration
- ☐ 20 Nm

5 - Engine lifting eye

6 - Gasket

- ☐ Renew

7 - Vacuum pump

- ☐ Removing and installing
⇒ Brake system; Rep. gr. 47 ; Vacuum system;
Removing and installing vacuum pump

8 - Bolt

- ☐ Tightening torque ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Exploded view - vacuum pump

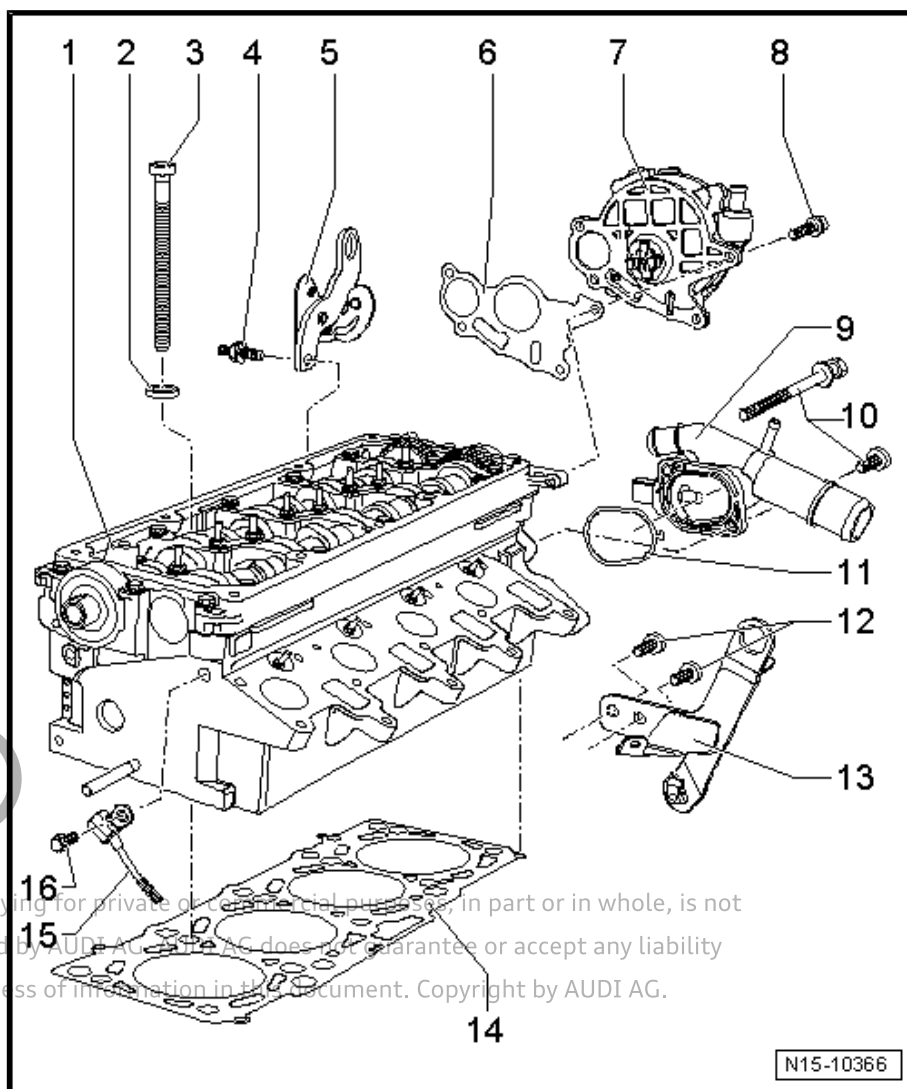
9 - Connection

10 - Bolts

- ☐ Tightening torque ⇒ [Item 19 \(page 184\)](#) and ⇒ [Item 20 \(page 184\)](#)

11 - Gasket

- ☐ Renew



N15-10366

**12 - Bolts**

- ☐ 20 Nm

13 - Engine lifting eye

- ☐ Version fitted in vehicle may differ from illustration

14 - Cylinder head gasket

- ☐ Renewing ⇒ ["2.3 Removing and installing cylinder head", page 105](#)
- ☐ Identification of cylinder head gasket ⇒ [page 102](#)
- ☐ If renewed, change coolant and engine oil

15 - Hall sender - G40-

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

16 - Bolt

- ☐ Tightening torque ⇒ [Item 2 \(page 323\)](#)

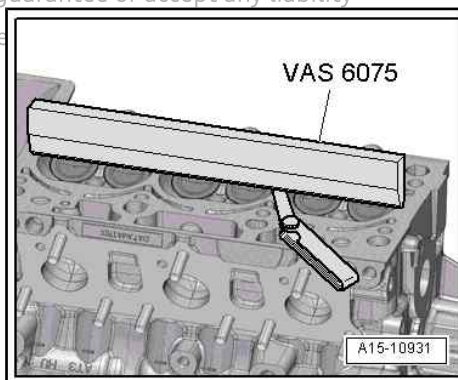
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Checking cylinder head for distortion

- 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**

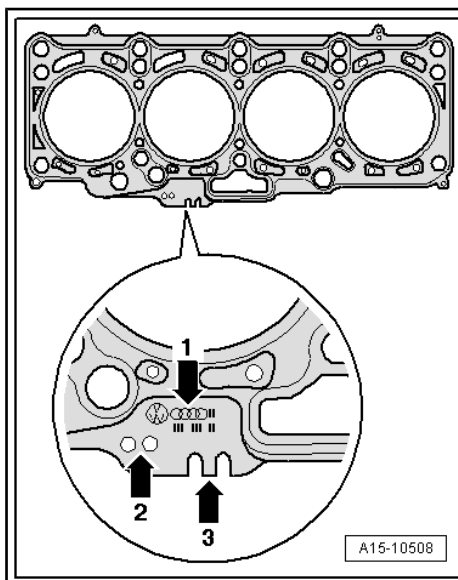
Cylinder heads must not be reworked on TDI engines.

**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

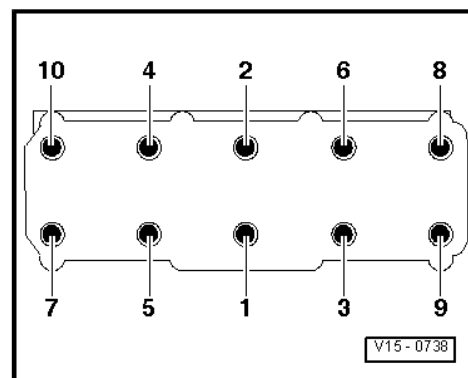


Note

Renew the bolts tightened with specified tightening angle.

– Tighten bolts in 4 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 10-	30 Nm
2.	-1 ... 10-	50 Nm
3.	-1 ... 10-	Turn 90° further
4.	-1 ... 10-	Turn 90° further



2.2 Exploded view - cylinder head cover

1 - Gasket

- ☐ Renew if damaged or leaking

2 - Cylinder head cover

- ☐ Removing and installing
⇒ [page 117](#)

3 - O-ring

- ☐ Renew

4 - Hose

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

5 - Sealing bush

- ☐ For fuel rail
- ☐ Renew if damaged or leaking

6 - Cable guide

7 - Grommet

8 - Bolt

- ☐ Tightening torque
⇒ [Item 1 \(page 241\)](#)

9 - Fuel rail

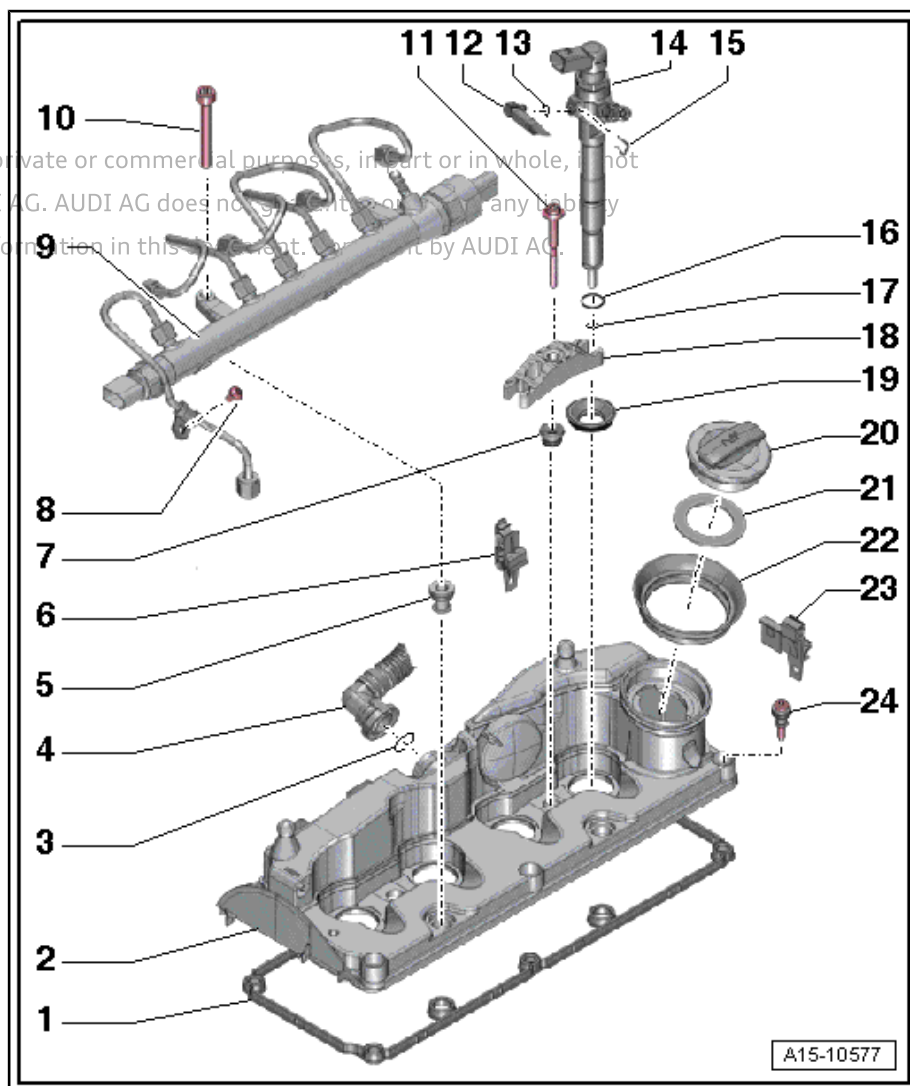
- ☐ Observe rules for cleanliness ⇒ [page 6](#)
- ☐ Do not attempt to bend high-pressure pipes to a different shape
- ☐ Installing high-pressure pipes ⇒ [page 258](#)

10 - Bolt

- ☐ Tightening torque ⇒ [Item 14 \(page 242\)](#)

11 - Bolt

- ☐ Tightening torque ⇒ [Item 11 \(page 242\)](#)





12 - Fuel return hose

- ☐ Do not dismantle
- ☐ Installing ⇒ [page 260](#)

13 - O-ring

- ☐ Renew

14 - Injector

- ☐ Observe rules for cleanliness ⇒ [page 6](#)
- ☐ Removing and installing ⇒ [page 252](#)

15 - Retaining clip

- ☐ Renew

16 - O-ring

- ☐ Renew

17 - Copper seal

- ☐ Renew

18 - Clamping piece

19 - Seal

- ☐ For injector
- ☐ Renewing ⇒ [page 119](#)

20 - Filler cap

21 - Seal

22 - Grommet

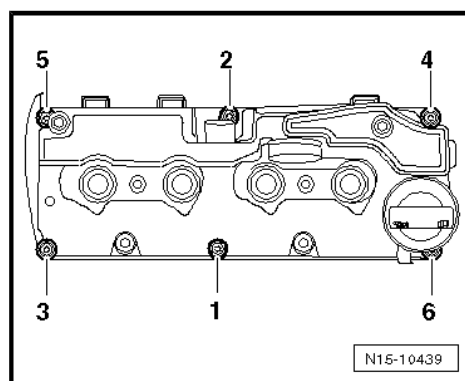
23 - Cable guide

24 - Bolt

- ☐ Renew if seal is damaged
- ☐ Tightening torque and sequence ⇒ [page 104](#)

Cylinder head cover - tightening torque and sequence

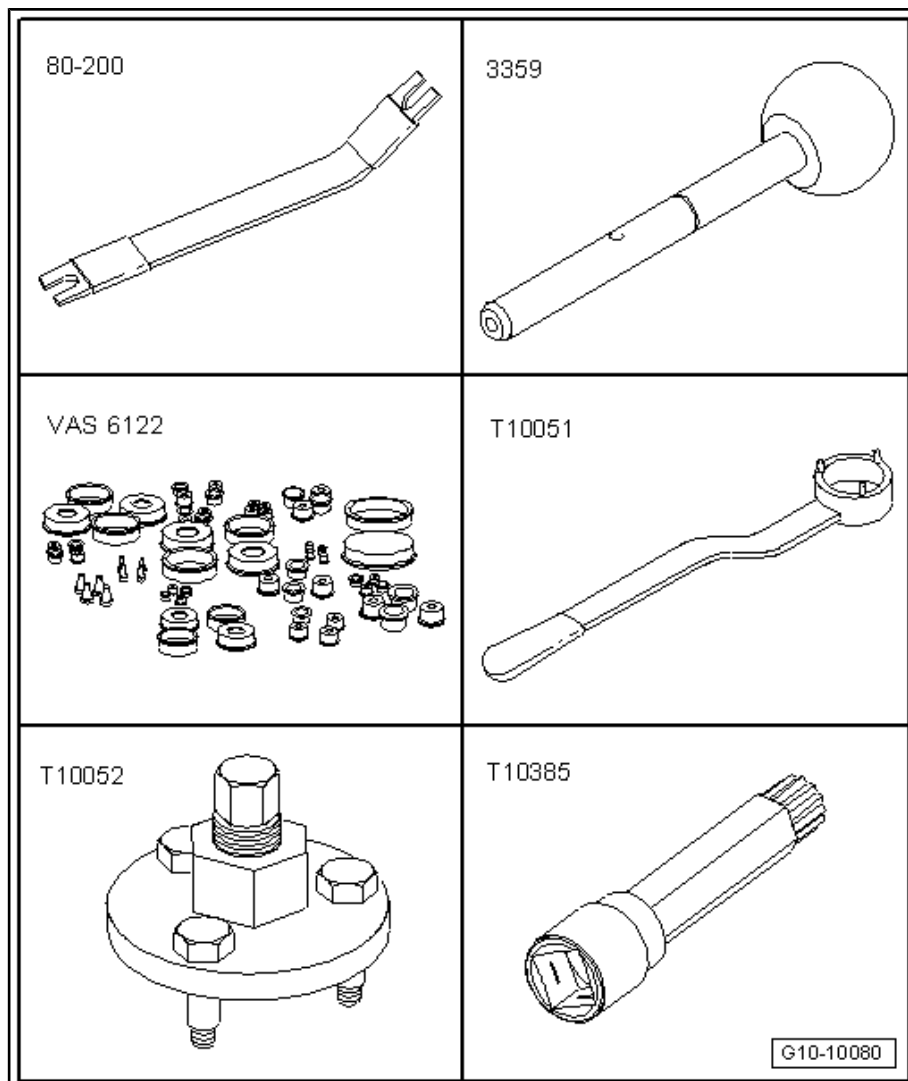
- Tighten bolts for cylinder head cover in the sequence -1 ... 6- to 9 Nm.





2.3 Removing and installing cylinder head

Special tools and workshop equipment required



- ◆ Removal lever - 80 - 200-
- ◆ Diesel injection pump locking pin - 3359-
- ◆ Engine bung set - VAS 6122-
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Bit XZN 10 - T10385-

Removing

- Drain coolant ⇒ [page 161](#) .
- Remove air cleaner housing ⇒ [page 229](#) .
- Remove plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .

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- Version for countries with cold climates: Unplug electrical connector -2-.
- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.



Note

Disregard -item 4-.

- Detach vacuum hose -2- from vacuum unit of turbocharger.
- Disconnect vacuum hose -3-.

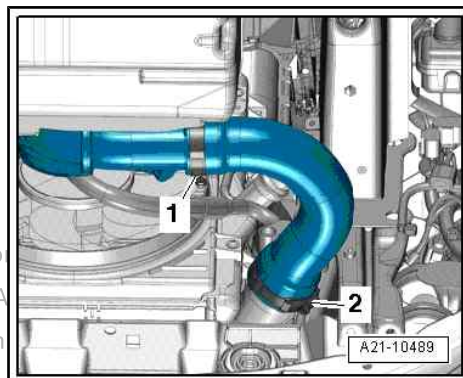
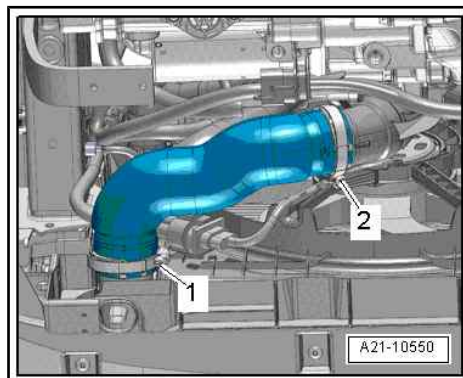
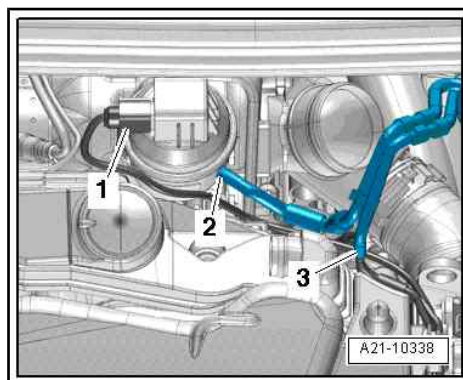
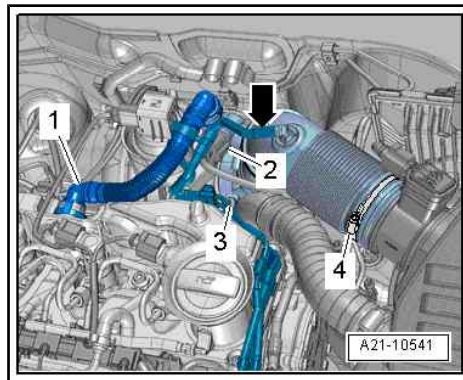


Note

Disregard -item 1-.

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

- Release hose clips -1- and -2- and remove air hose.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122-.



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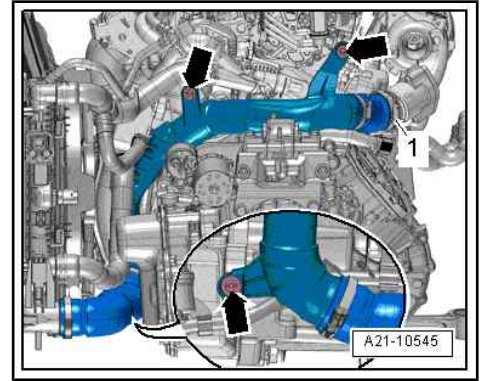
- Remove bolts -arrows-.



Note

Depending on version, bolt (top right) may not be fitted.

- Using removal lever - 80 - 200- , move clear electrical wiring and hoses at air pipe (left-side).
- Loosen hose clip -1- and detach air pipe (left-side).

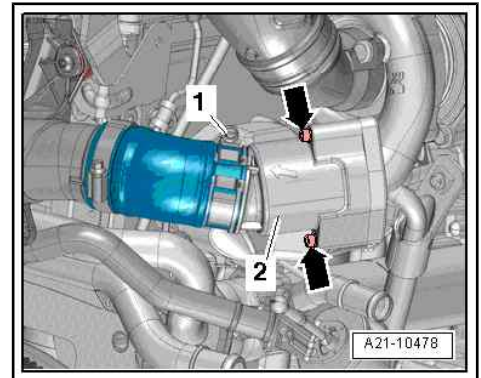


- Remove bolts -arrows- and detach pulsation damper -2-.

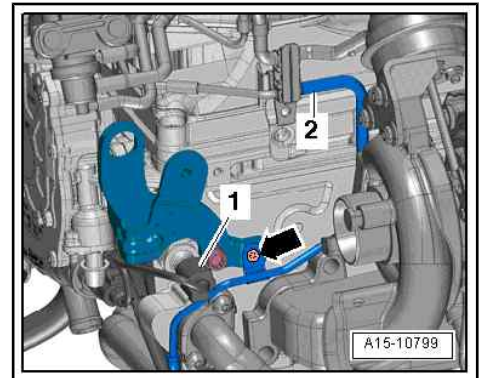


Note

Disregard -item 1-.



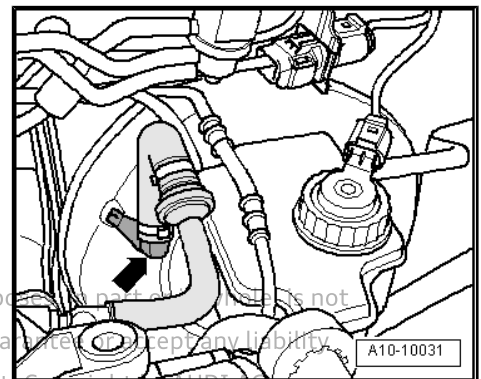
- Unplug electrical connector -1- on oil pressure switch - F1- .
- Remove bolt -arrow-.
- Disconnect vacuum hose -2-.



- Detach vacuum hose -arrow- from brake servo.



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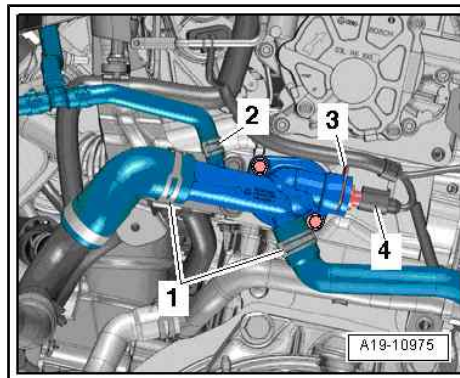




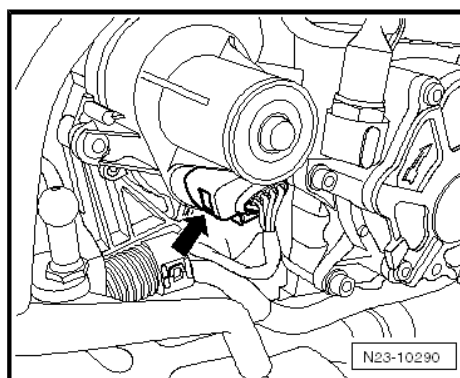
- Unplug electrical connector -4- at coolant temperature sender - G62- .
- Release hose clips -1- and -2- and disconnect coolant hoses from connection.

**Note**

Disregard -item 3-.



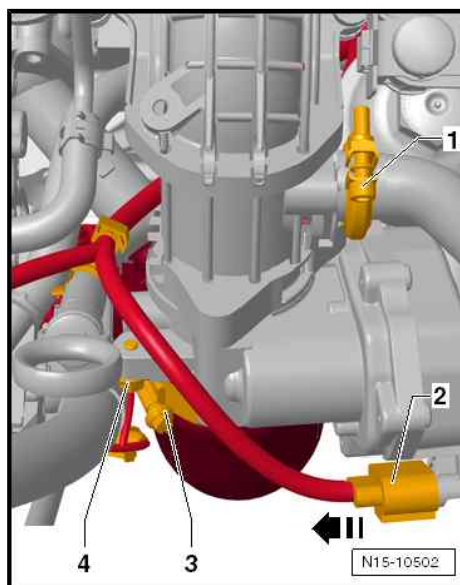
- If fitted, unplug electrical connector -arrow- at intake manifold flap motor - V157- .
- Place engine wiring harness to one side.



- Unplug electrical connector -2- at throttle valve module - J338- -arrow-.
- Remove bolt -4- for dipstick guide tube.

**Note**

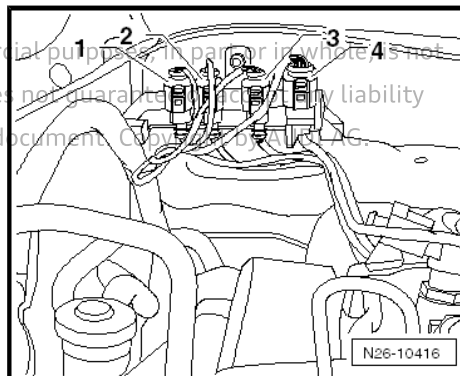
Disregard items -1 and 3-.



- Detach electrical connector -3- from bracket and unplug.
- Move clear electrical wiring at turbocharger.

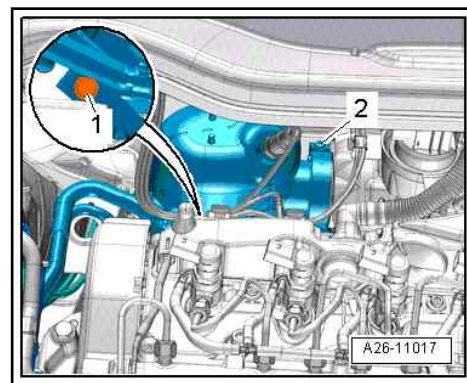
**Note**

Disregard -items 1, 2, 4-.

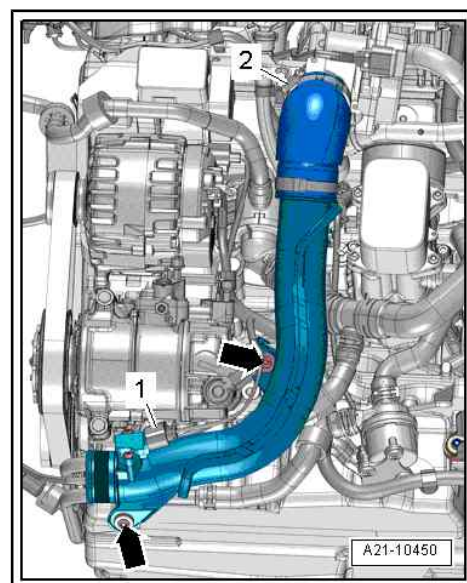




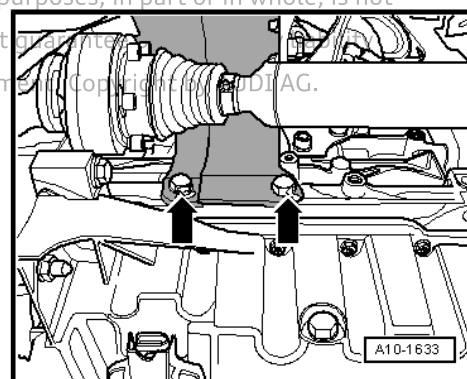
- Slacken bolt -2- and remove clamp.
- Remove bolt -1- securing bracket (top) for particulate filter.



- Remove bolts -arrows-.
- Release hose clip -2-.
- Unplug electrical connector -1- on charge pressure sender - G31- / intake air temperature sender - G42- and move clear electrical wiring.
- Detach air pipe (right-side).



- If fitted, remove bolts -arrows- and detach heat shield for drive shaft (right-side).

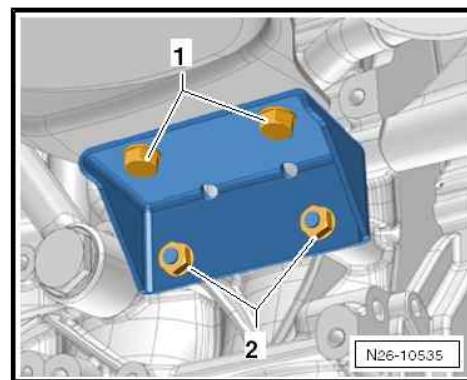


- Remove nuts -2-, tie up particulate filter to rear.



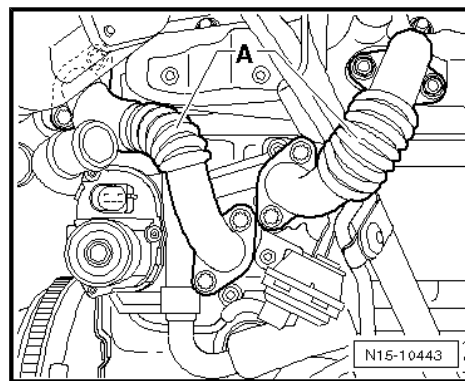
Note

Disregard -item 1-.

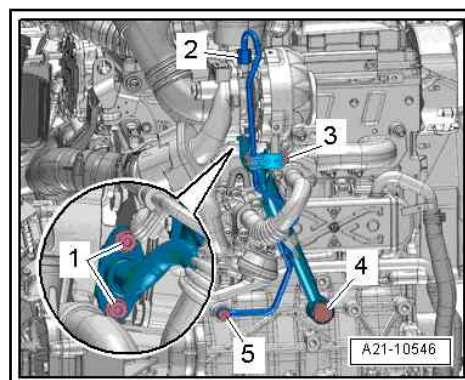




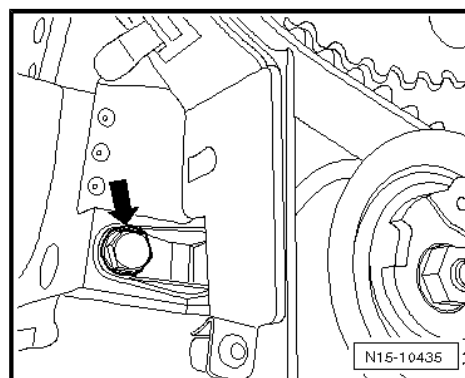
- Remove bolts and detach exhaust gas recirculation pipes -A-.



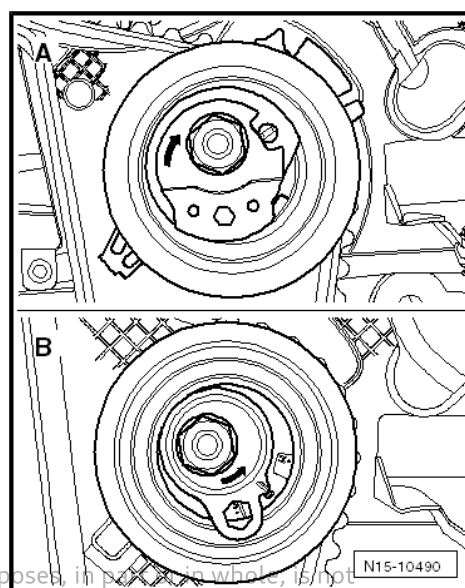
- Remove union nut -2-.
- Remove bolts -1, 3- and banjo bolts -4, 5- and detach support for turbocharger with oil supply line.



- Remove bolt -arrow- for toothed belt cover (rear).
- Take toothed belt off camshaft sprocket ⇒ [page 88](#) .



Vehicles with tensioning roller version -A-:



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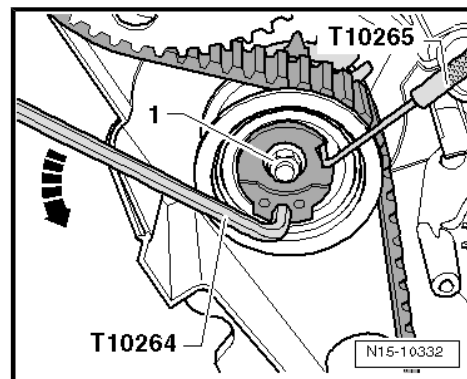


- Remove nut -1- and detach tensioning roller.

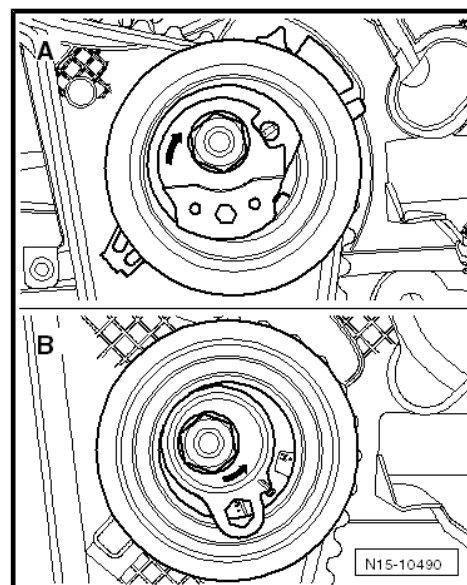


Note

Disregard -arrow- and -T10264-.



Vehicles with tensioning roller version -B-:

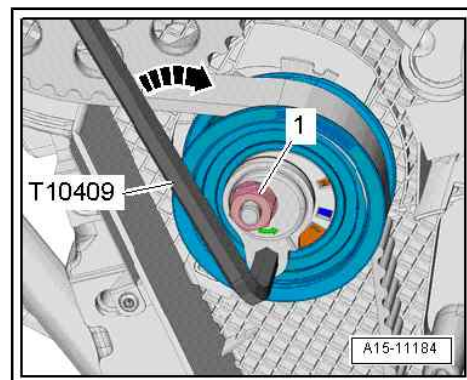


- Remove nut -1- and detach tensioning roller.



Note

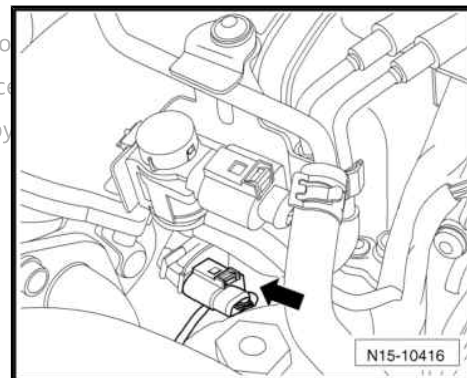
Disregard -arrow- and -T10409-.



All vehicles (continued):

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- Unplug electrical connector -arrow- at Hall sender - G40-.
- Remove cylinder head cover ⇒ [page 117](#).



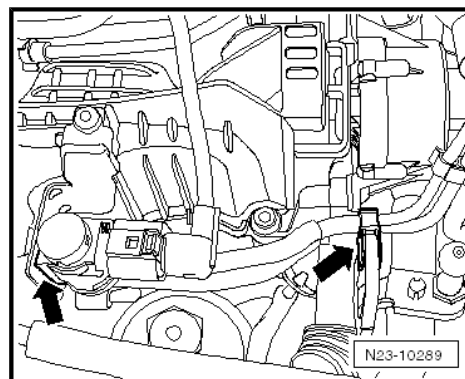


- Take exhaust gas recirculation cooler change-over valve - N345- -left arrow- out of bracket and move clear to one side.

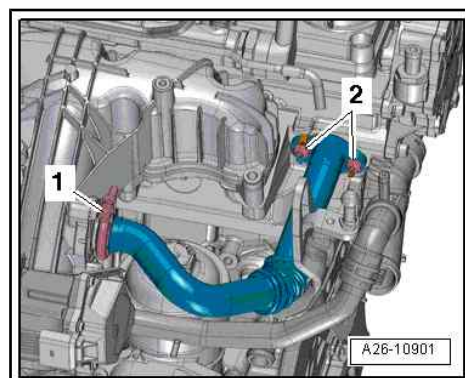


Note

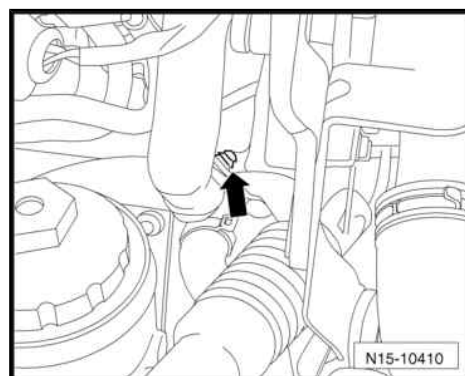
Disregard -arrow- on right-side of illustration.



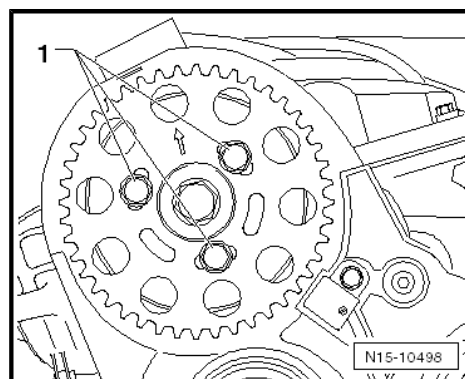
- Remove bolts -2-.
- Open clamp -1- and detach exhaust gas recirculation pipe.



- Unclip wiring harness from retainer -arrow-.



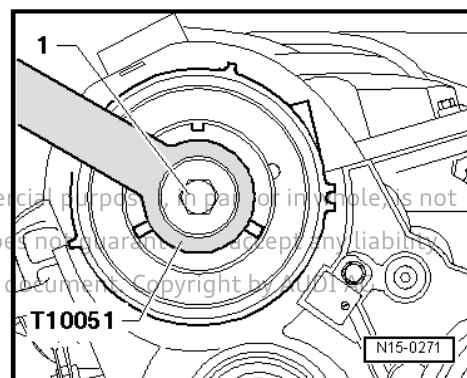
- Remove bolts -1- and detach camshaft sprocket.



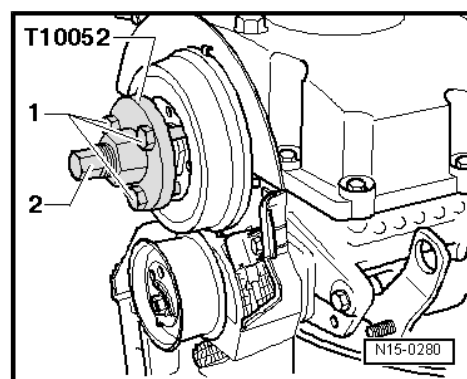


- Counterhold using counterhold tool - T10051- and loosen bolt -1- for camshaft hub.
- Unscrew bolt approx. 2 turns.

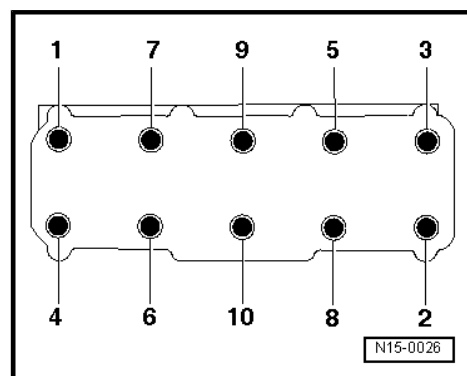
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- Apply puller - T10052- to camshaft hub and screw bolts -1- into hub.
- Counterhold on hexagon flats (30 mm) of puller and screw in bolt -2- to pull off camshaft hub.
- Detach hub from taper of camshaft.



- Slacken cylinder head bolts in the sequence -1 ... 10-.
- Swivel cylinder head to the left and out of toothed belt cover (rear).
- Take care not to damage oil return line for turbocharger.
- Take care to place cylinder head down without bending oil return line. If necessary, place a block of wood below exhaust manifold.



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.



Note

Audi A1 models with 1.6 ltr. 4-valve common rail TDI engine are always equipped with steel glow plugs.

Installing



Note

- ◆ *Use of impermissible abrasive materials can lead to subsequent damage to the turbocharger, conrod bearings or similar.*
- ◆ *Do NOT use abrasive materials (sandpaper, sanding discs, sanding pads, abrasive web, wire wool, etc.).*
- ◆ *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.*



- Sealant residue may only be removed 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 fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.
- Before fitting cylinder head, remove crankshaft stop - T10050- and turn crankshaft against normal direction of rotation until all pistons are positioned approximately equally below "TDC".
- If not already fitted, install dowel sleeves for centring cylinder block and cylinder head in cylinder block.



– 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, the new cylinder head gasket must be selected by measuring the piston projection at "TDC" ⇒ [page 82](#).



- Fit cylinder head gasket onto dowel sleeves -arrows- in cylinder block.
- Installation position of cylinder head gasket: the word "oben" (top) or the part number should face towards the cylinder head.
- Swivel cylinder head so that stud for toothed belt tensioning roller is inserted into aperture in toothed belt cover (rear).



Note

Make sure that electrical wiring to Hall sender - G40- is properly routed.

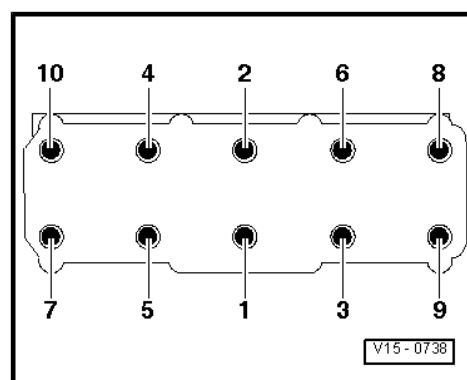
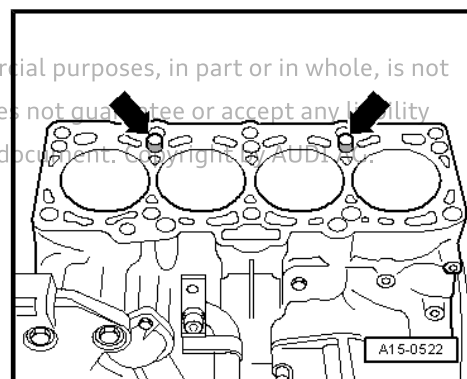
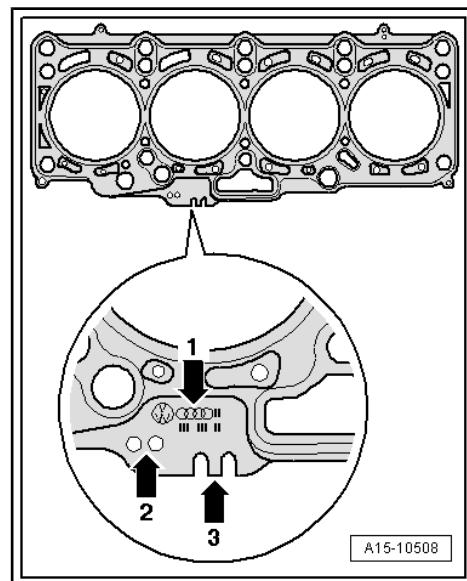
- Fit cylinder head.
- Renew cylinder head bolts and screw them in by hand until they make contact.
- Tighten cylinder head bolts ⇒ [page 103](#).



Note

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

- Install rear toothed belt cover, camshaft hub and sprocket ⇒ [page 86](#).



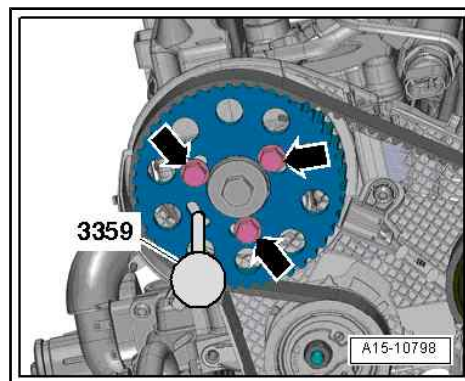


- Lock camshaft hub with diesel injection pump locking pin - 3359- .



Note

Disregard -arrows-.

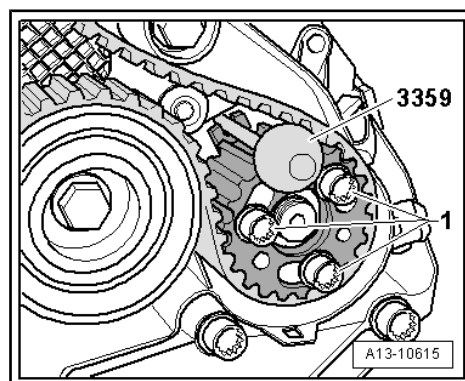


- Lock high-pressure pump hub with diesel injection pump locking pin - 3359- .



Note

Disregard -item 1-.



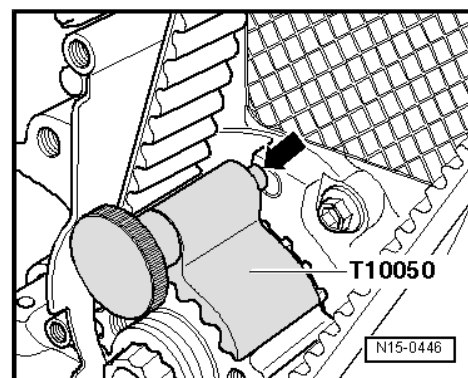
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- Then turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop - T10050- engages in sealing flange as crankshaft rotates.
- Install toothed belt (adjust valve timing) ⇒ [page 93](#) .

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

- Install cylinder head cover ⇒ [page 117](#) .
- Install support for turbocharger with oil supply line ⇒ [page 200](#) .
- Install exhaust gas recirculation pipes ⇒ [page 312](#) .
- Install particulate filter ⇒ [page 294](#) .
- Install dipstick guide tube ⇒ [page 143](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install vacuum line to exhaust gas recirculation cooler ⇒ [page 312](#) .
- Install air pipes ⇒ [page 206](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install air pipe with connection and pulsation damper ⇒ [page 200](#) .
- Install plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .
- Install air cleaner housing ⇒ [page 229](#) .
- Change engine oil ⇒ Maintenance ; Booklet 819 .
- Fill cooling system with fresh coolant ⇒ [page 164](#) .



Tightening torques

- ◆ ⇒ [“2.1 Exploded view - cylinder head”, page 101](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt”, page 86](#)
- ◆ Heat shield for drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft

2.4 Removing and installing cylinder head cover

Removing



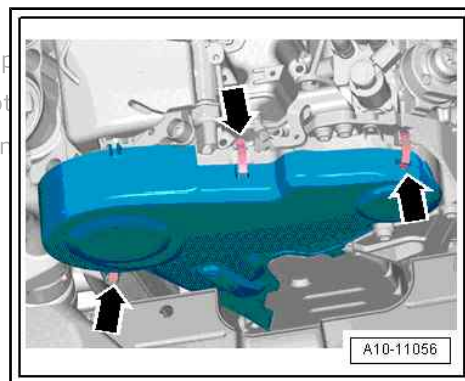
Note

Secure the heat insulation sleeve in the original position when installing.

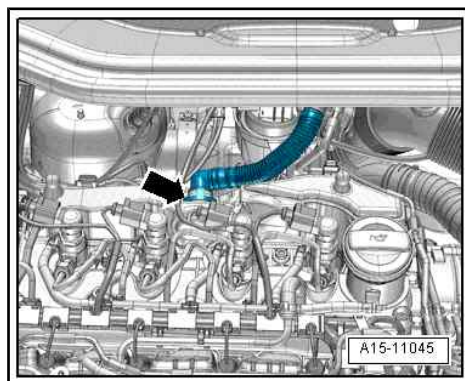
- Remove engine cover panel ⇒ [page 43](#) .



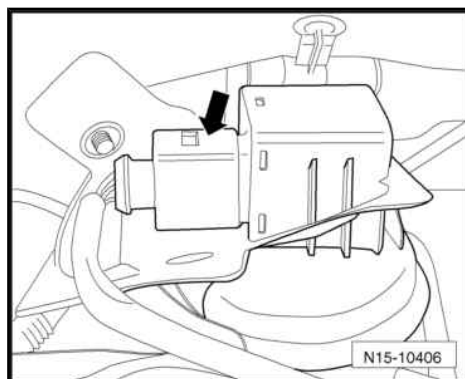
- Unfasten clips -arrows- and press toothed belt cover (top) to right side.
- Remove injectors and fuel rail [= page 252](#)



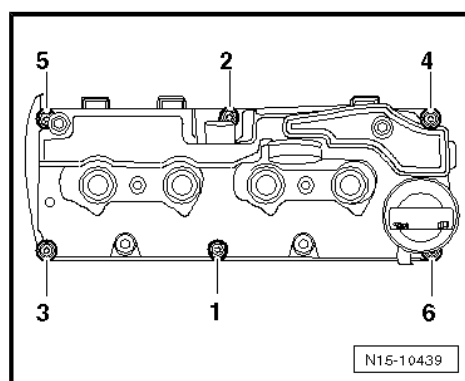
- Press release tabs and disconnect crankcase breather hose -arrow- from cylinder head cover.



- Detach heat insulation sleeve.
- Unplug electrical connector -arrow- at position sender for charge pressure positioner - G581- .



- Slacken cylinder head cover bolts in the sequence -6 ... 1- and remove.



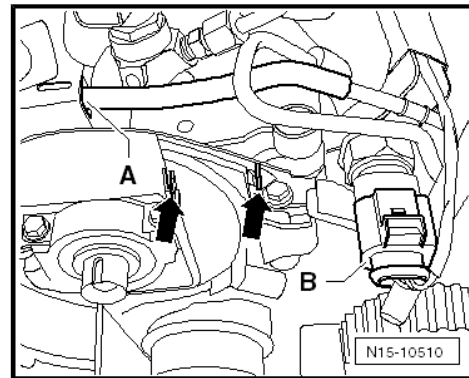


- Unclip retaining tabs at toothed belt cover (rear) -arrows- and detach cylinder head cover.



Note

Disregard -items A, B-.



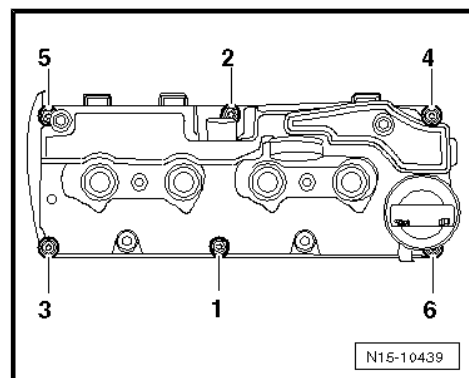
Installing

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



Note

- ◆ Renew gasket for cylinder head cover and bolts for cylinder head cover if damaged or leaking.
- ◆ Fit new O-ring.
- ◆ Renew grommets and seals for injectors if damaged or leaking.



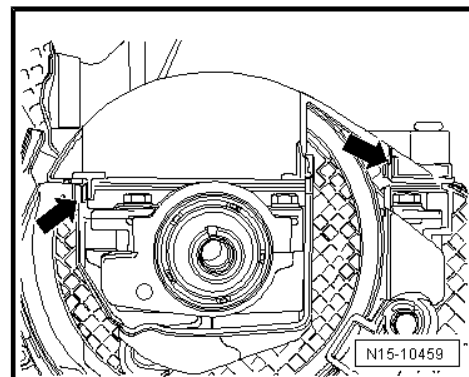
- Tighten cylinder head cover bolts ⇒ [page 104](#) .
- Make sure that cylinder head cover is properly clipped to toothed belt cover (rear).



Note

For illustration purposes, the installation position is shown with the camshaft sprocket removed.

- For this purpose, use screwdriver to press toothed belt cover (rear) onto cylinder head cover in area of clips -arrows- until the clips engage audibly.
- Make sure there is a clearance between hub and toothed belt cover.
- Install fuel rail and injectors ⇒ [page 252](#) .



2.5 Removing and installing seals for injectors

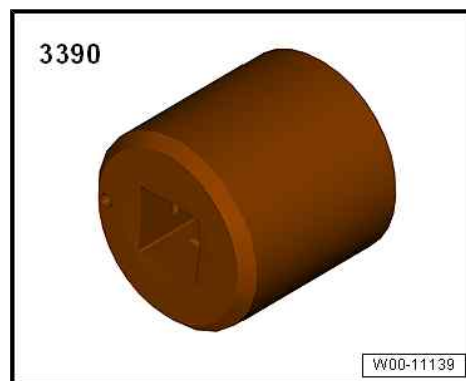
Special tools and workshop equipment required

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

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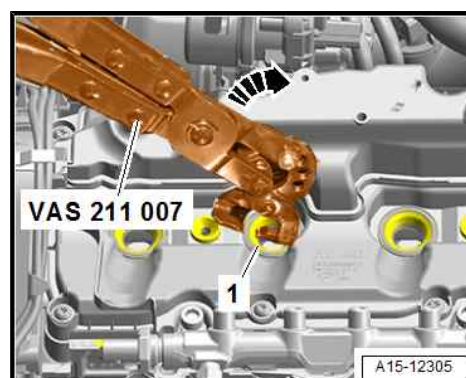


◆ Carrier - 3390-

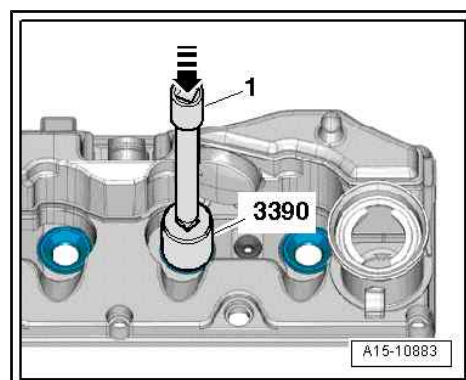


Removing

- Remove corresponding injector ⇒ [page 252](#) .
- Pull off seal -1- using pliers -VAS 211 007- -arrow-.



- Use suitable thrust piece (e.g. carrier - 3390-) and short extension -1- to press new injector seal in from above -arrow- as far as stop.



2.6 Checking compression

Special tools and workshop equipment required

- ◆ Articulated wrench, 10 mm - 3220-



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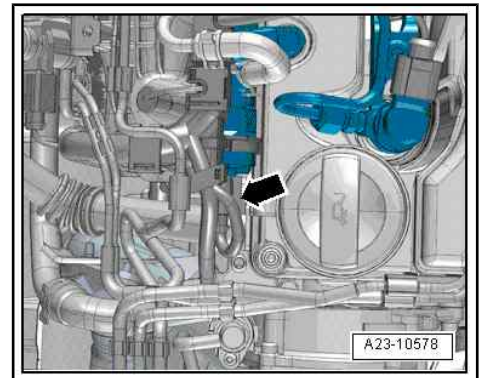


- ◆ Compression tester - V.A.G 1763- with adapter - V.A.G 1763/8-



Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Remove engine cover panel ⇒ [page 43](#) .
- Unplug electrical connector -arrow- for fuel pressure regulating valve - N276- at fuel rail.
- Briefly start engine to relieve fuel pressure in fuel rail.
- Remove all glow plugs ⇒ [page 323](#) .



- Screw in adapter - V.A.G 1763/8- in place of the glow plugs and connect compression tester - V.A.G 1763- .

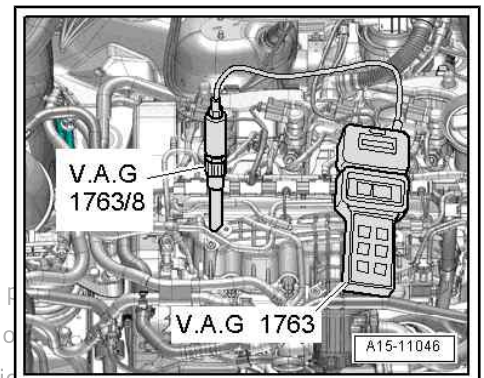


Note

Using the compression tester ⇒ Operating instructions .

- Have a second mechanic operate starter until tester shows no further pressure increase.

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



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

- Install glow plugs ⇒ [page 323](#) .
- Entries are stored in event memory of engine control unit because electrical connectors were unplugged and the engine was started: Interrogate event memory in Vehicle self-diagnosis ⇒ Vehicle diagnostic tester.



3 Valve gear

⇒ "3.1 Exploded view - valve gear", page 122

⇒ "3.2 Measuring axial clearance of camshaft", page 123

⇒ "3.3 Measuring radial clearance of camshaft", page 124

⇒ "3.4 Removing and installing camshaft oil seal", page 125

⇒ "3.5 Removing and installing camshaft", page 127

⇒ "3.6 Removing and installing valve stem oil seals", page 133

3.1 Exploded view - valve gear



Note

Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.

1 - Valve

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Mark installation position for re-installation
- ☐ Checking ⇒ [page 142](#)
- ☐ Valve dimensions ⇒ [page 142](#)
- ☐ Checking valve guides ⇒ [page 141](#)

2 - Cylinder head

3 - Valve stem oil seal

- ☐ Renewing with cylinder head installed ⇒ [page 133](#)
- ☐ Renewing with cylinder head removed ⇒ [page 137](#)

4 - Valve spring

5 - Valve spring plate

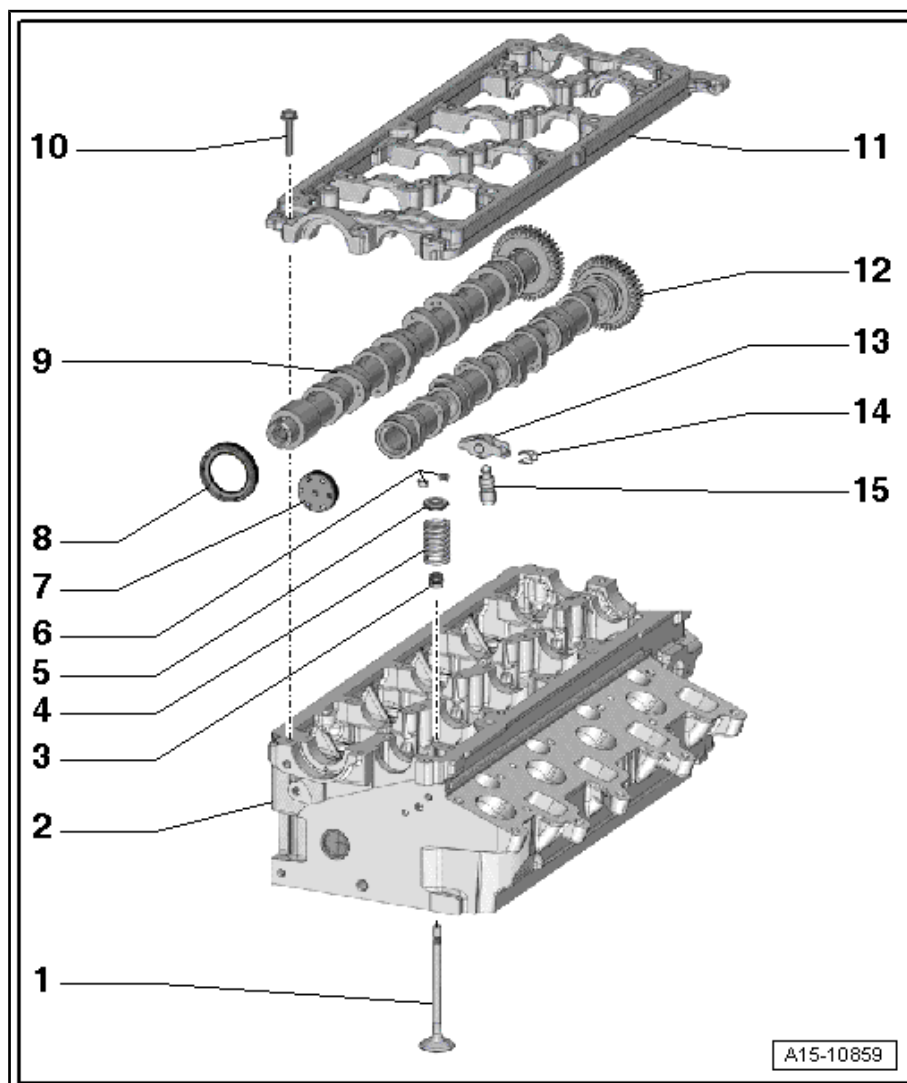
6 - Valve cotters

7 - Sealing cap

- ☐ Renew
- ☐ Removing sealing cap with retaining frame installed: pierce on one side with an awl and pry out
- ☐ Installing: drive in without sealant using suitable thrust piece
- ☐ Installation depth 1 ... 2 mm

8 - Oil seal

- ☐ Renewing ⇒ [page 125](#)



A15-10859



9 - Exhaust camshaft

- ☐ Removing and installing ⇒ [page 127](#)
- ☐ Measuring axial clearance ⇒ [page 123](#)
- ☐ Measuring radial clearance ⇒ [page 124](#)

10 - Bolt

- ☐ Correct sequence when slackening ⇒ [page 129](#)
- ☐ Tightening torque and sequence ⇒ [page 123](#)

11 - Retaining frame

- ☐ With integrated camshaft bearings
- ☐ Removing and installing ⇒ ["3.5 Removing and installing camshaft", page 127](#)

12 - Inlet camshaft

- ☐ Removing and installing ⇒ [page 127](#)
- ☐ Measuring axial clearance ⇒ [page 123](#)
- ☐ Measuring radial clearance ⇒ [page 124](#)

13 - Roller rocker finger

- ☐ Removing and installing ⇒ ["3.5 Removing and installing camshaft", page 127](#)
- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surfaces before installing

14 - Securing clip

- ☐ For hydraulic compensation element

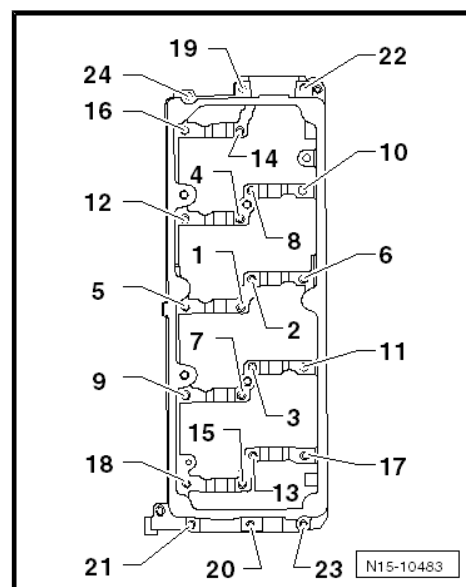
15 - Hydraulic compensation element

- ☐ Mark installation position for re-installation
- ☐ Lubricate contact surfaces before installing

Retaining frame - tightening torque and sequence

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 ... 24-	Screw in by hand until contact is made • The retaining frame should make contact with the cylinder head over the full surface
2.	-1 ... 24-	10 Nm



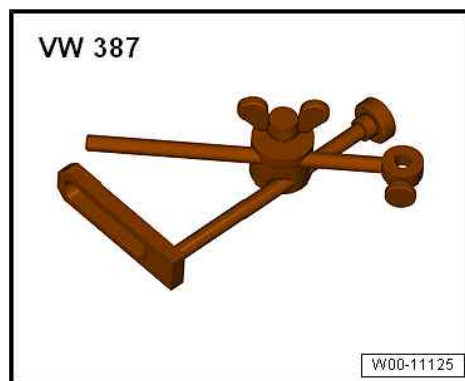
3.2 Measuring axial clearance of camshaft

Special tools and workshop equipment required

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- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-

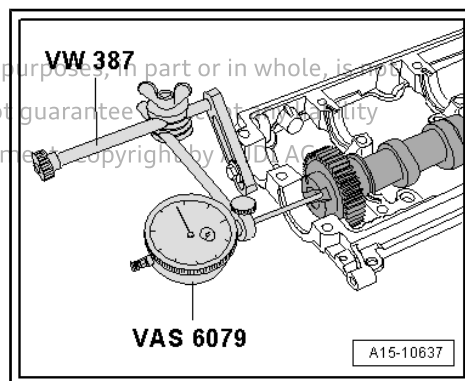


Procedure

- Remove retaining frame
⇒ ["3.5 Removing and installing camshaft", page 127](#)
- Secure dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to retaining frame as shown in illustration.
- Press camshaft against dial gauge by hand.
- Set dial gauge to "0".
- Press camshaft away from dial gauge and read off value:

Axial clearance on inlet camshaft and exhaust camshaft:

- Specification: 0.048 ... 0.118 mm.
- Wear limit: 0.17 mm.



3.3 Measuring radial clearance of camshaft

Special tools and workshop equipment required

- ◆ Plastigauge

Procedure

- Remove roller rocker fingers
⇒ ["3.5 Removing and installing camshaft", page 127](#) .
- Clean bearings and bearing journals.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.
- The Plastigauge must be positioned in the centre of the bearing.
- Fit retaining frame and tighten to 10 Nm without rotating camshafts ⇒ [page 123](#) .
- Remove retaining frame again.



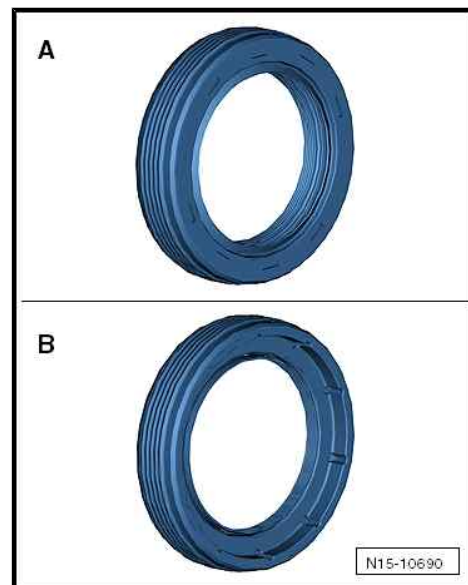
- Compare width of Plastigauge with measurement scale.
- Radial clearance: 0.035 ... 0.085 mm

3.4 Removing and installing camshaft oil seal



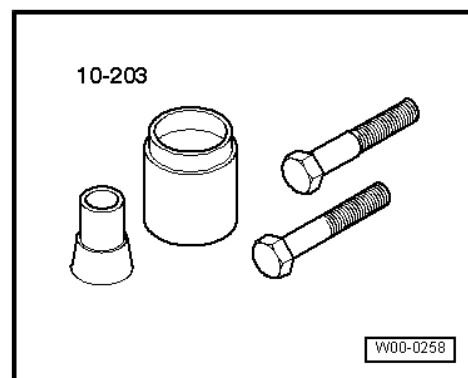
Note

- ◆ A modified oil seal is being phased in.
- ◆ The "old" version oil seal -item A- forms a continuous surface between the camshaft and the cylinder head.
- ◆ The "new" version oil seal -item B- has a shoulder between the camshaft and the cylinder head.

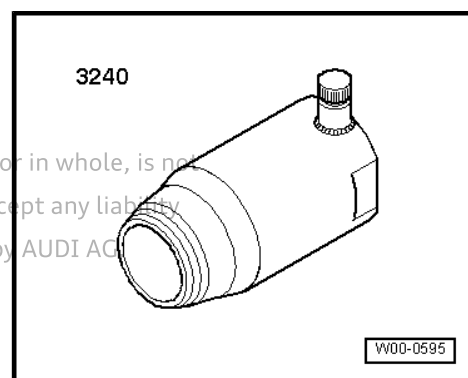


Special tools and workshop equipment required

- ◆ Fitting tool - 10 - 203-



- ◆ Oil seal extractor - 3240- for "old" version oil seal



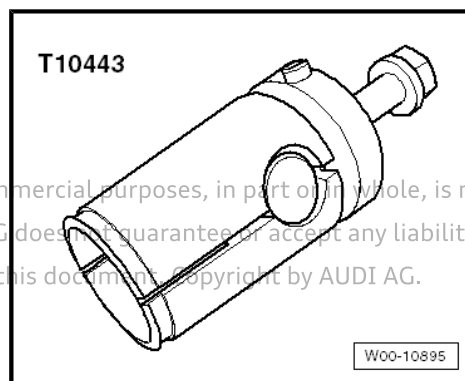
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- ◆ Puller - T10443- for "new" version oil seal



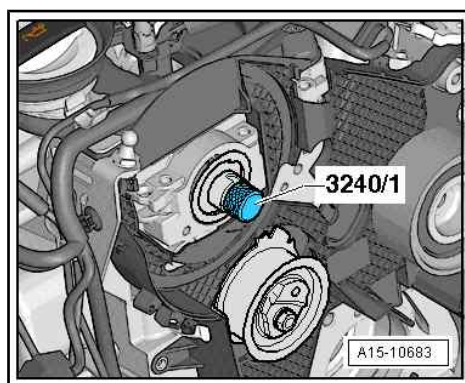
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- ◆ Bolt M12x1.5x75

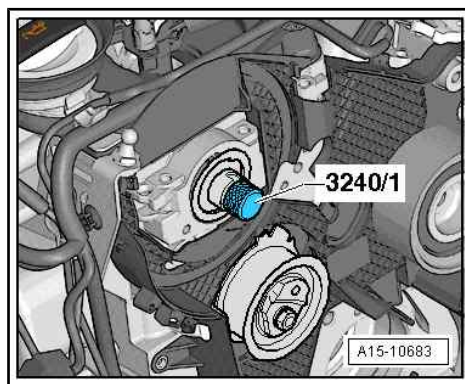
Procedure

- Remove camshaft sprocket and hub
⇒ ["3.5 Removing and installing camshaft", page 127](#).

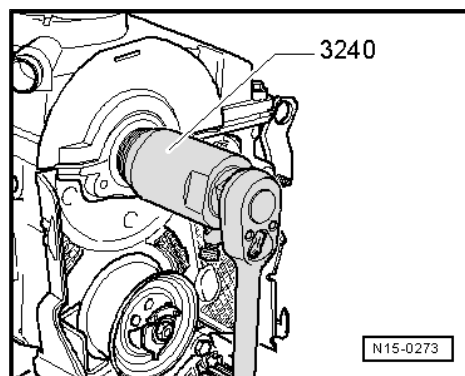


"Old" version oil seal:

- Insert thrust piece -3240/1- in camshaft.



- Screw inner section of oil seal extractor -3240- two turns out of outer section (approx. 3 mm) and lock with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.





"New" version oil seal:



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.

All types of oil seal (continued):

- Clean contact surface and sealing surface.



Note

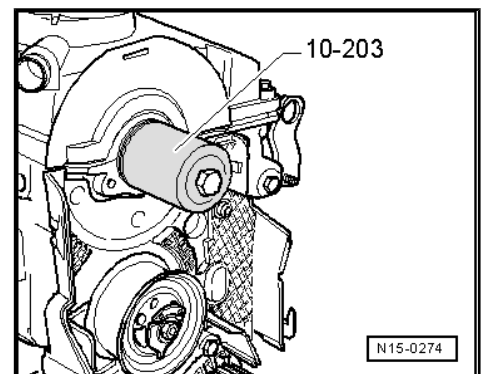
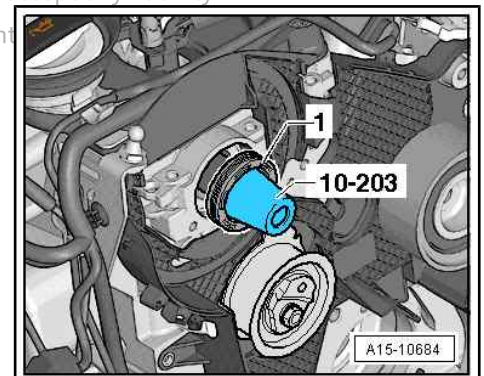
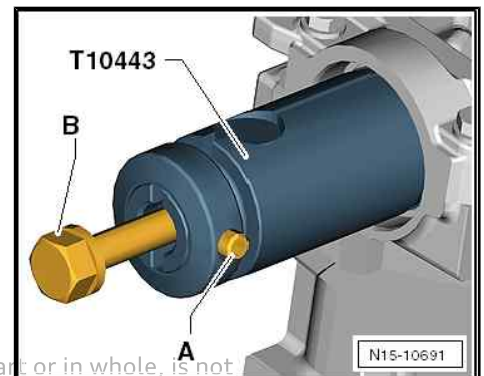
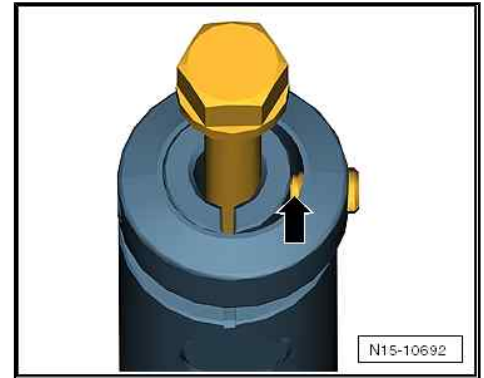
The sealing lip of the oil seal must not be additionally oiled or greased!

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- Apply guide sleeve of fitting tool - 10 - 203- to camshaft as shown in illustration.

- Carefully push oil seal -1- over guide sleeve and onto camshaft.

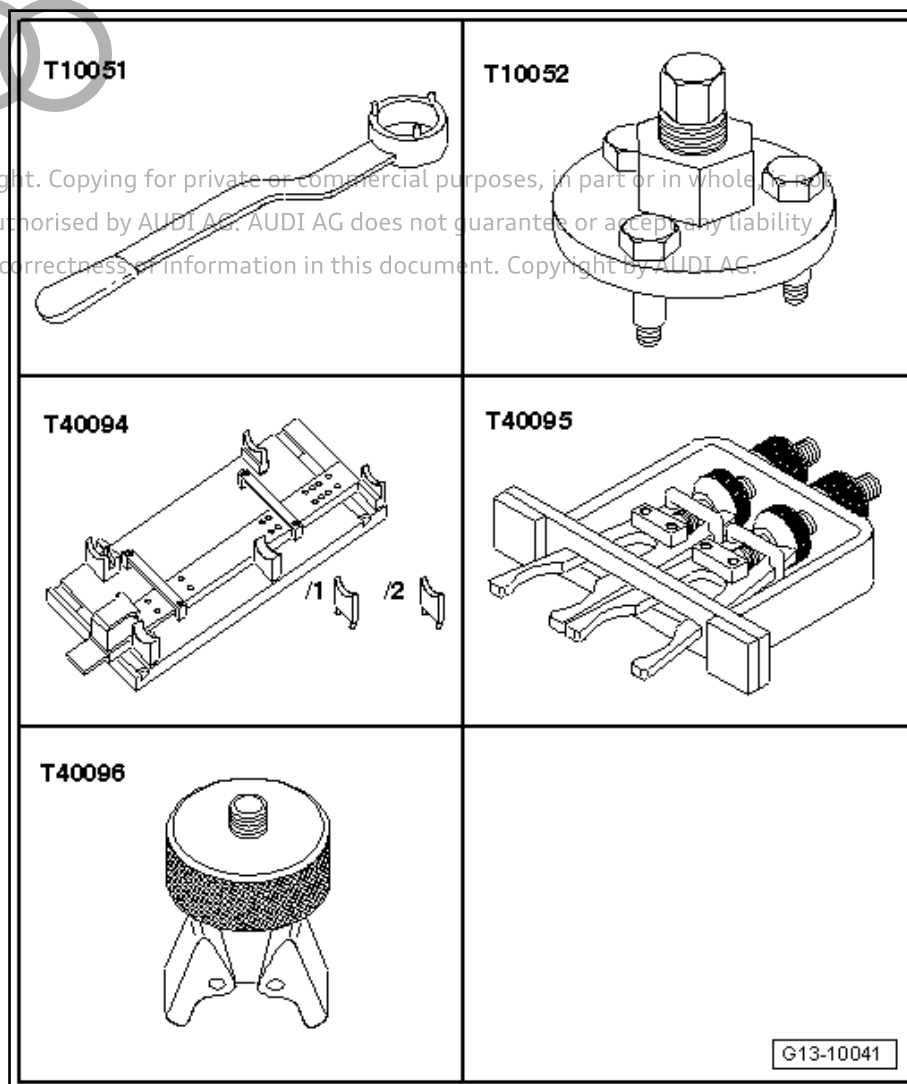
- Press in oil seal onto stop using thrust piece of fitting tool - 10 - 203- and bolt M12×1.5×75.
- Install camshaft sprocket and hub
⇒ ["3.5 Removing and installing camshaft", page 127](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 93](#) .



3.5 Removing and installing camshaft



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- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Camshaft fitting tool - T40094-
- ◆ Camshaft fitting tool - T40095-
- ◆ Clamping tool -T40096/1- for vehicles with two-piece camshaft gear
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Cylinder head installed.
- Remove engine cover panel ⇒ [page 43](#) .
- Take toothed belt off camshaft sprocket and high-pressure pump sprocket
⇒ [“1.2 Removing and installing toothed belt”, page 88](#) .
- Remove cylinder head cover ⇒ [page 117](#) .

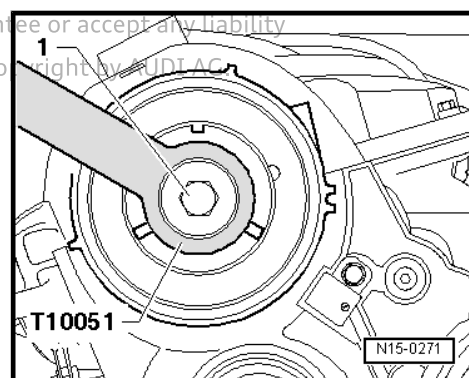
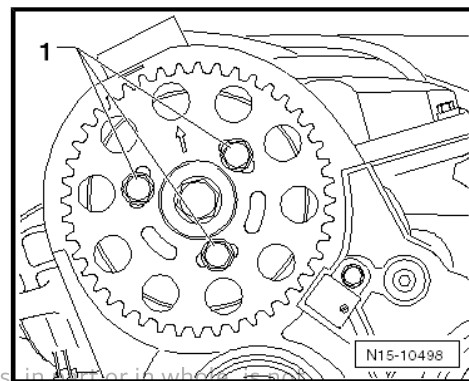


- Remove bolts -1- and detach camshaft sprocket.

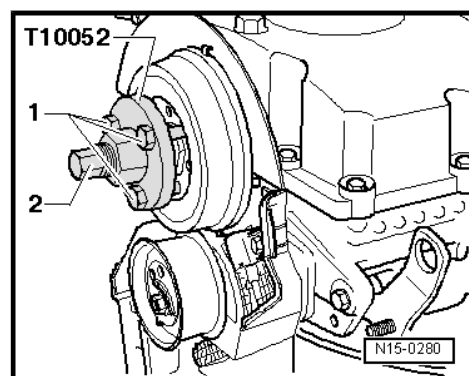


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- Counterhold using counterhold tool T10051 and loosen bolt -1- for camshaft hub.
- Unscrew bolt approx. 2 turns.



- Apply puller - T10052- to camshaft hub and screw bolts -1- into hub.
- Counterhold on hexagon flats (30 mm) of puller and screw in bolt -2- to pull off camshaft hub.
- Detach hub from taper of camshaft.
- Remove vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .



- Slacken retaining frame bolts in the sequence -24 ... 1-.
- Remove bolts and carefully release retaining frame from bonded joint.
- Mark fitting location of camshafts for re-installation and remove.

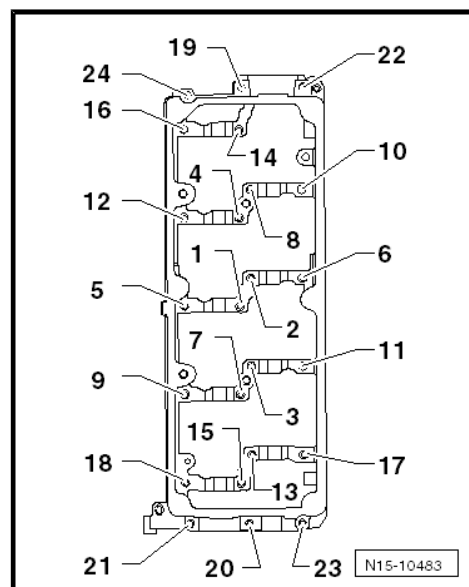
Installing



Caution

Make sure axial bearings in retaining frame are not damaged.

- ◆ **The camshafts *MUST* be installed using the camshaft fitting tool - T40094- as described in the following.**



**Caution**

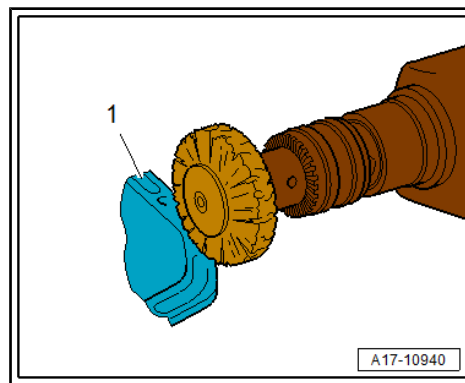
Protect lubrication system and bearings against contamination.

- ◆ *Cover exposed parts of the engine.*

**WARNING**

Risk of eye injury.

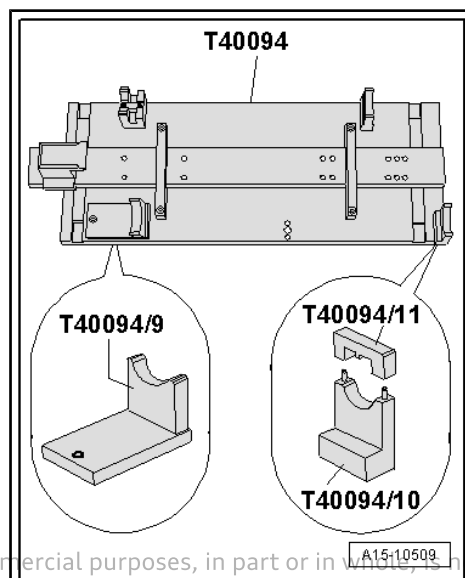
- ◆ *Put on safety goggles.*



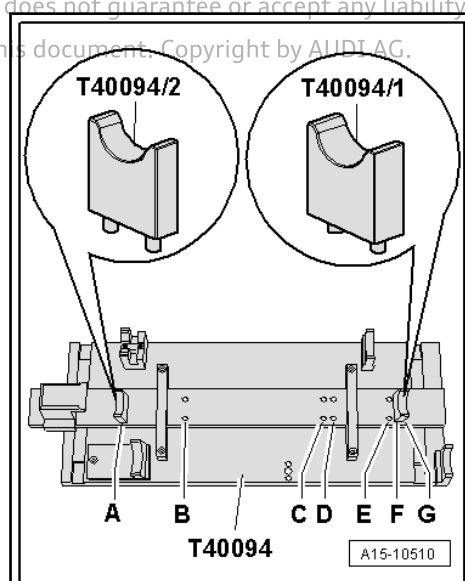
- Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Oil running surfaces of both camshafts.

Set up camshaft fitting tool - T40094- as follows:

- Secure supports -T40094/9- and -T40094/10- (with -T40094/11-) to base plate, as shown in illustration. If necessary, remove any supports already attached at these positions.

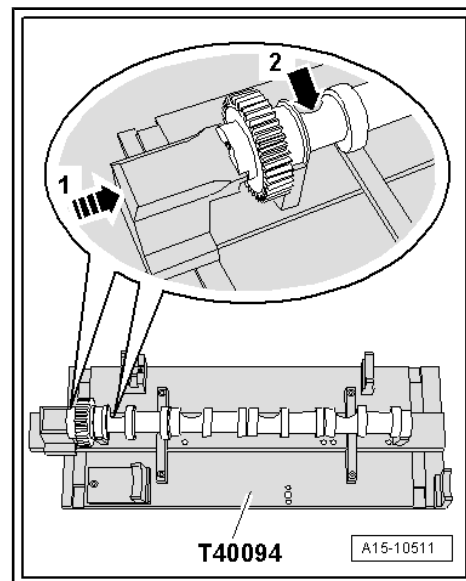


- Fit support -T40094/1- onto position -F- and support -T40094/2- onto position -A-.





- Place inlet camshaft in supports -T40094/1- and -T40094/2- .
- Turn inlet camshaft in such a way that it can be locked in “TDC” position using locking device -arrow 1-.
- Recess -arrow 2- for cylinder head bolt must face outwards.



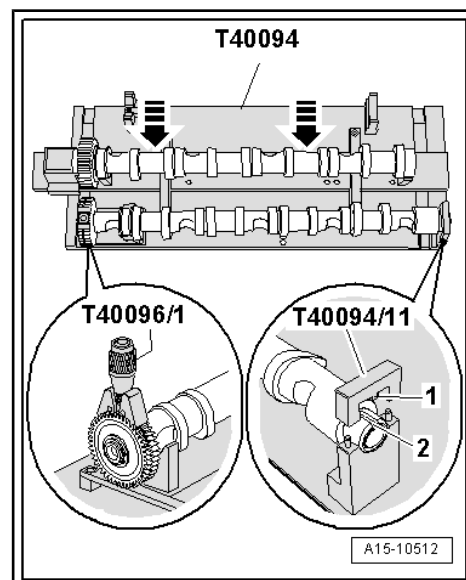
- Place exhaust camshaft in supports -T40094/9- and -T40094/10- .
- Lock exhaust camshaft with top section -T40094/11- .
- The lug -1- on the top section must engage in the slot -2- in the camshaft,

Vehicles with two-piece camshaft gear:

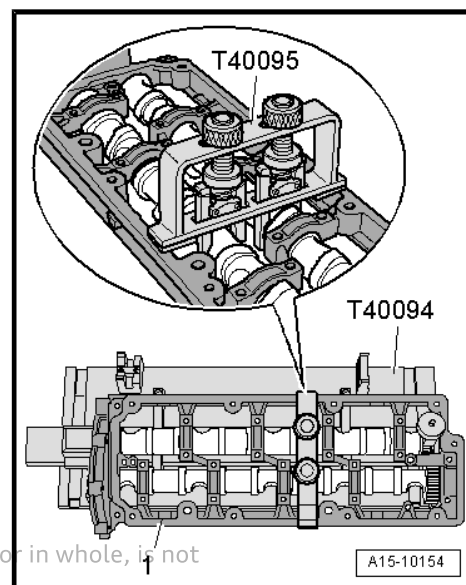
- Place clamping tool -T40096/1- on teeth of exhaust camshaft in such a way that the two arms of the tool engage on the two halves of the gear (one in each half, as shown in illustration).
- The wider arm must engage in the wider half of the gear.
- Tighten the clamping tool using the knurled wheel so that the faces of the gear teeth are in alignment.

All vehicles (continued):

- Slide inlet camshaft towards exhaust camshaft, until gear teeth engage -arrows-.



- Fit retaining frame -1- on camshafts.
- All camshaft bearings must be seated on the camshafts.
- Position camshaft fitting tool - T40095- and fix camshafts in position in retaining frame, as shown in illustration.
- Detach top section -T40094/11- .



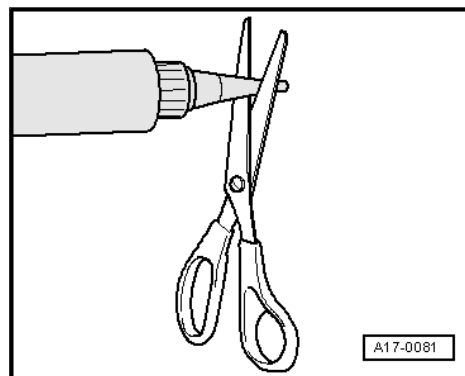
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Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle $\varnothing$ approx. 2 mm).



Caution

Make sure excess sealant does not contaminate camshaft bearings.

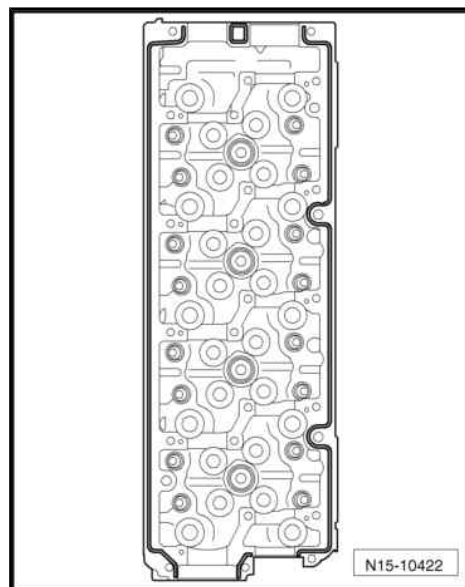
- ◆ ***The sealant beads must not be thicker than specified.***

- Apply beads of sealant onto clean sealing surfaces of cylinder head as shown in illustration.
- Thickness of sealant beads: 2 ... 3 mm



Note

- ◆ *The retaining frame should be fitted and secured without delay, as the sealant starts hardening immediately.*
- ◆ *After installing the retaining frame, wait about 30 minutes for the sealant to dry.*
- Take camshafts together with retaining frame, camshaft fitting tool - T40095- and, if necessary, clamping tool -T40096/1- out of camshaft fitting tool - T40094- and insert components carefully into cylinder head.



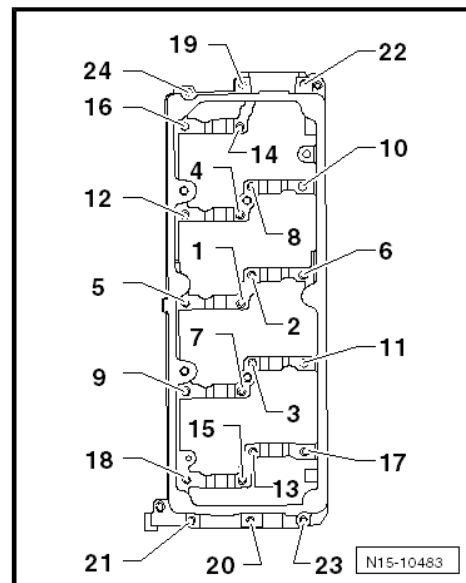
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- Screw in retaining frame bolts in the sequence -1 ... 24- evenly by hand until they make contact.
- The retaining frame should make contact with the cylinder head over the full surface.
- Tighten bolts ⇒ [page 123](#) .
- Remove camshaft fitting tool - T40095- and, if necessary, clamping tool -T40096/1- .

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

- Install camshaft oil seal ⇒ [page 125](#) .
- Drive new sealing cap ⇒ [Item 7 \(page 122\)](#) into cylinder head to a depth of approx. 1 ... 2 mm using suitable thrust piece.
- Install toothed belt (adjust valve timing) ⇒ [page 93](#) .
- Install vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .
- Install cylinder head cover ⇒ [page 117](#) .



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.*

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - valve gear”, page 122](#)

3.6 Removing and installing valve stem oil seals

⇒ [“3.6.1 Removing and installing valve stem oil seals \(cylinder head installed\)”, page 133](#)

⇒ [“3.6.2 Removing and installing valve stem oil seals \(cylinder head removed\)”, page 137](#)

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

Special tools and workshop equipment required



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- ◆ Valve stem seal puller - 3364-



- ◆ Valve stem seal fitting tool - 3365-



- ◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate for 3.0 ltr. TDI engine - VAS 5161/23- and sleeve -VAS 5161/23-1-



- ◆ Bolt, M6x30 (2x)

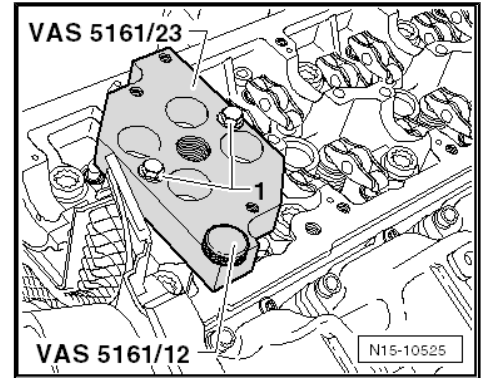
Procedure

- Remove all glow plugs ⇒ [page 323](#) .
- Remove camshafts ⇒ [page 127](#) .
- 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”.

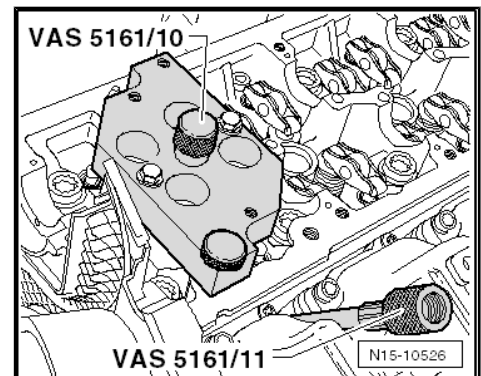
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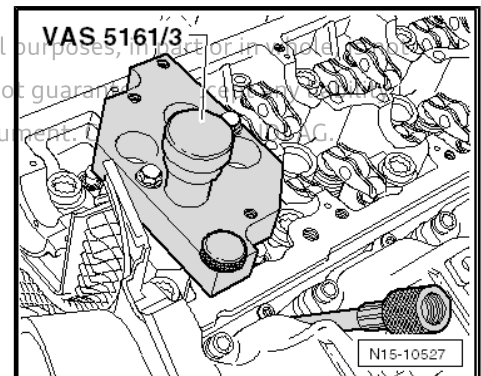
- Fit guide plate for 3.0 ltr. TDI engine - VAS 5161/23- onto cylinder head.
- Secure guide plate on intake manifold side with knurled screw -VAS 5161/12- and 2 M6x30 bolts by hand until they make contact.



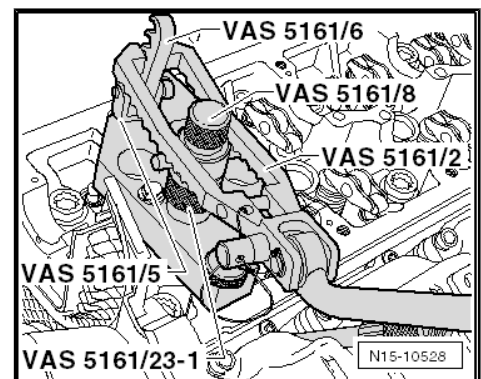
- Screw sealing pin -VAS 5161/10- into guide plate.
- Screw adapter -VAS 5161/11- hand-tight into corresponding glow plug thread.



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

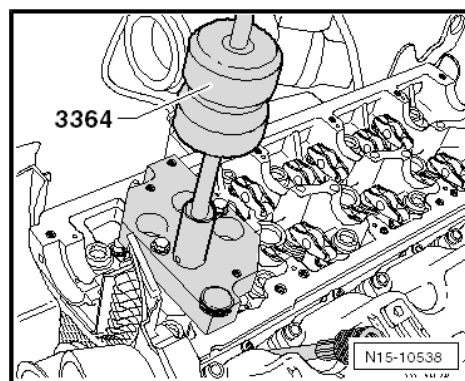


- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Slide sleeve -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8-.
- Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
 - Minimum pressure: 6 bar
- 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 knurled spacer ring.
- Detach valve spring with valve spring plate.





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

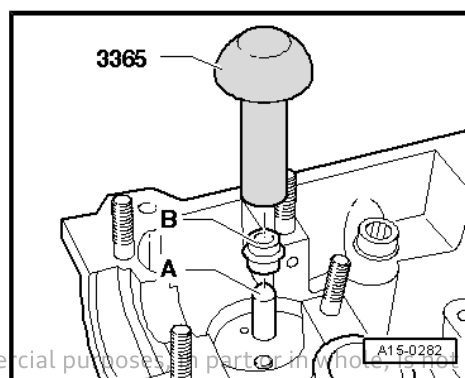


Caution

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

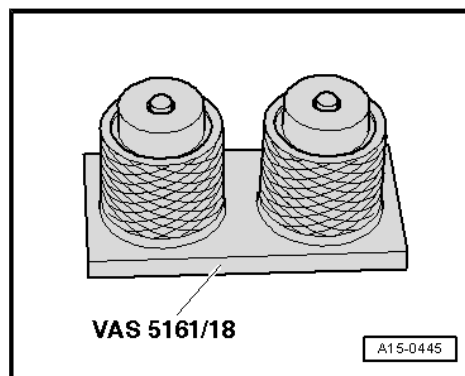
- ◆ ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***

- 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 pick up valve cotters.



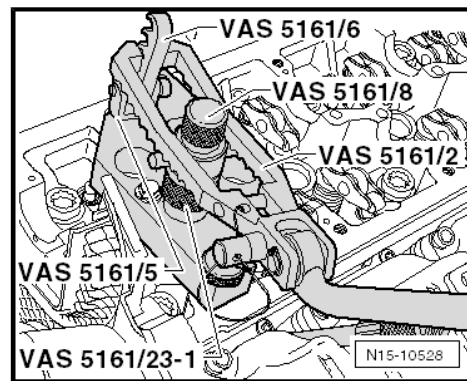


- Insert assembly cartridge in guide plate for 3.0 ltr. TDI engine - VAS 5161/23- again.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotteners.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

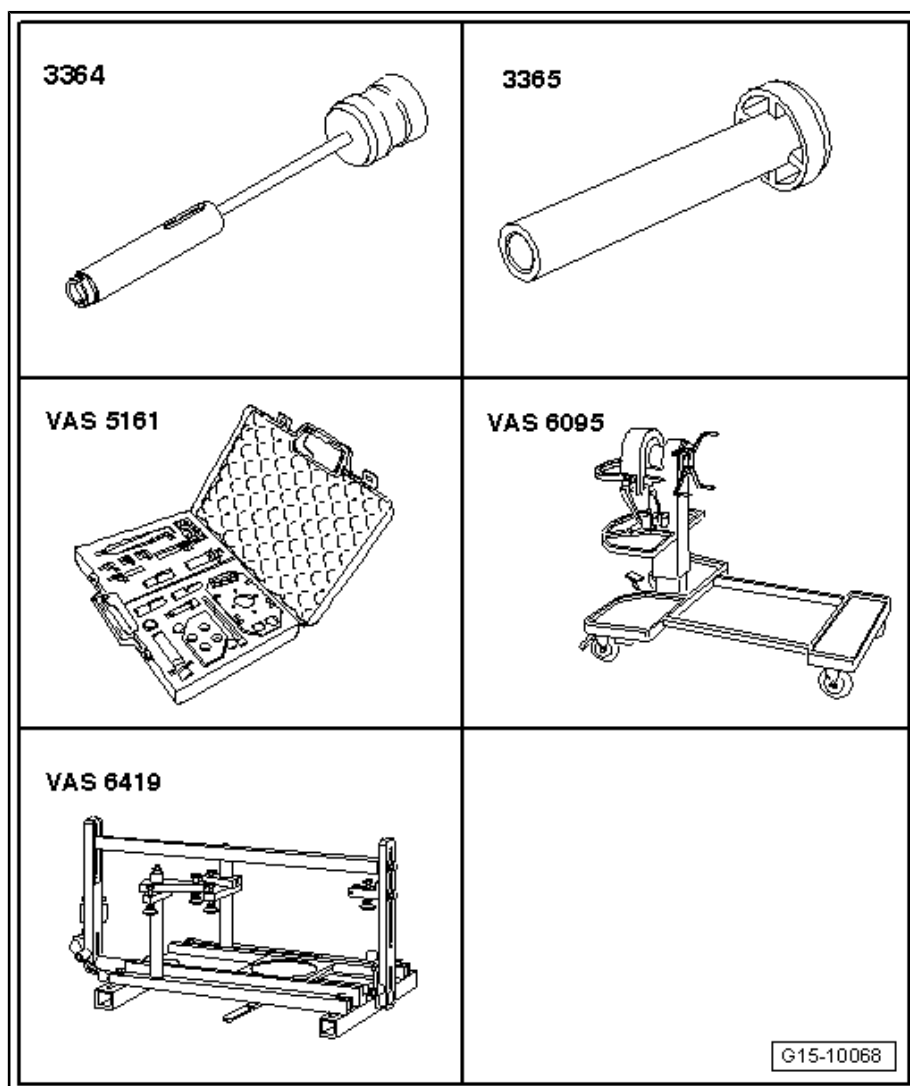
Installation is carried out in the reverse order; note the following:

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 127](#).
- Install glow plugs ⇒ [page 323](#).



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

Special tools and workshop equipment required



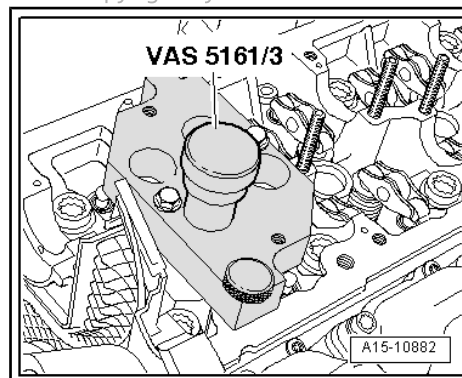
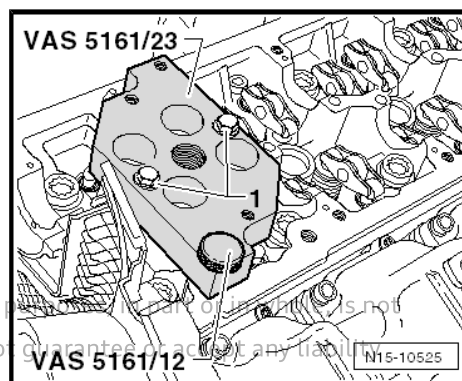
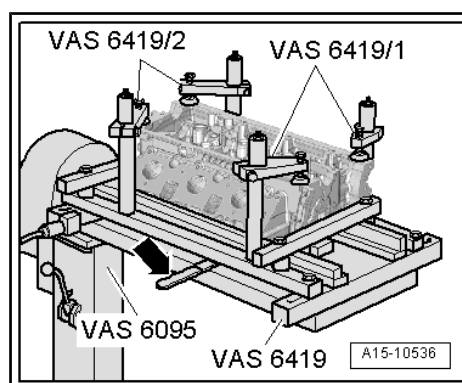
- ◆ Valve stem seal puller - 3364-



- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate for 3.0 ltr. TDI engine - VAS 5161/23- and sleeve -VAS 5161/23-1-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Cylinder head tensoning device - VAS 6419-
- ◆ Bolt, M6x30 (2x)

Procedure

- Remove camshafts ⇒ [page 127](#) .
- 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 tensoning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensoning device, as shown in illustration.
- Connect cylinder head tensoning device to compressed air supply.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.
- Fit guide plate for 3.0 ltr. TDI engine - VAS 5161/23- onto cylinder head.
- Secure guide plate on intake manifold side with knurled screw -VAS 5161/12- and 2 M6x30 bolts by hand until they make contact.



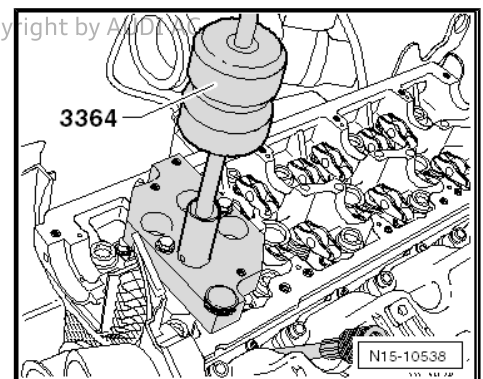
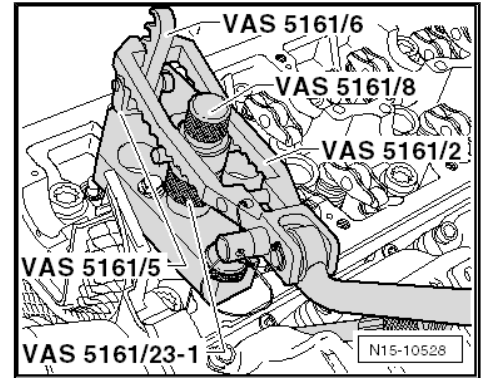
- Insert drift -VAS 5161/3- into guide plate and use plastic-headed hammer to release sticking valve cotters.



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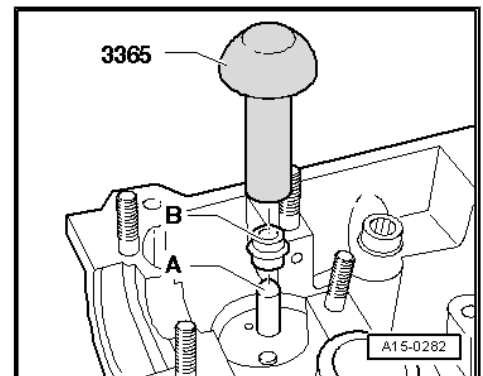
- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Slide sleeve -VAS 5161/23-1- onto assembly cartridge - VAS 5161/8- .
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge 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 knurled spacer ring.
- 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.

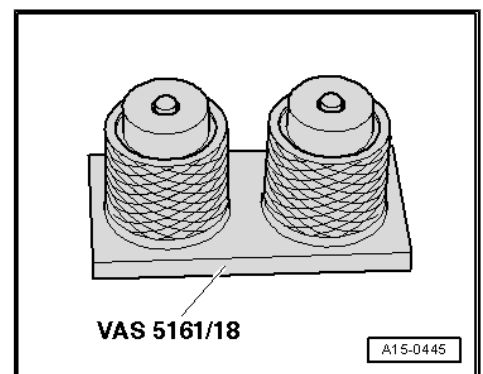
- ◆ ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***

- 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 pick up valve cotters.



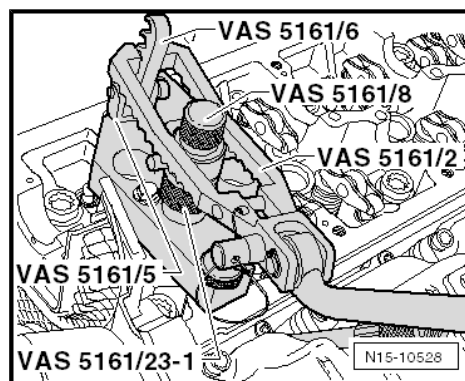


- Insert assembly cartridge in guide plate for 3.0 ltr. TDI engine - VAS 5161/23- again.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ⇒ [page 127](#) .



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4 Inlet and exhaust valves

⇒ ["4.1 Machining valve seats", page 141](#)

⇒ ["4.2 Checking valve guides", page 141](#)

⇒ ["4.3 Checking valves", page 142](#)

⇒ ["4.4 Valve dimensions", page 142](#)

4.1 Machining valve seats



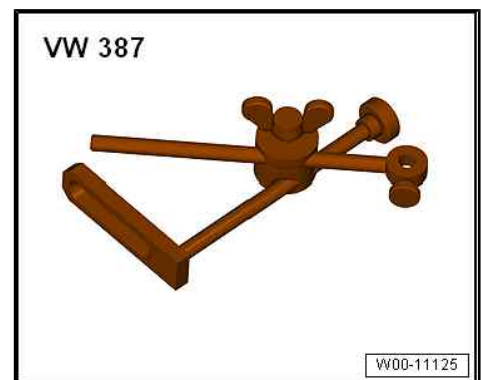
Note

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

4.2 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-



Procedure



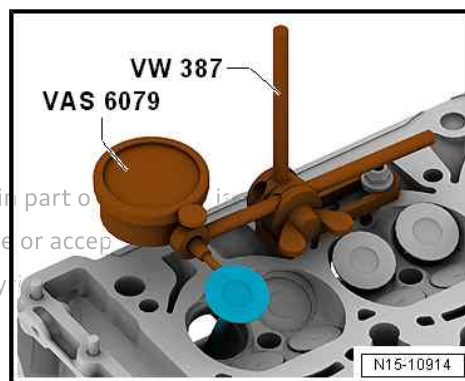
Note

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

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- 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: 1.3 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.

4.3 Checking valves

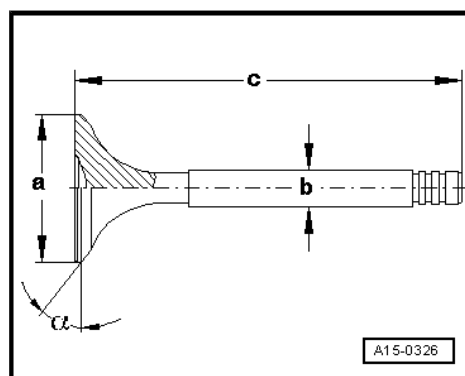
- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.

4.4 Valve dimensions

**Note**

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

Dimension		Inlet valve	Exhaust valve
Ø a	mm	26.5 ... 26.7	24.4 ... 24.6
Ø b	mm	5.968 ... 5.982	5.958 ... 5.972
c	mm	99.30	99.10
α	°	45	45





17 – Lubrication

1 Sump/oil pump

⇒ [“1.1 Exploded view - sump/oil pump”, page 143](#)

⇒ [“1.2 Engine oil”, page 145](#)

⇒ [“1.3 Removing and installing sump”, page 145](#)

⇒ [“1.4 Removing and installing oil pump”, page 150](#)

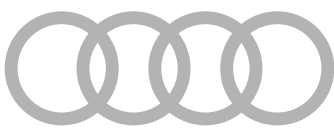
⇒ [“1.5 Removing and installing oil level and oil temperature sender G266”, page 151](#)

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, the following steps are required after completion of repair work: clean the oil passages carefully and renew the oil spray jets, engine oil cooler and oil filter.*
- ◆ *Oil capacities, oil specifications and viscosity grades ⇒ Maintenance tables .*
- ◆ *Oil spray jet and pressure relief valve ⇒ [page 80](#)*



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1 - Oil level and oil temperature sender - G266-

- ❑ Removing and installing
⇒ [page 151](#)

2 - Seal

- Renew

3 - Oil drain plug

- 30 Nm

4 - Seal

-

5 - Bolt

- ❑ Tightening torque and sequence ⇒ **page 145**

6 - Sump

- ❑ Removing and installing
⇒ page 145

7 - Bolt

- 16 Nm

8 - Oil pump

- ☐ Removing and installing
⇒ page 150

9 - Toothed belt

10 - Dowel sleeves

11 - Cylinder block

12 - O-ring

- ☐
- Renew

13 - Bolt

- 9 Nm

14 - Clip

15 - Dipstick guide tube

16 - Bolt

- 9 Nm

17 - Oil intake pipe

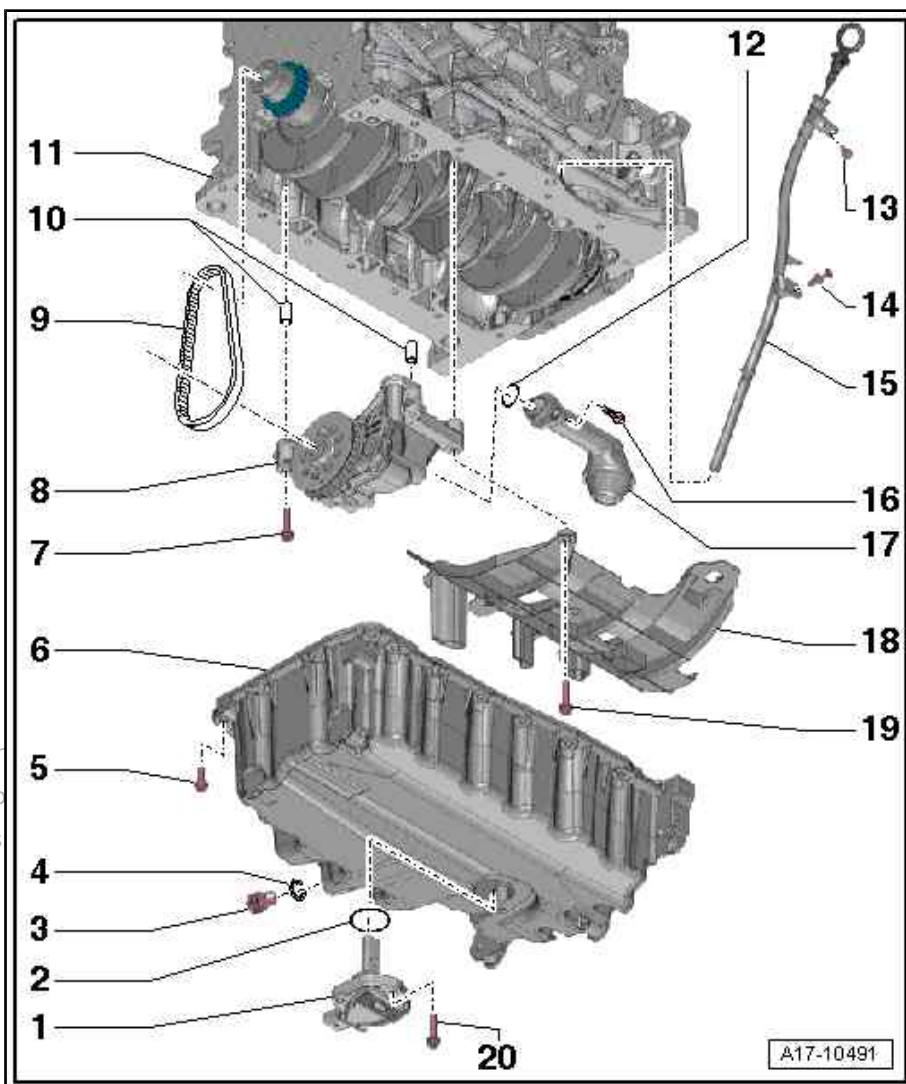
18 - Baffle plate

19 - Bolt

- 16 Nm

20 - Bolt

- ☐ Self-locking
- ☐ Renew
- ☐ 9 Nm

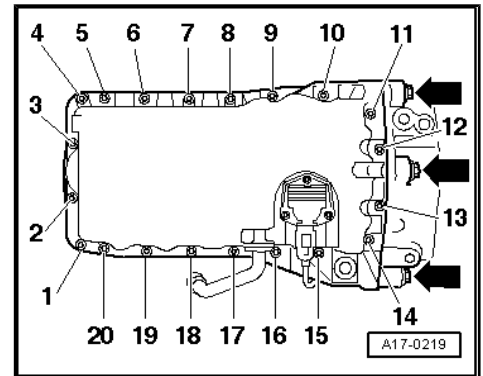




Sump - tightening torque and sequence

– Tighten bolts in 3 stages as follows:

Stage	Bolts	Tightening torque
1.	-1 ... 20-	5 Nm in diagonal sequence
2.	-Arrows-	40 Nm using Allen key, long reach - T10058-
3.	-1 ... 20-	Tighten in stages and in diagonal sequence; final torque 13 Nm



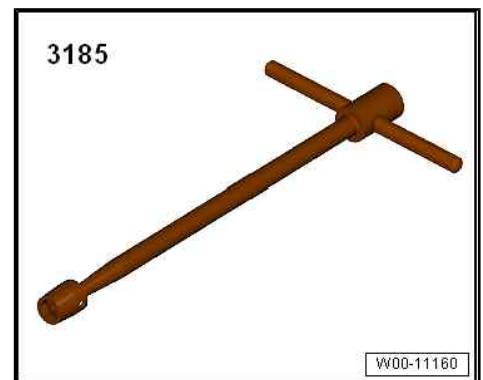
1.2 Engine oil

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

1.3 Removing and installing sump

Special tools and workshop equipment required

- ◆ Articulated wrench, 10 mm - 3185-



- ◆ Socket - T10058-



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

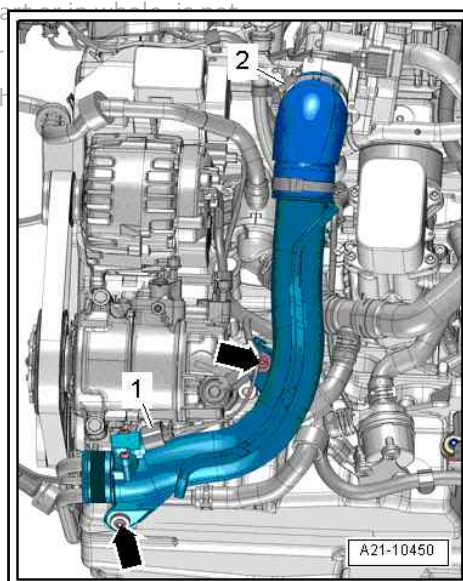
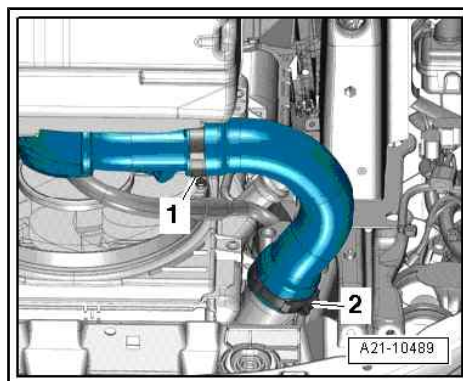


Removing

- Engine oil drained ⇒ Maintenance ; Booklet 819
- Release hose clips -1- and -2- and remove air hose.



- Remove bolts -arrows-.
- Release hose clip -2-.
- Unplug electrical connector -1- on charge pressure sender - G31- / intake air temperature sender - G42- and move clear electrical wiring.
- Detach air pipe (right-side).

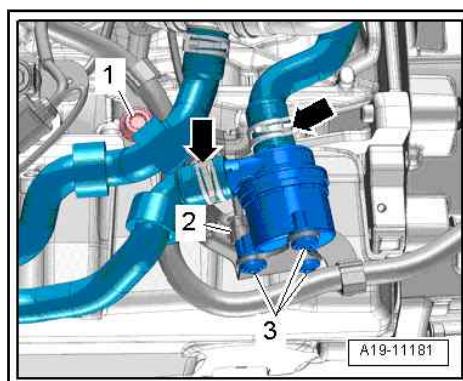


- Unscrew bolt -1- and press pump for exhaust gas recirculation cooler - V400- to the side.

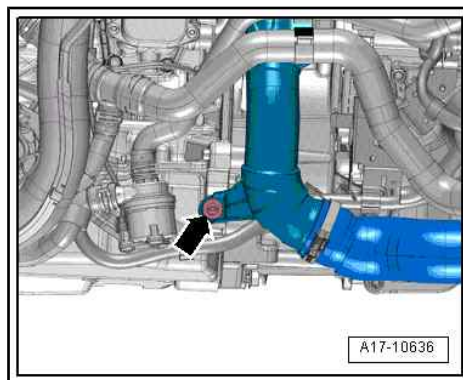


Note

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

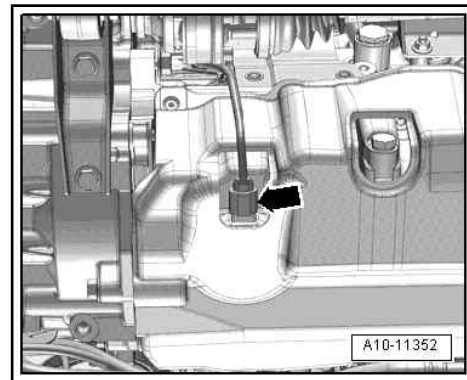


- Remove bolt -arrow- at air pipe (left-side).





- Unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .

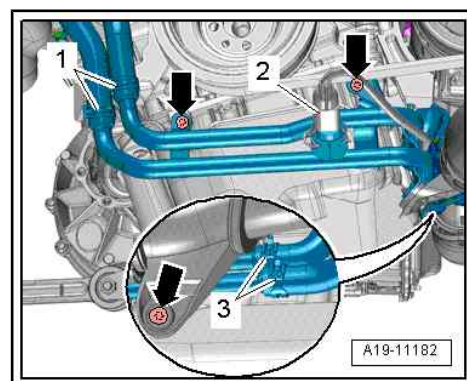


- Remove bolts -arrows- and move coolant pipes (right-side) to the side.

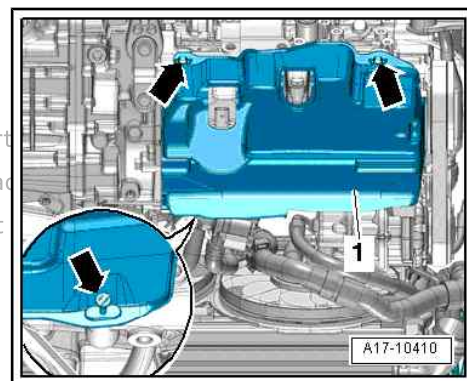


Note

Disregard -item 1-.



- Release fasteners -arrows- and remove noise insulation -1- for sump.



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- Remove bolts -arrows- securing sump to gearbox using Allen key, long reach - T10058- .
- Slacken bolts -1 ... 20- in diagonal sequence and remove.
- Carefully release sump from bonded joint.

Installing



Caution

Protect lubrication system and bearings against contamination.

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

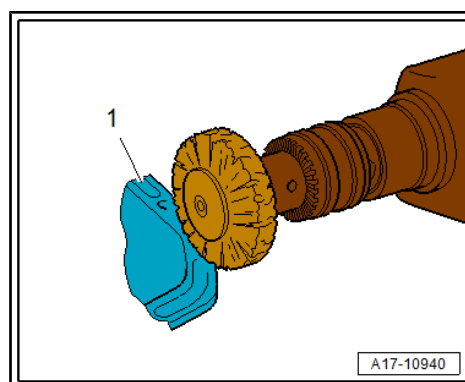
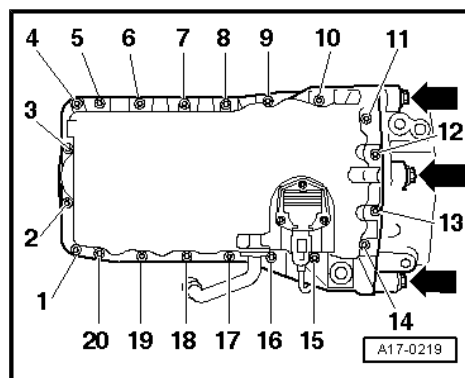


WARNING

Risk of eye injury.

- ◆ **Put on safety goggles.**

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



Note

Note the use-by date of the sealant.

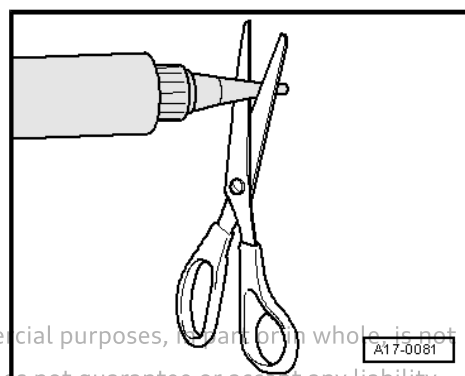
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

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



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

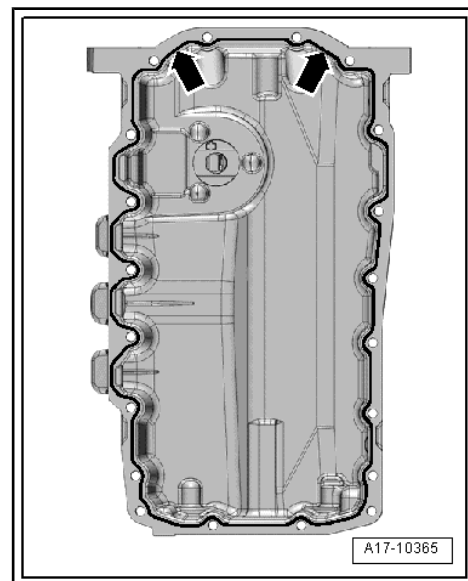


- Thickness of sealant bead: 2 ... 3 mm.



Note

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

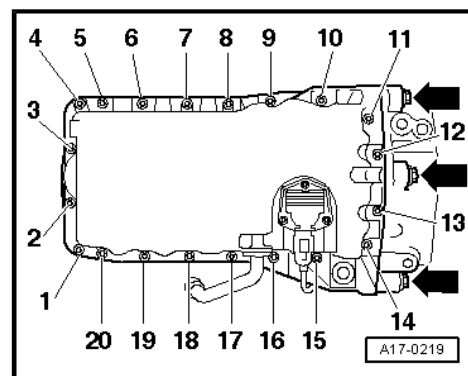


- Fit sump and tighten bolts ⇒ [page 145](#) .
- The sump must make flush contact with intermediate plate/ gearbox flange.



Note

- ◆ When installing sump with engine removed from vehicle, ensure that sump is positioned flush with cylinder block at fly-wheel 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:



Note

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

- Install pump for exhaust gas recirculation cooler - V400- ⇒ [page 183](#) .
- Install coolant pipes (right-side) ⇒ [page 190](#) .
- Install air pipes ⇒ [page 206](#) .

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Tightening torques

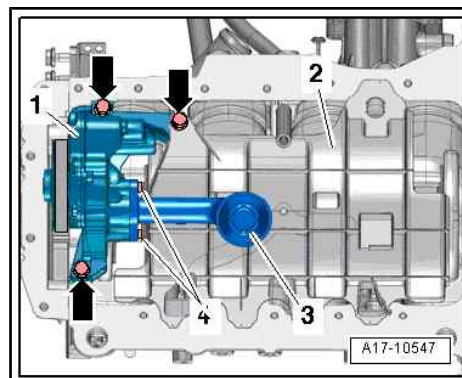
- ◆ ⇒ Fig. "Sump - tightening torque and sequence" , [page 145](#)



1.4 Removing and installing oil pump

Removing

- Remove sump ⇒ [page 145](#) .
- Remove bolts -4- and detach oil intake pipe -3- if oil pump must be renewed.
- Unscrew bolts -arrows- and remove baffle plate -2-.
- Disengage oil pump -1- from toothed belt and detach.



Installing

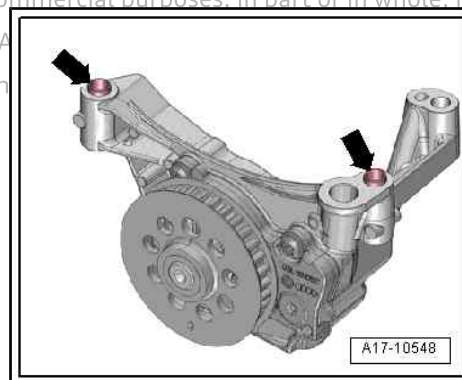
Installation is carried out in reverse order; note the following:



Note

Fit new O-ring.

- If no dowel sleeves -arrows- for centring the oil pump are fitted in the oil pump housing, install missing dowel sleeves.
- Turn toothed belt sprocket by hand to check oil pump for ease of movement.



Note

Renew oil pump if resistance can be felt.

- Check toothed belt for oil pump.



Note

- ◆ *Renew toothed belt if damaged.*
- ◆ *It is normal that the toothed belt is slack after a certain running period; this is not a fault.*
- Engage oil pump with toothed belt sprocket into toothed belt and secure together with baffle plate.
- Install sump ⇒ [page 145](#) .

Tightening torques

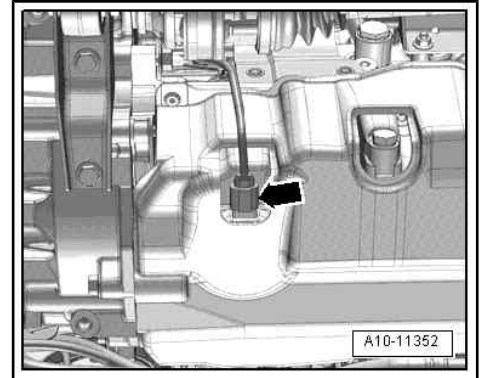
- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 143](#)



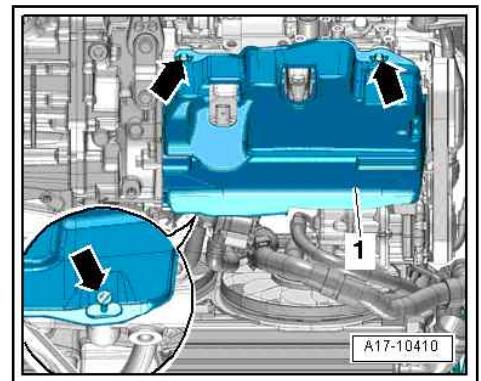
1.5 Removing and installing oil level and oil temperature sender - G266-

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 819
- Unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .



- Release fasteners -arrows- and remove noise insulation -1- for sump.



- Remove bolts -1- and detach oil level and oil temperature sender - G266- -item 4-.



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~~Disregard item 3-~~

Installing

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



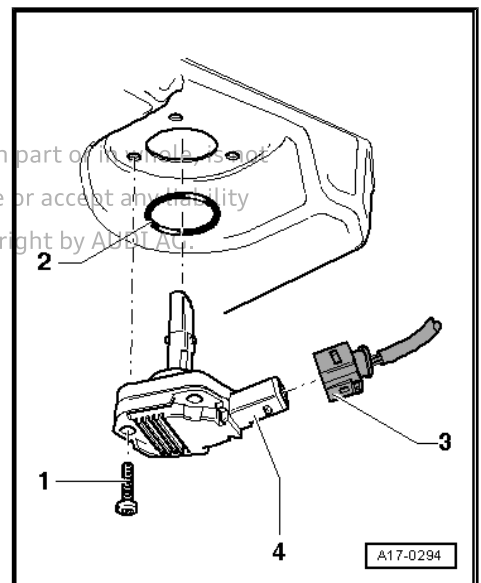
Note

Renew seal -2- and self-locking bolts -1-.

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

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 143](#)





2 Oil filter/oil pressure switches

⇒ ["2.1 Exploded view - oil filter housing/oil pressure switch", page 152](#)

⇒ ["2.2 Removing and installing oil pressure switch F1", page 153](#)

⇒ ["2.3 Checking oil pressure and oil pressure switch", page 154](#)

⇒ ["2.4 Removing and installing oil filter housing", page 156](#)

2.1 Exploded view - oil filter housing/oil pressure switch

1 - Sealing cap

- ☐ 25 Nm

2 - O-ring

- ☐ Renew

3 - O-ring

- ☐ Renew

4 - O-ring

- ☐ Renew

5 - Oil filter element

- ☐ See note ⇒ [page 143](#)
- ☐ Removing and installing ⇒ Maintenance ; Booklet 819

6 - Engine oil cooler

- ☐ See note ⇒ [page 143](#)
- ☐ Connection diagram - coolant hoses ⇒ [page 159](#)
- ☐ Removing and installing ⇒ ["2.4 Removing and installing oil filter housing", page 156](#)
- ☐ If renewed, refill system with fresh coolant

7 - Bolt

- ☐ 11 Nm

8 - Gaskets

- ☐ Renew

9 - Bolt

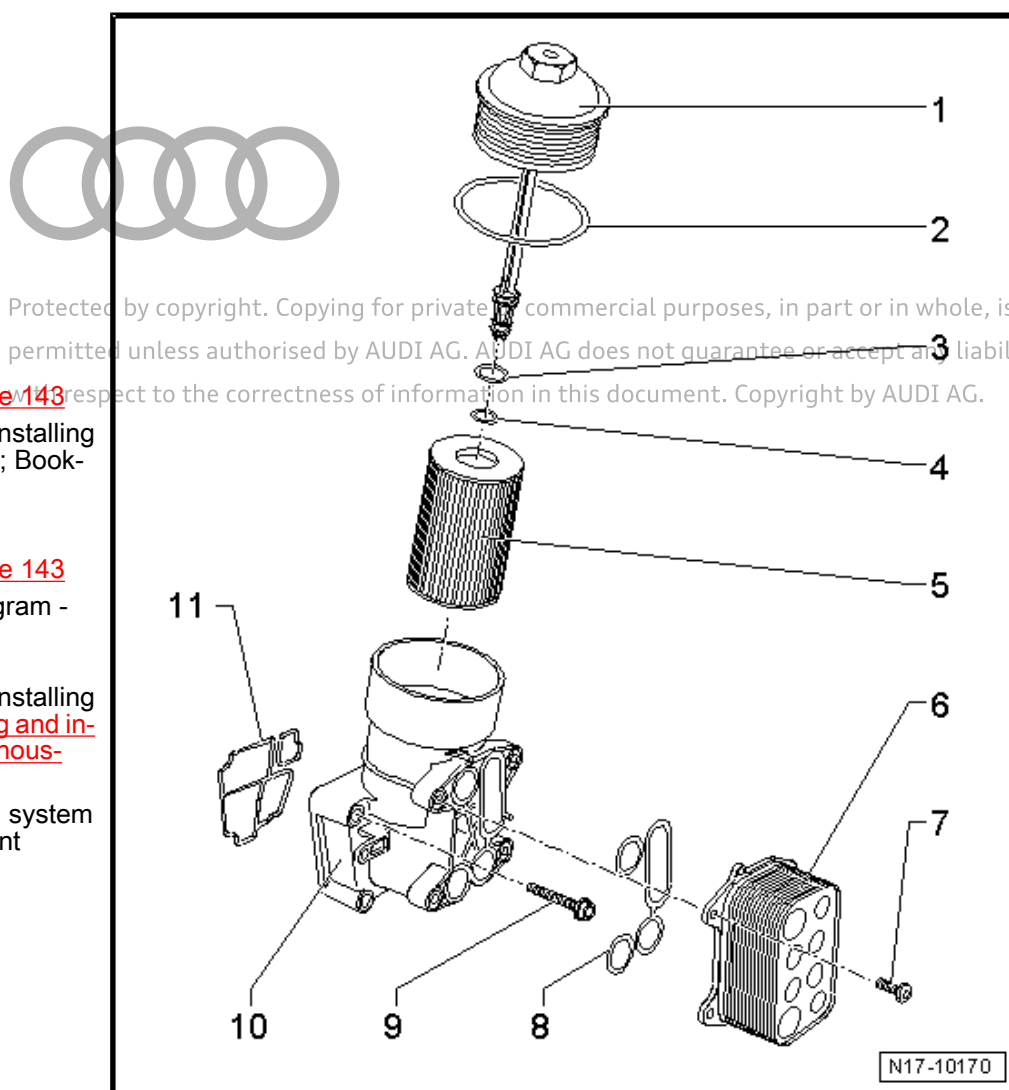
- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 153](#)

10 - Oil filter housing

- ☐ With integrated oil retention valve
- ☐ Removing and installing ⇒ [page 156](#)

11 - Gaskets

- ☐ Renew





Oil filter housing - tightening torque and sequence

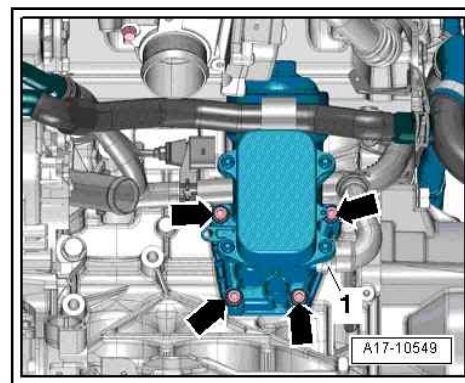


Note

Renew the bolts tightened with specified tightening angle.

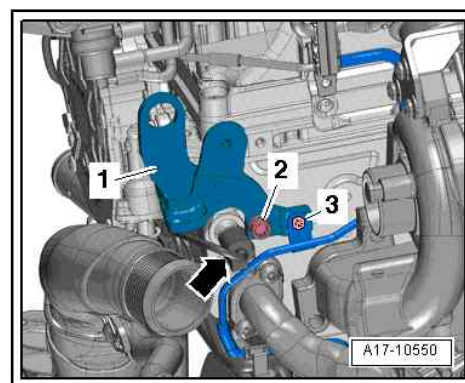
- Fit bolts at top left and bottom right first.
- Tighten bolts in 2 stages as follows:

Stage	Bolts	Tightening torque/angle specification
1.	-Arrows-	14 Nm in diagonal sequence
2.	-Arrows-	Turn 180° further in diagonal sequence



Oil pressure switch - F1- -arrow-

- ◆ With seal
- ◆ Renew seal.
- ◆ If seal is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal
- ◆ Opening/closing pressure 0.3 ... 0.6 bar
- ◆ Removing and installing ⇒ [page 153](#)
- ◆ Checking ⇒ [page 154](#)
- ◆ 20 Nm



2.2 Removing and installing oil pressure switch - F1-

Articulated wrench, 24 mm - T40175-

Removing

- Remove engine cover panel ⇒ [page 43](#) .

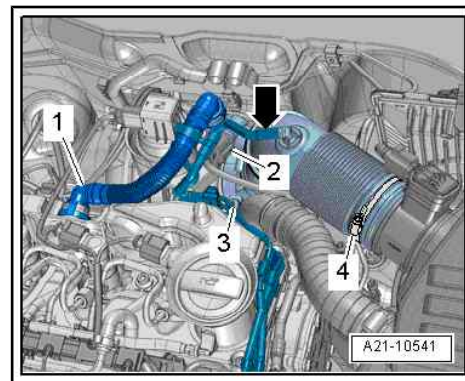
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T40175



W00-11242

- Version for countries with cold climates: Unplug electrical connector -2-.
- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Release hose clip -4- and detach air pipe from air cleaner housing.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.





- Remove bolts -2- and -3- and press engine lifting eye -1- to the side.
- Unplug electrical connector -arrow-.
- Unscrew oil pressure switch - F1- .

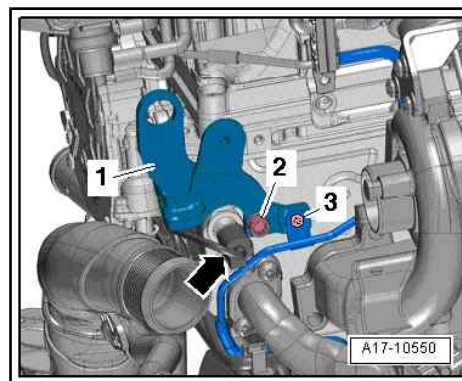
Installing

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

- Renew seal for oil pressure switch - F1- after removal.
- Cut seal open to renew.
- Install engine lifting eye ⇒ [page 101](#) .
- Install vacuum line to exhaust gas recirculation cooler ⇒ [page 312](#) .
- Install air pipe with connection ⇒ [page 200](#) .

Tightening torques

- ◆ ⇒ [Fig. “Oil pressure switch -F1- -arrow-”](#), [page 153](#)
- ◆ ⇒ [“2.1 Exploded view - cylinder head”](#), [page 101](#)



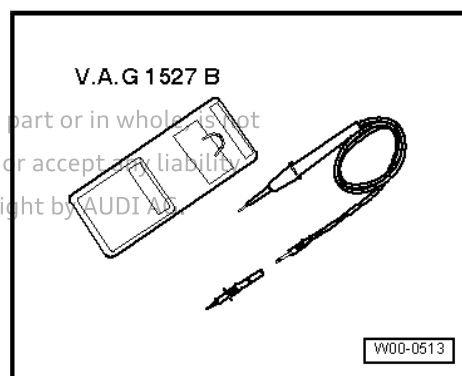
2.3 Checking oil pressure and oil pressure switch

Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-



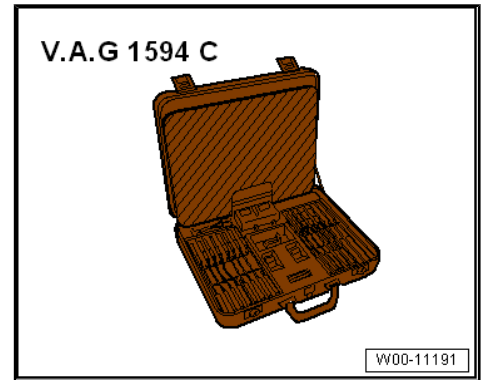
- ◆ Voltage tester - V.A.G 1527B-



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



Checking oil pressure

- Oil level OK
- Remove oil pressure switch - F1- [⇒ page 153](#).
- 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.

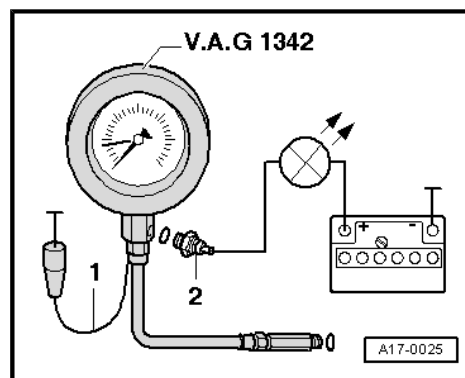
If specification is not obtained, switch off engine immediately and check oil pump drive; renew oil pump if necessary
[⇒ "1.4 Removing and installing oil pump", page 150](#) .

If specification is obtained, let engine warm up.

- Oil pressure specification at operating temperature and 2000 rpm: at least 1.0 bar.

**Checking oil pressure switch - F1-**

- Oil level OK
- Remove oil pressure switch - F1- ⇒ [page 153](#) .
- Connect oil pressure tester - V.A.G 1342- to bore for oil pressure switch.
- Screw oil pressure switch - F1- -item 2- into threaded hole in oil pressure tester.
- Connect brown wire -1- of oil pressure tester to earth (-).
- Connect voltage tester - V.A.G 1527B- with adapter leads from auxiliary measuring set - V.A.G 1594C- to oil pressure switch - F1- and battery positive (+).
- LED should not light up.

**Note**

Renew oil pressure switch - F1- if LED lights up at this stage.

- Start engine.

**Note**

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

- LED should light up at 0.3 ... 0.6 bar.
- Renew oil pressure switch - F1- if LED does not light up ⇒ [page 153](#) .

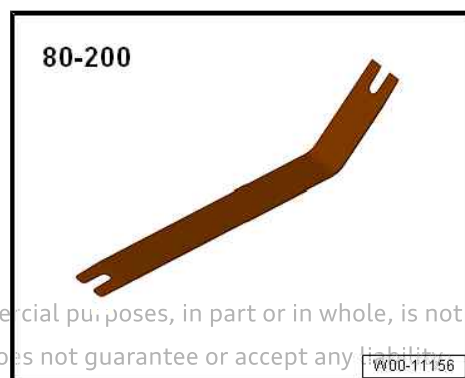
Assembling

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

- Install oil pressure switch - F1- ⇒ [page 153](#) .

2.4 Removing and installing oil filter housing**Special tools and workshop equipment required**

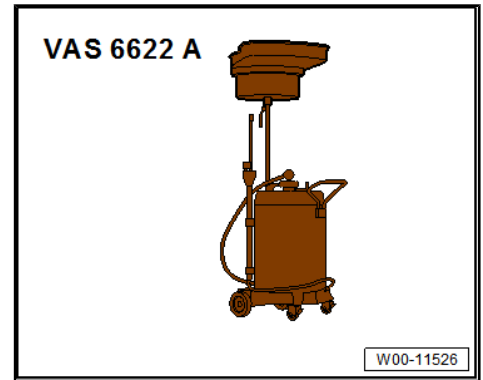
- ◆ Removal lever - 80 - 200-



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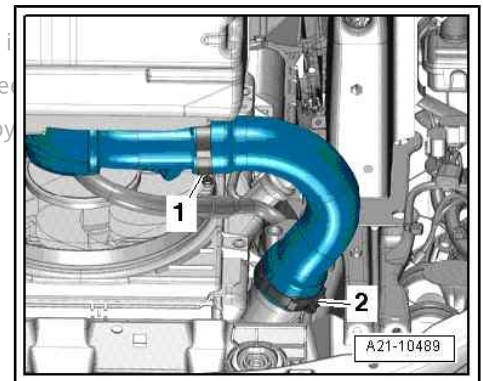
- ◆ Used oil collection and extraction unit - VAS 6622A-



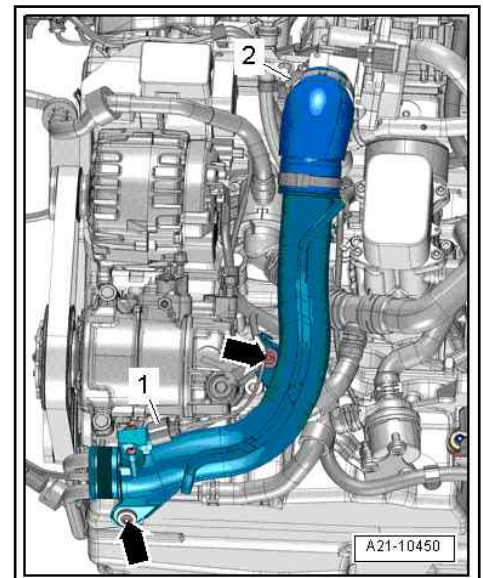
Removing

- Drain coolant ⇒ [page 161](#) .
- Remove oil filter element ⇒ Maintenance ; Booklet 819 .
- Release hose clips -1- and -2- and remove air hose.

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- Remove bolts -arrows-.
- Release hose clip -2-.
- Unplug electrical connector -1- on charge pressure sender - G31- / intake air temperature sender - G42- and move clear electrical wiring.
- Detach air pipe (right-side).

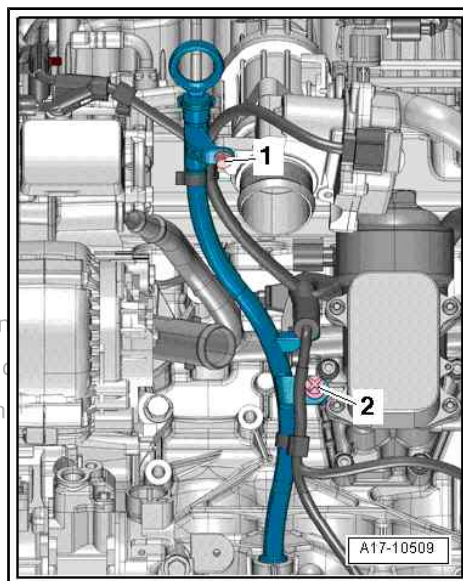




- Pull oil dipstick out slightly and remove bolt -1-.
- Release clip -2- with removal lever - 80 - 200- .
- Pull guide tube for oil dipstick upwards out of cylinder block and push to one side.



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- Position used oil collection and extraction unit - VAS 6622A- below engine.
- Unscrew bolts -arrows- and remove oil filter bracket with engine oil cooler.

Installing

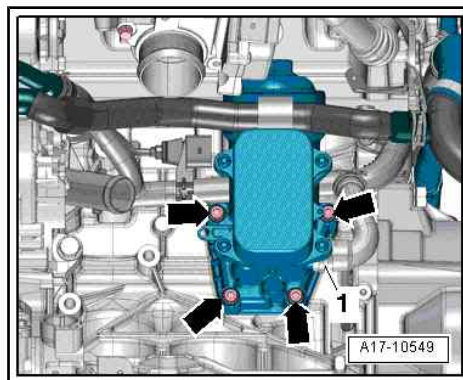
Installation is carried out in reverse order; note the following:



Note

Renew gaskets, seals and O-rings.

- Install dipstick guide tube ⇒ [page 143](#) .
- Install air pipe ⇒ [page 206](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install oil filter element, fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 819 .



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - oil filter housing/oil pressure switch”, page 152](#)



19 – Cooling

1 Cooling system/coolant

⇒ “1.1 Connection diagram - coolant hoses”, page 159

⇒ “1.2 Checking cooling system for leaks”, page 160

⇒ “1.3 Draining and filling cooling system”, page 161

1.1 Connection diagram - coolant hoses



Note

- ◆ Blue = Large coolant circuit
- ◆ Red = Small coolant circuit
- ◆ Orange = Coolant circuit for exhaust gas recirculation.
- ◆ Arrows show direction of coolant flow.

1 - Radiator

2 - Pump for exhaust gas re-circulation cooler - V400-

3 - Thermostat or 4/2-way valve

4 - Coolant pump

5 - Radiator outlet coolant temperature sender - G83-

6 - Coolant expansion tank

7 - Filler cap

- ☐ Checking pressure relief valve ⇒ [page 161](#)

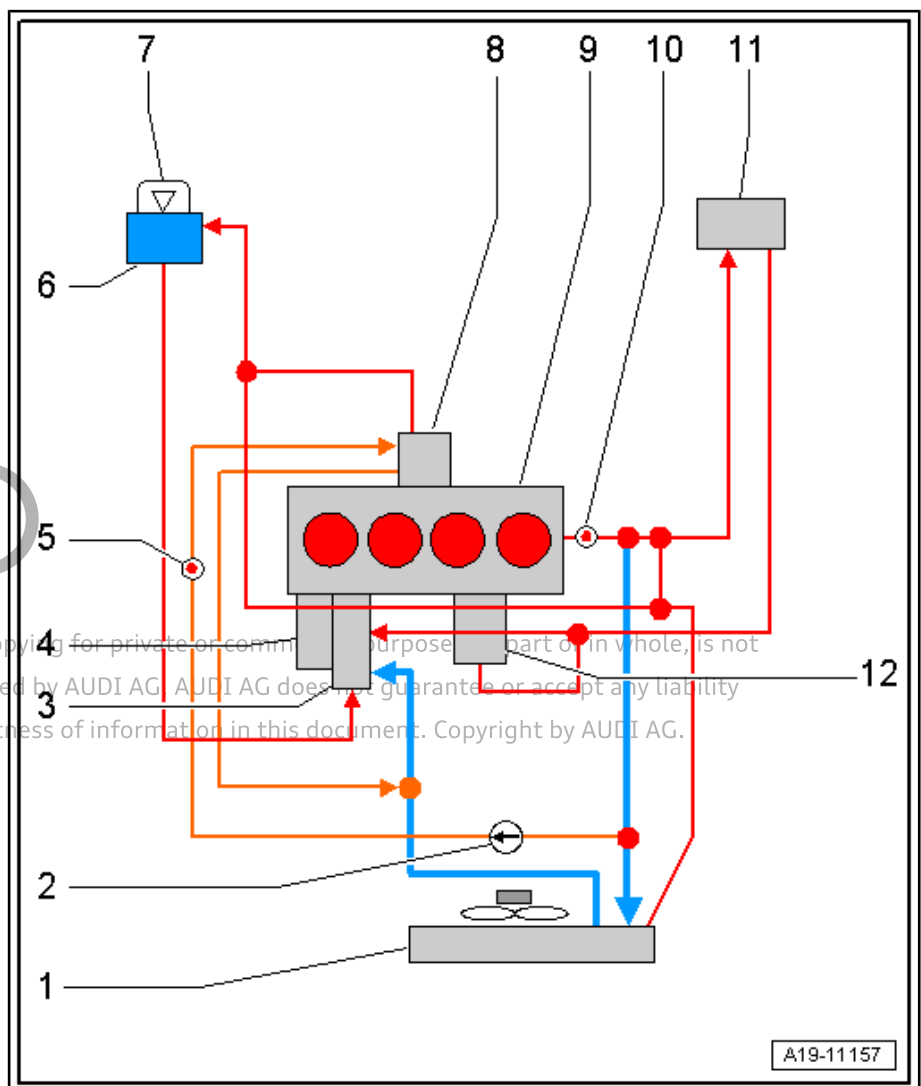
8 - Exhaust gas recirculation cooler

9 - Cylinder head/cylinder block

10 - Coolant temperature sender - G62-

11 - Heat exchanger for heater

12 - Engine oil cooler



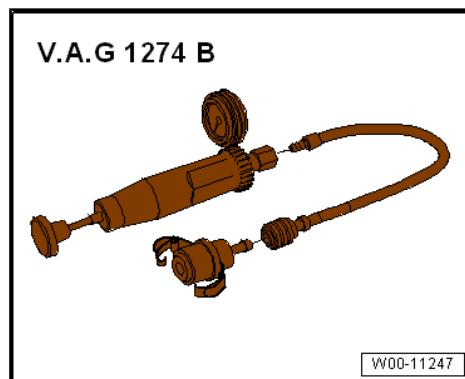
A19-11157



1.2 Checking cooling system for leaks

Special tools and workshop equipment required

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



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



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



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Procedure

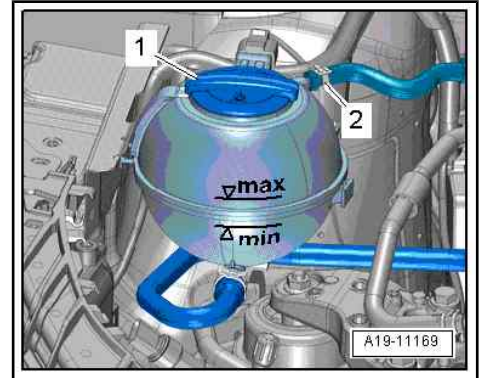
- Engine must be warm.
- Ignition switched off.



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.*



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

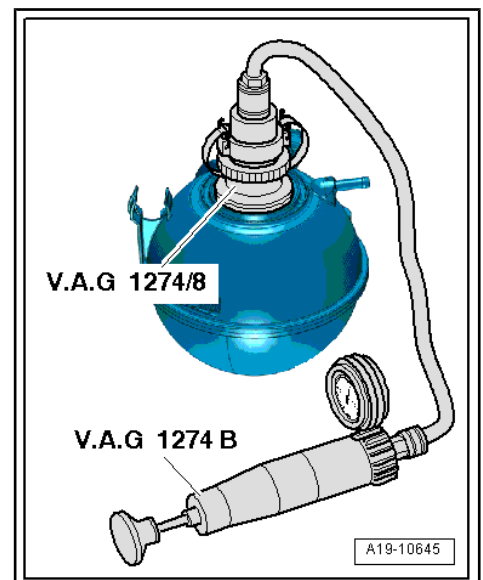


Note

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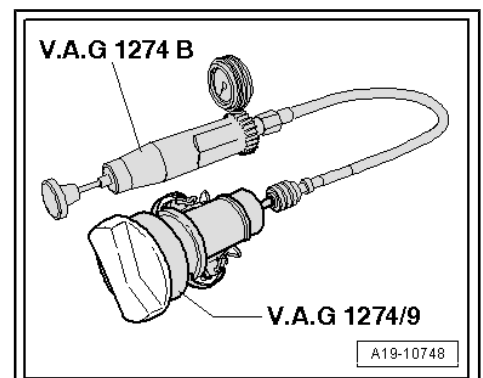
Disregard -item 2-.

- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.
- If this pressure is not maintained, locate and rectify leaks.

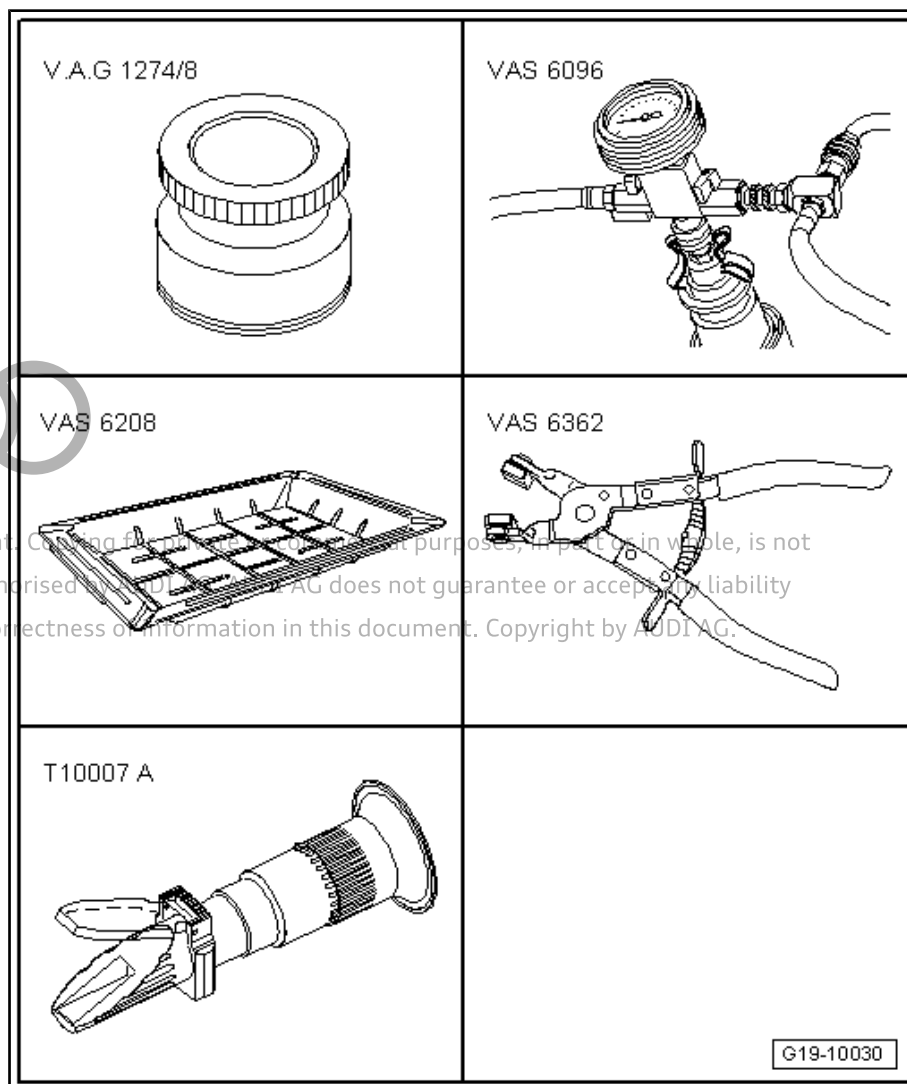


Checking pressure relief valve in filler cap

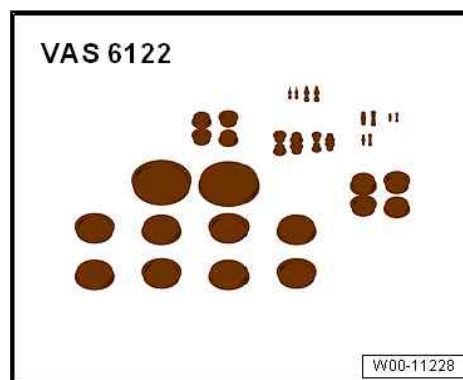
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
- Build up pressure with hand pump on cooling system tester.
- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.
- Renew filler cap if pressure relief valve does not open as described.



1.3 Draining and filling cooling system

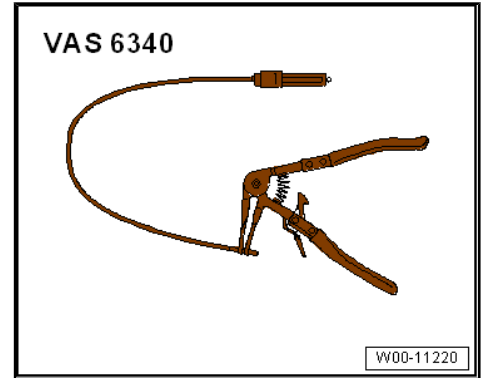
**Special tools and workshop equipment required**

- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Cooling system charge unit - VAS 6096- with -VAS 6096/1-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Refractometer - T10007A-
- ◆ Engine bung set - VAS 6122-





- ◆ Hose clip pliers - VAS 6340-



Draining



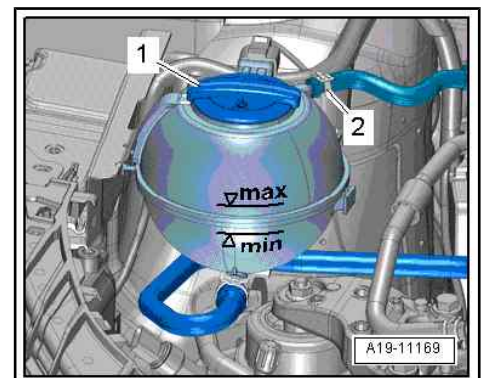
WARNING

Risk of scalding due to hot steam and hot coolant.

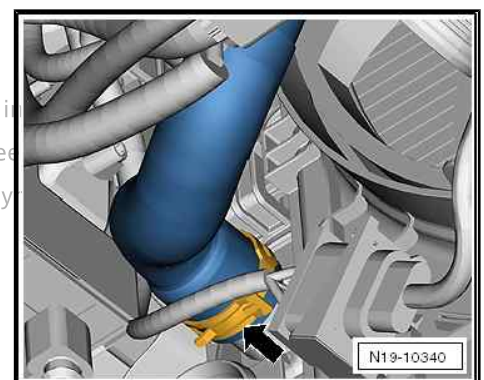
The cooling system is under pressure when the power unit is hot.

Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.

- Open filler cap -1- on coolant expansion tank.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

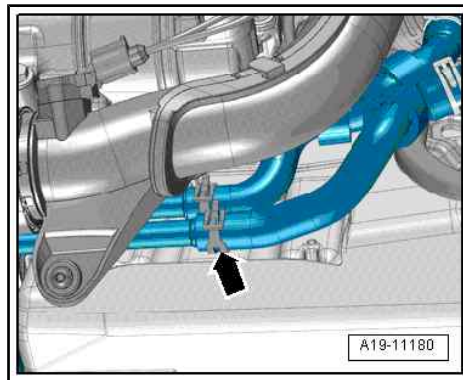


- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Release hose clip -arrow-, disconnect coolant hose from bottom of radiator and drain off coolant.





- Release hose clip -arrow-, disconnect coolant hose (bottom right) from coolant pipe and drain off coolant.



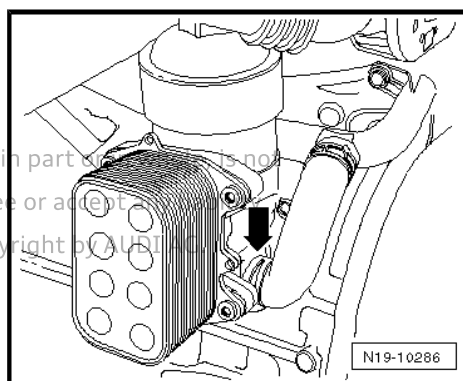
- Release hose clip -arrow-, disconnect coolant hose at oil filter housing and drain off remaining coolant.

Filling



Caution

To ensure optimal corrosion protection, only distilled water may be mixed with coolant additives.



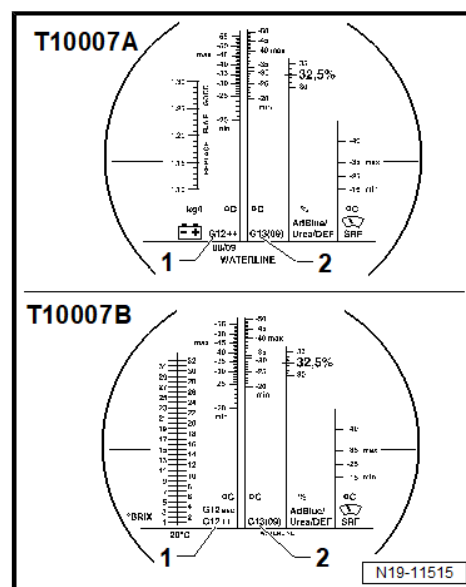


Note

- ◆ 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 engine damage.
- ◆ 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 engine 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

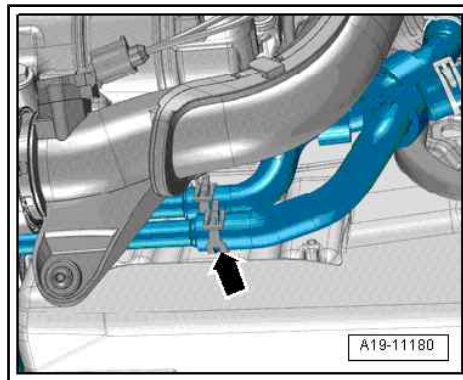
- Coolant (40 %) and distilled water (60 %) for frost protection to -25 °C
- Coolant (50 %) and distilled water (50 %) for frost protection to -36 °C
- Coolant additive ⇒ Electronic parts catalogue (ETKA)





Procedure

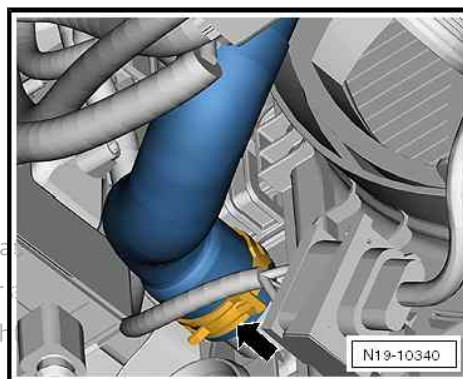
- Connect coolant hose (bottom right) to coolant pipe using hose clip -arrow-.



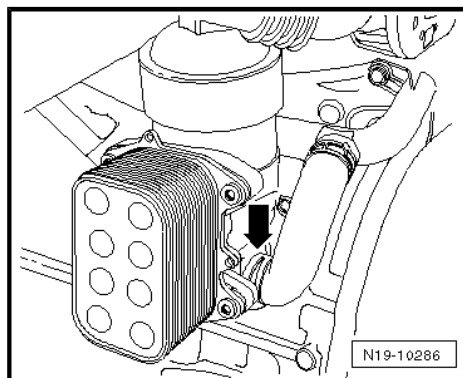
- Connect coolant hose (bottom) to radiator using hose clip -arrow-.



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- Connect coolant hose (top) to oil filter housing using hose clip -arrow-.



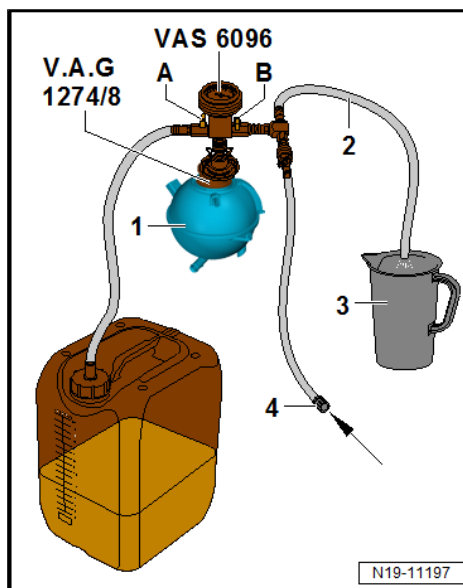
- Fill reservoir of -VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio):
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
- Run vent hose -2- into a small container -3-.



Note

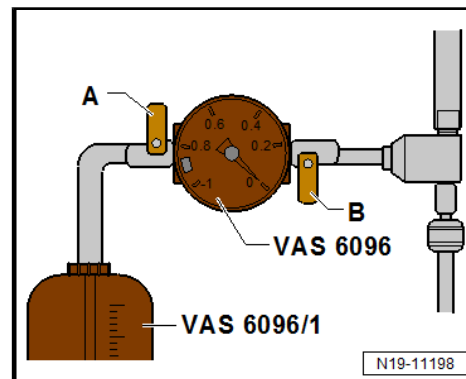
The vented air draws along a small amount of coolant, which should be collected.

- 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.





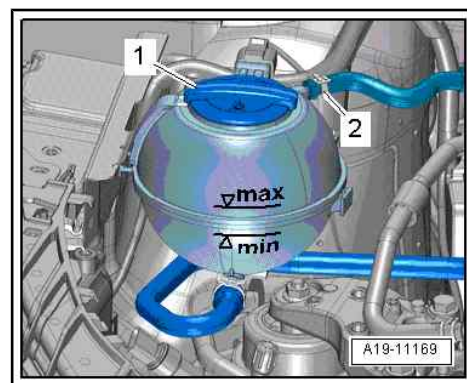
- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with 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.



Note

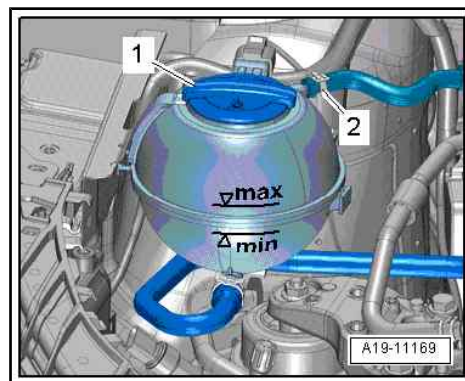
- ◆ *If the needle does not reach the green zone, repeat the process.*
- ◆ *Check cooling system for leaks if the vacuum is not maintained.*

- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.
- Detach cooling system charge unit - VAS 6096- from coolant expansion tank.
- Top up coolant to "max" mark.
- Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
- 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.
- Run engine for 2 minutes (maximum) at approx. 1500 rpm.
- Top up coolant to overflow hole on expansion tank with engine running.
- Close filler cap -1- on coolant expansion tank (make sure it engages).
- Allow engine to run at idling speed until both large coolant hoses at radiator become warm.
- Switch off ignition and allow engine to cool down.





- Check coolant level.
- The coolant level must be between the “min” and “max” markings when the engine is cold.
- Top up with coolant again if necessary.



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2 Coolant pump/thermostat assembly

⇒ ["2.1 Exploded view - coolant pump/thermostat", page 169](#)

⇒ ["2.2 Removing and installing electric coolant pump", page 171](#)

⇒ ["2.3 Removing and installing coolant pump", page 173](#)

⇒ ["2.4 Removing and installing thermostat", page 173](#)

⇒ ["2.5 Checking thermostat", page 175](#)

⇒ ["2.6 Removing and installing 4/2-way valve with thermostat", page 176](#)

⇒ ["2.7 Removing and installing coolant temperature sender G62", page 180](#)

⇒ ["2.8 Removing and installing radiator outlet coolant temperature sender G83", page 181](#)

2.1 Exploded view - coolant pump/thermostat

⇒ ["2.1.1 Exploded view - coolant pump/thermostat, cooling system with 4/2-way valve", page 169](#)

⇒ ["2.1.2 Exploded view - coolant pump/thermostat, cooling system with thermostat", page 171](#)

2.1.1 Exploded view - coolant pump/thermostat, cooling system with 4/2-way valve



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1 - Coolant pump

- ❑ Removing and installing
⇒ [page 173](#)

2 - Bolt

- ❑ 15 Nm

3 - O-ring

- ❑ Renew

4 - O-ring

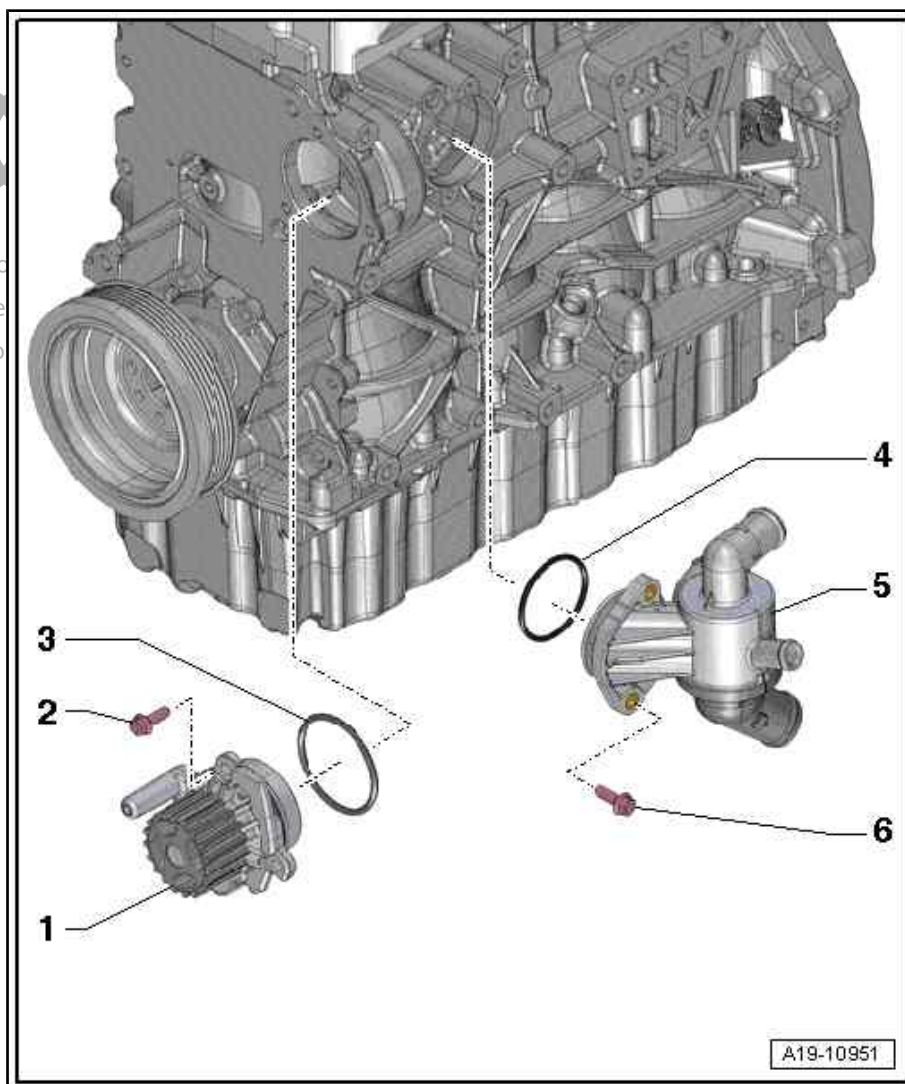
- ❑ Renew

5 - 4/2-way valve

- ❑ With thermostat
- ❑ The thermostat is located in the interior of the 4/2-way valve and cannot be renewed separately
- ❑ Removing and installing
⇒ [page 176](#)

6 - Bolt

- ❑ 15 Nm





2.1.2 Exploded view - coolant pump/thermostat, cooling system with thermostat

1 - Coolant pump

- ☐ Removing and installing
⇒ [page 173](#)

2 - Bolt

- ☐ Tightening torque
⇒ [Item 2 \(page 170\)](#)

3 - O-ring

- ☐ Renew

4 - Thermostat

- ☐ Removing and installing
⇒ [page 173](#)
- ☐ Checking thermostat
⇒ [page 175](#)

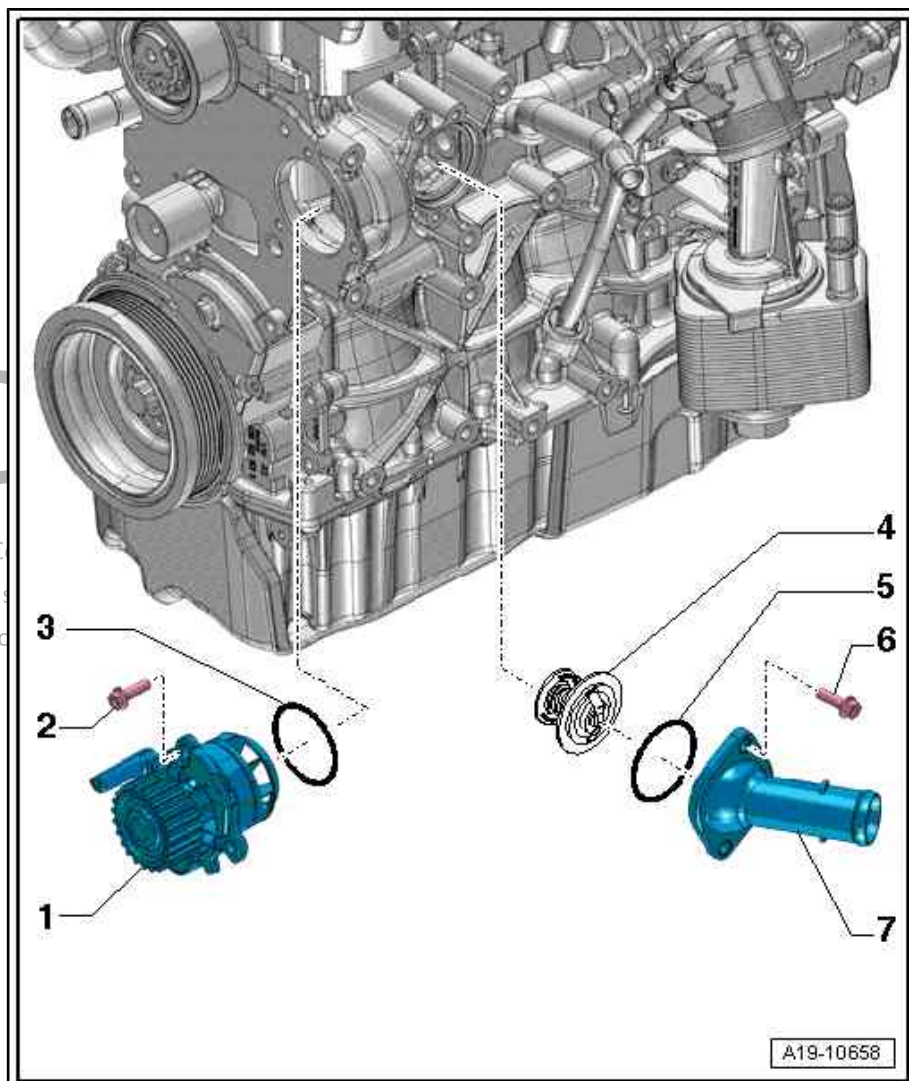
5 - O-ring

- ☐ Renew

6 - Bolt

- ☐ 13 Nm

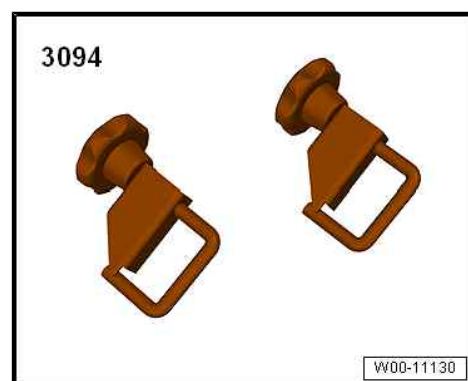
7 - Connection



2.2 Removing and installing electric coolant pump

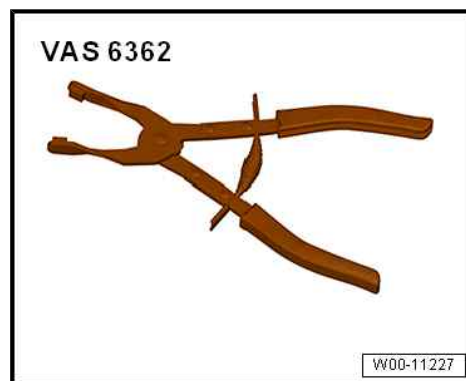
Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-





- ◆ Hose clip pliers - VAS 6362-



Removing

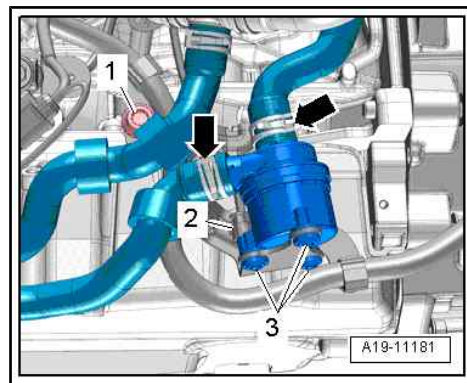
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



Note

Place a cloth underneath pump for exhaust gas recirculation cooler - V400- to catch escaping coolant.

- Clamp off coolant hoses using hose clamps -3094- , release hose clips -arrows- and disconnect hoses.
- Unplug electrical connector -2-.
- Unscrew bolts -3- and remove pump for exhaust gas recirculation cooler - V400- .



Note

Disregard -item 1-.



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.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .
- Check coolant level ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 183](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



2.3 Removing and installing coolant pump

Removing

- Drain coolant ⇒ [page 161](#) .
- Remove toothed belt ⇒ [page 88](#) .
- Unscrew bolts -1- and remove coolant pump -2-.
- Detach O-ring -3-.

Installing

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



Note

Fit new O-ring.

- Clean and smoothen sealing surface for O-ring.
- Lightly lubricate O-ring -3- with coolant.
- Fit coolant pump -2-.
- Installation position: Sealing plug in housing faces downwards.
- Install toothed belt (adjust valve timing) ⇒ [page 93](#) .



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .

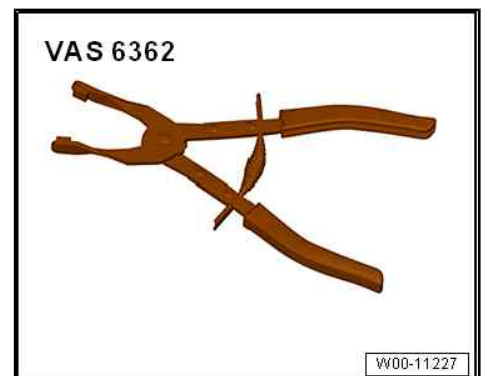
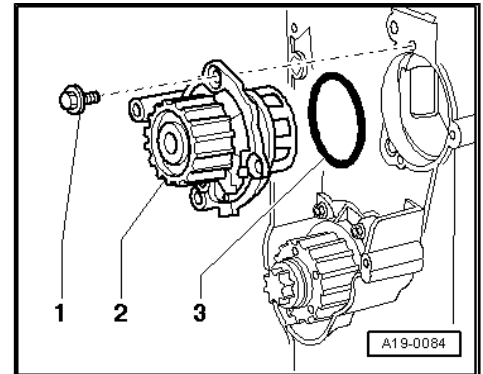
Tightening torques

- ♦ ⇒ ["2.1 Exploded view - coolant pump/thermostat", page 169](#)

2.4 Removing and installing thermostat

Special tools and workshop equipment required

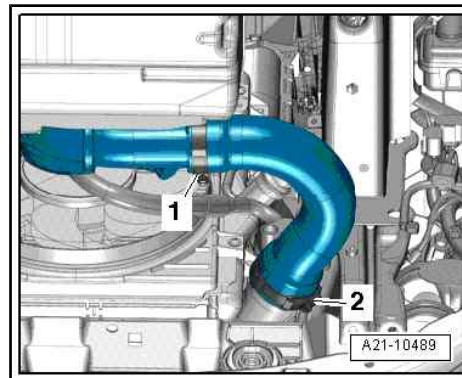
- ♦ Hose clip pliers - VAS 6362-





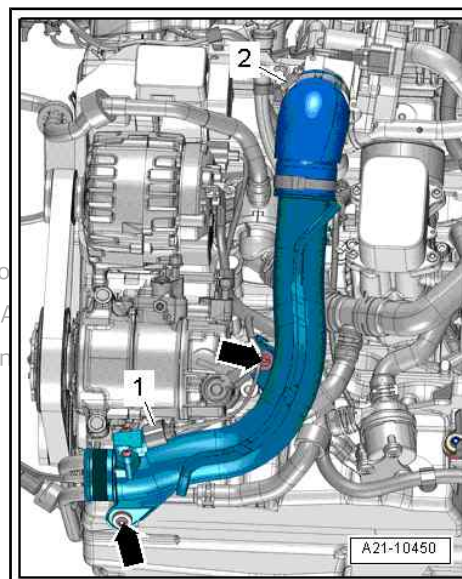
Removing

- Drain coolant ⇒ [page 161](#) .
- Release hose clips -1- and -2- and remove air hose.

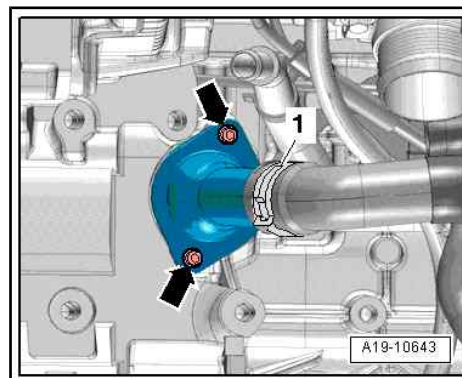


- Remove bolts -arrows-.
- Release hose clip -2-.
- Unplug electrical connector -1- on charge pressure sender - G31- / intake air temperature sender - G42- and move clear electrical wiring.
- Detach air pipe (right-side).

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- Release hose clip -1- and detach coolant hose from connection.
- Unscrew bolts -arrows- and remove connection.





- Turn thermostat -2- approx. 15° clockwise -arrow- and take thermostat out of connection.
- Detach O-ring -1-.

Installing

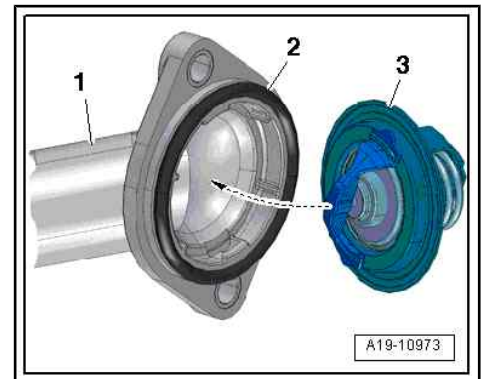
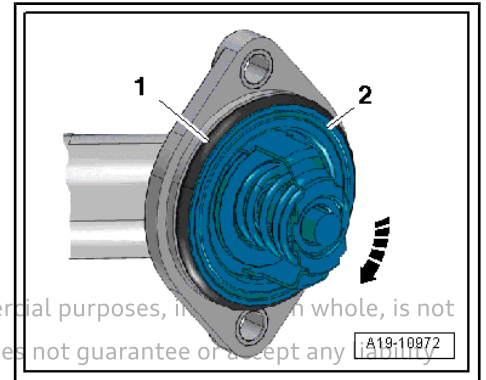
Installation is carried out in reverse order; note the following:



Note

- ◆ *Fit new O-ring.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

- Clean and smoothen sealing surface for O-ring.
- Lubricate O-ring with coolant.
- Fit thermostat -3- with O-ring -2- into guide at connection -1-.



- Turn thermostat -1- anti-clockwise -arrow- as far as stop.
- Install air pipe ⇒ [page 206](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .



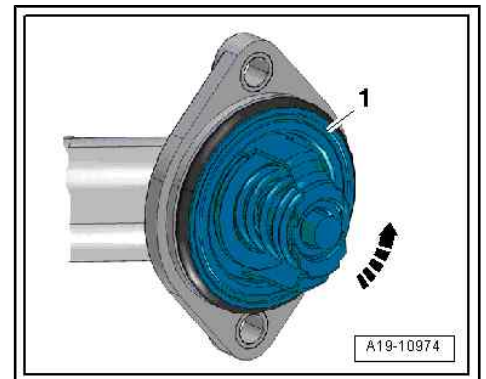
Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .

Tightening torques

- ◆ ⇒ [“2.1.2 Exploded view - coolant pump/thermostat, cooling system with thermostat”, page 171](#)



2.5 Checking thermostat

- Remove thermostat and heat it in a water bath.

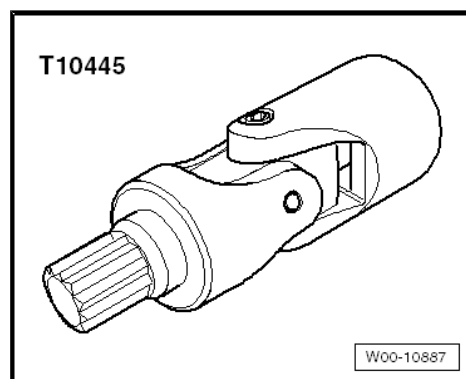
Starts to open	Fully open	Opening travel
approx. 92 °C	approx. 107 °C ¹⁾	at least 7 mm
• ¹⁾ Cannot be tested.		



2.6 Removing and installing 4/2-way valve with thermostat

Special tools and workshop equipment required

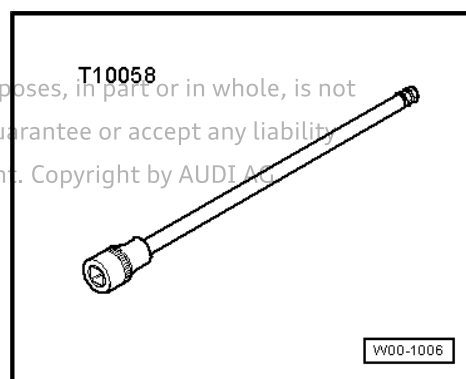
- ◆ Multi-point bit XZN 8 - T10445-



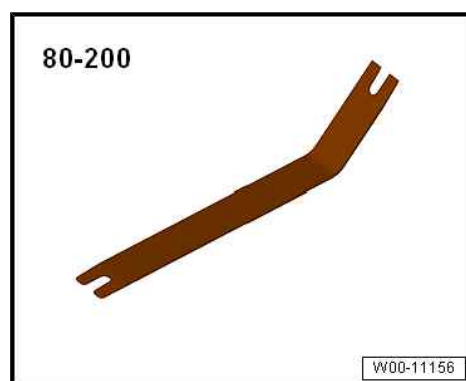
- ◆ Socket - T10058-



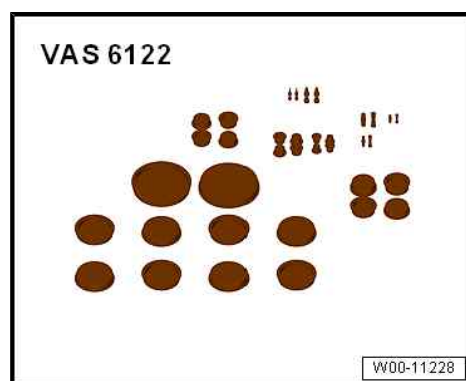
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- ◆ Removal lever - 80 - 200-

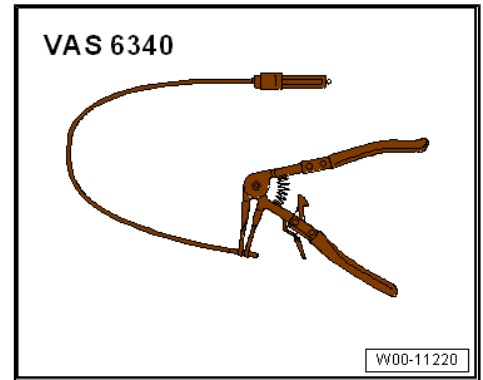


- ◆ Engine bung set - VAS 6122-

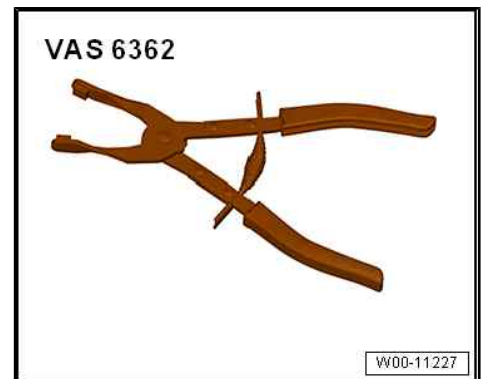




- ◆ Hose clip pliers - VAS 6340-



- ◆ Hose clip pliers - VAS 6362-



Removing

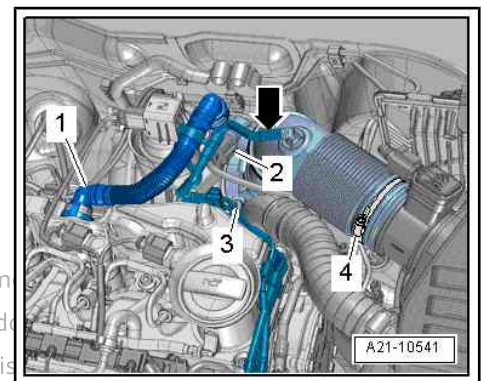
- Drain coolant ⇒ [page 161](#) .
- Remove air cleaner housing ⇒ [page 229](#) .
- Version for countries with cold climates: Unplug electrical connector -2-.
- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.



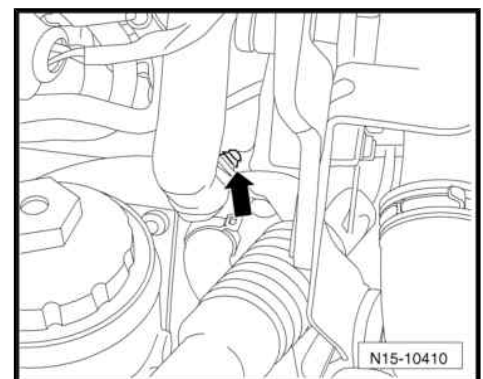
Note

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Disregard -item 4-.

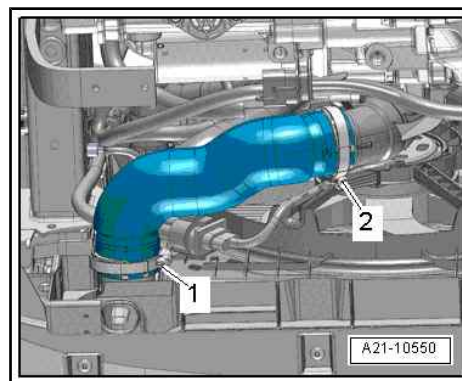


- Unclip wiring harness from retainer -arrow-.

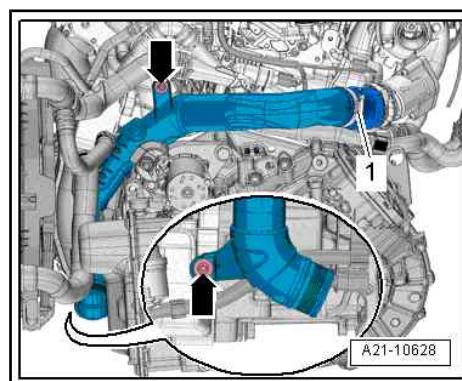




- Release hose clips -1- and -2- and remove air hose.



- Remove bolts -arrows-.
- Using removal lever - 80 - 200- , move clear electrical wiring and hoses at air pipe (left-side).
- Loosen hose clip -3- and detach air pipe (left-side).

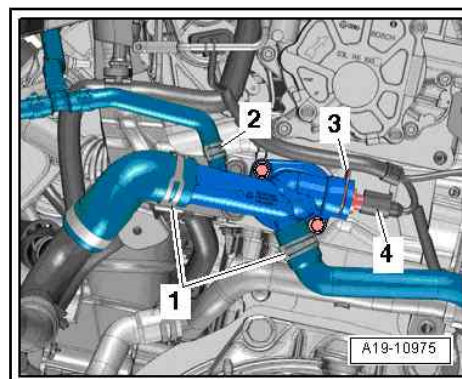


- Release hose clips -1-, detach coolant hoses and move clear.



Note

Disregard -items 2, 3, 4-.

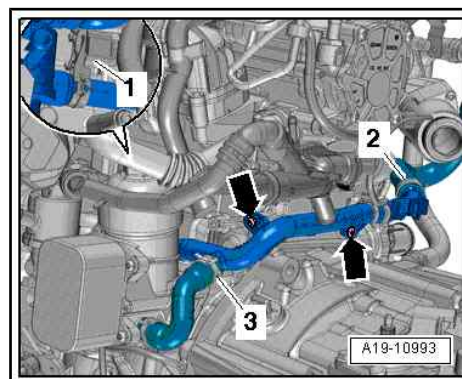


- Take electrical connector -1- for Hall sender - G40- out of retainer.
- Remove bolts -arrows-, pull off coolant pipe (front) from 4/2-way valve to left side and leave in installation position.



Note

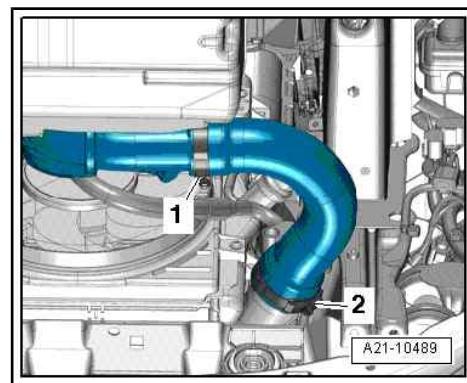
Disregard items -2 and 3-.



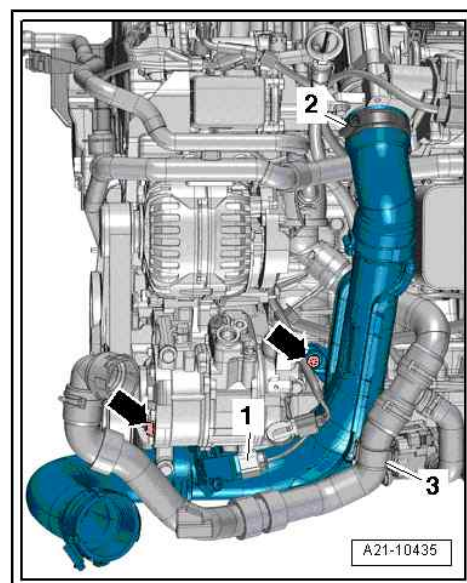
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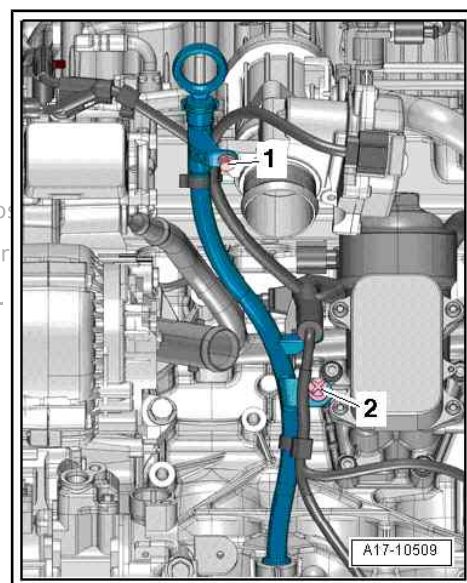
- Release hose clips -1- and -2- and remove air hose.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



- Remove bolts -arrows-.
- Move coolant hose -3- clear.
- Release hose clip -2-.
- Unplug electrical connector -1- at charge pressure sender - G31- / intake air temperature sender - G42- and detach air pipe (right-side).



- Pull oil dipstick out slightly and remove bolt -1-.
- Release clip -2- with removal lever - 80 - 200- .
- Pull guide tube for oil dipstick upwards out of cylinder block and push to one side.



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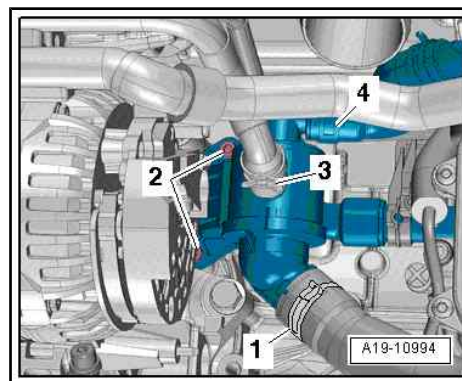


- Remove bolts -2-.
- Loosen hose clips -1, 3, 4-, detach coolant hoses and remove 4/2-way valve with thermostat.

Installing

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

- Install dipstick guide tube ⇒ [page 143](#) .
- Install coolant pipe (front) ⇒ [page 186](#) .
- Install air pipes ⇒ [page 206](#) .
- Install intake connecting pipe ⇒ [page 200](#) .
- Install air cleaner housing ⇒ [page 229](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .

Tightening torques

- ◆ ⇒ [“2.1.1 Exploded view - coolant pump/thermostat, cooling system with 4/2-way valve”, page 169](#)

2.7 Removing and installing coolant temperature sender - G62-

Removing

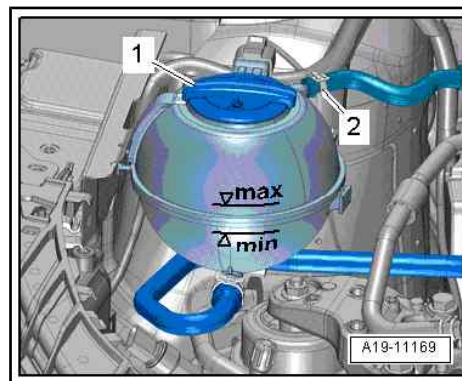
- Engine cold.
- To relieve residual pressure in cooling system, open filler cap -1- on coolant expansion tank briefly and then close cap again (it should click into place).



Note

Disregard -item 2-.

- Remove air cleaner housing ⇒ [page 229](#) .



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- Unplug electrical connector -4-.



Note

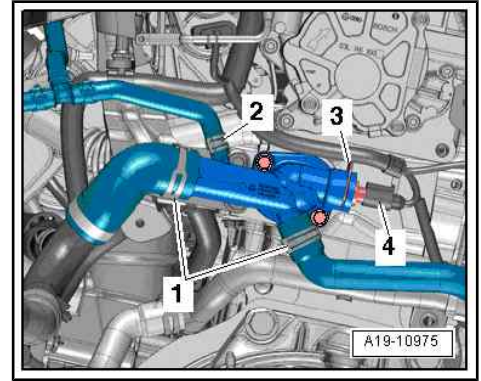
Place a cloth underneath the connection to catch escaping coolant.

- Pull off retaining clip -3- and pull coolant temperature sender - G62- out of connection.



Note

Disregard items -1 and 2-.



Installing

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



Note

- ◆ *Fit new O-ring.*
- ◆ *To avoid loss of coolant, insert new coolant temperature sender - G62- immediately into connection.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Install air cleaner housing ⇒ [page 229](#) .
- Check coolant level ⇒ [page 168](#) .

2.8 Removing and installing radiator outlet coolant temperature sender - G83-

Removing

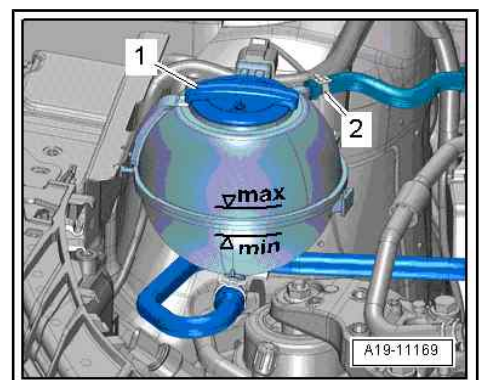
- Engine cold.
- Open filler cap -1- on coolant expansion tank briefly to relieve residual pressure in cooling system.



Note

Disregard -item 2-.

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





- Unplug electrical connector -2-.



Note

Place a cloth underneath to catch escaping coolant.

- Pull off retaining clip -1- and pull radiator outlet coolant temperature sender - G83- -item 3- out of connection on coolant pipe.

Installing

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



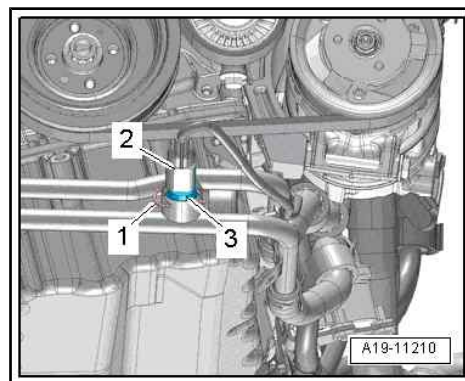
Note

- ◆ *Fit new O-ring.*
- ◆ *To avoid loss of coolant, fit new radiator outlet coolant temperature sender - G83- into coolant pipe immediately.*

- Check coolant level ⇒ [page 168](#) .

Tightening torques

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



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3 Coolant pipes

⇒ ["3.1 Exploded view - coolant pipes", page 183](#)

⇒ ["3.2 Removing and installing coolant pipes", page 186](#)

3.1 Exploded view - coolant pipes

⇒ ["3.1.1 Exploded view - coolant pipes, cooling system with 4/2-way valve", page 183](#)

⇒ ["3.1.2 Exploded view - coolant pipes, cooling system with thermostat", page 185](#)

3.1.1 Exploded view - coolant pipes, cooling system with 4/2-way valve



Note

The arrow markings on coolant pipes and on ends of hoses must align.

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1 - Bolt

- ☐ 2.7 Nm

2 - Sleeve

- ☐ Not available as separate part

3 - Grommet

- ☐ Not available as separate part

4 - Bracket

- ☐ For pump for exhaust gas recirculation cooler - V400-

5 - Bolt

- ☐ 40 Nm

6 - Coolant pipe (front)

- ☐ Removing and installing ⇒ [page 186](#)

7 - O-ring

- ☐ Renew

8 - Bolt

- ☐ 9 Nm

9 - Coolant pipes (right-side)

- ☐ Removing and installing ⇒ [page 190](#)

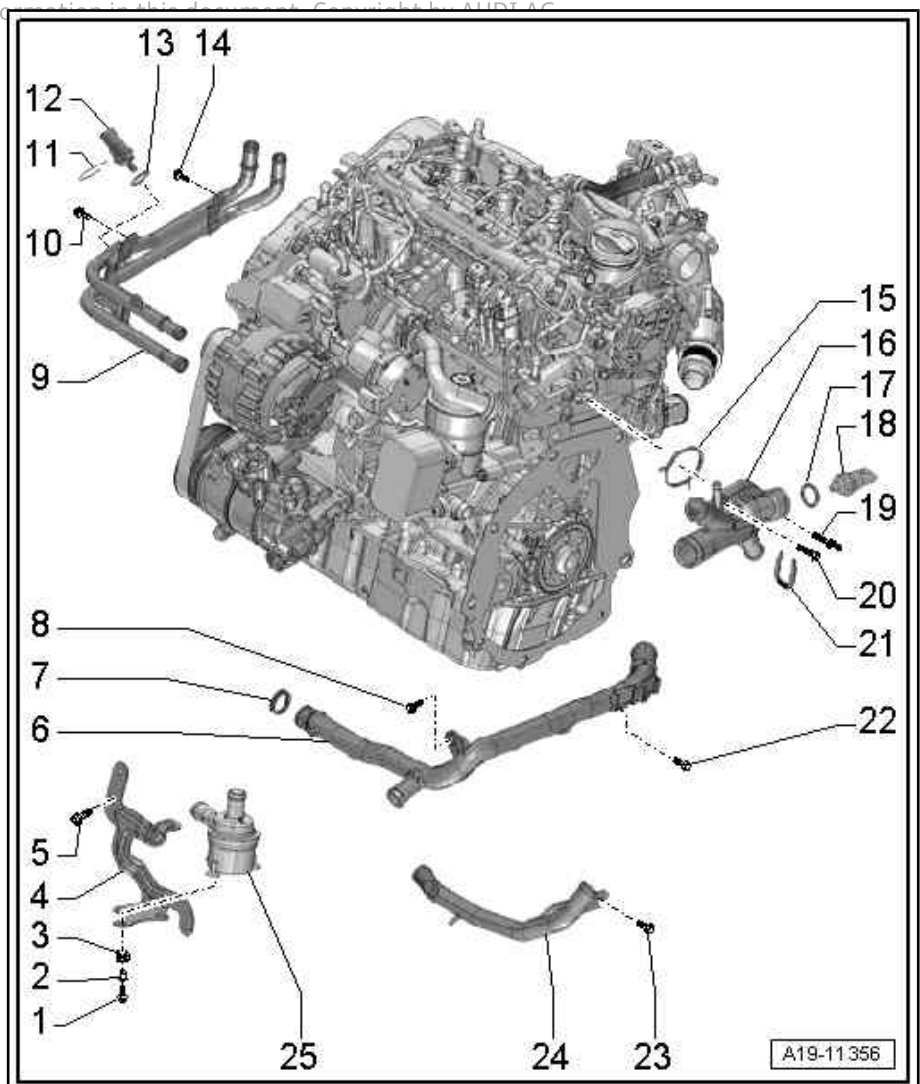
10 - Bolt

- ☐ 9 Nm

11 - Retaining clip

12 - Radiator outlet coolant temperature sender - G83-

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



A19-11356



13 - O-ring

- ☐ Renew

14 - Bolt

- ☐ 9 Nm

15 - Gasket

- ☐ Renew

16 - Connection

17 - O-ring

- ☐ Renew

18 - Coolant temperature sender - G62-

- ☐ Removing and installing ⇒ [page 180](#)

19 - Threaded pin

- ☐ 9 Nm

20 - Bolt

- ☐ 9 Nm

21 - Retaining clip

22 - Bolt

- ☐ 9 Nm

23 - Bolt

- ☐ 9 Nm

24 - Coolant pipe (top front)

- ☐ Removing and installing ⇒ [page 189](#)

25 - Pump for exhaust gas recirculation cooler - V400-

- ☐ Removing and installing ⇒ [page 171](#)



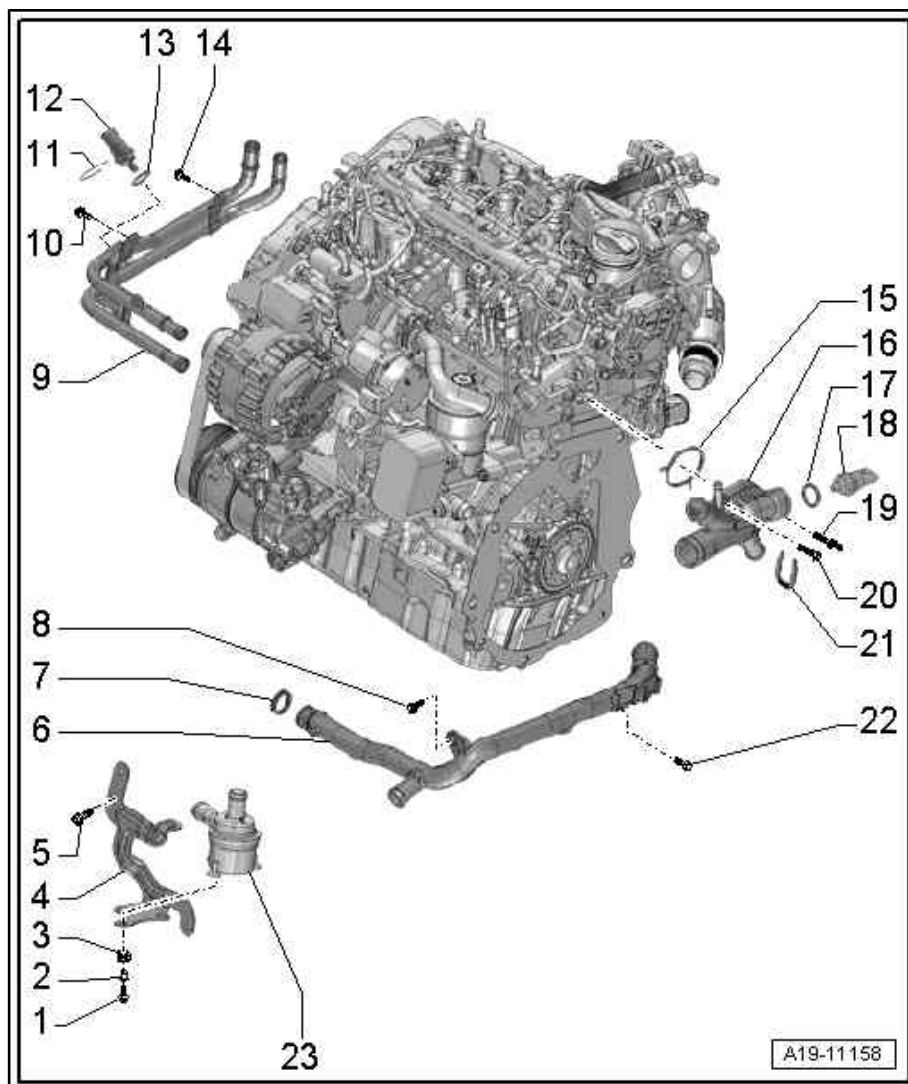
3.1.2 Exploded view - coolant pipes, cooling system with thermostat



Note

The arrow markings on coolant pipes and on ends of hoses must align.

- 1 - Bolt
 - 2.7 Nm
- 2 - Sleeve
 - Not available as separate part
- 3 - Grommet
 - Not available as separate part
- 4 - Bracket
 - For pump for exhaust gas recirculation cooler - V400-
- 5 - Bolt
 - 40 Nm
- 6 - Coolant pipe (front)
 - Removing and installing ⇒ [page 186](#)
- 7 - O-ring
 - Renew
- 8 - Bolt
 - 9 Nm
- 9 - Coolant pipes (right-side)
 - Removing and installing ⇒ [page 190](#)
- 10 - Bolt
 - 9 Nm
- 11 - Retaining clip
- 12 - Radiator outlet coolant temperature sender - G83-
 - Removing and installing ⇒ [page 181](#)
- 13 - O-ring
 - Renew
- 14 - Bolt
 - 9 Nm
- 15 - Gasket
 - Renew
- 16 - Connection
- 17 - O-ring
 - Renew
- 18 - Coolant temperature sender - G62-
 - Removing and installing ⇒ [page 180](#)





19 - Threaded pin

- Tightening torque ⇒ [Item 19 \(page 184\)](#)

20 - Bolt

- Tightening torque ⇒ [Item 20 \(page 184\)](#)

21 - Retaining clip

22 - Bolt

- 40 Nm

23 - Pump for exhaust gas recirculation cooler - V400-

- Removing and installing ⇒ [page 171](#)

3.2 Removing and installing coolant pipes

⇒ [“3.2.1 Removing and installing coolant pipe \(front\)”, page 186](#)

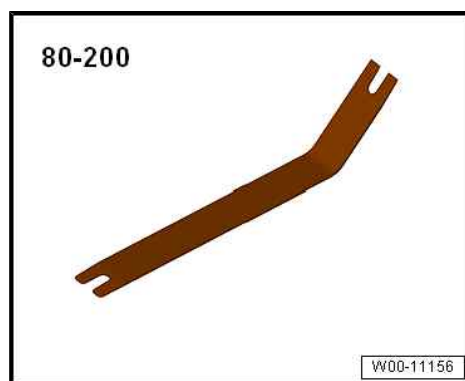
⇒ [“3.2.2 Removing and installing coolant pipe \(top front\)”, page 189](#)

⇒ [“3.2.3 Removing and installing coolant pipes \(right-side\)”, page 190](#)

3.2.1 Removing and installing coolant pipe (front)

Special tools and workshop equipment required

- ◆ Removal lever - 80 - 200-



- ◆ Hose clip pliers - VAS 6362-



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Removing

- Drain coolant ⇒ [page 161](#) .
- Remove air cleaner housing ⇒ [page 229](#) .



Vehicles with thermostat:

- Remove oil filter bracket with engine oil cooler ⇒ [page 156](#) .

Country-specific version (cold climates):

- Unplug electrical connector -2-.

All vehicles (continued):

- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.

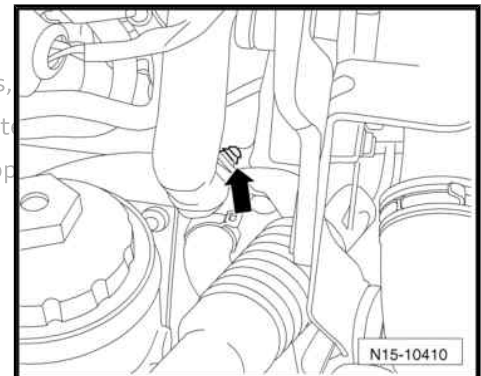
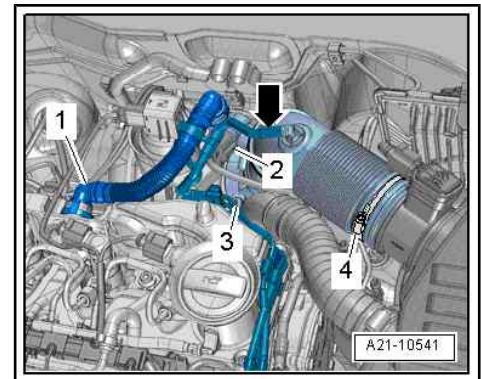


Note

Disregard -item 4-.

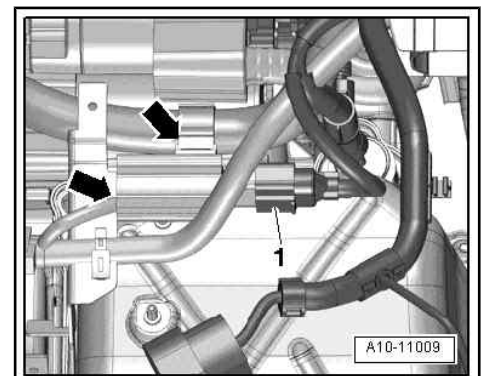
- Unclip wiring harness from retainer -arrow-.

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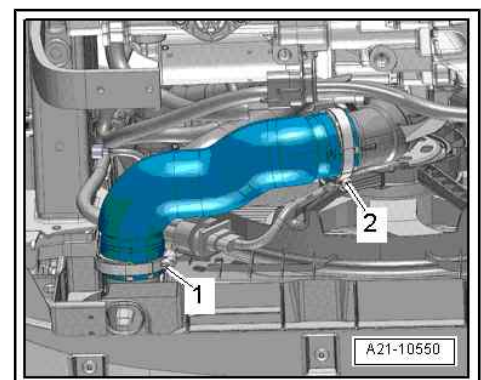


Vehicles with thermostat:

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



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





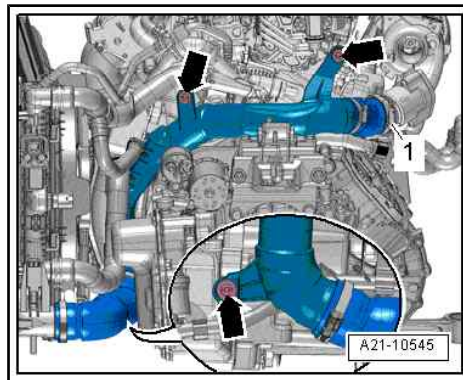
- Remove bolts -arrows-.



Note

Depending on version, bolt (top right) may not be fitted.

- Using removal lever - 80 - 200- , move clear electrical wiring and hoses at air pipe (left-side).
- Loosen hose clip -1- and detach air pipe (left-side).



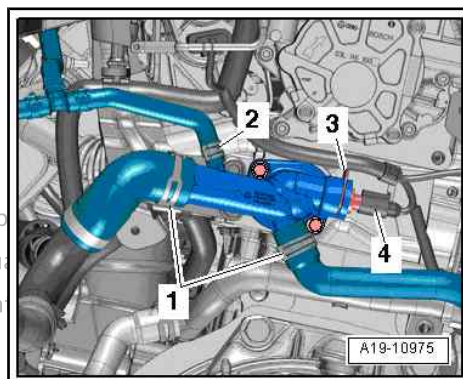
- Release hose clips -1-, detach coolant hoses and move clear.



Note

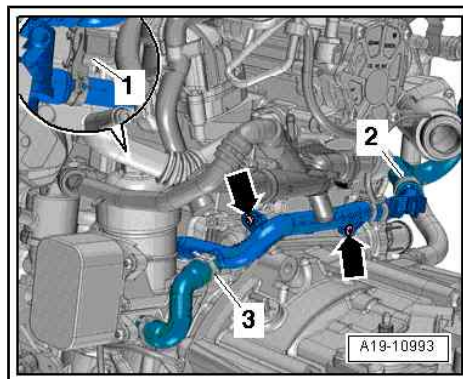
Disregard -items 2, 3, 4-.

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Vehicles with 4/2-way valve:

- Take electrical connector -1- for Hall sender - G40- out of retainer.
- Detach bracket from coolant pipe (front).
- Release hose clips -2- and -3- and disconnect coolant hoses.
- Remove bolts -arrows- and detach coolant pipe (front) from 4/2-way valve to left side.



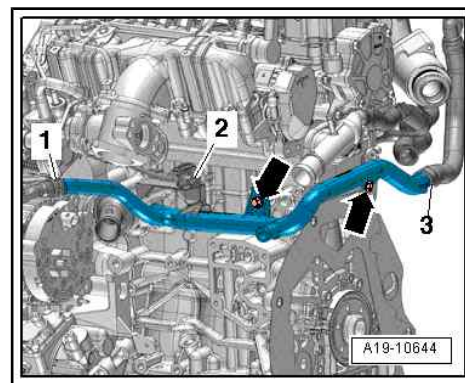


Vehicles with thermostat:

- Remove electrical connector -2- for Hall sender - G40- from bracket and unplug connector.
- Detach bracket from coolant pipe (front).
- Release hose clips -1- and -3- and disconnect coolant hoses.
- Remove bolts -arrows- and detach coolant pipe (front) from left side of cylinder block.

Installing

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



Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Clean and smoothen sealing surface for O-ring.
- Lightly lubricate O-ring with coolant and slide O-ring onto coolant pipe (front).
- Push coolant pipe (front) into cylinder block.
- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install air pipe ⇒ [page 206](#) .
- Install air pipe with connection ⇒ [page 200](#) .
- Install oil filter bracket with engine oil cooler ⇒ [page 156](#) .
- Install air cleaner housing ⇒ [page 229](#) .



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 183](#)

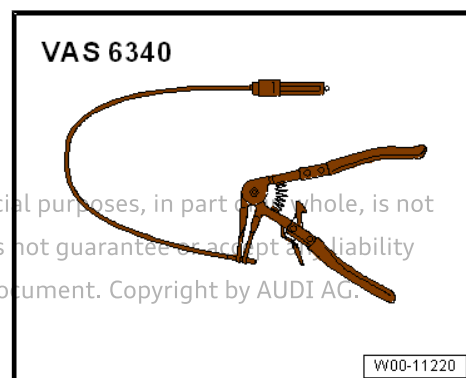
3.2.2 Removing and installing coolant pipe (top front)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6340-

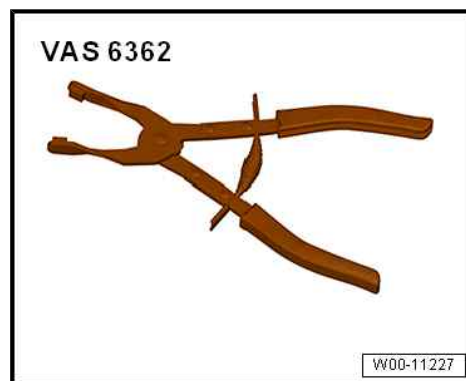


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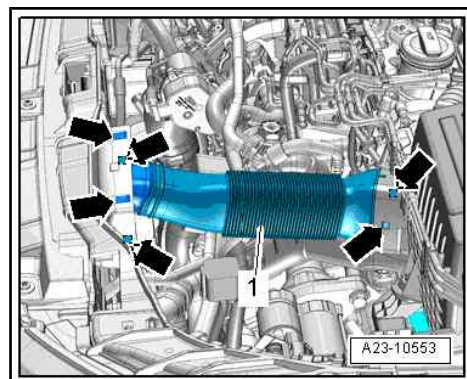


- ◆ Hose clip pliers - VAS 6362-



Removing

- Drain coolant ⇒ [page 161](#) .
- Release fasteners -arrows- and detach air pipe -1-.



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- Remove bolt -2-.
 - Release hose clips -1- and -3- and disconnect coolant hoses.
 - Detach coolant pipe (top front).

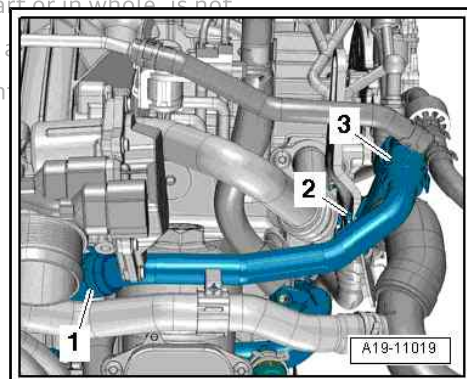
Installing

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

- Fill up with coolant ⇒ [page 164](#) .

Tightening torques

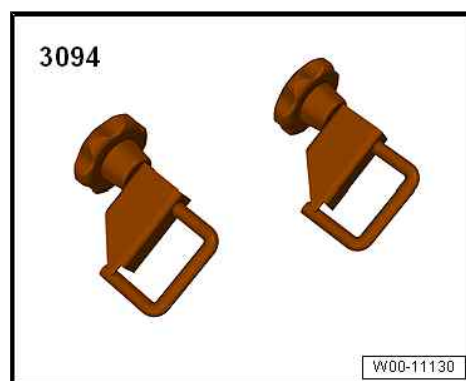
- ◆ ⇒ ["3.1 Exploded view - coolant pipes", page 183](#)



3.2.3 Removing and installing coolant pipes (right-side)

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-

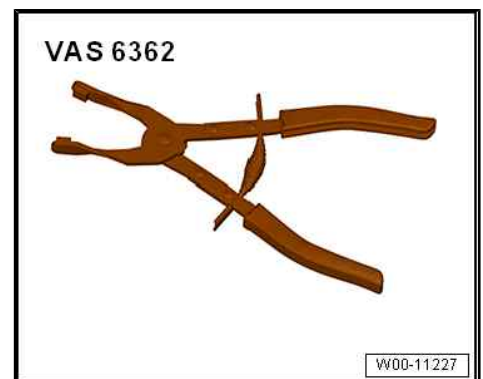




- ◆ Drip tray for workshop hoist - VAS 6208-

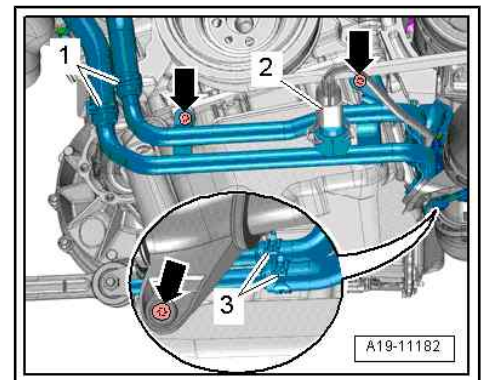


- ◆ Hose clip pliers - VAS 6362-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -2- and move wiring clear.
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Clamp off coolant hoses using hose clamps -3094- , release hose clips -1 and 3- and disconnect coolant hoses from coolant pipes (right-side).
- Unscrew bolts -arrows- and detach coolant pipes (right-side).



Installing

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



Note

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

- Check coolant level ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 183](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation





4 Radiator/radiator fan

⇒ "4.1 Exploded view - radiator/radiator fan", page 192

⇒ "4.2 Removing and installing radiator", page 194

⇒ "4.3 Removing and installing radiator cowl", page 197

⇒ "4.4 Removing and installing radiator fan", page 199

4.1 Exploded view - radiator/radiator fan

Radiator

1 - Air duct

2 - Air hose

- ☐ To throttle valve module
- J338-

3 - Coolant hose (bottom)

4 - Radiator

- ☐ Removing and installing
⇒ [page 194](#)
- ☐ If renewed, change
coolant in entire system

5 - Sealing plug

- ☐ 10 Nm

6 - O-ring

- ☐ Lubricate with coolant
- ☐ Renew if damaged

7 - Coolant hose (top)

8 - Air duct

9 - Coolant hose

- ☐ To coolant expansion
tank

10 - Condenser

- ☐ Removing and installing
⇒ Heating, air conditioning
Rep. gr. 87; Refrigerant circuit; Re-
moving and installing
condenser

11 - Bolts

- ☐ Tightening torque ⇒
Heating, air condition-
ing; Rep. gr. 87; Refrig-
erant circuit; Exploded view - condenser

12 - Bolt

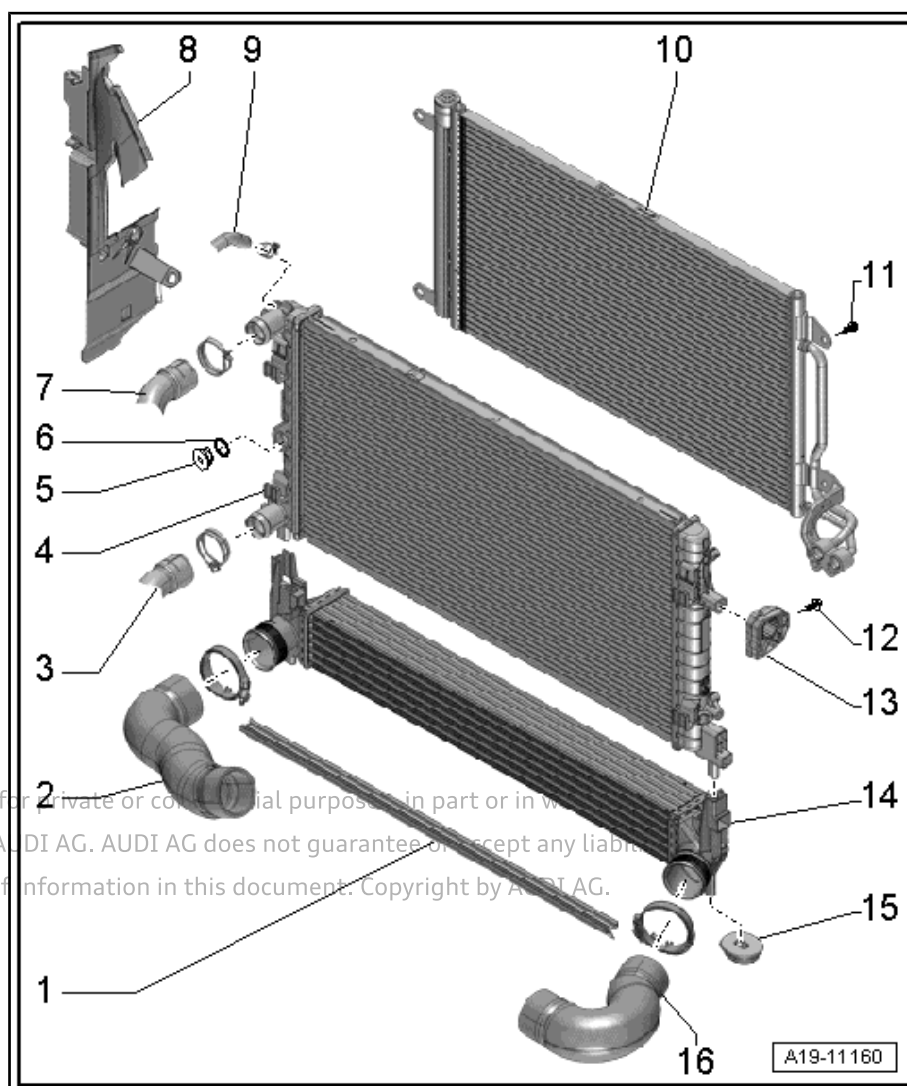
- ☐ 5 Nm

13 - Retainer

- ☐ Note installation position

14 - Charge air cooler

- ☐ Removing and installing ⇒ [page 207](#)





15 - Mounting

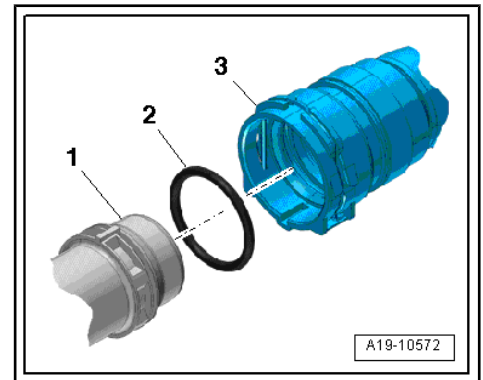
- ☐ For charge air cooler

16 - Air hose

- ☐ From turbocharger

Connecting coolant hose with plug-in connector

- Renew retaining clip if damaged.
- 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.



Radiator cowl and radiator fan

1 - Radiator cowl

- ☐ Removing and installing
⇒ [page 197](#)

2 - Bolt

- ☐ 1.5 Nm

3 - Heat shield

4 - Nut

- ☐ 9 Nm

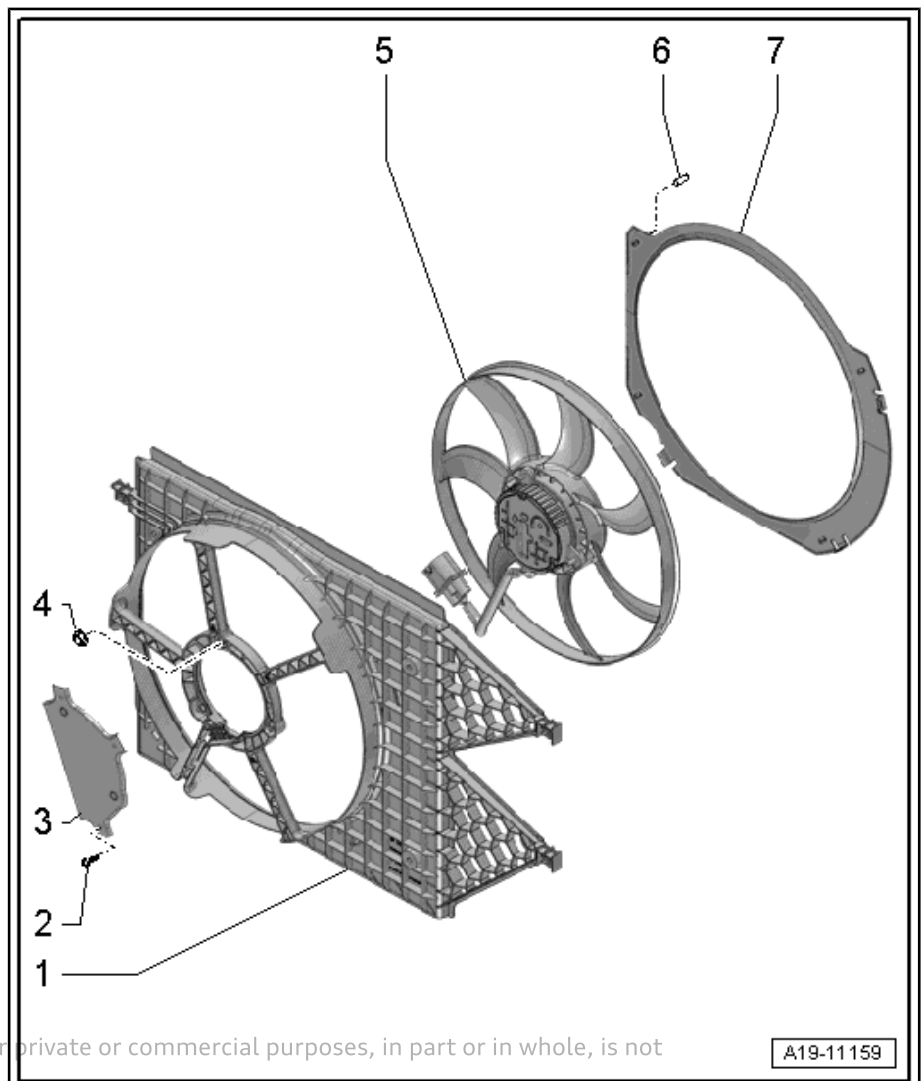
5 - Radiator fan - V7-

- ☐ With radiator fan control unit - J293-
- ☐ Removing and installing
⇒ [page 199](#)

6 - Pin

7 - Trim

- ☐ For radiator fan





4.2 Removing and installing radiator

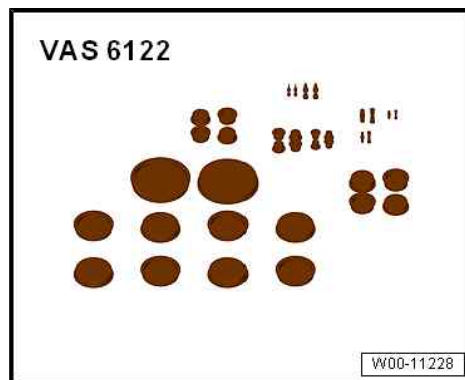


Note

Radiator and water radiator for charge air cooling circuit are removed together.

Special tools and workshop equipment required

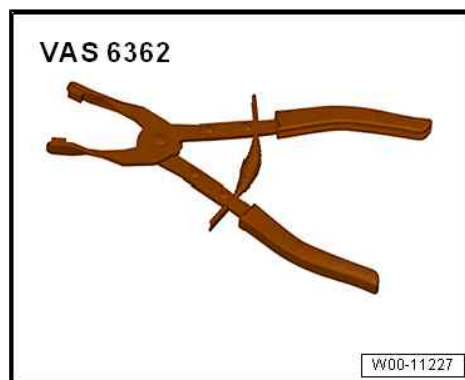
- ♦ Engine bung set - VAS 6122-



- ♦ Drip tray for workshop hoist - VAS 6208-



- ♦ Hose clip pliers - VAS 6362-



Removing



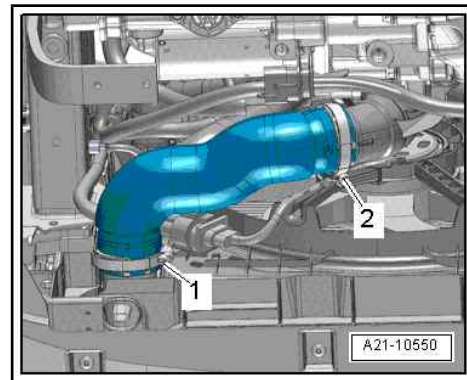
- Remove radiator cowl ➔ [page 197](#) .

- Drain coolant ➔ [page 161](#) .

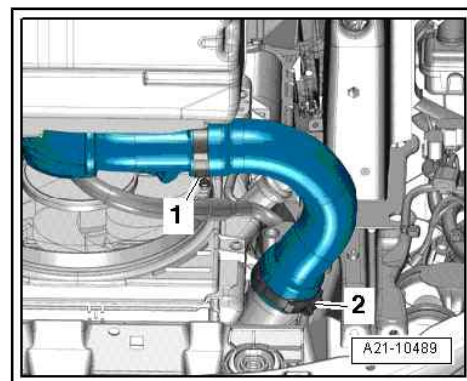
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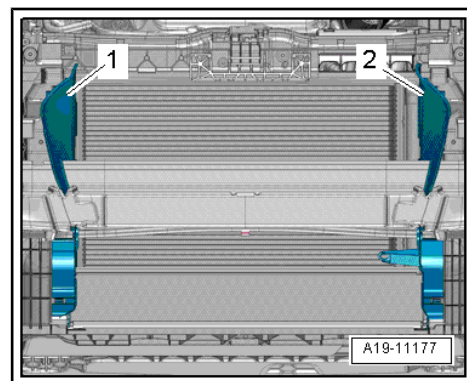
- Release hose clips -1- and -2- and remove air hose.



- Release hose clips -1- and -2- and remove air hose.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

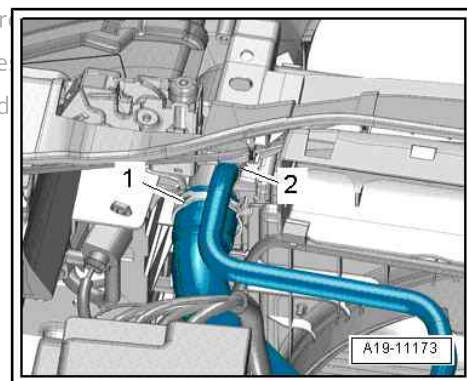


- Release fasteners and detach air ducts -1 and 2-.



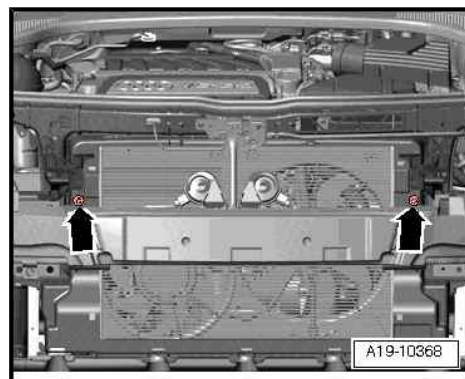
- Release hose clips -1 and 2- and detach coolant hoses (top left) from radiator.

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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-.

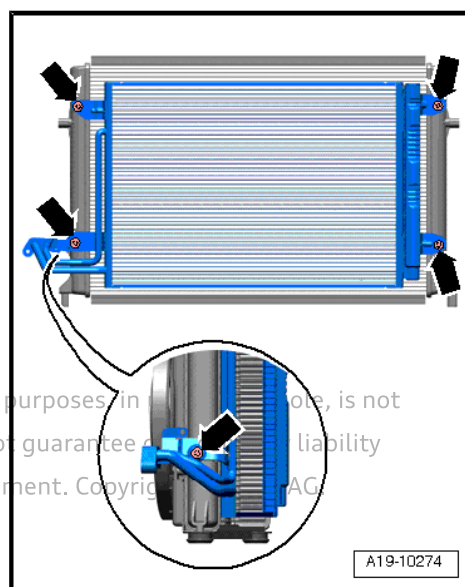


Caution

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.





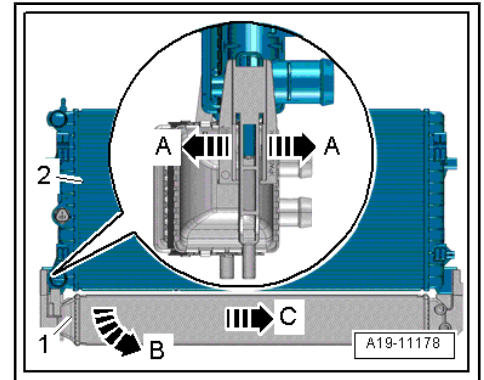
All vehicles (continued):

- Release fasteners on charge air cooler -1- -arrows A-.
- Pull charge air cooler off radiator -2- -arrow B- and disengage -arrow C-.
- Remove both radiators.



Note

If there are slight impressions on the fins, refer to [⇒ page 10](#).



Installing

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



Note

Secure all hose connections with the correct type of hose clips (same 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 bumper cover [⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper \(front\); Exploded view - bumper cover](#).
- Install radiator cowl [⇒ page 197](#).
- Install air hoses with screw-type clips [⇒ page 207](#).



Note

Do not reuse coolant.

- Fill up with coolant [⇒ page 164](#).

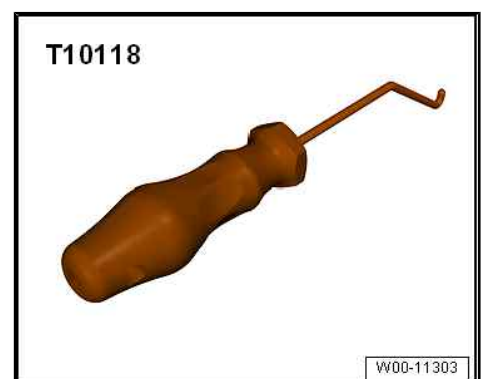
Tightening torques

- ◆ [⇒ "4.1 Exploded view - radiator/radiator fan", page 192](#)

4.3 Removing and installing radiator cowl

Special tools and workshop equipment required

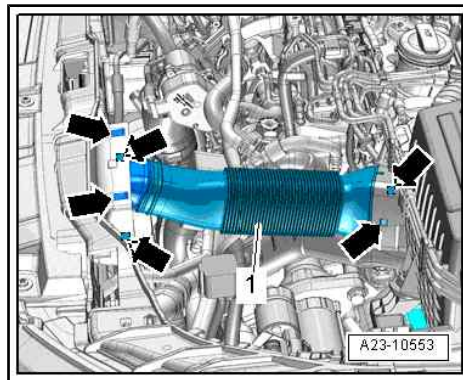
- ◆ Assembly tool - T10118-



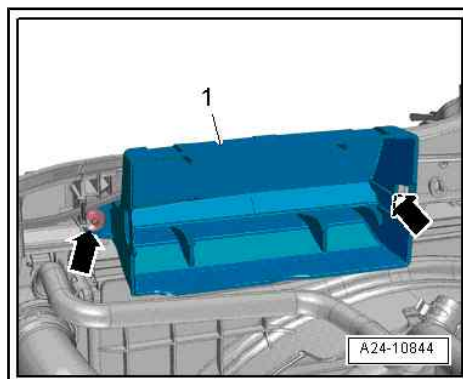


Removing

- Release fasteners -arrows- and detach air duct -1-.



- Remove bolts -arrows- and detach air duct -1-.



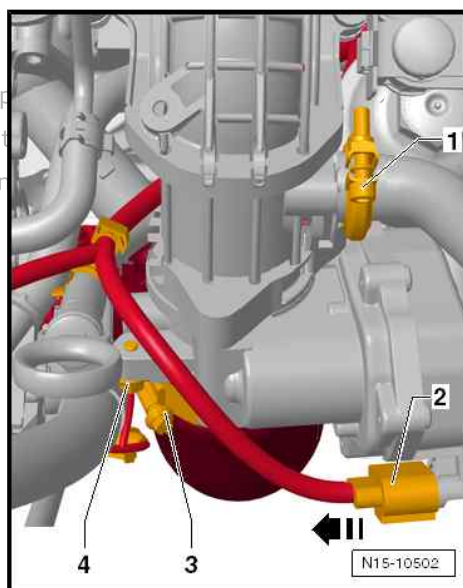
- Unplug electrical connector -2- at throttle valve module - J338- -arrow-.



Note

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Disregard -items 1, 3, 4-.





WARNING

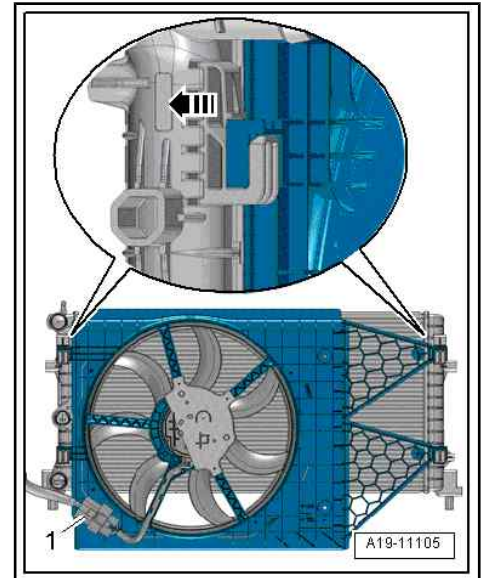
Risk of injury as the radiator fans may start up automatically.

- ◆ *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 sequence.

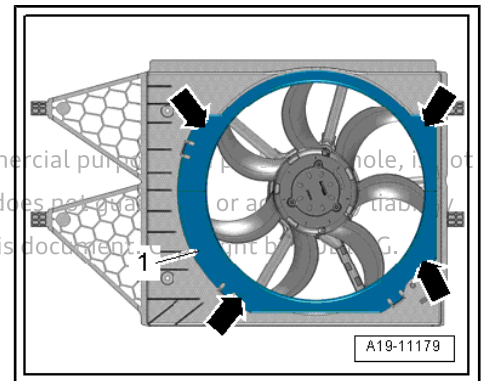


4.4 Removing and installing radiator fan

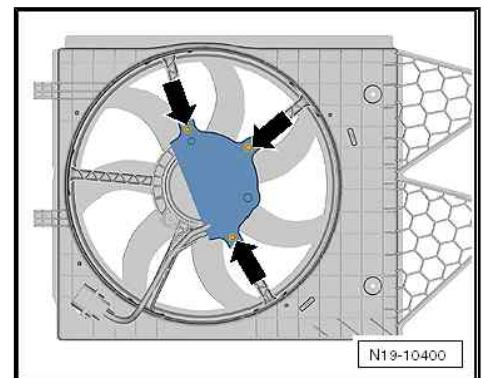
Removing

- Remove radiator cowl ⇒ [page 197](#).
- Press out clamping pins -arrows- and detach ring -1- of fan.

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- If fitted, unscrew bolts -arrows- and remove heat shield.



- Take electrical wiring -1- out of cable guide.
- Unscrew nuts -arrows- and detach radiator fan - V7-.

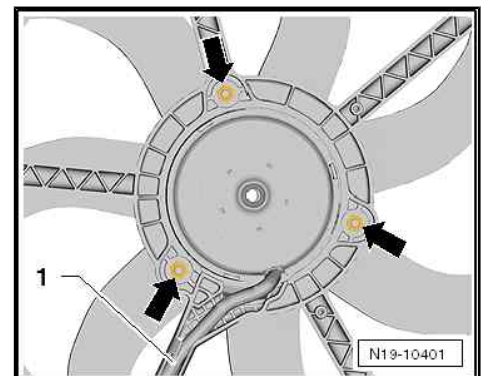
Installing

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

- Install radiator cowl ⇒ [page 197](#).

Tightening torques

- ◆ ⇒ ["4.1 Exploded view - radiator/radiator fan", page 192](#)





21 – Turbocharging/supercharging

1 Turbocharger

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⇒ [“1.1 Exploded view - turbocharger”, page 200](#)

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⇒ [“1.2 Removing and installing turbocharger”, page 202](#)

1.1 Exploded view - turbocharger

1 - Exhaust gas recirculation pipe

- ☐ With flexible joint; do not bend joint - risk of cracking

2 - Gasket

- ☐ Renew

3 - Ribbed bolt

- ☐ Renew
- ☐ 17 Nm

4 - Oil supply line

- ☐ Tighten union nut to 22 Nm

5 - Oil return line

6 - Gasket

- ☐ Renew

7 - Nut

- ☐ 24 Nm

8 - Heat shield

9 - Turbocharger

- ☐ Can only be renewed together with exhaust manifold and vacuum unit as one unit
- ☐ Removing and installing
⇒ [page 202](#)

10 - Retaining ring

- ☐ Can only be installed in one position

11 - O-ring

- ☐ Renew

12 - Pulsation damper

13 - Bolt

- ☐ 9 Nm

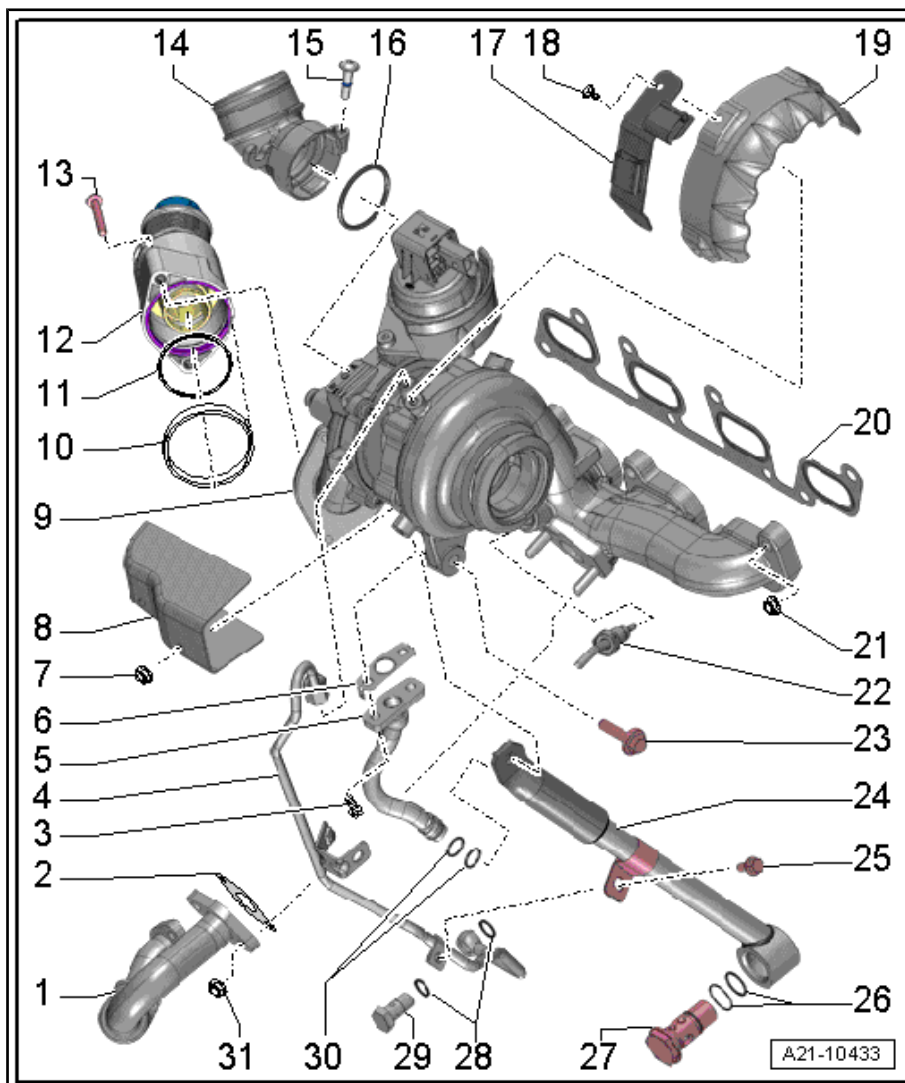
14 - Intake connecting pipe

15 - Bolt

- ☐ 9 Nm
- ☐ Captive in intake connecting pipe

16 - O-ring

- ☐ Renew





17 - Bracket

- ☐ For electrical wiring

18 - Bolt

- ☐ 15 Nm

19 - Heat shield

20 - Gasket

- ☐ Renew

21 - Nut

- ☐ Renew
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 24 Nm

22 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing ⇒ [page 304](#)

23 - Bolt

- ☐ 20 Nm

24 - Support

- ☐ For turbocharger

25 - Bolt

- ☐ 9 Nm

26 - O-rings

- ☐ Different diameters
- ☐ Renew

27 - Banjo bolt

- ☐ Renew
- ☐ Tighten banjo bolt using a commercially available open-end spanner insert (27 mm) and a suitable torque wrench
- ☐ 60 Nm

28 - Seals

- ☐ Renew

29 - Banjo bolt

- ☐ 30 Nm
- ☐ Tighten banjo bolt using a commercially available open-end spanner insert (17 mm) and a suitable torque wrench

30 - O-rings

- ☐ Renew

31 - Nut

- ☐ Renew
- ☐ 24 Nm

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1.2 Removing and installing turbocharger

Removing



Caution

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*



Note

- ◆ *Observe rules for cleanliness ⇒ [page 6](#).*
- ◆ *Secure the heat insulation sleeve in the original position when installing.*
- Remove particulate filter ⇒ [page 294](#).
- Remove air cleaner housing ⇒ [page 229](#).
- Version for countries with cold climates: Unplug electrical connector -2-.
- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.



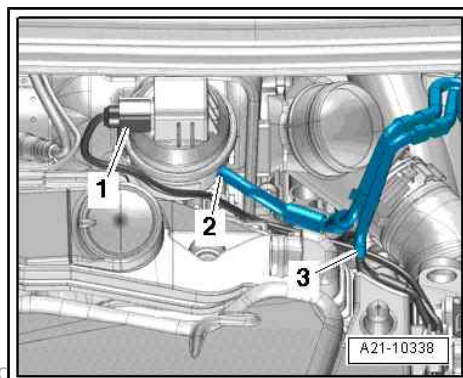
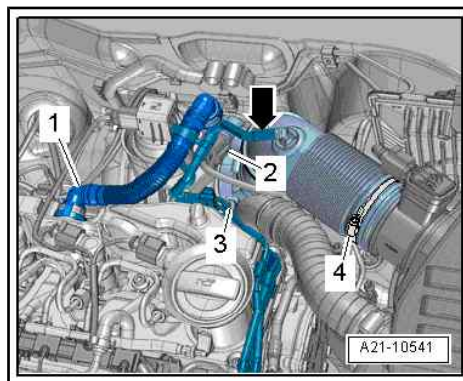
Note

Disregard -item 4-.

- Detach heat insulation sleeve.
- Detach vacuum hose -2- from vacuum unit of turbocharger.
- Disconnect vacuum hose -3-.
- Unplug electrical connector -1- at position sender for charge pressure positioner - G581-.

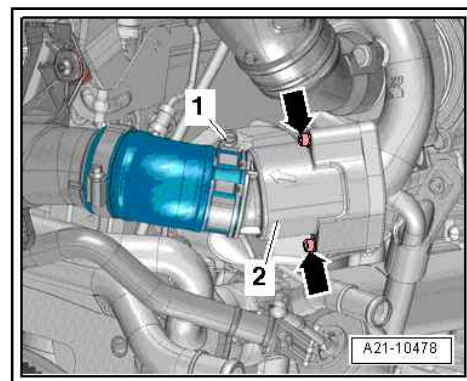


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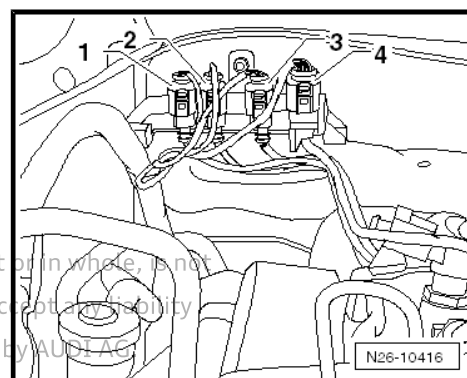
- Remove bolts -arrows-.
- Loosen hose clip -1- and detach pulsation damper -2-.



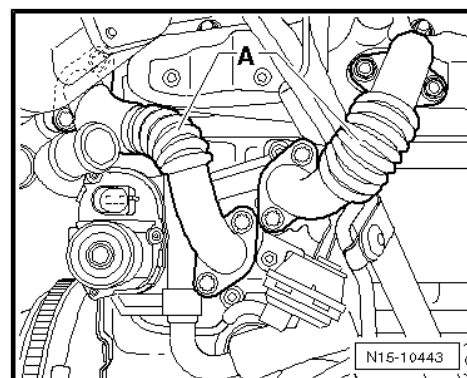
- Unplug electrical connector -1- for exhaust gas temperature sender 1 - G235- and move electrical wiring clear.



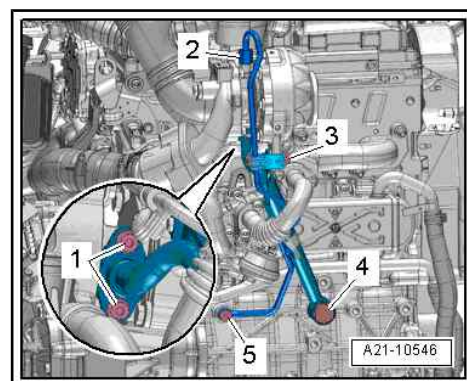
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- Remove bolts and detach exhaust gas recirculation pipes -A-.



- Remove union nut -2-.
- Remove bolts -1, 3- and banjo bolts -4, 5- and detach support for turbocharger with oil supply line.

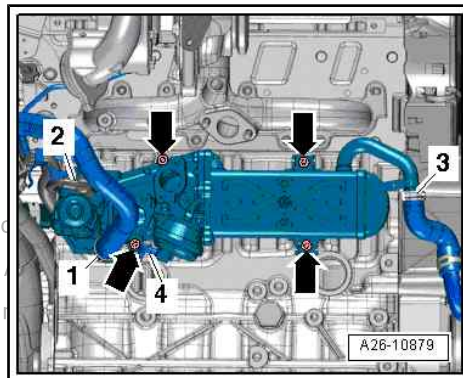




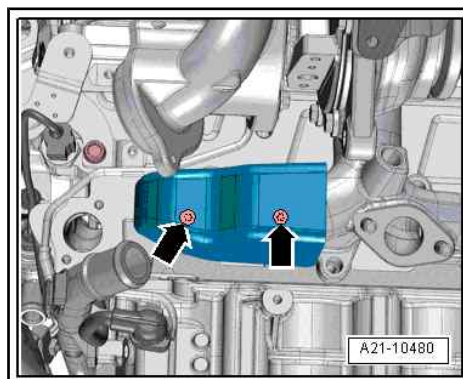
- Remove bolts -arrows- and move exhaust gas recirculation cooler towards rear.



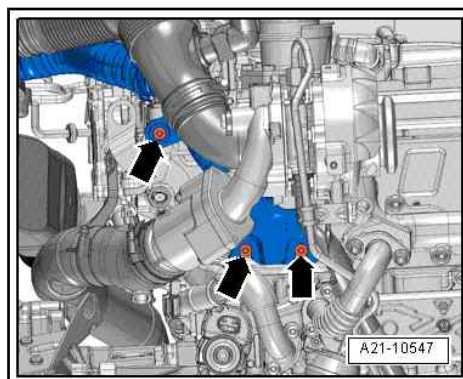
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- Remove bolts -arrows- and detach heat shield -1-.



- Version for countries with cold climates: Remove bolts -arrows- and detach heat shield -1- and pipe -2-.





- Remove nuts -arrows- and detach turbocharger with exhaust manifold from cylinder head.

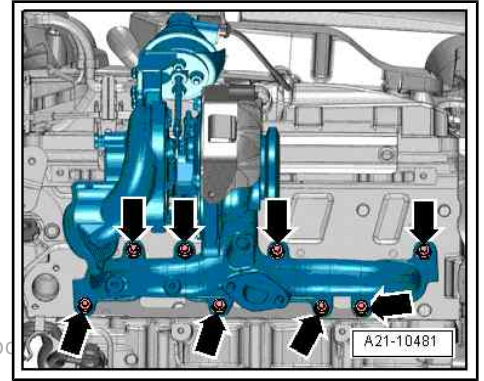
Installing

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



Note

- ◆ *Renew seals, gaskets, O-rings and self-locking nuts.*
- ◆ *Fill turbocharger with engine oil at connection for oil supply line.* Protected by copyright. Copying for private or commercial purposes is prohibited without the written permission of AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#)*
- ◆ *After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.*



- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install exhaust gas recirculation pipes ⇒ [page 312](#) .
- Install air pipe with connection ⇒ [page 200](#) .
- Install air cleaner housing ⇒ [page 229](#) .
- Install particulate filter ⇒ [page 294](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 200](#)



2 Charge air system

⇒ ["2.1 Exploded view - charge air system", page 206](#)

⇒ ["2.2 Exploded view - hose connections for charge air system", page 207](#)

⇒ ["2.3 Removing and installing charge air cooler", page 207](#)

⇒ ["2.4 Removing and installing charge pressure sender G31 / intake air temperature sender G42", page 210](#)

⇒ ["2.5 Checking charge air system for leaks", page 210](#)

2.1 Exploded view - charge air system



Note

- ◆ Check that all air pipes and hoses and vacuum lines are correctly fitted and that there are no leaks before carrying out tests or repairs.
- ◆ Observe rules for cleanliness ⇒ [page 6](#).



1 - Air hose

2 - Air pipe

□ From turbocharger

3 - Spacer sleeve

4 - Bolt

□ 9 Nm

5 - Grommet

6 - Air hose

7 - Air duct

8 - Charge air cooler

□ Removing and installing
⇒ [page 207](#)

9 - Mounting

□ For charge air cooler

10 - Air hose

11 - Bolt

□ 5 Nm

12 - Charge pressure sender -
G31- / intake air temperature
sender - G42-

□ Removing and installing
⇒ [page 210](#)

13 - O-ring

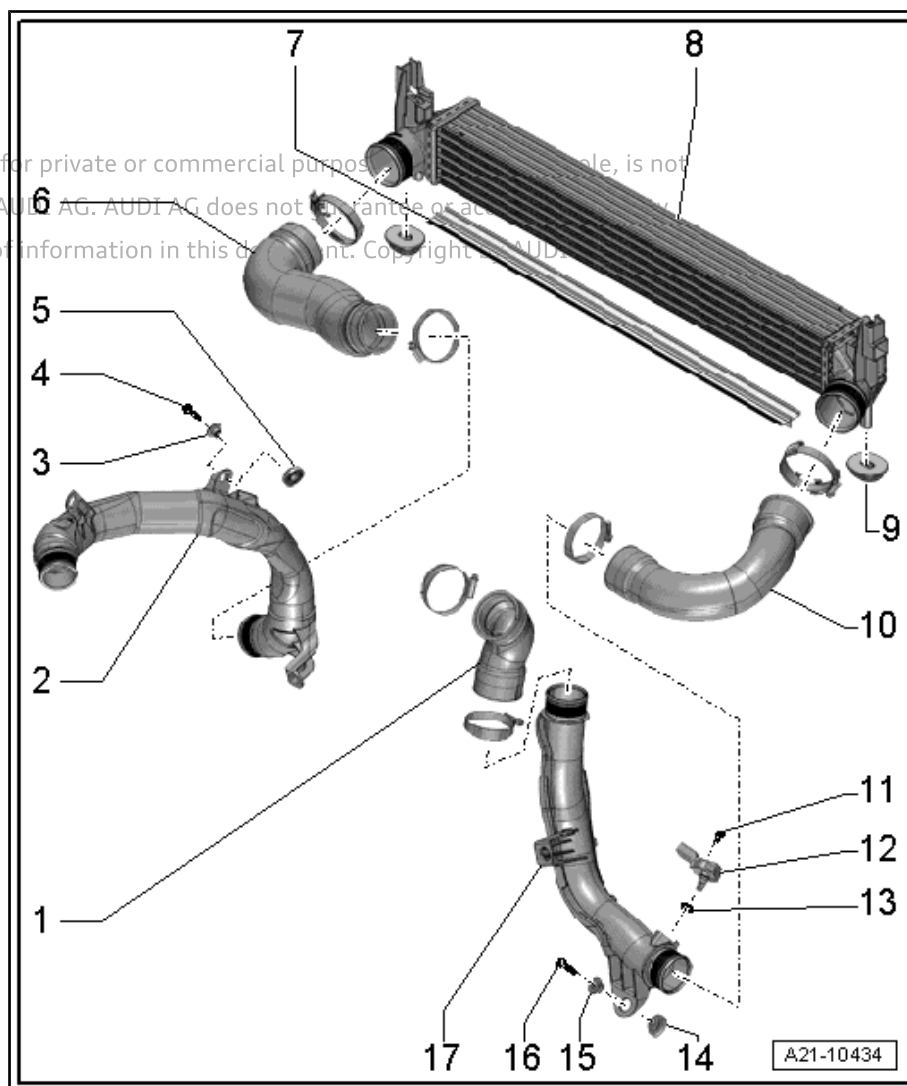
□ Renew

14 - Grommet

15 - Spacer sleeve

16 - Bolt

□ 9 Nm





17 - Air pipe

- ☐ To intake manifold

2.2 Exploded view - hose connections for charge air system

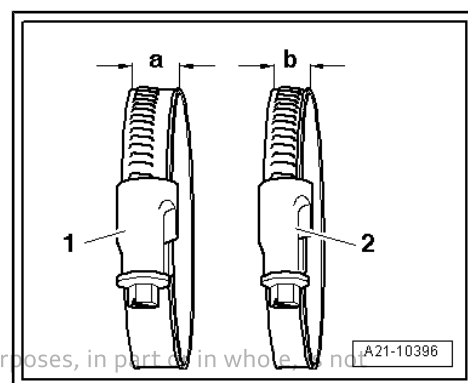


Note

- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same 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

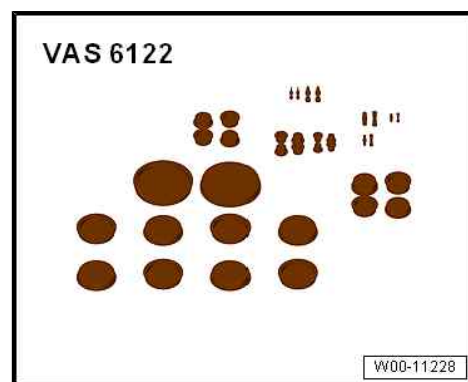


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2.3 Removing and installing charge air cooler

Special tools and workshop equipment required

- ◆ Engine bung set - VAS 6122-

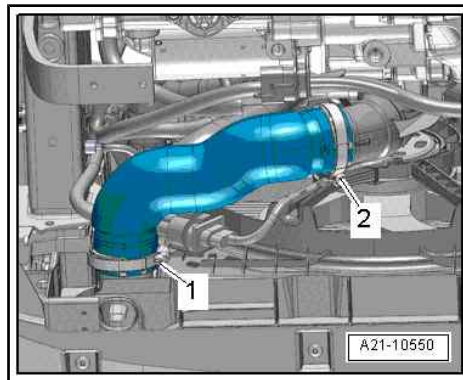


Removing

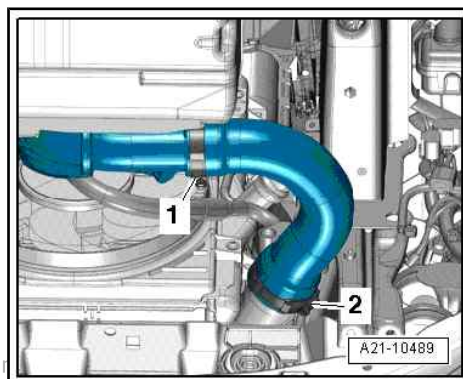
- Remove radiator cowl ⇒ [page 197](#) .
- Remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .



- Release hose clips -1- and -2- and remove air hose (left-side).

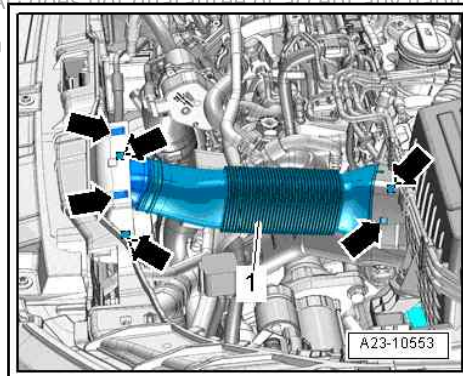


- Release hose clips -1- and -2- and detach air hose (right-side).
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



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- Release fasteners -arrows- and detach air duct -1-.

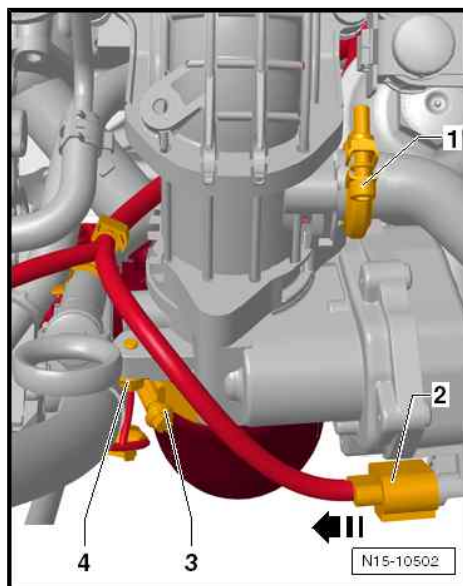


- Unplug electrical connector -2- at throttle valve module - J338- -arrow-.



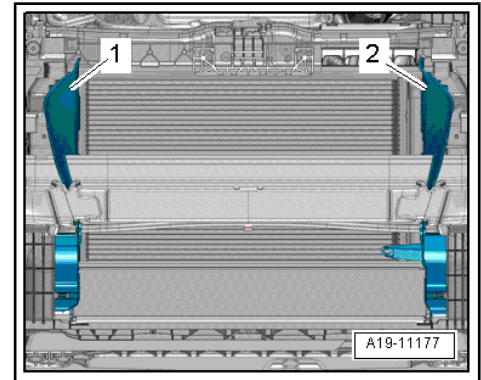
Note

Disregard -items 1, 3, 4-.

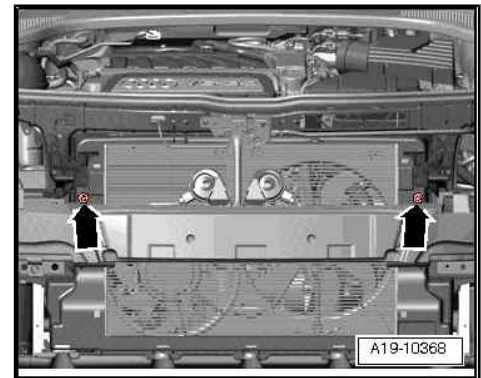




- Release fasteners and detach air ducts -1 and 2-.



- 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-.

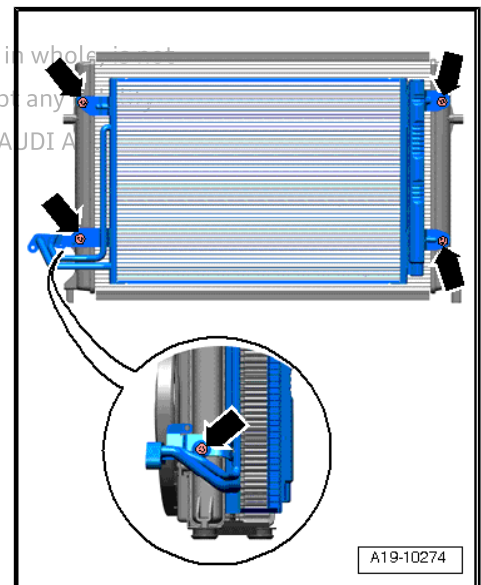


Caution

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.



**All vehicles (continued):**

- Release fasteners on charge air cooler -1- -arrows A-.
- Pull charge air cooler off radiator -2- -arrow B- and disengage -arrow C-.
- Detach charge air cooler.

Installing

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

**Note**

If there are slight impressions on the fins, refer to [⇒ page 10](#).

- Install condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser.
- Install radiator ⇒ [page 194](#)
- Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .

Tightening torques

- ♦ [⇒ “2.1 Exploded view - charge air system”, page 206](#)

2.4 Removing and installing charge pressure sender - G31- / intake air temperature sender - G42-

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -2-.
- Remove bolts -1- and pull charge pressure sender - G31- / intake air temperature sender - G42- out of air pipe.

Installing

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

**Note**

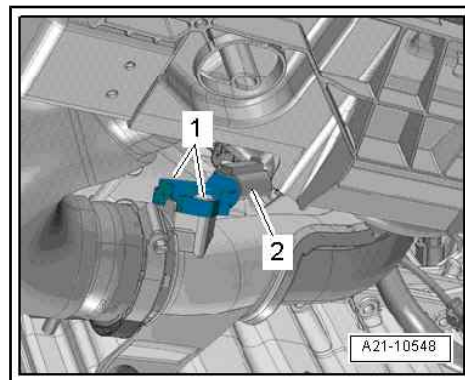
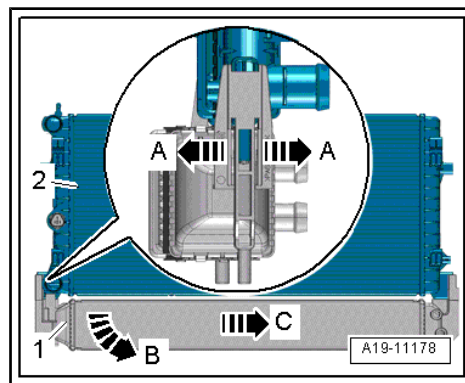
Fit new O-ring.

Tightening torques

- ♦ [⇒ “2.1 Exploded view - charge air system”, page 206](#)
- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

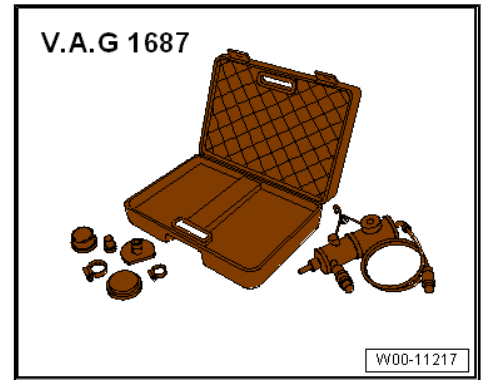
2.5 Checking charge air system for leaks

Special tools and workshop equipment required



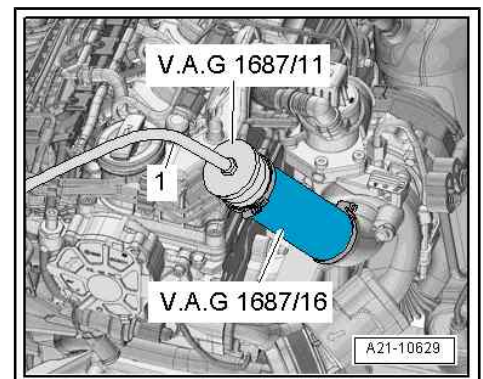
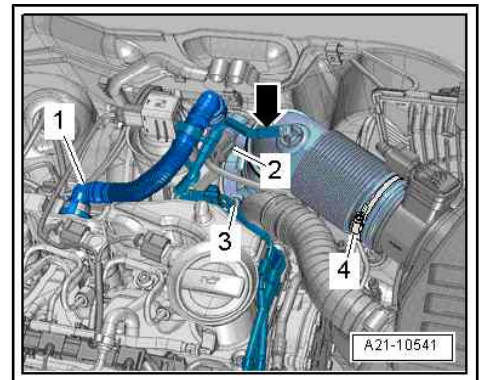


- ◆ Charge air system tester - V.A.G 1687- with adapters -V.A.G 1687/11- and -V.A.G 1687/16-



Procedure

- Remove engine cover panel ⇒ [page 43](#) .
- Version for countries with cold climates: Unplug electrical connector -2-.
- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Release hose clips -3 and 4- and remove air hose.
- Connect adapter - V.A.G 1687/11- with -V.A.G 1687/16- to turbocharger.
- Connect hose -1- of charge air system tester -V.A.G 1687- to adapter.



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Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Make sure knob is pulled out before turning pressure control valve -2-.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

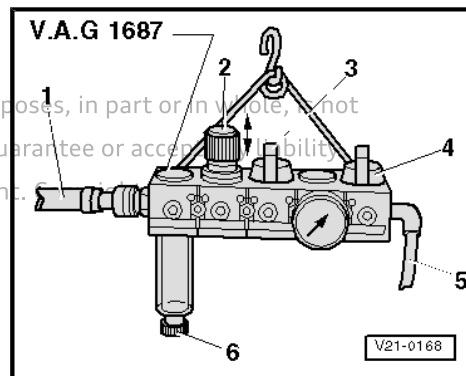
- Open valve -3-.



Caution

Risk of damage if pressure is set too high.

- ◆ ***The pressure must not exceed 0.5 bar.***



- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
- Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detection spray or use ultrasonic tester - V.A.G 1842- .



Note

- ◆ *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- ◆ *For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .*
- ◆ *Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.*

Assembling

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



Note

Renew gasket and O-rings.

- Install air pipe with connection ⇒ [page 200](#) .



23 – Mixture preparation - injection

1 Injection system

⇒ [“1.1 Overview - fuel system”, page 213](#)

⇒ [“1.2 Overview of fitting locations - injection system”, page 217](#)

⇒ [“1.3 Filling and bleeding fuel system”, page 222](#)

⇒ [“1.4 Checking fuel system for leaks”, page 223](#)

1.1 Overview - fuel system

⇒ [“1.1.1 Overview - fuel system”, page 213](#)

⇒ [“1.1.2 Conversion of low-pressure fuel system from 0.5 bar to 6.0 bar”, page 214](#)

1.1.1 Overview - fuel system

1 - Fuel tank

- ☐ With fuel system pressurisation pump - G6-

2 - Fuel filter

- ☐ Exploded view ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Fuel filter; Exploded view - fuel filter

3 - High-pressure pump

- ☐ Exploded view
⇒ [page 274](#)

4 - Fuel metering valve - N290-

- ☐ Do not unscrew

5 - Fuel pressure sender - G247-

6 - Fuel rail

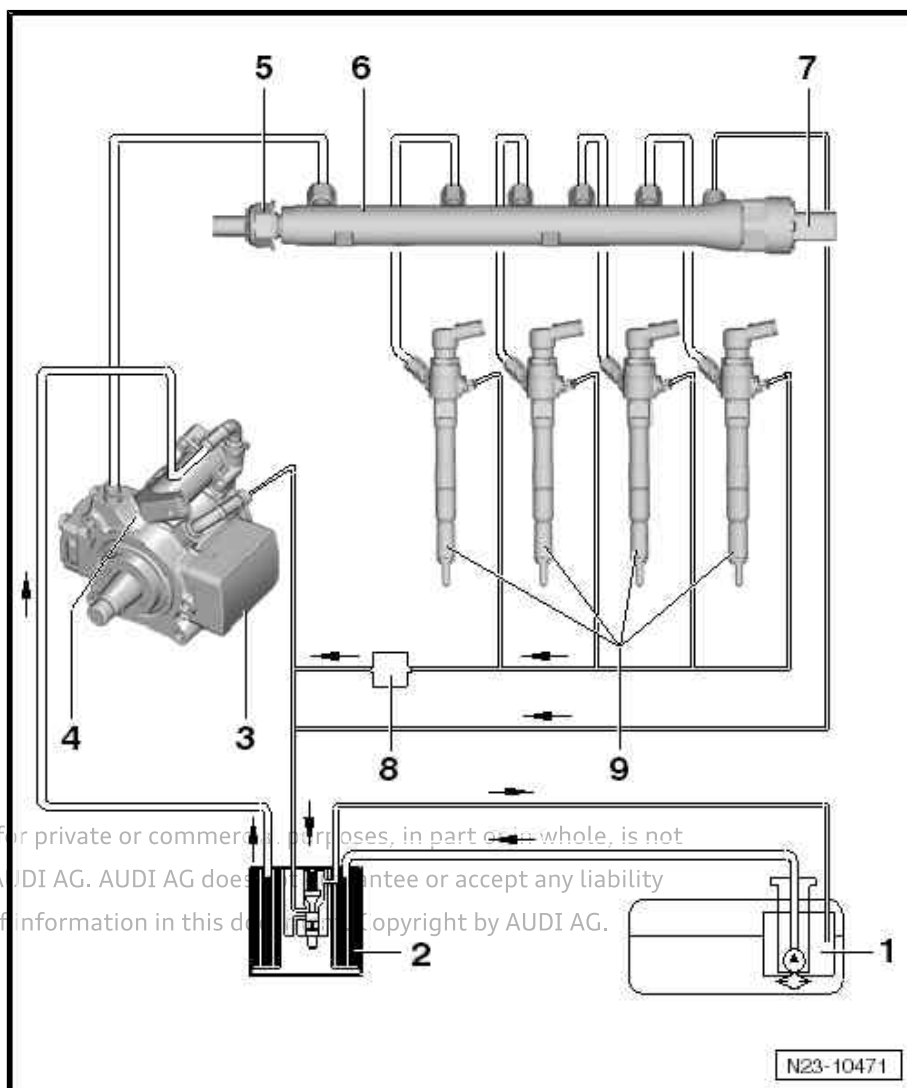
- ☐ Exploded view
⇒ [page 274](#)

7 - Fuel pressure regulating valve - N276-

- ☐ Exploded view
⇒ [page 274](#)

8 - Pressure retention valve

- ☐ The pressure retention valve maintains a residual pressure in the fuel return lines (required for control function).
- ☐ The pressure retention valve may only be renewed together with the fuel return lines.
- ☐ Removing and installing ⇒ [page 251](#)





9 - Injector

- ☐ Exploded view ⇒ [page 274](#)

1.1.2 Conversion of low-pressure fuel system from 0.5 bar to 6.0 bar

New components

- ◆ Fuel delivery unit, 6.0 bar (builds up required pressure for high-pressure pump).
- ◆ Fuel hoses in engine compartment, 6.0 bar (low-pressure fuel system).
- ◆ Fuel filter, 6.0 bar.
- ◆ Fuel return line (flexible), 6.0 bar, with pressure retention valve.
- ◆ The procedure for checking the pressure retention valve remains unchanged for all engines with code beginning CAY.
- ◆ Fuel return lines (fixed), 6.0 bar.
- ◆ High-pressure pump without fuel system pressurisation pump (required pressure for high-pressure pump is built up by fuel delivery unit).
- ◆ Fuel pressure regulating valve - N 276- , 6.0 bar.



1 - Fuel return line for 0.5 bar low-pressure fuel system

- ☐ Flexible
- ☐ With pressure retention valve

2 - Fuel return line for 6.0 bar low-pressure fuel system

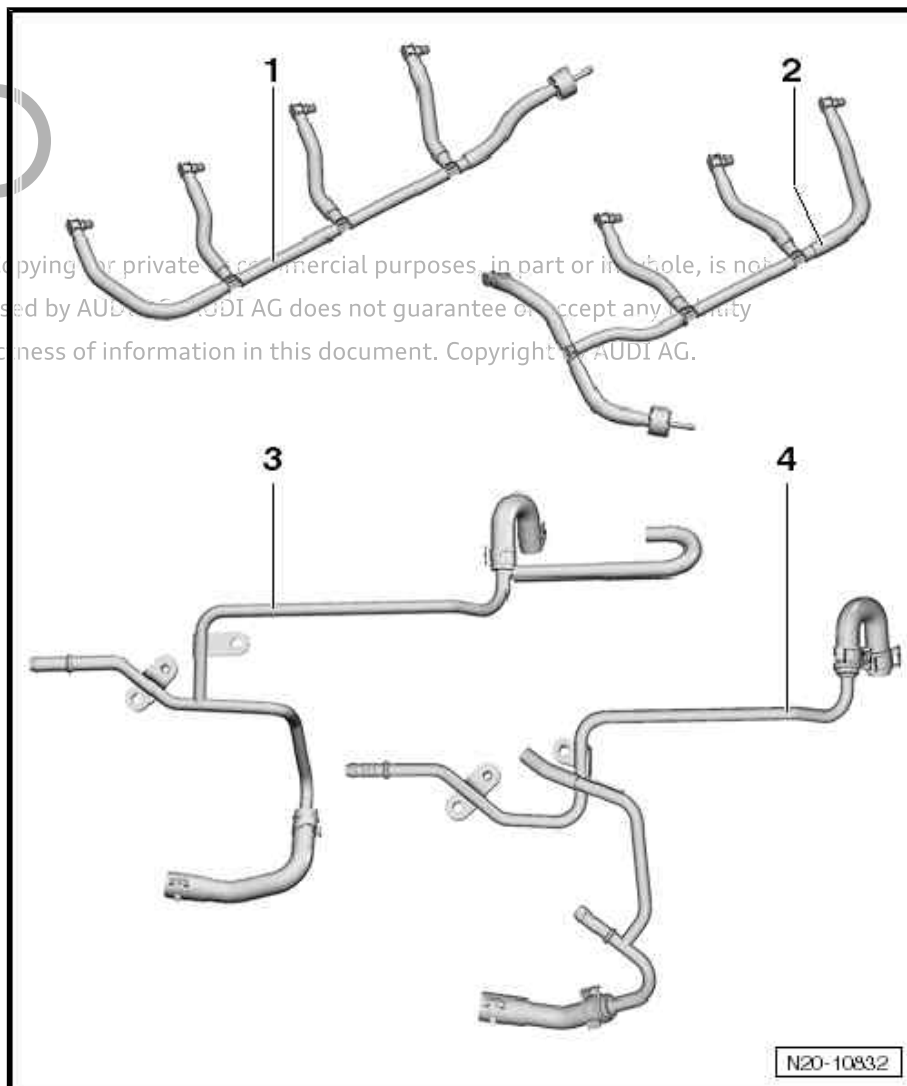
- ☐ Flexible
- ☐ With pressure retention valve

3 - Fuel return lines for 0.5 bar low-pressure fuel system

- ☐ Fixed

4 - Fuel return lines for 6.0 bar low-pressure fuel system

- ☐ Fixed



Differences: high-pressure pumps and fuel pressure regulating valve - N 276-



1 - High-pressure pump for 0.5 bar low-pressure fuel system

- ❑ With fuel system pressurisation pump fitted on high-pressure pump

2 - High-pressure pump for 6.0 bar low-pressure fuel system

- ❑ Without fuel system pressurisation pump
- ❑ The required pressure of 6.0 bar in the low-pressure fuel system is built up by the fuel delivery unit

3 - Fuel pressure regulating valve - N 276- , 0.5 bar low-pressure fuel system



Note

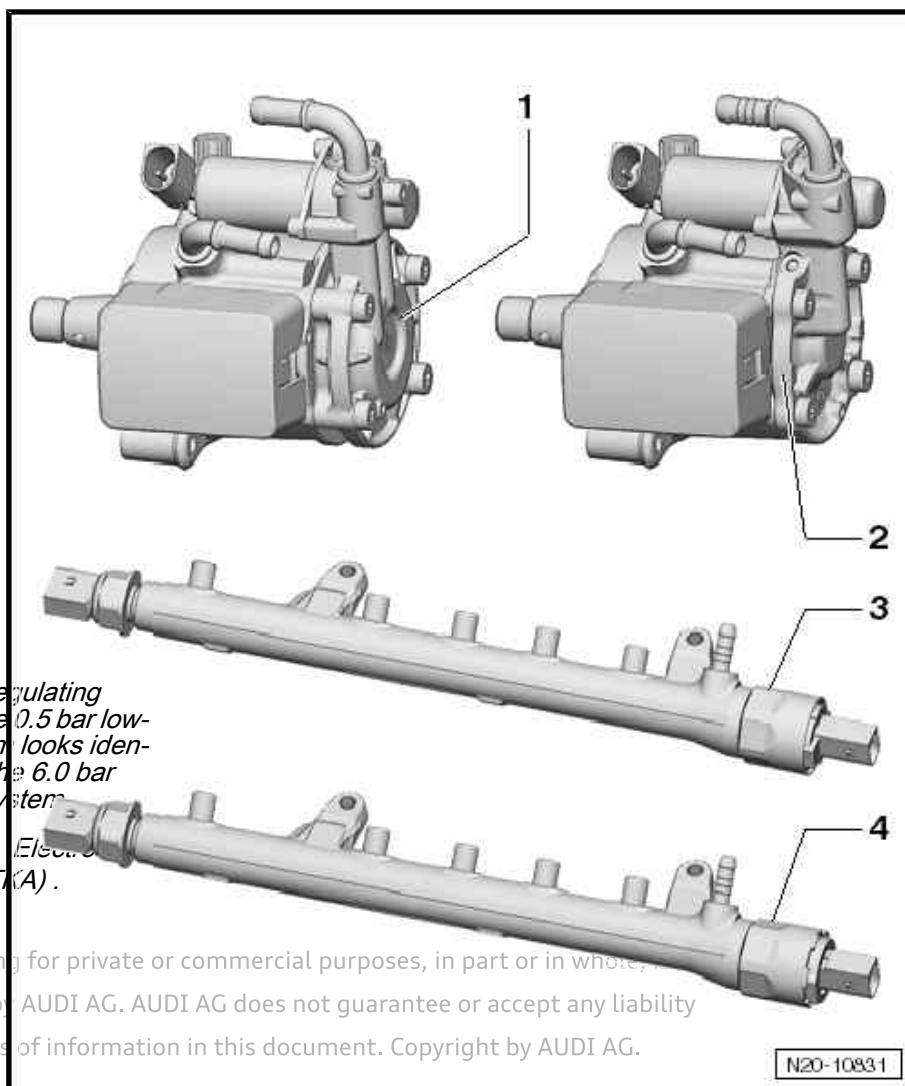
- ◆ *The fuel pressure regulating valve - N 276- on the 0.5 bar low-pressure fuel system looks identical to the one on the 6.0 bar low-pressure fuel system.*
- ◆ *For index refer to ⇒ Electronic parts catalogue (ETKA).*

4 - Fuel pressure regulating valve - N 276- , 6.0 bar low-pressure fuel system



Note

- ◆ *The fuel pressure regulating valve - N 276- on the 6.0 bar low-pressure fuel system looks identical to the one on the 0.5 bar low-pressure fuel system.*
- ◆ *For index refer to ⇒ Electronic parts catalogue (ETKA).*





1.2 Overview of fitting locations - injection system

Engine compartment

1 - Fuel temperature sender - G81-

- ☐ In fuel supply line

2 - Radiator outlet coolant temperature sender - G83-

- ☐ Exploded view
⇒ ["3.1 Exploded view - coolant pipes", page 183](#)

3 - Pressure differential sender - G505-

- ☐ Exploded view
⇒ ["8.1.1 Exploded view - Lambda probe, close-coupled particulate filter", page 279](#)

4 - Fuel pressure sender - G247-

- ☐ ⇒ ["5.2 Exploded view - high-pressure reservoir \(rail\)", page 240](#)

5 - Hall sender - G40-

- ☐ Camshaft position sensor
- ☐ Exploded view
⇒ [page 323](#)

6 - Injector, cylinder 1 - N30-

- ☐ Exploded view
⇒ [page 240](#)

7 - Injector, cylinder 2 - N31-

- ☐ Exploded view
⇒ [page 240](#)

8 - Injector, cylinder 3 - N32-

- ☐ Exploded view ⇒ [page 240](#)

9 - Heating element for crankcase breather - N79-

- ☐ Country-specific version

10 - Injector, cylinder 4 - N33-

- ☐ Exploded view ⇒ [page 240](#)

11 - Brake light switch - F- / brake pedal switch - F63-

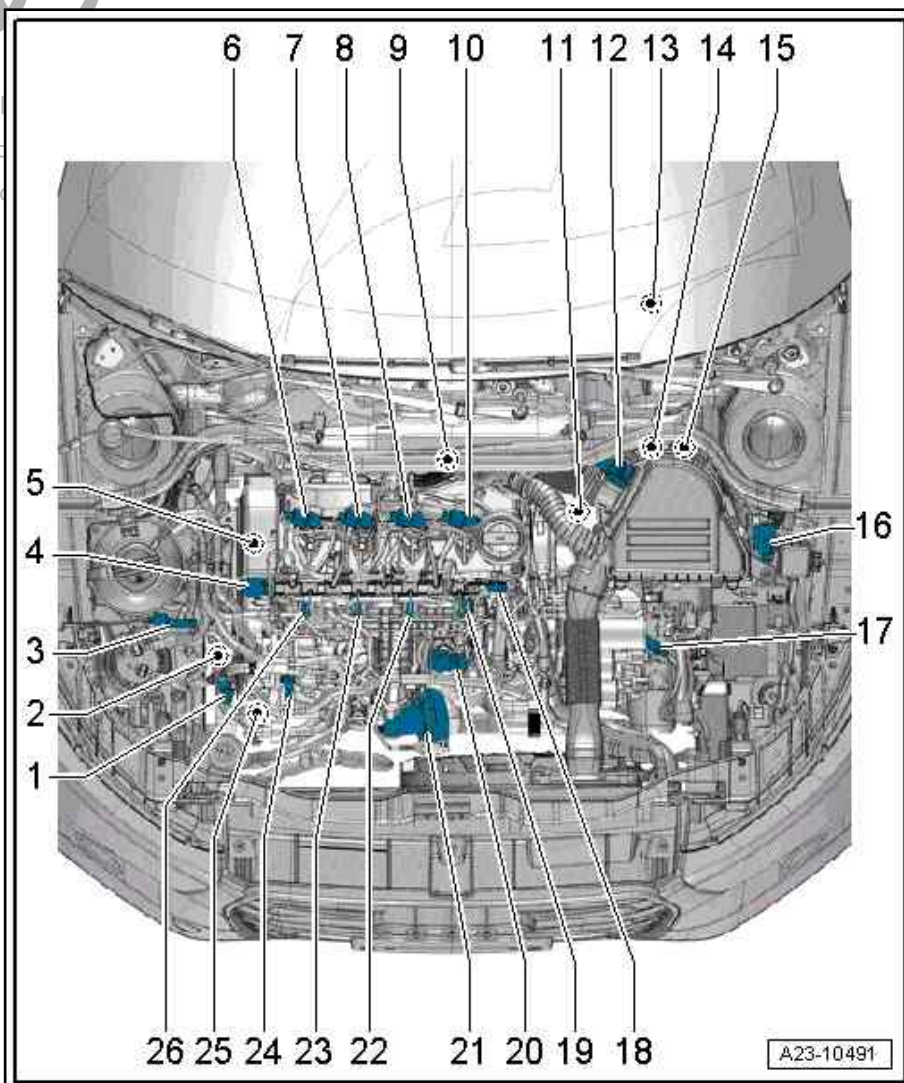
- ☐ Fitting location ⇒ [page 221](#)
- ☐ Removing and installing ⇒ Brake system; Rep. gr. 45 ; Sensors; Removing and installing brake light switch

12 - Air mass meter - G70-

- ☐ Exploded view ⇒ [page 227](#)

13 - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ☐ Fitting location ⇒ [page 221](#)
- ☐ Removing and installing ⇒ Fuel supply system, petrol engines; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-





14 - Clutch position sender - G476-

- ☐ For vehicles with manual gearbox
- ☐ Fitting location ⇒ [page 221](#)
- ☐ Removing and installing ⇒ Fuel supply system, petrol engines; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-

15 - Engine control unit - J623-

- ☐ Fitting location ⇒ [page 220](#)

16 - Charge pressure control solenoid valve - N75-

17 - Gearbox neutral position sender - G701-

- ☐ For vehicles with manual gearbox
- ☐ Fitting location ⇒ [page 221](#)

18 - Fuel pressure regulating valve - N276-

- ☐ Exploded view ⇒ [page 240](#)

19 - Glow plug 4 - Q13-

- ☐ Exploded view ⇒ [page 323](#)

20 - Exhaust gas recirculation cooler change-over valve - N345-

21 - Throttle valve module - J338-

- ☐ With throttle valve potentiometer - G69-
- ☐ Exploded view ⇒ [page 231](#)

22 - Glow plug 3 - Q12-

- ☐ Exploded view ⇒ [page 323](#)

23 - Glow plug 2 - Q11-

- ☐ Exploded view ⇒ [page 323](#)

24 - Fuel metering valve - N290-

25 - Charge pressure sender - G31- / intake air temperature sender - G42-

- ☐ Exploded view ⇒ [page 206](#)

26 - Glow plug 1 - Q10-

- ☐ Exploded view ⇒ [page 323](#)

Engine (gearbox end)



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1 - Engine speed sender - G28-

- ☐ Exploded view
⇒ [page 323](#)

2 - Coolant temperature sender - G62-

- ☐ Exploded view
⇒ [page 183](#)

3 - Position sender for charge pressure positioner - G581-

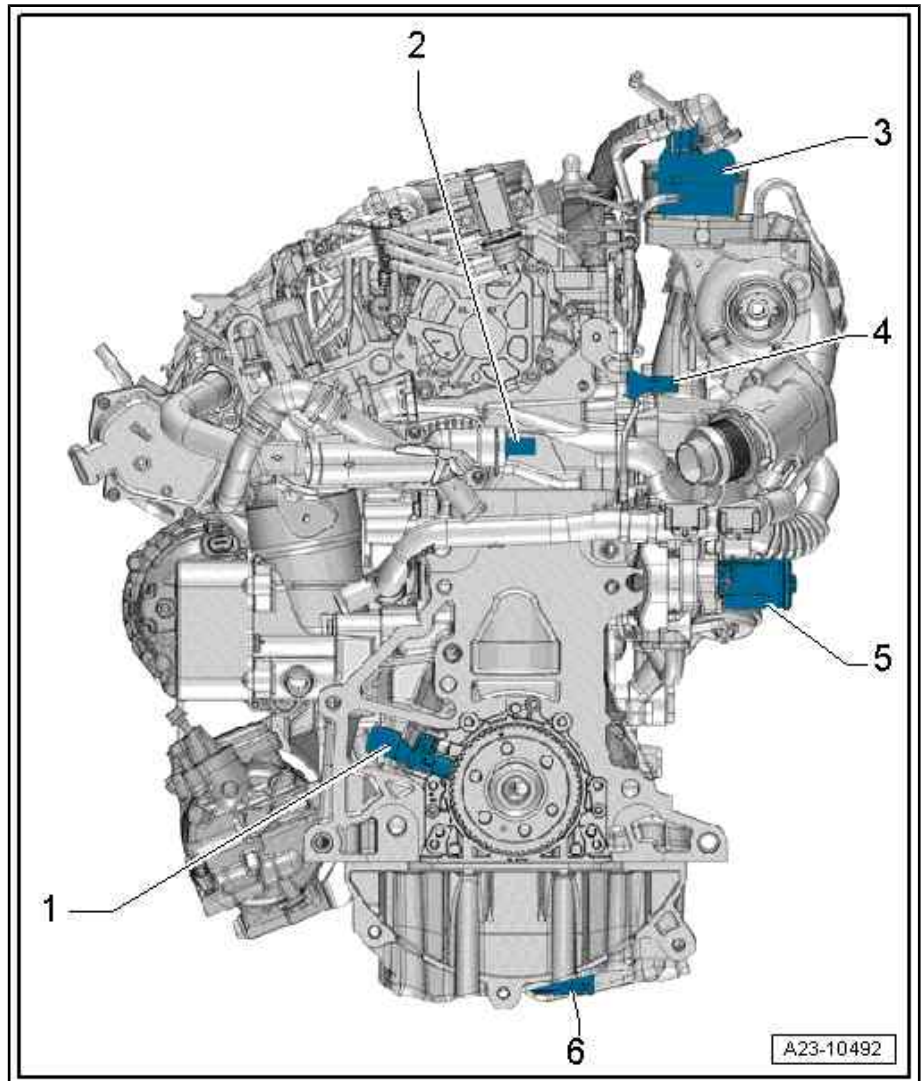
4 - Oil pressure switch - F1-

- ☐ Removing and installing
⇒ [page 153](#)

5 - Exhaust gas recirculation valve - N18- / exhaust gas recirculation potentiometer - G212-

6 - Oil level and oil temperature sender - G266-

- ☐ Exploded view
⇒ [page 143](#)



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1 - Exhaust gas temperature sender 4 - G648-

- ❑ Exploded view
⇒ [page 279](#)

2 - Exhaust gas temperature sender 1 - G235-

- ❑ Exploded view
⇒ [page 279](#)

3 - Exhaust gas temperature sender 3 - G495-

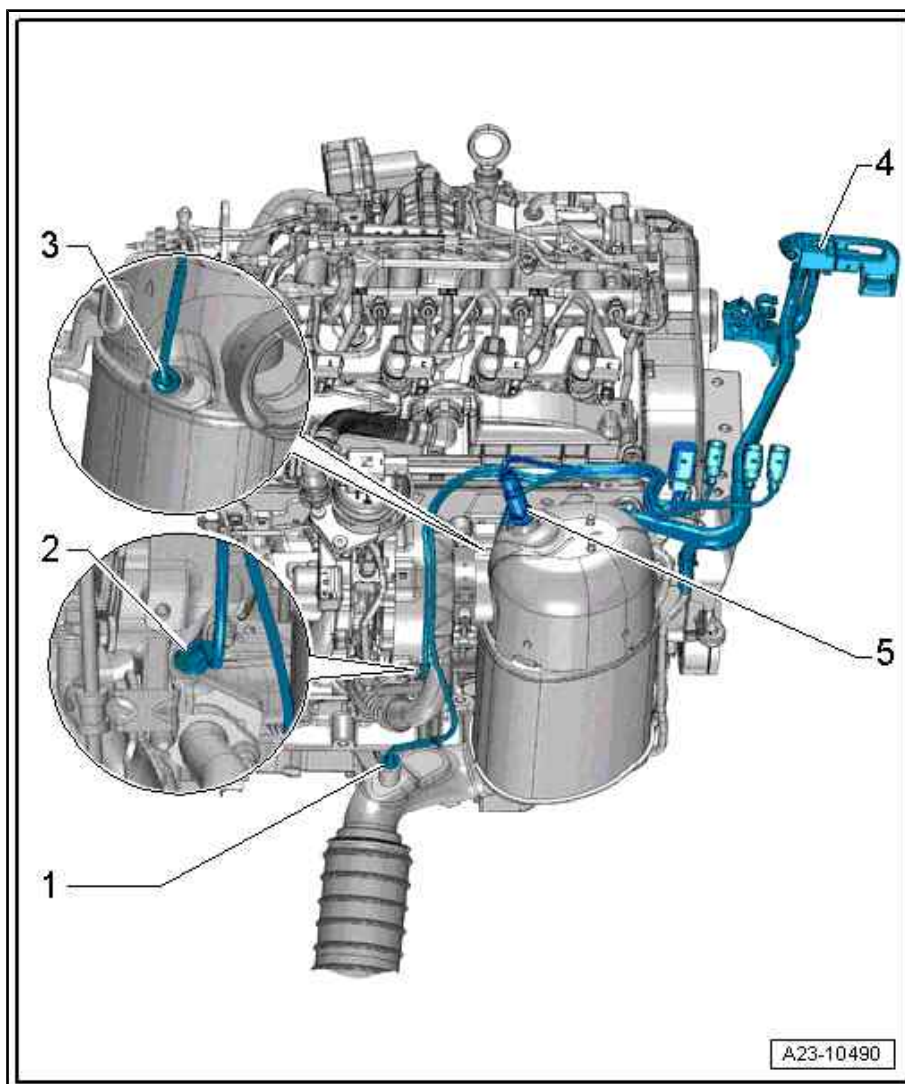
- ❑ Exploded view
⇒ [page 279](#)

4 - Pressure differential sender - G505-

- ❑ Exploded view
⇒ [page 279](#)

5 - Lambda probe - G39- with Lambda probe heater - Z19-

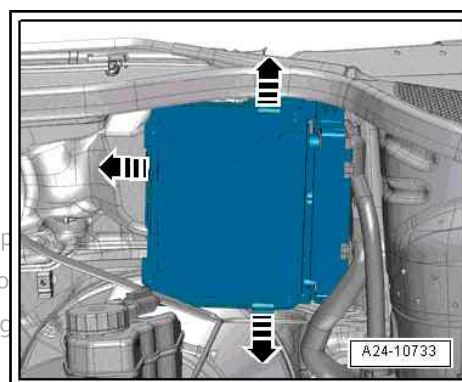
- ❑ Exploded view
⇒ [page 279](#)



Fitting location of engine control unit - J623-

- ◆ At plenum chamber partition panel (left-side)

Removing and installing ⇒ [page 282](#)



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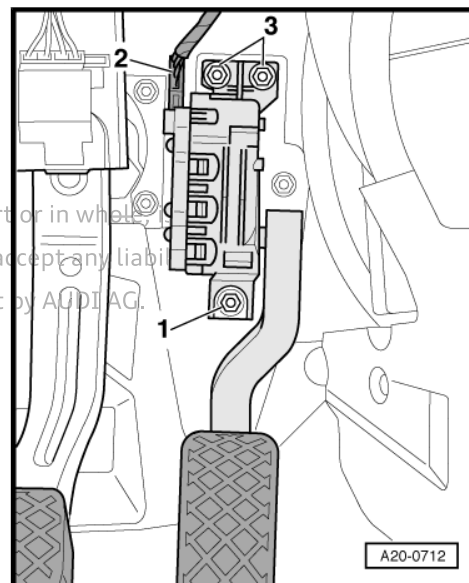
Fitting location of accelerator position sender - G79- / accelerator position sender 2 - G185-

- ◆ In accelerator pedal module



Note

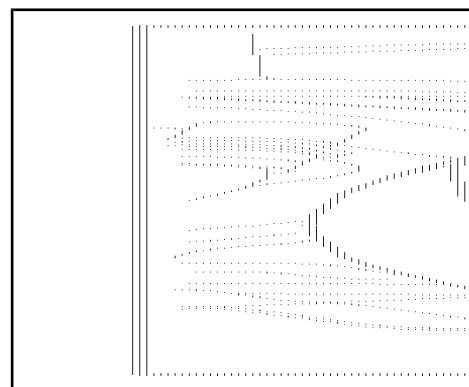
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is prohibited. The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.



Fitting location of brake light switch - F- / brake pedal switch - F63-

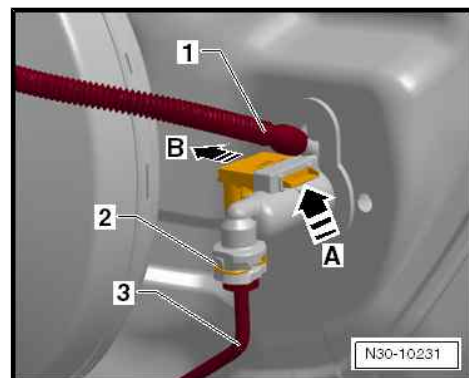
- ◆ On brake master cylinder

C - Brake light switch - F- / brake pedal switch - F63-



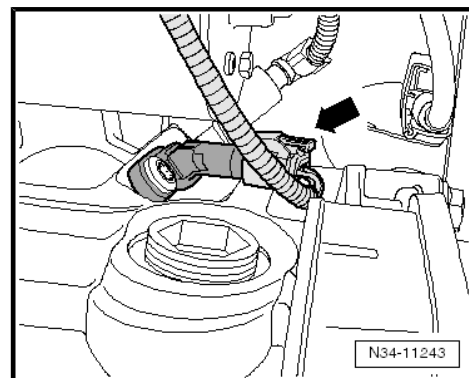
Fitting location of clutch position sender - G476-

- ◆ On clutch master cylinder, next to brake servo



Fitting location of gearbox neutral position sender - G701-

- ◆ At front of manual gearbox -arrow-

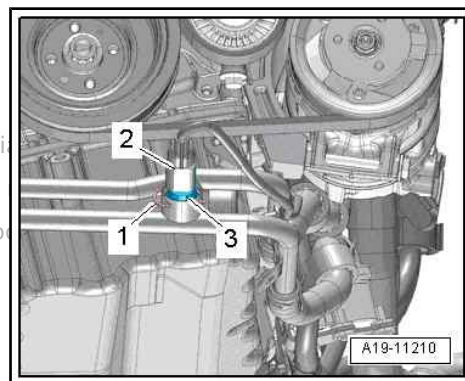




Fitting location of radiator outlet coolant temperature sender - G83-

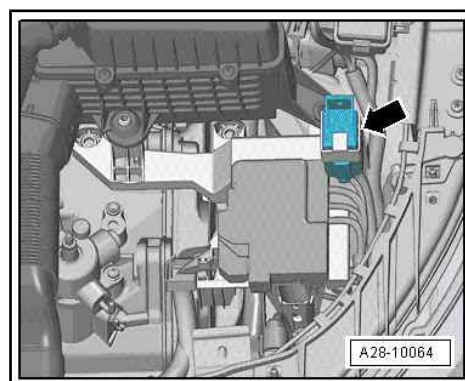
- ◆ -Item 3- in connection at coolant pipes (right-side)

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Automatic glow period control unit - J179-

- ◆ The control unit for the glow plug system -arrow- is located in the mounting for the fuse holder B - SB- in the engine compartment (front left) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



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 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.



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2 Vacuum system

⇒ ["2.1 Connection diagram - vacuum system", page 224](#)

⇒ ["2.2 Checking vacuum system", page 225](#)

2.1 Connection diagram - vacuum system



Caution

Risk of engine malfunctions

- ◆ *When routing vacuum lines, make sure they are not kinked, twisted or crushed.*



Note

- ◆ *Blue = vacuum line for exhaust gas recirculation (control function)*
- ◆ *Grey = breather pipe to air cleaner housing*
- ◆ *Green = vacuum line for turbocharger (control function)*
- ◆ *Red = vacuum line from vacuum pump*



1 - Vacuum unit

- ☐ For change-over function for exhaust gas recirculation cooler

2 - Non-return valve

3 - Exhaust gas recirculation cooler change-over valve - N345-

- ☐ Checking change-over function ⇒ [page 315](#)

4 - Cylinder head cover

- ☐ With integrated vacuum reservoir

5 - Vacuum unit

- ☐ On turbocharger
- ☐ With position sender for charge pressure positioner - G581-

6 - Air cleaner housing

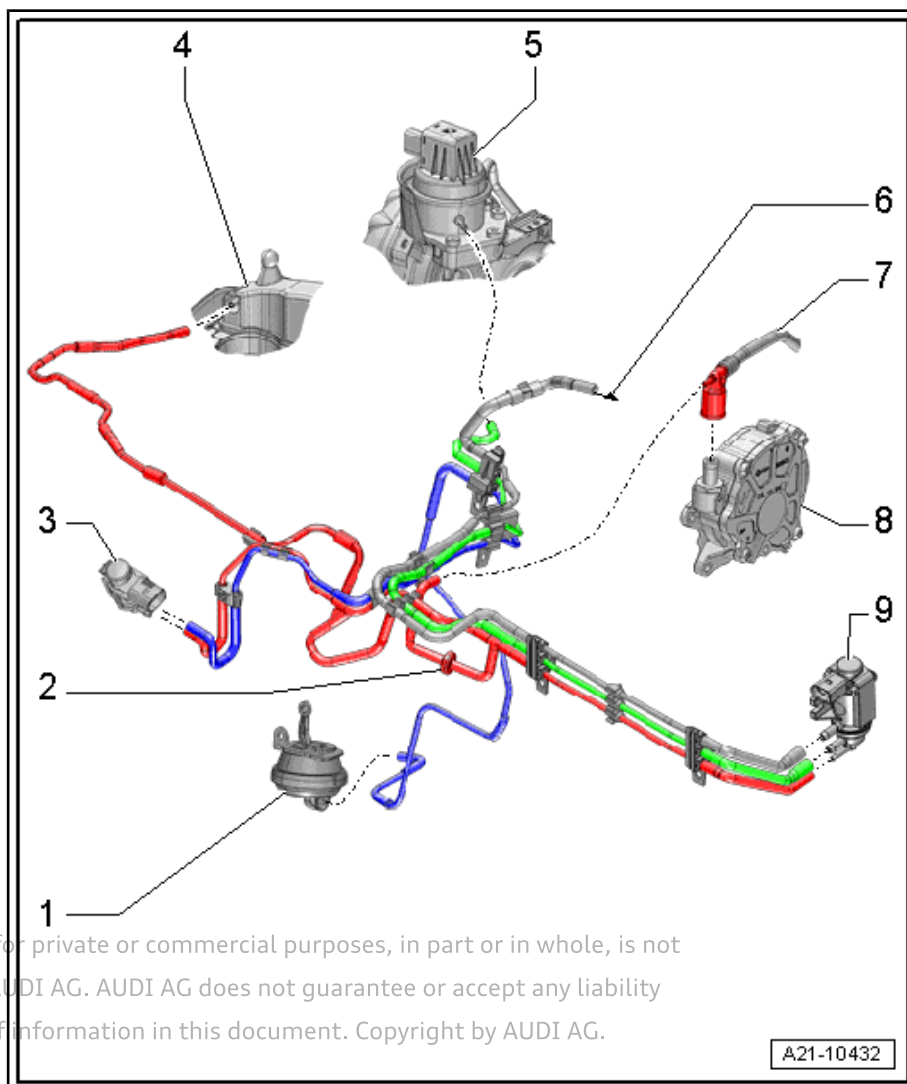
- ☐ With connection for breather pipe

7 - Vacuum line

- ☐ To brake servo

8 - Vacuum pump

9 - Charge pressure control solenoid valve - N75-

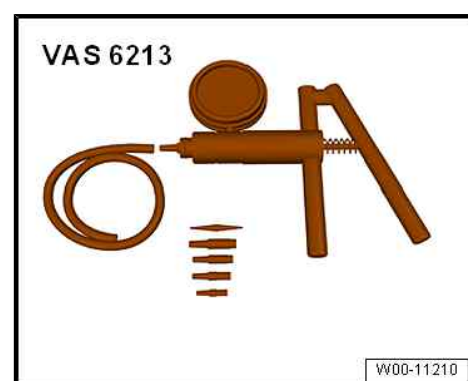


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2.2 Checking vacuum system

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



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- ☐ Installation position ⇒ [page 228](#)

17 - Bracket

- ☐ For air cleaner (bottom section)
- ☐ Lug on bracket must not be deformed
- ☐ Lug on bracket must be fully inserted in rubber buffer

18 - Bolt

- ☐ 9 Nm

19 - Rubber buffer

- ☐ Clipped onto air cleaner (bottom section)

20 - Bolt

- ☐ 9 Nm

21 - Sleeve

22 - Grommet

23 - Water drain hose

- ☐ Clean
- ☐ Renew O-ring if damaged

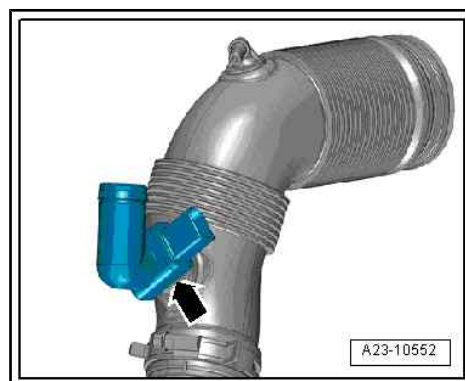
24 - Rubber buffer



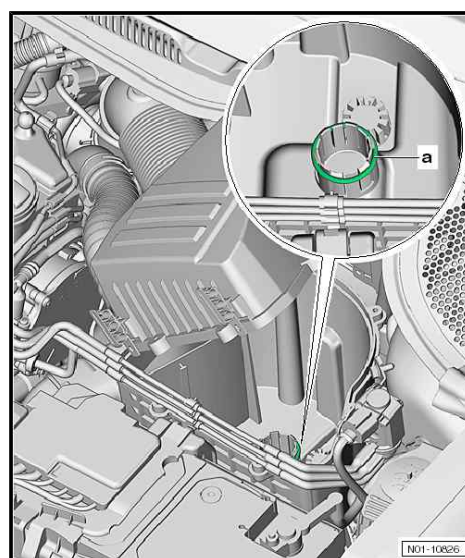
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Country-specific version with heater element for crankcase breather - N79-

- ◆ In air pipe to turbocharger -arrow-



Check that rubber ring -a- is properly secured at centring element on air cleaner (bottom section).





3.2 Removing and installing air cleaner housing

Removing

- Remove engine cover panel ⇒ [page 43](#) .
- Release fasteners -arrows- and detach air duct -1-.



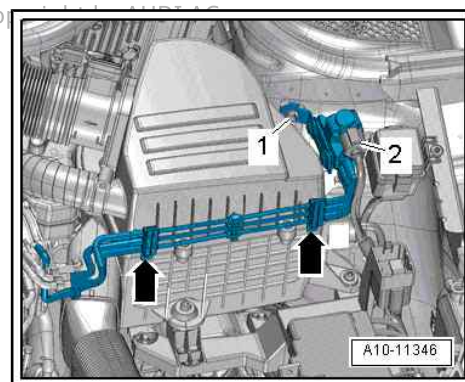
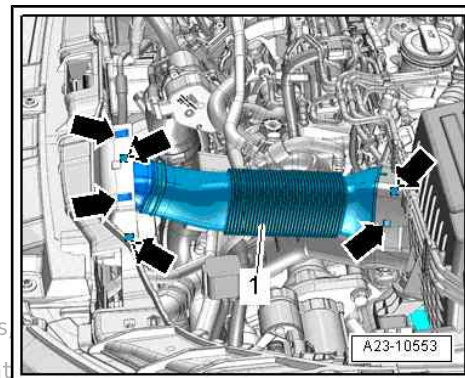
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- Unclip bracket -arrows- from air cleaner housing (with vacuum hoses attached).



Note

Disregard items -1 and 2-.





- Unplug electrical connector -3-.
- Release hose clips -1, 2- and detach air hoses.
- Unscrew bolt -4- and detach air cleaner housing.

Installing



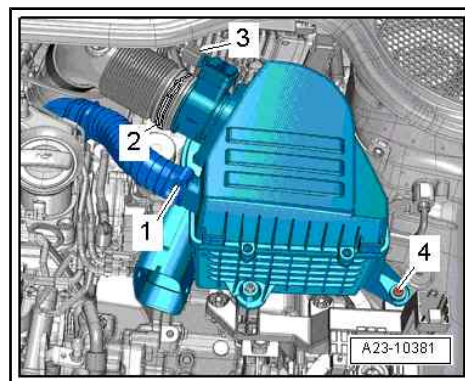
Note

- ◆ *The air cleaner housing must always be clean.*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Use a lubricant (silicone-free) when installing air hoses.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- Check for salt residue, dirt and leaves in air hose (engine intake side).
- Check air duct leading from lock carrier to air cleaner housing for dirt and leaves.
- Press release tabs and disconnect water drain hose
⇒ [Item 23 \(page 228\)](#) .
- Clean dirt and leaves out of connection and hose.

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

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 227](#)



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4 Intake manifold

⇒ ["4.1 Exploded view - intake manifold", page 231](#)

⇒ ["4.2 Removing and installing intake manifold", page 233](#)

⇒ ["4.3 Removing and installing throttle valve module J338", page 237](#)

4.1 Exploded view - intake manifold

⇒ ["4.1.1 Exploded view - intake manifold, vehicles without intake manifold flap V157", page 231](#)

⇒ ["4.1.2 Exploded view - intake manifold, vehicles with intake manifold flap V157", page 233](#)

4.1.1 Exploded view - intake manifold, vehicles without intake manifold flap - V157-

1 - Guide tube

- ☐ For oil dipstick

2 - Seal

- ☐ Renew

3 - Gaskets

- ☐ Renew

4 - Bolt

- ☐ Tighten in diagonal sequence, working from centre outwards
- ☐ 8 Nm

5 - Fuel return line

6 - Bolt

- ☐ 9 Nm

7 - Bolt

- ☐ 9 Nm

8 - Intake manifold

- ☐ Removing and installing
⇒ [page 233](#)

9 - Bracket

- ☐ For exhaust gas recirculation cooler change-over valve - N345-

10 - Bolt

- ☐ 9 Nm

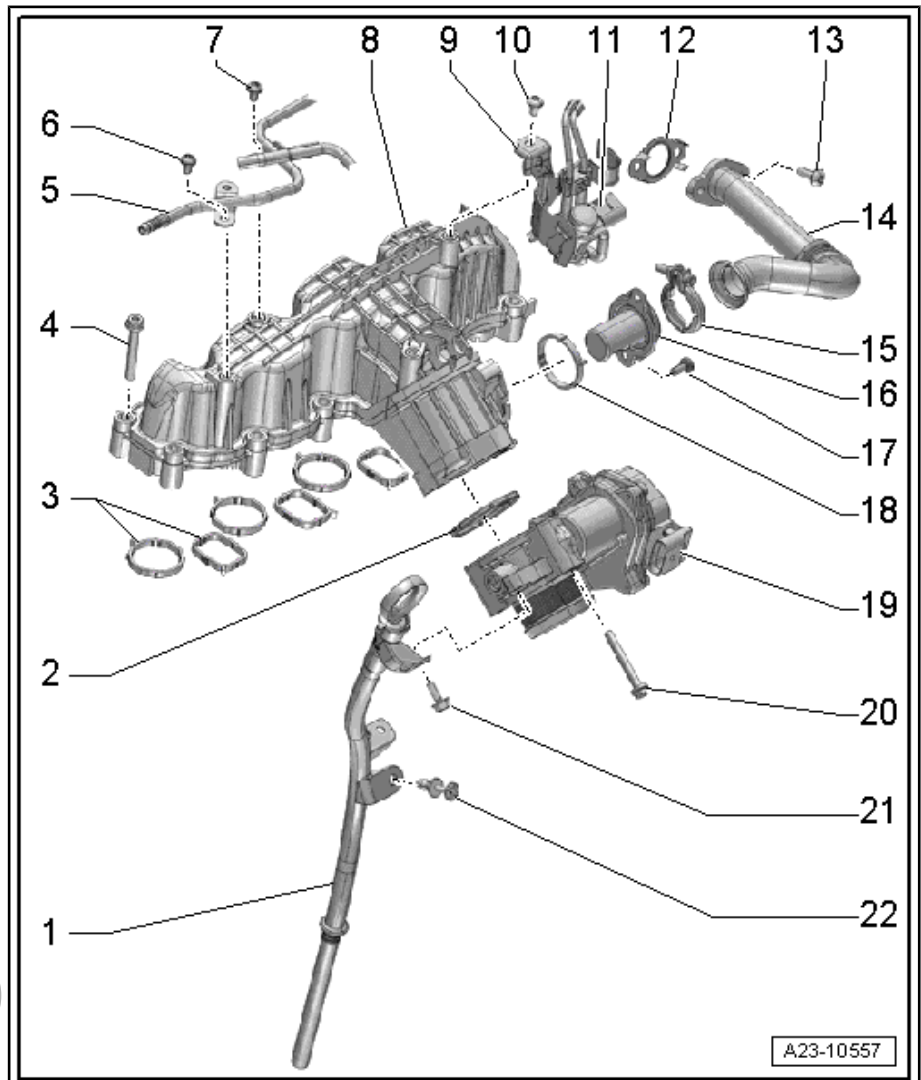
11 - Exhaust gas recirculation cooler change-over valve - N345-

12 - Gasket

- ☐ Renew

13 - Bolt

- ☐ Tightening torque ⇒ [Item 9 \(page 312\)](#)



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14 - Exhaust gas recirculation pipe

- ☐ To exhaust gas recirculation cooler

15 - Screw-type clip

- ☐ Tightening torque ⇒ [Item 10 \(page 312\)](#)

16 - Pipe connection

- ☐ For exhaust gas recirculation

17 - Bolt

- ☐ 8 Nm

18 - Seal

- ☐ Renew

19 - Throttle valve module - J338-

- ☐ With throttle valve potentiometer - G69-
- ☐ Removing and installing ⇒ [“4.3 Removing and installing throttle valve module J338”, page 237](#)

20 - Bolt

- ☐ 8 Nm

21 - Bolt

- ☐ Tightening torque ⇒ [Item 13 \(page 144\)](#)

22 - Clip



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4.1.2 Exploded view - intake manifold, vehicles with intake manifold flap - V157-

1 - Intake manifold

- ☐ With intake manifold flap motor - V157- and intake manifold flap potentiometer - G336- (combined in one component)

Gradual discontinuation of intake manifold flap motor - V157-

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- ☐ Must not be dismantled
- ☐ Removing and installing
⇒ [page 233](#)

2 - Bolt

- ☐ 8 Nm

3 - Gasket

- ☐ Renew

4 - Connecting pipe

- ☐ Between exhaust gas recirculation cooler and intake manifold

5 - Clamp

- ☐ Renew
- ☐ 5 Nm

6 - Seal

- ☐ Renew

7 - Bolt

- ☐ 20 Nm

8 - Throttle valve module - J338-

- ☐ Removing and installing
⇒ [page 237](#)

9 - Bolt

- ☐ 10 Nm

10 - Bolt

- ☐ 10 Nm

11 - Bolt

- ☐ 10 Nm

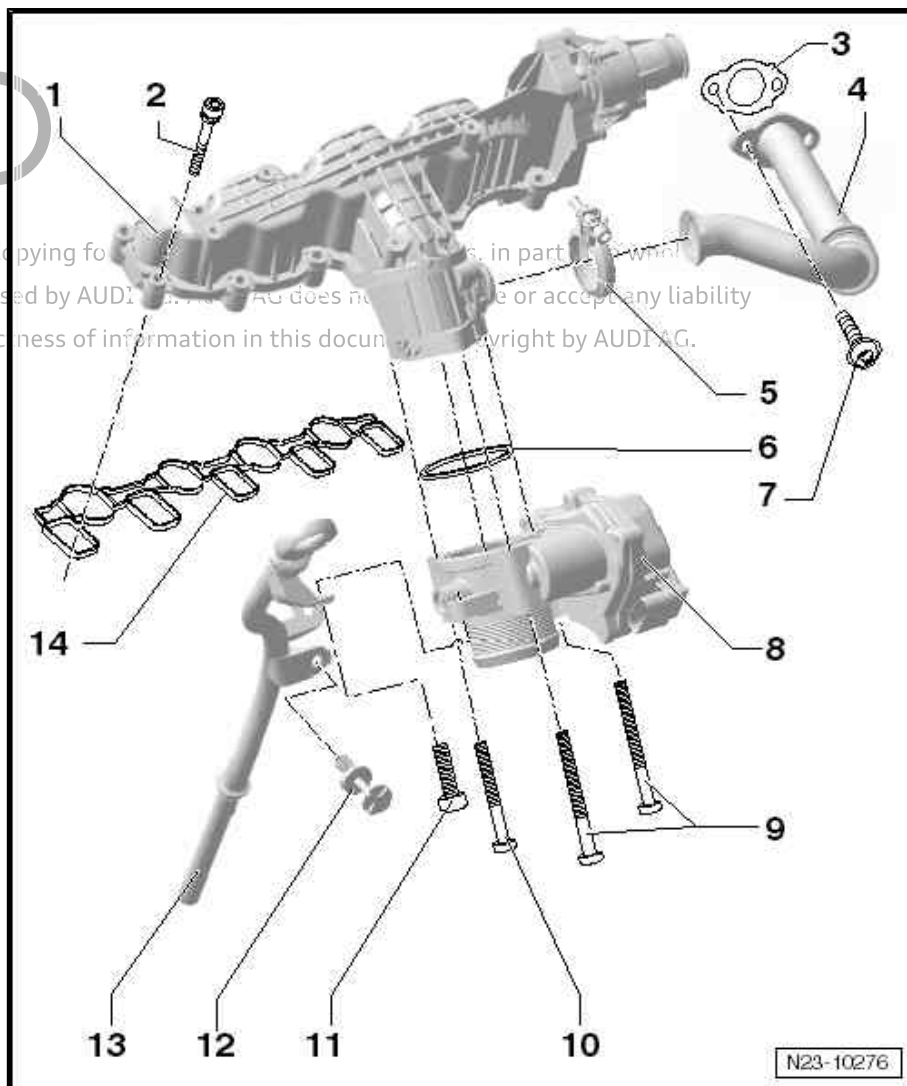
12 - Clip

- ☐ For securing tube for oil dipstick

13 - Tube for oil dipstick

14 - Gasket

- ☐ Renew

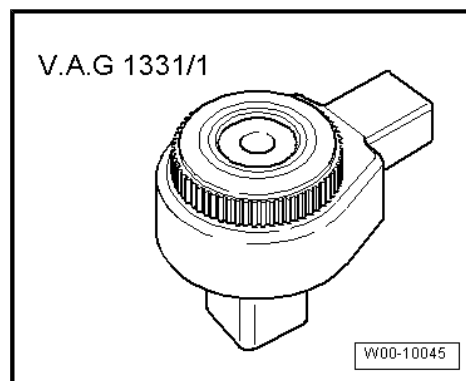


4.2 Removing and installing intake manifold

Special tools and workshop equipment required



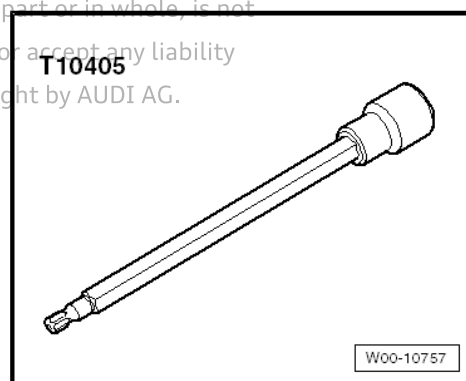
◆ Ratchet - V.A.G 1331/1-



◆ Pliers - 3314-



◆ Socket Torx T30 - T10405-



Removing



WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system ⇒ [page 6](#).*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

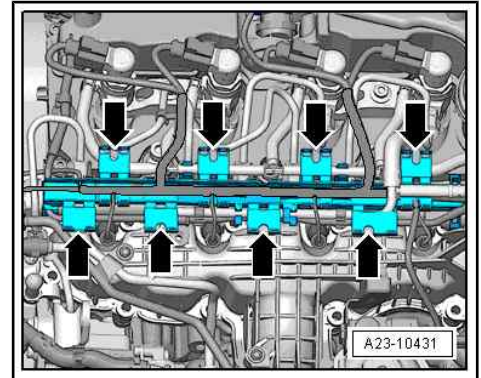
- Remove engine cover panel ⇒ [page 43](#) .
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



Caution

Make sure that no wire connection is damaged when unplugging the connectors; otherwise the entire wiring harness must be renewed. When unplugging the connectors, do not compress the pliers - 3314- with too much force so that the support sleeve is not damaged.

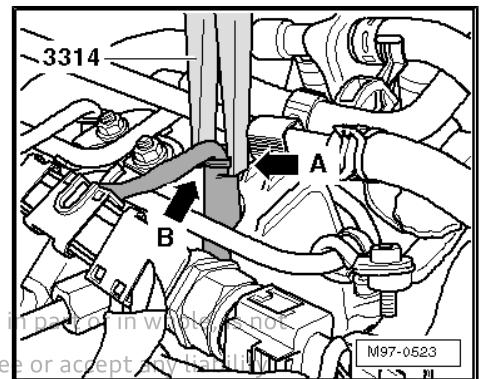
- Open catches -arrows- on cable duct to move clear wiring harness.



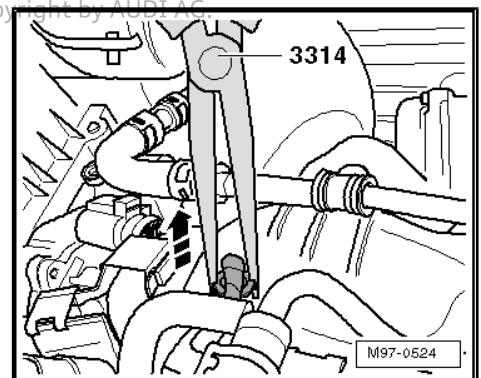
- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B-.



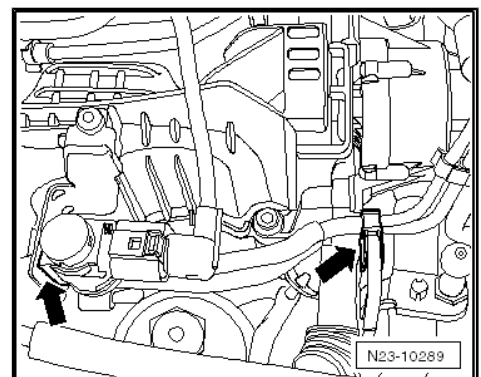
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- Carefully unplug connectors from glow plugs in direction of -arrow-.

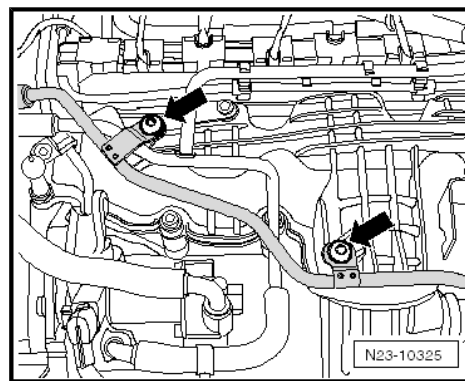


- Pull exhaust gas recirculation cooler changeover valve - N345- -left arrow- off bracket and move clear to one side.

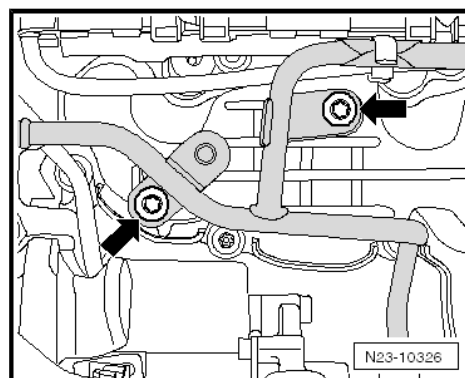




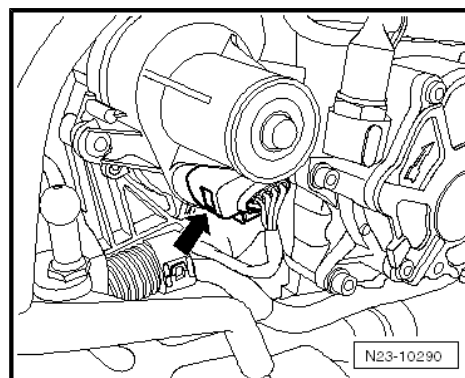
- Unscrew securing bolts -arrows- and move coolant return line clear to one side.



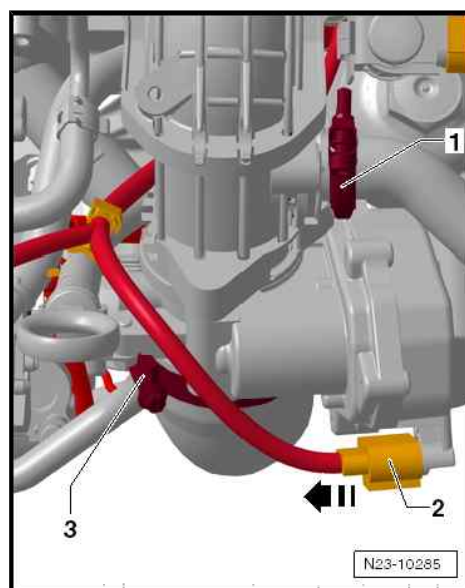
- Unscrew securing bolts -arrows- and move fuel return line clear to one side.



- Unplug connector -arrow- at intake manifold flap motor - V157- (if fitted).
- Remove fuel rail ⇒ [page 261](#) .



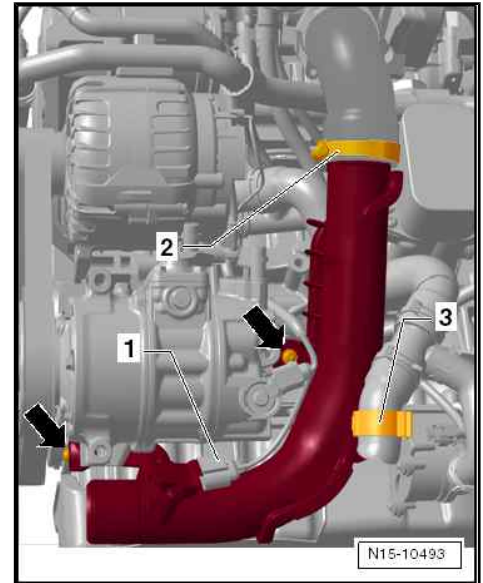
- Unplug connector -2- from throttle valve module - J338- .
- Open clamp -1- at connecting pipe for exhaust gas recirculation and remove connecting pipe.
- Remove bolt from mounting for oil dipstick tube.



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- Open clamp -2- on air pipe.
- Remove charge air hose between throttle valve module - J338- and air pipe. To do so, unscrew bolts -arrows-.

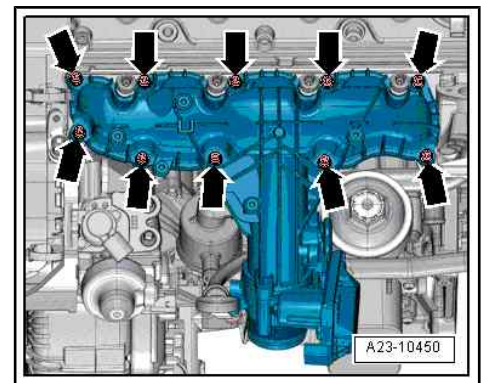


- Unscrew intake manifold bolts -arrows- in diagonal sequence starting from outside and working inwards using socket Torx T30 - T10405- .
- Carefully take out intake manifold.

Installing

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

- Renew seals and/or gaskets.
- Tighten bolts securing intake manifold in diagonal sequence starting from outside and working inwards.
- Carefully take out intake manifold.



Note

Renew seals and/or gaskets.

- Tighten intake manifold bolts in diagonal sequence, working from inside to outside.
- Install fuel rail ⇒ [page 261](#) .
- Install air pipe ⇒ [page 207](#) .

Tightening torques

♦ ⇒ [“4.1 Exploded view - intake manifold”, page 231](#)

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

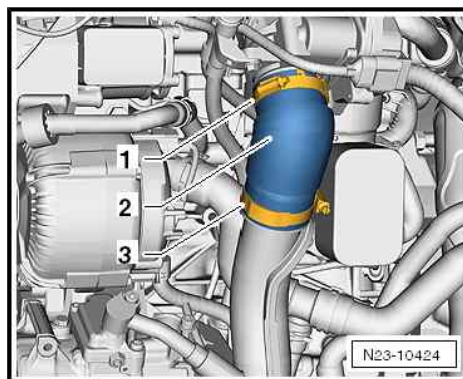
4.3 Removing and installing throttle valve module - J338-

Removing

- Remove engine cover panel ⇒ [page 43](#) .



- Release hose clips -1 and 3- and remove charge air hose -2- between throttle valve module - J338- and charge air pipe.



- Unplug electrical connector -2-.
- Remove bolt -1- for dipstick guide tube.
- Remove bolts -arrows- and detach throttle valve module - J338- from air hose.

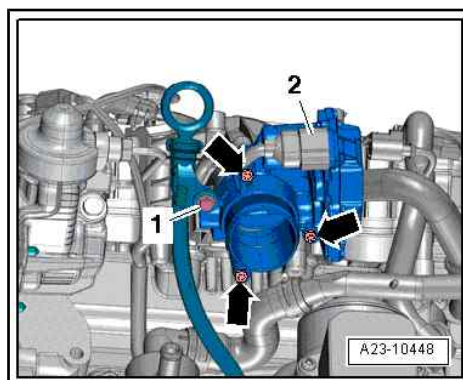
Installing

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



Note

Fit new O-ring.



Installing air hoses with plug-in connectors

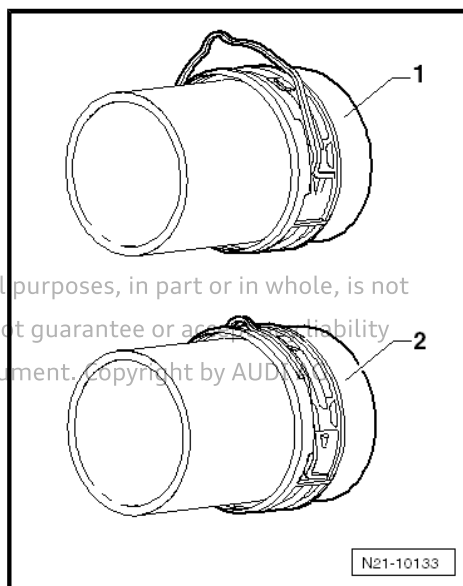


Note

- ◆ *Renew seal if damaged.*
- ◆ *Make sure that the seal is correctly seated in the groove on the complete circumference of the air pipe/hose.*
- ◆ *Apply a thin coating of silicon-free lubricant to the sealing area and the seal.*
- Release retaining clip (position -1-).
- Push air pipe/hose in as far as stop and press retaining clip to lock -2-.
- Press air pipe/hose again and pull again to check that plug-in connector is correctly engaged.

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - intake manifold”, page 231](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 207](#)





5 Injectors/high-pressure reservoir (rail)

⇒ [“5.1 Exploded view - injectors”, page 239](#)

⇒ [“5.2 Exploded view - high-pressure reservoir \(rail\)”, page 240](#)

⇒ [“5.3 Checking injectors”, page 243](#)

⇒ [“5.4 Performing adaption of correction values for injectors”, page 244](#)

⇒ [“5.5 Checking for injectors sticking open”, page 244](#)

⇒ [“5.6 Checking return flow rate of injectors with engine running”, page 246](#)

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⇒ [“5.7 Checking return flow rate of injectors at starter cranking speed”, page 249](#)

⇒ [“5.8 Checking pressure retention valve in fuel return line”, page 251](#)

⇒ [“5.9 Removing and installing injectors”, page 252](#)

⇒ [“5.10 Removing and installing high-pressure pipes”, page 258](#)

⇒ [“5.11 Installing fuel return lines”, page 260](#)

⇒ [“5.12 Removing and installing high-pressure reservoir \(rail\)”, page 261](#)

5.1 Exploded view - injectors

**1 - 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 252](#)

2 - Bolt for clamping piece

- ☐ 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)
- ☐ Note warning instructions for clamping piece
⇒ [Item 10 \(page 242\)](#)

3 - High-pressure connection

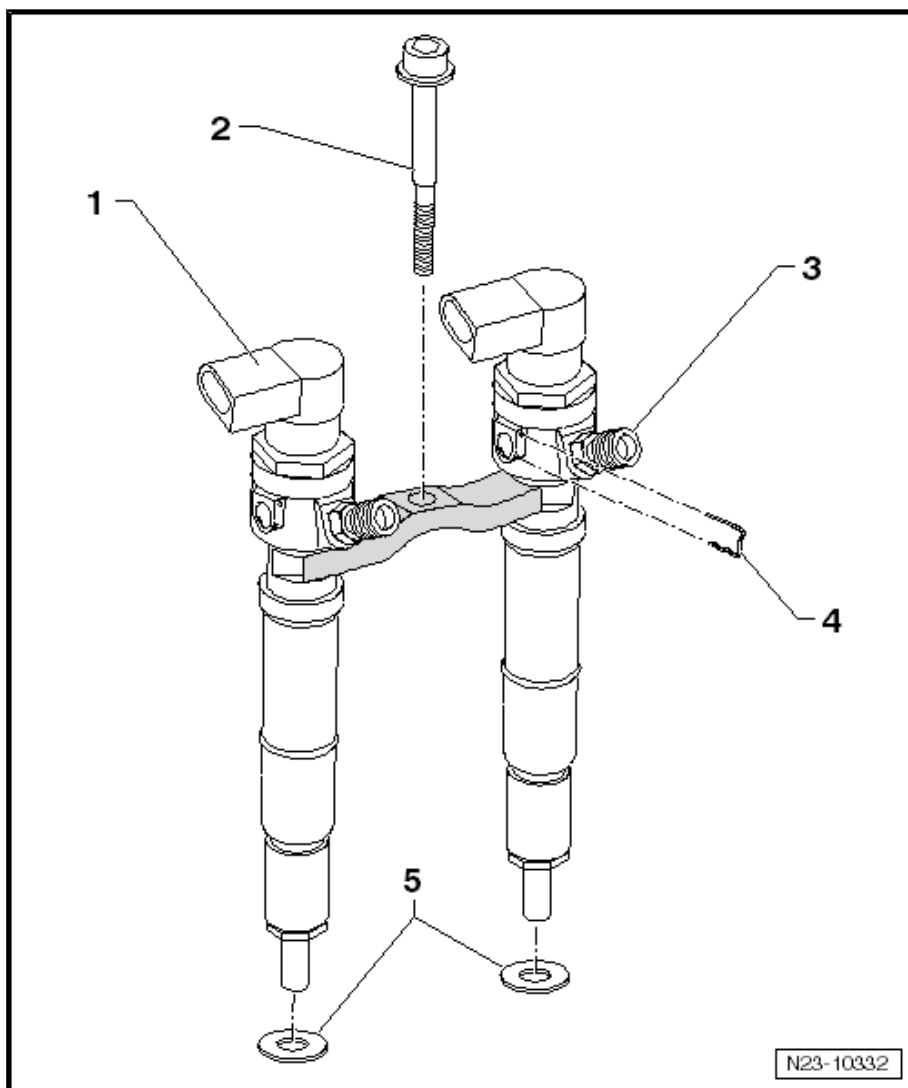
- ☐ Counterhold at high-pressure connection when loosening high-pressure pipes

4 - Retaining clip for return lines

- ☐ Renew
- ☐ Grease retaining clip lightly before fitting

5 - Copper seal

- ☐ Renew

**5.2 Exploded view - high-pressure reservoir (rail)****WARNING**

- ◆ **Always read rules for cleanliness and instructions for working on fuel system**
⇒ ["3.1 Rules for cleanliness", page 6](#).
- ◆ **Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.**



1 - Bolt

- ☐ 8 Nm

2 - High-pressure pipe

- ☐ From high-pressure pump to fuel rail
- ☐ Do not alter shape
- ☐ Mark allocation for re-installation; pay attention to marking when installing
- ☐ Check for damage before re-installing
- ☐ Installing ⇒ [page 258](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

3 - Seal

- ☐ For injector
- ☐ In cylinder head cover
- ☐ Renew if leaking
⇒ [page 119](#)

4 - Copper seal

- ☐ Renew

5 - O-ring

- ☐ Renew

6 - Injector

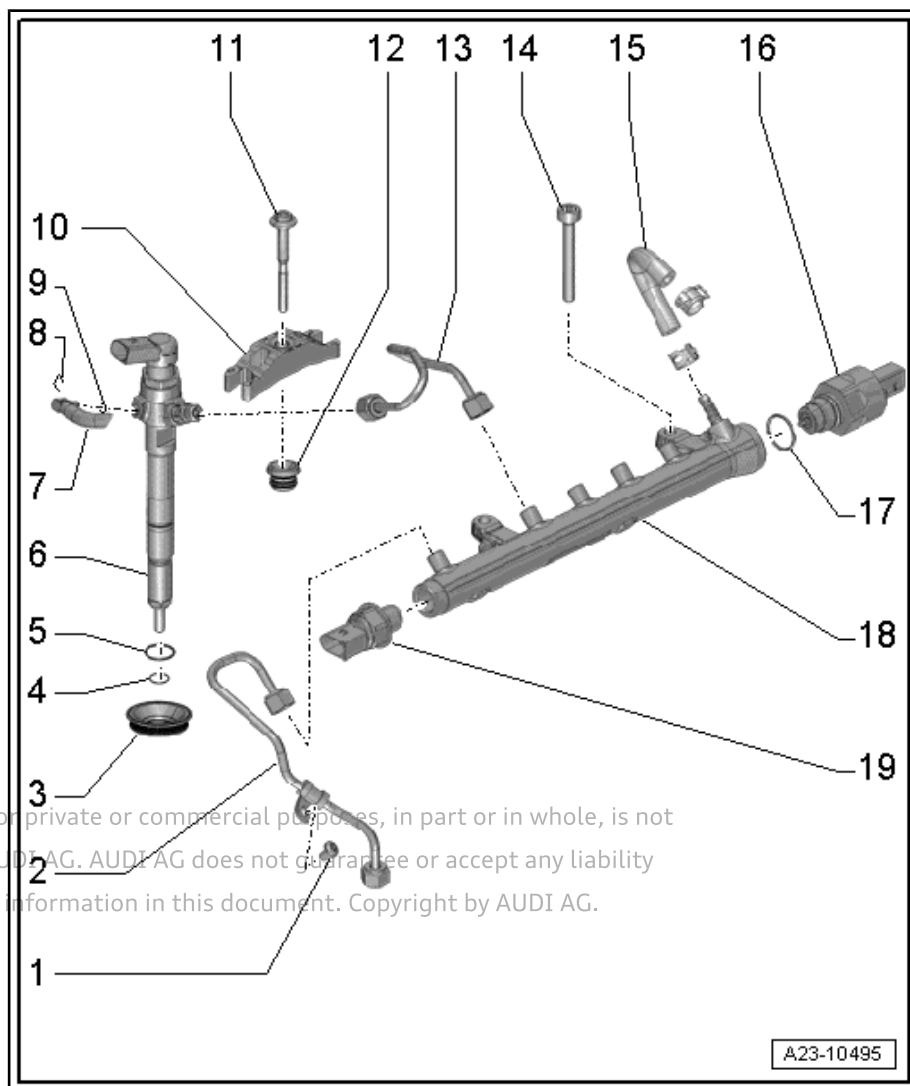
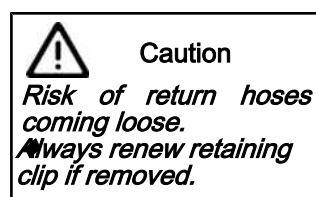
- ☐ Use a coloured pen to mark allocation of injectors to corresponding clamping piece and high-pressure pipe, and to corresponding cylinder for re-installation; pay attention to markings when installing
- ☐ Always renew copper seal when removing and installing
- ☐ To remove carbon deposits from the 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 252](#)

7 - Fuel return lines

- ☐ Do not dismantle
- ☐ Only renew together with pressure retention valve
- ☐ Check for damage before re-installing
- ☐ Installing ⇒ [page 260](#)
- ☐ After renewing, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ☐ Then check fuel return lines for leaks

8 - Retaining clip

- ☐ For fuel return lines



A23-10495



- ☐ Grease lightly before fitting

9 - O-ring

- ☐ Renew

10 - Clamping piece

**Caution**
Risk of damage to engine.
When installing a new base engine, it is essential that the clamping pieces for the injectors are tightened to the specified torque
⇒ [Item 11 \(page 242\)](#) after installing the high-pressure pipes. The clamping pieces are only secured hand-tight at the factory so the injectors can be aligned during installation.

- ☐ 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
- ☐ Each clamping piece secures two injectors

11 - Bolt for clamping piece

- ☐ 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)
- ☐ Note warning instructions for clamping piece ⇒ [Item 10 \(page 242\)](#)

12 - Grommet

- ☐ In cylinder head cover

13 - High-pressure pipe

- ☐ From fuel rail to injector
- ☐ When loosening connection, always counterhold connection on injector
- ☐ Do not alter shape
- ☐ Mark allocation for re-installation; pay attention to marking when installing
- ☐ Check for damage before re-installing
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

14 - Bolt

- ☐ 22 Nm

15 - Fuel return line

- ☐ To fuel tank

16 - Fuel pressure regulating valve - N276-

- ☐ With deformable sealing lip
- ☐ Cannot be re-installed
- ☐ Removing and installing ⇒ [page 266](#)
- ☐ Tightening torque ⇒ [page 243](#)

17 - O-ring

- ☐ Renew



18 - High-pressure reservoir

- ❑ Removing and installing ⇒ [page 261](#)

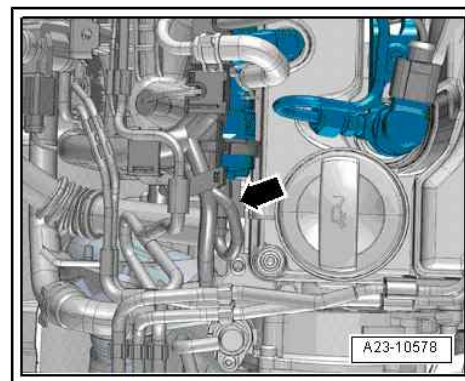
19 - Fuel pressure sender - G247-

- ❑ Removing and installing ⇒ [page 270](#)
- ❑ Tightening torque ⇒ [page 243](#)

Fuel pressure regulating valve - N276- - tightening torque

- Tighten regulating valve -arrow- in 2 stages as follows:

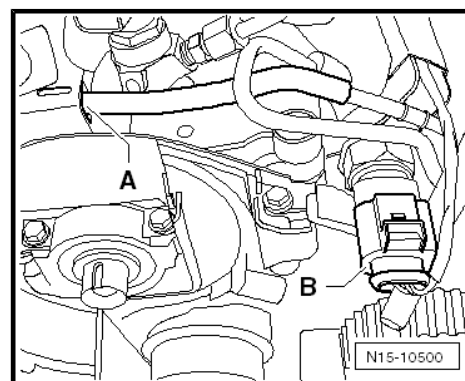
Stage	Tightening torque
1.	Screw in by hand until contact is made
2.	80 Nm



Fuel pressure sender - G247- - tightening torque

- Tighten fuel pressure sender - G247- in 2 stages as follows:

Stage	Fuel pressure sender - G247-	Tightening torque
1.	-Item B-	Screw in by hand until contact is made
2.	-Item B-	100 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 244](#)
- ⇒ [“5.5 Checking for injectors sticking open”, page 244](#)
- ⇒ [“5.6 Checking return flow rate of injectors with engine running”, page 246](#)
- ⇒ [“5.7 Checking return flow rate of injectors at starter cranking speed”, page 249](#)

Perform the following tests first if the engine does not start at all:

- ◆ ⇒ [“5.5 Checking for injectors sticking open”, page 244](#)
- ◆ ⇒ [“5.7 Checking return flow rate of injectors at starter cranking speed”, page 249](#)
- ◆ ⇒ [“6.2 Checking fuel pressure regulating valve N276”, page 268](#)

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5.4 Performing adaption of correction values for injectors

- ◆ The "Adaption for injectors" function serves to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.
- ◆ The 6-digit adaption value -b- (details in illustration are only an example) is marked separately on each injector. The values may consist of letters and/or numbers.
- ◆ The 6-digit adaption value (example) is marked on each injector. It may consist of letters and/or numbers (ASCII code).

a - Injector number

b - Checksum

c - Part number

d - Type approval number

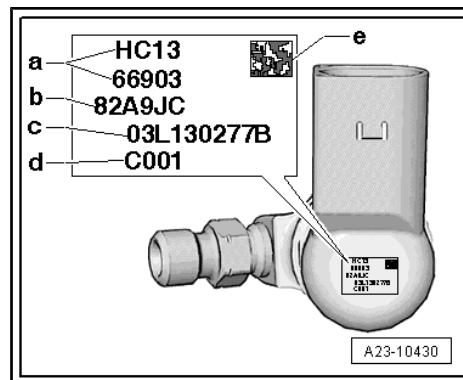
e - Data matrix code

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.

The adaption procedure is described in "Guided Fault Finding".
(The procedure is also described under "Guided Functions".) Use
⇒ Vehicle diagnostic tester

Also check that the values for the "Adaption for injectors" for all other injectors are stored in the engine control unit. Do NOT attempt to re-enter these values if the correct values are already stored in the engine control unit.



5.5 Checking for injectors sticking open



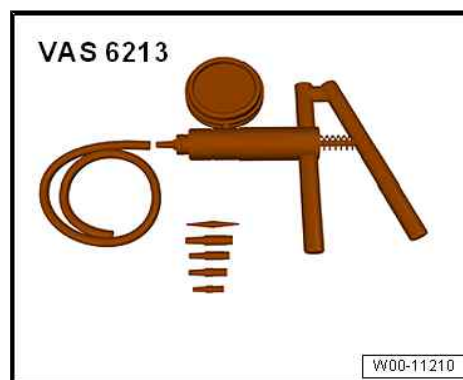
Note

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- ◆ *Leaking solenoid valves in the injectors can lead to the engine not running smoothly or not starting at all.*
- ◆ *To check the solenoid valves for dirt and thus an increased return flow rate, a vacuum test can be performed in addition to the "classic" return flow rate measurement.*

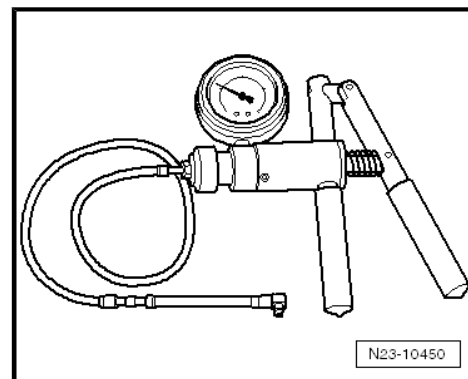
Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-





- ◆ Use a return line to make an -adapter-.



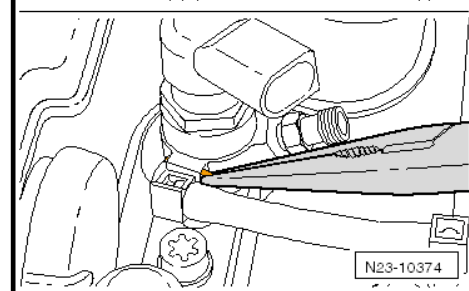
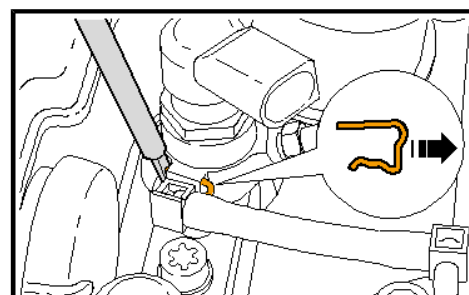
Procedure



WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system ⇒ [page 7](#).*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

- Remove engine cover panel ⇒ [page 43](#).
- Press retaining clips for return line connections out of all injectors using a screwdriver -arrow- and remove them using long-nose pliers.



- Then detach fuel return line connections from injectors in direction of -arrow-.

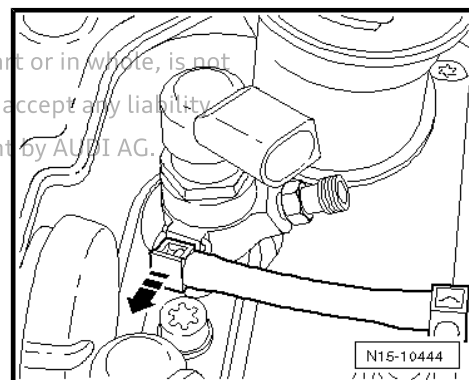
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Note

No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.

- Connect adapter to the injectors to be checked.





- Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .
- Specification: The vacuum should remain constant for 30 seconds.

In the case of a faulty injector, the vacuum will fall back to 0 bar within 2 to 3 seconds. Renew faulty injector ⇒ [page 252](#) .

Install fuel return lines ⇒ [page 260](#) .

Installing fuel return lines

- Connect fuel return lines ⇒ [page 260](#) .

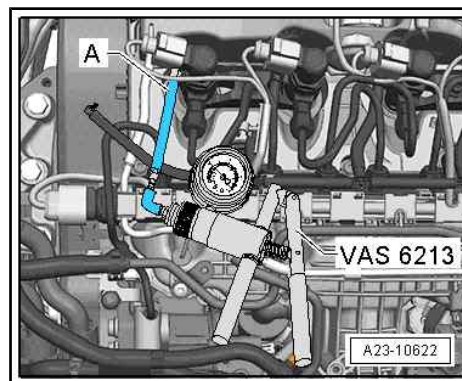
Checking fuel system for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

- Check 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 43](#) .



5.6 Checking return flow rate of injectors with engine running

Special tools and workshop equipment required

- ◆ Fuel-resistant measuring container

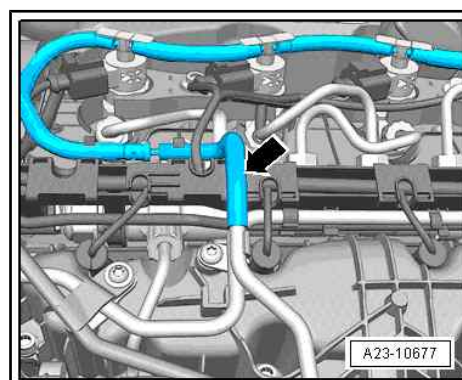


WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system ⇒ [page 7](#) .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

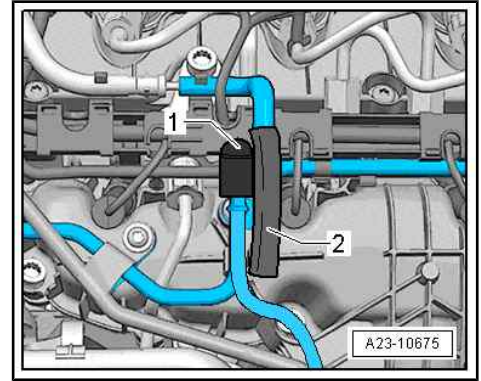
Checking return flow rate of all injectors

- Remove engine cover panel ⇒ [page 43](#) .
- Disconnect hose connection at fuel line.
- Disconnect hose connection -arrow-.





- Seal off open return line connection with plug -1-.
- Hold end of fuel return hose (lengthen with hose -2- if necessary) in a measuring container to measure the 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, 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

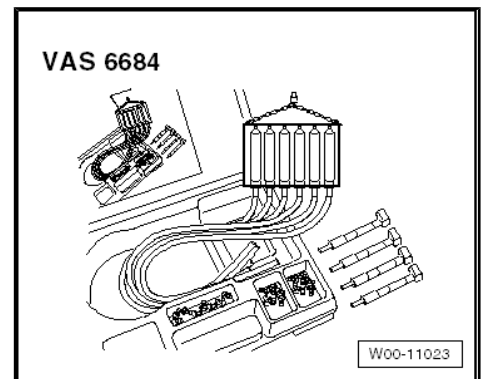
1000 ml = 1 litre

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

Special tools and workshop equipment required

- ◆ Return flow meter - VAS 6684-

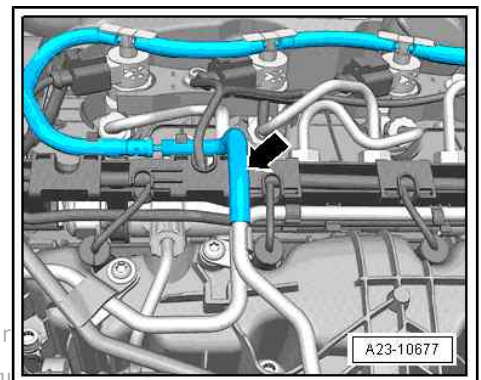


Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.
- Dry all components after cleaning.
- Disconnect hose connection -arrow-.

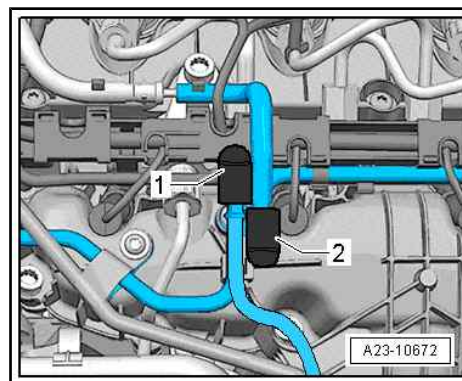


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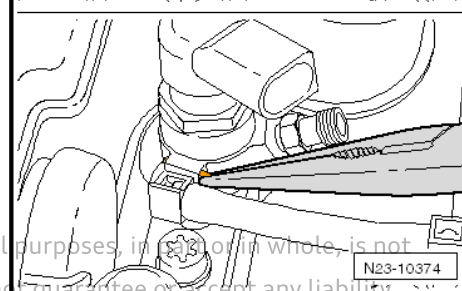
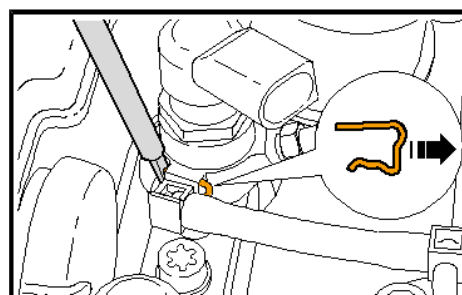




- Seal off open connections with a plug -1 and 2-



- Press retaining clips for return line connections out of all injectors using a screwdriver -arrow- and remove them using long-nose pliers.



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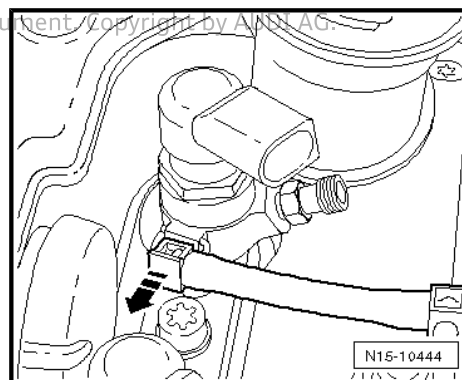
- Then detach fuel return line connections from injectors in direction of -arrow-.
- Connect hoses of return flow meter - VAS 6684- to return line connections of all four injectors.



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.



- When the engine is warm and running at idling speed, the return flow rates at each of the 4 return lines must not differ by more than a small amount.
- 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 252](#).

Installing fuel return lines

- Connect fuel return lines ⇒ [page 260](#).

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 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.

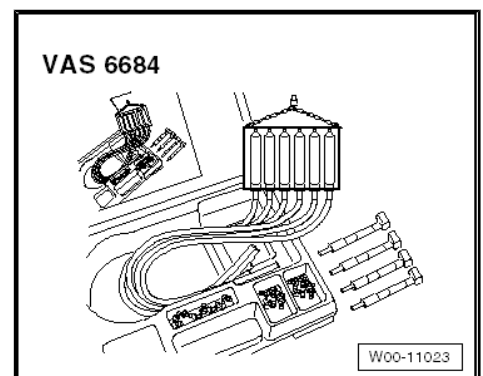
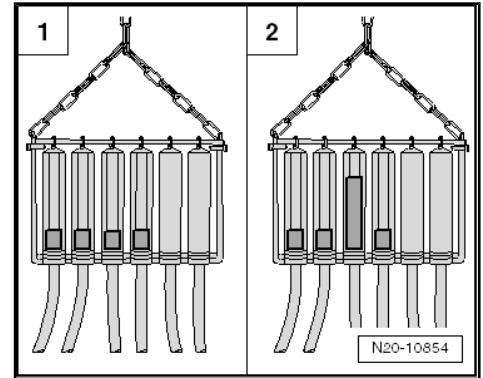
- Install engine cover panel ⇒ [page 43](#).

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-



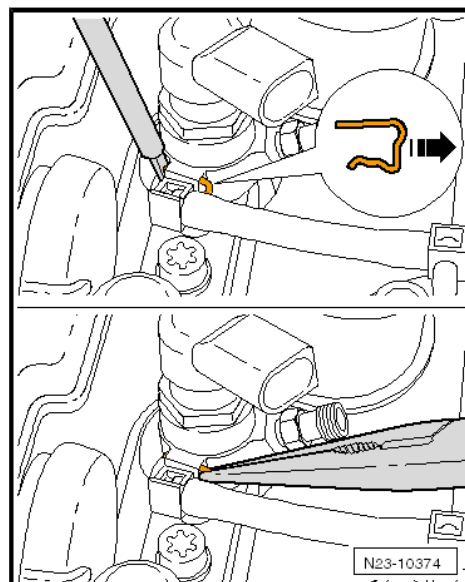


WARNING

- ◆ **Always read rules for cleanliness and instructions for working on fuel system ⇒ [page 7](#).**
- ◆ **Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.**

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 43](#).
- Remove noise insulation from injectors.
- Clean all return line connections (with commercial cleaning solution or similar) before removing.
- Dry all components after cleaning.
- Press retaining clips for return line connections out of all injectors using a screwdriver -arrow- and remove them using long-nose pliers.





- Then detach fuel return line connections from injectors in direction of -arrow-.
- Connect hoses of return flow meter - VAS 6684- to return line connections of all four 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

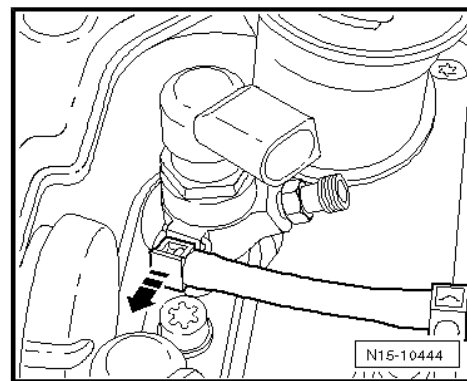
- Connect fuel return lines ⇒ [page 260](#) .

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 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 43](#) .



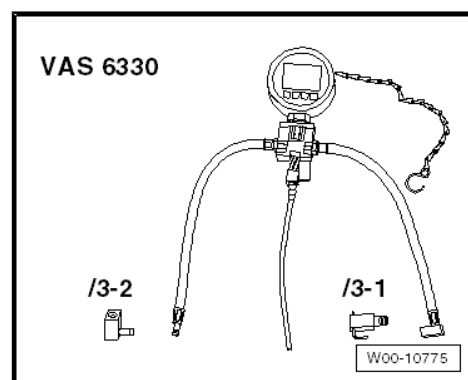
5.8 Checking pressure retention valve in fuel return line

The pressure retention valve maintains a residual pressure in the fuel return line.

This residual pressure is required for the control function of the injectors.

Special tools and workshop equipment required

- ◆ Tester for fuel return system - VAS 6330-



- ◆ Adapter - VAS 6330/3-1-
- ◆ Adapter - VAS 6330/3-2-

Procedure

- Remove engine cover panel ⇒ [page 43](#) .
- Clean return line connection on cylinder 1 (with cleaning solution or similar) before removing.
- Dry return line connection on cylinder 1.
- Cover return line connection on cylinder 1 with a cloth.

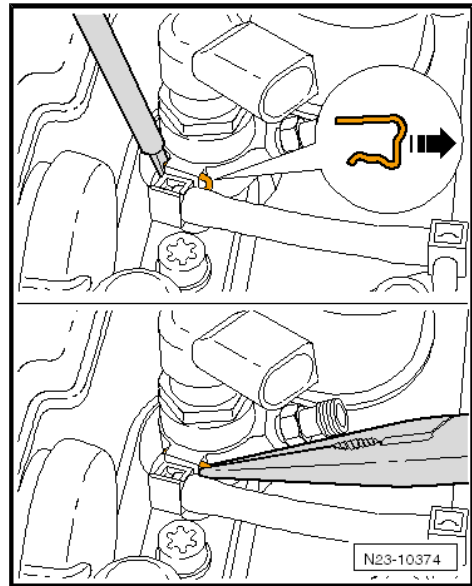


- Pull out release clip and detach return line connection from cylinder 1.



Note

- ◆ Open return line connection with a narrow screwdriver and long-nose pliers.
- ◆ Take care to keep all components clean. No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.
- ◆ Always renew clips.



- Connect tester for fuel return system - 6330- with adapters - VAS 6330/3-1- and -VAS 6330/3-2- between return line connection on injector and return line.
- Start engine.
- Check pressure indicated on tester.

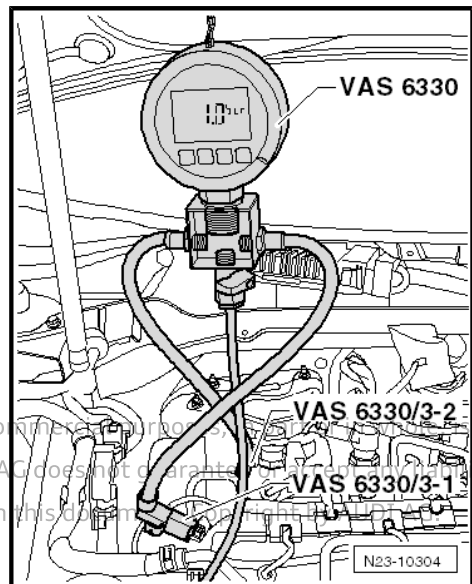


Note

- ◆ There are different low-pressure fuel systems.
- ◆ To identify which low-pressure fuel system is installed, see ⇒ [page 214](#).
- ◆ Specification: approx. 1 bar
- ◆ Or
- ◆ Specification: approx. 6 bar

If the value does not match the specification, fit a new pressure retention valve.

- Connect fuel return lines ⇒ [page 260](#).

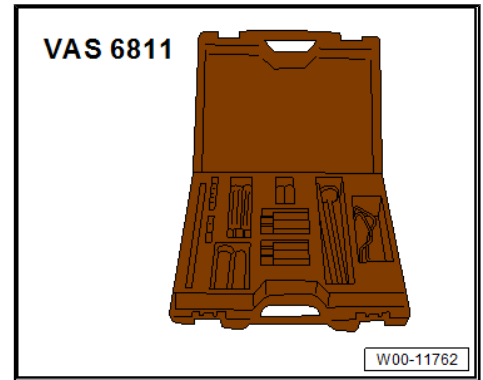


5.9 Removing and installing injectors

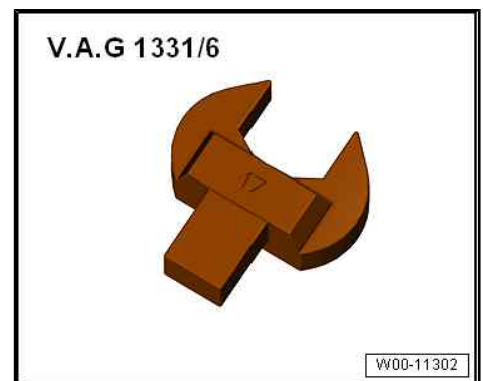
Special tools and workshop equipment required



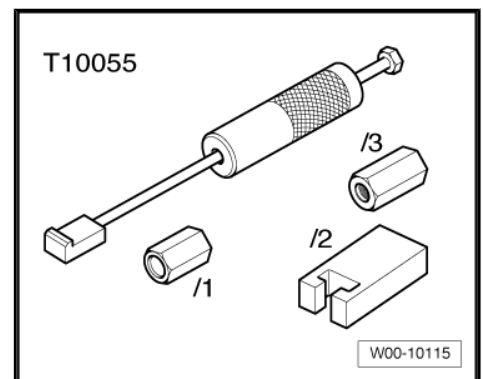
- ◆ Cleaning kit - VAS 6811-



- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



- ◆ Puller - T10055- with adapter - T10055/1-

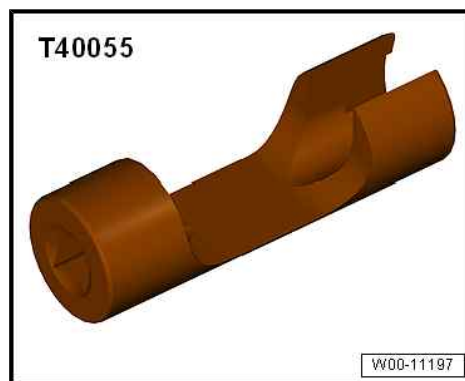


- ◆ Puller - T10402-Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.





◆ Socket - T40055-



◆ Oil seal extractor - T40195-



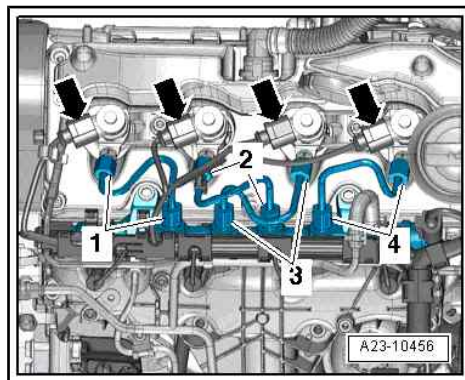
Removing

- Remove engine cover panel ⇒ [page 43](#) .
- Unplug electrical connectors -arrows- at injectors.



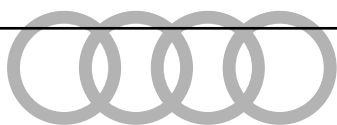
WARNING

- ◆ *Always read rules for cleanliness and instructions for working on fuel system
⇒ "3.1 Rules for cleanliness", page 6 .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*



Caution

- ◆ *Mark cylinder numbers on injector units. They must always be re-installed on the same cylinders.*
- ◆ *Observe rules for cleanliness when working on the injection system.*
- ◆ *Plug open connections with suitable sealing caps immediately.*



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- Unplug electrical connectors -1- at injectors which are to be removed.
- Remove high-pressure pipes between injectors and fuel rail.



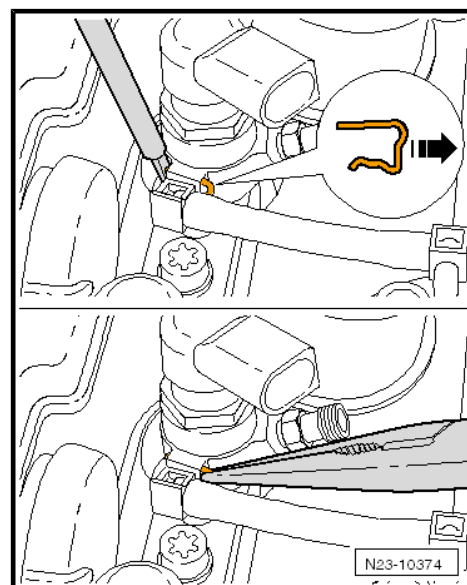
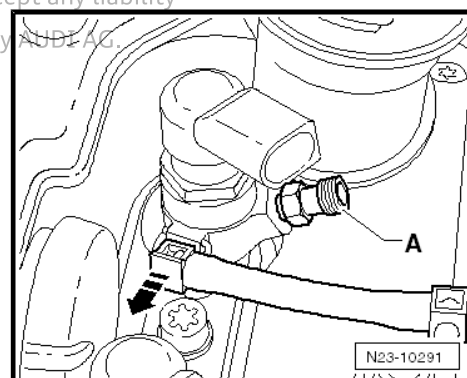
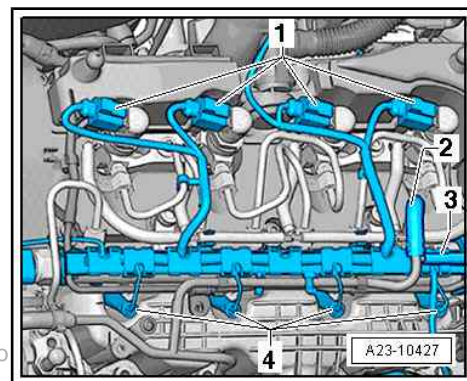
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Note

Counterhold at high-pressure connection -A- to loosen high-pressure pipes.

- Press retaining clips for return line connections out of all injectors using a screwdriver -arrow- and remove them using long-nose pliers.





- Then detach fuel return line connections from injectors in direction of -arrow-.



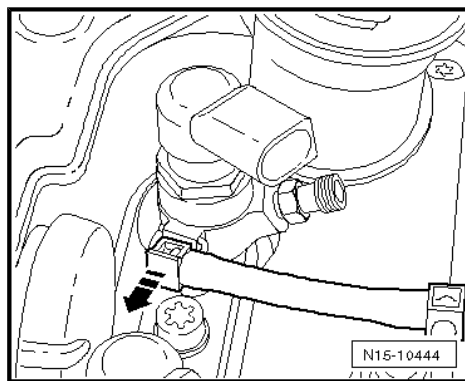
Note

- ◆ *No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.*
- ◆ *Each clamping piece secures two injectors.*



Caution

Proceed very carefully to prevent unnecessary dismantling or further damage.



- Remove bolt securing clamping piece to injectors to be removed.



Note

Leave clamping piece in position until adjacent injector is detached.



Caution

Risk of damage to injector if clamping piece is not kept straight.

- ◆ *First detach injectors for cylinders 1 and 4; then detach injectors for cylinders 2 and 3.*



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- Apply puller - T10055- with puller - T10402- -1- and -2- as shown in illustration and pull injectors out upwards by tapping gently.
- After removal, lay injectors on a clean cloth.

Removing and installing seal in cylinder head cover

⇒ **“2.5 Removing and installing seals for injectors”, page 119**

Important instructions for installing injectors:

When installing injectors, the following components must be renewed:

- ◆ Bolt for clamping piece
- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection
- ◆ Retaining clip for fuel return line connection

If a used injector is being re-installed:

- 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.

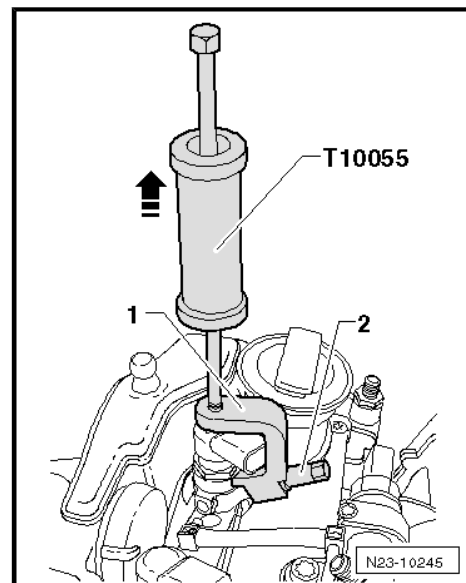
Continued (same procedure for used and new injectors):



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- .***



- Fit new copper seal.
- Lubricate all O-rings with engine oil or assembly oil before installing.





- Renew seal for injector using assembly sleeve - T10377- .
- Install injectors.
- Slide clamping piece onto injectors; observe installation position.
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
- Tighten clamping piece to specified torque.
- Connect fuel return lines ⇒ [page 260](#) .

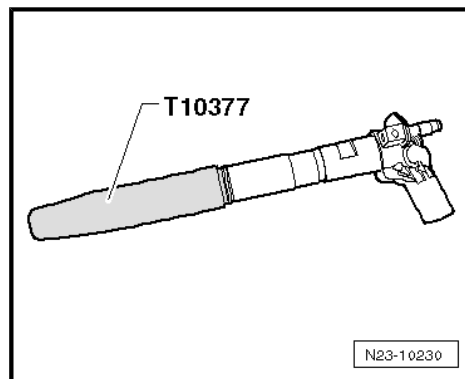
When a new injector is installed, the adaption value must be written into the engine control unit.

Also check that the values for the “Adaption for injectors” for all other injectors are stored in the engine control unit. Do NOT attempt to re-enter these values if the correct values are already stored in the engine control unit.

The adaption procedure is described in “Guided Fault Finding”. (The procedure is also described under “Guided Functions”).

Tightening torques

- ◆ ⇒ [“5.2 Exploded view - high-pressure reservoir \(rail\)”, page 240](#)



5.10 Removing and installing high-pressure pipes

Special tools and workshop equipment required

- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



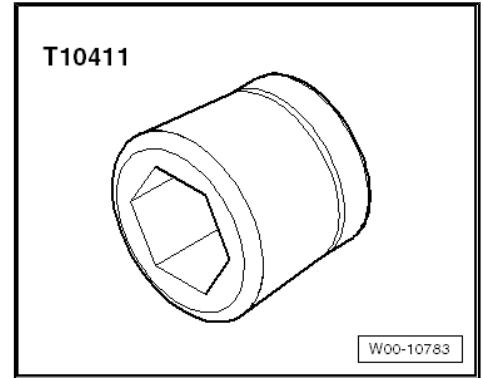
- ◆ Socket - T40055-



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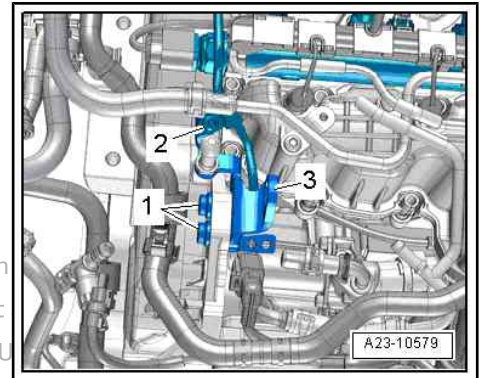


- ◆ Support sleeve -T10411-



Removing

- Remove engine cover panel ⇒ [page 43](#) .
- Remove bolts -1 and 2- and detach engine lifting eye -3-.



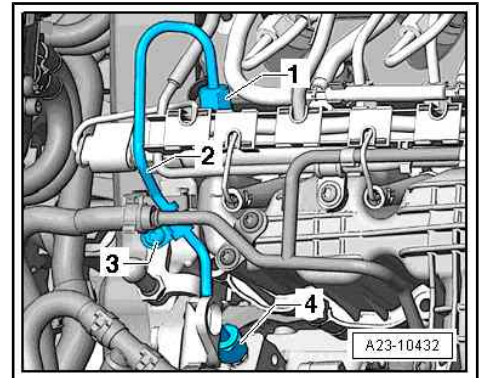
- Remove union nuts -1 and 4- and detach high-pressure pipe -2-.

Installing



Note

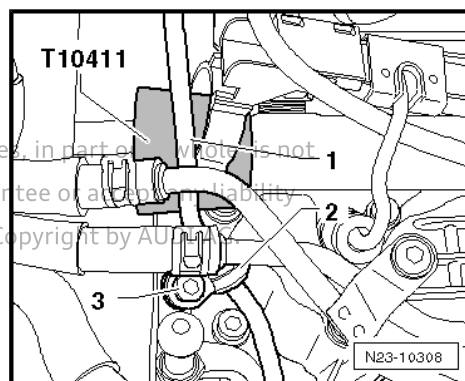
- ◆ *Before re-installation, check taper seats for deformation, cracks, damage, scores and corrosion. Renew high-pressure pipes if they are damaged or corroded.*
- ◆ *Check that bore in pipe is not distorted, restricted or damaged in any other way.*
- ◆ *When re-installing "old" high-pressure pipe, observe marking for installation position.*
- Use vacuum cleaner to remove dirt from taper seat at fuel rail.
- Clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.
- Lubricate threads of union nuts with fuel.
- Initially hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).
- Tighten high-pressure pipes between injectors and fuel rail first at injector and then at fuel rail.



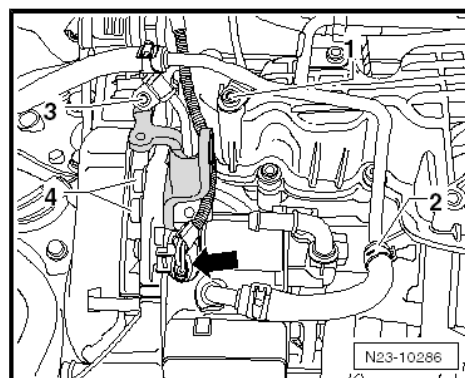


- To install high-pressure pipe between high-pressure pump and fuel rail, slide support sleeve -T10411- onto fuel pressure sender - G247- .

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**Note**

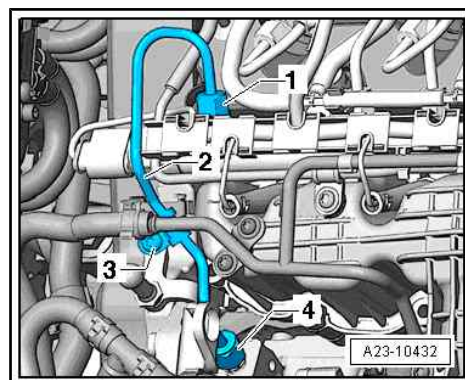
- ♦ To position union nut on high-pressure pump, it must be possible to move bracket (for engine lifting eye); to do so, loosen bolts -4-.
- ♦ Support sleeve -T10411- gives correct distance between fuel pressure sender - G247- and high-pressure pipe.



- Tighten high-pressure pipe -2- between high-pressure pump and fuel rail first at high-pressure pump -4- and then at fuel rail -1-.
- Tighten bolt -3- for bracket for high-pressure fuel pipe.
- Secure bracket (for engine lifting eye).
- Check fuel system for leaks ⇒ [page 222](#) .

Tightening torques

- ♦ ⇒ [“5.2 Exploded view - high-pressure reservoir \(rail\)”, page 240](#)
- ♦ ⇒ [“7.1 Exploded view - high-pressure pump”, page 274](#)

**5.11 Installing fuel return lines****Procedure**

- Prise O-rings off all return lines. Do not use sharp-edged tools to avoid damaging the return lines.

**Caution**

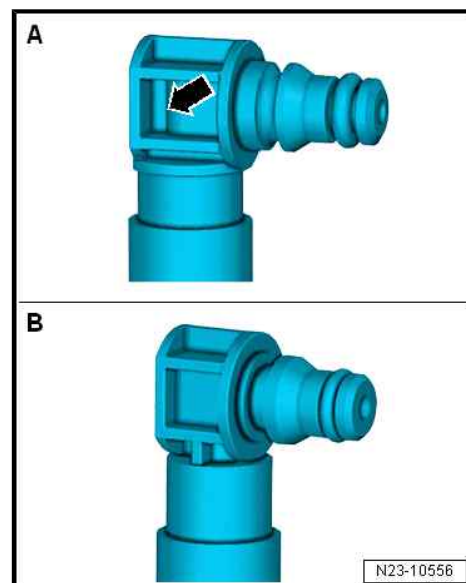
Gradual introduction of a new fuel return line; it is essential to ensure the correct assignment of components when renewing O-rings. The new return line can be recognised by the notch -arrow- on the connection pieces; the orange O-rings **MUST be fitted on this return line ⇒ Electronic parts catalogue (ET-KA) . Mixed installation is not permissible as this results in leakage and therefore failure of the return line.**



Differences in fuel return lines

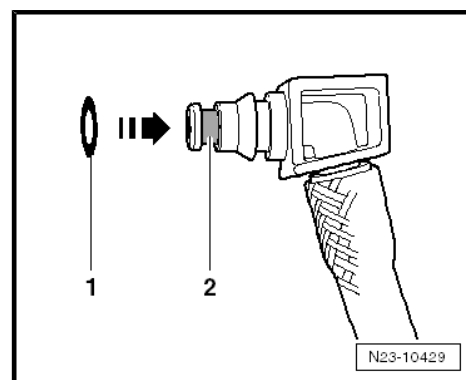
A - Connection for new fuel return line, with notch -arrow-: use orange O-rings.

B - Connection for old fuel return line, without notch: use green O-rings.



Note

- ◆ *Renew O-rings and retaining clips for return lines.*
- ◆ *Lubricate all O-rings with engine oil or assembly oil before installing.*
- ◆ *Carefully clean contact surface -2- for O-ring.*
- Prevent O-rings -1- from rolling when sliding them on. O-rings must not be twisted when fitted on fuel return line.
- Coat new retaining clips for return lines with grease.
- Press return lines onto side of injector and press on retaining clip using long-nose pliers.
- Check that return lines are properly secured by pulling them.



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.

5.12 Removing and installing high-pressure reservoir (rail)

Special tools and workshop equipment required

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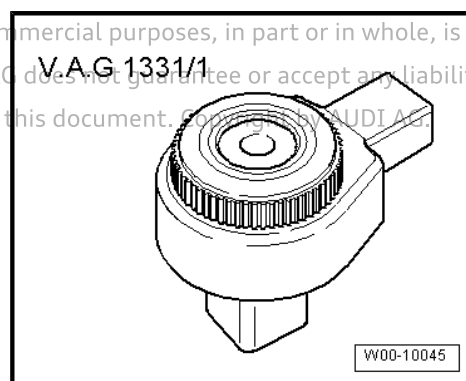


◆ Pliers - 3314-



◆ Ratchet - V.A.G 1331/1-

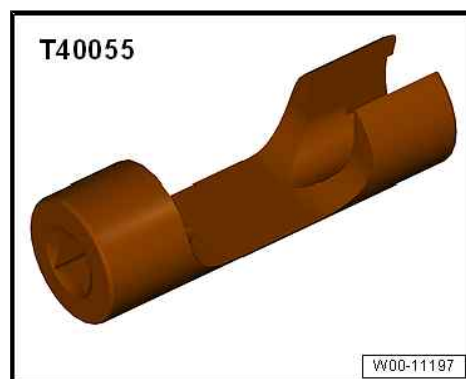
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◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



◆ Socket - T40055-





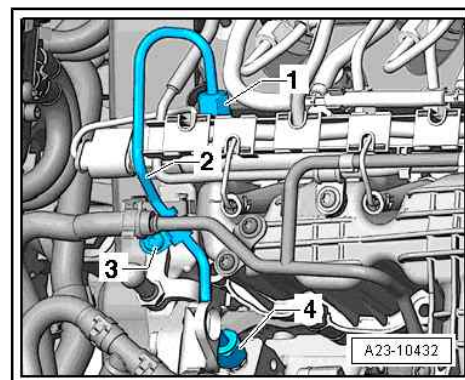
Removing



WARNING

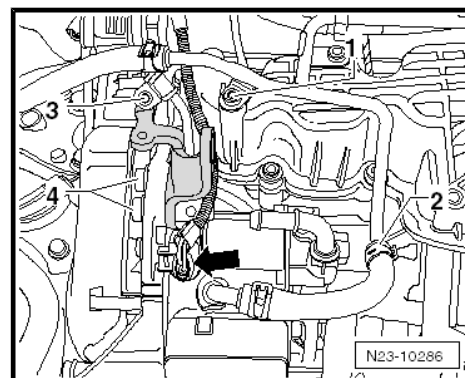
- ◆ *Always read rules for cleanliness and instructions for working on fuel system
⇒ "3.1 Rules for cleanliness", page 6 .*
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

- Remove engine cover panel ⇒ [page 43](#) .
- Unscrew bolt -3- from bracket for high-pressure fuel pipe.
- Unscrew union nuts at high-pressure pump -4- and high-pressure reservoir -1- and remove high-pressure fuel pipe -2-.

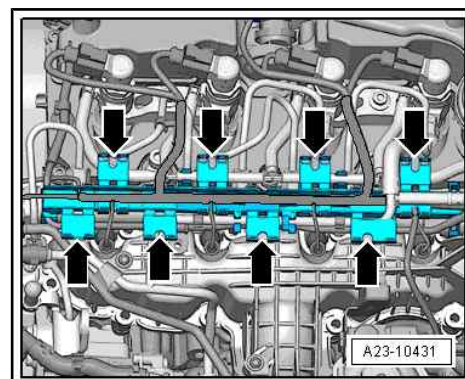


Note

To remove union nut at high-pressure pump, it must be possible to move bracket (for engine lifting eye); to do this, loosen bolts -4-.

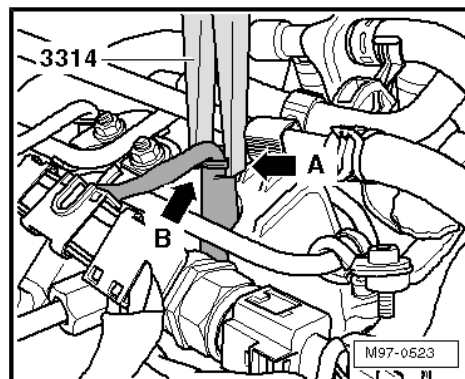


- Open catches -arrows- on cable duct to move clear wiring harness.





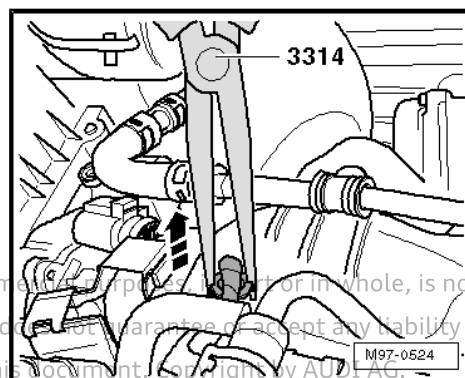
- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B-.



- Carefully unplug connectors from glow plugs in direction of -arrow-.



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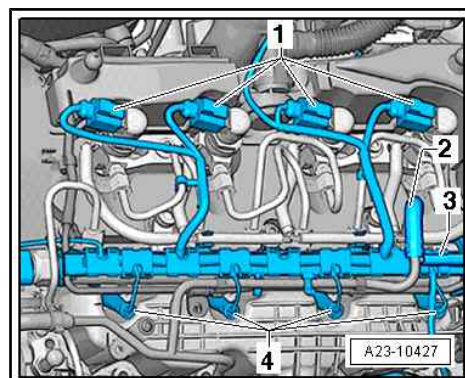


- Unplug electrical connectors -1 and 4-.
- Detach fuel return line -2-.



Note

Disregard -item 3-.

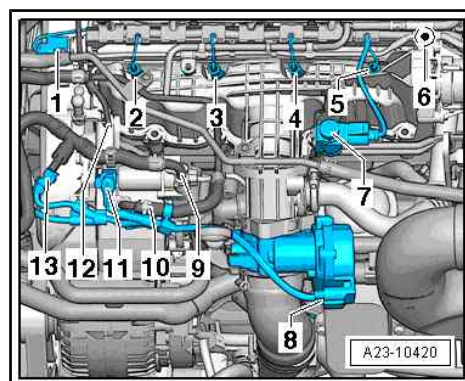


- Unplug electrical connectors -1, 6 and 7-.



Caution

- ◆ **Mark cylinder numbers on high-pressure pipes. They must always be re-installed on the same cylinders.**
- ◆ **Observe rules for cleanliness when working on the injection system.**
- ◆ **Plug open connections with suitable sealing caps immediately.**

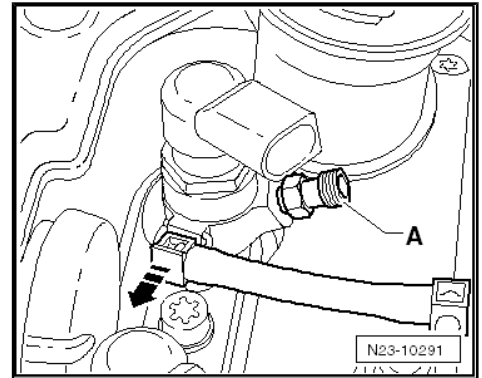


- Remove high-pressure pipes between injectors and high-pressure reservoir.



i Note

- ◆ Counterhold connection -A- to loosen union nuts at injectors.
- ◆ Disregard -arrow-.
- After removal, lay high-pressure pipes on a clean cloth.

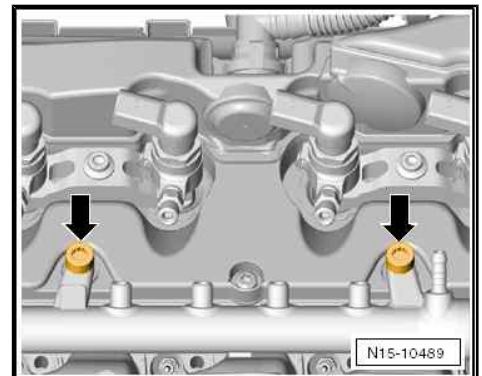


- Unscrew both bolts -arrows- and remove high-pressure reservoir.

Installing

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

- Install high-pressure pipes ⇒ [page 258](#) .



i Note

- ◆ Retaining clips must be renewed.
- ◆ 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.

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- ◆ ⇒ ["5.2 Exploded view - high-pressure reservoir \(rail\)", page 240](#)
- ◆ Engine lifting eye
⇒ ["2.1 Exploded view - cylinder head", page 101](#)



6 Senders and sensors

⇒ ["6.1 Removing and installing fuel pressure regulating valve N276", page 266](#)

⇒ ["6.2 Checking fuel pressure regulating valve N276", page 268](#)

⇒ ["6.3 Removing and installing fuel pressure sender G247", page 270](#)

⇒ ["6.4 Removing and installing air mass meter G70", page 272](#)

⇒ ["6.5 Removing and installing pressure differential sender G505", page 272](#)

6.1 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-





The fuel pressure regulating valve - N276- -6- is located in the fuel rail. It maintains a constant pressure in the fuel rail and the injector pipes.

If the pressure in the high-pressure fuel circuit is too high, the fuel pressure regulating valve - N276- opens to allow some of the fuel to flow back from the fuel rail to the fuel tank via a return line.

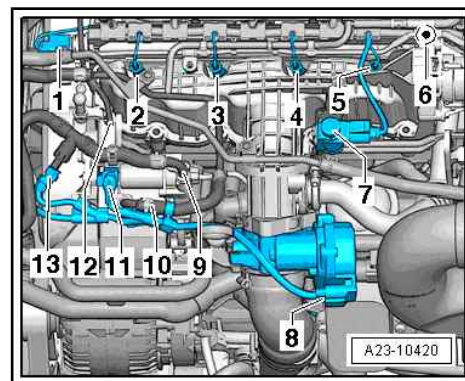
If the pressure in the high-pressure fuel circuit is too low, the fuel pressure regulating valve - N276- closes and seals off the high-pressure section of the system from the low-pressure section.



Note

The fuel pressure regulating valve - N276- cannot be re-used.

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Removing



WARNING

- ◆ **Always observe rules for cleanliness and instructions for working on fuel system**
⇒ **"3.1 Rules for cleanliness", page 6**.
- ◆ **Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.**

- Remove engine cover panel ⇒ [page 43](#).
- Remove fuel rail ⇒ [page 261](#).
- Before removal, clean area around thread for fuel pressure regulating valve - N276- using commercial cleaning solution etc. (no dirt must enter hole in fuel rail).



Note

Clean carefully; cleaning solution must not enter the electrical connector.

- Dry off fuel pressure regulating valve - N276-.
- Loosen union nut at fuel pressure regulating valve - N276- (counterhold at fuel rail). Then remove by hand.
- Remove dirt from thread and sealing surface using vacuum cleaner. Do not use metal tools, etc.



Note

Seal off hole immediately with a suitable plug to prevent dirt from entering.



Installing



Note

- ◆ *The fuel pressure regulating valve - N276- has a deformable sealing lip and no separate seal; it can therefore be used only once.*
- ◆ *Check that sealing surfaces (deformable sealing lip) and threads on new fuel pressure regulating valve - N276- are not damaged.*
- ◆ *Check sealing surface at bore.*
- ◆ *The beginning of the thread, the deformable sealing lip and the O-ring of the fuel pressure regulating valve - N276- must be coated with diesel fuel.*
- Use suitable torque wrench with open-end spanner insert (30 mm) - T10553- to tighten union nut.
- Install fuel rail
 - ⇒ **“5.12 Removing and installing high-pressure reservoir (rail)”: page 261**
- After installation, run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Interrogate event memory.

After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , adaption must be performed. (The procedure is described in Guided Functions.)

- 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.
- Interrogate event memory again.

Tightening torques

- ◆ ⇒ **Fig. ““ Fuel pressure regulating valve -N276- - tightening torque””, page 243**

6.2 Checking fuel pressure regulating valve - N276-

Special tools and workshop equipment required

- ◆ Fuel-resistant measuring container
- ◆ Hose for return line connection

Procedure



WARNING

- ◆ *Always observe rules for cleanliness and instructions for working on fuel system*
⇒ **“3.1 Rules for cleanliness”, page 6** .
- ◆ *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

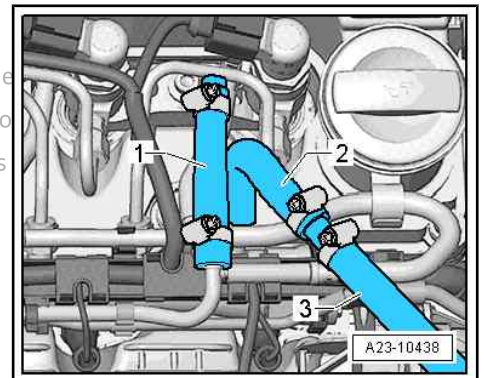
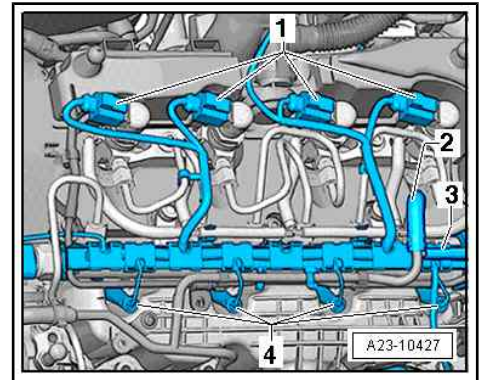
- Remove engine cover panel ⇒ **page 43** .



- Detach fuel return line -2- from fuel rail.



- Seal off open return line connection with a plug -1-.
 - Attach a suitable hose -3- to return line -2-.
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- Hold this hose -1- in a suitable container -2- to measure the return flow rate.

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.

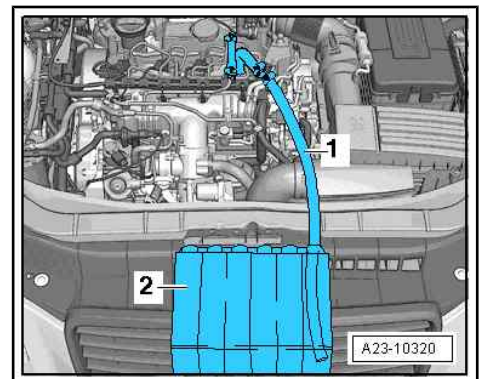
- Fuel is still discharged in the first few seconds after the engine is started
- Specification after a few seconds: return flow rate = 0 ml
- Drip leaks are permissible

If specification is not obtained, fuel pressure regulating valve - N276- 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.





6.3 Removing and installing fuel pressure sender - G247-

The fuel pressure sender - G247- -1- is located in the fuel rail and continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623-

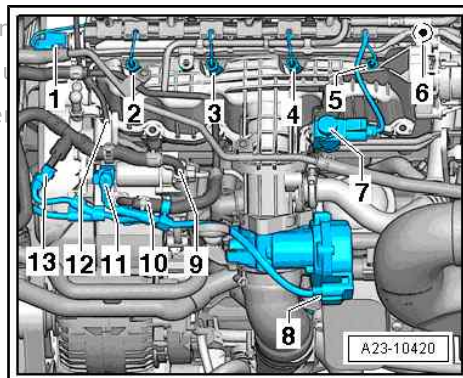
Should the sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function, allowing a maximum of approx. 3000 rpm.

Removing



WARNING

- ◆ **Always observe rules for cleanliness and instructions for working on fuel system**
⇒ **"3.1 Rules for cleanliness", page 6**.
- ◆ **Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.**



- Remove engine cover panel ⇒ **page 43**.
- Before removal, clean area around thread for fuel pressure sender using commercial cleaning solution etc. (no dirt must enter opening in fuel rail).



Note

Clean carefully; cleaning solution must not enter the electrical connector.

- Dry off fuel pressure sender - G247- .

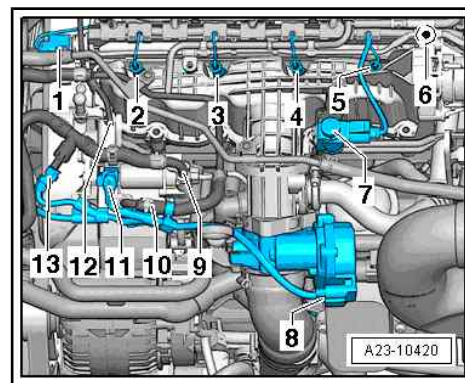


- Unplug electrical connector -1- at fuel pressure sender - G247- .
- Unscrew fuel pressure sender - G247- .
- Extract dirt from opening in fuel rail (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.



Note

Seal off opening in fuel rail immediately with a suitable plug to prevent dirt from entering.



Installing

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



Note

- ◆ *The fuel pressure sender - G247- does not have a seal; instead, it has a deformable sealing lip.*
- ◆ *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure sender - G247- are not damaged. If inspection of fuel pressure sender - G247- shows that it is OK, it can be used again.*
- ◆ *Also check sealing surface at opening in fuel rail.*
- ◆ *The beginning of the thread and the deformable sealing lip of the fuel pressure regulating valve - N276- must be coated with diesel fuel.*
- Screw in fuel pressure sender - G247- by hand.
- Then tighten fuel pressure sender - G247- to specified torque.

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.

- Interrogate event memory and erase it if necessary.
- 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.

Tightening torques

- ♦ ⇒ Fig. ““Fuel pressure sender -G247- - tightening torque””, page 243

6.4 Removing and installing air mass meter - G70-

Removing

- Remove engine cover panel ⇒ page 43 .
- Unplug electrical connector -1-.
- Release hose clip -2- and detach air hose.
- Unscrew bolts -arrows- and carefully pull air mass meter - G70- out of guide in air cleaner housing.

Installing

To ensure that the air mass meter -G70- functions correctly, it is important to observe the following notes and procedures.



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 renew O-ring for air mass meter if damaged (air leak).*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

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

Tightening torques

- ♦ ⇒ “3.1 Exploded view - air cleaner housing”, page 227

6.5 Removing and installing pressure differential sender - G505-

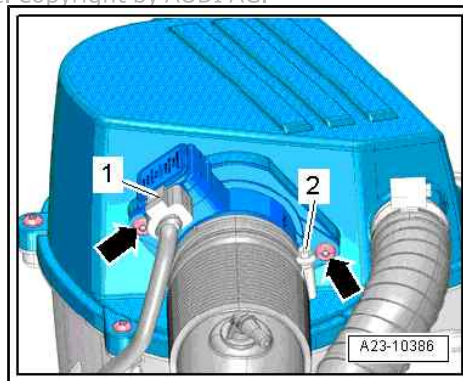
The pressure differential sender - G505- detects the amount of deposits in the particulate filter.

Special tools and workshop equipment required

- ♦ Vehicle diagnostic tester

Removing

- Remove engine cover panel ⇒ page 43 .





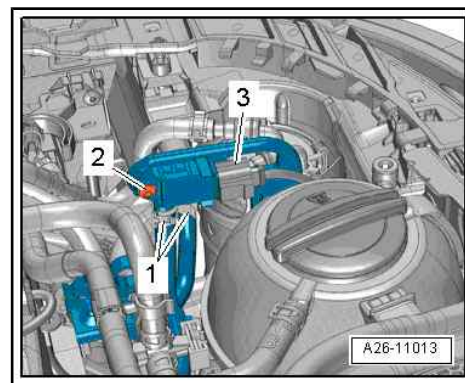
- Unplug electrical connector -3-.
- Release hose clips -1- and spray hoses at pressure differential sender - G505- with silicone-free lubricant before detaching.



Note

The two connections can easily break off the pressure differential sender - G505-.

- Carefully disconnect the hoses from their connections (take care to keep the hoses straight).
- Remove bolt -2- and detach pressure differential sender - G505- from bracket -arrow-.



Installing

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



Note

- ◆ *Before installing, blow out control pipes from pressure differential sender - G505- to particulate filter towards particulate filter with compressed air (pipes can become obstructed or may ice up due to condensation).*
- ◆ *Make sure that hoses are securely fitted and seal properly.*
- ◆ *If control pipes have been released from particulate filter, tighten to 45 Nm.*

After renewing pressure differential sender - G505- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use ⇒ Vehicle diagnostic tester.

Tightening torques

- ◆ ⇒ ["8.1 Exploded view - Lambda probe", page 279](#)

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7 High-pressure pump

⇒ "7.1 Exploded view - high-pressure pump", page 274

⇒ "7.2 Removing and installing high-pressure pump", page 275

7.1 Exploded view - high-pressure pump

1 - Bracket for ancillaries

- ☐ Removing and installing
⇒ page 56

2 - Bolt

- ☐ 2x
- ☐ Renew
- ☐ 20 Nm +180°

3 - Hub

- ☐ Use counterhold tool - T10051- to loosen and tighten
- ☐ To remove, use puller - T40064-

4 - High-pressure pump sprocket

5 - Bolt

- ☐ 3x
- ☐ Renew
- ☐ 20 Nm

6 - Nut

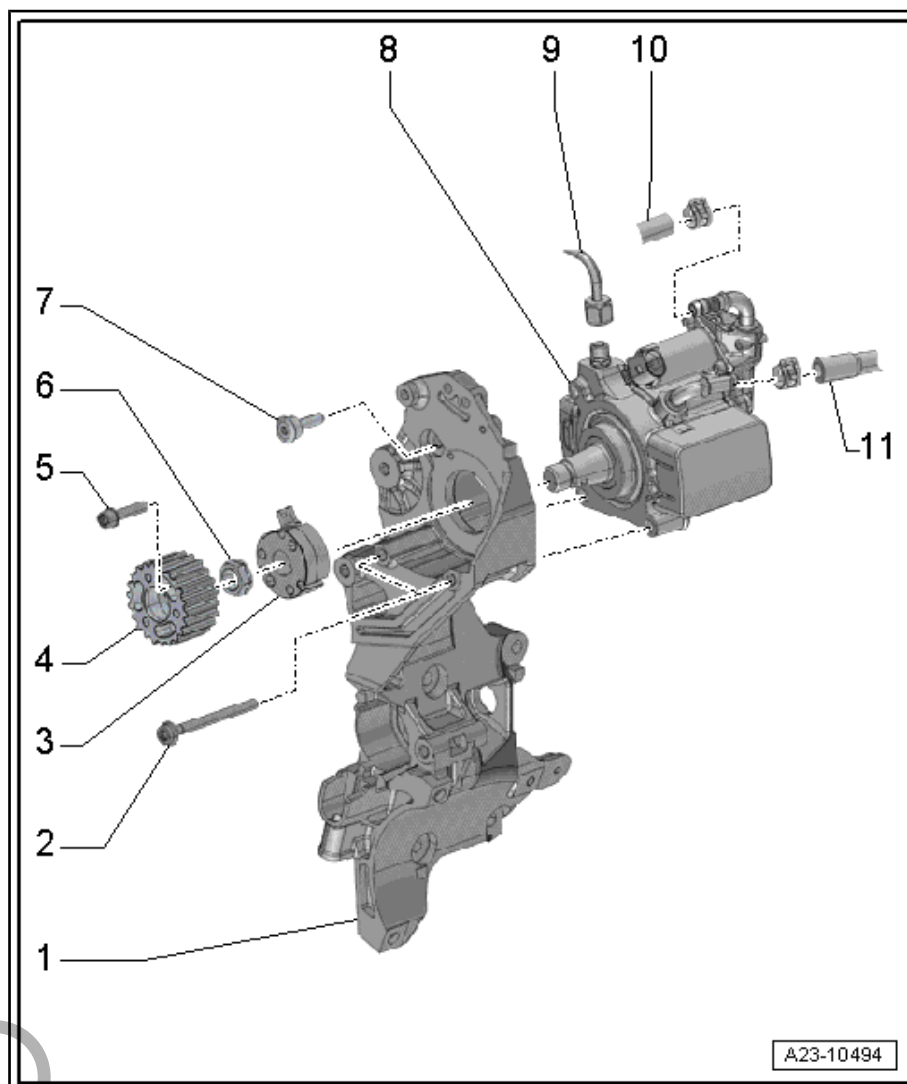
- ☐ 95 Nm

7 - Bolt

- ☐ Renew
- ☐ 20 Nm +45°

8 - High-pressure pump

- ☐ After installing the high-pressure pump, the pump must be filled with fuel before the engine is started for the first time
⇒ page 222



A23-10494

- ☐ After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester

- ☐ With fuel metering valve - N290- (do not open)
- ☐ Removing and installing ⇒ page 275

9 - High-pressure pipe

- ☐ Between high-pressure pump and fuel rail
- ☐ Do not alter shape
- ☐ Check for damage before re-installing
- ☐ Always renew high-pressure pipe when renewing high-pressure pump.
- ☐ Removing and installing ⇒ page 258
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm



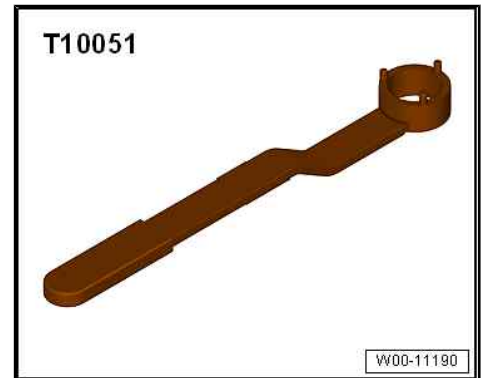
10 - Fuel supply hose

11 - Fuel return line

7.2 Removing and installing high-pressure pump

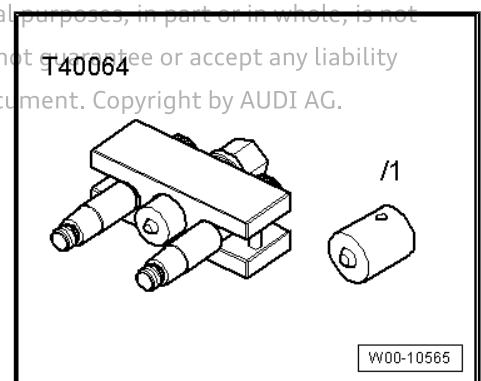
Special tools and workshop equipment required

- ◆ Counterhold tool - T10051-



- ◆ Puller - T40064- with T40064/1

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Removing



Caution

Risk of malfunctions caused by dirt.

- ◆ ***Observe ⇒ "3.1 Rules for cleanliness", page 6 .***

The high-pressure fuel pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start quickly after parts have been renewed, it is important to observe the following:

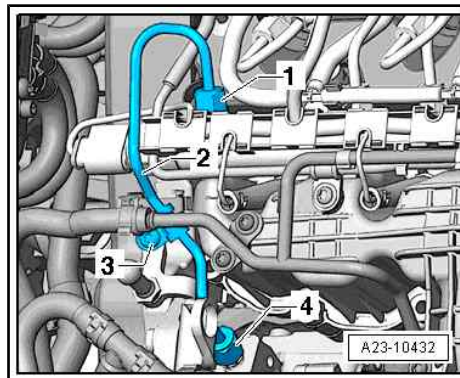
- ◆ ***If the high-pressure pump is removed or renewed, the fuel system must be bled before the engine is started for the first time.***

Procedure for first fuel filling ⇒ page 222

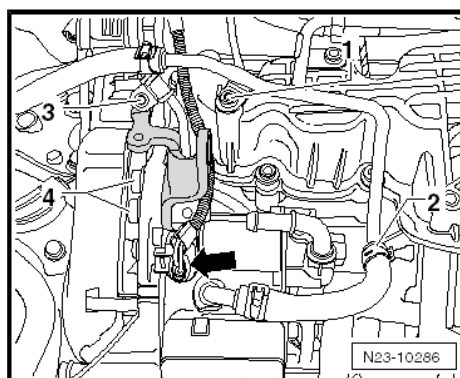
- Remove toothed belt from camshaft and high-pressure pump
⇒ [page 88](#) .



- Unscrew bolt -3- from bracket for high-pressure fuel pipe.



- Remove bracket (for engine lifting eye). To do so, loosen bolts -4-.



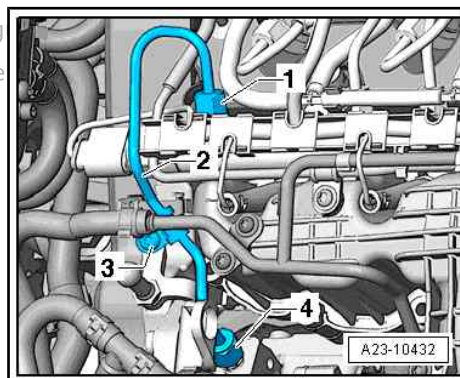
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- Unscrew union nuts at high-pressure pump -4- and fuel rail -1- and remove high-pressure fuel pipe -2-.

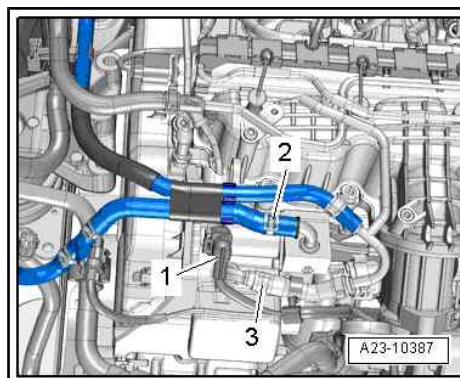


Note

Do not bend fuel lines.

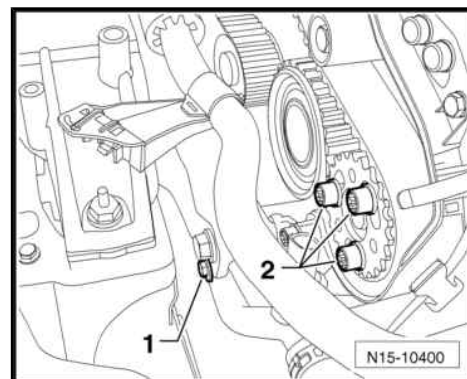


- Unplug electrical connector -1- at fuel metering valve - N290- .
- Detach fuel lines -2 and 3- from high-pressure pump.

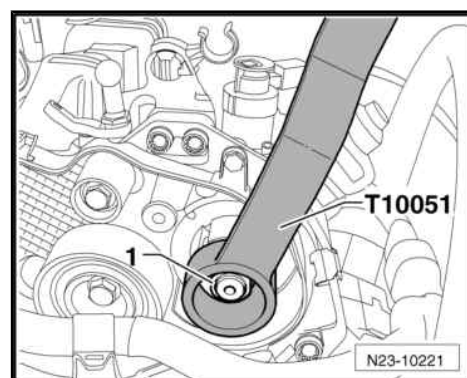




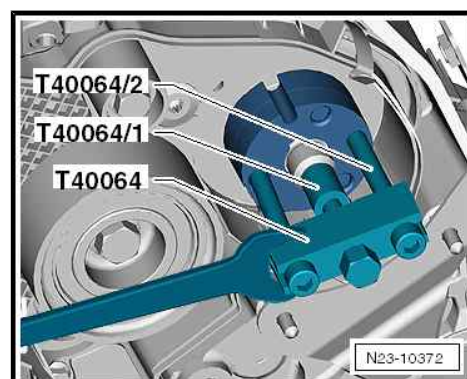
- Remove bolts -2- and detach toothed belt sprocket from high-pressure pump.



- Counterhold hub of high-pressure pump using counterhold tool - T10051- and unscrew securing nut -1-.



- Apply puller - T40064- with thrust piece - T40064/1- and pin - T40064/2- as shown in illustration and pull hub off high-pressure pump. If necessary, counterhold using an open-end spanner (24 mm).





- Unscrew securing bolts -arrows- for high-pressure pump.
- Carefully take out high-pressure pump.

Installing

Installation is carried out in reverse sequence.

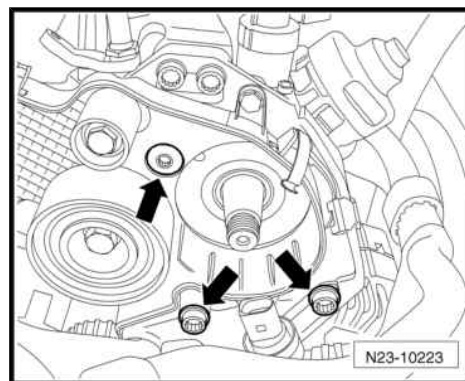
- Install high-pressure pipe ⇒ [page 258](#) .
- Install toothed belt for camshaft and high-pressure pump ⇒ [page 88](#) .



Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ *After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time ⇒ [page 222](#) .*



After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , adaption must be performed. The adaption procedure is described in the Guided Fault Finding or Guided Functions; use ⇒ Vehicle diagnostic tester.

Tightening torques

- ◆ ⇒ [“7.1 Exploded view - high-pressure pump”, page 274](#)



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8 Lambda probe

⇒ "8.1 Exploded view - Lambda probe", page 279

⇒ "8.2 Removing and installing Lambda probe", page 280

8.1 Exploded view - Lambda probe

⇒ "8.1.1 Exploded view - Lambda probe, close-coupled particulate filter", page 279

⇒ "8.1.2 Exploded view - Lambda probe, particulate filter installed away from engine", page 280

8.1.1 Exploded view - Lambda probe, close-coupled particulate filter

1 - Exhaust gas temperature sender 4 - G648-

- ☐ Removing and installing
⇒ page 308

2 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing
⇒ page 304

3 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing
⇒ page 307

4 - Pressure differential sender - G505-

- ☐ 8 Nm
- ☐ Removing and installing
⇒ page 272

- ☐ Pressure pipes to particulate filter: 45 Nm

5 - Lambda probe - G39- with Lambda probe heater - Z19-

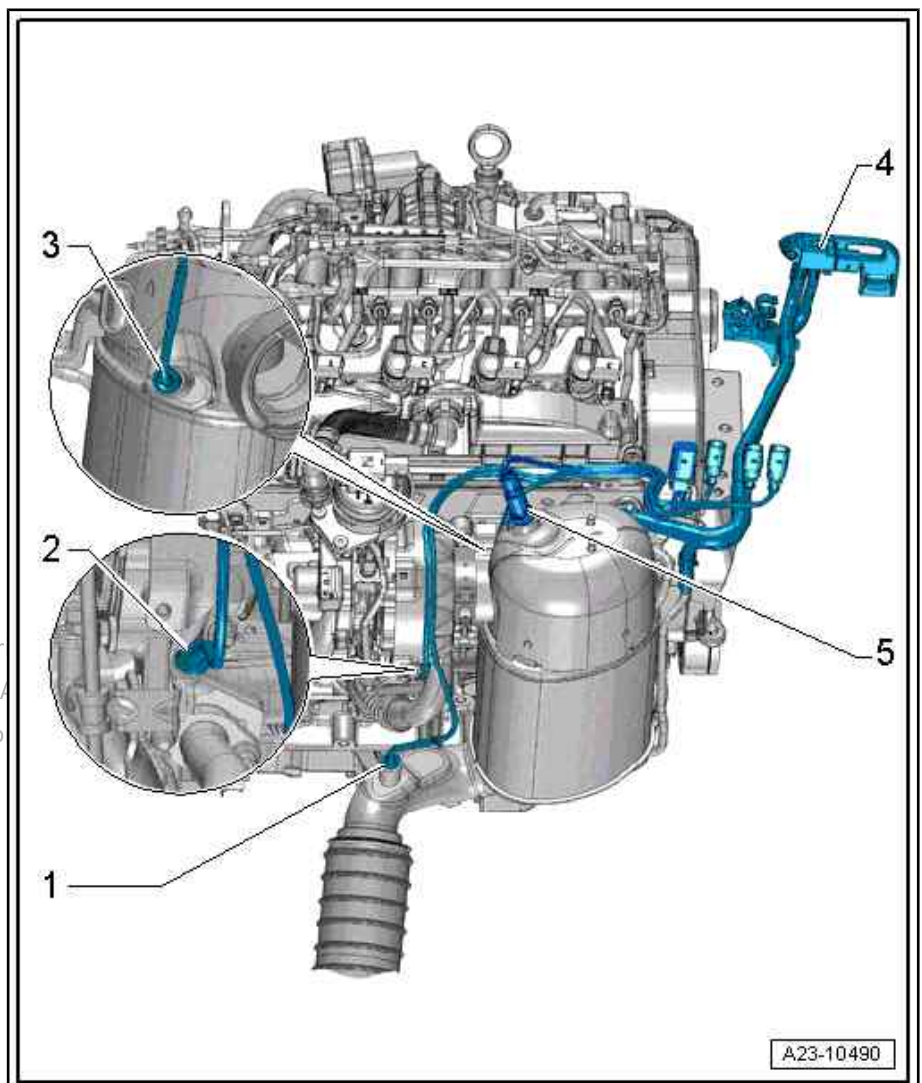
- ☐ Removing and installing
⇒ page 280

- ☐ New Lambda probes are coated with an assembly paste

- ☐ If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste

- ☐ High-temperature paste must not get into slots on Lambda probe body

- ☐ 55 Nm





8.1.2 Exploded view - Lambda probe, particulate filter installed away from engine

1 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing
⇒ [page 280](#)
- ☐ New Lambda probes are coated with an assembly paste
- ☐ If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste
- ☐ High-temperature paste must not get into slots on Lambda probe body
- ☐ 55 Nm

2 - Seal

- ☐ Renew
- ☐ Note installation position

3 - Clamp

4 - Exhaust gas temperature sender 4 - G648-

- ☐ Removing and installing
⇒ [page 308](#)

5 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing
⇒ [page 307](#)

6 - Bracket for pressure differential sender - G505-

7 - Clamps

8 - Control pipes

9 - Pressure differential sender - G505-

- ☐ 8 Nm
- ☐ Removing and installing ⇒ [page 272](#)
- ☐ Pressure pipes to particulate filter: 45 Nm

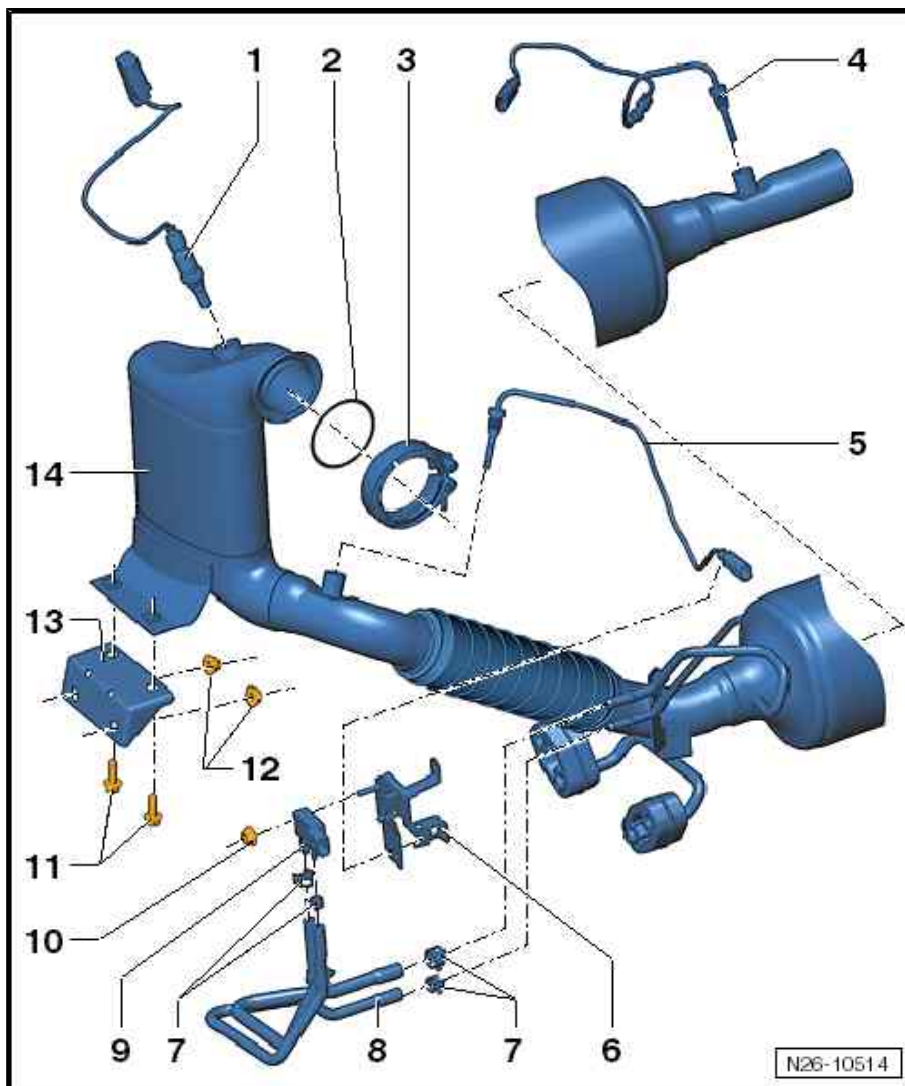
10 - Nut

11 - Bolt

12 - Nut

13 - Bracket

14 - Catalytic converter with particulate filter installed away from engine



8.2 Removing and installing Lambda probe

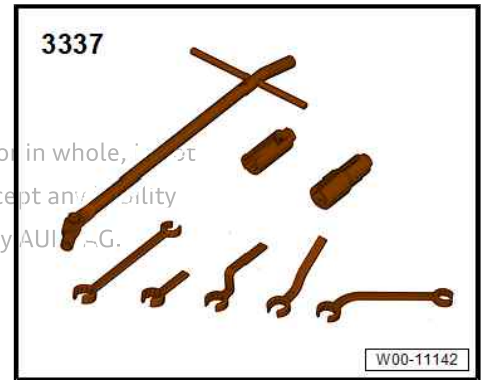
Special tools and workshop equipment required

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◆ Lambda probe open ring spanner set - 3337-

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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 5**.*

- Remove engine cover panel ⇒ [page 43](#).
- Unplug electrical connector -4- for Lambda probe - G39-.
- Unscrew Lambda probe - G39- -2- using tool from Lambda probe open ring spanner set - 3337-.

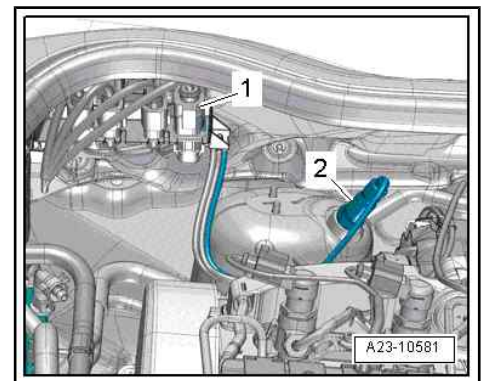
Installing

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 ⇒ *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.*



Tightening torques

- ◆ ⇒ ["8.1 Exploded view - Lambda probe", page 279](#)



9 Engine control unit

⇒ ["9.1 Removing and installing engine control unit J623", page 282](#)

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

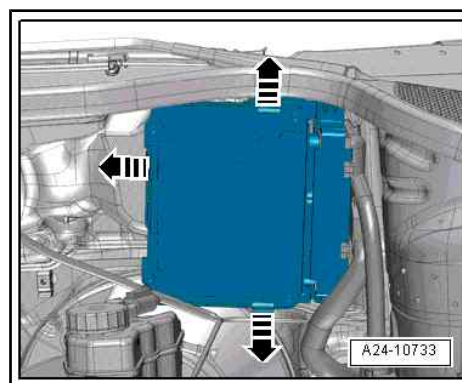
Removing

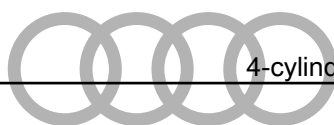
- If the engine control unit - J623- is renewed, the adaption values must be read out and stored before the engine control unit - J623- is removed.
- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options 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.
- Remove air cleaner housing
⇒ ["3.2 Removing and installing air cleaner housing", page 229](#).

Engine control unit without protective housing

- Release fasteners -arrows- and detach engine control unit - J623- from bracket.

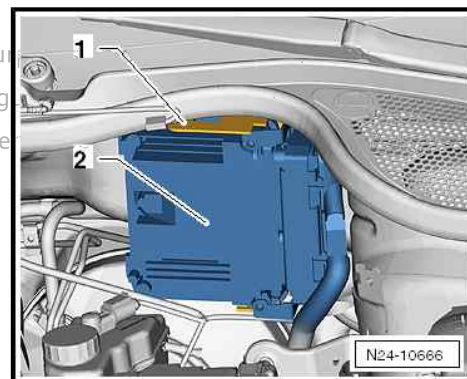
Engine control unit with protective housing



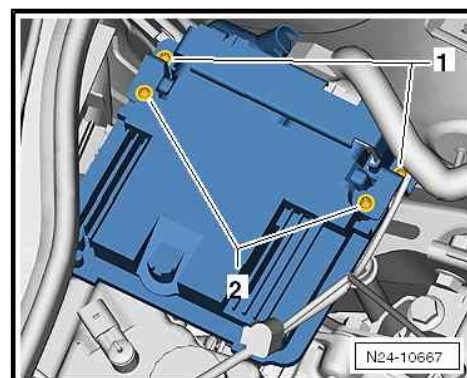


- Lift fastener -1- and detach engine control unit -2-.

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- Remove shear bolts -1- using pliers.



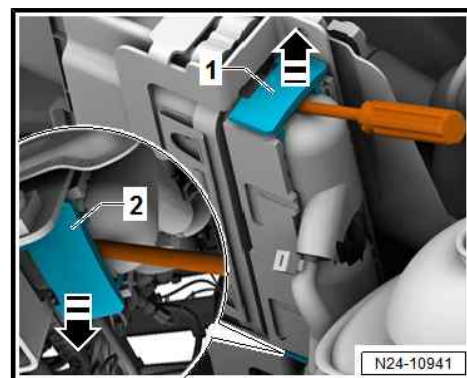
All versions

- 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.

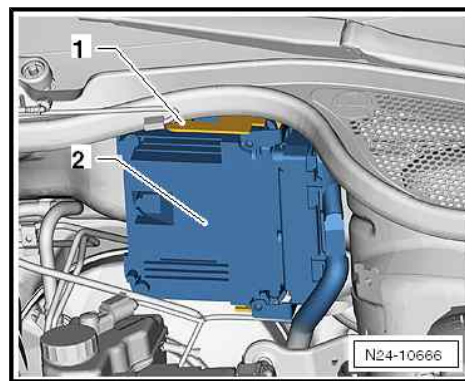


Installing

- 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.
- If engine control unit - J623- has been renewed, connect ⇒ Vehicle diagnostic tester, switch on ignition and select Replace engine control unit in Guided Functions mode.



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26 – Exhaust system

1 Exhaust pipes/silencer

⇒ [“1.1 Exploded view - silencer”, page 285](#)

⇒ [“1.3 Stress-free alignment of exhaust system”, page 288](#)

⇒ [“1.4 Checking exhaust system for leaks”, page 288](#)

1.1 Exploded view - silencer

1 - Exhaust pipe with silencer

- ☐ Cutting point
- ☐ Indicated by indentations on exhaust pipe
- ☐ Silencer and exhaust pipe are one unit as original equipment. For repair purposes, silencer and exhaust pipe are supplied separately (together with a clamp).
- ☐ Cut through connecting pipe at right angles e.g. using pneumatic sabre saw - V.A.G 1523A- at position marked (wear safety goggles).
- ☐ When installing, position double clamp provided for repair at side markings.
- ☐ Tighten bolts for clamp (double clamp for repairs) evenly; tightening torque: M 8 = 25 Nm, M10 = 40 Nm
- ☐ Before tightening clamp, align exhaust system so it is free of stress while it is still cold.

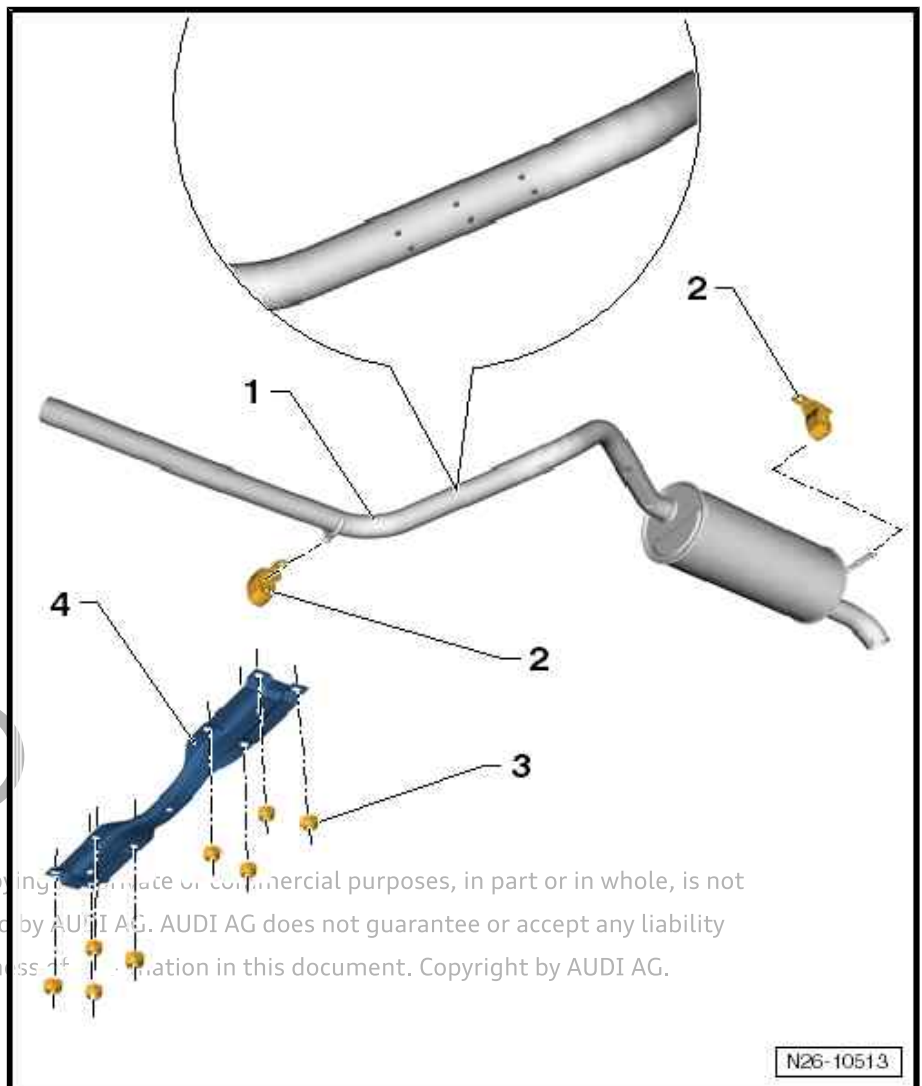
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2 - Retaining ring

- ☐ 23 Nm
- ☐ Renew if damaged

3 - 20 Nm

4 - Tunnel cross-piece



N26-10513

**Tightening torque and installation position of clamp**

Clamp -A- (comprising two separate clamps)

Tightening torque: 25 Nm

Installation dimension -a- = 5 mm (for front clamp only)

Clamp -B- (comprising one continuous clamp)

Tightening torque: 35 Nm

Installation dimension -a- = 6.6 mm (for front clamp only)



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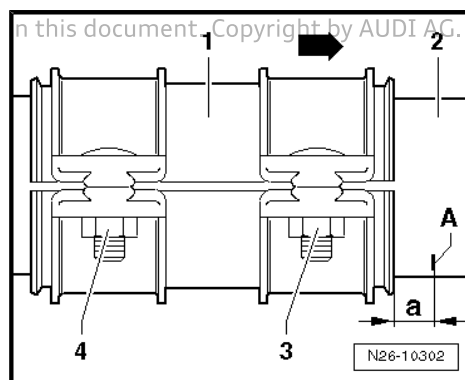
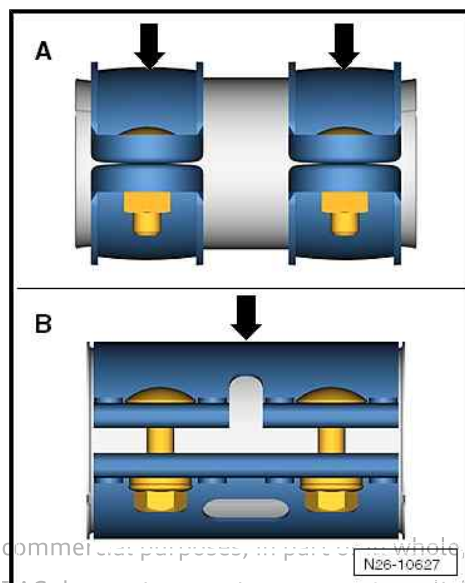
Installation dimension -a- for vehicles with marking on front exhaust pipe

1 - Clamp

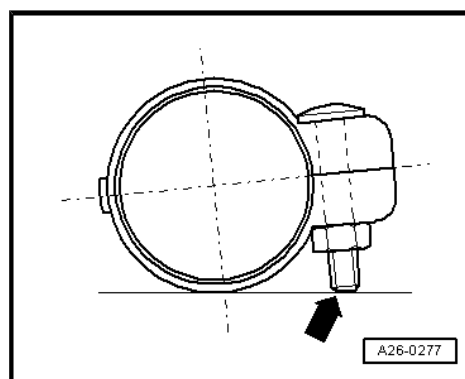
2 - Front exhaust pipe

a - Installation dimension

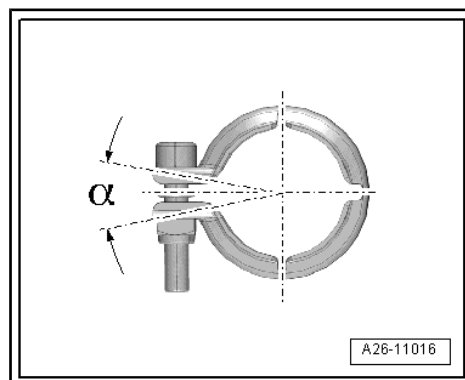
A - Marking

**Installation position of clamp**

- Install clamp so that ends of bolts do not protrude beyond bottom of clamp -arrow-.
- Bolted connection facing towards right

**Installation position of clamp for particulate filter**

- Angle α = $0 \pm 10^\circ$
- End of bolt faces downwards.





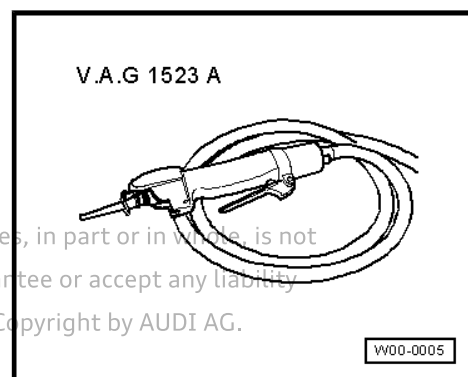
1.2 Separating components of exhaust system

Special tools and workshop equipment required

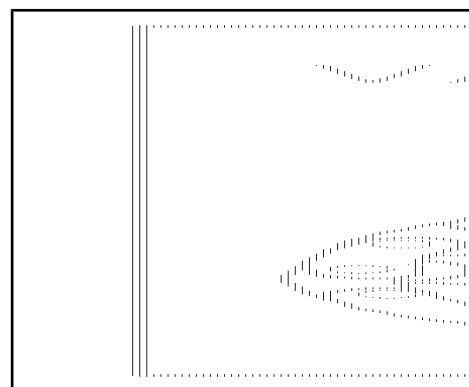
- ◆ Body repair saw , e.g. -V.A.G 1523 A-



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- ◆ Or
- ◆ Chain pipe cutter - VAS 6254-



- ◆ Safety goggles

Procedure

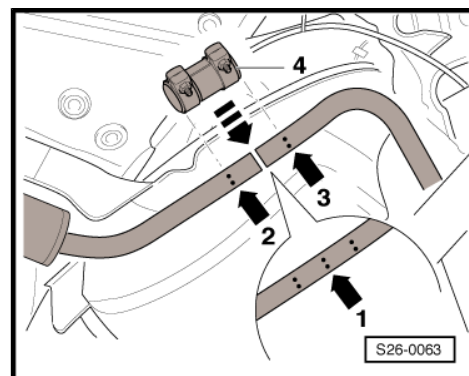
Indentations on the exhaust pipe mark the cutting point for separating the exhaust pipe and silencer.



WARNING

Put on safety goggles.

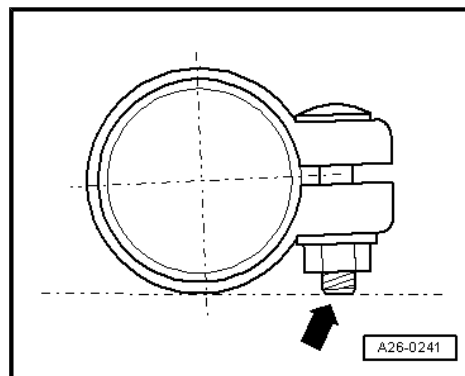
- Using a body saw, cut through exhaust pipe at a right angle at cutting location -arrow 1-.
- Position double clamp -4- at side marks when installing -arrow 2- and -arrow 3-.





- Install clamp so that bolt end does not protrude beyond bottom of clamp -arrow-.
- Bolt connection faces to right.
- Tighten bolt connections of double clamp evenly to 23 Nm.

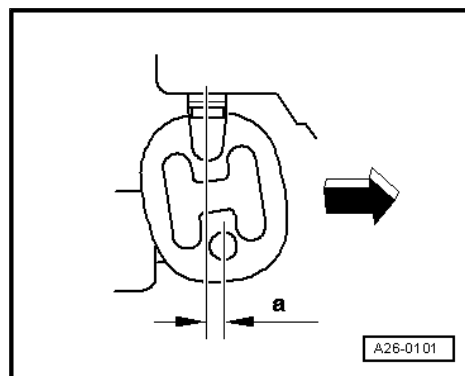
Before tightening clamp, align exhaust system so it is free of stress while it is cold ⇒ [page 288](#)



1.3 Stress-free alignment of exhaust system

Procedure

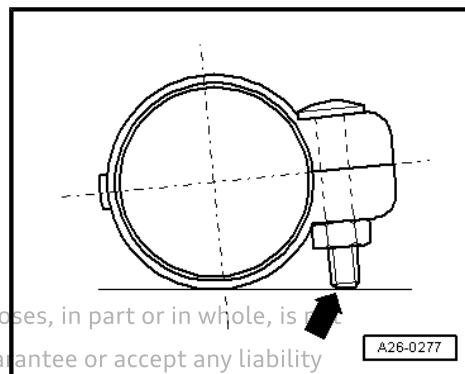
- The exhaust system must be aligned when it is cool.
- Loosen bolt connections for front clamp.
- Push exhaust system towards front of vehicle -arrow- so that mounting for rear silencer is preloaded by -a- = 15 ... 17 mm.



- Install clamp so that ends of bolts do not protrude beyond bottom of clamp -arrow-.
- Bolted connection facing towards right
- Tighten bolt connections on clamp evenly.



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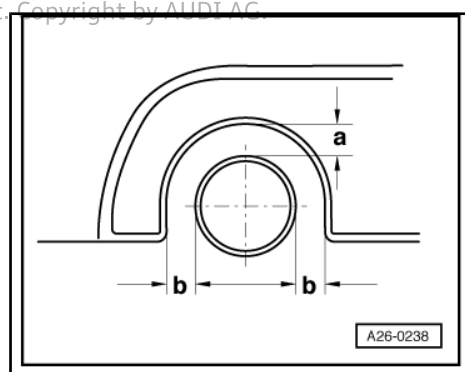


Aligning tailpipe

- 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 285](#)



1.4 Checking exhaust system for leaks

Procedure

- Start the engine and run at idling speed.
- Plug tailpipe during leak test (e.g. with cloth or plugs).



- 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

⇒ ["2.3 Removing and installing particulate filter", page 294](#)

2.1 Exploded view - front exhaust pipe with particulate filter, left-hand drive vehicles



Note

- ◆ *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body.*
- ◆ *If necessary, loosen double and single clamps and align silencers and exhaust pipes so that there is sufficient clearance from the body at all points, and so that the mountings are evenly loaded.*
- ◆ *If the particulate filter or pressure differential sender - G 505- has been renewed, the pressure differential sender - G 505- must be adapted using the vehicle diagnostic tester ; select "Guided Functions", Adapt pressure differential sender - G 505- .*
- ◆ *Removing and installing exhaust manifold with turbocharger
⇒ [page 202](#)*
- ◆ *The flexible joint (de-coupling element) in the front exhaust pipe must not be bent more than 10°; otherwise it can be damaged.*
- ◆ *Renew seals, gaskets and self-locking nuts.*



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**1 - Pressure differential sender
- G 505-**

2 - Bolt

- ☐ 3 Nm

3 - Control pipes

4 - Clamps

**5 - Exhaust gas temperature
sender 4 - G 648-**

- ☐ Grease thread of sender with high-temperature paste - G 052 112 A3-
- ☐ 45 Nm

6 - Lambda probe - G 39-

- ☐ Lubricate threads only with high-temperature paste - G 052 112 A3-
- ☐ High-temperature paste - G 052 112 A3- must not get into slots on body of Lambda probe
- ☐ Remove using Lambda probe open ring spanner set - 3337-
- ☐ 50 Nm

7 - Heat shield

8 - Nuts

- ☐ 9 Nm

9 - Particulate filter

- ☐ Removing and installing
⇒ [page 294](#)

10 - Seal

- ☐ Renew
- ☐ Note installation position

11 - Clamp

- ☐ 7 Nm

12 - Nuts

- ☐ 25 Nm

13 - Bolts

- ☐ 25 Nm

14 - Bracket

- ☐ Bolted to cylinder block

15 - Exhaust gas temperature sender 3 - G 495- , 45 Nm

- ☐ Grease thread of sender with high-temperature paste - G 052 112 A3-
- ☐ Remove using tool set - T10395/6 -

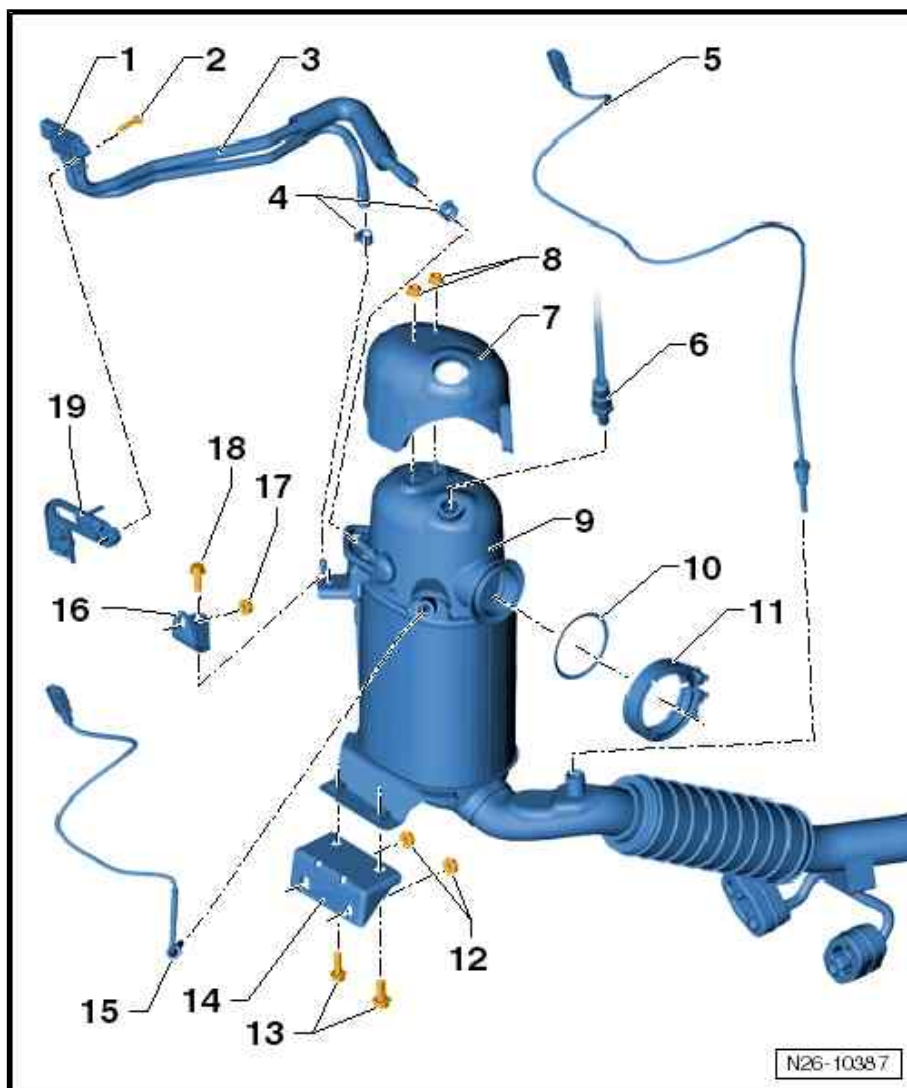
16 - Retainer

17 - Nuts

- ☐ 25 Nm

18 - Bolts

- ☐ 45 Nm



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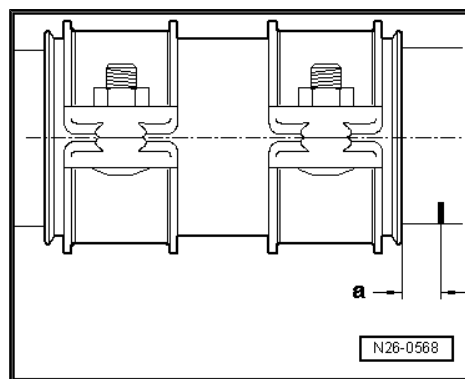
- ☐ For control pipe

19 - Bracket

- ☐ For pressure differential sender - G 505-

Installation position of clamp

- Position double clamp at distance -a- = 5 mm from marking on front exhaust pipe.



2.2 Exploded view - front exhaust pipe with particulate filter, right-hand drive vehicles

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Note

- ◆ After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body.
- ◆ If necessary, loosen double and single clamps and align silencers and exhaust pipes so that there is sufficient clearance from the body at all points, and so that the mountings are evenly loaded.
- ◆ If the particulate filter or pressure differential sender - G 505- has been renewed, the pressure differential sender - G 505- must be adapted using the vehicle diagnostic tester ; select "Guided Functions", Adapt pressure differential sender - G 505- .
- ◆ Removing and installing exhaust manifold with turbocharger
⇒ [page 202](#)
- ◆ The flexible joint (de-coupling element) in the front exhaust pipe must not be bent more than 10°; otherwise it can be damaged.
- ◆ Renew seals, gaskets and self-locking nuts.



1 - Lambda probe - G 39-

- ☐ 50 Nm
- ☐ Lubricate threads only with high-temperature paste - G 052 112 A3-
- ☐ High-temperature paste - G 052 112 A3- must not get into slots on body of Lambda probe
- ☐ Remove using Lambda probe open ring spanner set - 3337-

2 - Seal

- ☐ Renew
- ☐ Note installation position

3 - Clamp

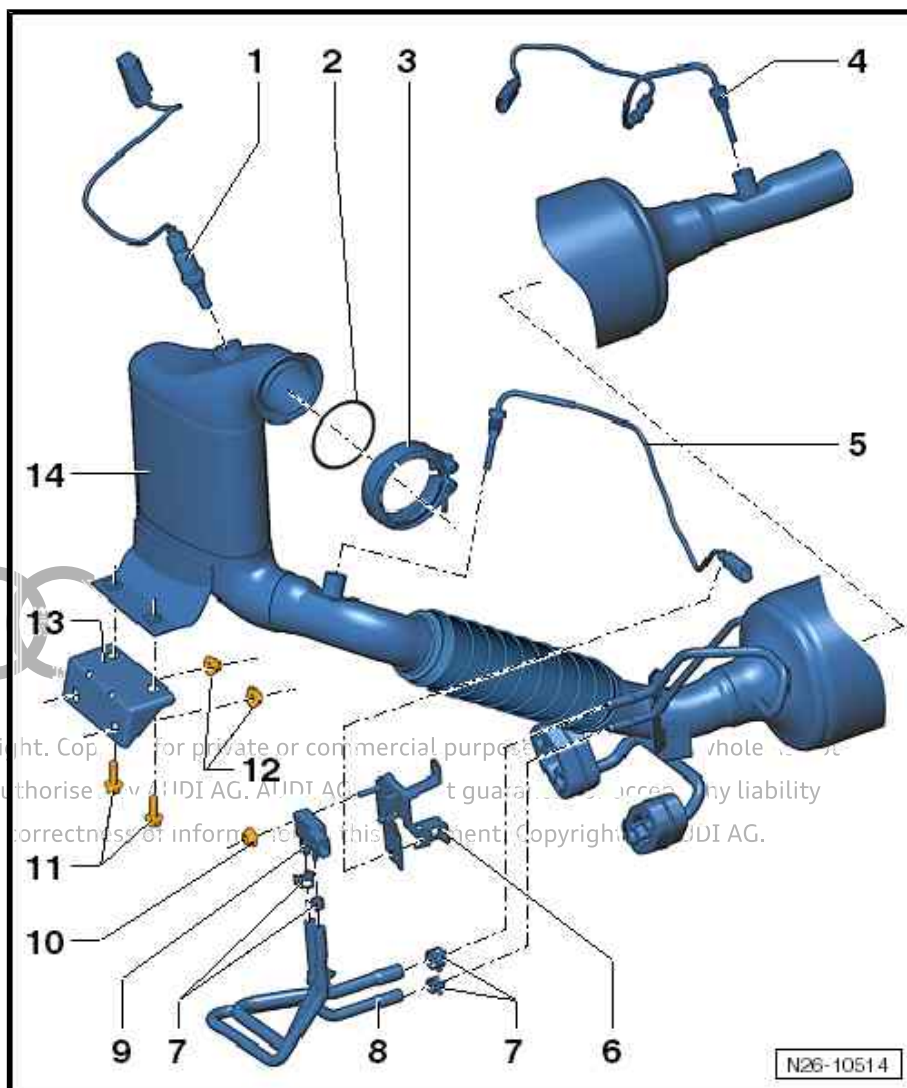
- ☐ 7 Nm

4 - Exhaust gas temperature sender 4 - G 648-

- ☐ 45 Nm
- ☐ Grease thread of sender with high-temperature paste - G 052 112 A3-
- ☐ Removing and installing ⇒ [page 310](#)

5 - Exhaust gas temperature sender 3 - G 495-

- ☐ 45 Nm
- ☐ Grease thread of sender with high-temperature paste - G 052 112 A3-
- ☐ Removing and installing ⇒ [page 310](#)



6 - Bracket for pressure differential sender - G 505-

7 - Clamps

8 - Control pipes

9 - Pressure differential sender - G 505-

- ☐ Removing and installing ⇒ [page 272](#)

10 - Nuts

- ☐ 4.5 Nm

11 - Bolts

- ☐ 25 Nm

12 - Nuts

- ☐ 25 Nm

13 - Bracket

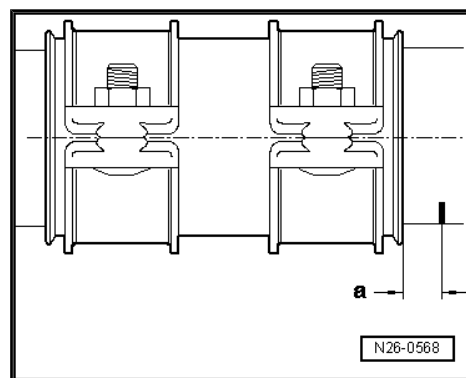
- ☐ Bolted to cylinder block

14 - Particulate filter



Installation position of clamp

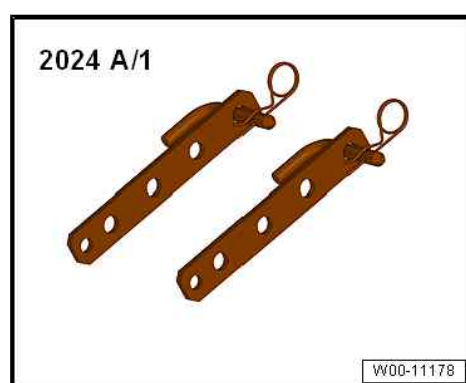
- Position double clamp at distance -a- = 5 mm from marking on front exhaust pipe.



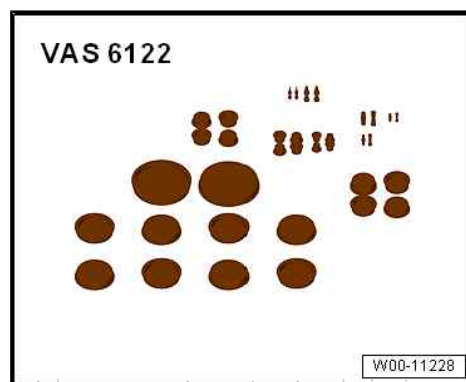
2.3 Removing and installing particulate filter

Special tools and workshop equipment required

- ◆ Hook -2024 A /1- of lifting tackle - 2024 A-



- ◆ Engine bung set - VAS 6122-



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Removing



Note

Fit all cable ties in the original positions when installing.



WARNING

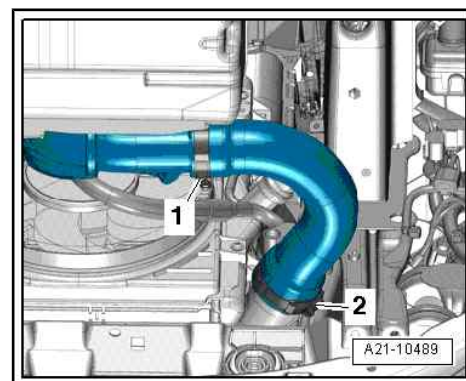
When working on all parts of the exhaust system:

- ◆ **Observe safety precautions when working on the exhaust system**
⇒ **"2.5 Safety precautions when working on the exhaust system", page 5**.

- Remove Lambda probe - G39- ⇒ [page 280](#) .



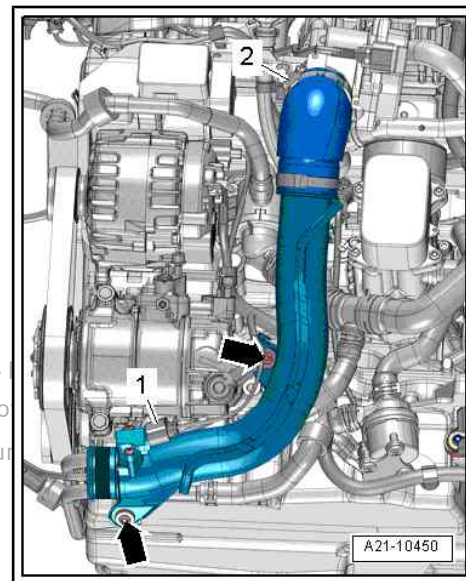
- Remove exhaust gas temperature sender 3 - G495-
⇒ [page 307](#) .
- Remove exhaust gas temperature sender 4 - G648-
⇒ [page 308](#) .
- Remove radiator cowl ⇒ [page 197](#) .
- Remove coolant pipes (right-side) ⇒ [page 190](#) .
- Remove heat shield for tunnel ⇒ General body repairs, exterior; Rep. gr. 66 ; Strips / trim panels / extensions; Exploded view - heat shield .
- Remove wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Release hose clips -1- and -2- and remove air hose.
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



Vehicles with air conditioner:

- Remove poly V-belt ⇒ [page 51](#) .
- Remove bolts -arrows-.
- Release hose clip -2-.
- Unplug electrical connector -1- on charge pressure sender - G31- / intake air temperature sender - G42- and move clear electrical wiring.
- Detach air pipe (right-side).

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

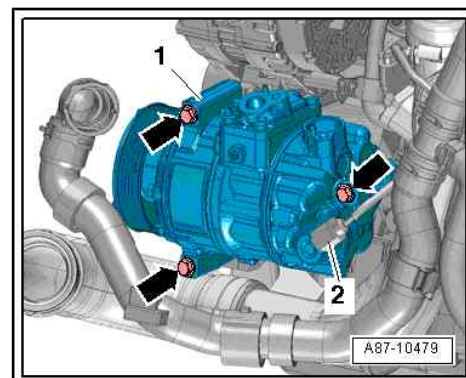


Caution

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

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

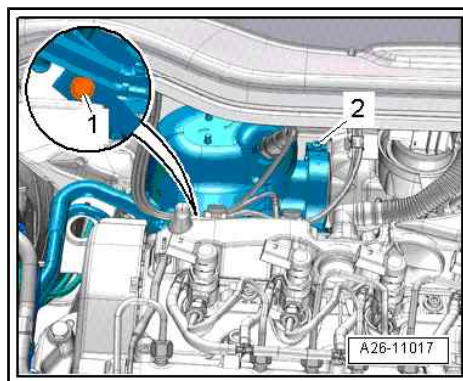
- Remove bolts -arrows-, detach air conditioner compressor -1- with pipe/hose assemblies connected and tie up to front.



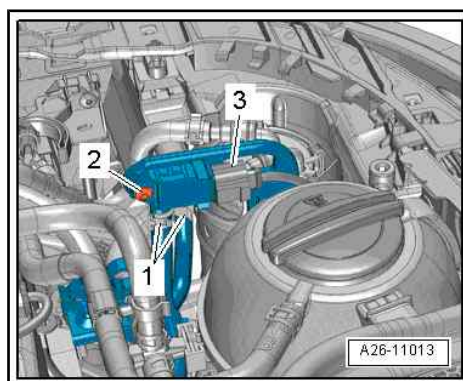


All vehicles (continued):

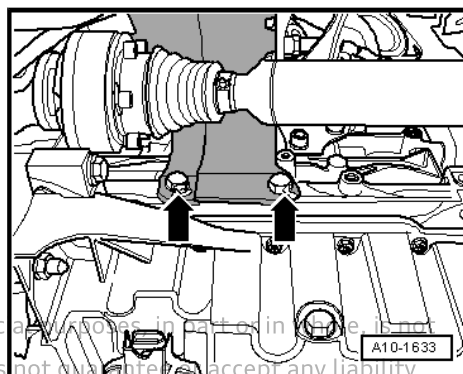
- Remove bolt -1-.
- Slacken bolt -2- and remove clamp.



- Unplug electrical connector -3-.
- Unscrew bolt -2-, detach pressure differential sender - G505- and move clear hoses -1-.



- If fitted, remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Unbolt drive shaft (right-side) from gearbox flange.



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WARNING

Risk of accident.

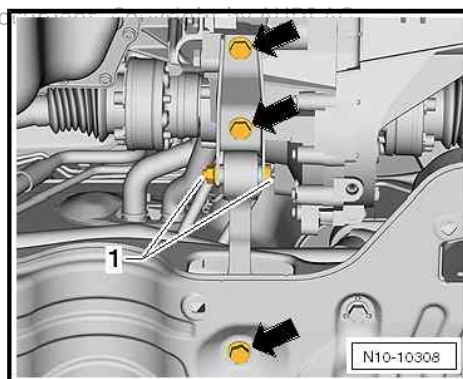
- ◆ **Do NOT loosen bolted connection -1-.**

- Remove bolts -top arrows-.



Note

Disregard -bottom arrow-.





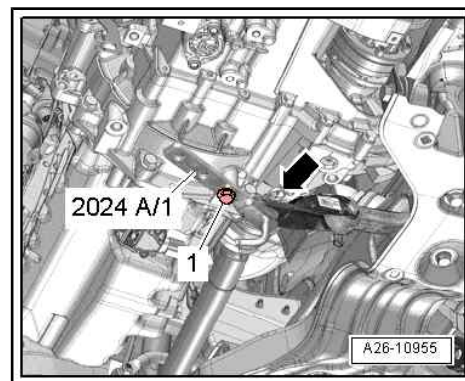
- Press engine/gearbox assembly towards lock carrier and support using extension -2024 A /1- , as shown in illustration.



WARNING

Accident risk from loose components of support bracket.

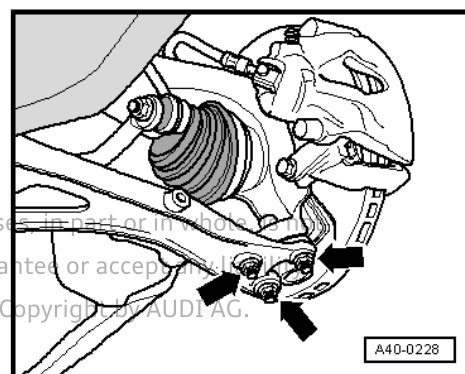
- ◆ *Secure retaining pin with locking pin -arrow- and extension -2024 A /1- with bolt -1- for pendulum support.*



- Unscrew nuts -arrows- for swivel joint (right-side).
- Disengage swivel joint (right-side) from wishbone.



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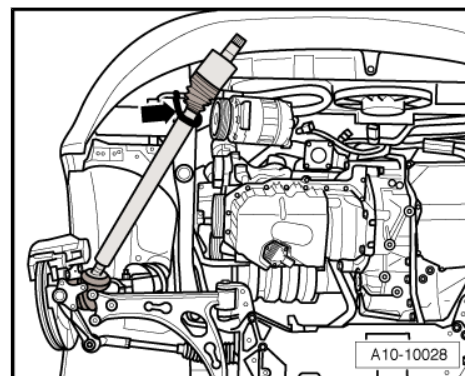


- Pivot drive shaft (right-side) towards the front.
- Tie up drive shaft to longitudinal member -arrow-.

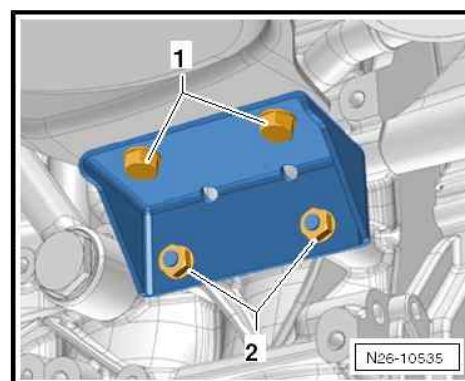


Note

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



- Remove bolts -1- and nuts -2- and detach bracket for particulate filter.





- Pull particulate filter off mountings -arrows- and detach to the right.

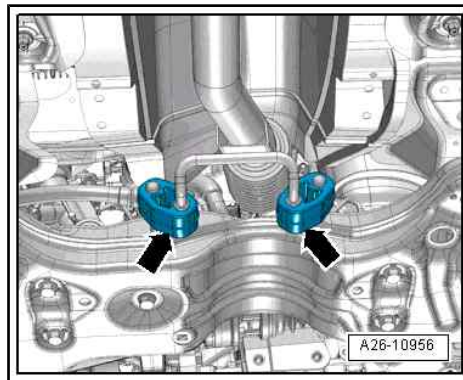
Installing

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



Note

Renew gaskets, self-locking nuts and clamp for particulate filter.



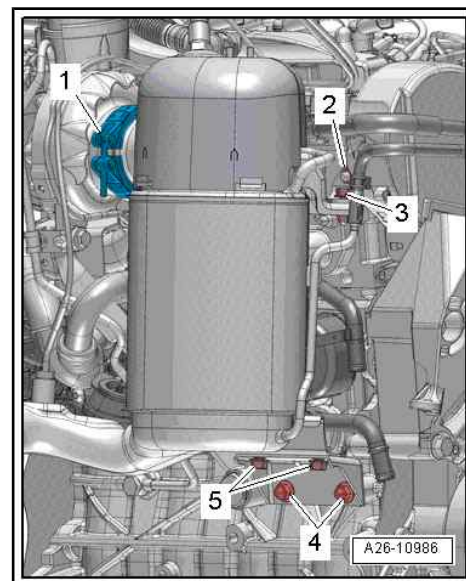
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- Note sequence when installing particulate filter:

1.	Fit particulate filter to turbocharger, attach clip -1- without tightening
2.	Loosely screw in nuts -2, 4- and bolts -3, 5- by hand • It must still be possible to move particulate filter and bracket
3.	Tighten clamp -1-
4.	Tighten nuts -2, 4-
5.	Tighten bolts -3, 5-

- Install poly V-belt ⇒ [page 51](#) .
- Install air pipe ⇒ [page 206](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install coolant pipes (right-side) ⇒ [page 190](#) .
- Install radiator cowl ⇒ [page 197](#) .
- Install exhaust gas temperature sender 4 - G648- ⇒ [page 308](#) .
- Install exhaust gas temperature sender 3 - G495- ⇒ [page 307](#) .
- Install Lambda probe - G39- ⇒ [page 280](#) .
- Install pressure differential sender - G505- ⇒ [page 272](#) .
- Align the exhaust system so it is free of stress ⇒ [page 288](#) .
- After renewing particulate filter, perform "Adaption" in **Guided Functions** mode using ⇒ Vehicle diagnostic tester.



Tightening torques

- ◆ ⇒ ["1.1 Exploded view - silencer", page 285](#)
- ◆ Pendulum support
⇒ ["2.1 Exploded view - assembly mountings", page 33](#)
- ◆ Drive shaft and heat shield ⇒ Running gear, axles, steering;
Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft
- ◆ Wishbone and swivel joint ⇒ Running gear, axles, steering;
Rep. gr. 40 ; Lower wishbone, swivel joint; Exploded view - lower wishbone, swivel joint
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)
- ◆ Heat shield for tunnel ⇒ General body repairs, exterior; Rep. gr. 66 ; Strips / trim panels / extensions; Exploded view - heat shield



3 Exhaust gas temperature control

⇒ **"3.1 Exploded view - exhaust gas temperature control", page 300**

⇒ **"3.2 Removing and installing exhaust gas temperature sender", page 304**

3.1 Exploded view - exhaust gas temperature control

⇒ **"3.1.1 Exploded view - exhaust gas temperature control, close-coupled particulate filter, left-hand drive vehicles", page 300**

⇒ **"3.1.2 Exploded view - exhaust gas temperature control, particulate filter installed away from engine, right-hand drive vehicles", page 303**

3.1.1 Exploded view - exhaust gas temperature control, close-coupled particulate filter, left-hand drive vehicles



Note

- ◆ *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body.*
- ◆ *If necessary, loosen double and single clamps and align silencers and exhaust pipes so that there is sufficient clearance from the body at all points, and so that the mountings are evenly loaded.*
- ◆ *If the particulate filter or pressure differential sender - G 505- has been renewed, the pressure differential sender - G 505- must be adapted using the vehicle diagnostic tester ; select "Guided Functions", Adapt pressure differential sender - G 505- .*
- ◆ *Removing and installing exhaust manifold with turbocharger
⇒ page 202*
- ◆ *The flexible joint (de-coupling element) in the front exhaust pipe must not be bent more than 10°; otherwise it can be damaged.*
- ◆ *Renew seals, gaskets and self-locking nuts.*



1 - Pressure differential sender - G505-

- ☐ Removing and installing
⇒ [page 272](#)

2 - Bolt

- ☐ 3 Nm

3 - Control pipes

4 - Clamps

5 - Exhaust gas temperature sender 4 - G648-

- ☐ Removing and installing
⇒ [page 308](#)
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 45 Nm

6 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing
⇒ [page 280](#)
- ☐ 50 Nm

7 - Heat shield

8 - Nut

- ☐ 9 Nm

9 - Particulate filter

- ☐ Removing and installing
⇒ [page 294](#)

10 - Seal

- ☐ Renew
- ☐ Note installation position

11 - Clamp

- ☐ 7 Nm

12 - Nuts

- ☐ 25 Nm

13 - Bolts

- ☐ 25 Nm

14 - Bracket

- ☐ Bolted to cylinder block

15 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing ⇒ [page 307](#)
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 45 Nm

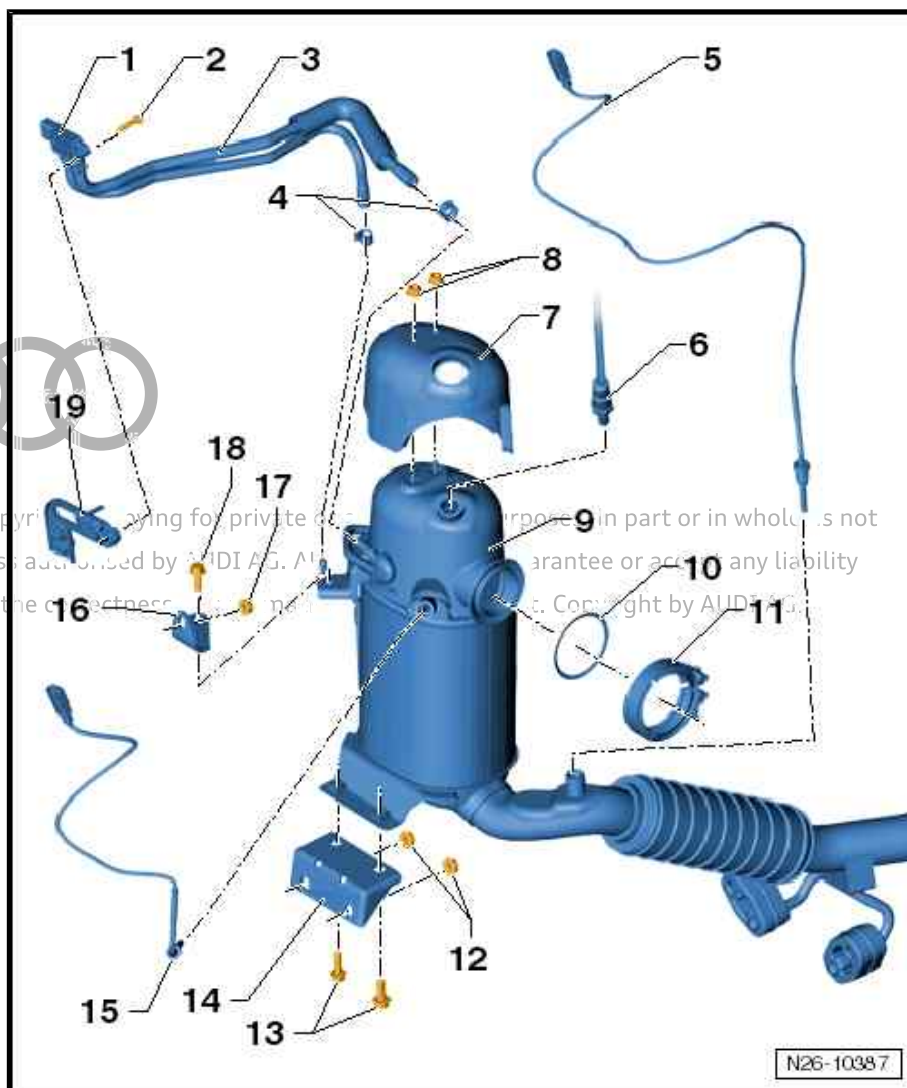
16 - Retainer

17 - Nuts

- ☐ 25 Nm

18 - Bolts

- ☐ 45 Nm





19 - Bracket

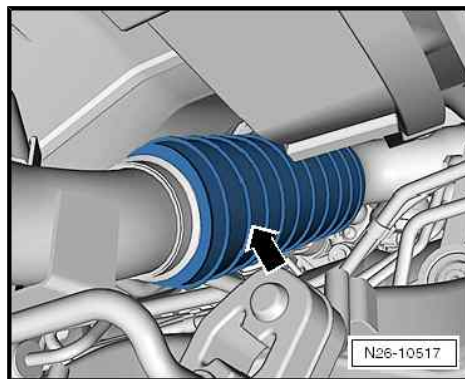
- For pressure differential sender - G 505-

20 - Exhaust gas temperature sender 1 - G235-

- Removing and installing ⇒ [page 304](#)
- Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- 45 Nm

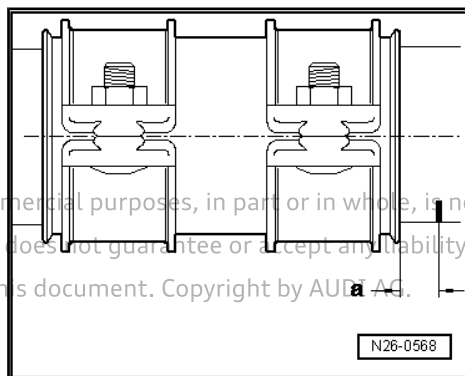
The flexible joint (de-coupling element) in the front exhaust pipe must not be bent more than 10°; otherwise it can be damaged.

If the catalytic converter is going to be re-installed, always secure a transportation lock - T10404- -arrow- to the decoupling element in the front exhaust pipe.



Installation position of clamp

- Position double clamp at distance -a- = 5 mm from marking on front exhaust pipe.



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3.1.2 Exploded view - exhaust gas temperature control, particulate filter installed away from engine, right-hand drive vehicles

1 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ 50 Nm
- ☐ Removing and installing ⇒ [page 280](#)

2 - Seal

- ☐ Renew
- ☐ Note installation position

3 - Clamp

4 - Exhaust gas temperature sender 4 - G648-

- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 45 Nm
- ☐ Removing and installing ⇒ [page 310](#)

5 - Exhaust gas temperature sender 3 - G495-

- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 45 Nm
- ☐ Removing and installing ⇒ [page 310](#)

6 - Bracket for pressure differential sender - G505-

7 - Clamps

8 - Control pipes

9 - Pressure differential sender - G505-

- ☐ Removing and installing ⇒ [page 272](#)

10 - Nut

- ☐ 4.5 Nm

11 - Bolt

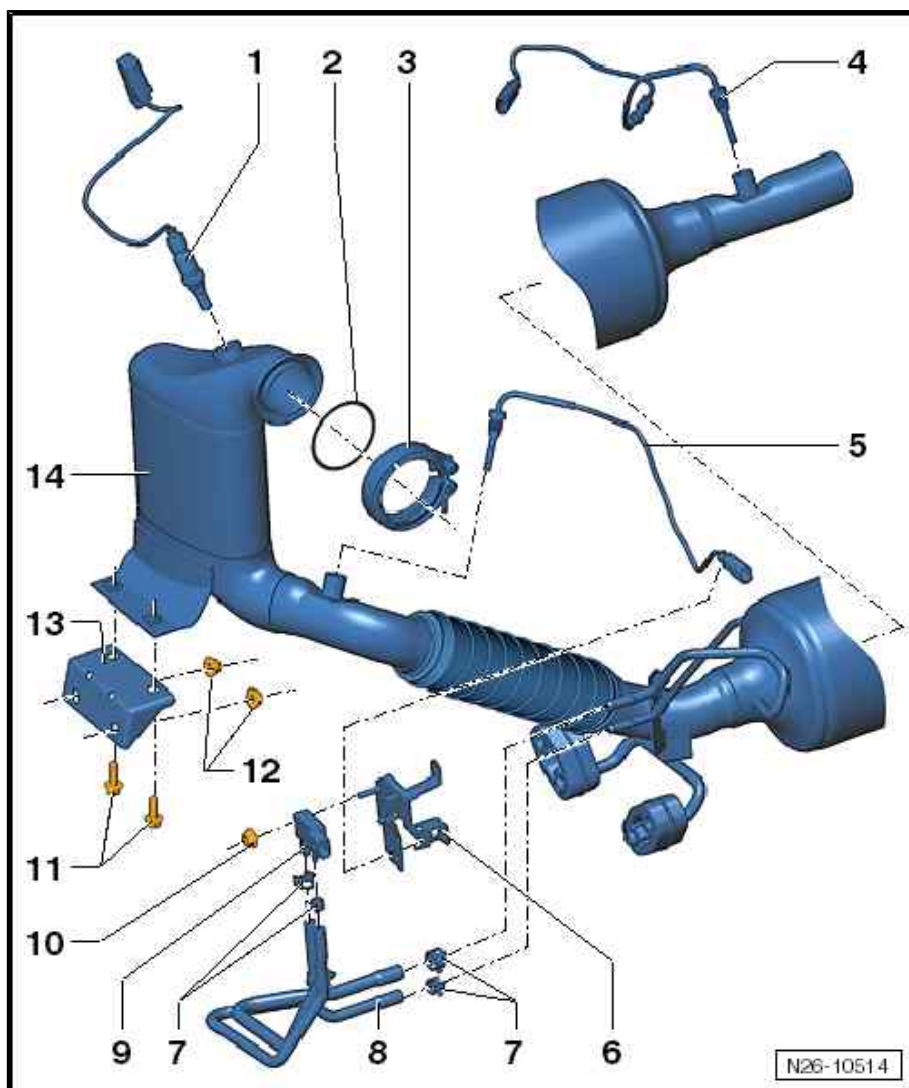
- ☐ 25 Nm

12 - Nut

- ☐ 25 Nm

13 - Bracket

14 - Catalytic converter with particulate filter installed away from engine

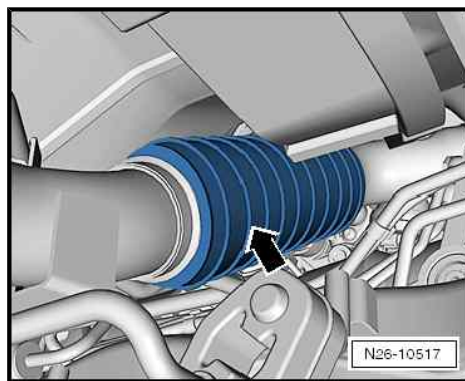


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The flexible joint (de-coupling element) in the front exhaust pipe must not be bent more than 10°; otherwise it can be damaged.

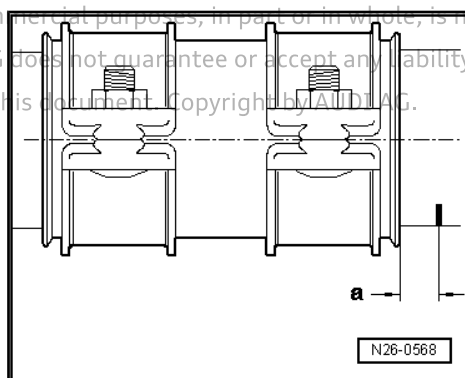


If the catalytic converter is going to be re-installed, always secure a transportation lock - T10404- -arrow- to the decoupling element in the front exhaust pipe.



Installation position of clamp

- Position double clamp at distance -a- = 5 mm from marking on front exhaust pipe.



3.2 Removing and installing exhaust gas temperature sender

⇒ [“3.2.1 Removing and installing exhaust gas temperature sender 1 G235”, page 304](#)

⇒ [“3.2.2 Removing and installing exhaust gas temperature sender 3 G495, left-hand drive vehicles”, page 307](#)

⇒ [“3.2.3 Removing and installing exhaust gas temperature sender 4 G648, left-hand drive vehicles”, page 308](#)

⇒ [“3.2.4 Removing and installing exhaust gas temperature sender 3 G 495, right-hand drive vehicles”, page 310](#)

⇒ [“3.2.5 Removing and installing exhaust gas temperature sender 4 G 648, right-hand drive vehicles”, page 310](#)

3.2.1 Removing and installing exhaust gas temperature sender 1 - G235-

Removing



Note

Fit all cable ties in the original positions when installing.



WARNING

When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system*

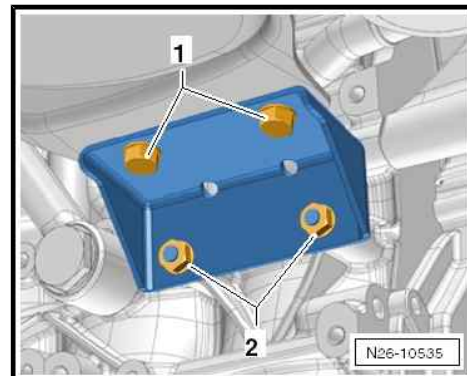
⇒ [“2.5 Safety precautions when working on the exhaust system”, page 5](#).



- Remove engine cover panel ⇒ [page 43](#) .

Vehicles with air conditioner:

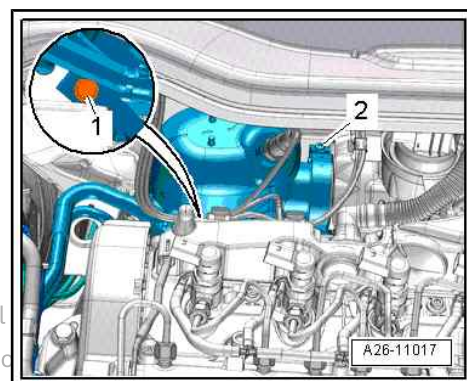
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove bolts -1- and nuts -2- and detach bracket for particulate filter.



- Slacken bolt -2- and remove clamp.
- Remove bolt -1-.
- Press particulate filter to rear.



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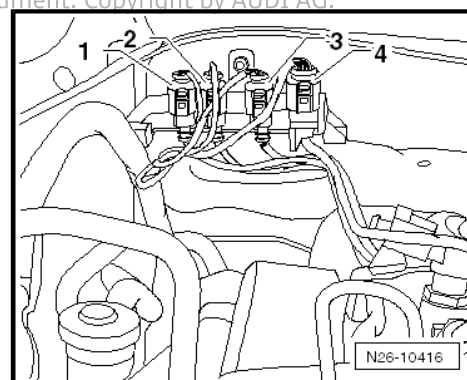
All vehicles (continued):

- Unplug electrical connector -1- for exhaust gas temperature sender 1 - G235- and move electrical wiring clear.



Note

Disregard -items 2, 3, 4-.





- Unscrew exhaust gas temperature sender 1 - G235- -item 1- from exhaust manifold.

**Note**

Disregard -arrows-.

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 threads of exhaust gas temperature sender with high-temperature paste ⇒ Electronic parts catalogue .

Installation position of exhaust gas temperature sender -G235- :

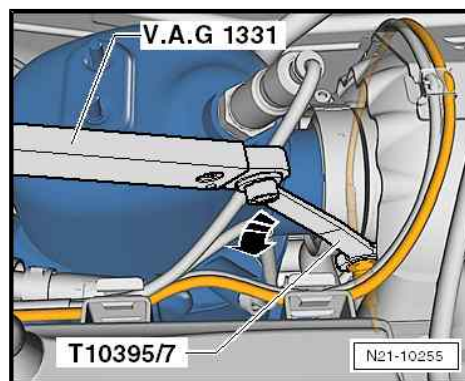
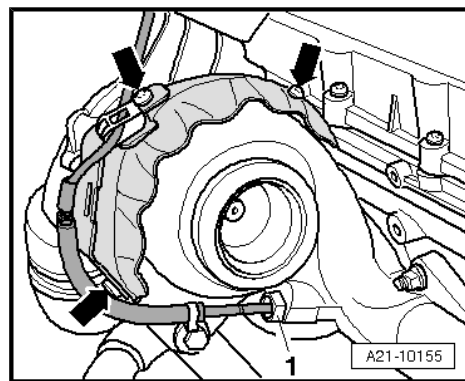
**WARNING**

The torque wrench - V.A.G 1331- must be set to 28 Nm in this case.

By extending the torque wrench - V.A.G 1331- with socket - T10395/7- , the correct torque of 45 Nm will be achieved.

Grease thread of sender with high-temperature paste - G 052 112 A3- .

- Screw in exhaust gas temperature sender 1 - G 235- by hand.
- Then tighten to specified torque using torque wrench - V.A.G 1331- together with socket - T10395/7- .



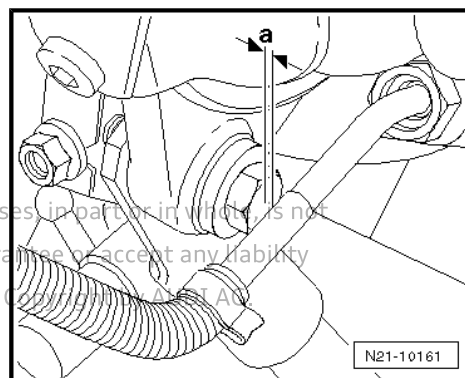
- The angled part of the pipe must have a clearance of -a- = 3 ... 5 mm from the bolt on the turbocharger support.

Tightening torques

- ◆ ⇒ ["3.1.1 Exploded view - exhaust gas temperature control, close-coupled particulate filter, left-hand drive vehicles", page 300](#)

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

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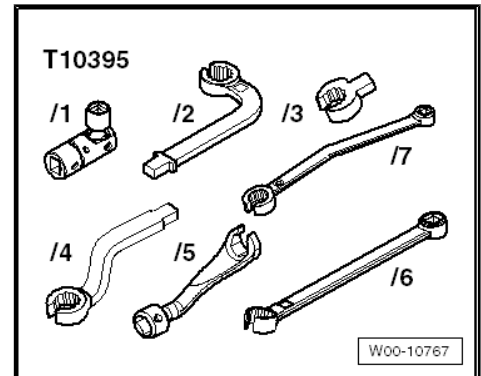




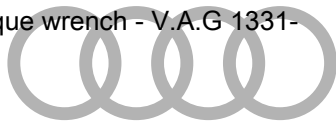
3.2.2 Removing and installing exhaust gas temperature sender 3 - G495- , left-hand drive vehicles

Special tools and workshop equipment required

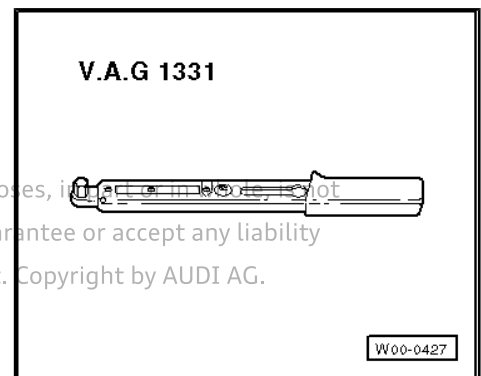
- ◆ Tool set, 17 mm - T10395-



- ◆ Torque wrench - V.A.G 1331-



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Removing



Note

Fit all cable ties in the original positions when installing.



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 5**.



- Unplug electrical connector -1- for exhaust gas temperature sender 3 - G495- and move electrical wiring clear.
- Unscrew exhaust gas temperature sender 3 - G495- -2- using a tool from tool set, 17 mm - T10395- .

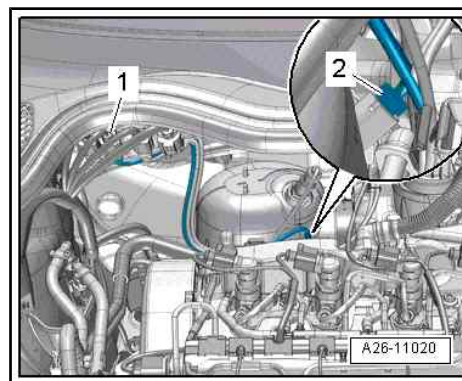
Installing

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.*
- ◆ *The threads of the exhaust gas temperature senders -G495- and -G648- 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.*



WARNING

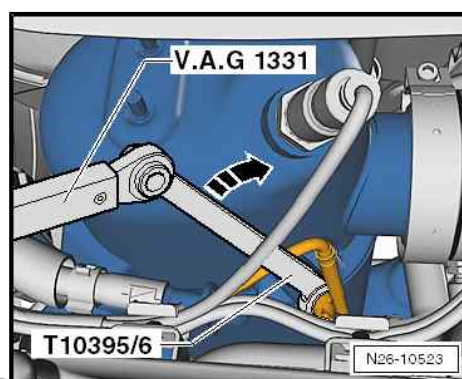
The torque wrench - V.A.G 1331- must be set to 29 Nm in this case.

By extending the torque wrench - V.A.G 1331- with socket - T10395/6- , the correct torque of 45 Nm will be achieved.

- Screw in exhaust gas temperature sender 1 - G 495- by hand and align so that there is as much clearance from surrounding components as possible.
- Then tighten to specified torque using torque wrench - V.A.G 1331- together with socket - T10395/6- .

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - exhaust gas temperature control", page 300](#)

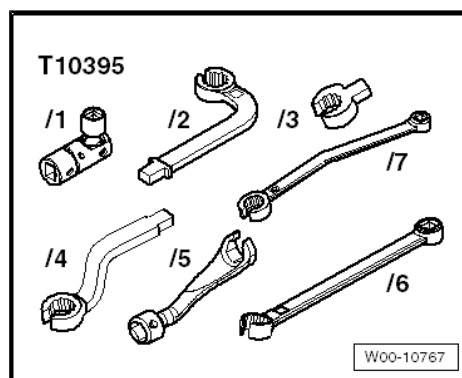


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3.2.3 Removing and installing exhaust gas temperature sender 4 - G648- , left-hand drive vehicles

Special tools and workshop equipment required

- ◆ Tool set, 17 mm - T10395-

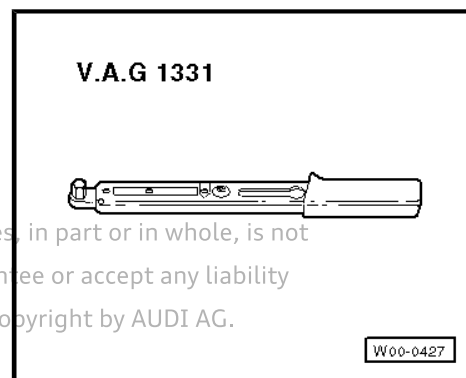




◆ Torque wrench - V.A.G 1331-



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Removing

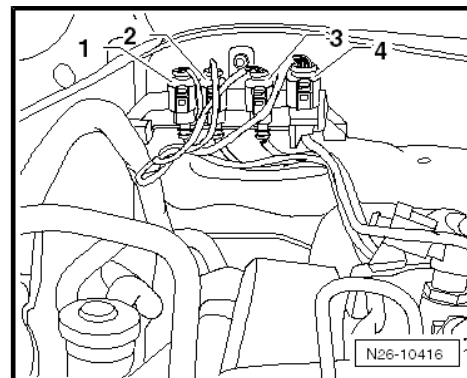


WARNING

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 5***.

- Unplug electrical connector -3- for exhaust gas temperature sender 4 - G648- and move electrical wiring clear.



- Unscrew exhaust gas temperature sender 4 - G648- -arrow- from exhaust pipe behind particulate filter.

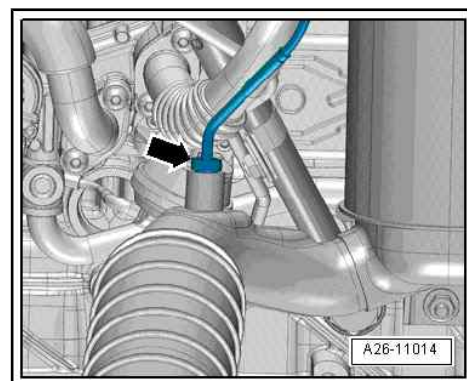
Installing

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.*
- ◆ *The threads of the exhaust gas temperature senders -G495- and -G648- 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.*



Tightening torques

- ◆ ⇒ ***"3.1 Exploded view - exhaust gas temperature control", page 300***

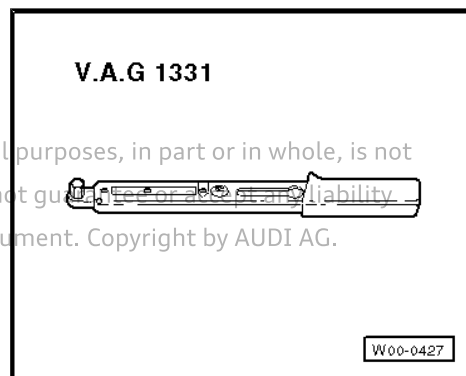


3.2.4 Removing and installing exhaust gas temperature sender 3 - G 495- , right-hand drive vehicles

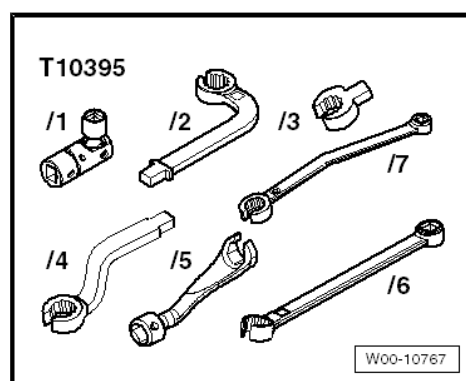
Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-

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- ◆ Tool set - T10395-



Tightening torque for exhaust gas temperature sender 3 - G 495- upstream of particulate filter (right-hand drive vehicles)

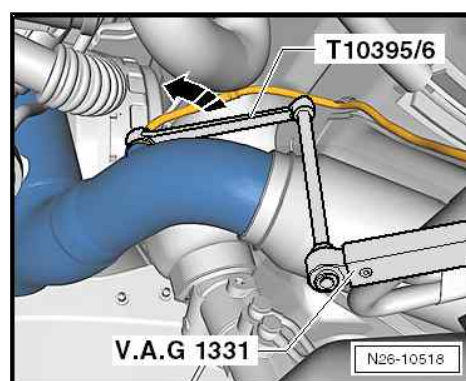
Tighten using torque wrench - V.A.G 1331- together with socket - T10395/6- .



WARNING

The torque wrench - V.A.G 1331- must be set to 29 Nm in this case.

By extending the torque wrench - V.A.G 1331- with socket - T10395/6- , the correct torque of 45 Nm will be achieved.

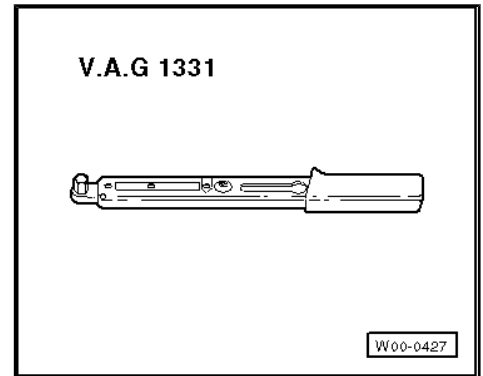


3.2.5 Removing and installing exhaust gas temperature sender 4 - G 648- , right-hand drive vehicles

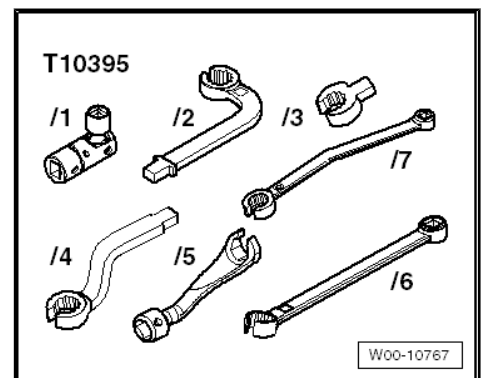
Special tools and workshop equipment required



- ◆ Torque wrench - V.A.G 1331-



- ◆ Tool set - T10395-



**Tightening torque for exhaust gas temperature sender 4 - G 648-
downstream of particulate filter**

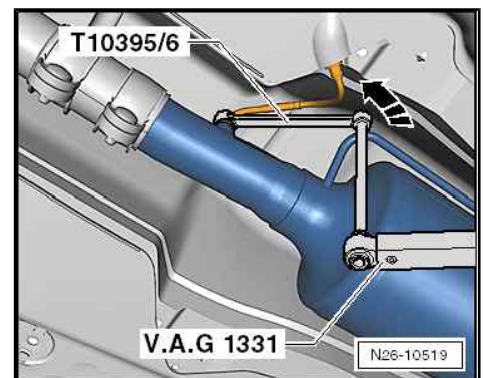
Tighten using torque wrench - V.A.G 1331- together with socket
- T10395/6- .



WARNING

The torque wrench - V.A.G 1331- must be set to 29 Nm in this case.

By extending the torque wrench - V.A.G 1331- with socket -
T10395/6- , the correct torque of 45 Nm will be achieved.



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4 Exhaust gas recirculation

⇒ ["4.1 Exploded view - exhaust gas recirculation system", page 312](#)

⇒ ["4.2 Removing and installing exhaust gas recirculation cooler", page 313](#)

⇒ ["4.3 Checking exhaust gas recirculation cooler change-over", page 315](#)

⇒ ["4.4 Cleaning exhaust gas recirculation system", page 316](#)

4.1 Exploded view - exhaust gas recirculation system

1 - Bolt

- ☐ 9 Nm

2 - Exhaust gas recirculation pipe

- ☐ With flexible joint; do not bend joint - risk of cracking

3 - Bolt

- ☐ 9 Nm

4 - Gasket

- ☐ Renew

5 - Vacuum line

- ☐ Do not alter shape

6 - Bolt

- ☐ 9 Nm

7 - Gasket

- ☐ Renew

8 - Exhaust gas recirculation pipe

- ☐ With flexible joint; do not bend joint - risk of cracking

9 - Bolt

- ☐ 9 Nm

10 - Screw-type clip

- ☐ Renew
- ☐ 4 Nm

11 - Exhaust gas recirculation cooler

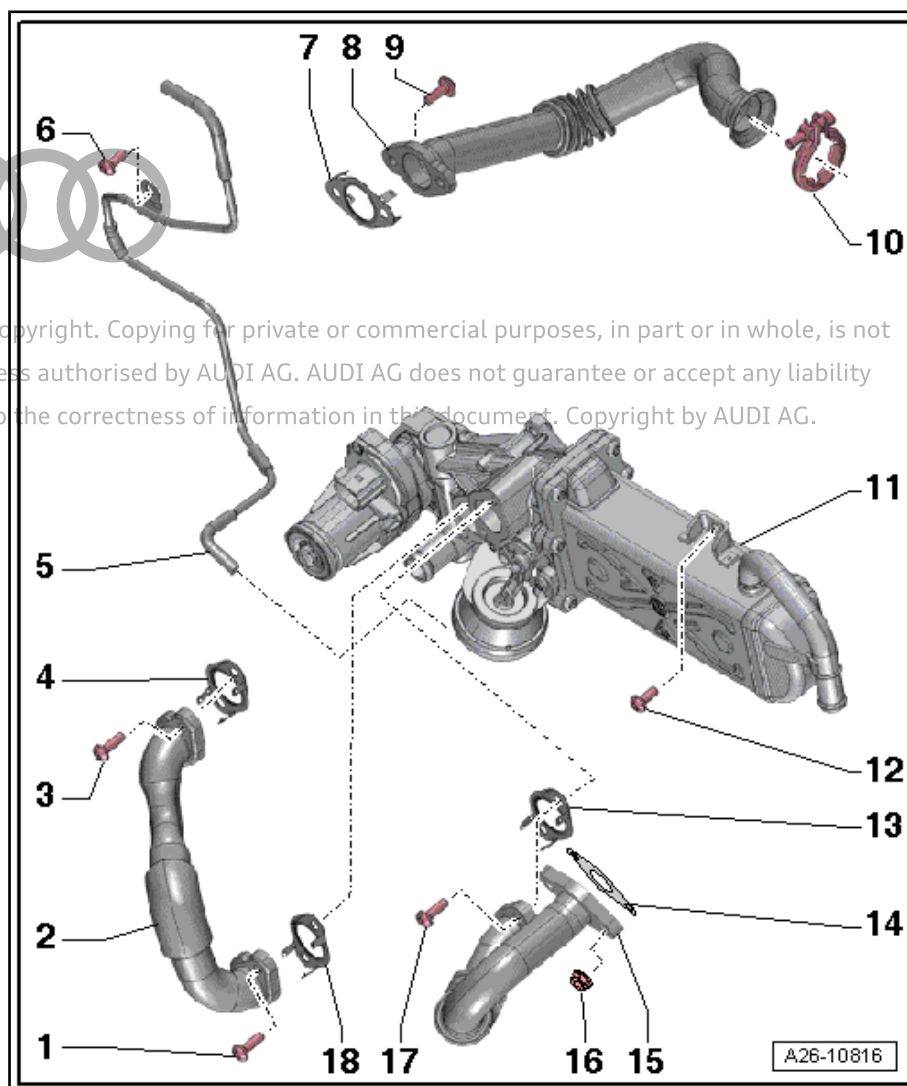
- ☐ With integrated exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-
- ☐ Checking change-over function ⇒ [page 315](#)
- ☐ Removing and installing ⇒ [page 313](#)

12 - Bolt

- ☐ 9 Nm

13 - Gasket

- ☐ Renew





14 - Gasket

- ☐ Renew

15 - Exhaust gas recirculation pipe

- ☐ With flexible joint; do not bend joint - risk of cracking

16 - Nut

- ☐ 24 Nm

17 - Bolt

- ☐ 9 Nm

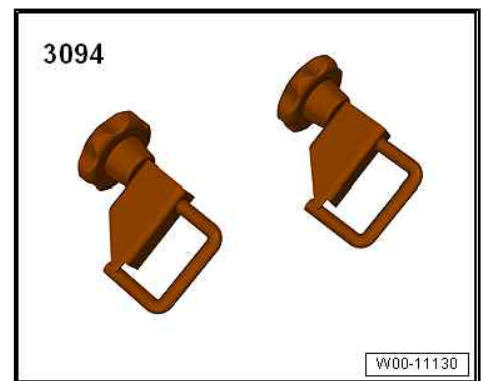
18 - Gasket

- ☐ Renew

4.2 Removing and installing exhaust gas recirculation cooler

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



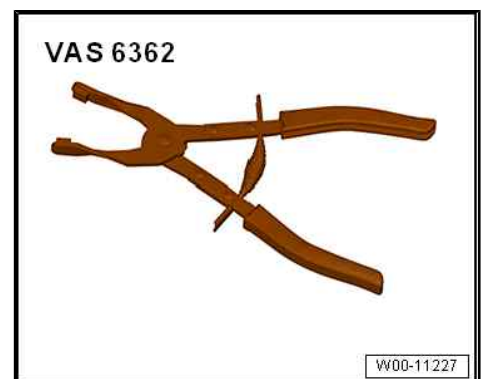
- ◆ Drip tray for workshop hoist - VAS 6208-



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- ◆ Hose clip pliers - VAS 6362-





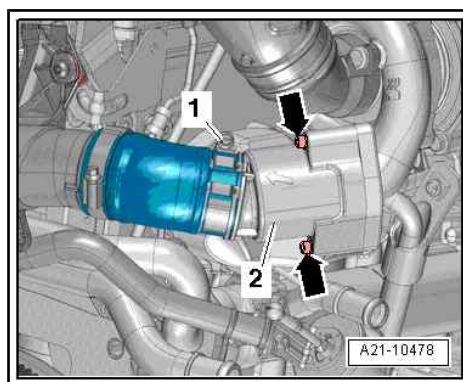
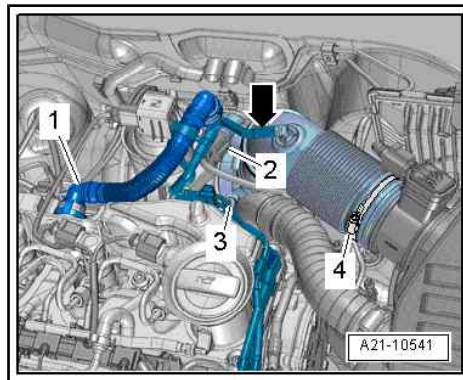
Removing



Note

Secure the heat insulation sleeve in the original position when installing.

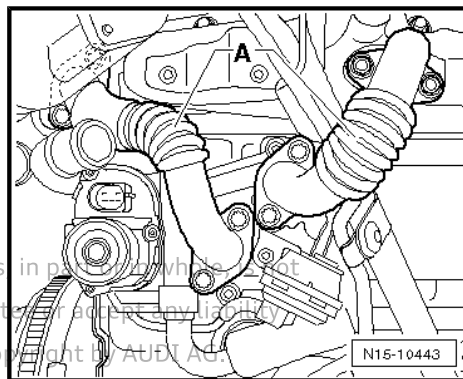
- Remove particulate filter ⇒ [page 294](#) .
- Version for countries with cold climates: Unplug electrical connector -2-.
- Press release tabs and detach crankcase breather hose -1-.
- Disconnect vacuum hose -arrow-.
- Remove bolt -3-, swivel air pipe with connection to rear and detach from turbocharger.
- Remove bolts -arrows-.
- Loosen hose clip -1- and detach pulsation damper -2-.



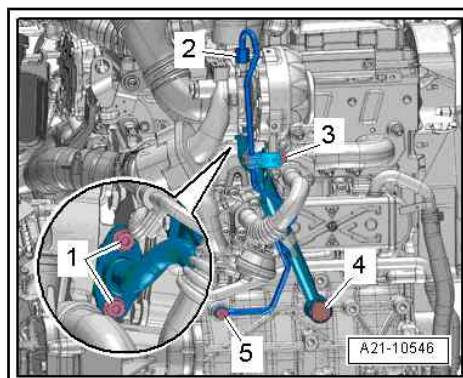
- Remove bolts and detach exhaust gas recirculation pipes -A-.



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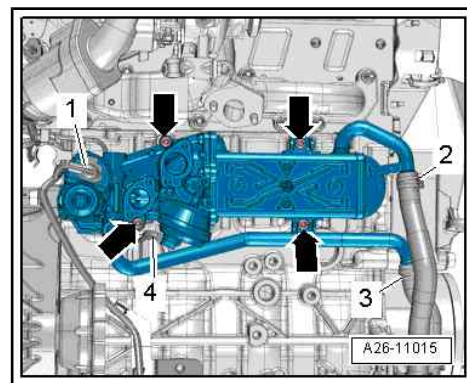


- Remove union nut -2-.
- Remove bolts -1, 3- and banjo bolts -4, 5- and detach support for turbocharger with oil supply line.





- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Clamp off coolant hoses -2- and -3- using hose clamps -3094- , release hose clips and disconnect coolant hoses from exhaust gas recirculation cooler.
- Unplug electrical connector -1-.
- Detach heat insulation sleeve, disconnect vacuum hose -4- from vacuum unit and move clear.
- Remove bolts -arrows- and detach exhaust gas recirculation cooler.



Installing

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



Note

Renew gaskets, seals and self-locking nuts.

- Install support for turbocharger with oil supply line, pulsation damper and air pipe with connection ⇒ [page 200](#) .
- Install air hoses with screw-type clips ⇒ [page 207](#) .
- Install particulate filter ⇒ [page 294](#) .
- Check coolant level ⇒ [page 168](#) .

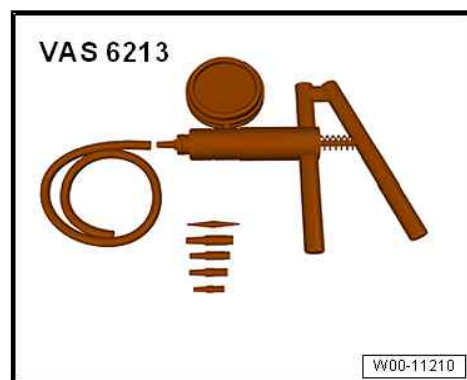
Tightening torques

- ◆ ⇒ ["4.1 Exploded view - exhaust gas recirculation system", page 312](#)

4.3 Checking exhaust gas recirculation cooler change-over

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-





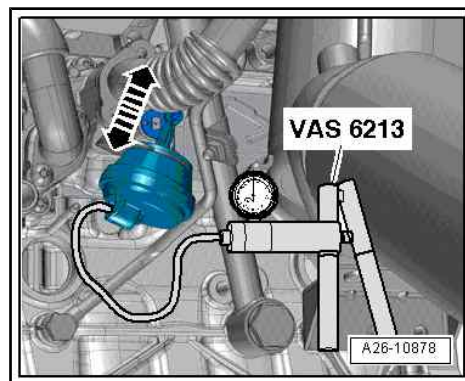
Procedure



Note

Secure the heat insulation sleeve in the original position when installing.

- Detach heat shield sleeve.
- Disconnect vacuum hose from vacuum unit and connect hand vacuum pump - VAS 6213- in its place.
- Operate hand vacuum pump to produce a vacuum.
- The linkage of the exhaust gas recirculation cooler change-over should move -arrows-.



If the linkage does not move or only moves jerkily:

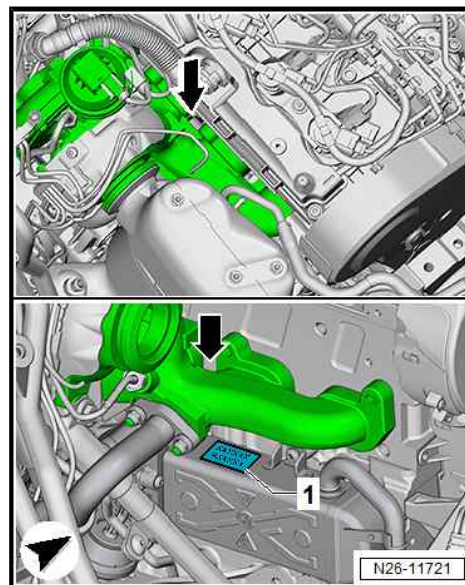
- ◆ The vacuum unit is defective.
- ◆ The change-over flap for exhaust gas recirculation is sticking.

4.4 Cleaning exhaust gas recirculation system



Note

- ◆ The exhaust gas recirculation module consists of the exhaust gas recirculation cooler and the exhaust gas recirculation valve - N18- which is integrated in it.
- ◆ The cleaning procedure is only possible for vehicles with exhaust gas recirculation modules from part number - 03L 131 512 DQ/DP- onwards.
- ◆ Before starting the procedure, check the part number -1- using an endoscope (e.g. VAS 6748A/1).
- ◆ To do so, guide the endoscope between the cylinder head and exhaust manifold -arrow- and slightly to the right (as seen in the direction of travel).
- ◆ For greater clarity, the particulate filter has been removed in the lower part of the illustration.



Explanation

Certain extreme driving modes (e.g. short distances) may result in varnish formation/carbon deposits inside the exhaust gas recirculation cooler. In this case, the exhaust emissions warning lamp in the instrument cluster lights up and one of the following codes appears in the event memory:

- ◆ P401 EGR system throughput too low
- ◆ P046C Sensor 1 for exhaust gas recirculation implausible signal

In most cases, these carbon deposits can be removed by carrying out the rinsing/cleaning procedure described below

⇒ [page 317](#) .



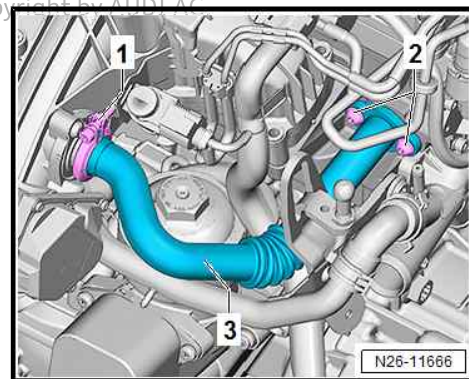
4.4.1 Starting cleaning procedure for exhaust gas recirculation system

Special tools and workshop equipment required

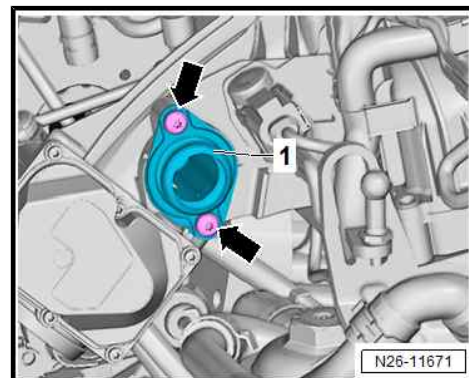
- ◆ Cooler rinsing system for exhaust gas recirculation - VAS 542 007-



- ◆ Adapter - VAS 542 007/7- , 2x
- ◆ Ultrasonic cleaning unit - VAS 6418-
- Remove engine cover panel.
- Open clamp -1- and detach.
- Remove bolts -2- and detach connecting pipe -3- going to intake manifold.

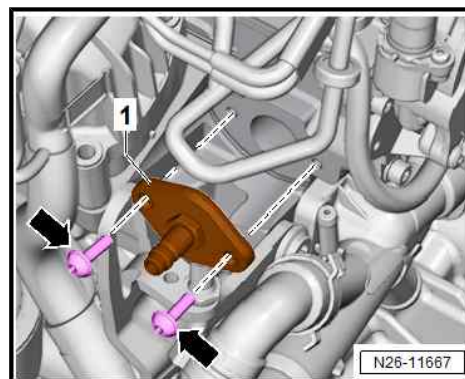


- Remove bolts -arrows- and pull pipe connection -1- out of intake manifold.

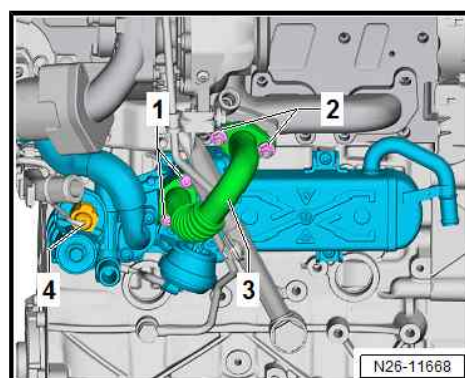




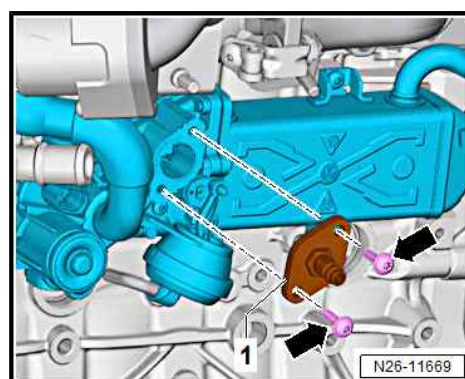
- Fit adapter - VAS 542 007/7- -1- onto opening on cylinder head.
- Screw in original bolts -arrows- from connecting pipe and hand-tighten. Ensure that seal on adapter is not pinched.
- Remove noise insulation ⇒ Rep. gr. 50 .



- Remove bolts -1- and nuts -2-.
- Detach connecting pipe -3- between exhaust manifold and exhaust gas recirculation cooler.
- Release and unplug electrical connector -4- from exhaust gas recirculation valve - N18- .



- Fit adapter - VAS 542 007/7- -1- onto opening on exhaust gas recirculation cooler.
- Screw in original bolts -arrows- from connecting pipe and hand-tighten. Ensure that seal on adapter is not pinched.
- Connect supply hose - VAS 542 007/2-2- of cleaning unit to adapter on exhaust gas recirculation cooler.
- Connect return hose - VAS 542 007/2-3- of cleaning unit to adapter on cylinder head.
- Connect battery charger to vehicle battery.
- Connect battery clamps of valve actuator - VAS 542 007/6- to vehicle battery.
- Connect battery clamps of pump - VAS 542 007/3- to vehicle battery.



Preparing cooler rinsing system for exhaust gas recirculation - VAS 542 007-

- Fill canister - VAS 542 007/1- with 9 litres of warm (approx. 40 °C – 50° C) tap water.
- Pour 1 litre of cleaning solution - D 600 200 A2- into canister.
- Connect intake hose - VAS 542 007/2-1- of pump to connection -1- on canister lid.



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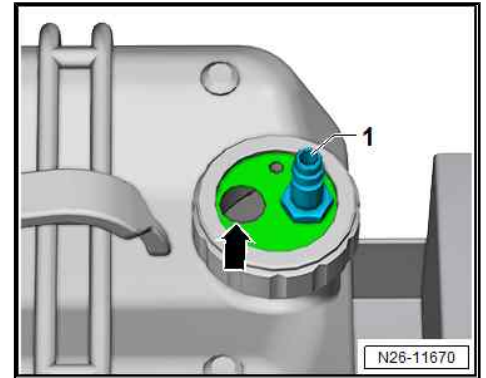


- Insert open end of return hose - VAS 542 007/2-3- into opening -arrow- on canister lid to approx half height of canister.
- Plug connector of valve actuator - VAS 542 007/6- into exhaust gas recirculation valve - N18- .
- Switch on valve actuator - VAS 542 007/6- to open exhaust gas recirculation valve.



Note

- ◆ Ensure that the bleeder screw tap on the intake hose - VAS 542007/2-2- is closed.
 - ◆ If the pressure (approx. 1.6 bar) provided by the pump - VAS 542007/3- is not sufficient to activate the exhaust gas recirculation valve via the valve actuator - VAS 542007/6- , the pump will switch itself off after a short period.
 - ◆ In this case, the exhaust gas recirculation valve has a mechanical fault or is not supplied with current. The exhaust gas recirculation cooler must be renewed.
 - ◆ Before disconnecting the intake hose - VAS 542007/2-2- , the pressure must be released by carefully opening the bleeder screw tap and escaping cleaning solution must be caught.
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- Clean connecting pipes ⇒ [page 321](#) while cleaning procedure is under way.
 - Operate pump - VAS 542 007/3- as follows:

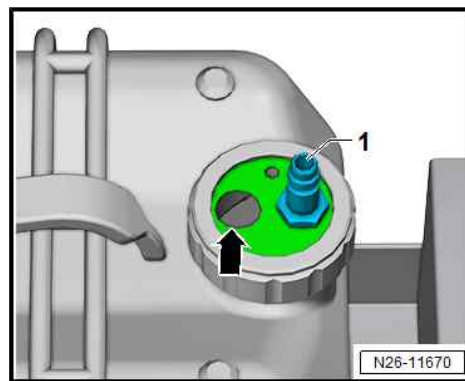


Pump - VAS 542 007/3-	Time	Action
Switch on	25 minutes	Cleaning
Switch off	10 minutes	Cleaning solution taking effect
Switch on	25 minutes	Cleaning
Switch off	---	End of cleaning procedure

- Disconnect intake hose from canister and leave pump switched on until no more cleaning solution is extracted (empty the system).
- Pull return hose out of canister (cleaning solution may come out).
- Empty canister (observe country-specific requirements for disposal).
- Fill canister with 10 litres of warm (approx. 40 °C – 50 °C) tap water.



- Connect intake hose - VAS 542 007/2-1- of pump to connection -1- on canister lid.
- Guide return hose - VAS 542 007/2-3- into a suitable container (minimum capacity of 12 litres) and fix in position.
- Switch on pump - VAS 542 007/3- and leave it on until the contents of the canister have fully flowed through the exhaust gas recirculation system.
- Release and detach supply hose - VAS 542 007/2-2- from adapter on exhaust gas recirculation cooler.
- Connect compressed air adapter - VAS 542 007/5- to adapter on exhaust gas recirculation cooler.
- Insert open end of return hose - VAS 542 007/2-3- into opening -arrow- on canister lid to approx half height of canister.
- Intake hose - VAS 542 007/2-1- of pump must be connected to connection -1- on canister lid.
- Connect compressed air line to compressed air adapter - VAS 542 007/5- and blow all remaining water out of exhaust gas recirculation system (minimum 2 minutes).

**Caution**

All water must be removed from the exhaust gas recirculation system. Otherwise the engine could be damaged.

- Release and unplug compressed air adapter - VAS 542 007/5- .
- Remove adapter from exhaust gas recirculation cooler.
- Unplug connector for valve actuator - VAS 542 007/6- on exhaust gas recirculation valve - N18- and plug in original connector.
- After cleaning, the effectiveness of the cleaning process must be checked with ⇒ Vehicle diagnostic tester.
- 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 - Check exhaust gas recirculation valve 1 -GX5 after cleaning according to the repair manual

If the result of the test is »not OK«, the exhaust gas recirculation cooler with integrated exhaust gas recirculation valve - N18- must be renewed ⇒ [page 313](#) .

Continued after successful cleaning:

- Install connecting pipe with new gaskets and new nuts
⇒ ["4.1 Exploded view - exhaust gas recirculation system", page 312](#) .

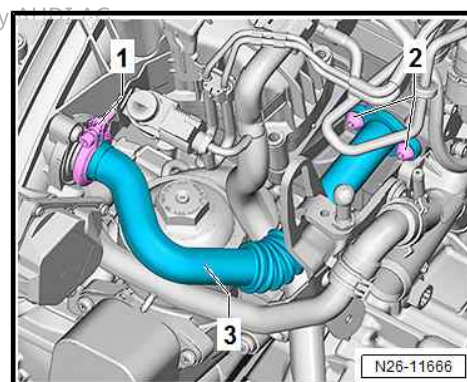
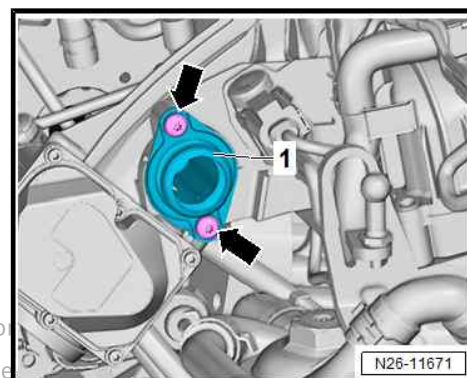


- Install noise insulation ⇒ Rep. gr. 50 .
- Release and detach return hose from adapter on cylinder head.
- Insert pipe connection -1- in intake manifold.
- Screw in bolts -arrows- and tighten to 9 Nm.



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- Remove adapter from cylinder head and install connecting pipe with new gasket ⇒ TDI injection and glow plug system (4-cyl. 2.0 ltr. 4-valve common rail, generation II); Rep. gr. 23 ; Intake manifold; Exploded view - intake manifold .
- Install engine cover panel.
- Perform road test.
- Interrogate event memory and erase entries if necessary.



4.4.2 Cleaning connecting pipes and pipe connection

Special tools and workshop equipment required

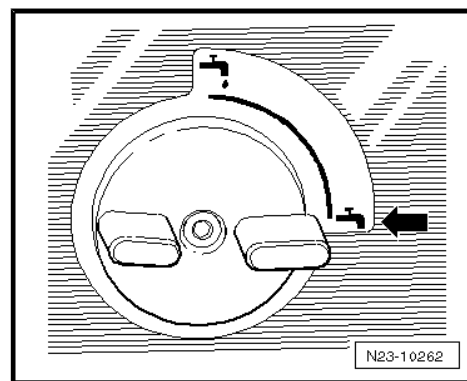
- ◆ Ultrasonic cleaning unit - VAS 6418-
- Close drain tap -arrow- on ultrasonic cleaning unit - VAS 6418- (located on right side of housing).



Note

The ultrasonic bath can be heated up more quickly by using warm tap water.

- Fill ultrasonic cleaning unit - VAS 6418- with 1,800 ml of tap water and 200 ml of cleaning solution - D 600 200 A2- .
- Put connecting pipes and connection for exhaust gas recirculation in. If necessary, change the position of the connecting pipes in the bath occasionally.



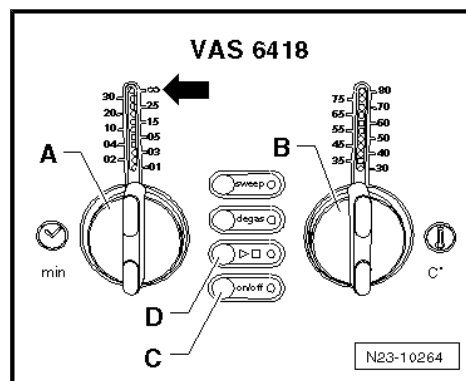


- Switch on cleaning unit by pressing **on/off** button -C-.
- Turn rotary temperature control -B- until LED for heating temperature is at 40 °C.
- Set rotary control for operating time -A- to “10” -arrow-.
- Press **▶** -D- for longer than 2 seconds to start operation of unit.



Note

- ◆ *The temperature-controlled cleaning process is now started. While the fluid is being heated, the ultrasound is activated at intervals in order to circulate the cleaning solution. The ultrasound is activated continuously when the preselected temperature is reached.*
- ◆ *The actual cleaning process commences when the temperature reaches at least 40 °C and must last for at least 10 minutes.*
- After cleaning successfully, rinse connecting pipes and pipe connection with clean water and blow out with compressed air.



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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 323](#)

⇒ [“1.3 Removing and installing Hall sender G40”, page 327](#)

⇒ [“1.4 Removing and installing engine speed sender G28”, page 327](#)

1.1 Exploded view - glow plug system

1 - Hall sender - G40-

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

2 - Bolt

- ☐ Apply locking fluid when installing; refer to [Electronic parts catalogue](#)
- ☐ 9 Nm

3 - Glow plug

- ☐ Glow plug 1 - Q10-, glow plug 2 - Q11-, glow plug 3 - Q12-, glow plug 4 - Q13-
- ☐ Removing and installing
⇒ [page 323](#)
- ☐ 17 Nm

4 - Electrical connector

- ☐ For glow plug

5 - Bolt

- ☐ 4.5 Nm

6 - Engine speed sender - G28-

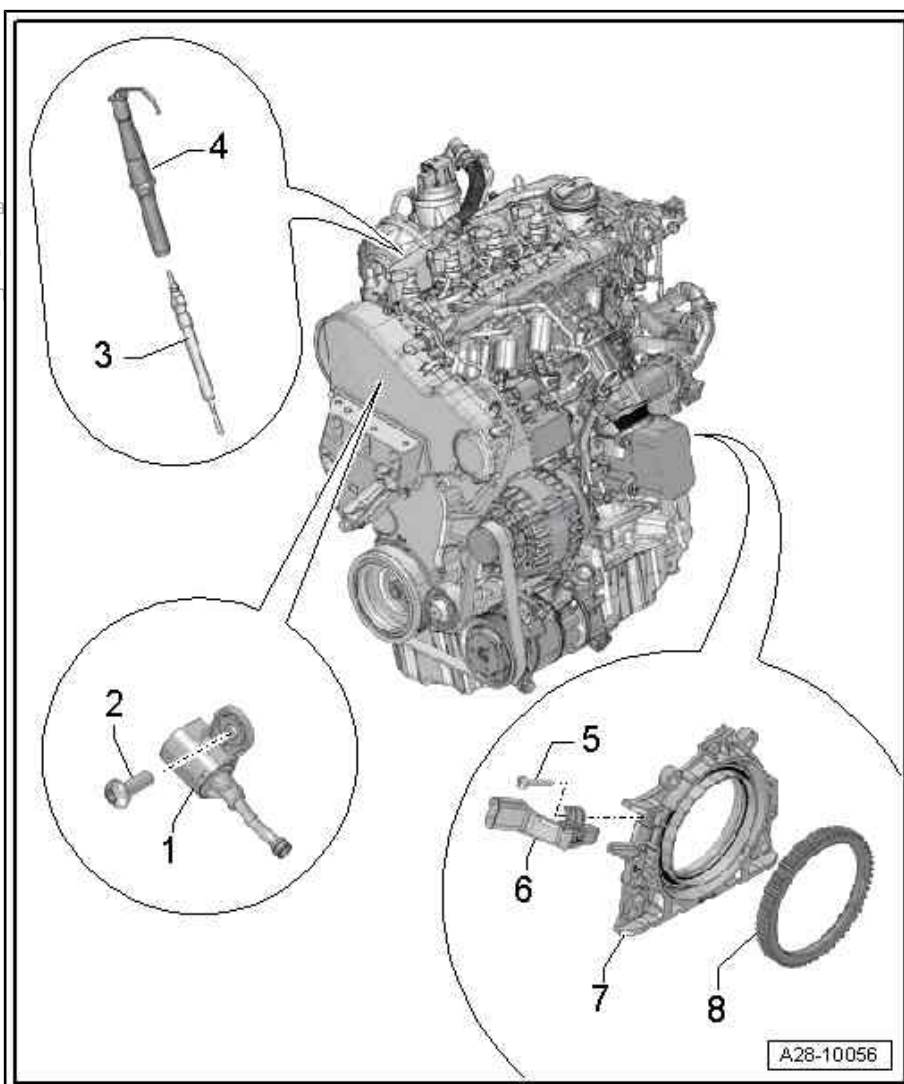
- ☐ Removing and installing
⇒ [page 327](#)

7 - Sealing flange (gearbox end)

- ☐ With oil seal
- ☐ Removing and installing
⇒ [page 66](#)

8 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Cannot be renewed separately
- ☐ Removing and installing ⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 66](#)



1.2 Removing and installing glow plug

Special tools and workshop equipment required



- ◆ Articulated wrench, 10 mm - 3220-



- ◆ Pliers - 3314-



- ◆ Assembly tool - T40428-

- ◆ Safety goggles

Removing

- Switch off ignition.
- Remove engine cover panel ⇒ [page 43](#) .

– Clean glow plug openings 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 openings, let it work in briefly, and blow out with compressed air.*
- ◆ *Then clean the glow plug openings using a cloth moistened with oil.*



WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

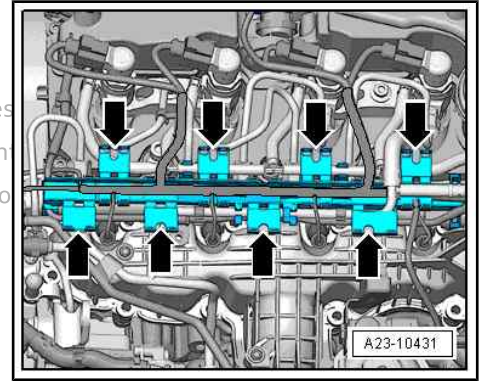


- Open catches on cable duct to move clear wiring harness.

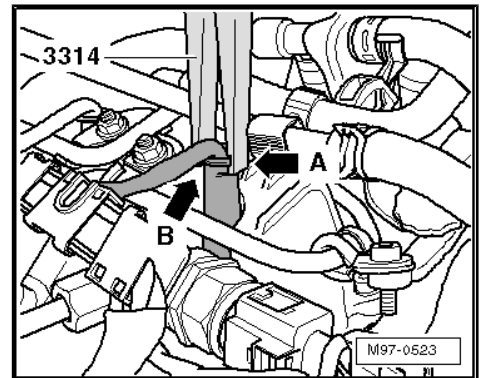


Caution

- ◆ **Make sure that no wire connection is damaged when unplugging the glow plug connectors; otherwise the entire wiring harness must be renewed.**
- ◆ **When unplugging the glow plug connectors, do not compress the pliers - 3314- with too much force so that the support sleeve is not damaged.**



- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B- and pull glow plug connectors off glow plugs.

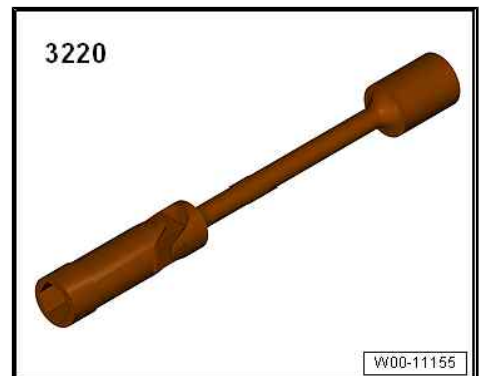


- To slacken the glow plugs use special tool U/J extension and socket, 10 mm - 3220-



Note

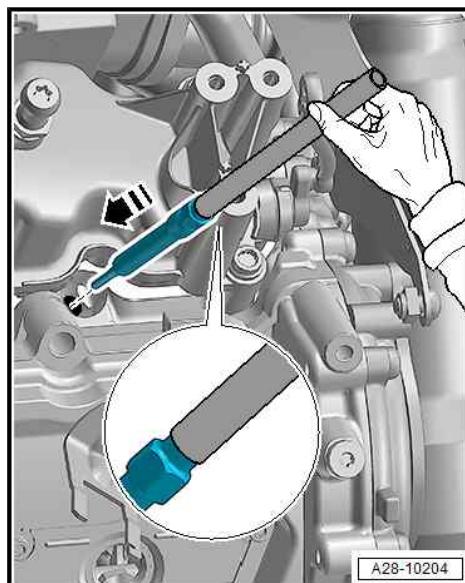
- ◆ *The glow plugs can only be released up to an angle of approx. 90°. After this, the turning movement is hindered in part by a tendency to seize.*
- ◆ *This tendency to seize is caused by particles of dirt (e.g. sand) entering the first glow plug threads as heat causes the glow plugs (steel) and the cylinder head (aluminium) to expand.*
- Unscrew glow plug until it begins to stick, then screw it in again. After this, unscrew it again until it begins to stick.
- Keep turning the glow plug back and forth up to the point where it begins to stick. Repeat this procedure until the glow plug can be removed.



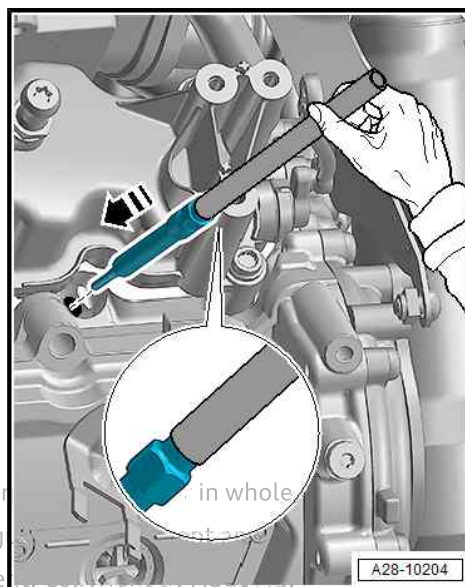


- Pull out glow plugs carefully by hand or using assembly tool - T40428- , as shown in illustration. Keep glow plugs straight while unscrewing.

Installing



- Screw in glow plugs carefully by hand or using assembly tool - T40428- , keeping them straight, as shown in illustration, and then tighten them to specified torque.
- To tighten the glow plugs use special tool U/J extension and socket, 10 mm - 3220- with a suitable torque wrench.



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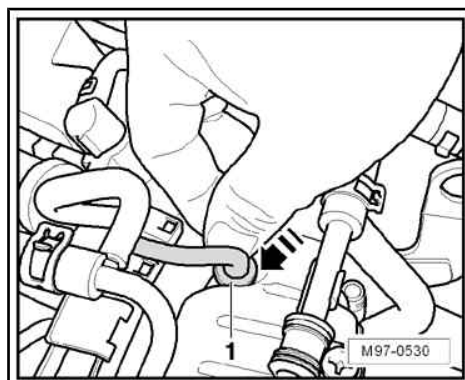
- Then tighten glow plugs to specified torque.
- Fit glow plug connectors -1- back onto glow plugs -arrow-.



Note

Check that glow plug connectors are securely seated.

- Secure wiring harness in cable duct again.
- The remaining installation steps are carried out in the reverse sequence.



Tightening torques

- ◆ ⇒ [“1.1 Exploded view - glow plug system”, page 323](#)



1.3 Removing and installing Hall sender - G40-

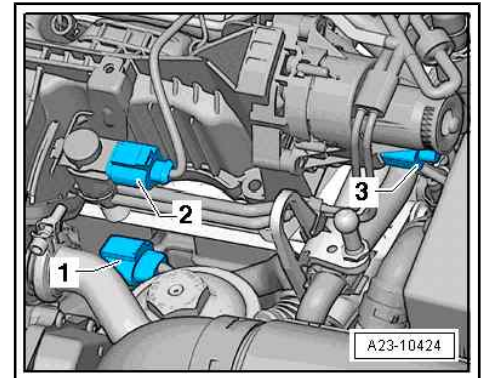
Removing

- Detach toothed belt from idler roller and high-pressure pump
⇒ [page 88](#) .
- Unplug connector -1- for Hall sender - G40- and detach connector from retainer.

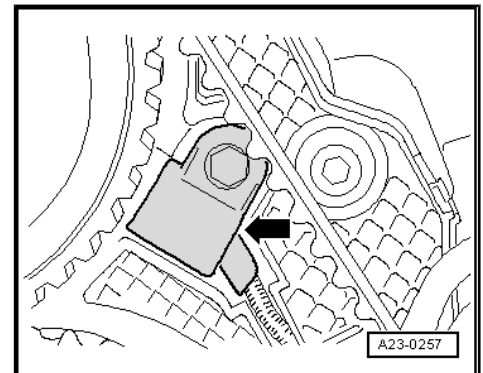


Note

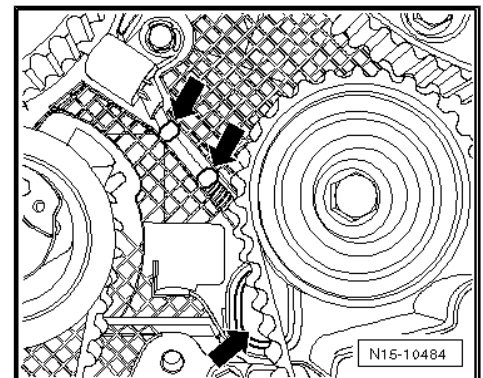
Disregard items -2 and 3-.



- Unbolt Hall sender - G40- -arrow-.



- Using a screwdriver, remove projections and take out cover for repair opening -arrows-.
- Take Hall sender - G40- off cylinder head and guide connector through repair opening in toothed belt cover.



Installing

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

- Seal repair opening in toothed belt cover with plug; for plug refer to ⇒ [Electronic parts catalogue](#) .
- Install toothed belt ⇒ [page 88](#) .

Tightening torques

- ♦ ⇒ ["1.1 Exploded view - glow plug system", page 323](#)

1.4 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

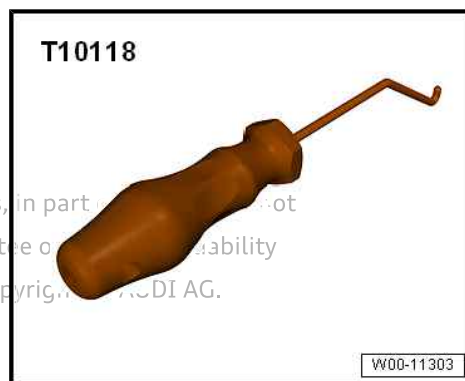
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◆ Assembly tool - T10118-



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◆ Socket, 4 mm - T10370-



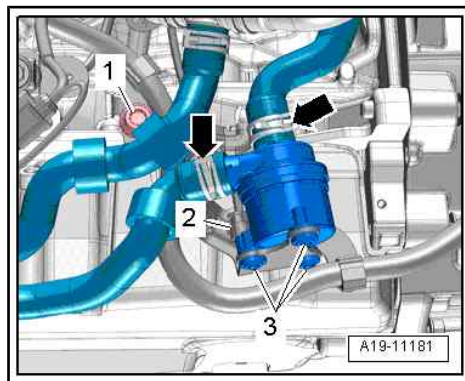
Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unscrew bolts -3- and tie pump for exhaust gas recirculation cooler - V400- up to the right side (with coolant hoses -arrows- attached).



Note

Disregard items -1 and 2-.

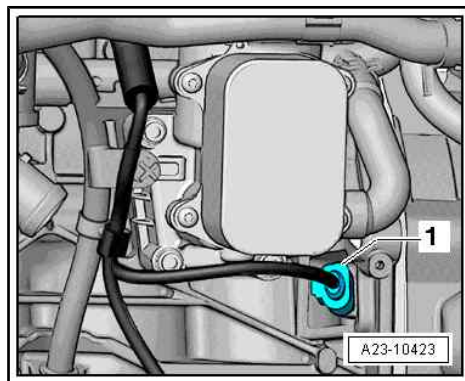


- Unplug electrical connector -1- at engine speed sender - G28- using assembly tool - T10118- .



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.





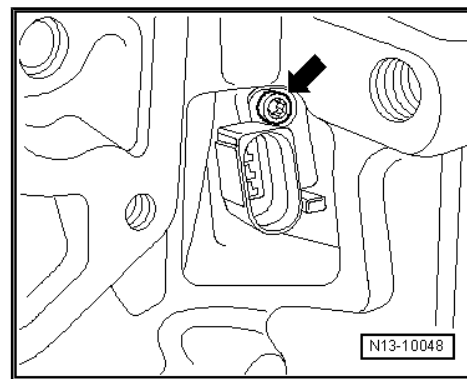
- Unscrew securing bolt -arrow- for engine speed sender - G28- using socket AF 4 mm - T10370- .

Installing

Installation is carried out in reverse sequence.

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - glow plug system", page 323](#)
- ◆ Pump for exhaust gas recirculation cooler - V400-
⇒ ["3.1 Exploded view - coolant pipes", page 183](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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