Workshop Manual

Audi A4 2008 ➤
Audi A5 Cabriolet 2009 ➤
Audi A5 Coupé 2008 ➤

4-cylinder TDI engine (2.0 ltr. 4-valve common rail)									
Engine ID	CAG A	CAG B	CAG C	CAH A	CAH B	CME A			

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List of Workshop Manual Repair Groups

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Repair Group

00 - Technical data
10 - Removing and installing engine
13 - Crankshaft group
15 - Cylinder head, valve gear
17 - Lubrication
19 - Cooling
21 - Turbocharging/supercharging
23 - Mixture preparation - injection
26 - Exhaust system
28 - Glow plug system

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

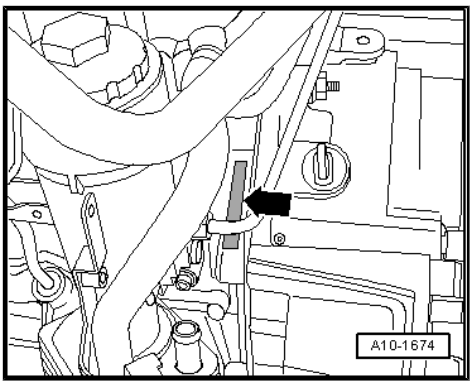
1 Identification

(ARL006701; Edition 10.2019)

⇒ "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 on the left side (seen in the direction of travel) at 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

- *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 811 or ⇒ Maintenance ; Booklet 812 .*

For engine data refer to:

- A4 ⇒ Technical data for diesel engines; Rep. gr. 00 ; Overview of engines
- A5 Coupé ⇒ Technical data for diesel engines; Rep. gr. 00 ; Overview of engines
- A5 Cabriolet ⇒ Technical data for engines; Rep. gr. 00 ; Overview of engines

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2 Safety precautions

⇒ “2.1 Safety precautions when working on the fuel supply system”, page 2

⇒ “2.2 Safety precautions when working on vehicles with start/stop system”, page 3

⇒ “2.3 Safety precautions when using testers and measuring instruments during a road test”, page 3

⇒ “2.4 Safety precautions when working on the subframe”, page 4

⇒ “2.5 Safety precautions when working on the cooling system”, page 4

⇒ “2.6 Safety precautions when working on the exhaust system”, page 4

2.1 Safety precautions when working on the fuel supply system

When working on the fuel system note the following warnings:

Risk of 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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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).

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
⇒ “1.4 Filling and bleeding fuel system”, page 205 .

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.

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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.

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 subframe

Please note the following warnings when working on the subframe:

Caution

Risk of damage to running gear components.

- *The vehicle must NOT be lowered onto its wheels if the engine/gearbox mountings, steering rack or subframe cross brace are not properly installed.*
- *The vehicle must NOT be supported by applying a trolley jack or similar to the subframe or subframe cross brace.*

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2.5 Safety precautions when working on the cooling system

When working on the cooling system note the following warnings:

Risk of scalding as hot coolant can escape

The cooling system is under pressure when the engine 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.

- *The filler cap must engage positively and audibly when it is closed.*

2.6 Safety precautions when working on the exhaust system

Do not dismantle exhaust gas temperature sender - risk of injury.

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 Bolts/nuts”, 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 9

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- .
- Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be reused in new, sealable plastic bags.
- After removal, place parts on a clean surface and cover them. Only use lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in the proper packaging (e.g. in tool boxes etc.).
- Do not work with compressed air when the system is open. If possible, do not move vehicle.
- Make sure that no fuel runs onto the fuel hoses. Should this occur, the fuel hoses must be cleaned again immediately.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

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3.2 General notes

- The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- A voltage of at least 11.5 V is required for proper operation of the electrical components.

- Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.
- The vehicles are fitted with a crash/fuel shut-off system. This system is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the fuel pump relay.
- At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system ⇒ page 2 .

3.3 General repair instructions

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 205 .***

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- Clean tools and workbench etc. before working on the injection system.
- Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- Never attempt to bend high-pressure fuel lines to shape.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.
- Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.
- When the engine is running, do not perform any repairs to the common rail system.
- Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.

- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.

3.4 Bolts/nuts

- 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”.

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Use:

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

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3.7 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.

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 the use of Audi Genuine Parts.
- ♦ 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.
- ♦ Because of the limited space in the engine compartment, it is important to ensure that there is adequate clearance to any moving or hot components to avoid damage to lines and wiring.

3.10 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, condenser or charge air cooler.

10 – Removing and installing engine

1 Removing and installing engine

⇒ “1.1 Removing engine”, page 10

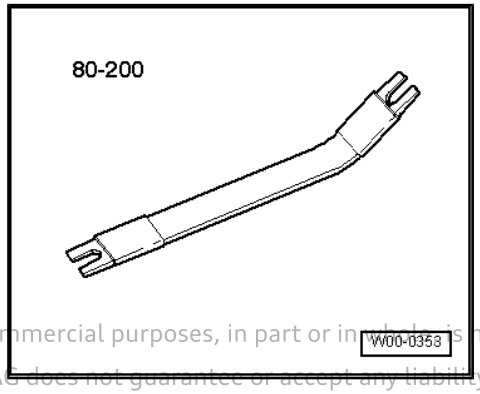
⇒ “1.2 Securing engine to engine and gearbox support”, page 24

⇒ “1.3 Installing engine”, page 25

1.1 Removing engine

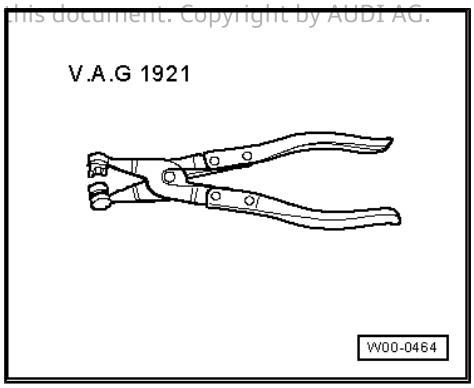
Special tools and workshop equipment required

- Removal lever - 80 - 200-

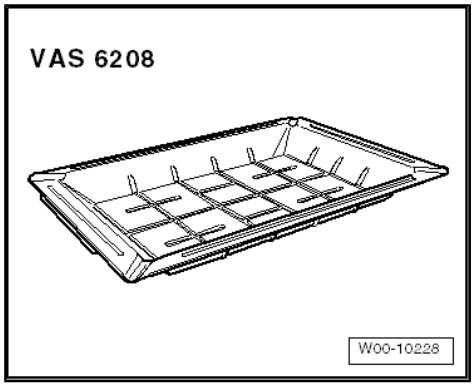


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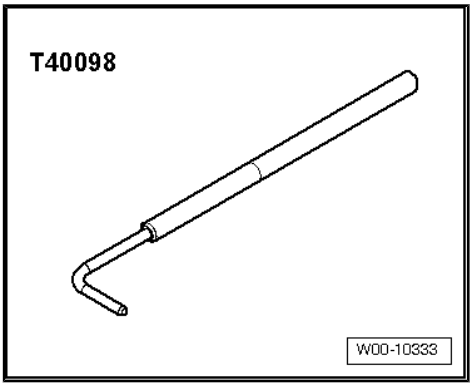
- Hose clip pliers - V.A.G 1921-



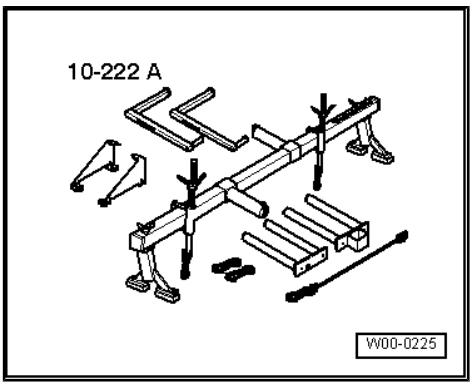
- Drip tray for workshop hoist - VAS 6208-



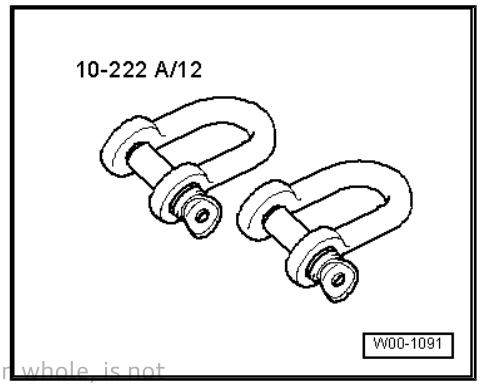
- Locking tool - T40098-



- Support bracket - 10 - 222 A-

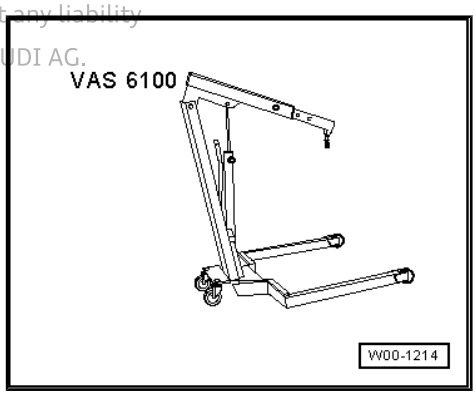


- Shackle - 10-222 A/12-

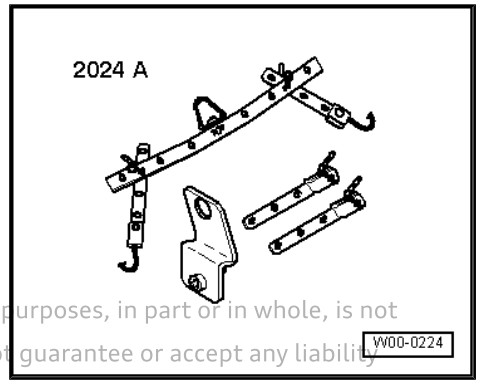


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- Workshop hoist - VAS 6100-



- Lifting tackle - 2024 A-



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Procedure

WARNING

Make sure the vehicle cannot tip over when the engine is removed.

- ***Secure the vehicle, to do so, the luggage compartment must be empty.***

Note

- *Lift out engine without gearbox.*
- *Collect drained coolant in a container for disposal.*
- *Fit all cable ties in the original positions when installing.*
- *On four-wheel drive vehicles the electromechanical parking brake must be released before disconnecting the battery, so that the propshaft can be turned during removal.*

Caution

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

- ***Observe notes on procedure for disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .***

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

– Remove both front wheels.

– Remove wheel spoilers (front) on both sides ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .

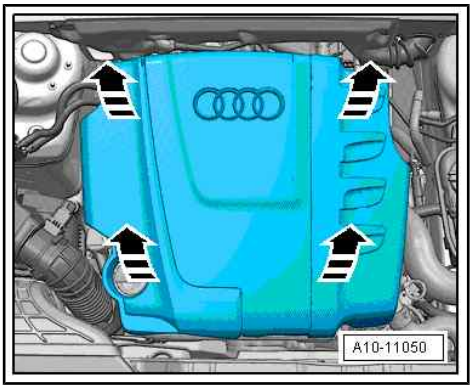
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

– Remove front exhaust pipe ⇒ page 263 .

– Set lock carrier to service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Setting service position and returning to normal position .

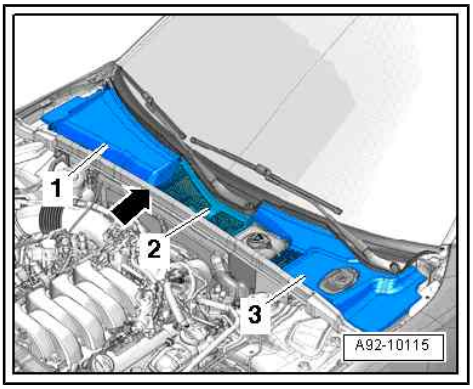
– Remove air cleaner housing
⇒ “3.3 Removing and installing air cleaner housing”, page 212 .

– Remove engine cover panel -arrows-.



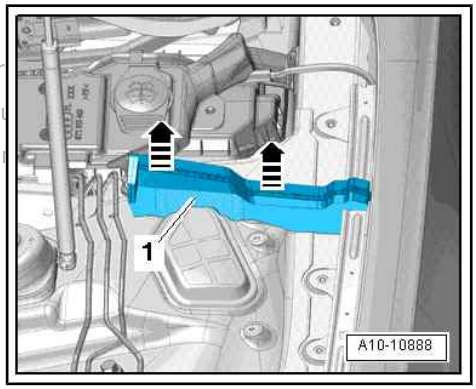
– Remove seal -arrow-.

– Unclip and detach plenum chamber covers -1, 2, 3-.

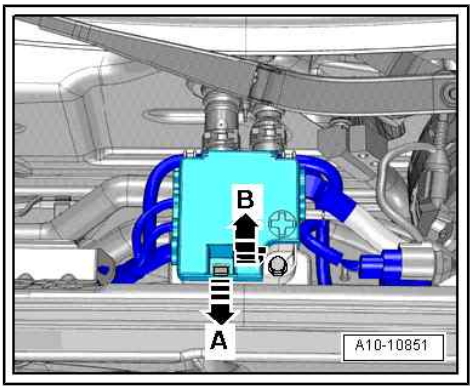


– Lift off foam plastic block -1- on both sides of vehicle -arrows-.

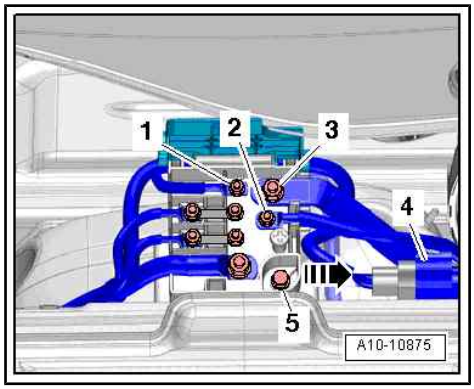
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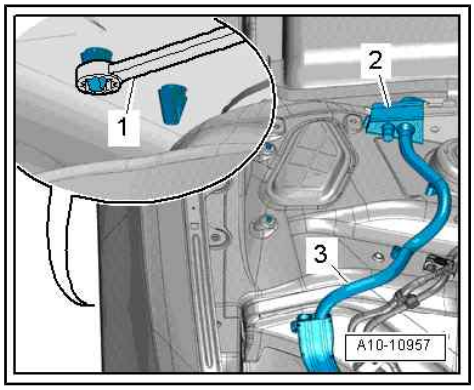
– Release catch -arrow A- and open cover -arrow B-.



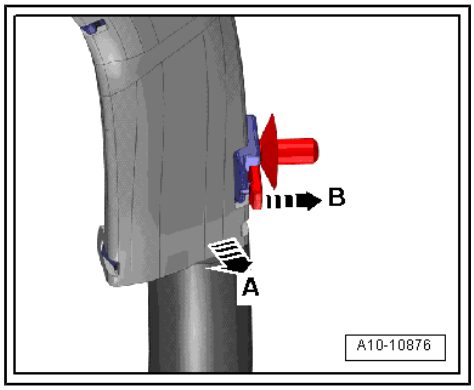
– Remove nuts -1 ... 3- for electrical wiring.
– Detach electrical connector -4- from bracket and unplug.
– Remove bolt -5- and detach wiring junction from body brace -arrow-.



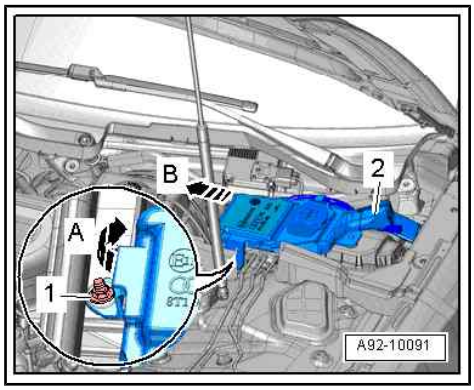
– Working from wheel housing, release catches using a 5.5 mm ring spanner -item 1- and remove wiring protector -2- from above.



– Release catch -arrow B- and move wiring duct forwards -arrow A- to open wiring duct and move electrical wiring clear.

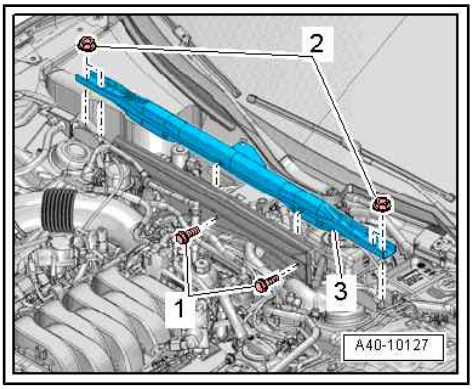


– Remove nut -1- and swivel filler neck for washer fluid reservoir slightly upwards -arrow A-.
– Pull filler neck -2- with filler pipe out of washer fluid reservoir and through opening in body -arrow B-.

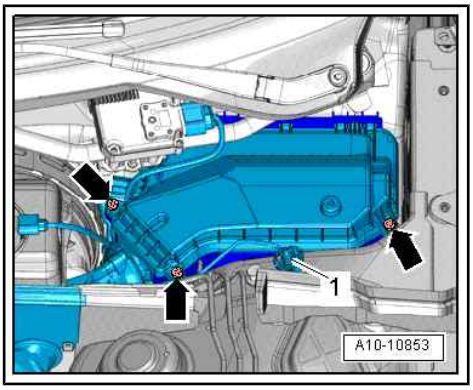


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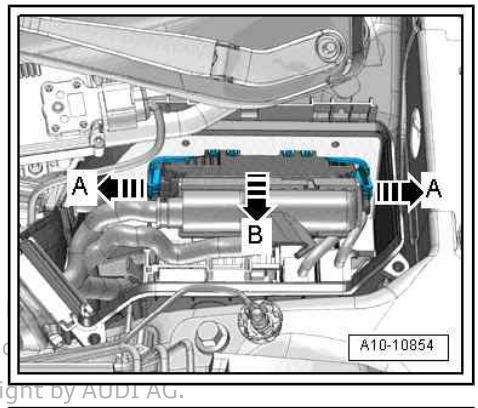
– Remove bolts -1- and nuts -2- and detach body brace -3-.



– Remove bolts -arrows- and detach cover for electronics box in engine compartment.
– Remove nut -1- and move electrical wiring clear.

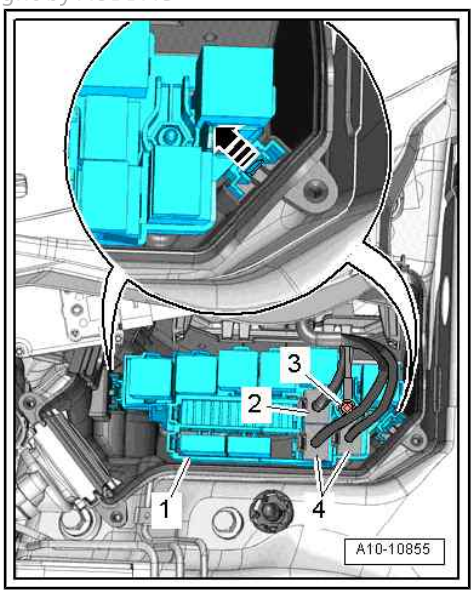


– Release catches -arrows A- and take out engine control unit -arrow B-.

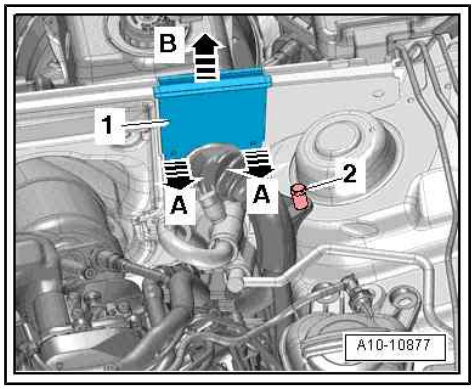


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– Unplug electrical connectors -4- and unscrew nut -3- for wiring.
– If fitted, unplug electrical connector -2-.
– Release catches -arrow- and detach relay carrier with fuse holder -1-.



– Release catches -arrows A- and lift off wiring protector -1- -arrow B-.
– Disengage engine wiring harness at electronics box in engine compartment and move clear.
– Place wiring harness on engine and secure engine control unit to prevent it from dropping.



WARNING

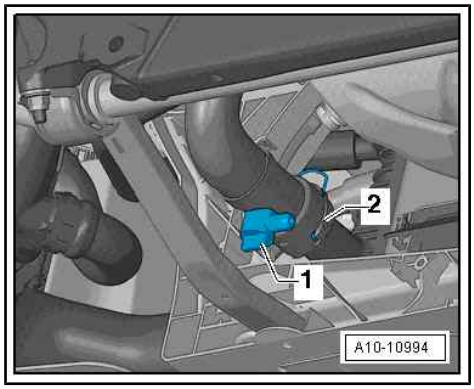
Risk of scalding due to hot steam and hot coolant.

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

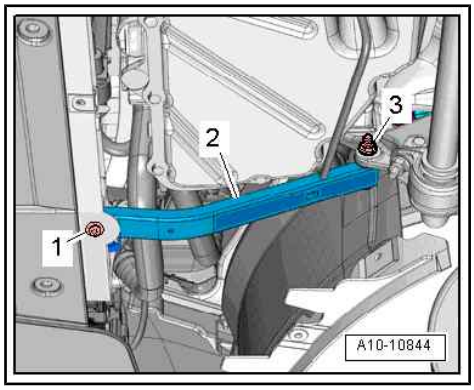
– Open filler cap on coolant expansion tank.
– Place drip tray for workshop hoist - VAS 6208- beneath engine.

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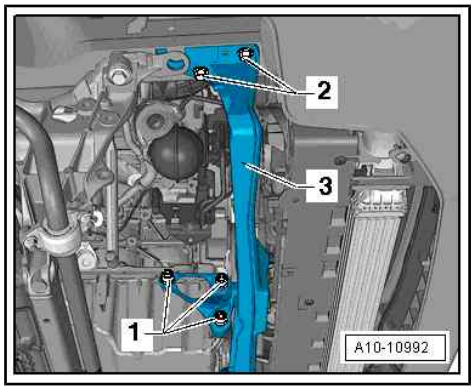
– Unscrew radiator drain tap -1- at connection and drain off coolant, then detach connection -2- from radiator.



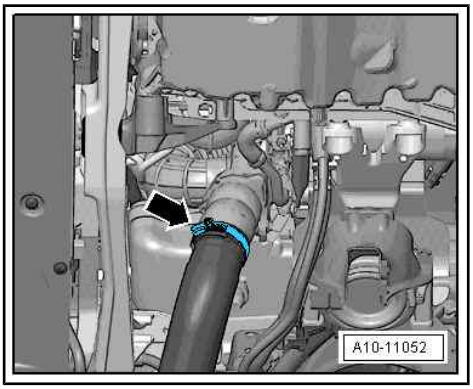
– Remove nuts -3- and longitudinal struts -2- on both sides.



– Remove bolts -1- and remove torque reaction support.
– Remove bolts -2- on both sides and remove cross member -3-.

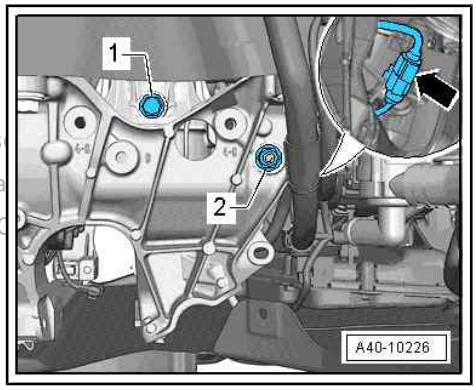


– Open hose clip -arrow-, detach air hose and swivel to side.

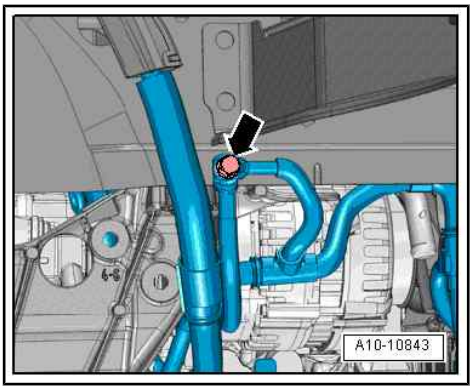


– Remove nut -2- for bracket with wiring on right-hand side of vehicle.

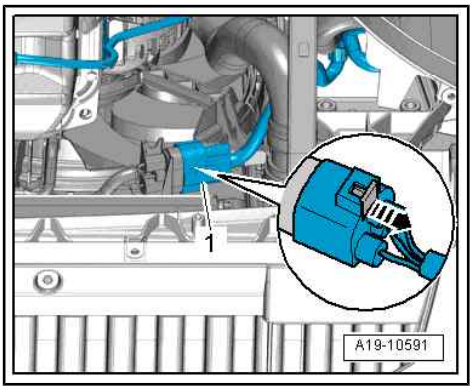
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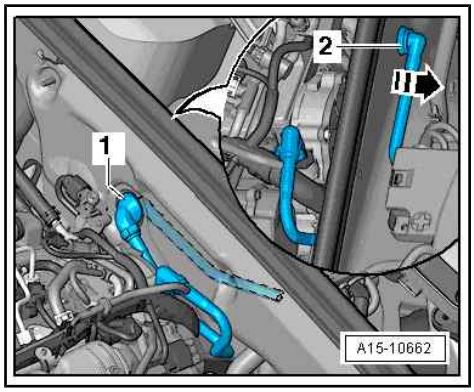
– Unscrew nut -arrow- on longitudinal member (right-side) and move earth cables clear.



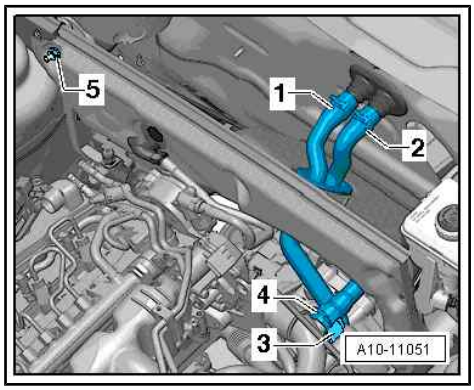
– Unplug electrical connector -1- for radiator fan (push retainer to the rear -arrow- and press down release catch).
– Place wiring harness on engine and secure to prevent it from dropping.



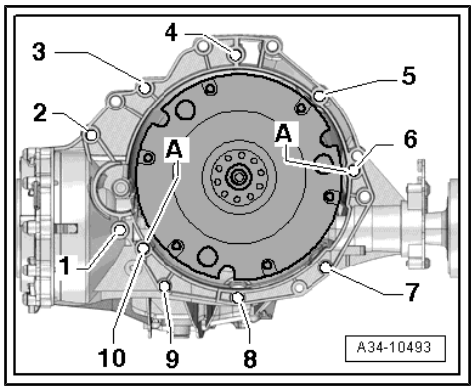
– Disconnect vacuum hose -2- on rear of plenum chamber partition panel -arrow- and detach vacuum connection -1- from plenum chamber partition panel.



– Remove nut -5-.
– Detach coolant hoses -1- to -4- and remove plenum chamber partition panel.

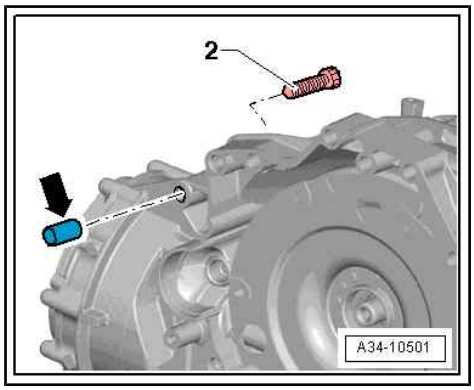


– Remove bolts -2 ... 6-.



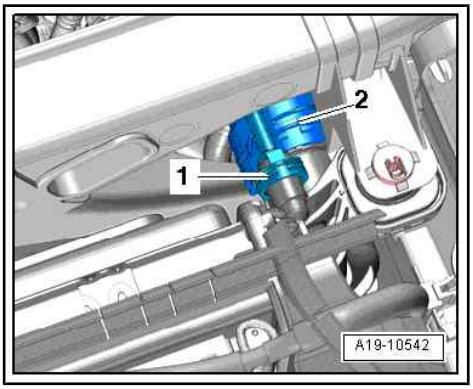
Note

- *Bolt -2- secures the starter to the gearbox and is provided with an additional spacer sleeve -arrow-.*
- *Pay attention to the spacer sleeve -arrow- when removing and installing the engine. The spacer sleeve must be fitted between the starter and the gearbox.*

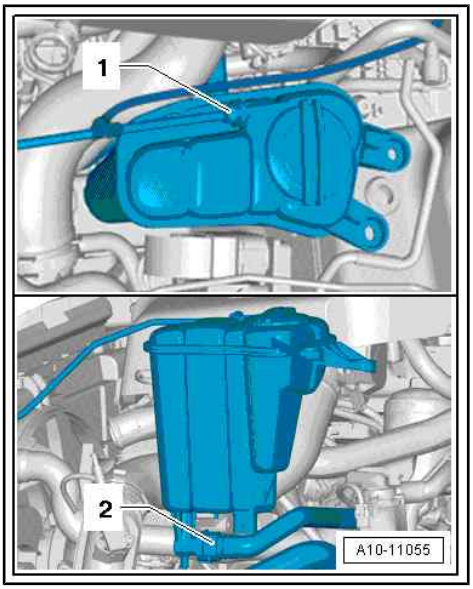


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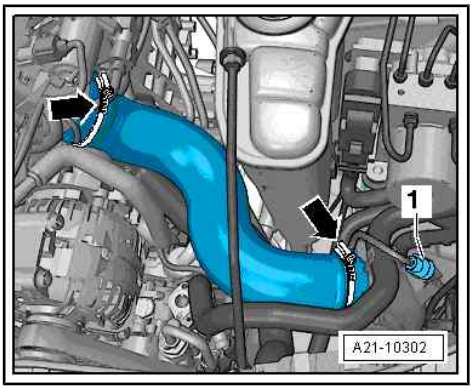
– Detach coolant hose -2- and permanent breather -1-.



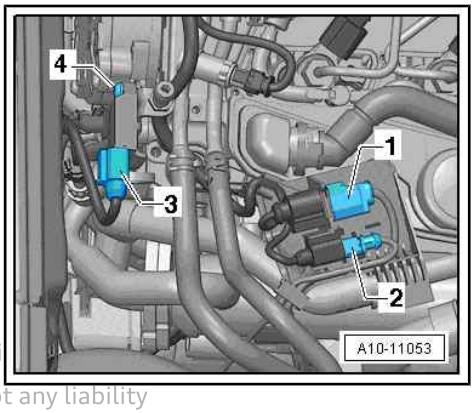
– Detach permanent breather -1- and coolant hose -2- from coolant expansion tank.



– Release hose clips -arrows- and detach air hose.
– Unplug electrical connector for charge pressure sender - G31- -1- and move clear.

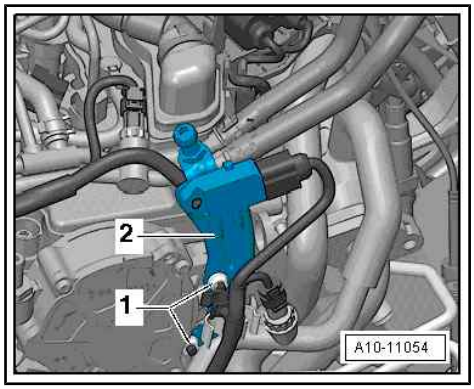


– Unplug electrical connector -1- for Lambda probe - G39- and electrical connector -2- for exhaust gas temperature sender 3 - G495- and move clear.
– Unplug electrical connector -3- for exhaust gas pressure sensor 1 .
– Remove bolt -4- and unclip air hoses for exhaust gas pressure sensor 1 .

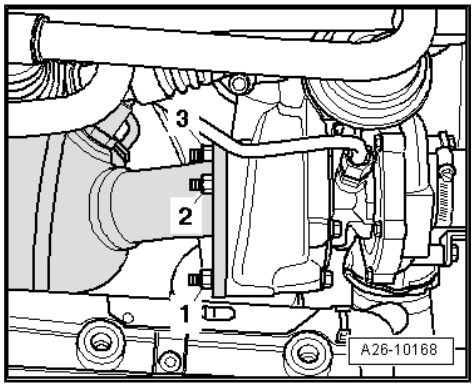


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– Remove nuts -1- and detach bracket -2-.



– Remove nuts -1- to -3- on turbocharger.

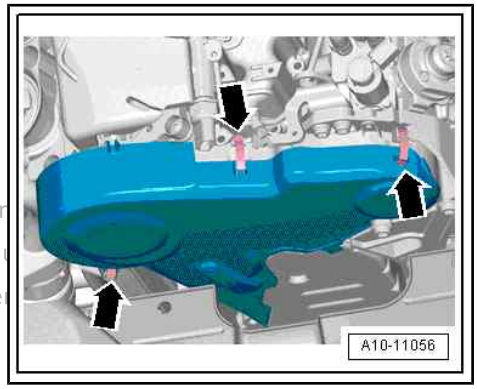


Note

Nut -1- is accessible from below on vehicles with auxiliary heater.

– Open clips -arrows- and remove toothed belt cover.

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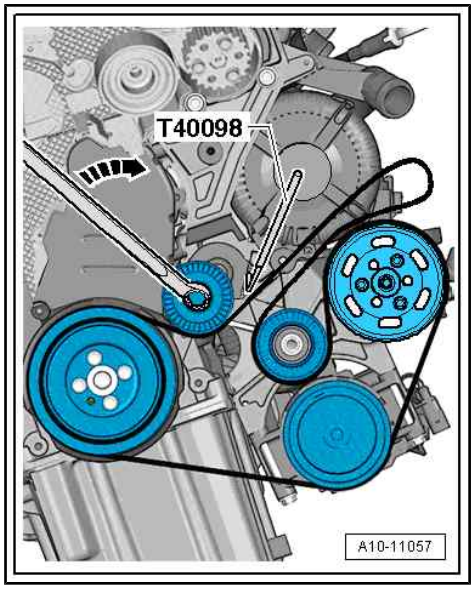


Note

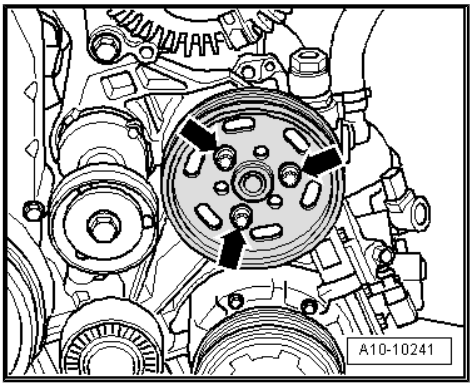
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Swivel tensioner in direction of -arrow-, detach poly V-belt from alternator pulley and lock tensioner using locking tool -T40098- .

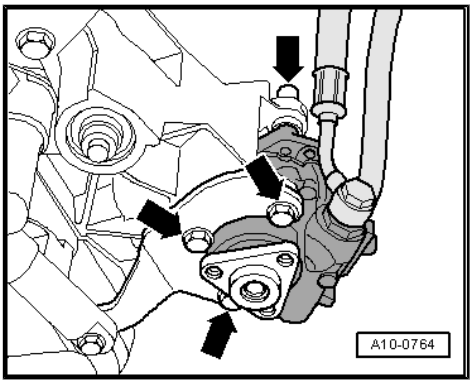
– Take off poly V-belt.



– Remove bolts -arrows- and detach pulley.



– Unbolt power steering pump -arrows- and tie up to one side; the hoses/pipes remain connected.

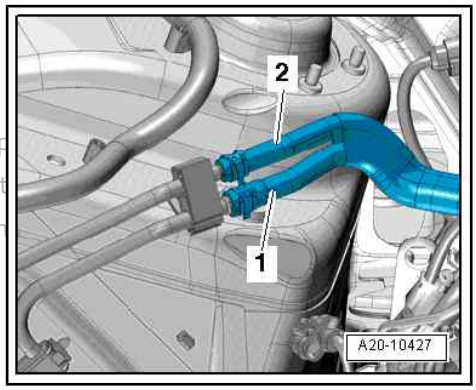


Caution

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

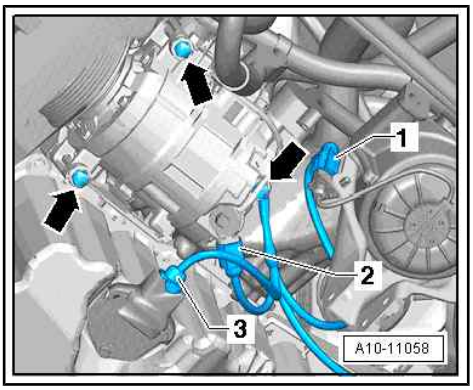
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– Disconnect fuel supply hose -1- and fuel return hose -2-.

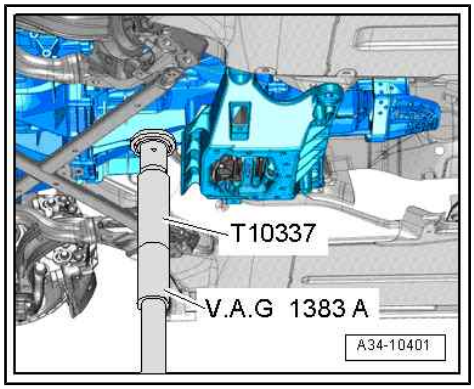


– Unplug electrical connectors -1-, -2- and -3- and move clear.

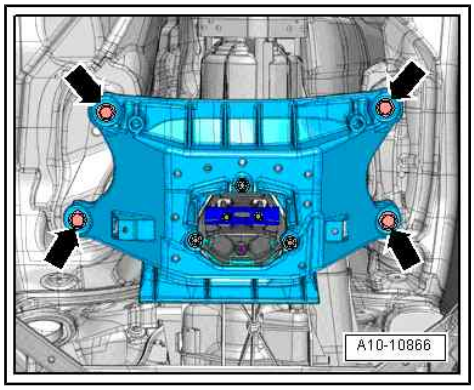
– Remove bolts -arrows- and tie air conditioner compressor up to one side; the hoses/pipes remain connected.



– Support gearbox using engine and gearbox jack - V.A.G 1383 A- with gearbox support - T10337- attached.

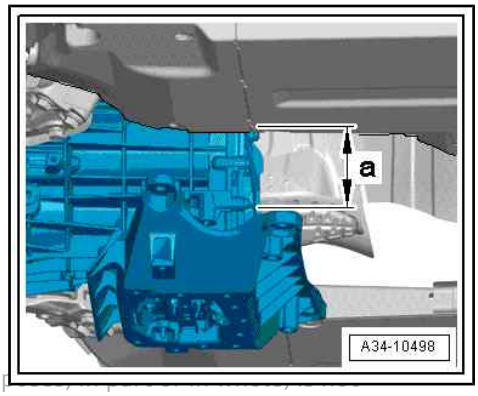


– Remove bolts -arrows- for tunnel cross member.



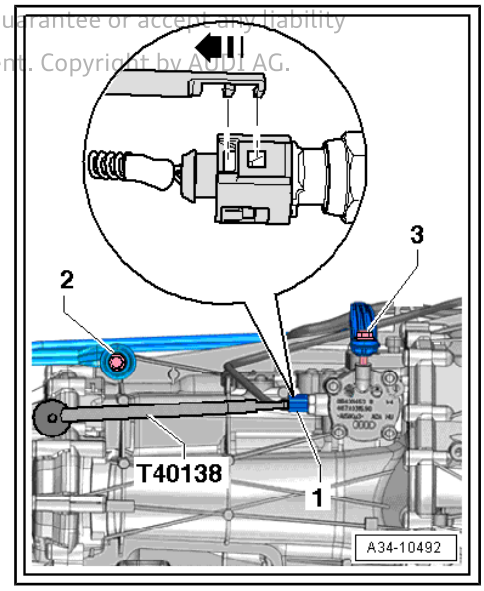
– Lower gearbox using engine and gearbox jack - V.A.G 1383 A- as far as distance -a-.

• Dimension -a- = 80 mm (maximum).

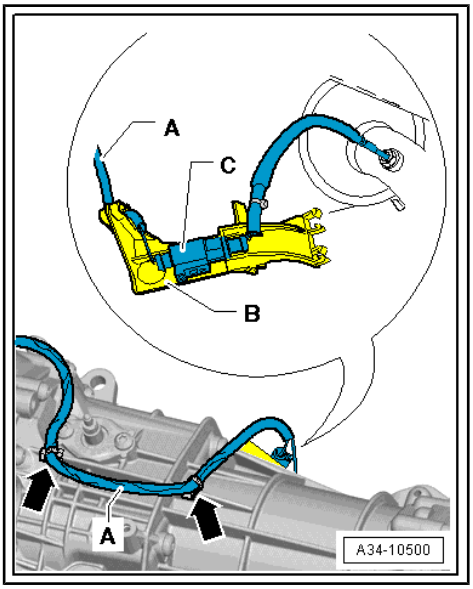


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– Use release tool -T40138- to unplug electrical connector -1- at reversing light switch - F4- and move clear.

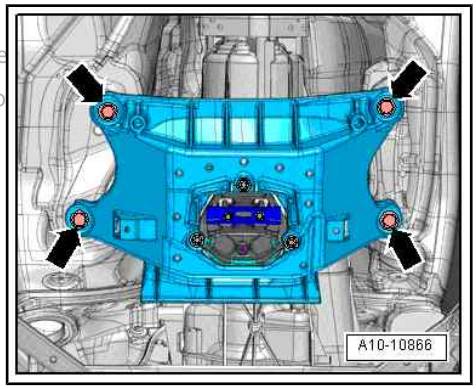


– Unclip electrical wiring -A- from gearbox and unplug electrical connector -C-.

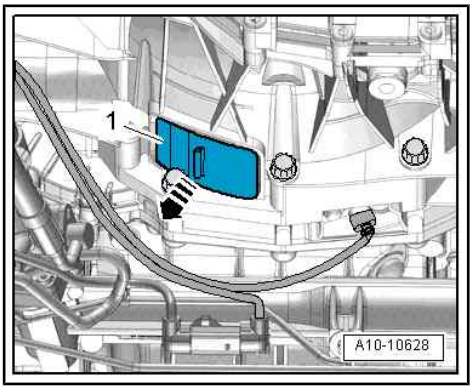


– Raise gearbox using engine and gearbox jack - V.A.G 1383 A- and fit bolts -arrows- for tunnel cross member.

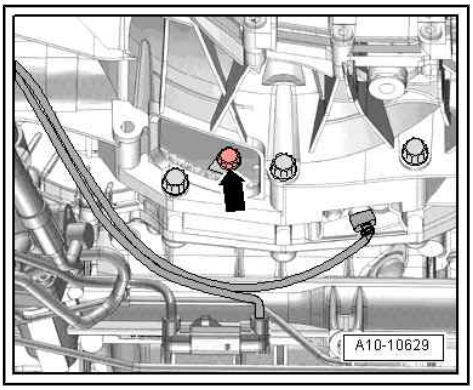
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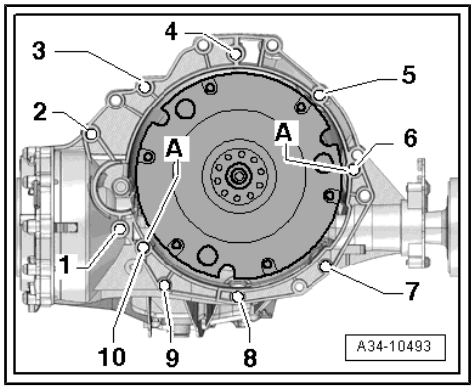
– Detach bottom cover -1- from gearbox -arrow-.



– Remove 3 bolts -arrow- for drive plate. Turn crankshaft 120° in direction of engine rotation each time.



– Remove bolt -1- securing starter (work from side facing engine).
– Detach starter from gearbox, place starter on engine support and secure to prevent it from dropping out.

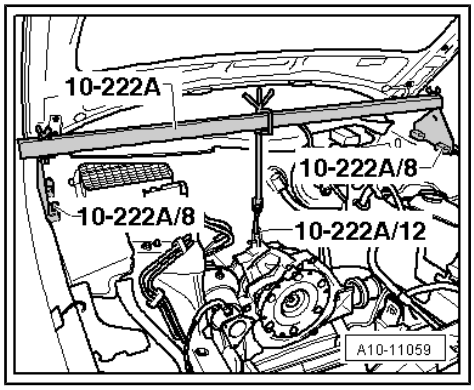


Note

- *It is not possible to remove the starter completely.*
- *When installing the engine, the starter must therefore be put back into position before joining the engine to the gearbox.*

– Unscrew remaining bolts -7 ... 10- securing engine to gearbox.

– Set up support bracket - 10 - 222 A- with stands - 10-222 A/8- on suspension turrets (left and right) as illustrated.
– Use shackle - 10-222 A/12- to hook spindle onto gearbox.

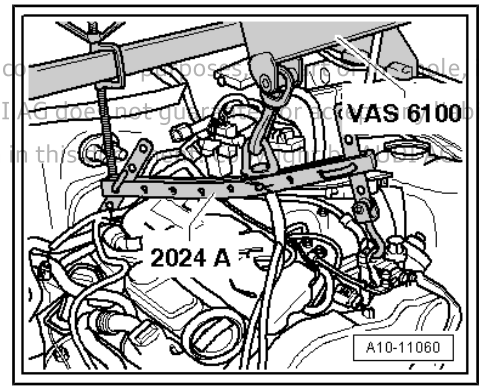


Note

Shown in illustration with engine removed.

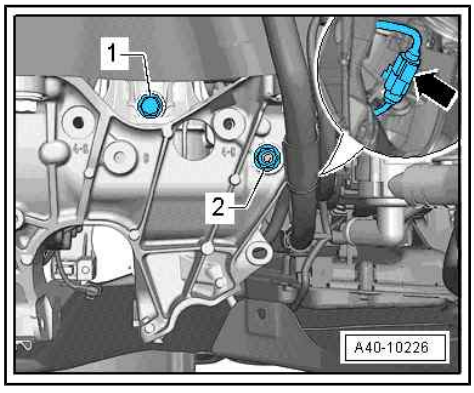
– Pre-tension spindle of support bracket - 10-222 A- slightly.

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



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– Tighten bolts -1- for left and right engine mountings.



Note

Check that all hoses and other connections between engine and body have been detached.

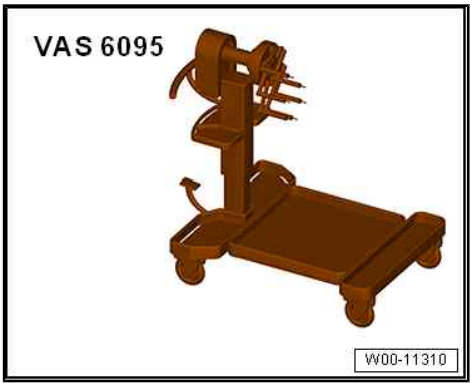
– Raise engine until engine mountings are clear.
– Tighten spindle of support bracket - 10-222 A- further.
– Separate engine from gearbox and lift engine out of engine compartment.

1.2 Securing engine to engine and gearbox support

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

Special tools and workshop equipment required

- Engine and gearbox support - VAS 6095A-



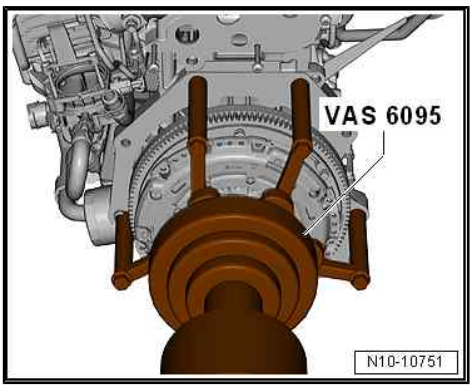
- Workshop hoist - VAS 6100-



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Procedure

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



Tightening torque

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

1.3 Installing engine

Tightening torques

Note

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

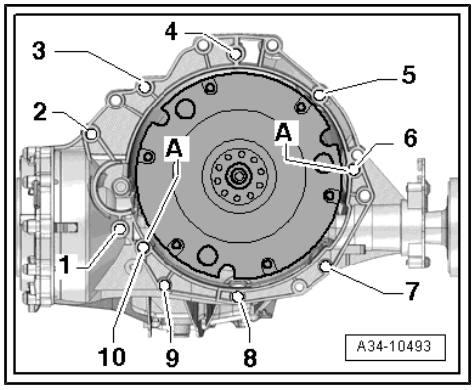
Component		Nm
Bolts/nuts	M6	9
	M8	20

Component		Nm
	M10	40
	M12	65

Securing engine to manual gearbox

Item	Bolt	Nm
1 3)	M10 x 50 1)	65
2 4)	M12 x 100 2)	30 + 90°
3 5), 6	M12 x 75 2)	30 + 90°
4 … 5 5)	M12 x 120 2)	30 + 90°
7…9	M10 x 75 2)	15 + 90°
10	M12 x 50 2)	30 + 90°
A	Dowel sleeves for centralising	

- 1) Steel bolt - is not renewed
- 2) Renew bolts.
- 3) Also secures starter
- 4) Also secures starter, with additional spacer sleeve between starter and gearbox
- 5) Also secures cable retainer



Procedure

Note

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- *Renew bolts tightened with specified tightening angle.*
- *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
- *Hose connections and hoses for charge air system 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 .*
- *To secure the charge air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*
- *Fit all cable ties in the original positions when installing.*

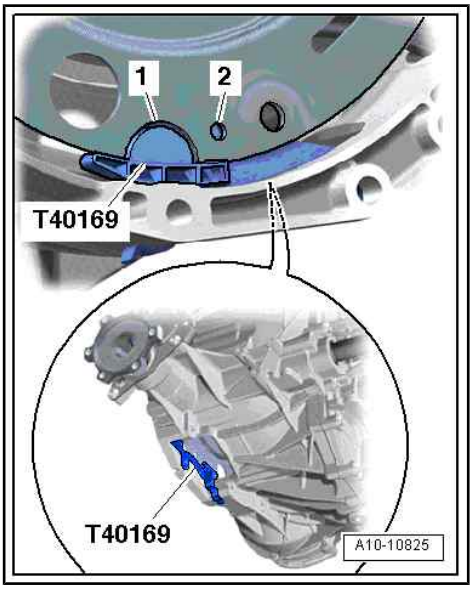
– Check that dowel sleeves for centring engine and gearbox are fitted in the cylinder block; install missing dowel sleeves.

– Before installing gearbox, remove residue from threaded holes for engine/gearbox bolts in cylinder block using a thread tap.

– The following preparations are required before joining engine and gearbox:

– Insert assembly aid - T40169- into gearbox housing between flywheel/torque converter and gearbox housing from below, as illustrated.

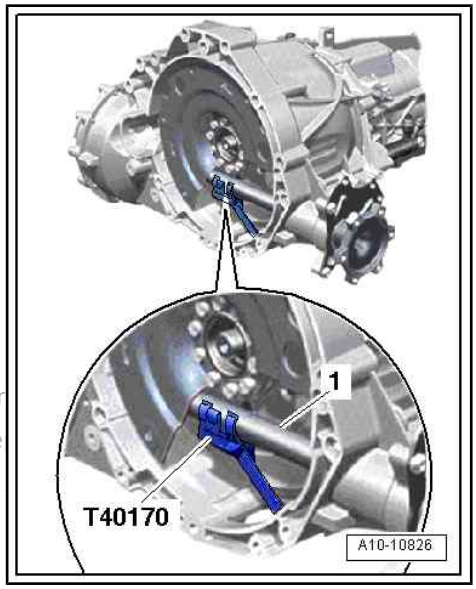
• The assembly aid -T40169- must engage in the semi-circular recess -1- and in the inspection hole -2-.



Note

There is only one inspection hole on the circumference; turn the clutch module accordingly.

– Insert retainer -T40170- into gearbox housing from below and clamp onto flange shaft -1-.

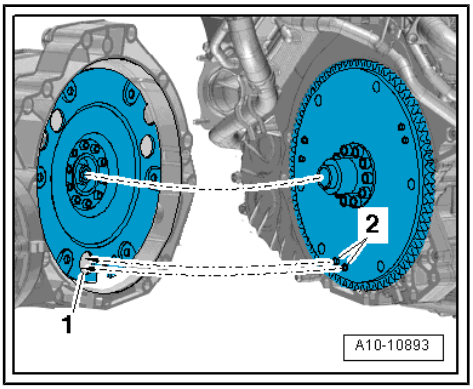


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Note

The next work step is only required if a drive plate with locating pins -2- is fitted.

– In addition, align drive plate relative to clutch module so that locating pins -2- (if fitted) on drive plate are in position to engage in large holes -1- in clutch module.



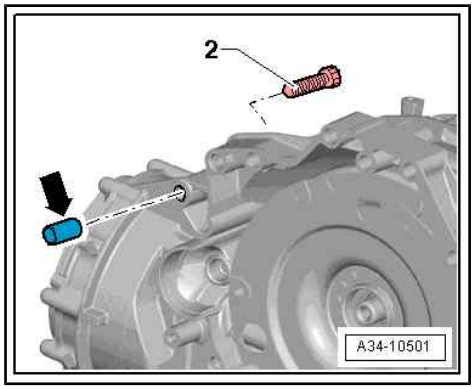
Caution

Incorrect installation will cause the clutch mechanism to malfunction.

- ***If the locating pins of the drive plate -2- do not engage in the holes in the clutch module -1-, this can cause serious malfunctioning of the clutch mechanism.***

Note

- *Bolt -2- secures the starter to the gearbox and is provided with an additional spacer sleeve -arrow-.*
- *Pay attention to the spacer sleeve -arrow- when removing and installing the engine. The spacer sleeve must be fitted between the starter and the gearbox.*

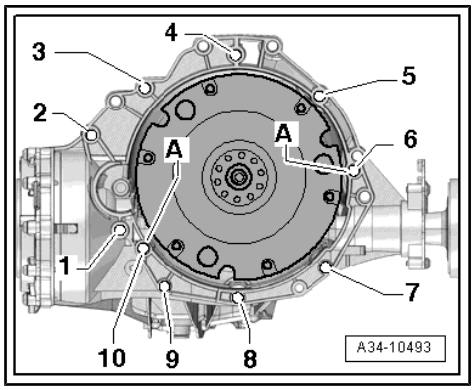


– Place starter in engine support and secure to prevent it from dropping out.

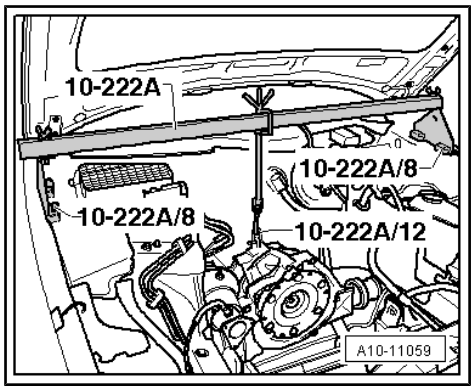
Note

After the engine has been joined to the gearbox, the starter can no longer be installed without removing the engine support.

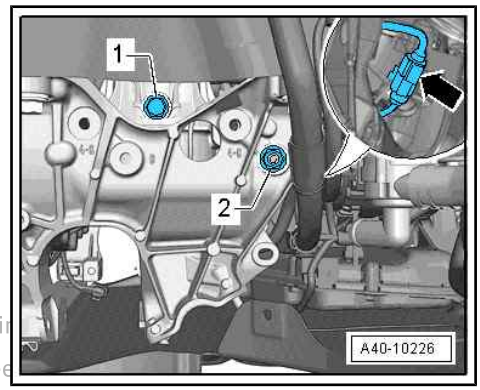
– Join engine onto gearbox, screw in bolts -2 … 6- and tighten.



– Release spindle of support bracket - 10-222 A- .
– Lower workshop hoist and place engine/gearbox assembly onto engine mounting.

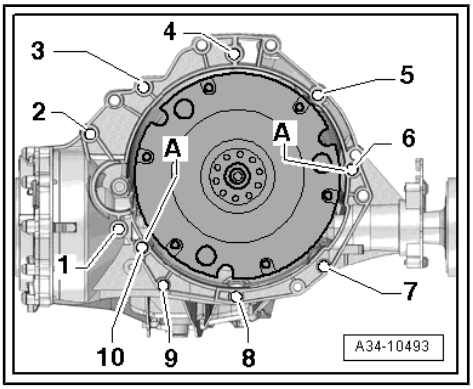


– Fit bolts -1- for left and right engine mountings.
– Detach workshop hoist - VAS 6100- and lifting tackle - 2024 A- .



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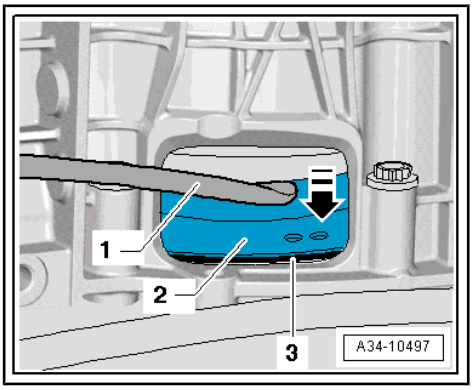
– Screw in bolt -1- and bolts -7 … 10- of engine/gearbox assembly and tighten.



Note

Disregard -item A-.

– Remove retainer -T40170- and assembly aid -T40169- .



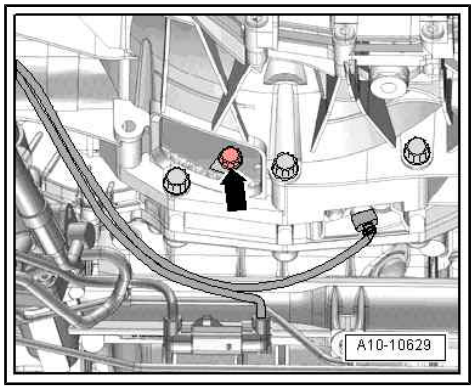
Note

The following step is necessary to ensure that the clutch module is straight and that it makes even contact with the drive plate.

– Use assembly lever -1- to press clutch module -2- slightly against drive plate -3- in direction of -arrow-.

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Tightening sequence - clutch module to drive plate



- Screw in first bolt -arrow- hand-tight (2 Nm).
- Turn crankshaft by 120° in direction of engine rotation and fit second bolt hand-tight.
- Turn crankshaft 120° in direction of engine rotation once again.
- Then tighten third bolt to final torque ⇒ Rep. gr. 30 ; Clutch; Exploded view - clutch module .
- Now tighten remaining bolts securing clutch module to drive plate to final torque.

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

- Install starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter .
- Install particulate filter ⇒ page 268 .
- Install front exhaust pipe ⇒ page 263 .
- Install torque reaction support and cross member ⇒ page 34 .
- Align the exhaust system so it is free of stress ⇒ page 266 .
- Observe electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install engine control unit ⇒ page 257 .
- Install electrical wiring, terminal 30 wiring junction 2 - TV22- and cover for electronics box in engine compartment ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes .
- Install body brace ⇒ Running gear, axles, steering; Rep. gr. 40 ; Suspension strut, upper links; Removing and installing body brace .
- Install filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 ; Windscreen washer system .
- Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

Caution

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

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

- Install air cleaner housing ⇒ page 212 .

Checking oil level (Audi A4) ⇒ Maintenance ; Booklet 812

Checking oil level (Audi A5) ⇒ Maintenance ; Booklet 811

- Fill up with coolant ⇒ page 149 .

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Note

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

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– Install wheel housing liners ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .

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

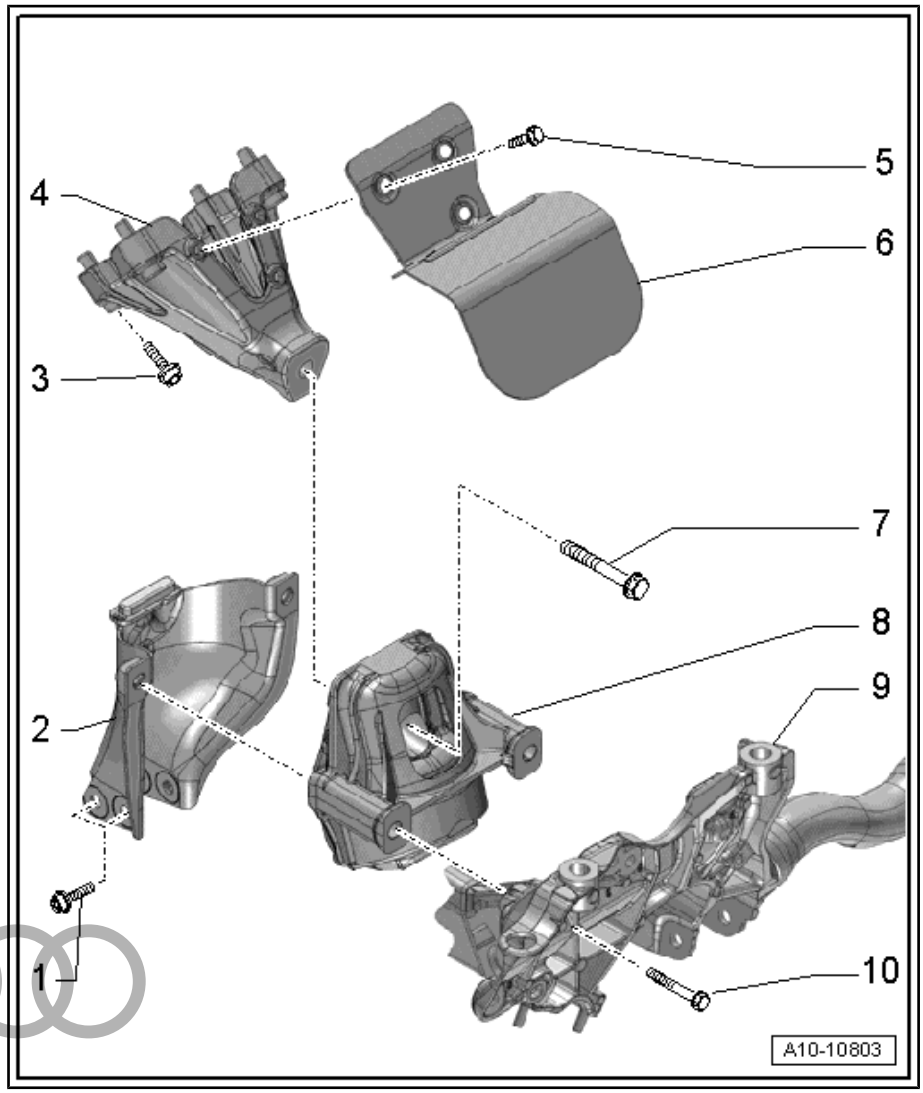
2 Assembly mountings

⇒ “2.1 Exploded view - assembly mountings”, page 32

⇒ “2.2 Removing and installing engine mountings”, page 33

⇒ “2.3 Removing and installing torque reaction support and cross member”, page 34

2.1 Exploded view - assembly mountings



1 - Bolt
- ❑ 20 Nm

2 - Retaining plate
- ❑ For engine mounting
- ❑ Always renew when renewing engine mountings
- ❑ Check retaining plate on opposite side; renew if necessary

3 - Bolt
- ❑ 40 Nm

4 - Engine support

5 - Bolt
- ❑ 10 Nm

6 - Heat shield

7 - Bolt
- ❑ 90 Nm + 90°
- ❑ Renew

8 - Engine mounting
- ❑ With left electrohydraulic engine mounting solenoid valve - N144- (left-side only)
- ❑ On some vehicle versions, the engine mounting on the other side of the vehicle has to be renewed as well; for allocation refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ page 33

9 - Subframe

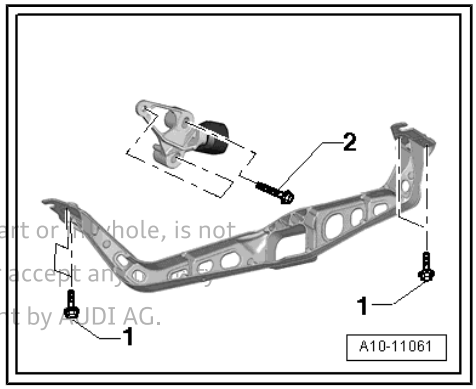
10 - Bolt
- ❑ 55 Nm

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Torque reaction support and cross member

1 - 25 Nm

2 - 40 Nm

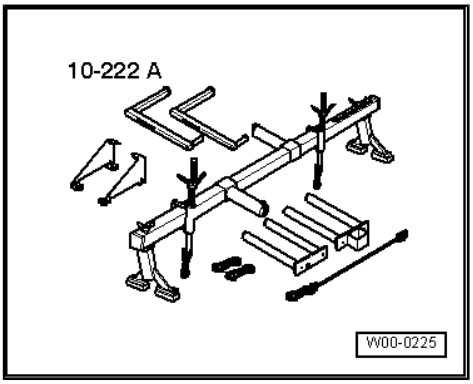


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2.2 Removing and installing engine mountings

Special tools and workshop equipment required

- Support bracket - 10 - 222 A-

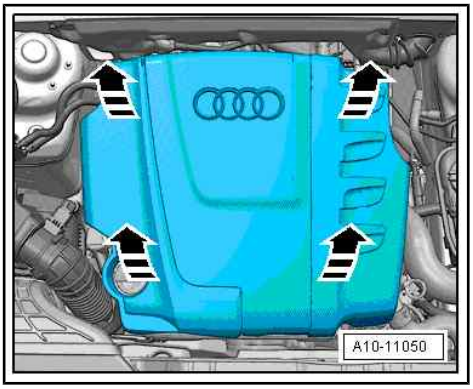


Removing

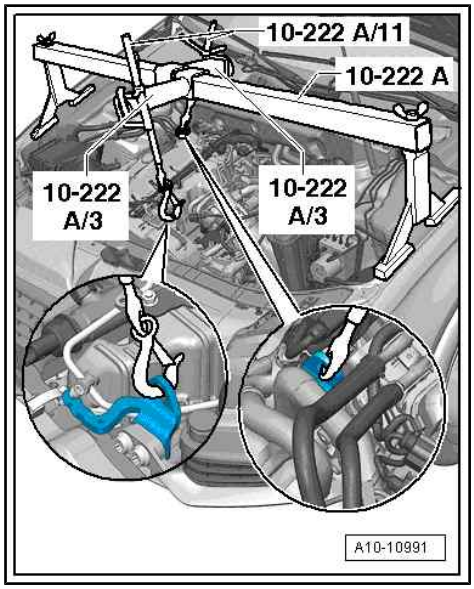
Note

- *To avoid repeat repairs, proceed as follows if an engine mounting is defective:*
- *Renew engine mounting and corresponding retaining plate.*
- *On some vehicle versions, the engine mounting on the other side of the vehicle has to be renewed as well; for allocation refer to ⇒ Electronic parts catalogue .*

– Remove engine cover panel -arrows-.



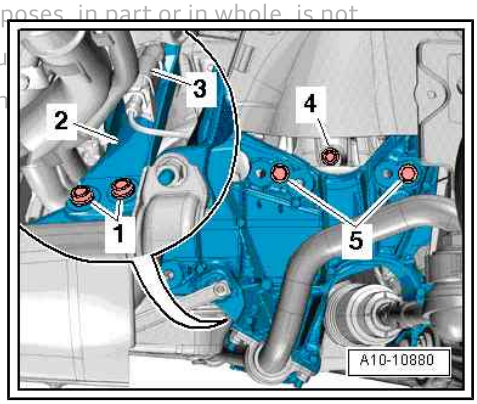
– Set up support bracket - 10 - 222 A- with adapters -10 - 222 A /3- on suspension turrets (left and right) as illustrated.



– Attach spindles -10 - 222 A /11- to engine lifting eyes.
– Partly take up weight of engine with spindles.
– Remove wheel.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Remove wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .

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– Release and unplug electrical connector -3- on left electrohydraulic engine mounting solenoid valve - N144- .
– Remove bolts -1, 4, 5- for engine mounting.
– Move retaining plate -2- for engine mounting clear to the side.
– Detach engine mounting.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “2.1 Exploded view - assembly mountings”, page 32

Note

Renew bolts tightened with specified tightening angle.

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

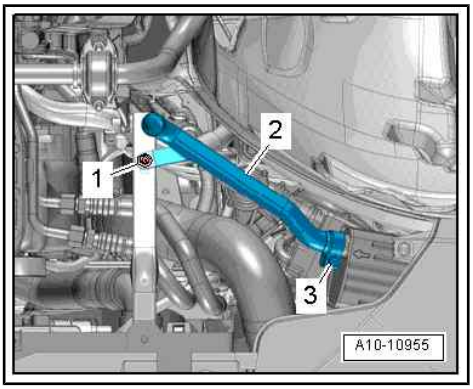
2.3 Removing and installing torque reaction support and cross member

Removing

– Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

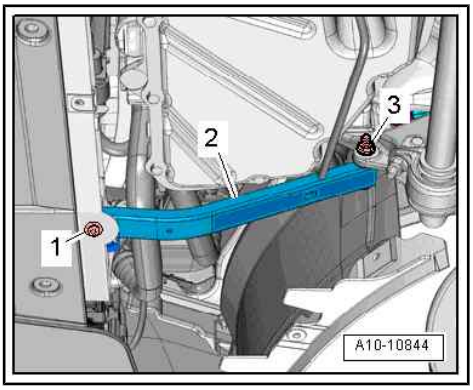
Vehicles with auxiliary heater:

– Remove nut -1-, loosen clamp -3- and detach exhaust pipe -2- for auxiliary heater.



All vehicles (continued):

– Remove bolt -1- and nut -3- and detach strut -2- for lock carrier.



Vehicles with multitronic gearbox:

– Position used oil collection and extraction unit - V.A.G 1782- below connection point.

Note

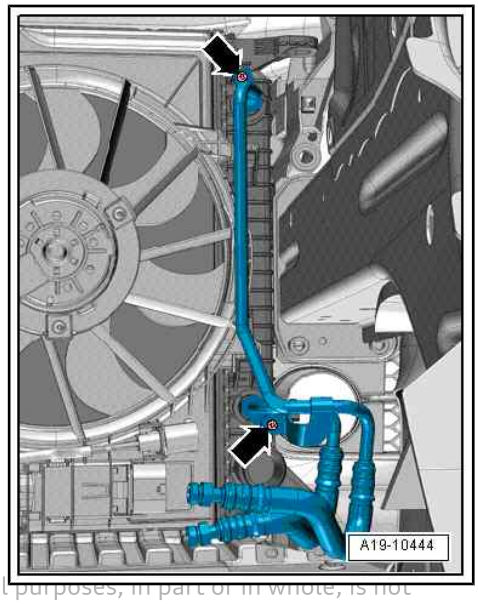
Observe rules for cleanliness when working on gearbox ⇒ Rep. gr. 00 ; Repair instructions; Rules for cleanliness .

– Unscrew bolts -arrows- and detach ATF lines from radiator.

Note

Tie ATF lines up onto longitudinal member to prevent fluid escaping.

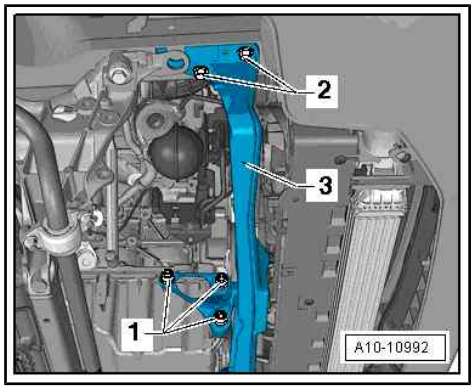
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122-.



All vehicles (continued):

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– Move electrical wiring -3- clear at cross member.
– Remove bolts -1- and take torque reaction support out of cross member.
– Remove bolts -2- on both sides of cross member.



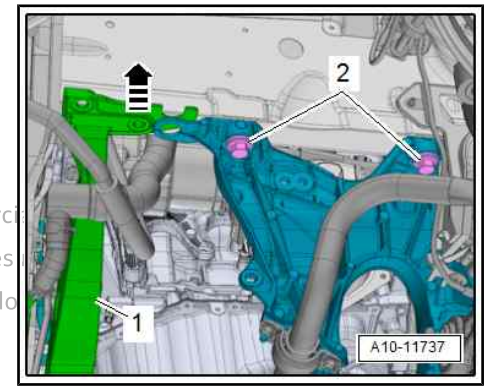
– Loosen subframe bolts -2- (left-side as seen in direction of travel) only as much as is necessary for cross member -1- to move freely in direction of -arrow-.

WARNING

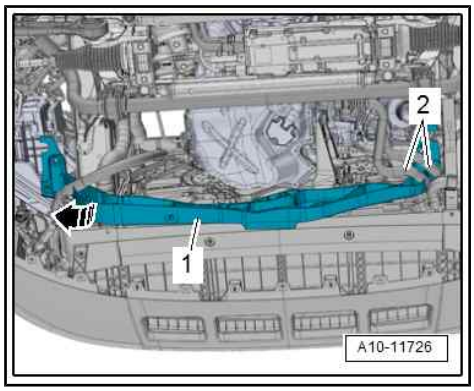
Accident risk if subframe mountings are detached.

- ***Subframe bolts must not be fully removed.***

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– Push cross member -1- slightly towards left side -arrow- so that cross member can be removed from below at longitudinal member (right-side).



Installing

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

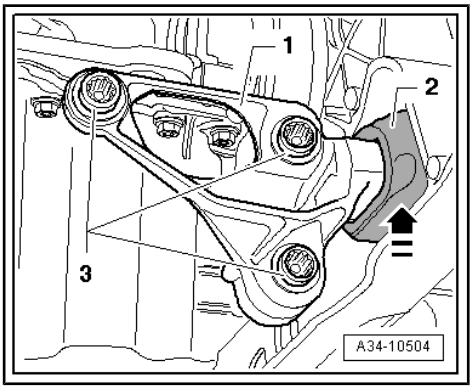
Note

- *Renew bolts tightened with specified tightening angle.*
- *Remove and renew subframe bolts one after the other.*

– Push torque reaction support -1- upwards -arrow- until it makes contact with cross member.

• The buffer stop -2- must be free of stress and must lie against the cross member without play.

– Tighten bolts -3- in this position.



Tightening torques

♦ ⇒ “2.1 Exploded view - assembly mountings”, page 32

♦ Subframe ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Exploded view - subframe

♦ Lock carrier brace ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Exploded view - lock carrier

♦ Exhaust pipe for auxiliary heater ⇒ Auxiliary heater, supplementary heater; Rep. gr. 82 ; Overview of fitting locations - auxiliary/supplementary heater; Overview of fitting locations - components not located in passenger compartment

– Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

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3 Engine cover panel

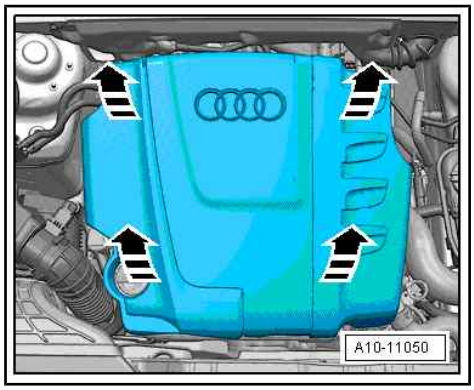
⇒ “3.1 Removing and installing engine cover panel”, page 38

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3.1 Removing and installing engine cover panel

Removing

– Carefully pull engine cover panel off four retaining pins one after the other “arrows”. Do not jerk the cover panel away, and do not try to pull on one side only.



Installing

– To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.

– Position engine cover panel on engine (note locations of oil filler neck and oil dipstick).

– First press engine cover panel into rear rubber grommets and then into front rubber grommets with both hands.

13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ “1.1 Exploded view - poly V-belt drive”, page 39

⇒ “1.2 Exploded view - sealing flange (pulley end)”, page 41

⇒ “1.3 Removing and installing poly V-belt”, page 42

⇒ “1.4 Removing and installing poly V-belt tensioner”, page 43

⇒ “1.5 Removing and installing vibration damper”, page 45

⇒ “1.6 Removing and installing bracket for ancillaries”, page 46

⇒ “1.7 Renewing crankshaft oil seal (pulley end)”, page 48

⇒ “1.8 Removing and installing sealing flange (pulley end)”, page 50

1.1 Exploded view - poly V-belt drive

1 - Poly V-belt

- ❑ Check for wear
- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen
- ❑ Removing and installing ⇒ page 42
- ❑ When installing, make sure it is properly seated on pulleys

2 - Vibration damper with poly V-belt pulley

- ❑ Can only be installed in one position
- ❑ Removing and installing ⇒ page 45

3 - Cover cap for vibration damper

4 - Bolt

- ❑ Renew
- ❑ 10 Nm + 90°

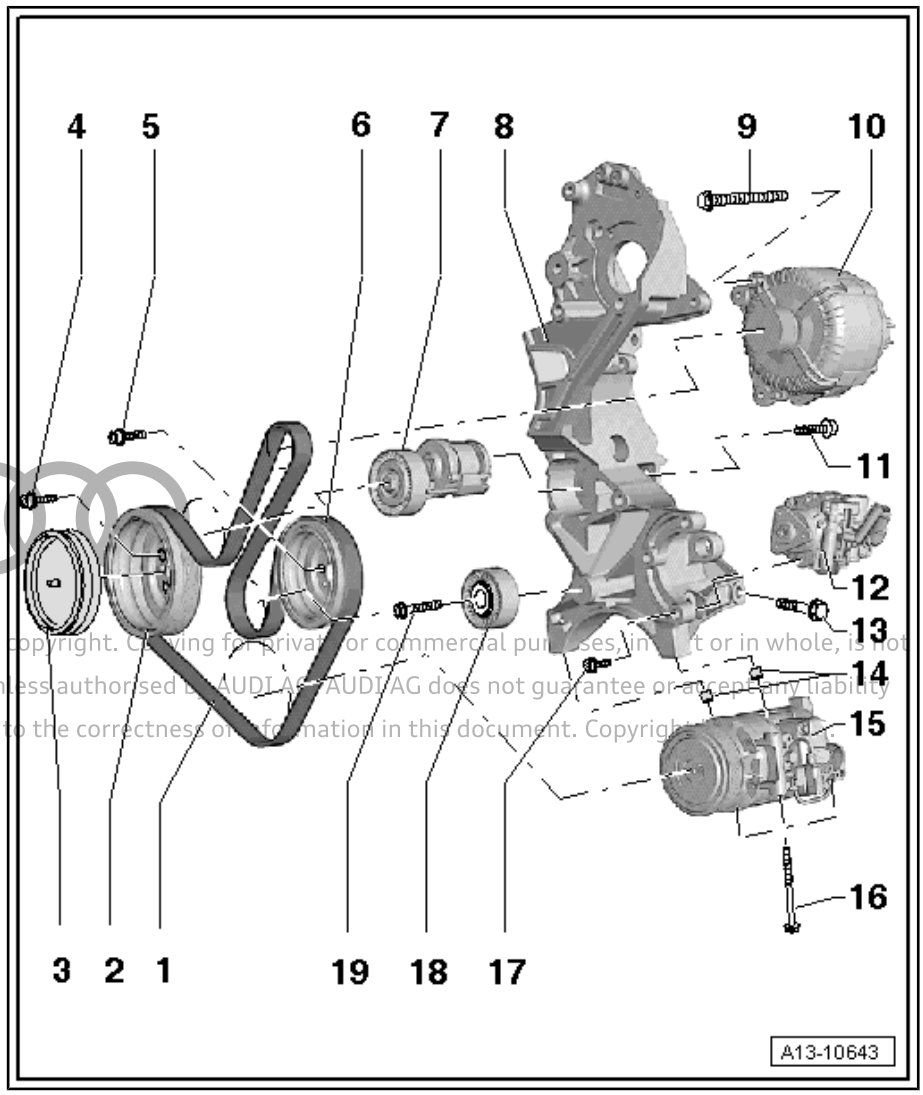
5 - Bolt

- ❑ Tightening torque ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Exploded view - power steering pump

6 - Poly V-belt pulley for power steering pump

7 - Poly V-belt tensioner

- ❑ Use locking tool - T40098- to lock tensioner.
- ❑ Removing and installing ⇒ page 43



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8 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 46

9 - Bolt

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

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10 - Alternator

- ❑ Removing and installing ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator

11 - Bolt

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

12 - Power steering pump

- ❑ Removing and installing ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing power steering pump

13 - Bolt

- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 41

14 - Dowel sleeve

- ❑ Ensure correct seating in bracket

15 - Air conditioner compressor

- ❑ Do not unscrew or disconnect refrigerant hoses or pipes.
- ❑ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket
- ❑ Pay attention to dowel sleeves ⇒ Item 14 (page 40) when installing

16 - Bolt

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

17 - Bolt

- ❑ Tightening torque ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Exploded view - power steering pump

18 - Idler roller for poly V-belt

- ❑ Note installation position

19 - Bolt

- ❑ Renew
- ❑ 20 Nm + 90°

Bracket for ancillaries - tightening torque and tightening sequence

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

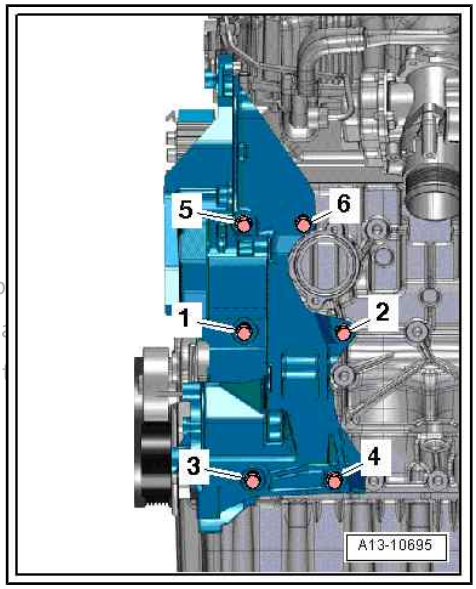
♦ Bolts -1, 5, 6- M10x60.

♦ Bolt -2- M10x40

♦ Bolts -3, 4- M10x155.

– Tighten bolts for bracket for ancillaries in the sequence -1 ... 6- in 5 stages as follows:

1. Screw in all bolts by hand until they make contact.
2. Tighten all bolts to 40 Nm.
3. Turn bolts -1- and -2- 60° further.
4. Turn bolts -3- and -4- 180° further.
5. Turn bolts -5- and -6- 60° further.



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1.2 Exploded view - sealing flange (pulley end)

1 - Cylinder block

2 - Sealing flange

❑ Removing and installing ⇒ page 50

3 - Bolt

❑ Tightening sequence ⇒ page 42

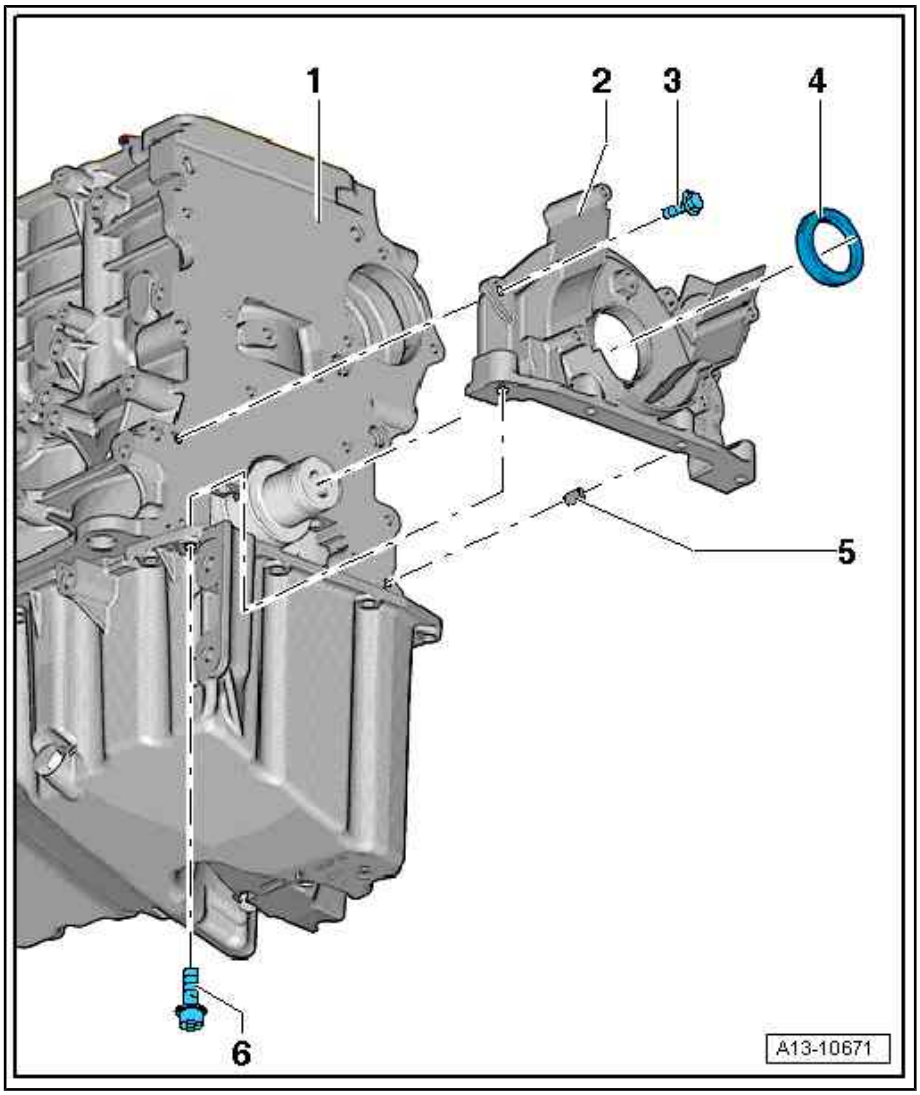
4 - Oil seal

❑ Renewing ⇒ page 48

5 - Dowel sleeve

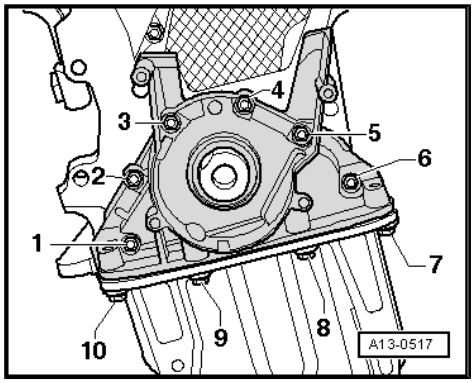
6 - Bolt

❑ Tightening torque ⇒ page 42



Tightening sequence on sealing flange

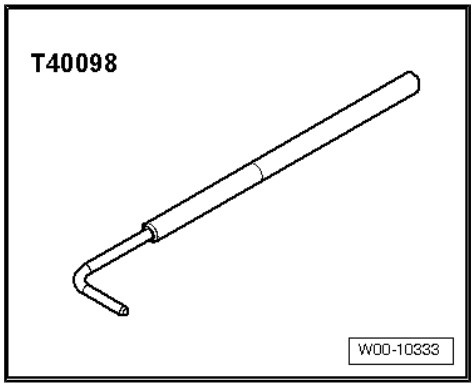
1. Screw in bolts in the sequence -1 ... 10- hand-tight.
2. Tighten bolts in the sequence -1 ... 6- to 15 Nm.
3. Tighten bolts in the sequence -7 ... 10- to 15 Nm.



1.3 Removing and installing poly V-belt

Special tools and workshop equipment required

- Locking tool - T40098-



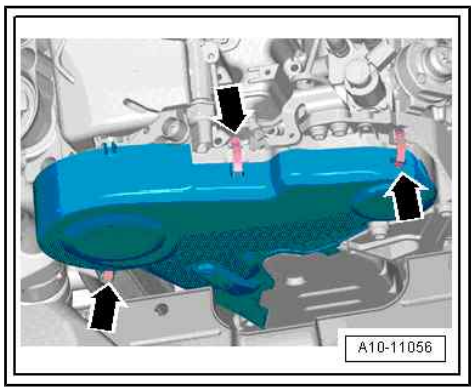
Removing

– Remove engine cover panel -arrows-.

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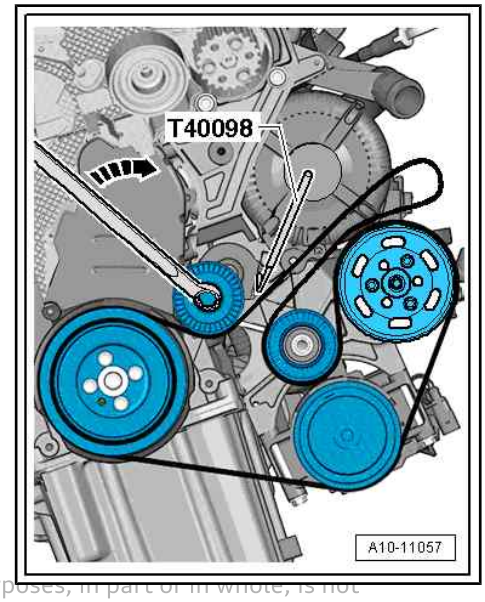
– Open clips -arrows- and remove toothed belt cover.



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.*



– Swivel tensioner in direction of -arrow-, detach poly V-belt from alternator pulley and lock tensioner using locking tool - T40098- .

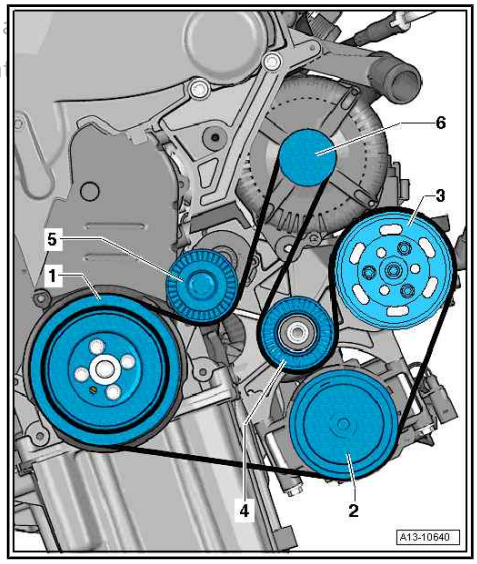
– Take off poly V-belt.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

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Fit poly V-belt as illustrated.



1 - Vibration damper
2 - Air conditioner compressor
3 - Power steering pump pulley
4 - Idler roller
5 - Poly V-belt tensioner
6 - Alternator

Note

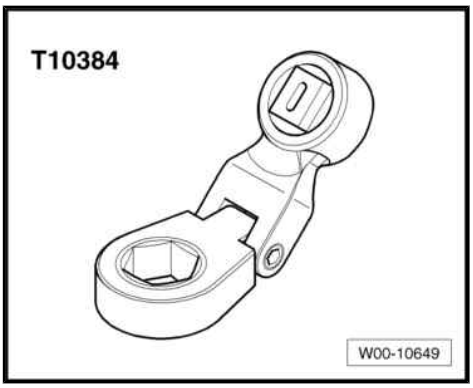
When installing poly V-belt, make sure it is properly seated on pulleys.

– Start engine and check that poly V-belt(s) run properly.

1.4 Removing and installing poly V-belt tensioner

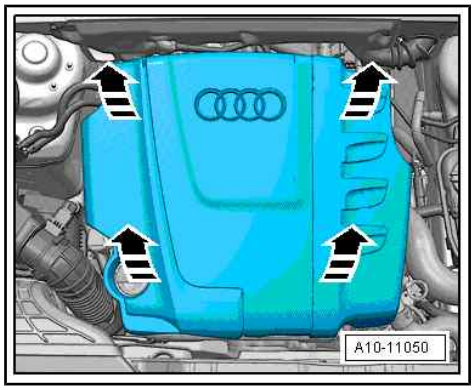
Special tools and workshop equipment required

- Ratchet wrench 13 mm - T10384-



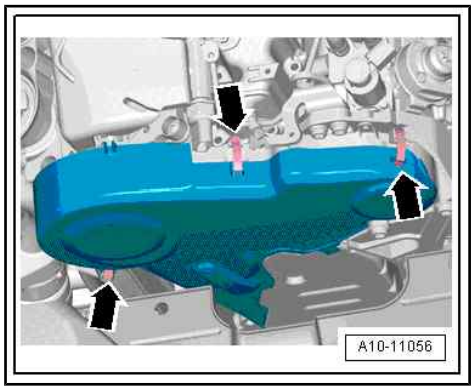
Removing

– Remove engine cover panel -arrows-.



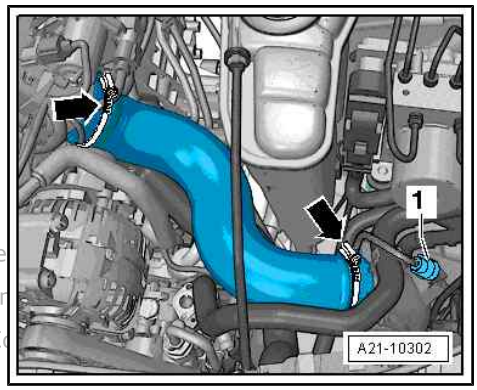
– Open clips -arrows- and remove toothed belt cover.

– Remove poly V-belt ⇒ page 42 .

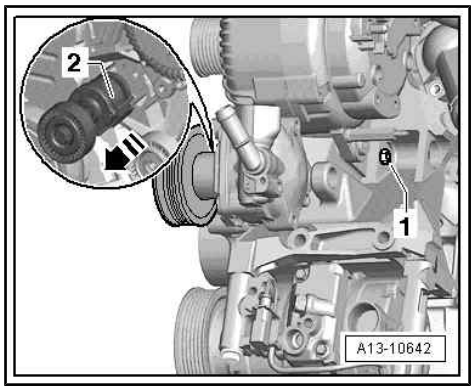


– Release hose clips -arrows- and detach air hose.

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– Remove bolt -1-.



Note

- *If bolt -1- makes contact with engine bracket, leave bolt in installation position.*
- *Due to lack of space, the tensioner must be guided out upwards by rotating it.*

– Lift out poly V-belt tensioner -2-.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques

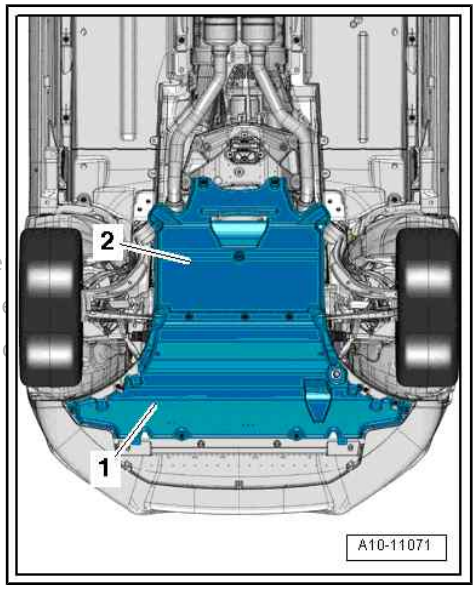
- ⇒ “1.1 Exploded view - poly V-belt drive”, page 39

1.5 Removing and installing vibration damper

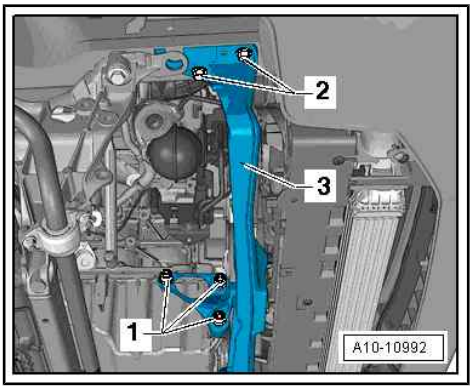
Removing

– Remove front noise insulation -1- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

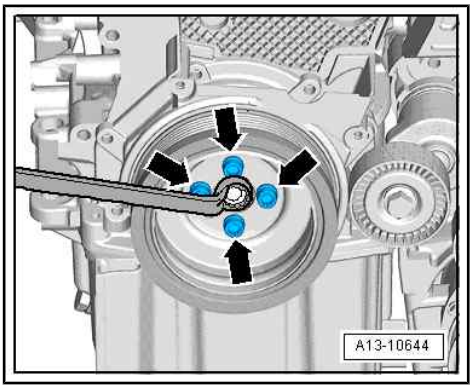
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– Vehicles with torque reaction support: remove cross member for torque reaction support ⇒ page 34 .
– Remove radiator fan control unit - J293- ⇒ page 175 .
– Remove poly V-belt ⇒ page 42 .
– Detach cover cap for vibration damper.



– Remove bolts -arrows- (counterhold at central bolt).
– Remove vibration damper.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

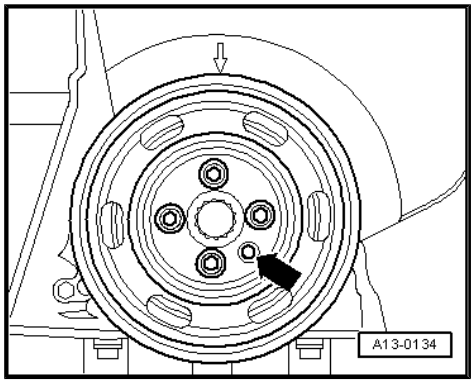
Tightening torques
⇒ “1.1 Exploded view - poly V-belt drive”, page 39

Tightening torques
⇒ “2.1 Exploded view - assembly mountings”, page 32

Note

Renew bolts tightened with specified tightening angle.

- Installation position: hole -arrow- in vibration damper must be positioned over raised section of crankshaft sprocket.



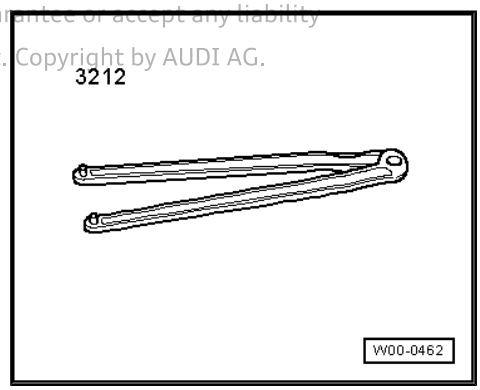
– Install radiator fan control unit - J293- ⇒ page 175 .
– Install poly V-belt ⇒ page 42 .
– Vehicles with torque reaction support: install cross member for torque reaction support ⇒ page 34 .

1.6 Removing and installing bracket for ancillaries

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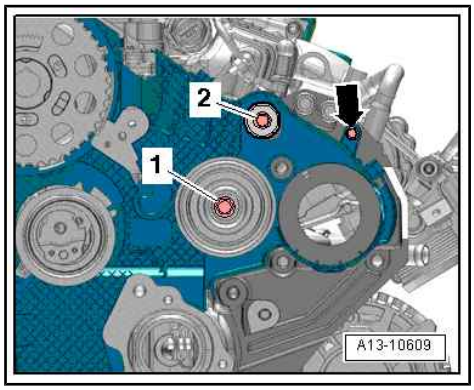
Special tools and workshop equipment required

◆ Pin wrench - 3212-

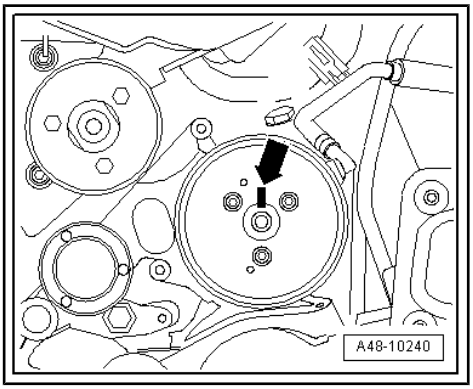


Removing

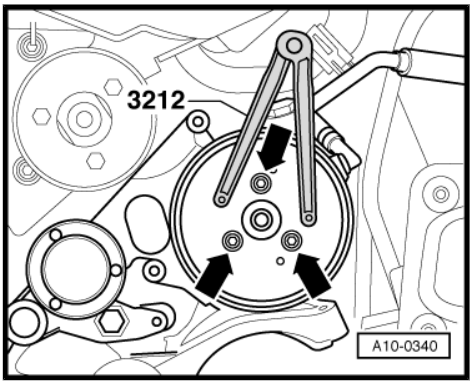
– Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
– Remove high-pressure pump ⇒ page 241 .
– Drain coolant ⇒ page 149 .
– Remove bolt -arrow-.
– Remove bolts -1- and -2- and remove idler rollers for toothed belt.



– Mark position of pulley on hub. To do so, make a marking -arrow-.

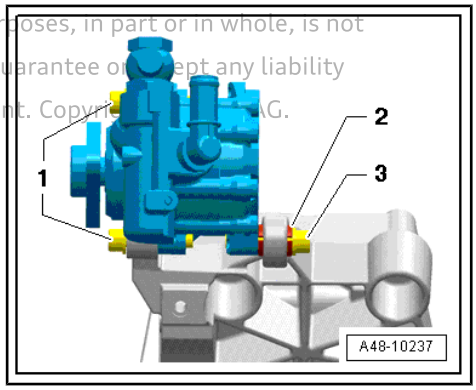


– Remove bolts -arrow-. Use pin wrench - 3212- as counterhold tool.

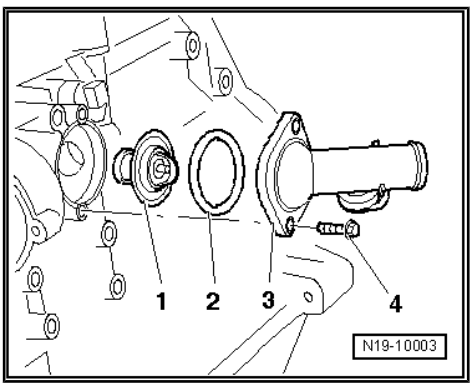


– Unscrew bolts -1- (3x) and bolt -3-.
– Tie up power steering pump to one side with hydraulic lines attached.
– Detach air conditioner compressor from bracket for ancillaries and tie up to one side ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .

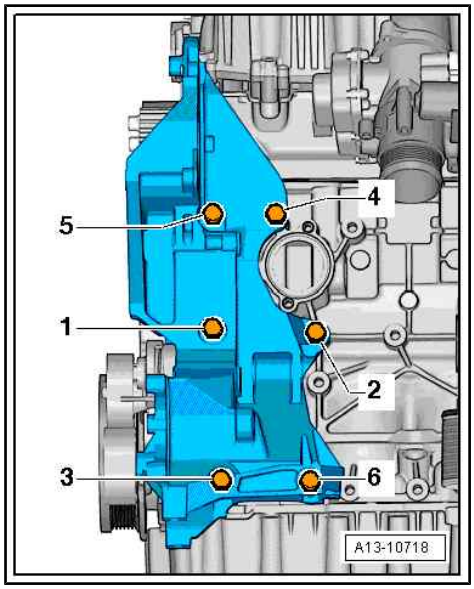
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– Using articulated wrench, 10 mm - 3185- and socket - T10058- , loosen bolts -4- of connection -3- and remove connection -3- with thermostat -1-.



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



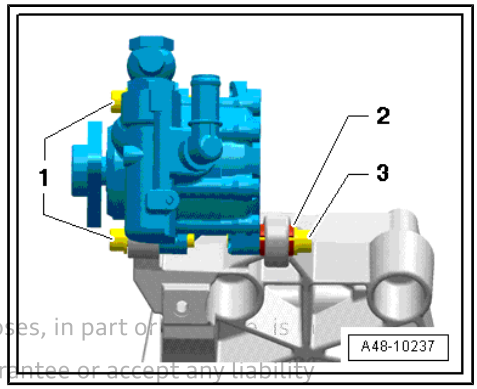
Installing

Installation is carried out in reverse sequence. When doing so, 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 41 .



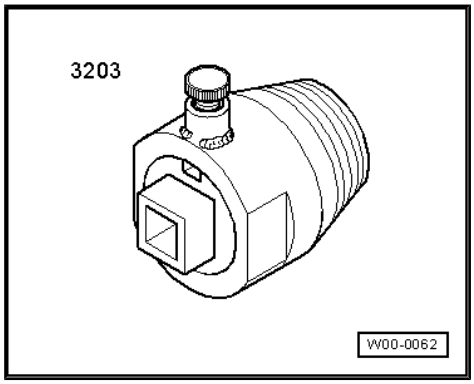
– To install power steering pump it is necessary to slightly knock back sleeve -2- for bolt -3- in bracket.
– Install high-pressure pump ⇒ page 241 .
– Install toothed belt ⇒ page 90 .
– Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
– Fill up with coolant ⇒ page 149 .

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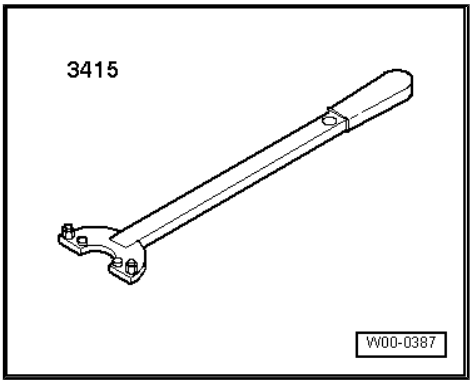
1.7 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

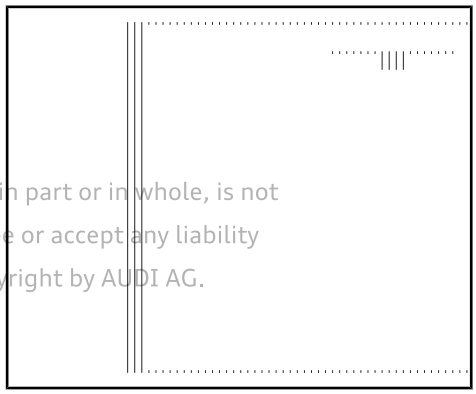
♦ Oil seal extractor - 3203-



♦ Counterhold tool - 3415-



♦ Assembly tool - T10053-



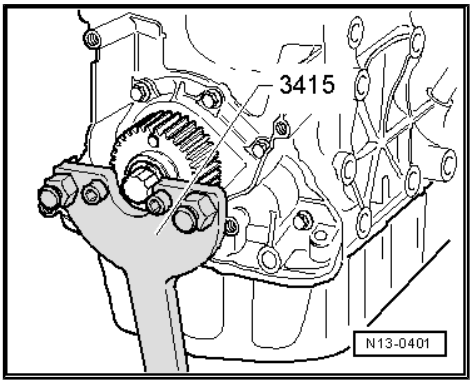
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Procedure

– Remove toothed belt ⇒ page 90 .

– 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.

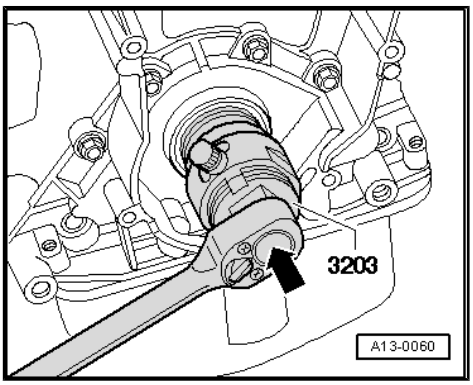
– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).

– 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.

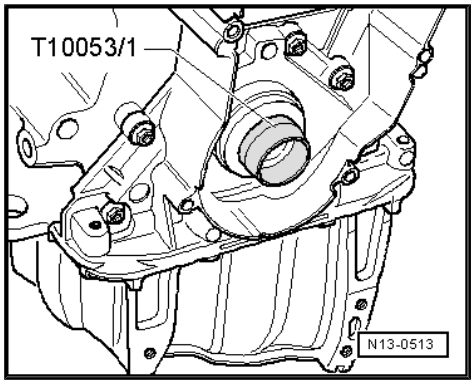
– Remove oil residue from crankshaft journal with a clean cloth.



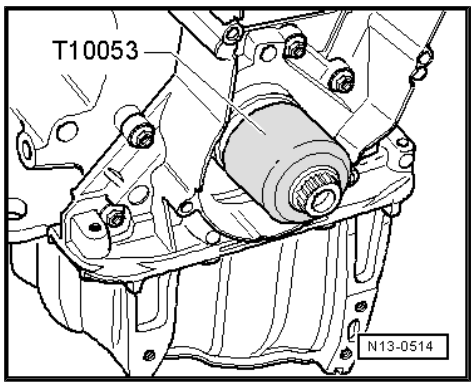
Note

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.



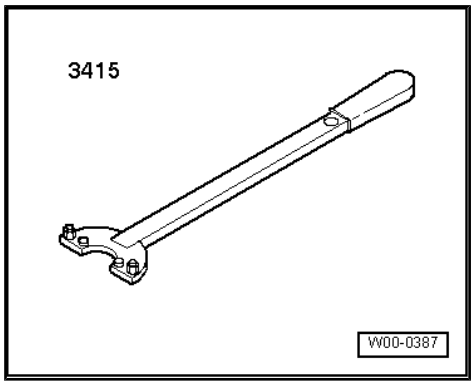
– Press in oil seal using bolt for crankshaft sprocket and thrust sleeve of assembly tool - T10053- until flush.
– Install crankshaft sprocket ⇒ page 89 .
– Install toothed belt ⇒ page 90 .



1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

♦ Counterhold tool - 3415-

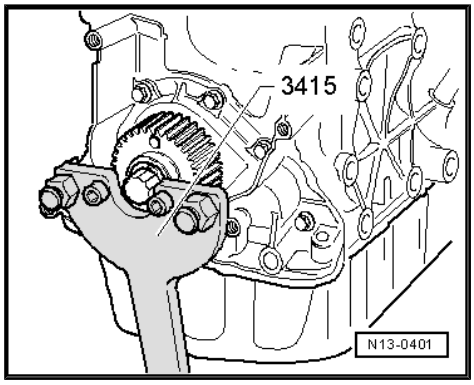


♦ Electric drill with plastic brush attachment
♦ Safety goggles
♦ Sealant ⇒ Electronic parts catalogue

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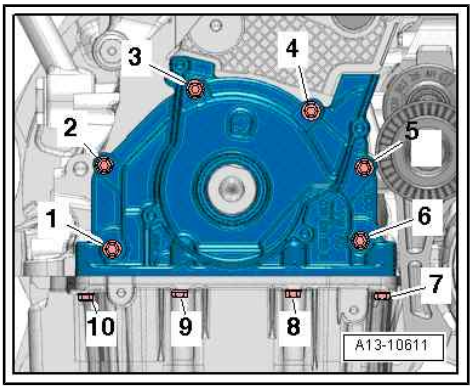
Removing

– Remove toothed belt ⇒ page 90 .
– Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .
– Remove bolt and detach crankshaft sprocket.



– Remove bolts -1 ... 10- and carefully release sealing flange from bonded joint.

– Drive out oil seal with sealing flange removed.



Installing

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

- Tightening torques
  ⇒ “1.2 Exploded view - sealing flange (pulley end)”, page 41

Caution

Make sure sealant residue does not enter lubrication system.

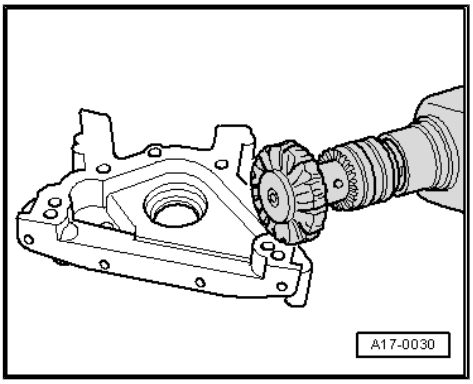
- ***Place a clean cloth over the exposed section of the sump.***

– Carefully remove sealant residue on cylinder block and sump.

WARNING

Risk of eye injury.

- ***Put on safety goggles.***



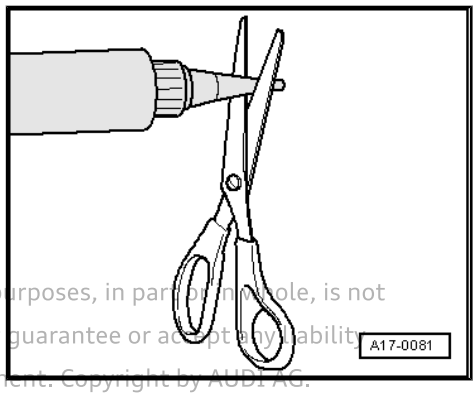
– Use e.g. rotating plastic brush to remove sealant residue on sealing flange.

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

Note

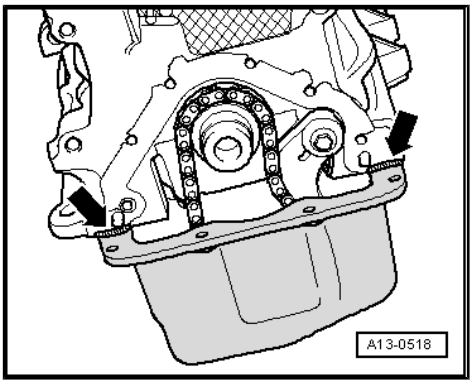
Note the use-by date of the sealant.

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



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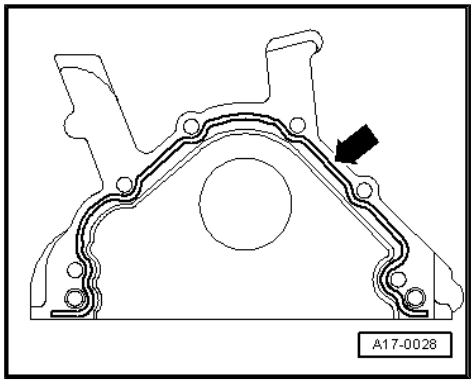
– Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



Caution

Make sure lubrication system is not clogged by excess sealant.

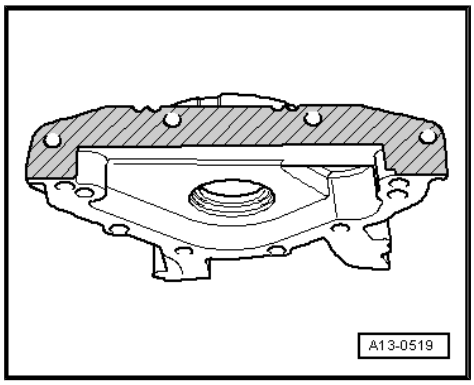
- ***The sealant bead must not be thicker than specified.***



– Apply sealant bead -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.



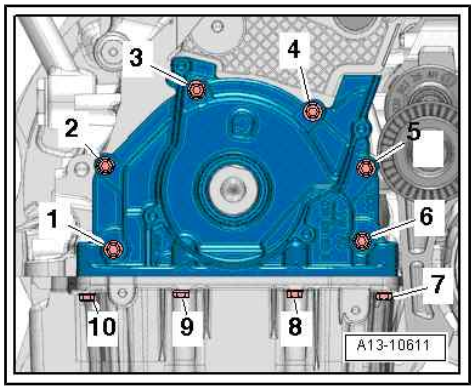
Note

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 42 .

– Install crankshaft oil seal (pulley end) ⇒ page 48 .



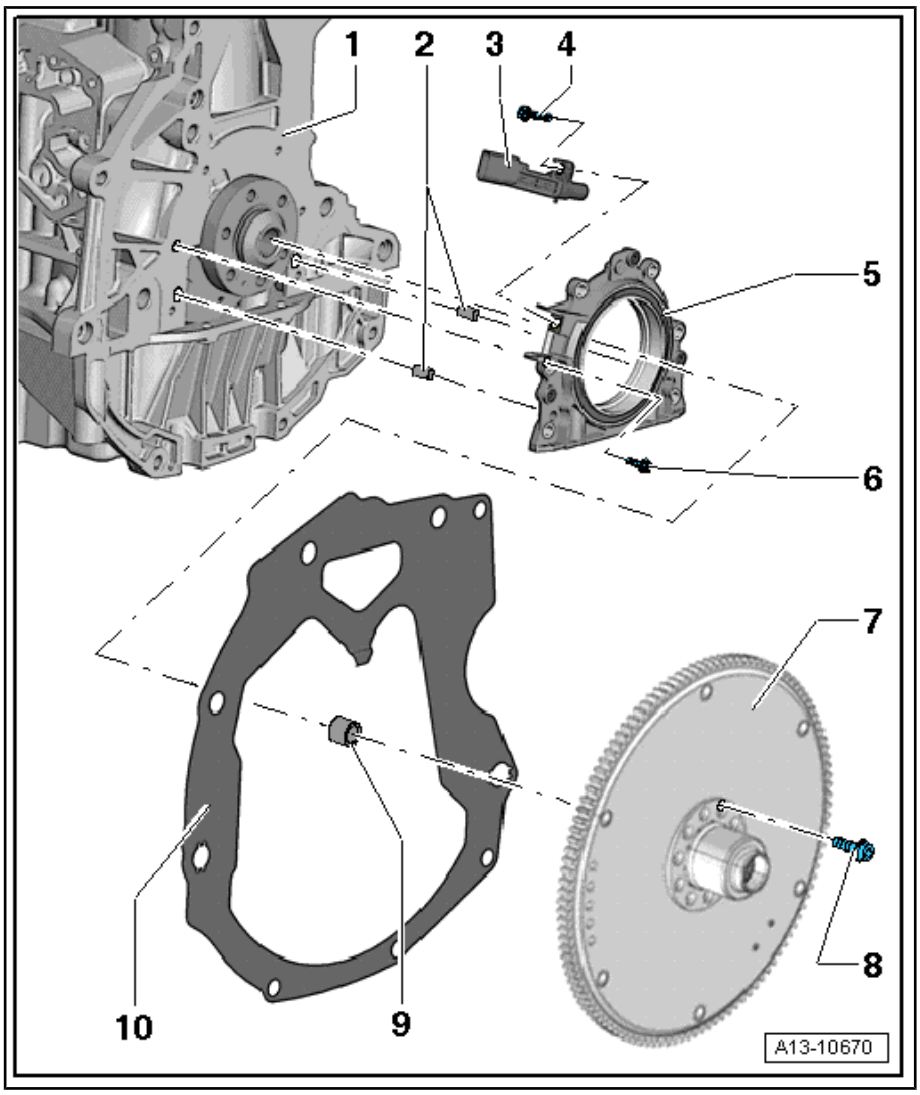
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2 Cylinder block (gearbox end)

⇒ “2.1 Exploded view - cylinder block (gearbox end)”, page 53
⇒ “2.2 Removing and installing drive plate”, page 54
⇒ “2.3 Removing and installing sealing flange (gearbox end)”, page 55
⇒ “2.4 Renewing needle bearing in drive plate”, page 63

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2.1 Exploded view - cylinder block (gearbox end)



1 - Cylinder block

2 - Dowel sleeves

3 - Engine speed sender - G28-

4 - Bolt

- ❑ 4.5 Nm

5 - Sealing flange with oil seal

- ❑ Removing and installing ⇒ page 55
- ❑ With sender ring for engine speed sender
- ❑ Renew only as complete unit
- ❑ Do not additionally oil or grease sealing lip of oil seal
- ❑ Before installing, remove oil residue from crankshaft journal with a clean cloth.
- ❑ Use support sleeve supplied when fitting

6 - Bolt

- ❑ 15 Nm

7 - Drive plate

- ❑ Lock with counterhold tool - 3067- to slacken off bolts

8 - Bolt

- ❑ 60 Nm + 90°
- ❑ Renew

9 - Needle bearing

- ❑ Removing and installing needle bearing ⇒ page 63

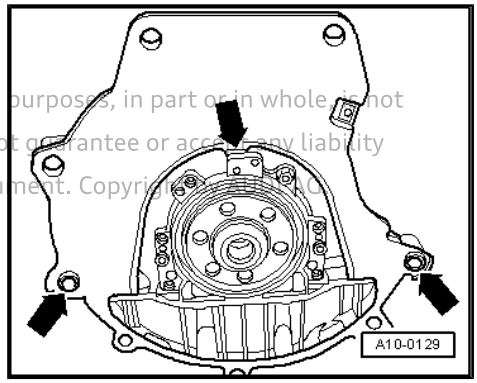
10 - Intermediate plate

- ❑ Is fitted onto sealing flange ⇒ page 54
- ❑ Must be positioned on dowel sleeves
- ❑ Do not damage/bend when assembling

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Installing intermediate plate

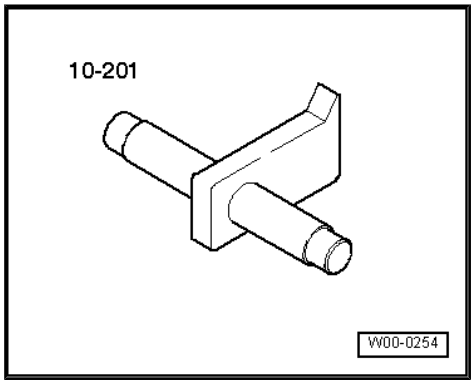
– Fit intermediate plate on sealing flange and push onto dowel sleeves -arrows-.



2.2 Removing and installing drive plate

Special tools and workshop equipment required

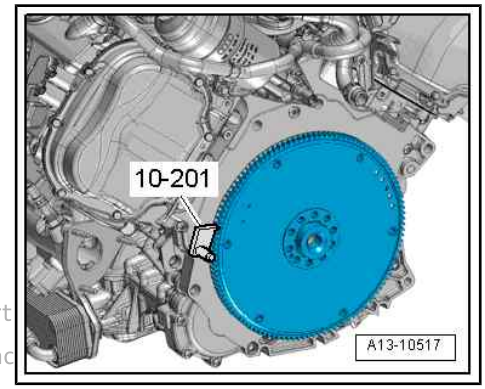
- Counterhold tool - 10 - 201-



Removing

- Gearbox removed

– Insert counterhold tool - 10 - 201- to slacken bolts.



Caution

Take care not to damage outer surface of bearing flange on drive plate.

- ***Use a multi-point socket bit with a length of at least 40 mm to slacken and tighten the drive plate bolts.***

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– Remove bolts and take off drive plate.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ "2.1 Exploded view - cylinder block (gearbox end)", page 53

Note

- *Renew bolts for drive plate.*
- *On vehicles with manual gearbox, a needle bearing is fitted in the drive plate. Before installing, check that the needle bearing is fitted. Removing and installing needle bearing in drive plate (pressing in and out)* *⇒ page 63* *.*

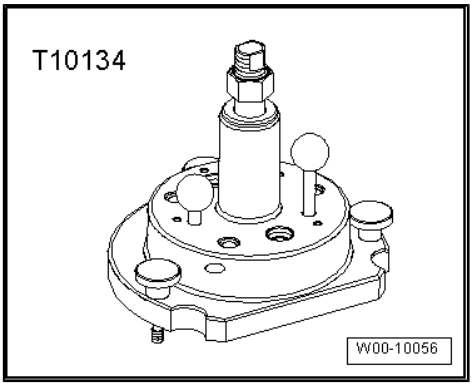
– Pay attention to dowel pin when installing drive plate.

– Fit counterhold tool - 10 - 201- the other way round to tighten bolts.

2.3 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

- Assembly tool - T10134-



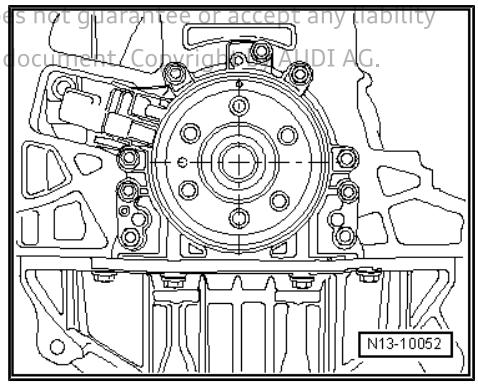
- Depth gauge
- M6 x 35 bolt (3x)
- M7 x 35 bolt (2x)

Pressing out sealing flange with sender wheel

– Remove gearbox ⇒ Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox .

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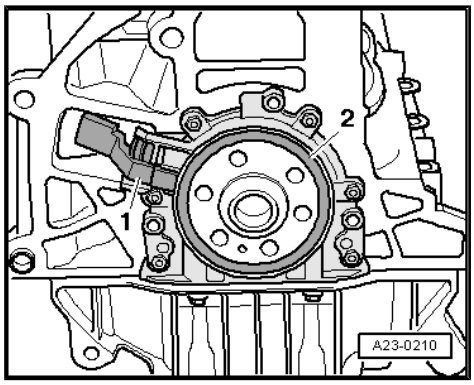
– Remove drive plate ⇒ page 54 .
– Place used oil collection and extraction unit - V.A.G 1782- under engine and drain engine oil.
– Detach intermediate plate.
– Turn crankshaft to TDC for cylinder 1 as illustrated.
– Remove sump ⇒ page 123 .



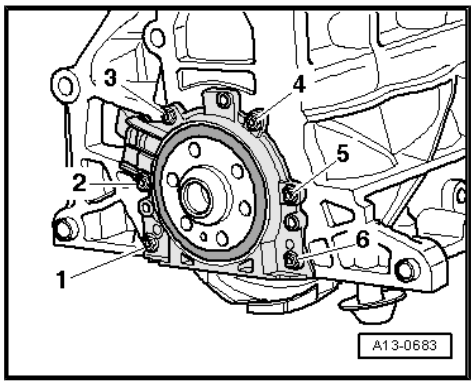
Note

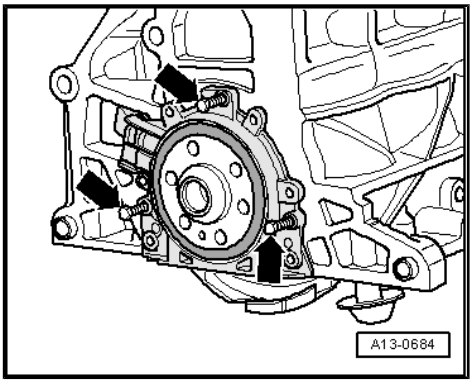
- *The engine is shown removed for illustration purposes.*
- *The procedure is identical with the engine installed and the gearbox removed.*

– Remove engine speed sender - G28- -item 1- using a standard ball head hexagon key.



– Unscrew bolts -1 ... 6- for sealing flange.





Note

The sealing flange is pressed off the crankshaft together with the sender wheel.

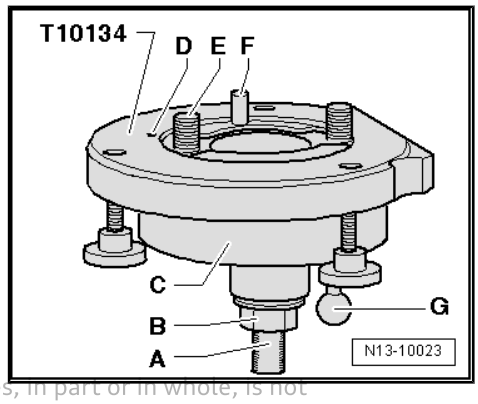
– To press out, screw in three M6 x 35 bolts -arrows- alternately into sealing flange not more than $^1/_2$ turn at a time.

– Remove sealing flange together with the 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. This support ring acts as an assembly sleeve and must not be removed before installation.*
- *The sealing flange and sender wheel must not be separated or twisted after removal from the replacement parts 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 a single unit and must only be replaced together with the sender wheel.*
- *The assembly tool - T10134- is held in its installation position for the crankshaft by a guide pin which is inserted into a hole on the crankshaft.*



Construction of assembly tool - T10134-

A - Tensioning flats

B - Hexagon nut

C - Assembly housing

D - Locating pin

E - Hexagon socket-head bolt

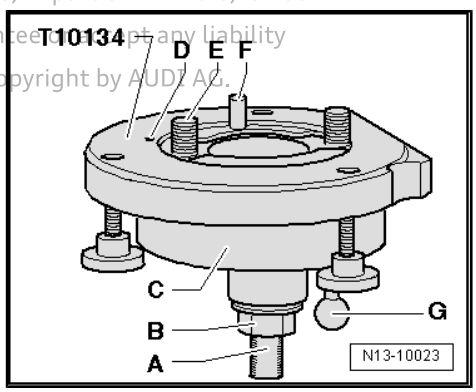
F - Guide pin for diesel engines (black handle)

G - Guide pin for petrol engines (red handle)

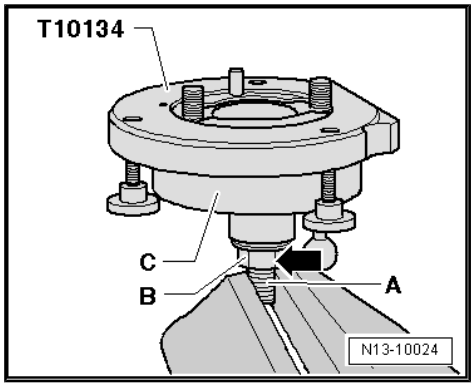
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A - Fitting sealing flange with sender wheel onto assembly tool - T10134- :

– Turn hexagon nut -B- until it is just in front of flats -A- on threaded spindle.



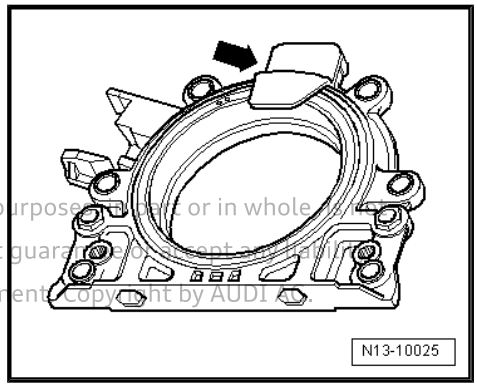
– Clamp assembly tool - T10134- in a vice on tightening flats -A- of threaded spindle.
– Press assembly housing -C- downwards so that it lies on hexagon nut -B-.



Note

Inner part of assembly device and assembly housing must align (be level) with each other.

– Remove the securing clip -arrow- from new sealing flange.



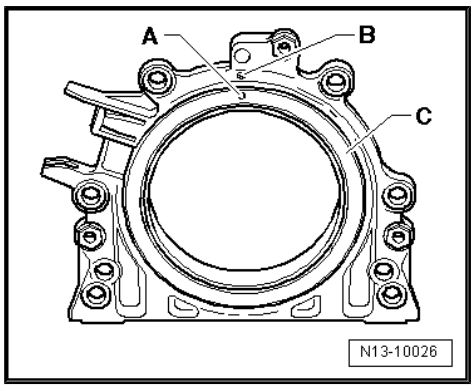
Note

The sender wheel must not be removed from the sealing flange or twisted.

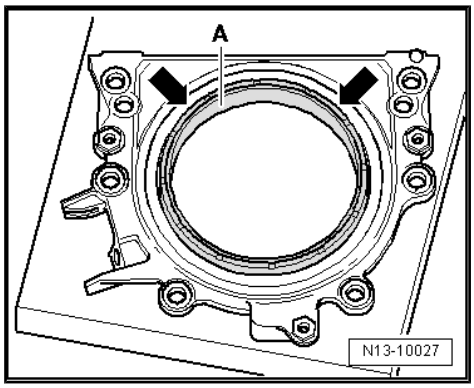
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- The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.

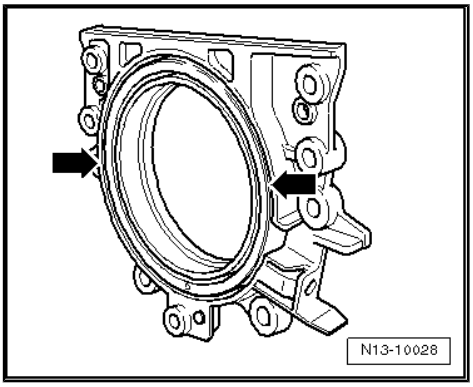
– Place the sealing flange (with the front side downwards) on a clean flat surface.



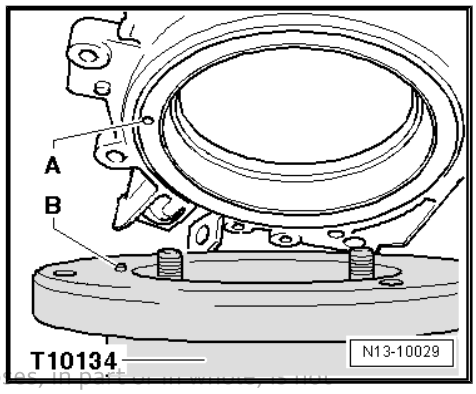
– Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



- The upper edge of the sender wheel and the front edge of the sealing flange must align -arrows-.



– Place front side of sealing flange on assembly tool - T10134- so that locating pin -B- can be inserted in hole -A- in sender wheel.

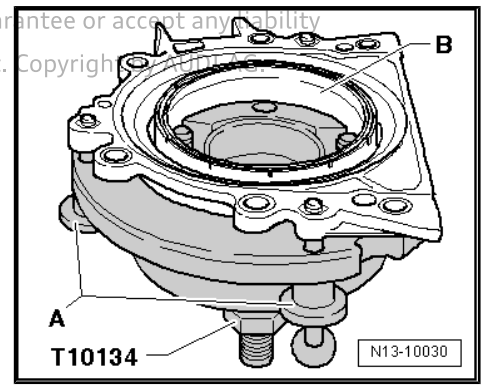


Note

Ensure the sealing flange lies flat on the assembly tool.

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– Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool - T10134- when tightening the three knurled screws -A- so that the locating pin will not slip out of the hole on the sender wheel.



Note

Ensure the sender wheel remains fixed on the assembly tool when installing the sealing flange.

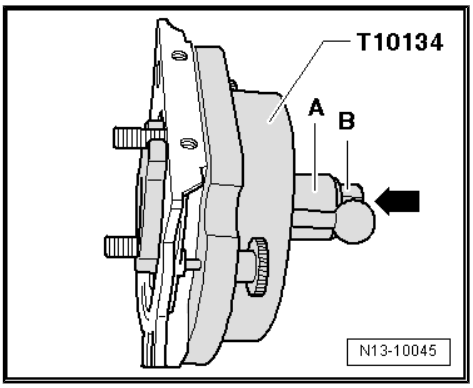
B - Installing assembly tool - T10134- with sealing flange on crankshaft flange:

- Crankshaft flange free of oil and grease.
- Engine positioned at TDC (cylinder 1).

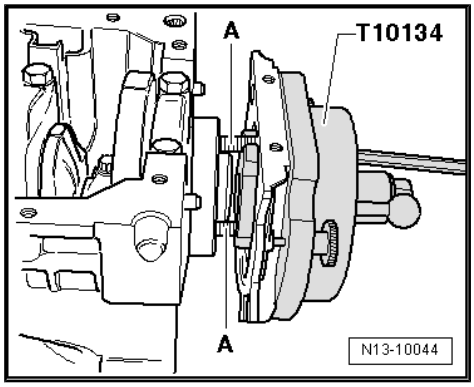
– Screw hexagon nut -B- to end of threaded spindle.

– Press the threaded spindle of assembly tool - T10134- in direction of -arrow- until the hexagon nut -B- lies on the assembly housing -A-.

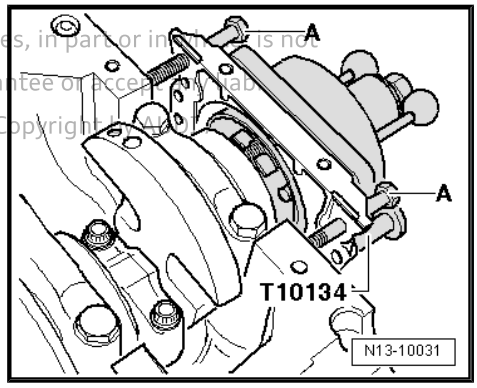
– Position flat edge of assembly housing towards sealing surface for sump on cylinder block.



– Secure assembly tool - T10134- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.



– Screw two bolts M7×35 mm -A- into cylinder block to guide sealing flange.

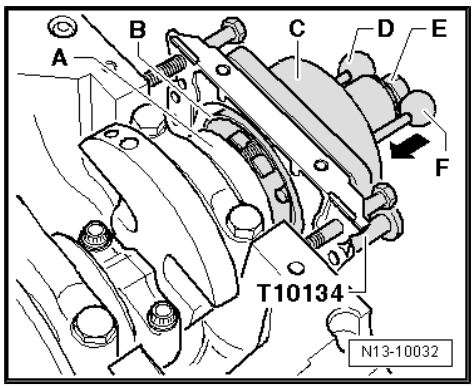


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C - Securing assembly tool - T10134- onto crankshaft flange:

– Press the assembly housing -C- by hand in the direction of the -arrow- until the sealing lip support ring -B- lies on the surface of the crankshaft flange -A-.

– Press the guide pin for diesel engines (black handle) -D- into hole of crankshaft. This ensures that the sender wheel is in its final installation position.



Note

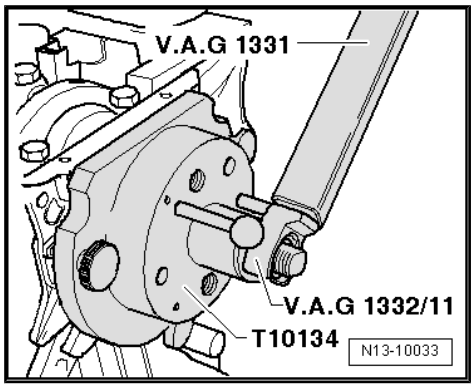
The guide pin for PETROL engines (red handle) -F- MUST NOT be inserted into the threaded hole in the crankshaft.

– Tighten both hexagon socket head bolts on assembly tool finger-tight.

– Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.

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

– Tighten hexagon nut of assembly tool - T10134- to 35 Nm.

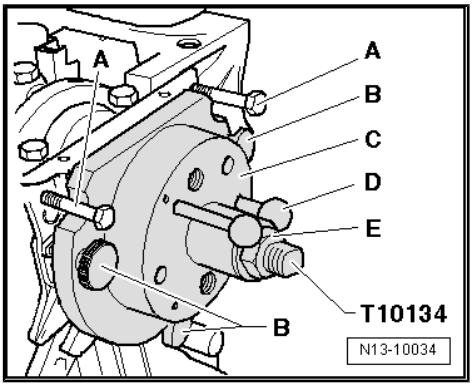


Note

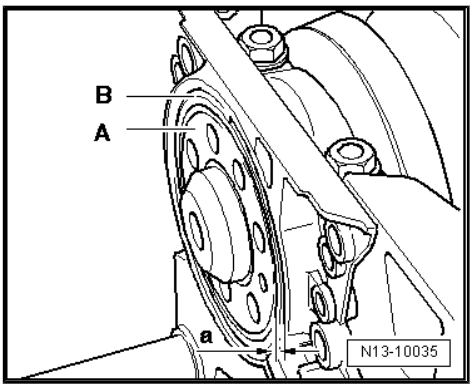
A small air gap must be present between cylinder block and sealing flange after tightening hexagon nut to 35 Nm.

E - Checking sender wheel installation position on crankshaft:

– Screw hexagon nut -E- to end of threaded spindle.
– Unscrew the 2 bolts -A- out of cylinder block.
– Unscrew the three knurled screws -B- from sealing flange.
– Remove assembly tool - T10134- .
– Remove sealing lip support ring.



• The sender wheel is positioned correctly on the crankshaft if the distance -a- between the crankshaft flange -A- and sender wheel -B- is 0.5 mm.



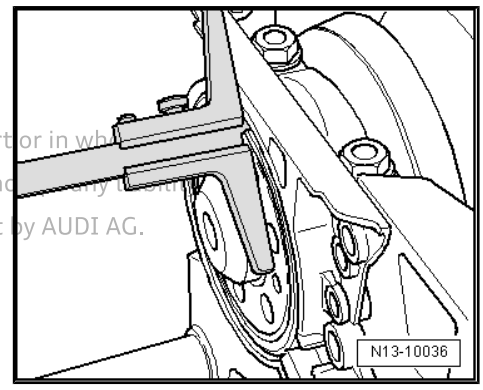
– Apply a depth gauge on the crankshaft flange.
– Measure the distance “a” between crankshaft flange and sender wheel.

If dimension “a” is too small:

– Press in the sender wheel further ⇒ page 61 .

When dimension “a” is achieved:

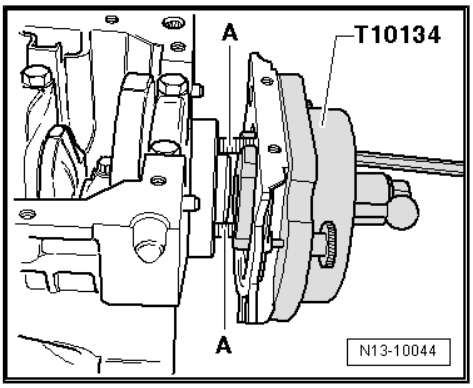
– Perform remaining assembly steps ⇒ page 62 .



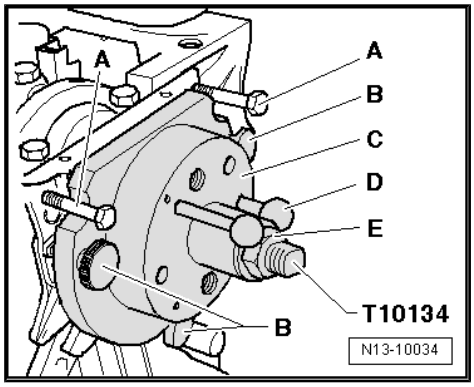
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F - Pressing sender wheel in further:

– Secure the assembly tool - T10134- -A- to crankshaft flange by tightening hexagon socket head bolts finger-tight.
– Press the assembly tool - T10134- towards the sealing flange by hand.



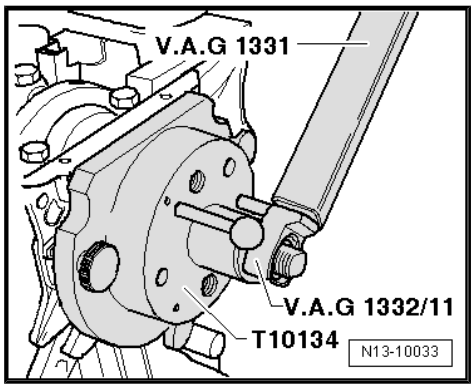
– Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.



– Tighten hexagon nut of assembly tool - T10134- to 40 Nm.
– Check installation position of sender wheel on crankshaft again ⇒ page 61 .

If dimension “a” is too small again:

– Tighten hexagon nut of assembly tool - T10134- to 45 Nm.
– Check installation position of sender wheel on crankshaft again ⇒ page 61 .

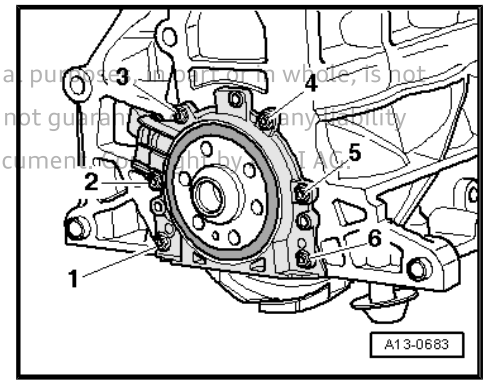


Assembling:

Installation is carried out in reverse sequence. When doing so, note the following:

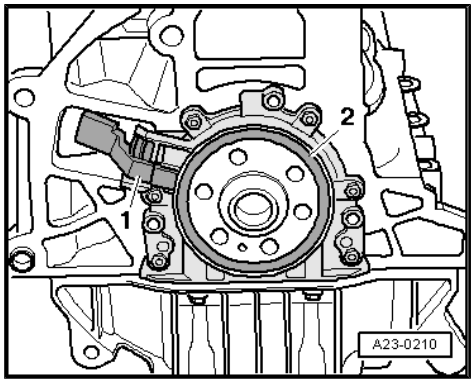
Tightening torques
⇒ “2.1 Exploded view - cylinder block (gearbox end)”, page 53

– Tighten new bolts -1 ... 6- for sealing flange alternately in diagonal sequence.



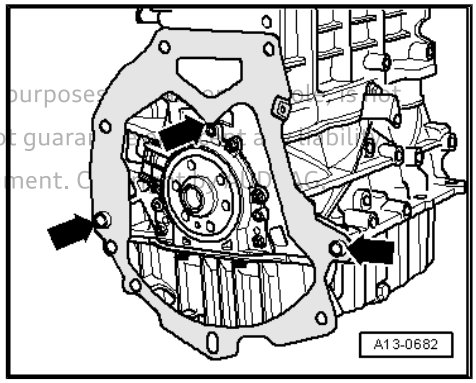
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– Secure engine speed sender - G28- -item 1-.
– Install sump ⇒ page 123 .



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– Fit intermediate plate on sealing flange and push onto dowel sleeves -arrows-.
– Install drive plate ⇒ page 54 .
– Install gearbox. ⇒ Rep. gr. 34 ; Removing and installing gearbox; Installing gearbox

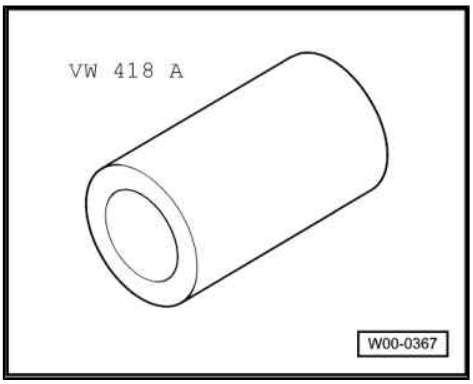


2.4 Renewing needle bearing in drive plate

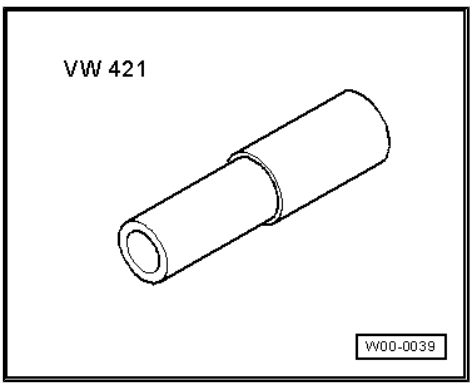
This procedure is only necessary for vehicles with manual gearbox.

Special tools and workshop equipment required

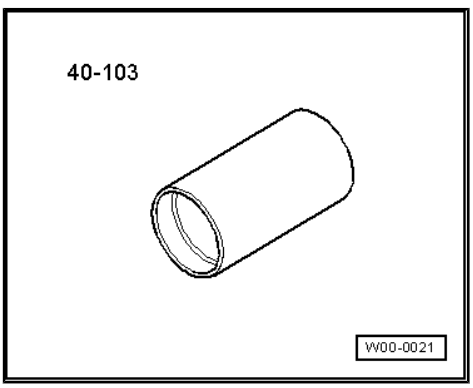
♦ Tube - VW 418 A-



♦ Tube - VW 421-



♦ Support - 40 - 103-



Procedure

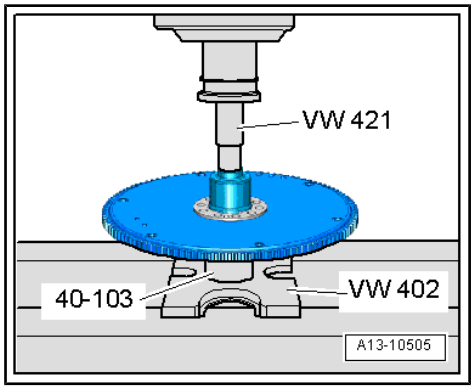
- Gearbox removed

– Remove drive plate ⇒ page 54 .

– Place support - 40 - 103- under drive plate when pressing out and pressing in needle bearing.

– Use tube - VW 421- and workshop press and press out needle bearing.

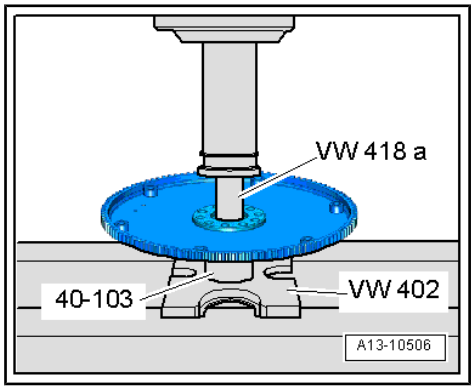
- Smaller diameter of tube -VW 421- faces drive plate.



– Carefully press in needle bearing as far as stop, using tube - VW 418 A- and workshop press.

- Installation position: closed side of needle bearing faces engine.

– Install drive plate ⇒ page 54 .



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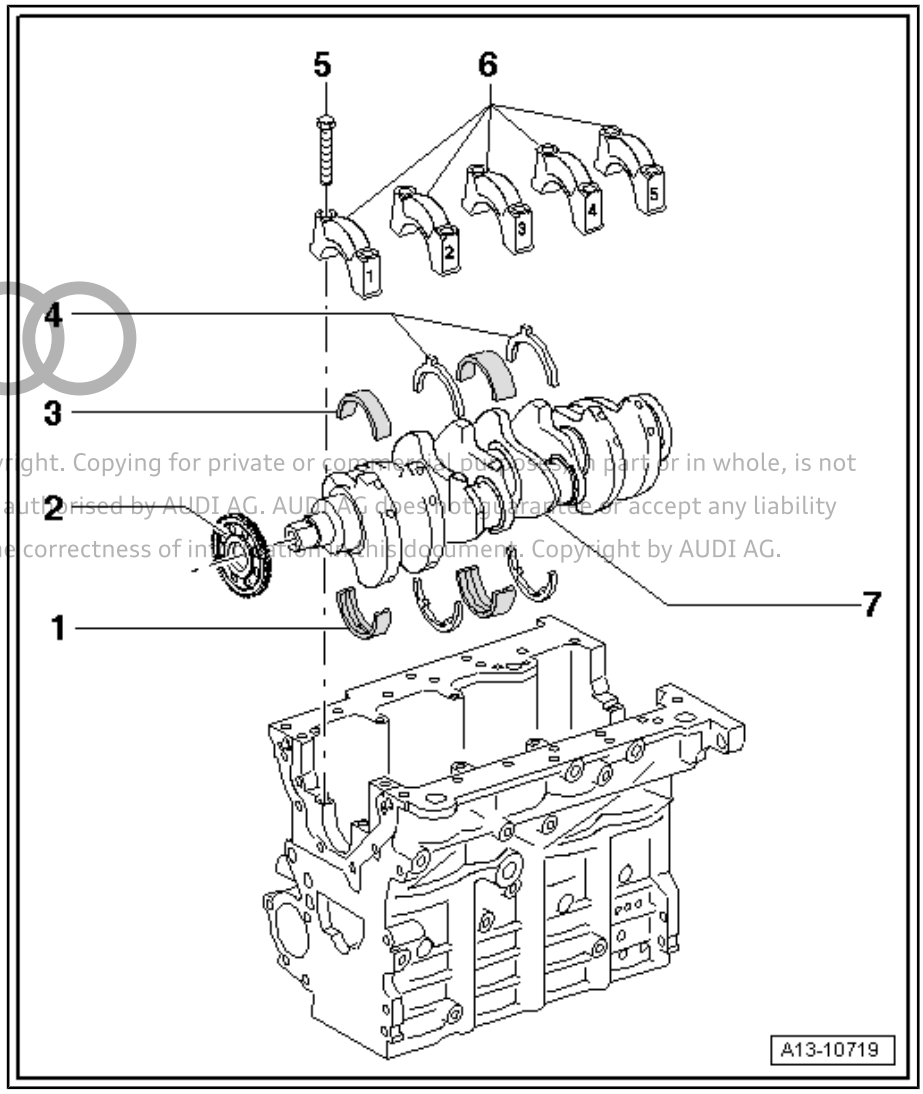
3 Crankshaft

⇒ “3.1 Exploded view - crankshaft”, page 65

⇒ “3.2 Crankshaft dimensions”, page 65

⇒ “3.4 Pulling spur gear off crankshaft and shrink-fitting new spur gear”, page 66

3.1 Exploded view - crankshaft



1 - Bearing shell

- For cylinder block (with oil groove)
- Do not interchange used bearing shells (mark positions)

2 - Spur gear

- Removing and installing spur gear ⇒ page 66

3 - Bearing shell

- For bearing cap (without oil groove)
- Do not interchange used bearing shells (mark positions)

4 - Thrust washer

- For bearing cap 3
- Note location

5 - Bolt

- 65 Nm + 90°
- Renew
- When measuring radial clearance, tighten used bolt to 65 Nm and turn 90° further

6 - Bearing caps

- Bearing cap 1: Pulley end
- Bearing cap 3 with recesses for thrust washers
- Bearing shell retaining lugs (cylinder block/ bearing cap) must be on the same side

7 - Crankshaft

- Axial clearance when new: 0.07...0.17 mm; wear limit: 0.37 mm
- Check radial clearance with Plastigauge: New: 0.03...0.08 mm; wear limit: 0.17 mm
- Do not rotate the crankshaft when checking the radial clearance
- Crankshaft dimensions ⇒ page 65

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3.2 Crankshaft dimensions

(in mm)

	Crankshaft main bearing journal ∅	Conrod bearing journal ∅
Basic dimension	54.00 -0.022 -0.042	50.90 -0.022 -0.042

3.3 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

- Plastigauge

Procedure

Note

- *Mark used bearing shells for re-installation (but do not mark bearing surface).*
- *If bearing shells are worn down to nickel layer they must be renewed.*

– Remove bearing cap and clean 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 65) without rotating crankshaft.

– Remove bearing cap again.

– Compare width of Plastigauge with measurement scale.

Radial clearance:

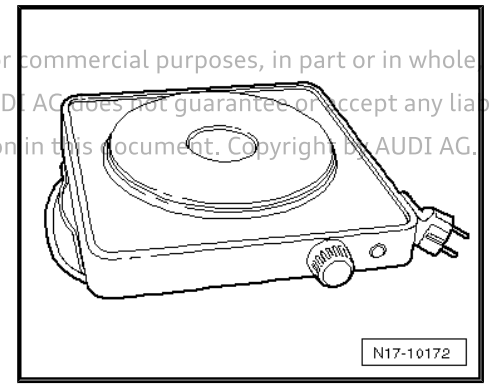
• New: 0.03 ... 0.08 mm.

• Wear limit: 0.17 mm.

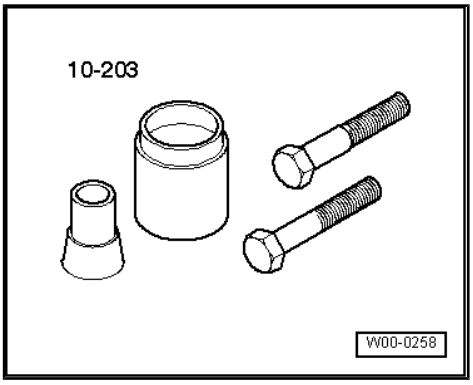
3.4 Pulling spur gear off crankshaft and shrink-fitting new spur gear

- Hotplate (commercially available)

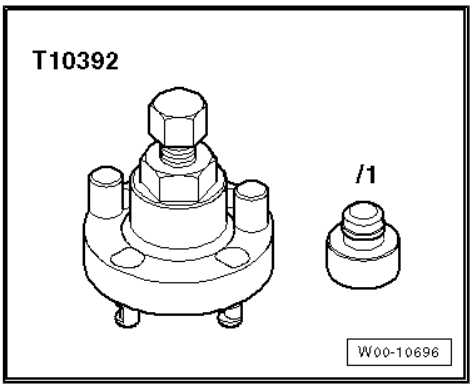
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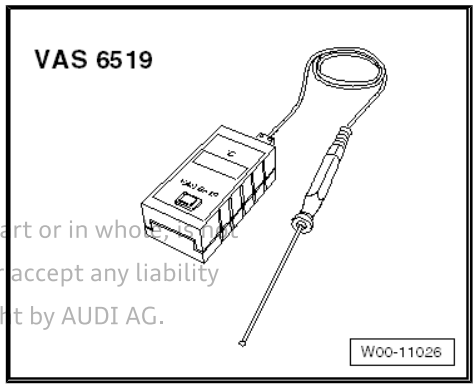
♦ Fitting tool - 10 - 203-



♦ Puller - T10392- with thrust piece - T10392/1-



♦ Temperature gauge - VAS 6519-



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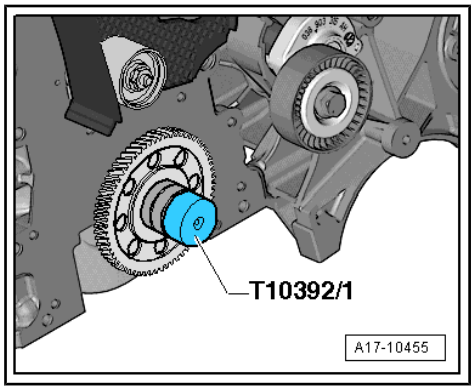
– Remove sealing flange (pulley end) ⇒ page 50 .
– Remove sump ⇒ page 123 .
– Remove balance shaft assembly ⇒ page 138 .

Note

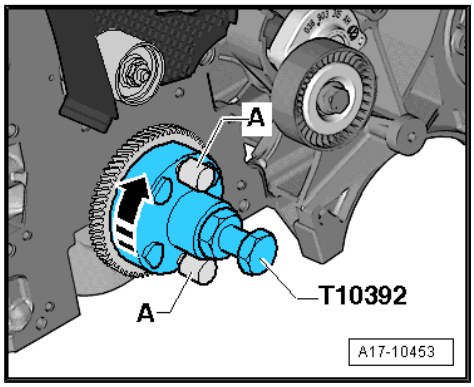
If the balance shaft assembly does not have to be renewed, it is sufficient just to detach the idler gear.

Pulling off spur gear

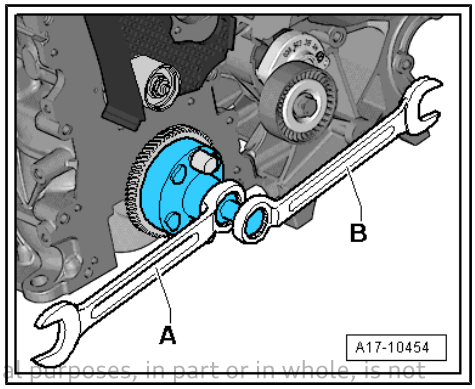
– Insert thrust piece -T10392/1- in end of crankshaft.



– Insert puller -T10392- into holes in spur gear, turn clockwise -arrow- and screw in locating pins -A-.



– Counterhold crankshaft with ring spanner -A-. Pull spur gear off end of crankshaft by screwing in spindle with ring spanner -B-.



Shrink-fitting spur gear

Note

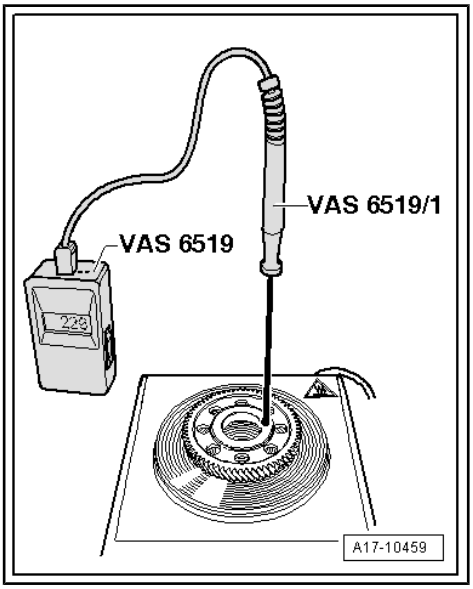
- *While heating up the new spur gear, monitor the temperature with the temperature gauge -VAS 6519- .*
- *When the temperature reaches 200 °C, you have approx. 4 seconds to fit the spur gear on the crankshaft.*
- *A higher temperature increases the amount of time available (220 °C = approx. 6 seconds).*
- *Make sure the end of the crankshaft is clean.*

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Caution

Do not exceed a maximum temperature of 240 °C; otherwise the spur gear can become discoloured and distorted.

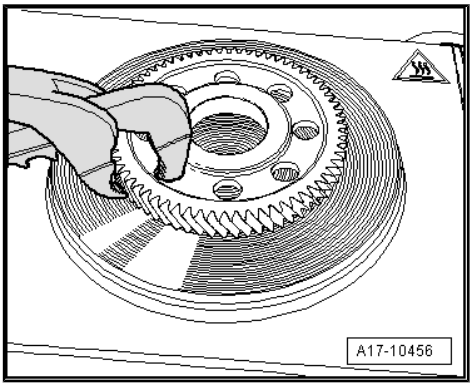
– Place the new spur gear flat on a commercially available hot-plate and heat it up to at least 200 °C, but not more than 240 ° C. Lettering faces upwards.
– Set temperature gauge -VAS 6519- to measuring range 2.
– Position temperature sensor -VAS 6519/1- on collar of spur gear (as shown) and read off temperature at temperature gauge.



WARNING

Risk of burns. Use suitable protective gloves for the following steps.

– When the required temperature has been reached, pick up the spur gear with pliers as illustrated.



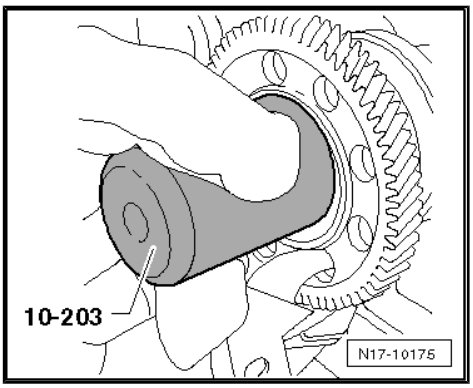
Note

Take care not to damage the teeth of the spur gear.

– With the aid of fitting tool - 10 - 203- , slide spur gear by hand onto end of crankshaft as far as stop. This must be done without delay, taking care to keep the gear straight.
– Wait a few minutes to allow the spur gear to cool down, and then install the balance shaft assembly.

⇒ “4.1.2 Installing a new balance shaft assembly”, page 139

⇒ “4.1.3 Re-installing a used balance shaft assembly”, page 141

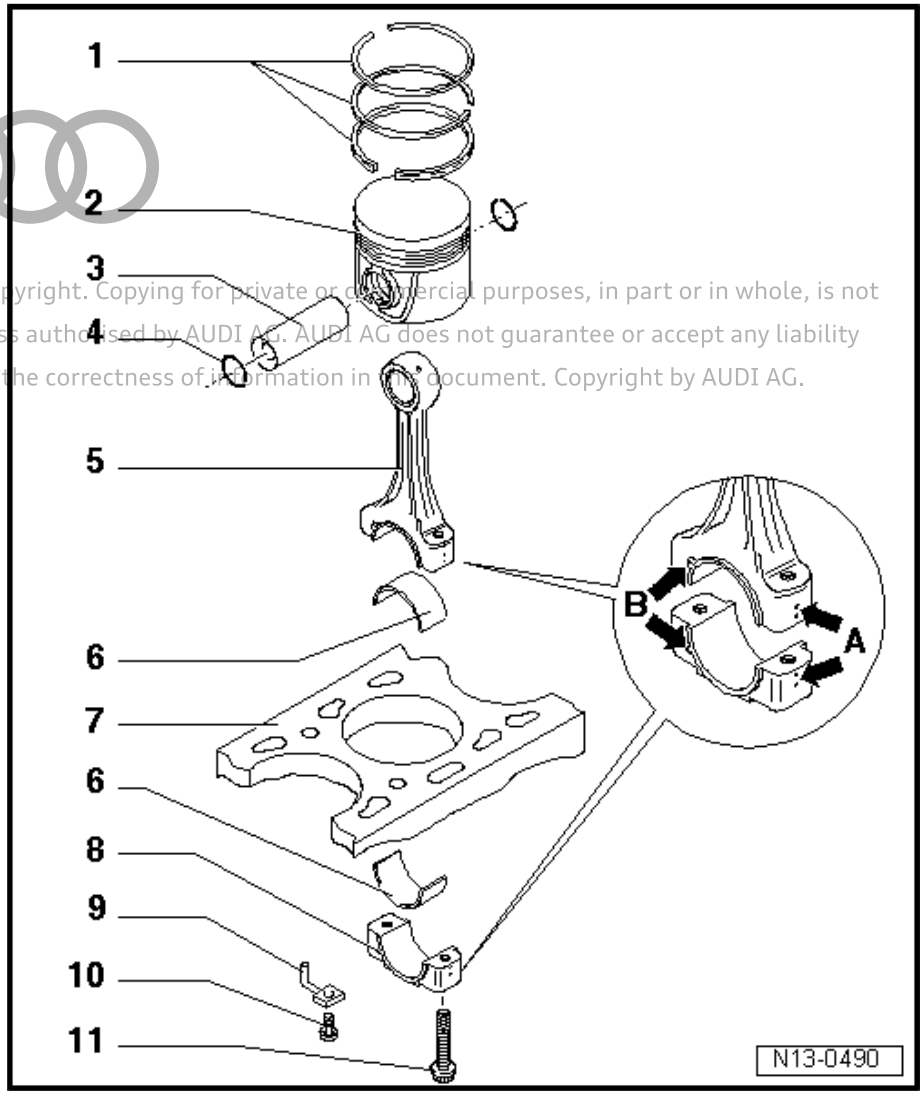


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4 Pistons and conrods

⇒ “4.1 Exploded view - pistons and conrods”, page 70
⇒ “4.2 Measuring piston projection at TDC”, page 73
⇒ “4.3 Piston and cylinder dimensions”, page 74
⇒ “4.4 Separating parts of new conrod”, page 74
⇒ “4.5 Bearing shells - installation position”, page 75

4.1 Exploded view - pistons and conrods



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1 - Piston rings

- ❑ Offset gaps by 120°
- ❑ Use piston ring pliers to remove and install
- ❑ Inscription “TOP” faces towards piston crown
- ❑ Checking ring gap ⇒ page 71
- ❑ Checking ring-to-groove clearance ⇒ page 72

2 - Piston

- ❑ With combustion chamber
- ❑ Mark installation position and cylinder number
- ❑ Installation position and allocation of piston/cylinder ⇒ page 73
- ❑ Arrow on piston crown points to pulley end
- ❑ Install using piston ring clamp
- ❑ If cracking is visible on piston skirt, renew piston
- ❑ Checking piston projection at TDC ⇒ page 73

3 - Piston pin

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

4 - Circlip

5 - Conrod

- ❑ Mark cylinder allocation -A- with coloured pen
- ❑ Installation position: Marking -B- faces towards pulley end
- ❑ With industrially cracked conrod bearing cap

6 - Bearing shell

- ❑ Note installation position
- ❑ Note version: Upper bearing shell (closest to piston) is constructed from a more wear-resistant material; refer to ⇒ Electronic parts catalogue

- ❑ Do not interchange used bearing shells
- ❑ Insert bearing shells centrally
- ❑ Check that it is securely seated
- ❑ Axial clearance: wear limit: 0.37 mm
- ❑ Check radial clearance with Plastigauge; Wear limit: 0.08 mm
- ❑ Do not rotate crankshaft when checking radial clearance

7 - Cylinder block

- ❑ Checking cylinder bore ⇒ page 72
- ❑ Piston and cylinder dimensions ⇒ page 74

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8 - Conrod bearing cap

- ❑ Note installation position
- ❑ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the cap only fits in one position and only on the appropriate conrod

9 - Oil spray jet

- ❑ For piston cooling

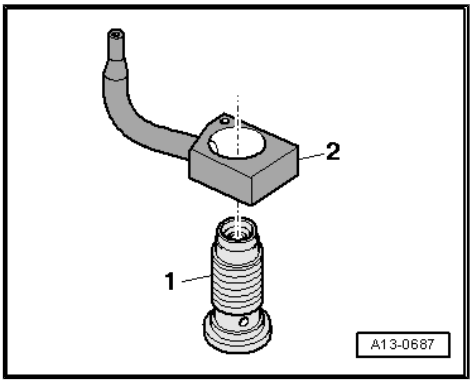
10 - Bolt for oil spray jet

- ❑ 25 Nm
- ❑ Insert without sealant

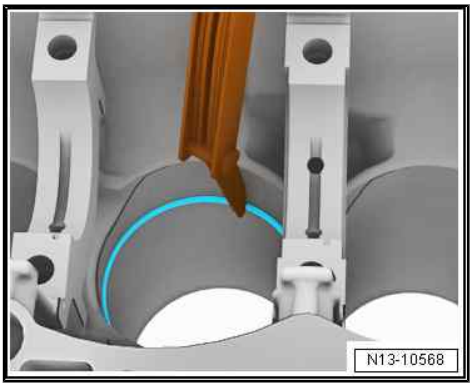
11 - Conrod bolt

- ❑ Renew
- ❑ Lubricate threads and contact surface
- ❑ 30 Nm + 90°
- ❑ When measuring radial clearance, tighten used bolt to 30 Nm and turn 90° further

Oil spray jet and pressure relief valve



Checking piston ring gap



Special tools and workshop equipment required

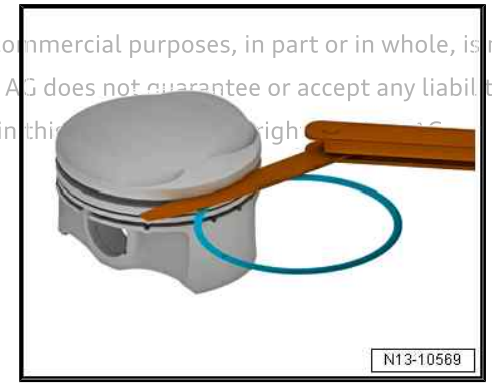
- ♦ Feeler gauge

– Insert piston ring at right angles from above and push down into cylinder approx. 15 mm from bottom end of cylinder.

Piston ring (in mm)	New	Wear limit
1st compression ring	0.20...0.40	1.0
2nd compression ring	0.20...0.40	1.0
Oil scraper ring	0.25...0.50	1.0

Checking ring-to-groove clearance

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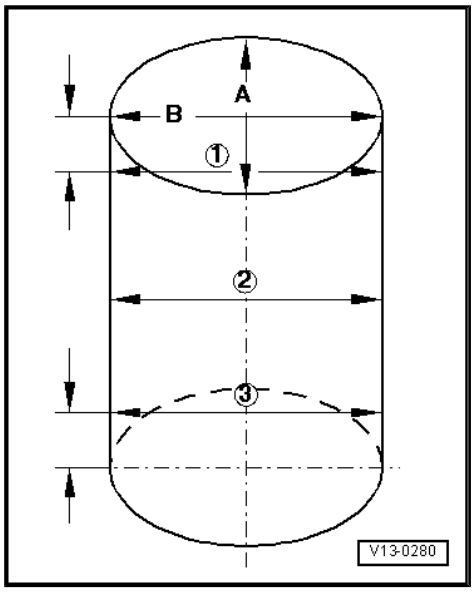
Special tools and workshop equipment required

- Feeler gauge

– Clean groove in piston before checking clearance.

Piston ring (in mm)	New	Wear limit
1st compression ring	0.06...0.09	0.25
2nd compression ring	0.05...0.08	0.25
Oil scraper ring	0.03...0.06	0.15

Checking cylinder bore



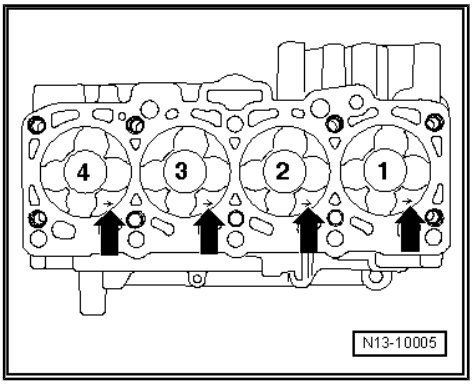
Special tools and workshop equipment required

- Cylinder gauge, 50 ... 100 mm

– Make measurements at three positions diagonally in transverse direction -A- and in longitudinal direction -B-. Difference between actual and nominal diameter: not more than 0.10 mm.

Note

Do not measure the cylinder bore when the cylinder block is mounted to the engine and gearbox support - VAS 6095A- with the universal mounting - VAS 6095/1- , as this may result in incorrect measurements.



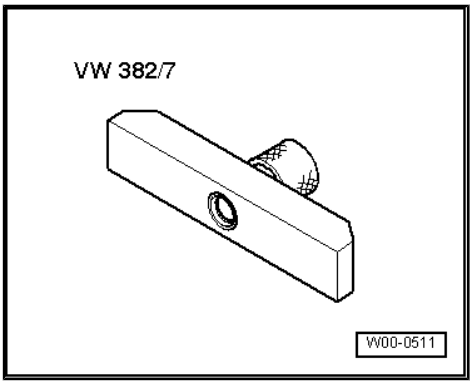
Piston installation position and piston/cylinder allocation

The arrow faces towards cylinder 1 -arrows-.

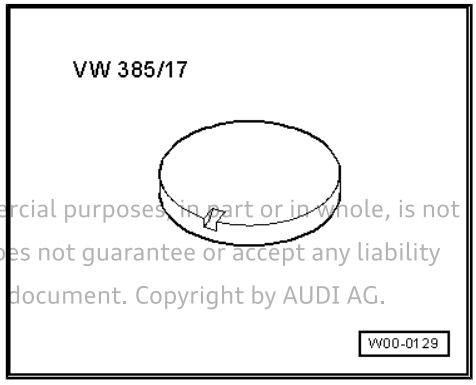
4.2 Measuring piston projection at TDC

Special tools and workshop equipment required

- Measuring tool - VW 382/7-



- Gauge plate - VW 385/17-

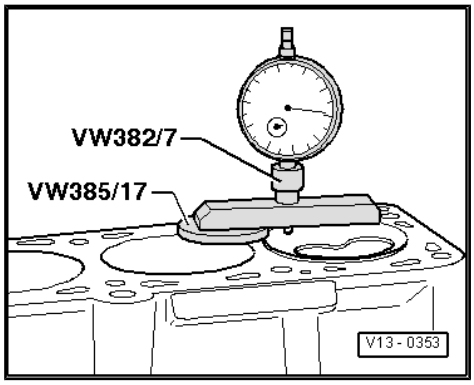


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- Dial gauge

Test sequence

Piston projection at TDC must be measured when installing new pistons or a short engine. Depending upon piston projection, install the corresponding cylinder head gasket according to following table:



Note

- *Turn engine in clockwise direction to measure piston projection at TDC.*
- *If differing figures are obtained when measuring piston projection, the highest figure should be taken when selecting the gasket.*

Piston projection	Identification Holes/notches
0.91 mm ... 1.00 mm	1
1.01 mm ... 1.10 mm	2
1.11 mm ... 1.20 mm	3

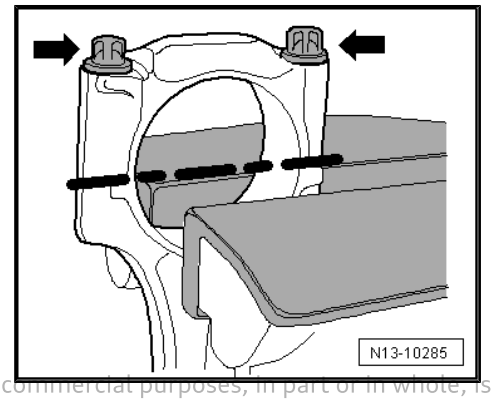
4.3 Piston and cylinder dimensions

	Piston ∅	Cylinder bore ∅
Basic dimension mm	80.96	81.01

4.4 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:

– Clamp the conrod in a vice using aluminium jaw covers as shown in illustration.

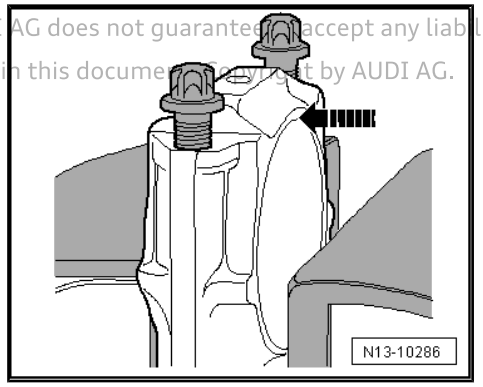


Note

- *To avoid any risk of damage, the conrod should only be clamped lightly.*
- *The conrod is clamped in position below the dotted line.*

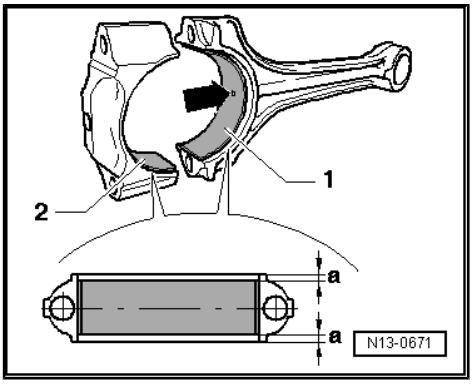
– Unscrew bolts -arrows- approx. 5 turns.

– Using a plastic hammer, carefully knock conrod bearing cap loose in direction indicated by -arrow-.



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4.5 Bearing shells - installation position



Bearing shell -1- with oil drilling -arrow- for conrod.

Bearing shell -2- without oil drilling for conrod bearing cap.

– Position bearing shells in centre of conrod and conrod bearing cap when fitting.

Dimension -a- must be identical on both sides.

4.6 Measuring radial clearance of conrods

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 11 (page 71) without rotating crankshaft.

– Remove conrod bearing cap again.

– Compare width of Plastigauge with measurement scale.

Radial clearance:

• Wear limit: 0.08 mm.

– Renew conrod bolts.

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15 – Cylinder head, valve gear

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1 Cylinder head

⇒ “1.1 Exploded view - cylinder head”, page 76

⇒ “1.2 Exploded view - cylinder head cover”, page 79

⇒ “1.3 Removing and installing cylinder head”, page 80

⇒ “1.4 Removing and installing cylinder head cover”, page 85

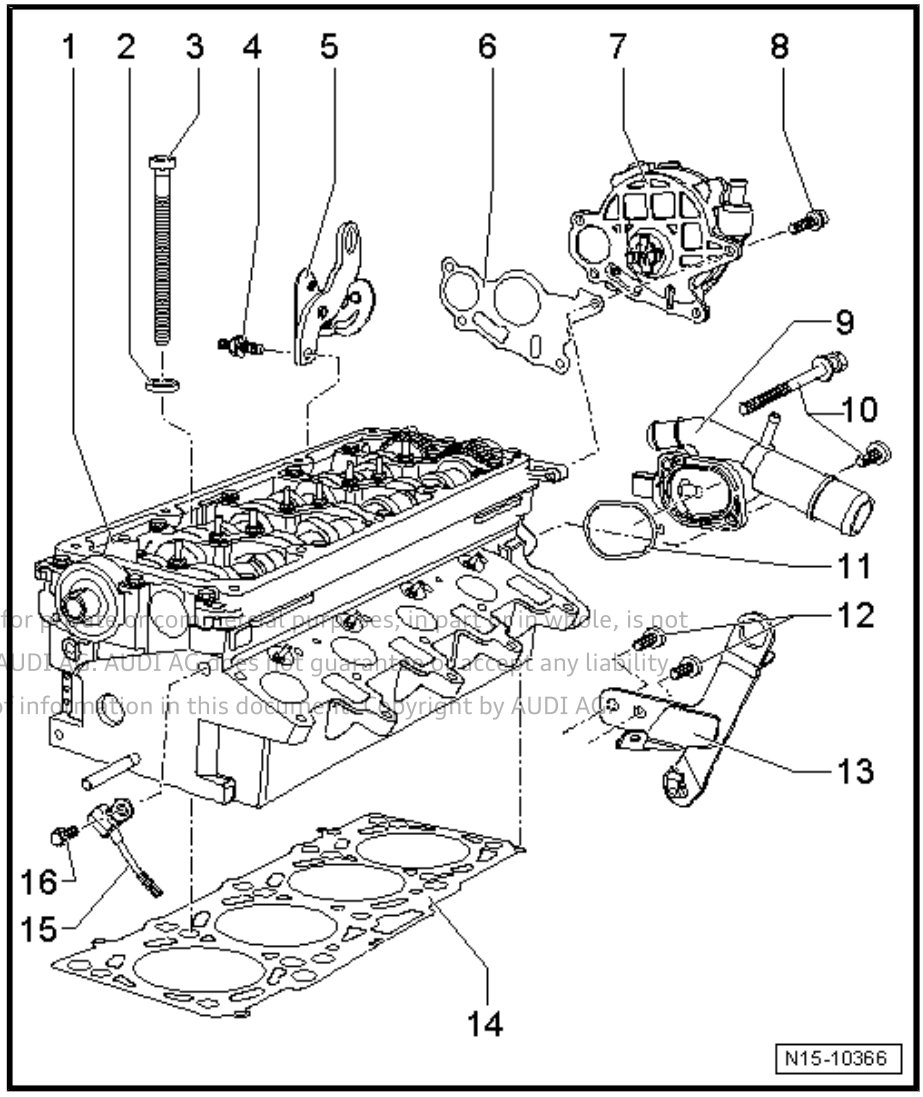
⇒ “1.5 Checking compression”, page 86

⇒ “1.6 Identification of cylinder head gasket”, page 88

1.1 Exploded view - cylinder head

Note

- *The plastic protectors fitted to protect the open valves must not be removed until immediately before fitting the cylinder head.*
- *If the cylinder head is replaced, all the coolant in the system must also be renewed.*



1 - Cylinder head

- ❑ Removing and installing ⇒ page 80
- ❑ If renewed, change coolant in entire system

2 - Washer

- ❑ For cylinder head bolt

3 - Cylinder head bolt

- ❑ Note correct sequence when loosening ⇒ page 78
- ❑ Note correct sequence when tightening ⇒ page 78
- ❑ Prior to installation, insert washer in cylinder head ⇒ Item 2 (page 77)

4 - Bolt

- ❑ 25 Nm

5 - Lifting eye

6 - Gasket

- ❑ Renew

7 - Vacuum pump

8 - Bolt

- ❑ 10 Nm

9 - Coolant hose connection

10 - Bolt

- ❑ 10 Nm

11 - Gasket

- ❑ Renew

12 - Bolt

- ❑ 25 Nm

13 - Lifting eye

14 - Cylinder head gasket

- ❑ Renew
- ❑ Note marking ⇒ page 79
- ❑ If renewed, change coolant in entire system

15 - Hall sender - G40-

- ❑ For camshaft position
- ❑ To remove and install, detach toothed belt from camshaft sprockets and loosen idler roller.

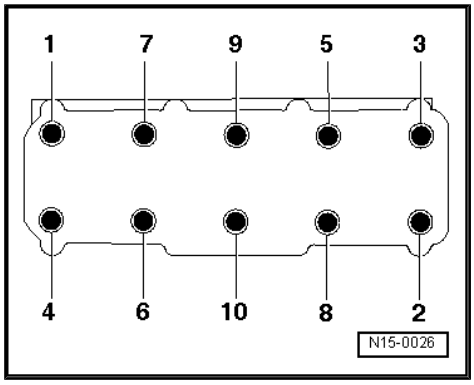
16 - Bolt

- ❑ 10 Nm

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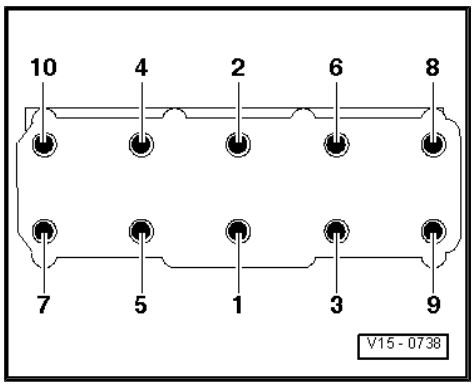
Slackening cylinder head bolts

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



Tightening sequence for cylinder head

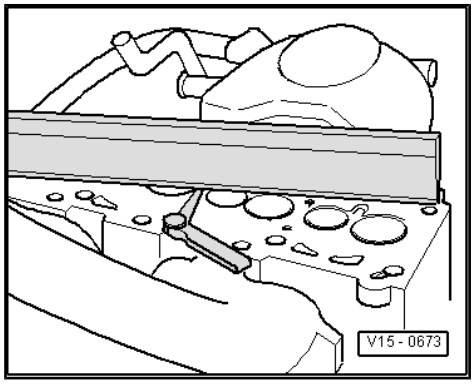
1. Tighten with torque wrench to 40 Nm.
2. Tighten with torque wrench to 60 Nm.
3. Use rigid wrench to turn 90° further.
4. Use rigid wrench to turn 90° further.



Note

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

Checking cylinder head for distortion



Special tools and workshop equipment required

- Straight edge
- Feeler gauge

Max. permissible distortion: 0.1 mm

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Note

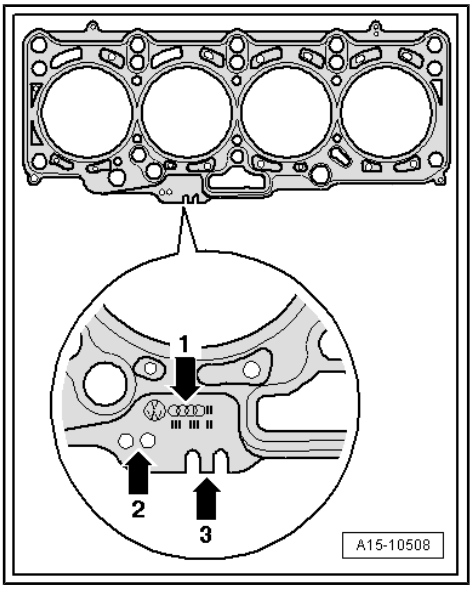
The cylinder heads of diesel engines must not be machined.

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 gasket size.*
- *Cylinder head gaskets of different thicknesses are fitted depending on piston projection. When replacing the cylinder head gasket, install a new gasket with the same identification -arrow 2-.*

1.2 Exploded view - cylinder head cover

1 - High-pressure reservoir (rail)
- ❑ With injector pipes
- ❑ Do not attempt to bend injector pipes to a different shape

2 - Bolt
- ❑ 22 Nm

3 - Injector (piezo injector)
- ❑ Removing and installing ⇒ page 229

4 - Bolt
- ❑ Tightening torque ⇒ page 201

5 - Retaining clip

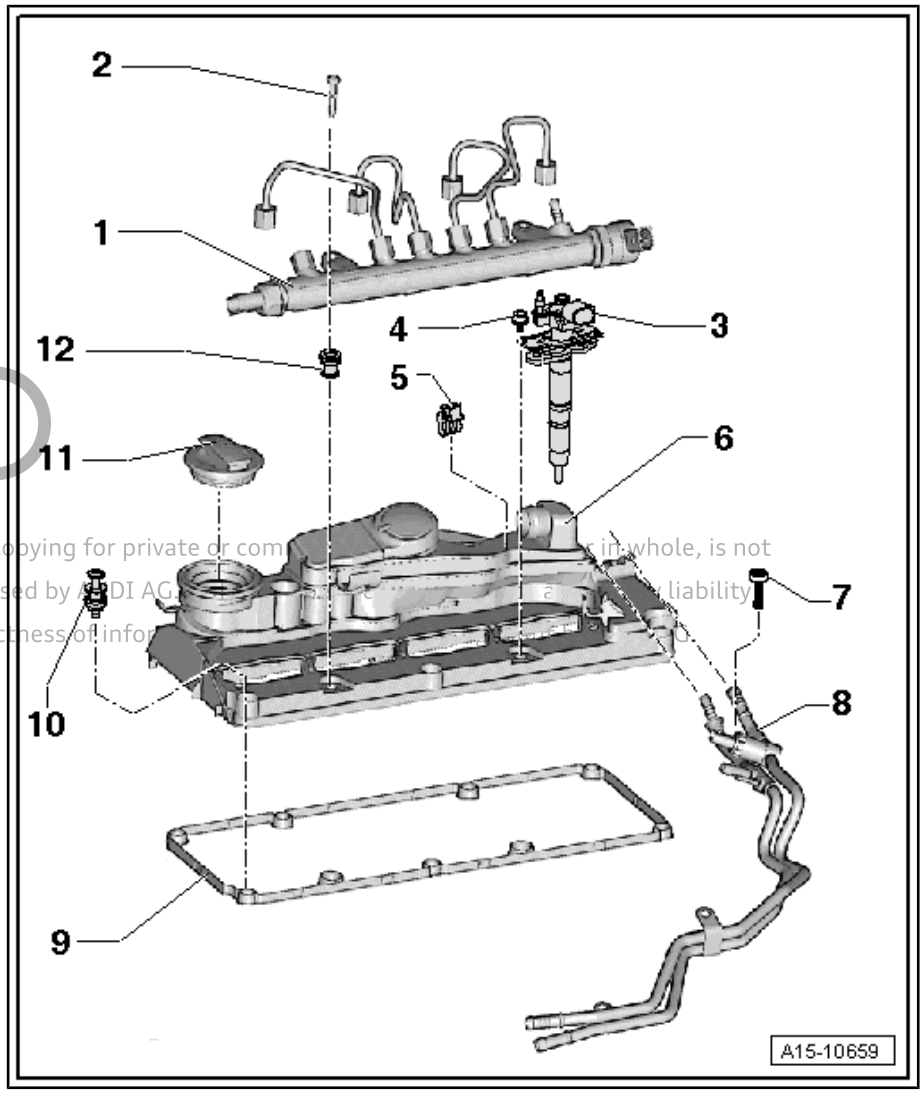
6 - Cylinder head cover
- ❑ Removing and installing ⇒ page 85

7 - Bolt
- ❑ 10 Nm

8 - Fuel lines

9 - Gasket
- ❑ Renew if damaged or leaking

10 - Bolt
- ❑ Slackening ⇒ page 80
- ❑ Observe correct tightening sequence



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⇒ page 80

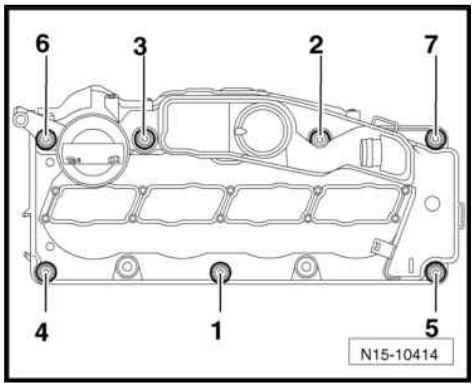
11 - Filler cap

12 - Bush

- ❑ To secure high-pressure reservoir (rail)
- ❑ Renew if damaged

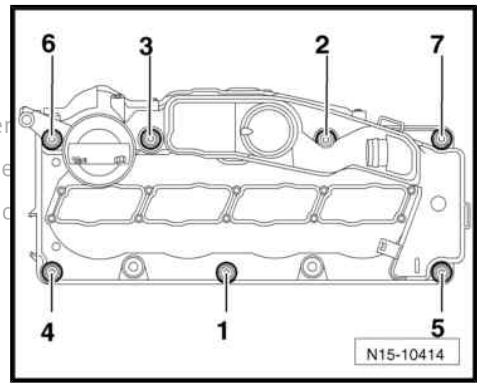
Loosening cylinder head cover

1. Loosen bolts in the sequence -7 ... 1-.



Tightening sequence for cylinder head cover

1. Fit bolts in the sequence -1 ... 7- and hand-tighten in several stages.
2. Tighten bolts in the sequence -1 ... 7- to 10 Nm using torque wrench.



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Note

Take care to keep cylinder head cover straight.

1.3 Removing and installing cylinder head

Removing

Caution

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

- ***Observe notes on procedure for disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .***

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

– Drain coolant ⇒ page 149 .

– Remove air cleaner housing ⇒ page 212 .

– Remove exhaust gas recirculation cooler ⇒ page 282 .

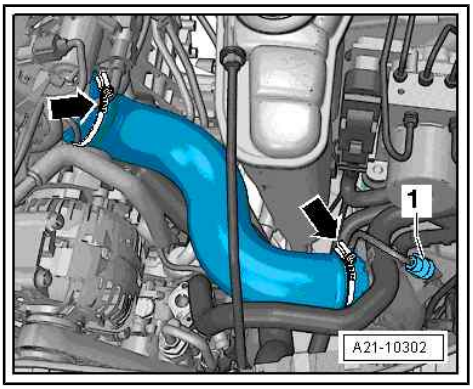
– Remove turbocharger ⇒ page 179 .

– Remove toothed belt ⇒ page 90 .

– Remove cylinder head cover ⇒ page 85 .

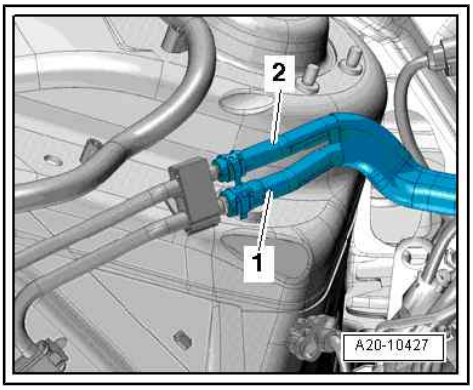
– Remove front exhaust pipe ⇒ page 263 .

– Release hose clips -arrows- and detach air hose.
– Detach guide tube for oil dipstick from throttle valve housing.



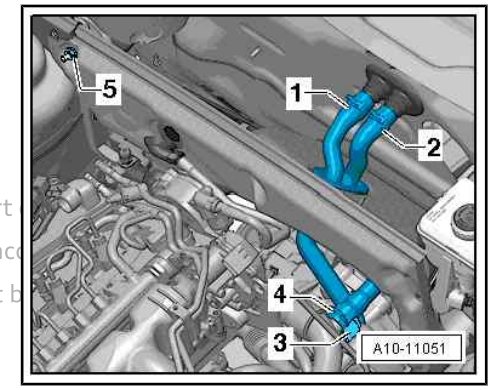
Caution

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



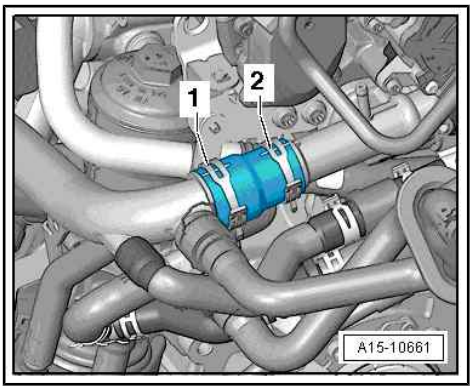
– Disconnect fuel supply hose -1- and fuel return hose -2-.

– Detach coolant hoses -3- and -4-.

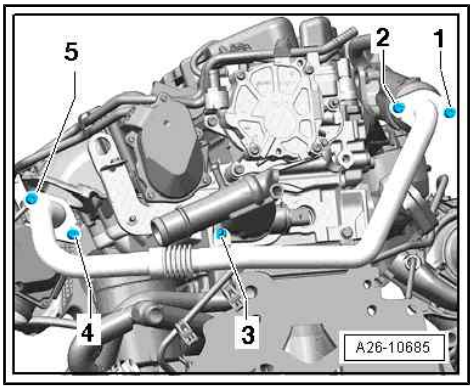


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– Detach hose clips -1- and -2- and remove coolant hose.



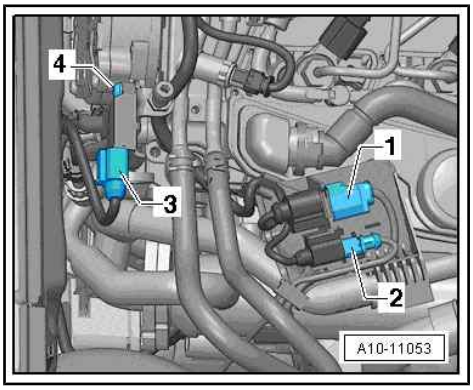
– Remove nut -3- for exhaust gas recirculation pipe.
– Remove bolts -4- and -5-, move exhaust gas recirculation pipe aside.
– Remove bolt on cylinder head for oil pressure pipe to turbocharger.



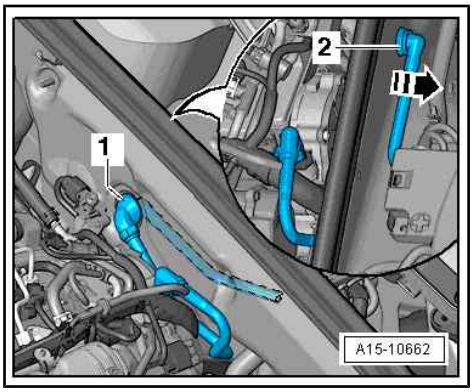
Note

It is not possible to remove exhaust gas recirculation pipe.

– Remove bolt -4- and unclip air hoses for exhaust gas pressure sensor 1 .



– Disconnect vacuum hose -2- on rear of plenum chamber partition panel -arrow- and detach vacuum connection -1- from plenum chamber partition panel.



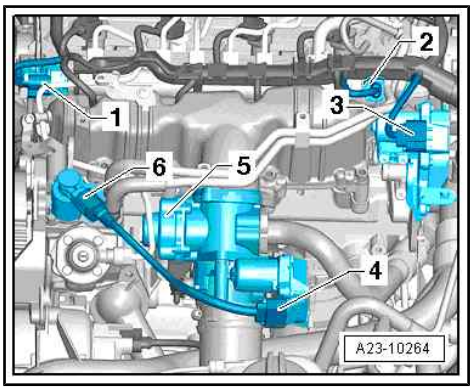
– Unplug the following electrical connectors:

3 - Variable intake manifold motor - V183-

4 - Intake manifold flap motor - V157-

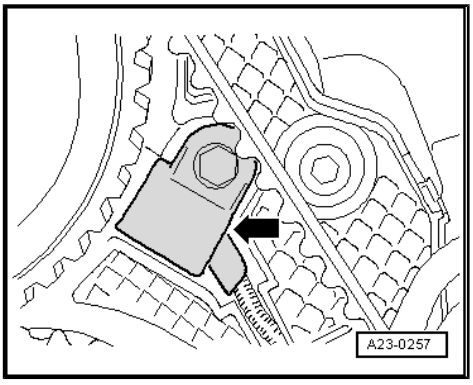
5 - Exhaust gas recirculation valve - N18-

– Remove camshaft toothed belt sprocket and use puller - T10052- to detach hub from camshaft.
– Remove bolt securing toothed belt cover.
– Remove nut securing toothed belt tensioning roller.

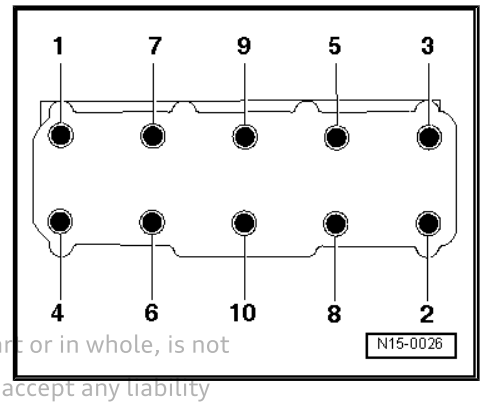


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– Unscrew bolt for Hall sender - G40- -arrow- and move Hall sender - G40- to one side.



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



Note

- *A second mechanic is required when removing the cylinder head.*
- *The toothed belt tensioning roller is detached from the stud when the cylinder head is lifted out.*

– Lift cylinder head at gearbox end first and guide out of toothed belt cover. Make sure toothed belt tensioning roller does not drop out.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

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Note

- *Do NOT use abrasive materials (sandpaper, sanding discs, sanding pads, abrasive web, wire wool, etc.).*
- *Sealing surface (see photo) must not be raised.*
- *Dark discolouration (see photo) does not have to be removed.*
- *When removing sealant residue, make sure none of the residue enters the open channels of the engine.*
- *Ensure that nearby workspaces are kept clean and that the abrasive materials listed above are not being used there.*
- *Use of non-approved abrasive materials can lead to subsequent damage to the turbocharger, conrod bearings, etc.*

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– Remove sealant residue from cylinder head and cylinder block using a commercially available blade scraper (blade width at least 40 mm).

• 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.

• Always renew cylinder head bolts.

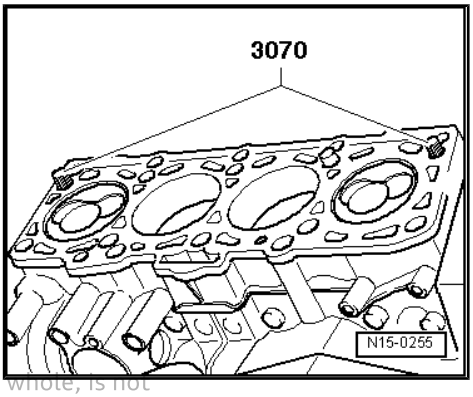
• After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.

– Remove loose residue with a lint-free cloth.

– Before fitting cylinder head, remove crankshaft stop - T10050- and turn crankshaft in opposite direction of normal rotation until all pistons are almost evenly positioned below TDC.

– Fit cylinder head gasket with marking facing upwards.

– To centralise, screw guide pins - 3070- into outer holes on inlet side.



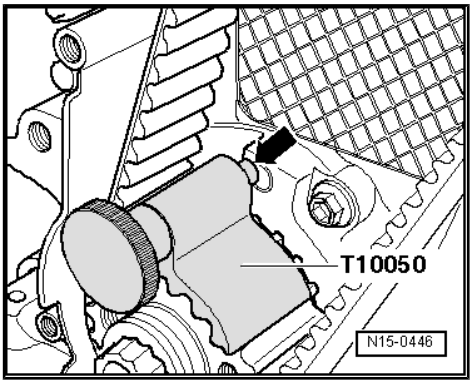
Note

Position tensioning roller on dowel pin when fitting cylinder head.

– Fit cylinder head, screw in 8 remaining cylinder head bolts and tighten by hand.
– Unscrew guide pins through bolt holes in cylinder head using fitting tool from 3070 and install remaining cylinder head bolts.
– Tighten cylinder head in four stages. ⇒ page 78
– Secure toothed belt cover (rear) to cylinder head.
– Install hub and camshaft sprocket.
– Lock camshaft and high-pressure pump with diesel injection pump locking pin - 3359- .

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– Rotate crankshaft to TDC in direction of engine rotation and lock in position with crankshaft stop - T10050- .
– Install toothed belt ⇒ page 90 .



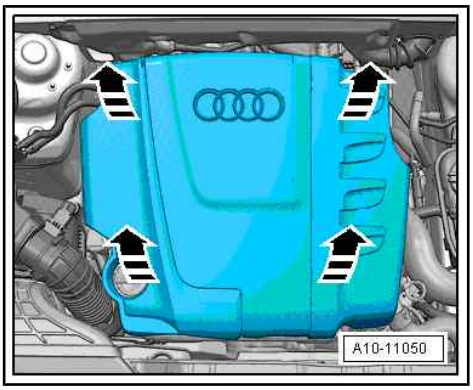
The remaining installation steps are carried out in the reverse sequence. Note the following:

– Install cylinder head cover ⇒ page 85 .
– Install poly V-belt ⇒ page 42 .
– Fill up with coolant ⇒ page 149 .

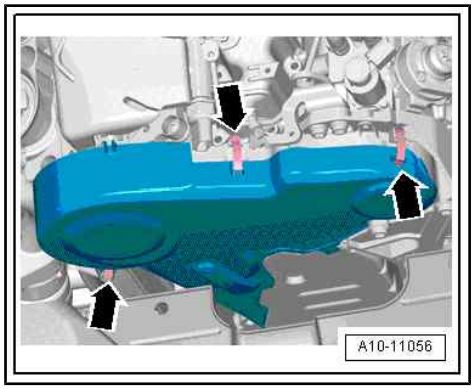
1.4 Removing and installing cylinder head cover

Removing

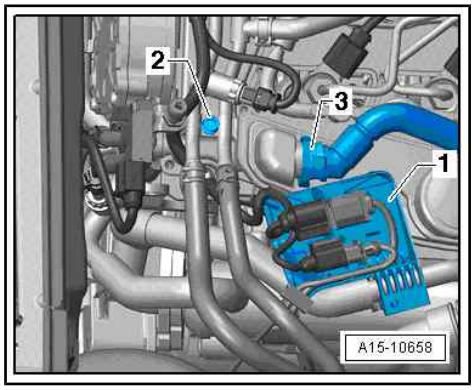
– Remove engine cover panel -arrows-.
– Take out noise insulation at injectors.
– Remove injectors ⇒ page 229 .
– Remove fuel rail ⇒ page 238 .



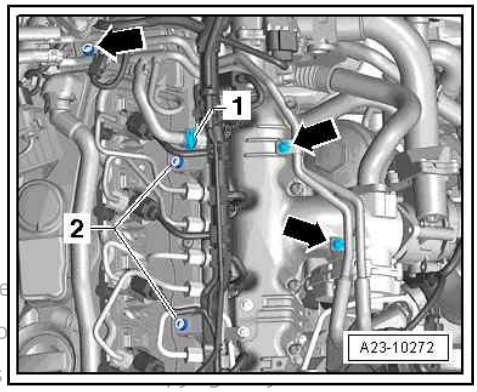
– Open clips -arrows- and remove toothed belt cover.



– Detach bracket -1- with wiring for Lambda probe and temperature sender before particulate filter from cylinder head cover.
– Detach crankcase breather line -3- and move clear.

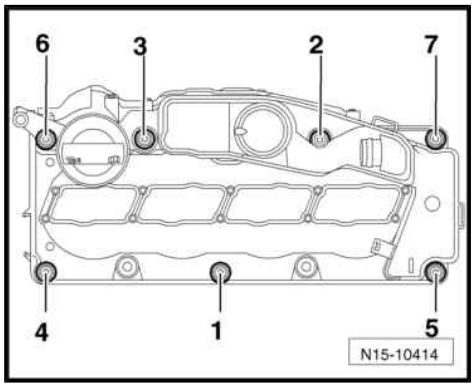


– Unscrew bolts for fuel lines -arrows-.



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– Remove bolts -1- to -7- and detach cylinder head cover.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

⇒ “1.2 Exploded view - cylinder head cover”, page 79

Note

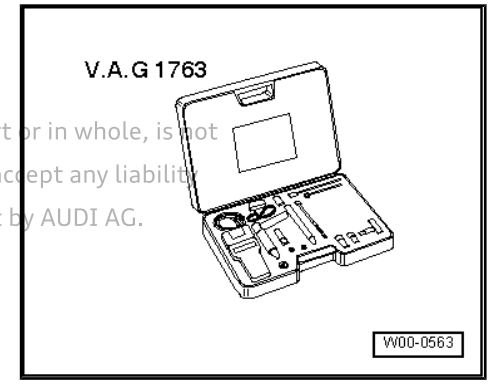
Renew gasket for bolts if damaged.

– Install cylinder head cover, tightening sequence ⇒ page 80 .

1.5 Checking compression

Special tools and workshop equipment required

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

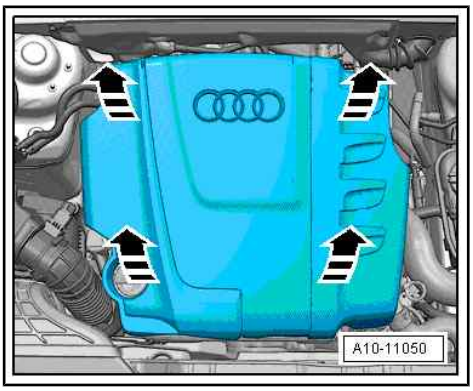


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Procedure

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

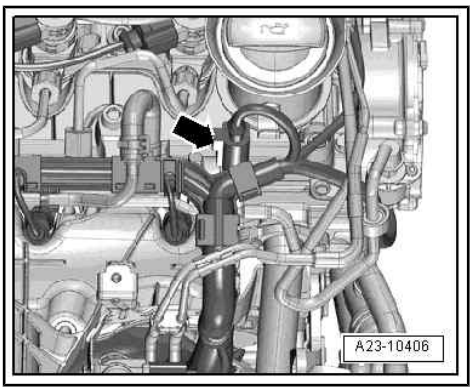
– Remove engine cover panel -arrows-.



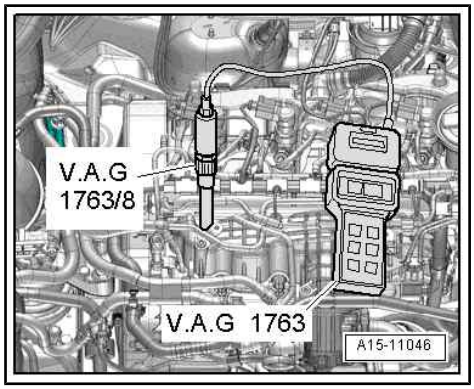
– Unplug electrical connector -arrow- for fuel pressure regulating valve - N276- at fuel rail.

– Briefly start engine to relieve fuel pressure in fuel rail.

– Remove all glow plugs ⇒ page 292 .



– Screw in adapter - V.A.G 1763/8- in place of corresponding glow plug 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.

– Repeat procedure on each cylinder.

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

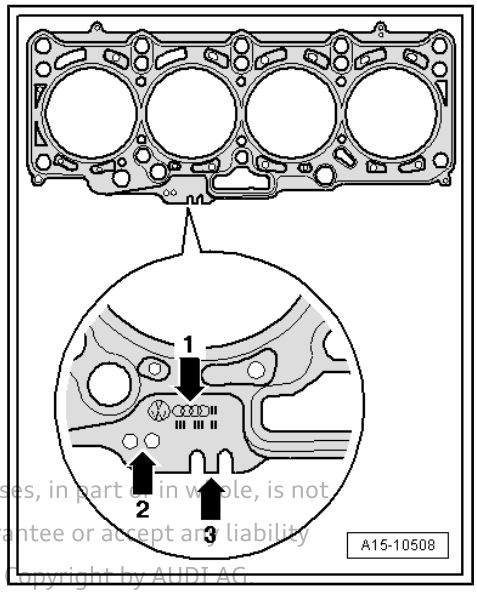
Assembling

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

– Install glow plugs ⇒ page 292 .

– 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.

1.6 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 gasket size.*
- *Cylinder head gaskets of different thicknesses are fitted depending on piston projection. When replacing the cylinder head gasket, install a new gasket with the same identification -arrow 2-.*

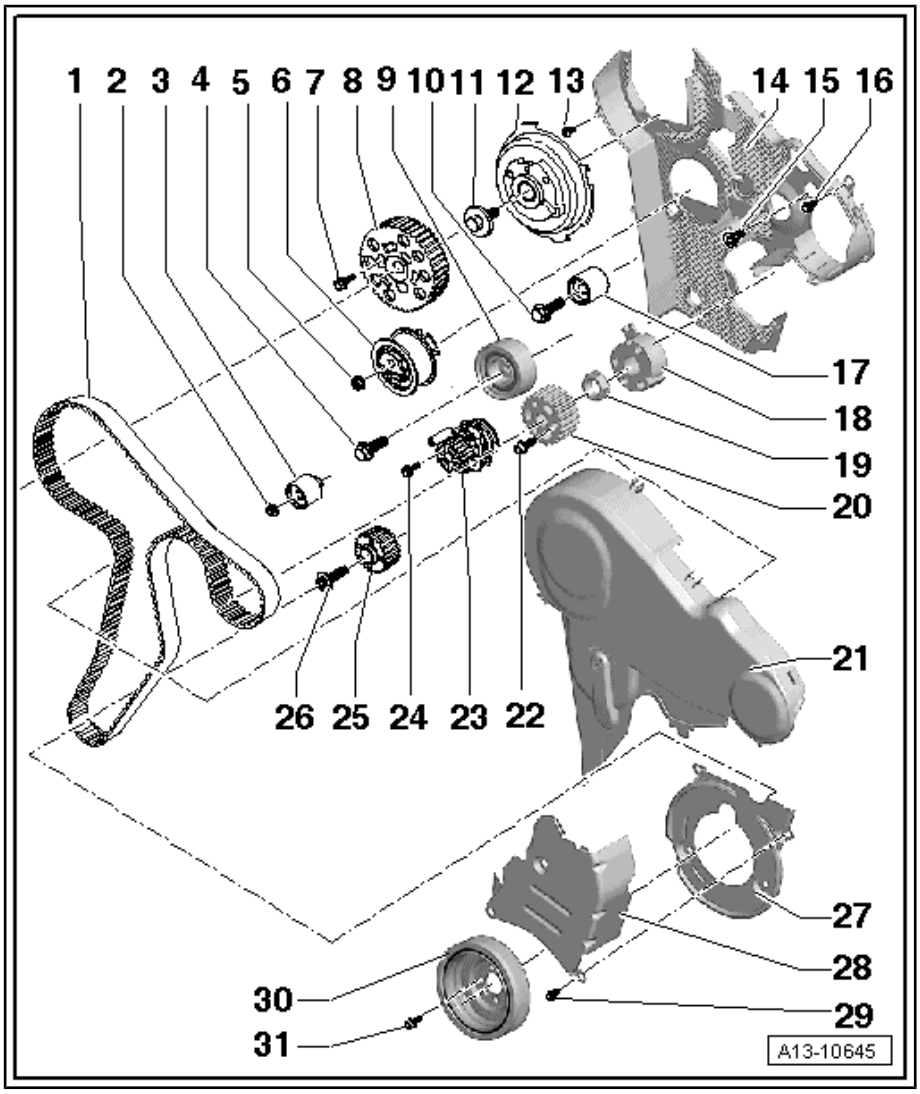
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2 Toothed belt drive

⇒ "2.1 Exploded view - toothed belt", page 89

⇒ "2.2 Removing and installing toothed belt", page 90

2.1 Exploded view - toothed belt



1 - Toothed belt

- ❑ Mark direction of rotation before removing
- ❑ Check for wear
- ❑ Do not kink
- ❑ Removing and installing ⇒ page 90

2 - Nut

- ❑ 20 Nm
- ❑ Make sure that stud is fitted securely
- ❑ Stud, 15 Nm

3 - Idler roller

4 - Bolt

- ❑ Renew
- ❑ 50 Nm + 90°

5 - Nut

- ❑ Renew nut
- ❑ 20 Nm + 45°
- ❑ Make sure that stud is fitted securely
- ❑ Stud, 15 Nm

6 - Tensioning roller

7 - Bolt

- ❑ Renew
- ❑ 20 Nm +45°

8 - Camshaft sprocket

9 - Idler roller

10 - Bolt

- ❑ 20 Nm

11 - Bolt

- ❑ 100 Nm

12 - Hub

- ❑ Use counterhold tool - 3415- to loosen and tighten
- ❑ To remove, use puller - T10052-
- ❑ Removing and installing ⇒ page 104

13 - Bolt

- ❑ 5 Nm

14 - Toothed belt cover (rear)

15 - Bolt

- ❑ 20 Nm

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16 - Bolt

- ❑ 5 Nm

17 - Idler roller

18 - Hub

- ❑ With sender wheel
- ❑ Use counterhold tool - T10051- to loosen and tighten
- ❑ To remove, use puller - T40064-

19 - Nut

- ❑ 100 Nm

20 - High-pressure pump sprocket

21 - Toothed belt cover (top section)

22 - Bolt

- ❑ Tightening torque ⇒ page 201

23 - Coolant pump

- ❑ Removing and installing ⇒ page 160

24 - Bolt

- ❑ 15 Nm

25 - Crankshaft sprocket

26 - Bolt

- ❑ Renew
- ❑ Use counterhold tool - 3415- to loosen and tighten
- ❑ Do not additionally oil or grease the 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

27 - Toothed belt cover (bottom section)

28 - Toothed belt cover (centre section)

29 - Bolt

- ❑ 10 Nm

30 - Belt pulley/vibration damper

- ❑ Can only be installed in one position (holes are off-set)

31 - Bolt

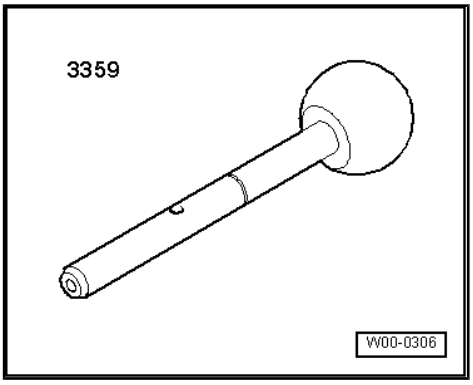
- ❑ Renew
- ❑ 10 Nm + 90°

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2.2 Removing and installing toothed belt

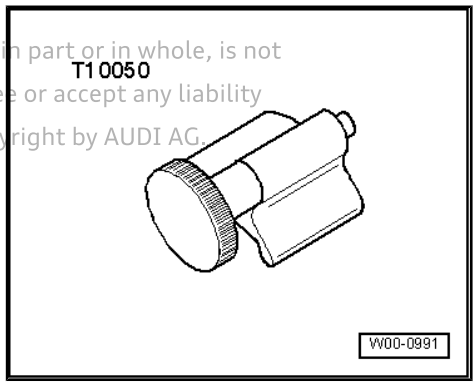
Special tools and workshop equipment required

- Locking pin - 3359- or commercially available M6x50 bolt

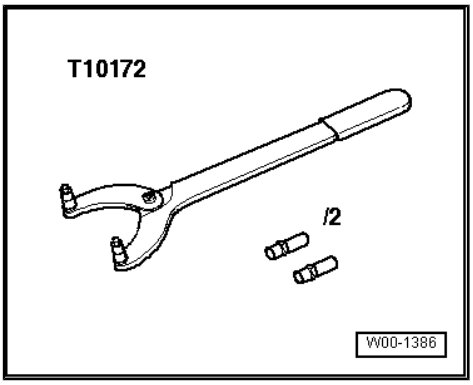


- Crankshaft stop - T10050-

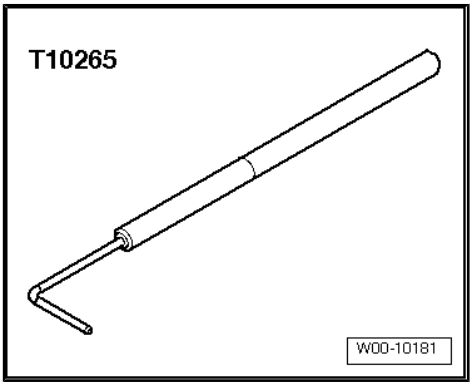
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- Counterhold tool - T10172-

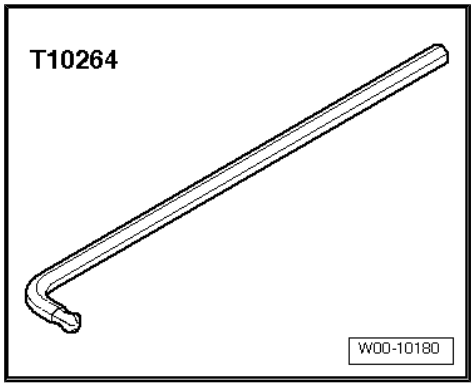


- Locking tool - T10265- (not required for all tensioning rollers)

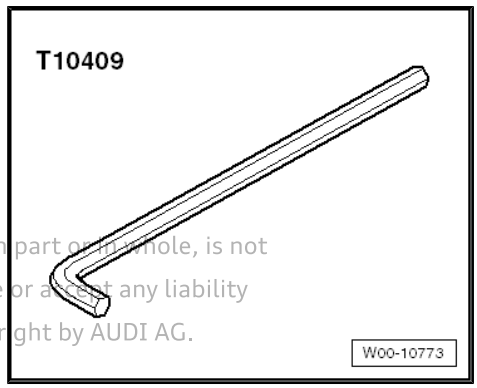


- M10 bit
- Torque wrench

- Offset screwdriver - T10264- for tensioning roller A



- Offset screwdriver, 8 mm - T10409- for tensioning roller B



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Differences between tensioning roller versions

Note

Two different tensioning roller versions are installed. It is possible to switch between them. When making adjustments, first check which tensioning roller version is installed.

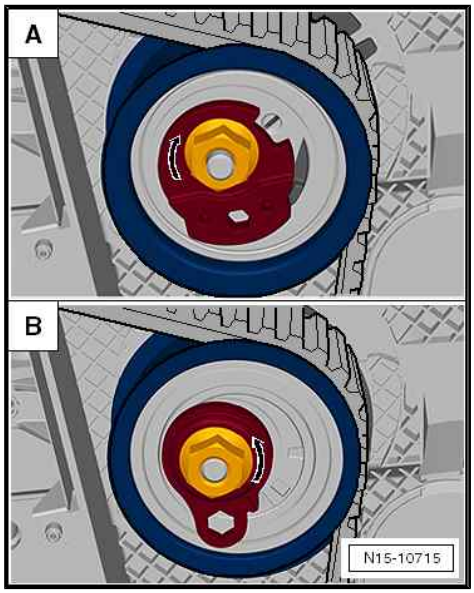
Note different directions of rotation when tensioning

Features of tensioning roller A:

- Locking tool - T10265- is required for installation
- Make sure tensioning roller is positioned correctly in toothed belt cover
- Toothed belt is tensioned by turning eccentric adjuster on tensioning roller clockwise

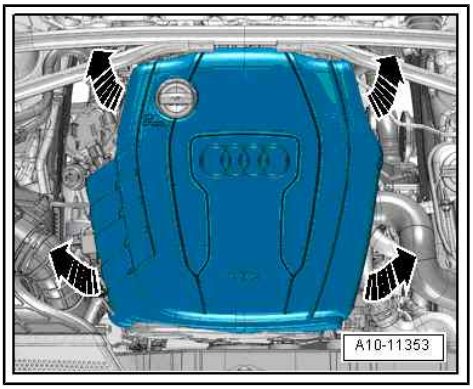
Features of tensioning roller B:

- No locking tool required
- Tensioning roller is not located in toothed belt cover
- Toothed belt is tensioned by turning eccentric adjuster on tensioning roller anti-clockwise



Removing

– Remove engine cover panel -arrows-.

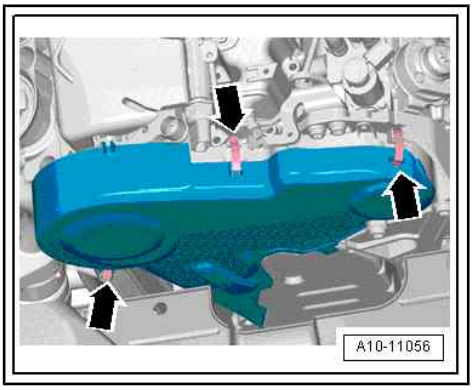


Note

Perform adjustments on toothed belt only when engine is cold; position of tensioner varies according to temperature of engine.

– Open clips -arrows- and remove toothed belt cover.

– Remove vibration damper ⇒ page 45 .



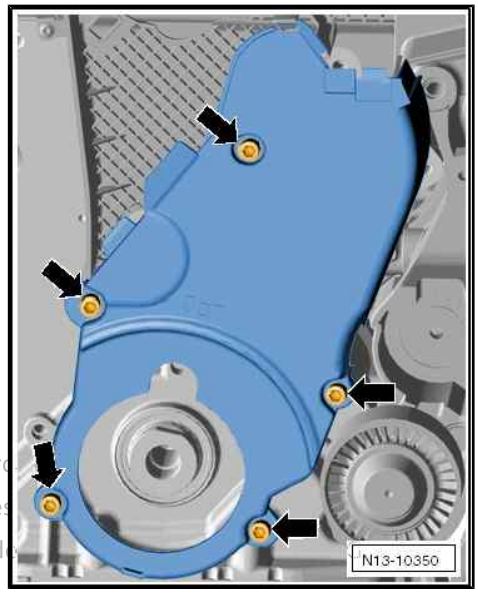
– Remove bolts -arrows-.

– Detach toothed belt cover (bottom).

Caution

Irreparable damage can be caused if the toothed belt slips.

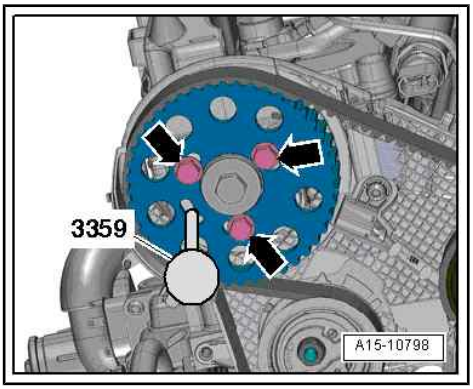
- ***Only turn crankshaft in direction of engine rotation.***



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– 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- or an M6x50 bolt (commercially available).

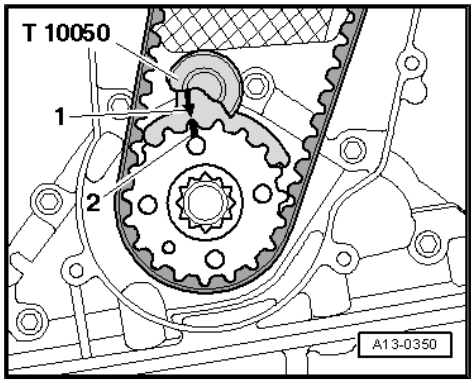


Note

- *If it is not possible to push the diesel injection pump locking pin - 3359- in (lack of space), use an M6x50 bolt (commercially available).*
- *Disregard -arrows-.*

– Lock crankshaft sprocket in position with crankshaft stop - T10050- .

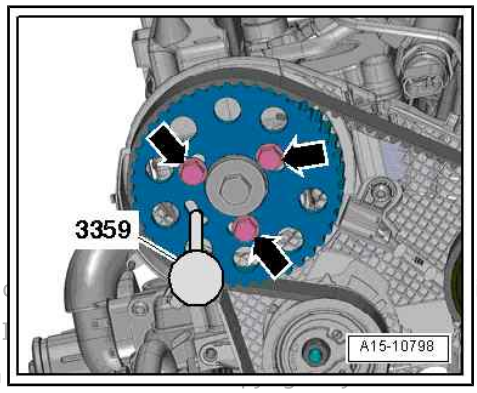
• The markings on the sprocket -2- and the crankshaft stop -1- must align -arrow-. The pin of the crankshaft stop must engage in the aperture in the sealing flange.



Note

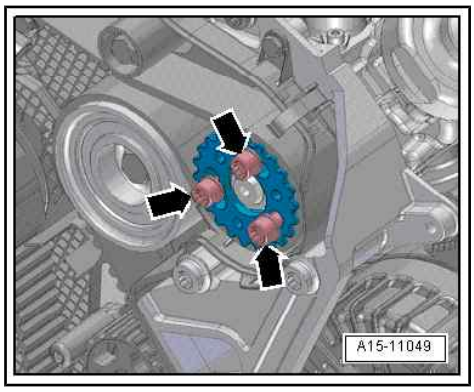
The crankshaft stop can only be pushed onto the sprocket from the front face of the teeth.

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



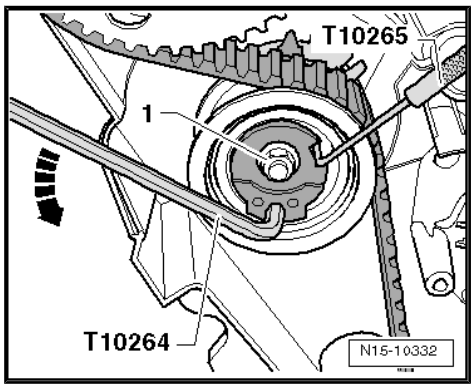
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– Using an M10 bit , loosen bolts -arrows- for toothed belt sprocket on high-pressure pump by approx. 90°.



– 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- .

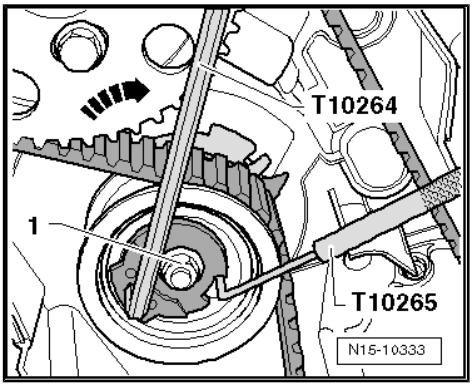


Note

♦ *Different tensioning roller versions: Not all tensioning rollers can be locked with the locking tool - T10265- .*

♦ *Tensioning rollers which cannot be locked must be loosened with the offset screwdriver - T10264- without being locked.*

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



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.

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Installing (adjusting valve timing)

- Tightening torques

⇒ "2.1 Exploded view - toothed belt", page 89

Note

Perform adjustments on toothed belt only when engine is cold.

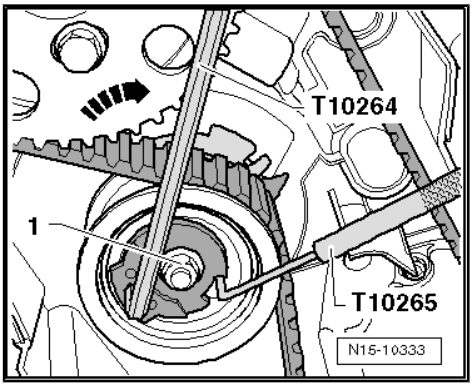
Caution

Risk of damage to valves and piston crowns.

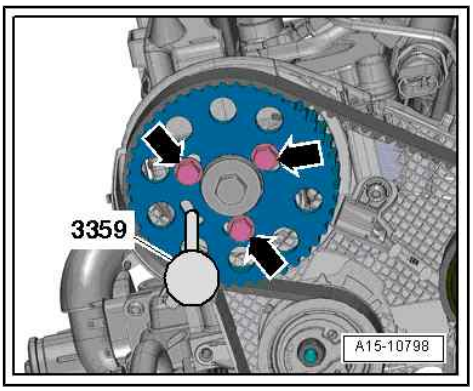
- ***The crankshaft must not be at "TDC" at any cylinder when the camshaft is turned.***

Requirements:

- Different tensioning roller versions: Not all tensioning rollers can be locked with the locking tool - T10265- .
- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut -1-.



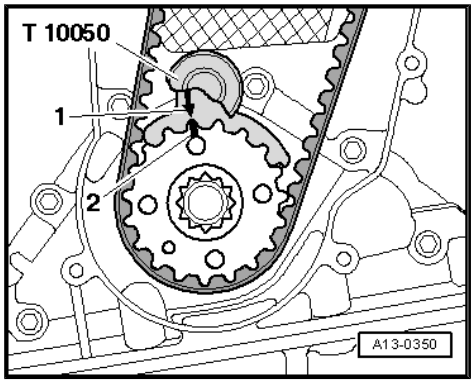
- Lock camshaft hub with diesel injection pump locking pin - 3359- or an M6x50 bolt.
- Bolts -arrows- are fitted but not tightened.
- It should just be possible to turn the sprocket on the camshaft without axial movement.



Note

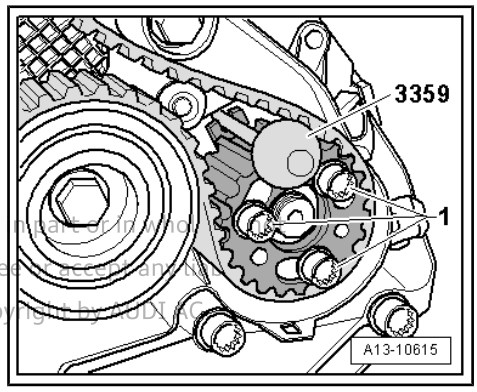
- *If it is not possible to push the diesel injection pump locking pin - 3359- in (lack of space), use an M6x50 bolt (commercially available).*
- *Disregard -arrows-.*

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



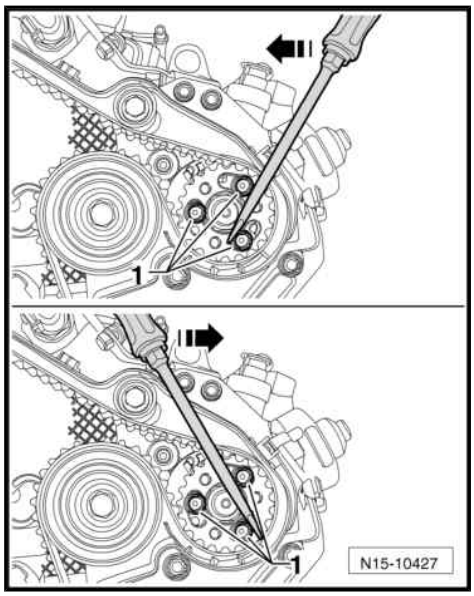
- Hub of high-pressure pump locked with diesel injection pump locking pin - 3359- .
- Bolts -1- are fitted but not tightened.
- The high-pressure pump sprocket should still just turn, but there must be no axial movement.

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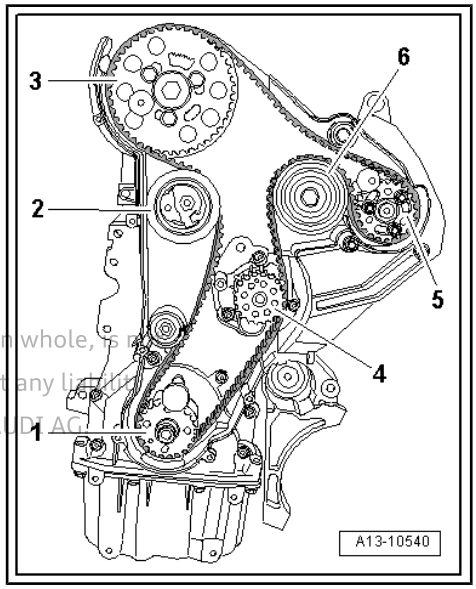
Note

If necessary, apply a screwdriver -arrows- 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

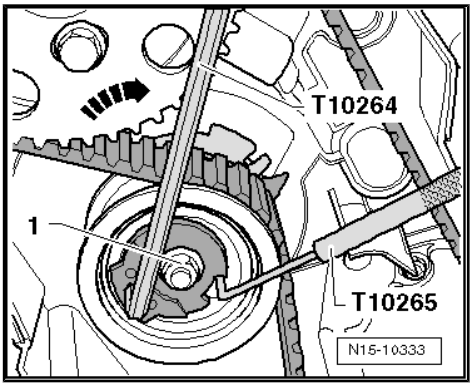


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– Loosen nut -1- for tensioning roller and detach locking tool - T10265- .

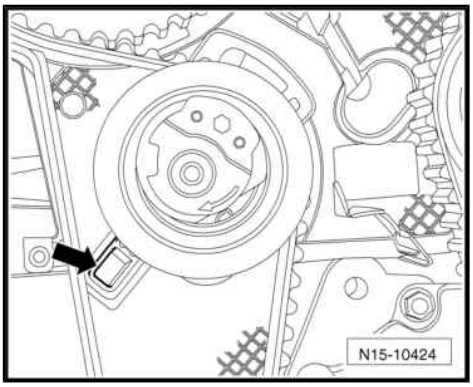
Note

- *This applies if locking tool - T10265- is attached.*
- *Disregard -arrow-.*



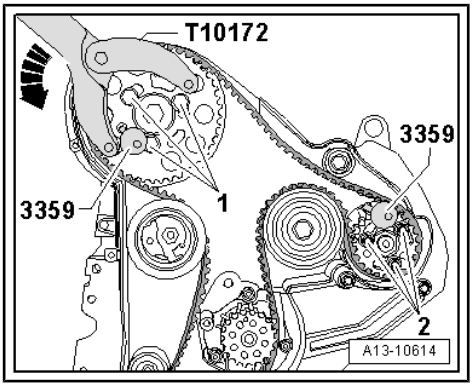
Note

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



– Position counterhold tool - T10172- on camshaft sprocket as shown in illustration.
– Apply force to counterhold tool in anti-clockwise direction -arrow- and maintain tension.
– Tighten bolts -1- for camshaft sprocket and bolts -2- for high-pressure pump sprocket in this position.

- Initial tightening torque: 20 Nm

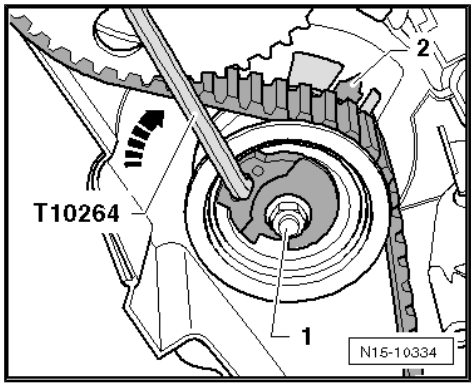


– Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -2- aligns with centre of slot on base plate.

• Nut -1- must not turn.

– Hold tensioning roller in this position and tighten nut.

– Remove diesel injection pump locking pin - 3359- or M6x50 bolt and crankshaft stop - T10050- .



Checking valve timing:

Caution

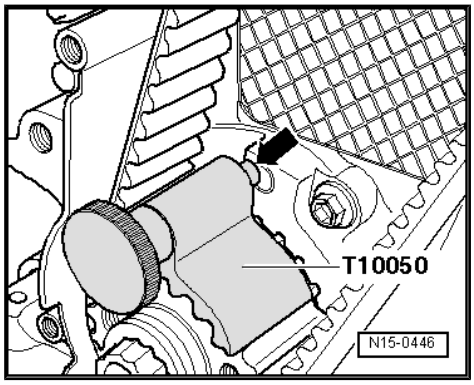
Irreparable damage can be caused if the toothed belt slips.

♦ *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.

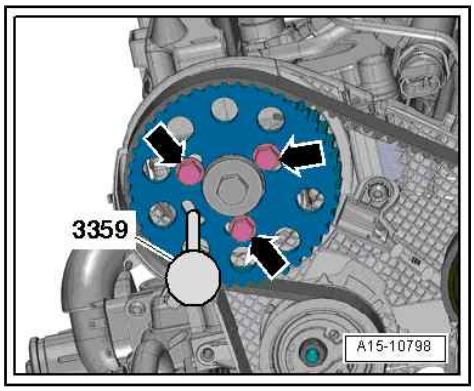
– Turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop engages in sealing flange as crankshaft rotates.



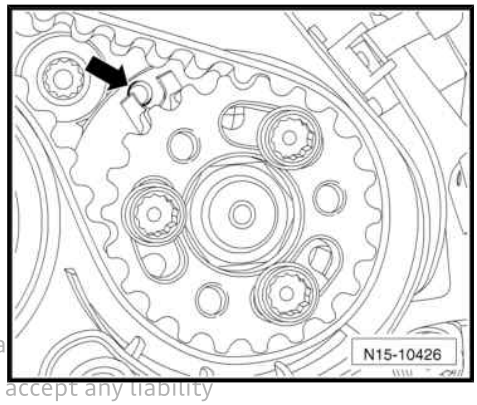
• Lock camshaft hub with diesel injection pump locking pin - 3359- or an M6x50 bolt.

Note

Disregard -arrows-.

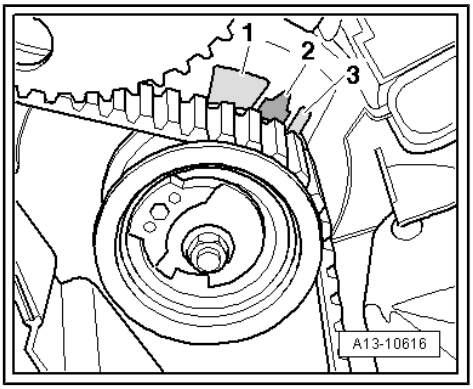


• It is very difficult to reproduce the locking position of the high-pressure pump hub. However, a slight deviation -arrow- does not influence engine operation.



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



Note

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 99 .

Re-adjusting valve timing:

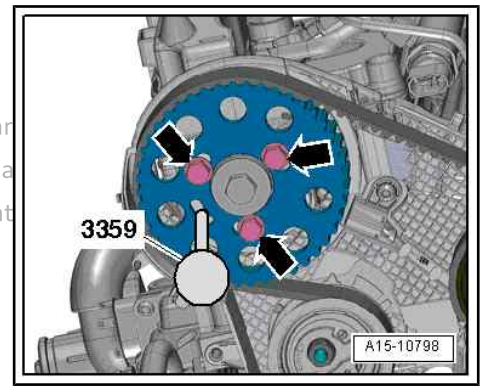
– If camshaft hub cannot be locked, withdraw crankshaft stop - T10050- until pin is clear of bore.

– 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 with diesel injection pump locking pin - 3359- or M6x50 bolt.

– Loosen bolts for camshaft sprocket after locking hub.

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

– Turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop engages in sealing flange as crankshaft rotates.

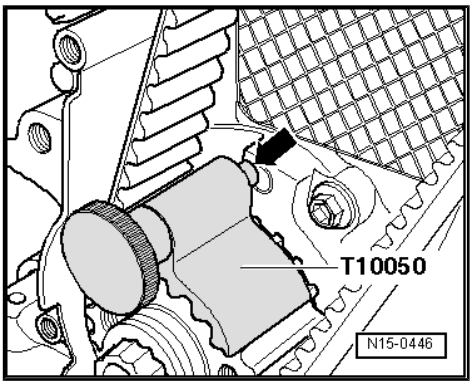
– Tighten camshaft sprocket bolts to 20 Nm initially.

B - If pin 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.



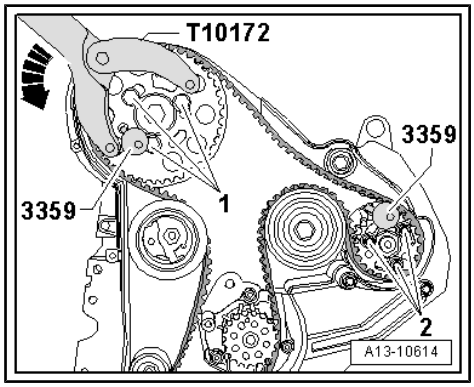
Procedure after adjusting valve timing correctly:

– Remove diesel injection pump locking pin - 3359- or M6x50 bolt 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 7 (page 89) .
– Tighten bolts -2- for high-pressure pump sprocket to final torque ⇒ Item 11 (page 204) .
– 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 vibration damper ⇒ page 45 .
– Install engine cover panel.

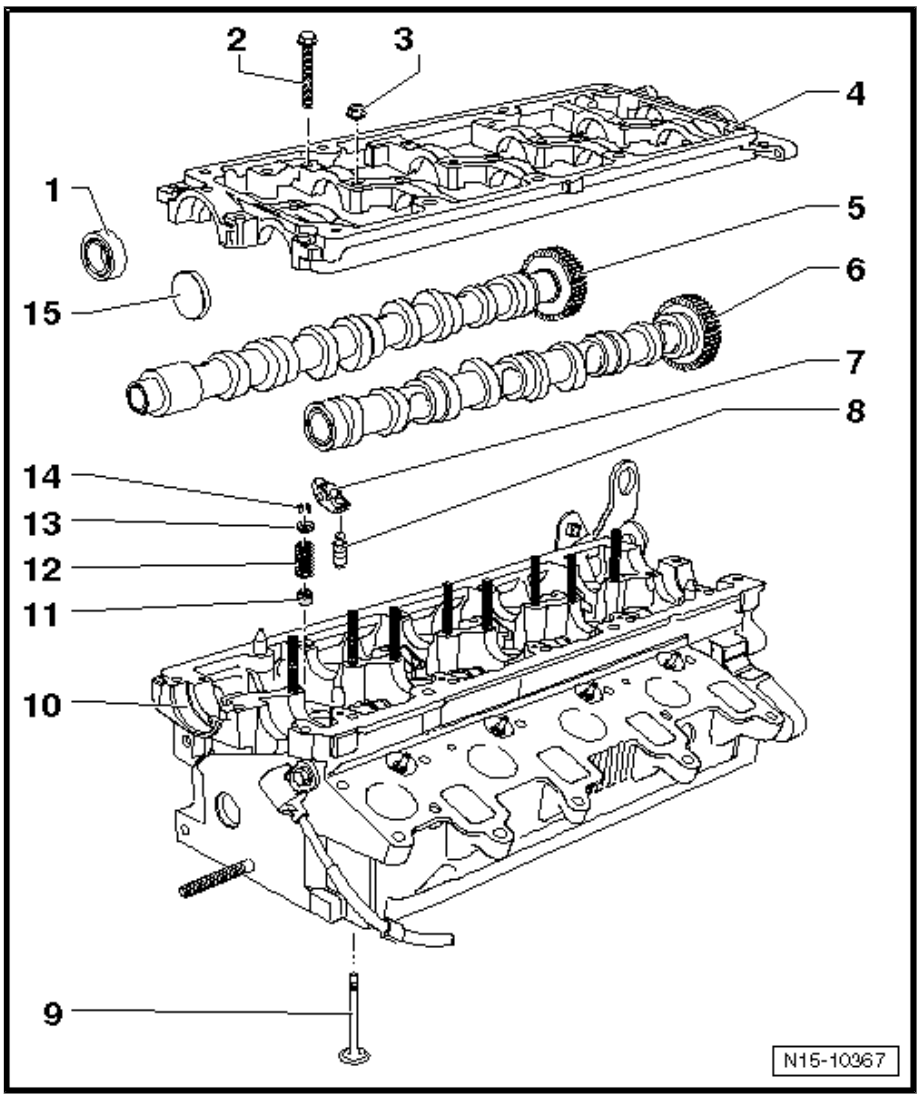
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3 Valve gear

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⇒ “3.1 Exploded view - valve gear”, page 101
⇒ “3.2 Removing and installing camshaft oil seal”, page 103
⇒ “3.3 Removing and installing camshaft”, page 104
⇒ “3.4 Removing and installing valve stem oil seals”, page 112

3.1 Exploded view - valve gear



1 - Oil seal

- ❑ Do not additionally oil or grease sealing lip of oil seal
- ❑ Before installing, use clean cloth to wipe oil residue off camshaft journal.
- ❑ When fitting, mask groove on taper of camshaft (using e.g. transparent adhesive tape)
- ❑ Removing and installing ⇒ page 103

2 - Bolt

- ❑ Note correct sequence when loosening ⇒ page 102
- ❑ Note correct sequence when tightening ⇒ page 102

3 - Nut

- ❑ 10 Nm

4 - Retaining frame

- ❑ With integrated camshaft bearings
- ❑ Note correct sequence when loosening ⇒ page 102
- ❑ Note correct sequence when tightening ⇒ page 102
- ❑ Clean sealing surface; machining not permitted

5 - Exhaust camshaft

6 - Inlet camshaft

7 - Roller rocker finger

- ❑ Mark installation position
- ❑ Do not interchange
- ❑ Check roller bearings for ease of movement
- ❑ Lubricate contact surface

8 - Hydraulic compensation element

- ❑ Mark installation position
- ❑ Lubricate contact surfaces before installing

9 - Valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Valve dimensions ⇒ page 119
- ❑ Checking valve guides ⇒ page 119

10 - Cylinder head

- ❑ See note ⇒ page 76

11 - Valve stem oil seal

- ❑ Renewing valve stem oil seals ⇒ page 112

12 - Valve spring

13 - Valve spring plate

14 - Valve cotter

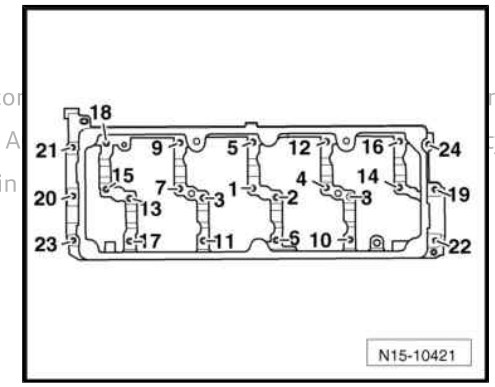
15 - Sealing cap

- ❑ Renew

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Loosening retaining frame

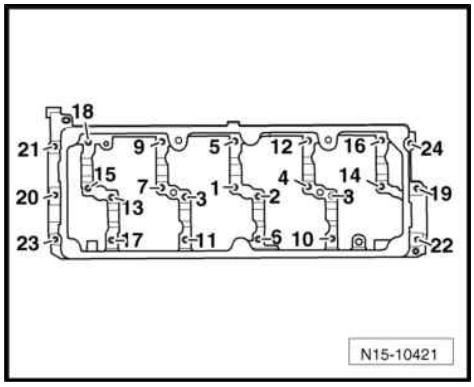
– Remove bolts securing retaining frame in the sequence -24 ... 1-.



Tightening sequence for retaining frame

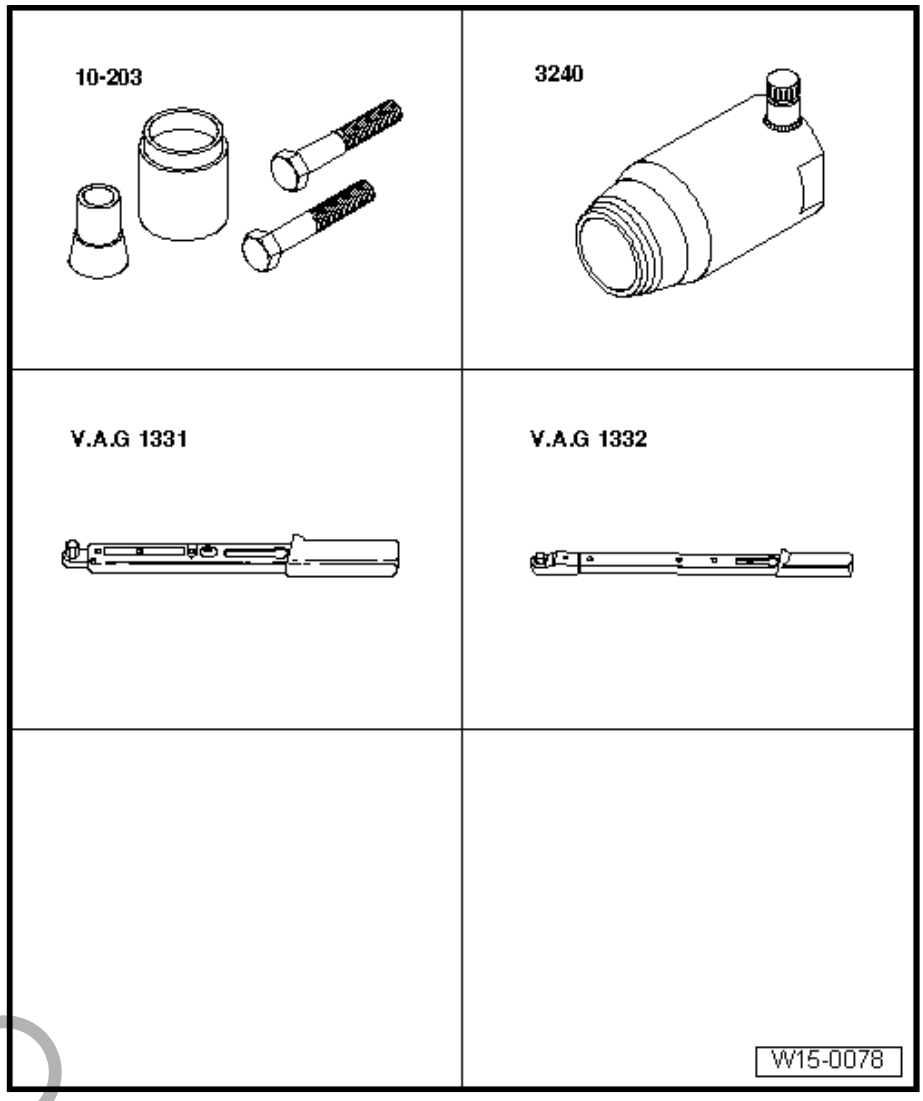
– Tighten cylinder head bolts in the sequence -1 ... 24- as follows:

1. Fit bolts in the sequence -1 ... 24- and hand-tighten in several stages.
2. Tighten bolts in the sequence -1 ... 24- to 10 Nm using torque wrench.



3.2 Removing and installing camshaft oil seal

Special tools and workshop equipment required



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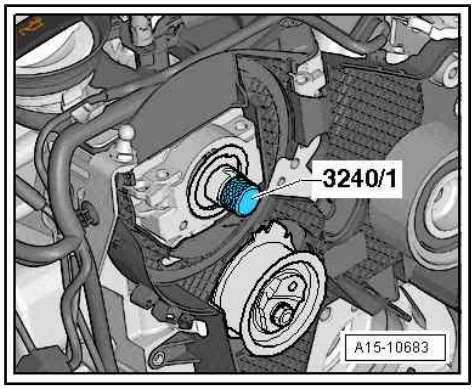
- Fitting tool - 10-203-
- Oil seal extractor - 3240-
- Torque wrench - V.A.G 1331/-
- Torque wrench - V.A.G 1332/-
- Bolt M12×1.5×75

Removing

– Detach toothed belt from camshaft and high-pressure pump ⇒ page 90 .

– Remove camshaft sprocket and hub ⇒ page 104 .

– Insert thrust piece -3240/1- in camshaft.
– Screw inner section of oil seal extractor 3240 out of outer section by two turns (approx. 3 mm) and lock with knurled screw.

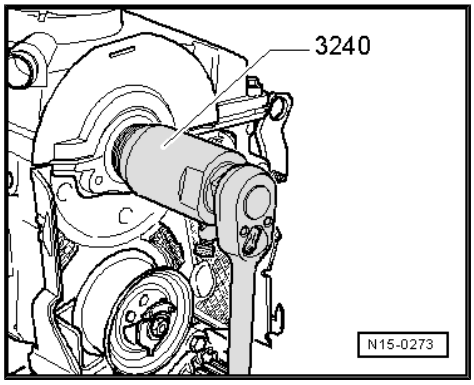


– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
– Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.

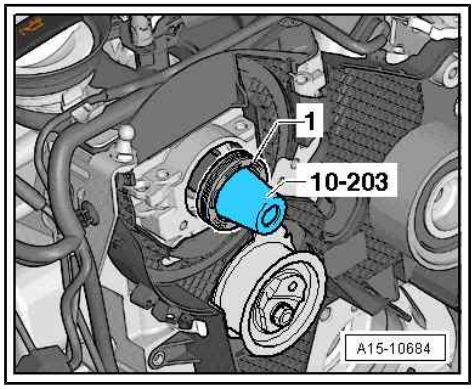
Installing

Note

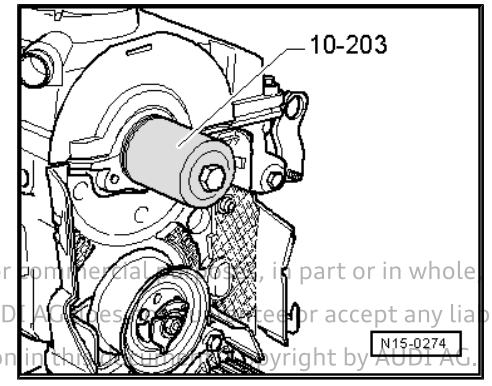
The sealing lip of the oil seal must not be additionally oiled or greased.



– Apply guide sleeve -10-203- to camshaft as shown in illustration.
– Carefully push oil seal -1- over guide sleeve and onto camshaft.

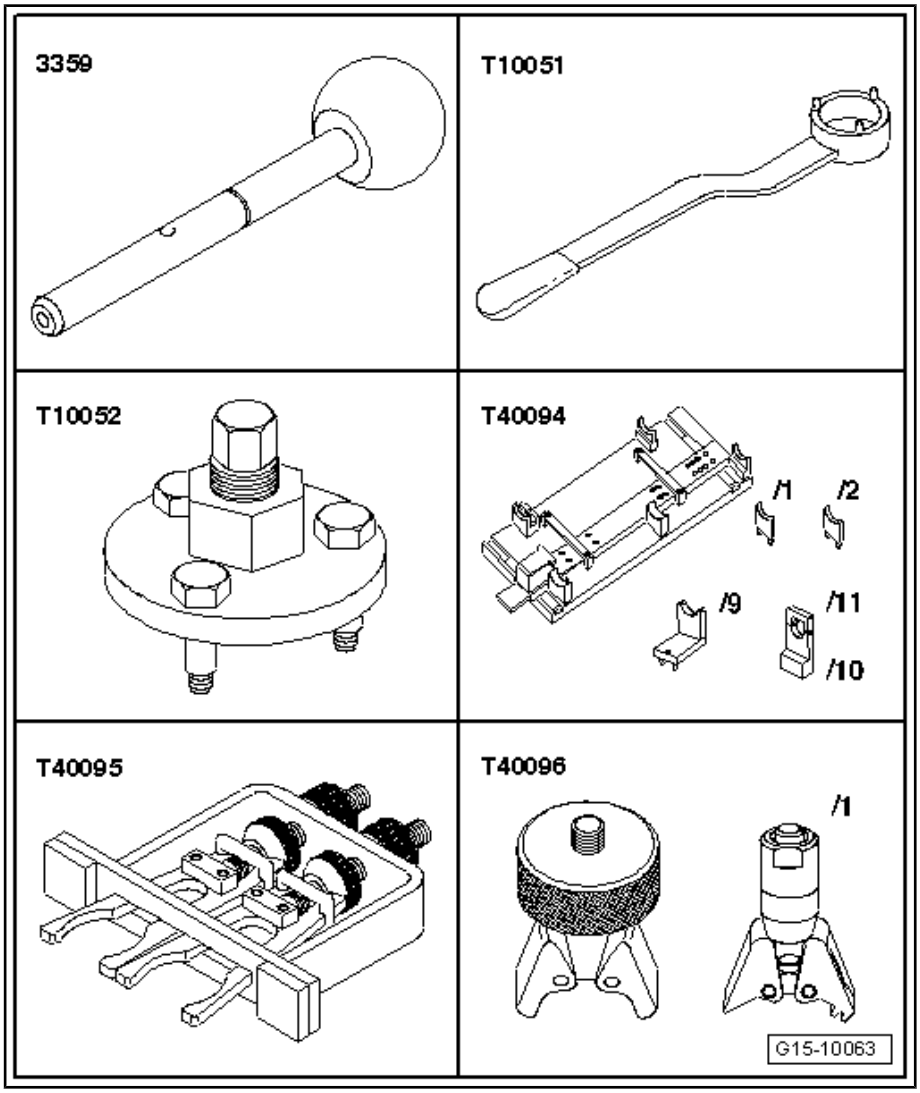


– Press in oil seal onto stop using thrust piece of fitting tool 10-203 and bolt M12×1.5×75.
– Install camshaft sprocket and hub ⇒ page 104 .
– Fit toothed belt and adjust valve timing ⇒ page 90 .



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3.3 Removing and installing camshaft

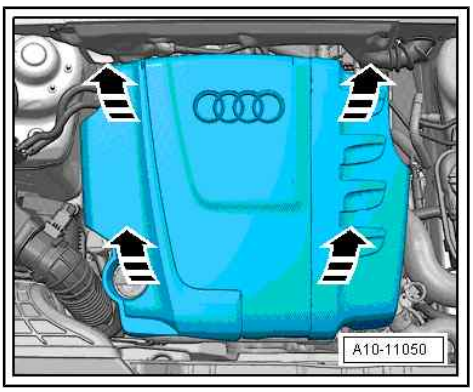


- Diesel injection pump locking pin - 3359-
- Counterhold tool - T10051-
- Puller - T10052-
- Camshaft fitting tool - T40094-
- Camshaft fitting tool - T40095-
- Clamping tool -T40096/1-

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Removing

– Remove engine cover panel -arrows-.



– Take out noise insulation at injectors.

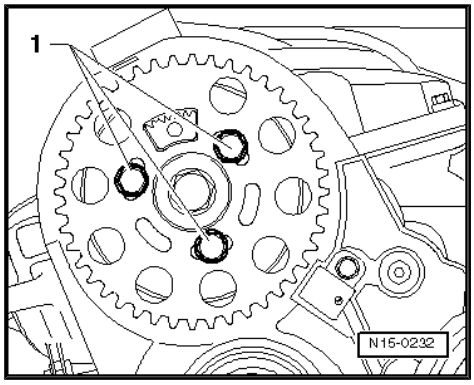
– Remove injectors ⇒ page 229 .

– Remove fuel rail ⇒ page 238 .

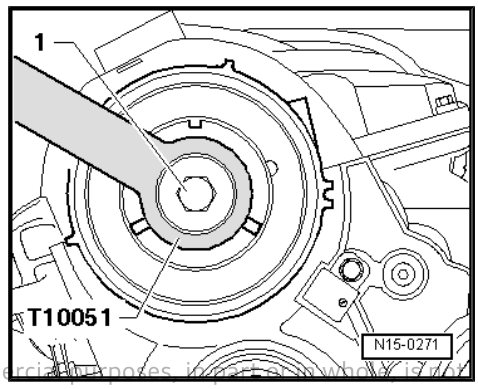
– Detach toothed belt from camshaft and high-pressure pump ⇒ page 90 .

– Detach cylinder head cover ⇒ page 85 .

– Unscrew bolts -1- on camshaft sprocket.
– Detach camshaft sprocket from hub.

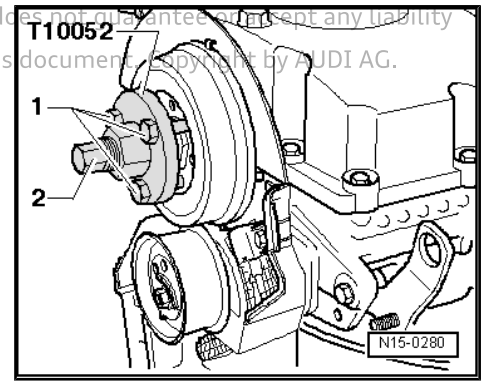


– Counterhold hub with counterhold tool - T10051- and loosen bolt -1- securing hub.
– Unscrew securing bolt of hub approx. 2 turns.



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– Set up puller - T10052- and align it with holes in hub.
– Tighten securing bolts -1-.
– Apply tension to hub by evenly tightening puller -2- until hub separates from taper of camshaft.

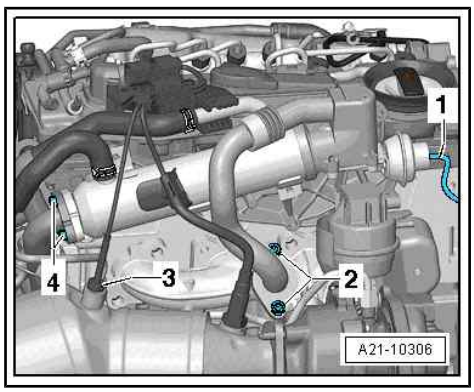


Note

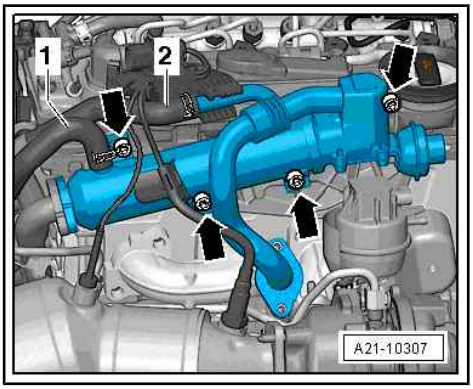
Use 30 mm spanner to hold puller.

– Detach hub from taper of camshaft.
– Remove vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .

– Disconnect vacuum hose -1-.



– Remove bolts -2- and -4-.

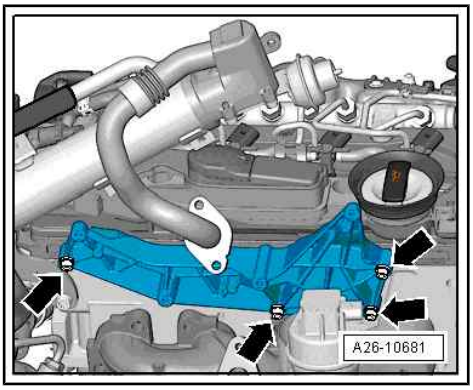


Note

Coolant hoses -1- and -2- must not be detached.

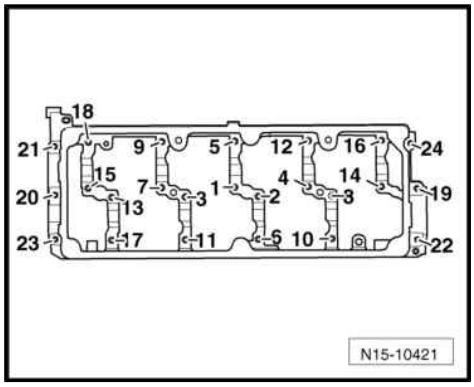
– Remove bolts -arrows- and tie up exhaust gas recirculation cooler.

– Unfasten bolts -arrows- and remove bracket for exhaust gas recirculation.



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– Remove bolts securing retaining frame in the sequence -24 ... 1-.
– Detach retaining frame.
– Mark fitting location of camshafts for re-installation and remove.



Installing

Tightening torques
⇒ “3.1 Exploded view - valve gear”, page 101

Note

Use silicone sealant to seal sealing surface between retaining frame and cylinder head.

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.***

– Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.

Caution

Protect lubrication system and bearings against contamination.

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

WARNING

Risk of eye injury.

- ***Put on safety goggles.***

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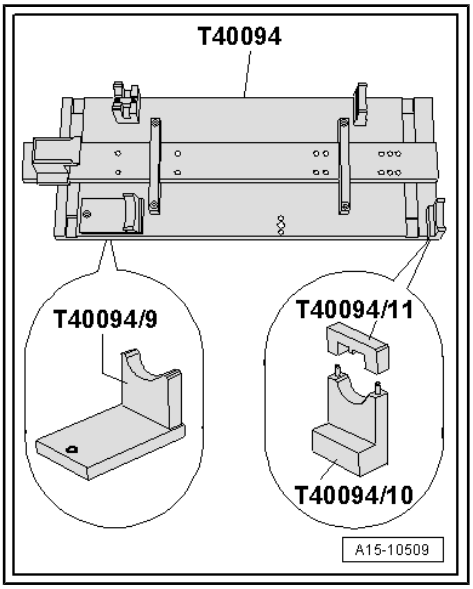
– Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.

Note

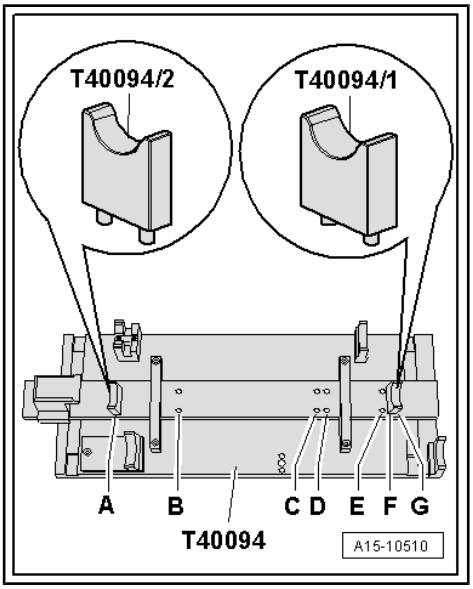
– Oil running surfaces of both camshafts.

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.



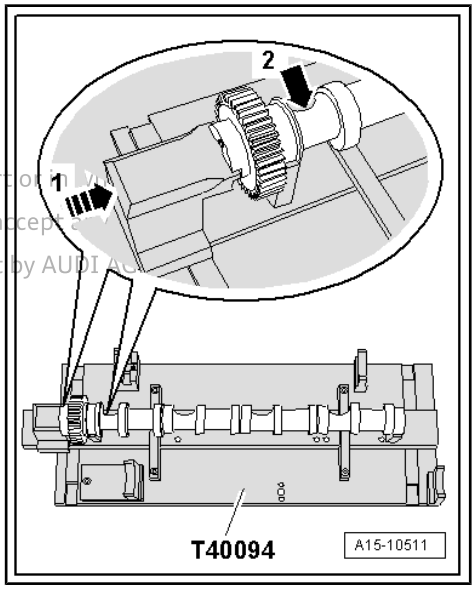
– Fit support -T40094/1- onto position -F- and support -T40094/2- onto position -A-.



– Place inlet camshaft in supports -T40094/1- and -T40094/2- .

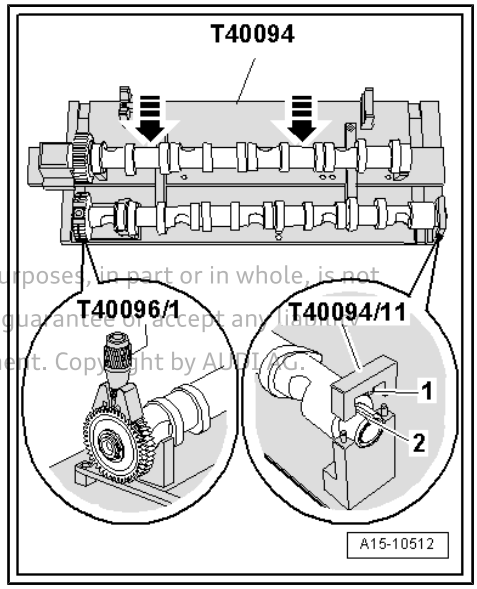
– Turn inlet camshaft in such a way that it can be locked in “TDC” position using locking device -arrow 1-.

• Recess -arrow 2- for cylinder head bolt must face outwards.



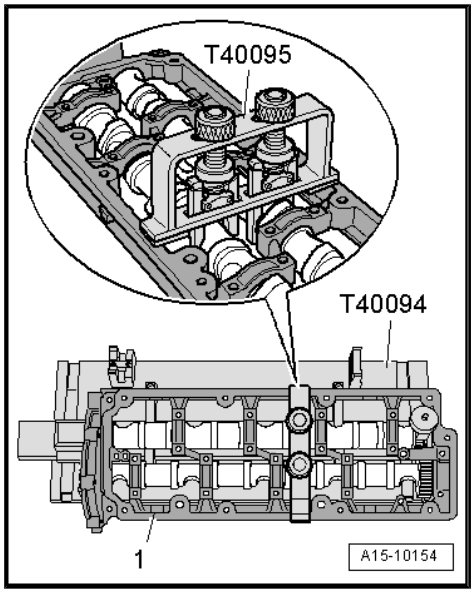
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– Place exhaust camshaft in supports -T40094/9- and -T40094/11- .
– Lock exhaust camshaft with top section -T40094/11- .
• The lug -1- on the top section must engage in the slot -2- in the camshaft,
– Place clamping tool -T40096/1- on teeth of exhaust camshaft so that the two arms of the tool engage in the two halves of the gear.
• 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.
– Slide inlet camshaft towards exhaust camshaft until gear teeth -arrows- engage.

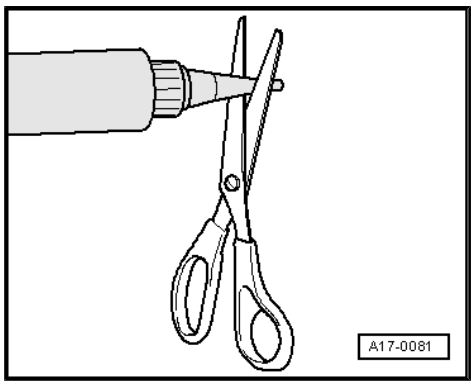


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– Fit retaining frame on camshafts.
• All camshaft bearings must be seated on the camshafts.
– Position camshaft fitting tool - T40095- and fix camshafts in position in retaining frame, as shown in illustration.
– Detach top section -T40094/11- .



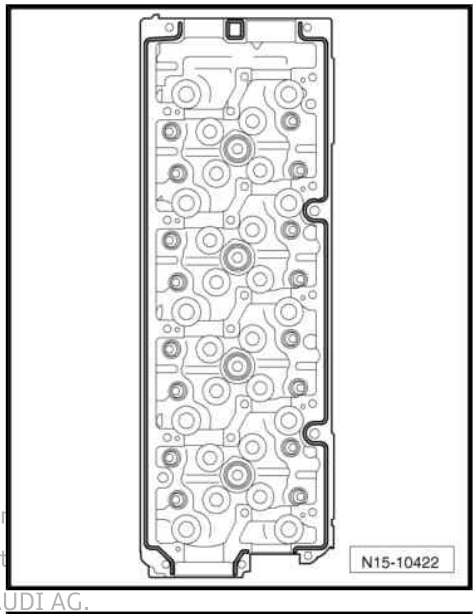
– Cut off nozzle of tube at front marking (∅ of nozzle approx. 2 mm).
– Apply beads of sealant (approx. 2 ... 3 mm width) -arrows- onto clean sealing surfaces of cylinder head as illustrated.



Note

The sealant beads must not be thicker than specified, otherwise excess sealant could enter the camshaft bearings.

– Take camshafts together with retaining frame, camshaft fitting tool - T40095- and clamping tool -T40096/1- out of camshaft fitting tool - T40094- and insert components carefully into cylinder head.



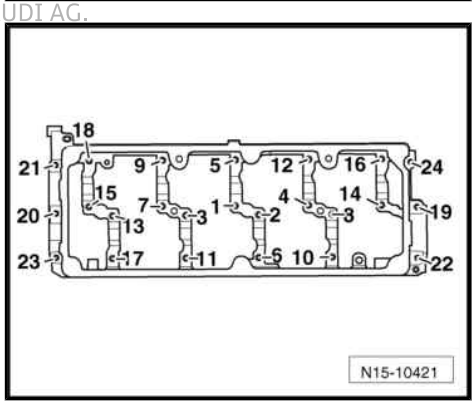
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– Tighten retaining frame bolts in the sequence -1 ... 24- hand-tight initially.

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

– Tighten retaining frame bolts in the sequence -1 ... 24- to final torque. Tightening torque ⇒ page 102

– Remove camshaft fitting tool - T40095- and clamping tool - T40096/1- .



Perform further installation in reverse order, paying attention to the following:

– Renew camshaft oil seal ⇒ page 103 .

– Use suitable drift to drive in new sealing cap ⇒ Item 15 (page 102) at cylinder head until flush.

– Install vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .

– Install cylinder head cover ⇒ page 85 .

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.***

3.4 Removing and installing valve stem oil seals

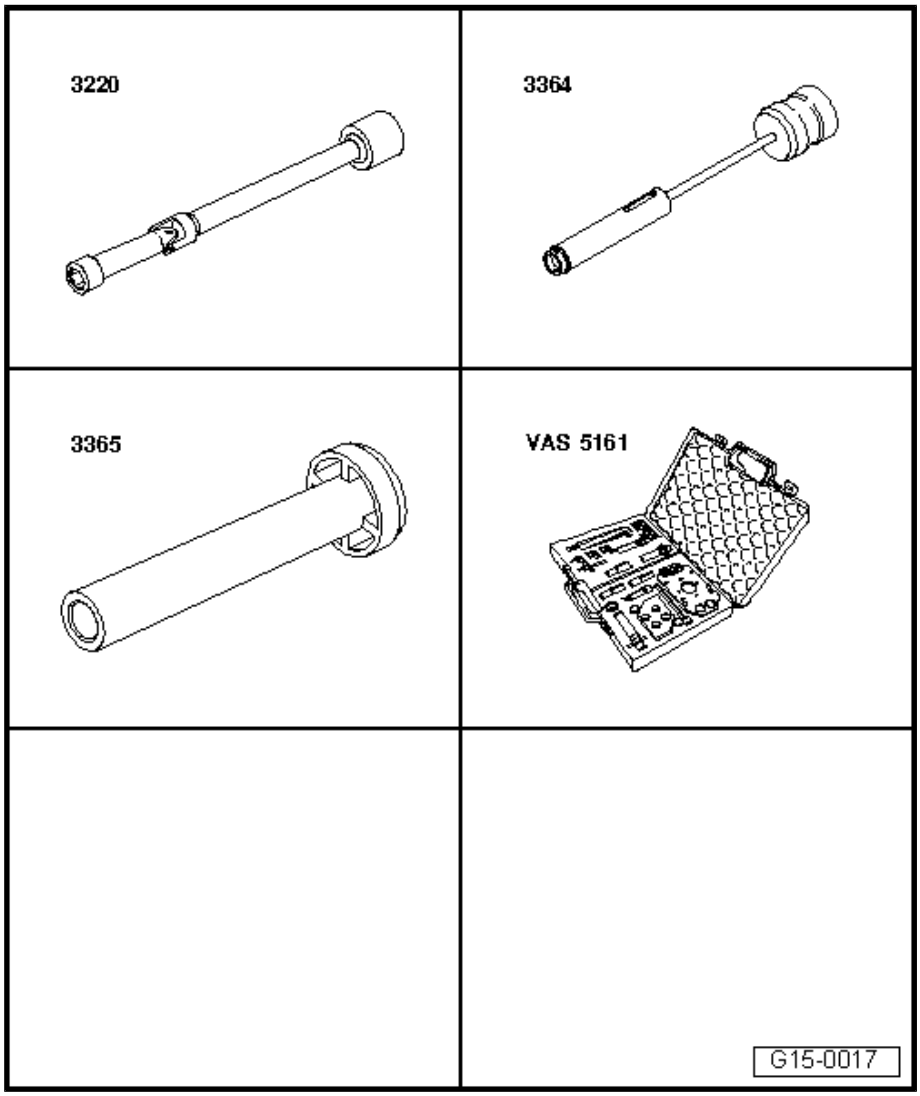
⇒ “3.4.1 Removing and installing valve stem oil seals with cylinder head installed”, page 112

⇒ “3.4.2 Removing and installing valve stem oil seals with cylinder head removed”, page 115

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3.4.1 Removing and installing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required



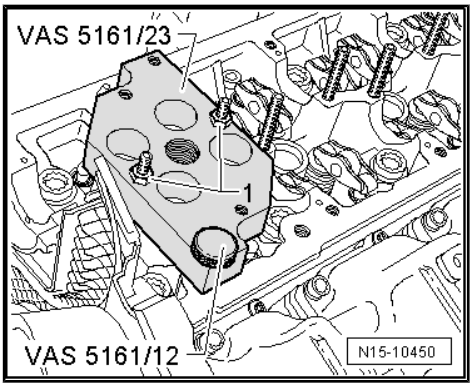
- Articulated wrench, 10 mm - 3220-
- Valve stem seal puller - 3364-
- Valve stem oil seal fitting tool - 3365-
- Removal and installation device for valve cotters - VAS 5161 A- with guide plate - VAS 5161/23- and knurled spacer ring - VAS 5161/23-1-

Procedure

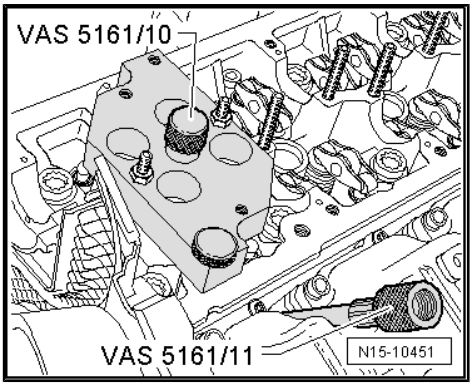
– Remove glow plugs using U/J extension and socket - 3220- ⇒ page 292 .

– Remove camshafts ⇒ page 104 .

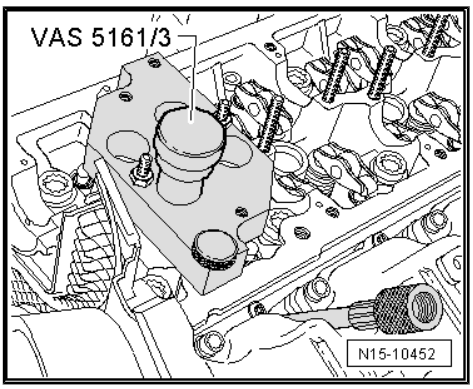
– Attach guide plate - VAS 5161/23- to cylinder head.
– Secure guide plate - VAS 5161/23- hand-tight with knurled screw - VAS 5161/12- on the intake manifold side and with flangeless M6 nuts -1- on the studs.
– Screw sealing pin - VAS 5161/10- into guide plate - VAS 5161/23- .



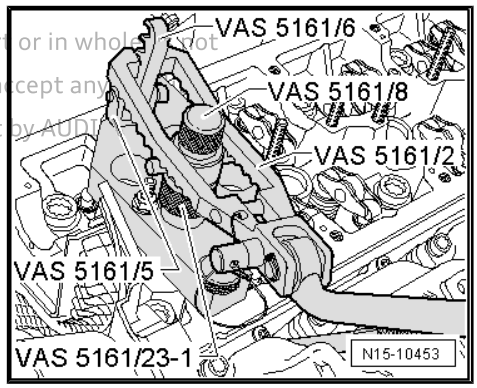
– Screw adapter - VAS 5161/11- hand-tight into corresponding glow plug thread.



– Insert drift - VAS 5161/3- in guide plate - VAS 5161/23- and use plastic-headed hammer to release valve cotters that are stuck.



– Screw engaging fork - VAS 5161/5- with snap-in device - VAS 5161/6- into guide plate - VAS 5161/23- .
– Slide knurled spacer ring -VAS 5161/23-1- onto assembly cartridge - VAS 5161/8- .



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– Connect adapter - VAS 5161/11- to compressed air line using a commercially available connection piece, and apply constant air pressure.

• Minimum pressure: 6 bar

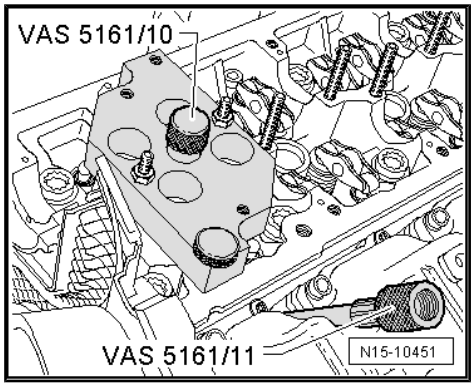
– Attach pressure fork - VAS 5161/2- to snap-in device and push assembly cartridge - VAS 5161/8- down.

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

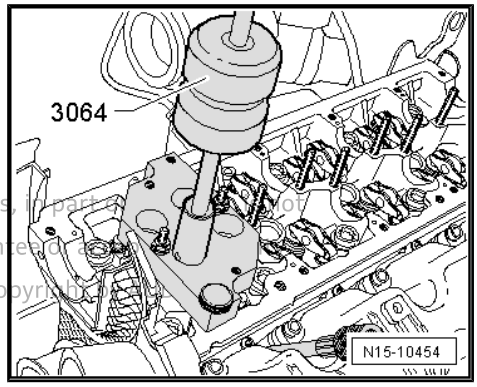
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge - VAS 5161/8- .

– Release pressure fork.

– Take out assembly cartridge - VAS 5161/8- with knurled spacer ring, valve spring plate and valve spring.



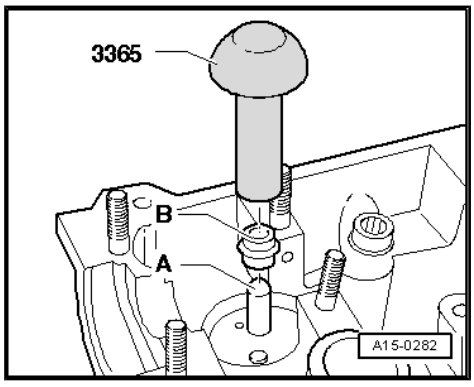
– Pull off valve stem oil seal with valve stem seal puller - 3364- .



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Note

A plastic sleeve -A- is included with the new valve stem oil seals.



– Fit plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.

– Lightly oil sealing lip of valve stem oil seal.

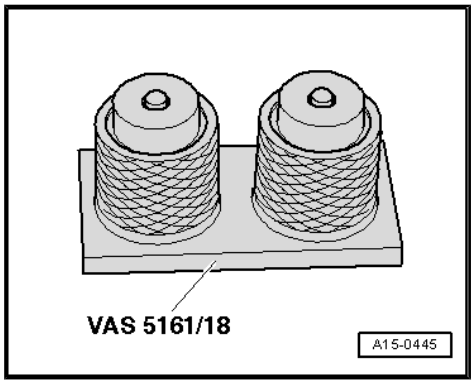
– Slide valve stem oil seal onto plastic sleeve.

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

– Remove plastic sleeve -A-.

– Install valve spring and valve spring plate in cylinder head.

– If valve cotters have been removed from assembly cartridge - VAS 5161/8- , they need to be put into valve insertion device - VAS 5161/18- first.

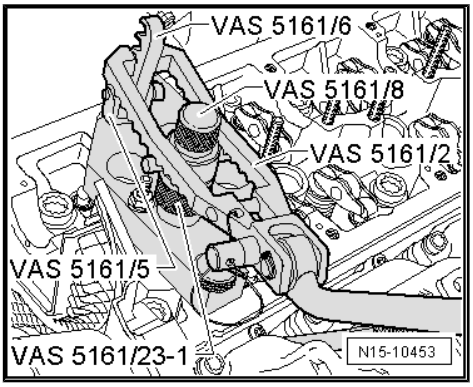


Note

Larger diameter of valve cotters faces upwards.

– Press assembly cartridge - VAS 5161/8- onto insertion device from above and pick up valve cotters.

– Insert assembly cartridge - VAS 5161/8- in guide plate again.
– Press down assembly cartridge - VAS 5161/8- using pressure fork - VAS 5161/2- . Turn knurled screw of assembly cartridge back and forth while pulling upwards.
– Release pressure fork - VAS 5161/2- with knurled screw still in pulled position.



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

– Install glow plugs ⇒ page 292 .
– Install camshafts ⇒ page 104 .

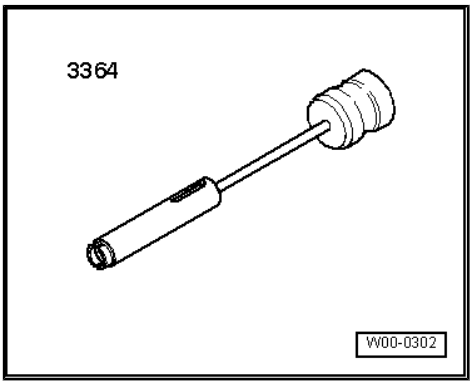
Note

- *Engine is not to be rotated for approx. 30 minutes after installing camshafts. The hydraulic compensation elements must settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

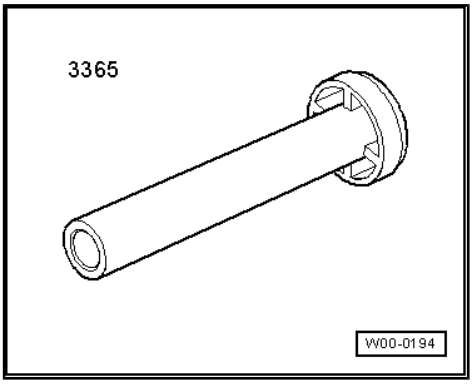
3.4.2 Removing and installing valve stem oil seals with cylinder head removed

Special tools and workshop equipment required

- Valve stem seal puller - 3364-

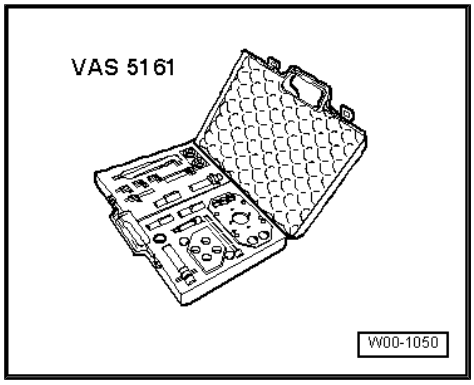


- Valve stem oil seal fitting tool - 3365-

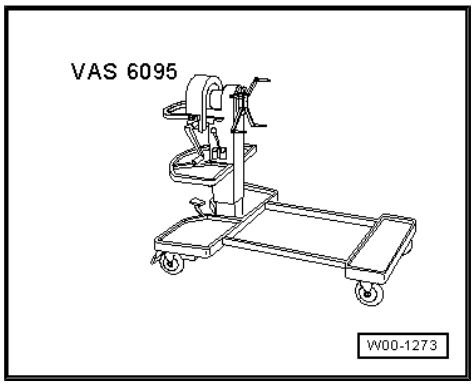


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- Removal and installation device for valve cotters - VAS 5161/A- with knurled spacer ring -VAS 5161/23-1- and guide plate -VAS 5161/23-



- Engine and gearbox support - VAS 6095-



- Cylinder head tensioning device - VAS 6419-

Procedure

Proceed as follows:

– Remove camshafts ⇒ page 104 .

– Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.

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

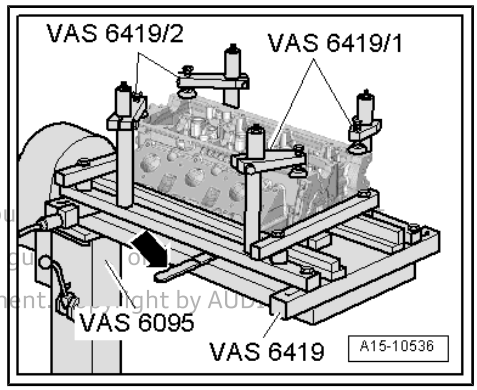
– Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095- .

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

– Connect cylinder head tensioning device to compressed air supply.

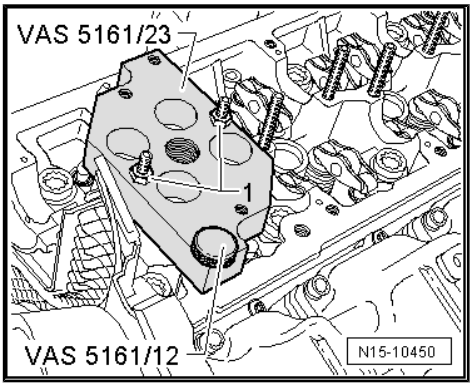
– Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.

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

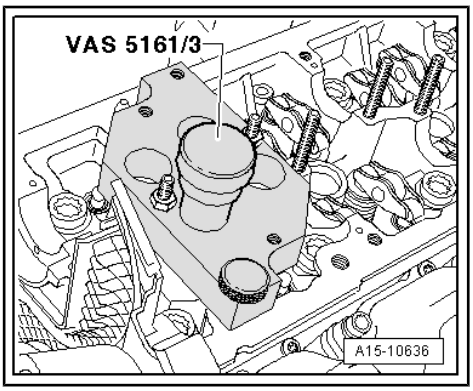


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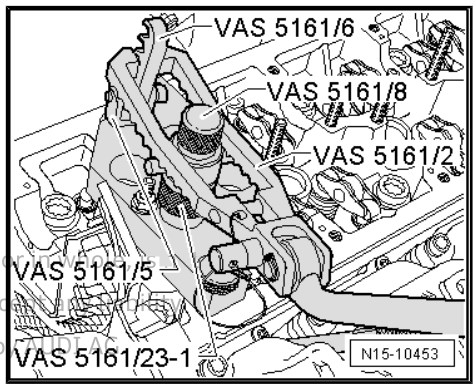
– Fit guide plate -VAS 5161/23- onto cylinder head.
– Secure guide plate on intake manifold side with knurled screw -VAS 5161/12- and at studs by screwing on 2 nuts M6 without shoulder by hand until they make contact.



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

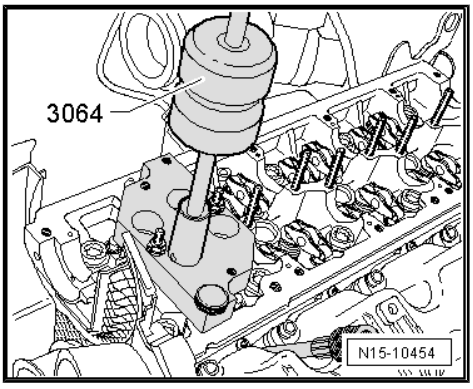


– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Slide knurled spacer ring -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8- .
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled screw of assembly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



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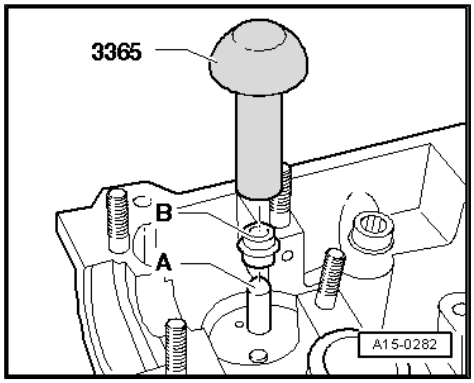
– Release pressure fork.
– Take off assembly cartridge with knurled spacer ring.
– Detach valve spring with valve spring plate.
– Pull off valve stem oil seal with valve stem seal puller - 3364- .



Caution

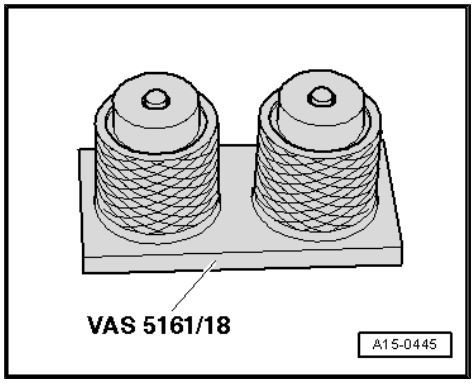
Make sure valve stem oil seals are not damaged when installing.

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



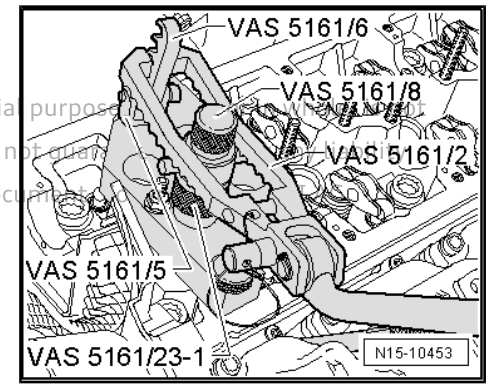
– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
– Take off plastic sleeve.

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 take up valve cotters.

– Insert assembly cartridge in guide plate -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.



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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 104 .

4 Inlet and exhaust valves

⇒ “4.1 Machining valve seats”, page 119
⇒ “4.2 Checking valve guides”, page 119
⇒ “4.3 Valve dimensions”, page 119

4.1 Machining valve seats

Note

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

4.2 Checking valve guides

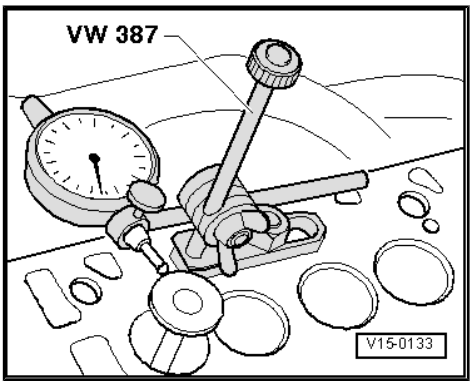
Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-
- Dial gauge

– Insert new valve into guide. End of valve stem must be flush with guide. Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.

– Determine wear limit (sideways play): max. 1.3 mm.

– Renew cylinder head if the determined sideways play is above wear limit.

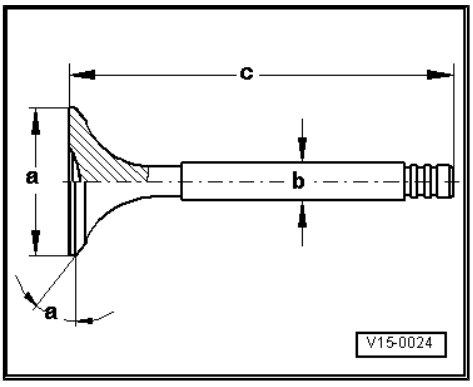


4.3 Valve dimensions

Note

Valves must not be machined. Only grinding-in is permitted.

Dimension		Inlet valve	Exhaust valve
∅ a	mm	28.10	26.00
∅ b	mm	5.975	5.965
c	mm	99.30	99.10
α	∠°	45	45



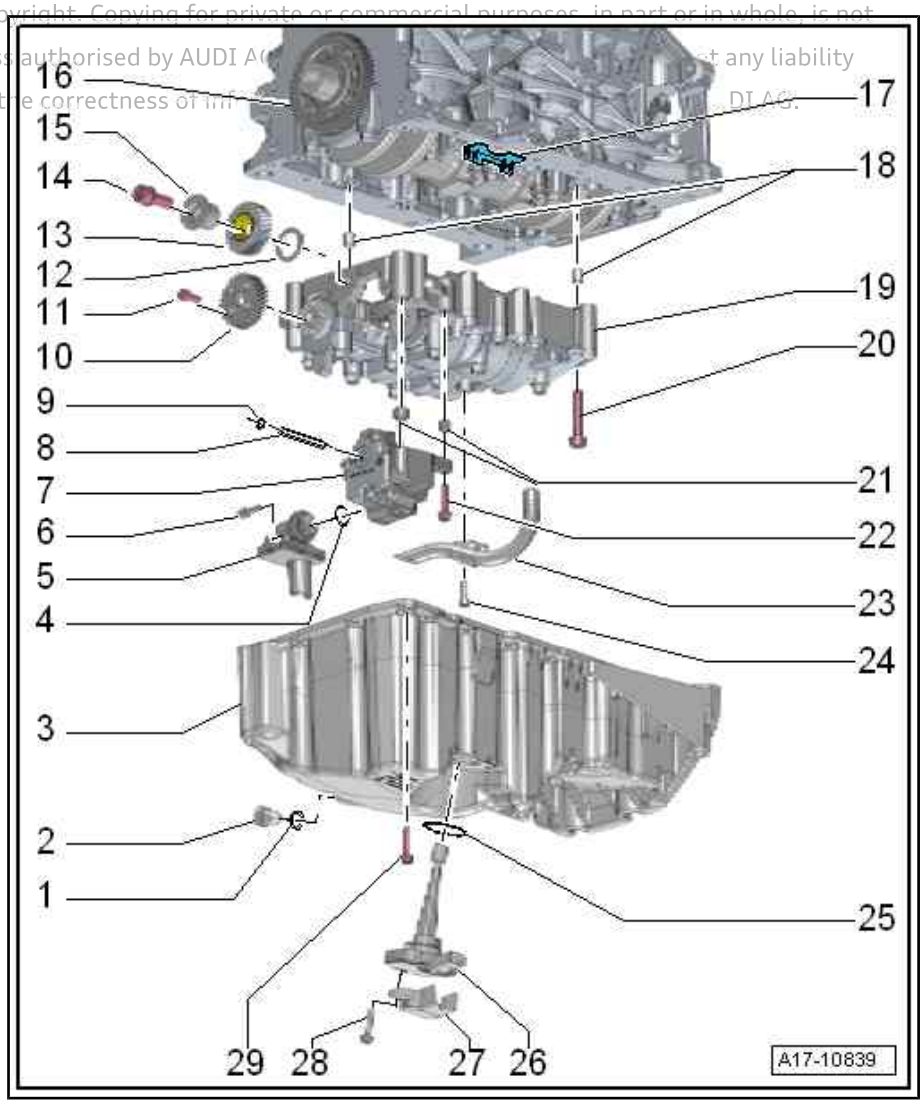
17 – Lubrication

1 Sump/oil pump

⇒ “1.1 Exploded view - sump/oil pump”, page 120
⇒ “1.2 Engine oil”, page 123
⇒ “1.3 Removing and installing sump”, page 123
⇒ “1.4 Removing and installing oil pump”, page 127

1.1 Exploded view - sump/oil pump

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1 - Seal
- ❑ Renew

2 - Oil drain plug
- ❑ 30 Nm

3 - Sump
- ❑ Removing and installing ⇒ page 123

4 - O-ring
- ❑ Renew

5 - Suction pipe
- ❑ Clean strainer if dirty

6 - Bolt
- ❑ 9 Nm

7 - Oil pump
- ❑ Removing and installing ⇒ page 127
- ❑ Before installing, check that the two dowel sleeves for centring oil pump are fitted onto balance shaft assembly

8 - Drive shaft
- ❑ For oil pump

9 - Circlip
- ❑ Must fit securely in groove
- ❑ Renew circlip if damaged or stretched

10 - Spur gear
- ❑ For balance shaft

11 - Bolt
- ❑ Renew
- ❑ 20 Nm + 90°

12 - Thrust washer
- ❑ For idler gear
- ❑ Renew
- ❑ Installation position ⇒ page 123
- ❑ When installing idler gear, apply grease to hold washer on balance shaft assembly

13 - Idler gear

- ❑ Renew
- ❑ To achieve the correct backlash a suitably thick coating is already applied to the new idler gear; the required clearance is achieved as the coating is worn down
- ❑ Installation position: Part No. must be visible.
- ❑ Make sure thrust washer is properly seated ⇒ page 123

14 - Bolt

- ❑ With washer
- ❑ Renew
- ❑ 90 Nm + 90°

15 - Hub

- ❑ For idler gear
- ❑ Renew

16 - Crankshaft gear

17 - Cover

- ❑ Installation position for cover of oil level and oil temperature sender - G266- ⇒ page 122

18 - Dowel sleeves

19 - Balance shaft assembly

- ❑ Removing ⇒ “4.1 Removing and installing balance shaft assembly”, page 138
- ❑ Re-installing "old" balance shaft assembly
  ⇒ “4.1.3 Re-installing a used balance shaft assembly”, page 141
- ❑ Installing new balance shaft assembly ⇒ “4.1.2 Installing a new balance shaft assembly”, page 139
- ❑ Before installing, check that the two dowel sleeves for centring balance shaft assembly are fitted on cylinder block

20 - Bolt

- ❑ Renew
- ❑ Tightening torque and sequence for balance shaft assembly with eight attachment points ⇒ page 122
- ❑ Tightening torque and sequence for balance shaft assembly with six attachment points ⇒ page 123

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21 - Dowel sleeves

22 - Bolt

- ❑ 9 Nm

23 - Oil intake pipe

24 - Bolt

- ❑ 9 Nm

25 - Seal

- ❑ Renew

26 - Oil level and oil temperature sender - G266-

- ❑ Removing and installing ⇒ page 123

27 - Cover

- ❑ For oil level and oil temperature sender - G266-

28 - Bolt

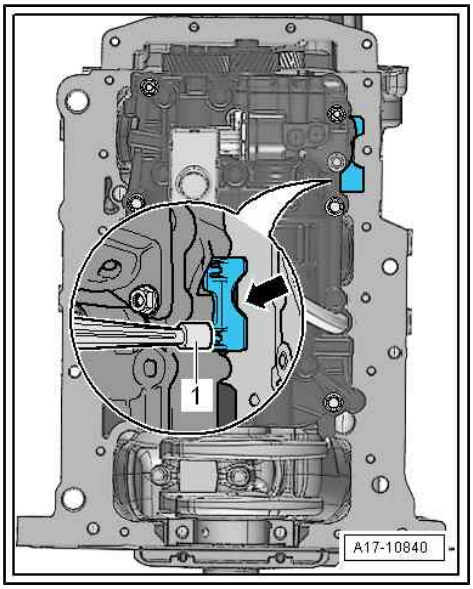
- ❑ Self-locking
- ❑ Renew
- ❑ 9 Nm

29 - Bolt

- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 122

Installation position for cover of oil level and oil temperature sender - G266-

– Clip in cover for oil level and oil temperature sender - G266- -arrow-, as shown in illustration.



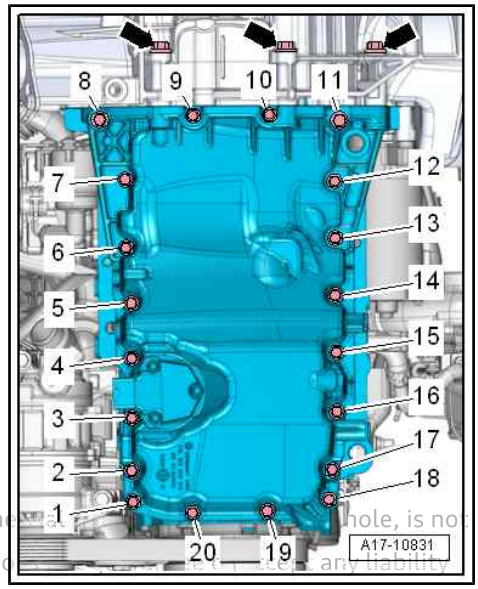
Note

For greater clarity, item -1- shows oil level and oil temperature sender .

Sump - tightening torque and sequence

– Tighten bolts in stages:

Stage	Bolts	Tightening torque
1.	-1 to 20-	5 Nm in diagonal sequence
2.	-Arrows-	15 Nm + turn 90° further (renew bolts)
3.	-1 to 7-, -9 and 10-, -12 to 20-	Tighten in stages and in diagonal sequence; final torque 13 Nm
4.	-8 and 11-	23 Nm

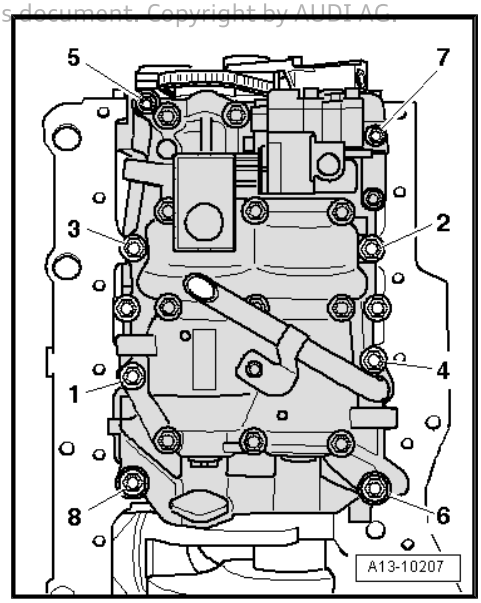


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Tightening sequence - balance shaft assembly with eight attachment points

– Tighten bolts securing balance shaft assembly as follows:

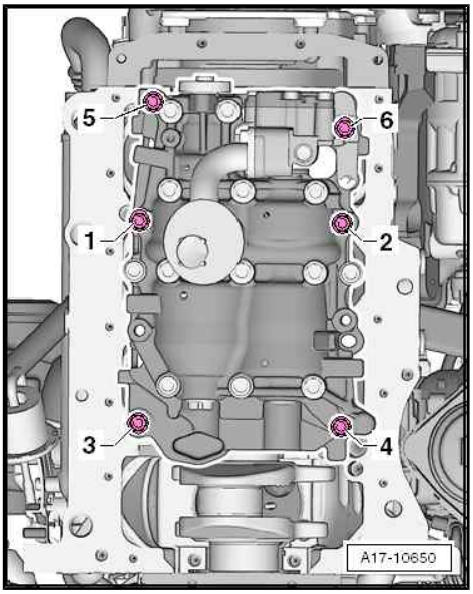
Stage	Bolts	Tightening torque/angle specification
1.	-1 to 8-	Screw in hand-tight in this sequence
2.	-1 to 8-	Pre-tighten in this sequence to 6 Nm
3.	-1 to 4-	Tighten to 20 Nm
4.	-5-	Tighten to 13 Nm
5.	-6-	Tighten to 20 Nm
6.	-7-	Tighten to 13 Nm
7.	-8-	Tighten to 20 Nm
8.	-1 to 8-	Use rigid wrench to turn 90° further in this sequence



Tightening sequence - balance shaft assembly with six attachment points

– Tighten bolts securing balance shaft assembly as follows:

Stage	Bolts	Tightening torque/angle specification
1.	-1 to 6-	Screw in hand-tight in this sequence
2.	-1 to 6-	Pre-tighten bolts in this sequence to 6 Nm
3.	-1 to 4-	Tighten to 20 Nm
4.	-5 and 6-	Tighten to 13 Nm
5.	-1 to 6-	Use rigid wrench to turn 90° further in this sequence



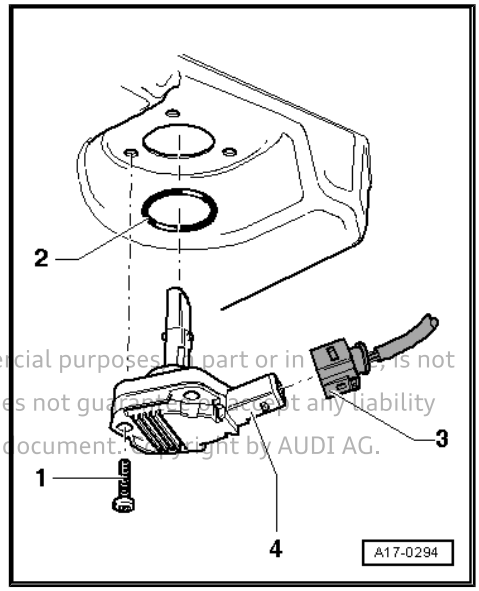
Removing and installing oil level and oil temperature sender - G266-

1 - Bolt, 9 Nm

2 - Seal; renew

3 - Electrical connector

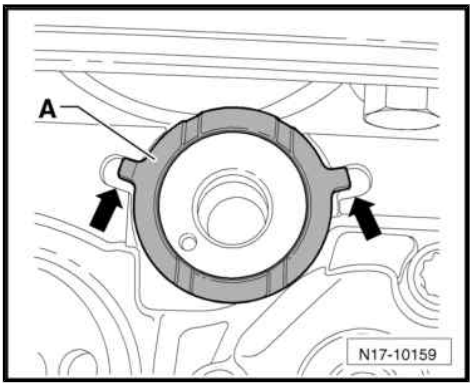
4 - Oil level and oil temperature sender - G266-



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Installation position of thrust washer

> **Caution**
>
> *Make sure that the thrust washer -A- does not slip out of the recesses in the balance shaft assembly -arrows- when fitting the idler gear. If this is neglected, the thrust washer can become stuck. If necessary, apply grease to the thrust washer and attach it to the balance shaft assembly.*



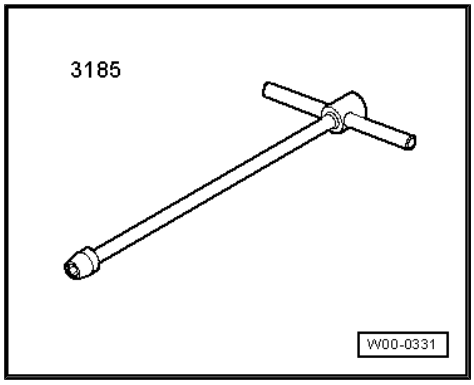
1.2 Engine oil

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

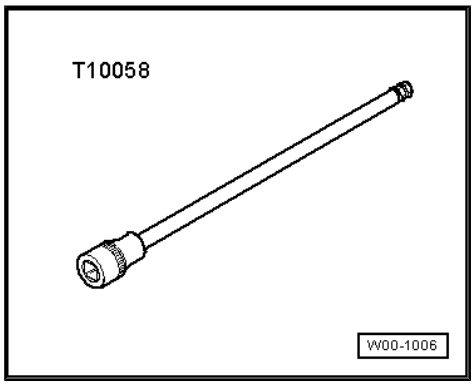
1.3 Removing and installing sump

Special tools and workshop equipment required

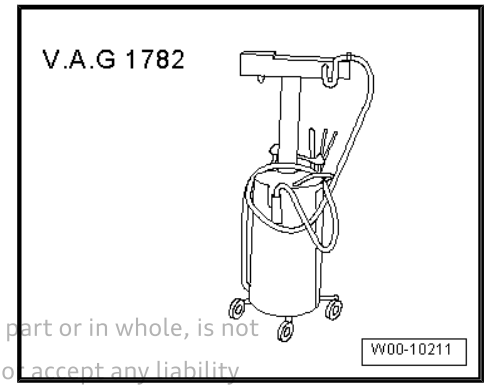
- Articulated wrench, 10 mm - 3185-



- Socket - T10058-

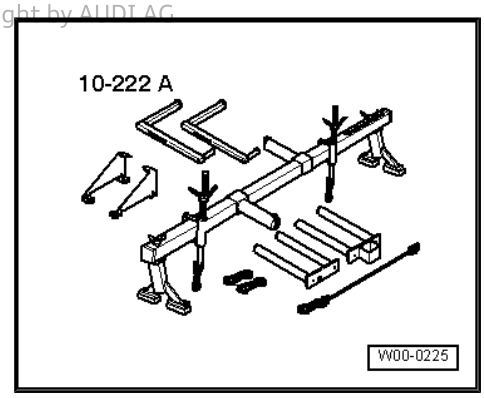


- Used oil collection and extraction unit - V.A.G 1782-



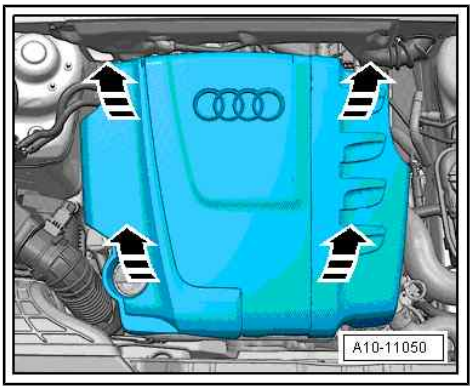
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- Support bracket - 10 - 222 A-



Removing

– Remove engine cover panel -arrows-.



– Set up support bracket - 10 - 222 A- with adapters -10 - 222 A /3- on suspension turrets (left and right) as illustrated.

– Attach spindles -10 - 222 A /11- to engine lifting eyes.

– Partly take up weight of engine with spindles.

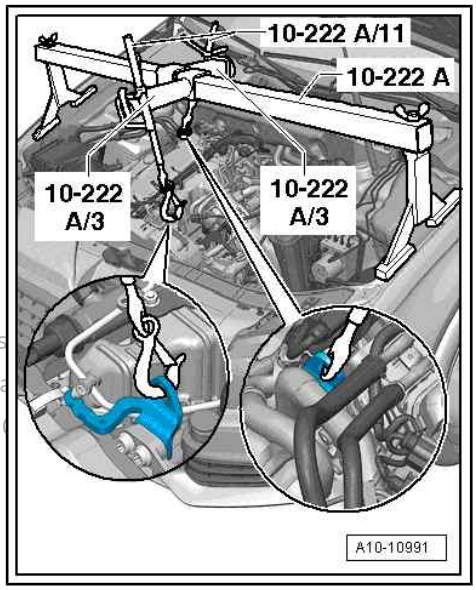
– Remove front wheels.

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

– Remove subframe cross brace ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe cross brace.

– Remove subframe ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe .

– Place used oil collection and extraction unit - V.A.G 1782- below engine and drain off engine oil.

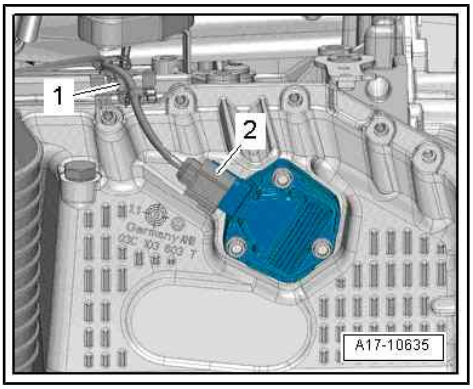


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Note

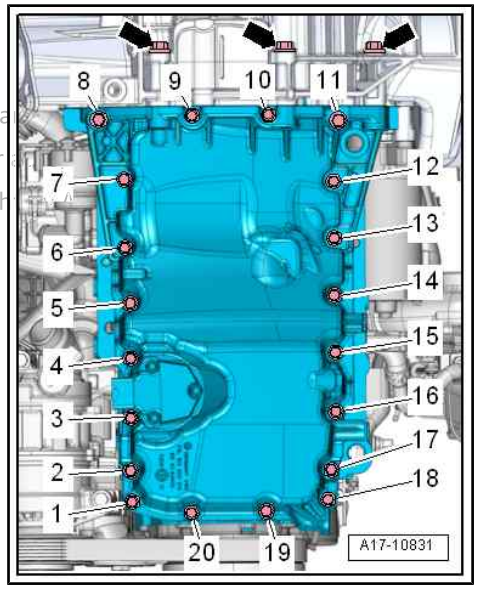
Please observe requirements for disposal.

– Unplug electrical connector -2- from oil level and oil temperature sender - G266- .



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– Remove bolts -arrows-.
– Unscrew bolts -1 to 20- in diagonal sequence and remove.
– Carefully release sump from bonded joint.



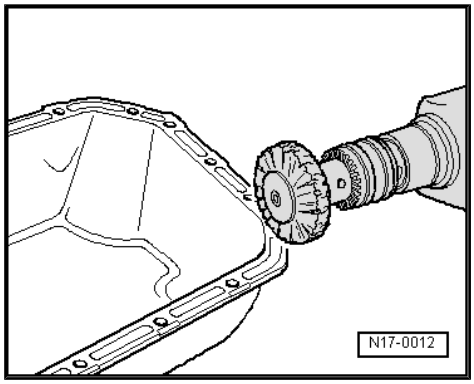
Installing

Installation is carried out in reverse sequence. When doing so, note the following:

– Remove sealant remaining on crankcase with flat scraper.

> **WARNING**
>
> ***Put on safety goggles.***

– Remove sealant residue on the sump with a rotating brush, e.g. an electric drill with a plastic brush attachment.
– Clean sealing surfaces; they must be free of oil and grease.

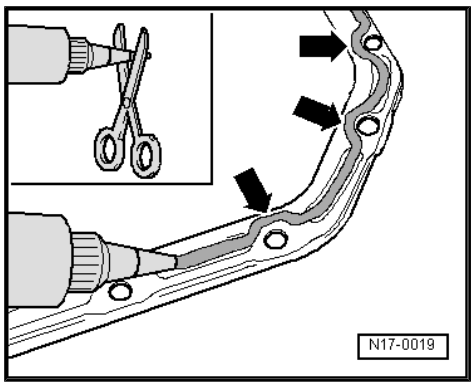


Note

- *Note the use-by date of the sealant.*
- *The sump must be installed within 5 minutes after applying the silicone sealant.*

– Cut off nozzle of tube at front marking (∅ of nozzle approx. 3 mm).
– Apply silicone sealant onto clean sealing surface of sump as illustrated. Sealant bead must:

- be 2...3 mm thick.
- Pass round bolt holes on inside as shown in illustration -arrows-.

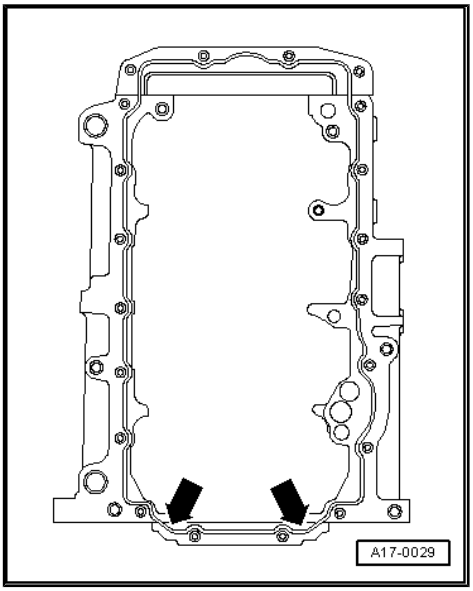


Note

The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump and block the strainer in the oil intake pipe.

– Apply bead of silicone sealant onto clean sealing surface of sump, as illustrated. (The illustration shows the position of the sealant bead on the crankcase.)

– Immediately fit sump and lightly tighten bolts securing sump to gearbox and all bolts securing sump. The sump must make flush contact with spacer plate/gearbox flange.



Note

When installing sump with engine removed from vehicle, ensure that sump is positioned flush with crankcase at flywheel end.

– Tighten sump bolts in diagonal sequence.

– Tighten sump/gearbox bolts.

Tightening torques
⇒ “1.1 Exploded view - sump/oil pump”, page 120

Note

After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.

– Fill with engine oil and check oil level (Audi A4) ⇒ Maintenance ; Booklet 812 .

– Fill with engine oil and check oil level (Audi A5) ⇒ Maintenance ; Booklet 811 .

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

– Install subframe cross brace ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe cross brace .

– Install steering rack ⇒ Running gear, axles, steering; Rep. gr. 48 ; Steering rack; Removing and installing steering rack .

– Install subframe ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe .

Further assembly is basically carried out in reverse order of dismantling.

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1.4 Removing and installing oil pump

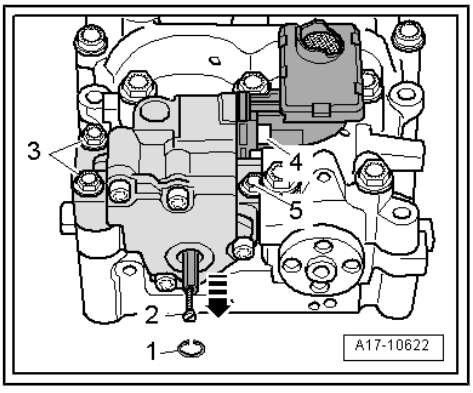
Removing

– Remove sump ⇒ page 123 .

– Remove bolt -4- and detach intake connecting pipe from oil pump.

– Remove circlip -1- using circlip pliers.

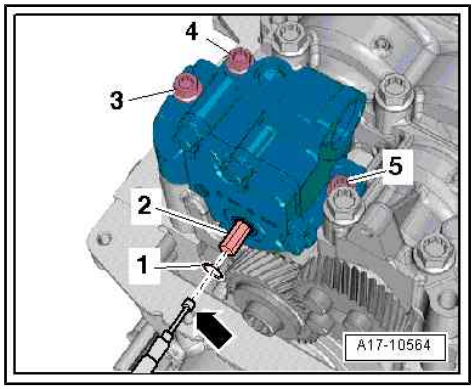
– If there is a thread in the drive shaft, screw an M3 bolt -2- into drive shaft and pull drive shaft out of oil pump -arrow-.



Note

- *If there is no thread in the drive shaft, use a magnet -arrow- and pull the drive shaft out of the oil pump.*
- *Pull drive shaft -2- out of oil pump using a magnet -arrow-.*

– Remove bolts -3, 4, 5- and detach oil pump.



Caution

The bolt on the idler gear must NOT be loosened.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

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Tightening torques
⇒ “1.1 Exploded view - sump/oil pump”, page 120

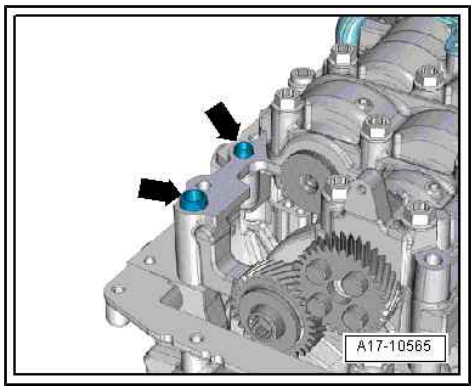
Note

- *Renew O-ring.*
- *Renew circlip if damaged or stretched.*
- *Circlip must fit securely in groove.*

– Insert dowel sleeves -arrows- in oil pump, if not fitted.

– If no dowel sleeves for centring the oil pump are fitted in the balance shaft assembly, install missing dowel sleeves.

– Install sump ⇒ page 123 .



2 Engine oil cooler

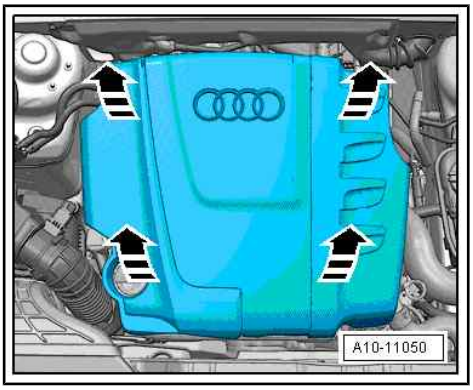
⇒ “2.1 Removing and installing engine oil cooler”, page 129

2.1 Removing and installing engine oil cooler

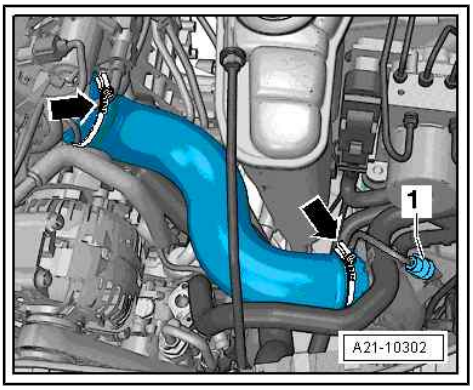
Removing

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

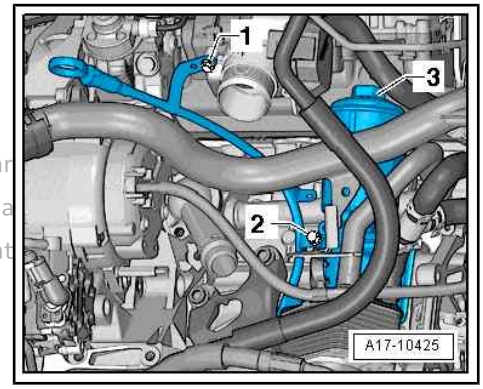
– Remove engine cover panel -arrows-.



– Release hose clips -arrows- and detach air hose.

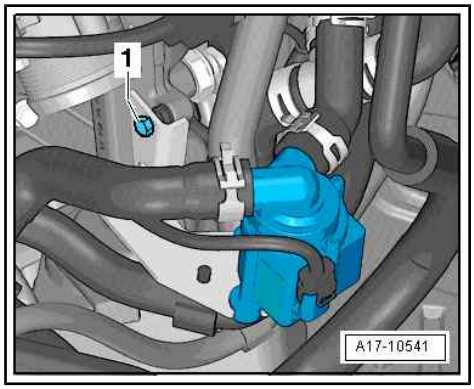


– Unscrew sealing cap -3- and take out oil filter element.



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– Remove bolt -1- and swivel pump for exhaust gas recirculation cooler - V400- to the side.



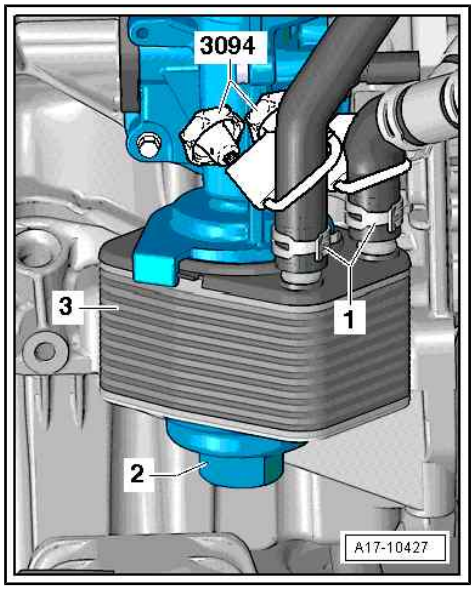
WARNING

Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the engine is hot.

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

– Clamp off coolant hoses with hose clamps up to 25 mm - 3094- as shown in illustration.



– Disconnect coolant hoses -1-.

– Unscrew sealing cap -2- and take out engine oil cooler -3-.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “3.1 Exploded view - oil filter housing/oil pressure switch”, page 131

– Fill up with coolant ⇒ page 149 .

Checking oil level (Audi A4) ⇒ Maintenance ; Booklet 812

Checking oil level (Audi A5) ⇒ Maintenance ; Booklet 811

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3 Oil filter housing/oil pressure switches and oil supply line

⇒ “3.1 Exploded view - oil filter housing/oil pressure switch”, page 131

⇒ “3.2 Checking oil pressure and oil pressure switch”, page 133

⇒ “3.3 Removing and installing oil supply line”, page 134

⇒ “3.4 Removing and installing oil filter housing”, page 136

⇒ “3.5 Checking oil level”, page 137

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3.1 Exploded view - oil filter housing/oil pressure switch

1 - Gasket
- ❑ Renew

2 - Bolt
- ❑ 15 Nm + 90°
- ❑ Renew
- ❑ First fit bolts on top left and bottom right, then tighten all four bolts in diagonal sequence

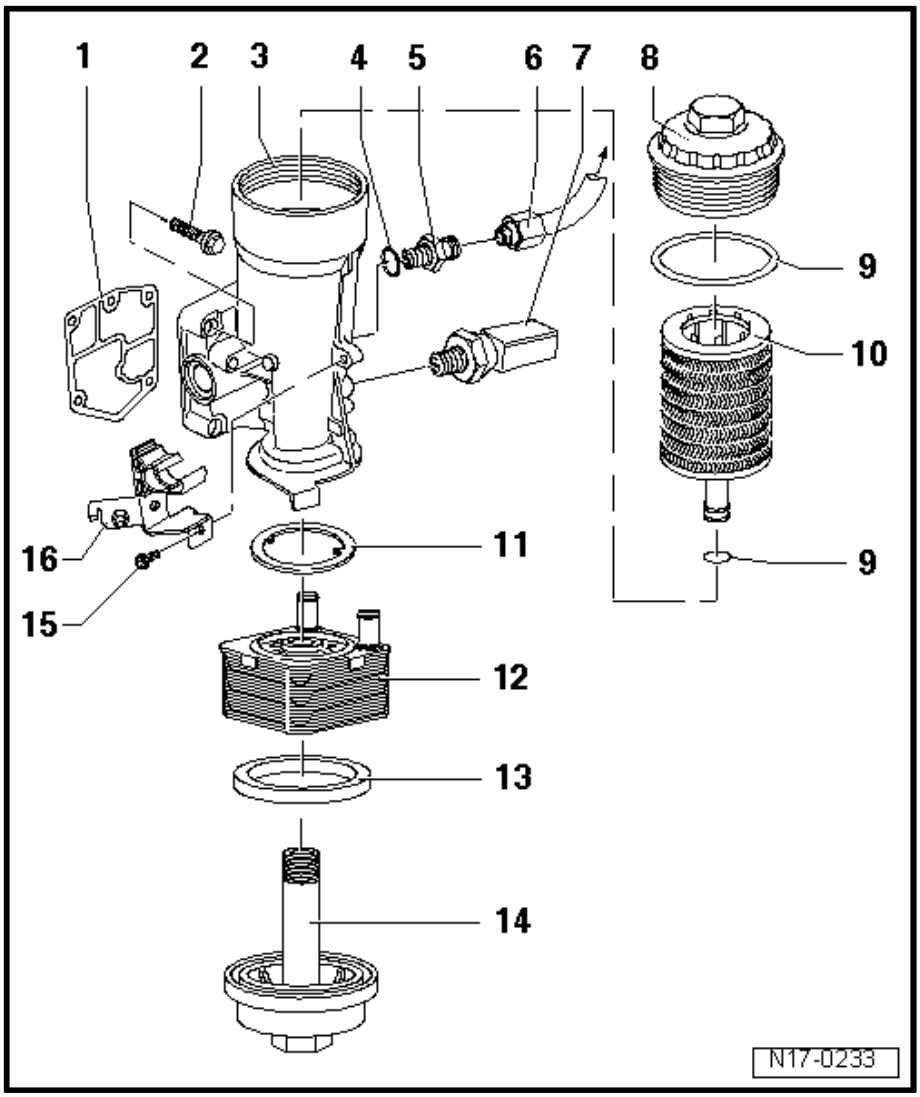
3 - Oil filter housing
- ❑ Ensure clearance from surrounding components

4 - Seal
- ❑ Renew

5 - Connection
- ❑ 30 Nm

6 - Oil supply line
- ❑ 22 Nm
- ❑ To turbocharger
- ❑ ⇒ “3.3 Removing and installing oil supply line”, page 134

7 - Oil pressure switch - F1-
- ❑ 22 Nm
- ❑ Identification: brown
- ❑ 0.7 bar
- ❑ In case of leakage, cut open seal and renew
- ❑ If seal is not available



separately, refer to ⇒
Electronic parts catalogue ; renew oil pressure switch after removal

- ❑ Checking ⇒ page 133

8 - Sealing cap

- ❑ 25 Nm

9 - O-ring

- ❑ Renew

10 - Oil filter element

- ❑ See note
- ❑ Observe change intervals

11 - Seal

- ❑ Renew
- ❑ Lubricate before installing
- ❑ Engage in lugs on engine oil cooler

12 - Engine oil cooler

- ❑ Ensure clearance from surrounding components

13 - Seal

- ❑ Renew
- ❑ Installation position ⇒ page 132

14 - Plug

- ❑ 25 Nm

15 - Bolt

- ❑ 10 Nm

16 - Bracket

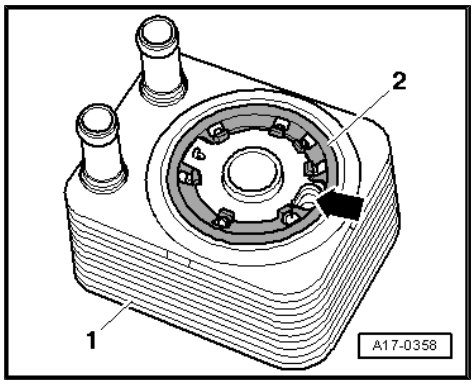
- ❑ For wiring harness

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Installation position of seal for engine oil cooler

– Fit seal -2- so it can be attached to all tabs on engine oil cooler -1-.

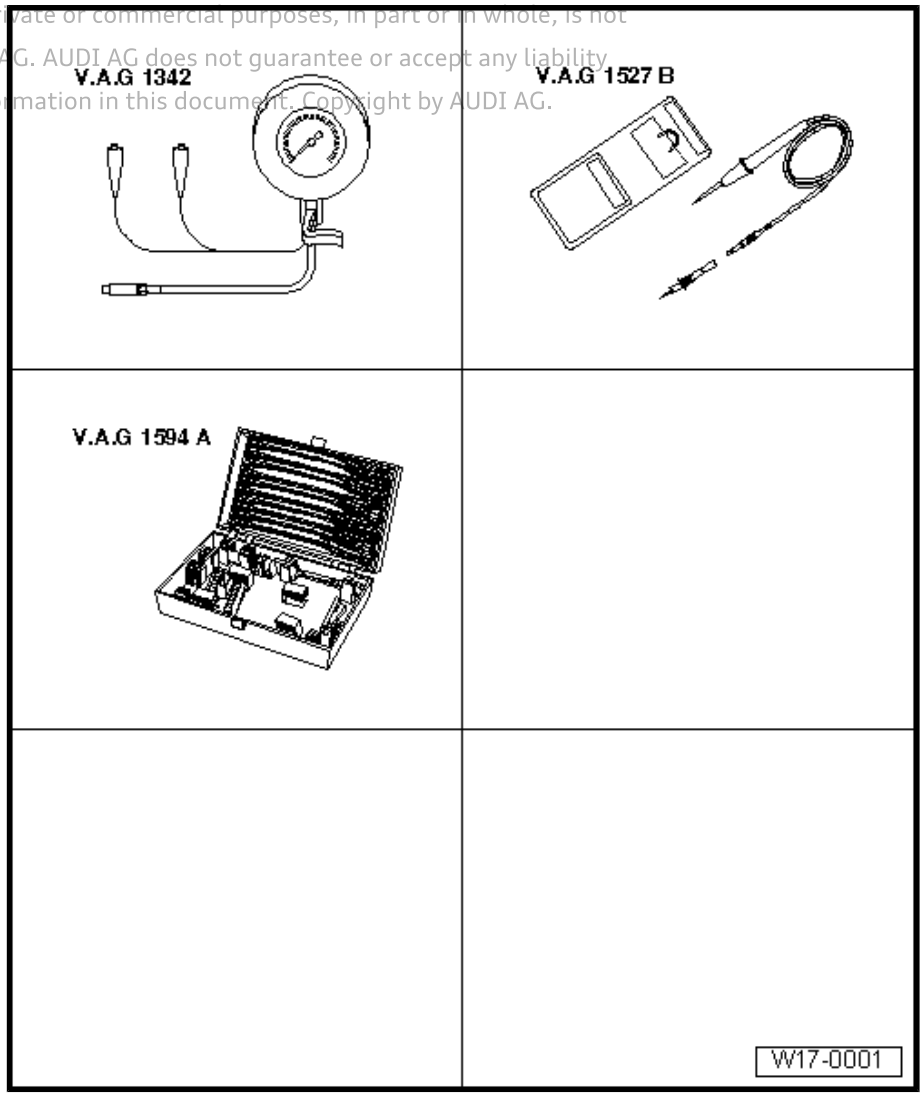
• The oil drilling -arrow- must not be covered by the seal.



3.2 Checking oil pressure and oil pressure switch

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Special tools and workshop equipment required



- Oil pressure tester - V.A.G 1342-
- Voltage tester - V.A.G 1527/B-
- Auxiliary measuring set - V.A.G 1594C-

Checking oil pressure switch

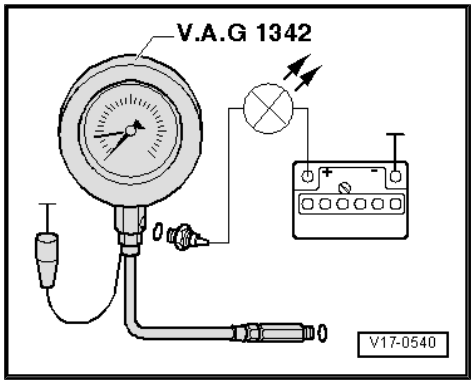
Test conditions

- Oil level OK
- Operating temperature

Note

Functional check and servicing the visual and acoustic oil pressure warning ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Remove oil pressure switch - F1- -brown insulation- from oil filter bracket and screw it onto tester.
– Screw tester into oil filter bracket in place of oil pressure switch.
– Connect brown wire of tester to earth (–).
– Connect voltage tester - V.A.G 1527B- to positive battery terminal (+) and oil pressure switch using adapter leads from auxiliary measuring set - V.A.G 1594C- . LED must not light up.
– Start engine and increase engine speed slowly. The LED should light up at 0.55...0.85 bar. If it does not, renew oil pressure switch.



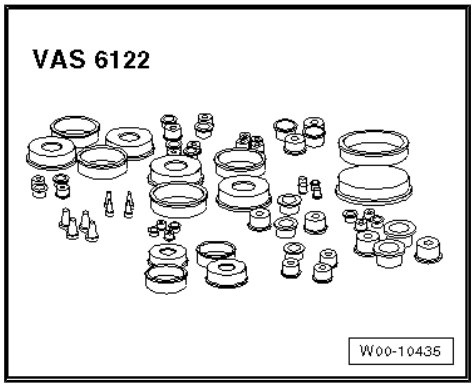
Checking oil pressure

- Oil pressure at idling speed: at least 0.8 bar
- Oil pressure at 2000 rpm: at least 2.0 bar

3.3 Removing and installing oil supply line

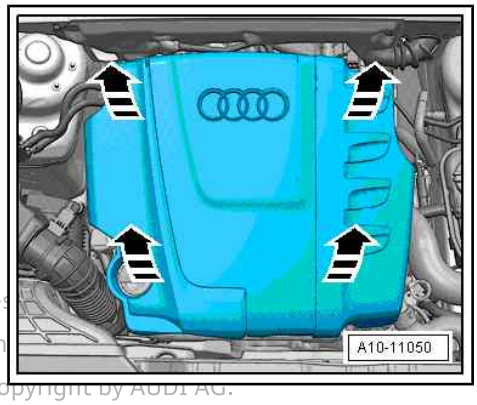
Special tools and workshop equipment required

♦ Engine bung set - VAS 6122-



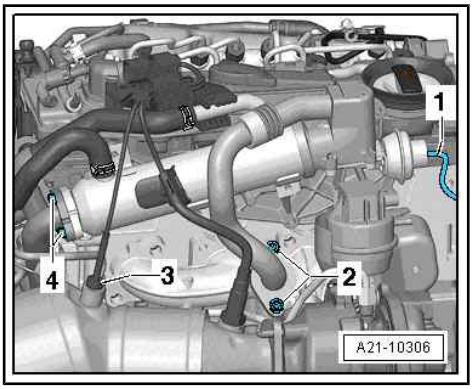
Removing

– Remove engine cover panel -arrows-.
– Remove air cleaner housing
⇒ “3.3 Removing and installing air cleaner housing”, page 212 .



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– Disconnect vacuum hose -1-.
– Remove bolts -2- and -4-.

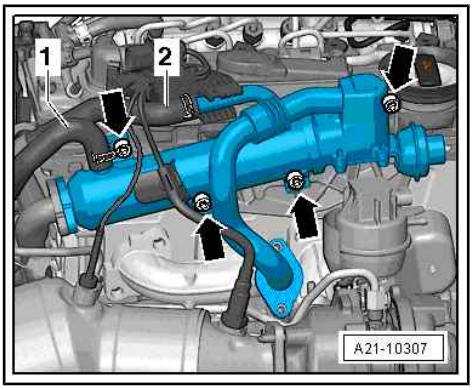


– Remove bolts -arrows- from exhaust gas recirculation cooler and place cooler to one side.

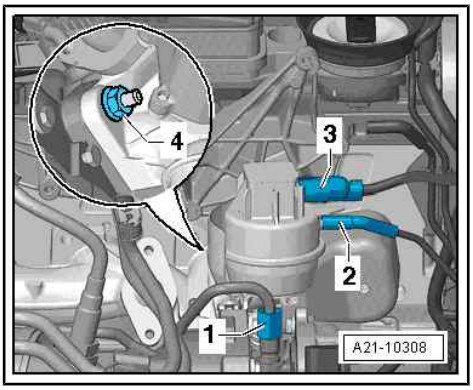
Note

Coolant hoses -1- and -2- must not be detached.

– Unfasten oil supply line from fluid connection and cylinder head (rear).



– Remove union nut -1- from turbocharger.



– Remove oil supply line -2- from oil filter flange and lift oil supply line out.

Installing

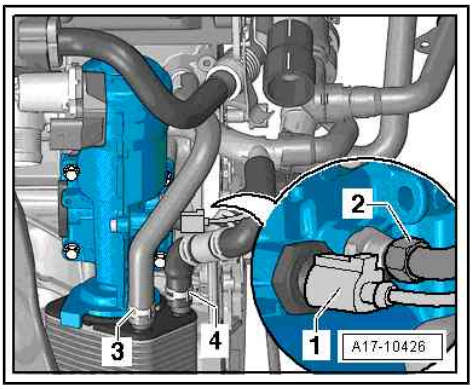
Installation is carried out in reverse sequence.

Checking oil level (Audi A4) ⇒ Maintenance ; Booklet 812

Checking oil level (Audi A5) ⇒ Maintenance ; Booklet 811

Tightening torques

♦ ⇒ “3.1 Exploded view - oil filter housing/oil pressure switch”, page 131

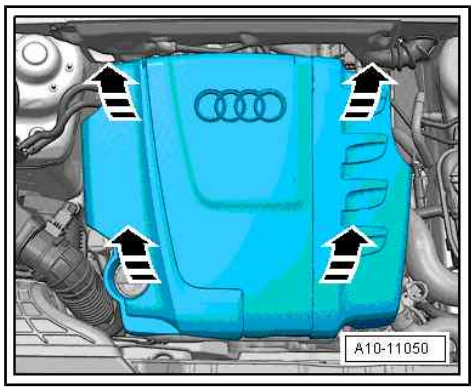


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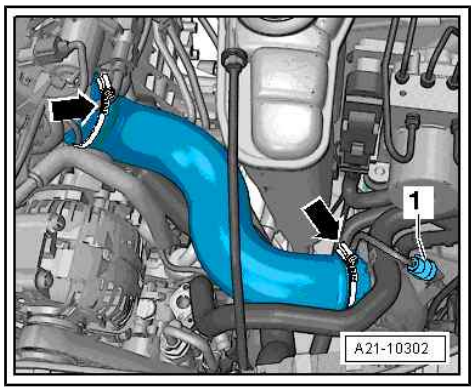
3.4 Removing and installing oil filter housing

Removing

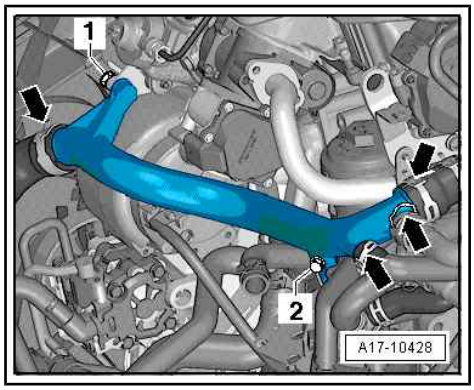
– Remove engine cover panel -arrows-.



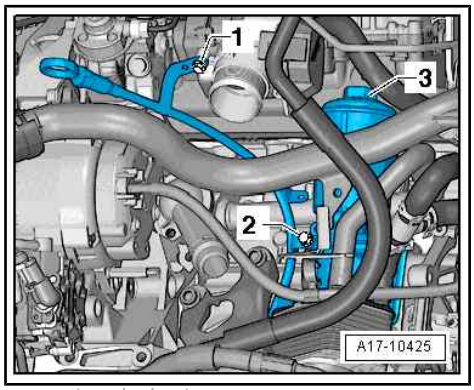
– Release hose clips -arrows- and detach air hose.
– Drain coolant ⇒ page 149 .



– Detach coolant hoses -arrows-.
– Remove bolts -1- and -2- and take out coolant pipe.

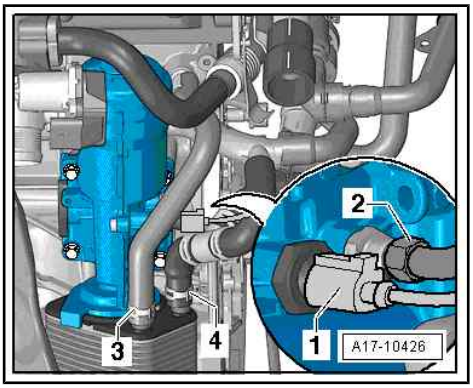


– Remove bolts -1- and -2-.
– Unscrew sealing cap -3- and take out oil filter element.

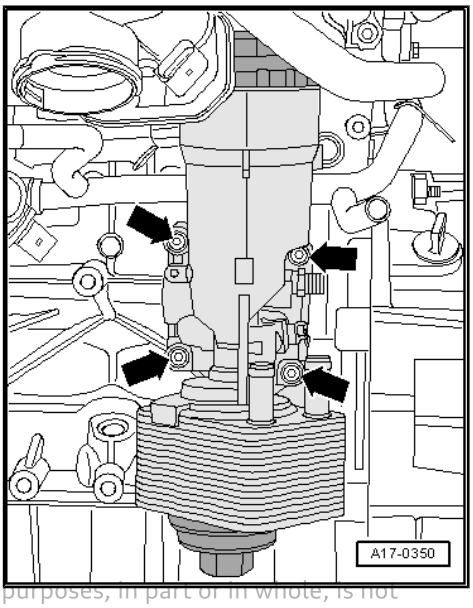


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– Unplug electrical connector -1-.
– Disconnect oil supply line -2-.
– Detach coolant hoses -3- and -4-.



– Unscrew bolts -arrows- and remove oil filter housing.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “3.1 Exploded view - oil filter housing/oil pressure switch”, page 131

– Fill up with coolant ⇒ page 149 .

Checking oil level (Audi A4) ⇒ Maintenance ; Booklet 812

Checking oil level (Audi A5) ⇒ Maintenance ; Booklet 811

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3.5 Checking oil level

Checking oil level (Audi A4) ⇒ Maintenance ; Booklet 812

Checking oil level (Audi A5) ⇒ Maintenance ; Booklet 811

4 Balance shaft assembly

⇒ “4.1 Removing and installing balance shaft assembly”, page 138

4.1 Removing and installing balance shaft assembly

⇒ “4.1.1 Removing balance shaft assembly”, page 138

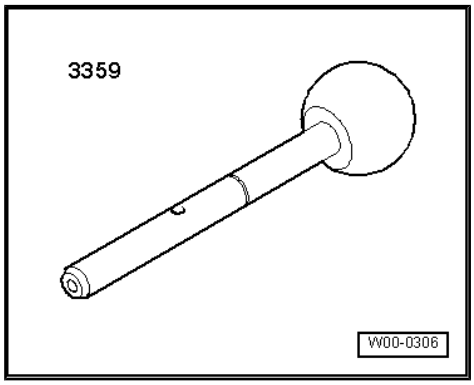
⇒ “4.1.2 Installing a new balance shaft assembly”, page 139

⇒ “4.1.3 Re-installing a used balance shaft assembly”, page 141

4.1.1 Removing balance shaft assembly

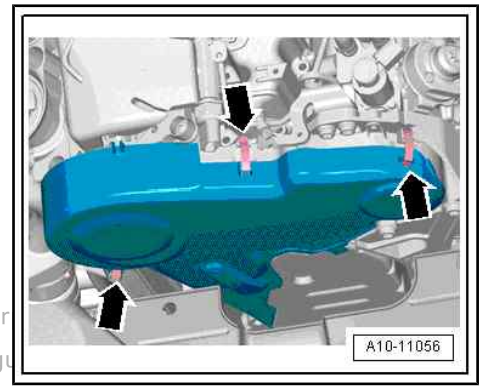
Special tools and workshop equipment required

- Locking pin - 3359-



Procedure

– Open clips -arrows- and remove toothed belt cover.



Note

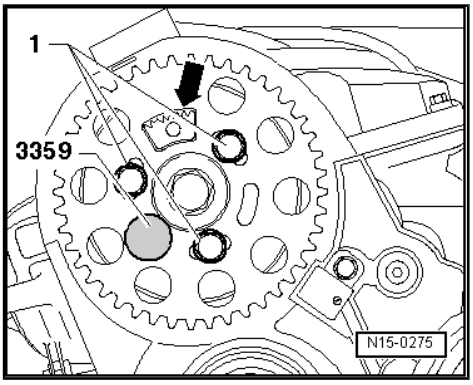
-Item 1- can be disregarded.

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Caution

Irreparable damage can be caused if the toothed belt slips.

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



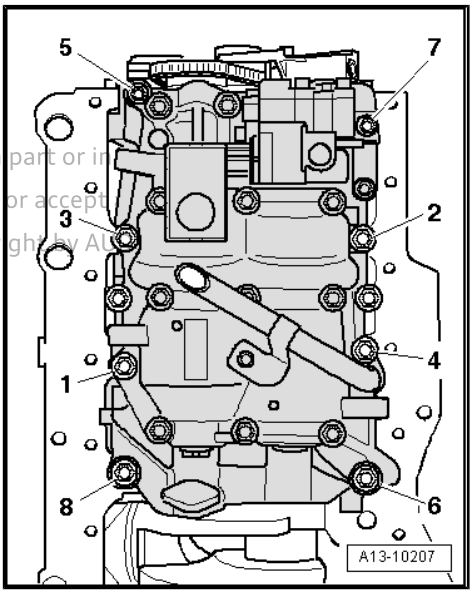
– Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at “TDC”.
– Lock camshaft hub with diesel injection pump locking pin - 3359- .
• The toothed segment -arrow- must face upwards.
– Remove sump ⇒ page 123 .

Balance shaft assembly with eight attachment points

– Unscrew bolts in the sequence -8 ... 1- and remove balance shaft assembly with oil pump.

Balance shaft assembly with six attachment points

– Unscrew bolts in the sequence -6 ... 1- and remove balance shaft assembly with oil pump.



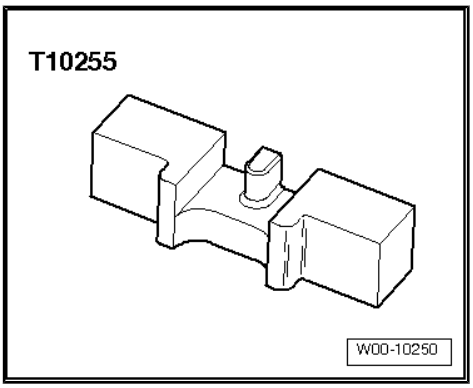
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⇒ “4.1.2 Installing a new balance shaft assembly”, page 139
⇒ “4.1.3 Re-installing a used balance shaft assembly”, page 141

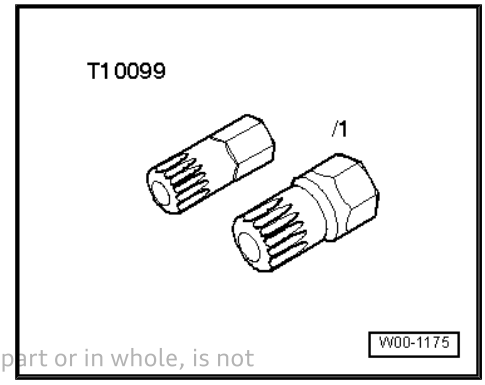
4.1.2 Installing a new balance shaft assembly

Special tools and workshop equipment required

♦ Locking tool - T10255-



- Bits - T10099-



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- Insert tool for torque wrench -T10393- (not illustrated)

Procedure

Tightening torques
⇒ “1.1 Exploded view - sump/oil pump”, page 120

Note

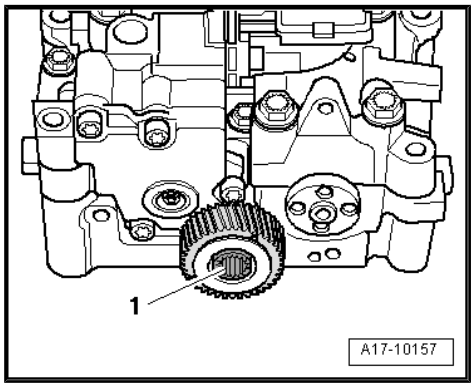
- *The spur gear drive of the balance shaft assembly must be installed with a specified backlash.*
- *To achieve the correct backlash, a coating is already applied to the new idler gear.*
- *The coating is worn down rapidly and the backlash is then correct.*
- *Therefore, a new balance shaft assembly must always be installed in conjunction with a new idler gear which has the correct coating.*
- *Renew bolts tightened with specified tightening angle.*

Caution

Before positioning balance shaft assembly slacken off idler gear bolt. Do not loosen bolt too much, otherwise the thrust washer can slip behind the idler gear. Installation position of thrust washer ⇒ page 123

– Before positioning balance shaft assembly on cylinder block, loosen bolt -1- for idler gear by approx. 45° ($^1/_8$ turn).

– Check that the two dowel sleeves are in place to ensure that balance shaft assembly is located correctly on cylinder block.



Note

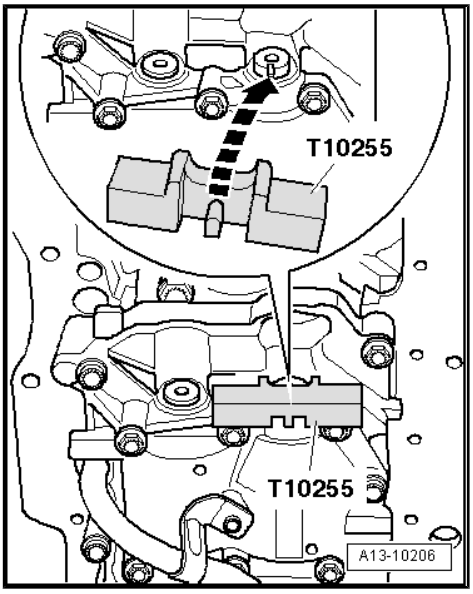
Take care not to damage coating on idler gear.

– Balance shaft assembly with eight attachment points: tighten bolts ⇒ page 122 .

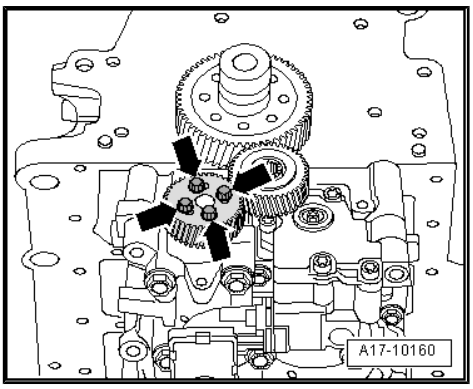
– Balance shaft assembly with six attachment points: tighten bolts ⇒ page 123 .

– Lock balance shaft with locking tool - T10255- ; turn balance shaft to do so, if necessary.

• The lug of the locking tool must engage in the groove of the balance shaft.



– Carefully fit balance shaft gear onto balance shaft; to do so, push idler gear slightly to one side.



Note

♦ *Check that threaded holes of balance shaft align centrally with elongated holes of balance shaft gear.*

♦ *If it is not possible to align the elongated holes in the balance shaft gear with the threaded holes, you must turn the gear some teeth further as required and then fit it again.*

– Secure balance shaft gear -arrows-.

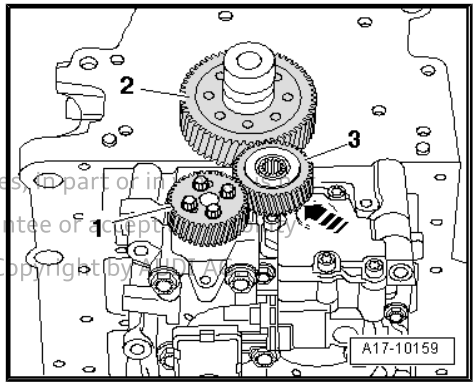
– Detach locking tool - T10255- .

The following three steps have to be performed simultaneously (a second mechanic is therefore required).

– Push idler gear -3- firmly in direction of -arrow- into teeth on drive gear -2- and balance shaft gear -1-. If necessary use a suitable wooden tool.

– Turn balance shaft gear slightly anti-clockwise when doing this.

– Tighten new bolt for idler gear ⇒ Item 14 (page 121) .



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Note

After installation the idler gear must have no backlash. This can be checked by exerting light pressure by hand.

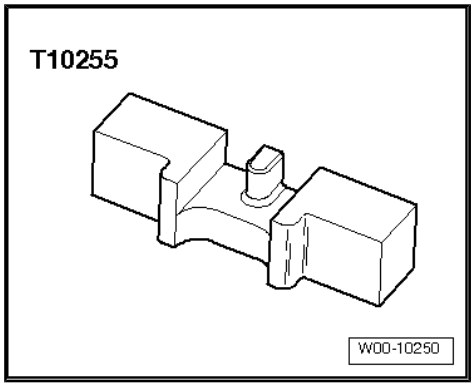
The remaining installation steps are carried out in the reverse sequence. When doing so, note the following:

– Install sump ⇒ page 123 .

4.1.3 Re-installing a used balance shaft assembly

Special tools and workshop equipment required

- Locking tool - T10255-



Caution

If the bolt for the idler gear has been loosened, the drive gear on the crankshaft has been renewed or the crankshaft has been removed, you must install a new idler gear with the appropriate coating and renew the hub ⇒ Item 15 (page 121) with the bolt ⇒ Item 14 (page 121) and thrust washers. Otherwise the backlash will not be correct.

Tightening torques
⇒ "1.1 Exploded view - sump/oil pump", page 120

Note

- *If re-installing the used balance shaft assembly and neither the drive gear on the crankshaft nor the crankshaft itself have been renewed, proceed as described in the following. It is also essential that the idler gear has NOT been slackened.*
- *Renew bolts tightened with specified tightening angle.*

– Lock balance shaft with locking tool - T10255- ; turn balance shaft to do so, if necessary.

• The lug of the locking tool must engage in the groove of the balance shaft.

– Check that the two dowel sleeves are in place to ensure that balance shaft assembly is located correctly on cylinder block.

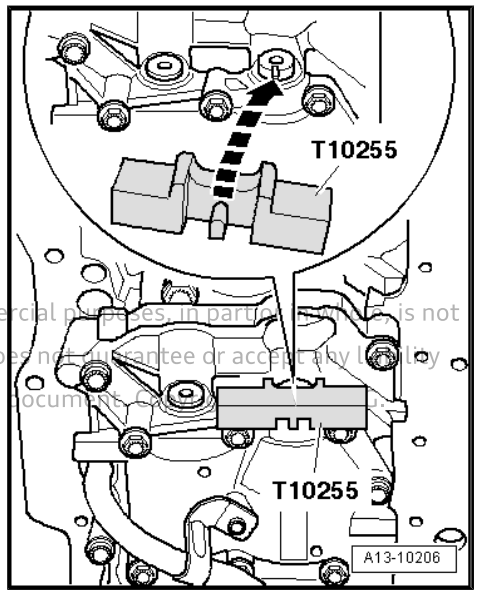
– Attach balance shaft assembly to cylinder block.

• With the balance shaft locked in position, the idler gear must engage in the drive gear on the crankshaft.

• Idler gear must have noticeable backlash.

– Balance shaft assembly with eight attachment points: tighten bolts ⇒ page 122 .

– Balance shaft assembly with six attachment points: tighten bolts ⇒ page 123 .



The remaining installation steps are carried out in the reverse sequence. When doing so, note the following:

– Install sump ⇒ page 123 .

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19 – Cooling

1 Cooling system/coolant

⇒ “1.1 Connection diagram - coolant hoses”, page 143

⇒ “1.2 Checking cooling system for leaks”, page 148

⇒ “1.3 Draining and filling cooling system”, page 149

1.1 Connection diagram - coolant hoses

⇒ “1.1.1 Connection diagram - coolant hoses without 4/2-way valve, vehicles without auxiliary heater”, page 143

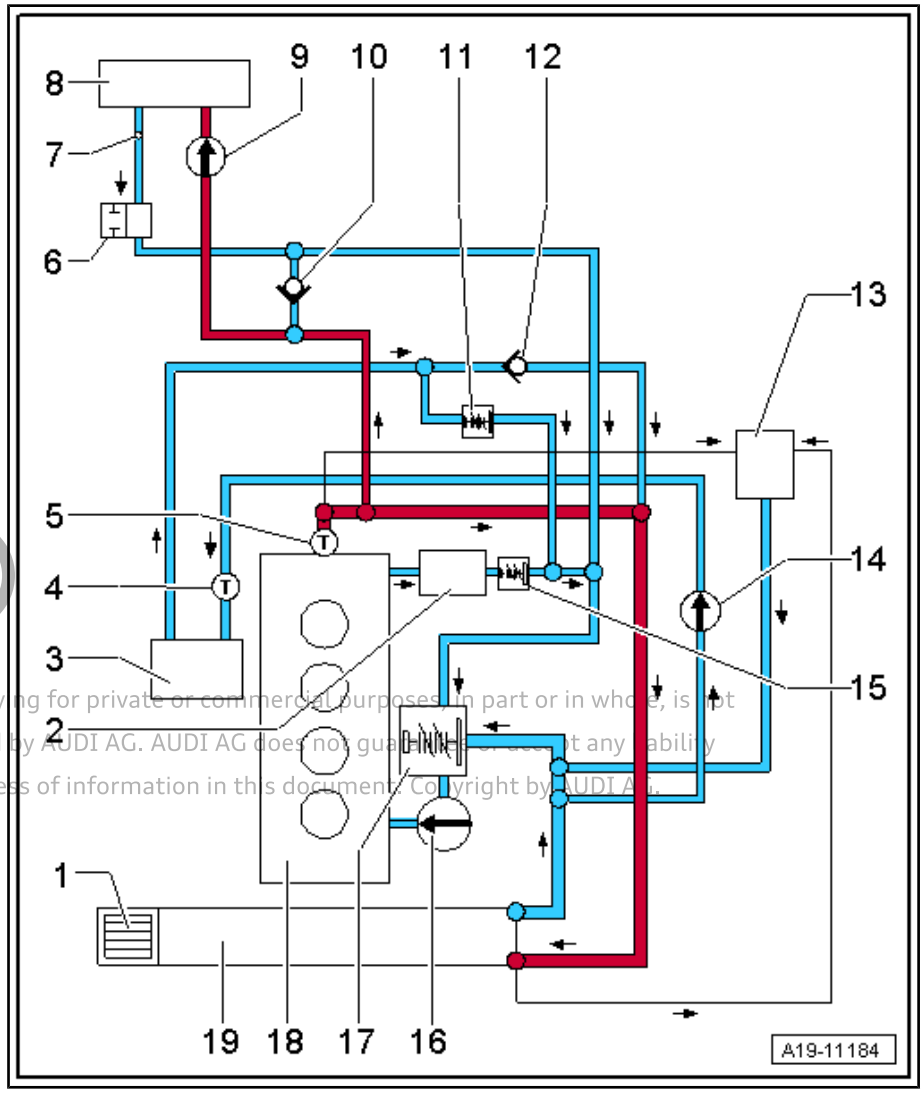
⇒ “1.1.2 Connection diagram - coolant hoses without 4/2-way valve, vehicles with auxiliary heater”, page 145

⇒ “1.1.3 Connection diagram - coolant hoses with 4/2-way valve with thermostat, vehicles without auxiliary heater”, page 146

⇒ “1.1.4 Connection diagram - coolant hoses with 4/2-way valve with thermostat, vehicles with auxiliary heater”, page 147

1.1.1 Connection diagram - coolant hoses without 4/2-way valve, vehicles without auxiliary heater

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1 - ATF cooler

- ❑ Not installed on vehicles with manual gearbox

2 - Engine oil cooler

- ❑ Removing and installing ⇒ page 129

3 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 282

4 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 166

5 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ page 165

6 - Coolant shut-off valve

- ❑ Not always fitted
- ❑ Depending on production period and version of vehicle
- ❑ On vehicles with auxiliary heater ⇒ Auxiliary heater, supplementary heater; Rep. gr. 82 ; Coolant circuit with auxiliary/supplementary heater; Removing and installing heater coolant shut-off valve

7 - Bleeder hole

8 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

9 - Coolant circulation pump - V50-

- ❑ Only installed on vehicles with start/stop system

10 - Non-return valve

11 - Hose thermostat

12 - Non-return valve

13 - Coolant expansion tank

- ❑ With filler cap
- ❑ Checking cooling system for leaks ⇒ page 148

14 - Pump for exhaust gas recirculation cooler - V400-

15 - Hose thermostat

- ❑ Not always fitted
- ❑ Depending on production period and version of vehicle

16 - Coolant pump

- ❑ Removing and installing ⇒ page 160

17 - Thermostat

- ❑ Removing and installing ⇒ page 161

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18 - Cylinder head/cylinder block

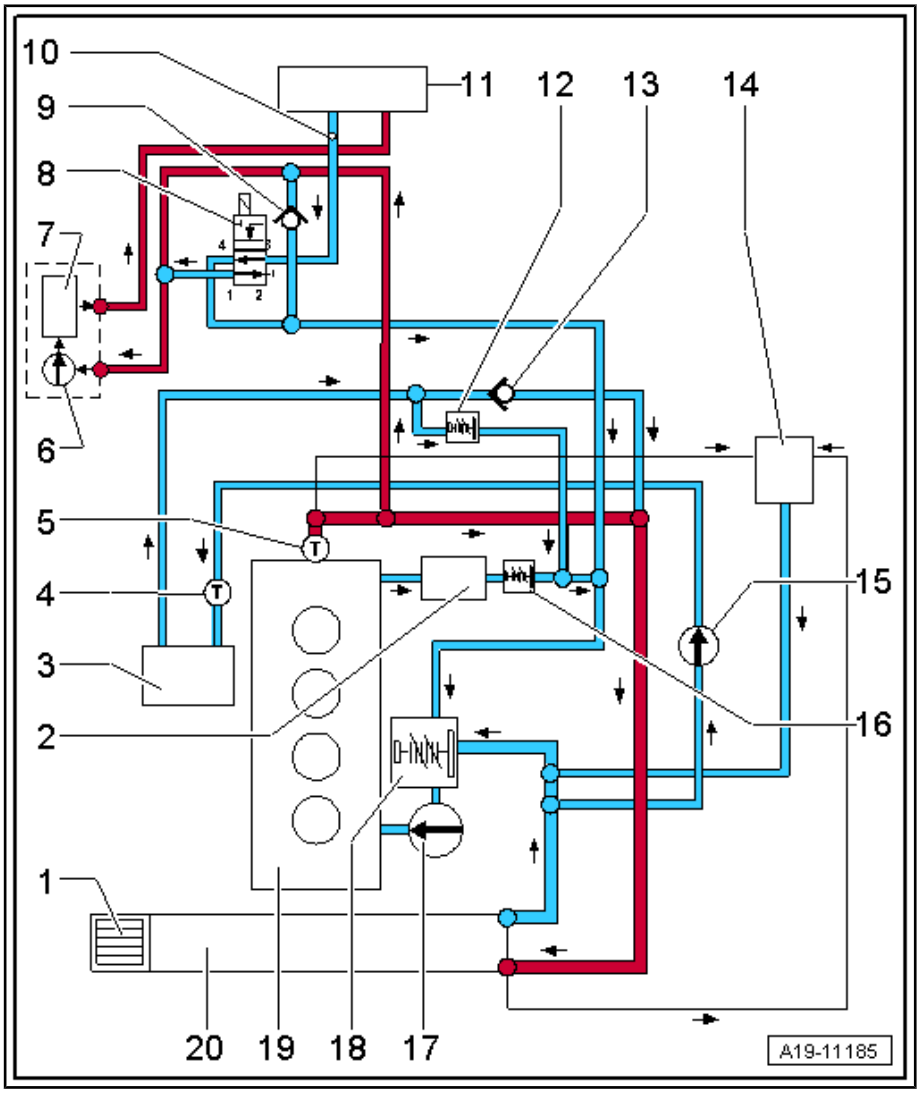
- ❑ If renewed, refill system with fresh coolant

19 - Radiator

- ❑ Removing and installing ⇒ page 169
- ❑ If renewed, refill system with fresh coolant

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1.1.2 Connection diagram - coolant hoses without 4/2-way valve, vehicles with auxiliary heater



1 - ATF cooler

- ❑ Not installed on vehicles with manual gearbox

2 - Engine oil cooler

- ❑ Removing and installing ⇒ page 129

3 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 282

4 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 166

5 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ page 165

6 - Circulation pump - V55-

7 - Auxiliary heater

8 - Heater coolant shut-off valve - N279-

9 - Non-return valve

10 - Bleeder hole

11 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

12 - Hose thermostat

13 - Non-return valve

14 - Coolant expansion tank

- ❑ With filler cap
- ❑ Checking cooling system for leaks ⇒ page 148

15 - Pump for exhaust gas recirculation cooler - V400-

16 - Hose thermostat

- ❑ Not always fitted
- ❑ Depending on production period and version of vehicle

17 - Coolant pump

- ❑ Removing and installing ⇒ page 160

18 - Thermostat

- ❑ Removing and installing ⇒ page 161

19 - Cylinder head/cylinder block

- ❑ If renewed, refill system with fresh coolant

20 - Radiator

- ❑ Removing and installing ⇒ page 169
- ❑ If renewed, refill system with fresh coolant

1.1.3 Connection diagram - coolant hoses with 4/2-way valve with thermostat, vehicles without auxiliary heater

1 - ATF cooler

- ❑ Not installed on vehicles with manual gearbox

2 - Engine oil cooler

- ❑ Removing and installing ⇒ page 129

3 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 282

4 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 166

5 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ page 165

6 - Coolant shut-off valve

- ❑ Not always fitted
- ❑ Depending on production period and version of vehicle
- ❑ Activated via Climatronic coolant shut-off valve - N422-

7 - Bleeder hole

8 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

9 - Coolant circulation pump - V50-

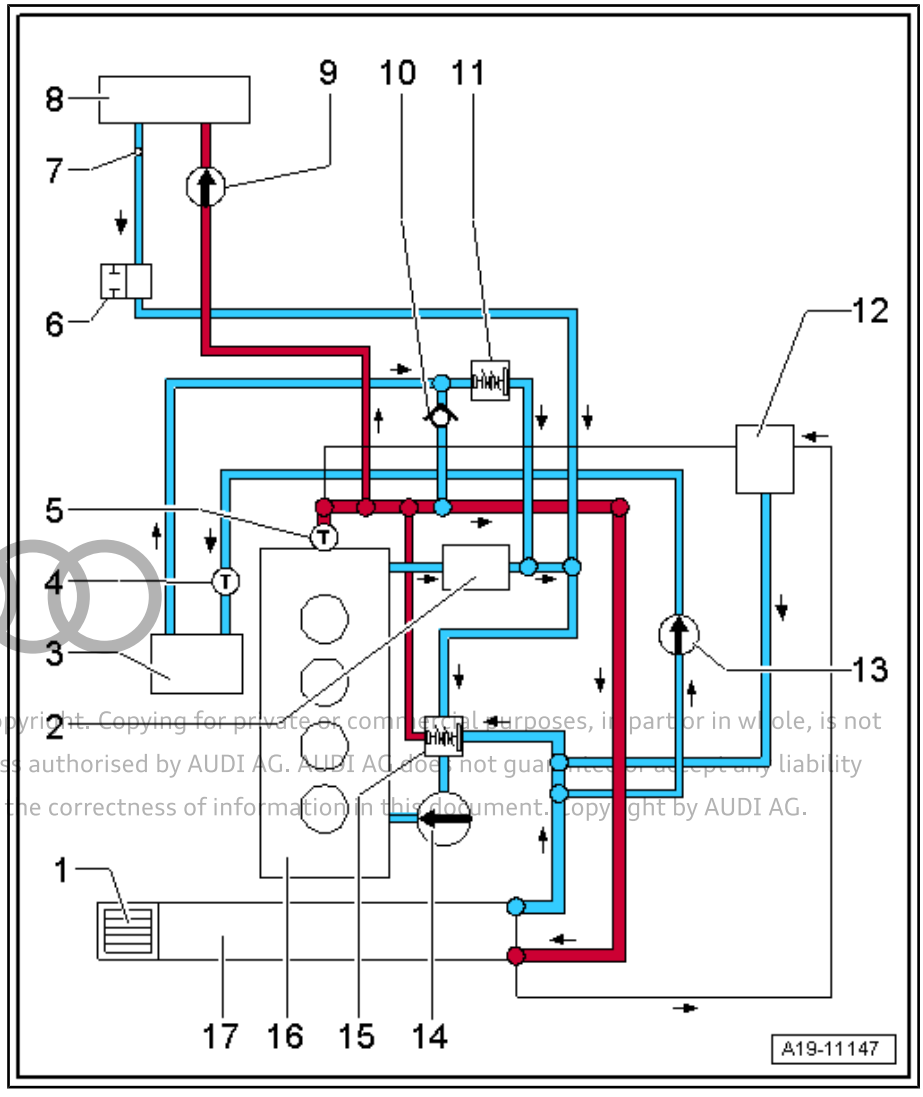
- ❑ Only installed on vehicles with start/stop system

10 - Non-return valve

11 - Hose thermostat

12 - Coolant expansion tank

- ❑ With filler cap
- ❑ Checking cooling system for leaks ⇒ page 148



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13 - Pump for exhaust gas recirculation cooler - V400-

14 - Coolant pump

- ❑ Removing and installing ⇒ page 160

15 - 4/2-way valve with thermostat

- ❑ Removing and installing ⇒ page 163
- ❑ The thermostat is located in the interior of the 4/2-way valve and cannot be renewed separately

16 - Cylinder head/cylinder block

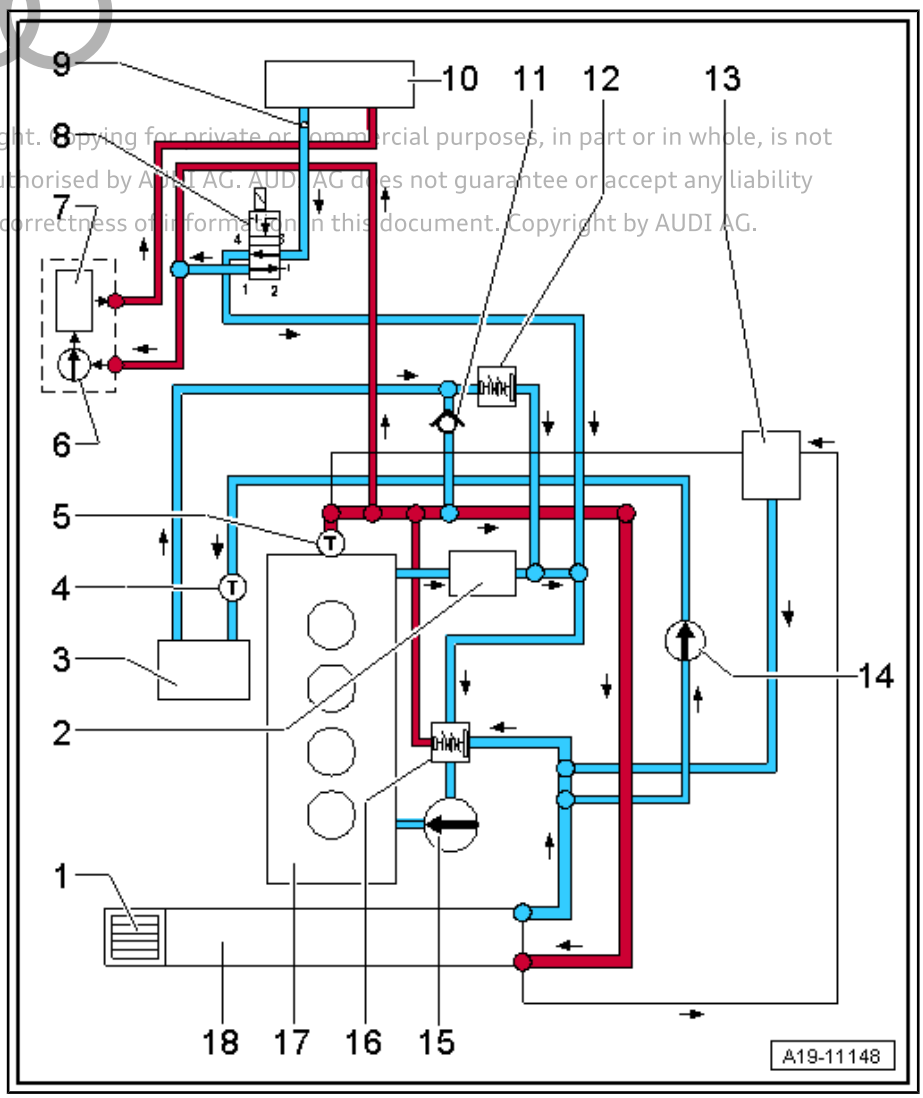
- ❑ If renewed, refill system with fresh coolant

17 - Radiator

- ❑ Removing and installing ⇒ page 169
- ❑ If renewed, refill system with fresh coolant

1.1.4 Connection diagram - coolant hoses with 4/2-way valve with thermostat, vehicles with auxiliary heater

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1 - ATF cooler

- ❑ Not installed on vehicles with manual gearbox

2 - Engine oil cooler

- ❑ Removing and installing ⇒ page 129

3 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 282

4 - Radiator outlet coolant temperature sender - G83-

- ❑ Removing and installing ⇒ page 166

5 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ page 165

6 - Circulation pump - V55-

7 - Auxiliary heater

8 - Heater coolant shut-off valve - N279-

9 - Bleeder hole

10 - Heat exchanger

- ❑ If renewed, refill system with fresh coolant

11 - Non-return valve

12 - Hose thermostat

13 - Coolant expansion tank

- ❑ With filler cap
- ❑ Checking cooling system for leaks ⇒ page 148

14 - Pump for exhaust gas recirculation cooler - V400-

15 - Coolant pump

- ❑ Removing and installing ⇒ page 160

16 - 4/2-way valve with thermostat

- ❑ Removing and installing ⇒ page 163
- ❑ The thermostat is located in the interior of the 4/2-way valve and cannot be renewed separately

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17 - Cylinder head/cylinder block

- ❑ If renewed, refill system with fresh coolant

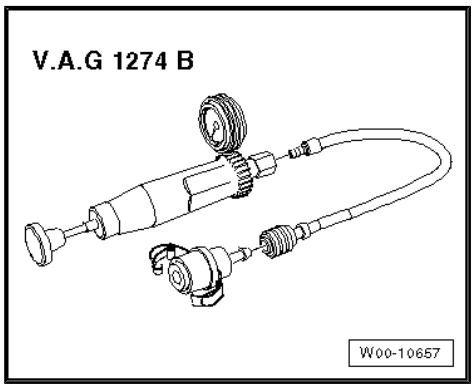
18 - Radiator

- ❑ Removing and installing ⇒ page 169
- ❑ If renewed, refill system with fresh coolant

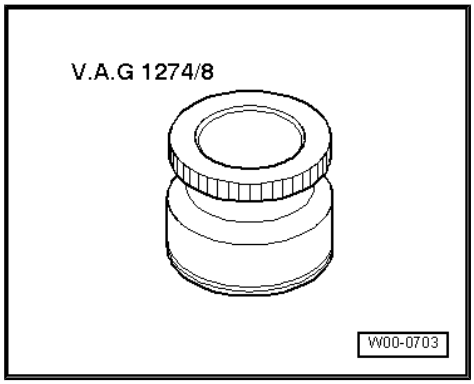
1.2 Checking cooling system for leaks

Special tools and workshop equipment required

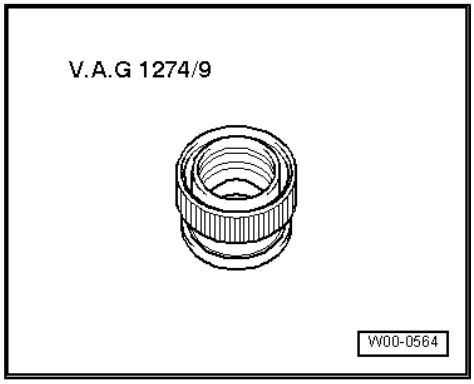
- ♦ Cooling system tester - V.A.G 1274 B-



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



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



Procedure

- Engine must be warm.
- Ignition switched off.

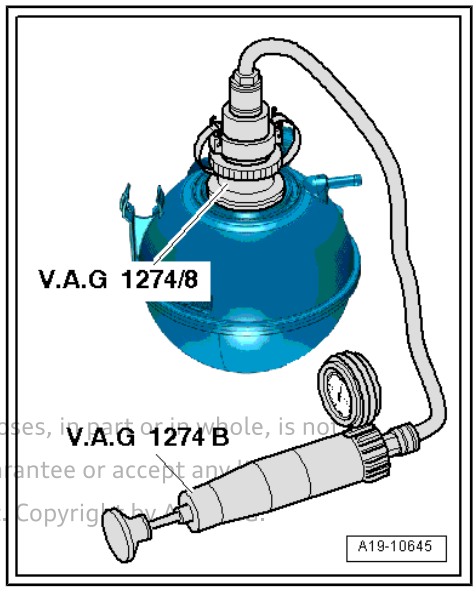
WARNING

Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the engine is hot.

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

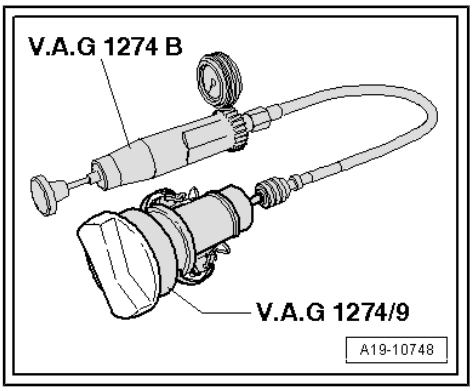
– Open filler cap on coolant expansion tank.
– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
– Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.
– If this pressure is not maintained, locate and rectify leaks.



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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

WARNING

Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the engine is hot.

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

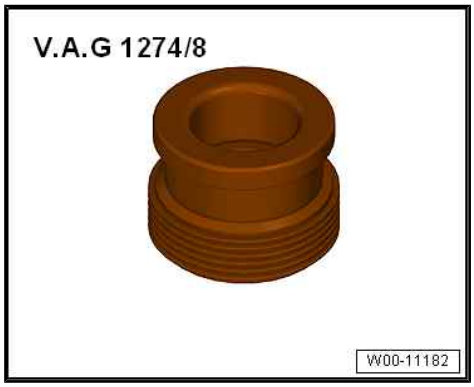
Note

- *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Hose clip pliers - V.A.G 1921- or hose clip pliers - VAS 6340- are recommended for use when installing spring-type clips.*
- *Renew gaskets and seals.*
- *The arrow markings on coolant pipes and on ends of hoses must align.*

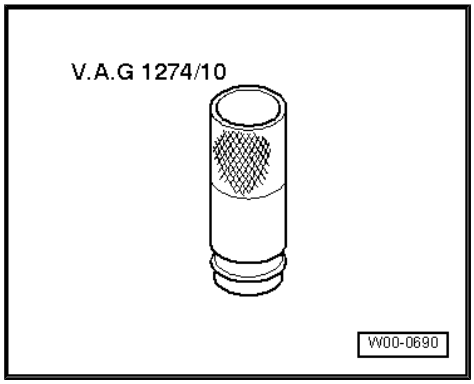
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Special tools and workshop equipment required

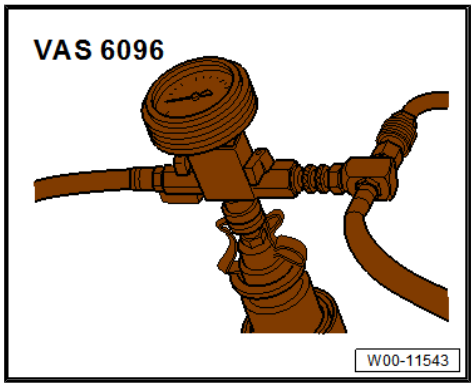
- Adapter for cooling system tester - V.A.G 1274/8-



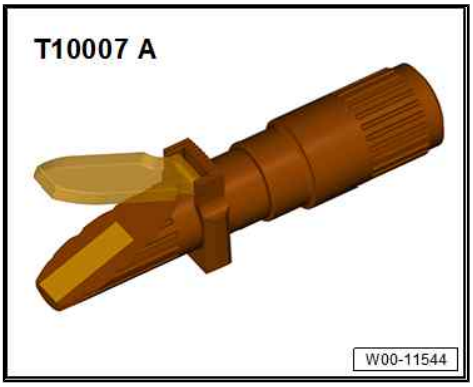
- Pipe for cooling system tester - V.A.G 1274/10-



- Cooling system charge unit - VAS 6096-



- Refractometer - T10007A- or refractometer - T10007B-

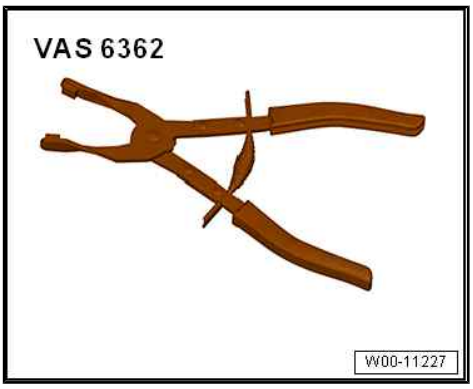


- Coolant collecting system - VAS 5014- or drip tray for workshop hoist - VAS 6208-

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- Hose clip pliers - VAS 6362-



- Safety goggles
- Protective gloves

Draining

WARNING

Risk of scalding due to hot steam and hot coolant.

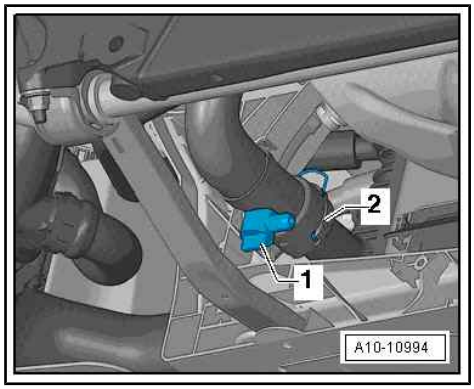
The cooling system is under pressure when the engine is hot.

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

– Open filler cap on coolant expansion tank.

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

– Place drip tray for workshop hoist - VAS 6208- beneath engine.
– Remove drain plug -1- and drain off coolant.

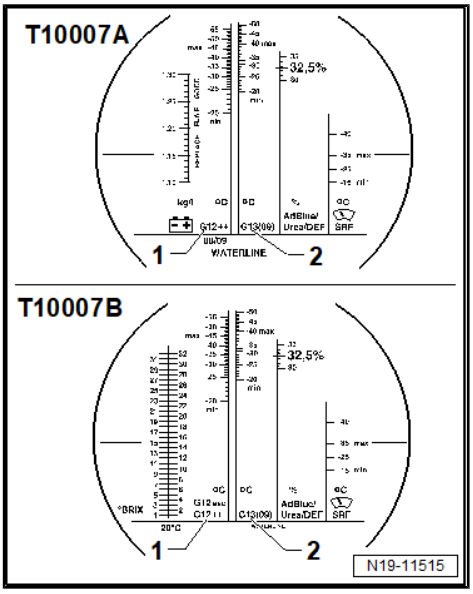


Filling

Caution

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

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Note

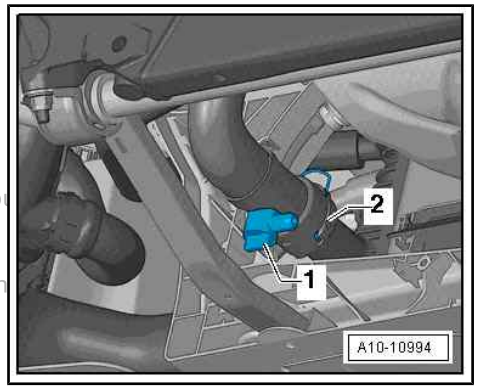
- *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . If you use other coolant additives, this can significantly impair in particular the corrosion protection effect. The resulting damage could lead to loss of coolant and consequently to serious 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.*

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Recommended mixture ratio for coolant

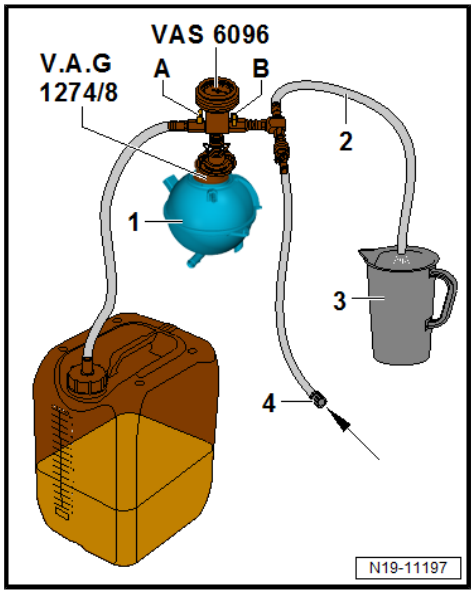
- Coolant (40 %) and distilled water (60 %) for frost protection to -25 °C
- Coolant (50 %) and distilled water (50 %) for frost protection to -36 °C
- Coolant additive ⇒ Electronic parts catalogue (ETKA)

– Close drain plug -1-.



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

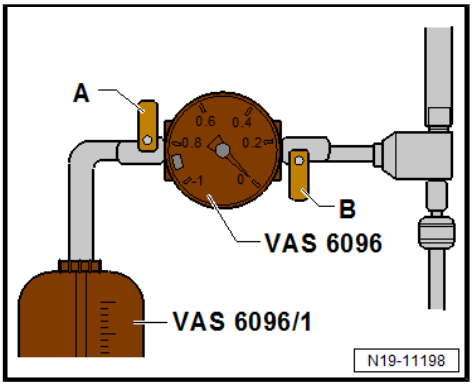
– Close valve -A- again.

– Leave valve -B- open for another 2 minutes.

• The suction jet pump will continue generating a 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 remain 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.

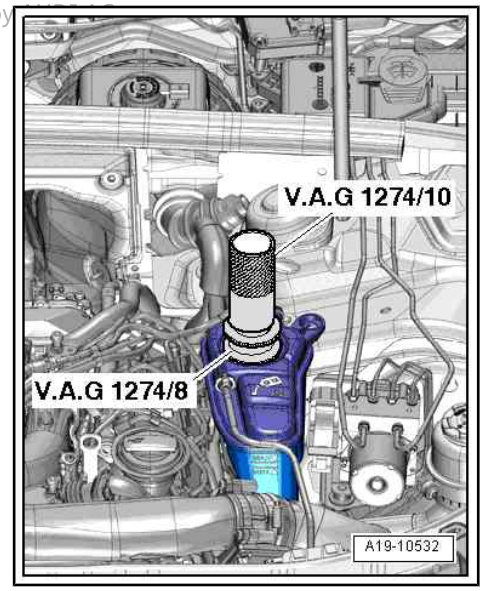
– Open valve -A-.

• 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 adapter -V.A.G 1274/8- on coolant expansion tank.

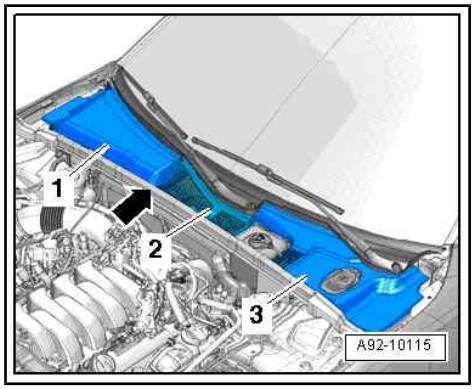
– Fit pipe for cooling system tester - V.A.G 1274/10- onto adapter for cooling system tester - V.A.G 1274/8- .

– Fill up pipe for cooling system tester - V.A.G 1274/10- with coolant.

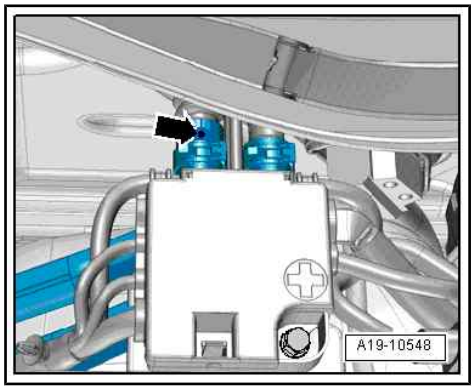


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– Unclip plenum chamber cover -2- and remove.



– Release coolant hose going to heat exchanger for heater and pull back hose until bleeder hole -arrow- in hose is no longer blocked by connection.
– Fill up with coolant until it comes out at bleeder hole in coolant hose.
– Push coolant hose back onto connection and secure with spring-type hose clip.
– Detach pipe for cooling system tester - V.A.G 1274/10- and close filler cap on coolant expansion tank.
– Start engine.
– Set temperature to “HI” in all zones.
– Switch off air conditioner compressor (press ECON button).
– Set fresh air blower to lowest setting.
– Run engine for 3 minutes at 2000 rpm.
– Allow engine to run at idling speed until both large coolant hoses at radiator become warm.
– Run engine for 1 minute at 2000 rpm.
– Switch off ignition and allow engine to cool down.
– Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



WARNING

Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the engine is hot.

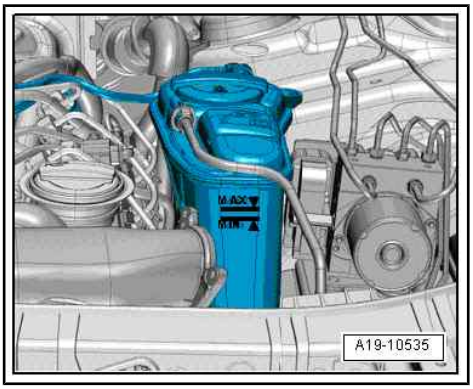
Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.

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– Check coolant level.

- The coolant level must be at the MAX marking when the engine is cold.
- The coolant level can be above the MAX marking when the engine is warm.

– Top up with coolant again if necessary.



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2 Coolant pump/thermostat assembly

⇒ “2.1 Exploded view - coolant pump/thermostat”, page 158

⇒ “2.2 Removing and installing pump for exhaust gas recirculation cooler V400 ”, page 158

⇒ “2.3 Removing and installing coolant pump”, page 160

⇒ “2.4 Removing and installing thermostat”, page 161

⇒ “2.5 Removing and installing 4/2-way valve with thermostat”, page 163

⇒ “2.6 Removing and installing coolant temperature sender G62 ”, page 165

⇒ “2.7 Removing and installing radiator outlet coolant temperature sender G83 ”, page 166

2.1 Exploded view - coolant pump/thermostat

1 - Bolt
- ❑ 15 Nm

2 - Coolant pump
- ❑ Removing and installing ⇒ page 160

3 - O-ring
- ❑ Renew

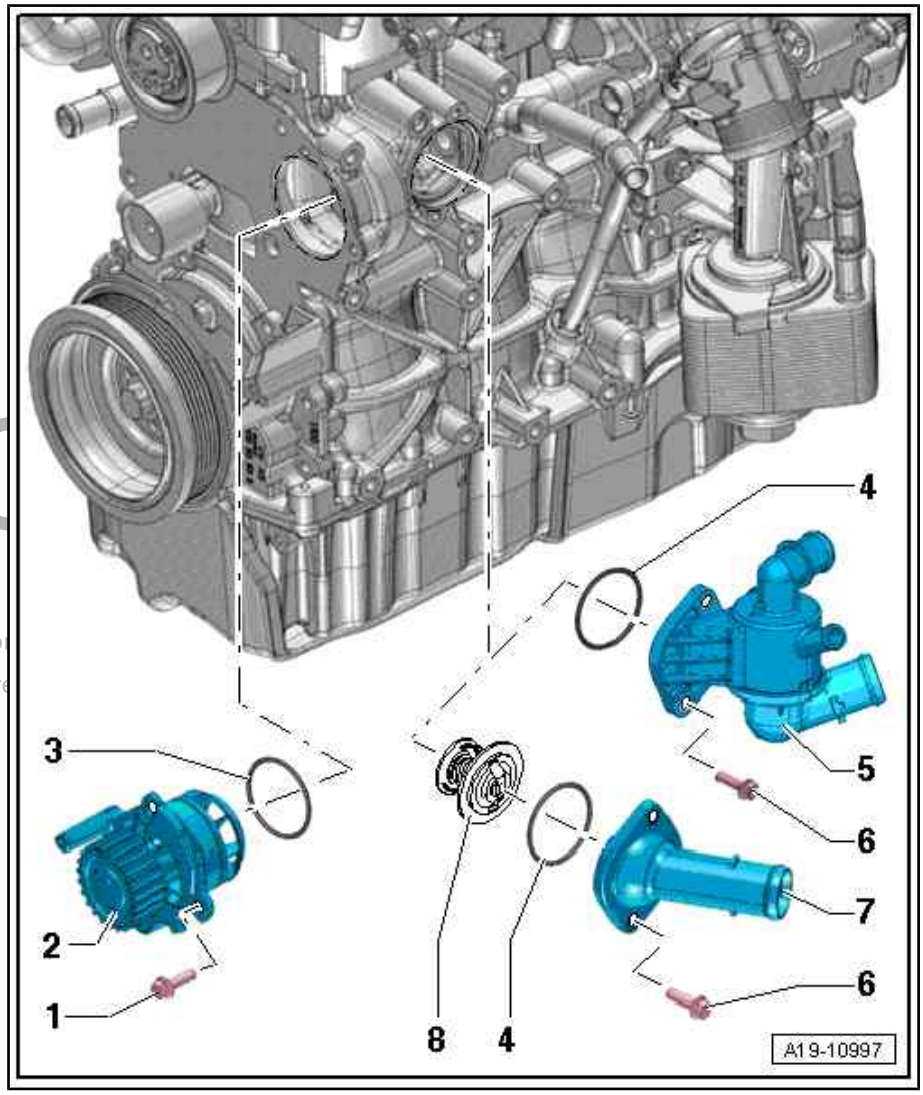
4 - O-ring
- ❑ Renew

5 - 4/2-way valve with thermostat
- ❑ Installed according to version
- ❑ Removing and installing ⇒ page 163
- ❑ The thermostat is located in the interior of the 4/2-way valve and cannot be renewed separately

6 - Bolt
- ❑ 15 Nm

7 - Connection
- ❑ Installed according to version

8 - Thermostat
- ❑ Removing and installing ⇒ page 161
- ❑ Only fitted on version with connection -7-

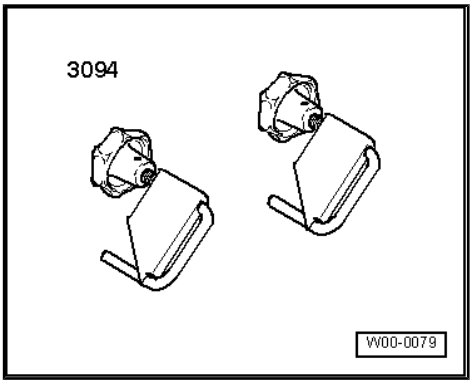


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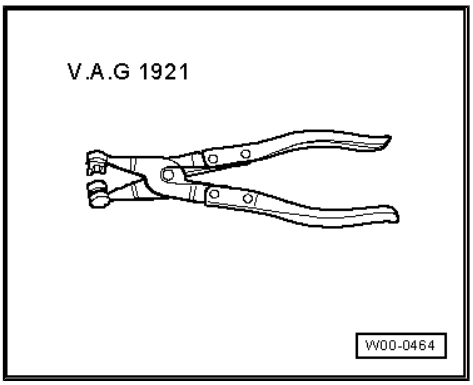
2.2 Removing and installing pump for exhaust gas recirculation cooler - V400-

Special tools and workshop equipment required

♦ Hose clamps up to 25 mm - 3094-



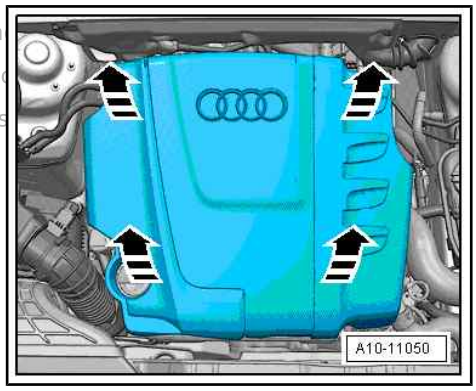
♦ Hose clip pliers - V.A.G 1921-



Removing

– Remove engine cover panel -arrows-.

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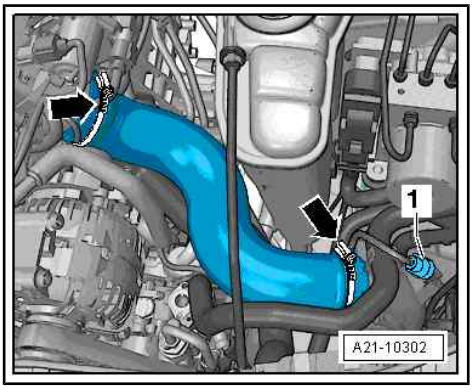
– Release hose clips -arrows- and detach air hose.

WARNING

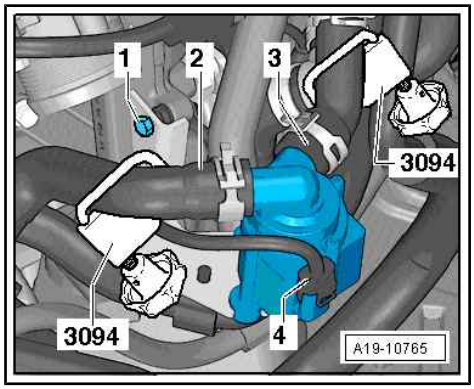
Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the engine is hot.

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



– Clamp off coolant hoses with hose clamps up to 25 mm - 3094- as shown in illustration.
– Detach coolant hoses -2- and -3-.
– Unplug electrical connector -4-.
– Unscrew bolt -1- and remove pump for exhaust gas recirculation cooler - V400- with bracket.
– Detach pump for exhaust gas recirculation cooler from bracket.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Note

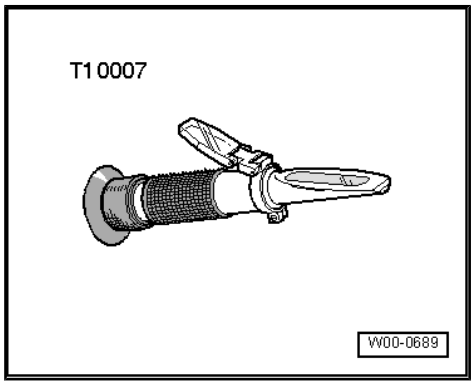
- *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the air hoses can be properly secured at their connections, spray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

– Fill up with coolant ⇒ page 149 .

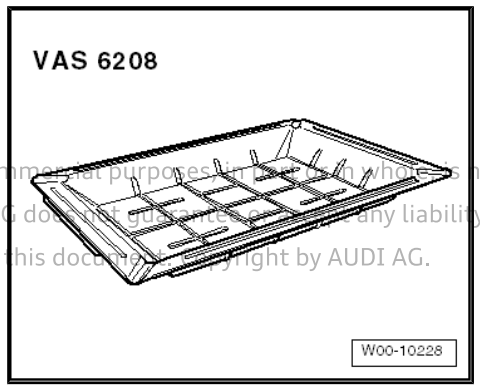
2.3 Removing and installing coolant pump

Special tools and workshop equipment required

- Refractometer - T10007-



- Drip tray for workshop hoist - VAS 6208-



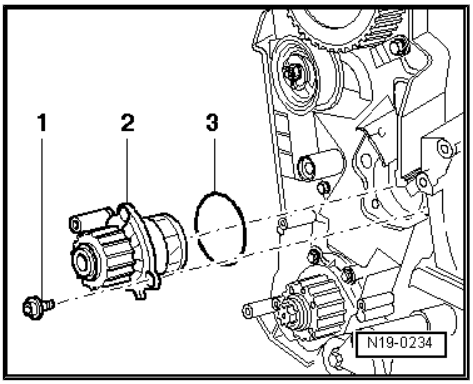
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Removing

Note

Always renew seals and gaskets.

– Drain coolant ⇒ page 149 .
– Remove poly V-belt ⇒ page 42 .
– Remove toothed belt. ⇒ page 90
– Unscrew bolts -1- and pull out coolant pump -2-.

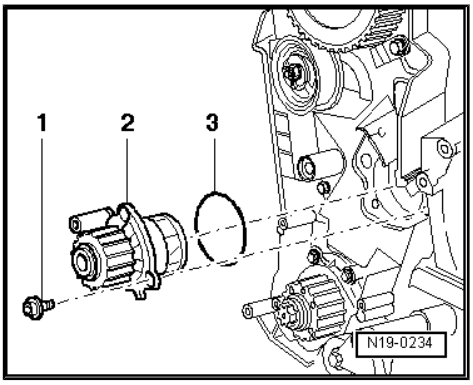


Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “2.1 Exploded view - coolant pump/thermostat”, page 158

– Moisten new O-ring -3- with coolant.
– Insert coolant pump -2- into cylinder block and tighten securing bolts -1-.



Note

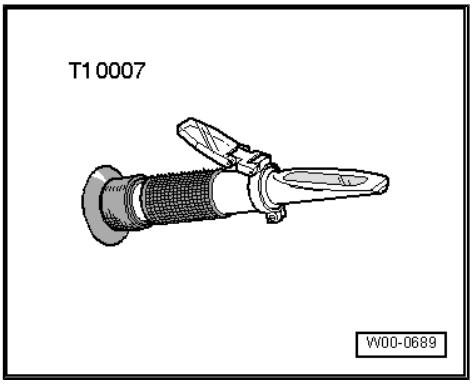
Sealing plug for coolant pump faces downwards.

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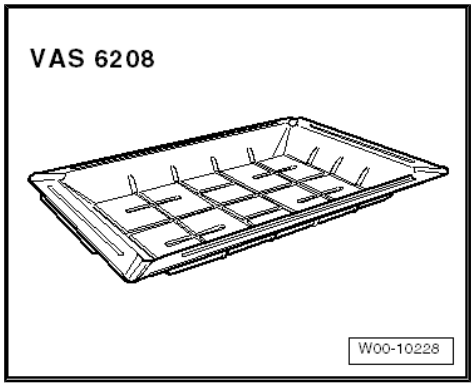
2.4 Removing and installing thermostat

Special tools and workshop equipment required

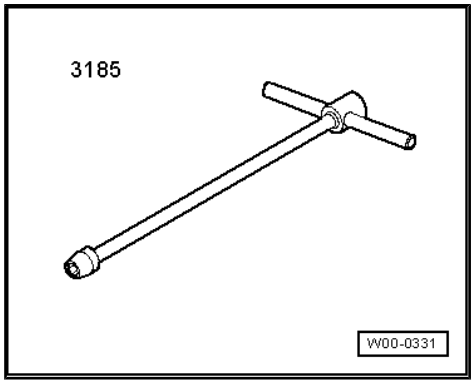
♦ Refractometer - T10007-



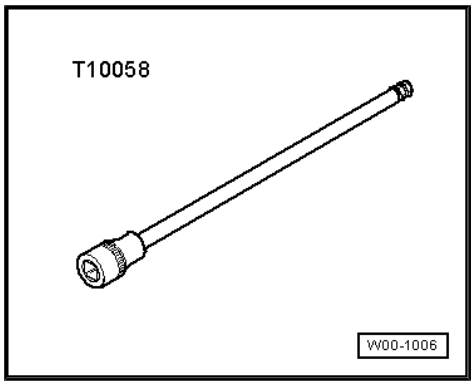
- Drip tray for workshop hoist - VAS 6208-



- Articulated wrench, 10 mm - 3185-



- Socket - T10058-



Removing

Note

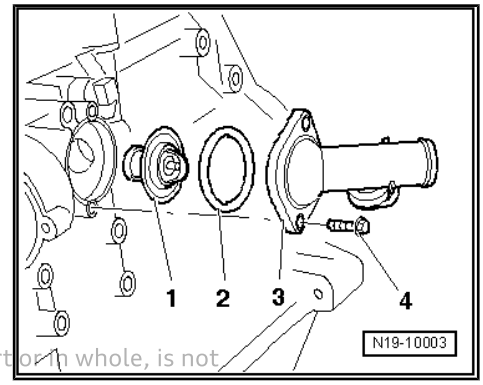
Always renew seals and gaskets.

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– Drain coolant ⇒ page 149 .
– Detach coolant hose from connection.

– Using articulated wrench, 10 mm - 3185- and socket - T10058- , unscrew securing bolts -4- of connection -3- and remove connection -3- with thermostat -1-.

– Turn thermostat -1- 90° in anti-clockwise direction and take thermostat out of connection -3-.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “2.1 Exploded view - coolant pump/thermostat”, page 158

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– Moisten new O-ring -2- with coolant.

– Fit thermostat -1- with O-ring -2- into connection -3- and turn 90° in clockwise direction.

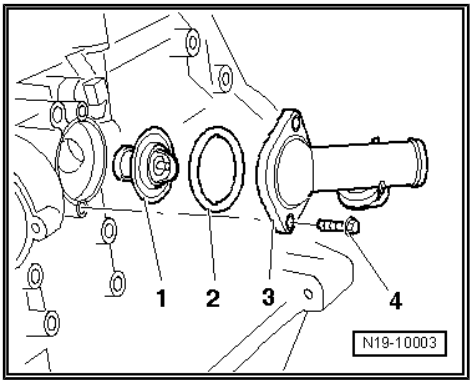
Note

The brace on the thermostat must be almost vertical.

– Insert connection -3- with thermostat -1- into engine block.

– Use articulated wrench - 3185- to tighten securing bolts -4-.

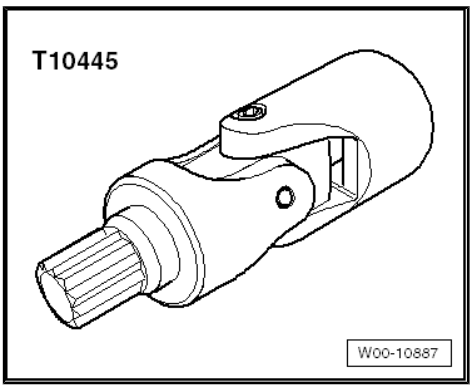
– Fill up with coolant ⇒ page 149 .



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

Special tools and workshop equipment required

♦ Multi-point bit XZN 8 - T10445-

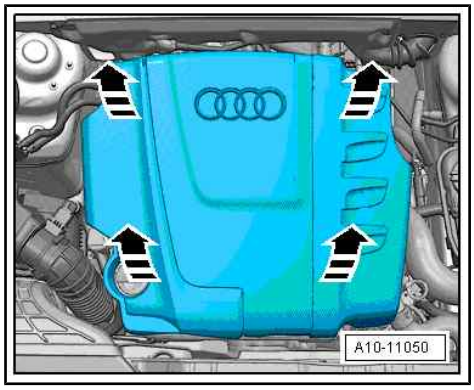


Removing

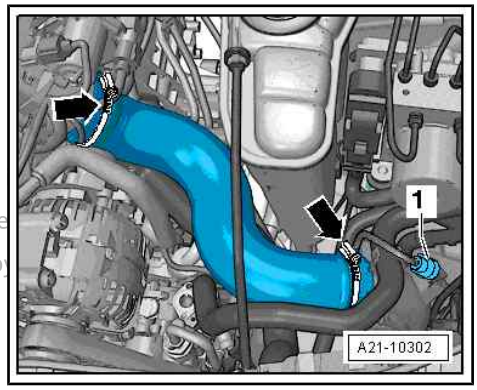
Note

The thermostat is located in the interior of the 4/2-way valve and cannot be renewed separately.

– Remove engine cover panel -arrows-.

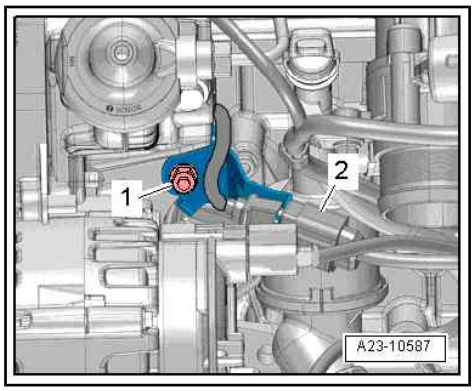


– Release hose clips -arrows- and detach air hose.

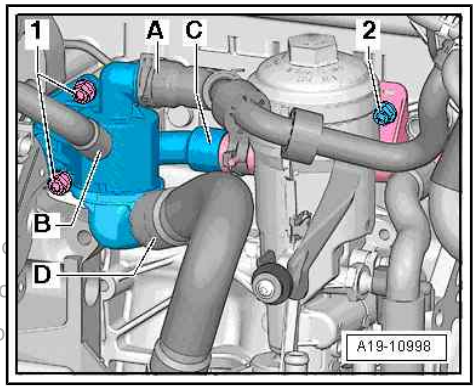


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– Unplug electrical connector -2-.
– Remove nut -1- and move bracket with electrical connectors to one side.
– Drain coolant ⇒ page 149 .



– Detach coolant hoses from connections -A, B and D-.
– Remove bolt -2- with multi-point bit XZN 8 - T10445- .
– Remove bolts -1-.
– Pull valve out of cylinder block and detach connection -C- from coolant pipe to the left.



Installing

- Tightening torque

⇒ "2.1 Exploded view - coolant pump/thermostat", page 158

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

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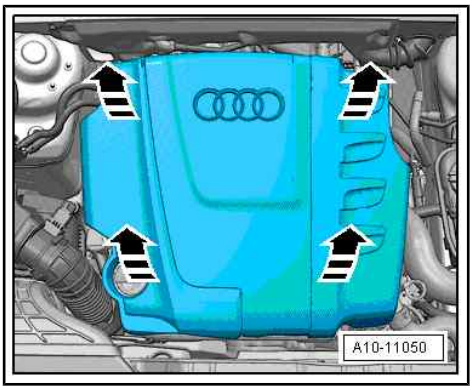
Note

Fit new O-ring.

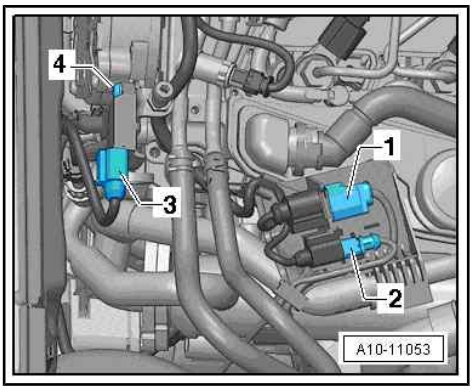
2.6 Removing and installing coolant temperature sender - G62-

Removing

– Remove engine cover panel -arrows-.

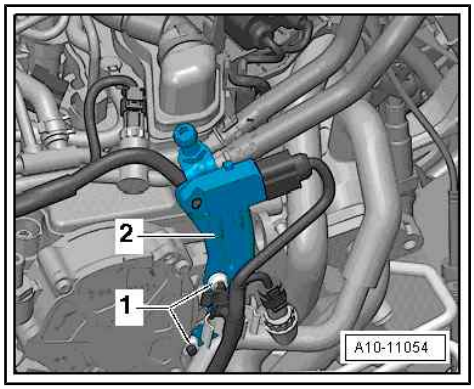


- Engine cold.
– Open filler cap on coolant expansion tank briefly and allow residual pressure in cooling system to dissipate.
– Remove bolt -4- and unclip air hoses for exhaust gas pressure sensor 1 .



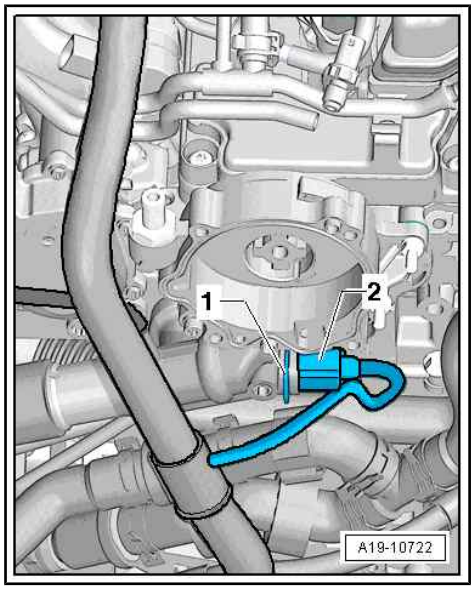
– Remove nuts -1- and detach bracket -2-.

– Remove vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .



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

– Pull off retaining clip -1- and pull out coolant temperature sender - G62- .



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Note

- *Renew O-rings.*
- *Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.*

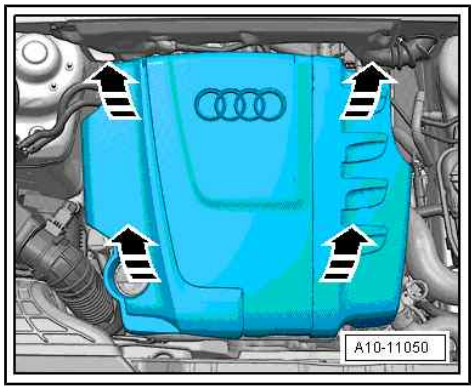
– Check coolant level ⇒ page 149 .

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

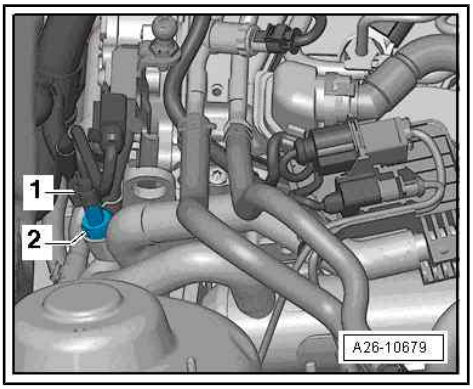
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Removing

– Remove engine cover panel -arrows-.



– Unplug electrical connector -1- and unscrew radiator outlet coolant temperature sender - G83- -2-.



WARNING

Risk of scalding due to hot steam and hot coolant.

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

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

– Top up coolant.

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3 Radiator/radiator fans

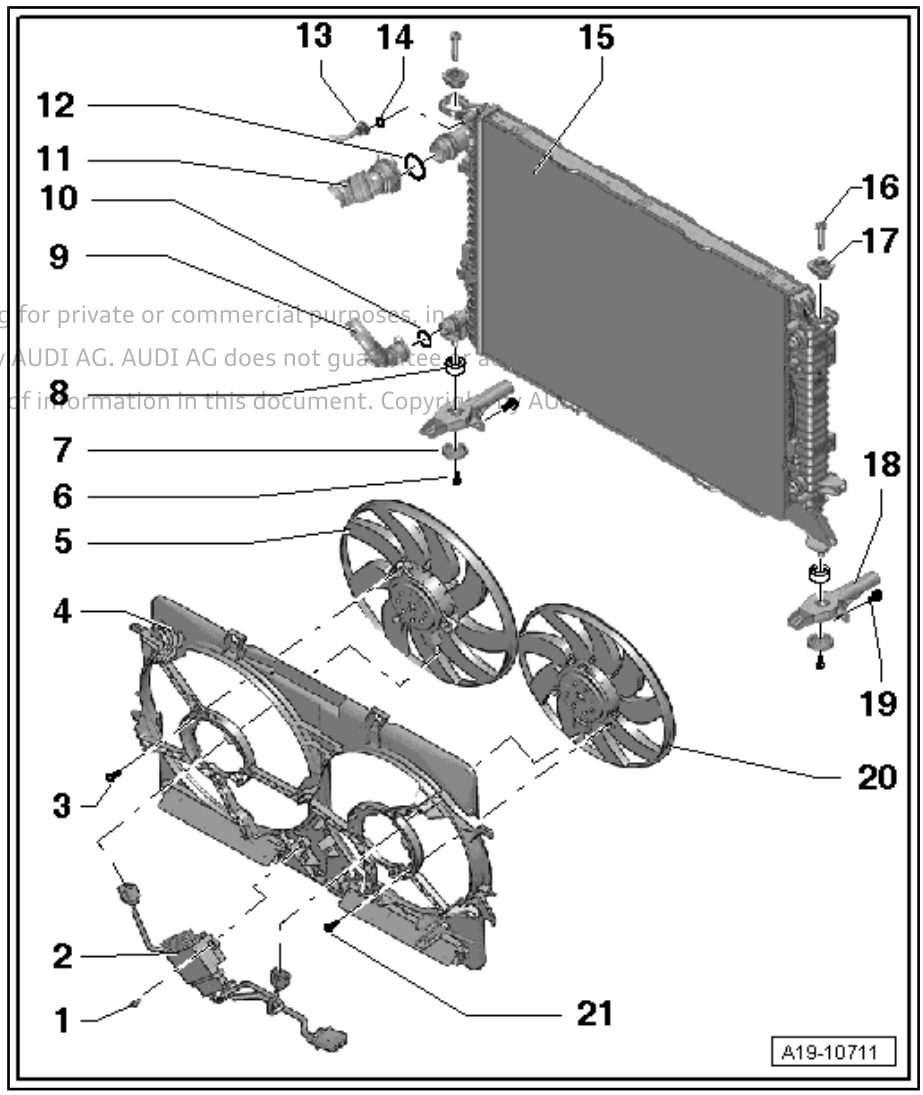
⇒ “3.1 Exploded view - radiator/radiator fans”, page 168

⇒ “3.2 Removing and installing radiator”, page 169

⇒ “3.3 Removing and installing radiator fan control unit J293 ”, page 175

⇒ “3.4 Removing and installing radiator fans”, page 176

3.1 Exploded view - radiator/radiator fans



1 - Bolt
- ❑ 4.5 Nm

2 - Radiator fan control unit - J293-
- ❑ Removing and installing ⇒ page 175

3 - Bolt
- ❑ 5 Nm

4 - Radiator cowl
- ❑ Removing and installing ⇒ page 169

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5 - Radiator fan - V7-
- ❑ Removing and installing ⇒ page 176

6 - Bolt
- ❑ 3.5 Nm

7 - Support

8 - Rubber bush
- ❑ For radiator

9 - Coolant hose
- ❑ Lift retaining clip to detach

10 - O-ring
- ❑ Renew if damaged
- ❑ Lubricate with coolant

11 - Coolant hose
- ❑ Lift retaining clip to detach

12 - O-ring
- ❑ Renew if damaged
- ❑ Lubricate with coolant

13 - Coolant hose
- ❑ To coolant expansion tank

14 - O-ring
- ❑ Renew if damaged
- ❑ Lubricate with coolant

15 - Radiator
- ❑ Remove and install together with radiator cowl ⇒ page 169

❑ If renewed, change coolant in entire system

16 - Retaining pin

❑ Use screwdriver to release and pull off

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17 - Rubber buffer

18 - Radiator bracket

19 - Bolt

❑ 5.5 Nm

20 - Radiator fan 2 - V177-

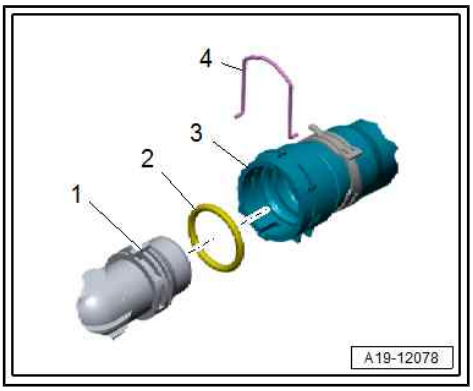
❑ Not fitted if fan runs with 400 W

❑ Removing and installing ⇒ page 176

21 - Bolt

❑ 5 Nm

Connecting coolant hose with plug-in connector to coolant pipe



- If damaged, renew retaining clip -4-.

– If damaged, renew O-ring. To do so, remove O-ring -2- from plug-in connector -3- using a suitable tool (do not use a sharp tool). Take care not to damage the plug-in connector or the surface on which the O-ring is seated.

– Lightly lubricate new O-ring with coolant and fit O-ring in coolant hose.

– Press coolant hose onto connection -1- until it engages audibly.

– Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.

3.2 Removing and installing radiator

WARNING

Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the engine is hot.

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

WARNING

Risk of injury as the radiator fans may start up automatically.

- *Unplug electrical connectors before working in vicinity of radiator cowl.*

Note

- *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- *Hose clip pliers - V.A.G 1921- or hose clip pliers - VAS 6340- are recommended for use when installing spring-type clips.*
- *Renew gaskets and seals.*
- *The arrow markings on coolant pipes and on ends of hoses must align.*

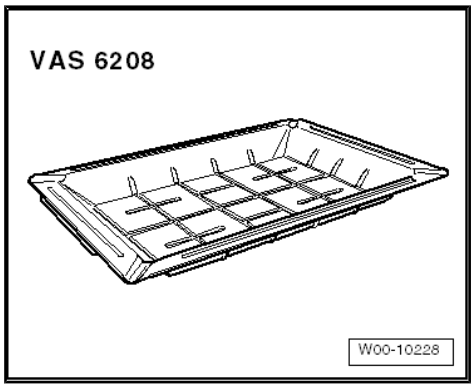
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Note

Radiator and radiator cowl can only be removed and installed together as one unit.

Special tools and workshop equipment required

- Drip tray for workshop hoist - VAS 6208-



Removing

Note

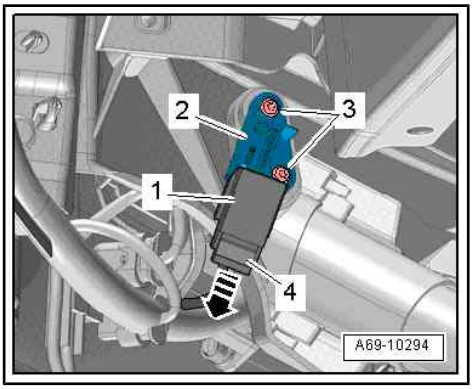
Even when the radiator and condenser are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator or the condenser.

– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Remove bumper cover (front) and bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .
– Remove charge air cooler ⇒ page 185 .

A4 vehicles

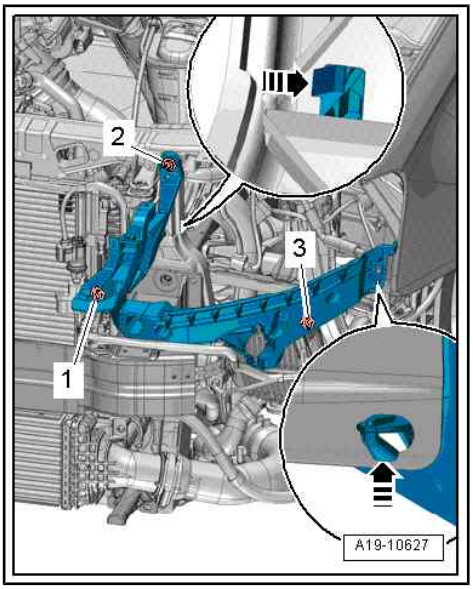
– Remove headlight (right-side) ⇒ Electrical system; Rep. gr. 94 ; Headlights; Removing and installing headlights .
– If fitted, remove headlight washer jet (right-side) ⇒ Electrical system; Rep. gr. 92 ; Headlight washer system; Removing and installing washer jets .

– Unplug electrical connector -1- at front airbag crash sensor for front passenger side - G284- ⇒ General body repairs, interior; Rep. gr. 69 ; Crash sensors for airbags; Removing and installing front airbag crash sensor for driver side - G283- .

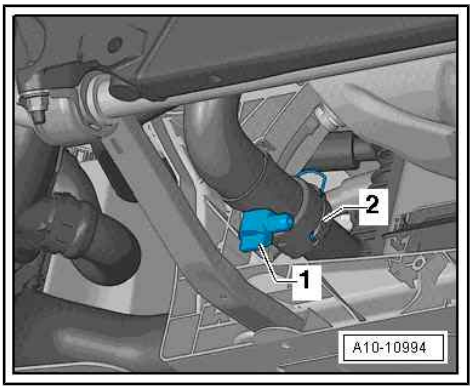


– Remove bolts -1- and -2-.
– Unclip mounting for headlight (right-side) -arrows- and remove.

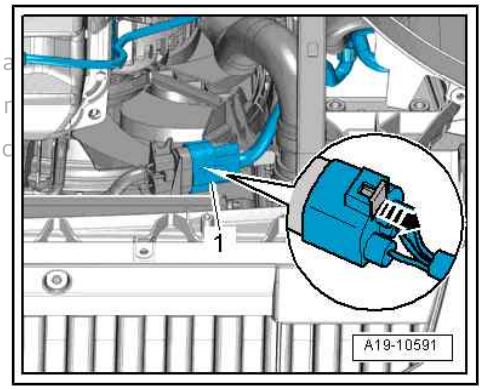
All vehicles



– Place drip tray for workshop hoist - VAS 6208- beneath engine.
– Remove drain plug -1- and drain off coolant.
– Then disconnect coolant hose -2- from radiator (pull out retaining clip).

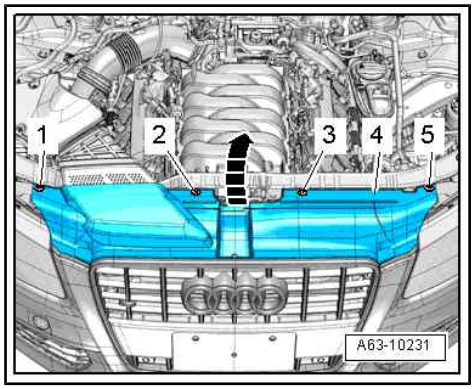


– Take electrical connector -1- for radiator fan out of bracket and unplug connector (push retainer to the rear -arrow- and press down release catch).

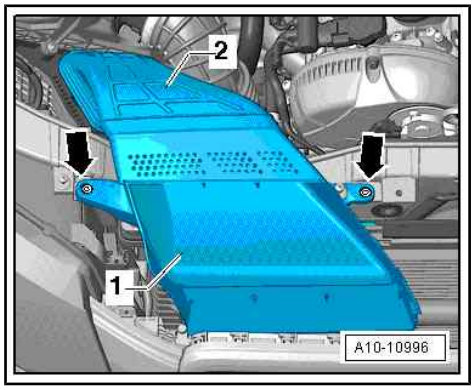


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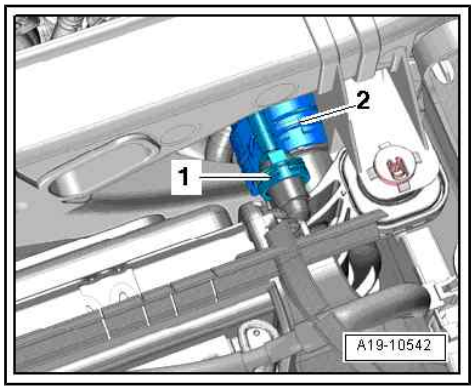
– Remove bolts -1, 2, 3, 5-.
– Lift cover -4- above lock carrier and detach from radiator grille -arrow-.



– Remove bolts -arrows-.



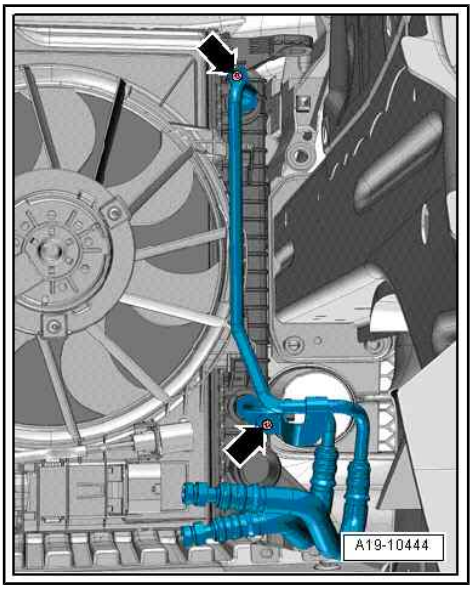
– Detach connections -1- and -2- from radiator (lift retaining clip).
– Remove air duct -1- and intermediate flange -2-.



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Vehicles with multitronic gearbox:

– Position used oil collection and extraction unit - V.A.G 1782- below connection point.



Note

Observe rules for cleanliness when working on multitronic gearbox ⇒ Rep. gr. 00 ; Repair instructions; Rules for cleanliness .

– Unscrew bolts -arrows- and detach ATF lines from radiator.

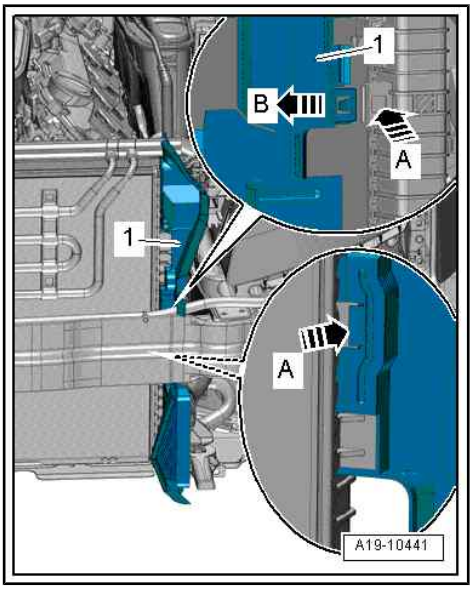
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

Note

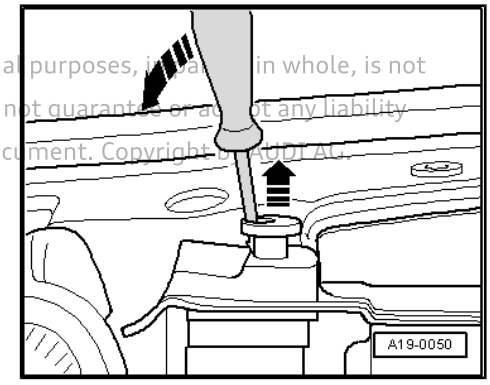
Tie ATF lines up onto longitudinal member to prevent fluid escaping.

All vehicles

– Release catches -arrows A- and detach air duct -1- on left and right -arrow B-.



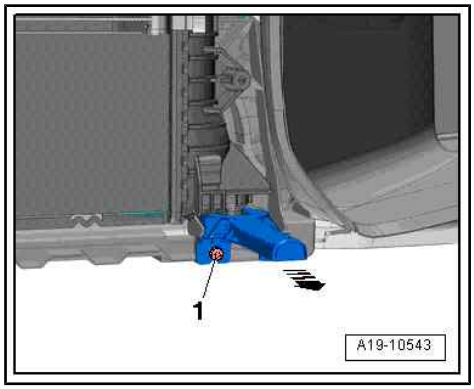
– Release retaining pins for radiator on both sides and pull out upwards -arrows-.



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– Remove bolts -1- on both sides and detach radiator bracket with radiator from lock carrier -arrow-.

– Slightly lower radiator.



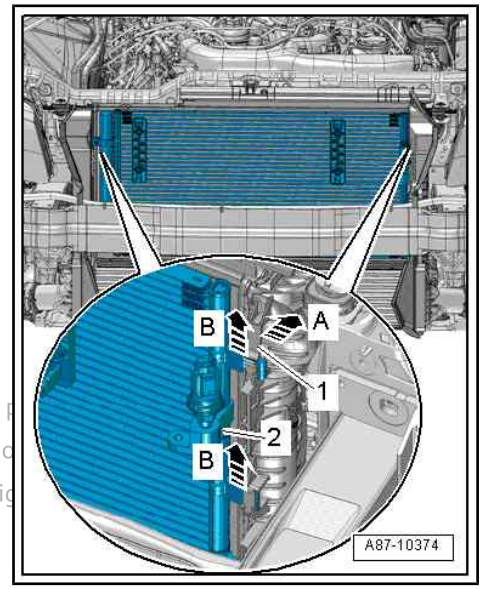
Vehicles with refrigerant lines (version 1):

– Have a second mechanic release retaining clips -1- in direction of -arrow A- and lift condenser -2- out of mountings on radiator -arrows B-.

Caution

Risk of damage to condenser, refrigerant lines and refrigerant hoses.

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



– Pivot condenser forwards with pipes/hoses attached.

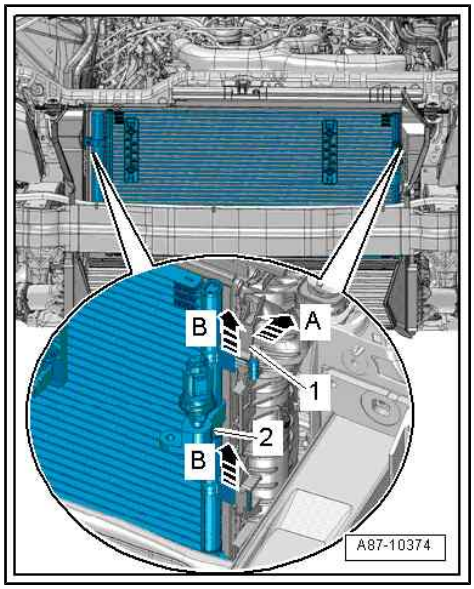
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Note

On more recent versions it is no longer possible to remove the condenser from the radiator with the refrigerant lines attached. This is described below under "version 2".

Vehicles with refrigerant lines (version 2):

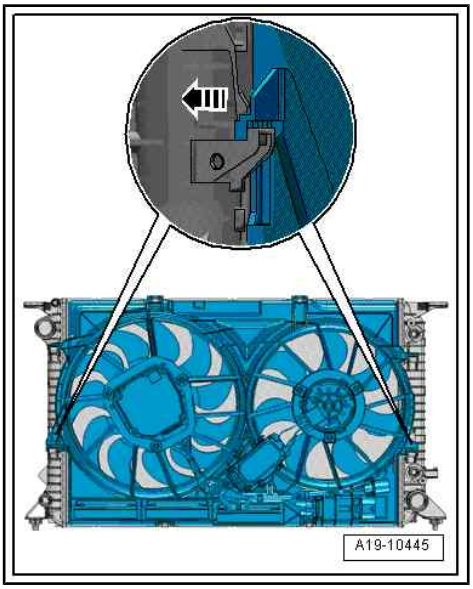
– Remove condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser .



All vehicles (continued):

– Detach radiator.

– Press locking tabs on left and right sides of radiator cowl together -arrow- and lift radiator cowl off radiator.



Installing

- Tightening torque ⇒ page 168

Installation is carried out in reverse sequence. When doing so, note the following:

– Attach air duct to intermediate flange for air cleaner housing.

– On vehicles with multitronic gearbox: secure ATF lines ⇒ Rep. gr. 37 ; ATF circuit; Removing and installing ATF lines .

– Install charge air cooler ⇒ page 185 .

– Install bumper and bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

– Connect coolant hose with plug-in connector to coolant pipe ⇒ page 169 .

– Fill up with coolant ⇒ page 149 .

Note

The coolant in the entire system must be changed if the radiator is renewed.

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– On vehicles with multitronic gearbox: check ATF level ⇒ Rep. gr. 37 ; ATF; Checking ATF level .

3.3 Removing and installing radiator fan control unit - J293-

Removing

Note

Fit all cable ties in the original positions when installing.

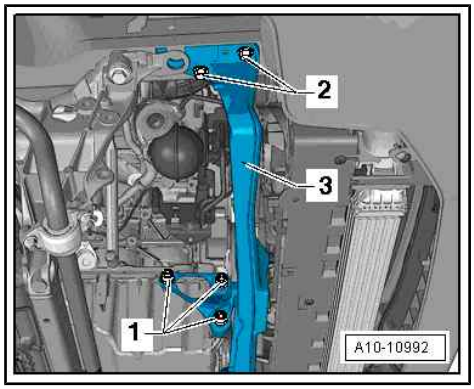
– Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

WARNING

Risk of injury as the radiator fans may start up automatically.

- ***Unplug electrical connectors before working in vicinity of radiator cowl.***

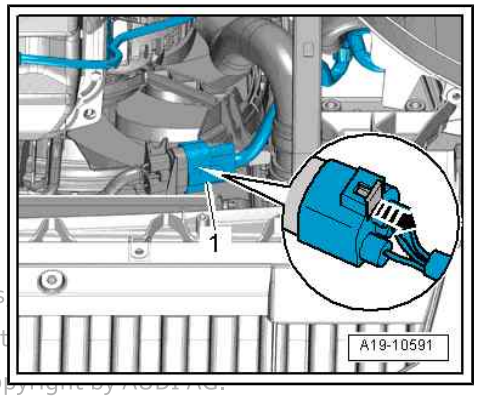
– On vehicles with cross member -3-, remove bolts -1- for torque reaction support.
– Remove bolts -2- from cross member -3- on both sides.



Note

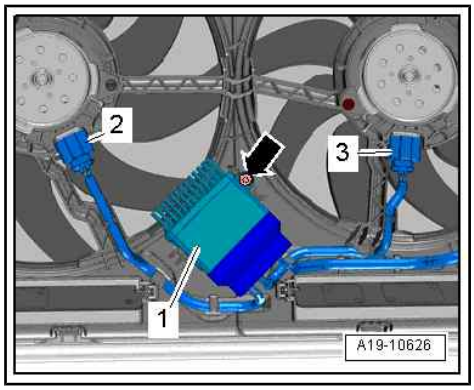
- *Due to the limited space available, the cross member cannot be removed.*
- *Cross member must only be detached; leave it in installation position.*

– Take electrical connector -1- for radiator fan out of bracket and unplug connector (push retainer to the rear -arrow- and press down release catch).
– Move clear electrical wiring harness leading to radiator fan control unit - J293- .



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– Unplug electrical connectors -2- and -3-.
– Unscrew bolt -arrow- and remove radiator fan control unit - J293- -1-.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

– If previously fitted, re-install cross member ⇒ “2.3 Removing and installing torque reaction support and cross member”, page 34 .

- Tightening torque ⇒ “3.1 Exploded view - radiator/radiator fans”, page 168

– Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

3.4 Removing and installing radiator fans

Removing

Note

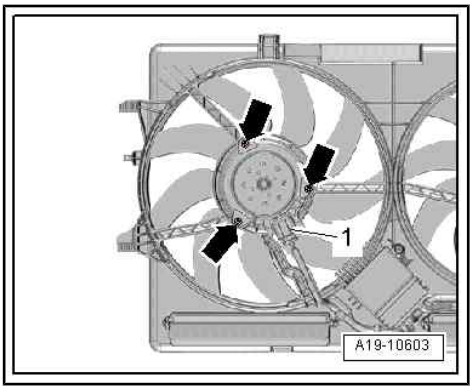
Fit all cable ties in the original positions when installing.

– Remove radiator cowl ⇒ page 169 .

Radiator fan - V7-

– Unplug electrical connector -1-.

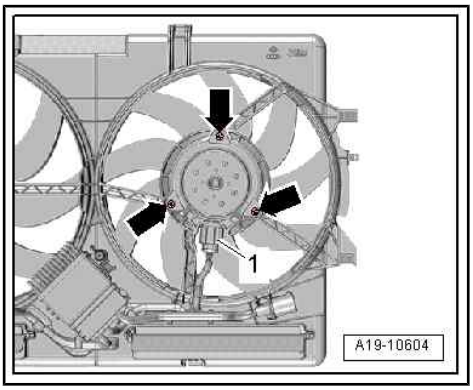
– Unscrew bolts -arrows- and remove radiator fan - V7- .



Radiator fan 2 - V177-

– Unplug electrical connector -1-.

– Unscrew bolts -arrows- and remove radiator fan 2 - V177- .



Installing

• Tightening torque ⇒ page 168

Installation is carried out in reverse sequence. When doing so, note the following:

– Install radiator cowl ⇒ page 169 .

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21 – Turbocharging/supercharging

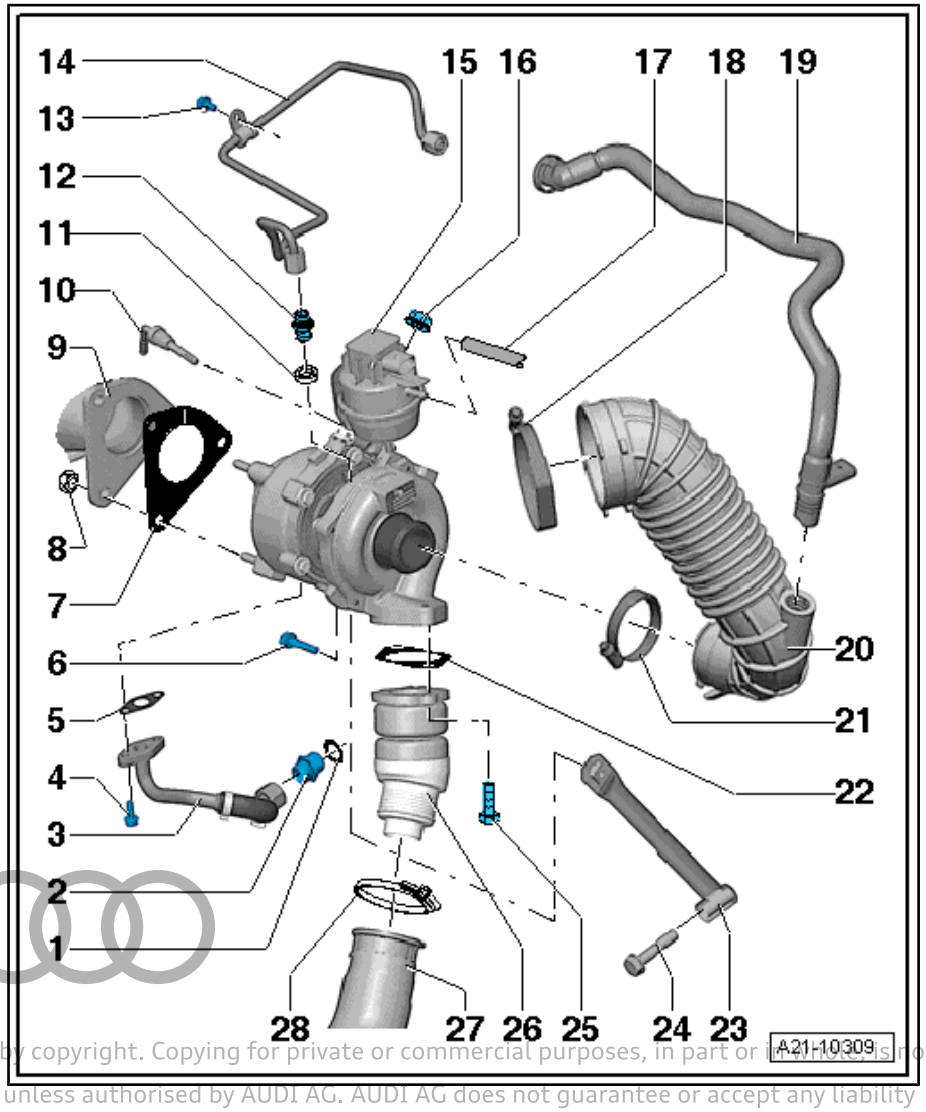
1 Turbocharger

⇒ “1.1 Exploded view - turbocharger”, page 178

⇒ “1.2 Removing and installing turbocharger”, page 179

1.1 Exploded view - turbocharger

– Observe rules for cleanliness ⇒ page 6 .



1 - Seal
- ❑ Renew

2 - Connection
- ❑ 40 Nm

3 - Oil return line
- ❑ To cylinder block
- ❑ Tighten union nut to 40 Nm

4 - Bolt
- ❑ Renew
- ❑ 15 Nm
- ❑ Property class 10.9; use only genuine bolts (same as original equipment) ⇒ Electronic parts catalogue

5 - Gasket
- ❑ Renew

6 - Bolt
- ❑ 20 Nm

7 - Gasket
- ❑ Renew

8 - Bolt
- ❑ 23 Nm
- ❑ Renew

9 - Particulate filter with catalytic converter
- ❑ Removing and installing ⇒ page 268

10 - Exhaust gas temperature sender 1 - G235-
- ❑ Removing and installing ⇒ page 273

11 - Seal
- ❑ Renew

12 - Connection
- ❑ 30 Nm

13 - Bolt
- ❑ 10 Nm

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14 - Oil supply line

- ❑ Tighten union nuts to 22 Nm

15 - Turbocharger

- ❑ Removing and installing ⇒ page 179

16 - Nut

- ❑ 25 Nm
- ❑ Securing turbocharger to exhaust manifold
- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

17 - Vacuum hose

- ❑ From charge pressure control solenoid valve - N75-

18 - Hose clip

- ❑ 3.5 Nm

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19 - Crankcase breather hose

20 - Air hose

21 - Hose clip

- ❑ 3.5 Nm

22 - Gasket

- ❑ Renew if damaged or leaking

23 - Support

24 - Bolt

- ❑ 40 Nm

25 - Bolt

- ❑ 10 Nm

26 - Connection

27 - Air hose to charge air cooler

28 - Hose clip

- ❑ 3.5 Nm

1.2 Removing and installing turbocharger

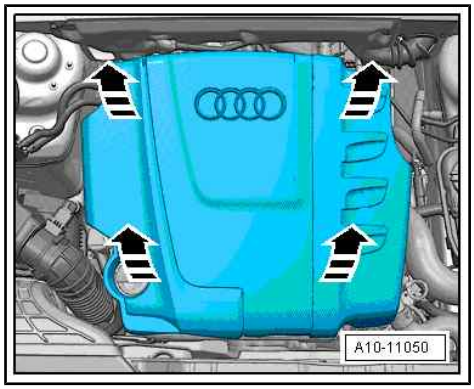
Removing

Caution

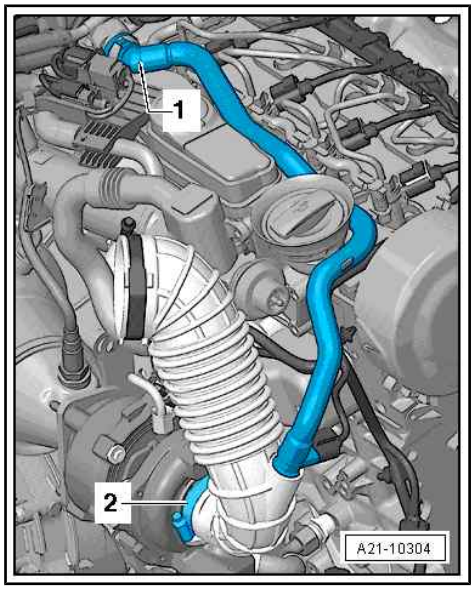
If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- *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.*

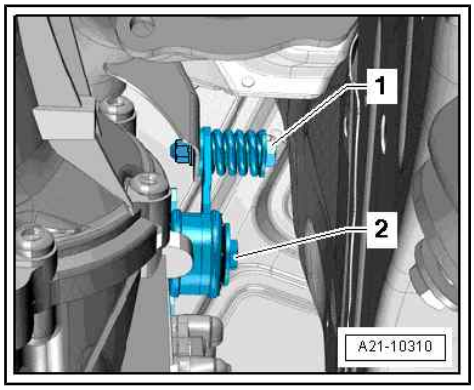
– Remove engine cover panel -arrows-.
– Remove air cleaner housing ⇒ page 212 .



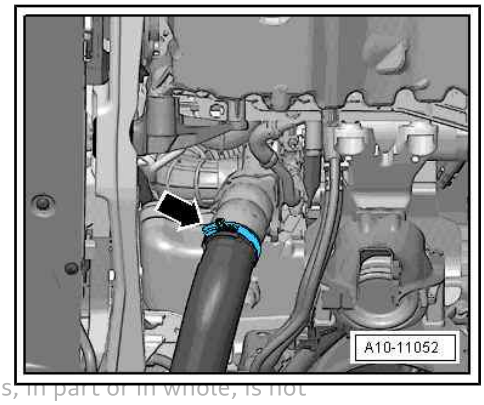
– Detach crankcase breather line -1- and move clear.
– Open hose clip -2-, detach air hose and remove.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Remove front exhaust pipe ⇒ page 263 .



– Unfasten connection -1-, remove bolt -2- and take out mounting for particulate filter.

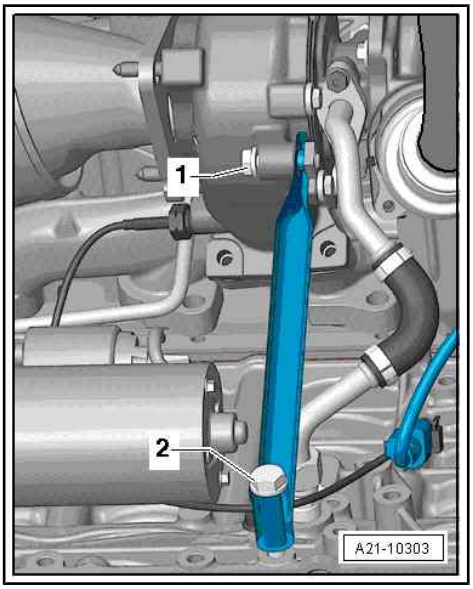


– Open hose clip -arrow-, detach air hose and swivel to side.

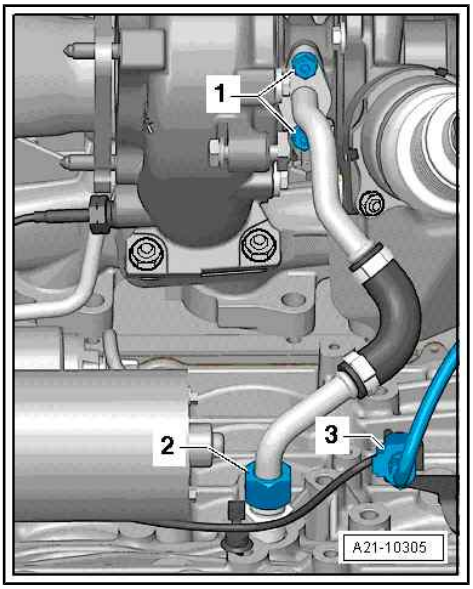


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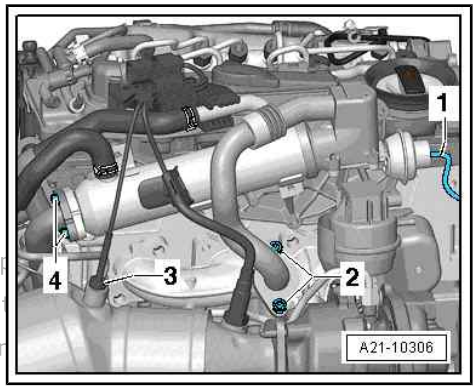
– Remove bolts -1- and -2- and remove support.



– Remove bolts -1-.
– Unplug electrical connector -3- for exhaust gas temperature sender 1 - G235- and unclip from bottom of cylinder block.



– Disconnect vacuum hose -1-.
– Remove bolts -2- and -4-.

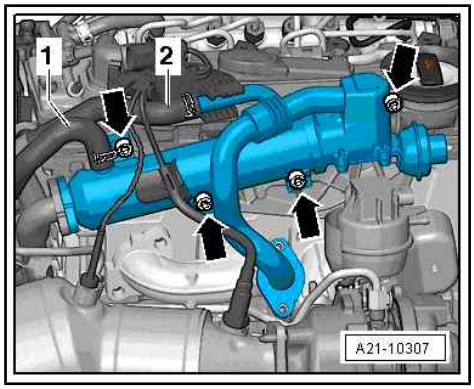


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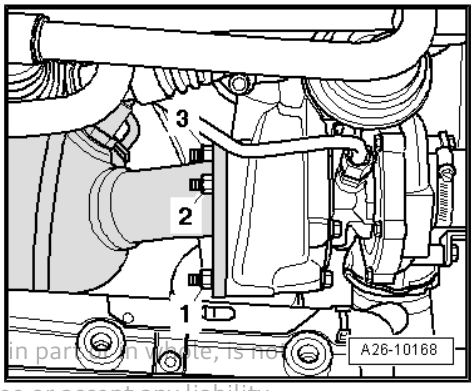
Note

Coolant hoses -1- and -2- must not be detached.

– Remove bolts -arrows- and tie up exhaust gas recirculation cooler.



– Remove nuts -1- and -2- on turbocharger.

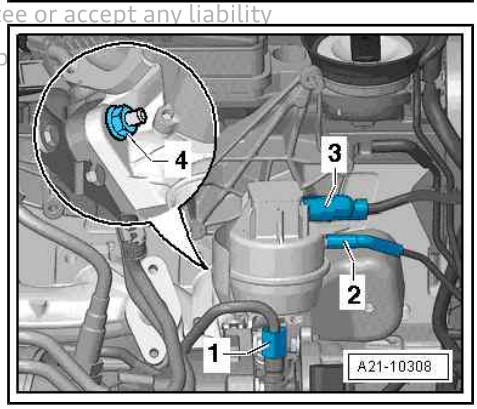


Note

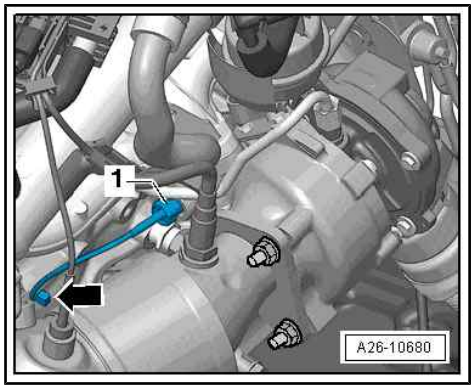
- *Nut -3- is removed later.*
- *Nut -1- is accessible from below on vehicles with auxiliary heater.*

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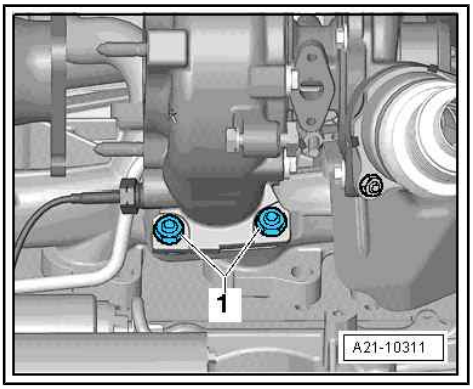
– Remove union nut -1-.
– Disconnect vacuum hose -2-.
– Unplug electrical connector -3- for position sender for charge pressure positioner - G581- .
– Remove nut -4- securing turbocharger to exhaust manifold.



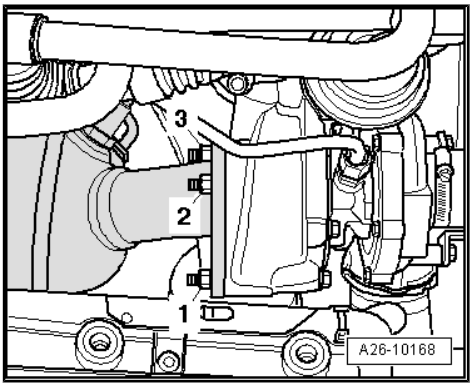
– Unclip electrical wiring from cylinder block -arrow-.



– Remove nuts -1-, pull turbocharger and particulate filter off studs and swivel to side as far as possible.



– Remove nut -3- and disconnect turbocharger from particulate filter.



Note

- *Seal off open pipes/lines and connections on turbocharger with clean plugs or protective caps to prevent dirt from entering.*
- *After removing the turbocharger, do not put it down so it rests on the top section of the oil return line – this could cause damage.*

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “1.1 Exploded view - turbocharger”, page 178

Tightening torques ⇒ “1.1 Exploded view - silencers”, page 261

Note

- *Renew gaskets, seals and O-rings.*
- *Fit all heat insulation sleeves in the original position when installing.*
- *Fill turbocharger with engine oil at connection for oil supply line.*
- *Hose connections and hoses for charge air system 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 .*
- *To secure the charge air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*
- *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.*

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2 Charge air system

⇒ “2.1 Exploded view - charge air system”, page 184

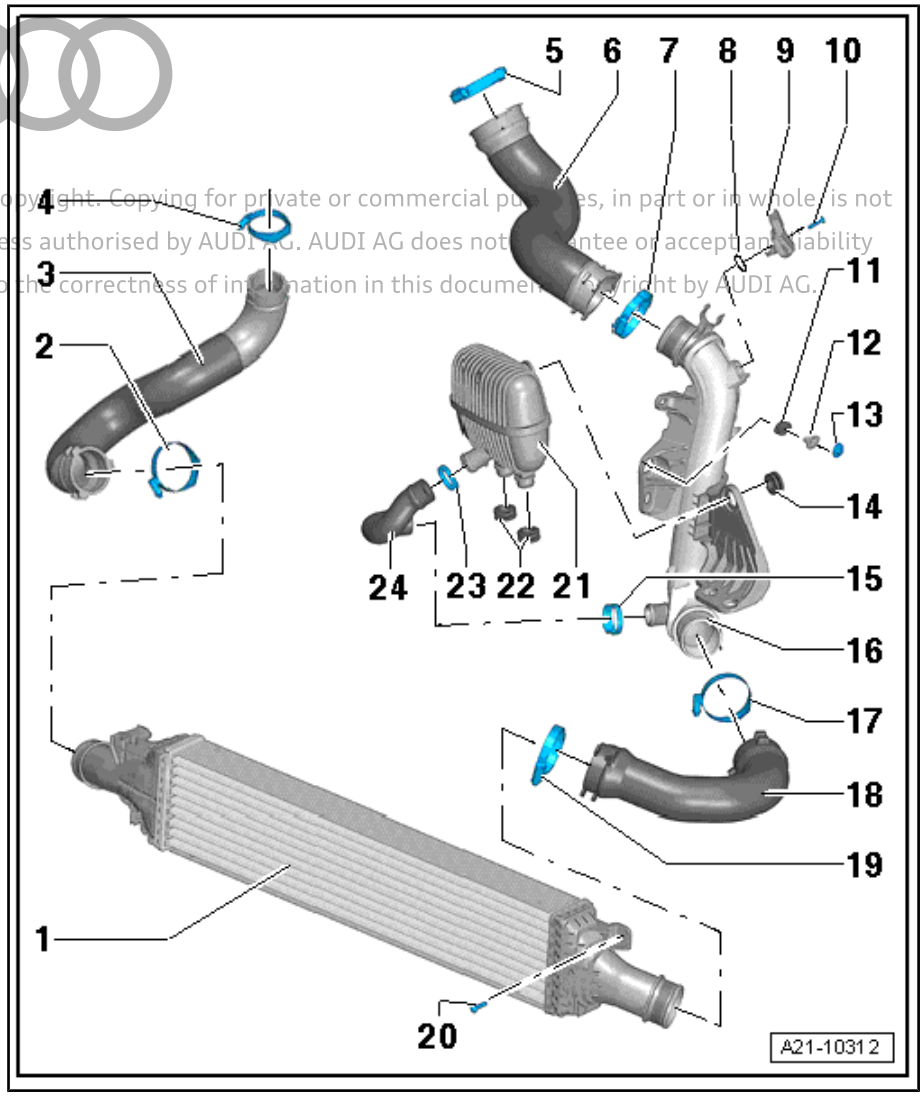
⇒ “2.2 Removing and installing charge air cooler”, page 185

⇒ “2.3 Removing and installing charge pressure sender G31 ”, page 188

⇒ “2.4 Checking charge air system for leaks”, page 188

2.1 Exploded view - charge air system

– Observe rules for cleanliness ⇒ page 6 .



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1 - Charge air cooler
- ❑ Removing and installing ⇒ page 185

2 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

3 - Air hose
- ❑ To turbocharger
- ❑ Must be free of oil and grease when installing

4 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

5 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

6 - Air hose
- ❑ To intake manifold
- ❑ Must be free of oil and grease when installing

7 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

8 - O-ring
- ❑ Renew

9 - Charge pressure sender - G31-
- ❑ Removing and installing ⇒ page 188

10 - Bolt
- ❑ 5 Nm

11 - Rubber grommet

12 - Bush

13 - Nut
- ❑ 9 Nm

14 - Rubber grommet

15 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

16 - Air pipe

17 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

18 - Air hose
- ❑ From charge air cooler
- ❑ Must be free of oil and grease when installing

19 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

20 - Bolt
- ❑ 7 Nm

21 - Resonator

22 - Rubber grommet

23 - Hose clip
- ❑ Reinforced
- ❑ 5.5 Nm

24 - Air hose
- ❑ To resonator
- ❑ Must be free of oil and grease when installing

2.2 Removing and installing charge air cooler

Removing

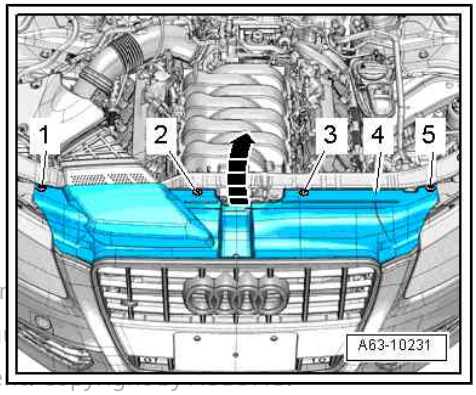
The following step is only required on allroad models:

– On allroad models: Remove bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

All vehicles except allroad models:

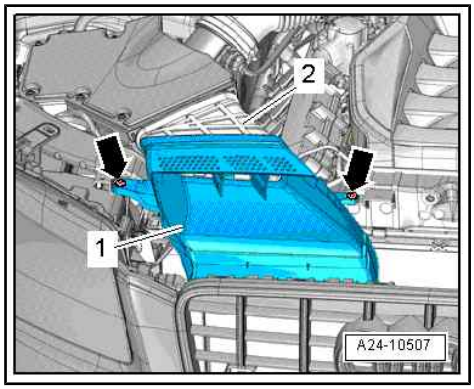
– Remove bolts -1, 2, 3, 5-.

– Lift cover -4- above lock carrier and detach from radiator grille -arrow-.

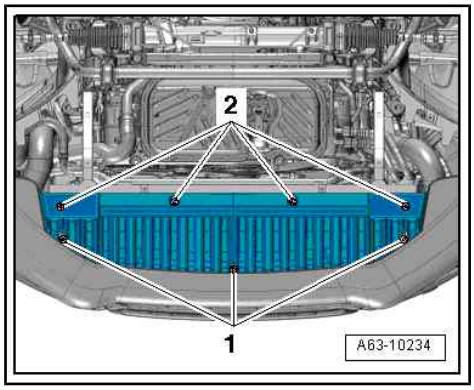


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– Remove bolts -arrows-.
– Detach air duct -1- from intermediate flange -2- for air cleaner housing.



– Remove closure plate at bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .

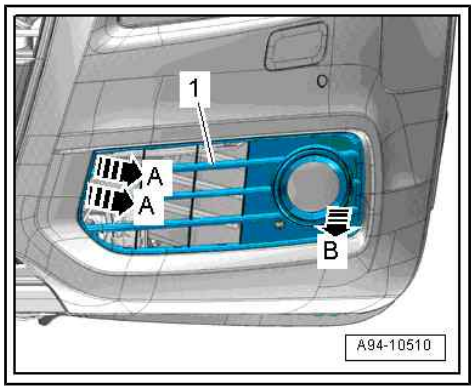


– Release retaining clips -arrows A- and detach air intake grille -1- on left and right from bottom section of bumper cover -arrow B-.

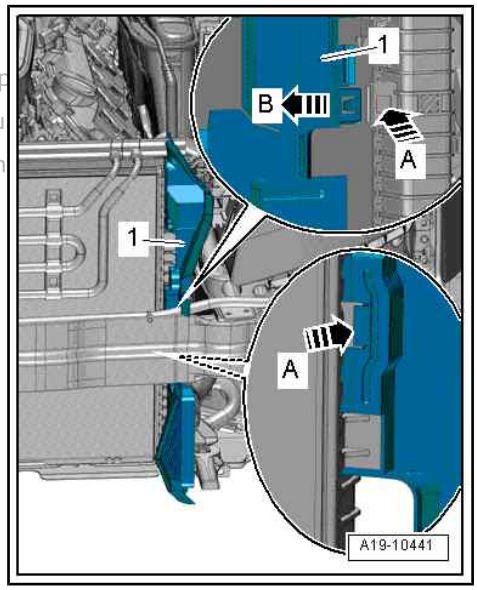
All vehicles:

Note

For illustration purposes, the installation position is shown in the following illustrations with the bumper removed.

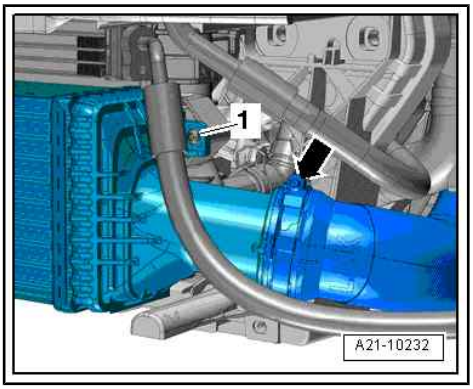


– Release catches -arrows A- and swivel air duct -1- on left and right to centre of vehicle -arrow B-.

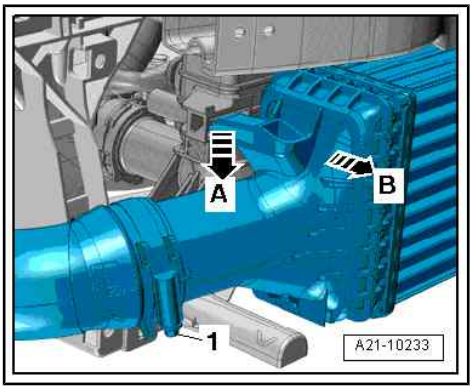


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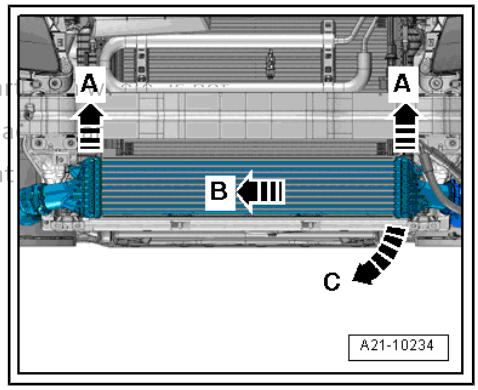
– Release hose clip -arrow- and detach air hose from charge air cooler.
– Remove bolt -1-.



– Release hose clip -1- and detach air hose from charge air cooler.
– Push catch down -arrow A- and move top of charge air cooler slightly in direction of -arrow B-.



– Lift charge air cooler off radiator -arrows A- and press in direction of -arrow B-.
– Pull left side of charge air cooler downwards -arrow C- and detach charge air cooler.



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Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques

♦ ⇒ “2.1 Exploded view - charge air system”, page 184

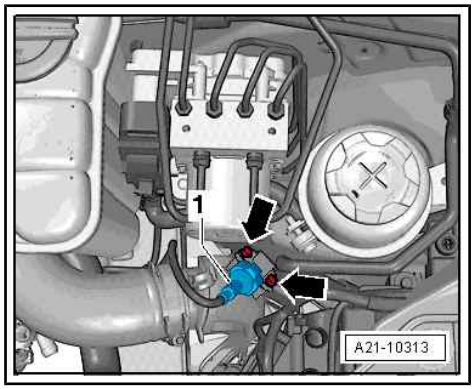
Note

♦ *Hose connections and hoses for charge air system 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 .*
♦ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Install lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .
– On allroad models: Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

2.3 Removing and installing charge pressure sender - G31-

Removing



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

– Remove bolts -arrows- and pull charge pressure sender - G31- out of air pipe.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

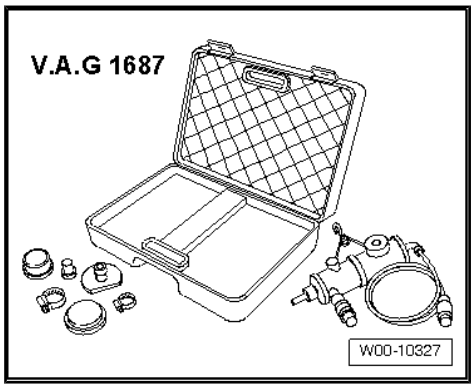
Tightening torques
⇒ “2.1 Exploded view - charge air system”, page 184

Note

Fit new O-ring.

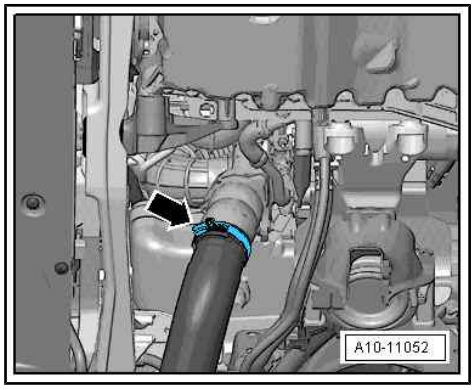
2.4 Checking charge air system for leaks

Special tools and workshop equipment required



♦ Charge air system tester - V.A.G 1687-

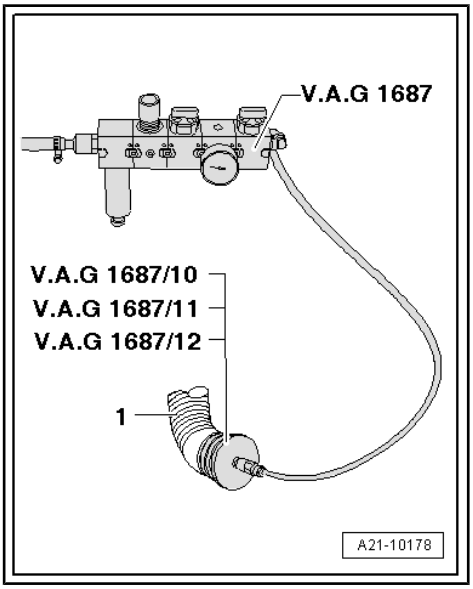
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



– Open hose clip -arrow-, detach air hose and swivel to side.

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– Depending on hose diameter, insert adapter - 1687/10- , -1687/11- or -1687/12- into air hose -1- and secure with hose clip.
– Connect charge air system tester - V.A.G 1687- as shown on illustration.

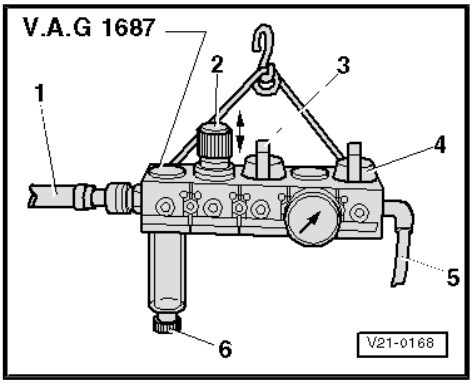


Prepare charge air system tester - V.A.G 1687- as follows:

– Unscrew pressure control valve -2- completely and close valves -3- and -4-.

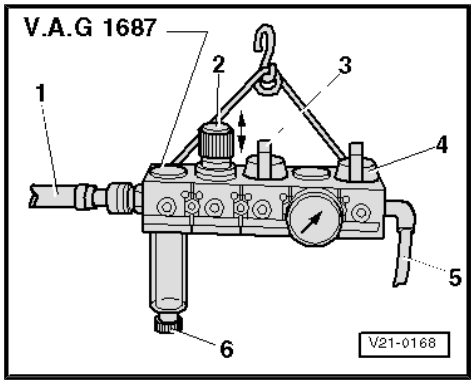
Note

Make sure knob is pulled out before turning pressure control valve -2-.



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– Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

– Open valve -3-.

Caution

Risk of damage if pressure is set too high.

- ***The pressure must not exceed 0.5 bar.***

– Adjust pressure to 0.5 bar via pressure control valve -2-.

– Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.

– Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detecting spray or use ultrasonic tester - V.A.G 1842- .

Note

- *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- *Operation of ultrasonic tester - V.A.G 1842- ⇒ Operating instructions .*
- *Release pressure in test circuit by detaching coupling from adapter before removing adapter.*
- *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 .*
- *To secure the air hoses properly at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*

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23 – Mixture preparation - injection

1 Injection system

⇒ “1.1 Overview of fitting locations - injection system”, page 191

⇒ “1.2 Overview - fuel system”, page 199

⇒ “1.3 Exploded view - fuel system”, page 201

⇒ “1.4 Filling and bleeding fuel system”, page 205

⇒ “1.5 Checking fuel system for leaks”, page 206

⇒ “1.6 Checking fuel pressure (low pressure) system”, page 206

1.1 Overview of fitting locations - injection system

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Components A to J are not shown on the exploded view.

1 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 251

2 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Fitting location ⇒ page 199
- ❑ Removing and installing ⇒ page 254

3 - Exhaust gas temperature sender 3 - G495-

- ❑ Fitting location ⇒ page 199
- ❑ Removing and installing ⇒ page 273

4 - Electrical connector for exhaust gas temperature sender 3 - G495-

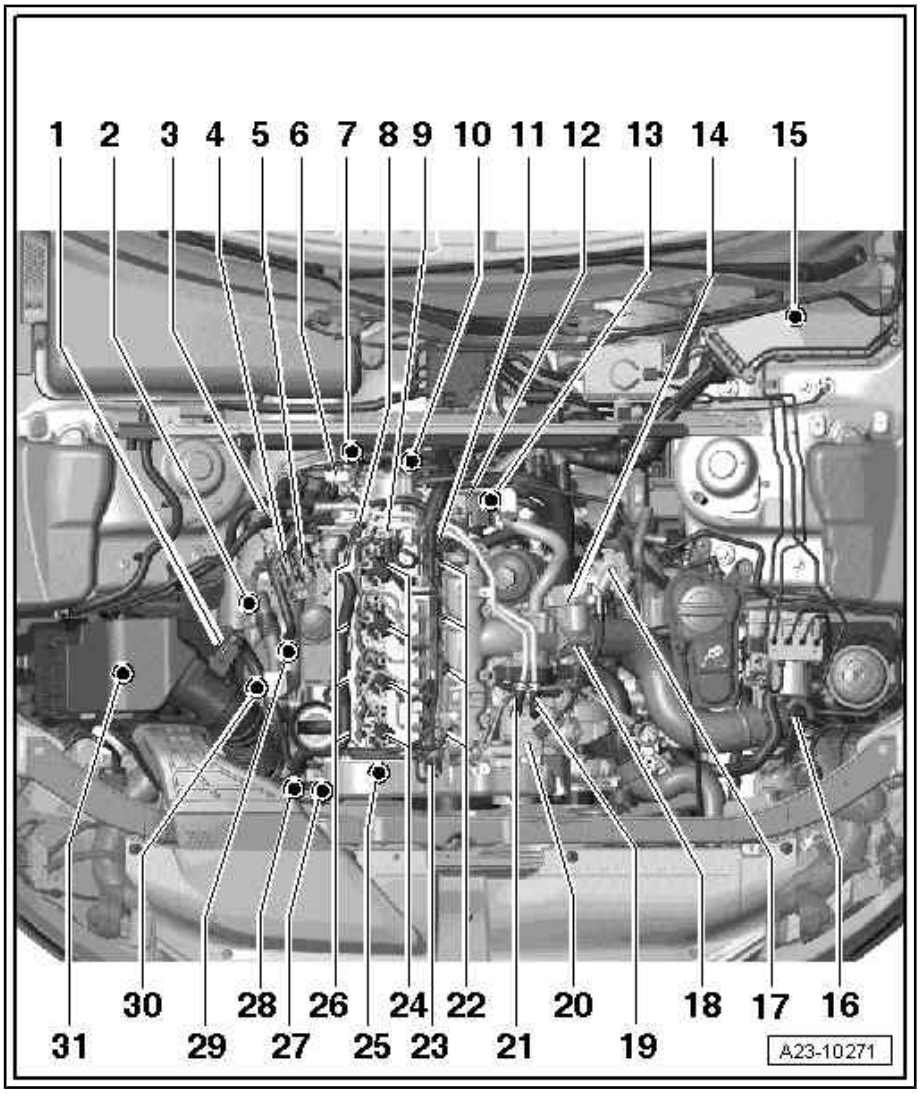
- ❑ Fitting location ⇒ page 199
- ❑ Removing and installing ⇒ page 273

5 - Connector for Lambda probe - G39-

- ❑ Fitting location ⇒ page 199

6 - Exhaust gas pressure sensor 1 - G450-

- ❑ Fitting location ⇒ page 196
- ❑ Adaption must be performed after renewing



this component

- ❑ Removing and installing ⇒ page 251

7 - Radiator outlet coolant temperature sender - G83-

- ❑ Fitting location ⇒ page 196
- ❑ Removing and installing ⇒ page 166

8 - Fuel temperature sender - G81-

- ❑ Fitting location ⇒ page 199

9 - Pressure retention valve

- ❑ Fitting location ⇒ page 199
- ❑ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines
- ❑ This residual pressure is required for the control function of the injectors
- ❑ The pressure retention valve may only be renewed together with the fuel return lines
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ❑ Checking pressure retention valve ⇒ page 228

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10 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ page 165

11 - Fuel pressure regulating valve - N276-

- ❑ Fitting location ⇒ page 197
- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , the learnt values must be reset. The procedure is described in `Guided Fault Finding` or `Guided Functions`; use ⇒ Vehicle diagnostic tester.
- ❑ Guided Functions are not available for certain engine versions because it is not necessary to reset the learned values on these engines.
- ❑ Removing and installing ⇒ page 246
- ❑ 80 Nm

12 - Variable intake manifold motor - V183-

- ❑ With variable intake manifold position sender - G513-
- ❑ Fitting location ⇒ page 197

13 - Engine speed sender - G28-

- ❑ Fitting location ⇒ page 196
- ❑ 4.5 Nm

14 - Intake manifold flap motor - V157-

- ❑ With throttle valve potentiometer - G69-
- ❑ Fitting location ⇒ page 195
- ❑ Exploded view - intake manifold ⇒ page 215

15 - Engine control unit - J623-

- ❑ Fitting location ⇒ page 194
- ❑ Removing and installing ⇒ page 256

16 - Charge pressure sender - G31-

- ❑ Combined with intake air temperature sender - G42-
- ❑ Fitting location ⇒ page 197
- ❑ Removing and installing ⇒ page 188

17 - Pump for exhaust gas recirculation cooler - V400-

- ❑ Fitting location ⇒ page 195

18 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

- ❑ Fitting location ⇒ page 195

19 - Fuel return line connection

20 - High-pressure pump with fuel metering valve - N290-

- Do not open fuel metering valve - N290-
- Removing and installing ⇒ page 241

21 - Fuel supply line connection

22 - Glow plugs

- Glow plug 1 - Q10-
- Glow plug 2 - Q11-
- Glow plug 3 - Q12-
- Glow plug 4 - Q13-
- Fitting location ⇒ page 197
- Removing and installing ⇒ page 292

23 - Fuel pressure sender - G247-

- Always renew after removing
- Fitting location ⇒ page 195
- Removing and installing ⇒ page 248
- 100 Nm

24 - Injectors

- Fitting location ⇒ page 197
- Removing and installing ⇒ page 229

25 - Hall sender - G40-

- Fitting location ⇒ page 196
- Removing and installing ⇒ page 295

26 - Fuel return lines

- The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve.
- After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system; then check fuel return lines for leaks

27 - Charge pressure control solenoid valve - N75-

- Fitting location ⇒ page 198

28 - Exhaust gas recirculation cooler change-over valve - N345-

- Fitting location ⇒ page 198

29 - Electrical connector for exhaust gas temperature sender 1 - G235-

- Fitting location ⇒ page 198

30 - Position sender for charge pressure positioner - G581-

- Fitting location ⇒ page 197

31 - Air filter bypass flap valve - N275-

- These components (bypass flap with air filter bypass flap valve - N275-) are not installed on certain equipment versions or on vehicles for certain export markets
- Exploded view - air cleaner housing ⇒ page 210

A - Relay and fuse holder in electronics box in plenum chamber (left-side)

- Fitting location ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

B - Low heat output relay - J359- and high heat output relay - J360-

- Fitting location ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

C - Brake light switch - F- and brake pedal switch - F47-

- Fitting location ⇒ page 195
- In footwell on brake pedal

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D - Clutch position sender - G476-

- ❑ Fitting location ⇒ page 195
- ❑ Only fitted on vehicles with manual gearbox

E - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ❑ Fitting location ⇒ page 195
- ❑ Removing and installing ⇒ Fuel supply system; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-

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F - Supplementary fuel pump - V393-

- ❑ Fitting location ⇒ page 196
- ❑ Removing and installing ⇒ Fuel supply system; Rep. gr. 20 ; Fuel pump; Removing and installing fuel pump

G - Exhaust gas temperature sender 1 - G235-

- ❑ Fitting location on turbocharger ⇒ page 198
- ❑ 45 Nm
- ❑ Removing and installing ⇒ page 273

H - Exhaust gas temperature sender 4 - G648-

- ❑ Fitting location ⇒ page 199
- ❑ 45 Nm
- ❑ Removing and installing ⇒ page 273

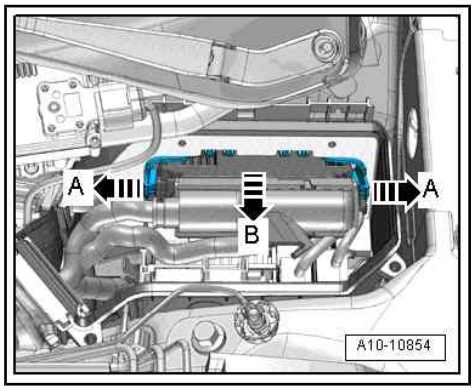
I - Electrical connector for exhaust gas temperature sender 4 - G648-

- ❑ Fitting location ⇒ page 199

J - Particulate filter

- ❑ Fitted on underbody
- ❑ Combined with catalytic converter
- ❑ Adaption must be performed after renewing this component
- ❑ Removing and installing ⇒ page 268

Adaption must be performed after renewing exhaust gas pressure sensor 1 - G450- and/or particulate filter. The adaption procedure is described in the Guided Functions; use ⇒ Vehicle diagnostic tester.



Fitting location of engine control unit - J623-

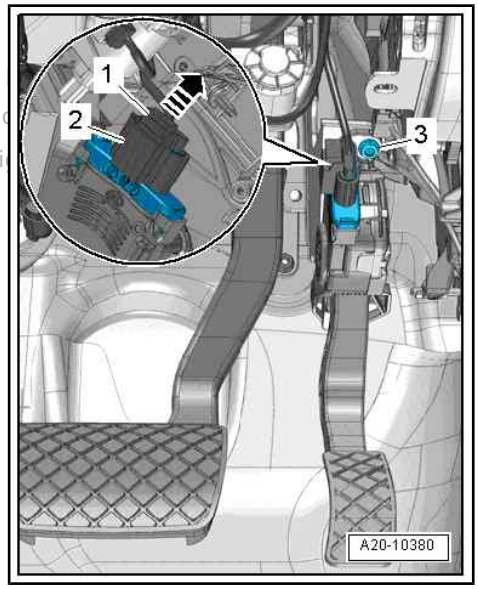
- ◆ In left electronics box in engine compartment

Removing and installing ⇒ page 257

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Accelerator position sender - G79- and accelerator position sender 2 - G185-

Removing and installing ⇒ Fuel supply system; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-



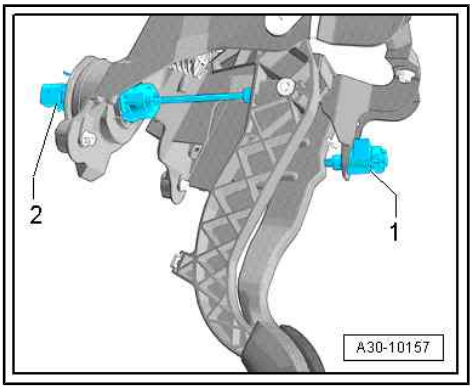
Note

The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.

Brake light switch - F- and brake pedal switch - F47- -1-

2 - Clutch position sender - G476-

Integrated functions: clutch pedal switch for engine start - F194- and clutch pedal switch - F36- (manual gearbox only)



Fitting locations

1 - Fuel pressure sender - G247-

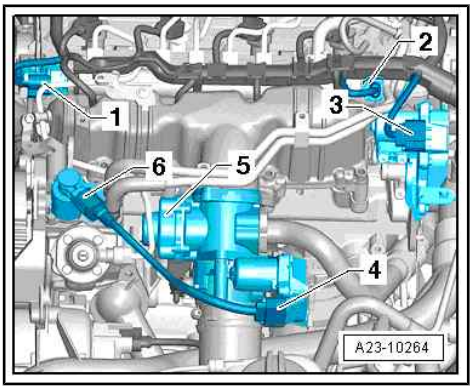
2 - Fuel pressure regulating valve - N276-

3 - Variable intake manifold motor - V183- with variable intake manifold position sender - G513-

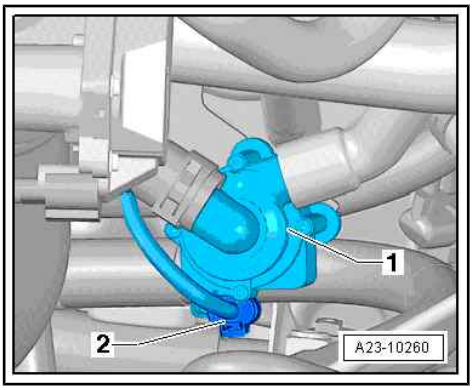
4 - Intake manifold flap motor - V157- with throttle valve potentiometer - G69-

5 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

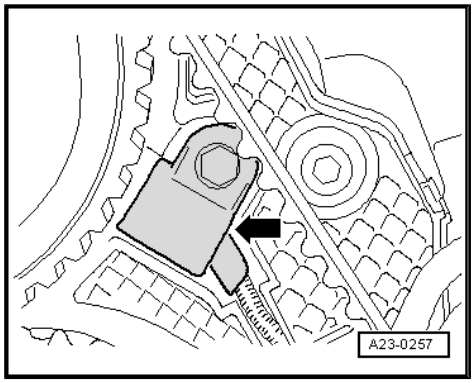
6 - Fuel metering valve - N290-



Pump for exhaust gas recirculation cooler - V400-



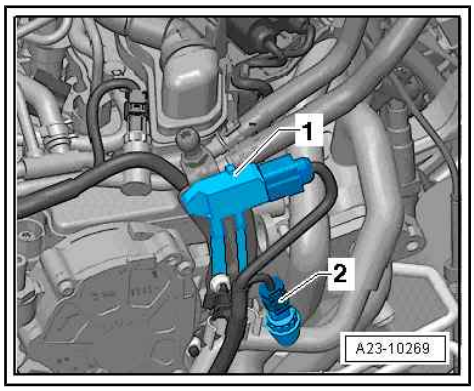
Hall sender - G40-



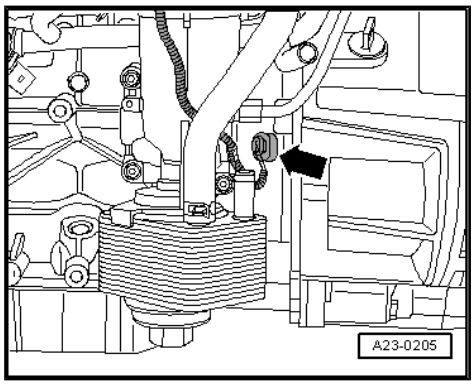
Components at rear of engine

1 - Exhaust gas pressure sensor 1 - G450-

2 - Radiator outlet coolant temperature sender - G83-



Engine speed sender - G28- -arrow-



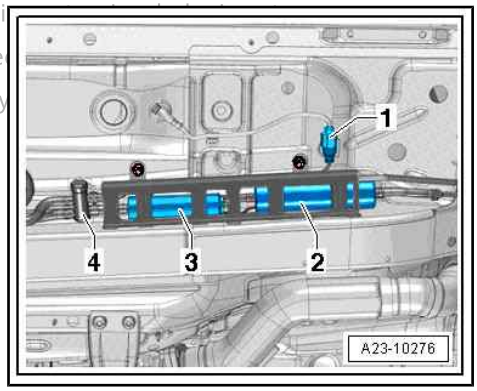
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Supplementary fuel pump - V393- -3-

1 - Electrical connector for supplementary fuel pump - V393-

2 - Fuel filter

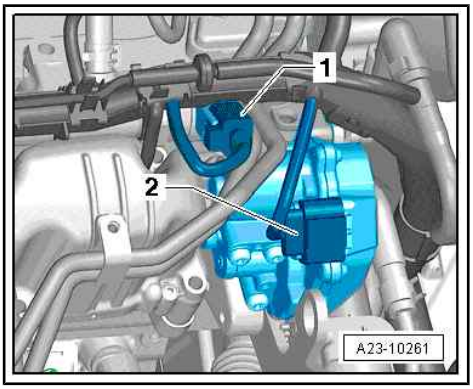
4 - Preheating valve



Components

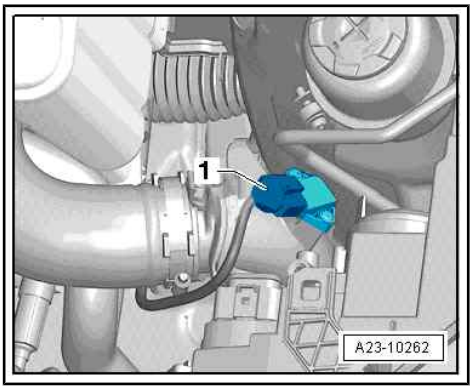
1 - Fuel pressure regulating valve - N276-

2 - Variable intake manifold motor - V183-

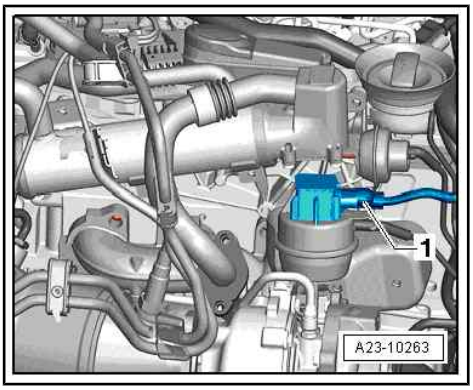


Charge pressure sender - G31- with intake air temperature sender - G42- -1-

Combined in one unit



Position sender for charge pressure positioner - G581- -1-



Injectors and glow plugs

1 - Injector, cylinder 1 - N30-

2 - Injector, cylinder 2 - N31-

3 - Injector, cylinder 3 - N32-

4 - Injector, cylinder 4 - N33-

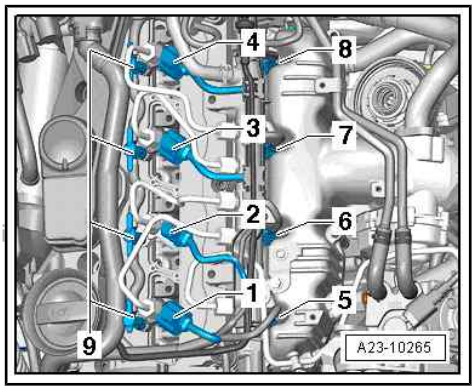
5 - Glow plug 1 - Q10-

6 - Glow plug 2 - Q11-

7 - Glow plug 3 - Q12-

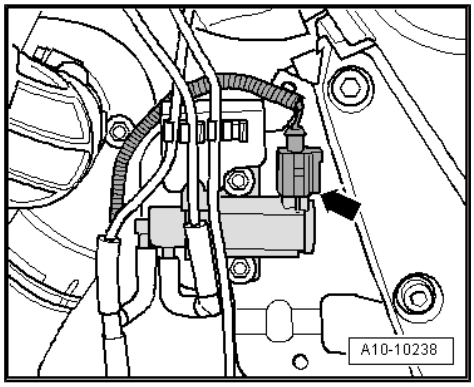
8 - Glow plug 4 - Q13-

9 - Fuel return line connections

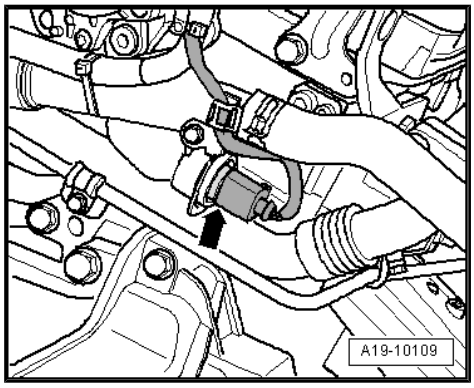


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Charge pressure control solenoid valve - N75- -arrow-



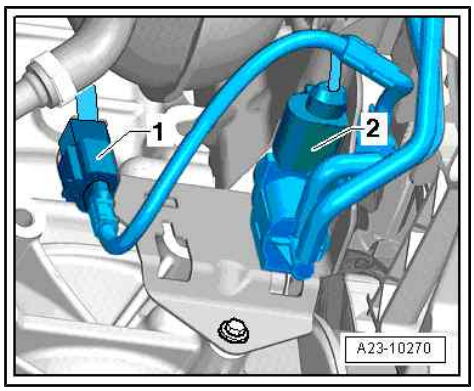
Coolant temperature sender - G62- -arrow-



Components

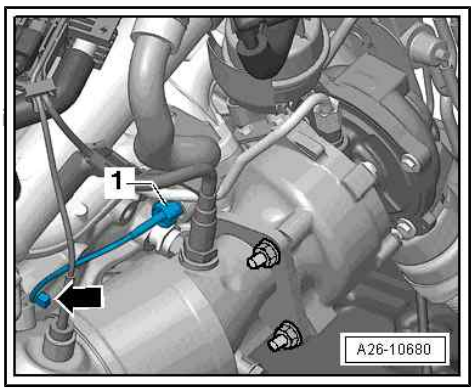
1 - Electrical connector for exhaust gas temperature sender 1 - G235-

2 - Exhaust gas recirculation cooler change-over valve - N345-



Exhaust gas temperature sender 1 - G235- -1-

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Components

1 - Electrical connector for Lambda probe - G39- with Lambda probe heater - Z19-

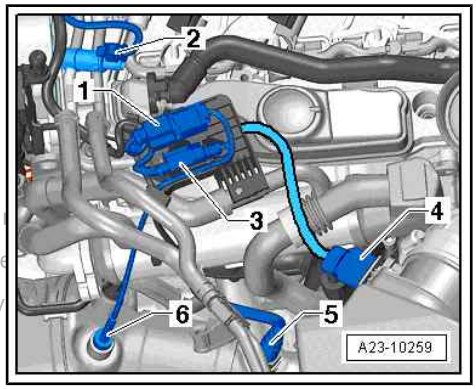
2 - Fuel temperature sender - G81-

3 - Electrical connector for exhaust gas temperature sender 3 - G495-

4 - Air mass meter - G70-

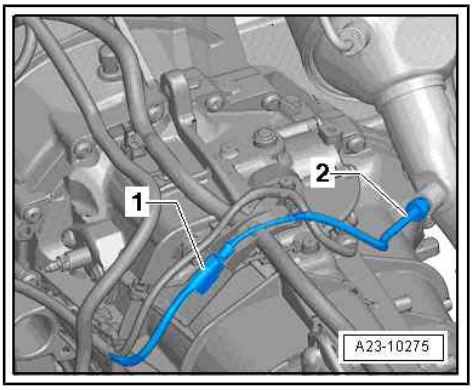
5 - Lambda probe - G39- with Lambda probe heater - Z19-

6 - Exhaust gas temperature sender 3 - G495-



Exhaust gas temperature sender 4 - G648- -2-

1 - Electrical connector for exhaust gas temperature sender 4 - G648-



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1.2 Overview - fuel system

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.*

Caution

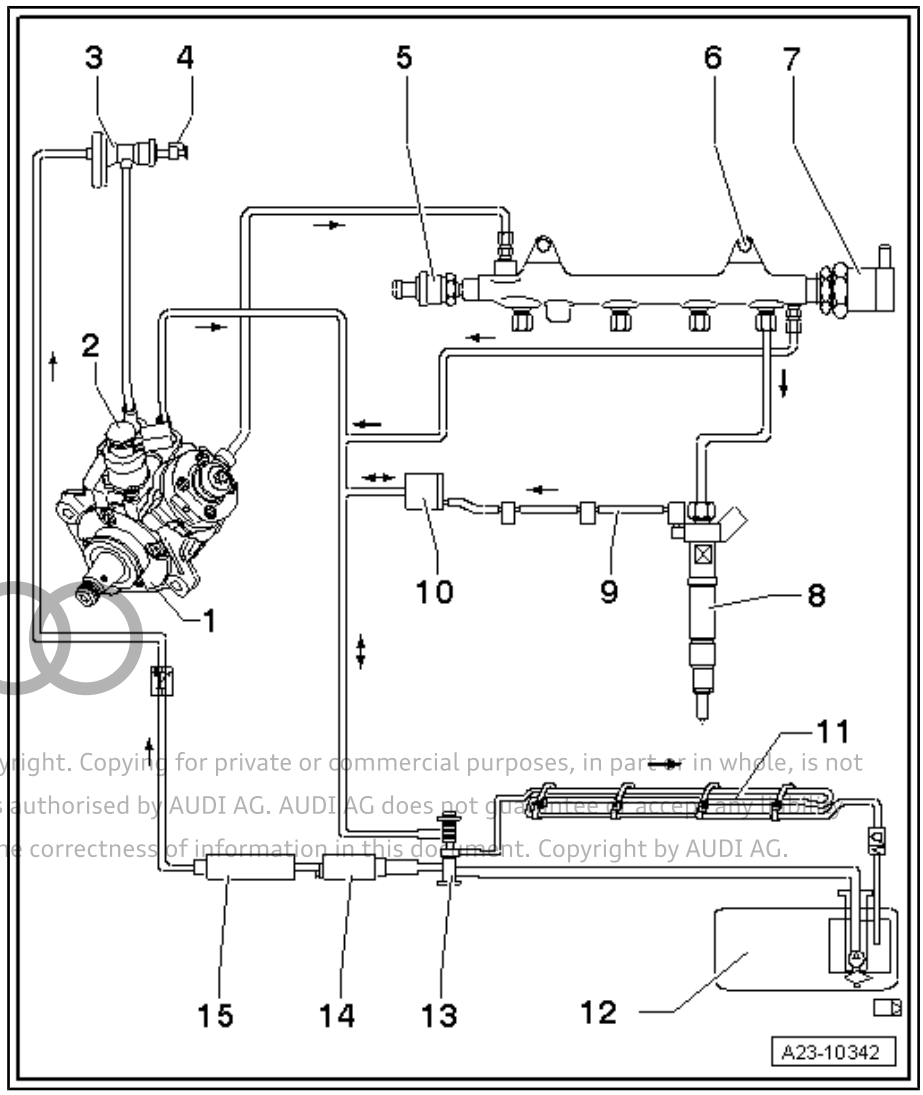
To prevent the high-pressure fuel pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:

- *If components of the fuel system between the fuel tank and the high-pressure fuel pump are removed or renewed, the first fuel filling must be performed.*
- *If a fuel pump, fuel line (between fuel tank and high-pressure fuel pump) or fuel filter is removed or renewed, the fuel system must be bled before the engine is started for the first time.*
- *If the high-pressure fuel 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 205

Note

The high-pressure pump will be damaged if the first fuel filling operation is not performed.



1 - High-pressure fuel pump

- ❑ After renewing, first fuel filling operation MUST be performed (it is important not to allow pump to run while it is still empty) ⇒ page 243
- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , the learnt values must be reset. The procedure is described in Guided Fault Finding or Guided Functions; use ⇒ Vehicle diagnostic tester.
- ❑ Guided Functions are not available for certain engine versions because it is not necessary to reset the learned values on these engines.
- ❑ Removing and installing ⇒ page 241

2 - Fuel metering valve - N290-

- ❑ Do not unscrew

3 - Filter strainer

4 - Fuel temperature sender - G81-

5 - Fuel pressure sender - G247-

- ❑ Always renew after re-

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moving

- ❑ 100 Nm
- ❑ Removing and installing ⇒ page 248

6 - Fuel rail

7 - Fuel pressure regulating valve - N276-

- ❑ Cannot be re-installed
- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , the learnt values must be reset. The procedure is described in Guided Fault Finding or Guided Functions; use ⇒ Vehicle diagnostic tester.
- ❑ Guided Functions are not available for certain engine versions because it is not necessary to reset the learned values on these engines.
- ❑ Removing and installing ⇒ page 246
- ❑ 80 Nm

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8 - Injectors

- ❑ Removing and installing ⇒ page 229

9 - Fuel return lines

- ❑ The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system; then check fuel return line for leaks

10 - Pressure retention valve

- ❑ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- ❑ This residual pressure is required for the control function of the injectors
- ❑ The pressure retention valve may only be renewed together with the fuel return lines
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ❑ Checking pressure retention valve ⇒ page 228

11 - Fuel cooler

- ❑ Fitted on underbody

12 - Fuel tank

- ❑ With fuel system pressurisation pump - G6-

13 - Preheating valve

14 - Supplementary fuel pump - V393-

15 - Fuel filter

- ❑ Fuel filter - exploded view ⇒ Fuel supply system; Rep. gr. 20 ; Fuel filter; Exploded view - fuel filter
- ❑ Renewing fuel filter ⇒ Fuel supply system; Rep. gr. 20 ; Fuel filter; Removing and installing fuel filter

1.3 Exploded view - fuel system

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.*

Caution

To prevent the high-pressure fuel pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:

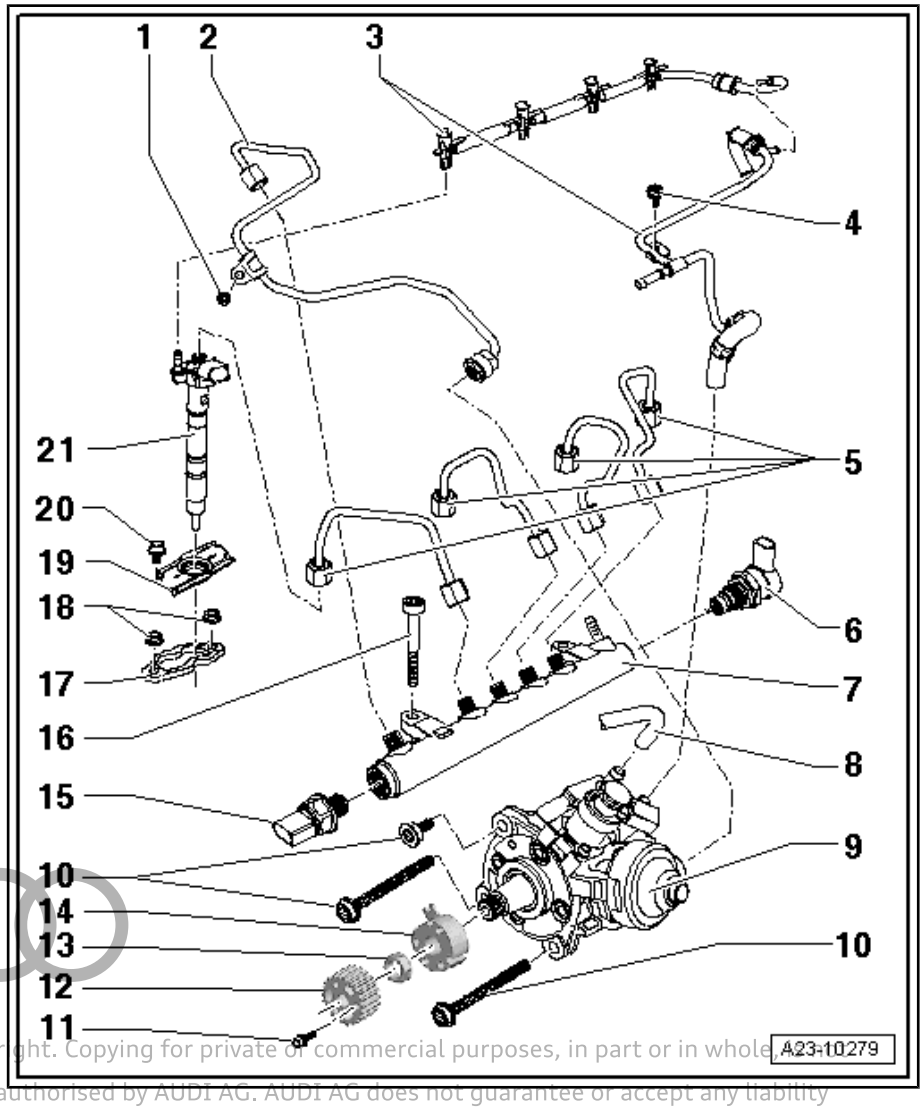
- *If components of the fuel system between the fuel tank and the high-pressure fuel pump are removed or renewed, the first fuel filling must be performed.*
- *If a fuel pump, fuel line (between fuel tank and high-pressure fuel pump) or fuel filter is removed or renewed, the fuel system must be bled before the engine is started for the first time.*
- *If the high-pressure fuel 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 205*

Note

The high-pressure pump will be damaged if the first fuel filling operation is not performed.

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1 - Bolt

- ❑ 10 Nm

2 - High-pressure pipe

- ❑ 25 Nm
- ❑ Between high-pressure pump and fuel rail

3 - Fuel return lines

- ❑ To fuel tank
- ❑ Fuel return line must not be kinked, damaged or clogged
- ❑ The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve
- ❑ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines
- ❑ This residual pressure is required for the control function of the injectors
- ❑ Checking pressure retention valve ⇒ page 228
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system; then check fuel return lines for leaks

4 - Bolt

- ❑ 10 Nm

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5 - High-pressure pipes

- ❑ 25 Nm
- ❑ Between fuel rail and injectors
- ❑ Do not interchange
- ❑ Install free of stress
- ❑ Installing high-pressure pipes ⇒ page 236

6 - Fuel pressure regulating valve - N276-

- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , the learnt values must be reset. The procedure is described in `Guided Fault Finding` or `Guided Functions`; use ⇒ Vehicle diagnostic tester.
- ❑ Guided Functions are not available for certain engine versions because it is not necessary to reset the learned values on these engines.
- ❑ Cannot be re-installed
- ❑ Remove and install using open-end spanner insert, 30 mm - T10553-
- ❑ Removing and installing ⇒ page 246
- ❑ 80 Nm

7 - Fuel rail

- ❑ Removing and installing ⇒ page 238

8 - Fuel supply line

9 - High-pressure pump

- ❑ With fuel metering valve - N290- (do not open)
- ❑ After renewing, first fuel filling operation MUST be performed (it is important not to allow pump to run while it is still empty) ⇒ page 243
- ❑ After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , the learnt values must be reset. The procedure is described in `Guided Fault Finding` or `Guided Functions`; use ⇒ Vehicle diagnostic tester.
- ❑ Guided Functions are not available for certain engine versions because it is not necessary to reset the learned values on these engines.
- ❑ Removing and installing ⇒ page 241

10 - Bolt

- ❑ Renew
- ❑ 20 Nm
- ❑ Turn long bolts 180° further
- ❑ Turn short bolts 45° further

11 - Bolt

- ❑ 20 Nm

12 - Toothed belt sprocket for high-pressure pump

13 - Nut

- ❑ 95 Nm

14 - Hub

- ❑ With sender wheel
- ❑ Use counterhold tool - T10051- to loosen and tighten
- ❑ To remove, use puller - T40064-

15 - Fuel pressure sender - G247-

- ❑ Always renew after removing
- ❑ 100 Nm
- ❑ Removing and installing ⇒ page 248

16 - Bolt

- ❑ 22 Nm

17 - Clamping piece

- ❑ Renew

18 - Hexagon flange nut

- ❑ For clamping piece
- ❑ 10 Nm

19 - Cover for injector

20 - Bolt

- ❑ 5 Nm

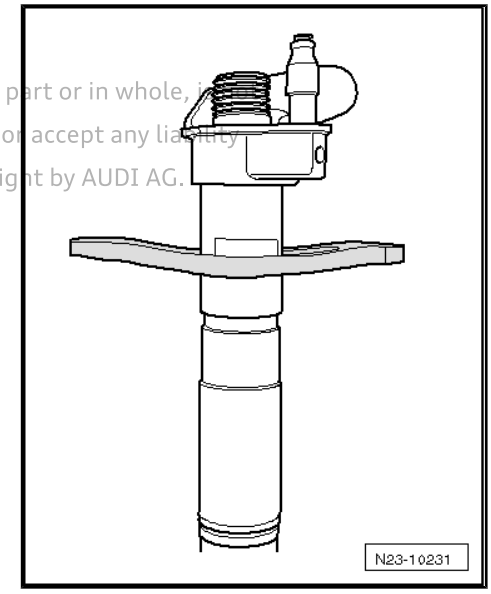
21 - Injector

- ❑ Use a coloured pen to mark injectors and corresponding high-pressure pipes and 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 229

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Installation position of clamping piece

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1.4 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 fuel system with fuel:

• Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.

– Connect vehicle diagnostic tester .

– Select `Self diagnosis` mode in ODIS.

– Select `Start self diagnosis`.

– Wait until the system is fully ready.

– Select the control unit `01 - Engine electronics`.

– Select self-diagnosis function `Basic setting`.

– From the list of basic settings, select `Transfer Fuel Pump (FP) test` and click on `>` to add it to the selection list.

– Select the basic setting in the list again.

– Select `Start/Stop` to start or stop the basic setting process.

– The fuel pump starts running.

– The fuel pump must run for approx. 3 minutes 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.
– Interrogate event memory.

1.5 Checking fuel system for leaks

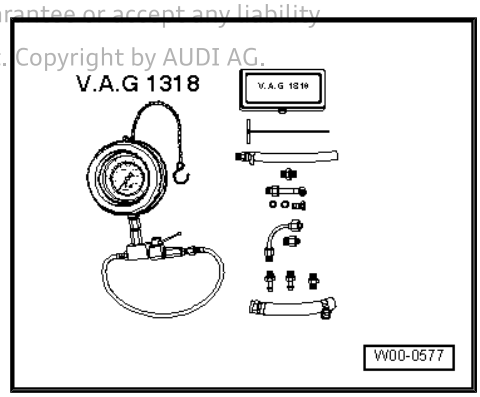
– Allow engine to run for several minutes at moderate rpm.
– Switch off ignition.
– Check complete fuel system for leaks.
– If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
– Road-test vehicle and accelerate with full throttle at least once.
– Then check high-pressure system again for leaks.

1.6 Checking fuel pressure (low pressure) system

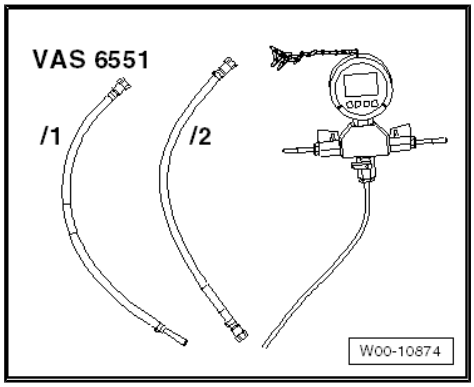
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Special tools and workshop equipment required

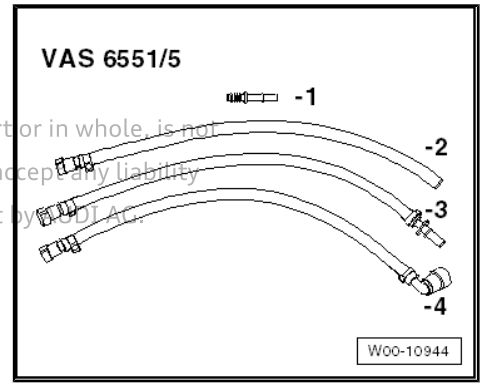
♦ K-Jetronic pressure tester - V.A.G 1318-



♦ Or pressure tester (diesel) - VAS 6551-



♦ Adapter set - VAS 6551/5-



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Test conditions:

- Battery voltage at least 12.5 V
- Fuel filter OK.
- Fuel tank at least $^1/_2$ full
- Ignition switched off.

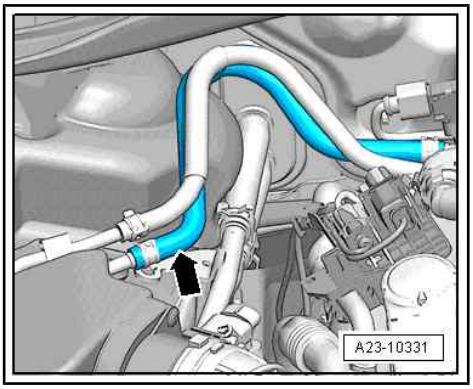
Checking residual pressure

– Remove engine cover panel ⇒ page 38 .

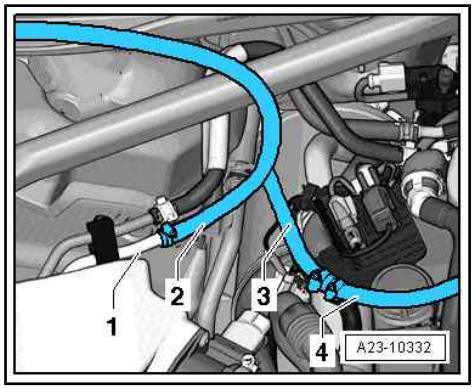
WARNING

- *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.*
- *To reduce the pressure in the fuel system, wrap a clean cloth around the connection and carefully loosen the connection.*

– Disconnect fuel supply line -arrow- at connection point.



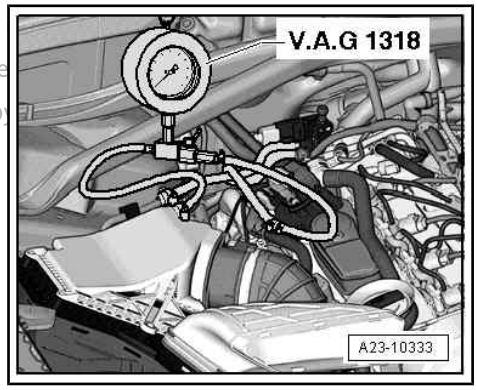
– Connect K-Jetronic pressure tester - V.A.G 1318- or pressure tester (diesel) - VAS 6551- to fuel supply line -1- with suitable adapter -2-. Connect other adapter -4- of pressure tester to fuel supply line -3-.



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Note

In this way the K-Jetronic pressure tester - V.A.G 1318- or pressure tester (diesel) - VAS 6551- is connected into the fuel supply line.



– Connect a ⇒ Vehicle diagnostic tester.
– Switch on ignition.
– Select `Self diagnosis` mode in ODIS.
– Select `Start self diagnosis`.
– Wait until the system is fully ready.
– Select the control unit `01 - Engine electronics`.
– Select self-diagnosis function `Basic setting`.
– From the list of basic settings, select `Transfer Fuel Pump (FP) test` and click on `>` to add it to the selection list.
– Select the basic setting in the list again.
– Select `Start/Stop` to start or stop the basic setting process.
– Let fuel pumps run until maximum fuel pressure has built up.

• Specification: at least 3.5 bar

If specification is not obtained:

Check union between pressure tester and fuel line for leaks.

Check pressure tester for leaks.

Check fuel lines and their connections for leaks.

Fuel filter is blocked.

Check delivery rate of fuel pump ⇒ Fuel supply system; Rep. gr. 20 ; Fuel pump; Checking fuel system pressurisation pump - G6- .

Note

Check fuel system for leaks.

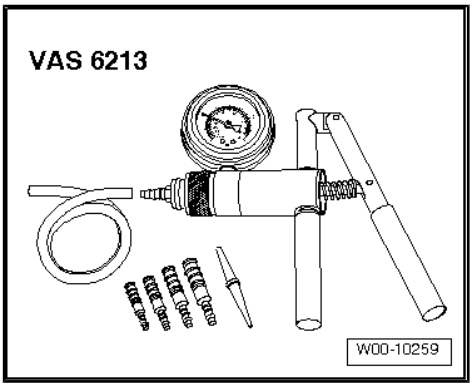
2 Vacuum system

⇒ “2.1 Checking vacuum system”, page 209

2.1 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



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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 all vacuum lines leading to the corresponding component, and also check the remaining vacuum lines leading to other components.

– If it is not possible to build up pressure with the hand vacuum pump - VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

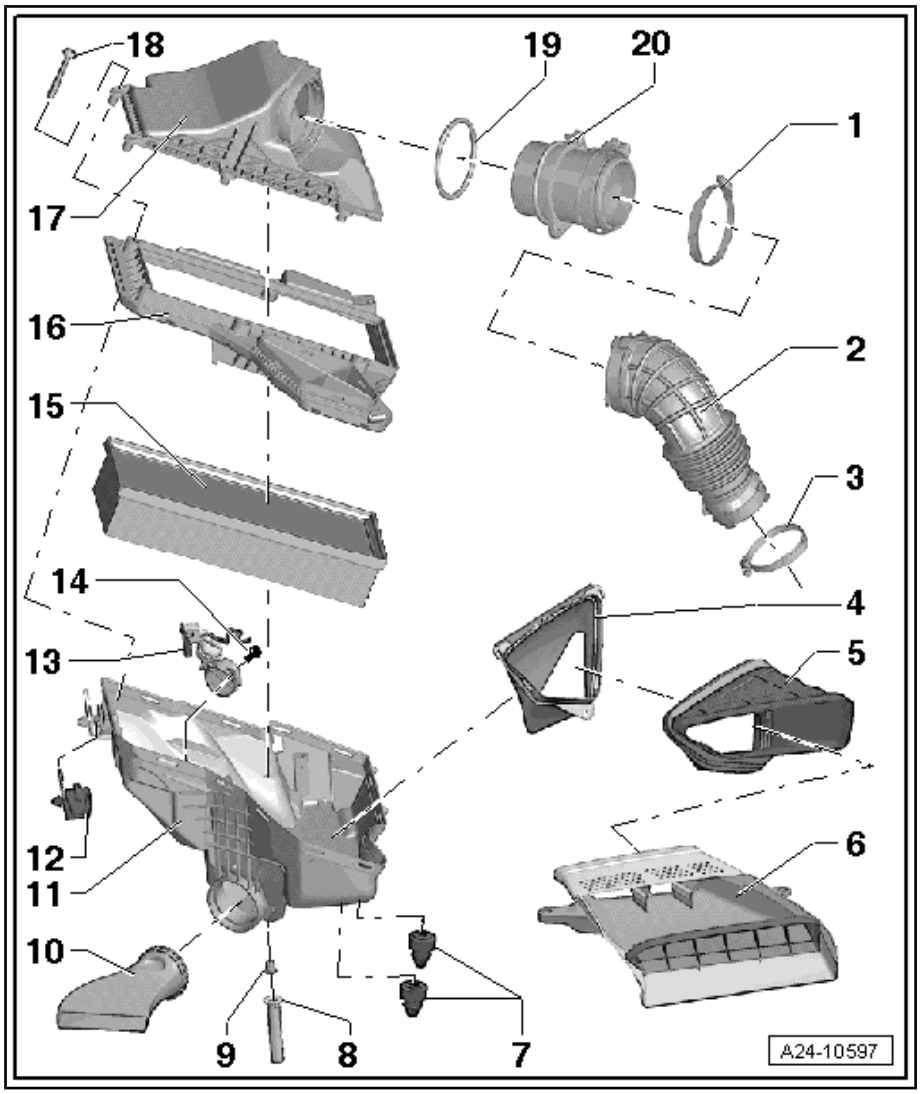
3 Air cleaner

⇒ “3.1 Exploded view - air cleaner housing”, page 210

⇒ “3.2 Removing and installing air filter element”, page 211

⇒ “3.3 Removing and installing air cleaner housing”, page 212

3.1 Exploded view - air cleaner housing



1 - Hose clip

- ❑ 3.5 Nm

2 - Air hose

3 - Hose clip

- ❑ 3.5 Nm

4 - Air duct

- ❑ Clipped into air cleaner housing
- ❑ Clean dirt and leaves out of air duct

5 - Air duct

- ❑ Clean dirt and leaves out of air duct

6 - Air duct

- ❑ Secure to lock carrier (2 Nm)
- ❑ Clean dirt and leaves out of air duct

7 - Rubber grommet

8 - Water drain hose

- ❑ Clean any leaves and dirt out of water drain hose (important)

9 - Guide for water drain hose

10 - Hot air intake (countries with cold climates only)

- ❑ Slide hot air intake into air cleaner as far as stop; then turn clockwise until it engages no-

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ticeably

11 - Air cleaner (bottom section)

- ❑ Clean any salt residue, leaves and dirt out of air cleaner (bottom section)
- ❑ Check for dirt in water drain and clean as required (important)

12 - Retainer for air cleaner (bottom section)

- ❑ Must engage positively
- ❑ Do not use any lubricants

13 - Air filter bypass flap valve - N275-

- ❑ With flap for variable intake manifold change-over

14 - Bolt

- ❑ For air filter bypass flap valve - N275-

15 - Air filter element

- ❑ Always use a genuine Audi air filter element
- ❑ For maintenance intervals refer to A4 ⇒ Maintenance ; Booklet 812 , or A5 Coupé ⇒ Maintenance ; Booklet 811
- ❑ Removing and installing ⇒ page 211
- ❑ Also clean snow screen (if fitted)

16 - Frame insert for air cleaner (bottom section)

17 - Air cleaner (top section)

- ❑ Clean any salt residue, leaves and dirt out of air cleaner (top section)

18 - Bolt

19 - O-ring

- ❑ Renew if damaged

20 - Air mass meter

- ❑ Removing and installing air mass meter - G70- ⇒ page 251

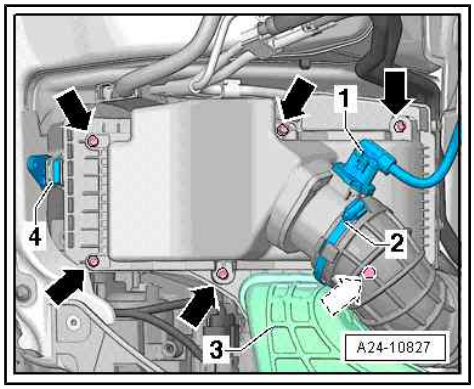
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3.2 Removing and installing air filter element

Removing

– Unplug electrical connector -1- at air mass meter - G70- .

– Open hose clip -2- on air hose leading to turbocharger and disconnect hose at air mass meter - G70- .
– Remove all bolts -arrows- from air cleaner (top section) and lift out air cleaner (top section).
– Take out old air filter element.



Installing

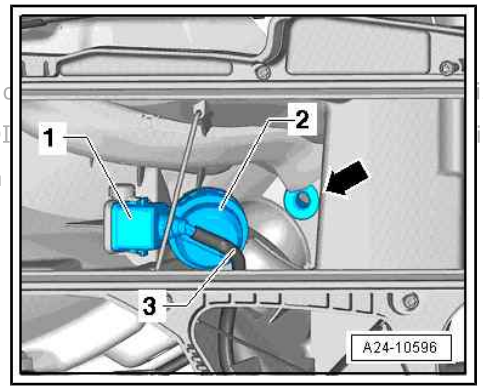
To ensure the correct function of the air mass meter - G70- , it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter - G70- and falsify the detected air mass values. This will cause a loss of power as the calculated injection quantities will be too low.*
- *Always use genuine air filter elements (same as original equipment).*
- *Hose connections and charge air system hoses must be free of oil and grease prior to fitting. Do not use any lubricants containing silicone when assembling.*
- *Both sections of the air cleaner housing must be clean.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- *To prevent malfunctions, cover all critical parts of the engine air intake tract (air mass meter, intake pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Please observe requirements for disposal.*

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– Blow out water drain -arrow- in air cleaner (bottom section) with compressed air.
– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
– Check air mass meter and air hose (engine intake side) for salt residue, dirt and leaves.
– Check air duct leading from lock carrier to air cleaner housing for dirt and leaves.
– When installing the air filter element, check that it is properly centred in the retainer in the air cleaner (bottom section).
– Carefully fit air cleaner (top section) on air cleaner (bottom section) without applying any force. Make sure the top section of the air cleaner is fitted straight on the air filter element (note position of sealing lip on air filter element).
– Make sure that air hose is correctly seated at air mass meter - G70- .



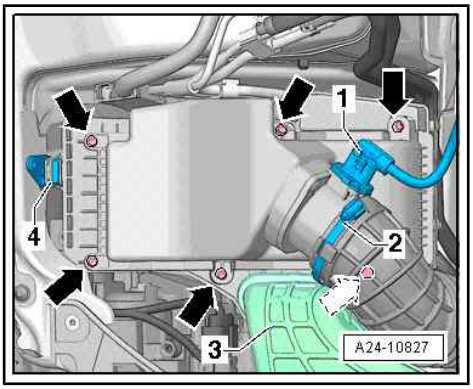
The remaining installation steps are carried out in the reverse sequence.

3.3 Removing and installing air cleaner housing

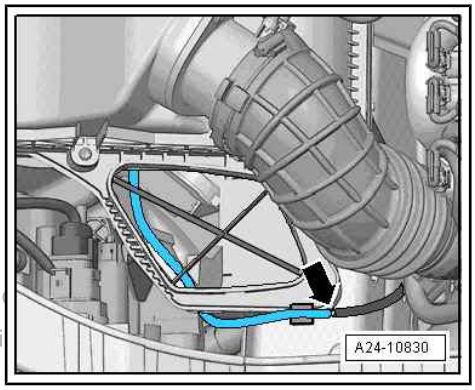
Removing

– Unplug electrical connector -1- at air mass meter - G70- .

– Open hose clip -2- on air hose leading to turbocharger and disconnect hose at air mass meter - G70- .
– Remove air duct -3-.

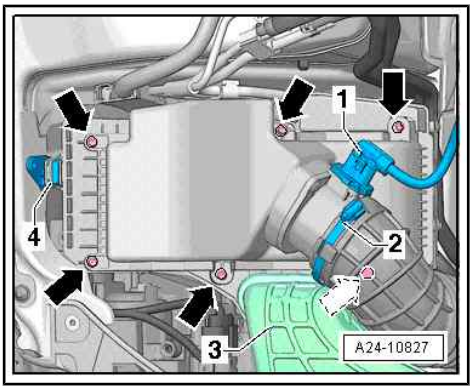


– Detach vacuum hose -arrow- (if fitted).



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– Release retainer -4- for bottom section of air cleaner (press in rubber on left and right side and pull upwards).



Note

- *These components (bypass flap with variable intake manifold change-over valve - N335- -1-) are not installed on certain equipment versions or on vehicles for certain export markets.*
- *Do not use lubricants when installing retainer.*

– Disconnect electrical connector at variable intake manifold change-over valve - N335- (if fitted).
– Carefully take out complete air cleaner housing.

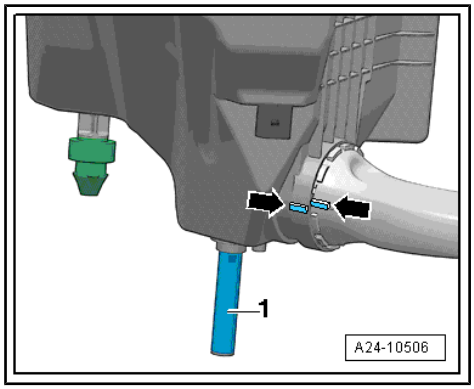
Installing

To ensure the proper function of the air mass meter - G70- it is important to observe the following instructions.

Note

- *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter - G70- and falsify the detected air mass values. This will cause a loss of power as the calculated injection quantities will be too low.*
- *Always use genuine air filter elements (same as original equipment).*
- *Use a silicone-free lubricant when installing the intake hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- If hot air intake is fitted (for countries with cold climates only), make sure that air intake connection has engaged properly -arrows- (pay attention to marking).
- Check water drain hose -1- in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
- Check air mass meter and air hose (engine intake side) for salt residue, dirt and leaves.
- Check intake duct as far as air filter element for dirt.
- Plug electrical connector at air filter bypass flap valve - N275- in again (if fitted).
- Re-install air cleaner (bottom section).

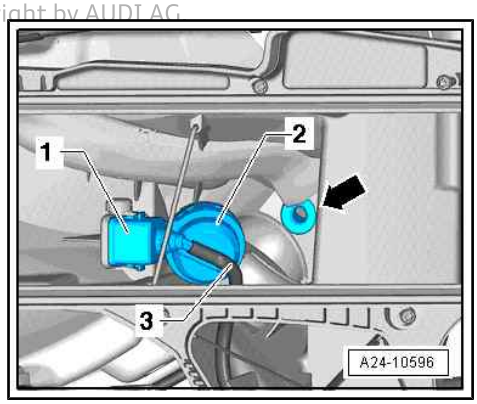


Note

The water drain hose must be routed straight downwards; make sure it is not kinked or twisted.

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- Slide vacuum hose -3- (if fitted) back onto connection of air filter bypass flap valve - N275- -1-.
- Carefully fit air cleaner (top section) on air cleaner (bottom section) without applying any force.



Note

Before tightening bolts, make sure that top section of air cleaner is inserted into groove on bottom section of air cleaner (to prevent air leaks).

- Then secure top section of air cleaner to bottom section.
- Make sure that air hose is correctly seated at air mass meter - G70- .
- Re-attach electrical connector to air mass meter - G70- .
- The remaining installation steps are carried out in the reverse sequence.

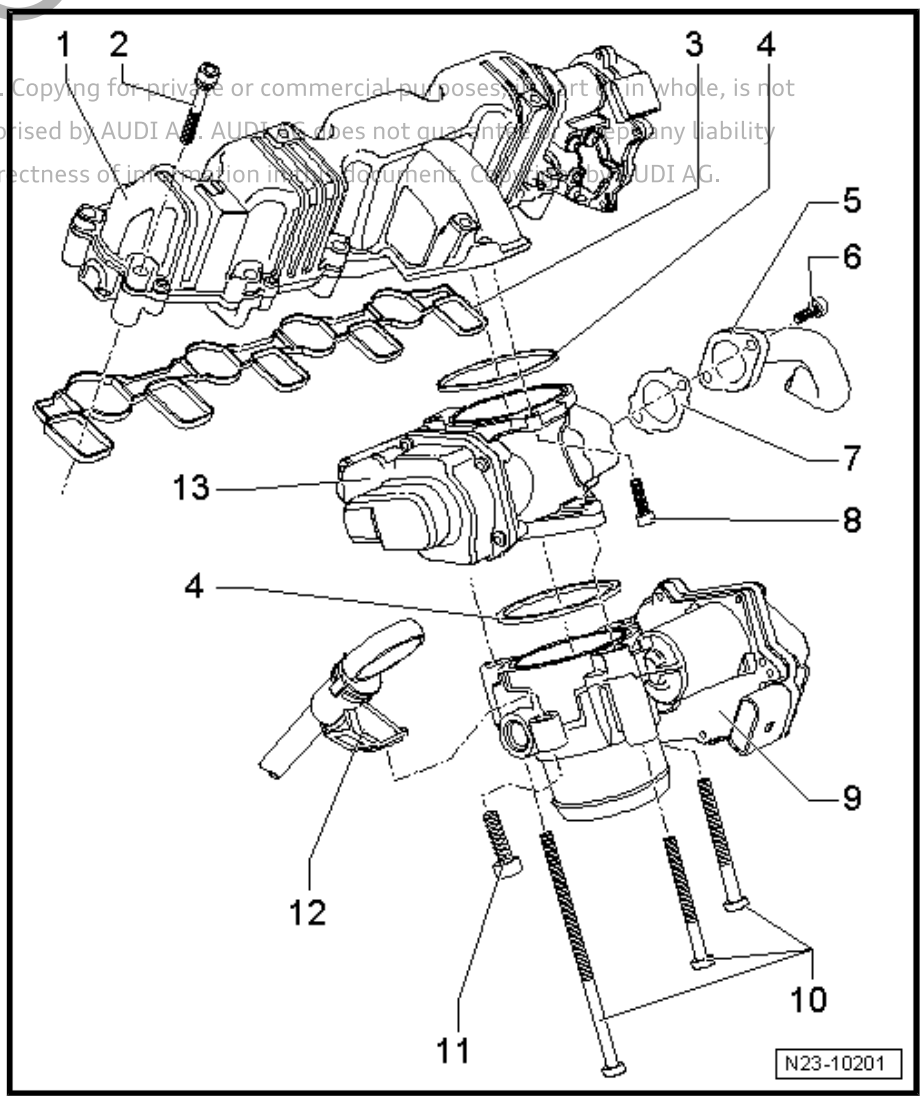
4 Intake manifold

⇒ “4.1 Exploded view - intake manifold”, page 215

⇒ “4.2 Removing and installing intake manifold”, page 215

4.1 Exploded view - intake manifold

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1 - Intake manifold

- ❑ With variable intake manifold motor - V183- and variable intake manifold position sender - G513- (combined in one component)
- ❑ Must not be dismantled

2 - Bolt

- ❑ 8 Nm

3 - Gasket

- ❑ Renew

4 - Seal

- ❑ Renew

5 - Connecting pipe

- ❑ To exhaust gas recirculation cooler

6 - Bolt

- ❑ 20 Nm

7 - Gasket

- ❑ Renew

8 - Bolt

- ❑ 10 Nm

9 - Intake manifold flap motor - V157-

- ❑ With throttle valve potentiometer - G69-

10 - Bolt

- ❑ 10 Nm

11 - Bolt

- ❑ 10 Nm

12 - Oil dipstick

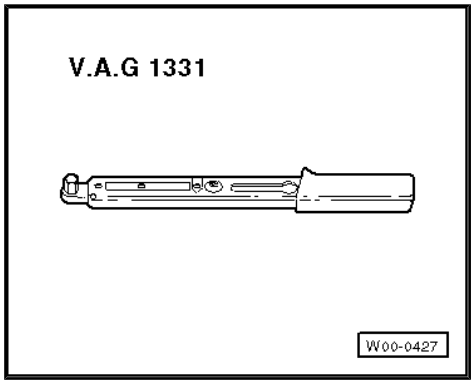
13 - Exhaust gas recirculation valve - N18-

- ❑ With exhaust gas recirculation potentiometer - G212-

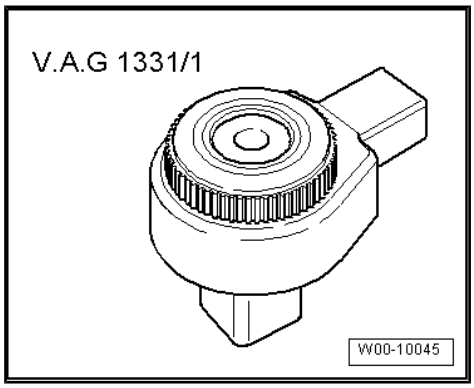
4.2 Removing and installing intake manifold

Special tools and workshop equipment required

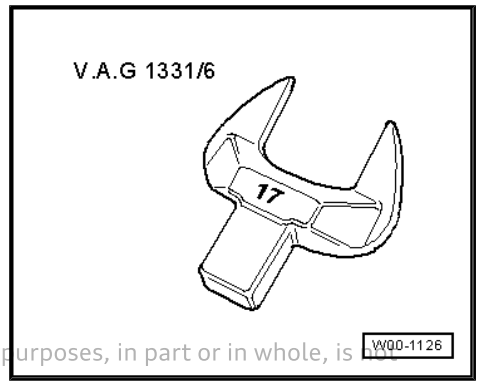
- Torque wrench - V.A.G 1331-



- Ratchet - V.A.G 1331/1-

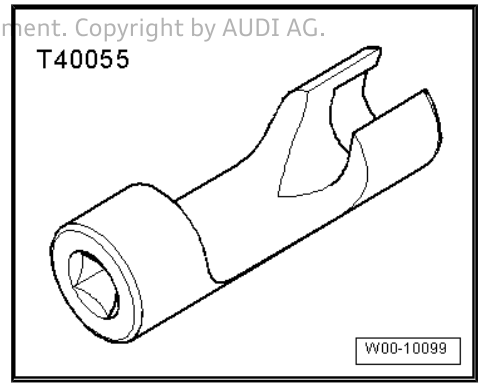


- Open end spanner insert, AF 17 - V.A.G 1331/6-

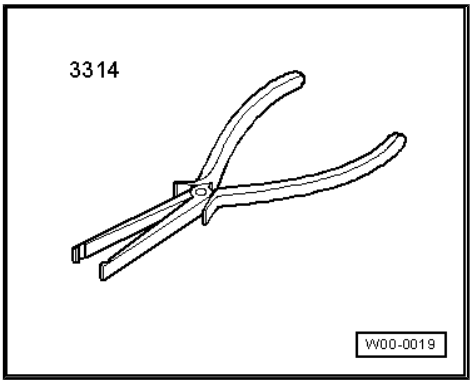


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- Socket - T40055-

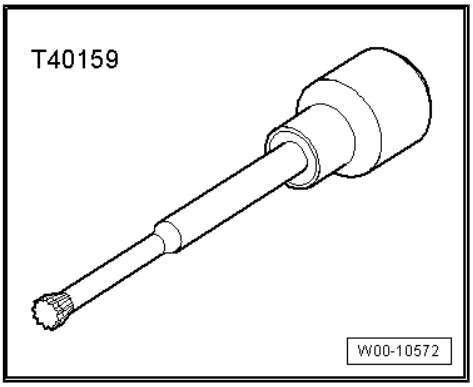


♦ Pliers - 3314-



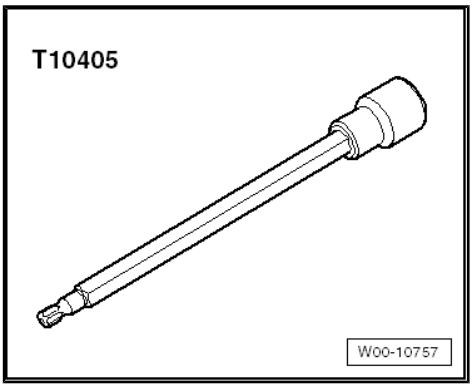
Vehicles with aluminium intake manifold

♦ Bit XZN 8 - T40159-



Vehicles with plastic intake manifold

♦ Socket Torx T30 - T10405-



Removing

WARNING

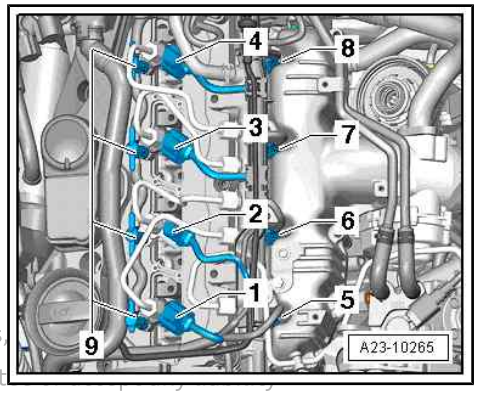
- ***Always read rules for cleanliness and instructions for working on fuel system ⇒ page 6 .***
- ***Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.***

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– Remove engine cover panel ⇒ page 38 .

– Take noise insulation off cylinder head cover.

– Unplug electrical connectors -5, 6, 7 and 8- at glow plugs.

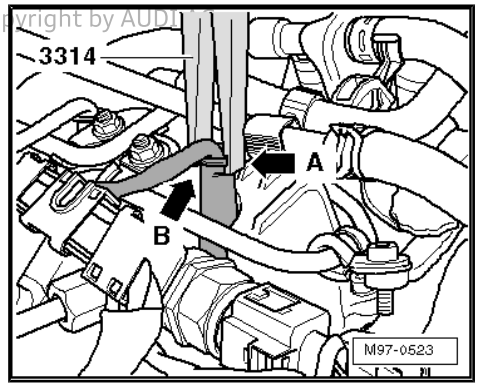


Caution

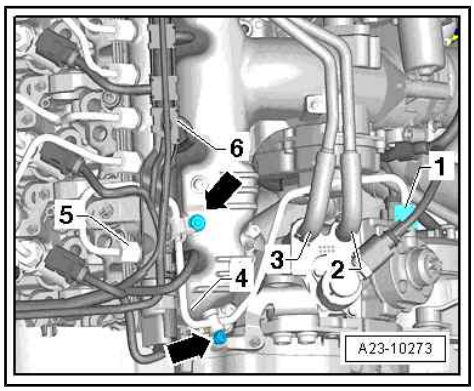
Make sure that no wire connection is damaged when unplugging the connectors; otherwise the entire wiring harness must be renewed. When unplugging the connectors, do not compress the pliers - 3314- with too much force so that the support sleeve is not damaged.

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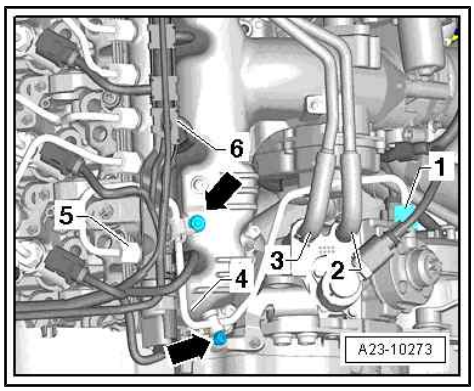
– Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B- and pull connectors off glow plugs.



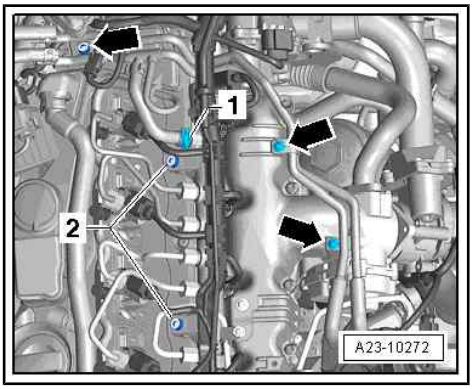
– Unscrew union nuts at high-pressure pump -1- and fuel rail -5- and remove high-pressure fuel pipe -4-.
– Remove bolts -arrows- for high-pressure fuel pipe.
– Move wiring harness -6- clear.



– Pull fuel pipe connections -2 and 3- off high-pressure pump.



– Remove bolts -arrows- securing the two fuel pipes.



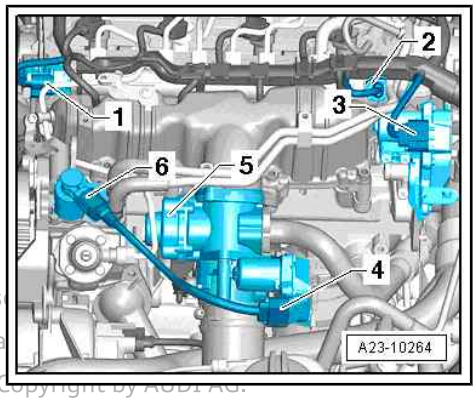
Note

Do not bend fuel lines.

Caution

- ***Rules for cleanliness when working on the injection system ⇒ page 6 .***
- ***Plug open connections with suitable sealing caps immediately.***

– Unplug following electrical connectors:



1 - Fuel pressure sender - G247-
2 - Fuel pressure regulating valve - N276-
3 - Variable intake manifold motor - V183-
4 - Intake manifold flap motor - V157-
5 - Exhaust gas recirculation valve - N18-

Steps for vehicles with plastic intake manifold only

– Remove injector pipes leading to injectors.

– Remove high-pressure reservoir (rail) ⇒ page 238 .

All vehicles (continued)

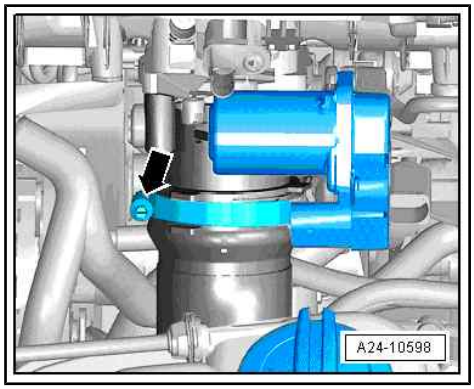
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– Open hose clip -arrow- securing air hose and disconnect hose downwards from intake manifold flap motor - V157- .

– Remove bolt on bracket for oil dipstick.

– Detach connecting pipe for exhaust gas recirculation from exhaust gas recirculation valve - N18- .

– Remove bolts securing intake manifold in diagonal sequence starting from outside and working inwards.



To do so, use appropriate bit/socket:

♦ Vehicles with aluminium intake manifold: Bit XZN 8 - T40159-

♦ Vehicles with plastic intake manifold: Socket T30 - T10405-

– Remove 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.

Vehicles with plastic intake manifold

– Install high-pressure reservoir (rail) ⇒ page 238 .

– Install injector pipes leading to injectors.

Tightening torque

• Exploded view - intake manifold ⇒ Item 2 (page 215)

• ⇒ “4.1 Exploded view - intake manifold”, page 215

• ⇒ “1.3 Exploded view - fuel system”, page 201

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5 Injectors/high-pressure reservoir (rail)

⇒ “5.1 Checking injectors”, page 221

⇒ “5.2 Performing adaption of correction values for injectors”, page 221

⇒ “5.3 Checking for injectors sticking open”, page 222

⇒ “5.4 Checking return flow rate of injectors with engine running”, page 223

⇒ “5.5 Checking return flow rate of injectors at starter cranking speed”, page 226

⇒ “5.6 Checking pressure retention valve in fuel return line”, page 228

⇒ “5.7 Removing and installing injectors”, page 229

⇒ “5.8 Removing and installing high-pressure pipes”, page 236

⇒ “5.9 Removing and installing high-pressure reservoir (rail)”, page 238

5.1 Checking injectors

- Checking adaption of “Injector delivery calibration values” and “Injector voltage calibration values” ⇒ page 221
- Checking for injectors sticking open ⇒ page 222
- Checking return flow rate of injectors with engine running ⇒ page 223
- Checking return flow rate of injectors at starter cranking speed ⇒ page 226

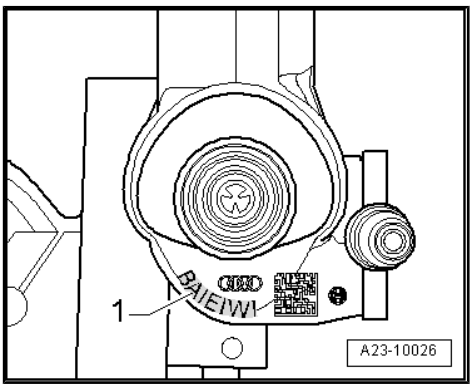
Perform the following tests first if the engine does not start at all:

- ♦ Checking for injectors sticking open ⇒ page 222
- ♦ Checking return flow rate of injectors at starter cranking speed ⇒ page 226
- ♦ Checking fuel pressure regulating valve - N276- ⇒ page 245

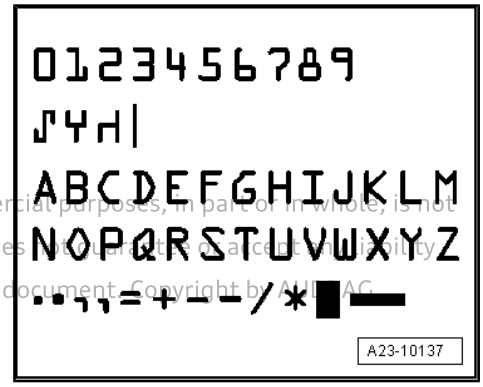
5.2 Performing adaption of correction values for injectors

The “Injector delivery calibration” and “Injector voltage calibration” functions serve to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.

The 7-digit adaption values -1- (details in illustration are only an example) are marked separately on each injector. They may consist of letters and/or numbers (ASCII code).



Reference table for reading out letters and/or numbers on each injector



When a new injector is installed, the adaption value for the new injector must be written into the engine control unit.

When a new engine control unit is installed, the “Adaption values for injectors” must be written into the new control unit.

Additionally, check that the “injector delivery calibration values” with “injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

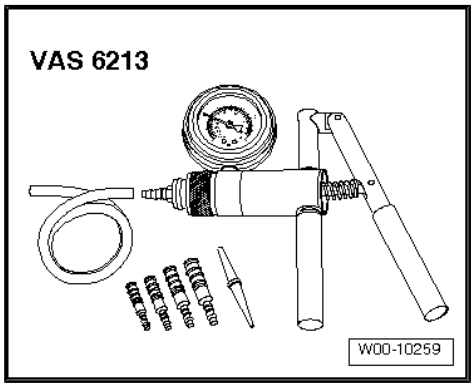
The adaption procedure is described in “Guided Fault Finding”. (The procedure is also described under “Guided Functions”.) Use ⇒ Vehicle diagnostic tester

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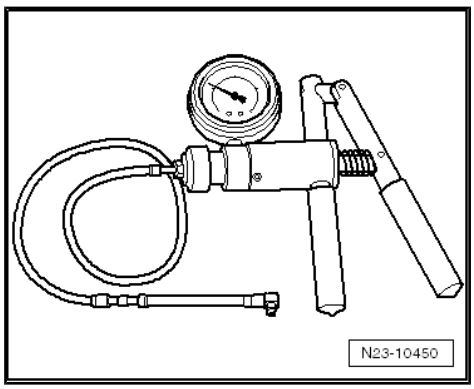
5.3 Checking for injectors sticking open

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



- Use a return line to make an -adapter-.



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 38 .

– Clean all connections (with commercial cleaning solution or similar) before removing.

Note

♦ *Make sure all parts are clean; no dirt must be allowed to enter the fuel system.*

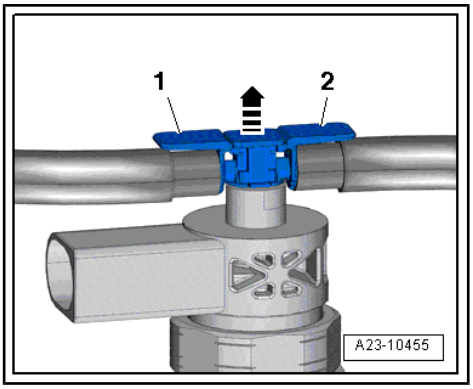
♦ *Check all cylinders in turn.*

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– Dry all components after cleaning.

Start with cylinder No. 1.

– Pull return line connections off injectors; to do so, press tabs -1- and -2- down and at the same time pull release pin upwards -arrow-.



– Connect adapter to return line connection of injector to be tested after adapter has been cleaned and blown out.

– Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .

If the vacuum reading remains the same for 30 seconds, the injector is OK.

If the injector is faulty, the vacuum reading will fall back to 0 bar within 2 to 3 seconds.

Repeat test if necessary; note drop in vacuum reading on hand vacuum pump - VAS 6213- .

– Renew faulty injectors ⇒ page 229 .

Installing fuel return lines

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

Note

Lubricate all seals with engine oil or assembly oil before installing.

– Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.

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.

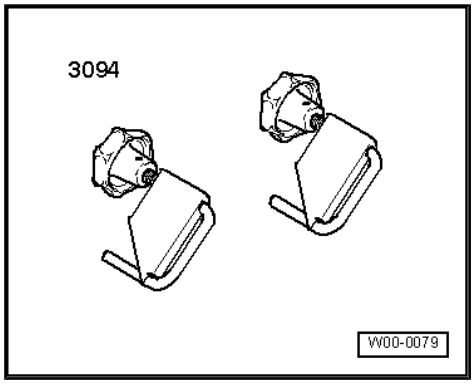
– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

– Install engine cover panel.

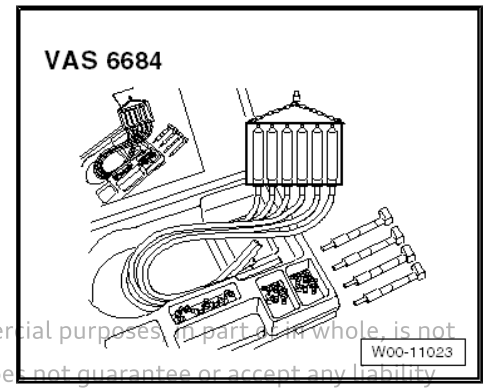
5.4 Checking return flow rate of injectors with engine running

Special tools and workshop equipment required

- Hose clamps up to 25 mm - 3094-



- Return flow meter - VAS 6684-



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Checking return flow rate of all injectors

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 38 .

– Disconnect hose connection -3- downstream of pressure retention valve -2- in fuel return line.

– Seal off open return line connection with plug -1-.

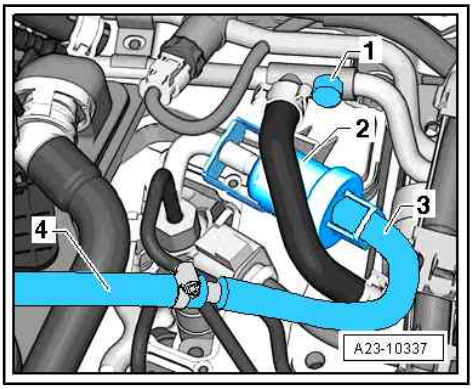
– Hold end of this hose -3- (lengthen with hose -4- if necessary) in a suitable container to measure total return flow rate.

– Start engine and let it idle for 2 minutes.

• Specification for 2 minutes: 0 ml to 50 ml

– If specification is attained, 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.

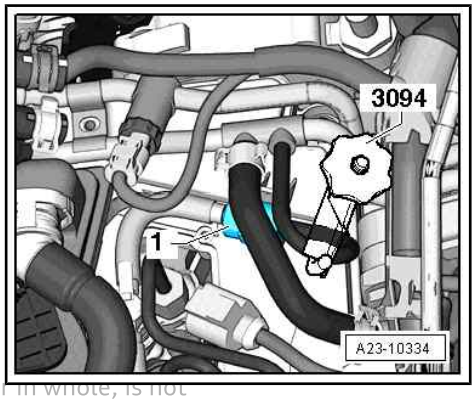
Checking return flow rate of individual injectors

Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

– Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.

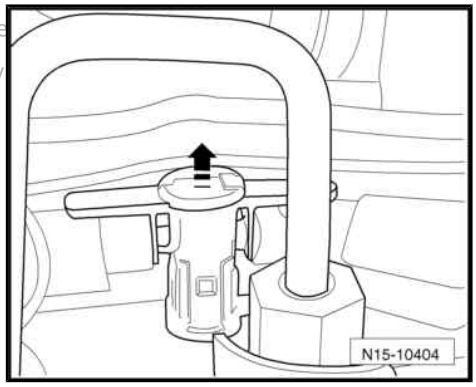
– Dry all components after cleaning.

– Clamp off fuel return line downstream of pressure retention valve -1- using hose clamp up to 25 mm - 3094- .



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– Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -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.

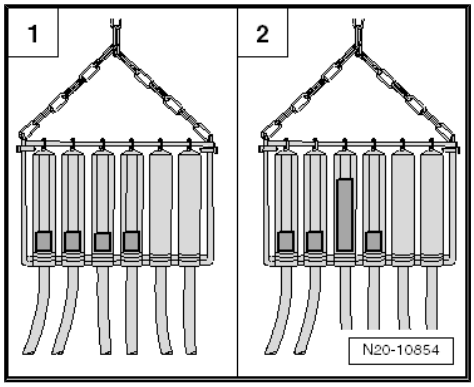
- ***Do NOT press the accelerator during this test; the engine must only run at idling speed.***

– 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 229 .

Installing fuel return lines

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

Note

Lubricate all seals with engine oil or assembly oil before installing.

– Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

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.

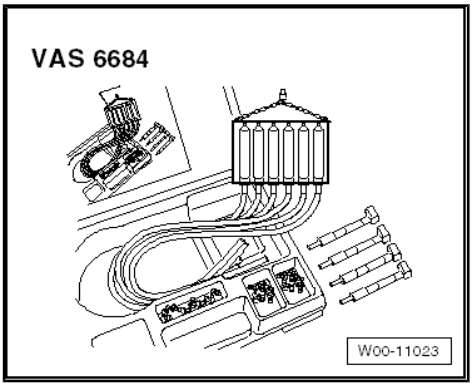
5.5 Checking return flow rate of injectors at starter cranking speed

Only perform this test if the engine does not start at all.

Special tools and workshop equipment required

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- Return flow meter - VAS 6684-



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.*

Procedure

Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

– Remove engine cover panel ⇒ page 38 .
– Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.
– Dry all components after cleaning.

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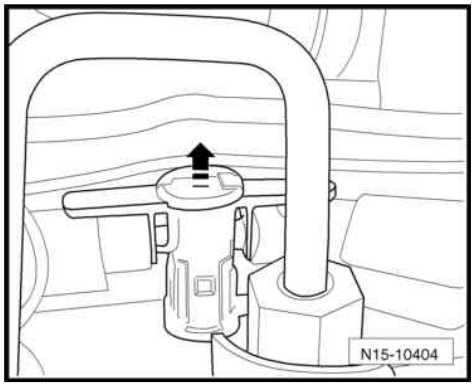
– Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.

– 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

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

Note

Lubricate all seals with engine oil or assembly oil before installing.

– Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

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.

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5.6 Checking pressure retention valve in fuel return line

The pressure retention valve maintains a residual pressure of approx. 10 bar 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 - 6330-

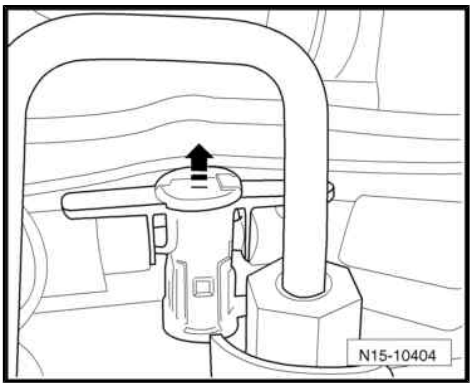
WARNING

- ***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 38 .

– Clean return line connection on cylinder 1 (with commercial cleaning solution or similar) before removing.

– Dry return line connection on cylinder 1.
– Cover return line connection on cylinder 1 with a cloth.
– Pull return line connection off cylinder 1; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.

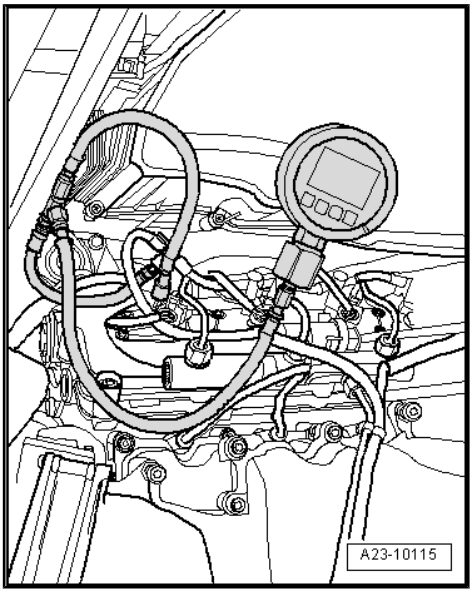


Note

No dirt must be allowed to get into the disconnected return line or the open connection on the injector.

– Connect tester for fuel return system - VAS 6330- between return line connection on injector and return line.
– Start engine.
– Check pressure indicated on tester.
♦ Specification: approx. 10 bar

If the value does not match the specification, fit a new pressure retention valve.



5.7 Removing and installing injectors

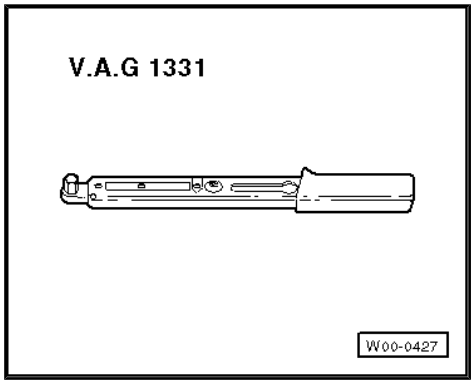
Special tools and workshop equipment required

♦ Cleaning kit - VAS 6811-

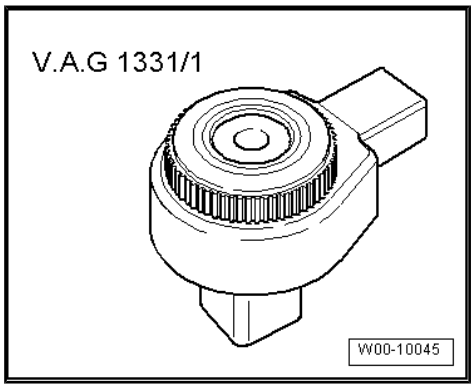


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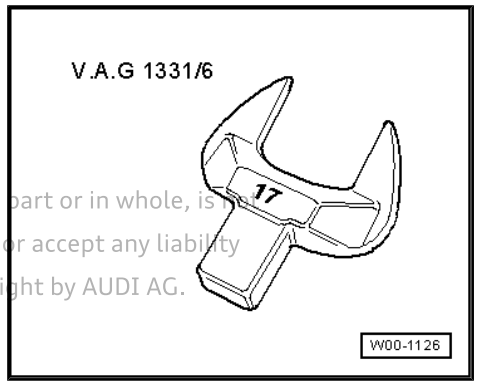
- Torque wrench - V.A.G 1331-



- Ratchet - V.A.G 1331/1-

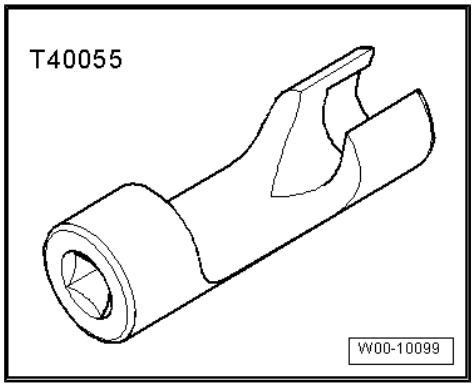


- Open end spanner insert, AF 17 - V.A.G 1331/6-

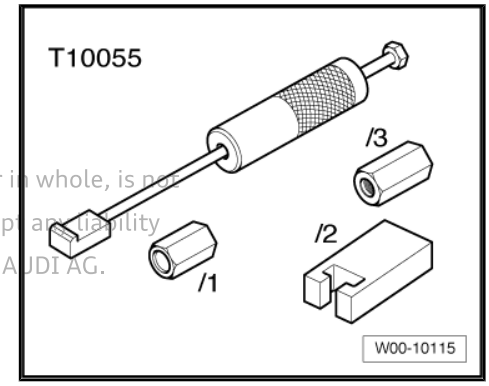


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- Socket - T40055-

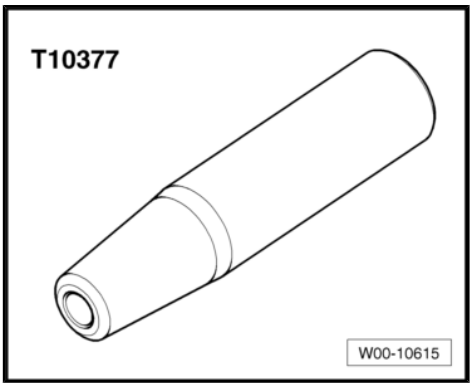


- Puller - T10055- with adapter - T10055/1-



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- Assembly sleeve - T10377-



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.*

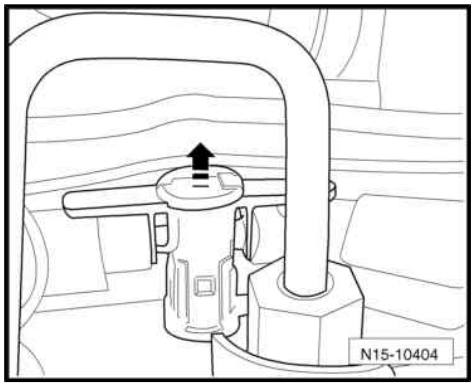
– Remove engine cover panel ⇒ page 38 .

– Take noise insulation off cylinder head cover.

Caution

- *Mark cylinder numbers on injector units. They must always be re-installed on the same cylinders.*
- *Rules for cleanliness when working on the injection system ⇒ page 6 .*
- *Plug open connections with suitable sealing caps immediately.*

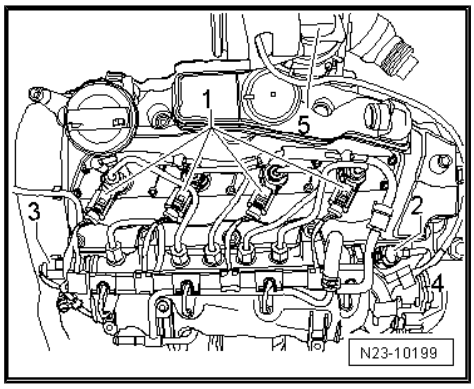
– Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.



Note

No dirt must be allowed to get into the disconnected return lines or the open connections on the injectors.

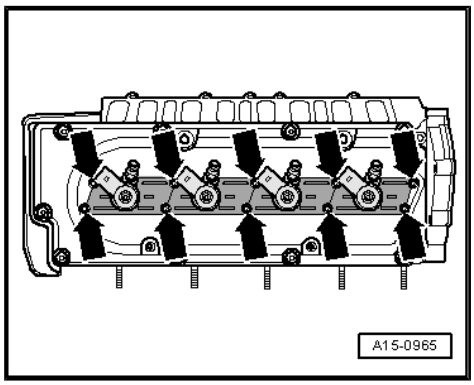
– Unplug electrical connectors -1- at injectors which are to be removed.
– Loosen union nuts for high-pressure pipes at injectors using socket - T40055- .
– Loosen union nuts for high-pressure pipes at fuel rail using open end spanner insert, AF 17 - V.A.G 1331/6- .



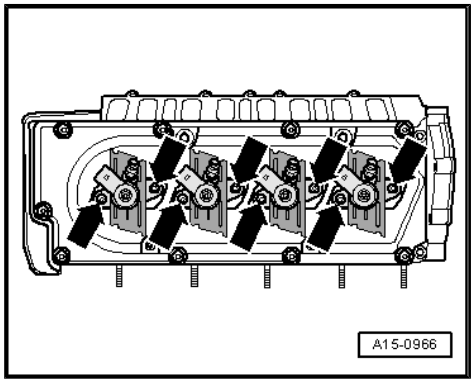
– Unbolt covers for injectors -arrows-.
– Pull covers upwards and turn them $^{1}/_{4}$ turn (90°).

Caution

When removing the securing nuts on the injectors there is a risk that the nuts will drop into the cylinder head. Proceed very carefully to prevent unnecessary dismantling or further damage.



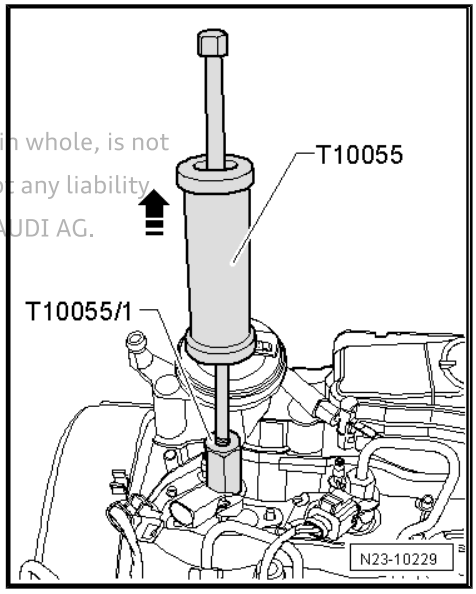
– Unbolt clamping pieces for injectors -arrows-.



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– Apply puller - T10055- with adapter - T10055/1- as shown in illustration and pull injector out upwards by tapping gently.

– After removal, lay injectors on a clean cloth.



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Important instructions for installing injectors:

When installing injectors, the following components must be renewed:

- Clamping piece
- Copper seal
- O-ring for injector bore
- O-ring for fuel return line connection

Note

- *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.*

If a used injector is being re-installed:

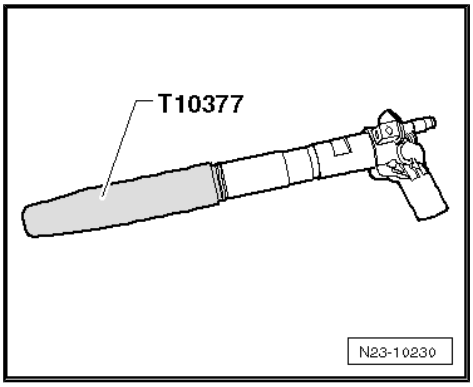
– Spray tip of injector nozzle with rust-releasing spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.

– 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):

– Fit seal for injector using assembly sleeve - T10377- .
– To prevent damage to the new O-ring, lubricate it with oil and carefully push it onto the fuel return line connection.



Note

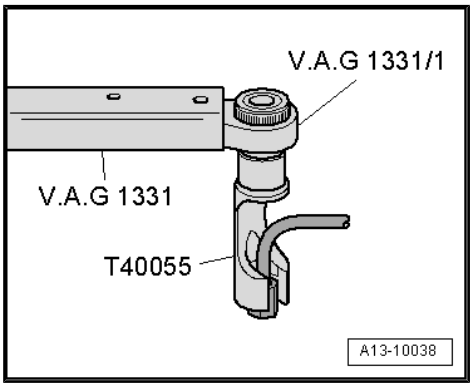
Lubricate all O-rings with assembly oil, engine oil or diesel fuel before installing.

Caution

Risk of damage to injector sealing surface.

- ***To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- .***

– Install injectors.
– Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
– To tighten unions of high-pressure pipes at injectors, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- .



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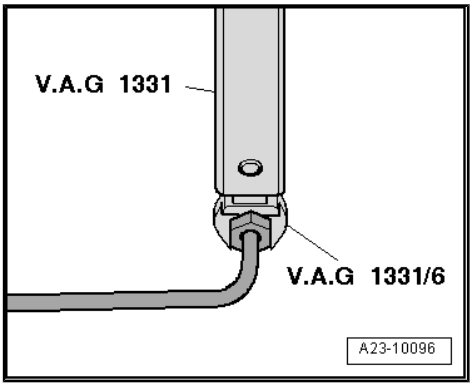
– To tighten unions of high-pressure pipes to fuel rail, use torque wrench - V.A.G 1331- with tool insert, AF 17 - V.A.G 1331/6- .

♦ Tightening torques: refer to exploded view of fuel system ⇒ page 201 .

♦ Observe tightening torque: Installing high-pressure pipes ⇒ page 236 .

♦ Tightening torques: refer to exploded view of fuel system ⇒ page 201 .

– Press return line connections carefully over seals and onto injectors (check seal for damage before connecting return line). The catch should engage audibly. Then press release pin down carefully.



After renewing one or more injectors, the “injector delivery calibration values” and “injector voltage calibration values” for the new injectors must be written into the engine control unit.

Additionally, check that the “injector delivery calibration values” and “injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

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After renewing one or more injectors, learnt values for fuel pressure regulating valve - N276- must be reset; refer to ⇒ Vehicle diagnostic tester (“Guided Functions” `Engine electronics - Reset learnt values`).

Bleeding fuel system and checking for leaks

Note

The fuel system is self-bleeding; do not open the high-pressure connections.

– Run engine at idling speed for several minutes and then switch off.

– Switch off ignition.

– Check the complete fuel system including all 4 return line connections for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

– 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.

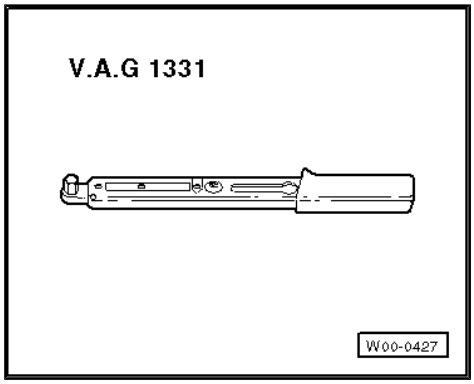
Note

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.

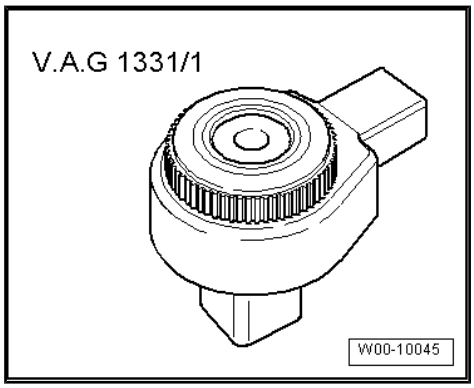
5.8 Removing and installing high-pressure pipes

Special tools and workshop equipment required

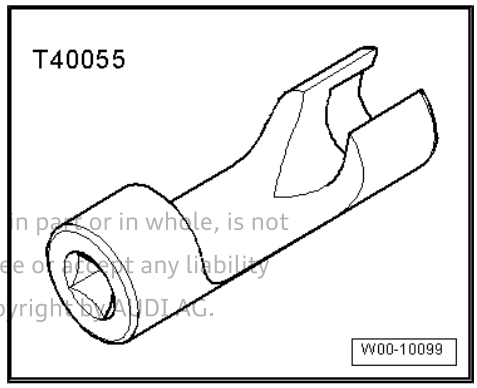
- Torque wrench - V.A.G 1331-



- Ratchet - V.A.G 1331/1-



- Socket - T40055-



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Procedure

Note

- *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.*

Installing individual injector pipes (cylinders 1...4, between fuel rail and injectors)

– 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.

– If necessary, the fuel rail can be slackened and moved slightly so that the injector pipes are not installed under tension. Never bend the injector pipes or subject them to tension. This would ultimately cause the injector pipes to fracture.

– Take new injector pipe out of packaging, remove sealing plugs and immediately install injector pipe between fuel rail and injector.

– Initially hand-tighten union nuts of injector pipe (do not use a tool). Make sure that injector pipe is correctly seated.

Sequence for tightening injector pipes:

1 - First tighten union nut to specified torque at injector.

2 - Tighten union nut at fuel rail to specified torque.

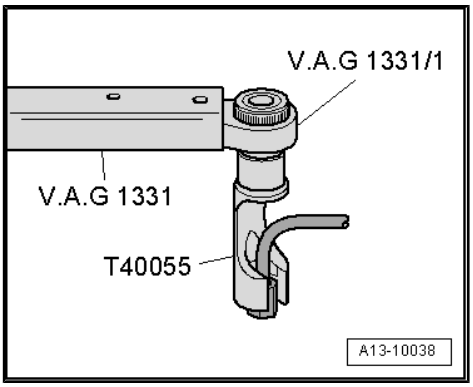
– Follow the same procedure to install any further injector pipes.

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– Tighten fuel rail again if it was slackened earlier.

• Tightening torque for fuel rail: refer to exploded view of fuel system ⇒ page 201 .

– Tighten union nuts of all installed injector pipes using torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- .



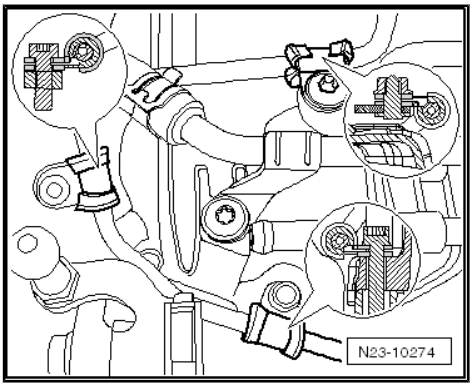
• Tightening torque for injector pipes: refer to exploded view of fuel system ⇒ page 201 .

Installing fuel pipe between high-pressure pump and fuel rail

– Loosen bolts securing fuel rail and check that rail can be moved.

– Then take new fuel pipe out of packaging, remove sealing plugs and immediately install fuel pipe between high-pressure pump and fuel rail without setting it down before installing it.

– Initially hand-tighten union nuts of fuel pipe (do not use a tool). Make sure that fuel pipe is correctly seated.



– Fit all three securing clips to fuel pipe, making sure they are aligned correctly.

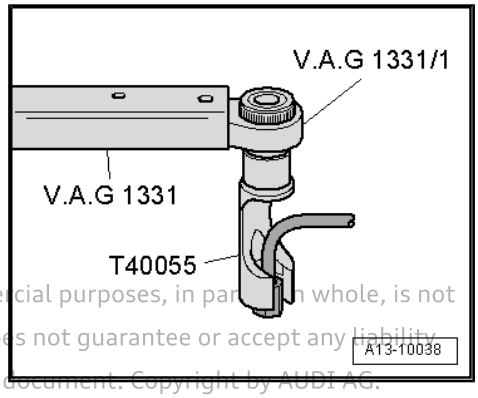
– Screw in bolts on securing clips approx. 3 turns.

– Secure fuel rail again.

• Tightening torque for fuel rail: refer to exploded view of fuel system ⇒ page 201 .

– Tighten securing clip (top) on intake manifold to 8 Nm.

– Tighten union nuts of fuel line using torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- .



Tightening sequence for securing fuel line:

1 - First tighten union nut to specified torque at high-pressure pump.

2 - Tighten union nut at fuel rail to specified torque.

- Tightening torque for fuel line: refer to exploded view of fuel system ⇒ page 201

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– Now tighten remaining two securing clips to 8 Nm.

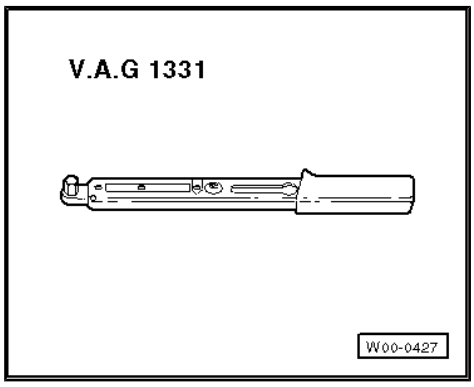
– Fill fuel system ⇒ page 243 .

– Check fuel system for leaks ⇒ page 206 .

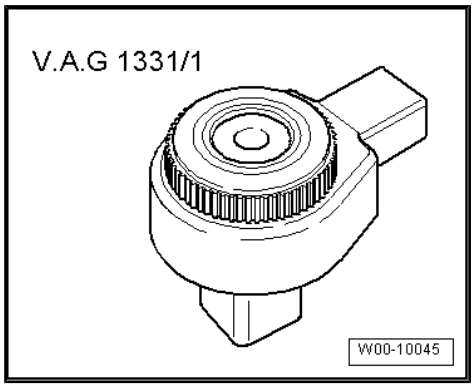
5.9 Removing and installing high-pressure reservoir (rail)

Special tools and workshop equipment required

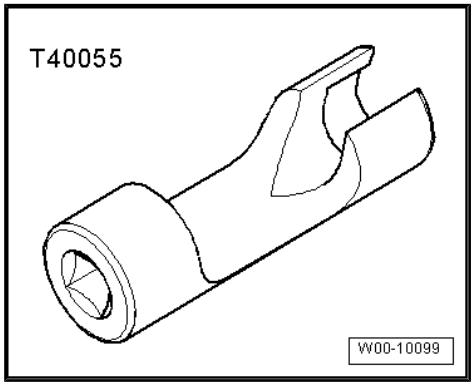
♦ Torque wrench - V.A.G 1331-



♦ Ratchet - V.A.G 1331/1-



♦ Socket - T40055-



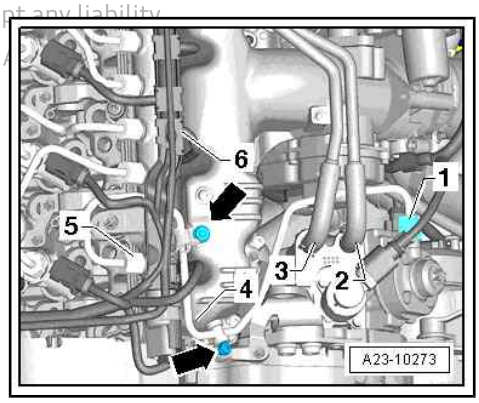
Removing

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.*

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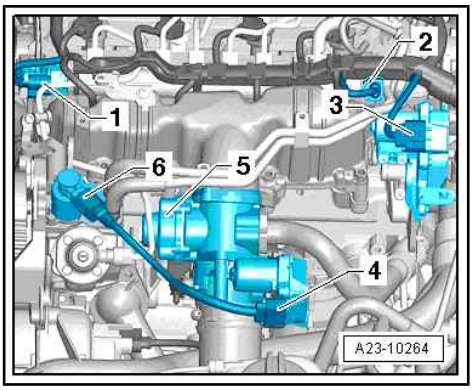
– Remove engine cover panel ⇒ page 38 .
– Take noise insulation off cylinder head cover.
– Unscrew union nuts at high-pressure pump -1- and fuel rail -5- and remove high-pressure fuel pipe -4-.
– Remove bolts -arrows- for high-pressure fuel pipe.
– Move wiring harness -6- clear.



– Unplug following electrical connectors:

1 - Fuel pressure sender - G247-

2 - Fuel pressure regulating valve - N276-

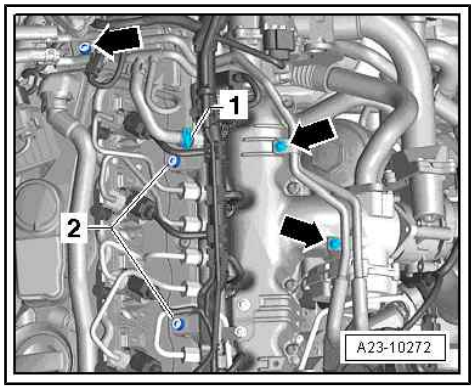


Caution

- *Mark cylinder numbers on high-pressure pipes. They must always be re-installed on the same cylinders.*
- *Rules for cleanliness when working on the injection system ⇒ page 6 .*
- *Plug open connections with suitable sealing caps immediately.*

– Loosen union nuts for high-pressure pipes using socket - T40055- .
– Detach fuel return line -1- from fuel rail.

– Unscrew bolts -2- and remove fuel rail.



Installing

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

– Install high-pressure pipes so they are free of stress.

Note

- *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.*

- Tightening torque for high-pressure pipes: exploded view - fuel system ⇒ page 201

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6 High-pressure pump

⇒ "6.1 Removing and installing high-pressure pump", page 241

⇒ "6.2 Performing first fuel filling operation after installing high-pressure pump", page 243

6.1 Removing and installing high-pressure pump

Caution

- *Always observe 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.*
- *Running when dry causes irreparable damage to high-pressure pump.*
- *The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty. First fuel filling ⇒ page 243 .*

Removing

– Set service position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Setting service position and returning to normal position .

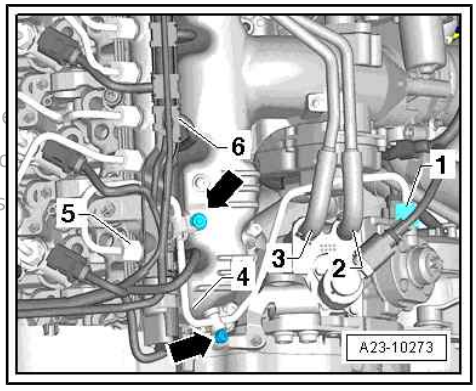
– Remove toothed belt ⇒ page 90 .

– Unplug electrical connector at fuel metering valve - N290- .

– Unscrew union nuts at high-pressure pump -1- and fuel rail -5- and remove high-pressure fuel pipe -4-.

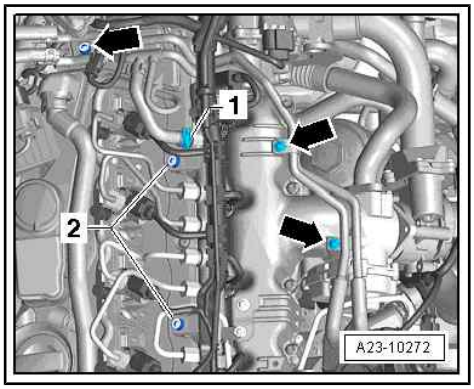
– Remove bolts -arrows- for high-pressure fuel pipe.

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– Pull fuel pipe connections -2 and 3- off high-pressure pump.

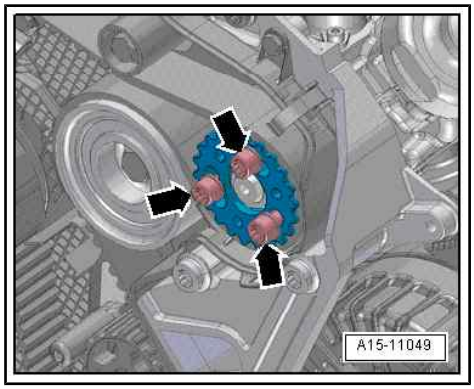
– Remove bolts -arrows- securing the two fuel pipes.



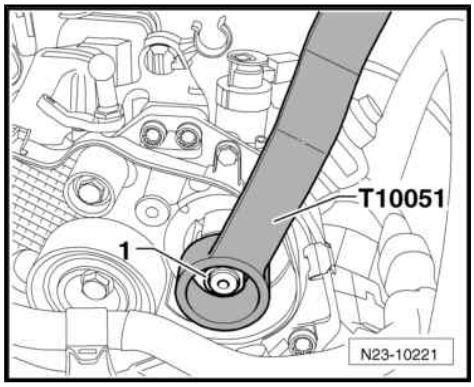
Note

Do not bend fuel lines.

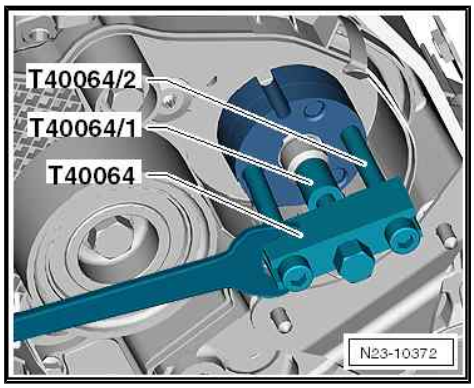
– Using bit XZN 10 - T10385- or M10 bit, unscrew bolts -arrows- for high-pressure pump sprocket.



– Counterhold hub of high-pressure pump using counterhold tool - T10051- and unscrew securing nut -1-.



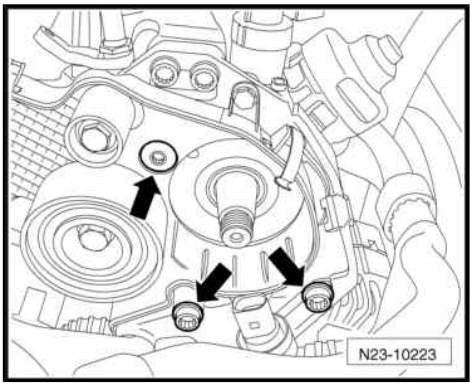
– Apply puller - T40064- with thrust piece - T40064/1- and pin - T40064/2- as shown in illustration and pull hub off high-pressure pump. If necessary, counterhold using an open-end spanner (24 mm).



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– Unscrew securing bolts -arrows- for high-pressure pump.

– Carefully take out high-pressure pump.



Installing

Installation is carried out in reverse sequence.

- Tightening torques: refer to exploded view of fuel system ⇒ page 201 .

– Install toothed belt for high-pressure pump ⇒ page 90 .

– Install high-pressure pipes ⇒ page 236 .

– Return to normal position ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Setting service position and returning to normal position .

Caution

- ***The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty. First fuel filling ⇒ page 243 .***
- ***Running when dry causes irreparable damage to high-pressure pump.***

Note

Guided Functions are not available for certain engine versions because the routine is not necessary and the learned values need not be reset.

After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , the learnt values must be reset. The procedure is described in `Guided Fault Finding` or `Guided Functions`; use ⇒ Vehicle diagnostic tester.

6.2 Performing first fuel filling operation after installing high-pressure pump

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.

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Proceed as follows to fill fuel system with fuel:

- Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.

- Connect vehicle diagnostic tester .
- Select `Self diagnosis` mode in ODIS.
- Select `Start self diagnosis`.
- Wait until the system is fully ready.
- Select the control unit `01 - Engine electronics`.
- Select self-diagnosis function `Basic setting`.
- From the list of basic settings, select `Transfer Fuel Pump (FP) test` and click on `>` to add it to the selection list.
- Select the basic setting in the list again.
- Select `Start/Stop` to start or stop the basic setting process.
- The fuel pump starts running.
- The fuel pump must run for approx. 3 minutes 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.
- Interrogate event memory.

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7 Senders and sensors

⇒ “7.1 Checking fuel pressure regulating valve N276 ”, page 245

⇒ “7.2 Removing and installing fuel pressure regulating valve N276 ”, page 246

⇒ “7.3 Removing and installing fuel pressure sender G247 ”, page 248

⇒ “7.4 Removing and installing air mass meter G70 ”, page 251

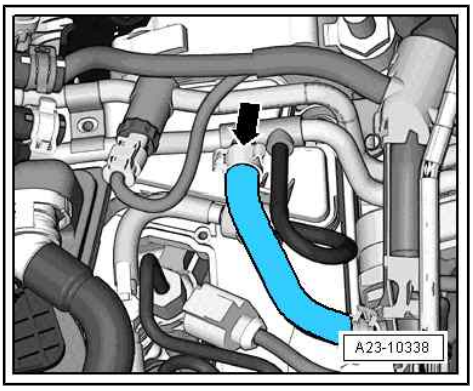
⇒ “7.5 Removing and installing exhaust gas pressure sensor 1 G450 ”, page 251

7.1 Checking fuel pressure regulating valve - N276-

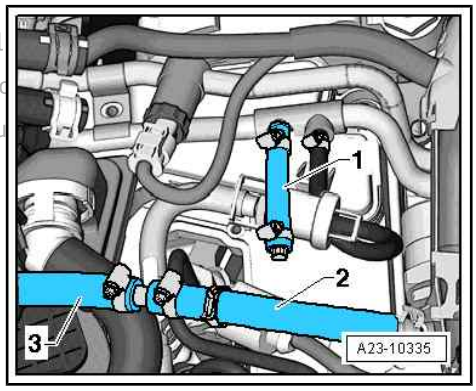
WARNING

- *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 38 .
– Remove noise insulation from injectors.
– Open hose clip -arrow- and detach fuel return line.

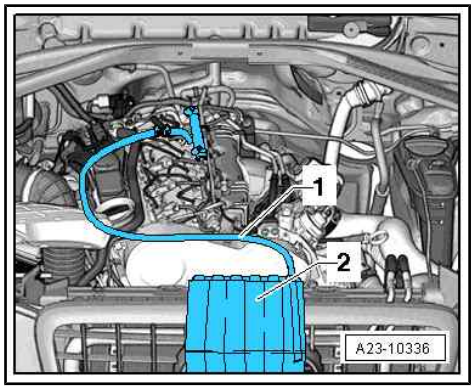


– Seal off open return line connection with a plug -1-.
– Attach a suitable hose -3- to return line -2-.



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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 - N 276- is defective.

3) If engine can no longer be started

Perform check at cranking speed.

- Specification of return flow rate: 0 ml
- Drip leaks are permissible
- If specification is not obtained, fuel pressure regulating valve - N 276- is defective.

7.2 Removing and installing fuel pressure regulating valve - N276-

Special tools and workshop equipment required

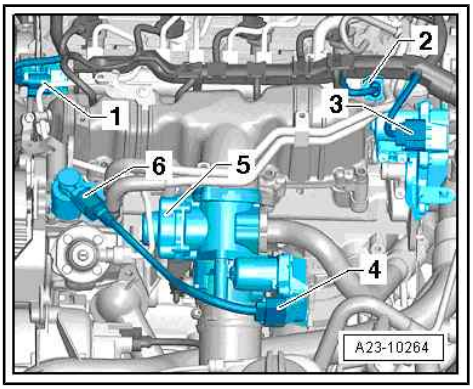
- Open-end spanner insert, 30 mm - T10553-
- Torque wrench

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The fuel pressure regulating valve - N276- -2- 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

Fuel pressure regulating valve - N276- must always be renewed after it has been removed.

Removing

WARNING

- *Always observe 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 38 .

– Remove fuel rail ⇒ page 238 .

– Before removal, clean area around thread for fuel pressure regulating valve - N276- using commercial cleaning solution or similar (no dirt must enter opening in fuel rail).

Note

Clean carefully; cleaning solution must not enter the electrical connector.

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– Dry off fuel pressure regulating valve - N276- .

– Open cable tie securing wiring harness located above fuel pressure regulating valve - N276- .

– Detach electrical connector at fuel pressure regulating valve - N276- .

– Loosen union nut using open-end spanner insert, 30 mm - T10553- (at the same time, counterhold at hexagon flats on housing). Then unscrew and remove by hand.

– Extract dirt from opening in fuel rail (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.

– Seal off open fuel rail connection with clean plug.

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 opening in fuel rail.*
- *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.*

– Screw on union nut by hand.

– Align new regulating valve so that connecting wire is free of tension after connector is attached.

– Hold regulating valve in this position by holding hexagon flats on housing of regulating valve with open-end spanner or pliers (water pump pliers or similar).

– Tighten union nut using open-end spanner insert, 30 mm - T10553- (at the same time, counterhold at hexagon flats on housing).

Tightening torques

- ⇒ “1.3 Exploded view - fuel system”, page 201

– Install fuel rail ⇒ page 238 .

After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , the learnt values must be reset. The procedure is described in `Guided Fault Finding` or `Guided Functions`; use ⇒ Vehicle diagnostic tester.

Note

Guided Functions are not available for certain engine versions because it is not necessary to reset the learned values on these engines.

– After installation, run engine at moderate speed for several minutes and then switch off.

– Check fuel system for leaks.

– Interrogate event memory.

– 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.

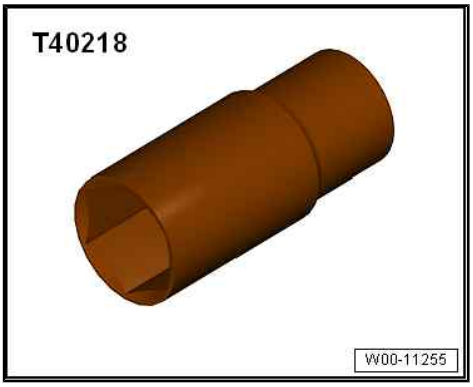
– Interrogate event memory again.

7.3 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

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- Bit (27 mm) - T40218- or commercially available socket (27 mm)



- Torque wrench

Note

- *The fuel pressure sender - G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623- .*
- *Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.*
- *The fuel pressure sender - G247- has a deformable sealing lip and no separate seal; it can therefore be used only once.*

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 38 .

– Before removal, clean area around thread for fuel pressure sender using commercial cleaning solution or similar (no dirt must enter opening in fuel rail).

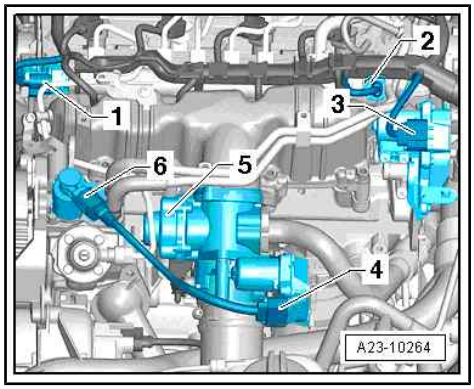
Note

Clean carefully; cleaning solution must not enter the electrical connector.

– Dry off fuel pressure sender - G247- .

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– Unplug electrical connector -1- at fuel pressure sender - G247- .
– Unscrew fuel pressure sender - G247- using socket, 27 mm - T40218- .



Note

An open-end spanner must not be used for loosening or tightening.

– Extract dirt from opening in fuel rail (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.
– Seal off opening in fuel rail with a plug.

Installing

Note

- *Fuel pressure sender - G247- must always be renewed after it has been removed.*
- *Check sealing surface at opening in fuel rail.*
- *The beginning of the thread and the deformable sealing lip of the fuel pressure sender - G247- must be coated with diesel fuel.*

– Screw in fuel pressure sender - G247- by hand.
– Then tighten fuel pressure sender - G247- to specified torque.

Tightening torques

- ⇒ “1.3 Exploded view - fuel system”, page 201

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.

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– After road test, interrogate event memory again.

7.4 Removing and installing air mass meter - G70-

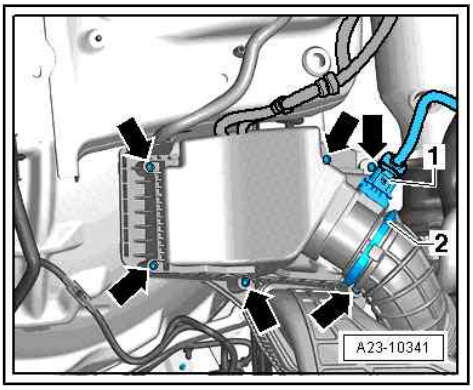
Removing

– Detach electrical connector -1- from air mass meter - G70- .

– Release hose clip securing air hose (coming from turbocharger) and disconnect hose from air mass meter - G70- .

– Unscrew both bolts from air mass meter - G70- .

– Then carefully pull air mass meter - G70- out of guide on air cleaner housing.



Installing

To ensure the correct function of the air mass meter - G70- , it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter - G70- and falsify the detected air mass values. This will cause a loss of power as the calculated injection quantities will be too low.*
- *Always use genuine air filter elements (same as original equipment).*
- *Use a silicone-free lubricant when installing the air hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).

– Check intake duct as far as air filter element for dirt. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner ⇒ page 211 .

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

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7.5 Removing and installing exhaust gas pressure sensor 1 - G450-

Exhaust gas pressure sensor 1 - G450- is connected via two pipes to take-off points upstream and downstream of particulate filter. Exploded view - Lambda probe ⇒ page 253

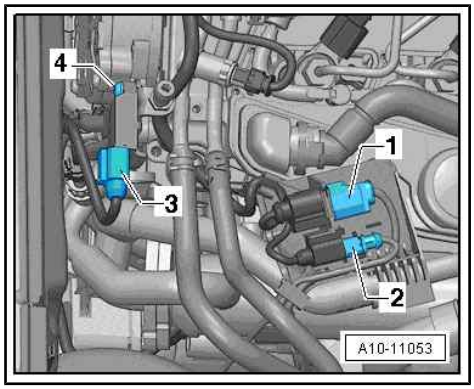
Exhaust gas pressure sensor 1 - G450- detects the amount of deposits in the particulate filter.

Removing

– Remove engine cover panel ⇒ page 38 .

– Before disconnecting, spray hoses coming from exhaust gas pressure sensor 1 - G450- with suitable release agent.

– Detach electrical connector -3- from exhaust gas pressure sensor 1 - G450- .
– Carefully pull hoses off connections (take care to keep the hoses straight; the connections can easily break off exhaust gas pressure sensor 1 - G450-).
– Unscrew bolt -4- and remove exhaust gas pressure sensor 1 - G450- .



Installing

– When installing, note the following:

• Tightening torque for bolt for exhaust gas pressure sensor 1 - G450- ⇒ Item 4 (page 253)

Note

♦ *Before installing, blow out hoses leading from exhaust gas pressure sensor 1 - G450- to particulate filter towards particulate filter with compressed air (hoses can become obstructed or may ice up due to condensation).*
♦ *Make sure that hoses are securely fitted and seal properly.*
♦ *If pressure connections are detached from particulate filter, tighten to 45 Nm.*

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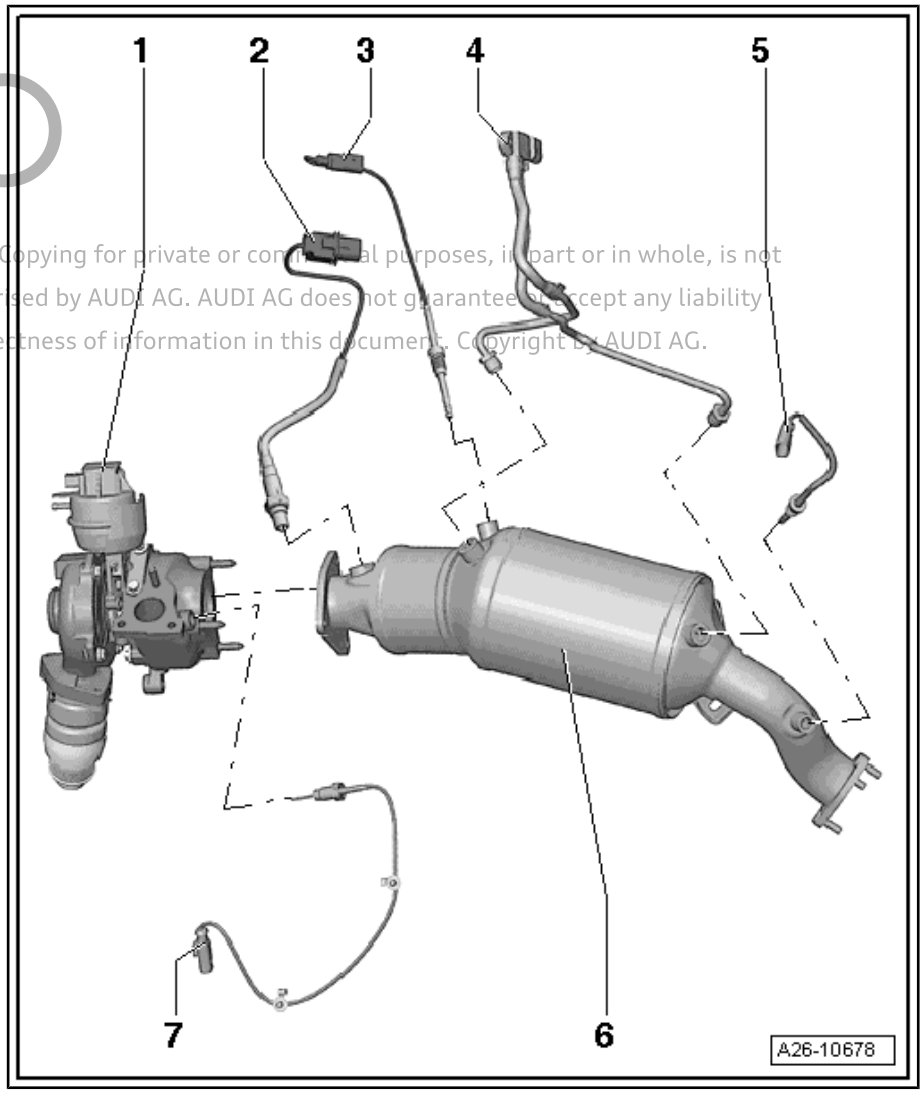
After renewing exhaust gas pressure sensor 1 - G450- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Functions; use ⇒ Vehicle diagnostic tester.

8 Lambda probe

⇒ "8.1 Exploded view - Lambda probe", page 253

⇒ "8.2 Removing and installing Lambda probe", page 254

8.1 Exploded view - Lambda probe



1 - Turbocharger

- With position sender for charge pressure positioner - G581-

2 - Lambda probe - G39- with Lambda probe heater - Z19-

- New Lambda probes are coated with an assembly paste
- In the case of a used Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Parts catalogue for high-temperature paste
- The assembly paste/ high-temperature paste must not make contact with the slots on the Lambda probe body
- Removing and installing ⇒ page 254
- 50 Nm

3 - Exhaust gas temperature sender 3 - G495-

- Removing and installing ⇒ page 273
- 45 Nm

4 - Exhaust gas pressure sensor 1 - G450-

- Tighten bolt to 4.5 Nm
- Removing and installing ⇒ page 251
- Pressure pipes to particulate filter: 45 Nm

5 - Exhaust gas temperature sender 4 - G648-

- Removing and installing ⇒ page 273
- 45 Nm

6 - Particulate filter

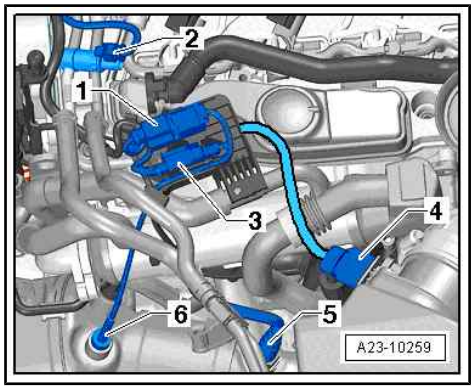
- Adaption must be performed after renewing particulate filter. Use ⇒ Vehicle diagnostic tester

7 - Exhaust gas temperature sender 1 - G235-

- Removing and installing ⇒ page 273
- 45 Nm

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Components



1 - Electrical connector for Lambda probe - G39- with Lambda probe heater - Z19-

2 - Fuel temperature sender - G81-

3 - Electrical connector for exhaust gas temperature sender 3 - G495-

4 - Air mass meter - G70-

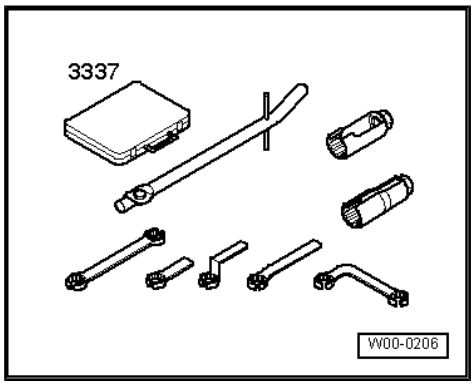
5 - Lambda probe - G39- with Lambda probe heater - Z19-

6 - Exhaust gas temperature sender 3 - G495-

8.2 Removing and installing Lambda probe

Special tools and workshop equipment required

- Lambda probe open ring spanner set - 3337-



Removing

WARNING

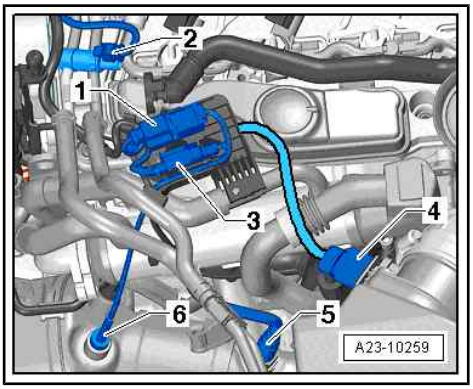
When working on all parts of the exhaust system:

- *Observe safety precautions when working on the exhaust system*
  ⇒ "2.6 Safety precautions when working on the exhaust system", page 4 .

– Remove engine cover panel ⇒ page 38 .

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– Unplug electrical connector -1- for Lambda probe - G39- .
– Unscrew Lambda probe - G39- -5- using tool from Lambda probe open ring spanner set - 3337- .



Installing

When installing, 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 reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*

- Tightening torques: refer to Exploded view - Lambda probe ⇒ page 253

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9 Engine control unit

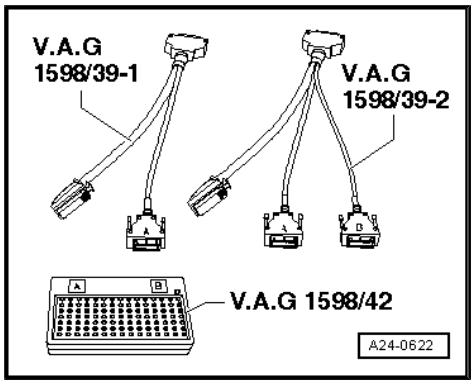
⇒ “9.1 Wiring and component check with test box V.A.G 1598/42 ”, page 256

⇒ “9.2 Removing and installing engine/motor control unit J623 ”, page 257

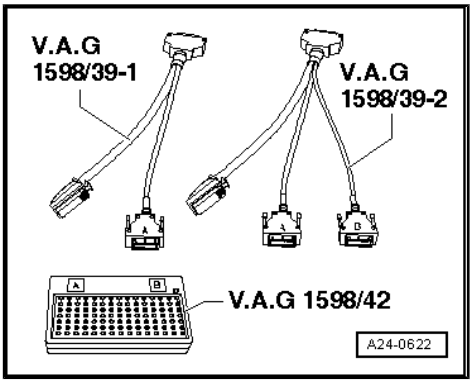
9.1 Wiring and component check with test box - V.A.G 1598/42-

Special tools and workshop equipment required

- Adapter cable - V.A.G 1598/39-1-
- Adapter cable - V.A.G 1598/39-2-
- Test box - V.A.G 1598/42-



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Note

- *The test box has 105 sockets. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.*
- *The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.*
- *To carry out tests on the 60-pin wiring harness connector, the adapter cable - V.A.G 1598/39-1- is connected to connector "A" on the test box. For components connected to 60-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *To carry out tests on the 94-pin wiring harness connector, the adapter cable - V.A.G 1598/39-2- must be connected to connectors "A" and "B" on the test box. For components connected to 94-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *The test box - V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.*
- *The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).*
- *The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.*

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WARNING

To prevent irreparable damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

– Remove engine control unit ⇒ page 257 .
– Connect the test box - V.A.G 1598/42- to wiring harness with adapter cable - V.A.G 1598/39-1- or adapter cable - V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
– Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence; the engine control unit must be installed with the protective housing. New shear bolts must be used.

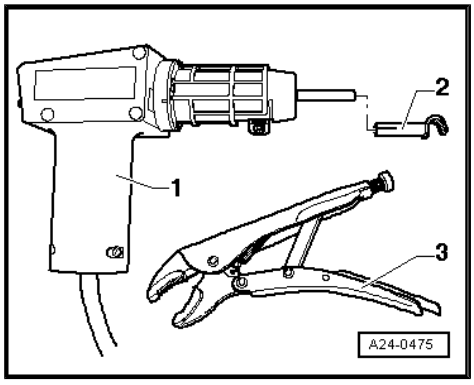
Perform the following after reconnecting engine control unit:

– Interrogate event memory.

9.2 Removing and installing engine/motor control unit - J623-

Special tools and workshop equipment required

- Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-
- Small, commercially available mole grips -3-



Removing

– Before removing the engine control unit - J623- , the adaption values of the injectors and the ash deposit mass must be read out. Use ⇒ Vehicle diagnostic tester.

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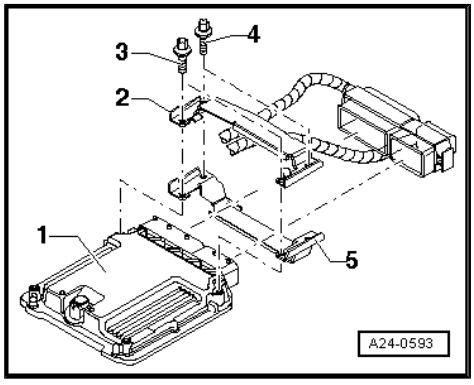
Note

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.

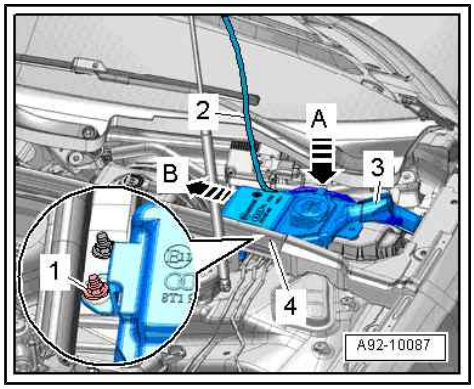
– Switch off ignition and remove ignition key after storing electronic file containing adaption values.

Note

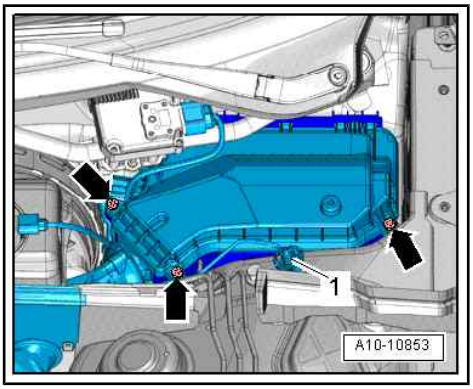
- *Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/gearbox combination.*
- *The engine control unit -1- is bolted to the protective housing -5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -2-, their threads have been coated with locking fluid.*
- *The protective housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).*



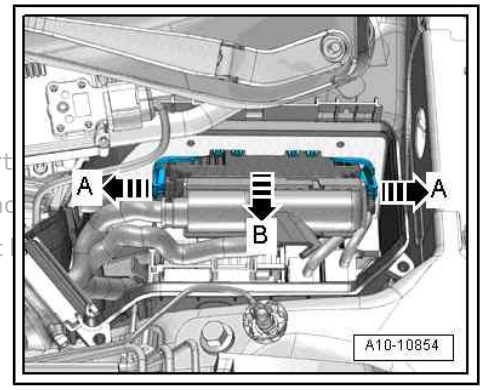
– Slightly pull off rubber seal in front of nut -1- on plenum chamber cover.
– Unscrew nut -1-.
– Unhook wiring harness -2- from retainers -A-.
– Pull filler neck -3- with filler pipe out of washer fluid reservoir and through opening in body.



– Unscrew bolts -arrows- and take off lid for electronics box.



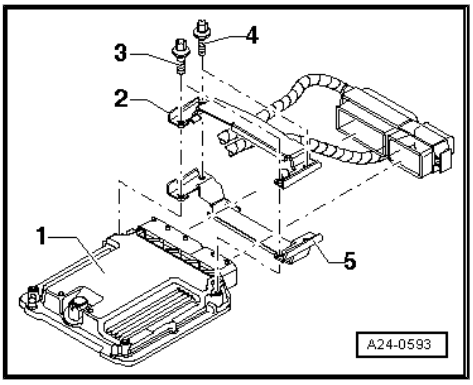
– Release retainers -arrows A- and pull out engine/motor control unit - J623- -arrow B-.



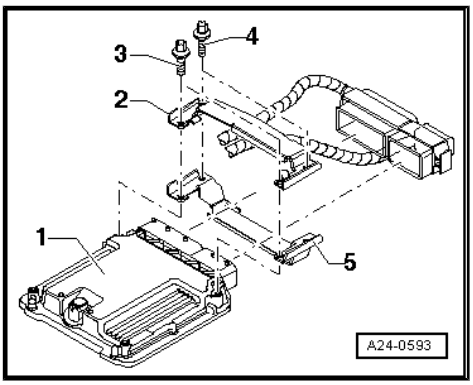
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To help prevent unauthorised access to the connectors on the engine control unit, the engine control unit -1- is bolted on by means of locking plates -2 and 5- and shear bolts -3 and 4-.

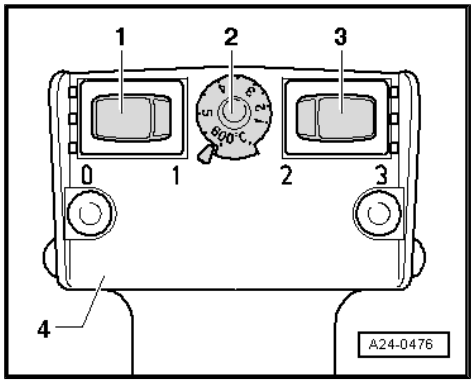
The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



– Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.

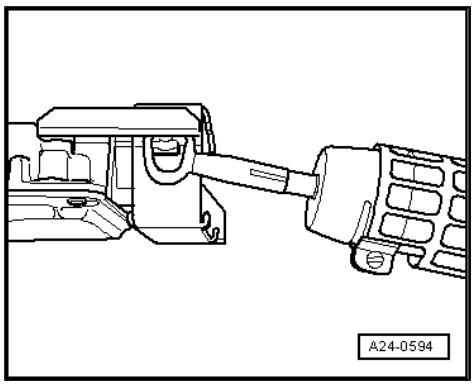


WARNING

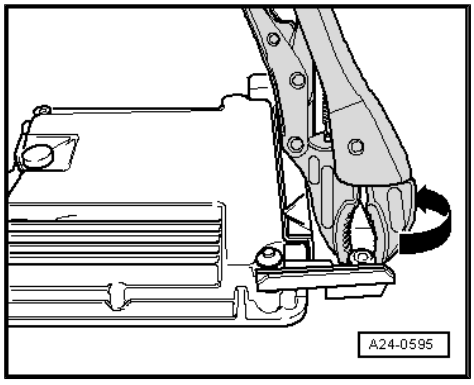
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

Switch on the hot air blower and heat the bolt for approximately 20 ... 30 seconds.

– Unscrew shear bolts using mole grips (see arrow in illustration).



– The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.



– Detach protective housing from control unit connectors.
– Release connectors on engine control unit and unplug connectors.
– Take out old engine control unit - J623- and install new engine control unit - J623- .

Installing

Installation is performed in the reverse sequence.

– After installation, the protective housing must be re-fitted on the engine control unit - J623- .
– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
– Always use new shear bolts.
• Tightening torque for bolts securing lid of electronics box: 3.5 Nm.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions. Use ⇒ Vehicle diagnostic tester.

– The injector delivery calibration and the injector voltage calibration must additionally be re-adapted in the engine control unit - J623- after the control unit has been renewed (these functions influence engine power and exhaust emissions).
– On vehicles with particulate filter the current mileage (km) reading must be stored in the engine control unit via an adaption procedure.

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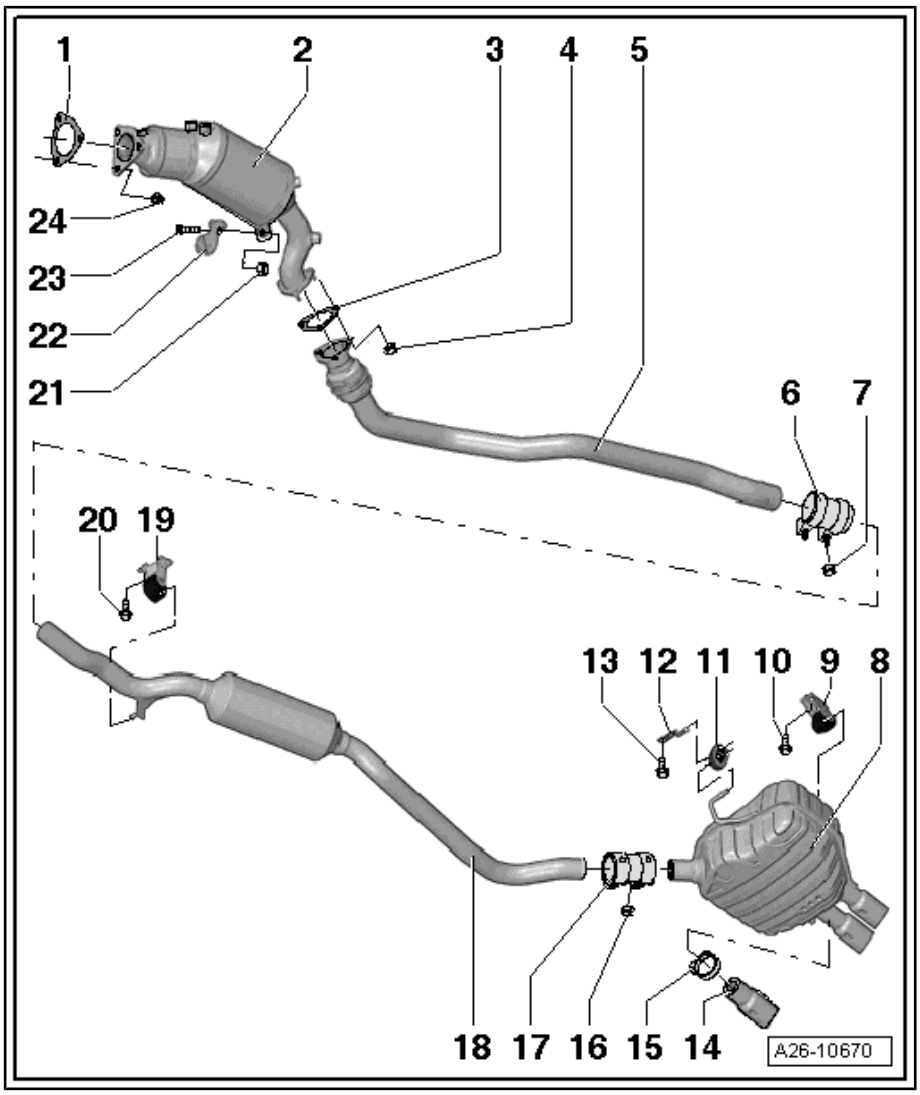
26 – Exhaust system

1 Exhaust pipes/silencers

⇒ “1.1 Exploded view - silencers”, page 261
⇒ “1.2 Removing and installing front exhaust pipe”, page 263
⇒ “1.3 Separating exhaust pipes/silencers”, page 264
⇒ “1.4 Renewing tailpipes”, page 265
⇒ “1.5 Stress-free alignment of exhaust system”, page 266
⇒ “1.6 Checking exhaust system for leaks”, page 267

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1.1 Exploded view - silencers



1 - Gasket
- ❑ Renew

2 - Particulate filter
- ❑ With catalytic converter
- ❑ With pressure line for exhaust gas pressure sensor 1 - G450-
- ❑ Removing and installing ⇒ page 268
- ❑ Mounting components ⇒ page 263
- ❑ After renewing, perform adaption in “Guided Functions” mode ⇒ Vehicle diagnostic tester

3 - Gasket
- ❑ Renew

4 - Nut
- ❑ Renew
- ❑ 23 Nm

5 - Front exhaust pipe
- ❑ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ❑ Protect against knocks and impact
- ❑ Removing and installing ⇒ page 263
- ❑ Align exhaust system so it is free of stress ⇒ page 266

6 - Clamp (front)
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 266
- ❑ Installation position ⇒ page 263
- ❑ Tighten bolted connections evenly

7 - Nut
- ❑ 23 Nm

8 - Rear silencer

- ❑ Combined in one unit with centre silencer as original equipment. Can be renewed separately for repair purposes
- ❑ Cutting point between centre silencer and rear silencer ⇒ page 264
- ❑ Renewing tailpipe ⇒ page 265
- ❑ Align exhaust system so it is free of stress ⇒ page 266

9 - Mounting

- ❑ Renew if damaged
- ❑ Check preload ⇒ “1.5 Stress-free alignment of exhaust system”, page 266

10 - Bolt

- ❑ 20 Nm

11 - Rubber mounting

- ❑ Renew if damaged

12 - Bracket

13 - Bolt

- ❑ 23 Nm

14 - Tailpipe

- ❑ Can be renewed separately for repair purposes ⇒ page 265
- ❑ Cutting point between rear silencer and tailpipe ⇒ page 265

15 - Clamp

16 - Nut

- ❑ 23 Nm

17 - Clamp (rear)

- ❑ For separate replacement of centre and rear silencers
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 266
- ❑ Installation position ⇒ page 263
- ❑ Tighten bolted connections evenly

18 - Centre silencer

- ❑ Combined in one unit with rear silencers as original equipment. Can be renewed separately for repair purposes
- ❑ Cutting point between centre silencer and rear silencer ⇒ page 264
- ❑ Align exhaust system so it is free of stress ⇒ page 266

19 - Mounting

- ❑ Renew if damaged
- ❑ Check preload ⇒ “1.5 Stress-free alignment of exhaust system”, page 266

20 - Bolt

- ❑ 23 Nm

21 - Nut

- ❑ 23 Nm

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22 - Bracket

23 - Bolt

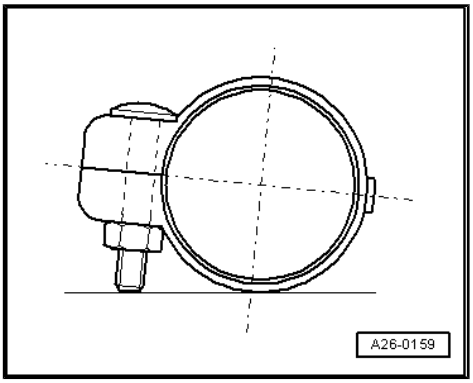
24 - Nut

- ❑ Renew
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 23 Nm

Installation position of front clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

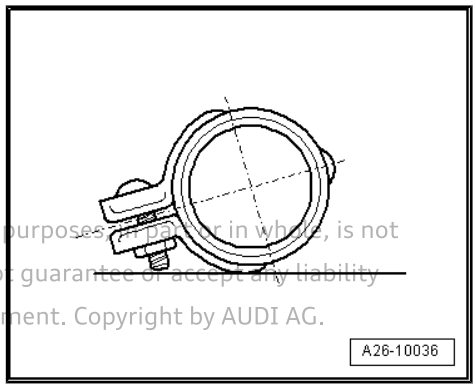
• Bolt connection faces to right.



Installation position of rear clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

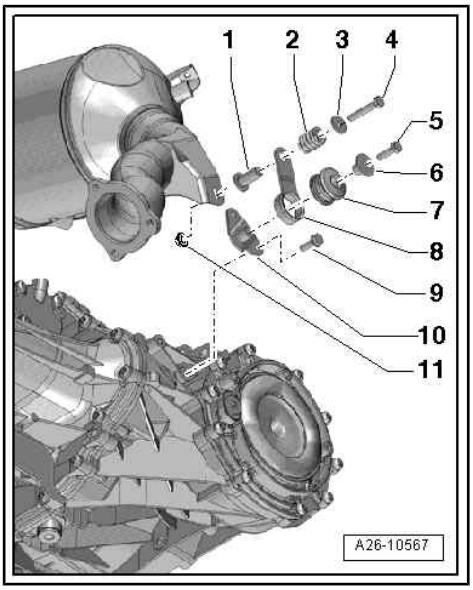
• Bolted connection faces to left.



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Components of mountings for particulate filter

1 - Spacer sleeve
2 - Compression spring
3 - Washer
4 - Bolt, 23 Nm
5 - Bolt, 23 Nm
6 - Spacer sleeve
7 - Buffer
8 - Bracket
9 - Bolt, 23 Nm
10 - Bracket
11 - Nut



1.2 Removing and installing front exhaust pipe

Removing

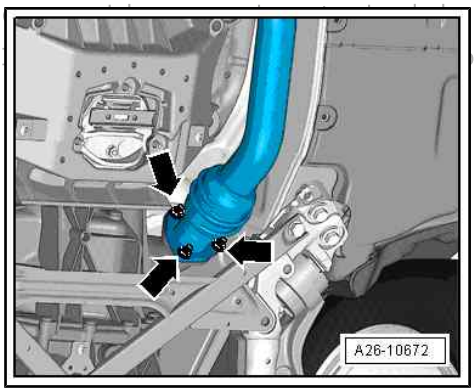
WARNING

When working on all parts of the exhaust system:

- *Observe safety precautions when working on the exhaust system*
  ⇒ "2.6 Safety precautions when working on the exhaust system", page 4 .

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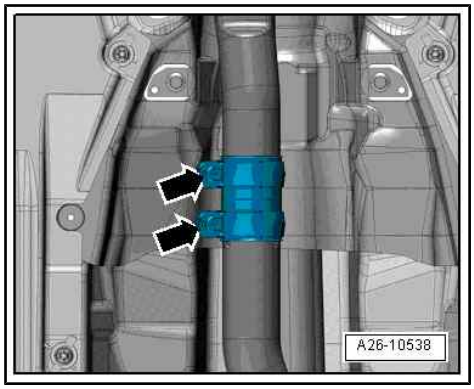
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Remove nuts -arrows- for front exhaust pipe.



Caution

Risk of damage to flexible joints in front exhaust pipe

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



– Loosen bolts -arrows-, push back clamp and detach front exhaust pipe.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques

- ⇒ “1.1 Exploded view - silencers”, page 261

Note

Renew seals, gaskets and self-locking nuts.

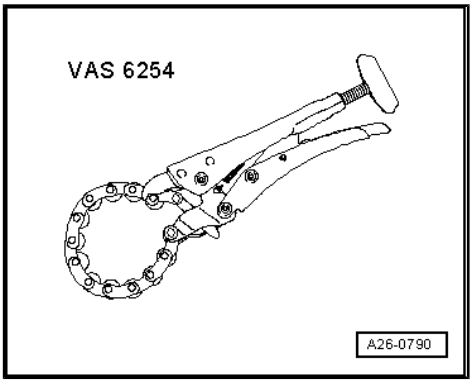
– Align the exhaust system so it is free of stress ⇒ page 266 .
– Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

1.3 Separating exhaust pipes/silencers

- The connecting pipe can be cut through at the cutting location in order to renew the centre and rear silencers separately.
- The cutting point is marked by an indentation on the circumference of the exhaust pipe.

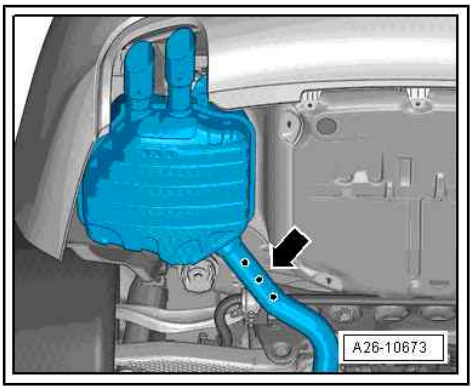
Special tools and workshop equipment required

♦ Chain pipe cutter - VAS 6254-

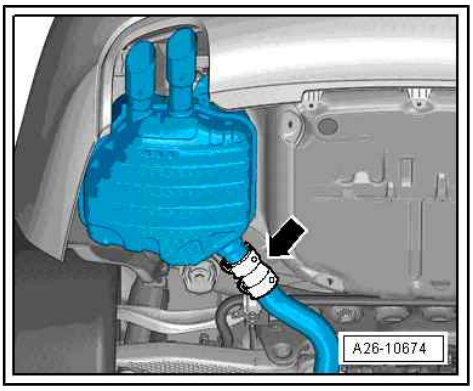


Procedure

– Cut through exhaust pipe at right angles at the position marked -arrow- using chain pipe cutter - VAS 6254- .



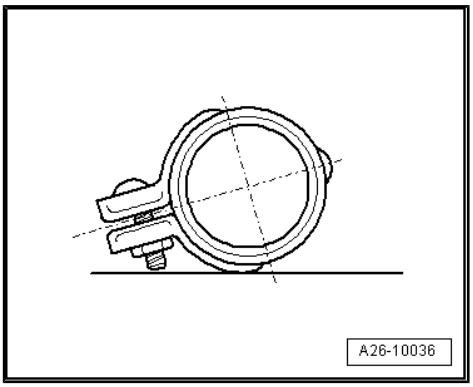
– Position centre of clamp -arrow- over cutting location.



– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Bolted connection faces to left.

– Align the exhaust system so it is free of stress ⇒ page 266 .



1.4 Renewing tailpipes

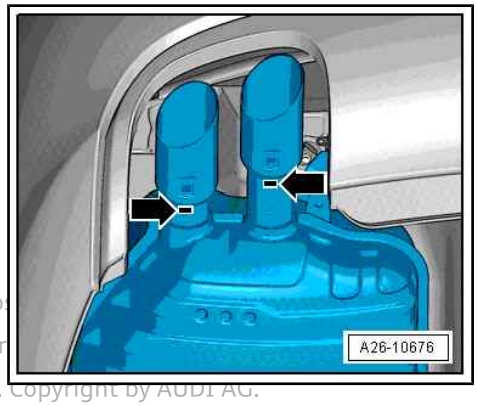
♦ The tailpipes can be cut through at the point marked so that the tailpipes can be renewed separately.

♦ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

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– Cut through exhaust pipe at right angle at the position marked by -arrows- using chain pipe cutter - VAS 6254- .

– Fit tailpipe.

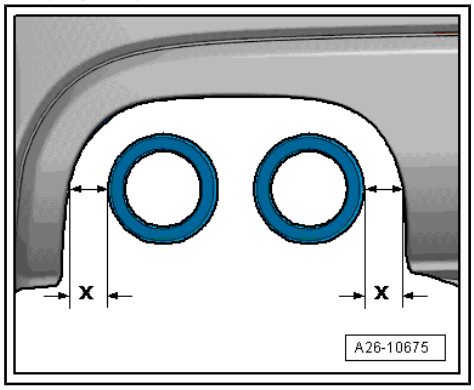


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– Check clearance between tailpipe and bumper:

• Dimension -x- (left-side) = dimension -x- (right-side)

– Tighten bolt connections on clamps.



1.5 Stress-free alignment of exhaust system

Procedure

• The exhaust system must be aligned when it is cool.

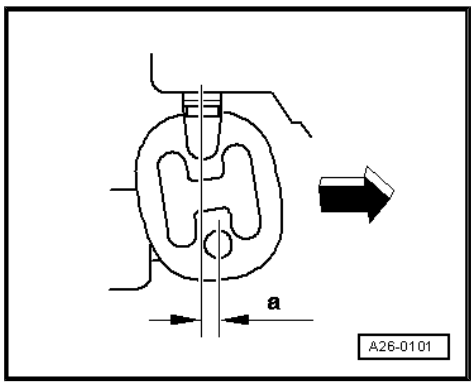
• Tightening torque ⇒ page 261

Vehicles without clamps between centre silencer and rear silencer

– Loosen bolted connections on front clamp.

– Push exhaust system towards front of vehicle -arrow- so that rear mountings for rear silencer are preloaded by -a- = 11 ... 15 mm.

– Align rear silencer so it is horizontal.



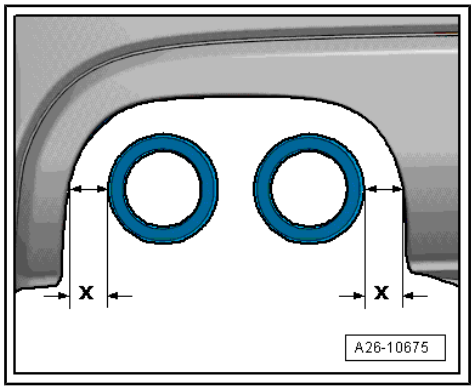
– Check clearance between tailpipes and bumper:

• Dimension -x- (left-side) = dimension -x- (right-side)

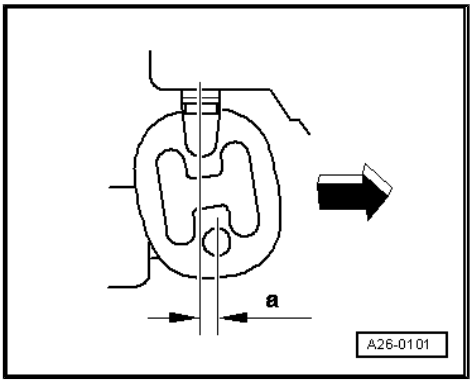
– Tighten bolt connections on clamp evenly.

Vehicles with clamps between centre silencer and rear silencer

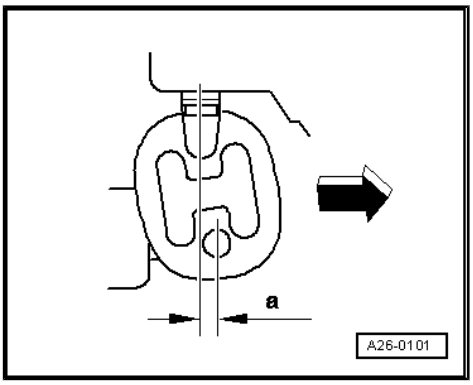
– Loosen bolted connections on front and rear clamps.



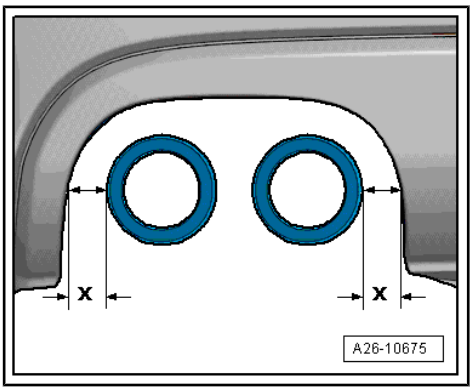
– Push centre silencer towards front of vehicle -arrow- until mounting for centre silencer is preloaded by -a- = 6 ... 10 mm.
– Tighten bolt connections on front clamp evenly.



– Push rear silencer towards front of vehicle -arrow- so that rear mounting for rear silencer is preloaded by -a- = 11 ... 15 mm.
– Align rear silencer so it is horizontal.



– Check clearance between tailpipes and bumper:
• Dimension -x- (left-side) = dimension -x- (right-side)
– Tighten bolted connections on rear clamps evenly.



1.6 Checking exhaust system for leaks

– Start the engine and run at idling speed.
– Plug tailpipe during leak test (e.g. with cloth or plugs).
– Listen for leaks at connection points between cylinder head/exhaust manifold, exhaust manifold/intermediate pipe and turbocharger/intermediate flange etc.
– Rectify any leaks that are found.

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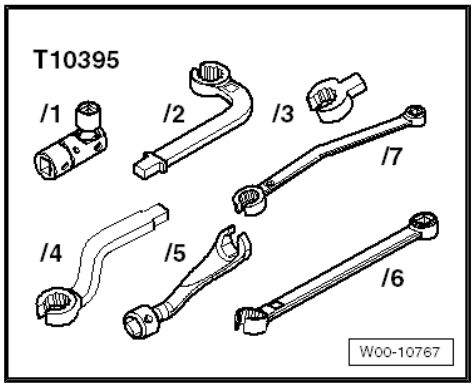
2 Emission control system

⇒ “2.1 Removing and installing particulate filter”, page 268

2.1 Removing and installing particulate filter

Special tools and workshop equipment required

- Tool set, 17 mm - T10395-



Removing

Note

- *Fit all cable ties in the original positions when installing.*
- *On vehicles with a multitronic gearbox the turbocharger must be removed to remove the particulate filter ⇒ “1.2 Removing and installing turbocharger”, page 179 .*

WARNING

When working on all parts of the exhaust system:

- ***Observe safety precautions when working on the exhaust system ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .***

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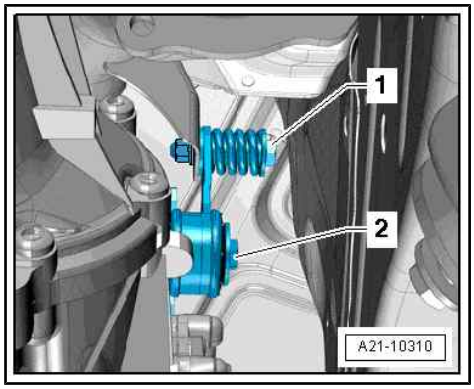
Vehicles with multitronic gearbox

– Remove turbocharger ⇒ page 179 .

All vehicles (continued)

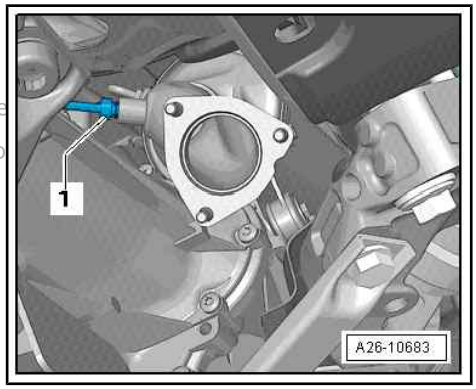
– Remove front exhaust pipe ⇒ page 263 .

– Unfasten connection -1-, remove bolt -2- and take out mounting for particulate filter.

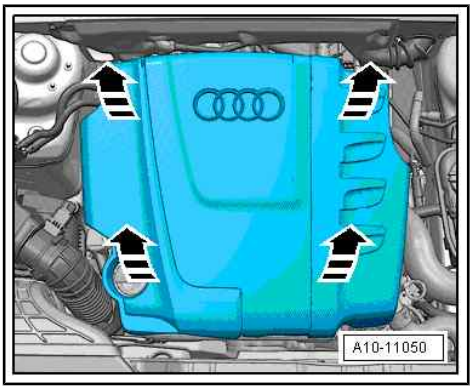


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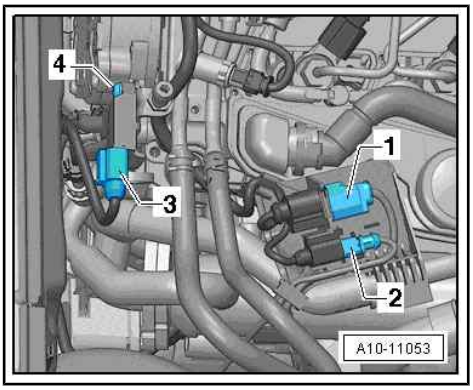
– Remove exhaust gas temperature sender 4 - G648- -1-.



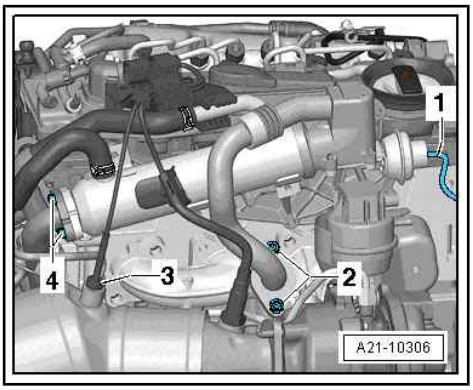
– Remove engine cover panel -arrows-.
– Remove air cleaner housing ⇒ page 212 .



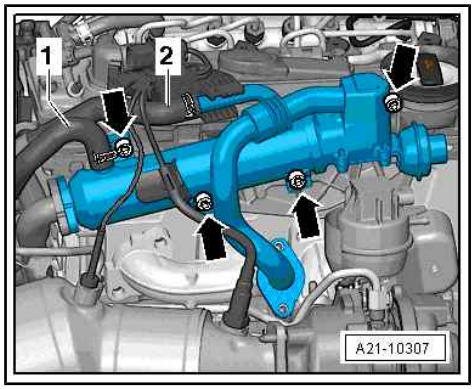
– Unplug electrical connectors -1- for Lambda probe - G39- and -2- for exhaust gas temperature sender 3 - G495- and move clear.
– Unplug electrical connector -3- for exhaust gas pressure sensor 1 - G450- .
– Remove bolt -4-, unclip air hoses for exhaust gas pressure sensor 1 and remove from particulate filter.



– Remove exhaust gas temperature sender 3 - G495- -3-.
– Disconnect vacuum hose -1-.
– Remove bolts -2-.



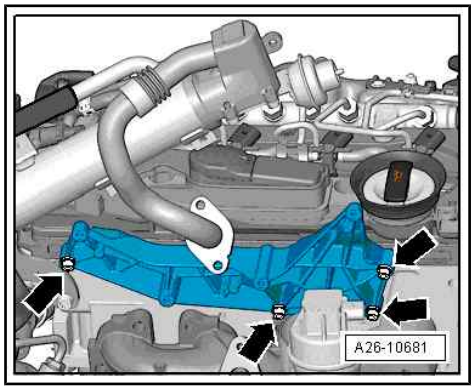
– Remove bolts -arrows- and tie up exhaust gas recirculation cooler.



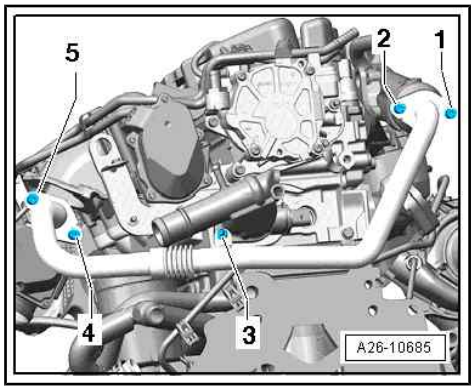
Note

Coolant hoses -1- and -2- must not be detached.

– Unfasten bolts -arrows- and remove bracket for exhaust gas recirculation.



– Remove nut -3- for exhaust gas recirculation pipe.
– Remove bolts -1 and 2- and -4 and 5-, move exhaust gas recirculation pipe aside.



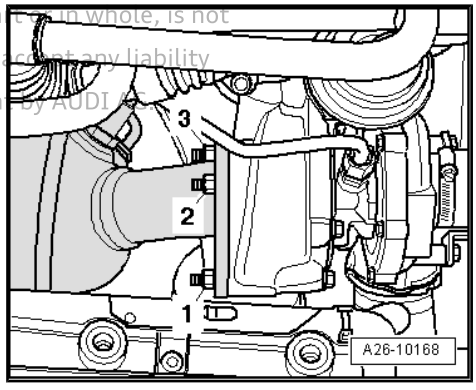
Note

It is not possible to remove exhaust gas recirculation pipe.

Note

- *On vehicles with auxiliary heater*
- *Using hose clamps up to 25 mm - 3094- clamp off coolant hoses at plenum chamber partition panel and detach from metal pipe.*
- *Unfasten coolant line from suspension turret and longitudinal member and swivel to side.*

– Remove nuts -1, 2 and 3- on turbocharger.

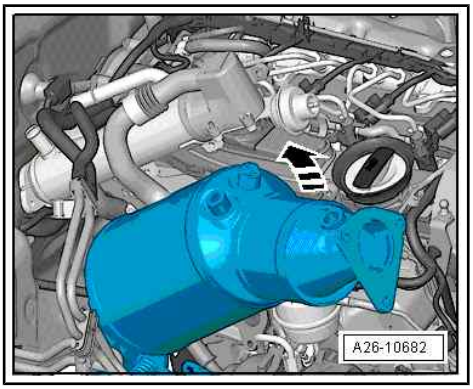


Note

Nut -1- is accessible from below on vehicles with auxiliary heater.

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– Guide out particulate filter upwards -arrow-.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques

- ⇒ “1.1 Exploded view - silencers”, page 261
- ⇒ “3.1 Exploded view - exhaust gas temperature control”, page 272
- ⇒ “4.1 Exploded view - exhaust gas recirculation system”, page 279

Note

Renew seals, gaskets and self-locking nuts.

– After renewing particulate filter, perform "Adaption" in “Guided Functions” mode ⇒ Vehicle diagnostic tester.

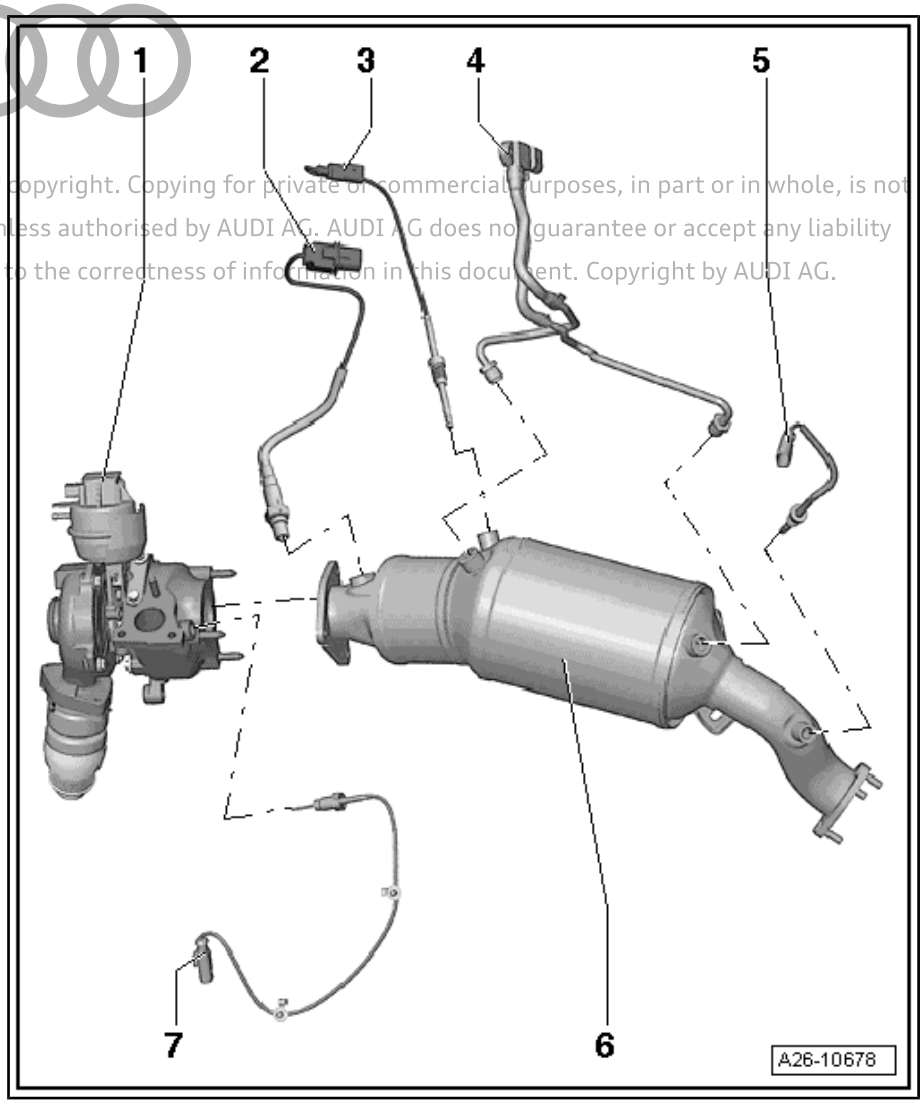
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3 Exhaust gas temperature control

⇒ “3.1 Exploded view - exhaust gas temperature control”, page 272

⇒ “3.2 Removing and installing exhaust gas temperature sender”, page 273

3.1 Exploded view - exhaust gas temperature control



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1 - Turbocharger

2 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing ⇒ page 254

3 - Exhaust gas temperature sender 3 - G495-

- ❑ 45 Nm
- ❑ Removing and installing ⇒ page 275
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

4 - Exhaust gas pressure sensor 1 - G450-

- ❑ Removing and installing ⇒ page 251
- ❑ Pressure pipes to particulate filter: 45 Nm
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

5 - Exhaust gas temperature sender 4 - G648-

- ❑ 45 Nm
- ❑ Removing and installing ⇒ page 273
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

6 - Particulate filter

7 - Exhaust gas temperature sender 1 - G235-

- ❑ 45 Nm
- ❑ Removing and installing ⇒ page 273
- ❑ Coat with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

3.2 Removing and installing exhaust gas temperature sender

⇒ "3.2.1 Removing and installing exhaust gas temperature sender 1 G235 ", page 273

⇒ "3.2.2 Removing and installing exhaust gas temperature sender 3 G495 ", page 275

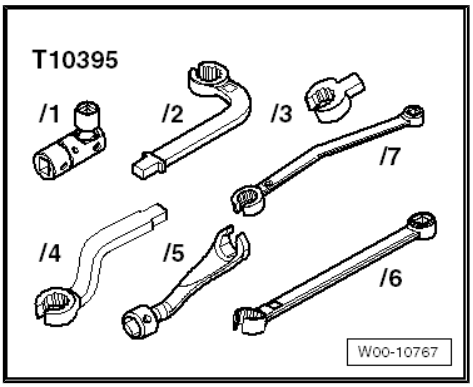
⇒ "3.2.3 Removing and installing exhaust gas temperature sender 4 G648 ", page 276

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3.2.1 Removing and installing exhaust gas temperature sender 1 - G235-

Special tools and workshop equipment required

- Tool set, 17 mm - T10395-



Removing

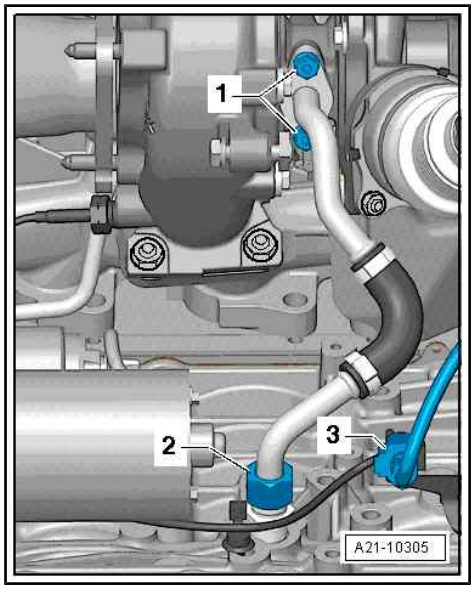
WARNING

When working on all parts of the exhaust system:

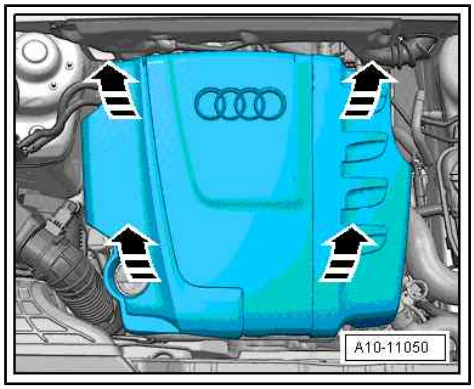
- *Observe safety precautions when working on the exhaust system*
  ⇒ "2.6 Safety precautions when working on the exhaust system", page 4 .

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

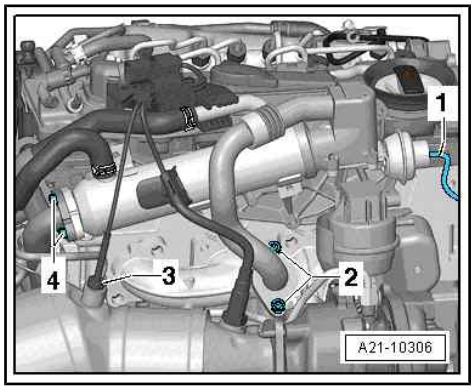
– Unplug electrical connector -3- for exhaust gas temperature sender 1 - G235- and unclip from bottom of cylinder block.
– Remove air cleaner housing ⇒ page 212 .



– Remove engine cover panel -arrows-.



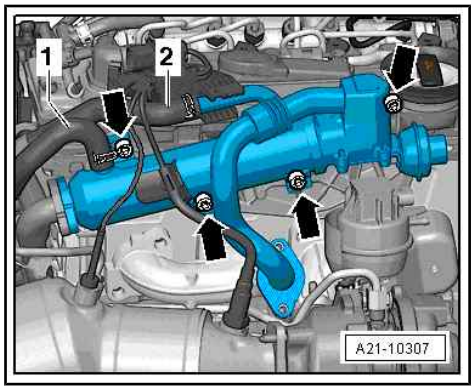
– Disconnect vacuum hose -1-.
– Remove bolts -2- and -4-.



Note

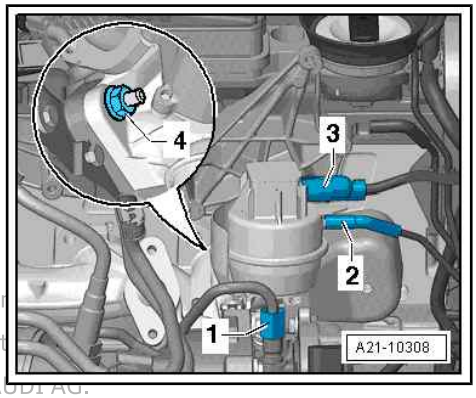
Coolant hoses -1- and -2- must not be detached.

– Remove bolts -arrows- and tie up exhaust gas recirculation cooler.



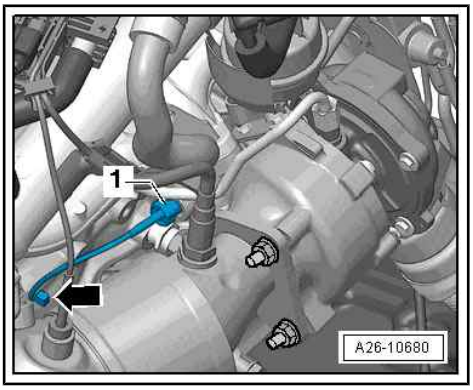
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– Remove union nut -1-.



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– Remove exhaust gas temperature sender 1 - G235- -1- and unclip electrical wiring on cylinder block -arrow-.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

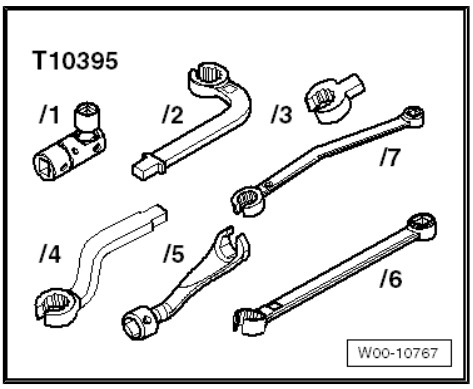
Tightening torques
⇒ “3.1 Exploded view - exhaust gas temperature control”, page 272

Tightening torques
⇒ “4.1 Exploded view - exhaust gas recirculation system”, page 279

3.2.2 Removing and installing exhaust gas temperature sender 3 - G495-

Special tools and workshop equipment required

- Tool set, 17 mm - T10395-



Removing

Note

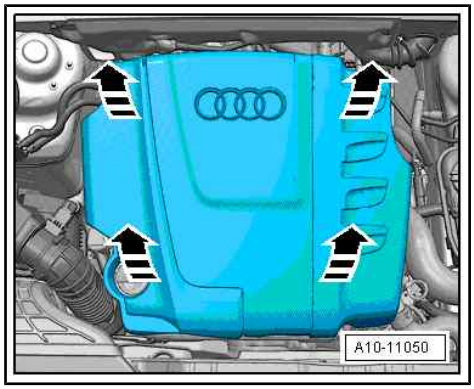
Fit all cable ties in the original positions when installing.

WARNING

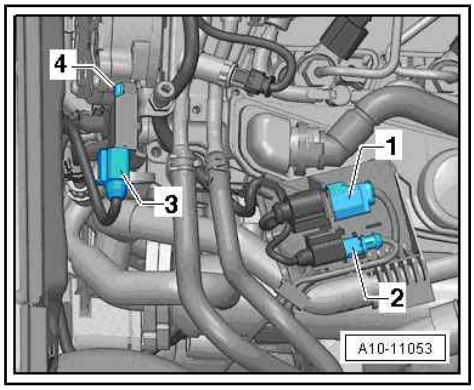
When working on all parts of the exhaust system:

- ***Observe safety precautions when working on the exhaust system***
  ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

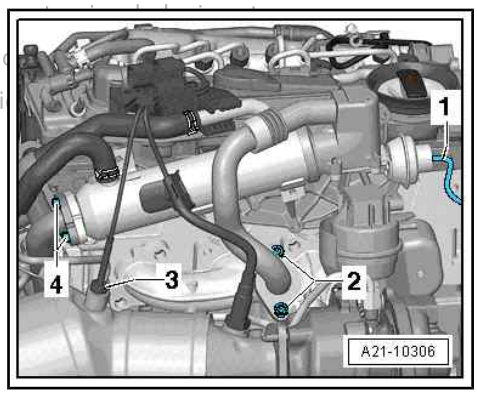
– Remove engine cover panel -arrows-.



– Unplug electrical connector -2- at exhaust gas temperature sender 3 - G495- and move clear.



– Remove exhaust gas temperature sender 3 - G495- -3-.



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Installing

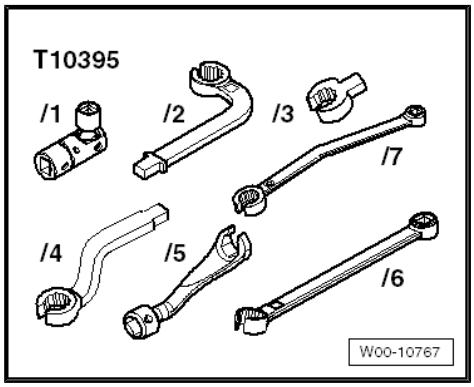
Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “3.1 Exploded view - exhaust gas temperature control”, page 272

3.2.3 Removing and installing exhaust gas temperature sender 4 - G648-

Special tools and workshop equipment required

♦ Tool set, 17 mm - T10395-



Removing

WARNING

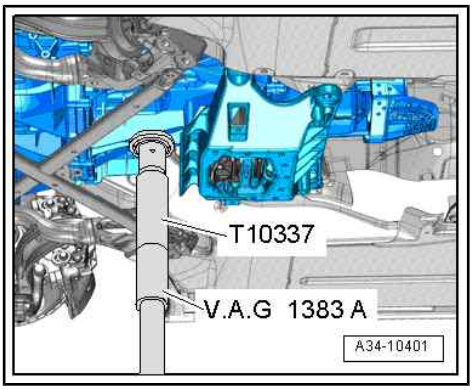
When working on all parts of the exhaust system:

- *Observe safety precautions when working on the exhaust system*
  ⇒ "2.6 Safety precautions when working on the exhaust system", page 4 .

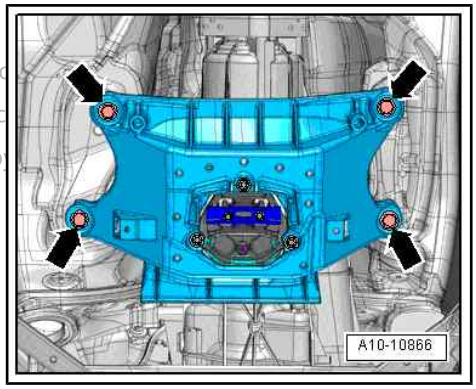
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

– Remove front exhaust pipe ⇒ page 263 .

– Support gearbox using engine and gearbox jack - V.A.G 1383 A- with gearbox support - T10337- attached.



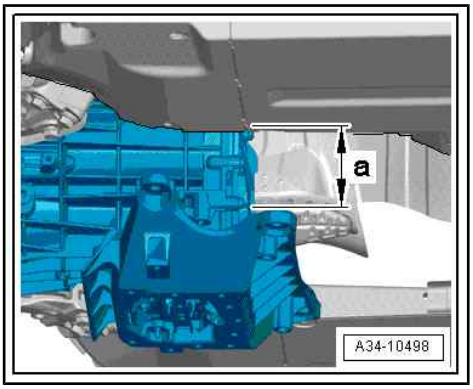
– Remove bolts -arrows- for tunnel cross member.



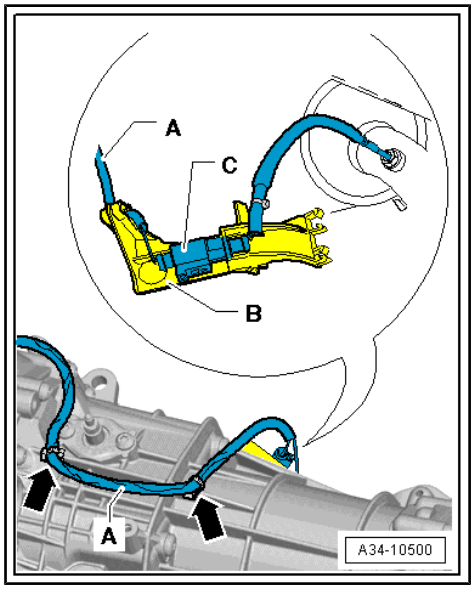
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– Lower gearbox using engine and gearbox jack - V.A.G 1383 A- as far as distance -a-.

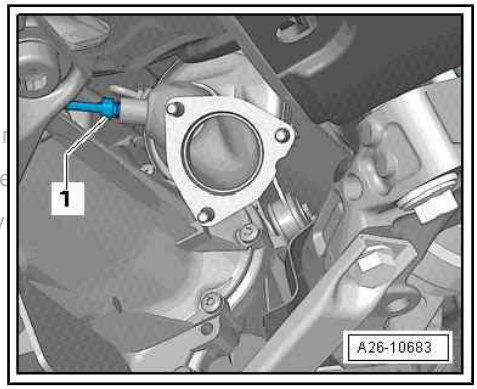
- Dimension -a- = 80 mm (maximum).



– Unclip electrical wiring -A- from gearbox and unplug electrical connector -C-.
– Unclip bracket -B- for exhaust gas temperature sender 4 - G648- from gearbox.



– Remove exhaust gas temperature sender 4 - G648- -1-.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques ⇒ “3.1 Exploded view - exhaust gas temperature control”, page 272

Tightening torques ⇒ “1.1 Exploded view - silencers”, page 261

Tightening torques for tunnel cross member ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

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4 Exhaust gas recirculation

⇒ “4.1 Exploded view - exhaust gas recirculation system”, page 279

⇒ “4.2 Exploded view - exhaust gas recirculation valve N18 with exhaust gas recirculation potentiometer G212 ”, page 280

⇒ “4.3 Removing and installing exhaust gas recirculation valve N18 ”, page 281

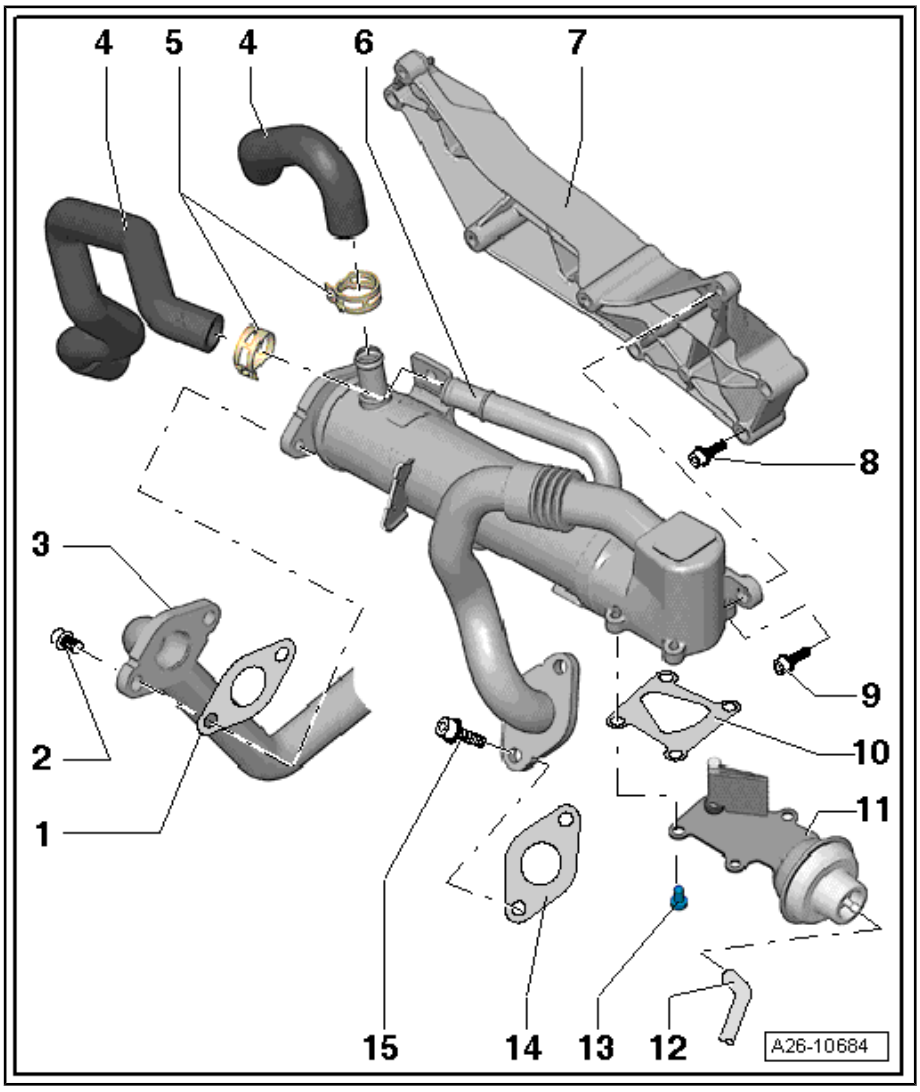
⇒ “4.4 Removing and installing exhaust gas recirculation cooler”, page 282

⇒ “4.5 Removing and installing vacuum unit for exhaust gas recirculation cooler”, page 283

⇒ “4.6 Cleaning exhaust gas recirculation system”, page 285

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4.1 Exploded view - exhaust gas recirculation system



1 - Gasket
- ❑ Renew

2 - Bolt
- ❑ Tightening torque and sequence ⇒ page 280

3 - Connecting pipe for exhaust gas recirculation
- ❑ Tightening torque and sequence ⇒ page 280

4 - Coolant hoses

5 - Spring-type clip

6 - Exhaust gas recirculation cooler
- ❑ Removing and installing ⇒ page 282

7 - Bracket

8 - Bolt
- ❑ 9 Nm

9 - Bolt
- ❑ 9 Nm

10 - Gasket

11 - Vacuum unit

12 - Vacuum hose
- ❑ From exhaust gas recirculation cooler change-over valve - N345-

13 - Bolt
- ❑ 7 Nm

14 - Gasket
- ❑ Renew

15 - Bolt
- ❑ 25 Nm
- ❑ Renew

Tightening torque and sequence

1 - Position bolts -4- and-5-.

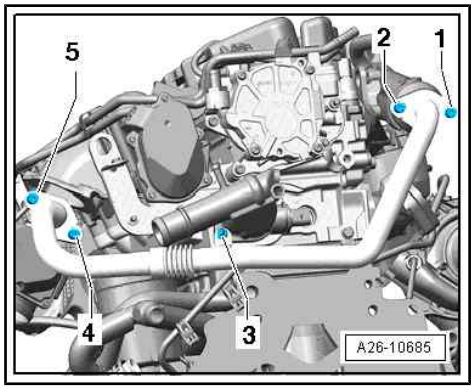
2 - Position bolts -1- and-2-.

3 - Fit nut -3-.

4 - Tighten bolts -1- and -2- to 20 Nm.

5 - Tighten bolts -4- and -5- to 20 Nm.

6 - Tighten bolt -3- to 8 Nm.



4.2 Exploded view - exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

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1 - Intake manifold

- ❑ Removing and installing ⇒ page 215

2 - Bolt

- ❑ Tightening torque ⇒ Item 2 (page 215)

3 - Gasket

- ❑ Renew

4 - Seal

- ❑ Renew

5 - Pipe

- ❑ Tightening torque and sequence ⇒ page 280
- ❑ To exhaust gas recirculation cooler

6 - Bolt

- ❑ Tightening torque and sequence ⇒ page 280

7 - Gasket

- ❑ Renew

8 - Bolt

- ❑ 10 Nm

9 - Intake manifold flap motor - V157-

10 - Bolt

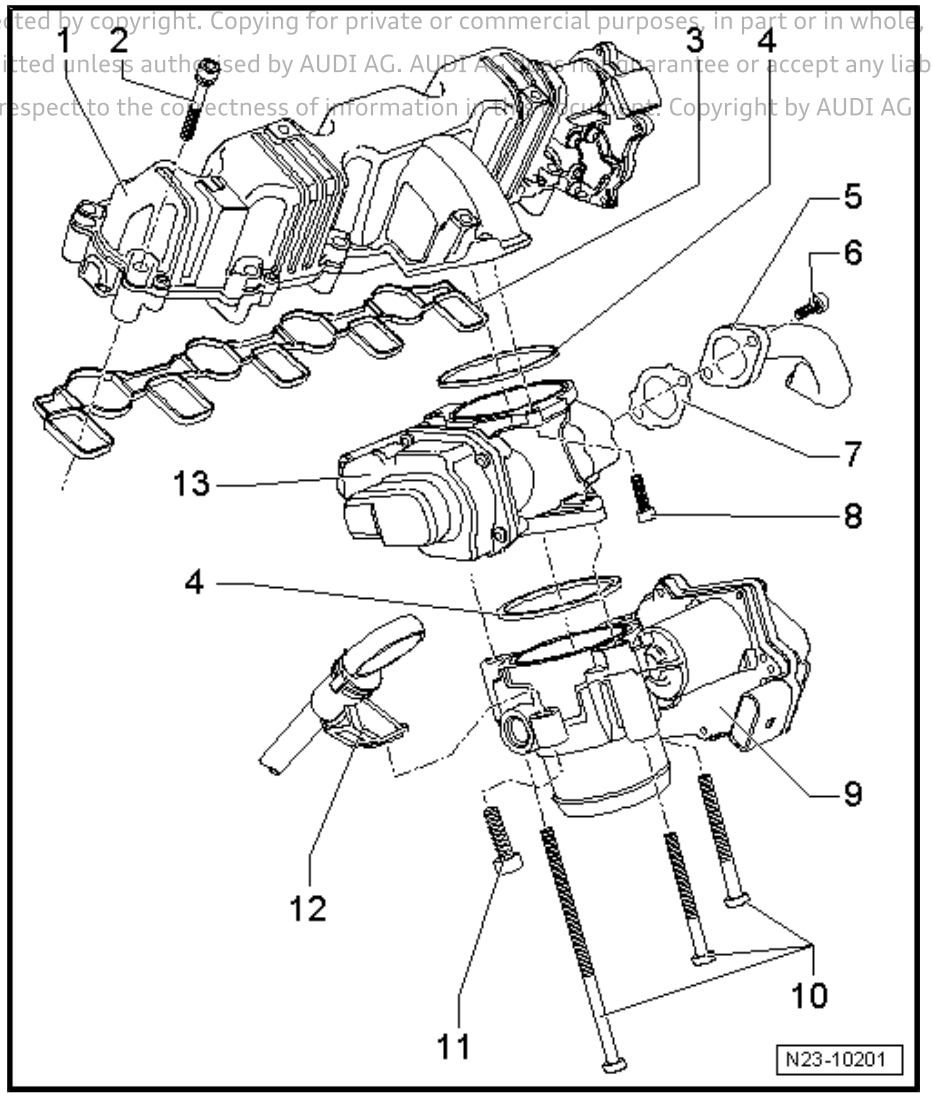
- ❑ Tightening torque ⇒ Item 10 (page 215)

11 - Bolt

- ❑ 10 Nm

12 - Dipstick guide tube

13 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

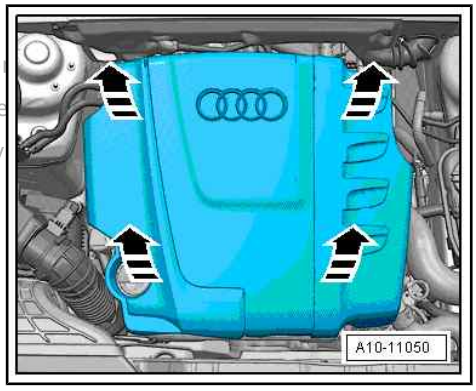


4.3 Removing and installing exhaust gas recirculation valve - N18-

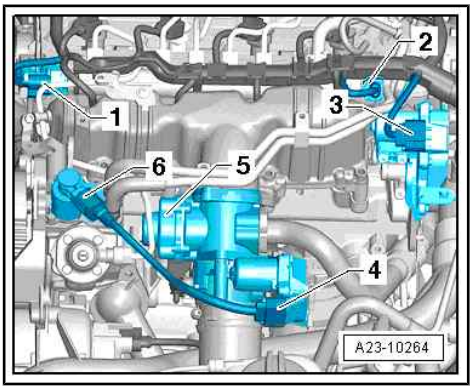
Removing

– Remove engine cover panel -arrows-.

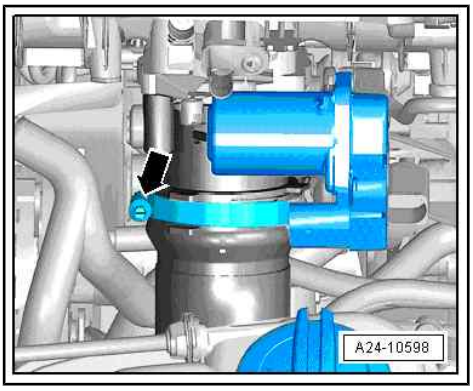
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– Unplug electrical connector -4-.

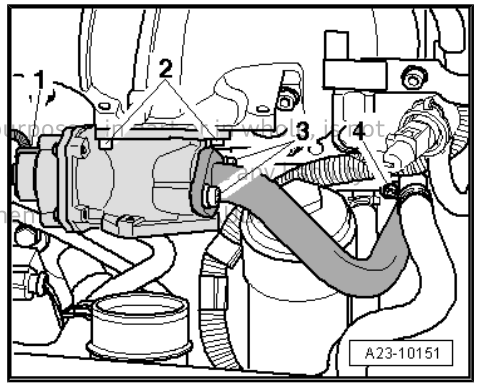


– Open hose clip -arrow- securing air hose and disconnect hose downwards from intake manifold flap motor - V157- .
– Remove intake manifold flap motor - V157- .



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– Unplug electrical connector -1-.
– Remove bolts -2- and -3- and detach exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212- .



Note

Disregard -item 4-.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

– Remove exhaust gas recirculation valve - N18-
⇒ “4.3 Removing and installing exhaust gas recirculation valve N18 ”, page 281 .

Note

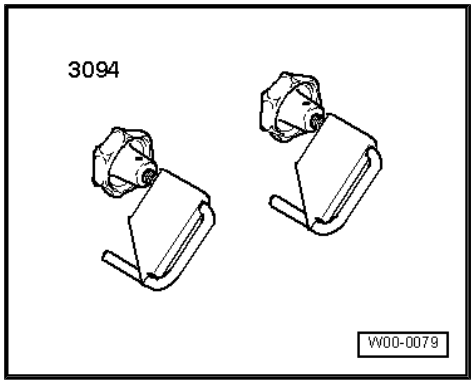
Renew seals.

– Install intake manifold flap motor - V157-
⇒ “4.1 Exploded view - intake manifold”, page 215 .

4.4 Removing and installing exhaust gas recirculation cooler

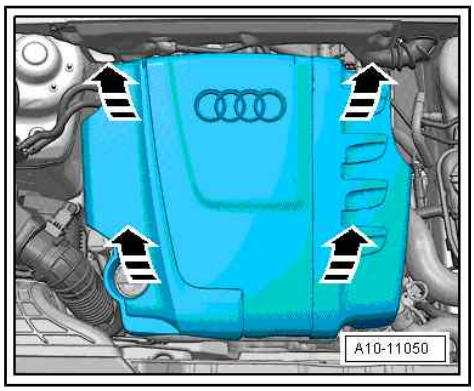
Special tools and workshop equipment required

♦ Hose clamps up to 25 mm - 3094-

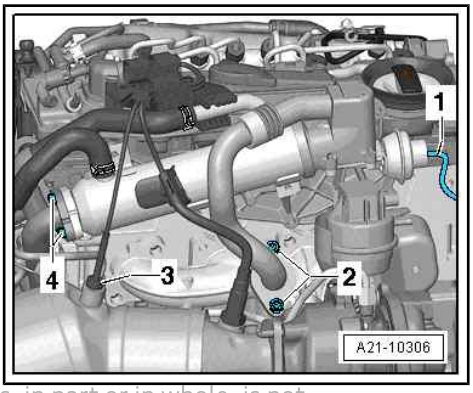


Removing

– Remove engine cover panel -arrows-.
– Remove air cleaner housing ⇒ page 212 .

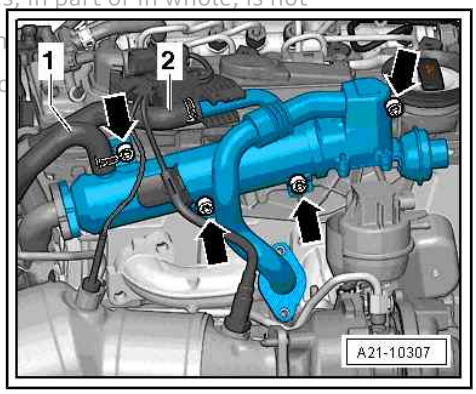


– Disconnect vacuum hose -1-.
– Remove bolts -2- and -4-.



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– Clamp off coolant hoses -1- and -2- using hose clamps up to 25 mm - 3094- and disconnect hoses.
– Remove bolts -arrows- and detach exhaust gas recirculation cooler.



Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “4.1 Exploded view - exhaust gas recirculation system”, page 279

Note

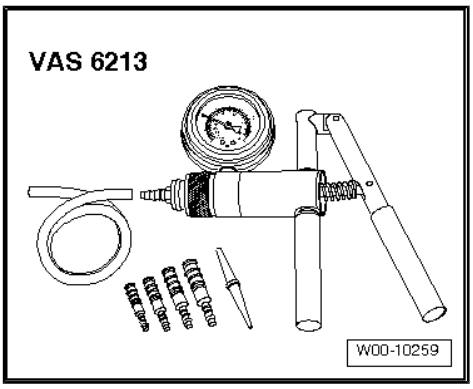
- *Renew gaskets and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Top up coolant.

4.5 Removing and installing vacuum unit for exhaust gas recirculation cooler

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



Removing

– Remove engine cover panel -arrows-.

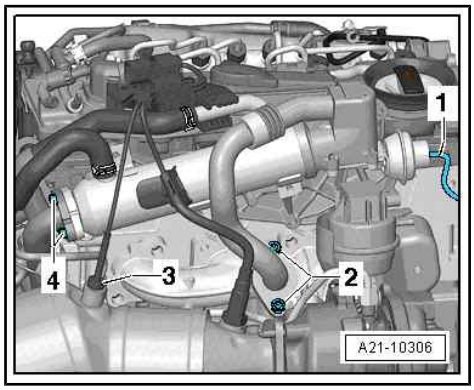
– Remove air cleaner housing ⇒ page 212 .

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– Disconnect vacuum hose -1-.

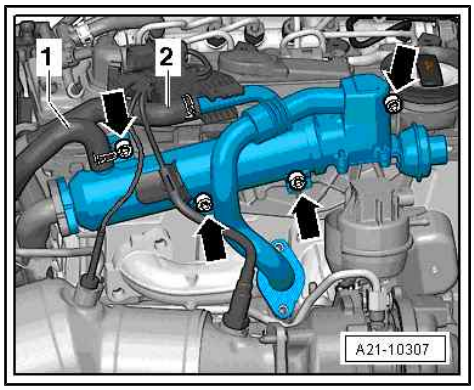
– Remove bolts -2- and -4-.



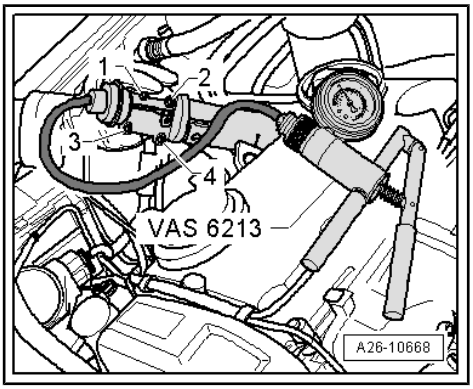
Note

Coolant hoses -1- and -2- must not be detached.

– Remove bolts -arrows- and move exhaust gas recirculation cooler to one side.



– Remove bolts -1- to -4- and detach vacuum unit with gasket.



Note

Disregard hand vacuum pump - VAS 6213- .

Installing

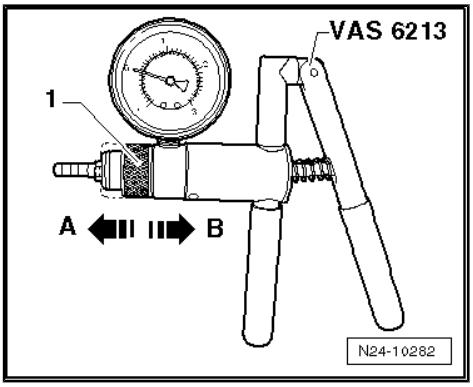
Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “4.1 Exploded view - exhaust gas recirculation system”, page 279

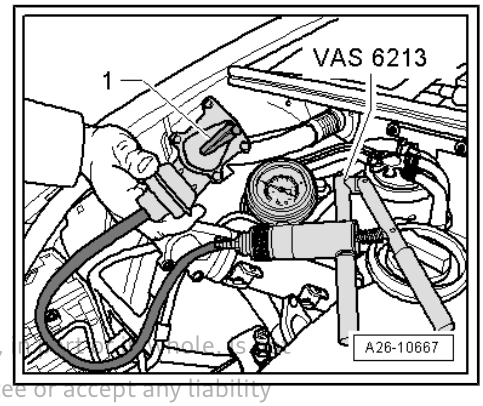
Note

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

– Set sliding ring -1- to position -A- for vacuum function.



– Set change-over flap -1- as shown in illustration using hand vacuum pump - VAS 6213- .
– Install vacuum unit with gasket and secure in position.



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4.6 Cleaning exhaust gas recirculation system

Special tools and workshop equipment required

- Cooler rinsing system for exhaust gas recirculation - VAS 542 007-



- Adapter - VAS 542007/4-2- , 2x
- Ultrasonic cleaning unit - VAS 6418-

Explanation:

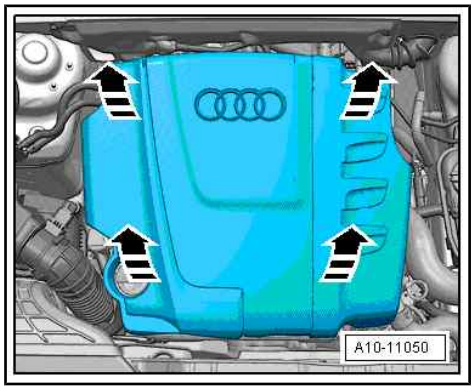
Certain extreme driving modes (e.g. short distances) may result in varnish formation/carbon deposits inside the exhaust gas re-circulation cooler. In this case, the exhaust emissions warning lamp in the instrument cluster lights up and the following code appears in the event memory:

- P401 EGR system throughput too low

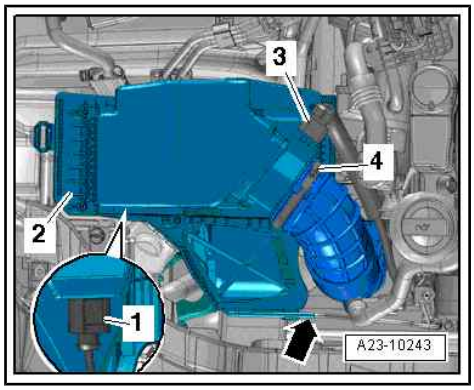
In these cases, these carbon deposits can be removed by carrying out the rinsing/cleaning procedure described below.

Starting cleaning procedure for exhaust gas recirculation system

– Remove engine cover panel -arrows-.



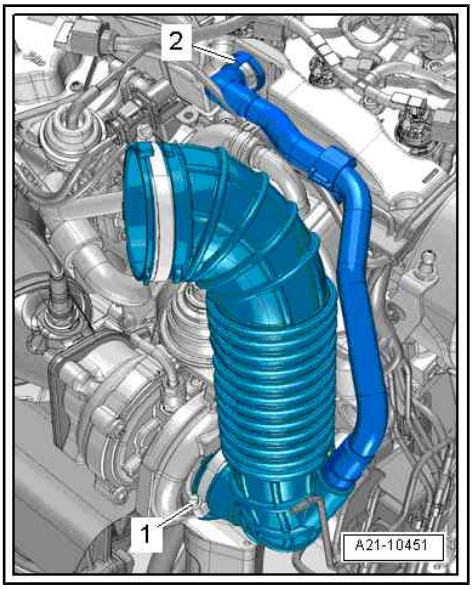
– Remove air cleaner housing ⇒ page 212 .



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– Press release tabs and detach crankcase breather hose -2-.

– Loosen hose clip -1- and remove air hose.



Cleaning exhaust gas recirculation valve - N18- :

– Remove exhaust gas recirculation valve - N18-
⇒ “4.3 Removing and installing exhaust gas recirculation valve N18 ”, page 281 .

Note

The ultrasonic bath can be heated up more quickly by using warm tap water.

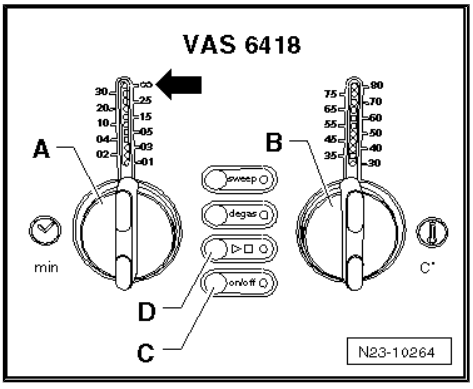
– Fill ultrasonic cleaning unit - VAS 6418- with 1800 ml of warm (approx. 40 °C) tap water and 200 ml cleaning solution D 600 200 A2.

– 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

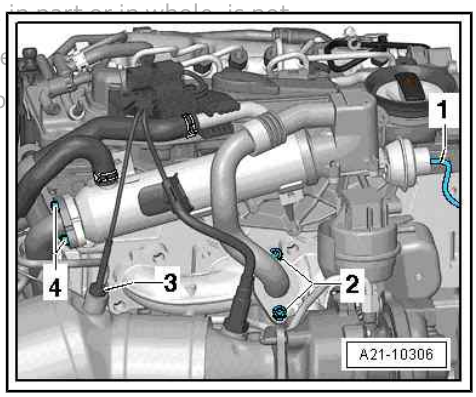
- *The temperature-controlled cleaning process is now started. While the fluid is being heated, the ultrasound is activated at intervals in order to circulate the cleaning solution. The ultrasound is activated continuously when the preselected temperature is reached.*
- *The actual cleaning process commences when the temperature reaches at least 40 °C and must last for at least 10 minutes.*

– After cleaning, rinse exhaust gas recirculation valve - N18- with clean water and blow out with compressed air.

On vehicle (continued):

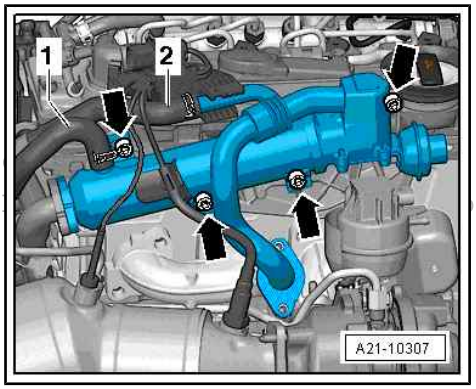
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– Remove bolts -2- and -4- for connecting pipes.



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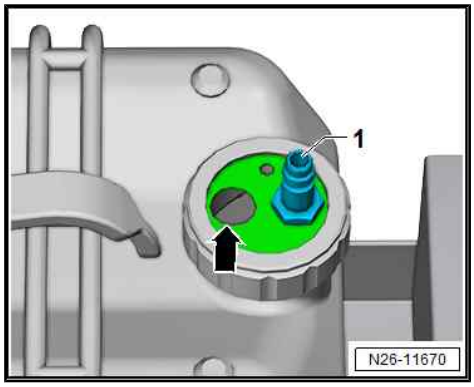
– Remove bolts -arrows- and press exhaust gas recirculation cooler to side (coolant hoses remain connected).



– Screw adapter - VAS 542 007/4-2- onto open connection of exhaust gas recirculation cooler using bolts from connecting pipe and hand-tighten. Ensure that seal on adapter is not pinched.
– Attach second adapter - VAS 542 007/4-2- to connecting pipe and hand-tighten. Ensure that seal on adapter is not pinched.
– Connect intake hose - VAS 542007/2-2- of cleaning unit to adapter - VAS 542 007/4-2- on connecting pipe.
– Connect return hose - VAS 542007/2-3- of cleaning unit to adapter - VAS 542 007/4-2- on exhaust gas recirculation cooler.
– Connect battery charger to battery.
– Connect battery clamps of pump - VAS 542007/3- to battery.

Preparing cooler rinsing system for exhaust gas recirculation - VAS 542 007- :

– Fill canister - VAS 542007/1- with 9 litres of warm (approx. 40 ° C) tap water.
– Pour 1 litre of cleaning solution - D 600 200 A2- into canister.



– Connect suction hose - VAS 542007/2-1- of pump to connection -1- on canister lid.
– Insert open end of return hose - VAS 542007/2-3- into opening -arrow- on canister lid to approx half height of canister.

Note

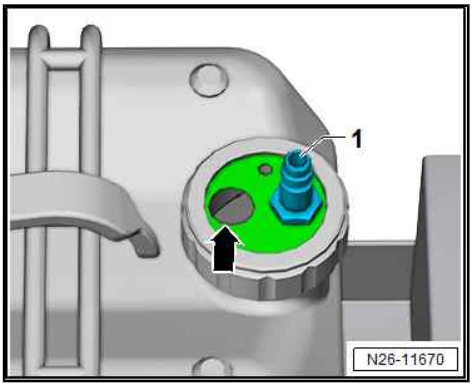
- *Ensure that the bleeder screw tap on the intake hose - VAS 542007/2-2- is closed.*
- *Before disconnecting the intake hose - VAS 542007/2-2- , the pressure must be released by carefully opening the bleeder screw tap and escaping cleaning solution must be caught.*

Operate pump - VAS 542007/3- 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 and return hose from canister.
– 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 542007/2-1- of pump to connection -1- on canister lid.
– Insert open end of return hose - VAS 542 007/2-3- into a suitable container (minimum capacity of 12 litres) and fix in position.
– Connect supply hose - VAS 542007/2-2- to adapter - VAS 542 007/4-2- on connecting pipe.
– Connect compressed air adapter - VAS 542007/5- to adapter - VAS 542 007/4-2- on exhaust gas recirculation cooler.
– Connect compressed air line to compressed air adapter - VAS 542007/5- 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 542007/5- .
– Detach both adapters - VAS 542 007/4-2- from exhaust gas recirculation cooler and from connecting pipe.
– Install exhaust gas recirculation pipe with new gaskets ⇒ “4.1 Exploded view - exhaust gas recirculation system”, page 279 .
– Tighten bolts securing exhaust gas recirculation cooler.
– Install exhaust gas recirculation valve - N18- ⇒ “4.3 Removing and installing exhaust gas recirculation valve N18 ”, page 281 .
– Install engine cover panel.
– Interrogate event memory and erase entries if necessary ⇒ Vehicle diagnostic tester.
– Perform road test.

Tightening torques:

◆ ⇒ “4.1 Exploded view - exhaust gas recirculation system”, page 279
◆ ⇒ “4.2 Exploded view - exhaust gas recirculation valve N18 with exhaust gas recirculation potentiometer G212 ”, page 280

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5 Exhaust manifold

⇒ “5.1 Exploded view - exhaust manifold”, page 290

⇒ “5.2 Removing and installing exhaust manifold”, page 290

5.1 Exploded view - exhaust manifold

1 - Gasket

- ❑ Renew

2 - Exhaust manifold

- ❑ Removing and installing ⇒ page 290

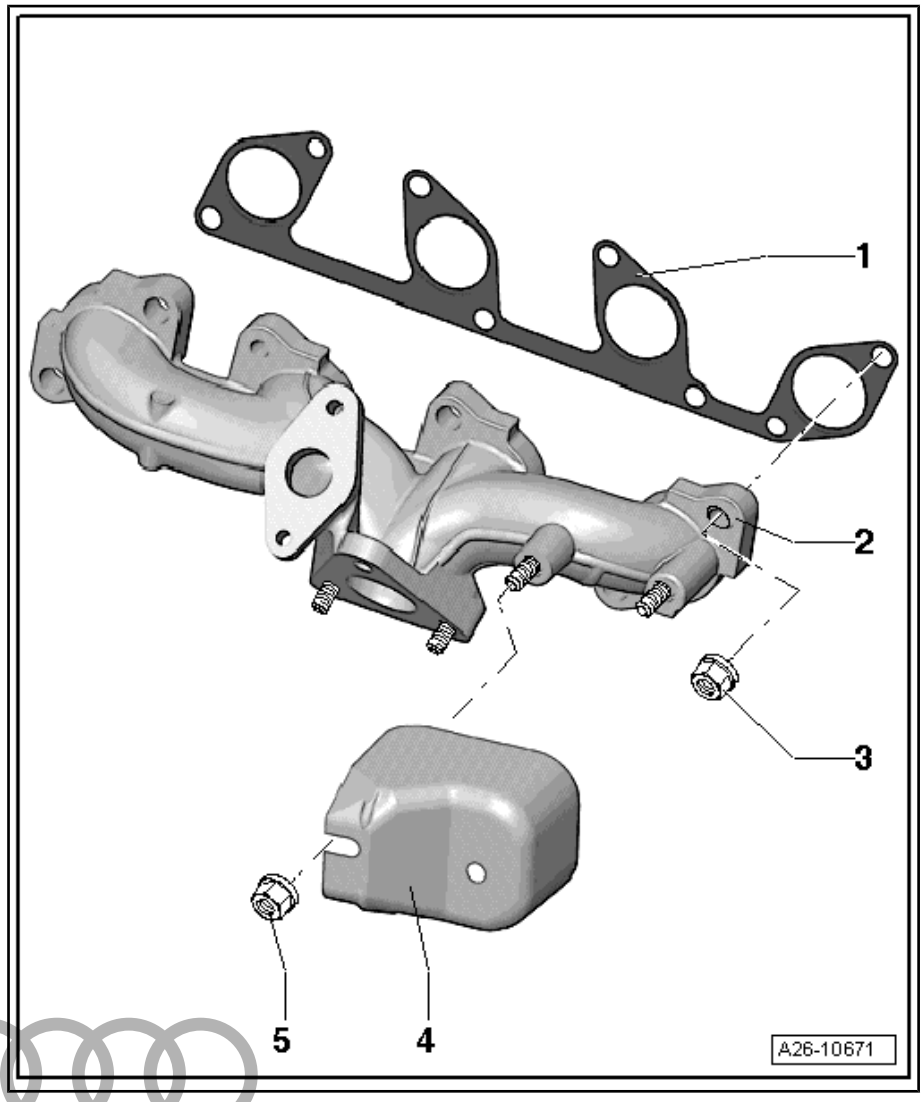
3 - Nut

- ❑ 25 Nm
- ❑ Renew
- ❑ Lubricate exhaust manifold studs with high-temperature paste
- ❑ If studs are renewed, too, tighten them to 15 Nm

4 - Heat shield

5 - Nut

- ❑ 25 Nm



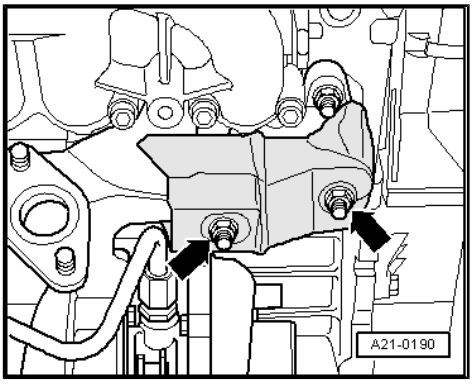
5.2 Removing and installing exhaust manifold

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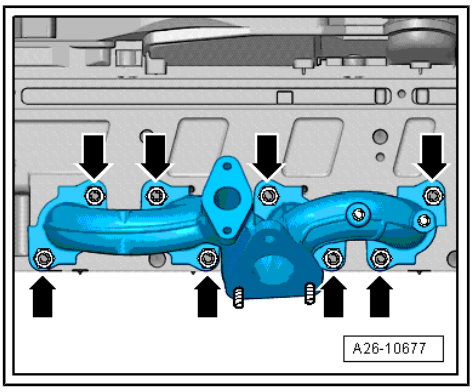
Removing

– Remove turbocharger ⇒ page 179 .

– Remove heat shield at exhaust manifold -arrows-.



– Remove nuts -arrows- for exhaust manifold.



– Remove exhaust manifold.

Installing

Installation is carried out in reverse sequence. When doing so, note the following:

Tightening torques
⇒ “5.1 Exploded view - exhaust manifold”, page 290

Tightening torques
⇒ “1.1 Exploded view - turbocharger”, page 178

Note

Renew gaskets and self-locking nuts.

– Install turbocharger ⇒ page 179 .

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28 – Glow plug system

1 Glow plug system

⇒ “1.1 Checking glow plug system”, page 292

⇒ “1.2 Removing and installing glow plug”, page 292

⇒ “1.3 Different types of glow plugs”, page 294

⇒ “1.4 Handling ceramic glow plugs”, page 295

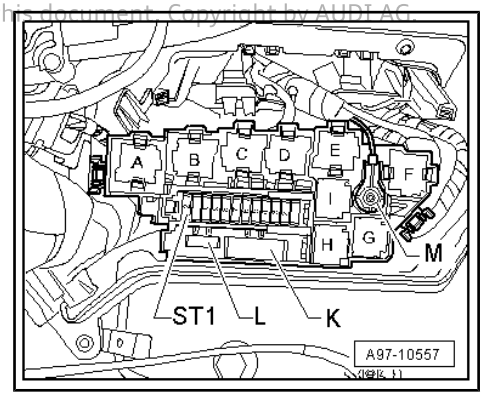
⇒ “1.5 Removing and installing Hall sender G40 ”, page 295

⇒ “1.6 Removing and installing engine speed sender G28 ”, page 296

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1.1 Checking glow plug system

Automatic glow period control unit - J179- is located in relay and fuse holder in electronics box in plenum chamber.



A - Automatic glow period control unit - J179-

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 engine control unit 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.

Note

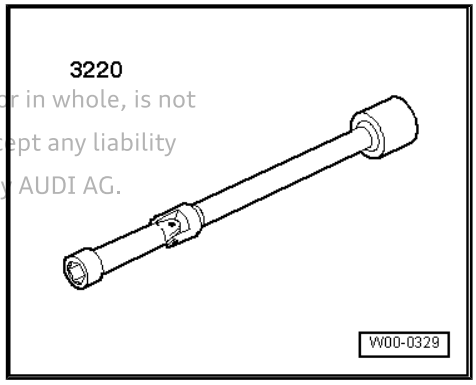
- *Wait for 60 seconds each time after performing final control diagnosis of the glow period control unit. The ignition must remain switched on.*
- *If you do not wait for 60 seconds (if ignition is switched off and immediately switched on again), the glow plugs can be damaged (due to repeated pre-heating).*
- *The activation of the glow plugs is controlled according to coolant temperature.*

1.2 Removing and installing glow plug

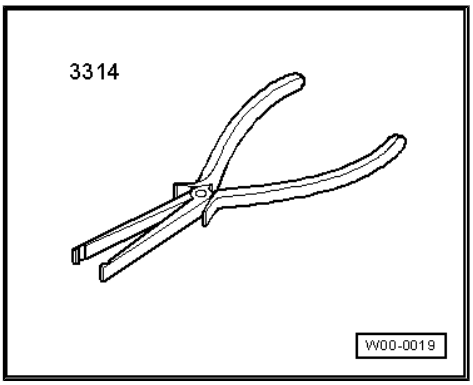
Special tools and workshop equipment required

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- Articulated wrench, 10 mm - 3220-



- Pliers - 3314-



Removing

– Switch off ignition.

– Remove engine cover panel ⇒ page 38 .

– Detach glow plug connectors from glow plugs.

– Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.

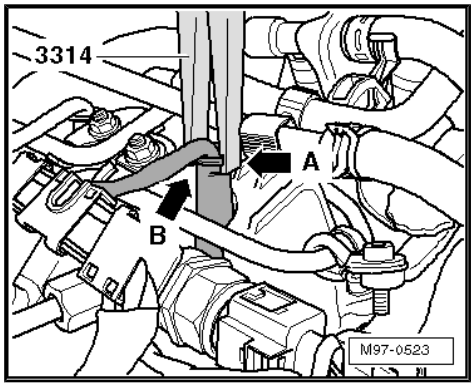
Note

- *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.*

Caution

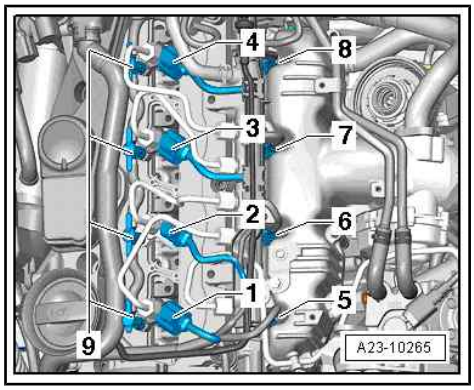
Make sure that no wire connection is damaged when unplugging the glow plug connectors; otherwise the entire wiring harness must be renewed. When unplugging the glow plug connectors, do not compress the pliers - 3314- with too much force so that the support sleeve is not damaged.

– Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B- and pull glow plug connectors off glow plugs.

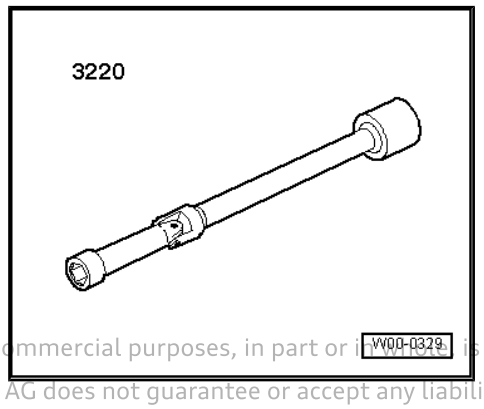


Note

- *Glow plug 1 - Q10- -5-*
- *Glow plug 2 - Q11- -6-*
- *Glow plug 3 - Q12- -7-*
- *Glow plug 4 - Q13- -8-*



– To slacken the glow plugs use special tool U/J extension and socket, 10 mm - 3220- .



Installing

– To tighten the glow plugs use special tool U/J extension and socket, 10 mm - 3220- with a suitable torque wrench.

– Then tighten glow plugs to specified torque.

• Tightening torque: 17 Nm

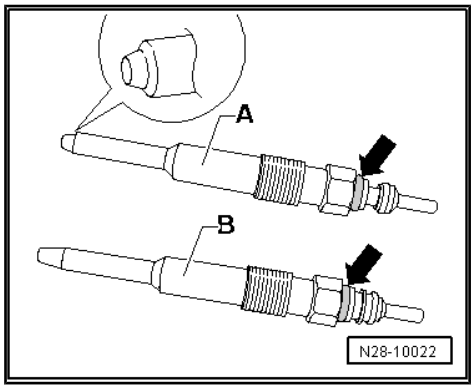
– Attach glow plug connectors correctly and make sure they are securely fitted.

– Install engine cover panel ⇒ page 38 .

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1.3 Different types of glow plugs

- These engines can be fitted with either metal or ceramic glow plugs.



A - Bosch ceramic glow plugs are colour-coded with a “white seal” -arrow- and have a chamfered shoulder (-detail view-) at the tip.

A - NGK ceramic glow plugs are colour-coded with a “white seal (on some versions painted over in silver)” -arrow- but do not have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a “red seal” -arrow-.

Caution

It is very important that you observe the handling procedures for ceramic glow plugs. The metal glow plugs do not require any special handling procedures.

1.4 Handling ceramic glow plugs

It is important to note the following points regarding ceramic glow plugs:

Caution

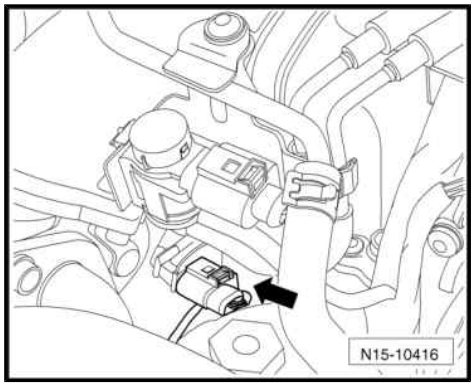
- *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ page 292 .*
- *Transport and store only in original packaging or packed separately in bubble wrap.*
- *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time; otherwise this will invariably cause mechanical damage (piston seizure).*
- *To check compression, select function "Self-diagnosis compatible systems" in "Guided Fault Finding" ⇒ Vehicle diagnostic tester.*
- *The ceramic glow plugs must not be removed when checking cylinder compression.*
- *The software of the engine control unit is specifically adapted to either the ceramic or the metal glow plugs, so it is important to install the correct type.*
- *Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.*

1.5 Removing and installing Hall sender - G40-

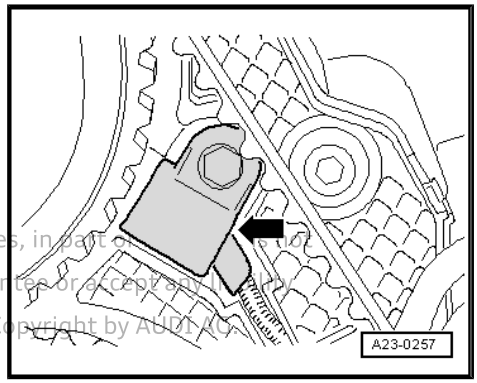
– Remove poly V-belt ⇒ page 42 .
– Remove toothed belt ⇒ page 90 .
– Remove vibration damper ⇒ page 45 .

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– Unplug electrical connector for Hall sender - G40- -arrow-.
– Release connector from its retainer.

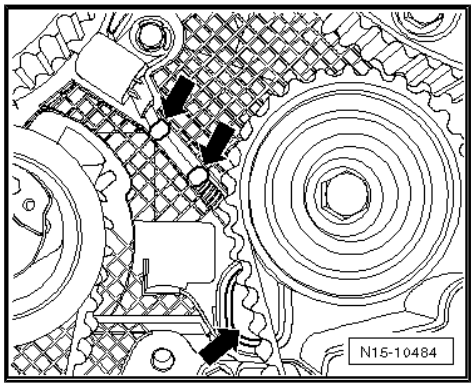


– Unbolt Hall sender - G40- -arrow-.



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– Using a screwdriver, remove projections and take out cover for repair opening -arrows-.
– Take Hall sender - G40- off cylinder head and guide its connector through repair opening in toothed belt cover.



Installing

Installation is carried out in reverse sequence. Note the following:

♦ Seal repair opening in toothed belt cover with rubber plug; for rubber plug refer to ⇒ ETKA (Electronic parts catalogue) .

Tightening torque

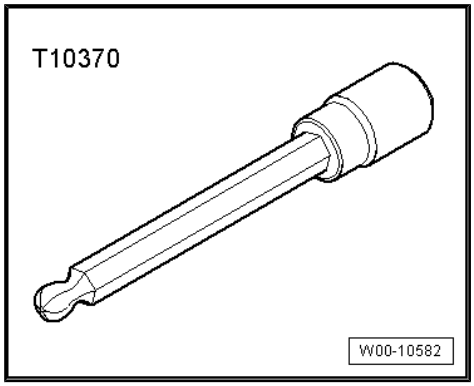
♦ ⇒ Item 16 (page 77)

– Fit toothed belt and adjust valve timing ⇒ page 90 .

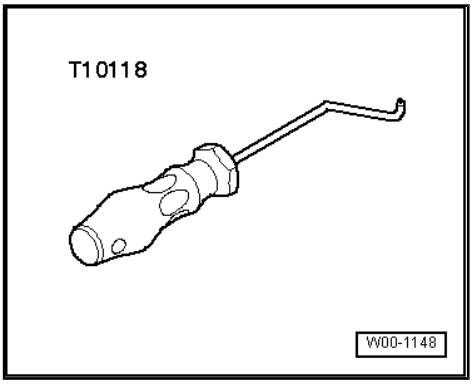
1.6 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

♦ Socket (4 mm) - T10370-



♦ Assembly tool - T10118-



Removing

– Remove oil filter bracket ⇒ page 136 .

– Unplug electrical connector at engine speed sender - G28- -arrow- using assembly tool - T10118- .

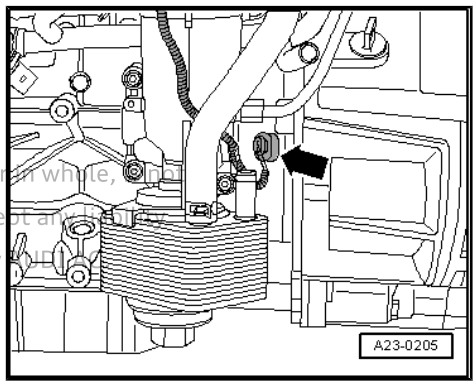
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Note

♦ *To release electrical connector without assembly tool - T10118-, use a screwdriver.*

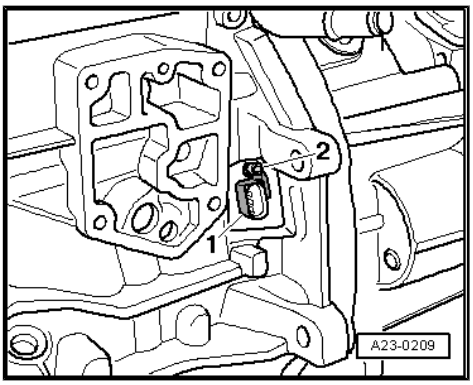
♦ *Press in connector on engine speed sender.*

♦ *At the same time, lift release tab with a thin wire hook.*



– Move wiring clear.

– Unscrew securing bolt -2- for engine speed sender - G28- -item 1-.



Installing

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

– Install oil filter bracket ⇒ page 136 .

• Tightening torque: refer to overview of fitting locations ⇒ “2.1 Exploded view - cylinder block (gearbox end)”, page 53 .