



Workshop Manual

Audi A1 2011 ➤

Audi A1 Sportback 2012 ➤

4-cylinder direct injection engine (1.2 ltr. 2-valve TFSI EA111)

Engine ID	CBZ A								
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Edition 09.2019



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List of Workshop Manual Repair Groups

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15 - Cylinder head, valve gear

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26 - Exhaust system

28 - Ignition system



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



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00 – Technical data

1 Identification

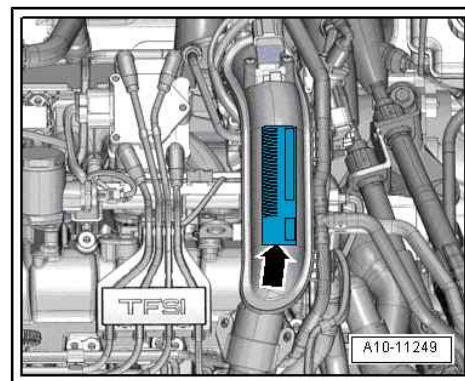
(ARL006646; Edition 09.2019)

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

1.1 Engine number/engine data

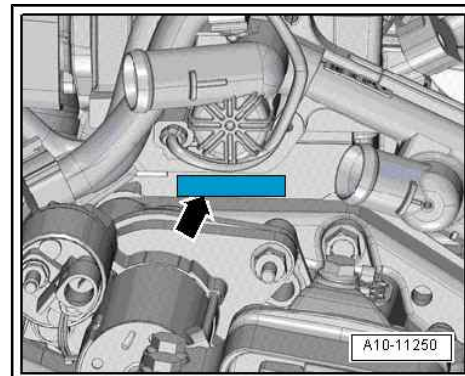
Engine number

- ◆ A sticker with “engine code” and “serial number” is attached to the air intake pipe -arrow-.
- ◆ 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 819
- ◆ If the sticker is missing, use a mirror and a torch to read off the “Engine code” and the “Serial number”:
- ◆ Read off the engine code and serial number on the left-side of the cylinder block -arrow-.



Engine data

- ◆ ⇒ 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 2](#)

⇒ [“2.3 Safety precautions when using testers and measuring instruments during a road test”, page 2](#)

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

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

2.1 Safety precautions when working on the fuel supply system

Risk of injury - fuel system operates under high pressure

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

Before opening the fuel system:

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

Risk of fire due to escaping fuel

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

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

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

Risk of injury - engine may start unexpectedly

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

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



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

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Risk of injury if test equipment is not secured. AUDI AG does not guarantee or accept any liability

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. Copyright by AUDI AG.



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

Or:

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

2.4 Safety precautions when working on the cooling system

Risk of scalding as hot coolant can escape

The cooling system is under pressure when the 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.

2.5 Safety precautions when working on the ignition system

Risk of injury due to electric shock

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

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



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Risk of damage to components

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

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



3 Repair instructions

⇒ [“3.1 Rules for cleanliness”, page 4](#)

⇒ [“3.2 General notes”, page 4](#)

⇒ [“3.3 General repair instructions”, page 5](#)

⇒ [“3.4 Foreign particles in engine”, page 5](#)

⇒ [“3.5 Contact corrosion”, page 5](#)

⇒ [“3.6 Routing and attachment of pipes, hoses and wiring”, page 6](#)

⇒ [“3.7 Installing radiators and condensers”, page 6](#)

⇒ [“3.8 Nuts, bolts”, page 6](#)

⇒ [“3.9 Identification plates”, page 6](#)

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

⇒ [“3.11 Checking vacuum system”, page 7](#)

3.1 Rules for cleanliness

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

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

3.2 General notes

- ◆ The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.



- ◆ The vehicles are fitted with a crash fuel shut-off system. This system is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the fuel pump relay.
- ◆ At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system
⇒ ["2.1 Safety precautions when working on the fuel supply system", page 2](#) .

3.3 General repair instructions

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

3.4 Foreign particles in engine

- ◆ When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122-) to prevent foreign particles from entering the engine.
- ◆ In the event of mechanical damage to one of the cylinder banks, the intake and exhaust systems and combustion chambers of the opposite cylinder bank must always be examined for foreign particles to prevent further damage occurring later.



Note

*If the turbocharger has suffered mechanical damage
⇒ ["1.2 Removing and installing turbocharger", page 167](#)*

3.5 Contact corrosion

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

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

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

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



Please note:

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

3.6 Routing and attachment of pipes, hoses and wiring

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

3.7 Installing radiators and condensers

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

3.8 Nuts, bolts

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

3.9 Identification plates

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



3.10 Use of impact wrenches

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

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

Requirements:

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

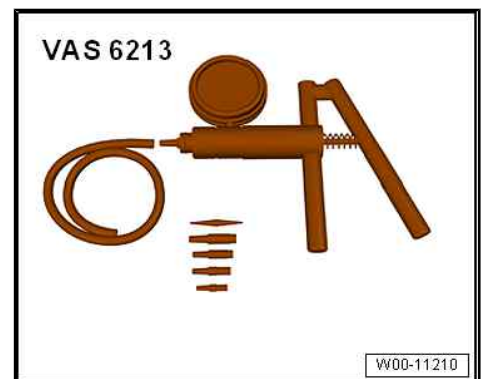
Use:

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

3.11 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Porous or leaking lines



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



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10 – Removing and installing engine

1 Removing and installing engine

⇒ [“1.1 Removing engine”, page 9](#)

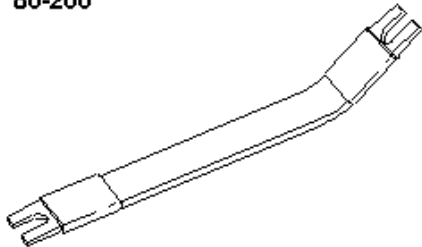
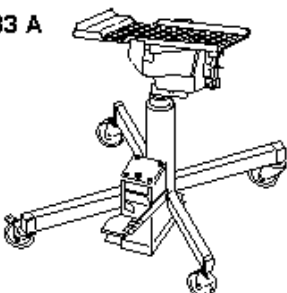
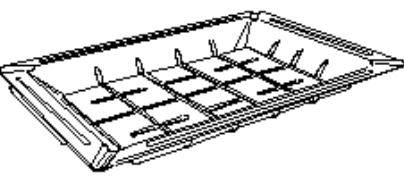
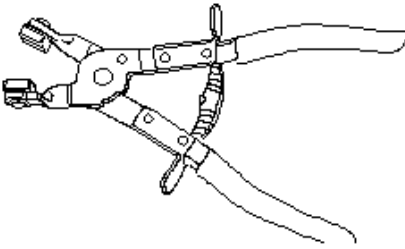
⇒ [“1.2 Separating engine and gearbox”, page 21](#)

⇒ [“1.3 Securing engine to engine and gearbox support”, page 23](#)

⇒ [“1.4 Installing engine”, page 25](#)

1.1 Removing engine

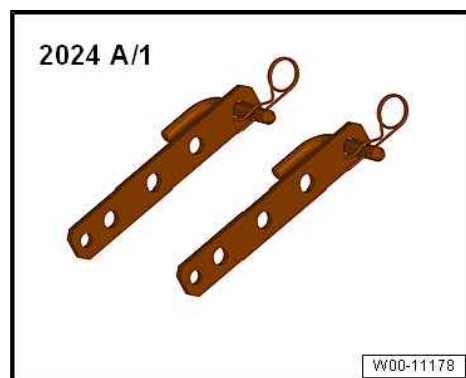
Special tools and workshop equipment required

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

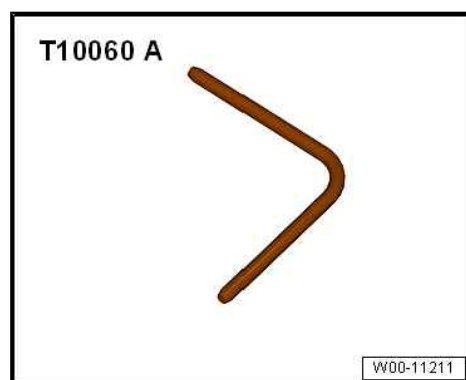
- ◆ Removal lever - 80 - 200-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Stepladder - VAS 5085-
- ◆ Engine bung set - VAS 6122-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-



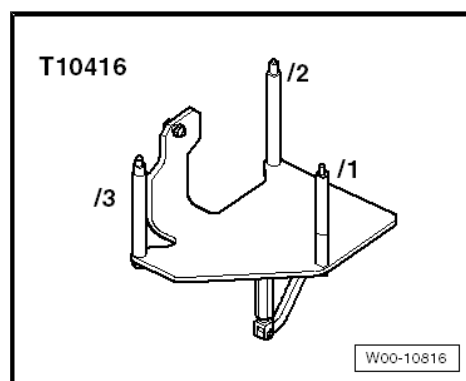
- ◆ Hook -2024 A /1- (part of lifting tackle - 2024 A-)



- ◆ Locking pin - T10060 A-



- ◆ Engine support -T10416- with adapters -T10416/1- , -
T10416/2- , -T10416/3-



Procedure



Note

- ◆ *The engine is removed from underneath together with the gearbox.*
- ◆ *Fit cable ties in the original positions when installing.*
- Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

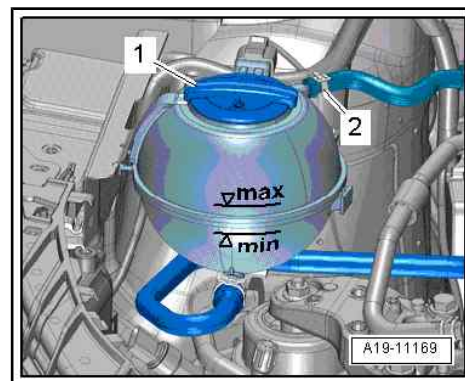


WARNING

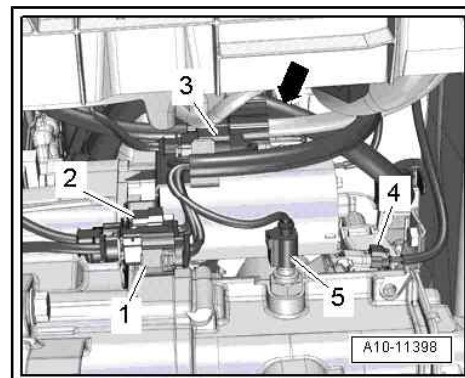
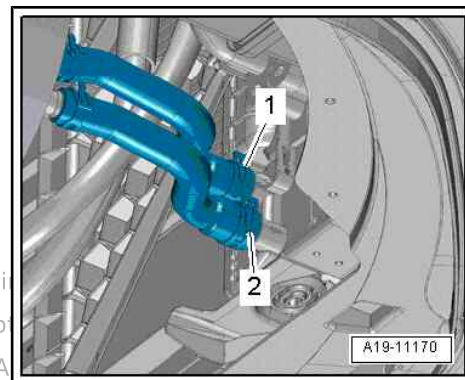
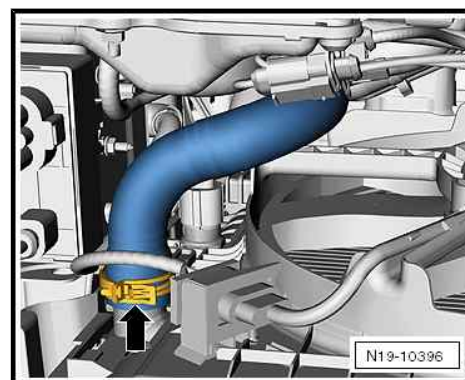
Risk of scalding due to hot steam and hot coolant.

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



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



- Unplug electrical connectors and remove from bracket:
 - 1 - For Lambda probe - G39-
 - 2 - For Lambda probe after catalytic converter - G130-
 - 3 - To alternator - C-
- Unplug electrical connectors:
 - 4 - At gearbox neutral position sender - G701-
 - 5 - At reversing light switch - F4-
- Remove electrical wiring -arrow- from bracket and move clear.

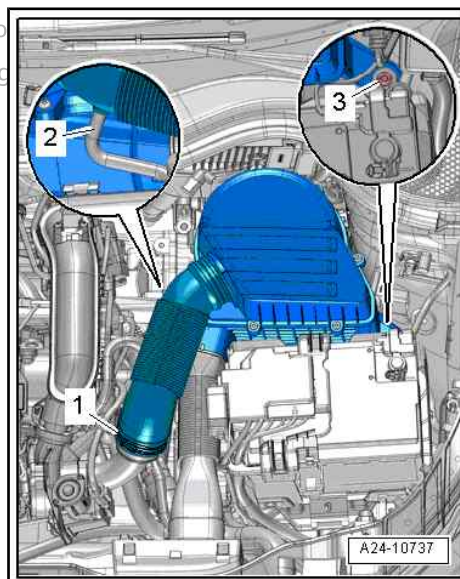
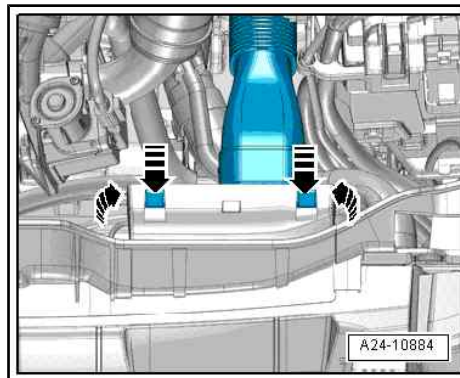


- Unclip air duct at lock carrier -arrows-.

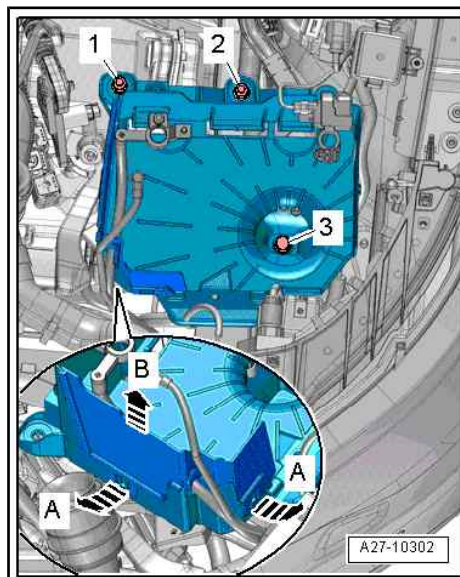


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- Carefully disconnect vacuum hose -2- from air hose.
- Release hose clip -1- and detach air hose.
- Remove bolt -3- and detach air cleaner housing from rubber mountings.



- Release retainers -arrows A- and pull off side plate for battery tray upwards -arrow B-.
- Remove bolt -3- and nuts -1 and 2- and remove battery tray.





- Press release tabs and detach vacuum hose -arrow-.



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- Press release tabs and disconnect vacuum hose -1- from activated charcoal filter.
- Release hose clip -3- and detach coolant hose.

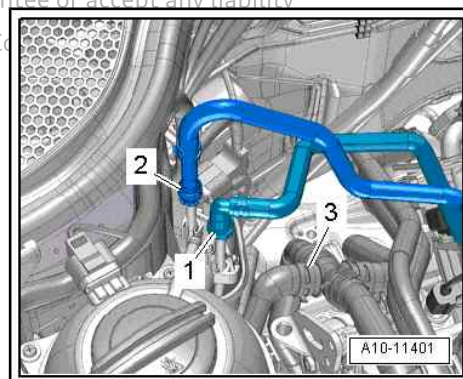
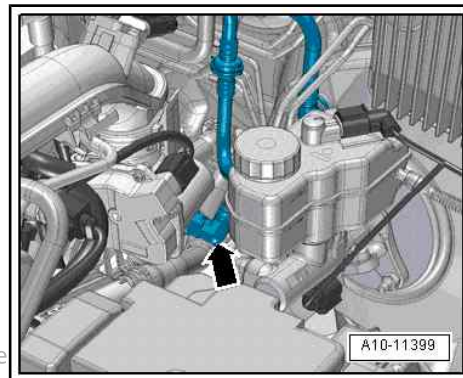


WARNING

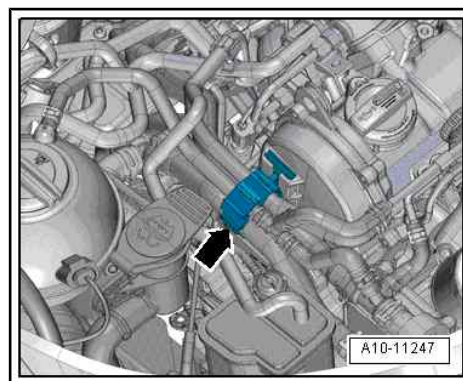
The fuel system is pressurised.

Risk of injury as fuel may spray out.

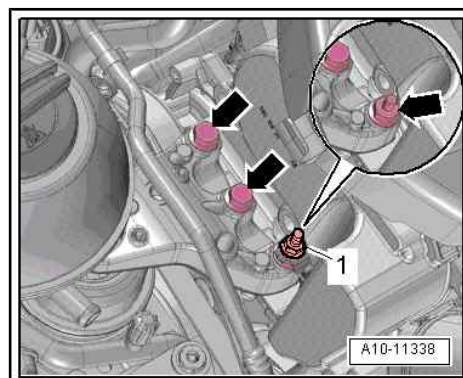
- *Put on safety goggles.*
- *Put on protective gloves.*
- *Release pressure (wrap a clean cloth around connection and open connection carefully).*



- Disconnect fuel supply line -2- (pull release ring).
- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
- Press release tab at bottom of bracket and unhook bracket -arrow- from timing chain cover (top) with coolant hoses still attached.

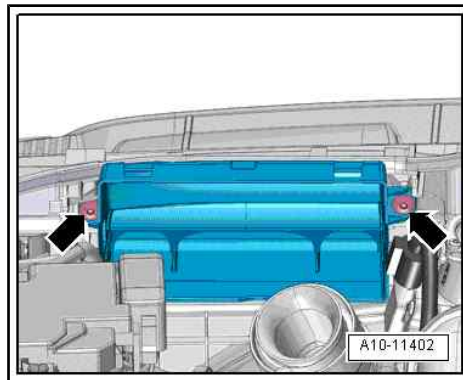


- Remove nut -1- and move earth wire clear.
- Loosen bolts -arrows- for support arm of engine mounting approx. 2 turns.

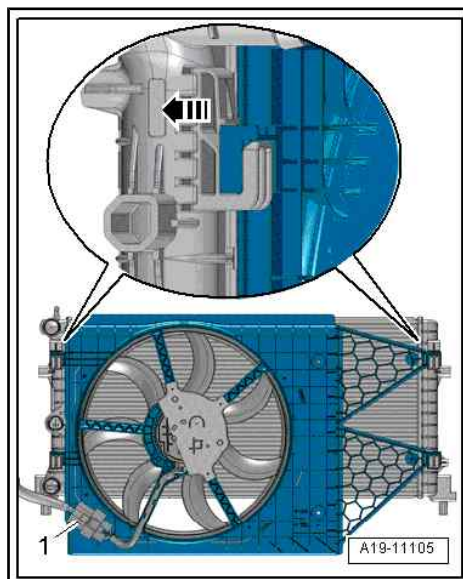




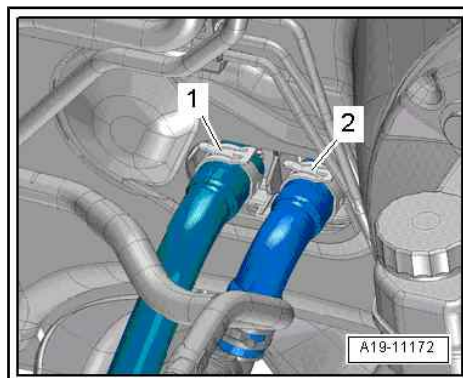
- Unscrew bolts -arrows- from lock carrier and detach air duct.



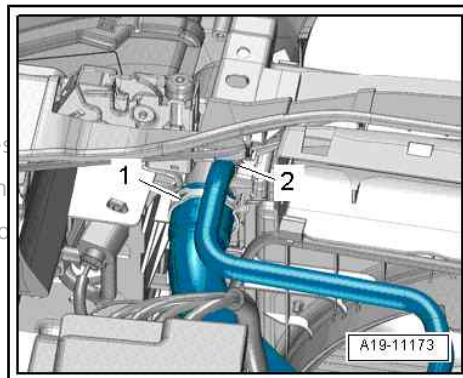
- Unplug electrical connector -1- for radiator fan.
- Press locking tabs (left and right) for radiator cowl -arrow- simultaneously.
- Lift radiator cowl off radiator and detach it downwards.



- Release hose clips -1 and 2- and disconnect coolant hoses from heat exchanger.



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



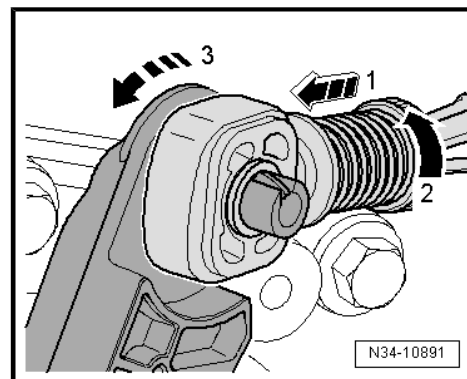
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Note

To prevent damage to gate selector cable, cable end-piece must be detached from gate selector cable before removing.

- Pull locking device forwards onto stop -arrow 1- and lock by turning anti-clockwise -arrow 2-.
- Press gate relay lever towards front -arrow 3-.

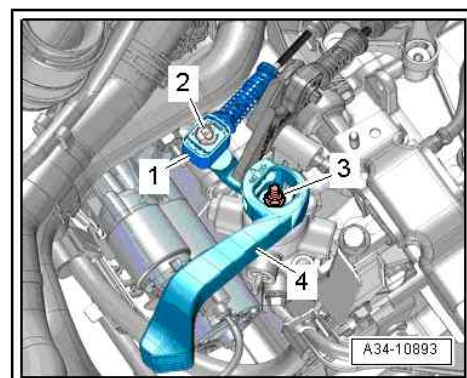


- Detach securing clip -2-.
- Detach gear selector cable -1- from gearbox selector lever -4-.

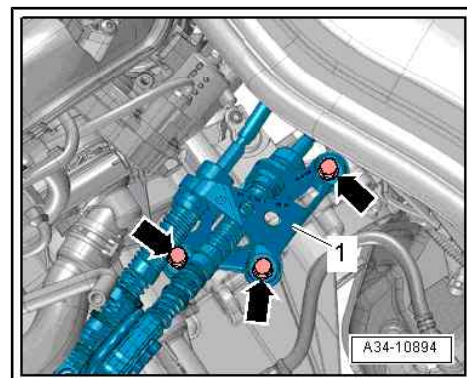


Note

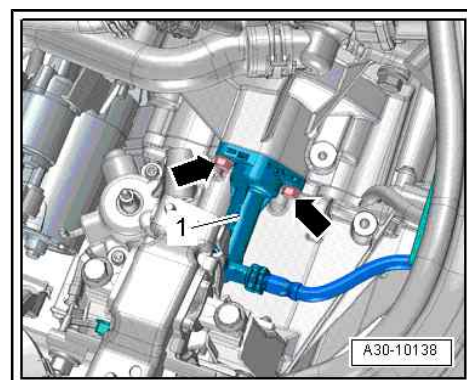
Disregard -item 3-.



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



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



Caution

Risk of irreparable damage to clutch slave cylinder.

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



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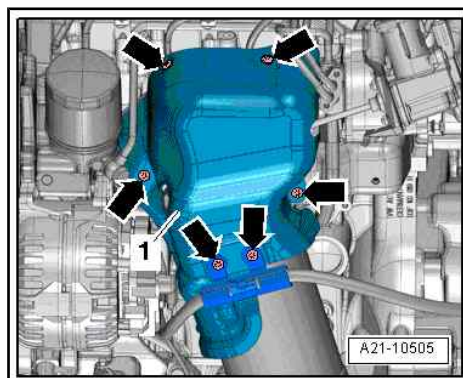
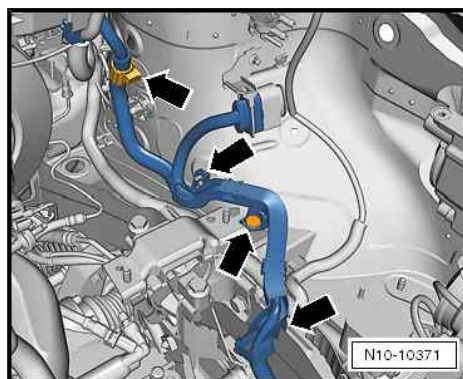
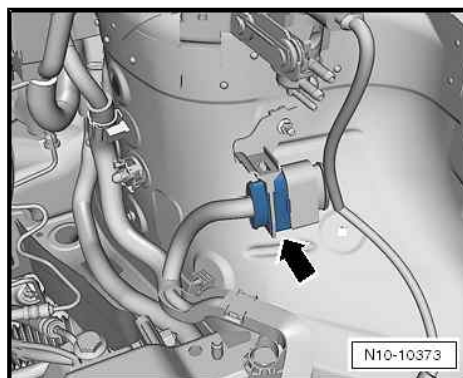
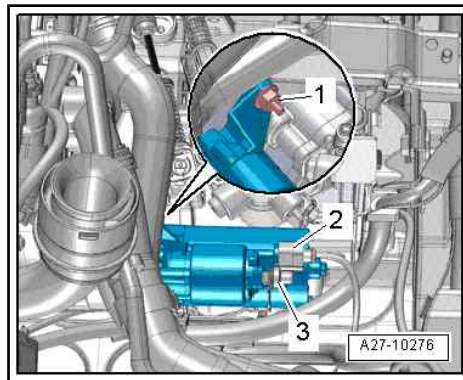
- Unplug electrical connector -2-.
- Detach cover for B+ wire -3-.
- Remove nut and move B+ wire clear.



Note

Disregard -item 1-.

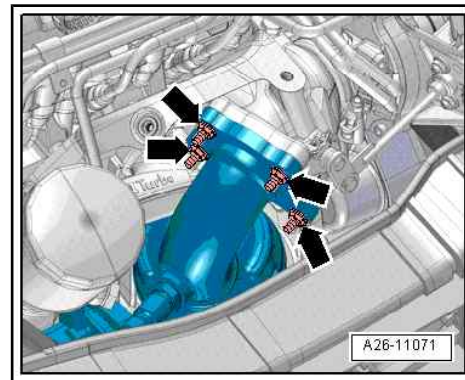
- Remove engine control unit
⇒ ["8.2 Removing and installing engine/motor control unit J623"](#), [page 215](#) .
- Unplug electrical connector -arrow- and unclip from bracket.
- Move engine wiring harness clear using removal lever - 80 - 200- -arrows- and lay down on top of engine.
- Remove Lambda probe - G39-
⇒ ["7.2.1 Removing and installing Lambda probe G39"](#), [page 211](#) .
- Move clear electrical wiring harness leading to alternator.
- Remove bolts -arrows- and detach heat shield -1-.



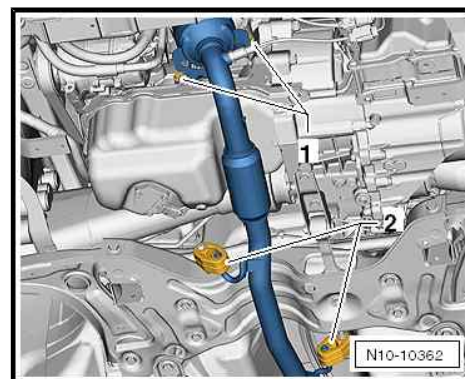
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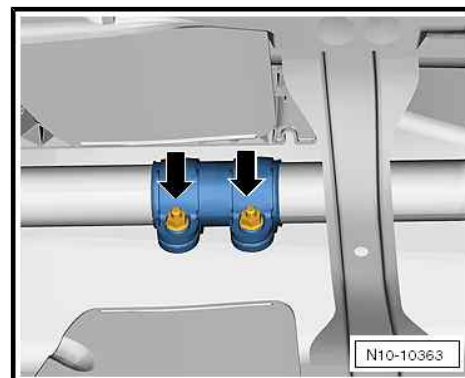
- Remove nuts -arrows- for catalytic converter.



- Remove bolts -1-.
- Press mountings -2- for exhaust system off pins.



- Unscrew nuts -arrows- and push clamp towards rear.
- Remove catalytic converter from below.



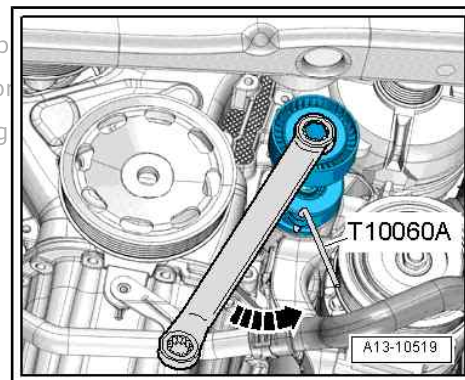
Vehicles with air conditioner:

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Note

- ♦ *Running a used poly V-belt in the opposite direction could cause irreparable damage.*
- ♦ *Before removing the poly V-belt, mark the direction of rotation with chalk or a felt-tip pen for re-installation.*
- To slacken poly V-belt turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.





- Unplug electrical connector -1- for air conditioner compressor regulating valve - N280- at air conditioner compressor.



WARNING

Risk of injury caused by refrigerant.

- ◆ *The air conditioner refrigerant circuit must not be opened.*

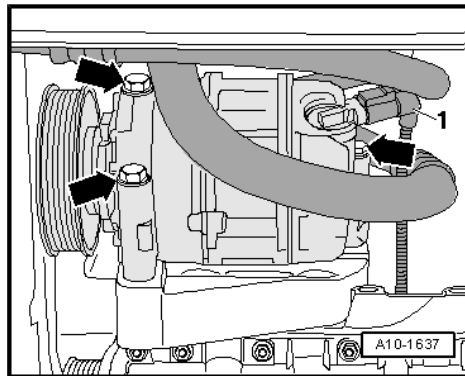
- Remove bolts -arrows- for air conditioner compressor.



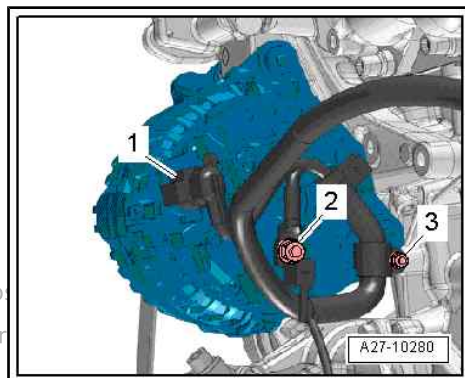
Caution

Risk of damage to refrigerant lines and hoses

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

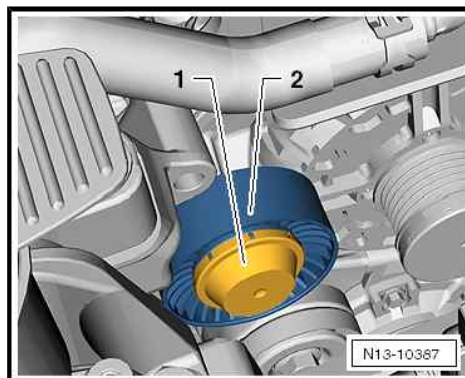


- Tie up air conditioner compressor together with refrigerant hoses to longitudinal member (refrigerant hoses remain connected).
- Unplug electrical connector -1-.
- Remove nut -2- and move clear electrical wiring.
- Unbolt retaining clamp -3- from alternator and move clear electrical wiring harness.



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- Press off cover -1-.
- Remove idler roller -2-.





- Unscrew bolts -arrows- and detach alternator.



Note

- ◆ *If alternator sticks in its bracket, screw bolt back in again down to the last two turns.*
- ◆ *Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.*

All vehicles (continued):

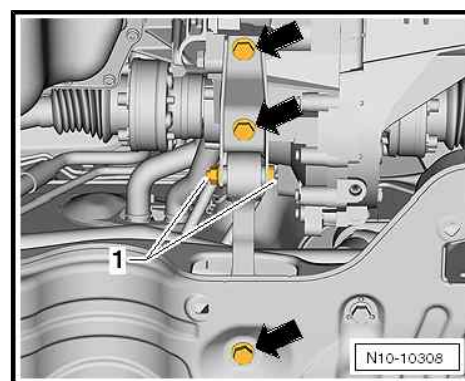
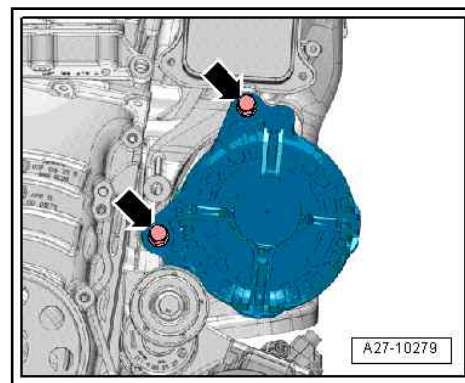
- Unbolt drive shaft (left and right) from gearbox flange shafts
⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft;
Removing and installing drive shaft .
- Remove bolts -arrows- and detach pendulum support.



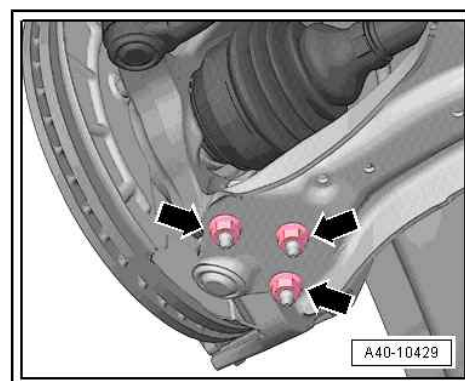
WARNING

Risk of damage.

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



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

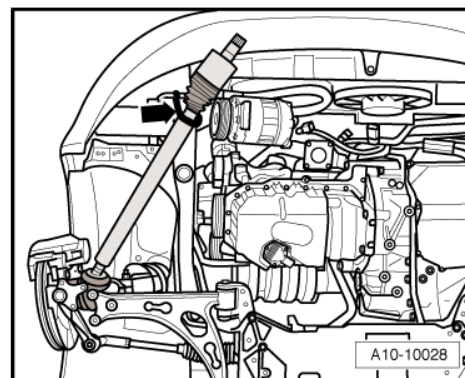


- Pivot drive shaft (right-side) forwards; to do so, push engine/ gearbox assembly slightly forwards.
- Tie up drive shaft to longitudinal member -arrow-.



Note

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



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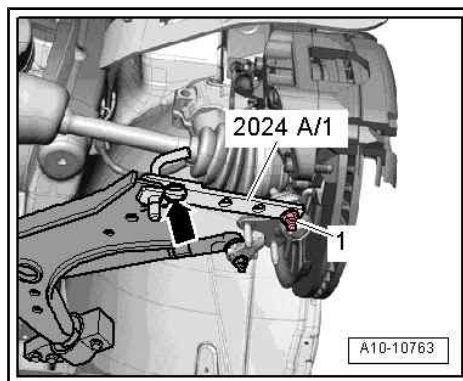
- Swivel suspension strut (left-side) outwards and support with support bracket -2024 A /1- , as shown in illustration.



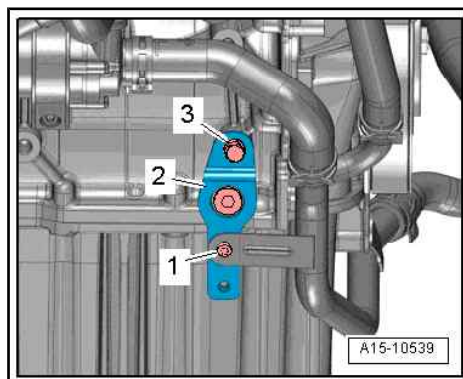
WARNING

Accident risk from loose components of support bracket.

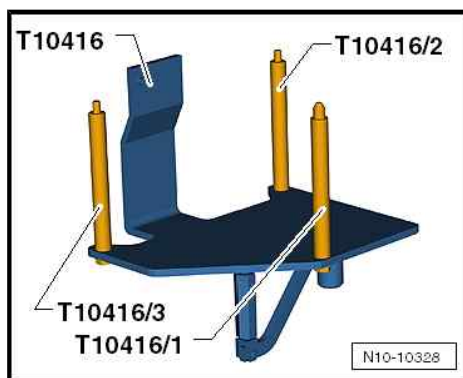
- ◆ *Secure retaining pin and swivel joint with locking pin -arrow- and nut -1-.*



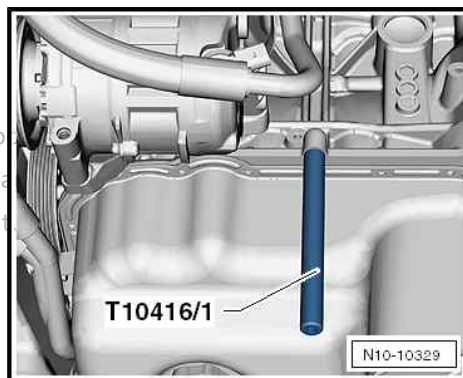
- Remove bolts -1, 3-.
- Press bracket -2- for coolant pipe slightly towards rear.



Use engine support -T10416- with adapters -T10416/1- , -T10416/2- and -T10416/3- to lower engine/gearbox assembly.



- Screw adapter -T10416/1- into hole on cylinder block as far as stop, as shown in illustration.
- Bring engine support -T10416- with adapters -T10416/2- and -T10416/3- into position on cylinder block.



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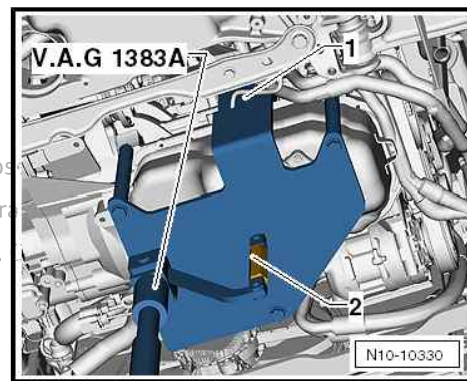


- Screw in bolt -1- by hand until it makes contact.
- Tighten all bolts on engine support to 20 Nm.
- Attach engine and gearbox jack - V.A.G 1383 A- to engine support -T10416- .

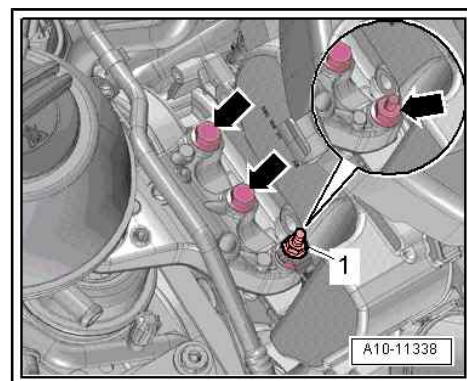


Note

- ◆ *The adjusting nut -2- is used to set the correct angle between the pin on the engine support -T10416- and the engine and gearbox jack - V.A.G 1383 A- .*
- ◆ *To unscrew bolts for assembly mounting use stepladder - VAS 5085- .*



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



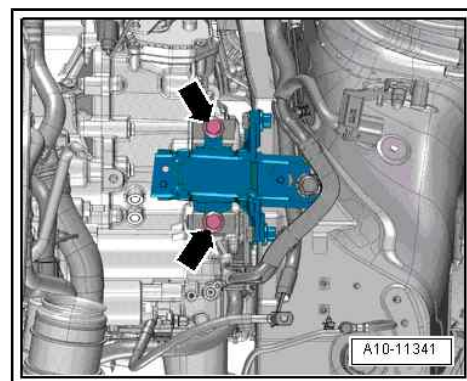
- Remove bolts -arrows- securing gearbox mounting -1-.



Caution

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

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



- Pull engine/gearbox assembly as far forward as possible, and lower gradually.

1.2 Separating engine and gearbox

Special tools and workshop equipment required



◆ Shackle - 10 - 222 A /12-



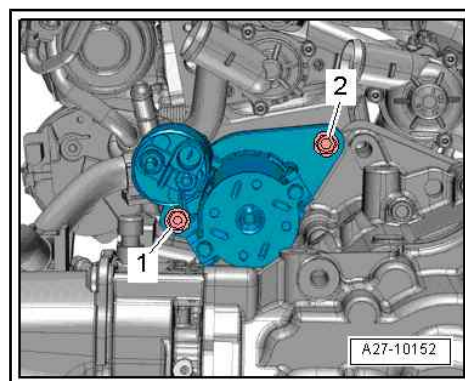
◆ Workshop hoist - VAS 6100-

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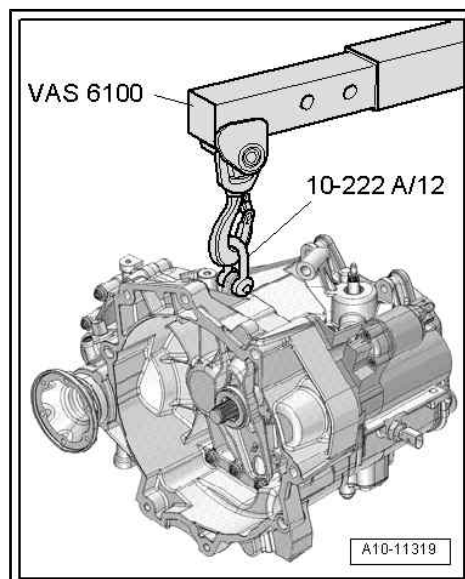


Procedure

- Engine/gearbox assembly removed and attached to engine support -T10416- .
- Unscrew bolts -1 and 2- and detach starter from gearbox.

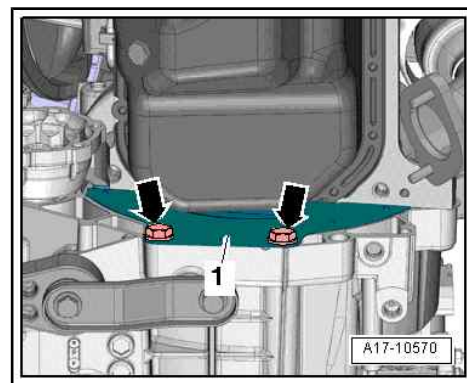


- Fit shackle - 10 - 222 A /12- on gearbox, as shown in illustration.
- Hook workshop hoist - VAS 6100- into shackle.





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



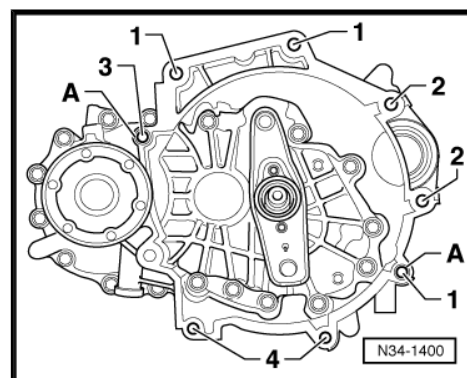
- Remove bolts -1, 3- securing gearbox to engine.



Note

Disregard -items 2, 4, A-.

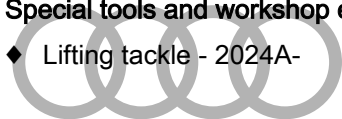
- Detach gearbox from engine.



1.3 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- ◆ Lifting tackle - 2024A-



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- ◆ Engine and gearbox support - VAS 6095A-





◆ Workshop hoist - VAS 6100-



Procedure

- Gearbox detached from engine
⇒ ["1.2 Separating engine and gearbox", page 21](#).
- Remove flywheel
⇒ ["2.2 Removing and installing flywheel", page 47](#).
- To transport engine, engage lifting tackle - 2024 A- on engine and workshop hoist - VAS 6100- .



Note

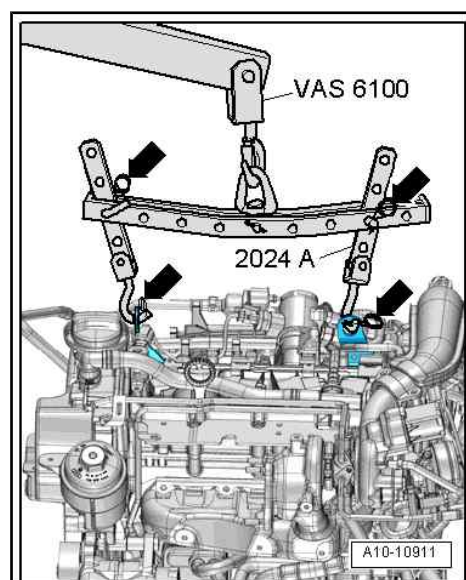
To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks must be positioned as shown.



WARNING

Accident risk from loose components of support bracket.

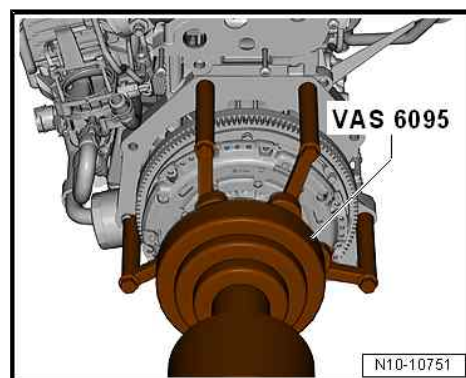
- ◆ The support hooks and retaining pins on the support bracket must be secured with locking pins -arrows-.



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

Tightening torque

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





1.4 Installing engine

Tightening torques



Note

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

Component		Nm
Bolts/nuts	M6	9
	M7	15
	M8	22
	M10	40
	M12	65

- ◆ Assembly mountings
⇒ ["2.1 Exploded view - assembly mountings", page 29](#)
- ◆ Securing gearbox to engine ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox

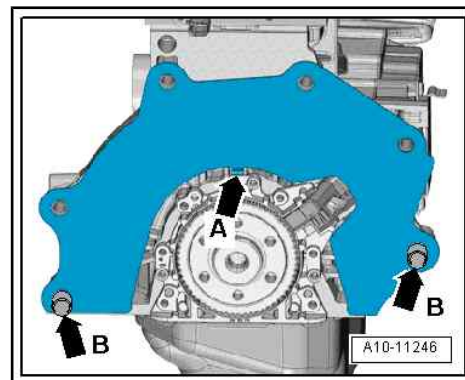
Procedure

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



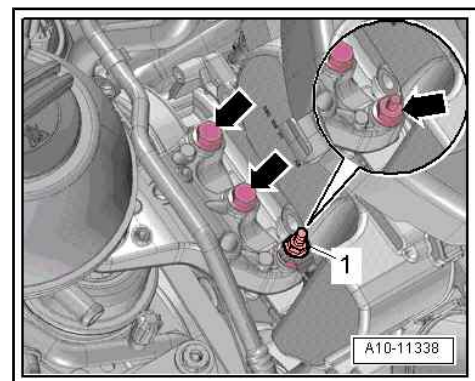
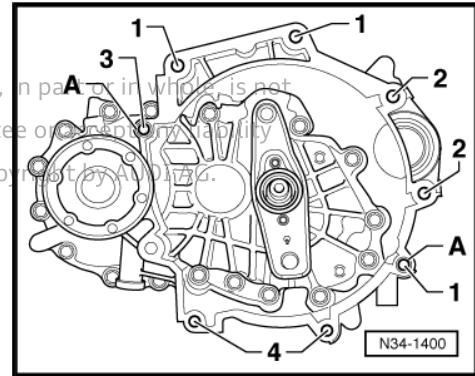
Note

- ◆ *Renew bolts tightened with specified tightening angle.*
 - ◆ *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
 - ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
 - ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
 - ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
 - ◆ *Fit all cable ties in the original positions when installing.*
- Ensure that intermediate plate is engaged on sealing flange -arrow A- and pushed onto dowel sleeves -arrows B-.



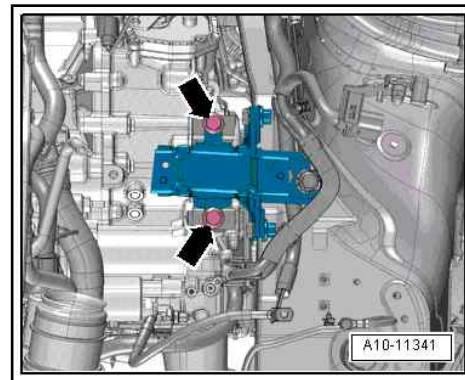


- If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.
- Renew clutch release bearing if worn ➔ Rep. gr 30 ; Clutch mechanism; Exploded view - clutch release mechanism.
- Clean the input shaft splines and the hub splines. Remove corrosion and apply only a very thin coating of grease - G 000 100- to the splines. Remove any excess grease.
- Install flywheel
⇒ ["2.2 Removing and installing flywheel", page 47](#) .
- Secure gearbox to engine.
- Install starter ➔ Electrical system; Rep. gr. 27 ; Starter; Exploded view - starter .
- Guide engine/gearbox assembly into body.
- Initially hand-tighten bolts -arrows- for support arm of engine mounting until they make contact.





- Initially screw in bolts -arrows- for gearbox mounting by hand until they make contact.
- Detach engine support -T10416- from engine.
- Install drive shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .
- Install pendulum support
⇒ [“2.4 Removing and installing pendulum support”](#),
[page 34](#) .
- Install wishbone and swivel joint ⇒ Running gear, axles, steering; Rep. gr. 40 ; Lower wishbone, swivel joint; Exploded view - lower wishbone, swivel joint .
- Install catalytic converter
⇒ [“2.1 Removing and installing catalytic converter”](#),
[page 222](#) .
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit .
- Install poly V-belt
⇒ [“1.2 Removing and installing poly V-belt”](#), [page 37](#) .
- Install engine mountings
⇒ [“2.2 Removing and installing engine mountings”](#),
[page 30](#) .
- Install engine control unit
⇒ [“8.2 Removing and installing engine/motor control unit J623”](#),
[page 215](#) .



Caution

Risk of damage to clutch slave cylinder.

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

- Install clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch slave cylinder .
- Install and adjust gear selector cable and gate selector cable
⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector cables .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install battery mounting and battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Exploded view - battery .
- Install air cleaner housing
⇒ [“2.2 Removing and installing air cleaner housing”](#),
[page 188](#) .
- Install wheel housing liners ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Check oil level ⇒ Maintenance ; Booklet 819 .



Caution

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

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



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 143](#) .
- After renewing engine, misfire adaption must be reset. To do so, select 01 - Reset adaptations misfires in Guided Functions mode of ⇒ Vehicle diagnostic tester.



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2 Assembly mountings

⇒ "2.1 Exploded view - assembly mountings", page 29

⇒ "2.2 Removing and installing engine mountings", page 30

⇒ "2.3 Removing and installing gearbox mounting", page 32

⇒ "2.4 Removing and installing pendulum support", page 34

2.1 Exploded view - assembly mountings

1 - Engine support

2 - Bolt

- ☐ 50 Nm

3 - Engine mounting

- ☐ Removing and installing
⇒ page 30

4 - Bolt

- ☐ Renew
- ☐ 20 Nm +90°

5 - Support arm

6 - Nut

- ☐ Do not loosen unless re-
newing engine mount-
ing -item 2-
- ☐ Renew
- ☐ 40 Nm +90°

7 - Threaded pin

- ☐ Renew
- ☐ 30 Nm +90°

8 - Bolt

- ☐ Renew
- ☐ 30 Nm +90°

9 - Pendulum support

- ☐ Removing and installing
⇒ page 34

10 - Bolt

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

11 - Bolt

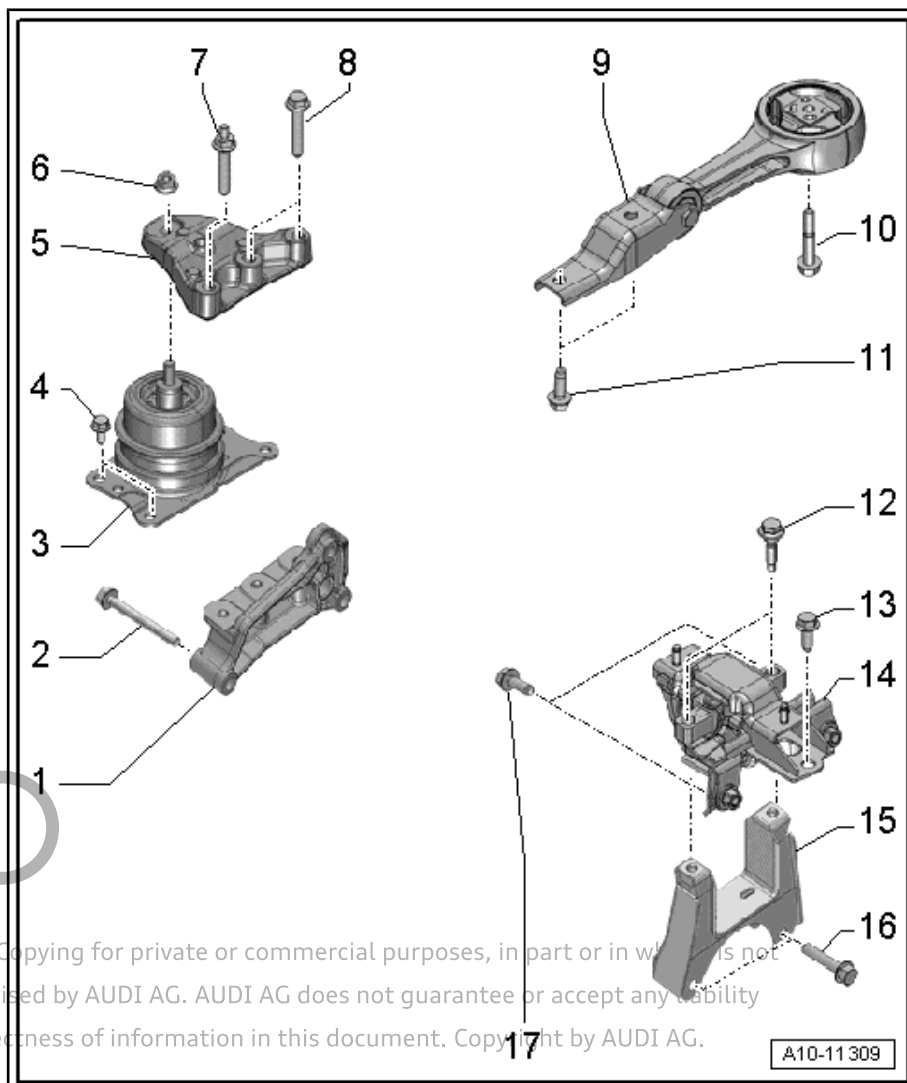
- ☐ Pendulum support to gearbox
- ☐ Renew
- ☐ 30 Nm +90°

12 - Bolt

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

13 - Bolt

- ☐ Gearbox mounting to body





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

14 - Gearbox mounting

- ❑ Removing and installing ⇒ [page 32](#)

15 - Gearbox support

16 - Bolt

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

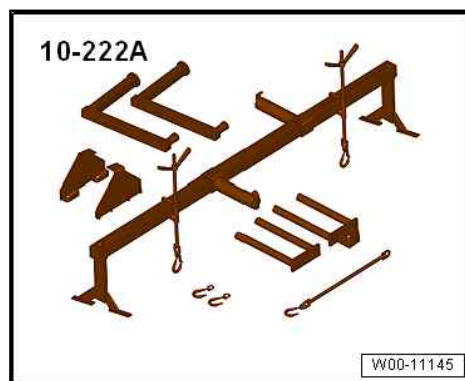
17 - Bolt

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

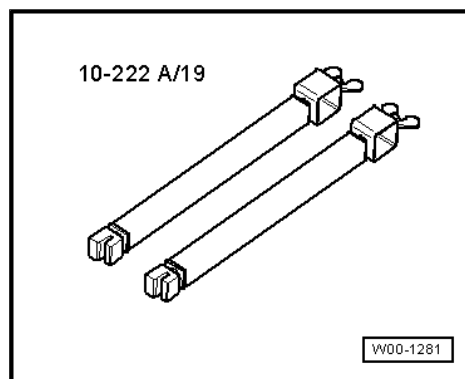
2.2 Removing and installing engine mountings

Special tools and workshop equipment required

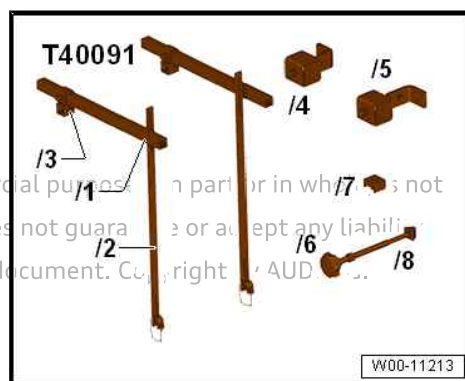
- ◆ Support bracket - 10 - 222 A-



- ◆ Adapters - 10 - 222 A/19-



- ◆ Engine support basic set - T40091-



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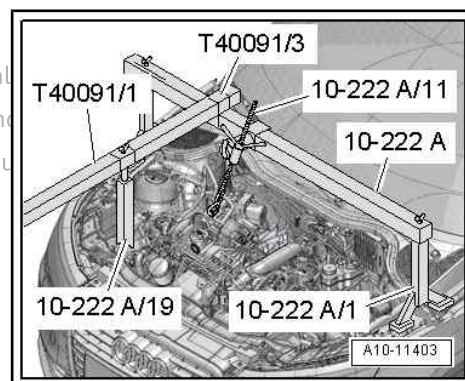
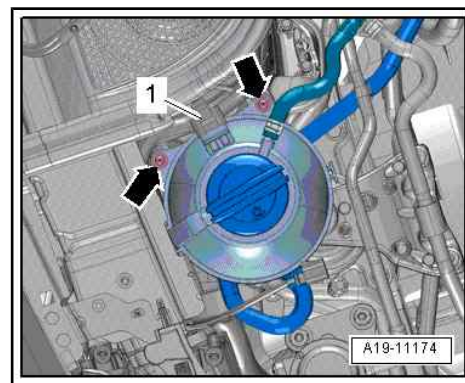


Removing

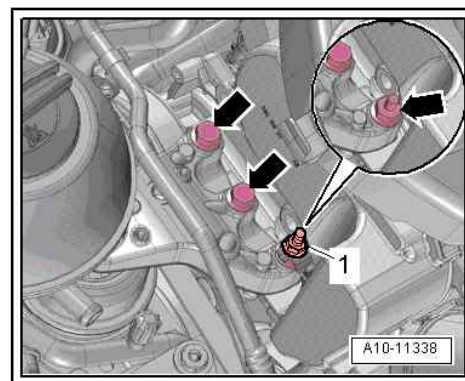
- Remove bolts -arrows-.
- Unplug electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.



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



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



WARNING

Risk of accident.

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

- Remove bolts -arrows- and detach engine mounting.

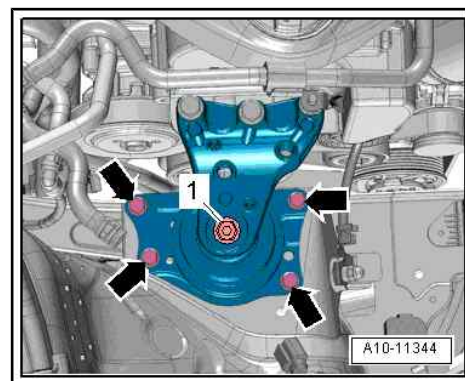
Installing

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



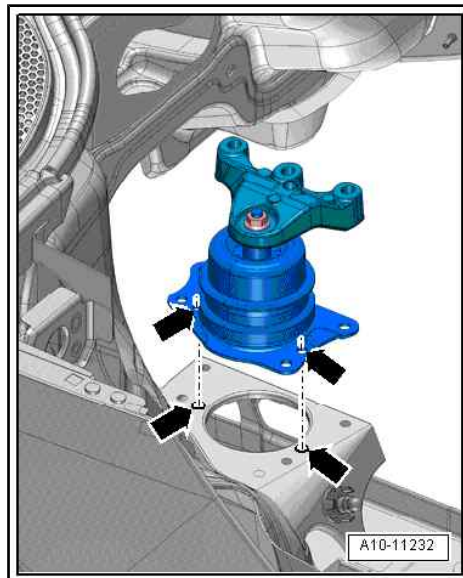
Note

Renew bolts tightened with specified tightening angle.





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

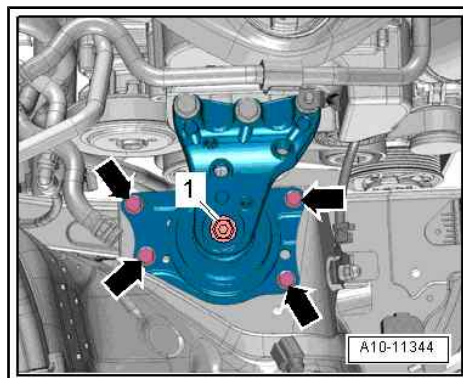


- Initially screw in bolts -arrows- by hand until they make contact.
- Tighten bolts.



Note

Disregard -item 1-



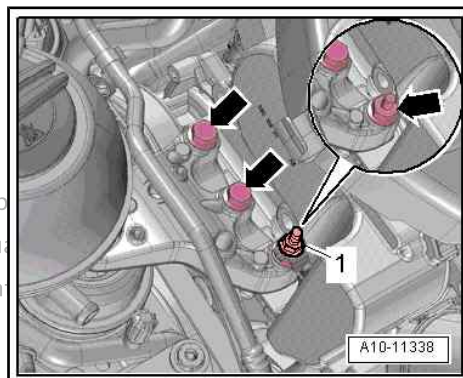
- Initially hand-tighten bolts -arrows- for support arm of engine mounting until they make contact.
- The support arm must not turn when you tighten the bolts.
- Tighten bolts.



Note

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Disregard -item 1-



Tightening torques

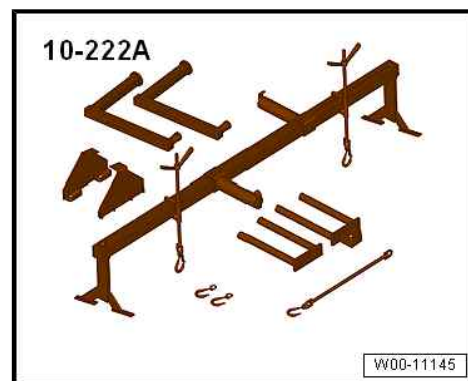
- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 29](#)

2.3 Removing and installing gearbox mounting

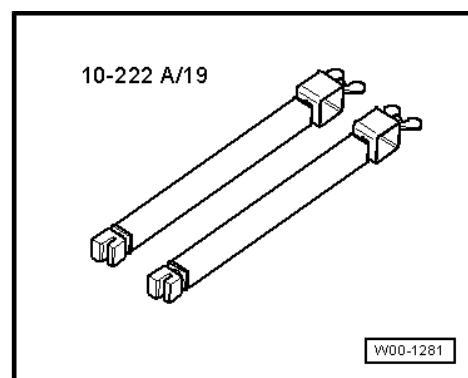
Special tools and workshop equipment required



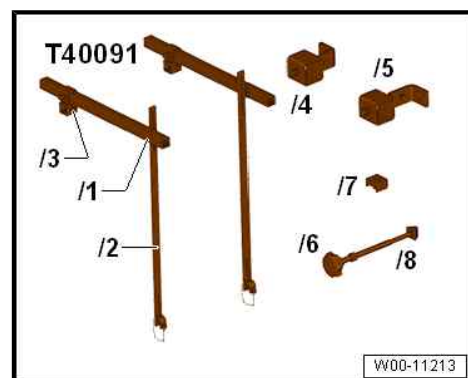
◆ Support bracket - 10 - 222 A-



◆ Adapters - 10 - 222 A /19-

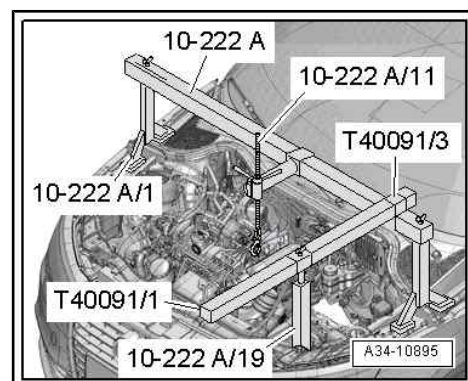


◆ Engine support basic set - T40091-



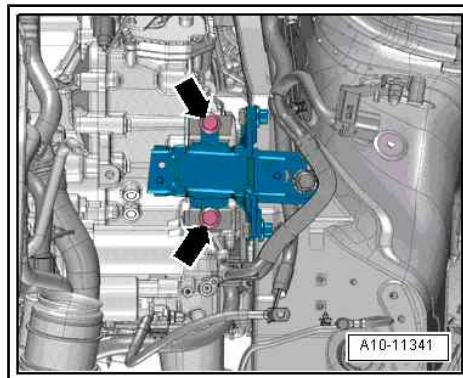
Removing

- Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .
- Position support bracket - 10 - 222 A- on bolted flanges of wing panels as shown in illustration.
- Attach hook of spindle - 10 - 222 A /11- to engine lifting eye (left-side).
- Take up weight of engine with the spindle, but do not lift.





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



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

Installing

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



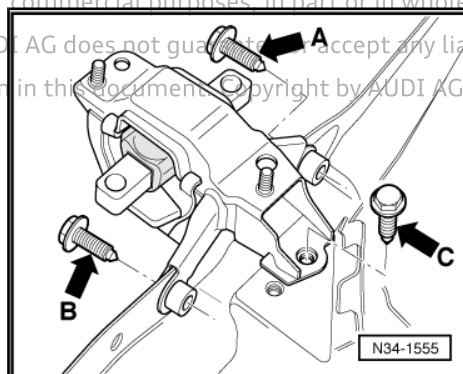
Note

Renew bolts tightened with specified tightening angle.

- Install battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery;
Removing and installing battery tray .

Tightening torques

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



2.4 Removing and installing pendulum support

Removing

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



WARNING

Risk of accident.

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

- Remove bolts -arrows- and detach pendulum support.

Installing

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



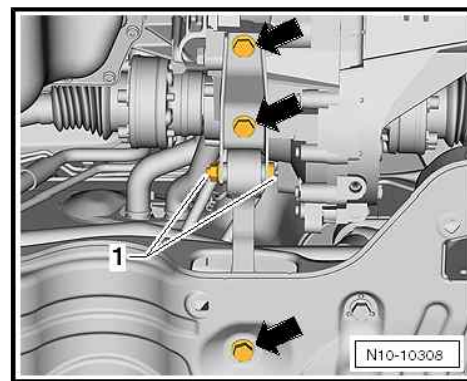
Note

Renew bolts tightened with specified tightening angle.

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

Tightening torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 29](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ "1.1 Exploded view - poly V-belt drive", page 36

⇒ "1.2 Removing and installing poly V-belt", page 37

⇒ "1.3 Removing and installing tensioner for poly V-belt", page 39

⇒ "1.4 Removing and installing bracket for ancillaries", page 40

⇒ "1.5 Removing and installing pulley", page 41

⇒ "1.6 Renewing crankshaft oil seal (pulley end)", page 44

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 37
- ☐ Do not kink
- ☐ When installing, make sure it is properly seated on pulleys

2 - Bolt

- ☐ With washer
- ☐ Renew
- ☐ Lubricate thread with oil before fitting
- ☐ Contact surface must be free of oil and grease
- ☐ 150 Nm +180°

3 - Poly V-belt pulley

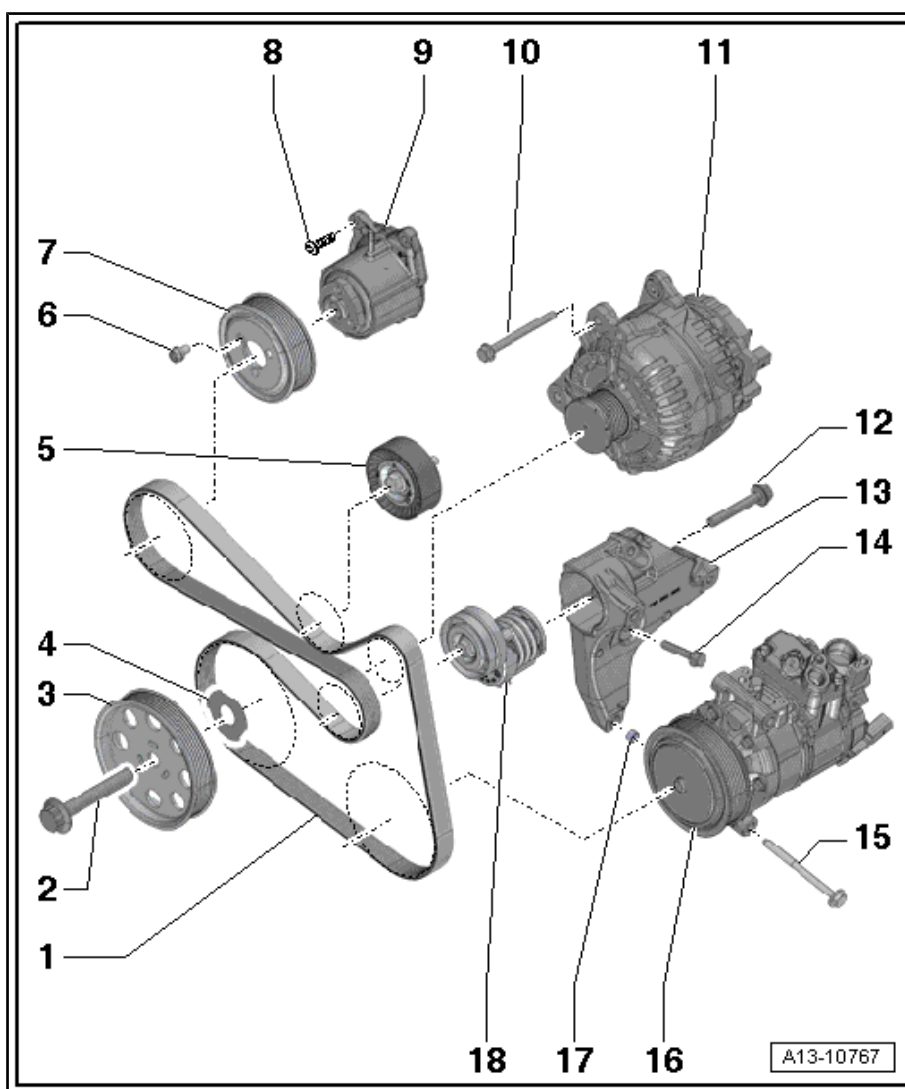
- ☐ For crankshaft
- ☐ Removing and installing
⇒ page 41
- ☐ Contact surfaces must be free of oil and grease
- ☐ When loosening and tightening, use counter-hold tool - 3415- and -3415/2-
- ☐ Contact surfaces must be free of oil and grease

4 - Diamond-coated washer

- ☐ Renew
- ☐ Insert in notches on poly V-belt pulley

5 - Idler roller

- ☐ For poly V-belt
- ☐ With cover cap for bolt





- ☐ 40 Nm

6 - Bolt

- ☐ Tightening torque ⇒ [Item 10 \(page 148\)](#)

7 - Poly V-belt pulley

- ☐ For coolant pump
- ☐ Removing and installing ⇒ [page 150](#)

8 - Bolt

- ☐ Tightening torque ⇒ [Item 11 \(page 148\)](#)

9 - Coolant pump

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

10 - Bolt

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

11 - Alternator

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

12 - Bolt

- ☐ Renew
- ☐ 20 Nm +90°

13 - Bracket

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

14 - Bolt

- ☐ 23 Nm

15 - Bolt

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

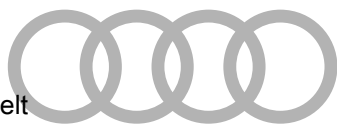
16 - Air conditioner compressor

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

17 - Dowel sleeve

18 - Tensioner

- ☐ For poly V-belt
- ☐ Lock in position with locking pin - T10060 A- .
- ☐ Removing and installing ⇒ [page 39](#)



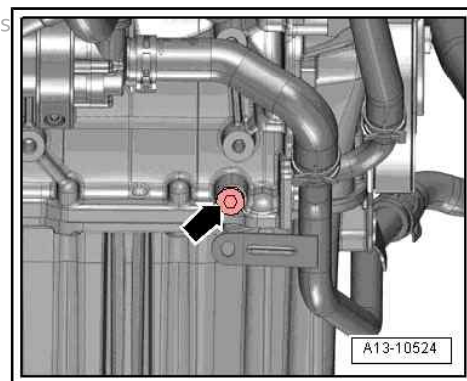
Plug for "TDC" drilling - tightening torque



Note

Renew the seal on the screw plug for the "TDC" drilling.

- Tighten plug -arrow- in cylinder block to 30 Nm.

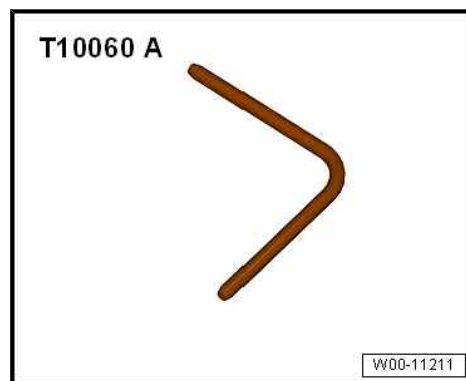


1.2 Removing and installing poly V-belt

Special tools and workshop equipment required



◆ Locking pin - T10060 A-



Removing

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

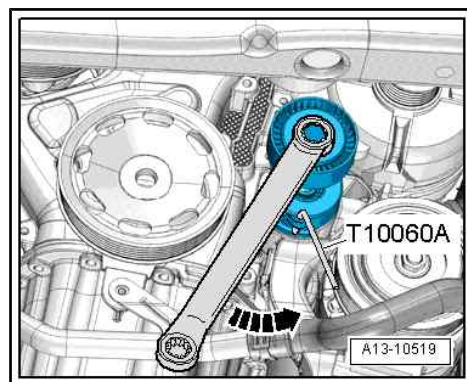


Caution

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

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

- To slacken poly V-belt turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060 A- .
- Take off poly V-belt.



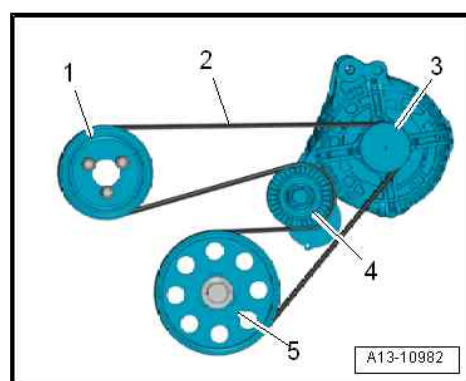
Installing

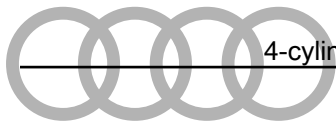
Installation is carried out in reverse order; note the following:

- Fit poly V-belt onto pulleys as shown in illustration.

Vehicles without air conditioner:

- 1 - Coolant pump
- 2 - Poly V-belt
- 3 - Alternator
- 4 - Tensioner
- 5 - Crankshaft





Vehicles with air conditioner:

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1 - Coolant pump

2 - Crankshaft

3 - Tensioner

4 - Idler roller

5 - Alternator

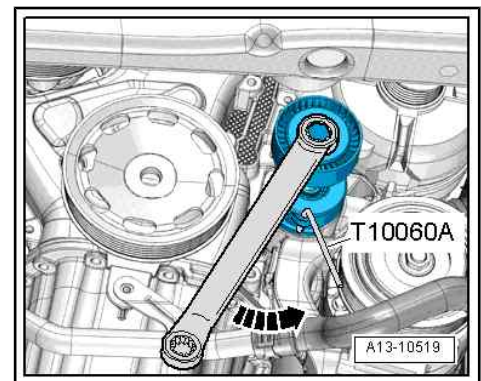
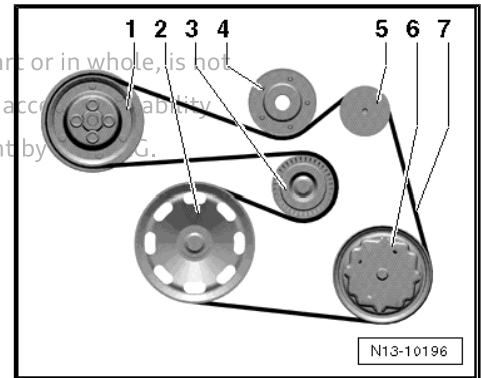
6 - Air conditioner compressor

7 - Poly V-belt

- Hold tensioner with ring spanner and remove locking pin - T10060 A- .
- Release tensioner.
- Check that poly V-belt is properly seated.
- Start engine and check that poly V-belt runs properly.

Tightening torques

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



1.3 Removing and installing tensioner for poly V-belt

⇒ ["1.3.1 Removing and installing tensioner for poly V-belt", page 39](#)

⇒ ["1.3.2 Removing and installing idler roller for poly V-belt", page 40](#)

1.3.1 Removing and installing tensioner for poly V-belt

Removing

- Remove poly V-belt ⇒ [page 37](#) .



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



WARNING

Risk of injury caused by refrigerant.

- ◆ ***The air conditioner refrigerant circuit must not be opened.***

- Remove bolts -arrows- for air conditioner compressor.



Caution

Risk of damage to refrigerant lines and hoses

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

- Tie up air conditioner compressor together with refrigerant hoses to longitudinal member (refrigerant hoses remain connected).

- Remove bolt -arrow- and take off tensioner -1-.

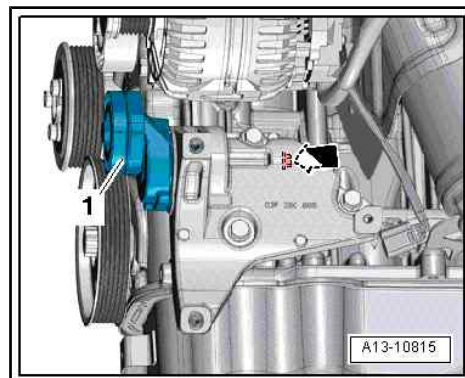
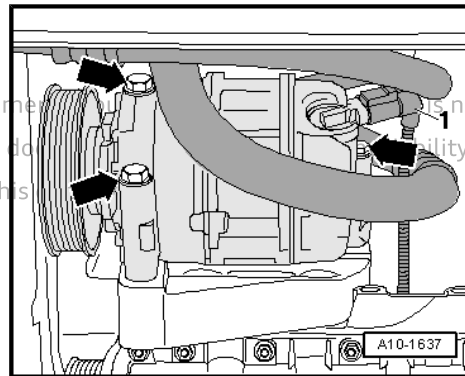
Installing

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

- Install poly V-belt ⇒ [page 37](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 36](#)
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit



1.3.2 Removing and installing idler roller for poly V-belt

Removing

- Remove poly V-belt ⇒ [page 37](#) .
- Pry off cap -1-.
- Unscrew idler roller -2-.

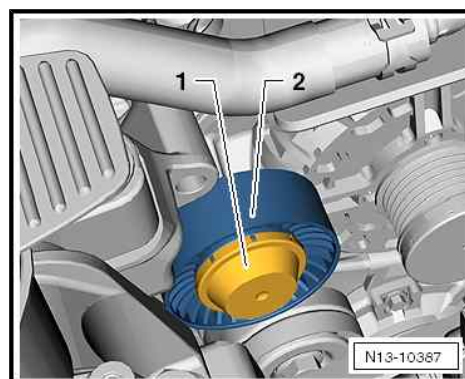
Installing

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

- Install poly V-belt ⇒ [page 37](#) .

Tightening torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 36](#)



1.4 Removing and installing bracket for ancillaries

Removing

- Remove poly V-belt ⇒ [page 37](#) .



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



WARNING

Risk of injury caused by refrigerant.

- ◆ *The air conditioner refrigerant circuit must not be opened.*

- Remove bolts -arrows- for air conditioner compressor.



Caution

Risk of damage to refrigerant lines and hoses

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

- Tie up air conditioner compressor together with refrigerant hoses to longitudinal member (refrigerant hoses remain connected).

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

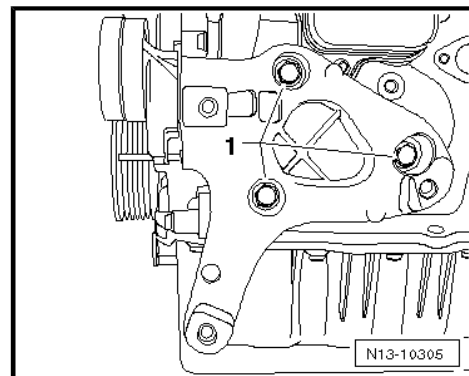
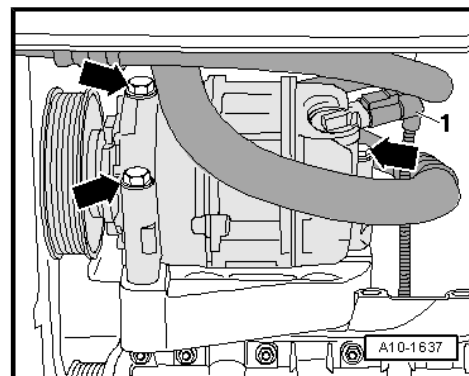
Installing

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

- Install poly V-belt ➔ [page 37](#) .

Tightening torques

- ◆ ➔ [“1.1 Exploded view - poly V-belt drive”, page 36](#)
- ◆ ➔ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit



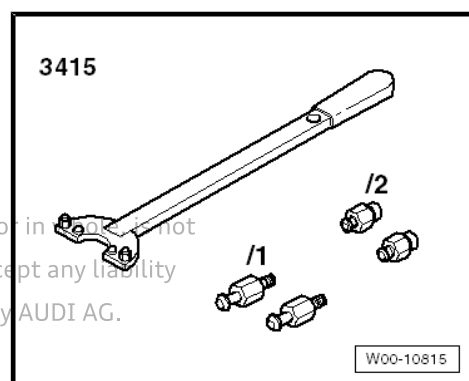
1.5 Removing and installing pulley

Special tools and workshop equipment required

- ◆ Counterhold tool - 3415- with pins -3415/2-



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◆ Locking pin - T10340-



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Removing

- Remove poly V-belt ➔ [page 37](#) .
- Loosen bolt for poly V-belt pulley using counterhold tool - 3415- with pin -3415/2- .
- Remove bolt and take off poly V-belt pulley and diamond-coated washer.

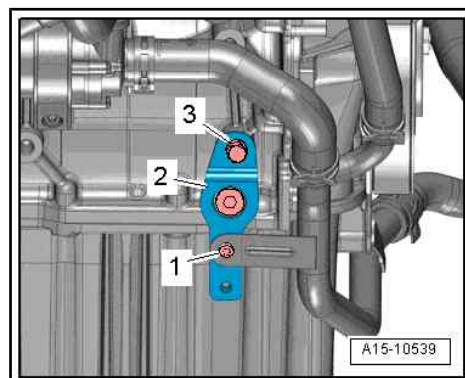
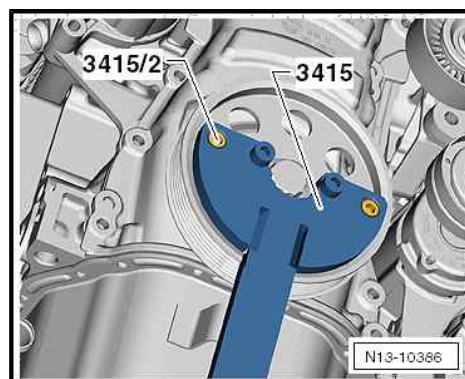
Installing



Note

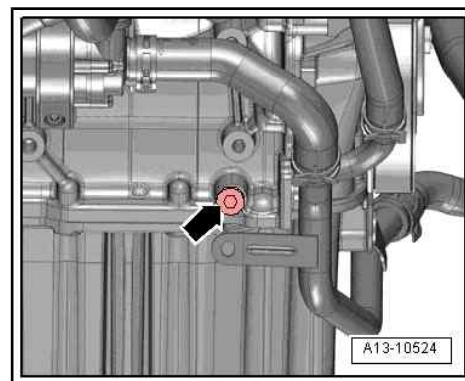
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew the diamond-coated washer.*
- ◆ *All contact surfaces between bolt, poly V-belt pulley, bush and chain sprocket must be free of oil and grease.*
- ◆ *Use locking pin - 3415- in addition to counterhold tool - T10340- to prevent slipping and to make sure the tightening torque for the crankshaft pulley bolt is maintained.*

- Remove bolts -1- and -3- and take off bracket -2- for coolant pipe (right-side).





- Unscrew plug -arrow- for “TDC” hole on cylinder block.



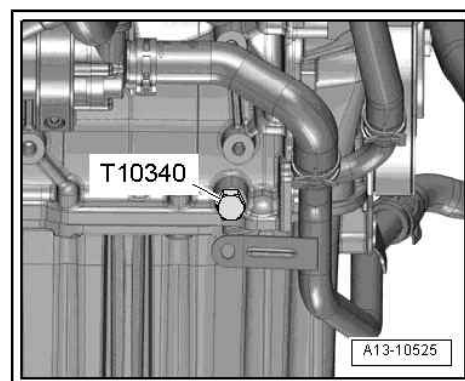
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.



Caution

Risk of damage to engine.

- ◆ *If the locking pin - T10340- cannot be screwed in as far as the stop, the crankshaft is not in the correct position.*
- ◆ *In this case proceed as follows:*



- Remove locking pin.
- Turn crankshaft by 90° in direction of engine rotation.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.



Note

The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

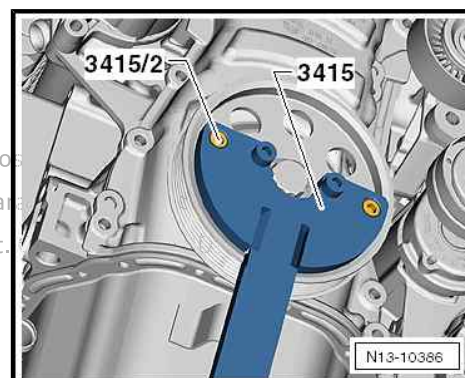
- Fit diamond-coated washer and poly V-belt pulley, lubricate threads of bolt for poly V-belt pulley with oil and screw in by hand until bolt makes contact.
- Turn crankshaft in normal direction of rotation to check whether crankshaft web is resting against locking pin.



Caution

Risk of damage to engine.

- ◆ *Also use counterhold tool - 3415- and pin -3415/2- to counterhold poly V-belt pulley when tightening bolt.*



- Tighten bolt for poly V-belt pulley (counterhold with counterhold tool - 3415- and pin -3415/2-).



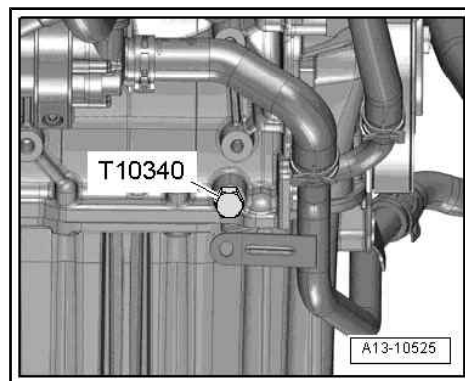
- Remove locking pin - T10340- .

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

- Install coolant pipe (right-side) ➔ [page 155](#) .
- Install poly V-belt ➔ [page 37](#) .

Tightening torques

- ◆ ➔ [“1.1 Exploded view - poly V-belt drive”, page 36](#)
- ◆ ➔ [Fig. “Plug for TDC drilling - tightening torque” , page 37](#)

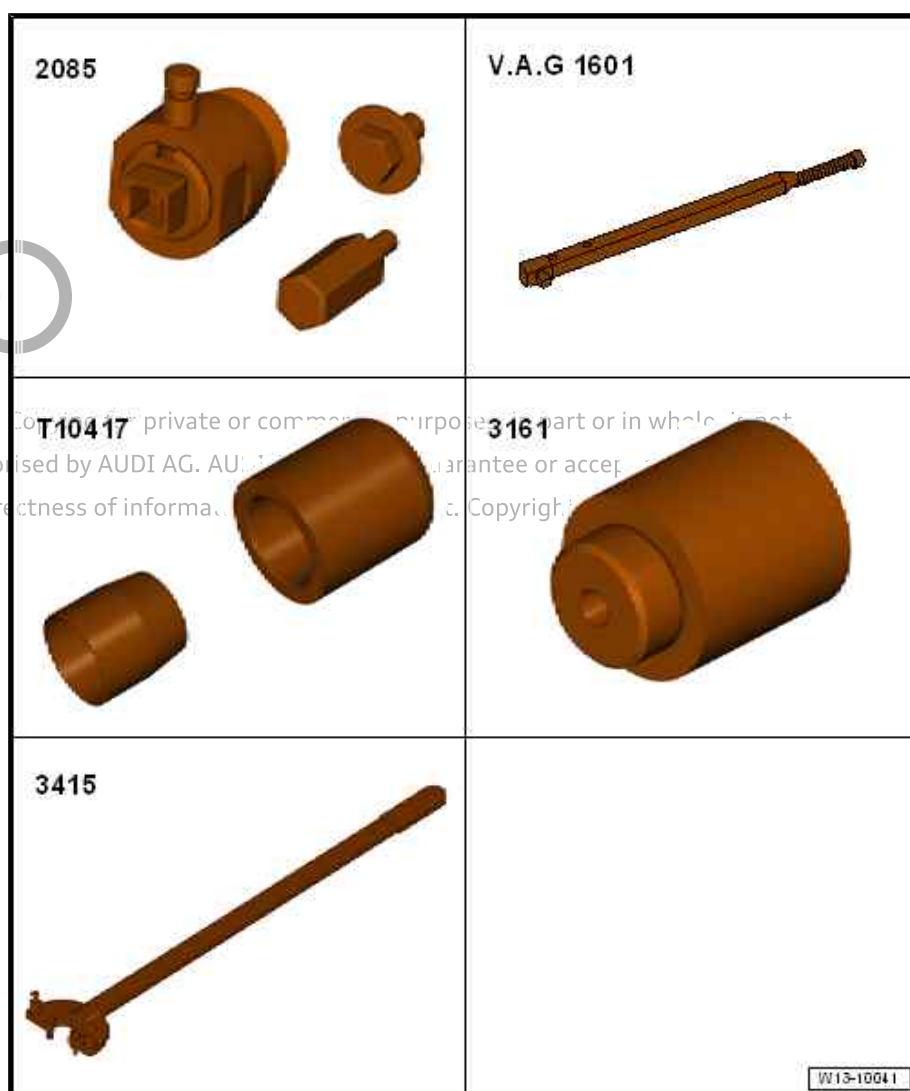


1.6 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required



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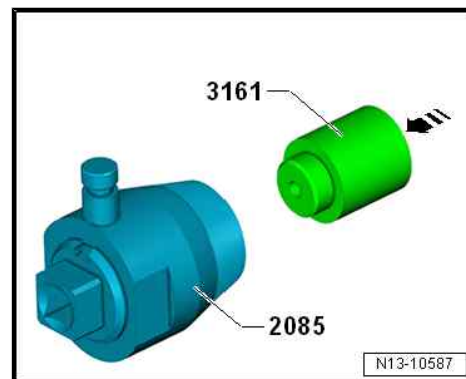


- ◆ Oil seal extractor - 2085-
- ◆ Torque wrench - V.A.G 1601-
- ◆ Assembly tool - T10417-
- ◆ Extension - 3161-
- ◆ Counterhold tool - 3415-

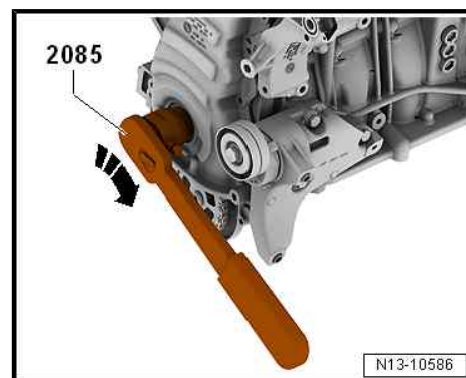


Procedure

- Remove wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Remove poly V-belt pulley for crankshaft ⇒ [page 41](#) .
- Fit extension - 3161- into oil seal extractor - 2085- .
- Unscrew inner section of oil seal extractor -2085- as far as beginning of thread, and lock with knurled screw.
- Oil threaded head of oil seal extractor.
- Attach oil seal extractor and screw it firmly into oil seal as far as it will go.



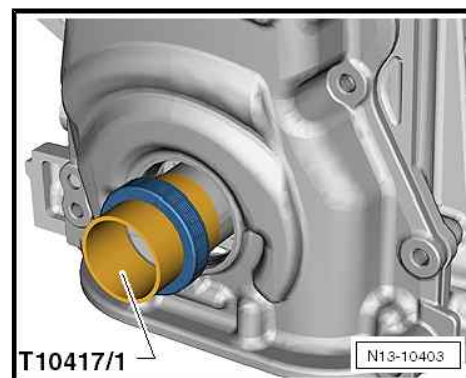
- Loosen knurled screw and turn inner section against crankshaft in direction of -arrow- until oil seal is pulled out.
- Clamp flat surfaces of oil seal extractor in a vice and remove oil seal with pliers.
- Clean contact surface and sealing surface of oil seal.



Note

Do not lubricate sealing lip and outer rim of oil seal before pressing in.

- Fit sleeve -T10417/1- onto crankshaft journal and push oil seal over sleeve.
- Detach sleeve -T10417/1- from crankshaft journal.



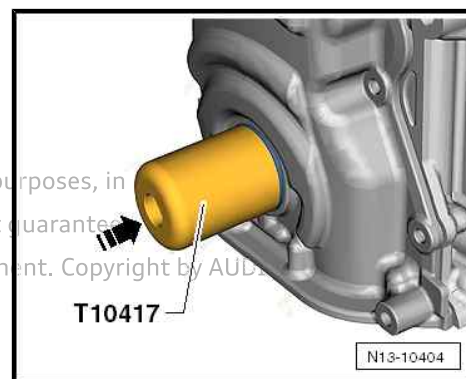
- Drive in oil seal as far as stop using assembly tool - T10417- by tapping evenly.

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

- Install poly V-belt pulley for crankshaft ⇒ [page 41](#) .

Tightening torques

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





2 Cylinder block (gearbox end)

⇒ [“2.1 Exploded view - cylinder block \(gearbox end\)”, page 46](#)

⇒ [“2.2 Removing and installing flywheel”, page 47](#)

⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 48](#)

2.1 Exploded view - cylinder block (gearbox end)

1 - Bolt

- ☐ Renew
- ☐ 60 Nm +90°

2 - Flywheel

- ☐ Can only be installed in one position (holes are off-set)
- ☐ Removing and installing
⇒ [page 47](#)

3 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Removing and installing
⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 48](#)

4 - Bolt

- ☐ Renew
- ☐ Tighten in diagonal sequence
- ☐ 10 Nm

5 - Intermediate plate

- ☐ Must be positioned on dowel sleeves
- ☐ Do not damage or bend when assembling
- ☐ Is fitted onto sealing flange ⇒ [page 47](#)

6 - Engine speed sender - G28-

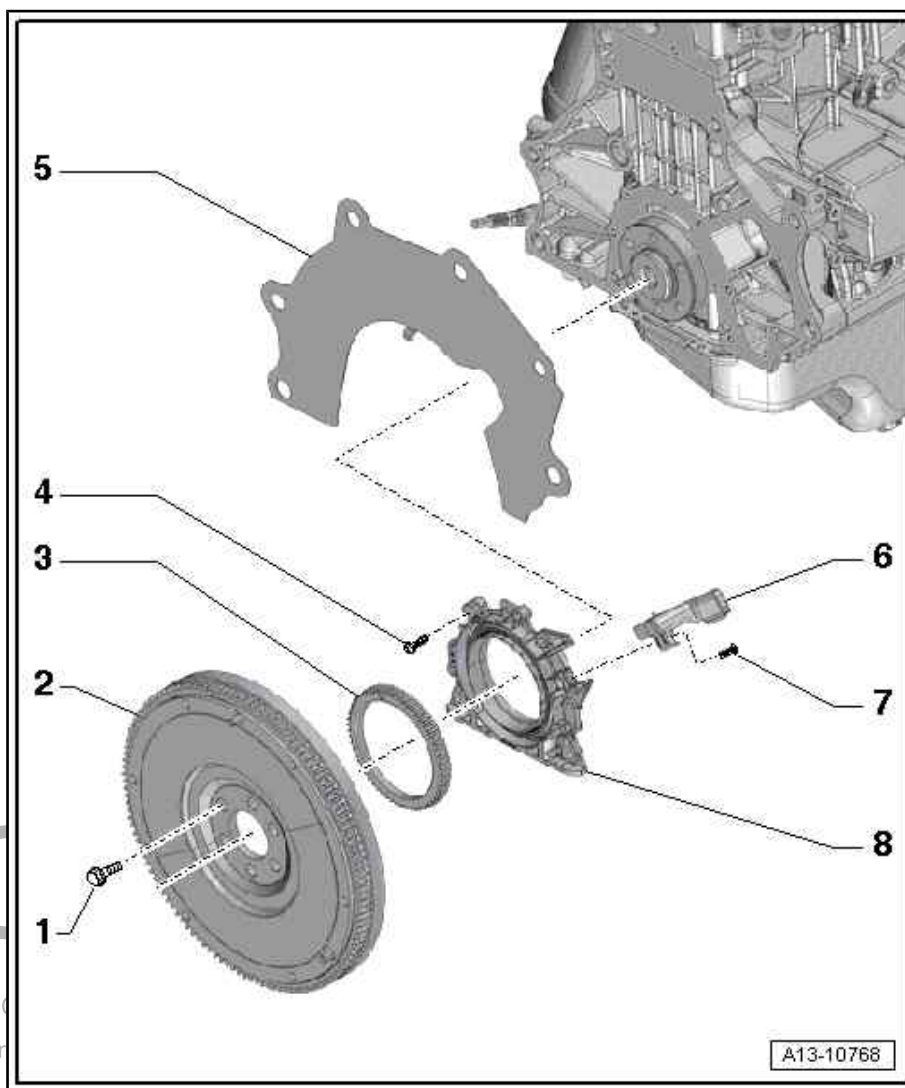
- ☐ Removing and installing
⇒ [page 228](#)

7 - Bolt

- ☐ Tightening torque ⇒ [Item 14 \(page 227\)](#)

8 - Sealing flange

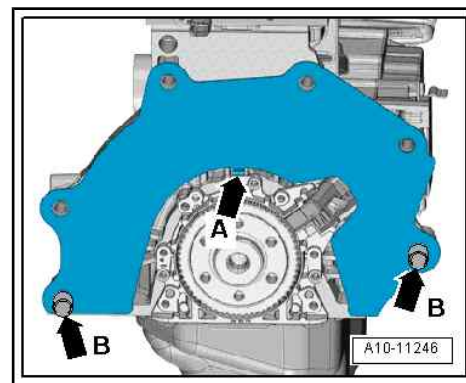
- ☐ With seal
- ☐ Renewing ⇒ [page 48](#)





Installing intermediate plate

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



2.2 Removing and installing flywheel

Special tools and workshop equipment required

- ◆ Counterhold tool - 3067-

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Removing

- Gearbox removed
- Remove clutch pressure plate ⇒ Rep. gr. 30 ; Clutch; Removing and installing clutch .
- Insert counterhold tool - 3067- to slacken bolts.
- Remove bolts and take off flywheel.

Installing

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

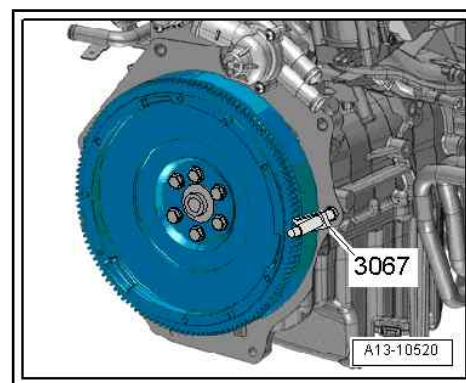


Note

- ◆ *Renew bolts tightened with specified tightening angle.*
- ◆ *Can only be installed in one position (holes are off-set)*
- Fit counterhold tool - 3067- the other way round to tighten bolts.
- Install clutch pressure plate ⇒ Rep. gr. 30 ; Clutch; Removing and installing clutch .

Tightening torques

- ◆ ⇒ "2.1 Exploded view - cylinder block (gearbox end)", page 46





2.3 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

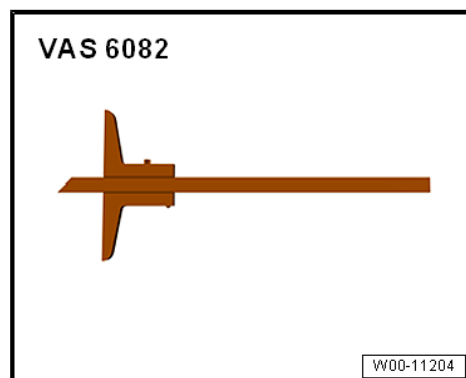
- ◆ Open ring spanner - V.A.G 1332/11-



- ◆ Assembly tool - T10134-



- ◆ Depth gauge - VAS 6082-



- ◆ Bolt, M6x35 (3x)
- ◆ Feeler gauge



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Pressing sealing flange with sender wheel off crankshaft

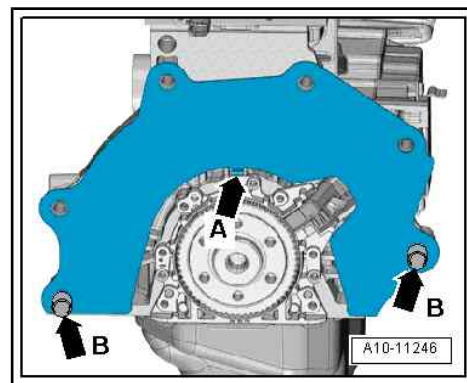
- Gearbox removed



Note

For illustration purposes, the procedure is shown with the engine removed.

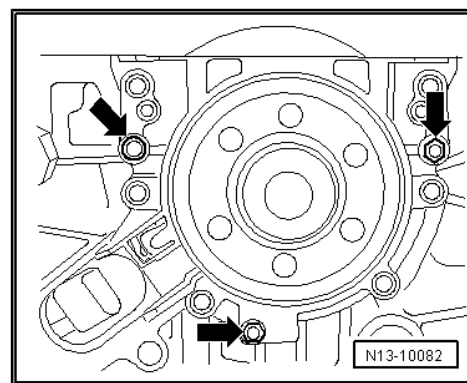
- Remove flywheel ➔ [page 47](#) .
- Press intermediate plate off dowel sleeves -arrows B- and detach from top of sealing flange -arrow A-
- Remove sump ➔ [page 121](#) .
- Remove engine speed sender - G28- ➔ [page 228](#) .
- Remove bolts for sealing flange.



Note

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

- To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than 1/2 turn at a time.
- Take off sealing flange with sender wheel.



Pressing in sealing flange with sender wheel



Note

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

Construction of assembly tool - T10134- :

A - Tensioning flats

B - Nut

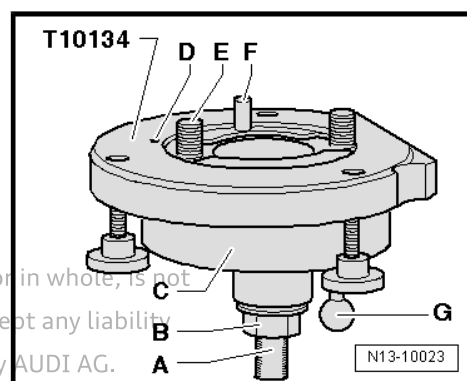
C - Assembly housing

D - Locating pin

E - Hexagon socket-head bolt

F - Guide pin for diesel engines (black handle)

G - Guide pin for petrol engines (red handle)

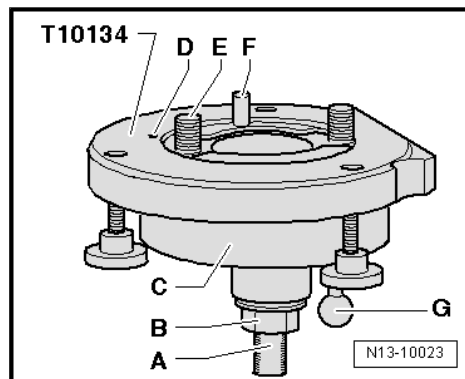


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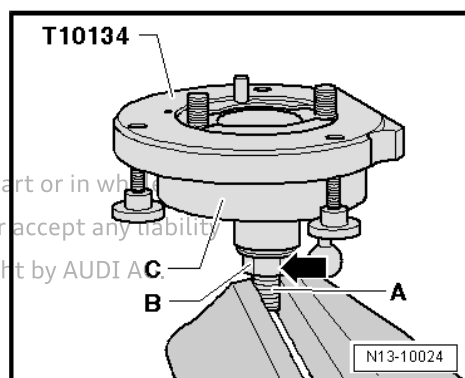


A - Fitting sealing flange with sender wheel onto assembly tool - T10134- :

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



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

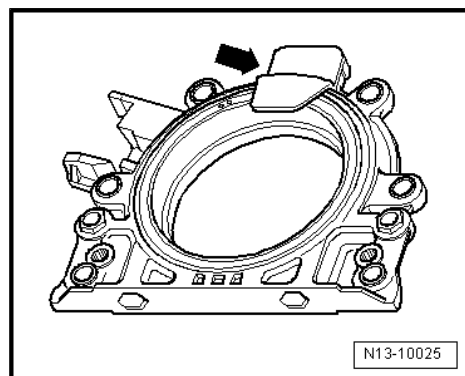


- Remove the securing clip -arrow- from new sealing flange.

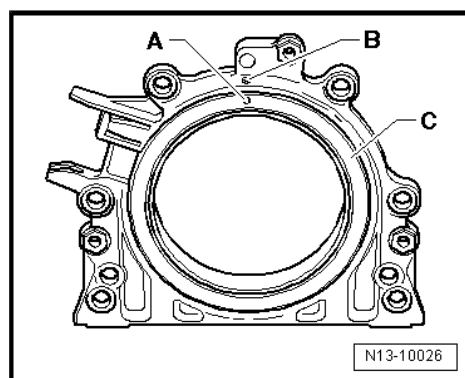


Note

The sender wheel must not be taken out of the sealing flange or rotated out of position.

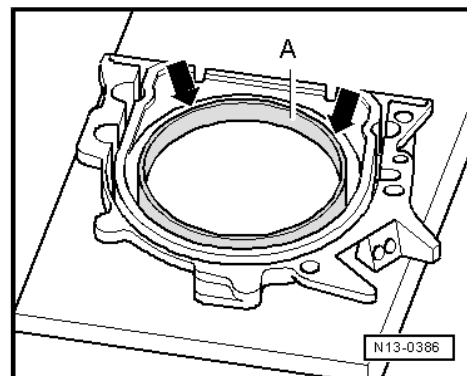


- The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.

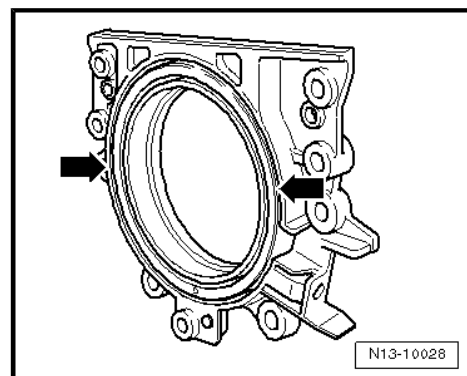




- Place sealing flange (with front side downwards) on a clean flat surface.
- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



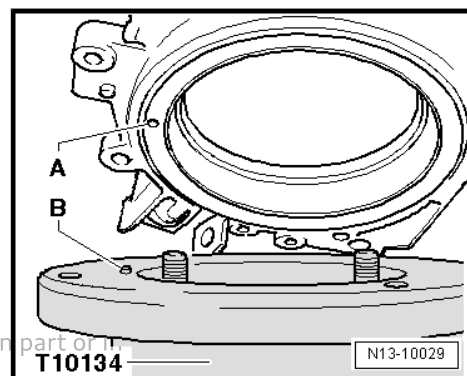
- The upper edge of the sealing lip support ring must be flush with the front edge of the sealing flange -arrows-.



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



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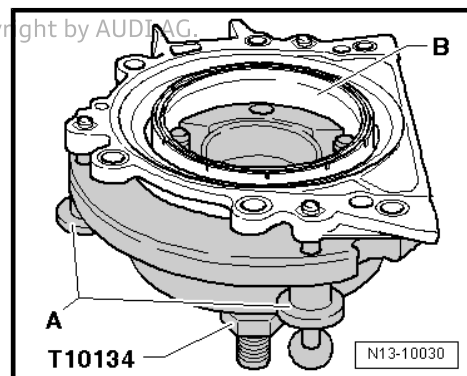


- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool - T10134- while tightening the 3 knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.



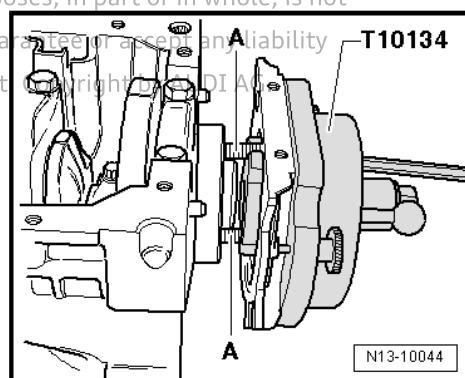
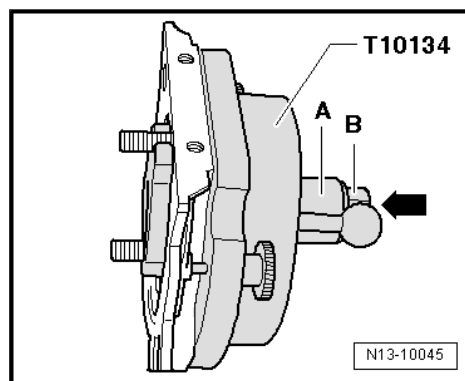
Note

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

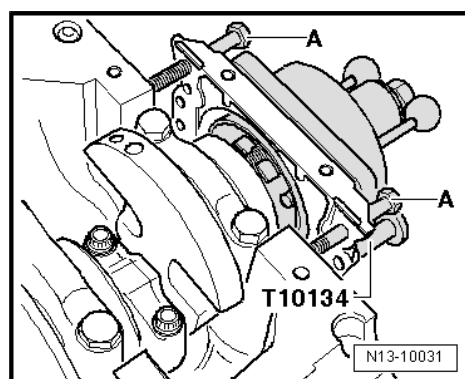


**B - Installing assembly tool - T10134- with sealing flange on crankshaft flange:**

- Crankshaft flange must be free of oil and grease.
- Engine is at "TDC" position.
- Screw nut -B- to end of threaded spindle.
- Press threaded spindle of assembly tool - T10134- in direction of -arrow- until nut -B- makes contact with assembly housing -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 M6×35 mm -item A- into cylinder block to guide sealing flange.

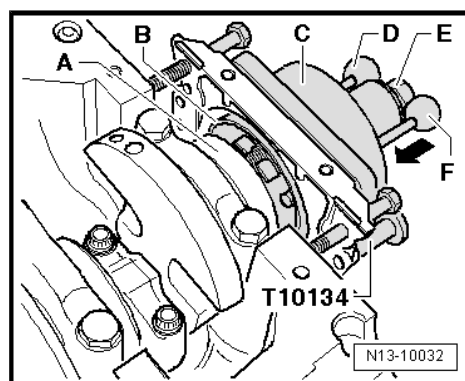
**C - Securing assembly tool - T10134- onto crankshaft flange:**

- 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 petrol engines (red handle) -F- into aperture in crankshaft. This ensures that sender wheel reaches its final installation position.

**Note**

The guide pin for diesel engines (black handle) -D- must not be inserted into threaded hole in crankshaft.

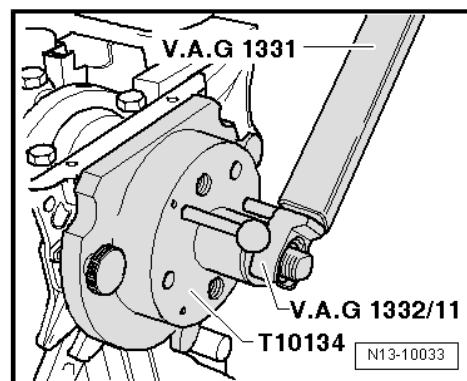
- Tighten the two hexagon socket head bolts on assembly tool hand-tight.
- Screw nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.





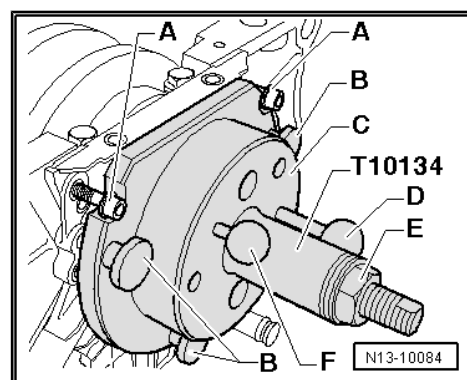
D - Pressing sender wheel onto crankshaft flange with assembly tool - T10134- :

- Tighten nut on assembly tool - T10134- to 35 Nm.
- A small air gap must be present between cylinder block and sealing flange after tightening nut to 35 Nm.

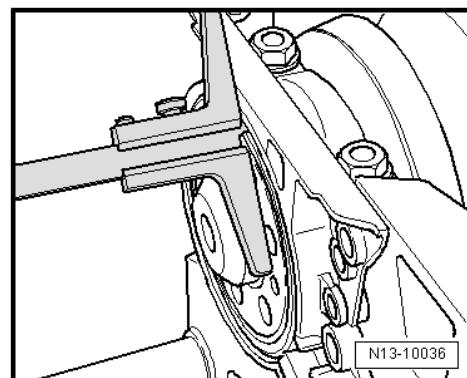


E - Checking installation position of sender wheel on crankshaft:

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



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

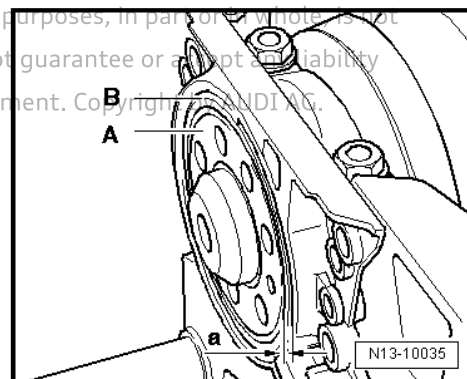


- Measure distance -a- between crankshaft flange -A- and sender wheel -B-.

- Specification: Distance -a- = 0.5 mm.

- Press sender wheel in further if distance is too small
⇒ [page 54](#) .

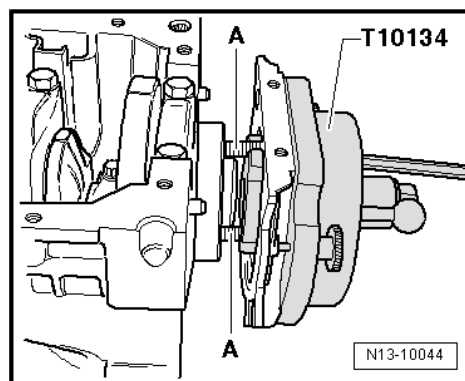
- If reading matches specification, continue with assembly
⇒ [page 54](#) .



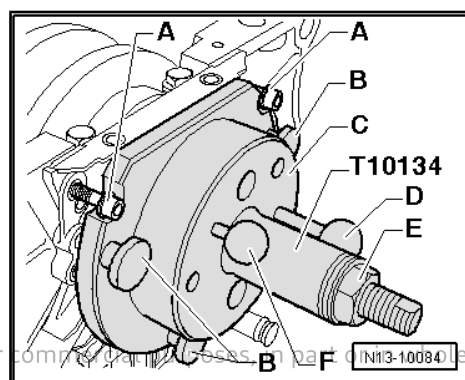


F - Pressing sender wheel in further:

- Secure assembly tool - T10134- to crankshaft flange by tightening hexagon socket head bolts -A- hand-tight.
- Slide assembly tool - T10134- onto sealing flange by hand.



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



- Tighten nut on assembly tool - T10134- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 53](#) .
- Tighten nut on assembly tool - T10134- to 45 Nm if distance is too small.
- Check installation position of sender wheel on crankshaft again ⇒ [page 53](#) .

Assembling:



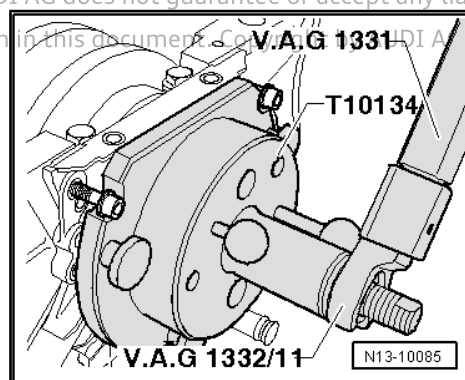
Note

Renew sealing flange bolts.

- Install sump ⇒ [page 121](#) .
- Install intermediate plate ⇒ [page 47](#) .
- Install flywheel ⇒ [page 47](#) .

Tightening torques

- ♦ ⇒ [“2.1 Exploded view - cylinder block \(gearbox end\)”](#), [page 46](#)
- ♦ Engine speed sender - G28-
⇒ [“1.1 Exploded view - ignition system”](#), [page 226](#)





3 Crankshaft

⇒ **"3.1 Crankshaft dimensions", page 55**

3.1 Crankshaft dimensions



Caution

Risk of deformation of the cylinder block bearing pedestals.

- ◆ ***The crankshaft must not be removed. Even loosening the main bearing cap bolts will cause deformation of the cylinder block bearing pedestals. This will result in reduced bearing clearance. Even if bearing shells are not renewed, a change in bearing clearance can cause bearing damage.***
- ◆ ***If the bearing cap bolts are loosened, the cylinder block must be renewed together with the crankshaft.***
- ◆ ***Crankshaft bearing clearance cannot be measured using workshop equipment.***

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4 Pistons and conrods

⇒ "4.1 Exploded view - pistons and conrods", page 56

⇒ "4.2 Removing and installing pistons", page 58

⇒ "4.3 Checking pistons and cylinder bores", page 59

⇒ "4.4 Checking radial clearance of conrod bearings", page 60

4.1 Exploded view - pistons and conrods



Note

- ◆ All bearing and running surfaces must be oiled before assembling.
- ◆ Oil spray jet and pressure relief valve ⇒ [page 58](#)

1 - Bolts

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

2 - Conrod bearing cap

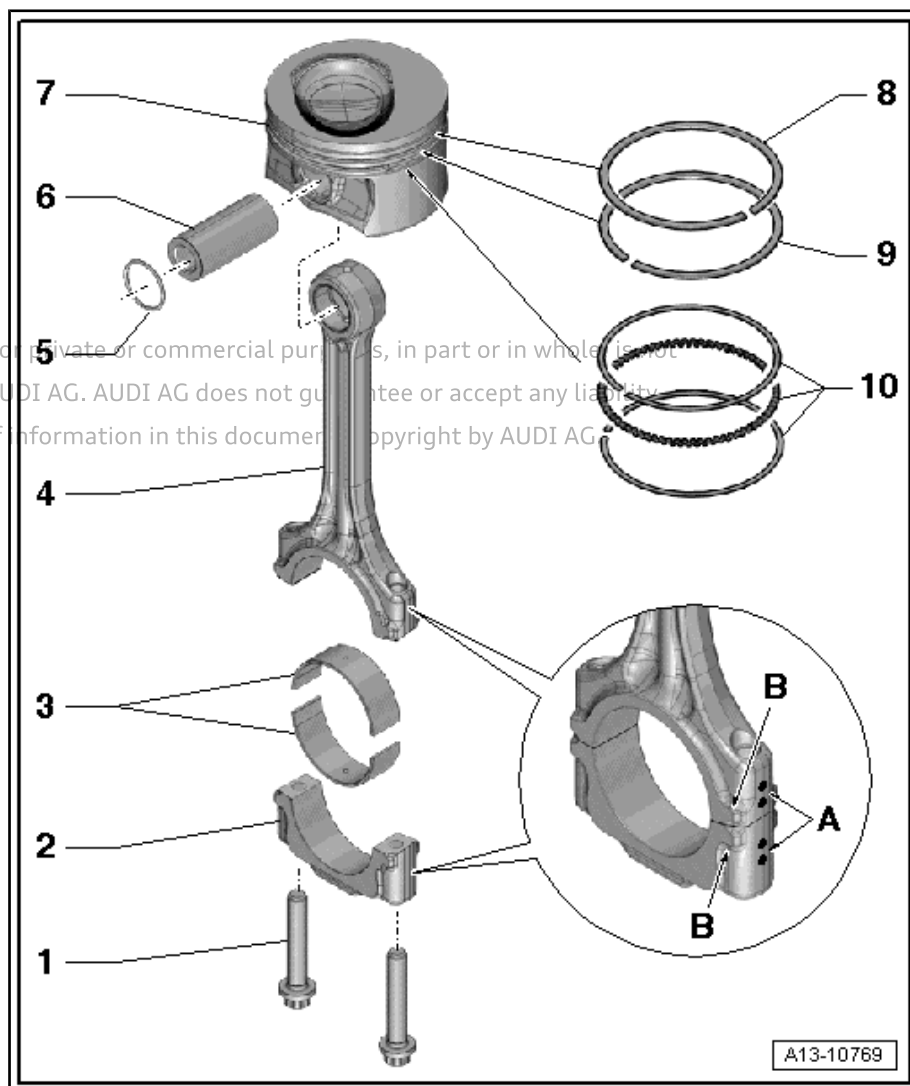
- ☐ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ☐ Mark cylinder allocation in colour -A-
- ☐ Installation position: Markings -B- must be on same side

3 - Bearing shells

- ☐ With oil drilling
- ☐ Renew used bearing shells
- ☐ Installation position ⇒ [page 57](#)

4 - Conrod

- ☐ Only renew as a complete set
- ☐ With industrially cracked conrod bearing cap
- ☐ Separating parts of new conrod ⇒ [page 58](#)
- ☐ Mark cylinder allocation in colour -A-
- ☐ Installation position: Markings -B- must be on same side
- ☐ Guided axially via piston





- ☐ Measuring radial clearance ⇒ [page 60](#)

5 - Circlip

- ☐ 2x
- ☐ Renew

6 - Piston pin

- ☐ Removing and installing ⇒ [“4.2 Removing and installing pistons”, page 58](#)

7 - Piston

- ☐ Removing and installing ⇒ [page 58](#)
- ☐ Mark installation position and cylinder number
- ☐ Installation position: arrow on piston crown points to pulley end
- ☐ Checking pistons and cylinder bores ⇒ [page 59](#)

8 - Compression ring

- ☐ Marking “TOP” or side with lettering faces towards piston crown
- ☐ Use piston ring pliers to remove and install
- ☐ Measuring ring gap ⇒ [page 60](#)
- ☐ Measuring ring-to-groove clearance ⇒ [page 60](#)

9 - Compression ring

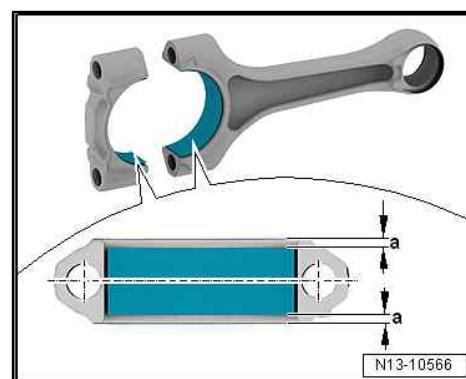
- ☐ Marking “TOP” or side with lettering faces towards piston crown
- ☐ Offset gap 120° relative to adjacent oil scraper ring
- ☐ Use piston ring pliers to remove and install
- ☐ Measuring ring gap ⇒ [page 60](#)
- ☐ Measuring ring-to-groove clearance ⇒ [page 60](#)

10 - Oil scraper ring

- ☐ 3 parts
- ☐ Offset gap of top steel element of piston ring by 120° to next compression ring
- ☐ Offset gaps of individual parts of oil scraper ring
- ☐ Measuring ring gap ⇒ [page 60](#)
- ☐ Ring-to-groove clearance cannot be checked

Installation position of bearing shells in conrods

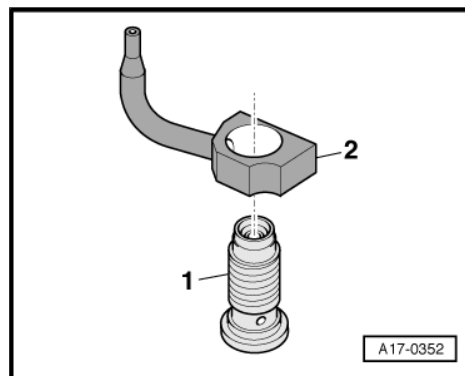
- Insert bearing shells centrally in conrod/conrod bearing cap.
- Distance -a- = approx. 1.0 mm.





Oil spray jet and pressure relief valve

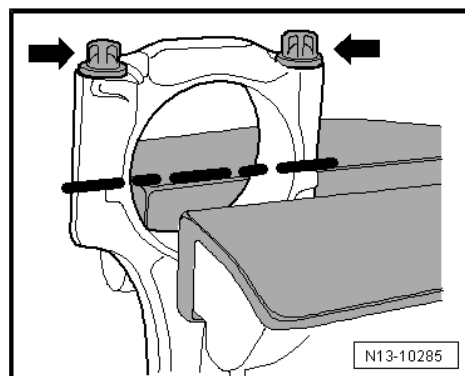
- 1 - Bolt with pressure relief valve, 27 Nm
 - 2 - Oil spray jet (for cooling of pistons)
- Installation position: align locating edge of oil spray jet with machined surface of cylinder block.



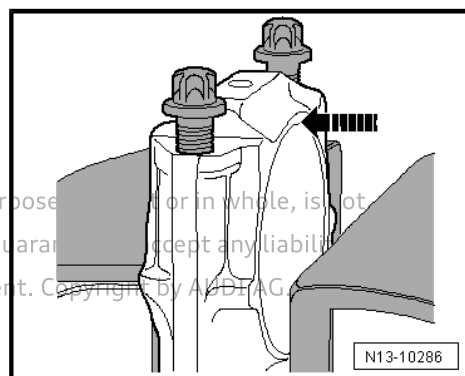
Separating parts of new conrod

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

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



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



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4.2 Removing and installing pistons

Special tools and workshop equipment required

- ♦ Pin - VW 222 A-



- ♦ Piston ring clamp, commercially available

Removing

- Remove cylinder head ➔ [page 94](#).



- Remove sump ➔ [page 121](#) .
- Mark installation position and cylinder number of piston.
- Mark installation position and matching of cylinder and conrod bearing cap to conrod ➔ [Item 4 \(page 56\)](#) .
- Remove conrod bearing cap and pull out piston and conrod upwards.



Note

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

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

Installing

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



Note

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- Oil running surfaces of bearing shells.
- Install pistons using commercially available piston ring clamp.
- Installation position ➔ [Item 7 \(page 57\)](#) .
- Install conrod bearing caps according to markings.
- Install sump ➔ [page 121](#) .
- Install cylinder head ➔ [page 94](#) .

Tightening torques

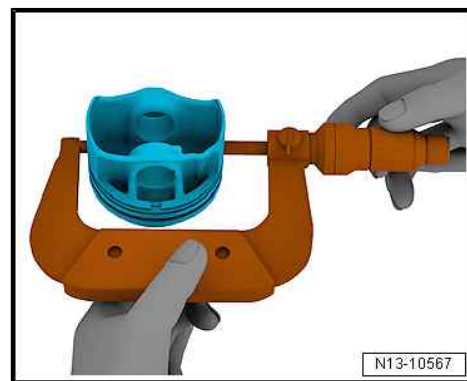
- ◆ ➔ [“4.1 Exploded view - pistons and conrods”, page 56](#)

4.3 Checking pistons and cylinder bores

Checking piston

- Using a micrometer (75 ... 100 mm), measure approx. 12 mm from the lower edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.

Piston Ø mm	
Basic dimension	70.955 ¹⁾
Repair oversize I	71.205 ¹⁾
Repair oversize II	71.455 ¹⁾
• ¹⁾ Dimensions including coating (thickness 0.01 mm). The coating will wear down in service.	

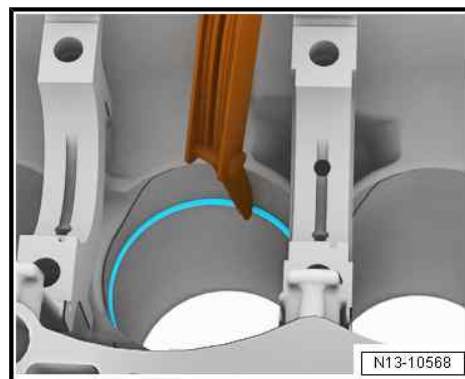




Measuring piston ring gap

- Insert piston ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. To do so, use a piston without rings.

Piston ring	new mm	Wear limit mm
1st compression ring	0.20 ... 0.40	1.00
2nd compression ring	0.40 ... 0.60	1.00
Oil scraper ring	0.25 ... 0.75	No wear limit data available



Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
1st compression ring	0.03 ... 0.09	0.15
2nd compression ring	0.02 ... 0.06	0.15
Oil scraper ring	Cannot be measured	



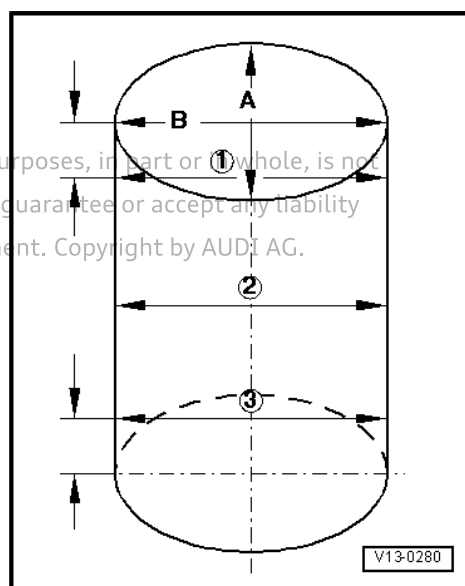
Measuring cylinder bore

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

**Note**

Do not mount cylinder block on engine and gearbox support - VAS 6095- , as incorrect measurements may result.

Cylinder bore Ø mm	
Basic dimension	71.000
Repair oversize I	71.250
Repair oversize II	71.500



4.4 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

- ♦ Plastigauge

Procedure

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- Fit conrod bearing cap and secure with old bolts
⇒ [Item 1 \(page 56\)](#) without rotating crankshaft.



- Remove conrod bearing cap again.
- Compare width of Plastigauge with measurement scale.

Radial clearance:

- New: 0.02 ... 0.06 mm.
- Wear limit: 0.09 mm.
- Renew conrod bolts.



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15 – Cylinder head, valve gear

1 Timing chain cover

⇒ “1.1 Exploded view - timing chain cover”, page 62

1.1 Exploded view - timing chain cover

1 - Cover (bottom)

- ☐ For timing chain
- ☐ Removing and installing
⇒ [page 65](#)
- ☐ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

2 - Oil seal

- ☐ For crankshaft
- ☐ Renewing ⇒ [page 44](#)

3 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 63](#)

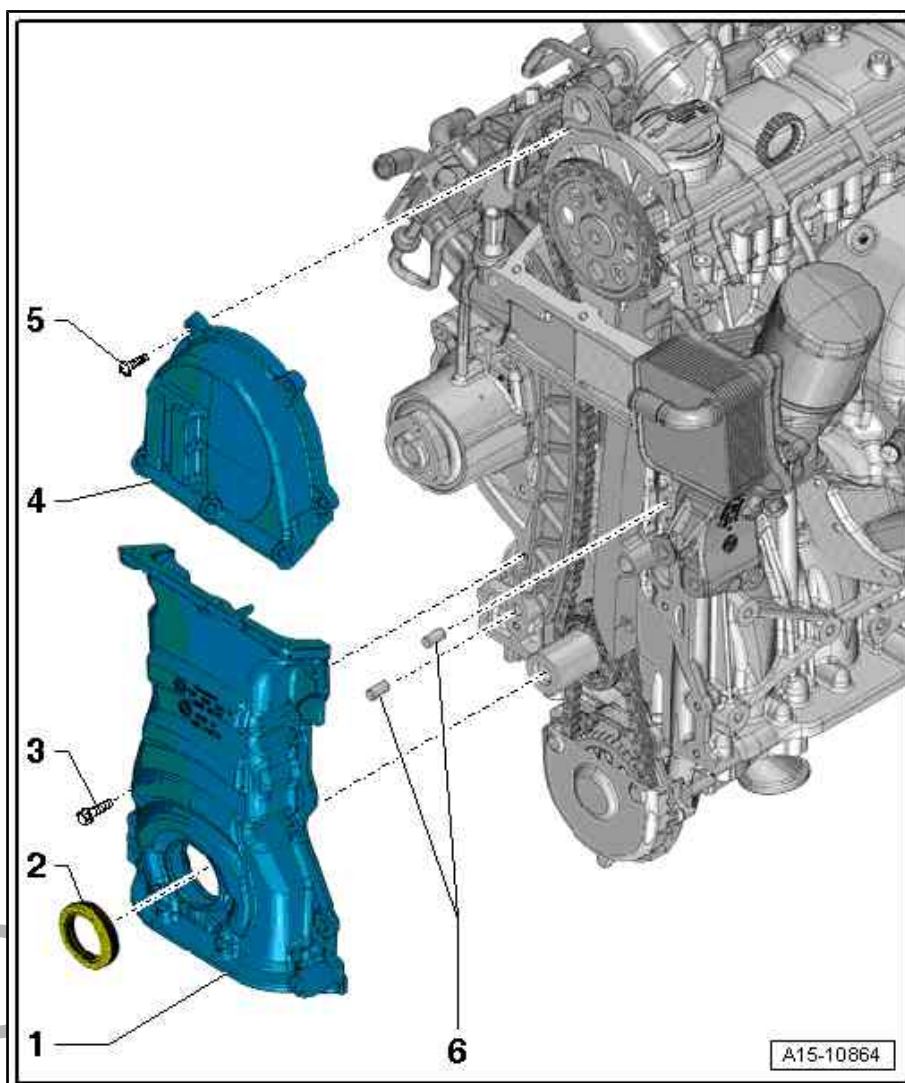
4 - Cover (top)

- ☐ For timing chain
- ☐ Removing and installing
⇒ [page 63](#)
- ☐ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

5 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 62](#)

6 - Dowel pins

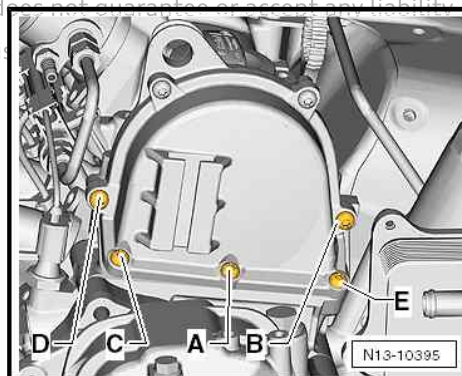


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Timing chain cover (top) - tightening torque and tightening sequence

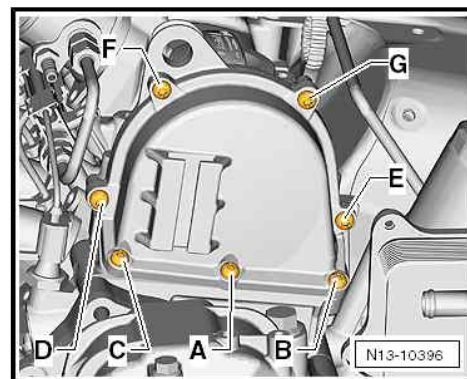
– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-A ... E-	5 Nm





Stage	Bolts	Tightening torque
2.	-A ... G-	8 Nm



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

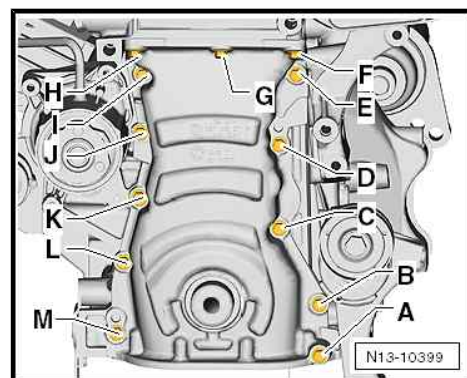


Note

Renew the bolts tightened with specified tightening angle.

- Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-A ... M-	5 Nm
2.	-A ... M-	Turn 30° further



1.2 Removing and installing timing chain cover

⇒ ["1.2.1 Removing and installing timing chain cover \(top\)", page 63](#)

⇒ ["1.2.2 Removing and installing timing chain cover \(bottom\)", page 65](#)

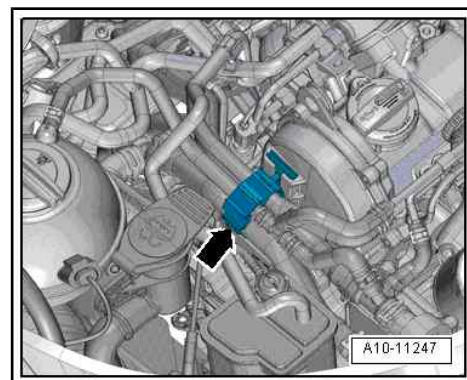
1.2.1 Removing and installing timing chain cover (top)

Special tools and workshop equipment required

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

- Press release tab at bottom of bracket and unhook bracket -arrow- from timing chain cover (top) with coolant hoses still attached.





- Loosen and remove bolts in sequence -G ... A-.
- Carefully release timing chain cover (top) from bonded joint and remove cover.

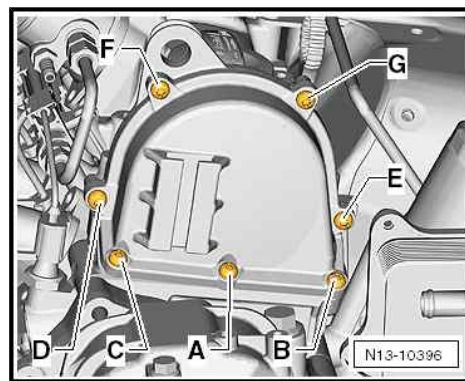
Installing



Caution

Protect lubrication system against contamination.

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



- Remove old sealant from grooves on timing chain cover (top) and from sealing surfaces.

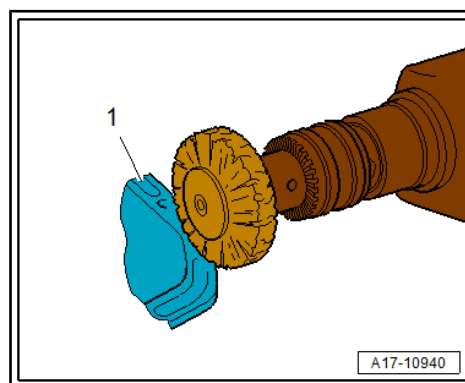


WARNING

Risk of eye injury.

- ◆ **Put on safety goggles.**

- Remove remaining sealant on timing chain cover (top) and cylinder head cover using rotating plastic brush or similar.

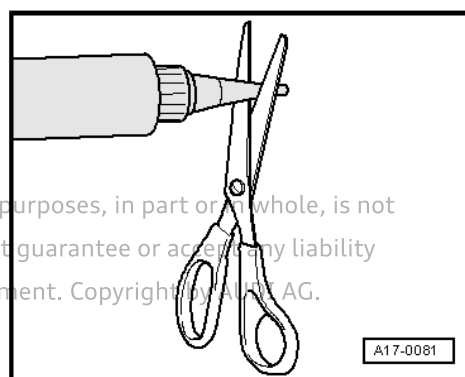


Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 2.5 mm).
- Clean sealing surfaces; they must be free of oil and grease.

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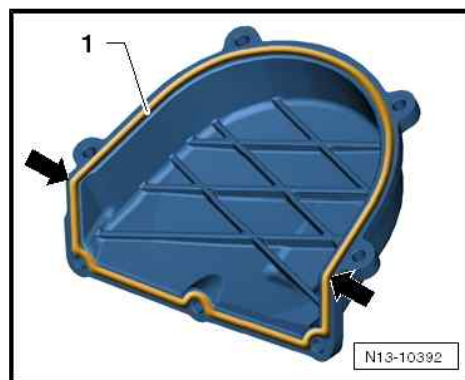


Caution

Make sure lubrication system is not clogged by excess sealant.

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

- Apply bead of sealant -1- onto clean sealing surface of timing chain cover (top) as shown in illustration.
- The bead of sealant must be 2.0 ... 3.0 mm thick.
- Apply slightly more sealant to area marked by -arrows-.



Note

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

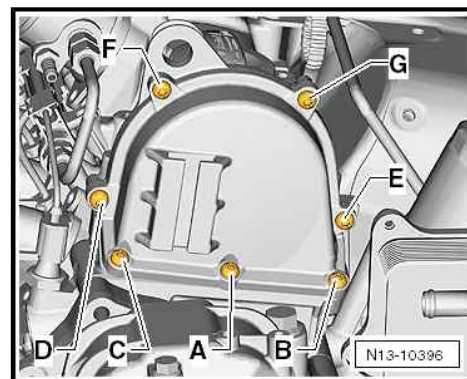


- Fit timing chain cover (top), screw bolts in by hand until they make contact and then tighten bolts ⇒ [page 62](#) .

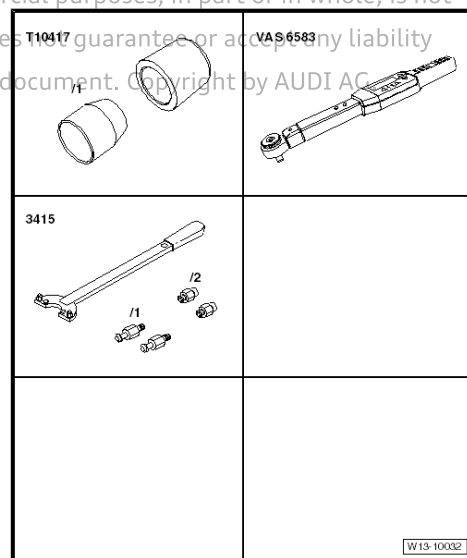
The remaining installation steps are carried out in the reverse sequence.

Tightening torques

- ◆ Tightening torques
⇒ Fig. “Timing chain cover (top) - tightening torque and tightening sequence” , [page 62](#)



1.2.2 Removing and installing timing chain cover (bottom)



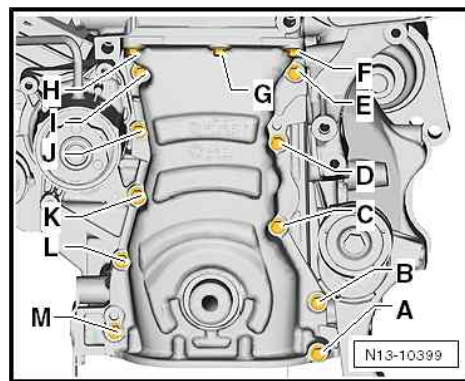
Special tools and workshop equipment required

- ◆ Assembly tool - T10417/1-
- ◆ Torque wrench - VAS 6583-
- ◆ Counterhold tool - 3415-
- ◆ Pin - 3415/2-
- ◆ Socket - VAS 262 001- (not illustrated)
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue



Removing

- Remove sump ⇒ [page 121](#) .
- Removing idler roller for poly V-belt ⇒ [page 40](#) .
- Remove poly V-belt pulley for coolant pump ⇒ [page 150](#) .
- Remove poly V-belt pulley for crankshaft ⇒ [page 41](#) .
- Loosen and remove bolts in sequence -M ... A-.
- Carefully release timing chain cover (bottom) from bonded joint and remove cover.
- Press crankshaft oil seal out of timing chain cover (bottom).



Installing



Note

- ◆ Renew the bolts tightened with specified tightening angle.
- ◆ Renew the crankshaft oil seal.



Caution

Protect lubrication system against contamination.

- ◆ Cover exposed parts of the engine.

- Remove old sealant from grooves on timing chain cover (bottom) and from sealing surfaces.

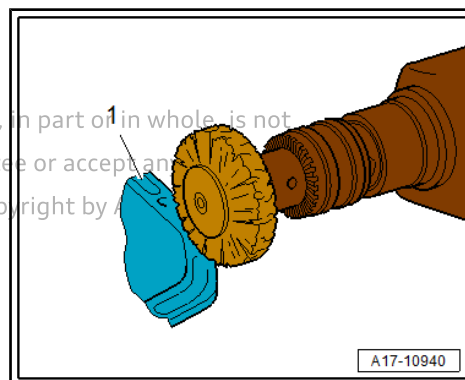


WARNING

Risk of eye injury.

- ◆ Put on safety goggles.

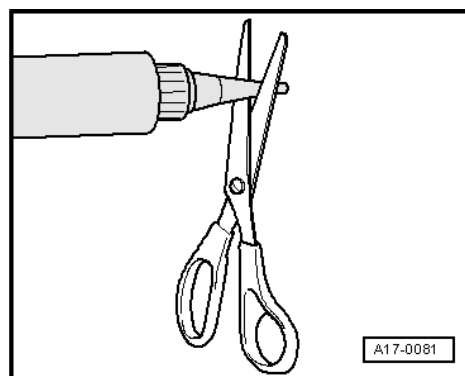
- Remove remaining sealant on timing chain cover (bottom), cylinder head and cylinder block using rotating plastic brush or similar.



Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 2.5 mm).
- Clean sealing surfaces; they must be free of oil and grease.





Caution

Make sure lubrication system is not clogged by excess sealant.

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

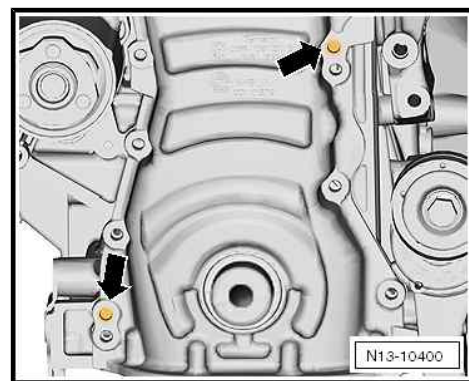
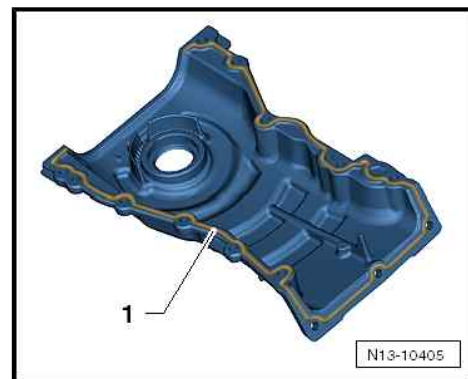
- Apply sealant bead -1- onto clean sealing surface of timing chain cover (bottom) as shown in illustration.
- The bead of sealant must be 2.0 ... 3.0 mm thick.



Note

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

- Carefully fit timing chain cover (bottom) onto dowel pins -arrows- and press cover on until it makes contact with cylinder block and cylinder head.



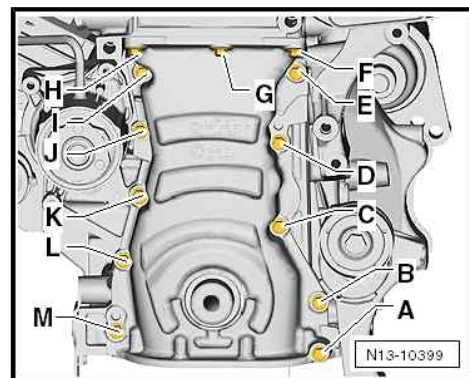
- Screw bolts for timing chain cover (bottom) in by hand until they make contact and then tighten bolts ➔ [page 63](#) .

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

- Install crankshaft oil seal ➔ [page 44](#) .
- Install poly V-belt pulley for coolant pump ➔ [page 148](#) .
- Install idler roller for poly V-belt ➔ [page 40](#) .
- Install sump ➔ [page 121](#) .

Tightening torques

- ◆ Tightening torques
➔ [Fig. “Timing chain cover \(bottom\) - tightening torque and tightening sequence”](#), [page 63](#)



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2 Chain drive

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⇒ [“2.1 Exploded view - timing chain”, page 68](#)

⇒ [“2.2 Checking valve timing”, page 69](#)

⇒ [“2.3 Removing camshaft timing chain from camshafts”, page 71](#)

⇒ [“2.4 Removing and installing camshaft timing chain”, page 78](#)

⇒ [“2.5 Checking timing chain”, page 85](#)

2.1 Exploded view - timing chain

1 - Camshaft timing chain

- ☐ Before removing, mark running direction with paint
- ☐ ⇒ [“2.2 Checking valve timing”, page 69](#)
- ☐ ⇒ [“2.3 Removing camshaft timing chain from camshafts”, page 71](#)
- ☐ ⇒ [“2.4 Removing and installing camshaft timing chain”, page 78](#)
- ☐ Vehicles from 06.2011 onwards: after installing camshaft timing chain, perform [\[01 - Chain elongation adaption diagnosis\]](#) function in [\[Guided Functions\]](#) mode of ⇒ Vehicle diagnostic tester.

2 - Guide pin

- ☐ 18 Nm

3 - Tensioning rail

4 - Bolt

- ☐ Renew
- ☐ When loosening and tightening, lock camshaft chain sprocket using counterhold tool - T10172-
- ☐ 50 Nm +90°

5 - Camshaft chain sprocket

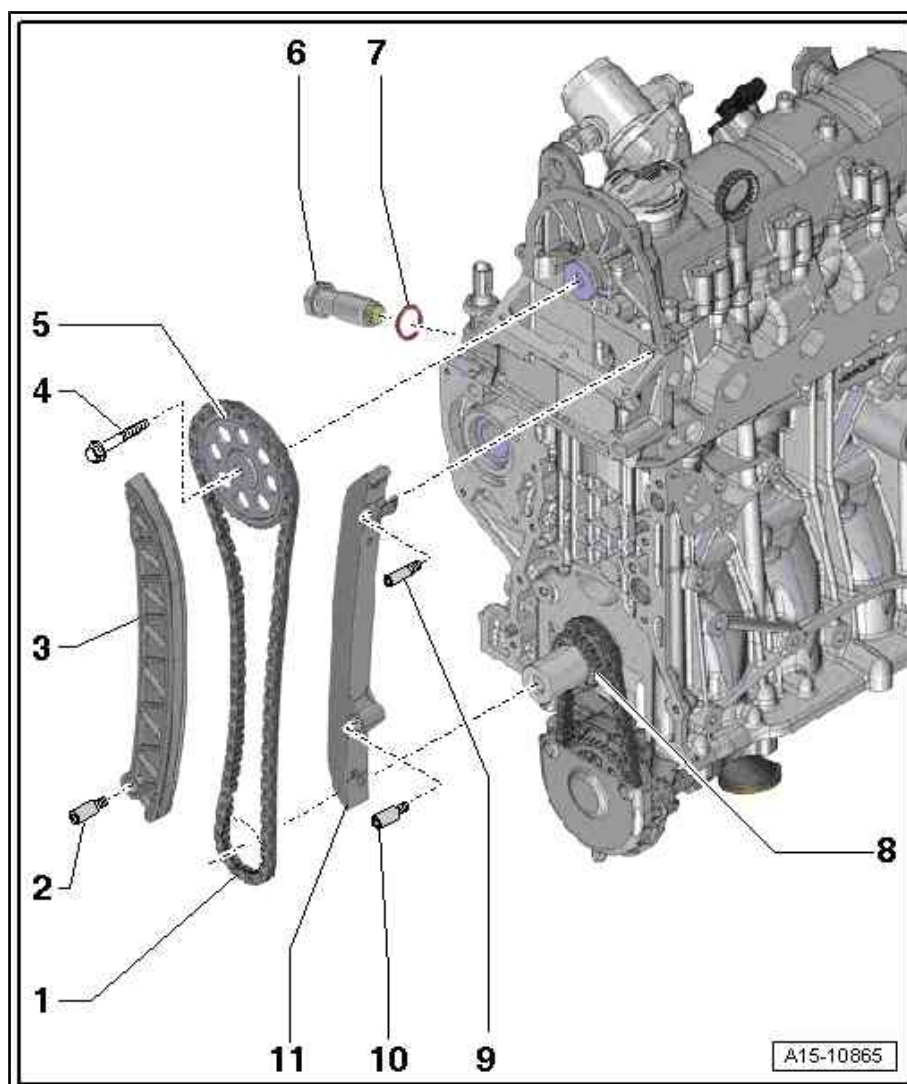
- ☐ Removing and installing
⇒ [“2.4 Removing and installing camshaft timing chain”, page 78](#)

6 - Chain tensioner

- ☐ For camshaft timing chain
- ☐ Exerts spring pressure
- ☐ 60 Nm

7 - Seal

- ☐ Renew





8 - Chain sprocket

- ☐ For camshaft timing chain
- ☐ On crankshaft

9 - Guide pin

- ☐ 18 Nm

10 - Guide pin

- ☐ 18 Nm

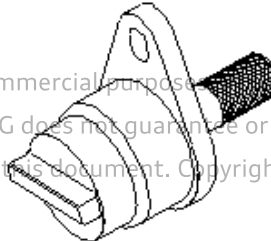
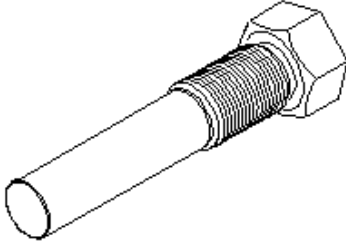
11 - Guide rail

- ☐ Removing and installing ⇒ ["2.4 Removing and installing camshaft timing chain", page 78](#)

2.2 Checking valve timing

Special tools and workshop equipment required

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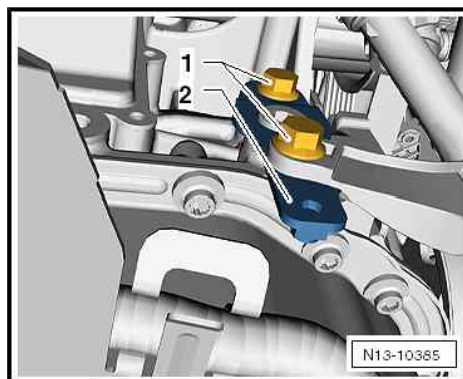
T10414 	V.A.G 1331 
T10340 	
	W15-10099

- ◆ Camshaft clamp - T10414-
- ◆ Torque wrench (5 ... 50 Nm) - V.A.G 1331-
- ◆ Locking pin - T10340-



Test sequence

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Exploded view - noise insulation .
- Remove securing bolts -1- and detach bracket for coolant pipe -2-.



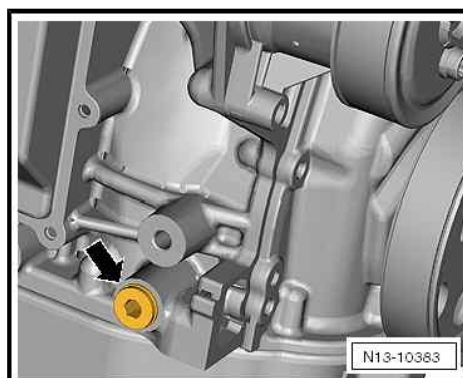
- Unscrew plug -arrow- on crankcase.
- Screw locking pin - T10340- into crankcase as far as stop.



Caution

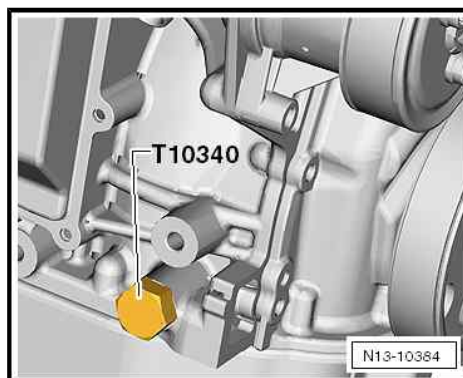
If the locking pin - T10340- cannot be screwed in as far as the stop, the crankshaft is not in the correct position.

In this case, proceed as follows.

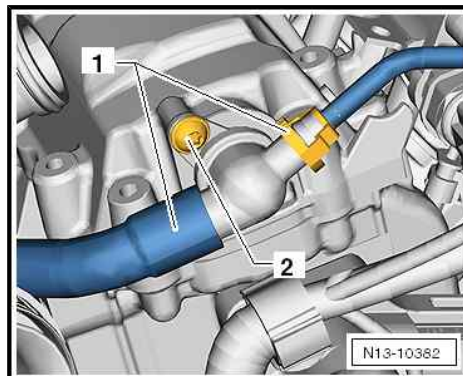


- Remove locking pin.
- Turn crankshaft 90° (1/4 revolution) in normal direction of rotation.
- Screw locking pin - T10340- into crankcase as far as stop.
- Tighten locking pin - T10340- to 30 Nm.
- Turn crankshaft in normal direction of rotation as far as stop.

The locking pin - T10340- locks the crankshaft in the normal direction of rotation.



- Disconnect both hoses -1- from non-return valve.
- Remove securing bolt -2- and pull non-return valve out of cylinder head cover.

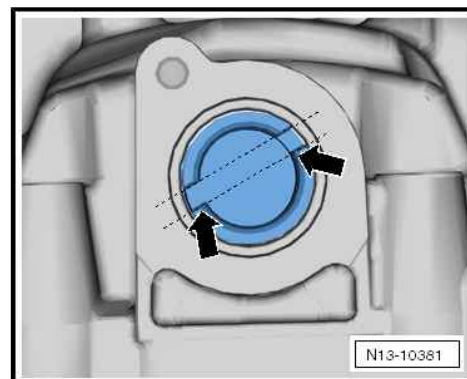


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Grooves in camshaft -arrows- should be positioned as shown.

- Insert camshaft clamp - T10414- into cylinder head cover as far as stop.



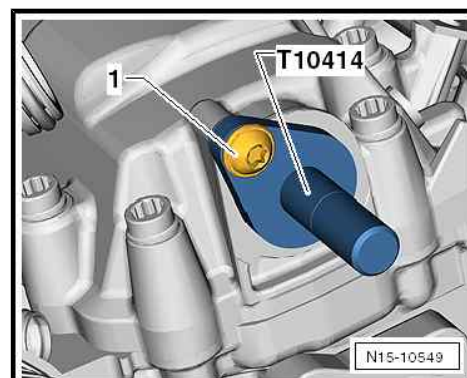
- Hand-tighten securing bolt -1-.

If the camshaft clamp - T10414- cannot be inserted into the camshaft opening as far as the stop, the valve timing is not correct and must be adjusted.

The valve timing is OK if the camshaft clamp - T10414- can be pushed into the cylinder head cover as far as the stop and the bolt -1- can be screwed in hand-tight.

- Remove camshaft clamp - T10414- and locking pin - T10340- .

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



Tightening torques:

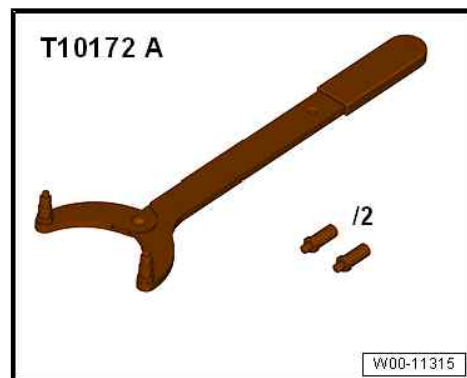
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 154](#)
- ◆ ⇒ [“2.1 Exploded view - timing chain”, page 68](#)
- ◆ ⇒ [“3.1 Exploded view - cylinder head”, page 90](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling - tightening torque””, page 37](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Exploded view - noise insulation

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2.3 Removing camshaft timing chain from camshafts

Special tools and workshop equipment required

- ◆ Counterhold tool - T10172 A-





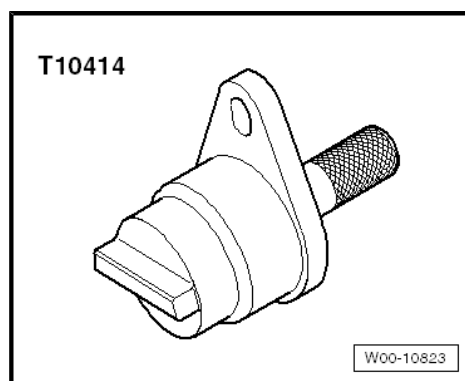
◆ Locking pin - T10340-



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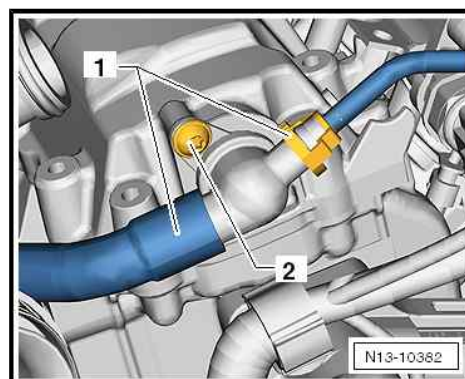


◆ Camshaft clamp - T10414-

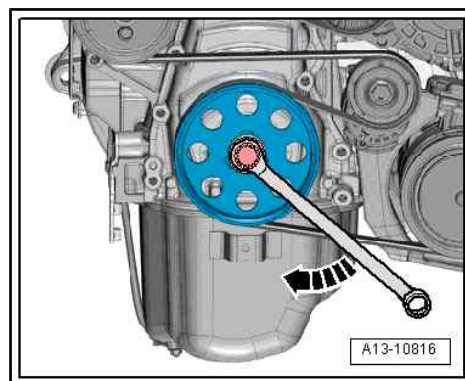


Removing

- Press release tabs on hose (right-side) and disconnect both hoses -1- from non-return valve.
- Remove bolt -2- and pull non-return valve out of camshaft housing.

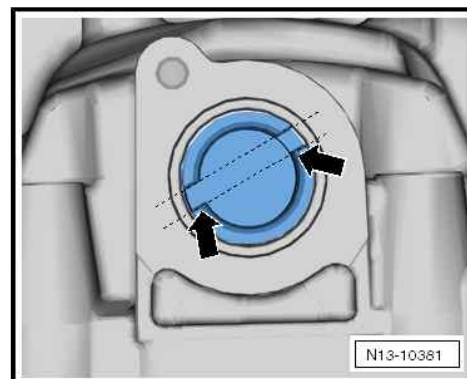


- Rotate crankshaft in normal direction of rotation -arrow- until camshaft is at "TDC".

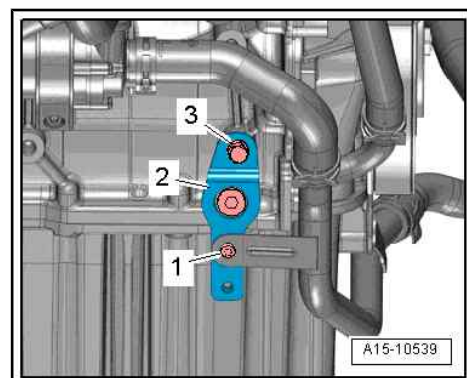




- Grooves -arrows- on camshaft should be positioned as shown in illustration.



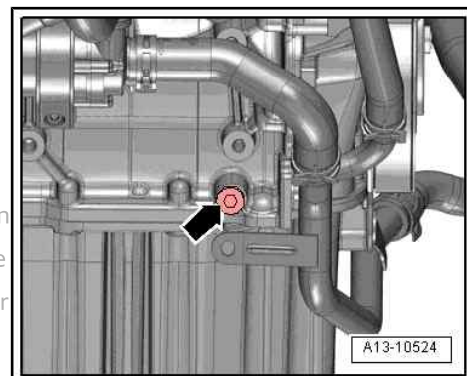
- Remove bolts -1- and -3- and take off bracket -2- for coolant pipe (right-side).



- Unscrew plug -arrow- for "TDC" hole on cylinder block.



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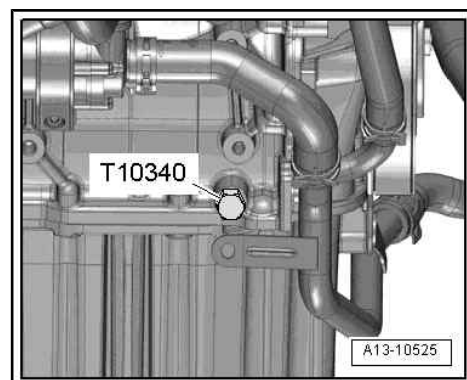
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.



Note

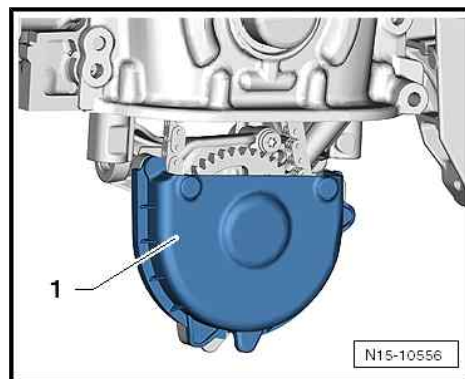
The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

- Remove timing chain cover (top) ⇒ [page 63](#) .

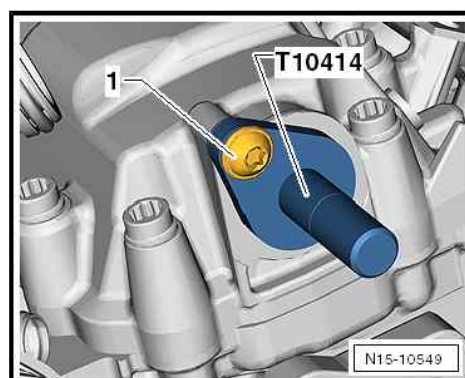




- Remove sump ➔ [page 121](#) .
- Unclip cover -1- for oil pump drive chain sprocket.

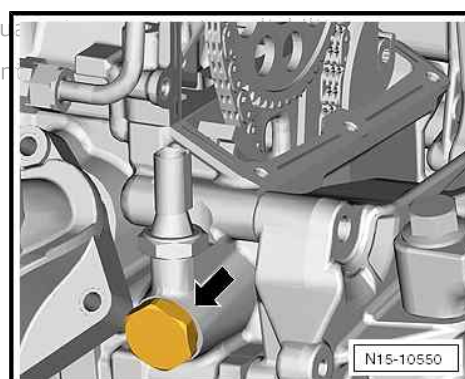


- Slide camshaft clamp - T10414- into camshaft housing as far as stop and screw bolt -1- in by hand until it makes contact.



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- Unscrew chain tensioner arrow for camshaft timing chain.



Caution

Risk of damage to camshaft.

- ◆ *The camshaft clamp - T10414- must not be used as a counterhold tool.*

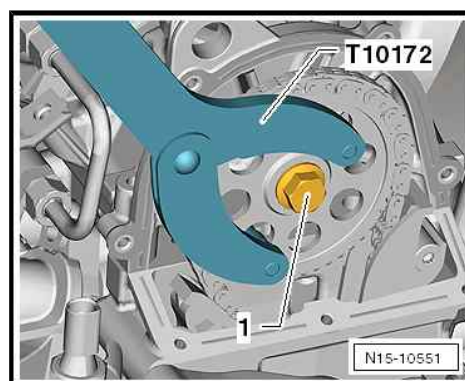
- Apply counterhold tool - T10172- to camshaft chain sprocket and remove bolt -1-.
- Detach camshaft chain sprocket.
- Place camshaft timing chain to one side and use a screwdriver or similar tool to prevent it dropping.

Installing



Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew the seal and O-rings.*
- Check "TDC" position of camshaft and crankshaft:





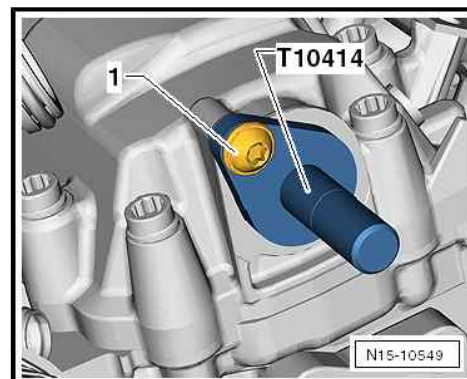
- Camshaft clamp - T10414- must be fitted to camshaft housing.



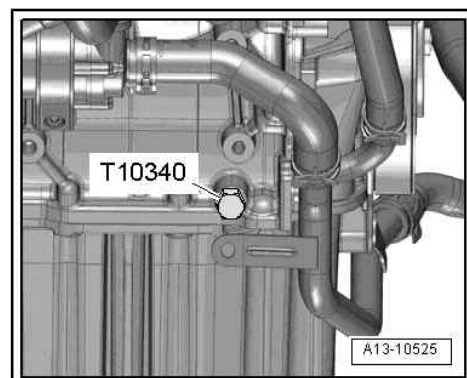
Caution

Risk of damage to camshaft.

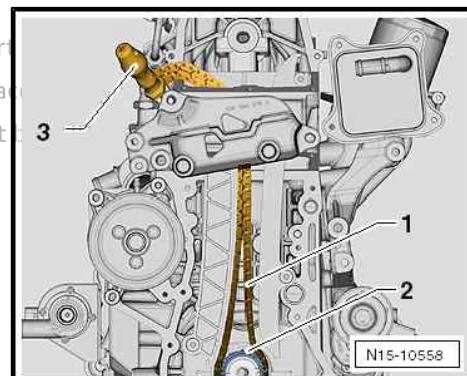
- ◆ *The camshaft clamp - T10414- must not be used as a counterhold tool.*



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



- Fit camshaft timing chain -1- onto crankshaft chain sprocket -2- from below and pull chain upwards between guide rail and tensioning rail so it is taut.
- Use a screwdriver -3- or similar tool to prevent the camshaft timing chain from dropping out.

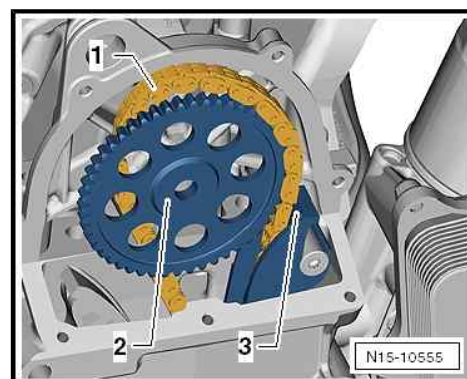


- Fit camshaft timing chain -1- onto camshaft chain sprocket -2-.
- Position camshaft chain sprocket on camshaft and fit bolt for camshaft chain sprocket without tightening.
- It should just be possible to turn the camshaft chain sprocket on the camshaft without axial movement.



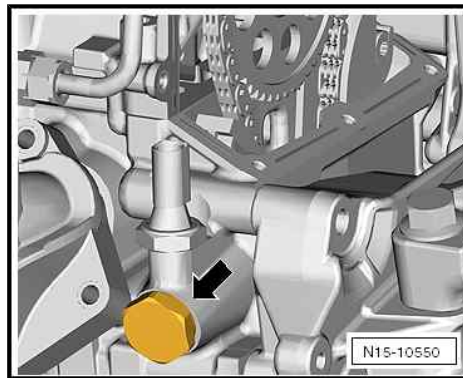
Note

Disregard -item 3-.





- Screw in and tighten chain tensioner -arrow- for timing chain.

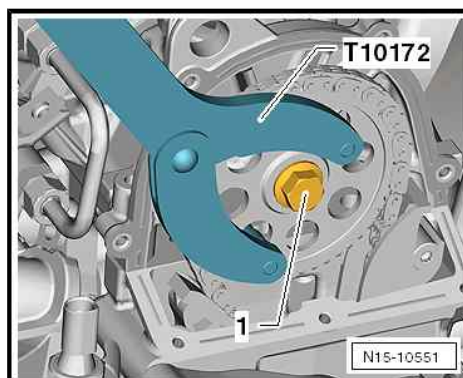


Caution

Risk of damage to camshaft.

- ◆ *The camshaft clamp - T10414- must not be used as a counterhold tool.*

- Tighten bolt -1- initially to 50 Nm (counterhold at camshaft chain sprocket using counterhold tool - T10172-).



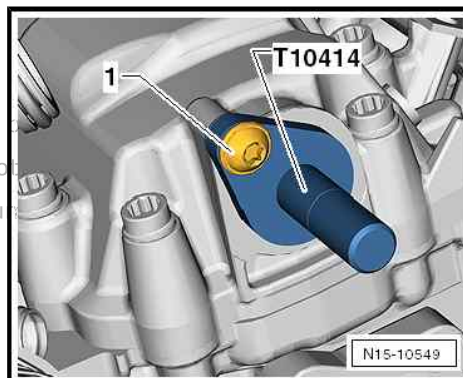
Note

The bolt for the camshaft chain sprocket is not tightened to its final torque until the valve timing has been checked.

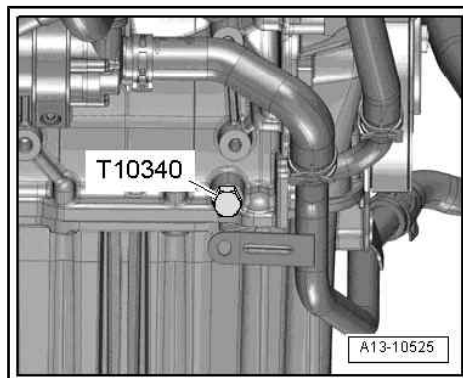
Checking adjustment

- Unscrew bolt -1- and remove camshaft clamp - T10414- .

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- Remove locking pin - T10340- .

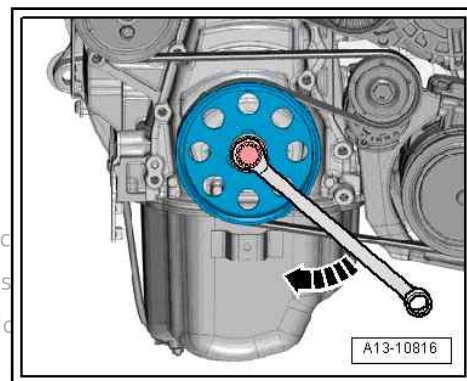




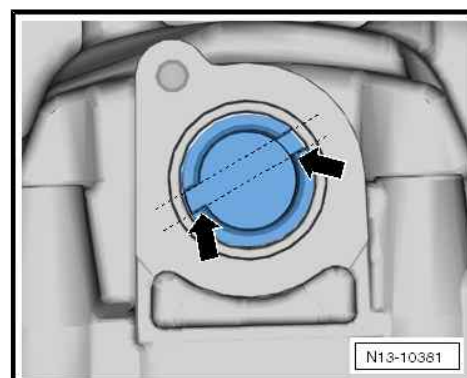
- Turn crankshaft 2 revolutions in normal direction of rotation -arrow- until camshaft is at “TDC” again.



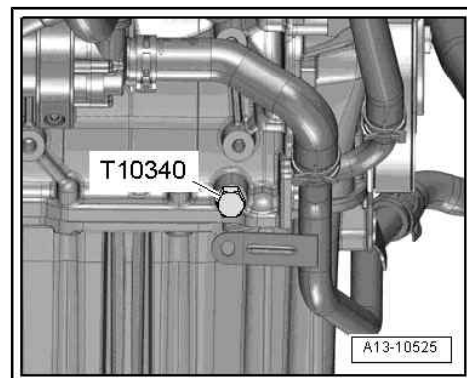
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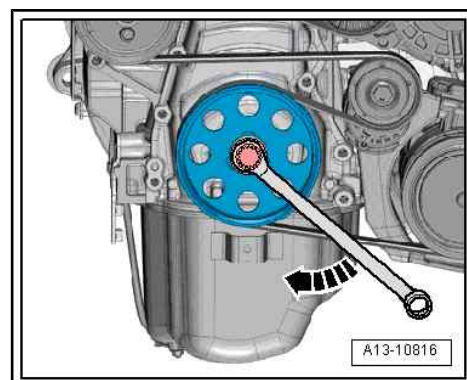
- Grooves -arrows- on camshaft should be positioned as shown in illustration.



- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.



- Turn crankshaft in normal direction of rotation -arrow- until it makes contact with locking pin.





- It should be possible to insert camshaft clamp - T10414- into camshaft housing as far as stop and lock it in place with bolt -1-.
- If camshaft clamp - T10414- cannot be inserted into camshaft housing as far as stop, repeat adjustment procedure ➔ [page 81](#) .
- If it is possible to insert camshaft clamp - T10414- completely, take off camshaft clamp again.
- Remove locking pin - T10340- .

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

- Install sump ➔ [page 121](#) .
- Install timing chain cover (top) ➔ [page 63](#) .
- Install bracket for coolant pipe (right-side) ➔ [page 154](#) .
- Vehicles from 06.2011 onwards: after installing camshaft timing chain, perform 01 - Chain elongation adaption diagnosis function in Guided Functions mode of ➔ Vehicle diagnostic tester.

Tightening torques

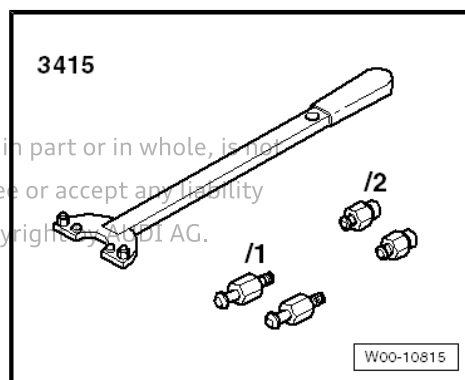
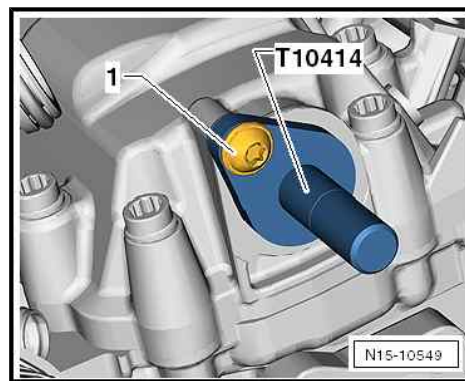
- ◆ ➔ [“2.1 Exploded view - timing chain”, page 68](#)
- ◆ ➔ [“3.1 Exploded view - cylinder head”, page 90](#)
- ◆ ➔ [Fig. ““Plug for TDC drilling - tightening torque””, page 37](#)

2.4 Removing and installing camshaft timing chain

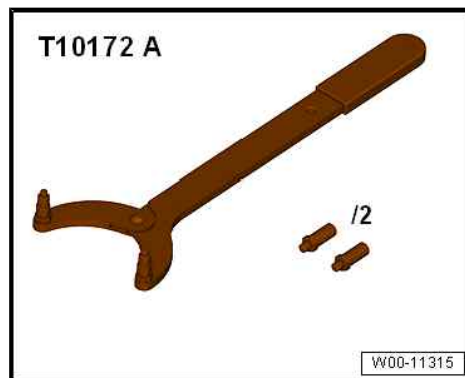
Special tools and workshop equipment required

- ◆ Counterhold tool - 3415- with pins -3415/2-

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- ◆ Counterhold tool - T10172 A-

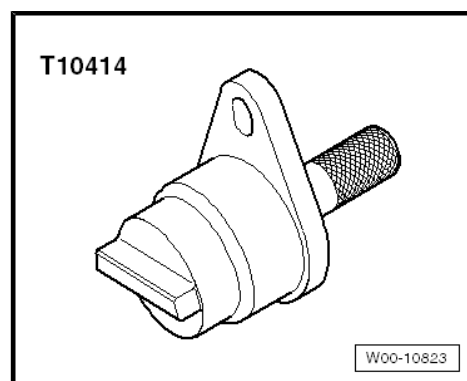




◆ Locking pin - T10340-



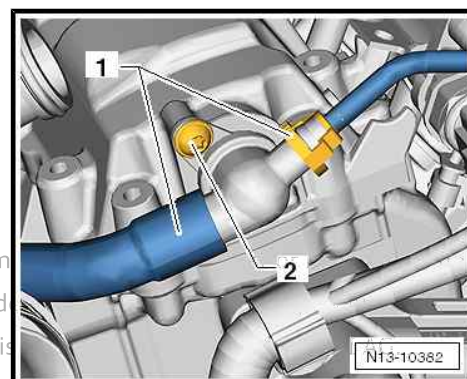
◆ Camshaft clamp - T10414-



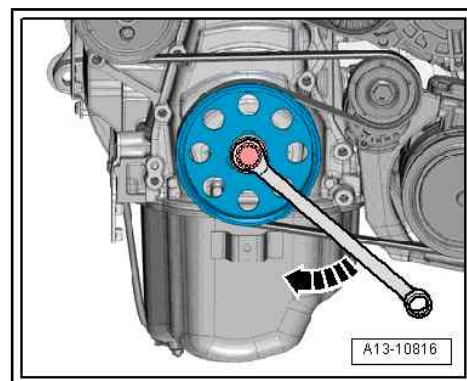
Removing

- Press release tabs on hose (right-side) and disconnect both hoses -1- from non-return valve.
- Remove bolt -2- and pull non-return valve out of camshaft housing.

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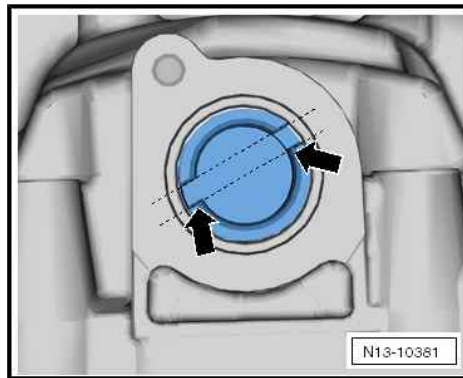


- Rotate crankshaft in normal direction of rotation -arrow- until camshaft is at "TDC".

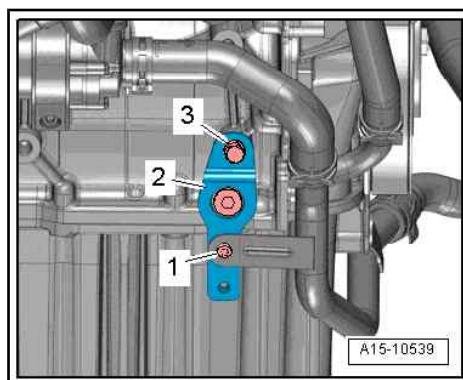




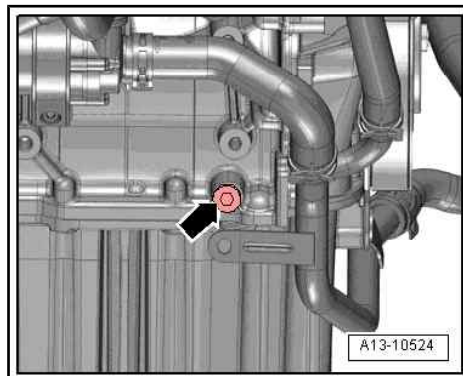
- Grooves -arrows- on camshaft should be positioned as shown in illustration.



- Remove bolts -1- and -3- and take off bracket -2- for coolant pipe (right-side).



- Unscrew plug -arrow- for “TDC” hole on cylinder block.



- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.



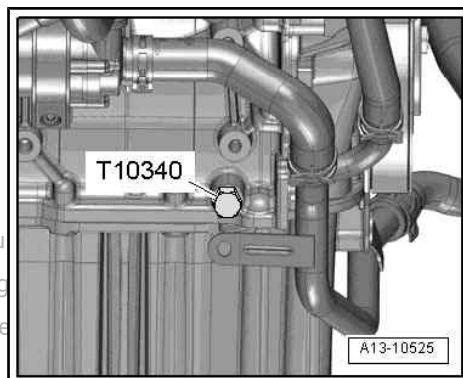
Note



The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

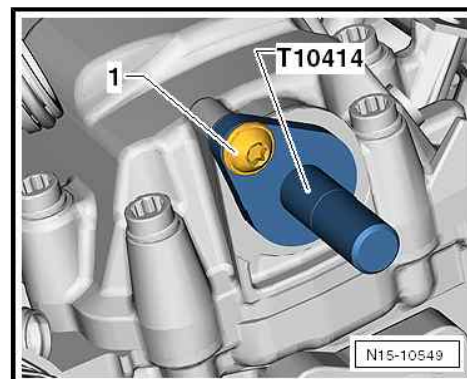
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- Remove timing chain cover (top) => [page 63](#)
- Remove timing chain cover (bottom) => [page 65](#)





- Slide camshaft clamp - T10414- into camshaft housing as far as stop and screw bolt -1- in by hand until it makes contact.



- Unscrew chain tensioner -arrow- for camshaft timing chain.



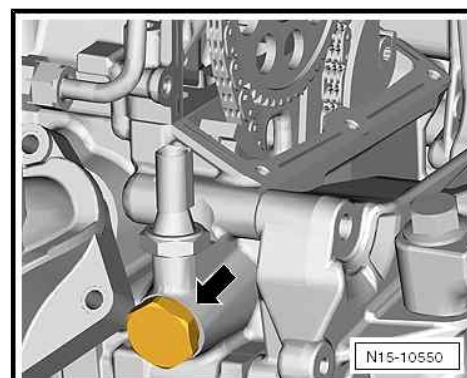
Caution

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

- ◆ *Mark running direction of timing chain with coloured arrows for re-installation.*

Risk of damage to camshaft.

- ◆ *The camshaft clamp - T10414- must not be used as a counterhold tool.*



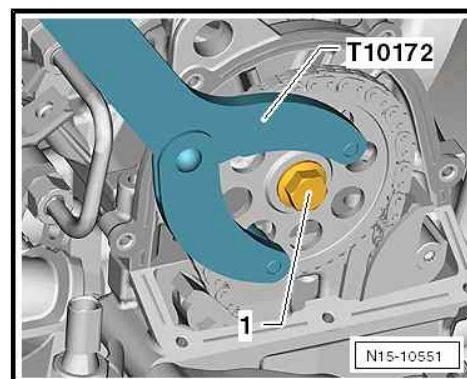
- Apply counterhold tool - T10172- to camshaft chain sprocket and remove bolt -1-.
- Detach camshaft chain sprocket together with camshaft timing chain.
- Pull out camshaft timing chain from below.

Installing



Note

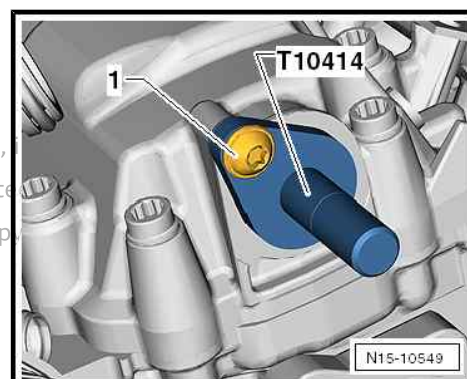
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew the seal and O-rings.*
- Check “TDC” position of camshaft and crankshaft:
- Camshaft clamp - T10414- must be fitted to camshaft housing.



Caution

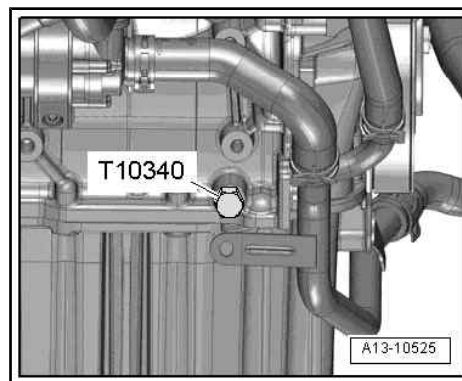
Risk of damage to camshaft.

- ◆ *The camshaft clamp - T10414- must not be used as a counterhold tool.*

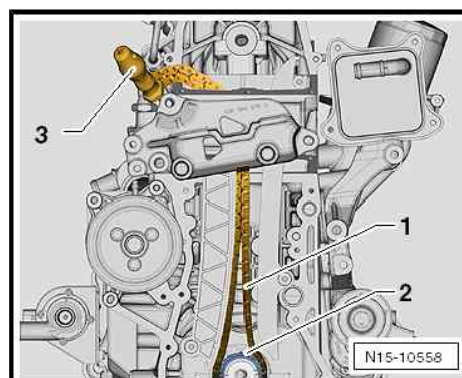




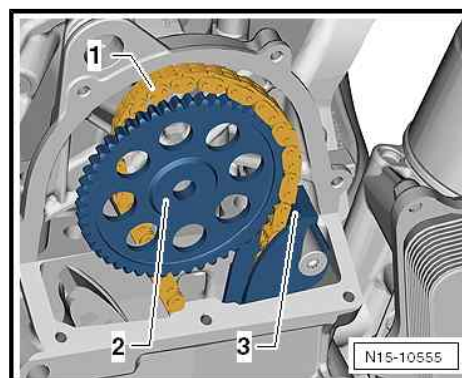
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.



- Fit camshaft timing chain according to marks applied when removing.
- Fit camshaft timing chain -1- onto crankshaft chain sprocket -2- from below and guide chain upwards between guide rail and tensioning rail.
- Use a screwdriver -3- or similar tool to prevent the camshaft timing chain from dropping out.



- Fit camshaft timing chain -1- onto camshaft chain sprocket -2-.
- Position camshaft chain sprocket on camshaft and fit bolt for camshaft chain sprocket without tightening.
- It should just be possible to turn the camshaft chain sprocket on the camshaft without axial movement.



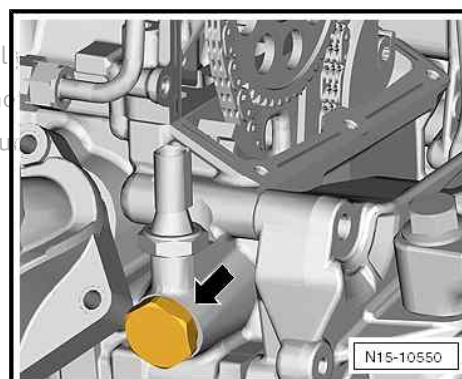
Note

Disregard -item 3-.



- Screw in and tighten chain tensioner -arrow- for timing chain.

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Caution

Risk of damage to camshaft.

- ◆ *The camshaft clamp - T10414- must not be used as a counterhold tool.*

- Tighten bolt -1- initially to 50 Nm (counterhold at camshaft chain sprocket using counterhold tool - T10172-).



Note

The bolt for the camshaft chain sprocket is not tightened to its final torque until the valve timing has been checked.

Checking adjustment

- Fit poly V-belt pulley onto crankshaft.
- Screw in old bolt for poly V-belt pulley and tighten to 50 Nm (counterhold with counterhold tool - 3415- and pin -3415/2-).



Note

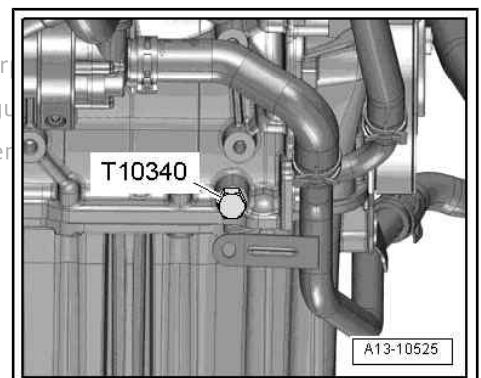
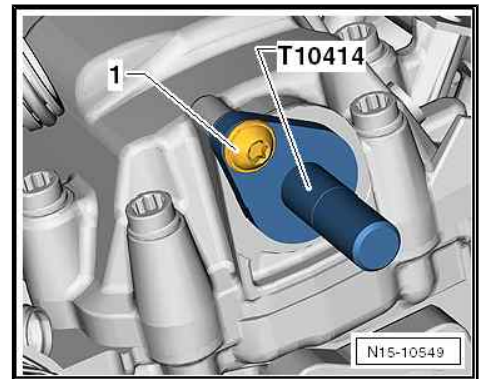
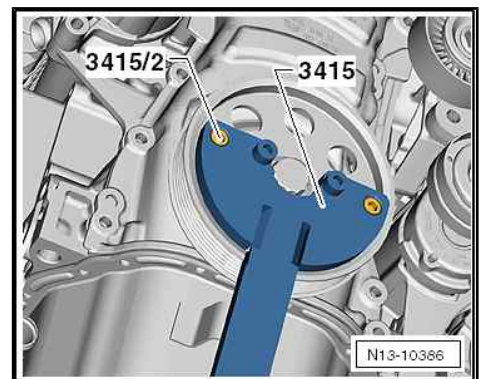
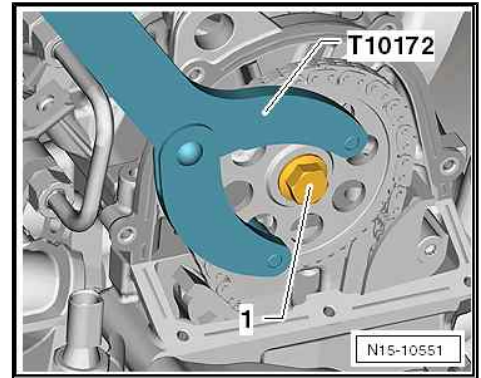
Illustration shows installation position with timing chain cover fitted.

- Unscrew bolt -1- and remove camshaft clamp - T10414- .



- Remove locking pin - T10340- .

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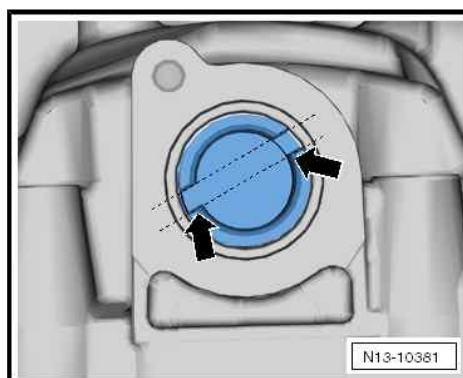
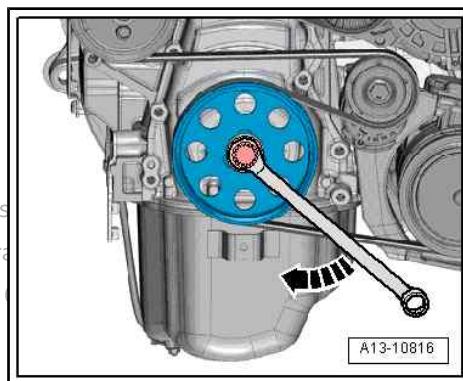


- Turn crankshaft 2 revolutions in normal direction of rotation -arrow- until camshaft is at “TDC” again.

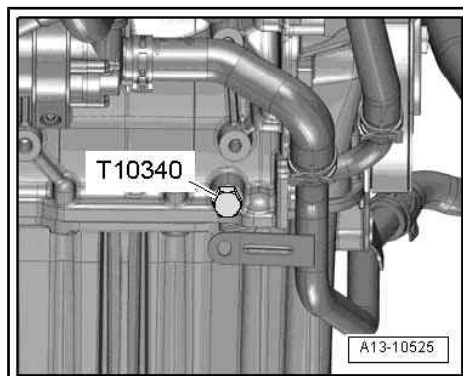


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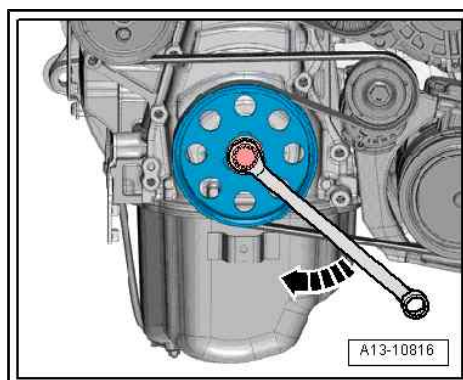
- Grooves -arrows- on camshaft should be positioned as shown in illustration.



- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.

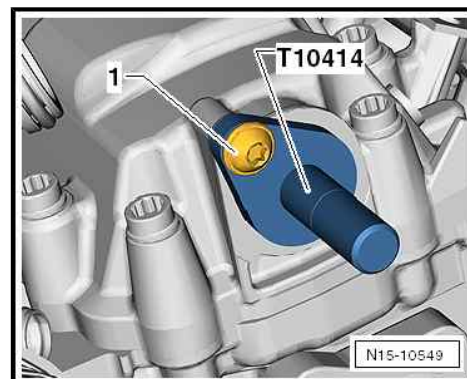


- Turn crankshaft in normal direction of rotation -arrow- until it makes contact with locking pin.





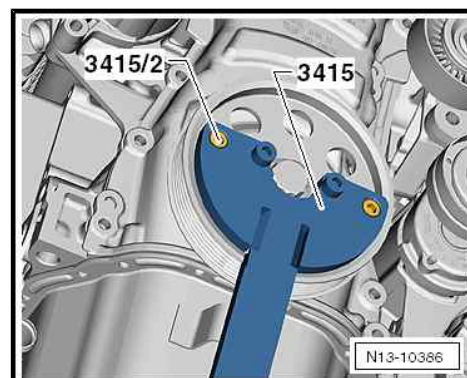
- It should be possible to insert camshaft clamp - T10414- into camshaft housing as far as stop and lock it in place with bolt -1-.
- If camshaft clamp - T10414- cannot be inserted into camshaft housing as far as stop, repeat adjustment procedure ⇒ [page 81](#) .
- If it is possible to insert camshaft clamp - T10414- completely, take off camshaft clamp again.
- Remove locking pin - T10340- .



- Remove old bolt for poly V-belt pulley (counterhold with counterhold tool - 3415- and pin -3415/2-).

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

- Install timing chain cover (bottom) ⇒ [page 65](#) .
- Install timing chain cover (top) ⇒ [page 63](#) .
- Install bracket for coolant pipe (right-side) ⇒ [page 154](#) .
- Vehicles from 06.2011 onwards: after installing camshaft timing chain, perform 01 - Chain elongation adaption diagnosis function in Guided Functions mode of ⇒ Vehicle diagnostic tester.



Tightening torques

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◆ ⇒ ["2.1 Exploded view - timing chain", page 68](#)

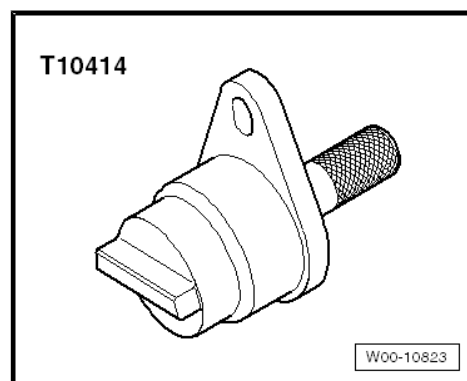
◆ ⇒ ["3.1 Exploded view - cylinder head", page 90](#)

◆ ⇒ [Fig. "Plug for TDC drilling - tightening torque", page 37](#)

2.5 Checking timing chain

Special tools and workshop equipment required

- ◆ Camshaft clamp - T10414-





◆ Torque wrench - VAS 6583-



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◆ Testing tools - T10550-



◆ Pointer - T10550/2-

◆ Scaling sleeve - T10550/3-

◆ Adapter - T10550/4-

- Engine oil temperature must be at least 40° ⇒ Vehicle diagnostic tester.
- Engine must not be at »TDC« position.
- Remove front wheel (right-side) ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres .
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Exploded view - noise insulation .
- Remove front wheel housing liner (right-side) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner .
- Remove poly V-belt ⇒ [page 37](#) .

Vehicles with auxiliary/supplementary heater:

- Remove auxiliary/supplementary heater with exhaust pipe and coolant hoses connected ⇒ Auxiliary/supplementary heater; Rep. gr. 82 ; Auxiliary/supplementary heater; Removing and installing auxiliary/supplementary heater .



All vehicles (continued):

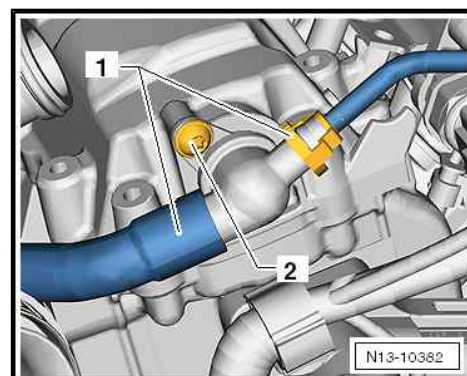
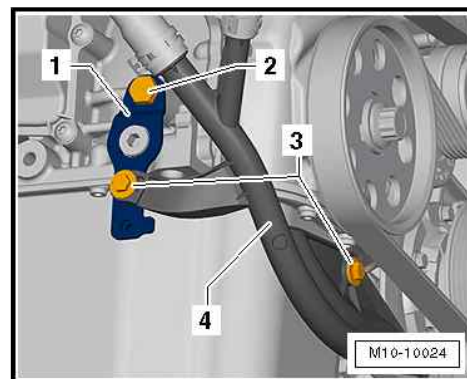
- Remove bolts -3- for coolant pipe.



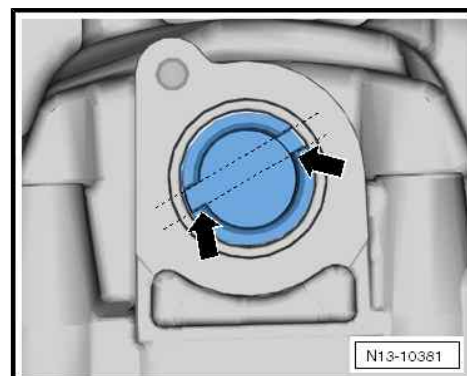
Note

Disregard items -1 and 2-.

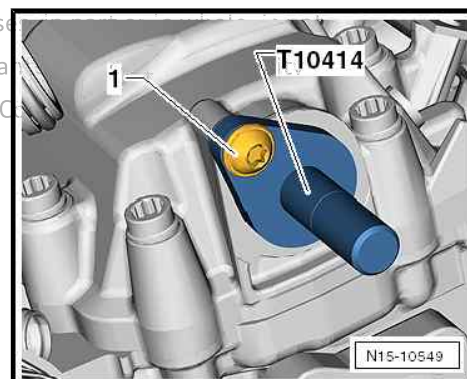
- Move coolant pipe -4- clear to one side (coolant hoses remain connected).
- Disconnect both hoses -1- from non-return valve.
- Remove securing bolt -2- and pull non-return valve out of cylinder head cover.



- Rotate crankshaft in normal direction of rotation until notches on camshaft -arrows- are at the position shown.

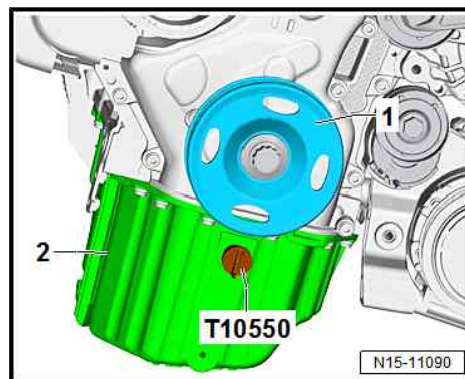


- Insert camshaft clamp -T10414- into cylinder head cover as far as possible.
- Hand-tighten securing bolt -1-.





- Screw pointer - T10550/2- into hole underneath pulley -1- in sump -2-.
- Align pointer vertically, ensuring that the tip faces upwards.
- Tighten pointer with knurled nut.



- Fit adapter - T10550/4- in scaling sleeve - T10550/3- as shown. To do so, proceed as follows.



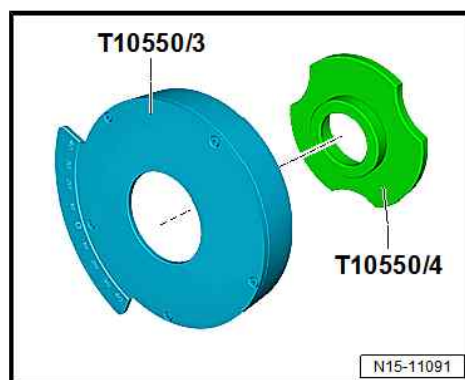
Caution

Risk of injury: fingers could become jammed between the parts.

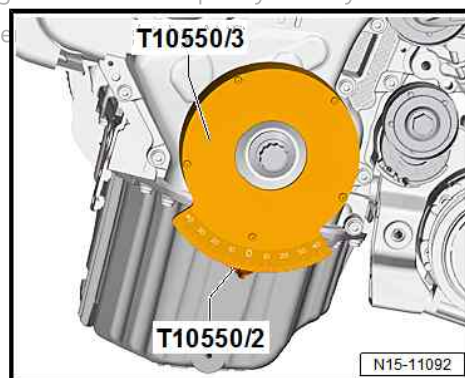
The scaling sleeve - T10550/3- is fitted with magnets.

Carefully bring the parts together.

When doing so, note that the parts pull towards each other very quickly.

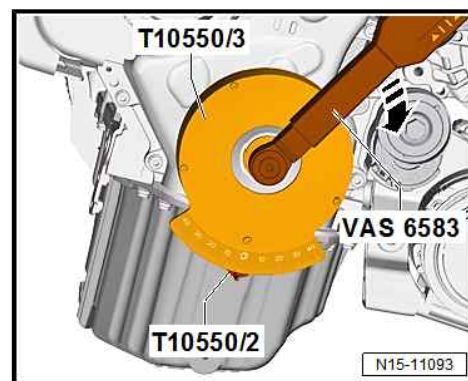


- Place adapter - T10550/4- on workbench with the three pins facing downwards.
- Hold scaling sleeve - T10550/3- with the opening centrally above adapter - T10550/4- .
- Use your thumbs to reach into the adapter opening and pull the adapter upwards while guiding the scaling sleeve downwards.
- Three lugs of adapter - T10550/4- must face engine later.
- Position scaling sleeve - T10550/3- on pulley -1- together with adapter - T10550/4- .
- Align scaling sleeve - T10550/3- with pointer - T10550/2- as shown.

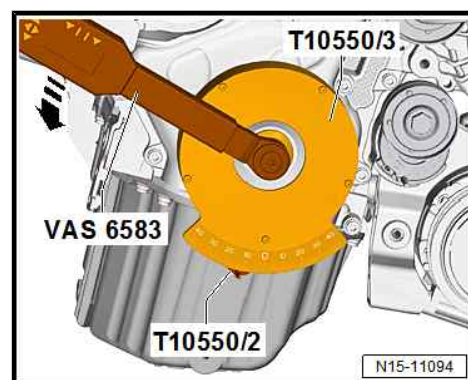




- Fit torque wrench - VAS 6583- onto crankshaft bolt using a suitable socket.
- Push torque wrench - VAS 6583- clockwise and hold at 40 Nm.
- Turn scaling sleeve - T10550/3- so that pointer - T10550/2- is at position »0«.



- Switch torque wrench - VAS 6583- direction setting and slowly push it anti-clockwise.
- Hold torque wrench - VAS 6583- at 40 Nm.
- Read off value indicated on scaling sleeve.
- If the timing chain skips during the test, it must be renewed
⇒ [page 78](#) .
- Timing chain skipping can be easily heard and felt.



Test evaluation

- If the chain is elongated by up to 25°, the timing chain is OK.
- If the timing chain is elongated by 26° or more, it is not OK and must be renewed ⇒ [page 78](#) .

Assembly is performed in reverse sequence; note the following:



Note

- ◆ The scaling sleeve - T10550/3- is fitted with magnets.
- ◆ Do not use any tools to prise the scaling sleeve - T10550/3- off the pulley.
- Turn scaling sleeve - T10550/3- approx. 45° to the right so that the scaling area is no longer above the pointer - T10550/2- .
- Reach behind scaling sleeve - T10550/3- with both hands.
- Press against pulley bolt with your thumbs and pull off scaling sleeve - T10550/3- .
- Hold edges of scaling sleeve - T10550/3- with both hands.
- Hold scaling sleeve - T10550/3- a small distance above a workbench.
- Press off adapter - T10550/4- with your thumbs.
- Fill up with coolant.

Tightening torque

- ◆ ⇒ ["3.1 Exploded view - cylinder head", page 90](#)
- ◆ ⇒ ["1.2 Removing and installing poly V-belt", page 37](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50; Noise insulation; Exploded view - noise insulation
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66; Wheel housing liners; Removing and installing wheel housing liner
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 44; Wheels, tyres



3 Cylinder head

⇒ [“3.1 Exploded view - cylinder head”, page 90](#)

⇒ [“3.2 Exploded view - camshaft housing”, page 92](#)

⇒ [“3.3 Removing and installing cylinder head”, page 94](#)

⇒ [“3.4 Removing and installing camshaft housing”, page 100](#)

⇒ [“3.5 Checking compression”, page 105](#)

3.1 Exploded view - cylinder head

1 - Cylinder head gasket

- ☐ Renewing
⇒ [“3.3 Removing and installing cylinder head”, page 94](#)

- ☐ Installation position:
Part number points towards cylinder head, and must be legible from the inlet side

- ☐ If renewed, change coolant and engine oil

2 - Cylinder head

- ☐ Removing and installing
⇒ [page 94](#)
- ☐ Checking for distortion
⇒ [page 91](#)
- ☐ Sealing surface for camshaft housing must be free of oil and grease
- ☐ If renewed, change coolant and engine oil

3 - Seal

- ☐ Renew

4 - Oil pressure switch - F1-

- ☐ Removing and installing
⇒ [page 133](#)

5 - Bolt

- ☐ Renew
- ☐ Correct sequence when slackening ⇒ [page 97](#)
- ☐ Tightening torque and sequence ⇒ [page 92](#)

6 - Camshaft housing

- ☐ Removing and installing ⇒ [page 100](#)

7 - O-ring

- ☐ Renew

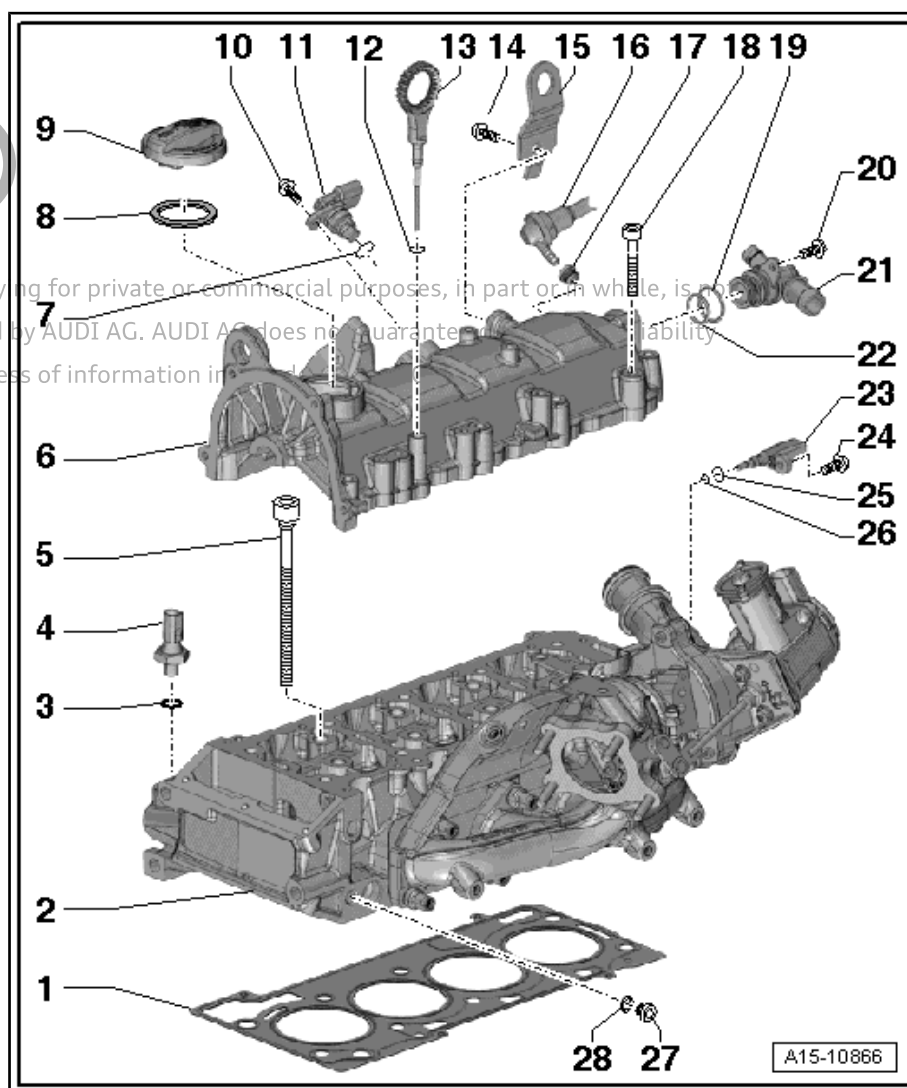
8 - Seal

- ☐ Renew if damaged or leaking

9 - Filler cap

10 - Bolt

- ☐ Tightening torque ⇒ [Item 6 \(page 226\)](#)





11 - Hall sender - G40-

- ☐ Removing and installing ⇒ [page 228](#)

12 - O-ring

- ☐ Renew

13 - Oil dipstick

14 - Bolt

- ☐ 20 Nm

15 - Engine lifting eye

16 - Non-return valve

- ☐ For crankcase breather

17 - Grommet

18 - Bolt

- ☐ Correct sequence when slackening ⇒ [page 102](#)
- ☐ Tightening torque and sequence ⇒ [page 93](#)

19 - O-ring

- ☐ Renew
- ☐ Part of non-return valve; not available separately ⇒ [Item 21 \(page 91\)](#)

20 - Bolt

- ☐ 7 Nm

21 - Non-return valve

22 - O-ring

- ☐ Renew
- ☐ Part of non-return valve; not available separately ⇒ [Item 21 \(page 91\)](#)

23 - Coolant temperature sender - G62-

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

24 - Bolt

- ☐ Tightening torque ⇒ [Item 7 \(page 154\)](#)

25 - O-ring

- ☐ Renew

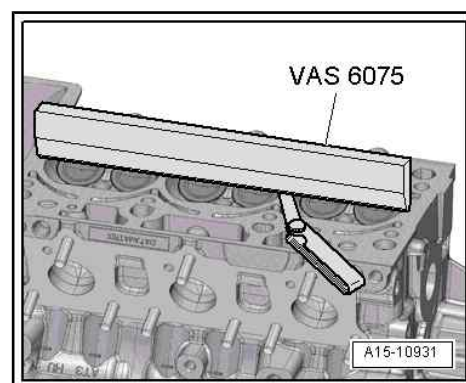
26 - Teflon ring

27 - Not fitted

28 - Not fitted

Checking cylinder head for distortion

- Use straight edge 500 mm - VAS 6075- and feeler gauge to measure cylinder head for distortion at several points.
- Max. permissible distortion: 0.05 mm.

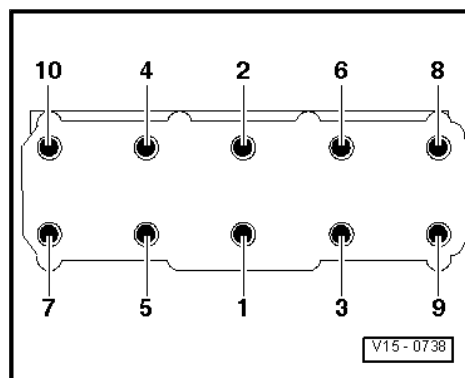


**Cylinder head - tightening torque and sequence****Note**

Renew bolts tightened with specified tightening angle.

– Tighten bolts in 4 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 10-	Screw in by hand until contact is made
2.	-1 ... 10-	40 Nm
3.	-1 ... 10-	Turn 90° further
4.	-1 ... 10-	Turn 90° further

**3.2 Exploded view - camshaft housing****1 - Cylinder head**

- ❑ Removing and installing
⇒ [page 94](#)

2 - Dowel pin

- ❑ 2x

3 - Bolt

- ❑ Correct sequence when slackening ⇒ [page 109](#)
- ❑ Tightening torque and sequence ⇒ [page 94](#)

4 - Retaining frame

- ❑ For camshaft
- ❑ Removing and installing
⇒ ["4.2 Removing and installing camshaft", page 108](#)

5 - Camshaft

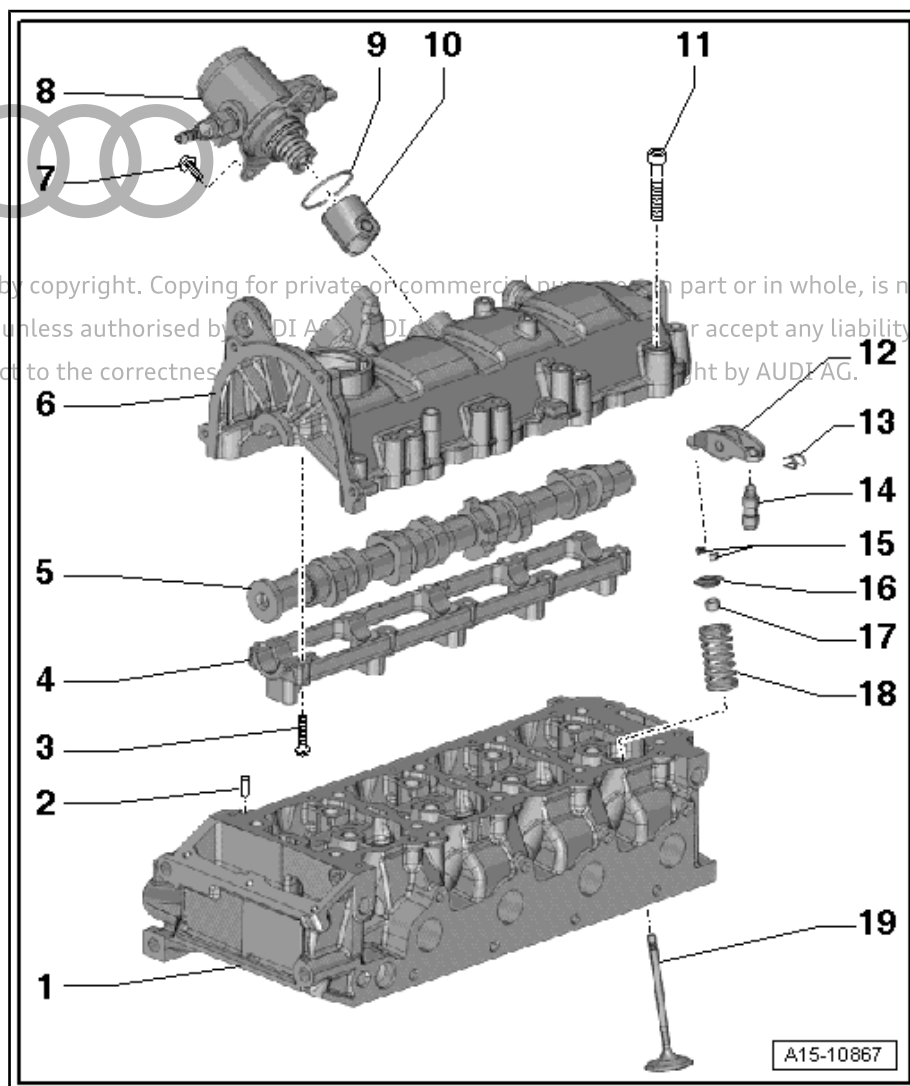
- ❑ With cam for high-pressure pump
- ❑ Before removing, detach roller tappet for high-pressure pump
- ❑ Checking axial clearance ⇒ [page 108](#)
- ❑ Removing and installing
⇒ [page 108](#)
- ❑ Lubricate with oil before installing (also lubricate collar of axial bearing)

6 - Camshaft housing

- ❑ With integrated camshaft bearings
- ❑ Removing and installing
⇒ [page 100](#)
- ❑ Apply sealant when installing (2 different sealants); refer to ⇒ Electronic parts catalogue

7 - Bolt

- ❑ Tightening torque ⇒ [Item 1 \(page 206\)](#)





8 - High-pressure pump

- ☐ Removing and installing ⇒ [page 207](#)

9 - O-ring

- ☐ Renew

10 - Roller tappet

- ☐ For high-pressure pump

11 - Bolt

- ☐ Renew
- ☐ Correct sequence when slackening ⇒ [page 102](#)
- ☐ Tightening torque and sequence ⇒ [page 93](#)

12 - Roller rocker finger

- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surfaces before installing
- ☐ Attach to hydraulic compensation element -item 15- using securing clip -item 13-

13 - Securing clip

- ☐ Not available as separate part

14 - Valve cotters

15 - Hydraulic compensation element

- ☐ Mark installation position for re-installation
- ☐ Lubricate running surfaces with oil

16 - Valve spring plate

17 - Valve stem oil seal

- ☐ Renewing with cylinder head installed ⇒ [page 110](#)
- ☐ Renewing with cylinder head removed ⇒ [page 113](#)

18 - Valve spring

19 - Valve

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Valve dimensions ⇒ [page 118](#)
- ☐ Checking valve guides ⇒ [page 117](#)

Camshaft housing - tightening torque and sequence

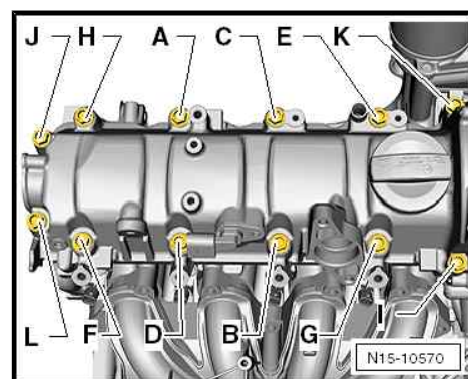


Note

Renew the bolts tightened with specified tightening angle.

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-A ... L-	8 Nm
2.	-A ... L-	Turn 90° further

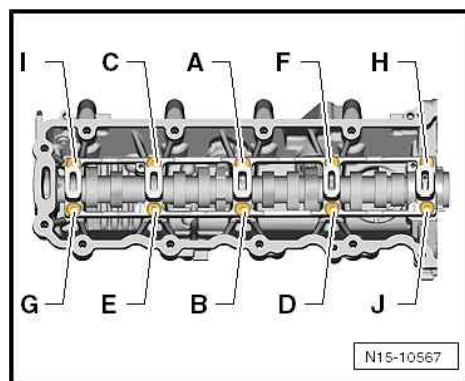




Retaining frame for camshaft - tightening torque and sequence

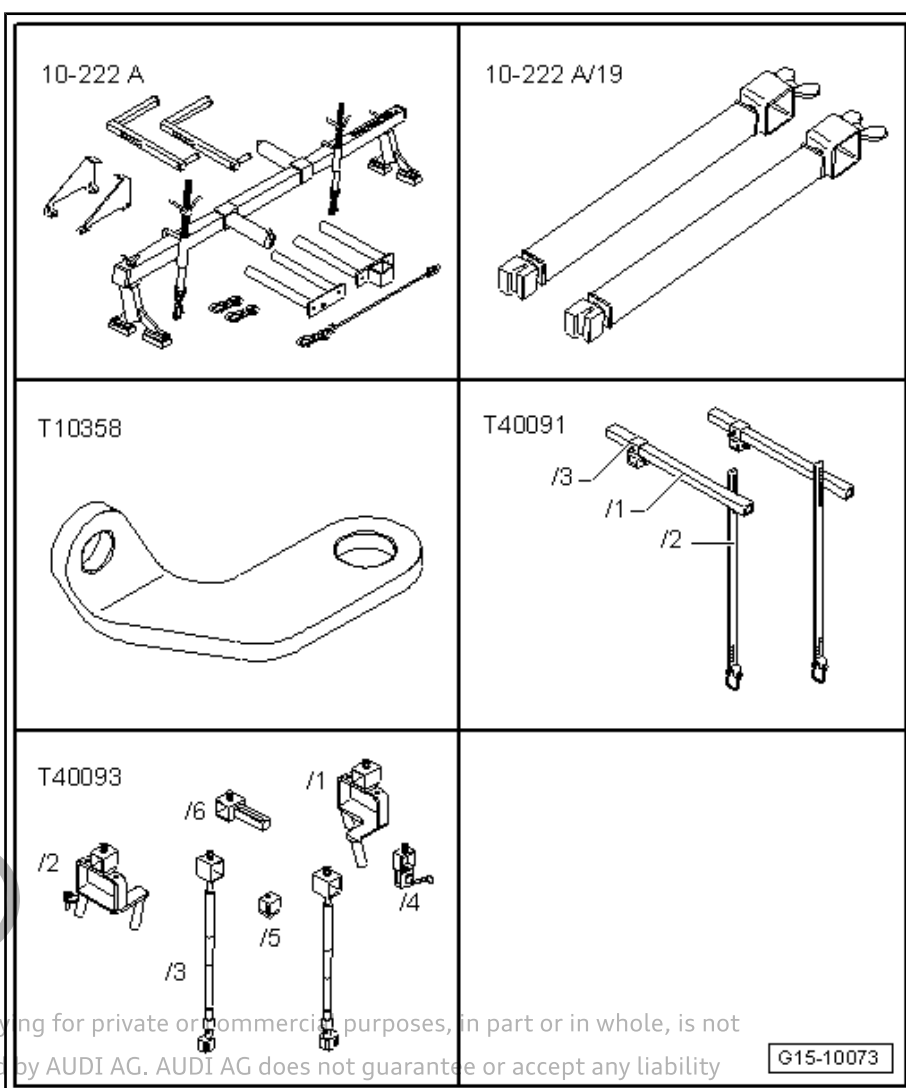
– Tighten bolts in 2 stages in the sequence shown:

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



3.3 Removing and installing cylinder head

Special tools and workshop equipment required



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- ◆ Support bracket - 10 - 222 A-
- ◆ Adapters - 10 - 222 A /19-
- ◆ Bracket - T10358-
- ◆ -T40091-/3- from engine support basic set - T40091-
- ◆ -T40093-/6- from engine support supplementary set - T40093-



- ◆ M8x30 bolt
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Drain coolant ⇒ [page 141](#) .
- Remove oil filter bracket ⇒ [page 135](#) .
- Remove intake manifold ⇒ [page 191](#) .
- Remove camshaft housing ⇒ [page 100](#) .
- Remove bolts -arrows-.
- Detach electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.

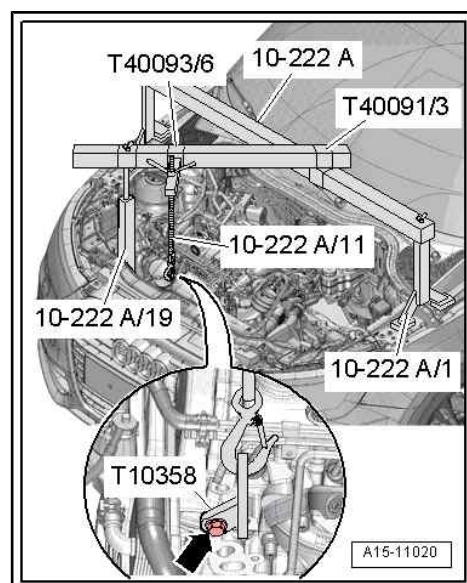
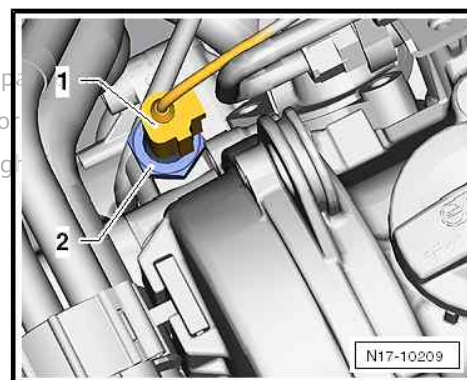
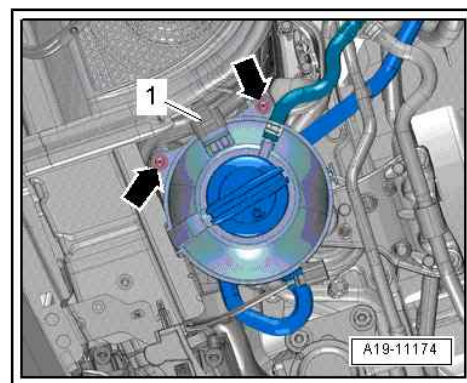


- Unplug electrical connector -1- on oil pressure switch - F1-item 2-.

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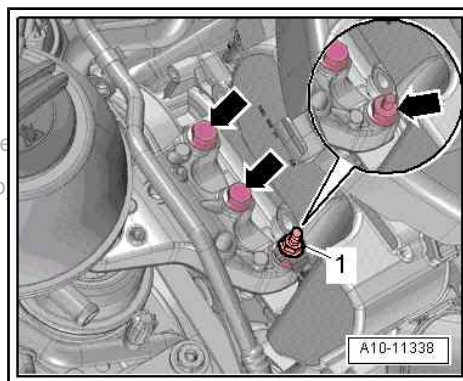
- Remove thermostat housing ⇒ [page 156](#) .

- Secure bracket - T10358- in hole for oil filter bracket with bolt M8x30 -arrow-.
- Washer must be placed under bolt head.
- Two washers must be inserted between bracket - T10358- and cylinder block.
- Set up support bracket - 10 - 222 A- on top edges of body flanges (left and right) and longitudinal member (right-side), as shown in illustration.
- Engage hook of spindle - 10 - 222 A /11- in retainer - T10358- .
- Apply light tension to spindle.





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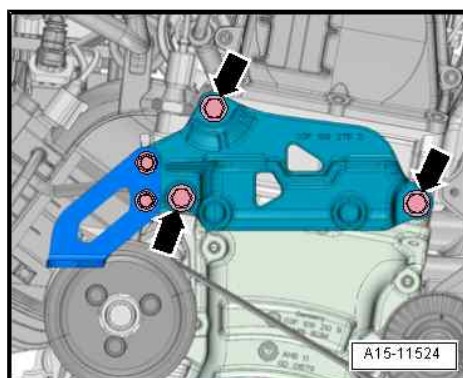
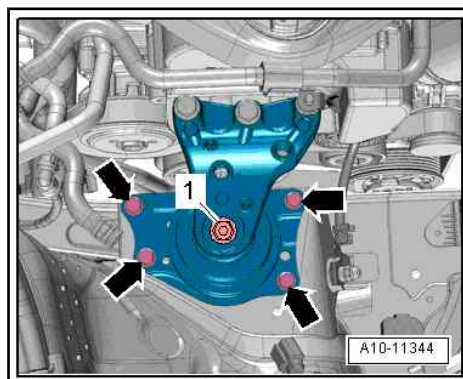


WARNING

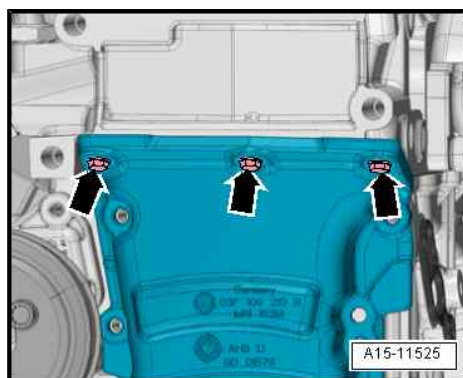
Risk of accident.

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

- Remove bolts -arrows- and detach engine mounting.
- Unscrew bolts -arrows- and remove engine support.



- Remove bolts -arrows-.





- Mark original positions of roller rocker fingers and compensation elements for re-installation.
- Remove roller rocker fingers together with compensation elements and put down on a clean surface.
- Slacken cylinder head bolts in the sequence -1...10-.
- Remove bolts and carefully take off cylinder head.
- Place cylinder head onto soft surface (foam plastic).

Installing



Caution

Risk of damage to sealing surfaces.

- ◆ *Carefully remove sealant residue from cylinder head and cylinder block.*
- ◆ *Ensure that no long scores or scratches are made on the surfaces.*

Risk of damage to cylinder block.

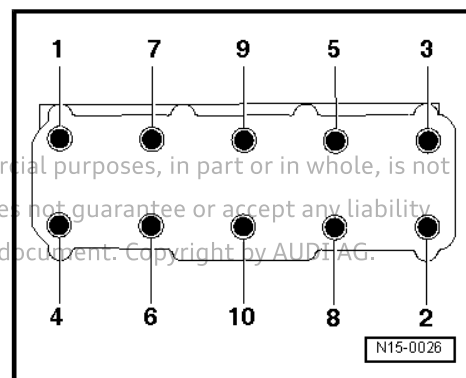
- ◆ *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*

Risk of leaks at cylinder head gasket.

- ◆ *Carefully remove any sealant residue from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- ◆ *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- ◆ *Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.*

Risk of damage to open valves.

- ◆ *When installing an exchange cylinder head, the plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*





Note

- ◆ *Do NOT use abrasive materials (sandpaper, sanding discs, sanding pads, abrasive web, wire wool, etc.).*
- ◆ *When removing sealant residue, make sure none of the residue enters the open channels of the engine.*
- ◆ *Ensure that nearby workspaces are kept clean and that the abrasive materials listed above are not being used there.*
- ◆ *Use of non-approved abrasive materials can lead to subsequent damage to the turbocharger, conrod bearings, etc.*
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew gasket and O-rings.*
- ◆ *When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the camshaft housing.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue.*
- ◆ *After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.*



Caution

Protect lubrication system and bearings against contamination.

- ◆ *Cover exposed parts of the engine.*

- Sealant residue may only be removed from cylinder head and cylinder block using a commercially available scraper (blade width at least 40 mm).
- Remove loose residue with a lint-free cloth.
- Clean sealing surfaces on cylinder head and cylinder block; they must be free of oil and grease.

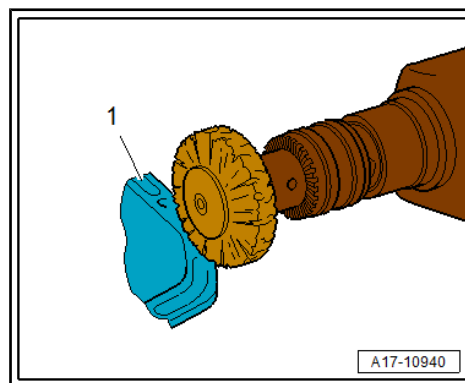


WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

- Remove remaining sealant on timing chain cover (bottom) using rotating plastic brush or similar.



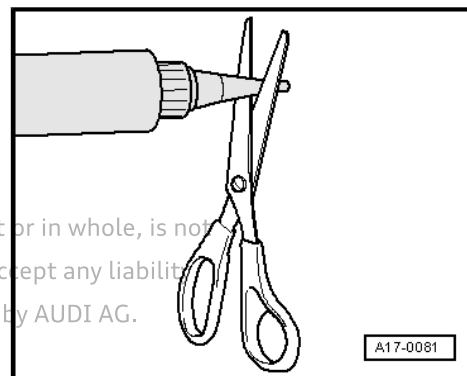


i Note

Note expiry date of silicone sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 2.5 mm).

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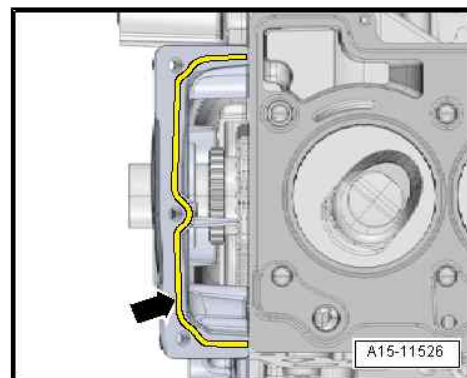


Caution

Make sure lubrication system is not clogged by excess sealant.

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

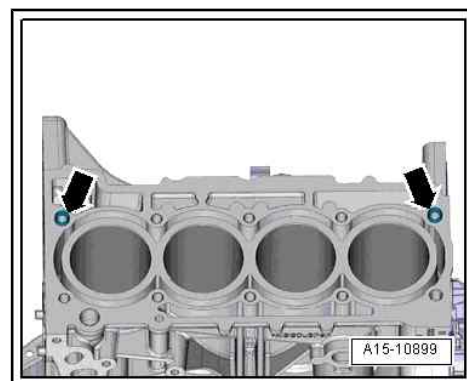
- Apply bead of sealant -arrow- onto clean outer sealing surface of camshaft housing, as shown in illustration.
- The bead of sealant must be 2.0 ... 3.0 mm thick.



i Note

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

- Check that crankshaft is still positioned at "TDC" and then turn back in the opposite direction of engine rotation by approx. 45°.
- If not already fitted, install dowel sleeves -arrows- in cylinder block.
- Fit cylinder head gasket onto dowel sleeves in cylinder block.
- Installation position: Part No. must be visible.
- Fit cylinder head.





- Screw in cylinder head bolts by hand until they make contact and then tighten ⇒ [page 92](#) .



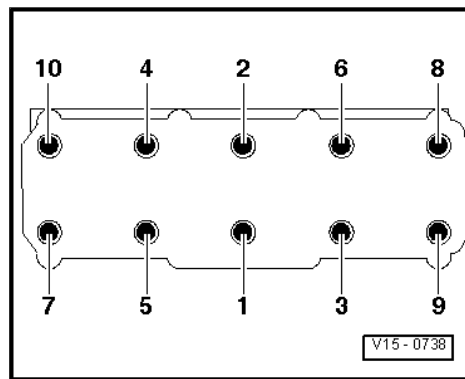
Note

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

- Fit each roller rocker finger onto end of corresponding valve stem and clip onto hydraulic compensation element.

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

- Install engine mountings ⇒ [page 30](#) .
- Install thermostat housing ⇒ [page 156](#) .
- Install camshaft housing ⇒ [page 100](#) .
- Install intake manifold ⇒ [page 191](#) .
- Install oil filter bracket ⇒ [page 135](#) .
- Change engine oil ⇒ Maintenance ; Booklet 819 .



Caution

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

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

- Fill cooling system with fresh coolant ⇒ [page 143](#) .

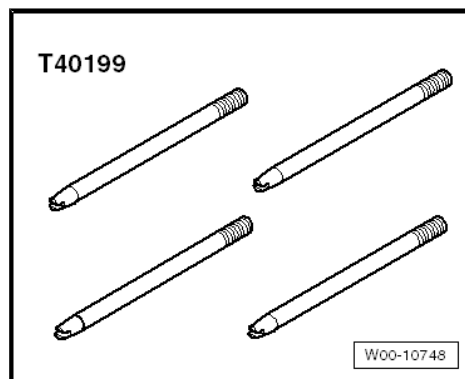
Tightening torques

- ◆ ⇒ [“3.1 Exploded view - cylinder head”, page 90](#)
- ◆ ⇒ [Fig. “Cylinder head - tightening torque and sequence”, page 92](#)

3.4 Removing and installing camshaft housing

Special tools and workshop equipment required

- ◆ Guide pins - T40199-

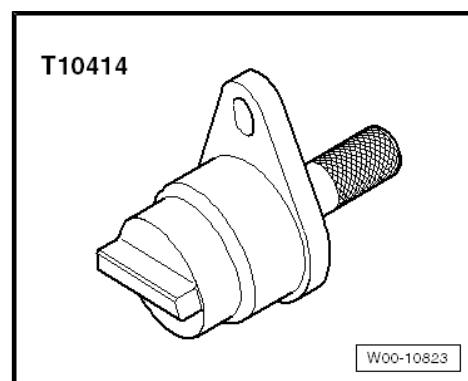




- ◆ Locking pin - T10340-



- ◆ Camshaft clamp - T10414-



- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant (2x) ⇒ Electronic parts catalogue

Removing

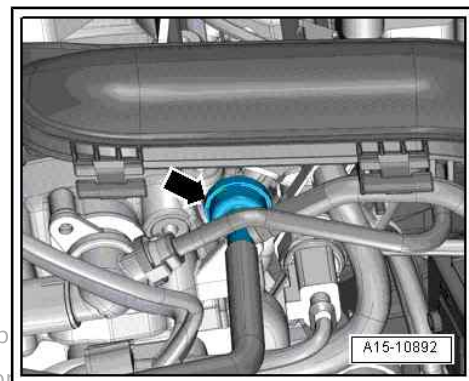
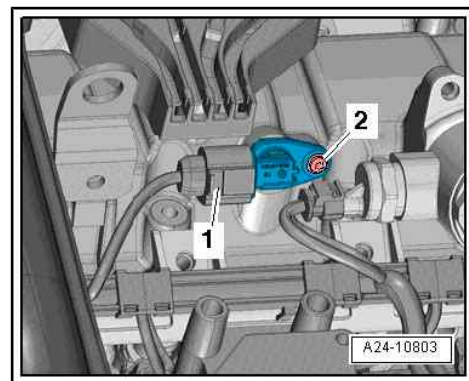
- Detach camshaft timing chain from camshaft sprocket ⇒ [page 71](#) .
- Remove turbocharger ⇒ [page 167](#) .
- Unplug electrical connector -1- at Hall sender - G40- .



Note

Disregard -item 2-.

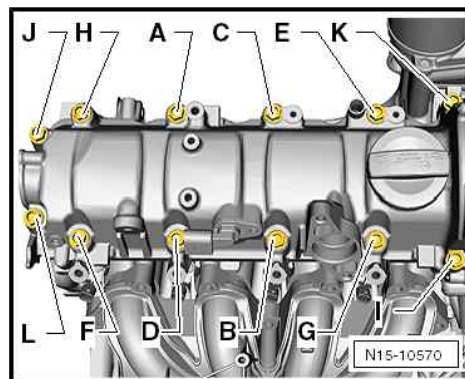
- Remove fuel rail
⇒ [“4.1 Removing and installing injectors”, page 196](#) .
- Detach non-return valve -arrow- for crankcase breather system.
- Pull oil dipstick out of guide tube.



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- Loosen and remove bolts for camshaft housing in the sequence -L ... A-.
- Carefully release camshaft housing from bonded joint and detach.



Installing

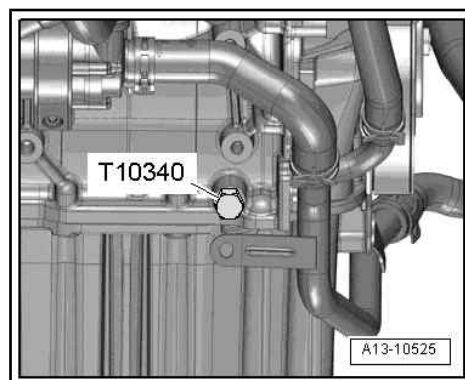
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.



Caution

Protect lubrication system and bearings against contamination.

- ◆ *Cover exposed parts of the engine.*



- Remove old sealant from sealing surfaces.



Caution

Protect lubrication system against contamination.

- ◆ *Cover exposed parts of the engine.*

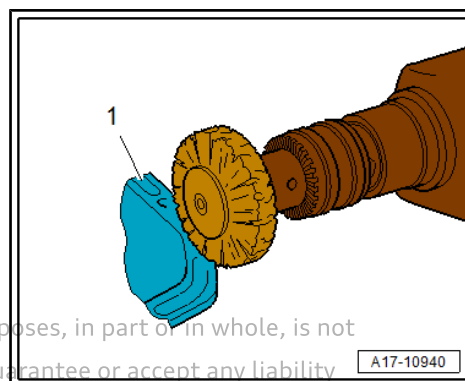


WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

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



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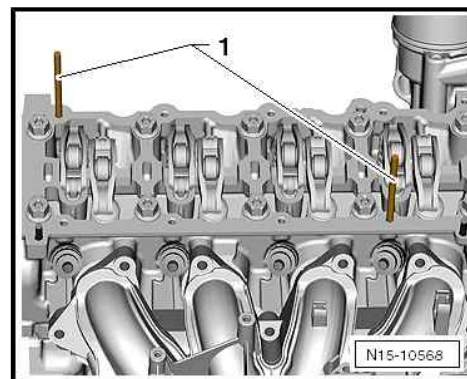


- Screw guide pins - T40199- -item 1- into cylinder head.

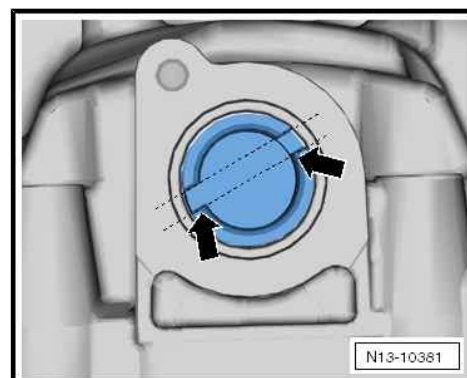


Note

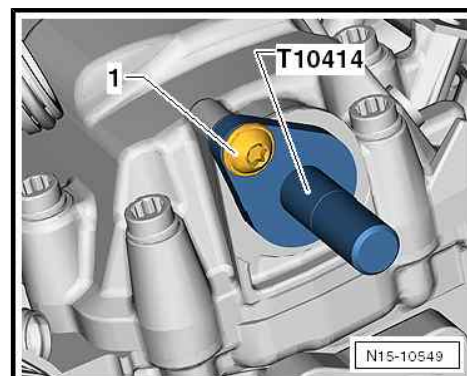
The guide pins are used to position the camshaft housing correctly when installing. This prevents the roller rocker fingers from slipping off the compensation elements.



- Turn camshaft to “TDC”.
- Grooves -arrows- on camshaft should be positioned as shown in illustration.



- Slide camshaft clamp - T10414- into camshaft housing as far as stop and screw bolt -1- in by hand until it makes contact.



Caution

Risk of leaks.

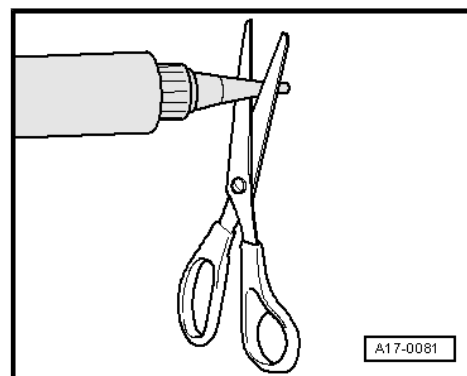
- ◆ *Different sealants must be used for the outer seal on the camshaft housing and for the seal at the camshaft bearing pedestals. For correct types of sealant refer to ➔ Electronic parts catalogue .*



Note

Note the use-by date of the sealant.

- For outer seal on camshaft housing: cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).



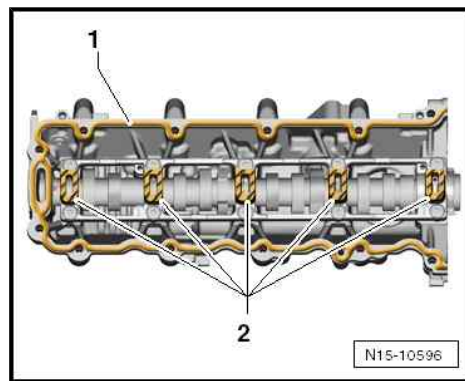


Caution

Make sure lubrication system is not clogged by excess sealant.

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

- Apply bead of sealant -1- onto clean outer sealing surface of camshaft housing, as shown in illustration.
- The bead of sealant must be 2.0 ... 3.0 mm thick.
- Apply a thin and even layer of sealant to clean sealing surfaces of camshaft housing (hatched areas -2- in illustration).
- Make sure that all roller rocker fingers make contact with the corresponding valve ends correctly and are clipped into their respective support elements.



Note

The camshaft housing must be installed within 5 minutes after applying the sealant.

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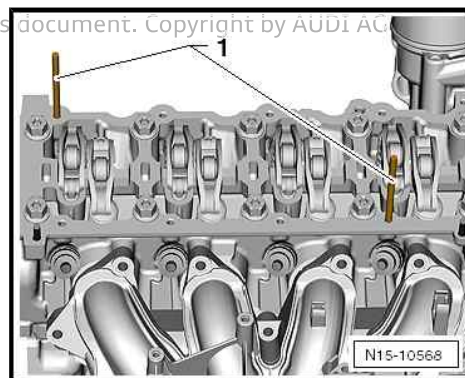


Caution

Make sure remnants of oil are removed before fitting, otherwise leakage can occur.

- ◆ ***Make sure sealing surfaces are free of oil when fitting camshaft housing.***

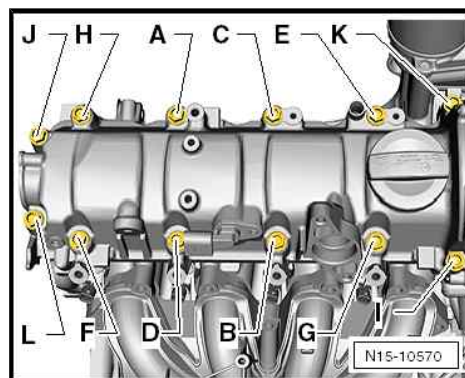
- Carefully lower camshaft housing vertically onto guide pins - T40199- -item 1- in cylinder head.



Note

Make sure that camshaft housing is kept straight.

- Tighten camshaft housing bolts ➤ [page 93](#) .





Caution

Risk of leaks.

- ◆ *Sealants for camshaft housing and timing chain cover (top) must not be allowed to mix.*

- Remove any excess sealant in area of -arrows-.



Note

After fitting camshaft housing, allow sealant to dry for approx. 30 minutes.

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

- Install fuel rail ➔ [page 196](#) .
- Install turbocharger ➔ [page 167](#) .
- Install camshaft timing chain ➔ [page 74](#) .

Tightening torques

- ◆ ➔ [Fig. ““Camshaft housing - tightening torque and sequence””, page 93](#)
- ◆ ➔ [“1.1 Exploded view - turbocharger”, page 166](#)

3.5 Checking compression

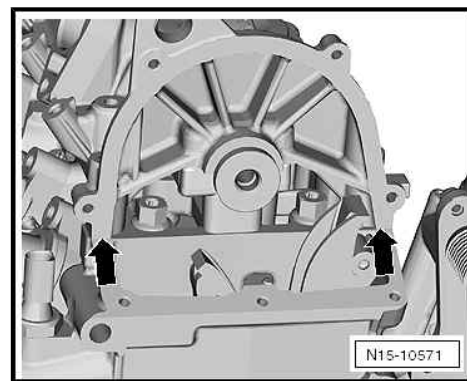
Special tools and workshop equipment required

- ◆ Spark plug spanner - 3122 B-



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- ◆ Compression tester - V.A.G 1763-



3122 B



W00-11129

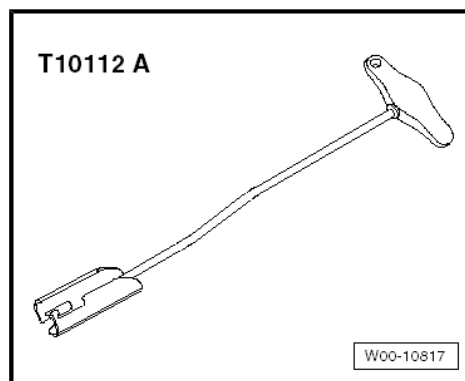
V.A.G 1763



W00-11177

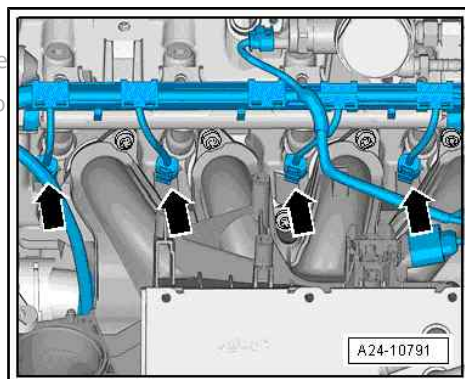


◆ Puller - T10112 A-

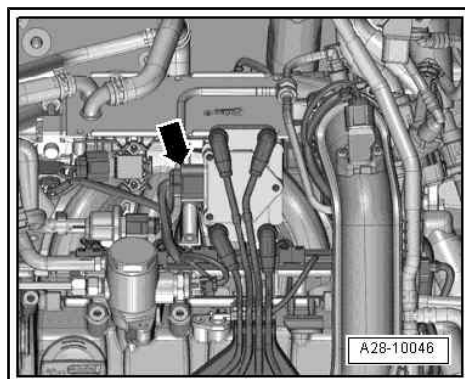


Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Switch off ignition.
- Unplug electrical connectors -arrows- at injectors.

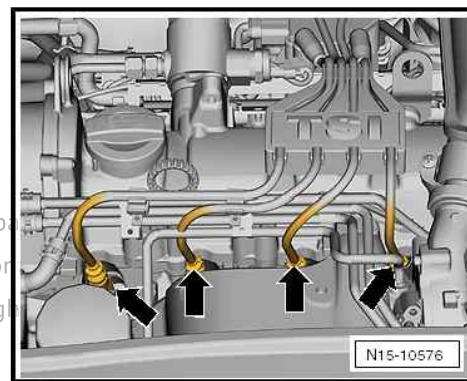


- Unplug electrical connector -arrow- at ignition transformer - N152- .





- Pull off spark plug connectors -arrows- using puller - T10112 A- .
- Unscrew spark plugs using spark plug socket - 3122 B- .
- Check compression pressure with compression tester - V.A.G 1763- (see ⇒ operating instructions for details of how to use tester).
- Have a second mechanic press down the accelerator pedal completely and at the same time operate the starter until the pressure on the tester display no longer increases.
- Repeat procedure on each cylinder.



Compression pressure	bar
When new	10.0 ... 15.0
Wear limit	7.0
Maximum difference between cylinders	3.0

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

- Install spark plugs ⇒ Maintenance ; Booklet 819 .
- Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester, [Guided Functions], then [Interrogate event memory].



4 Valve gear

⇒ ["4.1 Measuring axial clearance of camshaft", page 108](#)

⇒ ["4.2 Removing and installing camshaft", page 108](#)

⇒ ["4.3 Removing and installing valve stem oil seals", page 110](#)

4.1 Measuring axial clearance of camshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



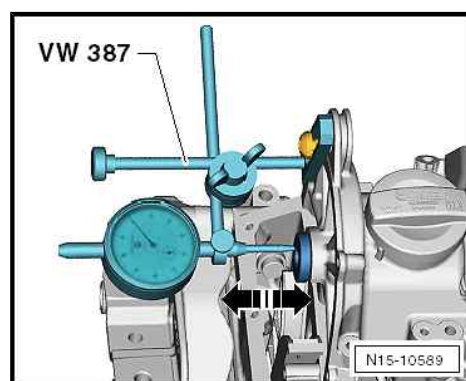
- ◆ Dial gauge - VAS 6080-



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Procedure

- Perform measurement with camshaft housing installed.
- Secure universal dial gauge bracket - VW 387- with dial gauge - VAS 6080- to camshaft housing, as shown in illustration.
- Measure axial clearance.
- Wear limit: 0.40 mm.



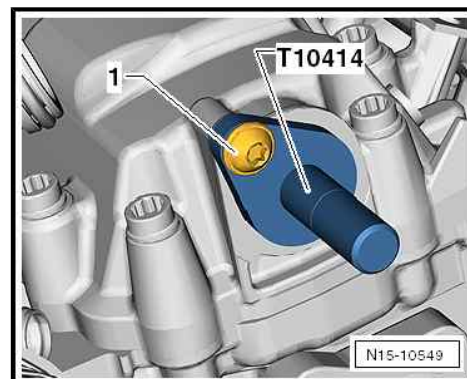
4.2 Removing and installing camshaft

Removing

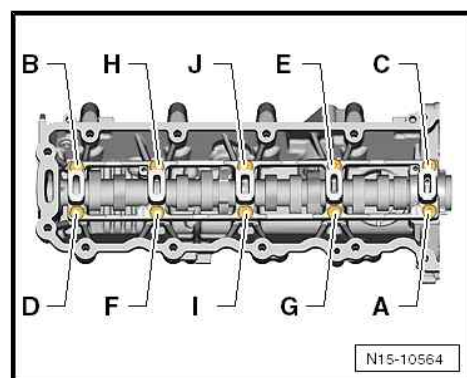
- Remove high-pressure pump ⇒ [page 207](#) .
- Remove camshaft housing ⇒ [page 100](#) .



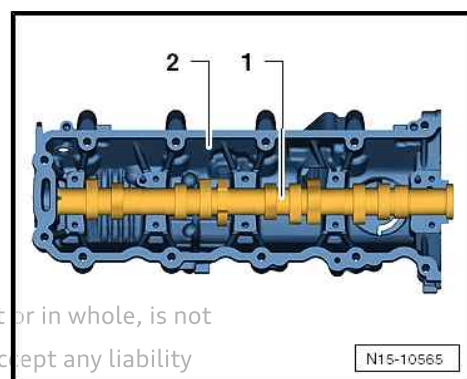
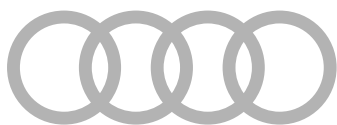
- Unscrew bolt -1- and remove camshaft clamp - T10414- .



- Remove bolts in sequence -A ... J-.
- Detach retaining frame from camshaft housing.



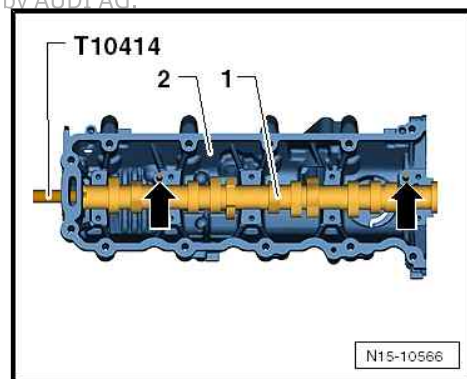
- Pull camshaft -1- out of camshaft housing -2-.



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Installing

- Insert camshaft -1- into camshaft housing -2- (lubricate running surfaces with oil before inserting).
- Slide camshaft clamp - T10414- into camshaft housing as far as stop and screw bolt in by hand until it makes contact.
- Fit retaining frame onto camshaft bearing points (note position of dowel pins -arrows-).





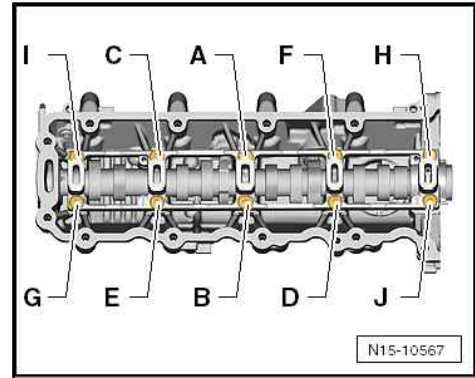
- Screw in retaining frame bolts by hand until they make contact and then tighten ⇒ [page 94](#) .

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

- Install camshaft housing ⇒ [page 100](#) .
- Install high-pressure pump ⇒ [page 207](#) .

Tightening torques

- ♦ ⇒ [Fig. “Retaining frame for camshaft - tightening torque and sequence”](#) , [page 94](#)



4.3 Removing and installing valve stem oil seals

⇒ [“4.3.1 Removing and installing valve stem oil seals \(cylinder head installed\)”](#), [page 110](#)

⇒ [“4.3.2 Removing and installing valve stem oil seals \(cylinder head removed\)”](#), [page 113](#)

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

Special tools and workshop equipment required



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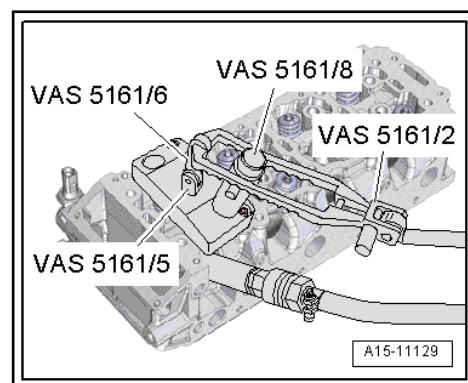
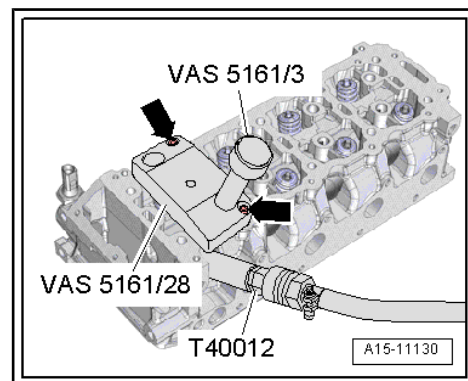
3122 B 	3364
3365 	VAS 5161
T40012 	G15-0058



- ◆ Spark plug spanner - 3122 B-
- ◆ 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 5161/28-
- ◆ Adapters - T40012-

Procedure

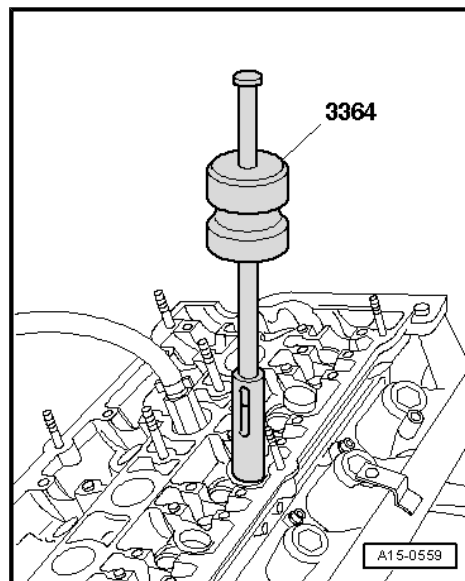
- Remove camshaft housing ➔ [page 100](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Unscrew spark plugs using spark plug socket - 3122 B- .
- Set piston of appropriate cylinder to "bottom dead centre".
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.
- Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
- Minimum pressure: 6 bar
- Fit guide plate -VAS 5161/28- onto cylinder head in correct position:
- Mark "A" should face exhaust side; mark "E" should face inlet side.
- Secure guide plate to cylinder head with hexagon socket head bolts -arrows-.
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.
- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
- The compressed air hose remains connected.
- Detach valve spring with valve spring plate.



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

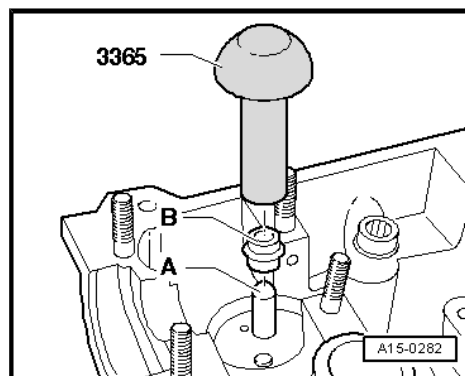


Caution

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

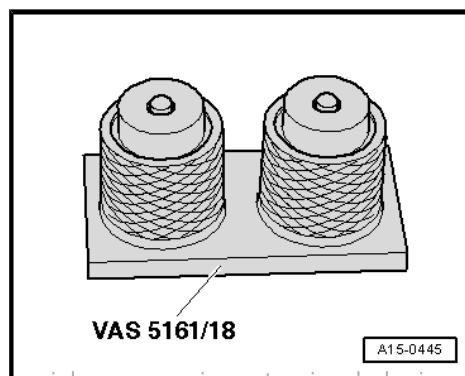
- ◆ ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***

- 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- .
- Remove plastic sleeve.



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

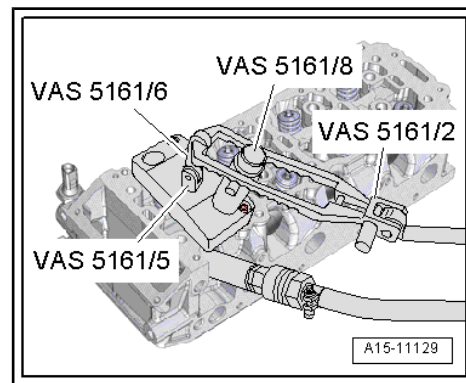
- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and pick up valve cotters.



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- Insert valve spring and valve spring plate.
- Secure guide plate -VAS 5161/28- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.



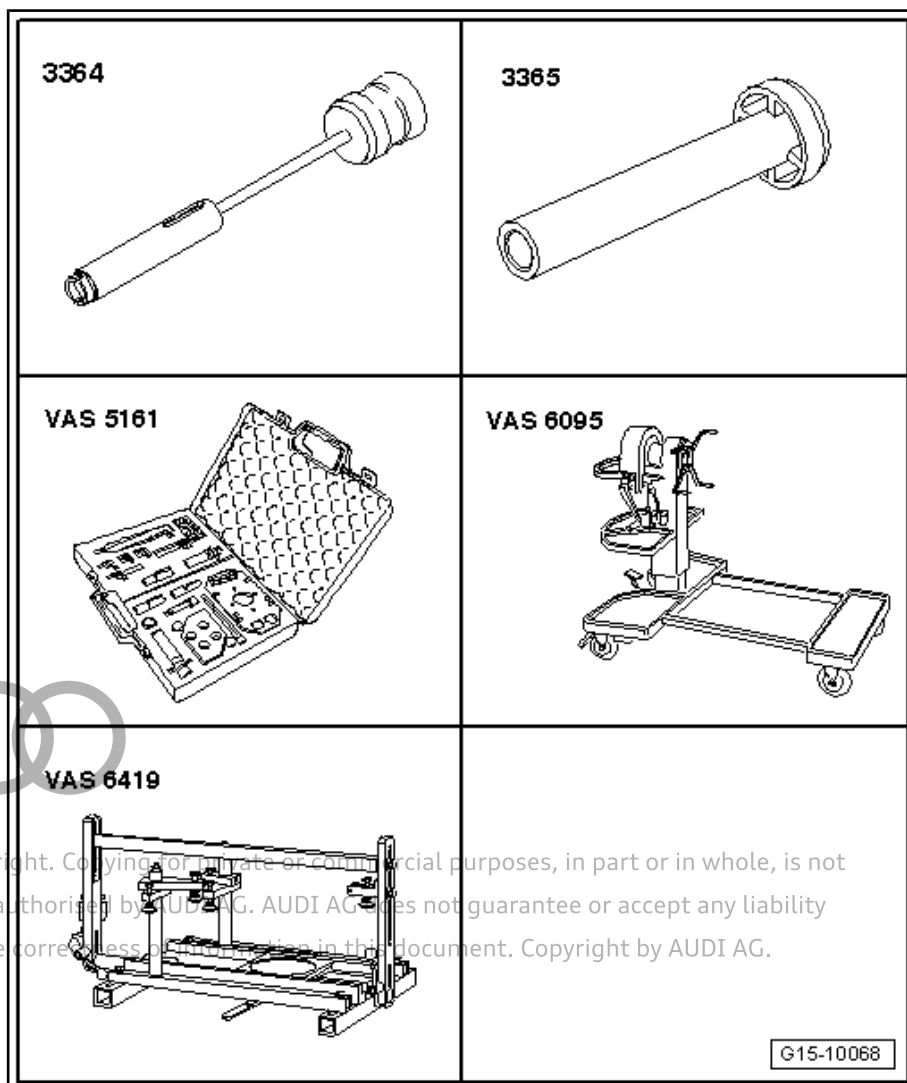
Assembling

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

- Install spark plugs ⇒ Maintenance ; Booklet 819 .
- Install camshaft housing ⇒ [page 100](#) .

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

Special tools and workshop equipment required



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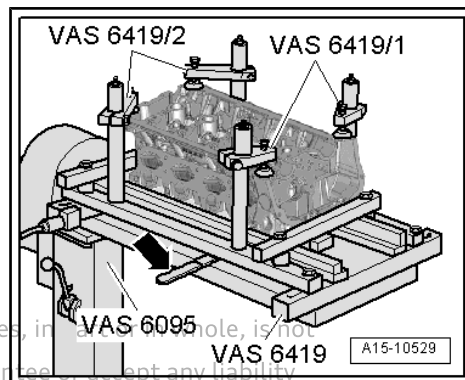
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem oil seal fitting tool - 3365-



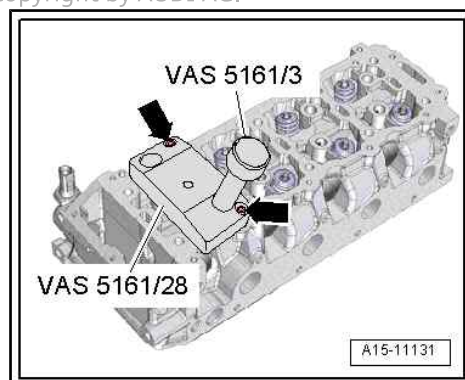
- ◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate -VAS 5161/28-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Cylinder head tensioning device - VAS 6419-

Procedure

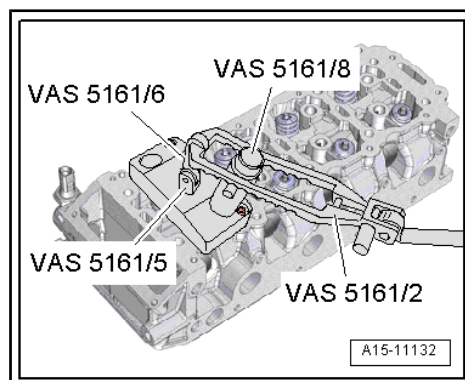
- Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensioning device, as shown in illustration.
- Connect cylinder tensioning device to compressed air supply.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.



- Fit guide plate -VAS 5161/28- onto cylinder head in correct position:
 - Mark "A" should face exhaust side; mark "E" should face inlet side.
- Secure guide plate to cylinder head with hexagon socket head bolts -arrows-.
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.

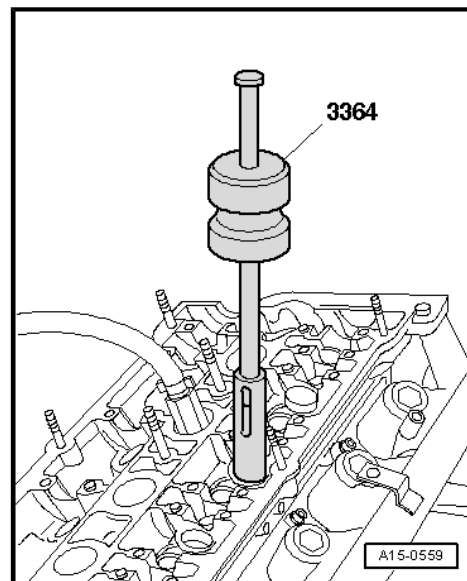


- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise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





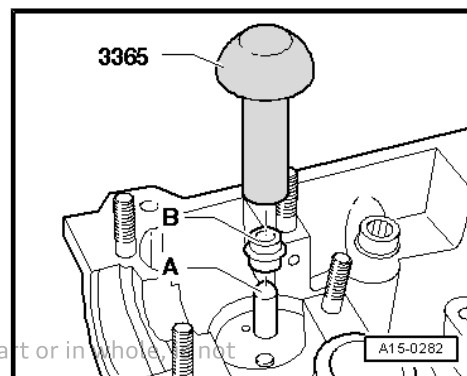
- Pull off valve stem oil seal with valve stem seal puller - 3364- .



Caution

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

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



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

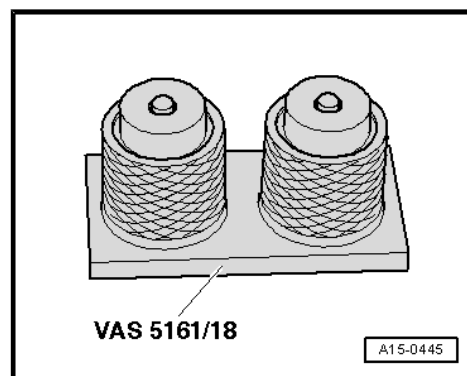
If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .



Note

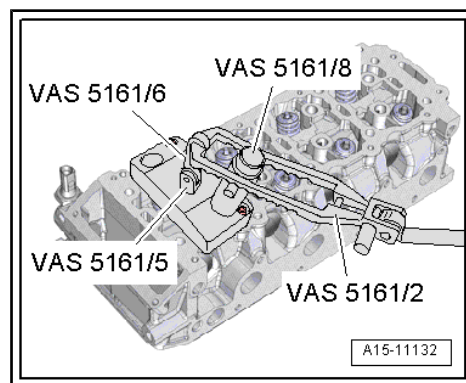
Larger diameter of valve cotters faces upwards.

- Press assembly cartridge onto insertion device from above and pick up valve cotters.





- Insert valve spring and valve spring plate.
- Secure guide plate -VAS 5161/28- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.



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5 Inlet and exhaust valves

⇒ ["5.1 Checking valve guides", page 117](#)

⇒ ["5.2 Checking valves", page 118](#)

⇒ ["5.3 Valve dimensions", page 118](#)

5.1 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

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- ◆ Dial gauge - VAS 6079-



Procedure

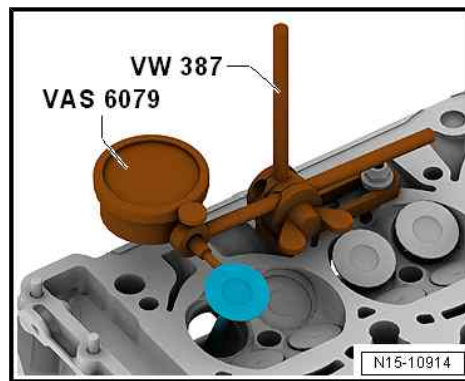


Note

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



- Secure dial gauge - VAS 6079- to cylinder head with universal dial gauge bracket - VW 387- as shown in illustration.
- Insert valve into guide.
- End of valve stem must be flush with valve guide.
- Measure the amount of sideways play.
- Wear limit: 0.8 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded.



Note

Valve guides cannot be renewed.

5.2 Checking valves

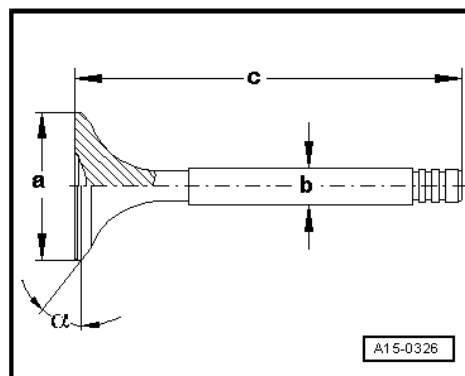
- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.

5.3 Valve dimensions



Note

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



Dimension		Inlet valve	Exhaust valve
Ø a	mm	35.5	30.0
Ø b	mm	5.98	5.96
c	mm	98.67	98.36
α	°	45	45



WARNING

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

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



17 – Lubrication

1 Sump/oil pump

⇒ [“1.1 Exploded view - sump/oil pump”, page 119](#)

⇒ [“1.2 Engine oil”, page 121](#)

⇒ [“1.3 Removing and installing sump”, page 121](#)

⇒ [“1.4 Removing and installing oil pump”, page 124](#)

⇒ [“1.5 Removing and installing oil level and oil temperature sender G266”, page 127](#)

1.1 Exploded view - sump/oil pump



Note

- ◆ *If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil passages carefully and renew the oil spray jets, engine oil cooler and oil filter.*
- ◆ *Non-return valve is fitted in different locations on cylinder head depending on version.*
- ◆ *Threaded version: non-return valve is screwed into top of cylinder block; for allocation refer to ⇒ [Electronic parts catalogue](#) . Removing and installing ⇒ [page 137](#)*
- ◆ *Push-fitted version: non-return valve is fitted in underside of cylinder block; for allocation refer to ⇒ [Electronic parts catalogue](#) . Removing and installing ⇒ [page 137](#)*
- ◆ *Oil spray jet and pressure relief valve ⇒ [page 58](#)*



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1 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing
⇒ [page 127](#)

2 - Seal

- ☐ Renew

3 - Sump

- ☐ Removing and installing
⇒ [page 121](#)
- ☐ Apply sealant when installing; refer to ⇒ Electronic parts catalogue

4 - Bolt

- ☐ Renew
- ☐ 14 Nm +90°

5 - Drive chain sprocket

- ☐ For oil pump
- ☐ Sprocket can only be fitted on oil pump shaft in one position.
- ☐ Counterhold using counterhold tool - T10172-

6 - Bolt

- ☐ Renew
- ☐ 20 Nm +90°

7 - Cover

- ☐ For chain sprocket
- ☐ Clipped onto oil pump

8 - Drive chain

- ☐ For oil pump
- ☐ Before removing, mark running direction with paint
- ☐ Check for wear
- ☐ Removing and installing ⇒ [page 124](#)

9 - Dowel sleeves

10 - Chain sprocket

- ☐ For drive chain for oil pump
- ☐ On crankshaft

11 - Oil pump

- ☐ With pressure relief valve
- ☐ Removing and installing ⇒ [page 125](#)
- ☐ Before installing, check that the two dowel sleeves for centring oil pump/cylinder block are fitted

12 - O-ring

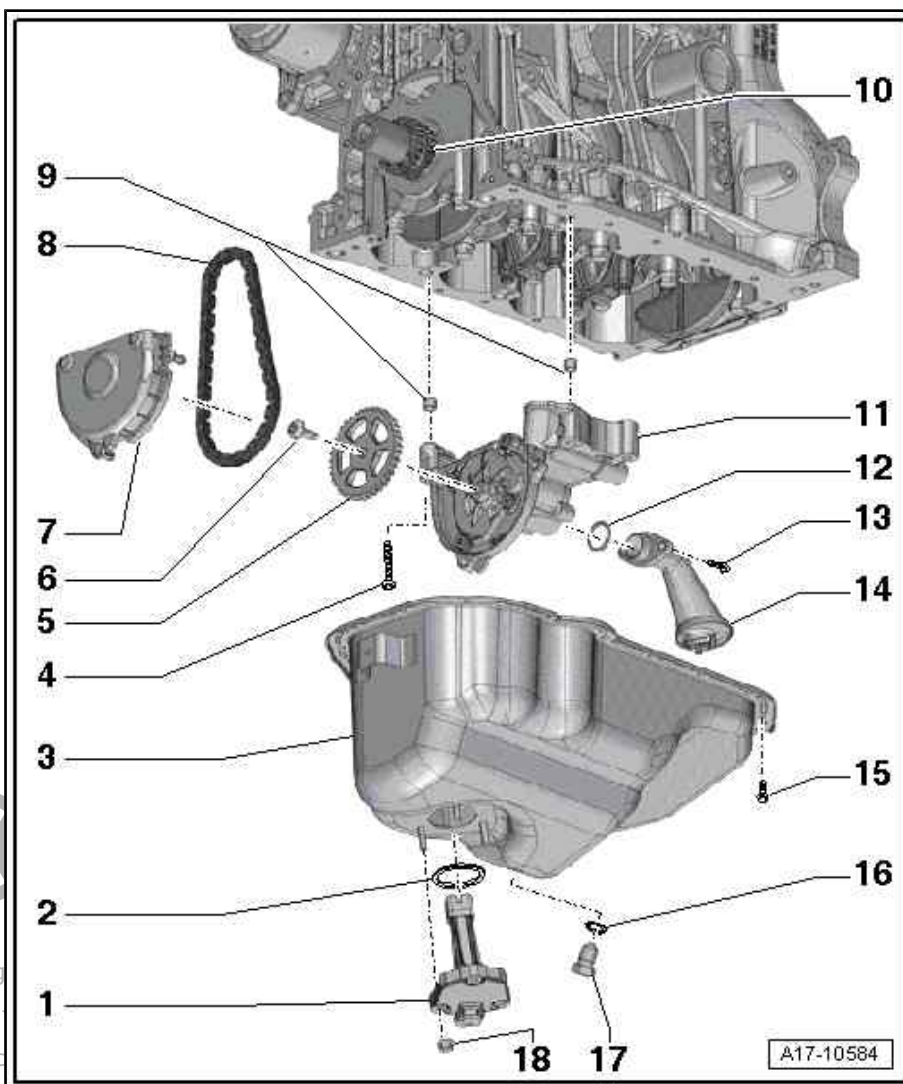
- ☐ Renew

13 - Bolt

- ☐ 8 Nm

14 - Suction pipe

- ☐ Clean strainer if dirty





15 - Bolt

- ☐ Renew
- ☐ 13 Nm
- ☐ When loosening and tightening the bolts on the gearbox end, use Allen key, long reach - T10058-

16 - Seal

- ☐ Renew

17 - Oil drain plug

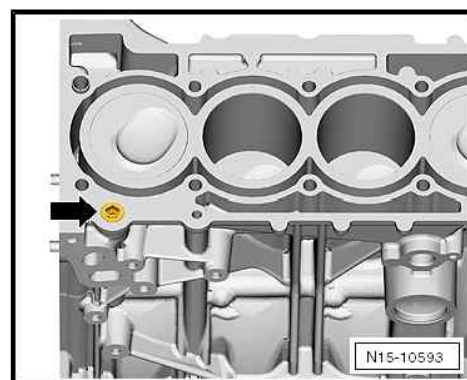
- ☐ 30 Nm

18 - Nut

- ☐ 9 Nm

Non-return valve (threaded version) - tightening torque

- Tighten non-return valve -arrow- to 7 Nm.



1.2 Engine oil

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



Caution

Risk of damage to catalytic converter.

- ◆ *The oil level must not be above the "MAX" mark on the dipstick.*

1.3 Removing and installing sump

Special tools and workshop equipment required

- ◆ Socket - T10058-



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

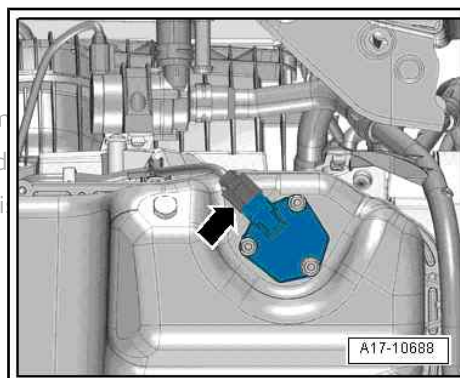




♦ Sealant ⇒ Electronic parts catalogue

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 819
- Remove catalytic converter ⇒ [page 222](#)
- Unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .

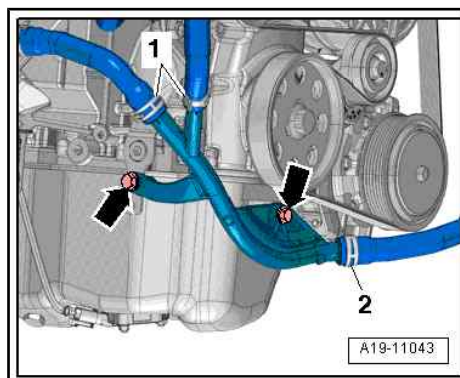


- Remove bolts -arrows- and move coolant pipe (right-side) to side.

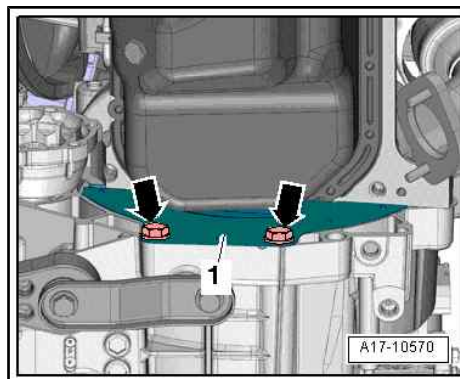


Note

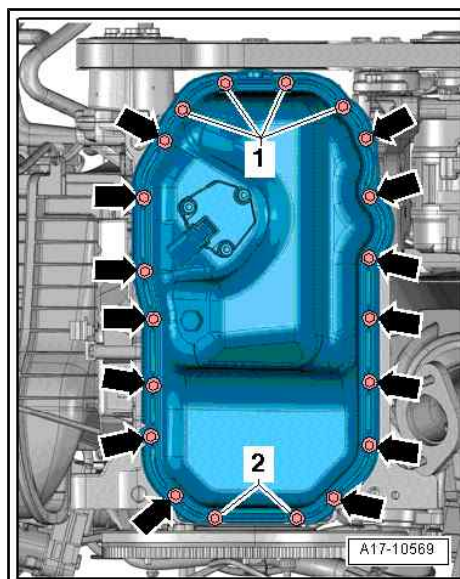
Disregard items -1 and 2-.



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



- Slacken bolts -1, 2- and -arrows- in diagonal sequence and remove.
- Carefully release oil sump from bonded joint and detach.





Installing



Caution

Protect lubrication system against contamination.

- ◆ *Cover exposed parts of the engine.*

- Remove old sealant from sealing surfaces.



WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

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



Note

Note the use-by date of the sealant.

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



Caution

Make sure lubrication system is not clogged by excess sealant.

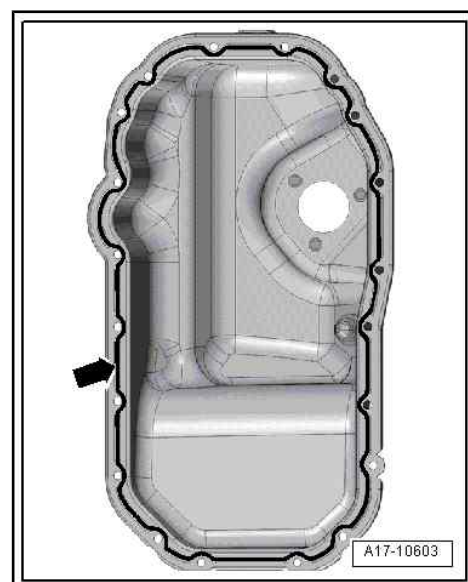
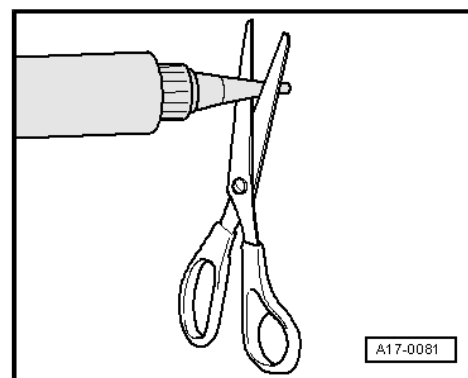
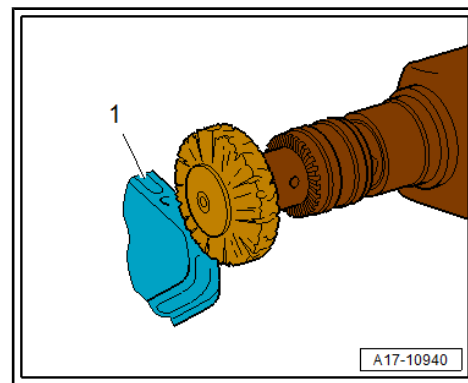
- ◆ *The sealant bead must not be thicker than specified.*

- Apply bead of sealant -arrow- onto clean sealing surface of sump as illustrated.
- Thickness of sealant bead: 2 ... 3 mm



Note

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





- Fit sump and tighten bolts
⇒ ["1.1 Exploded view - sump/oil pump", page 119](#) .



Note

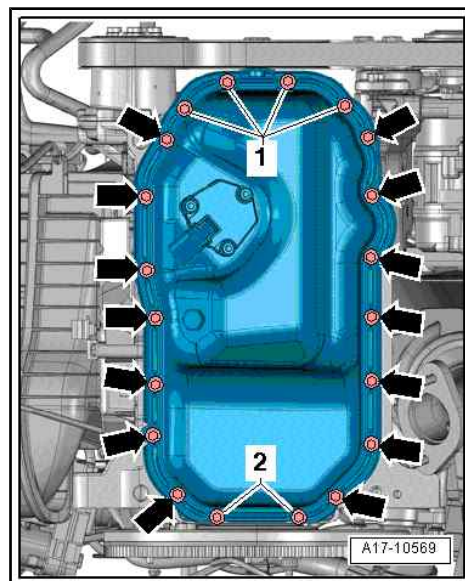
After fitting sump, sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.

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

- Install coolant pipe (right-side) ⇒ [page 155](#) .
- Install catalytic converter ⇒ [page 222](#) .

Tightening torques

- ♦ ⇒ ["1.1 Exploded view - sump/oil pump", page 119](#)
- ♦ Cover plate ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox



1.4 Removing and installing oil pump

⇒ ["1.4.1 Removing and installing drive chain for oil pump", page 124](#)

⇒ ["1.4.2 Removing and installing oil pump", page 125](#)

1.4.1 Removing and installing drive chain for oil pump

Special tools and workshop equipment required

- ♦ Counterhold tool - T10172 A-

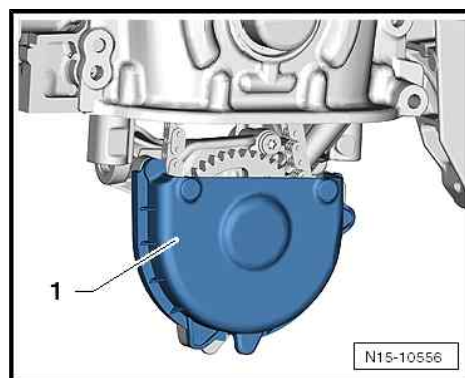


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Removing

- Remove camshaft timing chain ⇒ [page 78](#) .
- Unclip cover -1- for oil pump drive chain sprocket.



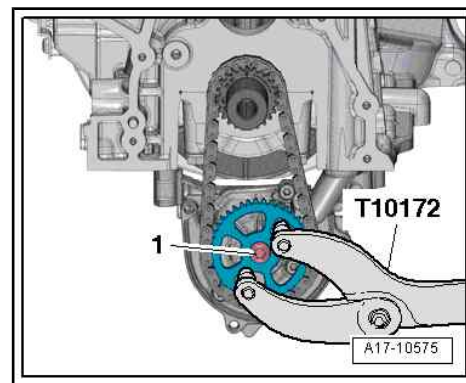


Caution

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

- ◆ *Mark running direction of drive chain with paint for re-installation.*

- Slacken off bolt -1- for chain sprocket for oil pump; use counterhold tool - T10172 A- to counterhold at chain sprocket.
- Remove bolt and detach chain sprocket for oil pump together with drive chain.



Installing

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



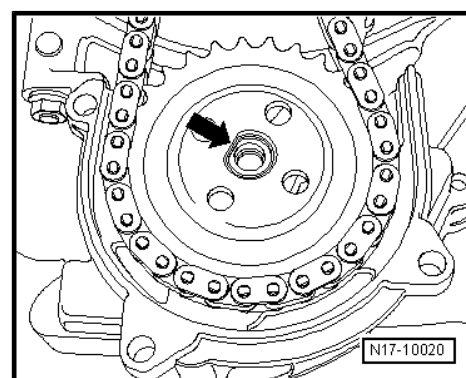
Note

Renew the bolts tightened with specified tightening angle.

- Install drive chain for oil pump together with drive chain sprocket according to marks applied when removing.
- Drive chain sprocket for oil pump can only be installed in one position -arrow-.
- Install camshaft timing chain ➔ [page 78](#) .

Tightening torques

- ◆ ➔ ["1.1 Exploded view - sump/oil pump", page 119](#)



1.4.2 Removing and installing oil pump

Special tools and workshop equipment required

- ◆ Counterhold tool - T10172 A-

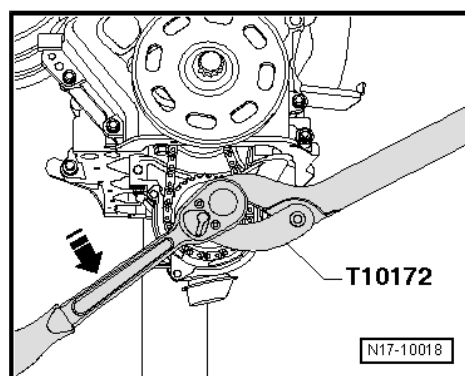
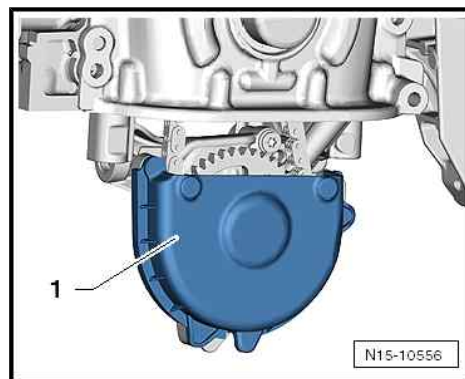
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Removing

- Remove sump ➔ [page 121](#) .
- Unclip cover -1- for oil pump drive chain sprocket.
- Slacken off bolt for drive chain sprocket for oil pump several turns -arrow-; use counterhold tool - T10172 A- to counterhold at drive chain sprocket.
- Remove bolt and detach drive chain sprocket from chain.



- Remove bolts -arrows- and remove oil pump.

Installing



Note

Renew the bolts tightened with specified tightening angle.

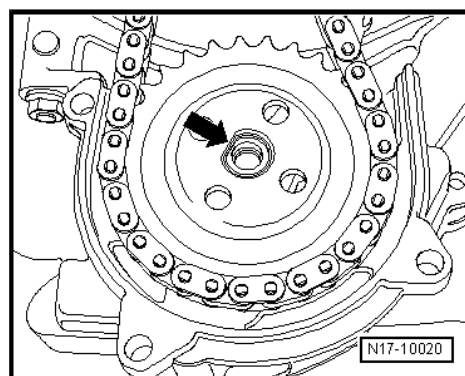
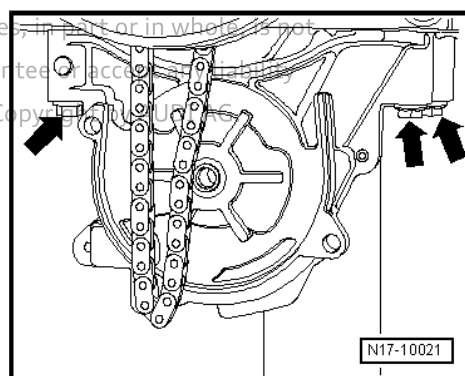
- Check whether dowel sleeves for centring oil pump and cylinder block are fitted; install missing dowel sleeves.
- Fit oil pump and tighten bolts.
- Drive chain sprocket for oil pump can only be installed in one position -arrow-.

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

- Install sump ➔ [page 121](#) .

Tightening torques

- ➔ ["1.1 Exploded view - sump/oil pump", page 119](#)





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

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 819
- Unplug electrical connector -3-.
- Remove nuts -1- and detach oil level and oil temperature sender - G266- -item 4-.

Installing

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

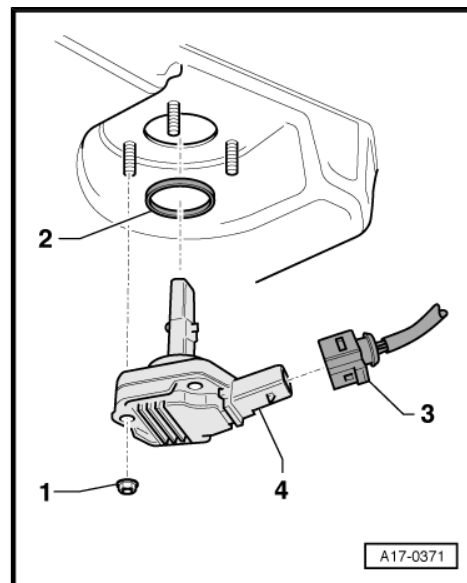


Note

Renew seal -2-.

Tightening torques

- ⇒ [“1.1 Exploded view - sump/oil pump”, page 119](#)



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2 Engine oil cooler

⇒ ["2.1 Removing and installing engine oil cooler", page 128](#)

2.1 Removing and installing engine oil cooler

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362 -



Removing

- Drain coolant ⇒ [page 141](#) .
- Release hose clip -1- and detach coolant hose.
- Remove bolts -arrows- and detach engine oil cooler from cylinder block.

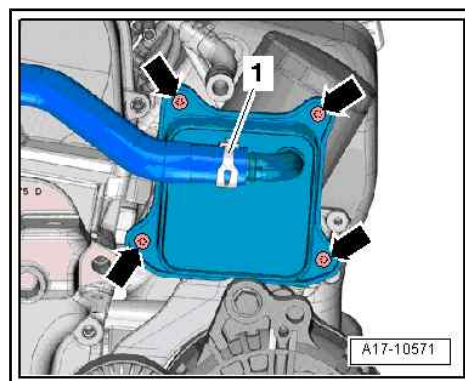
Installing

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



Note

- ◆ *Renew bolts tightened with specified tightening angle.*
 - ◆ *Renew gasket.*
 - ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
 - ◆ *Do not reuse coolant.*
- Fill up with coolant ⇒ [page 143](#) .



Tightening torques

- ◆ ⇒ ["4.1 Exploded view - oil filter/oil pressure switch", page 132](#)



3 Crankcase breather

⇒ [“3.1 Exploded view - crankcase breather system”, page 129](#)

⇒ [“3.2 Removing and installing oil separator”, page 129](#)

3.1 Exploded view - crankcase breather system

1 - Bolt

- ❑ Tightening torque
⇒ [Item 2 \(page 148\)](#)

2 - Continued coolant circulation pump - V51-

- ❑ Removing and installing
⇒ [page 148](#)

3 - Bolt

- ❑ 8 Nm

4 - Bracket

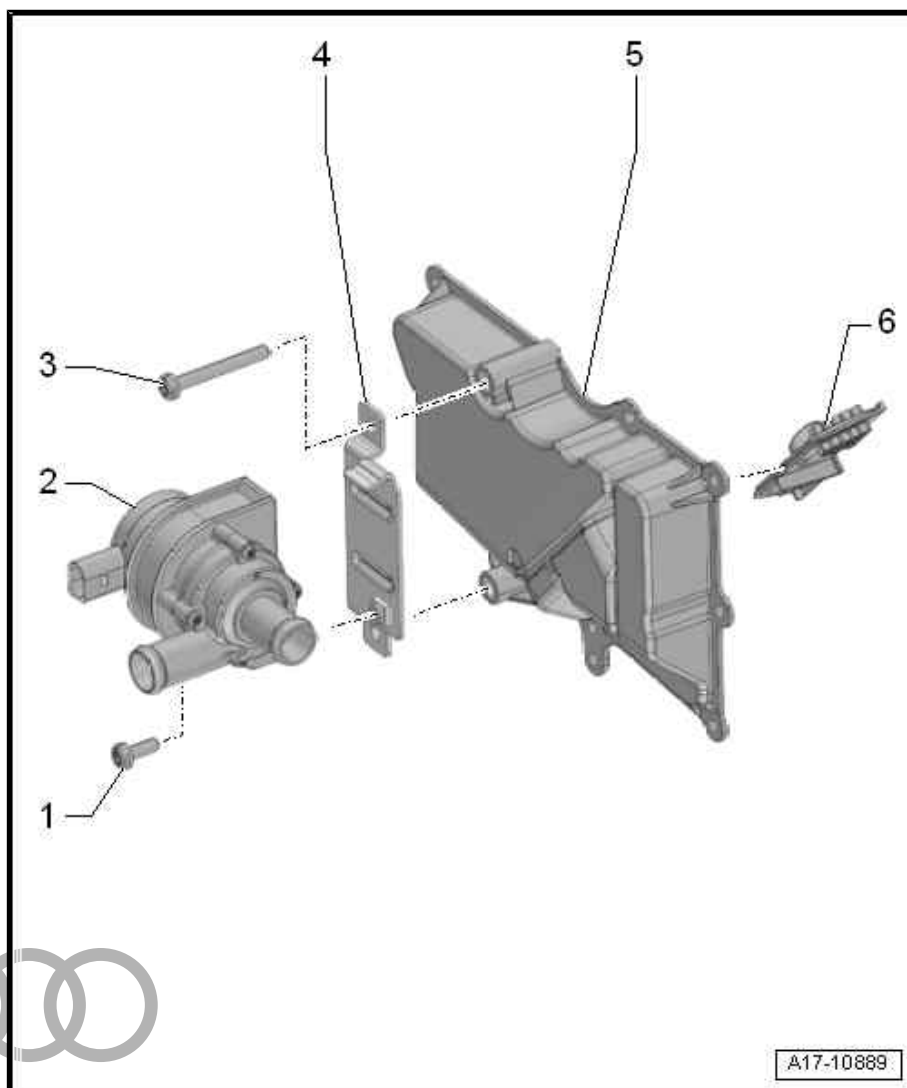
- ❑ For continued coolant circulation pump - V51-

5 - Oil separator

- ❑ Removing and installing
⇒ [page 129](#)

6 - Intermediate plate

- ❑ With valves



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3.2 Removing and installing oil separator

Special tools and workshop equipment required

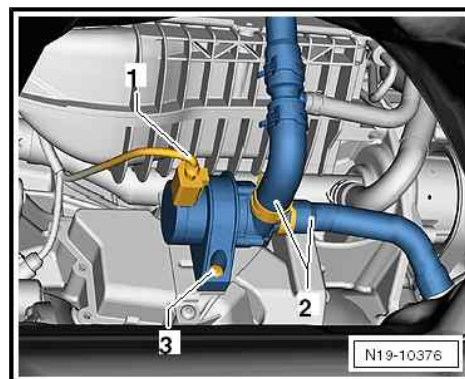
- ◆ Flat scraper
- ◆ Studs, M6x20 mm
- ◆ Sealant remover
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

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



- Unplug electrical connector -1-.
- Tie continued coolant circulation pump - V51- to one side.



- Remove bolts -arrows- and carefully release oil separator -1- with bracket -2- from bonded joint.

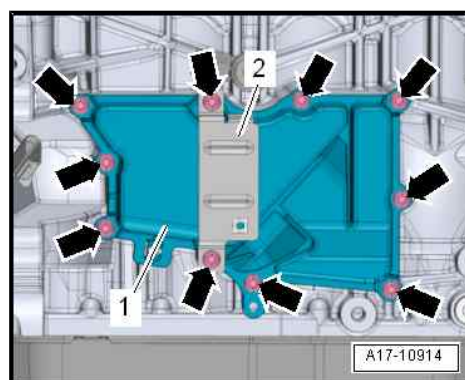
Installing



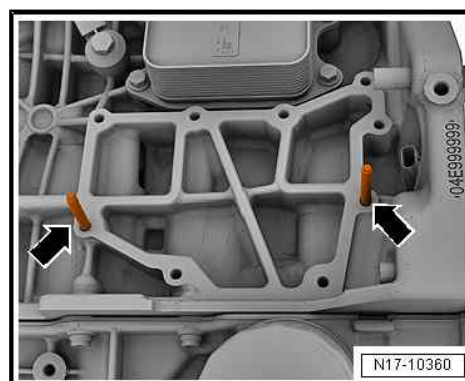
Caution

Protect lubrication system against contamination.

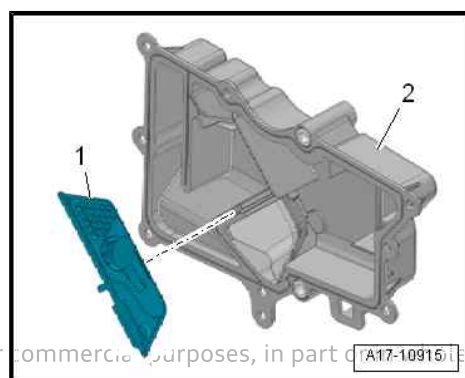
- ◆ *Cover exposed parts of the engine.*



- Remove old sealant from sealing surfaces.
- Clean sealing surfaces; they must be free of oil and grease.
- Screw 2 studs a few turns into holes -arrows-.



- Insert intermediate plate with valves in oil separator.



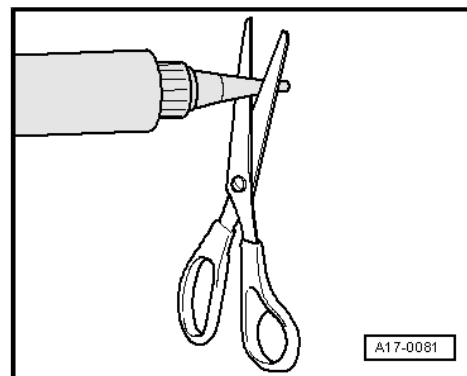
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i Note

Note the use-by date of the sealant.

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

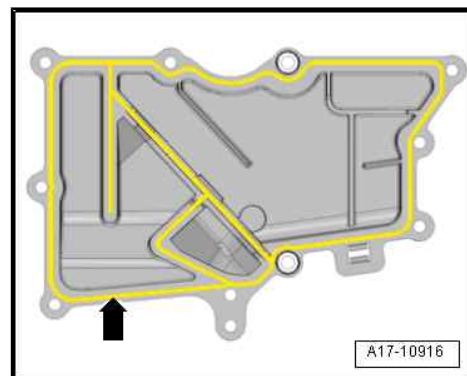


Caution

Make sure lubrication system is not clogged by excess sealant.

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

- Apply bead of sealant -arrow- onto clean sealing surface of oil separator as illustrated.
- Thickness of sealant bead: 2 ... 3 mm



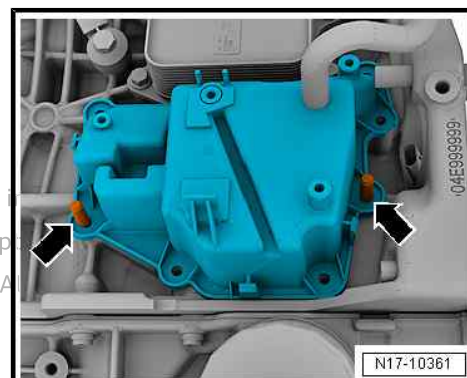
i Note

The oil separator must be installed within 5 minutes after applying the sealant.

- Place oil separator onto studs and crankcase.
- Remove studs again.



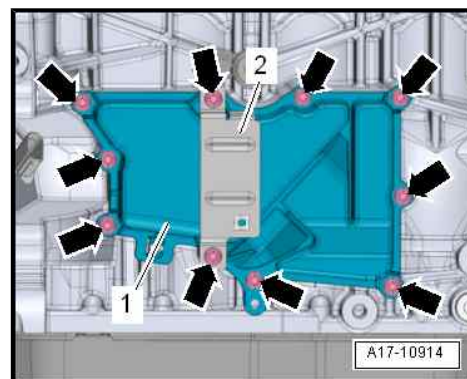
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- Tighten bolts -arrows- in diagonal sequence and in stages.
- Install continued coolant circulation pump - V51-
⇒ [page 148](#) .

Tightening torques

- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 129](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation





4 Oil filter/oil pressure switch

⇒ ["4.1 Exploded view - oil filter/oil pressure switch", page 132](#)

⇒ ["4.2 Removing and installing oil pressure switch F1", page 133](#)

⇒ ["4.3 Checking oil pressure and oil pressure switch", page 133](#)

⇒ ["4.4 Removing and installing oil filter housing", page 135](#)

4.1 Exploded view - oil filter/oil pressure switch

1 - Bolt

- ☐ Renew
- ☐ 8 Nm +90°

2 - Engine oil cooler

- ☐ See note ⇒ [page 119](#)
- ☐ Connection diagram - coolant hoses ⇒ [page 139](#)
- ☐ Removing and installing ⇒ [page 128](#)
- ☐ If renewed, refill system with fresh coolant

3 - Gasket

- ☐ Renew

4 - Gasket

- ☐ Renew

5 - Connecting pipe

- ☐ Renew

6 - Oil filter

- ☐ Removing and installing ⇒ Maintenance ; Booklet 819

7 - Oil supply line

- ☐ To turbocharger

8 - Banjo bolt

- ☐ 30 Nm

9 - Seals

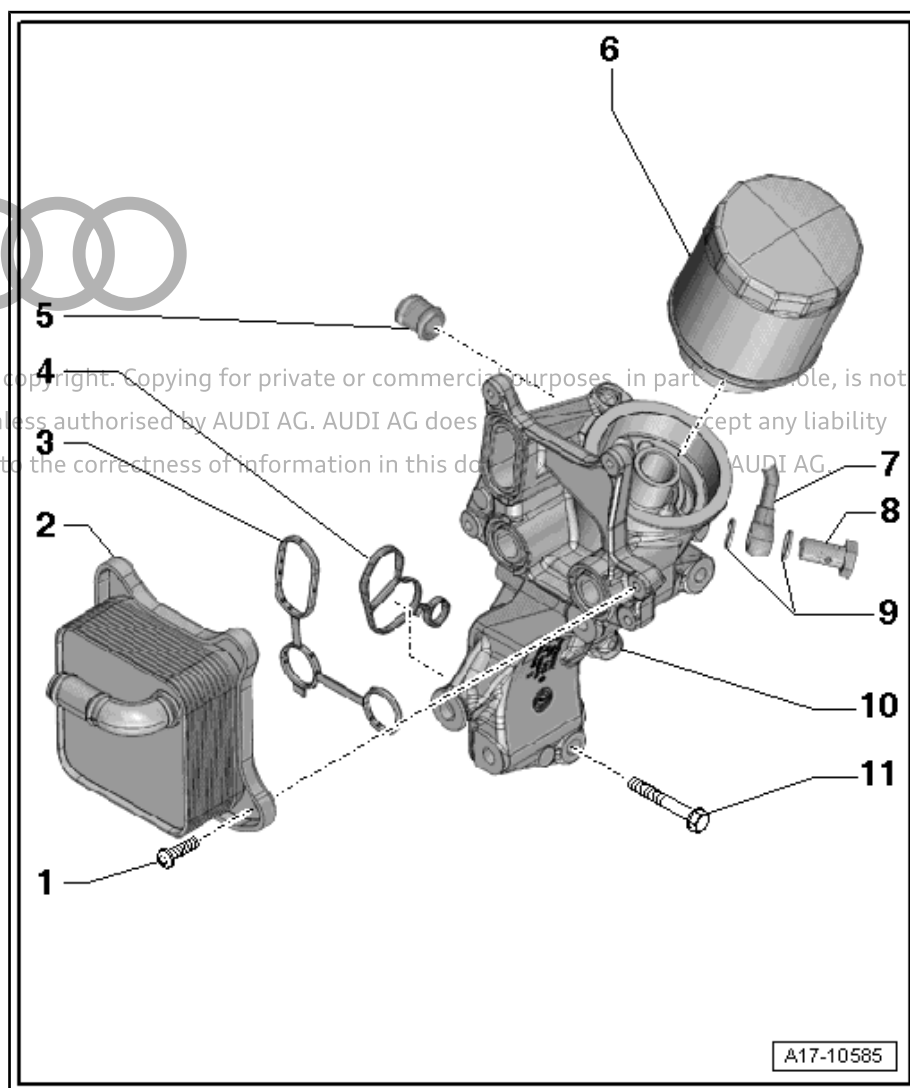
- ☐ Renew

10 - Oil filter bracket

- ☐ Removing and installing ⇒ [page 135](#)

11 - Bolt

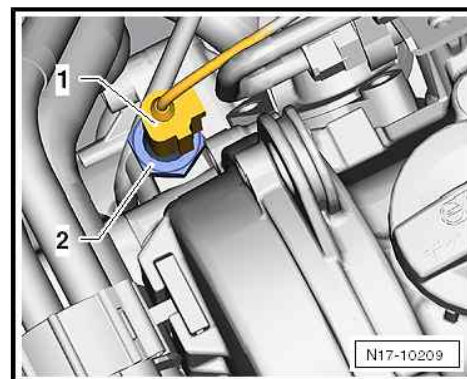
- ☐ 25 Nm





Oil pressure switch - F1-

- 1 - Electrical connector
- 2 - Oil pressure switch - F1-
- ◆ Opening/closing pressure 0.3 ... 0.6 bar
- ◆ Removing and installing ⇒ [page 133](#)
- ◆ Checking ⇒ [page 133](#)
- ◆ 20 Nm



4.2 Removing and installing oil pressure switch - F1-

Special tools and workshop equipment required

- ◆ Articulated wrench, 24 mm - T40175-



Removing

- Unplug electrical connector -1-.
- Remove oil pressure switch - F1- -item 2-.

Installing

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



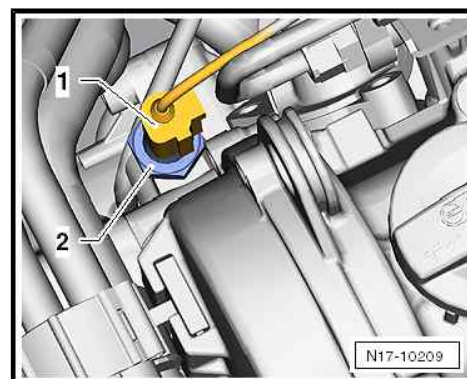
Note

Renew seal.

- Check oil level ⇒ Maintenance ; Booklet 819 .

Tightening torques

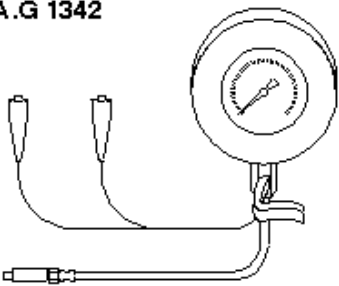
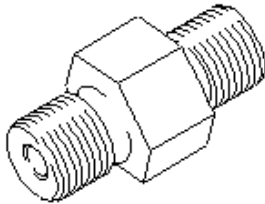
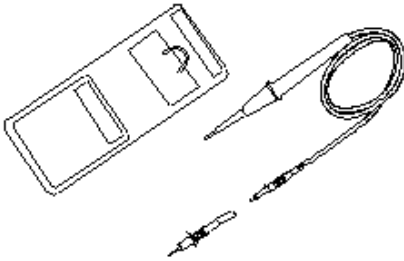
- ◆ ⇒ Fig. ““ Oil pressure switch -F1- ””, page 133



4.3 Checking oil pressure and oil pressure switch



Special tools and workshop equipment required

V.A.G 1342 	V.A.G 1342/14 
V.A.G 1527 B 	V.A.G 1594 C 
	G17-10005

◆ Oil pressure tester - V.A.G 1342-

◆ Adapter - V.A.G 1342/14-

◆ Voltage tester - V.A.G 1527B-

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

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• Oil level OK respect to the correctness of information in this document. Copyright by AUDI AG.

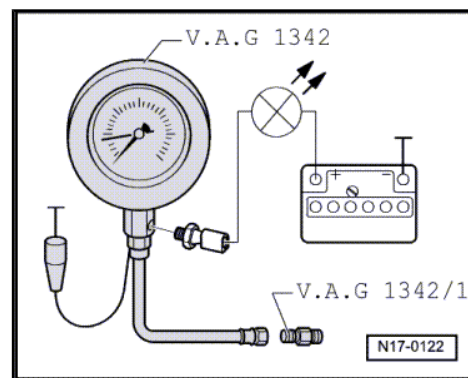
– Remove oil pressure switch - F1- ➔ [page 133](#) .



- Connect oil pressure tester - V.A.G 1342- with adapter - V.A.G 1342/14- to bore for oil pressure switch.
- Screw oil pressure switch - F1- into oil pressure tester.
- Connect brown wire of oil pressure tester to earth “-”.

Checking oil pressure switch

- Connect voltage tester - V.A.G 1527B- with adapter leads from auxiliary measuring set - V.A.G 1594C- to oil pressure switch and battery positive (“+”).
- LED should not light up.



Note

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

- Start engine.



Note

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

- LED should light up at 0.3 ... 0.6 bar.
- Renew oil pressure switch if LED does not light up.

Checking oil pressure

- Start engine.
- Specification at operating temperature and 2000 rpm: at least 2.0 bar

Assembling

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

- Install oil pressure switch - F1- ➔ [page 133](#) .

4.4 Removing and installing oil filter housing

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



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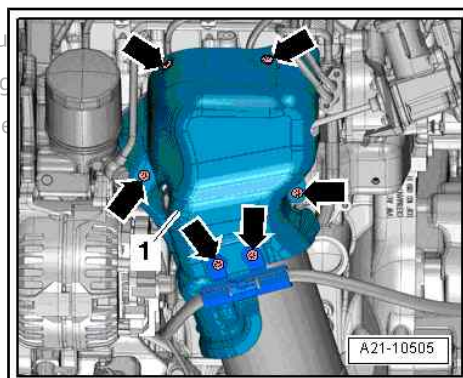
Removing

- Drain coolant ➔ [page 141](#) .
- Remove alternator ➔ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .

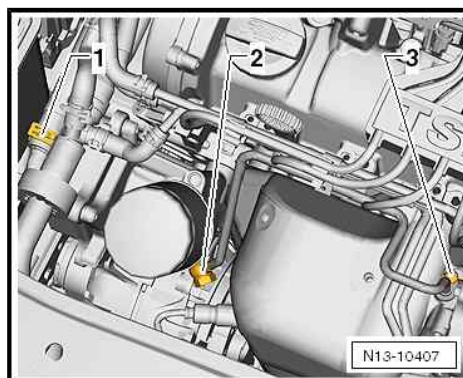


- Remove Lambda probe - G39- ➔ [page 211](#) .
- Remove bolts -arrows- and detach heat shield -1-.

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- Release hose clip -1- and detach coolant hose.
- Remove banjo bolt -2-.
- Remove bolt -3- and detach oil supply line.



- Remove bolt -1- and detach oil filter bracket.

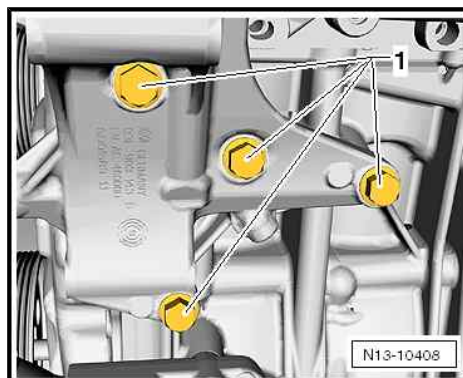
Installing

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



Note

- ◆ *Renew seals, gasket and connecting pipe.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Electronic parts catalogue .*
- Install heat shield ➔ [page 166](#) .
- Install Lambda probe - G39- ➔ [page 211](#) .



Note

Do not reuse coolant.

- Fill up with coolant ➔ [page 143](#) .

Tightening torques

- ◆ ➔ [“4.1 Exploded view - oil filter/oil pressure switch”, page 132](#)
- ◆ ➔ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator



5 Oil circuit

⇒ [“5.1 Oil spray jets/valves”, page 137](#)

5.1 Oil spray jets/valves

⇒ [“5.1.1 Removing and installing non-return valve \(threaded version\)”, page 137](#)

⇒ [“5.1.2 Removing and installing non-return valve \(push-fitted version\)”, page 137](#)

5.1.1 Removing and installing non-return valve (threaded version)

Removing

- Remove cylinder head ⇒ [page 94](#) .
- Unscrew non-return valve -arrow-.

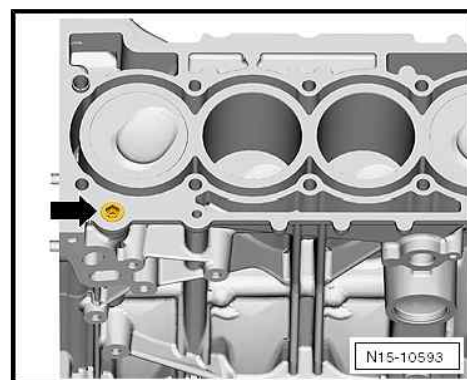
Installing

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

- Install cylinder head ⇒ [page 94](#) .

Tightening torques

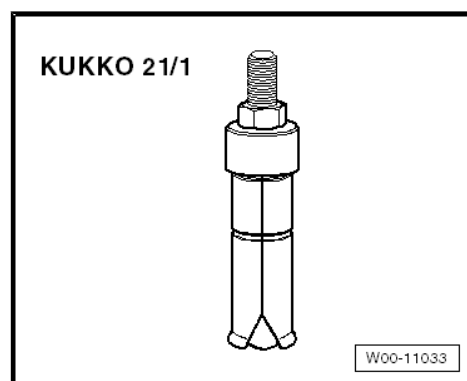
- ◆ ⇒ [Fig. “Non-return valve \(threaded version\) - tightening torque”](#), page 121



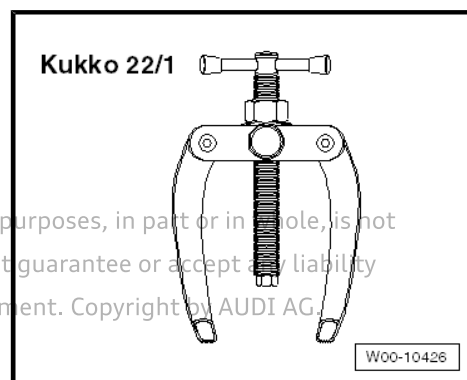
5.1.2 Removing and installing non-return valve (push-fitted version)

Special tools and workshop equipment required

- ◆ Internal puller Kukko -21/1-



- ◆ Adapter Kukko -22/1-

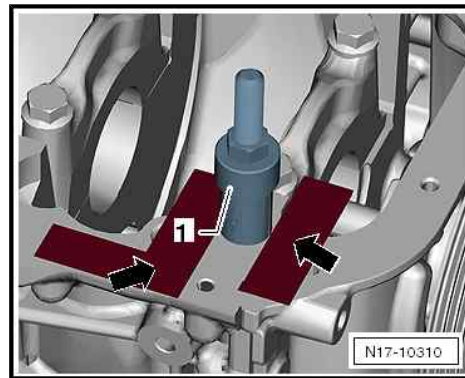


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Removing

- Remove oil pump ⇒ [page 125](#) .
- Clean sealing surface in area of non-return valve.
- To prevent damage, apply adhesive tape to sealing surface -arrows-.
- Insert internal puller Kukko -21/1- -item 1- into non-return valve and spread jaws of puller by turning hexagon nut.

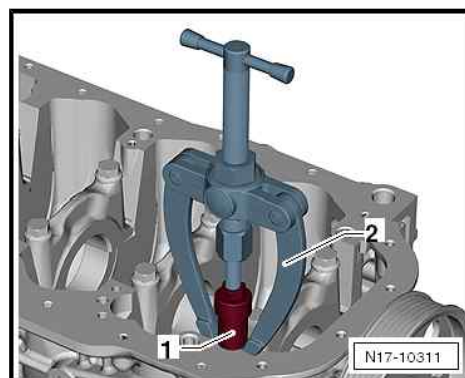


- Apply adapter Kukko -22/1- -item 2- to sealing surface of cylinder block and screw onto internal puller Kukko -21/1- -item 1-.
- Turn hexagon nut to extract non-return valve from cylinder block.

Installing

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

- Remove adhesive tape.
- Lubricate O-rings for new non-return valve with engine oil.
- Push non-return valve into cylinder block so that it is flush with cylinder block.
- Install oil pump ⇒ [page 125](#) .



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19 – Cooling

1 Cooling system/coolant

⇒ [“1.1 Connection diagram - coolant hoses”, page 139](#)

⇒ [“1.2 Checking cooling system for leaks”, page 140](#)

⇒ [“1.3 Draining and filling cooling system”, page 141](#)

1.1 Connection diagram - coolant hoses



Note

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

1 - Low-temperature radiator

- ☐ For charge air system

2 - Non-return valve

- ☐ Arrow points in direction of through-flow

3 - Non-return valve

- ☐ Arrow points in direction of through-flow

4 - Engine oil cooler

5 - Coolant pump

6 - Coolant expansion tank

7 - Filler cap

- ☐ For coolant expansion tank
- ☐ Checking pressure relief valve ⇒ [page 141](#)

8 - Continued coolant circulation pump - V51-

9 - Intake manifold

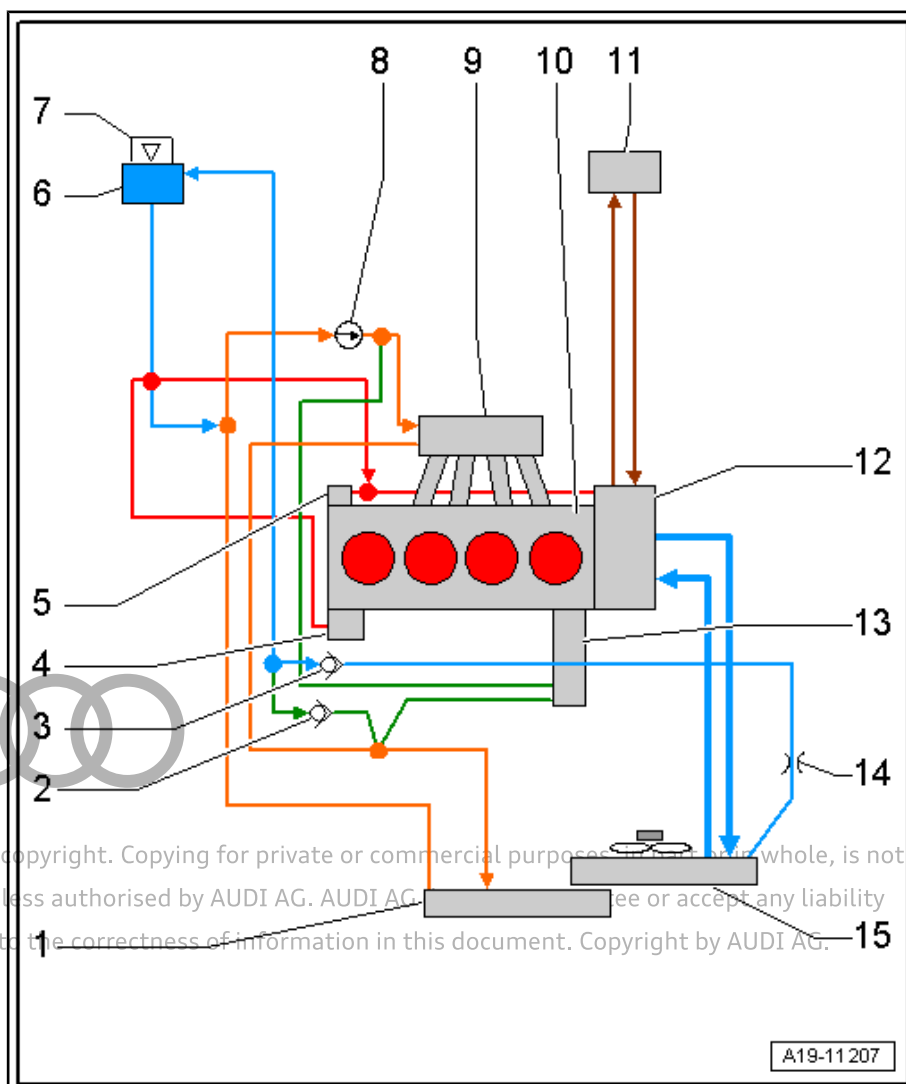
- ☐ With charge air cooler

10 - Cylinder head and cylinder block

11 - Heat exchanger for heater

12 - Housing

- ☐ For thermostat



A19-11207



13 - Turbocharger

14 - Restrictor

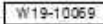
15 - Radiator

- ☐ Combined with low-temperature radiator for charge air system

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1.2 Checking cooling system for leaks

Special tools and workshop equipment required

V.A.G 1274/8 	V.A.G 1274/9 
V.A.G 1274 B 	
	

- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Adapter for cooling system tester - V.A.G 1274/9-
- ◆ Cooling system tester - V.A.G 1274 B-



Procedure

- Engine must be warm.

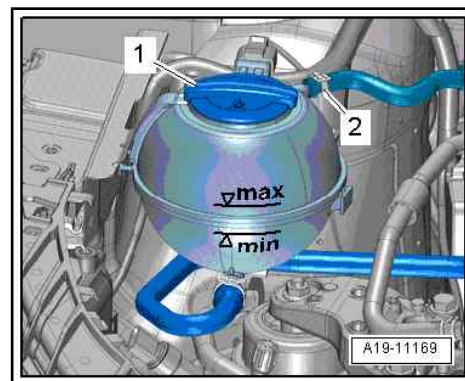


WARNING

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

Danger of scalding skin and other parts of the body.

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



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



Note

Disregard -item 2-.

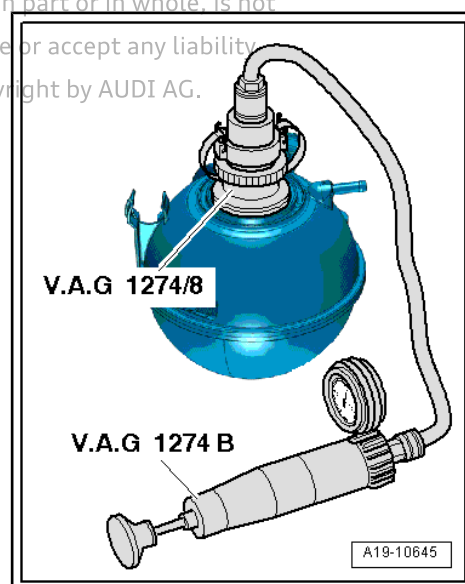
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.

- Using hand pump on cooling system tester, build up a pressure of approx. 1.5 bar.
- The pressure should not drop more than 0.2 bar within 10 minutes.
- If the pressure drops more than 0.2 bar, locate leak and eliminate fault.



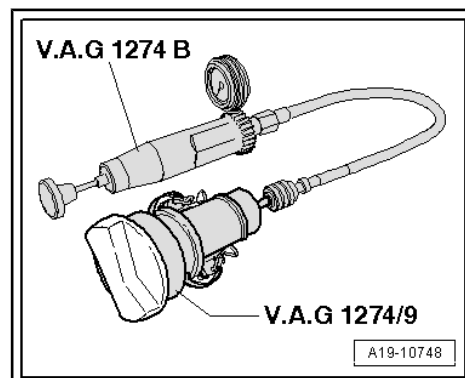
Note

The drop in pressure of 0.2 bar within 10 minutes is caused by the decrease in coolant temperature. The colder the engine is, the less the pressure will fall. If necessary, check again when the engine is cold.



Checking pressure relief valve in filler cap

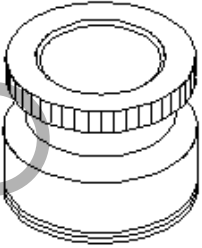
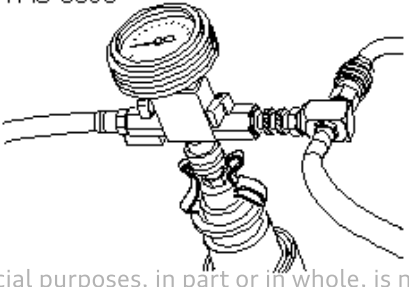
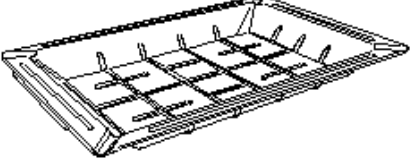
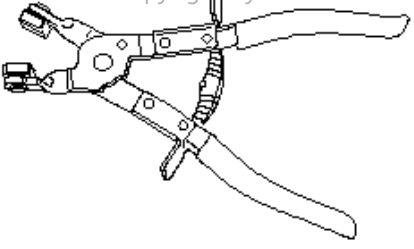
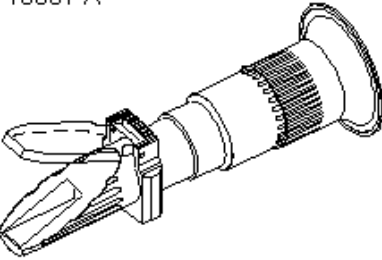
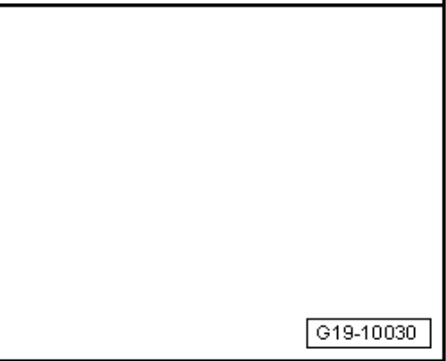
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
- Build up pressure with hand pump on cooling system tester.
- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.
- Renew filler cap if pressure relief valve does not open as described.



1.3 Draining and filling cooling system



Special tools and workshop equipment required

V.A.G 1274/8 	VAS 6096 
VAS 6208 	VAS 6362 
T10007 A 	

G19-10030

- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Cooling system charge unit - VAS 6096- with -VAS 6096/1-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Refractometer - T10007 A-



Draining



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.*

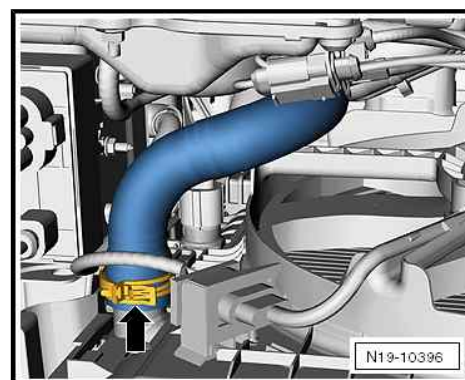
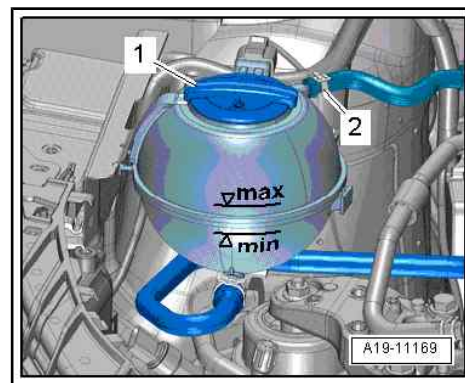
- Open filler cap -1- on coolant expansion tank.



Note

Disregard -item 2-.

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Release hose clip -arrow- and detach coolant hose (bottom left) from radiator.



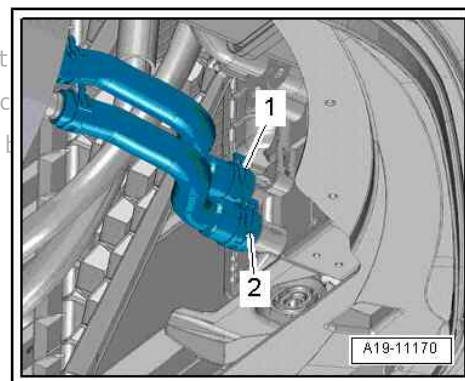
- Release hose clips -1 and 2- and disconnect coolant hoses (bottom right) from low-temperature radiator for charge air system.

Filling



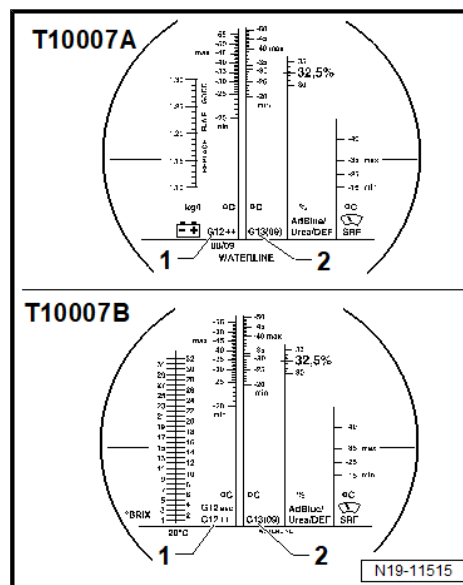
Caution

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



**Note**

- ◆ *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- ◆ *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . If you use other coolant additives, this can significantly impair in particular the corrosion protection effect. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- ◆ *Coolant with the recommended mixture ratio prevents frost and corrosion damage and stops scaling. At the same time it raises the boiling point of the fluid in the system. For this reason the cooling system must be filled all year round with the correct coolant additive.*
- ◆ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *Refractometer - T10007A- or refractometer - T10007B- MUST be used to determine the current level of frost protection.*
- ◆ *Scale -1- on the refractometer applies to coolant additives G12 ++ and G12evo.*
- ◆ *Scale -2- on the refractometer applies to coolant additive G13.*
- ◆ *If more than one type of coolant additive has been used: Always use the scale for G13 to determine the anti-freeze protection.*
- ◆ *The mixture must guarantee frost protection down to at least -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze should only be increased if greater frost protection is required in very cold climates. This must only be down to -48 °C, however, as otherwise the cooling efficiency of the coolant is impaired.*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be provided to at least -25 °C.*
- ◆ *The temperature indicated on the refractometer corresponds to the temperature at which the first ice crystals can form in the coolant.*
- ◆ *Do not reuse coolant.*
- ◆ *Only use water/coolant additive as a lubricant for coolant hoses.*

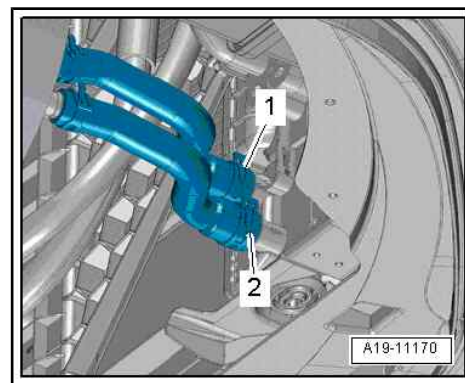
**Recommended mixture ratio for coolant**

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

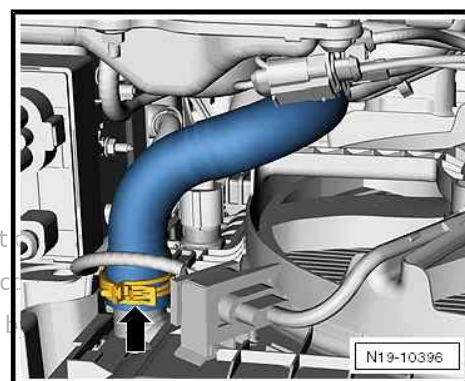


Procedure

- Connect coolant hoses to low-temperature radiator for charge air system with hose clips -1, 2-.



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



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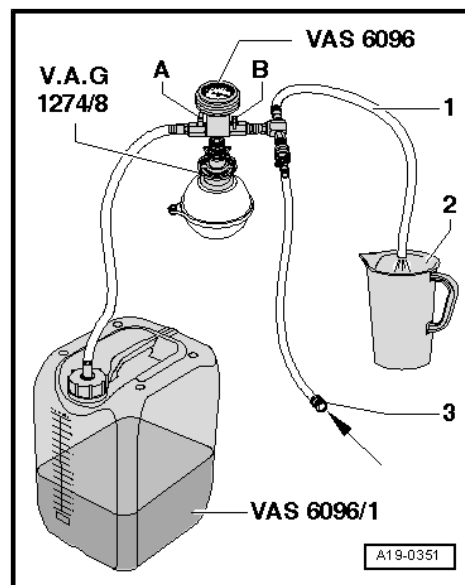
- Fill reservoir of -VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio).
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-.



Note

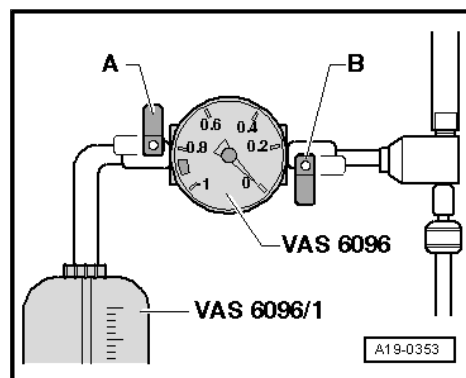
The vented air draws along a small amount of coolant, which should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -3- to compressed air supply.
- Pressure: 7 ... 10 bar.



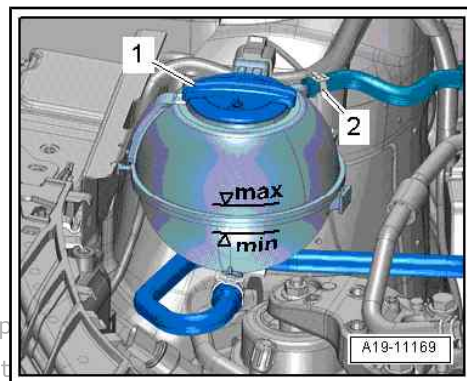


- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump continues to generate a partial vacuum in the cooling system; the needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.



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.
- Top up coolant to “max” mark.
- Start engine and run for 2 minutes (maximum) at approx. 1500 rpm.
- Top up coolant to overflow hole on expansion tank with engine running.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Close filler cap -1- on coolant expansion tank (make sure it engages).
- Allow engine to run at idling speed until both large coolant hoses at radiator become warm.
- Switch off ignition and allow engine to cool down.
- Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



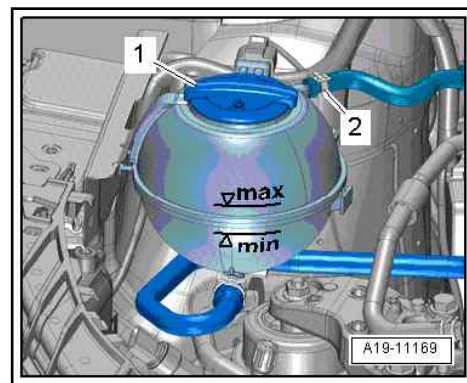


- Check coolant level.
- The coolant level must be between the “min” and “max” markings when the engine is cold.
- The coolant level can be at the “max” marking when the engine is warm.
- Top up with coolant again if necessary.



Note

Disregard items -1 and 2-



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2 Coolant pump/thermostat assembly

⇒ ["2.1 Exploded view - coolant pump", page 148](#)

⇒ ["2.2 Removing and installing electric coolant pump", page 148](#)

⇒ ["2.3 Removing and installing coolant pump", page 150](#)

⇒ ["2.4 Removing and installing coolant pump pulley", page 150](#)

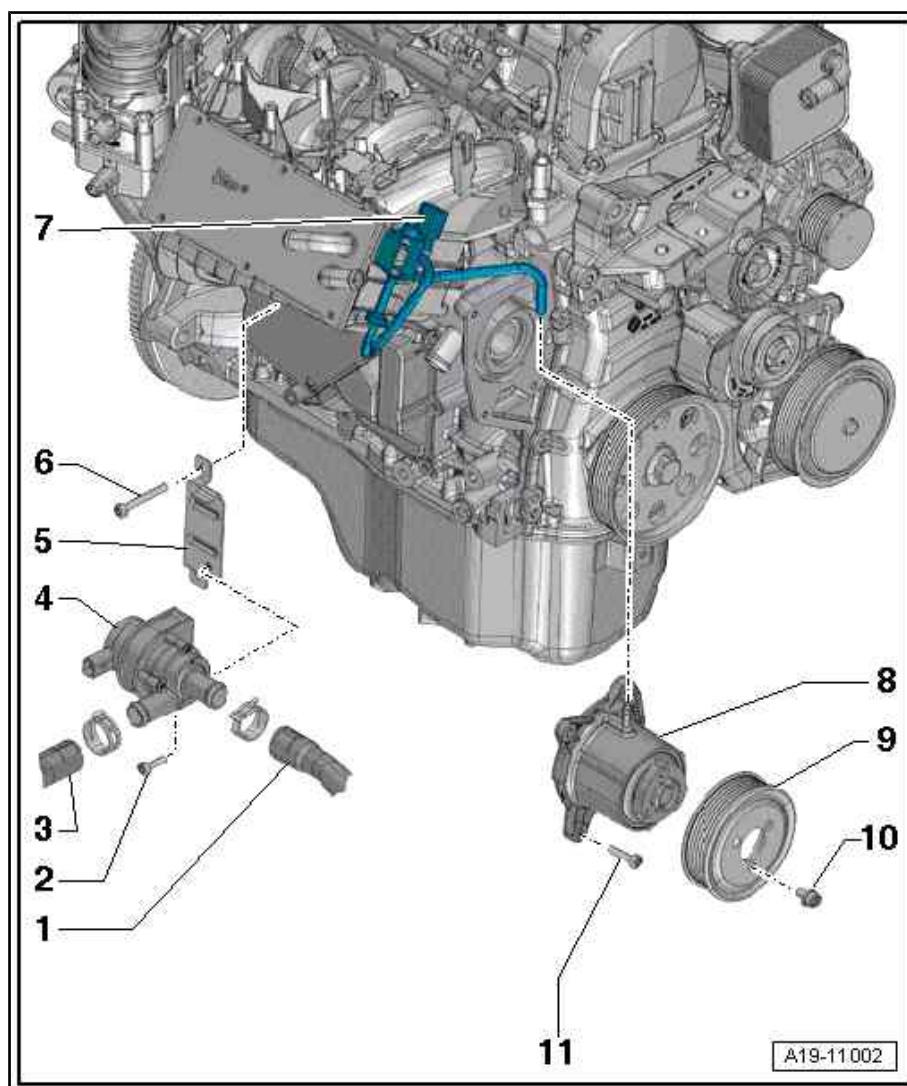
⇒ ["2.5 Removing and installing coolant temperature sender G62", page 151](#)

⇒ ["2.6 Removing and installing radiator outlet coolant temperature sender G83", page 152](#)

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2.1 Exploded view - coolant pump

- 1 - Coolant hose
- 2 - Bolt
 - 9 Nm
- 3 - Coolant hose
- 4 - Continued coolant circulation pump - V51-
 - Removing and installing
⇒ [page 148](#)
- 5 - Bracket
- 6 - Bolt
 - 9 Nm
- 7 - Solenoid for coolant circuit - N492-
- 8 - Coolant pump
 - With integral seal
 - Removing and installing
⇒ [page 150](#)
- 9 - Poly V-belt pulley
 - For coolant pump
 - Removing and installing
⇒ [page 150](#)
- 10 - Bolt
 - 20 Nm
- 11 - Bolt
 - 9 Nm



2.2 Removing and installing electric coolant pump

Special tools and workshop equipment required

- 3094
- 
- W00-11130

- VAS 6362**
- 
- W00-11227

- Clamp off coolant hoses -2- using hose clamps, up to 25 mm
- 3094- and detach from continued coolant circulation pump -
- V51-

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



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

- ## Tightening torques

-
- Diagram illustrating the engine cooling system components and connections:
- 1: Large blue hose connected to the water pump.
 - 2: Smaller blue hose connected to the water pump.
 - 3: Yellow hose connected to the water pump.
- Reference number: N19-10376



2.3 Removing and installing coolant pump

Removing

- Drain coolant ⇒ [page 141](#) .
- Remove poly V-belt pulley for coolant pump ⇒ [page 150](#) .
- Disconnect vacuum hose -1-.
- Remove bolts -arrows- and detach coolant pump.

Installing

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

- Install poly V-belt pulley for coolant pump ⇒ [page 150](#) .



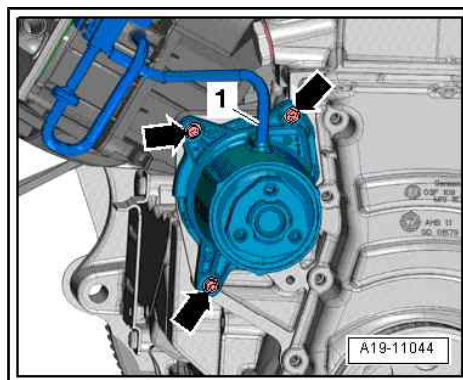
Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 143](#) .

Tightening torques

- ♦ ⇒ “2.1 Exploded view - coolant pump”, [page 148](#)

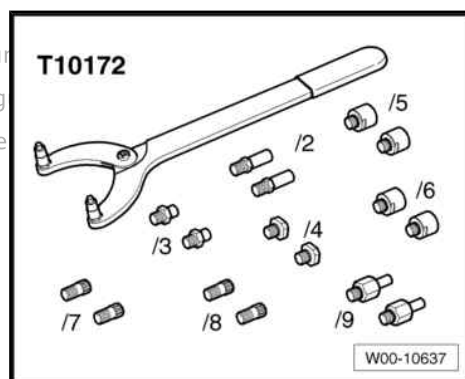


2.4 Removing and installing coolant pump pulley

Special tools and workshop equipment required

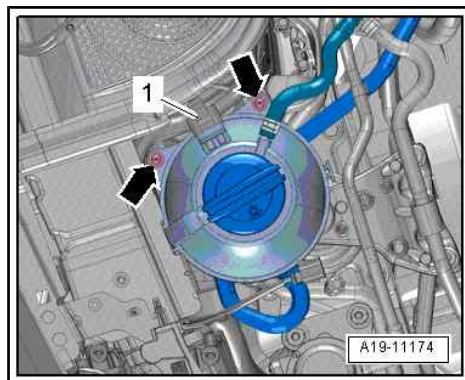
- ♦ Counterhold tool - T10172 A- with adapters -T10172/7-

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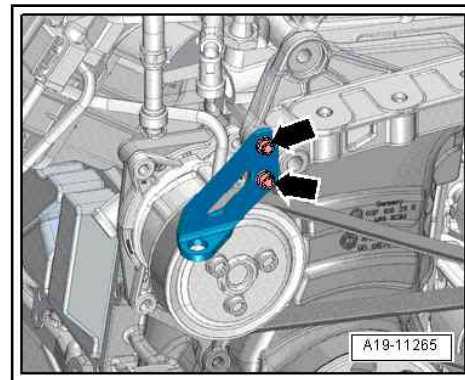
Removing

- Remove bolts -arrows-.
- Unplug electrical connector -1- for coolant shortage indicator switch - F66- and move coolant expansion tank to side.
- Remove poly V-belt ⇒ [page 37](#) .





- Remove bolts -arrow- and detach bracket from engine support.



- Loosen bolts on poly V-belt pulley for coolant pump using counterhold tool - T10172 A- with adapter -T10172/7- .
- Remove bolts and take off poly V-belt pulley.

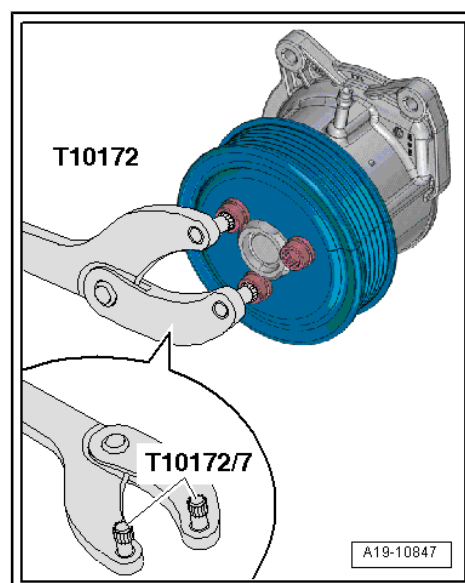
Installing

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

- Install poly V-belt ➔ [page 37](#) .

Tightening torques

- ◆ ➔ [“2.1 Exploded view - coolant pump”, page 148](#)
- ◆ ➔ [“2.1 Exploded view - assembly mountings”, page 29](#)



2.5 Removing and installing coolant temperature sender - G62-

Removing

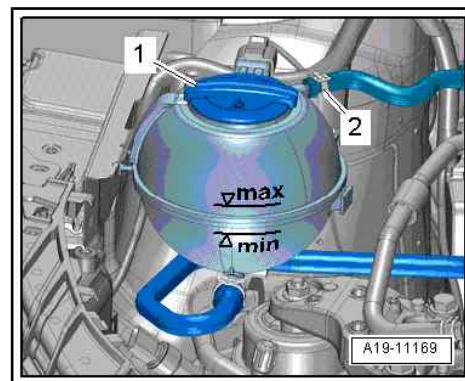
- Engine cold.
- Open filler cap -1- on coolant expansion tank briefly to relieve residual pressure in cooling system.



Note

Disregard -item 2-.

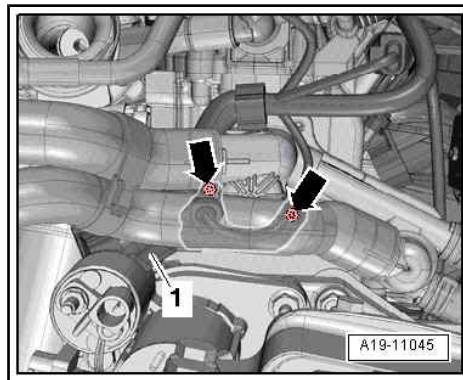
- Remove air cleaner housing ➔ [page 188](#) .



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- Remove bolts -arrows-.
- Push bracket -1- for electrical wiring harness and coolant hoses to one side.



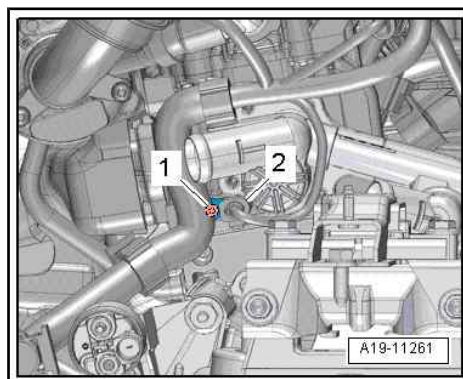
- Unplug electrical connector -2- at coolant temperature sender - G62- .



Note

Place a cloth underneath to catch escaping coolant.

- Unscrew bolt -1- and pull off coolant temperature sender - G62- .
- Use a small hook to remove O-ring and teflon ring, taking care not to damage sealing surface.



Installing

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



Note

Fit new O-ring.

- Install air cleaner housing ⇒ [page 188](#) .
- Check coolant level ⇒ [page 147](#) .

Tightening torques

- ♦ ⇒ ["3.1 Exploded view - coolant pipes", page 154](#)

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

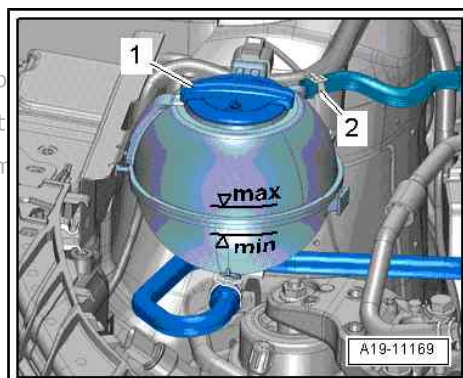
Removing

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



Note

Disregard -item 2-.





- Unplug electrical connector -arrow-.



Note

Place a cloth underneath to catch escaping coolant.

- Unscrew radiator outlet coolant temperature sender - G83- .

Installing

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

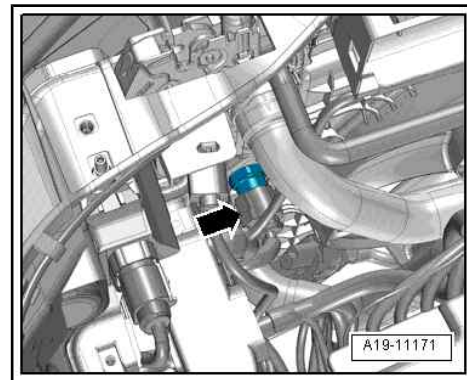


Note

- ◆ *Fit new O-ring.*
- ◆ *To avoid loss of coolant, screw in new radiator outlet coolant temperature sender - G83- immediately.*
- Check coolant level ⇒ [page 147](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiator/radiator fan”, page 159](#)



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3 Coolant pipes

⇒ ["3.1 Exploded view - coolant pipes", page 154](#)

⇒ ["3.2 Removing and installing coolant pipes", page 155](#)

3.1 Exploded view - coolant pipes



Note

The arrow markings on coolant pipes and on ends of hoses must align.

1 - Housing

- ☐ For thermostat
- ☐ Removing and installing
⇒ [page 156](#)

2 - Bolt

- ☐ 11 Nm

3 - Bracket

- ☐ For electrical wiring harness

4 - Bolt

- ☐ 9 Nm

5 - Gasket

- ☐ Renew

6 - Coolant temperature sender - G62-

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

7 - Bolt

- ☐ 9 Nm

8 - O-ring

- ☐ Renew

9 - Teflon ring

10 - Coolant pipe (right-side)

- ☐ Removing and installing
⇒ [page 155](#)

11 - Bolt

- ☐ 9 Nm

12 - Bolt

- ☐ 9 Nm

13 - Bolt

- ☐ 40 Nm

14 - Bracket

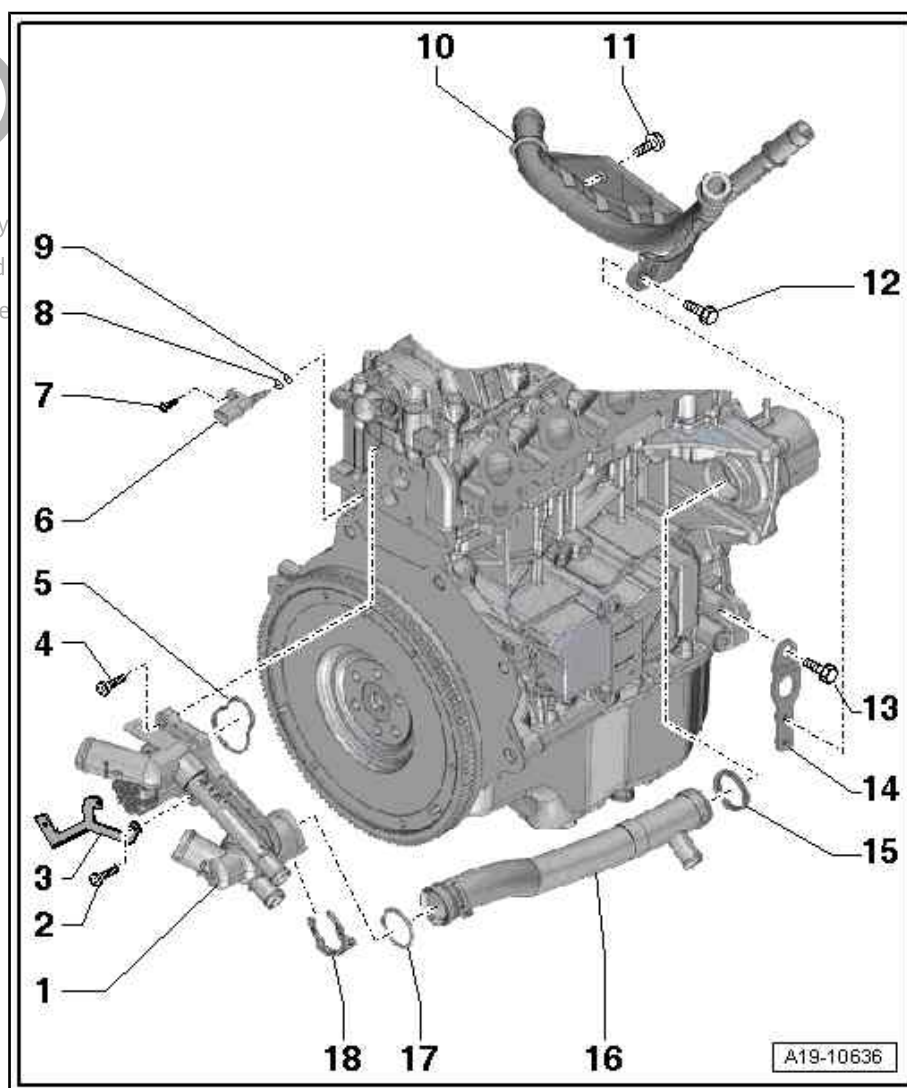
- ☐ For coolant pipe (right-side)

15 - Seal

- ☐ Renew

16 - Coolant pipe (rear)

- ☐ Removing and installing ⇒ [page 156](#)





17 - O-ring

- ☐ Renew

18 - Retaining clip

3.2 Removing and installing coolant pipes

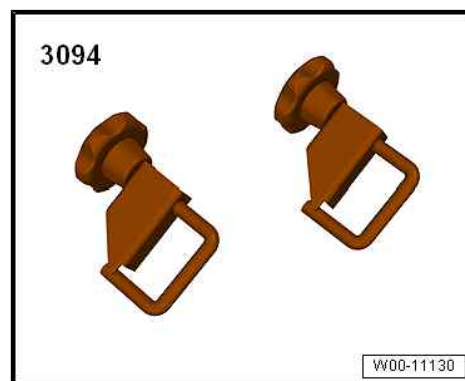
⇒ ["3.2.1 Removing and installing coolant pipe \(right-side\)", page 155](#)

⇒ ["3.2.2 Removing and installing rear coolant pipe with thermostat housing", page 156](#)

3.2.1 Removing and installing coolant pipe (right-side)

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - VAS 6362-



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Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Clamp off coolant hoses using hose clamps, up to 25 mm - 3094- , release hose clips -1 and 2- and disconnect hoses.
- Unscrew bolts -arrows- and remove coolant pipe (right-side).

Installing

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



Note

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

- Check coolant level ⇒ [page 147](#) .

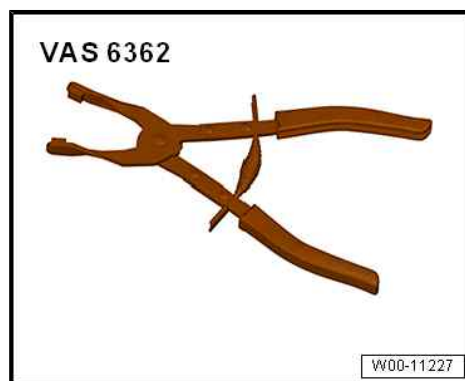
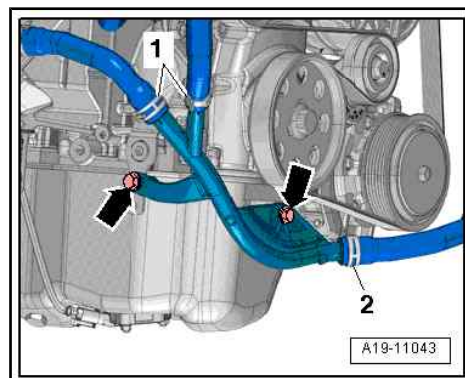
Tightening torques

- ♦ ⇒ [“3.1 Exploded view - coolant pipes”, page 154](#)
- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

3.2.2 Removing and installing rear coolant pipe with thermostat housing

Special tools and workshop equipment required

- ♦ Hose clip pliers - VAS 6362-



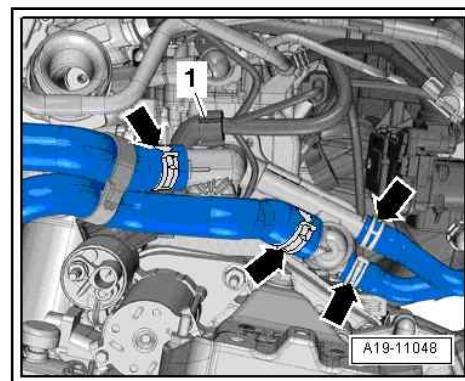
Removing

- Drain coolant ⇒ [page 141](#) .
- Remove air cleaner housing ⇒ [page 188](#) .

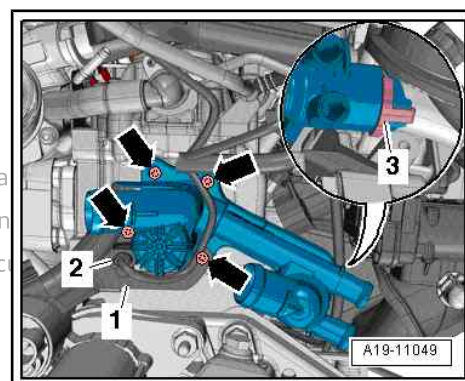
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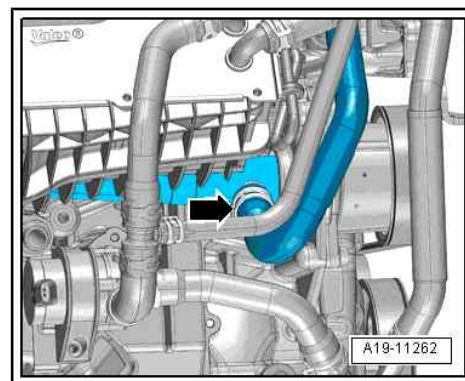
- Release hose clips -arrows- and detach coolant hoses.
- Move electrical wiring harness -1- clear.



- Unplug electrical connector -2- at coolant temperature sender - G62- .
- Pull off retaining clip -3-.
- Remove bolts -arrows- and move bracket -1- clear to one side.
- Detach thermostat housing from rear coolant pipe.



- Release hose clip -arrow- and disconnect coolant hose from rear coolant pipe.



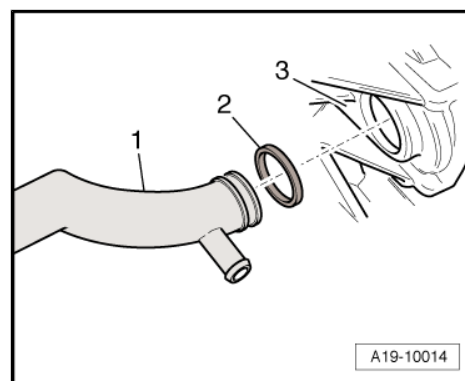
- Detach rear coolant pipe -1- from cylinder block -3-.

Installing



Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Clean and smoothen sealing surfaces for seal -2-.
- Lubricate seal lightly with coolant.





- After securing thermostat housing, move coolant pipe up against housing as far as stop and only then insert retaining clip -arrow-.
- Check that coolant pipe is firmly secured in thermostat housing.

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

- Install air cleaner housing ⇒ [page 188](#) .



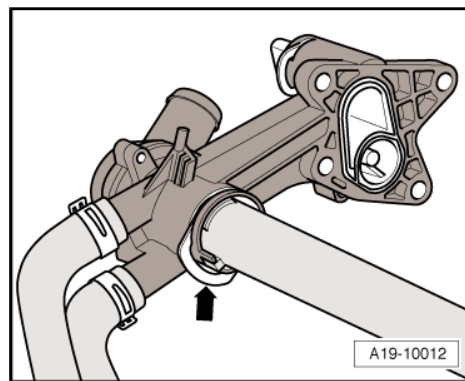
Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 143](#) .

Tightening torques

- ♦ ⇒ [“3.1 Exploded view - coolant pipes”, page 154](#)



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4 Radiator/radiator fan

⇒ "4.1 Exploded view - radiator/radiator fan", page 159

⇒ "4.2 Removing and installing radiator", page 160

⇒ "4.4 Removing and installing radiator fan", page 164

⇒ "4.3 Removing and installing radiator cowl", page 163

4.1 Exploded view - radiator/radiator fan

Radiator

1 - Coolant hoses

- ☐ For coolant circuit for charge air cooler

2 - Air duct

3 - Low-temperature radiator for charge air system

- ☐ Removing and installing
⇒ [page 160](#)

4 - Coolant hose (bottom)

5 - Radiator outlet coolant temperature sender - G83-

- ☐ Removing and installing
⇒ [page 152](#)
- ☐ 35 Nm

6 - Seal

- ☐ Renew

7 - Coolant hose (top)

8 - Air duct

9 - Coolant hose

- ☐ To coolant expansion tank

10 - Radiator

- ☐ Removing and installing
⇒ [page 160](#)

11 - Condenser

- ☐ For vehicles with air conditioner
- ☐ Removing and installing
⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser

12 - Bolt

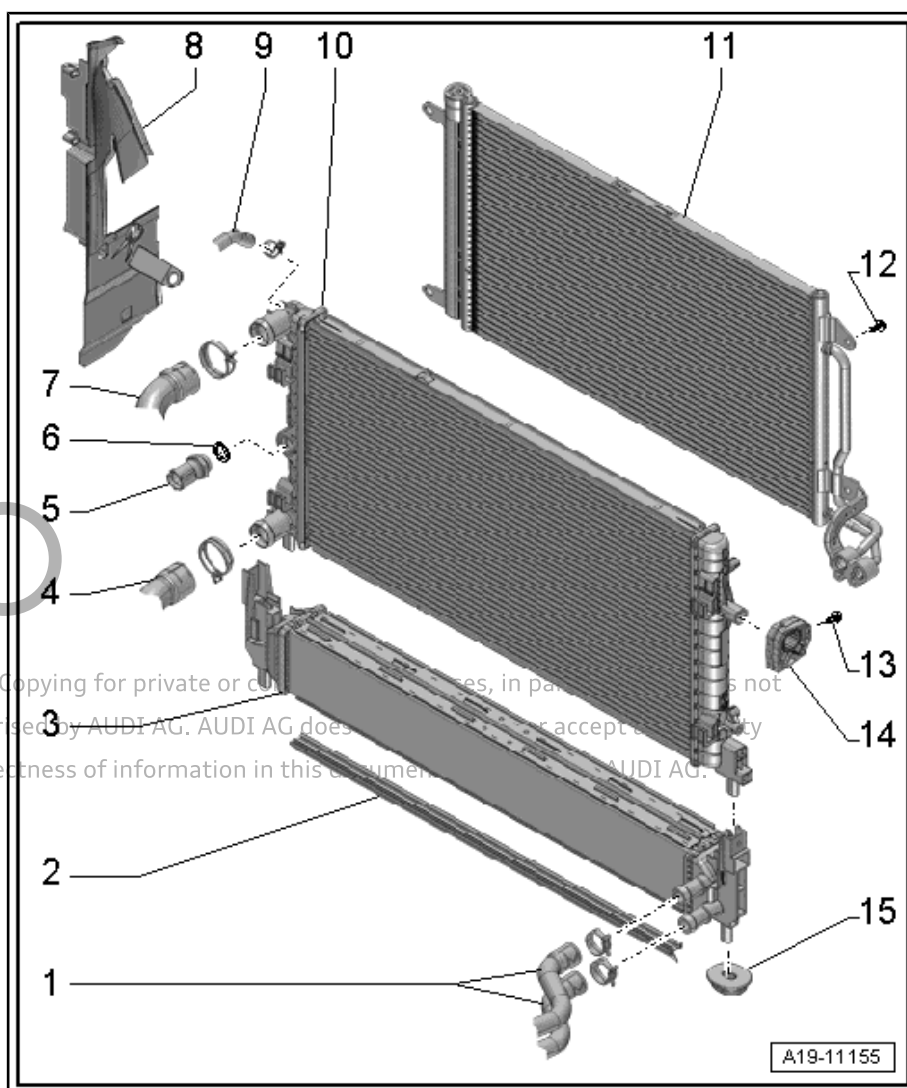
- ☐ Tightening torque ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Exploded view - condenser

13 - Bolt

- ☐ 5 Nm

14 - Bracket

- ☐ For radiator
- ☐ Note installation position





15 - Bracket

- ☐ For low-temperature radiator for charge air system

Radiator cowl and radiator fan

1 - Radiator cowl

- ☐ Removing and installing
⇒ [page 163](#)

2 - Bolt

- ☐ 1.5 Nm

3 - Heat shield

4 - Nut

- ☐ 9 Nm

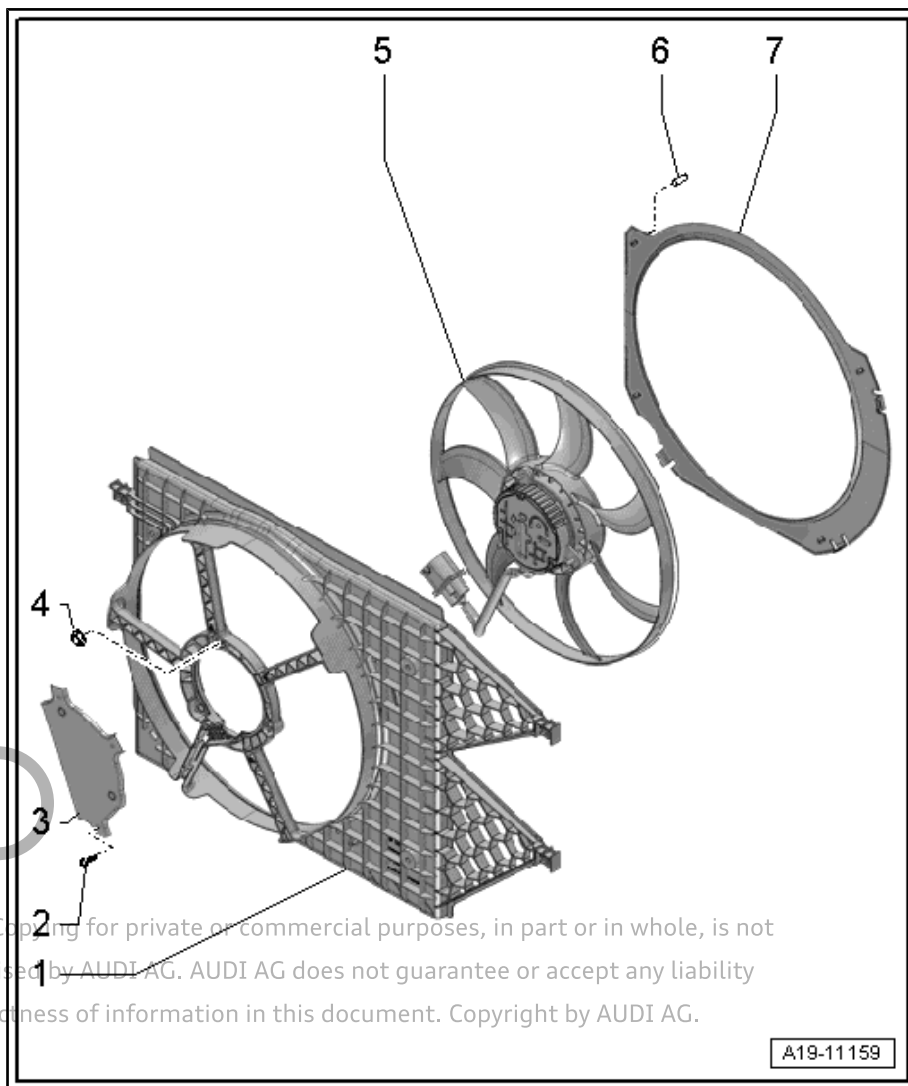
5 - Radiator fan - V7-

- ☐ With radiator fan control unit - J293-
- ☐ Removing and installing
⇒ [page 164](#)

6 - Pin

7 - Trim

- ☐ For radiator fan



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4.2 Removing and installing radiator



Note

Radiator and low-temperature radiator for charge air system must be removed and installed together.

Special tools and workshop equipment required



- ◆ Drip tray for workshop hoist - VAS 6208-

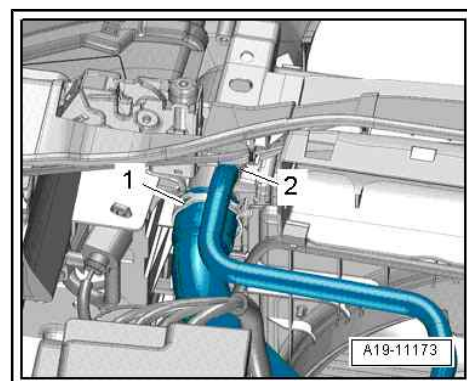
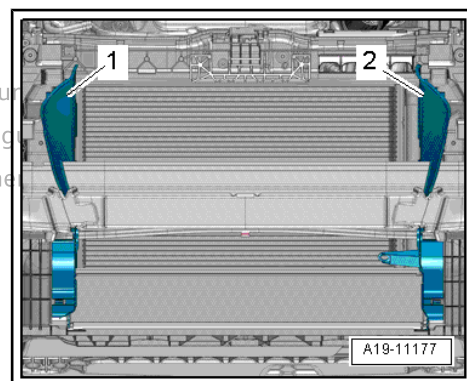


- ◆ Hose clip pliers - VAS 6362-



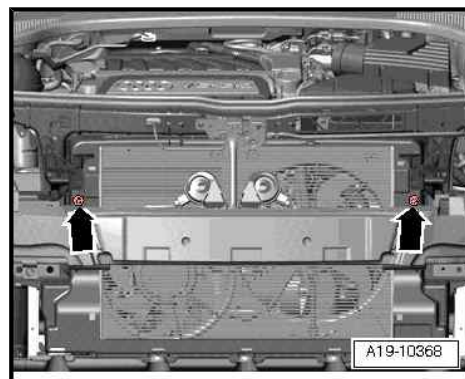
Removing

- Remove radiator cowl ⇒ [page 163](#) .
- Drain coolant ⇒ [page 141](#) .
- Remove bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .
- Release fasteners and detach air ducts -1 and 2-.
- Release hose clips -1 and 2- and detach coolant hoses (top left) from radiator.





- Remove bolts -arrows-.
- Swivel top edge of radiator slightly to rear.
- Lift radiator, disengage it from bottom mounting points and press it to the rear.



Vehicles with air conditioner:



WARNING

Risk of injury caused by refrigerant.

- ◆ *The air conditioner refrigerant circuit must not be opened.*

- Remove bolts -arrows-.

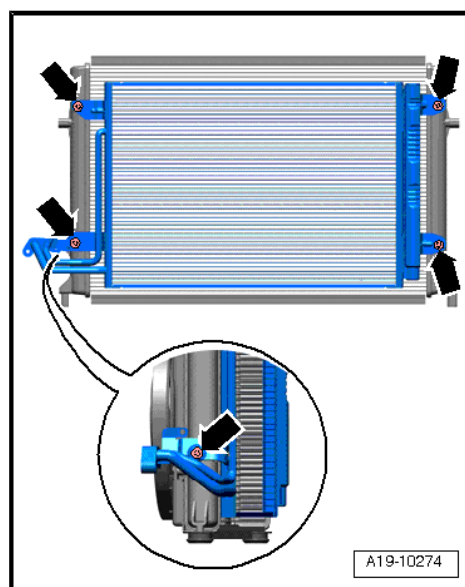


Caution

Risk of damage to refrigerant lines and hoses

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

- Move condenser to front and place in lock carrier, then secure with cable ties to prevent from dropping.



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All vehicles (continued):

- Release fasteners at water radiator for charge air cooler -1- -arrows A-.
- Pull low-temperature radiator for charge air system off radiator -2- -arrow B- and disengage -arrow C-.
- Remove both radiators.

Installing

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

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Note

- ♦ If there are slight impressions on the fins, refer to [⇒ page 6](#).
- ♦ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
- Vehicles with air conditioning: Install condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser.
- Install bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover.
- Install radiator cowl [⇒ page 163](#).



Note

Do not reuse coolant.

- Fill up with coolant [⇒ page 143](#).

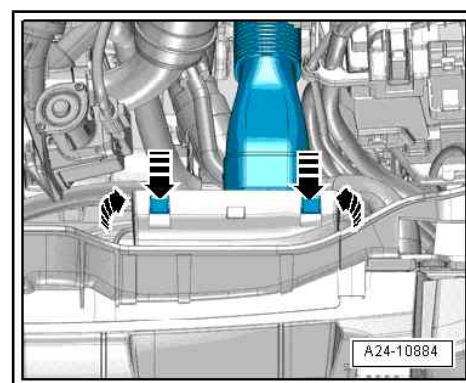
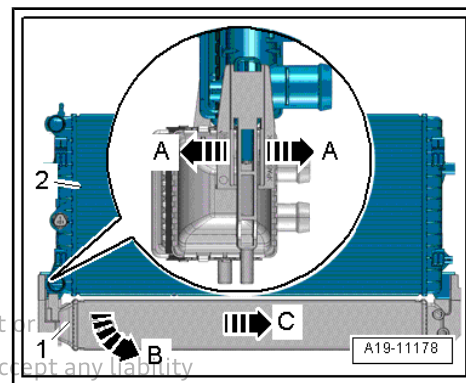
Tightening torques

- ♦ [⇒ "4.1 Exploded view - radiator/radiator fan", page 159](#)

4.3 Removing and installing radiator cowl

Removing

- Unclip air duct at lock carrier -arrows-.





- Unscrew bolts -arrows- from lock carrier and detach air duct.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



WARNING

Risk of injury as the radiator fans may start up automatically.

- ◆ ***Unplug electrical connectors before performing work on radiator cowl.***

- Unplug electrical connector -1- for radiator fan at bottom of radiator cowl.
- Press locking tabs on left and right sides of radiator cowl together -arrow- and lift radiator cowl off radiator.

Installing

Installation is carried out in reverse sequence.

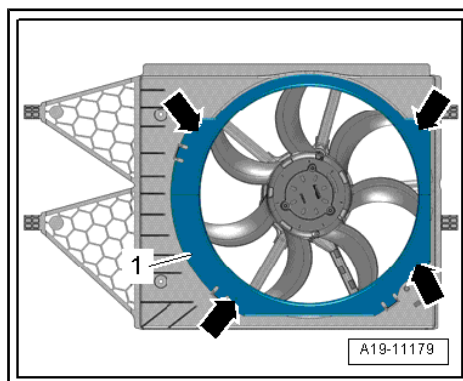
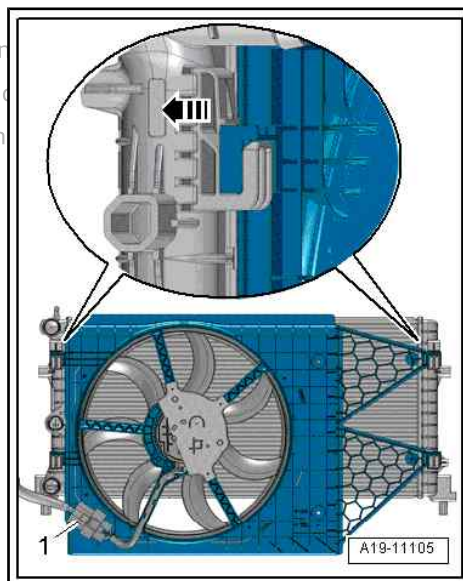
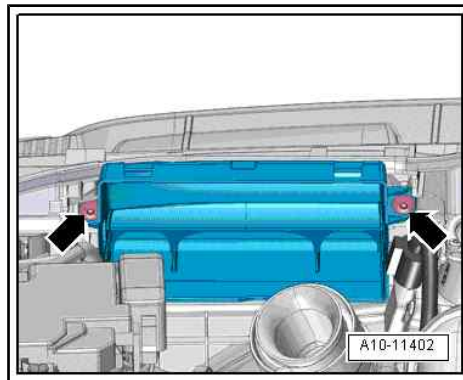
Tightening torques

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

4.4 Removing and installing radiator fan

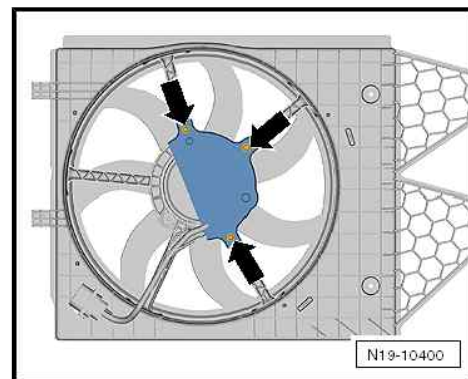
Removing

- Remove radiator cowl ⇒ [page 163](#) .
- Press out clamping pins -arrows- and detach ring -1- of fan.





- Remove bolts -arrows- and detach heat shield.



- Take electrical wiring -1- out of cable guide.
- Unscrew nuts -arrows- and detach radiator fan - V7- .

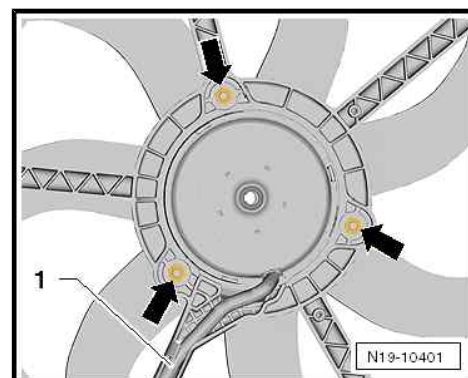
Installing

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

- Install radiator cowl ⇒ [page 163](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiator/radiator fan”, page 159](#)





21 – Turbocharging/supercharging

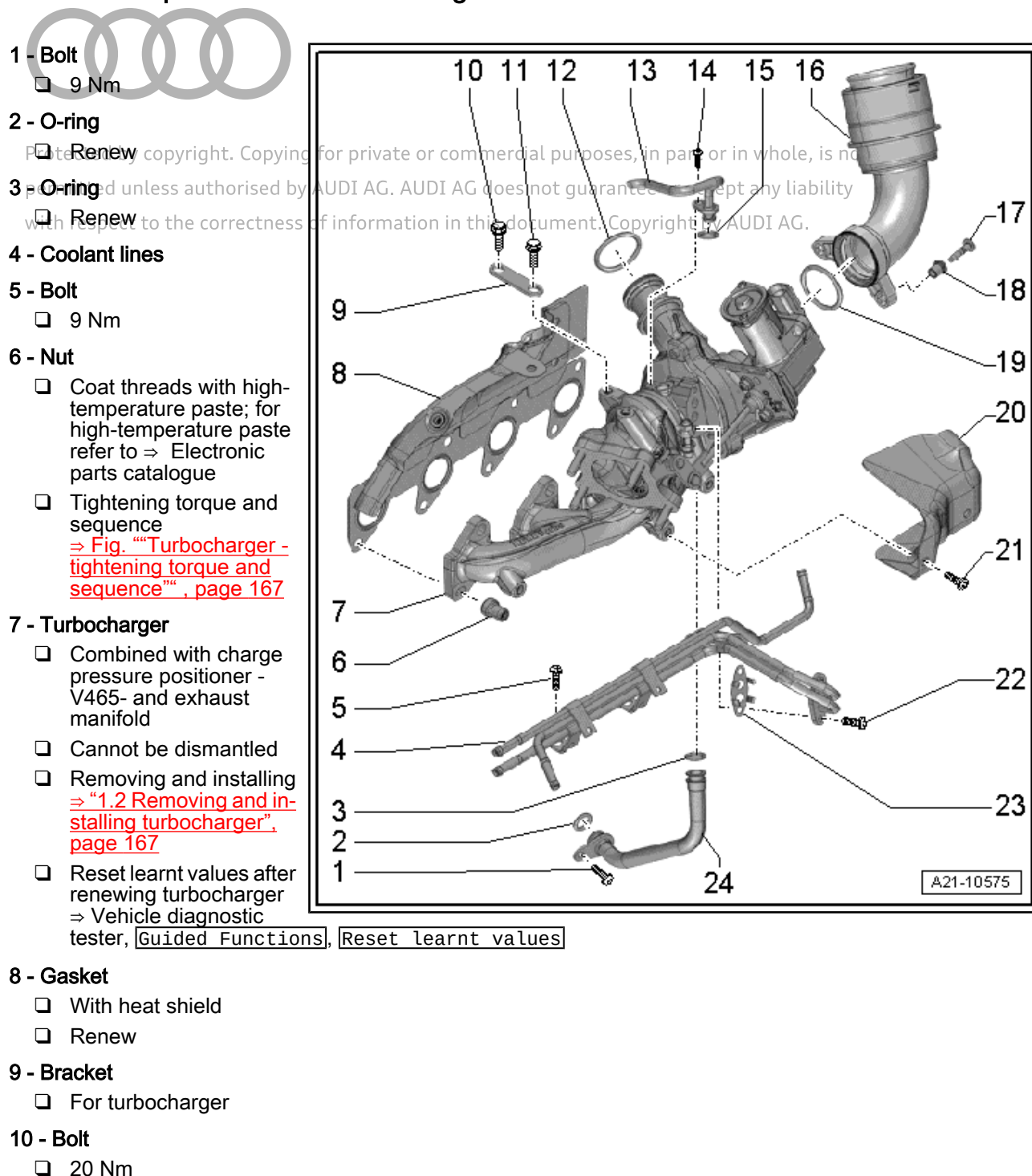
1 Turbocharger

⇒ [“1.1 Exploded view - turbocharger”, page 166](#)

⇒ [“1.2 Removing and installing turbocharger”, page 167](#)

⇒ [“1.3 Removing and installing charge pressure positioner V465”, page 171](#)

1.1 Exploded view - turbocharger





11 - Bolt

- ☐ 20 Nm

12 - O-ring

- ☐ Renew

13 - Oil supply line

14 - Bolt

- ☐ 9 Nm

15 - O-ring

- ☐ Renew

16 - Pulsation damper

17 - Bolt

- ☐ 9 Nm

18 - Sleeve

19 - O-ring

- ☐ Renew

20 - Heat shield

21 - Bolt

- ☐ 8 Nm

22 - Bolt

- ☐ 9 Nm

23 - Gasket

- ☐ Renew

24 - Oil return pipe

Turbocharger - tightening torque and sequence

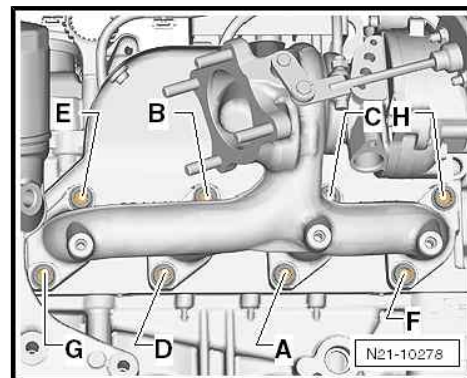


Note

Renew nuts.

- Tighten nuts in 4 stages in the sequence shown:

Stage	Nuts	Tightening torque
1.	-A ... H-	Screw in by hand until contact is made
2.	-A ... H-	18 Nm
3.	-A ... H-	Re-tighten to 12 Nm
4.	-A ... H-	Re-tighten to 12 Nm



Note

This tightening sequence has been specified in order to compensate for the settling of the joints.

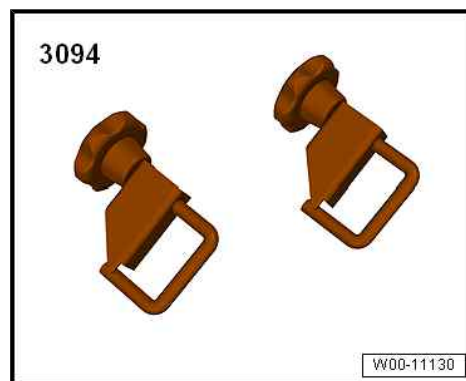
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1.2 Removing and installing turbocharger

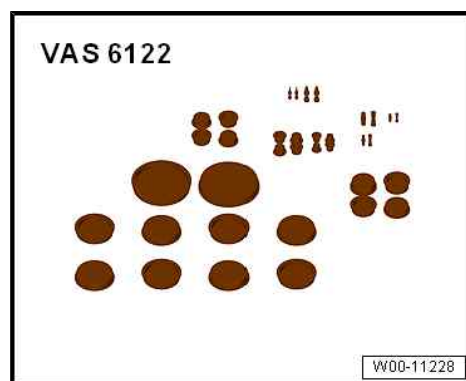
Special tools and workshop equipment required



- ◆ Hose clamps up to 25 mm - 3094-

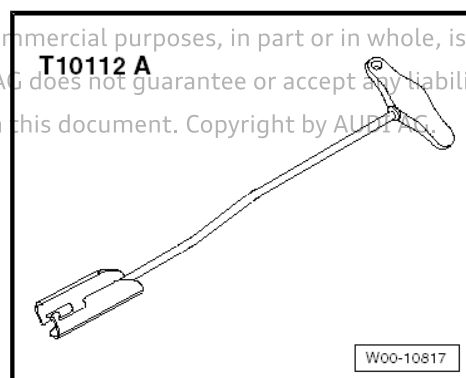


- ◆ Engine bung set - VAS 6122-



- ◆ Puller - T10112 A-

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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:

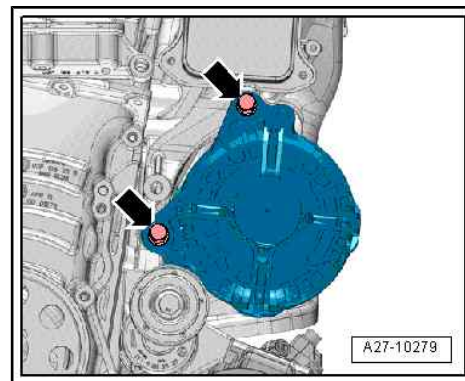
- ◆ Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.
- ◆ Check the entire charge air system (including the charge air cooler) for foreign matter.
- ◆ If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.



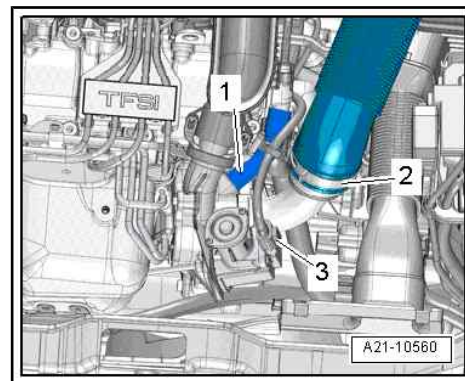
i Note

Observe rules for cleanliness ⇒ [page 4](#) .

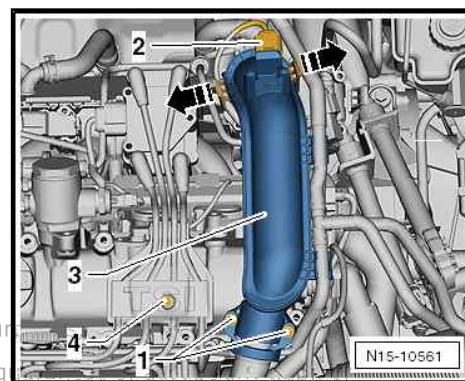
- Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Remove top bolt -top arrow- and push alternator downwards.
- Remove catalytic converter ⇒ [page 222](#) .



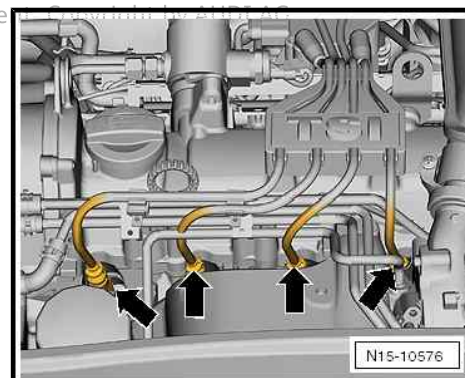
- Disconnect crankcase breather hose -1-.
- Release hose clip -2- and detach air hose.
- Unplug electrical connector -3-.



- Remove bolts -1- and detach retaining bracket.
- Unplug electrical connector -2- on charge pressure sender - G31- / intake air temperature sender 2 - G299- and move clear electrical wiring.
- Release retainers -arrows- and detach air pipe -3- first from throttle valve module - J338- and then from turbocharger.
- Fold open cover -4- and remove bolt behind it.



- Pull off spark plug connectors -arrows- using puller - T10112 A- and move ignition cables back towards rear.



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- Remove banjo bolt -2-.
- Remove bolt -3- and detach oil supply line.



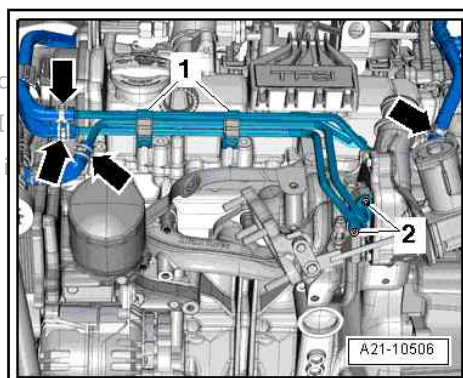
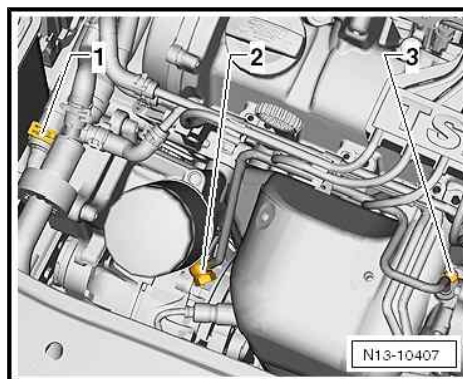
Note

Disregard -item 1-.

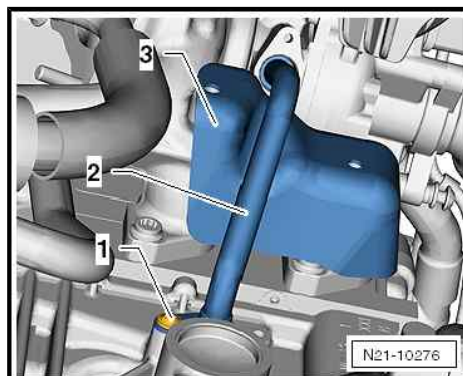


- Clamp off coolant hoses using hose clamps up to 25 mm - 3094- , release hose clips -arrows- and disconnect hoses.
- Unscrew bolts -1 and 2- and detach coolant pipes.

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- Unscrew bolt -1- and pull oil return line -2- out of turbocharger.
- Unscrew bolt for heat shield -3- and detach heat shield.





- Slacken nuts in the sequence: -H ... A-.
- Remove nuts and detach turbocharger with exhaust manifold.
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .

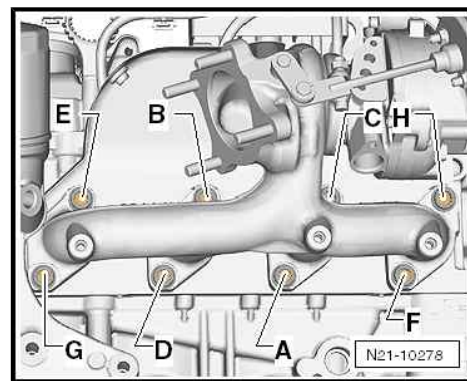
Installing

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



Note

- ◆ *Renew seals, gaskets, O-rings and self-locking nuts.*
- ◆ *Fill turbocharger with engine oil at connection for oil supply line.*
- ◆ *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 .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
- ◆ *After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.*



- Install catalytic converter ⇒ [page 222](#) .
- Check oil level ⇒ Maintenance ; Booklet 819 .
- Observe notes on procedure for connecting the battery ⇒ Electrical system; Rep. gr. 27 .
- Check coolant level ⇒ [page 147](#) .
- Reset learnt values after renewing turbocharger with charge pressure positioner - V465- ⇒ Vehicle diagnostic tester, Guided Functions, Reset learnt values

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - oil filter/oil pressure switch”, page 132](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 166](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 174](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator

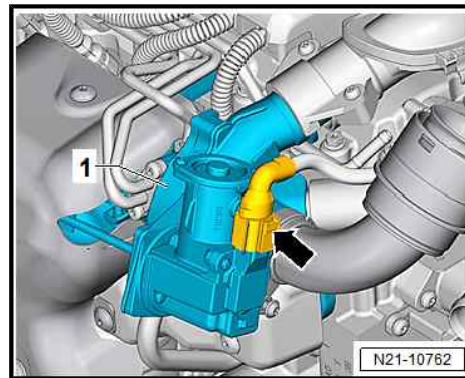
1.3 Removing and installing charge pressure positioner - V465-

Removing

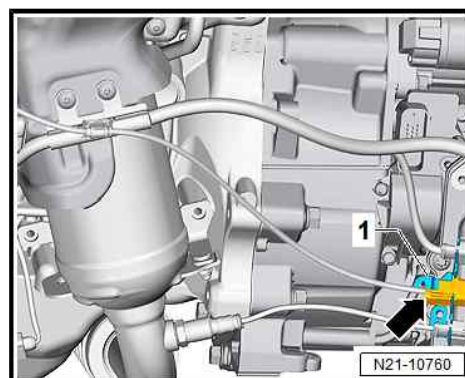
- Check if a spacer is installed before removing or renewing the charge pressure positioner - V465- .
- Please refer to the current TPI for information on whether a spacer has to be installed and, if so, which type.
- Switch off ignition.



- Unplug connector -arrow- from charge pressure positioner - V465- -1-.



- Unplug electrical connector -arrow- for Lambda probe - G39- -1- and unclip it from bracket -1-.

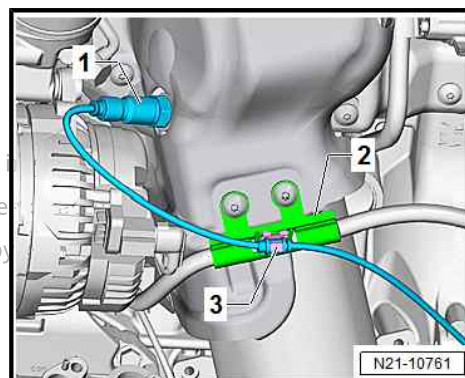


- Unclip electrical wire for Lambda probe - G39- -1- from bracket -3-.

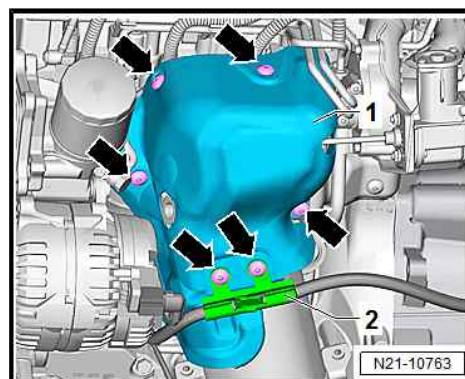
- Remove Lambda probe - G39- -1-

⇒ ["7.2.1 Removing and installing Lambda probe G39."](#), [page 211](#).

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- Remove securing bolts -arrows-.
- Push heat shield -1- for turbocharger to side so that control rod is accessible.
- Wiring retainer -2- remains in installation position.





- Detach securing clip -3- from control rod connection to turbo-charger -2-.
- Remove nuts -arrows- and detach charge pressure positioner - V465- -1-.
- If fitted, remove spacer -4-.



Note

- ◆ One or two spacers may be fitted.
- ◆ For greater clarity, the heat shield is not illustrated.

Installing

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

- Secure charge pressure positioner - V465- with new nuts.

Fit new securing clip -3-.

- Adapt engine control unit - J623- to charge pressure positioner - V465- ➔ Vehicle diagnostic tester; , “Guided Functions” .
- If necessary, insert spacer -2-.



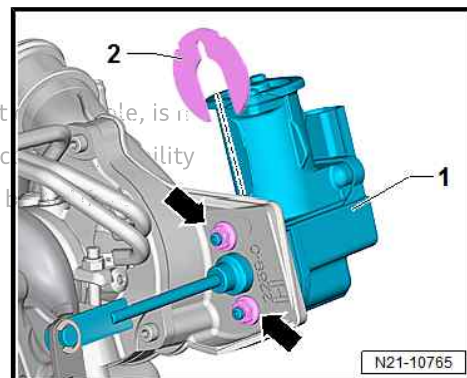
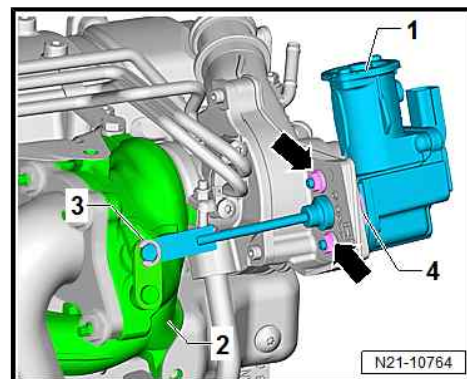
Note

For greater clarity, the heat shield is not illustrated.

Only fit new securing nuts -arrows- after performing adaption in
➔ Vehicle diagnostic tester; “Guided Functions” mode.

Tightening torques

- ◆ ➔ [“1.1 Exploded view - turbocharger”, page 166](#)
- ◆ ➔ [“7.1 Exploded view - Lambda probe”, page 211](#)





2 Charge air system

⇒ ["2.1 Exploded view - charge air system", page 174](#)

⇒ ["2.2 Removing and installing charge air cooler", page 175](#)

⇒ ["2.3 Removing and installing charge pressure sender G31 / intake air temperature sender 2 G299", page 176](#)

⇒ ["2.4 Checking charge air system for leaks", page 176](#)

2.1 Exploded view - charge air system

1 - Intake manifold

- ☐ Removing and installing
⇒ [page 191](#)

2 - Seal

- ☐ Renew

3 - Throttle valve module - J338-

- ☐ Removing and installing
⇒ [page 194](#)

4 - Retaining clip

5 - Bolt

- ☐ 7 Nm

6 - Support ring

- ☐ Renew

7 - O-ring

- ☐ Renew

8 - Air pipe

9 - Retaining bracket

10 - Bolt

- ☐ 5 Nm

11 - O-ring

- ☐ Renew

12 - Charge pressure sender - G31- / intake air temperature sender 2 - G299-

- ☐ Removing and installing
⇒ [page 176](#)

13 - Bolt

- ☐ 3 Nm

14 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

- ☐ Clipped on

15 - O-ring

- ☐ Renew

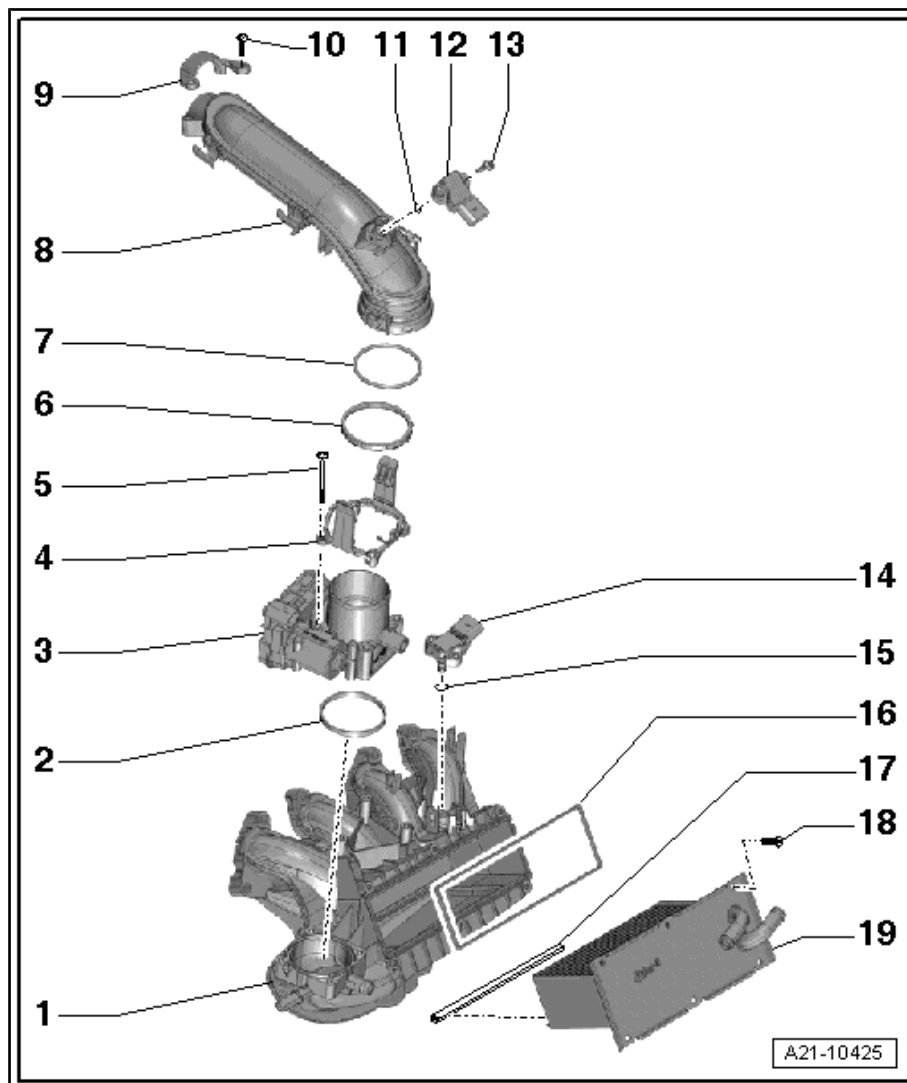
16 - Gasket

- ☐ Renew

17 - Sealing lip

18 - Bolt

- ☐ Screw in bolts initially by hand until they make contact





- 7 Nm

19 - Charge air cooler

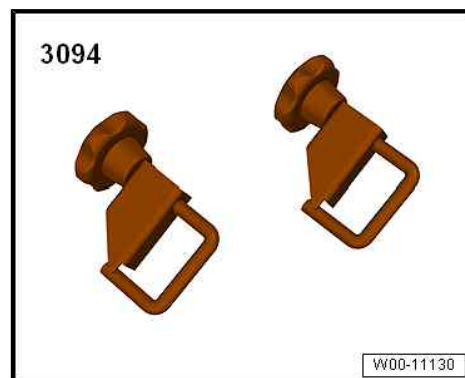
- Removing and installing ⇒ [page 175](#)

2.2 Removing and installing charge air cooler

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Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Drip tray for workshop hoist - VAS 6208-





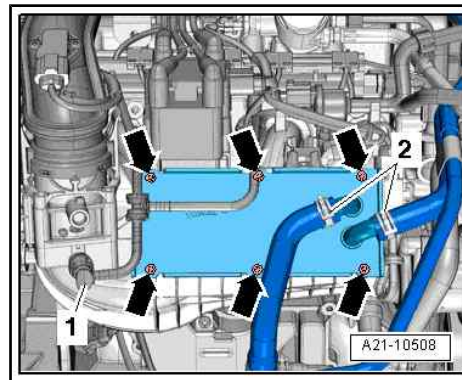
Removing



Note

Observe rules for cleanliness ➔ [page 4](#) .

- Disconnect pipe -1- leading to activated charcoal filter solenoid valve 1 - N80- by pressing release tabs.
- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Clamp off coolant hoses using hose clamps, up to 25 mm - 3094- , release hose clips -2- and disconnect hoses from charge air cooler.
- Remove bolts -arrows- and detach charge air cooler.



Note

For illustration purposes, the installation position is shown from the rear and with the engine removed.

Installing

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



Note

- ◆ Renew gasket and O-ring.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ *Electronic parts catalogue* .
- Check coolant level ➔ [page 147](#) .

2.3 Removing and installing charge pressure sender - G31- / intake air temperature sender 2 - G299-

Removing

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

Installing

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



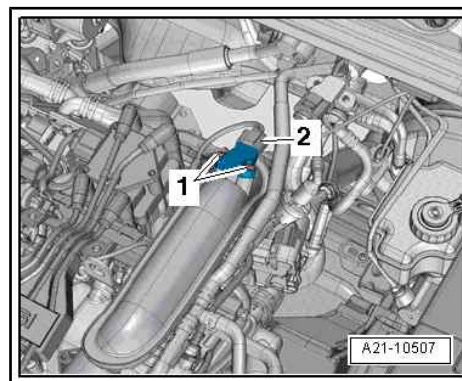
Note

Fit new O-ring.

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2.4 Checking charge air system for leaks

Special tools and workshop equipment required



- ◆ Charge air system tester - V.A.G 1687- with adapters -V.A.G 1687/10- and -V.A.G 1687/14-

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- ◆ Hose clip pliers - VAS 6362-



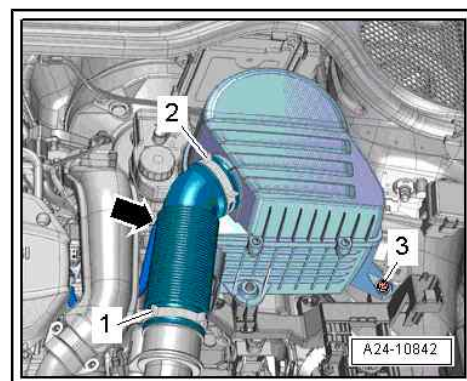
Procedure

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

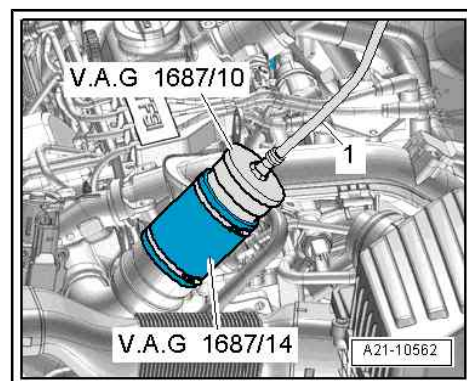


Note

Disregard -item 3-.



- Connect adapter - V.A.G 1687/10- with -V.A.G 1687/14- to turbocharger.
- Connect hose -1- of charge air system tester -V.A.G 1687- to adapter.





Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Make sure knob is pulled out before turning pressure control valve.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

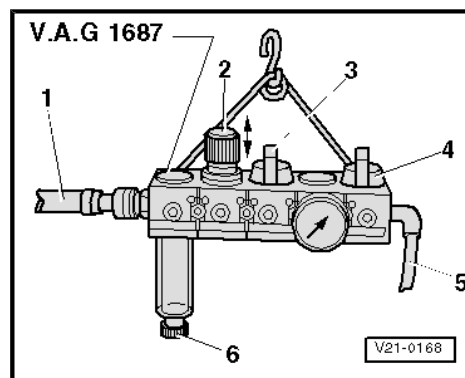
- Open valve -3-.



Caution

Risk of damage if pressure is set too high.

- ◆ *The pressure must not exceed 0.5 bar.*

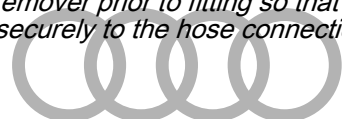


- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
- Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detection spray or use ultrasonic tester - V.A.G 1842- .



Note

- ◆ *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- ◆ *For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .*
- ◆ *Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*



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24 – Mixture preparation - injection

1 Injection system

⇒ "1.1 Overview of fitting locations - injection system",
page 179

1.1 Overview of fitting locations - injection system

Components A to F are not shown in the exploded view of components.

1 - Oil pressure switch - F1-

- ☐ Fitting location
⇒ [page 183](#)
- ☐ Removing and installing
⇒ [page 133](#)

2 - Solenoid for coolant circuit - N492-

- ☐ Fitting location
⇒ [page 183](#)

3 - Intake air temperature sender - G42- and intake manifold pressure sender - G71-

- ☐ Fitting location
⇒ [page 183](#)
- ☐ In standard production, intake air temperature sender - G42- is clipped on via retainer tabs (moulded onto intake manifold), but not bolted on. If a retainer tab should break off, intake air temperature sender - G42- can be secured with securing bolts

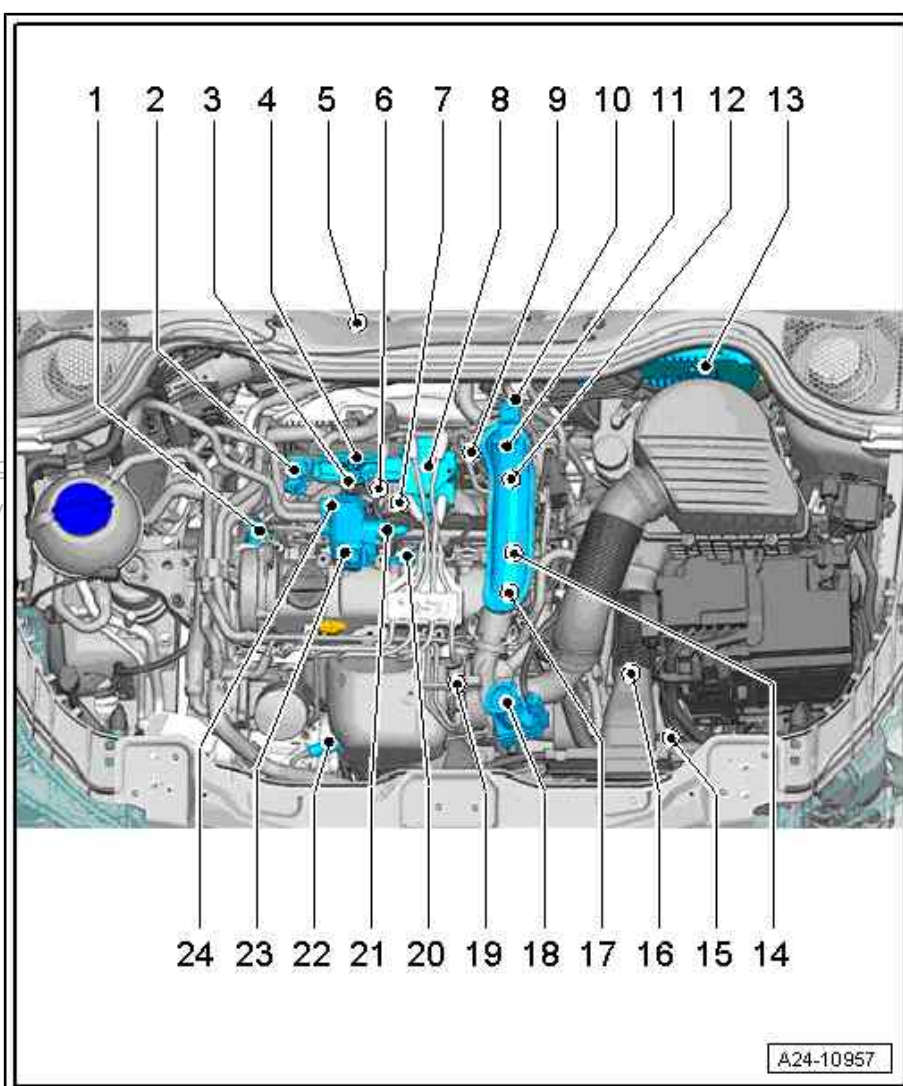
4 - Charge air cooler

6 - Continued coolant circulation pump - V51-

- ☐ Fitting location
⇒ [page 185](#)

7 - Knock sensor 1 - G61-

- ☐ Fitting location
⇒ [page 185](#)
- ☐ Removing and installing





⇒ [page 227](#)

- ☐ 20 Nm

8 - Ignition transformer - N152-

- ☐ Fitting location ⇒ [page 183](#)

9 - Throttle valve module - J338- , throttle valve drive for electric throttle - G186-

- ☐ Throttle valve drive angle sender 1 for electric throttle - G187- and throttle valve drive angle sender 2 for electric throttle - G188-
- ☐ After throttle valve module - J338- or engine control unit has been renewed, throttle valve module must be re-adapted to engine control unit - J623- using a vehicle diagnostic tester

10 - Vacuum sender - G608-

- ☐ Only installed on vehicles with dual clutch gearbox
- ☐ Removing and installing ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum sender - G608-

11 - Charge pressure sender - G31- / intake air temperature sender 2 - G299-

- ☐ Fitting location ⇒ [page 184](#)
- ☐ Removing and installing ⇒ [page 176](#)

12 - Engine speed sender - G28-

- ☐ Fitting location ⇒ [page 185](#)
- ☐ Removing and installing ⇒ [page 228](#)

13 - Engine control unit - J623-

- ☐ Fitting location ⇒ [page 181](#)
- ☐ Removing and installing ⇒ [page 215](#)

14 - Fuel pressure sender - G247-

- ☐ Fitting location ⇒ [page 183](#)
- ☐ Removing and installing ⇒ [page 203](#)

15 - Radiator outlet coolant temperature sender - G83-

- ☐ Fitting location ⇒ [page 184](#)
- ☐ Removing and installing ⇒ [page 152](#)

16 - Electrical connectors for Lambda probes

- ☐ Fitting location ⇒ [page 186](#)

17 - Coolant temperature sender - G62-

- ☐ Fitting location ⇒ [page 184](#)

18 - Charge pressure positioner - V465-

- ☐ Located directly on turbocharger ⇒ [page 186](#)
- ☐ Charge pressure positioner - V465- can only be renewed together with turbocharger
- ☐ Removing and installing turbocharger ⇒ [page 167](#)

19 - Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-

- ☐ Fitting location ⇒ [page 186](#)
 - ☐ Fitting location of electrical connector ⇒ [page 186](#)
 - ☐ Removing and installing ⇒ [page 212](#)
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20 - Hall sender - G40-

- ☐ Fitting location ⇒ [page 183](#)
- ☐ Removing and installing ⇒ [page 228](#)

21 - Fuel pressure regulating valve - N276-

- ☐ Fitting location ⇒ [page 183](#)



22 - Lambda probe - G39- and Lambda probe heater - Z19-

- ☐ Fitting location ➔ [page 186](#)
- ☐ Fitting location of electrical connector ➔ [page 186](#)
- ☐ Removing and installing ➔ [page 211](#)

23 - High-pressure pump with fuel pressure regulating valve - N276-

- ☐ Fitting location ➔ [page 183](#)
- ☐ Removing and installing ➔ [page 207](#)

24 - Activated charcoal filter solenoid valve 1 - N80-

- ☐ Fitting location ➔ [page 183](#)

A - Injectors

- ☐ Removing and installing ➔ [page 196](#)
- ☐ Injector, cylinder 1 - N30-
- ☐ Injector, cylinder 2 - N31-
- ☐ Injector, cylinder 3 - N32-
- ☐ Injector, cylinder 4 - N33-

B - Clutch position sender - G476-

- ☐ Only fitted on vehicles with manual gearbox
- ☐ Fitting location ➔ [page 182](#)
- ☐ Removing and installing ➔ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch position sender - G476-

C - Brake light switch - F- and brake pedal switch - F63-

- ☐ Fitting location ➔ [page 182](#)
- ☐ Removing and installing ➔ Brake system; Rep. gr. 45 ; Sensors; Removing and installing brake light switch

D - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ☐ Fitting location ➔ [page 182](#)
- ☐ On accelerator pedal (both senders are accommodated in one housing)
- ☐ If accelerator pedal module or engine control unit is renewed, kick-down function must be adapted on vehicles with automatic gearbox
- ☐ Removing and installing ➔ Fuel supply system, petrol engines; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-

E - Fuel pump control unit - J538-

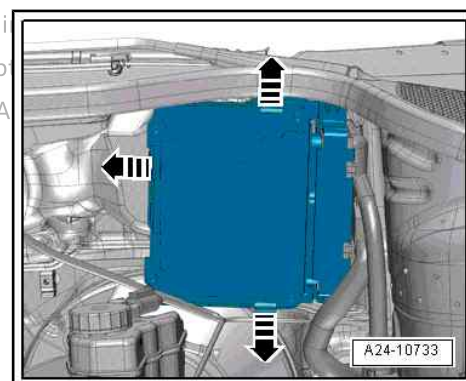
- ☐ Fitting location ➔ [page 182](#)
- ☐ Removing and installing ➔ Fuel supply system, petrol engines; Rep. gr. 20 ; Fuel pump; Removing and installing fuel pump control unit - J538-

F - Radiator fan control unit - J293- with radiator fan - V7-

- ☐ Removing and installing ➔ [page 164](#)

Engine control unit - J623-

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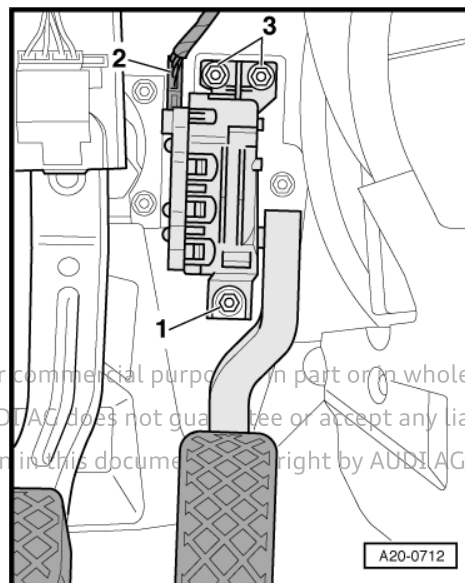


Accelerator position sender - G79- and accelerator position sender 2 - G185-

2 - Electrical connector for accelerator pedal module

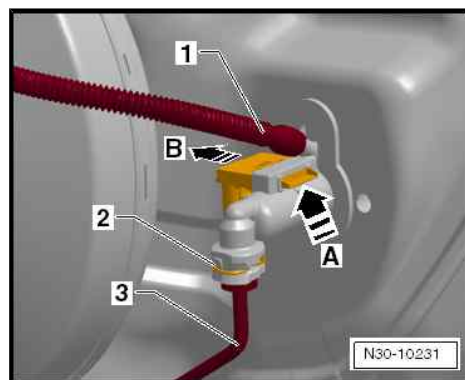


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Clutch position sender - G476-

◆ On clutch master cylinder, next to brake servo

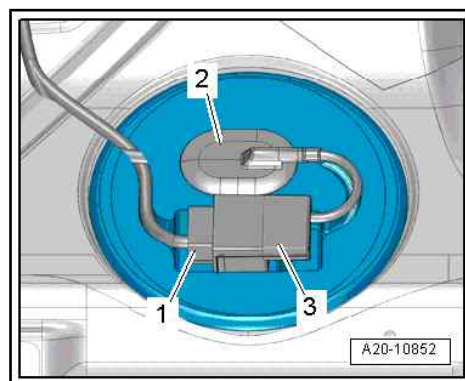


Fuel pump control unit - J538-

1 - Connector for fuel pump control unit - J538-

2 - Fuel system pressurisation pump - G6-

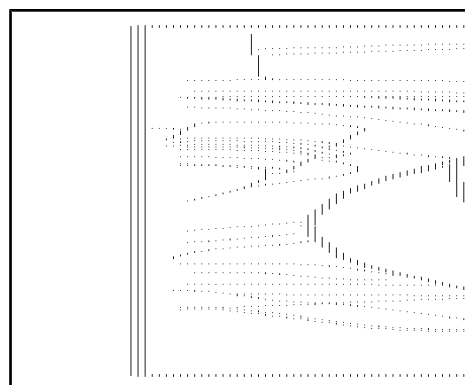
3 - Fuel pump control unit - J538-



Fitting location of brake light switch - F- and brake pedal switch - F63-

◆ On brake master cylinder

C - Brake light switch - F- / brake pedal switch - F63-

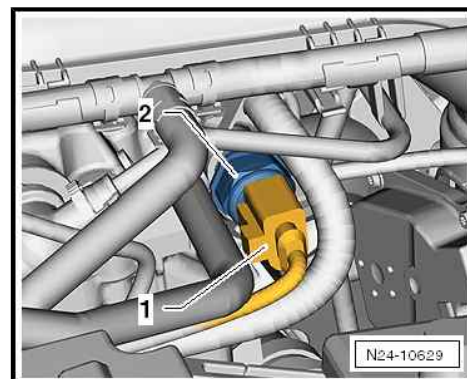




Fuel pressure sender - G247-

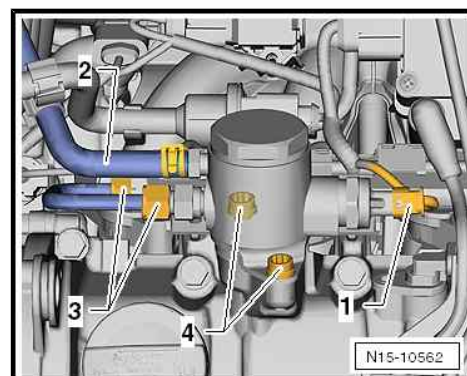
- 1 - Electrical connector for fuel pressure sender - G247-
- 2 - Fuel pressure sender - G247-

Removing and installing ⇒ [page 203](#)



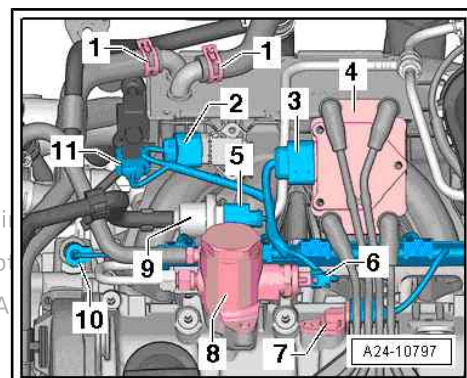
High-pressure fuel pump

- 1 - Fuel pressure regulating valve - N276-
- 2 - Fuel supply line
- 3 - High-pressure fuel pipe
- 4 - Bolts for high-pressure pump



Components

- 1 - Coolant hoses for charge air cooler
- 2 - Intake air temperature sender - G42- and intake manifold pressure sender - G71-
- 3 - Electrical connector for ignition transformer - N152-
- 4 - Ignition transformer - N152-
- 5 - Electrical connector for activated charcoal filter solenoid valve 1 - N80-
- 6 - Fuel pressure regulating valve - N276-
- 7 - Hall sender - G40-
- 8 - High-pressure fuel pump
- 9 - Activated charcoal filter solenoid valve 1 - N80-
- 10 - Oil pressure switch - F1-
- 11 - Solenoid for coolant circuit - N492-

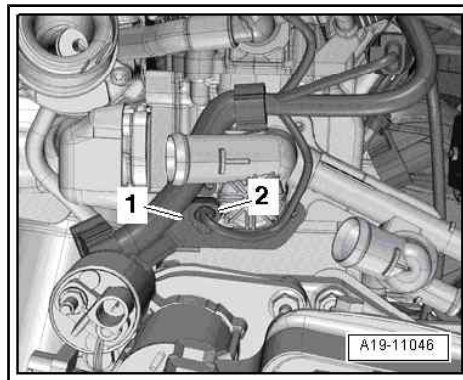


Note

In standard production, intake air temperature sender - G42- is clipped on via retainer tabs (moulded onto intake manifold), but not bolted on. If a retainer tab should break off, intake air temperature sender - G42- can be secured with securing bolts.

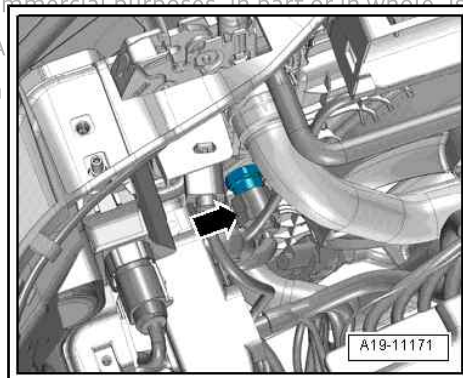


Coolant temperature sender - G62- -1-

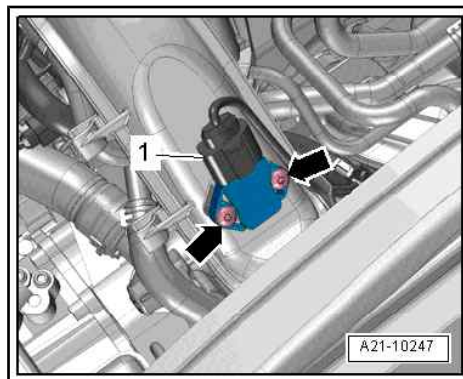


Radiator outlet coolant temperature sender - G83- -arrow-

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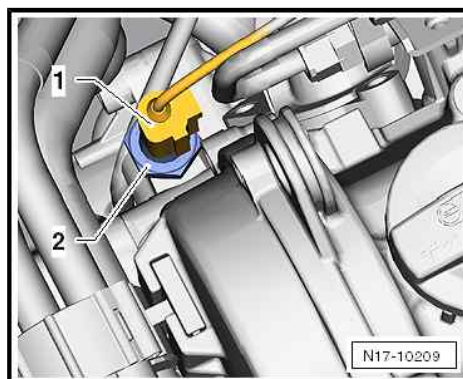
Charge pressure sender - G31- / intake air temperature sender 2 - G299- -1-



Oil pressure switch - F1-

1 - Electrical connector for oil pressure switch - F1-

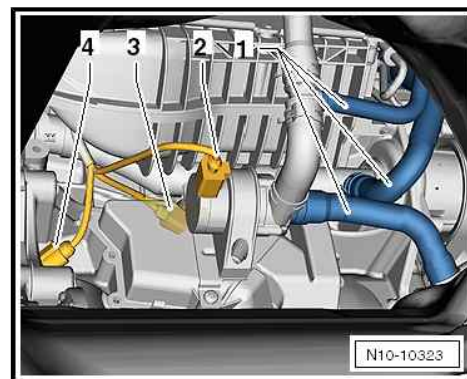
2 - Oil pressure switch - F1-



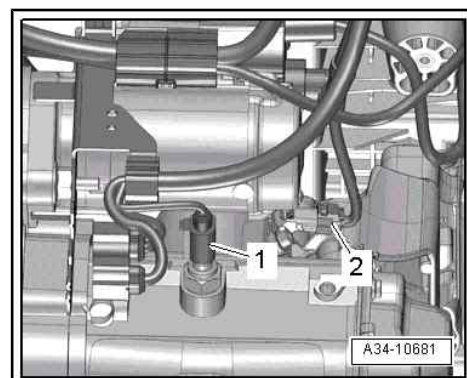


Components below intake manifold

- 1 - Coolant hoses
- 2 - Electrical connector for continued coolant circulation pump - V51-
- 3 - Electrical connector for knock sensor 1 - G61-
- 4 - Electrical connector for engine speed sender - G28-



Fitting location of gearbox neutral position sender - G701-

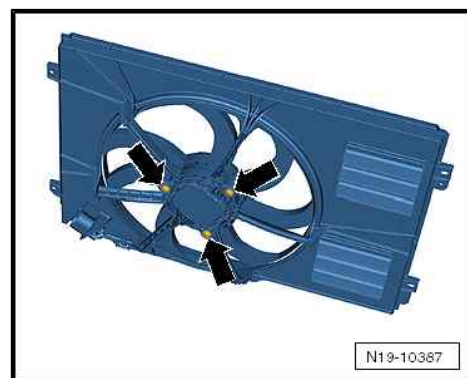


Radiator fan control unit - J293-



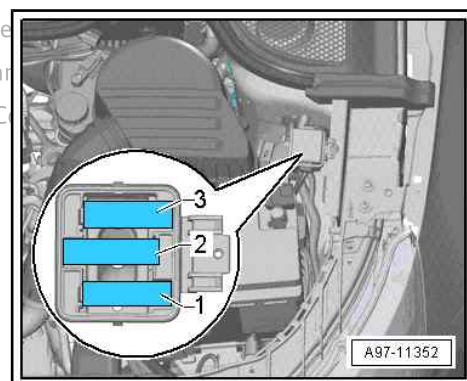
Note

The radiator fan control unit - J293- is integrated into the radiator fan - V7- .



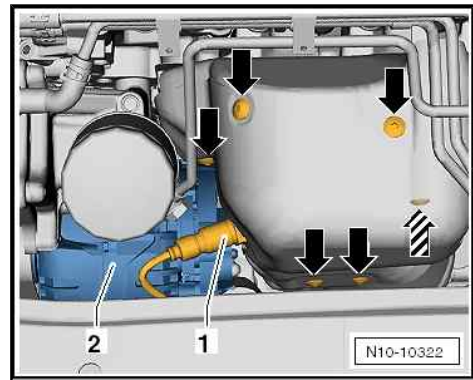
Additional coolant pump relay - J496--1-

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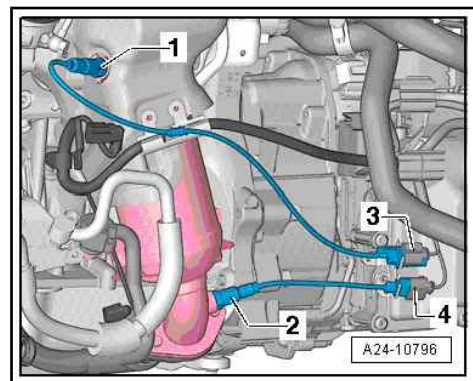


Lambda probe - G39- and Lambda probe heater - Z19- -1-



Fitting locations of Lambda probes

- 1 - Lambda probe - G39- and Lambda probe heater - Z19-
- 2 - Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-
- 3 - Electrical connector for Lambda probe - G39-
- 4 - Electrical connector for Lambda probe after catalytic converter - G130-

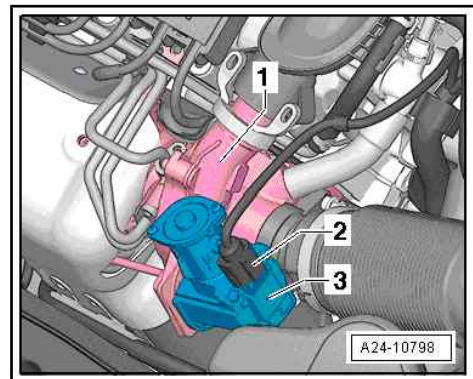


Components on turbocharger

- 1 - Turbocharger
- 2 - Electrical connector for charge pressure positioner - V465-
- 3 - Charge pressure positioner - V465-

Charge pressure positioner - V465- can only be renewed together with turbocharger.

After charge pressure positioner - V465- has been renewed, adaption must be performed using a ➔ Vehicle diagnostic tester.



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2 Air cleaner

⇒ [“2.1 Exploded view - air cleaner housing”, page 187](#)

⇒ [“2.2 Removing and installing air cleaner housing”, page 188](#)

2.1 Exploded view - air cleaner housing

1 - O-ring

- ☐ Renew if damaged

2 - Intake connecting pipe

3 - Spring-type clip

- ☐ Remove and install using hose clip pliers - VAS 6340

4 - Intake air duct

- ☐ Clean any leaves and dirt out of intake air duct

5 - Vacuum hose

- ☐ Renew if damaged
- ☐ To cylinder head cover

6 - Intake connecting pipe

7 - Air cleaner (top section)

- ☐ Clean any salt residue, leaves and dirt out of air cleaner (top section)

8 - Bolt

- ☐ Tighten to 1.5 Nm using torque screwdriver - VAS 6494-

9 - Filter element

- ☐ Always use genuine part for air filter element
- ☐ Removing and installing ⇒ Maintenance ; Booklet 819
- ☐ Change intervals ⇒ Maintenance tables

10 - Rubber mounting

11 - Air cleaner (bottom section)

- ☐ Clean any salt residue, leaves and dirt out of air cleaner (bottom section)
- ☐ Clean water drain
- ☐ Removing and installing ⇒ [“2.2 Removing and installing air cleaner housing”, page 188](#)

12 - Bolt

- ☐ 8 Nm

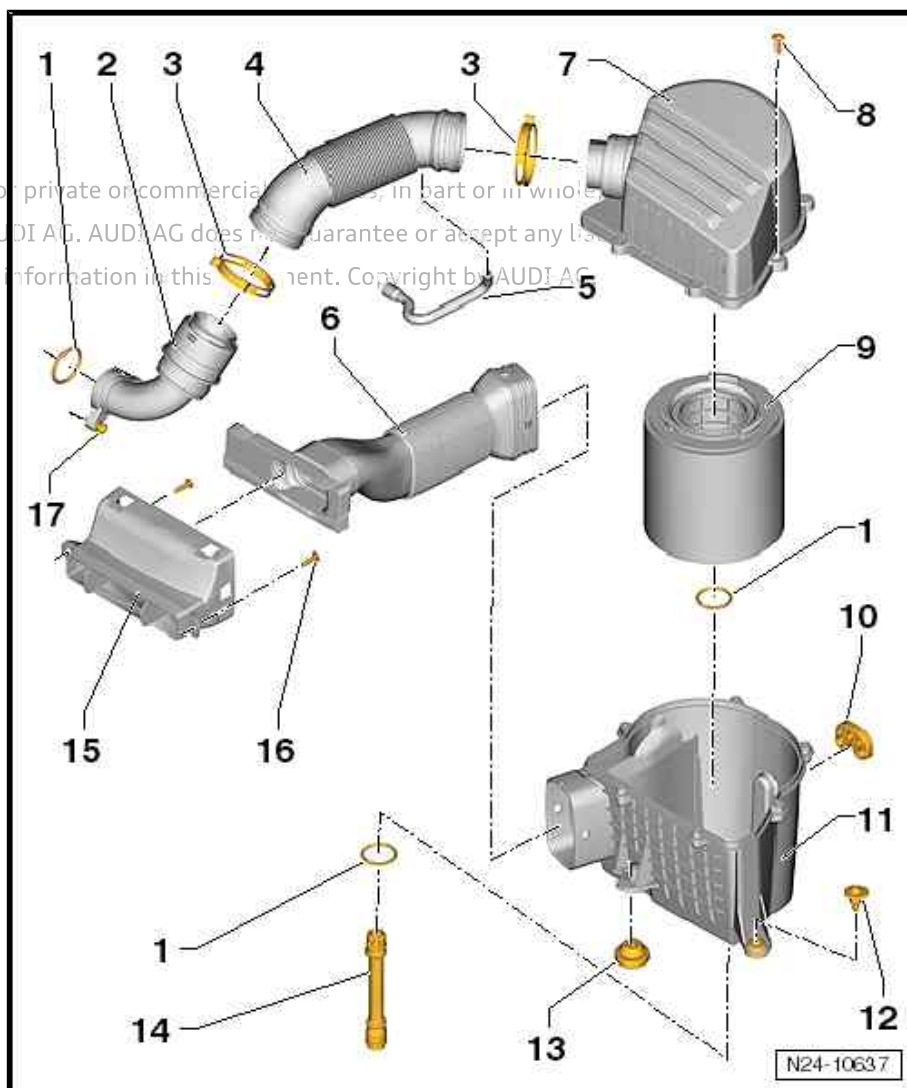
13 - Rubber mounting

14 - Water drain connection

15 - Intake air duct

16 - Bolt

- ☐ 3 Nm





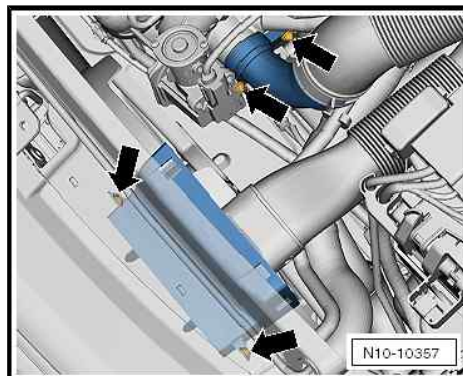
17 - Bolt

- 10 Nm

2.2 Removing and installing air cleaner housing

Removing

- Unscrew securing bolts -arrows-.



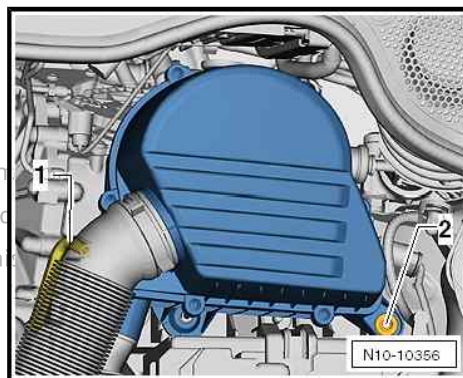
- Detach vacuum hose -1- beneath intake hose.
- Remove securing bolt -2-.
- Lift air cleaner housing.

Installing

Installation is carried out in reverse sequence.

Tightening torques

- ♦ ⇒ [“2.1 Exploded view - air cleaner housing”, page 187](#)





3 Intake manifold

⇒ "3.1 Exploded view - intake manifold", page 189

⇒ "3.2 Removing and installing intake manifold", page 191

⇒ "3.3 Removing and installing throttle valve module J338", page 194

⇒ "3.4 Cleaning throttle valve module", page 195

3.1 Exploded view - intake manifold

Part 1

1 - Connecting hose

- ☐ To air cleaner

2 - Electrical connector

- ☐ For intake manifold pressure sender - G71-
- ☐ Intake manifold pressure sender - G71- is only secured with retaining tabs; if the retaining tabs break off the intake manifold pressure sender - G71- must be secured with self-tapping screws

3 - Electrical connector

- ☐ Solenoid for coolant circuit - N492-

4 - Bolt

- ☐ 10 Nm

5 - Non-return valve

- ☐ For crankcase breather

6 - Connecting hose

- ☐ To turbocharger

7 - O-rings

- ☐ Renew

8 - Intake manifold

- ☐ Removing and installing
⇒ [page 191](#)

9 - Connecting hose

- ☐ To coolant pump



Note

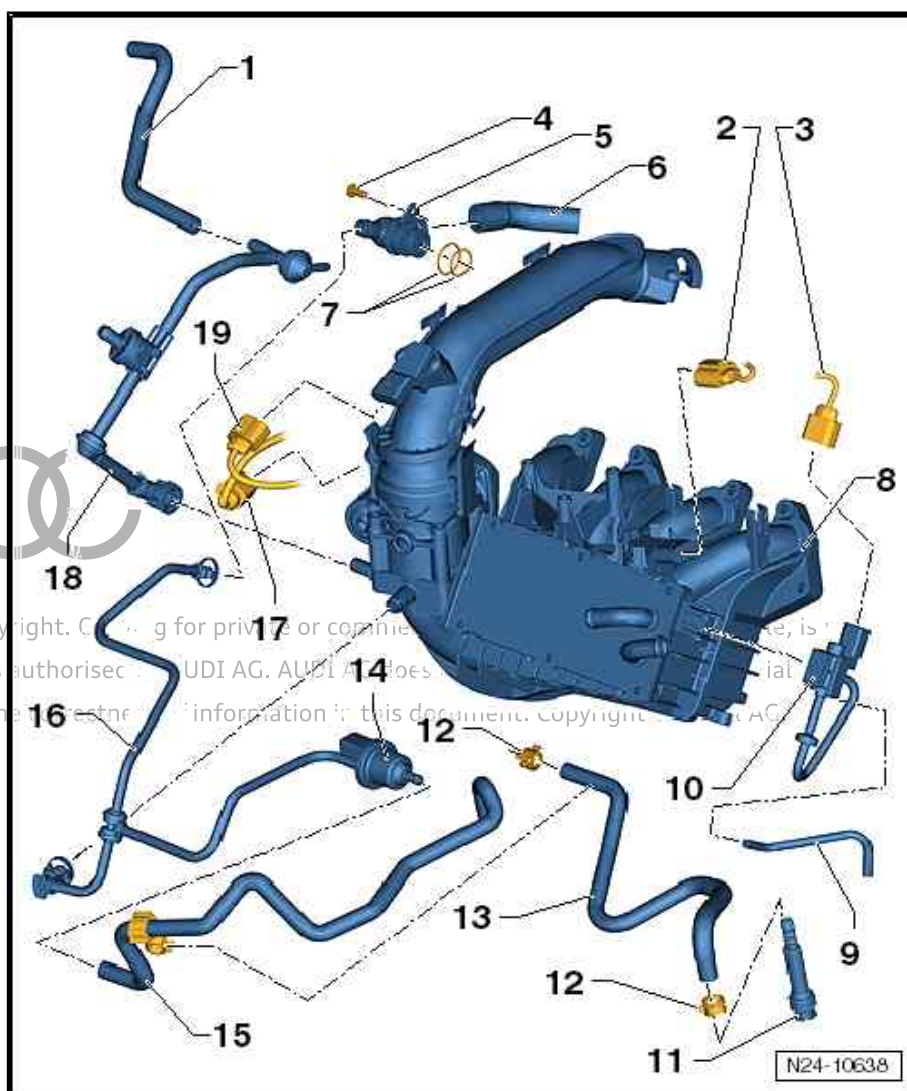
For engines with a coolant pump that can be switched off

10 - Solenoid for coolant circuit - N492-



Note

For engines with a coolant pump that can be switched off





11 - Connection

- ☐ For fuel supply

12 - Spring-type clip

- ☐ Remove and install using hose clip pliers - VAS 6340-

13 - Fuel supply hose

- ☐ To high-pressure pump

14 - Activated charcoal filter solenoid valve 1 - N80-

15 - Connecting hose

- ☐ To activated charcoal filter

16 - Connecting hose

17 - Electrical connector

- ☐ For throttle valve module - J338-

18 - Connecting hose

19 - Connector

- ☐ For charge pressure sender - G31- with intake air temperature sender 2 - G299-

Part 2

1 - Pressure pipe

- ☐ Use lubricant when installing

2 - Bolt

- ☐ 7 Nm

3 - Retaining clip

4 - Fuel pressure sender - G247-

- ☐ 22 Nm
- ☐ Checking ⇒ [page 203](#)
- ☐ Removing and installing ⇒ [page 203](#)

5 - Fuel rail

- ☐ Removing and installing ⇒ ["4.1 Removing and installing injectors"](#), [page 196](#)

6 - Bolt

- ☐ 20 Nm

7 - Adapter

- ☐ Always renew after removing
- ☐ 30 Nm

8 - High-pressure pipe

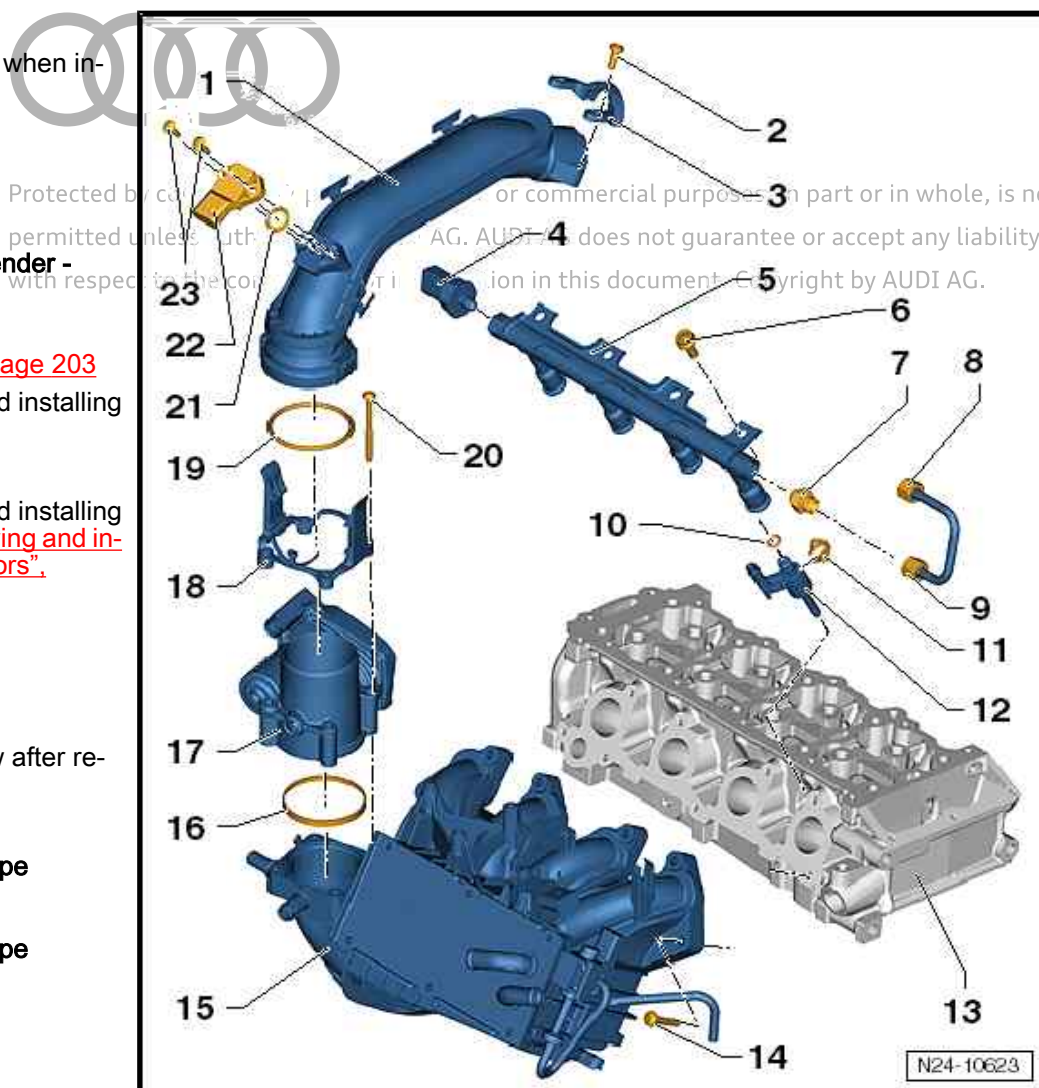
- ☐ 25 Nm

9 - High-pressure pipe

- ☐ 25 Nm

10 - O-ring

- ☐ Renew





11 - Spring element

- ☐ Check for correct fit on injector

12 - Injector, cylinder 1 - N30-

- ☐ Injector, cylinder 2 - N31-
- ☐ Injector, cylinder 3 - N32-
- ☐ Injector, cylinder 4 - N33-
- ☐ With teflon seal and support ring
- ☐ Always renew teflon seal and support ring after removing injector
- ☐ Removing and installing injectors ⇒ [page 196](#)

13 - Cylinder head

14 - Bolt

- ☐ 9 Nm

15 - Intake manifold

- ☐ With intake air temperature sender - G42- and intake manifold pressure sender - G71- (clipped onto intake manifold)
- ☐ In standard production, intake air temperature sender - G42- is clipped on via retainer tabs (moulded onto intake manifold), but not bolted on. If a retainer tab should break off, intake air temperature sender - G42- can be secured with securing bolts
- ☐ Removing and installing intake manifold ⇒ [page 191](#)

16 - Seal

- ☐ Renew

17 - Throttle valve module - J338-

- ☐ Removing and installing ⇒ [page 194](#)
- ☐ Cleaning ⇒ [page 195](#)
- ☐ When renewing, erase learnt values and adapt engine control unit - J623- using a vehicle diagnostic tester

18 - Adapter

19 - O-ring

- ☐ Renew

20 - Bolt

- ☐ 7 Nm

21 - O-ring

- ☐ Renew

22 - Charge pressure sender - G31- with intake air temperature sender 2 - G299-

- ☐ Removing and installing ⇒ [page 176](#)

23 - Bolt

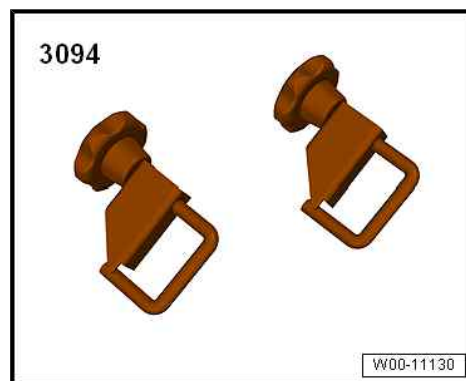
- ☐ 3 Nm

3.2 Removing and installing intake manifold

Special tools and workshop equipment required



- ◆ Hose clamps up to 25 mm - 3094-

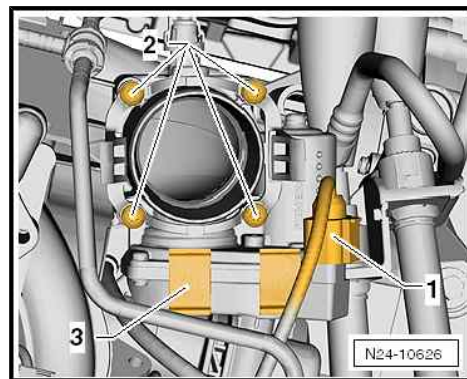
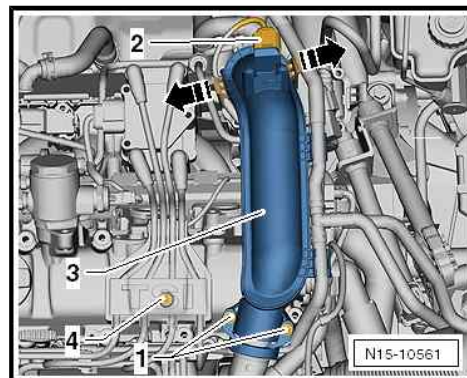


- ◆ Hose clip pliers - VAS 6362-



Removing

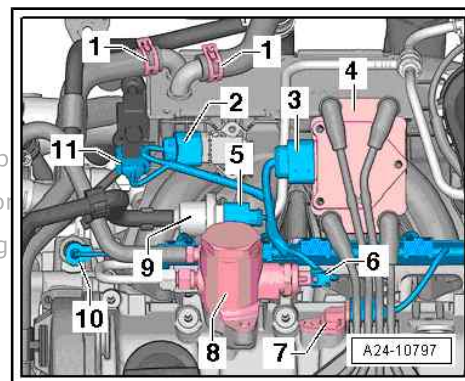
- Remove bolts -1- and remove retaining bracket.
- Move clear coolant hose on pressure pipe.
- Unplug electrical connector -2- at charge pressure sender - G31- .
- Release retainers in direction of -arrow- and detach pressure pipe -3- first from throttle valve module - J338- and then from turbocharger.
- Detach connector -1- from throttle valve module - J338- .
- Remove securing bolts -2- and detach throttle valve module -3- from intake manifold.



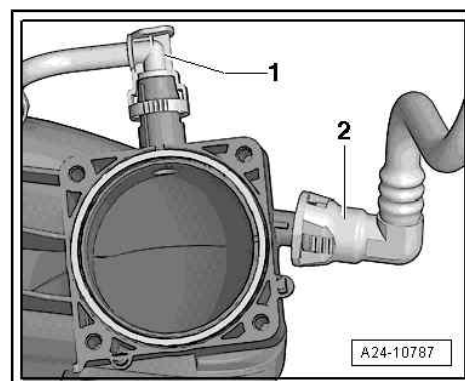
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- Use hose clamps (up to 25 mm) - 3094- to clamp off coolant hoses -1- and detach coolant hoses from charge air cooler.
- Unplug electrical connectors -2, 3, 5 and 11-.
- Remove securing bolts from ignition transformer - N152- -4- and move ignition transformer to one side.
- Pull activated charcoal filter solenoid valve 1- N80- -9- out of bracket.



- Detach vacuum connections -1 and 2- from intake manifold.

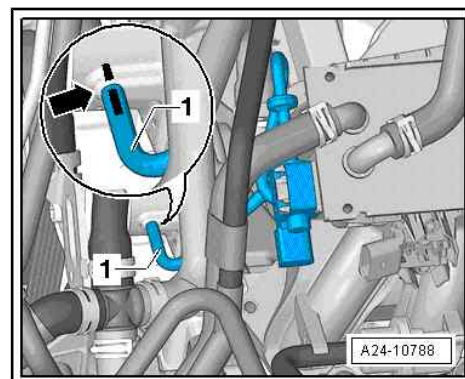


- Detach vacuum line -1- from coolant pump.



Note

Only installed on engines with a coolant pump that can be switched off.



- Unscrew intake manifold securing bolts -arrows- below fuel rail.
- Carefully remove intake manifold upwards.

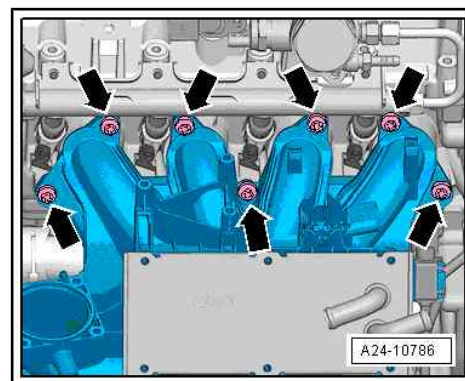
Installing

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

- Install throttle valve module - J338- ➔ [page 194](#) .
- Check coolant level ➔ [page 147](#) .

Tightening torques:

- ◆ ➔ [“3.1 Exploded view - intake manifold”, page 189](#)

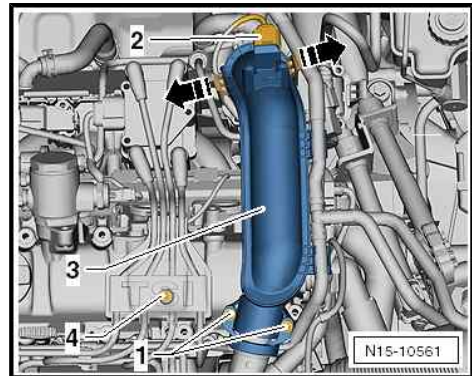




3.3 Removing and installing throttle valve module - J338-

Removing

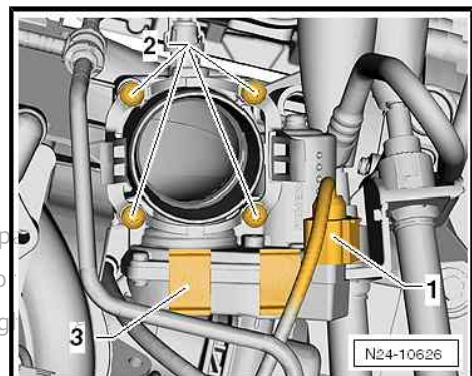
- Remove bolts -1- and remove retaining bracket.
- Unplug connector -2- at charge pressure sender - G31- with intake air temperature sender 2 - G299- .
- Move clear coolant hose on pressure pipe.
- Release retainers in direction of -arrow- and detach pressure pipe -3- first from throttle valve module - J338- and then from turbocharger.



- Detach connector -1- from throttle valve module - J338- .
- Remove securing bolts -2- and detach throttle valve module -3- from intake manifold.

Installing

- Insert new seal in groove on intake manifold.
 - Position throttle valve module - J338- with adapter on intake manifold.
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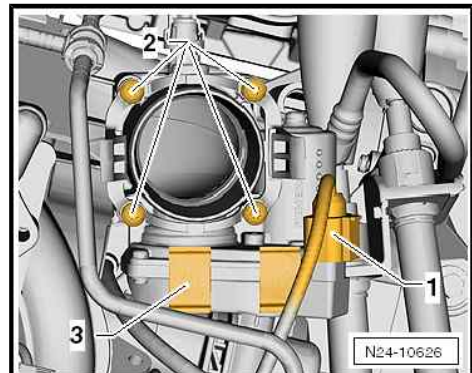


- Tighten securing bolts -2-.
- Plug in electrical connector -1- at throttle valve module - J338- -3-.



Note

Before installing, lubricate O-rings at turbocharger and in pressure pipe lightly with engine oil.



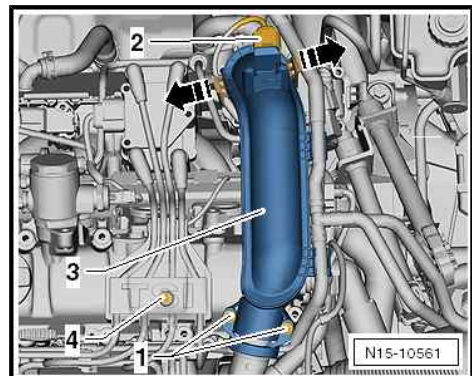
- Fit pressure pipe -3- on turbocharger.
- Push pressure pipe -3- onto throttle valve module - J338- .

The retaining clips must engage audibly.

- Tighten securing bolts -1- for retaining clips.
- Plug in electrical connector -2- at charge pressure sender - G31- / intake air temperature sender 2 - G299- .

If a new throttle valve module - J338- has been installed:

- Erase learnt values and adapt engine control unit - J623- to throttle valve module - J338- . Use ⇒ Vehicle diagnostic tester.



Tightening torques:

- ♦ ⇒ ["3.1 Exploded view - intake manifold", page 189](#)



3.4 Cleaning throttle valve module



Note

- ◆ If a new engine control unit - J623- is installed, it must be adapted to the throttle valve module.
- ◆ Carbon deposits and dirt in the throttle valve limit stop can lead to incorrect adaption values.
- ◆ Take care not to scratch the throttle valve housing when cleaning it.

- Remove throttle valve module - J338- ➔ [page 194](#) .
- Open throttle valve by hand and block it in the open position with a suitable object (e.g. plastic or wooden wedge) -arrow-.



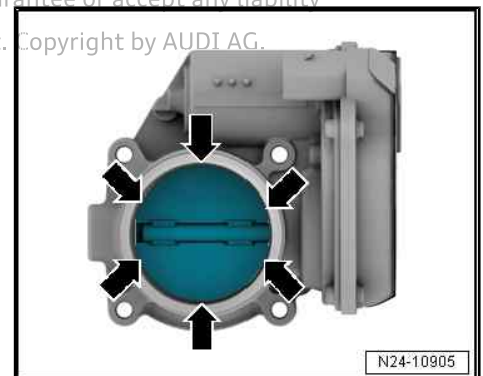
WARNING

Acetone is highly flammable. Please observe all accident prevention regulations and safety precautions when handling flammable liquids. Do not use compressed air when cleaning the throttle valve. Wear safety goggles and protective clothing to avoid possible injury and skin contact.

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- Clean throttle valve housing thoroughly, especially around the points arrows where the throttle valve closes, using commercially available acetone and a small brush.
- Wipe out throttle valve housing with a lint-free cloth.
- Allow acetone to evaporate completely and re-install throttle valve module after cleaning.
- Erase learnt values and adapt engine control unit - J623- to throttle valve module - J338- . Use vehicle diagnostic tester .





4 Injectors

⇒ "4.1 Removing and installing injectors", page 196

⇒ "4.2 Cleaning injectors", page 201

4.1 Removing and installing injectors

Special tools and workshop equipment required

- ◆ Tool set for FSI engines - T10133 C-

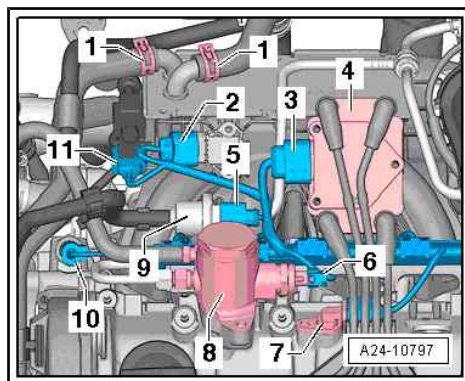
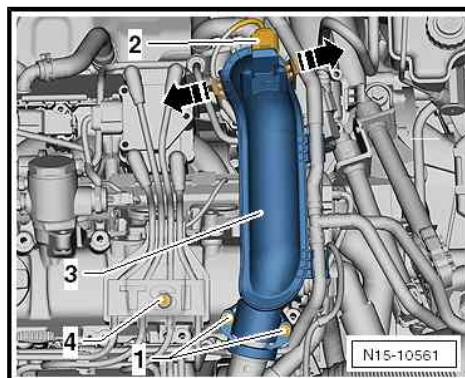


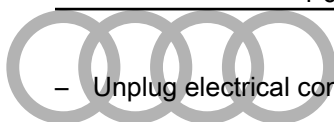
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Removing

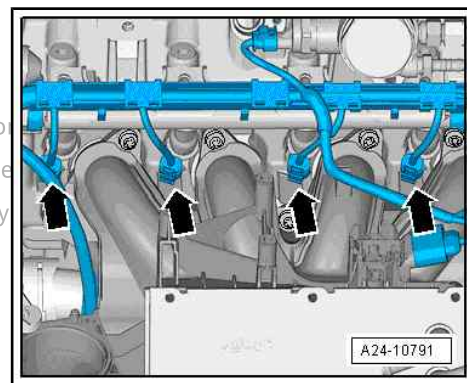
- Remove bolts -1- and remove retaining bracket.
- Move clear coolant hose on pressure pipe.
- Unplug electrical connector -2- at charge pressure sender - G31- .
- Release retainers in direction of -arrow- and detach pressure pipe -3- first from throttle valve module - J338- and then from turbocharger.
- Remove high-pressure pump -8- ⇒ [page 207](#) .
- Remove securing bolts from ignition transformer - N152- -4- and move ignition transformer to one side.
- Unplug all electrical connectors as necessary.
- Pull activated charcoal filter solenoid valve 1 - N80- -9- out of bracket.



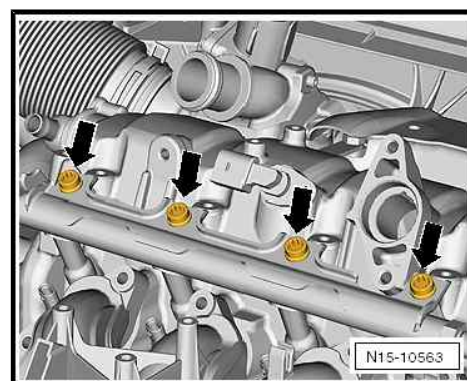


- Unplug electrical connectors -arrows- at injectors.

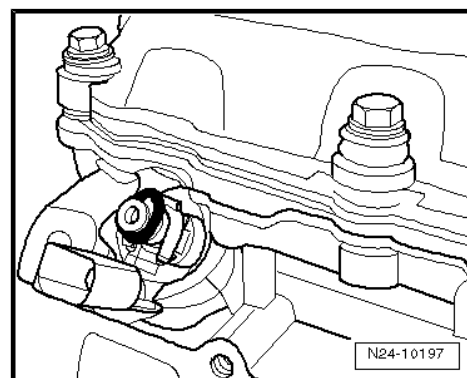
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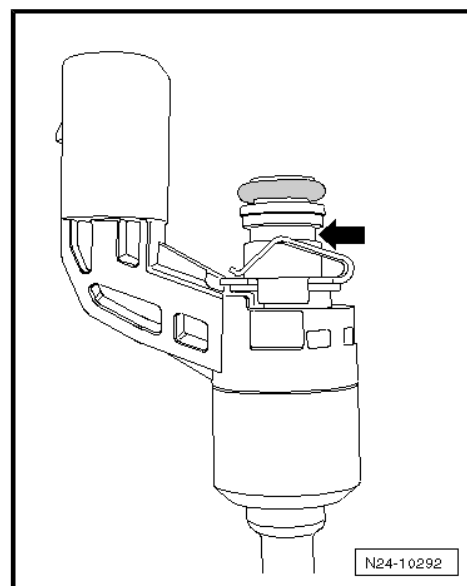
- Unscrew bolts -arrows- and pull fuel rail off injectors.



- Press O-ring by hand upwards (as illustrated) and remove from injector.
- Screw striker - T10133/3- onto puller - T10133/15- .



- Then guide puller - T10133/15- into groove -arrow- on injector.





- Pull out injector by knocking carefully.



Note

The combustion chamber ring seal must always be renewed before the injector is re-installed.

Renewing combustion chamber ring seal

- Remove injector ⇒ [page 196](#) .

- Carefully remove old combustion chamber ring seal -arrow- using suitable tools (e.g. cut open seal using razor blade, or prise open seal with small screwdriver and then pull off forwards). It is important to ensure that the groove and the continuous ridge in the bottom of the groove are not damaged.



Note

The injector must be renewed if the groove is damaged.

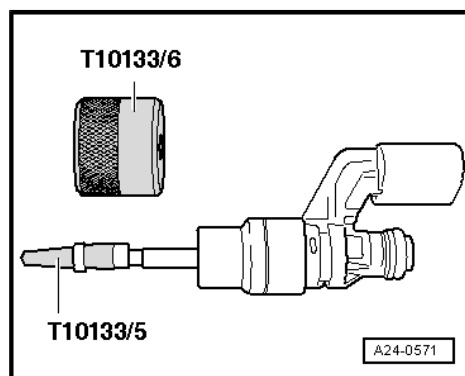
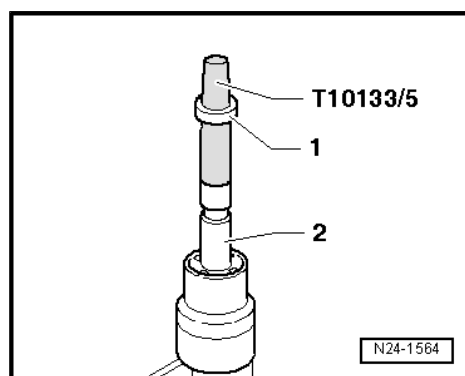
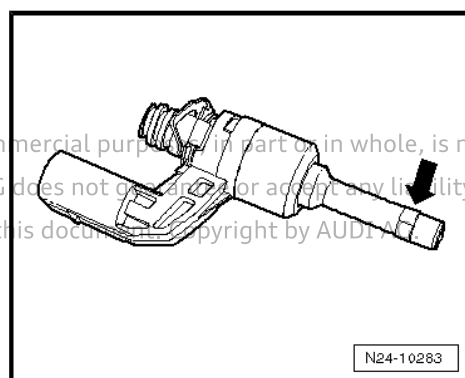
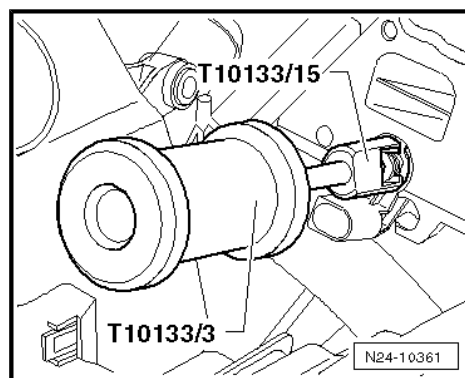
- Before new combustion chamber ring seal -1- is fitted, any combustion residue must be removed from ring groove and injector stem using a clean cloth.
- Fit assembly cone - T10133/5- with new combustion chamber ring seal -1- onto injector -2-.

- Use assembly sleeve - T10133/6- to press combustion chamber ring seal further onto assembly cone - T10133/5- until it seats in groove. Do not use any lubricants during this procedure.



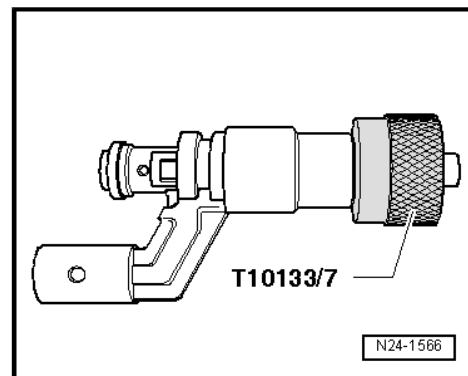
Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

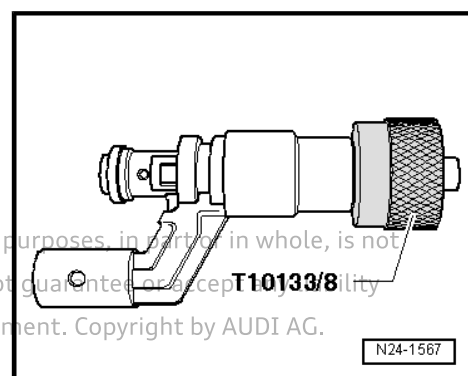




- Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.



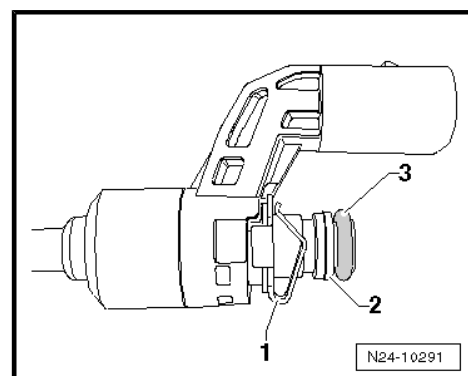
- Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.



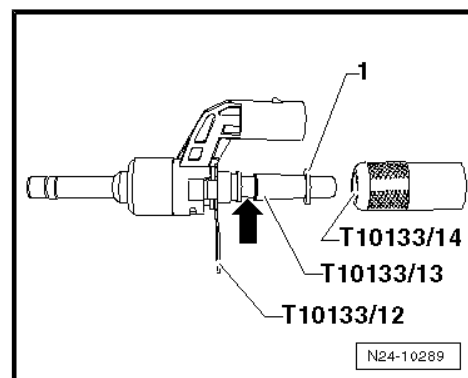
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Renewing support ring and O-ring

- Remove O-ring -3-.
- Cut open support ring -2- with small side-cutting pliers and remove support ring.
- Detach spring element -1- from injector and fit locking plate -T10133/12- in place of spring element.



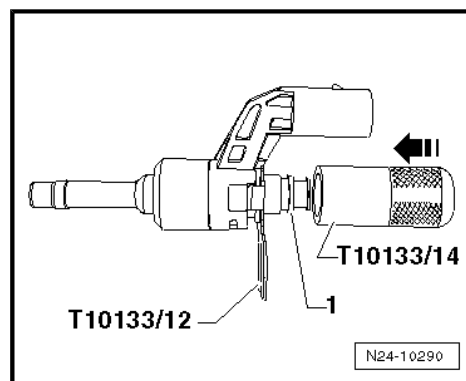
- Fit a new support ring -1- onto assembly cone - T10133/13- and fit onto injector (as illustrated).
- Using calibration sleeve - T10133/14- (knurled side faces towards injector), push support ring -1- into first groove -arrow- on injector.
- Then turn round calibration sleeve - T10133/14- (knurled side now faces away from injector).





- Push calibration sleeve over support ring -1- in direction of -arrow- until it makes contact with locking plate - T10133/12- .
- Pull calibration sleeve - T10133/14- off again.

Support ring now has its correct installation depth.

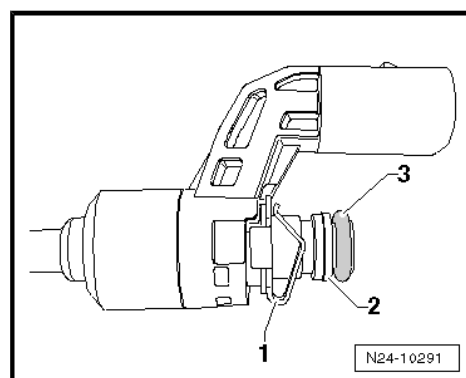


- Now install a new spring element -1- in place of locking plate - T10133/12- .
- Renew O-ring -3-.



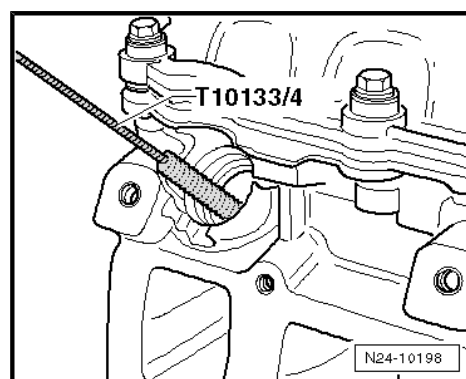
Note

Lubricate O-ring lightly with assembly oil or engine oil before installing.

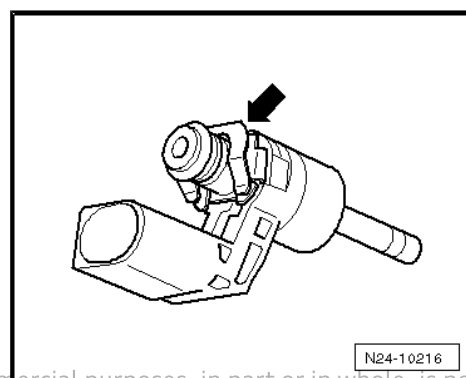


Installing

- Before installing injectors, thoroughly clean apertures for injectors in cylinder head using supplied nylon brush - T10133/4- .



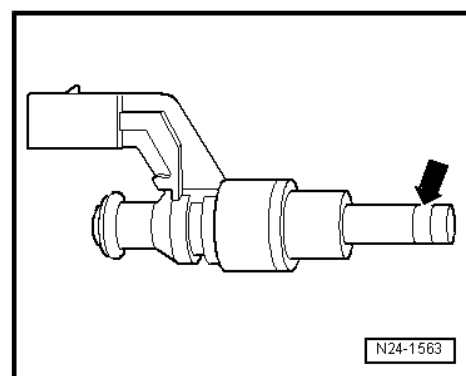
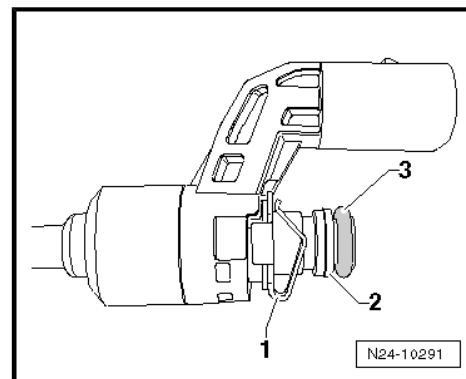
- Always renew spring element -arrow- if injectors have been removed.



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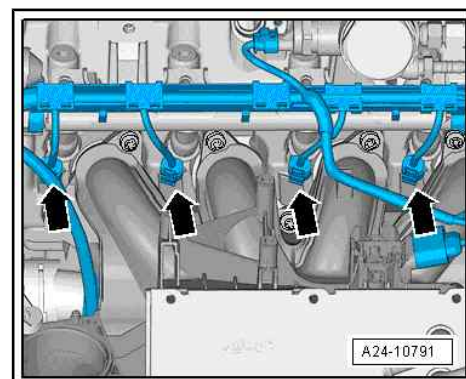


- Fit a new O-ring on each injector. Lubricate O-ring -3- lightly with clean engine oil before installing.
- Push injector by hand as far as it will go into aperture in cylinder head (do not use oil or grease). Ensure that the injector is properly seated in the cylinder head.



Note

- ◆ *The teflon seal -arrow- must not be lubricated when fitting the injector.*
- ◆ *Make sure that there is no cleaning fluid or oil in the holes in the cylinder head when installing the injectors.*
- ◆ *It should be possible to insert the injector easily. If necessary, wait until the teflon seal has contracted sufficiently.*
- ◆ *Note correct installation position and ensure that injectors -arrows- are properly seated in cylinder head.*



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

- Install high-pressure pump ➔ [page 207](#) .

Tightening torques:

- ◆ ➔ [“3.1 Exploded view - intake manifold”, page 189](#)

4.2 Cleaning injectors

Special tools and workshop equipment required

- ◆ Ultrasonic cleaning unit - VAS 6418-
- ◆ Mounting plate for injectors - VAS 6418/1-
- ◆ Cleaning fluid - VAS 6418/2-

Cleaning

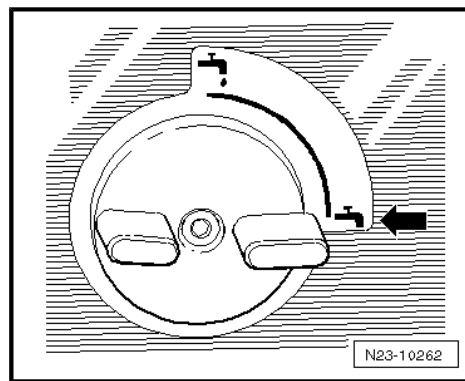
- Remove injectors ➔ [page 196](#) .



- Close drain tap -arrow- on ultrasonic cleaning unit - VAS 6418- (located on right side of housing).
- Fill ultrasonic unit with 2,120 ml of water which has been allowed to settle for a few minutes and cleaning fluid - VAS 6418/2- .

Mixture ratio for cleaning fluid

- 2,100 ml of tap water which has been allowed to settle for a few minutes and 20 ml of cleaning fluid - VAS 6418/2-

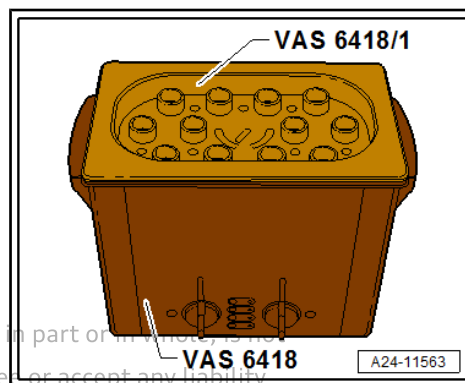


- Place mounting plate for injectors - VAS 6418/1- on top of cleaning unit.

WARNING

It is important to read the safety notes in the operating instructions before switching on the ultrasonic cleaning unit - VAS 6418- .

The ideal fluid level is approx. 1-4 mm above the base of the mounting plate. The ultrasonic cleaning unit - VAS 6418- can be damaged if the fluid level is too low.

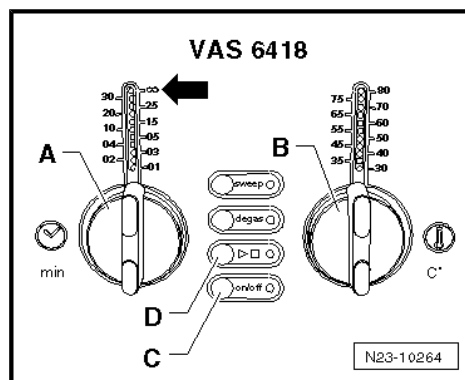


- Insert FSI injectors all the way into guides of mounting plate for injectors - VAS 6418/1- .

- Switch on cleaning unit by pressing **[on/off]** button -item C-.
- Select a cleaning time of 30 minutes with rotary control -A-.
- Set rotary control -B- to a temperature of 50°C.
- Press **[▶]** button -item D- to start cleaning procedure.

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 50 °C and must last for at least 30 minutes.*



- Install injectors ➔ [page 196](#) .



5 Senders and sensors

⇒ ["5.1 Removing and installing fuel pressure sender G247", page 203](#)

⇒ ["5.2 Checking fuel pressure sender G247", page 203](#)

5.1 Removing and installing fuel pressure sender - G247-

If the fuel pressure sender - G247- fails, the fuel pressure regulating valve - N276- is switched off, the electric fuel pump is fully activated and the engine is operated with the fuel pressure which remains. This will reduce engine torque considerably.

Special tools and workshop equipment required

- ◆ Bit (27 mm) - T40218- or commercially available socket (27 mm)



Removing



WARNING

The fuel system is pressurised.

Risk of injury as fuel may spray out.

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

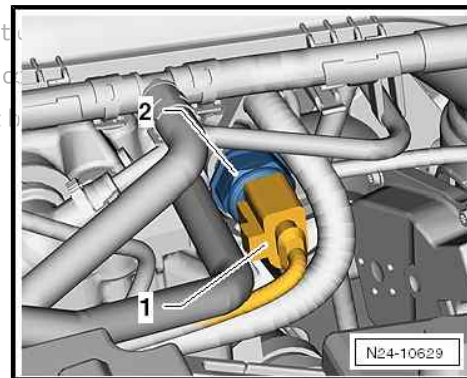
- Unplug connector -1- and remove fuel pressure sender - G247- -2-.

Installing

- Installation is carried out in reverse sequence.

Tightening torques:

- ◆ ⇒ ["3.1 Exploded view - intake manifold", page 189](#)



5.2 Checking fuel pressure sender - G247-

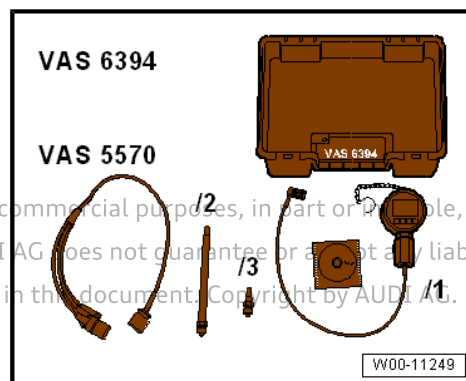
Special tools and workshop equipment required



◆ Pressure sensor tester - VAS 6394-



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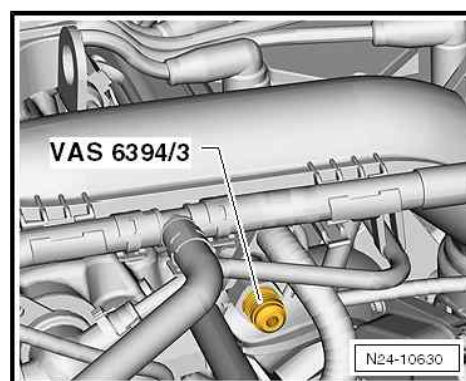
◆ Socket, 27 mm, long (commercially available)

◆ Test instrument adapter - VAS 5570-

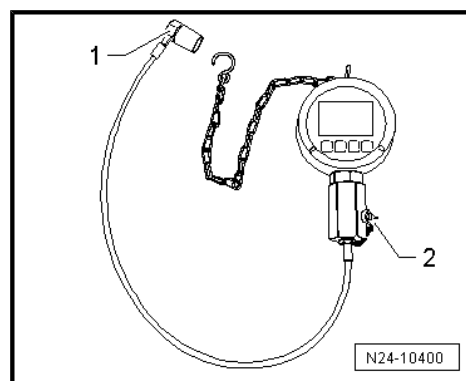
◆ Vehicle diagnostic tester

Procedure

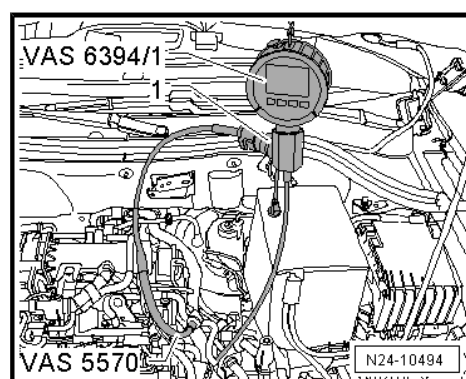
- Remove fuel pressure sender - G247- ➔ [page 203](#) .
- Lubricate taper seal of adapter - VAS 6394/3- lightly with clean engine oil and screw into fuel rail. Tightening torque: 22 Nm



- Unscrew plug -2- and screw fuel pressure sender - G247- into tester - VAS 6394/1- . Tightening torque: 22 Nm



- Connect pressure line of tester - VAS 6394/1- to adapter - VAS 6394/3- .
- Use test instrument adapter - VAS 5570- to make electrical connection between vehicle and fuel pressure sender - G247- .





- Switch on tester - VAS 6394/1- by pressing button -A- once briefly.



Note

- ◆ *You can press and hold button -A- for 2 seconds to switch on the illumination for 20 seconds.*
- ◆ *If tester - VAS 6394/1- does not indicate 0 bar, zero the tester ⇒ Operating instructions .*

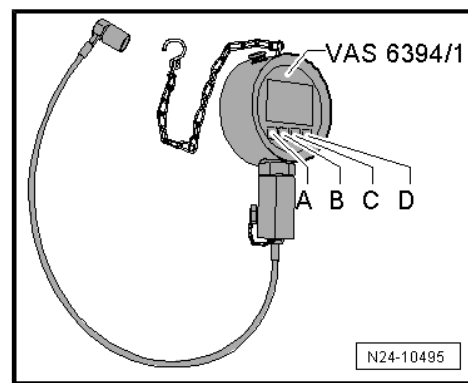
- Connect a ⇒ Vehicle diagnostic tester.
- Start engine and run at idling speed.
- Select “Engine electronics” in vehicle self-diagnosis.
- Then select function read “Measured values”.
- Select “Fuel pressure” from the list.
- Compare fuel pressure indicated on tester - VAS 6394/1- with actual value displayed on ⇒ Vehicle diagnostic tester.
- The pressure readings must not deviate by more than 5 bar.
- If the deviation is more than 5 bar, renew fuel pressure sender - G247- .
- Screw a new fuel pressure sender - G247- into the pressure gauge - VAS 6394/1- .
- Repeat the test with the new fuel pressure sender - G247- and compare the two pressure values.

If the values agree:

- Install the new fuel pressure sender - G247- ⇒ [page 203](#) .

If the two values still do not agree:

- Check the electrical connection between the fuel pressure sender - G247- and the engine control unit; refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.





6 High-pressure pump

⇒ "6.1 Exploded view - high-pressure pump", page 206

⇒ "6.2 Removing and installing high-pressure pump", page 207

6.1 Exploded view - high-pressure pump

1 - Bolts for high-pressure pump

- ☐ Hand-tighten alternately, then tighten to 5 Nm
- ☐ Final torque: 20 Nm
- ☐ Do not tilt high-pressure pump

2 - Connecting piece for fuel supply line from fuel tank

- ☐ Always renew after removing

3 - Spring-type clip

- ☐ Remove and install using hose clip pliers - VAS 6340-

4 - Fuel supply line

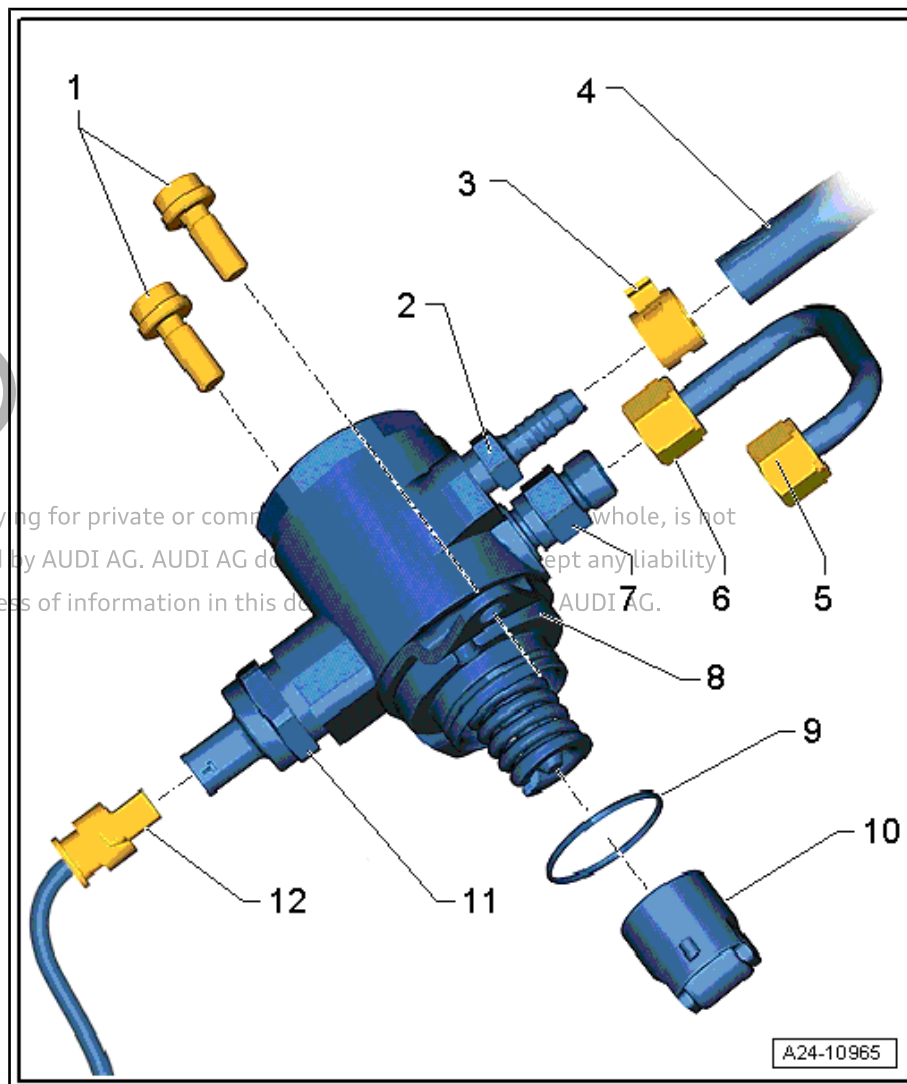
- ☐ From fuel tank

5 - High-pressure pipe

- ☐ Do not alter shape
- ☐ Tighten bracket for fuel supply line to 8 Nm
- ☐ Check for damage before re-installing
- ☐ Lubricate thread of union nut with fuel
- ☐ 25 Nm

6 - High-pressure pipe

- ☐ Do not alter shape
- ☐ Counterhold at connecting piece when loosening





ing union nut

- ☐ Tighten bracket for fuel supply line to 8 Nm
- ☐ Check for damage before re-installing
- ☐ Lubricate thread of union nut with fuel
- ☐ 25 Nm

7 - Connection

- ☐ Always renew after removing
- ☐ Check tightening torque: 30 Nm

8 - High-pressure pump with fuel pressure regulating valve - N276-

- ☐ An electric fuel pump (fitted in fuel tank) supplies fuel to the mechanical high-pressure pump
- ☐ When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.
- ☐ Fuel lines must be free of tension when installed.
- ☐ When connector is unplugged, high-pressure pump switches to full delivery (approx. 140 bar)
- ☐ Removing and installing ⇒ [page 207](#)

9 - O-ring

- ☐ Renew
- ☐ When installing lubricate lightly with engine oil

10 - Roller tappet

- ☐ May possibly remain lodged in camshaft housing when high-pressure pump is removed
- ☐ When installing lubricate lightly with engine oil

11 - Fuel pressure regulating valve - N276-

12 - Electrical connector for fuel pressure regulating valve - N276-

6.2 Removing and installing high-pressure pump

Removing



Note

- ◆ *The high-pressure fuel pump should only be removed and installed when the engine is cold.*
- ◆ *When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.*
- ◆ *Use a cloth to catch escaping fuel.*
- ◆ *The O-ring must always be renewed.*
- ◆ *Always ensure that the high-pressure fuel pipes are free of tension when tightening the connections.*





- Unplug electrical connector -1- on fuel pressure regulating valve - N276- .
- Disconnect fuel supply line -2- at high-pressure pump.

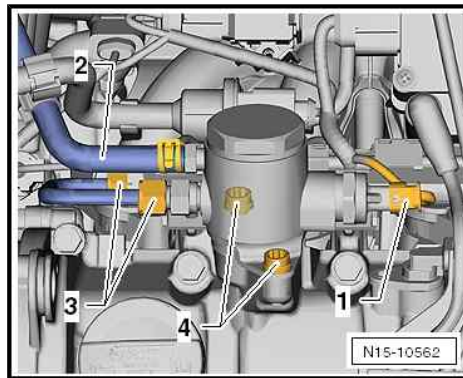


WARNING

The fuel system is pressurised.

Risk of injury as fuel may spray out.

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



- Loosen union nuts -3- and take out high-pressure pipe.

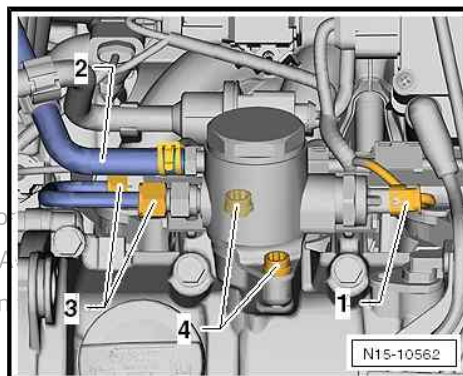


Note

- ◆ *Counterhold connections on high-pressure pump and fuel rail with a spanner when loosening union nuts.*
 - ◆ *Use a cloth to catch escaping fuel.*
- Unscrew securing bolts -4- evenly.



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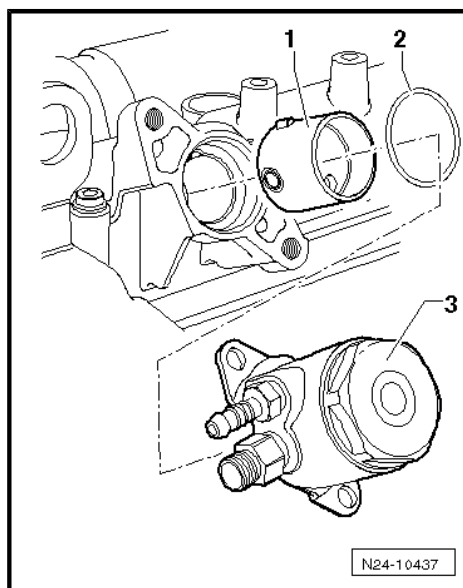
- Pull high-pressure pump -3- and roller tappet -1- out of camshaft housing.



Caution

When removing or installing the high-pressure pump, take hold of it only by the housing.

If the piston spring assembly of the high-pressure pump comes loose, the high-pressure pump will leak and must be renewed.



Installing



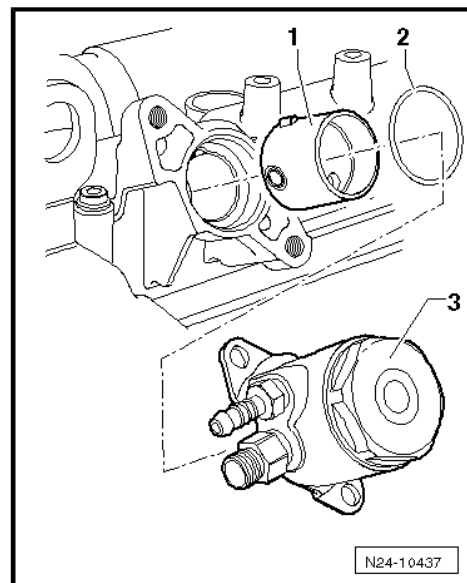
Note

Renew O-ring for high-pressure pump.

- Check roller tappet for damage and renew if necessary.



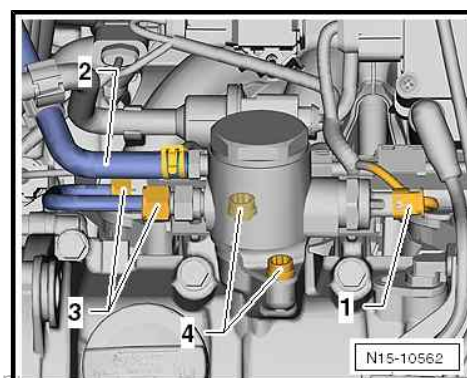
- Lubricate roller tappet -1- with clean engine oil.
- Insert lubricated roller tappet -1- into camshaft housing.
- Turn crankshaft in direction of engine rotation until roller tappet is positioned at lowest point.
- Renew connecting piece for high-pressure pipe at high-pressure pump.
- Insert a new, oiled O-ring -2- into groove on high-pressure pump -3-.
- Carefully insert high-pressure pump -3-.
- Press high-pressure pump down by hand as far as possible onto stop.



- At the same time, tighten securing bolts -4- by hand.
- Then tighten securing bolts -4- alternately to 5 Nm (do not tilt high-pressure pump).
- Now tighten securing bolts -4- alternately to final torque.



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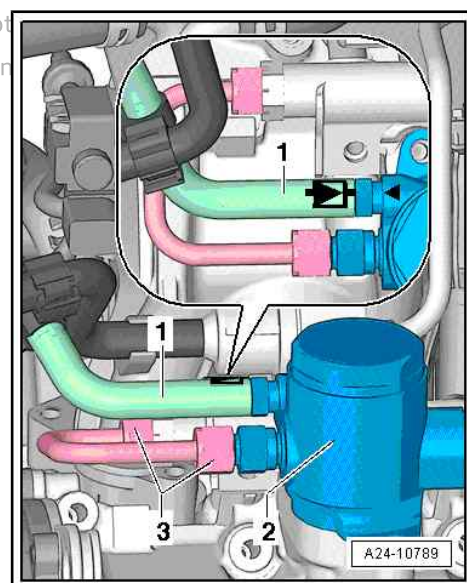


- Hand-tighten union nuts -3- on high-pressure pipe. Align so that parts are free of tension.
- Align high-pressure pipe so it is free of tension and tighten to specified torque.
- Re-connect fuel supply line -1- to high-pressure pump (make sure it is securely fitted).



Note

Note arrows between fuel supply line and high-pressure pump.





- Re-attach electrical connector -1- for fuel pressure regulating valve - N276- .

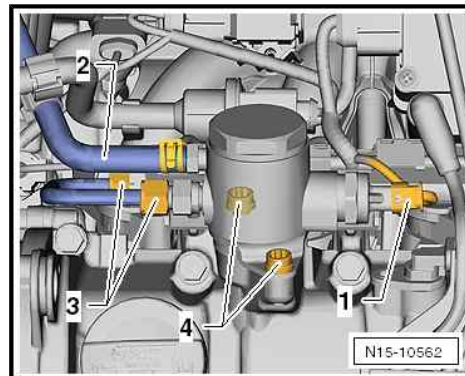


Note

Check fuel system for leaks.

Tightening torques

- ♦ ⇒ [“6.1 Exploded view - high-pressure pump”, page 206](#)



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7 Lambda probe

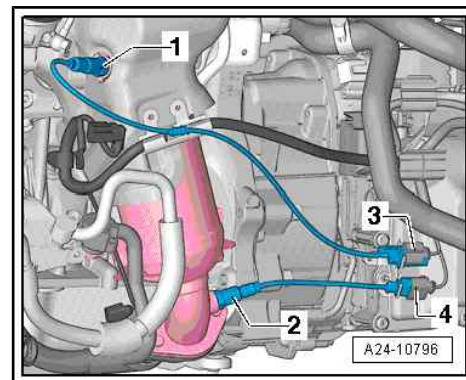
⇒ [“7.1 Exploded view - Lambda probe”, page 211](#)

⇒ [“7.2 Removing and installing Lambda probe”, page 211](#)

7.1 Exploded view - Lambda probe

Lambda probes

- 1 - Lambda probe - G39- with Lambda probe heater - Z19-
- 2 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29-
- 3 - Electrical connector for Lambda probe - G39-
- 4 - Electrical connector for Lambda probe after catalytic converter - G130-



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. High-temperature paste ⇒ Electronic parts catalogue*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*

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• Tightening torque: 55 Nm
Removing and installing Lambda probe - G39- and Lambda probe heater - Z19- ⇒ [page 211](#).

Removing and installing Lambda probe after catalytic converter - G130- and Lambda probe 1 heater after catalytic converter - Z29- ⇒ [page 212](#)

7.2 Removing and installing Lambda probe

⇒ [“7.2.1 Removing and installing Lambda probe G39 ”, page 211](#)

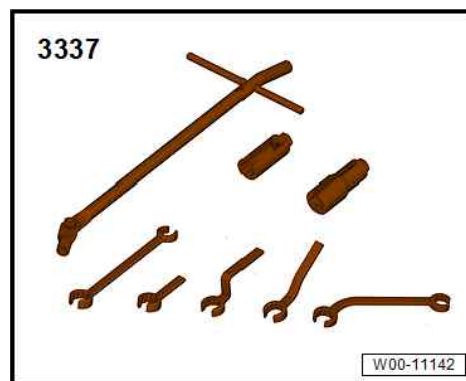
⇒ [“7.2.2 Removing and installing Lambda probe after catalytic converter G130 ”, page 212](#)

7.2.1 Removing and installing Lambda probe - G39-

Special tools and workshop equipment required



- ◆ Lambda probe open ring spanner set - 3337-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -3- for Lambda probe - G39- and Lambda probe heater - Z19- .
- Unscrew Lambda probe - G39- -1- using tool from Lambda probe open ring spanner set - 3337- .

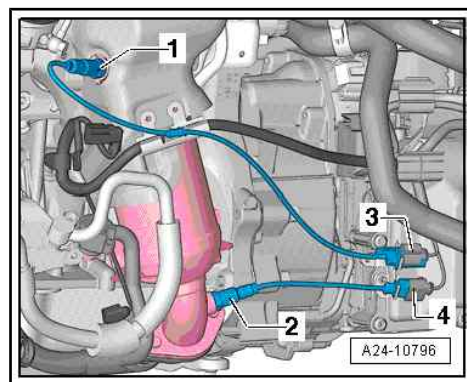
Installing

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. High-temperature paste ⇒ Electronic parts catalogue*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*



Tightening torques:

- ◆ ⇒ [“7.1 Exploded view - Lambda probe”, page 211](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

7.2.2 Removing and installing Lambda probe after catalytic converter - G130-

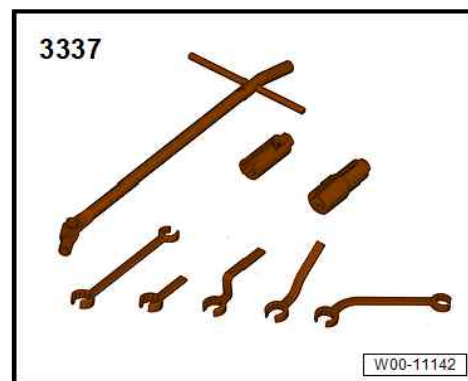
Special tools and workshop equipment required



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- ◆ Lambda probe open ring spanner set - 3337-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -4- for Lambda probe after catalytic converter - G130- and Lambda probe heater - Z19- .
- Unscrew Lambda probe after catalytic converter - G130- -2- using tool from Lambda probe open ring spanner set - 3337- .

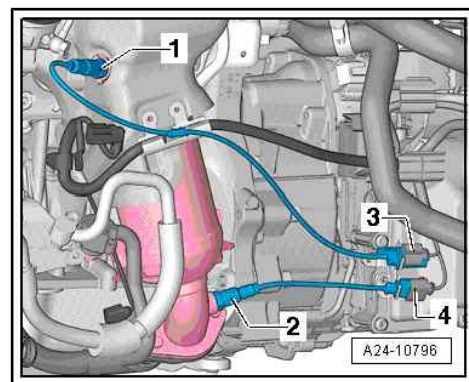
Installing

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. High-temperature paste ⇒ Electronic parts catalogue*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*



Tightening torques:

- ◆ ⇒ [“7.1 Exploded view - Lambda probe”, page 211](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



8 Engine control unit

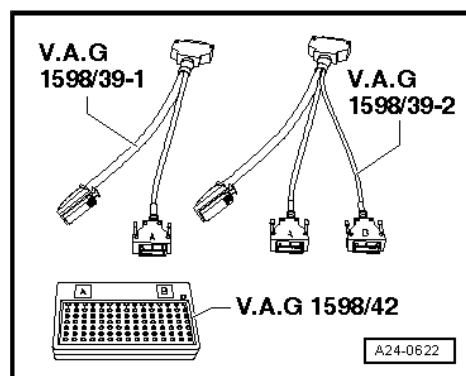
⇒ ["8.1 Wiring and component check with test box", page 214](#)

⇒ ["8.2 Removing and installing engine/motor control unit J623 ", page 215](#)

8.1 Wiring and component check with test box

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-



Note

- ◆ The test box - V.A.G 1598/42- has 105 sockets. It can be connected to the engine control unit via 2 different adapter cables.
- ◆ Each engine control unit is connected to the vehicle's wiring harness via two connectors, one of which has 60 pins, the other has 94 pins.
- ◆ 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).
- ◆ Always use auxiliary measuring set - V.A.G 1527B- to connect test equipment (e.g. voltage tester - V.A.G 1526D- , hand-held multimeter - V.A.G 1594C- etc.).

The engine control unit has to be removed before connectors can be unplugged from engine control unit ⇒ [page 215](#) .



Caution

Risk of irreparable damage to electronic components.

- ◆ **Select the appropriate measuring range before connecting the test leads and observe test requirements.**

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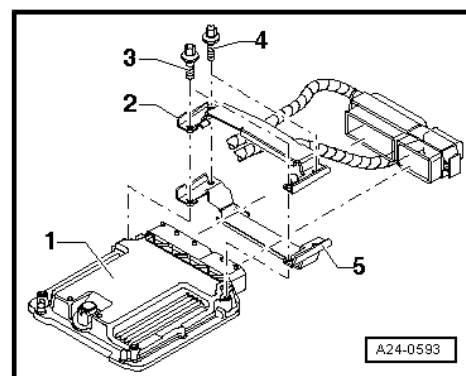
- Connect test box - V.A.G 1598/42- to wiring harness with adapter cable - V.A.G 1598/39-1- or adapter cable - V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in repair procedure.
- The metal locking plate must always be re-fitted on the engine control unit.
- 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.
- Interrogate event memory and erase if necessary.

8.2 Removing and installing engine/motor control unit - J623-



Note

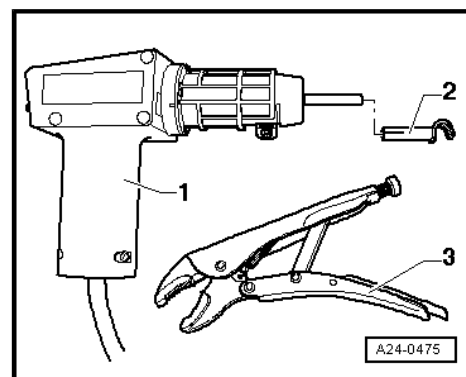
- ◆ *Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/gearbox combination.*
- ◆ *The engine control unit -1- is bolted to the protective housing -5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -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).*



The following special tools are required if a protective housing is fitted:

Special tools and workshop equipment required

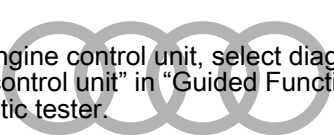
- ◆ Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-

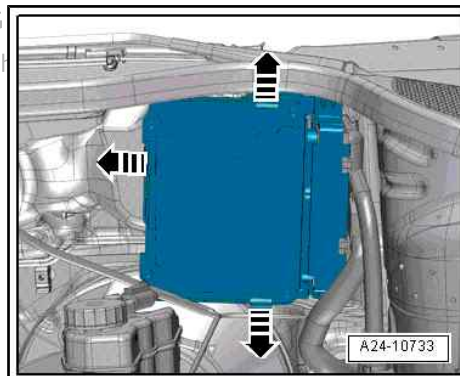


- ◆ Mole grips (commercially available) -3-
- ◆ Vehicle diagnostic tester



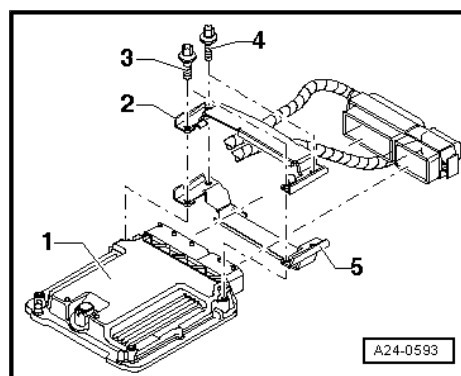
Removing

- When renewing engine control unit, select diagnosis object “Replace engine control unit” in “Guided Functions” mode of ⇒ Vehicle diagnostic tester.
- Switch off ignition and remove ignition key.
- Remove air cleaner housing ⇒ [page 188](#)
- Release fasteners  and detach engine control unit J623- from bracket.



Note

- ◆ The threads of the two shear bolts -4- which are not screwed into the engine control unit -1- 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.



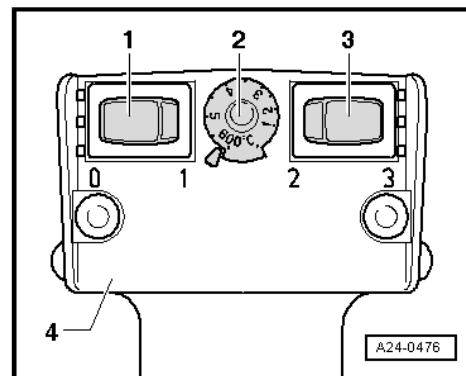


Caution

Wiring, connectors, insulation and control units can be burnt and damaged.

- ◆ *Keep exactly to the following procedure. Observe operating instructions for hot air blower.*

- Select settings on hot air blower -4- as shown in illustration:
- 2 - Temperature potentiometer to maximum heat output
- 3 - Two-stage air flow switch to position “3”



Note

- ◆ *Then use hot air blower to heat threaded holes in protective housing into which shear bolts have been screwed. This reduces the inhibiting action of the locking fluid on the shear bolt threads and makes it easier to unscrew these bolts.*
- ◆ *Cover up all painted parts to avoid any damage caused by hot air blower or vice-grip pliers.*

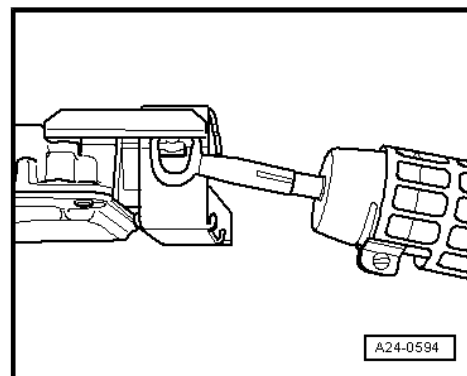


WARNING

Risk of burns.

- ◆ *Parts of the metal locking plate will become very hot as a result of heating the shear bolts. Try to ensure that only the thread is heated and none of the nearby components. These should be covered if necessary.*

- Attach shrink element for hot air blower - VAS 1978/15A- to hot air blower - VAS 1978/14A- .
- Hold shrink element on hot air blower close to shear bolt on protective housing.
- Switch on hot air blower and heat bolt for 20 ... 25 seconds.



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- Then grasp bolt head with vice-grip pliers and unscrew shear bolt.
- Repeat procedure for second shear bolt.
- Detach protective housing from multi-pin connectors.
- Unscrew the two shear bolts screwed into the engine control unit (they do not need to be heated).

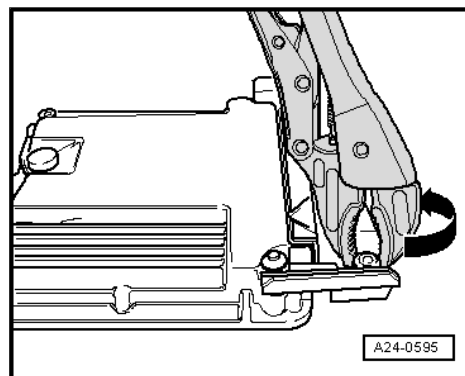
Installing

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

- 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.

After installing a new engine control unit, the following operation must be performed:

- Activate engine control unit using ⇒ Vehicle diagnostic tester in “Guided Functions” mode, “Replace engine control unit”.



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26 – Exhaust system

1 Exhaust pipes/silencer

⇒ [“1.1 Exploded view - silencer”, page 219](#)

⇒ [“1.2 Stress-free alignment of exhaust system”, page 220](#)

⇒ [“1.3 Checking exhaust system for leaks”, page 221](#)

1.1 Exploded view - silencer



Note

The exhaust manifold and the turbocharger are combined as one unit; removing and installing ⇒ [page 167](#) .

1 - Bolt

- ☐ 23 Nm

2 - Rubber mounting

- ☐ Renew if damaged

3 - Rubber mounting

- ☐ Renew if damaged

4 - Bolt

- ☐ Tightening sequence

⇒ [page 224](#)

- ☐ 23 Nm

5 - Catalytic converter

- ☐ Protect against knocks and impact
- ☐ Removing and installing
⇒ [page 222](#)

6 - Nut

- ☐ Tightening sequence
⇒ [page 224](#)
- ☐ 23 Nm

7 - Gasket

- ☐ Renew

8 - Rubber mounting

- ☐ Renew if damaged

9 - Nut

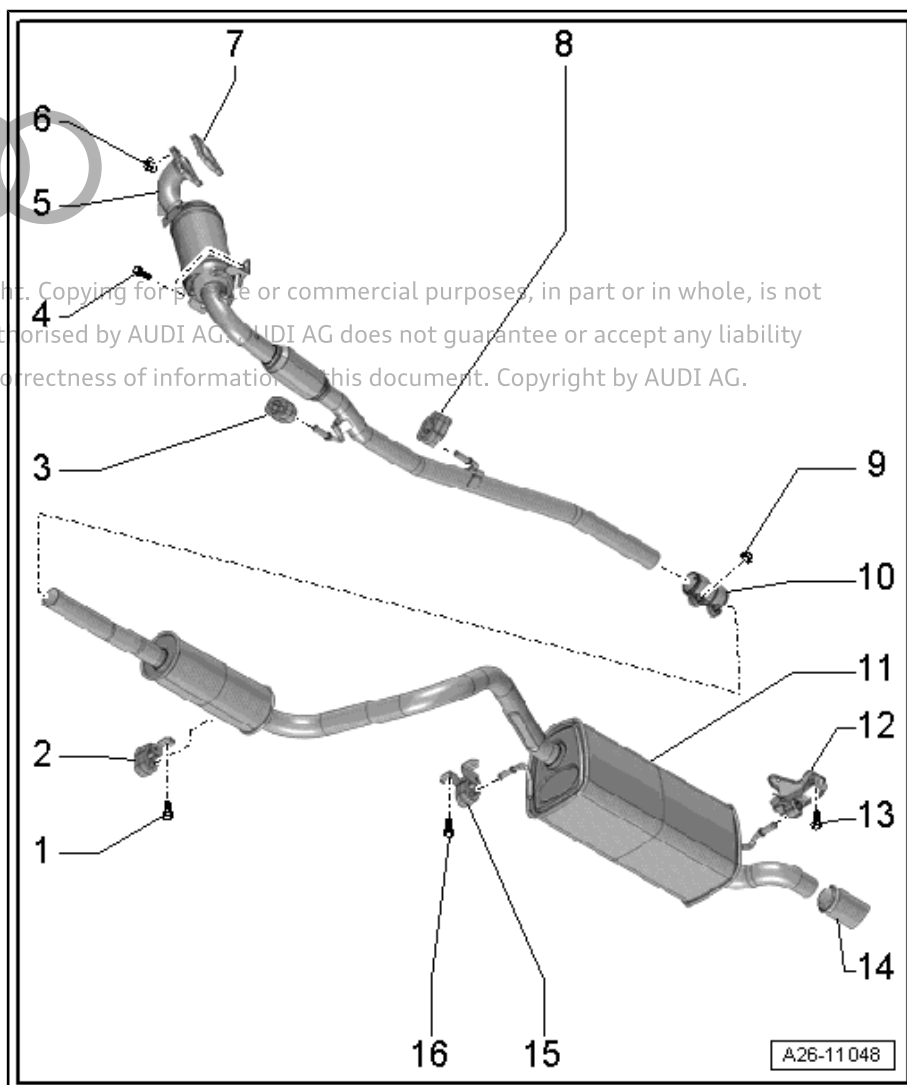
- ☐ 23 Nm

10 - Clamp

- ☐ Before tightening, align exhaust system so it is free of stress
⇒ [page 220](#)
- ☐ Installation position ⇒ [page 220](#)
- ☐ Tighten bolted connections evenly

11 - Rear silencer

- ☐ Align exhaust system so it is free of stress ⇒ [page 220](#)





12 - Rubber mounting

- ❑ Renew if damaged

13 - Bolt

- ❑ 23 Nm

14 - Trim

- ❑ For tailpipe
- ❑ Slide onto tailpipe as far as stop

15 - Rubber mounting

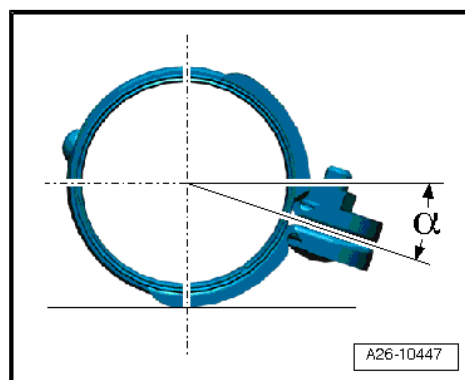
- ❑ Renew if damaged

16 - Bolt

- ❑ 23 Nm

Installation position of clamp

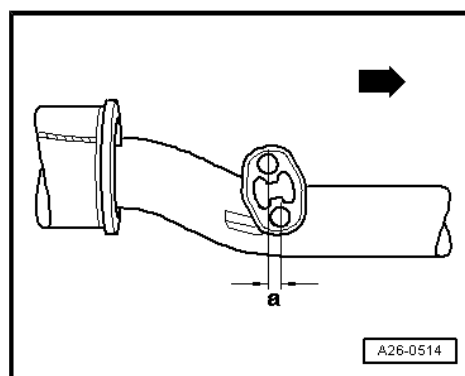
- Fit the clamp at the angle shown.
- Bolted connections face to right.
- Nuts face upwards.
- $\alpha = \text{approx. } 20^\circ$



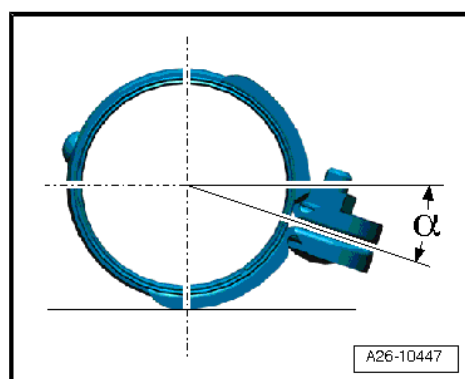
1.2 Stress-free alignment of exhaust system

Procedure

- The exhaust system must be aligned when it is cool.
- Loosen bolt connections for clamp.
- Push rear section of exhaust system towards front of vehicle -arrow-, so that rear mounting for centre silencer is preloaded by -a- = 13 ... 17 mm.



- Fit the clamp at the angle shown.
- Bolted connections face to right.
- Nuts face upwards.
- $\alpha = \text{approx. } 20^\circ$

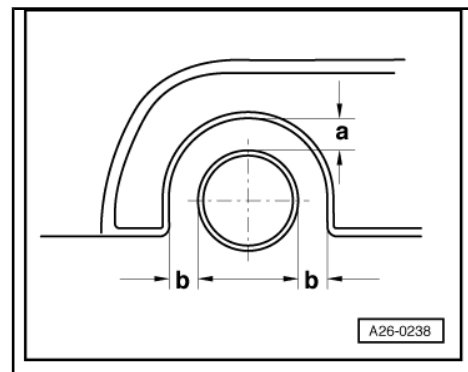




- Position rear silencer to align tailpipe as follows:
- Distance between tailpipe and bumper cut-out must be equal on both sides.
- Distance -a- (top) = distance -b- (left) = distance -b- (right).
- If necessary, unfasten rear silencer mounting to align tailpipe.

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - silencer", page 219](#)



1.3 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipe during leak test (e.g. with cloth or plugs).
- Listen for noise at connections between cylinder head/exhaust manifold with turbocharger, exhaust manifold with turbocharger/catalytic converter etc. to locate any leaks.
- Rectify any leaks that are found.



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2 Emission control system

⇒ "2.1 Removing and installing catalytic converter", page 222

2.1 Removing and installing catalytic converter

Removing

Vehicles without air conditioner:

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

All vehicles (continued):

- Remove Lambda probe - G39- ⇒ [page 211](#) .

Vehicles with air conditioner:

- Unplug electrical connector -2-.



Note

Disregard -items 1, 3, 4-.

- Remove poly V-belt ⇒ [page 37](#) .

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



WARNING

Risk of injury caused by refrigerant.

- ♦ *The air conditioner refrigerant circuit must not be opened.*

- Remove bolts -arrows- for air conditioner compressor.

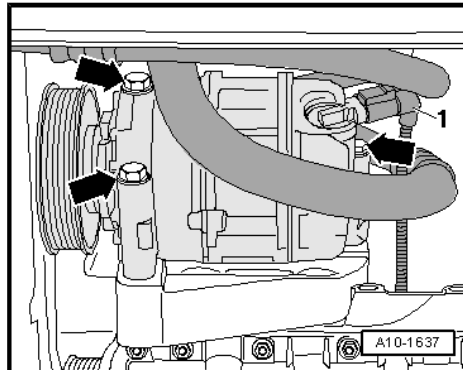
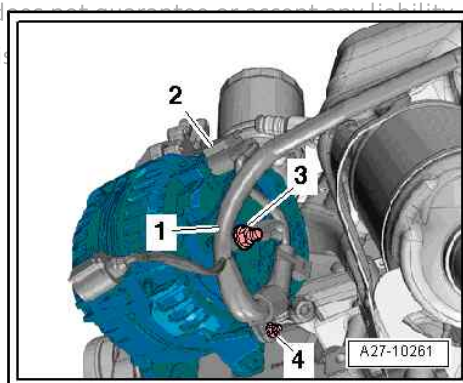


Caution

Risk of damage to refrigerant lines and hoses

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

- Tie up air conditioner compressor together with refrigerant hoses to longitudinal member (refrigerant hoses remain connected).





All vehicles (continued):

- Remove banjo bolt -2-.
- Remove bolt -3- and detach oil supply line.
- Move clear electrical wiring harness leading to alternator.
- Remove bolts -arrows- and detach heat shield -1-.
- Remove nuts -arrows- for catalytic converter.



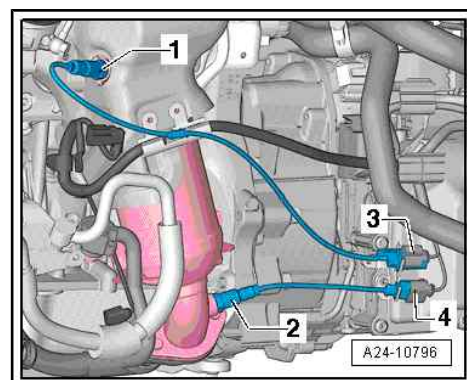
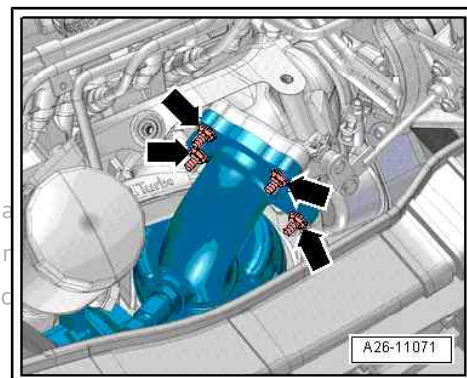
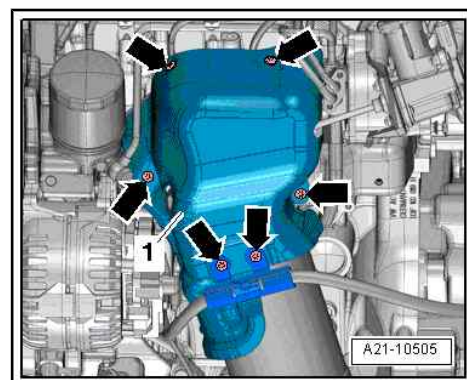
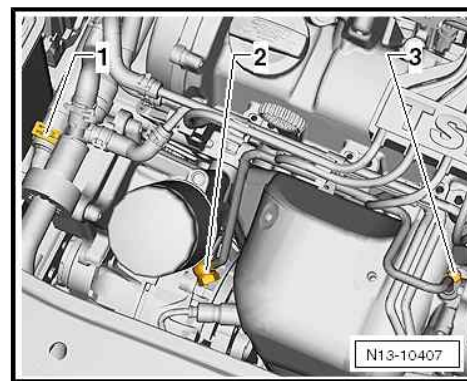
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- Remove electrical connector for Lambda probe after catalytic converter - G130- -item 2- from bracket and unplug connector.



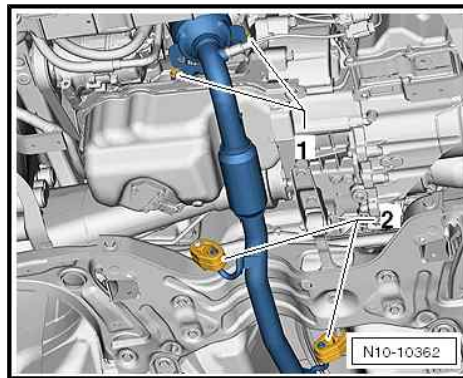
Note

Disregard items -1 and 3-.





- Remove bolts -1-.
- Press mountings -2- for exhaust system off pins.



- Unscrew nuts -arrows- and push clamp towards rear.
- Remove catalytic converter from below.

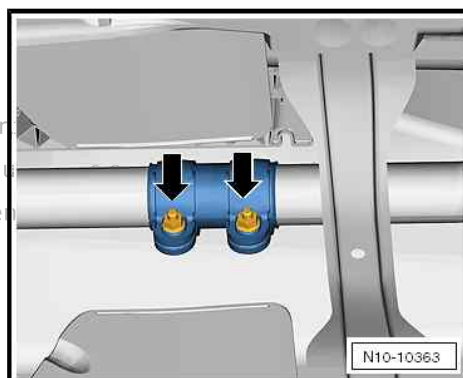
Installing

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



Note

Renew gasket and nuts.



- Note sequence for installing catalytic converter:



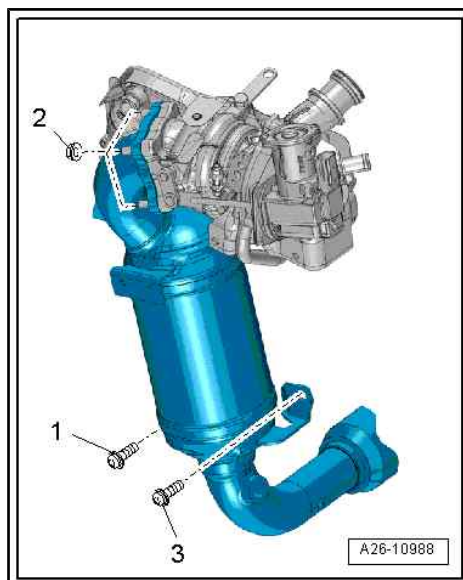
Caution

Risk of damage to flexible joint.

- ◆ While the catalytic converter is being secured to the engine, a second mechanic must take hold of the exhaust pipe to take the load off the flexible joint.

- Secure catalytic converter in 5 stages as follows:

Stage	Bolts/nuts	Tightening torque
1.		Fit catalytic converter onto studs of turbocharger.
2.	-2-	Screw in by hand until contact is made
3.	-3-	Tighten
4.	-1-	Tighten
5.	-2-	Tighten



Tightening torques

- ◆ ⇒ [“1.1 Exploded view - silencer”, page 219](#)
- ◆ ⇒ [“4.1 Exploded view - oil filter/oil pressure switch”, page 132](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 166](#)
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit



3 Exhaust manifold

The exhaust manifold and the turbocharger are combined as one unit; removing and installing ⇒ [page 167](#) .



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28 – Ignition system

1 Ignition system

⇒ [“1.1 Exploded view - ignition system”, page 226](#)

⇒ [“1.2 Test data - spark plugs”, page 227](#)

⇒ [“1.3 Removing and installing knock sensor”, page 227](#)

⇒ [“1.4 Removing and installing Hall senders”, page 228](#)

⇒ [“1.5 Removing and installing engine speed sender G28 ”, page 228](#)

1.1 Exploded view - ignition system

1 - Cable guide

2 - Bolt

□ 8 Nm

3 - Cover

4 - Connector for Hall sender - G40-

5 - Hall sender - G40-

□ Renew O-ring

□ Fitting location: cylinder head cover

6 - Bolt

□ 10 Nm

7 - Spark plug connector with ignition cable

Note markings on ignition cables

◆ Ignition transformer D = cylinder 1 ignition cable

◆ Ignition transformer B = cylinder 2 ignition cable

◆ Ignition transformer C = cylinder 3 ignition cable

◆ Ignition transformer A = cylinder 4 ignition cable

□ Use puller - T10112 A- for removing and installing

8 - Spark plug

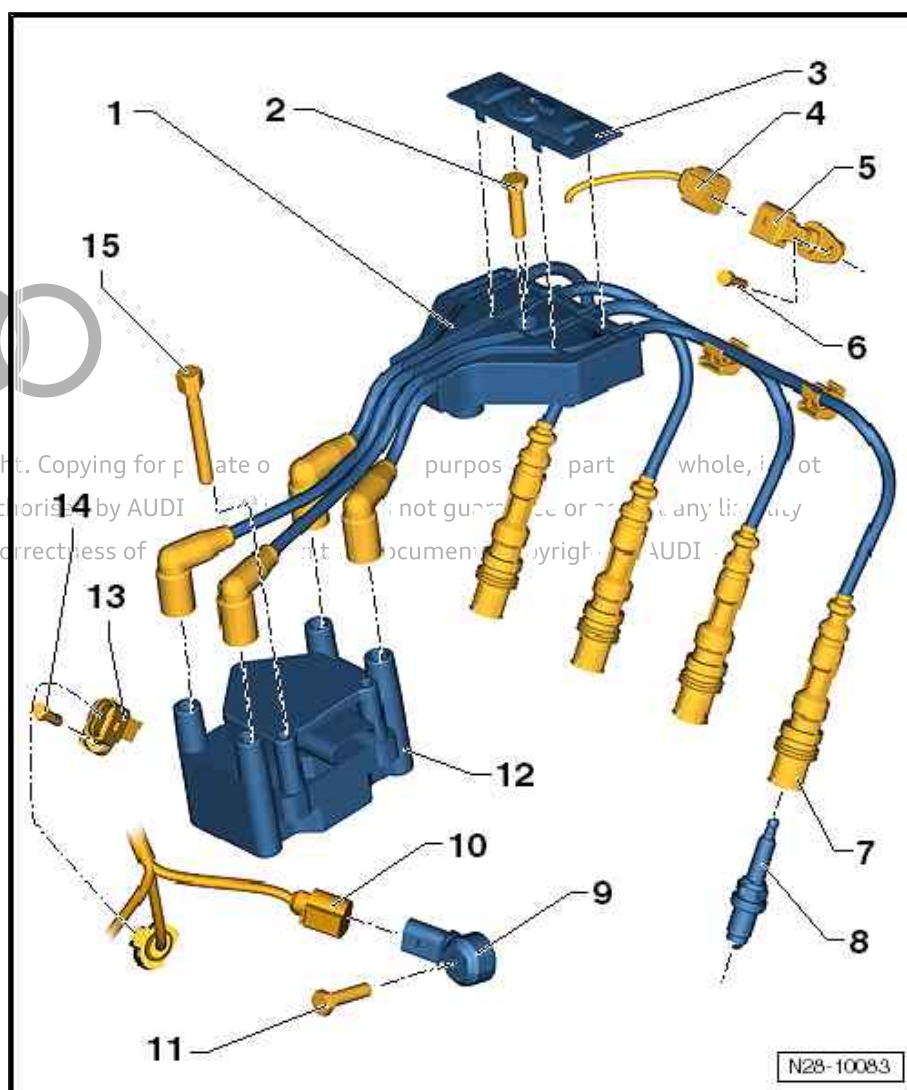
□ Remove and install with puller - T10112 A- and spark plug socket and extension - 3122 B-

□ Tightening torque ⇒ Maintenance ; Booklet 819

9 - Knock sensor 1 - G61-

□ Fitting location: beneath intake manifold on cylinder block

□ Removing and installing ⇒ [page 227](#)





10 - Connector for knock sensor 1 - G61-

11 - Bolt

- ☐ 20 Nm
- ☐ Tightening torque influences the function of the knock sensor

12 - Ignition transformer - N152-

Note markings on ignition cables

- ◆ Ignition transformer D = cylinder 1 ignition cable
- ◆ Ignition transformer B = cylinder 2 ignition cable
- ◆ Ignition transformer C = cylinder 3 ignition cable
- ◆ Ignition transformer A = cylinder 4 ignition cable

13 - Engine speed sender - G28-

- ☐ Fitting location: beneath intake manifold (gearbox end)
- ☐ Removing and installing ⇒ [page 228](#)

14 - Bolt for engine speed sender - G28-

- ☐ 5 Nm

15 - Bolt for ignition transformer - N152-

- ☐ 7 Nm

1.2 Test data - spark plugs

1.2 ltr. TFSI engine	
Idling speed	Cannot be adjusted; regulated by idling speed stabilisation
Ignition timing	Not adjustable (determined by control unit)
Ignition system	Ignition transformer with individual ignition cables connected to spark plugs
Spark plugs	⇒ Electronic parts catalogue
Designations	⇒ Maintenance ; Booklet 819
Tightening torque	⇒ Maintenance ; Booklet 819
Firing order	1-3-4-2

1.3 Removing and installing knock sensor

Removing

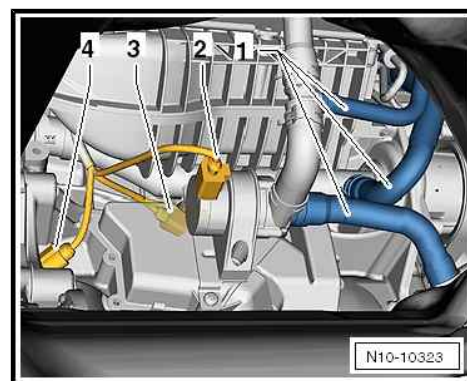
- Remove intake manifold ⇒ [page 191](#) .
- Unplug electrical connector at knock sensor 1 - G61- -3-.
- Remove knock sensor 1 - G61- .

Installing

- Installation is carried out in reverse sequence.
- Install intake manifold ⇒ [page 191](#) .

Tightening torques:

- ◆ ⇒ ["1.1 Exploded view - ignition system", page 226](#)





1.4 Removing and installing Hall senders

Removing

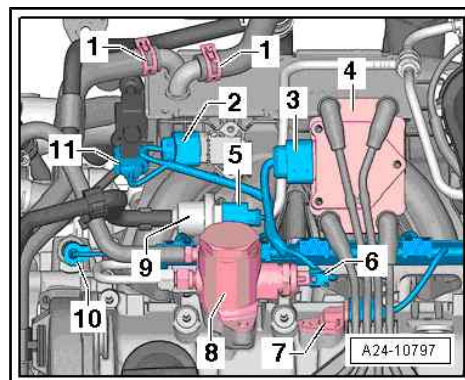
- Unplug electrical connector at Hall sender - G40- and remove Hall sender - G40- -7-.

Installing

- Installation is carried out in reverse sequence.

Tightening torques:

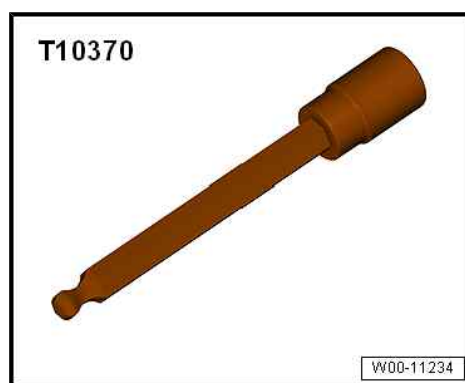
- ♦ ⇒ [“1.1 Exploded view - ignition system”, page 226](#)



1.5 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

- ♦ Socket - T10370-



Removing

The fitting location of the engine speed sensor is below the intake manifold on the crankshaft sealing flange (flywheel end).

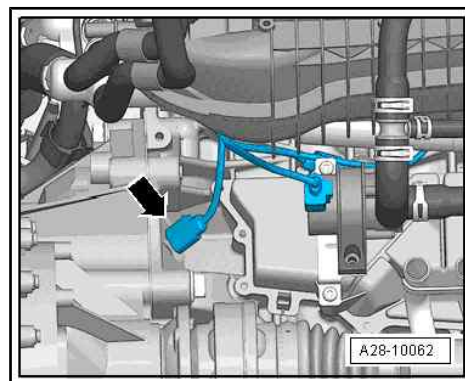
- Detach electrical connector -arrow- at engine speed sender - G28- .
- Unscrew securing bolt for engine speed sender - G28- using socket - T10370- .
- Pull out engine speed sender - G28- .

Installing

- Install engine speed sender - G28- .

Tightening torques:

- ♦ ⇒ [“1.1 Exploded view - Ignition system”, page 226](#)



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