

Workshop Manual

León 2013 ➤

León ST 2013 ➤

4-cylinder petrol engine (1.4 l direct injection, 4 V, turbocharger, EA211)

Engine ID	CMB A	CHP A	CXS A	CZC A	CZE A	CZD A			
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Edition 02.2017

List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 21 - Turbocharging/supercharging
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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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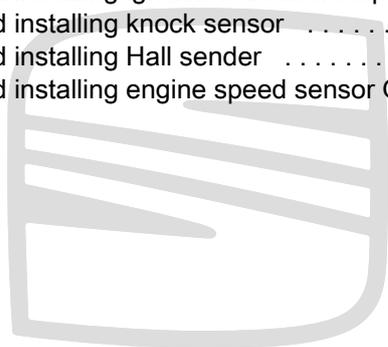
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00 – Technical data

1 Identification

(ERL003286; Edition 02.2017)



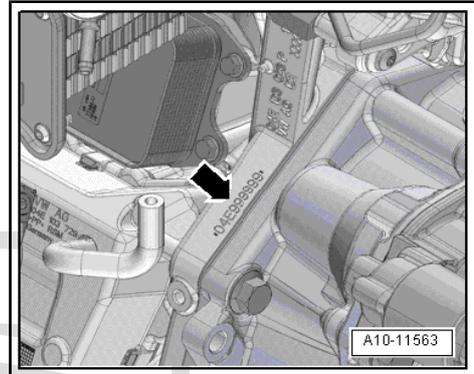
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⇒ "1.1 Engine identification number/engine data", page 2

1.1 Engine identification number/engine data

- ◆ The engine number ("Engine code" and "Serial number") can be found on the left of the joint between engine and gearbox -arrow-.
- ◆ Additionally there is a sticker on the toothed belt cover (top) with engine code and serial number.
- ◆ Starting with the letter "C", the engine codes consist of 4 letters.
- ◆ The first 3 characters of the engine code stand for the engine capacity and the mechanical construction and design. They are stamped on 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 4-character engine code can be found on the type plate (in versions for some countries only) and on the vehicle data sticker and the engine control unit.*
- ◆ *Fitting locations of the type plate (certain countries only) and the vehicle data sticker ⇒ Maintenance ; Booklet 501 .*

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Engine codes	CHPA	CMBA	CXSA	CZCA	CZEA	CZDA
Emission standards	EU5	EU5	EU5	EU6	EU6	EU5
Capacity cm ³	1395	1395	1395	1395	1395	1395
Engine output kW at rpm	103/4500-6000	90/5000-6000	90/5000-6000	92/5000-6000	110/5000-6000	110/5000-6000
Torque Nm/min	250/1500-3500	200/1400-4000	200/1400-4000	200/1400-4000	250/1500-3500	250/1500-3500
Bore: Ø mm	74.5	74.5	74.5	74.5	74.5	74.5
Stroke mm	80.0	80.0	80.0	80.0	80.0	80.0
Compression:	10.5	10.0	10.5	10.5	10.0	10.0
Valves per cylinder	4	4	4	4	4	4
RON min.	95 octane unleaded (in exceptional cases, 91 octane as a minimum, but with a loss of power)	95 octane unleaded (in exceptional cases, 91 octane as a minimum, but with a loss of power)	95 octane unleaded (in exceptional cases, 91 octane as a minimum, but with a loss of power)	95 octane unleaded (in exceptional cases, 91 octane as a minimum, but with a loss of power)	95 octane unleaded (in exceptional cases, 91 octane as a minimum, but with a loss of power)	95 octane unleaded (in exceptional cases, 91 octane as a minimum, but with a loss of power)
Injection, ignition system	Mo-tronic ME 17					
Order of starting	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2

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2 Safety instructions

⇒ [“2.1 Safety precautions when working on fuel supply system”, page 4](#)

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

⇒ [“2.3 Safety precautions during road tests in which testing and measuring equipment is used”, page 5](#)

⇒ [“2.4 Safety precautions when working on the cooling system”, page 5](#)

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

2.1 Safety precautions when working on fuel supply system

Risk of injury due to highly-pressurised fuel.

The fuel system is pressurised. **Risk of injury caused by fuel spillage** permitted unless authorised by SEAT S.A. SEAT S.A does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by SEAT S.A.

Before opening the fuel system:

- Use safety goggles.
- Wear protection gloves.
- Release pressure: place clean cloth around connection and carefully open connection.

For a description of the procedure for releasing the high pressure, refer to ⇒ [page 316](#) .

Risk of fire due to escaping fuel

If the battery is connected, the door contact switch will activate the fuel pump when the door is opened. Escaping fuel may ignite and cause a fire.

- Disconnect the fuel pump from the power supply before opening the fuel system.

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

Risk of injury due to unexpected engine start

In vehicles with activated Start/Stop system, the engine may start up unexpectedly. The status of the Start/Stop system is indicated by a message in the dash panel insert.

- Deactivate Start/Stop system by switching off the ignition.

2.3 Safety precautions during road tests in which testing and measuring equipment is used

Risk of injury due to unsecured test and measuring equipment

If a front passenger airbag is triggered during an accident, unsecured test and measuring equipment can become dangerous projectiles.

- Secure test and measuring equipment with seat belts on the rear seat.

Or

- Have a second person operate test and measuring equipment on the rear seat.

2.4 Safety precautions when working on the cooling system

Risk of scalding due to hot coolant

The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

- Wear protection gloves.
- Use safety goggles.
- Reduce pressure by covering the cap of the coolant expansion tank with cloths and opening it carefully.

2.5 Safety precautions when working on ignition system

Risk of injury due to electric shock

The ignition system is under high-voltage when the engine is running. Touching the ignition system may result in an electric shock.

- Do not touch or disconnect ignition cables when the engine is running or being turned at starter speed.

Risk of damage to components

If the engine is washed while running and if electric cables are connected or disconnected, components may become damaged.

- Switch off the ignition before connecting or disconnecting electric cables.
- Also, switch off the ignition before washing the engine.

3 Repair instructions

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

⇒ [“3.2 General notes”, page 6](#)

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

⇒ [“3.4 Vacuum system: checking”, page 7](#)

⇒ [“3.5 Foreign particles in engine”, page 8](#)

⇒ [“3.6 Contact corrosion”, page 8](#)

⇒ [“3.7 Routing and attaching pipes and wiring”, page 8](#)

⇒ [“3.8 Installing radiators and condensers”, page 8](#)

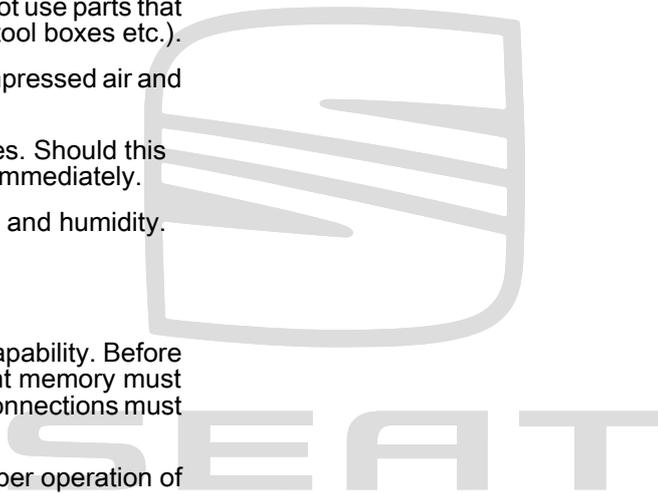
3.1 Rules for cleanliness

A little dirt may also cause faults. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- ◆ Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine sealing cap set - VAS 6122- .
- ◆ Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be re-used in new, sealable plastic bags.
- ◆ Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- ◆ Cover or carefully close any exposed parts if the repair is not to be made immediately.
- ◆ Only fit clean parts: Only remove replacement parts from packaging immediately before assembly. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- ◆ When the fuel system is open, avoid using compressed air and avoid moving the vehicle
- ◆ Make sure that no fuel runs onto the fuel hoses. Should this occur, the fuel hoses must be cleaned again immediately.
- ◆ Protect the unplugged connectors against dirt and humidity. They should be dry before plugging them.

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. Also the vacuum hoses and connections must be checked (unmetered air).
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burnt in the engine and damage the Lambda probe.
- ◆ The vehicles are fitted with a crash fuel shut-off system. It reduces the danger of a fire in a crash as the fuel pump is switched off 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



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pump is activated for 2 seconds in order to build up pressure in the fuel system ⇒ [page 4](#) .

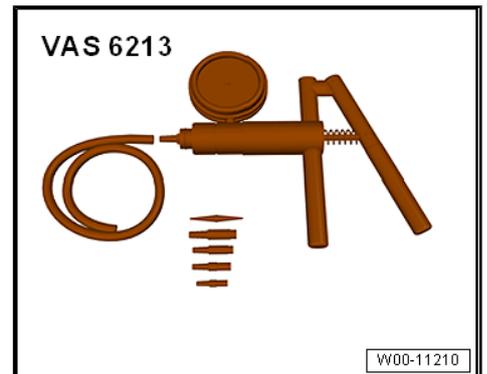
3.3 General repair instructions

- ◆ Clean tools and workbench etc. before working on the injection system.
- ◆ If high-pressure lines are not renewed, they must be labelled on removal. High-pressure fuel lines must always only be re-installed in their original positions.
- ◆ 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 were opened or cut during removal must be renewed at the same points.
- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. The use of clamp or screw-type clips is not permissible.

3.4 Vacuum system: checking

Special tools and workshop equipment required

- ◆ Manual vacuum pump - VAS 6213-



Procedure

- Check all the vacuum lines of the entire vacuum system. When doing so, keep in mind the following:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking
- Check the vacuum hose to solenoid valve and from solenoid valve to relevant 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.

3.5 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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.



Note

*In case of mechanical damage of the exhaust gas turbocharger
⇒ [page 297](#).*

3.6 Contact corrosion

Contact corrosion can occur if unsuitable connecting elements (bolts, nuts, washers...) are used.

For this reason, joint elements are mounted only with surfaces treated with a special cover.

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

If there is any doubt about the suitability of parts, a general rule is to use new parts ⇒ Electronic Parts Catalogue (ETKA) .

Take into account:

- ◆ We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- ◆ We recommend using SEAT accessories.
- ◆ Damage caused by contact corrosion are excluded from the guarantee.

3.7 Routing and attaching pipes and wiring

- ◆ Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter system and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. If necessary, draw diagrams or take photos.
- ◆ 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.

3.8 Installing radiators and condensers

Even if they are installed correctly, small traces can remain on the radiator, the condenser and the charge air cooler. This does not mean that the components are damaged. Radiators, condensers and charge air coolers may not be replaced due to such minor impressions.

10 – Removing and installing engine

1 Removing and positioning the engine

⇒ [“1.1 Engine: dismantling”, page 9](#)

⇒ [“1.2 Separating engine and gearbox”, page 20](#)

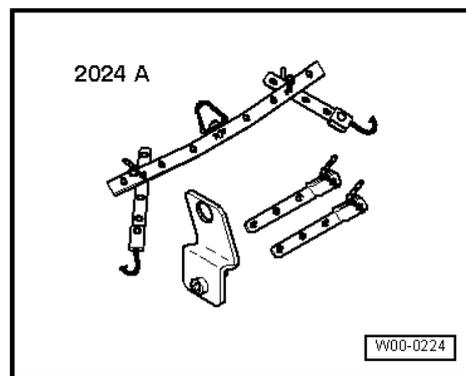
⇒ [“1.3 Securing engine to engine and gearbox support”, page 22](#)

⇒ [“1.4 Engine: fitting”, page 23](#)

1.1 Engine: dismantling

Special tools and workshop equipment required

- ◆ Support tool - 2024A-



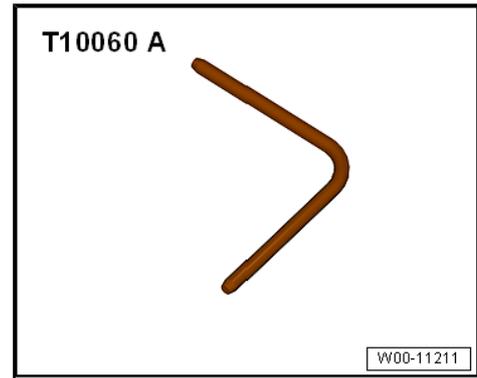
- ◆ Workshop crane - VAS 6100-



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- ◆ Support tool - T10038-
- ◆ Locking pin - T10060 A-
- ◆ Engine bung set - VAS 6122-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Protective glasses
- ◆ Protective gloves

- ◆ Locking pin - T10060 A-



- ◆ Protective glasses
- ◆ Protective gloves

Work sequence



Note

- ◆ *The engine is removed upwards using the lifting tackle - 2024A-.*
- ◆ *After removing of coolant or fuel lines, these must be sealed using the engine sealing cap set - VAS 6122- to prevent dirt from entering or coolant or fuel from running out.*
- ◆ *The cable clamps must be installed in their same place again.*
- ◆ *All cable ties which were opened or cut when the engine was removed must be replaced with new cable ties in the same positions when engine is installed.*

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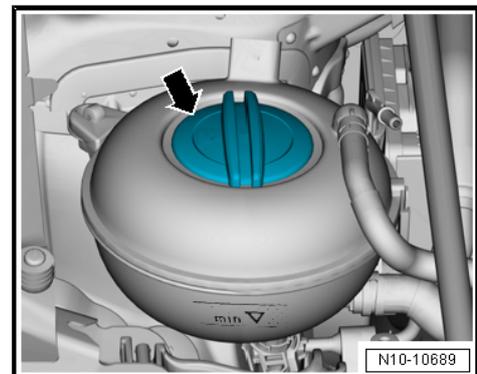
CAUTION

The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

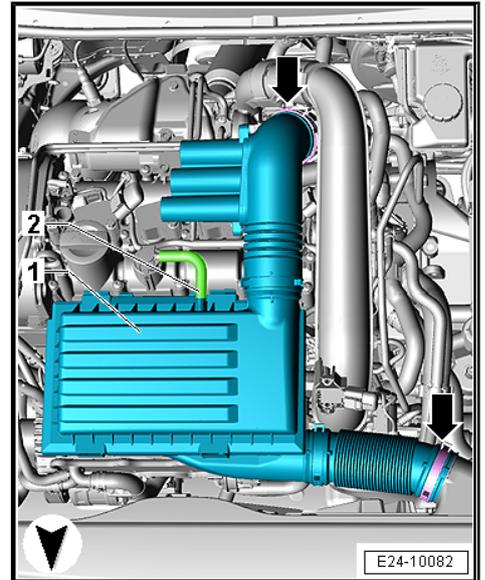
Risk of scalding to skin and body parts.

- Wear protection gloves.
- Use safety goggles.
- Reduce pressure by covering the cap of the coolant expansion tank with cloths and opening it carefully.

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



- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.

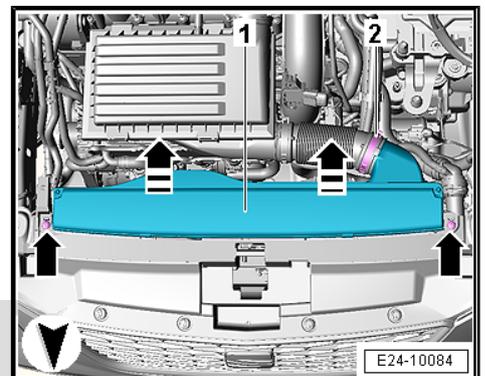


- Remove bolts -arrows-.

i Note

Item -2- can be disregarded.

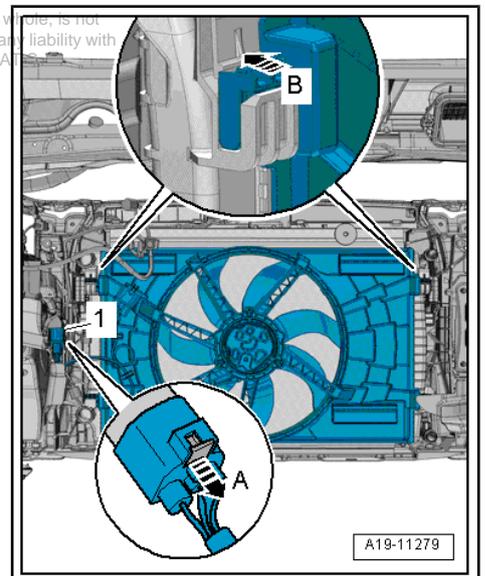
- Unlatch the air duct in the lock carrier and remove -in the direction of the arrow-.
- Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .



- Unplug electrical connector -1- for radiator fan (push retainer to the rear -arrow A- and press down release catch).
- Press locking tabs on left and right sides of radiator cowl -arrow B- and at the same time lift radiator cowl off radiator.
- Remove noise insulation ⇒ Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

i Note

After removing of coolant or fuel lines, these must be sealed using the engine sealing cap set - VAS 6122- to prevent dirt from entering or coolant or fuel from running out.

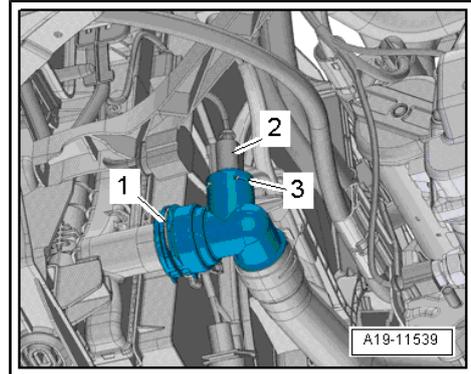


- Remove connector -2- on the coolant temperature sender - G83- at the radiator outlet.
- Set drip tray for workshop hoist - VAS 6208- underneath.
- Lift retaining clip -1-, disconnect coolant hose from radiator (bottom left) and drain off coolant.

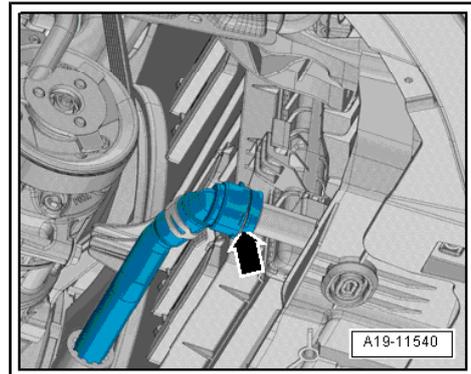


Note

Item -3- can be disregarded.

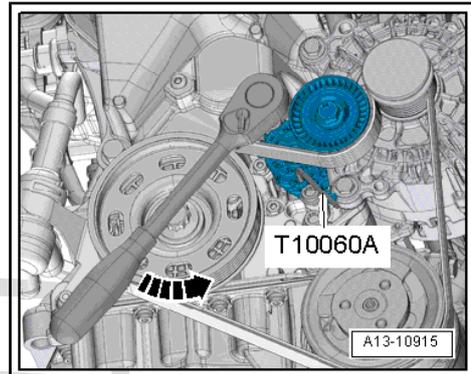


- Lift retaining clip -arrow-, disconnect coolant hose from water radiator (bottom right) for charge air cooling circuit and drain off coolant.



Vehicles with air conditioning compressor:

- If poly V-belt is to be reinstalled, mark direction of rotation on belt using chalk or felt tip pen before removing.
- To slacken poly V-belt, swivel tensioning device anti-clockwise in -direction of arrow-.
- Secure tensioner with locking pin - T10060 A- .
- Remove the V-ribbed belt.

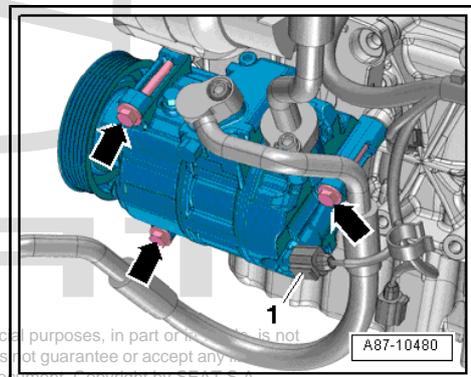


CAUTION

Risk of freezing injury caused by refrigerant.

- Do not open refrigerant circuit of air conditioning system.

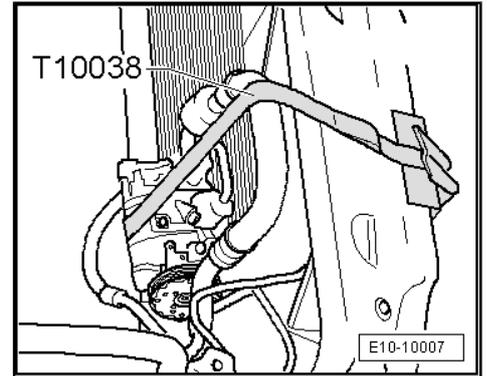
- Unplug the connector -1- at the air conditioner compressor regulating valve - N280- .
- Unscrew the bolts -arrow- for air conditioner compressor.



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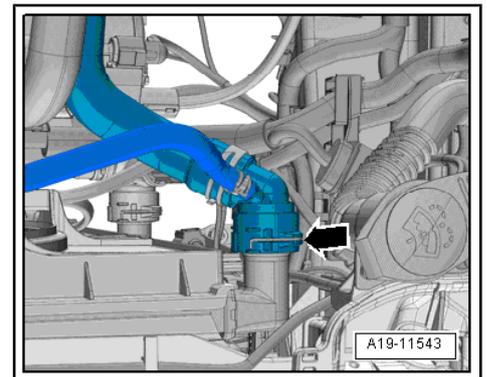


- Lift the air conditioner compressor with connected refrigerant pipes and, using the supporting tool - T10038- , fix on the lock carrier and suspend. Proceed with great care in order not to damage the system.

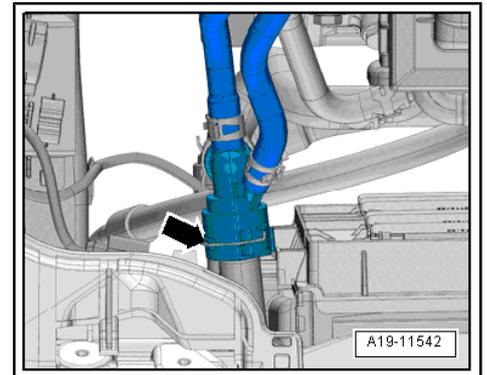


Continuation for all vehicles:

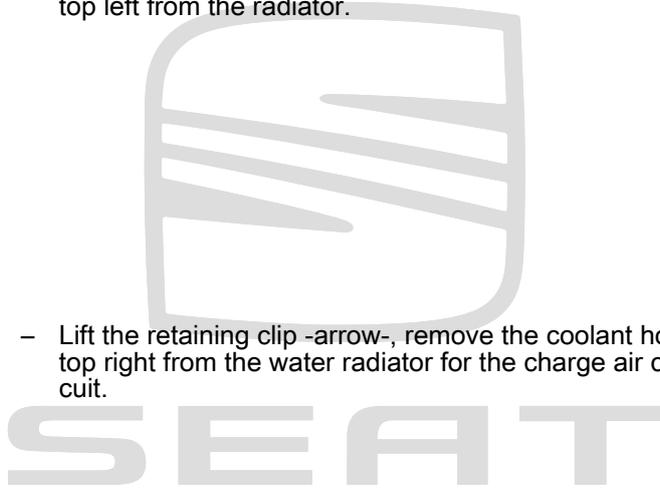
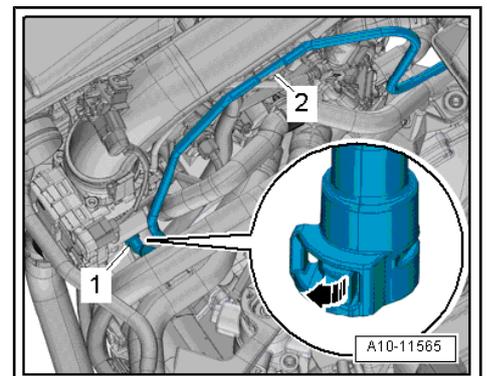
- Lift the retaining clip -arrow-, remove the coolant hose at the top left from the radiator.



- Lift the retaining clip -arrow-, remove the coolant hose at the top right from the water radiator for the charge air cooling circuit.



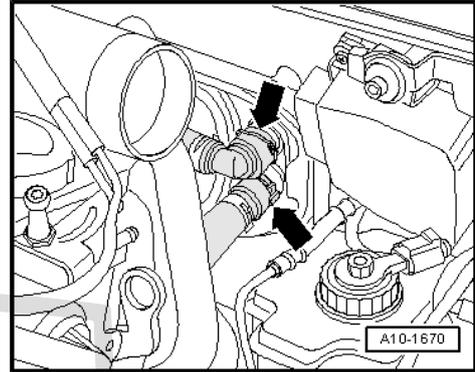
- Release catch -arrow- and disconnect vacuum hose -1-.
- Move clear vacuum hose at air intake pipe -2-.



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- Lift the retaining clips -arrows- and detach the coolant hoses from the heat exchanger for heater.

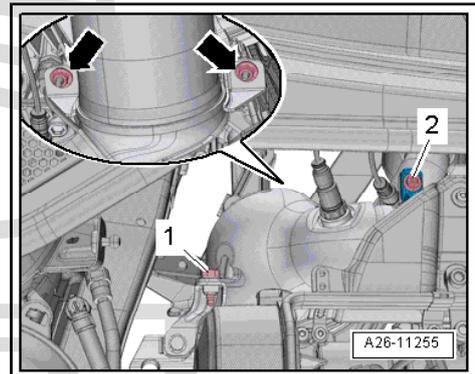


- Unscrew bolt -2- and remove screw-type clip.
- Remove bolt -1- and nuts -arrows- and tie up catalytic converter.



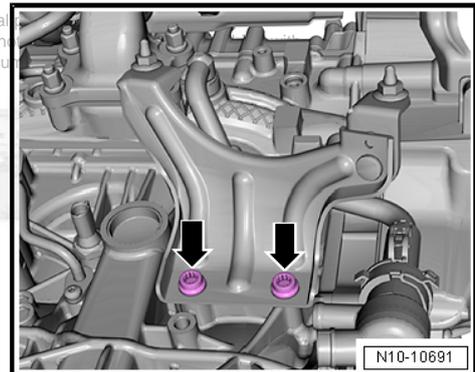
Note

Do not bend decoupling element more than 10°. It may be damaged

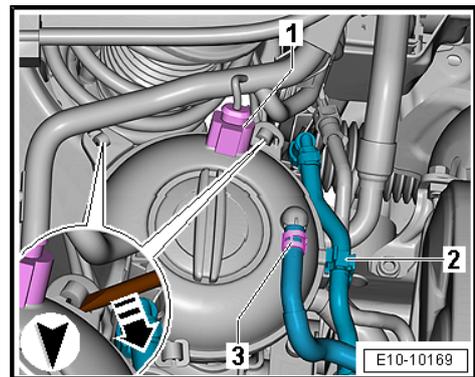


- Unscrew bolts -arrows- and remove bracket.

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- Loosen hose -2- for activated carbon filter.
- Unplug the electrical connector -1-.
- Open the catch mechanisms with a screwdriver -Arrow-.
- Loosen the hose clip -3-, remove the coolant hose.



- Remove clip -1-, remove coolant hose and remove the coolant expansion tank.

CAUTION

The fuel system is pressurised.
Risk of injury due to fuel which may spurt out.

- Use safety goggles.
- Wear protection gloves.
- Release pressure: place clean cloth around connection and carefully open connection.

- Observe rules for cleanliness when working on the fuel supply system ⇒ [page 6](#) .
- First press hose connector -1- downwards, and then press release tabs -arrows-.
- Pull off hose connector, keeping release tabs depressed.
- Press release tab on hose -2- connected to activated charcoal filter.
- Disconnect hose and move it clear.

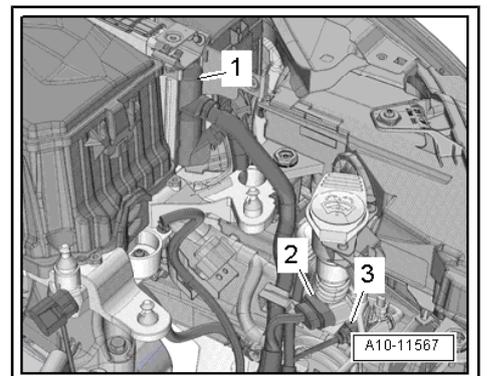
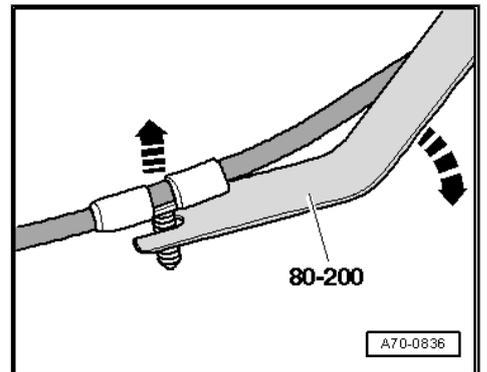
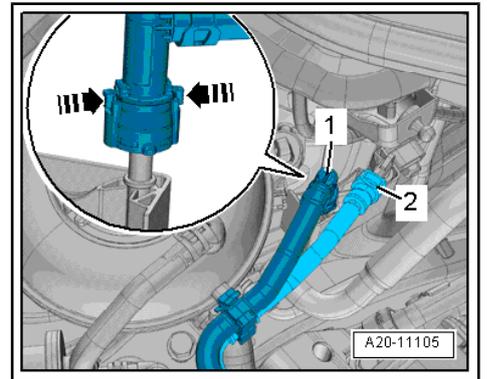
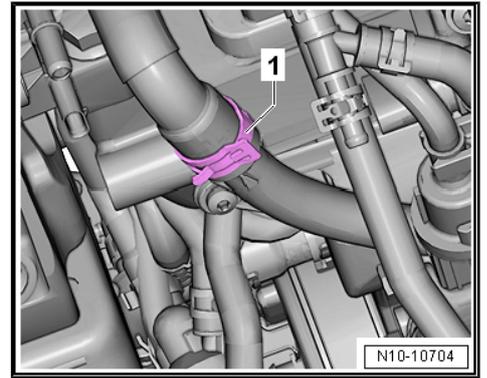
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Note

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

- Remove engine control unit - J623- ⇒ [page 340](#) .
- Detach electrical connectors -2- and -3- from the bracket and separate.

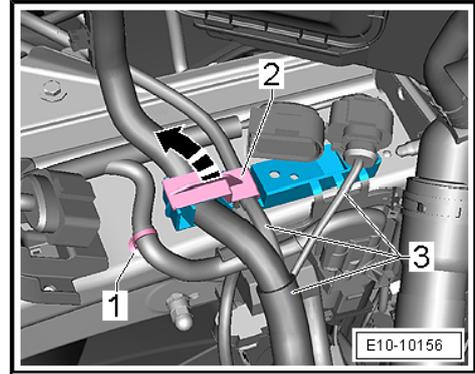


- Open the cable duct -2- upward
-in the direction of the arrow-

i Note

Item -1- can be disregarded.

- Move electrical wiring clear.

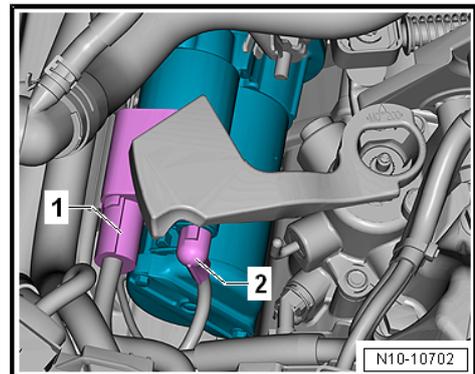


- Unplug the electrical connector -2-.

i Note

Item -1- can be disregarded.

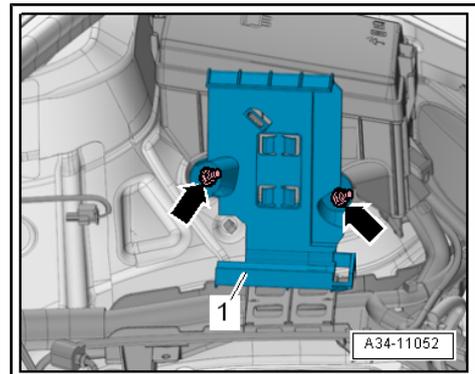
- Unscrew earth cable on the bodywork.



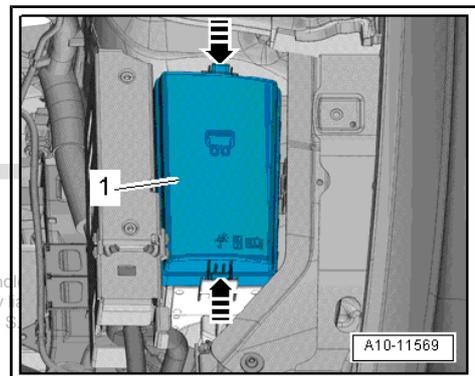
- Remove nuts -arrows- and detach bracket -1-.

i Note

Different types of brackets are fitted depending on version.



- Release catches -arrows- and detach cover -1- for electronics box in engine compartment.



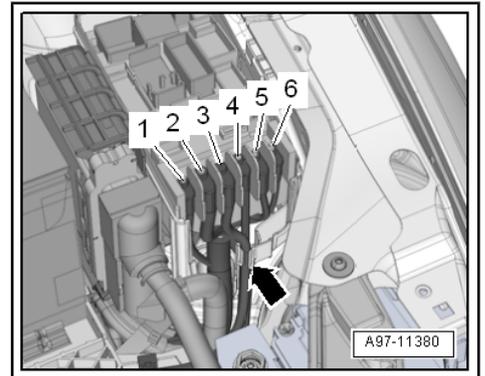
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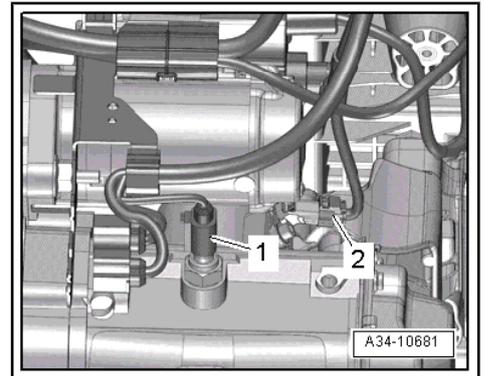
- Release catch using a screwdriver -arrow- and detach cover -1- for electronics box in engine compartment upwards.



- Remove nut -2- and screw -3- and disconnect electrical lines -arrow-.
- Release the requisite plug connections and clips.



- Unplug electrical connectors -1- and -2-.
- Remove line sections from the mounts and lay on the engine.



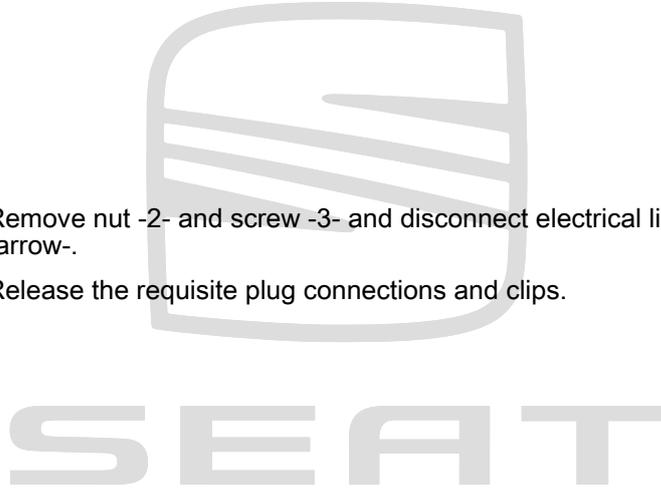
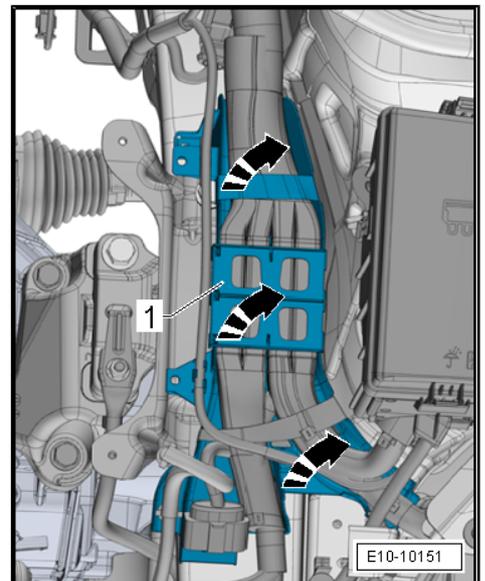
- Remove line guide -1- from its clips, slide upwards -in direction of arrow- and secure on one side.

Manual gearbox

- Remove gearbox selector mechanism ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .
- Remove clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch slave cylinder .

Dual clutch gearbox

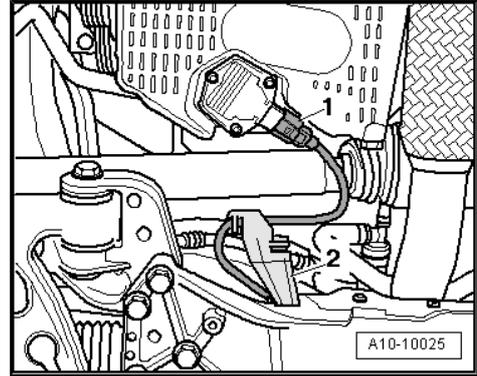
- Remove selector lever cable, pull connector of mechatronic off and remove all retainers from gearbox: ⇒ Rep. gr. 34 ; Removing and installing gearbox



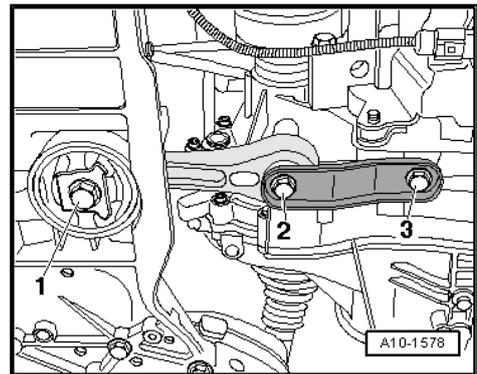
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Continued procedure for all vehicles

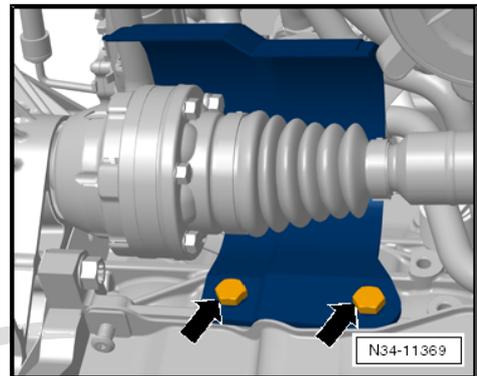
- Disconnect connector -1- of the oil level and oil temperature sender - G266- .



- Remove bolts -1, 2, 3- and detach pendulum support.



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



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- Unplug and detach the drive shafts from the flange shafts / gearbox.
- Leave the drive shafts supported at the subframes.

 **Note**

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

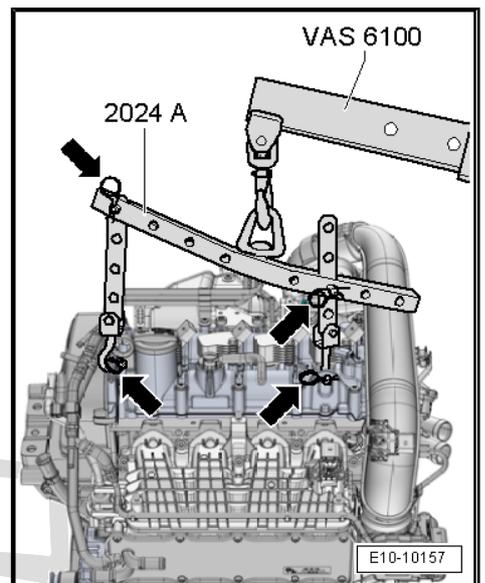
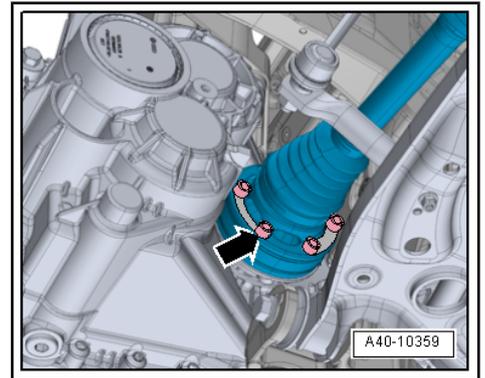
 **Note**

- ◆ *All periphery elements, such as electrical line sections, gear activators, low pressure lines, which are in the engine space and make the removal of the »engine/gear box bracket« should be ordered and secured with flanges.*
- ◆ *Make sure that all lines of the exhaust temperature sender are not exposed to tension and that they are not damaged when removing the »engine assembly«.*
- ◆ *Check that all hose and line connections between engine, gearbox and body have been detached.*

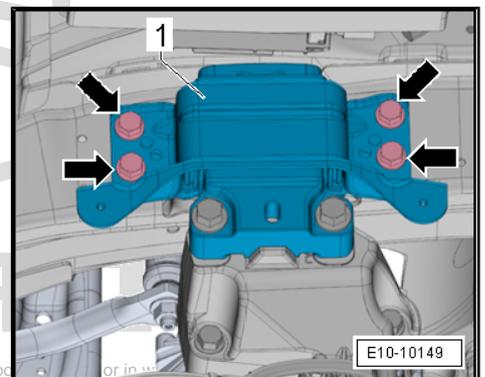
- Hook the lifting tackle - 2024A- as described in the following and, using the workshop crane - VAS 6100- , lift the »engine assembly« into its assembly position.

 **Note**

- ◆ *To adjust to the centre of gravity of the assembly, the perforated rails must be positioned as shown.*
- ◆ *The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.*



- Unscrew bolts -arrows- from gearbox support -1-.



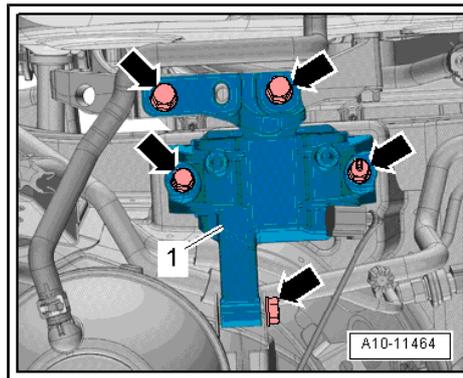
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- Remove bolts -arrows- and detach engine mounting -1-.



Note

- ◆ *Danger of damage to vacuum lines or electrical wiring and to engine compartment.*
- ◆ *Check that all hose and line connections between engine, gearbox and body have been detached.*
- ◆ *Carefully remove the engine/gearbox unit out of the engine bay whilst lifting it up.*
- ◆ *Do not stretch, kink or bend refrigerant pipes and hoses.*



Note

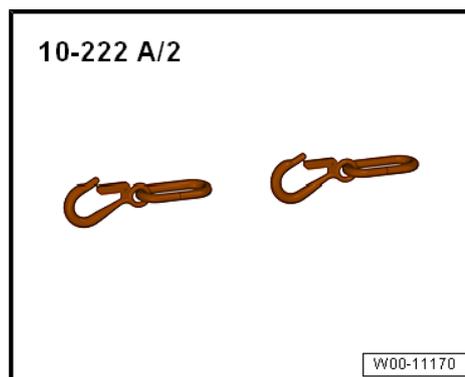
Carefully lift the »engine/gearbox unit« upwards when removing it, in order not to damage the bodywork and the coolant hoses.

Secure engine to engine and gearbox support - VAS 6095- to carry out repairs ⇒ [page 22](#) .

1.2 Separating engine and gearbox

Special tools and workshop equipment required

- ◆ Hook - 10 - 222 A /2-



- ◆ Shackle - 10 - 222 A /12-



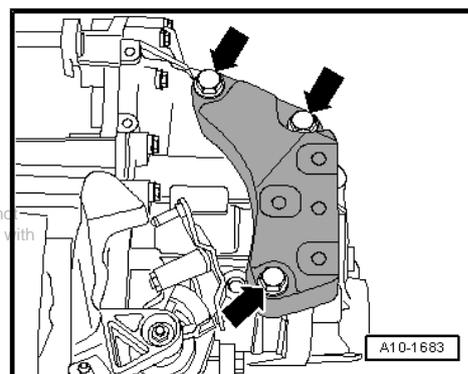
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◆ Workshop crane - VAS 6100-

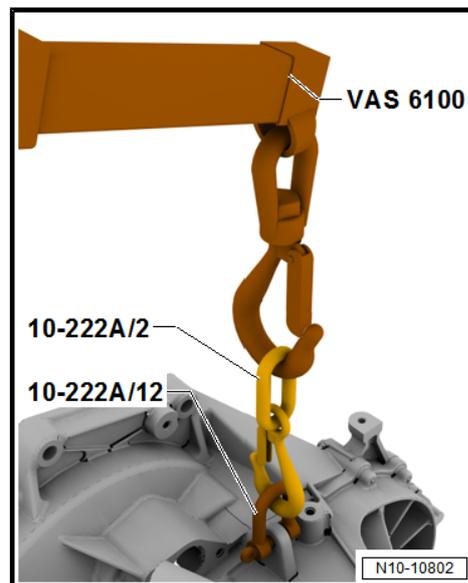


Work sequence

- Remove starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter
- Unscrew bolts -arrows- and detach gearbox support.



- Bolt shackle - 10 - 222 A /12- to gearbox.
- Attach workshop hoist - VAS 6100- with hook - 10 - 222 A /2- to shackle - 10 - 222 A /12- .



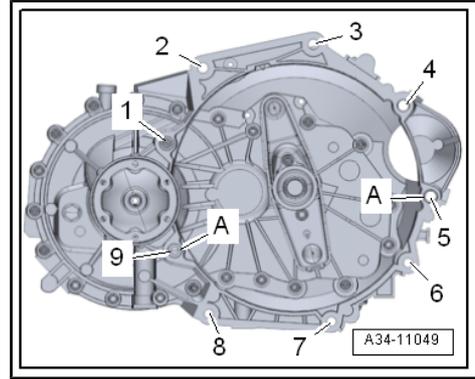
- Remove bolts -1, 2, 3, 6, 7, 8, 9- securing gearbox to engine.



Note

Ignore -items 4, 5- and -A-.

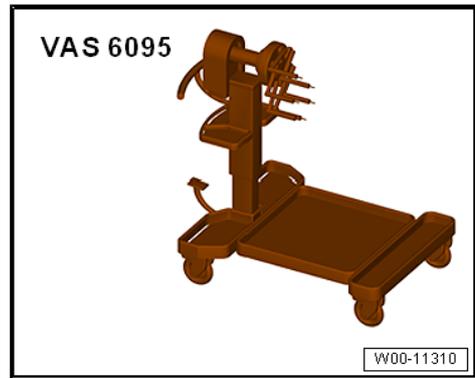
- Detach gearbox from engine.



1.3 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- ◆ Engine / gearbox support - VAS 6095-



- ◆ Workshop crane - VAS 6100-



- ◆ Lifting Tackle - 2024 A-

Work sequence

- With the gearbox separated from the engine ⇒ [page 20](#) .

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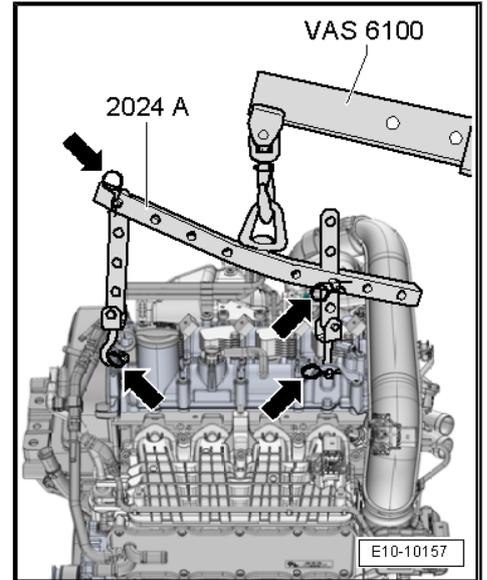
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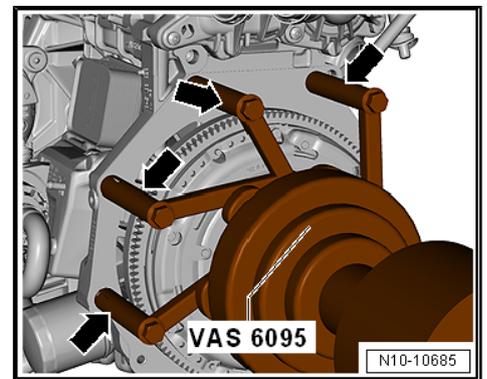
- Attach lifting tackle - 2024 A- to engine and workshop hoist - VAS 6100- as shown in illustration.

i Note

- ◆ *To adjust to the centre of gravity of the assembly, the perforated rails must be positioned as shown.*
- ◆ *The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.*



- Secure engine with pins -arrows- on engine and gearbox support - VAS 6095- as shown in illustration.



1.4 Engine: fitting

Work sequence

- Attach power unit with the aid of the lifting device - 2024 A- and the workshop crane - VAS 6100- .

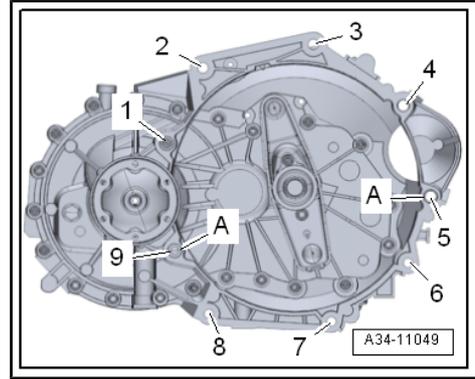
i Note

- ◆ *Renew bolts that are tightened with specified further tightening angle.*
 - ◆ *Renew self-locking nuts and bolts, and seals, O-rings and gaskets.*
 - ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) => [Electronic parts catalogue \(ETKA\)](#)*
 - ◆ *The cable clamps must be installed in their same place again.*
- Intermediate plate installation => [page 56](#)

- If there are no dowel sleeves -A- in cylinder block for centring engine and gearbox, insert new ones.
- Bolt gearbox to engine at positions -1, 2, 3, 6, 7, 8, 9-.
- Install gearbox support.

The engine/gearbox unit is inserted into the engine compartment with the assembled engine and gearbox supports.

- Using the lifting tackle - 2024 A- and the workshop crane - VAS 6100- insert the engine/gearbox unit.
- Support the gearbox mounting on the longitudinal member initially.



Note

Carefully lower the »engine/gearbox unit« downwards when installing it, in order not to damage the bodywork and the coolant hoses.



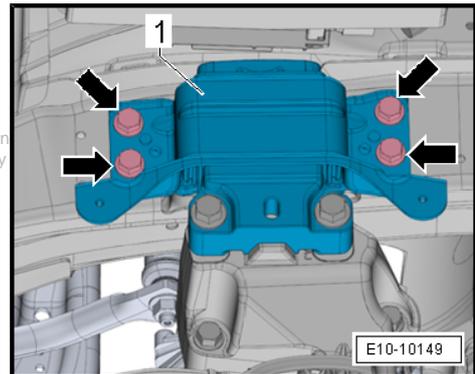
Note

Attach drive shafts to corresponding flange shafts of gearbox.

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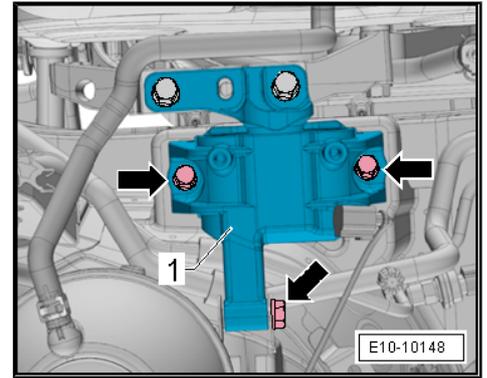
- Screw in bolts -arrows- by hand until stop in the gearbox support -1-.
- Screw in bolts -arrows- by hand until stop in the engine bracket -1-.

 **Note**

Different types of brackets are fitted depending on version.

 **Note**

The bolts are tightened to final torque only after adjusting the assembly mountings ⇒ [page 34](#) .



- Install starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Starter: assembly overview .
- Install air intake pipe ⇒ [page 306](#) .
- Install air ducts ⇒ [page 308](#) .

Vehicles with manual gearboxes

- Install clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch slave cylinder .
- Installing control cables with counter-hold tool ⇒ Rep. gr. 34 ; Selector mechanism; Control cables: assembly overview .

Vehicles with dual clutch gearbox:

- Install selector lever cable, fit connector of mechatronic and install all retainers on gearbox: ⇒ Rep. gr. 34 ; Removing and installing gearbox

Continued procedure for all vehicles

- Install radiator cowl ⇒ [page 293](#) .
- Install catalytic converter ⇒ [page 357](#) .
- Install drive shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Assembly overview - drive shaft .
- Install air conditioner compressor ⇒ Rep. gr. 87 ; Air conditioner compressor; Exploded view- drive train for air conditioner compressor .
- Fit poly V-belt ⇒ [page 39](#) .
- Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install engine control unit - J623- ⇒ [page 340](#) .
- Connect coolant hoses with plug-in connector ⇒ [page 285](#) .
- Install the pendulum support.
- Assembly mounting: adjusting ⇒ [page 34](#) .
- Install battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .
- Install air cleaner housing. ⇒ [page 326](#)
- check oil level ⇒ Maintenance ; Booklet 501 .



Note

- ◆ *Do not use charger for boost starting,*
- ◆ *Overvoltage can cause irreparable damage to control units.*
- Fill up with coolant ⇒ [page 252](#) .



Note

Do not re-use soiled coolant.

Specified torques

- ◆ Assembly mountings
⇒ [“2.1 Exploded view - assembly mountings”, page 27](#)
- ◆ Securing the gearbox to engine ⇒ Rep. gr. 34 ; Gearbox:
removing and installing; Gearbox: installing .



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2 Assembly mountings

⇒ [“2.1 Exploded view - assembly mountings”, page 27](#)

⇒ [“2.2 Supporting engine in installation position”, page 28](#)

⇒ [“2.3 Removing and installing engine mountings”, page 31](#)

⇒ [“2.4 Removing and installing gearbox mounting”, page 31](#)

⇒ [“2.5 Removing and installing pendulum support”, page 33](#)

⇒ [“2.6 Checking adjustment of assembly mountings”, page 34](#)

⇒ [“2.7 Adjusting assembly mounting”, page 34](#)

2.1 Exploded view - assembly mountings

1 - Bolt

- renew
- Tightening sequence
⇒ [page 28](#)

2 - Engine support

- Tightening torque and sequence ⇒ [page 28](#) .

3 - Engine carrier

- With support arm
- Removing and installing
⇒ [page 31](#)

4 - Bolt

- renew
- 40 Nm +90°

5 - Bolt

- renew
- 20 Nm +90°

6 - Bolt

- 8 Nm

7 - Support bracket

8 - Bolt

- renew
- 60 Nm +90°

9 - Pendulum support

- Removing and installing
⇒ [page 33](#)

10 - Bolt

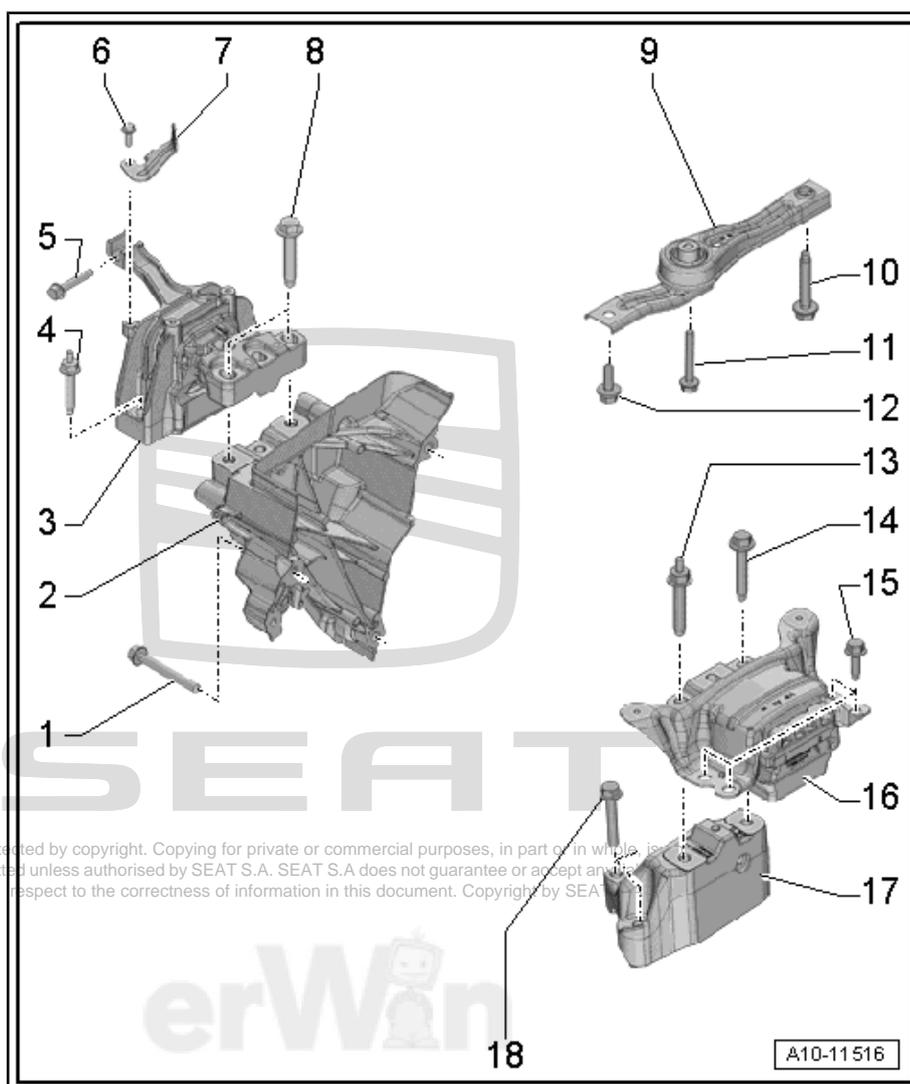
- renew
- Tightening torque and sequence ⇒ [page 28](#) .

11 - Bolt

- renew
- Tightening torque and sequence ⇒ [page 28](#) .

12 - Bolts

- renew
- Tightening torque and sequence ⇒ [page 28](#) .



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13 - Bolt

- renew
- 60 Nm +90°

14 - Bolt

- renew
- 60 Nm +90°

15 - Bolt

- renew
- 50 Nm +90°

16 - Gearbox support

- With support arm
- Removing and installing ⇒ [page 31](#)

17 - Gearbox support

- For vehicles with manual gearbox

18 - Bolt

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

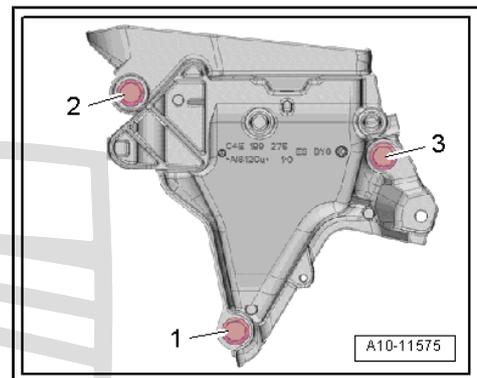
Engine support - Tightening torque and sequence

Note

Renew bolts that are tightened with specified further tightening angle.

- Tighten bolts step by step in the following sequence:

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



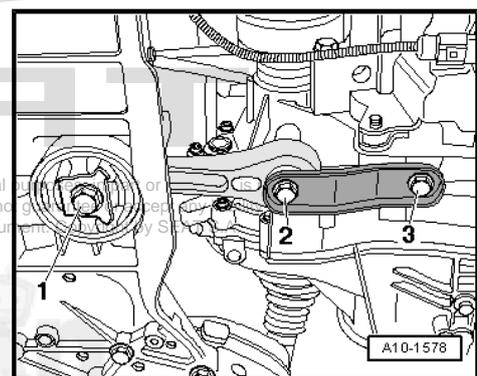
Installing pendulum support

Note

Renew bolts that are tightened with specified further tightening angle.

- Tighten bolts step by step in the following sequence:

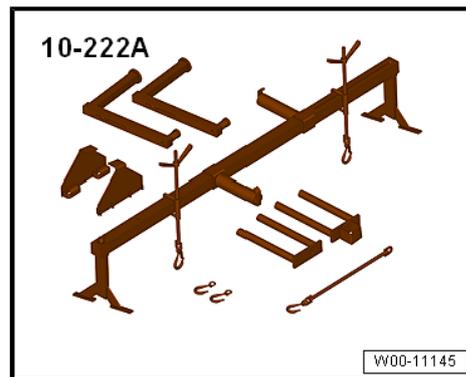
stage	Bolts	Tightening torque/angle specification
1.	-2, 3-	50 Nm
2.	-1-	130 Nm
3.	-1 ... 3-	Turn 90° further



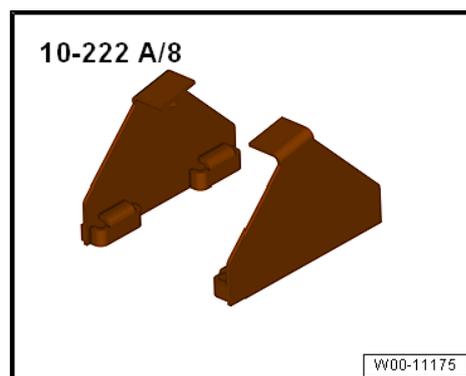
2.2 Supporting engine in installation position

Special tools and workshop equipment required

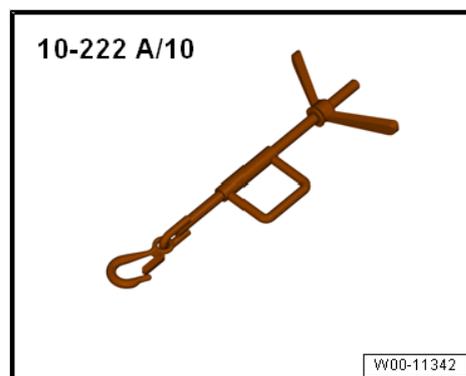
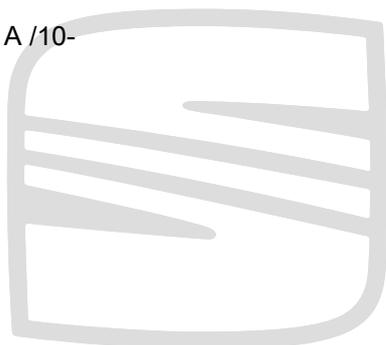
- ◆ Support tool - 10 - 222 A-



- ◆ Adapter - 10-222A/13-



- ◆ Spindle - 10 - 222 A /10-

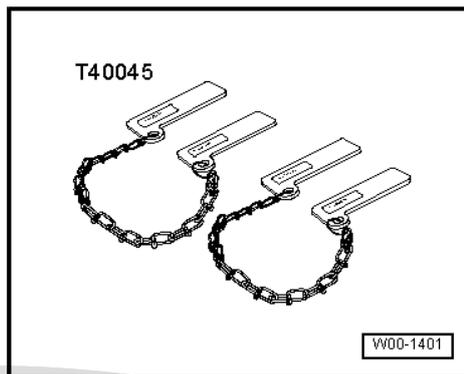


- ◆ Shackle - 10 - 222 A /12-

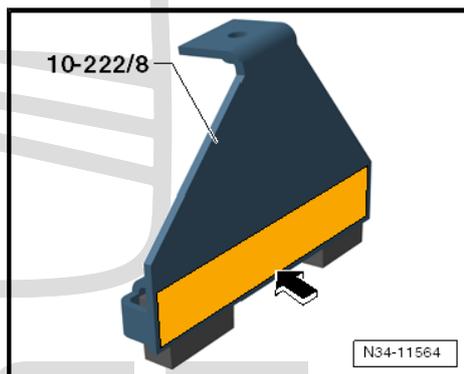
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◆ Gauge - T40045-

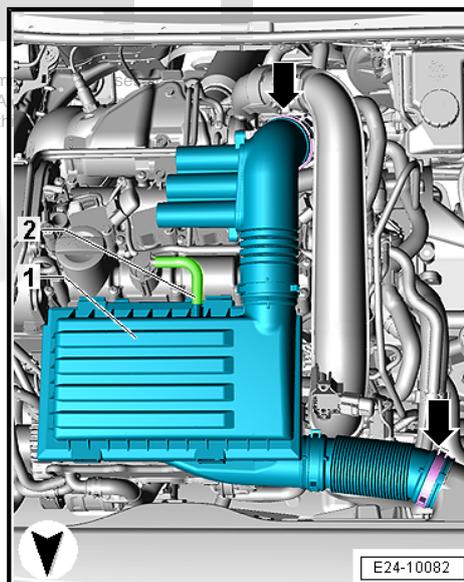


To prevent damage to edges of wings, cover lower areas of both adapters - 10 - 222 A /8- with woven adhesive tape -arrow- → Electronic Parts Catalogue (ETKA) .

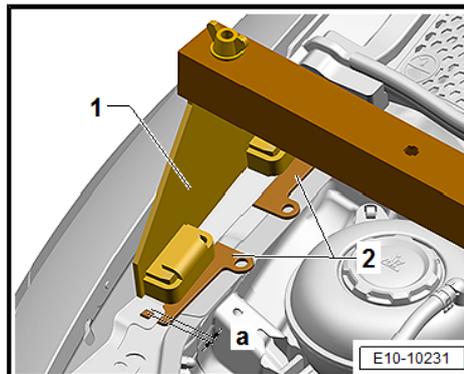


Work sequence

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



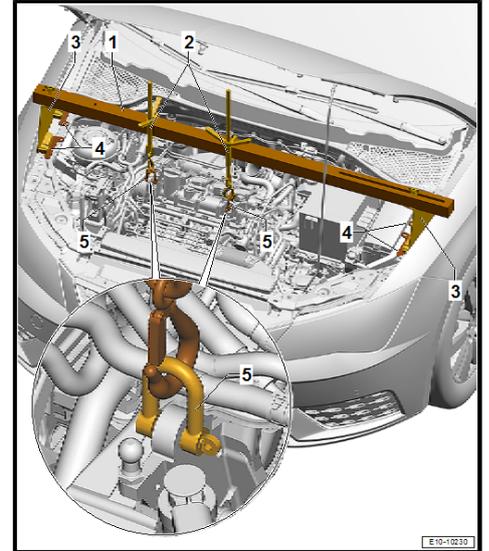
- Insert and position the gauge - T40045- -2- as shown in the illustration on the front longitudinal members left and right, observe the dimension -a- in doing so.
- Attach the adapter - 10 - 222 A /8- -1- on left and right onto longitudinal members as shown in illustration.



- Slide the spindles - 10 - 222 A /10- -2- onto the engine interception device - 10 - 222 A- .
- Screw in the adapter - 10 - 222 A /8- -3- into the engine interception device - 10-222 A- -1-.
- Insert the engine interception device - 10 - 222 A- -1- and the adapter - 10 - 222 A /8- -3- on left and right onto longitudinal members as shown.

Observe the position and setting of the gauge - T40045- -4- ⇒ [page 30](#) .

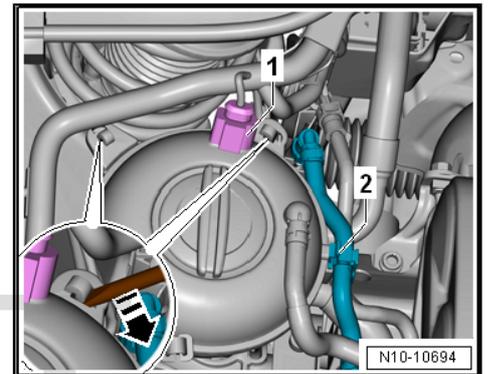
- Fit the shackle - 10 - 222 A /12- -5- into the lifting eyes of the engine left and right.
- Hook the karabiners of the spindles - 10 - 222 A /10- -2- into the shackle - 10 - 222 A /12- -5-.
- Take up weight of engine/gearbox assembly with spindle, but without raising it.



2.3 Removing and installing engine mountings

Removing

- Loosen hose -2- for activated carbon filter.
- Disconnect connector -1-.
- Release detent using a screwdriver -arrow- and place coolant expansion tank to one side.
- Support engine and gearbox in installation position ⇒ [page 28](#) .



- Unscrew and remove the screws -Arrows- and remove engine mounting -1-.

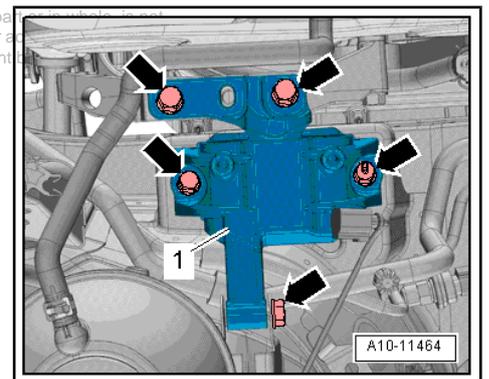
Installation

Install in the reverse order of removal, observing the following:

- Check adjustment of assembly mountings (engine/gearbox mountings) ⇒ [page 34](#) .

Specified torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 27](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber partition panel; remove and install plenum chamber cover

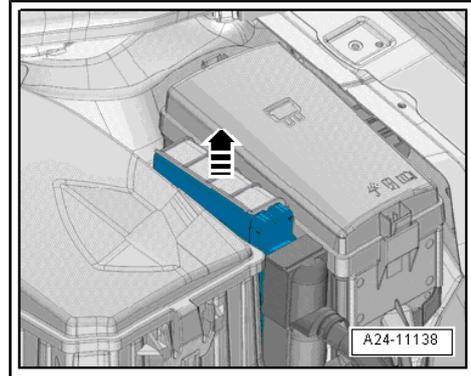


2.4 Removing and installing gearbox mounting

Removing

- Support engine and gearbox in installation position ⇒ [page 28](#) .
- Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .

- Release fastener -arrow-, detach engine control unit - J623- and place to one side.
- Remove engine control unit => [page 340](#) .

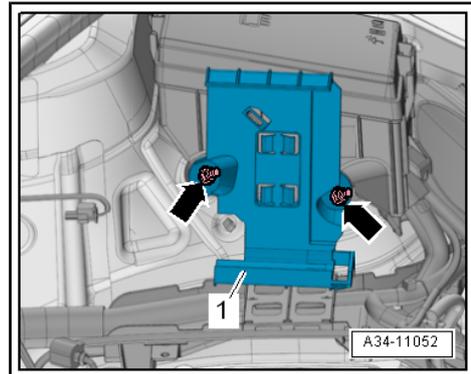


- Remove nuts -arrows- and detach bracket -1-.

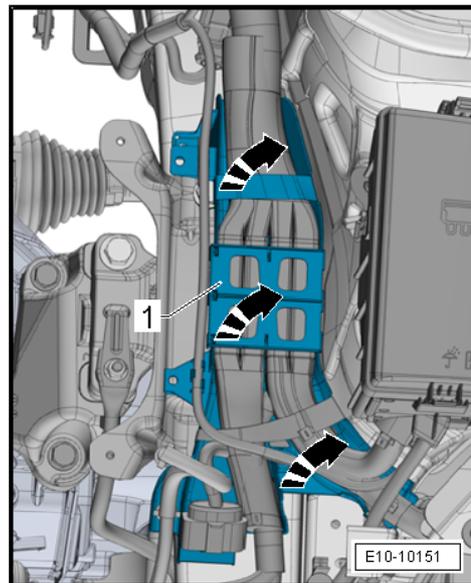


Note

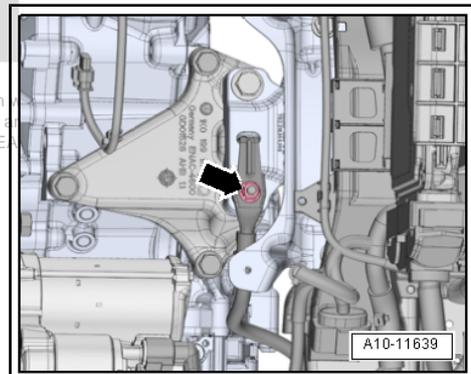
Different types of brackets are fitted depending on version.



- Unclip wire guide -1- upwards -arrows- and push slightly to one side.



- Depending on version, unscrew and remove nut -Arrow- and expose the earth wire.



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

Installation

Install in the reverse order of removal, observing the following:



Note

Renew bolts that are tightened with specified further tightening angle.



Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Gearbox support and support arm of gearbox mounting must be perfectly parallel to each other before screwing in bolts -arrows 1-. If necessary, lift gearbox at rear using trolley jack.*
- ◆ *Only remove support bracket - 10 - 222 A- when bolts on assembly mounting have been tightened to specified torque.*

- Pull gearbox up with spindle on support bracket until gearbox support contacts support arm of gearbox mounting.
- Check adjustment of assembly mountings (engine/gearbox mountings) ⇒ [page 34](#) .
- Remove the gearbox support - 10 - 222 A- from the engine.

Specified torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 27](#)
- ◆ ⇒ [“3.2 Removing and installing air filter housing”, page 327](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Battery; Battery - Exploded view
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber partition panel; remove and install plenum chamber cover

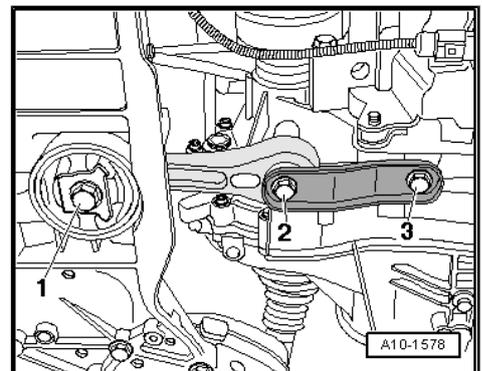
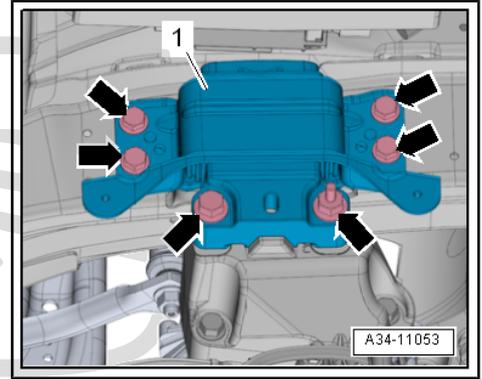
2.5 Removing and installing pendulum support

Removing

- Unscrew bolts -1, 2, 3- and remove the pendulum support.

Installation

Install in the reverse order of removal, observing the following:



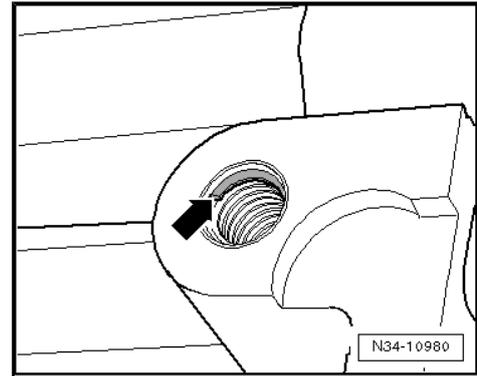


Note

- ◆ Bolt holes for pendulum support are fitted with thread inserts (e.g. "HeliCoil").
- ◆ Identification: Shoulder on first thread -arrow-.

Specified torques

- ◆ ⇒ Fig. "Installing pendulum support", page 28 .



2.6 Checking adjustment of assembly mountings

Procedure

The following dimensions must be reached:

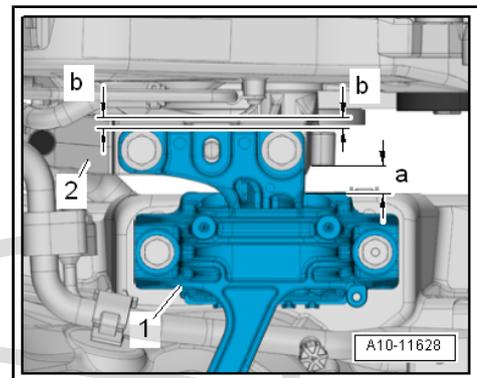
- There must be a distance of -a- = 10 mm between engine support -2- and engine mounting -1-.
- Side surface of engine support casting should be located parallel to support arm of engine mounting -1-.
- Distance -b- = distance -b-.



Note

For example, distance -a- = 10 mm can be checked with a metal rod of suitable size.

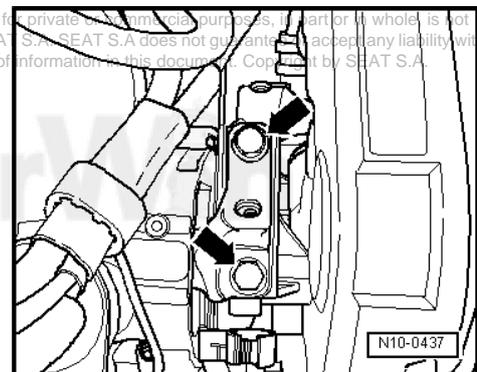
- If the distance measured is too large or small, the assembly mountings must be adjusted ⇒ page 34 .



2.7 Adjusting assembly mounting

Work sequence

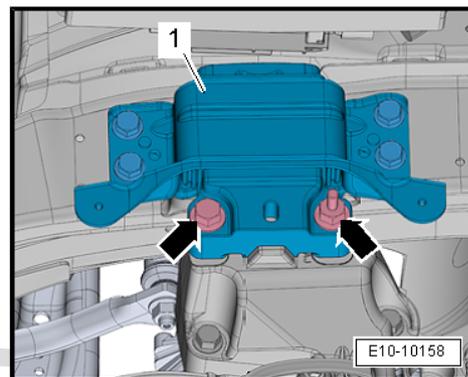
- Support engine and gearbox in installation position ⇒ page 31 .
- Remove bolts -arrows- for engine mounting one by one and renew (if they were not renewed when installing engine).
- First screw bolts in loosely.



- Remove bolts -arrows- for gearbox mounting -1- one by one and renew (if they were not renewed when installing engine).
- First screw bolts in loosely.

**Note**

Ignore -arrows 2-.

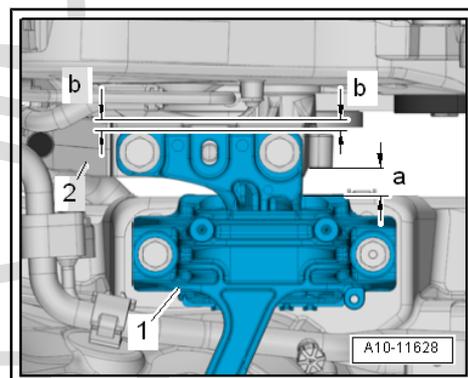


- Using assembly lever, adjust engine/gearbox assembly so that specifications listed below are attained:

There must be a distance of -a- = 10 mm between engine support -2- and engine mounting -1-.

Side surface of engine support casting should be located parallel to support arm of engine mounting -1-.

Distance -b- = distance -b-.

**Note**

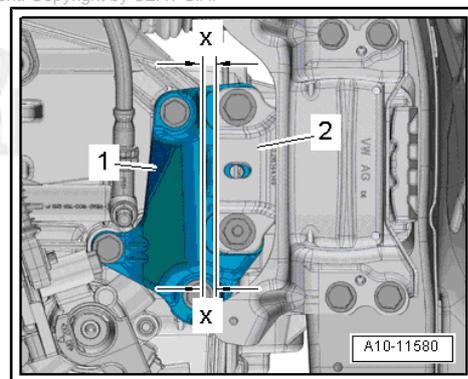
For example, distance -a- = 10 mm can be checked with a metal rod of suitable size.

- Tighten bolts for engine mounting.
- On the gearbox side, ensure that the edges of the support arm -2- and gearbox support -1- are parallel.
- Dimension -x- = dimension -x-.
- Tighten bolts for gearbox mounting.

Install in the reverse order of removal, observing the following:

Specified torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 27](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)
- ◆ ⇒ [“3.2 Removing and installing air filter housing”, page 327](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Battery; Battery - Exploded view
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Plenum chamber partition panel; remove and install plenum chamber cover



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-belts”, page 39](#)

⇒ [“1.3 Assembly overview - Sealing flange, belt pulley end.”, page 42](#)

⇒ [“1.4 Removing and installing tensioner for poly V-belt”, page 44](#)

⇒ [“1.5 Removing and installing vibration damper”, page 45](#)

⇒ [“1.6 Removing and installing engine support”, page 46](#)

⇒ [“1.7 Crankshaft oil seal- pulley side: replace”, page 50](#)

⇒ [“1.8 Removing and installing sealing flange \(pulley end\)”, page 52](#)

1.1 Exploded view - poly V-belt drive

⇒ [“1.1.1 Exploded view - poly V-belt drive, vehicles without air conditioner compressor”, page 36](#)

⇒ [“1.1.2 Exploded view - poly V-belt drive, vehicles with air conditioner compressor”, page 38](#)

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



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1 - Bolt

- renew
- 150 Nm +180°
- Use counterholder - T10475- to loosen and tighten.

2 - Poly V-belt pulley

- Removing and installing ⇒ [page 45](#)

3 - Poly-V belt:

- Check for wear
- Mark direction of rotation with chalk or felt pen before removing
- The length of the poly V-belt must be determined depending on the design of the overrunning alternator pulley in accordance with the ⇒ [Electronic Parts Catalogue \(ETKA\)](#).

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- Do not kink
- Routing of poly V-belt ⇒ [page 40](#)
- Removing and installing ⇒ [page 39](#)
- When installing, make sure it is properly seated on the pulleys.

4 - Bolt

- 20 Nm +90°

5 - Poly V-belt tightener

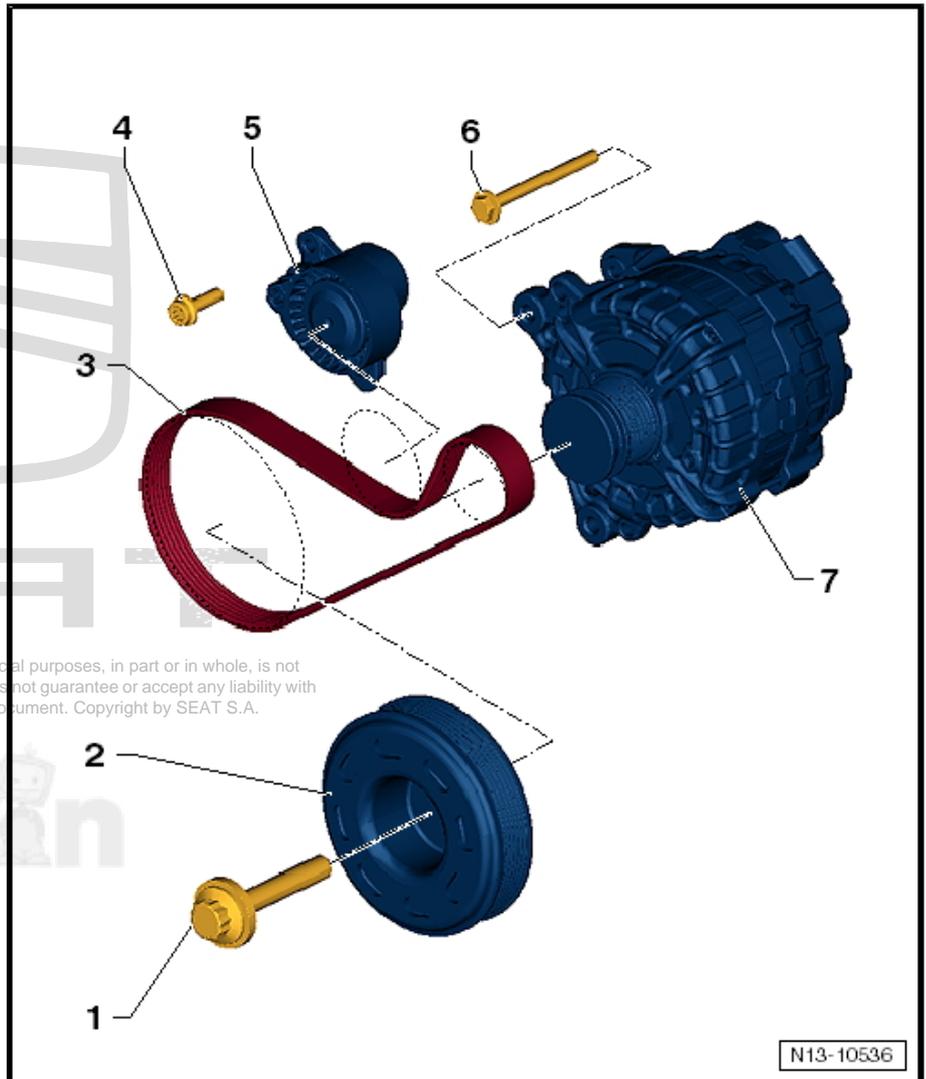
- Pivot with socket to slacken poly V-belt
- Lock with locking pin - T10060 A-
- Removing and installing ⇒ [page 44](#)

6 - Bolt

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

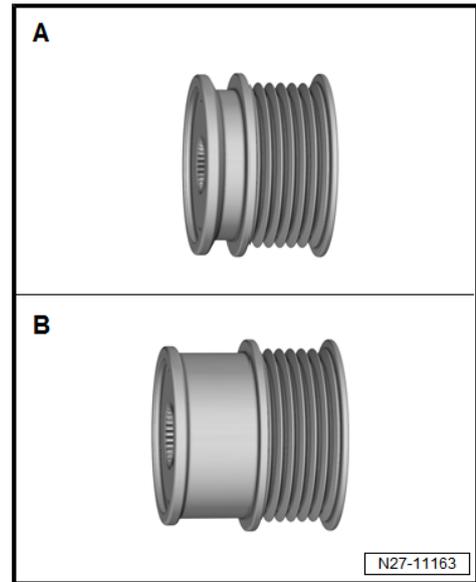
7 - Alternator

- Exploded view ⇒ Electrical system; Rep. gr. 27 ; Alternator; Alternator: Exploded view
- With coasting function
- Depending on the type and version of the alternator different overrunning alternator pulleys -A- and -B- may be installed: correspondence ⇒ [page 38](#) .
- The length of the poly V-belt must be determined depending on the design of the overrunning alternator pulley in accordance with the ⇒ [Electronic Parts Catalogue \(ETKA\)](#) .



Allocation of the overrunning alternator pulley

The length of the poly V-belt must be determined according to the ⇒ Electronic Parts Catalogue (ETKA) depending on the version of overrunning alternator pulley.



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

1 - Poly-V belt:

- Check for wear
- Mark direction of rotation with chalk or felt pen before removing
- The length of the poly V-belt must be determined depending on the design of the overrunning alternator pulley in accordance with the ⇒ Electronic Parts Catalogue (ETKA) .
- Do not kink
- Routing of poly V-belt ⇒ [page 42](#)
- Removing and installing ⇒ [page 39](#)
- When installing, make sure it is properly seated on the pulleys.

2 - Bolt

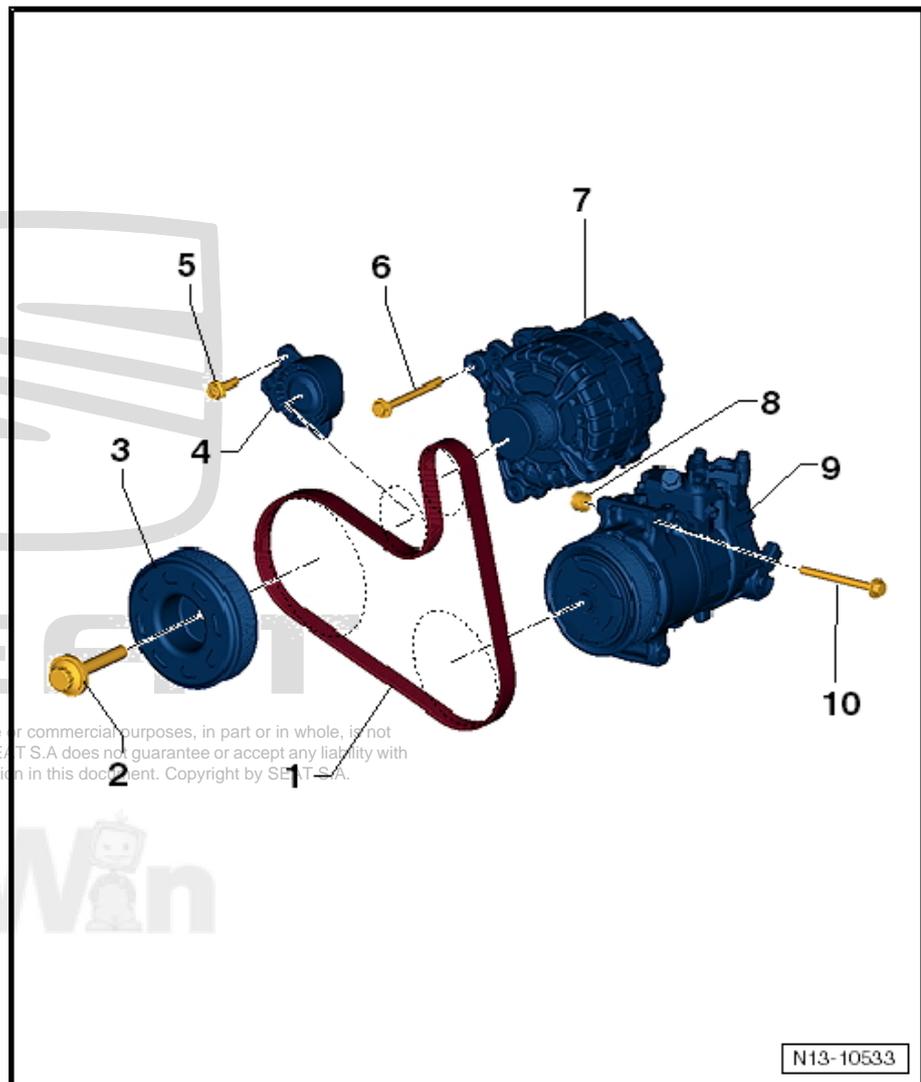
- Tightening torque ⇒ [item 1 \(page 37\)](#)

3 - Vibration damper

- Removing and installing ⇒ [page 45](#)

4 - Poly V-belt tightener

- Pivot with socket to slacken poly V-belt
- Lock with locking pin - T10060 A-
- Removing and installing ⇒ [page 44](#)



5 - Bolt

- 20 Nm +90°

6 - Bolt

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

7 - Alternator

- Exploded view ⇒ Electrical system; Rep. gr. 27 ; Alternator; Alternator: Exploded view

8 - Adjusting sleeve

- For air conditioner compressor

9 - Air conditioning compressor

- Do not unscrew or disconnect the refrigerant hoses or pipes
- Remove and install ⇒ Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .

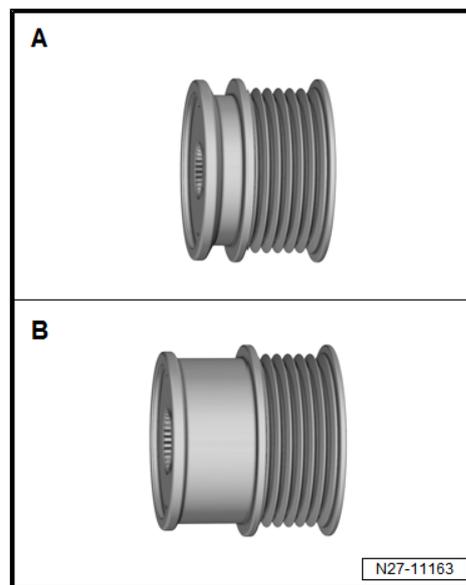
10 - Bolt

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

Allocation of the overrunning alternator pulley

The length of the poly V-belt must be determined according to the ⇒ Electronic Parts Catalogue (ETKA) depending on the version of overrunning alternator pulley

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1.2 Removing and installing poly V-belts

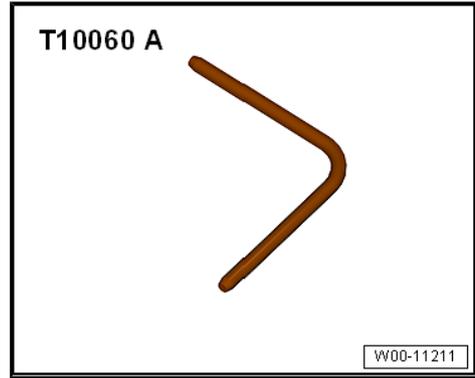
⇒ [“1.2.1 Poly-V belt: Removing and installing, vehicles without air conditioner compressor”, page 39](#)

⇒ [“1.2.2 Poly-V belt: Removing and installing, vehicles with air conditioner compressor”, page 41](#)

1.2.1 Poly-V belt: Removing and installing, vehicles without air conditioner compressor

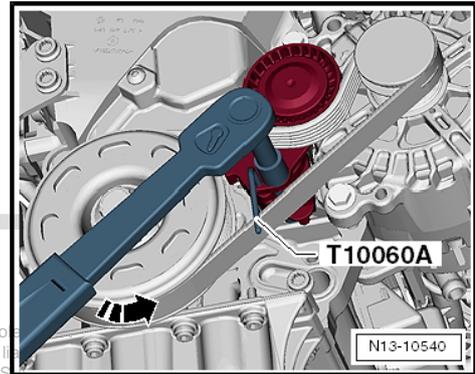
Special tools and workshop equipment required

◆ Locking pin - T10060 A-



Removing

- To slacken poly V-belt, turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060 A- .
- If poly V-belt is to be reinstalled, mark direction of rotation on belt using chalk or felt tip pen before removing.
- Remove the V-ribbed belt.

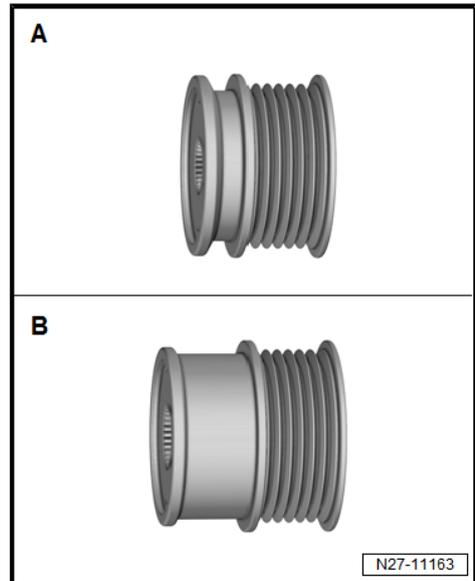


Installation

Install in the reverse order of removal, observing the following:

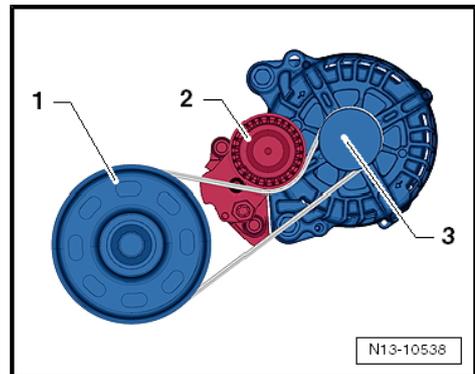
Various versions of the overrunning alternator pulley, -A- or -B-, may be fitted depending on the type and version of the alternator.

The length of the poly V-belt must be determined according to the ⇒ Electronic Parts Catalogue (ETKA) depending on the version of overrunning alternator pulley.

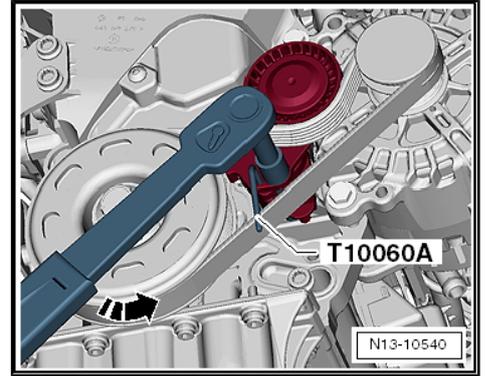


- Install the poly V-belt as depicted in the illustration:

- 1 - Pulley
- 2 - Poly V-belt tightener
- 3 - Alternator



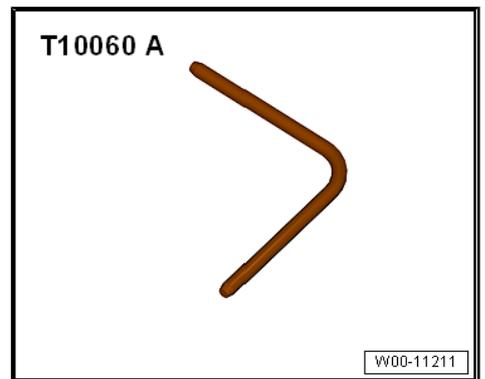
- Turn tensioner in direction of -arrow- and remove locking pin - T10060 A- .
- Release the tension devices.
- Check that poly V-belt is properly seated.
- Start engine and check that poly V-belt runs properly.



1.2.2 Poly-V belt: Removing and installing, vehicles with air conditioner compressor

Special tools and workshop equipment required

- ◆ Locking pin - T10060 A-

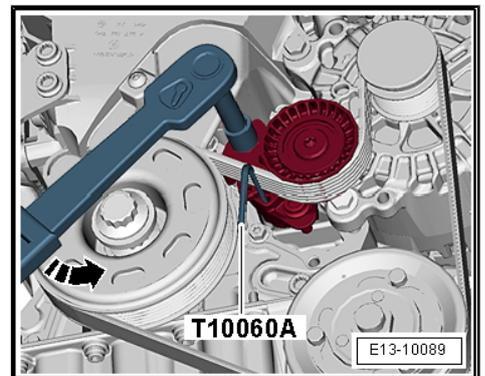


Removing

- To slacken poly V-belt, turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060 A-.
- If poly V-belt is to be reinstalled, mark direction of rotation on belt using chalk or felt tip pen before removing.
- Remove the V-ribbed belt.

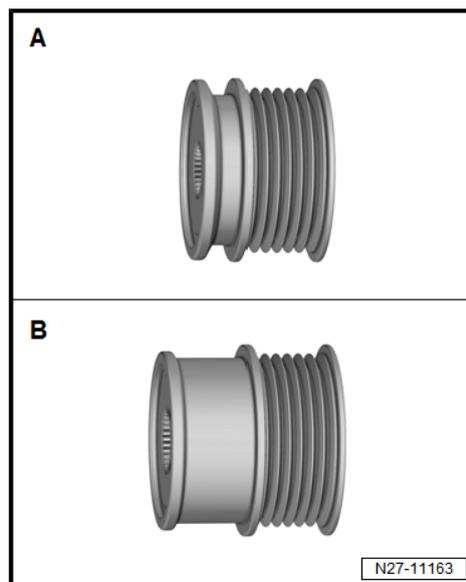
Installation

Install in the reverse order of removal, observing the following:



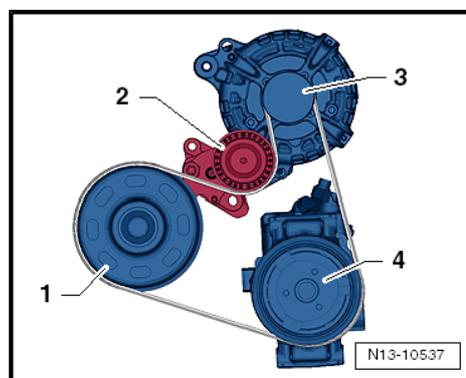
Various versions of the overrunning alternator pulley, -A- or -B-, may be fitted depending on the type and version of the alternator.

The length of the poly V-belt must be determined according to the ⇒ Electronic Parts Catalogue (ETKA) depending on the version of overrunning alternator pulley.

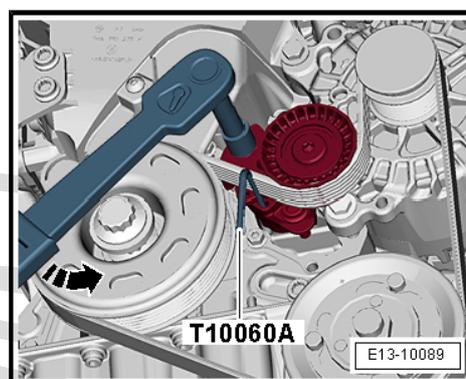


– Install the poly V-belt as depicted in the illustration:

- 1 - Pulley
- 2 - Poly V-belt tightener
- 3 - Alternator
- 4 - Air conditioning compressor



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



1.3 Assembly overview - Sealing flange, belt pulley end.

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erWin

1 - Bolt

- Tightening torque
 => [Item 1 \(page 37\)](#)

2 - Vibration damper

- Removing and installing
 => [page 45](#)

3 - Oil seal

- For crankshaft (pulley end)
- Replace => [page 50](#)
- Do not oil

4 - Sealing flange (pulley end)

- Must seat on dowel pins.
- Removing and installing
 => [page 52](#)

5 - Bolt

- Different thread diameters => Electronic Parts Catalogue (ETKA)
- renew
- Tightening torque and sequence => [page 43](#) .

6 - Seal

- renew

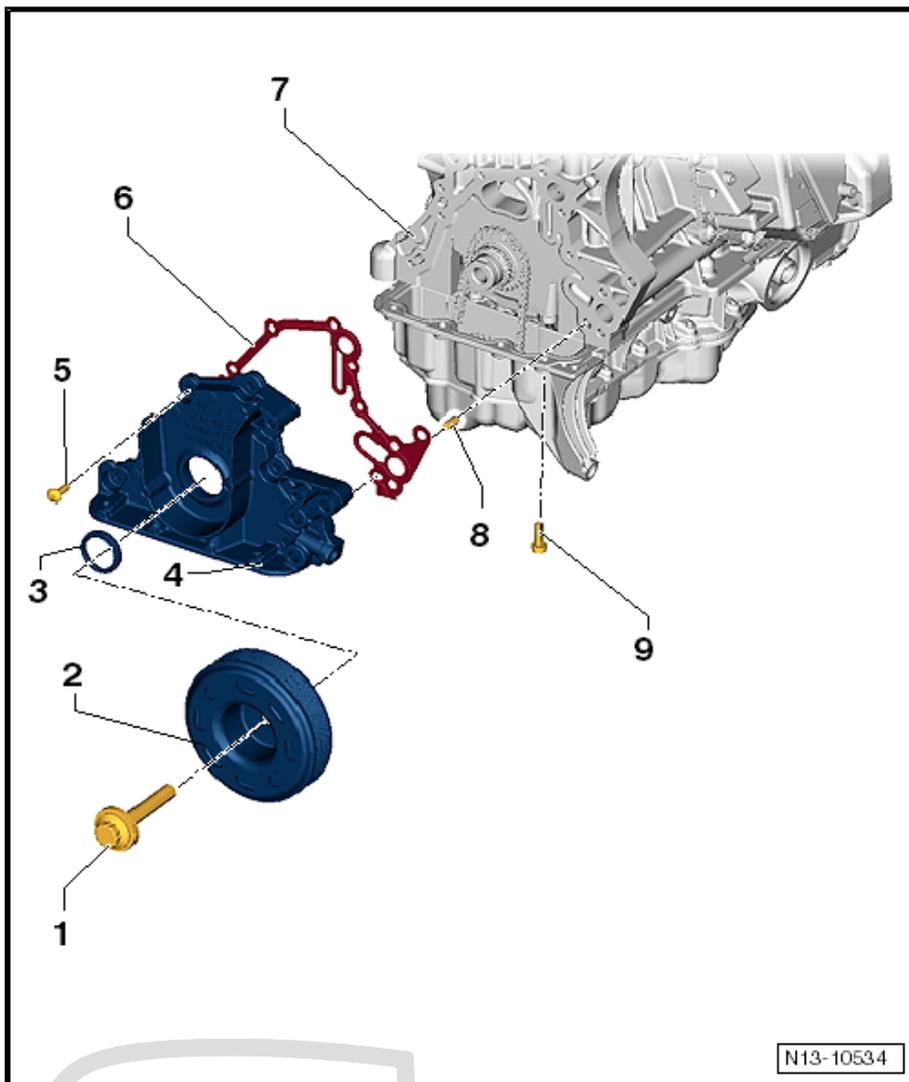
7 - cylinder block

8 - Split pin

- 2 pieces

9 - Bolt

- renew
- Tightening torque and sequence => [page 43](#) .



Sealing flange (pulley end) - tightening torque and sequence

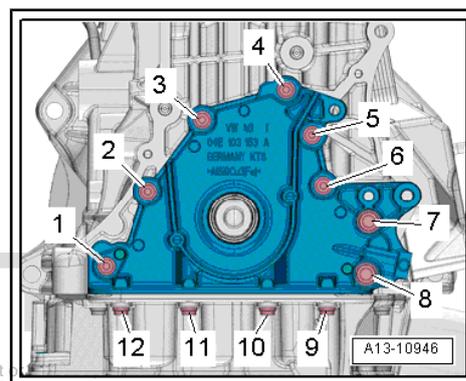


Note

Renew bolts that are tightened with specified further tightening angle.

– Tighten bolts in stages:

stage	Bolts	Tightening torque/angle specification
1.	-1 ... 12-	Screw in by hand until it stops.
2.	-1 ... 12-	8 Nm in diagonal sequence
3.	-7, 8-	20 Nm
4th	-1 ... 12-	Tighten crosswise by 90°



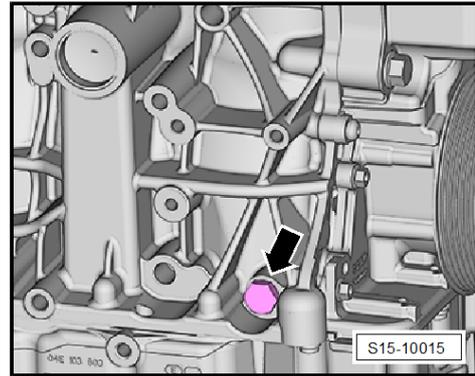
Plug for "TDC" drilling in cylinder block at rear – specified torque



Note

- ◆ Plug with integrated seal -arrow-
- ◆ Replace if damaged

Bolt	Tightening torque
-Arrow-	Tighten to 30 Nm



1.4 Removing and installing tensioner for poly V-belt

⇒ ["1.4.1 Clamping fixture for V-belt: removing and installing, vehicles without air conditioner compressor", page 44](#)

⇒ ["1.4.2 Clamping fixture for V-belt: removing and installing, vehicles with air conditioner compressor", page 44](#)

1.4.1 Clamping fixture for V-belt: removing and installing, vehicles without air conditioner compressor

Removing

- Detach poly V-belt from tensioner
⇒ ["1.2.1 Poly-V belt: Removing and installing, vehicles without air conditioner compressor", page 39](#) .
- Remove bolts -arrows- and detach poly V-belt tensioner -1-.

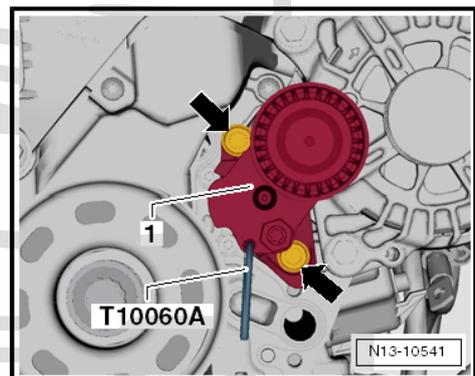
Installation

Install in the reverse order of removal, observing the following:

- Fit poly V-belt ⇒ [page 39](#) .

Specified torques

- ◆ ⇒ ["1.1.1 Exploded view - poly V-belt drive, vehicles without air conditioner compressor", page 36](#)



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1.4.2 Clamping fixture for V-belt: removing and installing, vehicles with air conditioner compressor

Removing

- Detach poly V-belt from tensioner
⇒ ["1.2.2 Poly-V belt: Removing and installing, vehicles with air conditioner compressor", page 41](#) .
- Remove bolts -arrows- and detach poly V-belt tensioner -1-.

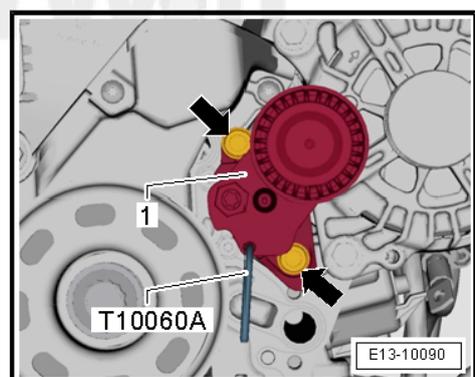
Installation

Install in the reverse order of removal, observing the following:

- Fit poly V-belt ⇒ [page 41](#) .

Specified torques

- ◆ ⇒ ["1.1.2 Exploded view - poly V-belt drive, vehicles with air conditioner compressor", page 38](#)



1.5 Removing and installing vibration damper

Special tools and workshop equipment required

- ◆ Counter-hold tool - T10475-



Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Removing and installing noise insulation .
- Remove poly V-belt ⇒ [page 39](#) .
- Loosen bolt -arrow- of the vibration damper, using the counterhold tool - T10475- to do so.
- Remove bolt and take off vibration damper.

NOTICE

Risk of damage to engine caused by incorrect valve timing.

- Do not turn crankshaft out of TDC position.

Installation



Note

- ◆ Renew bolts that are tightened with specified further tightening angle.
- ◆ All contact surfaces between bolt, vibration damper and crankshaft toothed belt pulley must be free of oil and grease.

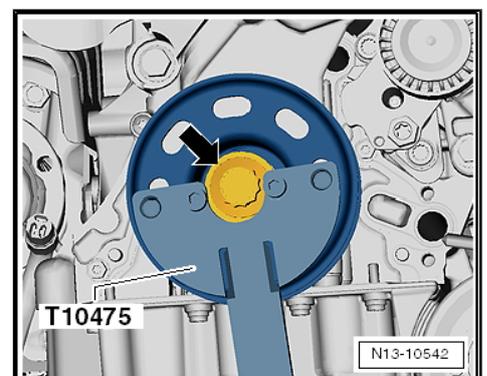
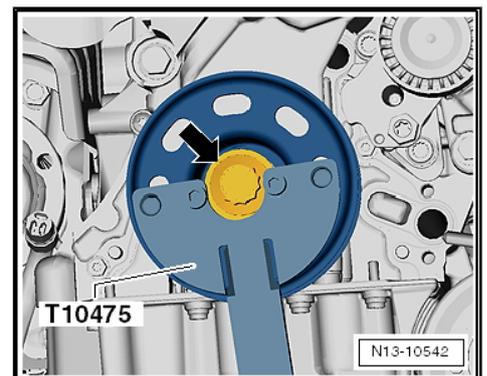
- Fit vibration damper, oil threads of bolt for vibration damper and screw it in to stop by hand.
- Tighten bolt -arrow- for poly V-belt pulley using counterhold tool - T10475- .

Install in reverse order of removal, observing the following:

- Fit poly V-belt ⇒ [page 39](#) .

Specified torques

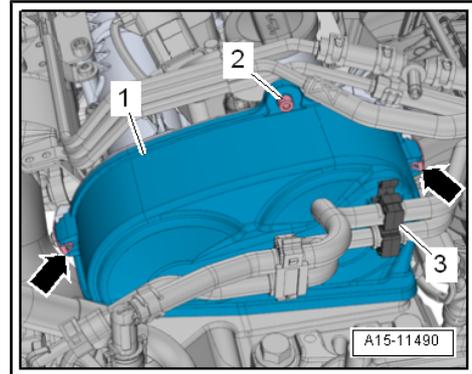
- ◆ ⇒ "1.1 Exploded view - poly V-belt drive", [page 36](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Removing and installing noise insulation .



1.6 Removing and installing engine support

Removing

- Move clear hoses at bracket -3-.
- Unscrew bolt -2-.
- Release clips -arrows- and remove upper toothed belt guard -1-.



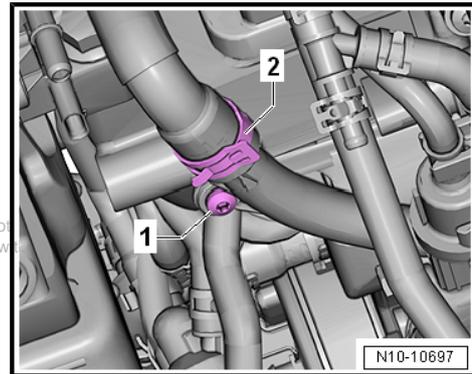
- Unscrew bolt -1-.



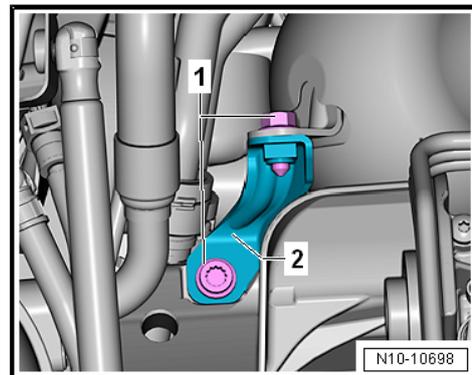
Note

Item -2- can be disregarded.

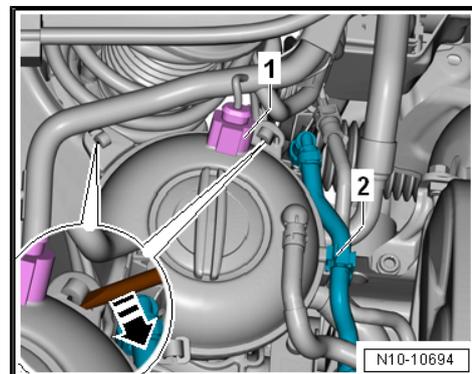
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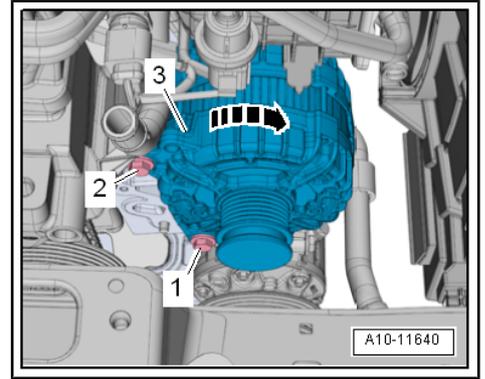
- Screw out bolt -1- and remove the retainer -2- for the catalytic converter.



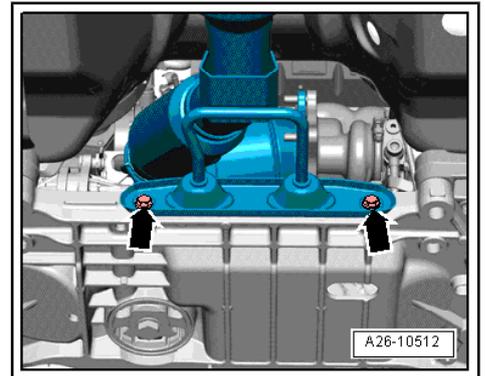
- Loosen hose -2- for activated carbon filter.
- Disconnect connector -1-.
- Release detent using a screwdriver -arrow- and place coolant expansion tank to one side.
- Remove tensioner for poly V-belt ⇒ [page 44](#) .



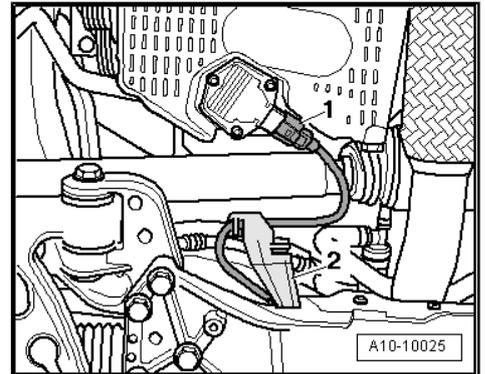
- Loosen bolt -1- but do not remove.
- Unscrew bolt -2-.
- Swivel alternator -3- in -direction of arrow- towards front.
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 50 ; Noise insulation; Removing and installing noise insulation .



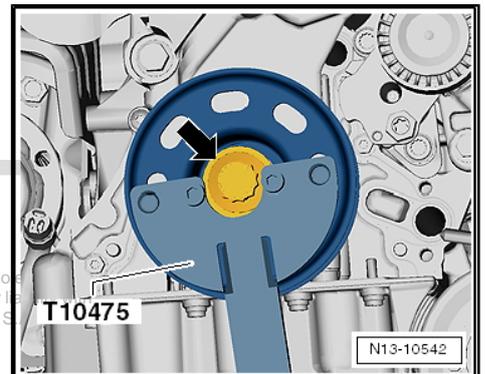
- Screw out bolts -arrows- from the retainer of the front exhaust pipe.



- Disconnect connector -1- of the oil level and oil temperature sender - G266- .



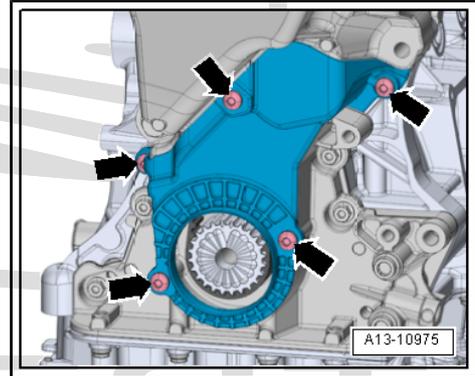
- Loosen bolt -arrow- of the vibration damper, using the counterhold tool - T10475- to do so.
- Remove bolt and take off vibration damper.



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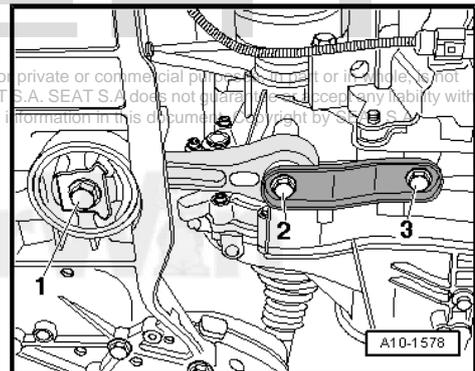
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- Unscrew bolts -arrows-, and remove lower toothed belt guard.

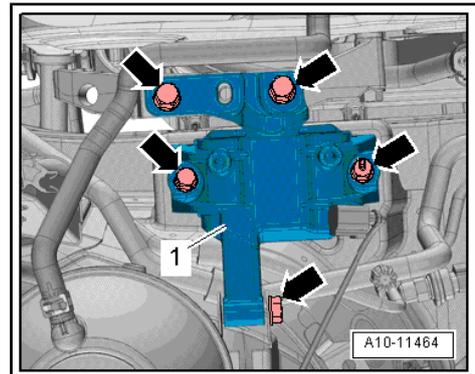


- Remove bolts -1, 2, 3- and detach pendulum support.

- Support engine and gearbox in installation position
⇒ [page 28](#) .



- Unscrew and remove the screws -Arrows- and remove engine mounting -1-.



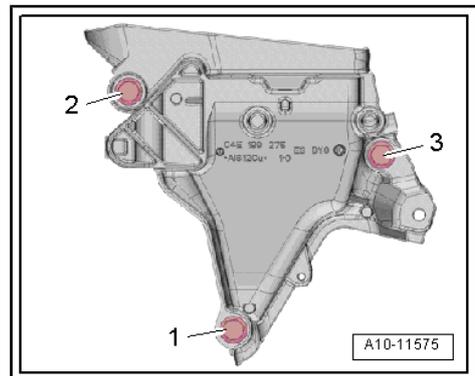
- Unscrew the bolts -1, 2, 3-.



Note

Make sure that all lines of the exhaust temperature sender are not exposed to tension and that they are not damaged when removing the »engine support«.

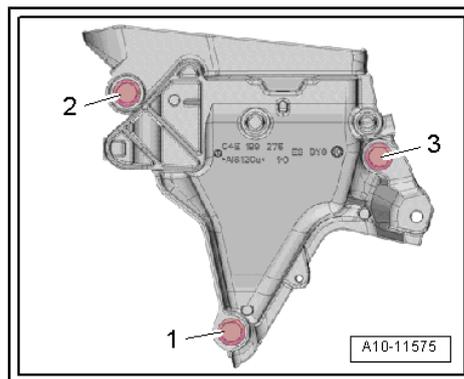
- Adjust the engine/gearbox assembly as needed using the spindle of the support bracket - 10-222 A- .
- Pull out engine support downwards.



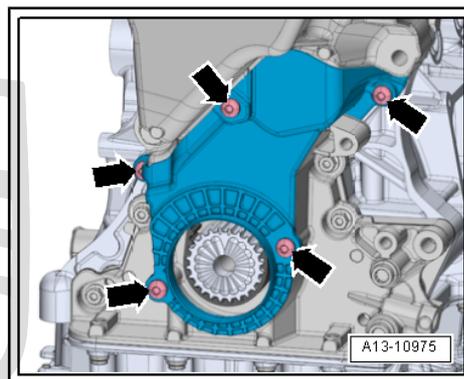
Installation

Install in the reverse order of removal, observing the following:

- Fit the engine support and hand-tighten -1, 2 and 3- firmly.



- Fit the lower toothed belt guard and tighten to a torque of 8 Nm.

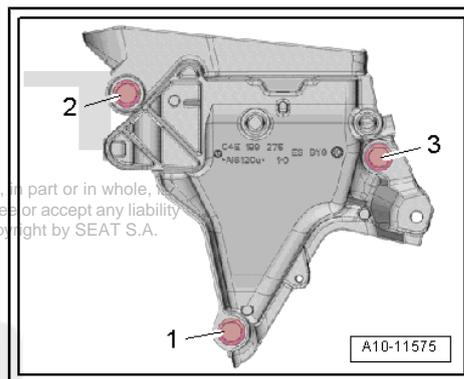


- Tighten screws -1, 2 and 3- on the engine support - to a torque of [⇒ page 28](#)

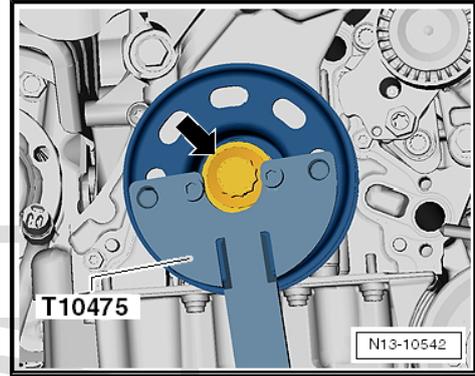


Note

- ◆ **Renew bolts that are tightened with specified further tightening angle.**
- ◆ **All contact surfaces between bolt, vibration damper and crankshaft toothed belt pulley must be free of oil and grease.**



- Fit vibration damper, oil threads of bolt for vibration damper and screw it in to stop by hand.
- Tighten bolt -arrow- of the vibration damper, using the counterhold tool - T10475- to do so.
- Install poly V-belt tensioner ⇒ [page 44](#) .
- Check adjustment of assembly mountings (engine/gearbox mountings) ⇒ [page 34](#) .



Specified torques

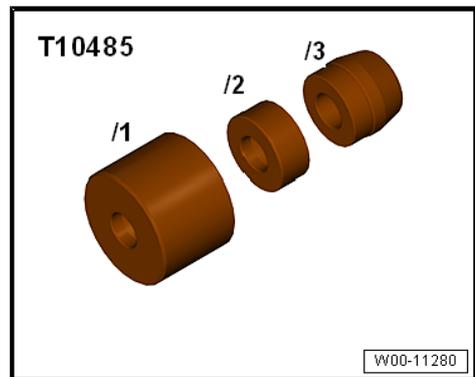
- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 27](#)
- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 36](#)
- ◆ ⇒ [“2.1 Assembly overview - emission control”, page 356](#)
- ◆ ⇒ [“2.1 Exploded view - toothed belt cover”, page 95](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 280](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)
- ◆ ⇒ [“3.2 Removing and installing air filter housing”, page 327](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Battery; Battery - Exploded view
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Removing and installing noise insulation .

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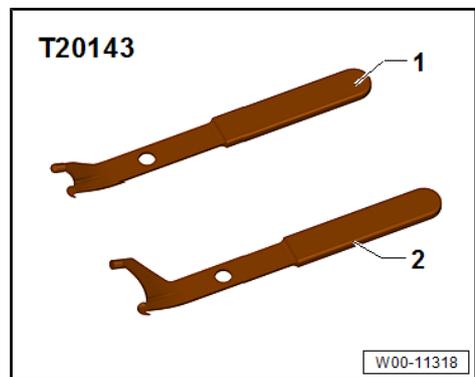
1.7 Crankshaft oil seal- pulley side: replace

Special tools and workshop equipment required

- ◆ Assembly tool - T10485/1-3-



- ◆ Puller hooks - T20143-



Work sequence

- Remove toothed belt => [page 149](#) .
- Detach crankshaft sprocket -1- -arrow-.

NOTICE

- Risk of damage to engine caused by incorrect valve timing.**
- Do not turn crankshaft out of TDC position.

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

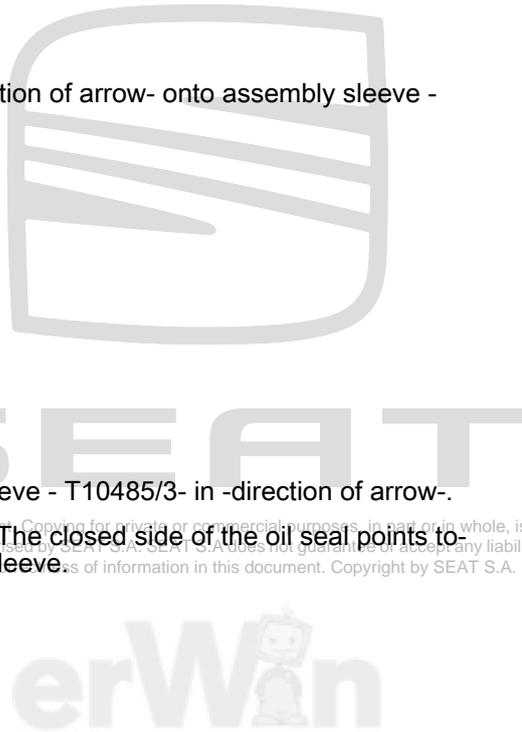
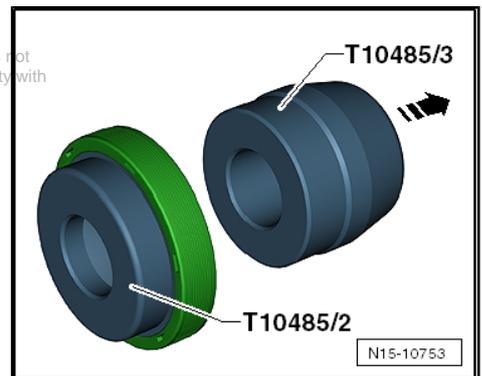
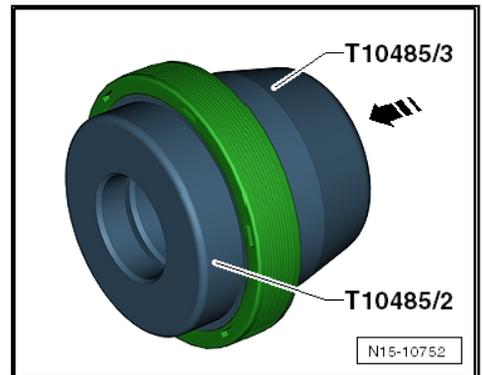
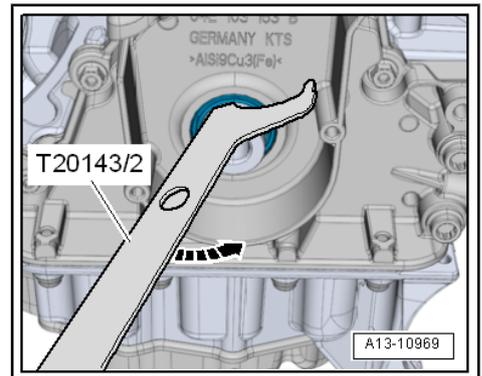
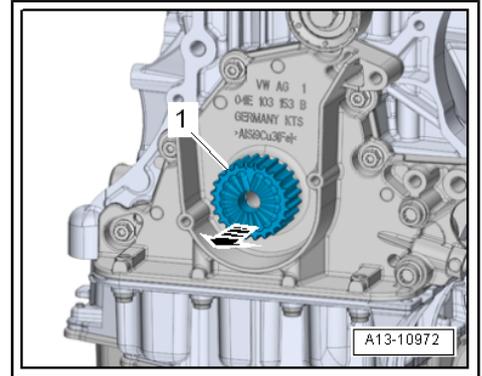
Note

Do not lubricate new seal.

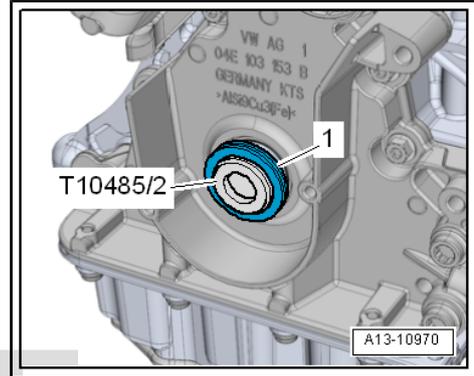
- Fit new seal in -direction of arrow- onto assembly sleeve - T10485/2- .

- Pull off assembly sleeve - T10485/3- in -direction of arrow-.

- Installation position: The closed side of the oil seal points toward the assembly sleeve.

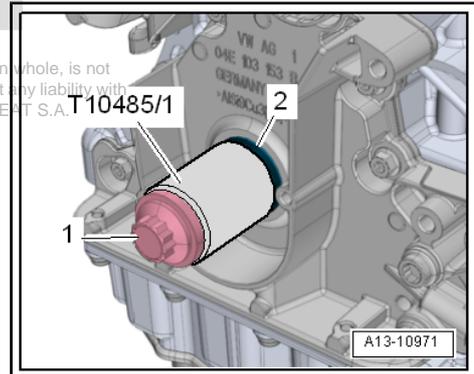


- Fit guide sleeve -T10485/2- with oil seal -1- onto crankshaft.

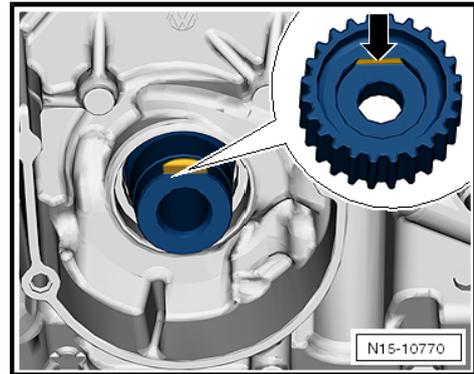


- Use fitting sleeve -T10485/1- and bolt -1- for poly V-belt pulley to pull in oil seal -2- onto stop.

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- Fit crankshaft sprocket onto crankshaft.
- The contact surface between vibration damper and crankshaft toothed belt pulley must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.
- Install notched belt (adjusting valve timing) ⇒ [page 111](#)



1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

- ◆ Flat scraper
- ◆ Sealant ⇒ Electronic parts catalogue (ETKA)

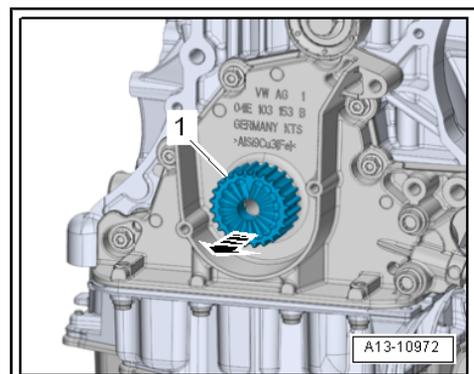
Removing

- Remove toothed belt ⇒ [page 149](#) .
- Detach crankshaft sprocket -1- -arrow-.

NOTICE

Risk of damage to engine caused by incorrect valve timing.

- Do not turn crankshaft out of TDC position.

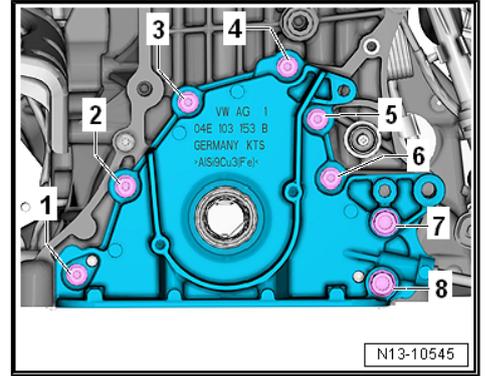


- Remove bolts -1 ... 12- and carefully release sealing flange from bonded joint.
- Drive out oil seal with sealing flange removed.

Installation

Install in the reverse order of removal, observing the following:

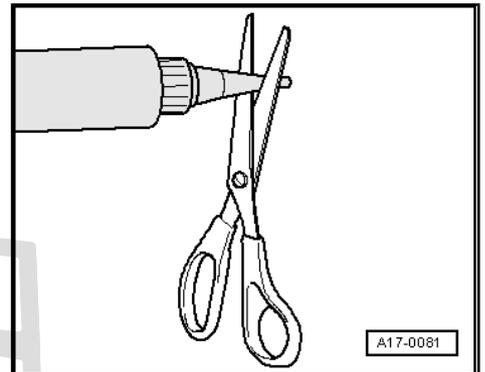
- Make sure sealant residue does not enter lubrication system.
- Place a clean cloth over the exposed section of the sump.
- Remove sealant residue from sealing flange and sump (top section).
- Clean surfaces; they must be free of oil and grease.



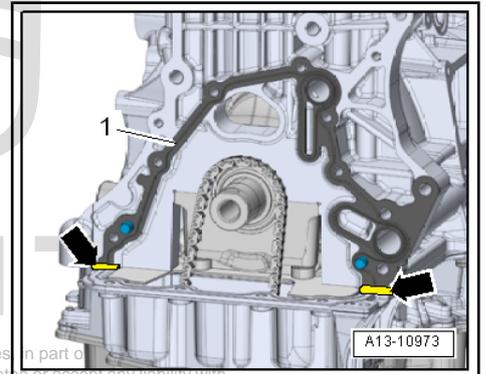
Note

Observe use-by date of sealant.

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



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

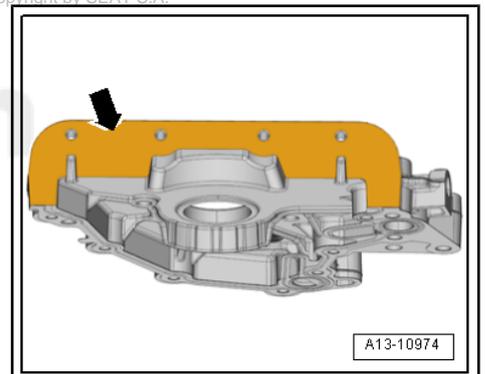


- Apply a thin coat of sealant to bottom sealing surface -arrow- on sealing flange.

Note

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

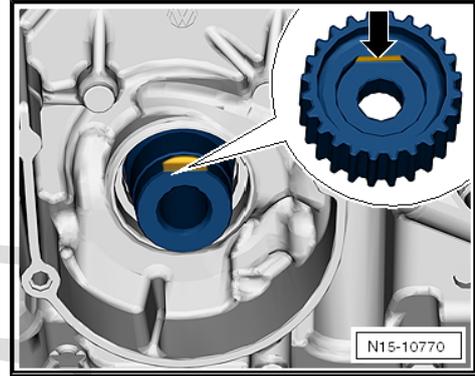
- Carefully fit sealing flange onto dowel pins in cylinder block.
- Tighten sealing flange bolts \Rightarrow page 43 .
- Install crankshaft oil seal (pulley end) \Rightarrow page 50 .



- Fit crankshaft sprocket onto crankshaft.
- Contact surface between poly V-belt pulley and crankshaft sprocket must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.
- Install notched belt (adjusting valve timing) ⇒ [page 111](#) .

Specified torques

- ◆ ⇒ [Fig. ""Sealing flange \(pulley end\) - tightening torque and sequence""](#), [page 43](#)



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2 Cylinder block, gearbox end

⇒ "2.1 Exploded view - cylinder block, gearbox end", page 55

⇒ "2.2 Removing and installing flywheel", page 56

⇒ "2.3 Removing and installing sealing flange (gearbox end)", page 57

2.1 Exploded view - cylinder block, gearbox end



When performing assembly work, secure engine to engine and gearbox support ⇒ page 22 .

1 - Bolt

- renew
- 60 Nm +90°

2 - Flywheel

- Removing and installing ⇒ page 56
- Fitting can only be completed in one position only:

3 - Engine speed sender - G28-

- Exploded view ⇒ page 360

4 - Bolt

- Tightening torque ⇒ page 360

5 - Split pin

- 2 pieces

6 - Shim

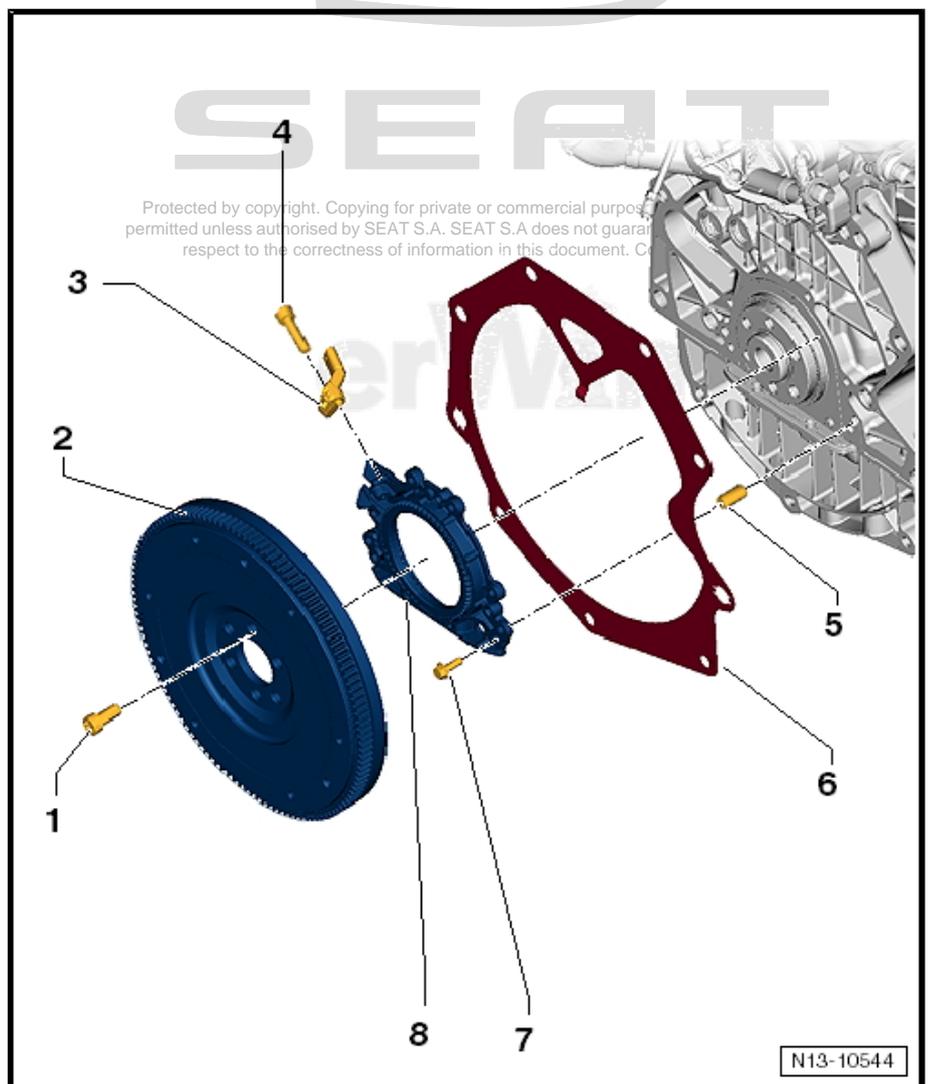
- Do not damage or bend when assembling
- Install ⇒ page 56

7 - Bolt

- Tightening torque and sequence ⇒ page 56 .

8 - Sealing flange with sender crown and seal

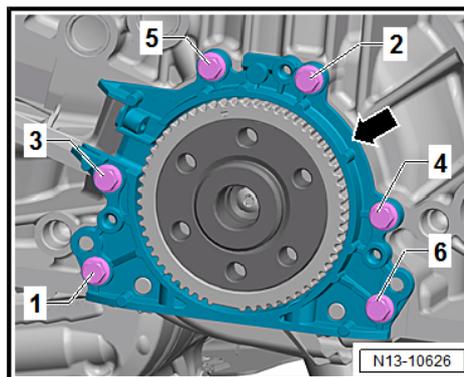
- Renew sealing flange complete with oil seal and sender wheel only.
- Removing and installing ⇒ page 57



Sealing flange on gearbox side - Prescribed torque and tightening sequence

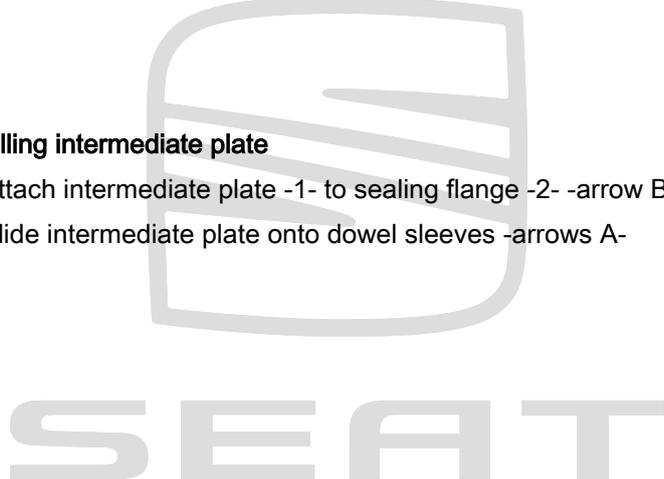
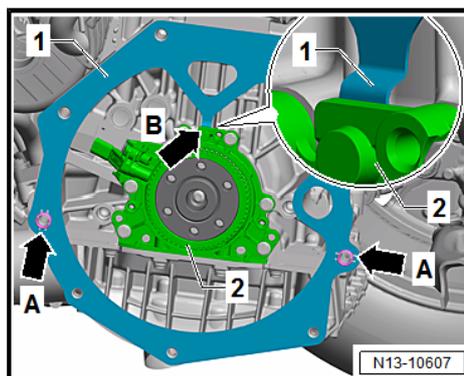
- Tighten bolts in stages as follows:

stage	Bolts	Tightening torque
1.	-1 ... 6-	Screw in by hand until it stops.
2.	-1 ... 6-	Tighten in stages and in diagonal sequence; final torque 10 Nm.



Installing intermediate plate

- Attach intermediate plate -1- to sealing flange -2- -arrow B-.
- Slide intermediate plate onto dowel sleeves -arrows A-

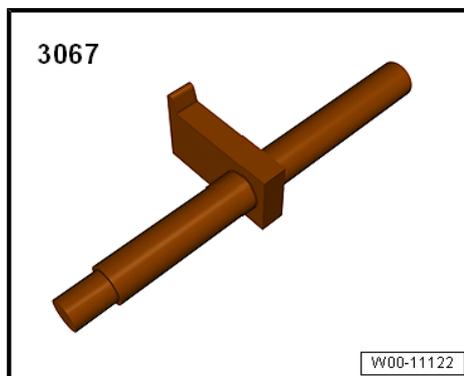


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2.2 Removing and installing flywheel

Special tools and workshop equipment required

- ◆ Counter-hold tool - 3067-



Removing

- Gearbox removed

- Insert counter-hold tool - 3067- into the hole -pos. B- of cylinder block.
- Loosen and remove flywheel bolts.

Installation

Install in the reverse order of removal, observing the following:

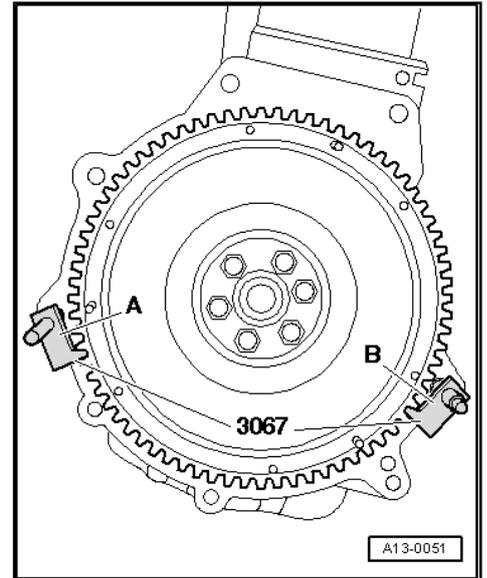


Note

- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Flywheel with sender wheel can only be fitted in one position.*
- Insert the counterhold - 3067- into the borehole in the engine block -item A-.

Specified torques

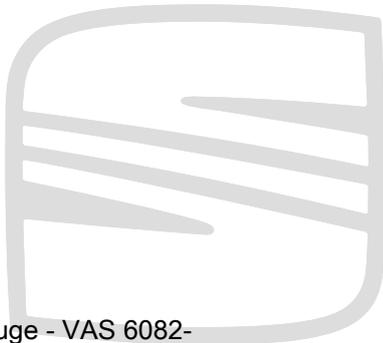
- ◆ ⇒ ["2.1 Exploded view - cylinder block, gearbox end", page 55](#)



2.3 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

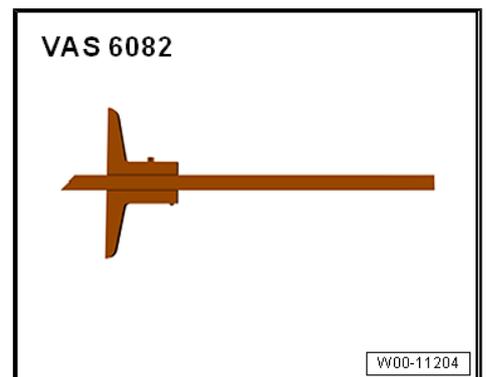
- ◆ Open ring spanner - V.A.G 1332/11-



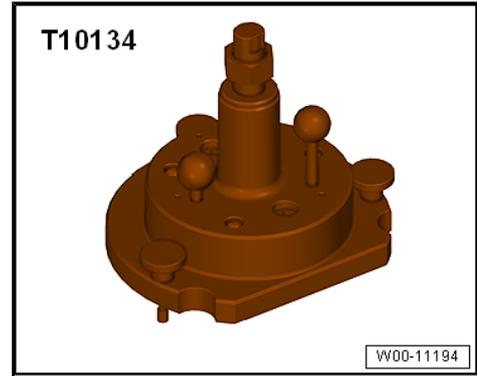
- ◆ Depth gauge - VAS 6082-

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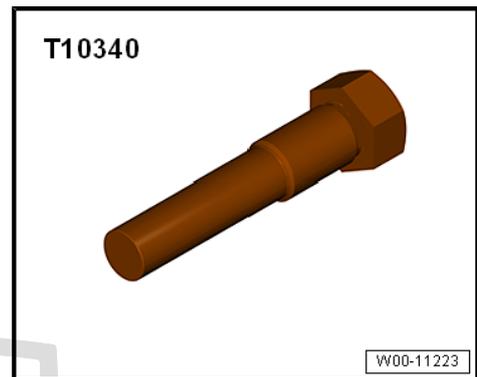
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◆ Assembly tool - T10134-



◆ Securing bolts - T10340-



◆ Bolt M6x35 (3x)

Work sequence

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

Note

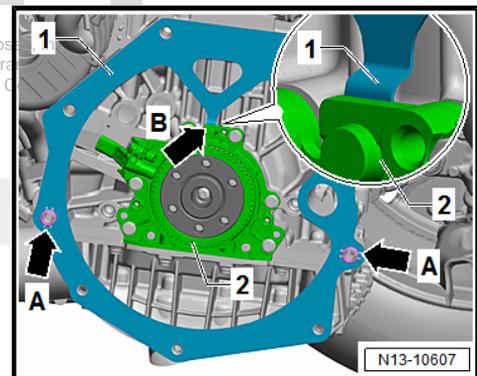
For reasons of clarity, illustration shows work procedure with engine removed.

- Remove the flywheel ⇒ [page 56](#) .
- Remove intermediate plate -1- from dowel sleeves -arrows A-.
- Guide intermediate plate -1- upwards.
- While doing so, pull retaining lug -arrow B- of intermediate plate -1- out of recess behind sealing flange.

Setting crankshaft to "TDC" position:

- Remove ignition coil 1 with output stage - N70- ⇒ [page 361](#) .
- Remove spark plug from cylinder 1.

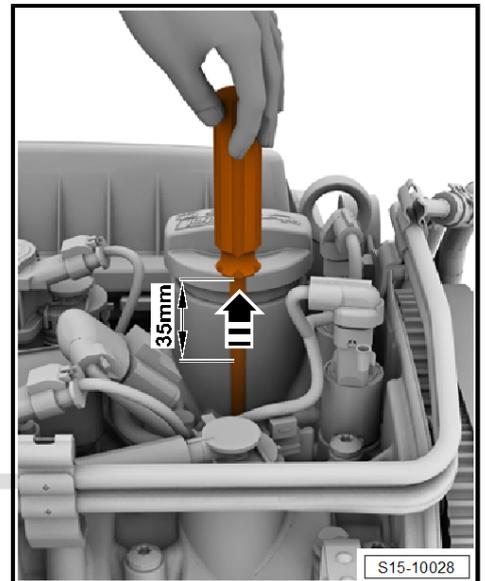
Setting correct position of crankshaft for screwing in locking pin:



- Carefully insert a screwdriver with a shaft length of at least 250 mm in -direction of arrow- into spark plug hole so that it contacts piston crown.
- Turn crankshaft in direction of engine rotation to "BDC" for no. 1 cylinder.



- Turn crankshaft further in direction of engine rotation, until screwdriver has moved 35 mm upwards in -direction of arrow-.



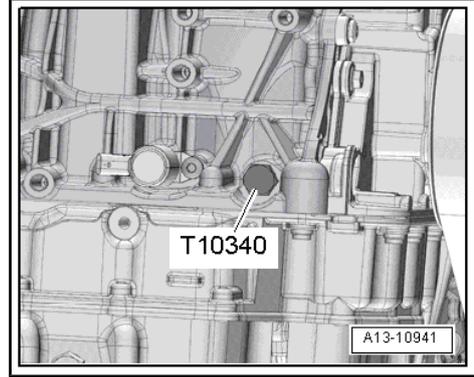
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- Unscrew plug for "TDC" drilling on cylinder block ⇒ [page 44](#)
- Unscrew plug for "TDC" hole on cylinder block.

Risk of damage to engine

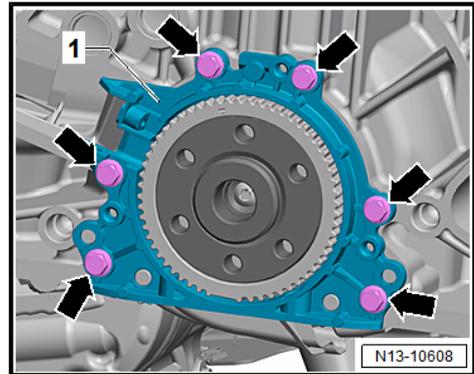
- If the locking pin - T10340- cannot be screwed in as far as the stop, the crankshaft is not in the correct position.
- In this case, proceed as follows:
- Unscrew locking pin.
- Turn crankshaft 90° in direction of rotation of engine.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft further in normal direction of rotation as far as stop.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the stop.
- The locking pin is now in contact with the crank web.



i Note

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

- Remove lower part of sump ⇒ [page 229](#) .
- Remove upper part of sump ⇒ [page 232](#) .
- Remove engine speed sender - G28- ⇒ [page 360](#) .
- Unscrew bolts -arrows- for sealing flange -1-.

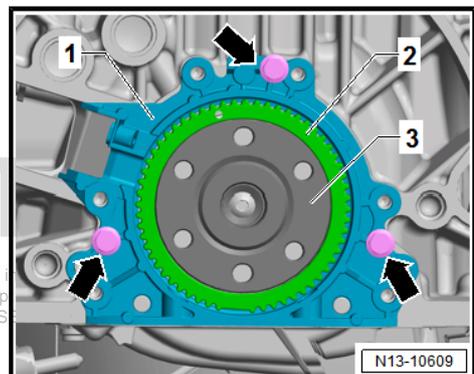


- To press off, screw 3 M6 x 35 bolts -arrows- into sealing flange -1-.

i Note

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

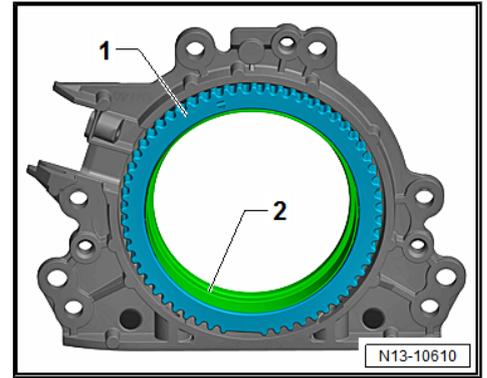
- Turn the screws in an alternating manner by a maximum of 1/2 a turn into the sealing flange.
- Remove sealing flange -1- together with sender wheel -2-.



To insert the sealing flange with sensor wheel

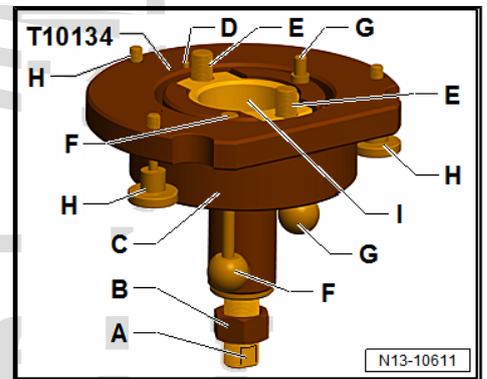
 Note

- ◆ The sealing flange with PTFE oil seal is fitted with a sealing lip support ring -2-. This pressure ring fulfils the function of an assembly sleeve and cannot be removed before fitting.
- ◆ Sealing flange and sender wheel -1- must not be separated or rotated out of position after removal from packaging.
- ◆ The sender wheel -1- is held in its installation position on the assembly tool - T10134- ⇒ [page 61](#) by a locating pin.
- ◆ Sealing flange and oil seal form a unit and may only be re-placed 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 ⇒ [page 61](#) .



Structure of the assembly tool - T10134- :

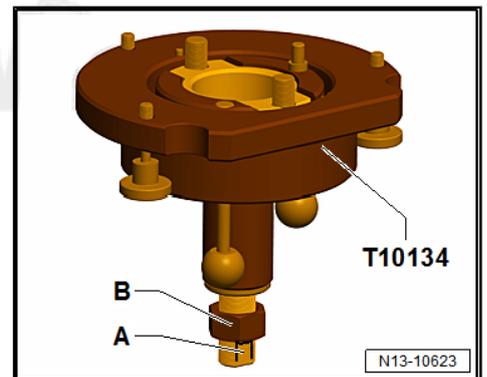
- A - Attachment surface
- B - Nut
- C - Assembly housing
- D - Locating pin
- E - Hexagon socket head bolts (2x)
- F - Guide pin for diesel engines (red handle)
- G - Guide pin for diesel engines (black handle)
- H - Knurled screws (3x)
- I - Inner side



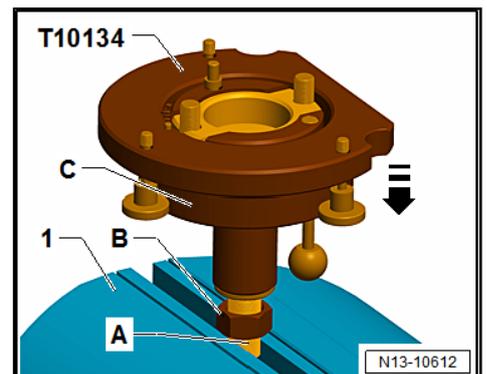
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Securing sealing flange with sender wheel onto assembly tool - T10134- :

- Screw on nut -B- until just before it touches the clamping surface -A- of the threaded spindle.



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



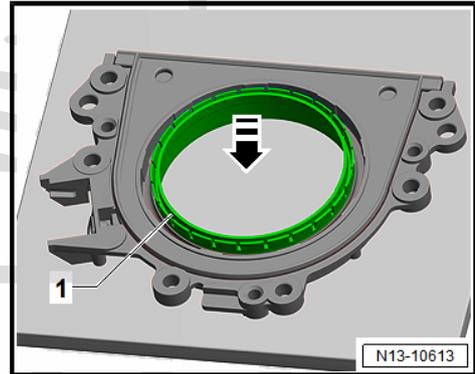
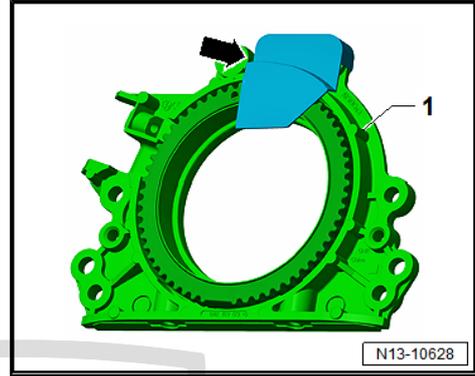
- If fitted, remove the securing clip -arrow- from new sealing flange.



Note

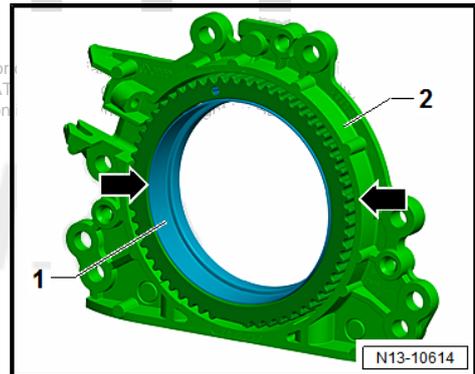
Do not take the sensor wheel out of the sealing flange or rotate it out of position.

- Secure the sealing flange by the front on a flat, clean surface.
- Press sealing lip support ring -1- downwards in direction of -arrow- until it touches flat surface.

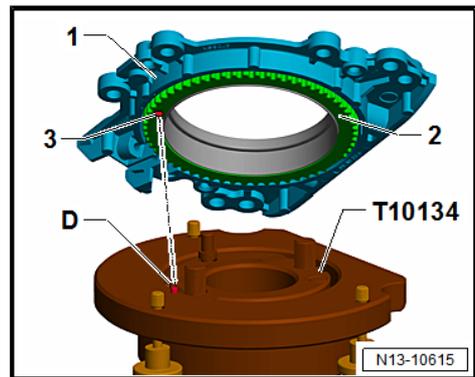


- The upper edge of the sealing lip support ring -1- must be flush with the front edge of the sealing flange -2- -arrows-.

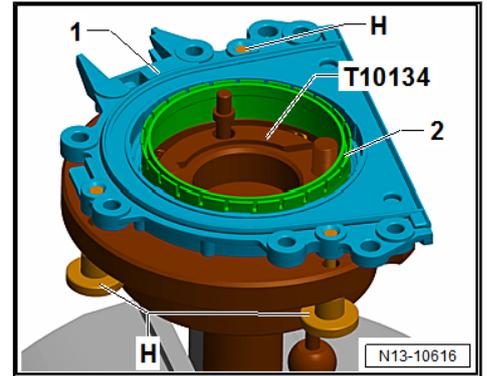
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- Place front side of sealing flange -1- on assembly tool -T10134- so that locating pin -D- is seated in hole -3- in sender wheel -2-.
- Ensure that sealing flange lies flat on assembly tool.

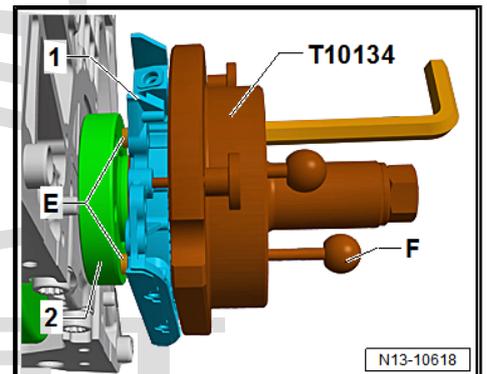
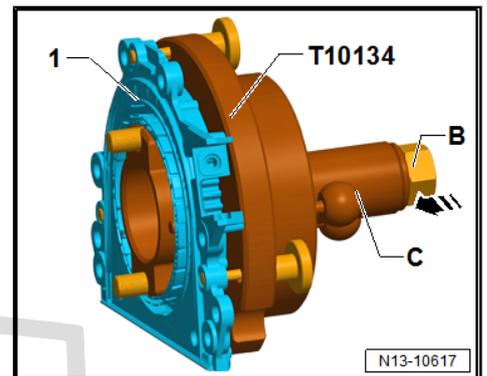


- Screw knurled screws -H- onto sealing flange -1-.
- When tightening, press sealing flange -1- and sealing lip support ring -2- against surface of assembly tool - T10134- .
- This prevents the locating pin from slipping out of the sensor wheel hole.
- Ensure that the sender wheel remains fixed in the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



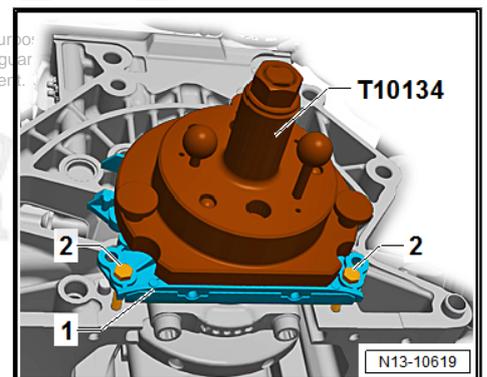
Securing assembly tool - T10134- with sealing flange -1- on crankshaft flange:

- Crankshaft flange must be free of oil and grease.
- Engine is at “TDC” position ⇒ [page 58](#) .
- Screw nut -B- to end of threaded spindle.
- Press threaded spindle of assembly tool - T10134- in direction of -arrow- until nut -B- makes contact with assembly housing -C-.
- Point the flat part of the installation socket towards the sealing surface of the engine block in contact with the oil sump.
- Fasten assembly tool - T10134- together with the sealing flange -1- to the crankshaft flange -2-.
- For this purpose, screw the hexagon socket head bolt -E- with a hexagon key approx. 5 rotations into the crankshaft flange.
- Push guide pin for petrol engines (red handle) -F- into crankshaft flange.



- Screw two bolts M6 x 35 mm -2- into cylinder block to guide the sealing flange -1-.

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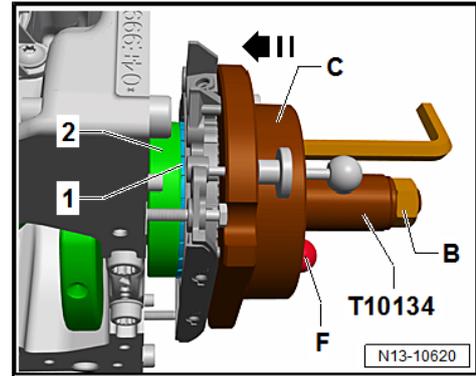
Securing assembly tool - T10134- on crankshaft flange:

- Press the assembly housing -C- by hand in the direction of the -arrow- until the sealing lip support ring -1- lies on the surface of the crankshaft flange -2-.
- Check that the guide pin for petrol engines (red handle) -F- is seated correctly in the hole in the crankshaft. This ensures that sender wheel reaches its final installation position.



Note

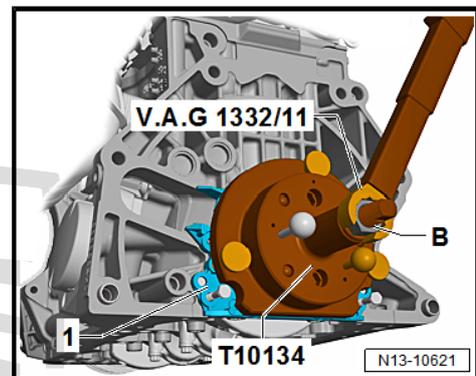
The guide pin for diesel engines (black handle) must not be inserted in threaded hole of crankshaft.



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

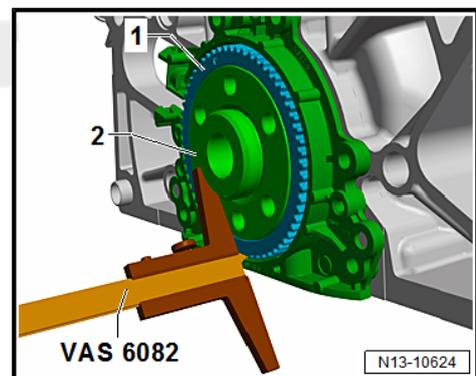
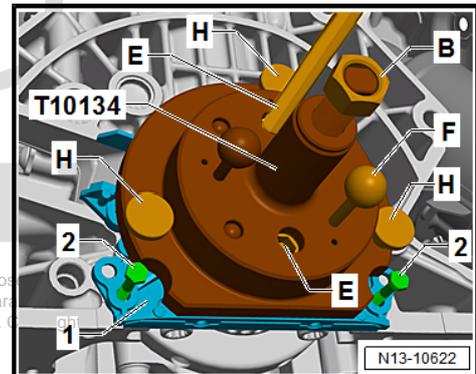
Pressing sender wheel onto the crankshaft flange using assembly tool - T10134- :

- Tighten nut -B- on assembly tool - T10134- to 35 Nm.
- A small gap must be present between cylinder block and sealing flange after tightening nut to 35 Nm -1-.

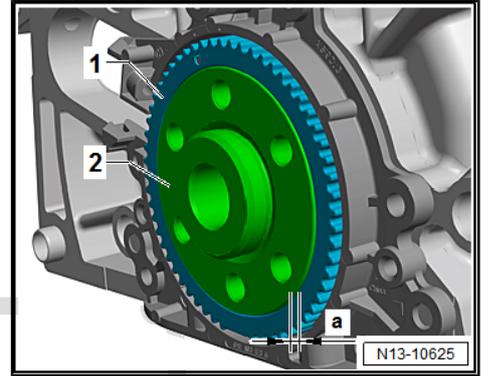


Checking sender wheel installation position on crankshaft:

- Screw nut -B- to end of threaded spindle.
- Remove both bolts -A2- from cylinder block.
- Screw out the guide pins for petrol engines (red handle) -F- from the crankshaft flange.
- Unscrew knurled screws -H- from sealing flange -1-.
- Unbolt assembly tool - T10134- from crankshaft flange (remove hexagon socket head bolts -E- from crankshaft flange).
- Remove the pressure ring from the sealing lip.
- Apply depth gauge - VAS 6082- to crankshaft flange -2-.

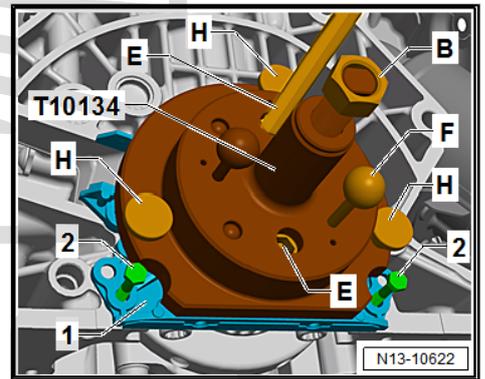


- Measure distance -a- between crankshaft flange -2- and sensor wheel -1-.
- Specification: Distance -a- = 0.5 mm
- Press sensor wheel in further if distance is too small
⇒ [page 65](#) .
- If reading matches specification, continue with assembly
⇒ [page 65](#) .



Re-pressing sender wheel:

- Secure assembly tool - T10134- on crankshaft flange -1-.
- Take care to ensure that the locating pin of the assembly tool - T10134- is seated in the hole in the sender wheel.
- Hand-tighten hexagon socket head bolts -E-.
- Slide assembly tool - T10134- onto sealing flange -1- by hand.
- Screw nut -B- onto threaded spindle by hand until it touches assembly tool - T10134- .
- Push guide pin for petrol engines (red handle) -F- into crankshaft flange.
- Screw knurled screws -H- onto sealing flange -1-.
- Screw two bolts M6 x 35 mm -2- into cylinder block to guide the sealing flange.



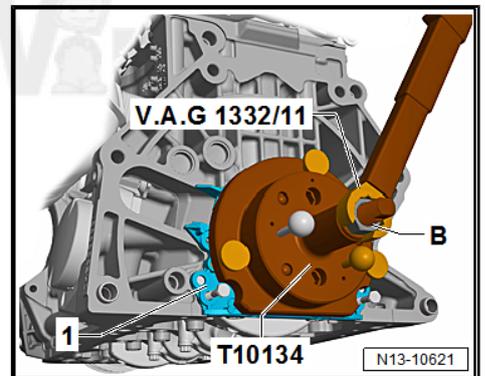
- Tighten nut -B- on assembly tool - T10134- to 40 Nm.
- Check the sender wheel installation position on the crankshaft again ⇒ [page 64](#) .
- Tighten nut on assembly tool - T10134- to 45 Nm if distance is too small.
- Check the sender wheel installation position on the crankshaft again ⇒ [page 64](#) .

Assembling

- Tighten sealing flange bolts ⇒ [page 56](#) .
- Install sump (top section) ⇒ [page 232](#) .
- Install sump (bottom section) ⇒ [page 229](#) .
- Install intermediate plate ⇒ [page 56](#) .
- Install flywheel ⇒ [page 56](#) .

Specified torques

- ◆ ⇒ [Fig. "Sealing flange on gearbox side - Prescribed torque and tightening sequence"](#) , [page 56](#)
- ◆ ⇒ ["2.1 Exploded view - cylinder block, gearbox end"](#) , [page 55](#)
- ◆ ⇒ ["1.1 Assembly overview - ignition system"](#) , [page 360](#)
- ◆ ⇒ [Fig. "Plug for TDC drilling in cylinder block - tightening torque"](#) , [page 97](#)
- ◆ Engine speed sender - G28- *
⇒ ["1.1 Assembly overview - ignition system"](#) , [page 360](#)



3 Crankshaft

⇒ “3.1 Crankshaft dimensions”, page 66

⇒ “3.2 Renewing needle bearing in crankshaft”, page 66

⇒ “3.3 Measuring crankshaft axial clearance”, page 68

3.1 Crankshaft dimensions

NOTICE

Risk of damage to bearing pedestals when the crankshaft is removed.

If the bolts of the crankshaft bearing cap are loosened, the bearing pedestals of the cylinder block will be deformed, and damage to the bearings will result.

- Never remove the crankshaft.

Measuring the main bearing clearance is not possible with normal workshop equipment.

Honing dimension	Ø Conrod journal mm
Basic dimension	48.00 -0,022 -0,042

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3.2 Renewing needle bearing in crankshaft

Only vehicles with a dual clutch gearbox

Special tools and workshop equipment required

- ◆ Adapter - 22/1- from Kukko



- ◆ Puller - Kukko 21/2-



◆ Punch - VW 207 C-

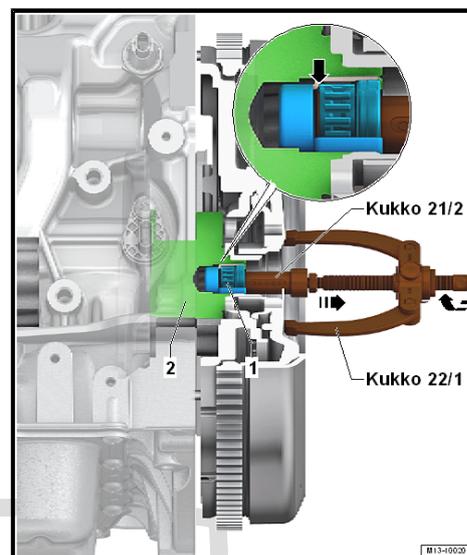


Removing

- Remove the gearbox ⇒ Rep. gr. 34 ; Removing and installing the gearbox .

Driving out needle bearing

- Pull needle bearing -1- out of crankshaft -2- using a standard pulling tool e. g. Kukko - 21/2- and counter support e.g. Kukko - 22/1- .
- The internal puller must be positioned behind the needle-and-cage assembly -arrow-.



Installation

Note

If bearings are open, the labelled side of the needle bearing must be legible when installed. The bearings closed on one side must be displayed with the closed side to the crankshaft.

- Clean bearing seat in crankshaft and apply as thin coating of grease.
- Drive needle bearing into crankshaft to installation depth using drift - VW 207 C- .



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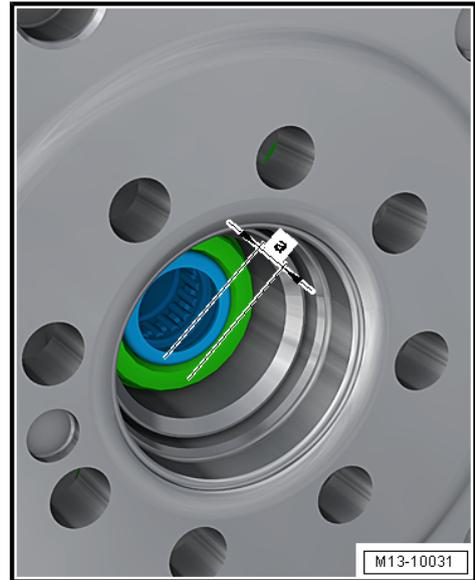
Installation depth: Dimension -a- - 2.0 mm



Note

If the needle bearing has been accidentally driven in too far, it must be renewed because it will be damaged when it is pulled out.

- Install gearbox ⇒ Rep. gr. 34 ; Removing and installing gearbox .



3.3 Measuring crankshaft axial clearance



NOTICE

Risk of damage to bearing pedestals when the crankshaft is removed.

If the bolts of the crankshaft bearing cap are loosened, the bearing pedestals of the cylinder block will be deformed, and damage to the bearings will result.

- Never remove the crankshaft.

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



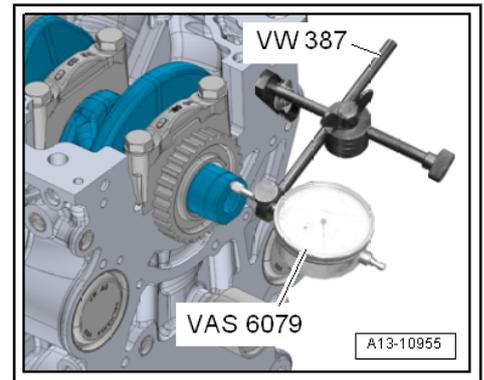
- ◆ Gauge - VAS 6079-



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Work sequence

- Bolt dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- onto cylinder block as shown in illustration and set it against crankshaft.
- Press crankshaft against dial gauge by hand.
- Set gauge to "zero".
- Push crankshaft away from dial gauge and read off measured value.
- Axial clearance: 0.066 ... 0.233 mm.



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4 Pistons and conrods

⇒ [“4.1 Assembly overview - pistons and conrods”, page 70](#)

⇒ [“4.2 Removing and installing pistons”, page 72](#)

⇒ [“4.3 Removing and installing oil spray jet”, page 73](#)

⇒ [“4.4 Checking pistons and cylinder bores”, page 74](#)

⇒ [“4.5 Checking radial clearance of conrod bearings”, page 75](#)

4.1 Assembly overview - pistons and conrods

1 - Bolts

- renew
- Lubricate threads and contact surface
- 30 Nm +90°

2 - Bearing cap

- Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- Mark cylinder and conrod allocation in colour -B-
- Fitting position: The tab -A- on the conrod bearing cap points to the pulley end

3 - Bearing shells

- Installation position ⇒ [page 71](#)
- Renew used bearing shells
- Check for secure seating.

4 - Conrod

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

- Mark cylinder and conrod bearing cap allocation in colour -B-

- Measuring radial clearance ⇒ [page 75](#)

- Separating new conrod ⇒ [page 72](#) .

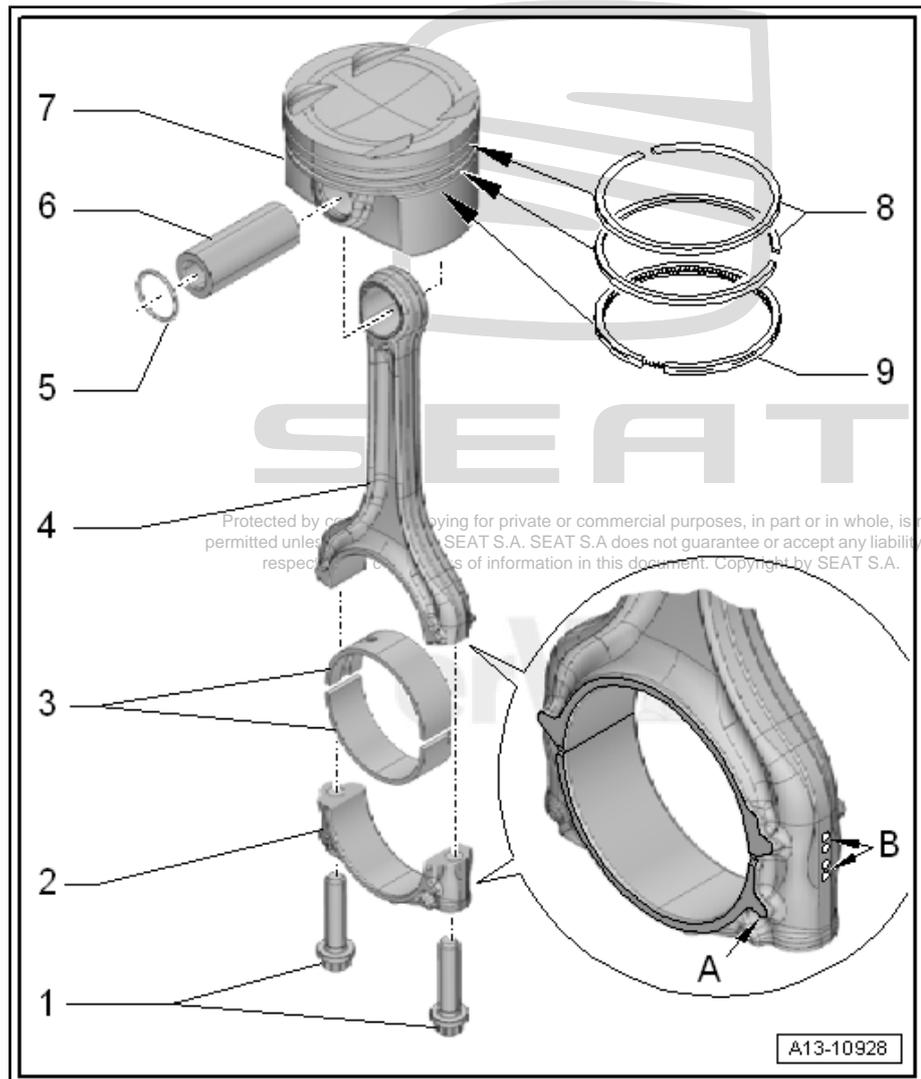
- Fitting position: The tab -A- on the conrod bearing cap points to the pulley end

5 - Circlip

- 2 pieces
- renew

6 - Piston pin

- Removing and installing ⇒ [“4.2 Removing and installing pistons”, page 72](#)



7 - Piston

- With combustion chamber.
- Mark installation position and cylinder number ⇒ [page 71](#)
- Removing and installing ⇒ [page 72](#)
- Checking pistons and cylinder bores ⇒ [page 74](#)

8 - Piston rings

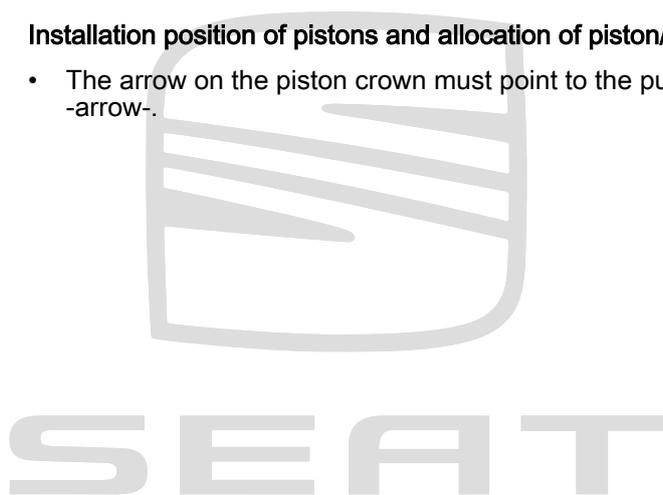
- Compression rings
- Measuring ring gap ⇒ [page 74](#)
- Measuring clearance ⇒ [page 74](#)
- Remove and fit using pliers adapted for piston rings (normal version)
- Installation position: marking "TOP" or side with lettering faces towards piston crown
- Offset gaps by 120°

9 - Segment ring

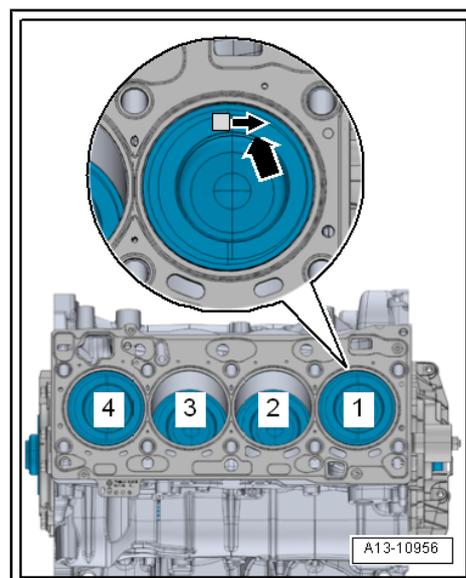
- Oil scraping ring
- Measuring ring gap ⇒ [page 74](#)
- Measuring clearance ⇒ [page 74](#)
- use piston ring pliers for removing and installing
- Installation position: marking "TOP" or side with lettering faces towards piston crown
- Offset gap 120° from bottom compression ring

Installation position of pistons and allocation of piston/cylinder

- The arrow on the piston crown must point to the pulley side -arrow-.

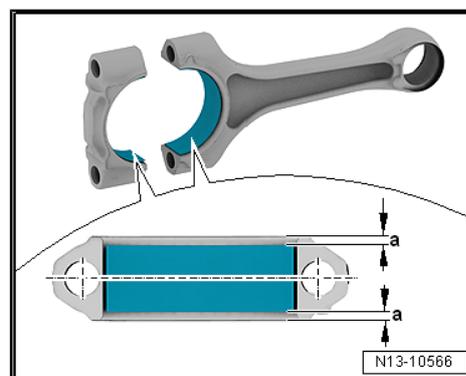


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Installation position of bearing shell

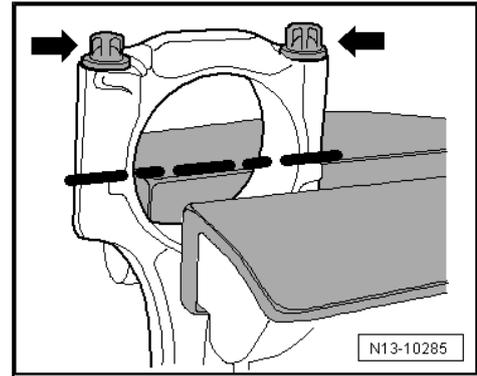
- Insert bearing shells centrally in conrod/conrod bearing cap.
- Dimension -a- = 2.5 mm



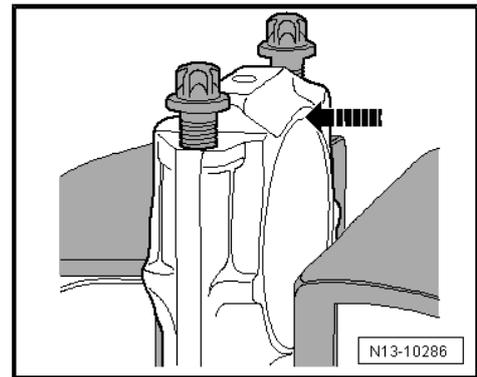
Separate new conrod

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.



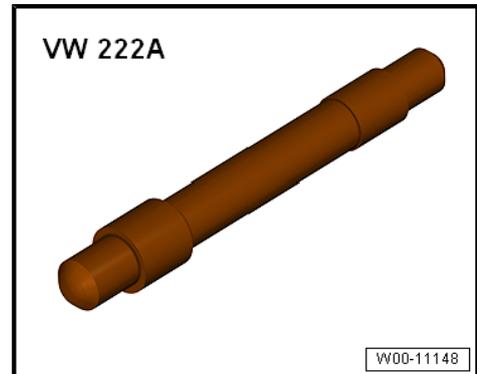
- Using a plastic hammer, carefully knock conrod bearing cap loose -arrow-.



4.2 Removing and installing pistons

Special tools and workshop equipment required

- ◆ Mandrel - VW 222 A-



- ◆ Piston ring clamp, commercially available

Removing

- Remove cylinder head ⇒ [page 84](#) .
- Remove upper section of sump ⇒ [page 232](#) and detach baffle plate.
- Mark the installation position of the piston as well as its correspondence to the respective cylinder.
- Mark installation position and matching of cylinder and conrod bearing cap to conrod ⇒ [Item 4 \(page 70\)](#) .
- Remove the conrod and take the piston and conrod out upwards.

i Note

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

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

Installation

Install in the reverse order of removal, observing the following:

i Note

Renew bolts that are tightened with specified further tightening angle.

- Lubricate the sliding surface of the half bearings.
- Install piston using commercially available piston ring clamp; note installation position ⇒ [page 71](#) .
- Install conrod bearing cap; note installation position ⇒ [Item 2 \(page 70\)](#) .
- Install cylinder head ⇒ [page 84](#) .
- Install upper section of sump ⇒ [page 232](#) .

Specified torques

- ◆ ⇒ [“4.1 Assembly overview - pistons and conrods”, page 70](#)

4.3 Removing and installing oil spray jet

Special tools and workshop equipment required

- ◆ Socket and key - T10545-

Removing

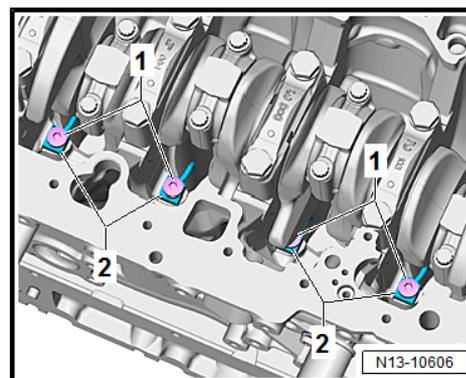
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Assembly overview - noise insulation .
- Remove upper part of sump ⇒ [page 232](#) .
- Turn crankshaft via vibration damper securing bolt in direction of engine rotation until the respective bolt is accessible.
- Unscrew pressure relief valve -1- using bit - T10545- .
- Remove oil spray jets -2-.

Installation

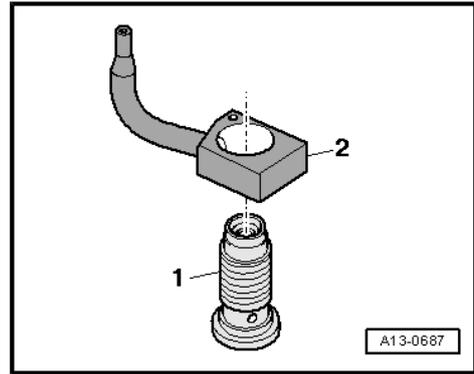
! NOTICE

Risk of damage to oil spray jets caused by deformation.

- Do not bend oil spray jets.



- 1 - Pressure relief valve, 27 Nm
 - 2 - Oil spray jet
- Installation position: align leading edge of oil spray jet with machined surface of cylinder block.
 - Install sump (top section) ⇒ [page 232](#) .
 - Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Assembly overview - noise insulation .

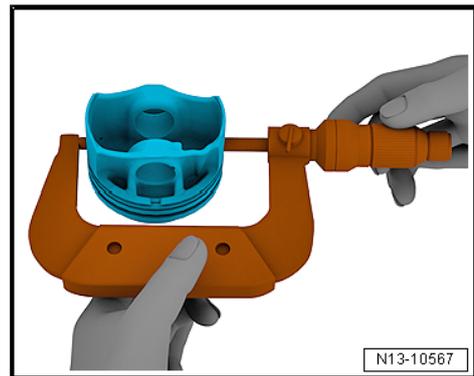


4.4 Checking pistons and cylinder bores

Checking pistons

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

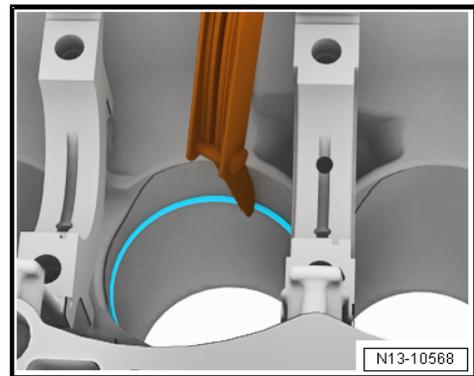
Piston Ø in mm	
Nominal dimension	74.42 ¹⁾
<ul style="list-style-type: none"> • ¹⁾ Dimensions without coating • Piston manufacturer Federal Mogul (thickness of 0.018 mm per side) • Piston manufacturer Mahle (thickness of 0.015 mm per side) 	



Measuring piston ring gap

- Insert the ring through the lower cylinder opening from above at right angles to the cylinder wall so that it is about 15 mm from the cylinder edge.
- Push in using a piston without piston rings.

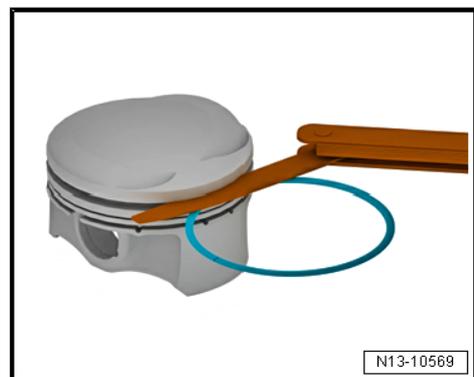
Segment ring	New mm	Wear limit mm
compression ring	0.20 + 0.15	1.0
Oil scraper ring (2 parts)	0.20 + 0.20	3.0
Oil scraper ring (3 parts)	0.50 +/- 0.25	3.0



Measuring ring-to-groove clearance

- Clean annular groove of piston before check.

Segment ring	New mm	Wear limit mm
1st compression ring (manufacturer Federal Mogul)	0.050 ... 0.090	0.15
1st compression ring (manufacturer Mahle)	0.035 ... 0.085	0.15
2nd compression ring	0.030 ... 0.070	0.15
Oil scraper rings (3 parts)	Cannot be measured	
Oil scraper rings (2 parts)	0.04 ... 0.08	



Measuring cylinder bore

NOTICE

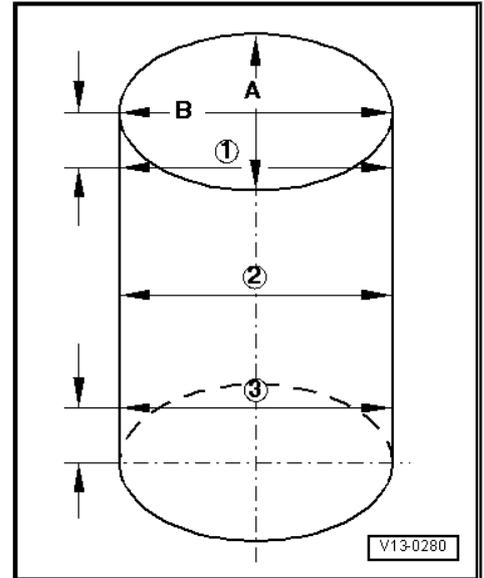
Risk of damage to the surface of the cylinder bore caused by incorrect machining.

- Do not machine cylinder bore (reboring, honing, grinding) with workshop equipment.
- Use a cylinder gauge - VAS 6078- to take measurements at 3 points criss-cross in transverse direction -A- and in longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.08 mm.

Inside diameter of cylinder in mm	
Nominal dimension	74.5 +0.015 ¹⁾ +0.005

Note

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



4.5 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

- ◆ Plastigage

Work sequence

- Remove conrod bearing cap.
- Clean bearing cap and bearing journal.
- Place a Plastigage corresponding to the width of the bearing on the journal or into the bearing shells.
- Fit conrod bearing caps and tighten to 30 Nm without turning bolts further; do not rotate crankshaft.
- Remove conrod bearing cap again.

- Compare width of Plastigage with the measurement scale.

- Radial clearance: 0.028 ... 0.065 mm
- Renew conrod bolts.

15 – Cylinder head, valve gear

1 Cylinder head

⇒ [“1.1 Exploded view - cylinder head”, page 76](#)

⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)

⇒ [“1.3 Removing and installing cylinder head”, page 84](#)

⇒ [“1.4 Removing and installing camshaft housing”, page 88](#)

⇒ [“1.5 Test compression pressure”, page 92](#)

1.1 Exploded view - cylinder head



Note

- ◆ *The camshafts must not be removed individually.*
- ◆ *In the event of repair, the camshaft housing must be renewed completely.*



Note

- ◆ *The cylinder head of engine codes CHPA, CMBA, CXSA, CZCA, CZDA is depicted*
- ◆ *The component positions for engine code CZEA are the same.*



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1 - Cylinder head gasket

- Replace ⇒ [page 84](#)
- Note the installation position: the part number faces the cylinder head.

2 - Adjusting sleeve

- 2 pieces

3 - Cylinder head

- Removing and installing ⇒ [page 84](#)
- check for distortion ⇒ [page 78](#)

4 - Pins

5 - Seal

- With oil strainer
- In cylinder head



Note

- ◆ *The oil strainer is only fitted if the corresponding recess is present in the cylinder head.*
- ◆ *Cylinder heads with recess do not require an oil strainer.*

6 - Seal

- renew

7 - Camshaft housing

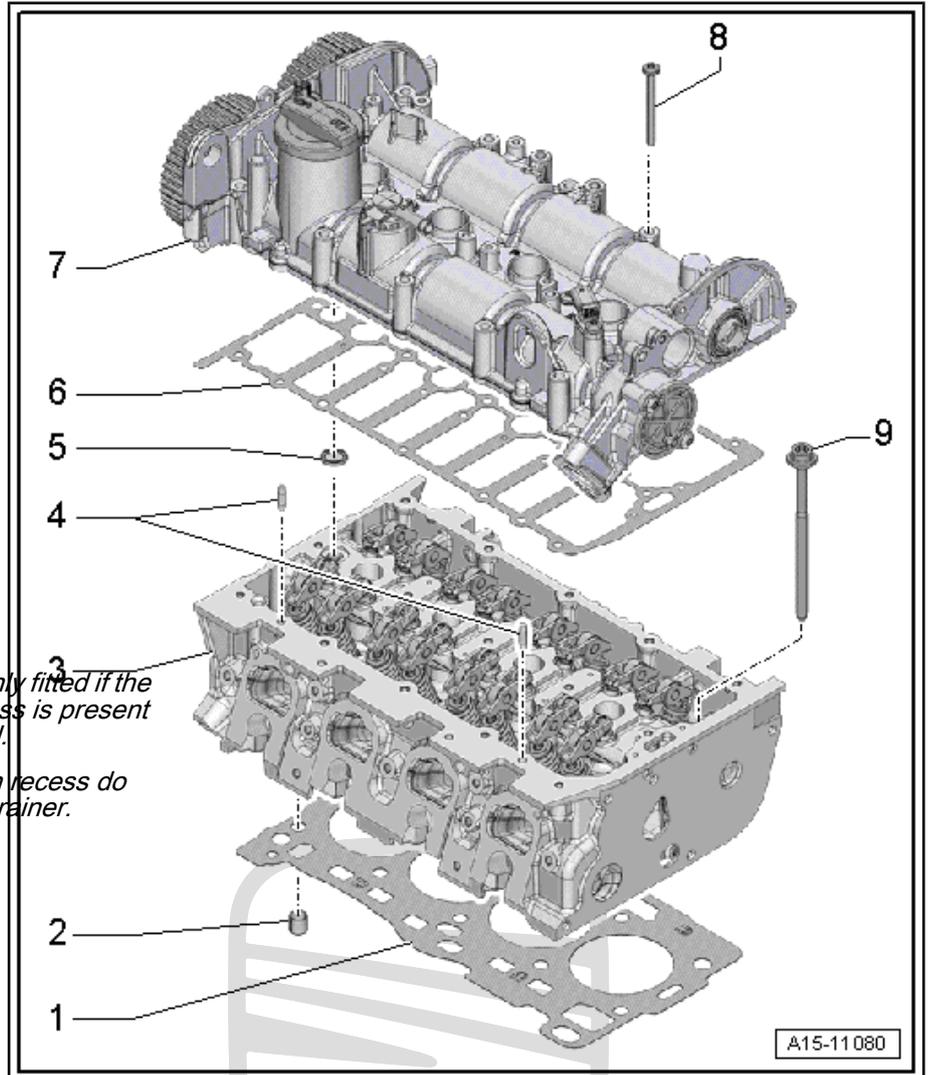
- Removing and installing ⇒ ["1.4 Removing and installing camshaft housing", page 88](#)

8 - Bolt

- Tightening torque and sequence ⇒ [page 82](#)

9 - Bolt

- renew
- Correct sequence when slackening ⇒ [page 87](#)
- Tightening torque and sequence ⇒ [page 78](#)



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Cylinder head - tightening torque and sequence

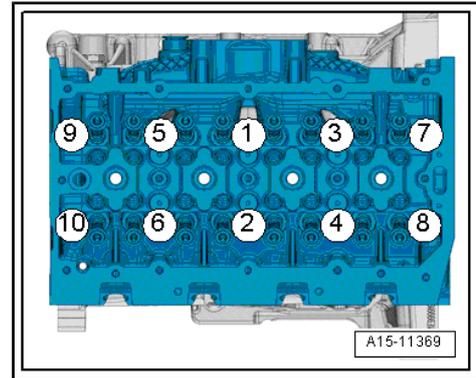


Note

Renew bolts that are tightened with specified further tightening angle.

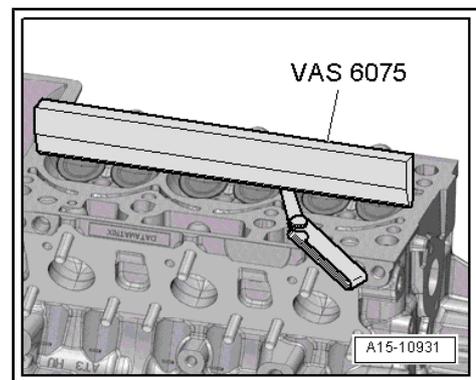
- Tighten bolts step by step in the following sequence:

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



Inspecting the cylinder head for distortion

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



1.2 Exploded view - camshaft housing

⇒ ["1.2.1 Assembly overview - camshaft housing, engine code CZEA", page 78](#)

⇒ ["1.2.2 Exploded view - camshaft housing, engine code CMBA, CXSA, CZCA", page 81](#)

⇒ ["1.2.3 Assembly overview - camshaft housing, engine codes CHPA, CZDA", page 83](#)

1.2.1 Assembly overview - camshaft housing, engine code CZEA

1 - Bolt

- 8 Nm

2 - Exhaust cam actuator for cylinder 2 - N587-

- Removing and installing
 ⇒ [page 195](#)

3 - Exhaust cam actuator for cylinder 3 - N595-

- Removing and installing
 ⇒ [page 196](#)

4 - Inlet cam actuator for cylinder 2 - N583-

- Removing and installing
 ⇒ [page 197](#)

5 - Inlet cam actuator for cylinder 3 - N591-

- Removing and installing
 ⇒ [page 198](#)

6 - Bolts

- 8 Nm

7 - Hall sender 3 - G300-

- Removing and installing
 ⇒ [page 364](#)

8 - Hall sender - G40-

- Removing and installing
 ⇒ [page 364](#)

9 - O-ring

- renew

10 - Oil seal

- For exhaust camshaft, gearbox end
- Replace ⇒ [page 210](#)

11 - Toothed belt sprocket

- For the coolant pump
- Removing and installing ⇒ [page 267](#)

12 - Bolt

- Tightening torque ⇒ [Item 8 \(page 259\)](#)

13 - Bolt

- 8 Nm

14 - Sealing cap

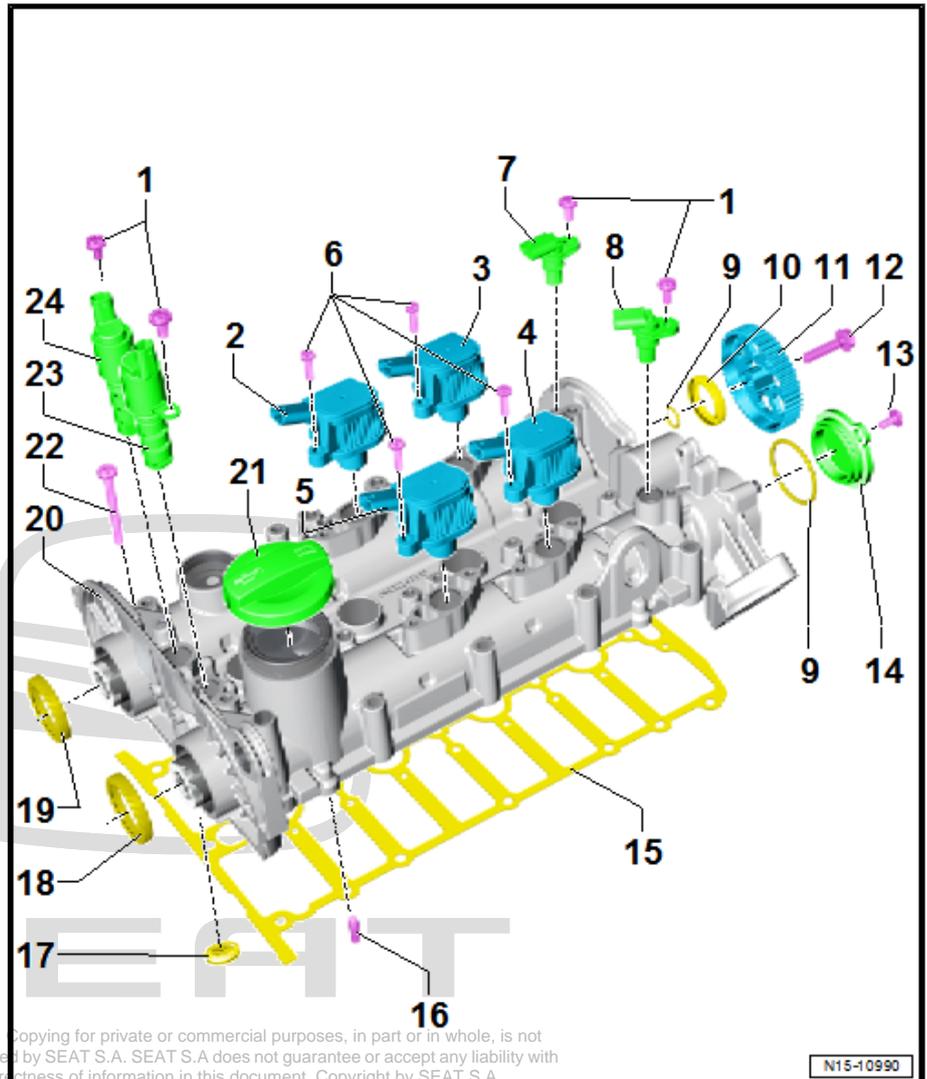
15 - Seal

- renew

16 - Split pin

17 - Seal

- With oil strainer
- Inserted into cylinder head.



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N15-10990



Note

- ◆ *The oil strainer is only fitted if the corresponding recess is present in the cylinder head.*
- ◆ *Cylinder heads with recess do not require an oil strainer.*

18 - Oil seal

- For inlet camshaft
- Replace ⇒ [page 203](#)

19 - Oil seal

- For exhaust camshaft
- Replace ⇒ [page 207](#)

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20 - Camshaft housing

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

21 - Sealing cap

22 - Bolt

- Tightening torque and sequence ⇒ [page 80](#) .

23 - Camshaft control valve 1 - N205-

- Removing and installing ⇒ [page 193](#)
- With O-ring
- Check O-ring for damage
- O-ring cannot be replaced individually. In event of damage, renew with camshaft control valve 1 - N205-

24 - Exhaust camshaft control valve 1 - N318-

- Removing and installing ⇒ [page 194](#)
- With O-ring
- Check O-ring for damage
- O-ring cannot be replaced individually. In event of damage, renew with camshaft control valve 1 - N205-

Camshaft housing - tightening torque and sequence

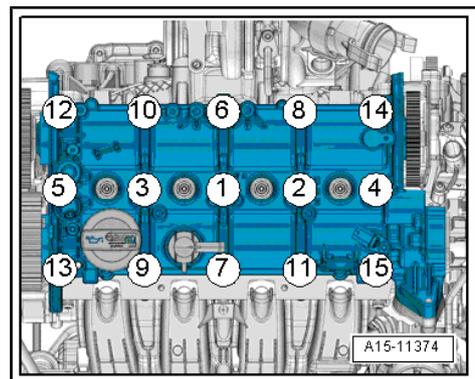


Note

Renew bolts that are tightened with specified further tightening angle.

– Tighten bolts in stages in the sequence shown:

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



1.2.2 Exploded view - camshaft housing, engine code CMBA, CXSA, CZCA

1 - Bolt

- Tightening torque and sequence ⇒ [page 82](#) .

2 - Camshaft control valve 1 - N205-

- Removing and installing ⇒ [page 193](#)
- With O-ring
- Check O-ring for damage
- O-ring cannot be replaced individually. In event of damage, renew with camshaft control valve 1 - N205-

3 - Bolt

- 8 Nm

4 - Camshaft housing

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

5 - Hall sender - G40-

- Removing and installing ⇒ [page 364](#)

6 - Bolt

- 8 Nm

7 - Oil seal

- For exhaust camshaft, gearbox end
- Replace ⇒ [page 213](#)

8 - Toothed belt sprocket

- For the coolant pump
- Removing and installing ⇒ [page 271](#)

9 - Bolt

- Tightening torque ⇒ [Item 8 \(page 259\)](#)

10 - Bolt

- 8 Nm

11 - Sealing cap

12 - O-ring

- renew

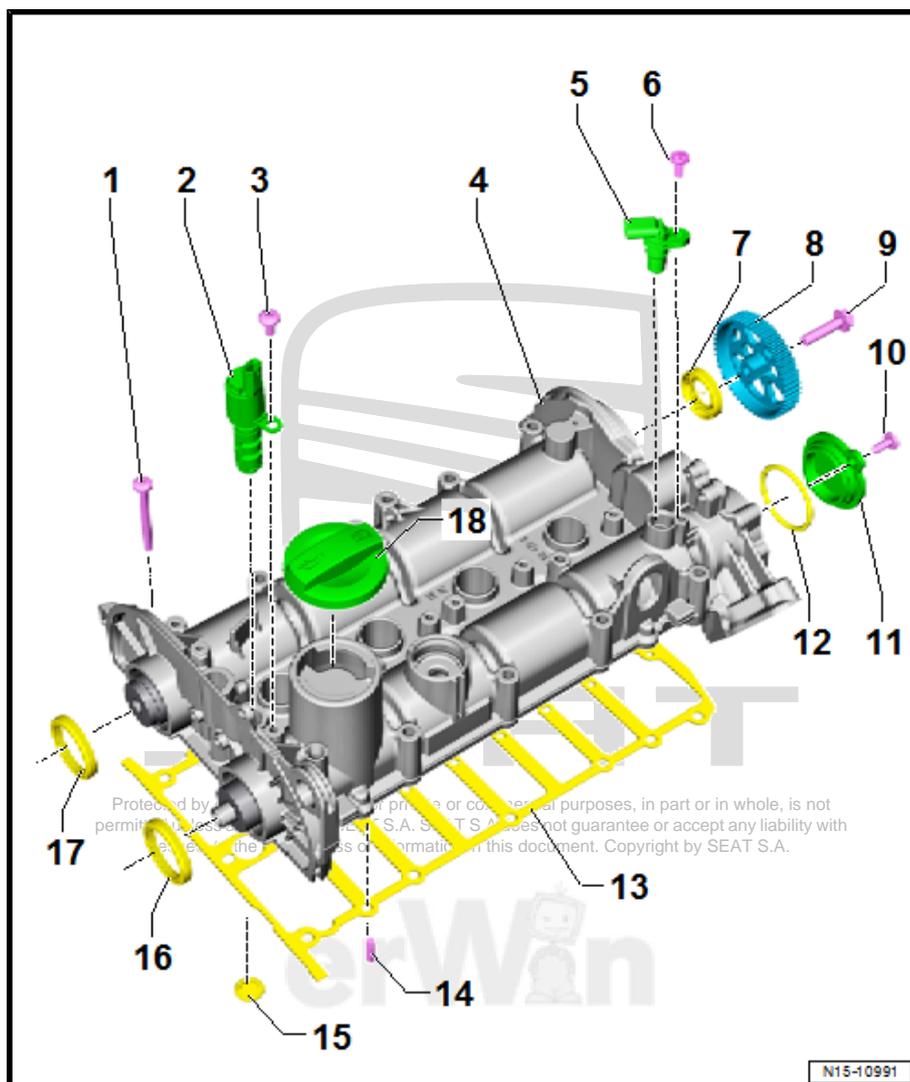
13 - Seal

- renew

14 - Split pin

15 - Seal

- With oil strainer
- Inserted into cylinder head.





Note

- ◆ *The oil strainer is only fitted if the corresponding recess is present in the cylinder head.*
- ◆ *Cylinder heads with recess do not require an oil strainer.*

16 - Oil seal

- For inlet camshaft (pulley side)
- Replace ⇒ [page 205](#)

17 - Oil seal

- For exhaust camshaft (pulley end)
- Replace ⇒ [page 209](#)

18 - Sealing cap

Camshaft housing: tightening torque and sequence

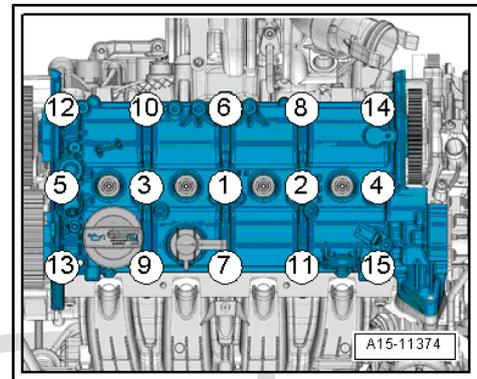


Note

Renew bolts that are tightened with specified further tightening angle.

– Tighten bolts step by step in the following sequence:

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



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erWin

1.2.3 Assembly overview – camshaft housing, engine codes CHPA, CZDA

1 - Exhaust camshaft control valve 1 - N318-

- Removing and installing
 ⇒ [page 194](#)
- With O-ring
- Check O-ring for damage
- O-ring cannot be replaced individually. In event of damage, renew with camshaft control valve 1 - N205-

2 - Bolt

- 8 Nm

3 - Camshaft control valve 1 - N205-

- Removing and installing
 ⇒ [page 193](#)
- With O-ring
- Check O-ring for damage
- O-ring cannot be replaced individually. In event of damage, renew with camshaft control valve 1 - N205-

4 - Camshaft housing

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

5 - Hall sender 3 - G300-

- Removing and installing
 ⇒ [page 364](#)

6 - Bolt

- 8 Nm

7 - Hall sender - G40-

- Removing and installing ⇒ [page 364](#)

8 - Oil seal

- For exhaust camshaft, gearbox end
- renew

9 - Toothed belt sprocket

- For the coolant pump
- Removing and installing ⇒ [page 267](#)

10 - Bolt

- Tightening torque ⇒ [Item 8 \(page 259\)](#)

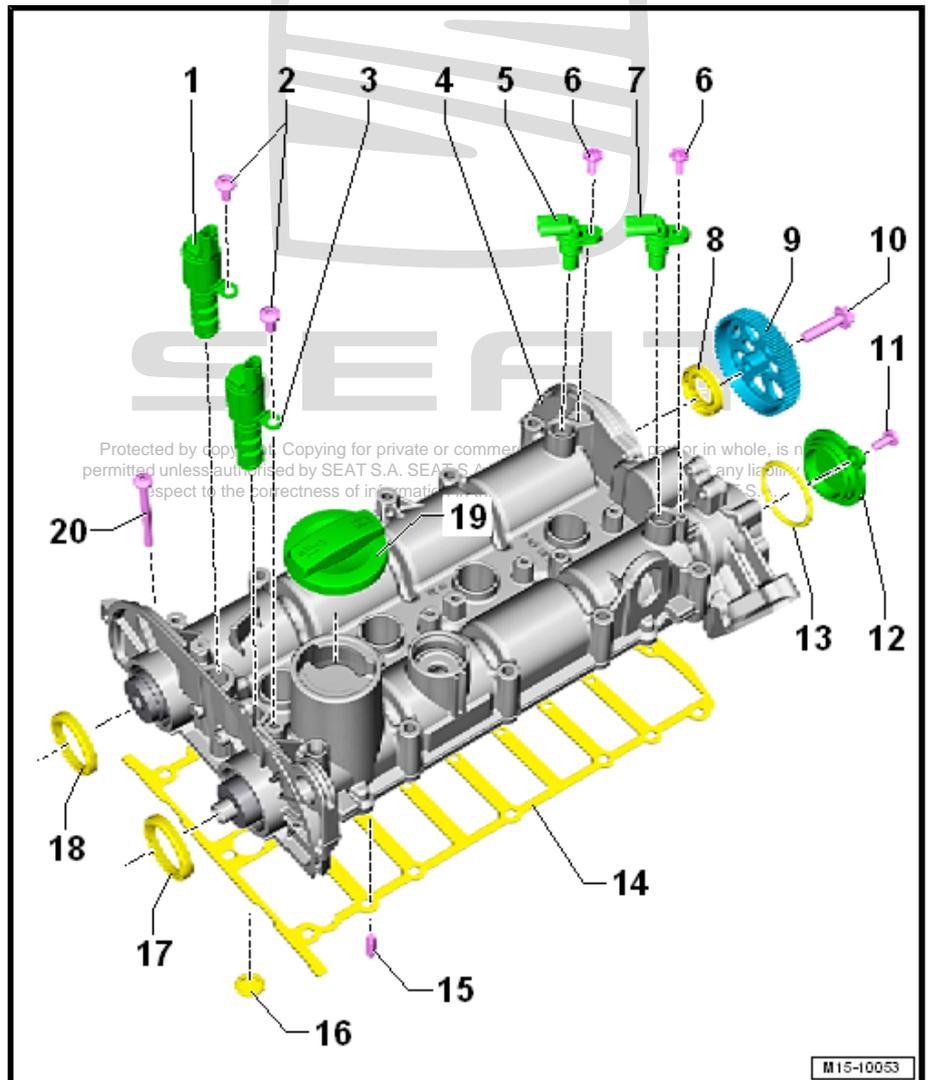
11 - Bolt

- 8 Nm

12 - Sealing plug

13 - O-ring

- renew



14 - Seal

- renew

15 - Split pin

16 - Seal

- With oil strainer
- Inserted into cylinder head.



Note

- ◆ *The oil strainer is fitted only if the cylinder head has the appropriate recess.*
- ◆ *Cylinder heads with recess do not require an oil strainer.*

17 - Oil seal

- For inlet camshaft
- renew

18 - Oil seal

- For exhaust camshaft (pulley end)
- renew

19 - Sealing plug

20 - Bolt

- Tightening torque and sequence ⇒ [page 84](#) .

Camshaft housing - tightening torque and sequence



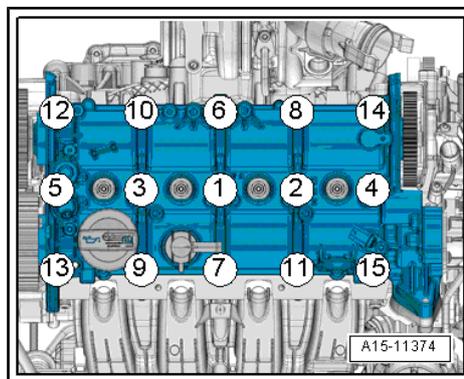
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Renew bolts that are tightened with specified further tightening angle.

– Tighten bolts in stages in the sequence shown:

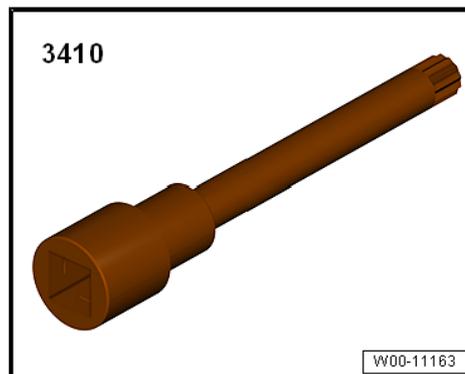
stage	Bolts	Tightening torque/angle specification
1	-1 ... 15-	10 Nm
2	-1 ... 15-	turn 180° further



1.3 Removing and installing cylinder head

Special tools and workshop equipment required

- ◆ Socket and key - 3410-



Removing



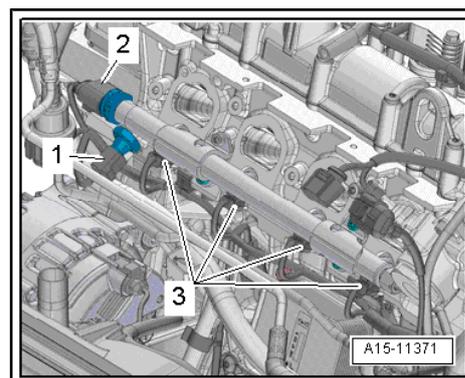
Note

- ◆ *Cover the openings in the gearbox with cloths so that fluid cannot enter the gearbox cover.*
- ◆ *Re-attach all heat insulation sleeves at the same locations when re-installing.*

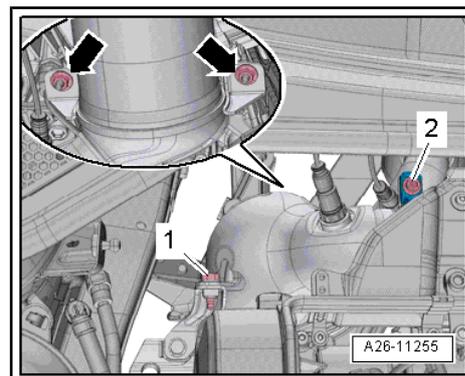
- Remove camshaft housing ⇒ [page 88](#) .
- Now remove the intake manifold ⇒ [page 329](#) .

- Unplug electrical connectors:

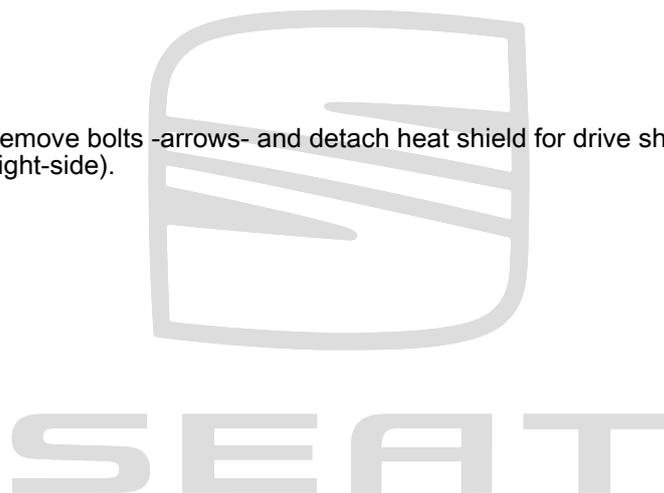
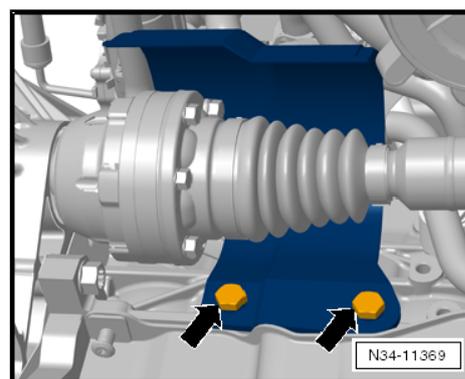
- 1 - At oil pressure switch for reduced oil pressure - F378-
- 2 - at fuel pressure sender - G247-
- 3 - At injectors



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



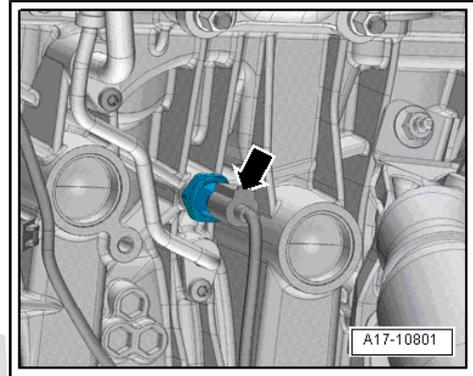
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).



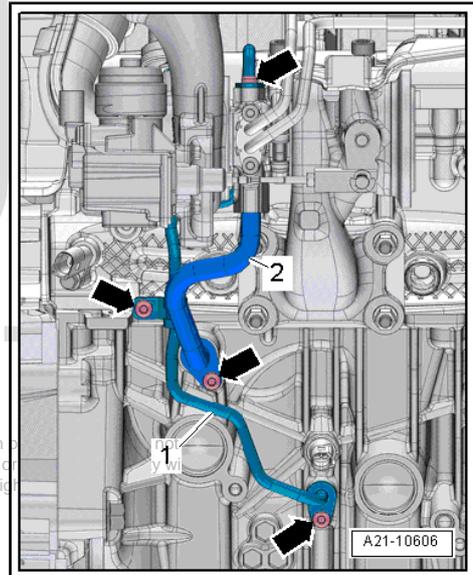
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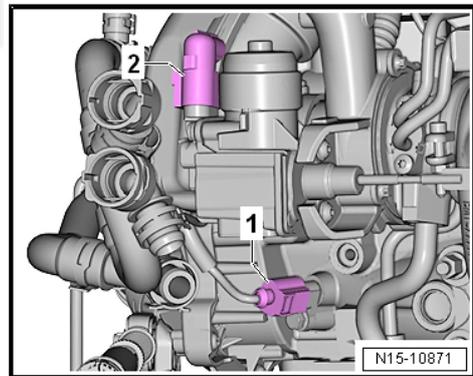
- Remove heat-shield sleeve
- Unplug the electrical connector -arrow- on the oil pressure switch - F1- .



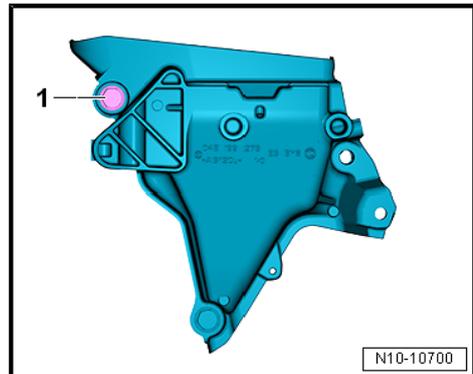
- Unscrew bolts -arrows- and detach oil supply pipe -1- and oil return pipe -2-.



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



- Remove bolt -1- on engine support.



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

 **Note**

Any coolant on the pistons and on the cylinder wall is to be removed immediately with a cloth.

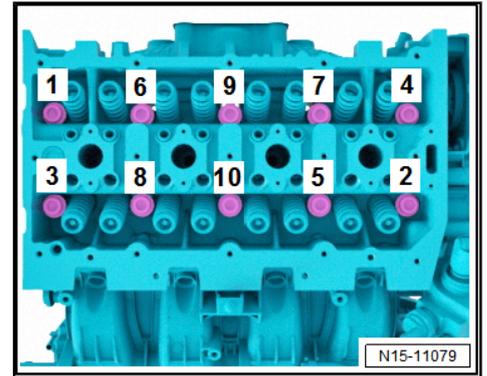
Installation

 **Note**

- ◆ *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, while doing so.*
- ◆ *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 in cylinder head gasket.*
- ◆ *Carefully remove any remaining emery and abrasive material.*
- ◆ *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.*

 **Note**

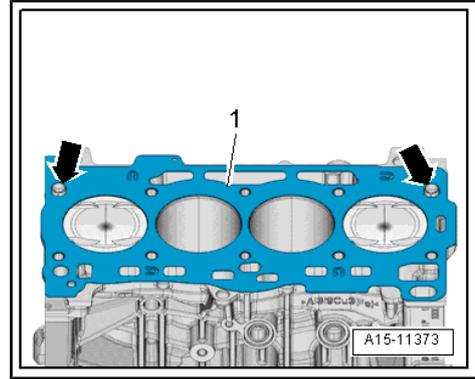
- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Renew self-locking nuts, seals, gaskets and O-rings.*
- ◆ *When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the camshaft housing.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) → Electronic parts catalogue (ETKA).*
- ◆ *Do not reuse coolant which has been drained off.*



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- Fit cylinder head gasket -1-.
- ◆ Note position of centralising pins in cylinder block -arrows-.
- ◆ Note the installation position of cylinder head cover. Part No. should be legible from inlet side.
- If crankshaft has been rotated: set No. 1 cylinder piston to top dead centre and then turn crankshaft back slightly.
- Fit cylinder head.
- Insert and hand-tighten cylinder head bolts.
- Tightening cylinder head bolts ⇒ [page 78](#) .



Note

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

Install in reverse order of removal, observing the following:

- Fit camshaft housing ⇒ [page 88](#) .
- Install intake manifold ⇒ [page 329](#) .
- Change engine oil ⇒ Maintenance ; Booklet 501 .
- Fill cooling system with fresh coolant ⇒ [page 251](#) .

Specified torques

- ◆ ⇒ [Fig. "Engine support - Tightening torque and sequence"](#) , [page 28](#)
- ◆ ⇒ ["1.1 Exploded view - cylinder head"](#) , [page 76](#)
- ◆ ⇒ ["1.1 Exploded view - turbocharger"](#) , [page 295](#)
- ◆ ⇒ ["4.1 Intake manifold - exploded view"](#) , [page 328](#)
- ◆ ⇒ [Fig. "Installing catalytic converter - tightening torque and sequence"](#) , [page 357](#)
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Assembly overview: drive shaft

1.4 Removing and installing camshaft housing

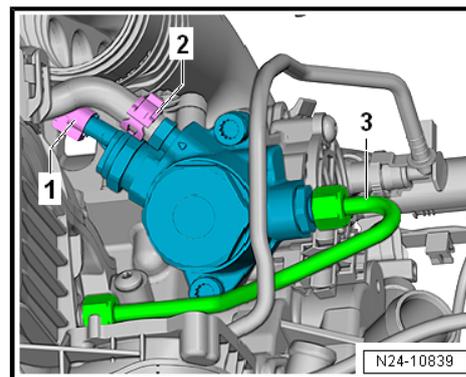
Special tools and workshop equipment required

- ◆ 2 threaded bolts M6x120 mm (commercial standard)

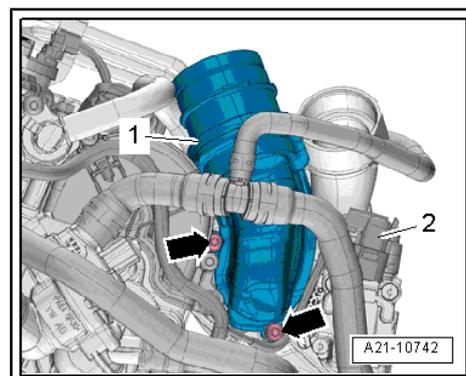
Removing

- Remove coolant pump ⇒ [page 263](#) .
- Remove air cleaner housing ⇒ [page 327](#) .
- Removing ignition coils. ⇒ [page 361](#)
- Detach toothed belt from camshafts ⇒ [page 111](#) .
- Unplug the electrical connector -1-.

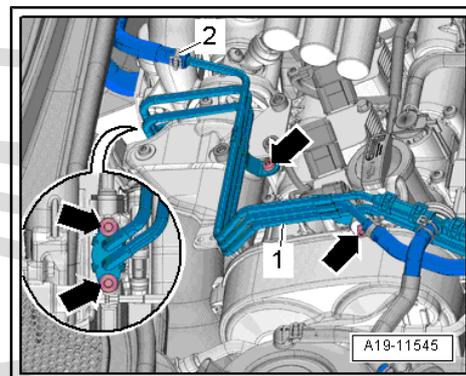
- Release clip -2- and detach hose.
- Remove high-pressure pipe -3- ⇒ [page 347](#) .
- Unplug the electrical connector -2-.



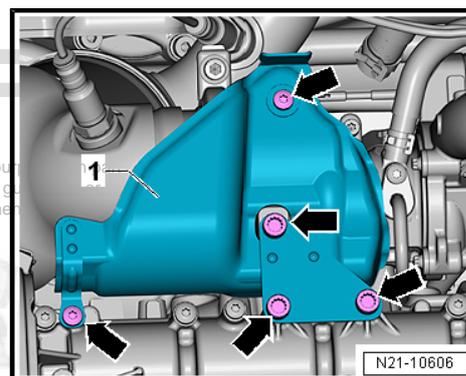
- Remove bolts -arrows- and detach connection -1-.



- Loosen the hose clip -2-, remove the coolant hose.
- Remove bolts -arrows- and swivel coolant lines -1- to right.

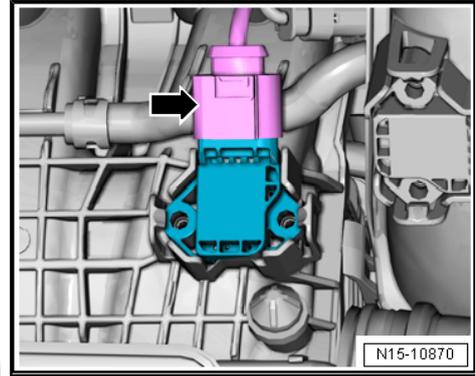


- Remove bolts -arrows- and detach heat shield -1-.



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- Disconnect connector -arrow- from intake air temperature sender - G42- / intake manifold temperature sender - G71- .



- Release connectors and pull them off:
- The number of connectors depends on the respective engine codes.

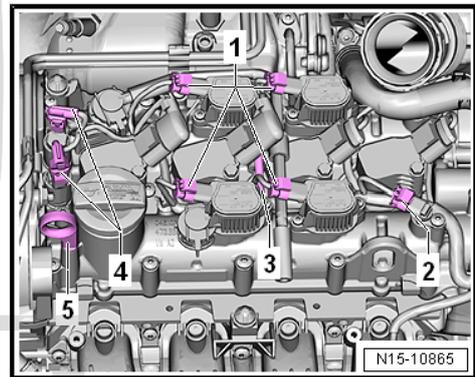
1 - For cam actuators - N583- / -N587- / -N591- / -N595-

2 - For Hall sender - G40- and Hall sender 3 - G300-

4 - For inlet camshaft control valve 1 - N205- and exhaust camshaft control valve 1 - N318-

- Remove bolt -3-, detach wiring harness and move clear to one side.

- Remove the dipstick -5-.

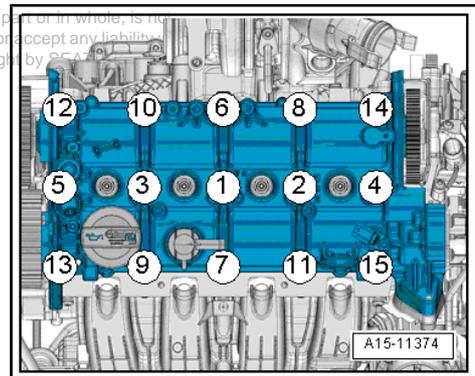


- Loosen bolts for camshaft housing in the sequence -15- and unscrew them.

- Carefully release camshaft housing from bonded joint and detach.

- Mark original positions of roller rocker fingers and compensation elements for reinstallation.

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



Installation



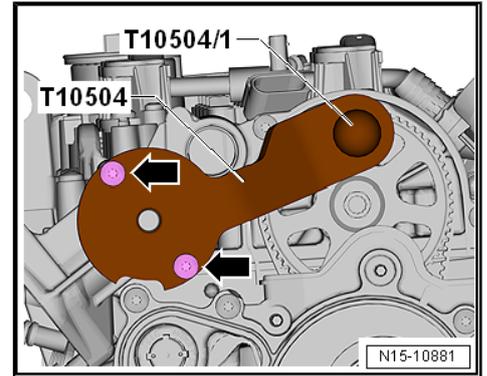
Note

- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Renew gasket and seal with oil strainer.*
- Check "TDC" position of camshaft and crankshaft:

Engine code **CZEA**

- Camshaft clamp - T10504- fitted on camshaft housing.

Engine codes CMBA, CXSA, CZCA, CHPA, CZDA



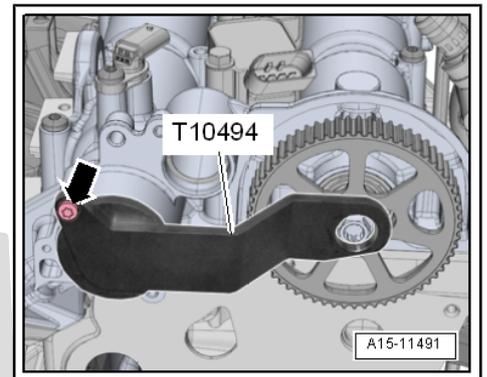
- Camshaft clamp -T10494- must be attached to camshaft housing.

Continuation for all engines:

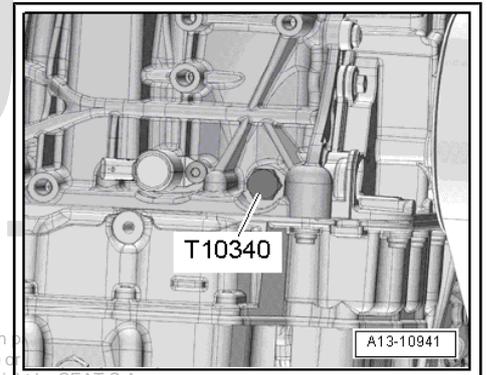
 **NOTICE**

Risk of damage to valve gear caused by axial movement of the camshafts.

- Never move camshafts in axial direction when turning them.



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

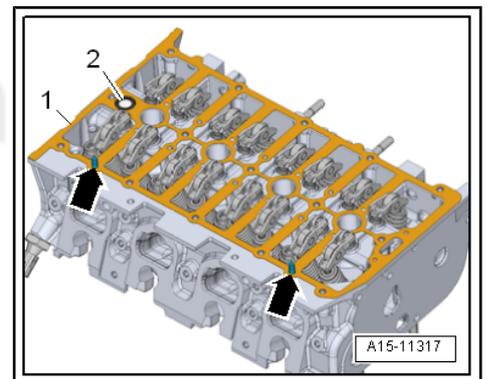


- Make sure that all roller rocker fingers make contact with the valve ends correctly and are clipped into their respective support elements.

 **Note**

- ◆ *The oil strainer is only fitted if the corresponding recess is present in the cylinder head.*
- ◆ *Cylinder heads with recess do not require an oil strainer.*

- Fit seal with oil strainer -2- into cylinder head -1-.
- Fit gasket onto dowel pins -arrows-.



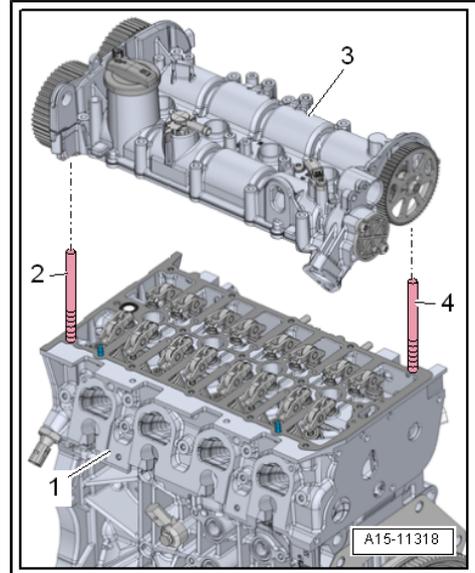
- Screw 2 studs M6x120 mm (standard) -items 2 and 4-, onto the cylinder head.
- Carefully lower camshaft housing -3- vertically onto studs in cylinder head.



Note

Take care not to tilt the camshaft housing.

- Tighten camshaft housing bolts ⇒ [page 78](#) .
- Remaining installation steps are carried out in reverse sequence; note the following:
- Install high-pressure pipe ⇒ [page 347](#) .
 - Install notched belt (adjusting valve timing) ⇒ [page 111](#) .
 - Install ignition coils ⇒ [page 361](#) .
 - Fit the coolant pump ⇒ [page 263](#) .
 - Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



Risk of damage to engine

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.

Specified torques

- ◆ ⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 295](#)
- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 326](#)

1.5 Test compression pressure

Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-



◆ Compression tester - V.A.G 1763-



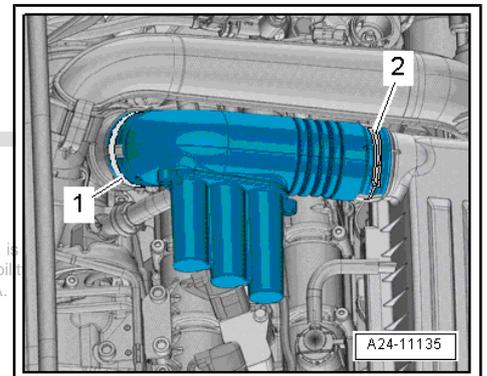
Work sequence

- Engine oil temperature at least 30 °C.
- Battery voltage: at least 12.5 V.
- Remove fuse for fuel pump control unit from fuse holder. Fuse installation ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

 **Note**

Removing fuse interrupts voltage supply for fuel pump control unit.

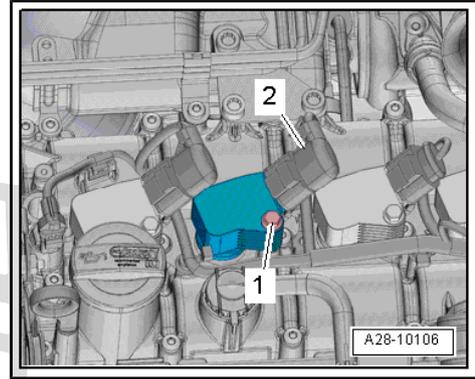
- Start engine and run it until it turns off.
- Switch off ignition.
- Loosen hose clips -1- and -2- and remove air pipe.



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erWin

- Disconnect connector -2- and remove bolt -1-.
- Remove ignition coils with output stages.
- Remove the spark plugs when using the spark plug spanner - 3122 B- .
- Check compression pressure with compression tester - V.A.G 1763- (see ⇒ operating instructions for details of how to use tester).
- Have a 2nd mechanic press down the accelerator pedal completely and simultaneously operate the starter until the pressure no longer increases on the tester display.
- Repeat procedure on each cylinder.



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

Assembling

Carry out installation in the reverse sequence, noting the following:

- Install spark plugs. Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by SEAT S.A. SEAT S.A does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by SEAT S.A.
- Install ignition coils with output stages ⇒ [page 361](#) .
- Because connectors were unplugged and the engine started, entries are stored in the event memory of the engine control unit: `Generate readiness code` in `Guided Functions`
⇒ Vehicle diagnostic tester.

Specified torques

- ◆ ⇒ [“1.1 Assembly overview - ignition system”, page 360](#)

2 Toothed belt drive

⇒ [“2.1 Exploded view - toothed belt cover”, page 95](#)

⇒ [“2.2 Exploded view - toothed belt”, page 96](#)

⇒ [“2.3 Checking distribution timing”, page 99](#)

⇒ [“2.4 Detaching toothed belt from camshaft”, page 111](#)

⇒ [“2.5 Timing belt: removing, fitting, tensioning”, page 149](#)

2.1 Exploded view - toothed belt cover

1 - Lower toothed belt guard

2 - Bolt

- 8 Nm

3 - Engine support

- Tightening torque and sequence ⇒ [page 28](#) .

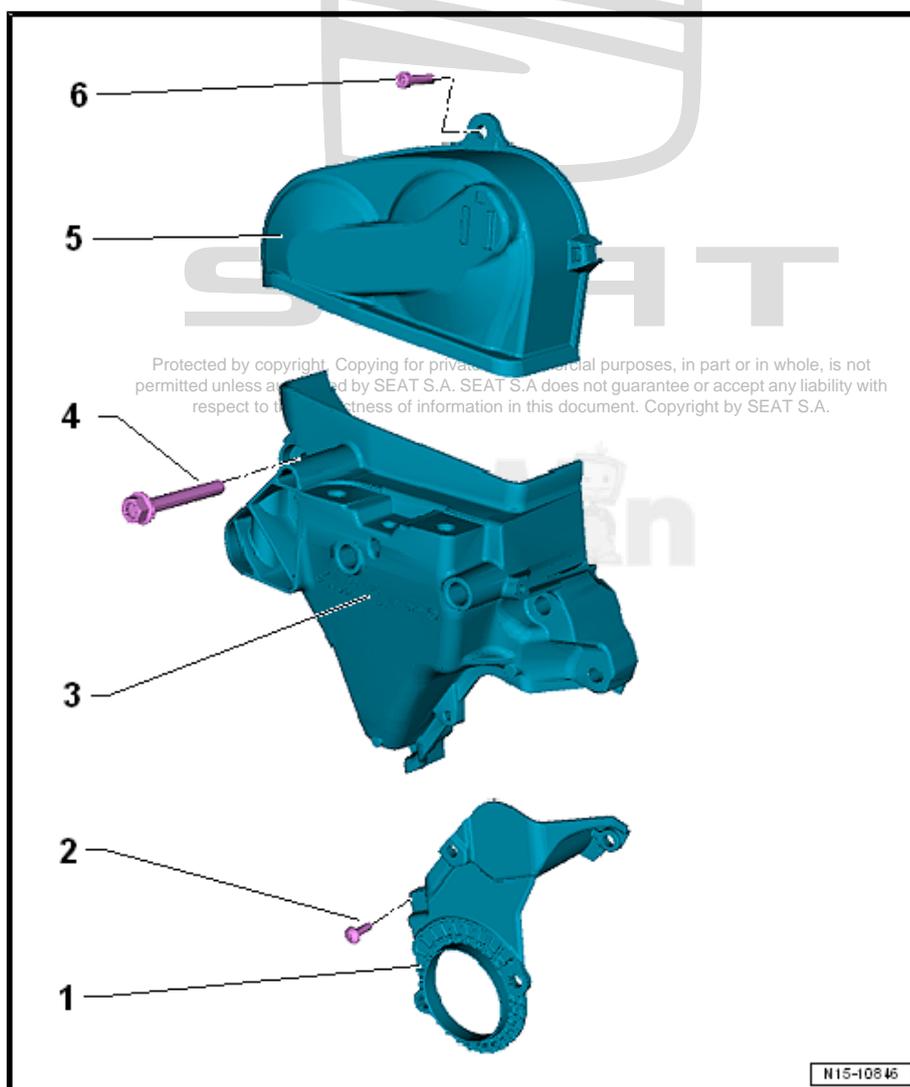
4 - Bolt

- Tightening torque and sequence ⇒ [page 28](#) .

5 - Toothed belt guard upper part

6 - Bolt

- 8 Nm



2.2 Exploded view - toothed belt

⇒ "2.2.1 Assembly overview - toothed belt, engine codes CHPA, CZEA, CZDA", page 96

⇒ "2.2.2 Exploded view - Toothed belt, engine code CMBA, CXSA, CZCA", page 98

2.2.1 Assembly overview - toothed belt, engine codes CHPA, CZEA, CZDA

1 - Notched belt

- Before removing, mark direction of rotation with chalk or felt-tip pen
- Check for wear
- Removing ⇒ [page 111](#)
- Installing (adjusting valve timing), CZEA ⇒ [page 156](#)
- Installing (adjusting valve timing), CHPA, CZDA ⇒ [page 171](#)

2 - Bolt

- 25 Nm



Note

- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
- ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10300- must be entered in the torque wrench.*
- ◆ *If you use a conventional torque wrench you might possibly tighten the bolt of the tensioning roller with too much torque and damage it.*

3 - Tensioning roller

- Removal and installation involve taking out engine support ⇒ [page 46](#)

4 - Bolt

- renew
- 8 Nm +45°

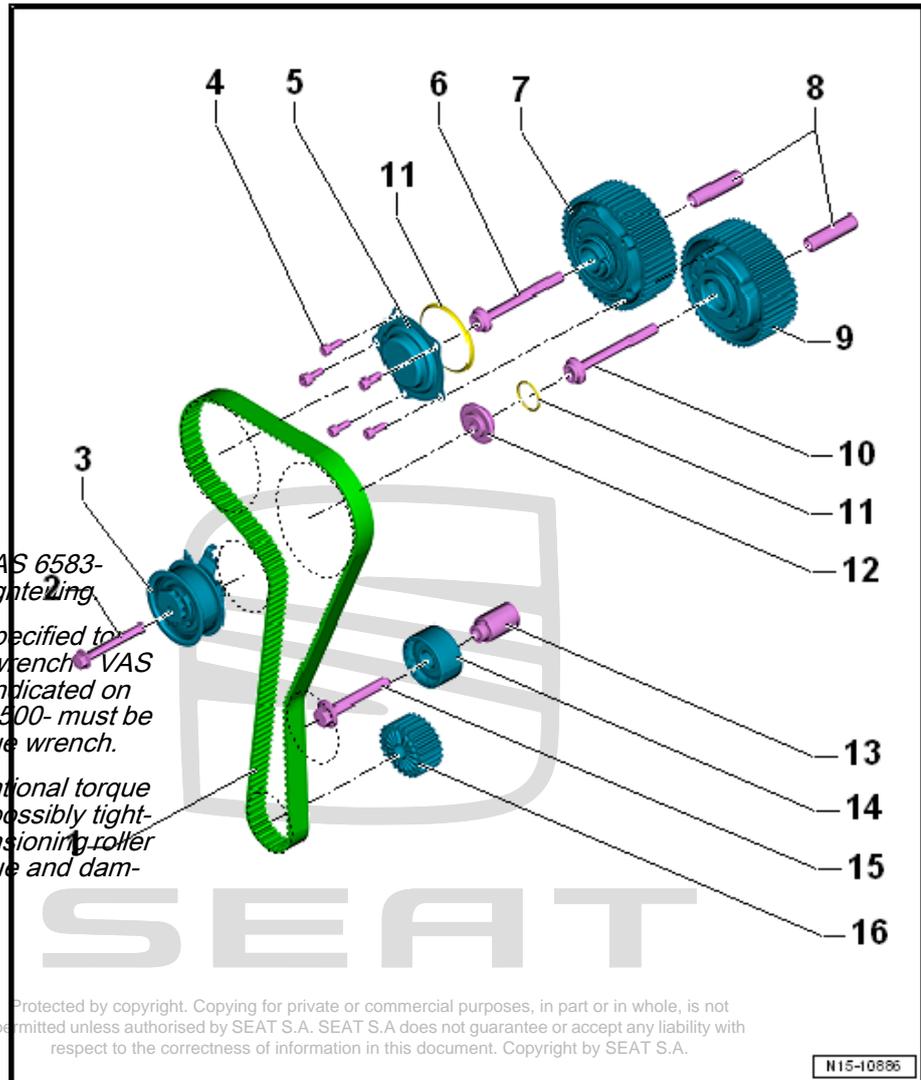
5 - Sealing cap

6 - Bolt

- renew
- 50 Nm +135°

7 - Toothed belt sprocket (exhaust camshaft)

- With camshaft adjuster
- Removing and installing camshaft adjuster ⇒ [page 199](#)



8 - Guide sleeve

9 - Toothed belt sprocket (inlet camshaft)

- With camshaft adjuster
- Removing and installing camshaft adjuster → [page 199](#)

10 - Bolt

- renew
- 50 Nm +135°

11 - O-ring

- renew

12 - Screw plug

- 20 Nm

13 - Spacer sleeve

- With O-ring
- Replace O-ring

14 - Idler roller

15 - Bolt

- 45 Nm

16 - Crankshaft pulley

- Contact surface between sprocket and crankshaft must be free of oil
- Fitting possible in one position only.

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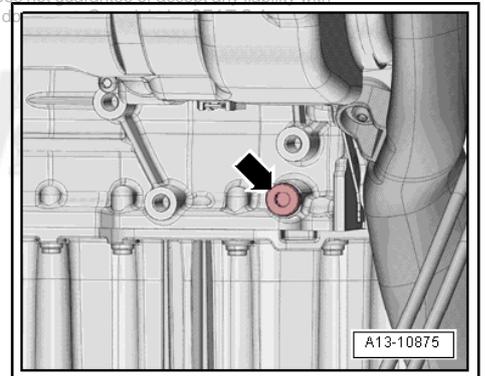
Plug for "TDC" drilling in cylinder block - tightening torque



Note

Replace the O-ring if damaged.

- Tighten bolt -arrow- to 30 Nm.



2.2.2 Exploded view - Toothed belt, engine code CMBA, CXSA, CZCA

1 - Notched belt

- Before removing, mark direction of rotation with chalk or felt-tip pen
- Check for wear
- Removing ⇒ [page 149](#)
- Installing (adjusting valve timing) ⇒ [page 144](#)

2 - Bolt

- 25 Nm



Note

- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
- ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10500- must be entered in the torque wrench.*
- ◆ *If you use a conventional torque wrench you might possibly tighten the bolt of the tensioning roller with too much torque and damage it.*

3 - Tensioning roller

- Removal and installation involve taking out engine support ⇒ [page 46](#)

4 - Bolt

- renew
- 50 Nm +90°

5 - Pinion for exhaust camshaft

6 - Toothed belt sprocket (inlet camshaft)

- With camshaft adjuster

7 - Guide sleeve

8 - Bolt

- renew
- 50 Nm +135°

9 - O-ring

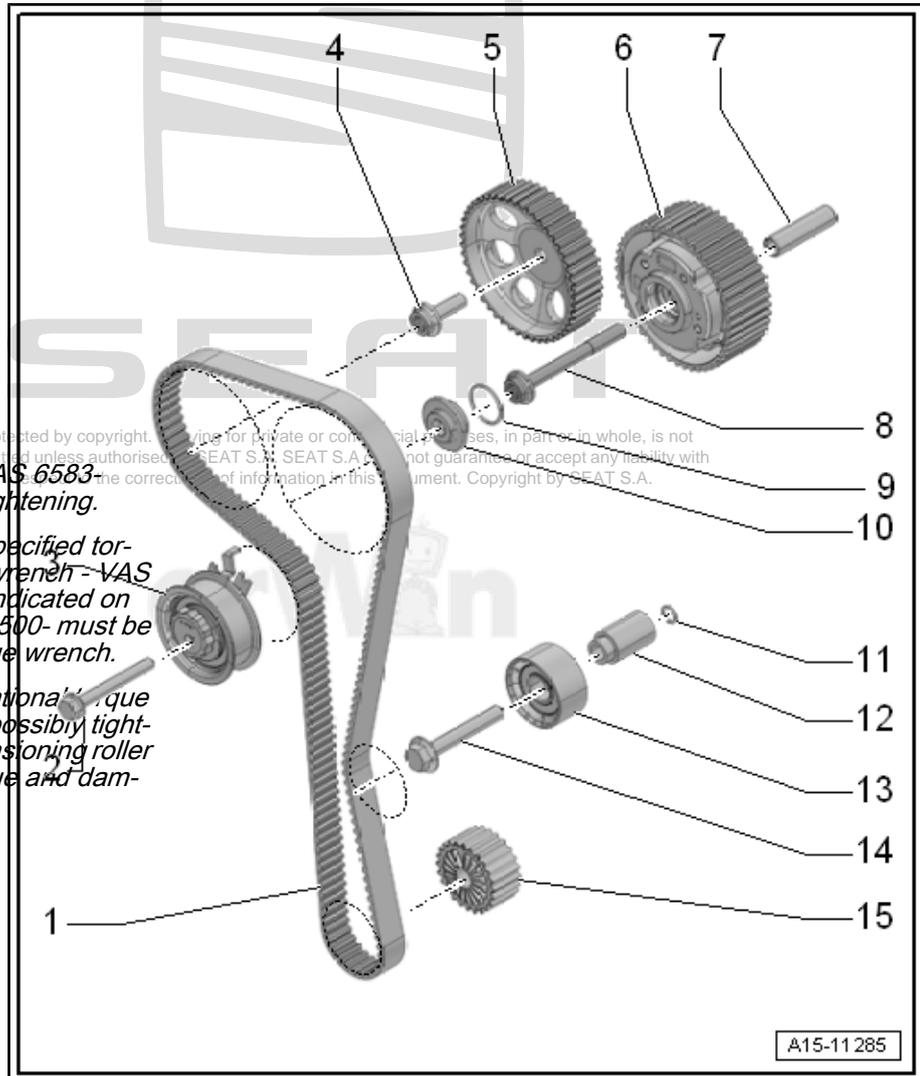
- renew

10 - Screw plug

- 20 Nm

11 - O-ring

- Captive
- renew



12 - Spacer sleeve

13 - Idler roller

14 - Bolt

- 45 Nm

15 - Crankshaft pulley

- Contact surface between sprocket and crankshaft must be free of oil
- Fitting can only be completed in one position only:

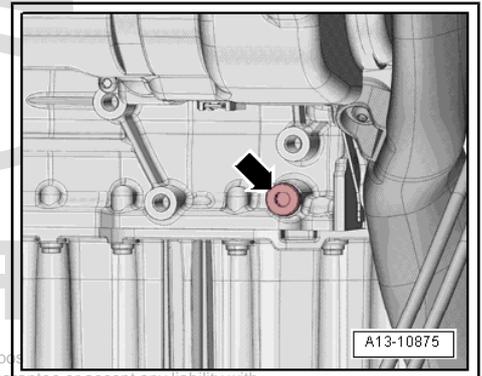
Plug for "PMS"drilling in cylinder block - tightening torque



Note

Renew O-ring if damaged.

- Tighten bolt -arrow- to 30 Nm.



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2.3 Checking distribution timing

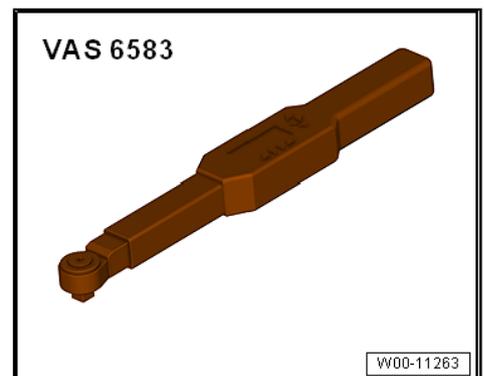
⇒ ["2.3.1 Checking valve timing, engine code CZEA", page 99](#)

⇒ ["2.3.2 Check valve timing, engine codes CMBA, CHPA, CXSA, CZCA, CZDA", page 105](#)

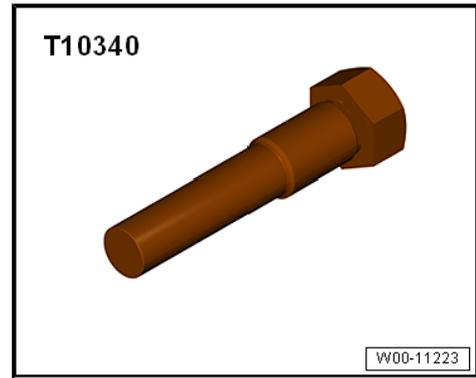
2.3.1 Checking valve timing, engine code CZEA

Special tools and workshop equipment required

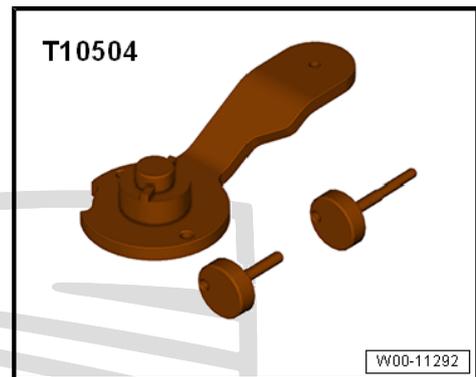
- ◆ Torque wrench - VAS 6583-



- ◆ Securing bolts - T10340-



- ◆ Camshaft clamp - T10504-



- ◆ Testing pin - T10504/2-

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

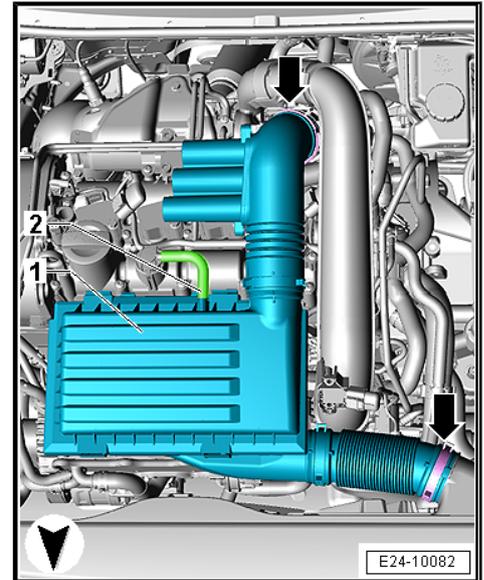


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- ◆ Screwdriver with minimum shaft length of 250 mm

Work sequence

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



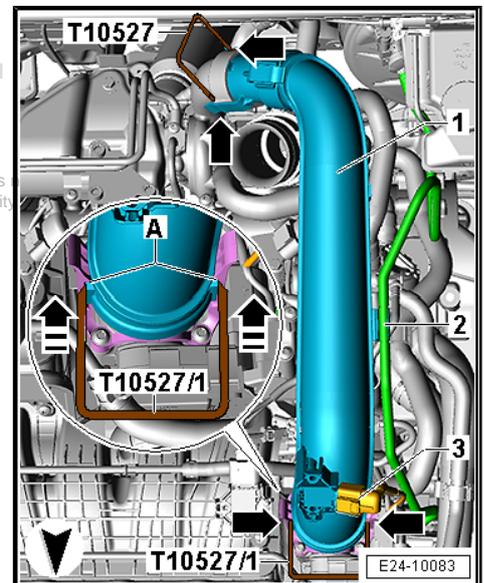
- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

Note

◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1-*

◆ *Insert the release tool , note the detailed image -A-.*

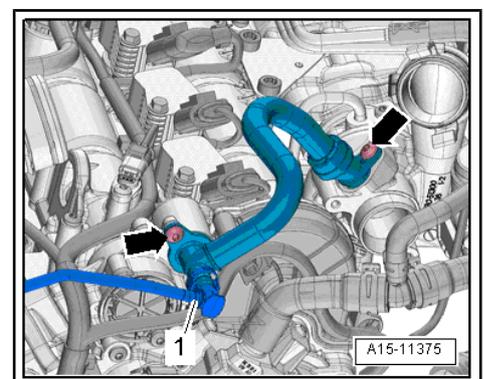
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.



Note

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.

- Press release tabs and disconnect hose -1- for activated charcoal filter.
- Remove bolts -arrows- and detach crankcase breather hose.

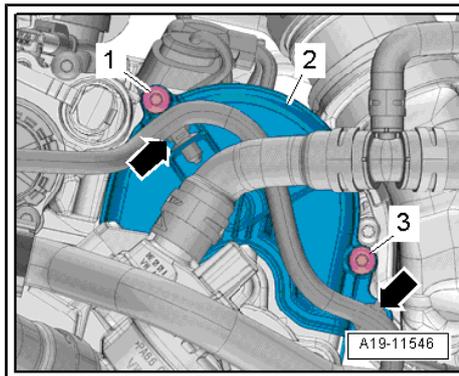


- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.



Note

To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.

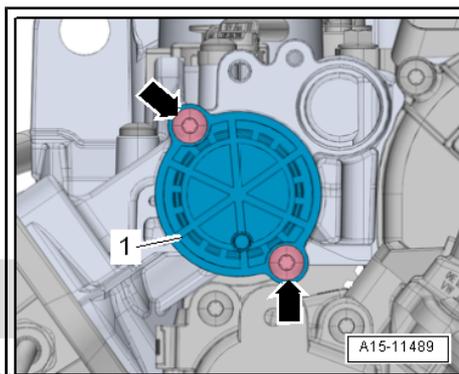


- Remove bolts -arrows-, remove cover cap -1-.



Note

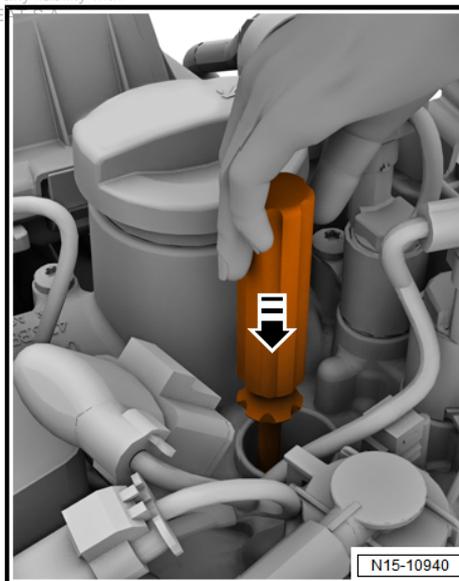
- ◆ A small quantity of oil may escape when opening the cover cap -1-.
- ◆ Use cloth to catch escaping engine oil.



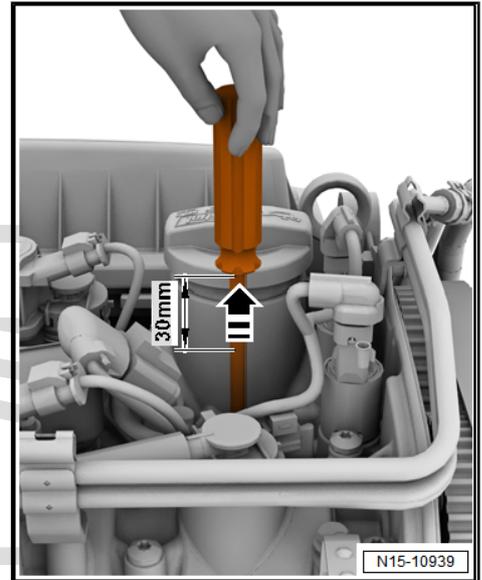
Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage - N70- and the spark plug cylinder 1 ⇒ [page 360](#) .
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

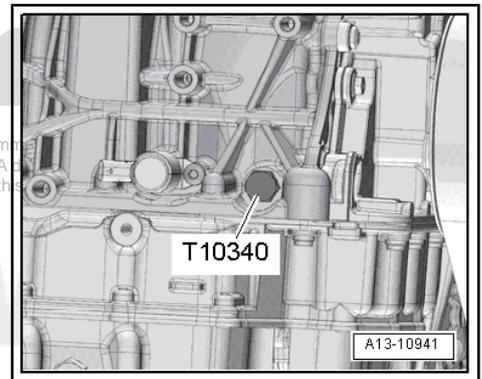
The screwdriver is turned in the -direction of the arrow-.



- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-



- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the 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.

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:
- Unscrew locking pin.
- Turn crankshaft 90° in direction of rotation of engine.
- 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.

- On exhaust camshaft, hole -arrow- in toothed belt pulley for coolant pump must be positioned opposite hole in camshaft housing.
- On inlet camshaft, grooves -bottom arrows- must be positioned above centre of camshaft.

A - Exhaust camshaft

E - Inlet camshaft

- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.

 **Note**

- ◆ *The camshaft clamp - T10504- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

- When camshafts are positioned as described, insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).

- Insert test pin - T10504/2- as far as stop.

- Hand-tighten the bolts -arrows-.

Risk of damage to engine

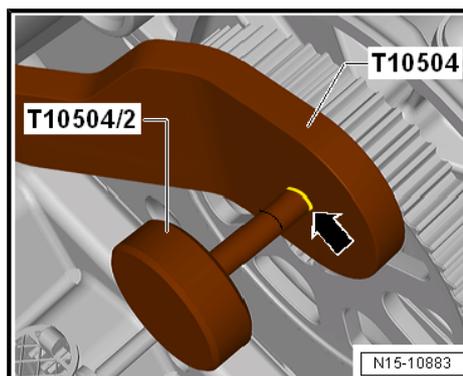
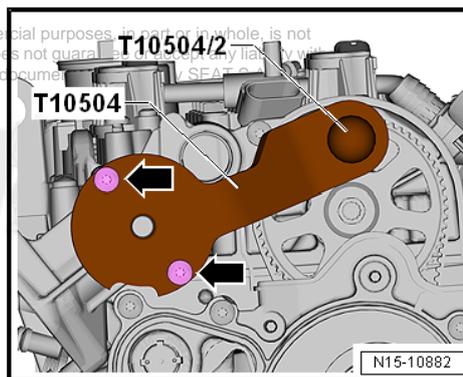
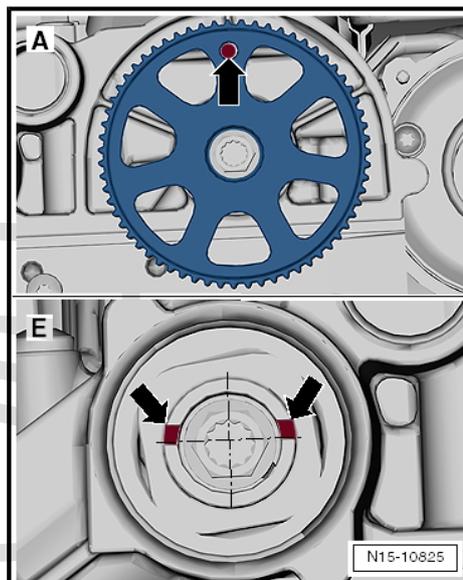
- ◆ If the groove -arrow- is not flush with the camshaft clamp - T10504- , the test pin - T10504/2- has not been inserted deep enough.
- ◆ This may cause damage to the engine due to disturbed valve timing.

- The groove -arrow- on test pin - T10504/2- must be flush with camshaft clamp - T10504- .

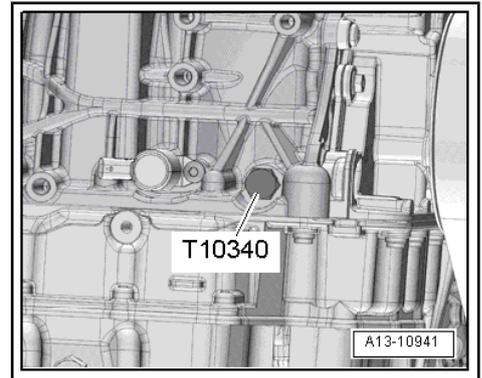
If it is not possible to insert the camshaft clamp - T10504- with the test pin - T10504/2- , then valve timing is not OK:

- Adjust valve timing, Removing toothed belt from camshafts
⇒ [page 111](#) .

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



- Remove locking pin - T10340- .
- Tighten plug to specified torque.



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

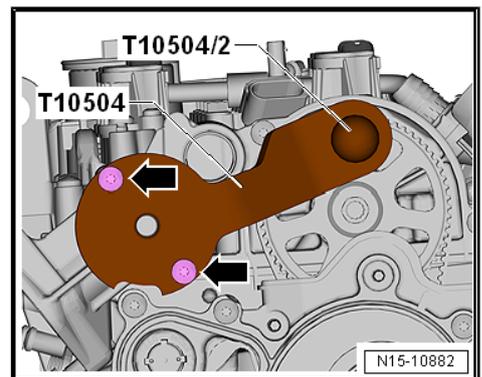
Risk of damage to engine

- ◆ After completing work, check that locking pin - T10340- and camshaft clamp -T10494- have been removed.

Install in the reverse order of removal, observing the following:

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- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Renew O-ring of plug if damaged.*



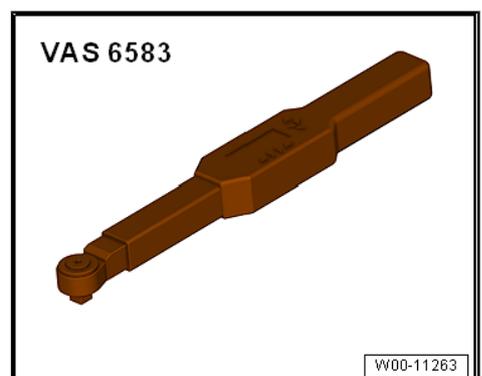
Specified torques

- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97](#)
- ◆ ⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 238](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)
- ◆ ⇒ [“1.1 Assembly overview - ignition system”, page 360](#)

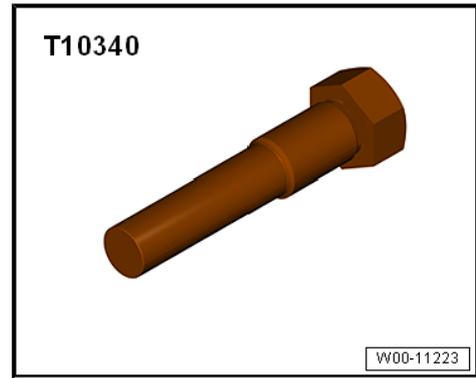
2.3.2 Check valve timing, engine codes CMBA, CHPA, CXSA, CZCA, CZDA

Special tools and workshop equipment required

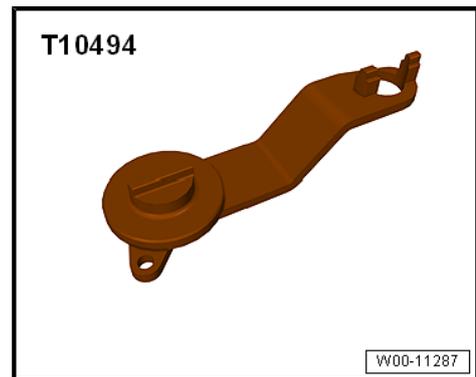
- ◆ Torque wrench - VAS 6583-



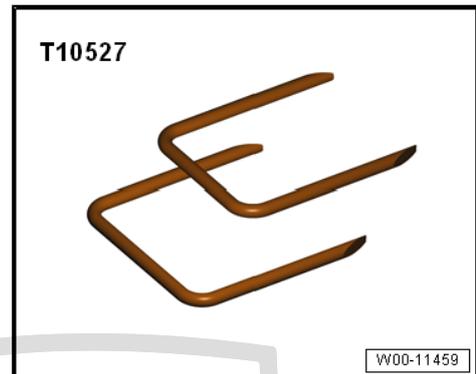
◆ Securing bolts - T10340-



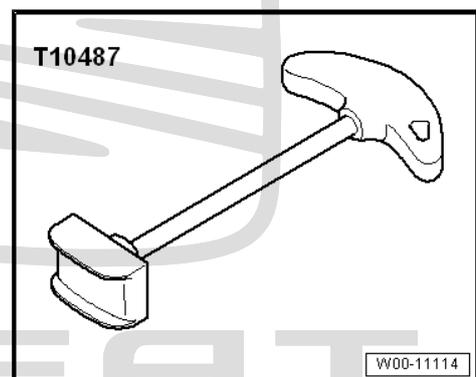
◆ Camshaft clamp - T10494-



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



◆ Assembly tool - T10487-

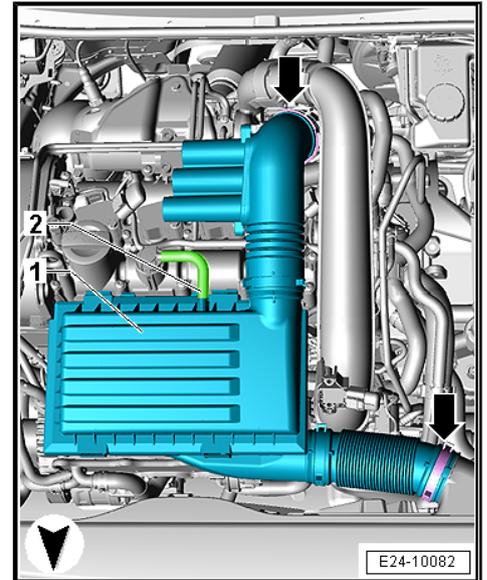


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erWin

Work sequence

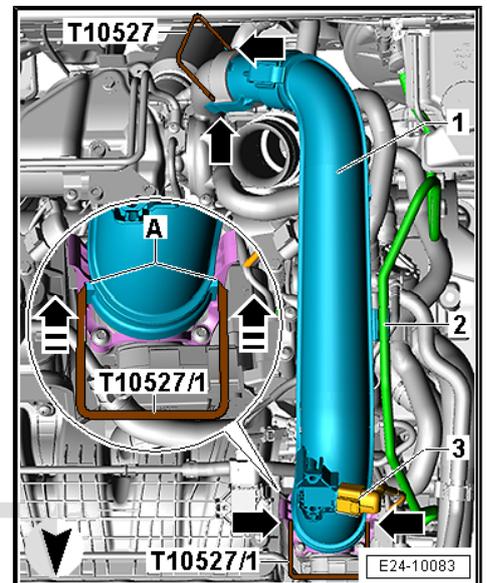
- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

Note

- ◆ To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .
- ◆ Insert the release tool , note the detailed image -A-.
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

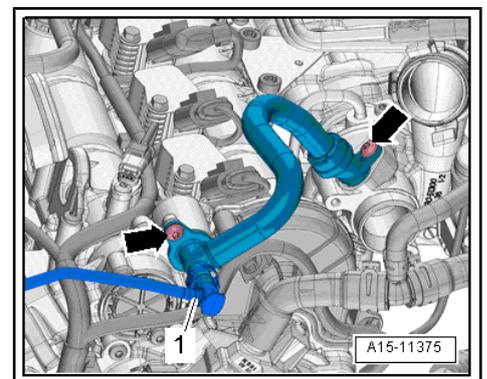


Note

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.

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- Press release tabs and disconnect hose -1- for activated charcoal filter.
- Remove bolts -arrows- and detach crankcase breather hose.

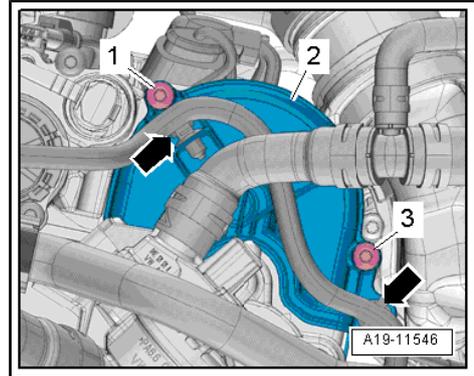


- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.



Note

To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.



- Remove bolts -arrows-, remove cover cap -1-.

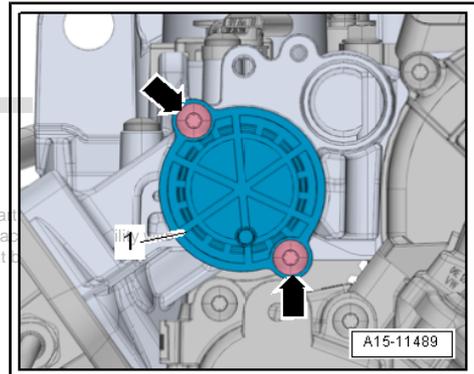


Note

◆ A small quantity of oil may escape when opening the cover cap -1-.

◆ Use cloth to catch escaping engine oil.

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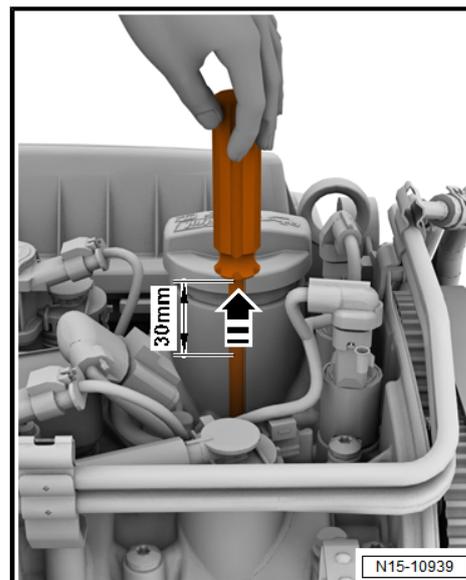
Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage - N70- and the spark plug cylinder 1 ⇒ [page 360](#) .
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

The screwdriver is turned in the -direction of the arrow-.



- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-

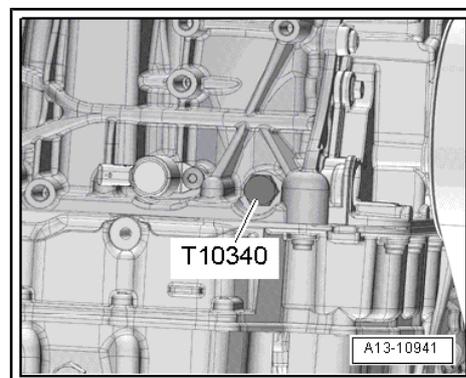


- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the stop.
- The locking pin is now in contact with the crank web.



Note

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



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:
- Unscrew locking pin.
- Turn crankshaft 90° in direction of rotation of engine.
- 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.

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- On both camshafts, asymmetrically positioned grooves -top arrows- on gearbox end must face upwards, as shown in illustration.
- The grooves on the exhaust camshaft -upper arrows- can be accessed through the recesses in toothed belt pulley for coolant pump.
- On the inlet camshaft the grooves -lower arrows- must also be positioned right above horizontal camshaft centre line.

A - Exhaust camshaft

E - Inlet camshaft

- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.



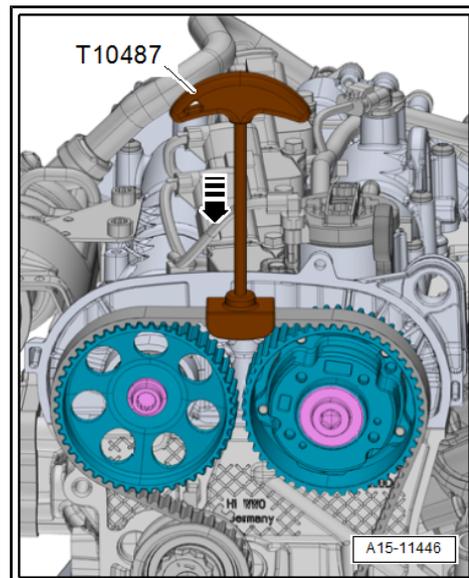
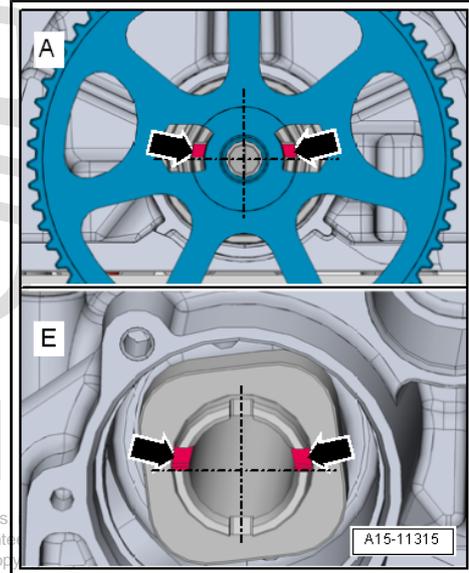
Note

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- ◆ *The camshaft clamp - T10494- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

If the camshaft clamp - T10494- cannot slide into position easily.

- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.



- Insert camshaft clamp - T10494- as far as stop into camshaft.
- Tighten bolts -arrow- by hand.

If camshaft clamp cannot be fitted:

- Adjust valve timing, Removing toothed belt from camshafts
⇒ [page 111](#) .

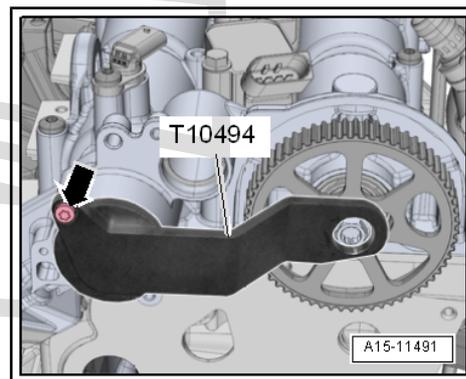
If camshaft clamp can be fitted:

- Valve timing is OK.

Risk of damage to engine

- ◆ After completing work, check that locking pin - T10340- and camshaft clamp -T10494- have been removed.

Install in the reverse order of removal, observing the following:



Note

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- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Renew O-ring of plug if damaged.*

Specified torques

- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97](#)
- ◆ ⇒ [“1.2.2 Exploded view - camshaft housing, engine code CMBA, CXSA, CZCA”, page 81](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 238](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)

2.4 Detaching toothed belt from camshaft

⇒ [“2.4.1 Removing toothed belt from camshaft, engine code CZEA”, page 111](#)

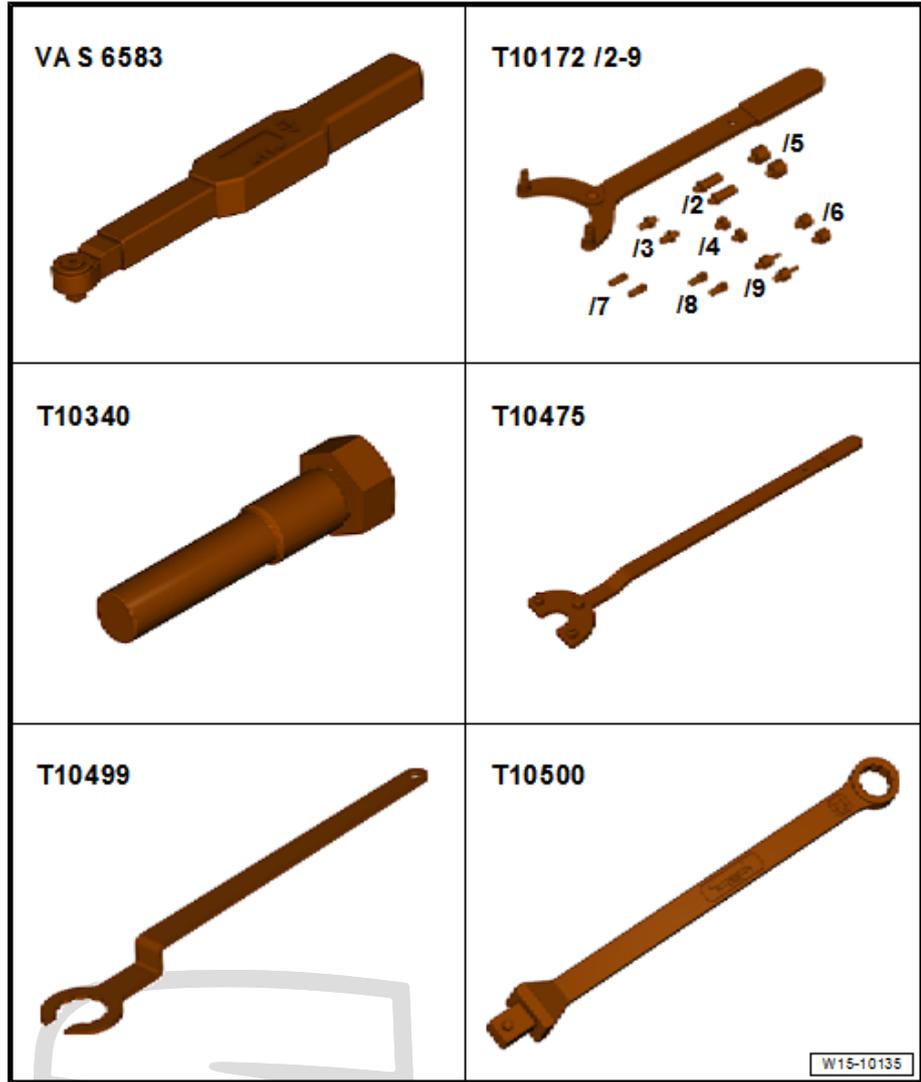
⇒ [“2.4.2 Detach toothed belt from the camshaft, engine codes CHPA, CZDA”, page 124](#)

⇒ [“2.4.3 Removing toothed belt from camshaft, engine codes CMBA, CXSA, CZCA”, page 136](#)

2.4.1 Removing toothed belt from camshaft, engine code CZEA

Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-
- ◆ counter-hold tool - T10172- with adapter -T10172/1-
- ◆ Securing bolts - T10340-
- ◆ Counter-hold tool - T10475-
- ◆ 30 mm ring spanner - T10499-
- ◆ Insert tool - T10500-



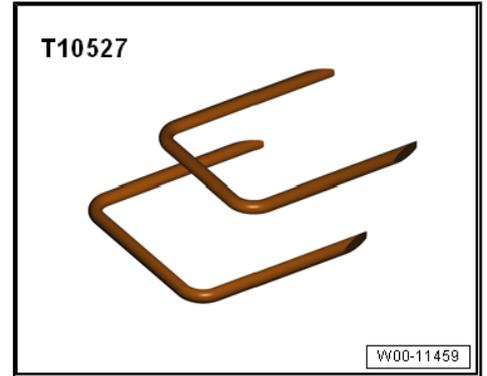
- ◆ Camshaft clamp - T10504-



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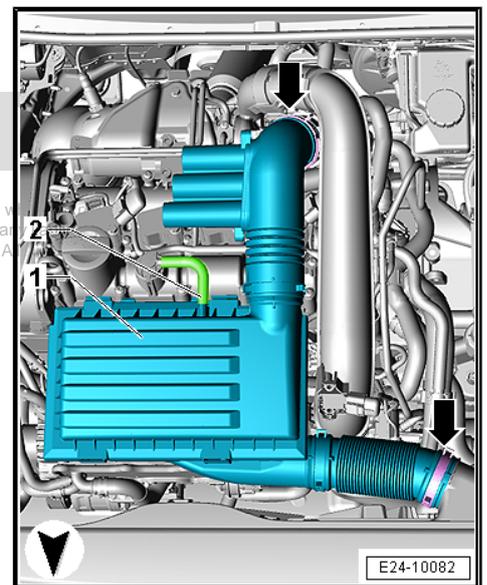
- ◆ Release tool - T10527- and -T10527/1-



- ◆ Locking pin - T10504/1-
- ◆ Testing pin - T10504/2-

Work sequence

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



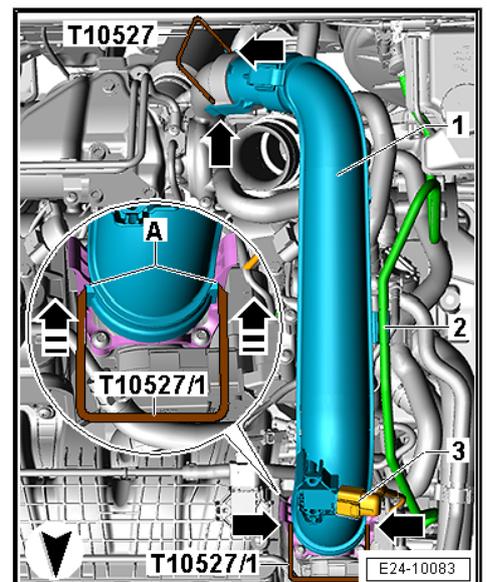
- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

 **Note**

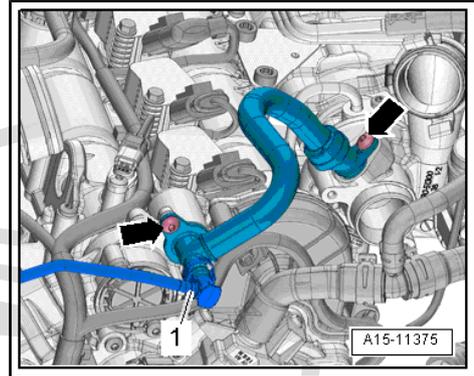
- ◆ To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .
- ◆ Insert the release tool , note the detailed image -A-.
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

 **Note**

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.



- Press release buttons and pull off hose -1-.
- Remove bolts -arrows- and detach crankcase breather hose.

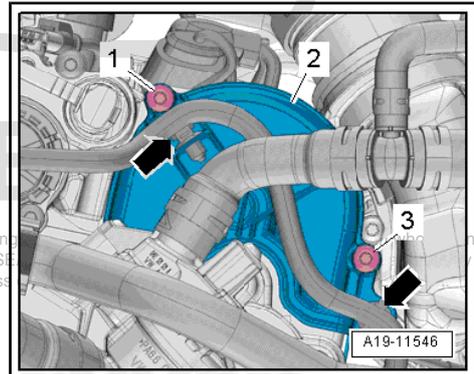


- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.



Note

To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.

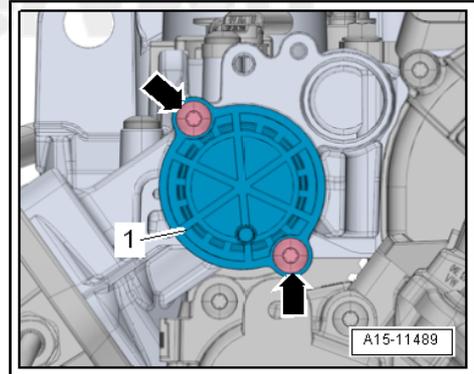


- Remove bolts -arrows-, remove cover cap -1-.

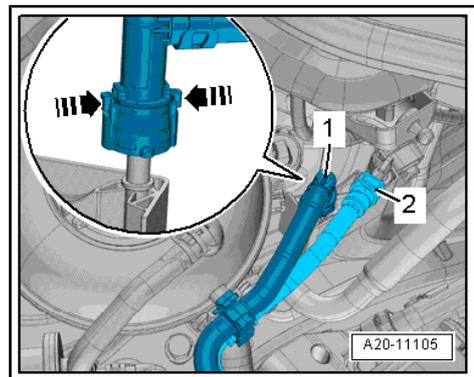


Note

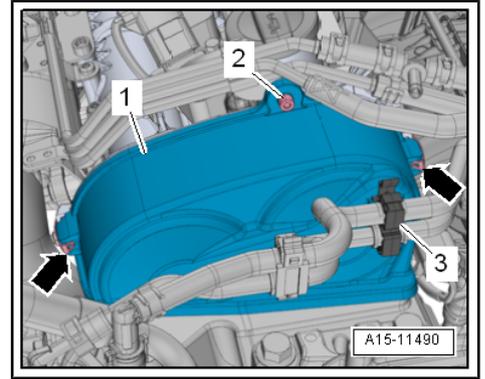
- ◆ A small quantity of oil may escape when opening the cover cap -1-.
- ◆ Use cloth to catch escaping engine oil.



- Disconnect quick couplings from fuel hose and from the tube to the activated carbon canister⇒ Rep. gr. 20 ; Quick couplings; disconnecting quick couplings .
- Move clear hoses at bracket -3-.



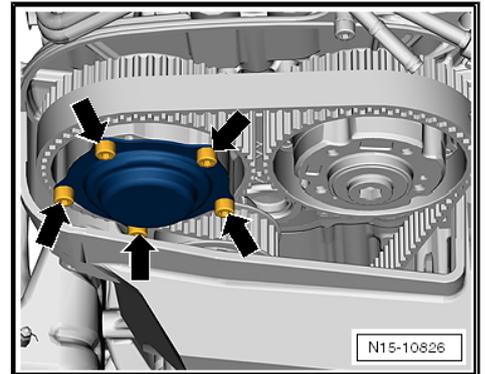
- Unscrew bolt -2-.
- Release clips -arrows- and remove upper toothed belt guard -1-.



- Unscrew bolts -arrows- and remove lid from camshaft adjuster for exhaust camshaft.

Risk of damage to engine

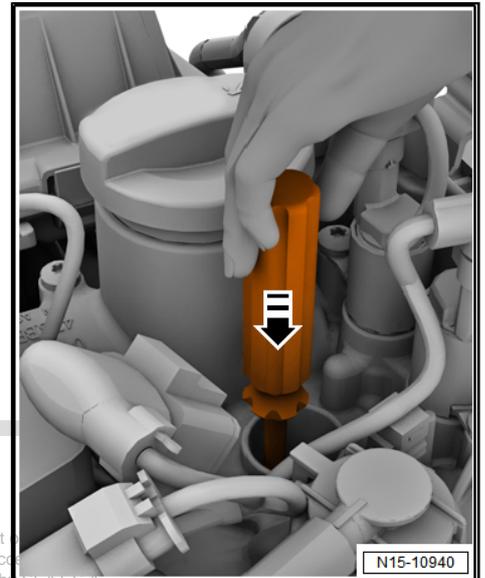
- To protect the toothed belt, place a cloth under the camshaft adjuster and tensioning roller to catch the engine oil which runs out.
- The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.



Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage - N70- and the spark plug cylinder 1 => [page 360](#) .
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

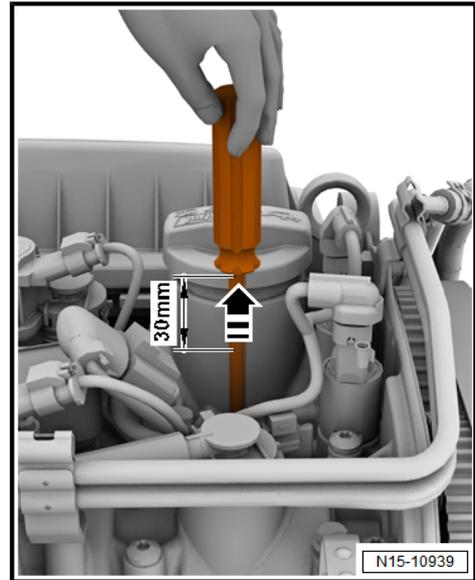
The screwdriver is turned in the -direction of the arrow-.



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- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-

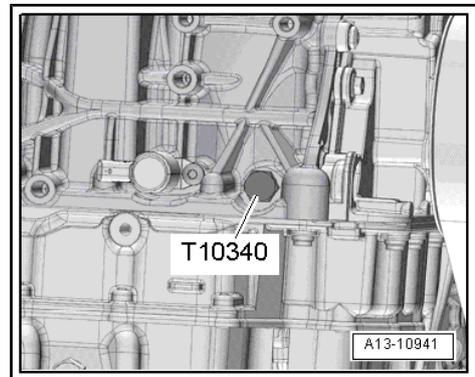


- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the stop.
- The locking pin is now in contact with the crank web.



Note

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



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:
- Unscrew locking pin.
- Turn crankshaft 90° in direction of rotation of engine.
- 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.

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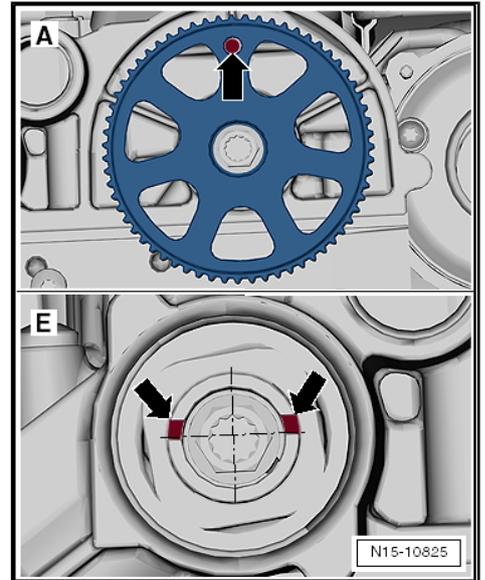
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- On exhaust camshaft, hole -arrow- in toothed belt pulley for coolant pump must be positioned opposite hole in camshaft housing.
- On inlet camshaft, grooves -bottom arrows- must be positioned above centre of camshaft.

A - Exhaust camshaft

E - Inlet camshaft

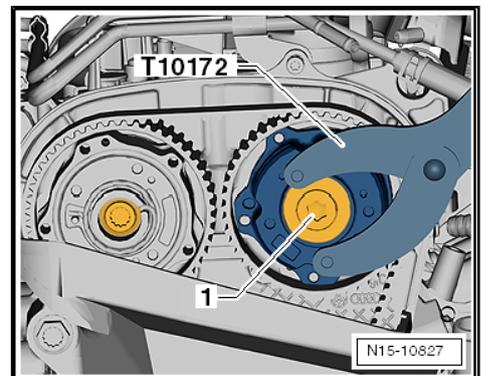


- Unscrew plug -1- on camshaft sprocket on intake side using counterhold tool - T10172- with adapter -T10172/1- .

 **NOTICE**

Risk of damage to camshaft caused by improper handling.

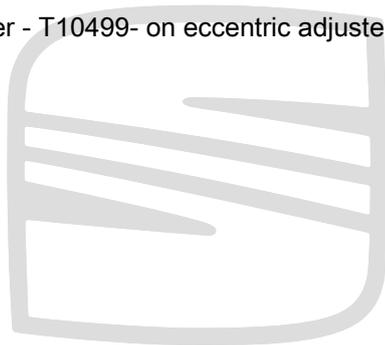
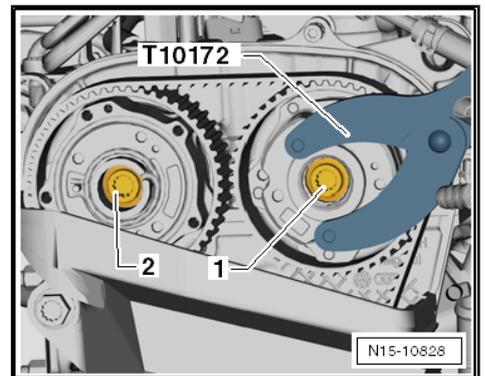
- Never use the camshaft clamp for counterholding.



- Loosen bolts -1, 2- approx. 1 turn using counterhold tool - T10172- with adapter -T10172/1- .

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

- Place 30 mm ring spanner - T10499- on eccentric adjuster -2- of tensioning roller.



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- Loosen bolt -1- with tool insert - T10500- .
- Release tensioning roller on eccentric adjuster -2- using 30 mm ring spanner - T10499- .

Risk of damage to engine

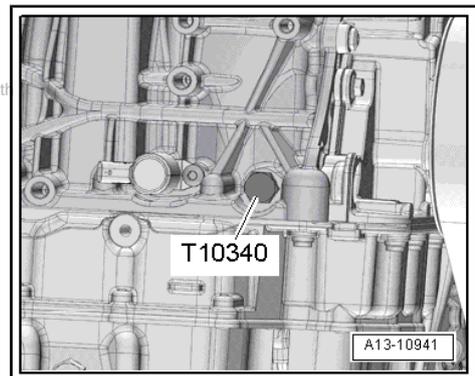
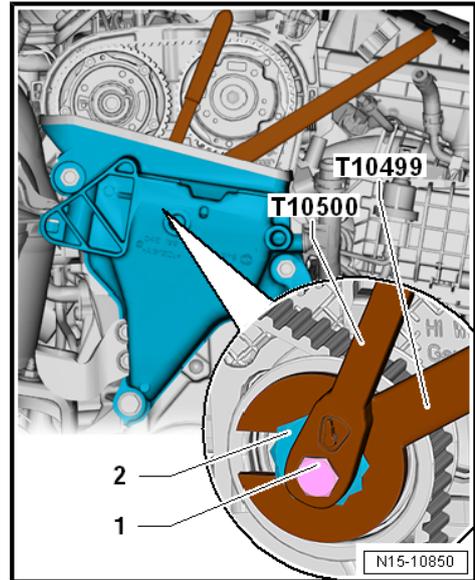
- Risk of damage to the toothed belt.
- The toothed belt is made of glass fibre fabric.
- Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- Otherwise the service life of the toothed belt will be reduced.
- Detach toothed belt from camshaft sprockets.

Installing (adjusting the valve timing)



Note

- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Renew O-ring of plug if damaged.*
- 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.
- Turn the camshafts into the correct positions.



- On exhaust camshaft, hole -arrow- in toothed belt pulley for coolant pump must be positioned opposite hole in camshaft housing.
- On inlet camshaft, grooves -bottom arrows- must be positioned above centre of camshaft.

A - Exhaust camshaft

E - Inlet camshaft

- Use a waterproof pen to mark the tooth over the hole in coolant pump drive sprocket from above.

Due to the marking the locking pin - T10504/1- can be inserted more easily.



Note

- ◆ *The camshaft clamp - T10504- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*
- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.
- When camshafts are positioned as described, insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).
- Turn inlet camshaft with camshaft clamp - T10504- in -direction of arrow A-.
- At the same time, turn the coolant pump drive sprocket -1- in -direction of arrow B-.
- Have a second mechanic insert the locking pin - T10504/1- as far as stop.
- Hand-tighten the bolts -arrows-.

Risk of damage to engine

- The locking pin - T10504/1- must be inserted in onto its stop.
- If the locking pin - T10504/1- is not inserted onto its stop, damage to the engine due to disturbed valve timing may be the result.

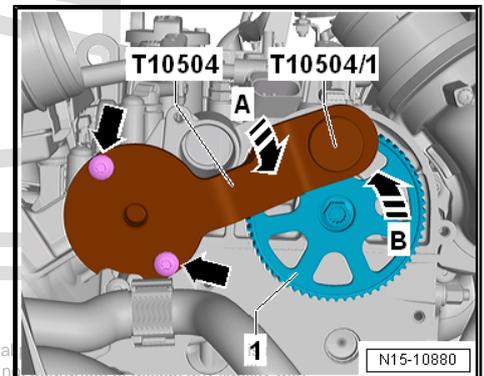
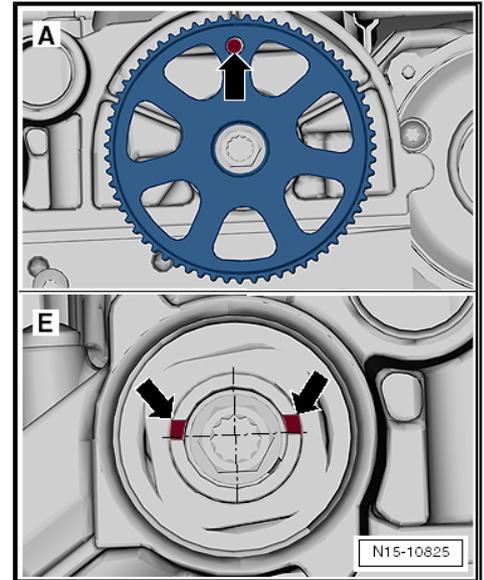
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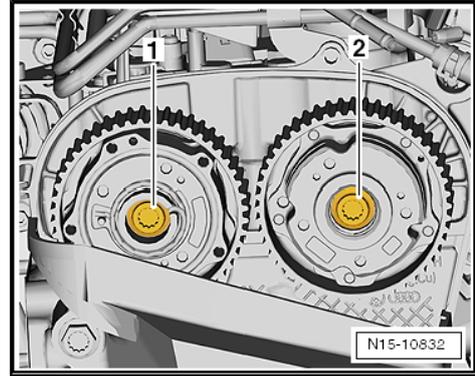
! NOTICE

Risk of damage to camshaft caused by improper handling.

- **Never use the camshaft clamp for counterholding.**



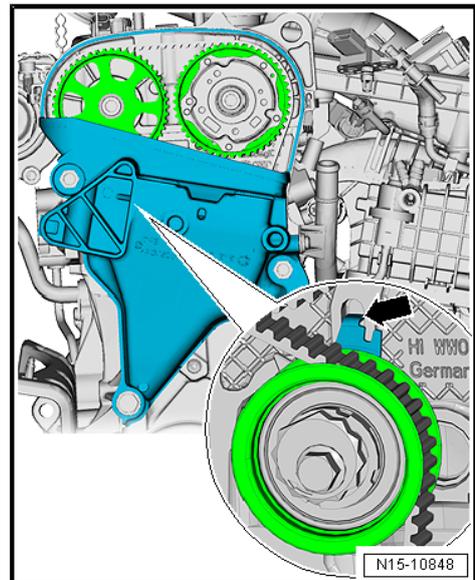
- Renew bolts -1- and -2- for camshaft pulleys and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.

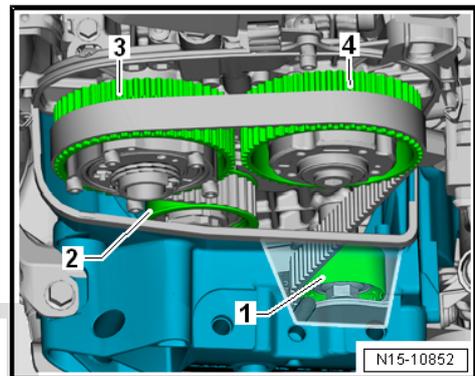
Risk of damage to engine

- Risk of damage to the toothed belt.
- The toothed belt is made of glass fibre fabric.
- Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- Otherwise the service life of the toothed belt will be reduced.



Fit toothed belt in prescribed sequence:

- Pull toothed belt upwards and fit it on idler roller -1-, tensioner roller -2- and camshaft pulleys -3- and -4-.



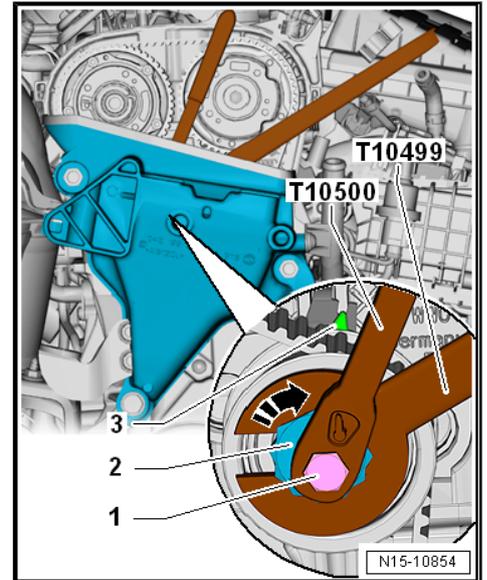
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- Using the ring spanner SW 30 - T10499- , turn the eccentric -2- of the tensioning roller in the direction of the -arrow- until the adjustment pointer -3- is positioned about 10 mm to the right of the setting window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.

 **Note**

- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
- ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10500- must be entered in the torque wrench.*
- Hold eccentric in that position and tighten bolt -1- to 25 Nm using insert tool - T10500- with torque wrench - VAS 6583- .



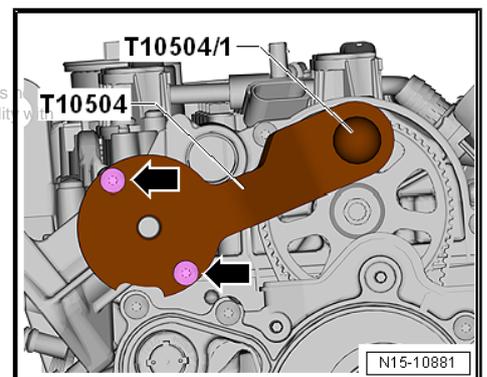
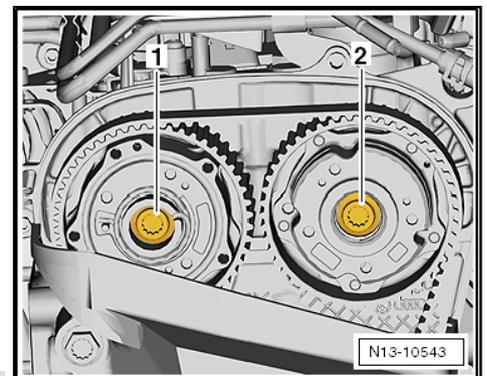
 **Note**

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

 **NOTICE**

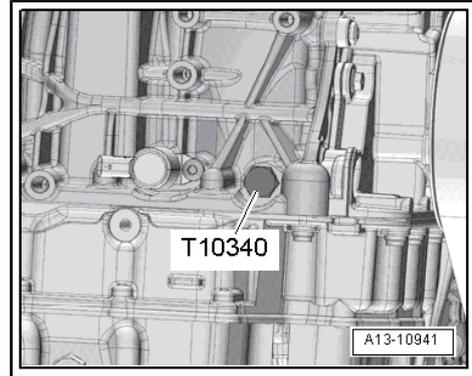
Risk of damage to camshaft caused by improper handling.

- **Never use the camshaft clamp for counterholding.**
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool - T10172- with adapter -T10172/1- .
- Pull out locking pin - T10504/1- .
- Remove bolts -arrows- and detach camshaft clamp - T10504- .



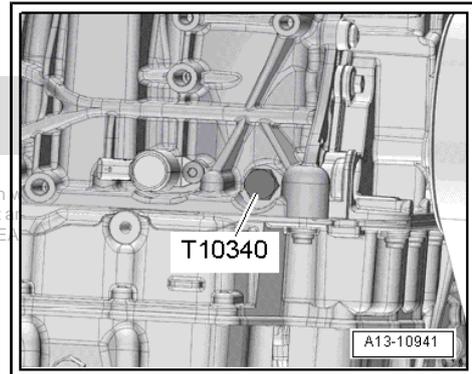
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- Remove locking pin - T10340- .



Check valve timing:

- Turn crankshaft 2 turns in direction of rotation of engine.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.



Note

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

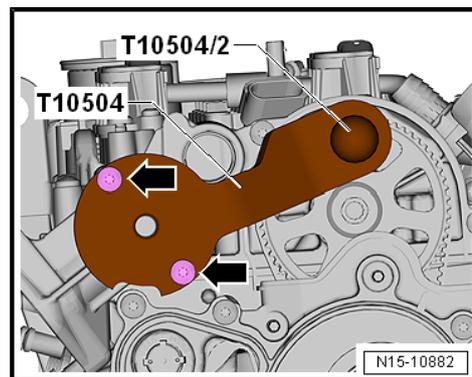


Note

- ◆ *The camshaft clamp - T10504- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*
- Insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).
- Insert test pin - T10504/2- as far as stop.
- Hand-tighten the bolts -arrows-.

Risk of damage to engine

- If the groove -arrow- is not flush with the camshaft clamp - T10504- , the test pin - T10504/2- has not been inserted deep enough.
- This may cause damage to the engine due to disturbed valve timing.

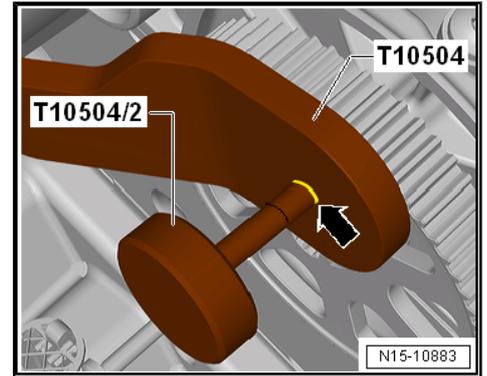


- The groove -arrow- on test pin - T10504/2- must be flush with camshaft clamp - T10504- .

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

- Repeat adjustment of valve timing.

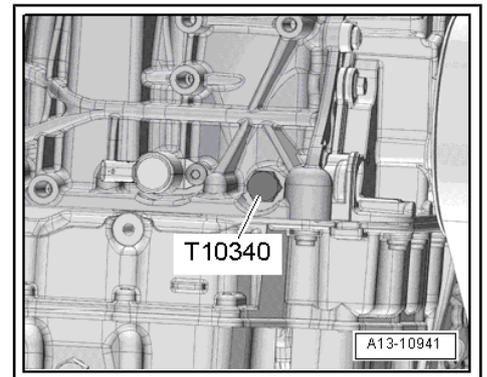
If it is possible to insert the camshaft clamp - T10504- with the test pin - T10504/2- , valve timing is OK.



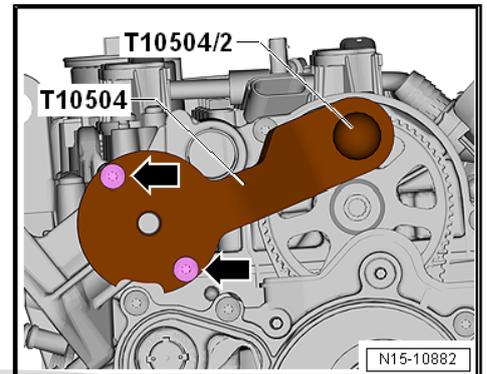
- Remove locking pin - T10340- .
- Tighten plug to specified torque.

⇒ Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97

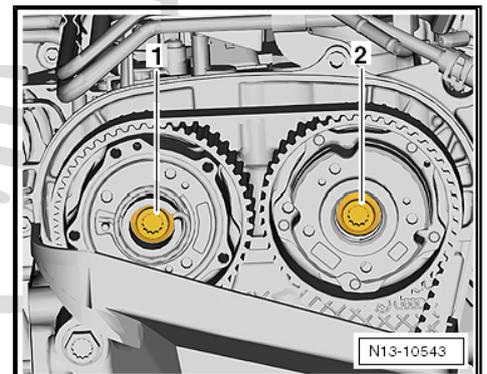
- Pull out test pin - T10504/2- .



- Remove bolts -arrows- and detach camshaft clamp - T10504- .
- Tighten bolts -1, 2- to final torque setting ⇒ page 96 .



- Use counter-hold tool - T10172- with adapter -T10172/1- .



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- Tighten plug -1- using counterhold tool - T10172- with adapter -T10172/1- .

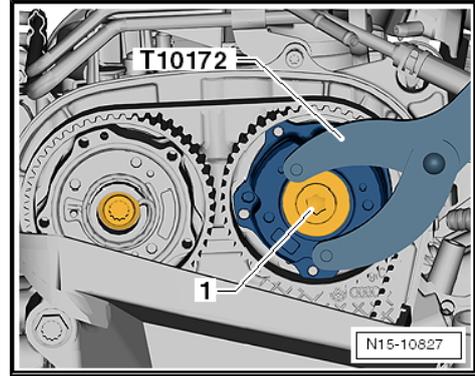
Risk of damage to engine

- After completing work, check that locking pin - T10340- and camshaft clamp - T10504- have been removed.

Install in the reverse order of removal, observing the following:

Specified torques

- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. “Plug for TDC drilling in cylinder block - tightening torque”, page 97](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 238](#)
- ◆ ⇒ [“1.2.1 Assembly overview - camshaft housing, engine code CZEA”, page 78](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)



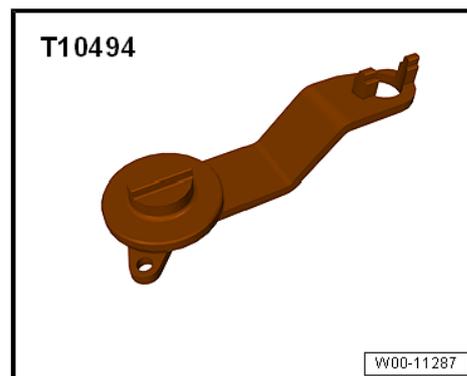
2.4.2 Detach toothed belt from the camshaft, engine codes CHPA, CZDA

Special tools and workshop equipment required

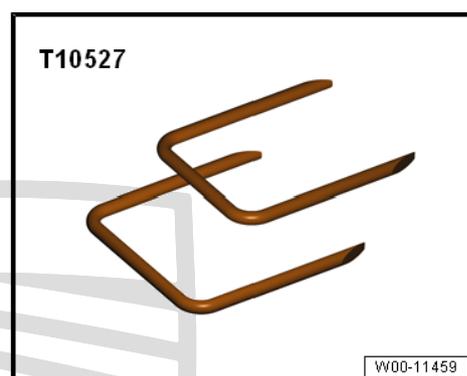
- ◆ Torque wrench - VAS 6583-
- ◆ counter-hold tool - T10172- with adapter -T10172/1-
- ◆ Securing bolts - T10340-
- ◆ Counter-hold tool - T10475-
- ◆ 30 mm ring spanner - T10499-
- ◆ Insert tool - T10500-



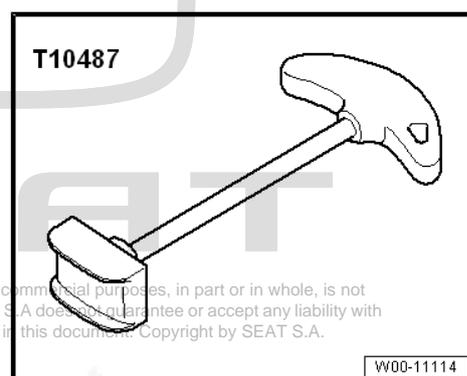
◆ Camshaft clamp - T10494-



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



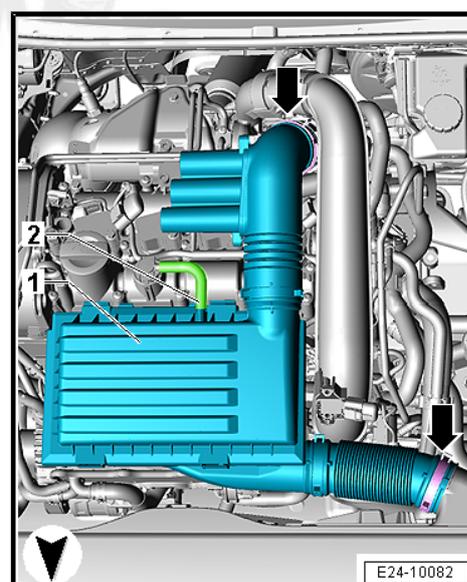
◆ Assembly tool - T10487-



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Work sequence

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



- Disconnect electrical connector from the charge pressure sender - GX26- -3-.



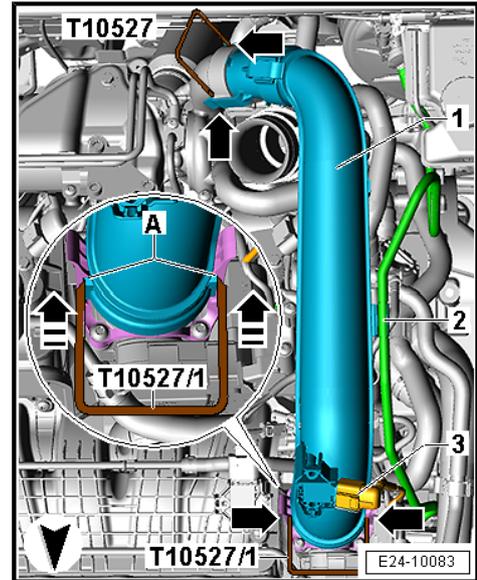
Note

- ◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .*
- ◆ *Insert the release tool , note the detailed image -A-.*
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

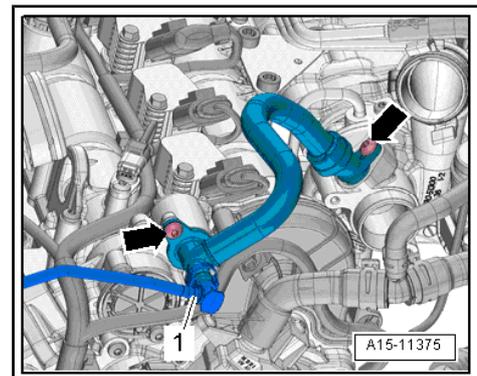


Note

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.



- Press release buttons and pull off hose -1-.
- Remove bolts -arrows- and detach crankcase breather hose.

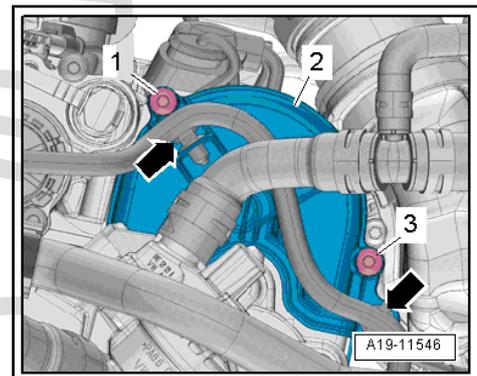


- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.



Note

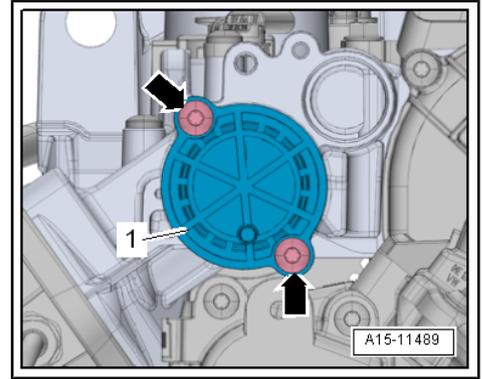
To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.



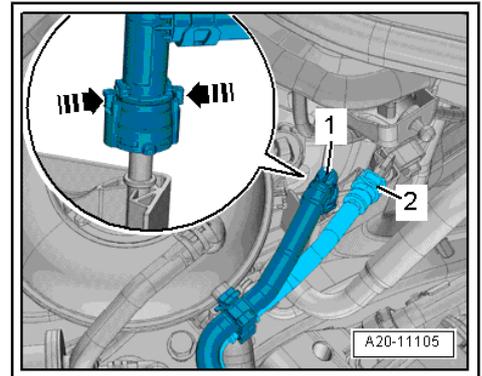
- Remove bolts -arrows-, remove cover cap -1-.

 **Note**

- ◆ *A small quantity of oil may escape when opening the cover cap -1-.*
- ◆ *Use cloth to catch escaping engine oil.*



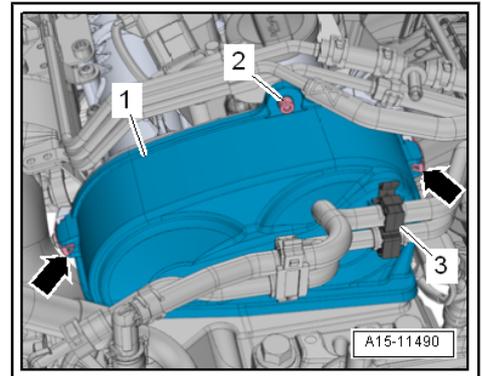
- Disconnect quick couplings from fuel hose and from the tube to the activated carbon canister→ Rep. gr. 20 ; Quick couplings; disconnecting quick couplings .
- Move clear hoses at bracket -3-.



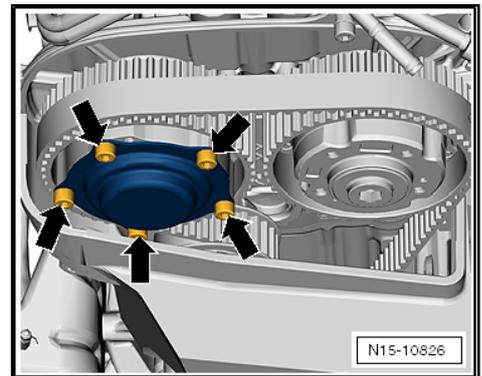
- Unscrew bolt -2-.
- Release clips -arrows- and remove upper toothed belt guard -1-.

 **Note**

- ◆ *Place a cloth under the camshaft adjuster and tensioning roller to catch the engine oil which runs out.*
- ◆ *The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.*



- Unscrew bolts -arrows- and remove lid from camshaft adjuster for exhaust camshaft.



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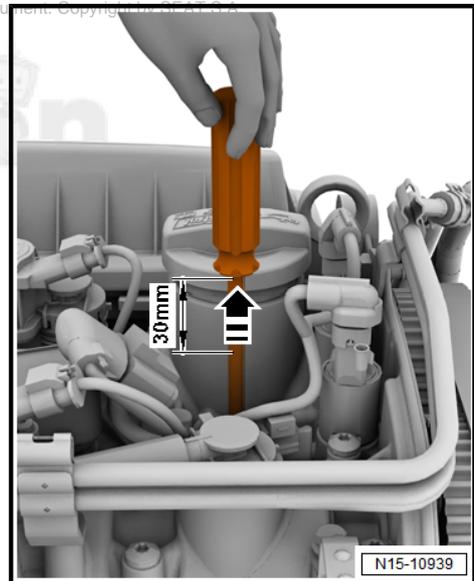
Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage - N70- and the spark plug cylinder 1 ➔ [page 360](#) .
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

The screwdriver is turned in the -direction of the arrow-



- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-

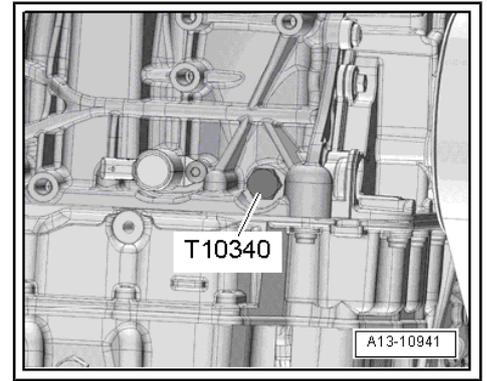


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- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the stop.
- The locking pin is now in contact with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

 **Note**

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



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:
- Unscrew locking pin.
- Turn crankshaft 90° in direction of rotation of engine.
- 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.

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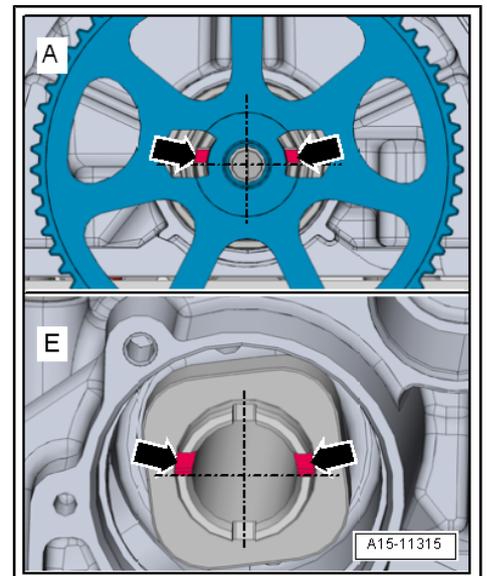
• On both camshafts on gearbox end the asymmetrical grooves -arrows- must be positioned right above horizontal camshaft centre line as shown in illustration.

- The grooves on the exhaust camshaft -upper arrows- can be accessed through the recesses in toothed belt pulley for coolant pump.
- On the inlet camshaft the grooves -lower arrows- must also be positioned right above horizontal camshaft centre line.

A - Exhaust camshaft

E - Inlet camshaft

- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.

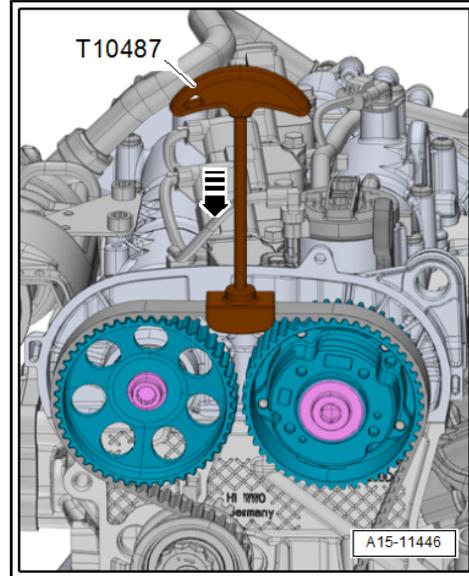


 **Note**

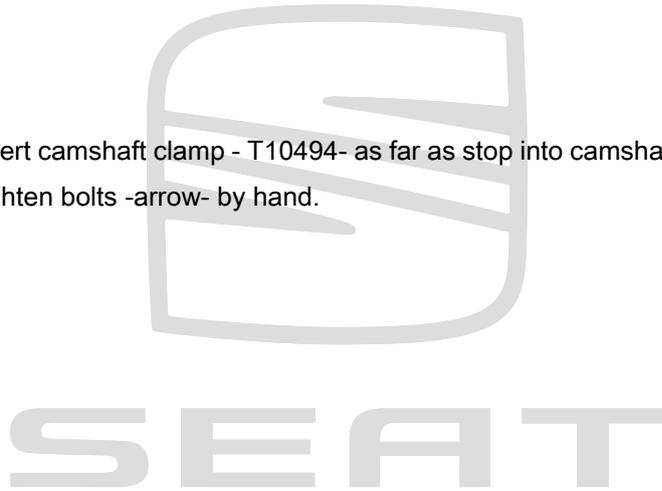
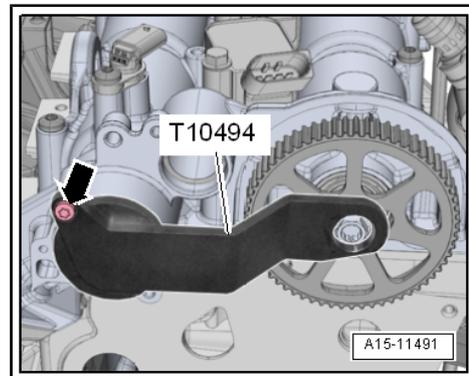
- ◆ *The camshaft clamp - T10494- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

If the camshaft clamp - T10494- cannot slide into position easily.

- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.



- Insert camshaft clamp - T10494- as far as stop into camshaft.
- Tighten bolts -arrow- by hand.

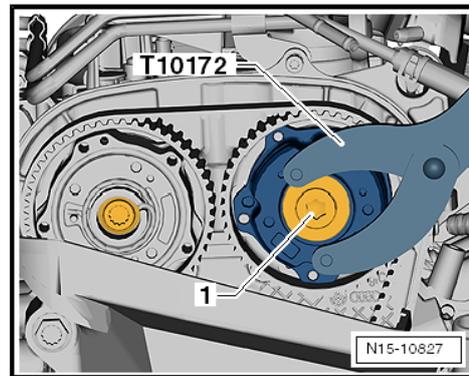


- Unscrew plug -1- on camshaft sprocket on intake side using counterhold tool - T10172- with adapter -T10172/1- .

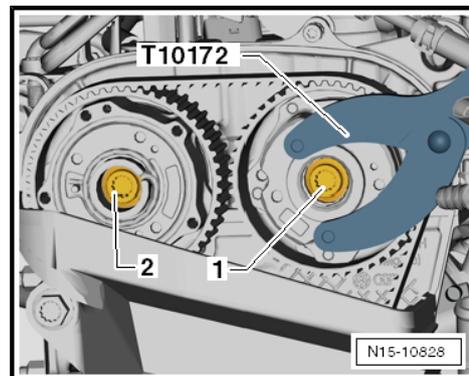
NOTICE

Risk of damage to camshaft caused by improper handling.

- Never use the camshaft clamp for counterholding.



- Loosen bolts -1, 2- approx. 1 turn using counterhold - T10172- with adapters -T10172/1- and -T10172/2- .



- Loosen bolt -1- with tool insert - T10500- .
- Release tensioning roller on eccentric adjuster -2- using 30 mm ring spanner - T10499- .

Risk of damage to engine

- Risk of damage to the toothed belt.
 - The toothed belt is made of glass fibre fabric.
 - Therefore, the toothed belt must not be smaller than 50 mm in diameter.
 - Otherwise the service life of the toothed belt will be reduced.
- Detach toothed belt from camshaft sprockets.

Installing (adjusting the valve timing)

i Note

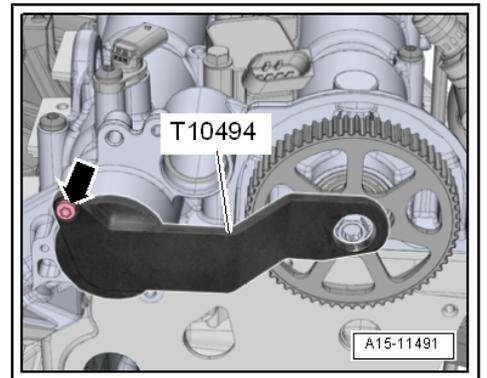
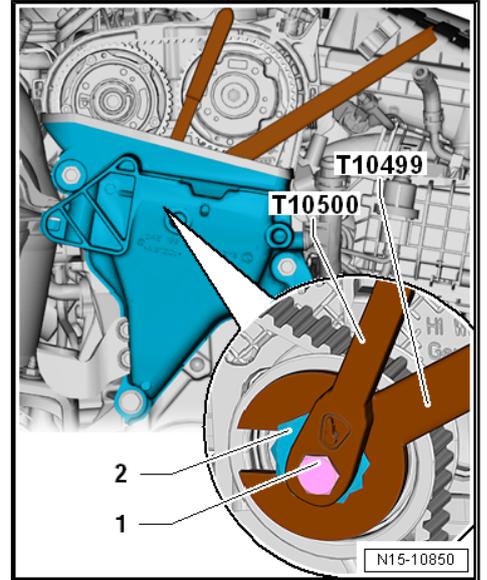
- ◆ *Renew bolts that are tightened with specified further tightening angle.*
 - ◆ *Renew O-ring of plug if damaged.*
- Check "TDC" position of camshaft and crankshaft:

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

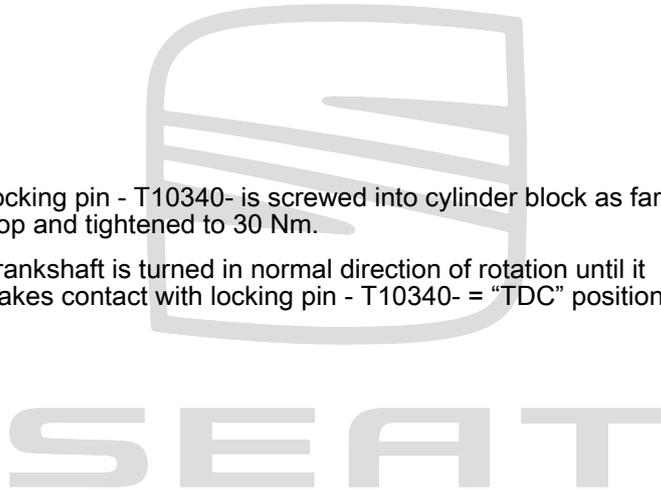
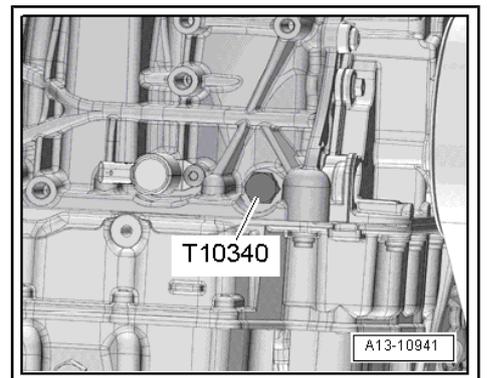
! NOTICE

Risk of damage to camshaft caused by improper handling.

- **Never use the camshaft clamp for counterholding.**



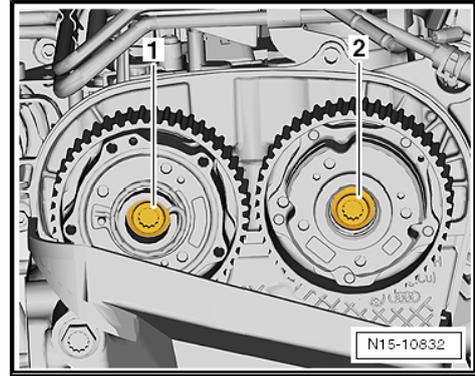
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.



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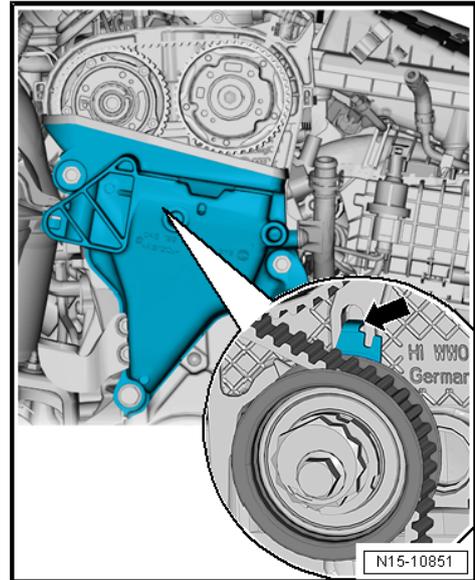
- Renew bolts -1- and -2- for camshaft pulleys and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.

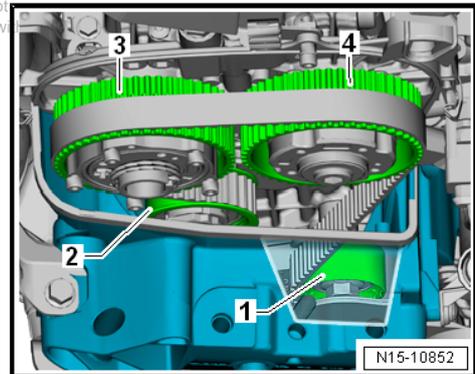
Risk of damage to engine

- Risk of damage to the toothed belt.
- The toothed belt is made of glass fibre fabric.
- Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- Otherwise the service life of the toothed belt will be reduced.



Fit toothed belt in prescribed sequence:

- Pull toothed belt upwards and fit it on idler roller -1-, tensioner roller -2- and camshaft pulleys -3- and -4-.



- Using the ring spanner SW 30 - T10499- , turn the eccentric -2- of the tensioning roller in the direction of the -arrow- until the adjustment pointer -3- is positioned about 10 mm to the right of the setting window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.

 Note

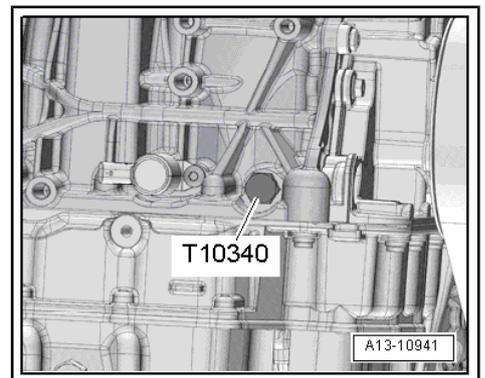
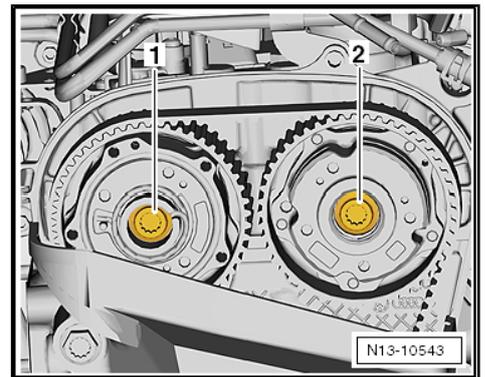
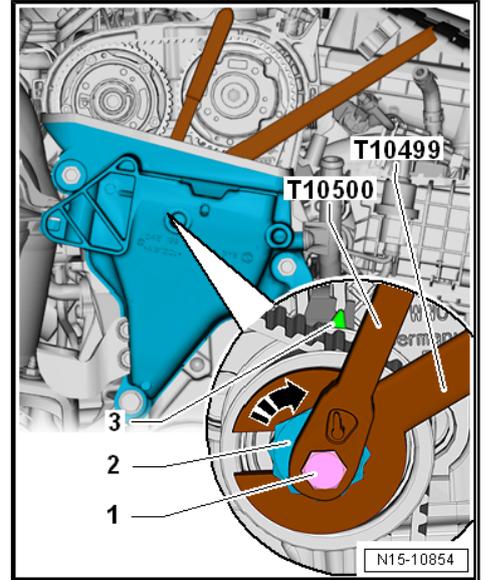
- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
- ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10500- must be entered in the torque wrench.*
- Hold eccentric in that position and tighten bolt -1- to 25 Nm using insert tool - T10500- with torque wrench - VAS 6583- .

 Note

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

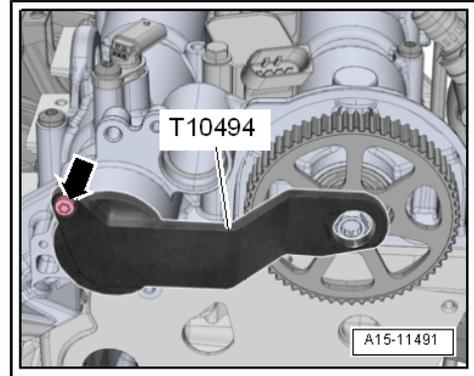
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool - T10172- with adapter -T10172/1- .

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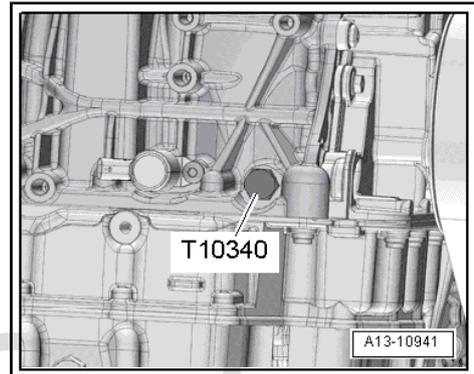
- Remove locking pin - T10340- .

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



Check valve timing:

- Turn crankshaft 2 turns in direction of rotation of engine.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.



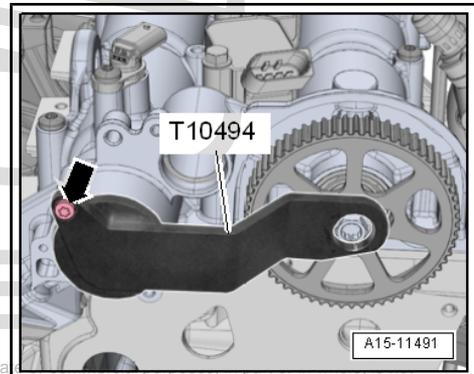
Note

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

- It should be possible to insert the camshaft clamp -T10494- easily.

The camshaft clamp must not be positioned using any kind of hammer.

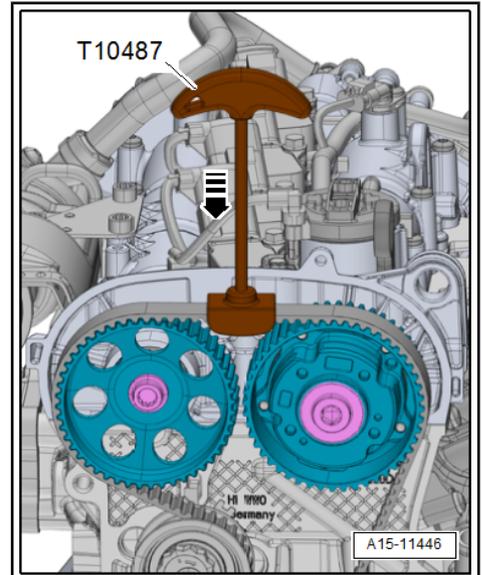
If the camshaft clamp - T10494- cannot slide into position easily.



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- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.

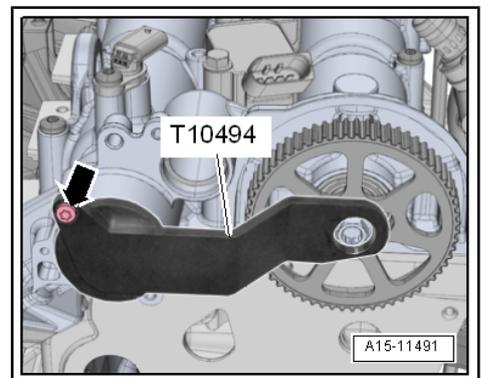


- Insert camshaft clamp -T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.

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

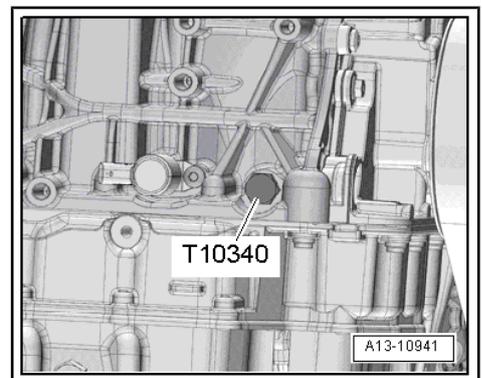
- Repeat adjustment of valve timing.

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

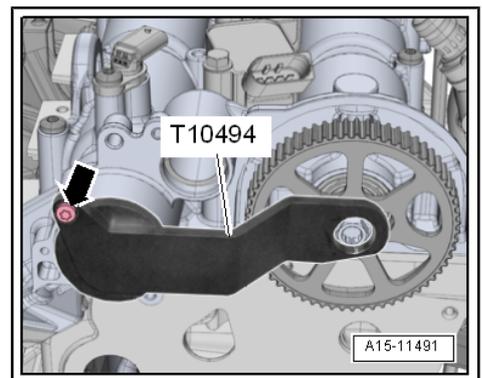


- Remove locking pin - T10340- .

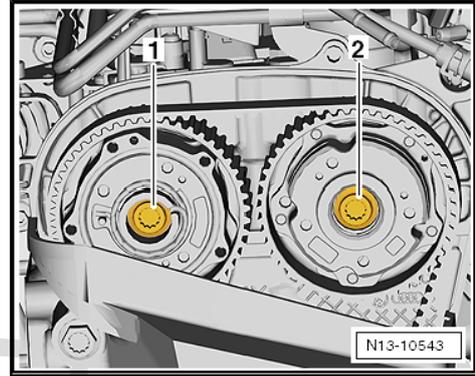
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- Remove bolt -arrow- and detach camshaft clamp -T10494- .
- Tighten bolts -1- and -2- to final torque => [page 96](#) .



- Use counter-hold tool - T10172- with adapter -T10172/1- .



- Tighten plug -1- using counterhold tool - T10172- with adapter -T10172/1- .

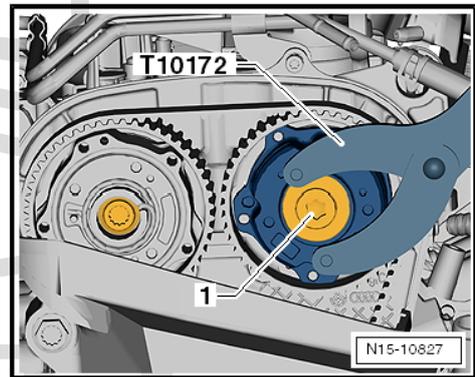
Risk of damage to engine

- After completing work, check that locking pin - T10340- and camshaft clamp - T10504- have been removed.

Install in the reverse order of removal, observing the following:

Specified torques

- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97](#)
- ◆ ⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”](#), page 238
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)



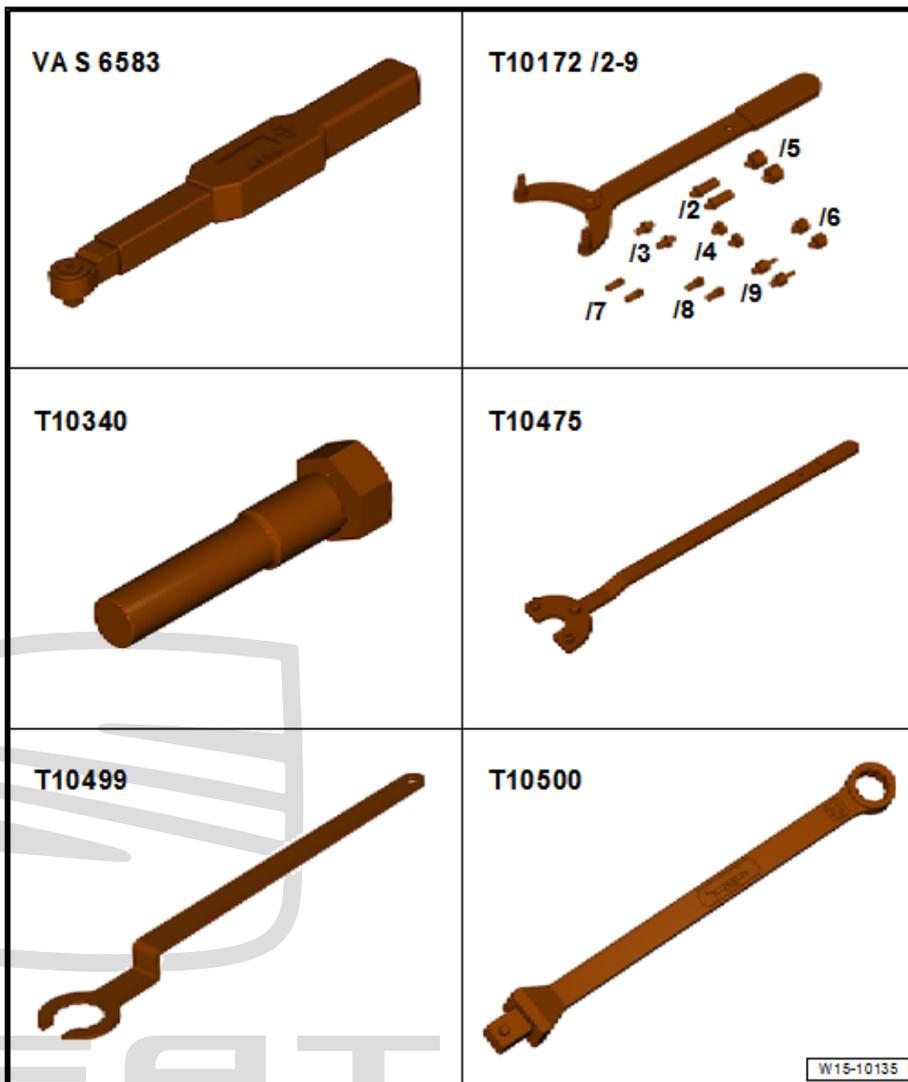
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2.4.3 Removing toothed belt from camshaft, engine codes CMBA, CXSA, CZCA

Adjust distribution timing ⇒ [page 144](#) .

Special tools and workshop equipment required

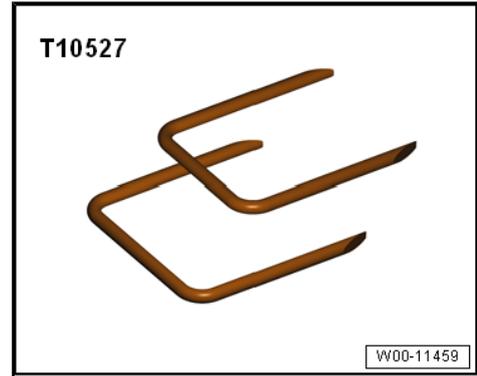
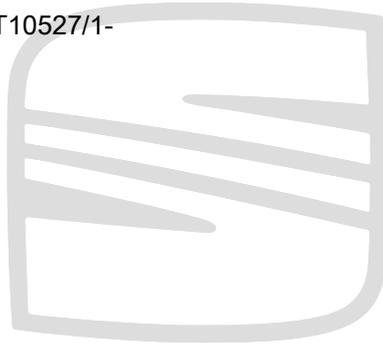
- ◆ Torque wrench - VAS 6583-
- ◆ Counterhold - T10172- with adapter -T10172/1- and -T10172/2-
- ◆ Securing bolts - T10340-
- ◆ Counter-hold tool - T10475-
- ◆ 30 mm ring spanner - T10499-
- ◆ Insert tool - T10500-



- ◆ **Camshaft clamp - T10494**



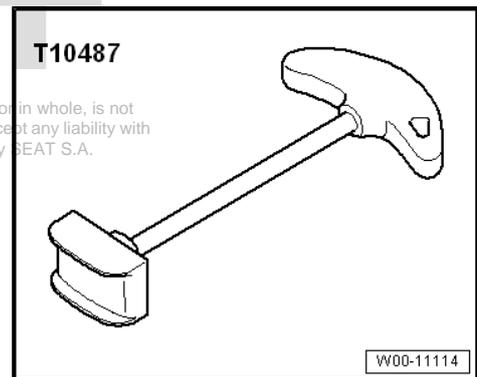
- ◆ Release tool - T10527- and -T10527/1-



- ◆ Assembly tool - T10487-

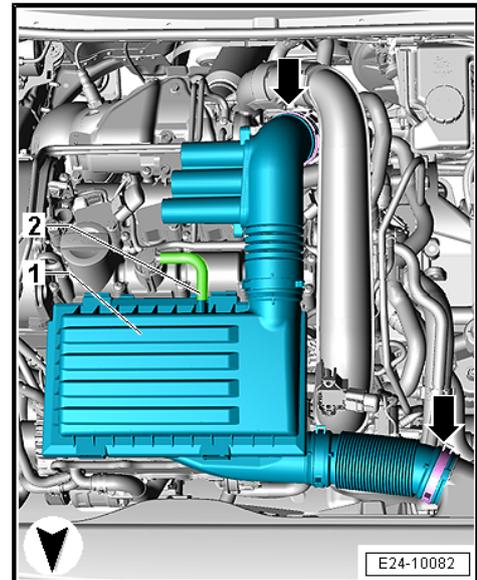


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Work sequence

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



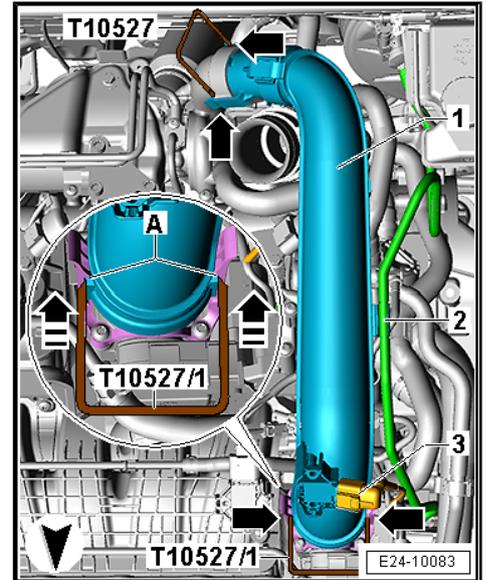
- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

 **Note**

- ◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .*
- ◆ *Insert the release tool , note the detailed image -A-.*
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

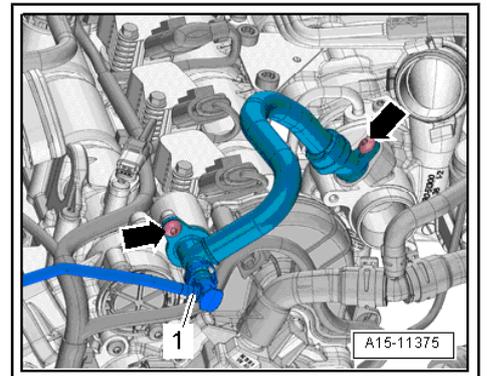
 **Note**

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.



- Press release buttons and pull off hose -1-.
- Remove bolts -arrows- and detach crankcase breather hose.

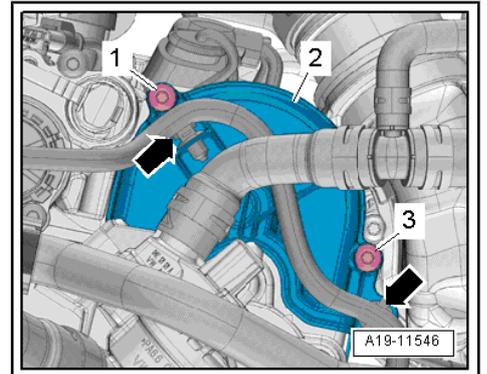
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- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- a remove toothed belt guard -2- of coolant pump.

 **Note**

To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.

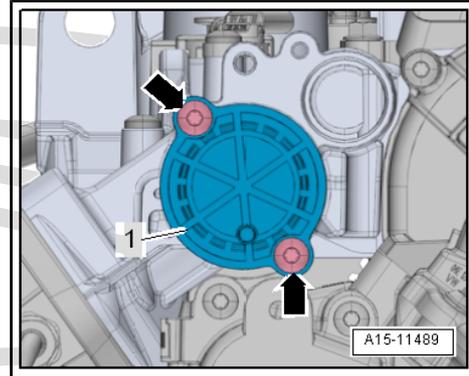


- Remove bolts -arrows-, remove cover cap -1-.



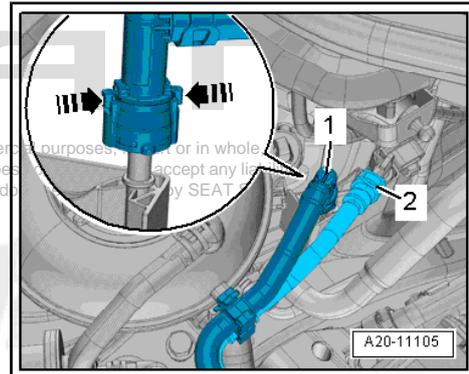
Note

- ◆ *A small quantity of oil may escape when opening the cover cap -1-.*
- ◆ *Use cloth to catch escaping engine oil.*

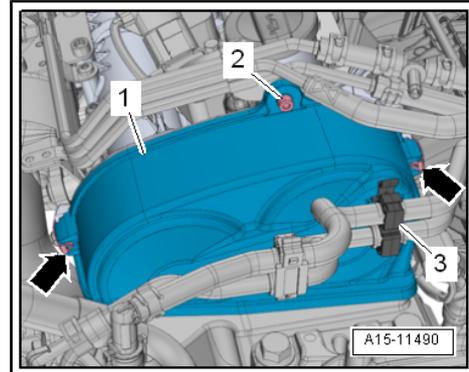


- Disconnect quick couplings from fuel hose and from the tube to the activated carbon canister ⇒ Rep. gr. 20 ; Quick couplings; disconnecting quick couplings .
- Move clear hoses at bracket -3-.

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- Unscrew bolt -2-.
- Release clips -arrows- and remove upper toothed belt guard -1-.



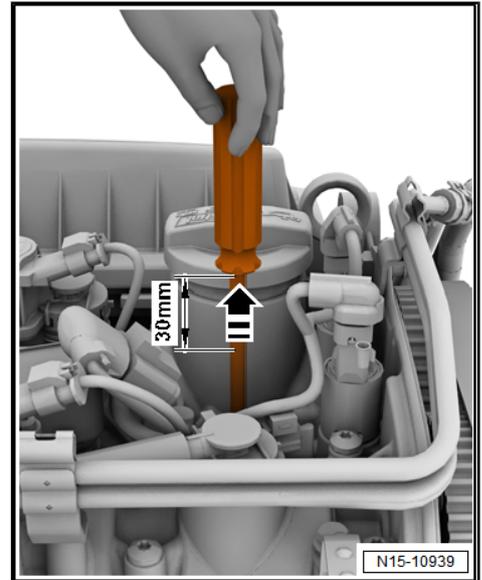
Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage - N70- and the spark plug cylinder 1 ⇒ [page 360](#) .
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

The screwdriver is turned in the -direction of the arrow-.



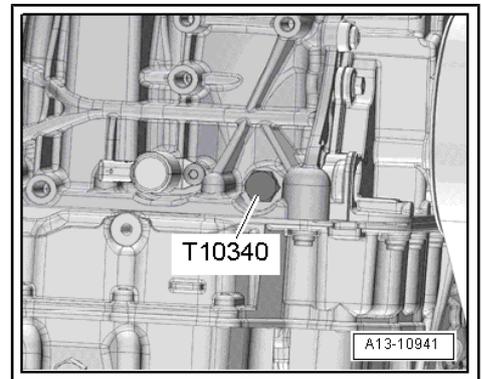
- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-



- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the 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.



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:
- ◆ Unscrew locking pin.
- ◆ Turn crankshaft 90° in direction of rotation of engine.
- ◆ 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.

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- On both camshafts, asymmetrically positioned grooves -top arrows- on gearbox end must face upwards, as shown in illustration.
- On exhaust camshaft, grooves -bottom arrows- are accessible via openings in coolant pump drive sprocket.

A - Exhaust camshaft

E - Inlet camshaft



Note

The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In "TDC" position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.

- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.

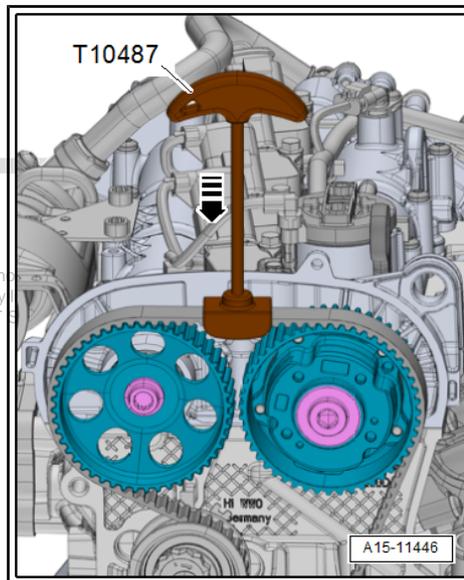
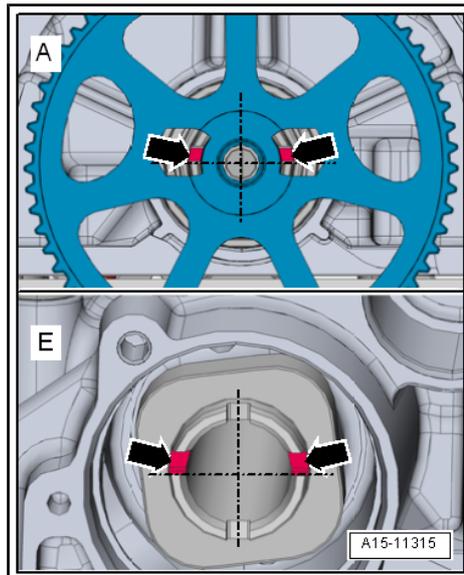


Note

- ◆ *It should be possible to insert the camshaft clamp -T10494- easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

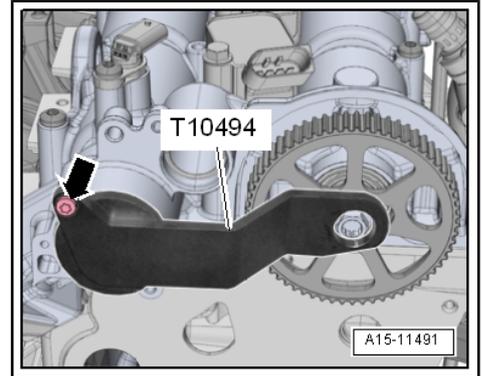
If the camshaft clamp - T10494- cannot slide into position easily.

- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.



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- Insert camshaft clamp -T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.

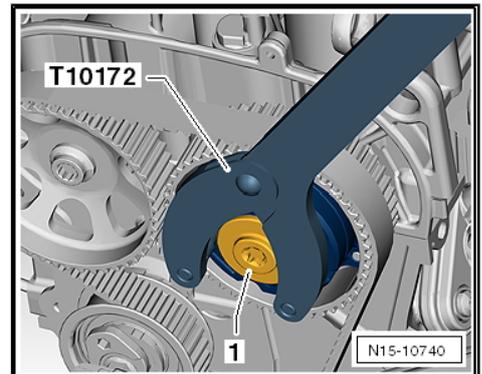


- Unscrew plug -1- on camshaft sprocket on intake side using counterhold tool - T10172- with adapter -T10172/1- .

! NOTICE

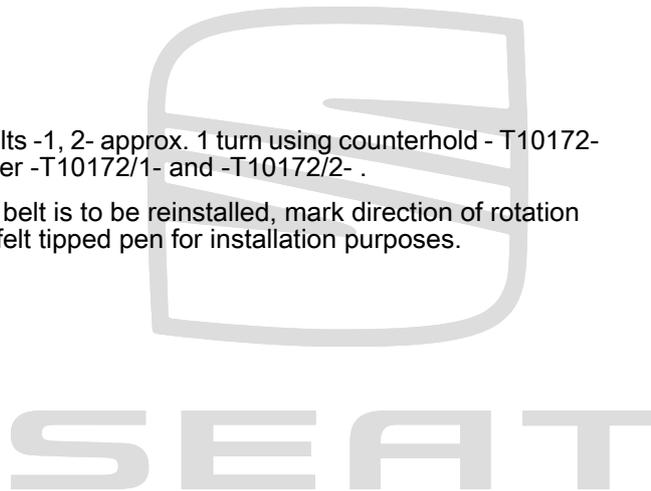
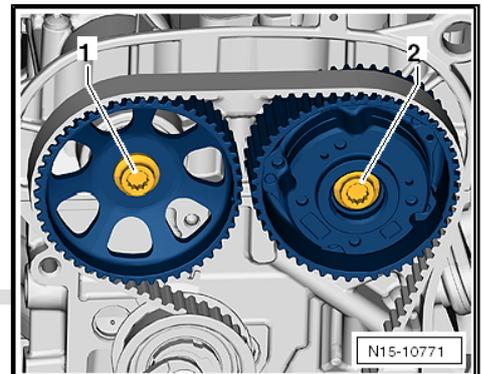
Risk of damage to camshaft caused by improper handling.

- Never use the camshaft clamp for counterholding.



- Loosen bolts -1, 2- approx. 1 turn using counterhold - T10172- with adapter -T10172/1- and -T10172/2- .

If the toothed belt is to be reinstalled, mark direction of rotation with chalk or felt tipped pen for installation purposes.



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- Loosen bolt -1- with tool insert - T10500- .
- Release tensioning roller on eccentric adjuster -2- using 30 mm ring spanner - T10499- .

Risk of damage to engine

- ◆ Risk of damage to the toothed belt.
- ◆ The toothed belt is made of glass fibre fabric.
- ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- ◆ Otherwise the service life of the toothed belt will be reduced.
- Detach toothed belt from camshaft sprockets.

Installing (adjusting the valve timing)

Note

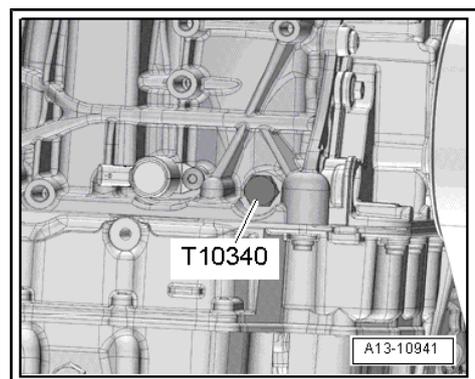
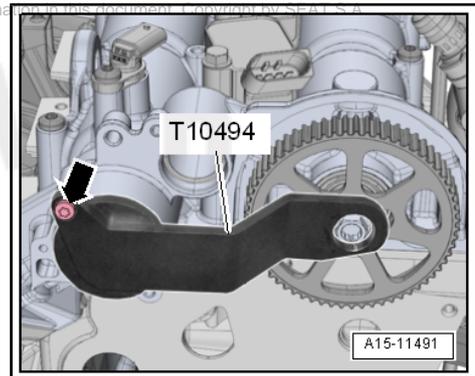
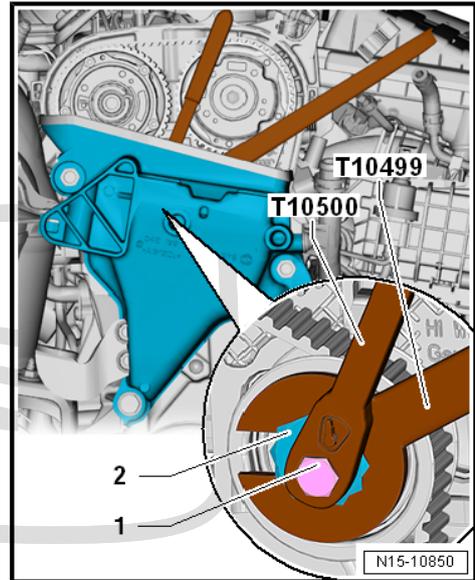
- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Renew O-ring of plug if damaged.*
- Check "TDC" position of camshaft and crankshaft.
- Camshaft clamp -T10494- must be attached to camshaft housing.

NOTICE

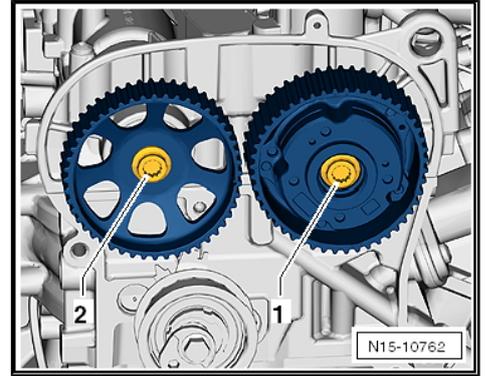
Risk of damage to camshaft caused by improper handling.

- Never use the camshaft clamp for counterholding.

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



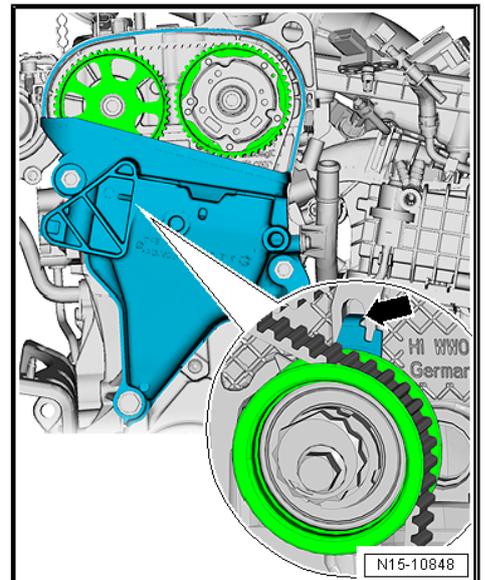
- Fit new bolts -1, 2- for camshaft sprockets, but do not tighten.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.

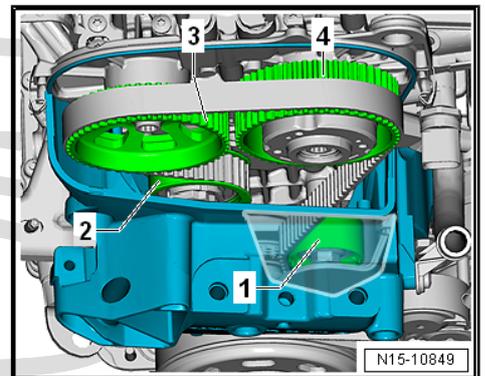
Risk of damage to engine

- ◆ Risk of damage to the toothed belt.
- ◆ The toothed belt is made of glass fibre fabric.
- ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- ◆ Otherwise the service life of the toothed belt will be reduced.



Fit toothed belt in prescribed sequence:

- Pull toothed belt upwards and fit it on idler roller -1-, tensioner roller -2- and camshaft pulleys -3- and -4-.



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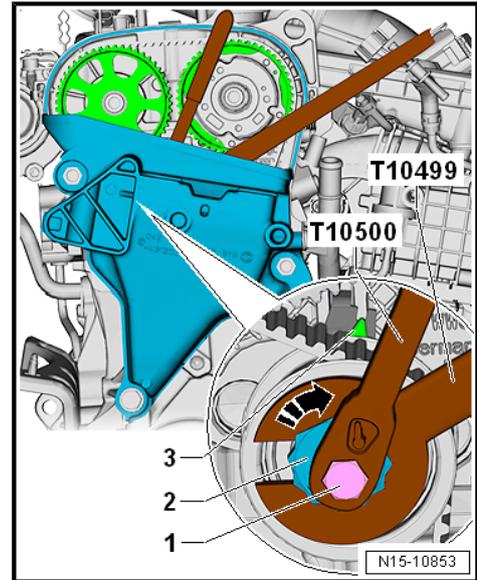
erWin

- Using the ring spanner SW 30 - T10499- , turn the eccentric -2- of the tensioning roller in the direction of the -arrow- until the adjustment pointer -3- is positioned about 10 mm to the right of the setting window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.



Note

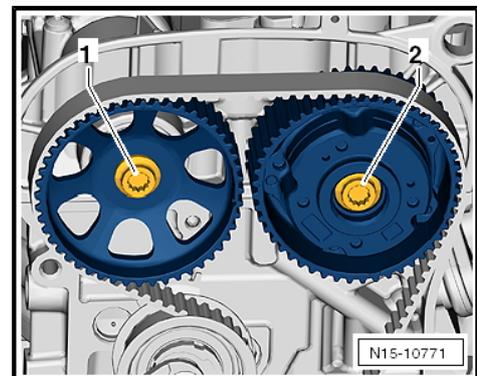
- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
 - ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10500- must be entered in the torque wrench.*
 - ◆ *If you use a conventional torque wrench you might possibly tighten the bolt of the tensioning roller with too much torque and damage it.*
- Hold eccentric in that position and tighten bolt -1- to 25 Nm using insert tool - T10500- with torque wrench - VAS 6583- .



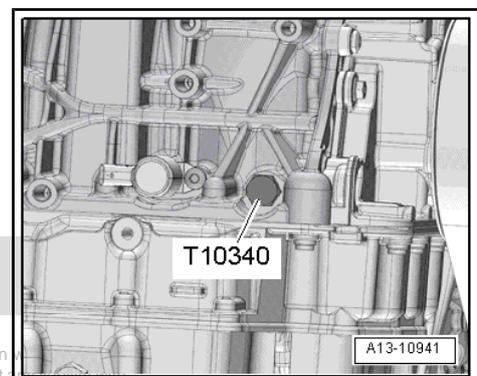
Note

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

- Tighten bolts -1, 2- initially to 50 Nm using counterhold - T10172- with adapter -T10172/1- and -T10172/2- .



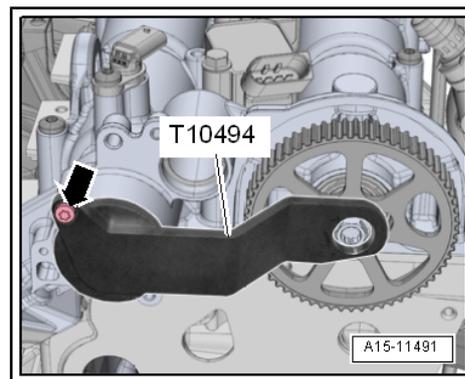
- Remove locking pin - T10340- .



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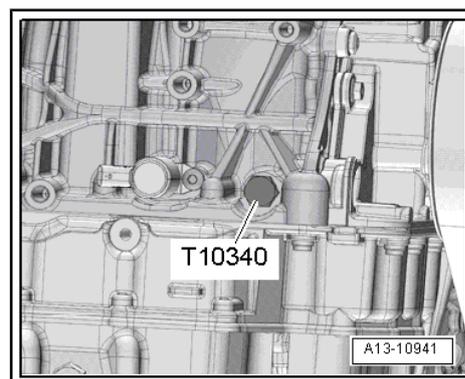


- Remove bolt -arrow- and detach camshaft clamp -T10494- .



Check valve timing:

- Turn crankshaft 2 turns in direction of rotation of engine.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.



Note

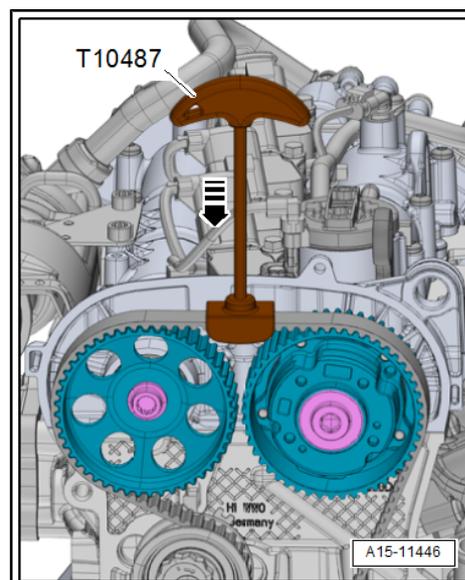
The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

Note

- ◆ *It should be possible to insert the camshaft clamp -T10494- easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

If the camshaft clamp - T10494- cannot slide into position easily.

- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.



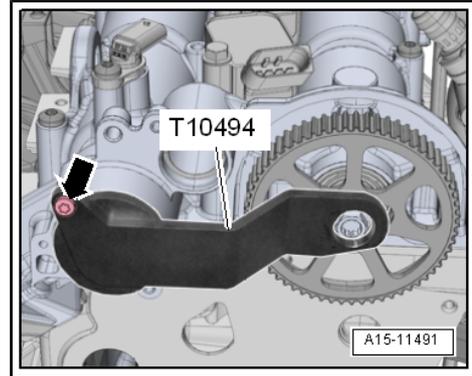
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erWin

- Insert camshaft clamp -T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.

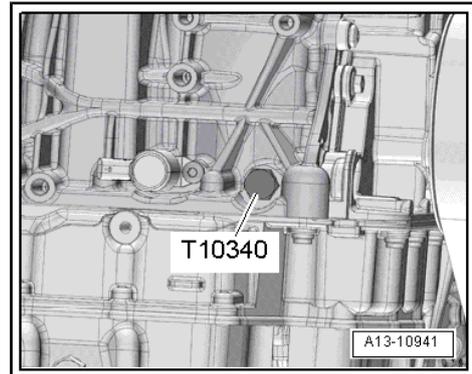
If it is not possible to insert camshaft clamp -T10494- , valve timing is not OK.

- Repeat adjustment of valve timing.

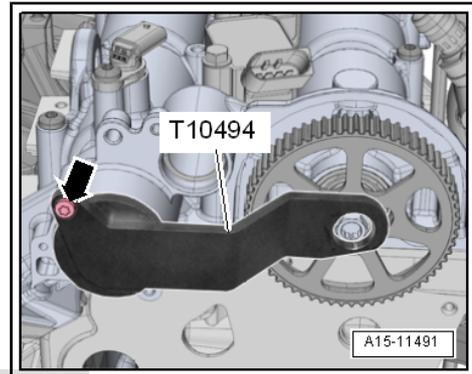


If it is possible to insert camshaft clamp -T10494- , valve timing is OK.

- Remove locking pin - T10340- .

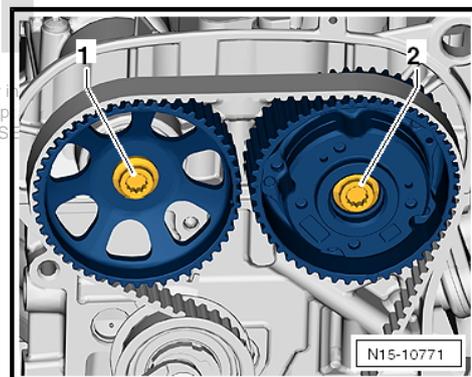


- Remove bolt -arrow- and detach camshaft clamp -T10494- .



- Tighten bolts -1, 2- to final tightening torque => [page 96](#) using counterhold - T10172- with adapter -T10172/1- and - T10172/2- .

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- Tighten plug -1- using counterhold tool - T10172- with adapter -T10172/1- .

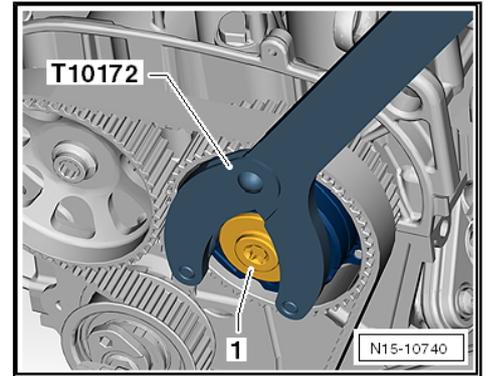
Risk of damage to engine

- ◆ After completing work, check that locking pin - T10340- and camshaft clamp -T10494- have been removed.

Install in the reverse order of removal, observing the following:

Specified torques

- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97](#)
- ◆ ⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 238](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Removing and installing noise insulation



2.5 Timing belt: removing, fitting, tensioning

⇒ [“2.5.1 Removing and installing toothed belt, engine code CZEA”, page 149](#)

⇒ [“2.5.2 Removing and installing toothed belt, engine codes CHPA, CZDA”, page 163](#)

⇒ [“2.5.3 Removing and installing toothed belt, engine codes CMBA, CXSA, CZCA”, page 177](#)

2.5.1 Removing and installing toothed belt, engine code CZEA



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Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-
- ◆ counter-hold tool - T10172- with adapter -T10172/1-
- ◆ Securing bolts - T10340-
- ◆ Counter-hold tool - T10475-
- ◆ 30 mm ring spanner - T10499-
- ◆ Insert tool - T10500-



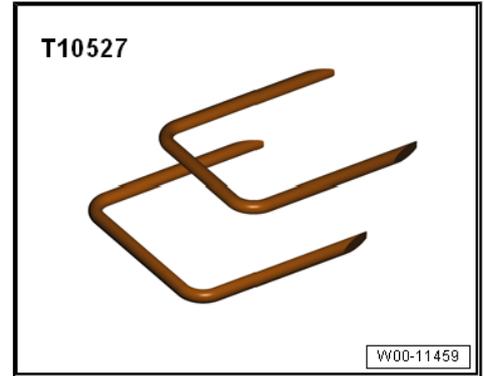
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- ◆ Camshaft clamp - T10504-



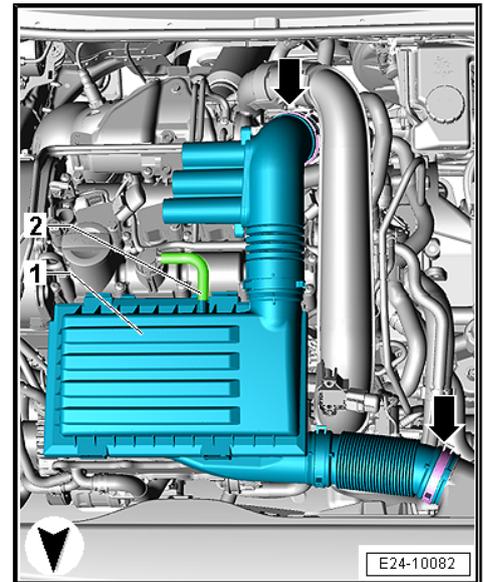
- ◆ Locking pin - T10504/1-
- ◆ Testing pin - T10504/2-

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



Work sequence

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

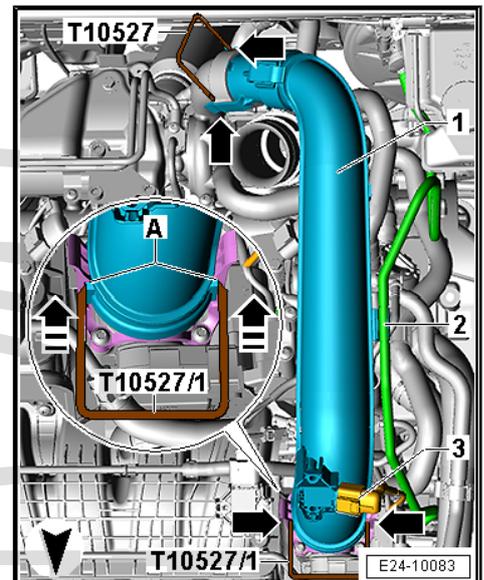
i Note

- ◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .*
- ◆ *Insert the release tool , note the detailed image -A-.*

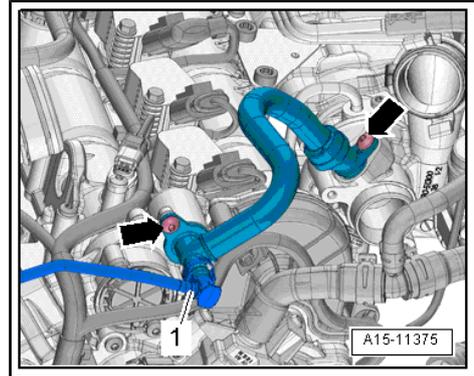
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

i Note

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.



- Press release buttons and pull off hose -1-.
- Remove bolts -arrows- and detach crankcase breather hose.

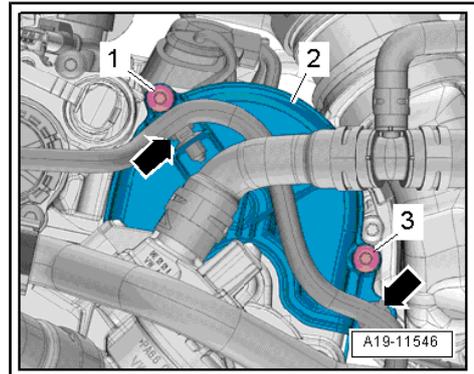


- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.



Note

To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.

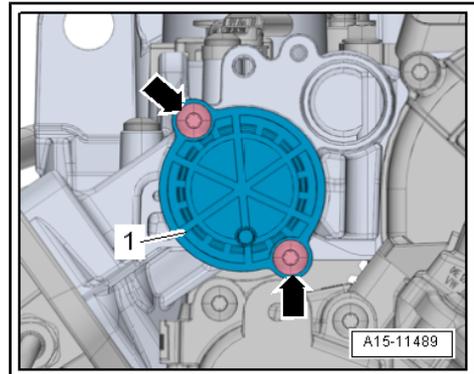


- Remove bolts -arrows-, remove cover cap -1-.

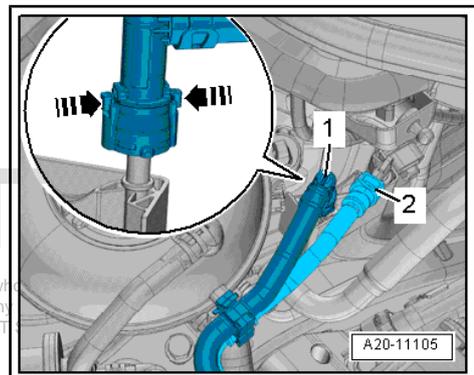


Note

- ◆ *A small quantity of oil may escape when opening the cover cap -1-.*
- ◆ *Use cloth to catch escaping engine oil.*



- Disconnect quick couplings from fuel hose and from the tube to the activated carbon canister⇒ Rep. gr. 20 ; Quick couplings; disconnecting quick couplings .
- Move clear hoses at bracket -3-.



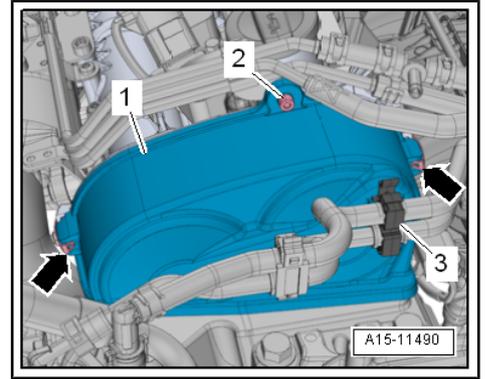
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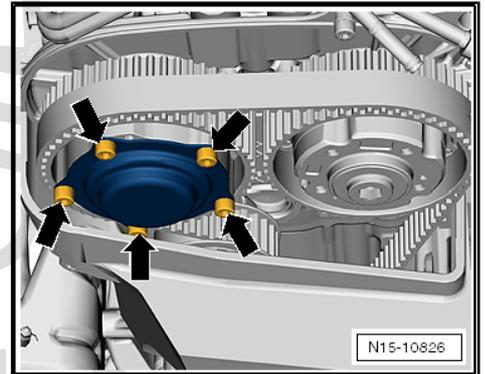
- Unscrew bolt -2-.
- Release clips -arrows- and remove upper toothed belt guard -1-.

 **Note**

- ◆ *To protect the toothed belt, place a cloth under the camshaft adjuster and tensioning roller to catch the engine oil which runs out.*
- ◆ *The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.*



- Unscrew bolts -arrows- and remove lid from camshaft adjuster for exhaust camshaft.



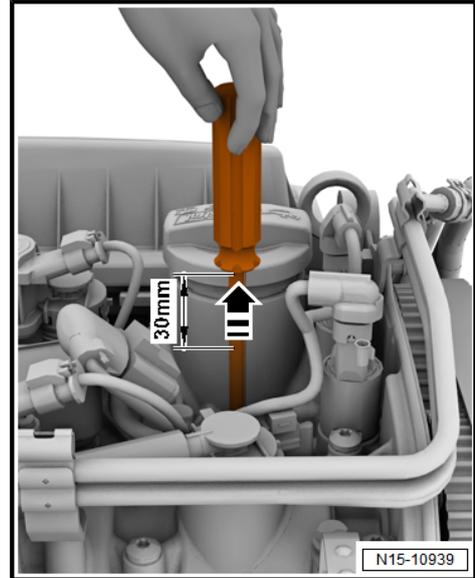
Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage, N70, and the spark plug cylinder 1 => [page 360](#)
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

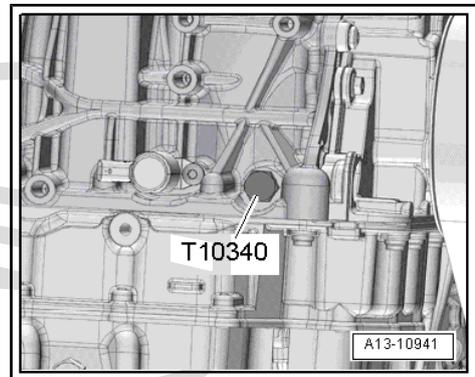
The screwdriver is turned in the -direction of the arrow-.



- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-



- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the 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.

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:
- ◆ Unscrew locking pin.
- ◆ Turn crankshaft 90° in direction of rotation of engine.
- ◆ 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.

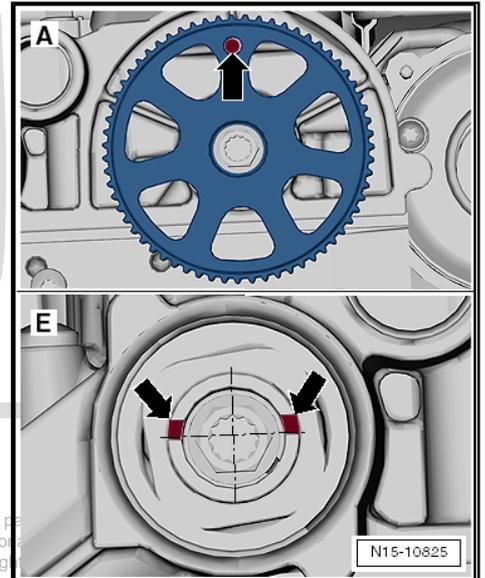
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- On exhaust camshaft, hole -arrow- in toothed belt pulley for coolant pump must be positioned opposite hole in camshaft housing.
- On inlet camshaft, grooves -bottom arrows- must be positioned above centre of camshaft.

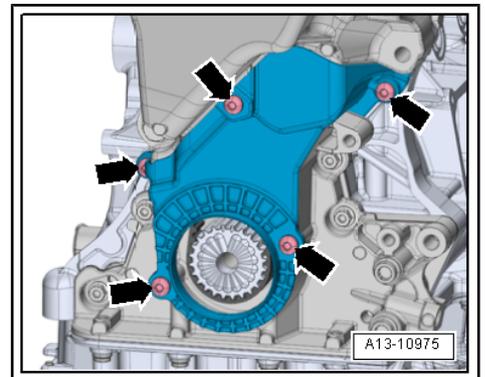
A - Exhaust camshaft

E - Inlet camshaft

- Remove vibration damper => [page 45](#) .



- Unscrew bolts -arrows-, and remove lower toothed belt guard.

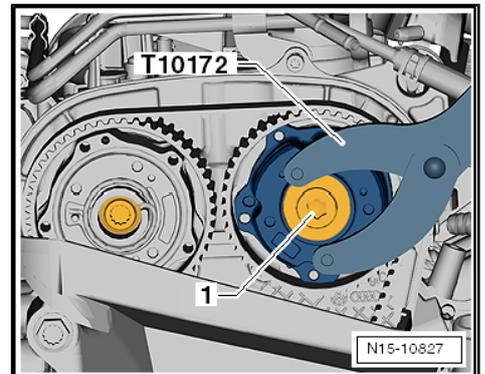


- Unscrew plug -1- on camshaft sprocket on intake side using counterhold tool - T10172- with adapter -T10172/1- .

! NOTICE

Risk of damage to camshaft caused by improper handling.

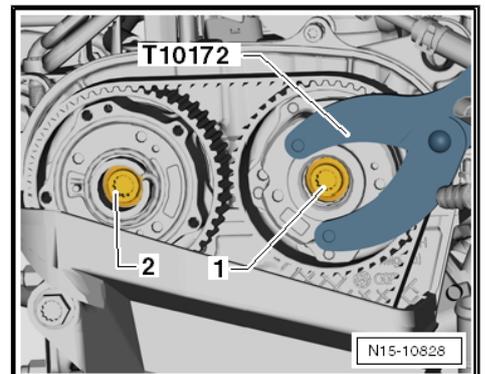
- Never use the camshaft clamp for counterholding.



- Loosen bolts -1- and -2- by approx. 1 turn using counter-hold tool - T10172- with adapter -T10172/1- .

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

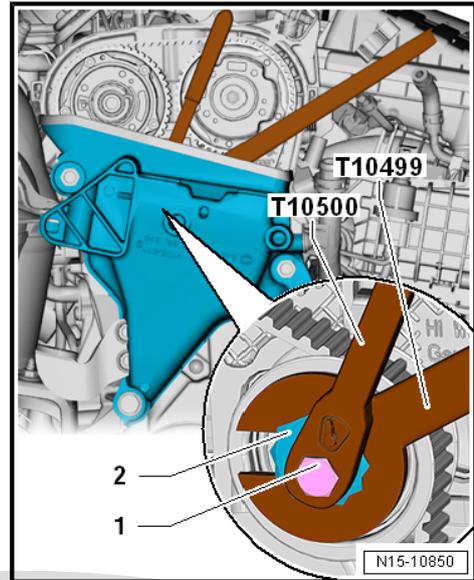
- Place 30 mm ring spanner - T10499- on eccentric adjuster -2- of tensioning roller.



- Loosen bolt -1- with tool insert - T10500- .
- Release tensioning roller on eccentric adjuster -2- using 30 mm ring spanner - T10499- .

Risk of damage to engine

- ◆ Risk of damage to the toothed belt.
 - ◆ The toothed belt is made of glass fibre fabric.
 - ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
 - ◆ Otherwise the service life of the toothed belt will be reduced.
 - ◆ The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.
- Removing notched belt



- Detach crankshaft sprocket -1- -arrow-.

Installing (adjusting the valve timing)



Note

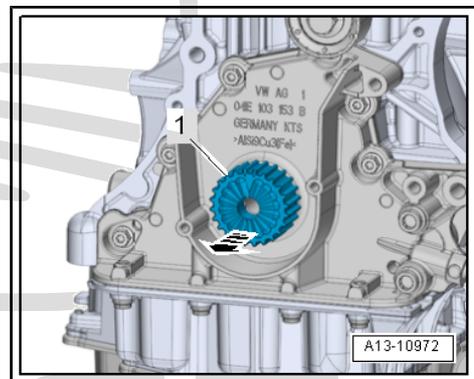
- ◆ Renew bolts that are tightened with specified further tightening angle.
- ◆ Renew O-ring of plug if damaged.



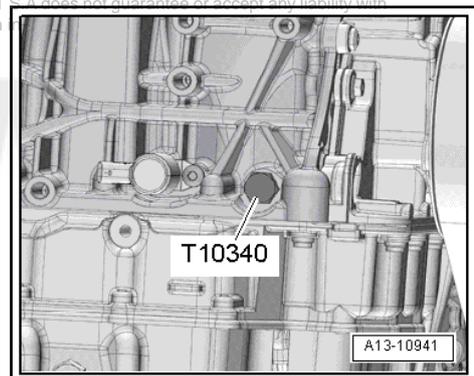
NOTICE

Risk of damage to camshaft caused by improper handling.

- Never use the camshaft clamp for counterholding.



- 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.
- Turn the camshafts into the correct positions.



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- On exhaust camshaft, hole -arrow- in toothed belt pulley for coolant pump must be positioned opposite hole in camshaft housing.
- On inlet camshaft, grooves -bottom arrows- must be positioned above centre of camshaft.

A - Exhaust camshaft

E - Inlet camshaft

- Use a waterproof pen to mark the tooth over the hole in coolant pump drive sprocket from above.

Due to the marking the locking pin - T10504/1- can be inserted more easily.

- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.

- When camshafts are positioned as described, insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).

- Turn inlet camshaft with camshaft clamp - T10504- in -direction of arrow A-.

- At the same time, turn the coolant pump drive sprocket -1- in -direction of arrow B-.

- Have a second mechanic insert the locking pin - T10504/1- as far as stop.

- Hand-tighten the bolts -arrows-.

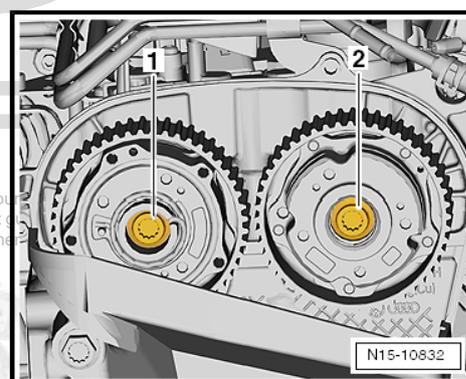
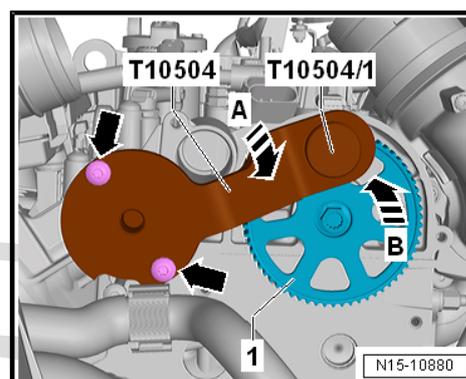
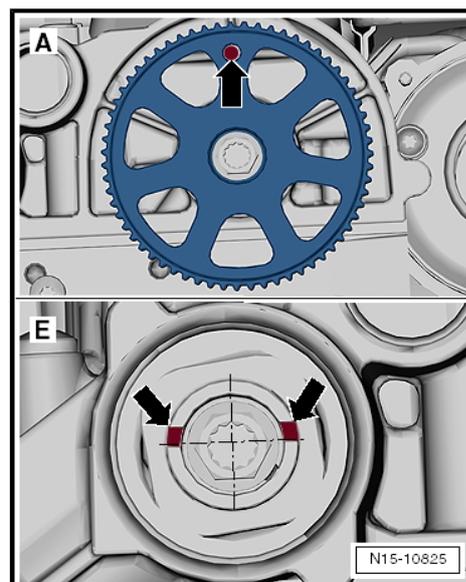
Risk of damage to engine

- ◆ The locking pin - T10504/1- must be inserted in onto its stop.
- ◆ If the locking pin - T10504/1- is not inserted onto its stop, damage to the engine due to disturbed valve timing may be the result.

NOTICE

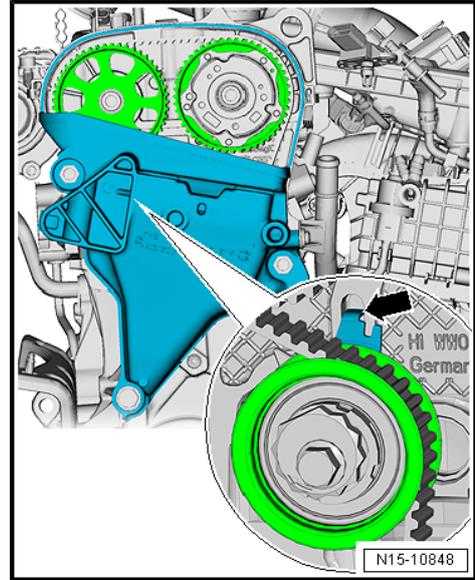
Risk of damage to camshaft caused by improper handling.

- Never use the camshaft clamp for counterholding.
- Renew bolts -1- and -2- for camshaft pulleys and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.

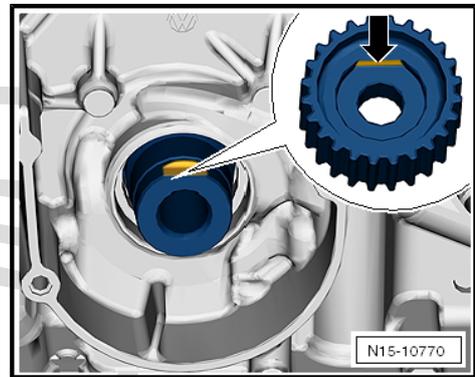


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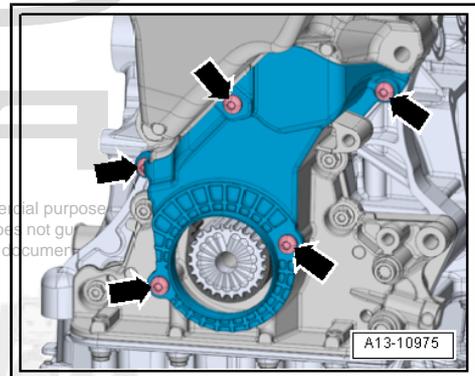
- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.



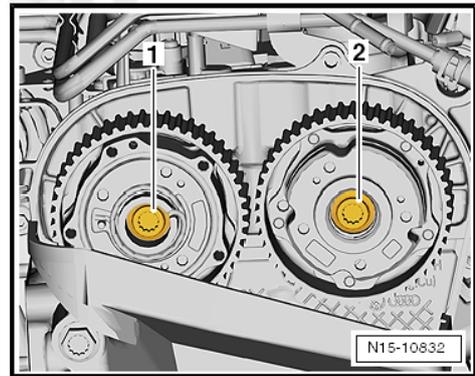
- Fit crankshaft sprocket onto crankshaft.
- The contact surface between vibration damper and crankshaft toothed belt pulley must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.
- Fit toothed belt first on crankshaft toothed belt pulley from below.



- Install toothed belt cover (bottom section) -arrows-.
- Install vibration damper => [page 45](#) .



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

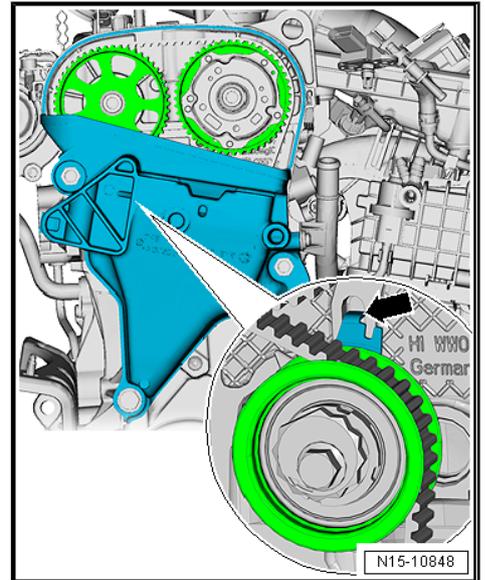


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- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.

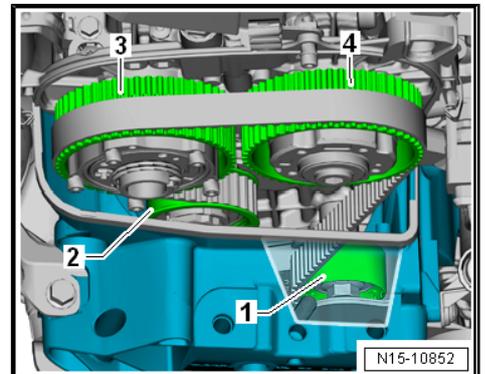
Risk of damage to engine

- ◆ Risk of damage to the toothed belt.
- ◆ The toothed belt is made of glass fibre fabric.
- ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- ◆ Otherwise the service life of the toothed belt will be reduced.
- ◆ The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.



Observe sequence when fitting the toothed belt

- Pull toothed belt upwards and fit it on idler roller -1-, tensioner roller -2- and camshaft pulleys -3- and -4-.



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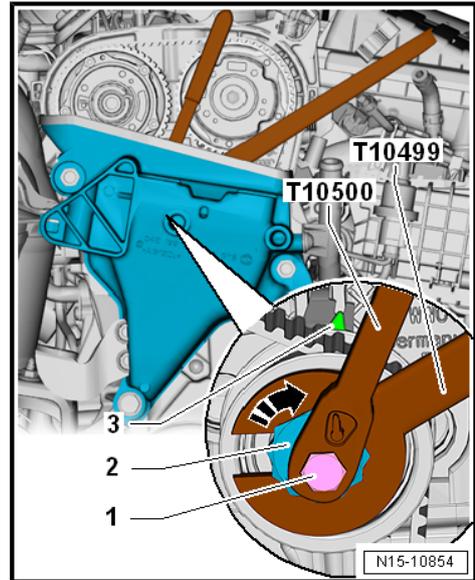
erWin

- Using the ring spanner SW 30 - T10499- , turn the eccentric -2- of the tensioning roller in the direction of the -arrow- until the adjustment pointer -3- is positioned about 10 mm to the right of the setting window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.



Note

- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
- ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10500- must be entered in the torque wrench.*
- ◆ *If you use a conventional torque wrench you might possibly tighten the bolt of the tensioning roller with too much torque and damage it.*
- Hold eccentric in that position and tighten bolt -1- to 25 Nm using insert tool - T10500- with torque wrench - VAS 6583- .



Note

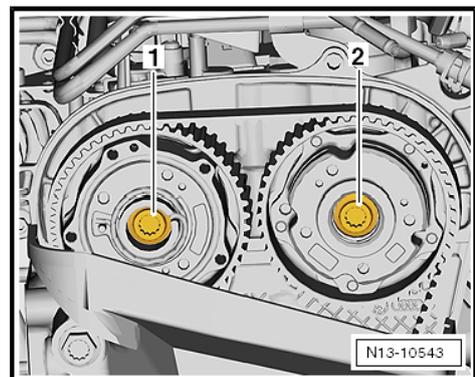
Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension or the timing.



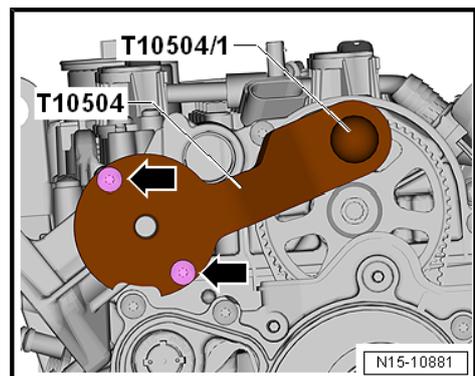
NOTICE

Risk of damage to camshaft caused by improper handling.

- **Never use the camshaft clamp for counterholding.**
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool - T10172- with adapter -T10172/1- .
- **Pull out locking pin - T10504/1-**



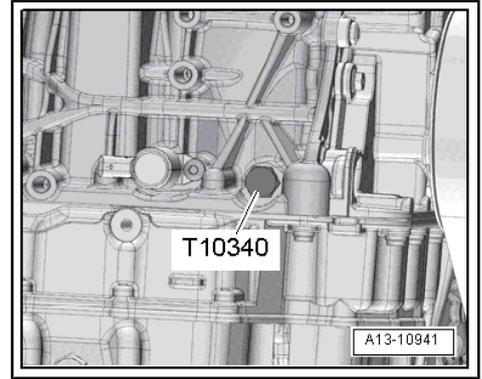
- Remove bolts -arrows- and detach camshaft clamp - T10504- .



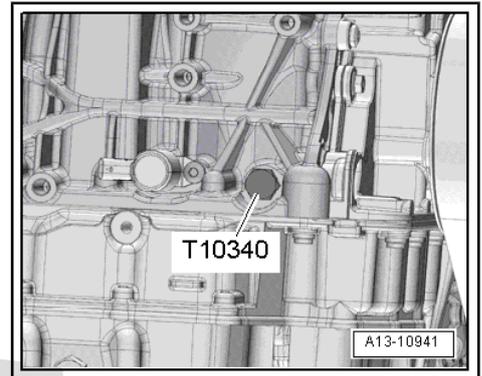
- Remove locking pin - T10340- .

Check valve timing:

- Turn crankshaft 2 turns in direction of rotation of engine.



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



 **Note**

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

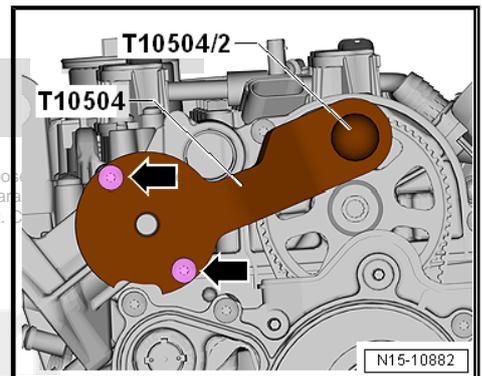
 **Note**

- ◆ *The camshaft clamp - T10504- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*
- Insert camshaft clamp - T10504- into inlet camshaft as far as stop and fit bolts -arrows- (do not screw in yet).

- Insert test pin - T10504/2- as far as stop.
- Hand-tighten the bolts -arrows-.

Risk of damage to engine

- ◆ If the groove -arrow- is not flush with the camshaft clamp - T10504- , the test pin - T10504/2- has not been inserted deep enough.
- ◆ This may cause damage to the engine due to disturbed valve timing.

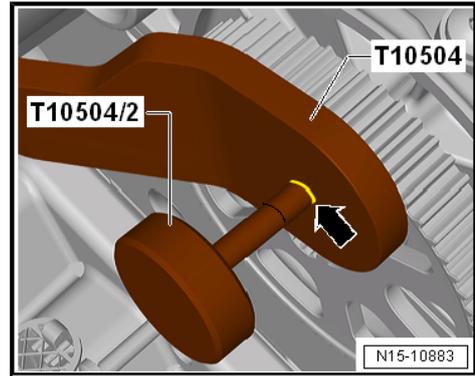


- The groove -arrow- on test pin - T10504/2- must be flush with camshaft clamp - T10504- .

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

- Repeat adjustment of valve timing.

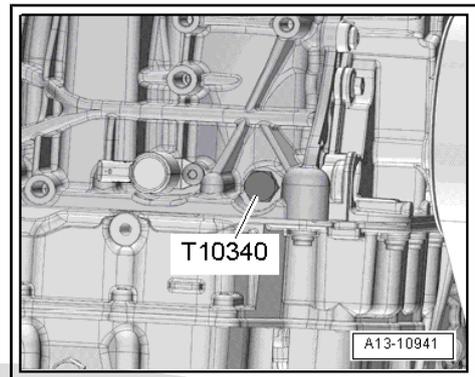
If it is possible to insert the camshaft clamp - T10504- with the test pin - T10504/2- , valve timing is OK.



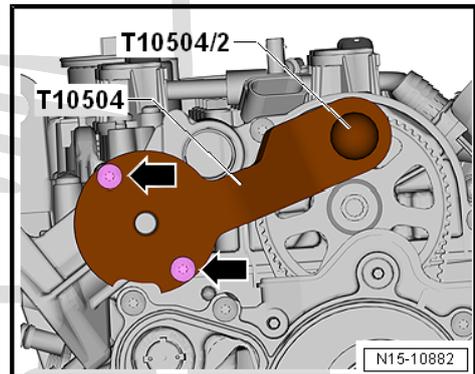
- Remove locking pin - T10340- .
- Tighten plug to specified torque.

⇒ Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97

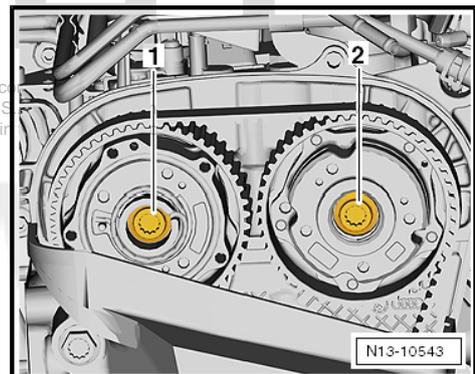
- Pull out test pin - T10504/2- .



- Remove bolts -arrows- and detach camshaft clamp - T10504- .



- Tighten bolts -1- and -2- to final torque ⇒ page 96 . Use counter-hold tool - T10172- with adapter -T10172/1- for this.



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- Tighten plug -1- using counterhold tool - T10172- with adapter -T10172/1- .

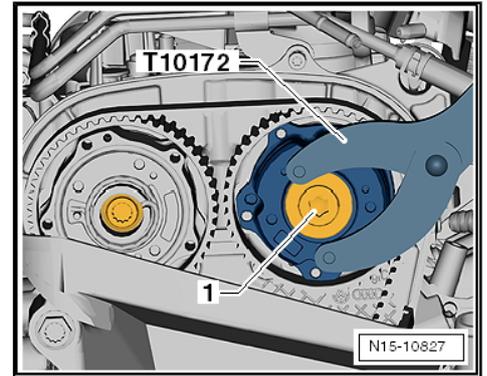
Risk of damage to engine

- ◆ After completing work, check that locking pin - T10340- and camshaft clamp - T10504- have been removed.

Install in the reverse order of removal, observing the following:

Specified torques

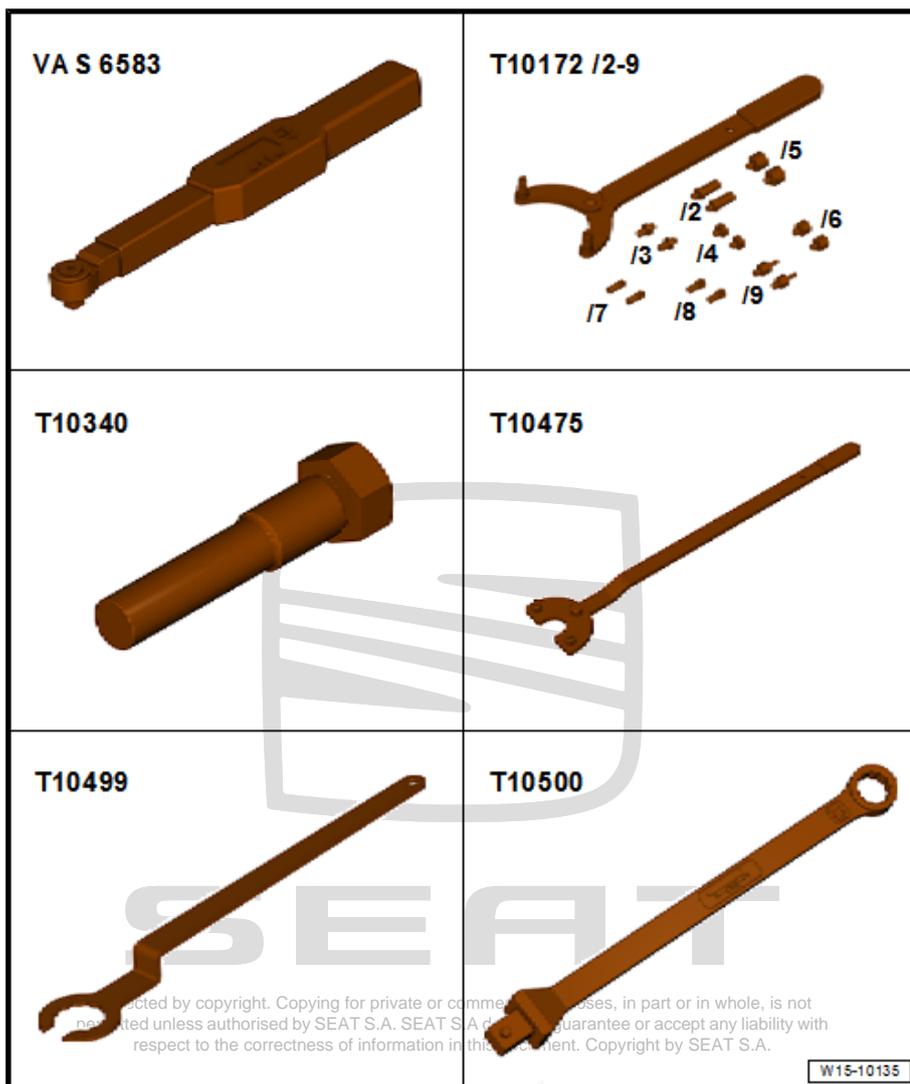
- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 36](#)
- ◆ ⇒ [“2.1 Exploded view - toothed belt cover”, page 95](#)
- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97](#)
- ◆ ⇒ [“1.2.1 Assembly overview - camshaft housing, engine code CZEA”, page 78](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 238](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 295](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)



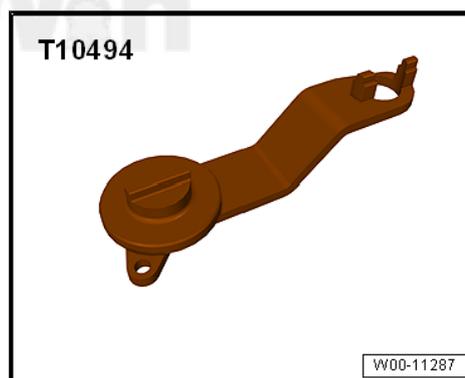
2.5.2 Removing and installing toothed belt, engine codes CHPA, CZDA

Special tools and workshop equipment required

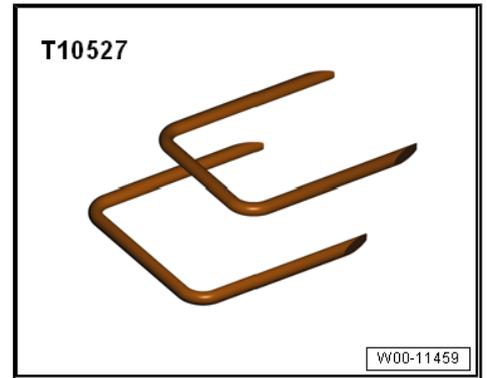
- ◆ Torque wrench - VAS 6583-
- ◆ counter-hold tool - T10172- with adapter -T10172/1-
- ◆ Securing bolts - T10340-
- ◆ Counter-hold tool - T10475-
- ◆ 30 mm ring spanner - T10499-
- ◆ Insert tool - T10500-



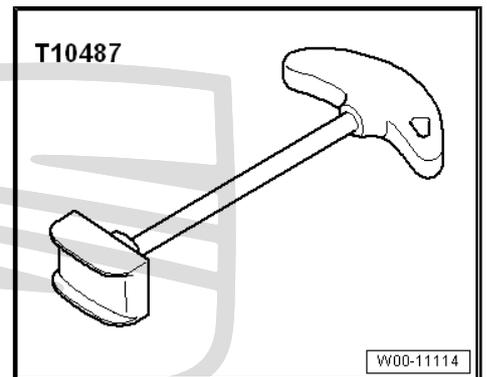
- ◆ Camshaft clamp - T10494-



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

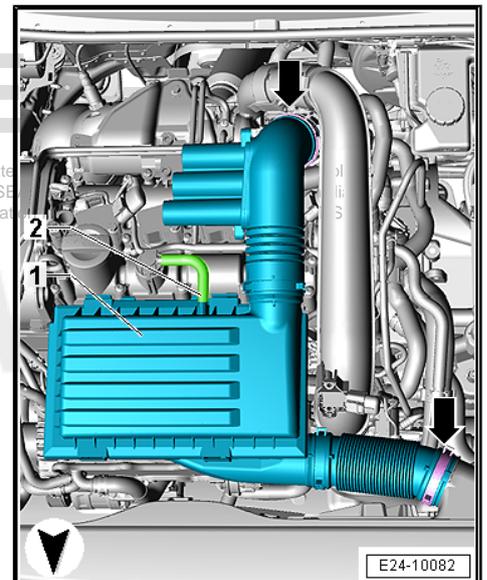


- ◆ Assembly tool - T10487-



Removing

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.

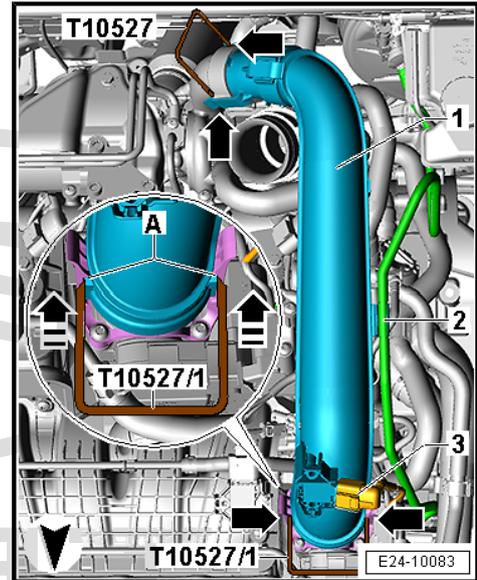


- Disconnect electrical connector from the charge pressure sender - GX26- -3-.



Note

- ◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .*
- ◆ *Insert the release tool , note the detailed image -A-.*
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

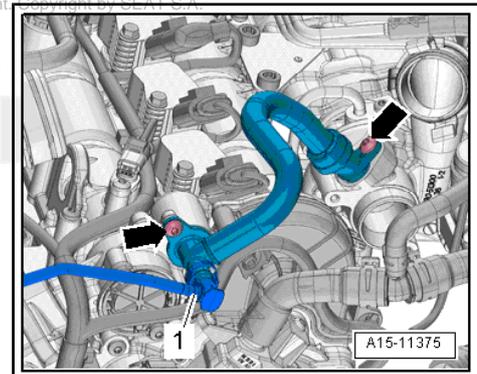


Note

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.

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- Press release tabs and disconnect hose -1- for activated charcoal filter.
- Remove bolts -arrows- and detach crankcase breather hose.

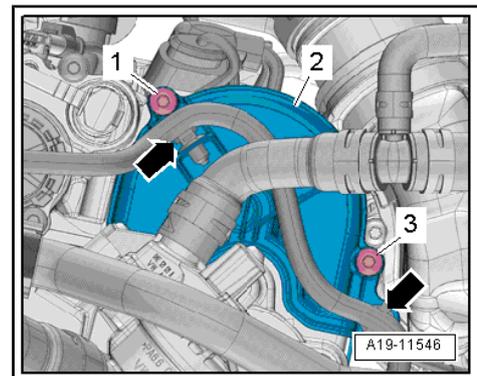


- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.



Note

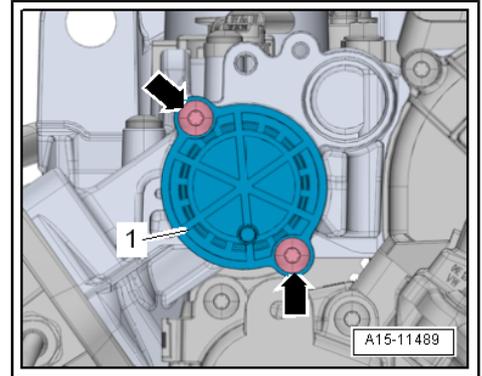
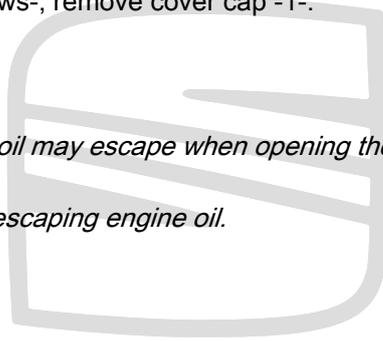
To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.



- Remove bolts -arrows-, remove cover cap -1-.

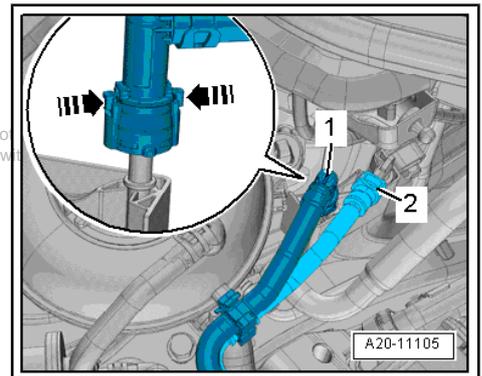
 Note

- ◆ A small quantity of oil may escape when opening the cover cap -1-.
- ◆ Use cloth to catch escaping engine oil.

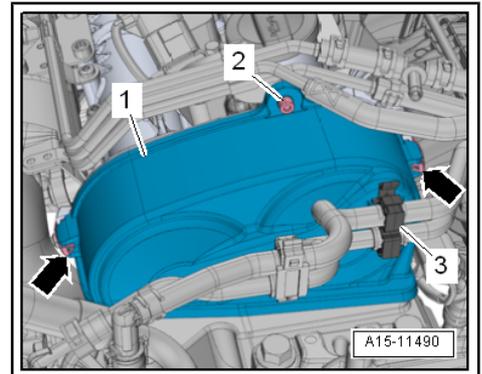


- Disconnect quick couplings from fuel hose and from the tube to the activated carbon canister → Rep. gr. 20 ; Quick couplings; disconnecting quick couplings .

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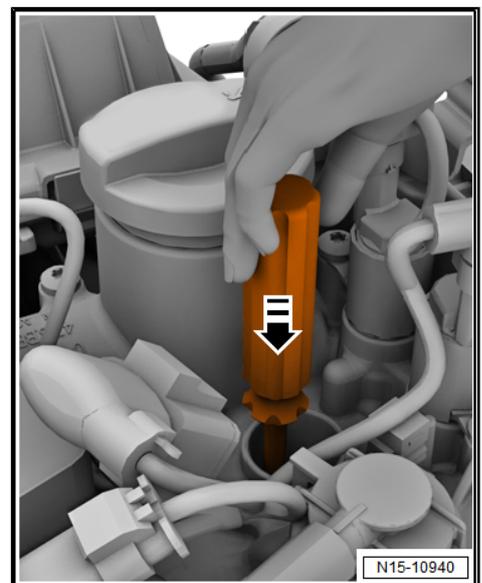
- Move clear hoses at bracket -3-.
- Unscrew bolt -2-.
- Release clips -arrows- and remove upper toothed belt guard -1-.



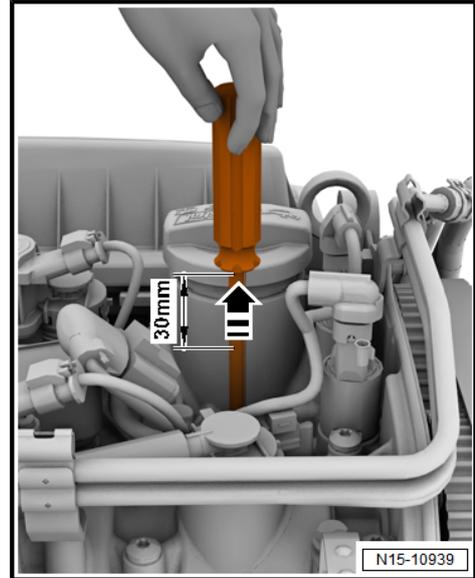
Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage - N70- and the spark plug cylinder 1 ⇒ [page 360](#) .
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

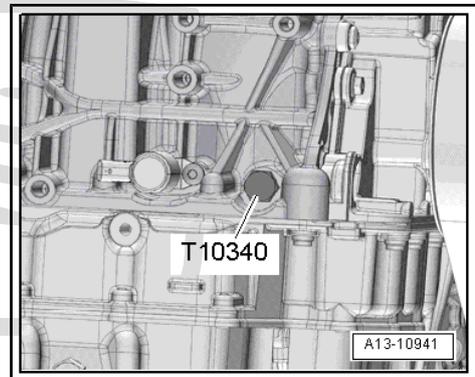
The screwdriver is turned in the -direction of the arrow-.



- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-



- Unscrew plug for "TDC" hole on cylinder block.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Turn crankshaft in direction of rotation of engine as far as the 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.

Risk of damage to engine

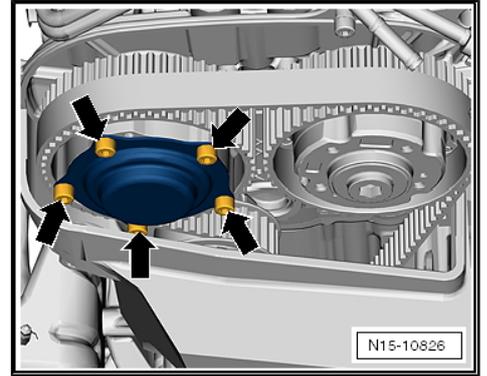
- ◆ If the locking pin - T10340- cannot be screwed in as far as the stop, the crankshaft is not in the correct position.
- ◆ In this case proceed as follows:
- ◆ Unscrew locking pin.
- ◆ Turn crankshaft 90° in direction of rotation of engine.
- ◆ Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- ◆ Turn crankshaft further in normal direction of rotation as far as stop.

To protect the toothed belt, place a cloth under the camshaft adjuster and tensioning roller to catch the engine oil which runs out.

The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.

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- Unscrew bolts -arrows- and remove lid from camshaft adjuster for exhaust camshaft.

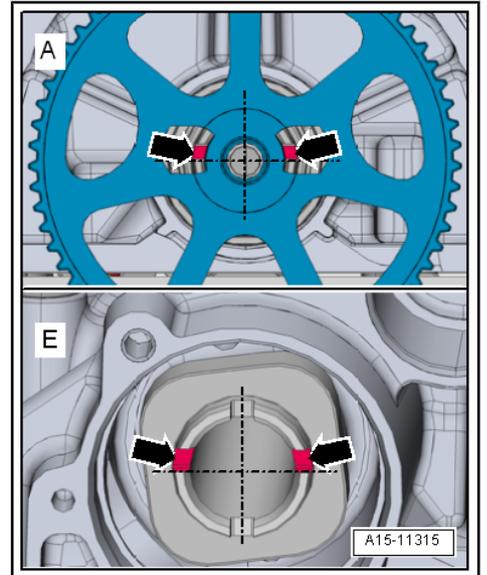


- On both camshafts on gearbox end the asymmetrical grooves -arrows- must be positioned right above horizontal camshaft centre line as shown in illustration.
- The grooves on the exhaust camshaft -upper arrows- can be accessed through the recesses in toothed belt pulley for coolant pump.
- On inlet camshaft, grooves -bottom arrows- must be positioned above centre of camshaft.

A - Exhaust camshaft

E - Inlet camshaft

- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.

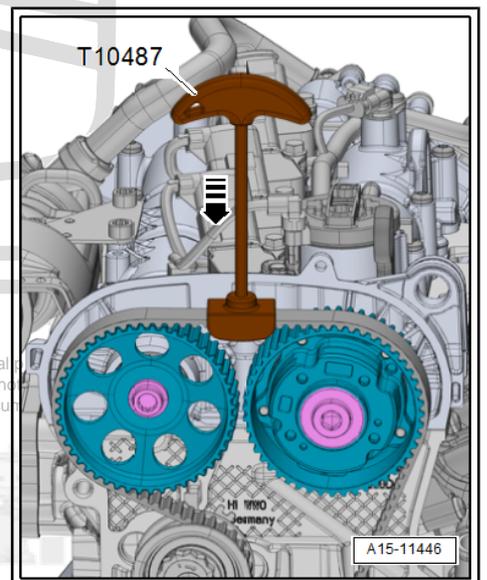


 **Note**

- ◆ *The camshaft clamp - T10494- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

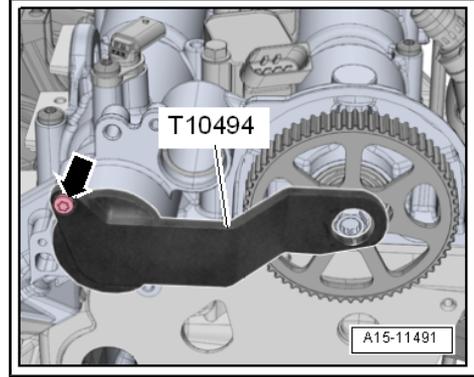
If the camshaft clamp - T10494- cannot slide into position easily.

- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.

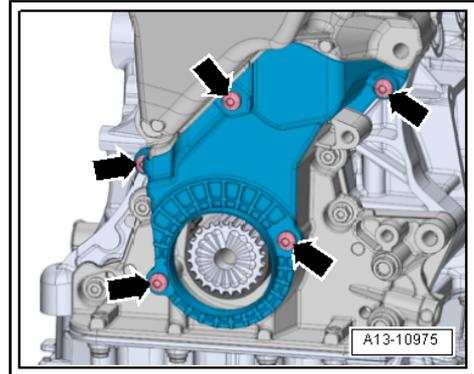


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- Insert camshaft clamp -T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.
- Remove vibration damper ⇒ [page 45](#) .



- Unscrew bolts -arrows-, and remove lower toothed belt guard.

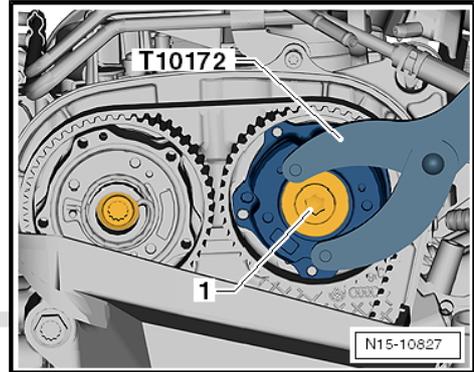


- Unscrew plug -1- on camshaft sprocket on intake side using counterhold tool - T10172- with adapter -T10172/1- .

NOTICE

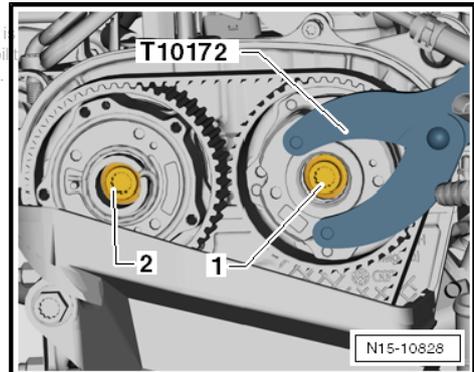
Risk of damage to camshaft caused by improper handling.

- Never use the camshaft clamp for counterholding.



- Loosen bolts -1- and -2- by approx. 1 turn using counter-hold tool - T10172- with adapter -T10172/1- .

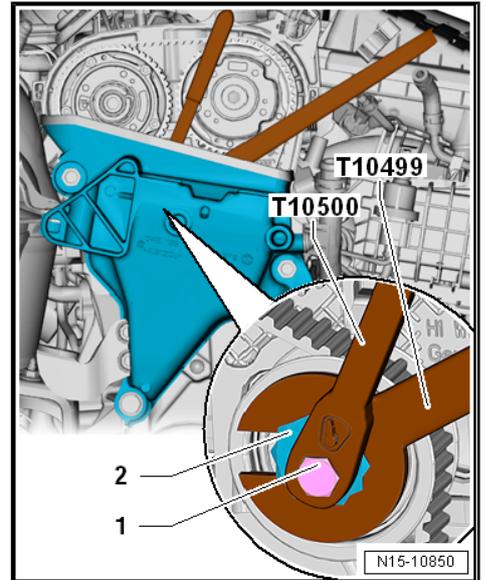
Before removing, mark direction of rotation of toothed belt with chalk or felt-tip pen for re-installation.



- Loosen bolt -1- with tool insert - T10500- .
- Release tensioning roller on eccentric adjuster -2- using 30 mm ring spanner - T10499- .

Risk of damage to engine

- ◆ Risk of damage to the toothed belt.
 - ◆ The toothed belt is made of glass fibre fabric.
 - ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
 - ◆ Otherwise the service life of the toothed belt will be reduced.
 - ◆ The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.
- Removing notched belt

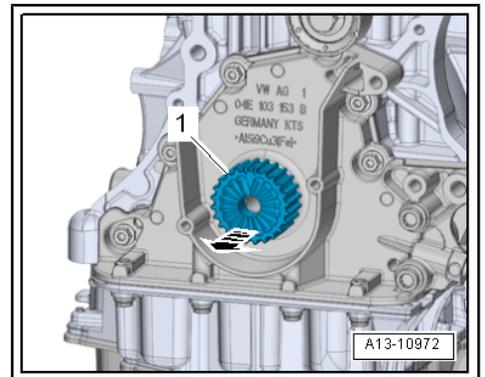


- Detach crankshaft sprocket -1- -arrow-.

Installing (adjusting the valve timing)

 **Note**

- ◆ Renew bolts that are tightened with specified further tightening angle.
 - ◆ Renew O-ring of plug if damaged.
- Check "TDC" position of camshaft and crankshaft:

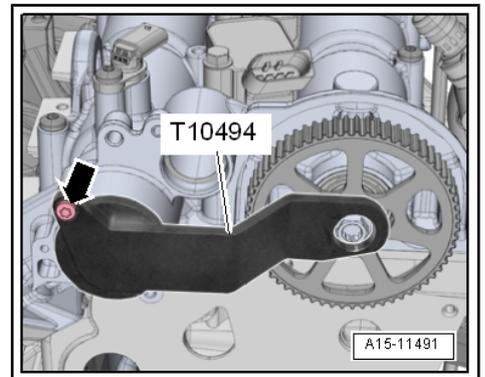


- Camshaft clamp - T10494- fitted on camshaft housing.

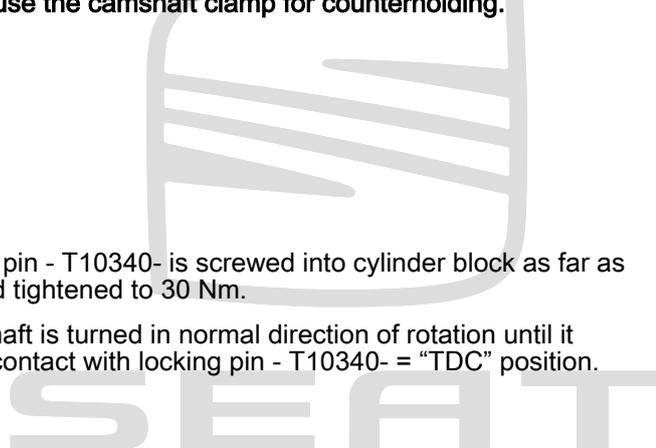
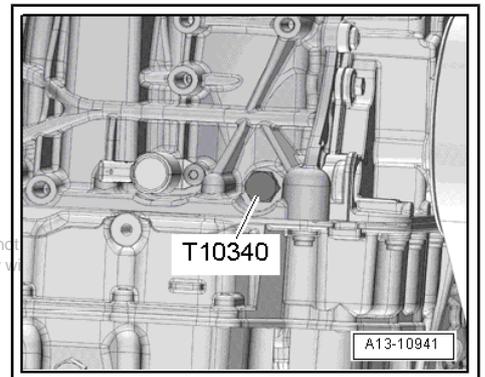
 **NOTICE**

Risk of damage to camshaft caused by improper handling.

- Never use the camshaft clamp for counterholding.



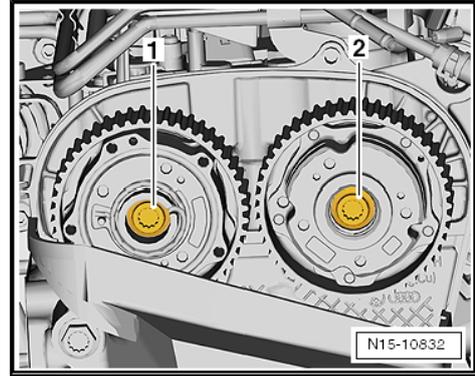
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.



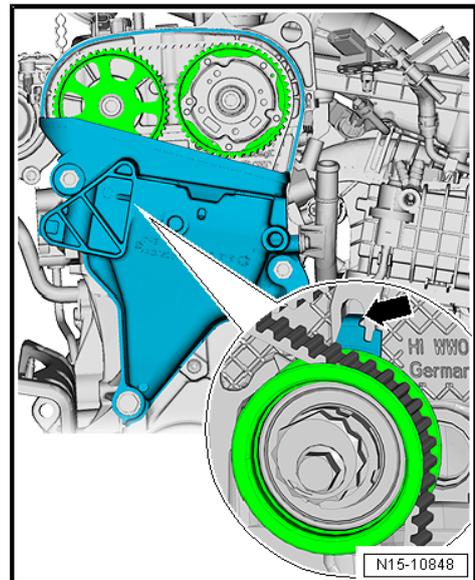
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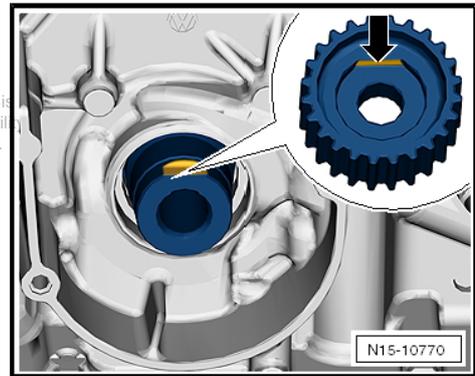
- Renew bolts -1- and -2- for camshaft pulleys and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



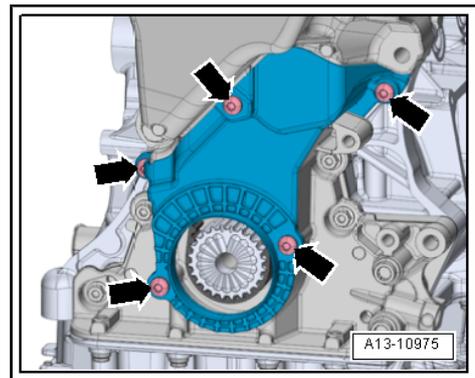
- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.



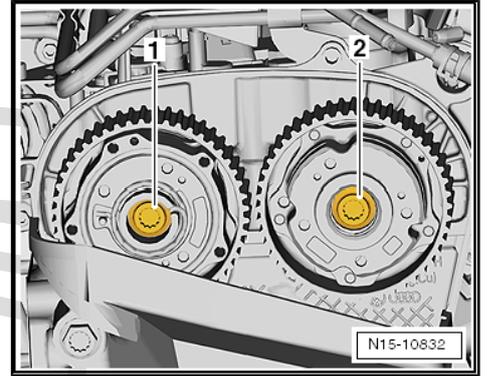
- Fit crankshaft sprocket onto crankshaft.
- The contact surface between vibration damper and crankshaft toothed belt pulley must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.
- Fit toothed belt first on crankshaft toothed belt pulley from below.



- Install toothed belt cover (bottom section) -arrows-.
- Install vibration damper => [page 45](#) .



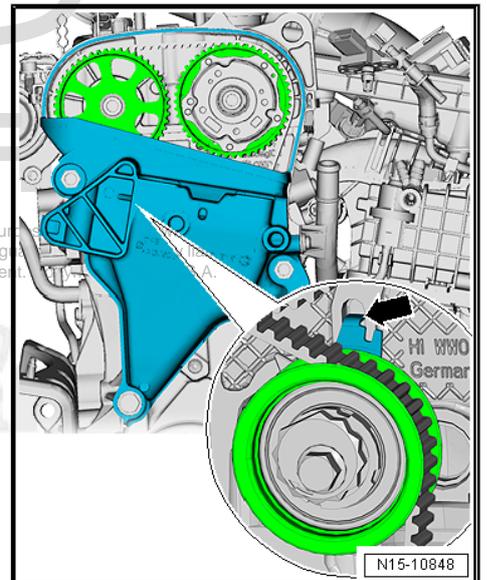
- Renew bolts -1- and -2- for camshaft pulleys and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.

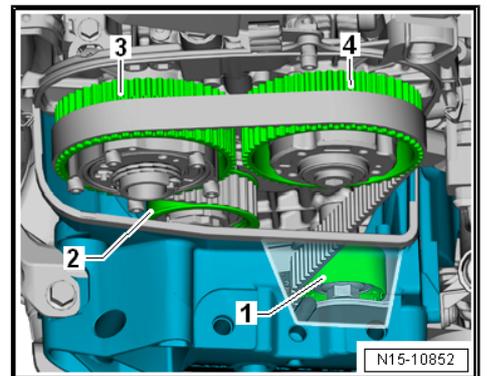
Risk of damage to engine

- ◆ Risk of damage to the toothed belt.
- ◆ The toothed belt is made of glass fibre fabric.
- ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- ◆ Otherwise the service life of the toothed belt will be reduced.
- ◆ The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.



Observe sequence when fitting the toothed belt

- Pull toothed belt upwards and fit it on idler roller -1-, tensioner roller -2- and camshaft pulleys -3- and -4-.

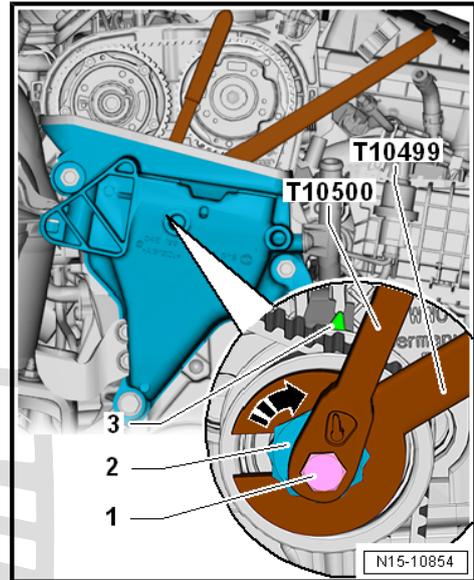


- Using the ring spanner SW 30 - T10499- , turn the eccentric -2- of the tensioning roller in the direction of the -arrow- until the adjustment pointer -3- is positioned about 10 mm to the right of the setting window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.



Note

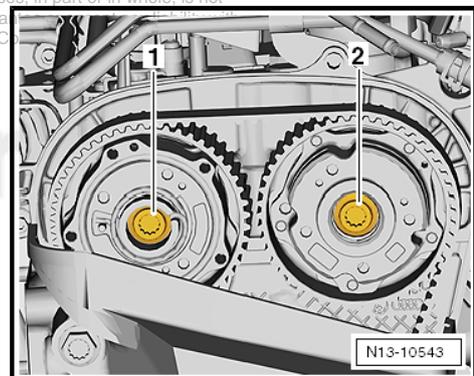
- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
 - ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10500- must be entered in the torque wrench.*
 - ◆ *If you use a conventional torque wrench you might possibly tighten the bolt of the tensioning roller with too much torque and damage it.*
- Hold eccentric in that position and tighten bolt -1- to 25 Nm using insert tool - T10500- with torque wrench - VAS 6583- .



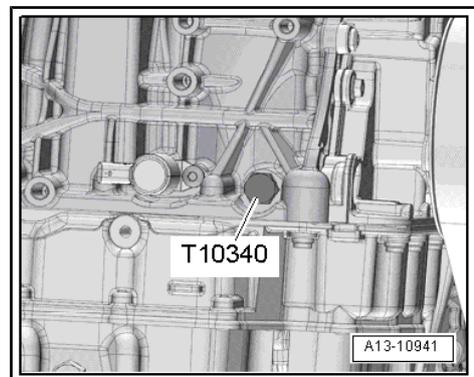
Note

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

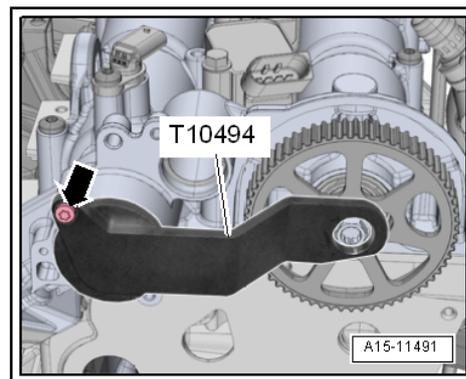
- Tighten bolts -1, 2- initially to 50 Nm using counterhold tool T10172- with adapter -T10172/1- .



- Remove locking pin - T10340- .

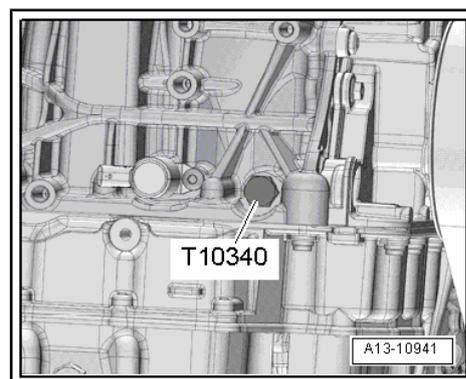


- Remove bolt -arrow- and detach camshaft clamp - T10494- .



Check valve timing:

- Turn crankshaft 2 turns in direction of rotation of engine.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.



i Note

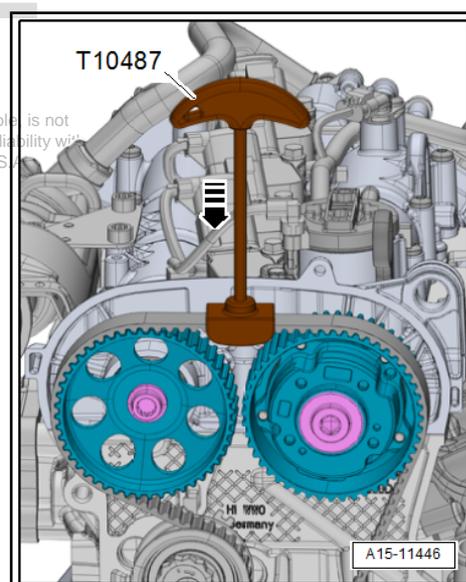
The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

i Note

- ◆ *The camshaft clamp - T10494- must slide into position easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

If the camshaft clamp - T10494- cannot slide into position easily.

- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.

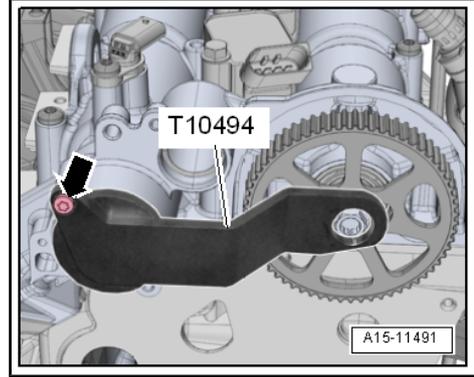


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- Insert camshaft clamp -T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.

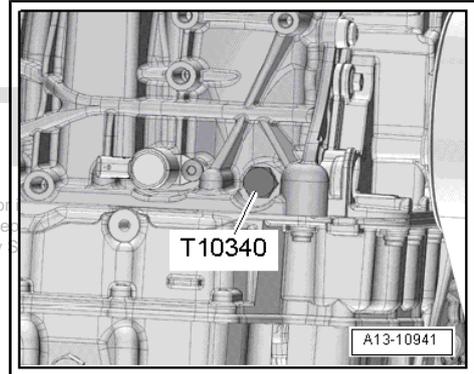
If it is not possible to insert camshaft clamp - T10494- , valve timing is not OK.

- Repeat adjustment of valve timing.

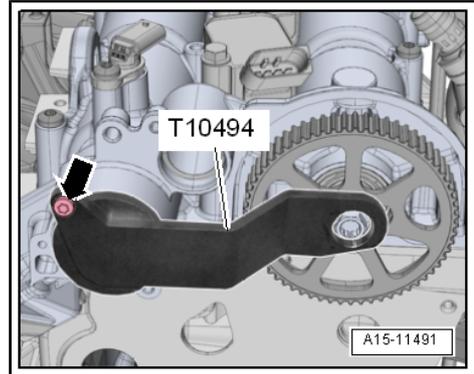


If it is possible to insert camshaft clamp - T10494- , valve timing is OK.

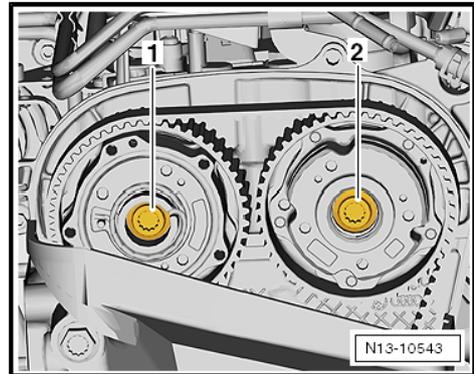
- Remove locking pin - T10340- .



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



- Tighten bolts -1- and -2- to final torque => [page 96](#) . Use counter-hold tool - T10172- with adapter -T10172/1- for this.



- Tighten plug -1- using counterhold tool - T10172- with adapter -T10172/1- .

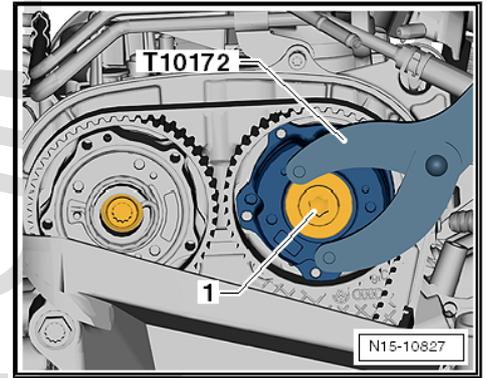
Risk of damage to engine

- ◆ After completing work, check that locking pin - T10340- and camshaft clamp - T10504- have been removed.

Install in the reverse order of removal, observing the following:

Specified torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 36](#)
- ◆ ⇒ [“2.1 Exploded view - toothed belt cover”, page 95](#)
- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97](#)
- ◆ ⇒ [“1.2 Exploded view - camshaft housing - page 78](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 238](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 295](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)

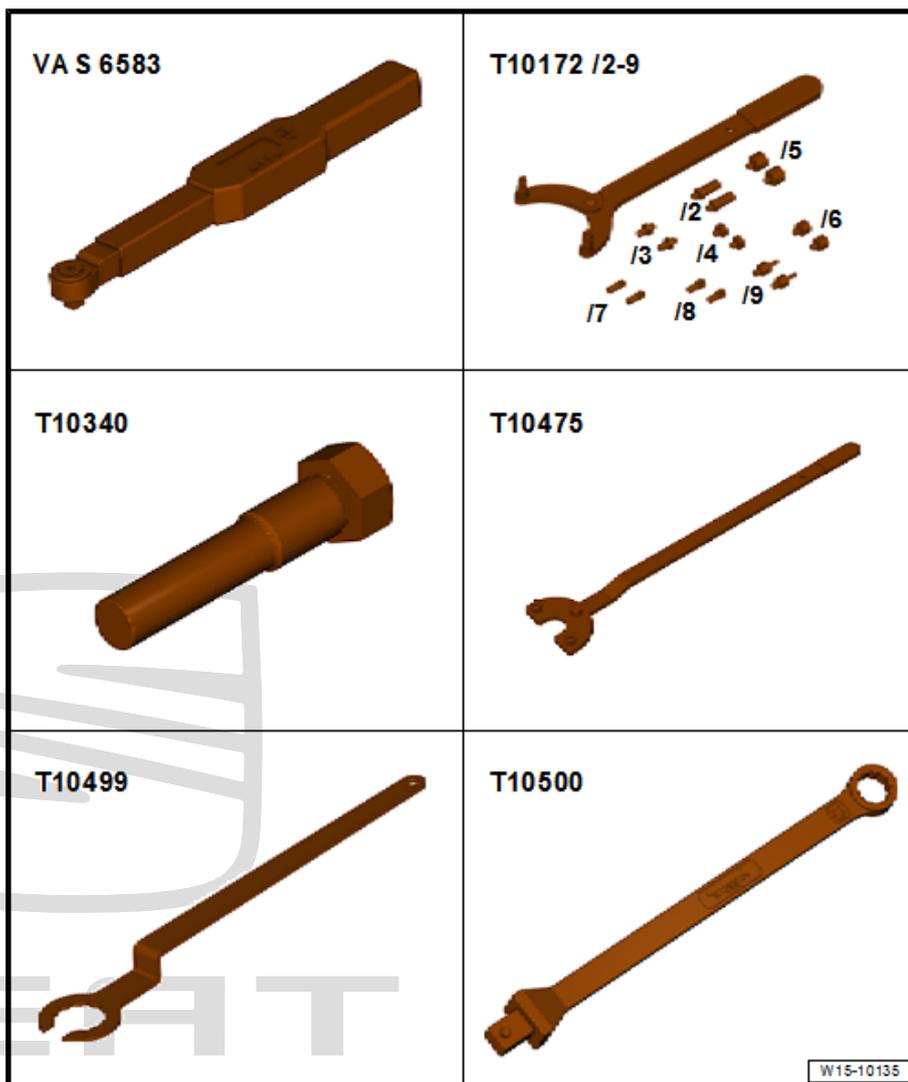


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2.5.3 Removing and installing toothed belt, engine codes CMBA, CXSA, CZCA

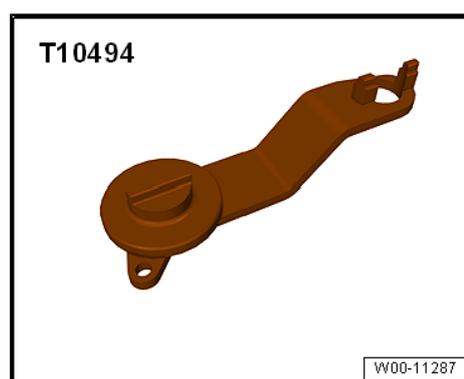
Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-
- ◆ Counterhold - T10172- with adapter -T10172/1- and -T10172/2-
- ◆ Securing bolts - T10340-
- ◆ Counter-hold tool - T10475-
- ◆ 30 mm ring spanner - T10499-
- ◆ Insert tool - T10500-



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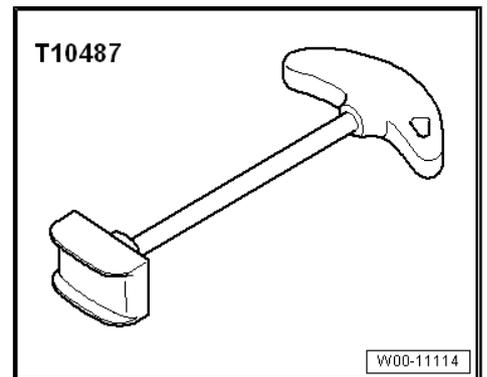
- ◆ Camshaft clamp - T10494-



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

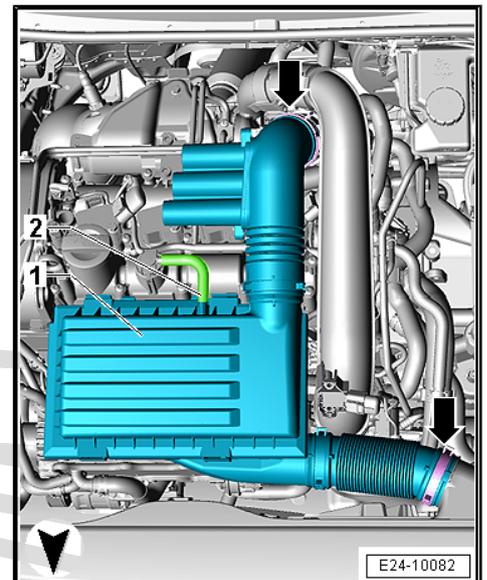


- ◆ Assembly tool - T10487-



Removing

- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



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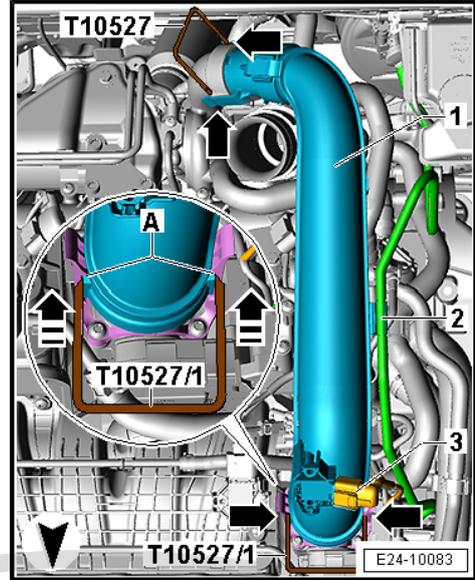
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- Disconnect electrical connector from the charge pressure sender - GX26- -3-.



Note

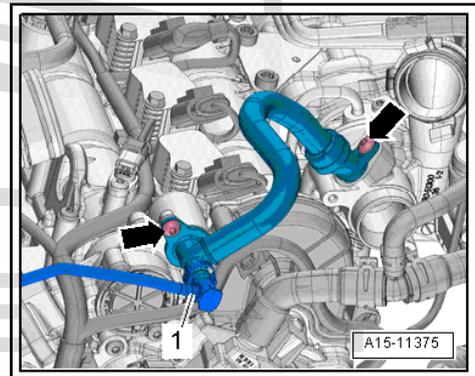
- ◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .*
- ◆ *Insert the release tool , note the detailed image -A-.*
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.



Note

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.

- Press release tabs and disconnect hose -1- for activated charcoal filter.
- Remove bolts -arrows- and detach crankcase breather hose.

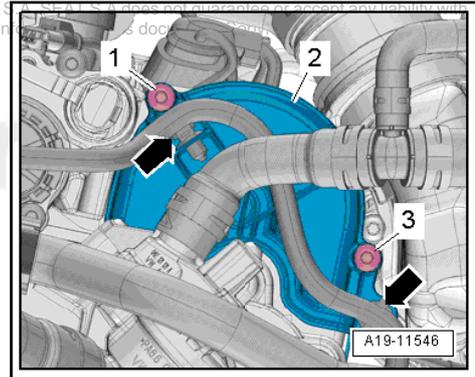


- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.



Note

To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.

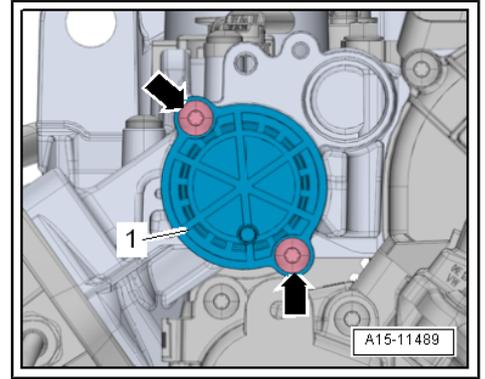


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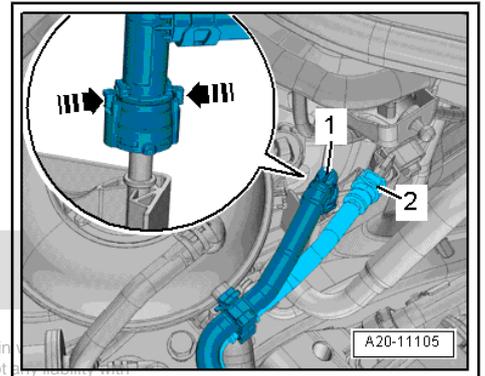
- Remove bolts -arrows-, remove cover cap -1-.

 Note

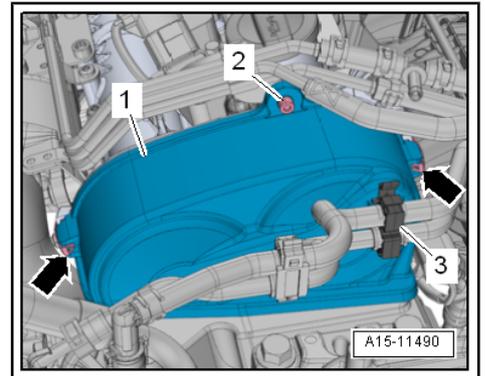
- ◆ A small quantity of oil may escape when opening the cover cap -1-.
- ◆ Use cloth to catch escaping engine oil.



- Disconnect quick couplings from fuel hose and from the tube to the activated carbon canister→ Rep. gr. 20 ; Quick couplings; disconnecting quick couplings .



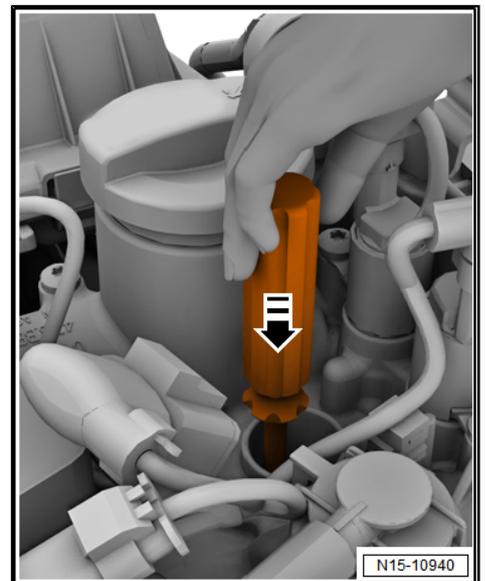
- Move clear hoses at bracket -3-.
- Unscrew bolt -2-.
- Release clips -arrows- and remove upper toothed belt guard -1-.



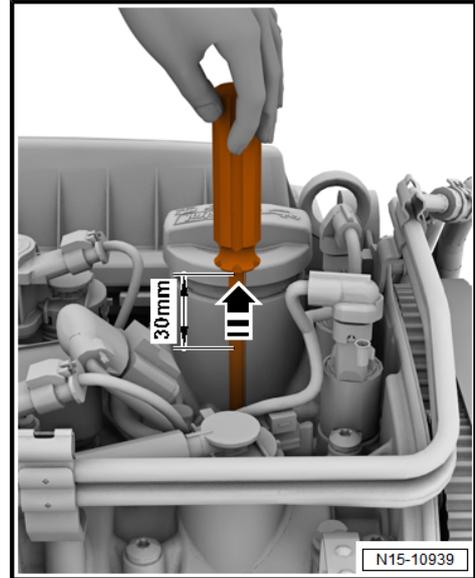
Rotate crankshaft to "TDC" as follows:

- Remove ignition coil 1 with output stage - N70- and the spark plug cylinder 1 ⇒ [page 360](#) .
- Insert a screwdriver with a minimum shaft length of 250 mm into the spark plug recess until it reaches the piston crown.
- Turn the crankshaft in the normal direction of rotation until the piston in cylinder 1 shows "BDC".

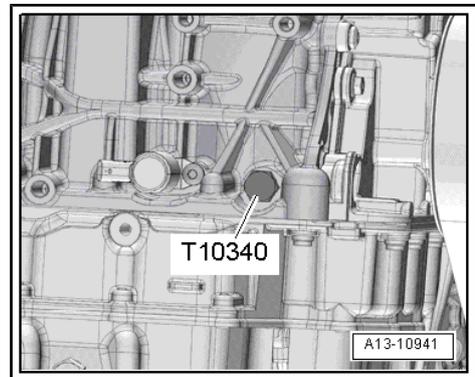
The screwdriver is turned in the -direction of the arrow-.



- Turn the crankshaft further, until the screwdriver has moved a further -30 mm- in the -direction of the arrows-



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

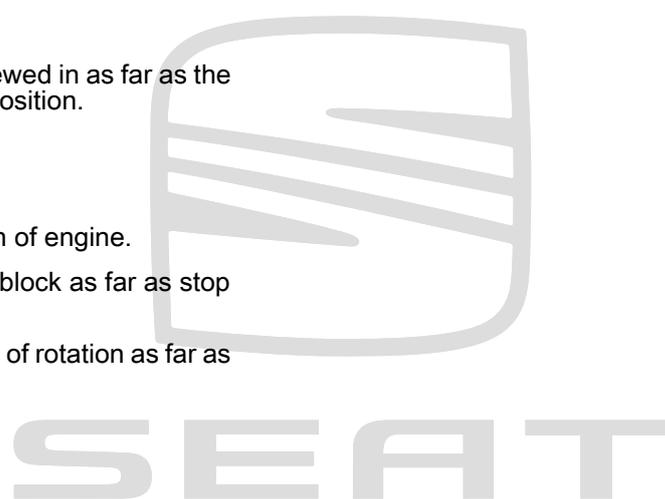


Note

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

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:
- ◆ Unscrew locking pin.
- ◆ Turn crankshaft 90° in direction of rotation of engine.
- ◆ 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.



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- On both camshafts, asymmetrically positioned grooves -top arrows- on gearbox end must face upwards, as shown in illustration.
- On exhaust camshaft, grooves -bottom arrows- are accessible via openings in coolant pump drive sprocket.

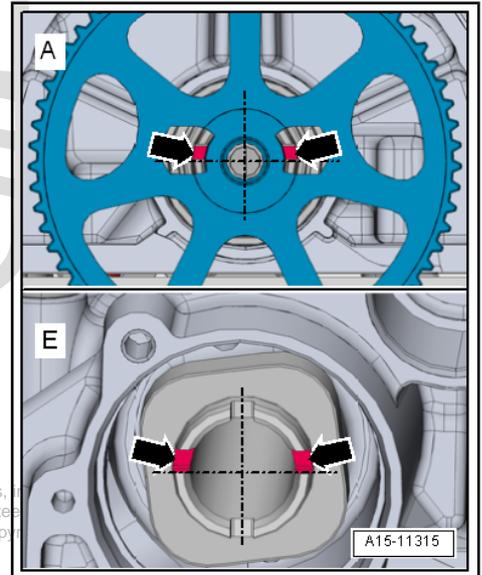
A - Exhaust camshaft

E - Inlet camshaft

 **Note**

The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In "TDC" position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.

- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to "TDC" position.

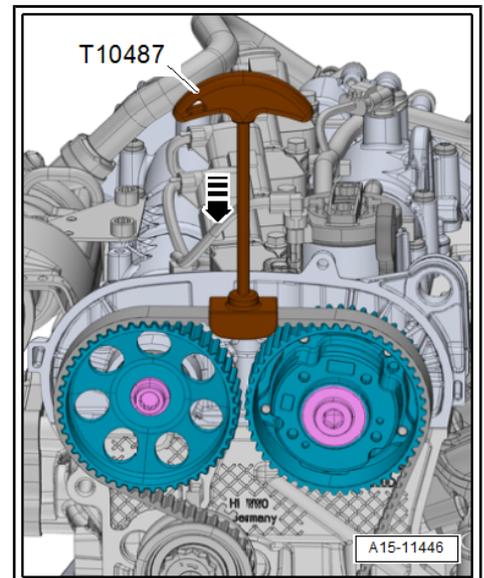


 **Note**

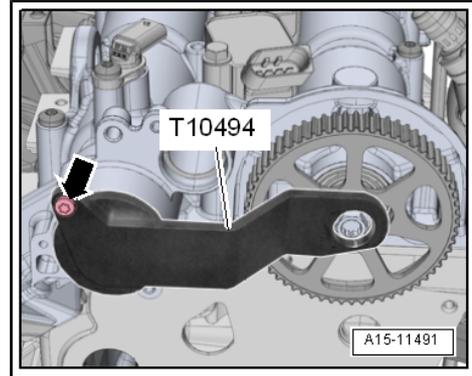
- ◆ *It should be possible to insert the camshaft clamp -T10494- easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

If the camshaft clamp - T10494- cannot slide into position easily.

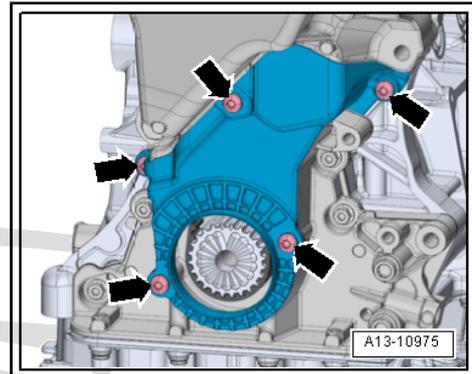
- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.



- Insert camshaft clamp -T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.
- Remove poly-V-belt pulley ⇒ [page 45](#) .



- Unscrew bolts -arrows-, and remove lower toothed belt guard.



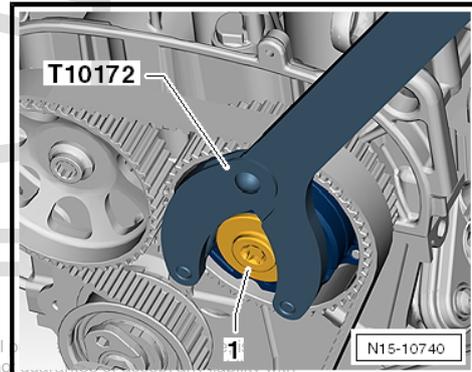
- Unscrew plug -1- on camshaft sprocket on intake side using counterhold tool - T10172- with adapter -T10172/2- .

NOTICE

Risk of damage to camshaft caused by improper handling.

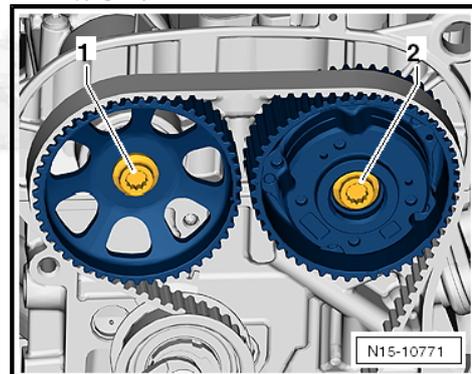
- **Never use the camshaft clamp for counterholding.**

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



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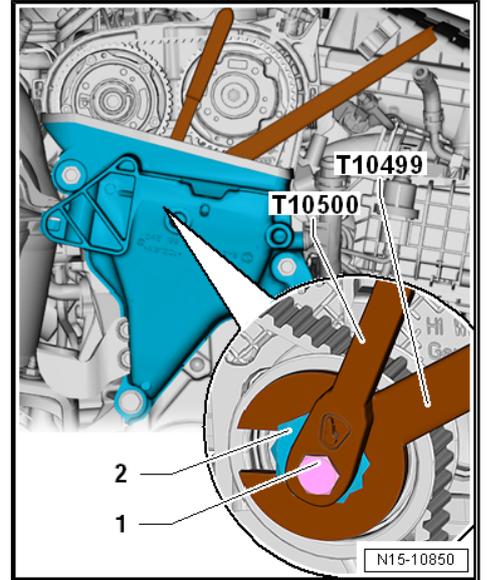
- Loosen bolts -1, 2- approx. 1 turn using counterhold - T10172- with adapter -T10172/1- and -T10172/2- .



- Loosen bolt -1- with tool insert - T10500- .
- Release tensioning roller on eccentric adjuster -2- using 30 mm ring spanner - T10499- .

Risk of damage to engine

- ◆ Risk of damage to the toothed belt.
 - ◆ The toothed belt is made of glass fibre fabric.
 - ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
 - ◆ Otherwise the service life of the toothed belt will be reduced.
 - ◆ The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.
- Removing notched belt

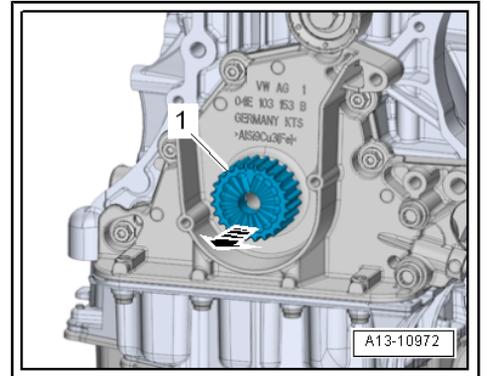


- Detach crankshaft sprocket -1- -arrow-.

Installing (adjusting the valve timing)

 **Note**

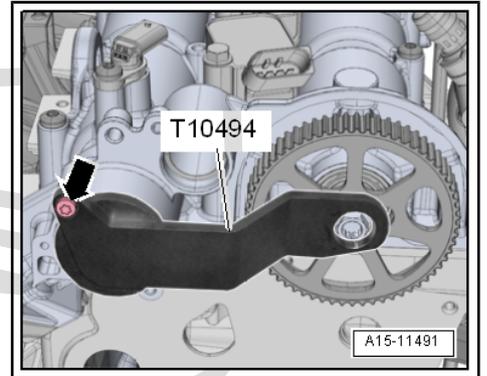
- ◆ Renew bolts that are tightened with specified further tightening angle.
 - ◆ Renew O-ring of plug if damaged.
- Check "TDC" position of camshaft and crankshaft:



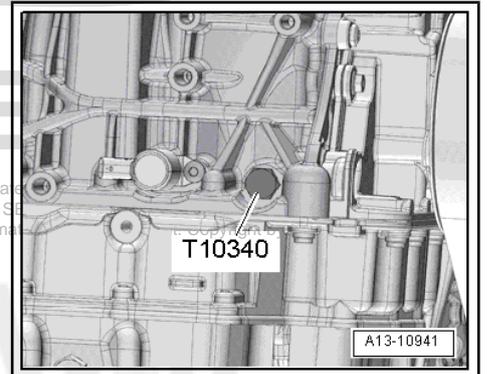
- Camshaft clamp -T10494- must be attached to camshaft housing.

 **NOTICE**

- Risk of damage to camshaft caused by improper handling.**
- Never use the camshaft clamp for counterholding.

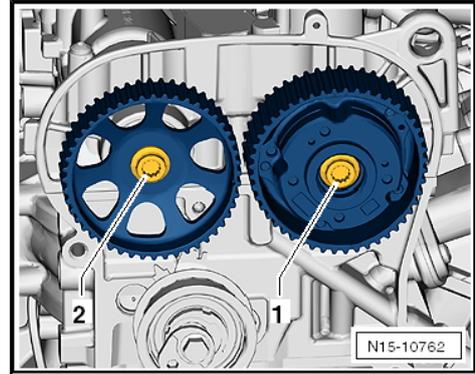


- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.

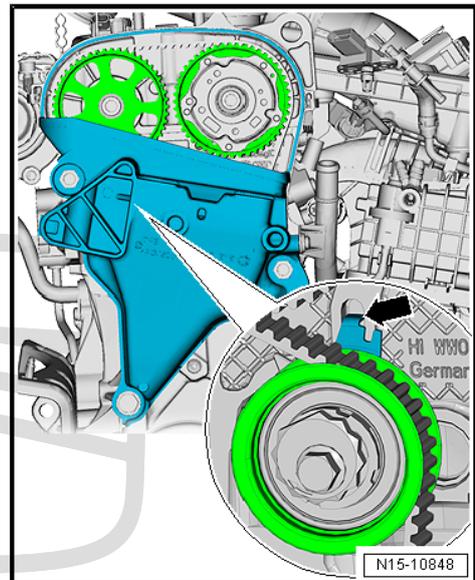


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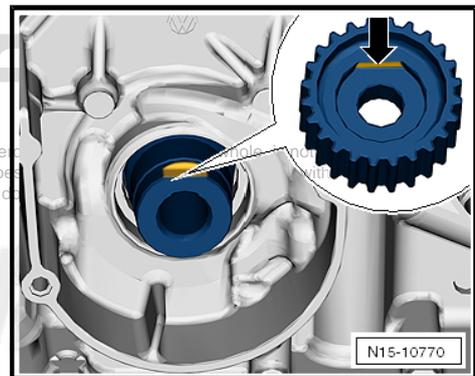
- Fit new bolts -1, 2- for camshaft sprockets, but do not tighten.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



- The sheet-metal tab -arrow- of the belt tensioner must engage in the cast notch of the cylinder head.



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

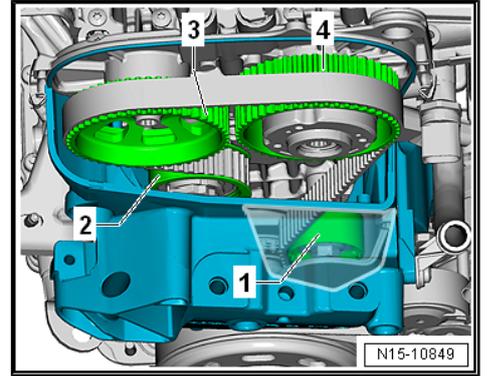


Risk of damage to engine

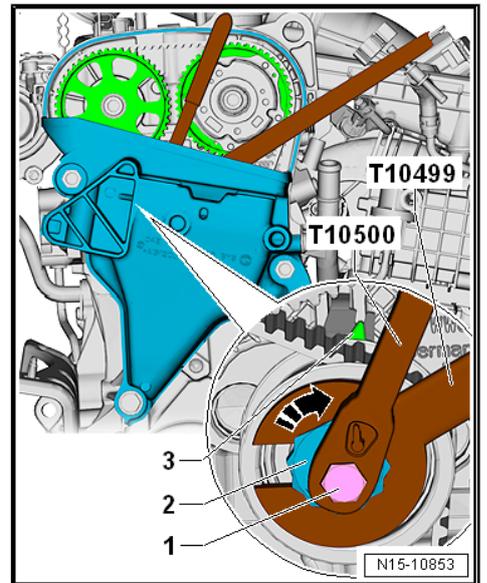
- ◆ Risk of damage to the toothed belt.
- ◆ The toothed belt is made of glass fibre fabric.
- ◆ Therefore, the toothed belt must not be smaller than 50 mm in diameter.
- ◆ Otherwise the service life of the toothed belt will be reduced.
- ◆ The contact points between the toothed belt and components such as camshaft pulleys, tensioning roller and idler pulley must be free of oil.

Observe sequence when fitting the toothed belt

- Pull toothed belt upwards and fit it on idler roller -1-, tensioner roller -2- and camshaft pulleys -3- and -4-.



- Using the ring spanner SW 30 - T10499- , turn the eccentric -2- of the tensioning roller in the direction of the -arrow- until the adjustment pointer -3- is positioned about 10 mm to the right of the setting window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.



Note

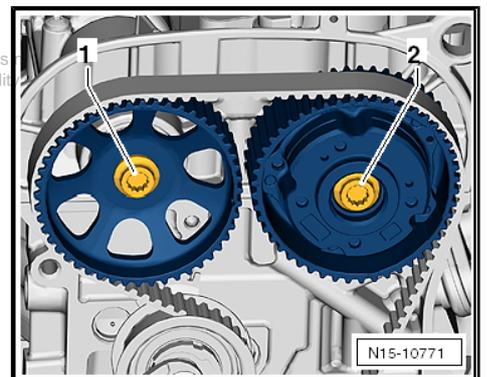
- ◆ *Torque wrench - VAS 6583- must be used for tightening.*
- ◆ *When setting the specified torque on the torque wrench - VAS 6583- , the length indicated on the insert tool - T10500- must be entered in the torque wrench.*
- ◆ *If you use a conventional torque wrench you might possibly tighten the bolt of the tensioning roller with too much torque and damage it.*
- Hold eccentric in that position and tighten bolt -1- to 25 Nm using insert tool - T10500- with torque wrench - VAS 6583- .

Note

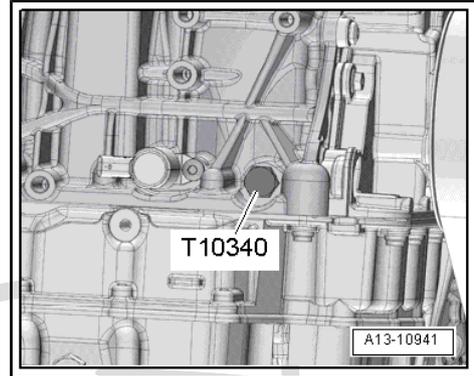
Turning the engine further or running the engine may lead to slight differences in the position of the adjustment indicator -3- in relation to the adjustment window. This does not affect the toothed belt tension or the timing.

- Tighten bolts -1, 2- initially to 50 Nm using counterhold - T10172- with adapter -T10172/1- and -T10172/2-

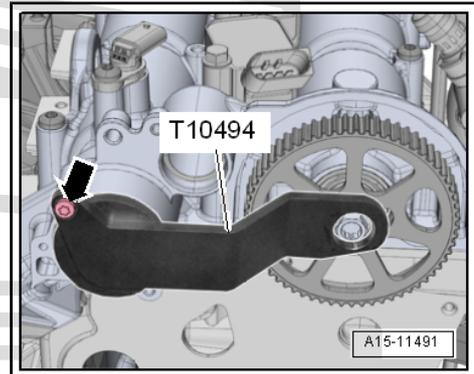
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- Remove locking pin - T10340- .

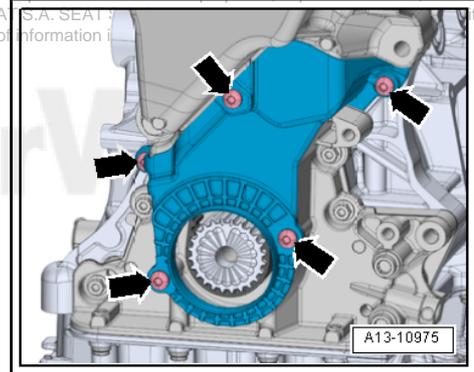


- Remove bolt -arrow- and detach camshaft clamp -T10494-



- Install toothed belt cover (bottom section) -arrows-

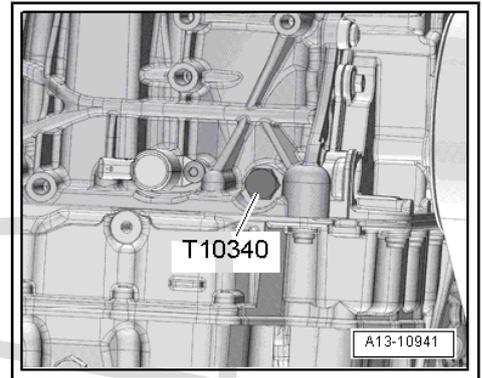
- Install vibration damper => [page 45](#) .



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Check valve timing:

- Turn crankshaft 2 turns in direction of rotation of engine.
- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Rotate crankshaft further in normal direction of rotation as far as stop.
- The locking pin is now in contact with the crank web.



 **Note**

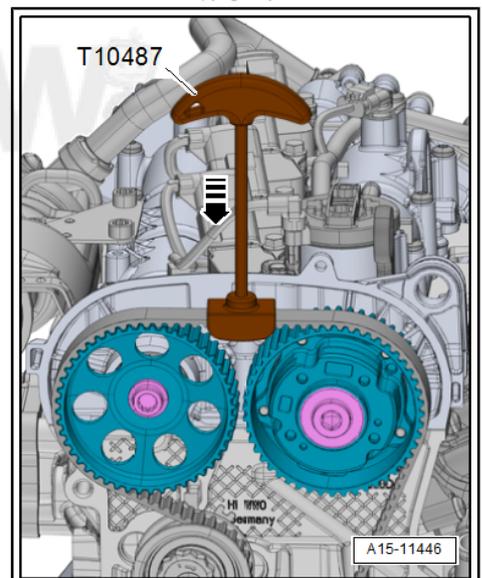
The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

 **Note**

- ◆ *It should be possible to insert the camshaft clamp -T10494- easily.*
- ◆ *The camshaft clamp must not be positioned using any kind of hammer.*

If the camshaft clamp - T10494- cannot slide into position easily,

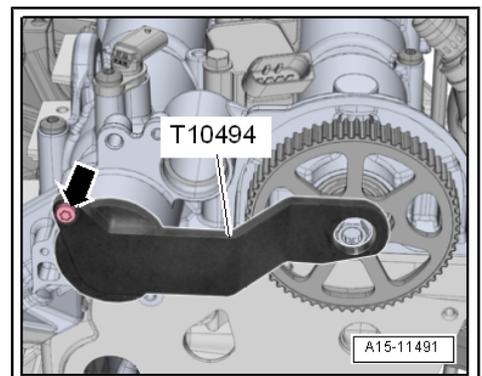
- Use the assembly tool - T10487- to push on toothed belt in -direction of arrow-.



- Insert camshaft clamp -T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.

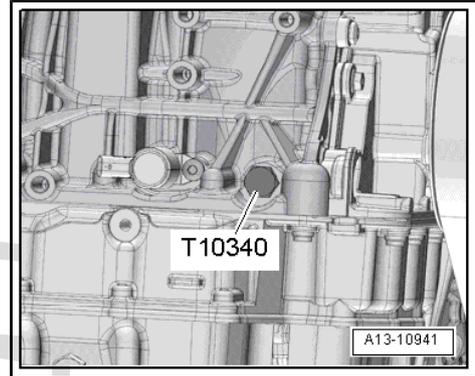
If it is not possible to insert camshaft clamp -T10494- , valve timing is not OK.

- Repeat adjustment of valve timing.

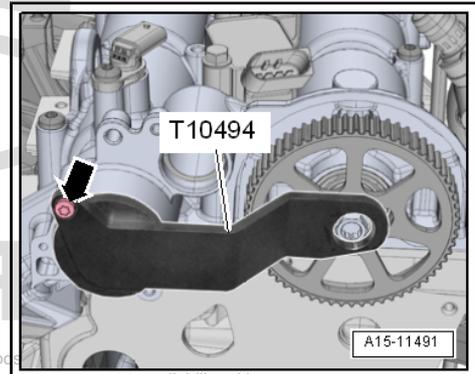


If it is possible to insert camshaft clamp -T10494- , valve timing is OK.

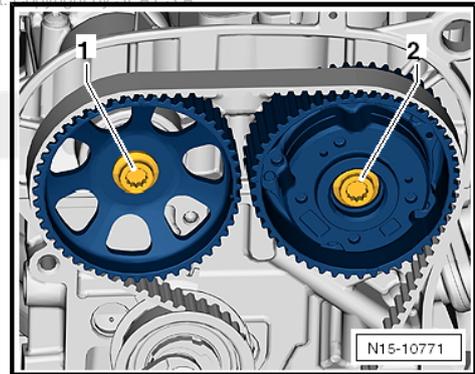
- Remove locking pin - T10340- .



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



- Tighten bolts -1, 2- to final tightening torque => [page 96](#) using counterhold - T10172- with adapter -T10172/1- and - T10172/2- .



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- Tighten plug -1- using counterhold tool - T10172- with adapter -T10172/1- .

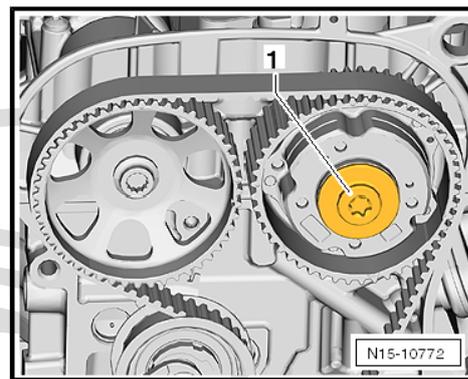
Risk of damage to engine

- ◆ After completing work, check that locking pin - T10340- and camshaft clamp -T10494- have been removed.

Install in the reverse order of removal, observing the following:

Specified torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 36](#)
- ◆ ⇒ [“2.1 Exploded view - toothed belt cover”, page 95](#)
- ◆ ⇒ [“2.2 Exploded view - toothed belt”, page 96](#)
- ◆ ⇒ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 97](#)
- ◆ ⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)
- ◆ ⇒ [“3.1 Exploded view - crankcase breather system”, page 238](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 295](#)
- ◆ ⇒ [“2.1 Assembly overview - charge air system”, page 306](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 50 ; Removing and installing noise insulation



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3 Valve control

- ⇒ [“3.1 Assembly overview - valve gear”, page 192](#)
- ⇒ [“3.2 Valve 1 for variable distribution N205 removing and fitting”, page 193](#)
- ⇒ [“3.3 Removing and installing exhaust camshaft control valve 1 N318”, page 194](#)
- ⇒ [“3.4 Removing and installing cam actuators”, page 195](#)
- ⇒ [“3.5 Removing and installing camshaft adjuster”, page 199](#)
- ⇒ [“3.6 Measuring axial play of camshaft”, page 202](#)
- ⇒ [“3.7 Removing and installing camshaft oil seal”, page 203](#)
- ⇒ [“3.8 Removing and installing valve stem seals”, page 214](#)

3.1 Assembly overview - valve gear

1 - Inlet valve

- Do not rework. Only lapping in is permitted.
- Valve dimensions
⇒ [page 223](#)
- Checking valve guides
⇒ [page 222](#)

2 - Outlet valve

- Do not rework. Only lapping in is permitted.
- Valve dimensions
⇒ [page 223](#)
- Checking valve guides
⇒ [page 222](#)

3 - Cylinder head

4 - Valve stem oil seal

- Replace ⇒ [page 214](#)

5 - Valve spring

- Installation position
⇒ [page 193](#)

6 - Valve plate spring

7 - Valve cotter

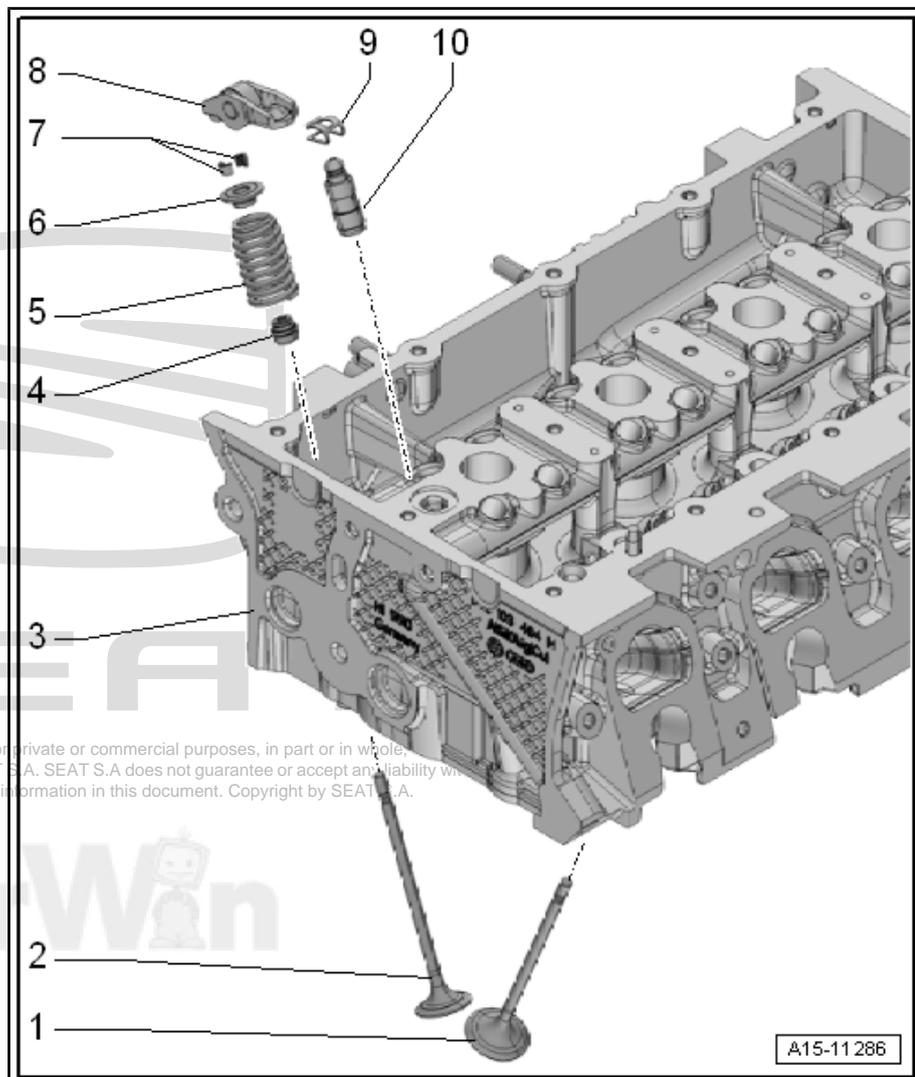
8 - Roller rocker finger

- Removing and installing
⇒ [“1.4 Removing and installing camshaft housing”, page 88](#)
- Mark installation position for re-installation
- Check tapered roller bearing for ease of movement.

- Lubricate contact surfaces before installing

9 - Clip

- For the hydraulic valve compensation element

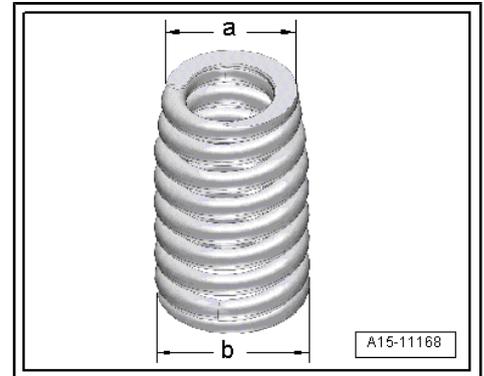


10 - Hydraulic compensation element

- Do not exchange position
- Lubricate contact surface

Position of valve spring

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



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3.2 Valve 1 for variable distribution - N205-removing and fitting

⇒ [“3.2.1 Removing and installing valve 1 for variable distribution N205 regulation, engine codes CHPA, CZDA, CZEA”, page 193](#)

⇒ [“3.2.2 Removing and installing valve 1 for variable distribution N205 regulation, engine codes CMBA, CXSA, CZCA”, page 194](#)

3.2.1 Removing and installing valve 1 for variable distribution - N205- regulation, engine codes CHPA, CZDA, CZEA

Removing

- Unplug the electrical connector -1-.
- Unscrew bolt -2- and remove camshaft control valve 1 - N205- .

Installation

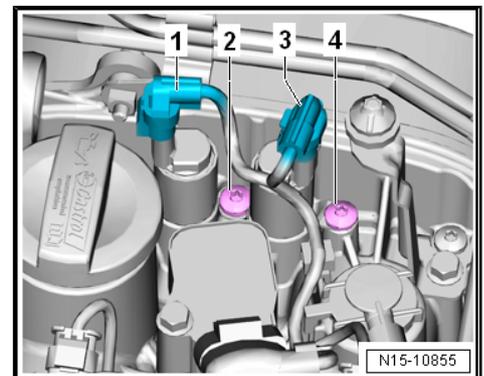
Install in the reverse order of removal, observing the following:



Replace the O-ring.

Specified torques

- ◆ ⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)

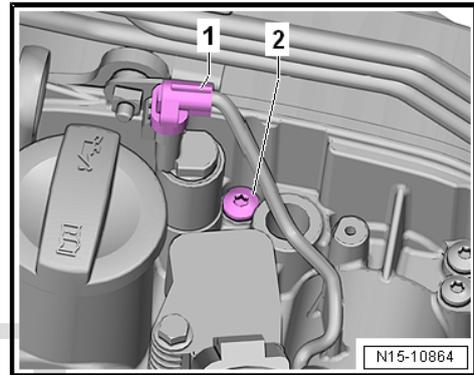


3.2.2 Removing and installing valve 1 for variable distribution - N205- regulation, engine codes CMBA, CXSA, CZCA

Removing

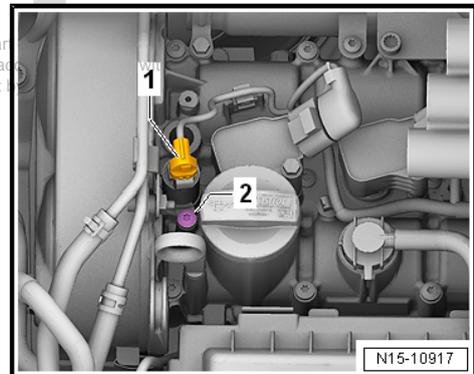
Variant 1:

- Release and unplug electrical connector -1-.
- Unscrew bolt -2- and remove camshaft control valve 1 - N205- .



Variant 2:

- Release and unplug electrical connector -1-.
- Unscrew bolt -2- and remove camshaft control valve 1 - N205- .



Installation

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



Note

- ◆ Check O-ring for damage.
- ◆ If it is damaged, renew it together with camshaft control valve 1 - N205- .
- ◆ The O-ring cannot be renewed individually.

Specified torques

- ◆ ⇒ [page 78](#)

3.3 Removing and installing exhaust camshaft control valve 1 - N318-

Removing

- Unplug the electrical connector -3-.
- Unscrew bolt -4- and remove exhaust camshaft control valve 1 - N318- .

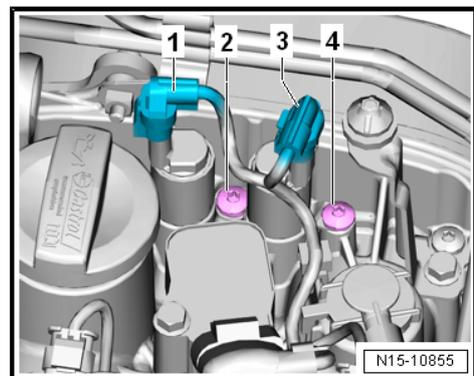
Installation

Install in the reverse order of removal, observing the following:



Note

Replace the O-ring.



Specified torques

- ◆ ⇒ [“1.2 Exploded view - camshaft housing”, page 78](#)

3.4 Removing and installing cam actuators

⇒ [“3.4.1 Removing and installing exhaust cam actuator for cylinder 2 N587”, page 195](#)

⇒ [“3.4.2 Removing and installing exhaust cam actuator for cylinder 3 N595”, page 196](#)

⇒ [“3.4.3 Removing and installing inlet cam actuator for cylinder 2 N583”, page 197](#)

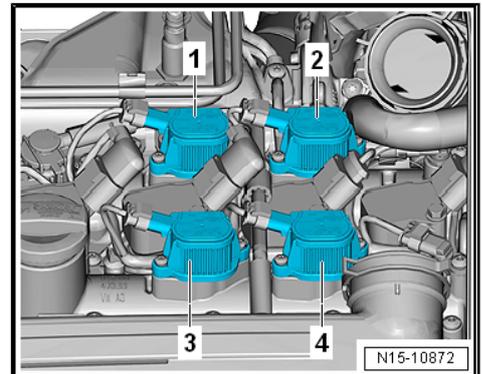
⇒ [“3.4.4 Removing and installing inlet cam actuator for cylinder 3 N591”, page 198](#)

3.4.1 Removing and installing exhaust cam actuator for cylinder 2 - N587-

Fitting location overview - cam actuators

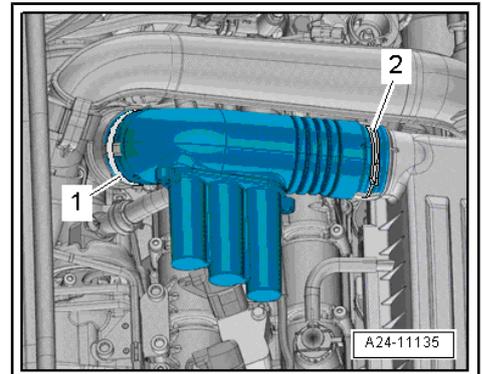
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- 1 - Exhaust cam actuator for cylinder 2 - N587-
- 2 - Exhaust cam actuator for cylinder 3 - N595-
- 3 - Inlet cam actuator for cylinder 2 - N583-
- 4 - Inlet cam actuator for cylinder 3 - N591-



Removing

- Loosen hose clips -1- and -2- and remove air pipe.



- Unplug relevant electrical connector -1-.
- Remove bolts -arrows- and detach cam actuator.

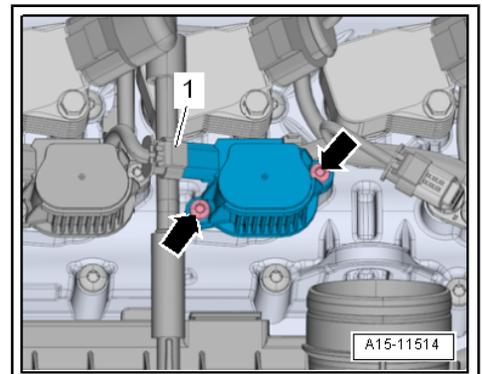
Installation

Install in the reverse order of removal, observing the following:



Note

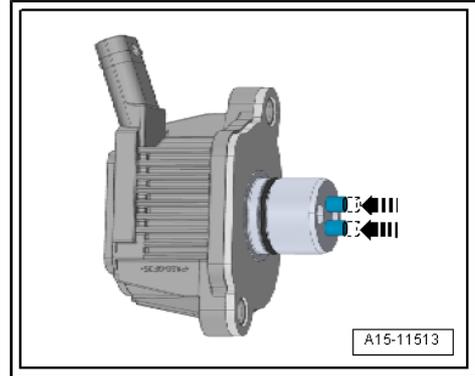
Replace the O-ring.



- Bring pins of cam actuator into installation position.
- Pins of actuators must be inserted completely -arrows-.

Specified torques

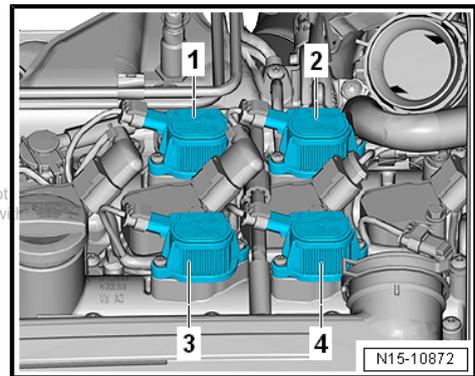
- ◆ => ["1.2.1 Assembly overview - camshaft housing, engine code CZEA", page 78](#)
- ◆ => ["1.1 Exploded view - turbocharger", page 295](#)



3.4.2 Removing and installing exhaust cam actuator for cylinder 3 - N595-

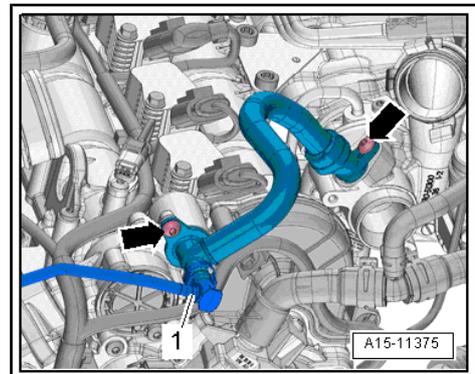
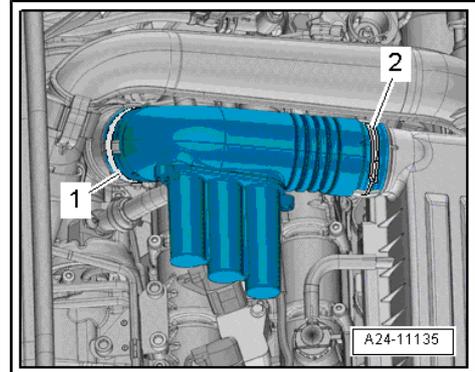
Fitting location overview - cam actuators

- 1 - Exhaust cam actuator for cylinder 2 - N587-
- 2 - Exhaust cam actuator for cylinder 3 - N595-
- 3 - Inlet cam actuator for cylinder 2 - N583-
- 4 - Inlet cam actuator for cylinder 3 - N591-



Removing

- Loosen hose clips -1- and -2- and remove air pipe.
- Press release tabs and disconnect hose -1- for activated charcoal filter.
- Remove bolts -arrows- and press crankcase breather hose slightly to one side.



- Unplug relevant electrical connector -1-.
- Remove bolts -arrows- and detach cam actuator.

Installation

Install in the reverse order of removal, observing the following:



Note

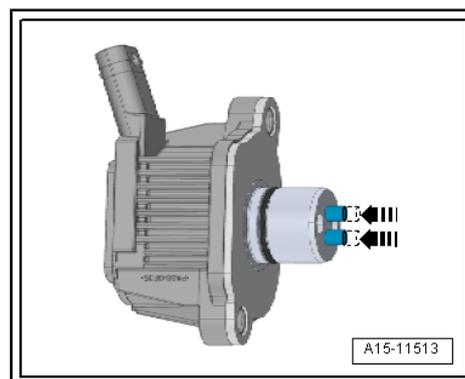
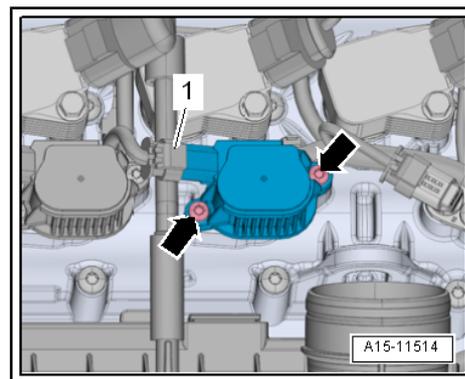
Replace the O-ring.

- Bring pins of cam actuator into installation position.

Pins of actuators must be inserted completely -arrows-.

Specified torques

- ◆ ⇒ ["1.2.1 Assembly overview - camshaft housing, engine code CZEA", page 78](#)
- ◆ ⇒ ["1.1 Exploded view - turbocharger", page 295](#)

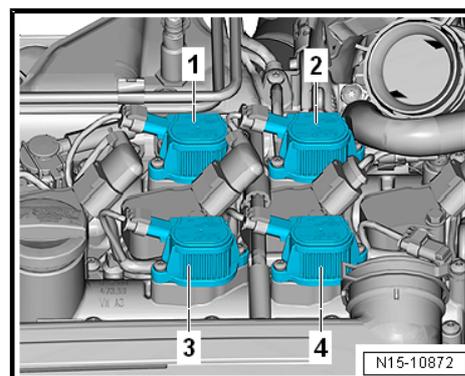


3.4.3 Removing and installing inlet cam actuator for cylinder 2 - N583-

Fitting location overview - cam actuators

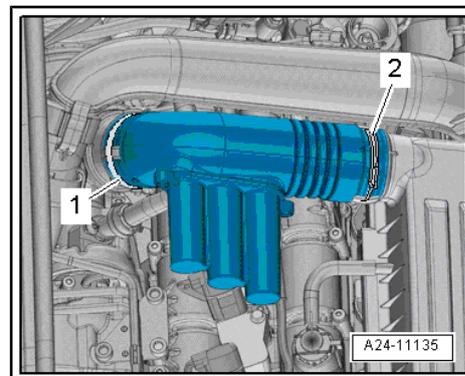
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- 1 - Exhaust cam actuator for cylinder 2 - N587-
- 2 - Exhaust cam actuator for cylinder 3 - N595-
- 3 - Inlet cam actuator for cylinder 2 - N583-
- 4 - Inlet cam actuator for cylinder 3 - N591-



Removing

- Loosen hose clips -1- and -2- and remove air pipe.



- Unplug relevant electrical connector -1-.
- Remove bolts -arrows- and detach cam actuator.

Installation

Install in the reverse order of removal, observing the following:



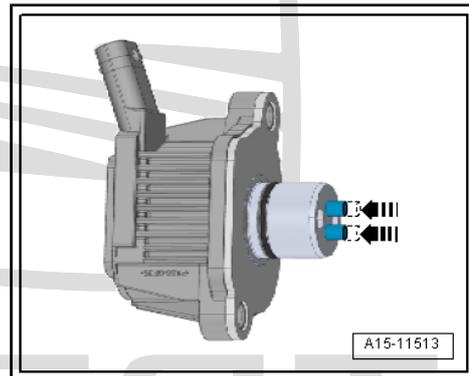
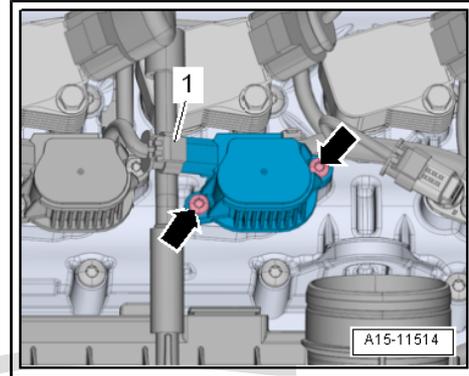
Note

Replace the O-ring.

- Bring pins of cam actuator into installation position.
- Pins of actuators must be inserted completely -arrows-.

Specified torques

- ◆ ⇒ ["1.2.1 Assembly overview - camshaft housing, engine code CZEA", page 78](#)
- ◆ ⇒ ["1.1 Exploded view - turbocharger", page 295](#)

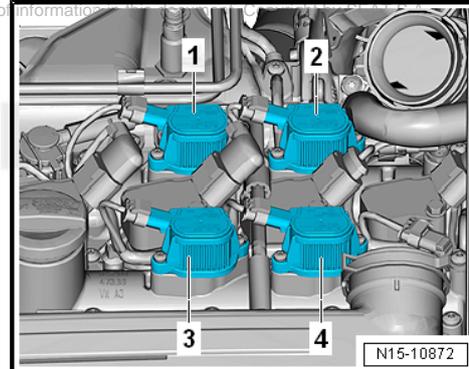


3.4.4 Removing and installing inlet cam actuator for cylinder 3 - N591-

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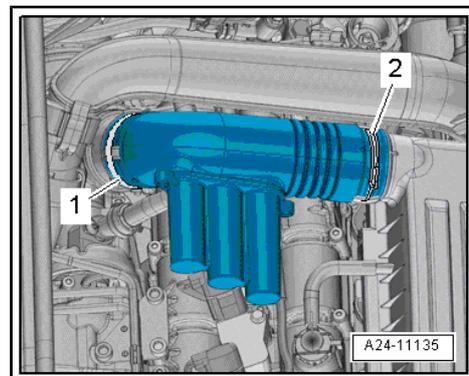
Fitting location overview - cam actuators

- 1 - Exhaust cam actuator for cylinder 2 - N587-
- 2 - Exhaust cam actuator for cylinder 3 - N595-
- 3 - Inlet cam actuator for cylinder 2 - N583-
- 4 - Inlet cam actuator for cylinder 3 - N591-



Removing

- Loosen hose clips -1- and -2- and remove air pipe.



- Unplug relevant electrical connector -1-.
- Remove bolts -arrows- and detach cam actuator.

Installation

Install in the reverse order of removal, observing the following:

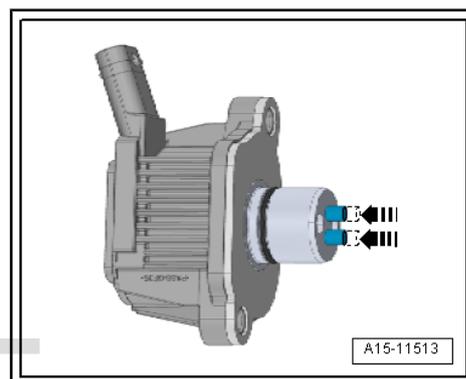
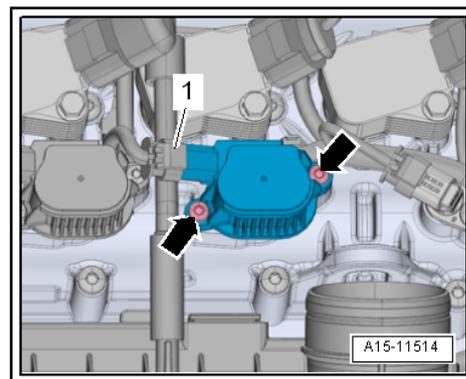


Replace the O-ring.

- Bring pins of cam actuator into installation position.
Pins of actuators must be inserted completely -arrows-.

Specified torques

- ◆ ⇒ ["1.2.1 Assembly overview - camshaft housing, engine code CZEA", page 78](#)
- ◆ ⇒ ["1.1 Exploded view - turbocharger", page 295](#)



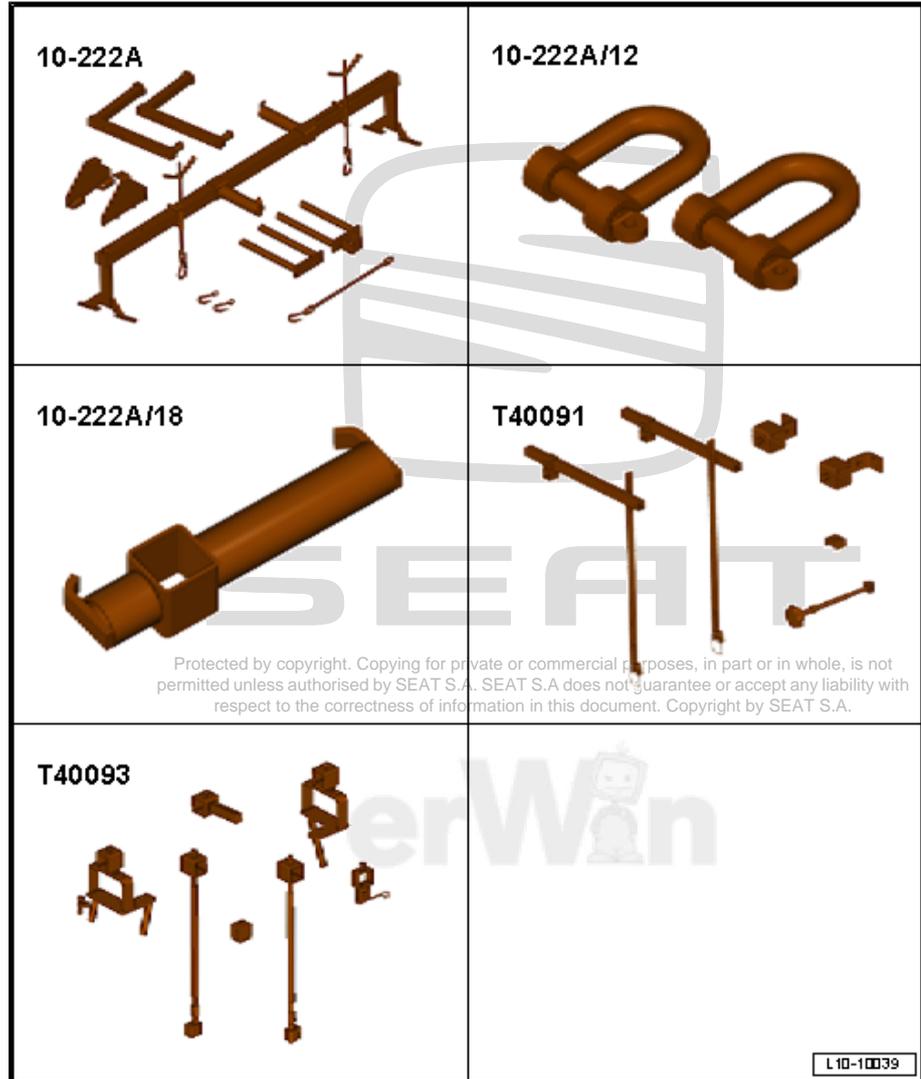
3.5 Removing and installing camshaft adjuster

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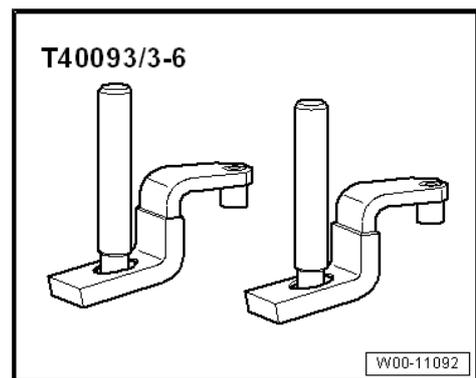
Special tools for removing and installing the camshaft adjuster of exhaust camshaft

Special tools and workshop equipment required

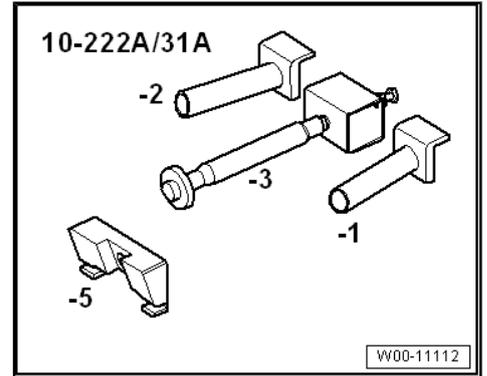
- ◆ Support. - 10 - 222 A-
- ◆ Shackle - 10 - 222 A /12-
- ◆ Adapter for the engine bracket - 10 222A/18-
- ◆ Square pipe - T40091/1- and connector - T40091/3-
- ◆ Spindle from engine support supplement set - T40093 /3-



- ◆ Adapter - T40093/3 6-



- ◆ Support tool - 10 - 222 A /31A- , adapter - 10 - 222 A /31-1- , adapter - 10 - 222 A /31-2-



- ◆ Wedge - 3409-



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Removing Camshaft adjuster for exhaust camshaft

Note

- ◆ *When disassembling the camshaft timing system for the inlet camshaft, engine mount and toothed belt cover only need to be loosened.*
- ◆ *For this, the bolts must be sufficiently loosened.*
- ◆ *Then, the top part of engine support is swung away from the engine.*

- Detach engine support ⇒ [page 46](#)
- Remove toothed belt from camshafts ⇒ [page 111](#) .

Camshaft adjuster for inlet camshaft

- Remove toothed belt from camshafts ⇒ [page 111](#) .

Installation

Install in the reverse order of removal, observing the following:

Note

Before installing the camshaft timing system, make sure that the guide bushing has been inserted in the camshaft.

Specified torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 27](#)
- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 36](#)

- ◆ ⇒ [“2.1 Exploded view - toothed belt cover”, page 95](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 280](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator
- ◆ Checking adjustment of assembly mountings ⇒ [page 34](#)

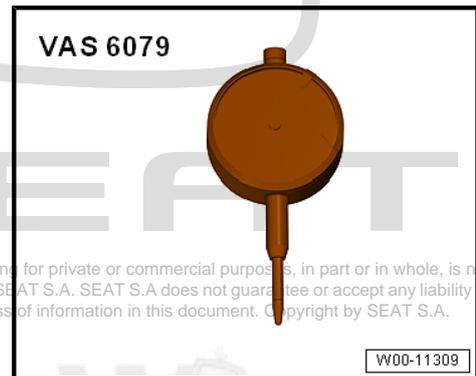
3.6 Measuring axial play of camshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Gauge - VAS 6079-



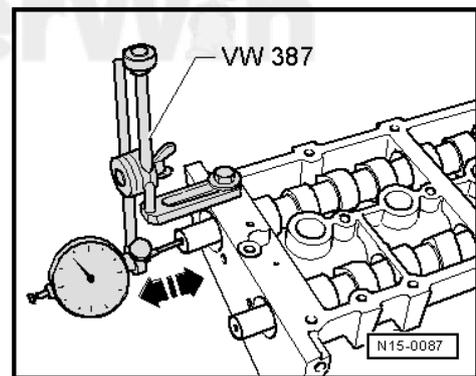
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Procedure

- Remove camshaft housing ⇒ [page 88](#) .
- Fasten dial gauge - VAS 6079- to the camshaft housing with universal dial gauge bracket - VW 387- as shown in the illustration.
- Press camshaft against dial gauge by hand.
- Set gauge to “zero”.
- Remove the camshaft from the gauge and read the result:

Axial clearance:

- Wear limit: 0.25 mm.



3.7 Removing and installing camshaft oil seal

⇒ [“3.7.1 Remove and install oil seal for inlet camshaft on pulley side, engine codes CHPA, CZEA, CZDA”, page 203](#)

⇒ [“3.7.2 Removing and installing inlet camshaft seal, pulley end, engine codes CMBA, CXSA and CZCA”, page 205](#)

⇒ [“3.7.3 Remove and install oil seal for exhaust camshaft on pulley side, engine codes CHPA, CZEA, CZDA”, page 207](#)

⇒ [“3.7.4 Removing and installing exhaust camshaft seal, pulley end, engine codes CMBA, CXSA and CZCA”, page 209](#)

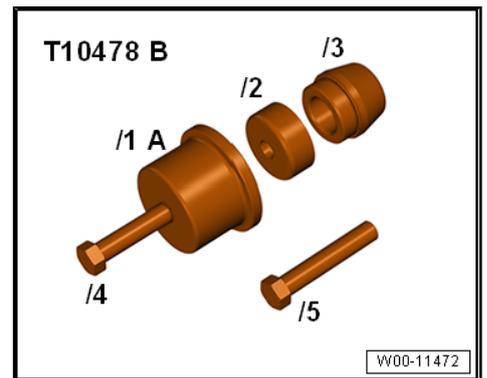
⇒ [“3.7.5 Removing and installing exhaust camshaft seal, gearbox side, engine code CZEA”, page 210](#)

⇒ [“3.7.6 Remove and install oil seal for exhaust camshaft, on gearbox side, engine codes CHPA, CMBA, CXSA, CZCA, CZDA”, page 213](#)

3.7.1 Remove and install oil seal for inlet camshaft on pulley side, engine codes CHPA, CZEA, CZDA

Special tools and workshop equipment required

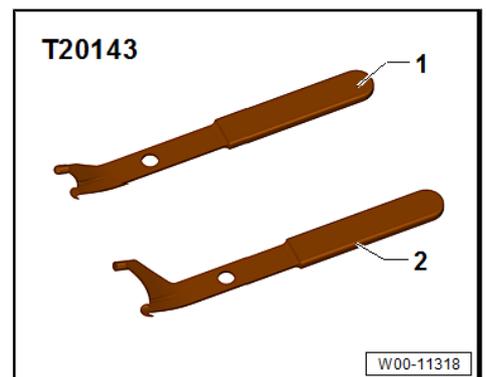
- ◆ Assembly tool - T10478 B-



- ◆ Puller hooks - T20143/1-



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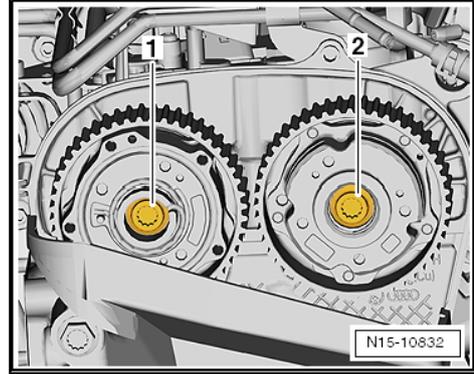


Removing

- Detach toothed belt from camshafts ⇒ [page 111](#) .
- Unscrew bolt -2- and remove camshaft sprocket.

Note

-Item 1- should be disregarded.

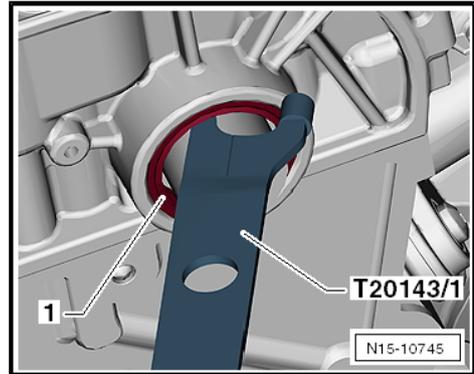
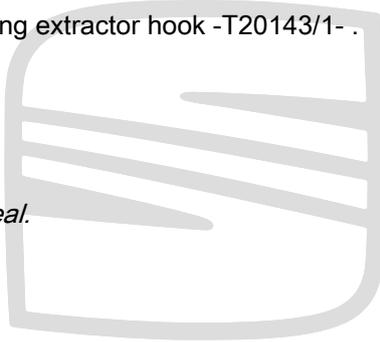


- Remove seal -1- using extractor hook -T20143/1- .

Installation

Note

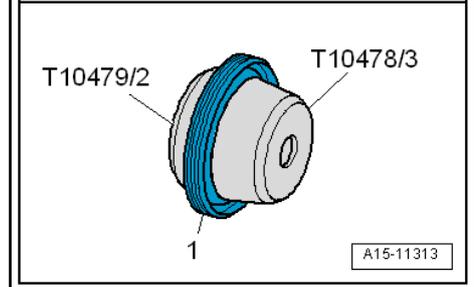
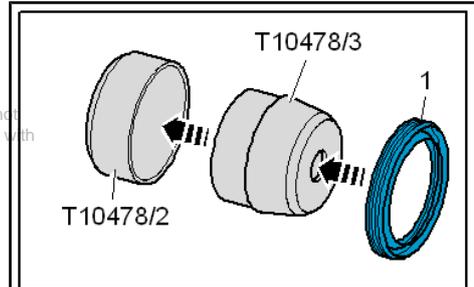
Do not lubricate new seal.



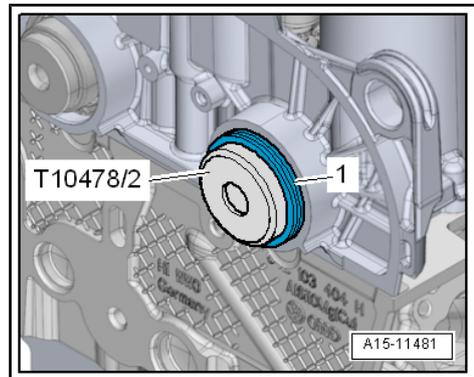
- Push the seal -1- onto the guide sleeve -T10478/2- ; this is done using the fitting sleeve -T10478/3- .

- Installation position: The closed side of the oil seal points toward the assembly sleeve.

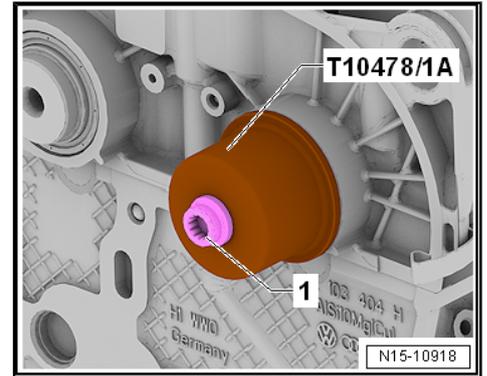
- Separate fitting sleeve from guide sleeve.



- Fit guide sleeve -T10478/2- with oil seal -1- onto camshaft.



- Draw in seal to stop using thrust piece -T10478/1A- and bolt -1- for camshaft pulley.
- Install notched belt (adjusting valve timing) ⇒ [page 111](#) .



3.7.2 Removing and installing inlet camshaft seal, pulley end, engine codes CMBA, CXSA and CZCA

Special tools and workshop equipment required

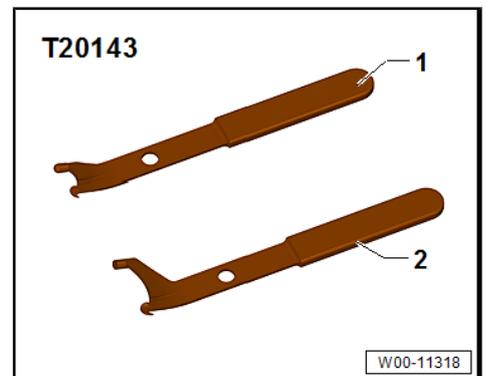
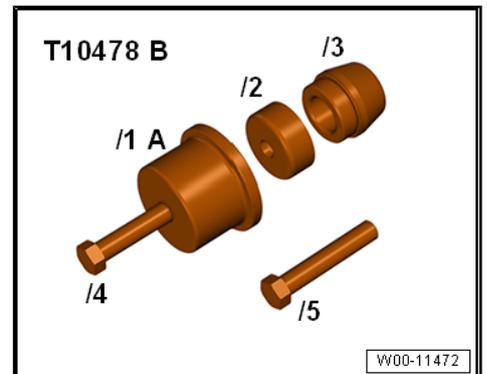
- ◆ Assembly tool - T10478 B-

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erWin

- ◆ Puller hooks - T20143/1-



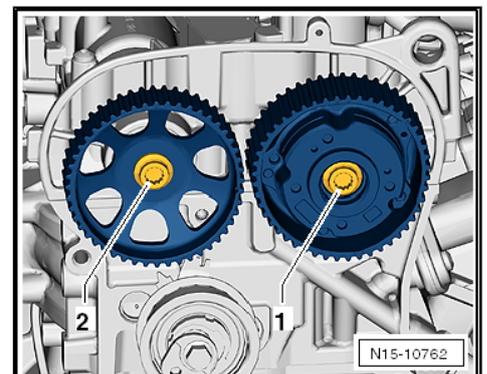
Removing

- Detach toothed belt from camshafts ⇒ [page 111](#) .
- Unscrew bolt -1- and remove camshaft sprocket.



Note

-Item 2- should be disregarded.



- Remove seal -1- using extractor hook -T20143/1- .

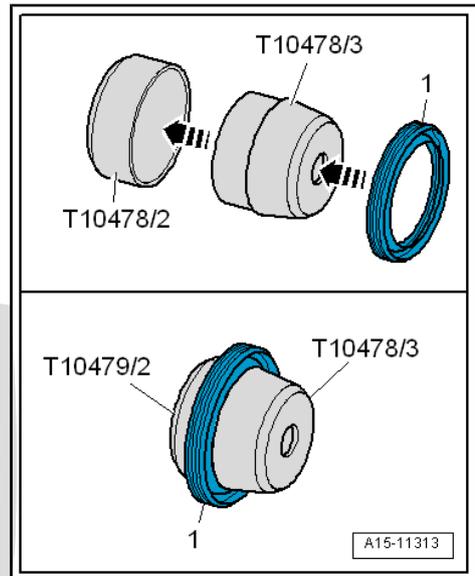
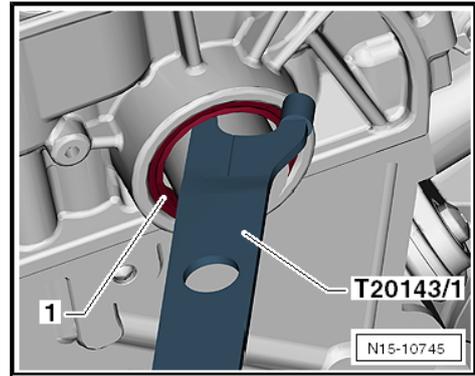
Installation



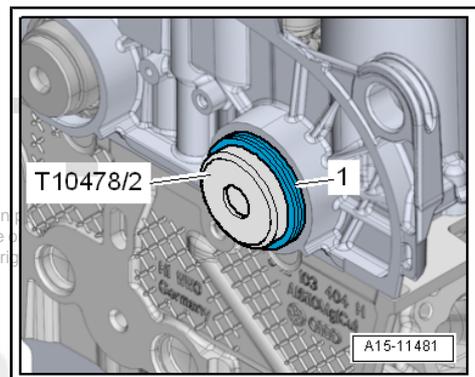
Note

Do not lubricate new seal.

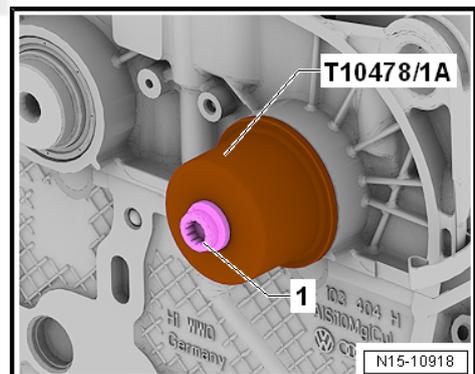
- Push the seal -1- onto the guide sleeve -T10478/2- ; this is done using the fitting sleeve -T10478/3- .
- Installation position: The closed side of the oil seal points toward the assembly sleeve.
- Separate fitting sleeve from guide sleeve.



- Fit guide sleeve -T10478/2- with oil seal -1- onto camshaft.



- Draw in seal to stop using thrust piece -T10478/1A- and insert bolt -1- for camshaft pulley.
- Install notched belt (adjusting valve timing) ⇒ [page 111](#)

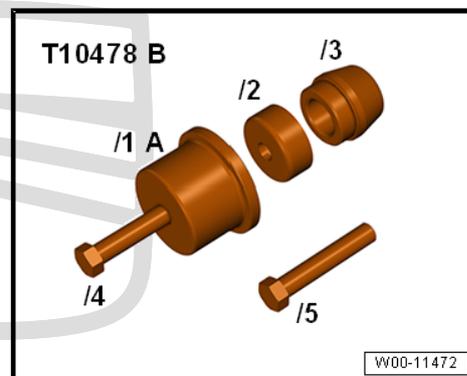


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3.7.3 Remove and install oil seal for exhaust camshaft on pulley side, engine codes CHPA, CZEA, CZDA

Special tools and workshop equipment required

- ◆ Assembly tool - T10478 B-



- ◆ Puller hooks - T20143/1-



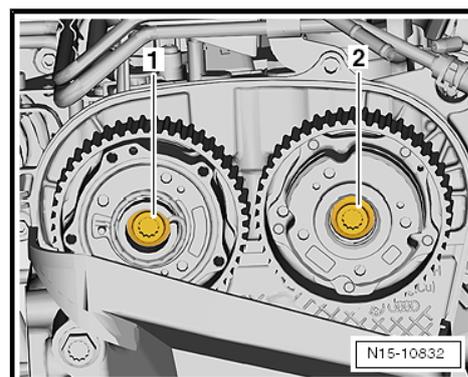
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Removing

- Detach toothed belt from camshafts ⇒ [page 111](#) .
- Remove engine support ⇒ [page 46](#) .
- Unscrew bolt -1- and remove camshaft sprocket.



-Item 2- should be disregarded.



- Remove seal -1- using extractor hook -T20143/1- .

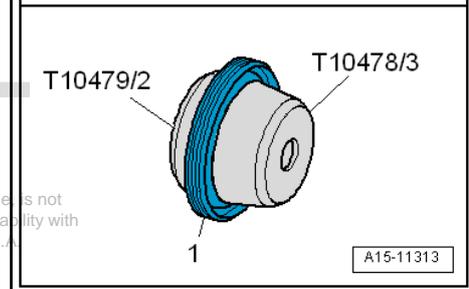
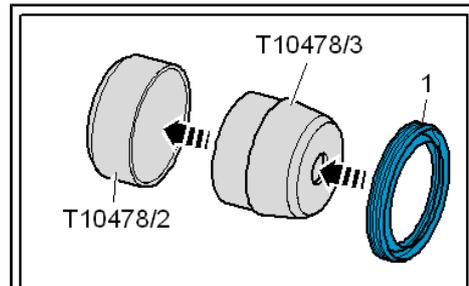
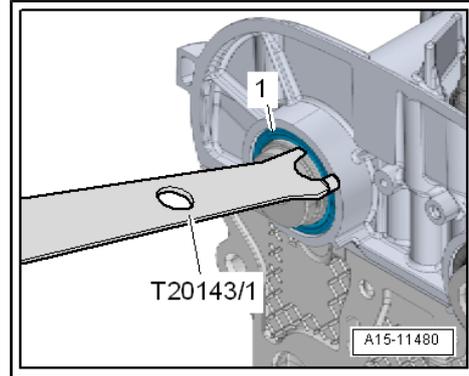
Installation



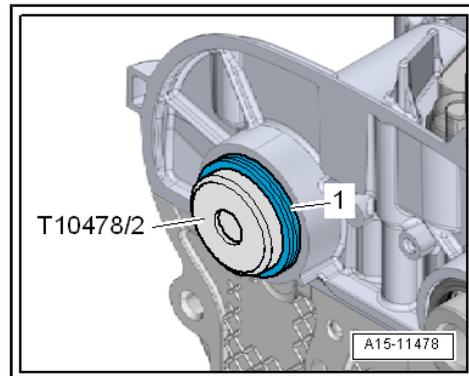
Note

Do not lubricate new seal.

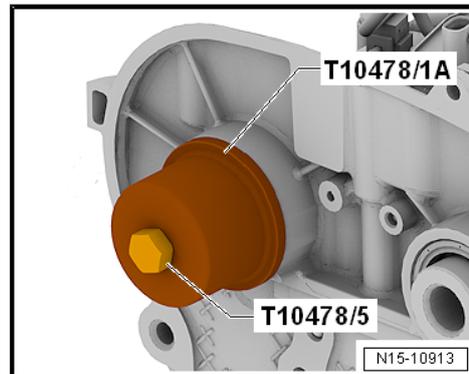
- Push the seal -1- onto the guide sleeve -T10478/2- ; this is done using the fitting sleeve -T10478/3- .
- Installation position: The closed side of the oil seal points toward the assembly sleeve.
- Separate fitting sleeve from guide sleeve.



- Fit guide sleeve -T10478/2- with oil seal -1- to camshaft.



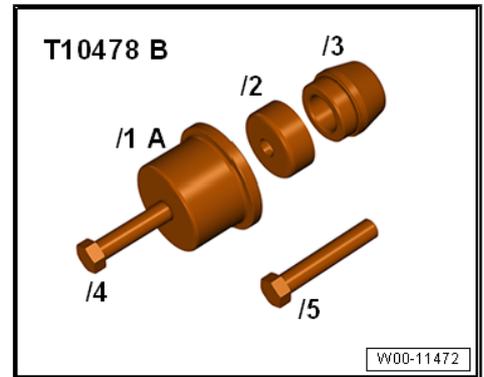
- Insert seal using the thrust block -T10478/1A- and bolt -T10478/5- as far as stop.
- Install notched belt (adjusting valve timing) ⇒ [page 111](#) .
- Install engine support ⇒ [page 46](#) .



3.7.4 Removing and installing exhaust camshaft seal, pulley end, engine codes CMBA, CXSA and CZCA

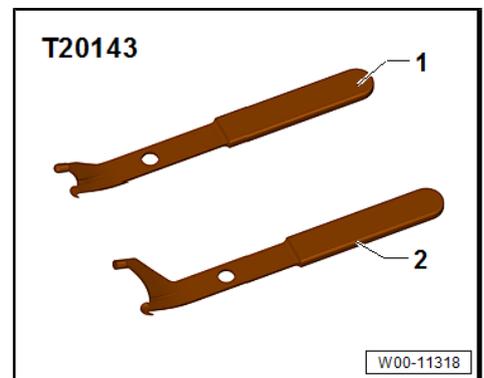
Special tools and workshop equipment required

- ◆ Assembly tool - T10478 B-



- ◆ Puller hooks - T20143/1-

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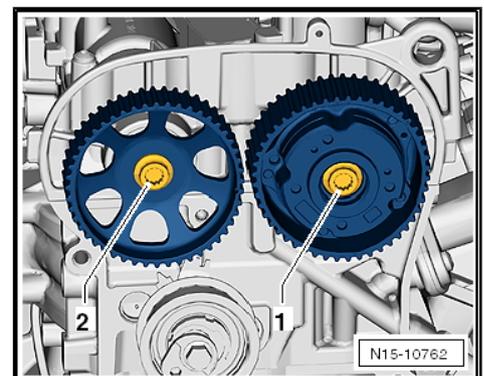
Removing

- Detach toothed belt from camshafts ⇒ [page 111](#) .
- Unscrew bolt -2- and remove camshaft sprocket.

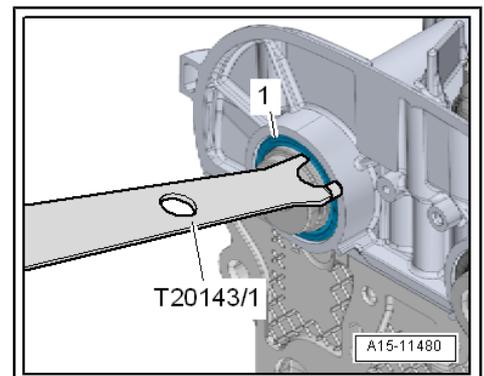


Note

-Item 1- should be disregarded.



- Remove seal -1- using extractor hook -T20143/1- .



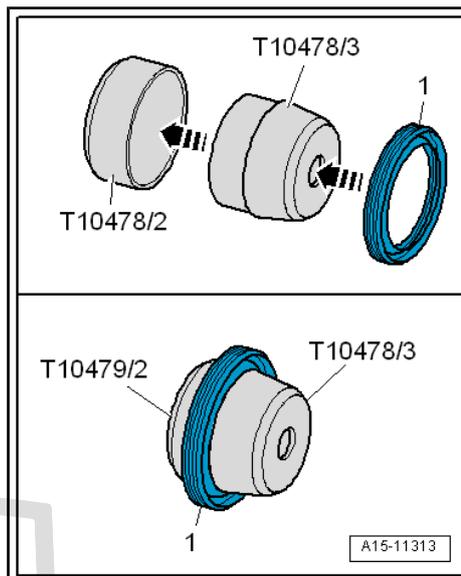
Installation



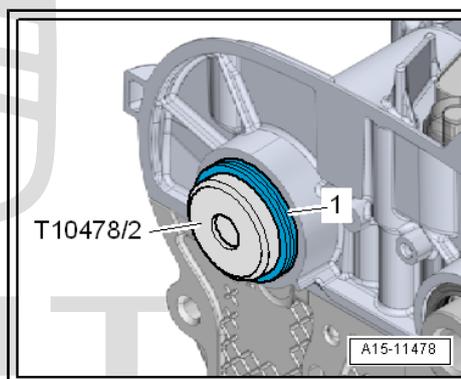
Note

Do not lubricate new seal.

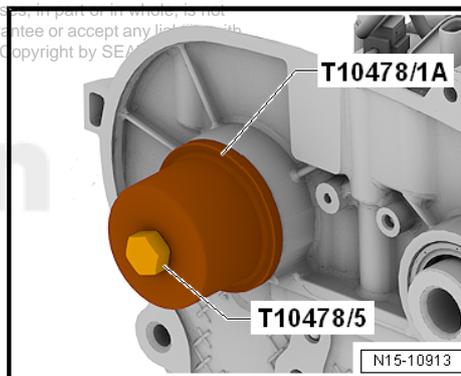
- Push the seal -1- onto the guide sleeve -T10479/2- ; this is done using the fitting sleeve -T10478/3- .
- Installation position: The closed side of the oil seal points toward the assembly sleeve.
- Separate fitting sleeve from guide sleeve.



- Fit guide sleeve -T10478/2- with oil seal -1- to camshaft.



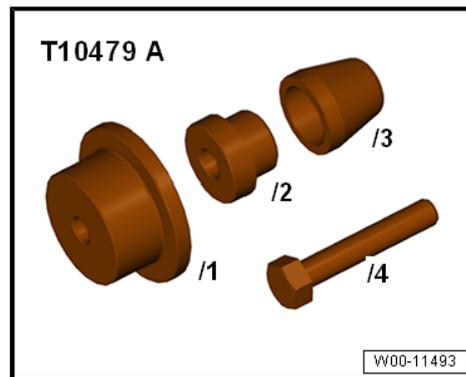
- Insert seal using the thrust block -T10478/1A- and bolt -T10478/5- as far as stop.
- Install notched belt (adjusting valve timing) ⇒ [page 111](#) .



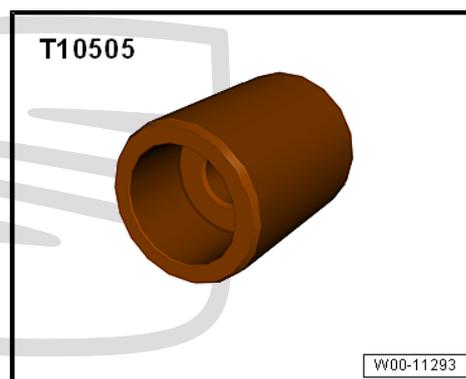
3.7.5 Removing and installing exhaust camshaft seal, gearbox side, engine code CZEA

Special tools and workshop equipment required

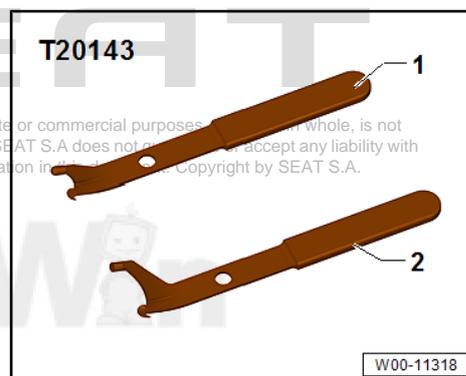
◆ Assembly tool - T10479 A-



◆ Slider - T10505-



◆ Puller hooks - T20143/1-



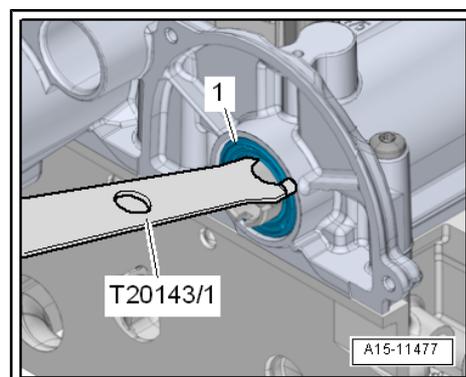
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- Remove toothed belt pulley for coolant pump ⇒ [page 267](#) .
- Carefully fit extractor hook -T20143/1- between camshaft and seal -1-.
- Lever out seal.

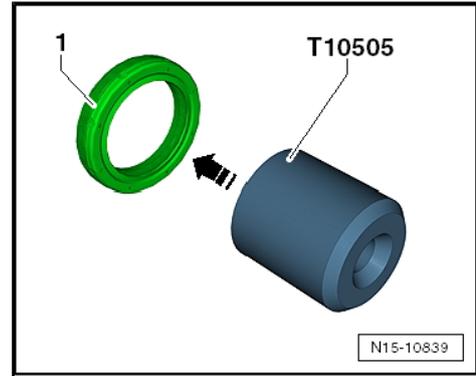
Installation



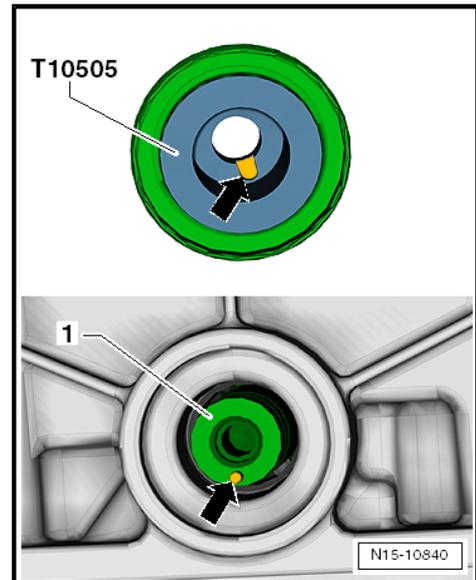
Do not lubricate new seal.



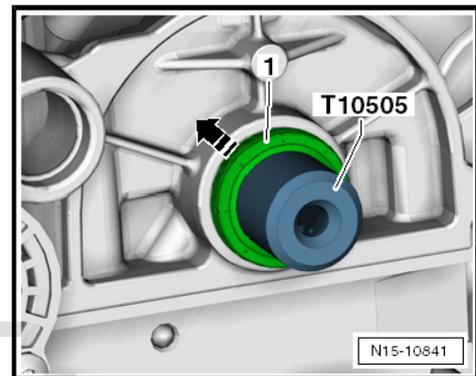
- Push assembly sleeve - T10505- in -direction of arrow- into seal -1-.
- Installation position: closed side of the oil seal points toward the assembly sleeve.
- Fit assembly sleeve - T10505- together with seal onto exhaust camshaft -1-.



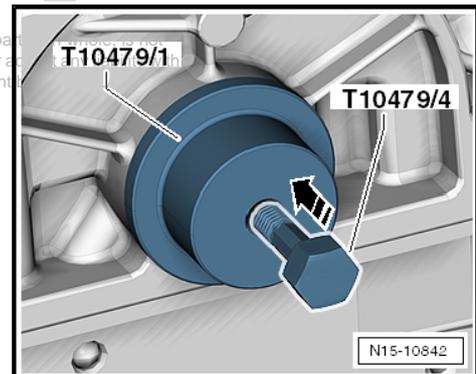
- Pin on camshaft -bottom arrow- must be positioned in recess on assembly sleeve -top arrow-.



- Push seal -1- in -direction of arrow- against camshaft housing.



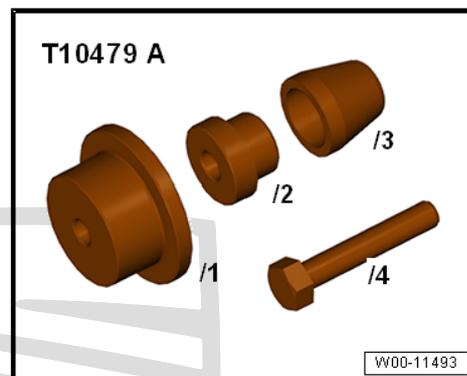
- Draw in oil seal to stop using thrust piece - T10479/1- and bolt - T10479/4- .
- Install toothed belt pulley for coolant pump => [page 267](#) .



3.7.6 Remove and install oil seal for exhaust camshaft, on gearbox side, engine codes CHPA, CMBA, CXSA, CZCA, CZDA

Special tools and workshop equipment required

- ◆ Assembly tool - T10479 A-



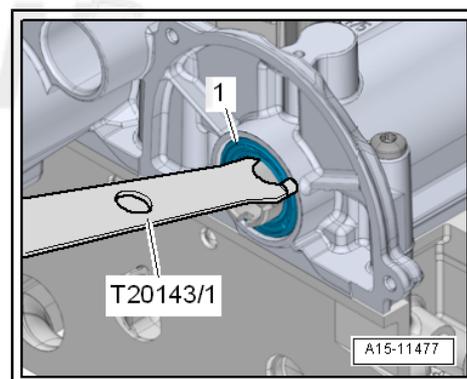
- ◆ Puller hooks - T20143/1-



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Removing

- Remove toothed belt pulley for coolant pump ⇒ [page 267](#).
- Carefully fit extractor hook -T20143/1- between camshaft and seal -1-.
- Lever out seal.

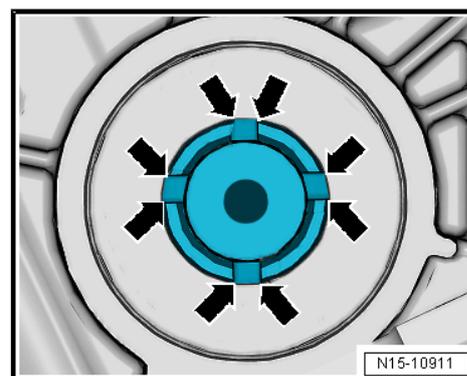


Installation

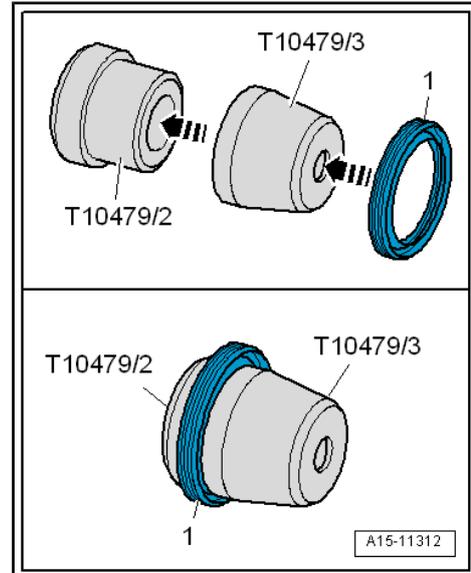
- Remove any burrs in the outer area of the grooves in the exhaust camshaft -arrows- using fine sandpaper (220 ... 1000 P).

 Note

Do not lubricate new oil seal.

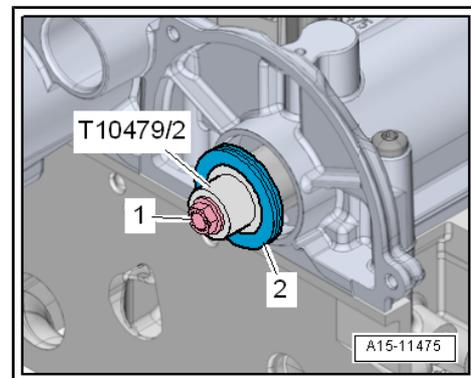


- Push the seal -1- onto the guide sleeve -T10479/2- ; this is done using the fitting sleeve -T10479/3- .
- Fitting position: The closed side of the oil seal shows towards the insertion bushing.
- Separate fitting sleeve from guide sleeve.

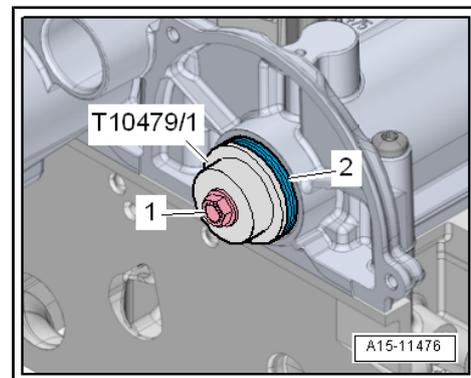


- Fit guide sleeve -T10479/2- with oil seal -2- centrally to camshaft.
- Secure guide sleeve onto camshaft using bolt -1- for coolant pump drive sprocket.
- Push seal onto camshaft and unbolt guide sleeve.

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- Draw in seal -2- to stop using thrust piece -T10479/1- and bolt -1- for toothed belt pulley for coolant pump.
- Install toothed belt pulley for coolant pump ⇒ [page 267](#) .



3.8 Removing and installing valve stem seals

⇒ [“3.8.1 Removing and installing valve stem oil seals \(cylinder head installed\)”, page 214](#)

⇒ [“3.8.2 Removing and installing valve stem oil seals \(cylinder head removed\)”, page 218](#)

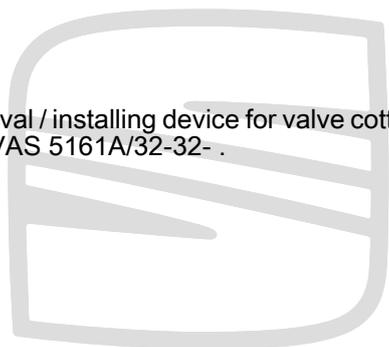
3.8.1 Removing and installing valve stem oil seals (cylinder head installed)

Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122 B-



- ◆ Removal / installing device for valve cotters - VAS 5161A- with set - VAS 5161A/32-32- .

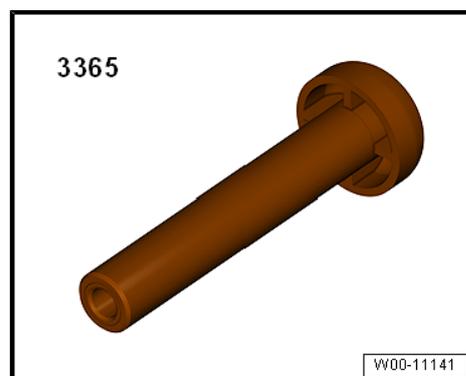


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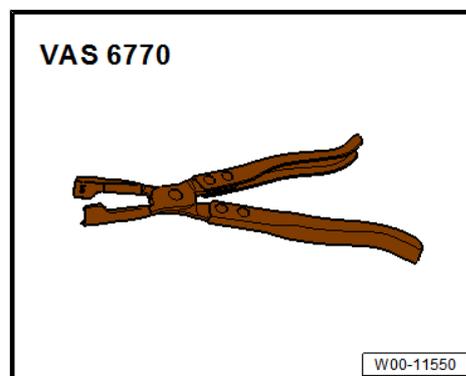


- ◆ Compressed air adapter VAS 5161 A/35- (not illustrated)
- ◆ Valve stem seal fitting tool - 3365-

erWin



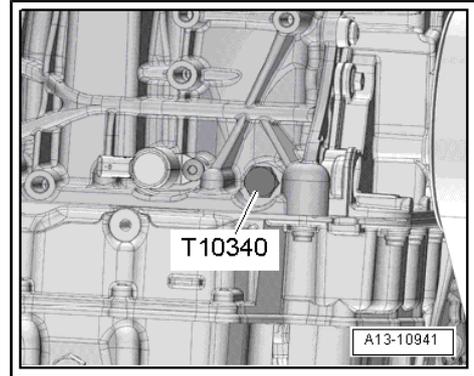
- ◆ Valve stem pliers - VAS 6770-



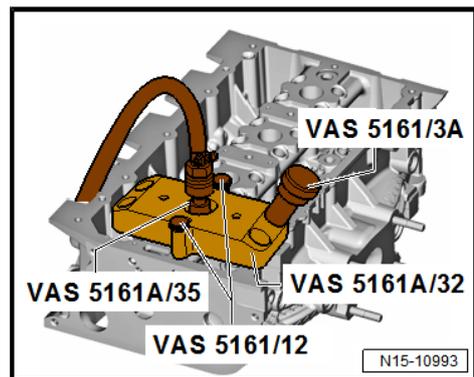
Procedure

- Remove camshaft housing ⇒ [page 88](#) .
- Unscrew the spark plugs using the spark plug spanner - 3122 B- .

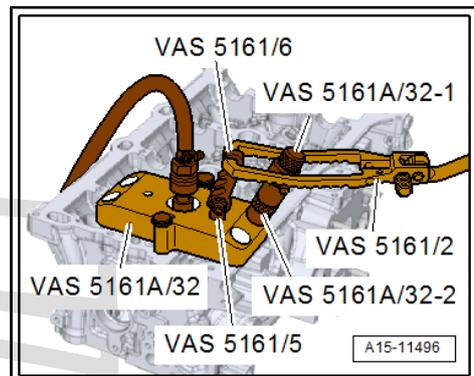
- Unscrew securing bolt - T10340- .
- Set piston of respective cylinder to "bottom dead centre"



- Fit guide plate -VAS 5161/32-1- onto cylinder head and secure with knurled screws -VAS 5161/12- .
- Screw compressed air adapter - VAS 5161 A/35- into the respective park plug thread hand-tight.
- Connect adapter to compressed air line using a commercially available connection piece, and apply constant air pressure.
- Minimum pressure: 6 bar
- Apply drift -VAS 5161/3A- to guide plate and use plastic-headed hammer to release sticking valve cotter pins.



- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/32-2- (slide on sleeve - VAS 5161/32-3-) 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 to press apart valve cotters and capture them in assembly cartridge.
- Release the pressure prong.
- Remove assembly cartridge.
- Detach guide plate and turn to one side.
- The compressed air hose remains connected.
- Remove valve spring and valve spring plate.



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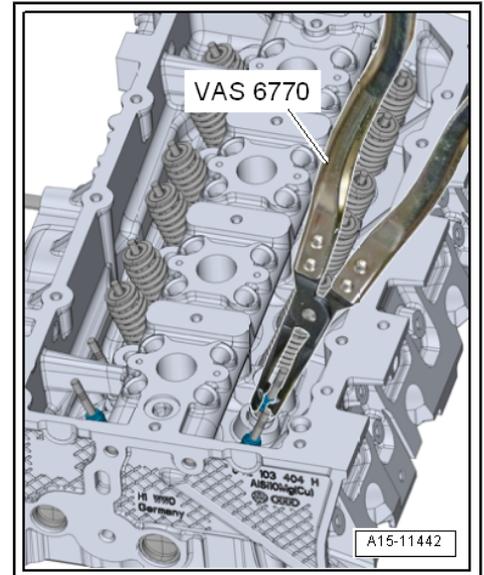
erWin

- Pull off valve stem seal using valve stem pliers - VAS 6770- .

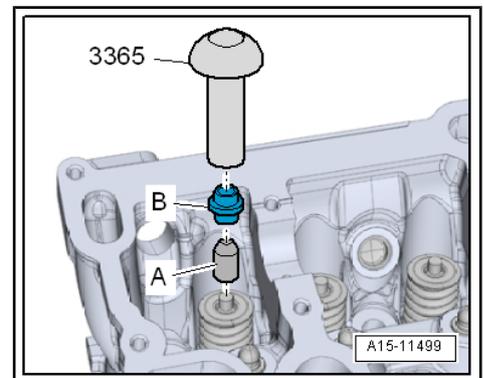


Note

Risk of damage when installing valve stem seals.

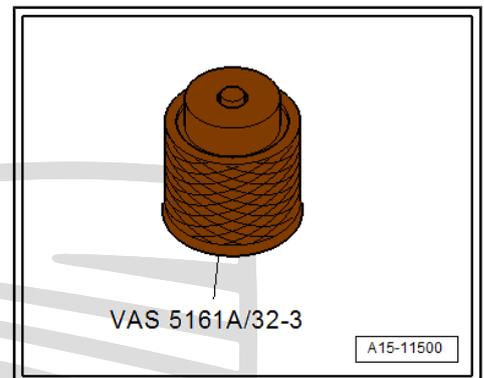


- New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.
- Lightly oil sealing lip of valve stem seal.
- Push valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.



If the valve cotters have been removed from the assembly cartridge, they must first be inserted into the insertion device.

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and pick up valve cotters.
- Insert valve spring and valve spring plate; installation position of valve spring ⇒ [page 193](#) .



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- Secure guide plate -VAS 5161/32-1- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/32-2- with sleeve -VAS 5161/32-3- into guide plate.
- Press down pressure fork and pull the knurled screw upwards while turning screw in both directions. The valve cones are mounted in this way.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure on each valve.

Assembling

Install in the reverse order of removal, observing the following:

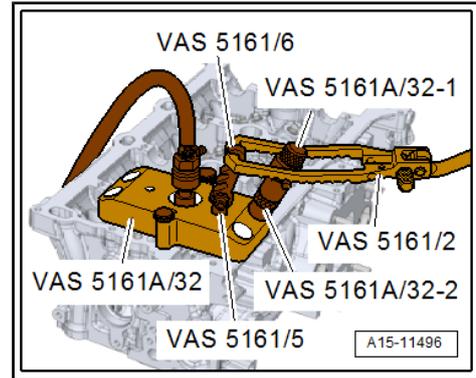
- Install glow plugs ⇒ Maintenance ; Booklet 501 .
- Fit camshaft housing ⇒ [page 88](#) .

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

Special tools and workshop equipment required

- ◆ Removal / installing device for valve cotters - VAS 5161A- with set - VAS 5161A/32-32- .

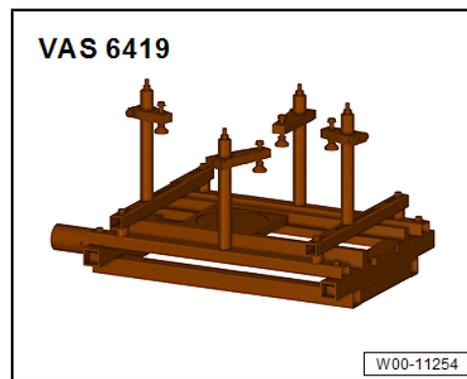
- ◆ Engine / gearbox support - VAS 6095-



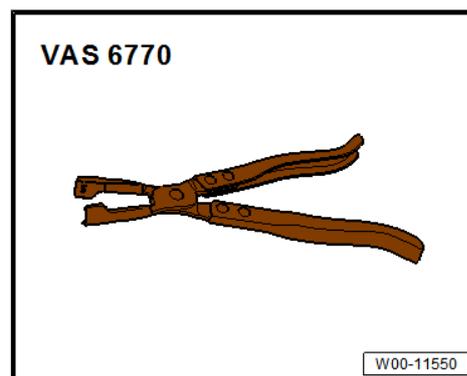
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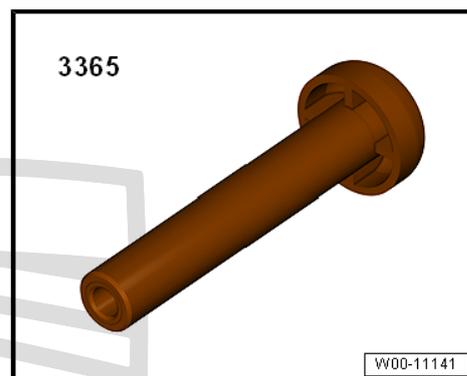
- ◆ Cylinder head tensoning device - VAS 6419-



- ◆ Valve stem pliers - VAS 6770-

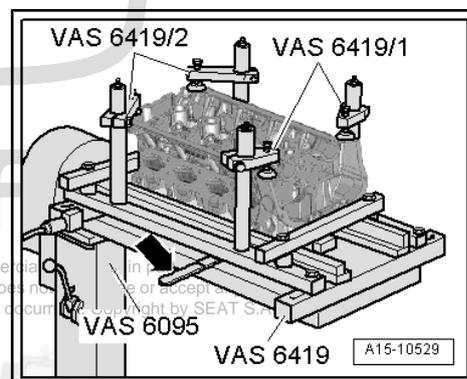


- ◆ Valve stem seal fitting tool - 3365-

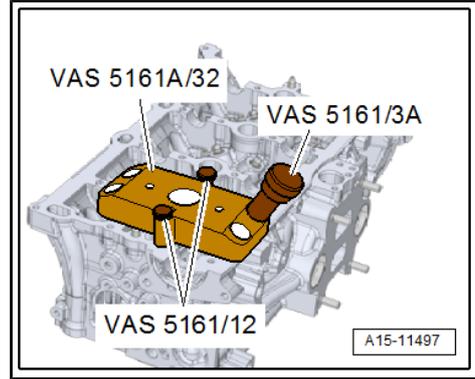


Procedure

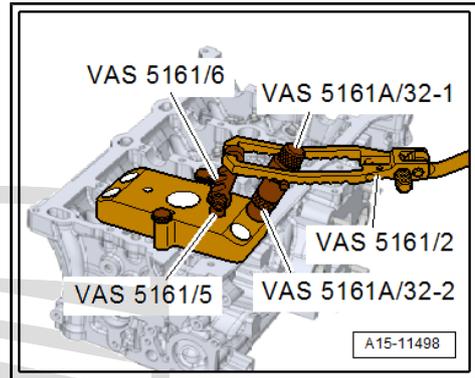
- Removing cylinder head ⇒ [page 84](#)
- Insert cylinder head tensoning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensoning device, as shown in illustration.
- Connect cylinder head tensoning device to compressed air.
- Use lever -arrow- to slide air cushion under combustion chamber from which valve stem seals are to be removed.
- Allow compressed air to flow into air cushion until it lies against valve disc.



- Fit guide plate -VAS 5161/32-1- onto cylinder head and secure with knurled screws -VAS 5161/12- .
- Apply drift -VAS 5161/3A- to guide plate and use plastic-headed hammer to release sticking valve cotter pins.



- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/32-2- (slide on sleeve -VAS 5161/32-3-) 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 to press apart valve cotters and capture them in assembly cartridge.
- Release the pressure prong.
- Remove assembly cartridge.
- Detach guide plate and turn to one side.
- Remove valve spring and valve spring plate.

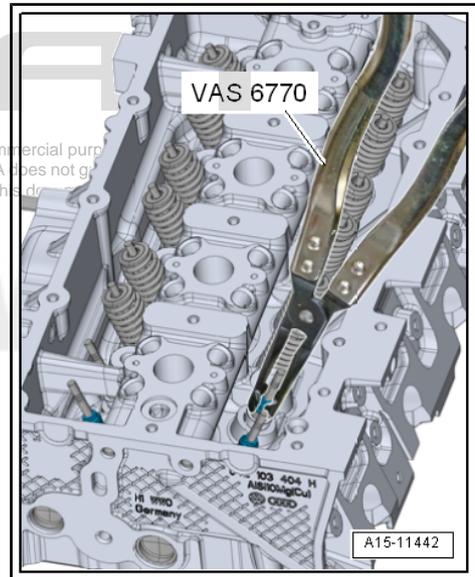


- Pull off valve stem seal using valve stem pliers - VAS 6770- .

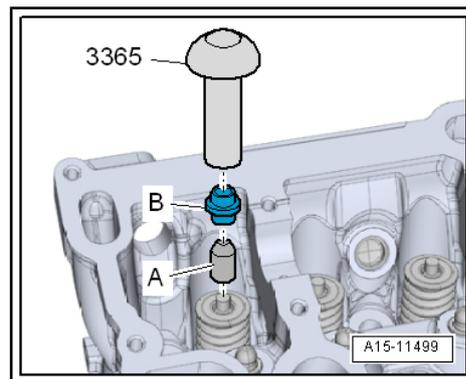
i Note

Risk of damage when installing valve stem seals.

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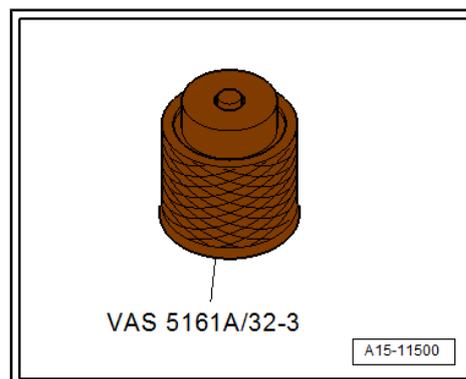


- New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.
- Lightly oil sealing lip of valve stem seal.
- Push valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Remove plastic sleeve.

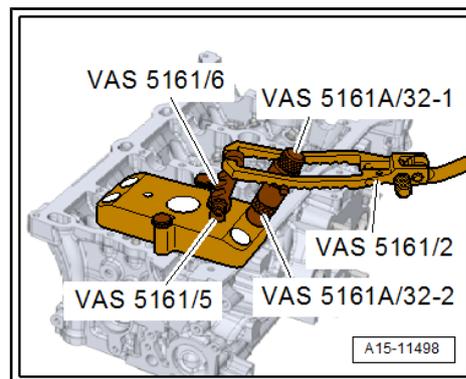


If the valve cotters have been removed from the assembly cartridge, they must first be inserted into the insertion device.

- Larger diameter of valve cotters faces upwards.
- Press assembly cartridge onto insertion device from above and pick up valve cotters.
- Insert valve spring and valve spring plate; installation position of valve spring ⇒ [page 193](#) .



- Secure guide plate -VAS 5161/32-1- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/32-2- with sleeve -VAS 5161/32-3- into guide plate.
- Press down pressure fork and pull the knurled screw upwards while turning screw in both directions. The valve cones are mounted in this way.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure on each valve.
- Install cylinder head ⇒ [page 84](#) .



4 Inlet and exhaust valves

⇒ [“4.1 Checking valve guides”, page 222](#)

⇒ [“4.2 Valves: checking”, page 222](#)

⇒ [“4.3 Valve dimensions”, page 223](#)

4.1 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

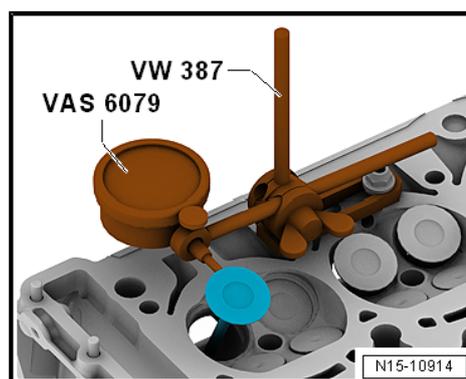


- ◆ Gauge - VAS 6079-



Development

- Insert valve into valve guide. The end of the valve stem should be flush with the guide. The diameter of the valve stems varies: the inlet valves only fit the inlet guides and the outlet valves only fit the outlet guides.
- Determine sideways play.
- Wear limit: 0.5 mm.
- If the wear limit is exceeded, repeat measurement with new valves.
- Renew cylinder head if wear limit is still exceeded.



Note

Valve guides cannot be exchanged.

4.2 Valves: checking

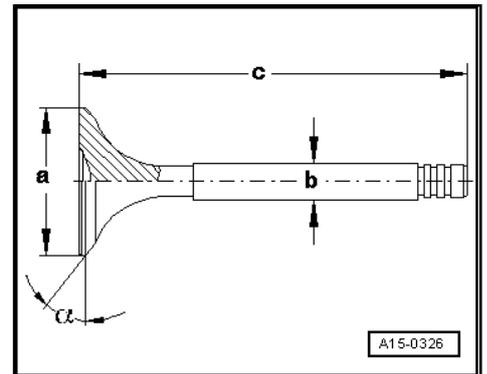
- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.

4.3 Valve dimensions

i Note

Inlet and exhaust valves must not be reworked. Only lapping-in is permitted.

Dim.		Inlet valve	Outlet valve
∅ a	mm	28.5	25.0
∅ b	mm	4.973	4.963
c	mm	110.25	110.09
α	∠°	45	30



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17 – Lubrication

1 Sump, oil pump

⇒ [“1.1 Exploded view - sump/oil pump”, page 224](#)

⇒ [“1.2 Removing and installing oil level and oil temperature sender G266”, page 229](#)

⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 229](#)

⇒ [“1.4 Oil pump: removing and installing”, page 231](#)

⇒ [“1.5 Removing and installing sump \(top section\)”, page 232](#)

⇒ [“1.6 Engine oil”, page 234](#)

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 galleries carefully and renew the oil spray jets, engine oil cooler and oil filter.*
- ◆ *Removing and installing piston cooling jet ⇒ [page 73](#).*



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1 - Nut

- 9 Nm

2 - Oil level/oil temperature sender - G266-

- Removing and installing
 => [page 229](#)

3 - Oil seal

- renew

4 - Oil drain plug

- renew



Note

- ◆ *The sump drain plug must only be replaced if it has a captive seal ring.*
- ◆ *The seal ring must always be replaced.*

- 30 Nm

5 - Oil seal

- renew



Note

New procedure for all subsequent maintenance work: => [page 228](#)

6 - Lower element on the case

- Removing and installing
 => [page 229](#)

7 - Bolt

- renew
- 5 Nm +90°

8 - Adjusting sleeve

- 2 pieces

9 - Cover

- For oil pump drive chain sprocket

10 - Control chain

- For oil pump
- Before removing, mark running direction with paint.

11 - Bolt

- renew
- Tightening torque and sequence => [page 227](#) .

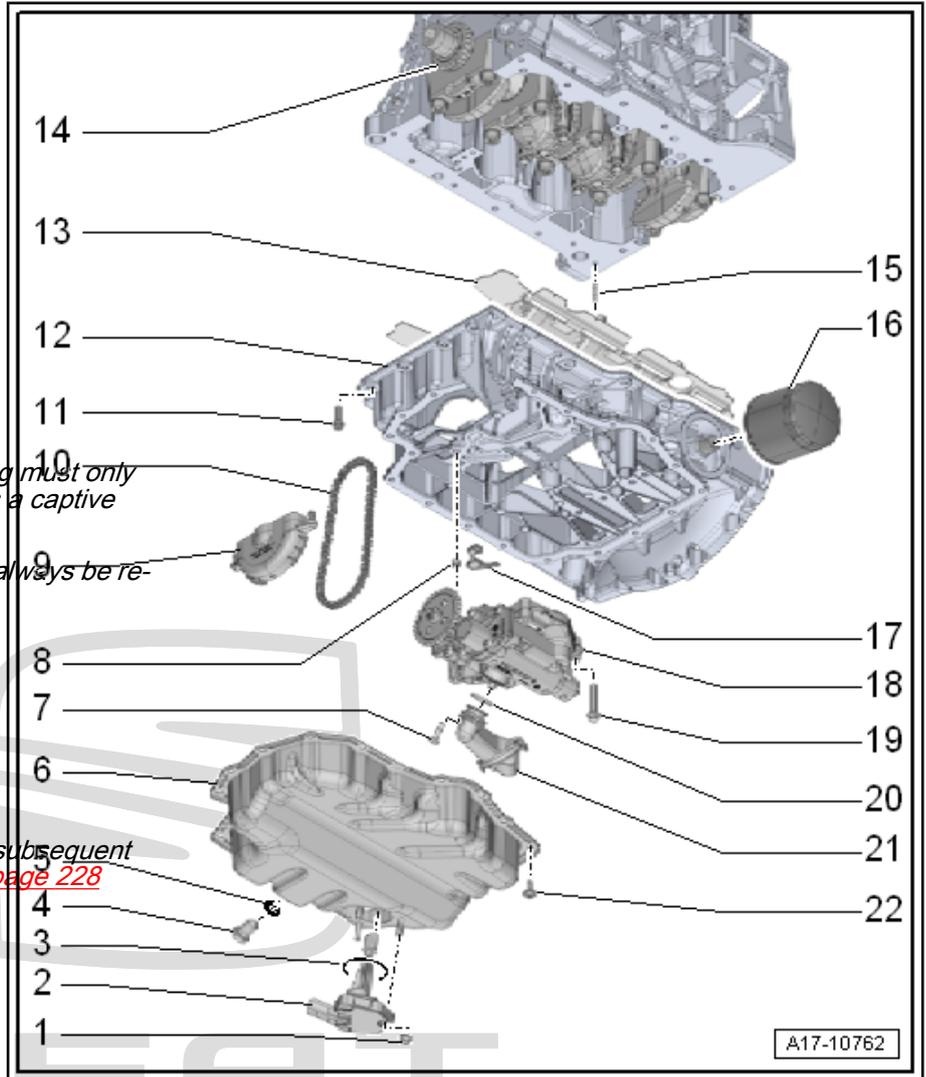
12 - Upper element on the case

- Removing and installing => [page 232](#)

13 - Baffle

14 - Pinions

- For oil pump drive



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15 - Split pin

16 - Oil filter

- Remove and install with oil filter tool - 3417- .
- 20 Nm
- Before installing, lightly coat seal with clean engine oil.
- If threaded connection for oil filter in top section of sump has loosened
⇒ [Fig. "“Securing threaded connection for oil filter”" , page 226](#)

17 - Seal

- With oil strainer

18 - Oil pump

- Removing and installing ⇒ [page 231](#)

19 - Bolt

- 10 Nm

20 - O-ring

- renew

21 - Oil suction pipe

- Clean strainer if dirty

22 - Bolt

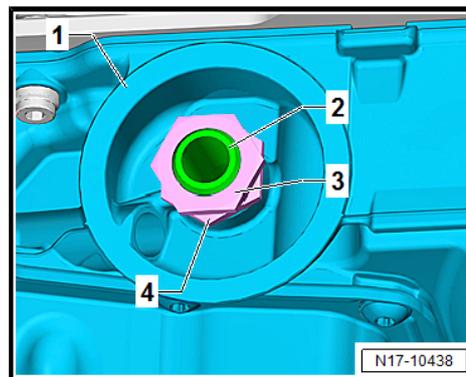
- renew
- Tightening sequence ⇒ [page 227](#)

Securing threaded connection for oil filter

- If threaded connection -2- from top section of sump -1- has loosened, secure it as described below.

Only carry out procedure with both nuts -3 and 4-

- 2 x hex nuts - 068 115 723- ⇒ Electronic parts catalogue
- Screw nuts -3- and -4- onto threaded connection -2- and counterlock them.
- Tighten threaded connection -2- by tightening nut -3-.
- Loosen and unscrew both nuts, taking care not to loosen threaded connection.



Tightening torque

Threaded connection	Tightening torque
-2-	50 Nm

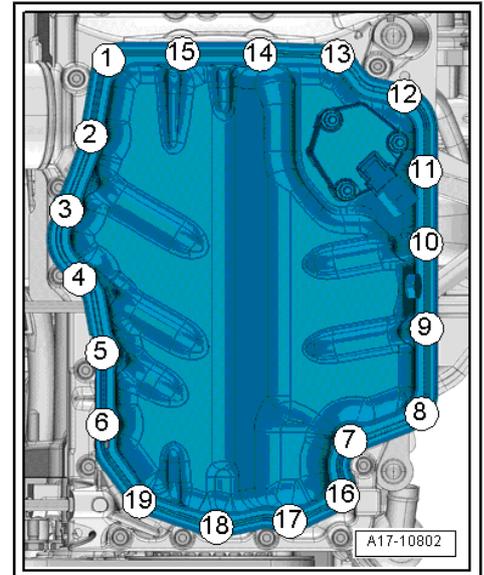
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Sump (bottom section) - tightening torque and sequence

– Tighten bolts step by step in the following sequence:

stage	Bolts	Tightening torque
1.	-1 ... 19-	Screw in by hand until it stops.
2.	-1 ... 19-	12 Nm



Sump (top section) - tightening torque and sequence

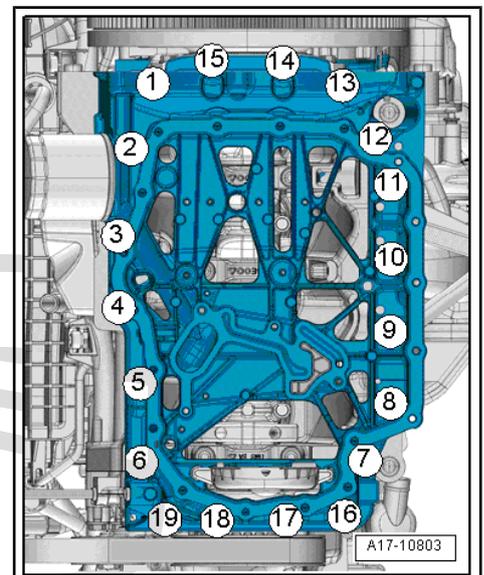


Note

Renew bolts that are tightened with specified further tightening angle.

– Tighten bolts step by step in the following sequence:

stage	Bolts	Tightening torque/angle specification
1.	-1 ... 19-	Screw in by hand until it stops.
1.	-1 ... 19-	8 Nm
2.	-1 ... 19-	Turn 90° further



Markings on oil dipstick

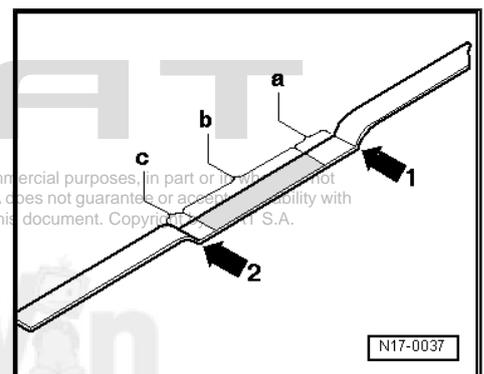
1 - Max. mark

2 - Min. mark

a - Zone between upper ridge of printed area and max. mark: do not add oil

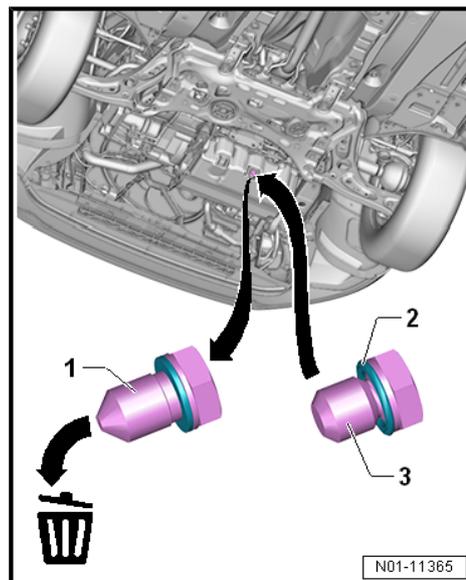
b - If the level is within the printed area, oil may be added

c - Area min marking up to screened field: refill with max. 0.5 l engine oil!



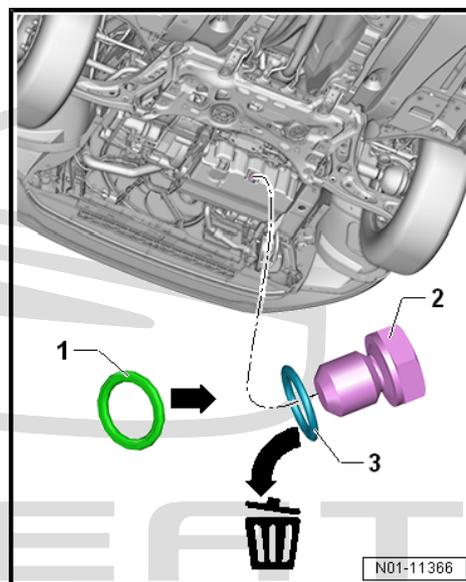
Oil drain plug with lock seal (factory fitting)

- Discard the oil drain plug with lock seal -1- at the first oil change.
- Install a new oil drain plug -3- with replaceable seal -2-.



Oil drain plug with replaceable seal (all subsequent oil changes).

- Screw out the oil drain plug -2- and discard the used seal -3-.
- You can replace the new seal -1- individually at the subsequent oil changes.



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erWin

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

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 501
- Separate the connector -3-.
- Unscrew the nuts -1- and remove the oil level and oil temperature sender - G266- -item 4-.

Installation

Install in the reverse order of removal, observing the following:



Note

Renew seal -2-.

- Fill up with engine oil and check the oil level ⇒ Maintenance ; Booklet 501 .

Specified torques

- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 224](#)

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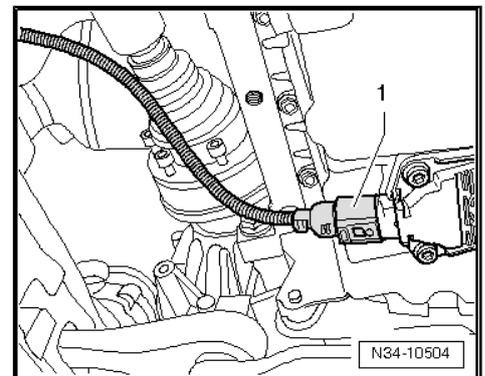
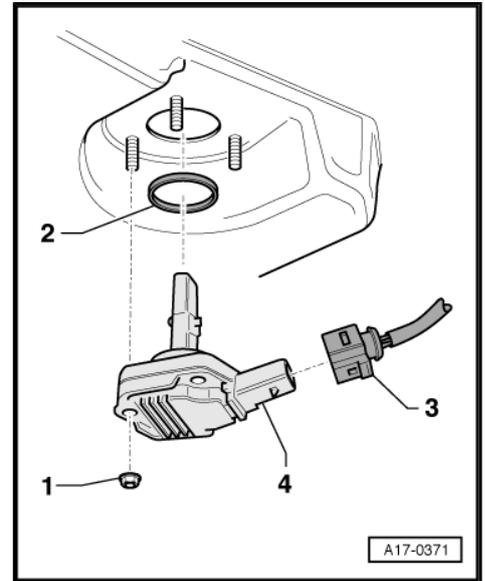
1.3 Removing and installing sump (bottom section)

Special tools and workshop equipment required

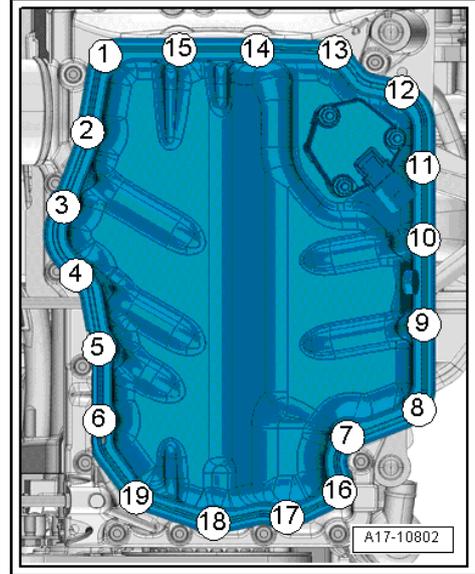
- ◆ Flat scraper
- ◆ Sealant remover
- ◆ Electric drill with plastic brush attachment
- ◆ Protective glasses
- ◆ Sealant ⇒ Electronic parts catalogue (ETKA)

Removing

- Remove noise insulation ⇒ Rep. gr. 66 ; Noise insulation; Assembly overview - noise insulation .
- Engine oil drained ⇒ Maintenance ; Booklet 501
- Disconnect the connector -1- of the oil level and temperature sender - G266- .



- Slacken and remove bolts in the sequence: -19 ... 1-
- Carefully detach lower part of sump from adhesive bond using a commercially available scraper.



- Carefully lever off lower part of sump using a suitable screwdriver or lever at the position marked with an -arrow-.

Installation



Note

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- ◆ **Danger of soiling lubrication system!**
- ◆ **Cover exposed parts of the engine.**
- Spray sealing surface with sealant remover and wait for it to take effect.
- Remove sealant remaining on sump (top section) with flat scraper.

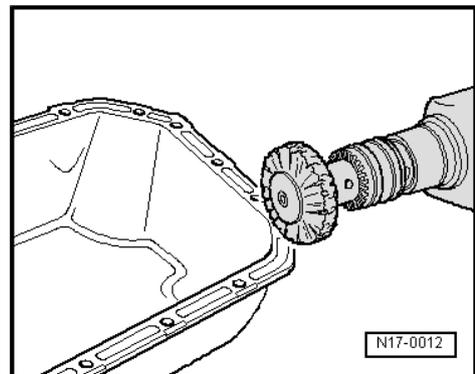


CAUTION

Risk of eye injury caused by sealant residue.

- Use safety goggles.

- Remove sealant residue on sump (bottom section) using rotating plastic brush or similar.
- Clean surfaces; they must be free of oil and grease.

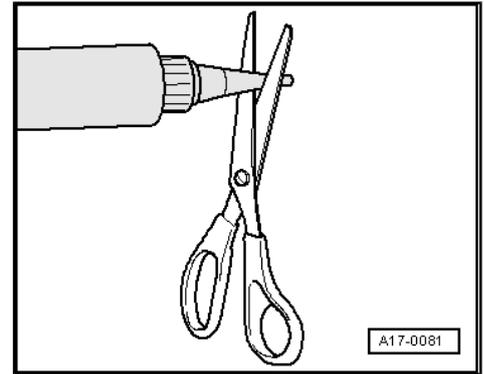


 **Note**

Observe use-by date of sealant.

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

Danger of blocking lubrication system with excess sealant.



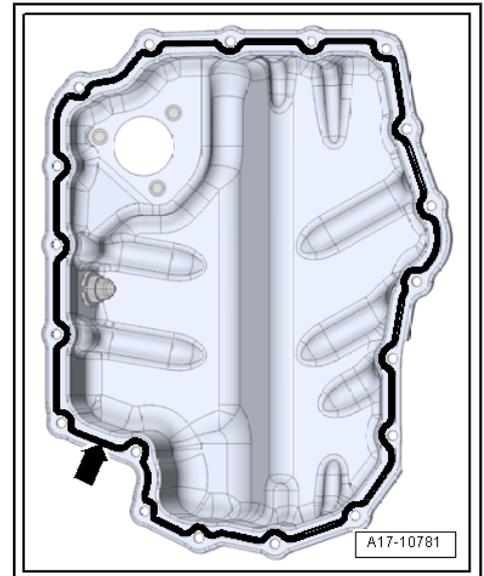
Do not apply sealant bead thicker than specified.

- Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as shown in illustration.
- Thickness of sealant bead: 2 ... 3 mm.

 **Note**

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

- Fit sump (bottom section) and tighten bolts [⇒ page 227](#) .



 **Note**

After installing the sump (bottom section), wait about 30 minutes for the sealant to dry. Only then should the engine be refilled with oil.

- Fill up with engine oil and check the oil level [⇒ Maintenance ; Booklet 501](#) .

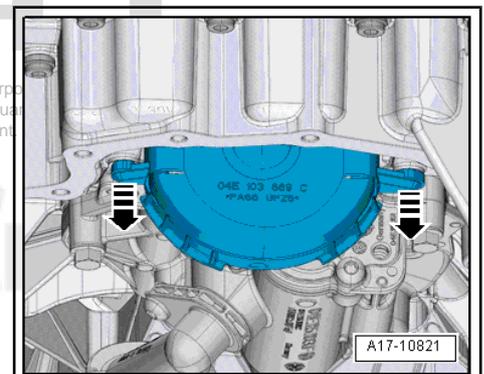
Specified torques

- ◆ [⇒ Fig. ““Sump \(bottom section\) - tightening torque and sequence””, page 227](#)
- ◆ Install noise insulation [⇒ Rep. gr. 66 ; Noise insulation; Assembly overview - noise insulation](#) .

1.4 Oil pump: removing and installing

Removing

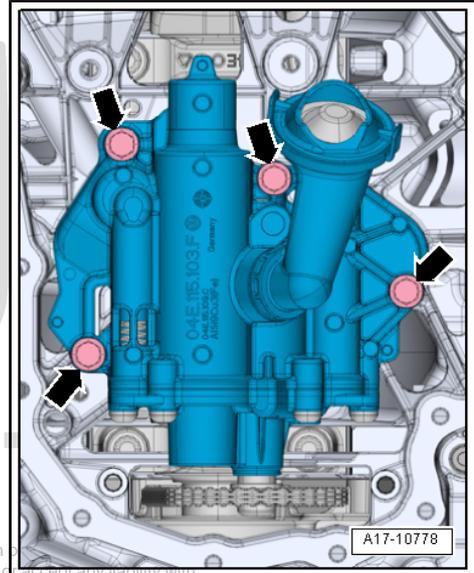
- Remove sump (bottom section) [⇒ page 229](#) .
- Unclip cover for oil pump drive chain sprocket -arrows-



- Remove bolts -arrows-.
- Guide out oil pump with drive chain sprocket under drive chain.

Installation

- Check that dowel sleeves -1, 3- are fitted in oil pump.



- Fit seal with strainer -2- in oil pump.

Install in the reverse order of removal, observing the following:

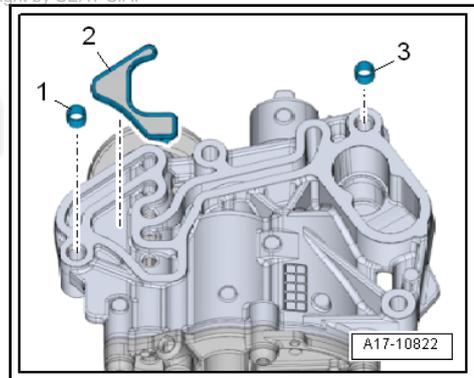
- Turn oil pump drive chain sprocket by hand to check oil pump for ease of movement.



Note

Renew oil pump if it does not turn easily.

- Fit oil pump with drive chain sprocket into drive chain and secure.
- Install sump (bottom section) ⇒ [page 229](#) .
- Fill up with engine oil and check the oil level ⇒ Maintenance ; Booklet 501 .



Specified torques

- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 224](#)

1.5 Removing and installing sump (top section)

Special tools and workshop equipment required

- ◆ Socket and key - T10058-

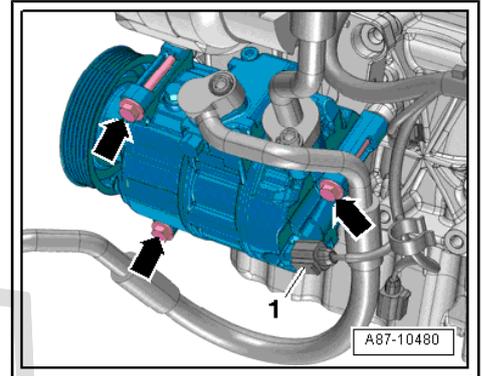


- ◆ Hand drill with plastic brush
- ◆ Protective glasses

◆ Sealant ⇒ Electronic parts catalogue (ETKA)

Removing

- Remove air conditioner compressor from bracket and tie up ⇒ Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .
- Remove lower part of sump ⇒ [page 229](#) .
- Remove the fluid pump ⇒ [page 231](#) .



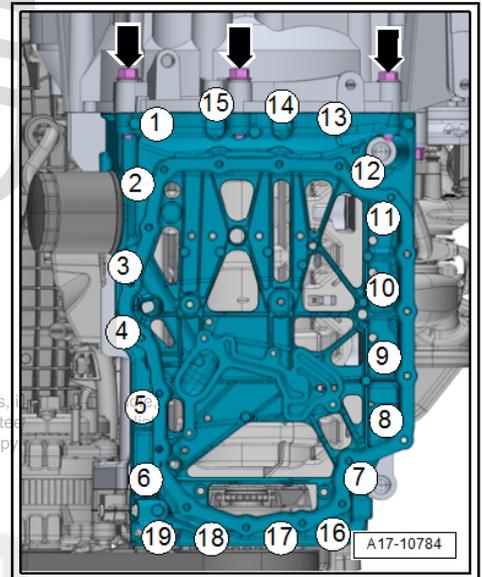
- Unscrew securing bolts -arrows- of gearbox in top section of sump.
- Slacken and remove bolts in the sequence: -19 ... 1-.
- Carefully release sump (top section) from bonded joint.
- Detach baffle plate.

Installation



Note

- ◆ *Renew bolts that are tightened with specified further tightening angle.*
- ◆ *Gaskets, oil seals and self-locking nuts must be renewed.*
- ◆ *Danger of soiling lubrication system!*
- ◆ *Cover exposed parts of the engine.*



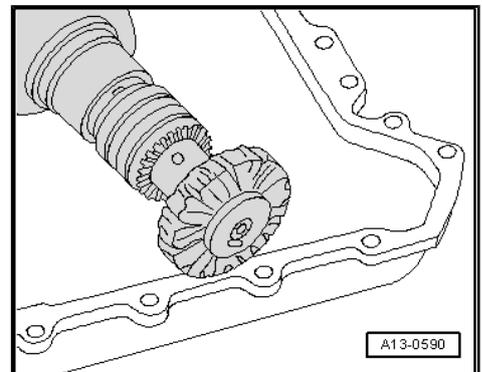
- Eliminate the sealant residue from cylinder block, using a flat rasp.

CAUTION

Risk of eye injury caused by sealant residue.

- Use safety goggles.

- Use e.g. a rotating plastic brush to remove sealant residue on sump (top section) flange.
- Check oil passages in sump (top section) and crankcase for contamination.
- Clean surfaces; they must be free of oil and grease.

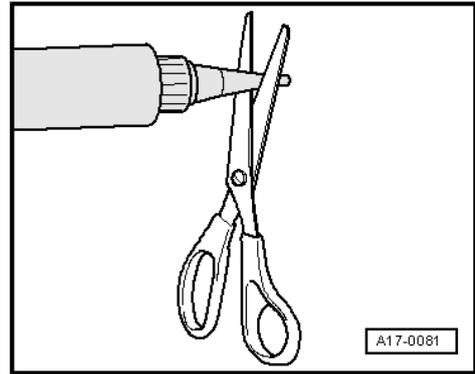


i Note

Observe use-by date of sealant.

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

Danger of blocking lubrication system with excess sealant.

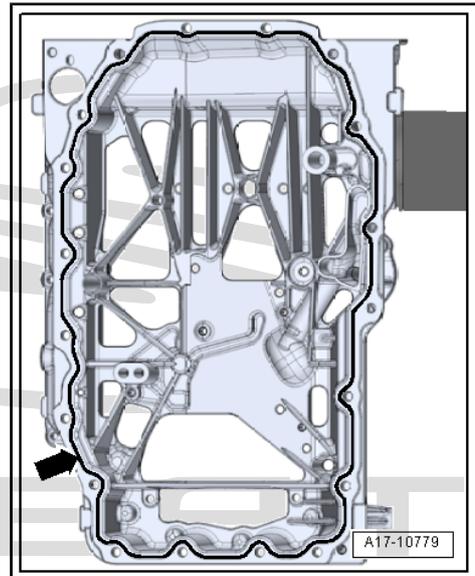


Do not apply sealant bead thicker than specified.

- Apply bead of sealant -arrow- onto clean sealing surface of sump (top section) as shown in illustration.
- Thickness of sealant bead: 2 ... 3 mm.

i Note

The sump (top section) must be installed within 5 minutes after applying the sealant.



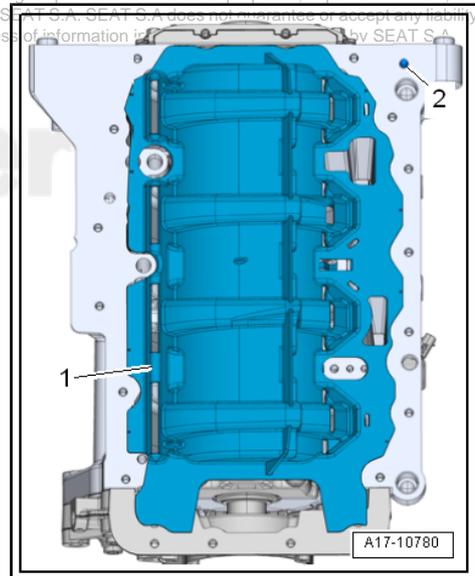
- Check that dowel pin -2- is securely seated in cylinder block.
- Attach baffle plate -1- to cylinder block.
- Fit sump (top section) and tighten bolts ⇒ [page 227](#) .

Install in reverse order of removal, observing the following:

- Fit the oil pump ⇒ [page 231](#) .
- Install air conditioner compressor ⇒ Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .
- Fill up with engine oil and check the oil level ⇒ Maintenance ; Booklet 501 .

Specified torques

- ◆ ⇒ ["1.1 Exploded view - sump/oil pump", page 224](#)
- ◆ Securing the gearbox to engine ⇒ Rep. gr. 34 ; Gearbox: removing and installing; Gearbox: installing .



1.6 Engine oil

Oil capacities

⇒ Maintenance ; Booklet 501

Engine oil specifications

Changing the engine oil: ⇒ Maintenance ; Booklet 501 "Engine oil: drain".



Note

The oil level must not be above the max. mark - danger of damaging catalytic converter. Marks ⇒ [page 227](#) ,



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2 Engine oil radiator

⇒ "2.1 Assembly overview - engine oil cooler", page 236

⇒ "2.2 Removing and installing engine oil cooler", page 236

2.1 Assembly overview - engine oil cooler

1 - Engine oil radiator

- See note ⇒ [page 224](#) .
- Removing and installing
⇒ [page 236](#)
- Change coolant after re-
newing.

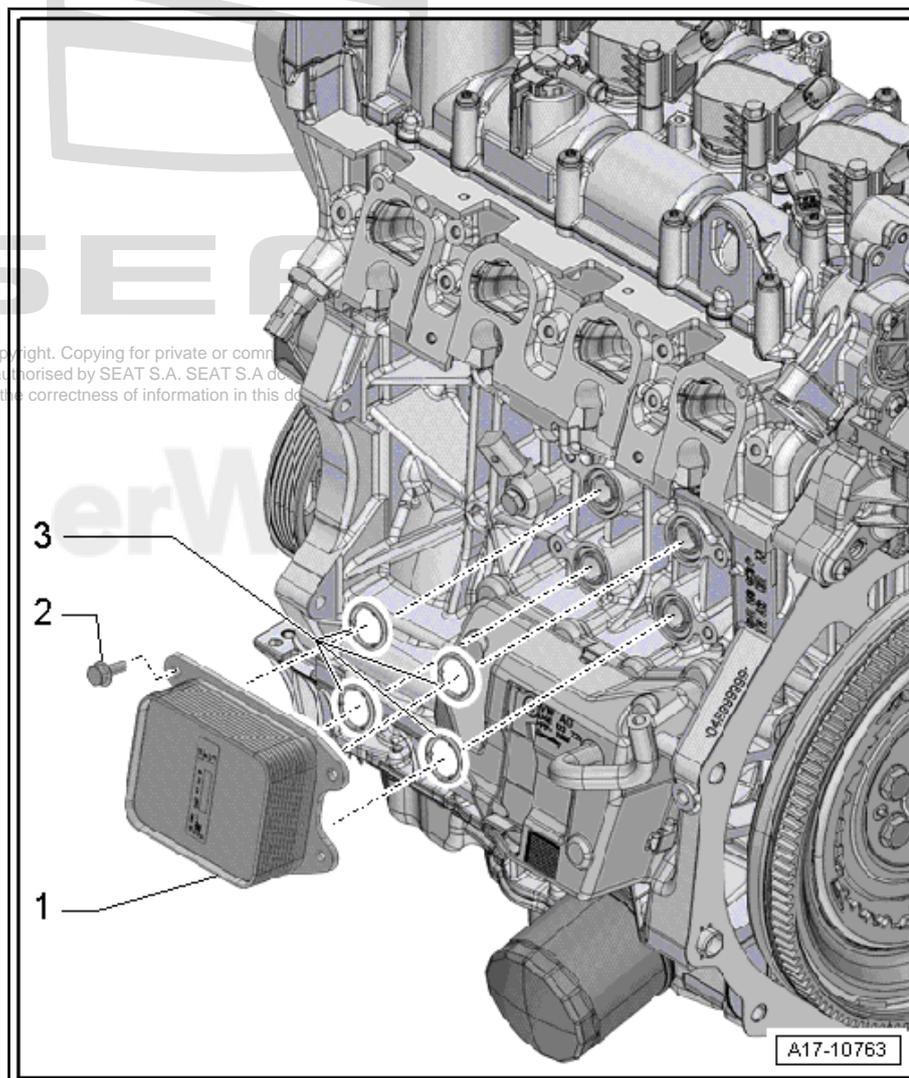
2 - Bolt

- renew
- 8 Nm +90°

3 - Sealing rings

- renew

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2.2 Removing and installing engine oil cooler

- Drain coolant ⇒ [page 251](#) .
- Remove intake manifold ⇒ [page 329](#)

- Unscrew bolts -arrows- and detach engine oil cooler -1-.

Installation

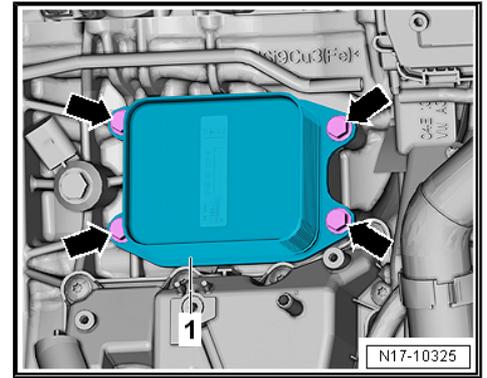
- Insert new O-rings.

Install in the reverse order of removal, observing the following:

- Install intake manifold ⇒ [page 329](#) .
- Fill up with coolant ⇒ [page 256](#) .

Specified torques

- ◆ ⇒ [“2.1 Assembly overview - engine oil cooler”, page 236](#)
- ◆ ⇒ [“1.1 Assembly overview - ignition system”, page 360](#)



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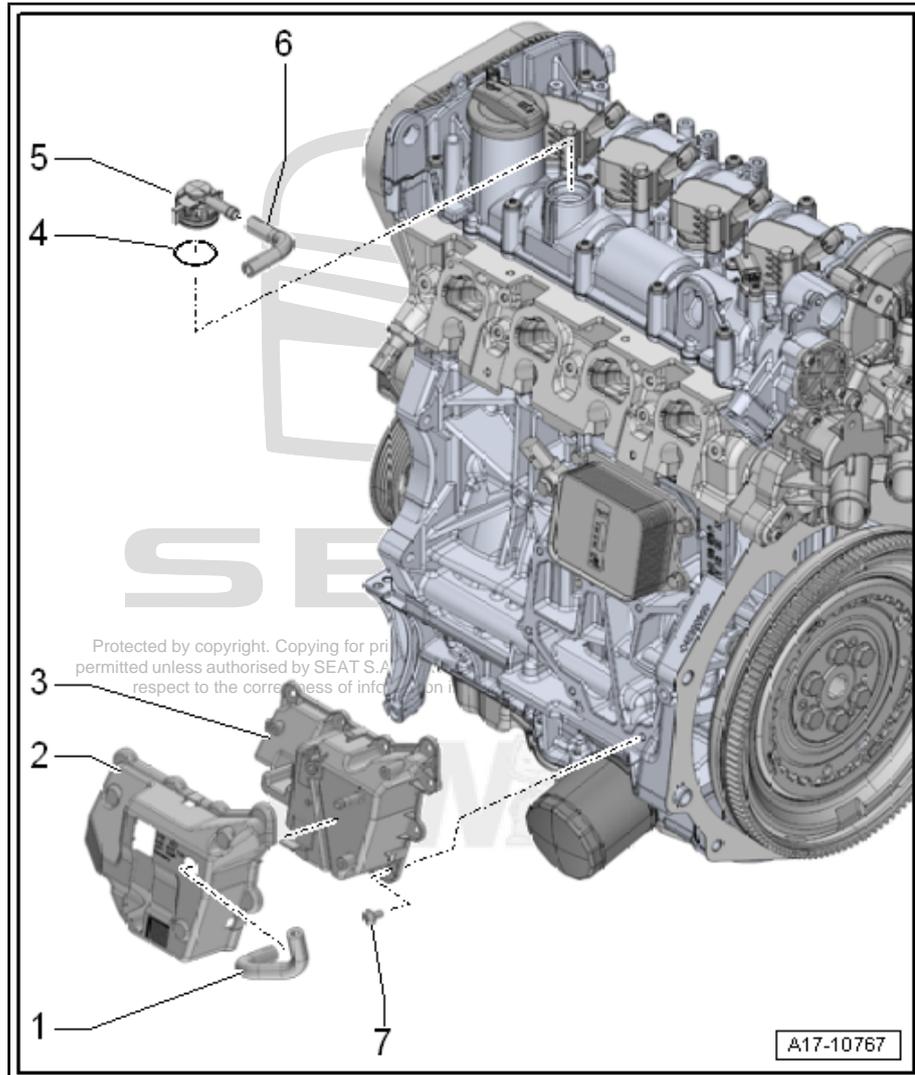
3 Crankcase breather system

⇒ "3.1 Exploded view - crankcase breather system", page 238

⇒ "3.2 Removing and installing the oil separator", page 239

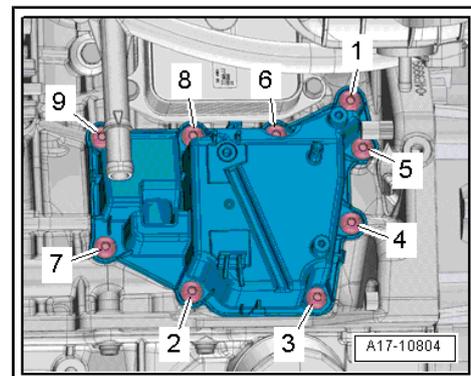
3.1 Exploded view - crankcase breather system

- 1 - Flexible pipe
 - For crankcase breather
- 2 - Cover
 - For oil separator
- 3 - Oil separator
 - Removing and installing ⇒ page 239
 - Renew if damaged.
- 4 - O-ring
 - renew
- 5 - Connection
- 6 - Flexible pipe
 - For crankcase breather
- 7 - Bolt
 - Self-locking
 - renew
 - 9 Nm



Oil separator - tightening torque and sequence

- Tighten bolts to 9 Nm in sequence -1 ... 9-



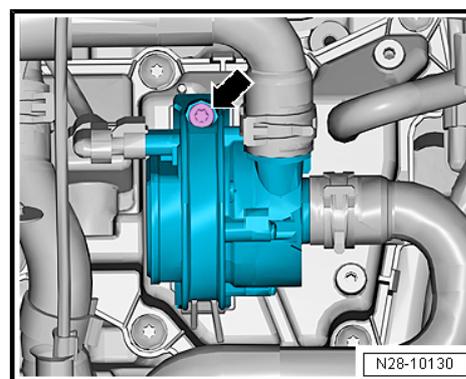
3.2 Removing and installing the oil separator

Special tools and workshop equipment required

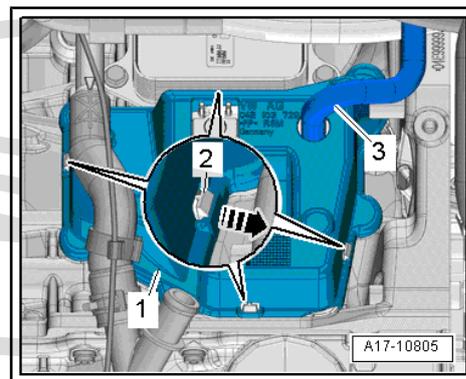
- ◆ Flat scraper
- ◆ 2 threaded bolts M6x20 mm (commercial standard)
- ◆ Sealant remover
- ◆ Sealant ⇒ Electronic parts catalogue (ETKA)

Removing

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Separate the connector -1-.
- Unscrew bolt -2- and press pump of charge air cooler - V188- to one side.



- Disconnect crankcase breather hose -3-.
- Release fasteners -2- -arrow- on cover -1- for oil separator and detach cover.



- Slacken and remove bolts in the sequence: -9 ... 1-.
- Carefully release oil separator from bonded joint.

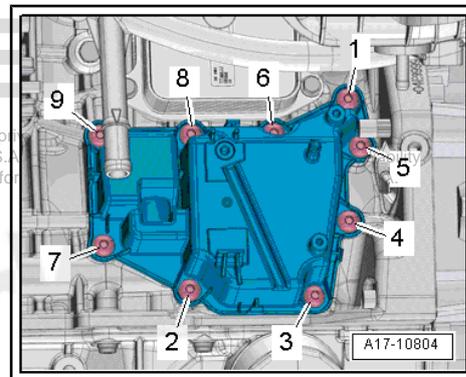
Installation

Install in the reverse order of removal, observing the following:

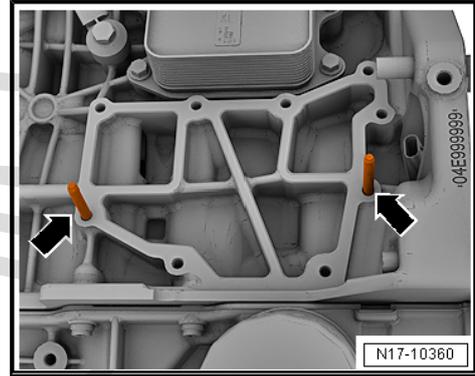
Note

- ◆ *Danger of soiling lubrication system!*
- ◆ *Cover exposed parts of the engine.*

- Eliminate the sealant residue from cylinder block, using a flat rasp.
- Clean surfaces; they must be free of oil and grease.



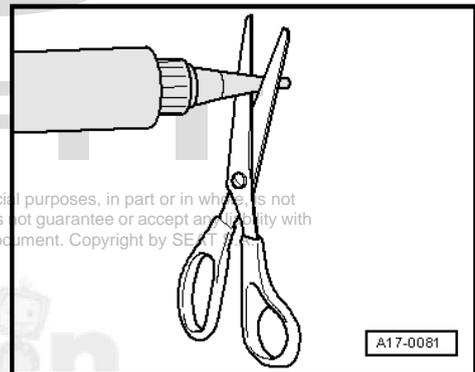
- Screw 2 threaded bolts M6x20 mm with a few turns into the holes -Arrows-.



Note

Observe use-by date of sealant.

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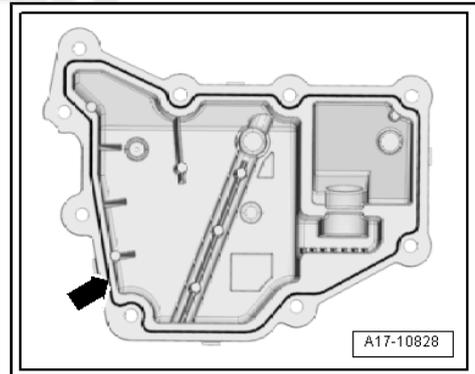
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).

Danger of blocking lubrication system with excess sealant.

Do not apply sealant bead thicker than specified.

- Apply bead of sealant -arrow- onto clean sealing surface of oil separator as shown in illustration.
- Width of the sealant line: 2.0 mm

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

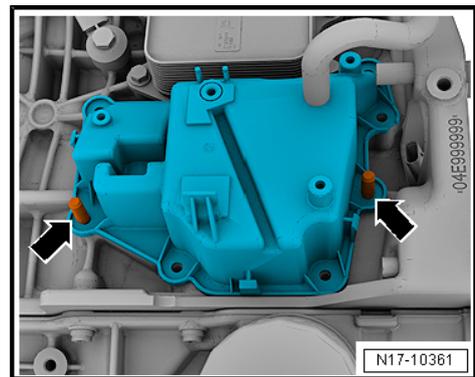


- Place the oil separator over the studs -Arrows- and push towards the engine block.
- Start securing bolts.
- Unscrew studs.
- Oil separator - tightening torque and sequence ⇒ [page 238](#)

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

Specified torques

- ◆ ⇒ [Fig. “Oil separator - tightening torque and sequence”](#), [page 238](#)
- ◆ ⇒ [“2.2 Exploded view - electric coolant pump”](#), [page 260](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Removing and installing noise insulation



4 Oil filter/oil pressure switches

⇒ [“4.1 Exploded view - oil filter housing/oil pressure switches”, page 241](#)

⇒ [“4.2 Removing and installing oil pressure switch F1”, page 242](#)

⇒ [“4.3 Removing and installing oil pressure switch for reduced oil pressure F378”, page 243](#)

⇒ [“4.4 Removing and installing valve for oil pressure control N428”, page 244](#)

⇒ [“4.5 Checking oil pressure”, page 245](#)

4.1 Exploded view - oil filter housing/oil pressure switches

1 - Oil filter

- Remove and install with oil filter tool - 3417- .
- Before installing, lightly coat seal with clean engine oil.
- 20 Nm
- See note ⇒ [page 224](#) .
- If threaded connection for oil filter in top section of sump has loosened ⇒ [Fig. “Securing threaded connection for oil filter”](#) , [page 226](#)

2 - Oil pressure switch for reduced oil pressure - F378-

- Opening/closing pressure 0.3 ... 0.6 bar
- Checking ⇒ [page 245](#)
- If removed, oil pressure switch must be renewed
- Removing and installing ⇒ [page 243](#)

20 Nm

3 - Oil seal

- the seal cannot be replaced individually
- If removed, oil pressure switch must be renewed

4 - O-ring

- renew

5 - Valve for oil pressure control - N428-

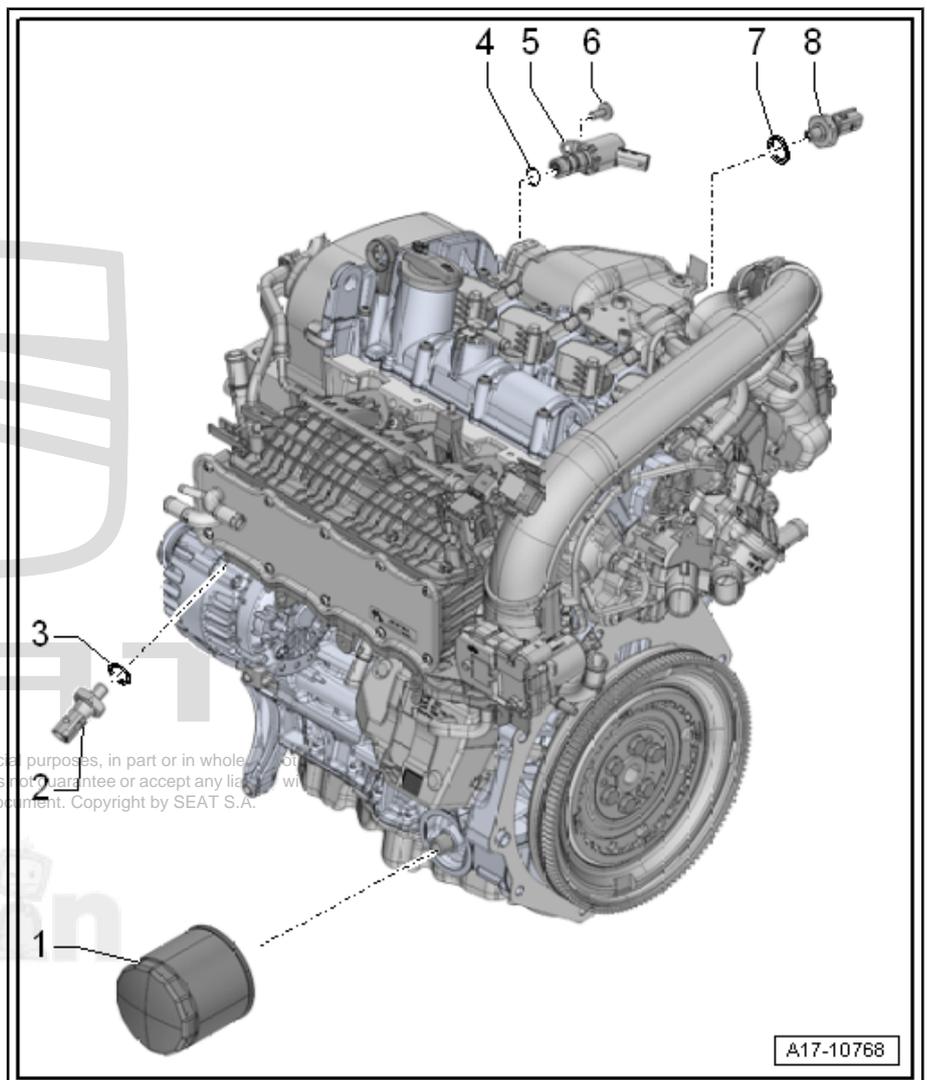
- Removing and installing ⇒ [page 244](#)

6 - Bolt

- 8 Nm

7 - Oil seal

- renew



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8 - Oil pressure switch - F1-

- Opening/closing pressure 2.15 ... 2.95 bar
- Checking ⇒ [page 245](#)
- If removed, oil pressure switch must be renewed
- Removing and installing ⇒ [page 242](#)
- 20 Nm

4.2 Removing and installing oil pressure switch - F1-

Special tools and workshop equipment required

- ◆ 24 mm jointed spanner - T40175-



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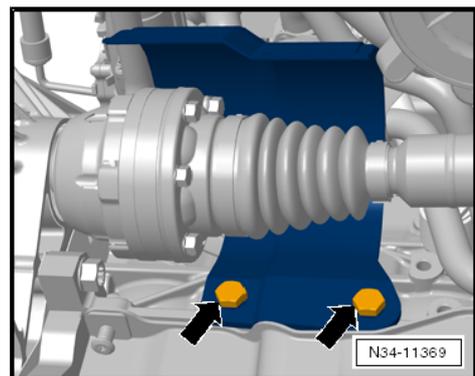
Removing



Note

Re-attach all heat insulation sleeves at the same locations when re-installing.

- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).
- Remove heat-shield sleeve



- Disconnect electrical connector -arrow-.

 **Note**

Place a cloth underneath to catch escaping engine oil.

- Remove the oil pressure switch - F1- .

Installation

Install in the reverse order of removal, observing the following:

 **Note**

- ◆ *The seal cannot be replaced individually.*
- ◆ *If removed, oil pressure switch must be renewed.*
- ◆ *Screw new oil pressure switch - F1- immediately into bore to avoid loss of oil.*

- check oil level⇒ Maintenance ; Booklet 501 .

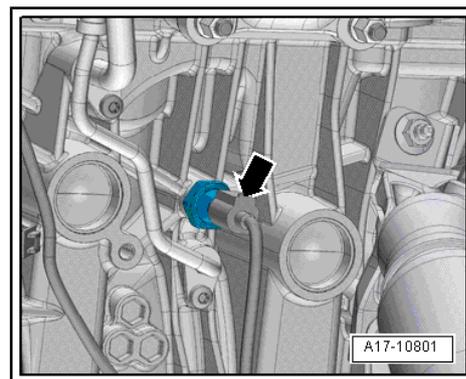
Specified torques

- ◆ ⇒ [“4.1 Exploded view - oil filter housing/oil pressure switches”, page 241](#)
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Assembly overview: drive shaft
- ◆ ⇒ Rep. gr. 66 ; Noise insulation; Assembly overview - noise insulation

4.3 Removing and installing oil pressure switch for reduced oil pressure - F378-

Special tools and workshop equipment required

- ◆ 24 mm jointed spanner - T40175-



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Removing

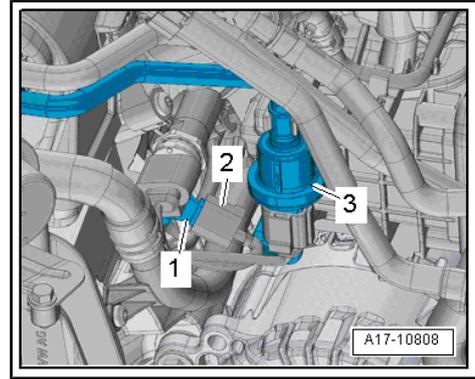
- Pull activated charcoal filter solenoid valve 1 - N80- -3- off intake manifold and push it downwards slightly.
- Separate the connector -2-.



Note

Place a cloth underneath to catch escaping engine oil.

- Unscrew oil pressure switch for reduced oil pressure - F378- -1-.



Installation

Install in the reverse order of removal, observing the following:



Note

- ◆ *The seal cannot be replaced individually.*
 - ◆ *If removed, oil pressure switch must be renewed.*
 - ◆ *Fit the new oil pressure switch for reduced oil pressure - F378- into the connection immediately to avoid loss of oil.*
- check oil level ⇒ Maintenance ; Booklet 501 .

Specified torques

- ◆ ⇒ ["4.1 Exploded view - oil filter housing/oil pressure switches", page 241](#)

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

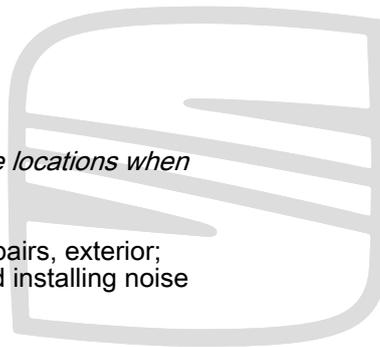
Removing



Note

Re-attach all heat insulation sleeves at the same locations when re-installing.

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



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- Unplug the electrical connector -1-.

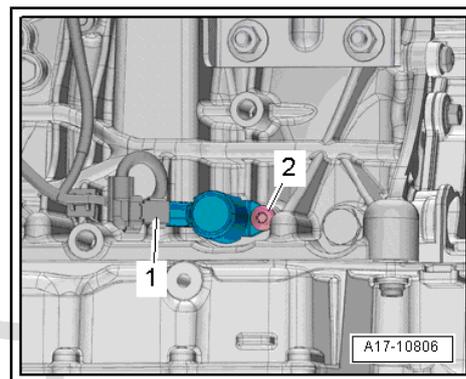
 **Note**

Place a cloth underneath to catch escaping engine oil.

- Unscrew bolt -2- and remove valve for oil pressure control - N428- .

Installation

Install in the reverse order of removal, observing the following:



 **Note**

Replace the O-ring.

Specified torques

- ◆ => ["4.1 Exploded view - oil filter housing/oil pressure switches", page 241](#)
- ◆ => General body repairs, exterior; Rep. gr. 66 ; Removing and installing noise insulation

4.5 Checking oil pressure

Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-



Work sequence

- Oil level OK, checking => Maintenance ; Booklet 501 .
- Engine oil temperature: at least 80 °C (the cooler fan must have run at least once)
- Remove oil pressure switch for reduced oil pressure - F378- => [page 243](#) .
- Screw oil pressure tester - V.A.G 1342- into hole for oil pressure switch.
- Screw oil pressure switch for reduced oil pressure - F378- into hole in oil pressure tester - V.A.G 1342- to seal it off.
- Start engine.

Check oil pressure at idling speed and at 2000 rpm

- Oil pressure at idling speed: at least 0.6 bar.
- Oil pressure at 2000 rpm: at least 1.5 bar
- Switch off engine.

Check oil pressure at 3800 rpm

- Pull off electrical plug-in connector from valve for the oil pressure - N428- control ⇒ [page 245](#) .
- Start engine.
- Increase engine speed to 3800 rpm and read off oil pressure on the oil pressure testing equipment - V.A.G 1342- .
- Minimum oil pressure at 3800 rpm at least minimum 2.8 bar

If the specifications are not met:

- Attach electrical plug-in connector onto the valve for the oil pressure - N428- control ⇒ [page 245](#) .
- Query event recorder of the engine management module and delete all recorded events vehicle diagnostic tester ⇒ Electronic Parts Catalogue (EPC) .
- Check valve for oil pressure control - N428- with ⇒ vehicle diagnosis tester .



Note

Low oil pressure can also be caused by mechanical faults, such as damaged bearings.

If no fault is found:

- Replace oil pump ⇒ [page 231](#) .

Check oil pressure switch for reduced oil pressure - F378- (brown):

- Switch off ignition.



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- Connect brown wire of tester to earth (-).
- Connect voltage tester - V.A.G 1527B- to battery positive (+) and oil pressure switch for reduced oil pressure - V.A.G 1594C- (brown) using cables from auxiliary test set - F378- .
- LED should not light up.
- If LED lights up, renew oil pressure switch for reduced oil pressure - F378- .

If LED does not light up:

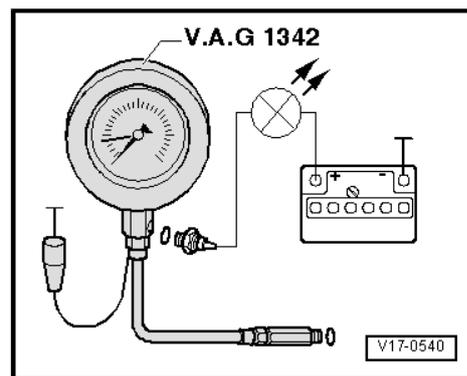
- Start engine: at 0.3 ... 0.6 bar the LED must light up, otherwise renew oil pressure switch.

Checking oil pressure switch - F1- (blue):

- Switch off engine.
- Connect voltage tester - V.A.G 1527B- to battery positive (+) and oil pressure switch - V.A.G 1594C- (blue) using cables from auxiliary test set - F1- .
- LED should not light up.
- If the LED lights up, replace oil pressure switch - F1- .

If LED does not light up:

- Pull off electrical plug-in connector from valve for the oil pressure - N428- control ⇒ [page 245](#) .
- Start engine, and increase speed. At 2.15 ... 2.95 bar the LED must light up, otherwise renew oil pressure switch.
- Attach electrical plug-in connector onto the valve for the oil pressure - N428- control ⇒ [page 245](#) .
- Install oil pressure switch for reduced oil pressure - F378- ⇒ [page 243](#) .
- Query event recorder of the engine management module and delete all recorded events ⇒ [vehicle diagnostic tester](#)



Specified torques

- ◆ ⇒ ["4.1 Exploded view - oil filter housing/oil pressure switches", page 241](#)

19 – Cooling

1 Cooling system/coolant

⇒ [“1.1 Connection diagram - coolant hoses”, page 248](#)

⇒ [“1.2 Draining and filling coolant”, page 251](#)

⇒ [“1.3 Check the cooling system for leaks”, page 256](#)

1.1 Connection diagram - coolant hoses

⇒ [“1.1.1 Connection diagram - Coolant hoses, vehicles ▶June 2013”, page 248](#)

⇒ [“1.1.2 Connection diagram - Coolant hoses, vehicles June 2013 ▶”, page 250](#)

1.1.1 Connection diagram - Coolant hoses, vehicles ▶June 2013



Note

- ◆ *Arrows show direction of coolant flow.*
- ◆ *The arrow markings on the coolant pipes and on the ends of the coolant hoses must align.*



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1 - Coolant expansion tank

2 - Sealing cap

- For coolant expansion tank
- Checking pressure relief valve ⇒ [page 257](#)

3 - Cylinder head/cylinder block

- Renew coolant after replacing.

4 - Engine preheating heater element - Z97-

- Will not be fitted

5 - Turbocharger

6 - Integrated exhaust manifold

7 - Heat exchanger for heater

- Renew coolant after replacing.

8 - Coolant temperature sender - G62-

9 - Coolant pump

- With thermostat housing

10 - Engine oil radiator

11 - Radiator outlet coolant temperature sender - G83-

12 - Radiator

- Renew coolant after replacing.

13 - Charge air cooling pump - V188-

14 - Radiator for charge air cooling circuit

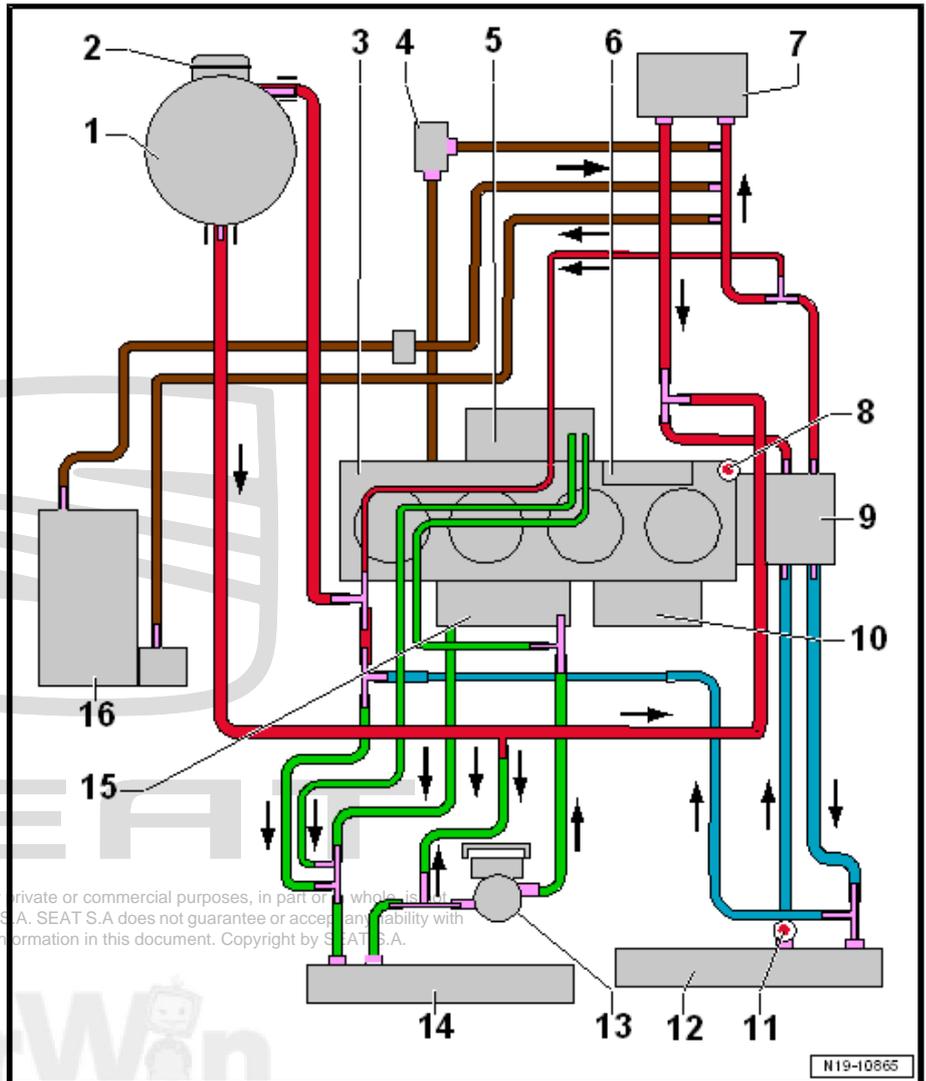
- Renew coolant after replacing.

15 - Charge air cooler in intake manifold

- Renew coolant after replacing.

16 - Auxiliary Heater

- Will not be fitted



1.1.2 Connection diagram - Coolant hoses, vehicles June 2013 ►

1 - Coolant expansion tank

2 - Sealing cap

- For coolant expansion tank
- Checking pressure relief valve ⇒ [page 257](#)

3 - Cylinder head/cylinder block

- Renew coolant after replacing.

4 - Engine preheating heater element - Z97-

- Will not be fitted

5 - Turbocharger

6 - Integrated exhaust manifold

7 - Heat exchanger for heater

- Renew coolant after replacing.

8 - Coolant temperature sender - G62-

9 - Coolant pump

- With thermostat housing

10 - Engine oil radiator

11 - Radiator outlet coolant temperature sender - G83-

12 - Radiator

- Renew coolant after replacing.

13 - Charge air cooling pump - V188-

14 - Radiator for charge air cooling circuit

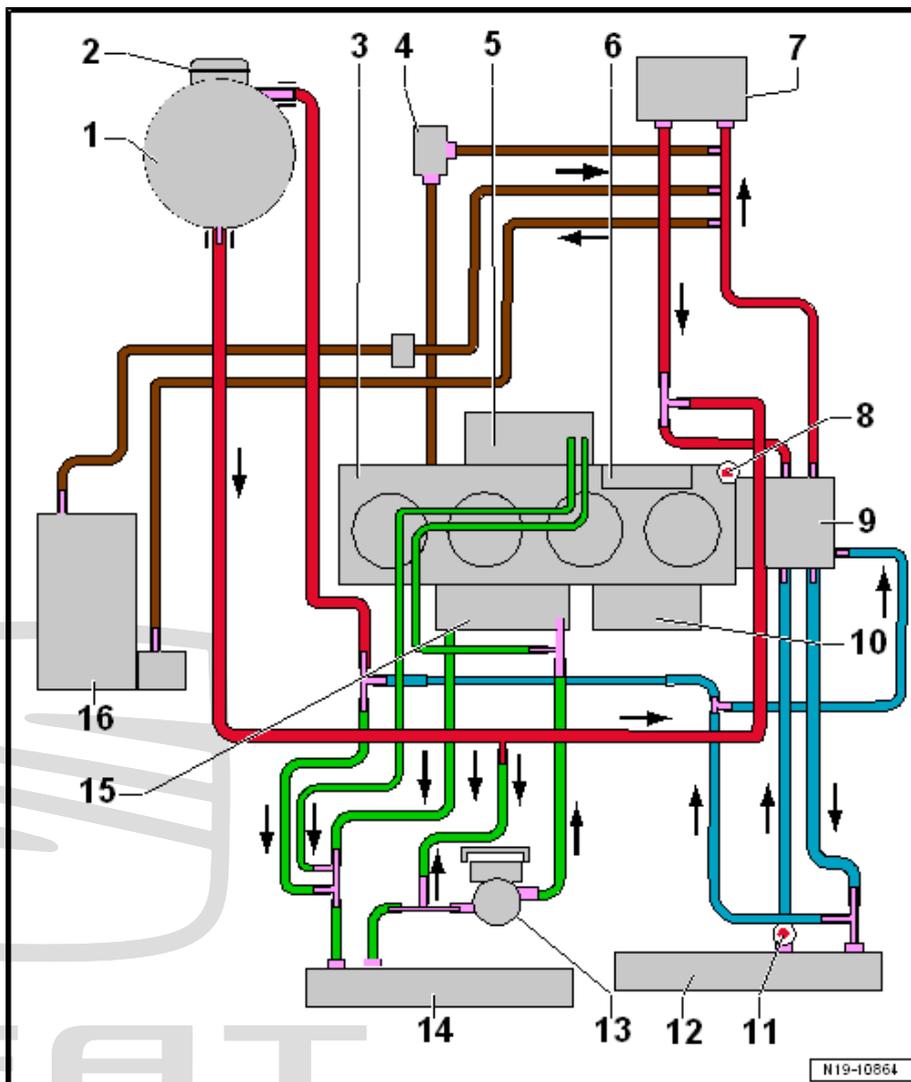
- Renew coolant after replacing.

15 - Charge air cooler in intake manifold

- Renew coolant after replacing.

16 - Auxiliary Heater

- Will not be fitted



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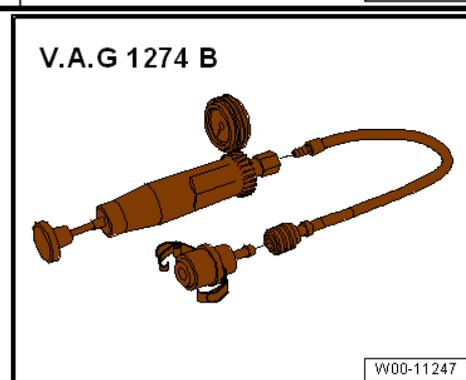
1.2 Draining and filling coolant

Special tools and workshop equipment required

- ◆ Refractometer - T10007 A-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6340-
- ◆ Cooling system charge unit - VAS 6096-
- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Protective glasses
- ◆ Protective gloves
- ◆ Cooling system tester - V.A.G 1274 B-



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Draining

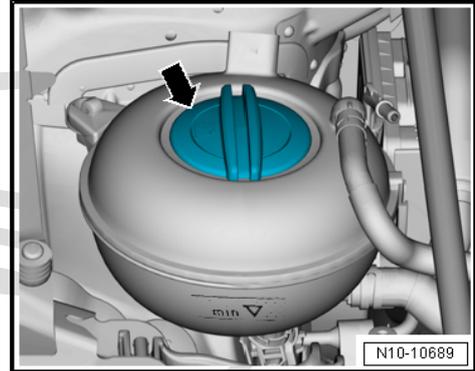
CAUTION

The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

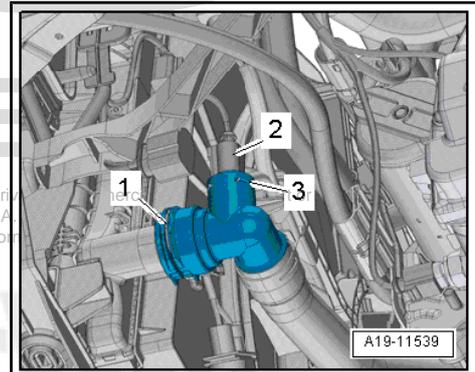
Risk of scalding to skin and body parts.

- Wear protection gloves.
- Use safety goggles.
- Reduce pressure by covering the cap of the coolant expansion tank with cloths and opening it carefully.

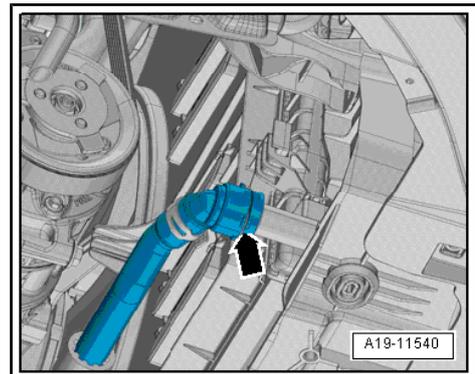
- Open filler cap -arrow- on coolant expansion tank.
- Remove noise insulation => General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Set drip tray for workshop hoist - VAS 6208- underneath.



- Disconnect connector -2- from radiator outlet coolant temperature sender - G83- -3-.
- Slightly lift retaining clip -1-, disconnect coolant hose from radiator (bottom left) and drain off coolant.



- Lift retaining clip -arrow-, disconnect coolant hose from water radiator (bottom right) for charge air cooling circuit and drain off remaining coolant.

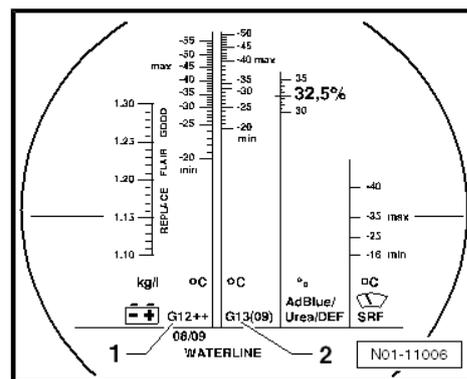


charge

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i Note

- ◆ The water used for the mixture has a significant influence on the affectivity of the cooling agent. The quality of water to be used is specified since the ingredients can vary from one land or region to another. Distilled water fulfils all requirements. For this reason, we recommend using distilled water when mixing coolant for topping up or replacing coolant.
- ◆ Use only coolant additives in accordance with the ⇒ Electronic parts catalogue (ETKA) . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.
- ◆ The correct coolant solution ratio helps prevent damage from freezing and corrosion as well as scaling. These also raise the boiling temperature. Therefore, the cooling system must be filled all year round with coolant additive.
- ◆ Because of its higher boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ ONLY refractometer - T10007A- may be used for determining current anti-freeze value.
- ◆ The normal frost protection must be to at least -25 °C, in countries with Arctic conditions to -36 °C. When climatic conditions require a stronger frost protection, only then may the frost protection be increased. But only down to -48 C, because below that, the cooling effect is impaired.
- ◆ The concentration of the coolant must not be reduced by adding water in summer or in countries with hot climates. Frost protection must be guaranteed down to at least -25 °C.
- ◆ Read anti-freeze figures from respective scale for type of anti-freeze added.
- ◆ The temperature read off the refractometer - T10007A- equates to the »ice flocculation point«. Ice flocculation can start forming in the coolant below this temperature.
- ◆ Do not reuse the dirty coolant.
- ◆ Use only a water/anti-freeze mixture as a slip agent for coolant hoses.



Recommended mixture ratio for coolant

Frost protection to	Coolant additive concentration	Coolant additive 1)	Distilled water 1)
-25 °C	40 %	3.2 l	4.8 l
-36 °C	50 %	4.0 l	4.0 l

1) The quantity of coolant can vary depending on the vehicle equipment.

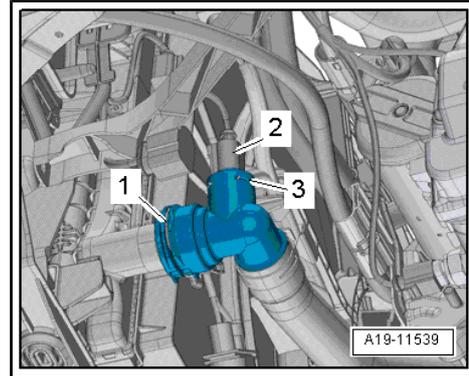
- Coolant ⇒ Electronic parts catalogue (ETKA)

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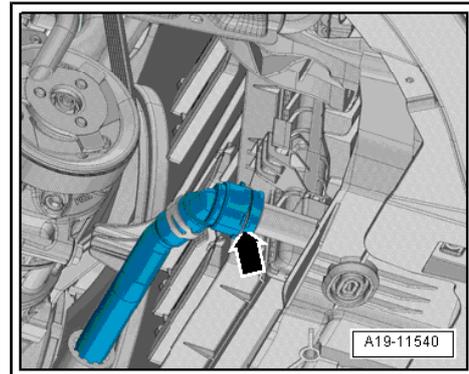


Work sequence

- Connect coolant hose with plug-in connector to radiator (bottom left) => [page 285](#) .



- Connect coolant hose to water radiator for charge air cooling circuit (bottom right) -arrow-.



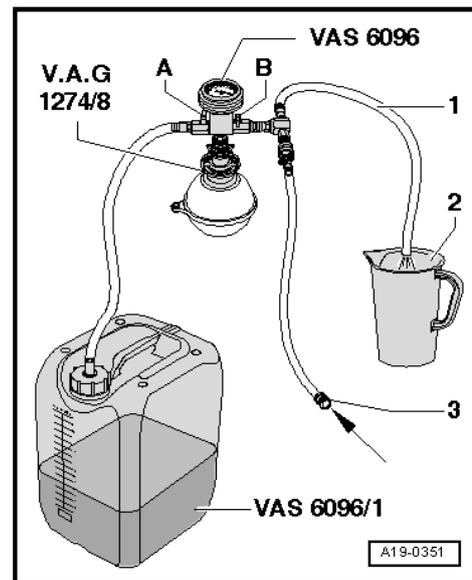
- Fill the coolant tank form -VAS 6096- with at least 10 litres of coolant that has previously been mixed at the respective ratio:
- Screw down adapter for cooling system tester - V.A.G 1274/8- to coolant expansion tank.
- Place cooling system charge unit - VAS 6096- on adapter - V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-.



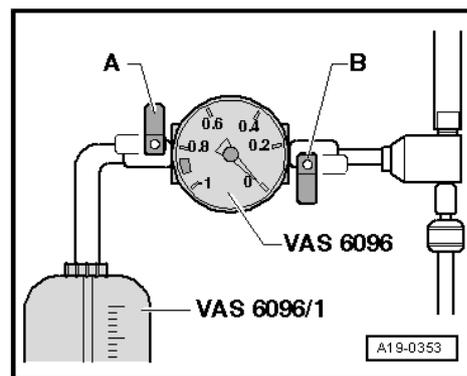
Note

Exhaust air takes a slight quantity of coolant along with it; this should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -3- to compressed air.
- 6 ... 10 bar of working pressure.

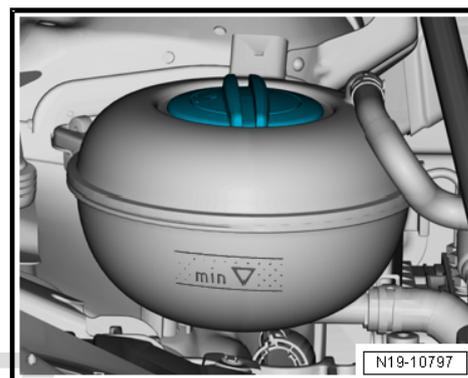


- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow to do this) so that hose on -VAS 6096- coolant reservoir fills with coolant.
- Close the 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 display instrument needle must remain in the green area so that the vacuum in the cooling system is sufficient for the following charge.



i Note

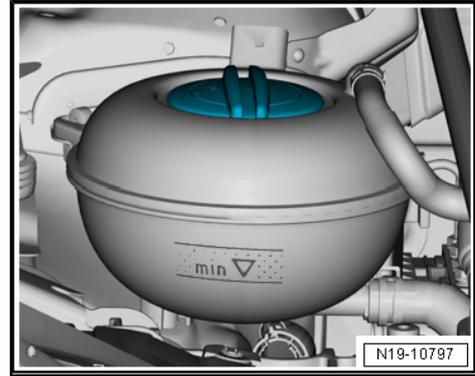
- ◆ *If the needle does not reach the green zone, repeat the process.*
- ◆ *If the vacuum drops, the cooling system must be checked for leaks.*
- Pull off compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.
- Detach cooling system charge unit - VAS 6096- from coolant expansion tank.
- Top up coolant to “max” mark.
- Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Leave the engine running between around 1500 rpm up to a maximum of 2800 rpm until the radiator fan jumps on.
- Close filler cap on coolant expansion tank (make sure it engages).
- Switch off ignition and allow engine to cool down.



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erWin

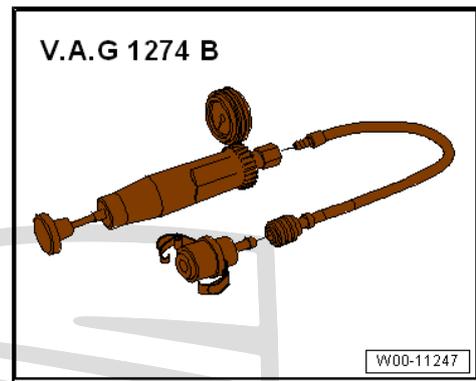
- Check coolant level.
- Screw on the adapter for the cooling system testing device - V.A.G 1274/8- on the expansion reservoir.
- Using the cooling system testing device - V.A.G 1274 B- enter 1 bar overpressure on the cooling system.
- With the engine running, fill with coolant up to approx. 5 mm above the Max mark.
- The coolant level must be between the “min”- and “max” - markings when the engine is cold.
- The coolant level can be at or above the “max” marking when the engine is warm.



1.3 Check the cooling system for leaks

Special tools and workshop equipment required

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



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



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



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Procedure

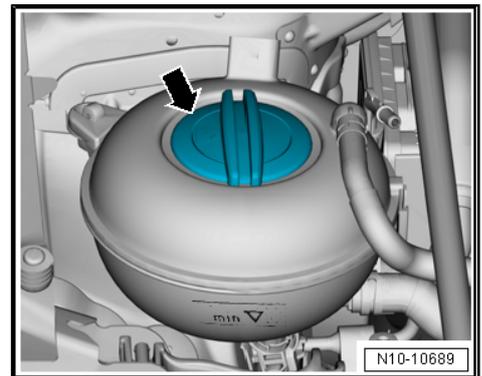
CAUTION

The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

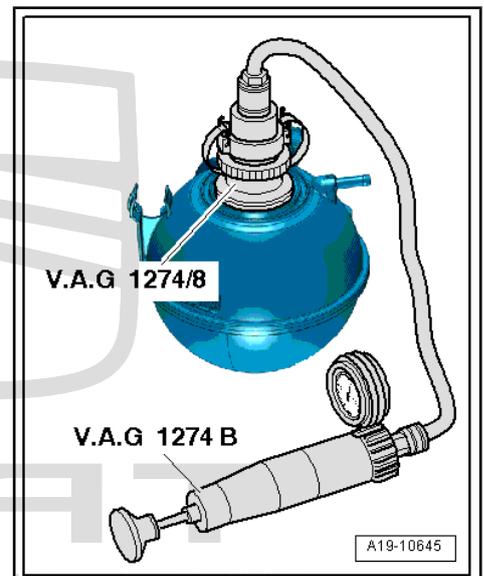
Risk of scalding to skin and body parts.

- Wear protection gloves.
- Use safety goggles.
- Reduce pressure by covering the cap of the coolant expansion tank with cloths and opening it carefully.

- Engine must be warm.
- Open filler cap -arrow- on coolant expansion tank.



- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.5 bar.
- The pressure must not drop by more than 0.2 bar within 10 minutes.
- If pressure drops by more than 0.2 bar, locate leaks and rectify faults.

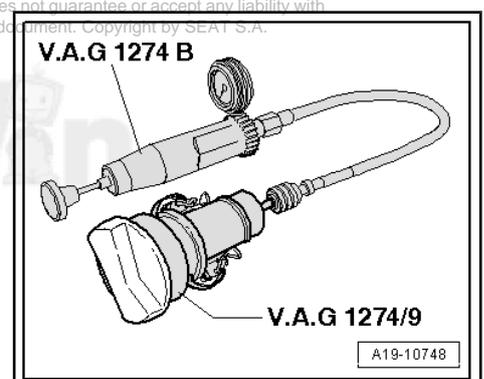


Note

The pressure drop by more than 0.2 bar within 10 minutes is caused by the coolant which cools down. The colder the engine the lower the pressure drop. If necessary, repeat the check while the engine is cold.

Check 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 1.6 ... 1.8 bar.
- Renew filler cap if pressure relief valve does not open as described.



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2 Coolant pump/thermostat assembly

⇒ [“2.1 Exploded view - coolant pump and thermostat”, page 258](#)

⇒ [“2.2 Exploded view - electric coolant pump”, page 260](#)

⇒ [“2.3 Exploded view - coolant temperature sensors”, page 262](#)

⇒ [“2.4 Removing and installing coolant pump”, page 263](#)

⇒ [“2.5 Removing and installing toothed belt pulley for coolant pump”, page 267](#)

⇒ [“2.6 Cooling system thermostat: removing and installing”, page 272](#)

⇒ [“2.7 Removing and installing electric coolant pump”, page 275](#)

⇒ [“2.8 Removing and installing coolant temperature sender G62”, page 277](#)

⇒ [“2.9 Removing and installing coolant temperature sender at radiator outlet G83”, page 278](#)

2.1 Exploded view - coolant pump and thermostat

1 - Thermostat housing

- Removing and installing
⇒ [page 272](#)

2 - Thermostat

- For small cooling circuit
- Start of opening at about 105 °C
- Different versions ⇒
Electronic parts catalogue
- Removing and installing
⇒ [page 272](#)

3 - Seal

- renew

4 - Coolant pump

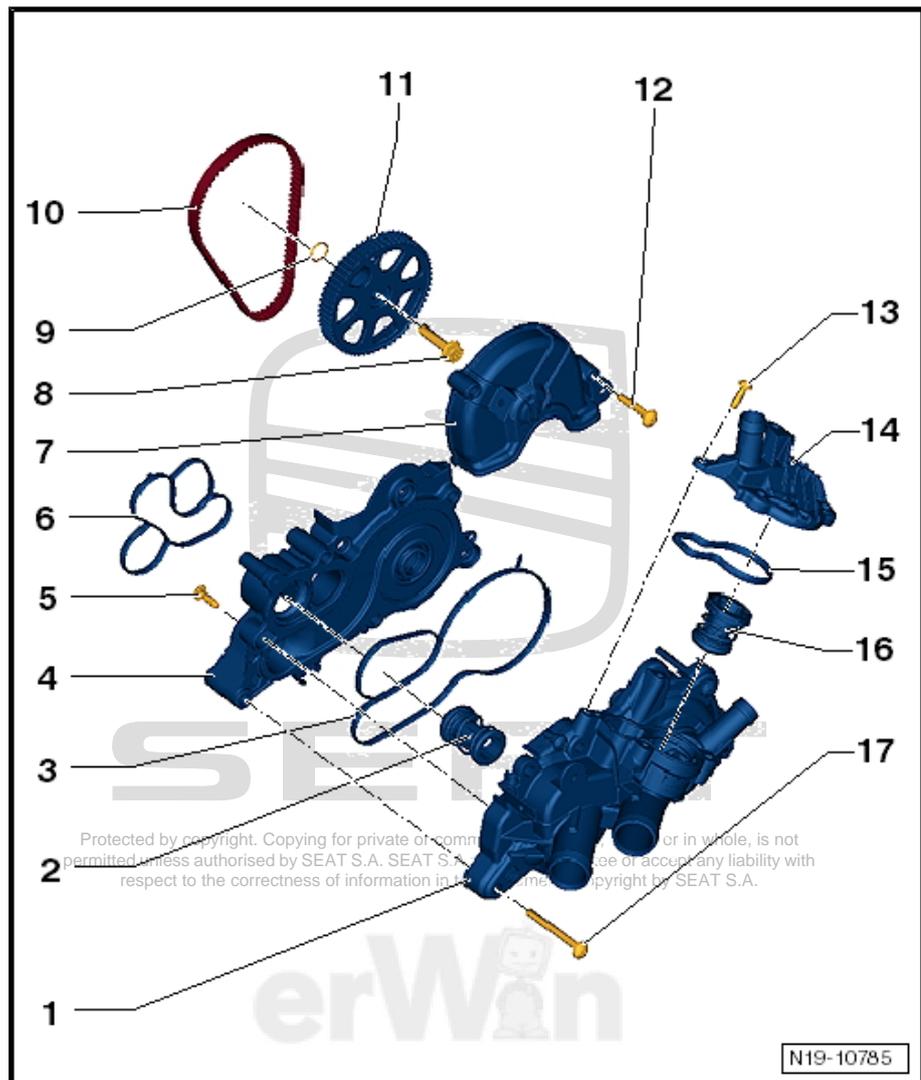
- Removing and installing
⇒ [page 263](#)
- Renew toothed belt as well when renewing coolant pump

5 - Bolt

- Thread-forming
- Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque.
- Tightening torque and sequence ⇒ [page 260](#)

6 - Seal

- renew



7 - Toothed belt guard

- For toothed belt for coolant pump

8 - Bolt

- renew
- 20 Nm +90°

9 - O-ring

- renew
- Only installed in engines with code CZEA
- Removing and installing ⇒ [page 267](#)

10 - Notched belt

- For coolant pump
- Renew toothed belt as well when renewing coolant pump

11 - Coolant pump sprocket

- For coolant pump
- Different versions, allocation ⇒ Electronic Parts Catalogue (EPC) .
- Removing and installing ⇒ [page 267](#)
- Installation position:

12 - Bolt

- 8 Nm

13 - Bolt

- Thread-forming
- Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque.
- Tightening torque and sequence ⇒ [page 260](#) .

14 - Cover

- For thermostat.
- With two coolant hose connections as of June 2013

15 - Seal

- renew

16 - Thermostat

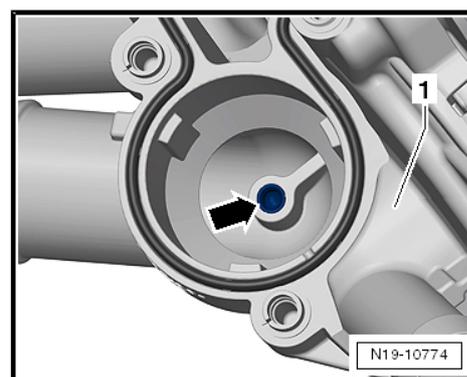
- For large cooling circuit
- until 11.2012: opening start at about 80 °C
- from 11.2012: opening start at about 87 °C
- Removing and installing ⇒ [page 272](#)
- Installation position ⇒ [page 259](#)

17 - Bolt

- Tightening torque and sequence ⇒ [page 266](#) .

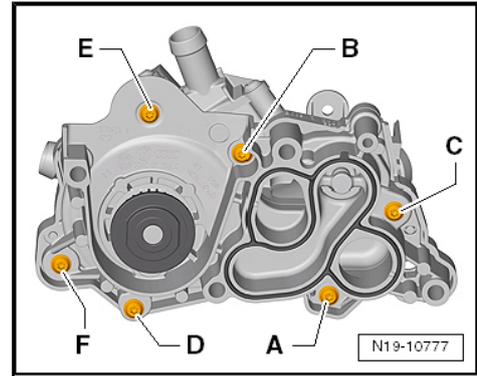
Installation position of thermostat for large cooling circuit

- Must be positioned with centring pin in guide -arrow- in thermostat housing.



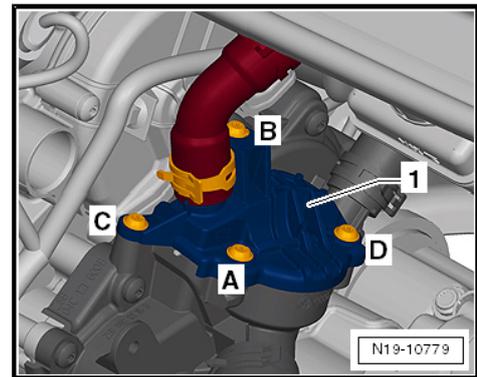
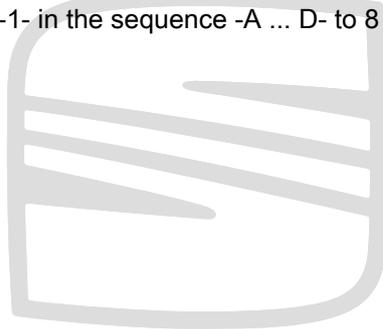
Thermostat housing to coolant pump - tightening torque and sequence

- Tighten bolts in the sequence -A ... F- to 8 Nm.



Cover for thermostat to thermostat housing - tightening torque

- Tighten bolts for cover -1- in the sequence -A ... D- to 8 Nm.



2.2 Exploded view - electric coolant pump

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erWin

1 - Charge air cooling pump - V188-

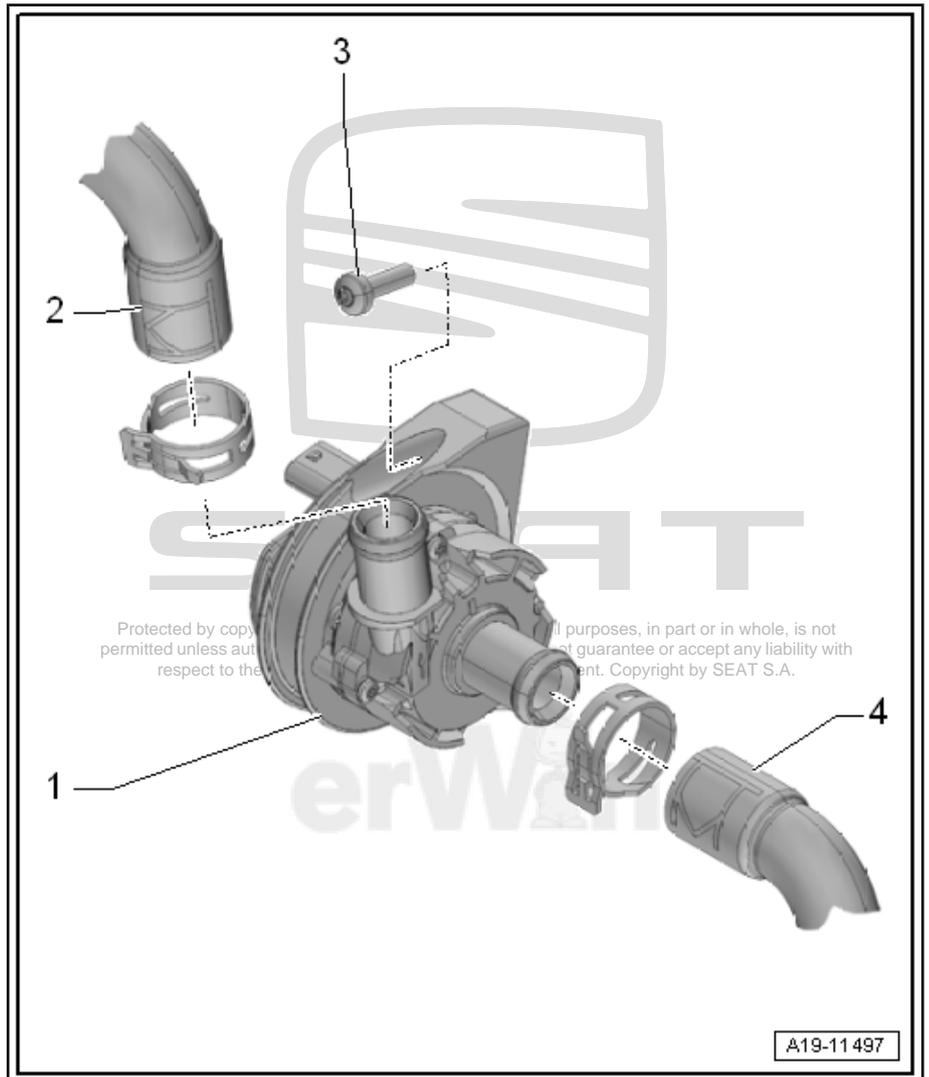
- With holder
- Removing and installing
⇒ [page 275](#)

2 - Coolant hose

3 - Bolt

- 8 Nm

4 - Coolant hose



2.3 Exploded view - coolant temperature sensors

1 - O-ring

- renew

2 - Radiator outlet coolant temperature sender - G83-

- Removing and installing
⇒ [page 278](#)

3 - Support ring

4 - O-ring

- renew

5 - Coolant temperature sender - G62-

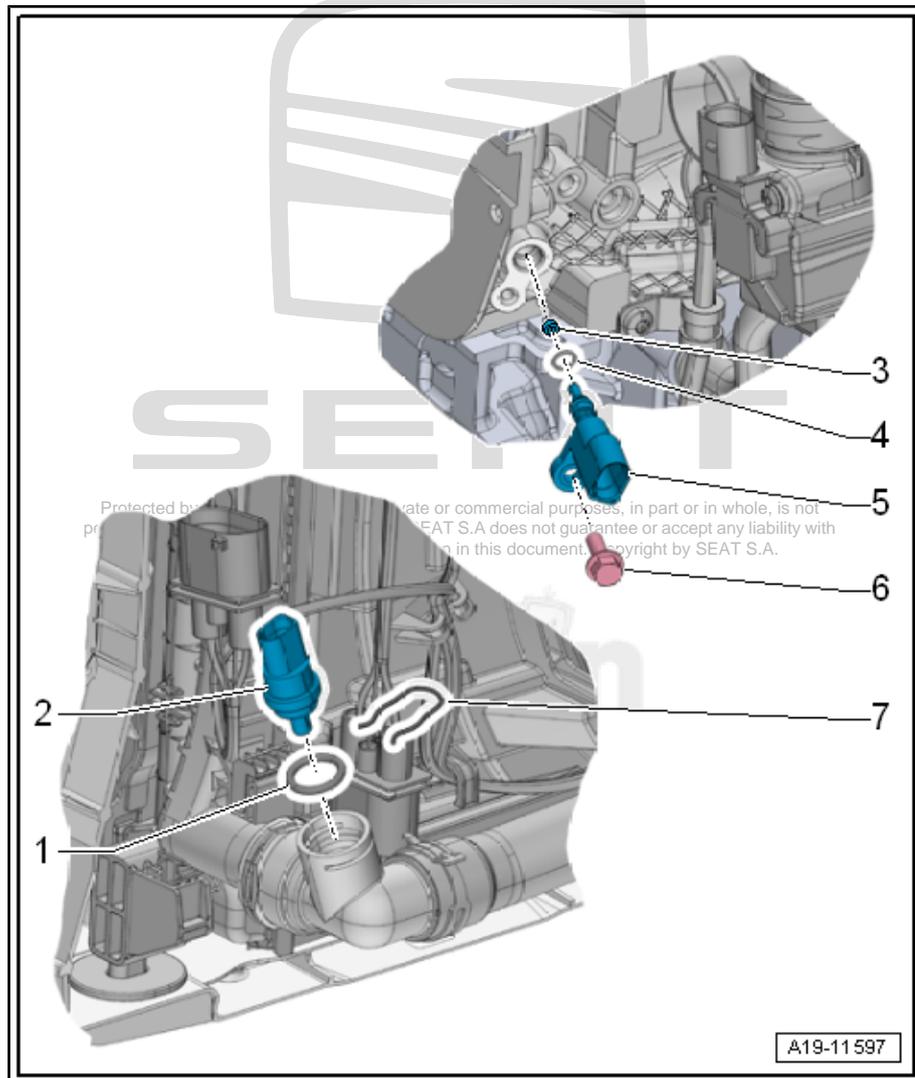
- Removing and installing
⇒ [page 277](#)

6 - Bolt

- 8 Nm

7 - Clip

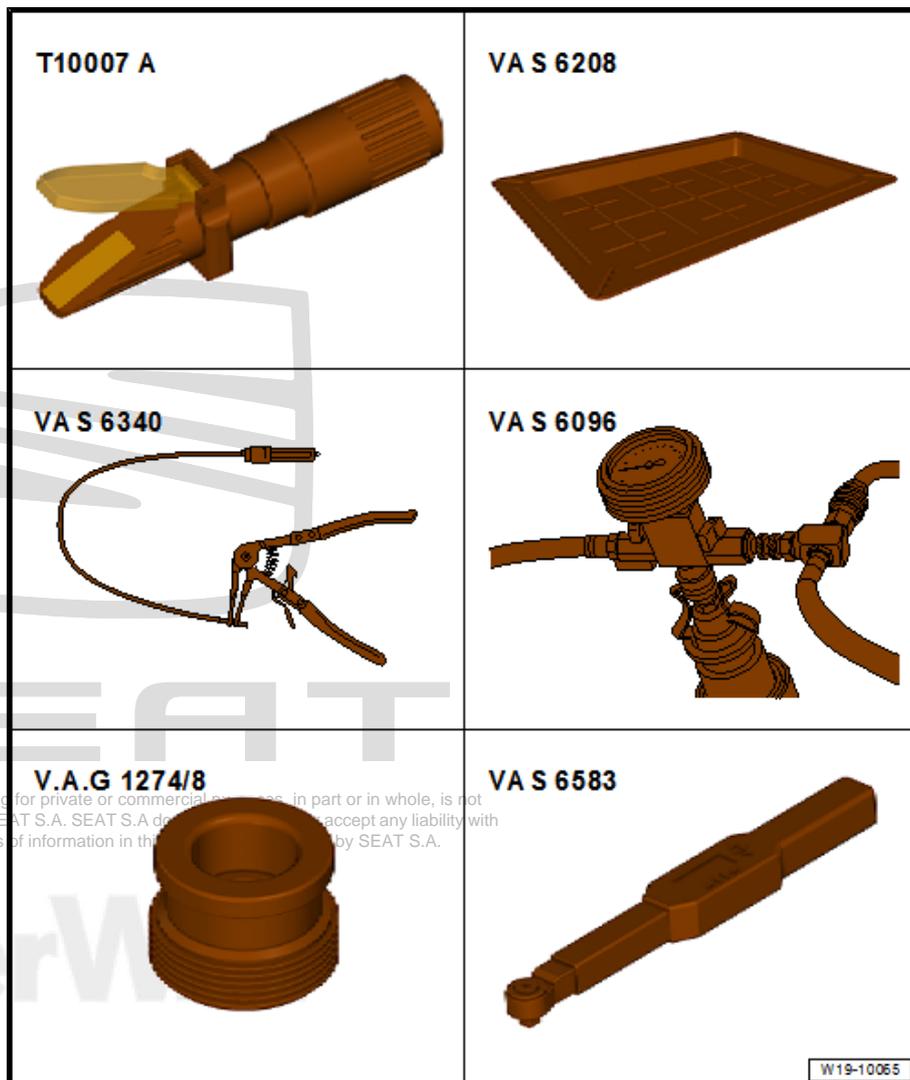
- Ensure correct seating



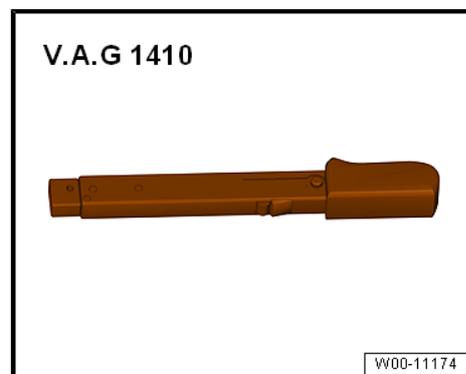
2.4 Removing and installing coolant pump

Special tools and workshop equipment required

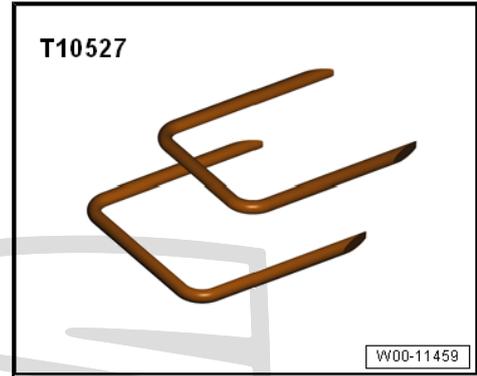
- ◆ Refractometer - T10007 A-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6340-
- ◆ Cooling system charge unit - VAS 6096-
- ◆ Adapter for cooling system tester - V.A.G 1274/8-
- ◆ Torque wrench - VAS 6583-



- ◆ Torque wrench - V.A.G 1410-

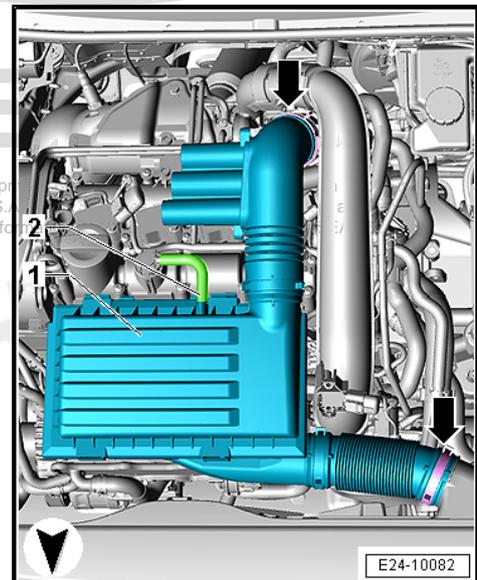


- ◆ Release tool - T10527- and -T10527/1-



Removing

- Drain coolant ⇒ [page 251](#) .
- Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .
- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

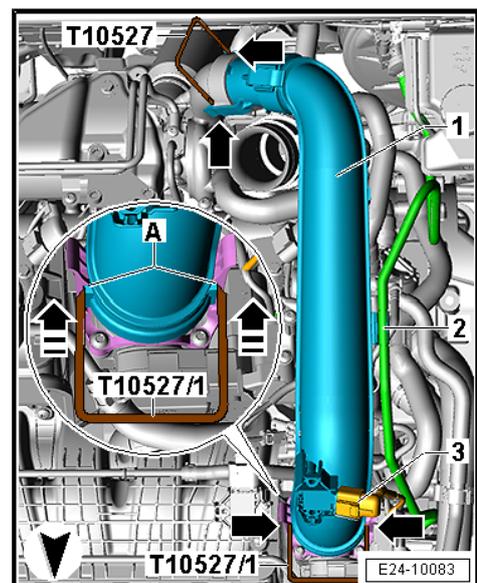
Note

- ◆ To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .
- ◆ Insert the release tool , note the detailed image -A-.

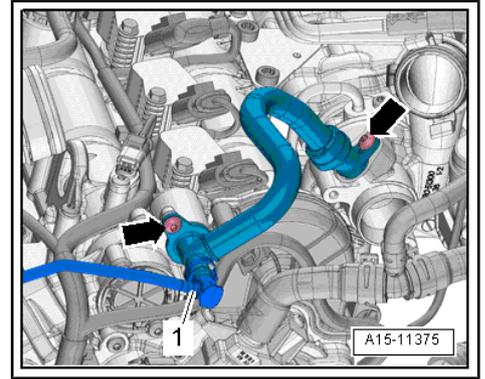
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

Note

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 sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.



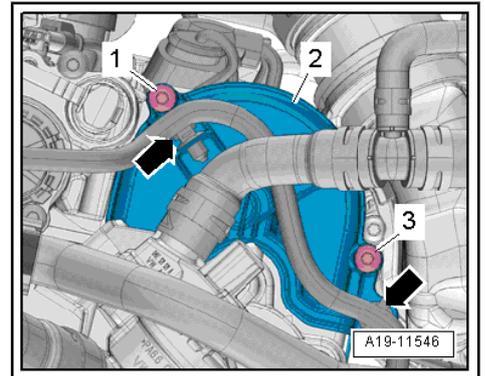
- Press release tabs and disconnect hose -1- for activated charcoal filter.
- Remove bolts -arrows- and detach crankcase breather hose.



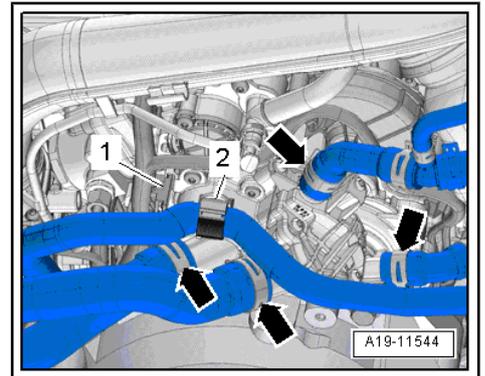
- Move clear electrical wiring harness -arrows-.
- Unscrew bolts -1-, -3- and remove toothed belt guard -2- of coolant pump.

 **Note**

To remove the toothed belt guard, push the coolant hose to one side and remove the guard carefully and without damaging the hose.



- Move clear electrical wiring harness -1- and coolant hose -2-.
- Loosen the hose clips -arrows-, remove the coolant hoses.

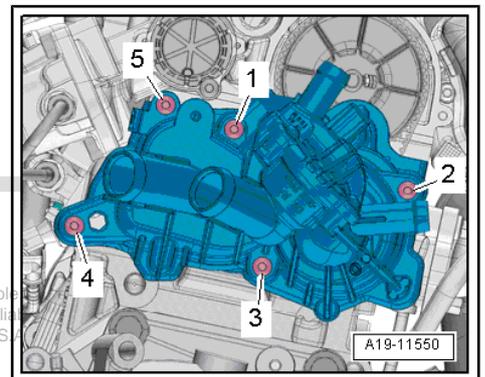


- Slacken and remove bolts in the sequence: -5 ... 1-.
- Detach coolant pump with toothed belt.

Installation

 **Note**

- ◆ *Renew gasket for housing -arrows-.*
- ◆ *If coolant pump is being renewed, renew toothed belt as well.*
- ◆ *Secure all hose connections with the hose clips corresponding to original equipment => Electronic parts catalogue .*

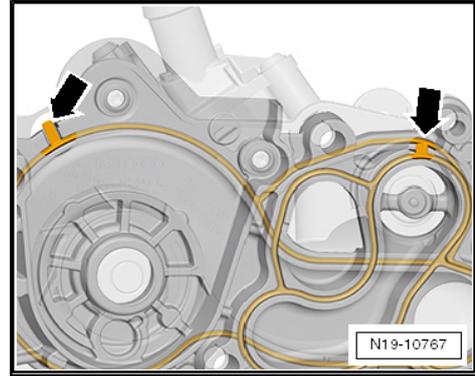


- Ensure proper seating of gaskets -arrows-.
- Lubricate seal for coolant pump lightly with coolant.



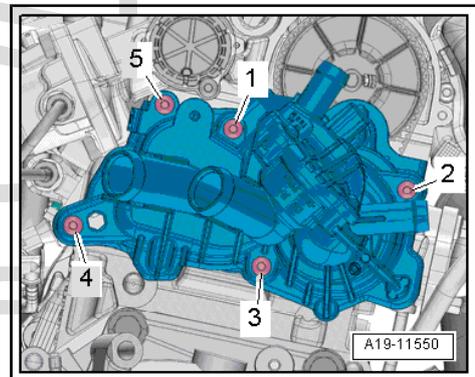
Note

- ◆ *Always adhere to the sequence of work steps given below when installing the coolant pump.*
- ◆ *This ensures that the toothed belt is correctly tensioned.*
- ◆ *The following work steps must be carried out with the aid of a 2nd mechanic.*



- Set No. 1 cylinder to TDC ⇒ [page 99](#) .
- Fit toothed belt so that it is centred and move coolant pump into installation position.
- Mount coolant pump on cylinder head with securing bolts.
- Pre-tighten bolts in the specified sequence:

stage	Bolts	Tightening torque
1.	-1 ... 5-	Screw in by hand until they make contact
2.	-1 ... 5-	10 Nm



- Loosen all bolts again by one turn.

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- Apply the torque wrench, -VAS 6583- with a hexagon key SW 10 -item 6- on the coolant pump.

i Note

For ease of handling, apply torque wrench -VAS 6583- vertically.

- Have a second mechanic apply a torque of 30 Nm to coolant pump.

i Note

- ◆ Do not support torque wrench with your other hand.
- ◆ Do not apply »excessive force« to torque wrench.

- While keeping coolant pump under tension, tighten bolts for coolant pump in specified sequence:

stage	Bolts	Tightening torque
3.	-2, 1, 5-	10 Nm
4th	-3, 4, 5, 1, 2-	12 Nm

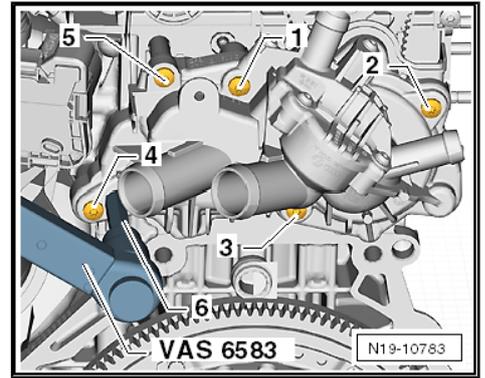
Install in reverse order of removal, observing the following:

- Fill up with coolant ⇒ [page 252](#) .

Specified torques

- ◆ Tightening sequence for coolant pump ⇒ [page 266](#)
- ◆ ⇒ ["2.1 Exploded view - coolant pump and thermostat", page 258](#)
- ◆ ⇒ ["1.1 Exploded view - turbocharger", page 295](#)
- ◆ ⇒ ["2.1 Assembly overview - charge air system", page 306](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Battery; Battery: Assembly overview .

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2.5 Removing and installing toothed belt pulley for coolant pump

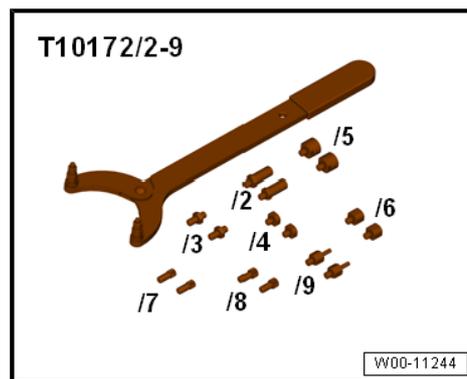
⇒ ["2.5.1 Removing and installing toothed belt pulley for coolant pump, engine code CZEA", page 267](#)

⇒ ["2.5.2 Remove and install toothed belt sprocket for coolant pump, engine codes CMBA, CHPA, CXSA, CZCA, CZDA", page 271](#)

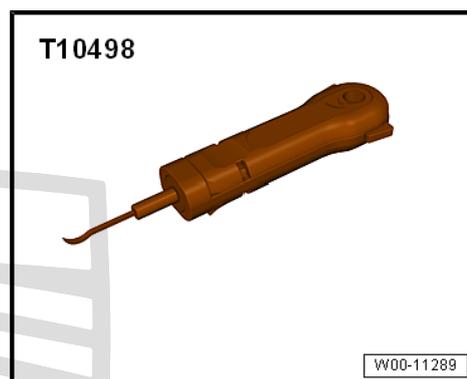
2.5.1 Removing and installing toothed belt pulley for coolant pump, engine code CZEA

Special tools and workshop equipment required

- ◆ counter-hold tool - T10172- with adapter -T10172/2-



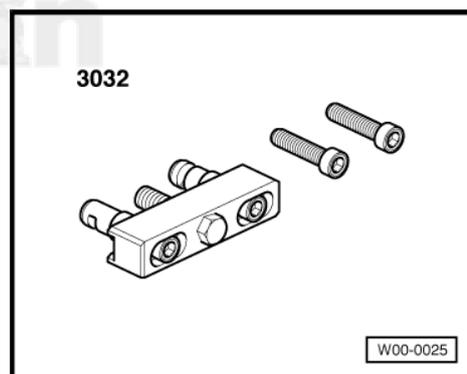
- ◆ Removal tool - T10498-



- ◆ Slider - T10505-

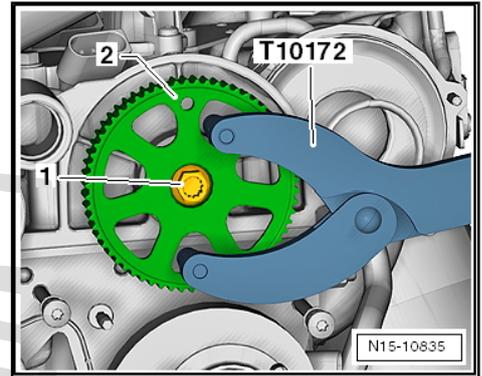


- ◆ Puller - 3032-

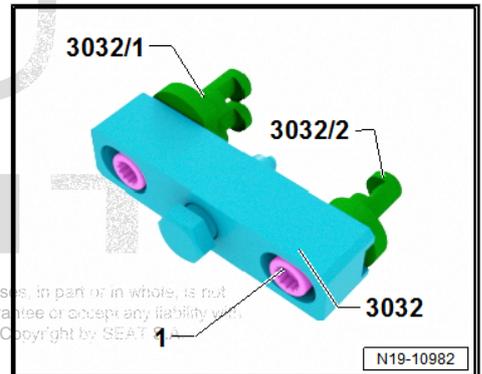


Removing

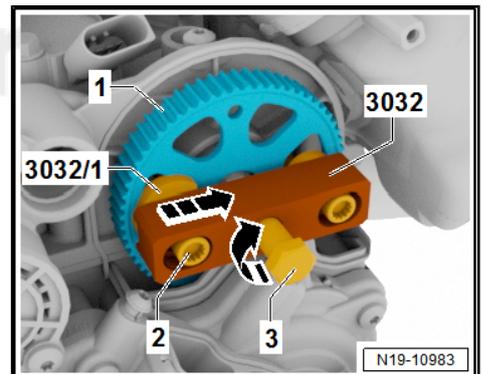
- Remove coolant pump ⇒ [page 263](#) .
- Unscrew bolt -1- using counterhold - T10172- with adapter - T10172/2- .
- Screw in bolt -1- by 3 turns.



- Tighten bolt -1- for adapter - 3032/2- while it is positioned in the centre of the elongated hole.
- Fit puller - 3032- on toothed belt pulley -1- as shown in illustration.



- Push adapter - 3032/1- to stop in -direction of arrow-.
- Tighten bolt -2- hand-tight.
- Screw in screw -3- in -direction of arrow-, until toothed belt pulley is removed.



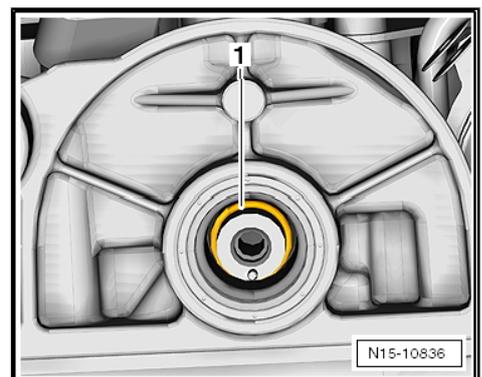
Note

After the toothed belt pulley has been removed, renew the O-ring on the camshaft.

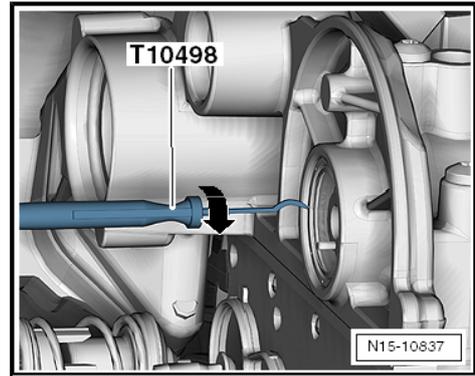
Removing O-ring

The O-ring -1- must be fitted at a depth of approx. 15 mm onto camshaft journal.

- Guide assembly tool - T10498- above camshaft as far as O-ring.



- Turn removing tool - T10498- -arrow- to insert it under O-ring.
- Pull O-ring off camshaft towards front.



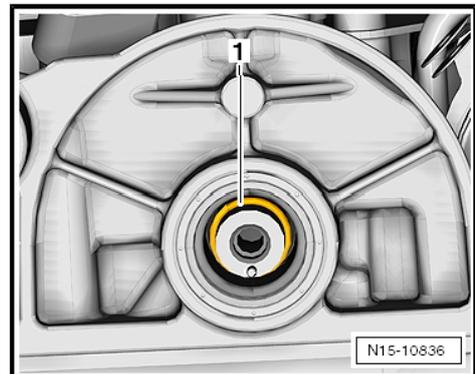
Installing O-ring

- Fit new O-ring -1- onto stub of camshaft.



Note

Ensure that the dowel pin on the camshaft is seated in recess in assembly sleeve - T10505- .



- Fit assembly sleeve - T10505- onto camshaft and push it to stop by hand in -direction of arrow-.
- Remove assembly sleeve - T10505- .

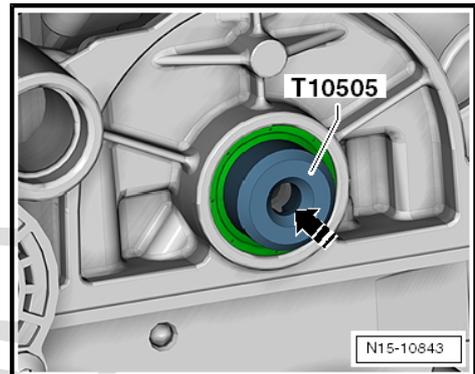
O-ring must be positioned in groove on camshaft.

Installation



Note

- ◆ No kind of striking tool may be used.
- ◆ Push the toothed belt pulley onto the camshaft only by hand.
- ◆ This prevents axial misalignment of the camshaft.



Fitting toothed belt pulley:

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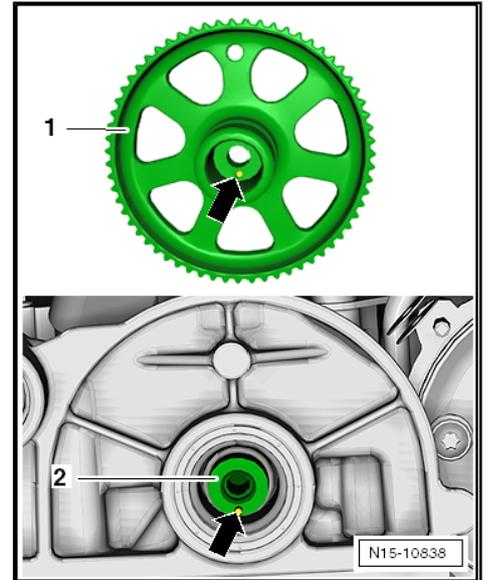
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- Fit toothed belt pulley -1- onto camshaft -2- so that the dowel pin of camshaft is seated in the hole of toothed belt pulley -arrows-.
- Fit the coolant pump ⇒ [page 263](#) .

Specified torques

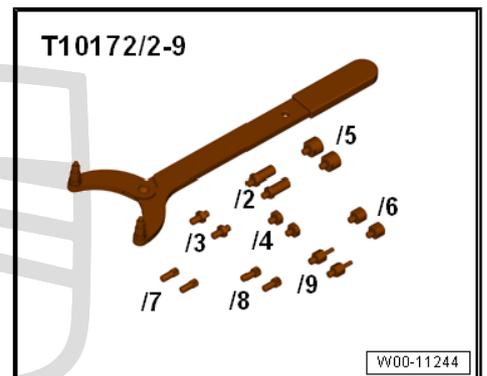
- ◆ ⇒ "2.1 Exploded view - coolant pump and thermostat", [page 258](#)



2.5.2 Remove and install toothed belt sprocket for coolant pump, engine codes CMBA, CHPA, CXSA, CZCA, CZDA

Special tools and workshop equipment required

- ◆ counter-hold tool - T10172- with adapter -T10172/2-



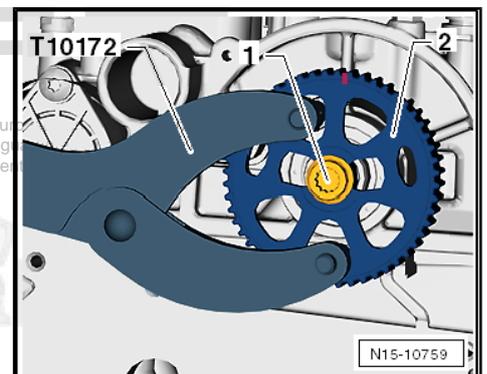
- ◆ Sealant ⇒ Electronic parts catalogue (ETKA)

Removing

- Remove coolant pump ⇒ [page 263](#) .
- Loosen bolt -1- using counter-hold tool - T10172- with adapters -T10172/2- .
- Remove bolt and take off toothed belt drive sprocket -2-.

Installation

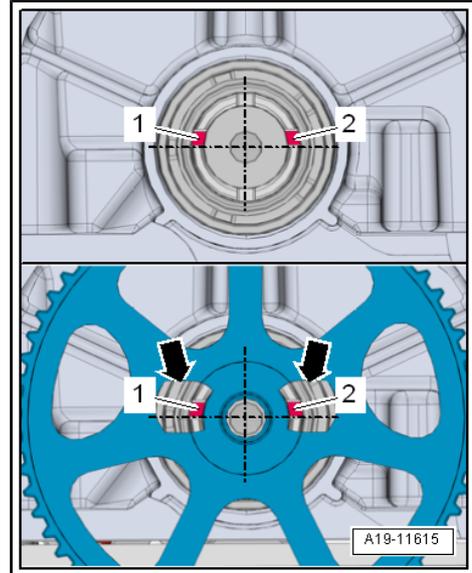
Install in the reverse order of removal, observing the following:



- Fit toothed belt drive sprocket:
- The grooves -1- and -2- in the camshaft are arranged asymmetrically.
- The recesses -arrows- in toothed belt pulley are also arranged in an asymmetrical way.
- Fit toothed belt pulley onto camshaft so that the grooves of the camshaft are fully centred within the recesses of the toothed belt pulley.
- Fit the coolant pump ⇒ [page 263](#) .

Specified torques

- ◆ ⇒ [“2.1 Exploded view - coolant pump and thermostat”, page 258](#)



2.6 Cooling system thermostat: removing and installing

⇒ [“2.6.1 Removing and installing thermostat for large cooling circuit”, page 272](#)

⇒ [“2.6.2 Removing and installing thermostat for small cooling circuit”, page 275](#)

2.6.1 Removing and installing thermostat for large cooling circuit

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



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- ◆ Spanner - T10508-

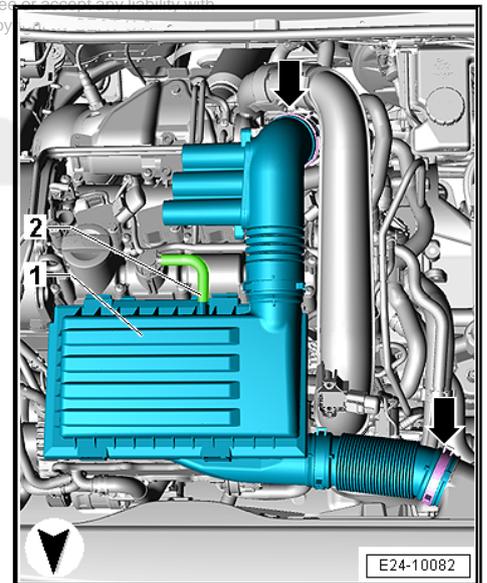


- ◆ Release tool - T10527- and -T10527/1-



Removing

- Drain coolant ⇒ [page 251](#).
- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



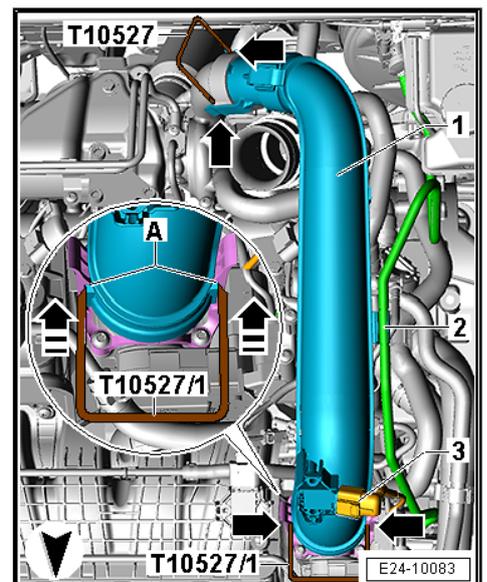
- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

Note

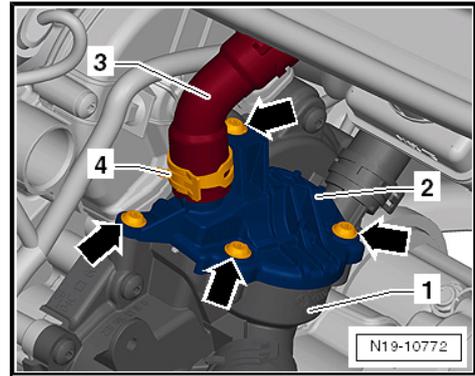
- ◆ To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .
- ◆ Insert the release tool , note the detailed image -A-.
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

Note

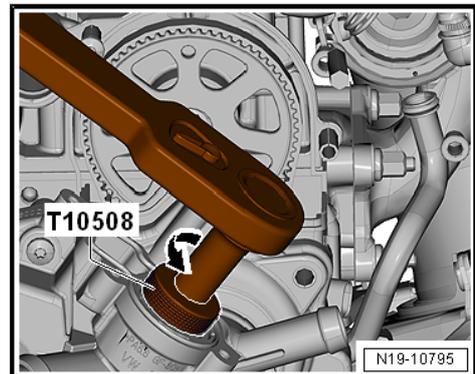
When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine sealing cap set - VAS 6122-) to prevent foreign particles from entering the engine.



- Release hose clip -4- and detach coolant hose -3-.
- Remove bolts -arrows- and detach cover -2- from thermostat housing.

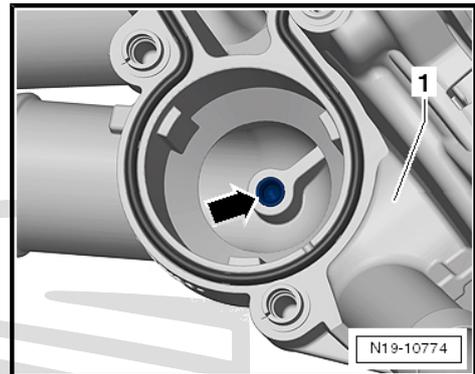


- Remove thermostat using special wrench - T10508- .
- Slightly push down special wrench - T10508- and turn it in -direction of arrow- while doing so.



Installation

- Insert thermostat ensuring that the centring pin of thermostat is seated in guide -arrow-.



- Install thermostat using special wrench - T10508- .
- Slightly push down special wrench - T10508- and turn it to stop in -direction of arrow- while doing so.

Install in the reverse order of removal, observing the following:

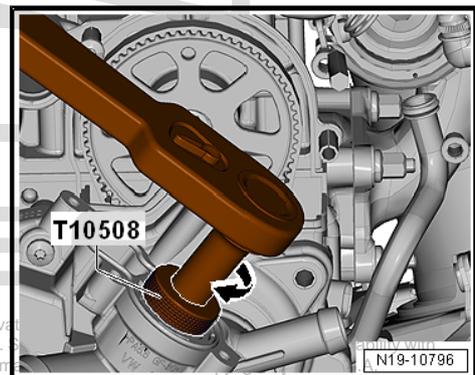
Note

Renew seals

- Moisten gasket with coolant.
- Fill up with coolant ⇒ [page 252](#) .

Specified torques

- ◆ ⇒ [Fig. "Cover for thermostat to thermostat housing - tightening torque"](#) , [page 260](#)

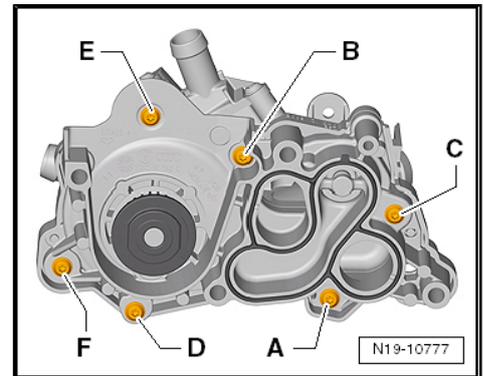


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2.6.2 Removing and installing thermostat for small cooling circuit

Removing

- Remove coolant pump ⇒ [page 263](#) .
- Remove bolts in the sequence -F ... A-.
- Detach coolant pump from thermostat housing.



- Detach thermostat -2- from coolant pump -1-.

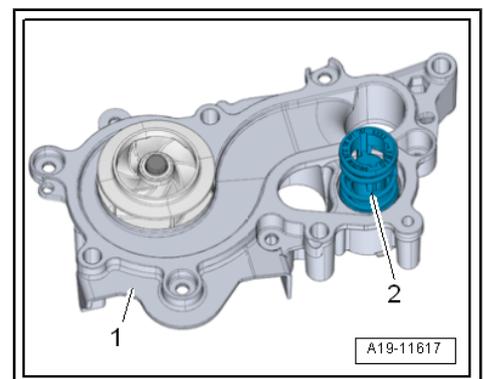
Installation

Install in the reverse order of removal, observing the following:



Renew seals

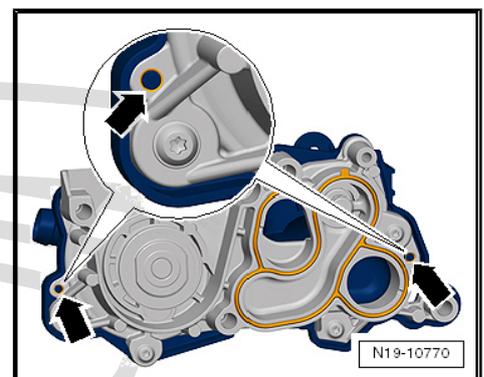
- Moisten gasket with coolant.



- Fit thermostat housing onto coolant pump.
- Centring pins on thermostat must be fitted in guides -arrows- on coolant pump.
- Tighten bolts for thermostat housing ⇒ [page 260](#)
- Install coolant pump ⇒ [page 263](#) .
- Fill up with coolant ⇒ [page 252](#) .

Specified torques

- ◆ ⇒ [Fig. "Thermostat housing to coolant pump - tightening torque and sequence"](#) , [page 260](#)



2.7 Removing and installing electric coolant pump

Special tools and workshop equipment required

- ◆ Hose clamps, up to Ø 25 mm - 3094-

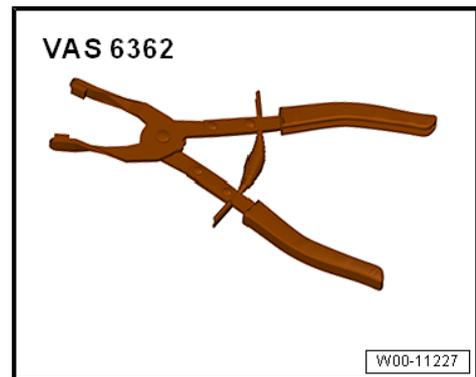
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- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - VAS 6362-



Removing

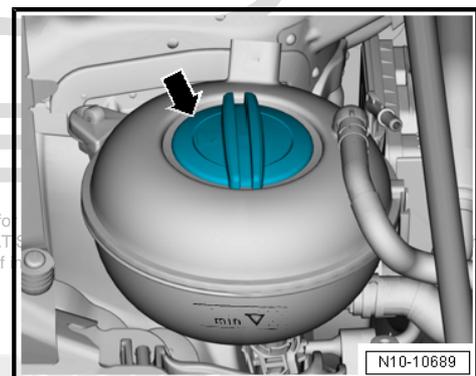
⚠ CAUTION

The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

Risk of scalding to skin and body parts.

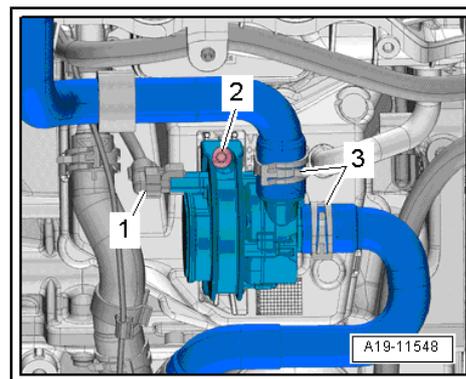
- Wear protection gloves.
- Use safety goggles.
- Reduce pressure by covering the cap of the coolant expansion tank with cloths and opening it carefully.

- Open filler cap -arrow- on coolant expansion tank.
- Remove noise insulation => Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



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- Unplug the electrical connector -1-.
- Set drip tray for workshop hoist - VAS 6208- underneath.
- Disconnect coolant hoses at the pump for charge air cooler - 3094- with hose clips -V188- .
- Loosen the hose clips -3-, remove the coolant hoses.
- Unscrew bolt -2- and remove charge air cooling pump - V188- .



Installation

Install in the reverse order of removal, observing the following:



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

- Check the coolant level ⇒ [page 256](#) .

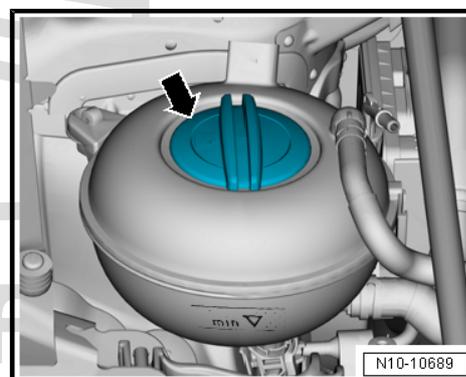
Specified torques

- ◆ ⇒ [“2.2 Exploded view - electric coolant pump”, page 260](#)
- ◆ ⇒ Rep. gr. 66 ; Noise insulation; Assembly overview - noise insulation

2.8 Removing and installing coolant temperature sender - G62-

Removing

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



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- Unplug the electrical connector.



Note

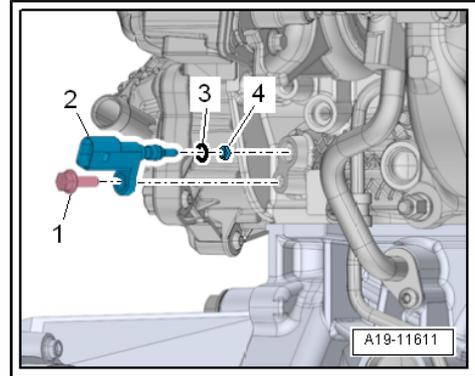
Place a cloth underneath to catch escaping coolant.

- Unscrew bolt -1-, coolant, remove temperature sender - G62- - item 2-.



Note

- ◆ If O-ring -3- with support ring -4- remains lodged in cylinder head, lift out O-ring with support ring using a piece of wire.
- ◆ Insert new coolant temperature sender - G62- immediately into cylinder head in order to avoid loss of coolant.



Installation

Install in the reverse order of removal, observing the following:



Note

Replace the O-ring.

- Check the coolant level ⇒ [page 256](#) .

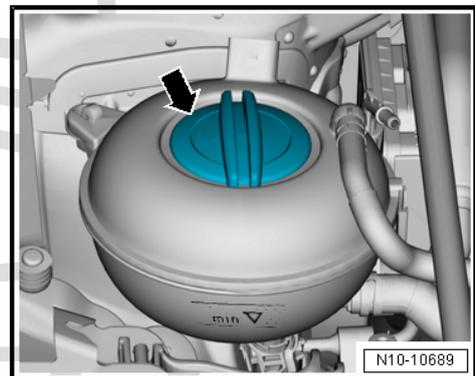
Specified torques

- ◆ ⇒ [“2.3 Exploded view - coolant temperature sensors”](#), [page 262](#)

2.9 Removing and installing coolant temperature sender at radiator outlet - G83-

Removing

- Engine cold.
- To relieve residual pressure in cooling system, open filler cap -arrow- on coolant expansion tank briefly and then close cap again (it should click into place).
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



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- Unplug the electrical connector -2-.

 **Note**

Place a cloth underneath to catch escaping coolant.

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

Installation

Install in the reverse order of removal, observing the following:

 **Note**

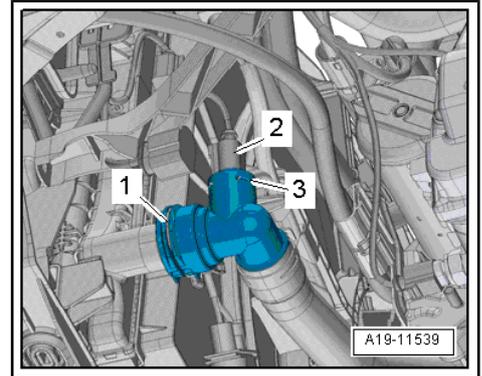
- ◆ *Replace the O-ring.*
- ◆ *To avoid coolant loss, immediately insert the new coolant temperature sender at the radiator outlet - G83- into the union.*

- Check the coolant level ⇒ [page 256](#) .

Specified torques

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

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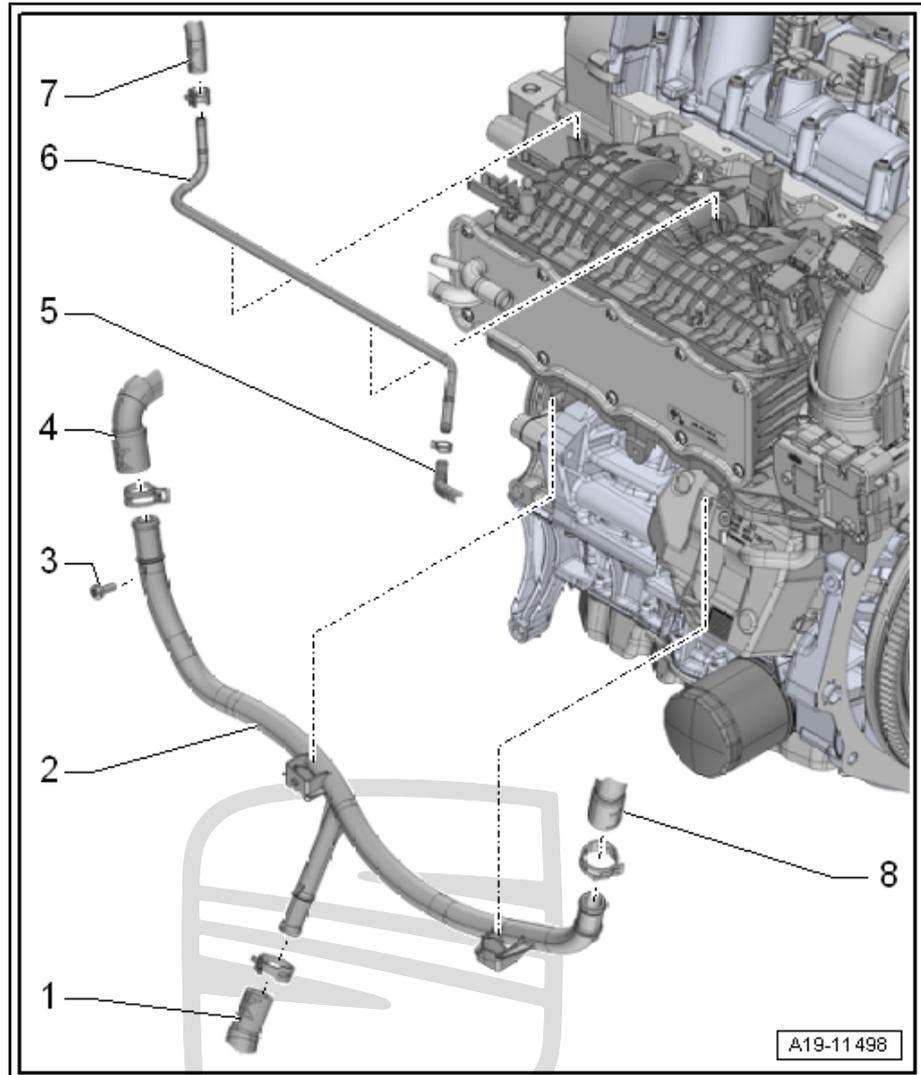
3 Coolant pipes

⇒ "3.1 Exploded view - coolant pipes", page 280

⇒ "3.2 Removing and installing coolant pipes", page 280

3.1 Exploded view - coolant pipes

- 1 - Coolant hose
- 2 - Coolant pipe
 - ❑ Clipped onto intake manifold (bottom)
 - ❑ Carefully lever it out of catches using a screwdriver when removing.
- 3 - Bolt
 - ❑ 8 Nm
- 4 - Coolant hose
- 5 - Coolant hose
- 6 - Coolant line
 - ❑ Clipped onto intake manifold (top)
- 7 - Coolant hose
- 8 - Coolant hose



3.2 Removing and installing coolant pipes

Special tools and workshop equipment required

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- ◆ Hose clamps, up to Ø 25 mm - 3094-

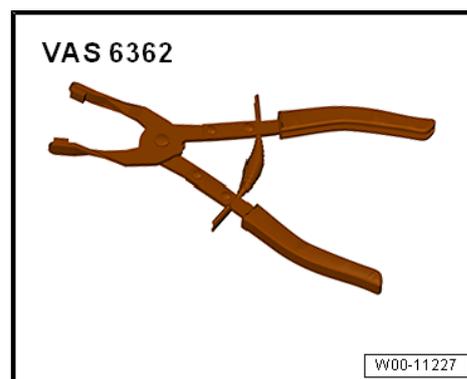
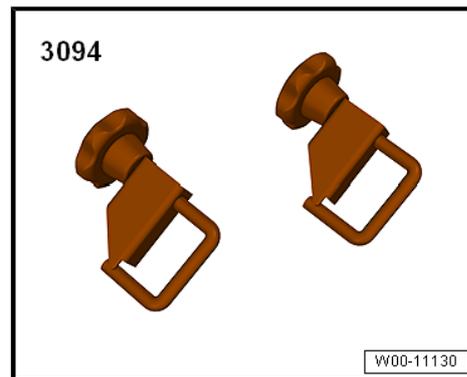


- ◆ Hose clip pliers - VAS 6362-

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erWin



Removing

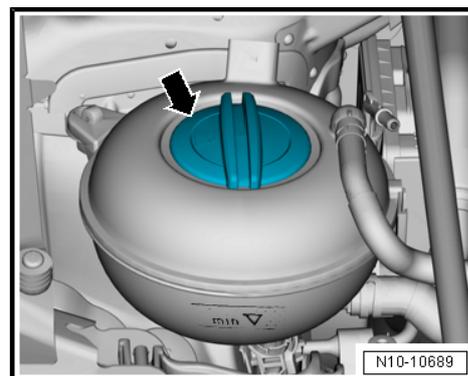
CAUTION

The cooling system is under pressure when the engine is hot. Hot steam/hot coolant can escape - risk of scalding.

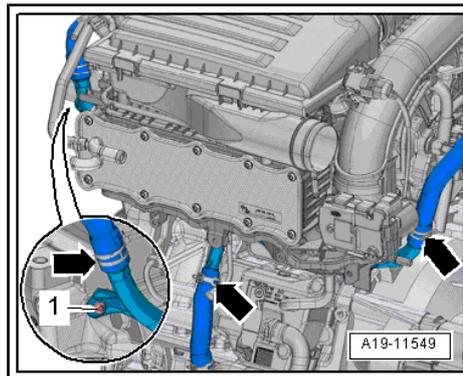
Risk of scalding to skin and body parts.

- Wear protection gloves.
- Use safety goggles.
- Reduce pressure by covering the cap of the coolant expansion tank with cloths and opening it carefully.

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



- Clamp off coolant hoses at coolant pipe with hose clamps -3094- .
- Loosen the hose clips -arrows-, remove the coolant hoses.
- Now remove the intake manifold => [page 329](#) .



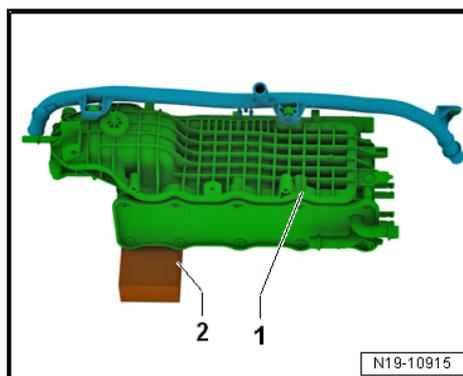
- Place the intake manifold -1- onto the workbench as shown.
- Place e.g. a block of wood -2- under the intake manifold as an underlay.



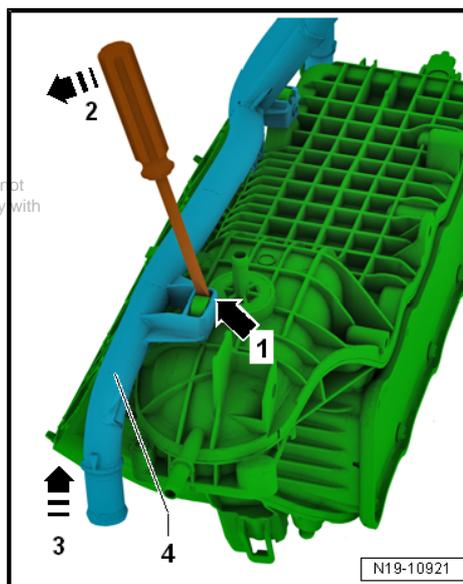
Note

To avoid damaging the intake manifold and coolant pipe, this work must be carried out very carefully!

- Push a pan head screwdriver into the recess -arrow 1-.

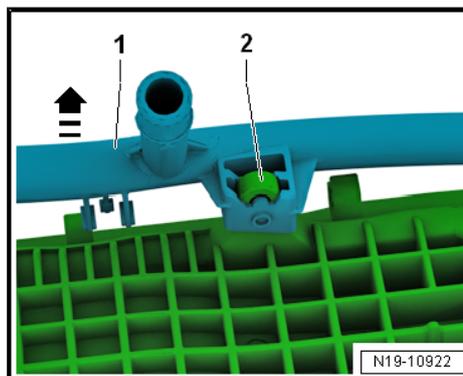


- Carefully press the screwdriver in the direction of the -arrow 2- and simultaneously lift the coolant pipe -4- in the direction of the -arrow 3- until the catch releases.



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- Continue to lift the coolant pipe -1- in -direction of arrow- until it comes free of the retainer -2-.



Installation

- First push the coolant pipe onto the mounting -1- until it engages.
- Then press the coolant pipe onto the mounting -2- until it engages.
- Pull to ensure that both mountings are engaged.

Install in the reverse order of removal, observing the following:



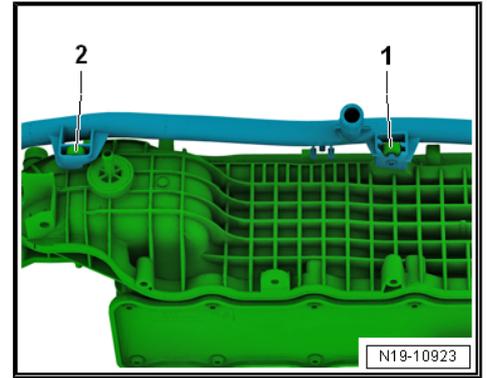
Note

- ◆ *Renew gaskets and O-rings.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue \(ETKA\)](#) .*

- **Install intake manifold** ⇒ [page 329](#) .
- **Check the coolant level** ⇒ [page 256](#) .

Specified torques

- ◆ ⇒ ["3.1 Exploded view - coolant pipes", page 280](#)



4 Radiator/radiator fans

⇒ [“4.1 Exploded view - radiator/radiator fans”, page 284](#)

⇒ [“4.2 Exploded view - radiator cowl and radiator fans”, page 286](#)

⇒ [“4.3 Removing and installing radiator”, page 286](#)

⇒ [“4.4 Removing and installing cooler for charge air cooling circuit”, page 288](#)

⇒ [“4.5 Removing and installing radiator cowl”, page 293](#)

⇒ [“4.6 Removing and installing radiator fans”, page 293](#)

4.1 Exploded view - radiator/radiator fans

1 - Coolant radiator

- Removing and installing ⇒ [page 286](#)

- Change coolant after re-
newing

2 - Coolant hose

- Lift retaining clip for re-
moval
- Connecting ⇒ [page 285](#)

3 - Retaining clip

4 - O-ring

- renew

5 - Radiator outlet coolant tem- perature sender - G83-

- Removing and installing ⇒ [page 278](#)

6 - O-ring

- renew

7 - Coolant hose

- Lift retaining clip for re-
moval
- Connecting ⇒ [page 285](#)

8 - O-ring

- renew

9 - Coolant hose

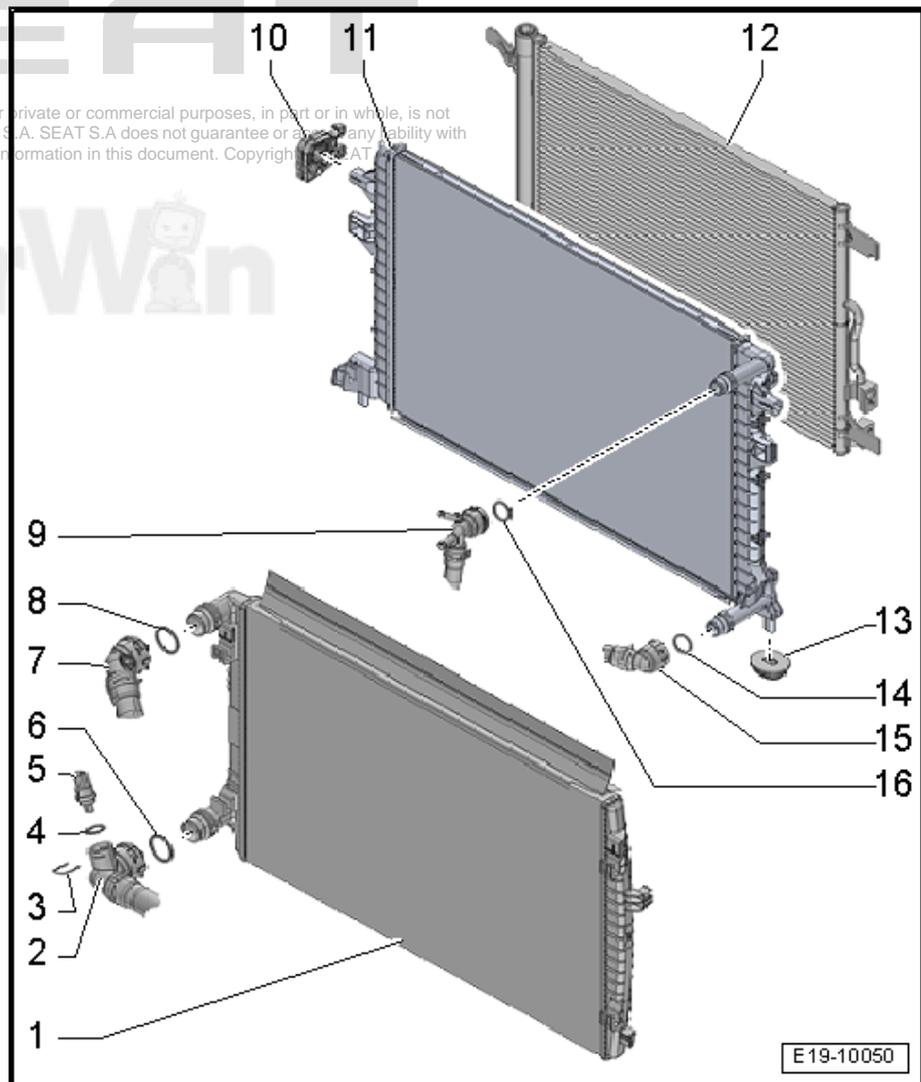
- Lift retaining clip for re-
moval
- Connecting ⇒ [page 285](#)

10 - Bonded rubber bush

- for radiator

11 - Water radiator for charge air cooling circuit

- Removing and installing ⇒ [“4.4 Removing and installing cooler for charge air cooling circuit”, page 288](#)



12 - Condenser

- Remove and install ⇒ Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .

13 - Bonded rubber bush

- for radiator

14 - O-ring

- renew

15 - Coolant hose

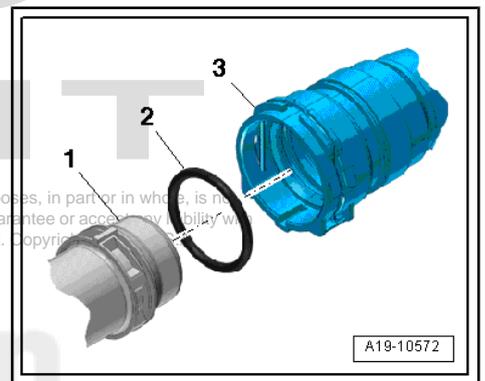
- Lift retaining clip for removal
- Connecting ⇒ [page 285](#)

16 - O-ring

- renew

Connecting coolant hose with plug-in connector to radiator

- Remove old O-ring -2- in coolant hose -3-.
- Moisten new O-ring with coolant and insert into coolant hose.
- Push coolant hose into connection -1- until it audibly engages.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.



4.2 Exploded view - radiator cowl and radiator fans

1 - Bolt

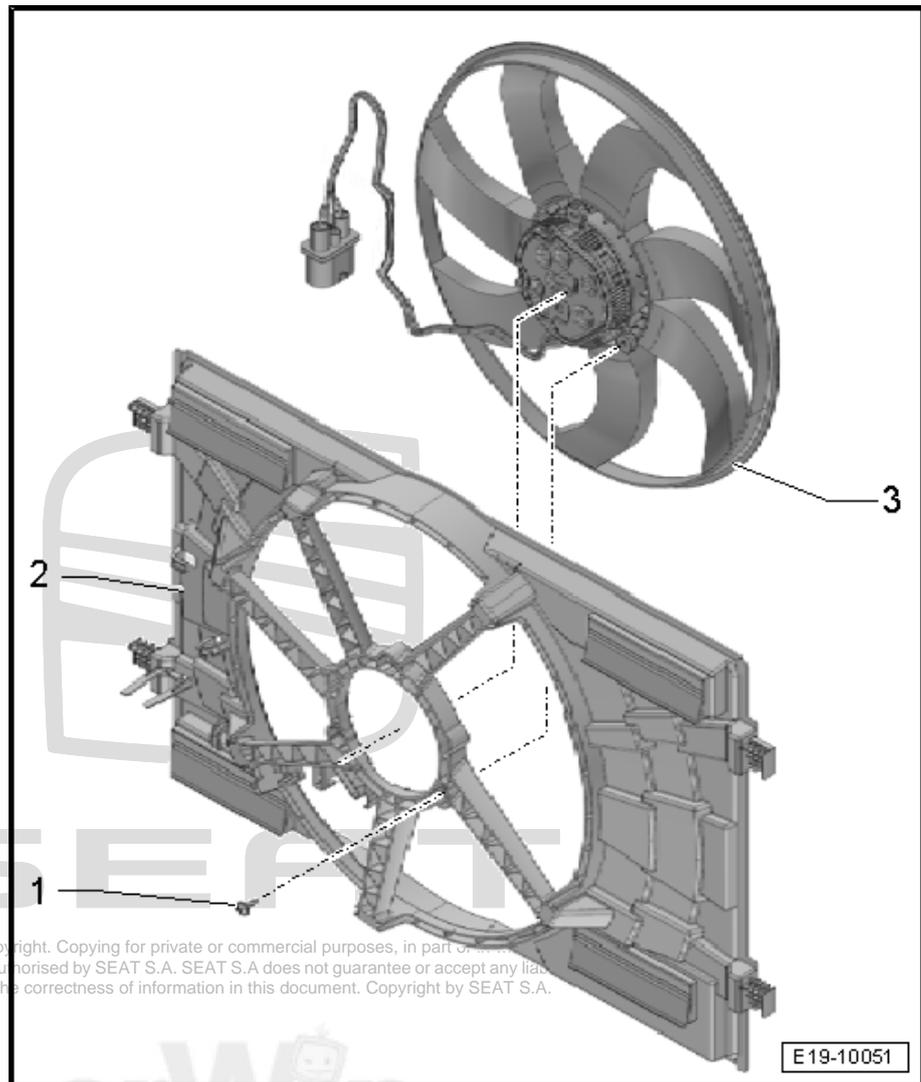
- 5 Nm

2 - Fan shroud

- Removing and installing
⇒ [page 293](#)

3 - Radiator fan - V7-

- Removing and installing
⇒ [page 293](#)



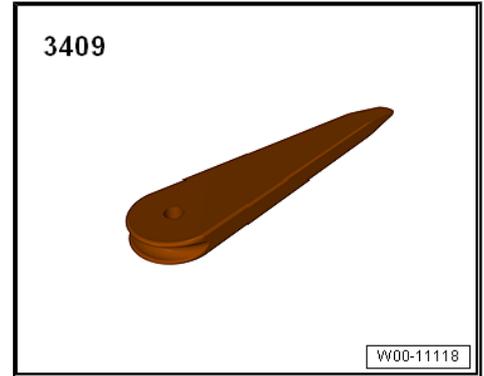
4.3 Removing and installing radiator

Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-

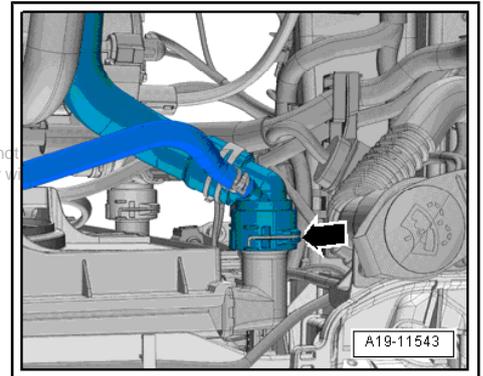


◆ Wedge - 3409-

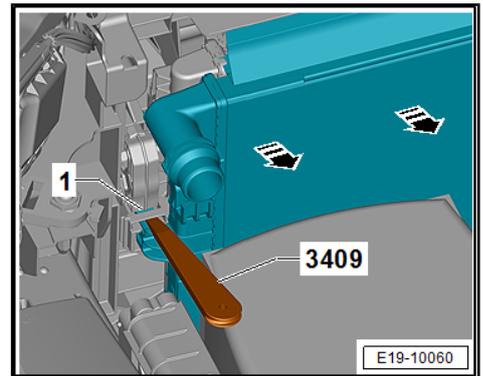


Removing

- Drain coolant ⇒ [page 251](#) .
- Lift the retaining clip -arrow-, remove the coolant hose at the top left from the radiator.
- Remove radiator cowl ⇒ [page 293](#) .



- Use the removal wedge to press both sides of locking tab -1- away from the engine compartment - 3409- and push the radiator -in the direction of the arrow-.
- Pull radiator out of mountings at bottom.
- Remove radiator from water radiator for charge air cooling circuit.
- Remove radiator (top section).



Installation

Install in the reverse order of removal, observing the following:



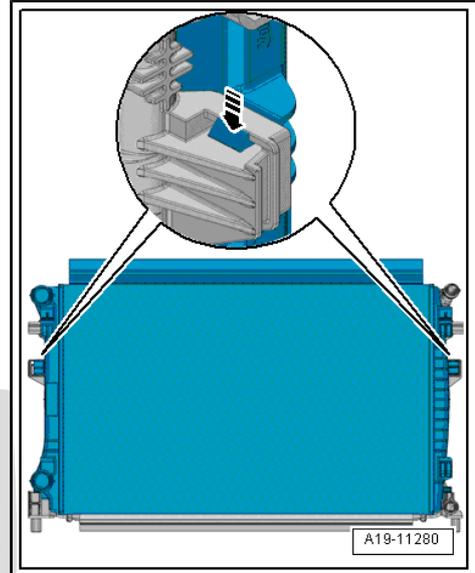
Note

- ◆ *If there are minor dents in the fins, refer to respective instructions ⇒ [page 8](#) .*
- ◆ *Renew O-rings after removal.*

- Engage radiator in charge air cooler. Ensure proper engagement by pulling.
- Install radiator cowl ⇒ [page 293](#) .
- Connect coolant hose with plug-in connector ⇒ [page 285](#) .
- Fill up with coolant ⇒ [page 256](#) .

Specified torques

- ◆ ⇒ [“3.1 Exploded view - air cleaner housing”, page 326](#)
- ◆ ⇒ [“4.2 Exploded view - radiator cowl and radiator fans”, page 286](#)
- ◆ ⇒ [“4.1 Exploded view - radiator/radiator fans”, page 284](#)



4.4 Removing and installing cooler for charge air cooling circuit

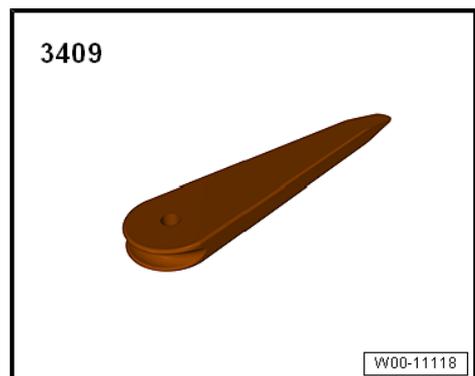
Special tools and workshop equipment required

- ◆ Drip tray for workshop hoist - VAS 6208-

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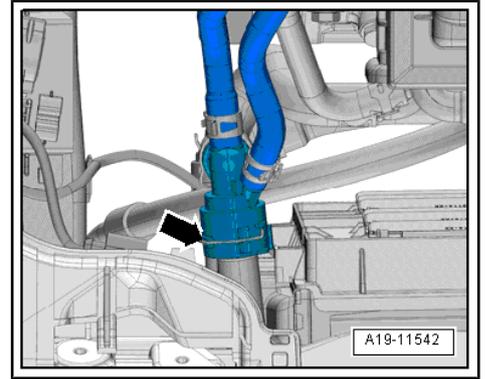


- ◆ Wedge - 3409-

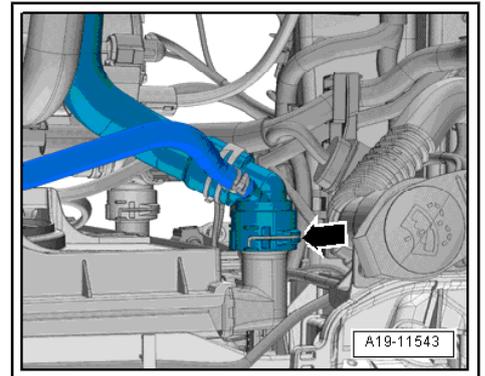


Removing

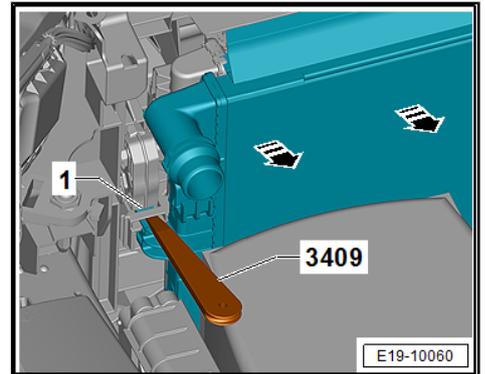
- Drain coolant ⇒ [page 251](#) .
- Lift retaining clip -arrow- and separate coolant hose (top right) from water radiator for charge air cooling circuit.



- Lift the retaining clip -arrow-, remove the coolant hose at the top left from the radiator.
- Remove radiator cowl ⇒ [page 293](#) .



- Use the removal wedge to press both sides of locking tab -1- away from the engine compartment - 3409- and push the radiator -in the direction of the arrow-.
- Pull radiator out of mountings at bottom.
- Remove coolant radiator of the cooler for charge air cooling circuit.
- Remove coolant radiator upwards.
- Remove front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper; Removing and installing bumper cover .
- Remove headlight ⇒ Electrical system; Rep. gr. 94 ; Removing and installing headlights .



Vehicles with coolant bearing support, clipped in

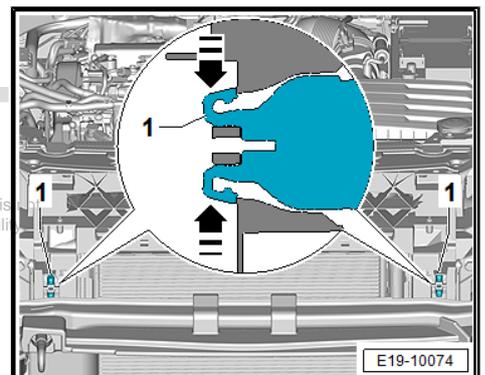
- Release catches -arrows- of radiator mounting -1- on left and right, or pinch them off using side cutters.



Note

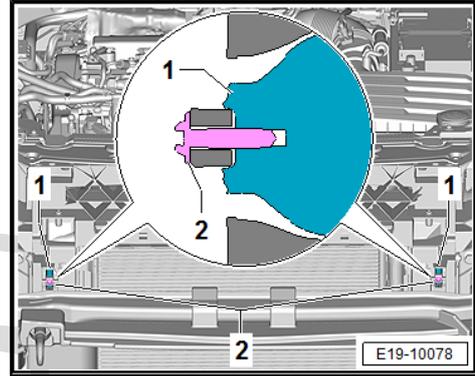
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The radiator mount support is reused during installation. It will then be bolted to lock carrier. Screws ⇒ ETKA (electronic spare parts catalogue) .



Vehicles with coolant bearing support, screwed

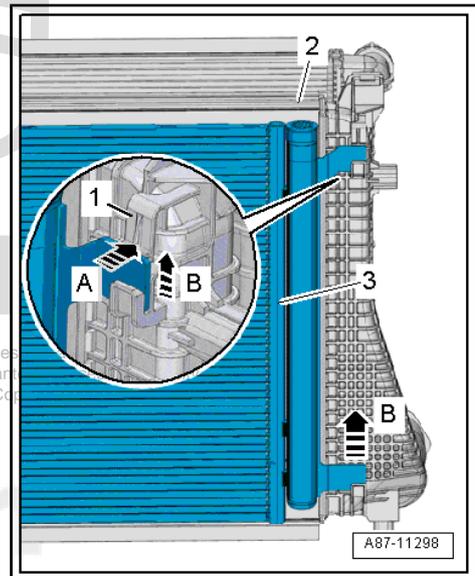
- Unscrew the screws -2- of the radiator mounting bracket -1- right and left.



Continued procedure for all vehicles

- Press cooler on the top edge in the direction of the engine.
- Unhook radiator from the lower supports and press backwards.
- Press catches -1- on both sides in -direction of arrow A- to release them.
- Pull condenser -3- in -direction of arrow B-, and detach it from charge-air cooler -2-.
- Tie up condenser on lock carrier.

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- Lift coolant radiator of charge air cooling circuit -1- at bottom out of radiator mountings -arrows-.
- Remove water radiator for charge air cooling circuit.

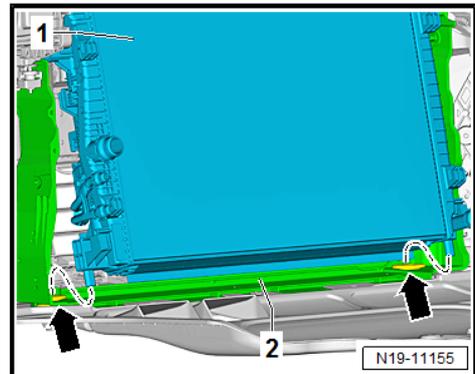
Installation

Install in the reverse order of removal, observing the following:

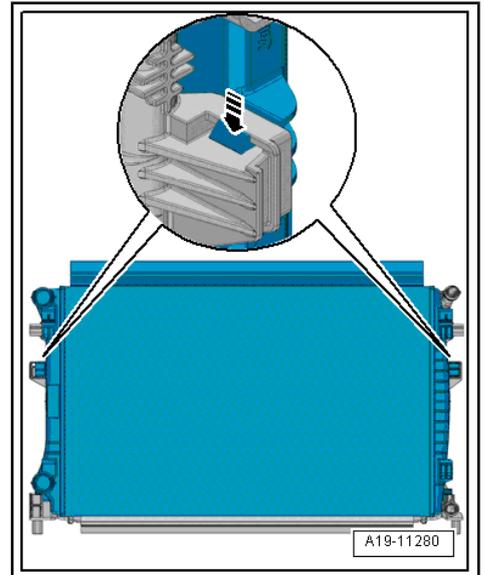


Note

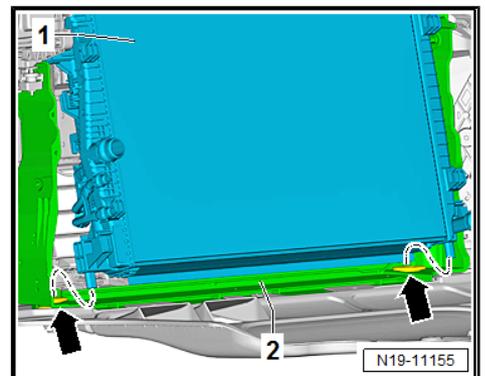
- ◆ If there are minor dents in the fins, refer to respective instructions ⇒ [page 8](#).
- ◆ Renew O-rings after removal.



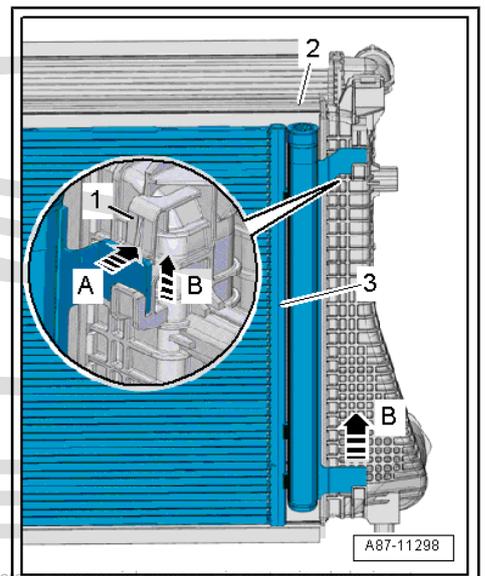
- Engage radiator in charge air cooler. Ensure proper engagement by pulling.



- Insert radiator module -1- at bottom into radiator mountings -arrows-.



- Place the condenser -3- in the installation position.

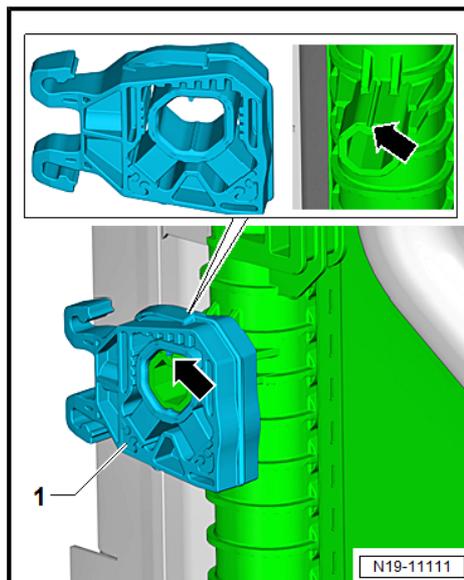


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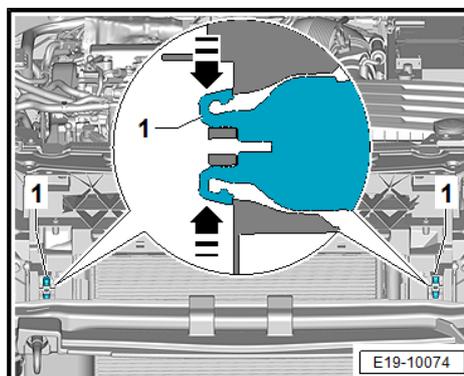


Installation position of the cooler bearing

- Fit radiator mountings -1- on left and right onto radiator. When doing so, note the installation position -arrow-.



- Swing water radiator for charge air cooling circuit into lock carrier. Ensure proper seating of radiator mountings -1- in lock carrier.

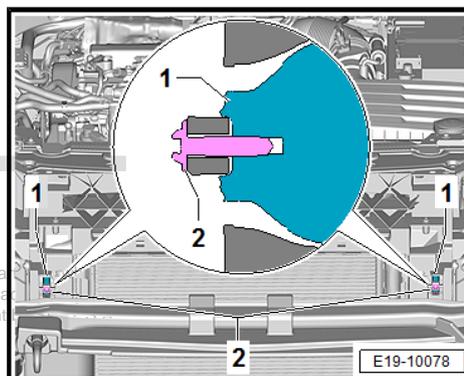


Vehicles with coolant bearing support, screwed

- Use bolts to secure radiator mountings, whose fasteners have been pinched off, to lock carrier. Screws -2- ⇒ ETKA (electronic spare parts catalogue) .
- Tightening torque: 5 Nm

Continued procedure for all vehicles

- Install the front headlights ⇒ Electrical System; Rep. gr. 94 ; Headlights; Assembly overview - Headlights
- Install the front bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper; Remove and install front bumper cover .
- Install radiator cowl ⇒ [page 293](#) .
- Connect coolant hose with plug-in connector ⇒ [page 285](#) .
- Fill up with coolant ⇒ [page 252](#) .



Specified torques

- ◆ ⇒ Electrical system; Rep. gr. 94 ; Headlight; exploded view: headlight
- ◆ ⇒ General body repairs, exterior; Rep. gr. 63 ; Front bumper; Removing and installing bumper cover
- ◆ ⇒ [“4.1 Exploded view - radiator/radiator fans”, page 284](#)
- ◆ ⇒ [“4.2 Exploded view - radiator cowl and radiator fans”, page 286](#)

4.5 Removing and installing radiator cowl

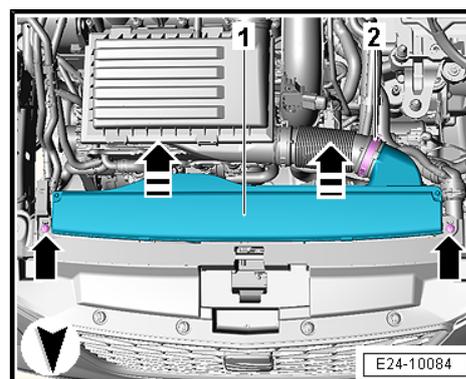
Removing

- Loosen the hose clip -2-, remove the air intake hose.
- Remove bolts -arrows-.
- Unlatch the air duct in the lock carrier and remove -in the direction of the arrow-.

CAUTION

Risk of injury to hands caused radiator fan which may start automatically at any time.

- Do not grasp into the radiator fan when disconnecting connector.



- Unplug electrical connector -1- for radiator fan (push retainer to the rear -arrow A- and press down release catch).
- Press locking tabs on left and right sides of radiator cowl -arrow B- and at the same time lift radiator cowl off radiator.
- For this purpose, turn the fan guard upwards by approximately 45° on one side.

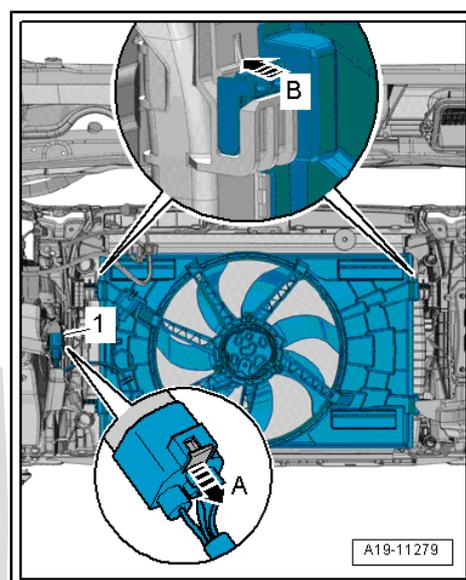
Installation

Install in the reverse order of removal, observing the following:

- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Specified torques

- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 326](#)



4.6 Removing and installing radiator fans

CAUTION

Risk of injury to hands caused radiator fan which may start automatically at any time.

- Do not grasp into the radiator fan when disconnecting connector.

Removing



Note

Fit cable ties in the same place when installing.

- Remove radiator cowl ⇒ [page 293](#) .

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- Unplug the electrical connector.
- Unscrew bolts -arrows- and remove radiator fan - V7- .

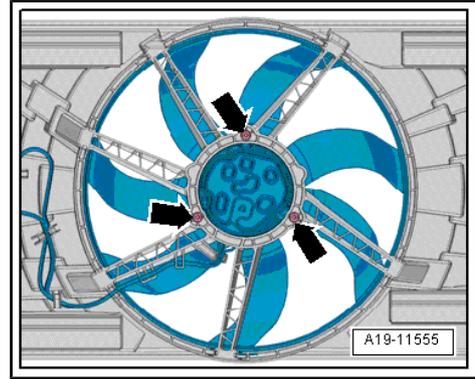
Installation

Install in the reverse order of removal, observing the following:

- Install radiator cowl ⇒ [page 293](#) .

Specified torques

- ◆ ⇒ ["4.2 Exploded view - radiator cowl and radiator fans"](#), [page 286](#)



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21 – Turbocharging/supercharging

1 Turbocharger

⇒ “1.1 Exploded view - turbocharger”, page 295

⇒ “1.2 Turbo compressor: removing and fitting”, page 297

⇒ “1.3 Removing and installing charge pressure positioner V465”, page 302

1.1 Exploded view - turbocharger

Part I

1 - Turbocharger

- Removing and installing
 ⇒ [page 297](#)

2 - Bolt

- 8 Nm

3 - Shift collar

4 - O-ring

- renew

5 - Seal

- renew

6 - Heat shield

7 - Bolt

- 25 Nm

8 - Bolt

- 8 Nm

9 - Nut

- 14 Nm

10 - Bolt

- renew
- Specified torque for securing bolts applies to all versions of charge pressure positioner.
- 9 Nm

11 - Securing clip

- renew

12 - Operating lever

13 - Counter nut

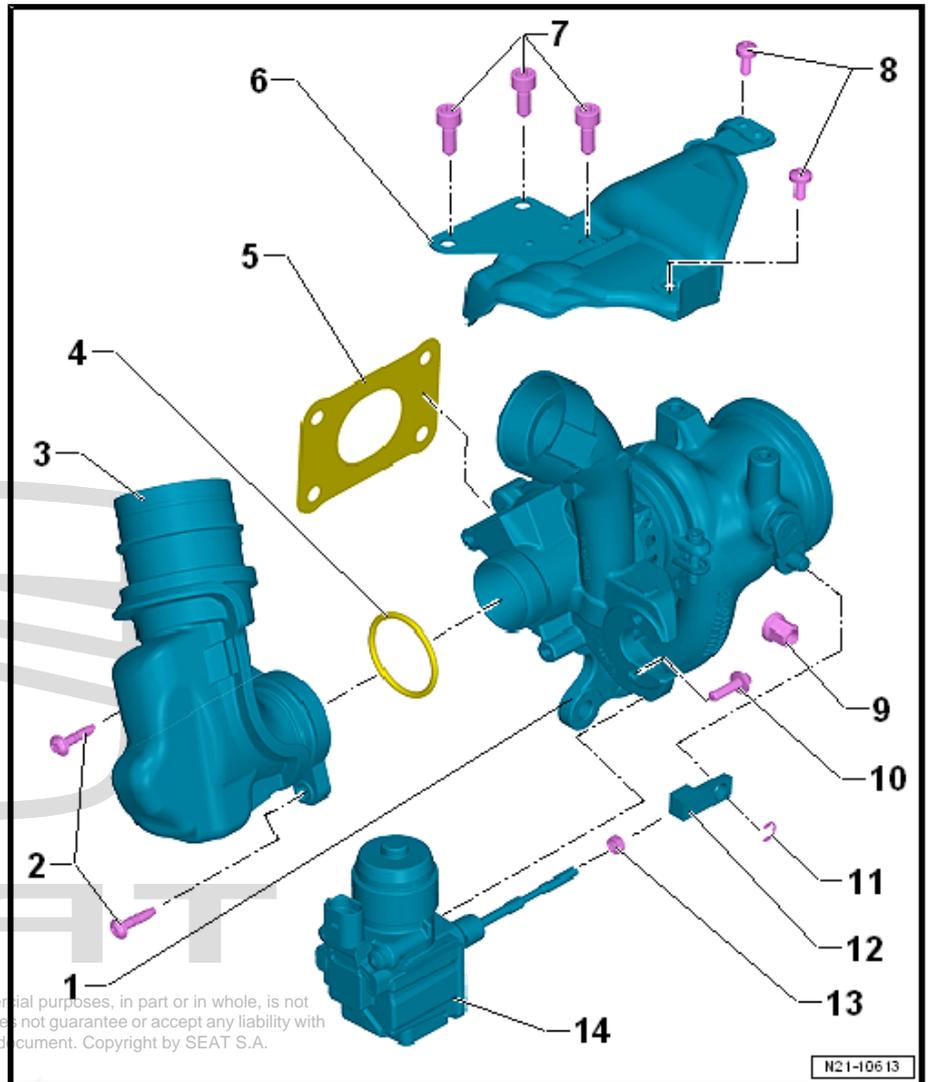
- 6 Nm
- Secure with sealing paint

14 - Charge pressure positioner - V465-



Note

- ◆ Note the following when installing!



N21-106 13

- ◆ *There may be different types of charge air pressure controllers installed.*

□ Removing and installing ⇒ [page 302](#)

Part II:

1 - Oil return pipe

2 - O-ring

□ renew

3 - Bolt

□ 9 Nm

4 - O-ring

□ renew

5 - Bolt

□ 9 Nm

6 - Oil supply line

7 - O-ring

□ renew

8 - Bolt

□ 9 Nm

9 - Bolt

□ renew

□ 9 Nm

10 - O-ring

□ If there is damage replace hose for crankcase breather
⇒ [Item 11 \(page 296\)](#)

11 - Flexible pipe

□ For crankcase breather

12 - Bolt

□ renew

□ 9 Nm

13 - O-ring

□ If there is damage replace hose for crankcase breather ⇒ [Item 11 \(page 296\)](#)

14 - Turbocharger

□ Can only be renewed together with exhaust manifold

□ Removing and installing ⇒ [page 297](#)

15 - Seal

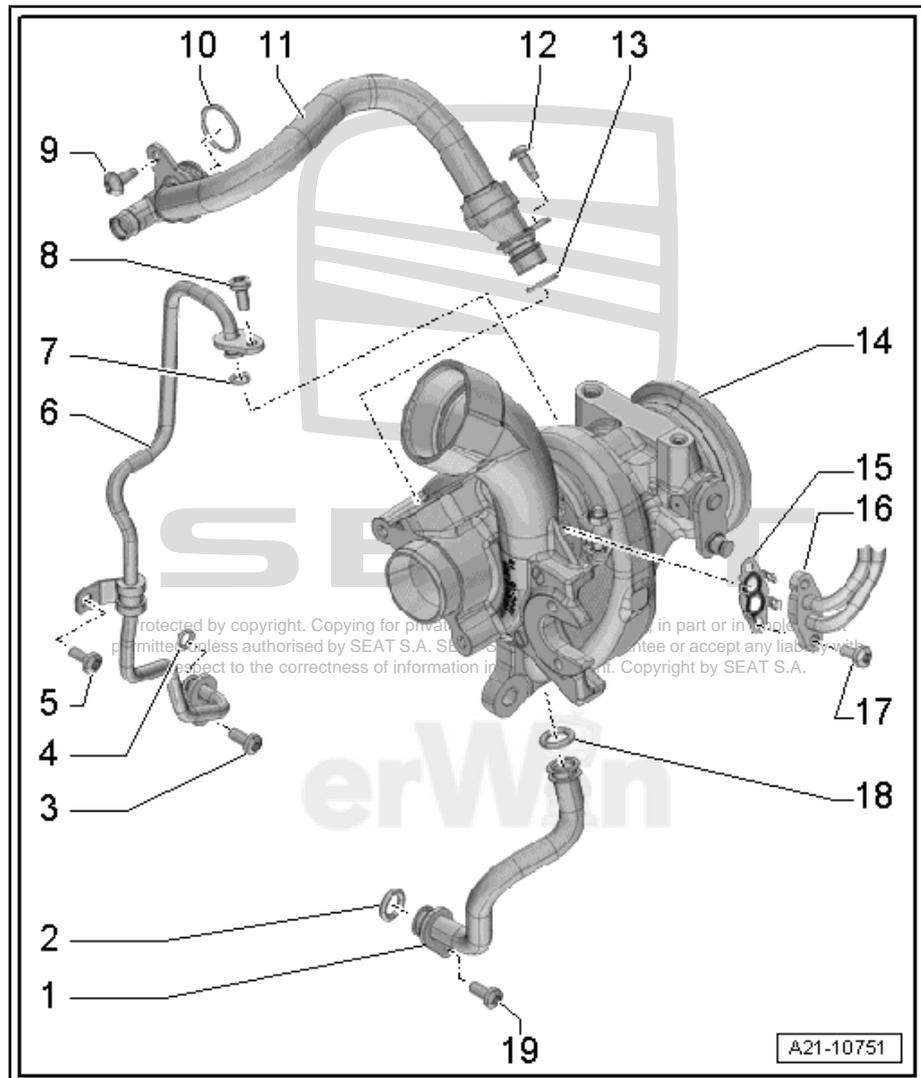
□ renew

16 - Coolant lines

□ Supply and return

17 - Bolt

□ 8 Nm



18 - O-ring

- renew

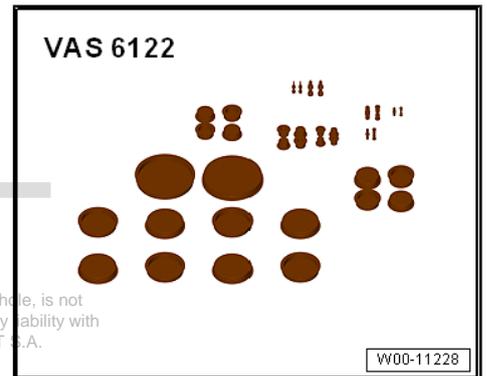
19 - Bolt

- 9 Nm

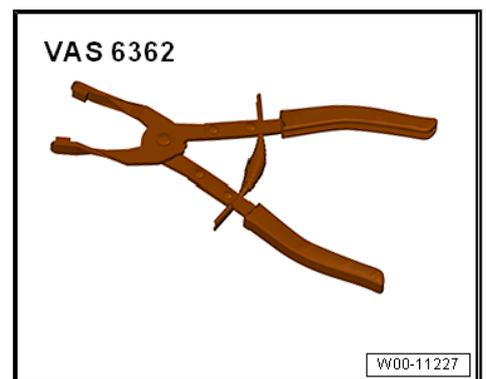
1.2 Turbo compressor: removing and fitting

Special tools and workshop equipment required

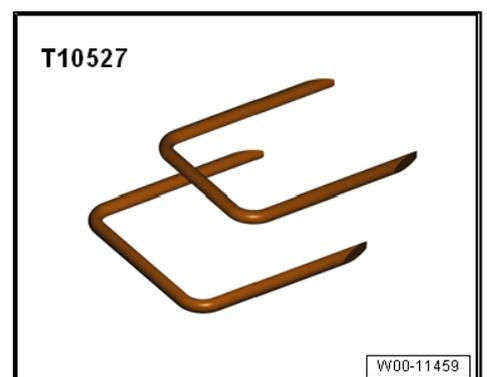
- ◆ Engine bung set - VAS 6122-



- ◆ Hose clip pliers - VAS 6362-



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

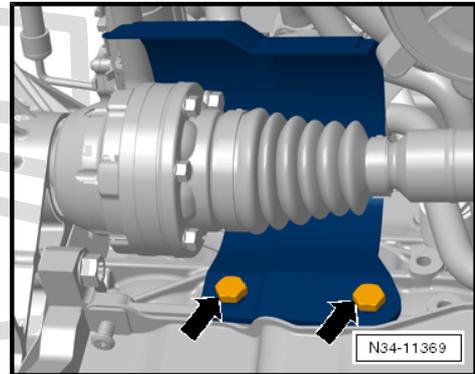


Removing



Note

- ◆ *Observe rules for cleanliness ⇒ page 6 .*
 - ◆ *Fit all heat shield sleeves in the same place when installing.*
 - ◆ *If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:*
 - ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
 - ◆ *Check the whole charge air path and charge air cooler for foreign objects.*
 - ◆ *If foreign objects are discovered in the charge air system, clean the charge air path and, if necessary, renew the charge air cooler.*
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).
 - Lay cloth around flange of oil lines.



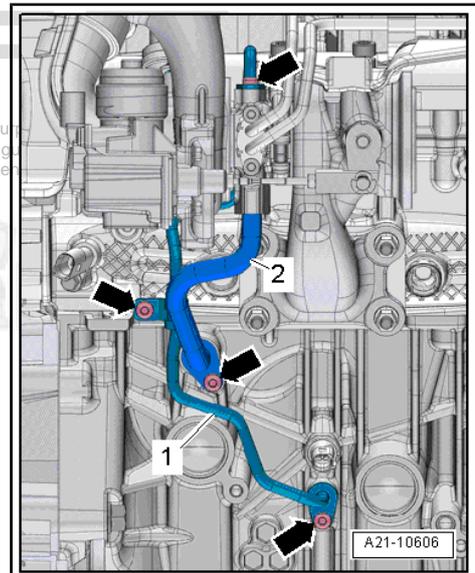
- Remove bolts -arrows- and detach oil supply line -1- and oil return line -2-.



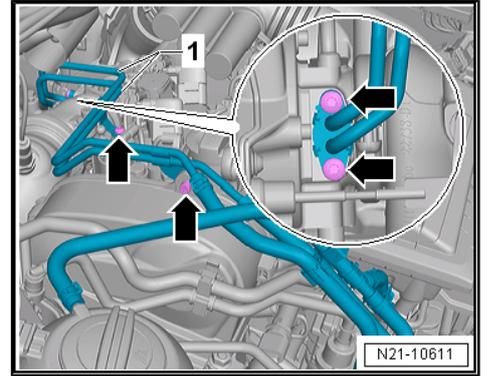
Note

Seal the engine block openings using the engine sealing plug set - VAS 6122- .

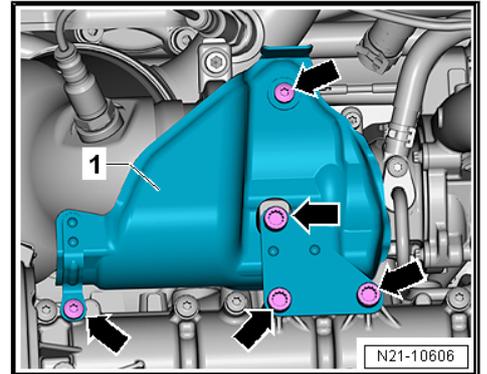
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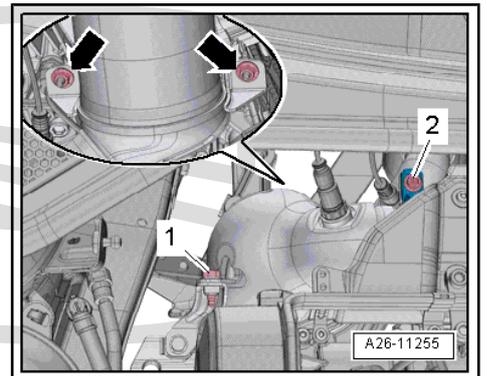
- Remove bolts -arrows-.
- Swivel coolant lines -1- to side.



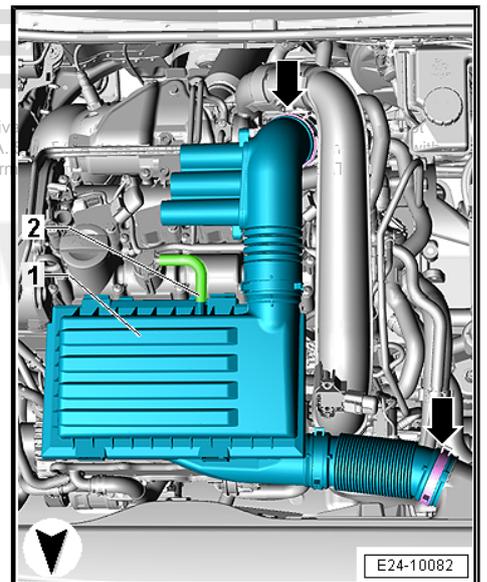
- Remove bolts -arrows- and detach heat shield -1-.



- Unscrew bolt -2- and remove screw-type clip.
- Loosen bolt -1- and nuts -arrows- by a few turns.



- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

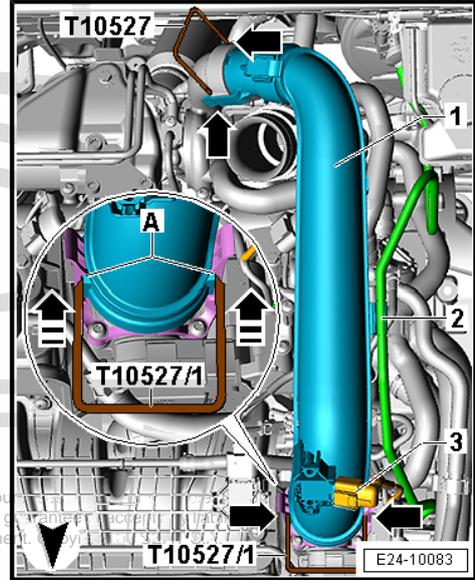
i Note

- ◆ To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .
- ◆ Insert the release tool , note the detailed image -A-.

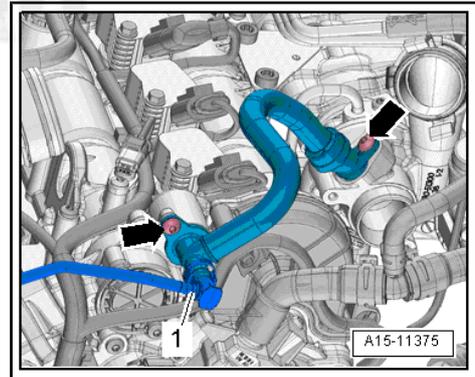
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.

i Note

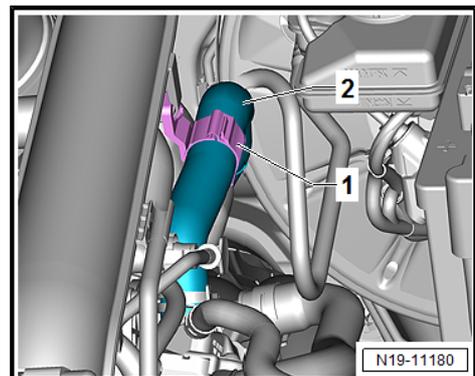
Use the engine sealing plug set - VAS 6122- to seal the throttle valve module - J338- , Contamination and combustion residues may cause wrong adaption values.



- Remove bolts -arrows-, adjust crank case breather hose.



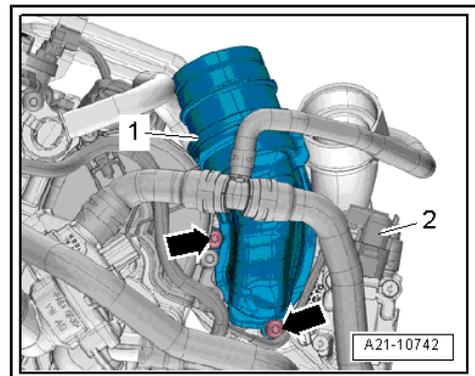
- Open hose clip -1- and push coolant hose -2- to one side.



- Unplug the electrical connector -2-.

i Note

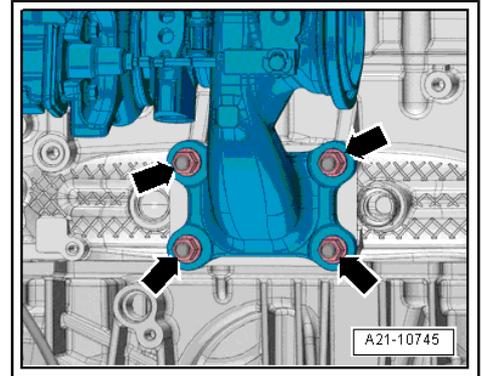
Ignore items marked -1- and -arrows-.



- Remove nuts -arrows- and detach turbocharger.

Installation

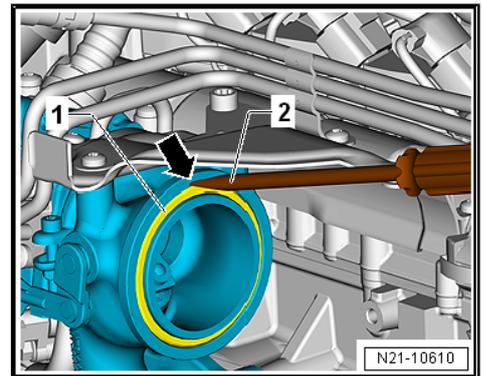
Install in the reverse order of removal, observing the following:



- Slide screw driver -2- into the recess -arrow- from the turbocharger and lever out the sealing ring -1-.

Note

- ◆ Renew seals, O-rings and securing nuts of cylinder head.
- ◆ Before installing, lightly moisten O-rings with clean engine oil.
- ◆ Renew clamps for attaching catalytic converter to turbocharger.
- ◆ Charge the turbocharger with engine oil using the connection sleeve of the oil supply pipe.
- ◆ Secure all hose connections with the hose clips corresponding to original equipment ⇒ *Electronic parts catalogue* .
- ◆ After installing turbocharger, run engine for about 1 minute at idling speed to ensure that oil is supplied to turbocharger.



- Ensure proper connection and routing of wires ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If a new turbocharger with charge pressure positioner has been installed:

- Adapt engine control unit - J623- to charge air pressure controller - V465- using ⇒ Vehicle diagnostic tester; “guided functions” .

Specified torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 295](#) .
- ◆ ⇒ [Fig. ““Air ducts with screw-type clips: installing””, page 308](#) .
- ◆ ⇒ [Fig. ““Installing catalytic converter - tightening torque and sequence””, page 357](#) .
- ◆ ⇒ Running gear, axles, steering, Rep-gr. 40; Drive shaft
 Overview: drive shaft

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1.3 Removing and installing charge pressure positioner - V465-



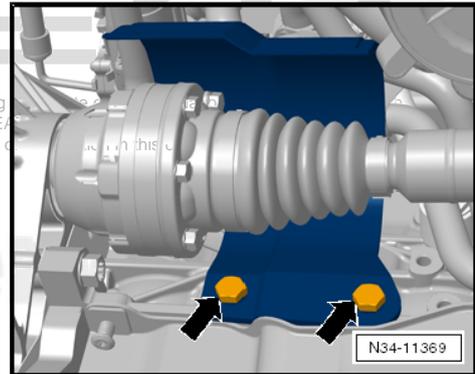
Note

- ◆ *Different versions of charge pressure positioner have been installed.*
- ◆ *They have different securing points.*
- ◆ *Before the installation, check visually which version is being repaired.*

1.3.1 Removing and installing charge pressure positioner - V465- , version 1

Removing

- Switch off ignition.
- Remove noise insulation => Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).



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- Unplug the electrical connector -1-.
- Remove securing clip -2-.
- Remove bolts -arrows- and detach charge pressure positioner - V465- .

Installation

Installation is carried out in the reverse order. Please note the following:

The attaching bolts and safety clip are to be replaced.



Note

There may be different types of charge air pressure controllers installed.

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Charge air pressure controller without adjustable linkage

- Adapt engine control unit - J623- to charge air pressure controller - V465- using ⇒ Vehicle diagnostic tester; “guided functions” .

Charge air pressure controller with adjustable linkage

- Fit thread of charge pressure positioner -V465- at central position in joint element.
- Set charge pressure positioner - V465- : ⇒ Vehicle diagnostic tester [01 - Select setting charge pressure positioner V465] in [Guided functions].
- Adjust to specified value by turning linkage. For specified value, see ⇒ Vehicle diagnostic tester.
- Tighten lock nut to 6 Nm and secure with sealing paint.

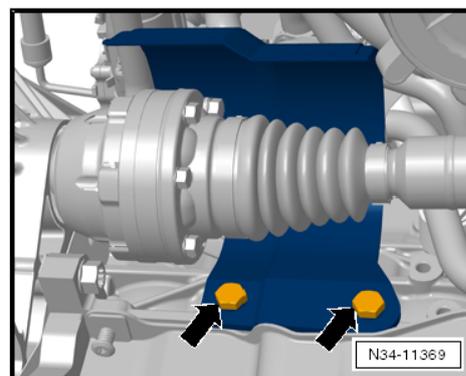
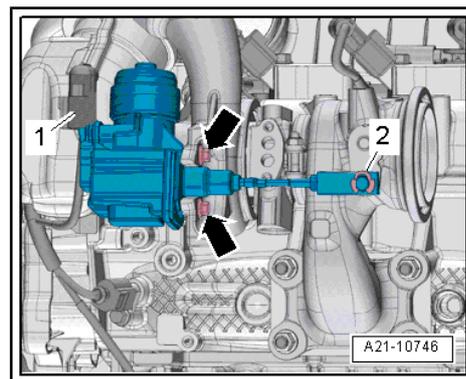
Specified torques

- ◆ ⇒ “1.1 Exploded view - turbocharger”, page 295 .
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Overview: drive shaft .

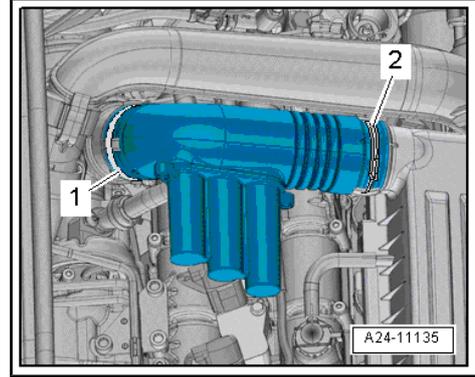
1.3.2 Removing and installing charge pressure positioner - V465- , version 2

Removing

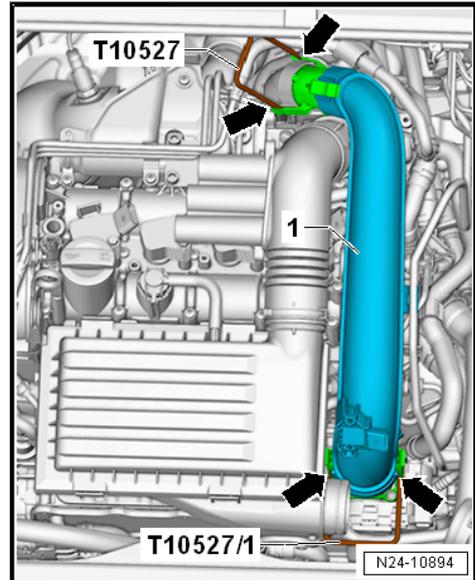
- Switch off ignition.
- Remove noise insulation ⇒ Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).



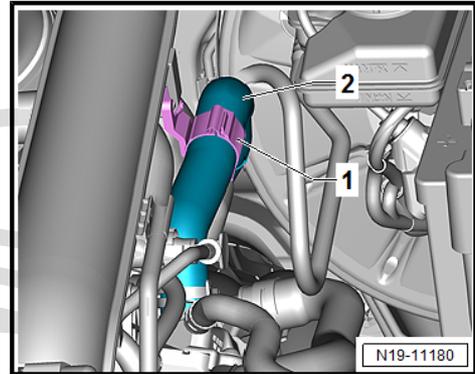
- Loosen hose clips -1- and -2- and remove air pipe.
- Free air hose from air pipe.
- Pull connector off charge pressure sender - GX26- .



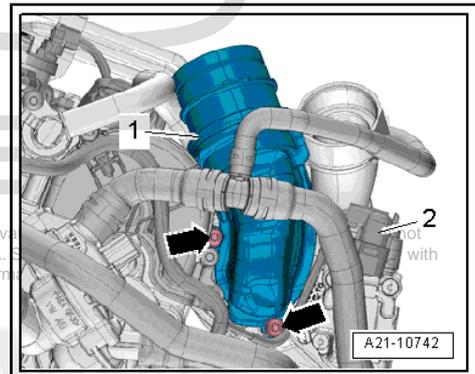
- Release fasteners -arrows- using release tools - T10527- and -T10527/1- .
- Remove air pipe -1-.



- Open hose clip -1- and push coolant hose -2- to one side.
- Remove bolts -arrows- and detach crankcase breather hose.



- Unplug the electrical connector -2-.
- Remove bolts -arrows- and detach connection -1-.
- Remove securing clips -3- and remove operating lever -4-.



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- Remove bolts -arrows-.
- Disconnect connector -2-, and remove charge pressure positioner - V465- -1-.

Installation

Installation is carried out in the reverse order. Please note the following:

The attaching bolts and safety clip are to be replaced.

Renew O-rings after removal.

Before installing, lightly moisten O-rings with clean engine oil.

Charge air pressure controller without adjustable linkage

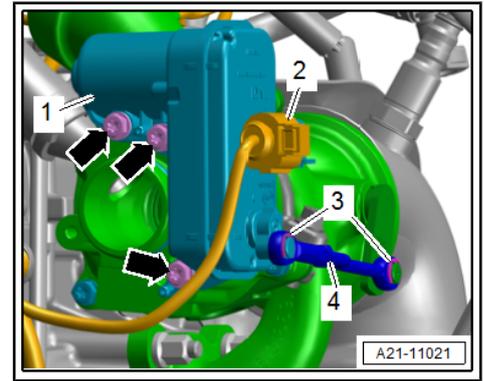
- Adapt engine control unit - J623- to charge air pressure controller - V465- using ⇒ Vehicle diagnostic tester; “guided functions” .

Charge air pressure controller with adjustable linkage

- Fit thread of charge pressure positioner -V465- at central position in joint element.
- Set charge pressure positioner - V465- : ⇒ Vehicle diagnostic tester [01 - Select setting charge pressure positioner V465] in [Guided functions].
- Adjust to specified value by turning linkage. For specified value, see ⇒ Vehicle diagnostic tester.
- Tighten lock nut to 6 Nm and secure with sealing paint.

Specified torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 295](#) .
- ◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Overview: drive shaft .



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2 Supercharger air system:

⇒ "2.1 Assembly overview - charge air system", page 306

⇒ "2.2 Removing and installing charge air pressure sender GX26", page 308

⇒ "2.3 Removing and installing charge air cooler", page 308

⇒ "2.4 Checking charge air system for leaks", page 311

2.1 Assembly overview - charge air system



Note

- ◆ Check all air hoses and pipes for firm seating and leaks before carrying out tests or repairs.
- ◆ Observe rules for cleanliness ⇒ [page 6](#).

1 - Coolant hose

2 - Bolt

- Thread-forming
- Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque.
- 15 Nm

3 - Coolant hose

4 - Coolant hose

5 - Intercooler system

- Removing and installing ⇒ [page 308](#)
- If renewed, refill system with fresh coolant

6 - Sealing lip

7 - Seal

- renew

8 - Intake manifold

Removing and installing
⇒ [page 329](#)

9 - Bolt

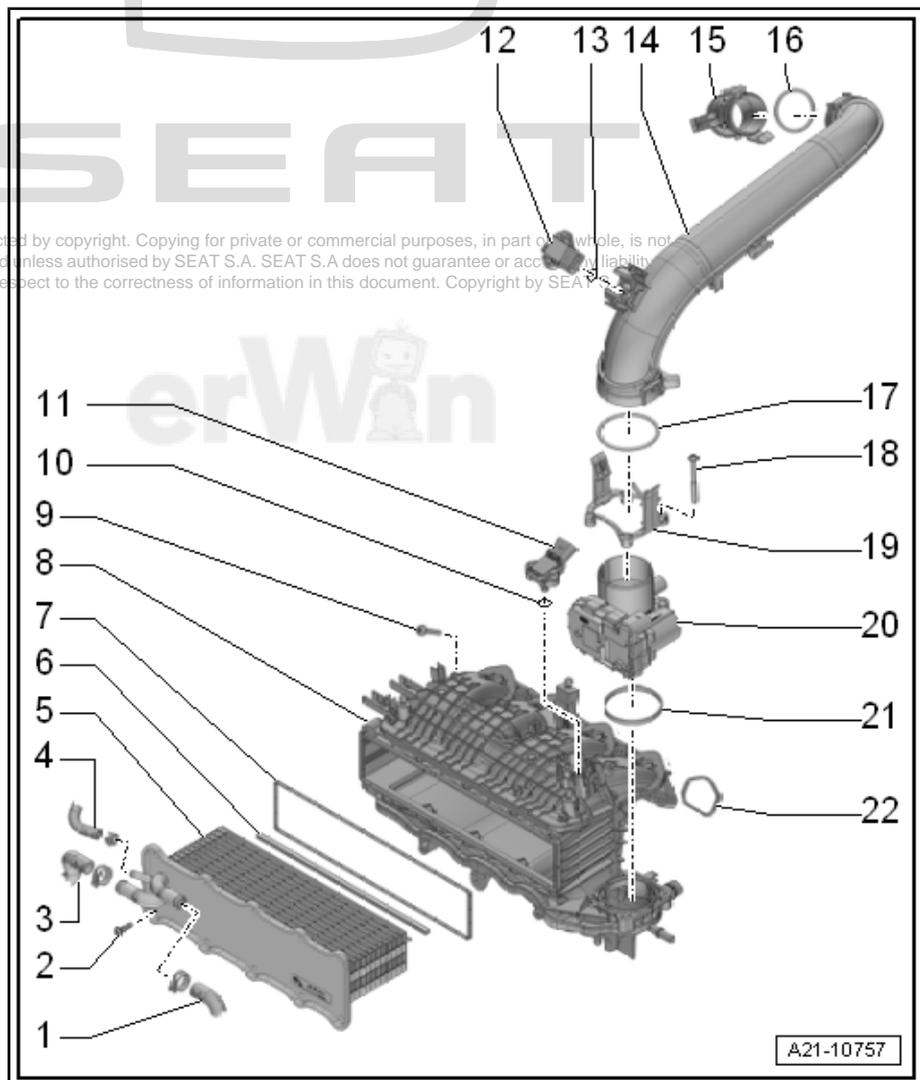
- Tightening torque and sequence ⇒ [page 328](#).

10 - O-ring

- renew

11 - Intake manifold sender - GX9-

- comprising:
 - Intake air temperature sensor - G42-
 - Intake manifold pressure sender - G71-
- Removing and installing ⇒ [page 336](#)



12 - Charge air pressure sender - GX26-

- comprising:

Charge-air regulator - G31-

Intake air temperature sensor - G42-

- Removing and installing ⇒ [page 308](#)

13 - O-ring

- renew

14 - Air conduction tube

- For removal, use release tools - T10527- and -T10527/1-

15 - Connection

16 - O-ring

- renew
- Before installing, lightly moisten O-ring with clean engine oil

17 - O-ring

- renew
- Before installing, lightly moisten O-ring with clean engine oil

18 - Bolt

- Thread-forming
- Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to specified torque.
- 7 Nm

19 - Retaining clip

- for air pipe

20 - Throttle valve control mechanism - GX3-

- comprising:

Throttle valve control mechanism - J338-

Throttle valve drive (electric power control) - G186-

Throttle valve drive angle sender 1 (electric power control) - G187-

Throttle valve drive angle sender 2 (electric power control) - G188-

- Removing and installing ⇒ [page 328](#)

21 - Oil seal

- renew

22 - Seal

- 4 pieces
- renew

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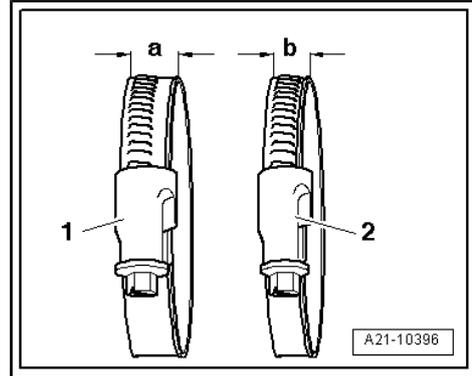


Air ducts with screw-type clips: installing



Note

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



Tightening torque for hose clips

- 1 - Hose clip -a- = 13 mm wide: 5.5 Nm
- 2 - Hose clip -b- = 9 mm wide: 3 Nm

2.2 Removing and installing charge air pressure sender - GX26-

Charge pressure sender - GX26- comprises:

- ◆ Charge-air regulator - G31-
- ◆ Intake air temperature sensor - G42-

Removing

- Unplug the electrical connector -1-.
- Release fasteners -arrows-, remove charge pressure sender - GX26- .

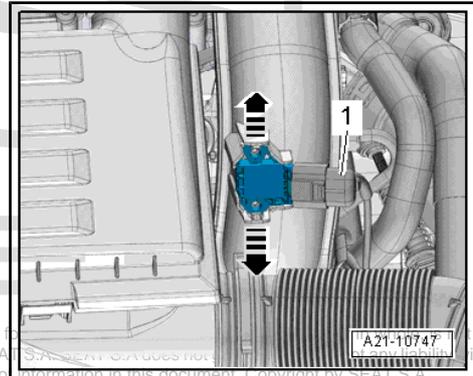
Installation

Install in the reverse order of removal, observing the following:



Note

- ◆ *Replace the O-ring.*
- ◆ *If the retaining tabs broke off during removal, the sender can be secured using two securing bolts as per ⇒ Electronic Parts Catalogue (EPC) . Tightening torque: ⇒ [page 308](#) .*



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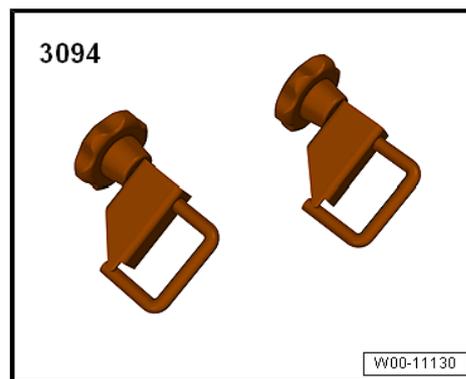
Tightening torque

Component	Tightening torque
Charge-air regulator - GX26-	3 Nm

2.3 Removing and installing charge air cooler

Special tools and workshop equipment required

- ◆ Hose clamps, up to Ø 25 mm - 3094-



- ◆ Drip tray for workshop hoist - VAS 6208-



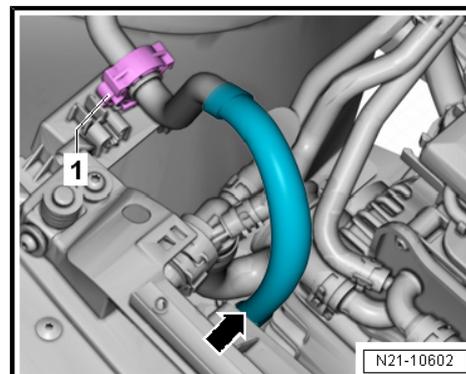
- ◆ Hose clip pliers - VAS 6362-



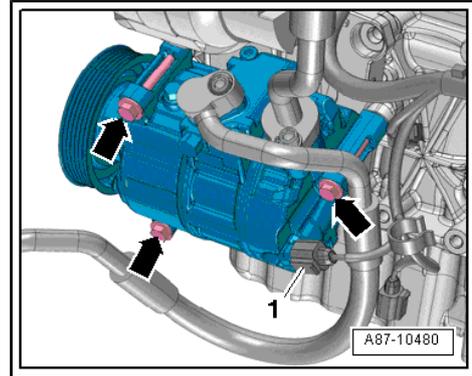
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Removing

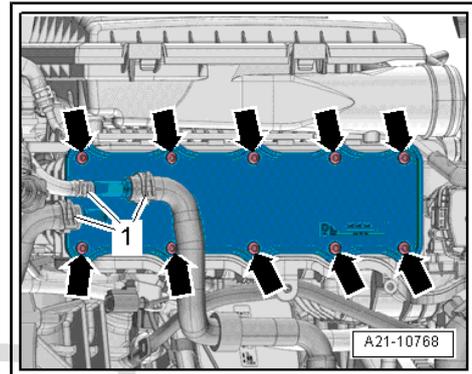
- Remove radiator cowl ⇒ [page 293](#) .
- Open clip -1- and push hose -arrow- to one side.



- Separate the connector -1-.
- Remove air conditioner compressor from bracket and tie up
⇒ Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .
- Set drip tray for workshop hoist - VAS 6208- underneath.
- Clamp off coolant hoses at charge air cooler with hose clamps -3094- .



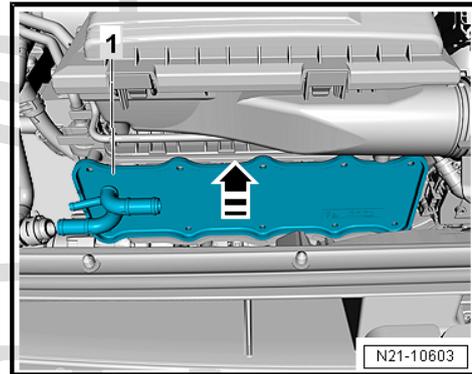
- Loosen the hose clips -1-, remove the coolant hoses.
- Remove bolts -arrows-.



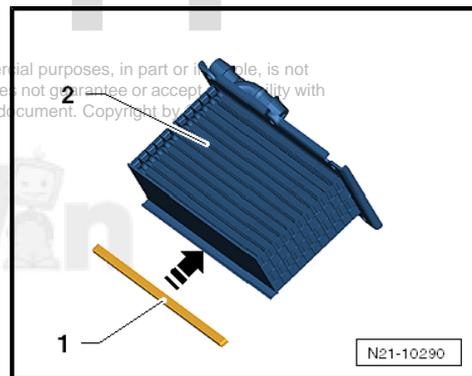
- Pull charge air cooler -1- evenly towards front (in -direction of arrow-) out of intake manifold.

Installation

Install in the reverse order of removal, observing the following:



- Fit sealing lip -1- in -direction of arrow- onto charge air cooler -2-.
- Insert new gasket into groove on intake manifold.



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- Tighten bolts -arrows- alternately and diagonally working from centre outwards.
- Install hose clips -1-.

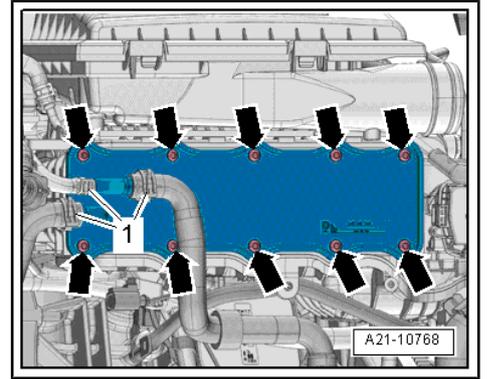
i Note

If there are slight impressions on the fins, refer to [page 8](#).

- Install radiator cowl [page 293](#).
- Check the coolant level [page 256](#).

Specified torques

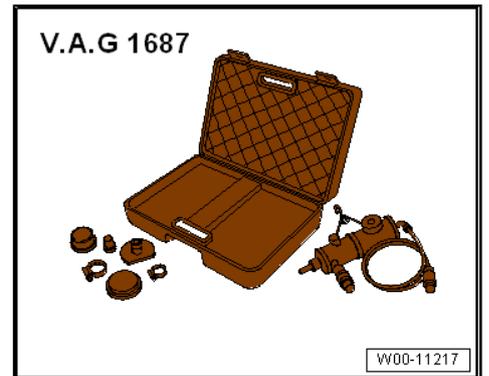
- ◆ ["2.1 Assembly overview - charge air system", page 306](#).
- ◆ \Rightarrow Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit .



2.4 Checking charge air system for leaks

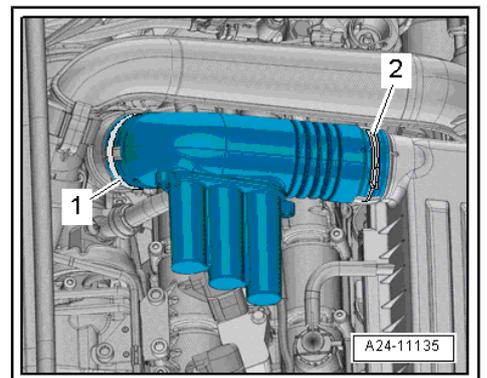
Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687-



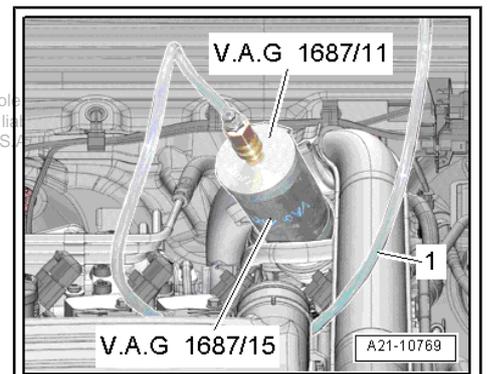
Work sequence

- Loosen hose clips -1- and -2- and remove air pipe.



- Connect the adapter - V.A.G 1687/15- with -V.A.G 1687/11- to the exhaust gas 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 -2-.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

- Open valve -3-.

Risk of damage to engine

- ◆ 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 circuit is full. If necessary, adjust pressure to 0.5 bar again.
- Check the charge air system for leaks by hearing, touching, with commercially available leak detector spray or using ultrasonic tester - V.A.G 1842- .



Note

- ◆ *A small amount of air escapes through the valves and enters the engine. Therefore a holding pressure test is not possible.*
- ◆ *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.*

Carry out installation in the reverse sequence, noting the following:

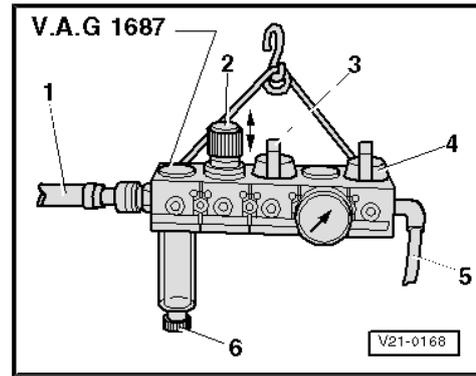


Note

Renew seal and O-rings.

Specified torques

- ◆ => Fig. [“Air ducts with screw-type clips: installing”](#), page 308



24 – Mixture preparation - injection

1 Injection system

⇒ [“1.1 Overview of fitting locations - injection system”, page 313](#)

1.1 Overview of fitting locations - injection system

Overview of fitting locations: Engine cavity

1 - Camshaft control valve 1 - N205-

- Only installed in CMBA, CXSA, CZCA
- Removing and installing ⇒ [page 193](#)

2 - Exhaust camshaft control valve 1 - N318-

- Installed only with CZEA, CHPA, CZDA
- Removing and installing ⇒ [page 194](#)

3 - Lambda sensor 1 before catalytic converter - GX10-

- comprising:
 Lambda sensor - G39-
 Lambda probe heater - Z19-

- Exploded view ⇒ [page 349](#)

4 - Lambda probe 1 after catalytic converter - GX7-

- comprising:
 Lambda probes after the catalytic converter - G130-
 Lambda probe heater 1 after catalytic converter - Z29-

- Exploded view ⇒ [page 349](#)

5 - Charge pressure positioner - V465-

- Removing and installing ⇒ [page 302](#)

6 - Exhaust cam actuator for cylinder 2 - N587-

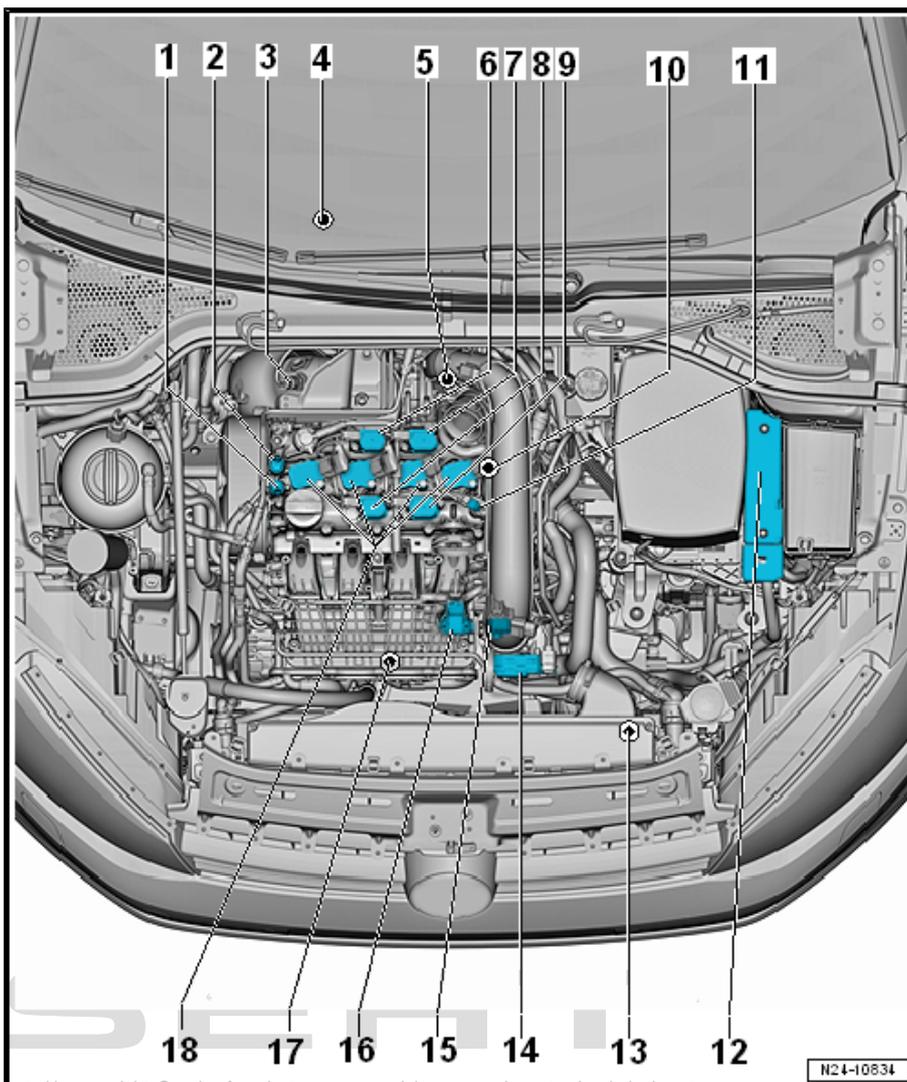
- Only installed in CZEA
- Removing and installing ⇒ [page 195](#)

7 - Exhaust cam actuator for cylinder 3 - N595-

- Only installed in CZEA
- Removing and installing ⇒ [page 196](#)

8 - Inlet cam actuator for cylinder 2 - N583-

- Only installed in CZEA



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- Removing and installing ⇒ [page 197](#)
- 9 - Inlet cam actuator for cylinder 3 - N591-**
 - Only installed in CZEA
 - Removing and installing ⇒ [page 198](#)
- 10 - Hall sender 3 - G300-**
 - Installed only with CZEA, CHPA, CZDA
 - Removing and installing ⇒ [page 364](#)
- 11 - Hall sender - G40-**
 - Removing and installing ⇒ [page 364](#)
 - Exploded view ⇒ [page 360](#)
- 12 - Engine control unit - J623-**
 - Removing and installing ⇒ [page 340](#)
- 13 - Radiator outlet coolant temperature sender - G83-**
 - Exploded view ⇒ [page 248](#)
- 14 - Throttle valve control mechanism - GX3-**
 - comprising
 - Throttle valve control mechanism - J338-
 - Throttle valve drive (electric power control) - G186-
 - Throttle valve drive angle sender 1 (electric power control) - G187-
 - Throttle valve drive angle sender 2 (electric power control) - G188-
 - Removing and installing ⇒ [page 333](#)
- 15 - Charge air pressure sender - GX26-**
 - comprising
 - Charge-air regulator - G31-
 - Intake air temperature sensor - G42-
 - Removing and installing ⇒ [page 308](#)
- 16 - Intake manifold sender - GX9-**
 - comprising
 - Intake air temperature sensor - G42-
 - Intake manifold pressure sender - G71-
 - Removing and installing ⇒ [page 336](#)
- 17 - Charge air cooling pump - V188-**
 - Removing and installing ⇒ [page 275](#)
 - Exploded view ⇒ [page 260](#)
- 18 - Ignition coils with output stages**
 - ◆ Ignition coil 1 with output stage - N70-
 - ◆ Ignition coil 2 with output stage - N127-
 - ◆ Ignition coil 3 with output stage - N291-
 - ◆ Ignition coil 4 with output stage - N292-
 - Removing and installing ⇒ [page 361](#)
 - Exploded view ⇒ [page 360](#)

Overview of fitting locations –engine, intake side

1 - Knock sensor 1 - G61-

- Exploded view
 => [page 360](#)

2 - Oil pressure switch for reduced oil pressure - F378-

- Exploded view
 => [page 236](#)

3 - Fuel pressure sender - G247-

- Exploded view
 => [page 318](#)

4 - Activated charcoal filter solenoid valve 1 - N80-

5 - Injectors

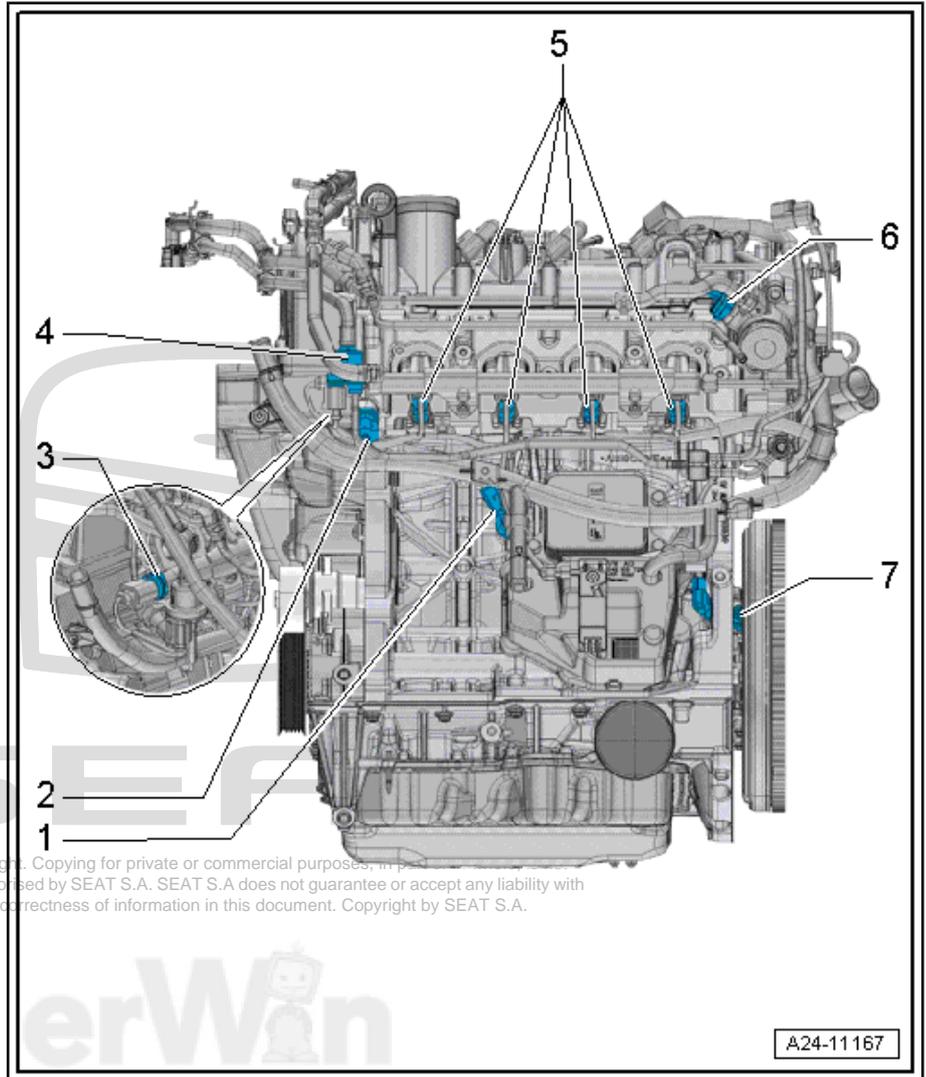
- ◆ Cylinder 1 injector - N30-
- ◆ Cylinder 2 injector - N31-
- ◆ Cylinder 3 injector - N32-
- ◆ Cylinder 4 injector - N33-
- Exploded view
 => [page 318](#)

6 - Fuel pressure regulating valve - N276-

- In high-pressure pump
- Exploded view
 => [page 345](#)

7 - Engine speed sender - G28-

- Exploded view
 => [page 360](#)



Overview of fitting locations – engine, exhaust side

1 - Oil level/oil temperature sender - G266-

- Exploded view
⇒ [page 224](#)

2 - Coolant temperature sender - G62-

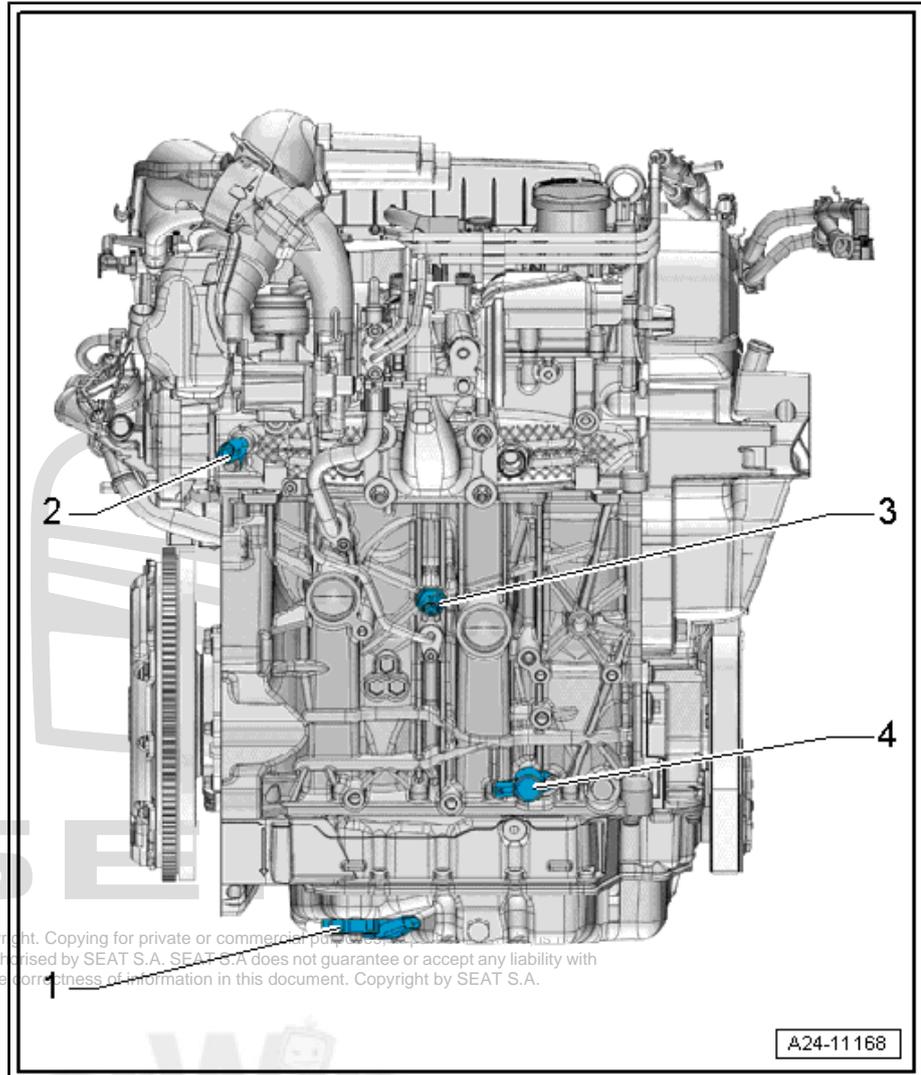
- Exploded view
⇒ [page 262](#)

3 - Oil pressure switch - F1-

- Exploded view
⇒ [page 241](#)

4 - Valve for oil pressure control - N428-

- Exploded view
⇒ [page 241](#)



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A24-11168

1.2 Reducing fuel pressure in high-pressure section

⚠ CAUTION

The fuel system is under high pressure.
Risk of injury due to fuel which may spurt out.
– Release high pressure.

Special tools and workshop equipment required

- ◆ Vehicle diagnosis and service information system

Reducing fuel pressure in high-pressure section:

- Connect vehicle diagnosis tester and then carry out the function “Reducing high fuel pressure” in “Guided functions”.
- Fuel pressure will drop to a specified value.
- Switch off ignition.

The fuel rail is still full of fuel; the fuel is, however, no longer under high pressure.

- After reducing the fuel high pressure, the high pressure area must »immediately« be opened. To do this, wrap a clean cloth around the connection. Catch the escaping fuel.



Note

- ◆ *The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.*
- ◆ *The ignition must not be switched on again from this point on as this would increase the pressure again.*

Additional steps required

- Clear event memory and generate the readiness code in engine control unit using "Guided functions" mode.



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2 Injectors

⇒ [“2.1 Assembly overview - fuel rail with injectors”, page 318](#)

⇒ [“2.2 Removing and installing fuel rail”, page 319](#)

⇒ [“2.3 Removing and installing injectors”, page 320](#)

⇒ [“2.4 Cleaning injectors”, page 324](#)

2.1 Assembly overview - fuel rail with injectors

1 - Fuel pressure sender - G247-

- Checking ⇒ [page 337](#)
- Removing and installing ⇒ [page 336](#)
- Lubricate taper lightly with clean engine oil; do not lubricate thread
- 22 Nm

2 - Fuel rail

- Removing and installing ⇒ [page 319](#)

3 - High-pressure pipe

Release high fuel pressure
⇒ [page 316](#)

- Connections must not be damaged
- Do not alter shape.
- Removing and installing ⇒ [page 347](#)
- 16 Nm + 45°

4 - Bolt

- Removing and installing ⇒ [page 319](#)
- 9 Nm

5 - Support ring

- renew
- Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head

- Attached with item 8-

6 - O-ring

- renew
- When installing lubricate lightly with clean engine oil

7 - Spacer ring

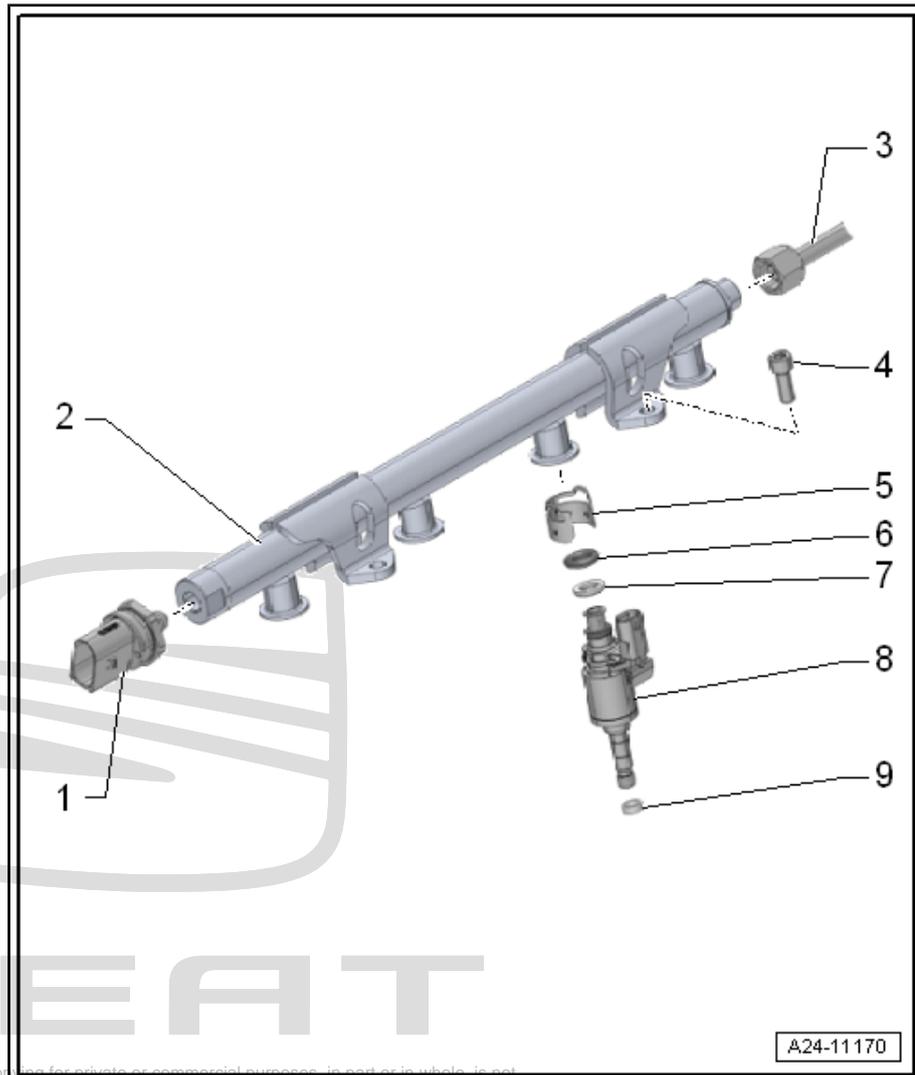
- Replace if damaged

8 - Injector

- Removing and installing ⇒ [“2.3 Removing and installing injectors”, page 320](#)

9 - Combustion chamber ring seal

- Do not apply grease or use any other lubricants



A24-11170

- Replace ⇒ [“2.3 Removing and installing injectors”, page 320](#)

2.2 Removing and installing fuel rail

Removing

CAUTION

The fuel system is under high pressure.
Risk of injury due to fuel which may spurt out.
– Release high pressure.

Release high fuel pressure ⇒ [page 316](#)

Risk of functional impairment due to soiling
⇒ [“2.1 Safety precautions when working on fuel supply system”, page 4](#).

- Now remove the intake manifold ⇒ [page 329](#).
- Remove high-pressure pipe ⇒ [page 347](#).
- Unplug the electrical connector -1-.

Note

Lay a cloth underneath to catch escaping fuel.

- Unscrew bolts -arrows- and detach fuel rail from injectors.

Installation

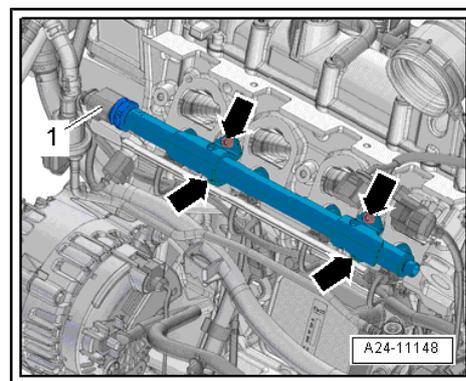
Install in the reverse order of removal, observing the following:

Note

- ◆ *Replace the O-rings.*
- ◆ *Before installing, lightly moisten O-rings with clean engine oil.*
- ◆ *Visually inspect fuel rail and remove any foreign bodies or old O-rings as necessary.*
- ◆ *If there is still an O-ring in the fuel rail, carefully lever it out using removal wedge - 3409-.*
- ◆ *The sealing surfaces in the fuel rail must be free of scoring or scratches. Otherwise renew the component.*
- Apply mountings on fuel rail onto injectors.
- Press fuel rail onto injectors as far as stop (first on right side, then on left side).
- Press fuel rail down firmly in vicinity of bracket and screw in bolts two turns.
- Tighten bolts evenly and diagonally.
- Install high-pressure pipe ⇒ [page 347](#).
- Install intake manifold ⇒ [page 329](#).

Specified torques

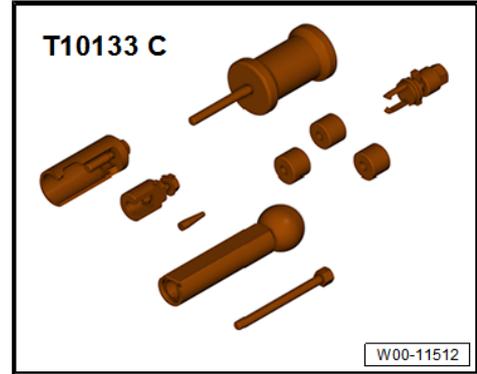
- ◆ ⇒ [“2.1 Assembly overview - fuel rail with injectors”, page 318](#)



2.3 Removing and installing injectors

Special tools and workshop equipment required

- ◆ Tool set for FSI engines - T10133 C- with -T10133/16 A- and -T10133/19-



Removing

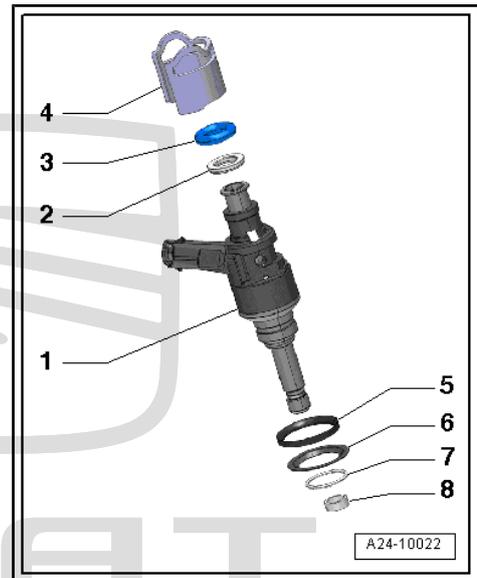
Risk of functional impairment due to soiling ⇒ [page 4](#) .



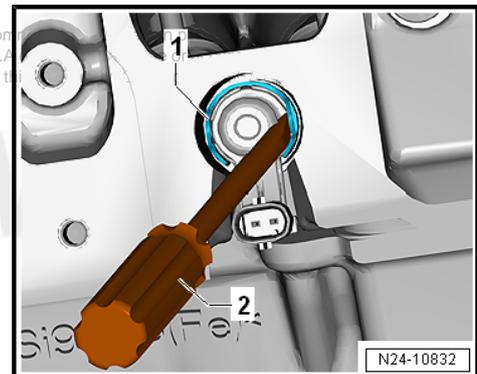
Note

Injectors must only be installed when the engine is cold.

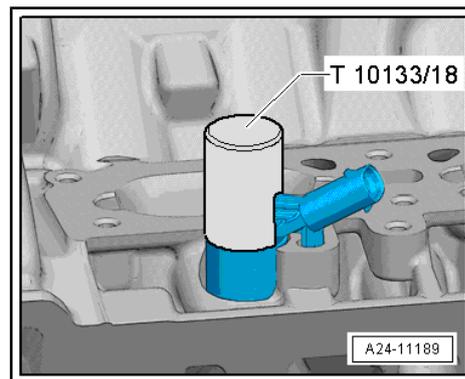
- Now remove the intake manifold ⇒ [page 329](#) .
- Removing fuel rail ⇒ [page 319](#) .
- Remove O-ring -3- from injector -1-.
- Unplug electrical connector from corresponding injector.



- Lever support ring -1- off injector using a screwdriver -2-.



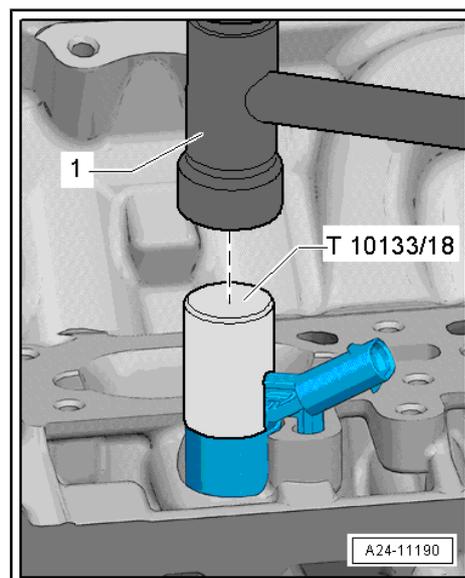
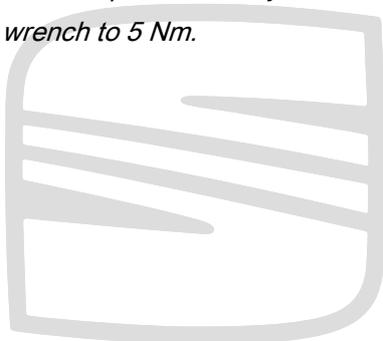
- Fit impact sleeve -T10133/18- over injector.



- Carefully loosen injector with light blows onto impact sleeve.

i Note

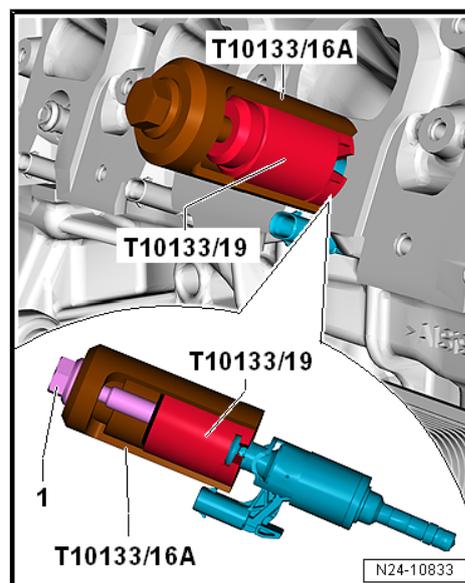
- ◆ Use a torque wrench to pull out the injector.
- ◆ Set the torque wrench to 5 Nm.



- Apply puller -T10133/19- to groove on injector.
- Attach removal tool -T10133/16 A- to puller.
- Pull out injector by screwing in bolt -1-.
- If injector does not come loose after limit torque of »5 Nm« is reached, remove puller and repeat procedure using stop sleeve to loosen injector.
- Repeat procedure for each injector.

i Note

- ◆ Observe correct torque to avoid irreparable damage to injector.
- ◆ The combustion chamber seal must always be renewed prior to reinstallation of the injector
- Detach gasket for intake manifold (bottom section).



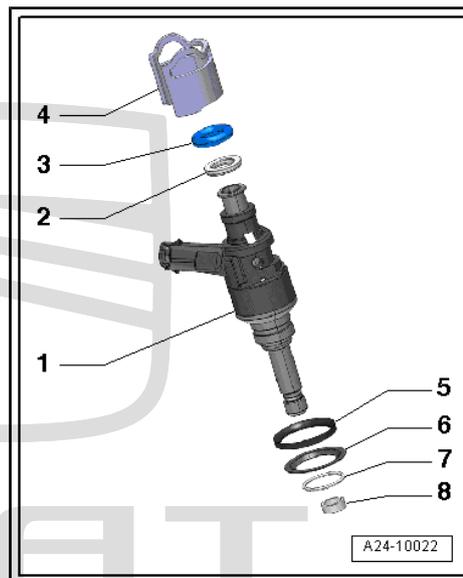
Dismantling injector

- Pull support ring -4- and spacer ring -2- of injector -1-.
- Detach circlip -7-, sealing element (top) -5- and sealing element (bottom) -6-.
- Carefully remove old combustion chamber ring seal -8-. To do so, cut open seal using knife or prise open with small screwdriver and then pull off forwards.



Note

Take care not to damage injector groove. The injector must be renewed if the groove is damaged.



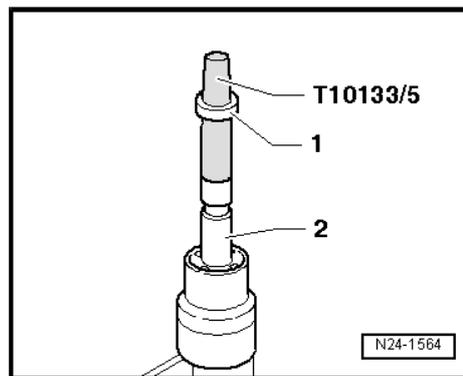
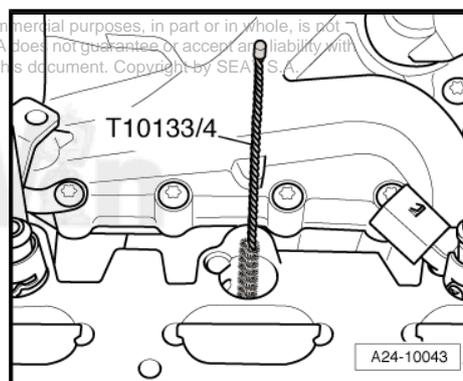
Installation

- Clean bore in cylinder head with nylon cylinder brush -T10133/4-.

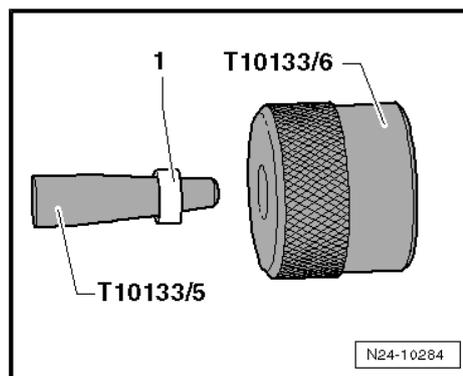


Note

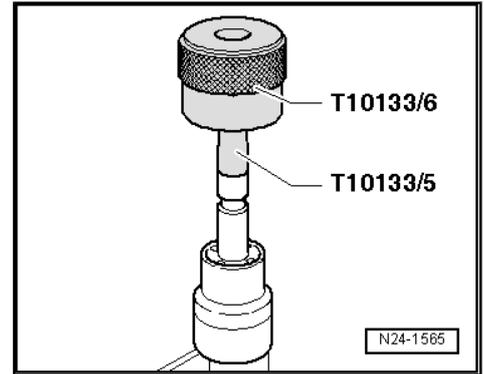
- ◆ Renew combustion-chamber ring seal and O-ring.
- ◆ Renew spacer ring if damaged.
- When re-installing an injector, clean any combustion residue off groove for combustion chamber ring seal and injector stem with a clean cloth.
- Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



- Push combustion chamber ring seal onto assembly cone -T10133/6- as far as it will go using assembly sleeve -T10133/5-.



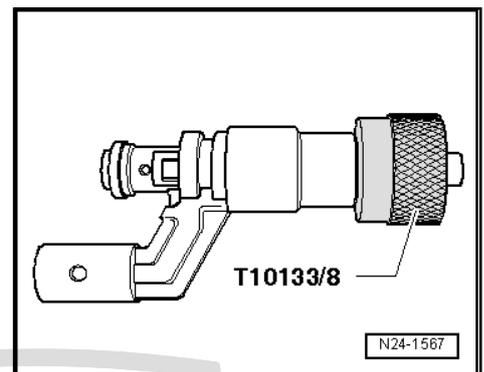
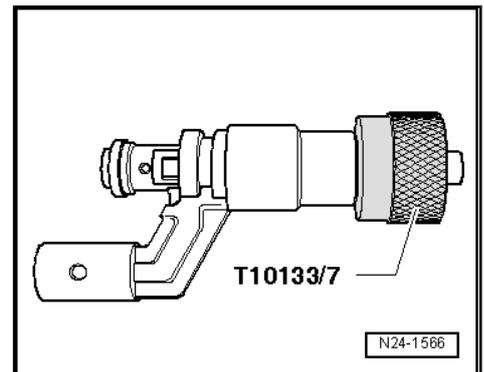
- Turn round assembly sleeve -T10133/6- and slide combustion chamber ring seal into groove.

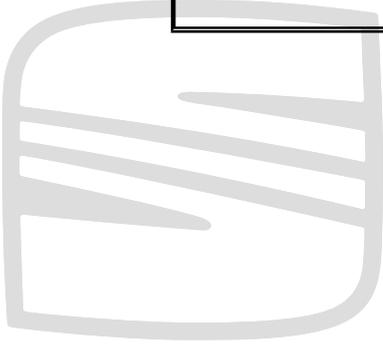


 **Note**

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.
- Fit support ring -4- and spacer ring -2- onto injector -1-.




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erWin 

- Before installing new injector -1-, lubricate new O-ring -3- lightly with clean engine oil.

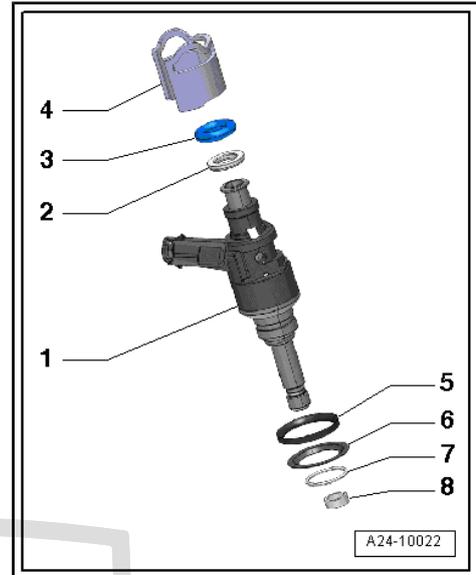
i Note

The combustion chamber ring seal -8- must not be lubricated.

- Push injectors by hand as far as they will go into the hole of the cylinder head (must be free of oil and grease). Ensure the correct positioning of the injectors in the cylinder head.

i Note

- ◆ *It must be possible to push in the injectors slightly. Where necessary, wait until the combustion chamber seal has contracted sufficiently.*
- ◆ *Make sure that the injectors are correctly seated on the cylinder head and that the assembly position is correct.*
- Electrical connector of injector must engage in recess in cylinder head.
- Install fuel rail ⇒ [page 319](#) .
- Install intake manifold ⇒ [page 329](#) .
- Connect vehicle diagnostic tester and apply the guided function "delete adaption values of injectors".



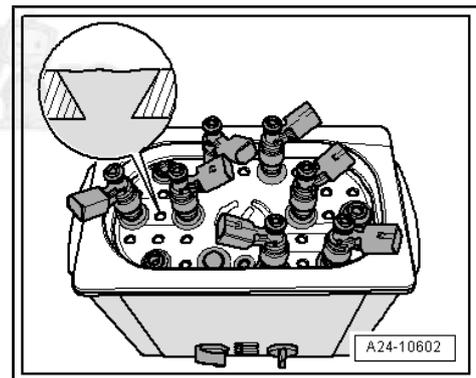
2.4 Cleaning injectors

Special tools and workshop equipment required

- ◆ Ultrasonic cleaning unit - VAS 6418-
- ◆ Mounting plate for injection modules VAS 6418/1
- ◆ Cleaning agents: ⇒ [Electronic parts catalogue](#)

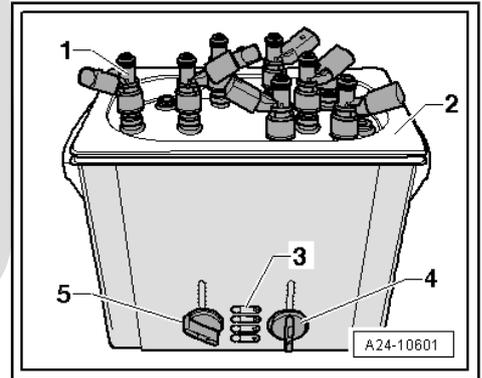
i Note

- ◆ *Ultrasonic unit must be filled with cleaning agent up to upper edge of holes (see expanded view).*
- ◆ *Observe safety precautions and operating instructions for ultrasonic unit.*



Clean

- Remove injectors ⇒ [page 320](#) .
- Insert injectors -1- all the way into mounting plate for injection modules - VAS 6418/1- -item 2-.
- Immerse injectors together with mounting plate for injection modules - VAS 6418/1- into cleaning fluid - VAS 6418/2- .
- Set rotary knob -4- to a temperature of 50°C.
- Select a cleaning time of 30 minutes with rotary knob -5-.
- Switch on ultrasonic unit with button -3-.



Note

The time set starts to elapse as soon as a cleaning temperature of 50°C has been reached.

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- After cleaning, renew combustion chamber ring seal for each injector ⇒ [page 320](#) .

3 Air filter

⇒ "3.1 Exploded view - air cleaner housing", page 326

⇒ "3.2 Removing and installing air filter housing", page 327

3.1 Exploded view - air cleaner housing

1 - Air duct (bottom section)

- On lock carrier

2 - Air duct (top section)

- On lock carrier

3 - Cover

- for air duct

4 - Bolt

- 2 Nm

5 - Air cleaner (bottom section)

- Clean out dirt, leaves and salt deposits

6 - Air filter element

- Use only genuine air filter elements ⇒ Electronic Parts Catalogue (ETKA) .
- Replacement interval ⇒ maintenance tables
- Removing and installing ⇒ Maintenance ; Booklet 501 .

7 - Air filter top section

- Clean out dirt, leaves and salt deposits

8 - Flexible pipe

- For crankcase breather

9 - Air hose

10 - Rubber buffer

11 - Bolt

- 1.5 Nm

12 - Air hose

13 - O-ring

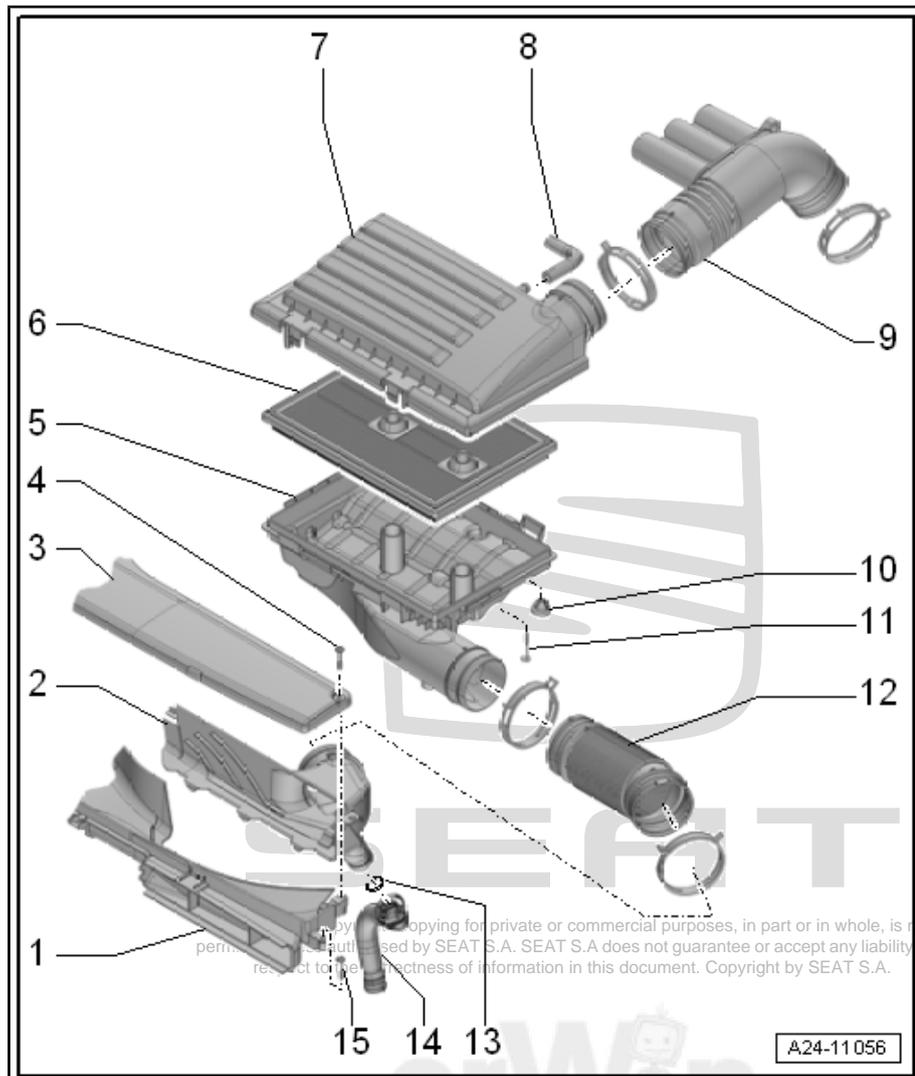
- Renew if damaged.

14 - Water drain hose

- Clean

15 - Bolt

- 2 Nm



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3.2 Removing and installing air filter housing

Removing

- Detach air hose -2-.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.



Note

Do not pull out the air filter housing suddenly or to one side.

- Loosen hose clips -3- and -4-.
- Detach air cleaner housing -1-.

Installation

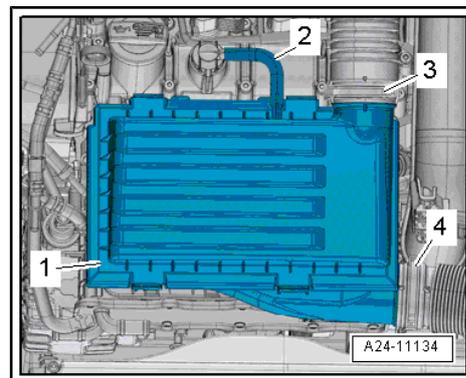


Note

- ◆ *If the air filter element is very dirty or wet, dirt or water could reach components and affect the measured values. This will cause a loss of power, as the calculated injection quantities will be too low.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *The air filter housings must be clean.*
- ◆ *Before fitting the air filter housing, the ball studs on the inlet manifold are to be wetted with water with no additives.*
- ◆ *Hose unions and air intake pipes/hoses must be free of oil and grease when installing.*
- ◆ *Use a silicone-free lubricant when installing the air hoses.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue (ETKA) .*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (air pipes etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Observe environmental requirements for disposal.*
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.
- Blow out water drain with compressed air.
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.
- Blow out water drain with compressed air.

Specified torques

- ◆ ⇒ ["3.1 Exploded view - air cleaner housing", page 326](#)



4 Intake manifold

⇒ ["4.1 Intake manifold - exploded view", page 328](#)

⇒ ["4.2 Removing and installing intake manifold", page 329](#)

⇒ ["4.3 Removing and installing throttle valve module GX3", page 333](#)

⇒ ["4.4 Cleaning throttle valve module GX3", page 335](#)

4.1 Intake manifold - exploded view

1 - Coolant pipe

- Clipped onto intake manifold.

2 - Intake manifold

- Combined with charge air cooler
- Removing and installing ⇒ [page 329](#)

3 - Coolant pipe

- Clipped onto intake manifold.

4 - Bolt

- Tightening torque and sequence ⇒ [page 329](#) .

5 - O-ring

- renew

6 - Intake manifold sender - GX9-

- comprising:
 - Intake air temperature sensor - G42-
 - Intake manifold pressure sender - G71-
- Removing and installing ⇒ [page 336](#)

7 - Seals

- renew

8 - Charge air pressure sender - GX26-

- comprising:
 - Charge-air regulator - G31-
 - Intake air temperature sensor - G42-
- Removing and installing ⇒ [page 308](#) .

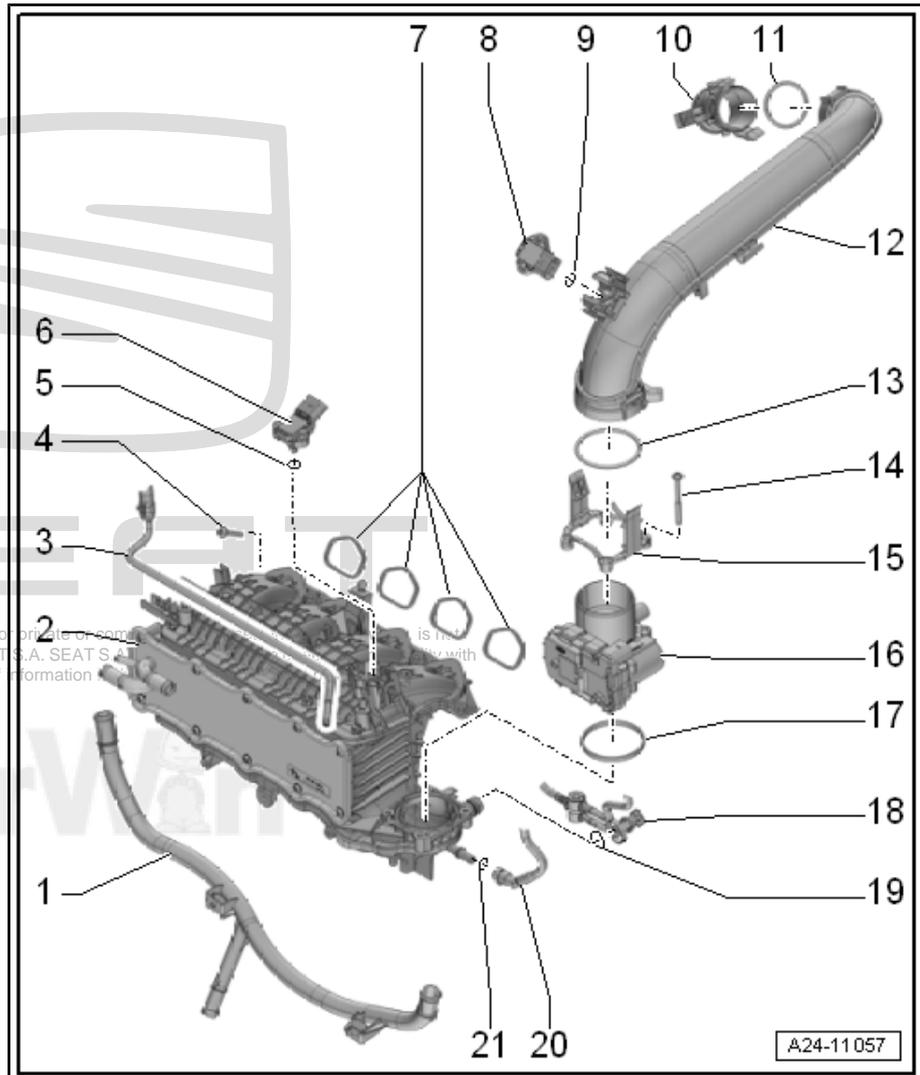
9 - O-ring

- renew

10 - Connection

11 - O-ring

- renew
- Before installing, lightly moisten O-ring with clean engine oil



12 - Air conduction tube

- For removal, use release tools - T10527- and -T10527/1-

13 - O-ring

- renew
- Before installing, lightly moisten O-ring with clean engine oil

14 - Bolt

- Thread-forming
- Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to specified torque.
- 7 Nm

15 - Retaining clip

- for air pipe

16 - Throttle valve control mechanism - GX3-

- comprising:

Throttle valve control mechanism - J338-

Throttle valve drive (electric power control) - G186-

Throttle valve drive angle sender 1 (electric power control) - G187-

Throttle valve drive angle sender 2 (electric power control) - G188-

- Removing and installing ⇒ [page 333](#)
- cleaning ⇒ [page 335](#)
- After throttle valve module - J338- has been renewed, it must be re-adapted to engine control unit - J623- . Use vehicle diagnostic tester

17 - Seal ring

- renew

18 - Vacuum line

19 - O-ring

- renew

20 - Vacuum line

21 - O-ring

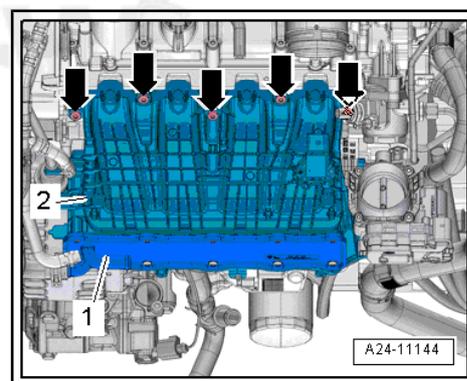
- In event of damage to O-ring, vacuum line ⇒ [Item 20 \(page 329\)](#) must be renewed

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Intake manifold - tightening torque and sequence

– Tighten bolts in stages as follows:

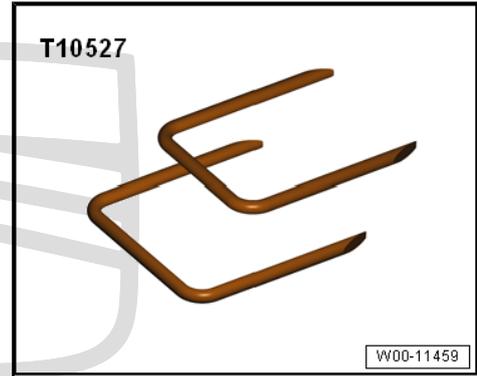
stage	Bolts	Tightening torque
1.	-arrows-	Starting in centre, screw in bolts alternately by hand until they make contact
2.	-arrows-	Starting in centre, screw in bolts alternately: 8 Nm



4.2 Removing and installing intake manifold

Special tools and workshop equipment required

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



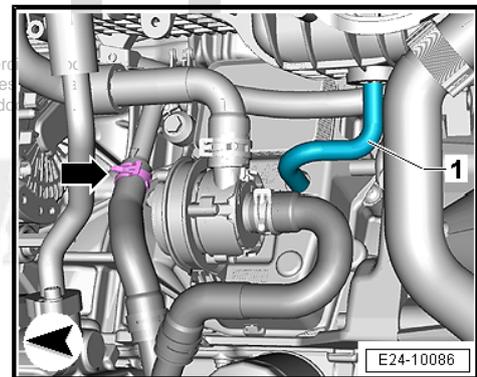
Removing

- Drain coolant ⇒ [page 251](#) .
- Release clip -arrow- and remove coolant hose.
- Disconnect crankcase breather hose -1-

CAUTION

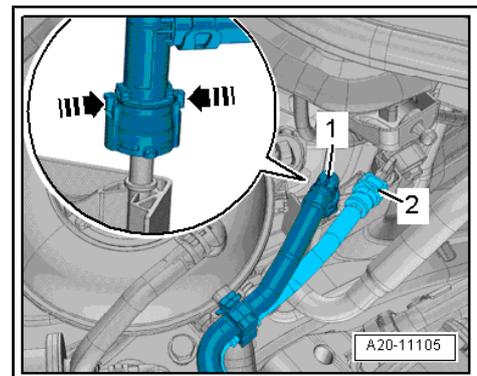
The fuel system is pressurised.
Risk of injury due to fuel which may spurt out.

- Use safety goggles.
- Wear protection gloves.
- Release pressure: place clean cloth around connection and carefully open connection.

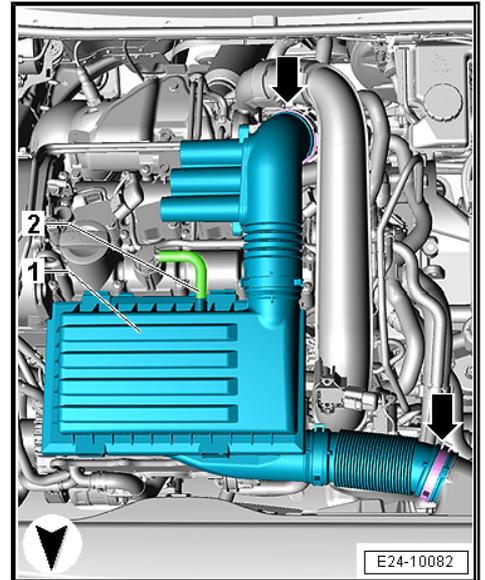


Risk of functional impairment due to soiling ⇒ [page 4](#) .

- First press hose connector -1- downwards, and then press release tabs -arrows-.
- Pull off hose connector, keeping release tabs depressed.
- Press release tab on hose -2- for activated charcoal filter.



- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



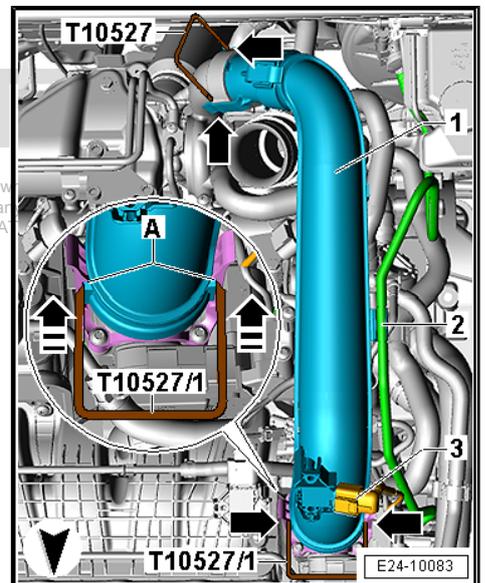
- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

 Note

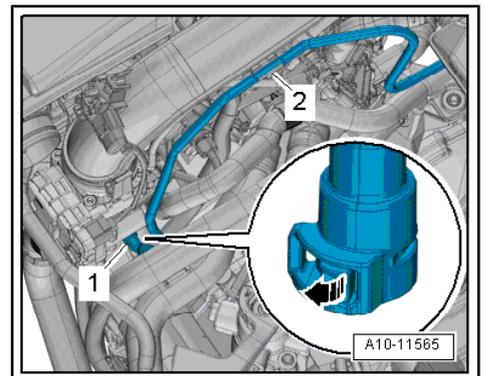
◆ To prevent the locating pins of the intake pipe from breaking off, please use the release tool -T10527- and -T10527/1- or in w
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◆ Insert the release tool , note the detailed image -A-.

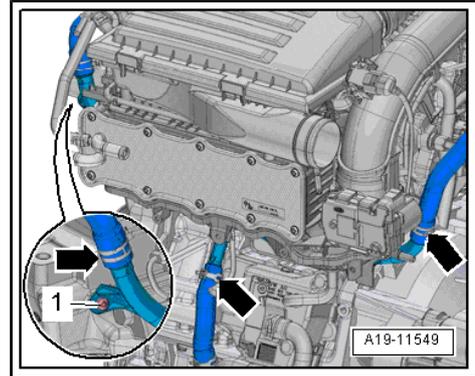
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.



- Release catch -arrow-, disconnect vacuum line -1-.



- Remove screw -1-, release upper clips -arrows- and remove coolant hoses.



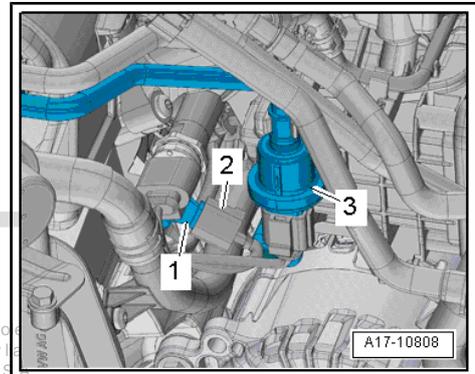
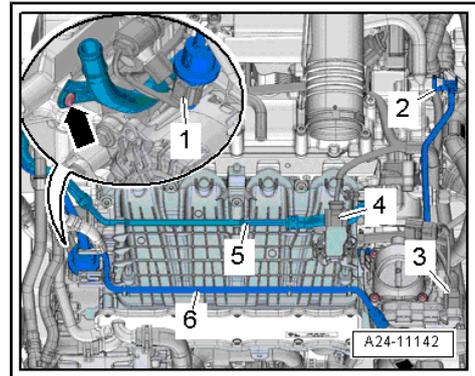
- Unplug electrical connectors:
 - 1 - For activated charcoal filter solenoid valve 1 - N80-
 - 3 - for throttle valve control unit - GX3-
 - 4 - for intake manifold sender - GX9-



Note

Disregard -arrow-.

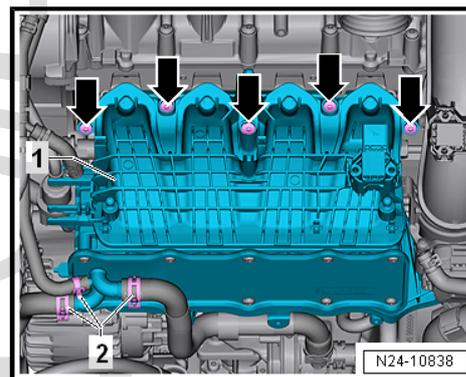
- Remove vacuum hose -2- for activated carbon canister.
- Unclip fuel supply line -5- and coolant line -6- from intake manifold and push them to one side.
- Pull activated charcoal filter solenoid valve 1 - N80- -3- off intake manifold and push it downwards slightly.
- Unplug electrical connector -2- for oil pressure switch.



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- Undo hose clamps -2- and pull off coolant hoses.
- Remove bolts -arrows-.
- Unclip electrical wire and coolant hose.
- Pull off hose from oil separator.
- Remove intake manifold.



Installation

Install in the reverse order of removal, observing the following:

Note

- ◆ *Renew gaskets and O-rings.*
- ◆ *Before installing, lightly moisten O-rings with clean engine oil.*
- Install air cleaner housing. ⇒ [page 327](#)
- Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Fill up with coolant ⇒ [page 251](#) .

Specified torques

- ◆ ⇒ [“4.1 Intake manifold - exploded view”, page 328](#)

4.3 Removing and installing throttle valve module - GX3-

Throttle valve control unit - GX3- comprising:

- ◆ Throttle valve control mechanism - J338-
- ◆ Throttle valve drive (electric power control) - G186-
- ◆ Throttle valve drive angle sender 1 (electric power control) - G187-
- ◆ Throttle valve drive angle sender 2 (electric power control) - G188-

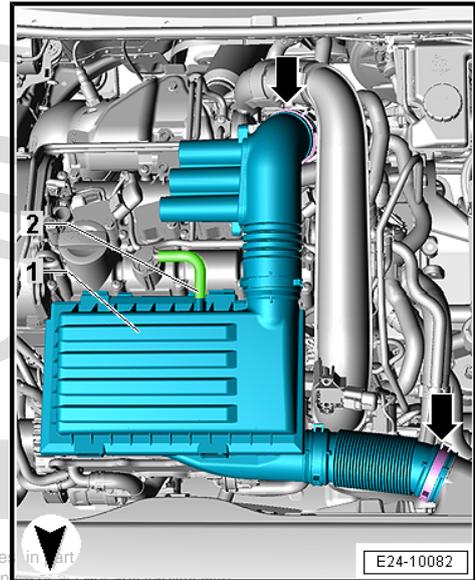
Special tools and workshop equipment required

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



Removing

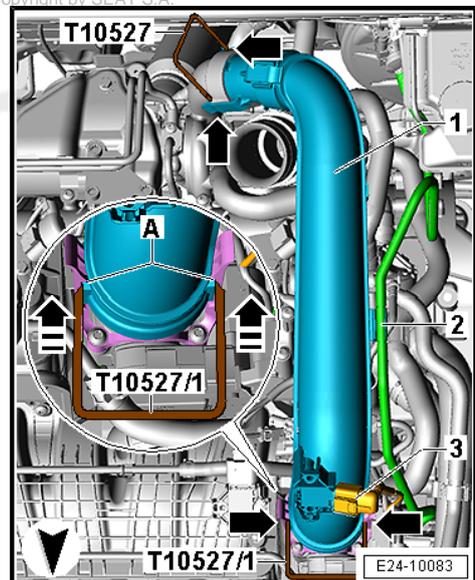
- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.



- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

Note

- ◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .*
- ◆ *Insert the release tool , note the detailed image -A-.*
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.



- Separate the connector -3-.
- Unscrew bolts -arrows- and remove throttle valve module - GX3- -1- with adapter -2-.

Installation

Note

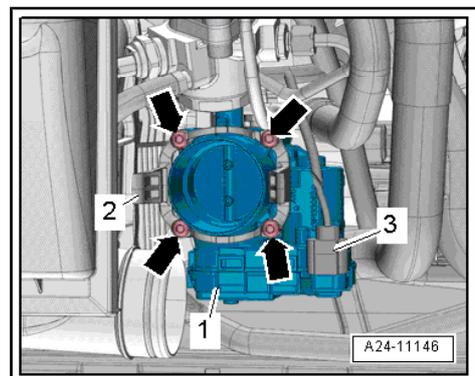
- ◆ *Renew gaskets and O-rings.*
- ◆ *Before installing, lightly moisten O-rings with clean engine oil.*

Install in the reverse order of removal, observing the following:

- After throttle valve module - GX3- has been renewed, it must be re-adapted to engine control unit - J623- . For this purpose the vehicle diagnostic tester is to be used.

Specified torques

- ◆ => ["4.1 Intake manifold - exploded view", page 328](#)



4.4 Cleaning throttle valve module - GX3-

Note

- ◆ *The throttle valve module must be adapted if a new engine control unit - J623- is installed.*
- ◆ *Dirt or carbon deposits at the stop may cause wrong adaption values.*
- ◆ *Throttle valve support must not be scratched when cleaning.*

Special tools and workshop equipment required

- ◆ Acetone (commercially available)
- ◆ Brush

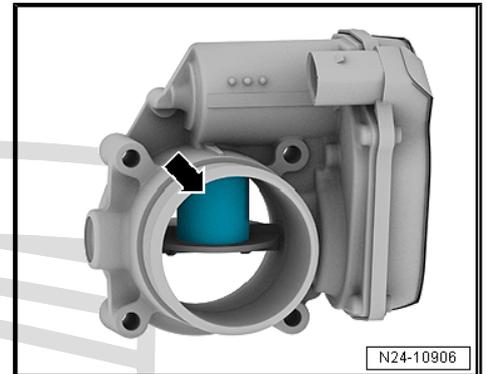
Work sequence

- Remove throttle valve control unit - GX3-
 ⇒ ["4.3 Removing and installing throttle valve module GX3 "](#),
[page 333](#) .
- Open throttle valve by hand and lock it in open position with a wedge (plastic or wood) -arrow-.

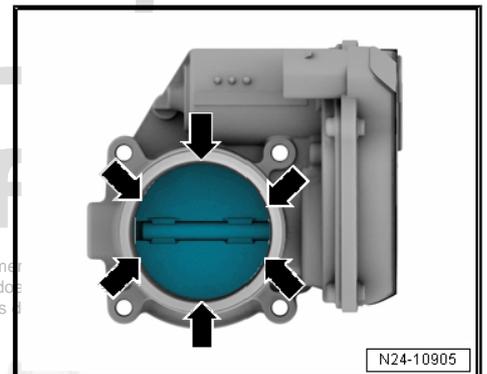
CAUTION

Risk of injury caused by acetone. Acetone is highly flammable and may cause eye and skin irritation.

- Use safety goggles.
- Wear protection gloves.



- Clean throttle valve housing thoroughly, especially around the points -arrows- where the throttle valve closes, using commercially available acetone and a small brush.
- Wipe the throttle valve support with a non-fluffy cloth.
- Allow the acetone to dry completely.
- Install throttle valve module - GX3- ⇒ [page 333](#) .
- Erase learnt values and adapt engine control unit - J623- to throttle valve module - GX3- . For this purpose, use Vehicle diagnostic and service information system



5 Sensors

⇒ ["5.1 Remove and install intake manifold sender GX9"](#), page 336

⇒ ["5.2 Removing and installing fuel pressure sensor G247"](#), page 336

⇒ ["5.3 Checking fuel pressure sender G247"](#), page 337

5.1 Remove and install intake manifold sender - GX9-

Intake manifold sender - GX9- is comprised of:

- ◆ Intake air temperature sensor - G42-
- ◆ Intake manifold pressure sender - G71-

Removing

- Remove air cleaner housing ⇒ [page 327](#) .
- Separate the connector -1-.
- Release detents -arrows-; Remove intake manifold sensor - GX9- .

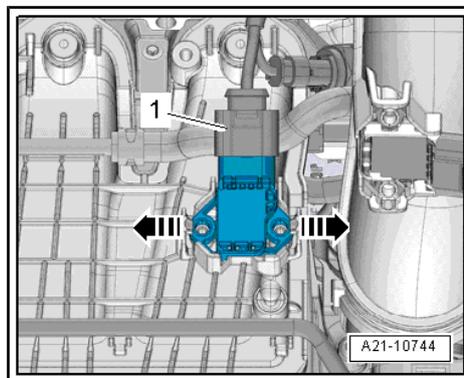
Installation

Install in the reverse order of removal, observing the following:



Note

- ◆ *Replace the O-ring.*
- ◆ *If the retaining tabs broke off during removal, the sender can be secured using two securing bolts as per ⇒ [Electronic Parts Catalogue \(EPC\)](#) . Tightening torque: ⇒ [page 336](#)*



Torque

Component	Tightening torque
Intake air temperature sensor / intake manifold pressure sensor	3 Nm

- Install air cleaner housing. ⇒ [page 327](#)

5.2 Removing and installing fuel pressure sensor - G247-

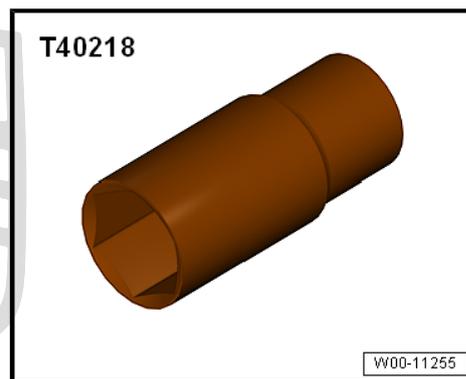
Special tools and workshop equipment required

- ◆ Assembly tool - T10118-



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- ◆ Bit (27 mm) - T40218- or commercially available socket (27 mm)



Removing

- Unplug the electrical connector -1-.

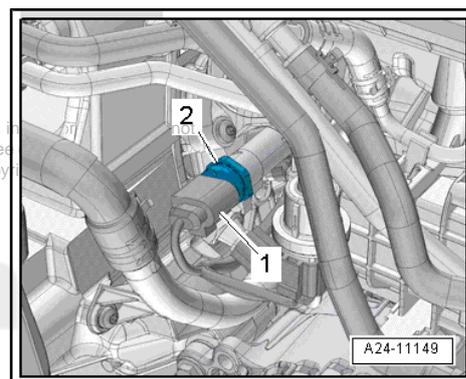


Note

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Lay a cloth underneath to catch escaping fuel.

- Unscrew fuel pressure sender - G247- -2- using bit, 27mm - T40218- .



Installation

Install in the reverse order of removal, observing the following:



Note

Do not lubricate thread of fuel pressure sender.

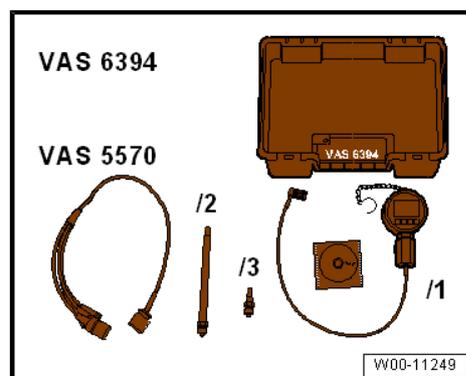
Specified torques

- ◆ ⇒ [“2.1 Assembly overview - fuel rail with injectors”, page 318](#)

5.3 Checking fuel pressure sender - G247-

Special tools and workshop equipment required

- ◆ Vehicle diagnosis and service information system
- ◆ Pressure sensor tester - VAS 6394-



- ◆ Test instrument adapter/DSO (3-pin) - VAS 5570-
- ◆ Socket, 27 mm (commercially available)

Work sequence

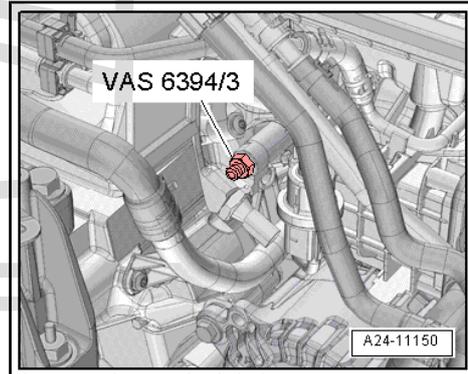
⚠ CAUTION

The fuel system is under high pressure.
 Risk of injury due to fuel which may spurt out.
 – Release high pressure.

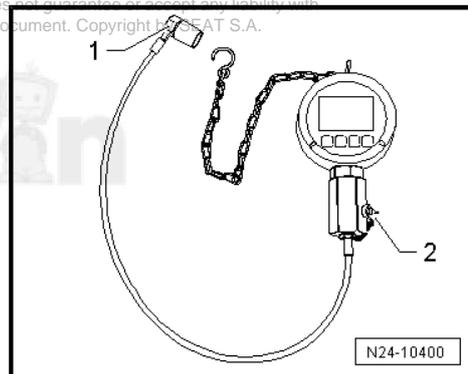
Release high fuel pressure ⇒ [page 316](#)

Risk of functional impairment due to soiling ⇒ [page 4](#) .

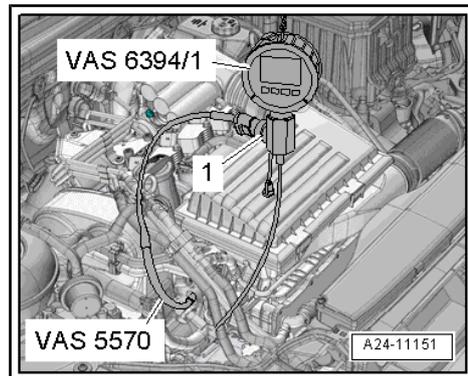
- Remove fuel pressure sender - G247- ⇒ [page 336](#) .
- Lubricate taper seal of adapter -VAS 6394/3- with clean engine oil and screw into fuel rail (22 Nm).



- Unscrew plug -2- and screw fuel pressure sender -G247- into tester -VAS 6394/1- .
- Connect pressure line -1- of tester to adapter - VAS 6394/3- .



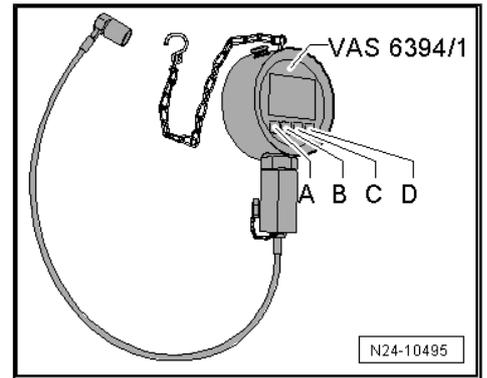
- Establish the electrical connection between vehicle and fuel pressure sender - G247- using the test instrument adapter/ DSO (3-pin) - VAS 5570- .



- Switch on tester -VAS 6394/1- by pressing button -A- once briefly.

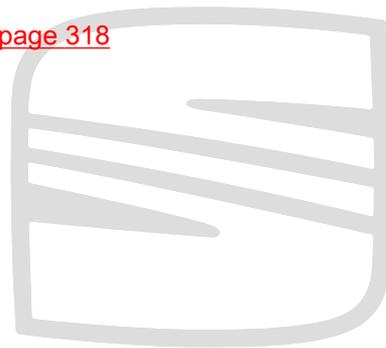
 **Note**

- ◆ *When button -A- is pressed for 2 seconds, the illumination is switched on for 20 seconds.*
- ◆ *If tester -VAS 6394/1- does not indicate 0 bar, zero the tester => Operating instructions .*
- Connect vehicle diagnostic tester .
- Start engine and run at idling speed.
- Select "Engine electronics" in the self-diagnosis program.
- Then select the "measured values".
- Select "Fuel pressure" from the list.
- Compare pressure displayed on tester -VAS 6394/1- with actual value displayed on vehicle diagnosis tester .
- Observe fuel pressure displayed on vehicle diagnostic tester.
- A maximum pressure deviation of 5 bar is permissible
- If deviation is greater than 5 bar, renew fuel pressure sender - G247- .
- Repeat the check with the new fuel pressure sender - G247- and compare both measurement values.
- If measured values are now the same, install new fuel pressure sender - G247- .
- If measured values are not the same again, check electrical connection between fuel pressure sender - G247- and engine control unit - J623- => Current flow diagrams, Electrical fault finding and Fitting locations.



Specified torques

- ◆ => ["2.1 Assembly overview - fuel rail with injectors", page 318](#)



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6 Engine control unit

⇒ [“6.1 Removing and installing engine control unit J623”, page 340](#)

6.1 Removing and installing engine control unit - J623-

⇒ [“6.1.1 Removing and installing engine control unit J623 \(with metal locking plate\)”, page 340](#)

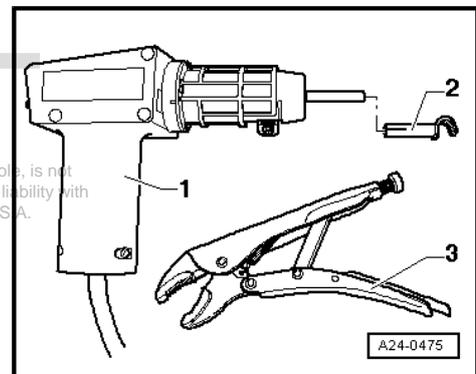
⇒ [“6.1.2 Removing and installing engine control unit J623 \(with protective housing\)”, page 342](#)

6.1.1 Removing and installing engine control unit - J623- (with metal locking plate)

Special tools and workshop equipment required

- ◆ Hot air blower - VAS 1978/14A- -item 1- with plug-in nozzle
- 2- from wiring harness repair set - VAS 1978 B-

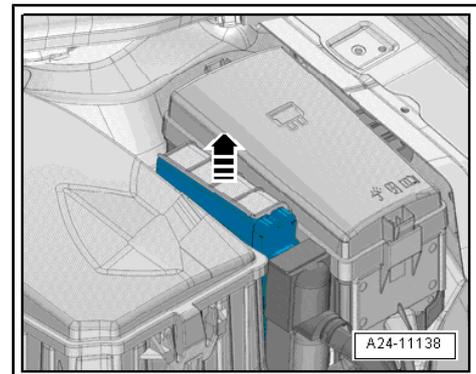
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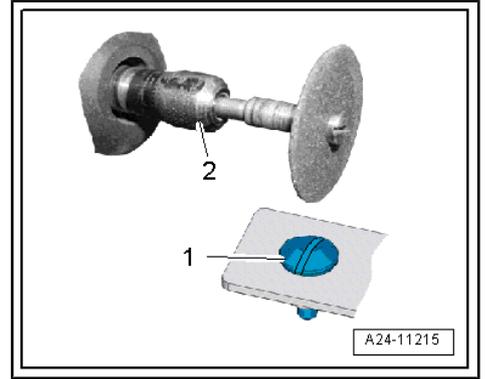
- ◆ Small grinder (commercially available)
- ◆ Vehicle diagnosis and service information system

Removing

- If engine control unit is renewed, select test sequence/function “Replace engine control unit on “vehicle diagnosis tester” in “Guided functions” mode.
- Switch off ignition and remove key.
- Release retaining clip -arrow- and take out engine control unit - J623- .



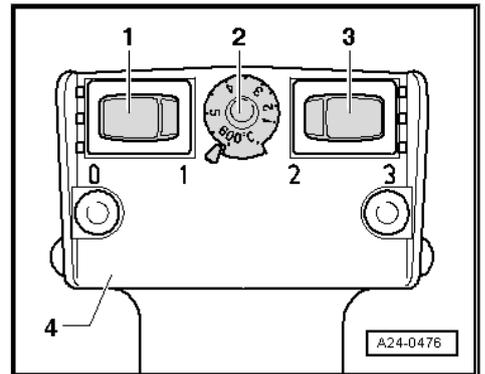
- Make groove (for a screwdriver) in head of shear bolt -1- using a small grinder -2-.



i Note

The threads of the shear bolts are secured with locking fluid. To unscrew these bolts, the threads must therefore be heated with the hot air blower.

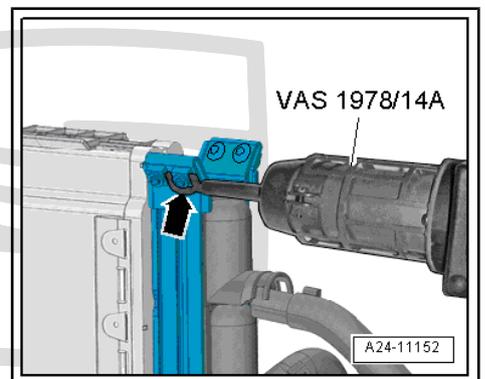
- Set the hot air blower as shown in illustration, meaning potentiometer for temperature regulation -2- set to maximum heating power and 2-stage switch for air volume -3- set to position 3.



! NOTICE

Risk of damage to adjacent components caused by hot air blower. Risk of overheating.

- If necessary, cover adjacent components.
- Hold hot air blower - VAS 1978/14A- with nozzle attachment -arrow- to thread of shear bolt and heat thread for about 20 to 30 seconds.



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erWin

- Unscrew shear bolt -1- using screwdriver -2-.
- Detach metal locking plate from connectors for engine control unit - J623- .
- Release and detach connectors.

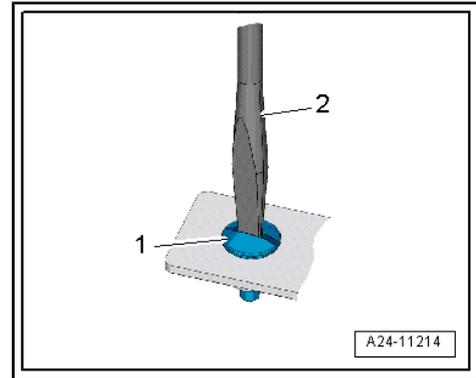
Installation

Install in the reverse order of removal, observing the following:

- The metal locking plate must always 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.
- Use new breakaway bolts.

After installing a new engine control unit, the following operation must be performed:

- Connect vehicle diagnostic tester .
- Activate engine control unit with the function "Replace engine control unit" on vehicle diagnosis tester in "Guided functions" mode.



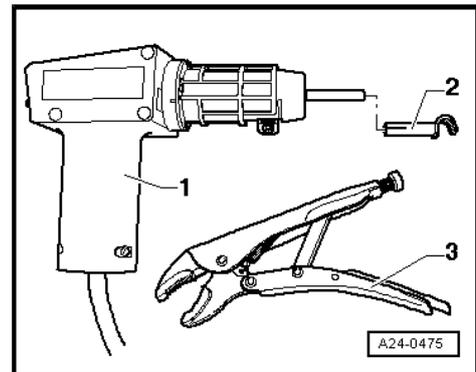
6.1.2 Removing and installing engine control unit - J623- (with protective housing)

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Removing

Special tools and workshop equipment required

- ◆ Hot air blower - VAS 1978/14A- -item 1- with plug-in nozzle -2- from wiring harness repair set - VAS 1978 B-



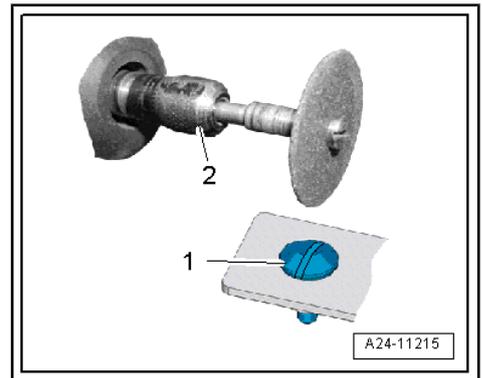
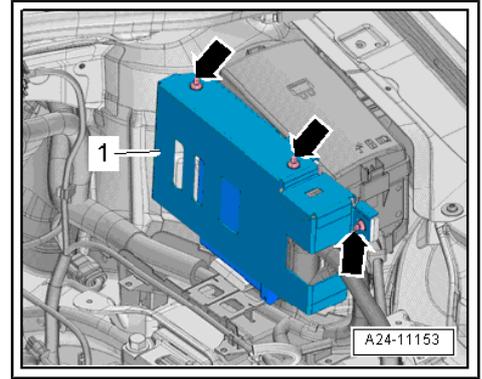
- ◆ Acetone (commercially available)
- ◆ Vehicle diagnosis and service information system

Removing

- If engine control unit is renewed, select test sequence/function Replace engine control unit on "vehicle diagnosis tester" in "Guided functions" mode.

To remove protective housing -1-, unscrew shear bolts -arrows- as follows:

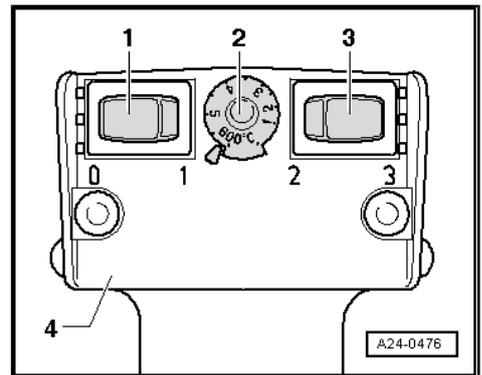
- Make groove (for a screwdriver) in head of shear bolt -1- using a small grinder -2-.



i Note

The threads of the shear bolts are secured with locking fluid. To unscrew these bolts, the threads must therefore be heated with the hot air blower.

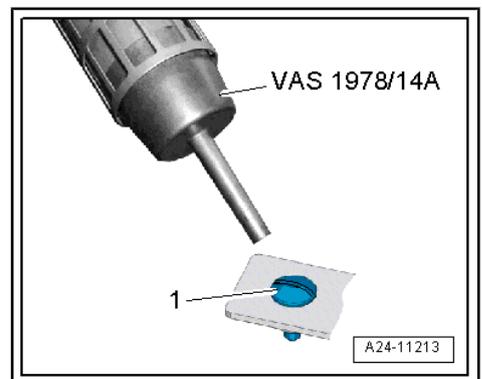
- Set the hot air blower as shown in illustration, meaning potentiometer for temperature regulation -2- set to maximum heating power and 2-stage switch for air volume -3- set to position 3.



! NOTICE

Risk of damage to adjacent components caused by hot air blower. Risk of overheating.

- If necessary, cover adjacent components.
- Heat head of shear bolt -1- for approx. 20 to 30 seconds.

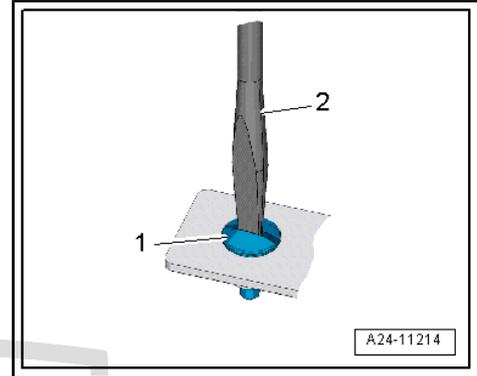


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erWin

- Unscrew shear bolt -1- using screwdriver -2-.

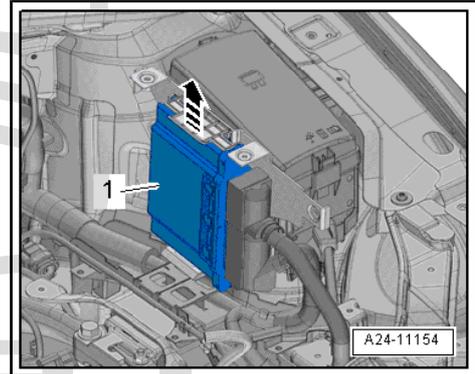


- Release fastener -arrow- and detach engine control unit -1-.
- Release and unplug connectors for engine control unit - J623- .

Installation

Install in the reverse order of removal, observing the following:

- Make sure you fit protective housing back on 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.
- Use new breakaway bolts.



After installing a new engine control unit, the following operation must be performed:

- Connect vehicle diagnostic tester.
- Activate engine control unit with the function "Replace engine control unit" on vehicle diagnosis tester in "Guided functions" mode.

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7 High-pressure pump

⇒ "7.1 Exploded view - high-pressure pump", page 345

⇒ "7.2 Removing and installing high-pressure pump", page 346

⇒ "7.3 Removing and installing high-pressure pipe", page 347

7.1 Exploded view - high-pressure pump

1 - Roller tappet

- When installing lubricate lightly with clean engine oil

2 - O-ring

- renew
- When installing lubricate lightly with clean engine oil

3 - High-pressure pump

- With fuel metering valve - N290-
- Do not dismantle
- Removing and installing ⇒ page 346

4 - High-pressure pipe

- Release high fuel pressure ⇒ page 316
- Removing and installing ⇒ page 347
- Check for damage before re-installing.
- Do not alter shape.
- Connections must not be damaged
- Lubricate threads of union nuts with clean engine oil
- 16 Nm + 45°

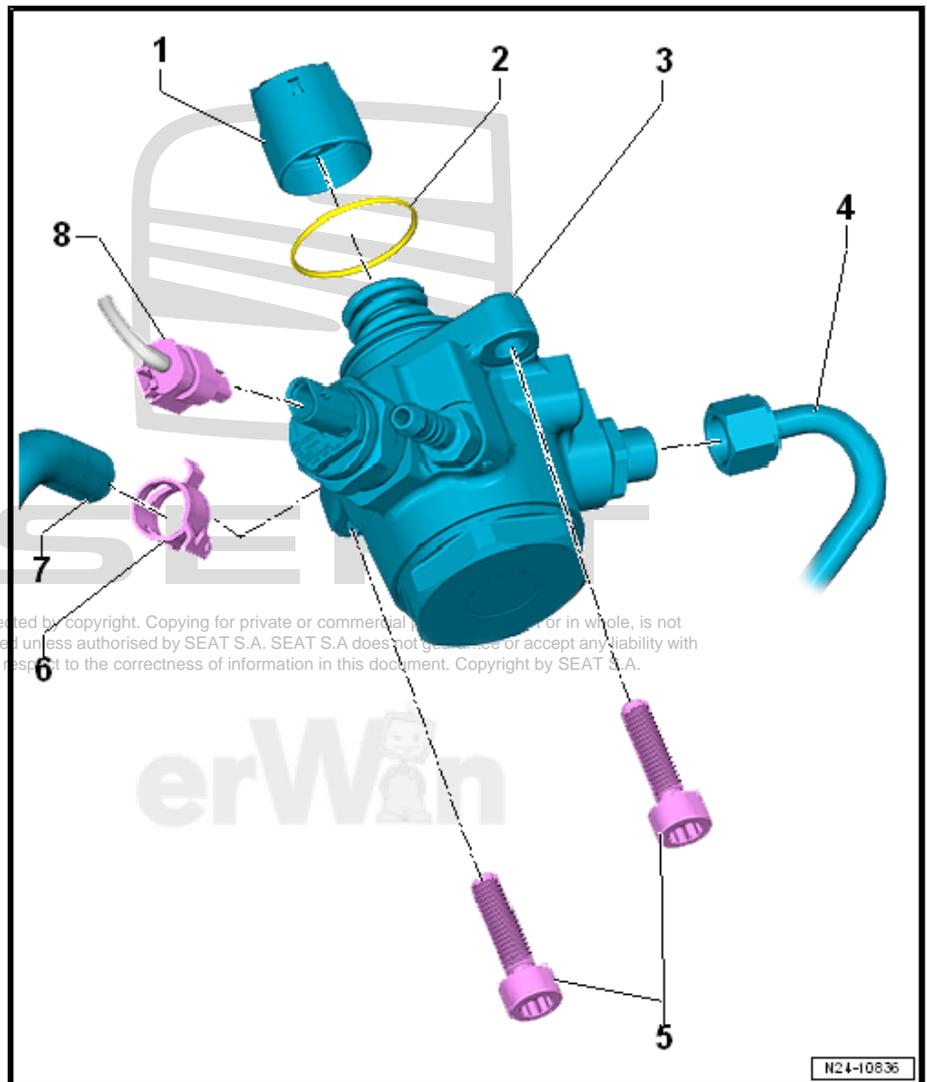
5 - Bolt

- renew
- Tightening torque and sequence ⇒ page 346 .

6 - Hose clip

7 - Fuel supply line

8 - Electric connector



High-pressure pump - tightening torque and sequence



Note

- ◆ *High-pressure pumps from different manufacturers have been installed.*
- ◆ *Bear in mind the different torque specifications for bolts!*

To prevent flange of high-pressure pump from being deformed during installation, fit high-pressure pump as follows:

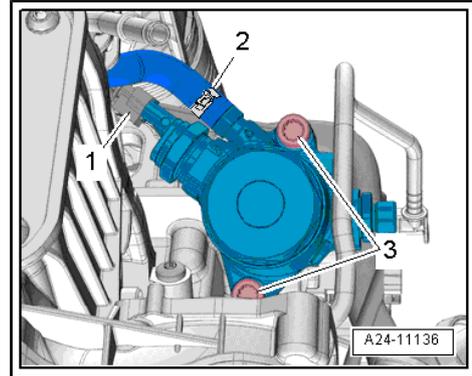
- Tighten new bolt in stages as follows:

Bolts M 8

stage	Bolts M 8	Tightening torque/angle specification
1.	-3-	Screw in by hand until they make contact
2.	-3-	Tighten one turn alternately until flange of high-pressure pump makes contact with camshaft housing
3.	-3-	20 Nm
4th	-3-	turn 90° further

Bolts M 6

stage	Bolts M 6	Tightening torque/angle specification
1.	-3-	Screw in by hand until they make contact
2.	-3-	Tighten one turn alternately until flange of high-pressure pump makes contact with camshaft housing
3.	-3-	8 Nm
4th	-3-	turn 90° further



7.2 Removing and installing high-pressure pump

Removing

- Engine cold.

CAUTION

**The fuel system is under high pressure.
Risk of injury due to fuel which may spurt out.**

- **Release high pressure.**

Release high fuel pressure ⇒ [page 316](#)

Risk of functional impairment due to soiling ⇒ [page 4](#) .

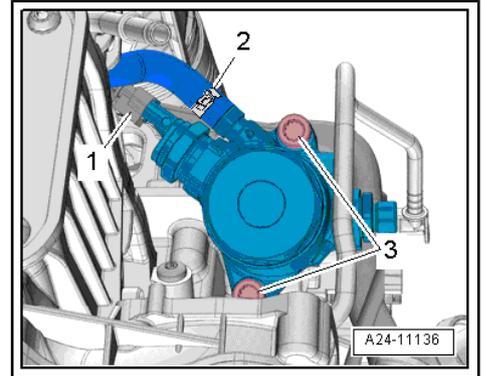
- Remove high-pressure pipe ⇒ [page 347](#) .

- Unplug the electrical connector -1-.

 **Note**

Lay a cloth underneath to catch escaping fuel.

- Release hose clip -2- and detach fuel supply hose.
- Unscrew bolts -3- and detach high-pressure pump with roller tappet.



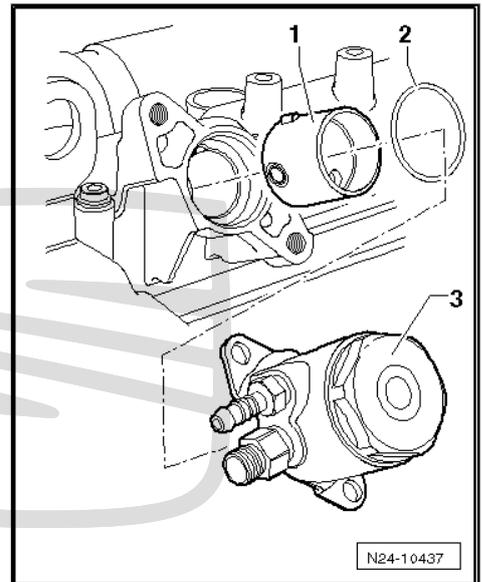
Installation

- Check roller tappet for damage and renew if necessary.
- Moisten roller tappet -1- with clean engine oil.
- Insert oiled roller tappet -1- into camshaft housing.

 **Note**

Replace the O-ring.

- Turn crankshaft in direction of engine rotation until roller tappet is at bottom dead centre.
- Place a new oiled O-ring -3- in the groove of the high pressure pump -2-.
- Tighten bolts hand tight.
- Tighten bolts in diagonal sequence to specified torque.
=> [page 346](#)
- Check complete fuel system for leaks.



7.3 Removing and installing high-pressure pipe

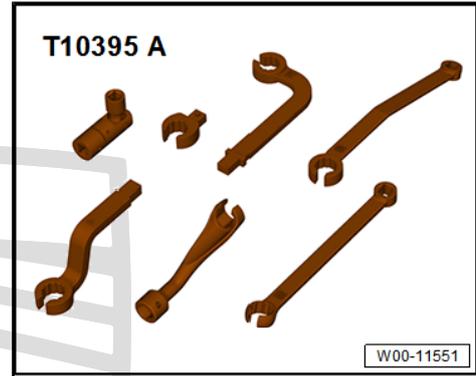
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Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-



- ◆ Insert - T10395/3- from tool set - T10395 A-



Removing

- Remove throttle valve control unit - GX3- ⇒ [page 333](#) .

⚠ CAUTION

The fuel system is under high pressure.
Risk of injury due to fuel which may spurt out.
- Release high pressure.

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Release high pressure in fuel system ⇒ [page 316](#) .

Risk of functional impairment due to soiling ⇒ [page 4](#) .



Note

Lay a cloth underneath to catch escaping fuel.

- Counterhold screw-in device on high-pressure pump using a suitable open-end spanner.
- Unscrew union nuts -arrows- and detach high-pressure pipe.

Installation

Install in the reverse order of removal, observing the following:

- Lubricate threads of union nuts with clean engine oil.
- Hand-tighten union nuts for high-pressure pipe (make sure that pipe is not under tension).



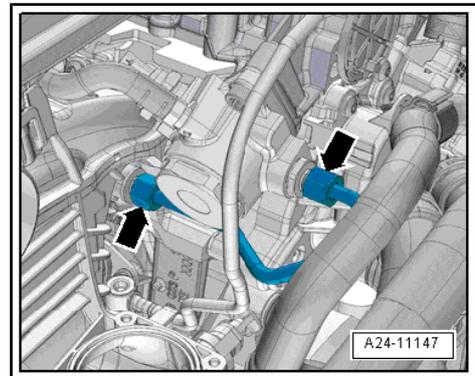
Note

Use an open-end wrench to counterhold at the hexagon on the high-pressure pump when tightening to the final specified torque.

- Tighten union nuts using torque wrench - V.A.G 1331- and insert from tool set - T10395 A- .
- Install throttle valve module - GX3- ⇒ [page 333](#) .

Specified torques

- ◆ ⇒ [“7.1 Exploded view - high-pressure pump”, page 345](#)



8 Lambda probe

⇒ ["8.1 Exploded view - Lambda probe", page 349](#)

⇒ ["8.2 Removing and installing lambda probe 1 before catalytic converter GX10 / lambda probe 1 after catalytic converter GX7", page 350](#)

8.1 Exploded view - Lambda probe

Note

- ◆ *New Lambda sensors are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ [Electronic parts catalogue \(ETKA\)](#) .*
- ◆ *When re-installing the electric wire of the lambda sensor, it is important that these are connected to the same locations. Contact of the electric wires with the exhaust pipe must be prevented in all cases.*

1 - Lambda probe 1 after catalytic converter - GX7-

- comprising:

Lambda probes after the catalytic converter - G130-

Lambda probe heater 1 after catalytic converter - Z29-

- Removing and installing ⇒ [page 350](#)
- 55 Nm

2 - Electric connector

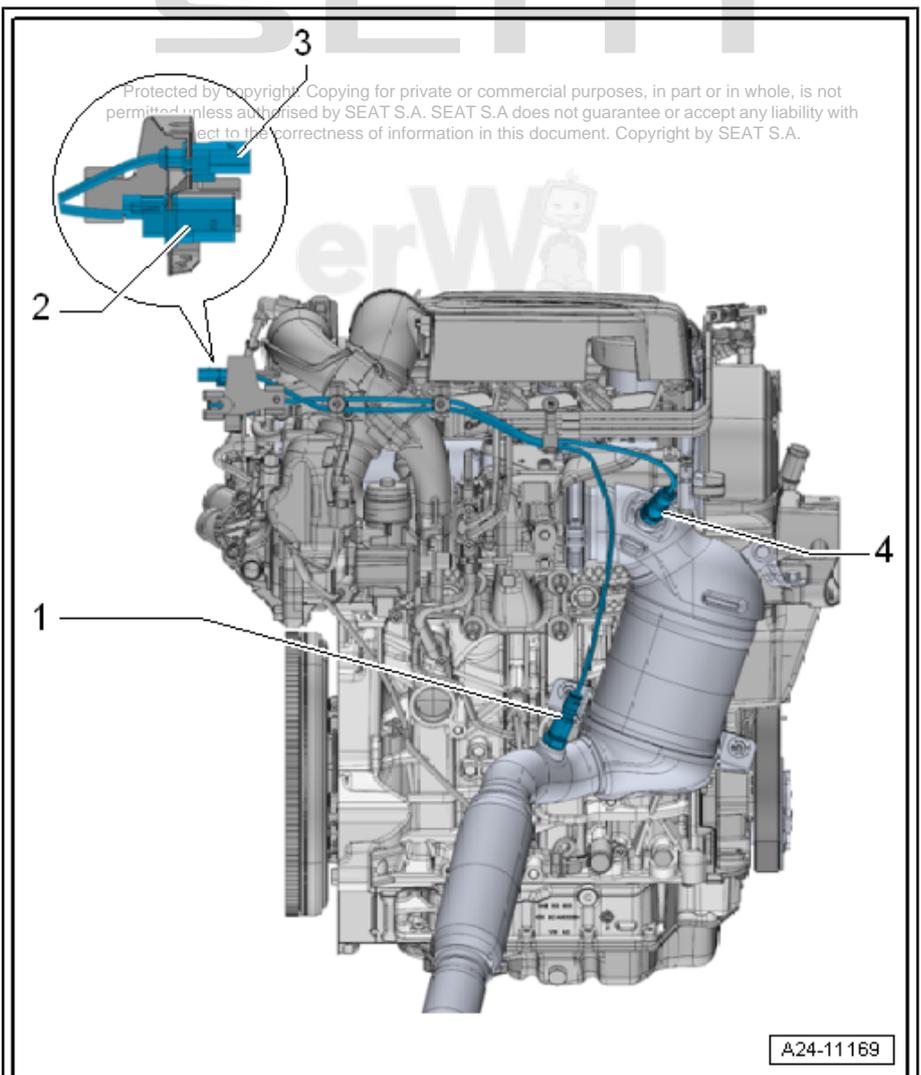
- For Lambda probe 1 - GX7- (after catalytic converter)
- Installed in plenum chamber

3 - Electric connector

- For Lambda probe 1 before catalytic converter - GX10- .
- Installed in plenum chamber

4 - Lambda probe 1 before catalytic converter - GX10- .

- comprising:
- Lambda sensor - G39-
- Lambda probe heater - Z19-
- Removing and installing



⇒ [page 350](#)

- 55 Nm

8.2 Removing and installing lambda probe 1 before catalytic converter - GX10- / lambda probe 1 after catalytic converter - GX7-

Lambda probe 1 before catalytic converter - GX10- comprises:

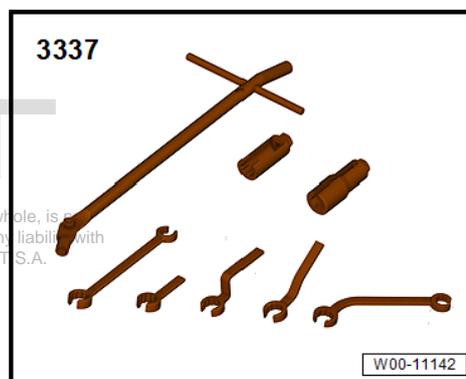
- ◆ Lambda sensor - G39-
- ◆ Lambda probe heater - Z19-

Lambda probe 1 after catalytic converter - GX7- comprises:

- ◆ Lambda probes after the catalytic converter - G130-
- ◆ Lambda probe heater 1 after catalytic converter - Z29-

Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set - 3337-

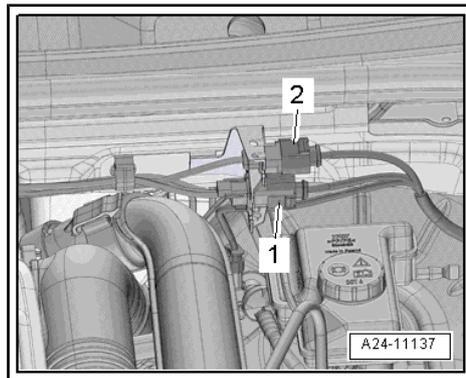


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Removing

– Unplug corresponding electrical connector:

- 1 - For Lambda probe 1 before catalytic converter - GX10- .
- 2 - For Lambda probe 1 - GX7- (after catalytic converter)



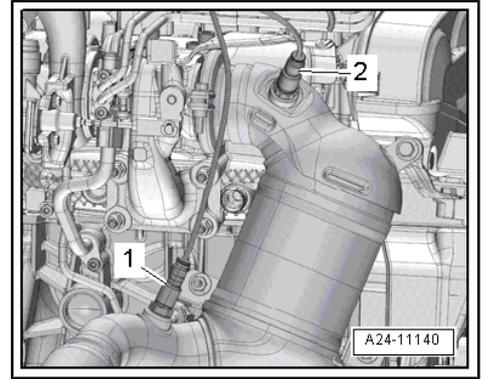
- Unscrew corresponding Lambda probe using a tool from Lambda probe open ring spanner set - 3337- .
- 1 - Lambda probe 1 after catalytic converter - GX7-
- 2 - Lambda sensor 1 before catalytic converter - GX10-

Installation

Install in the reverse order of removal, observing the following:

Note

- ◆ *New Lambda sensors are coated with an assembly paste. The paste must not get into the slots on the Lambda probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Electronic parts catalogue (ETKA) .*
- ◆ *When re-installing the electric wire of the lambda sensor, it is important that these are connected to the same locations. Contact of the electric wires with the exhaust pipe must be prevented in all cases.*



Vehicles as of July 2015

- If oxygen sensor has been renewed, erase learnt values and adapt oxygen sensor to engine control unit using ⇒ vehicle diagnostic tester .
- Switch on ignition and select the following menu items in the vehicle diagnostic and service information system :
 - ◆ `01 - Engine electronics`
 - ◆ `Guided functions`
 - ◆ `01 - Lambda probe adaption`

Continued procedure for all vehicles

Specified torques

- ◆ ⇒ ["8.1 Exploded view - Lambda probe", page 349](#)

26 – Exhaust system

1 Exhaust pipes/silencers

⇒ [“1.1 Exploded view - silencers”, page 352](#)

⇒ [“1.2 Removing and installing silencers”, page 353](#)

⇒ [“1.3 Disconnecting exhaust pipes/silencers”, page 354](#)

⇒ [“1.4 Align exhaust system to be free of stress”, page 355](#)

⇒ [“1.5 Checking exhaust system for leaks:”, page 355](#)

1.1 Exploded view - silencers

1 - Holder

- Renew if damaged.

2 - Bolt

- 20 Nm

3 - Mounting

- Renew if damaged.

4 - Secondary silencer

- Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- Removing and installing ⇒ [page 353](#)
- Disconnecting exhaust pipes/silencers ⇒ [page 354](#)
- Align exhaust system so it is free of stress ⇒ [page 355](#).

5 - Clamp (rear)

- Align exhaust system so it is free of stress before tightening clamp ⇒ [page 355](#)
- Installation position ⇒ [page 353](#)
- Tighten bolted connections evenly

6 - Nut

- 30 Nm

7 - Holder

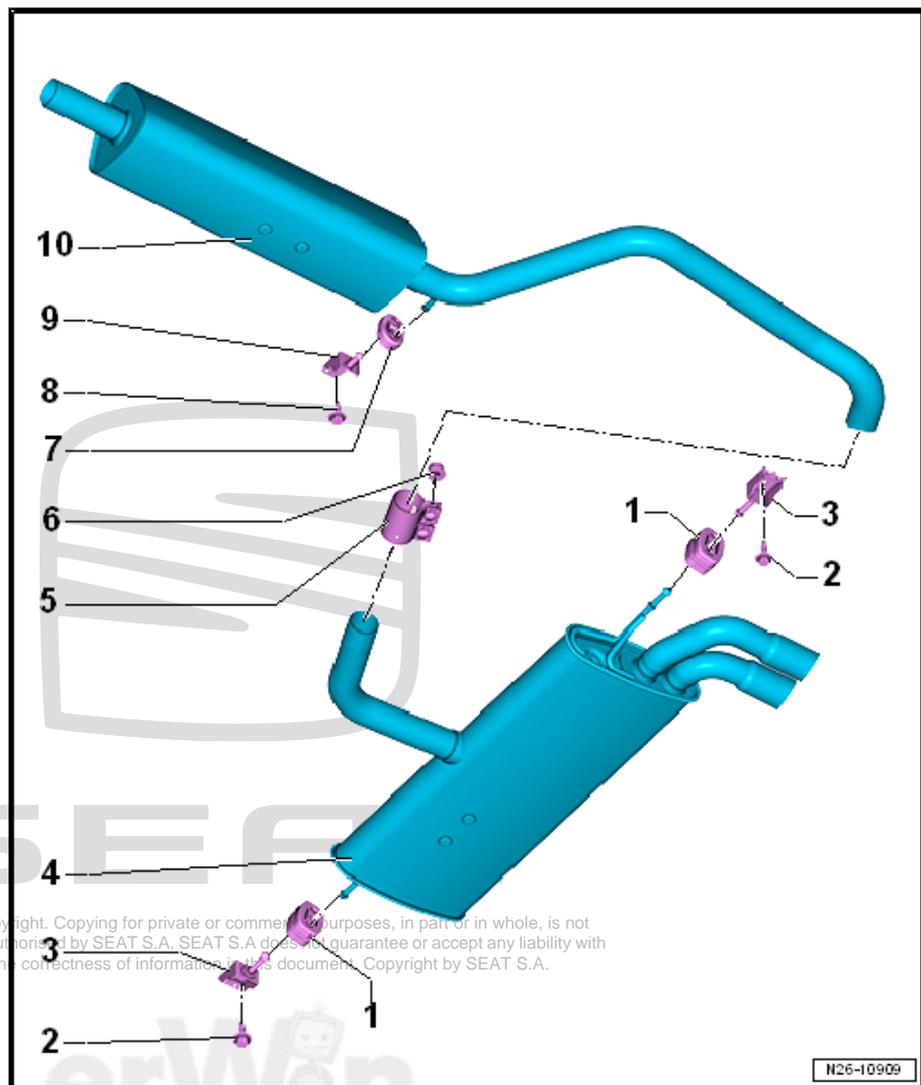
- Renew if damaged.

8 - Bolt

- 20 Nm

9 - Mounting

- Renew if damaged.

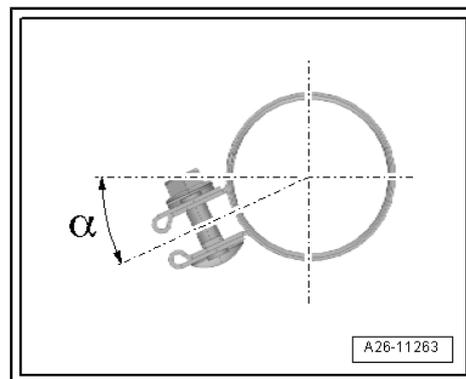


10 - The middle silencer

- Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- Removing and installing ⇒ [page 353](#)
- Disconnecting exhaust pipes/silencers ⇒ [page 354](#)
- Align exhaust system so it is free of stress ⇒ [page 355](#) .

Installation position of rear clamp

- Fit clamp in position shown.
- Angle $-\alpha-$ = approx. 20° .
- Bolt connections face to rear.
- Nuts facing upwards



1.2 Removing and installing silencers

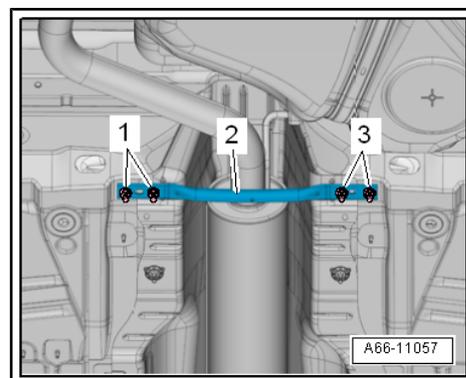


Implemented ex factory with centre silencer as one component; to be renewed individually in the event of a repair

Removing

- Detach tunnel cross-piece (rear) -2-

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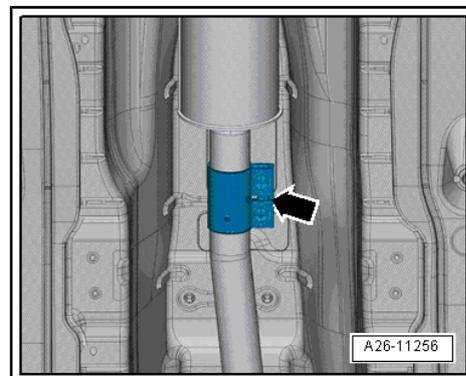


- Loosen clamp -arrow- and push towards rear.

CAUTION

Risk of accident caused by high weight of silencers.

- Seek help from a second a mechanic for the following work.



- Remove bolt -2- on both sides.
- Unscrew bolt -3- and remove silencer -1-.

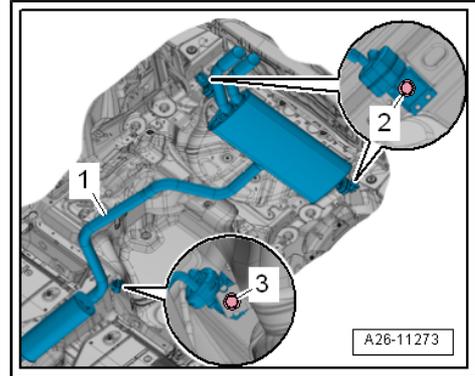
Installation

Install in the reverse order of removal, observing the following:

- Align exhaust system without tension ⇒ [page 355](#)

Specified torques

- ◆ ⇒ [“1.1 Exploded view - silencers”, page 352](#)
- ◆ ⇒ [“2.1 Assembly overview - emission control”, page 356](#)

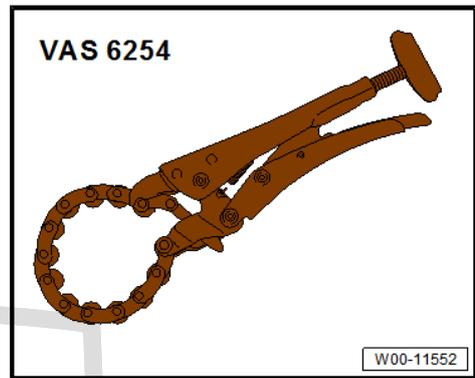


1.3 Disconnecting exhaust pipes/silencers

- ◆ The connecting pipe can be cut through at the cutting point in order to renew the centre and rear silencers separately.
- ◆ Cutting location is marked by an indentation on circumference of exhaust pipe.

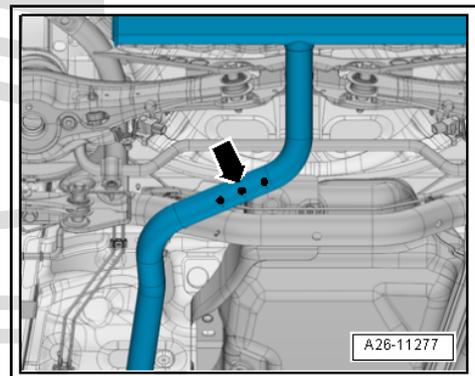
Special tools and workshop equipment required

- ◆ Chain-type pipe cutter - VAS 6254-

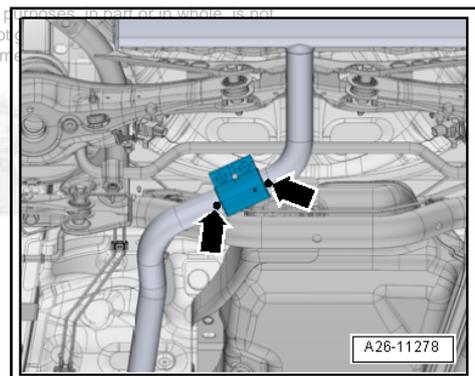


Procedure

- Cut through the exhaust pipe at a right angle at the position marked -arrow- using chain pipe cutter - VAS 6254- .



- Position clamp centrally at side marks -arrows- when installing.
- Fit rear clamp ⇒ [page 353](#) .
- Align exhaust system without tension ⇒ [page 355](#)



1.4 Align exhaust system to be free of stress

Procedure

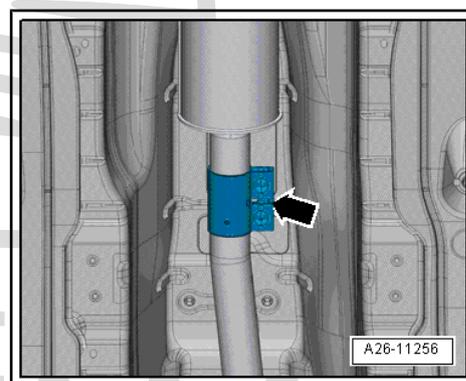
- The exhaust system must be aligned when cold.



Note

The *-arrow-* points forwards.

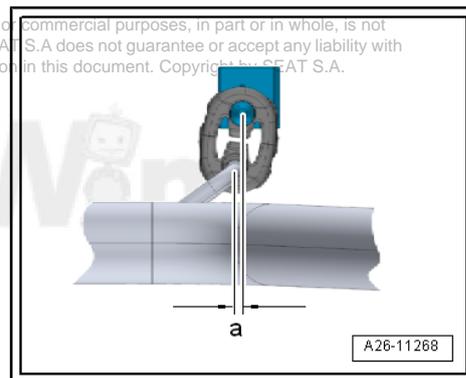
- Loosen bolt connections for front clamp *-arrow-*.



- Push exhaust system towards front of vehicle until preloading at holder for exhaust pipe *-a-* = 5 mm.
- Install front clamp ⇒ [page 357](#) .

Specified torques

- ◆ ⇒ ["2.1 Assembly overview - emission control", page 356](#)



1.5 Checking exhaust system for leaks:

Procedure

- Start engine and run in idle.
- Plug tailpipes during leak test (e.g. with cloth or plug).
- Listen for noise at the connection points of cylinder head/exhaust manifold, turbocharger/front exhaust pipe etc. to locate any leaks.
- Rectify any leaks that are found.

2 Emission control

⇒ "2.1 Assembly overview - emission control", page 356

⇒ "2.2 Removing and installing catalytic converter", page 357

2.1 Assembly overview - emission control

1 - Bolt

- 20 Nm

2 - Support bracket

- Renew if damaged.

3 - Nut

- Tightening torque and sequence ⇒ [page 357](#) .

4 - Bolt

- 20 Nm

5 - Nut

- Tightening torque and sequence ⇒ [page 357](#) .

6 - Support bracket

7 - Support bracket

8 - Bolt

- Tightening torque and sequence ⇒ [page 357](#) .

9 - Bolt

- Tightening torque and sequence ⇒ [page 357](#) .

10 - Front exhaust pipe with catalytic converter

- Do not bend decoupling element more than 10°. It may be damaged
- Install decoupling element so that it is not under tension.
- Take care not to damage wire mesh on decoupling element.

- Protect catalytic converter from damage by knocks and impact

- Removing and installing ⇒ [page 357](#)

- Do not remove protective packaging from replacement part until you are ready to fit the flexible joint

- Align exhaust system so it is free of stress ⇒ [page 355](#) .

11 - Screw-type clamp

- renew

- Tightening torque and sequence ⇒ [page 357](#) .

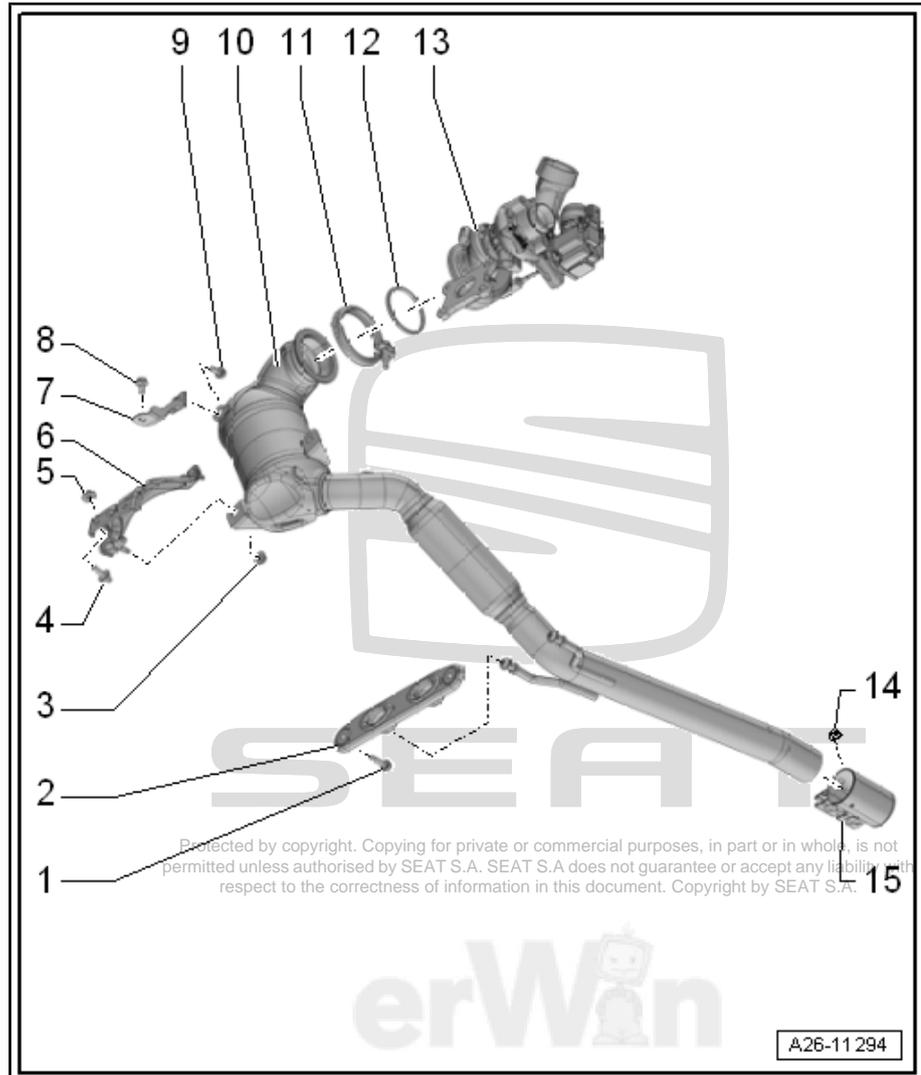
12 - Seal

- renew

13 - Turbocharger

14 - Nut

- 30 Nm

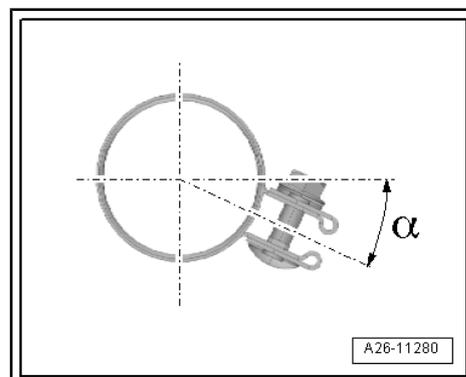


15 - Clamp (front)

- ❑ Before tightening, align exhaust system so it is free of stress ⇒ [page 355](#)
- ❑ Installation position ⇒ [page 357](#)
- ❑ Tighten bolted connections evenly

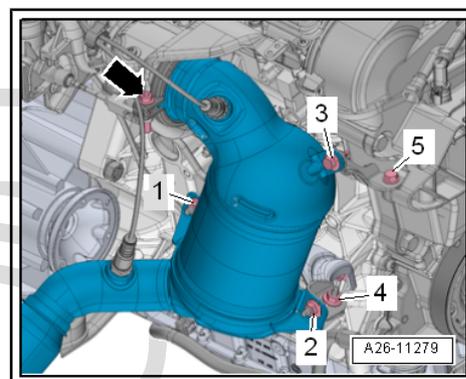
Installation position of front clamp

- Fit clamp in position shown.
- Angle $-\alpha-$ = approx. 20° .
- Bolt connection facing towards right
- Nuts facing upwards



Installing catalytic converter - tightening torque and sequence

1.	- Fit catalytic converter to turbocharger and fit screw-type clip -arrow- without tightening	
2.	- Loosely screw in bolts -3, 5- and bolts -1, 2, 4- by hand	• It should still be possible to move catalytic converter and bracket.
3.	- Tighten screw-type clip -arrow-	15 Nm
4th	- Tighten bolts and nuts in the sequence -1 ... 5-	20 Nm



2.2 Removing and installing catalytic converter



Note

The catalytic converter is removed together with the front exhaust pipe.

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Special tools and workshop equipment required

- ◆ High-temperature paste ⇒ Electronic parts catalogue (ETKA)

Removing



Note

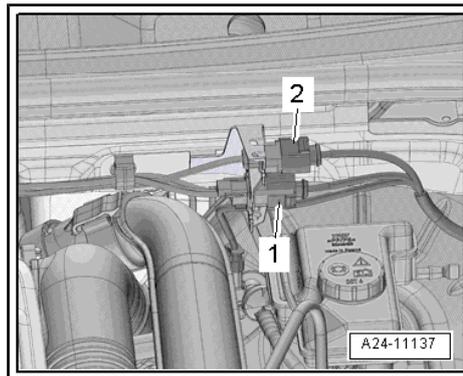
Fit cable ties in the same place when installing.

- Detach connectors -1- und -2- from retainer and disconnect them. Lay wires to one side.

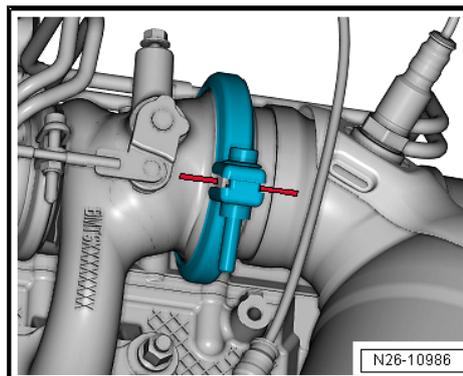


Note

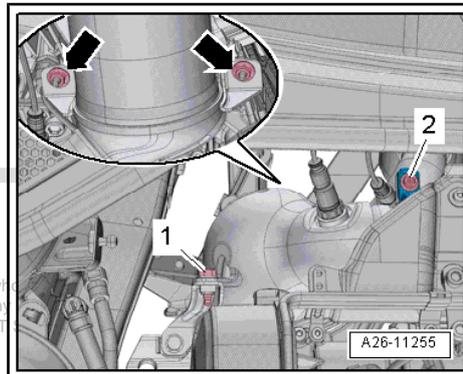
- ◆ *Prior to loosening the connection between the catalytic converter and the turbocharger, mark position of the clamp* ⇒ [page 358](#) .
- ◆ *The mark is to be made on the component opposite to the component to be renewed.*
- ◆ *Make sure that the clamp is fitted at the same position on re-installation.*



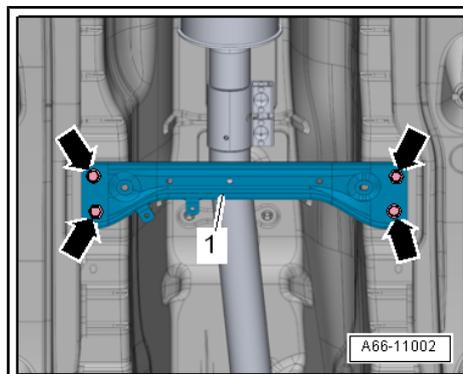
Clamp position



- Unscrew bolt -2- and remove screw-type clip.
- Remove bolt -1- and nuts -arrows-.

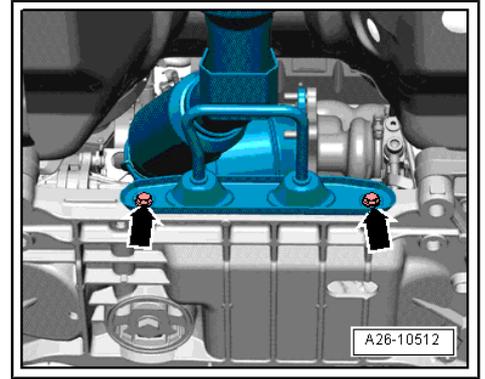


- Remove bolts -arrows-.
- Remove front tunnel cross-piece -1-.

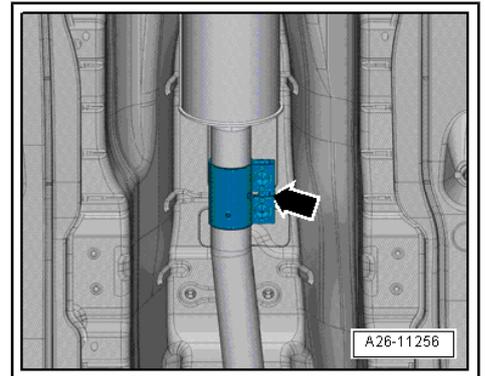
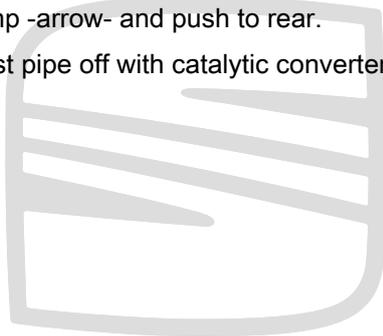


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- Remove bolts -arrows-.
- Remove electrical connector from bracket and lay electrical line to Lambda probe to side.



- Loosen clamp -arrow- and push to rear.
- Take exhaust pipe off with catalytic converter.



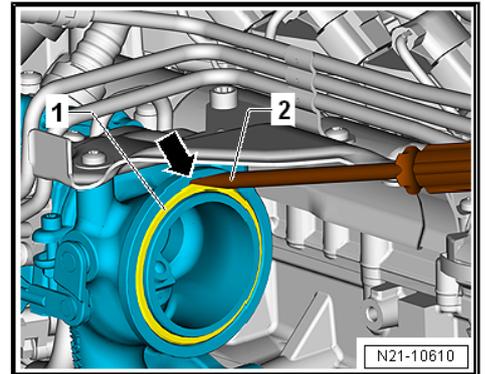
- Slide screwdriver -2- into the recess -Arrow- on the exhaust turbocharger and remove ring seal -1-.

Installation

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 Install in the reverse order of removal, observing the following:

Note

- ◆ Renew gaskets and self-locking nuts.
- ◆ Coat studs and bolts on catalytic converter with high-temperature paste; high-temperature paste ⇒ *Electronic parts catalogue* .



- Align exhaust system without tension ⇒ [page 355](#)

Specified torques

- ◆ ⇒ [Fig. "Installing catalytic converter - tightening torque and sequence"](#) , [page 357](#)
- ◆ ⇒ ["2.1 Assembly overview - emission control"](#) , [page 356](#)
- ◆ ⇒ Rep. gr. 66 ; Underbody trim; Removing and installing tunnel bridge

28 – Ignition system

1 Ignition system

⇒ “1.1 Assembly overview - ignition system”, page 360

⇒ “1.2 Spark plug test data”, page 361

⇒ “1.3 Removing and installing ignition coils with output stages”, page 361

⇒ “1.4 Removing and installing knock sensor”, page 363

⇒ “1.5 Removing and installing Hall sender”, page 364

⇒ “1.6 Removing and installing engine speed sensor G28”, page 366

1.1 Assembly overview - ignition system

1 - Bolt

- Tightening torque influences functions of knock sensor
- 20 Nm

2 - Knock sensor 1 - G61-

- Removing and installing ⇒ page 363

3 - Spark plug

- Remove and install with spark plug socket and extension - 3122-B ⇒ Maintenance Booklet 501
- Tightening torque ⇒ Maintenance ; Booklet 501
- Change interval ⇒ Maintenance tables

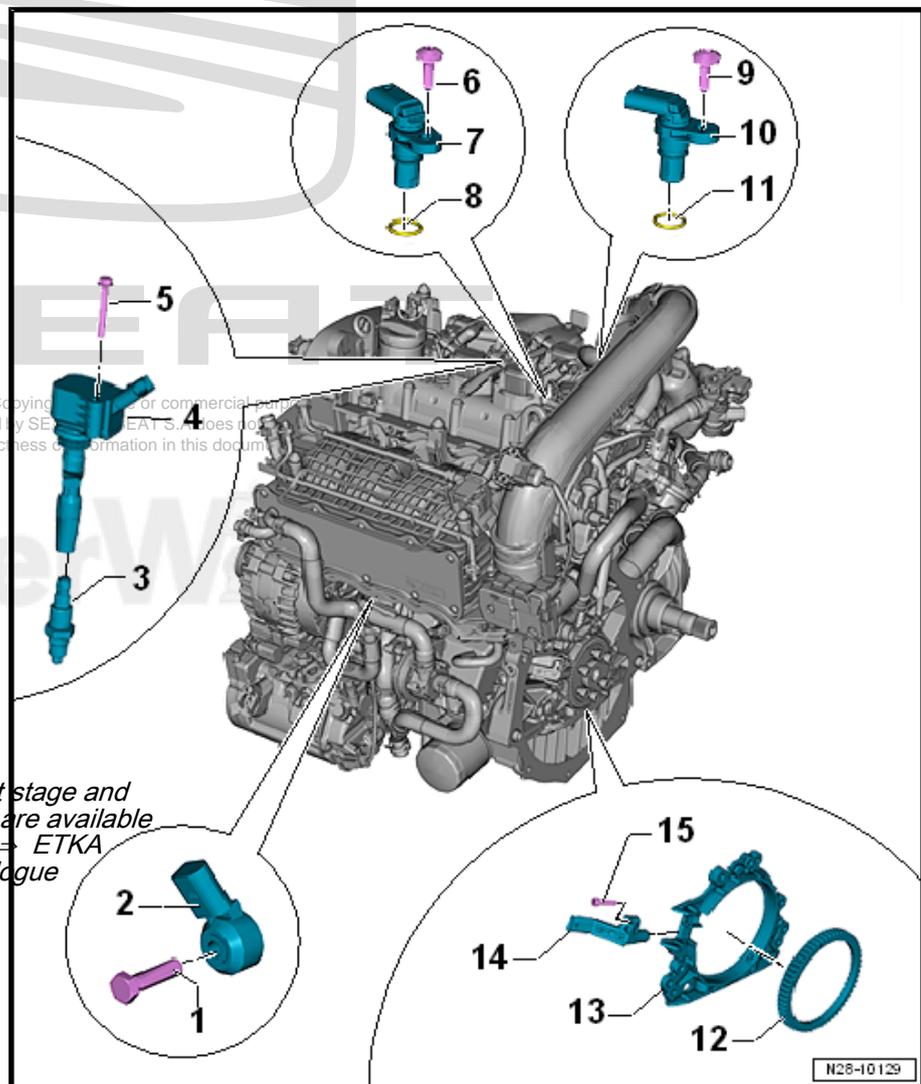
4 - Ignition coil with output stage



Note

Ignition coil with output stage and spark plug connectors are available individually for repairs ⇒ ETKA (Electronic Parts Catalogue)

- ◆ Ignition coil 1 with output stage - N70-
- ◆ Ignition coil 2 with output stage - N127-
- ◆ Ignition coil 3 with output stage - N291-
- ◆ Ignition coil 4 with output stage - N292-
 - To remove, use puller - T10530- .
 - Removing and installing ⇒ page 361



5 - Bolt

- 8 Nm

6 - Bolt

- 8 Nm

7 - Hall sender - G40-

- Removing and installing ⇒ [page 364](#)

8 - O-ring

- Renew if damaged.

9 - Bolt

- 8 Nm

10 - Hall sender 3 - G300-

- Removing and installing ⇒ [page 364](#)

11 - O-ring

- Replace if damaged

12 - Sender wheel

- For engine speed sender - G28- .
- Removing and installing ⇒ [page 57](#)

13 - Sealing flange (gearbox end)

- Removing and installing ⇒ [page 57](#)

14 - Engine speed sender - G28-

- Removing and installing ⇒ [page 366](#)

15 - Bolt

- 4.5 Nm



1.2 Spark plug test data

Engine codes	CZEA, CHPA, CZDA	CMBA, CXSA, CZCA
Order of starting	1-3-4-2	
Part number ¹⁾	04E 905 612	04E 905 601
Electrode gap	0.65 ... 0.75 mm	0.70 ... 0.80 mm
Tightening torque	22 Nm	
Change interval	⇒ Maintenance ; Booklet 501 ; Service tables	

1) Current spark plugs ⇒ Electronic parts catalogue (ETKA)

1.3 Removing and installing ignition coils with output stages

Special tools and workshop equipment required

◆ Puller - T10530-



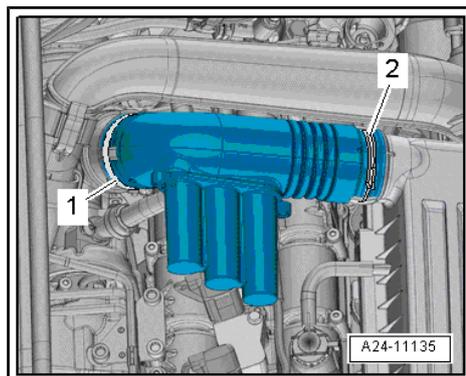
 Note

- ◆ *The ignition coils are easier to remove when the engine is warm. The grease added during installation of the ignition coils makes it easier to remove them and the ignition plug connectors when the engine is warm.*
- ◆ *Ignition coils with output stage and spark plug connectors are available individually for repairs ⇒ ETKA (Electronic Parts Catalogue)*

Removing

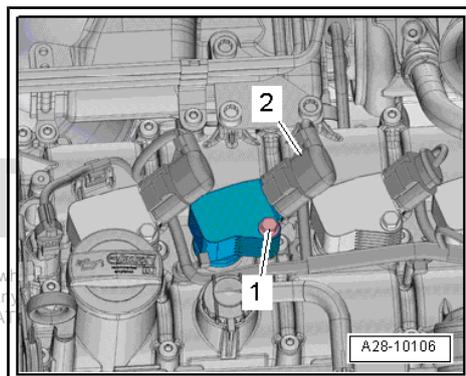
Ignition coils for "cylinders 2, 3, 4":

- Loosen hose clips -1- and -2- and remove air pipe.



All ignition coils (continued):

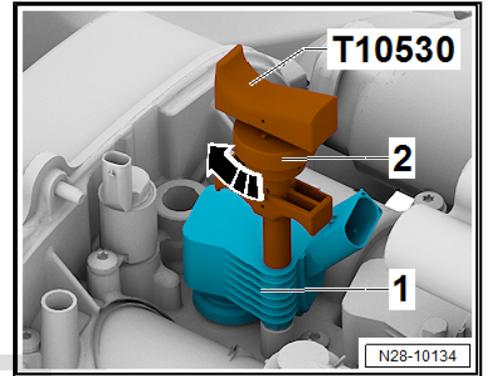
- Unplug the electrical connector -2-.
- Unscrew bolt -1-.



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- Push puller - T10530- into hole in ignition coil -1- to stop.
- Tighten knurled nob -2- in -direction of arrow-.



- Pull ignition coil out of camshaft housing in -direction of arrow- using puller - T10530- .

 **Note**

- ◆ Ignition coil with output stage and spark plug connectors are available individually for repairs ⇒ ETKA (Electronic Parts Catalogue)
- ◆ The spark plug connectors are removed from the ignition coils by hand.

Installation

Install in the reverse order of removal, observing the following:

- Fit all ignition coils loosely into spark plug holes.
- Align ignition coils with connectors and attach all connectors onto ignition coils simultaneously.
- Press ignition coils onto spark plugs by hand evenly (do not use tool).

Specified torques

- ◆ ⇒ ["1.1 Assembly overview - ignition system", page 360](#) .

1.4 Removing and installing knock sensor

Removing

- Remove air conditioner compressor from bracket and tie up ⇒ Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .
- Separate the connector -1-.
- Unscrew bolt -2- and remove knock sensor 1 - G61- .

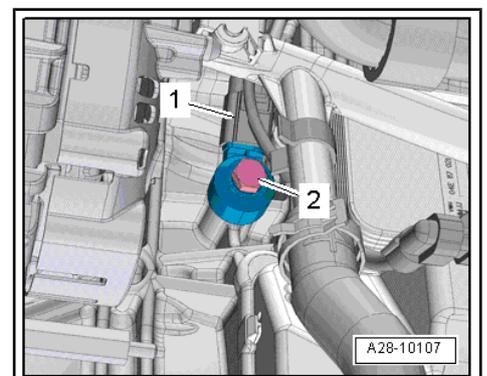
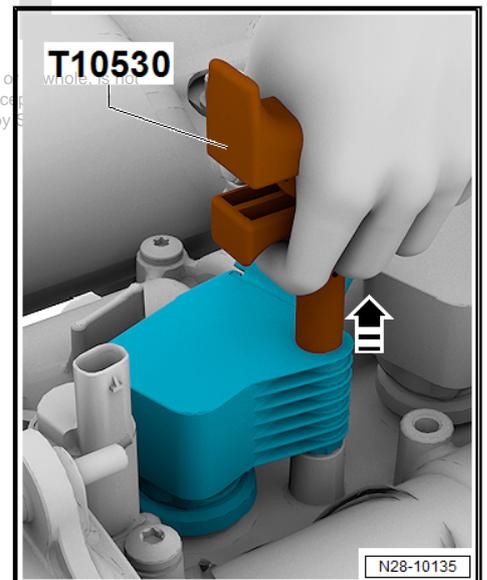
Installation

Install in the reverse order of removal, observing the following:

- Install air conditioner compressor ⇒ Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .

Specified torques

- ◆ ⇒ ["1.1 Assembly overview - ignition system", page 360](#) .



1.5 Removing and installing Hall sender

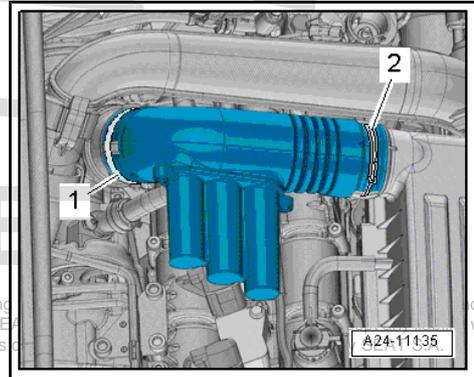
⇒ [“1.5.1 Removing and installing Hall sensor G40”, page 364](#)

⇒ [“1.5.2 Removing and installing Hall sender 3 G300”, page 364](#)

1.5.1 Removing and installing Hall sensor - G40-

Removing

- Loosen hose clips -1- and -2- and remove air pipe.



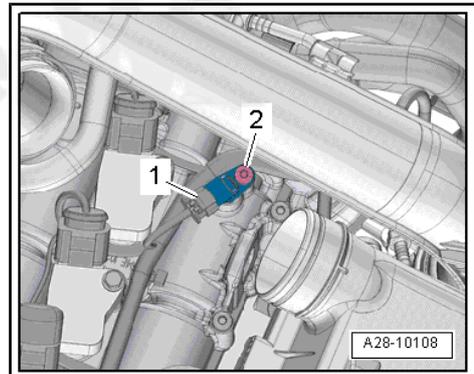
- Separate the connector -1-.
- Unscrew bolt -2- and remove Hall sender - G40- .

Installation

Install in the reverse order of removal, observing the following:

Tightening torque

- ⇒ [“1.1 Assembly overview - ignition system”, page 360](#) .



1.5.2 Removing and installing Hall sender 3 - G300-

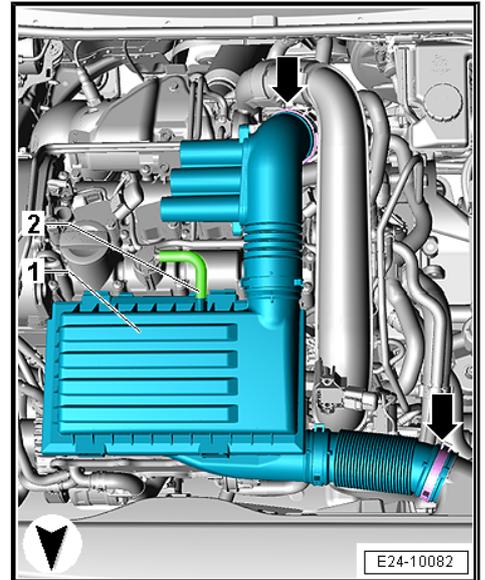
Special tools and workshop equipment required

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



Removing

- Separate the air hose -1- from the air filter housing.
- Separate the air hose -2- from the air filter housing.
- Carefully remove the air filter housing -1- from the retaining bolts in an upward motion, sequentially.
- Loosen the brackets -arrow- for the air duct hose.
- Disconnect the air filter housing -1- with the air duct hoses.

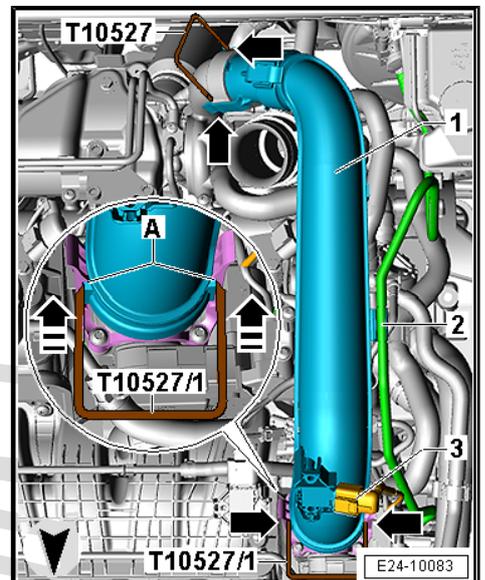


- Disconnect electrical connector from the charge pressure sender - GX26- -3-.

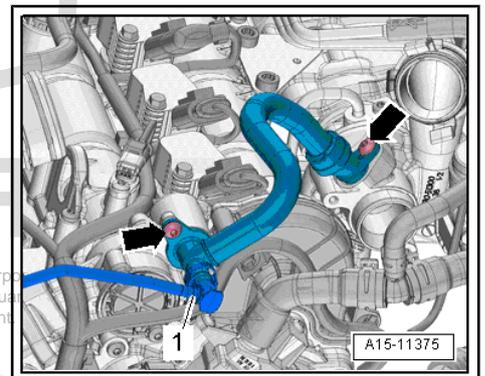


Note

- ◆ *To prevent the locating pins of the intake pipe from breaking off, please use the release tool - T10527- and -T10527/1- .*
- ◆ *Insert the release tool , note the detailed image -A-.*
- Move clear vacuum hose at air intake pipe -2-.
- Release fasteners -arrows- using release tool - T10527- and release tool - T10527/1- , and remove air pipe -1-.



- Press release buttons and pull off hose -1-.
- Remove bolts -arrows- and detach crankcase breather hose.



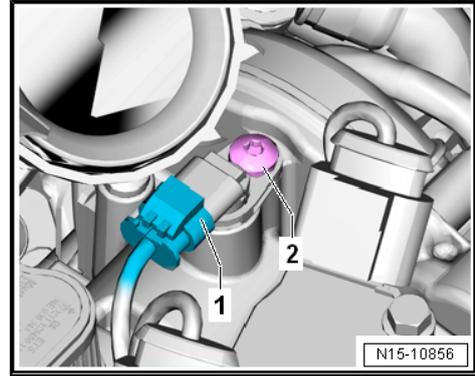
- Unplug the electrical connector -1-.
- Unscrew bolt -2- and remove Hall sender 3 - G300- .

Installation

Install in the reverse order of removal, observing the following:

Specified torques

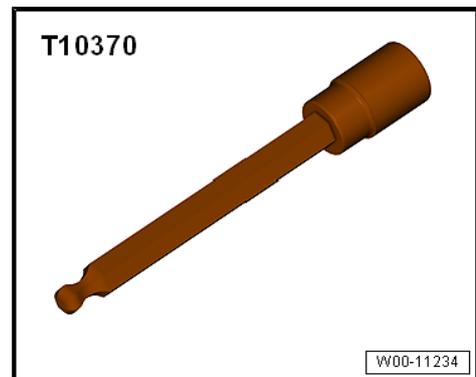
- ◆ ⇒ ["1.1 Assembly overview - ignition system", page 360](#) .



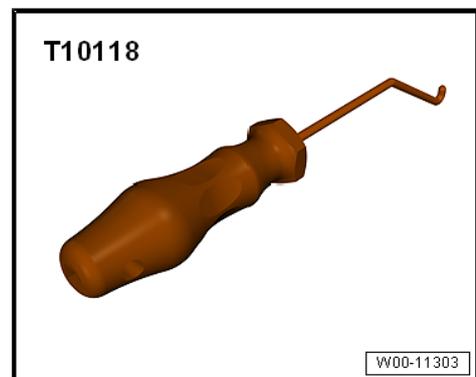
1.6 Removing and installing engine speed sensor - G28-

Special tools and workshop equipment required

- ◆ Socket 4 mm - T10370-



- ◆ Hold-down - T10118-



Removing

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

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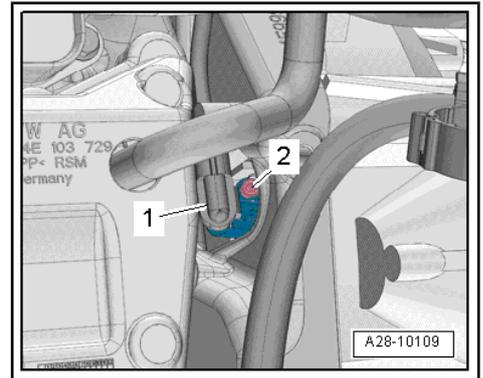
- Release and loosen electrical connector -1- using the assembly tool - T10118- .
- Unscrew bolt -2- using the socket e/c 4 - T10370- ; remove the engine speed sender - G28- .

Installation

Install in the reverse order of removal, observing the following:

Specified torques

- ◆ Assembly overview - ignition system
⇒ ["1.1 Assembly overview - ignition system", page 360](#) .
- ◆ Noise insulation; Assembly overview - noise insulation ⇒
General body repairs, exterior; Rep. gr. 66 ; Noise insulation;
Removing and installing noise insulation .



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