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## Workshop Manual

**Audi A4 2015 ➤**

**Audi A4 China 2016 ➤**

**Audi A5 2016 ➤**

**4-cylinder direct injection engine (1.4 ltr. 4-valve TFSI EA211)**

|           |          |  |  |  |  |  |  |  |  |
|-----------|----------|--|--|--|--|--|--|--|--|
| Engine ID | CVN<br>A |  |  |  |  |  |  |  |  |
|-----------|----------|--|--|--|--|--|--|--|--|

Edition 10.2019



## List of Workshop Manual Repair Groups

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



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## 00 – Technical data

### 1 Identification

(ARL006668; Edition 10.2019)

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

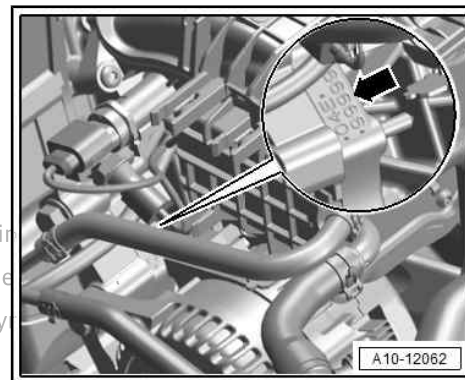
#### 1.1 Engine number/engine data

##### Engine number

- ◆ The engine number (“engine code” and “serial number”) is located on the left side at the joint between engine and gearbox -arrow-.
- ◆ Additionally there is a sticker on the toothed belt cover (top) with engine code and serial number.
- ◆ In addition, the engine code is listed on the vehicle data stickers.

##### Engine data

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





## 2 Safety precautions

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

⇒ ["2.2 Safety precautions when working on vehicles with start/stop system", page 2](#)

⇒ ["2.3 Safety precautions when using testers and measuring instruments during a road test", page 3](#)

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

⇒ ["2.6 Safety precautions when working on the cooling system", page 4](#)

⇒ ["2.7 Safety precautions when working on the exhaust system", page 4](#)

### 2.1 Safety precautions when working on the fuel supply system

#### Risk of injury - fuel system operates under high pressure

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

Before opening the fuel system:

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

#### Risk of fire due to escaping fuel

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

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

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

#### Risk of injury - engine may start unexpectedly

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

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



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

### Risk of injury if test equipment is not secured

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

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

Or:

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

## 2.4 Safety precautions when working on the subframe

### Risk of damage to components

Lowering the vehicle onto its wheels can damage components if the assembly mountings, steering rack or subframe cross brace are not properly fitted.

- Never lower vehicle onto its wheels with suspension components unfastened or detached.
- Never support weight of vehicle on subframe or subframe cross brace with suspension components unfastened or detached.

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## 2.5 Safety precautions when working on the ignition system

### Risk of injury due to electric shock

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

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



### Risk of damage to components

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

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



## 2.6 Safety precautions when working on the cooling system

### Risk of scalding as hot coolant can escape

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

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

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## 2.7 Safety precautions when working on the exhaust system

### Risk of damage to flexible joint

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

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

### Risk of injury caused by components of the exhaust system

Danger of injury to hands and other parts of the body due to hot or sharp parts of the exhaust system.

- Allow exhaust system to cool down.
- Put on protective gloves.



## 3 Repair instructions

⇒ [“3.1 Rules for cleanliness”, page 5](#)

⇒ [“3.2 Foreign particles in engine”, page 5](#)

⇒ [“3.3 Contact corrosion”, page 5](#)

⇒ [“3.4 Routing and attachment of pipes, hoses and wiring”, page 6](#)

⇒ [“3.5 Installing radiators and condensers”, page 6](#)

⇒ [“3.6 Nuts, bolts”, page 6](#)

⇒ [“3.7 Identification plates”, page 6](#)

⇒ [“3.8 Use of impact wrenches”, page 7](#)

⇒ [“3.9 Checking vacuum system”, page 7](#)

### 3.1 Rules for cleanliness

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

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

### 3.2 Foreign particles in engine

- ◆ When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122- ) to prevent foreign particles from entering the engine.
- ◆ If the turbocharger has suffered mechanical damage  
⇒ [“1.2 Removing and installing turbocharger”, page 196](#)

### 3.3 Contact corrosion

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

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

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



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

**Please note:**

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

### 3.4 Routing and attachment of pipes, hoses and wiring

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

### 3.5 Installing radiators and condensers

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

### 3.6 Nuts, bolts

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

### 3.7 Identification plates

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



### 3.8 Use of impact wrenches

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

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

#### Requirements:

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

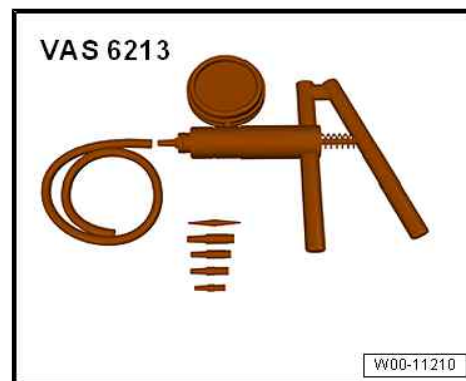
#### Use:

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

### 3.9 Checking vacuum system

#### Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



#### Procedure

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



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



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## 10 – Removing and installing engine

### 1 Removing and installing engine

⇒ [“1.1 Removing engine”, page 9](#)

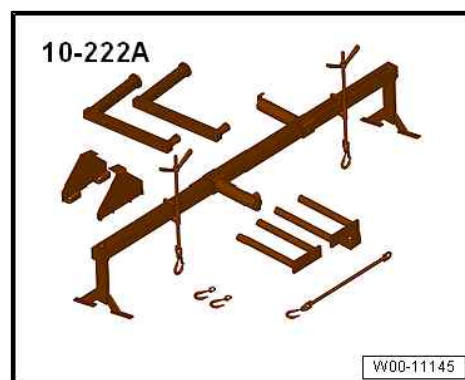
⇒ [“1.2 Securing engine to engine and gearbox support”, page 20](#)

⇒ [“1.3 Installing engine”, page 21](#)

#### 1.1 Removing engine

Special tools and workshop equipment required

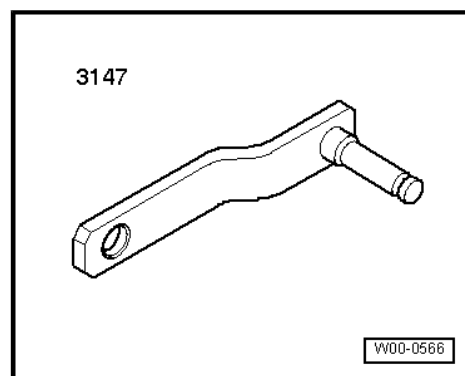
◆ Support bracket - 10-222A-



◆ Lifting tackle - 2024A-



◆ Gearbox support - 3147-



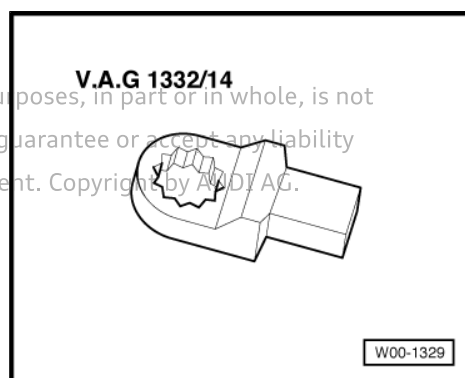


◆ Workshop hoist - VAS 6100-

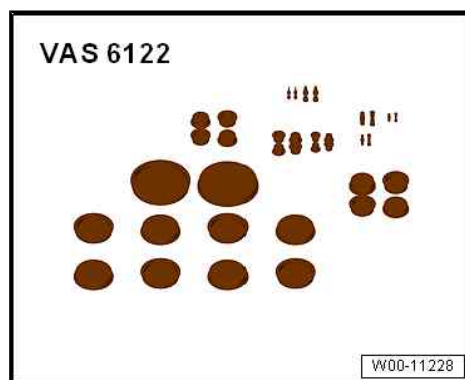


◆ Ring spanner insert AF 16 - V.A.G 1332/14-

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◆ Engine bung set - VAS 6122-



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



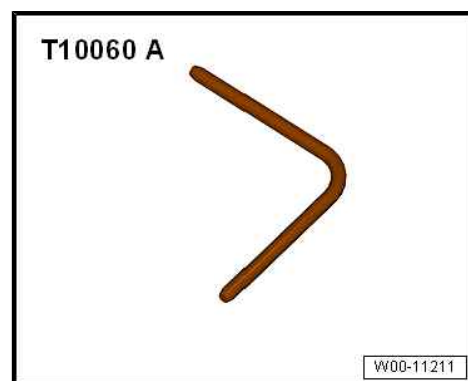


◆ Hose clip pliers - VAS 6362-

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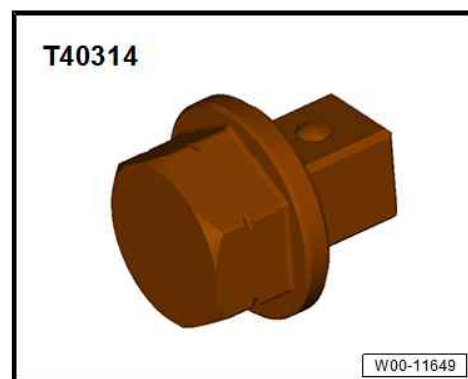
◆ Locking pin - T10060 A-



◆ Wrench, 21 mm - T40263-



◆ Adapter - T40314-



- ◆ Safety goggles
- ◆ Protective gloves

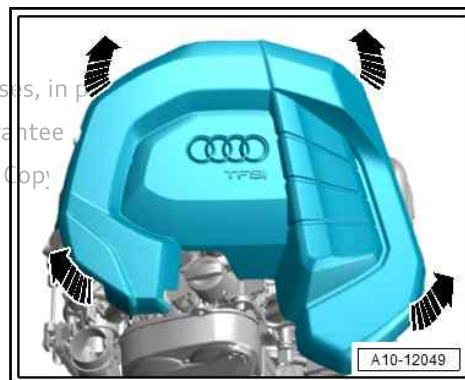
**Procedure**

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- The engine is removed upwards without gearbox.



- Re-install all cable ties in original positions.
- Disconnect battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- On vehicle versions with manual gearbox: Select 4th gear.
- Carefully pull engine cover panel off retaining pins one after another -arrows-. Do not jerk engine cover panel away, and do not try to pull on one side only.

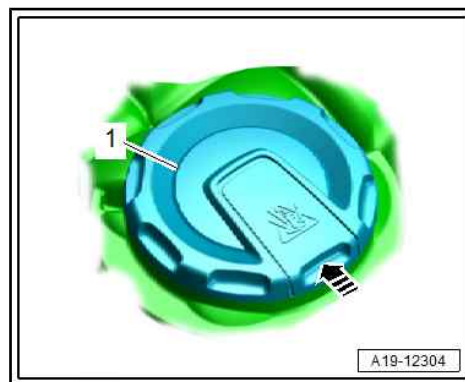
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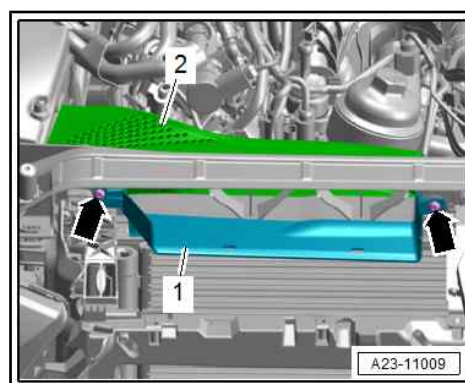
### WARNING

**Risk of scalding due to hot steam and hot coolant.**

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

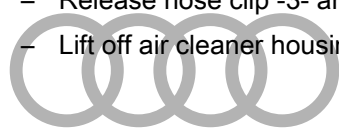


- Release fastener -arrow- and open filler cap -1- on coolant expansion tank.
- Remove lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Remove bolts -arrows- and detach air duct -2-.

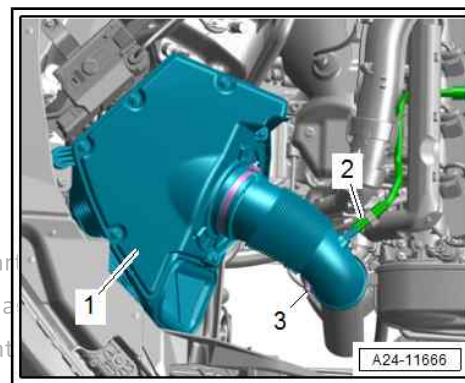




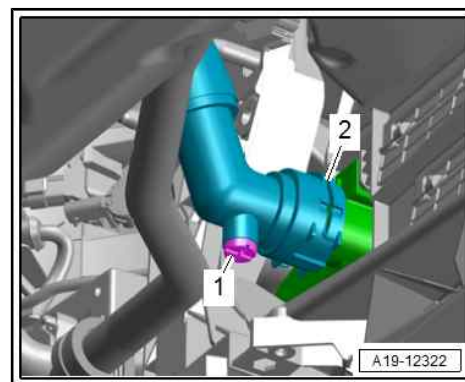
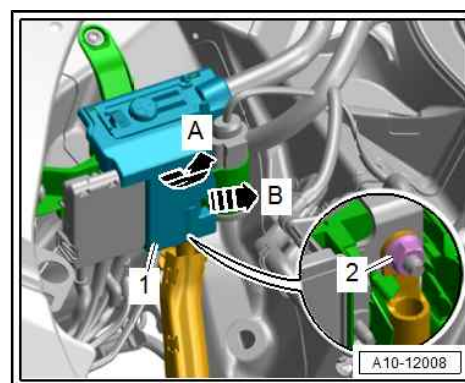
- Disconnect crankcase breather hose -2-.
- Release hose clip -3- and detach air pipe.
- Lift off air cleaner housing -1- and detach.



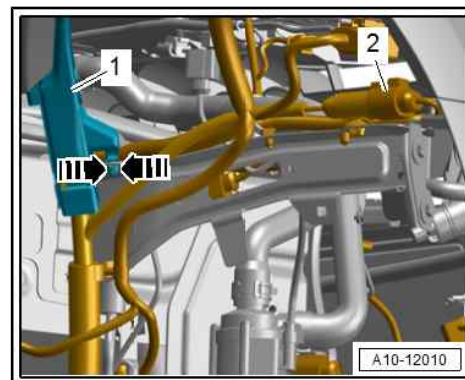
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- Release catch -arrow B- and open electronics box -1- -arrow A-.
- Remove nut -2- and move B+ wire clear.
- Move wiring duct (top) clear.
- Remove front wheels ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres .
- Remove drive shaft cover on both sides ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Remove wheel spoilers and unfasten front section of wheel housing liner (front) on both sides and press slightly towards rear ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
- Place collector tank from coolant collecting system -VAS 5014- or drip tray for workshop hoist - VAS 6208- underneath.
- Lift retaining clip -2- and disconnect coolant hose (bottom) from radiator.
- Drain off coolant.

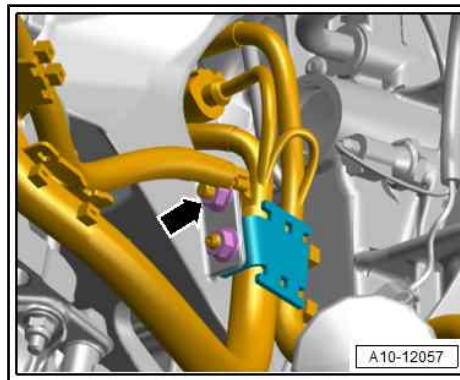


- Detach electrical connector -2- from bracket and unplug.
- Release fasteners -arrows- and move wiring duct -1- clear.
- Move clear electrical wiring harness leading to engine.

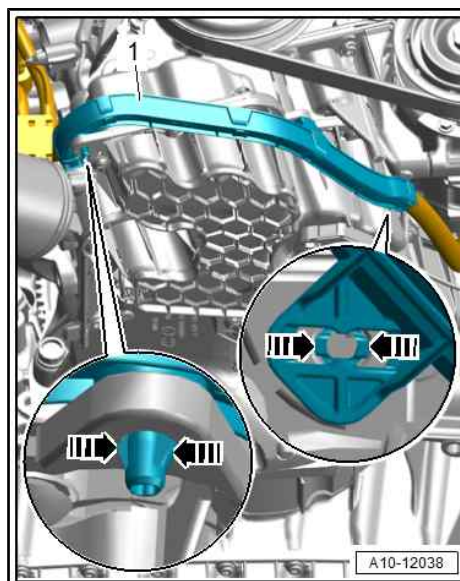




- Remove nut -arrow- and move earth wire clear.



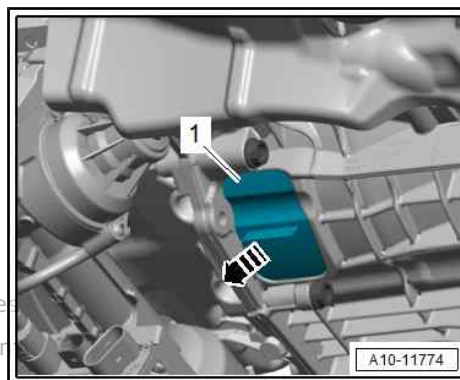
- Release catches -arrows- and move wiring duct -1- clear at sump.
- Press wiring duct down.



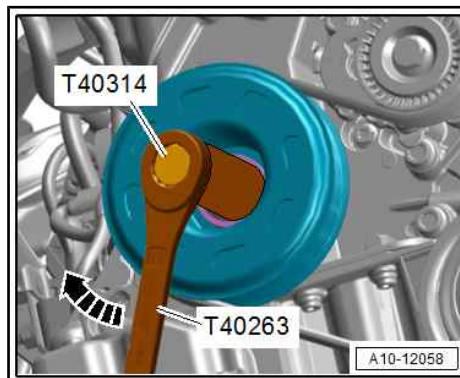
- Detach bottom cover -1- from gearbox -arrow-.



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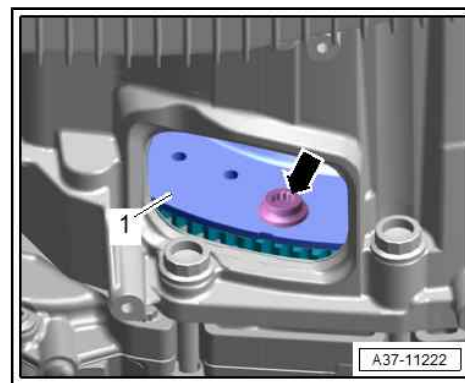


- Counterhold crankshaft with wrench, 21 mm - T40263-, adapter - T40314- and socket, 21 mm.
- When performing the next step, turn the crankshaft only in the normal direction of rotation -arrow-.

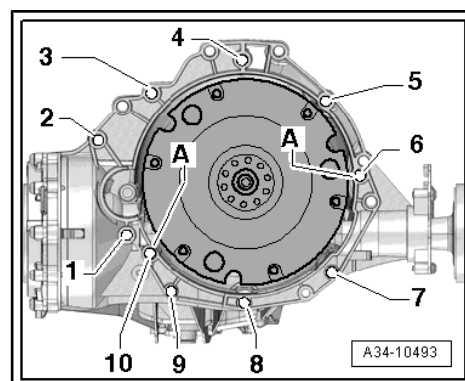




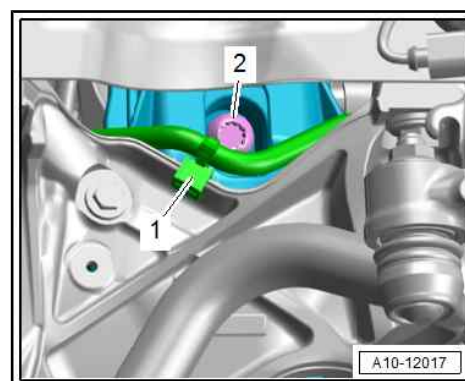
- Remove 3 bolts -arrow- for flywheel -1-, turning crankshaft 120° in normal direction of rotation each time.



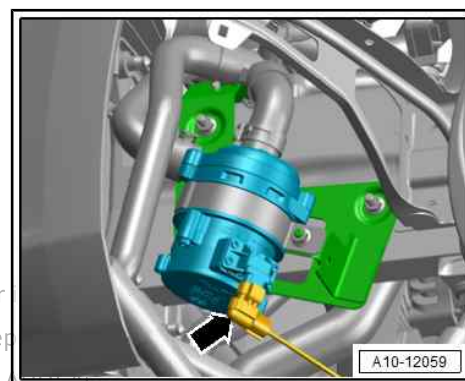
- Unscrew bolt -1- using ring spanner insert, 16 mm - V.A.G 1332/14- and adapter - VAS 6948- .
- Remove bolts -6 ... 10- securing gearbox to engine.



- Remove bolt -2- for engine mounting on both sides.



- Unplug electrical connector -arrow- for charge air cooling pump - V188- and move electrical wiring clear.



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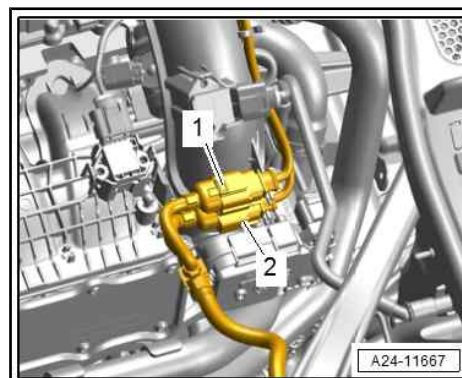
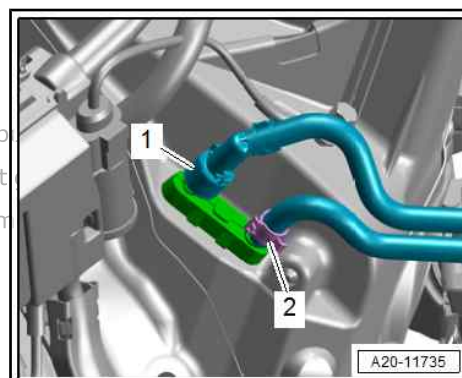
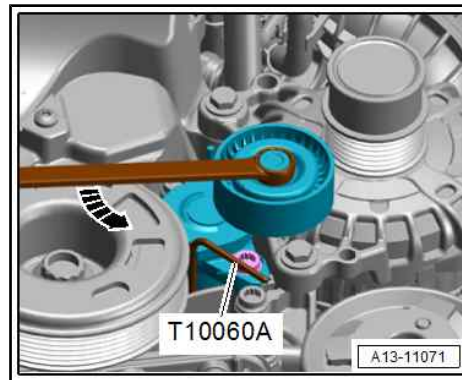
### Caution

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

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

- To slacken poly V-belt, turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060A- .
- Take off poly V-belt.
- Remove air conditioner compressor from bracket ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Remove subframe shield (right-side) ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe shield .
- Remove heat shield for drive shaft (right-side) ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing heat shield for drive shaft .
- Unbolt drive shaft (left and right) from gearbox ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .
- Disconnect fuel hose -1- ⇒ Fuel supply system; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .
- Release hose clip -2- and disconnect hose for activated charcoal filter system.

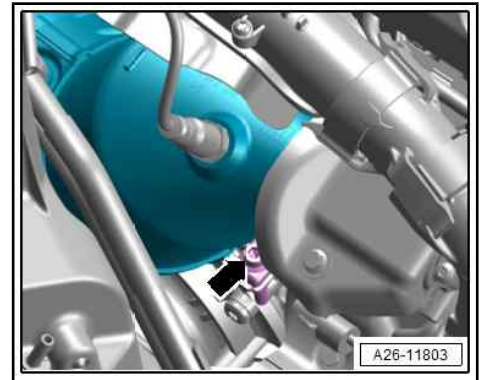
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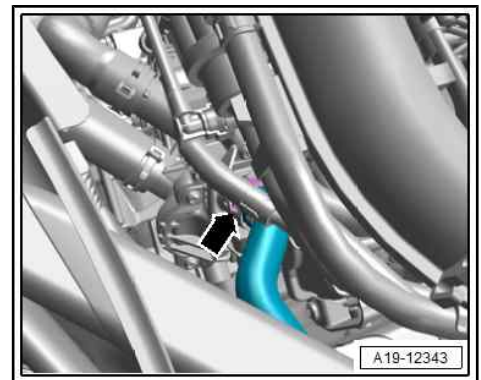
- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.



- Release screw-type clip -arrow- and move it onto intake funnel of turbocharger.

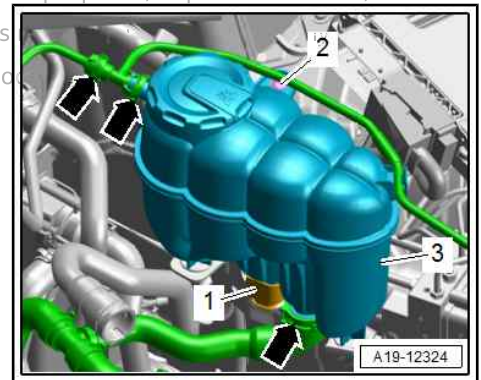


- Release hose clip -arrow- and disconnect coolant hose from thermostat housing.

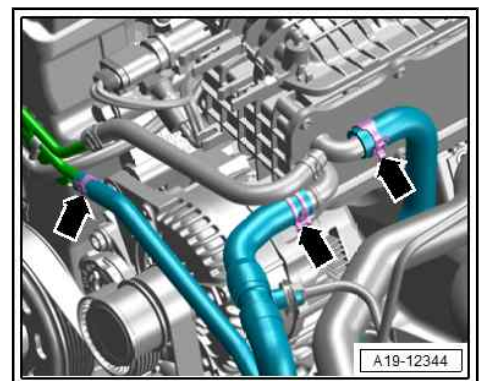


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- Move electrical wiring harness clear.
- Lift retaining clips -arrows-, disconnect coolant hoses and move them clear.
- Unplug electrical connector -1- for coolant shortage indicator switch - F66- .
- Unscrew bolt -2- and detach coolant expansion tank.

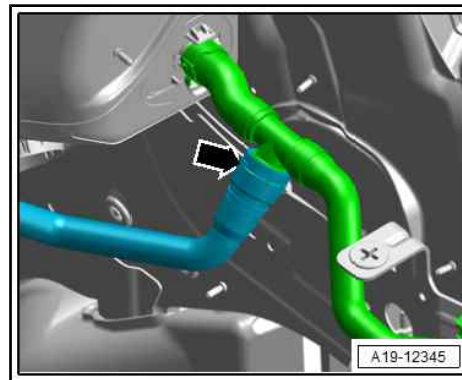


- Release hose clips -arrows- and disconnect coolant hoses.

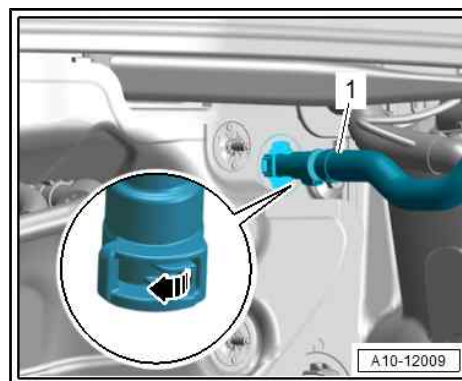




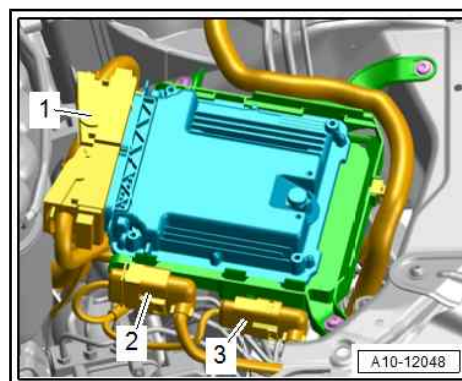
- Lift retaining clip -arrow- and disconnect coolant hose.



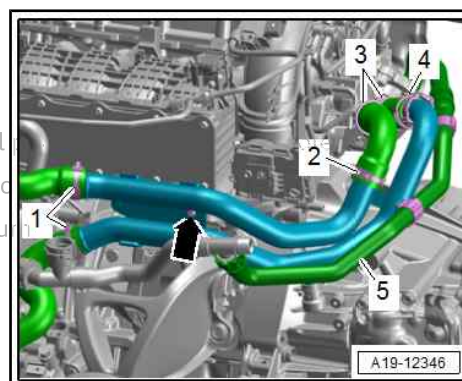
- Release fastener -arrow- and disconnect vacuum hose -1-, taking care not to damage it.



- Detach electrical connector -2- from bracket and unplug.
- Unplug electrical connector -1- for engine control unit - J623- .
- Move electrical wiring harness clear and place on engine.
- Remove plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Removing and installing plenum chamber partition panel .



- Remove bolt -arrow- and move coolant hose -5- clear.
- Loosen hose clips -1, 3- and disconnect coolant pipes on left.



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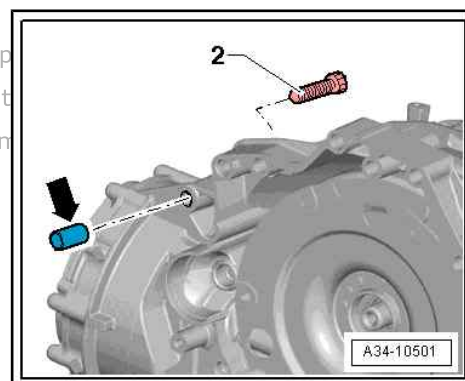
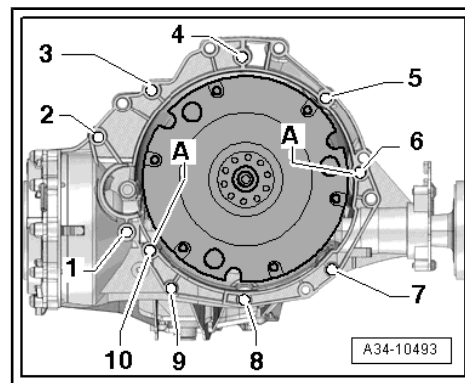


- Remove bolts -2 ... 5- securing gearbox to engine.
- Separate starter from gearbox and leave in position.

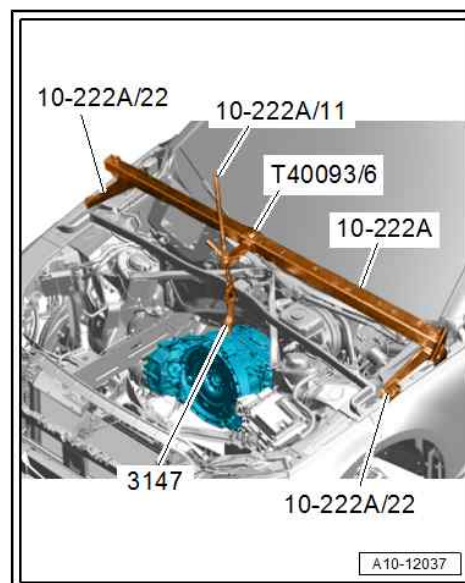


**Note:**

Bolt -2- secures the starter to the gearbox and is provided with a spacer sleeve -arrow-.



- Set up support bracket - 10-222A- with adapters -10-222A/22- on bolted flanges of wing panels (left and right) as illustrated.
- Use gearbox support - 10-222A/11- to hook spindle - 3147- onto gearbox. (Engine has been removed in illustration).





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



#### WARNING

**Accident risk from loose components of lifting tackle.**

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

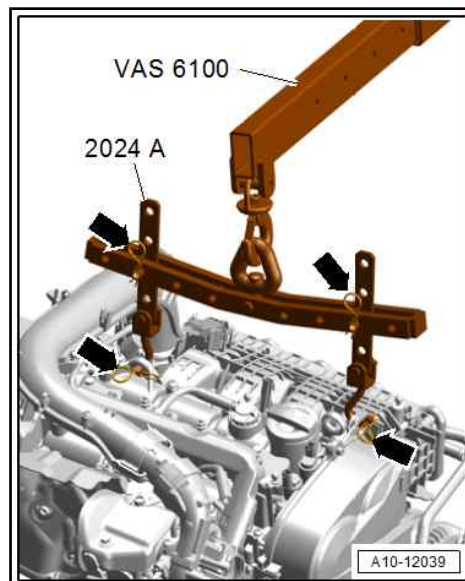
- Raise engine until engine mountings are clear.
- Tighten spindle - 10-222A/11- further.



#### Caution

**Danger of damage to hoses, pipes and wiring connections and to engine compartment.**

- ◆ **Check that all hoses and wiring connections between engine, gearbox, subframe and body have been detached.**
- ◆ **Carefully guide engine out of engine compartment when lifting out.**



- Separate engine from gearbox and lift engine out of engine compartment.

## 1.2 Securing engine to engine and gearbox support

### Special tools and workshop equipment required

- ◆ Engine and gearbox support - VAS 6095A-



- ◆ Nut M12



## Procedure

- Engine attached to workshop hoist - VAS 6100- using lifting tackle - 2024A-
- To adjust to the centre of gravity of the assembly, the perforated rails must be positioned as shown.



### WARNING

*Accident risk from loose components of lifting tackle.*

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

- Remove drive plate  
⇒ "2.2 Removing and installing drive plate", page 48 .
- Remove appropriate dowel sleeve.
- Attach engine to engine and gearbox support - VAS 6095- by securing support element -2- with a nut, M12 -item 1-.

## Tightening torque

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

## Assembling

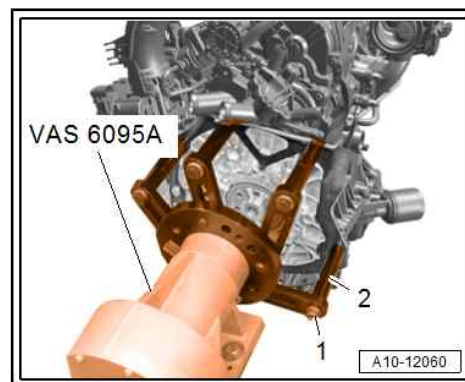
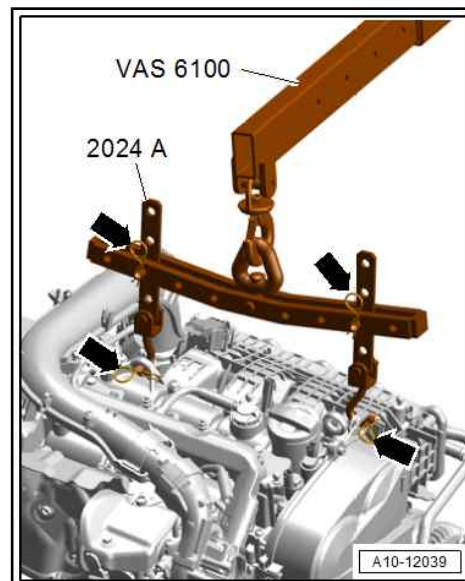
Assembly is performed in reverse sequence; note the following:

- Install drive plate  
⇒ "2.2 Removing and installing drive plate", page 48 .

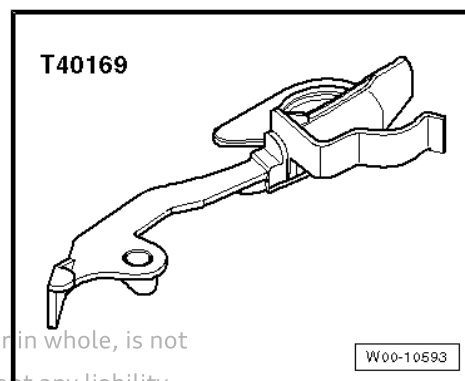
## 1.3 Installing engine

### Special tools and workshop equipment required

- ◆ Assembly aid - T40169-

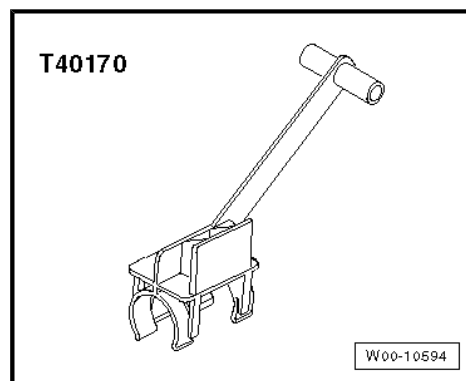


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◆ Transportation lock - T40170-



◆ All special tools listed under "Removing engine"

**Procedure**

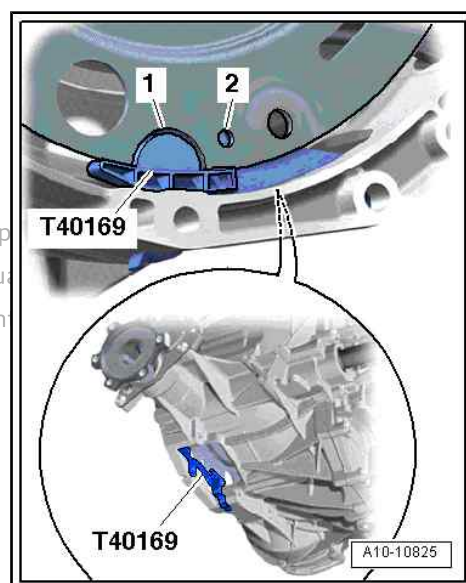
- After removing, renew bolts tightened with specified tightening angle.
- Renew self-locking nuts and bolts as well as seals, gaskets and O-rings after removal.
- Do not remove plugs or protective caps until you are ready to fit the relevant line.
- On vehicles with manual gearbox, a needle bearing must be fitted in the drive plate  
⇒ ["2.4 Renewing needle bearing in drive plate", page 57](#) .
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Before fitting, check vacuum hoses for damage and renew if necessary.
- Re-install all cable ties in original positions.
- Do not reuse coolant.
- Install drive plate  
⇒ ["2.2 Removing and installing drive plate", page 48](#) .
- The following preparations are required before joining engine and gearbox:
- Insert assembly aid - T40169- into gearbox housing between flywheel/torque converter and gearbox housing from below, as illustrated.

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

**Note:**

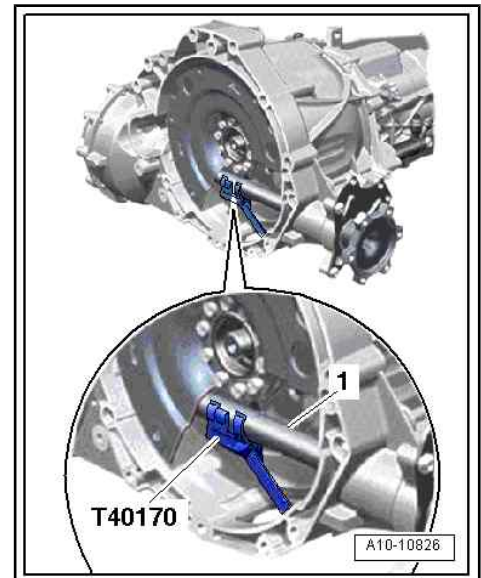
There is only one inspection hole on the circumference; turn the flywheel accordingly.

- Insert pin of assembly aid into hole on gearbox housing.



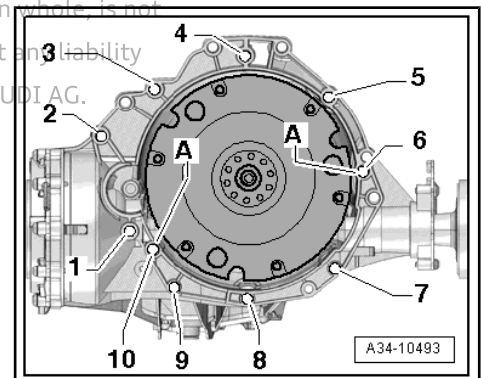


- Insert transportation lock - T40170- into gearbox housing from below and clamp onto flange shaft -1-.

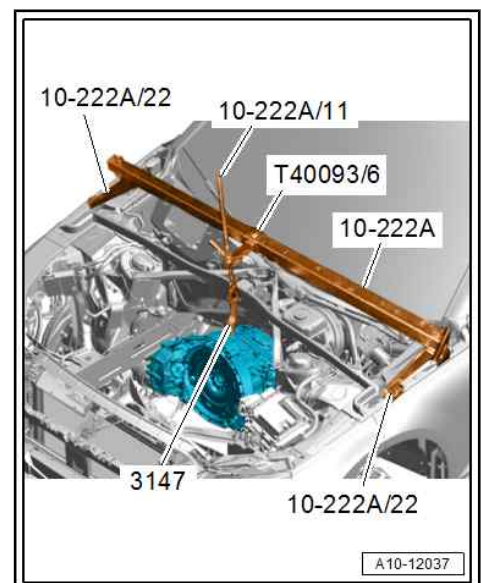


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- Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
- Check whether aluminium bolts securing engine to gearbox can be reused; if so, apply marking ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox .
- Bring gearbox into position on engine and tighten bolts -3, 4, 5-. Tightening torques ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox

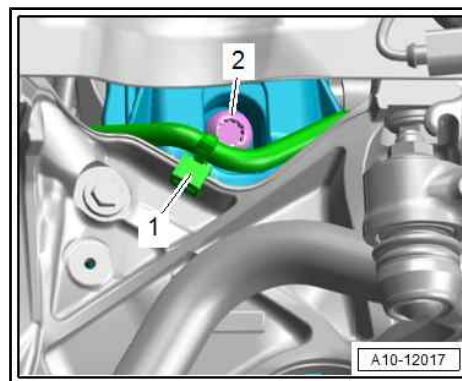


- Release spindle of support bracket - 10-222A- .
- Lower workshop hoist and place engine/gearbox assembly onto engine mounting.

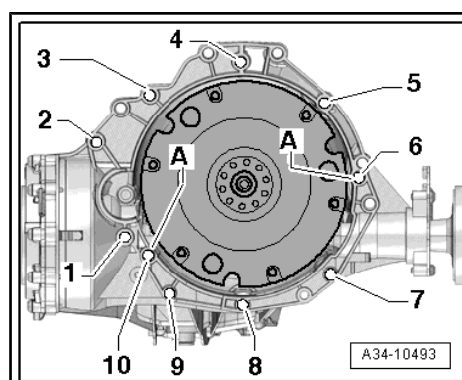




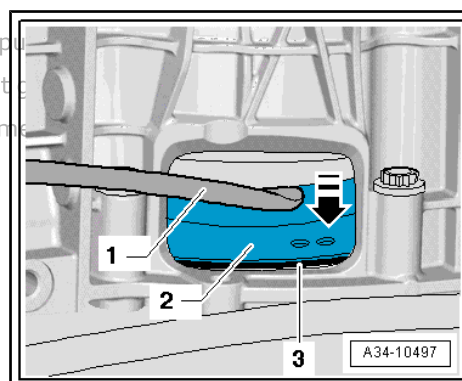
- Screw in bolts -2- (left and right) for engine mounting.
- Detach workshop hoist - VAS 6100- and lifting tackle - 2024A- .



- Screw in bolts -6 ... 10- securing engine to gearbox and tighten.
- Remove transport lock - T40170- and assembly aid - T40169- .



- The following step is necessary to ensure that the flywheel is straight and that it makes even contact with the drive plate.
- Using assembly lever -1-, press flywheel -2- slightly against drive plate -3- -arrow-.

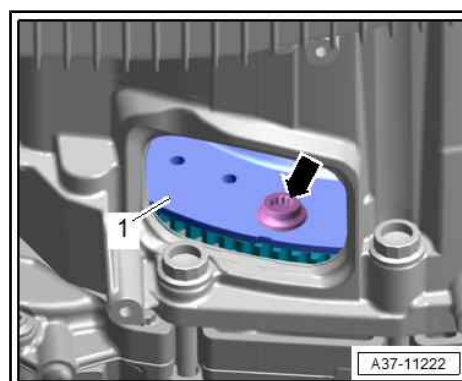


- Bolt flywheel -1- onto drive plate as follows:

**Note:**

Use ring spanner insert AF 16 - V.A.G 1332/14- to tighten bolts.

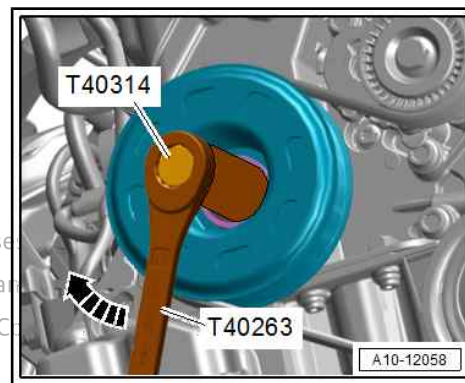
- Tighten first bolt -arrow- to 10 Nm and loosen again; then tighten to 2 Nm (hand-tight).





- Turn crankshaft 120° further in direction of normal engine rotation -arrow- using wrench, 21 mm - T40263- , adapter - T40314- and socket, 21 mm.
- With crankshaft in this position, tighten next bolt ⇒ 6-speed manual gearbox; Rep. gr. 30 ; Clutch; Exploded view - clutch module , or ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox.
- Turn crankshaft by 120° each time and tighten remaining 2 bolts to specified torque.

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

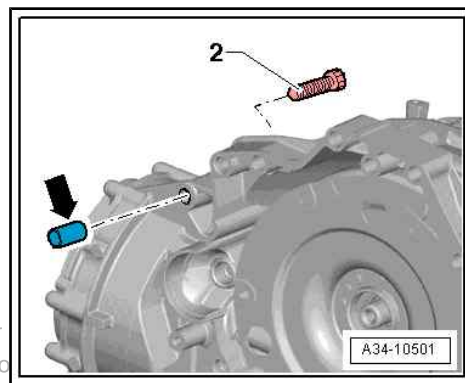




#### Note:

Bolt -2- secures the starter to the gearbox and is provided with a spacer sleeve -arrow-.

- Install starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter .
- Install coolant pipes (left-side)  
⇒ ["3.1 Exploded view - coolant pipes", page 180](#) .
- Install plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Removing and installing plenum chamber cover .
- Install catalytic converter  
⇒ ["2.2 Removing and installing catalytic converter", page 250](#) .
- Align the exhaust system so it is free of stress  
⇒ ["1.5 Stress-free alignment of exhaust system", page 247](#) .
- Connect fuel hose ⇒ Fuel supply system; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .
- Secure drive shaft with bolts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .
- Install heat shield for drive shaft ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing heat shield for drive shaft .
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Install poly V-belt  
⇒ ["1.3 Removing and installing poly V-belt", page 38](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install air cleaner housing  
⇒ ["2.2 Removing and installing air cleaner housing", page 215](#) .
- Top up engine oil/check oil level ⇒ Maintenance ; Booklet 830 .
- Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .



#### Caution

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

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

- If engine was renewed, perform adaptations listed in [Guided Function](#) [01 - Functions, engine mechanics](#) ⇒ Vehicle diagnostic tester.



#### Caution

***Risk of damage to components.***

- ◆ ***Only perform additional adaptations for those components which were renewed after removal.***



- Connect coolant hose with plug-in connector  
⇒ [Fig. ““Connecting coolant hose with plug-in connector””, page 183](#) .
- Fill up with coolant ⇒ [page 155](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Install wheel housing liners, wheel spoilers and drive shaft covers ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Install noise insulation panels ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

### Tightening torques

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

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

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 28](#)
- ◆ Bolts securing engine to gearbox ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox



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## 2 Assembly mountings

⇒ "2.1 Exploded view - assembly mountings", page 28

⇒ "2.2 Supporting engine in installation position", page 30

⇒ "2.3 Removing and installing engine mountings", page 31

⇒ "2.4 Removing and installing gearbox mounting", page 33

### 2.1 Exploded view - assembly mountings

#### Engine mounting

##### 1 - Subframe

##### 2 - Engine mounting

- ☐ Version with left electro-hydraulic engine mounting solenoid valve - N144-

- ☐ Removing and installing  
⇒ "2.3 Removing and installing engine mountings", page 31

##### 3 - Bolt

- ☐ 55 Nm

##### 4 - Bolt

- ☐ 55 Nm

##### 5 - Engine support

##### 6 - Heat shield

##### 7 - Bolt

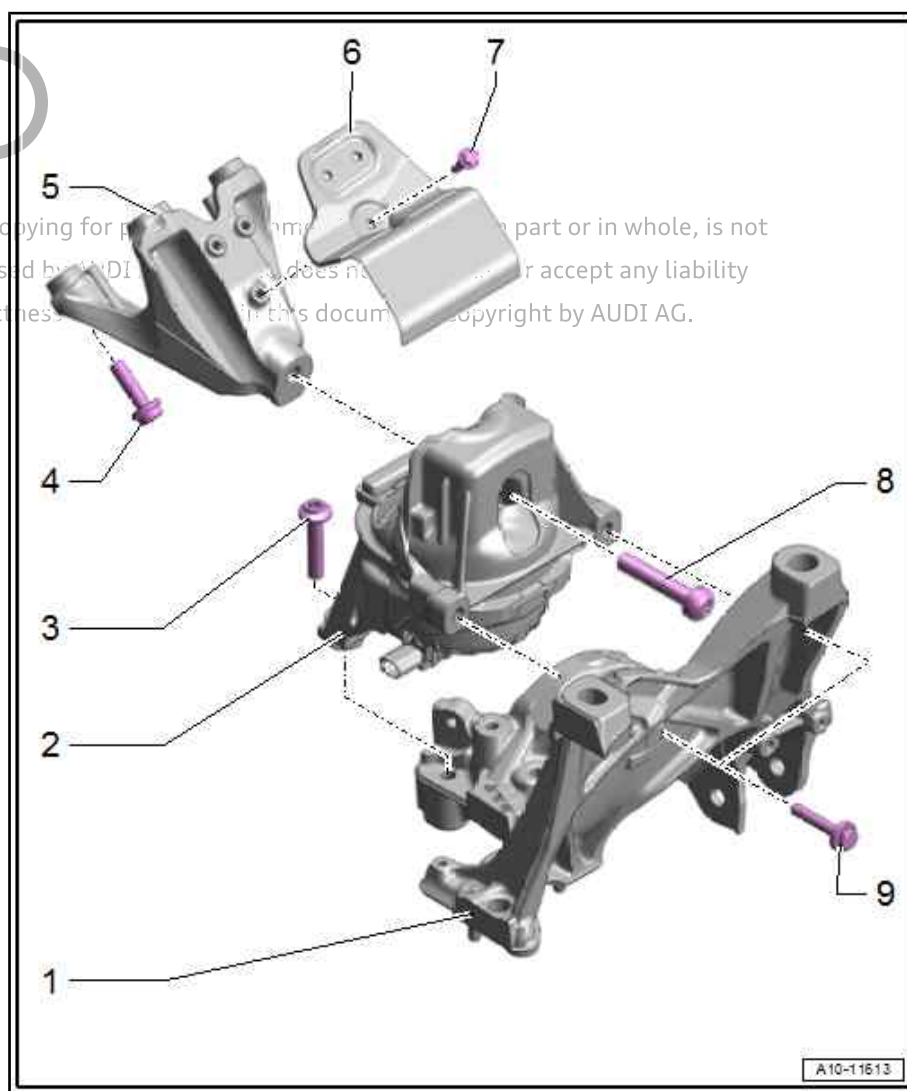
- ☐ 10 Nm

##### 8 - Bolt

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

##### 9 - Bolt

- ☐ 30 Nm



#### Gearbox mounting for manual gearbox



### 1 - Nut

- ☐ Only remove if detaching gearbox mounting from gearbox support
- ☐ Tightening torques ⇒ 6-speed manual gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

### 2 - Bolt

- ☐ Tightening torques ⇒ 6-speed manual gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

### 3 - Tunnel cross member

- ☐ Removing and installing ⇒ 6-speed manual gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

### 4 - Stop plate

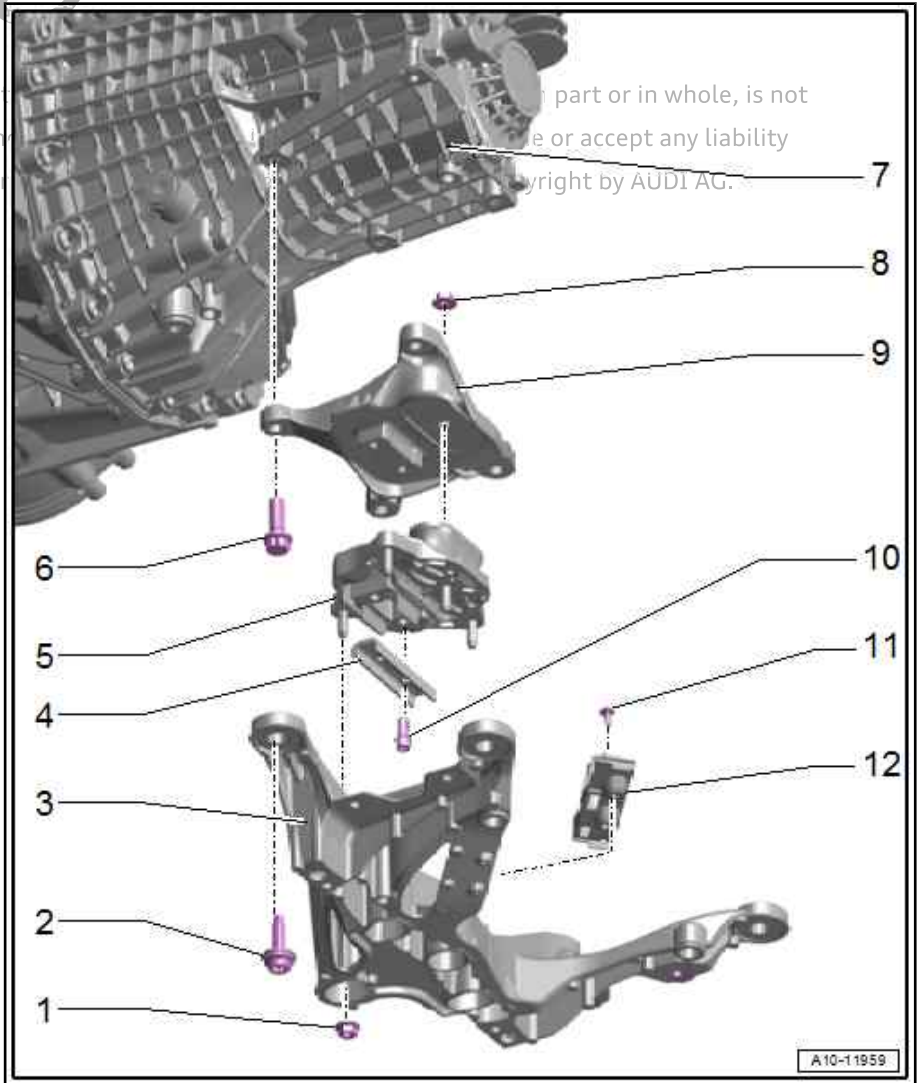
- ☐ For gearbox mounting

### 5 - Gearbox mounting

- ☐ Removing and installing ⇒ ["2.4 Removing and installing gearbox mounting", page 33](#)

### 6 - Bolt

- ☐ Tightening torques ⇒ 6-speed manual gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings



### 7 - Final drive

### 8 - Nut

- ☐ Only remove if detaching gearbox mounting from gearbox support
- ☐ Tightening torques ⇒ 6-speed manual gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

### 9 - Gearbox support

- ☐ Removing and installing ⇒ ["2.4 Removing and installing gearbox mounting", page 33](#)

### 10 - Bolt

- ☐ Tightening torques ⇒ 6-speed manual gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

### 11 - Bolt

- ☐ 9 Nm

### 12 - Bracket

- ☐ For electrical connector

Gearbox mounting for dual clutch gearbox



#### 1 - Bolt

- ❑ Tightening torques ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

#### 2 - Tunnel cross member

- ❑ Removing and installing ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

#### 3 - Stop plate

- ❑ For gearbox mounting

#### 4 - Gearbox mounting

- ❑ Removing and installing ⇒ ["2.4 Removing and installing gearbox mounting", page 33](#)

#### 5 - Final drive

#### 6 - Nut

- ❑ Only remove if detaching gearbox mounting from gearbox support
- ❑ Tightening torques ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

#### 7 - Gearbox support

- ❑ Removing and installing ⇒ ["2.4 Removing and installing gearbox mounting", page 33](#)

#### 8 - Bolt

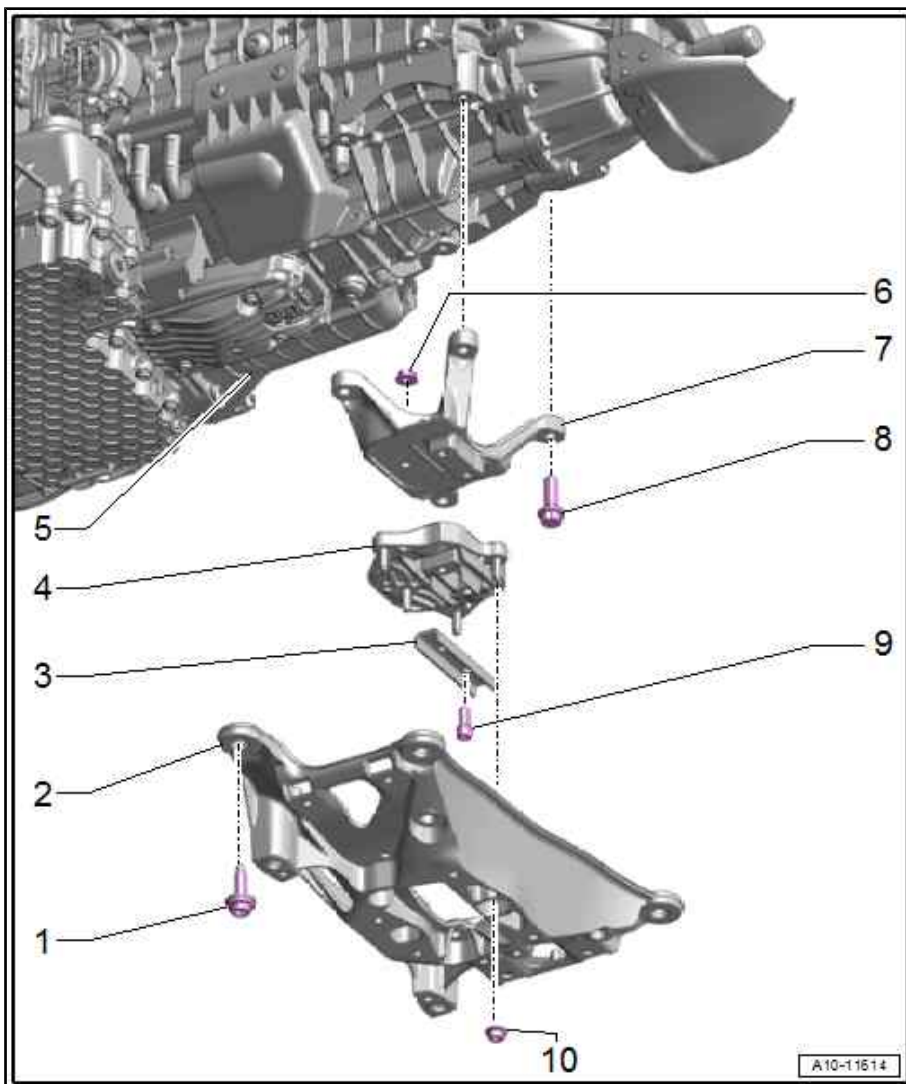
- ❑ Tightening torques ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

#### 9 - Bolt

- ❑ Only remove if detaching gearbox mounting from gearbox support
- ❑ Tightening torques ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

#### 10 - Nut

- ❑ Only remove if detaching gearbox mounting from gearbox support
- ❑ Tightening torques ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

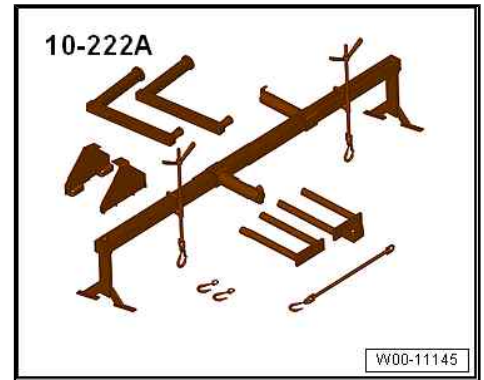


## 2.2 Supporting engine in installation position

Special tools and workshop equipment required



◆ Support bracket - 10-222A-

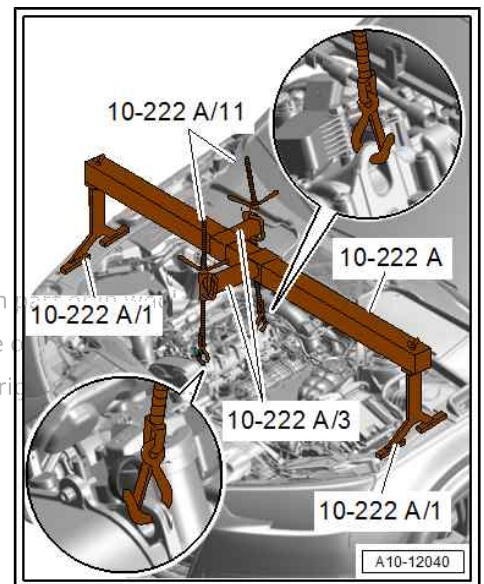


**Procedure**

- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#),  
[page 34](#).
- Set up support bracket - 10-222A- on upper wheel housing longitudinal members (left and right), as shown.
- Attach spindle - 10-222A/11- to rear engine lifting eye.
- Take up weight of engine with the spindle, but do not lift.

**Assembling**

Assemble in reverse order.



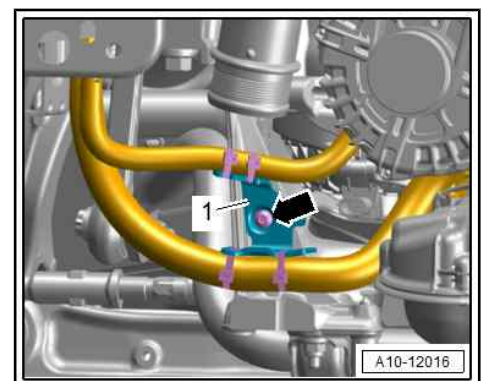
## 2.3 Removing and installing engine mountings

**Removing**

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

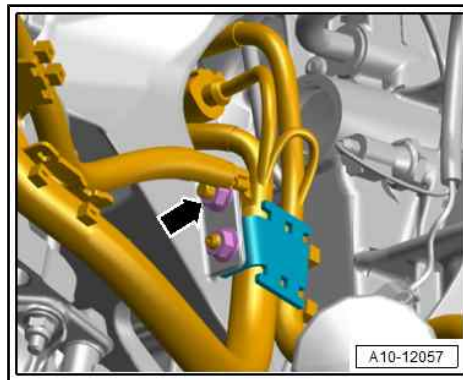
**Engine mounting (right-side):**

- Remove bolt -arrow- and move bracket -1- clear with electrical wiring harness.



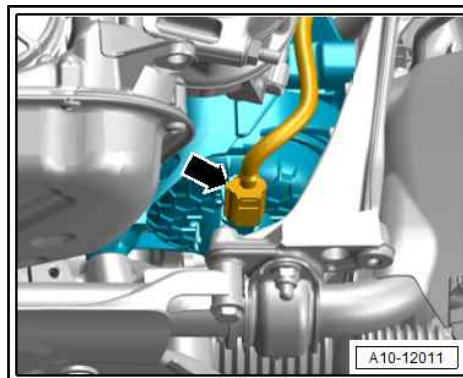


- Remove nut -arrow- and move earth wire clear.



#### Engine mounting (left-side):

- Unplug electrical connector -arrow-.



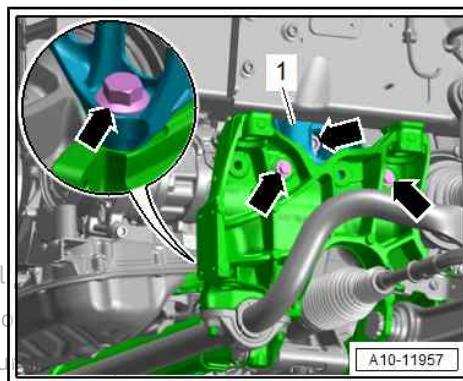
#### Both sides (continued):



#### Caution

*Risk of damage to drive shafts.*

- ◆ *When lifting the engine, the drive shafts must not make contact with the suspension struts.*



- Support engine in installation position ➔ [page 30](#) and take up weight with spindle - 10-222A/11- until load on engine mounting is relieved.

- Remove bolts -arrows- and detach engine mounting.

#### Installing

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

- After removing, renew bolts tightened with specified tightening angle.
- Electrical connections and routing ➔ Current flow diagrams, Electrical fault finding and Fitting locations.

#### Tightening torques

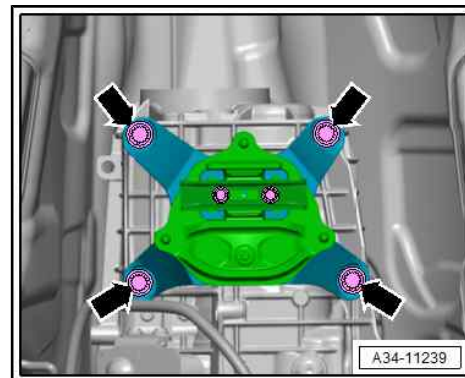
- ◆ ➔ [“2.1 Exploded view - assembly mountings”, page 28](#)
- ◆ ➔ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)
- ◆ ➔ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



## 2.4 Removing and installing gearbox mounting

### Removing gearbox support with gearbox mounting

- Remove tunnel cross member ⇒ 6-speed manual gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings , or ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings .
- Remove bolts -arrows- and detach gearbox support and gearbox mounting from gearbox.



### Removing gearbox mounting

- Unscrew bolts -1- and detach stop -2- for gearbox mounting.
- Remove nut -5- and detach gearbox mounting -3- from gearbox support -4-.

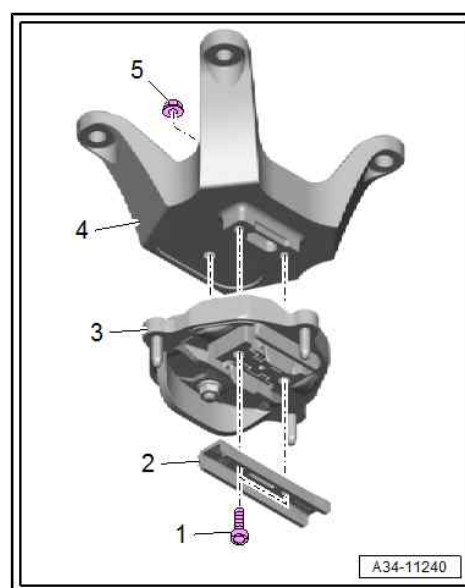
### Installing

- Tighten nut -5- hand-tight initially.
- Tighten bolts -1- and then nut -5-.

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

### Tightening torques

- ◆ ⇒ Gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings
- ◆ ⇒ 7-speed dual clutch gearbox; Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings



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### 3 Engine cover panel

⇒ **"3.1 Removing and installing engine cover panel", page 34**

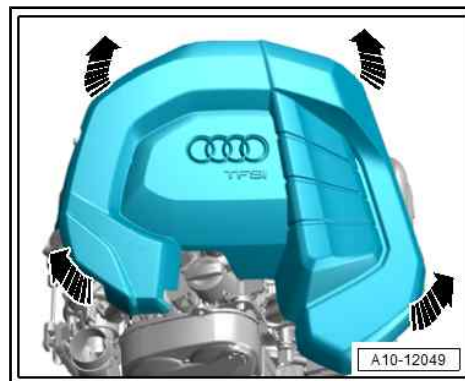
#### 3.1 Removing and installing engine cover panel

##### Removing

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

##### Installing

- To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.
- Press engine cover panel into rubber grommets first on the left side and then at front.



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## 13 – Crankshaft group

### 1 Cylinder block (pulley end)

⇒ [“1.1 Exploded view - poly V-belt drive”, page 35](#)

⇒ [“1.2 Exploded view - sealing flange \(pulley end\)”, page 37](#)

⇒ [“1.3 Removing and installing poly V-belt”, page 38](#)

⇒ [“1.4 Removing and installing tensioner for poly V-belt”, page 39](#)

⇒ [“1.5 Removing and installing engine support”, page 39](#)

⇒ [“1.6 Removing and installing vibration damper”, page 41](#)

⇒ [“1.7 Renewing crankshaft oil seal \(pulley end\)”, page 42](#)

⇒ [“1.8 Removing and installing sealing flange \(pulley end\)”, page 44](#)

#### 1.1 Exploded view - poly V-belt drive

##### 1 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Do not kink
- ☐ Removing and installing  
⇒ [“1.3 Removing and installing poly V-belt”, page 38](#)
- ☐ Routing of poly V-belt  
⇒ [Fig. “Routing of poly V-belt”, page 36](#)
- ☐ When installing, make sure it is properly seated on pulleys.

##### 2 - Bolt



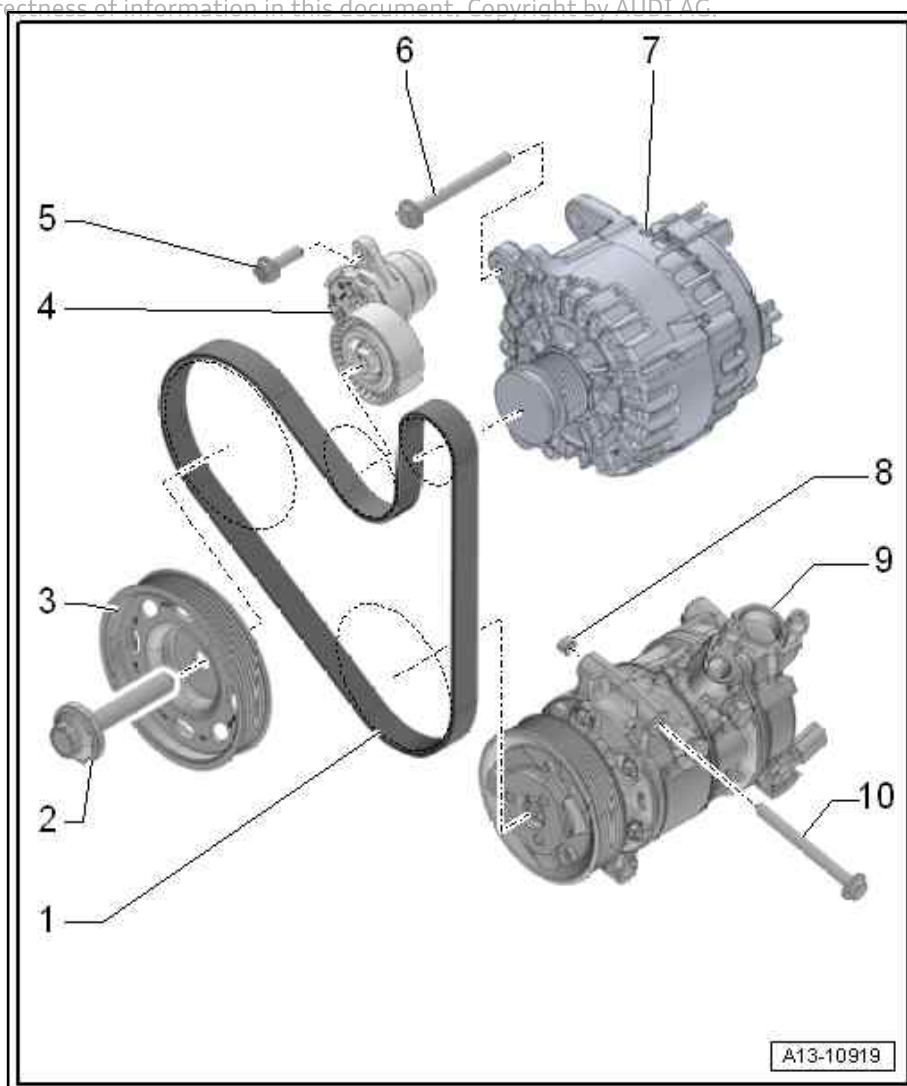
##### Caution

**Risk of irreparable damage to engine.**  
**No** avoid disturbing valve timing, do not turn crankshaft when bolt is removed.

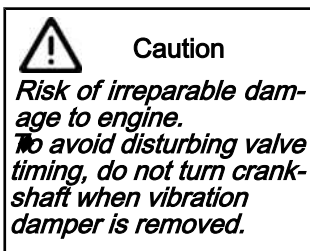
- ☐ Tightening torque  
⇒ [Item 1 \(page 37\)](#)

##### 3 - Vibration damper

- ☐ Removing and installing  
⇒ [“1.6 Removing and installing vibration damper”, page 41](#)



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#### 4 - Tensioner for poly V-belt

- ☐ Pivot with socket to slacken poly V-belt
- ☐ Lock in position with locking pin - T10060A- .
- ☐ Removing and installing ⇒ ["1.4 Removing and installing tensioner for poly V-belt", page 39](#)

#### 5 - Bolt

- ☐ 23 Nm

#### 6 - Bolt

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

#### 7 - Alternator

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

#### 8 - Dowel sleeve

- ☐ For air conditioner compressor

#### 9 - Air conditioner compressor

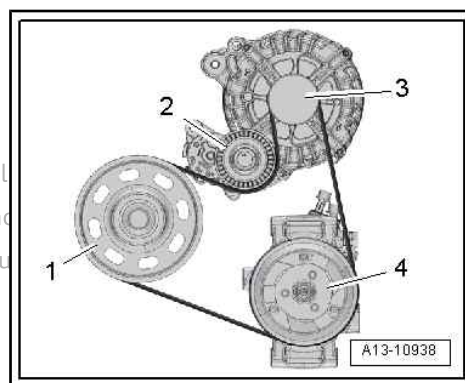
- ☐ Do not unscrew or disconnect refrigerant hoses or pipes
- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket

#### 10 - Bolt

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

#### Routing of poly V-belt

- 1 - Vibration damper
- 2 - Tensioner for poly V-belt
- 3 - Alternator
- 4 - Air conditioner compressor





## 1.2 Exploded view - sealing flange (pulley end)

### 1 - Bolt

- ☐ Renew after removing
- ☐ Use counterhold tool - T10475- when loosening and tightening



#### Caution

*Risk of irreparable damage to engine.  
To avoid disturbing valve timing, do not turn crankshaft when bolt is removed.*

- ☐ 150 Nm +180°

### 2 - Vibration damper

- ☐ Removing and installing  
⇒ [“1.6 Removing and installing vibration damper”, page 41](#)



#### Caution

*Risk of irreparable damage to engine.  
To avoid disturbing valve timing, do not turn crankshaft when vibration damper is removed.*

### 3 - Oil seal

- ☐ For crankshaft (pulley end)
- ☐ Renewing  
⇒ [“1.7 Renewing crankshaft oil seal \(pulley end\)”, page 42](#)
- ☐ Do not lubricate with oil

### 4 - Sealing flange (pulley end)

- ☐ Should be positioned on dowel pins
- ☐ Removing and installing ⇒ [“1.8 Removing and installing sealing flange \(pulley end\)”, page 44](#)

### 5 - Bolt

- ☐ Different thread diameters ⇒ Electronic parts catalogue
- ☐ Renew after removing
- ☐ Tightening torque and sequence  
⇒ [Fig. “Sealing flange \(pulley end\) - tightening torque and sequence”, page 38](#)

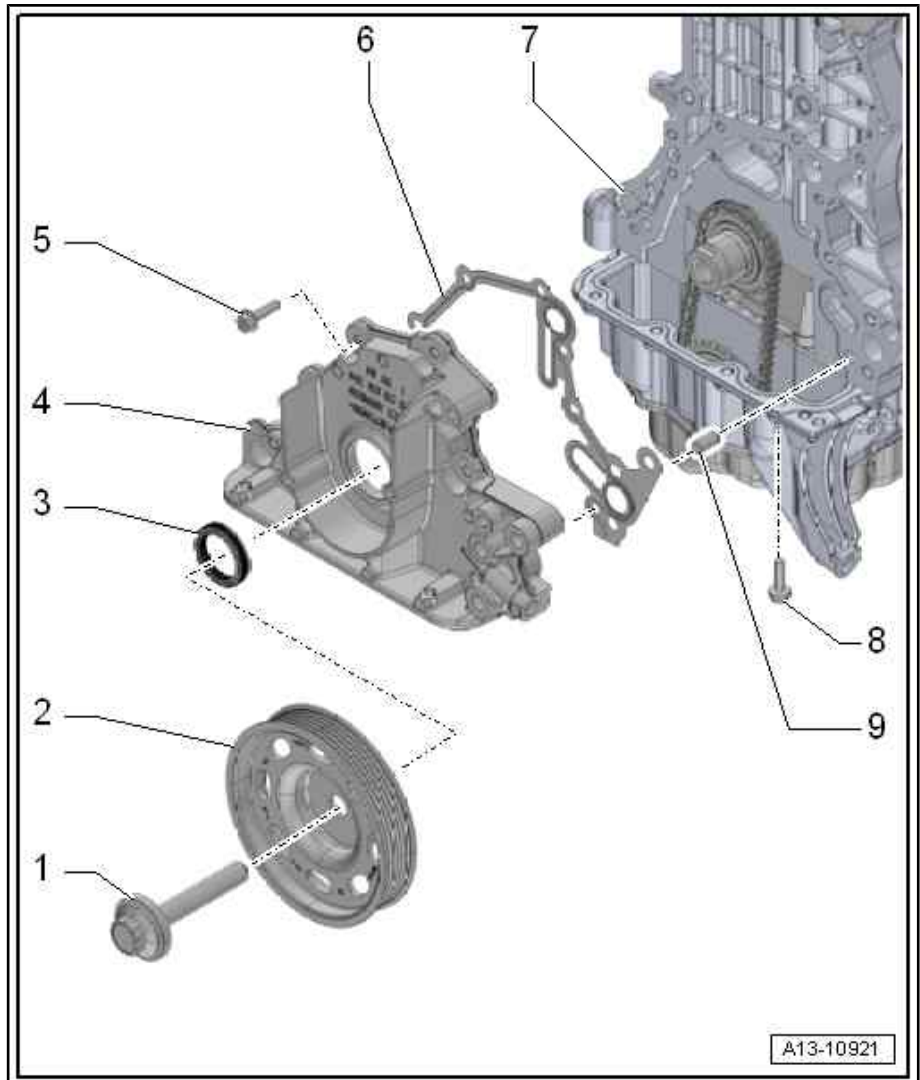
### 6 - Gasket

- ☐ Renew after removing

### 7 - Cylinder block

### 8 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence  
⇒ [Fig. “Sealing flange \(pulley end\) - tightening torque and sequence”, page 38](#)



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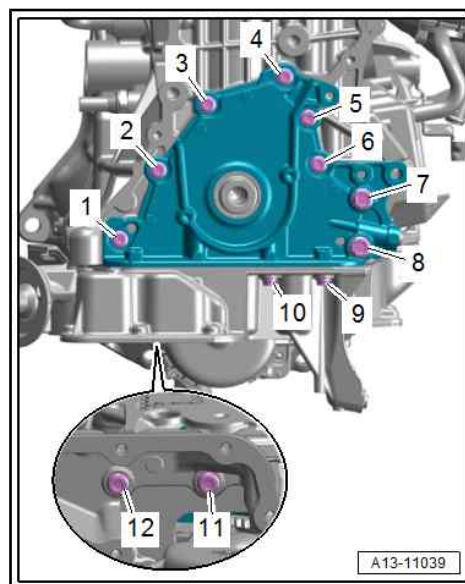
## 9 - Dowel pin

□ 2x

### Sealing flange (pulley end) - tightening torque and sequence

- After removing, renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

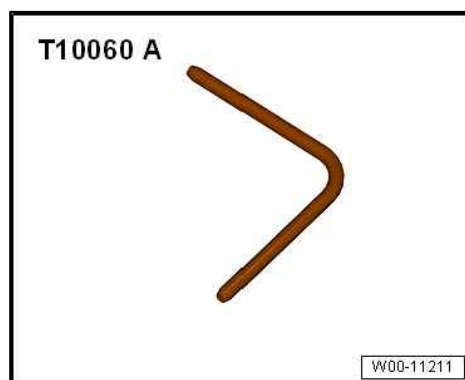
| Stage | Bolts      | Tightening torque/angle specification  |
|-------|------------|----------------------------------------|
| 1.    | -1 ... 12- | Screw in by hand until contact is made |
| 2.    | -1 ... 12- | 8 Nm in diagonal sequence              |
| 3.    | -7, 8-     | 20 Nm                                  |
| 4.    | -1 ... 12- | Turn 90° further in diagonal sequence  |



## 1.3 Removing and installing poly V-belt

### Special tools and workshop equipment required

- ◆ Locking pin - T10060A-



### Removing

**Caution**  
*Running a used poly V-belt in the opposite direction could cause irreparable damage.*  
◆ **Before removing the poly V-belt, mark the direction of rotation with chalk or a felt-tip pen for re-installation.**

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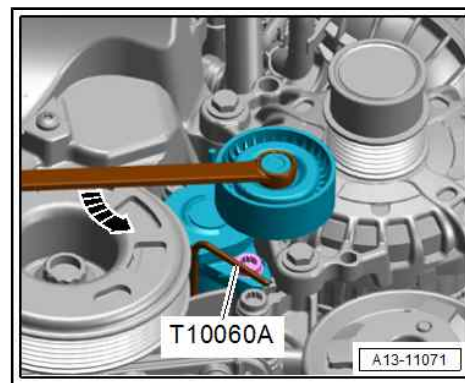


- To slacken poly V-belt, turn tensioner in anti-clockwise direction -arrow-.
- Lock tensioner with locking pin - T10060A- .
- Take off poly V-belt.

#### Installing

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

- Fit poly V-belt ⇒ Fig. [“Routing of poly V-belt”](#), page 36 .
- Turn tensioner anti-clockwise -arrow- and remove locking pin - T10060A- .
- Release tensioner.
- Check that poly V-belt is properly seated.
- Start engine and check that poly V-belt runs properly.



## 1.4 Removing and installing tensioner for poly V-belt

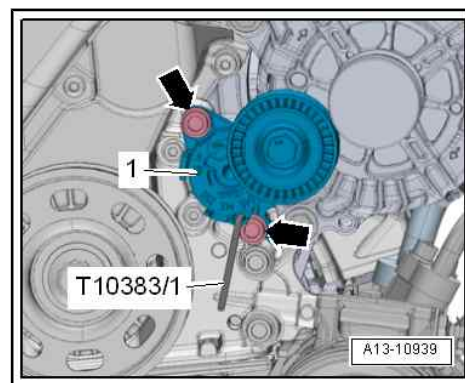
#### Removing

- Detach poly V-belt from tensioner  
⇒ [“1.3 Removing and installing poly V-belt”](#), page 38 .
- Remove bolts -arrows- and detach tensioner -1- for poly V-belt.

#### Installing

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

- Install poly V-belt  
⇒ [“1.3 Removing and installing poly V-belt”](#), page 38 .



#### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”](#), page 35

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## 1.5 Removing and installing engine support

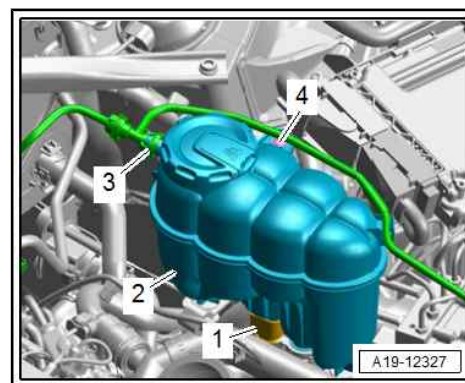
⇒ [“1.5.1 Removing and installing engine support \(left-side\)”](#), page 39

⇒ [“1.5.2 Removing and installing engine support \(right-side\)”](#), page 40

### 1.5.1 Removing and installing engine support (left-side)

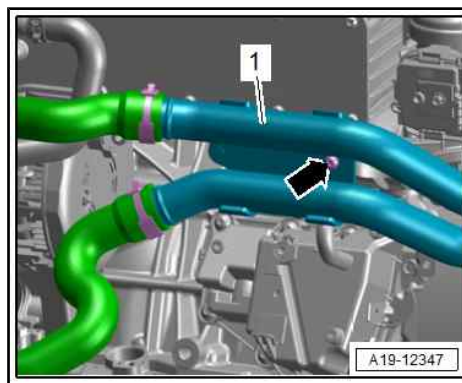
#### Removing

- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#), page 34 .
- Lift retaining clip -3-, disconnect coolant hose and move it clear.
- Unplug electrical connector -1- for coolant shortage indicator switch - F66- .
- Remove bolt -4- and push coolant expansion tank -2- to one side.

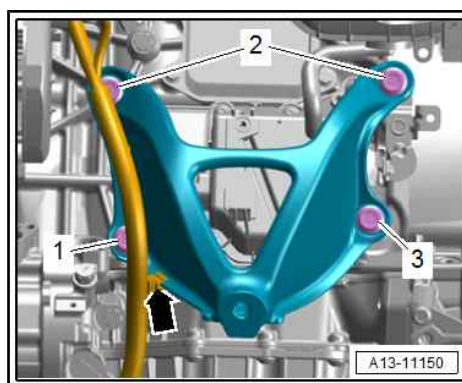




- Unscrew bolt -arrow- and press coolant pipes -1- slightly to one side.



- Move electrical wiring harness clear at retaining clip -arrow-.
- Remove top bolts -2- for engine support.
- Detach poly V-belt from air conditioner compressor pulley  
⇒ [“1.3 Removing and installing poly V-belt”, page 38](#) .
- Remove air conditioner compressor from bracket ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Remove engine mounting (left-side)  
⇒ [“2.3 Removing and installing engine mountings”, page 31](#) .
- Unscrew bottom bolts -1, 3- and detach engine support (left-side). (Engine has been removed in illustration).



### Installing

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

- After removing, renew bolts tightened with specified tightening angle.
- Connect coolant hose with plug-in connector  
⇒ [Fig. “Connecting coolant hose with plug-in connector”, page 183](#) .
- Install poly V-belt  
⇒ [“1.3 Removing and installing poly V-belt”, page 38](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .

### Tightening torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 28](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 180](#)

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

## 1.5.2 Removing and installing engine support (right-side)

### Removing

- Disconnect battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Remove engine mounting (right-side)  
⇒ [“2.3 Removing and installing engine mountings”, page 31](#) .

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- Unscrew nut -2- and move bracket with electrical wiring clear.
- Remove bolts -arrows- and detach engine support -1- (right-side).

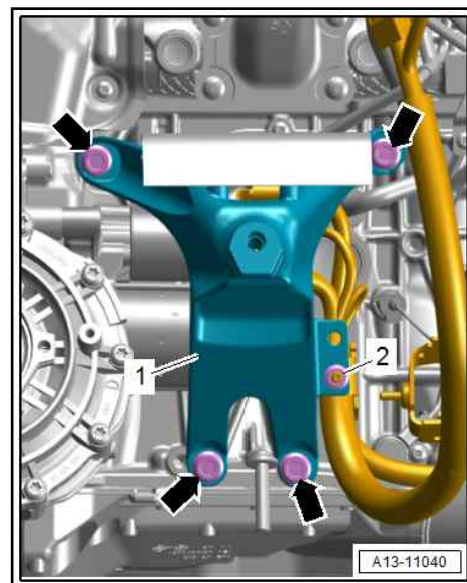
### Installing

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

- After removing, renew bolts tightened with specified tightening angle.
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

### Tightening torques

- ◆ ⇒ [“2.1 Exploded view - assembly mountings”, page 28](#)



## 1.6 Removing and installing vibration damper

### Special tools and workshop equipment required

- ◆ Counterhold tool - T10475-



### Removing

- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove poly V-belt  
⇒ [“1.3 Removing and installing poly V-belt”, page 38](#) .



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- Loosen bolt -arrow- using counterhold tool - T10475- .
- Remove bolt and take off pulley/vibration damper.



#### Caution

**Risk of irreparable damage to engine.**

- ◆ **To avoid disturbing valve timing, do not turn crankshaft when vibration damper is removed.**

#### Installing

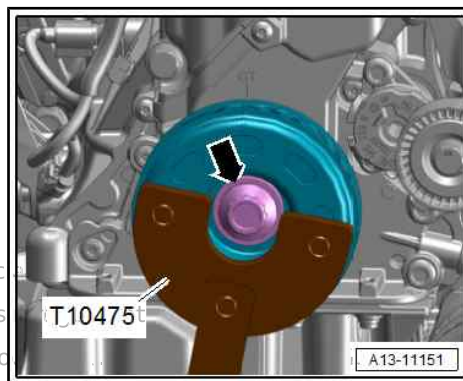
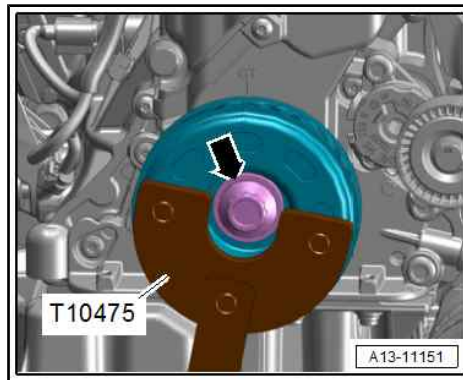
- After removing, renew bolts tightened with specified tightening angle.
- All contact surfaces between bolt, vibration damper and crankshaft sprocket must be free of oil and grease.
- Screw in bolt -arrow- by hand until it makes contact (lubricate thread of bolt).
- Tighten bolt using counterhold tool - T10475- .

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

- Install poly V-belt  
⇒ ["1.3 Removing and installing poly V-belt", page 38](#) .

#### Tightening torques

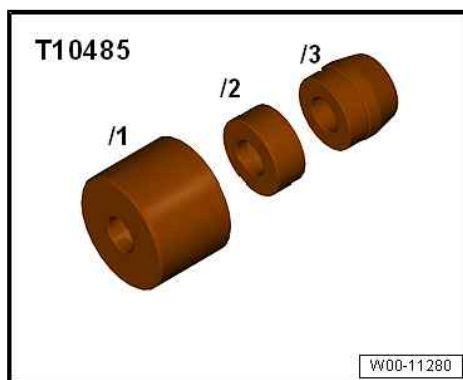
- ◆ ⇒ ["1.1 Exploded view - poly V-belt drive", page 35](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



## 1.7 Renewing crankshaft oil seal (pulley end)

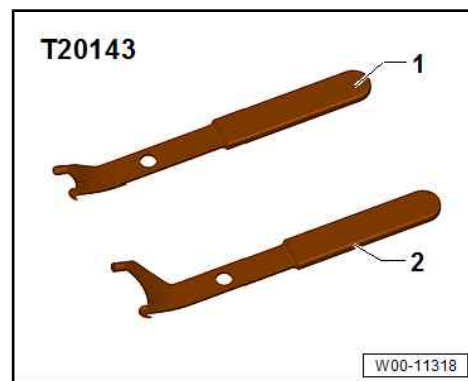
#### Special tools and workshop equipment required

- ◆ Assembly tool - T10485/1-3-





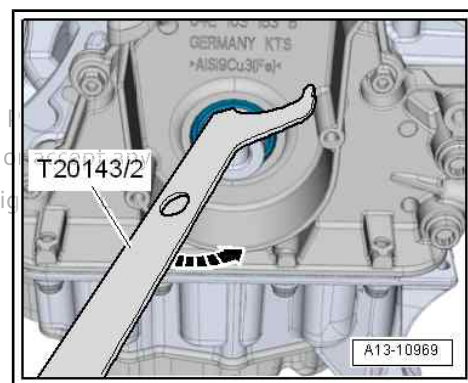
◆ Extractor tool - T20143-



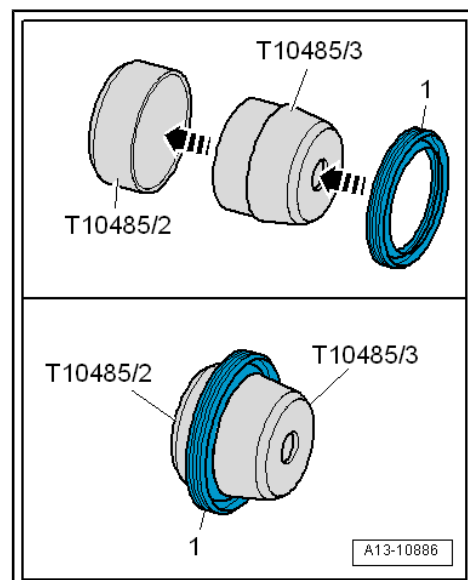
**Procedure**

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove toothed belt  
⇒ [“1.4 Detaching toothed belt from camshaft”, page 75](#) .
- Remove radiator cowl  
⇒ [“4.4 Removing and installing radiator cowl”, page 190](#) .
- Pry out oil seal using extractor tool -T20143/2- -arrow-.
- Clean contact surface and sealing surface.

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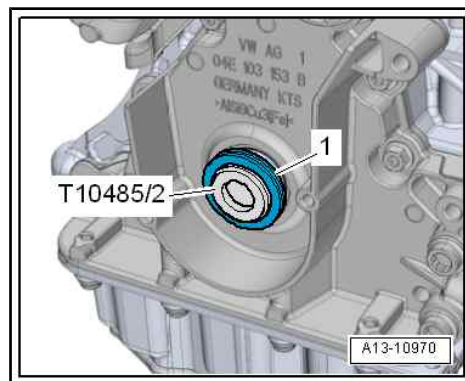


- Do not lubricate new oil seal.
- Slide oil seal -1- over fitting sleeve -T10485/3- onto guide sleeve -T10485/2- .
- Fitting position: closed side of oil seal faces guide sleeve.
- Detach fitting sleeve from guide sleeve.

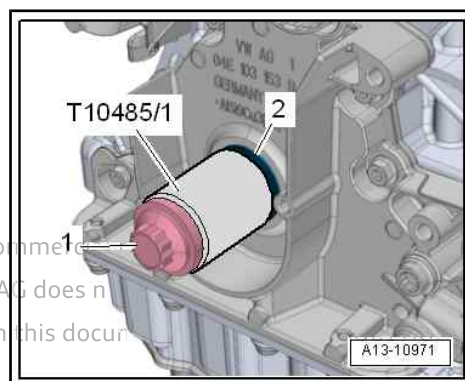




- Fit guide sleeve -T10485/2- with oil seal -1- onto crankshaft.



- Use thrust piece -T10485/1- and bolt -1- for pulley to pull in oil seal -2- onto stop.
- Install radiator cowl  
⇒ ["4.4 Removing and installing radiator cowl", page 190](#) .
- Install toothed belt (adjust valve timing)  
⇒ ["1.4 Detaching toothed belt from camshaft", page 75](#) .



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## 1.8 Removing and installing sealing flange (pulley end)

### Special tools and workshop equipment required

- ◆ Flat scraper
- ◆ Sealant ⇒ Electronic parts catalogue

### Removing

- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Remove air conditioner compressor from bracket ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove toothed belt  
⇒ ["1.4 Detaching toothed belt from camshaft", page 75](#) .
- Remove sump (bottom section)  
⇒ ["1.3 Removing and installing sump \(bottom section\)", page 132](#) .



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

### Installing

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

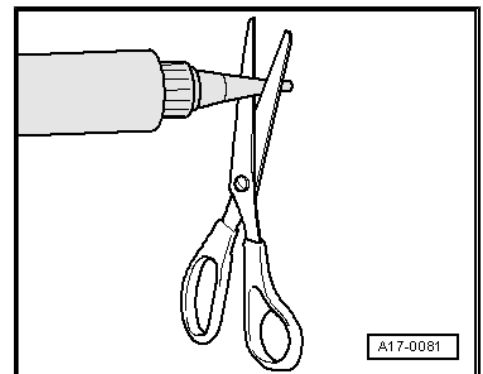
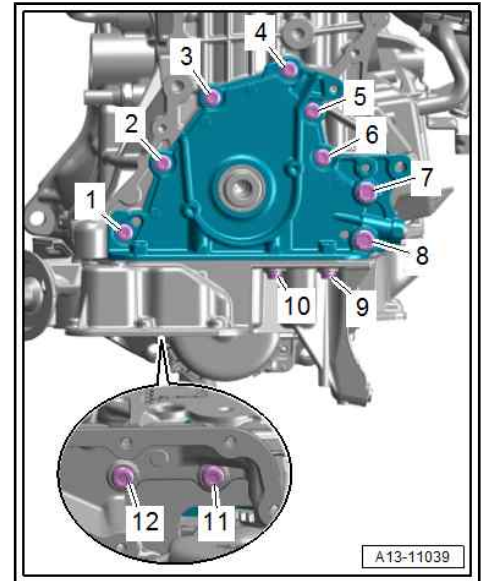


#### Caution

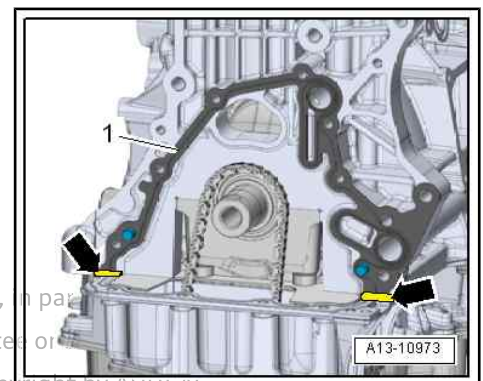
***Make sure sealant residue does not enter lubrication system.***

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

- Remove sealant residue from sealing flange and sump (top section).
- Clean sealing surfaces; they must be free of oil and grease.
- Note expiry date of sealant.
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).



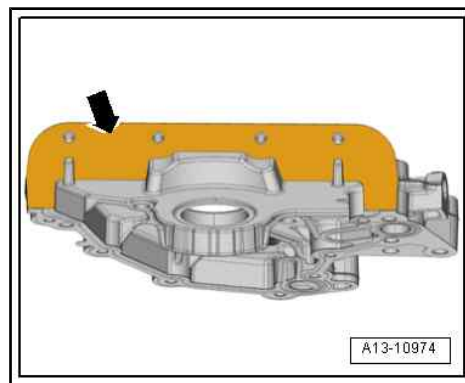
- Slide gasket -1- onto dowel pins in cylinder block.
- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.



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- Apply a thin coat of sealant to bottom sealing surface -arrow- on sealing flange.
- Install sealing flange within 5 minutes of applying the sealant.
- Carefully fit sealing flange onto dowel pins in cylinder block.
- Sealant must not be allowed to get into threaded holes.
- Tighten sealing flange bolts.
- Install crankshaft oil seal (pulley end)  
⇒ ["1.7 Renewing crankshaft oil seal \(pulley end\)", page 42](#) .
- Install sump (bottom section)  
⇒ ["1.3 Removing and installing sump \(bottom section\)", page 132](#) .
- Install toothed belt (adjust valve timing)  
⇒ ["1.4 Detaching toothed belt from camshaft", page 75](#) .



#### Tightening torques

- ◆ ⇒ [Fig. "Sealing flange \(pulley end\) - tightening torque and sequence", page 38](#)
- ◆ ⇒ ["1.1 Exploded view - poly V-belt drive", page 35](#)
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit



## 2 Cylinder block (gearbox end)

⇒ [“2.1 Exploded view - cylinder block \(gearbox end\)”, page 47](#)

⇒ [“2.2 Removing and installing drive plate”, page 48](#)

⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 49](#)

⇒ [“2.4 Renewing needle bearing in drive plate”, page 57](#)

### 2.1 Exploded view - cylinder block (gearbox end)

- Secure engine to engine and gearbox support when performing assembly work  
⇒ [“1.2 Securing engine to engine and gearbox support”, page 20](#).

#### 1 - Bolt

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

#### 2 - Drive plate

- ☐ Removing and installing  
⇒ [“2.2 Removing and installing drive plate”, page 48](#)
- ☐ Can only be installed in one position

#### 3 - Sealing flange (gearbox end)

- ☐ With oil seal and sender for private or commercial purposes. Copying for private or commercial purposes, in whole or in part, is prohibited. Audi AG does not guarantee the accuracy of the information in this document. Copyright © Audi AG
- ☐ With oil seal and sender wheel for engine speed sender - G28-
- ☐ Do not separate from sealing flange
- ☐ Removing and installing  
⇒ [“2.3 Removing and installing sealing flange \(gearbox end\)”, page 49](#)

#### 4 - Intermediate plate

- ☐ Do not damage or bend
- ☐ Installing  
⇒ [Fig. “Installing intermediate plate”, page 48](#)

#### 5 - Crankshaft

#### 6 - Dowel pin

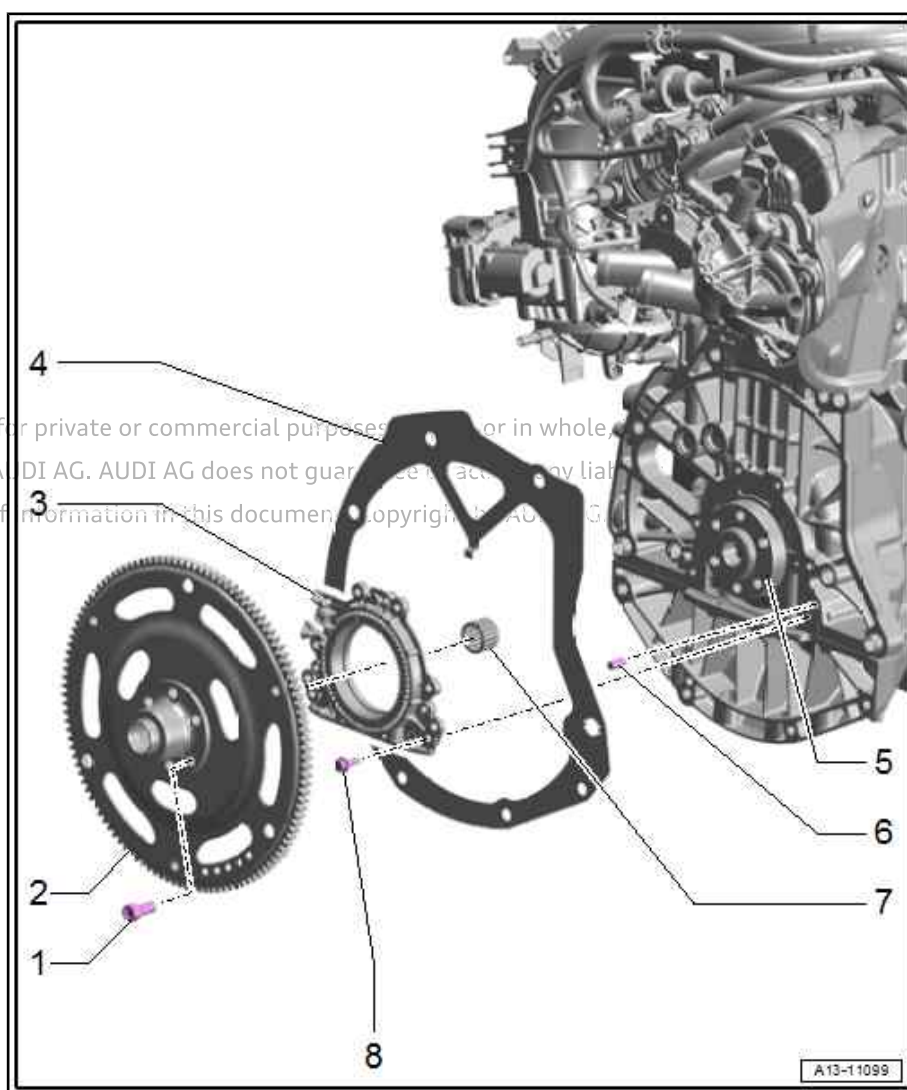
- ☐ 2x

#### 7 - Needle bearing

- ☐ For equipment version with manual gearbox
- ☐ Removing and installing ⇒ [“2.4 Renewing needle bearing in drive plate”, page 57](#)

#### 8 - Bolt

- ☐ Tightening torque and sequence  
⇒ [Fig. “Sealing flange \(gearbox end\) - tightening torque and sequence”, page 48](#)

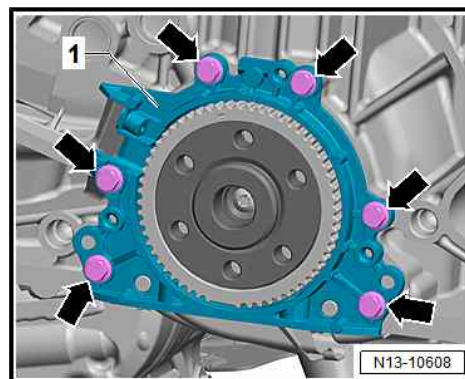




### Sealing flange (gearbox end) - tightening torque and sequence

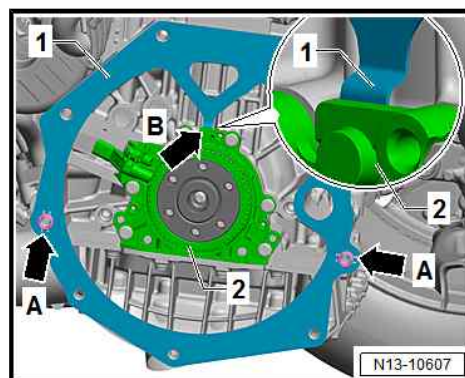
- Tighten bolts -arrows- in stages as follows:

| Stage | Tightening torque                                               |
|-------|-----------------------------------------------------------------|
| 1.    | Screw in by hand until contact is made                          |
| 2.    | Tighten in stages and in diagonal sequence; final torque 10 Nm. |



### Installing intermediate plate

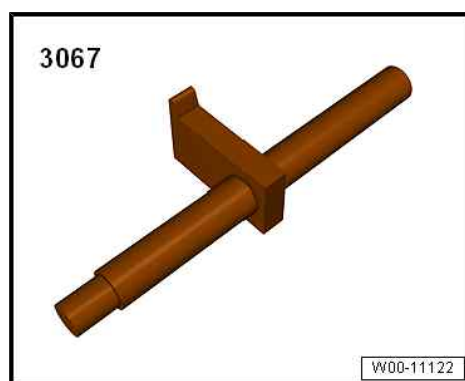
- Engage intermediate plate -1- on sealing flange -2- -arrow B- and push onto dowel sleeves -arrows A-.



## 2.2 Removing and installing drive plate

### Special tools and workshop equipment required

- ♦ Counterhold tool - 3067-



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## Removing

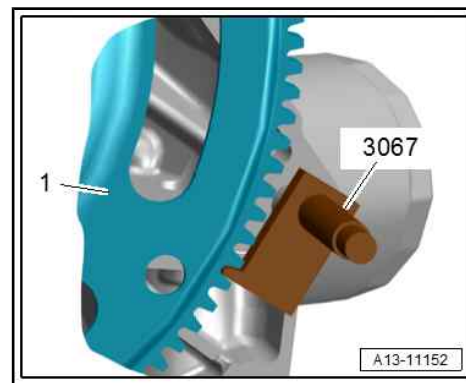
- Gearbox removed ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox .
- Insert counterhold tool - 3067- to slacken bolts.



### Caution

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

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



- Remove bolts and take off drive plate -1-.

## Installing

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

- After removing, renew bolts tightened with specified tightening angle.
- For equipment version with manual gearbox, a needle bearing is fitted in the drive plate. Before installing, check that the needle bearing is fitted. Removing and installing needle bearing in drive plate (pressing in and out)  
⇒ ["2.4 Renewing needle bearing in drive plate", page 57](#) .
- Fit counterhold tool - 3067- the other way round to tighten bolts.

## Tightening torques

- ◆ ⇒ ["2.1 Exploded view - cylinder block \(gearbox end\)", page 47](#)

## 2.3 Removing and installing sealing flange (gearbox end)

Illustrations show procedures with engine removed.

### Special tools and workshop equipment required

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



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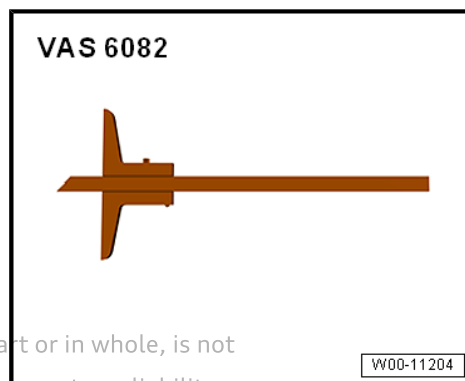


◆ Depth gauge - VAS 6082-



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◆ Assembly tool - T10134-



◆ Locking pin - T10340-

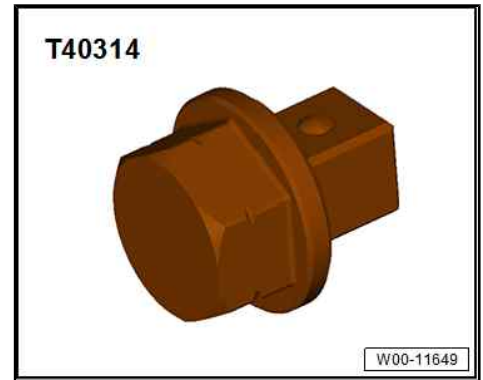


◆ Wrench, 21 mm - T40263-





◆ Adapter - T40314-



◆ Bolt, M6x35 (3x)

**Procedure**

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Gearbox removed ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox .
- Remove drive plate  
⇒ [“2.2 Removing and installing drive plate”, page 48](#) .
- Move electrical wiring harness clear at retaining clip -1- and press to one side.

Rotate crankshaft to “TDC” as follows:

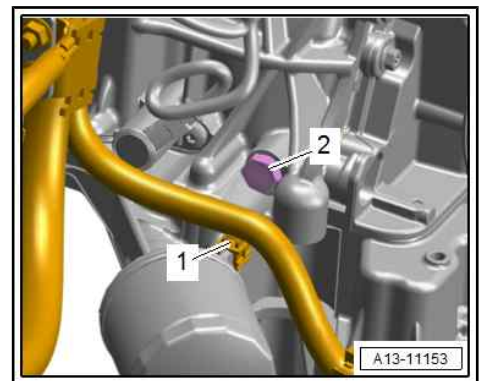
- Unscrew plug -2- for “TDC” hole on cylinder block.



**Caution**

**Risk of damage to engine.**

- ◆ *If the locking pin - T10340- cannot be screwed in far enough for the head of the pin to make contact, the crankshaft is not in the correct position.*
- ◆ *If this is the case, unscrew the locking pin and turn the crankshaft 90° in the direction of normal engine rotation.*

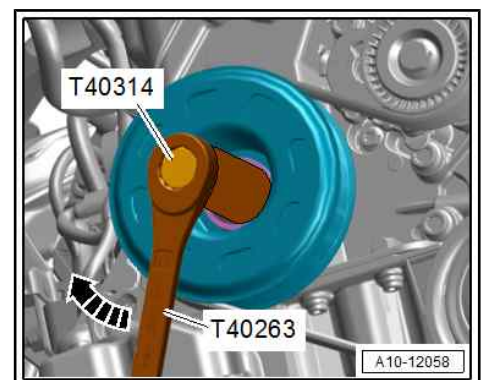


- Screw locking pin - T10340- into cylinder block as far as stop and tighten to 30 Nm.
- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft in direction of engine rotation -arrow- as far as stop.
- The crank web is now in contact with the locking pin.

**Note:**

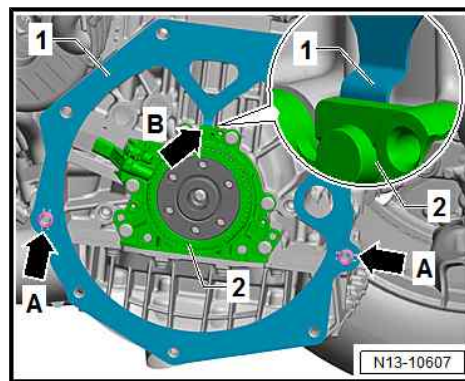
The locking pin - T10340- locks the crankshaft only in the direction of engine rotation.

- Remove sump (top section)  
⇒ [“1.4 Removing and installing sump \(top section\)”, page 134](#) .
- Remove engine speed sender - G28-  
⇒ [“1.5 Removing and installing engine speed sender G28”, page 260](#) .





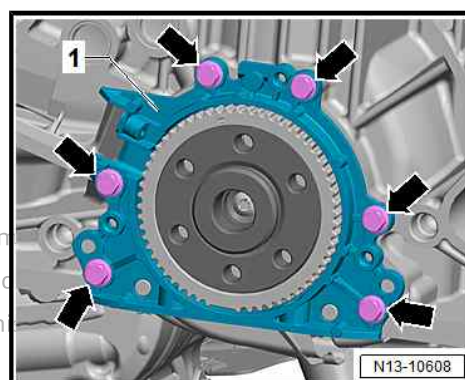
- Detach intermediate plate -1- from dowel sleeves -arrows A-.
- Guide intermediate plate upwards; at the same time, pull retaining tab -arrow B- out of opening behind sealing flange -2-.



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



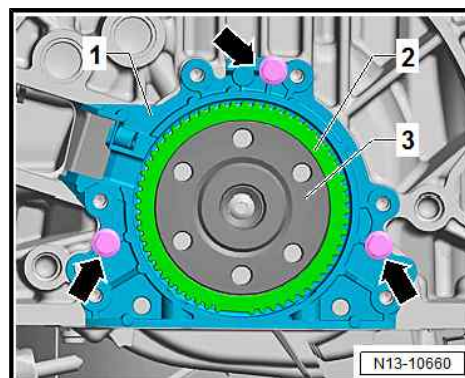
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#### Note:

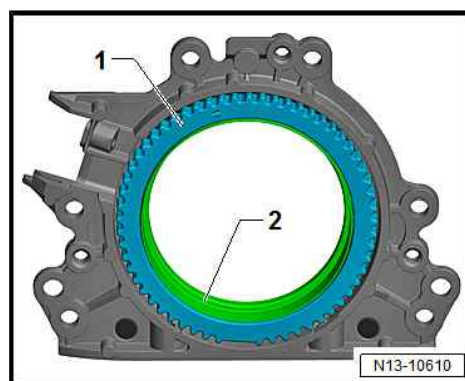
The sealing flange -1- is pressed off the crankshaft -3- together with the sender wheel -2-.

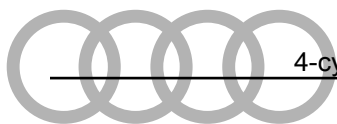
- To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than  $\frac{1}{2}$  turn at a time.
- Detach sealing flange together with sender wheel.



#### Pressing in sealing flange with sender wheel

- ◆ The sealing flange with PTFE oil seal is fitted with a sealing lip support ring -2-. This support ring acts as an assembly sleeve and must not be removed before installation.
- ◆ Sealing flange and sender wheel -1- must not be separated or rotated out of position after removal from packaging.
- ◆ The sender wheel is held in its installation position by a locating pin on the assembly tool - T10134- .
- ◆ The sealing flange and oil seal are one unit and can only be replaced together with the sender wheel.
- ◆ The assembly tool - T10134- is held in the correct position relative to the crankshaft by a guide pin which is inserted into a hole in the crankshaft.





### Construction of assembly tool - T10134- :

A - Tensioning flats

B - Nut

C - Assembly housing

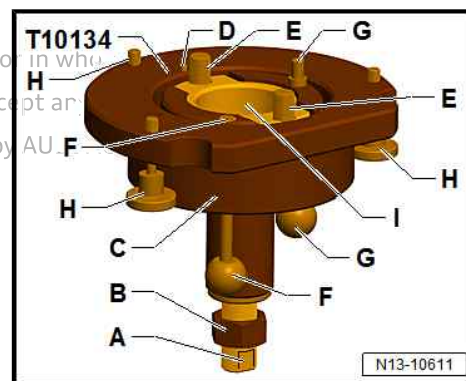
D - Locating pin

E - Hexagon socket head bolts (2x)

F - Guide pin for diesel engines (black handle)

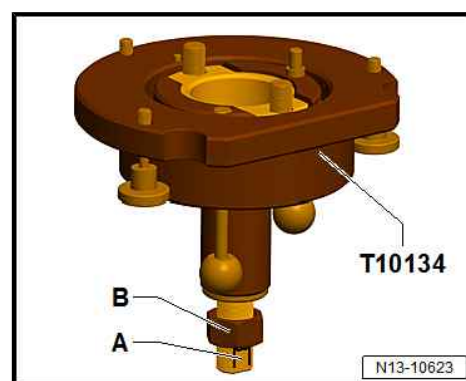
G - Guide pin for petrol engines (red handle)

H - Knurled screws (3x)

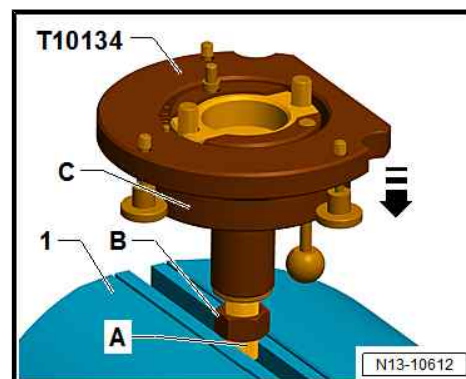


### Fitting sealing flange with sender wheel onto assembly tool - T10134- :

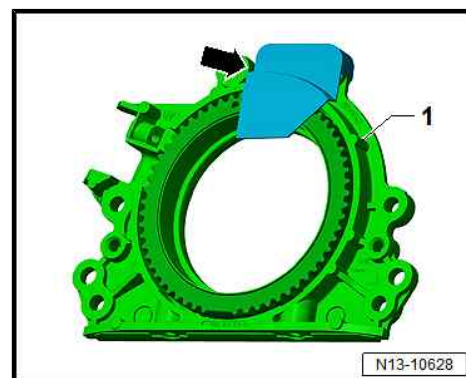
- Unscrew nut -B- until it is just in front of tightening flats -A- on threaded spindle.



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

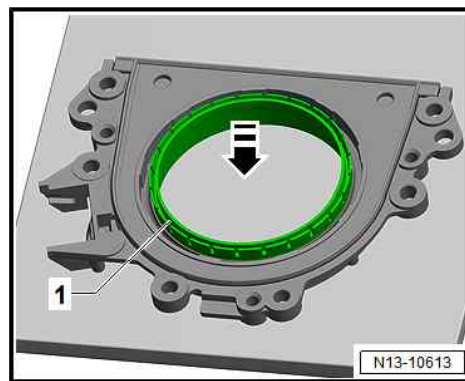


- If fitted, remove securing clip -arrow- from new sealing flange.
- Do not take the sender wheel out of the sealing flange or rotate it out of position.

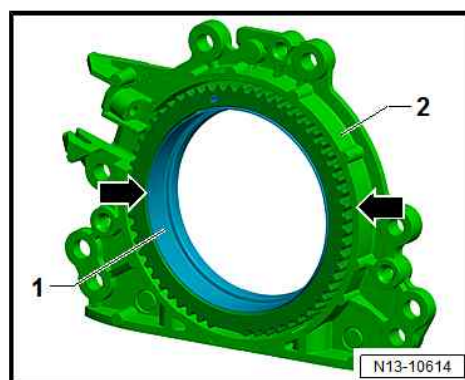




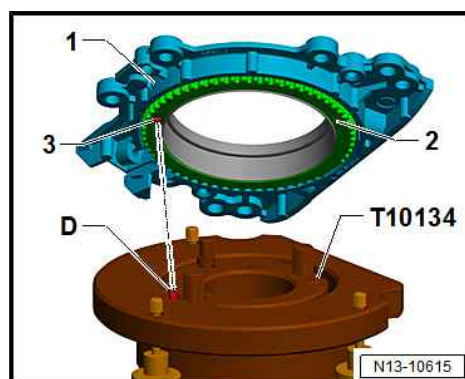
- Place sealing flange (with front side downwards) on a clean flat surface.
- Press sealing lip support ring -1- downwards in direction of -arrow- until it touches flat surface.



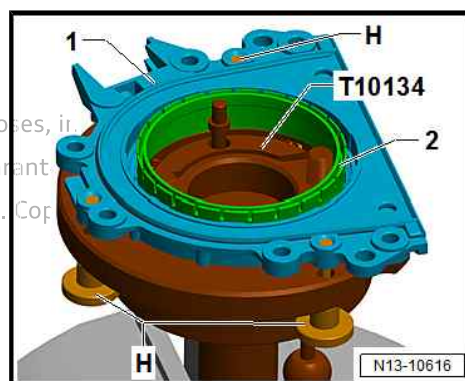
- Upper edge of sealing lip support ring -1- must be flush -arrows- with front edge of sealing flange -2-.



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



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

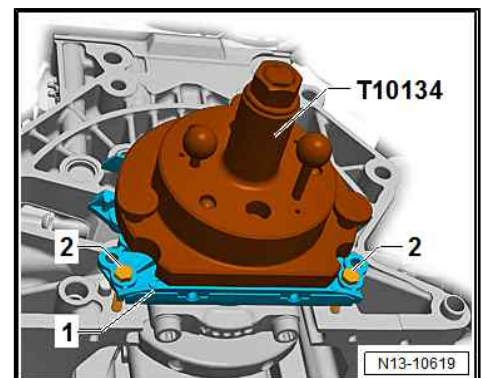
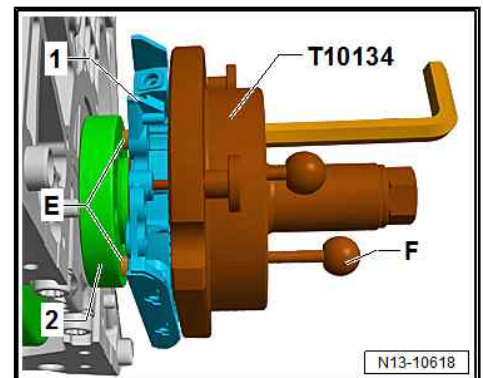
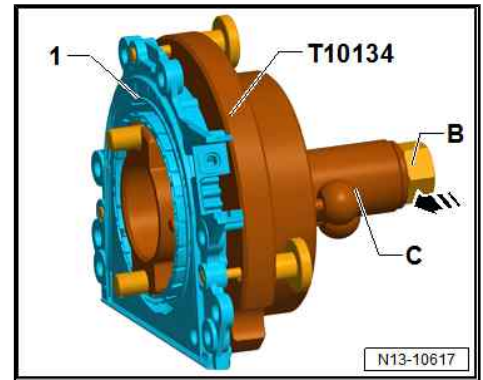


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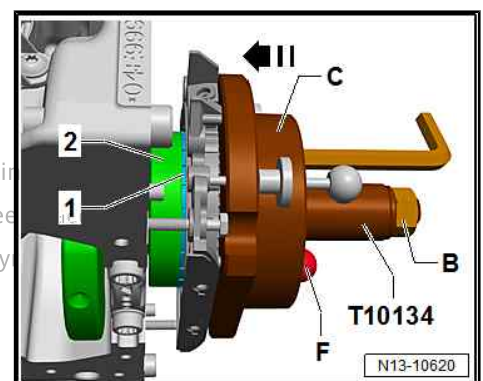
### Securing assembly tool - T10134- with sealing flange -1- on crankshaft flange:

- Crankshaft flange must be free of oil and grease.
- Engine is at "TDC" position.
- Screw nut -B- to end of threaded spindle.
- Press threaded spindle of assembly tool - T10134- in direction of -arrow- until nut -B- makes contact with assembly housing -C-.
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.
- Secure assembly tool - T10134- with sealing flange -1- to crankshaft flange -2-.
- To do so, screw hexagon socket head bolts -E- approx. 5 turns into crankshaft flange with hexagon key.
- Insert guide pin for petrol engines (red handle) -F- into crankshaft flange.
- Screw 2 bolts M6x35 -item 2- into cylinder block to guide sealing flange -1-.



### Securing assembly tool - T10134- on crankshaft flange:

- Press assembly housing -C- by hand in direction of -arrow- until sealing lip support ring -1- touches surface of crankshaft flange -2-.
- Check that guide pin for petrol engines (red handle) -F- is fitted correctly in hole in crankshaft. This ensures that sender wheel reaches its final installation position.
- The guide pin for diesel engines (black handle) must not be inserted into threaded hole in crankshaft.
- Tighten the two hexagon socket head bolts on assembly tool hand-tight.
- Screw nut -B- onto threaded spindle by hand until it touches assembly housing -C-.





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

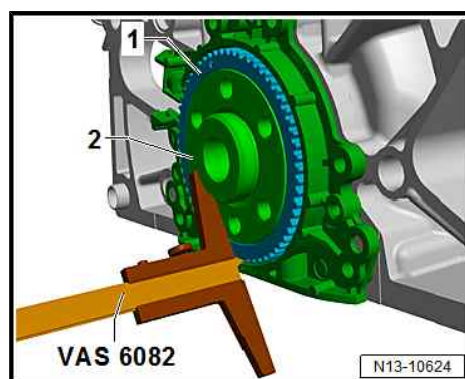
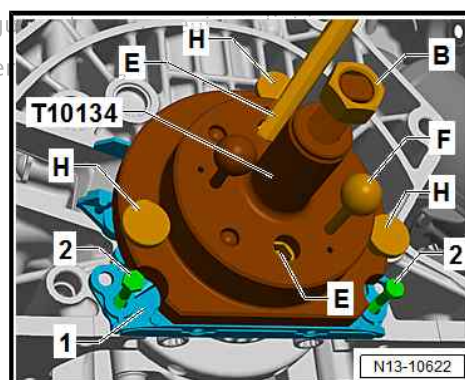
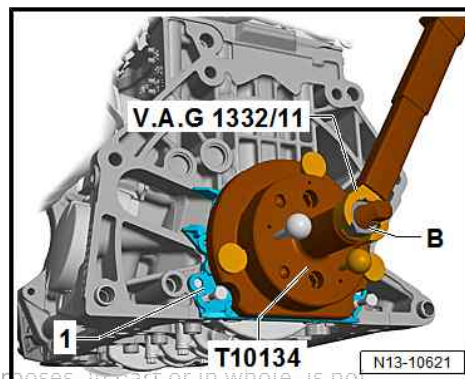
- Tighten nut -B- on assembly tool - T10134- to 35 Nm.
- There must be a small gap between cylinder block and sealing flange -1- after nut has been tightened to 35 Nm.



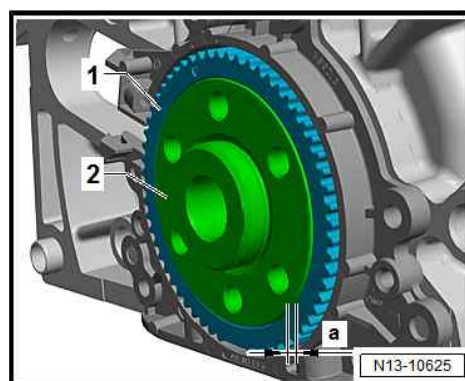
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### Checking installation position of sender wheel on crankshaft.

- Screw nut -B- to end of threaded spindle.
  - Remove both bolts -2- from cylinder block.
  - Unscrew knurled screws -H- from sealing flange -1-.
  - Unbolt assembly tool - T10134- from crankshaft flange (remove hexagon socket head bolts -E- from crankshaft flange).
  - Detach sealing lip support ring.
- 
- Apply depth gauge - VAS 6082- to crankshaft flange -2-.



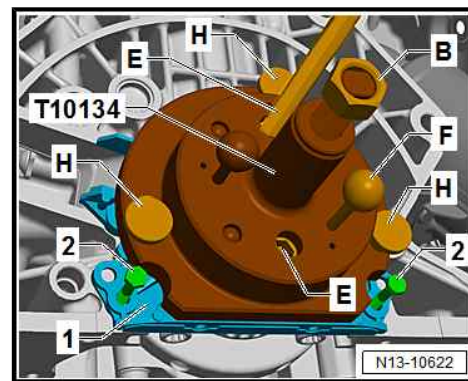
- Measure distance -a- between crankshaft flange -2- and sender wheel -1-.
- Specification: Distance -a- = 0.5 mm.
- Press sender wheel in further if measurement is too small  
⇒ [page 57](#) .
- If reading matches specification, continue with assembly  
⇒ [page 57](#) .





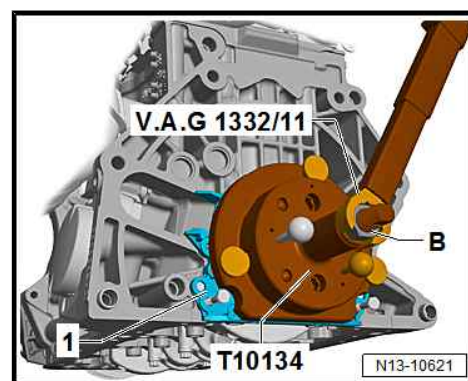
### Pressing sender wheel in further:

- Secure assembly tool - T10134- to crankshaft flange.
- Ensure that locating pin of assembly tool - T10134- is fitted in hole in sender wheel.
- Hand-tighten hexagon socket head bolts -E-.
- Slide assembly tool - T10134- onto sealing flange -1- by hand.
- Screw nut -B- onto threaded spindle by hand until it touches assembly tool - T10134- .
- Insert guide pin for petrol engines (red handle) -F- into crankshaft flange.
- Screw 2 bolts M6x35 -item 2- into cylinder block to guide sealing flange -1-.
- Tighten nut -B- on assembly tool - T10134- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ➔ [page 56](#) .
- Tighten nut on assembly tool - T10134- to 45 Nm if measurement is too small.
- Check installation position of sender wheel on crankshaft again ➔ [page 56](#) .



### Assembling:

- Tighten bolts for sealing flange in diagonal sequence.
- Install sump (upper section)  
➔ [“1.4 Removing and installing sump \(top section\)”, page 134](#) .
- Install intermediate plate  
➔ [Fig. ““Installing intermediate plate””, page 48](#) .
- Install drive plate  
➔ [“2.2 Removing and installing drive plate”, page 48](#) .
- If sender wheel was renewed together with sealing flange, perform adaptations listed in Guided Function “01 - Functions, engine mechanics” ➔ Vehicle diagnostic tester.



### Tightening torques

- ◆ ➔ [Fig. ““Sealing flange \(gearbox end\) - tightening torque and sequence””, page 48](#)
- ◆ ➔ [Fig. ““Plug for TDC drilling in cylinder block - tightening torque””, page 72](#)
- ◆ ➔ [“2.1 Exploded view - cylinder block \(gearbox end\)”, page 47](#)
- ◆ Engine speed sender - G28-  
➔ [“1.1 Exploded view - ignition system”, page 254](#)

## 2.4 Renewing needle bearing in drive plate

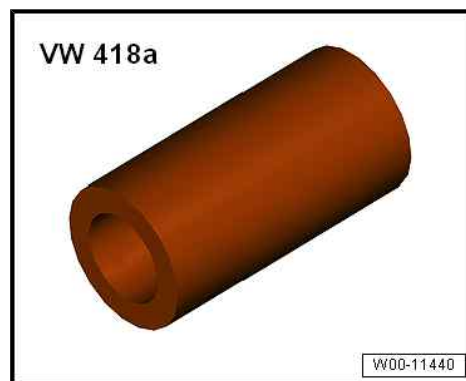
A needle bearing is fitted in the drive plate only on vehicles with manual gearbox.

**Special tools and workshop equipment required**

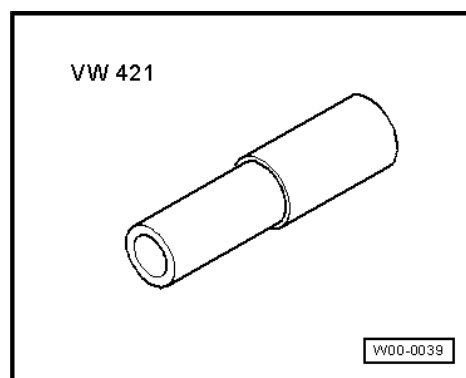




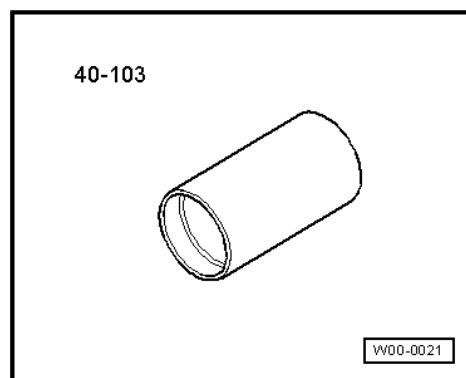
◆ Tube - VW 418 A-



◆ Tube - VW 421-

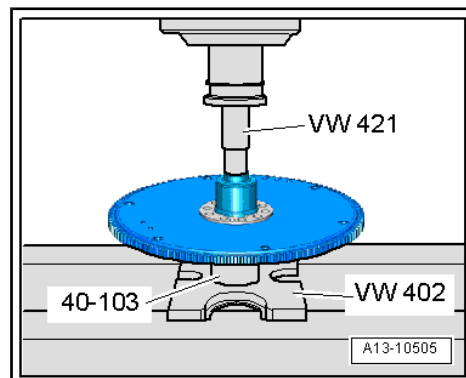


◆ Support - 40 - 103-



### Procedure

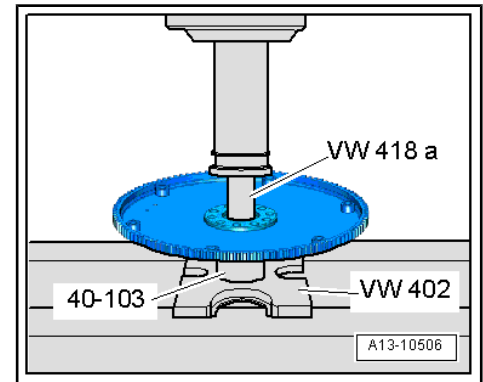
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Gearbox removed ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox .
- Remove drive plate  
⇒ [“2.2 Removing and installing drive plate”, page 48](#) .
- Place support - 40 - 103- under drive plate when pressing out and pressing in needle bearing.
- Use tube - VW 421- and workshop press and press out needle bearing.
- Smaller diameter of tube -VW 421- faces drive plate.



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- Carefully press in needle bearing as far as stop, using tube - VW 418 A- and workshop press.
- Installation position: closed side of needle bearing faces engine.
- Install drive plate  
⇒ ["2.2 Removing and installing drive plate", page 48](#) .



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### 3 Crankshaft



#### Caution

***Risk of deformation of the cylinder block bearing pedestals.***

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

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## 4 Pistons and conrods

⇒ [“4.1 Exploded view - pistons and conrods”, page 61](#)

⇒ [“4.2 Removing and installing pistons”, page 64](#)

⇒ [“4.3 Removing and installing oil spray jets”, page 65](#)

⇒ [“4.4 Checking pistons and cylinder bores”, page 67](#)

⇒ [“4.5 Separating parts of new conrod”, page 68](#)

⇒ [“4.6 Checking radial clearance of conrod bearings”, page 69](#)

### 4.1 Exploded view - pistons and conrods

- All bearing and running surfaces must be oiled before assembling.

#### 1 - Bolts

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

#### 2 - Conrod bearing cap

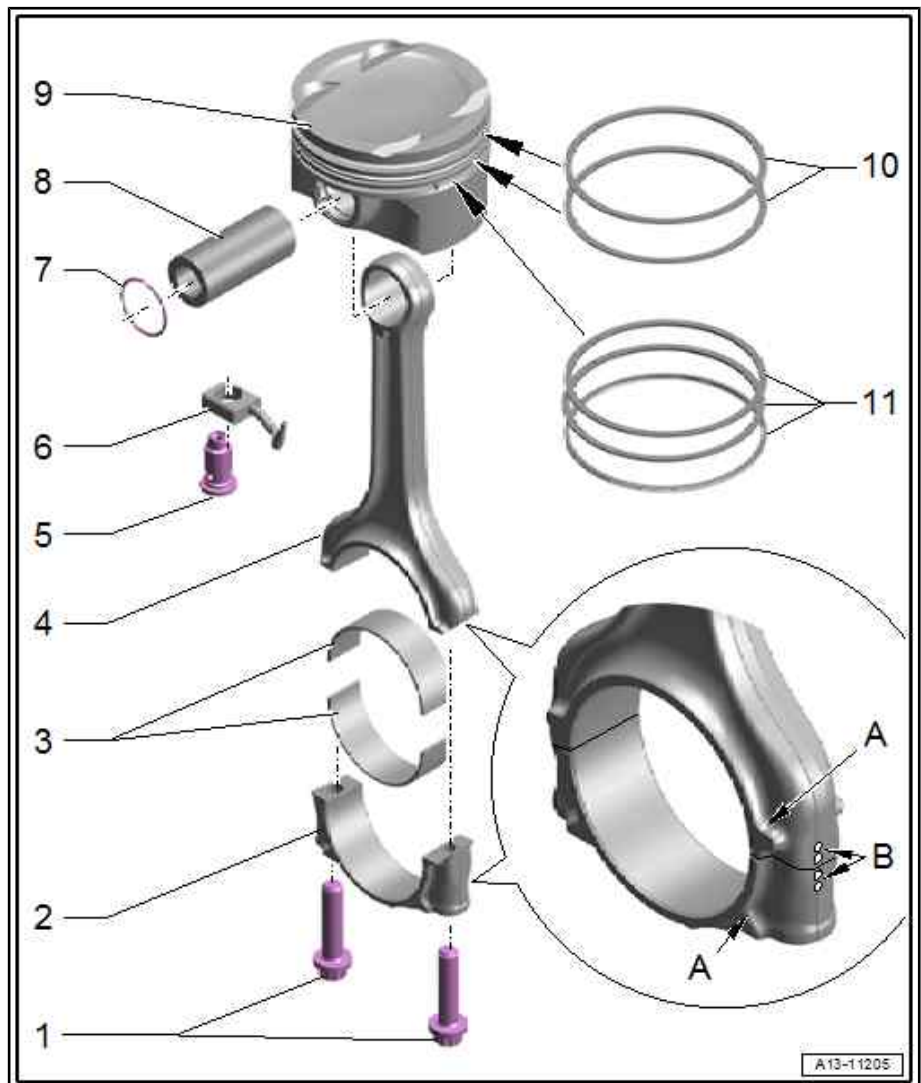
- ☐ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ☐ Mark cylinder and conrod allocation in colour -B-
- ☐ Installation position: Lug -A- on conrod bearing cap faces towards pulley end

#### 3 - Bearing shells

- ☐ Installation position  
⇒ [Fig. “Bearing shell - installation position””, page 64](#)
- ☐ Renew used bearing shells
- ☐ Check that it is securely seated

#### 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 ⇒ [“4.6 Checking radial clearance of conrod bearings”, page 69](#)
- ☐ Separating parts of new conrod ⇒ [“4.5 Separating parts of new conrod”, page 68](#)
- ☐ Installation position: Lug -A- on conrod bearing cap faces towards pulley end





## 5 - Pressure relief valve

- ☐ 27 Nm

## 6 - Oil spray jet

- ☐ For piston cooling
- ☐ Removing and installing ⇒ [“4.3 Removing and installing oil spray jets”, page 65](#)

## 7 - Circlip

- ☐ 2x
- ☐ Renew after removing

## 8 - Piston pin

- ☐ Removing and installing ⇒ [“4.2 Removing and installing pistons”, page 64](#)

## 9 - Piston

- ☐ Mark installation position and cylinder number  
⇒ [Fig. “Piston installation position and cylinder allocation”, page 62](#)
- ☐ Removing and installing ⇒ [“4.2 Removing and installing pistons”, page 64](#)
- ☐ Checking pistons and cylinder bores ⇒ [“4.4 Checking pistons and cylinder bores”, page 67](#)

## 10 - Compression rings

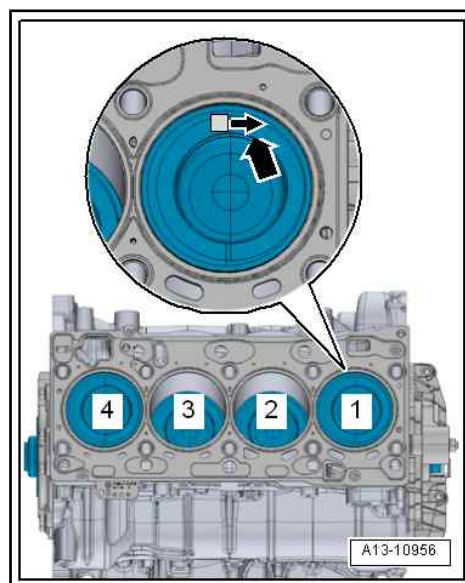
- ☐ Install using piston ring pliers -VAS 211 003- ⇒ [Fig. “Installing compression rings”, page 63](#)
- ☐ Measuring ring gap ⇒ [Fig. “Measuring piston ring gap”, page 67](#)
- ☐ Measuring ring-to-groove clearance ⇒ [Fig. “Measuring ring-to-groove clearance”, page 68](#)
- ☐ Allocation ⇒ [Fig. “Allocation of piston rings”, page 63](#)
- ☐ Installation position: marking “TOP” or side with lettering faces towards piston crown.
- ☐ Offset gaps by 120°

## 11 - Oil scraper ring

- ☐ Three-part
- ☐ Carefully remove and install by hand
- ☐ Gap cannot be measured
- ☐ Ring-to-groove clearance cannot be checked
- ☐ Allocation ⇒ [Fig. “Allocation of piston rings”, page 63](#)
- ☐ Installation position ⇒ [Fig. “Installing oil scraper ring”, page 63](#)

## Piston installation position and cylinder allocation

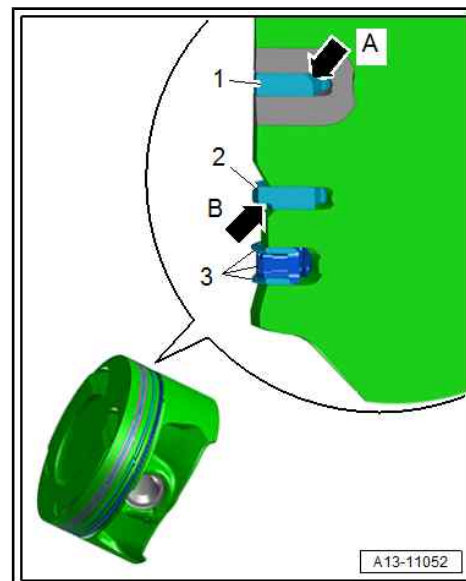
- If you intend to re-install used pistons, mark the cylinder number on the piston crown using paint.
- Arrow on piston crown points to pulley end -arrow-.





### Allocation of piston rings

- 1 - Compression ring with chamfer -arrow A- (inner side, top)
- 2 - Compression ring with shoulder -arrow B- (outer side, bottom)
- 3 - Three-part oil scraper ring



### Installing compression rings

- Installation position: marking "TOP" or side with lettering faces towards piston crown.
- Open up compression ring -2- using piston ring pliers -VAS 211 003- just far enough to be able to slide it over piston -1-.

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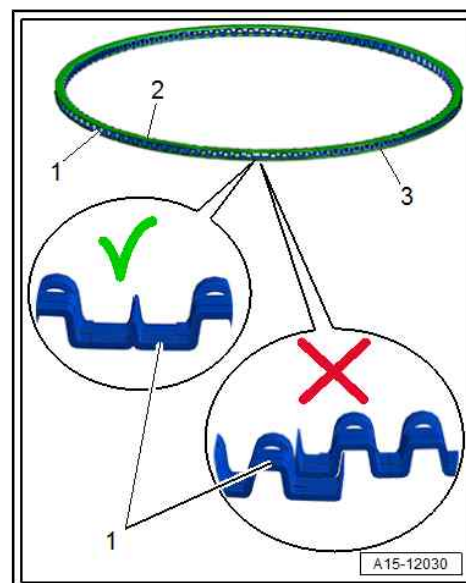


### Installing oil scraper ring

- Note installation position of spring:
- Ends of fins -2, 3- and spring -1- must be offset from one another by at least 90°.
- Install by hand.

Installation sequence:

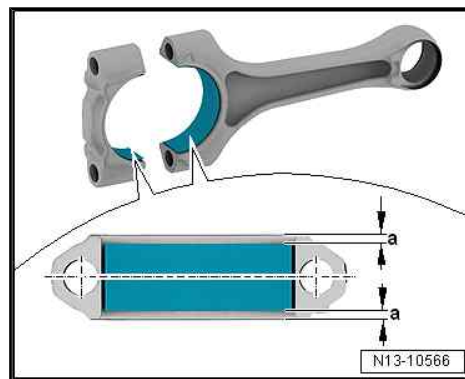
1. Insert spring -1- in groove.
2. Insert bottom fin -3- in groove.
3. Insert top fin -2- in groove.





### Bearing shell - installation position

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



## 4.2 Removing and installing pistons

### Special tools and workshop equipment required

- ◆ Pin - VW 222A-

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- ◆ Piston ring clamp, commercially available

### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Engine secured to engine and gearbox support  
⇒ [“1.2 Securing engine to engine and gearbox support”, page 20](#)
- Remove cylinder head  
⇒ [“2.3 Removing and installing cylinder head”, page 101](#) .
- Remove sump (top section)  
⇒ [“1.4 Removing and installing sump \(top section\)”, page 134](#) and detach baffle plate.
- Mark installation position and matching of:
  - ◆ Pistons to cylinders
  - ◆ Conrods to cylinders ⇒ [Item 4 \(page 61\)](#)
- Remove conrod bearing cap and pull out piston and conrod upwards.



- Take circlip -2- out of piston pin boss.
- Use drift - VW 222A- to drive out piston pin -3-.

**Note:**

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

- Detach piston -1- from conrod -4-.

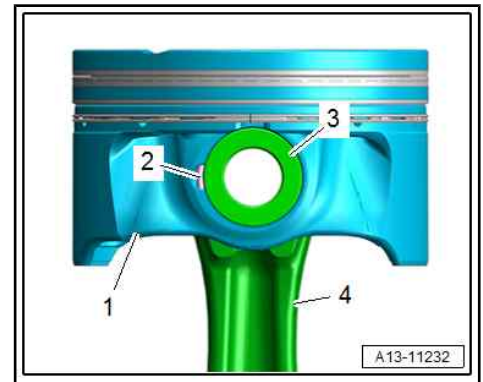
**Installing**

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

- After removing, renew bolts tightened with specified tightening angle.
- When installing, offset top gap of 3-part oil scraper ring by 120° to next compression ring.
- Install compression rings  
⇒ Fig. [““Installing compression rings””](#), page 63 .
- Install oil scraper ring  
⇒ Fig. [““Installing oil scraper ring””](#), page 63 .
- Lubricate running surfaces of bearing shells and cylinder wall with engine oil.
- Install piston using commercially available piston ring clamp; note installation position  
⇒ Fig. [““Piston installation position and cylinder allocation””](#), page 62 .
- Install conrod bearing cap; note installation position  
⇒ Item 2 (page 61) .
- Install sump (upper section)  
⇒ [“1.4 Removing and installing sump \(top section\)”](#), page 134 .
- Install cylinder head  
⇒ [“2.3 Removing and installing cylinder head”](#), page 101 .

**Tightening torques**

- ◆ ⇒ [“4.1 Exploded view - pistons and conrods”](#), page 61



## 4.3 Removing and installing oil spray jets

**Special tools and workshop equipment required**

- ◆ Socket - T10545- (no illustration)
- ◆ Wrench, 21 mm - T40263-





◆ Adapter - T40314-

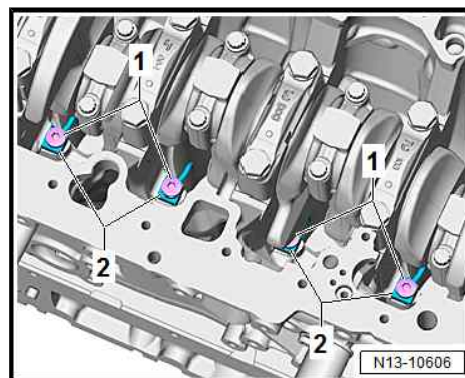
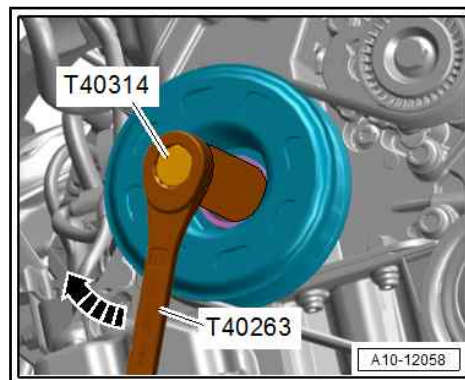


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**Removing**

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove sump (top section) ⇒ [page 134](#) and detach baffle plate.
- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft in direction of engine rotation -arrow- until corresponding bolt is accessible.
- Keeping it as vertical as possible, insert socket - T10545- into pressure relief valve and ensure that teeth of socket - T10545- and pressure relief valve engage well in each other.
- Unscrew pressure relief valve -1- using socket - T10545- .
- Remove oil spray jet -2-.





## Installing

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

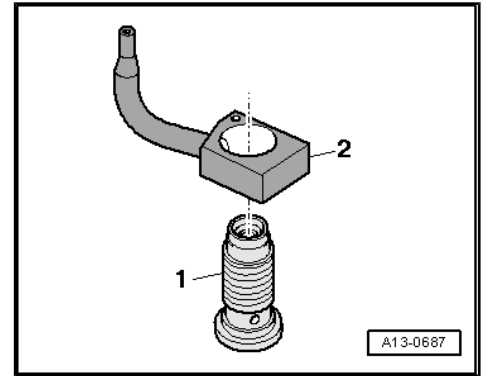
- Installation position: Align locating edge of oil spray jet -2- with machined surface of cylinder block.



### Caution

**Risk of damage to oil spray jets.**

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



- Install sump (upper section)  
⇒ [“1.4 Removing and installing sump \(top section\)”, page 134](#).

## Tightening torques

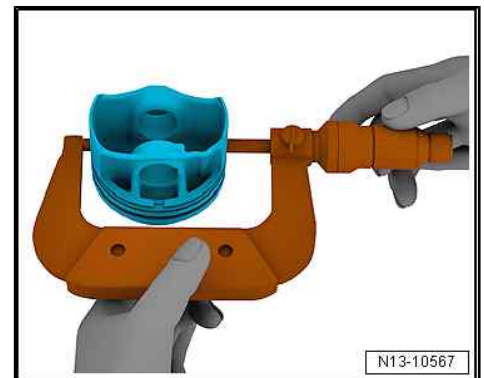
- ◆ ⇒ [“4.1 Exploded view - pistons and conrods”, page 61](#)
- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 129](#)

## 4.4 Checking pistons and cylinder bores

### Checking piston

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

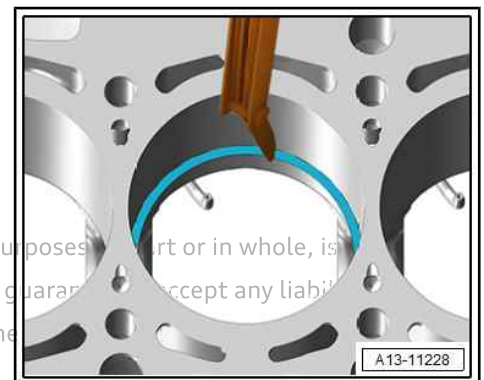
| Piston Ø mm                                                                                                                                                                                                                                                                              |                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Nominal dimension                                                                                                                                                                                                                                                                        | 74.42 <sup>1)</sup> |
| <ul style="list-style-type: none"> <li>• <sup>1)</sup> Dimensions not including coating</li> <li>• Coating thickness of pistons manufactured by “Federal-Mogul”: 0.018 mm on each side</li> <li>• Coating thickness of pistons manufactured by “Mahle”: 0.015 mm on each side</li> </ul> |                     |



### Measuring piston ring gap

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

| Piston ring      | new<br>mm             | Wear limit<br>mm |
|------------------|-----------------------|------------------|
| Compression ring | 0.20 <sup>+0.15</sup> | 1.0              |
| Oil scraper ring | Cannot be measured    |                  |

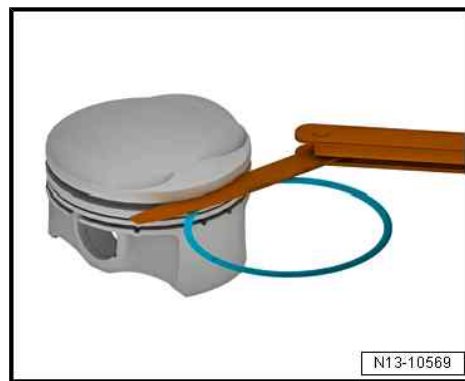




## Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

| Piston ring                                           | new mm             | Wear limit mm |
|-------------------------------------------------------|--------------------|---------------|
| 1st compression ring<br>Manufacturer: "Federal-Mogul" | 0.05 ... 0.09      | 0.15          |
| 1st compression ring<br>Manufacturer: "Mahle"         | 0.035 ... 0.085    | 0.15          |
| 2nd compression ring                                  | 0.03 ... 0.07      | 0.15          |
| Oil scraper ring                                      | Cannot be measured |               |



## Measuring cylinder bore



### Caution

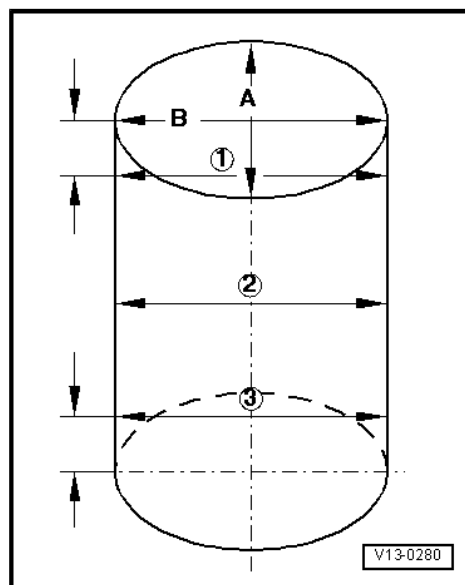
**Risk of damage to the surface of the cylinder bore.**

- ◆ **Do not machine cylinder bore (reboring, honing, grinding) with workshop equipment.**

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

| Cylinder bore Ø mm |                       |
|--------------------|-----------------------|
| Nominal dimension  | 74.5 +0.015<br>+0.005 |

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

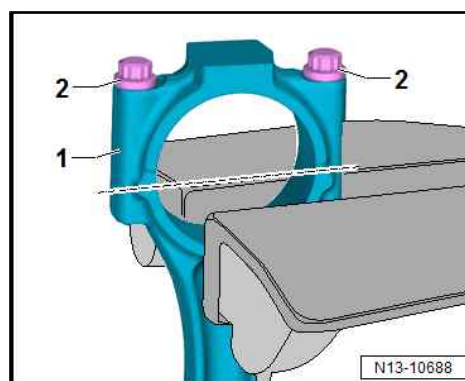


## 4.5 Separating parts of new conrod

### Procedure

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

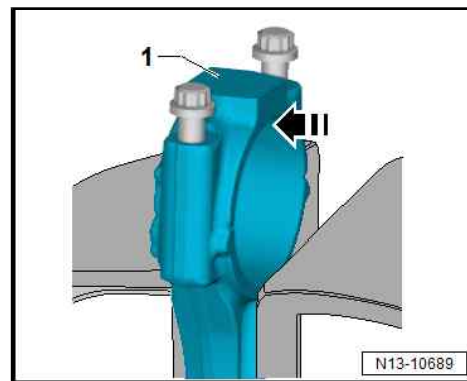
- Clamp conrod -1- lightly in a vice using aluminium jaw covers as shown in illustration.
- To avoid any risk of damage, the conrod should only be clamped lightly.
- The conrod is clamped in a position below the dotted line.
- Loosen the two bolts -2- approx. 5 turns.



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- Using a plastic hammer, carefully knock conrod bearing cap -1- loose in direction of -arrow-.



## 4.6 Checking radial clearance of conrod bearings

### Special tools and workshop equipment required

- ◆ Plastigauge

### Procedure

- Remove conrod bearing cap.
- Clean bearing cap and bearing journal.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- Fit conrod bearing cap and secure with old bolts  
⇒ [Item 1 \(page 61\)](#) without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigauge with measurement scale.
- Radial clearance: 0.028 ... 0.065 mm
- When carrying out final assembly, renew bolts.



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## 15 – Cylinder head, valve gear

### 1 Toothed belt drive

⇒ [“1.1 Exploded view - toothed belt cover”, page 70](#)

⇒ [“1.2 Exploded view - toothed belt”, page 71](#)

⇒ [“1.3 Removing and installing toothed belt cover”, page 73](#)

⇒ [“1.4 Detaching toothed belt from camshaft”, page 75](#)

⇒ [“1.5 Removing and installing toothed belt”, page 86](#)

#### 1.1 Exploded view - toothed belt cover

##### 1 - Bolt

- ☐ Renew after removing
- ☐ Tightening torque and sequence

⇒ [Fig. “Toothed belt cover \(centre\) - tightening torque and sequence”](#), page 71

##### 2 - Bolt

- ☐ 8 Nm

##### 3 - Coolant lines

##### 4 - Toothed belt cover (centre)

- ☐ Removing and installing  
⇒ [“1.3.2 Removing and installing toothed belt cover \(centre\)”](#), page 73

##### 5 - Toothed belt cover (top)

- ☐ Removing and installing  
⇒ [“1.3.1 Removing and installing toothed belt cover \(top\)”](#), page 73

##### 6 - Bolt

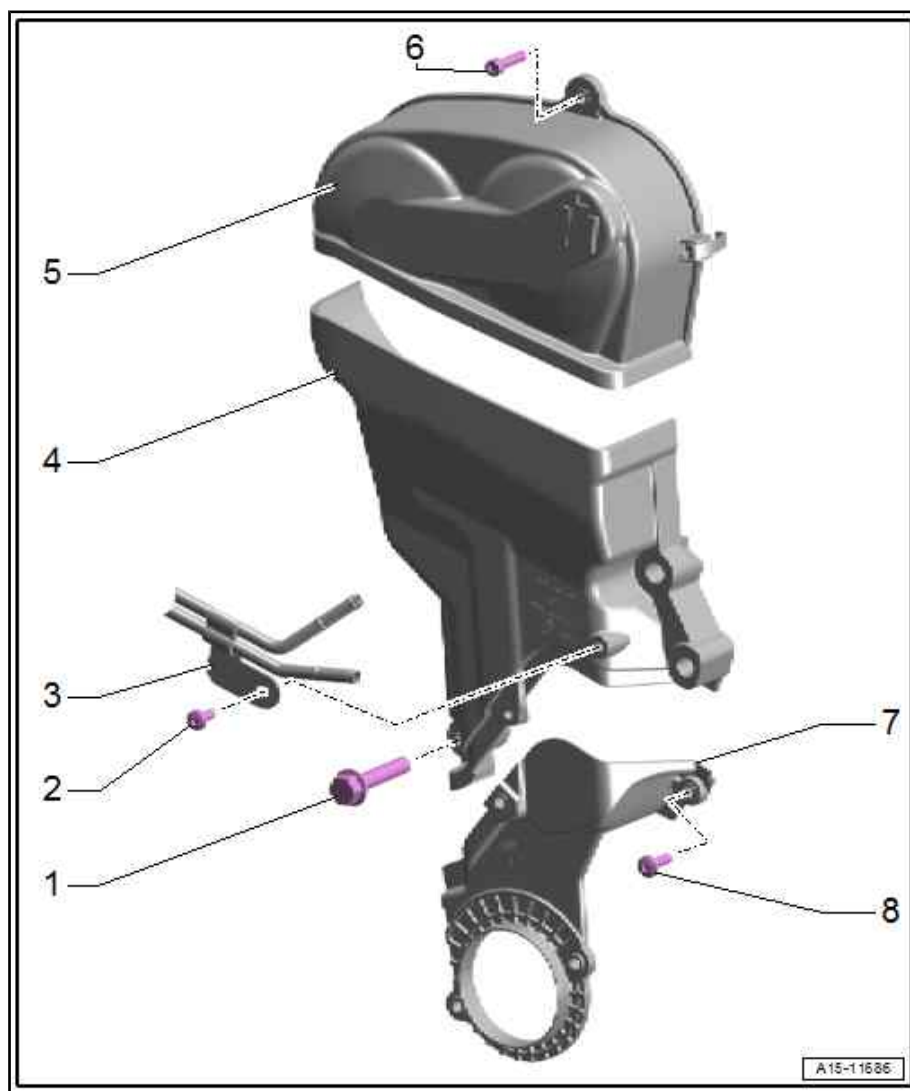
- ☐ 8 Nm

##### 7 - Toothed belt cover (bottom)

- ☐ Removing and installing  
⇒ [“1.3.3 Removing and installing toothed belt cover \(bottom\)”](#), page 75

##### 8 - Bolt

- ☐ 8 Nm



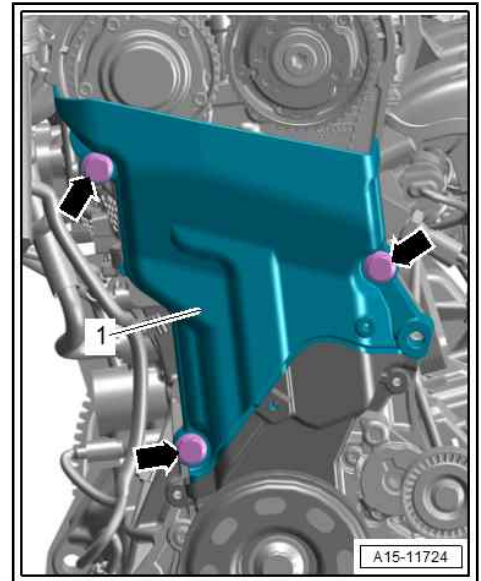
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## Toothed belt cover (centre) - tightening torque and sequence

- After removing, renew bolts tightened with specified tightening angle.
- Tighten bolts -arrows- in stages as follows:

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



## 1.2 Exploded view - toothed belt

### 1 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt tip pen
- ☐ Check for wear
- ☐ Removing from camshafts  
⇒ ["1.4 Detaching toothed belt from camshaft", page 75](#)
- ☐ Removing  
⇒ ["1.5 Removing and installing toothed belt", page 86](#)
- ☐ Installing (adjusting valve timing)  
⇒ [page 81](#)

### 2 - Bolt

- ☐ 25 Nm

### 3 - Tensioning roller

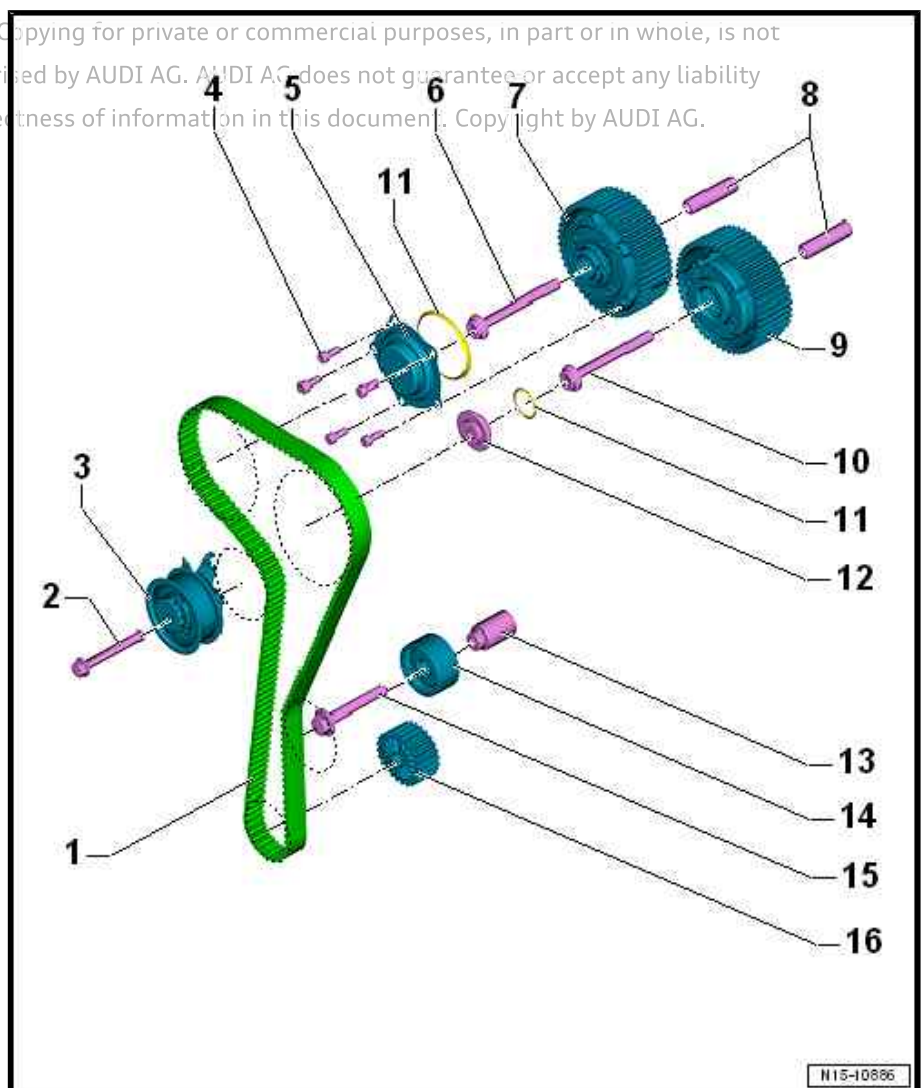
### 4 - Bolt

- ☐ 8 Nm
- ☐ Renew if damaged
- ☐ Slacken off and tighten alternately in stages (diagonal sequence)  
⇒ ["3.6 Nuts, bolts", page 6](#)

### 5 - Sealing cap

### 6 - Bolt

- ☐ Renew after removing
- ☐ 50 Nm +135°





**7 - Camshaft sprocket for exhaust camshaft**

- ☐ With camshaft adjuster

**8 - Guide sleeves**

**9 - Camshaft sprocket for inlet camshaft**

- ☐ With camshaft adjuster

**10 - Bolt**

- ☐ Renew after removing
- ☐ 50 Nm +135°

**11 - O-rings**

- ☐ Renew after removing

**12 - Plug**

- ☐ 20 Nm

**13 - Spacer sleeve**

**14 - Idler roller**

**15 - Bolt**

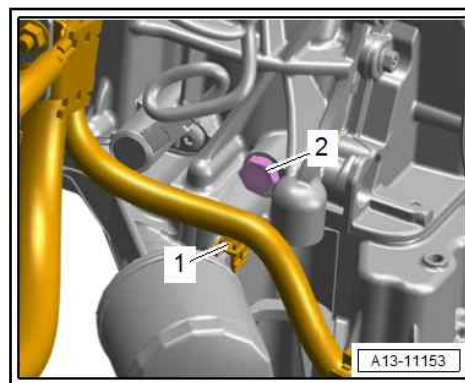
- ☐ 45 Nm

**16 - Crankshaft sprocket**

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

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

- Renew seal after removing.
- Tighten plug -2- to 30 Nm.



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## 1.3 Removing and installing toothed belt cover

⇒ [“1.3.1 Removing and installing toothed belt cover \(top\)”, page 73](#)

⇒ [“1.3.2 Removing and installing toothed belt cover \(centre\)”, page 73](#)

⇒ [“1.3.3 Removing and installing toothed belt cover \(bottom\)”, page 75](#)

### 1.3.1 Removing and installing toothed belt cover (top)

#### Removing

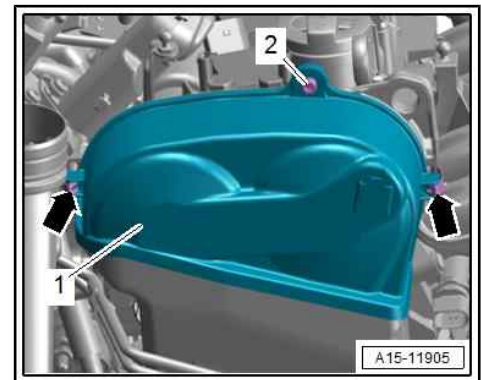
- Remove bolt -2-.
- Release clips -arrows- and detach toothed belt cover (top) -1-.

#### Installing

Installation is carried out in reverse sequence.

#### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 70](#)



### 1.3.2 Removing and installing toothed belt cover (centre)

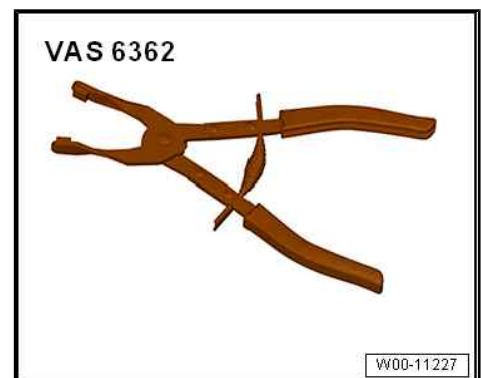
#### Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-

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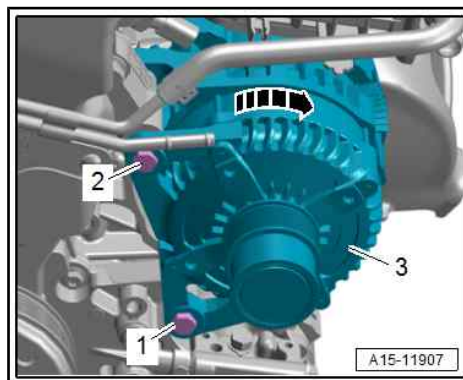
- ◆ Hose clip pliers - VAS 6362-



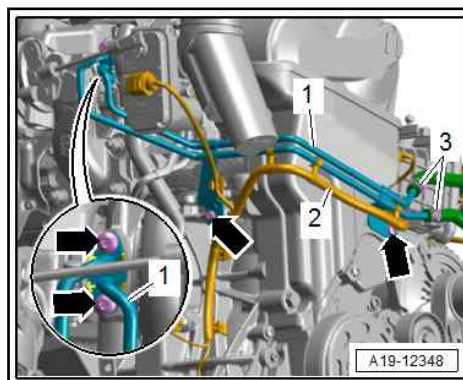


## Removing

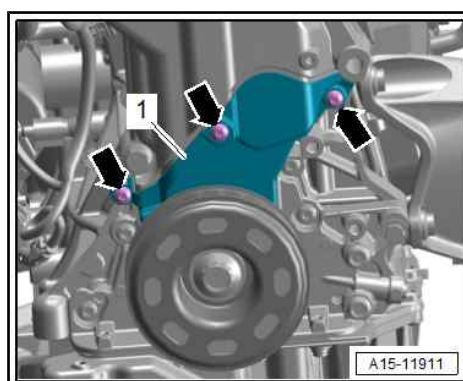
- Remove air cleaner housing  
⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#).
- Remove toothed belt cover (top)  
⇒ [“1.3.1 Removing and installing toothed belt cover \(top\)”, page 73](#).
- Remove tensioner for poly V-belt  
⇒ [“1.4 Removing and installing tensioner for poly V-belt”, page 39](#).
- Remove bolt -2- for alternator.
- Loosen (do not remove) bolt -1-, and pivot alternator -3- slightly to left side -arrow-.



- Move electrical wiring harness -2- clear.
- Place a cloth underneath to catch escaping coolant.
- Clamp off coolant hoses using hose clamps up to 25 mm -3094-, release hose clips -3- and disconnect hoses.
- Unscrew bolts -arrows- and detach coolant lines -1-.



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



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

#### Installing

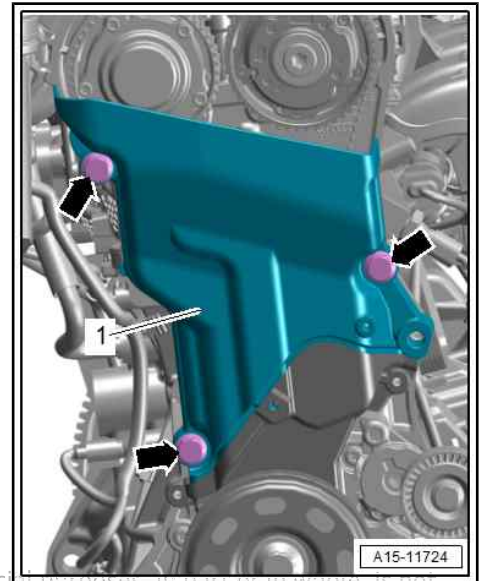
Installation is carried out in reverse order; note the following:

- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#) .
- Do not reuse coolant.
- Install air cleaner housing  
⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#) .
- Fill up with coolant ⇒ [page 155](#) .

#### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - poly V-belt drive”, page 35](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 70](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 193](#)

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



### 1.3.3 Removing and installing toothed belt cover (bottom)

#### Removing

- Remove vibration damper  
⇒ [“1.6 Removing and installing vibration damper”, page 41](#) .
- Remove bolts -arrows- and detach toothed belt cover (bottom).

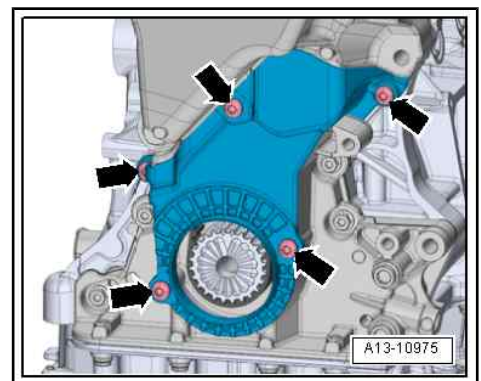
#### Installing

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

- Install vibration damper  
⇒ [“1.6 Removing and installing vibration damper”, page 41](#) .

#### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 70](#)



### 1.4 Detaching toothed belt from camshaft

#### Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-





◆ Counterhold tool - T10172A-



◆ Locking pin - T10340-



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◆ Camshaft clamp - T10494-

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◆ Assembly tool - T10487-





- ◆ Special wrench, 30 mm - T10499-



- ◆ Counterhold tool - T10554/1- with knurled screws - T10554/2-

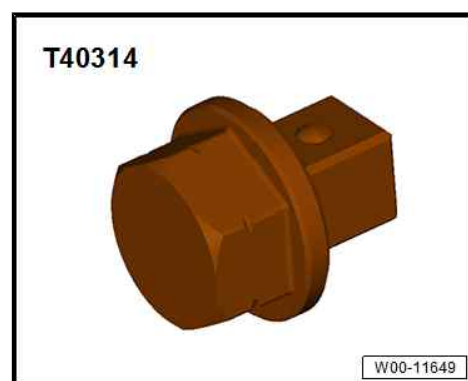


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- ◆ Wrench, 21 mm - T40263-



- ◆ Adapter - T40314-



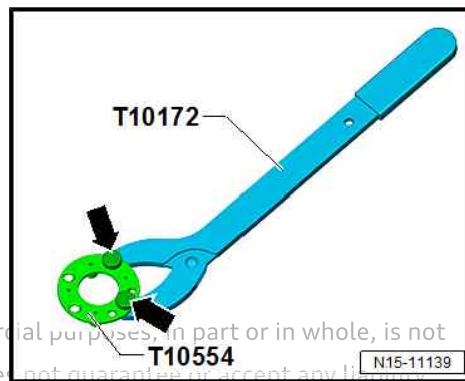


## Preparing tool

- Secure counterhold tool - T10554/1- to counterhold tool - T10554/2- using knurled screws - T10172A- -arrows-.



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## Procedure

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove cover of toothed belt for coolant pump  
⇒ [“2.5 Removing cover of toothed belt for coolant pump”, page 168](#) .
- Remove toothed belt cover (centre)  
⇒ [“1.3.2 Removing and installing toothed belt cover \(centre\)”, page 73](#) .

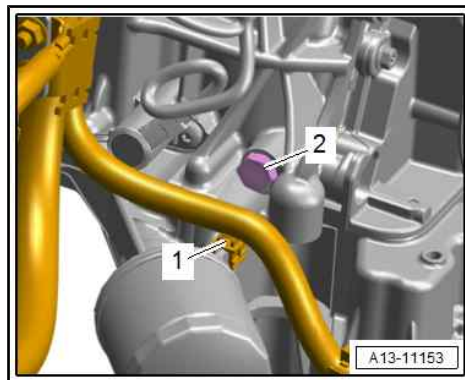
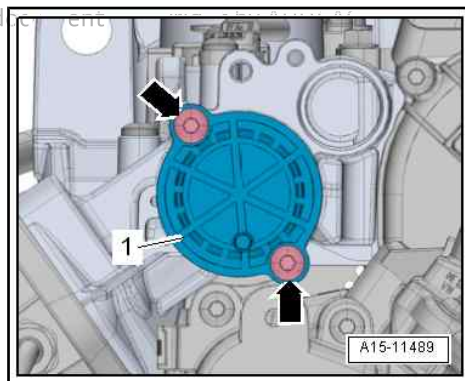


### Note

- ♦ *Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.*
- ♦ *Cover coolant pump with a cloth.*
- ♦ *Catch escaping engine oil with a cloth.*
- Unscrew bolts -arrows- and detach sealing cap -1-.
- Move electrical wiring harness clear at retaining clip -1- and press to one side.

Rotate crankshaft to “TDC” as follows:

- Unscrew plug -2- for “TDC” hole on cylinder block.

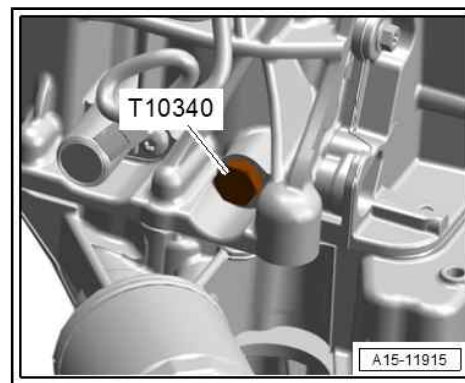




### Caution

#### *Risk of damage to engine.*

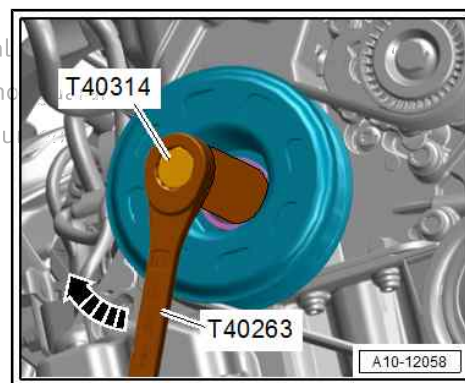
- ◆ *If the locking pin - T10340- cannot be screwed in far enough for the head of the pin to make contact, the crankshaft is not in the correct position.*
- ◆ *If this is the case, unscrew the locking pin and turn the crankshaft 90° further in the direction of normal engine rotation.*



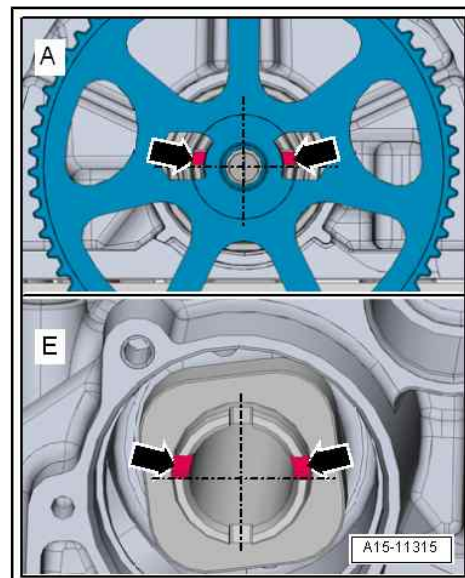
- Screw locking pin - T10340- by hand into cylinder block until head of pin makes contact, then tighten to 30 Nm.
- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft in direction of engine rotation -arrow- as far as stop.
- The crank web is now in contact with the locking pin.

#### Note:

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

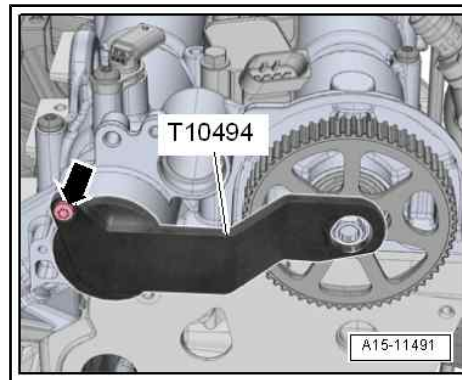


- On both camshafts, asymmetrically positioned grooves on gearbox end must now face upwards -arrows-.
- The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In TDC position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.
- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to TDC position.



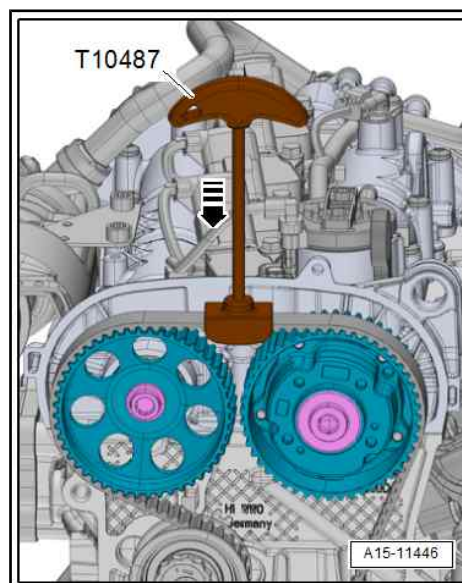


- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- When camshafts are positioned as described, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt -arrow-.



If it is not possible to insert the camshaft clamp - T10494- easily:

- Press down toothed belt -arrow- using assembly tool -T10487- and at the same time, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.



#### Caution

*Risk of damage to engine due to oil on toothed belt.*

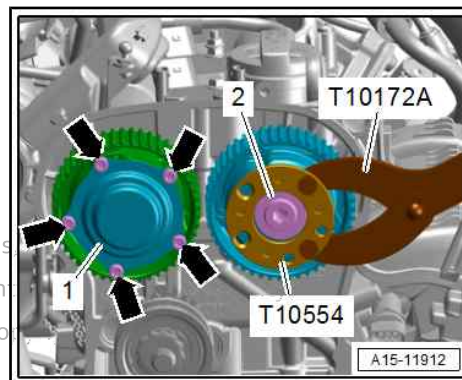
- ◆ Place a cloth underneath to catch escaping engine oil.

*Risk of damage to camshaft.*

- ◆ **The camshaft clamp - T10494- must not be used as a counterhold tool.**

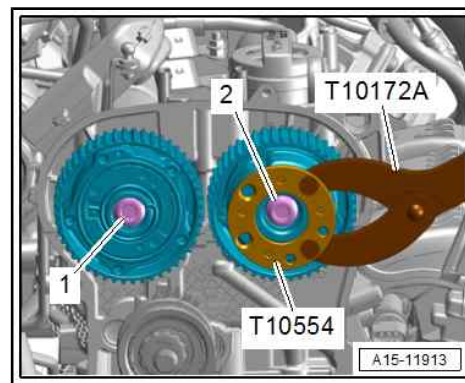
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- Remove bolts -arrows- ➔ [Item 4 \(page 71\)](#) .
- Detach filler cap -1-.
- Unscrew plug -2- using counterhold tool - T10172A- with counterhold tool - T10554- .

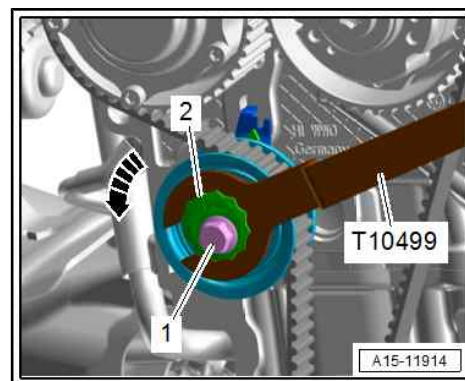




- Loosen bolts -1, 2- approx. 1 turn (use counterhold tool - T10172A- with counterhold tool - T10554- ).



- Loosen bolt -1-.
- Release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499- -arrow-.
- Detach toothed belt from camshaft sprockets.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).



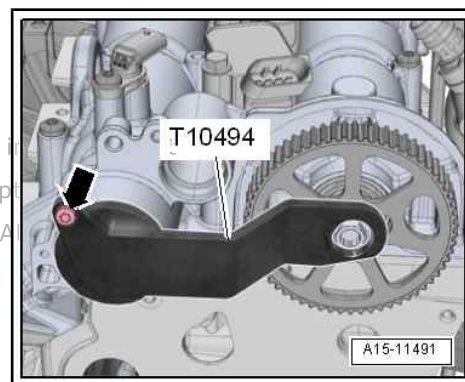
#### Caution

*Risk of damage to valves and piston crowns.*

- ◆ **Do not turn the crankshaft after the toothed belt has been removed.**

#### Installing (adjusting valve timing)

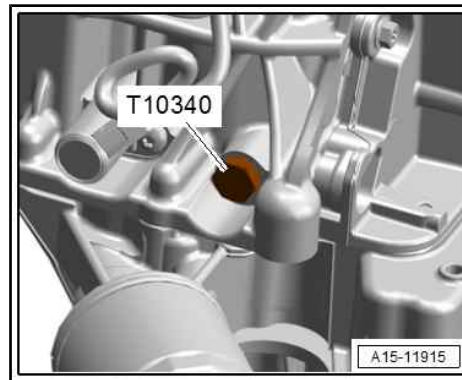
- After removing, renew bolts tightened with specified tightening angle.
- Renew O-rings and oil seal after removing.
- Check "TDC" position of camshaft and crankshaft:
- Camshaft clamp - T10494- must be fitted to camshaft housing.



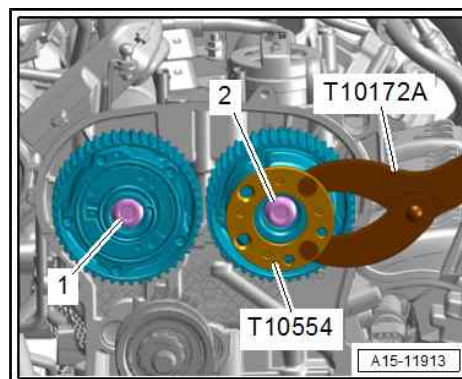
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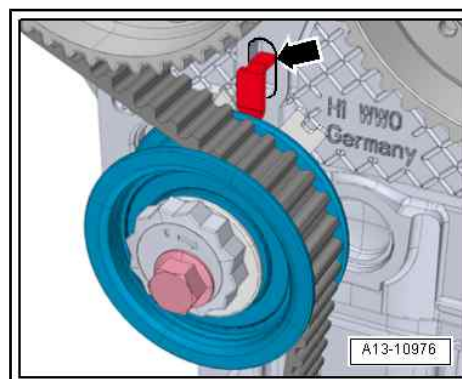
- Locking pin - T10340- is screwed into cylinder block as far as stop and tightened to 30 Nm.
- Crankshaft is turned in normal direction of rotation until it makes contact with locking pin - T10340- = "TDC" position.



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



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

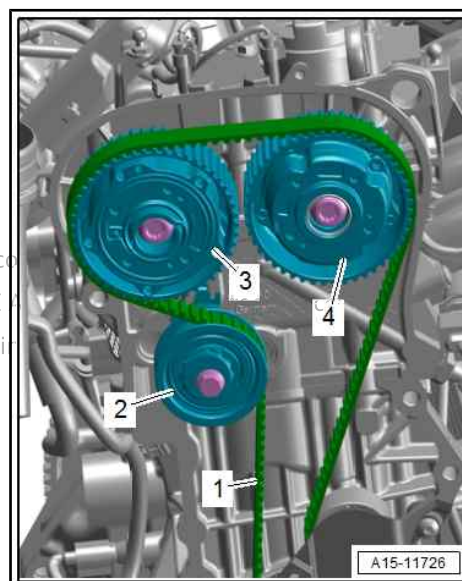


Note correct sequence for fitting toothed belt:

- Pull toothed belt -1- upwards and fit tensioning roller -2- and camshaft sprockets -3, 4-.



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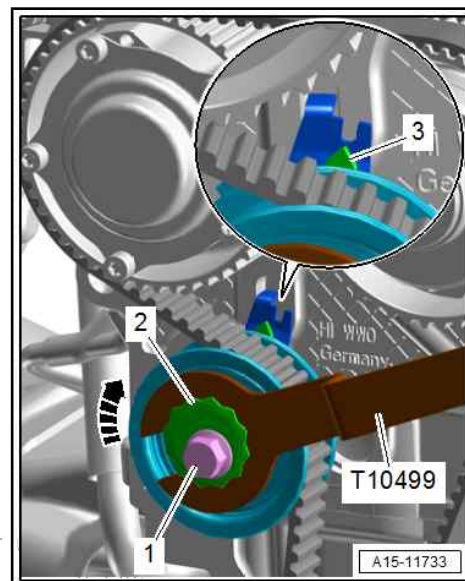




- Using special wrench, 30 mm - T10499- , turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - 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.



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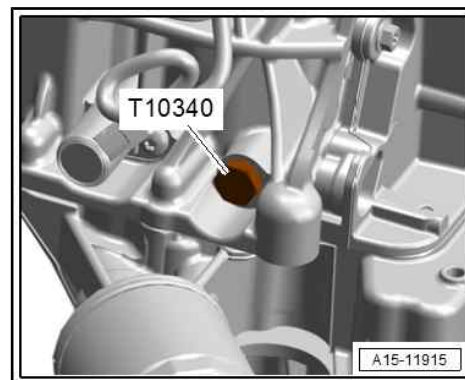
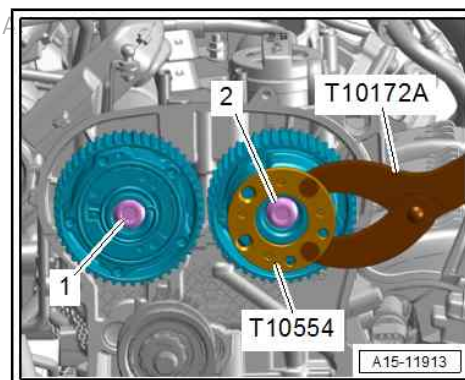


**Caution**

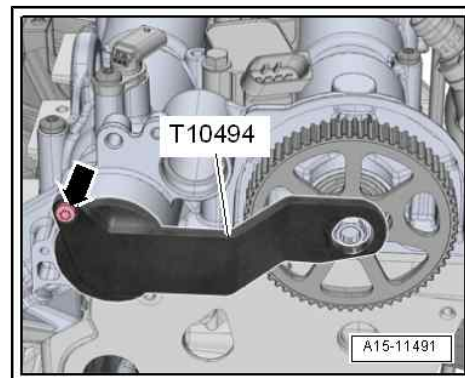
**Risk of damage to camshafts.**

- ♦ **The camshaft clamp - T10494- must not be used as a counterhold tool.**

- Tighten bolts -1, 2- initially to 50 Nm (use counterhold tool - T10172A- with counterhold tool - T10554- ).
- Remove locking pin - T10340- .



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



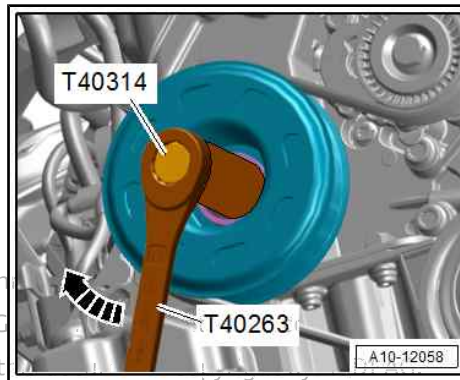


### Checking valve timing:

- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft two turns in direction of engine rotation -arrow-.



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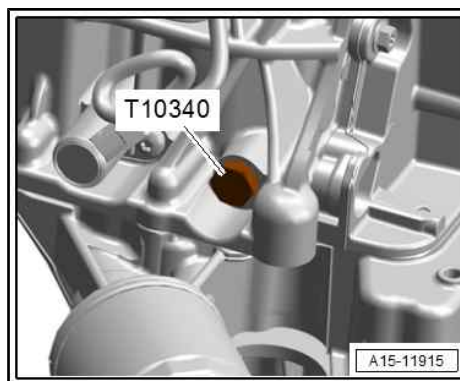
Rotate crankshaft to "TDC" as follows:



### Caution

#### *Risk of damage to engine.*

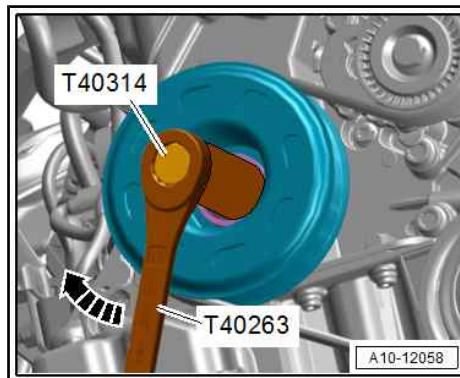
- ◆ *If the locking pin - T10340- cannot be screwed in far enough for the head of the pin to make contact, the crankshaft is not in the correct position.*
- ◆ *If this is the case, unscrew the locking pin and turn the crankshaft 90° further in the direction of normal engine rotation.*



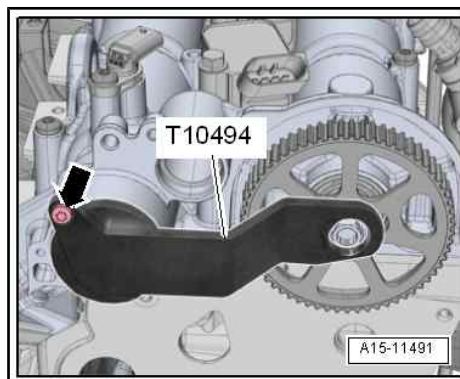
- Screw locking pin - T10340- by hand into cylinder block until head of pin makes contact, then tighten to 30 Nm.
- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft in direction of engine rotation -arrow- as far as stop.
- The crank web is now in contact with the locking pin.

### 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.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.





If it is not possible to insert the camshaft clamp - T10494- easily:

- Press down toothed belt -arrow- using assembly tool -T10487- and then insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.

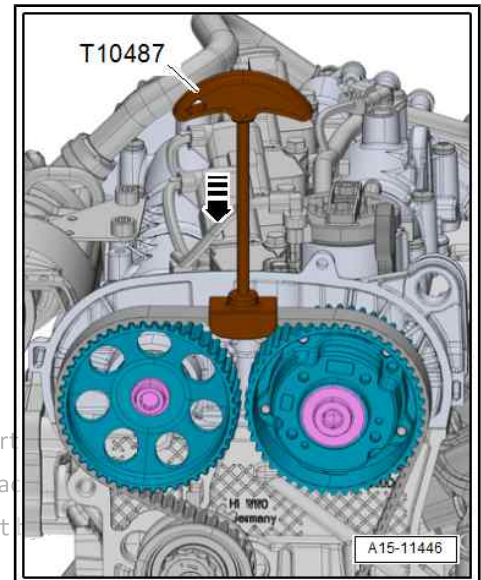
If it is not possible to insert camshaft clamp - T10494- , valve timing is not OK.

- Adjust valve timing again ➔ [page 81](#) .

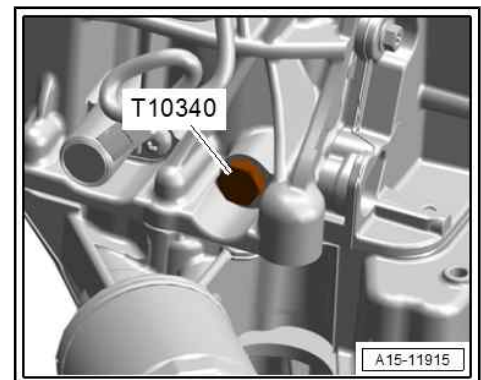
If it is possible to insert camshaft clamp - T10494- , valve timing is OK.



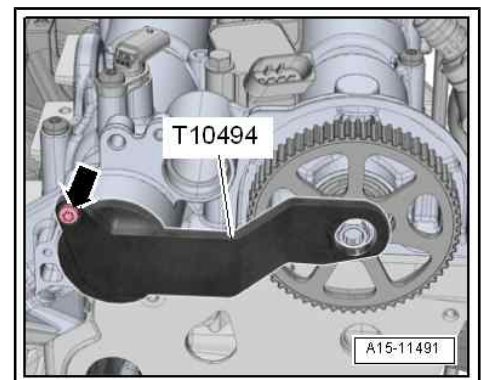
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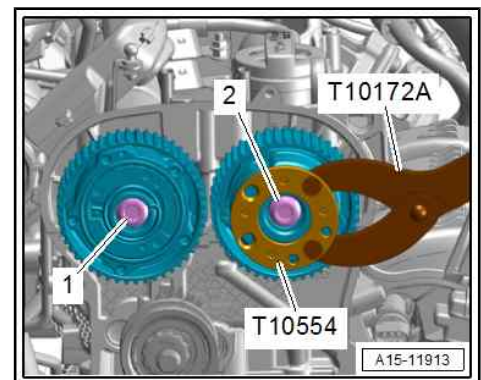
- Remove locking pin - T10340- .



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



- Tighten bolts -1, 2- (use counterhold tool - T10172A- with counterhold tool - T10554- ).





- Tighten plug -2- and bolts -arrows- for sealing cap -1- using counterhold tool - T10172A- with counterhold tool - T10554- .

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

- Install toothed belt cover (centre)  
⇒ [“1.3.2 Removing and installing toothed belt cover \(centre\)”](#), [page 73](#) .
- Install cover of toothed belt for coolant pump  
⇒ [“2.5 Removing cover of toothed belt for coolant pump”](#), [page 168](#) .

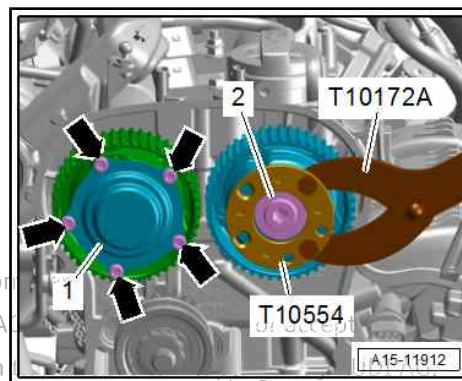
#### Tightening torques

- ◆ ⇒ [“1.2 Exploded view - toothed belt”](#), [page 71](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”](#), [page 70](#)
- ◆ ⇒ [Fig. “Plug for TDC drilling in cylinder block - tightening torque”](#), [page 72](#)
- ◆ ⇒ [“2.2 Exploded view - camshaft housing”](#), [page 99](#)

## 1.5 Removing and installing toothed belt

### Special tools and workshop equipment required

- ◆ Torque wrench - VAS 6583-



- ◆ Counterhold tool - T10172A-





- ◆ Locking pin - T10340-



- ◆ Camshaft clamp - T10494-



- ◆ Assembly tool - T10487-



- ◆ Special wrench, 30 mm - T10499-



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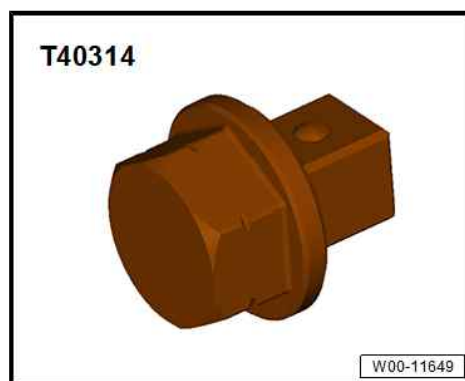
- ◆ Counterhold tool - T10554/1- with knurled screws - T10554/2-



- ◆ Wrench, 21 mm - T40263-



- ◆ Adapter - T40314-

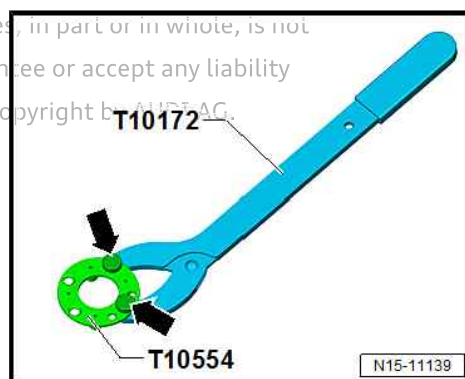


### Preparing tool

- Secure counterhold tool T10554/1- to counterhold tool T10554/2- using knurled screws - T10172A- -arrows-

### Procedure

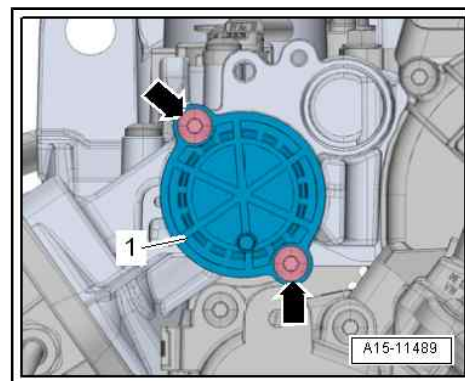
- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Remove cover of toothed belt for coolant pump  
⇒ ["2.5 Removing cover of toothed belt for coolant pump", page 168](#) .
- Remove toothed belt cover (centre)  
⇒ ["1.3.2 Removing and installing toothed belt cover \(centre\)", page 73](#) .





## Note

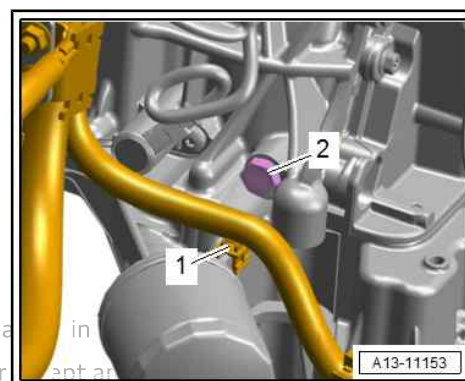
- ◆ *Danger of chemical damage to seal for coolant pump if oil enters between coolant pump and cylinder head.*
- ◆ *Cover coolant pump with a cloth.*
- ◆ *Catch escaping engine oil with a cloth.*
- Unscrew bolts -arrows- and detach sealing cap -1-.



- Move electrical wiring harness clear at retaining clip -1- and press to one side.

Rotate crankshaft to "TDC" as follows:

- Unscrew plug -2- for "TDC" hole on cylinder block.



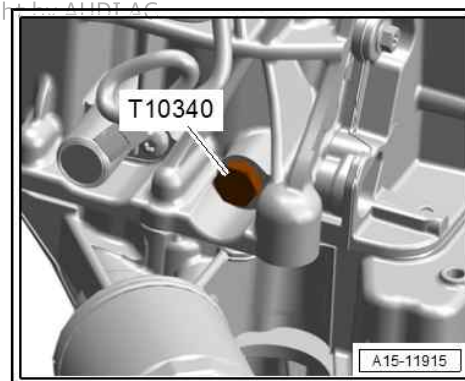
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## Caution

**Risk of damage to engine.**

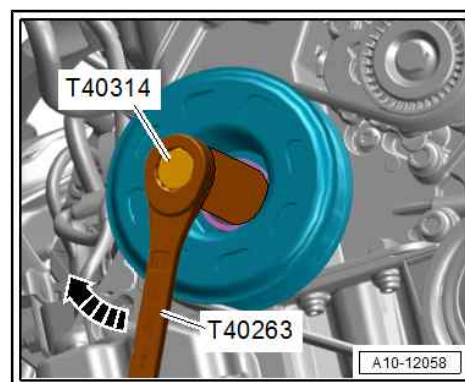
- ◆ *If the locking pin - T10340- cannot be screwed in far enough for the head of the pin to make contact, the crankshaft is not in the correct position.*
- ◆ *If this is the case, unscrew the locking pin and turn the crankshaft 90° further in the direction of normal engine rotation.*



- Screw locking pin - T10340- by hand into cylinder block until head of pin makes contact, then tighten to 30 Nm.
- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft in direction of engine rotation -arrow- as far as stop.
- The crank web is now in contact with the locking pin.

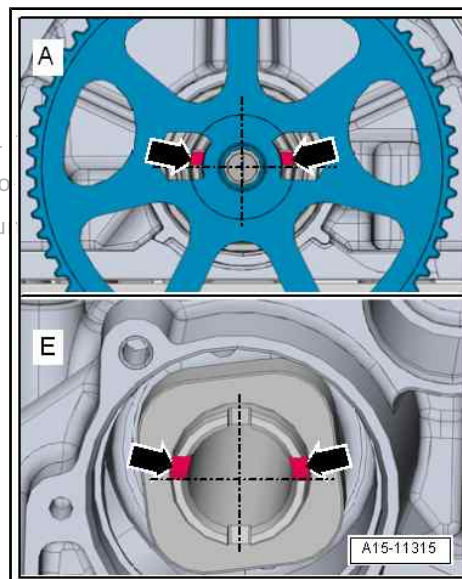
## Note:

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

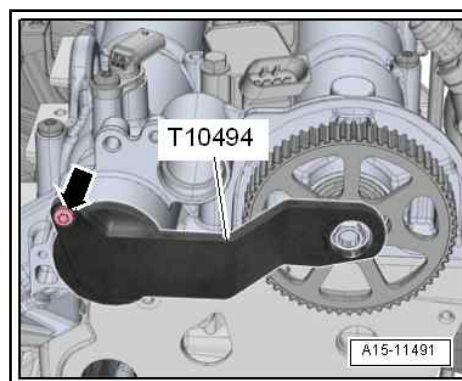




- On both camshafts, asymmetrically positioned grooves on gearbox end must now face upwards -arrows-.
- The camshafts have two pairs of grooves: one positioned symmetrically and one positioned asymmetrically. In TDC position, the asymmetrically positioned pair of grooves must be above the imaginary horizontal centre line.
- If camshafts are not positioned as described, unscrew locking pin - T10340- , turn crankshaft one rotation further and return to TDC position.
- Remove toothed belt cover (bottom)  
⇒ **“1.3.3 Removing and installing toothed belt cover (bottom)”**, **page 75** .

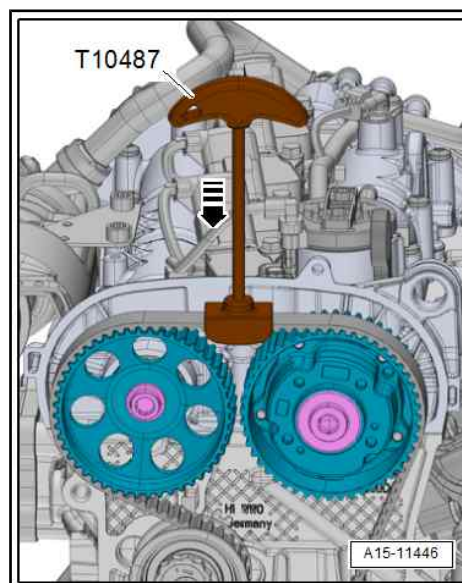


- It should be possible to insert the camshaft clamp - T10494- easily.
- Do not knock camshaft clamp into place with any kind of tool.
- When camshafts are positioned as described, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt -arrow-.



If it is not possible to insert the camshaft clamp - T10494- easily:

- Press down toothed belt -arrow- using assembly tool -T10487- and at the same time, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.





### Caution

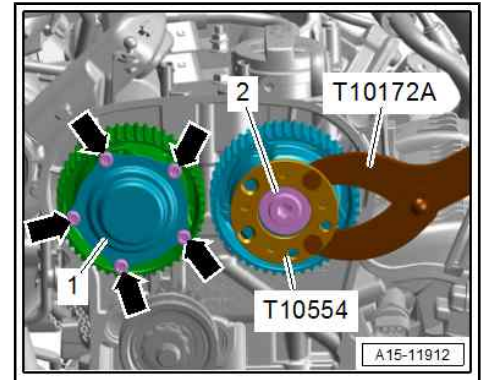
*Risk of damage to engine due to oil on toothed belt.*

◆ *Place a cloth underneath to catch escaping engine oil.*

*Risk of damage to camshaft.*

◆ *The camshaft clamp - T10494- must not be used as a counterhold tool.*

- Remove bolts -arrows- ➔ [Item 4 \(page 71\)](#) .
- Detach filler cap -1-.
- Unscrew plug -2- using counterhold tool - T10172A- with counterhold tool - T10554- .
- Loosen bolts -1, 2- approx. 1 turn (use counterhold tool - T10172A- with counterhold tool - T10554- ).

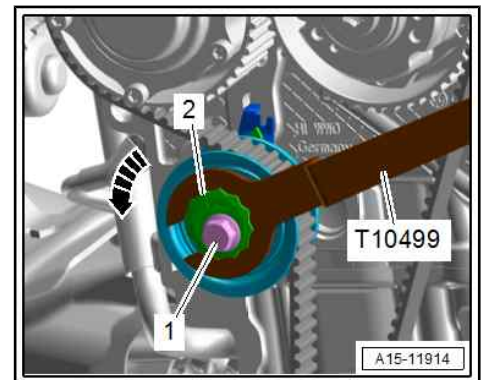
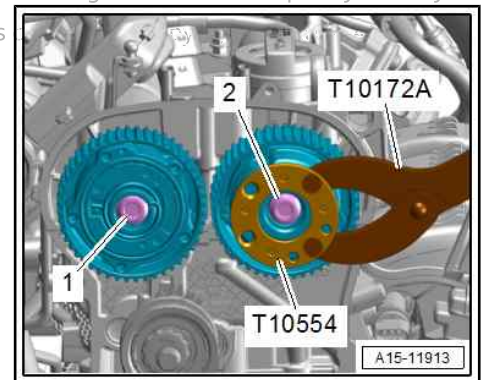


### Caution

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

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

- Loosen bolt -1-.
- Release tensioning roller on eccentric adjuster -2- using special wrench, 30 mm - T10499- -arrow-.
- Take off toothed belt.
- The bending radius of the toothed belt must be at least 25 mm (approx. half the diameter of the crankshaft sprocket).





- Detach crankshaft sprocket -1- -arrow-.



### Caution

***Risk of damage to valves and piston crowns.***

- ◆ ***Do not turn the crankshaft after the toothed belt has been removed.***

### Installing (adjusting valve timing)

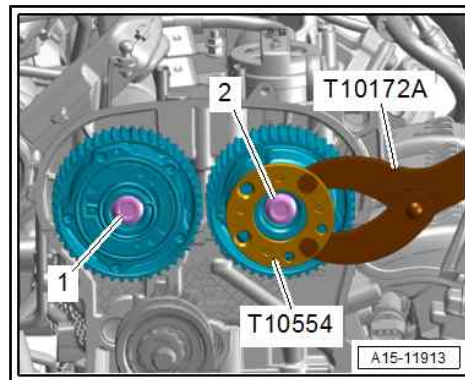
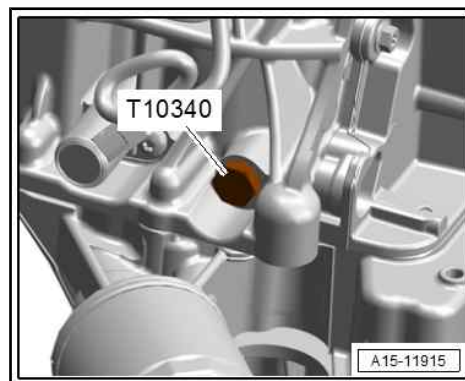
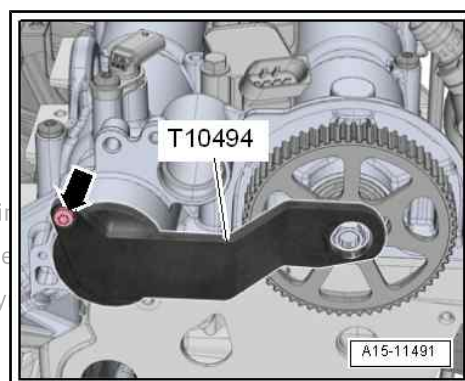
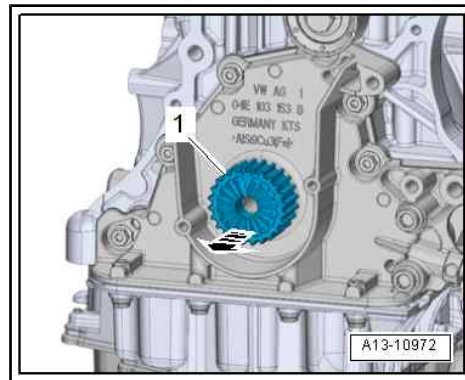
- After removing, renew bolts tightened with specified tightening angle.
- Renew O-rings and oil seal after removing.
- Check "TDC" position of camshaft and crankshaft:
- Camshaft clamp - T10494- must be fitted to camshaft housing.



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- 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 and screw them in loosely.
- It should just be possible to turn the adjusters on the camshafts without axial movement.



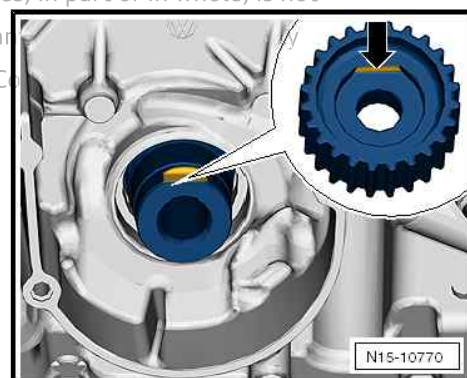
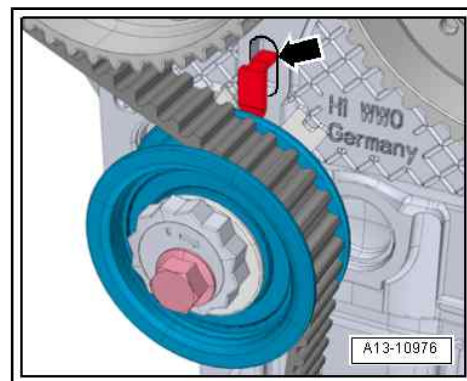


- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



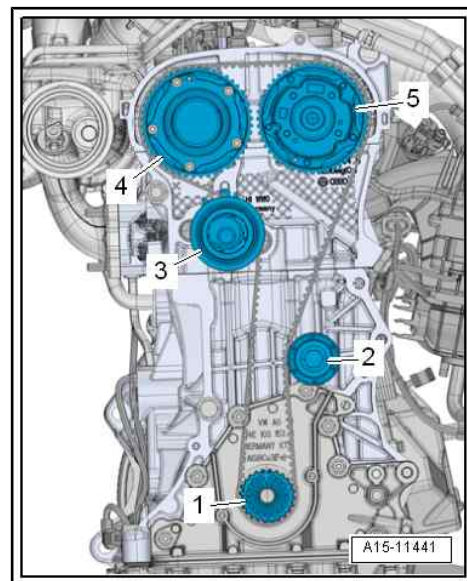
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- Fit crankshaft sprocket onto crankshaft.
- Contact surface between poly V-belt pulley and crankshaft sprocket must be free of oil and grease.
- Machined surface -arrow- of crankshaft sprocket must be positioned over machined surface of crankshaft journal.



Note correct sequence for fitting toothed belt:

- 1 - Crankshaft sprocket
  - 2 - Idler roller
  - 3 - Tensioning roller
  - 4 - Camshaft sprocket, exhaust side
  - 5 - Camshaft sprocket, inlet side
- Install toothed belt cover (bottom)  
⇒ "1.3.3 Removing and installing toothed belt cover (bottom)".  
[page 75](#) .





- Using special wrench, 30 mm - T10499- , turn eccentric adjuster -2- of tensioning roller in direction of -arrow- until adjustment indicator -3- is positioned approx. 10 mm to right of adjustment window.
- Turn eccentric adjuster back until adjustment indicator is positioned exactly in adjustment window.
- Hold eccentric adjuster in this position and tighten bolt -1- using insert tool, 13 mm - 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.



**Caution**

**Risk of damage to camshafts.**

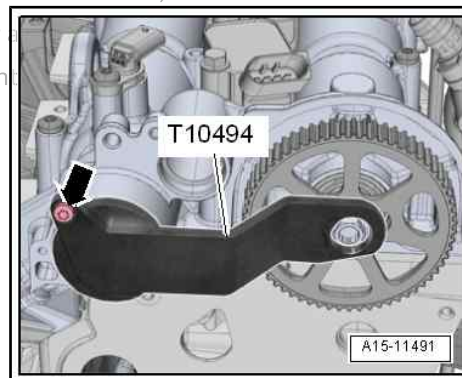
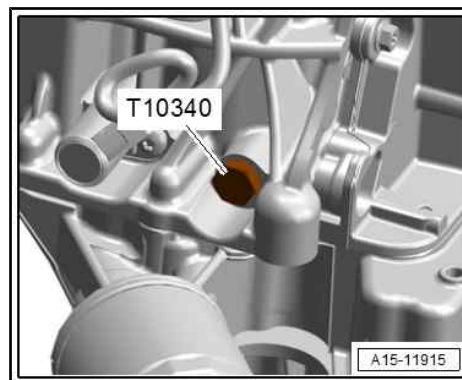
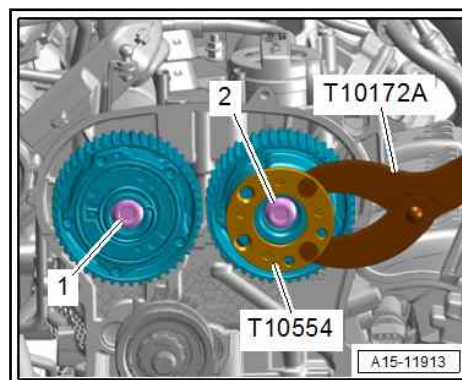
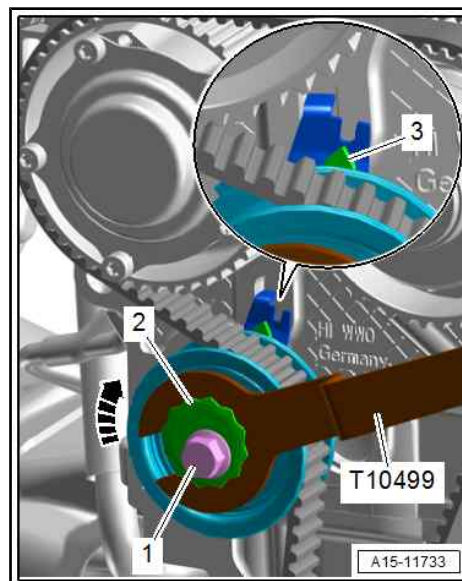
- ♦ *The camshaft clamp - T10494- must not be used as a counterhold tool.*

- Tighten bolts -1, 2- initially to 50 Nm (use counterhold tool - T10172A- with counterhold tool - T10554- ).
- Remove locking pin - T10340- .



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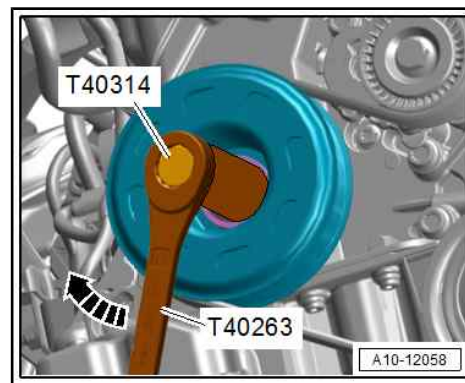
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### Checking valve timing:

- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft two turns in direction of engine rotation -arrow-.



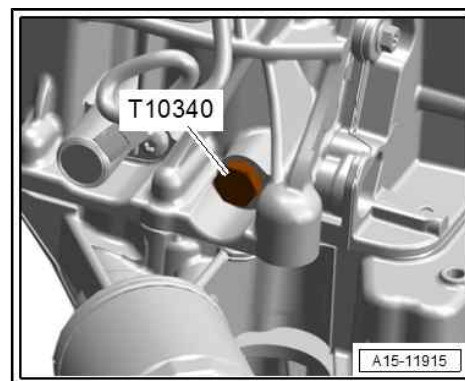
Rotate crankshaft to “TDC” as follows:



#### Caution

*Risk of damage to engine.*

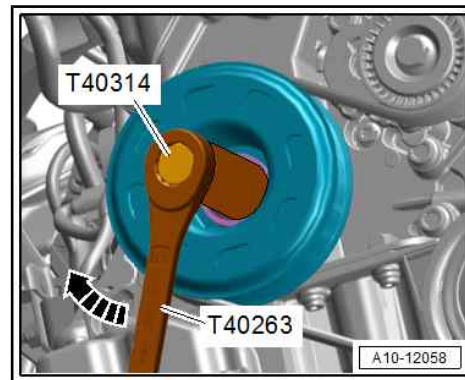
- ◆ *If the locking pin - T10340- cannot be screwed in far enough for the head of the pin to make contact, the crankshaft is not in the correct position.*
- ◆ *If this is the case, unscrew the locking pin and turn the crankshaft 90° further in the direction of normal engine rotation.*



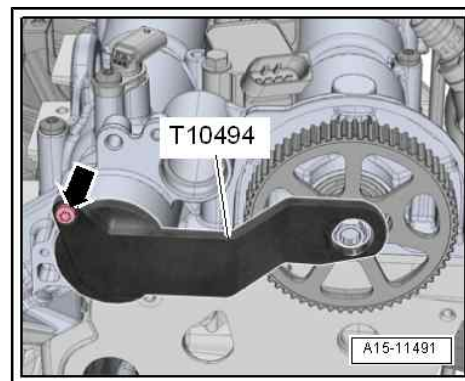
- Screw locking pin - T10340- by hand into cylinder block until head of pin makes contact, then tighten to 30 Nm.
- Using wrench, 21 mm - T40263- , adapter - T40314- and socket (21 mm), turn crankshaft in direction of engine rotation -arrow- as far as stop.
- The crank web is now in contact with the locking pin.

#### 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.
- Do not knock camshaft clamp into place with any kind of tool.
- Insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten with bolt -arrow-.



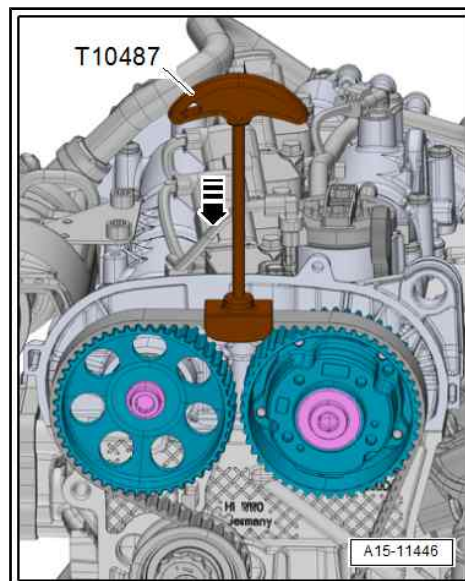


If it is not possible to insert the camshaft clamp - T10494- easily:

- Press down toothed belt -arrow- using assembly tool -T10487- and at the same time, insert camshaft clamp - T10494- into camshafts as far as stop and hand-tighten bolt.

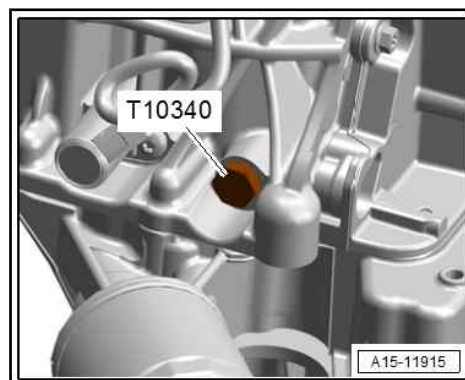
If it is not possible to insert camshaft clamp - T10494- , valve timing is not OK.

- Adjust valve timing again ➔ [page 92](#) .

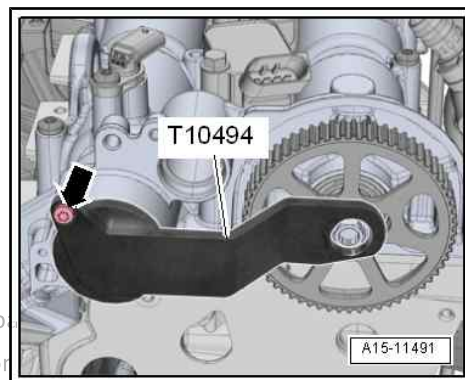


If it is possible to insert camshaft clamp - T10494- , valve timing is OK.

- Remove locking pin - T10340- .

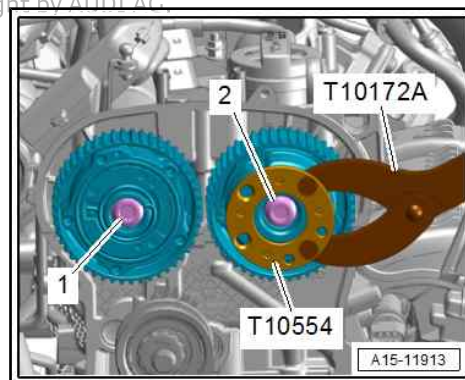


- Remove bolt -arrow- and detach camshaft clamp - T10494- .



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- Tighten bolts -1, 2- (use counterhold tool - T10172A- with counterhold tool - T10554- ).





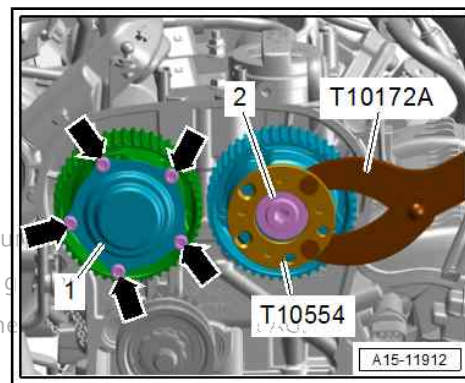
- Tighten plug -2- and bolts -arrows- for sealing cap -1- using counterhold tool - T10172A- with counterhold tool - T10554- .

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

- Install toothed belt cover (centre)  
⇒ [“1.3.2 Removing and installing toothed belt cover \(centre\)”, page 73](#)
- Install cover of toothed belt for coolant pump  
⇒ [“2.5 Removing cover of toothed belt for coolant pump”, page 168](#)

#### Tightening torques

- ◆ ⇒ [“1.2 Exploded view - toothed belt”, page 71](#)
- ◆ ⇒ [“1.1 Exploded view - toothed belt cover”, page 70](#)
- ◆ ⇒ Fig. [““Plug for TDC drilling in cylinder block - tightening torque””, page 72](#)
- ◆ ⇒ [“2.2 Exploded view - camshaft housing”, page 99](#)





## 2 Cylinder head

⇒ [“2.1 Exploded view - cylinder head”, page 98](#)

⇒ [“2.2 Exploded view - camshaft housing”, page 99](#)

⇒ [“2.3 Removing and installing cylinder head”, page 101](#)

⇒ [“2.4 Removing and installing camshaft housing”, page 105](#)

⇒ [“2.5 Checking compression”, page 109](#)

### 2.1 Exploded view - cylinder head

#### 1 - Cylinder head gasket

- ☐ Renewing  
⇒ [“2.3 Removing and installing cylinder head”, page 101](#)
- ☐ Different versions available; for allocation refer to ⇒ Electronic parts catalogue
- ☐ Note installation position: part number must face cylinder head

#### 2 - Dowel sleeve

- ☐ 2x

#### 3 - Cylinder head

- ☐ Removing and installing  
⇒ [“2.3 Removing and installing cylinder head”, page 101](#)
- ☐ Checking for distortion  
⇒ [Fig. “Checking cylinder head for distortion””, page 99](#)

#### 4 - Dowel pins

#### 5 - Not fitted

#### 6 - Gasket

- ☐ Renew after removing

#### 7 - Camshaft housing

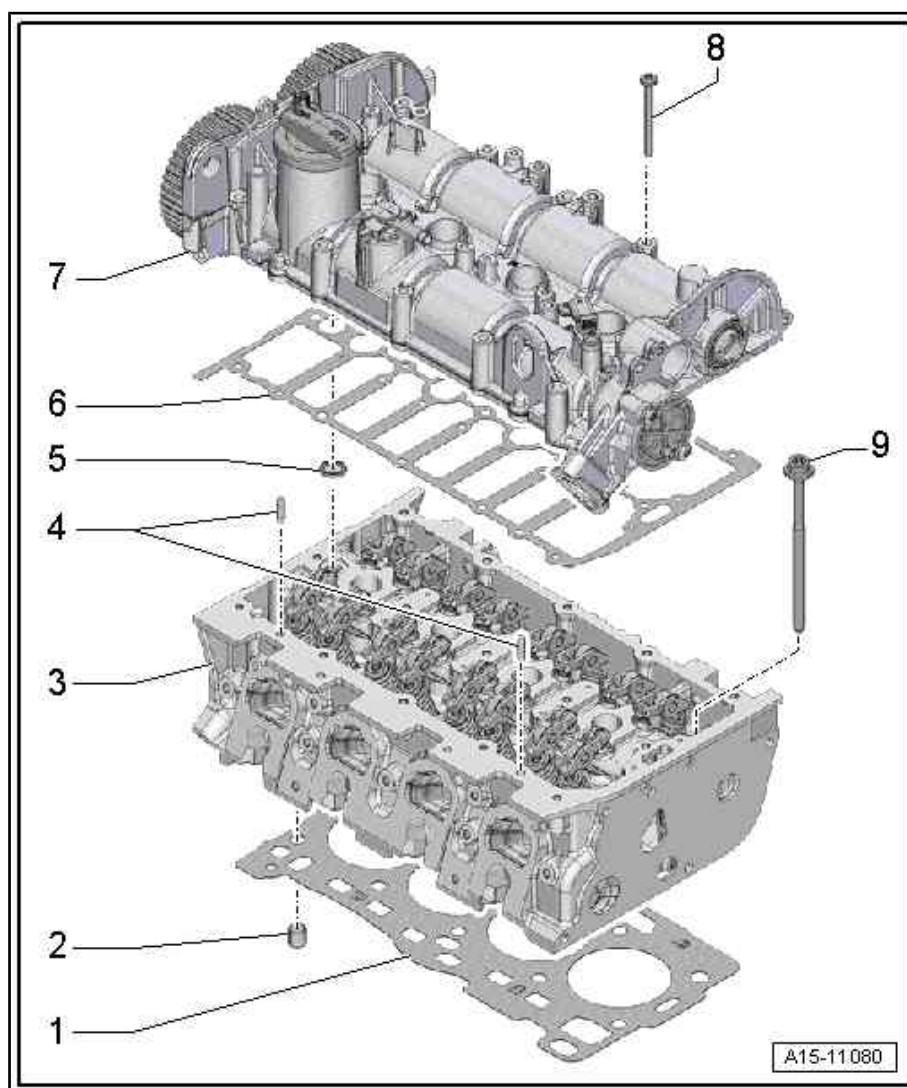
- ☐ Removing and installing  
⇒ [“2.4 Removing and installing camshaft housing”, page 105](#)

#### 8 - Bolt

- ☐ Tightening torque and sequence  
⇒ [Fig. “Camshaft housing - tightening torque and sequence””, page 101](#)

#### 9 - Bolt

- ☐ Renew after removing
- ☐ Correct sequence when slackening ⇒ [page 104](#)
- ☐ Tightening torque and sequence ⇒ [Fig. “Cylinder head - tightening torque and sequence””, page 99](#)



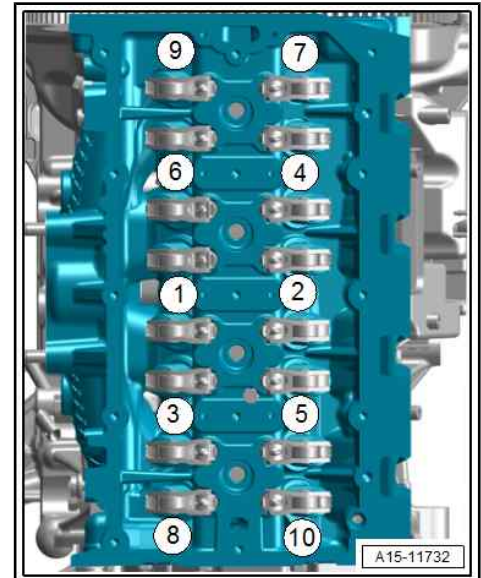
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### Cylinder head - tightening torque and sequence

- After removing, renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

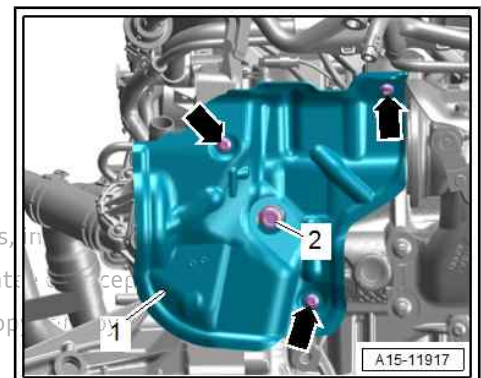
| Stage | Bolts      | Tightening torque/angle specification |
|-------|------------|---------------------------------------|
| 1.    | -1 ... 10- | 40 Nm                                 |
| 2.    | -1 ... 10- | Turn 90° further                      |
| 3.    | -1 ... 10- | Turn 90° further         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



### Heat shield - tightening torque

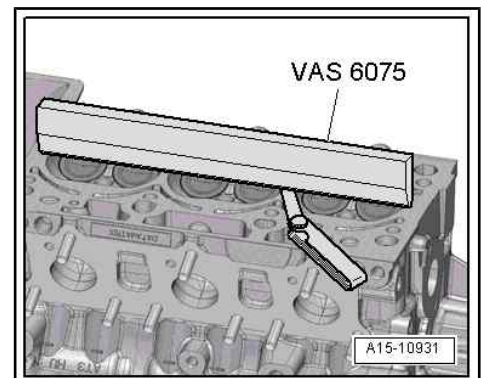
- Tighten bolts -arrows- to 9 Nm.
- Tighten bolt -2- to 20 Nm.

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### Checking cylinder head for distortion

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



## 2.2 Exploded view - camshaft housing



**1 - Dowel pin**

**2 - Seal**

- ☐ Inserted into cylinder head

**3 - Gasket**

- ☐ Renew after removing

**4 - Oil seal**

- ☐ For inlet camshaft
- ☐ Renewing  
⇒ [“3.3.1 Removing and installing inlet camshaft oil seal \(pulley end\)”, page 113](#)

**5 - Oil seal**

- ☐ For exhaust camshaft (pulley end)
- ☐ Renewing  
⇒ [“3.3.2 Removing and installing exhaust camshaft oil seal \(pulley end\)”, page 115](#)

**6 - Bolt**

- ☐ Tightening torque and sequence  
⇒ [Fig. “Camshaft housing - tightening torque and sequence”](#), page 101

**7 - Bolt**

- ☐ 8 Nm

**8 - Bracket**

- ☐ For electrical connector

**9 - Ball stud**

- ☐ For engine cover panel
- ☐ 8 Nm

**10 - O-rings**

- ☐ Renew after removing

**11 - Plug**

**12 - O-ring**

- ☐ Lubricate lightly with engine oil
- ☐ Check for damage and renew if necessary; supplied together with camshaft control valve 1

**13 - Camshaft control valve 1**

- ◆ Camshaft control valve 1 - N205-

- ◆ Exhaust camshaft control valve 1 - N318-

- ☐ Removing and installing ⇒ [“3.4 Removing and installing camshaft control valve 1 N205”, page 118](#)

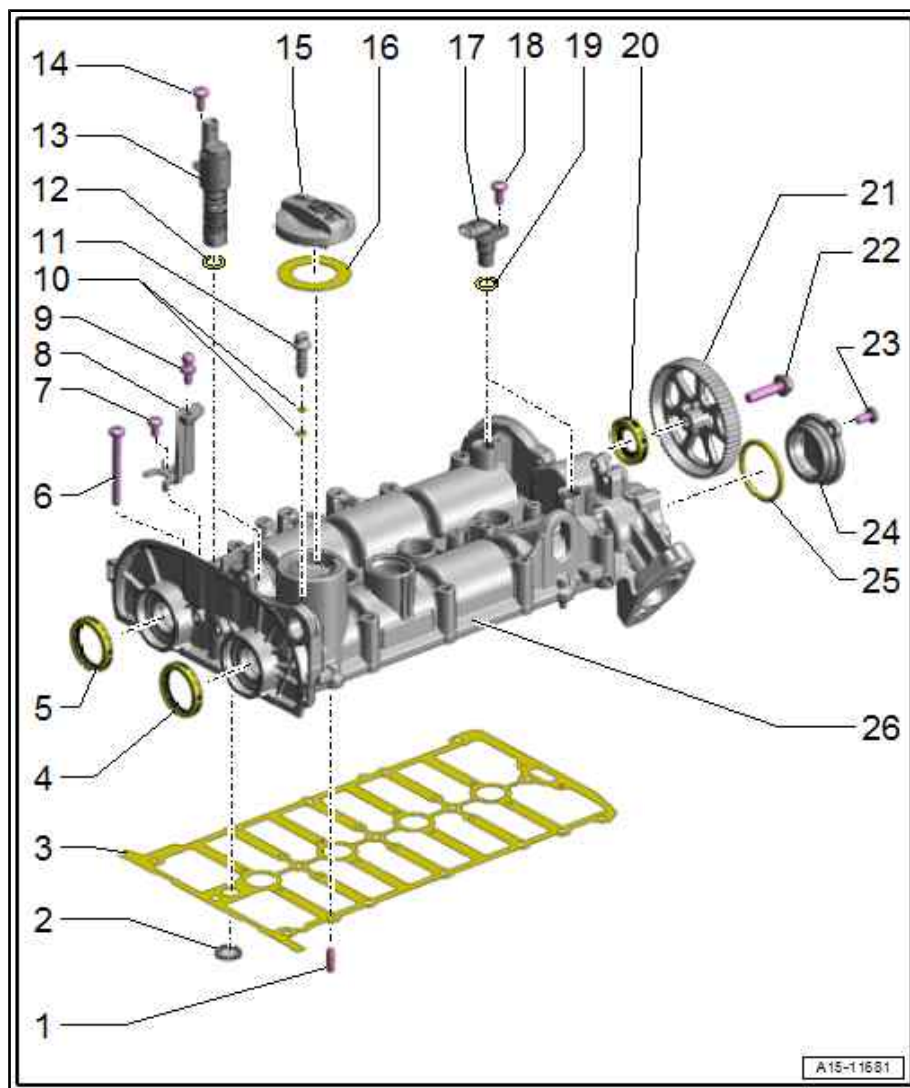
**14 - Bolt**

- ☐ 8 Nm

**15 - Filler cap**

**16 - Seal**

- ☐ For filler cap





## 17 - Hall sender

- ◆ Hall sender - G40-
- ◆ Hall sender 3 - G300-
  - ☐ Exploded view ⇒ [“1.1 Exploded view - ignition system”, page 254](#)

## 18 - Bolt

- ☐ Tightening torque ⇒ [Item 6 \(page 254\)](#)

## 19 - O-ring

- ☐ Lubricate lightly with engine oil
- ☐ Renew after removing

## 20 - Oil seal

- ☐ For exhaust camshaft (gearbox end)
- ☐ Renewing ⇒ [“3.3.3 Removing and installing exhaust camshaft oil seal \(gearbox end\)”, page 116](#)

## 21 - Toothed belt drive sprocket

- ☐ For coolant pump
- ☐ Removing and installing  
⇒ [“2.8 Removing and installing toothed belt sprocket for coolant pump”, page 175](#)

## 22 - Bolt

- ☐ Tightening torque ⇒ [Item 8 \(page 161\)](#)

## 23 - Bolt

- ☐ 8 Nm

## 24 - Sealing cap

## 25 - O-ring

- ☐ Renew after removing

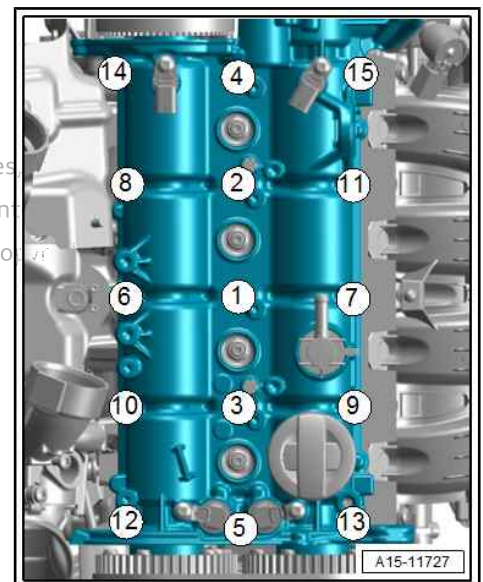
## 26 - Camshaft housing

- ☐ Removing and installing ⇒ [“2.4 Removing and installing camshaft housing”, page 105](#)

### Camshaft housing - tightening torque and sequence

- After removing, renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

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

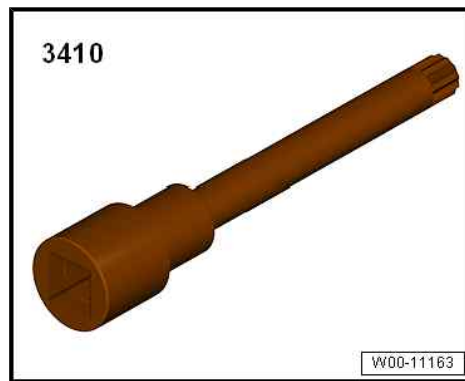


## 2.3 Removing and installing cylinder head

Special tools and workshop equipment required



◆ Socket - 3410-

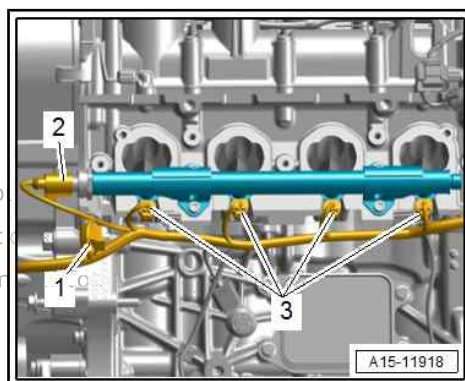


◆ Scraper; blade width at least 40 mm (commercially available)

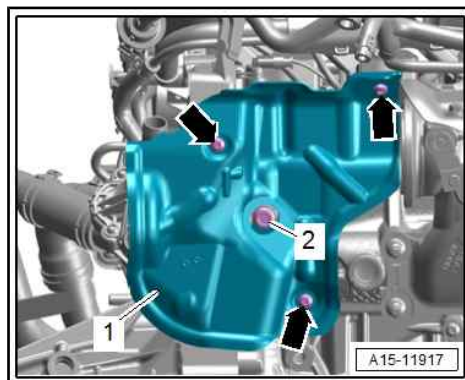
**Removing**

- Observe ➔ [“3.1 Rules for cleanliness”, page 5](#) .
- Re-install all heat insulation sleeves in the same locations when installing.
- Remove camshaft housing  
➔ [“2.4 Removing and installing camshaft housing”, page 105](#) .
- Remove intake manifold  
➔ [“3.2 Removing and installing intake manifold”, page 219](#) .
- Remove turbocharger  
➔ [“1.2 Removing and installing turbocharger”, page 196](#) .
- Unplug electrical connectors:
  - 1 - At oil pressure switch for reduced oil pressure - F378-
  - 2 - At fuel pressure sender - G247-
  - 3 - At injectors -N30- ... -N33-

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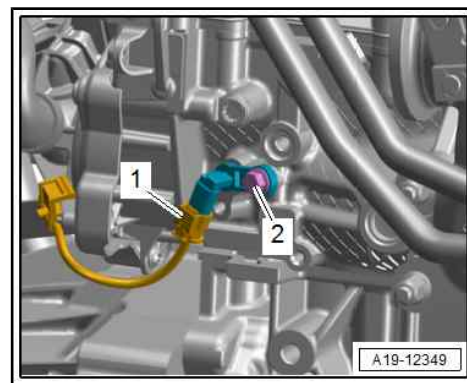


- Remove bolts -arrows- and -2- and detach heat shield -1-.





- Unplug electrical connector -1- for coolant temperature sender  
- G62- .



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

### Installing

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



#### WARNING

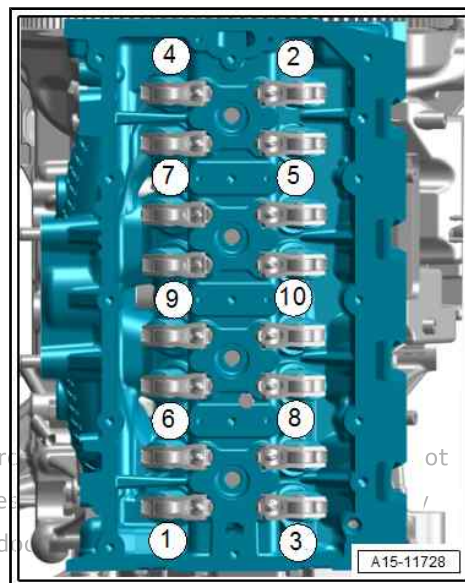
**Risk of eye injury due to sealant residue.**

- ◆ **Put on safety goggles.**



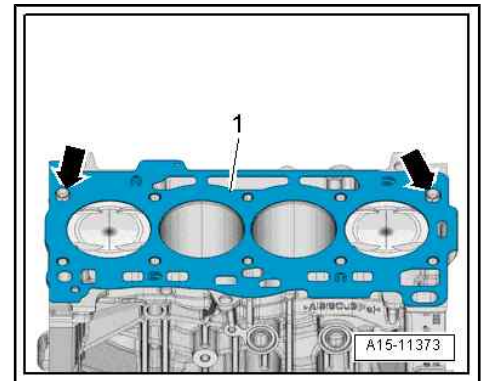
#### Note

- ◆ *Risk of damage to sealing surfaces if handled incorrectly.*
  - ◆ *Carefully remove sealant residue from cylinder head and cylinder block.*
  - ◆ *Do NOT use abrasive materials (sandpaper, sanding discs, sanding pads, abrasive web, wire wool, etc.).*
  - ◆ *When removing sealant residue, make sure none of the residue enters the open channels of the engine.*
  - ◆ *Ensure that nearby workspaces are kept clean and that the abrasive materials listed above are not being used there.*
  - ◆ *Use of non-approved abrasive materials can lead to subsequent damage to the turbocharger, conrod bearings, etc.*
- Sealant residue may only be removed from the cylinder head and cylinder block using a commercially available scraper (blade width at least 4 cm).
  - Remove loose residue with a lint-free cloth.
  - Sealing surfaces must NOT be damaged.
  - No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.
  - Renew bolts tightened with specified tightening angle.
  - Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.
  - When installing an exchange cylinder head, oil the contact surfaces between the roller rocker fingers and the running surfaces of the cams.
  - Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
  - After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.
  - 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.
  - Carefully remove sealant residue from cylinder head and cylinder block.





- Clean blind holes for cylinder head bolts in cylinder block so that they are free of oil and coolant residue.
- Fit cylinder head gasket -1-.
- ◆ Note position of centring pins in cylinder block -arrows-.
- ◆ Note installation position of cylinder head gasket. Part No. should be legible from inlet side.
- If crankshaft has been rotated: Set piston of cylinder 1 to top dead centre and then turn crankshaft back slightly.
- Fit cylinder head.
- Insert and hand-tighten cylinder head bolts.
- Tighten cylinder head bolts  
⇒ Fig. “Cylinder head - tightening torque and sequence”, page 99 .



#### Note:

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

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

- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install turbocharger  
⇒ “1.2 Removing and installing turbocharger”, page 196 .
- Install intake manifold  
⇒ “3.2 Removing and installing intake manifold”, page 219 .
- Install camshaft housing  
⇒ “2.4 Removing and installing camshaft housing”, page 105 .
- Change engine oil ⇒ Maintenance ; Booklet 830 .
- Fill cooling system with fresh coolant  
⇒ “1.3 Draining and filling cooling system”, page 153 .

#### Tightening torques

- ◆ ⇒ Fig. “Cylinder head - tightening torque and sequence”, page 99
- ◆ ⇒ Fig. “Heat shield - tightening torque”, page 99
- ◆ ⇒ “2.1 Exploded view - cylinder head”, page 98

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## 2.4 Removing and installing camshaft housing

Does not guarantee or accept any liability

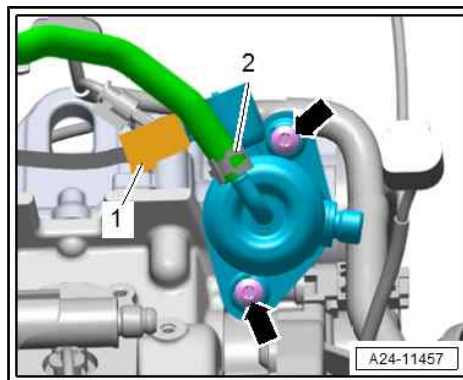
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#### Removing

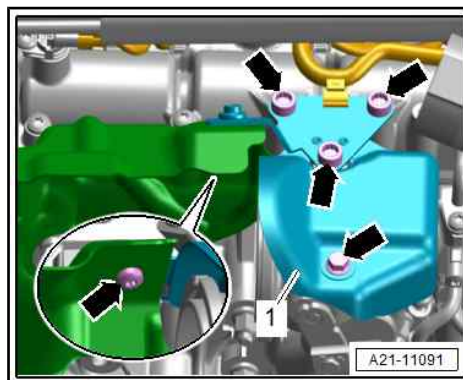
- Observe ⇒ “3.1 Rules for cleanliness”, page 5 .
- Remove engine cover panel  
⇒ “3.1 Removing and installing engine cover panel”, page 34 .
- Remove coolant pump  
⇒ “2.6 Removing and installing coolant pump”, page 169 .
- Remove ignition coils  
⇒ “1.2 Removing and installing ignition coils with output stages”, page 255 .



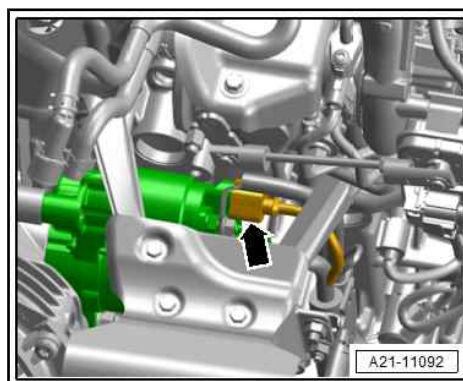
- Detach toothed belt from camshafts  
⇒ [“1.4 Detaching toothed belt from camshaft”, page 75](#) .
- Remove high-pressure pipe  
⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#) .
- Unplug electrical connector -1-.
- Release hose clip -2- and detach fuel supply hose.



- Move electrical wiring harness clear.
- Remove bolts -arrows- and detach heat shield -1-.



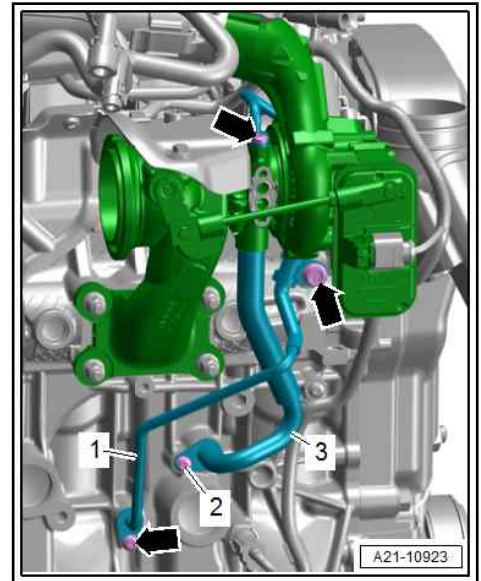
- Unplug electrical connector -arrow- for starter.



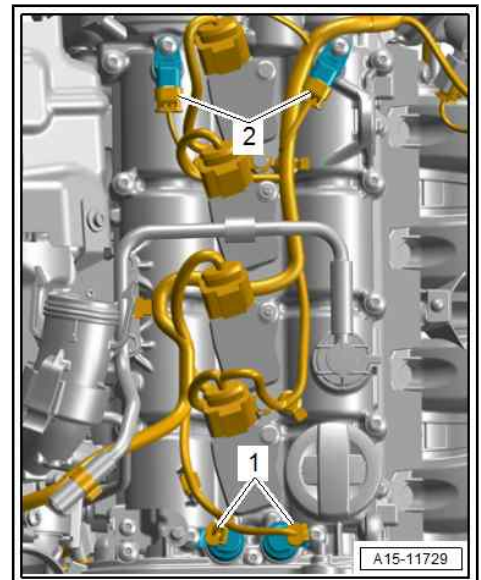
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- Remove bolts -arrows-, disconnect oil supply line -1- and press it slightly to one side. (Shown with engine support removed.)



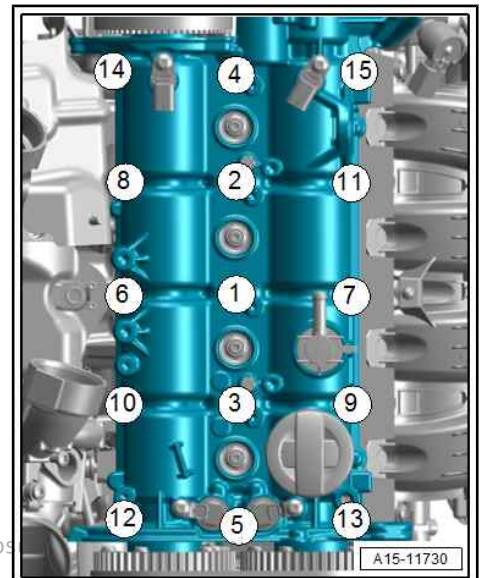
- Unplug electrical connectors:
- 1 - For camshaft control valve 1 - N205- / exhaust camshaft control valve 1 - N318-
- 2 - For Hall sender - G40- / Hall sender 2 - G163-



- Loosen and remove bolts for camshaft housing in the sequence -15 ... 1-.
- Carefully release camshaft housing from bonded joint and detach.
- Mark original positions of roller rocker fingers and compensation elements for re-installation.
- Remove roller rocker fingers together with compensation elements and put down on a clean surface.

#### Installing

- After removing, renew bolts tightened with specified tightening angle.
- Renew gasket and spring-type clips after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Check “TDC” position of camshaft and crankshaft:



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



**Caution**

***Risk of damage to valve gear.***

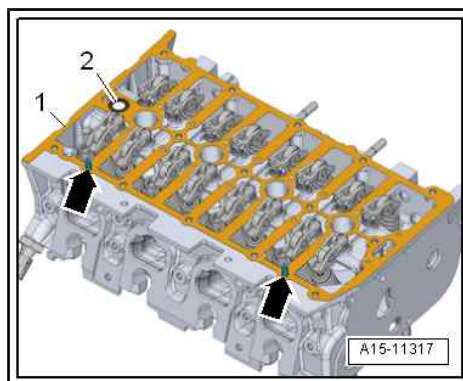
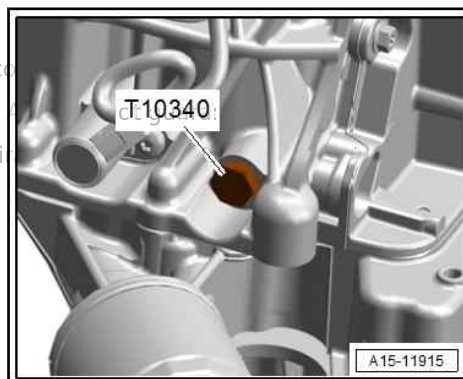
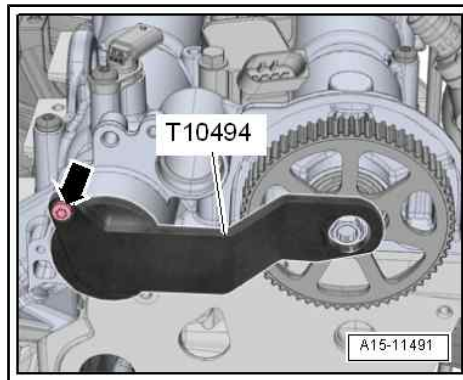
- ◆ ***The camshafts must not be moved axially when turning.***



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

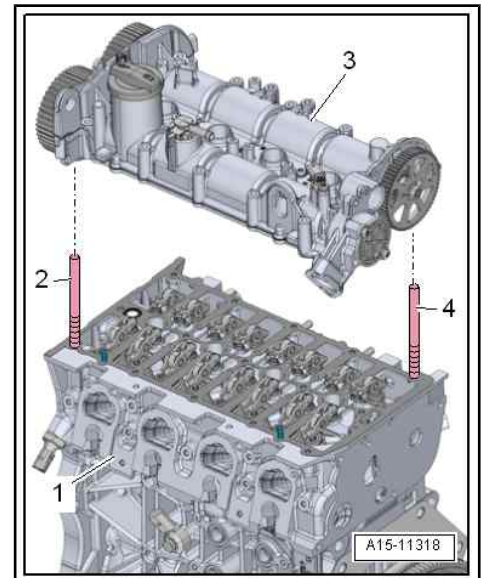




- Screw 2 studs -items 2, 4- (e.g. -T10288/4- ) into cylinder head.
- Carefully lower camshaft housing -3- vertically onto studs in cylinder head.
- Make sure that camshaft housing is kept straight.
- Tighten camshaft housing bolts  
⇒ [Fig. “Camshaft housing - tightening torque and sequence”](#), [page 101](#) .

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

- Install high-pressure pipe  
⇒ [“6.3 Removing and installing high-pressure pipe”](#), [page 236](#) .
- Install toothed belt (adjust valve timing)  
⇒ [“1.4 Detaching toothed belt from camshaft”](#), [page 75](#) .
- Install ignition coils  
⇒ [“1.2 Removing and installing ignition coils with output stages”](#), [page 255](#) .
- Install coolant pump  
⇒ [“2.6 Removing and installing coolant pump”](#), [page 169](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#), [page 34](#) .



#### Caution

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

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

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#### Tightening torques

- ◆ ⇒ [“2.2 Exploded view - camshaft housing”](#), [page 99](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”](#), [page 193](#)

## 2.5 Checking compression

### Special tools and workshop equipment required

- ◆ Spark plug spanner - 3122 B-



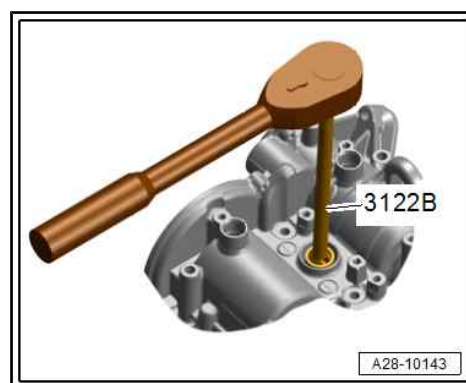


◆ Compression tester - V.A.G 1763-



### Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- To interrupt voltage supply to fuel system pressurisation pump - G6- , remove fuse for fuel pump control unit - J538- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Start engine and allow it to run at idling speed until it stops.
- Switch off ignition.
- Remove ignition coils  
⇒ [“1.2 Removing and installing ignition coils with output stages”, page 255](#) .
- Remove spark plugs with 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).
- A second mechanic is required for the following step.
- Have a second mechanic press down the accelerator pedal completely and at the same time operate the starter until the pressure on the tester display no longer increases.
- Repeat procedure on each cylinder.



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

### Assembling

Assembly is performed in reverse sequence; note the following:

- Install spark plugs ⇒ Maintenance ; Booklet 830 .
- Install ignition coils  
⇒ [“1.2 Removing and installing ignition coils with output stages”, page 255](#) .
- Insert fuse for fuel pump control unit - J538- .
- Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester.



### 3 Valve gear

⇒ [“3.1 Exploded view - valve gear”, page 111](#)

⇒ [“3.2 Measuring axial clearance of camshaft”, page 112](#)

⇒ [“3.3 Removing and installing camshaft oil seal”, page 113](#)

⇒ [“3.4 Removing and installing camshaft control valve 1 N205 ”, page 118](#)

⇒ [“3.5 Removing and installing valve stem oil seals”, page 119](#)

#### 3.1 Exploded view - valve gear

##### 1 - Inlet valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Valve dimensions  
⇒ [“4.3 Valve dimensions”, page 128](#)
- ☐ Checking valve guides  
⇒ [“4.1 Checking valve guides”, page 127](#)

##### 2 - Exhaust valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Valve dimensions  
⇒ [“4.3 Valve dimensions”, page 128](#)
- ☐ Checking valve guides  
⇒ [“4.1 Checking valve guides”, page 127](#)

##### 3 - Cylinder head

##### 4 - Valve stem oil seal

- ☐ Renewing  
⇒ [“3.5 Removing and installing valve stem oil seals”, page 119](#)

##### 5 - Valve spring

- ☐ Installation position  
⇒ [Fig. “Position of valve spring”, page 112](#)

##### 6 - Valve spring plate

##### 7 - Valve cotters

##### 8 - Roller rocker finger

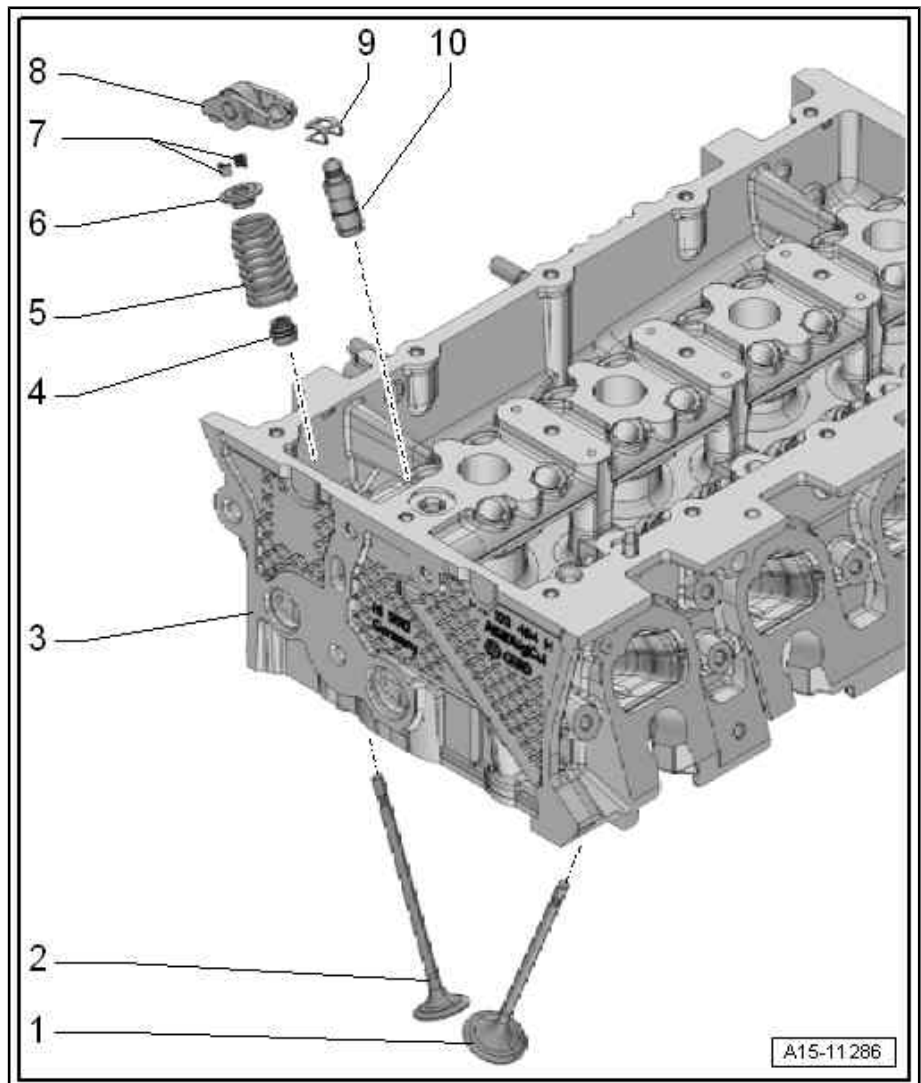
- ☐ Removing and installing  
⇒ [“2.4 Removing and installing camshaft housing”, page 105](#)
- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surfaces before installing

##### 9 - Securing clip

- ☐ For hydraulic compensation element

##### 10 - Hydraulic compensation element

- ☐ Do not interchange

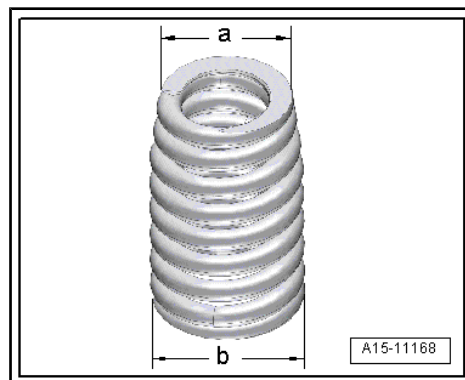




- ❑ Lubricate contact surface

### Position of valve spring

- The smaller  $\varnothing$  -a- faces the valve spring plate.
- The larger  $\varnothing$  -b- faces the cylinder head.



## 3.2 Measuring axial clearance of camshaft

### Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-

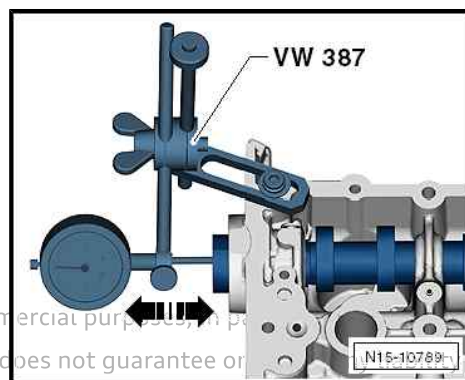


### Procedure

- Remove camshaft housing  
⇒ ["2.4 Removing and installing camshaft housing", page 105](#).
- Secure dial gauge - VAS 6079- to camshaft housing with universal dial gauge bracket - VW 387- as shown in illustration.
- Press camshaft against dial gauge by hand.
- Set dial gauge to "0".
- Press camshaft away from dial gauge and read off value.

### Axial clearance:

- Wear limit: 0.25 mm.





### 3.3 Removing and installing camshaft oil seal

⇒ [“3.3.1 Removing and installing inlet camshaft oil seal \(pulley end\)”](#), page 113

⇒ [“3.3.2 Removing and installing exhaust camshaft oil seal \(pulley end\)”](#), page 115

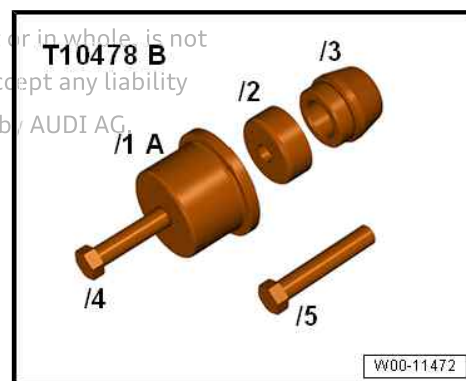
⇒ [“3.3.3 Removing and installing exhaust camshaft oil seal \(gear-box end\)”](#), page 116

#### 3.3.1 Removing and installing inlet camshaft oil seal (pulley end)

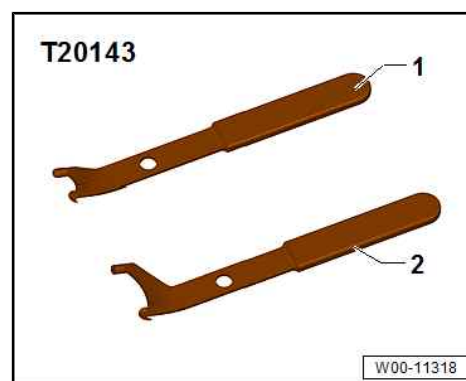
Special tools and workshop equipment required

◆ Assembly tool - T10478 B-

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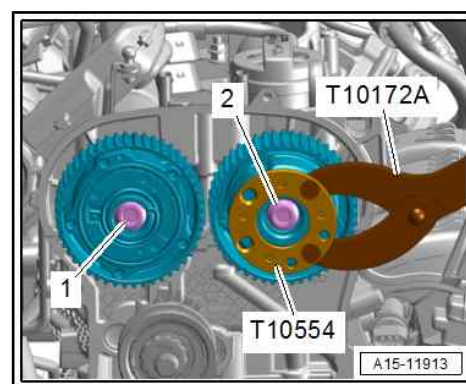


◆ Extractor tool - T20143-



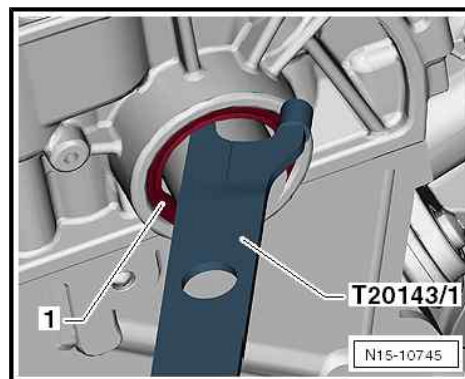
#### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”](#), page 5 .
- Detach toothed belt from camshafts  
⇒ [“1.4 Detaching toothed belt from camshaft”](#), page 75 .
- Unscrew bolt -2- and remove camshaft sprocket.





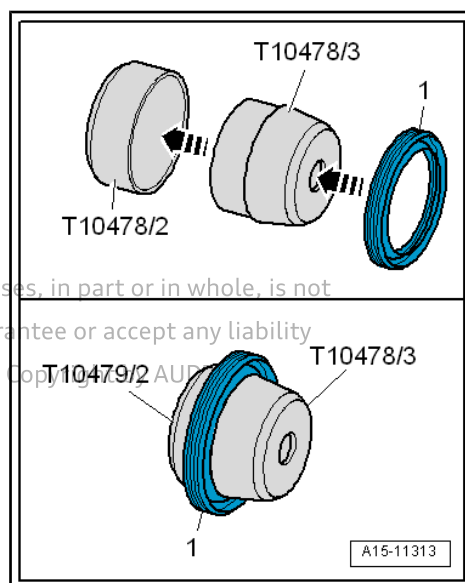
- Pull out oil seal -1- using extractor hook -T20143/1- .



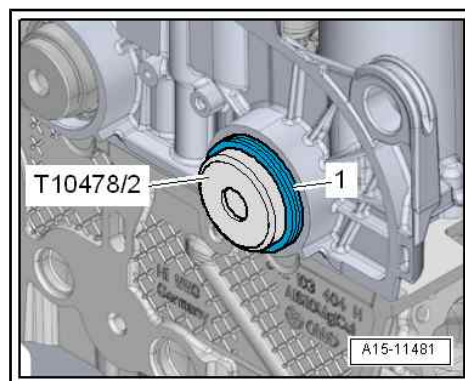
### Installing

- Do not lubricate new oil seal.
- Slide oil seal -1- over fitting sleeve -T10478/3- onto guide sleeve -T10478/2- .
- Fitting position: closed side of oil seal faces guide sleeve.
- Detach fitting sleeve from guide sleeve.

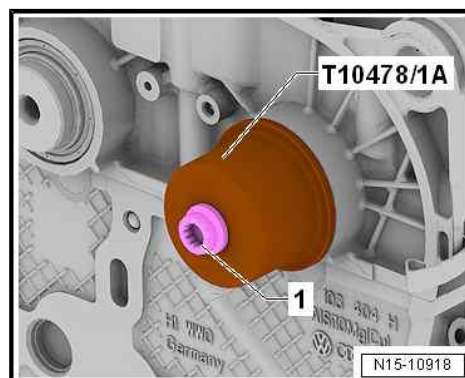
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- Fit guide sleeve -T10478/2- with oil seal -1- onto camshaft.



- Use thrust piece -T10478/1A- and bolt -1- for camshaft sprocket to pull in oil seal onto stop.
- Install toothed belt (adjust valve timing)  
⇒ [“1.4 Detaching toothed belt from camshaft”, page 75](#) .

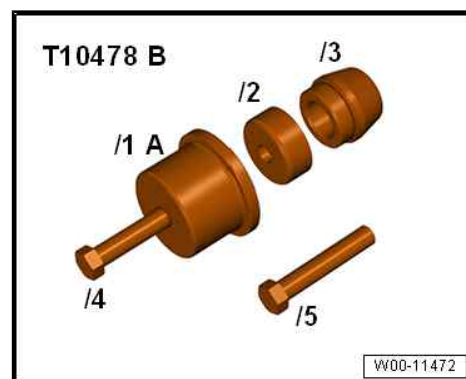




### 3.3.2 Removing and installing exhaust camshaft oil seal (pulley end)

Special tools and workshop equipment required

- ◆ Assembly tool - T10478 B-



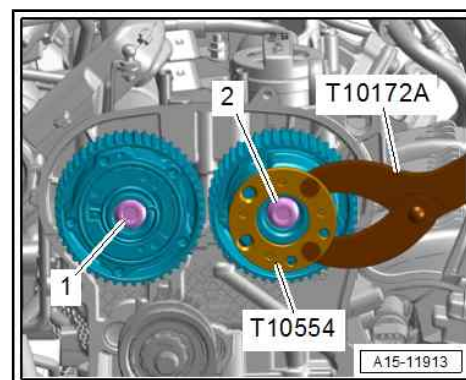
- ◆ Extractor tool - T20143-



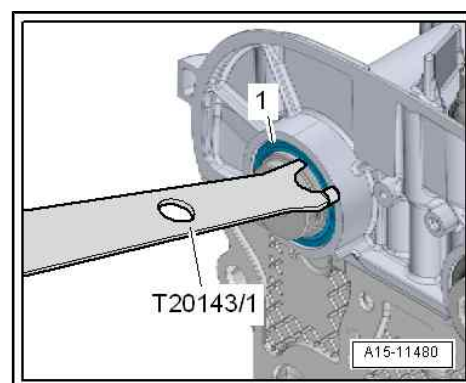
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#### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Detach toothed belt from camshafts  
⇒ [“1.4 Detaching toothed belt from camshaft”, page 75](#) .
- Unscrew bolt -1- and remove camshaft sprocket.



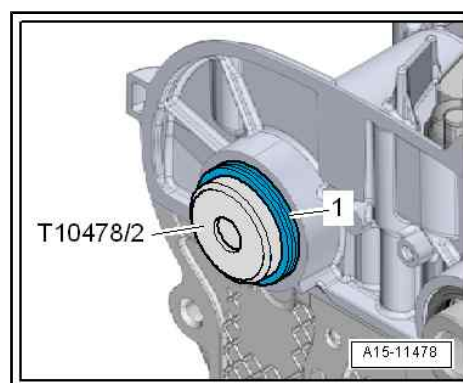
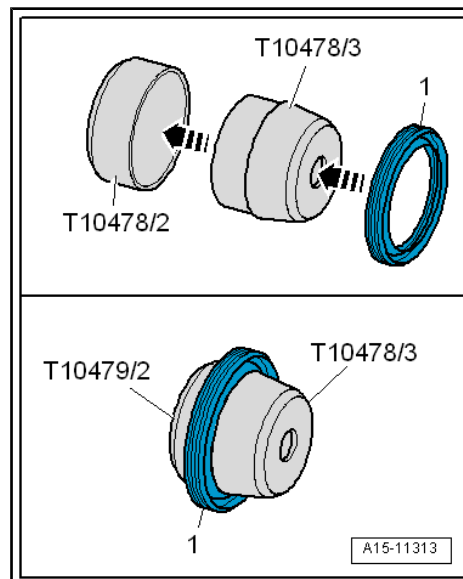
- Pull out oil seal -1- using extractor hook -T20143/1- .





## Installing

- Do not lubricate new oil seal.
  - Slide oil seal -1- over fitting sleeve -T10478/3- onto guide sleeve -T10478/2- .
  - Fitting position: closed side of oil seal faces guide sleeve.
  - Detach fitting sleeve from guide sleeve.
- 
- Fit guide sleeve -T10478/2- with oil seal -1- onto camshaft.

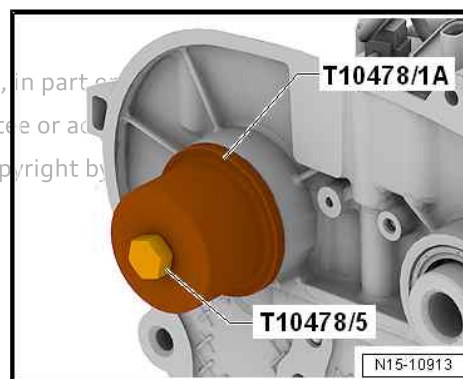


- Pull in thrust piece -T10478/1A- with bolt -T10478/5- as far as stop.

- Install toothed belt (adjust valve timing)

⇒ ["1.4 Detaching toothed belt from camshaft", page 75](#)

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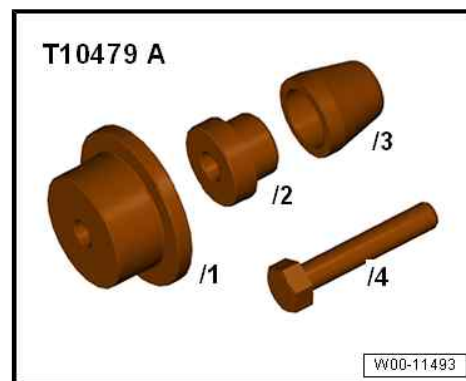


### 3.3.3 Removing and installing exhaust camshaft oil seal (gearbox end)

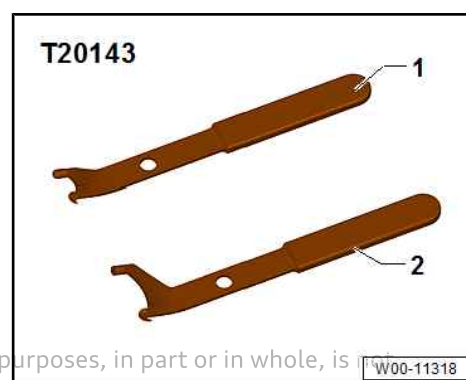
Special tools and workshop equipment required



◆ Assembly tool - T10479 A-



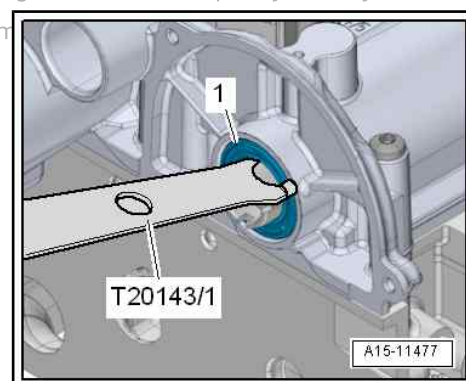
◆ Extractor tool - T20143-



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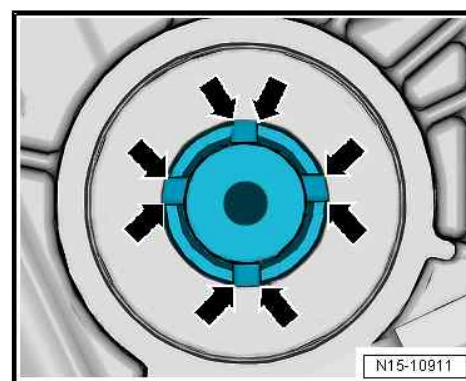
**Removing** with respect to the correctness of information in this document

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove toothed belt sprocket for coolant pump  
⇒ [“2.8 Removing and installing toothed belt sprocket for coolant pump”, page 175](#) .
- Carefully slide extractor hook -T20143/1- between camshaft and oil seal -1-.
- Pry out oil seal.



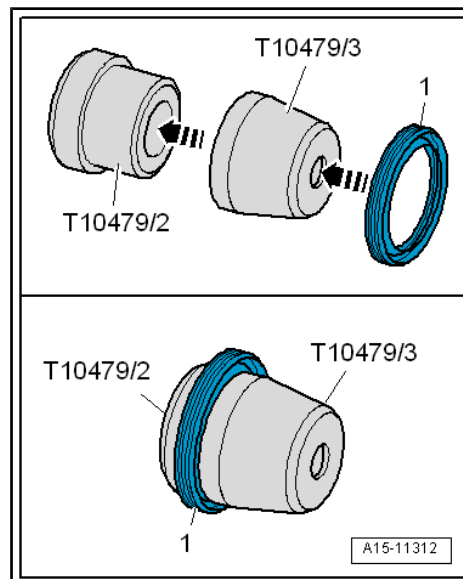
**Installing**

- If necessary, use fine sandpaper (grit 220 ... 1000) to remove any burrs that have formed on the outside of the outer grooves on the exhaust camshaft -arrows-.
- Do not lubricate new oil seal.

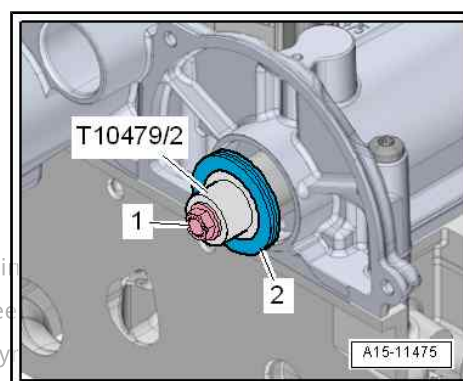




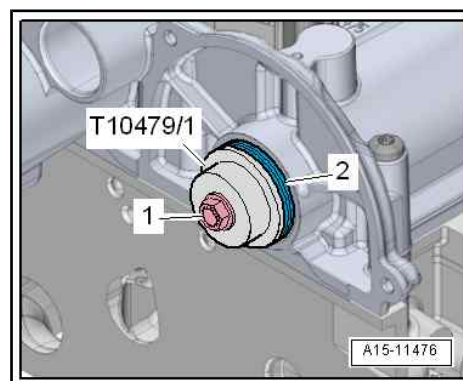
- Slide oil seal -1- over fitting sleeve -T10479/3- onto guide sleeve -T10479/2- .
- Fitting position: closed side of oil seal faces guide sleeve.
- Detach fitting sleeve from guide sleeve.



- Fit guide sleeve -T10479/2- with oil seal -2- onto camshaft so that it is centred.
- Secure guide sleeve onto camshaft using bolt -1- for coolant pump drive sprocket.
- Slide oil seal onto camshaft and unbolt guide sleeve.



- Use thrust piece -T10479/1- and bolt -1- for coolant pump drive sprocket to pull in oil seal -2- onto stop.
- Install toothed belt sprocket for coolant pump  
⇒ [“2.8 Removing and installing toothed belt sprocket for coolant pump”, page 175](#) .



### 3.4 Removing and installing camshaft control valve 1 - N205-

The description applies to camshaft control valve 1 - N205- and exhaust camshaft control valve 1 - N318- .

#### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .

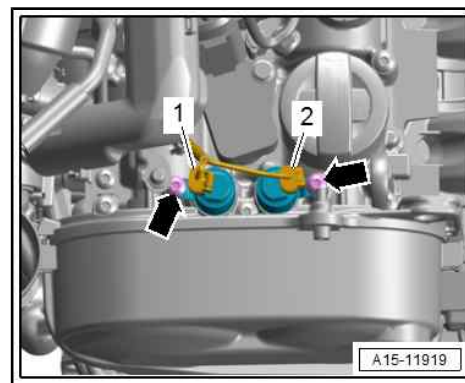


- Unplug electrical connector:
  - 1 - For exhaust camshaft control valve 1 - N318-
  - 2 - For camshaft control valve 1 - N205-
- Remove appropriate bolt -arrows- and detach camshaft control valve.

### Installing

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

- Lubricate O-ring with engine oil before installing.
- Check O-ring for damage and renew if necessary (supplied together with camshaft control valve 1 ⇒ Electronic parts catalogue ).
- Install engine cover panel  
⇒ ["3.1 Removing and installing engine cover panel"](#),  
[page 34](#) .



### Tightening torques

- ◆ ⇒ ["2.2 Exploded view - camshaft housing"](#), [page 99](#)

## 3.5 Removing and installing valve stem oil seals

⇒ ["3.5.1 Removing and installing valve stem oil seals \(cylinder head installed\)"](#), [page 119](#)

⇒ ["3.5.2 Removing and installing valve stem oil seals \(cylinder head removed\)"](#), [page 123](#)

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

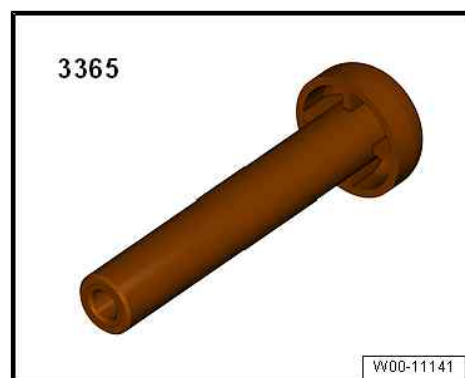
#### Special tools and workshop equipment required

- ◆ Spark plug spanner - 3122 B-

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- ◆ Valve stem oil seal fitting tool - 3365-





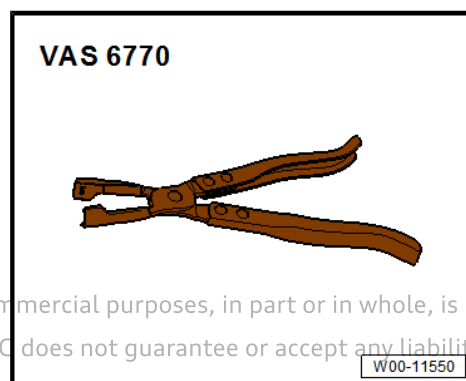
- ◆ Removal and installation device for valve cotters - VAS 5161 A- with set -VAS 5161 A/32-



- ◆ Adapter - T40012-



- ◆ Valve shaft pliers - VAS 6770-

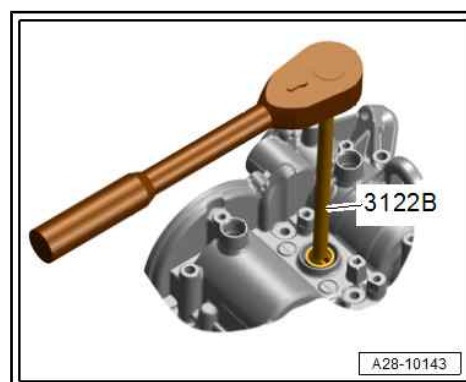


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- ◆ Assembly sleeve ⇒ Electronic parts catalogue

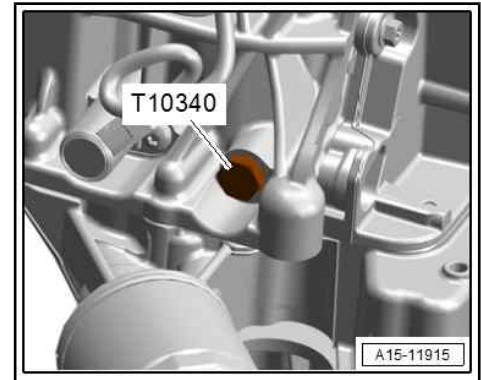
#### Procedure

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove camshaft housing  
⇒ [“2.4 Removing and installing camshaft housing”, page 105](#) .
- Unscrew spark plugs using spark plug socket - 3122 B- .

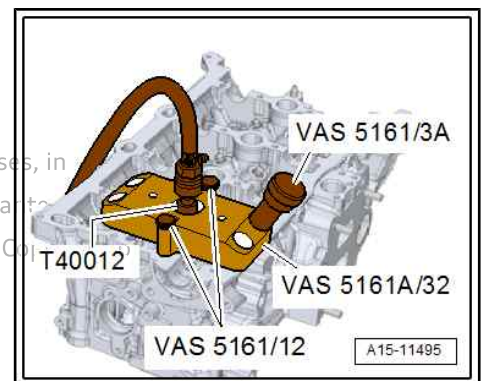




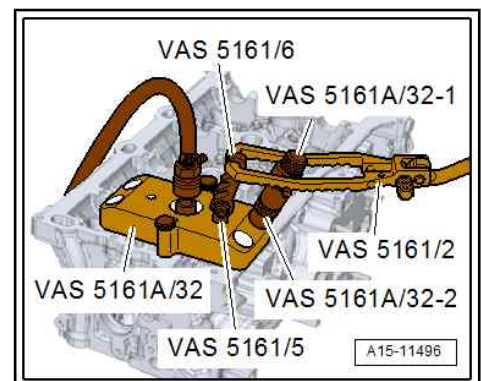
- Remove locking pin - T10340- .
- Set piston of appropriate cylinder to “bottom dead centre”.



- Fit guide plate -VAS 5161 A/32- onto cylinder head and secure with knurled screws -VAS 5161/12- .
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.
- Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
- Minimum pressure: 6 bar
- Apply drift -VAS 5161/3A- to guide plate and use plastic-headed hammer to release sticking valve cotters.



- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161 A/32-1- (slide on sleeve -VAS 5161 A/32-2- ) in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
- The compressed air hose remains connected.
- Detach valve spring with valve spring plate.

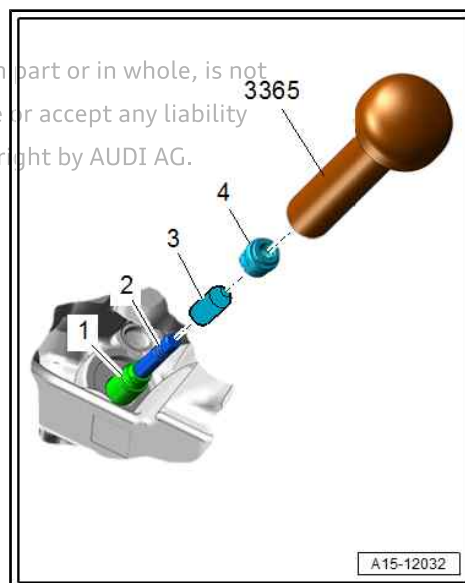




- Pull off valve stem oil seal with valve shaft pliers - VAS 6770- .

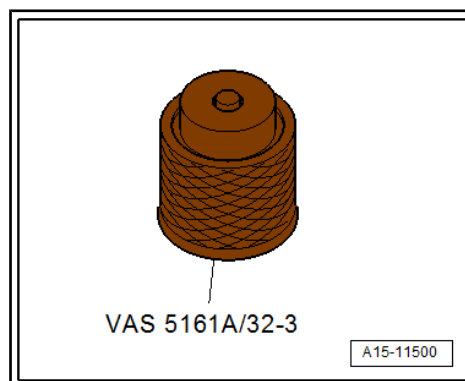


- To avoid damaging new valve stem oil seal -4- during installation, fit assembly sleeve -item 3- onto valve stem -2-.
- Lightly oil sealing lip of valve stem oil seal.
- Insert valve stem oil seal into valve stem oil seal fitting tool -3365- and use assembly sleeve to carefully press it onto valve guide -1- as far as stop.
- Remove assembly sleeve .



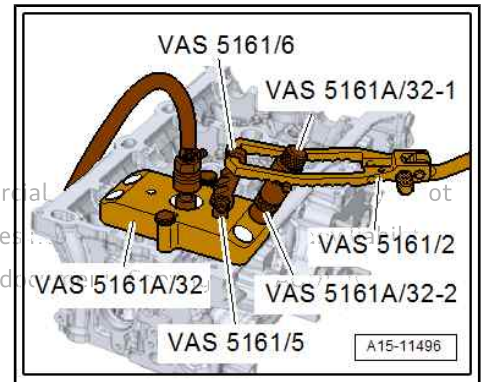
If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161 A/32-3- .

- 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 ⇒ [Fig. "Position of valve spring" , page 112](#) .





- Secure guide plate -VAS 5161 A/32- back onto cylinder head.
- Insert assembly cartridge -VAS 5161 A/32-1- with sleeve -VAS 5161 A/32-2- into guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.



#### Assembling

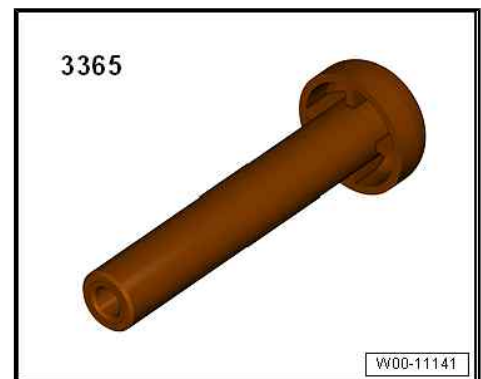
Assembly is performed in reverse sequence; note the following:

- Install spark plugs ⇒ Maintenance ; Booklet 830 .
- Install camshaft housing  
⇒ ["2.4 Removing and installing camshaft housing", page 105](#) .

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

Special tools and workshop equipment required

- ◆ Valve stem oil seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161 A- with set -VAS 5161 A/32-

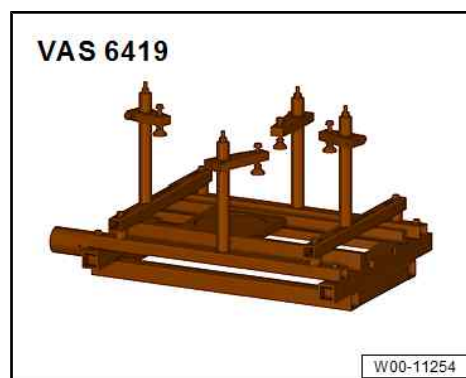




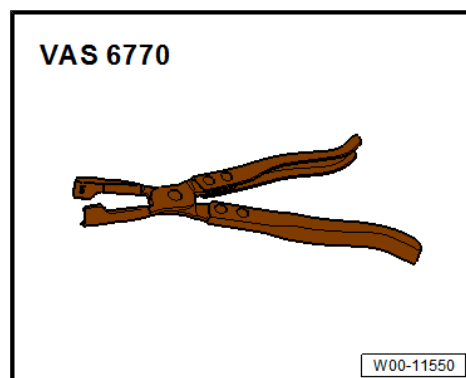
◆ Engine and gearbox support - VAS 6095A-



◆ Cylinder head tensioning device - VAS 6419-



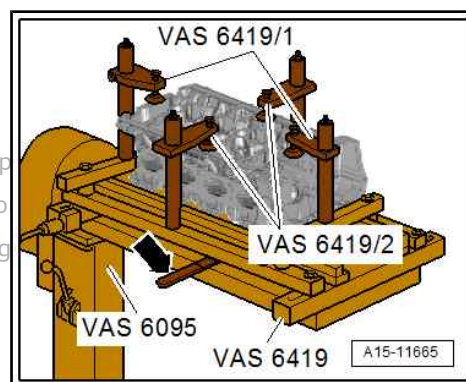
◆ Valve shaft pliers - VAS 6770-



◆ Assembly sleeve ➔ Electronic parts catalogue

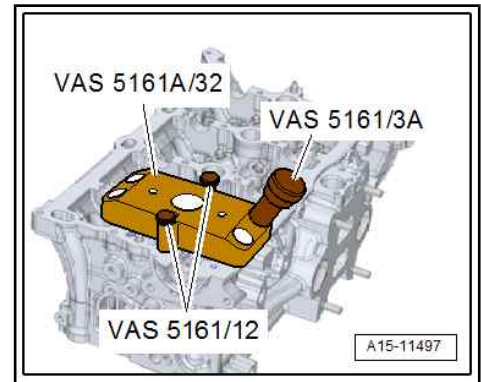
**Procedure**

- Observe ➔ ["3.1 Rules for cleanliness", page 5](#) .
- Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensioning device, as shown in illustration.
- Connect cylinder head tensioning device to compressed air supply.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.

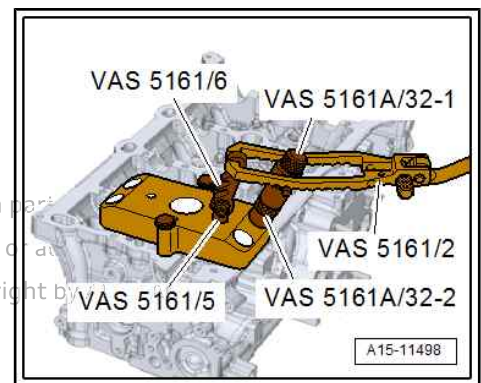




- Fit guide plate -VAS 5161 A/32- onto cylinder head and secure with knurled screws -VAS 5161/12- .
- Apply drift -VAS 5161/3A- to guide plate and use plastic-headed hammer to release sticking valve cotters.

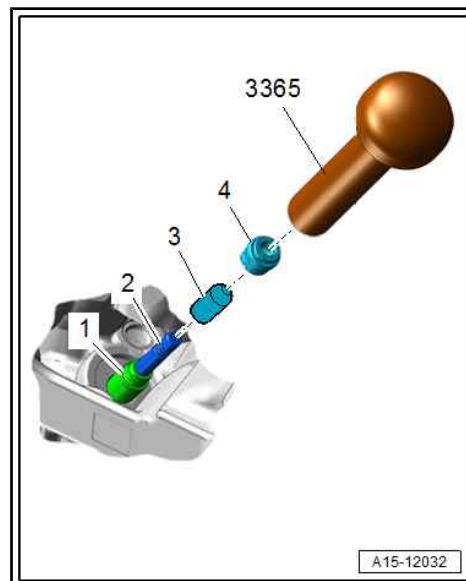


- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161 A/32-1- (slide on sleeve -VAS 5161 A/32-2- ) in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
- Detach valve spring with valve spring plate.
- Pull off valve stem oil seal with valve shaft pliers -VAS 6770- .





- To avoid damaging new valve stem oil seal -4- during installation, fit assembly sleeve -item 3- onto valve stem -2-.
- Lightly oil sealing lip of valve stem oil seal.
- Insert valve stem oil seal into valve stem oil seal fitting tool - 3365- and use assembly sleeve to carefully press it onto valve guide -1- as far as stop.
- Remove assembly sleeve .

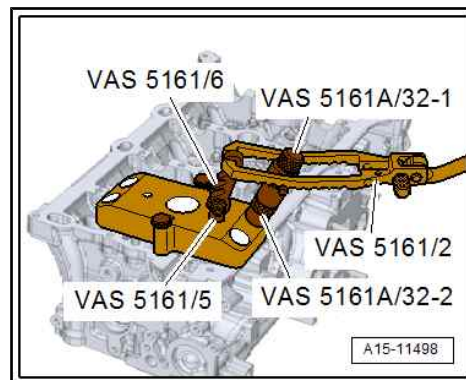


If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161 A/32-3- .

- 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 ⇒ [Fig. "Position of valve spring", page 112](#) .



- Secure guide plate -VAS 5161 A/32- back onto cylinder head.
- Insert assembly cartridge -VAS 5161 A/32-1- with sleeve -VAS 5161 A/32-2- into guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.





## 4 Inlet and exhaust valves

⇒ ["4.1 Checking valve guides", page 127](#)

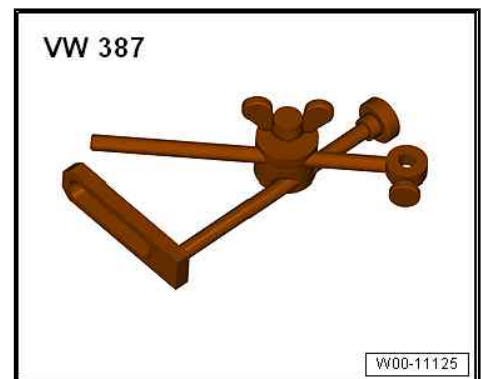
⇒ ["4.2 Checking valves", page 128](#)

⇒ ["4.3 Valve dimensions", page 128](#)

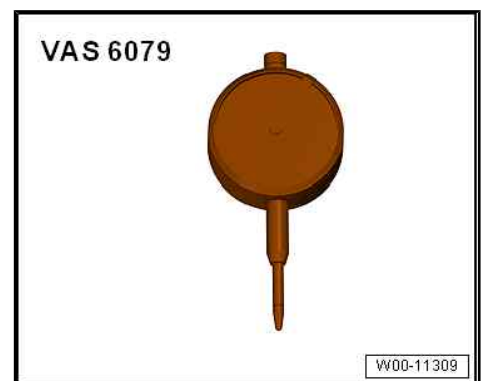
### 4.1 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

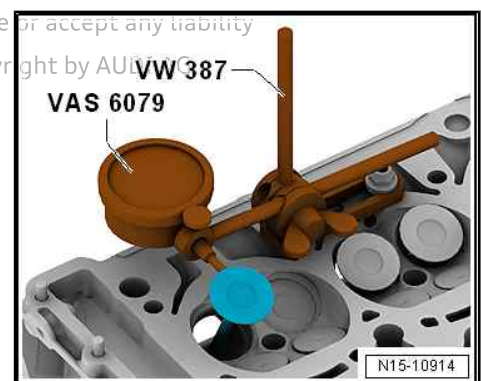


- ◆ Dial gauge - VAS 6079-



#### Test sequence

- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#).
- If the valve has to be renewed as part of a repair, use a new valve for the measurement.
- Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.
- Attach dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder head.
- Insert valve into guide.
- End of valve stem must be flush with valve guide.
- Measure the amount of sideways play.
- Wear limit: 0.5 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.





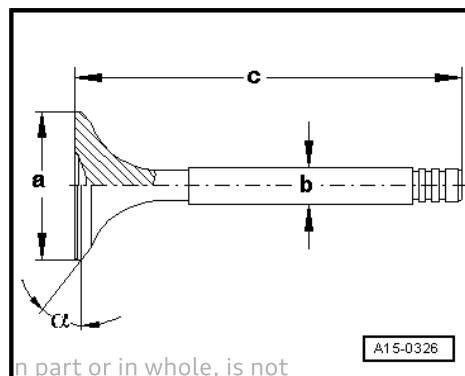
## 4.2 Checking valves

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

## 4.3 Valve dimensions

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

| Dimension |    | Inlet valve | Exhaust valve |
|-----------|----|-------------|---------------|
| Ø a       | mm | 28.5        | 25.0          |
| Ø 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 129](#)

⇒ [“1.2 Engine oil”, page 131](#)

⇒ [“1.3 Removing and installing sump \(bottom section\)”,  
page 132](#)

⇒ [“1.4 Removing and installing sump \(top section\)”, page 134](#)

⇒ [“1.5 Removing and installing oil pump”, page 137](#)

⇒ [“1.6 Removing and installing oil level and oil temperature send-  
er G266”, page 138](#)

#### 1.1 Exploded view - sump/oil pump

- ◆ If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully in order to prevent further damage occurring later. In addition, renew oil spray jets, engine oil cooler and oil filter.
- ◆ Oil spray jet and pressure relief valve  
⇒ [“4.3 Removing and installing oil spray jets”, page 65](#)



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**1 - Nut**

- ☐ 9 Nm

**2 - Oil level and oil temperature sender - G266-**

- ☐ Removing and installing  
⇒ [“1.6 Removing and installing oil level and oil temperature sender G266”, page 138](#)

**3 - Seal**

- ☐ Renew after removing

**4 - O-ring**

- ☐ Renew after removing
- ☐ Lubricate lightly with engine oil

**5 - Sealing plug**

- ☐ Tighten as far as stop

**6 - Bolt**

- ☐ Renew after removing
- ☐ Tightening sequence  
⇒ [Fig. “Sump \(bottom section\) - tightening torque and sequence”](#), page 131

**7 - Sump (bottom section)**

- ☐ Removing and installing  
⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 132](#)

**8 - Gasket**

- ☐ Renew after removing

**9 - Bolt**

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

**10 - Oil intake pipe**

- ☐ Clean strainer if dirty

**11 - O-ring**

- ☐ Renew after removing

**12 - Cover**

- ☐ For oil pump drive chain sprocket

**13 - Drive chain**

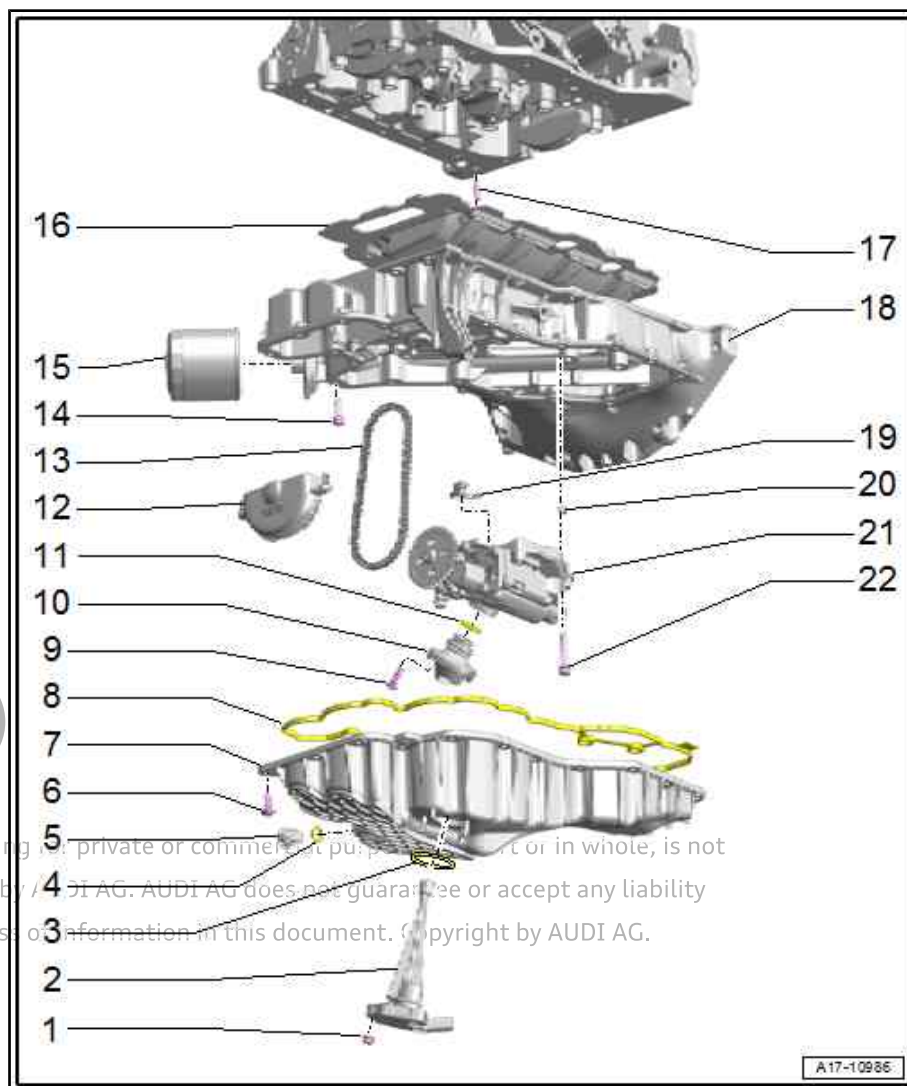
- ☐ For oil pump
- ☐ Before removing, mark running direction with paint

**14 - Bolt**

- ☐ Renew after removing
- ☐ Tightening torque and sequence  
⇒ [Fig. “Sump \(top section\) - tightening torque and sequence”](#), page 131

**15 - Oil filter**

- ☐ See note ⇒ [page 129](#)
- ☐ Removing and installing ⇒ Maintenance ; Booklet 830





## 16 - Baffle plate

## 17 - Dowel pin

## 18 - Sump (top section)

- ❑ Removing and installing ⇒ ["1.4 Removing and installing sump \(top section\)", page 134](#)

## 19 - Oil strainer

## 20 - Dowel sleeve

- ❑ 2x

## 21 - Oil pump

- ❑ Removing and installing ⇒ ["1.5 Removing and installing oil pump", page 137](#)

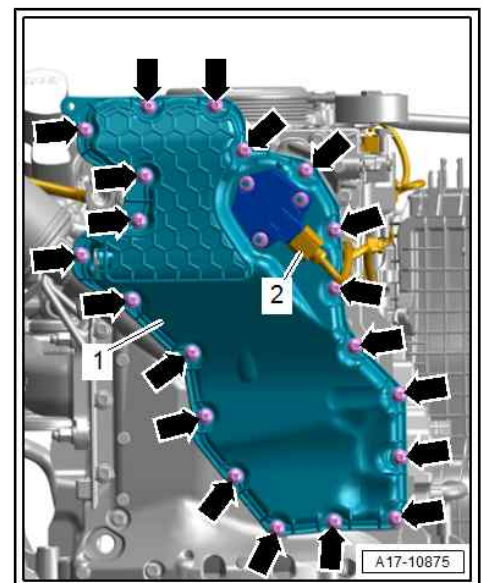
## 22 - Bolt

- ❑ 10 Nm

### Sump (bottom section) - tightening torque and sequence

- Renew bolts after removing.
- Tighten bolts -arrows- in stages as follows:

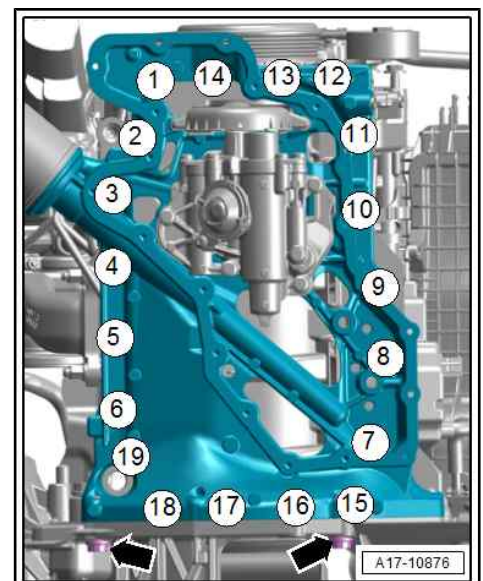
| Stage | Tightening torque                      |
|-------|----------------------------------------|
| 1.    | Screw in by hand until contact is made |
| 2.    | 5 Nm in diagonal sequence              |
| 3.    | 12 Nm in diagonal sequence             |



### Sump (top section) - tightening torque and sequence

- After removing, renew bolts tightened with specified tightening angle.
- Tighten bolts in stages in the sequence shown:

| Stage | Bolts      | Tightening torque/angle specification                                                                      |
|-------|------------|------------------------------------------------------------------------------------------------------------|
| 1.    | -1 ... 19- | Screw in by hand until contact is made                                                                     |
| 2.    | -Arrows-   | Screw in by hand until contact is made                                                                     |
| 3.    | -1 ... 19- | 8 Nm                                                                                                       |
| 4.    | -1 ... 19- | Turn 90° further                                                                                           |
| 5.    | -Arrows-   | Tightening torque ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox |



## 1.2 Engine oil

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



#### Caution

*Risk of damage to catalytic converter.*

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

## 1.3 Removing and installing sump (bottom section)

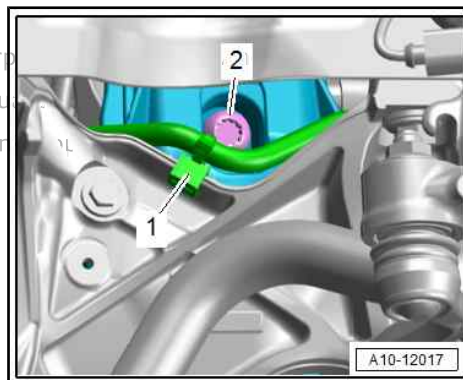
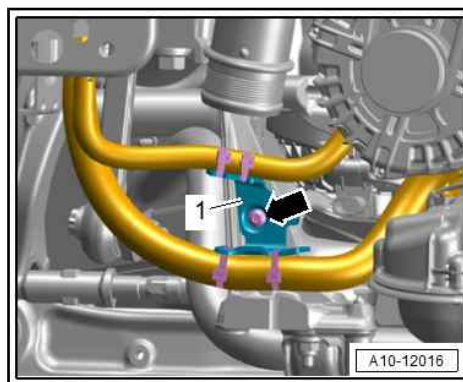
### Removing

- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Engine oil drained ⇒ Maintenance ; Booklet 830
- Remove wheel spoilers (left and right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
- Remove noise insulation (rear) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove heat shield for drive shaft (right-side) ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing heat shield for drive shaft .
- Unbolt drive shaft (left and right) from gearbox ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .
- Remove bolt -arrow- and move bracket -1- for electrical wiring harness clear.



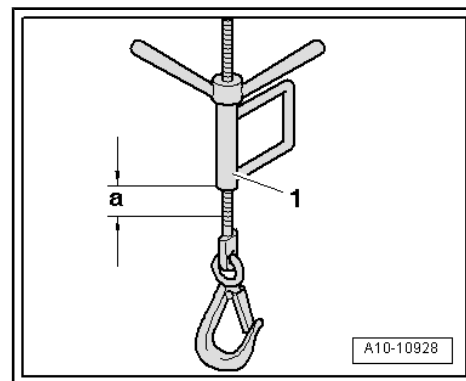
- Remove bolt -2- for engine mounting on both sides.
- Support engine in installation position  
⇒ ["2.2 Supporting engine in installation position", page 30](#)

with respect to the correctness of information in this document



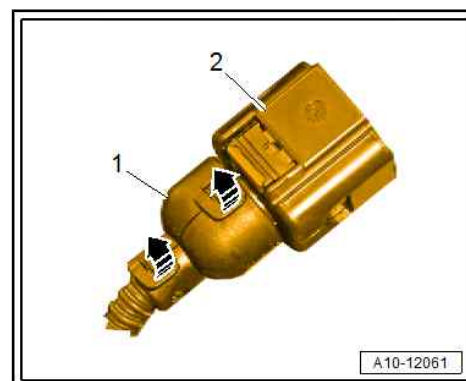


- Using spindle - 10-222A/11- -item 1-, raise engine through distance -a-.
- Distance -a- = approx. 40 mm.



#### Note:

If it is not possible to unplug electrical connector -2- for oil level and oil temperature sender - G266- , release catches -arrow- and detach protective cable cover -1-.



- Unplug electrical connector -2- for oil level and oil temperature sender - G266- .
- Loosen and remove bolts -arrows- in diagonal sequence and detach sump (bottom section) -1-.

#### Installing

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

- Renew gasket and bolts after removing.
- Detach support bracket  
⇒ ["2.2 Supporting engine in installation position", page 30](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 830 .

#### Tightening torques

◆ ⇒ [Fig. "Sump \(bottom section\) - tightening torque and sequence", page 131](#)

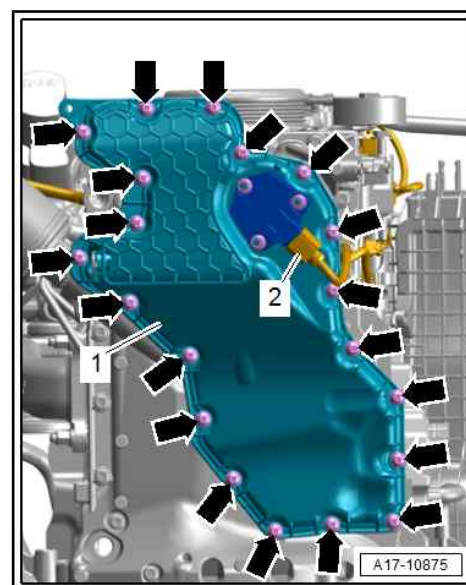
◆ ⇒ ["2.1 Exploded view - assembly mountings", page 28](#)

◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft

◆ ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing heat shield for drive shaft

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

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



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## 1.4 Removing and installing sump (top section)

### Special tools and workshop equipment required

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

### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .

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



### Caution

***Risk of damage to running gear components.***

- ◆ ***The vehicle must NOT be lowered onto its wheels if the engine/gearbox mountings, steering rack or subframe cross brace are not properly installed.***

- Remove steering rack ⇒ Running gear, axles, steering; Rep. gr. 48 ; Steering rack; Removing and installing steering rack .
- Remove poly V-belt  
⇒ [“1.3 Removing and installing poly V-belt”, page 38](#) .
- Detach air conditioner compressor from bracket and tie up ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Remove oil pump  
⇒ [“1.5 Removing and installing oil pump”, page 137](#) .



- Remove bolts -arrows- securing gearbox to sump (top section).
- Slacken and remove bolts in the sequence: -19 ... 1-.
- Carefully release sump (top section) from bonded joint.
- Detach baffle plate.

#### Installing

- After removing, renew bolts tightened with specified tightening angle.



#### Caution

*Protect lubrication system against contamination.*

- ◆ *Cover exposed parts of the engine.*

- Remove sealant remaining on cylinder block with flat scraper.



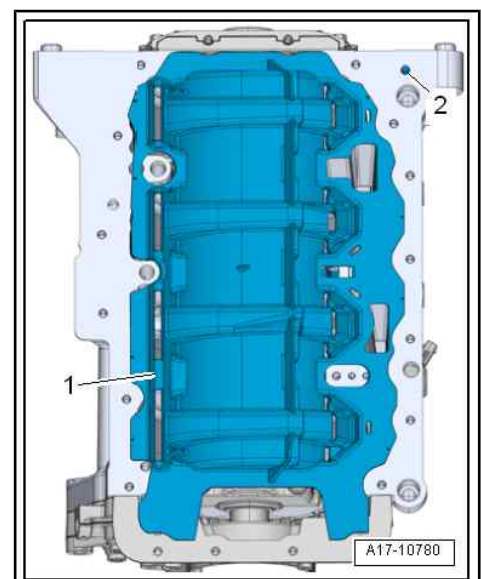
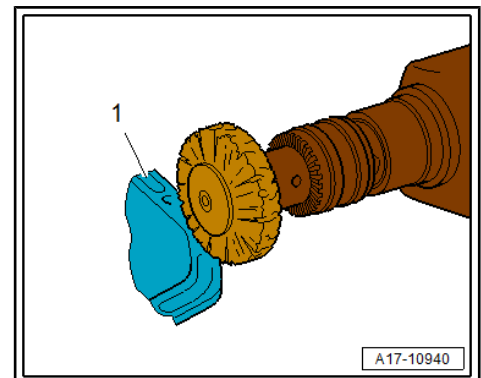
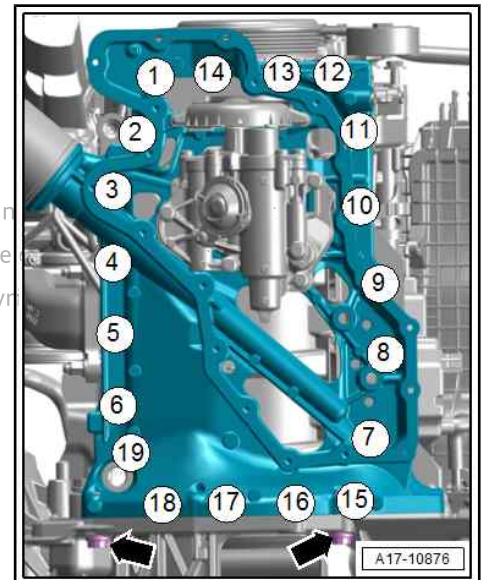
#### WARNING

*Risk of eye injury.*

- ◆ *Put on safety goggles.*

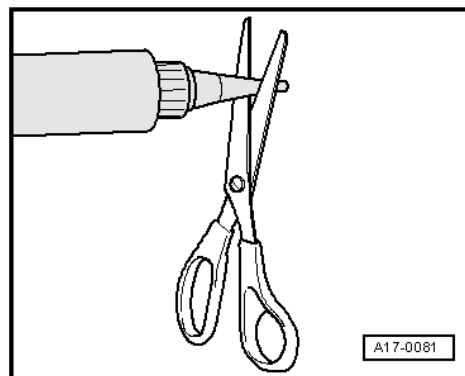
- Use e.g. a rotating plastic brush to remove sealant residue on sump (top section) flange.
- Check oil passages in sump (top section) and in cylinder block for dirt.
- Clean sealing surfaces; they must be free of oil and grease.

- Check that dowel pin -2- is securely seated in cylinder block.
- Attach baffle plate -1- to cylinder block.





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

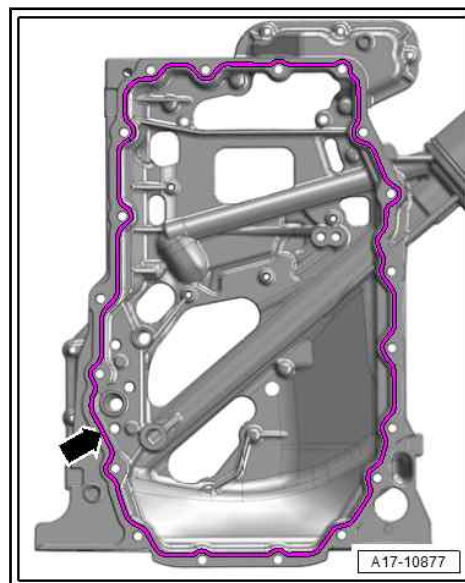


#### Caution

***Make sure lubrication system is not clogged by excess sealant.***

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

- Apply bead of sealant -arrow- onto clean sealing surface of sump (top section) as shown in illustration.
- Thickness of sealant bead: 2 ... 3 mm
- Install sump (top section) within 5 minutes of applying sealant.
- A second mechanic is required for the following step.
- Carefully fit sump (top section) with the help of a second mechanic but do not press sealant bead on yet.
- Sealant must not be allowed to get into threaded holes.
- First, screw all bolts in by hand and then tighten.



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

- Install oil pump  
⇒ [“1.5 Removing and installing oil pump”, page 137](#) .
- Install poly V-belt  
⇒ [“1.3 Removing and installing poly V-belt”, page 38](#) .
- Install steering rack ⇒ Running gear, axles, steering; Rep. gr. 48 ; Steering rack; Removing and installing steering rack .
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 830 .

#### Tightening torques

- ◆ ⇒ [Fig. “Sump \(top section\) - tightening torque and sequence”, page 131](#)
- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 129](#)
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit



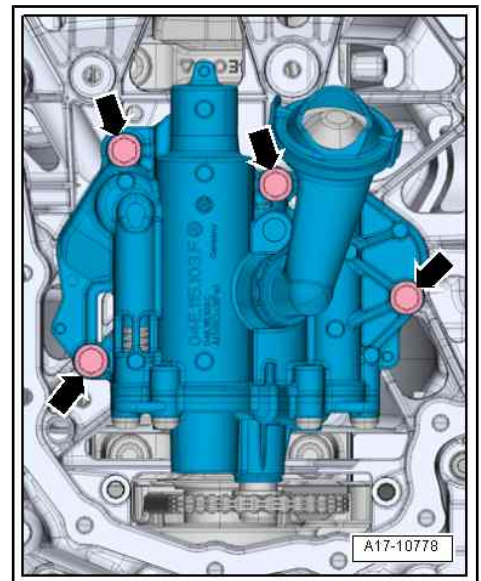
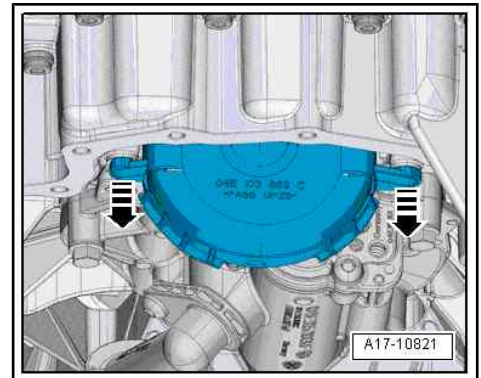
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## 1.5 Removing and installing oil pump

### Removing

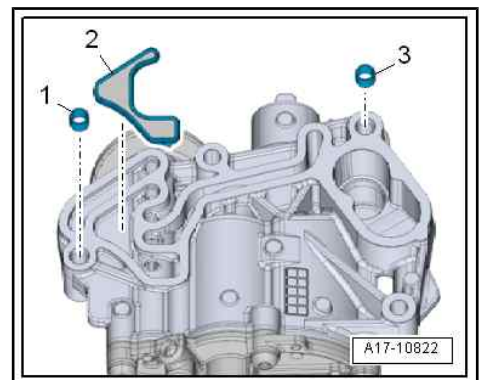
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove sump (bottom section)  
⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 132](#) .
- Unclip cover for oil pump drive chain sprocket -arrows-.
- Remove bolts -arrows-.
- Guide out oil pump with drive chain sprocket under drive chain.



### Installing

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

- Check that dowel sleeves -1, 3- are fitted in oil pump.
- Insert oil strainer -2- into oil pump.
- Turn oil pump drive chain sprocket by hand to check oil pump for ease of movement.
- 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)  
⇒ [“1.3 Removing and installing sump \(bottom section\)”, page 132](#) .



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- ♦ ⇒ [“1.1 Exploded view - sump/oil pump”, page 129](#)



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

### Removing

- Engine oil drained ⇒ Maintenance ; Booklet 830

### Note:

If it is not possible to unplug electrical connector -2- for oil level and oil temperature sender - G266- , release catches -arrow- and detach protective cable cover -1-.



- Unplug electrical connector -2-.
- Remove nuts -1- and detach oil level and oil temperature sender - G266- -item 3-.

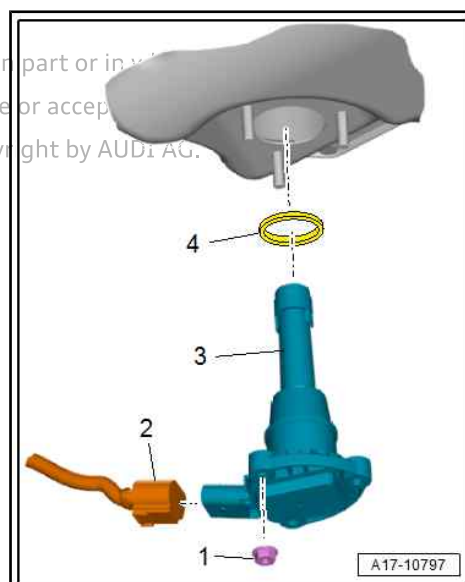
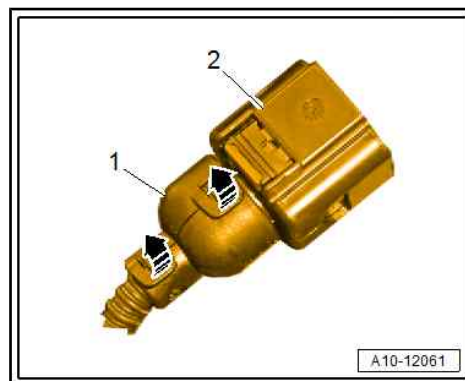
### Installing

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

- Renew seal -4- after removing.
- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 830 .

### Tightening torques

- ♦ ⇒ ["1.1 Exploded view - sump/oil pump", page 129](#)





## 2 Engine oil cooler

⇒ [“2.1 Exploded view - engine oil cooler”, page 139](#)

⇒ [“2.2 Removing and installing engine oil cooler”, page 139](#)

### 2.1 Exploded view - engine oil cooler

#### 1 - Bolt

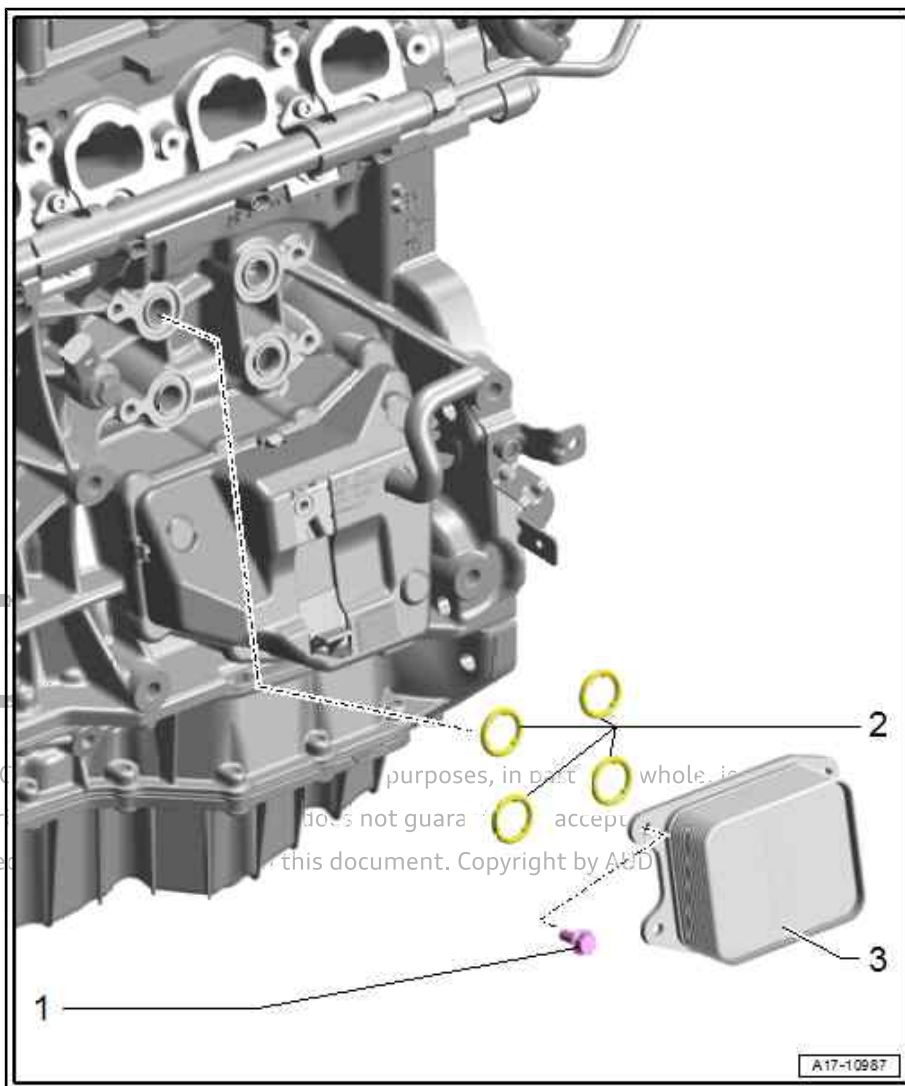
- ☐ Renew after removing
- ☐ 8 Nm +90°

#### 2 - Seals

- ☐ Renew after removing

#### 3 - Engine oil cooler

- ☐ See note  
⇒ [“1. Sump/oil pump”, page 129](#)
- ☐ Removing and installing  
⇒ [“2.2 Removing and installing engine oil cooler”, page 139](#)
- ☐ If renewed, refill system with fresh coolant

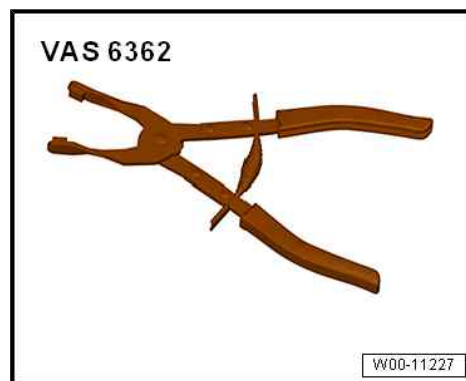


### 2.2 Removing and installing engine oil cooler

Special tools and workshop equipment required

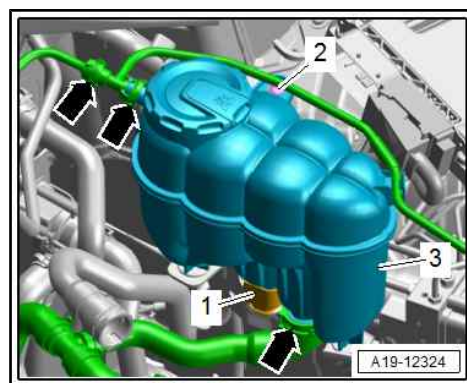


- ◆ Hose clip pliers - VAS 6362-



## Removing

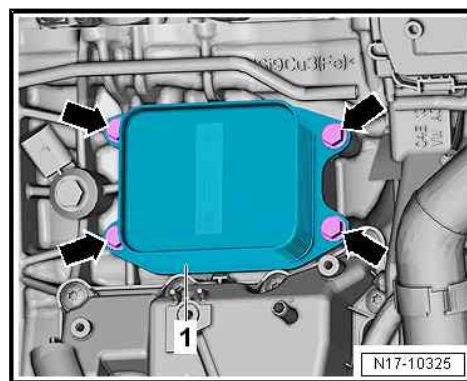
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Drain coolant  
⇒ [“1.3 Draining and filling cooling system”, page 153](#) .
- Lift retaining clips -arrows-, disconnect coolant hoses and move them clear.
- Unplug electrical connector -1- for coolant shortage indicator switch - F66- .
- Unscrew bolt -2- and detach coolant expansion tank.
- Remove coolant pipes  
⇒ [“3.2 Removing and installing coolant pipes”, page 180](#) .
- Unscrew bolts -arrows- and detach engine oil cooler -1-.



## Installing

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

- Renew seals after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Do not reuse coolant.
- Connect coolant hoses with plug-in connector  
⇒ Fig. [“Connecting coolant hose with plug-in connector”](#), [page 183](#) .
- Fill up with coolant ⇒ [page 155](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .



## Tightening torques

- ◆ ⇒ [“2.1 Exploded view - engine oil cooler”, page 139](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 180](#)

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### 3 Crankcase breather

⇒ [“3.1 Exploded view - crankcase breather system”, page 141](#)

⇒ [“3.2 Removing and installing oil separator”, page 142](#)

#### 3.1 Exploded view - crankcase breather system

##### 1 - Bolt

- ☐ Self-locking
- ☐ Renew after removing
- ☐ 9 Nm

##### 2 - Oil separator

- ☐ Removing and installing  
⇒ [“3.2 Removing and installing oil separator”, page 142](#)
- ☐ Renew if damaged

##### 3 - Hose

- ☐ For crankcase breather

##### 4 - Non-return valve

##### 5 - O-ring

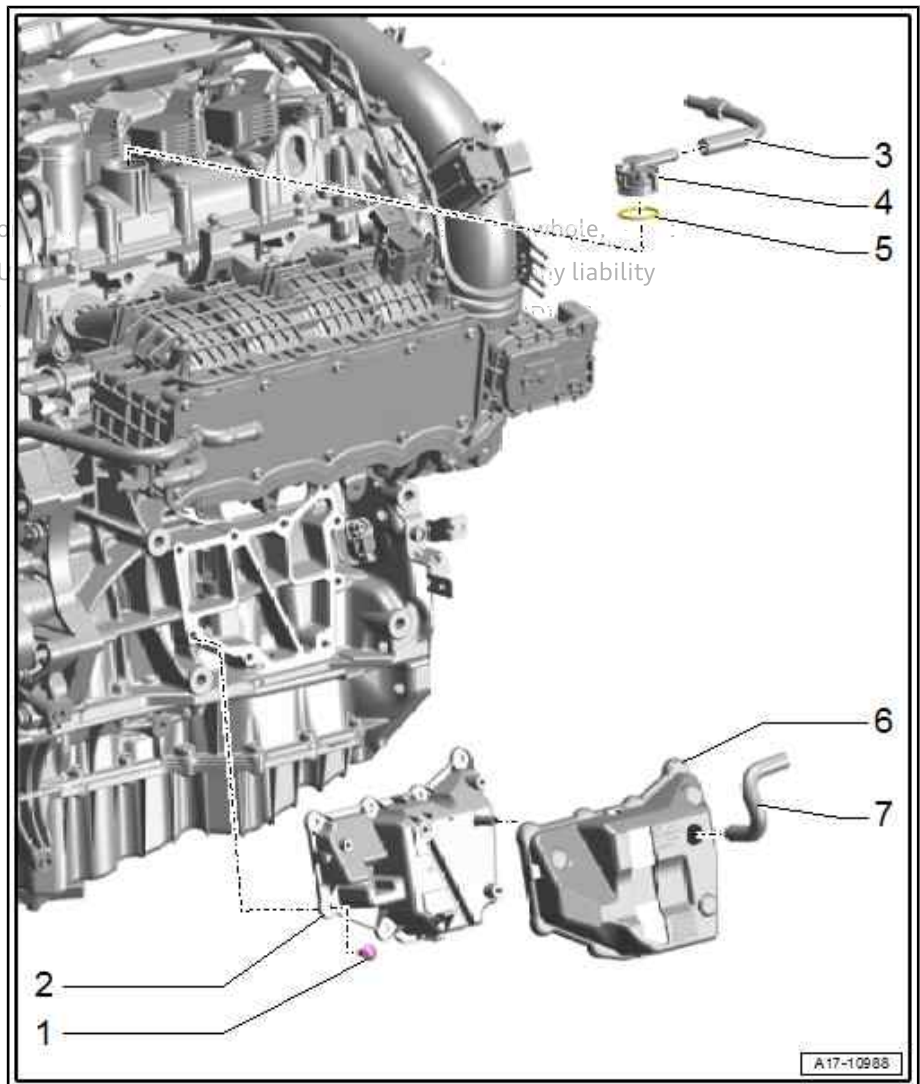
- ☐ Lubricate lightly with engine oil
- ☐ Check for damage and renew if necessary; supplied together with non-return valve

##### 6 - Cover

- ☐ For oil separator

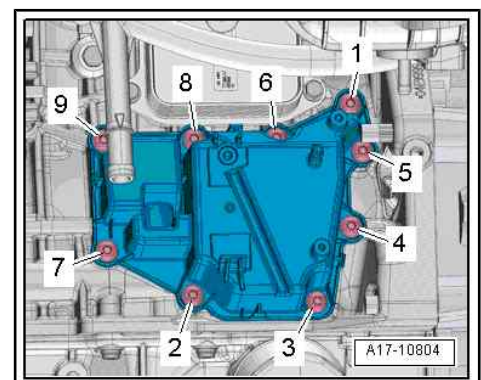
##### 7 - Hose

- ☐ For crankcase breather



#### Oil separator - tightening torque and sequence

- Tighten bolts in the sequence -1 ... 9- to 9 Nm.





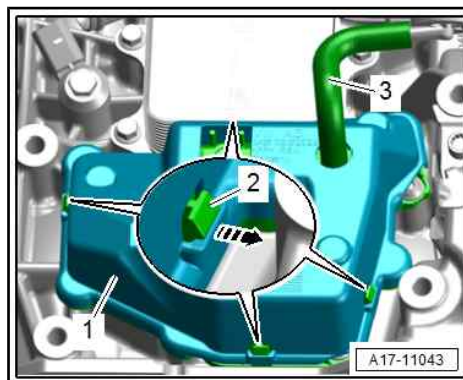
## 3.2 Removing and installing oil separator

### Special tools and workshop equipment required

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

### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine support (left-side)  
⇒ [“1.5.1 Removing and installing engine support \(left-side\)”, page 39](#) .
- 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.

### Installing

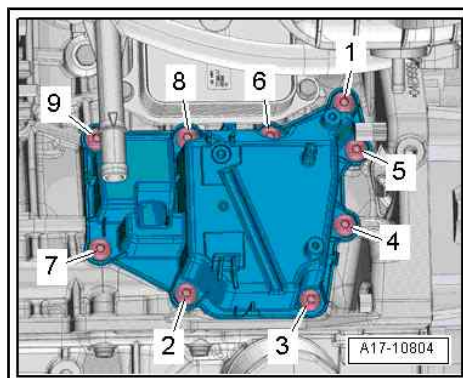
Installation is carried out in reverse order; note the following:



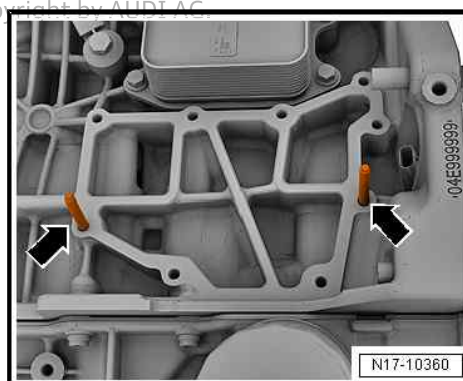
#### Caution

*Protect lubrication system against contamination.*

- ◆ *Cover exposed parts of the engine.*

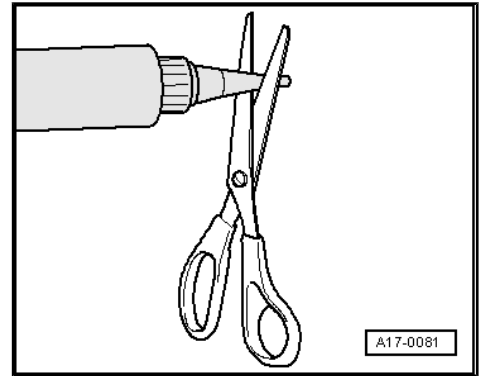


- Remove sealant remaining on cylinder block with flat scraper.
- Clean sealing surfaces; they must be free of oil and grease.
- Screw 2 studs a few turns into holes -arrows-.





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



#### Caution

***Make sure lubrication system is not clogged by excess sealant.***

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

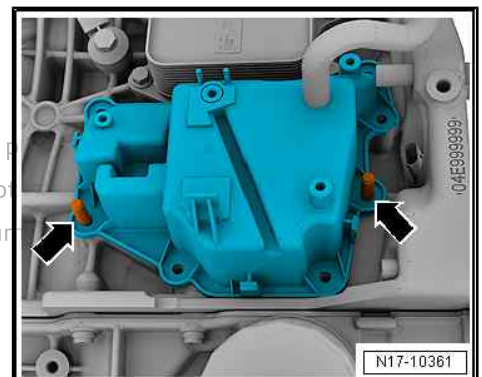
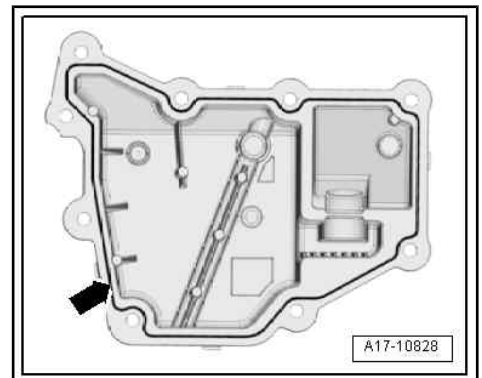
- Apply bead of sealant -arrow- onto clean sealing surface of oil separator as shown in illustration.
- Thickness of sealant bead: 2 ... 3 mm
- Install oil separator within 5 minutes after applying the sealant.
- Carefully fit oil separator onto studs but do not press sealant bead on yet.
- Sealant must not be allowed to get into threaded holes.
- Screw in bolts hand-tight at first.
- Unscrew studs again.
- Screw in last two bolts and tighten all bolts.
- Check oil level ⇒ Maintenance ; Booklet 830 .

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

- Install engine support (left-side)  
⇒ [“1.5.1 Removing and installing engine support \(left-side\)”, page 39](#) .

#### Tightening torques

- ◆ ⇒ Fig. [“Oil separator - tightening torque and sequence”](#), page 141





## 4 Oil filter/oil pressure switches

⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 144](#)

⇒ [“4.2 Removing and installing oil pressure switch F22 ”, page 145](#)

⇒ [“4.3 Removing and installing oil pressure switch for reduced oil pressure F378 ”, page 146](#)

⇒ [“4.4 Checking oil pressure”, page 146](#)

⇒ [“4.5 Removing and installing valve for oil pressure control N428 ”, page 147](#)

### 4.1 Exploded view - oil filter/oil pressure switches

#### 1 - Oil filter

- ☐ See note ⇒ [page 129](#)
- ☐ Removing and installing  
⇒ Maintenance ; Book-  
let 830

#### 2 - O-ring

- ☐ Lubricate lightly with en-  
gine oil
- ☐ Check for damage and  
renew if necessary; sup-  
plied together with valve  
for oil pressure control -  
N428- ⇒ Electronic  
parts catalogue

#### 3 - Bolt

- ☐ 8 Nm

#### 4 - Valve for oil pressure control - N428-

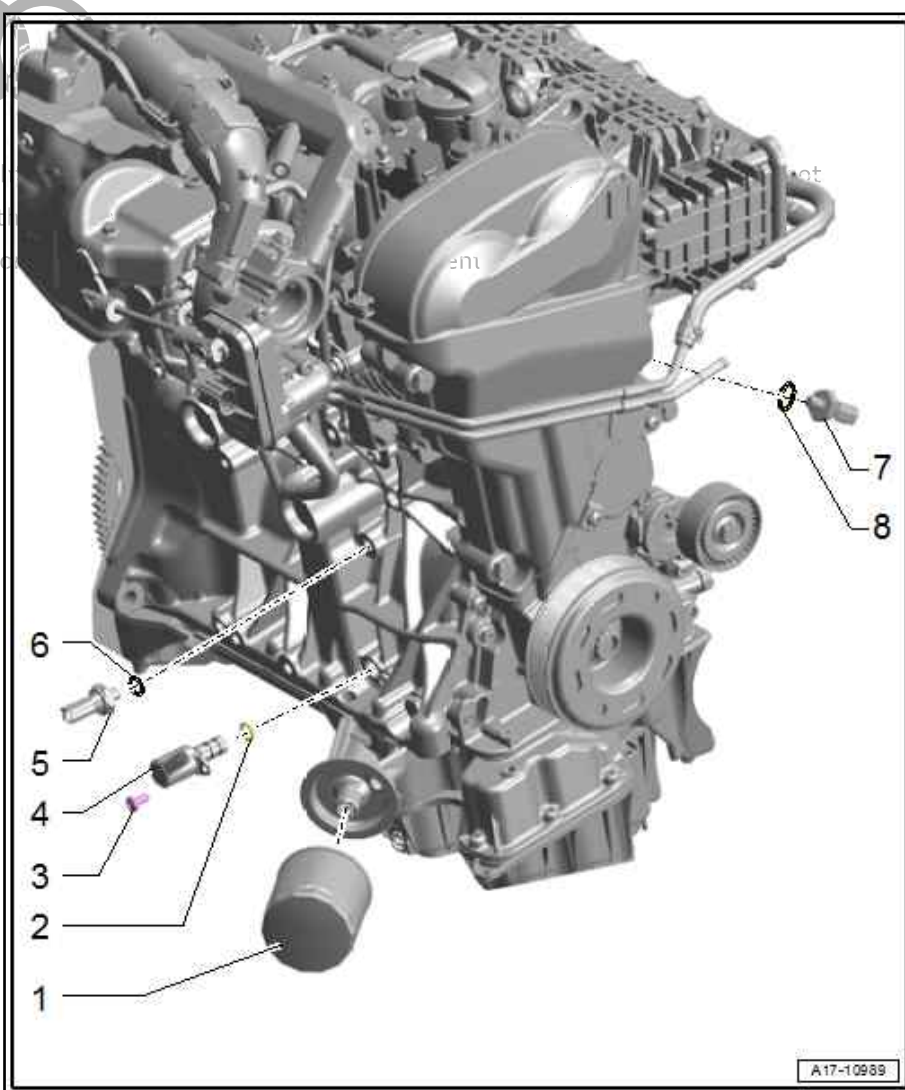
- ☐ Removing and installing  
⇒ [“4.5 Removing and in-  
stalling valve for oil  
pressure control N428 ”,  
page 147](#)

#### 5 - Oil pressure switch - F22-

- ☐ Opening/closing pres-  
sure 2.15 ... 2.95 bar
- ☐ Blue insulation
- ☐ Checking ⇒ Vehicle di-  
agnostic tester
- ☐ If seal -6- is not available  
separately, refer to ⇒  
Electronic parts cata-  
logue ; renew oil pres-  
sure switch after remov-  
al
- ☐ Removing and installing ⇒ [“4.2 Removing and installing oil pressure switch F22 ”, page 145](#)
- ☐ 20 Nm

#### 6 - Seal

- ☐ Renew if removed; check availability in ⇒ Electronic parts catalogue
- ☐ Cut seal open to renew





## 7 - Oil pressure switch for reduced oil pressure - F378-

- ☐ Opening/closing pressure 0.3 ... 0.6 bar
- ☐ Green insulation
- ☐ Checking ⇒ Vehicle diagnostic tester
- ☐ If seal -8 is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal
- ☐ Removing and installing  
⇒ ["4.3 Removing and installing oil pressure switch for reduced oil pressure F378", page 146](#)
- ☐ 20 Nm

## 8 - Seal

- ☐ Renew if removed; check availability in ⇒ Electronic parts catalogue
- ☐ Cut seal open to renew

## 4.2 Removing and installing oil pressure switch - F22-

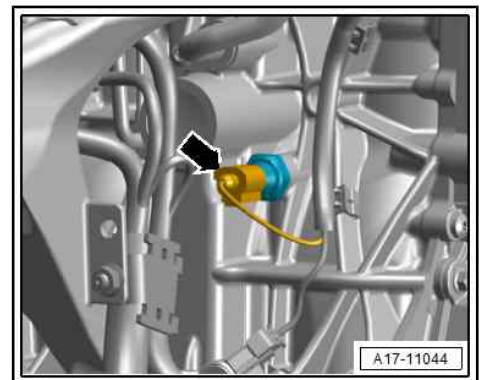
### Special tools and workshop equipment required

- ◆ Articulated wrench, 24 mm - T40175-



### Procedure

- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Remove air cleaner housing  
⇒ ["2.2 Removing and installing air cleaner housing", page 215](#) .
- Unplug electrical connector -arrow-.
- Place a cloth underneath to catch escaping engine oil.
- Unscrew oil pressure switch - F22- .
- Renew seal after removing  
⇒ ["4.1 Exploded view - oil filter/oil pressure switches", page 144](#) .
- Fit new oil pressure switch immediately so that as little oil as possible is lost.
- Check oil level ⇒ Maintenance ; Booklet 830 .
- Install air cleaner housing  
⇒ ["2.2 Removing and installing air cleaner housing", page 215](#) .



### Tightening torques

- ◆ ⇒ ["4.1 Exploded view - oil filter/oil pressure switches", page 144](#)



### 4.3 Removing and installing oil pressure switch for reduced oil pressure - F378-

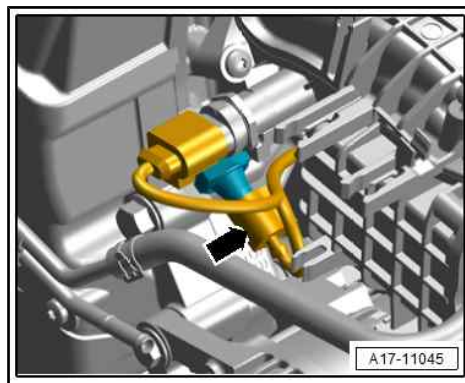
#### Special tools and workshop equipment required

- ◆ Articulated wrench, 24 mm - T40175-



#### Procedure

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Unplug electrical connector -arrow-.
- Place a cloth underneath to catch escaping engine oil.
- Unscrew oil pressure switch for reduced oil pressure - F378- .
- Renew seal after removing  
⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 144](#) .
- Fit new oil pressure switch immediately so that as little oil as possible is lost.
- Check oil level ⇒ Maintenance ; Booklet 830 .



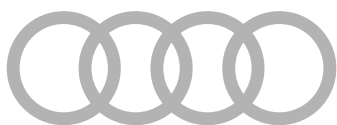
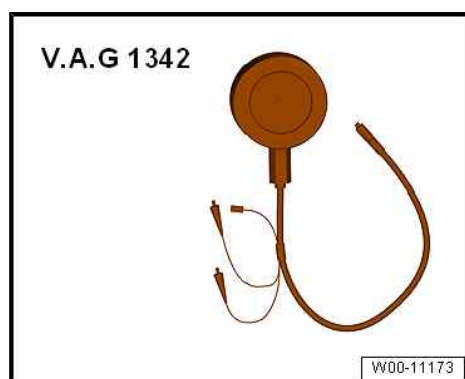
#### Tightening torques

- ◆ ⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 144](#)

### 4.4 Checking oil pressure

#### Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-



#### Procedure

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
  - Oil level has been checked and is OK ⇒ Maintenance ; Booklet 830
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- Engine oil temperature at least 80 °C (radiator fan must have run once).
- Remove oil pressure switch for reduced oil pressure - F378-  
⇒ [“4.3 Removing and installing oil pressure switch for reduced oil pressure F378”, page 146](#) .
- 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.
- Oil pressure at idling speed: at least 0.6 bar.
- Minimum oil pressure at 2000 rpm: 1.5 bar.
- Minimum oil pressure at 4500 rpm: 2.8 bar.

#### Assembling

- Install oil pressure switch for reduced oil pressure - F378-  
⇒ [“4.3 Removing and installing oil pressure switch for reduced oil pressure F378”, page 146](#) .

## 4.5 Removing and installing valve for oil pressure control - N428-

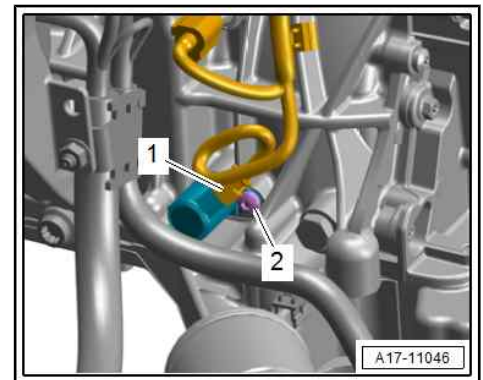
#### Procedure

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping engine oil.
- Remove bolt -2- and detach valve for oil pressure control - N428- .
- Check O-ring for damage ⇒ [Item 2 \(page 144\)](#) .
- Fit new valve for oil pressure control immediately so that as little oil as possible is lost.
- Check oil level ⇒ Maintenance ; Booklet 830 .

#### Tightening torques

- ◆ ⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 144](#)

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



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## 19 – Cooling

### 1 Cooling system/coolant

⇒ [“1.1 Connection diagram - coolant hoses”, page 148](#)

⇒ [“1.2 Checking cooling system for leaks”, page 150](#)

⇒ [“1.3 Draining and filling cooling system”, page 153](#)

#### 1.1 Connection diagram - coolant hoses

⇒ [“1.1.1 Connection diagram - coolant hoses, vehicles without auxiliary heater”, page 148](#)

⇒ [“1.1.2 Connection diagram - coolant hoses, vehicles with auxiliary heater”, page 149](#)

##### 1.1.1 Connection diagram - coolant hoses, vehicles without auxiliary heater

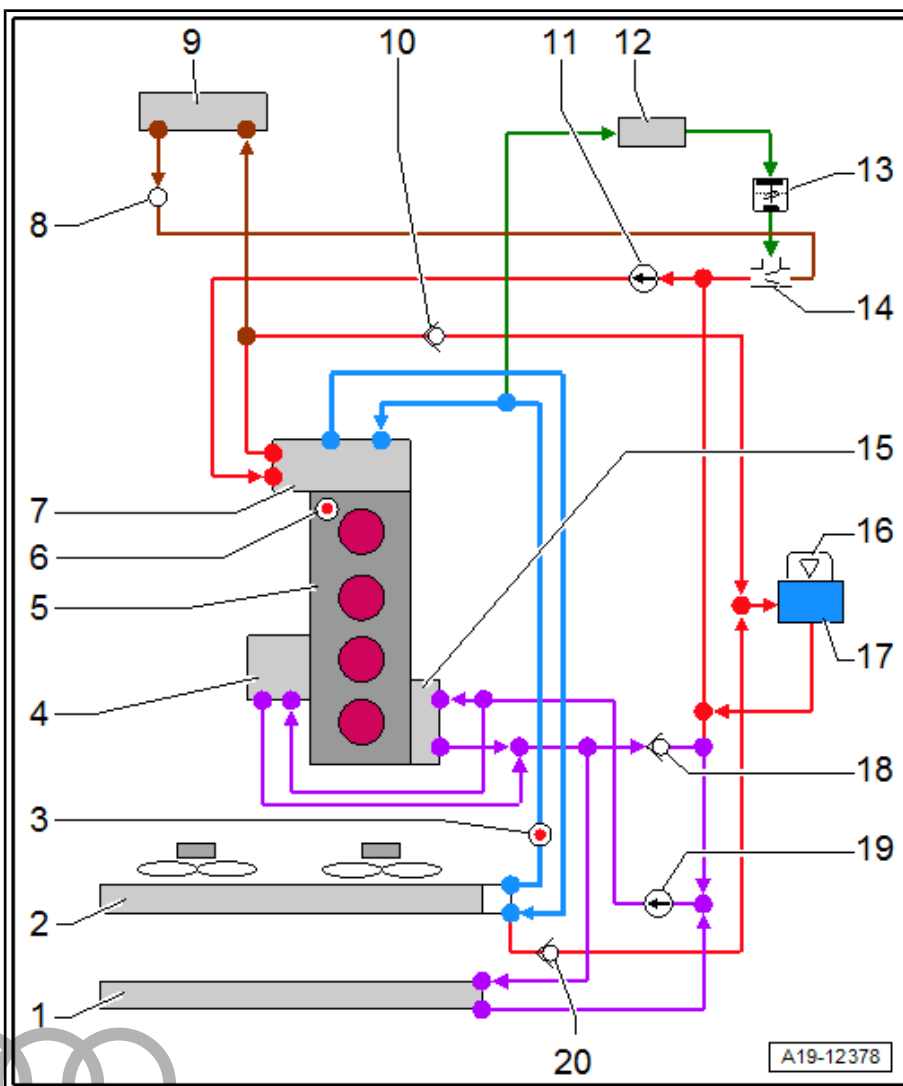
- ◆ Blue = Large coolant circuit
- ◆ Red = Small coolant circuit
- ◆ Violet = Coolant circuit for charge air cooler.
- ◆ Brown = Heating circuit
- ◆ Green = Coolant circuit for gearbox
- ◆ Arrows = Direction of coolant flow



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- 1 - Water radiator for charge air cooling circuit
- 2 - Radiator
- 3 - Radiator outlet coolant temperature sender - G83-
- 4 - Turbocharger
- 5 - Cylinder head/cylinder block
- 6 - Coolant temperature sender - G62-
- 7 - Coolant pump
  - ☐ With thermostat housing
- 8 - Bleeder hole
- 9 - Heat exchanger for heater
- 10 - Non-return valve
- 11 - Auxiliary pump for heating - V488-
  - ☐ For equipment version with dual clutch gearbox
- 12 - ATF cooler
  - ☐ For equipment version with dual clutch gearbox
- 13 - Thermostat
  - ☐ For coolant circuit for gearbox
  - ☐ Vehicles with dual clutch gearbox only
- 14 - Suction-jet pump
- 15 - Charge air cooler
- 16 - Filler cap
  - ☐ For coolant expansion tank
  - ☐ Checking pressure relief valve ➔ [page 152](#)
- 17 - Coolant expansion tank
- 18 - Non-return valve
- 19 - Charge air cooling pump - V188-
- 20 - Non-return valve



### 1.1.2 Connection diagram - coolant hoses, vehicles with auxiliary heater

- ◆ Blue = Large coolant circuit
- ◆ Red = Small coolant circuit
- ◆ Violet = Coolant circuit for charge air cooler.
- ◆ Brown = Heating circuit
- ◆ Green = Coolant circuit for gearbox
- ◆ Arrows = Direction of coolant flow



1 - Water radiator for charge air cooling circuit

2 - Radiator

3 - Radiator outlet coolant temperature sender - G83-

4 - Turbocharger

5 - Cylinder head/cylinder block

6 - Coolant temperature sender - G62-

7 - Coolant pump

- ☐ With thermostat housing

8 - Auxiliary heater

- ☐ With circulation pump - V55-

9 - Heater coolant shut-off valve - N279-

10 - Bleeder hole

11 - Heat exchanger for heater

12 - Non-return valve

13 - Auxiliary pump for heating - V488-

- ☐ For equipment version with dual clutch gearbox

14 - ATF cooler

- ☐ For equipment version with dual clutch gearbox

15 - Thermostat

- ☐ For coolant circuit for gearbox
- ☐ Vehicles with dual clutch gearbox only

16 - Suction-jet pump

17 - Charge air cooler

18 - Filler cap

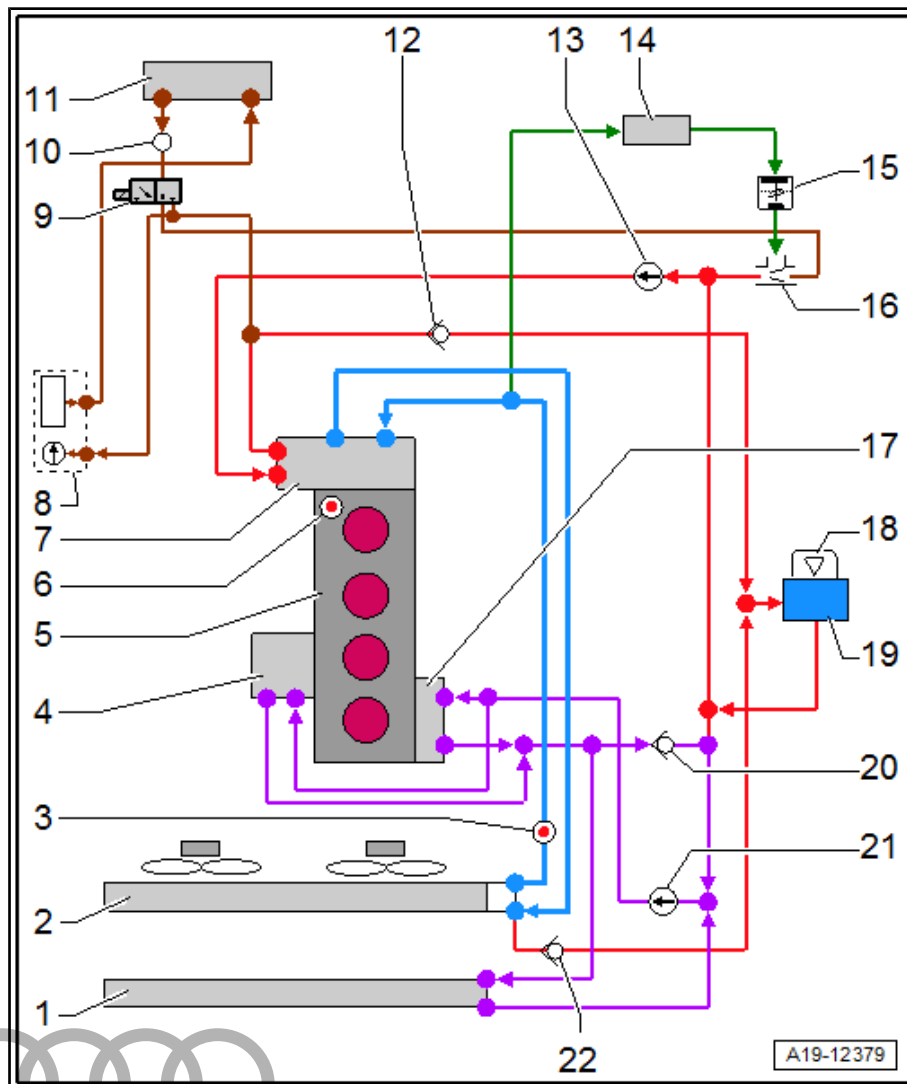
- ☐ For coolant expansion tank
- ☐ Checking pressure relief valve ➔ [page 152](#)

19 - Coolant expansion tank

20 - Non-return valve

21 - Charge air cooling pump - V188-

22 - Non-return valve



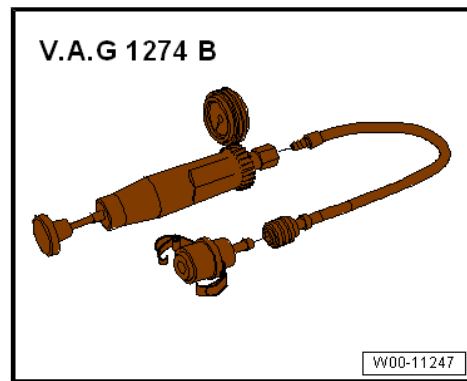
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## 1.2 Checking cooling system for leaks

Special tools and workshop equipment required



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



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



- ◆ Cooling system tester adapter - V.A.G 1274B/15- for filler cap, version 1 (not illustrated)
- ◆ Cooling system tester adapter - V.A.G 1274/9- for filler cap (version 2)



- ◆ Safety goggles
- ◆ Protective gloves

#### Procedure

- Engine must be warm.
- Ignition switched off.

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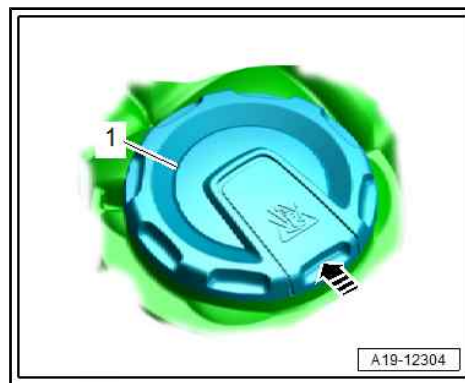


## WARNING

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

*Danger of scalding skin and other parts of the body.*

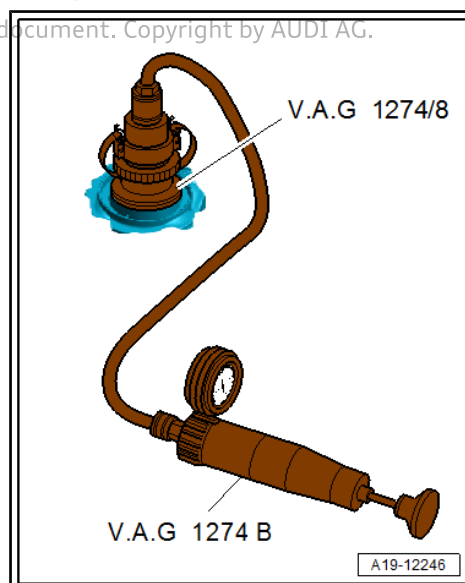
- ◆ *Put on protective gloves.*
- ◆ *Put on safety goggles.*
- ◆ *Cover filler cap on expansion tank with a cloth and open carefully to release pressure.*



- Release fastener -arrow- and open filler cap -1- on coolant expansion tank.
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.
- The pressure should not drop more than 0.2 bar within 10 minutes.
- If the pressure drops more than 0.2 bar, locate leak and eliminate fault.

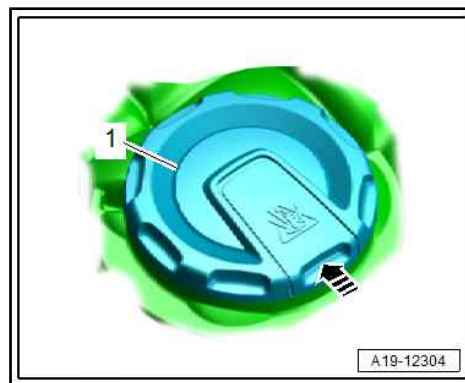
### Note:

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



### Checking pressure relief valve in filler cap, version 1

- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274 B/15- onto filler cap.





- Using hand pump on cooling system tester, build up a pressure of approx. 2 bar.

#### Blue filler cap

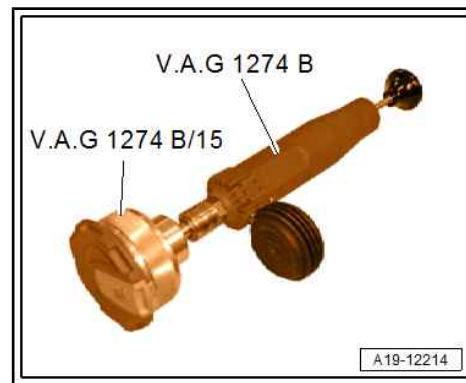
- The pressure must be reduced to 1.6 ... 1.4 bar and kept at this level.

#### Black filler cap

- The pressure must be reduced to 1.8 ... 1.6 bar and kept at this level.

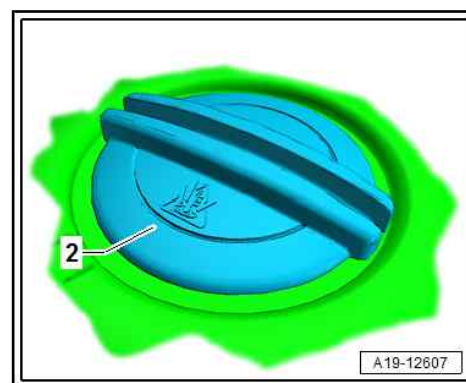
#### All filler caps

- Renew filler cap if pressure relief valve does not react as described.



#### Checking pressure relief valve in filler cap, version 2

- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.



- Build up pressure with hand pump on cooling system tester.

#### Blue filler cap

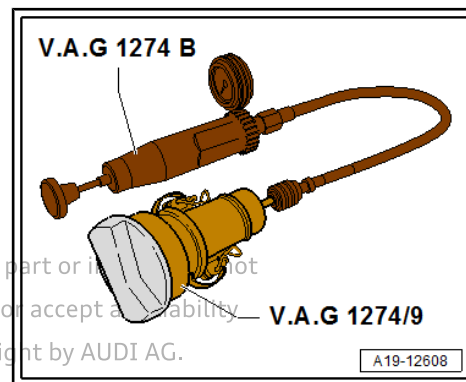
- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

#### Black filler cap

- The pressure relief valve should open at a pressure of 1.6 ... 1.8 bar.

#### All filler caps

- Renew filler cap if pressure relief valve does not open as described.



## 1.3 Draining and filling cooling system

### Special tools and workshop equipment required

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

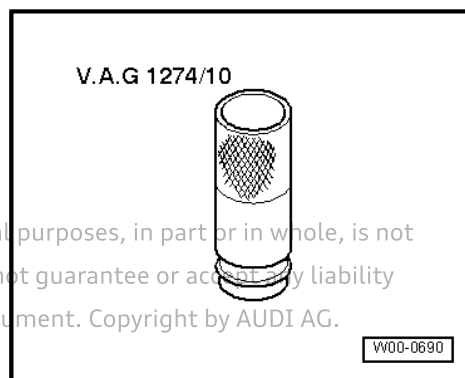




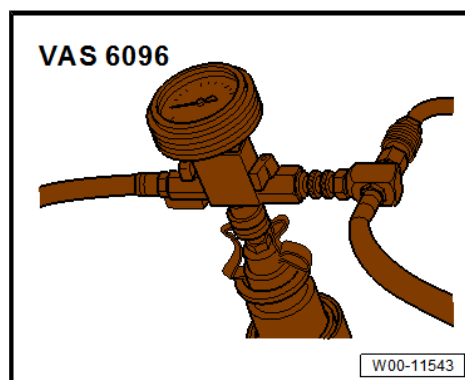
- ◆ Pipe for cooling system tester - V.A.G 1274/10-



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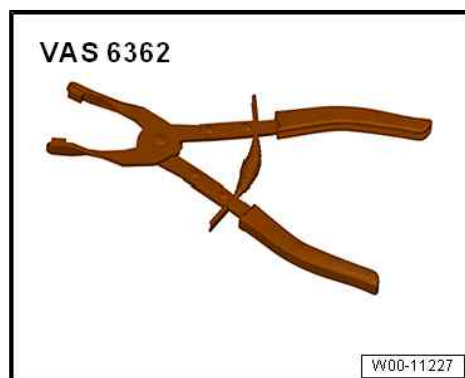
- ◆ Cooling system charge unit - VAS 6096-



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

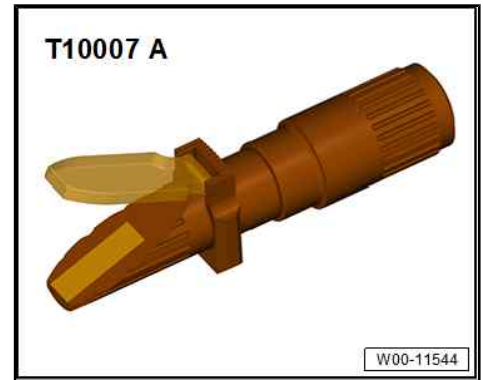


- ◆ Hose clip pliers - VAS 6362-





◆ Refractometer - T10007A-



- ◆ Safety goggles
- ◆ Protective gloves

**Draining**

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .

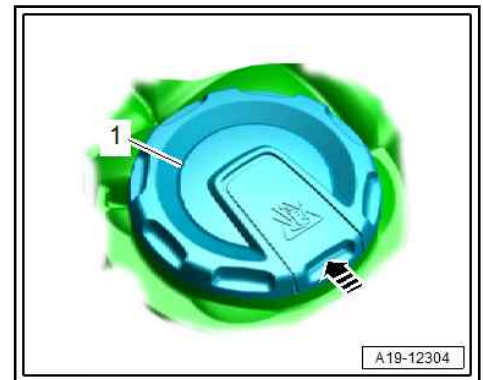


**WARNING**

*Risk of scalding due to hot steam and hot coolant.*

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

- Release fastener -arrow- and open filler cap -1- on coolant expansion tank.
- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

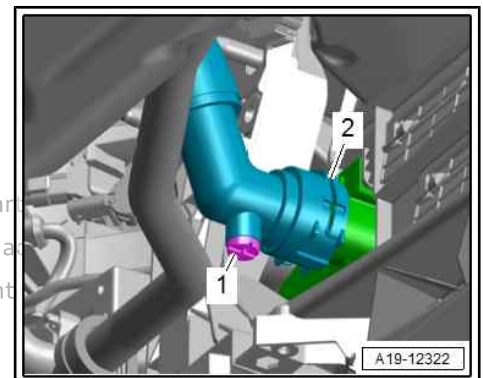


- Place collector tank from coolant collecting system -VAS 5014- or drip tray for workshop hoist - VAS 6208- underneath.
- Lift retaining clip -2- and disconnect coolant hose (bottom) from radiator.
- Drain off coolant.

– Connect coolant hose with plug-in connector to radiator

⇒ Fig. [“Connecting coolant hose with plug-in connector”](#), page 183 .

**Filling**

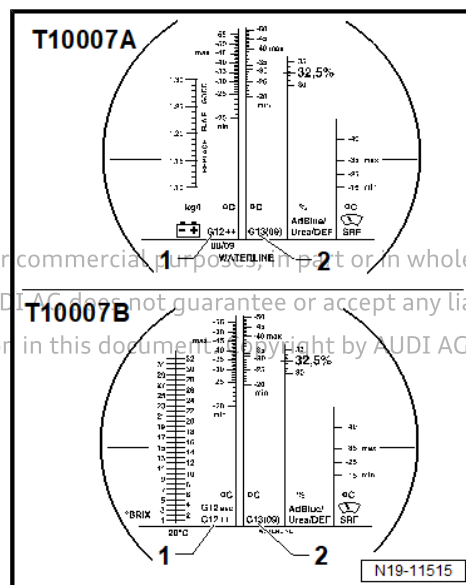


**Note**

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

**Recommended mixture ratio for coolant**

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





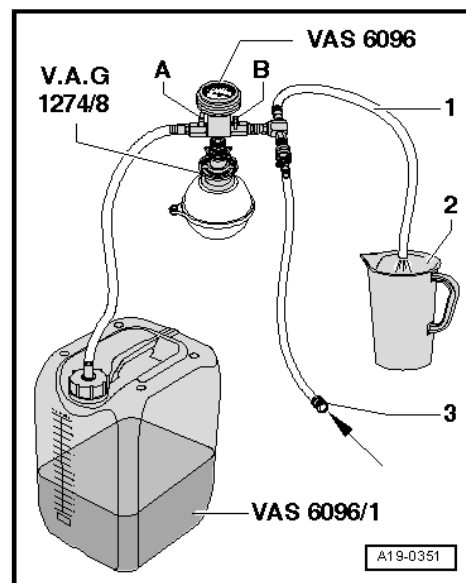
## Procedure

- Fill reservoir of -VAS 6096- with at least 10 litres of premixed coolant (according to recommended ratio).
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-.

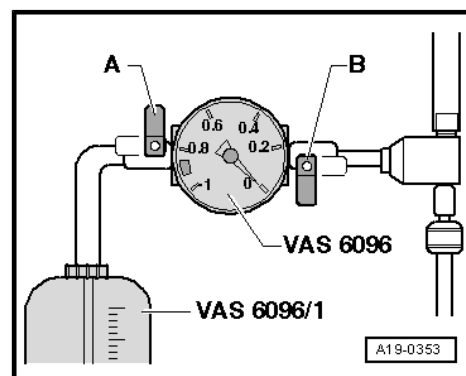
## Note:

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

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



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



- The suction jet pump continues to generate a partial vacuum in the cooling system; the needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.
- If the needle does not reach the green zone, repeat the process.

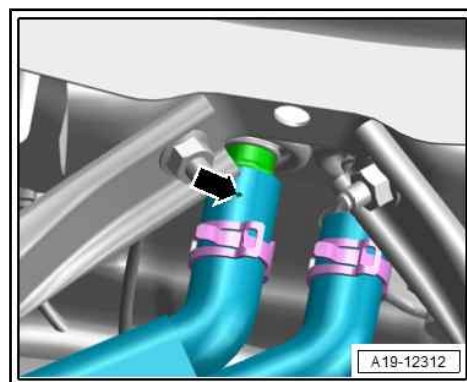
- Check cooling system for leaks if the vacuum is not maintained.
- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.
- Detach cooling system charge unit - VAS 6096- from adapter -V.A.G 1274/8- on coolant expansion tank.



- Attach pipe -V.A.G 1274/10- onto adapter -V.A.G 1274/8- .
- Fill up with coolant until pipe for cooling system tester is filled.  
If required, add further coolant when performing bleeding procedure.

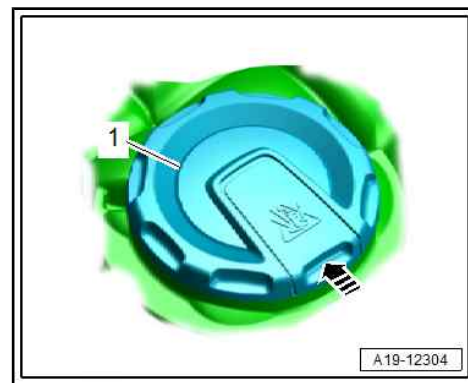


- Release hose clip -1- on coolant hose going to heat exchanger for heater and pull back hose until bleeder hole -arrow- is no longer blocked by connection.
- Fill up with coolant until it flows out at bleeder hole in coolant hose.
- Push coolant hose back onto connection and secure with hose clip.





- Close filler cap -1- on coolant expansion tank (make sure it engages).
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Start engine.
- Set temperature to “HI” in all zones.
- Switch off air conditioner compressor (press **AC** button).
- LED in button should not light up.
- Start engine and run alternately at approx. 1500 rpm and max. 2800 rpm until radiator fan cuts in.
- Switch off engine.
- Install plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Removing and installing plenum chamber cover .



#### Checking coolant level



#### WARNING

*Risk of scalding due to hot steam and hot coolant.*

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

- The coolant level must be at the “MAX” marking when the engine is cold.
- The coolant level can be above the “MAX” marking when the engine is warm.
- Top up with coolant again if necessary.

#### Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiators/radiator fan”, page 182](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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## 2 Coolant pump/thermostat assembly

⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 160](#)

⇒ [“2.2 Exploded view - electric coolant pump”, page 162](#)

⇒ [“2.3 Exploded view - coolant temperature senders”, page 165](#)

⇒ [“2.4 Removing and installing electric coolant pump”, page 165](#)

⇒ [“2.5 Removing cover of toothed belt for coolant pump”, page 168](#)

⇒ [“2.6 Removing and installing coolant pump”, page 169](#)

⇒ [“2.7 Removing and installing thermostat”, page 172](#)

⇒ [“2.8 Removing and installing toothed belt sprocket for coolant pump”, page 175](#)

⇒ [“2.9 Removing and installing coolant temperature sender G62”, page 176](#)

⇒ [“2.10 Removing and installing radiator outlet coolant temperature sender G83”, page 178](#)

### 2.1 Exploded view - coolant pump/thermostat

#### 1 - Thermostat housing

- ❑ Removing and installing  
⇒ [“2.7.2 Removing and installing thermostat for small coolant circuit”, page 174](#)

#### 2 - Thermostat

- ❑ For small coolant circuit
- ❑ Starts to open at approx. 105 °C
- ❑ Removing and installing  
⇒ [“2.7.2 Removing and installing thermostat for small coolant circuit”, page 174](#)

#### 3 - Gasket

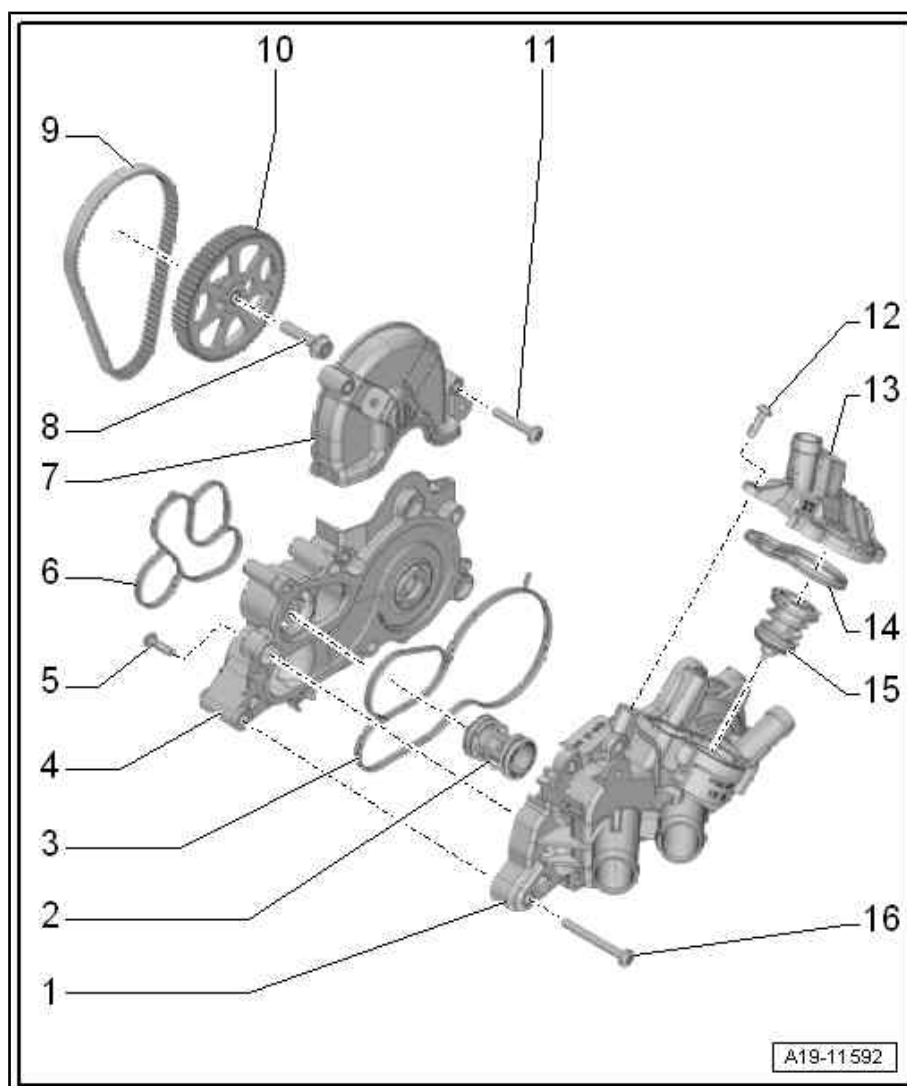
- ❑ Renew after removing

#### 4 - Coolant pump

- ❑ Removing and installing  
⇒ [“2.6 Removing and installing coolant pump”, page 169](#)

#### 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  
⇒ [Fig. “Thermostat housing to coolant pump - tightening torque](#)





[and sequence"" , page 162](#)

#### 6 - Gasket

- ☐ Renew after removing

#### 7 - Toothed belt cover

- ☐ For toothed belt for coolant pump
- ☐ Removing and installing ⇒ ["2.5 Removing cover of toothed belt for coolant pump", page 168](#)

#### 8 - Bolt

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

#### 9 - Toothed belt

- ☐ For coolant pump
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ When reinstalling, check for damage and renew if necessary

#### 10 - Toothed belt sprocket

- ☐ For coolant pump
- ☐ Removing and installing  
⇒ ["2.8 Removing and installing toothed belt sprocket for coolant pump", page 175](#)
- ☐ Installation position ⇒ [page 176](#)

#### 11 - Bolt

- ☐ 8 Nm

#### 12 - 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  
⇒ [Fig. ""Cover for thermostat to thermostat housing - tightening torque"" , page 162](#)

#### 13 - Cover

- ☐ For thermostat

#### 14 - Gasket

- ☐ Renew after removing

#### 15 - Thermostat

- ☐ For large coolant circuit
- ☐ Different versions available ⇒ Electronic parts catalogue
- ☐ Starts to open at approx. 87 °C
- ☐ Removing and installing  
⇒ ["2.7.2 Removing and installing thermostat for small coolant circuit", page 174](#)

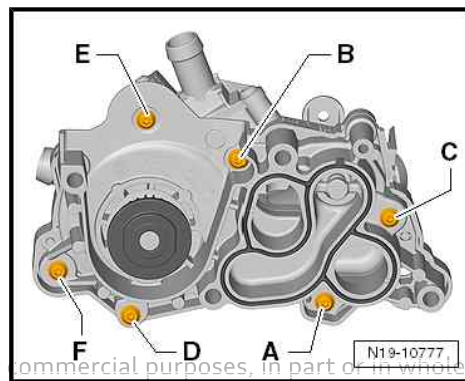
#### 16 - Bolt

- ☐ Tightening torque and sequence ⇒ [page 171](#)



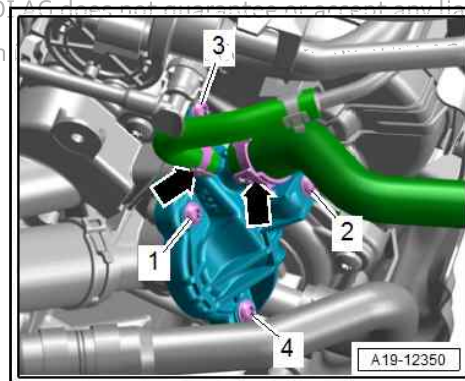
### Thermostat housing to coolant pump - tightening torque and sequence

- Tighten bolts in the sequence -A ... F- to 7 Nm.



### Cover for thermostat to thermostat housing - tightening torque

- Tighten bolts for cover in the sequence -1 ... 4- to 7 Nm.



## 2.2 Exploded view - electric coolant pump

⇒ ["2.2.1 Exploded view - charge air cooling pump V188", page 162](#)

⇒ ["2.2.2 Exploded view - auxiliary pump for heating V488", page 164](#)

### 2.2.1 Exploded view - charge air cooling pump - V188-



**1 - Charge air cooling pump - V188-**

- ❑ Removing and installing  
⇒ [“2.4.1 Removing and installing charge air cooling pump V188”](#),  
[page 165](#)

**2 - Bracket**

- ❑ For charge air cooling pump - V188-

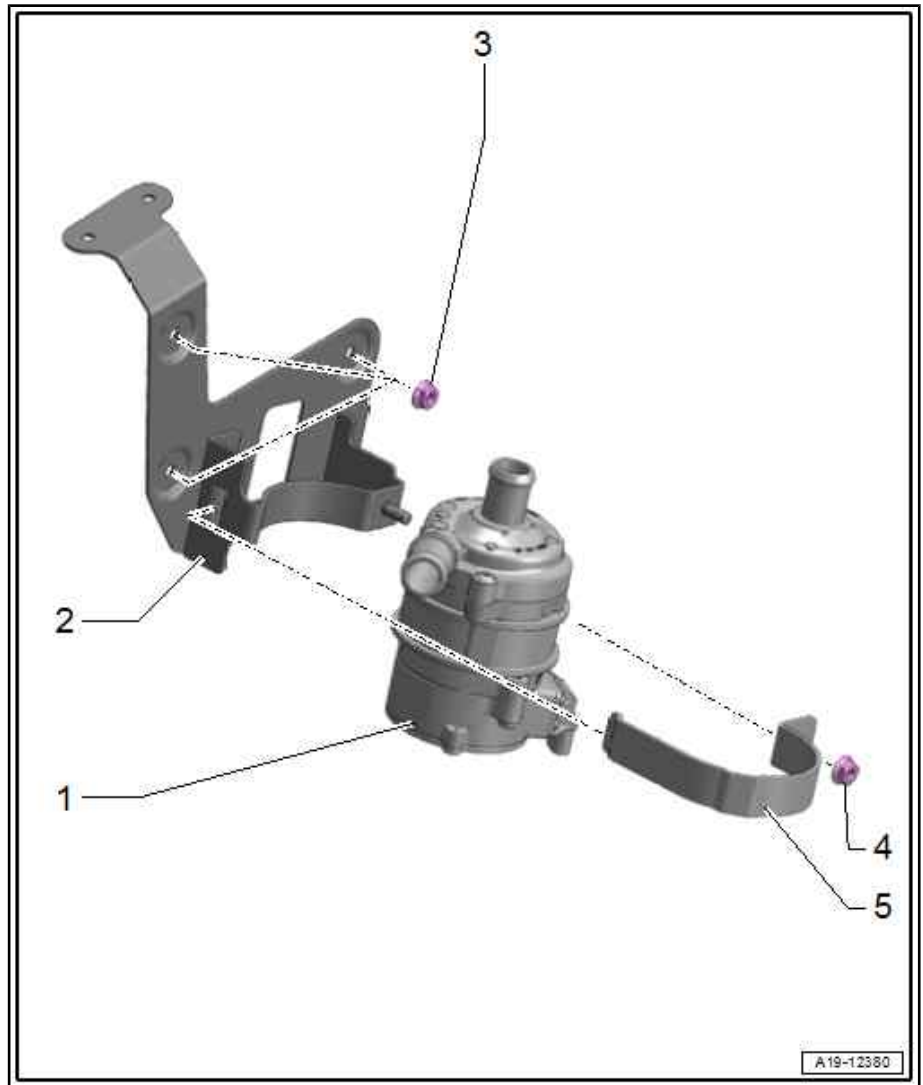
**3 - Nut**

- ❑ 8 Nm

**4 - Nut**

- ❑ 8 Nm

**5 - Retaining bracket**



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## 2.2.2 Exploded view - auxiliary pump for heating - V488-

### 1 - Bolt

- 9 Nm

### 2 - Auxiliary pump for heating - V488-

- Removing and installing  
⇒ ["2.4.2 Removing and installing auxiliary pump for heating V488", page 167](#)

### 3 - Bolt

- 9 Nm

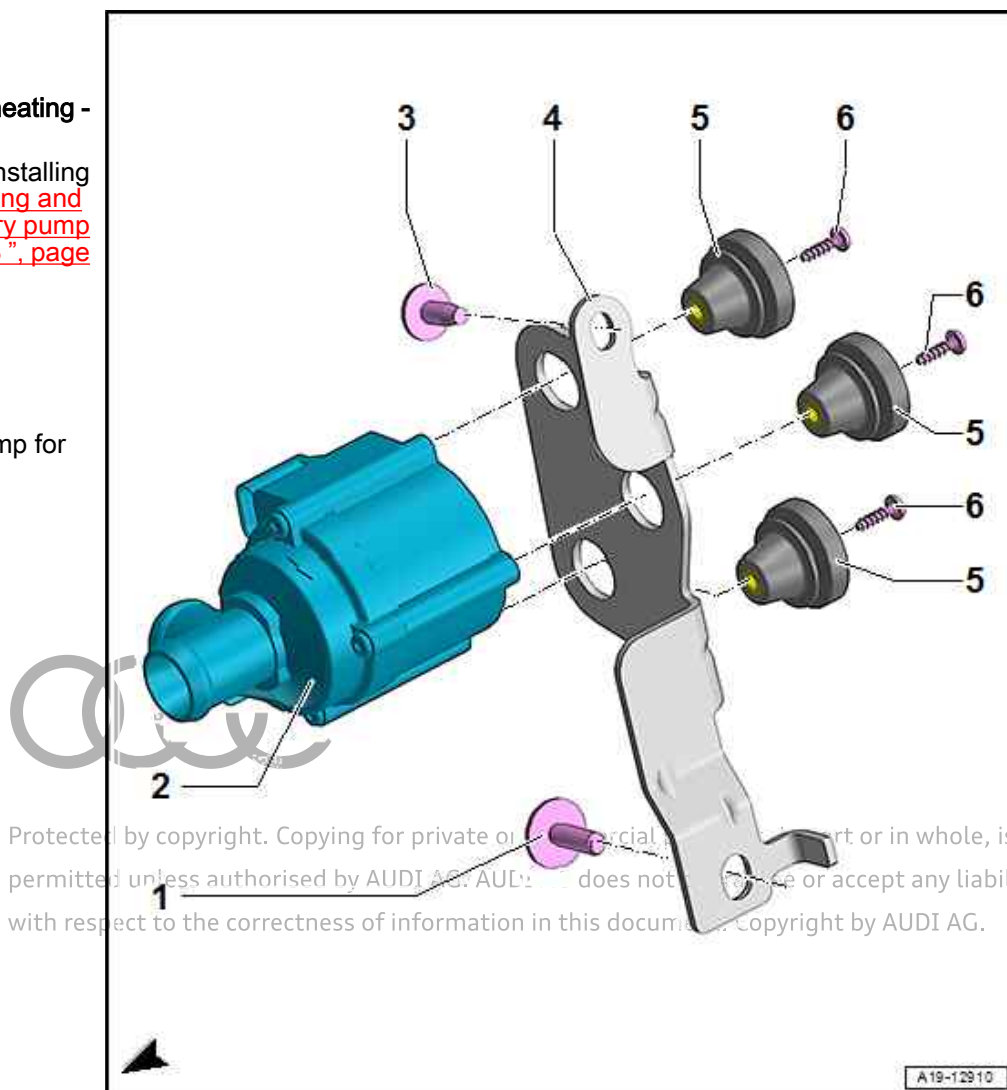
### 4 - Retainer

- For auxiliary pump for heating - V488-

### 5 - Rubber grommet

### 6 - Bolt

- 2.7 Nm





## 2.3 Exploded view - coolant temperature senders

### 1 - Retaining clip

- ☐ Check for firm attachment

### 2 - Radiator outlet coolant temperature sender - G83-

- ☐ Removing and installing  
⇒ ["2.10 Removing and installing radiator outlet coolant temperature sender G83"](#),  
[page 178](#)

### 3 - O-ring

- ☐ Renew after removing

### 4 - Bolt

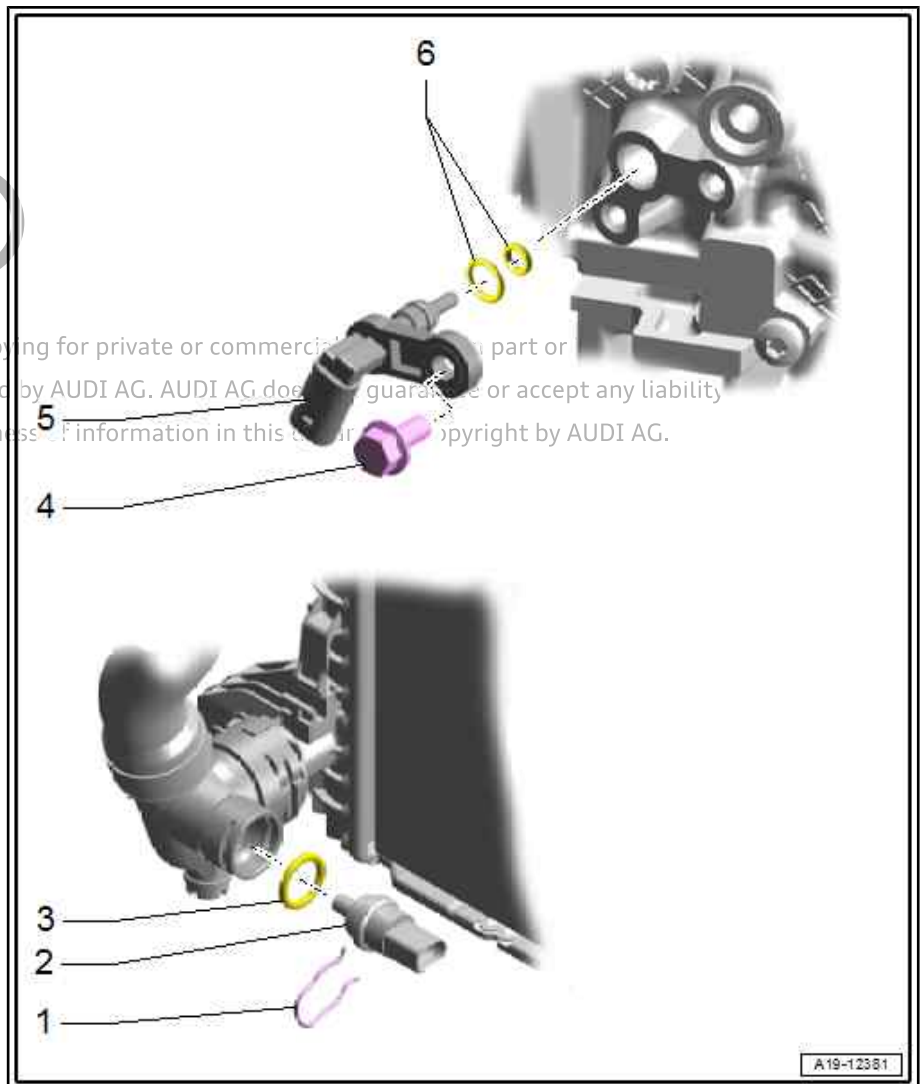
- ☐ 8 Nm

### 5 - Coolant temperature sender - G62-

- ☐ Removing and installing  
⇒ ["2.9 Removing and installing coolant temperature sender G62"](#),  
[page 176](#)

### 6 - O-rings

- ☐ Renew after removal;  
part of coolant temperature sender - G62-



## 2.4 Removing and installing electric coolant pump

⇒ ["2.4.1 Removing and installing charge air cooling pump V188"](#),  
[page 165](#)

⇒ ["2.4.2 Removing and installing auxiliary pump for heating V488"](#),  
[page 167](#)

### 2.4.1 Removing and installing charge air cooling pump - V188-

Special tools and workshop equipment required



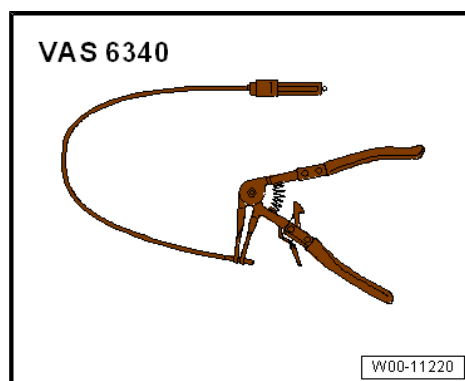
- ◆ Hose clamps up to 25 mm - 3094-



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- ◆ Hose clip pliers - VAS 6340-



- ◆ Hose clip pliers - VAS 6362-





## Removing

- Remove wheel spoiler (front left) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Unplug electrical connector -1-.
- Clamp off coolant hoses using hose clamps -3094- , release hose clips -2- and disconnect coolant hoses.
- Clamp off coolant hose with hose clamps up to 25 mm - 3094- and detach coolant hose.
- Remove nut -3-, release retaining bracket and detach charge air cooling pump - V188- .

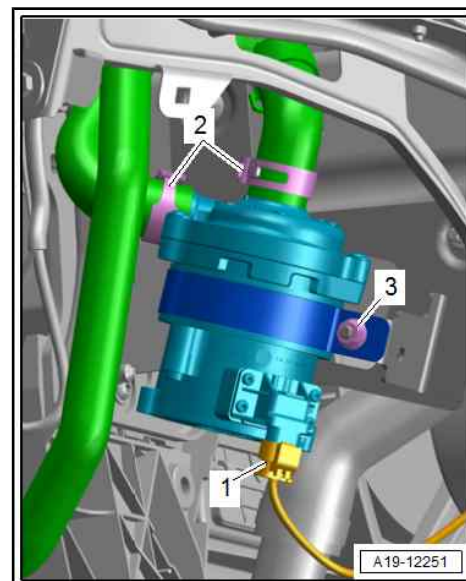
## Installing

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

- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Fill up with coolant ⇒ [page 155](#) .

## Tightening torques

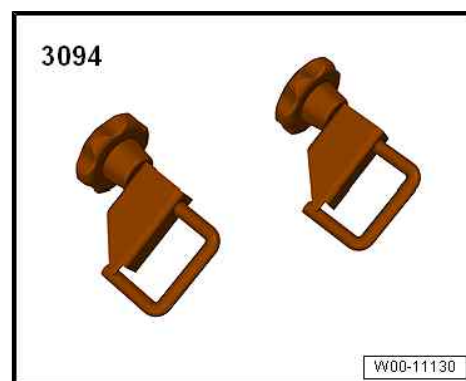
- ◆ ⇒ [“2.2.1 Exploded view - charge air cooling pump V188”](#), [page 162](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)



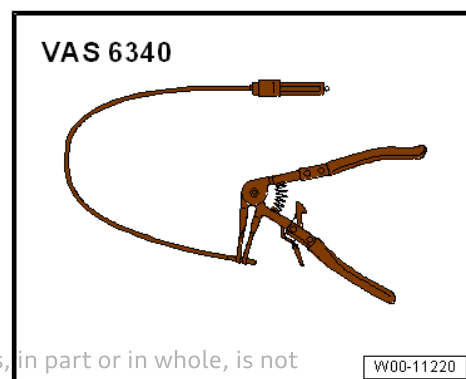
## 2.4.2 Removing and installing auxiliary pump for heating - V488-

### Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



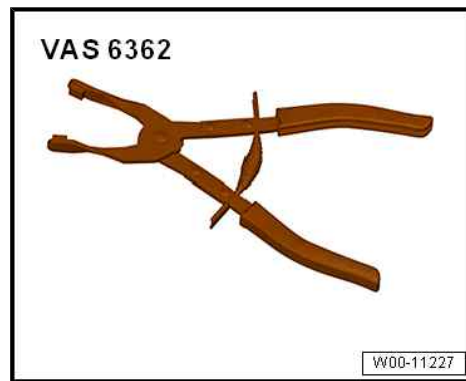
- ◆ Hose clip pliers - VAS 6340-



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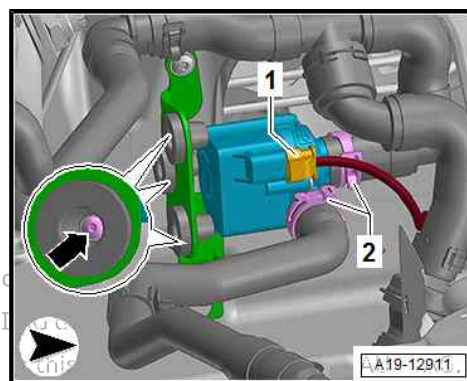
- ◆ Hose clip pliers - VAS 6362-



## Removing

Fitting location: beneath coolant expansion tank in vicinity of plenum chamber partition panel

- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping coolant.
- Clamp off coolant hoses using hose clamps -3094- , release hose clips -2- and disconnect coolant hoses.
- Remove bolts -arrows- and detach auxiliary pump for heating - V488- from bracket.



## Installing

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

- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Fill up with coolant ⇒ [page 155](#) .

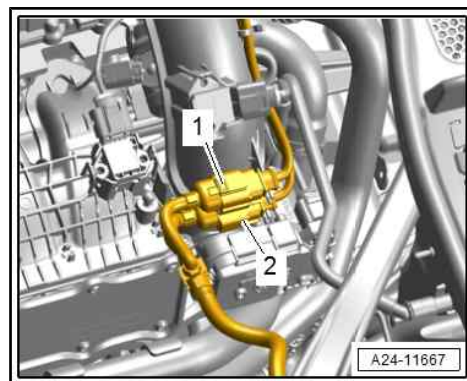
## Tightening torques

- ◆ ⇒ [“2.2.2 Exploded view - auxiliary pump for heating V488 ”, page 164](#)

## 2.5 Removing cover of toothed belt for coolant pump

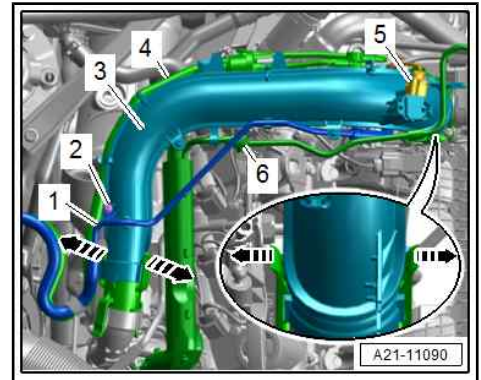
### Removing

- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.





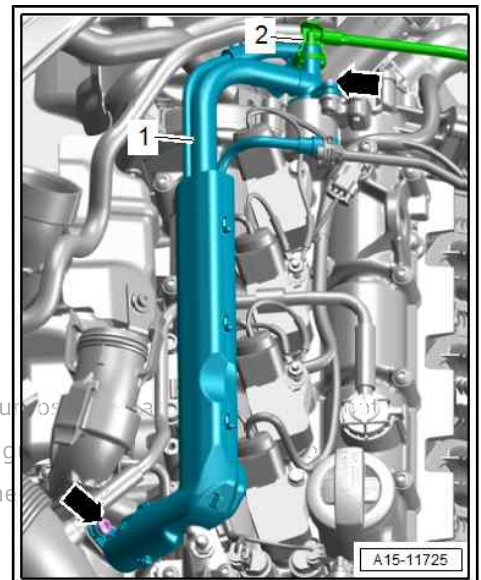
- Remove bolt -2- and move fuel line -1- clear.
- Move hose -4- for activated charcoal filter system and coolant hose -6- clear.
- Unplug electrical connector -5- from charge pressure sender - G31- .
- Release catches -arrows- and detach air pipe -3-.



- Press release tabs on both sides and disconnect hose -2- leading to activated charcoal filter.
- Remove bolts -arrows-, detach crankcase breather hose -1- and move it towards rear.



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- Unscrew bolts -arrows- and remove cover -1- for toothed belt for coolant pump and bracket -2-.

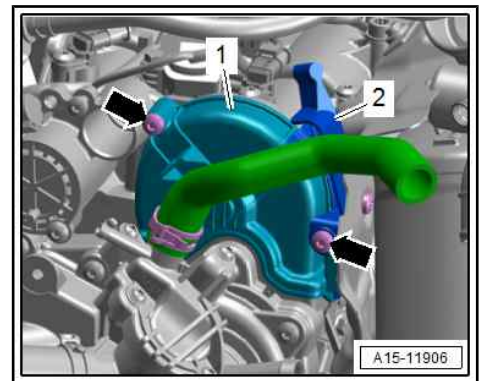
### Installing

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

- Renew O-rings after removing. See note  
⇒ [Item 4 \(page 217\)](#)
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .

### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - sump/oil pump”, page 129](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 201](#)

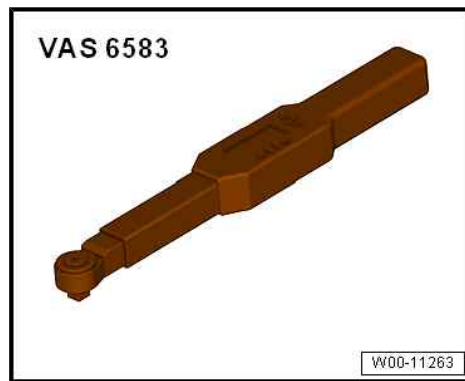


## 2.6 Removing and installing coolant pump

Special tools and workshop equipment required

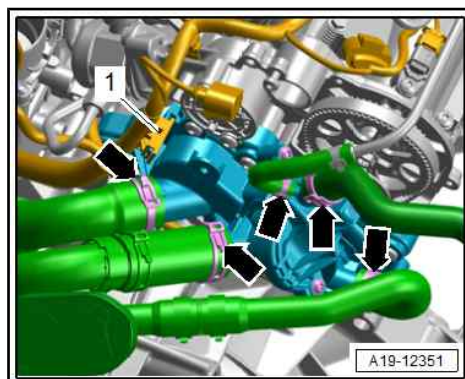
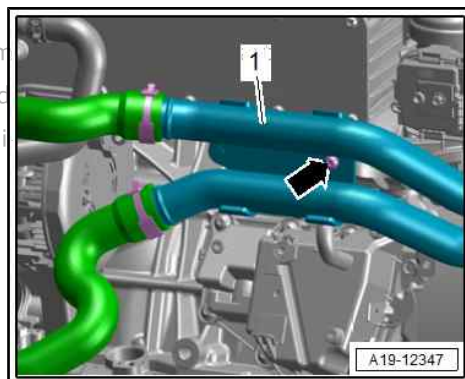


- ◆ Torque wrench - VAS 6583-



## Removing

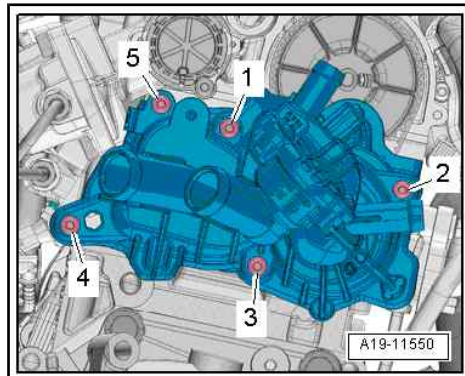
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#).
- Drain coolant  
⇒ [“1.3 Draining and filling cooling system”, page 153](#).
- Remove cover of toothed belt for coolant pump  
⇒ [“2.5 Removing cover of toothed belt for coolant pump”, page 168](#).
- Remove bolt -arrow- for coolant pipes -1-.
- Move electrical wiring harness -1- clear.
- Release hose clips -arrows- and disconnect coolant hoses.



- Slacken and remove bolts in the sequence: -5 ... 1-.
- Mark rotation direction of toothed belt with chalk or felt-tip pen before removing.
- Detach coolant pump with toothed belt.

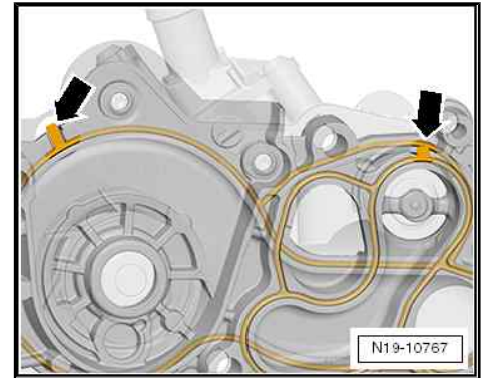
## Installing

- Renew seal and O-rings after removal.
- When reinstalling toothed belt of coolant pump, check it for damage and renew if necessary.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Do not reuse coolant.
- Set cylinder 1 to TDC position (for description of procedure refer to  
⇒ [“1.5 Removing and installing toothed belt”, page 86](#) ).





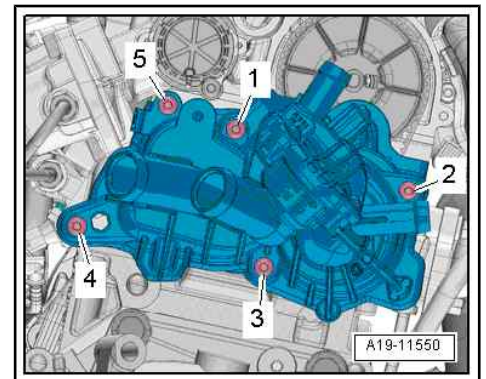
- Check that gaskets are correctly seated -arrows-.
- Lubricate seal for coolant pump lightly with coolant.
- Fit toothed belt so that it is centred and move coolant pump into installation position.



- Tighten bolts to initial torque in the specified sequence:

| Stage | Bolts     | Tightening torque                      |
|-------|-----------|----------------------------------------|
| 1.    | -1 ... 5- | Screw in by hand until contact is made |
| 2.    | -1 ... 5- | 10 Nm                                  |

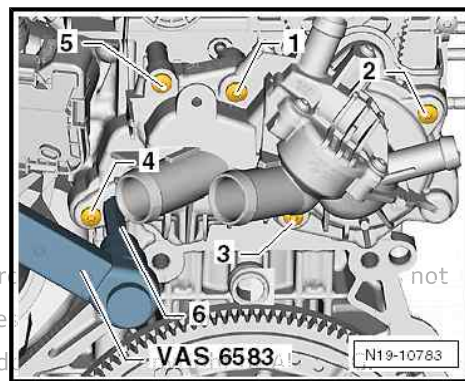
- Loosen all bolts again by one turn.



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- Apply torque wrench - VAS 6583- with hexagon key (10 mm) -item 6- to coolant pump.
- A second mechanic is required for the following step.
- Have a second mechanic apply a torque (clockwise) of 30 Nm to coolant pump.
- For ease of handling, apply torque wrench - VAS 6583- vertically.
- Do not support torque wrench with your other hand.
- Do not apply excessive force to torque wrench.
- A second mechanic must tighten the bolts -2-, -1- and -5- while the first mechanic maintains the torque on the torque wrench - VAS 6583- .
- Keep coolant pump under tension.
- At the same time, have a second mechanic turn bolts securing coolant pump anti-clockwise to an initial torque of 10 Nm, beginning with bolt -2-, -1- and -5- («stage 3«).
- The necessary belt tension is attained by tightening bolts -2-, -1- and -5-.
- Torque wrench - VAS 6583- can be removed after tightening bolts to initial torque.
- Then tighten bolts to »stage 4«.



| Stage | Bolts           | Tightening torque |
|-------|-----------------|-------------------|
| 4a.   | -2, 1, 5-       | 10 Nm             |
| 4b.   | -3, 4, 5, 1, 2- | 12 Nm             |

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

- Install cover of toothed belt for coolant pump  
⇒ [“2.5 Removing cover of toothed belt for coolant pump”, page 168](#) .
- Fill up with coolant ⇒ [page 155](#) .

#### Tightening torques

- ♦ Coolant pump ⇒ [page 171](#)
- ♦ ⇒ [“3.1 Exploded view - coolant pipes”, page 180](#)
- ♦ ⇒ [“1.1 Exploded view - turbocharger”, page 193](#)
- ♦ ⇒ [“2.1 Exploded view - charge air system”, page 201](#)

## 2.7 Removing and installing thermostat

⇒ [“2.7.1 Removing and installing thermostat for large coolant circuit”, page 172](#)

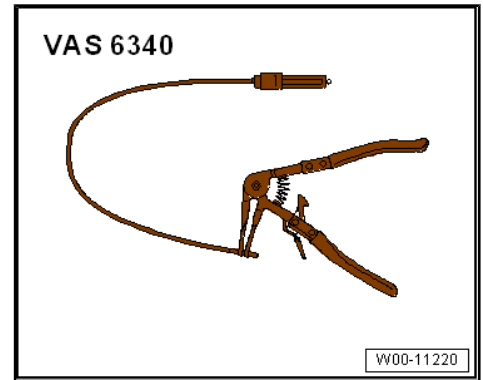
⇒ [“2.7.2 Removing and installing thermostat for small coolant circuit”, page 174](#)

### 2.7.1 Removing and installing thermostat for large coolant circuit

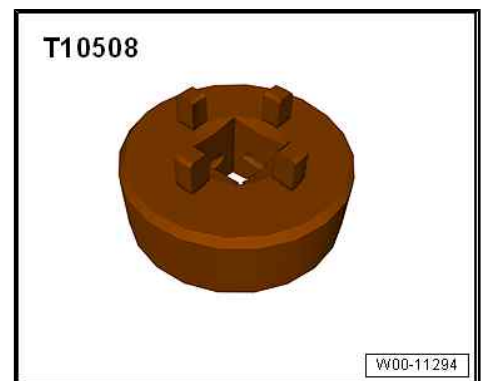
Special tools and workshop equipment required



- ◆ Hose clip pliers - VAS 6340-

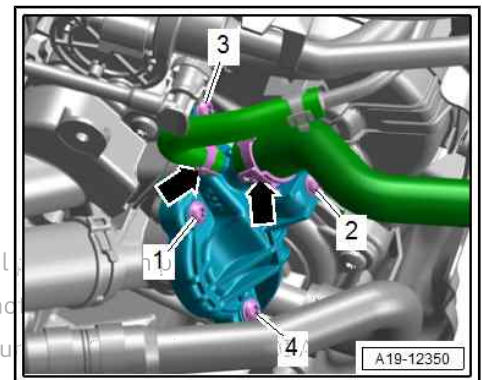


- ◆ Key - T10508-



## Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Drain coolant  
⇒ [“1.3 Draining and filling cooling system”, page 153](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Release hose clips -arrows- and disconnect coolant hoses.
- Unscrew bolts in the sequence -4 ... 1- and remove cover from thermostat housing.



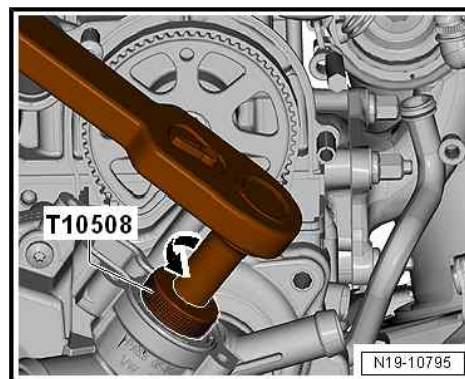


- Turn thermostat 45° anti-clockwise -arrow- using special wrench - T10508- and detach.

### Installing

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

- Renew gasket after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Do not reuse coolant.
- Lubricate gasket lightly with coolant.
- Bring thermostat into position with special wrench - T10508- , press down slightly and turn 45° clockwise as far as stop.
- Fill up with coolant ⇒ [page 155](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#),  
[page 34](#) .



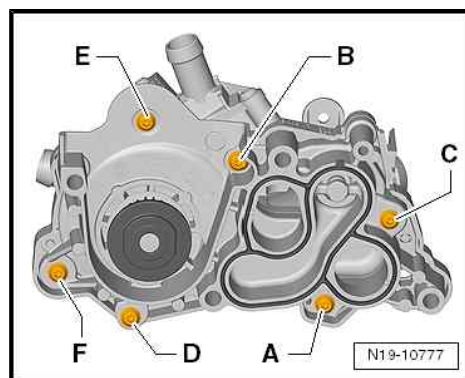
### Tightening torques

- ♦ ⇒ [Fig. “Cover for thermostat to thermostat housing - tightening torque”](#), [page 162](#)

## 2.7.2 Removing and installing thermostat for small coolant circuit

### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”](#), [page 5](#) .
- Remove coolant pump  
⇒ [“2.6 Removing and installing coolant pump”](#), [page 169](#) .
- Remove bolts in the sequence -F ... A-.
- Detach coolant pump from thermostat housing.

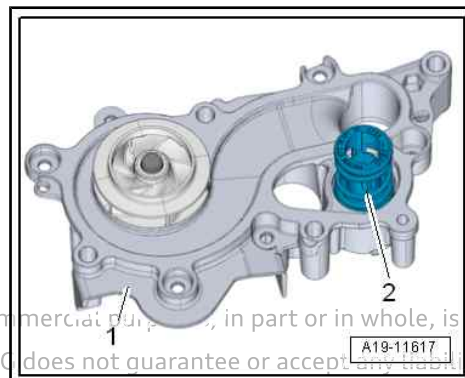


- Detach thermostat -2- from coolant pump -1-.

### Installing

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

- Renew gasket after removing.
- Do not reuse coolant.
- Lubricate gasket lightly with coolant.



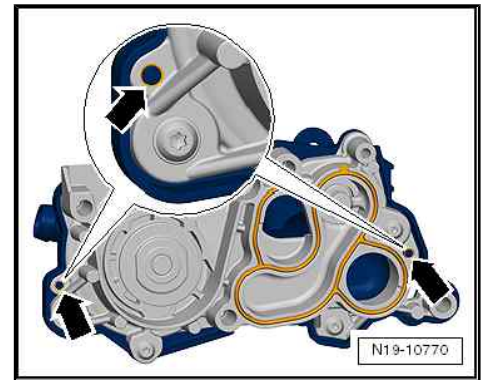
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- Fit thermostat housing onto coolant pump.
- Centring pins on thermostat must be fitted in guides -arrows- on coolant pump.
- Tighten bolts for thermostat housing  
⇒ [Fig. "Thermostat housing to coolant pump - tightening torque and sequence"](#) , page 162 .
- Install coolant pump  
⇒ ["2.6 Removing and installing coolant pump"](#) , page 169 .
- Fill up with coolant ⇒ [page 155](#) .

#### Tightening torques

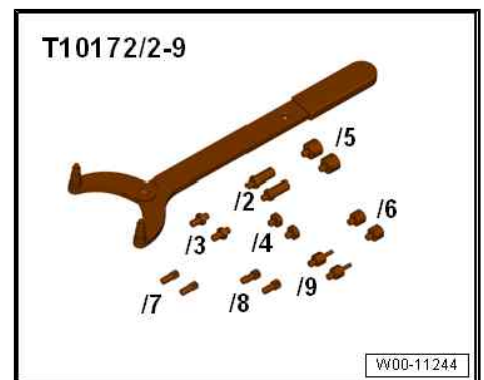
- ◆ ⇒ [Fig. "Thermostat housing to coolant pump - tightening torque and sequence"](#) , page 162



## 2.8 Removing and installing toothed belt sprocket for coolant pump

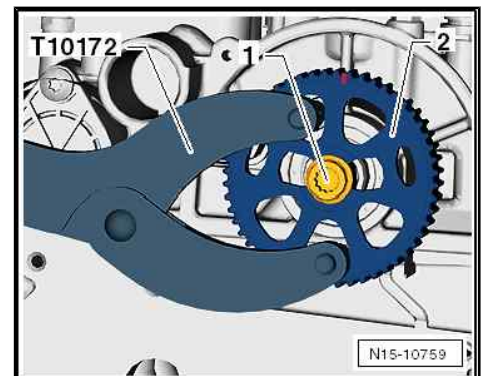
#### Special tools and workshop equipment required

- ◆ Counterhold tool - T10172A- with adapters -T10172/2-



#### Removing

- Remove coolant pump  
⇒ ["2.6 Removing and installing coolant pump"](#) , page 169 .
- Loosen bolt -1- using counterhold tool - T10172A- with adapters -T10172/2- .
- Remove bolt and take off toothed belt drive sprocket -2-.



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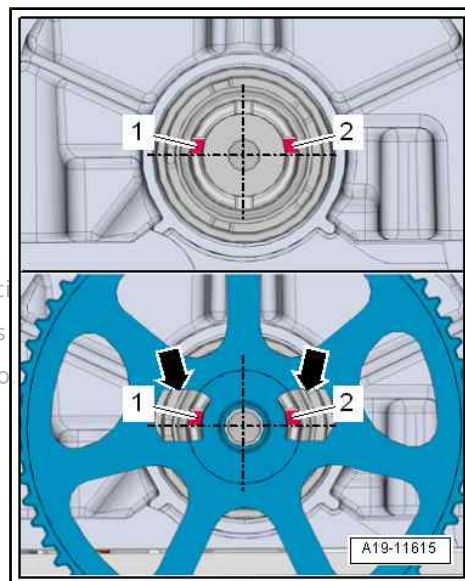
## Installing

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

- Fit toothed belt drive sprocket:
- Grooves -1, 2- in camshaft are arranged asymmetrically.
- Openings -arrows- in toothed belt sprocket are also arranged asymmetrically.
- Fit toothed belt sprocket onto camshaft so that asymmetrical grooves are positioned exactly in centre of openings.
- Install coolant pump  
⇒ ["2.6 Removing and installing coolant pump", page 169](#)

## Tightening torques

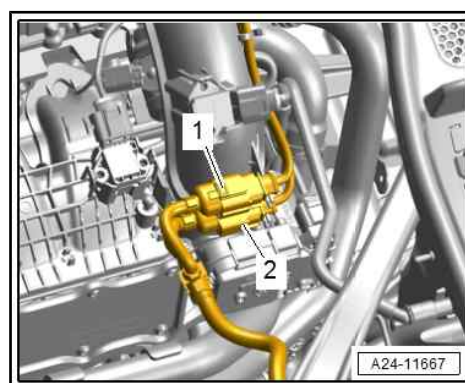
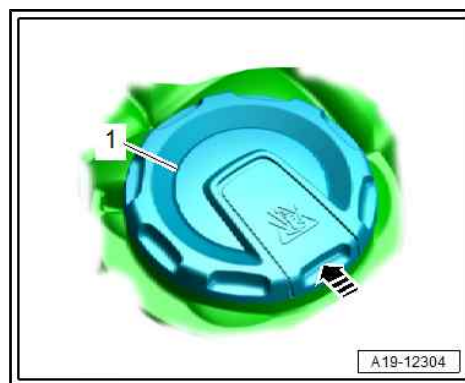
- ♦ ⇒ ["2.1 Exploded view - coolant pump/thermostat", page 160](#)



## 2.9 Removing and installing coolant temperature sender - G62-

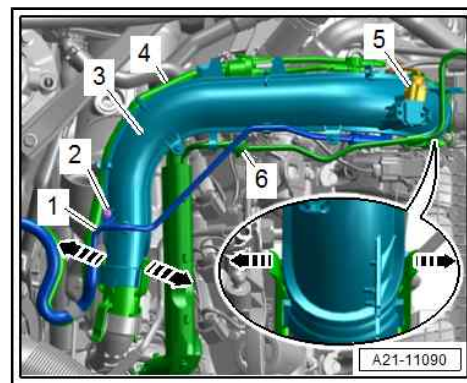
### Procedure

- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Engine cold.
- To relieve residual pressure in cooling system, release fastener -arrow- and briefly open filler cap -1- on coolant expansion tank.
- Remove engine cover panel  
⇒ ["3.1 Removing and installing engine cover panel", page 34](#) .
- Remove air cleaner housing  
⇒ ["2.2 Removing and installing air cleaner housing", page 215](#) .
- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.



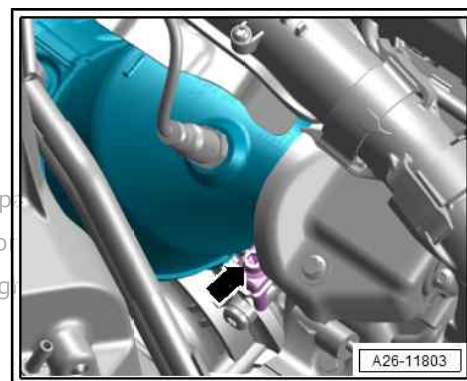


- Remove bolt -2- and move fuel line -1- clear.
- Move hose -4- for activated charcoal filter system and coolant hose -6- clear.
- Unplug electrical connector -5- from charge pressure sender - G31- .
- Release catches -arrows- and detach air pipe -3-.

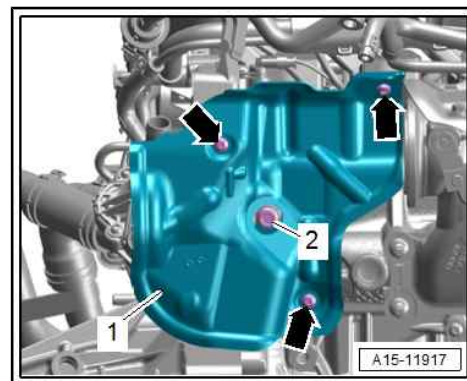


- Release screw-type clip -arrow- and move it onto intake funnel of turbocharger.
- Press catalytic converter slightly to right side.

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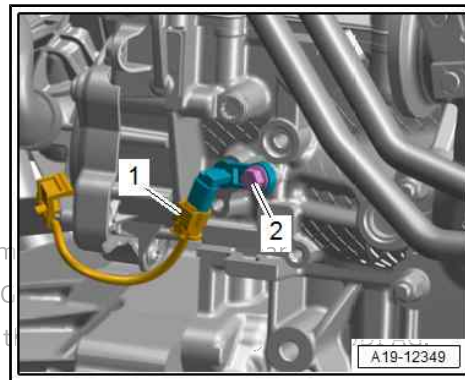


- Remove bolts -arrows- and -2- and detach heat shield -1-.





- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping coolant.
- Unscrew bolt -1- and pull off coolant temperature sender - G62- -item 2-.
- If O-ring with support ring remains lodged in cylinder head, lift it out using a piece of wire.
- Renew O-rings after removing. See note.  
⇒ [Item 6 \(page 165\)](#)
- Fit new coolant temperature sender immediately so that as little coolant as possible is lost.
- Install catalytic converter  
⇒ [“2.2 Removing and installing catalytic converter”, page 250](#) .
- Install air cleaner housing  
⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Check coolant level ⇒ [page 159](#) .



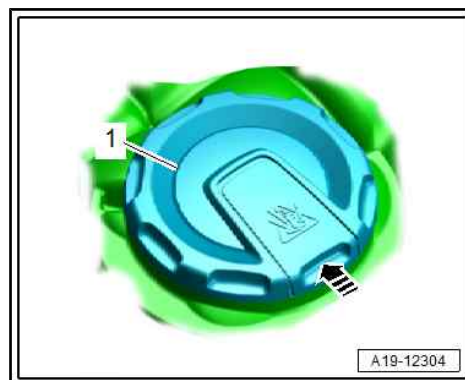
#### Tightening torques

- ♦ ⇒ [“2.3 Exploded view - coolant temperature senders”, page 165](#)
- ♦ ⇒ [Fig. “Heat shield - tightening torque”, page 99](#)
- ♦ ⇒ [“2.1 Exploded view - charge air system”, page 201](#)

## 2.10 Removing and installing radiator outlet coolant temperature sender - G83-

#### Procedure

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Engine cold.
- To relieve residual pressure in cooling system, release fastener -arrow- and briefly open filler cap -1- on coolant expansion tank.

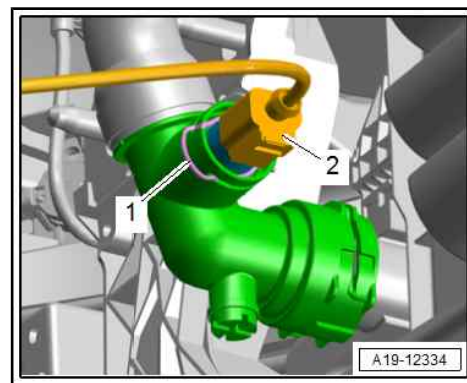




- Unplug electrical connector -2-.
- Place a cloth underneath to catch escaping coolant.
- Detach retaining clip -1- and pull out radiator outlet coolant temperature sender - G83- .
- Renew O-ring after removal.
- Fit new coolant temperature sender immediately so that as little coolant as possible is lost.
- Check coolant level ⇒ [page 159](#) .

#### Tightening torques

- ◆ ⇒ ["2.1 Exploded view - air cleaner housing", page 214](#)



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### 3 Coolant pipes

⇒ "3.1 Exploded view - coolant pipes", page 180

⇒ "3.2 Removing and installing coolant pipes", page 180

#### 3.1 Exploded view - coolant pipes

- The arrow markings on coolant pipes and on ends of hoses must align.

1 - Coolant hoses

2 - Coolant pipes

- ❑ Removing and installing  
⇒ "3.2 Removing and installing coolant pipes",  
page 180

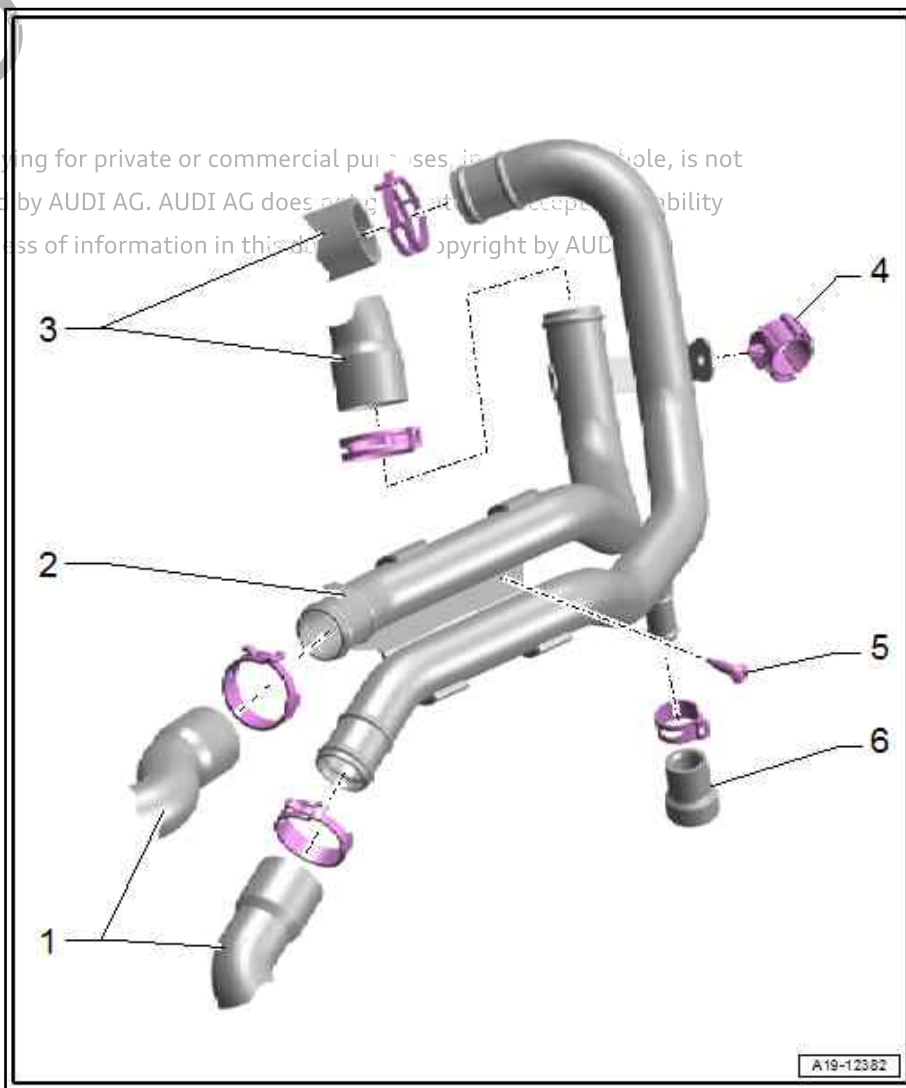
3 - Coolant hoses

4 - Clip

5 - Bolt

- ❑ Thread-forming
- ❑ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ❑ 4 Nm

6 - Sealing plug



#### 3.2 Removing and installing coolant pipes

Special tools and workshop equipment required

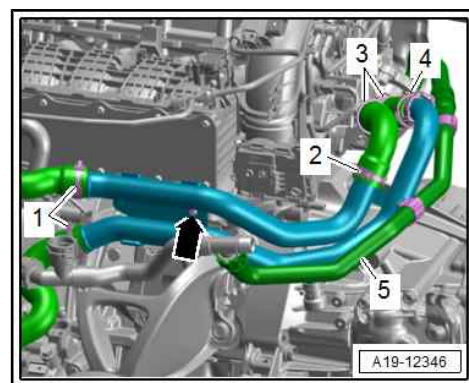


- ◆ Hose clip pliers - VAS 6362-



### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Drain coolant  
⇒ [“1.3 Draining and filling cooling system”, page 153](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Remove bolt -arrow- and move coolant hose -5- clear.
- Loosen hose clips -1, 2, 4- and disconnect coolant pipes.



### Installing

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

- Renew seals/gaskets and O-rings after removal.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Do not reuse coolant.
- Fill up with coolant ⇒ [page 155](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .

### Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 180](#)



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## 4 Radiators/radiator fan

⇒ [“4.1 Exploded view - radiators/radiator fan”, page 182](#)

⇒ [“4.2 Removing and installing radiator”, page 184](#)

⇒ [“4.3 Removing and installing water radiator for charge air cooling circuit”, page 188](#)

⇒ [“4.4 Removing and installing radiator cowl”, page 190](#)

⇒ [“4.5 Removing and installing radiator fan V7”, page 191](#)

### 4.1 Exploded view - radiators/radiator fan

Radiator cowl and radiator fan ⇒ [page 183](#)

Connecting coolant hose with plug-in connector ⇒ [page 183](#)

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#### 1 - Radiator

- ☐ Removing and installing  
⇒ [“4.2 Removing and installing radiator”, page 184](#)
- ☐ If there are slight impressions on the fins, refer to  
⇒ [“3.5 Installing radiators and condensers”, page 6](#)
- ☐ If renewed, change coolant in entire system

#### 2 - Drain plug

- ☐ 1.5 ... 3 Nm

#### 3 - O-ring

- ☐ Renew after removing

#### 4 - Coolant hose

- ☐ Lift retaining clip to detach
- ☐ Connecting  
⇒ [Fig. “Connecting coolant hose with plug-in connector”, page 183](#)

#### 5 - O-rings

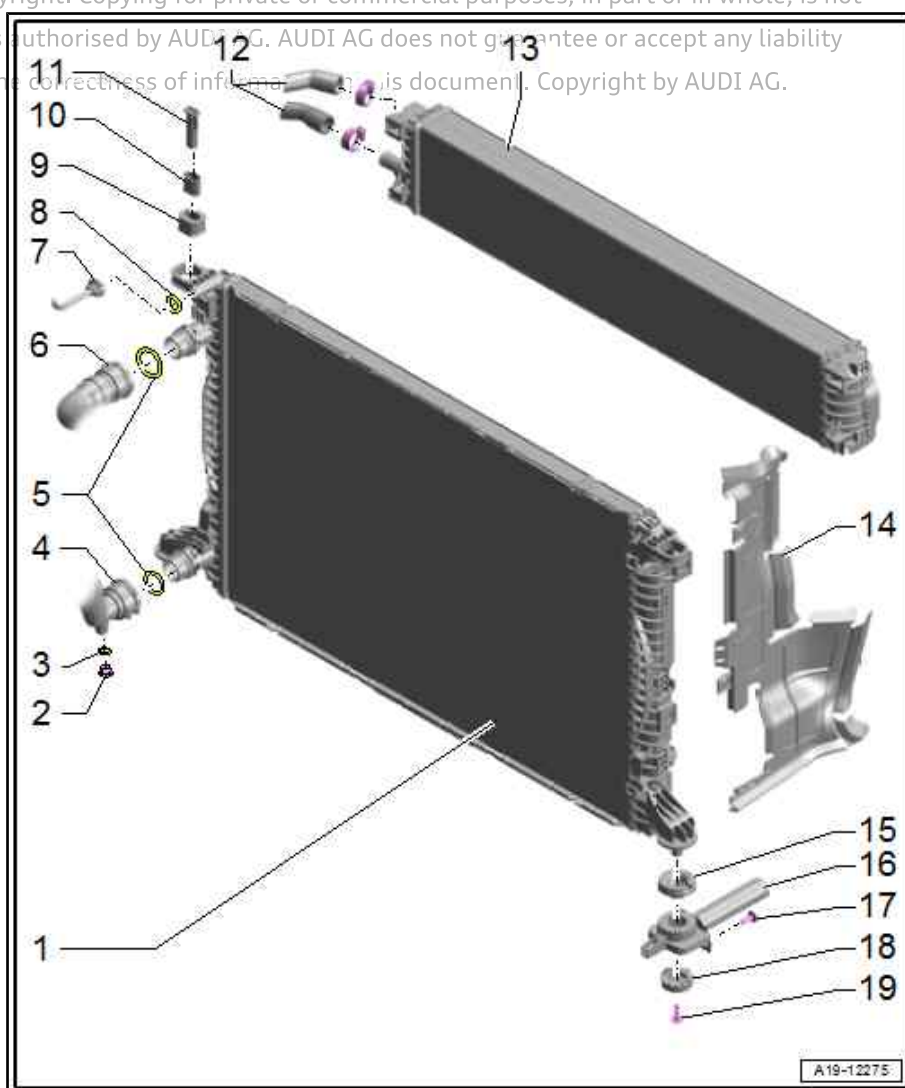
- ☐ Renew after removing

#### 6 - Coolant hose

- ☐ Lift retaining clip to detach
- ☐ Connecting  
⇒ [Fig. “Connecting coolant hose with plug-in connector”, page 183](#)

#### 7 - Coolant pipe

- ☐ To coolant expansion tank
- ☐ Press release ring to detach
- ☐ Connecting ⇒ [Fig. “Connecting coolant hose with plug-in connector”, page 183](#)





#### 8 - O-ring

- ☐ Renew after removing

#### 9 - Rubber bush

- ☐ For radiator

#### 10 - Sleeve

#### 11 - Retaining pin

- ☐ Use screwdriver to release and pull off

#### 12 - Coolant hoses

#### 13 - Water radiator for charge air cooling circuit

- ☐ Removing and installing  
⇒ [“4.3 Removing and installing water radiator for charge air cooling circuit”, page 188](#)
- ☐ If there are slight impressions on the fins, refer to [⇒ “3.5 Installing radiators and condensers”, page 6](#)
- ☐ If renewed, change coolant in entire system

#### 14 - Air duct

#### 15 - Rubber bush

- ☐ For radiator

#### 16 - Radiator bracket

#### 17 - Bolt

- ☐ 5 Nm

#### 18 - Support

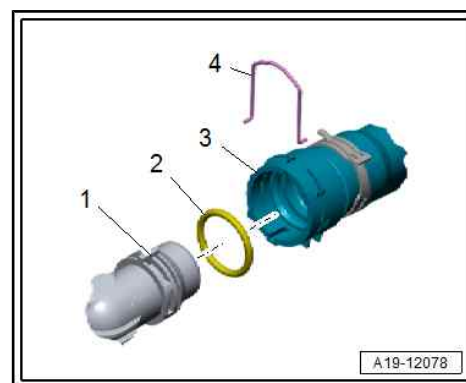
#### 19 - Bolt

- ☐ 4.5 Nm

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#### Connecting coolant hose with plug-in connector

- If damaged, renew retaining clip -4-.
- Check O-Ring -2- for damage and, if necessary, remove from coolant hose -3-.
- If it is renewed, lightly lubricate new O-ring with coolant and fit O-ring in coolant hose.
- Press coolant hose onto connection -1- until it engages audibly.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.



#### Radiator cowl and radiator fans



#### 1 - Radiator cowl

- ❑ Removing and installing  
⇒ ["4.4 Removing and installing radiator cowl"](#),  
[page 190](#)

#### 2 - Bolt

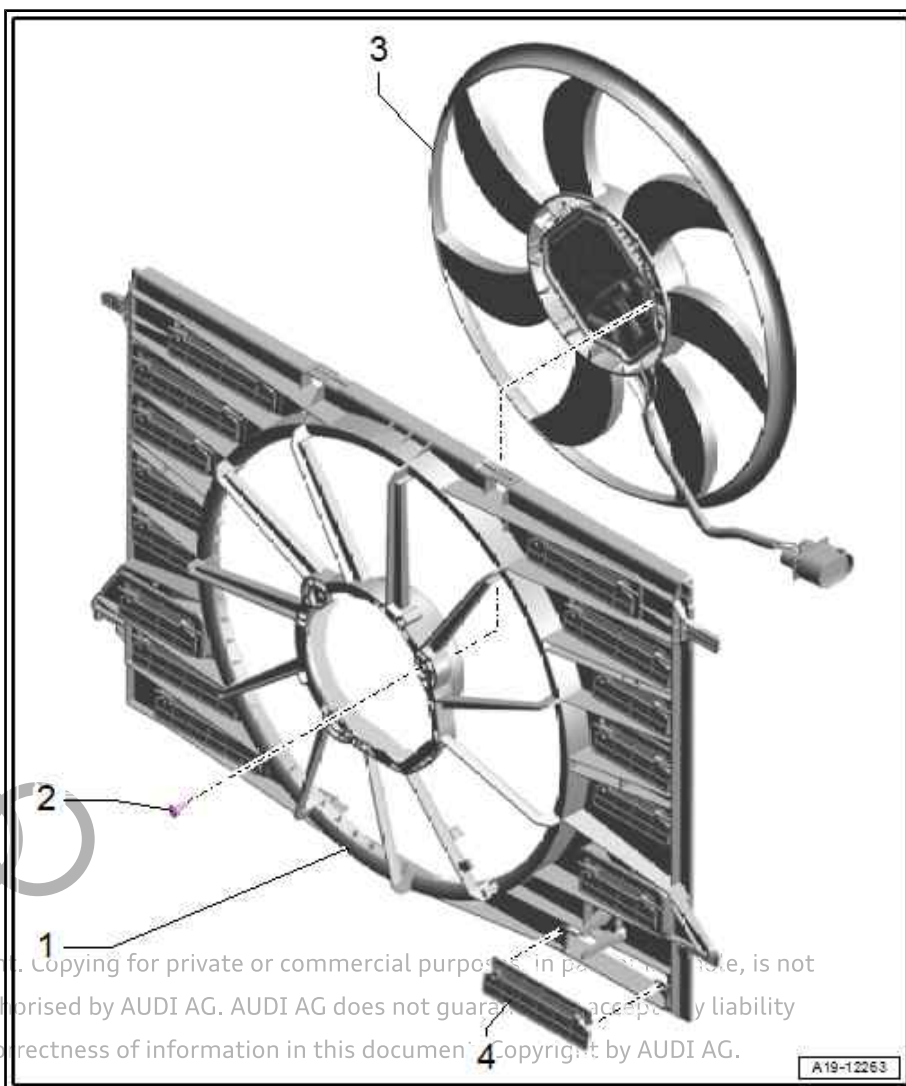
- ❑ 5 Nm

#### 3 - Radiator fan - V7-

- ❑ With radiator fan control unit - J293-
- ❑ Removing and installing  
⇒ ["4.5 Removing and installing radiator fan V7"](#),  
[page 191](#)

#### 4 - Air flow flap

- ❑ Different versions available ⇒ Electronic parts catalogue



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## 4.2 Removing and installing radiator

The radiator must be removed and installed together with the radiator cowl.

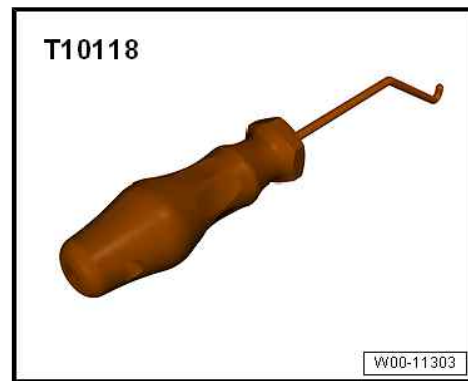
#### Special tools and workshop equipment required

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





- ◆ Assembly tool - T10118-



## Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .



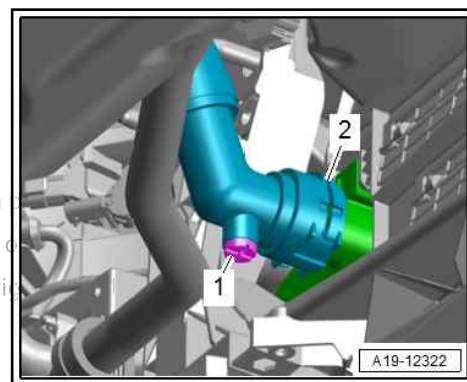
### WARNING

*Risk of injury as the radiator fans may start up automatically.*

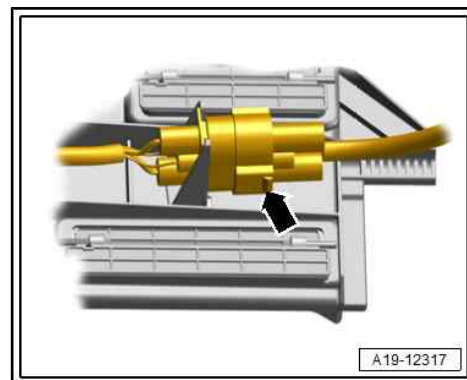
- ◆ *Even when the ignition is switched off, the radiator fans can start up without warning due to accumulated heat in the engine compartment, etc.*

- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove bracket for bumper cover together with impact bar ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Exploded view - lock carrier .
- A4 with LED and matrix LED headlights: Remove headlight (left-side) ⇒ Electrical system; Rep. gr. 94 ; Headlights; Removing and installing headlights .
- Place collector tank from coolant collecting system -VAS 5014- or drip tray for workshop hoist - VAS 6208- underneath.
- Lift retaining clip -2- and disconnect coolant hose from radiator (bottom right).

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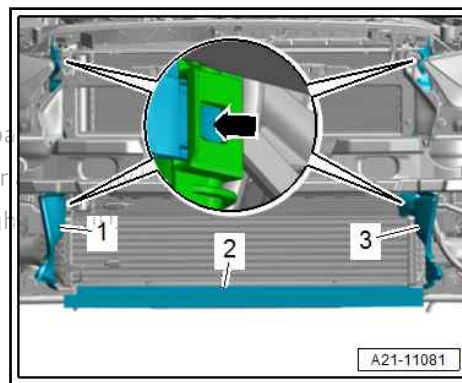
- Unplug electrical connector -arrow- for radiator fan.



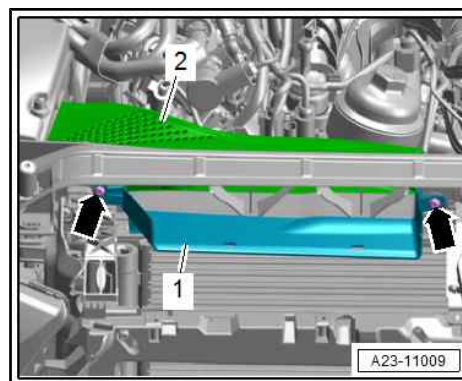


- Release catches -arrow- and detach air ducts -1, 3-.
- Unclip air duct -2-.

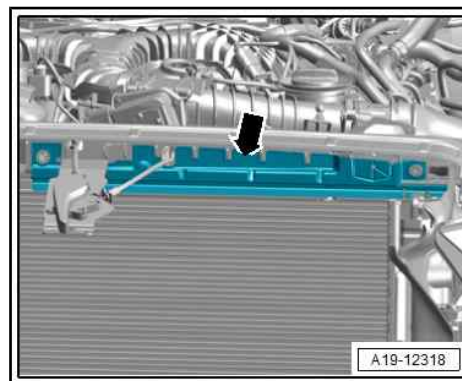
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- Remove bolts -arrows- and detach air duct -1-.



- Detach air duct (top) -arrow-.
- Remove water radiator for charge air cooling circuit  
⇒ ["4.3 Removing and installing water radiator for charge air cooling circuit", page 188](#) .



- Unplug electrical connector -2- for high-pressure sender - G65- .



#### Caution

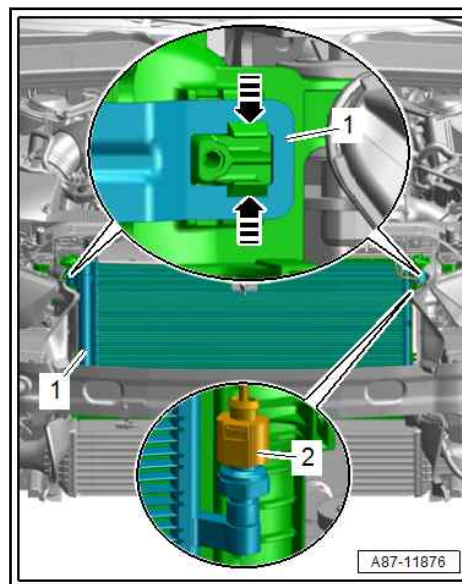
***Risk of irreparable damage to radiator.***

- ◆ ***The radiator must be renewed if the fasteners are damaged.***

***Risk of damage to refrigerant lines and hoses***

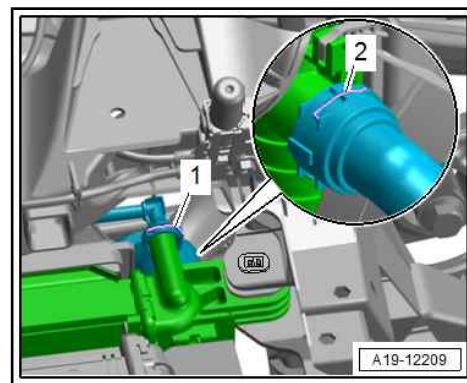
- ◆ ***Do NOT stretch, kink or bend refrigerant lines and hoses.***

- Release fasteners -arrows- on both sides, disengage condenser -1- from radiator and tie up to one side.

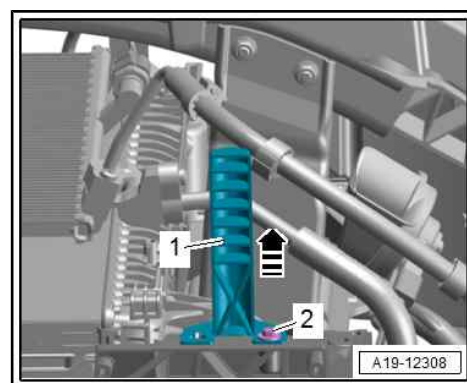




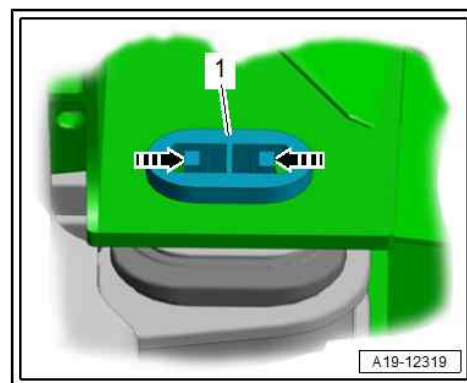
- Lift retaining clips -1, 2-, detach coolant connection from radiator and move connection clear.



- Remove bolt -2- on both sides and press radiator bracket -1- with radiator towards front -arrow-.



- Release fasteners -arrows- on both sides and pull retaining pins -1- for radiator out upwards.
- Detach radiator.



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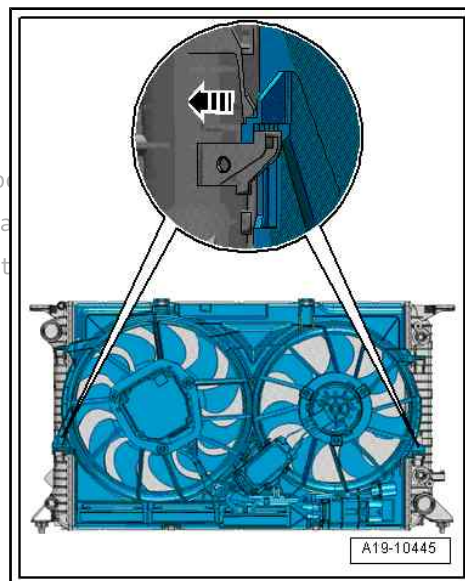


- Press locking tabs on left and right sides of radiator cowl together -arrow- and lift radiator cowl off radiator.

### Installing

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

- If there are slight impressions on the fins, refer to [“3.5 Installing radiators and condensers”, page 6](#)
- Do not reuse coolant.
- Install water radiator for charge air cooling circuit  
⇒ [“4.3 Removing and installing water radiator for charge air cooling circuit”, page 188](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Connect coolant hose with plug-in connector  
⇒ [Fig. “Connecting coolant hose with plug-in connector”, page 183](#) .
- Fill up with coolant ⇒ [page 155](#) .
- If removed: Install headlight (left-side) ⇒ Electrical system; Rep. gr. 94 ; Headlights; Removing and installing headlights .



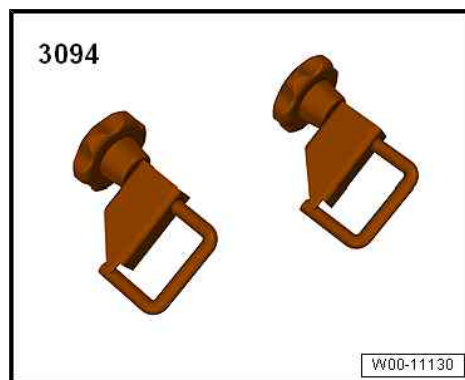
### Tightening torques

- ♦ ⇒ [“4.1 Exploded view - radiators/radiator fan”, page 182](#)
- ♦ ⇒ [“2.1 Exploded view - air cleaner housing”, page 214](#)
- ♦ ⇒ General body repairs, exterior; Rep. gr. 50 ; Lock carrier; Exploded view - lock carrier
- ♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

## 4.3 Removing and installing water radiator for charge air cooling circuit

### Special tools and workshop equipment required

- ♦ Hose clamps up to 25 mm - 3094-





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



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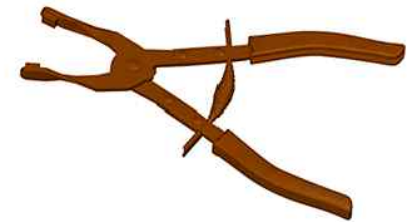
- ◆ Hose clip pliers - VAS 6362-

VAS 6208



W00-11209

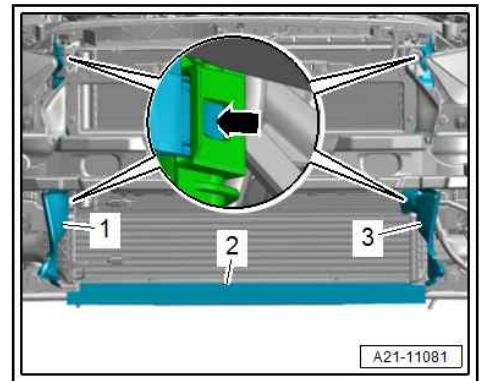
VAS 6362



W00-11227

## Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove closure plate at bumper cover and air intake grille (left and right) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Move air guides -1, 3- (left and right) clear at water radiator for charge air cooling circuit.



A21-11081



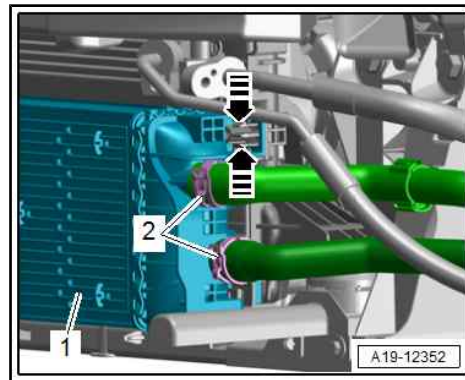
- Place collector tank from coolant collecting system -VAS 5014- or drip tray for workshop hoist - VAS 6208- underneath.
- Clamp off coolant hoses using hose clamps up to 25 mm - 3094- , lift hose clips -2- and disconnect hoses.



#### Caution

***Risk of irreparable damage to radiator.***

- ◆ ***The radiator must be renewed if the fasteners are damaged.***



- Release fasteners on both sides and detach water radiator for charge air cooling circuit -1-.

#### Installing

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

- Do not reuse coolant.
- Install closure plate at bumper cover and air intake grille (left and right) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Fill up with coolant ⇒ [page 155](#) .

## 4.4 Removing and installing radiator cowl

### Removing

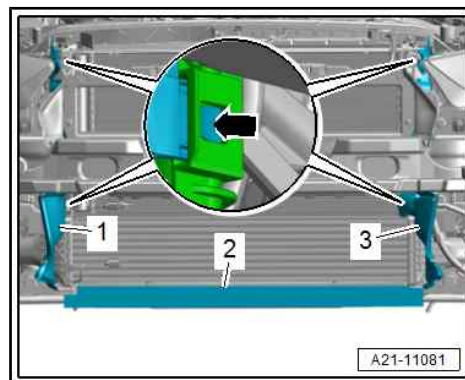


#### WARNING

***Risk of injury as the radiator fans may start up automatically.***

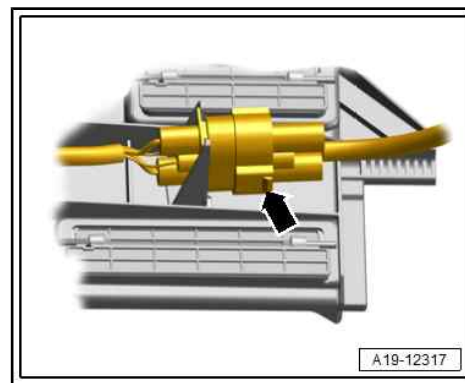
- ◆ ***Unplug electrical connectors before working in vicinity of radiator cowl.***

- Remove lock carrier cover, air intake grille (left and right) and closure plate at bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Release catches -arrow- and detach air ducts -1, 3-.
- Unclip air duct -2-.
- Move coolant hoses to water radiator for charge air cooling circuit clear.

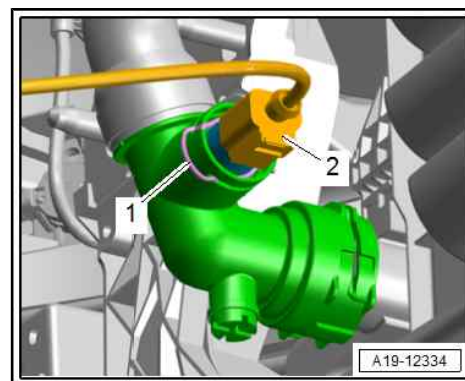




- Unplug electrical connector -arrow- for radiator fan.



- Unplug electrical connector -2- for radiator outlet coolant temperature sender - G83- .



- Press locking tabs on left and right sides of radiator cowl simultaneously -arrow- and detach radiator cowl downwards from radiator.

#### Installing

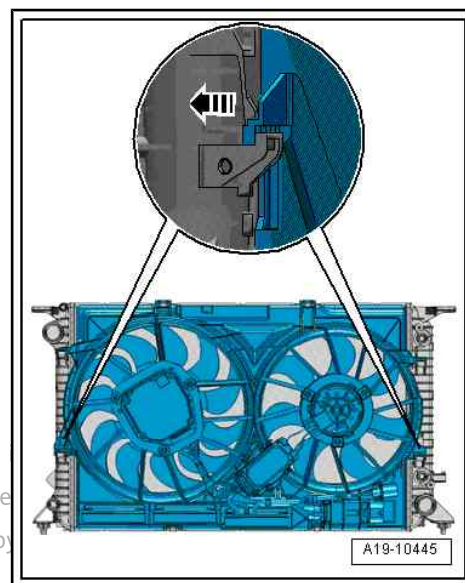
Installation is carried out in reverse order; note the following:

- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

#### Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiators/radiator fan”, page 182](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

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## 4.5 Removing and installing radiator fan - V7-

#### Removing

- Secure all cable ties in the same locations when re-installing.
- Remove radiator cowl  
⇒ [“4.4 Removing and installing radiator cowl”, page 190](#) .
- Move electrical wiring harness clear.



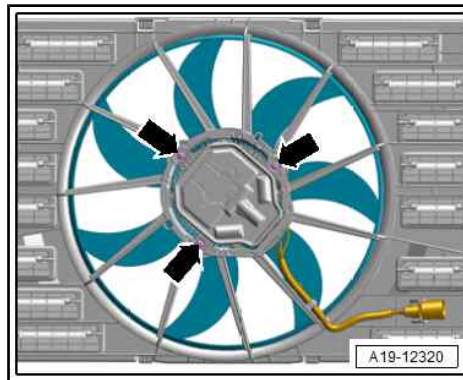
- Unscrew bolts -arrows- and remove radiator fan.



#### Caution

*Risk of noise due to imbalance in fan wheel.*

- ◆ *Do not remove balancing clamps from fan wheel.*



#### Installing

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

- Install radiator cowl  
⇒ [“4.4 Removing and installing radiator cowl”, page 190](#) .

#### Tightening torques

- ◆ ⇒ [“4.1 Exploded view - radiators/radiator fan”, page 182](#)



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## 21 – Turbocharging/supercharging

### 1 Turbocharger

⇒ [“1.1 Exploded view - turbocharger”, page 193](#)

⇒ [“1.2 Removing and installing turbocharger”, page 196](#)

⇒ [“1.3 Removing and installing charge pressure positioner V465”, page 200](#)

#### 1.1 Exploded view - turbocharger

##### Turbocharger

##### 1 - Connection

##### 2 - Bolt

- ☐ 8 Nm

##### 3 - Bolt

- ☐ Renew after removing
- ☐ Always renew all three bolts if one or more are loose.
- ☐ 8 Nm +45°

##### 4 - Charge pressure positioner - V465-

- ☐ Removing and installing  
⇒ [“1.3 Removing and installing charge pressure positioner V465”, page 200](#)
- ☐ After renewal, perform adaptations listed in Guided Function “01 - Functions, engine mechanics” ⇒ Vehicle diagnostic tester

##### 5 - Connecting rod

##### 6 - Securing clips

##### 7 - Turbocharger

- ☐ Can only be renewed together with exhaust manifold
- ☐ Removing and installing  
⇒ [“1.2 Removing and installing turbocharger”, page 196](#)

##### 8 - Heat shield

##### 9 - Bolt

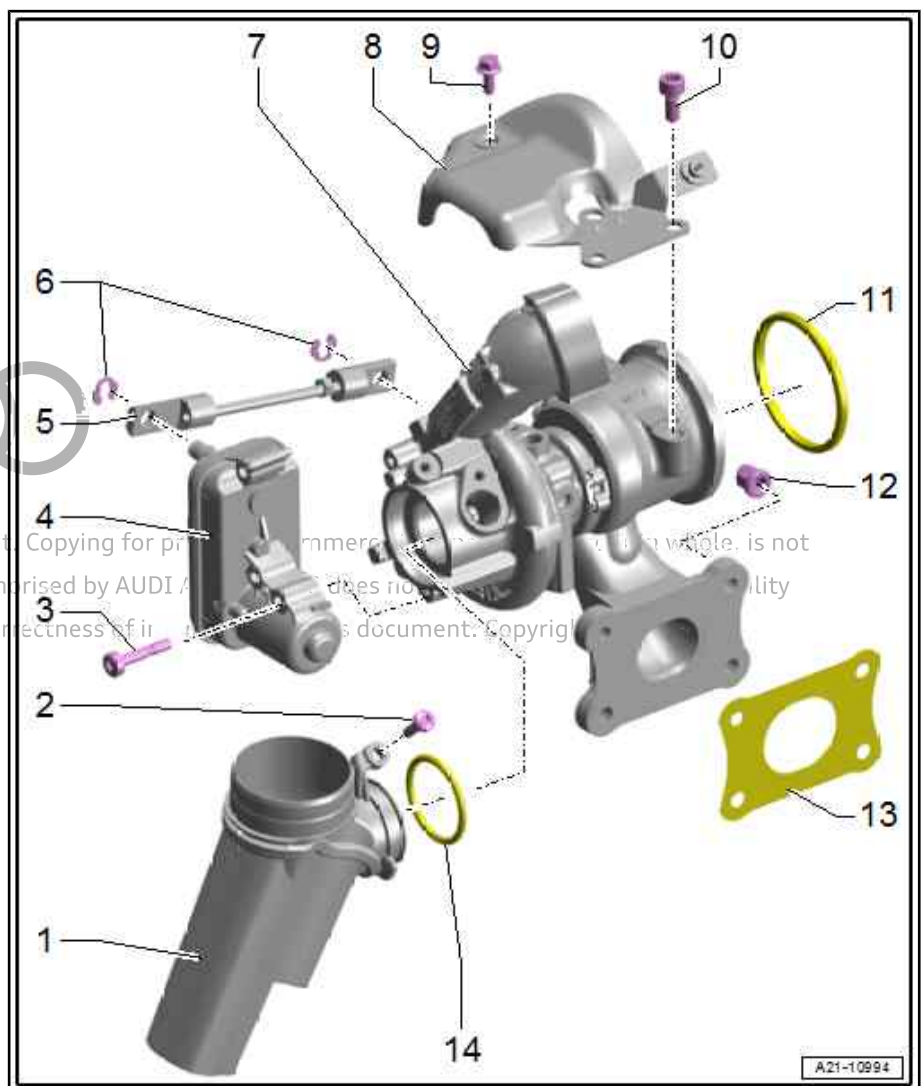
- ☐ 8 Nm

##### 10 - Bolt

- ☐ 20 Nm

##### 11 - Seal

- ☐ Renew after removing



A21-10994



## 12 - Nut

- ☐ Renew after removing
- ☐ Tightening torques and sequence  
⇒ Fig. "Turbocharger - tightening torques and sequence", page 194

## 13 - Gasket

- ☐ Renew after removing

## 14 - O-ring

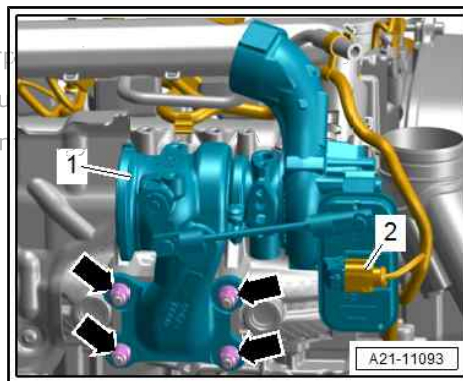
- ☐ Renew after removing



## Turbocharger - tightening torques and sequence

- Tighten nuts -arrows- in stages as follows:

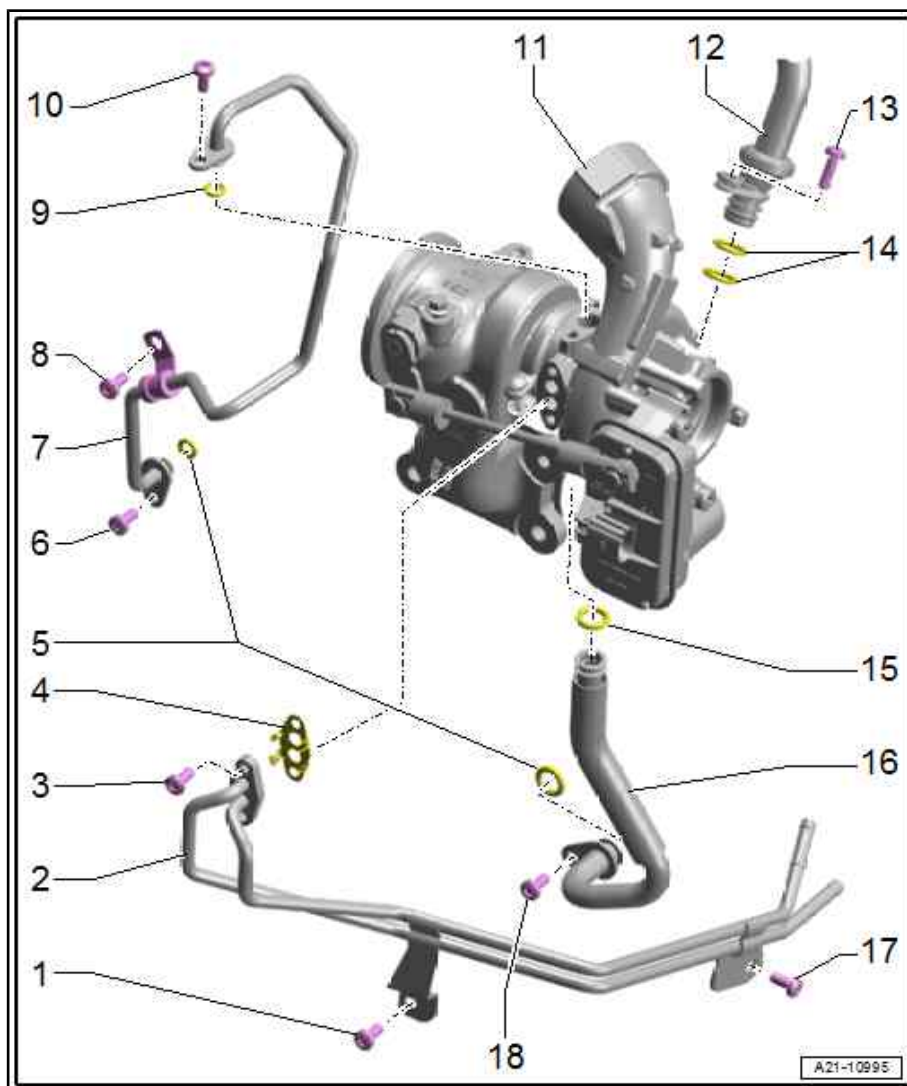
| Stage | Tightening torque                                                    |
|-------|----------------------------------------------------------------------|
| 1.    | Screw in by hand until contact is made (work in clockwise direction) |
| 2.    | 10 Nm (work in clockwise direction)                                  |
| 3.    | 14 Nm (work in clockwise direction)                                  |



## Pipes and lines on turbocharger



- 1 - Bolt**  
☐ 9 Nm
- 2 - Coolant lines**  
☐ Supply and return
- 3 - Bolt**  
☐ 9 Nm
- 4 - Gasket**  
☐ Renew after removing
- 5 - O-rings**  
☐ Renew after removing
- 6 - Bolt**  
☐ 9 Nm
- 7 - Oil supply line**
- 8 - Bolt**  
☐ 9 Nm
- 9 - O-ring**  
☐ Renew after removing
- 10 - Bolt**  
☐ 9 Nm
- 11 - Turbocharger**  
☐ Can only be renewed together with exhaust manifold  
☐ Removing and installing  
⇒ ["1.2 Removing and installing turbocharger", page 196](#)
- 12 - Crankcase breather pipe**
- 13 - Bolt**  
☐ 9 Nm
- 14 - O-rings**  
☐ Renew after removing
- 15 - O-ring**  
☐ Renew after removing
- 16 - Oil return line**
- 17 - Bolt**  
☐ 9 Nm
- 18 - Bolt**  
☐ 9 Nm



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## 1.2 Removing and installing turbocharger



### Caution

*If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:*

- ◆ *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- ◆ *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- ◆ *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

### Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-

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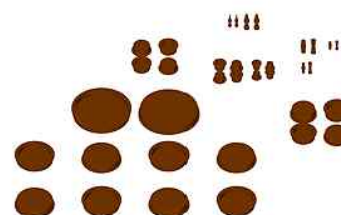
3094



W00-11130

- ◆ Engine bung set - VAS 6122-

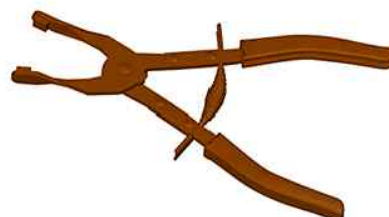
VAS 6122



W00-11228

- ◆ Hose clip pliers - VAS 6362-

VAS 6362



W00-11227

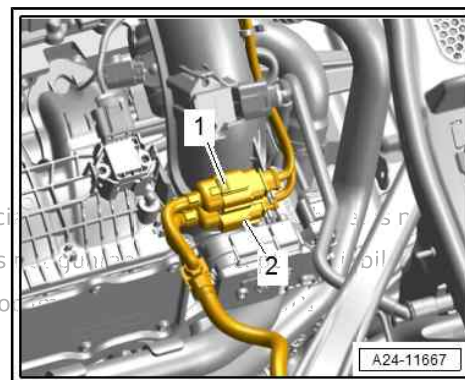


## Removing

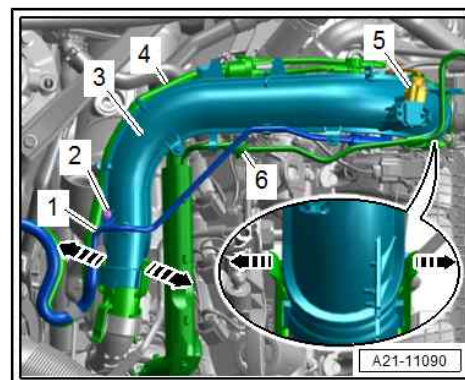
- Observe rules for cleanliness  
⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Remove air cleaner housing  
⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#) .
- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.



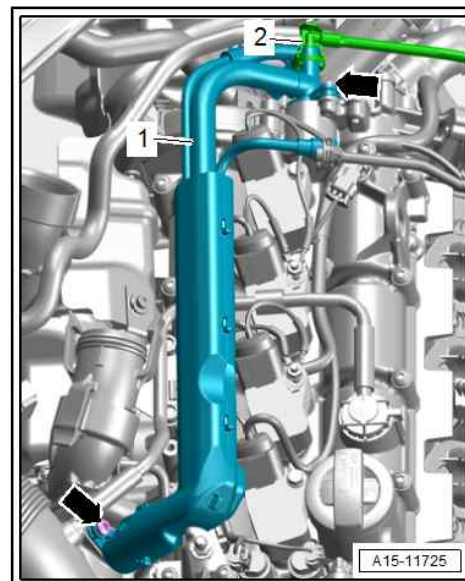
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- Remove bolt -2- and move fuel line -1- clear.
- Move hose -4- for activated charcoal filter system and coolant hose -6- clear.
- Unplug electrical connector -5- from charge pressure sender -G31- .
- Release catches -arrows- and detach air pipe -3-.

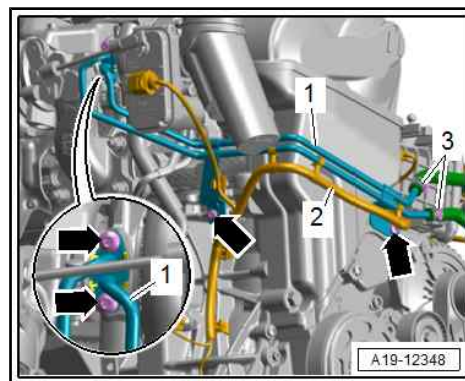


- Remove bolt -bottom arrow-, detach crankcase breather hose -1- and move it towards rear.



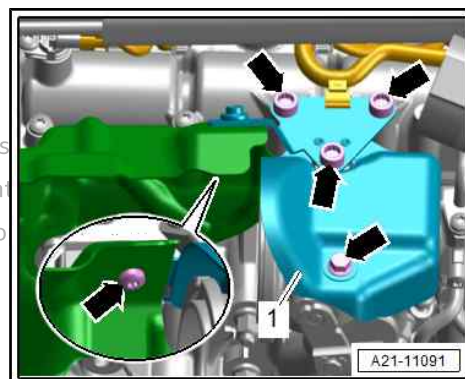


- Move electrical wiring harness -2- clear.
- Place a cloth underneath to catch escaping coolant.
- Clamp off coolant hoses using hose clamps up to 25 mm - 3094- , release hose clips -3- and disconnect hoses.
- Remove bolts -arrows- and move coolant lines -1- to one side.

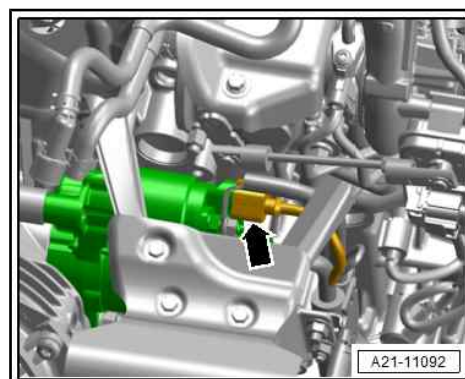


- Move electrical wiring harness clear.
- Remove bolts -arrows- and detach heat shield -1-.

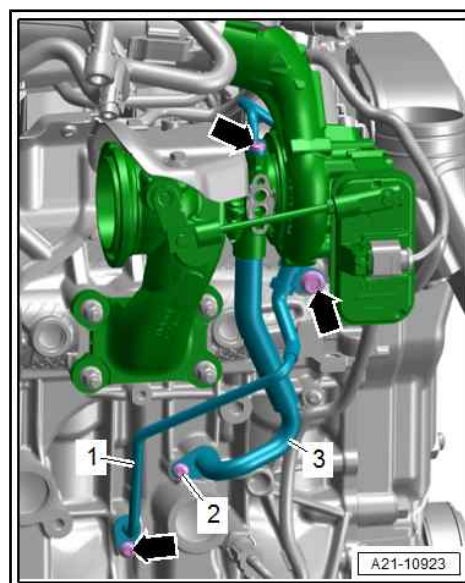
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- Unplug electrical connector -arrow- for starter.

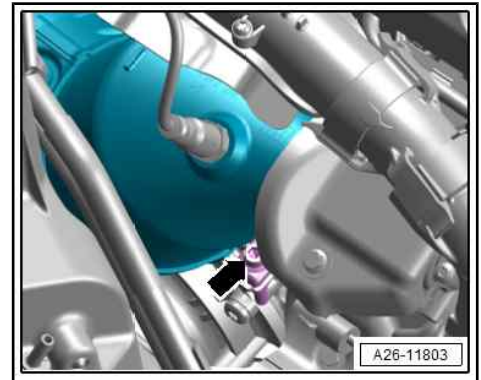


- Remove bolts -arrows- and -2-.
- Detach oil supply line -1-, press it slightly to one side and detach oil return line -3-. (Shown with engine support removed.)
- Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .





- Release screw-type clip -arrow- and move it onto intake funnel of turbocharger.

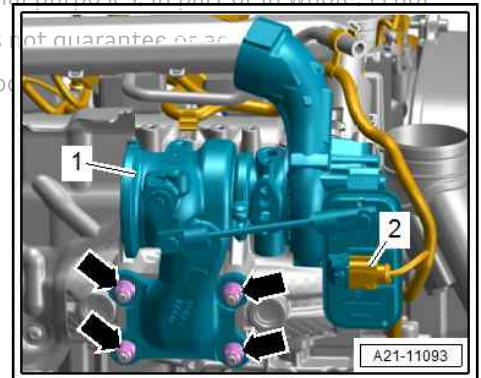


- Unplug electrical connector -2-.
- Remove nuts -arrows- and detach turbocharger -1-.

### Installing

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

- Renew seal, gasket and O-rings after removal. See note [⇒ Item 4 \(page 217\)](#) .
- Fill turbocharger with engine oil at connection for oil supply line.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.
- Install catalytic converter  
[⇒ “2.2 Removing and installing catalytic converter”, page 250](#) .
- Install air cleaner housing  
[⇒ “2.2 Removing and installing air cleaner housing”, page 215](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Check coolant level and top up if necessary [⇒ page 159](#) .
- Install engine cover panel  
[⇒ “3.1 Removing and installing engine cover panel”, page 34](#) .
- If a turbocharger with a new charge pressure positioner - V465- has been installed, select Guided Functions on ⇒ Vehicle diagnostic tester and perform function 0001 - Adapt/ set charge pressure adjuster -V465.



### Tightening torques

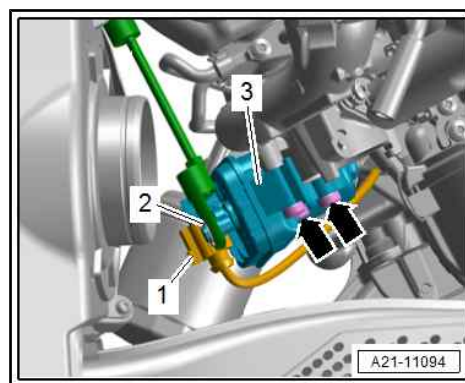
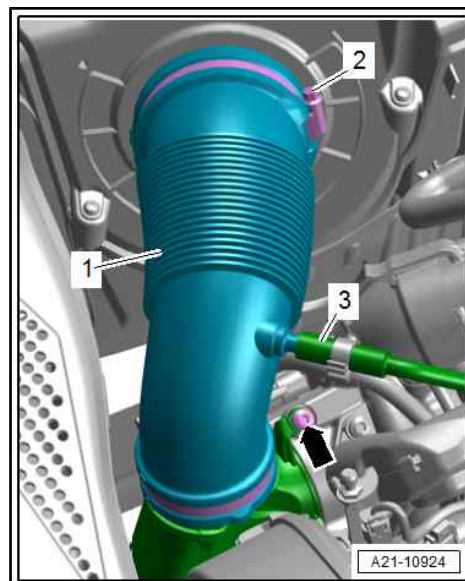
- ◆ [⇒ “1.1 Exploded view - turbocharger”, page 193](#)
- ◆ [⇒ “2.1 Exploded view - charge air system”, page 201](#)



## 1.3 Removing and installing charge pressure positioner - V465-

### Removing

- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
  - Disconnect crankcase breather hose -3-.
  - Loosen screw-type clip -2- and detach air pipe -1- from air filter housing.
  - Unscrew bolt -arrow-, pivot air pipe with connection to left side and detach it.
- 
- Unplug electrical connector -1-.
  - Detach securing clip -2-.
  - Remove bolts -arrows- and detach charge pressure positioner - V465- -3-.



### Installing

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

- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- If charge pressure positioner - V465- has been renewed, select Guided Functions on ⇒ Vehicle diagnostic tester and perform function 0001 - Adapt/set charge pressure positioner V465.

### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 193](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 202](#)



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## 2 Charge air system

⇒ ["2.1 Exploded view - charge air system", page 201](#)

⇒ ["2.2 Exploded view - hose connections for charge air system", page 202](#)

⇒ ["2.3 Removing and installing charge pressure sender G31", page 203](#)

⇒ ["2.4 Removing and installing charge air cooler", page 203](#)

⇒ ["2.5 Checking charge air system for leaks", page 205](#)

### 2.1 Exploded view - charge air system

- Check that all air pipes, air hoses and vacuum lines are correctly fitted and that there are no leaks before carrying out tests or repairs.

#### 1 - Intake manifold

Removing and installing  
⇒ ["3.2 Removing and installing intake manifold", page 219](#)

#### 2 - Bolt

- ☐ Tightening torques  
⇒ [Item 11 \(page 161\)](#)

#### 3 - Bracket

- ☐ For air pipe

#### 4 - O-rings

- ☐ Renew after removal  
(apply thin coating of clean engine oil prior to installation)

#### 5 - Connection

#### 6 - Fuel line

#### 7 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 4 Nm

#### 8 - Air pipe

#### 9 - Bolt

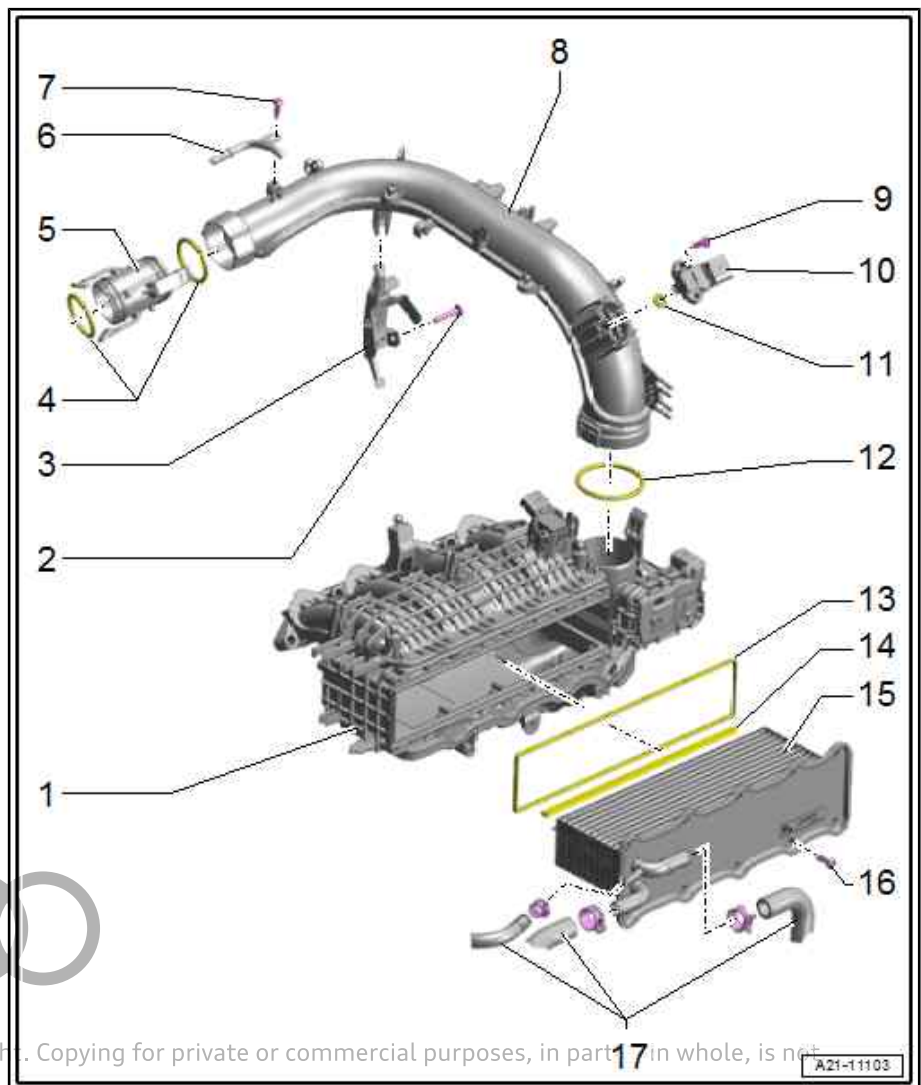
- ☐ Thread-forming
- ☐ Repair method if fasteners break off
- ☐ 4 Nm

#### 10 - Charge pressure sender - G31-

- ☐ Removing and installing ⇒ ["2.3 Removing and installing charge pressure sender G31", page 203](#)

#### 11 - O-ring

- ☐ If necessary, renew after removing



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## 12 - O-ring

- ☐ Renew after removal (apply thin coating of clean engine oil prior to installation)

## 13 - Gasket

- ☐ Renew after removing

## 14 - Sealing strip

- ☐ Renew after removing

## 15 - Charge air cooler

- ☐ Removing and installing ⇒ ["2.4 Removing and installing charge air cooler", page 203](#)
- ☐ If renewed, refill system with fresh coolant

## 16 - 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

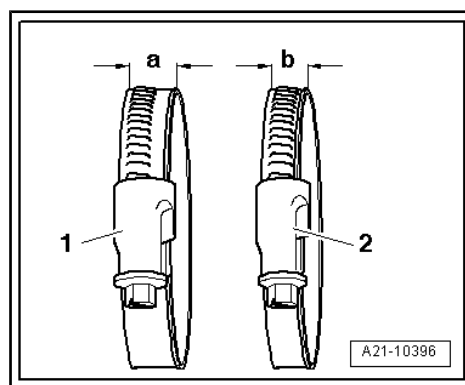
## 17 - Coolant hoses

## 2.2 Exploded view - hose connections for charge air system

- Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.
- Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .
- The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.

Tightening torque for

- 1 - Hose clip with width -a- = 13 mm: 5.5 Nm
- 2 - Hose clip with width -b- = 9 mm: 3.4 Nm



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## 2.3 Removing and installing charge pressure sender - G31-

### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Unplug electrical connector -1-.
- Release catches -arrows- and detach charge pressure sender - G31- .

### Installing

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

- If necessary, renew O-ring after removal.

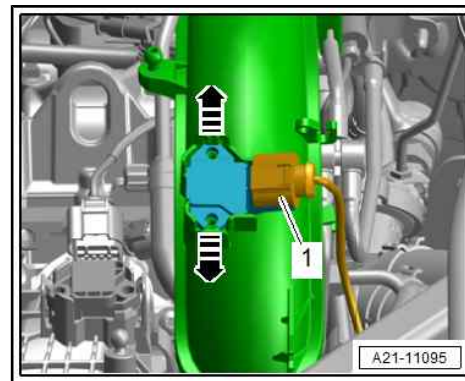
### Note:

Repair solution if fasteners have broken off: Secure charge pressure sender - G31- with two bolts, refer to ⇒ Electronic parts catalogue .

- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .

### Tightening torques

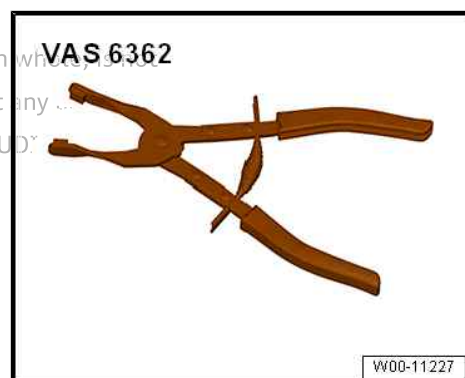
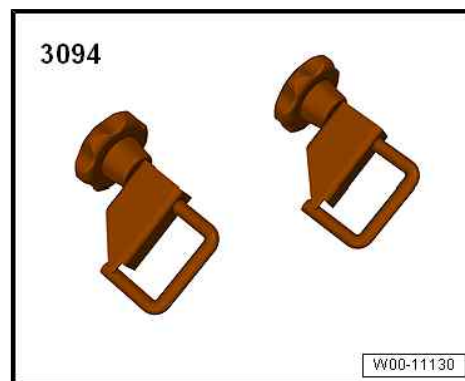
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 201](#)



## 2.4 Removing and installing charge air cooler

### Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



- ◆ Hose clip pliers - VAS 6362-

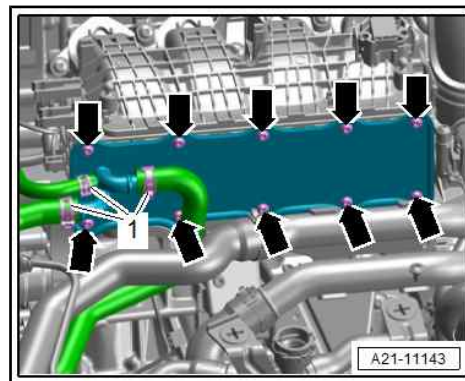
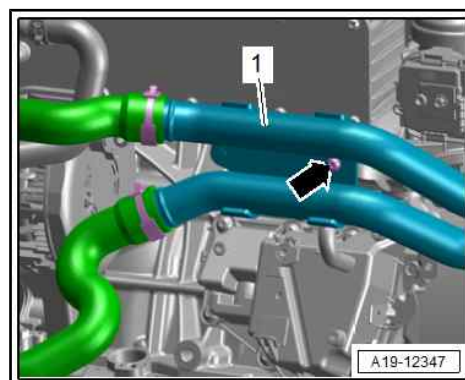
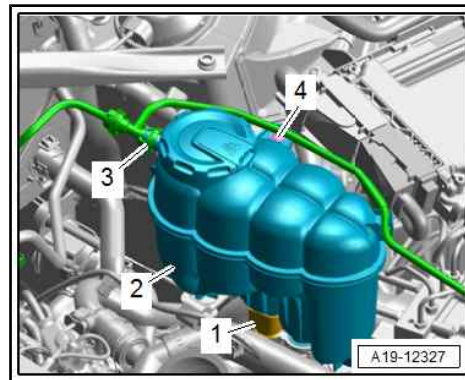


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## Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Engine cold.
- Observe rules for cleanliness  
⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Lift retaining clip -3-, disconnect coolant hose and move it clear.
- Unplug electrical connector -1- for coolant shortage indicator switch - F66- .
- Remove bolt -4- and push coolant expansion tank -2- to one side.
- Unscrew bolt -arrow- and press coolant pipes -1- slightly to one side.
- Place a cloth underneath to catch escaping coolant.
- Clamp off coolant hoses using hose clamps up to 25 mm - 3094- , release hose clips -1- and disconnect hoses.
- Remove bolts -arrows- and detach charge air cooler.
- Seal off open passages in the intake system with clean cloths.



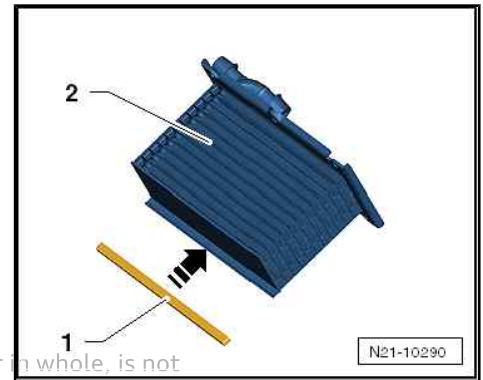
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## Installing

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

- If there are slight impressions on the fins, refer to  
⇒ [“3.5 Installing radiators and condensers”, page 6](#) .
- Renew sealing strip and gasket after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Attach sealing strip -1- to charge air cooler -2- (-arrow-).
- Insert gasket into groove on intake manifold.
- Connect coolant hoses with plug-in connector  
⇒ [Fig. “Connecting coolant hose with plug-in connector”, page 183](#) .
- Check coolant level ⇒ [page 159](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .



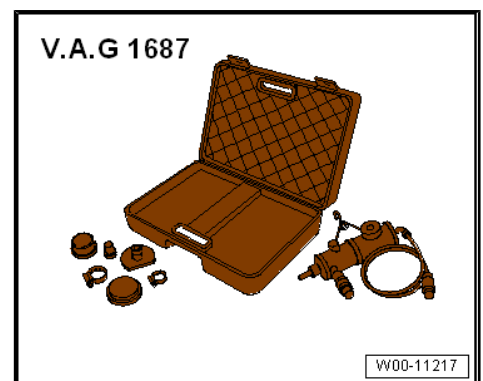
## Tightening torques

- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 201](#)
- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 180](#)
- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 214](#)

## 2.5 Checking charge air system for leaks

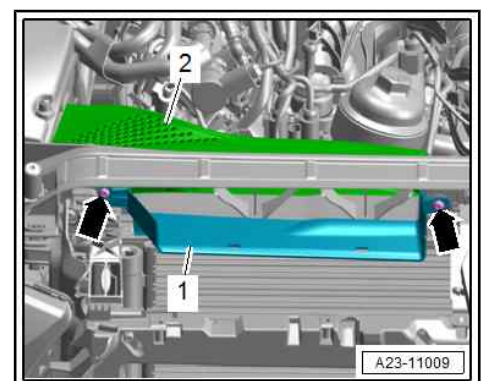
### Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687-



### Procedure

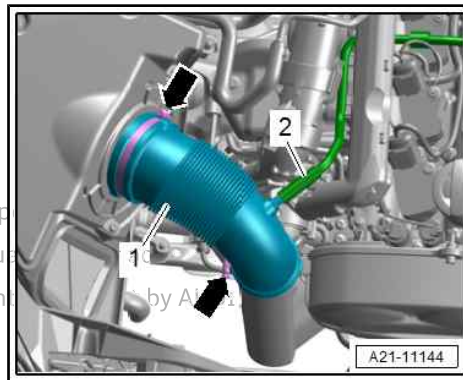
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Remove bolts -arrows- and detach air duct -2-.



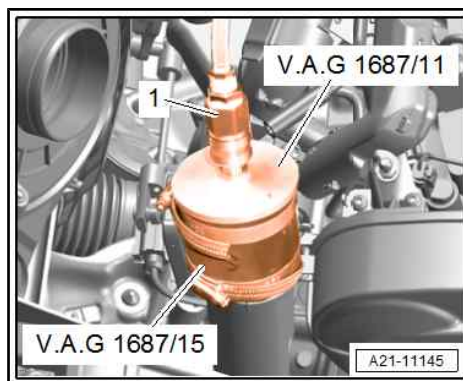


- Loosen hose clips -arrows-.
- Being careful not to damage it, detach vacuum hose -2-.
- Detach air pipe -1-.

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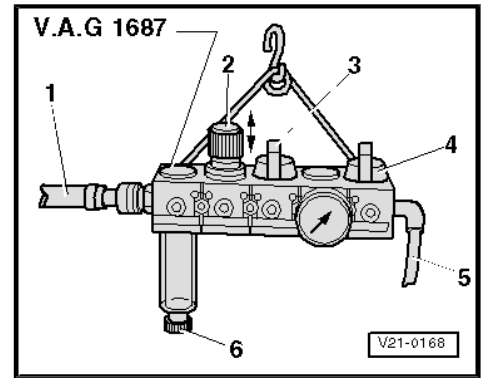
- Connect adapter - V.A.G 1687/15- with -V.A.G 1687/11- to turbocharger.
- Connect hose -1- of charge air system tester -V.A.G 1687- to adapter.





Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.
- Make sure knob is pulled out before turning pressure control valve -2-.
- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.
- If there is water in sight glass, remove drain plug -6- and drain water.
- Open valve -3-.



#### Caution

*Risk of damage if pressure is set too high.*

◆ *The pressure must not exceed 0.2 bar.*

- Adjust pressure to 0.2 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.2 bar again.
- Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detecting spray or use ultrasonic tester - V.A.G 1842- (refer to ⇒ operating manual ).

#### Note:

A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.

- Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.

#### Assembling

Assembly is performed in reverse sequence; note the following:

- Renew seal and O-rings after removal.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Before fitting, check vacuum hoses for damage and renew if necessary.
- Install lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .

#### Tightening torques

- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 214](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 202](#)





## 24 – Mixture preparation - injection

### 1 Injection system

⇒ [“1.1 Overview of fitting locations - injection system”, page 208](#)

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#### 1.1 Overview of fitting locations - injection system

Overview of fitting locations - engine compartment

1 - Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-

- ❑ Exploded view  
⇒ [“7.1 Exploded view - Lambda probe”, page 239](#)

2 - Gear detection sensor - G604-

- ❑ For vehicles with manual gearbox
- ❑ Fitting location  
⇒ [Fig. “Fitting location of gear detection sensor -G604-””, page 210](#)

3 - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ❑ Fitting location  
⇒ [Fig. “Accelerator position sender -G79- and accelerator position sender 2 -G185-””, page 209](#)

4 - Brake light switch - F-

- ❑ Fitting location  
⇒ [Fig. “Fitting location of brake light switch -F-””, page 209](#)

5 - Clutch position sender - G476-

- ❑ For equipment version with manual gearbox
- ❑ Fitting location  
⇒ [Fig. “Fitting location of clutch position sender -G476-””, page 210](#)

6 - Auxiliary pump for heating - V488-

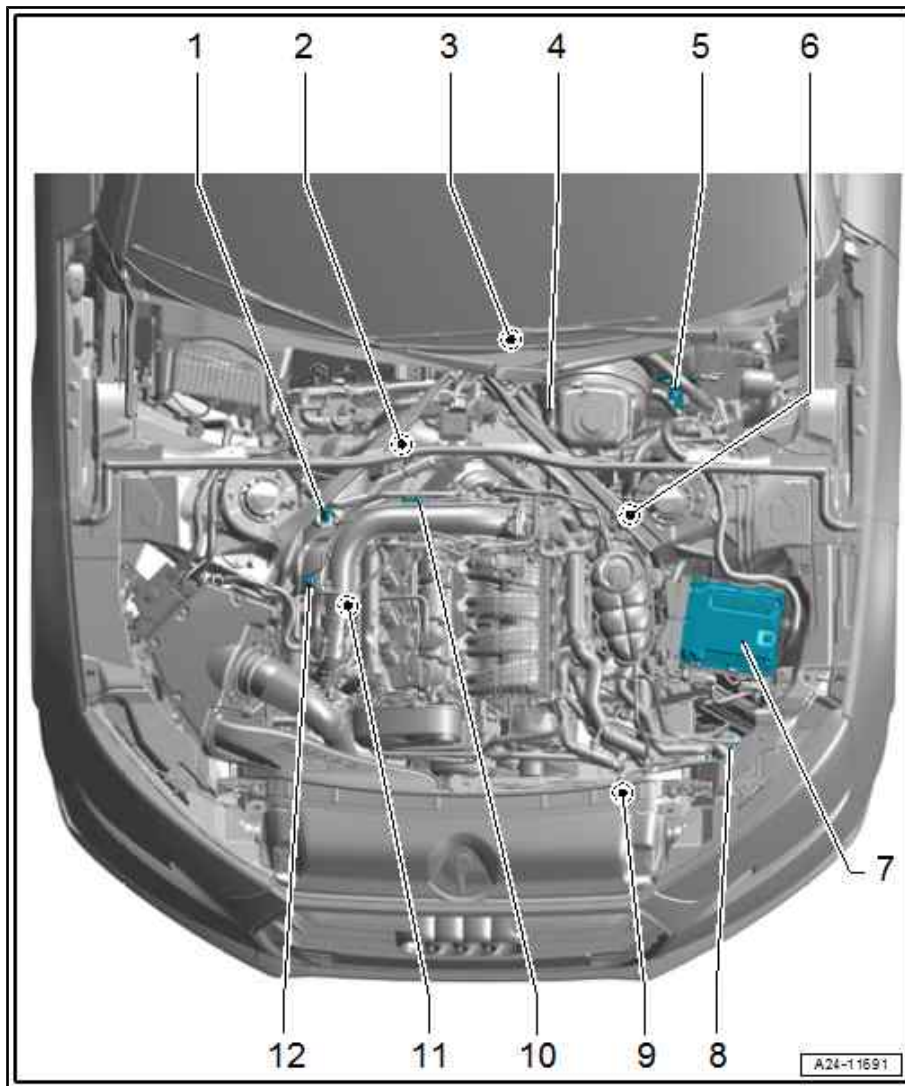
- ❑ For equipment version with dual clutch gearbox
- ❑ Fitting location ⇒ [page 209](#)

7 - Engine control unit - J623-

- ❑ Exploded view ⇒ [“8.1 Exploded view - engine control unit”, page 241](#)

8 - Charge air cooling pump - V188-

- ❑ Exploded view ⇒ [“2.2 Exploded view - electric coolant pump”, page 162](#)





## 9 - Radiator outlet coolant temperature sender - G83-

- ❑ Fitting location

⇒ Fig. "Fitting location of radiator outlet coolant temperature sender -G83- ", page 210

## 10 - Left electrohydraulic engine mounting solenoid valve - N144-

- ❑ For equipment version with dual clutch gearbox

- ❑ Fitting location

⇒ Fig. "Fitting location of left electrohydraulic engine mounting solenoid valve -N144- ", page 210

## 11 - Activated charcoal filter solenoid valve 1 - N80-

## 12 - Lambda probe - G39- and Lambda probe heater - Z19-

- ❑ Exploded view ⇒ "7.1 Exploded view - Lambda probe", page 239

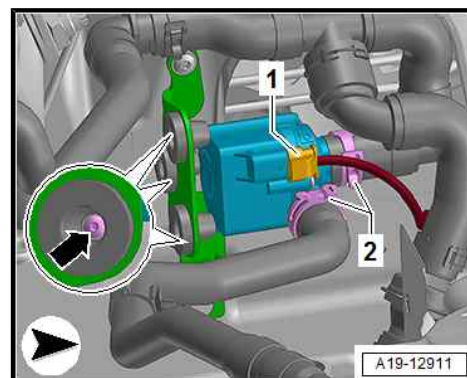
## Fitting location of auxiliary pump for heating - V488-

- In engine compartment, beneath coolant expansion tank in vicinity of plenum chamber partition panel

### 1 - Electrical connector for auxiliary pump for heating - V488-

Exploded view

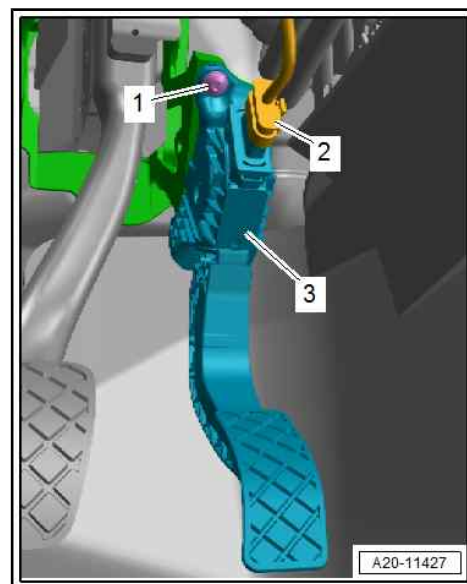
⇒ "2.2.2 Exploded view - auxiliary pump for heating V488 ", page 164 .



## Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ◆ In accelerator pedal module -3- The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.

Exploded view ⇒ Fuel supply system; Rep. gr. 20 ; Accelerator mechanism; Exploded view - accelerator pedal module



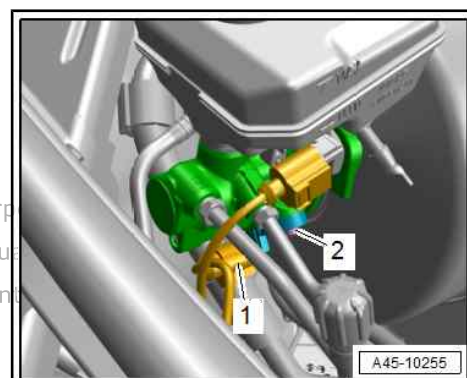
## Fitting location of brake light switch - F-

- ◆ In engine compartment on brake master cylinder

### 1 - Electrical connector for brake light switch - F-

Exploded view ⇒ Brake system; Rep. gr. 47 ; Brake servo/brake master cylinder; Exploded view - brake servo/brake master cylinder

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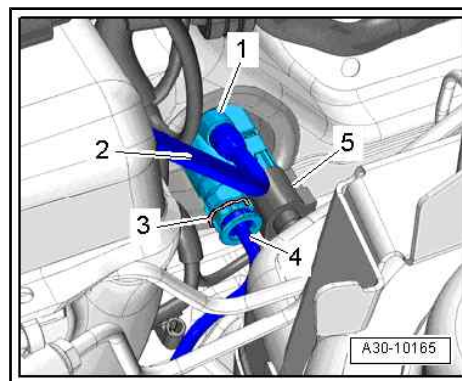




### Fitting location of clutch position sender - G476-

- ◆ In plenum chamber on driver's side.

5 - Electrical connector for clutch position sender - G476-

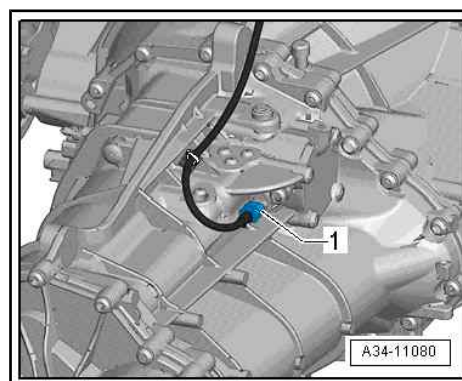


### Fitting location of gear detection sensor - G604-

- ◆ On right of gearbox.

1 - Gear detection sensor - G604-

Removing and installing ⇒ Gearbox; Rep. gr. 34 ; Selector mechanism



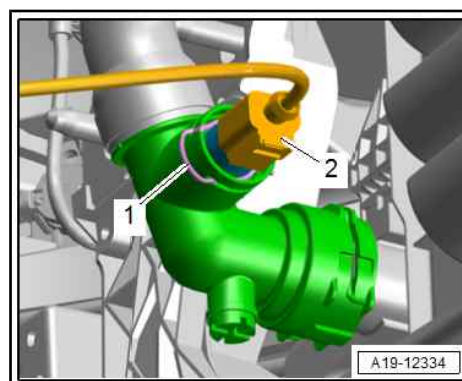
### Fitting location of radiator outlet coolant temperature sender - G83-

- In coolant connection on radiator at bottom left.

2 - Electrical connector for radiator outlet coolant temperature sender - G83-

Exploded view

⇒ ["2.2 Exploded view - electric coolant pump", page 162](#) .



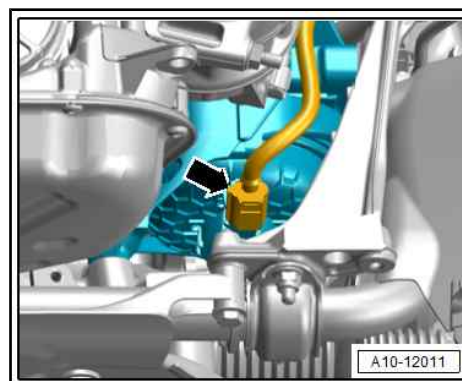
### Fitting location of left electrohydraulic engine mounting solenoid valve - N144-

- ◆ Integrated in engine mounting. It cannot be renewed separately if defective.

Pfeil - Electrical connector for electrohydraulic engine mounting solenoid valve

Removing and installing

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



### Overview of fitting locations - engine (view from above)



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**1 - Camshaft control valve 1 - N205-**

- ❑ Exploded view  
⇒ [“2.2 Exploded view - camshaft housing”, page 99](#)

**2 - Exhaust camshaft control valve 1 - N318-**

- ❑ Exploded view  
⇒ [“2.2 Exploded view - camshaft housing”, page 99](#)

**3 - Ignition coil 1 with output stage - N70-**

- ❑ Exploded view  
⇒ [“1.1 Exploded view - ignition system”, page 254](#)

**4 - Ignition coil 2 with output stage - N127-**

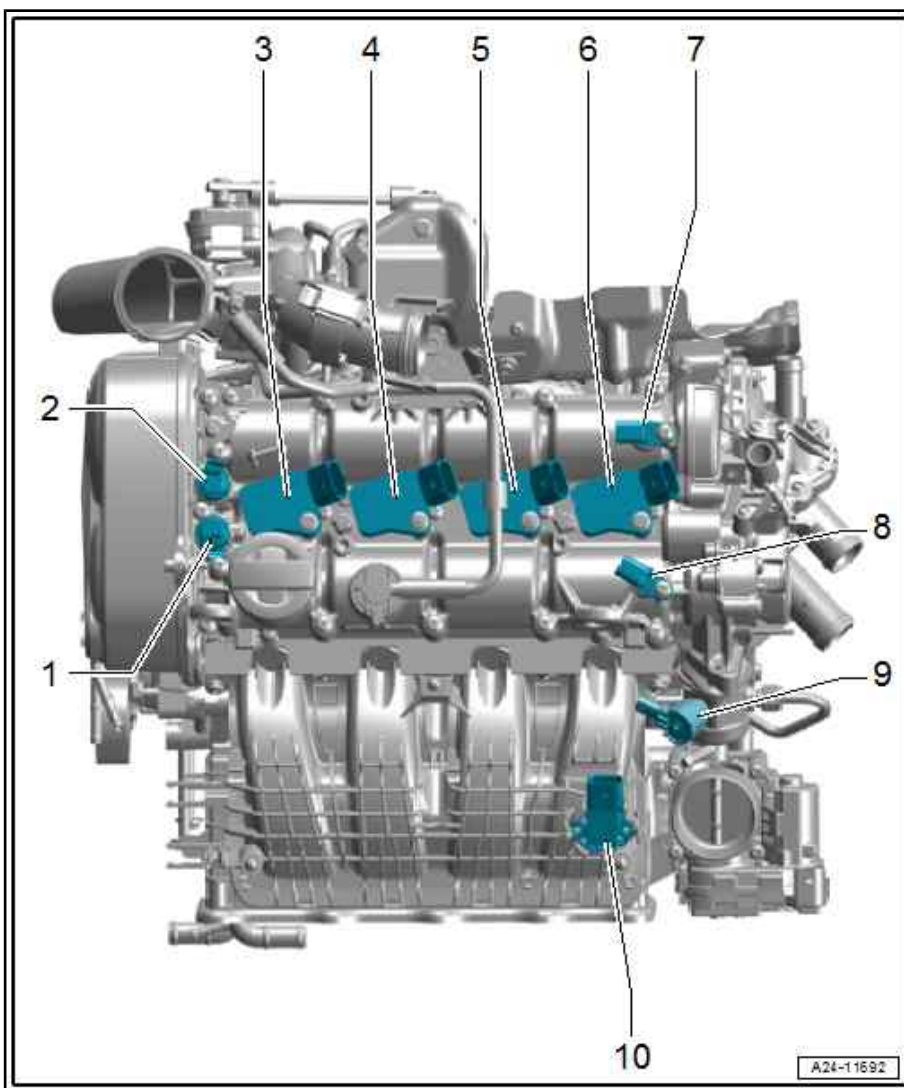
- ❑ Exploded view  
⇒ [“1.1 Exploded view - ignition system”, page 254](#)

**5 - Ignition coil 3 with output stage - N291-**

- ❑ Exploded view  
⇒ [“1.1 Exploded view - ignition system”, page 254](#)

**6 - Ignition coil 4 with output stage - N292-**

- ❑ Exploded view  
⇒ [“1.1 Exploded view - ignition system”, page 254](#)



**7 - Hall sender 2 - G163-**

- ❑ Exploded view ⇒ [“1.1 Exploded view - ignition system”, page 254](#)

**8 - Hall sender - G40- (camshaft position sensor)**

- ❑ Exploded view ⇒ [“1.1 Exploded view - ignition system”, page 254](#)

**9 - Fuel pressure regulating valve - N276-**

- ❑ Integrated in high-pressure pump
- ❑ Exploded view ⇒ [“6.1 Exploded view - high-pressure pump”, page 234](#)

**10 - Intake manifold pressure sender - G71-**

- ❑ Exploded view ⇒ [“3.1 Exploded view - intake manifold”, page 217](#)

**Overview of fitting locations - engine (inlet side)**



**1 - Oil level and oil temperature sender - G266-**

- ❑ Exploded view  
⇒ ["1.1 Exploded view - sump/oil pump", page 129](#)

**2 - Knock sensor 1 - G61-**

- ❑ Exploded view  
⇒ ["1.1 Exploded view - ignition system", page 254](#)

**3 - Oil pressure switch for reduced oil pressure - F378-**

- ❑ Exploded view  
⇒ ["4.1 Exploded view - oil filter/oil pressure switches", page 144](#)

**4 - Fuel pressure sender - G247-**

- ❑ Exploded view  
⇒ ["4.1 Exploded view - fuel rail with injectors", page 223](#)

**5 - Injector, cylinder 1 - N30-**

- ❑ Exploded view  
⇒ ["4.1 Exploded view - fuel rail with injectors", page 223](#)

**6 - Injector, cylinder 2 - N31-**

- ❑ Exploded view  
⇒ ["4.1 Exploded view - fuel rail with injectors", page 223](#)

**7 - Injector, cylinder 3 - N32-**

- ❑ Exploded view ⇒ ["4.1 Exploded view - fuel rail with injectors", page 223](#)

**8 - Injector, cylinder 4 - N33-**

- ❑ Exploded view ⇒ ["4.1 Exploded view - fuel rail with injectors", page 223](#)

**9 - Charge pressure sender - G31-**

- ❑ Exploded view ⇒ ["3.1 Exploded view - intake manifold", page 217](#)

**10 - Throttle valve module - J338-**

- ❑ with

◆ Throttle valve drive (for electric throttle) - G186-

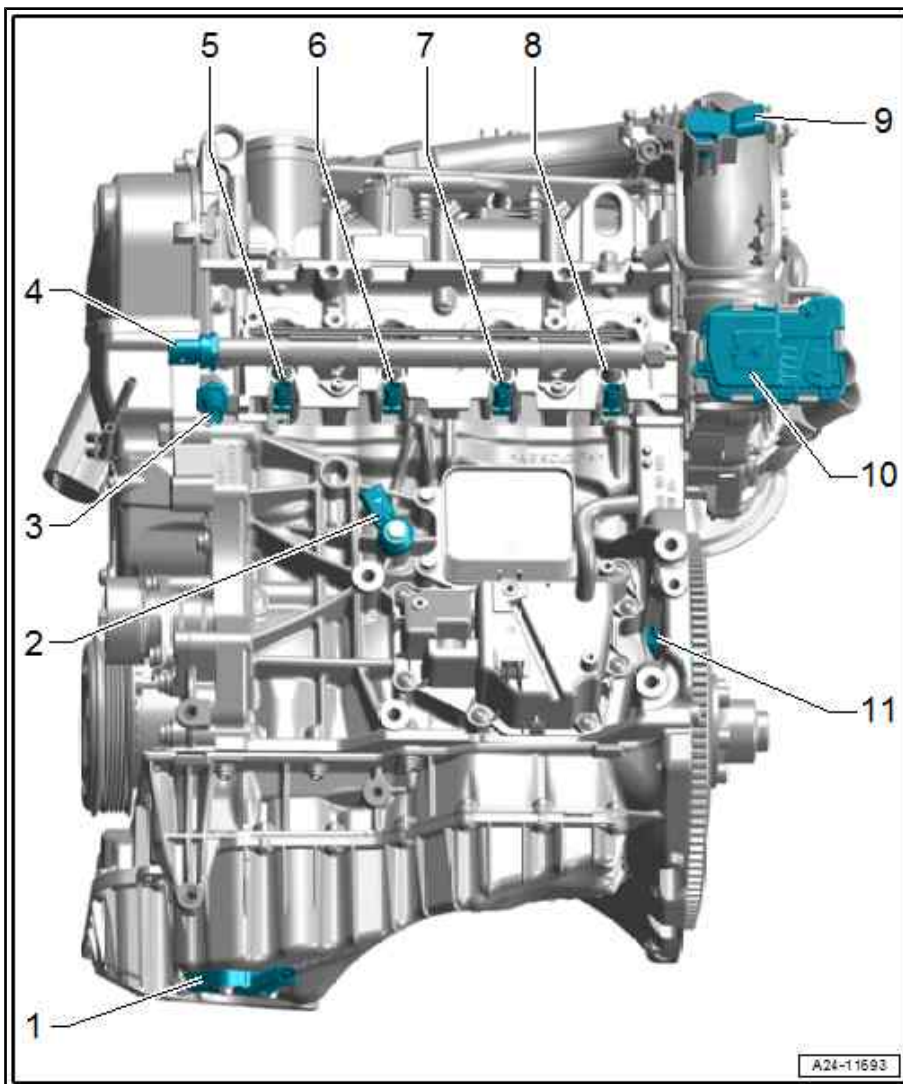
◆ Throttle valve drive angle sender - G187-

◆ Throttle valve drive angle sender 2 - G188-

- ❑ Exploded view ⇒ ["3.1 Exploded view - intake manifold", page 217](#)

**11 - Engine speed sender - G28-**

- ❑ Exploded view ⇒ ["1.1 Exploded view - ignition system", page 254](#)



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**Overview of fitting locations - engine (exhaust side)**

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**1 - Coolant temperature sender - G62-**

- ❑ Exploded view  
⇒ [“2.3 Exploded view - coolant temperature senders”, page 165](#)

**2 - Charge pressure positioner - V465-**

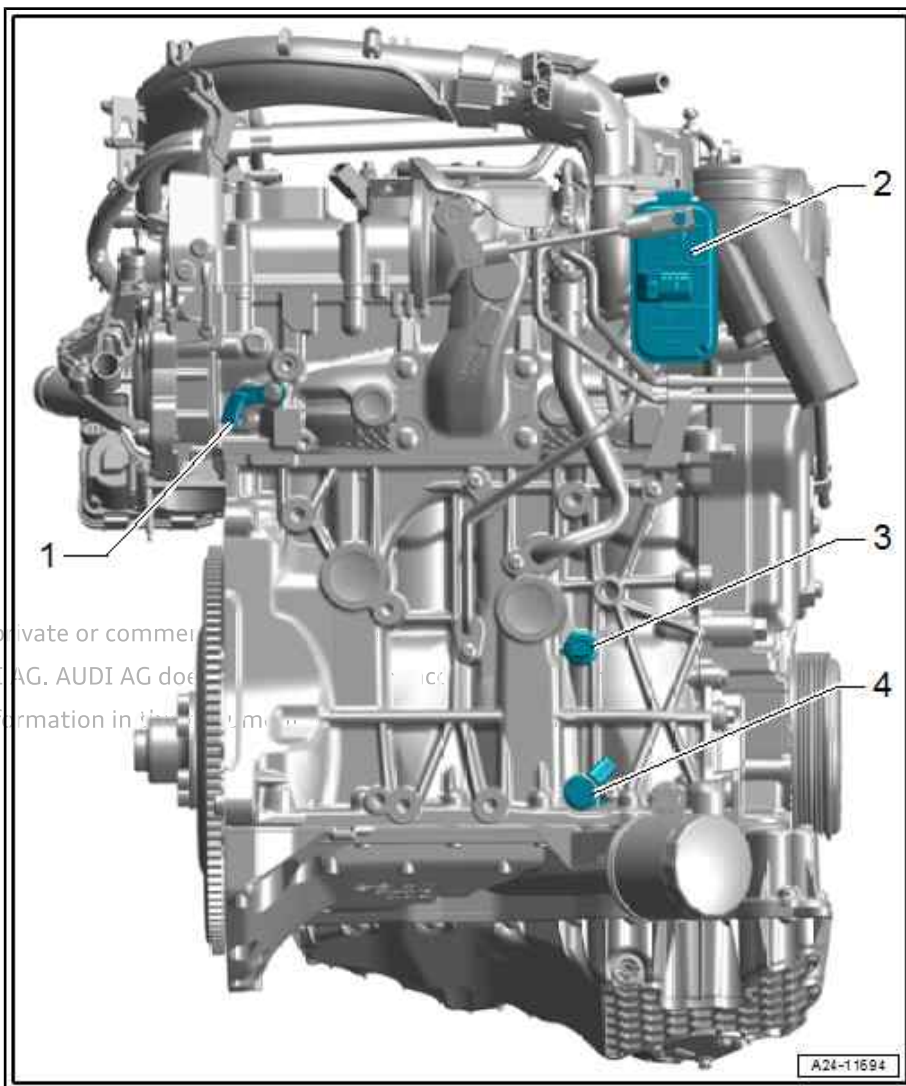
- ❑ Exploded view  
⇒ [“1.1 Exploded view - turbocharger”, page 193](#)

**3 - Oil pressure switch - F22-**

- ❑ Exploded view  
⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 144](#)

**4 - Valve for oil pressure control - N428-**

- ❑ Exploded view  
⇒ [“4.1 Exploded view - oil filter/oil pressure switches”, page 144](#)



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## 2 Air cleaner

⇒ [“2.1 Exploded view - air cleaner housing”, page 214](#)

⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#)

### 2.1 Exploded view - air cleaner housing

#### 1 - Snow screen

- ☐ Country-specific version

#### 2 - Air duct

- ☐ On lock carrier
- ☐ Remove any salt deposits or dirt

#### 3 - Sealing element

#### 4 - Water drain

- ☐ Clean

#### 5 - Mounting bracket

- ☐ For air cleaner housing

#### 6 - Not fitted

#### 7 - Air cleaner (bottom section)

- ☐ Remove any salt deposits or dirt
- ☐ Removing and installing  
⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#)

#### 8 - Air filter element

- ☒ Use genuine air filter element ⇒ Electronic parts catalogue
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing ⇒ Maintenance ; Booklet 830

#### 9 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 3.5 Nm

#### 10 - Air cleaner (top section)

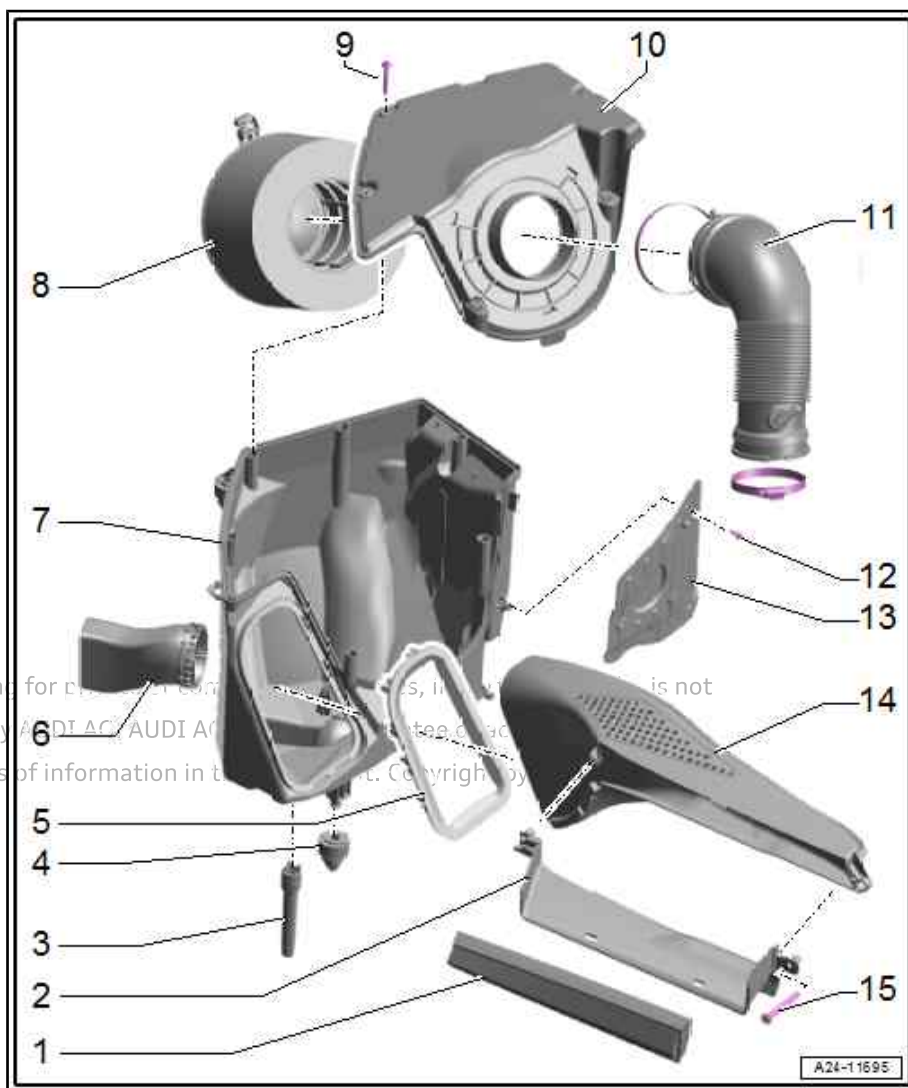
- ☐ Remove any salt deposits or dirt
- ☐ Removing and installing ⇒ Maintenance ; Booklet 830

#### 11 - Air pipe

- ☐ Observe installation markings
- ☐ Tightening torque for screw-type clips  
⇒ [“2.2 Exploded view - hose connections for charge air system”, page 202](#)

#### 12 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 1.5 Nm





### 13 - Heat shield

### 14 - Air duct

- ☐ On lock carrier
- ☐ Remove any salt deposits or dirt

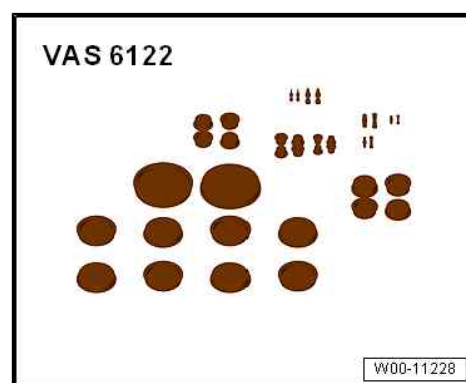
### 15 - Bolt

- ☐ Thread-forming
- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 2.5 Nm

## 2.2 Removing and installing air cleaner housing

### Special tools and workshop equipment required

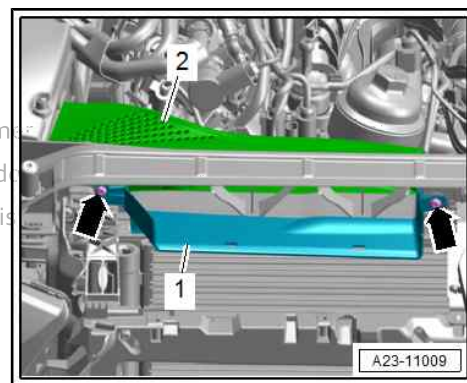
- ◆ Engine bung set - VAS 6122-



### Removing

- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Remove lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Remove bolts -arrows- and detach air duct -2-.

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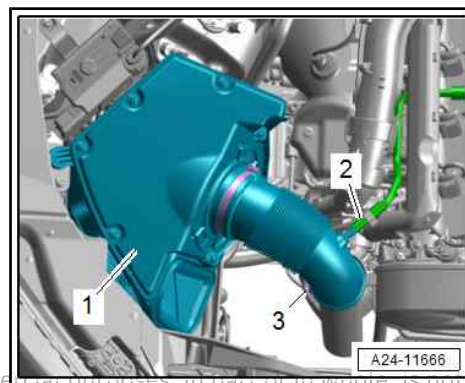


- Disconnect crankcase breather hose -2-.
- Release hose clip -3- and detach air hose.
- Lift off air cleaner housing -1- and detach.
- Seal off turbocharger with sealing plug (thoroughly cleaned) from engine bung set - VAS 6122- .

### Installing

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

- The air cleaner housing must always be clean.
- Use silicone-free lubricant when fitting air hose.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Check water drain in air cleaner (bottom section) for dirt and other obstructions and clean if necessary.
- Check for dirt in air duct going from lock carrier to air cleaner housing.
- Install lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .



### Tightening torques

- ◆ ⇒ [“2.1 Exploded view - air cleaner housing”, page 214](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 202](#)



### 3 Intake manifold

⇒ ["3.1 Exploded view - intake manifold", page 217](#)

⇒ ["3.2 Removing and installing intake manifold", page 219](#)

⇒ ["3.3 Removing and installing throttle valve module J338", page 220](#)

⇒ ["3.4 Cleaning throttle valve module", page 221](#)

#### 3.1 Exploded view - intake manifold

##### 1 - Intake manifold

- ☐ Combined with charge air cooler
- ☐ Removing and installing  
⇒ ["3.2 Removing and installing intake manifold", page 219](#)

##### 2 - Bolt

- ☐ Tightening torque and sequence  
⇒ [Fig. "Intake manifold - tightening torque and sequence", page 218](#)

##### 3 - Gaskets

- ☐ Renew after removing

##### 4 - O-rings

- ☐ Check for damage and renew if necessary
- ☐ Allocation  
⇒ [Fig. "Allocation of O-rings to connection -1-", page 218](#)

##### 5 - Connection

- ☐ From activated charcoal filter

##### 6 - O-ring

- ☐ If necessary, renew after removing

##### 7 - Intake manifold pressure sender - G71-

- ☐ Removing and installing  
⇒ ["5.1 Removing and installing intake manifold pressure sender G71", page 230](#)

##### 8 - Bolt

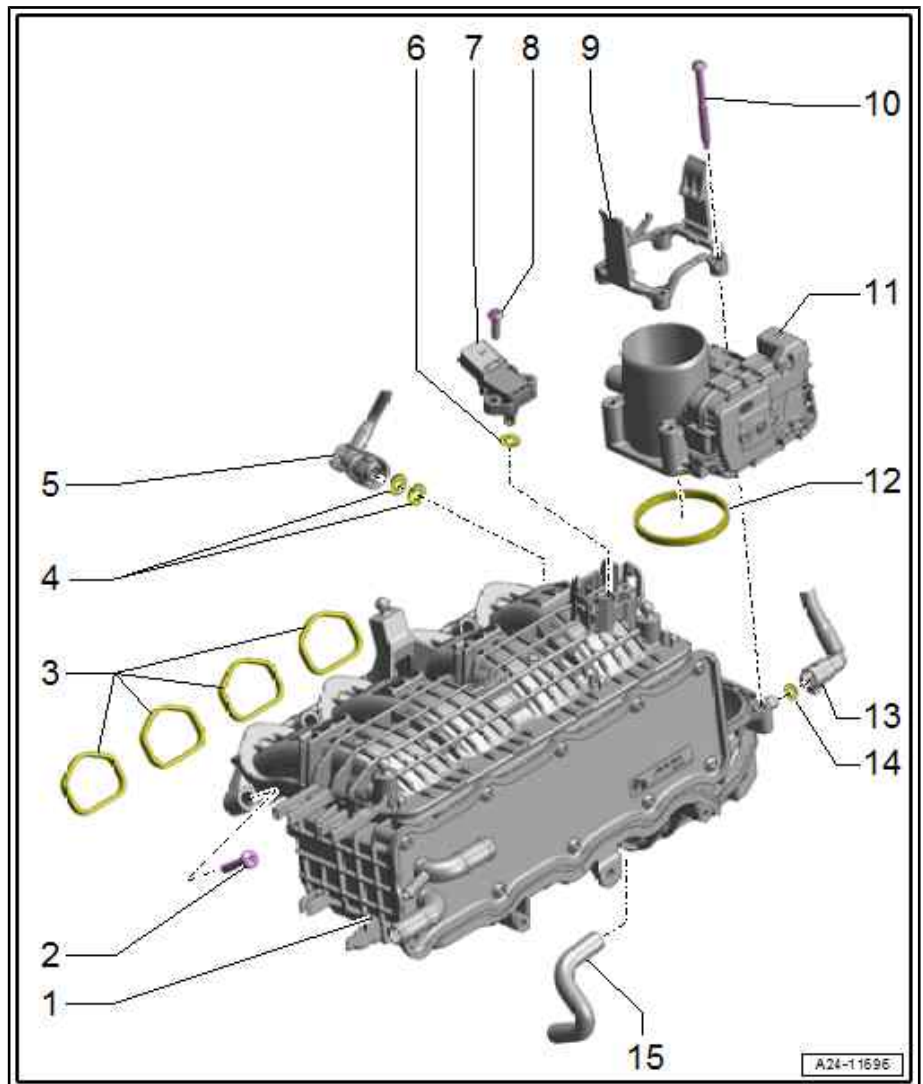
- ☐ Thread-forming
- ☐ Repair method if fasteners break off
- ☐ 1.5 Nm

##### 9 - Retaining clip

- ☐ For air pipe

##### 10 - Bolt

- ☐ Thread-forming





- ☐ Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolt to torque
- ☐ 7 Nm

#### 11 - Throttle valve module - J338-

- ☐ Removing and installing ⇒ ["3.3 Removing and installing throttle valve module J338", page 220](#)
- ☐ Cleaning ⇒ ["3.4 Cleaning throttle valve module", page 221](#)
- ☐ After renewal, perform adaptations listed in Guided Function "01 - Functions, engine mechanics" ⇒ Vehicle diagnostic tester

#### 12 - Seal

- ☐ Renew after removing

#### 13 - Vacuum line

#### 14 - O-ring

- ☐ Check for damage and renew if necessary

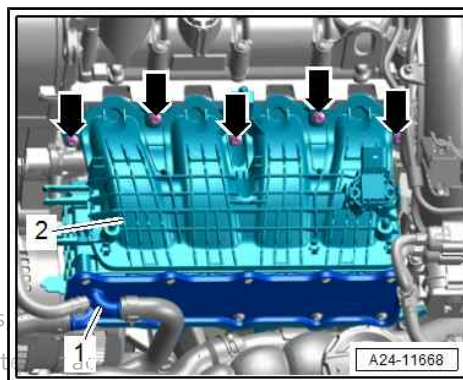
#### 15 - Hose

- ☐ For crankcase breather

### Intake manifold - tightening torque and sequence

- Tighten bolts -arrows- in stages as follows:

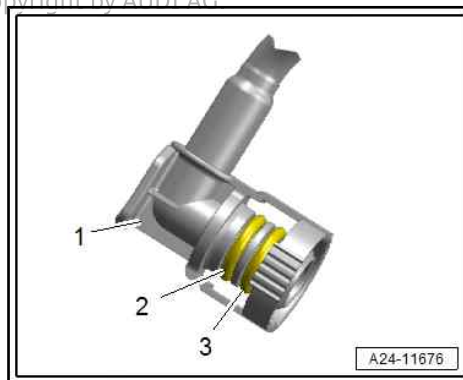
| Stage | Tightening torque                                                              |
|-------|--------------------------------------------------------------------------------|
| 1.    | Starting in centre, screw in bolts alternately by hand until they make contact |
| 2.    | Starting in centre, screw in bolts alternately: 8 Nm                           |



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### Allocation of O-rings to connection -1-

- Check O-rings for damage and renew if necessary.
- 2 - Blue O-ring
- 3 - O-ring, green

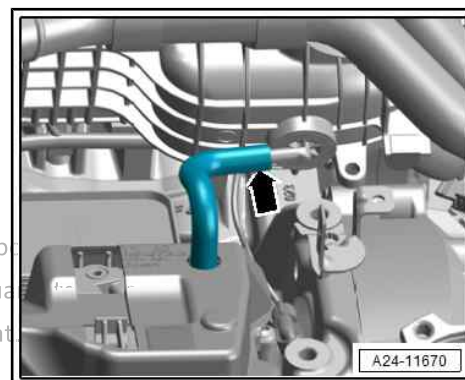
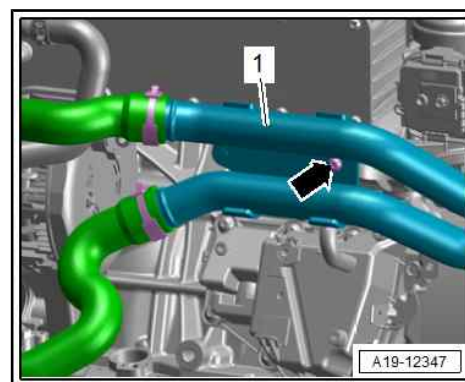
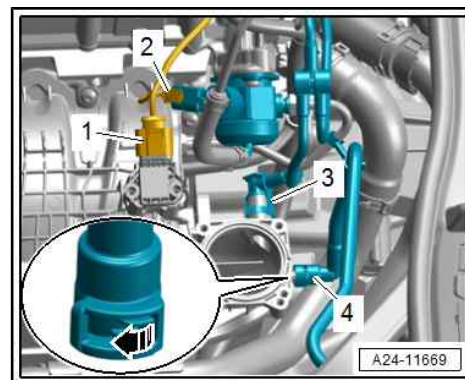




## 3.2 Removing and installing intake manifold

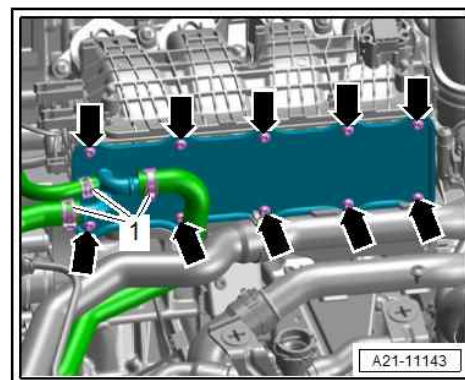
### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove throttle valve module - J338-  
⇒ [“3.3 Removing and installing throttle valve module J338 ”, page 220](#) .
- Unplug electrical connectors -1 and 2- and move electrical wiring clear.
- Press release tabs on both sides and disconnect hose -3- for activated charcoal filter system.
- Release fastener -arrow- and disconnect vacuum hose -4-, taking care not to damage it.
- Unscrew bolt -arrow- and press coolant pipes -1- slightly to one side.
- Disconnect crankcase breather hose -arrow-.



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- Remove bolts -arrows-.





- Move electrical wiring harness clear.
- Remove bolts -arrows-.
- Detach intake manifold -2-; at the same time pull off charge air cooler -1-.
- Block off intake ports with clean cloths.

### Installing

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

- Check gaskets/seals and O-rings for damage and renew as necessary; see notes  
⇒ [“3.1 Exploded view - intake manifold”, page 217](#) .
- Before fitting, check vacuum hoses for damage and renew if necessary.
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install throttle valve module - J338- ⇒ [page 220](#) .

### Tightening torques

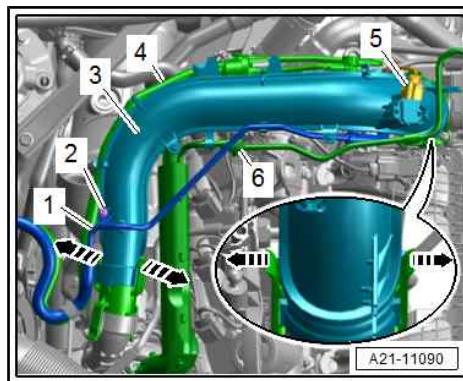
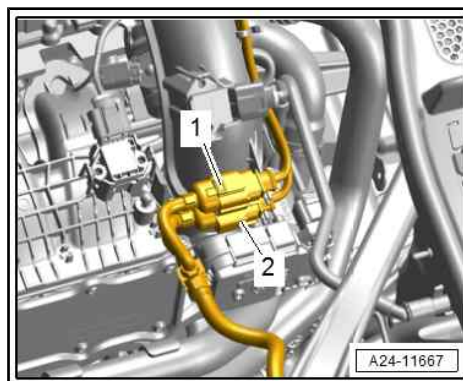
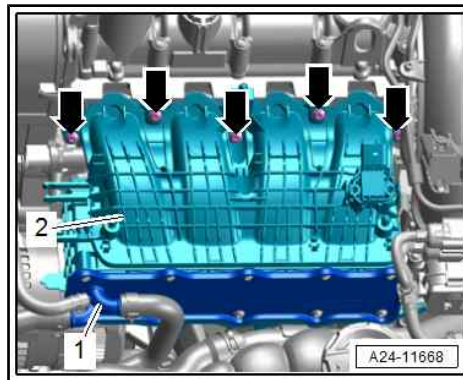
- ♦ ⇒ [Fig. “Intake manifold - tightening torque and sequence”](#), [page 218](#)
- ♦ ⇒ [“3.1 Exploded view - coolant pipes”, page 180](#)

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## 3.3 Removing and installing throttle valve module - J338-

### Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.
- Remove bolt -2- and move fuel line -1- clear.
- Move hose -4- for activated charcoal filter system and coolant hose -6- clear.
- Unplug electrical connector -5- from charge pressure sender - G31- .
- Release catches -arrows- and detach air pipe -3-.



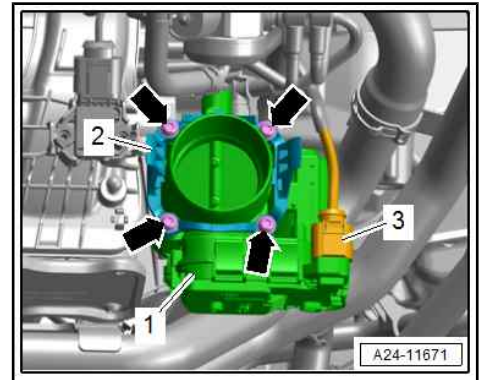


- Unplug electrical connector -3-.
- Remove bolts -arrows- and detach throttle valve module - J338- -item 1- with adapter -2-.

### Installing

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

- Check gaskets/seals and O-rings for damage and renew as necessary; see notes  
⇒ [“3.1 Exploded view - intake manifold”, page 217](#) .
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- If throttle valve module - J338- was renewed, perform adaptations listed in Guided Function “01 - Functions, engine mechanics” ⇒ Vehicle diagnostic tester.



### Tightening torques

- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 201](#)
- ◆ ⇒ [“3.1 Exploded view - intake manifold”, page 217](#)

## 3.4 Cleaning throttle valve module

Carbon deposits and dirt in the limit stop can lead to incorrect adaption values.

### Special tools and workshop equipment required

- ◆ Acetone (commercially available)
- ◆ Brush

### Procedure

- Remove throttle valve module - J338-  
⇒ [“3.3 Removing and installing throttle valve module J338”, page 220](#) .
- Take care not to scratch the throttle valve housing when cleaning it.
- Open throttle valve by hand and lock it in open position with a wedge (plastic or wood) -arrow-.



### WARNING

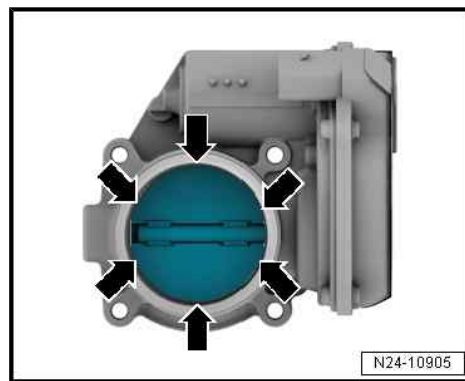
**Acetone is highly flammable.**

- ◆ **Please observe all accident prevention regulations and safety precautions when handling flammable liquids.**
- ◆ **Do not use compressed air when cleaning the throttle valve.**
- ◆ **Wear safety goggles and protective clothing to avoid any contact with skin and risk of injury.**





- Clean throttle valve housing thoroughly, especially around the points -arrows- where the throttle valve closes, using commercially available acetone and a small brush.
- Wipe out throttle valve housing with a lint-free cloth.
- Allow acetone to flash off completely.
- Install throttle valve module - J338-  
⇒ ["3.3 Removing and installing throttle valve module J338", page 220](#) .
- Erase learnt values and perform adaption ⇒ Vehicle diagnostic tester.



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## 4 Injectors

⇒ [“4.1 Exploded view - fuel rail with injectors”, page 223](#)

⇒ [“4.2 Removing and installing fuel rail”, page 224](#)

⇒ [“4.3 Removing and installing injectors”, page 224](#)

⇒ [“4.4 Cleaning injectors”, page 228](#)

### 4.1 Exploded view - fuel rail with injectors

#### 1 - Fuel pressure sender - G247-

- ☐ Renew after removing
- ☐ Checking  
⇒ [“5.3 Checking fuel pressure sender G247”, page 231](#)
- ☐ Removing and installing  
⇒ [“5.2 Removing and installing fuel pressure sender G247”, page 230](#)
- ☐ Lubricate taper and threads lightly with clean engine oil
- ☐ 22 Nm

#### 2 - Fuel rail

- ☐ Removing and installing  
⇒ [“4.2 Removing and installing fuel rail”, page 224](#)

#### 3 - High-pressure pipe

- ☐ Can be reused
- ☐ Connections must not be damaged
- ☐ Do not alter shape
- ☐ Removing and installing  
⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#)
- ☐ Lubricate threads lightly with clean engine oil
- ☐ 16 Nm + 45°

#### 4 - Bolt

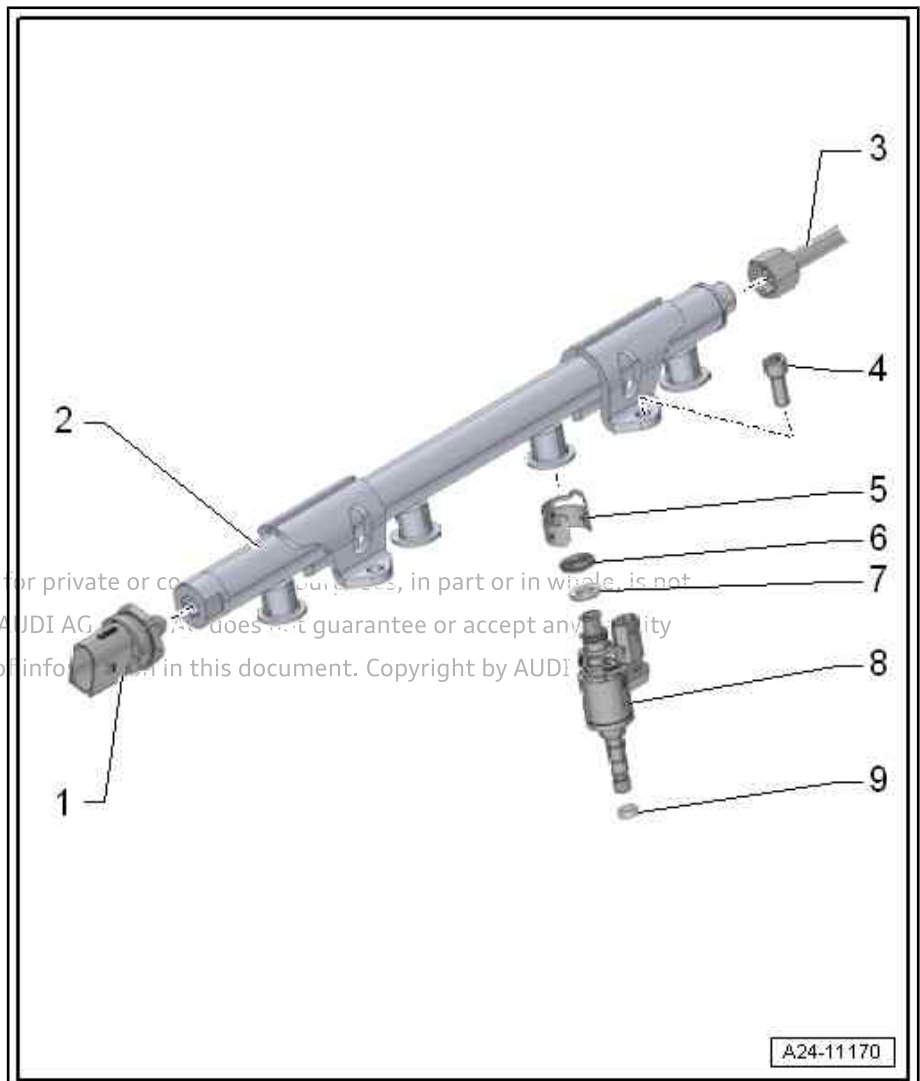
- ☐ Renew after removing
- ☐ 8 Nm + 90°

#### 5 - Support ring

- ☐ Renew after removing
- ☐ Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head
- ☐ Clipped to -item 8-

#### 6 - O-ring

- ☐ Renew after removing
- ☐ Lubricate lightly with clean engine oil





## 7 - Spacer ring

- ❑ Renew if damaged

## 8 - Injector

- ❑ Removing and installing ⇒ [“4.3 Removing and installing injectors”, page 224](#)

## 9 - Combustion chamber ring seal

- ❑ Do not apply grease or use any other lubricants
- ❑ Renewing ⇒ [“4.3 Removing and installing injectors”, page 224](#)

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## 4.2 Removing and installing fuel rail

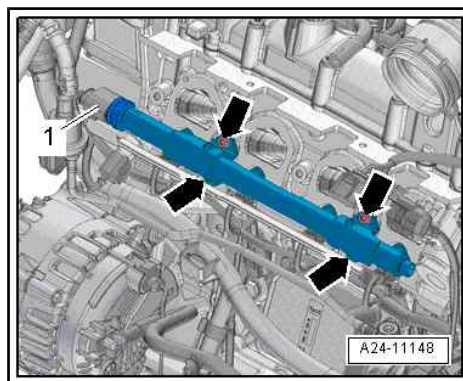
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- Observe rules for cleanliness  
⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove intake manifold  
⇒ [“3.2 Removing and installing intake manifold”, page 219](#) .
- Remove high-pressure pipe  
⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#) .
- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping fuel.
- Remove bolts -arrows- and pull fuel rail off injectors.
- If necessary, unplug electrical connectors at injectors.

### Installing

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

- Renew O-rings after removing.
- Renew support rings after removing.
- 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 hold, and screw bolts in up to base.
- Tighten bolts to specified torque.
- The fuel rail must not be pulled on using the bolts.
- Install high-pressure pipe  
⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#) .
- Install intake manifold  
⇒ [“3.2 Removing and installing intake manifold”, page 219](#) .



### Tightening torques

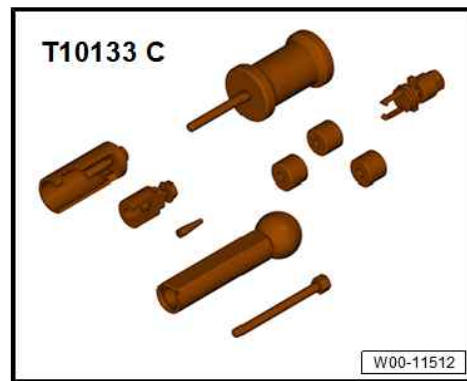
- ◆ ⇒ [“4.1 Exploded view - fuel rail with injectors”, page 223](#)

## 4.3 Removing and installing injectors

Special tools and workshop equipment required



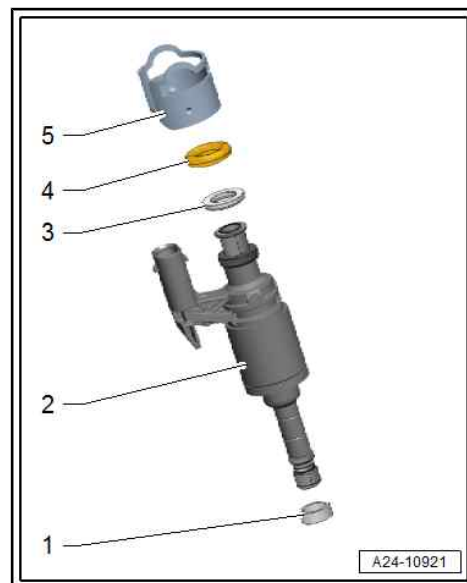
- ◆ Tool set for FSI engines - T10133 C- with -T10133/16A- and -T10133/19-



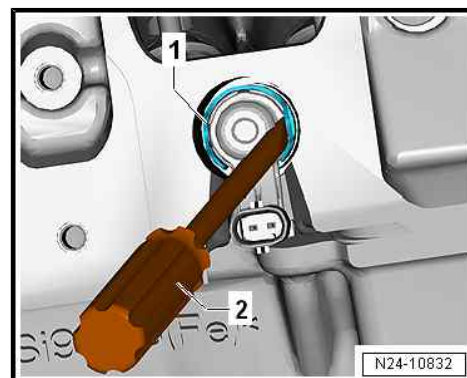
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### Removing

- Remove injection valves only when the engine is cold
- Observe rules for cleanliness  
⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove fuel rail  
⇒ [“4.2 Removing and installing fuel rail”, page 224](#) .
- Remove O-ring -4- from injector -2-.
- Unplug electrical connector from corresponding injector.



- Use screwdriver -2- to prise support ring -1- off injector.

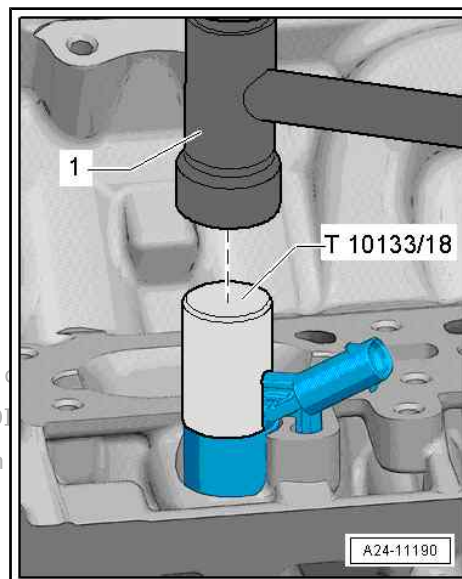




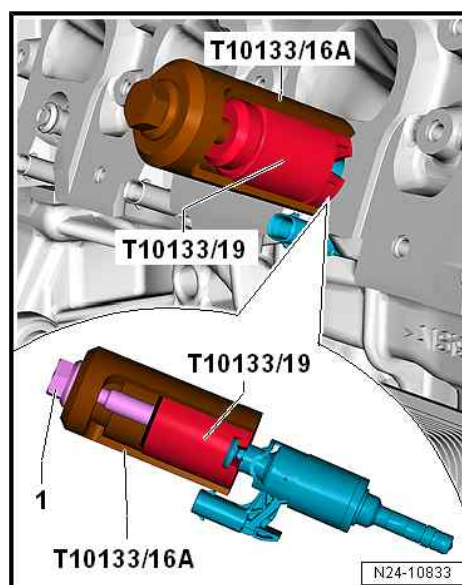
- Slide sleeve -T10133/18- over injector.
- Carefully knock against stop sleeve several times with a plastic hammer -1- to loosen injector.



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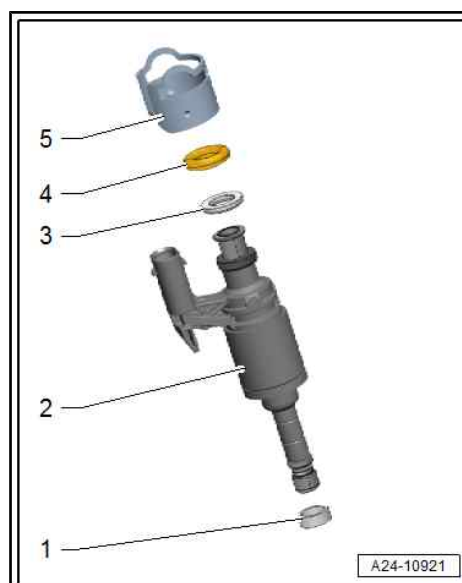
- Apply puller -T10133/19- to groove on injector.
- Attach puller -T10133/16A- .
- Pull out injector by screwing bolt -1- in with torque wrench.
- The torque must not exceed 5 Nm to avoid irreparable damage to the injector.
- If injector does not come loose after 5 Nm is reached, remove puller and repeat procedure using stop sleeve to loosen injector.



- Carefully remove old combustion chamber ring seal -1-. To do so, cut open seal using knife or prise open with small screwdriver and then detach.
- Take care not to damage the groove on the injector.
- Repeat procedure for each injector.

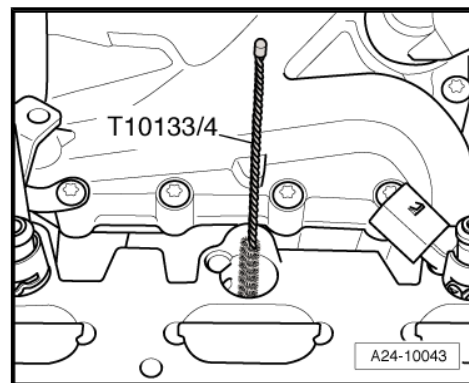
#### Installing

- Use complete repair set when installing.
- Renew support ring.
- Renew combustion chamber ring seal before re-installing injector.
- Lightly lubricate O-rings for injectors with clean engine oil.

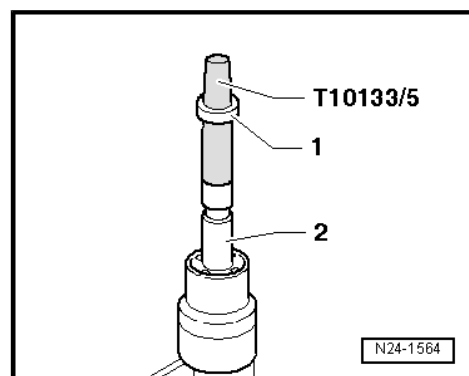




- Clean bore in cylinder head with nylon cylinder brush - T10133/4- .
- When re-installing an injector, clean any combustion residue off groove for combustion chamber ring seal and injector stem with a clean cloth.

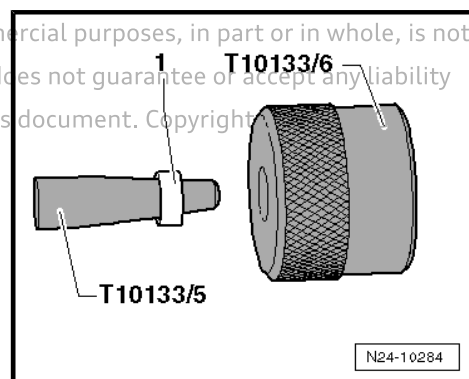


- Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.

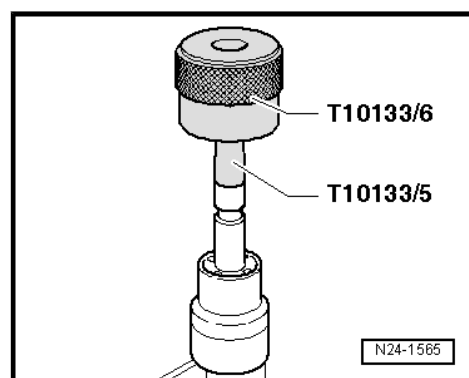


- Using assembly sleeve -T10133/6- , push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go.

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- 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.

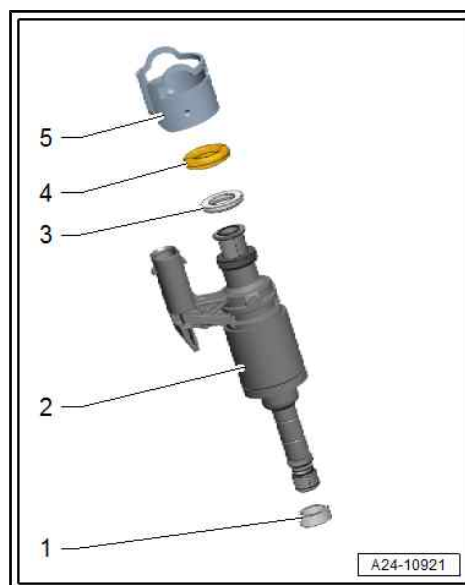
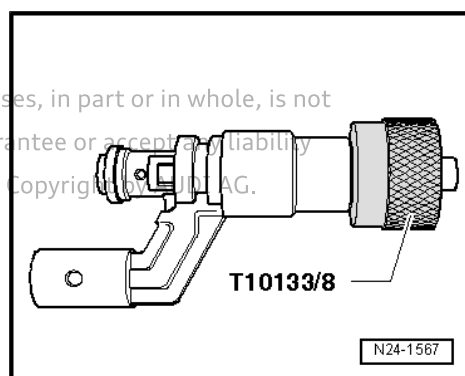
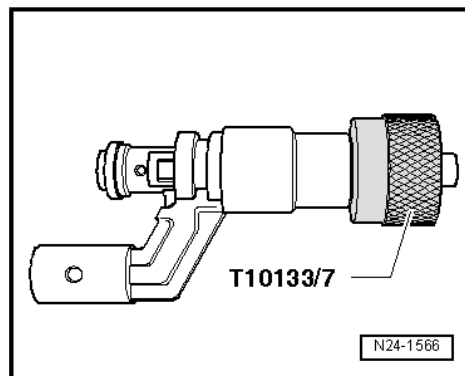
- Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.



- 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.

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- Before installing new injector -2-, lubricate new O-ring -4- lightly with clean engine oil.
- The combustion chamber ring seal -1- must not be lubricated.
- Press injector by hand as far as it will go into aperture in cylinder head (aperture must be free of oil and grease).
- It should be possible to insert the injector easily; if necessary wait until the combustion chamber ring seal has contracted sufficiently.
- Ensure that the injector is properly seated in the cylinder head.
- Electrical connector of injector must engage in recess in cylinder head.
- Fit support ring onto injector.
- Install fuel rail  
⇒ [“4.2 Removing and installing fuel rail”, page 224](#) .
- Connect vehicle diagnostic tester and perform the function “Delete injector adaption values” in Guided Functions.



## 4.4 Cleaning injectors

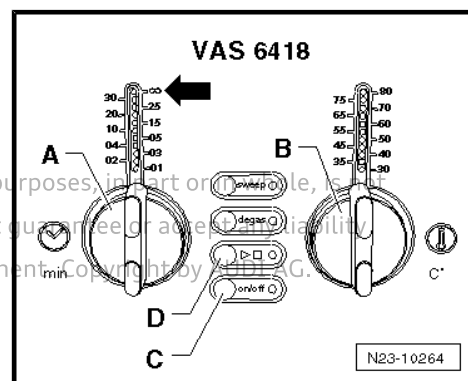
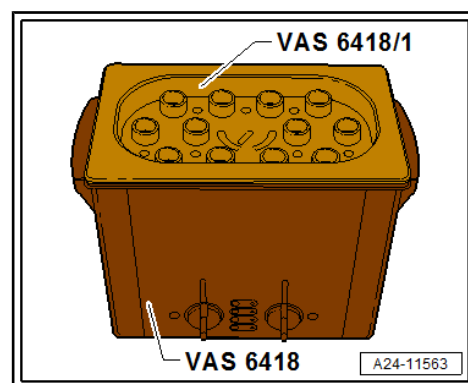
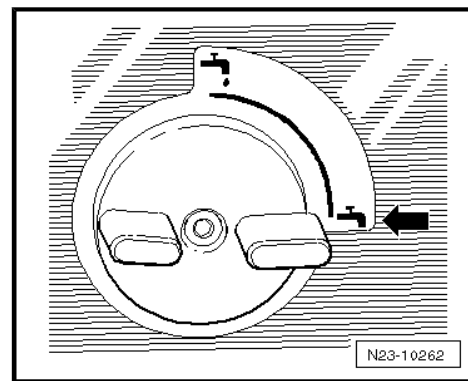
### Special tools and workshop equipment required

- ◆ Ultrasonic cleaning unit - VAS 6418-
- ◆ Mounting plate for injectors - VAS 6418/1-
- ◆ Cleaning fluid - VAS 6418/2-



## Procedure

- Close drain tap -arrow- on ultrasonic cleaning unit - VAS 6418- (located on right side of housing).
- Fill up ultrasonic cleaning unit - VAS 6418- .
- Ratio of cleaning fluid: 2,100 ml of tap water which has been allowed to settle for a few minutes and 20 ml of cleaning fluid - VAS 6418/2-
- The ideal fluid level is approx. 1 ... 4 mm above the base of the mounting plate. The ultrasonic cleaning unit - VAS 6418- can be damaged if the fluid level is too low.
- Remove injectors  
⇒ ["4.3 Removing and installing injectors", page 224](#) .
- Place mounting plate for injectors - VAS 6418/1- on top of cleaning unit.
- It is important to read the safety notes in the operating instructions before switching on the ultrasonic cleaning unit - VAS 6418- .
- Insert FSI injectors all the way into guides of mounting plate for injectors - VAS 6418/1- .
- Switch on cleaning unit by pressing **on/off** button -C-.
- Select a cleaning time of 30 minutes with rotary control -A-.
- Set rotary control -B- to a temperature of 50°C.
- Press **▶** button -D- to start cleaning procedure.
- The actual cleaning process commences when the temperature reaches at least 50 °C and must last for at least 30 minutes.
- Install injectors with new combustion chamber seal  
⇒ ["4.3 Removing and installing injectors", page 224](#) .





## 5 Senders and sensors

⇒ ["5.1 Removing and installing intake manifold pressure sender G71", page 230](#)

⇒ ["5.2 Removing and installing fuel pressure sender G247", page 230](#)

⇒ ["5.3 Checking fuel pressure sender G247", page 231](#)

### 5.1 Removing and installing intake manifold pressure sender - G71-

#### Removing

- Observe ⇒ ["3.1 Rules for cleanliness", page 5](#)
- Remove engine cover panel  
⇒ ["3.1 Removing and installing engine cover panel", page 34](#) .
- Unplug electrical connector -1-.
- Release fasteners -arrows- and remove intake manifold pressure sender - G71- .

#### Installing

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

- If necessary, renew O-ring after removal.

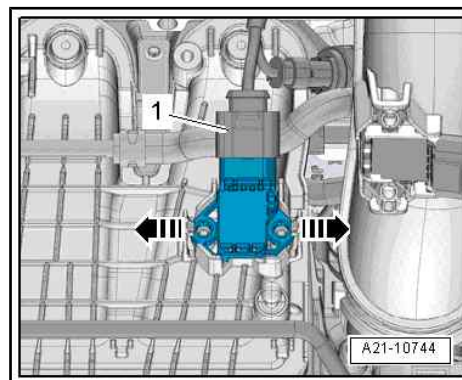
#### Note:

Repair solution if fasteners have broken off: Secure intake manifold pressure sender - G71- with two bolts, refer to ⇒ Electronic parts catalogue .

- Install engine cover panel  
⇒ ["3.1 Removing and installing engine cover panel", page 34](#) .

#### Tightening torques

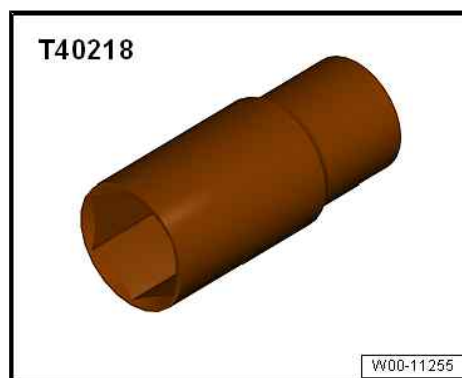
- ♦ ⇒ ["3.1 Exploded view - intake manifold", page 217](#)



### 5.2 Removing and installing fuel pressure sender - G247-

#### Special tools and workshop equipment required

- ♦ Socket, 27 mm - T40218-





## Removing

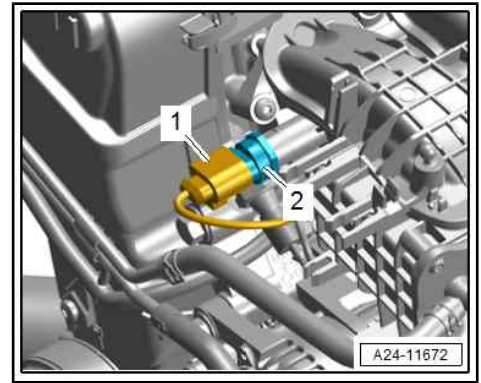
- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Unplug electrical connector -1-.



### WARNING

*Risk of scalding due to hot steam and hot coolant.*

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



- Place a cloth underneath to catch escaping fuel.
- Unscrew fuel pressure sender - G247- -item 2- using socket, 27 mm - T40218- .

## Installing

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

- Lubricate taper and threads lightly with clean engine oil

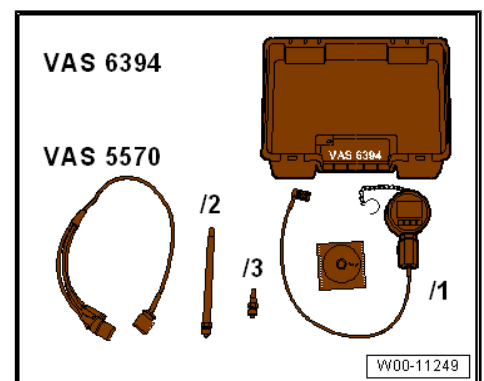
## Tightening torques

- ◆ ⇒ [“4.1 Exploded view - fuel rail with injectors”, page 223](#)

## 5.3 Checking fuel pressure sender - G247-

### Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester
- ◆ Test instrument adapter/DSO (3-pin) - VAS 5570-



- ◆ Pressure sensor tester - VAS 6394-

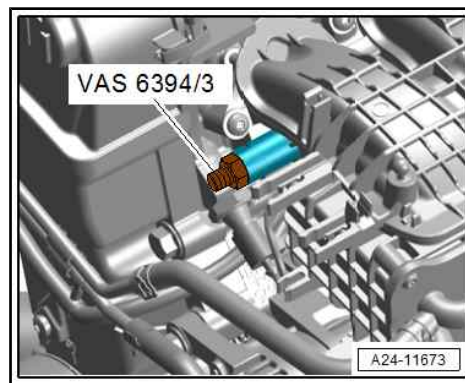
### Procedure

- Observe rules for cleanliness  
⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove fuel pressure sender - G247-  
⇒ [“5.2 Removing and installing fuel pressure sender G247 ”, page 230](#)

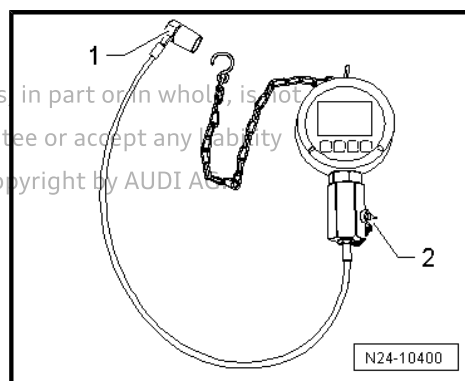
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- Lubricate taper seal of adapter -VAS 6394/3- with clean engine oil and screw into fuel rail (22 Nm).

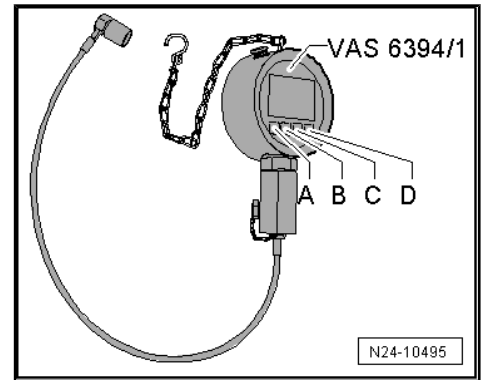


- Unscrew plug -2- and screw fuel pressure sender - G247- into tester -VAS 6394/1- .
- Connect pressure line -1- of tester to adapter - VAS 6394/3- .
- Connect vehicle and fuel pressure sender - G247- electrically using test instrument adapter/DSO (3-pin) - VAS 5570-





- Switch on tester -VAS 6394/1- by pressing button -A- once briefly.
- The digital pressure gauge - VAS 6394/1- should indicate 0 bar.
- If different value is shown, zero the tester by pressing button -C- briefly.
- Connect vehicle diagnostic tester .
- Start engine and run at idling speed.
- Select “Engine electronics” in vehicle self-diagnosis.
- Select “Measured values”.
- Select “Fuel pressure” from list.
- Compare fuel pressure indicated on tester -VAS 6394/1- with actual value displayed on vehicle diagnostic tester .
- Observe fuel pressure displayed on vehicle diagnostic tester.
- The pressure readings must not deviate by more than 5 bar.
- If the deviation is more than 5 bar, fit a new fuel pressure sender - G247- to test it.
- Place a cloth underneath to catch escaping fuel.



#### WARNING

***The fuel system is pressurised.***

***Risk of injury as fuel may spray out.***

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

- Screw a new fuel pressure sender - G247- into pressure gauge - VAS 6394/1- .
- Repeat the test with the new fuel pressure sender - G247- and compare the two pressure values.
- If measured values are still not the same, check electrical connection between fuel pressure sender - G247- and engine control unit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- If measured values are now the same, install new fuel pressure sender - G247-  
⇒ [“5.2 Removing and installing fuel pressure sender G247 ”, page 230](#).



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## 6 High-pressure pump

⇒ [“6.1 Exploded view - high-pressure pump”, page 234](#)

⇒ [“6.2 Removing and installing high-pressure pump”, page 235](#)

⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#)

### 6.1 Exploded view - high-pressure pump

#### 1 - Bolt

- ❑ Tightening torque and sequence  
⇒ [Fig. “High-pressure pump - tightening torque and sequence”](#), page 235

#### 2 - High-pressure pump

- ❑ With fuel metering valve - N290-
- ❑ Do not dismantle
- ❑ Removing and installing  
⇒ [“6.2 Removing and installing high-pressure pump”, page 235](#)

#### 3 - O-ring

- ❑ Renew after removing
- ❑ When installing lubricate lightly with clean engine oil

#### 4 - Roller tappet

- ❑ When installing lubricate lightly with clean engine oil

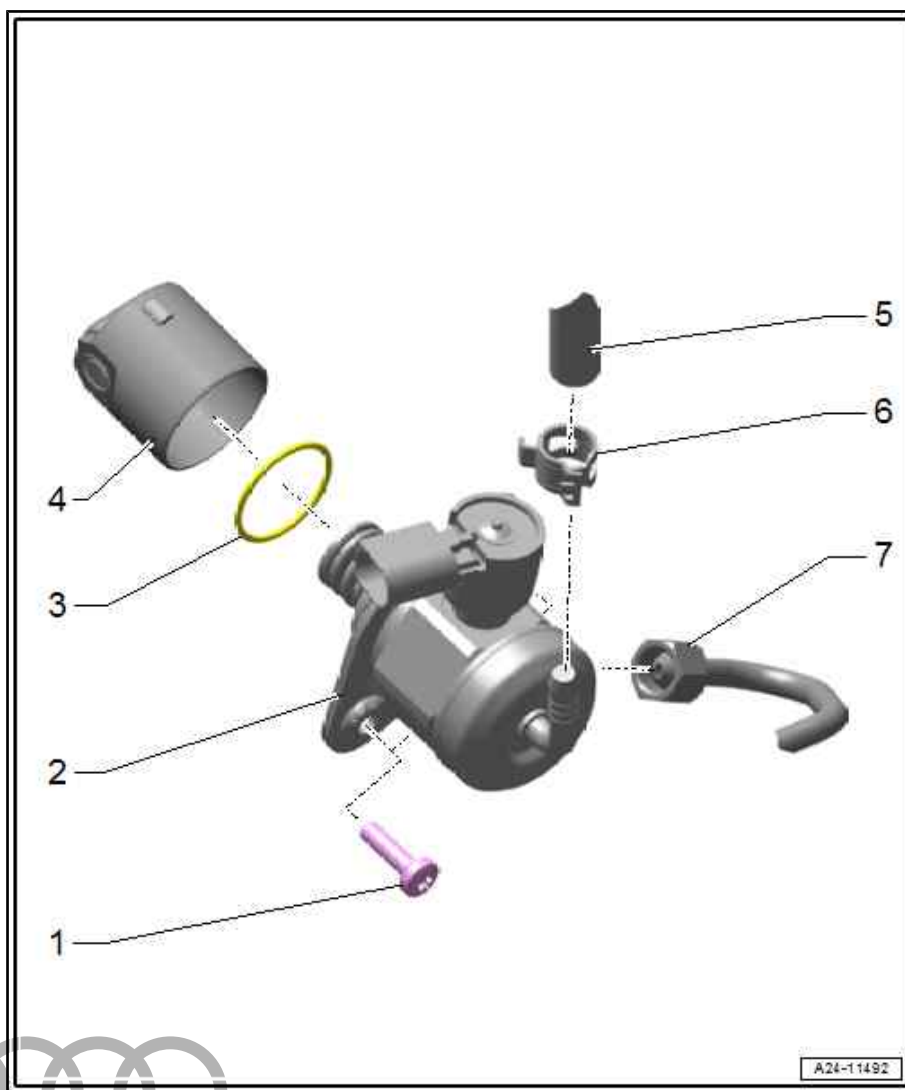
#### 5 - Fuel return line

#### 6 - Spring-type clip

- ❑ Renew after removing

#### 7 - High-pressure pipe

- ❑ Can be reused
- ❑ Removing and installing  
⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#)
- ❑ Do not alter shape
- ❑ Connections must not be damaged
- ❑ Lubricate threads of union nuts with clean engine oil
- ❑ 16 Nm +45°





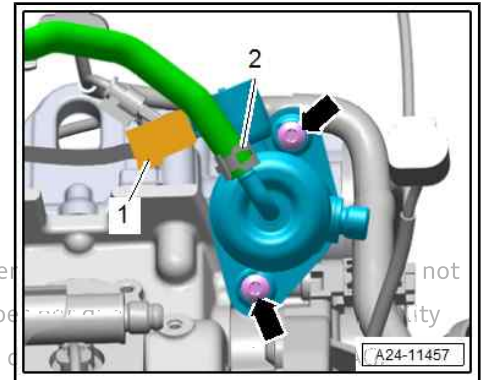
## High-pressure pump - tightening torque and sequence

- After removing, renew bolts tightened with specified tightening angle.

To prevent flange of high-pressure pump from being deformed during installation, fit high-pressure pump as follows:

- Tighten bolts -arrows- in stages as follows:

| Stage | Tightening torque/angle specification                                                               |
|-------|-----------------------------------------------------------------------------------------------------|
| 1.    | Screw in by hand until contact is made                                                              |
| 2.    | Tighten one turn alternately until flange of high-pressure pump makes contact with camshaft housing |
| 3.    | 8 Nm                                                                                                |
| 4.    | Turn 90° further                                                                                    |



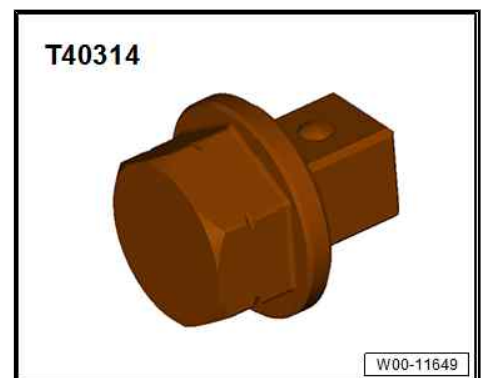
## 6.2 Removing and installing high-pressure pump

### Special tools and workshop equipment required

- ◆ Wrench, 21 mm - T40263-



- ◆ Adapter - T40314-



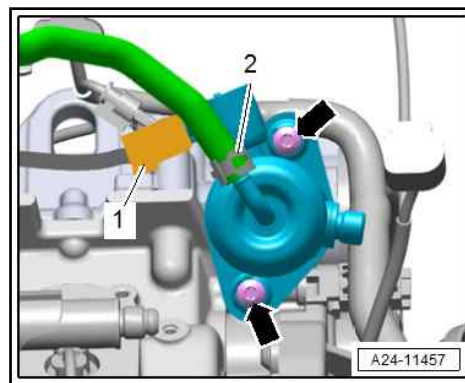
- ◆ Safety goggles
- ◆ Protective gloves

### Removing

- Engine cold.
- Observe rules for cleanliness  
⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove high-pressure pipe  
⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#) .



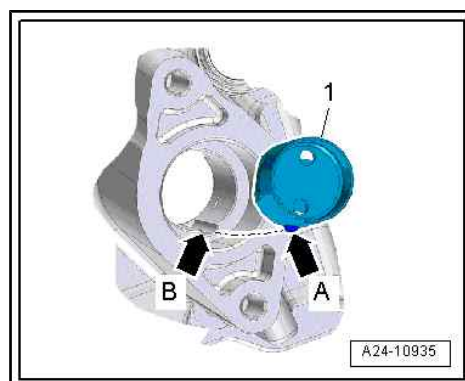
- Unplug electrical connector -1-.
- Place a cloth underneath to catch escaping fuel.
- Release hose clip -2- and detach fuel supply hose.
- Unscrew bolts -arrows- and detach high-pressure pump with roller tappet.



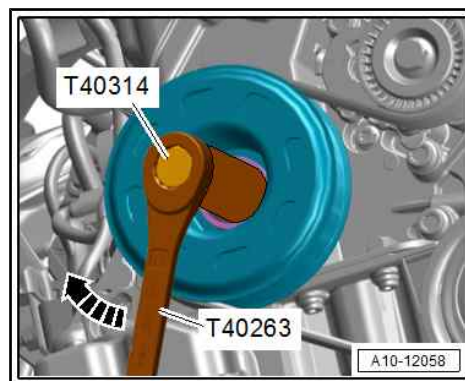
### Installing

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

- Renew O-ring and spring-type clip after removal.
- After removing, renew bolts tightened with specified tightening angle. See note ⇒ [Item 7 \(page 234\)](#).
- Check roller tappet -1- for damage and renew if necessary.
- Lightly lubricate roller tappet with oil and insert it so that lug -arrow A- slides into guide notch -arrow B-.



- A second mechanic is required for the following step.
- Have a second mechanic turn crankshaft with wrench, 21 mm - T40263- , adapter - T40314- and socket, 21 mm in direction of normal engine rotation -arrow- until roller tappet in camshaft housing reaches its lowest point.
- Lubricate O-ring lightly with clean engine oil when installing.
- Insert high-pressure pump with O-ring and tighten bolts in stages.
- Secure fuel hose with spring-type clip.
- Install high-pressure pipe  
⇒ [“6.3 Removing and installing high-pressure pipe”, page 236](#).
- Check fuel system for leaks.



### Tightening torques

- ♦ ⇒ [Fig. “High-pressure pump - tightening torque and sequence”, page 235](#)
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## 6.3 Removing and installing high-pressure pipe

### Special tools and workshop equipment required



- ◆ Tool insert - T10395/3- from tool set - T10395 A-



- ◆ Safety goggles
- ◆ Protective gloves

### Removing

- Observe rules for cleanliness  
⇒ ["3.1 Rules for cleanliness", page 5](#) .
- Remove throttle valve module - J338-  
⇒ ["3.3 Removing and installing throttle valve module J338", page 220](#) .



### WARNING

***The fuel system is pressurised.***

***Risk of injury as fuel may spray out.***

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



- Place a cloth underneath to catch escaping fuel.
- Unscrew union nuts -arrows- and detach high-pressure pipe -1-.

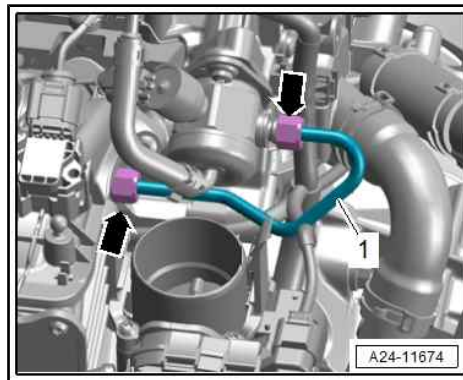
### Installing

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

- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ [Electronic parts catalogue](#) .
- High-pressure pipe does not have to be renewed after removal. See note ⇒ [Item 7 \(page 234\)](#) .
- 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).
- First tighten union nut at high-pressure pump and then at fuel rail.
- Install throttle valve module - J338-  
⇒ [“3.3 Removing and installing throttle valve module J338”](#),  
[page 220](#) .

### Tightening torques

- ◆ ⇒ [“4.1 Exploded view - fuel rail with injectors”](#), [page 223](#)
- ◆ ⇒ [“6.1 Exploded view - high-pressure pump”](#), [page 234](#)



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## 7 Lambda probe

⇒ [“7.1 Exploded view - Lambda probe”, page 239](#)

⇒ [“7.2 Removing and installing Lambda probe”, page 239](#)

### 7.1 Exploded view - Lambda probe

#### 1 - Catalytic converter

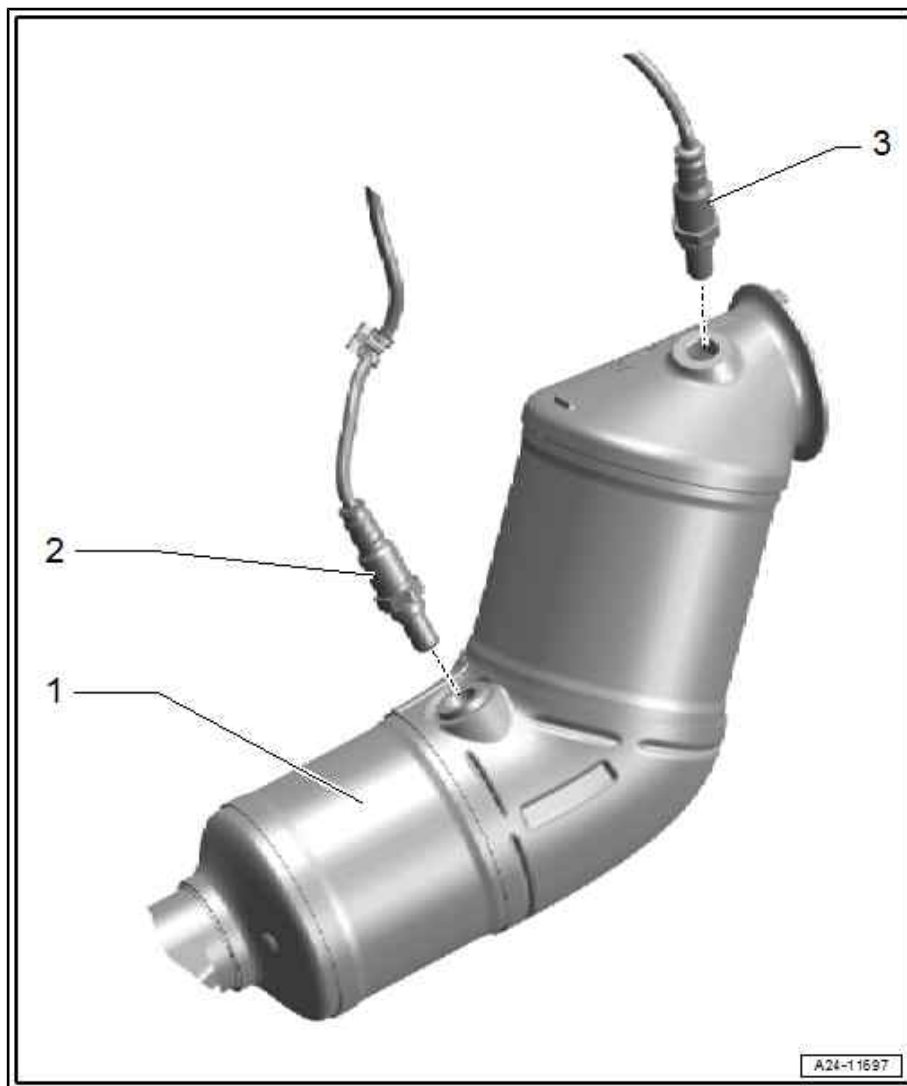
- ❑ Exploded view  
⇒ [“2.1 Exploded view - emission control system”, page 249](#)

#### 2 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29-

- ❑ Removing and installing  
⇒ [“7.2 Removing and installing Lambda probe”, page 239](#)
- ❑ Fitting instructions  
⇒ [page 240](#)
- ❑ 55 Nm

#### 3 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing  
⇒ [“7.2 Removing and installing Lambda probe”, page 239](#)
- ❑ Fitting instructions  
⇒ [page 240](#)
- ❑ 55 Nm



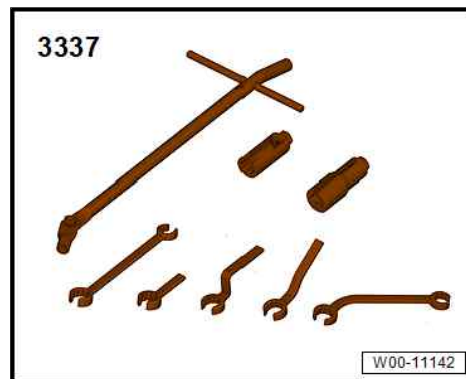
### 7.2 Removing and installing Lambda probe

#### Special tools and workshop equipment required

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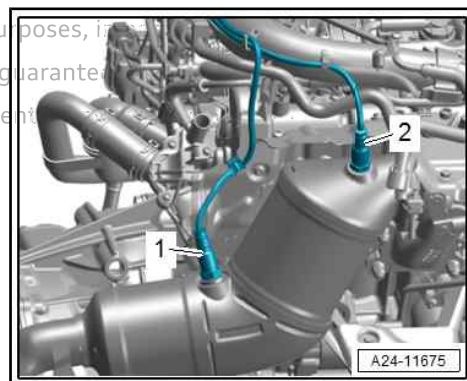
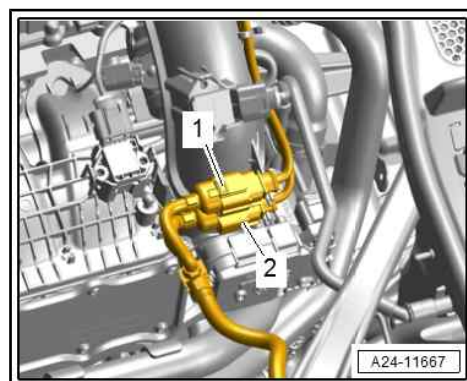


- ◆ Lambda probe open ring spanner set - 3337-



## Removing

- Observe ⇒ [“3.1 Rules for cleanliness”, page 5](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Unplug corresponding electrical connector:
  - 1 - For Lambda probe - G39- and Lambda probe heater - Z19-
  - 2 - For Lambda probe after catalytic converter - G130- and Lambda probe heater 1 after catalytic converter - Z29-
- Unscrew corresponding Lambda probe using a tool from Lambda probe open ring spanner set - 3337- .
  - 1 - Lambda probe after catalytic converter - G130-
  - 2 - Lambda probe - G39-



## Installing

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

- New Lambda probes 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
- The electrical wiring of the lambda probe must be secured at the original locations when installing. The wiring must NOT come into contact with the exhaust pipe.
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .

## Tightening torques

- ◆ ⇒ [“7.1 Exploded view - Lambda probe”, page 239](#)



## 8 Engine control unit

⇒ ["8.1 Exploded view - engine control unit", page 241](#)

⇒ ["8.2 Removing and installing motor control unit J623 ", page 241](#)

### 8.1 Exploded view - engine control unit

#### 1 - Bolt

- 9 Nm

#### 2 - Mounting

- For engine control unit - J623-

#### 3 - Engine control unit - J623-

- Removing and installing  
⇒ ["8.2 Removing and installing motor control unit J623 ", page 241](#)

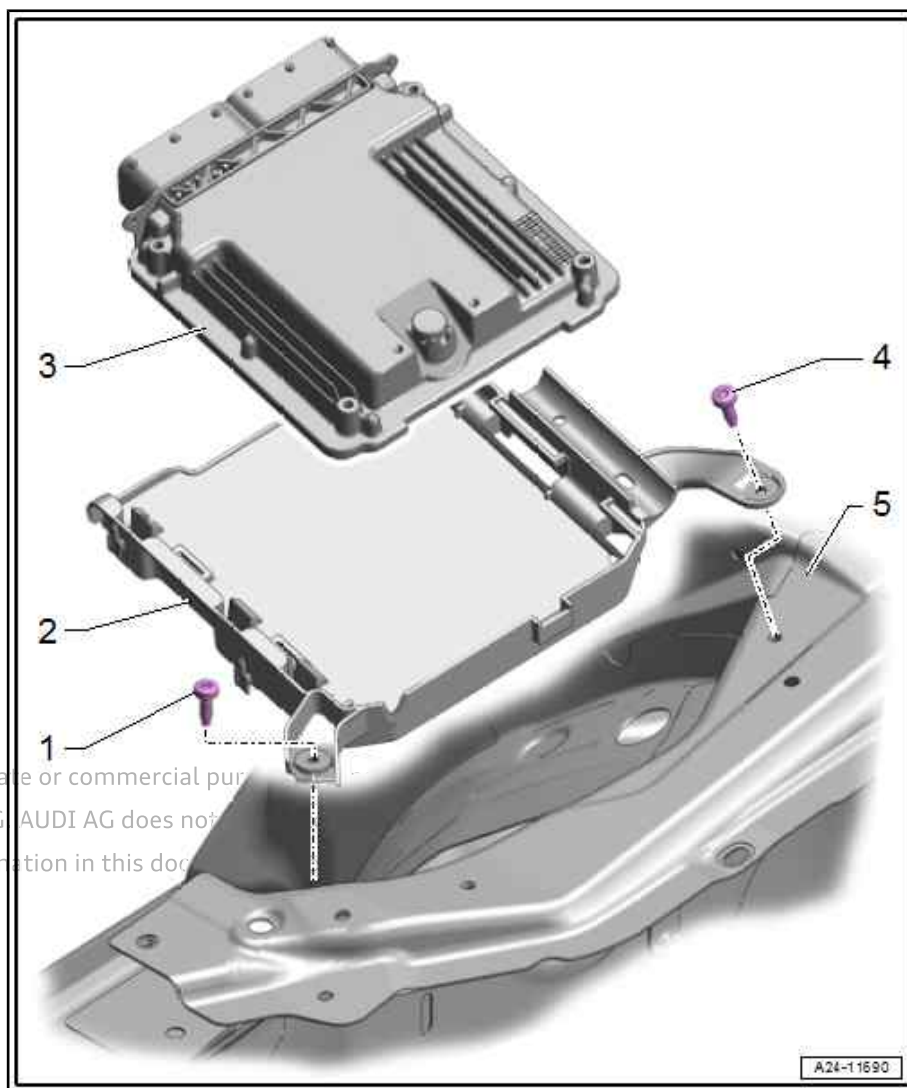
#### 4 - Bolt

- 9 Nm

#### 5 - Suspension turret



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### 8.2 Removing and installing motor control unit - J623-

#### Removing

- If engine control unit is renewed, run "01 - Replace control unit" in Guided Functions mode of ⇒ Vehicle diagnostic tester.

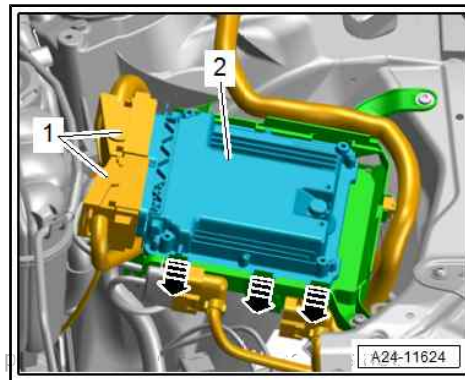


- Release catches -arrows- and detach engine control unit - J623- -item 2-.
- Unplug electrical connectors -1-.

### Installing

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

- If engine control unit - J623- was renewed, perform adaption listed in Guided Function "01 - Functions, engine mechanics"  
⇒ Vehicle diagnostic tester.



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## 26 – Exhaust system

### 1 Exhaust pipes/silencers

⇒ [“1.1 Exploded view - silencers”, page 243](#)

⇒ [“1.2 Separating exhaust pipes/silencers”, page 244](#)

⇒ [“1.3 Removing and installing front silencers”, page 245](#)

⇒ [“1.4 Removing and installing silencers”, page 246](#)

⇒ [“1.5 Stress-free alignment of exhaust system”, page 247](#)

⇒ [“1.6 Checking exhaust system for leaks”, page 248](#)

#### 1.1 Exploded view - silencers

##### 1 - Clamp (rear)

- ☐ Before tightening, align exhaust system so it is free of stress  
⇒ [“1.5 Stress-free alignment of exhaust system”, page 247](#)
- ☐ Installation position  
⇒ [Fig. “Installation position - rear clamp”, page 244](#)
- ☐ Tighten screw connections evenly to 23 Nm

##### 2 - Rubber mounting

- ☐ Renew if damaged

##### 3 - Bolt

- ☐ 23 Nm

##### 4 - Bracket

##### 5 - Centre silencer

- ☐ Align exhaust system so it is free of stress  
⇒ [“1.5 Stress-free alignment of exhaust system”, page 247](#)

##### 6 - Bolt

- ☐ 23 Nm

##### 7 - Bracket

##### 8 - Rubber mounting

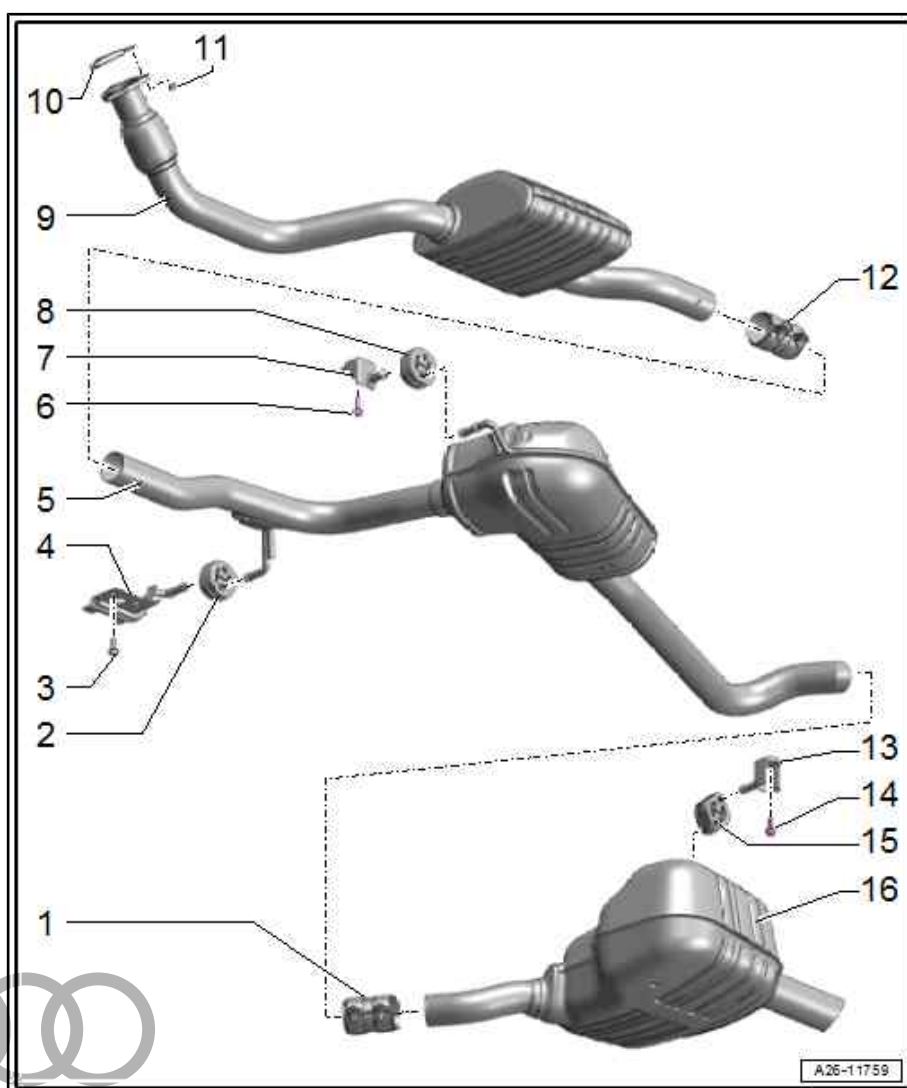
- ☐ Renew if damaged

##### 9 - Front silencer

- ☐ Do not bend flexible joint more than 10° - otherwise it can be damaged
- ☐ Install flexible joint so that it is not under tension.
- ☐ Take care not to damage wire mesh on flexible joint
- ☐ Removing and installing ⇒ [“1.3 Removing and installing front silencers”, page 245](#)

##### 10 - Gasket

- ☐ Renew after removing



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## 11 - Nut

- ☐ 23 Nm
- ☐ Renew after removing

## 12 - Clamp (front)

- ☐ Before tightening, align exhaust system so it is free of stress  
⇒ ["1.5 Stress-free alignment of exhaust system", page 247](#)
- ☐ Installation position ⇒ [Fig. "Installation position - front clamp", page 244](#)
- ☐ Tighten screw connections evenly to 23 Nm

## 13 - Bracket

## 14 - Bolt

- ☐ 23 Nm

## 15 - Rubber mounting

- ☐ Renew if damaged

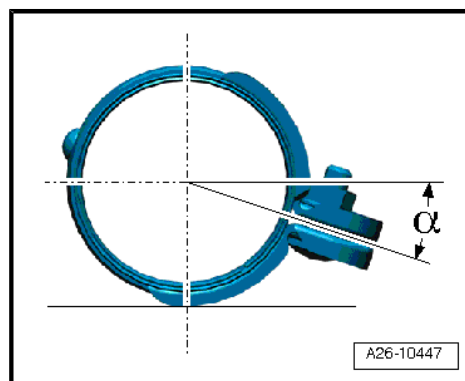
## 16 - Rear silencer

- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed separately for repair purposes
- ☐ Removing and installing ⇒ ["1.4 Removing and installing silencers", page 246](#)
- ☐ Align exhaust system so it is free of stress ⇒ ["1.5 Stress-free alignment of exhaust system", page 247](#)

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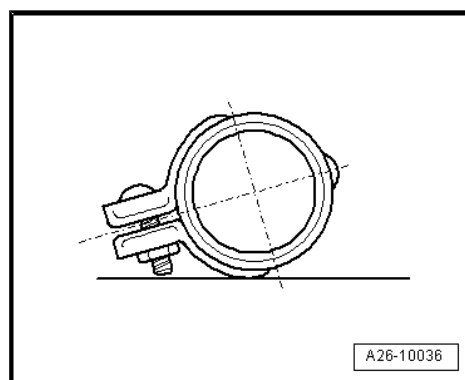
### Installation position - front clamp

- Fit clamp in position shown.
- Angle  $\alpha$  = approx.  $20^\circ$
- Bolt connections facing towards right
- Nuts face downwards.



### Installation position - rear clamp

- Fit clamp in position shown.
- Bolt connections face to left
- Nuts face downwards.
- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.



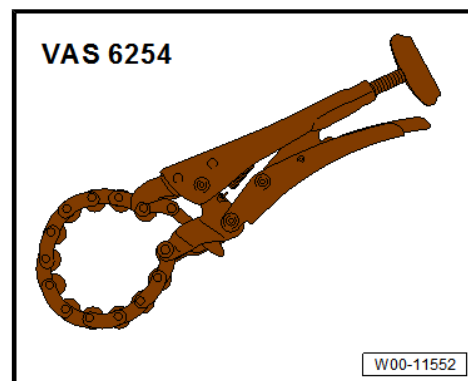
## 1.2 Separating exhaust pipes/silencers

- ◆ The connecting pipe can be cut through at the cutting location in order to renew the centre and rear silencers separately.
- ◆ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

### Special tools and workshop equipment required



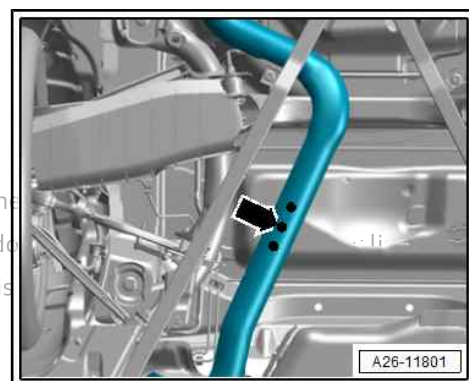
◆ Chain pipe cutter - VAS 6254-



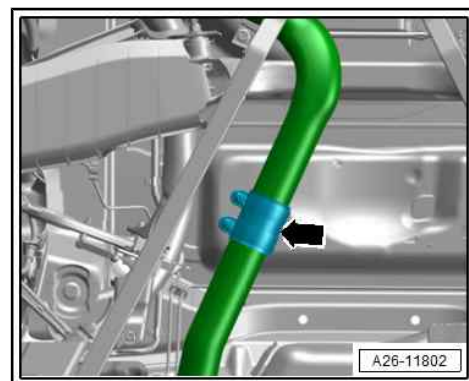
**Procedure**

- Cut through exhaust pipe at right angle at notch -arrow- using chain pipe cutter - VAS 6254- .

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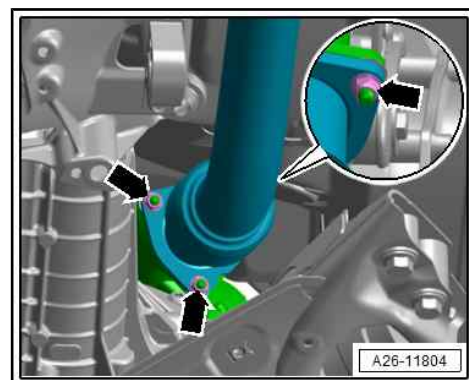
- Position centre of clamp -arrow- over cutting location.
- Fit clamp  
⇒ [Fig. "Installation position - rear clamp", page 244](#) .
- Align the exhaust system so it is free of stress  
⇒ ["1.5 Stress-free alignment of exhaust system", page 247](#) .



## 1.3 Removing and installing front silencers

### Removing

- Unscrew nuts -arrows- for front silencer.





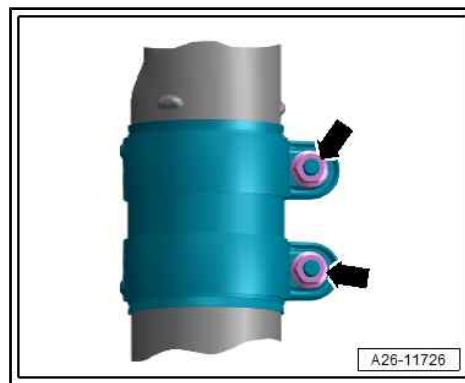
- Loosen clamp -arrows- and push towards rear.



#### Caution

*Risk of damage to flexible joint.*

- ◆ *Do not bend flexible joint more than 10°.*
- ◆ *Install flexible joint so that it is not under tension.*
- ◆ *Take care not to damage wire mesh on flexible joint.*



- Detach front silencer.

#### Installing

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

- Renew gaskets, seals and self-locking nuts after removal.
- Align the exhaust system so it is free of stress  
⇒ [“1.5 Stress-free alignment of exhaust system”, page 247](#) .

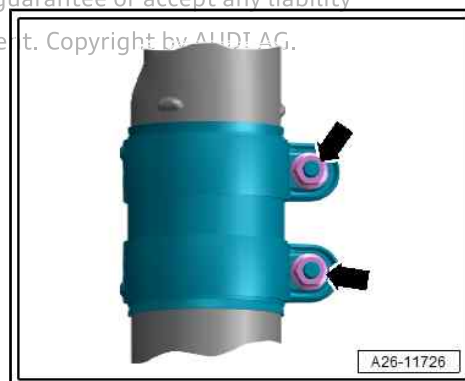
#### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - silencers”, page 243](#)

## 1.4 Removing and installing silencers

### Removing

- Loosen clamp -arrows- and push towards rear.





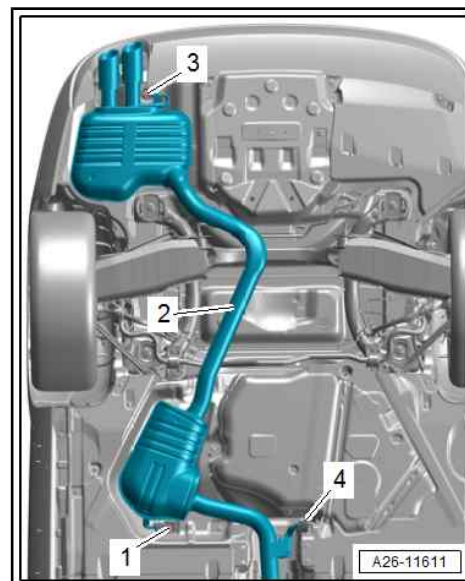
- Depending on equipment version: Remove diagonal strut (left-side) ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .
- Disengage rubber mounting -4-.



#### WARNING

*Risk of accident caused by weight of silencers.*

- ◆ *A second mechanic is required for removal of the rear silencer.*



- Unscrew bolts -1, 3- and remove silencer -2-.

#### Installing

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

- Align the exhaust system so it is free of stress  
⇒ [“1.5 Stress-free alignment of exhaust system”, page 247](#) .

#### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - silencers”, page 243](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim

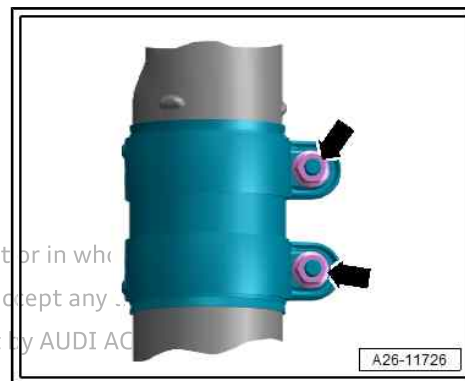
## 1.5 Stress-free alignment of exhaust system

#### Procedure

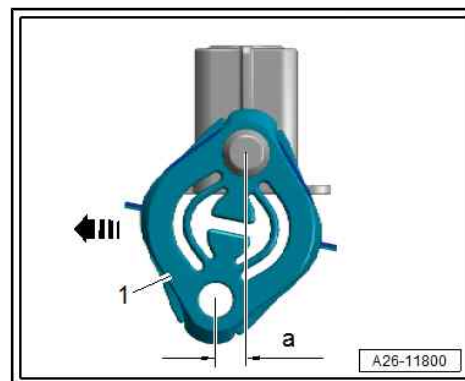
- The exhaust system must be aligned when it is cool.
- Slacken front clamp -arrows-.



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- Push exhaust system towards front of vehicle -arrow- so that mounting for exhaust pipe is preloaded by -a- = 6 ... 10 mm.
- Position clamp at front  
⇒ [Fig. “Installation position - front clamp”, page 244](#) and tighten bolted connections evenly.

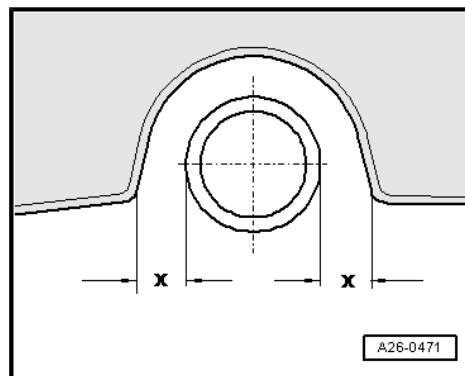




- Check clearance between tailpipe and bumper:
- Dimension -x- (left-side) = dimension -x- (right-side)

#### Tightening torques

- ♦ ⇒ [“1.1 Exploded view - silencers”, page 243](#)



## 1.6 Checking exhaust system for leaks

### Procedure

- Start the engine and run at idling speed.
- Plug tailpipe during leak test (e.g. with cloth or plugs).
- Listen for noise at the connection points of cylinder head/exhaust manifold, turbocharger/front exhaust pipe etc. to locate any leaks.
- Rectify any leaks that are found.



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## 2 Emission control system

⇒ [“2.1 Exploded view - emission control system”, page 249](#)

⇒ [“2.2 Removing and installing catalytic converter”, page 250](#)

### 2.1 Exploded view - emission control system

#### 1 - Catalytic converter

- ❑ Protect against knocks and impact
- ❑ Removing and installing  
⇒ [“2.2 Removing and installing catalytic converter”, page 250](#)
- ❑ Align exhaust system so it is free of stress  
⇒ [“1.5 Stress-free alignment of exhaust system”, page 247](#)

#### 2 - Lambda probe after catalytic converter - G130- with Lambda probe 1 heater after catalytic converter - Z29-

- ❑ Exploded view  
⇒ [“7.1 Exploded view - Lambda probe”, page 239](#)

#### 3 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Exploded view  
⇒ [“7.1 Exploded view - Lambda probe”, page 239](#)

#### 4 - Screw-type clip

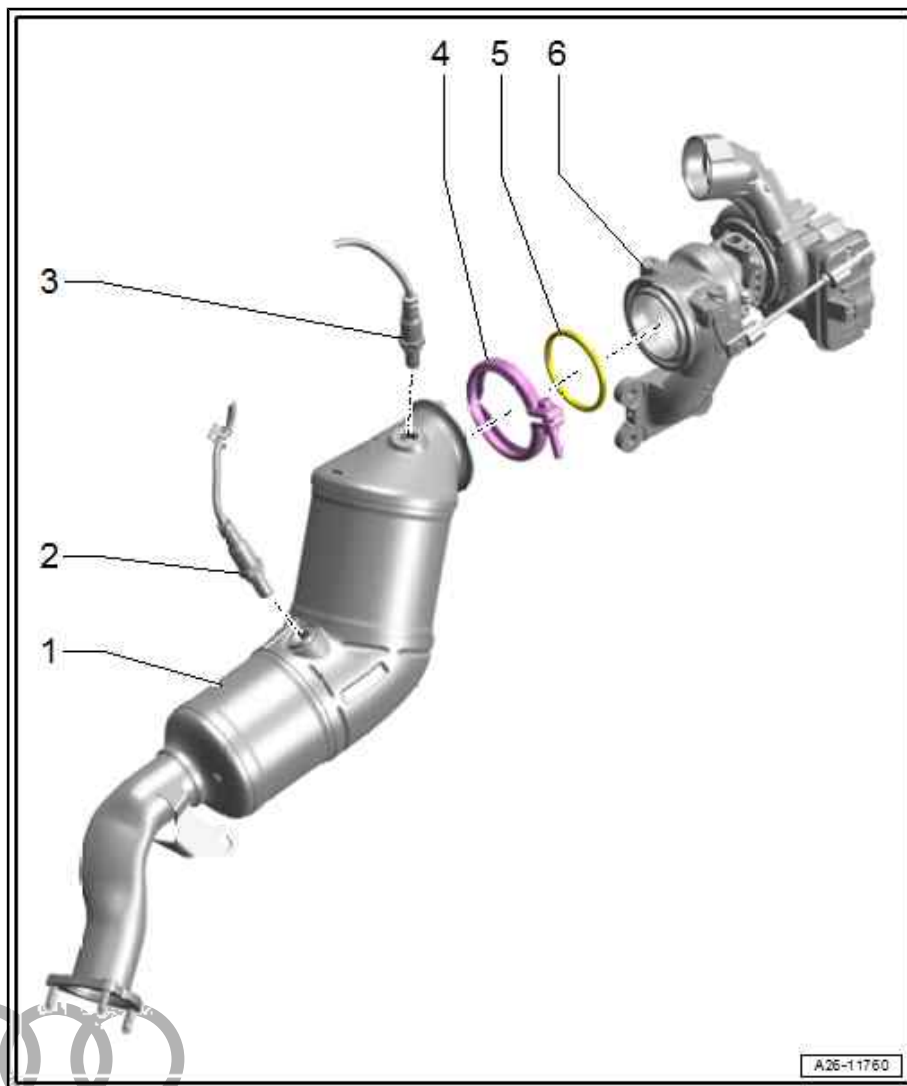
- ❑ Installation position  
⇒ [Fig. “Screw-type clip - installation position”, page 250](#)
- ❑ Tightening torque and sequence  
⇒ [Fig. “Installing catalytic converter - tightening torque and sequence”, page 250](#)

#### 5 - Seal

- ❑ Renew after removing

#### 6 - Turbocharger

- ❑ Exploded view ⇒ [“1.1 Exploded view - turbocharger”, page 193](#)

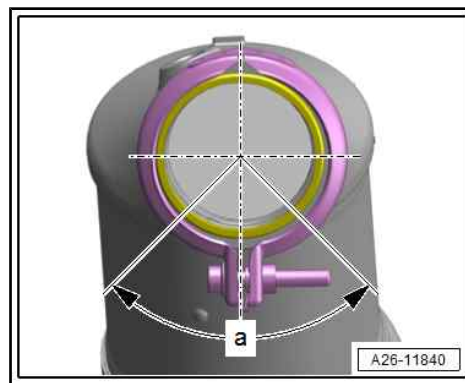


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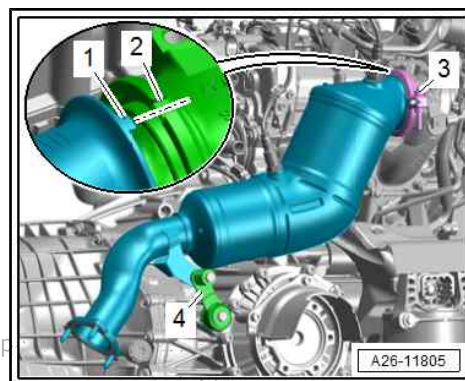
### Screw-type clip - installation position

- Position screw-type clip as shown.
- Angle  $\alpha$  = approx.  $30^\circ$



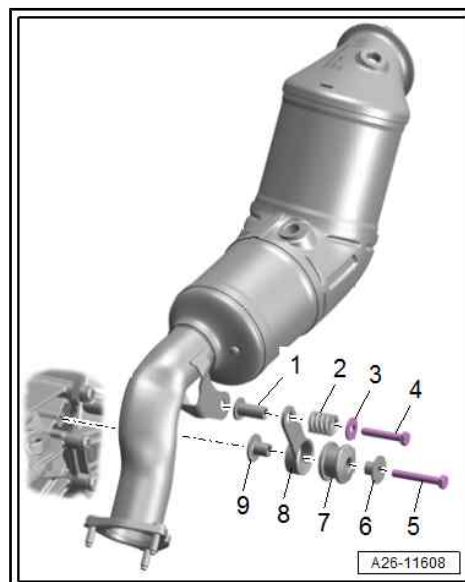
### Installing catalytic converter - tightening torque and sequence

|    |                                                                     |                                                                                    |
|----|---------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 1. | – Position screw-type clip on intake funnel of turbo-charger.       | • Do not bend clip open.                                                           |
| 2. | – Guide catalytic converter into installation position.             | • Protrusion -1- on catalytic converter must engage in groove -2- on turbocharger. |
| 3. | – Move screw-type clip into installation position (do not tighten). |                                                                                    |
| 3. | – Fit bolt -4- by hand without tightening.                          |                                                                                    |
|    | – Tighten screw-type clip.                                          | 15 Nm                                                                              |
| 4. | – Tighten bolts -4-.                                                | 20 Nm                                                                              |



### Components of mountings (front) for catalytic converter on gear-box

- 1 - Spacer sleeve
- 2 - Compression spring
- 3 - Washer
- 4 - Bolt, 23 Nm
- 5 - Bolt, 23 Nm
- 6 - Spacer sleeve
- 7 - Buffer
- 8 - Bracket
- 9 - Spacer sleeve



## 2.2 Removing and installing catalytic converter

### Special tools and workshop equipment required

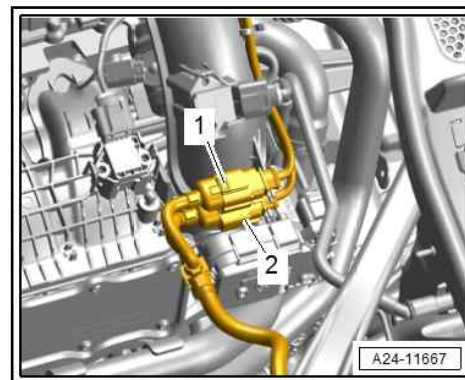
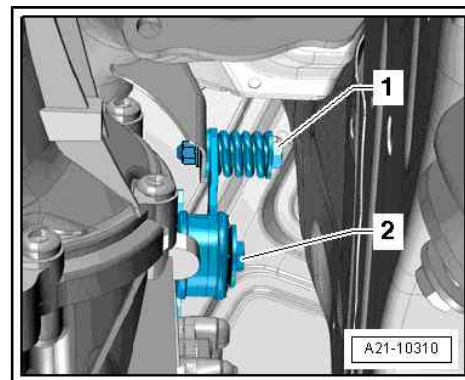
- ♦ High-temperature paste ⇒ Electronic parts catalogue

### Removing

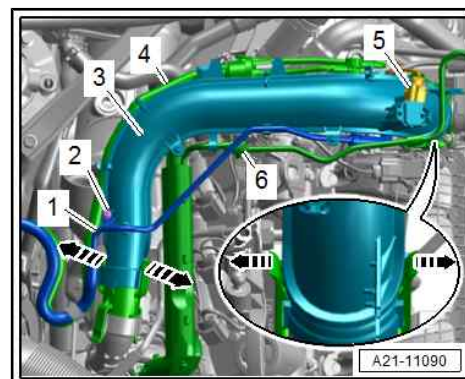
- Observe ⇒ [“3.1 Rules for cleanliness”](#), page 5 .



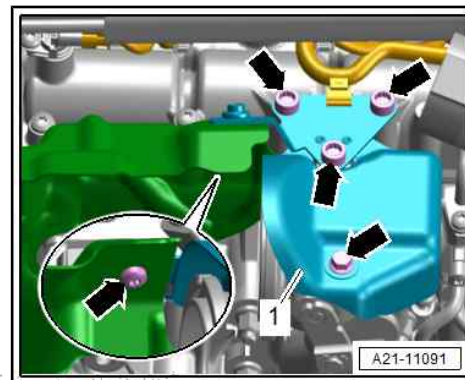
- Remove noise insulation (rear) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Remove front silencer  
⇒ [“1.3 Removing and installing front silencers”, page 245](#) .
- Unscrew bolts -1, 2- and detach retainer.
- Remove air cleaner housing  
⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#) .
- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .
- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.



- Remove bolt -2- and move fuel line -1- clear.
- Move hose -4- for activated charcoal filter system and coolant hose -6- clear.
- Unplug electrical connector -5- from charge pressure sender -G31- .
- Release catches -arrows- and detach air pipe -3-.



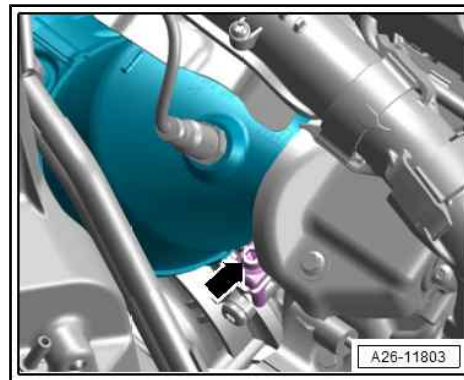
- Move electrical wiring harness clear.
- Remove bolts -arrows- and detach heat shield -1-.



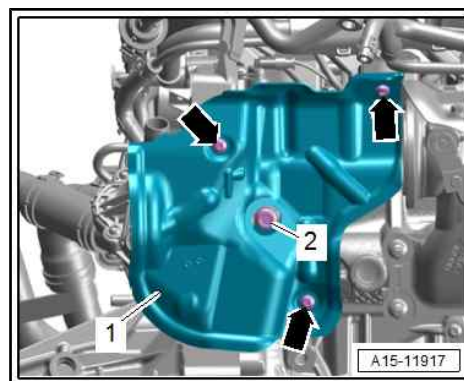
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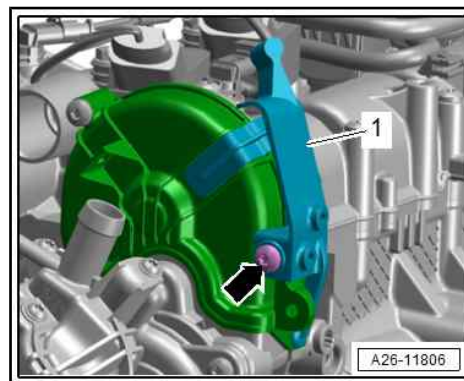
- Release screw-type clip -arrow- and move it onto intake funnel of turbocharger.



- Remove bolts -arrows- and -2- and detach heat shield -1-.



- Remove bolt -arrow- and detach bracket -1-.



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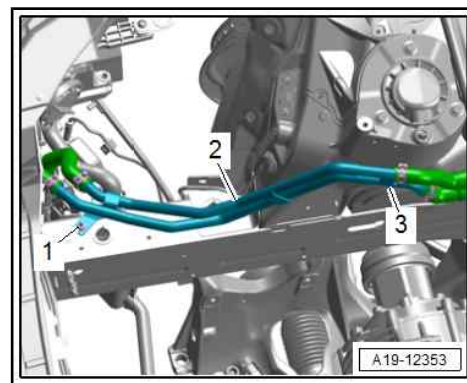


- Remove nut -1- and bolt -3- and push coolant pipes on right of longitudinal member slightly to right side (shown with engine removed).
- Lift out catalytic converter.

### Installing

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

- Renew seal and screw-type clip after removing.
- Align the exhaust system so it is free of stress  
⇒ [“1.5 Stress-free alignment of exhaust system”, page 247](#) .
- Install air cleaner housing  
⇒ [“2.2 Removing and installing air cleaner housing”, page 215](#) .
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”, page 34](#) .



### Tightening torques

- ◆ ⇒ [Fig. ““Installing catalytic converter - tightening torque and sequence””, page 250](#)
- ◆ ⇒ [Fig. ““Heat shield - tightening torque””, page 99](#)
- ◆ ⇒ [“1.1 Exploded view - turbocharger”, page 193](#)
- ◆ ⇒ [“1.1 Exploded view - silencers”, page 243](#)
- ◆ ⇒ [“2.1 Exploded view - charge air system”, page 201](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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## 28 – Ignition system

### 1 Ignition system

⇒ [“1.1 Exploded view - ignition system”, page 254](#)

⇒ [“1.2 Removing and installing ignition coils with output stages”, page 255](#)

⇒ [“1.3 Removing and installing knock sensor 1 G61”, page 258](#)

⇒ [“1.4 Removing and installing Hall senders”, page 258](#)

⇒ [“1.5 Removing and installing engine speed sender G28”, page 260](#)

#### 1.1 Exploded view - ignition system

##### 1 - Spark plug

- ☐ Removing and installing, tightening torque  
⇒ Maintenance ; Booklet 830
- ☐ Change interval ⇒ Maintenance tables

##### 2 - Spark plug connectors

##### 3 - Ignition coil with output stage

- ◆ 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  
⇒ [“1.2 Removing and installing ignition coils with output stages”, page 255](#)

##### 4 - Bolt

- ☐ 8 Nm

##### 5 - Nut

- ☐ 8 Nm

##### 6 - Bolt

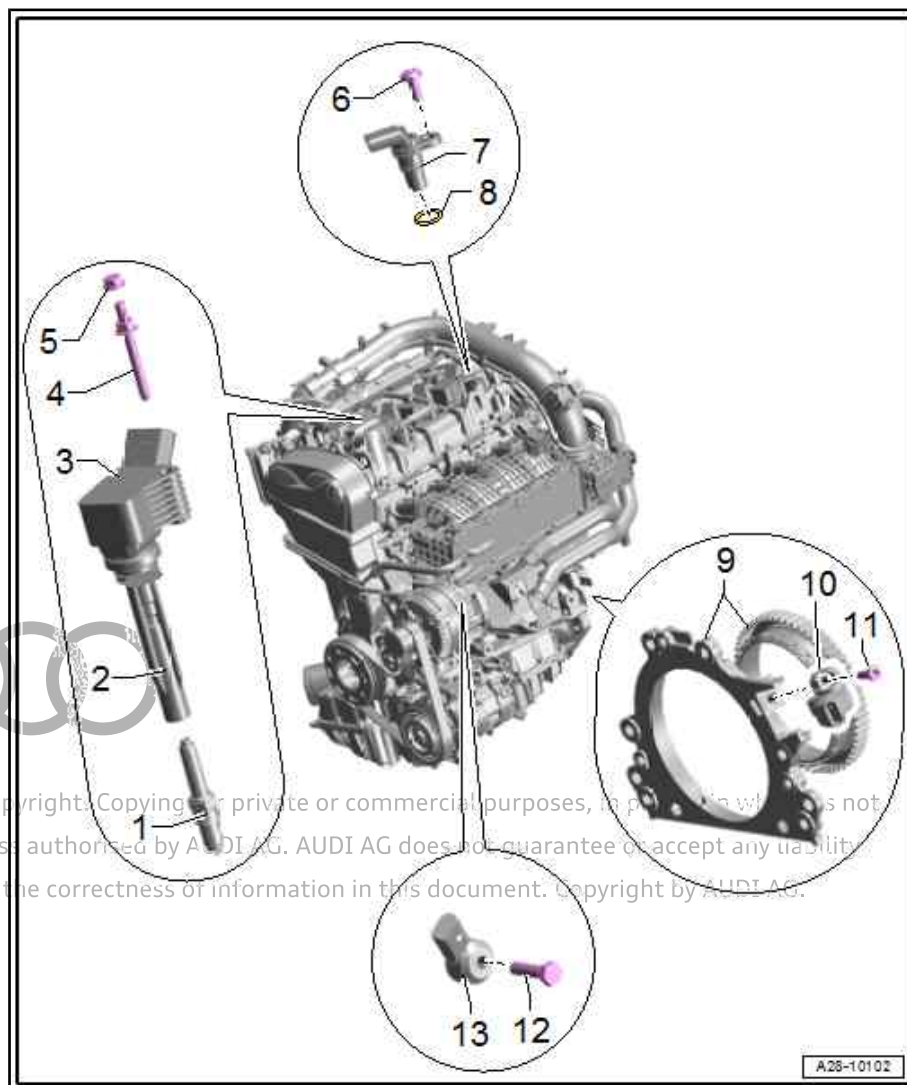
- ☐ 8 Nm

##### 7 - Hall sender

- ◆ Hall sender - G40- (inlet side)
- ◆ Hall sender 2 - G163- (exhaust side)
  - ☐ Removing and installing ⇒ [“1.4 Removing and installing Hall senders”, page 258](#)

##### 8 - O-ring

- ☐ Renew





#### 9 - Sealing flange (gearbox end)

- ☐ With oil seal and sender wheel for engine speed sender - G28-
- ☐ Do not separate from sealing flange
- ☐ Removing and installing ⇒ ["2.3 Removing and installing sealing flange \(gearbox end\)", page 49](#)

#### 10 - Engine speed sender - G28-

- ☐ Removing and installing ⇒ ["1.5 Removing and installing engine speed sender G28 ", page 260](#)

#### 11 - Bolt

- ☐ 4.5 Nm

#### 12 - Bolt

- ☐ Tightening torque influences the function of the knock sensor
- ☐ 20 Nm

#### 13 - Knock sensor 1 - G61-

- ☐ Removing and installing ⇒ ["1.3 Removing and installing knock sensor 1 G61 ", page 258](#)

## 1.2 Removing and installing ignition coils with output stages

### Special tools and workshop equipment required

- ◆ Puller - T10530-



### Removing

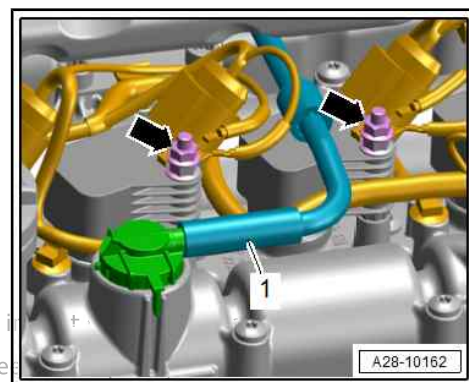
- Remove engine cover panel  
⇒ ["3.1 Removing and installing engine cover panel", page 34](#) .

### Ignition coils, cylinders 2, 3:

- Remove nut -arrows- and move earth wires clear.

### Ignition coil, cylinder 3:

- Disconnect crankcase breather hose -1-.

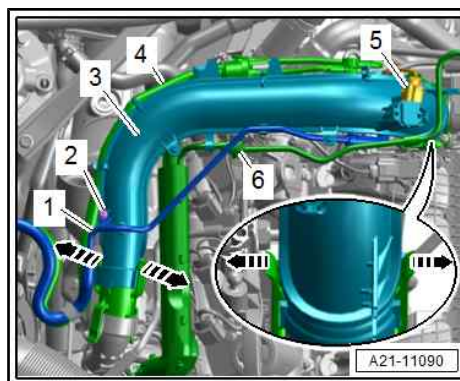
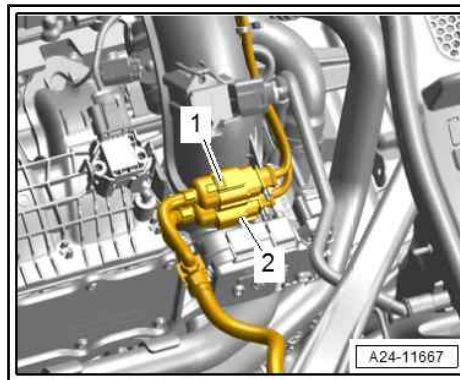


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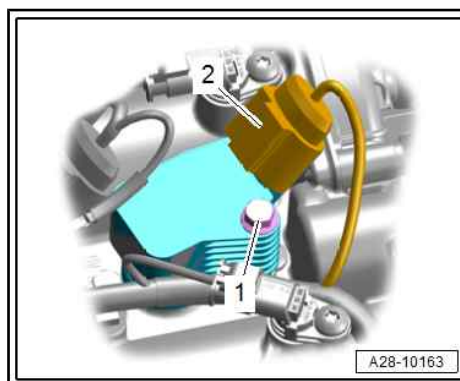
#### Ignition coil, cylinder 4:

- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.
- Remove bolt -2- and move fuel line -1- clear.
- Move hose -4- for activated charcoal filter system and coolant hose -6- clear.
- Unplug electrical connector -5- from charge pressure sender - G31- .
- Release catches -arrows- and detach air pipe -3-.

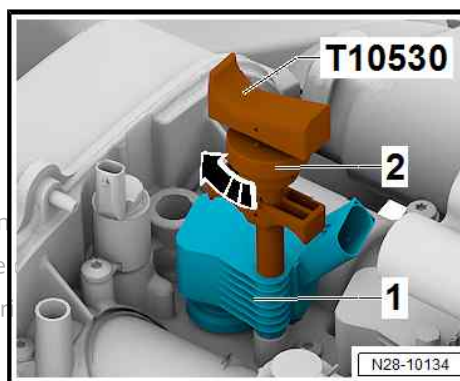


#### All ignition coils (continued):

- Unplug electrical connector -2-.
- Remove bolt -1-.



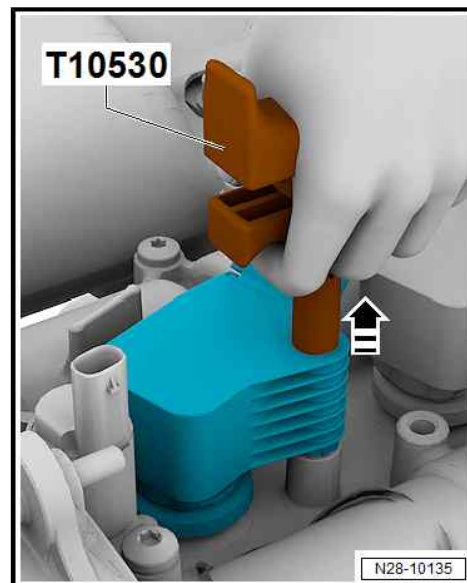
- Press puller - T10530- into hole in ignition coil -1- as far as stop.
- Tighten knurled nut -2- clockwise -arrow-.



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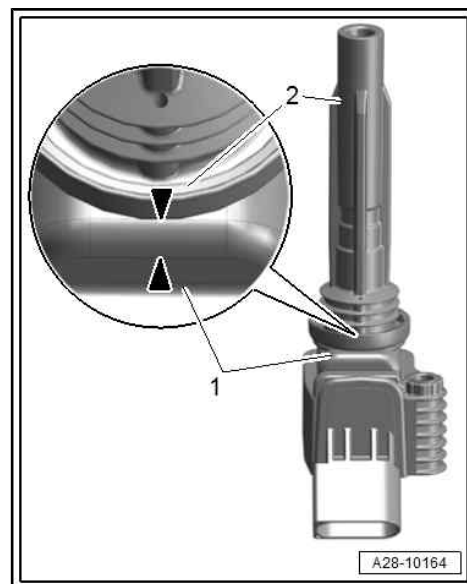
- Pull ignition coil out of camshaft housing with puller - T10530-  
-arrow-.



### Installing

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

- Renew O-rings after removing.
- Push spark plug connector -2- onto ignition coil -1- by hand as far as stop.
- The arrow markings on the spark plug connector and the ignition coil must be aligned, as shown.



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### Caution

*Ignition coils can be damaged irreparably if the wrong lubricant is used.*

- ◆ *Use only the approved silicone paste ⇒ Electronic parts catalogue .*

- Apply a thin bead of silicone paste all around end of sealing hose of ignition coil with output stage -arrow-.
- Press ignition coils onto spark plugs by hand evenly (do not use tools).
- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#), page 34 .

### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”](#), page 254
- ◆ ⇒ [“1.1 Exploded view - turbocharger”](#), page 193
- ◆ ⇒ [“2.1 Exploded view - charge air system”](#), page 201

## 1.3 Removing and installing knock sensor 1 - G61-

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### Removing

- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#), page 34 .
- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove knock sensor 1 - G61- .

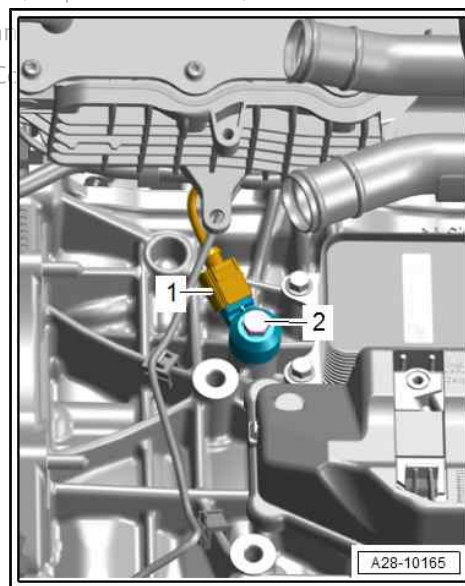
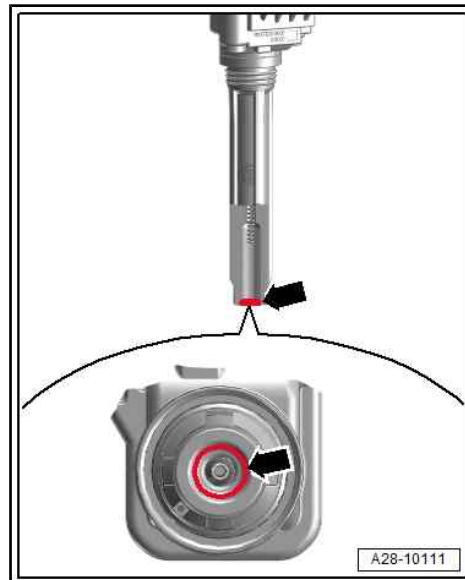
### Installing

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

- Install engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#), page 34 .

### Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”](#), page 254



## 1.4 Removing and installing Hall senders

Special tools and workshop equipment required



- ◆ Socket Torx T30 - T10405-

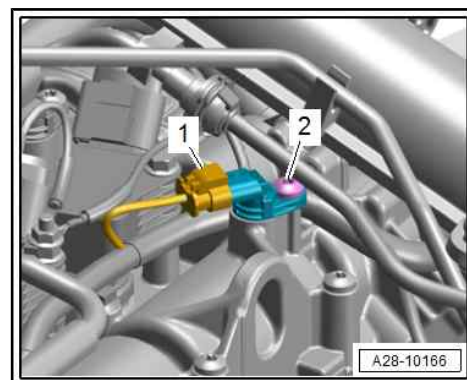


### Removing

- Remove engine cover panel  
⇒ [“3.1 Removing and installing engine cover panel”](#),  
[page 34](#) .

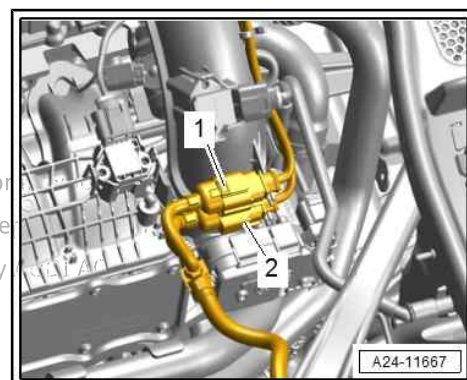
### Hall sender - G40- :

- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove Hall sender - G40- .



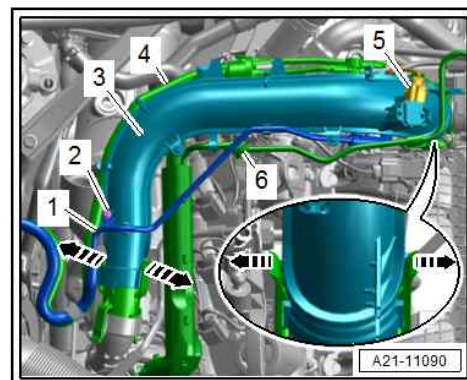
### Hall sender 2 - G163- :

- Take electrical connectors -1, 2- for Lambda probes out of bracket, unplug them and move electrical wiring clear.



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- Remove bolt -2- and move fuel line -1- clear.
- Move hose -4- for activated charcoal filter system and coolant hose -6- clear.
- Unplug electrical connector -5- from charge pressure sender - G31- .
- Release catches -arrows- and detach air pipe -3-.



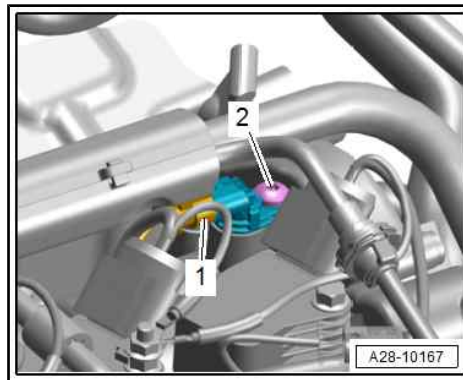


- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove Hall sender 2 - G163- .

### Installing

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

- Renew O-rings after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Install engine cover panel  
⇒ ["3.1 Removing and installing engine cover panel", page 34](#) .



### Tightening torques

- ◆ ⇒ ["1.1 Exploded view - ignition system", page 254](#)
- ◆ ⇒ ["2.1 Exploded view - charge air system", page 201](#)

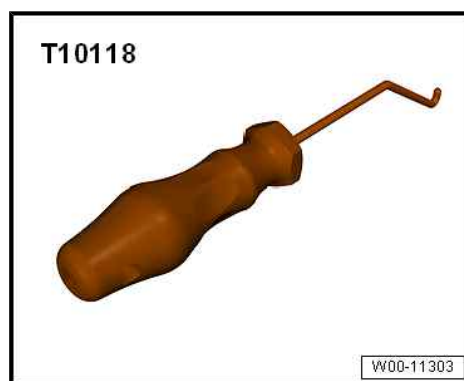
## 1.5 Removing and installing engine speed sender - G28-

### Special tools and workshop equipment required

- ◆ Socket, AF 4 mm - T10370-



- ◆ Assembly tool - T10118-

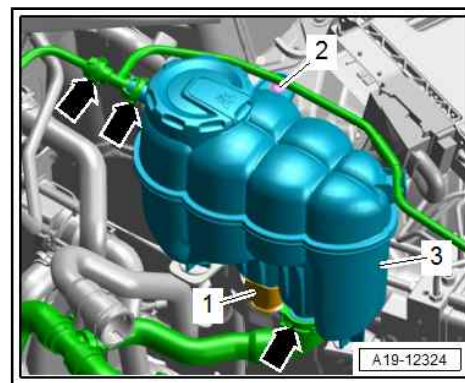


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## Removing

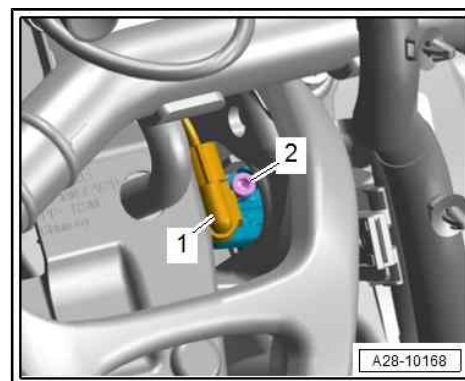
- Remove coolant pipes  
⇒ [“3.2 Removing and installing coolant pipes”, page 180](#) .
  - Move electrical wiring harness clear.
  - Lift retaining clips -arrows-, disconnect coolant hoses and move them clear.
  - Unplug electrical connector -1- for coolant shortage indicator switch - F66- .
  - Unscrew bolt -2- and detach coolant expansion tank.
- 
- Release and unplug electrical connector with assembly tool - T10118- .
  - Unscrew bolt -2- using socket, AF 4 mm - T10370- and remove engine speed sender - G28- .



## Installing

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

- Connect coolant hoses with plug-in connector  
⇒ [Fig. ““Connecting coolant hose with plug-in connector””, page 183](#) .
- Install coolant pipes  
⇒ [“3.2 Removing and installing coolant pipes”, page 180](#) .



## Tightening torques

- ◆ ⇒ [“1.1 Exploded view - ignition system”, page 254](#)



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